Aegis *EcoTec*

Air Insulated Ring Main Unit up to 12kV

Installation, Test & 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 and operation procedures for the AegisEcoTec Air Insulated 12kV Ring Main Unit. Produced in May 2024, this manual applies to the AegisEcoTec Air Insulated 12kV Ring Main Unit range only.

Due to Lucy Electrics 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 operated.
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 earthing 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 (PPE), 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. Many PPE suppliers provide flash resistant or arc flash clothing for this purpose.

3. GENERAL PRODUCT INFORMATION

The AegisEcoTec Air Insulated 12kV Ring Main Unit is a Ring Main Unit with combination of switching functions, comprising of Vacuum Circuit Breakers and Load Break Switches, all contained within a common insulated stainless steel enclosure.

The AegisEcoTec Air Insulated 12kV Ring Main Unit units are designed to be used for indoor and outdoor can be used either as a free-standing unit or installed in a compact substation or kiosk.

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

Circuit Breaker – Circuit Breaker comprises of three vacuum interrupters (which have fault make and break rating) and in series 3 position disconnector incorporating an earthing switch. Opening of the Circuit Breaker automatically when a fault is detected or manually by pushing the trip button.

Interlocks – Positive integral safety interlocks are incorporated on all Load Break Switch and Circuit Breaker functions.

Housing – The housing of the AegisEcoTec Air Insulated 12kV Ring Main Unit is fully treated using zinc coated steel and electro-statically applied oven cured paint to resist weather and pollution attacks.

Load Break Switch – The switches utilise a shunt Vacuum interrupter for load breaking and has three positions 'MAIN ON', 'OFF' and 'EARTH ON'.

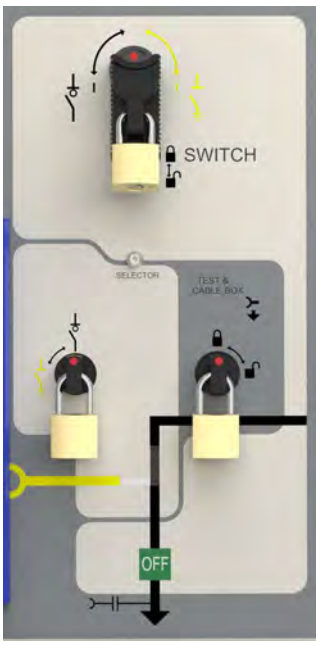
Operation – All operating positions and instructions are indicated on the main front fascia of the unit. Operation is by means of manually independent mechanisms, which are mounted externally to the gas enclosure.

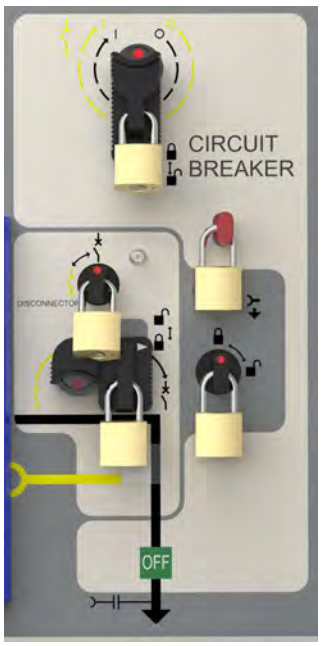
⚠ CAUTION

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

3.1 Padlocks

All load break switches and circuit breaker mechanism inputs for the main operations and selectors can be padlocked in any position. The slide covers and rotating selectors have an 8.5mm hole suitable for 8mm padlock clasps.





3.2 Pressure Indicator

The AegisEcoTec Air Insulated 12kV Ring Main Unit unit has a pressure indicator available, see below for further information.

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. FRONT PANEL LAYOUT

Key:

1 : Fault Indicator
2 : LV Panel
3 : Relay Protection
4 : Earth and Test Door
5 : Pressure Indication
6 : Switch Operation
7 : Switch Selector Operation
8 : Earth & Test Interlock (Switch)
9 : Switch Selector indication
10 : Switch Operation Indication
11 : VDS/VPIS
12 : Circuit Breaker Operation
13 : Push To Trip' Button
14 : Circuit Breaker Disconnector Operation
15 : Circuit Breaker Selector Operation
16 : Earth & Test Interlock (Circuit Breaker)
17 : Circuit Breaker Disconnector Indication
18 : Circuit Breaker Operation Indication
19 : Cable Box
20 : Operating Handle

Inside Left Hand Door

5. TECHNICAL DATA

General		
Rated Voltage		12kV
Frequency		50Hz
Rated Lightning Impulse Withstand Voltage	Directly Earthed Between Phases and Phase to Earth	95kV
	Across Disconnector Across Isolation Gap	110kV
Rated Power Frequency Withstand Voltage	Directly Earthed Between Phases and Phase to Earth	38kV
	Across Disconnector Across Isolation Gap	45kV
IP Rating	Indoor/Outdoor	IP54
	Tanks with HV parts	IP67
	Mechanical Impact Protection	IK10
Internal Arc Protection	AFL (Rear Vent)	21kA for 1 sec
Pressure Gas	Annual Leakage Rate	≤ 0.1%
	Filled Pressure (at 20°C)	0.5 Bar (G)
	Min Operating Pressure	0.4 Bar (G)
Installation Conditions	Relative Humidity (max) - over period of 24 hrs (IEC 62271-1, sub-clause 2.1)	98%

BusBars	
Rated Normal Current	630A/400A
Rated Short Time Withstand Current	21kA
Rated Duration Of Short Circuit	3s
Rated Peak Withstand Current	52.5kA

Load Break Switch: L Function		
Rated Normal Current	630A/400A	-25 to 40°C/-25 to 55°C De-rating is required for +55°C
Rated Active Load Breaking Current	630A/400A	
Rated Cable Charging Breaking Current		16A
Main Electrical Circuit	Rated Short Time Withstand Current	21kA
	Rated Duration Of Short Circuit	3s
	Rated Peak Withstand Current	52.5kA
Earthing Circuit	Rated Short Time Withstand Current	21kA
	Rated Duration Of Short Circuit	3s
	Rated Peak Withstand Current	52.5kA
Mechanical Endurance Class	Load Break Switch	M2 (5,000)
	Earth Switch	M0 (1,000)
Electrical Endurance Class Short Circuit Making	Load Break Switch	E3 (5 Times)
	Earth Switch	E2 (5 Times)
Operating Mechanism	Local: Spring Charging by operating handle Close - Open by operating handle	
	Remote: Spring charge by motor; close and open by motor	

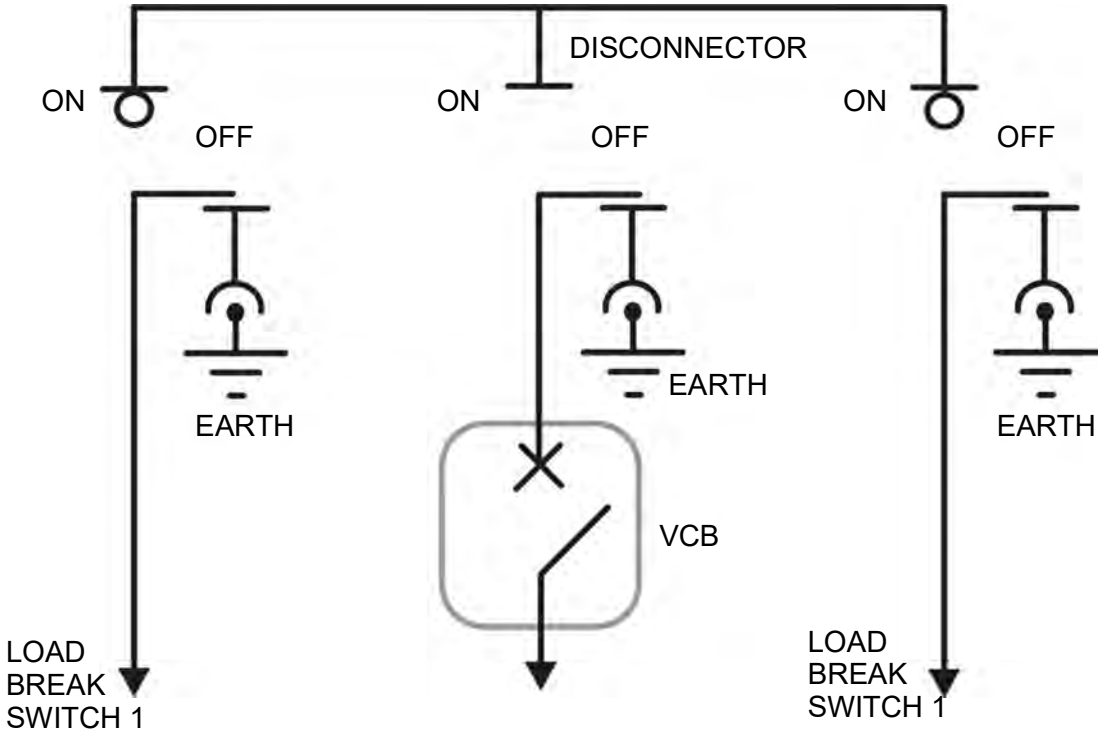
Circuit Breaker Switch: V Function		
Rated Voltage		12kV
Rated Normal Current	630A/400A/250A	-25 to 40°C/-25 to 55°C De-rating is required for +55°C
Rated Active Load Breaking Current	630A/4olaypse noow 00A/250A	
Rated Short Circuit Making Current		52.5kA
Rated Cable Charging Breaking Current		68A
Main Electrical Circuit	Rated Short Time Withstand Current	21kA
	Rated Duration Of Short Circuit	3s
	Rated Peak Withstand Current	52.5kA
Earthing Circuit	Rated Short Time Withstand Current	21kA
	Rated Duration Of Short Circuit	3s
	Rated Peak Withstand Current	52.5kA
Mechanical Endurance Class	Circuit Breaker	M1 (2,000)
	Earth Switch	M0 (1,000)
Electrical Endurance Class (Making)	Circuit Breaker	E2
	Earth Switch	E2 (5 Times)
Operating Mechanism	Operating Sequence For Mechanism	O-3min-C O-3min-C O
	Local: Close with operating handle; open by trip button	
	Remote: Springs charge by motor; close with motor; open by trip coil	

6. LINE DIAGRAMS

6.1 Function Terminology

The following line diagrams are an examples only.

Typical 3-Way 12kV, 630A, 50Hz - LVL

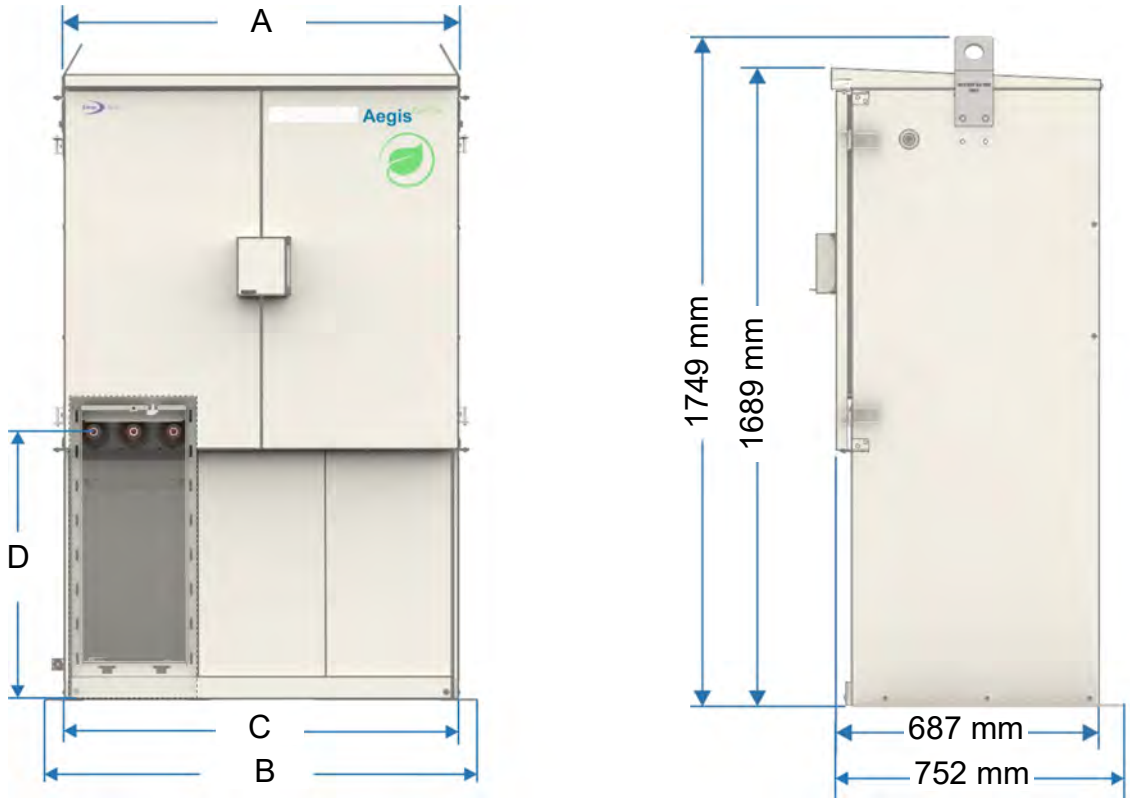


7. DIMENSIONAL DRAWINGS

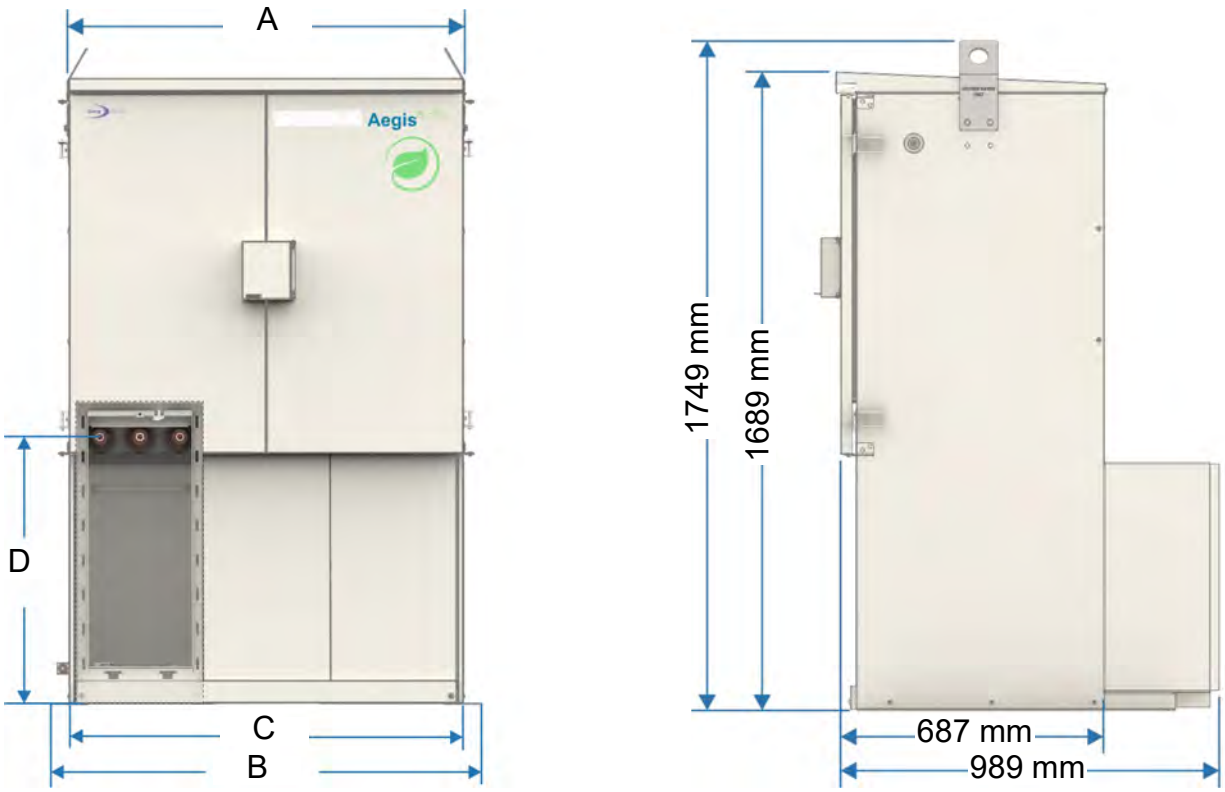
INFORMATION

Unit dimensions stated are for guidance purpose only and will vary depending on optional facilities added to the unit.

7.1 AF Unit Dimensions



7.2 AFL Unit Dimensions



No. OF WAYS	3	4
DIM A (mm)	1060	1400
DIM B (mm)	1148	1488
DIM C (mm)	1052	1393

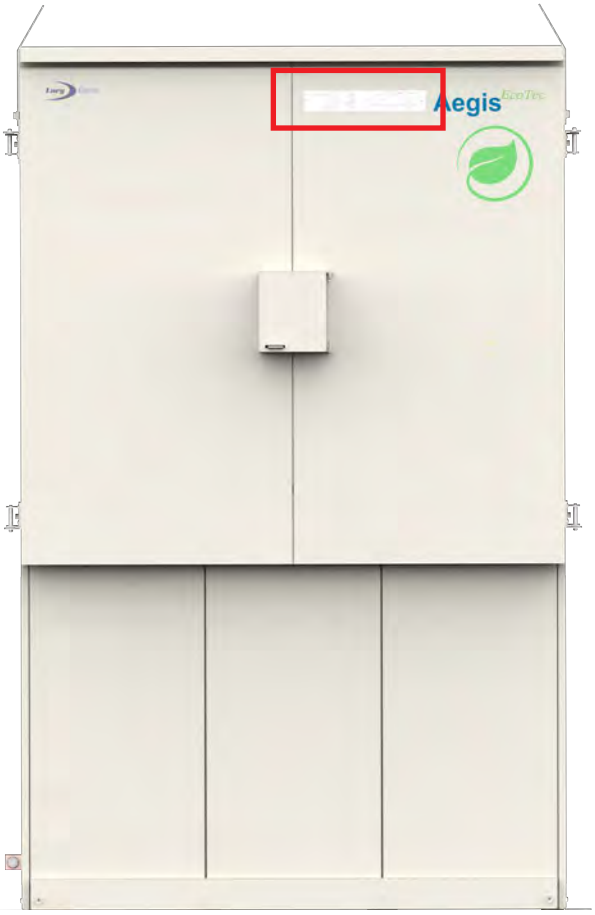
Cable Termination Height	
Cable Box DIM D (mm)	600
	750

8. RATING PLATE

8.1 Rating Plate Details

8.1.1 Rating Plate Location

The rating plate for the unit is located as shown below:



Rating Plate:

Lucy Electric	Type.AEGIS		IEC62271-200		Made in			Switch: L		IEC 62271-103		Circuit Breaker:		IEC 62271-100	
	Serial No.				Year:			Ik	kA	tk	S	Ik	kA	tk	S
	Ur	kV	Ip	kA	IAC			Ip	kA			Ip	kA	Isc	kA
	fr	Hz	tk	S	Int arc	kA for 1s		Ir	A	Class		Ir	A	Pcs	
	Up	kV	Pre	MPa (abs.)	DryAir	kg						o	co	co	Class
	Ud	kV	Pme	MPa (abs.)	TC	C		Disconnector and Earthing Switch				Disconnector and Earthing Switch			
	Ir busbar	A	LSC		Mass	kg		Ik	kA	IEC62271-102		Ik	kA	IEC62271-102	
	Ik busbar	kA			GWP			tk	S	Class		tk	S	Class	

Ur	- Rated voltage.	LSC	- Loss of service continuity category.
fr	- Rated frequency.	IAC	- Internal arc classification.
Ud	- Power frequency withstand voltage.	Int arc	- Internal arc rating of unit tank.
Ir busbar	- Rated normal current.	TC	- Temperature class.
Ik busbar	- Short time withstand current RMS.	Up	- Lightning impulse withstand voltage.
Ip	- Short time withstand current peak.	Pre	- Gas rated filling pressure (density) for insulation.
tk	- Short time withstand current rated duration of short circuit.	Mass	- Weight of unit.
Insulating Gas	- Synthetic Air	GWP	Global Warming Potential (GWP) = 0

8.2 Standards

AegisEcoTec complies with the following latest standards:

IEC 62271 - 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 control gear.
IEC 62271 - 206	VPIS systems for rated voltages between 1kV and 52kV.
IEC 62271 - 1	HV switchgear and control gear: Common specifications.
IEC 61243 - 5	Voltage detecting systems (VDS).
IEC 60255	Measuring relays and protection equipment.
IEC 60529	Degrees of Protection.

9. HANDLING

9.1 Symbol guidance

INFORMATION

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

Keep dry

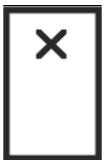
Handle with care

This way up

Keep away from direct sunlight

Storage Temp

Do not step on



High centre of gravity

Do not stack

9.2 Transport Conditions

CAUTION

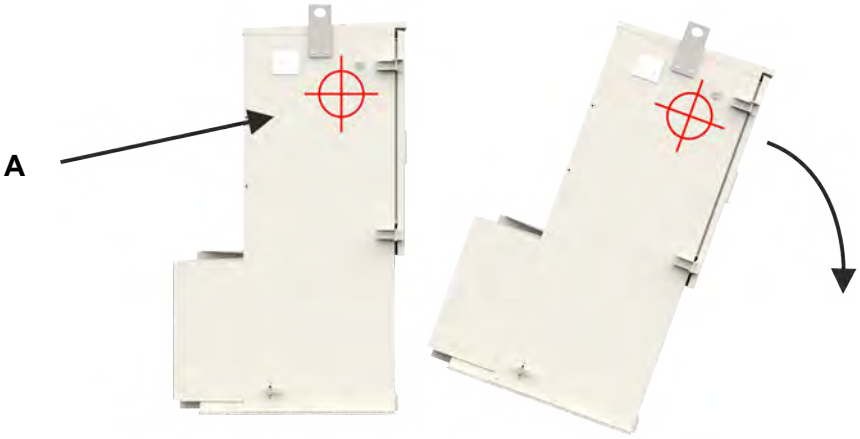
Keep AegisEcoTec unit surfaces clear, Do not place/rest objects on top of the AegisEcoTec unit.

9.3 Transportation centre of gravity

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

CAUTION

The unit has a high centre of gravity "(A)".



9.4 Forklift Truck

INFORMATION

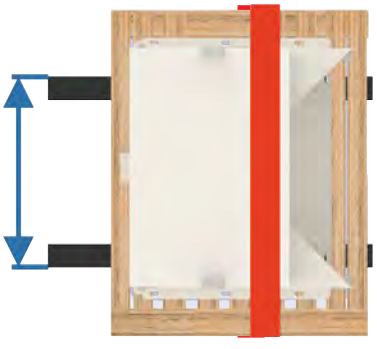
There are two ways to handle an AegisEcoTec unit (indoor/outdoor), using a forklift truck with Solution (A) being the recommended way.

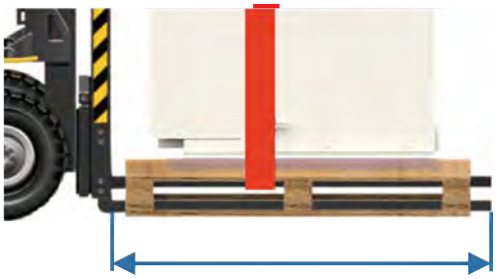
WARNING

When handling with a fork lift truck, beware the high centre of gravity of the unit, see "Transportation centre of gravity" on page 16

Solution A

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.

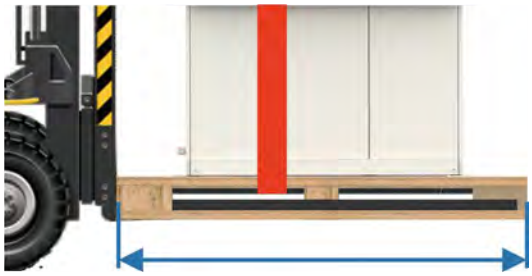
Solution B

CAUTION

The handling solution (B) is to be used only for narrow areas where handling solution (A) is impossible.

It is recommended to strap the unit to the forks for solution (B)

The forks are to be moved apart to support the unit front and back.



The forks are to be long enough to support the unit.

WARNING

Strap the unit only to retain, do not strap too tight as this may distort the roof.

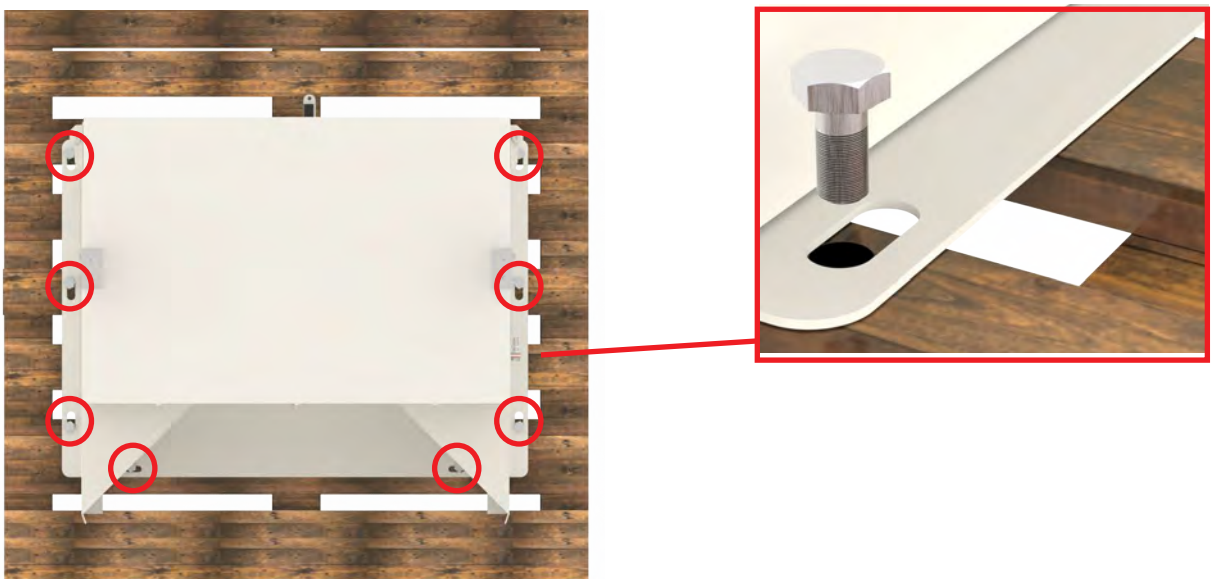
9.5 Removing unit from pallet

1 : Place the device with pallet on the ground.

9.5.1 Pallet Release

2 : Locate eight M10 Front, Sides and Rear fixings.

3 : Remove all M10 fixing in eight places.

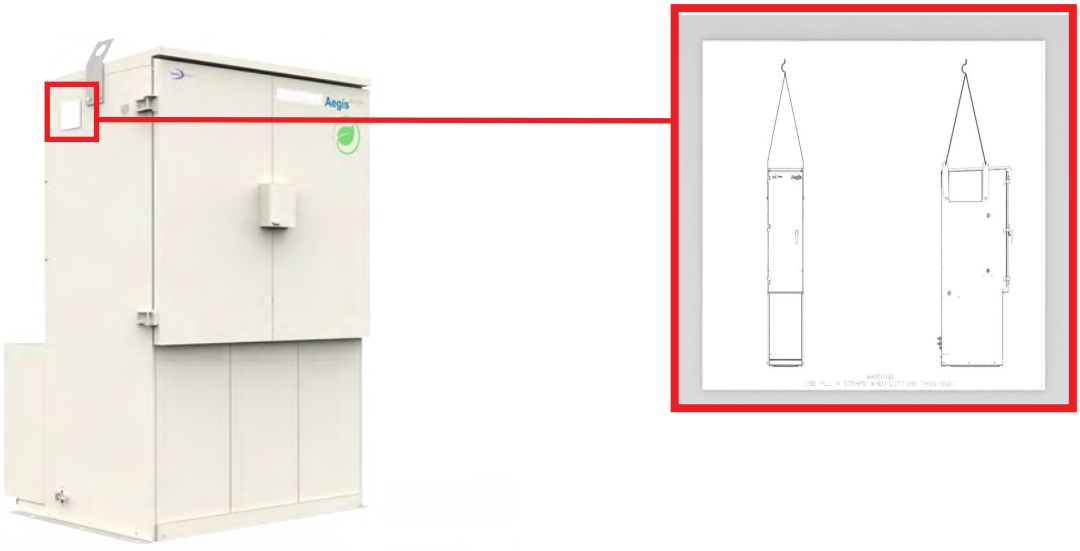


4 : The unit is now free from the pallet and can be prepared for lifting, using chains.

9.6 Lifting Options

9.6.1 Lifting Label and location

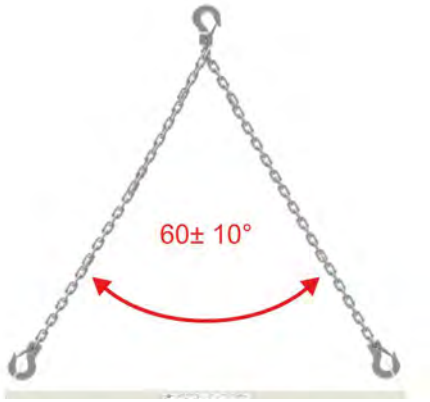
1 : Slinging label is located on the left hand side of the unit as seen from the front, as shown below.



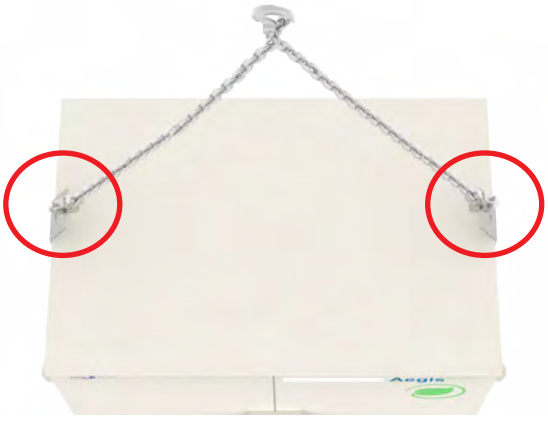
9.6.2 Lifting

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

2 : Using the Lifting Sling/Chain, the angle must be 60° ±10°.



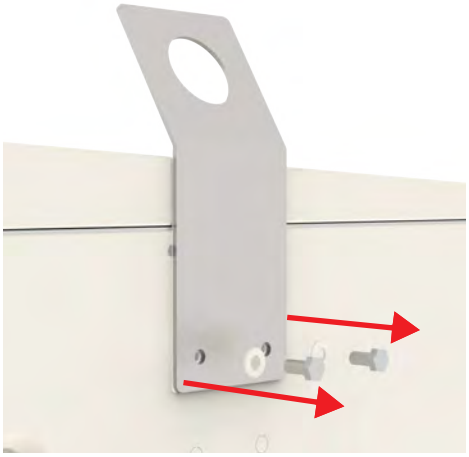
3 : Attach Sling/Chain hooks to the lifting lug in two places and ensure all hooks are secured before the unit is raised.



9.6.3 Removal of Lifting lugs.

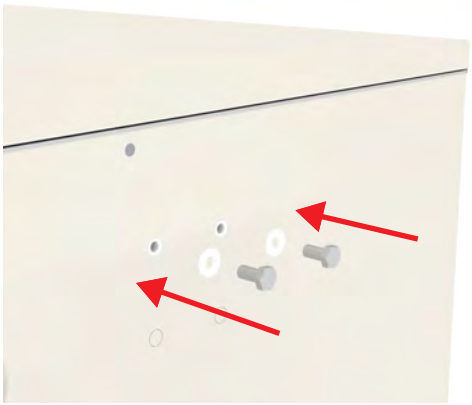
Once the unit is in it's final position, the lifting lugs must be removed and recycled.

1 : Remove the top two M6 fixings of the lifting lugs.



2 : Remove the bottom two M6 fixings of the lifting lugs.

3 : To maintain IP rating, re-install screws with plastic spacer washers instead of steel washers, the plastic washers can be found inside the LV Fascia Tray.



9.7 Packaging

After unpacking, the remaining materials must be sorted and recycled appropriately.

10. STORAGE

INFORMATION

Units are shipped with all covers closed. 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

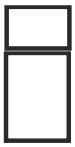
If any anomaly or damage to the unit is apparent, do not install it, and please contact Lucy Electric as soon as possible.

10.1 Storage Guide

Keep dry

This way up

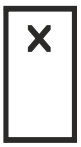
Storage Temp



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.

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. SUBSTATION INSTALLATION (RESISTANCE TO INTERNAL ARCING)

When an installation is requested with protection against internal arcing faults, consult the diagrams below.

The parts to vent the gases towards the evacuation openings (Stacks) and the cooling walls are not part of the switchgear supply, these components should be adapted to each type of use.

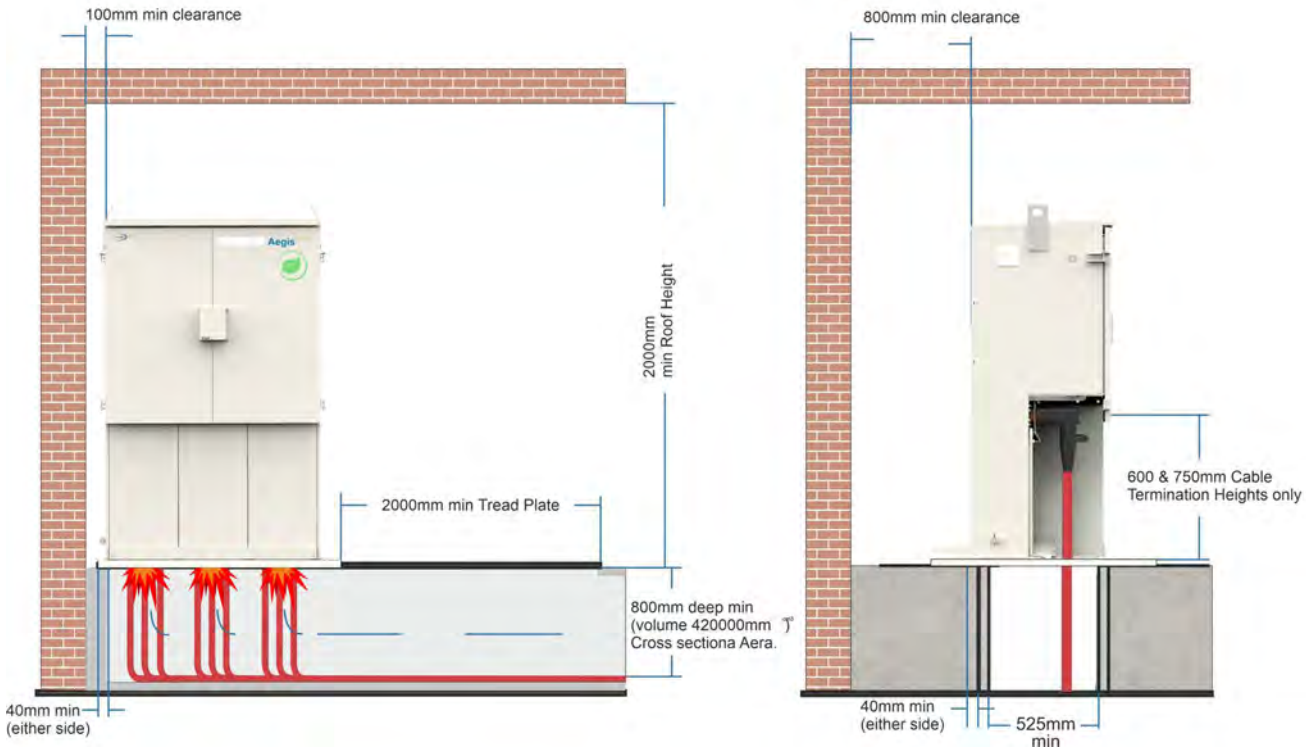
Classification according to I**EC 62271-200:IAC**

WARNING

Note: Evacuation of the exhaust gases after ignition of the internal arc fault must be catered for when installing.

11.1 Substation Position Clearance

* Consult Lucy Electric for a reduced ceiling height.



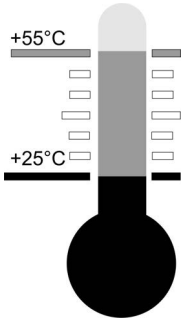
12. INSTALLATION RECOMMENDATION

12.1 Operating Conditions

WARNING

The operating ambient air temperature of the AegisEcoTec Air Insulated 12kV Ring Main Unit must be between -25°C and +40°C without de-rating or +55°C. at 400A.

Relative humidity over a period of 24 hours must be a maximum of 95%.



DANGER

DO NOT OPERATE THE UNIT IF IT IS DAMAGED.

CAUTION

Condensation can cause problems with the AegisEcoTec Air Insulated 12kV Ring Main Unit unit, 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 heating that causes condensation problems in a substation.

13. UNIT INSTALLATION

⚠ CAUTION

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

13.1 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 it's functional components.
- Verify that the rating plate data matches the original order.

13.2 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.

13.2.1 Unit RAL colour information

- Unit Chassis & Panels = RAL 7035 – Light Grey
- Fascia = RAL 7046 - Telegrey 2
- Earth and Test Covers = Pantone 286U - Blue Smooth

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

13.3 Check Pressure indicator gas

Before installation and energising, check that the gas 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.

13.4 AegisEcoTec Air Insulated 12kV Ring Main Unit Unit Floor Mounting Details

13.4.1 Floor fixing

The unit must be fixed to a concrete plinth that must be of a high quality and flat.
The AegisEcoTec Air Insulated 12kV Ring Main Unit units are designed to be bolted down to a concrete plinth using FAZ II 10 anchor bolts.

INFORMATION

For Floor fixing details please refer to the contract drawing.

CAUTION

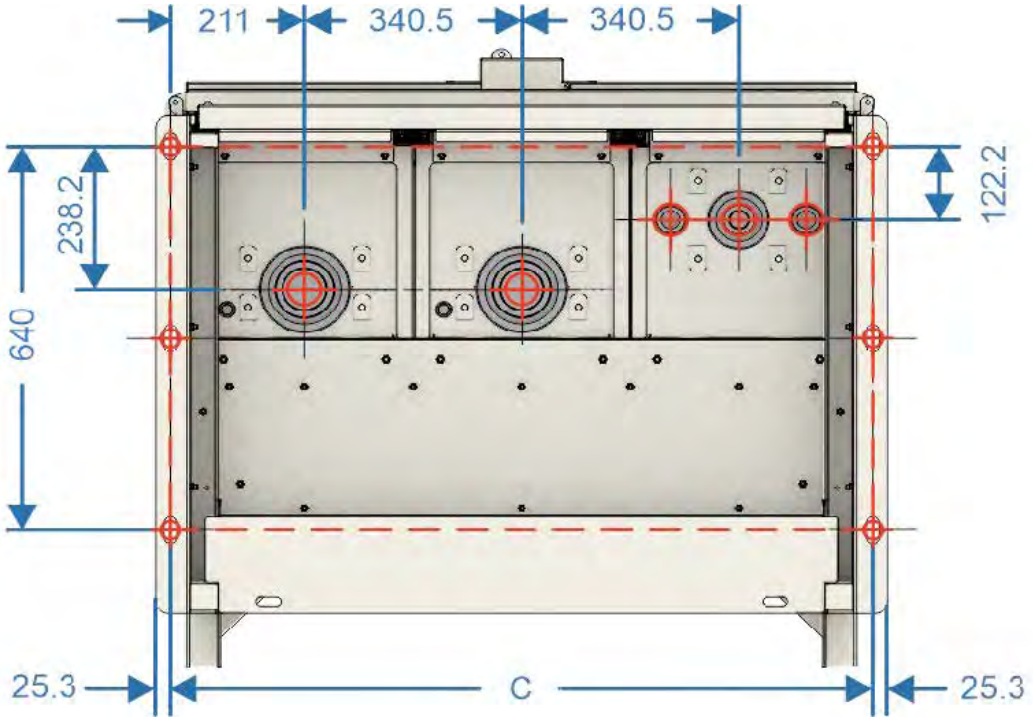
The concrete plinth must have no unevenness of greater than 7mm over a length of 2m and a width of 1m.

The AegisEcoTec Air Insulated 12kV Ring Main Unit unit <u>MUST BE</u> bolted to the floor in all 4 fixings points.

Prepare the ground for floor mounting by marking out, then drilling the required holes to suit the M10 bolts supplied.

13.4.2 AegisEcoTec Air Insulated 12kV Ring Main Unit Floor Indoor and Outdoor Hole Positions

Prepare the ground for floor mounting by marking out, then drilling 6 holes to suit the M10 bolts supplied.



No. OF WAYS	3	4
DIM C	1052	1383

14. COMMISSIONING TESTS

14.1 Main Circuit Resistance Tests

INFORMATION

It is recommended that Electrical Circuit Resistance readings are taken. This is to ensure 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 each of the following adjacent circuit paths for each phase:

1 : Load Break Switch to adjacent Load Break Switch.
2 : Load Break Switch to adjacent Circuit Breaker.
3 : Circuit Breaker to adjacent Circuit Breaker (if applicable).

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

14.1.1 Resistance test values

Functions		Switch 630A. Cable Bushing to Cable Bushing			Circuit Breaker 630A. Cable Bushing to Cable Bushing		
Fn1		Fn2	Fn3	Fn4	Fn2	Fn3	Fn4
SW	L1	212	243	265	220	243	259
	L2	191	219	242	215	229	241
	L3	183	224	246	181	223	223
CB	L1	249	243	266	255	271	287
	L2	229	229	248	233	248	264
	L3	219	223	233	225	240	256

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.

14.2 Secondary Wiring Insulation Resistance Testing

Insulation resistance testing is conducted at 1kV in accordance with international standards.
In addition to this, the AegisEcoTec Air Insulated 12kV Ring Main Unit 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, 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.

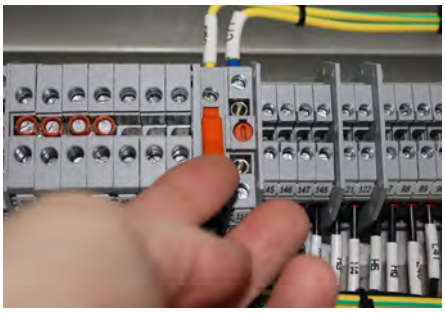
14.3 1 kV test.

- Remove the earth link.
- Where units are not fitted with a removable earth link, ensure all earth 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 LV Fascia Tray for approx 2 seconds.
- Any indication of continuity should be investigated and rectified.

14.3.1 Removal of the Earth link

1 : Position of earth link

2 : Lift link with finger.



3 : Rotate the link completely away from the terminal.

14.4 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 "Main Circuit Resistance Tests" on page 26.

⚠ CAUTION

Ensure appropriate screened insulation boots are to be used when HV testing.

For HV tests, the Primary Circuit Breaker and/or Load Break Switches must be in the 'ON' position, and the following tests to be taken through the cable terminals.

14.5 HV Insulation Resistance Testing

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

⚠ WARNING

WARNING: THE FOLLOWING TESTS SHOULD NOT BE UNDERTAKEN IF THESE READINGS ARE LESS THAN 100 MEGOHMS.

14.6 Power Frequency Testing

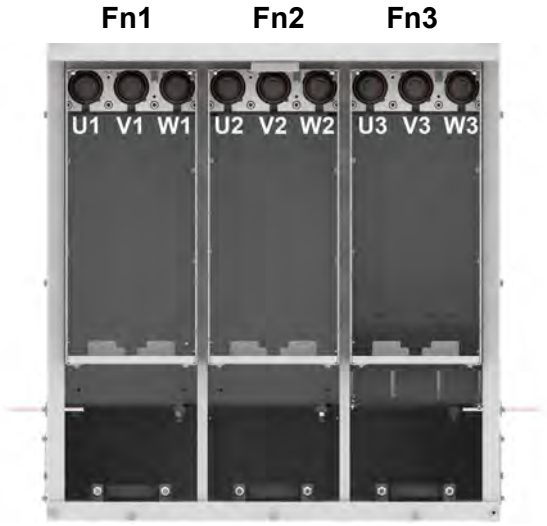
These test values are to IEC 62271-1.

Conduct tests as follows:

- Ensure unit has correct gas pressure.
- Ensure the tripper is shorted out before testing.
- Ensure the VPIS (if fitted) is shorted to earth.
- Follow the test schedule below see image below for labelling.
- As per the table below, apply test voltages to test the connection for each phase.
- The test is considered acceptable when neither breakdown or flash-over has occurred (where necessary, fit additional insulation onto the bushings).

14.7 Test Checks

3 Way Unit					
	Fn1	Fn2	Fn3	Voltage	Earth
Test 1	Closed/On	Closed/On	Closed/On	U1, W1	Frame, V1
Test 2	Closed/On	Closed/On	Closed/On	V1	Frame, W1, U1
Test 3	**Open/Off**	Closed/On	Closed/On	U1, V1, W1	U2, V2, W2
Test 4	Closed/On	**Open/Off**	Closed/On	U2, V2, W2	U1, V1, W1



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

	Rated Voltage		
Test	12kV	Duration	Fit insulation caps & adaptors
1 & 2	30.4kV	1 Minute	Yes
3	36kV	1 Minute	Yes

14.8 Electrical Tests After Cabling or Connection To Transformer

Switch one of the ring switches into the 'EARTH ON' position then open the cable test access door refer to Operating Manual, section "Earth & Test Access".

Refer to document guide: LIOM-16-009 AegisEcoTec Air Insulated 12kV Ring Main Unit DC Pressure Testing to apply a test voltage of 25kV DC (or as specified by network owner) to each test connection for 15 minutes. Repeat tests on the other functions.

INFORMATION

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.

14.9 Relay Type Protection Tests

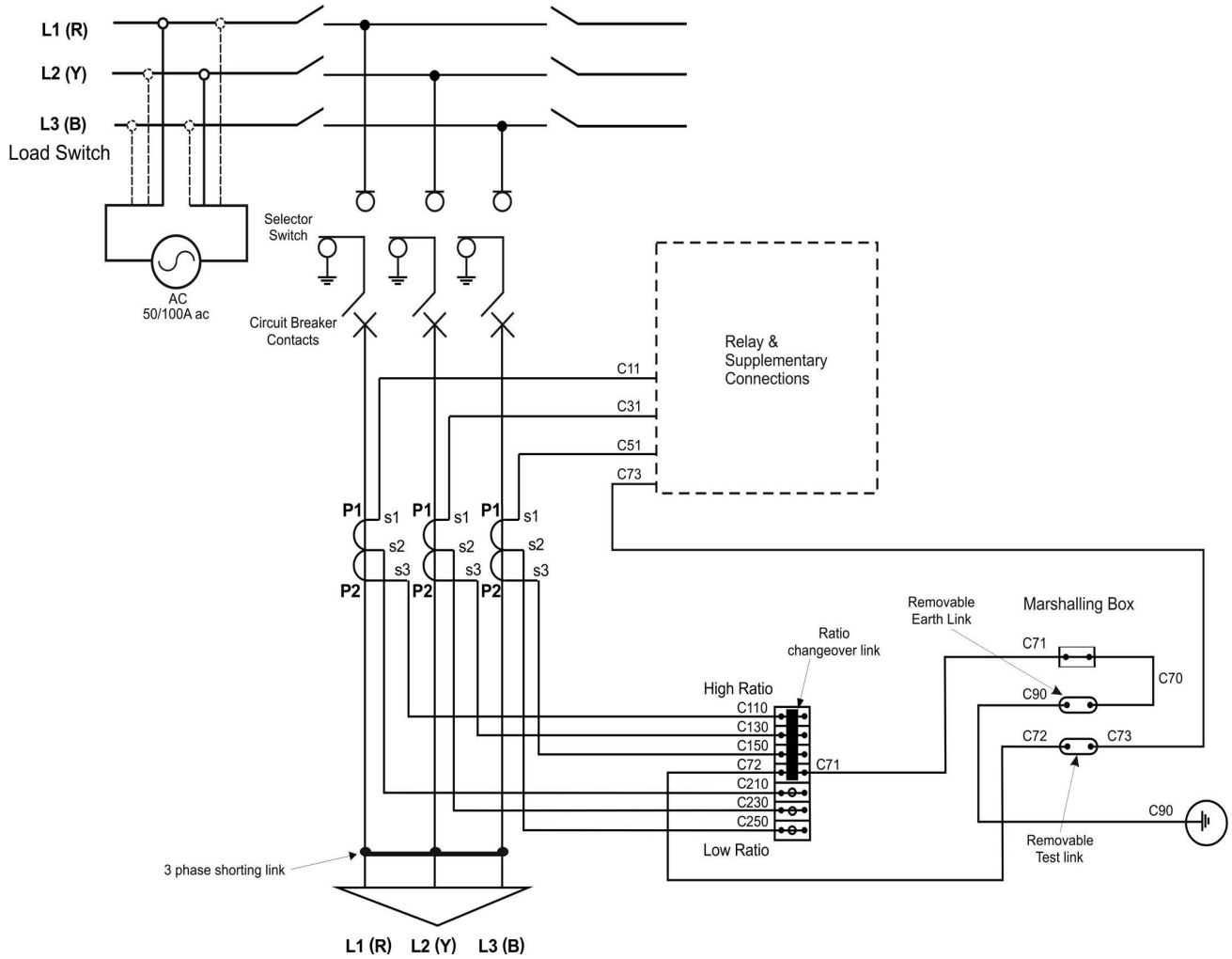
INFORMATION

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 diagrams supplied with each

14.9.1 Relay Primary Injection Test - Overcurrent Test

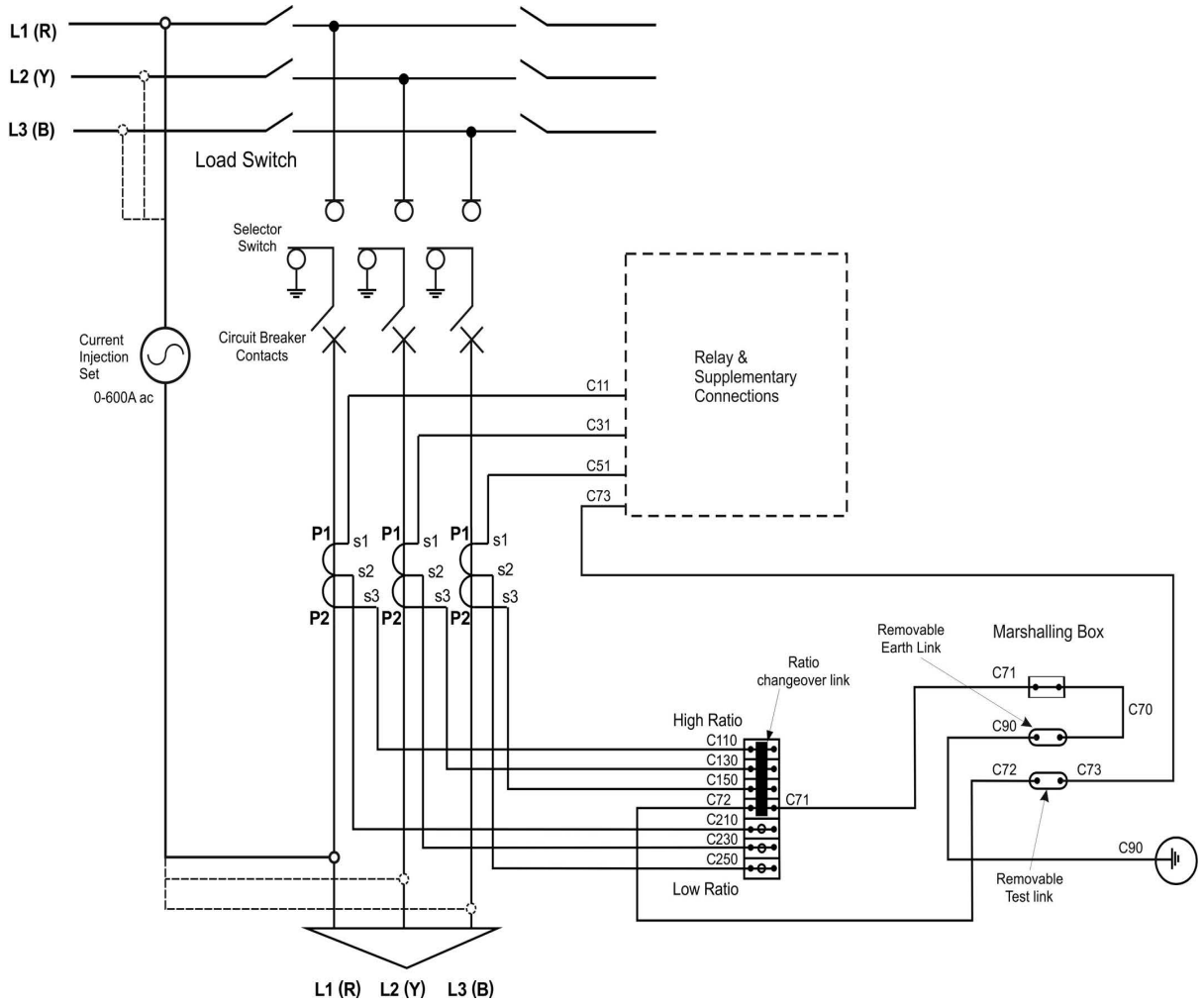
- Ensure the Load Break Switch and Circuit Breaker are closed.
- Setup test as shown, ensuring the removable earth link & test link are fitted and closed.
- Ensure the 3 phase shorting link (100A rating) is fitted as shown.
- Setup relay for overcurrent test, including settings.
- Apply the appropriate test current in accorance with the relay setting and CT ratio.
- Repeat for each phase.

Repeat for each ratio - values to be recorded if necessary.



14.9.2 Relay Primary Injection Test - Earth Fault Test

- Ensure the Load Break Switch 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.



14.9.2.1 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.

14.10 TLF Protection Test

The commissioning tests for TLF protection can be taken from the **AegisEcoTec Ring Unit Time Limit Fuse (TLF) Setup Manual LIOM16-018**.

14.11 VPIS & NEON Indication (if fitted)

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

The VPIS system is generally in accordance with IEC 61958 and 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 HR system using relevant HR adapters) which comply with IEC 61243-5 either with or without push button neons.

14.12 Commissioning Checks

WARNING

The following checks should be made during commissioning where applicable.

14.12.1 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).

14.12.2 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.
- 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.

14.12.3 Phase comparator

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

- Ensure Circuit Breaker/Load Break Switch is open if the HV cables are going to be used to carry out the test.
- For 12kV and higher system voltages, ensure the HR - 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.

14.13 Shunt Trip (if fitted)

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

- Locate the shunt trip terminals on the LV Fascia Tray 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.

14.14 Auxiliary Wiring Switch testing

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

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

- Load Break Switch's auxiliary contacts.
- CB/T-Off auxiliary contacts.

Motorization indication circuits - operation of motor actuation should be checked if fitted/supplied with the unit.

14.15 Secondary Wiring Insulation Resistance Testing

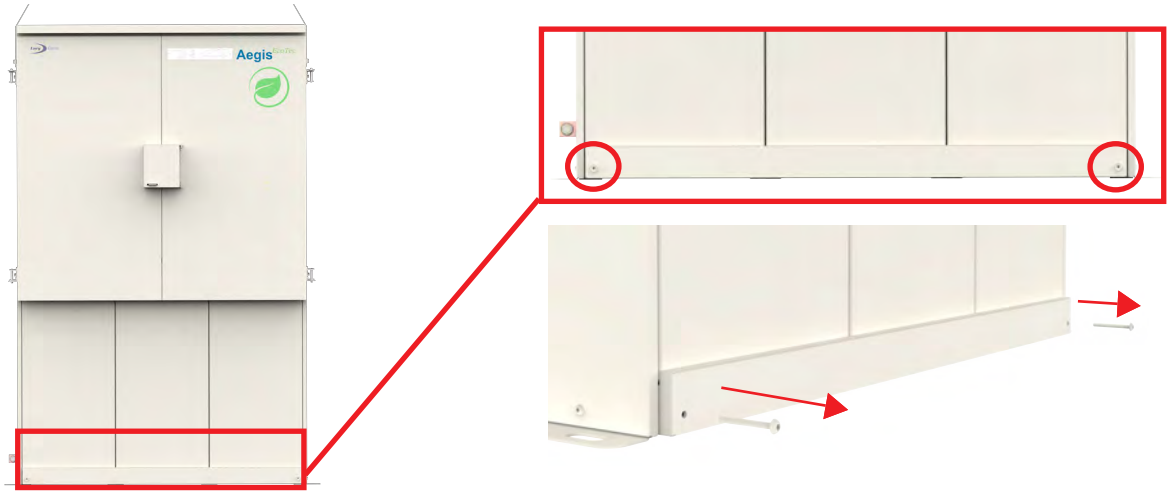
Insulation resistance testing is conducted at 1kV in accordance with international standards.
In addition to this, the AegisEcoTec Air Insulated 12kV Ring Main Unit unit is also tested at 2kV during the manufacturing process and is not required to be re-tested at this voltage level.

It is recommended that sensitive electronic devices, motors and actuators, 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.

15. GLAND PLATES & CABLE TERMINATION

15.1 Plinth Removal

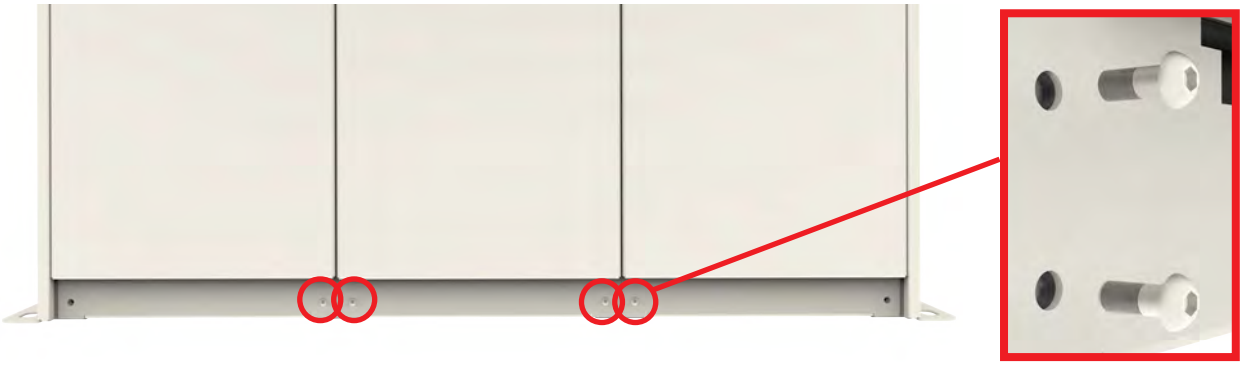
1 : Locate and remove the M6 bolt on either end of the front plinth in two places.



2 : Pull away and remove the plinth from the unit.

15.1.1 Support base plate

1 : Locate the M6 screw in four places and remove all fixings.



15.1.2 Cable Box Access

INFORMATION

Cable box door is interlocked.
To prevent removal of 'Cable Box' fit padlock through Test & Cable Box knob.

1 : Lift up the handle on the front of the cable box panel.

2 : Pull out the cable box panel away.

INFORMATION

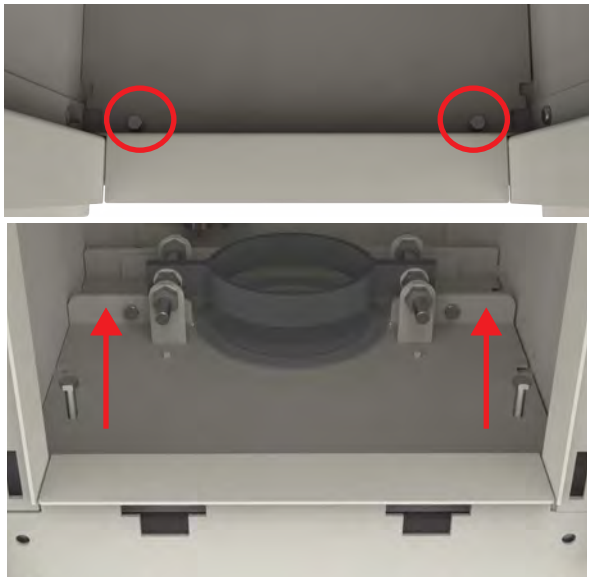
Relevant function cannot be removed from 'EARTH' until the 'Cable Box' cover is refitted.

15.1.3 Single 3-core Gland Plate Removal

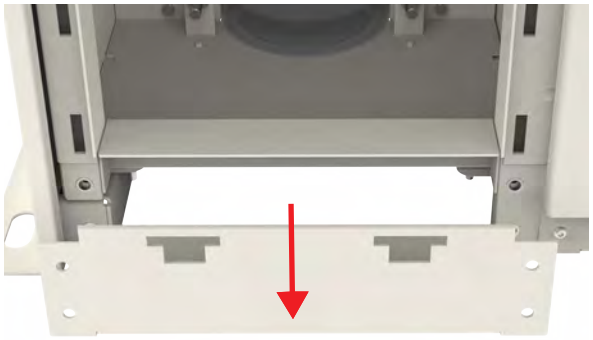
1 : Locate the deflector deflector

2 : Release the deflector by unscrewing the M6 fixings.

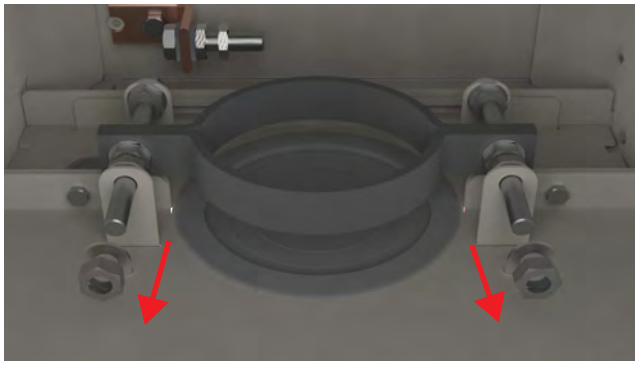
3 : Locate the M6 screw in two places at the front gland plate inside the cable box and remove the M6 bolt and washer from the cable box in two places.



4 : Remove the deflector.

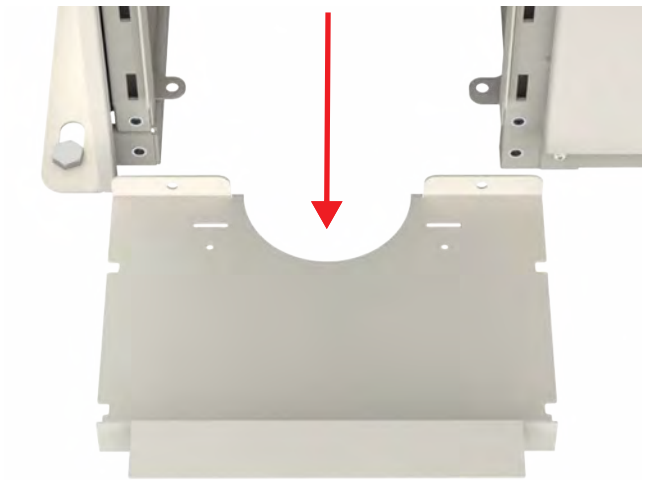


5 : To remove the front gland plate, unscrew the M6 fixings in two places.

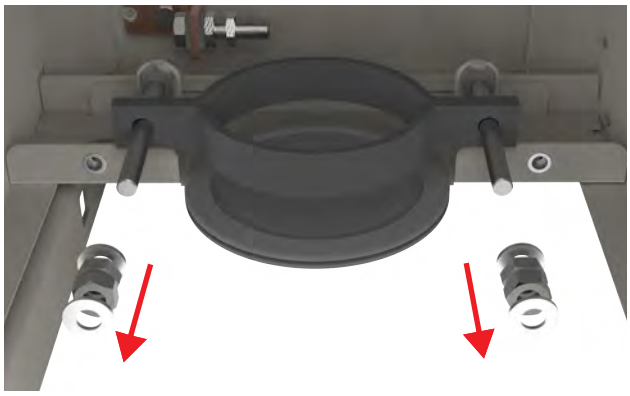


6 : Locate M6 bolts and the rear of the front gland plate in two places and unscrew the fixings to free the front cable clamp.

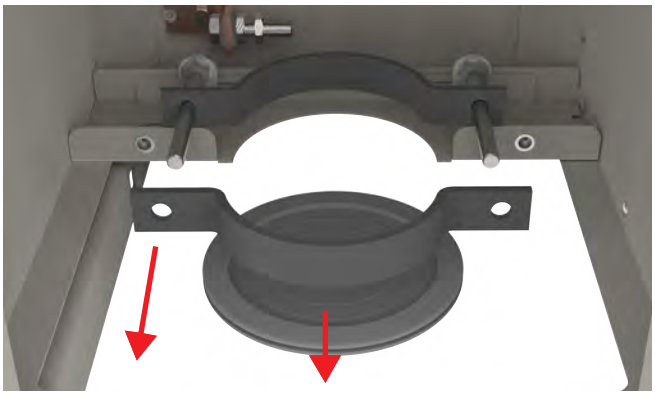
7 : Remove the front half of the gland plate.



8 : Remove the four M8 nuts and washers from the front of the cable clamp plate.



9 : Remove the front cable clamp and grommet (if fitted).



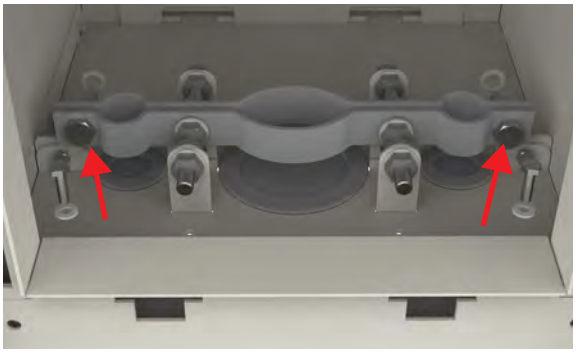
INFORMATION

Cable installation, **“section 15.5.1 Cable Installation - Single 3-core” on page 42.**

15.1.4 3 single core Gland Plate Removal

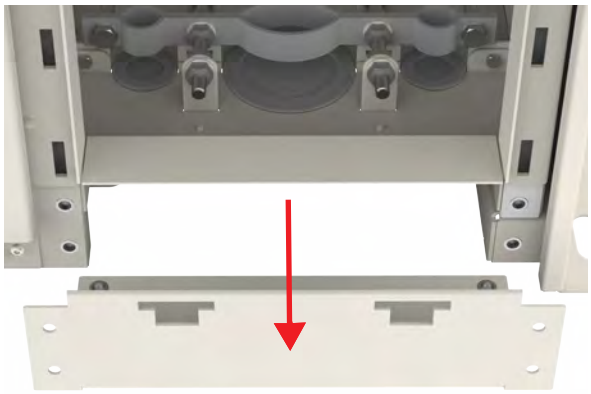
1 : Release the deflector by unscrewing the M6 fixings.

2 : Locate the M6 screw in two places inside the cable box.



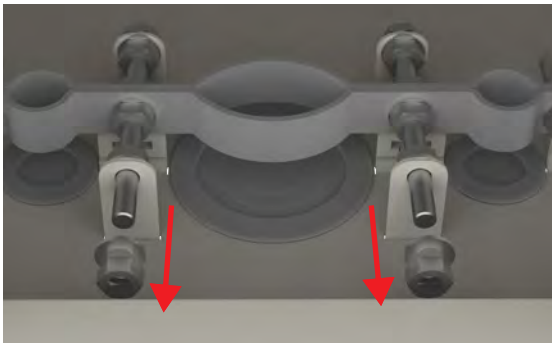
3 : Remove the M6 bolt and washer from the cable box in two places.

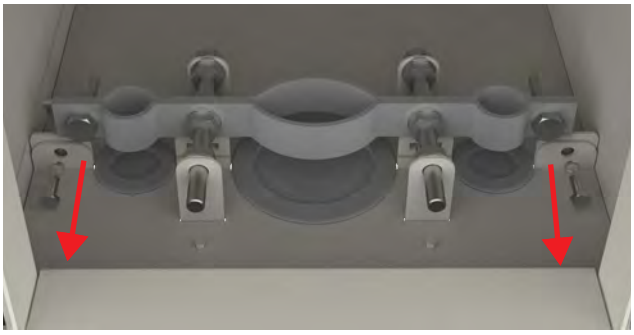
4 : Remove the deflector.



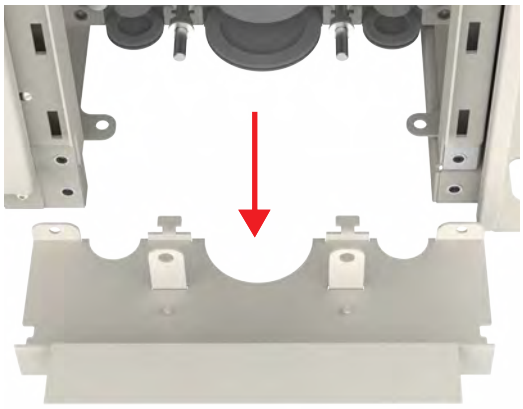
5 : To remove the front gland plate, unscrew the M6 screws and washers in four places.

6 : Locate M6 bolts and the rear of the front gland plate in two places and unscrew the fixings to free the front cable clamp.

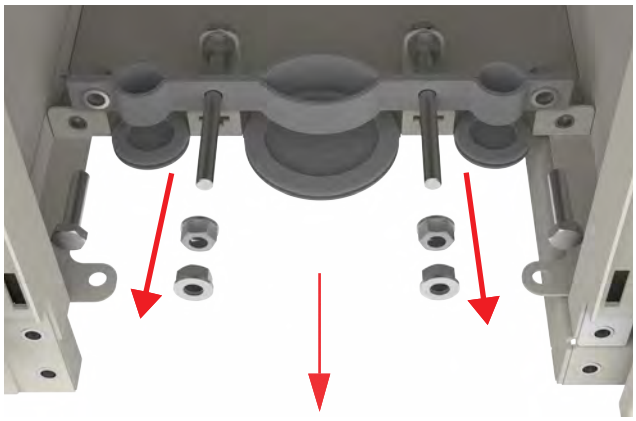




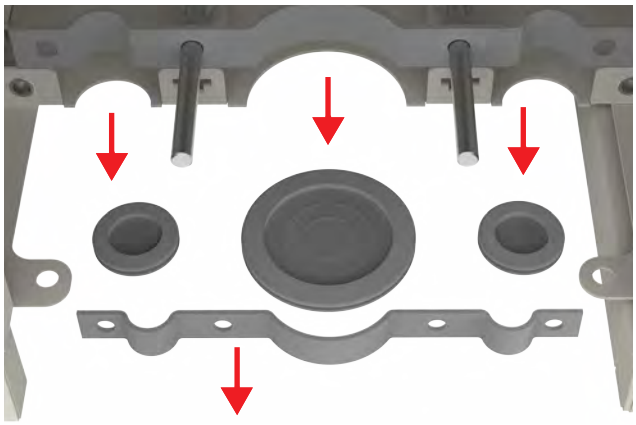
7 : Remove the front half of the gland plate, then the three grommets.



8 : Remove the four M8 nuts and washers from the front of the cable clamp plate.



9 : Remove the front cable clamp and grommets (if fitted).



INFORMATION

Cable installation, **“section 15.5.2 Cable Installation - 3 single core” on page 44.**

INFORMATION

The plinth, gland plates, support plate and cable box cover must be removed before commencing cabling.

15.2 Cable Terminations

The bushings for each function are located at the front of the unit.
The bushing type available :

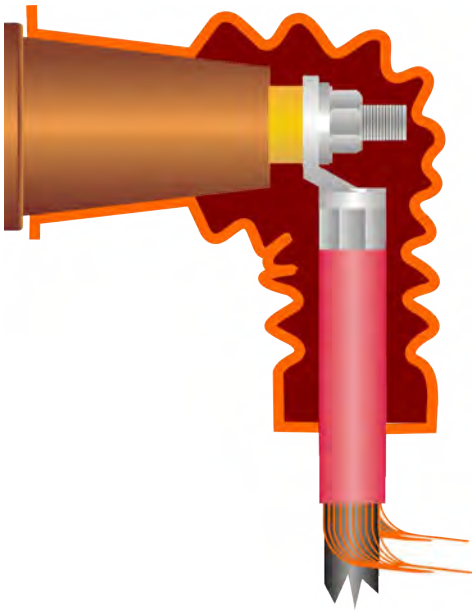
Bushing Type	Description	Functions	Maximum Cable Size
Type 'C'	with in-line bolted connection, M12 threaded in accordance with EN50181.	All function types	300mm² Single core cable 500mm² Three core cable

The bushings are accessible by removing the interlocked cable box covers at the front of the unit.

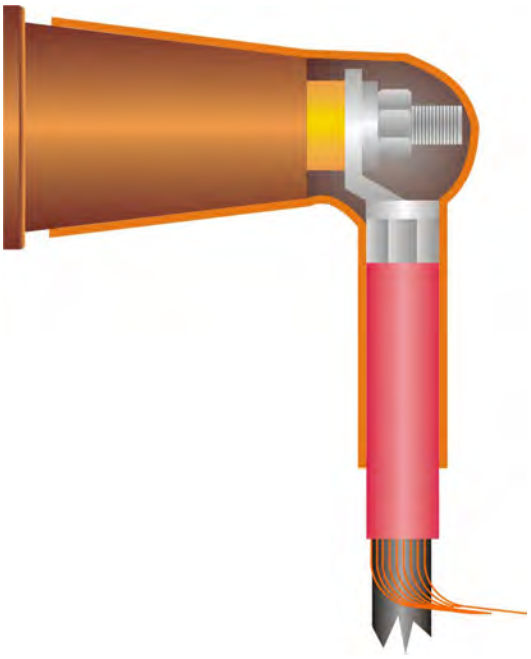
15.3 Cable Termination

The following types of cable terminations can be used with the AegisEcoTec:

Insulating Bushing Boot



Heat Shrink Insulating Bushing Boot

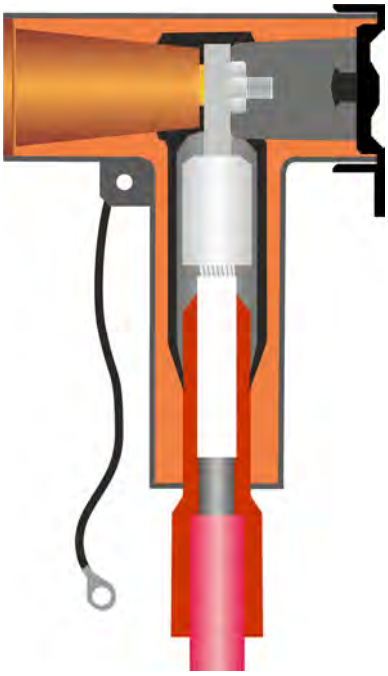


INFORMATION

Contact Lucy Electric for further cable termination details

M12 into copper - 35Nm
Cables can be routed via trenches, passages or ducts, depending on the type of gland plates fitted
All the cable boxes have removable covers for accessibility.

Plug-In Screened Elbow Connector



INFORMATION

Contact Lucy Electric for further cable termination details

Cables can be routed via trenches, passages or ducts, depending on the type of gland plates fitted
All the cable boxes have removable covers for accessibility.

To install the plug-in type sockets on to the end of each cable, comply with the socket manufacturer's instructions

Cables can be routed via trenches, passages or ducts, depending on the type of gland plates fitted
All the cable boxes have removable covers for accessibility.

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.

15.4 Cable Connecting Recommendations

CAUTION

The unit must be fixed to the floor before any cable connections are carried out - “section 13.4.1 Floor fixing” on page 25.

- 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.

Once the MV cables have been installed correctly, ensure no load is exerted on the bushings, by installing the cable clamps, see **“section 15.5.1 Cable Installation - Single 3-core” on page 42.**
The depth of the cable trenches must be compatible with the cables curvature radius

INFORMATION

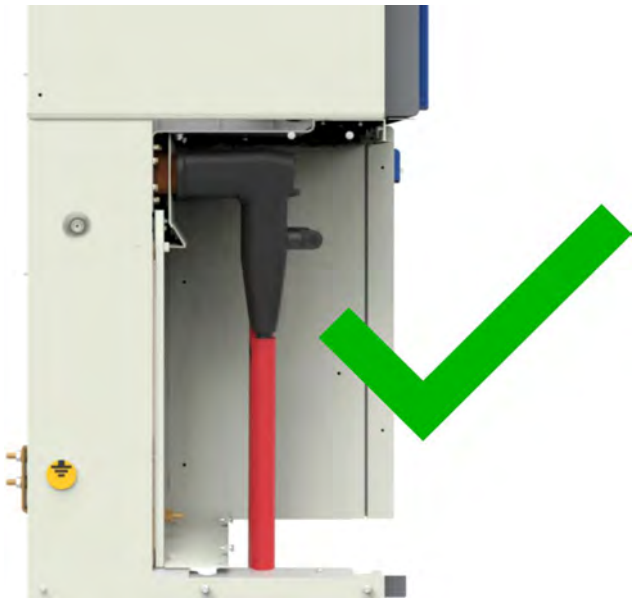
Ensure Plinth removal has been completed before continuing with the Cabling, see:“section 15.1 Plinth Removal” on page 33.for guidance.

WARNING

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.

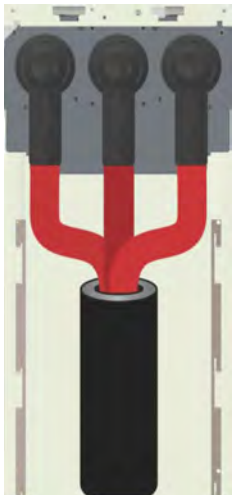


Incorrect Assembly

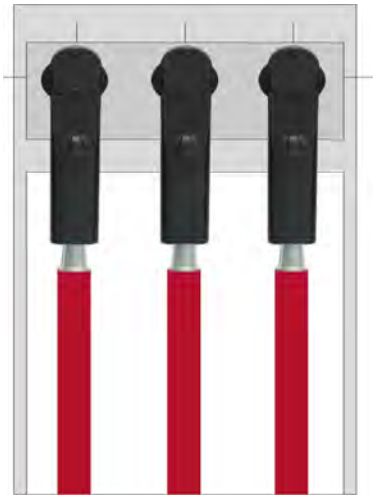
The cable termination must not pull on the bushing, as this can damage the AegisEcoTec Air Insulated 12kV Ring Main Unit unit and lead to gas leakage.

15.5 Cabling Installation

Single 3-core Cables



3 Single-core Cables



To begin this procedure the Plinth, Gland plate support base plate and Cable covers have to have been removed to gain access to the cable box, gland plates and before cabling.

Refer to: “section 15.1.1 Support base plate” on page 33.

15.5.1 Cable Installation - Single 3-core

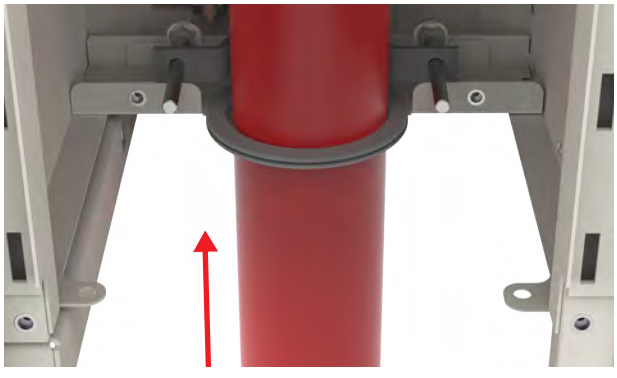
INFORMATION **This procedure is based on the single 3 core cable system.**

WARNING **The cable clamping must take the weight of the cable ensuring no mechanical load is exerted on the bushing.**

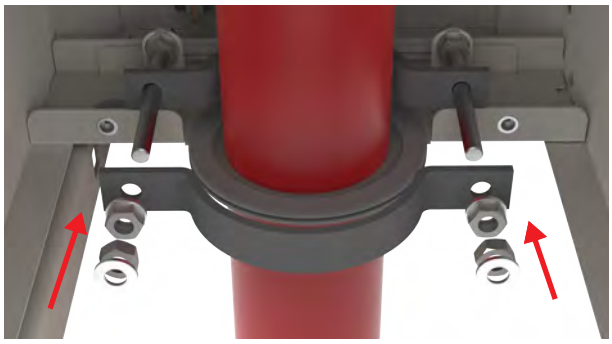
1 : Before installing cables ensure grommets, Front half of the gland plate and front cable clamp have been removed.

2 : Cut grommet as per cable diameter, then slide the grommets over cables and pull down to the gland plate.

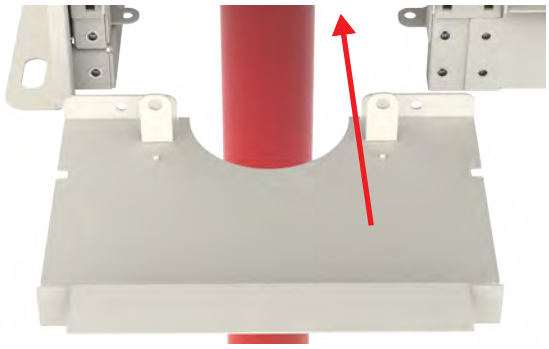
3 : Feed incoming cable up into the cable box and cut to length and slip over the grommet.



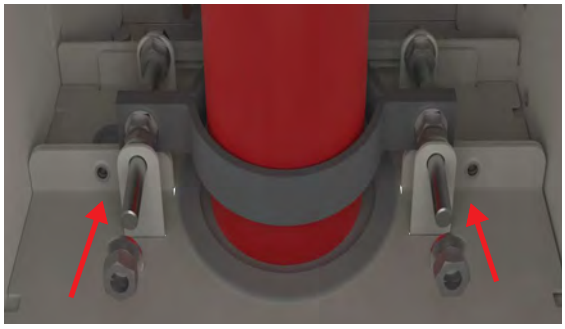
4 : Secure the front cable clamp using the M10 nuts, washers and spring washers in two places.



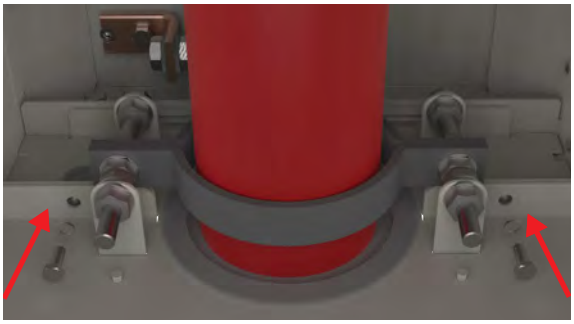
5 : Refit the front half of the cable gland.



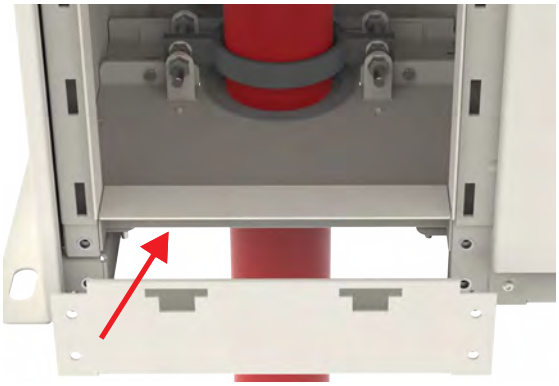
6 : Secure the front cable clamp using the M10 nuts, washers and spring washers.



7 : Secure the front gland plate using the M10 nuts and washers.



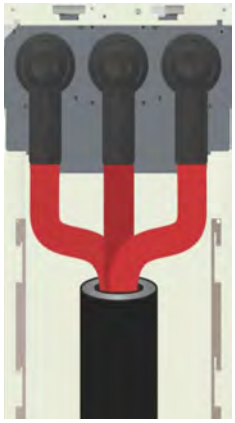
8 : Refit the deflector.



9 : Secure the deflector by screwing in the supplied M6 fixings.

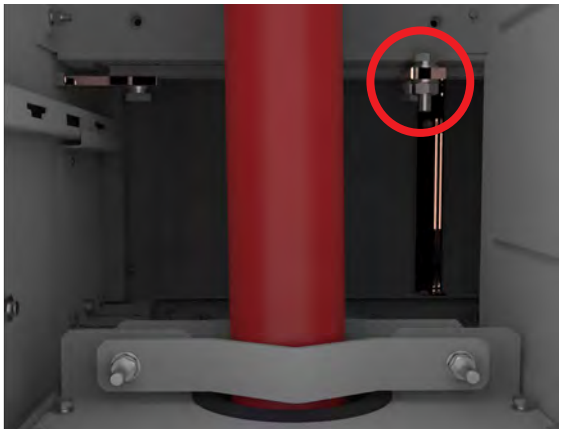
10 : Locate the M6 screw in two places at the front gland plate inside the cable box, screw the M6 fixings down in two places.

11 : Fit the end terminations to the incoming cable as per manufactures instructions.



INFORMATION

Earth point located at the rear of the cable box as shown below.



15.5.2 Cable Installation - 3 single core

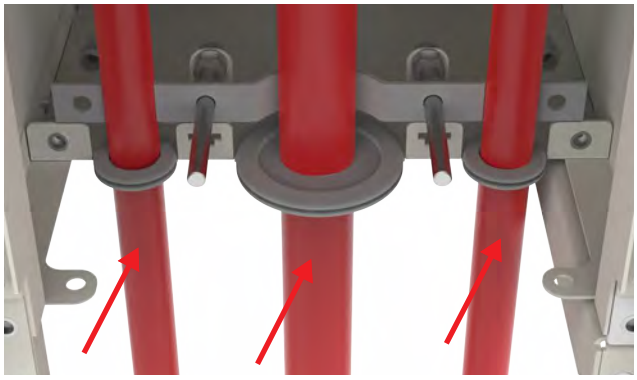
INFORMATION **This procedure is based on the 3 single core cable system.**

WARNING **The cable clamping must take the weight of the cable ensuring no mechanical load is exerted on the bushing.**

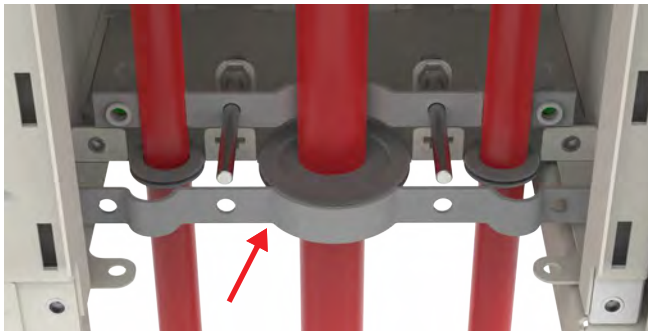
1 : Before installing cables ensure grommets, Front half of the gland plate and front cable clamp have been removed.

2 : Cut grommet as per cable diameter, then slide the grommets over cables and pull down to the gland plate.

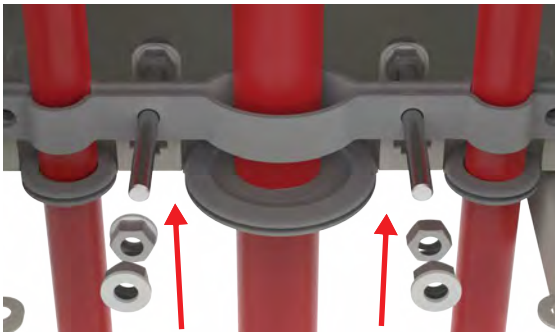
3 : Feed the incoming cables up into the cable box and cut to length.
Fit all three cables and slip over the grommets and locate in the half of the gland plate.



4 : Refit the front cable clamp.

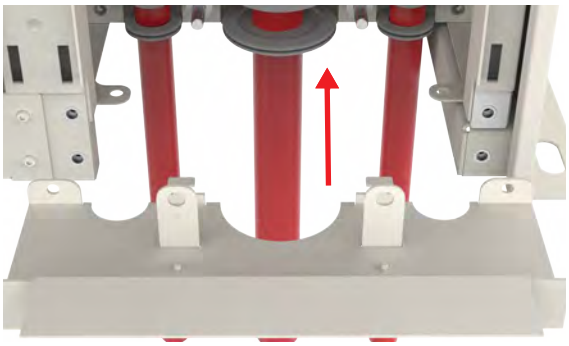


5 : Secure the front cable clamp using the M10 nuts, washers and spring washers.

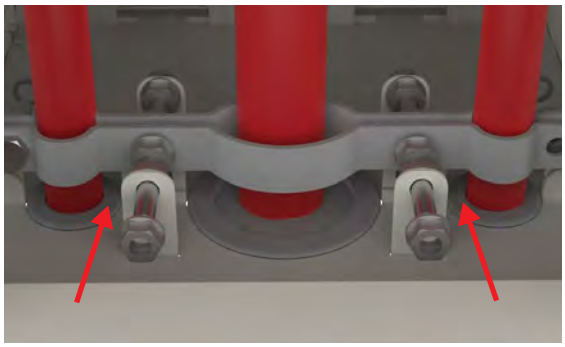


6 : Continue to secure the front cable clamps using the M10 washers nuts and bolts.

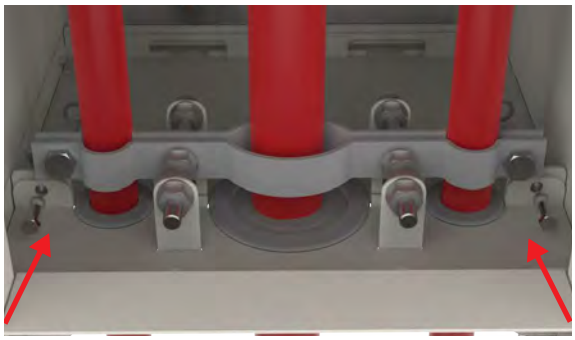
7 : Refit the front half of the cable gland.



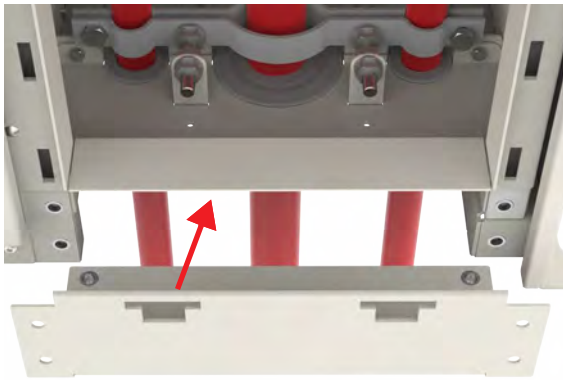
8 : Secure the front cable clamp using the M10 nuts, washers and spring washers.



9 : Secure the front gland plate using the M10 nuts and washers.

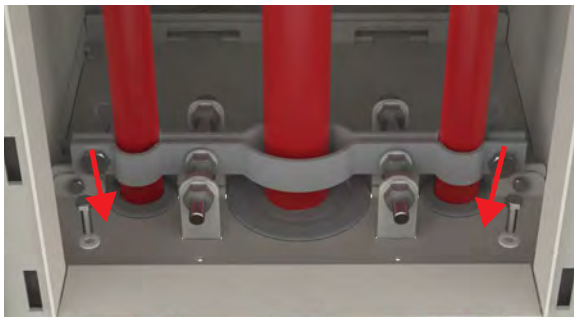


10 : Refit the deflector.



11 : secure the deflector by screwing in the supplied M6 fixings in three places.

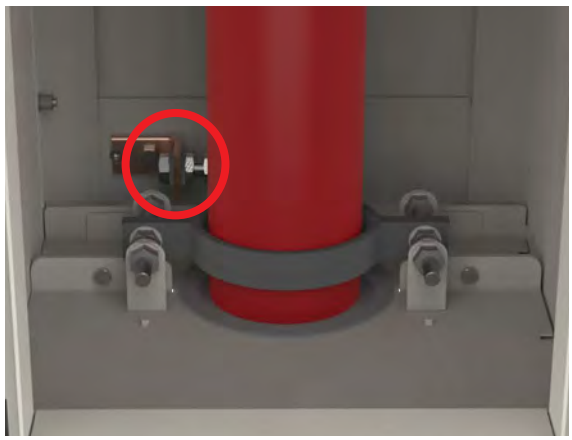
12 : Locate the M6 screw in two places at the front gland plate inside the cable box and screw the M6 bolt and washer from the cable box in in two places.



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

INFORMATION

Earth point located at the rear of the cable box as shown below.



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 then 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:

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