Aegis 36 technical documentation

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Installation, Test and Commissioning Manual

Operating and Maintenance Manual

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Lucy Electric

Aegis 36

Installation, Test and Commissioning Manual

engineering intelligent solutions

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 Aegis 36. Produced in December 2022, this manual applies to the Aegis 36 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.

This equipment contains the fluorinated greenhouse gas sulphur hexafluoride (SF6) covered by the Kyoto Protocol with a global warming potential. SF6 shall be recovered and not released into the atmosphere.

For further information on use and handling of SF6:

Refer to IEC 62271-4:2013 High-voltage switchgear and control-gear – Part 4: Handling procedures for sulphur hexafluoride (SF6).

3. GENERAL PRODUCT INFORMATION

Aegis 36 is a compact SF_6 insulated ring main unit, which is specially designed for secondary distribution networks, wind farms and photovoltaic power stations with ratings of up to 36kV.

Modularity – The flexibility of function combinations allows for Load Break Switch and Circuit Breaker modules to be placed in any position in the unit, according to the customer specification.

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

Housing – The housing of the Aegis 36 is fully treated using zinc coated steel and electrostatically applied oven cured paint to resist weather and aggressive atmospheric environments.

Circuit Breaker – Comprised of three single phase vacuum interrupters (which have fault make break rating) and in series with 3 position disconnector incorporating **ON**, **OFF** and **EARTH-ON** position. The opening of the circuit breaker occurs automatically when a fault is detected, or manually when the push-to-trip button is actuated.

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

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

Test facilities – Fully integrated and interlocked earth and test facilities in accordance with ENATS 41-36 requirements. Access to the test terminals is achieved by opening the cover located on the front fascia.

Interlocks – Positive operation safety interlocks are incorporated on all switch and circuit breaker positions.

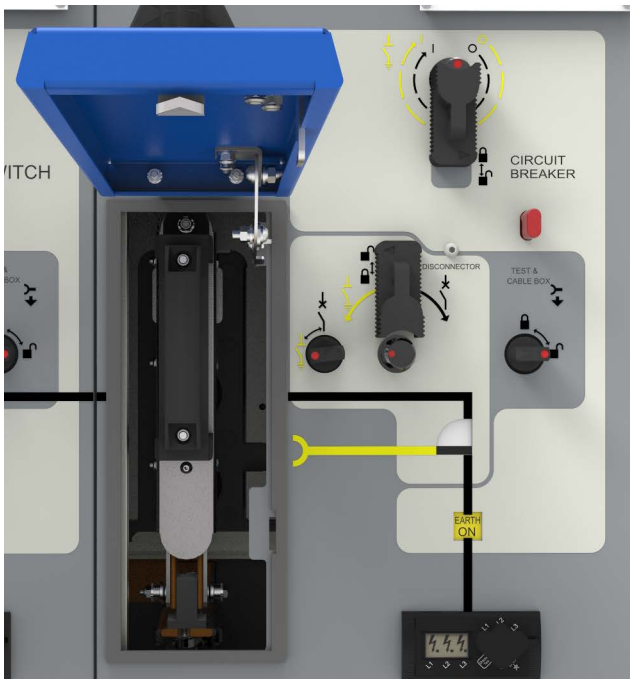
Padlocks – All switch and selector positions can be padlocked. The padlock has an 8.5 mm diameter hole size.

Pressure Gauges – Aegis 36 has three types of pressure gauges available, see "Pressure Indicators" on page 8 step 1

3.1 Test facilities

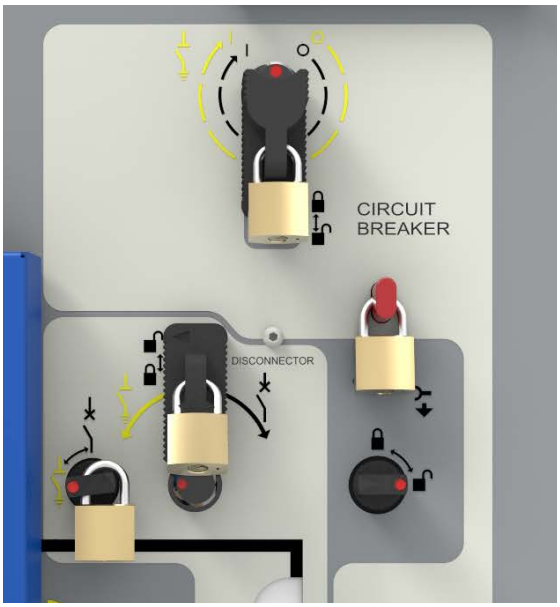
The Aegis 36 has optional fully interlocked integrated Earth and Test facilities. Access to the Earth and Test terminals are achieved by opening the Earth and Test door located on the front fascia.

See LIOM16-015 Operating & Maintenance Manual, section: “Earth & Test Access”.



3.2 Padlocks

All switch and selector positions can be padlocked. The padlock has an 8.5mm diameter hole size.



3.3 Pressure Indicators

The Aegis 36 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

Pressure Indicators Technical Data	
Accuracy	±1% at 20Deg.
Scale Range (Relative)	-1...0.8 Bar
Appearance	-1...0.2 Bar Red Zone 0.2 - 8.0 Bar Green Zone
Signalling Contact (Only in GDM)	1 x NO
Threshold Pressure	0.2 Bar
Connections to the Tank	Solid

4. FRONT PANEL LAYOUT

Legend:

1 : Gas Pressure Indication
2 : Earth Fault Indicator
3 : Rating Plate
4 : Load Switch Operation Collar
5 : Earth & Test Access Cover
6 : Load Switch Selector Indication Window
7 : Load Switch Position Indication Window
8 : LV Panels
9 : Load Switch Selector
10 : Load Switch Cable Test & Cable Box Interlock
11 : Voltage Detection System
12 : Protection Relay
13 : Circuit Breaker Operation Collar
14 : Circuit Breaker Disconnector Collar
15 : Circuit Breaker Cable Test & Cable Box Interlock
16 : Circuit Breaker Disconnector Selector
17 : Disconnector Position Indication Window
18 : Circuit Breaker Position Indication Window
19 : Operation Handle
20 : Document Holder
21 : Cable Compartment
22 : Push-to-trip Button

5. TECHNICAL DATA

General	
Rated voltage	36kV
Rated frequency	50/60Hz
Busbar Rated normal current	630A
Busbar Rated short time withstand current	21kA (1 s & 3 s), 25 kA (1 s & 3 s)
Busbar Rated peak withstand current	52.5kA, 62.5/65kA
Rated lightning impulse withstand voltage	
Phase-to-earth	170kVp
Across isolating gap	195/220kVp

Rated power frequency withstand voltage

Phase-to-earth	70kV for 1 min
Across isolating gap	80kV for 1 min
Degree of Protection	
Indoor	IP41
Outdoor	IP54
Tank with HV parts	IP67
Mechanical impact protection	IK07 indoor / IK10 outdoor
Internal arc rating	
AF/AFLR	16kA 1 sec, 20kA 1 sec, 25kA 1 sec
SF6 gas	
Annual leakage rate	<0.1%
Filled pressure (at 20ºC)	0.4 Bar (G)
Minimum operating pressure	0.2 Bar (G)
Installation conditions	
Ambient air temperature	-25 to +55°C
Maximum altitude	1000m
Relative humidity (max) – over period of 24hrs (IEC 62271-1, sub-clause 2.1)	95%
Salt deposit	40 mg/100 cm2mg/cm2
Continuity of Service	LSC2 Class
Partition Class	PM Class

Load Break Switch: L Function (Non-auto reclose)	
Rated normal current	630A
Rated circuit breaking current	630A
Rated cable charging breaking current	35A
Rated cable & Line charging breaking current under earth fault	35A
Rated cable and line charging current	60A
Rated earth fault breaking current	105A
Main electrical circuit	
Rated short time withstand current	21kA (1 s & 3 s), 25 kA (1 s & 3 s)
Rated peak withstand current	52.5A, 62.5/65.0A
Earthing circuit	
Rated short time withstand current	21kA (1 s & 3 s), 25 kA (1 s & 3 s)
Rated peak withstand current	52.5A, 62.5/65.0A
Mechanical endurance class	
Load break switch / Circuit Breaker	Class M1 (2000 operations)
Earth switch	Class M0 (1000 operations)
Electrical endurance class	
Load break switch	Class E3 (100 load breaks and 5 fault makes Operations)
Earth switch	Class E2 (5 fault makes Operations)
Operating mechanism	
Operating sequence for mechanism	-
Local: Close – Open	Hand Lever Close–Open
Remote: Close – Open	Motor Close–Open

Circuit Breaker Switch: V Function (Non-auto reclose)	
Rated normal current	630A
Rated short circuit breaking current	25kA
Rated cable charging breaking current	100A
Rated line charging breaking current	10A
Rated cable and line charging current	-
Rated earth fault breaking current	-
Main electrical circuit	
Rated short time withstand current	21kA (1 s & 3 s), 25 kA (1 s & 3 s)
Rated peak withstand current	52.5, 62.5/65.0
Earthing circuit	
Rated short time withstand current	21kA (1 s & 3 s), 25 kA (1 s & 3 s)
Rated peak withstand current	52.5, 62.5/65.0
Mechanical endurance class	
Load break switch / Circuit Breaker	M1 (2000 operations)
Earth switch	M0 (1000 operations)
Electrical endurance class	
Circuit Breaker	Class E2 (5 fault makes Operations)
Earth switch	Class E2 (5 fault makes Operations)
Operating mechanism	
Operating sequence for mechanism	O-3min-CO-3min-CO
Local: Close – Open	Lever – Push Button
Remote: Close – Open	Motor – Shunt Trip Coil

6. LINE DIAGRAMS

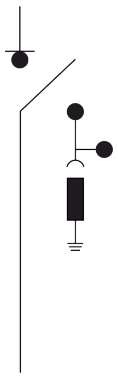
INFORMATION

All line diagrams shown are examples only.

6.1 Non-Extensible Functions.

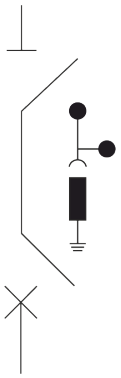
6.1.1 Single Function L: Load Break Switch 630A

Incoming/outgoing unit with load switch disconnector.



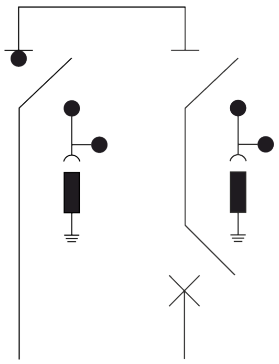
6.1.2 V: Circuit Breaker 630A

Transformer protection unit with vacuum circuit breaker.



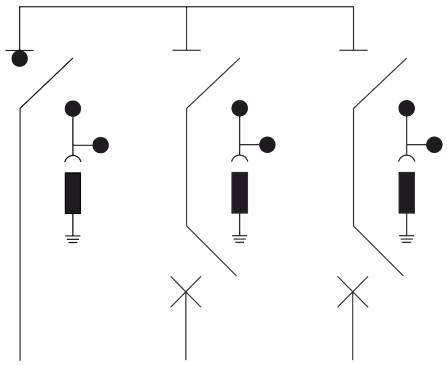
6.1.3 2-Way (LV)

Example of a 2-Way configuration.



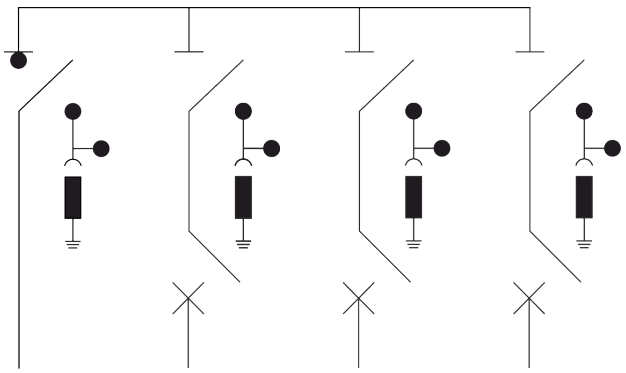
6.1.4 3-Way (LVV)

Example of 3-Way configurations.



6.1.5 4-Way (LVVV)

Example of a 4-Way configuration.



7. DIMENSIONAL DRAWINGS

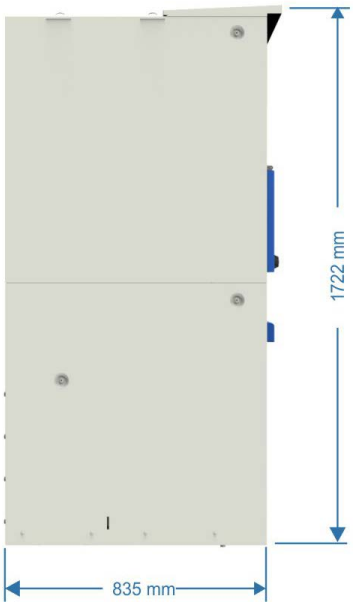
7.1 Unit Range - Dimensions and Weights

INFORMATION

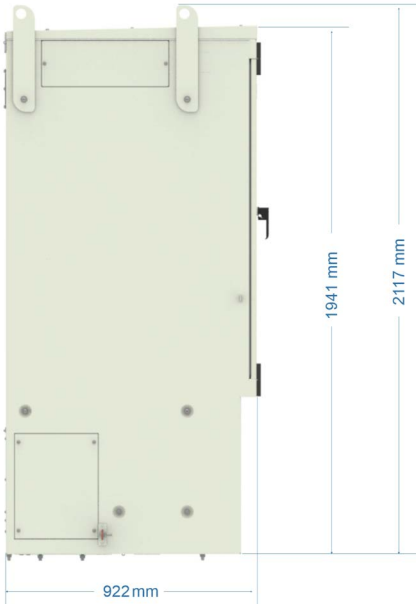
Unit weights stated are for guidance purpose only. Weights will vary depending on optional facilities added to the unit.

Dim A Cable Termination Height (mm)
Standard Termination Height=653mm
With additional Baseframe of 250mm= 903mm

7.1.1 Non Extensible Height



7.1.2 Extensible Height



7.1.3 1 - Way Outdoor

7.1.4 1 - Way Indoor

7.1.5 2 - Way Outdoor

7.1.6 2 - Way Indoor

7.1.7 3 - Way Outdoor

7.1.8 3 - Way Indoor

7.1.9 4 - Way Outdoor

7.1.10 4 - Way Indoor

7.1.11 Weights

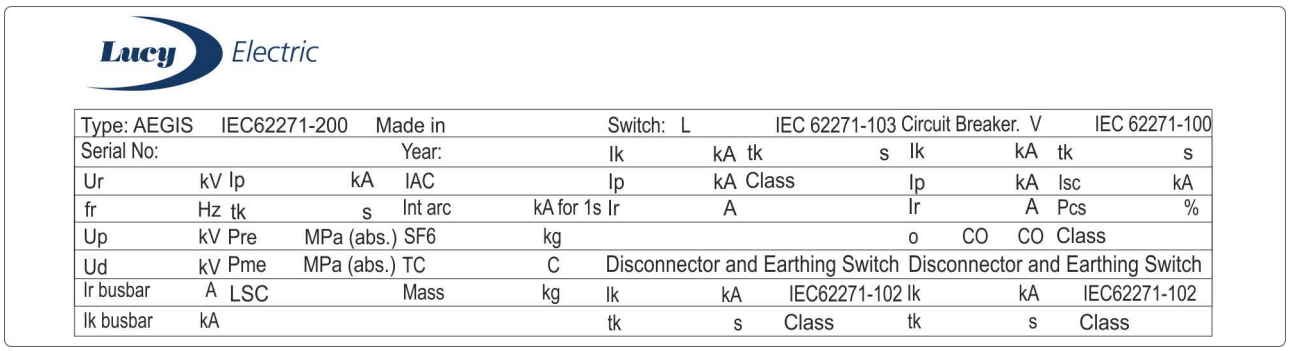
No of Ways	Indoor/Outdoor - Non Extensible (kg)	Indoor/Outdoor - Extensible (kg)
1-Way	-	400
2-Way	520	570
3-Way	850	950
4-Way	1000	1100

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:



Pme - SF_6 gas rated filling pressure (density) for operation

fr - Rated Frequency

Up - Lightning impulse withstand voltage

Ud - Power frequency withstand voltage

Ir - busbar Rated normal current

Ik - busbar Short time withstand current (RMS)

Ip - Short time withstand current (peak)

tk - Short time withstand current rated duration of short circuit

Pcs - D.C. component of rated short-circuit breaking current at contact separation corresponding to the d.c. time constant of the rated shortcircuit breaking current

Pre - SF_6 gas rated filling pressure (density) for insulation

Ur - Rated Voltage

LSC - Loss of service continuity category

IAC - Internal arc classification

Int arc - Internal arc rating of unit tank

SF_6 - Mass of SF_6 gas

TC - Temperature class

Mass - Weight of unit

Class - Electrical/mechanical endurance

Isc - Short Circuit Current

8.2 Standards

Aegis complies with the 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 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 Aegis 36 unit.

- Unit Chassis & Panels = **RAL 9002** – Grey white
- Fascia = **RAL 7046** - Telegrey
- 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.

9.3 Symbol guidance

INFORMATION

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

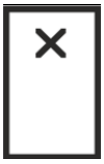
Handle with care

This way up

Keep away from direct sunlight

Storage Temp

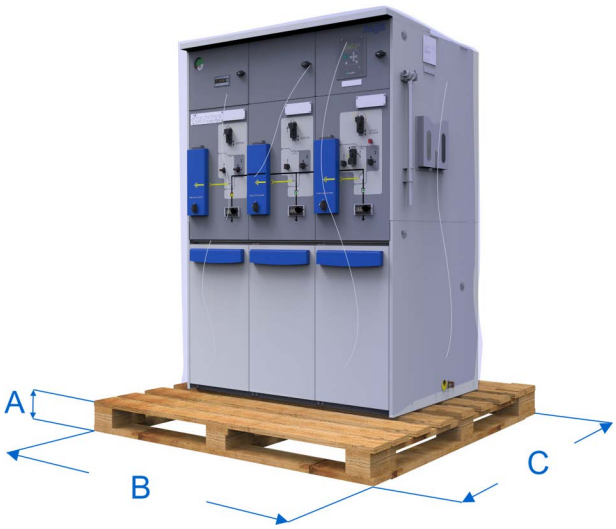
Do not step on



High centre of gravity

Do not stack

9.4 Packaging Dimensions



Package Dimensions			
Fn	Dimensions in mm		
	Height (A)	Width (B)	Depth (C)
1	150	700	1000
2	150	1000	1000
3	150	1600	1050
4	150	1900	1050

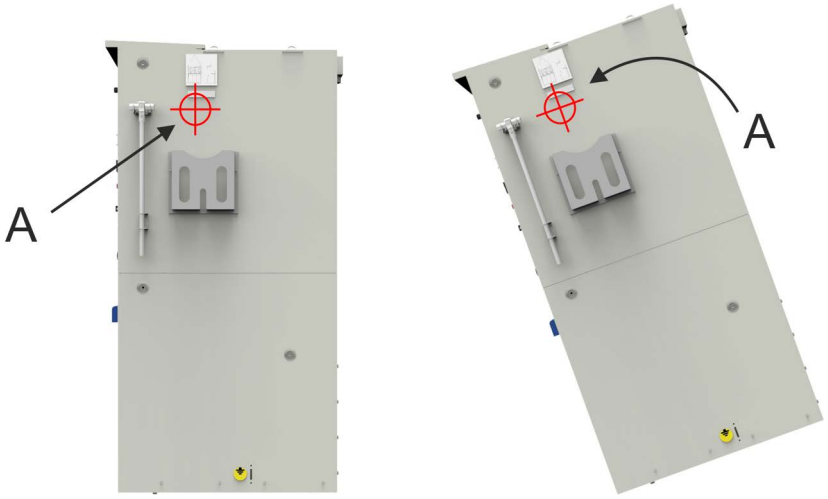
Fn = Number of functions

For unit weights, see “section 7.1.11 Weights” on page 16

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 **The unit has a high centre of gravity “(A)”.**



CAUTION

Keep all Aegis 36 unit surfaces clear, Do not place/rest objects on top of the Aegis 36 unit.

9.6 Forklift Truck

INFORMATION

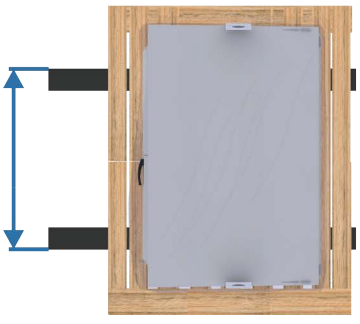
There are two ways to handle an Aegis unit (indoor/outdoor), using a fort lift truck with Solution (A) being the recommended way.

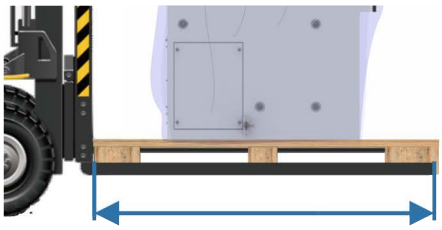
WARNING

When handling with a fork lift truck, beware the high centre of gravity of the unit, see “section 9.5 Transportation ‘centre of gravity” on page 18

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.**

9.7 Removing unit from pallet

When removing the unit from the pallet a few items must be temporally removed to access all mounting holes. See the following procedure below.

1 : Place the device with pallet on the ground.

2 : Remove all unit protection packaging.

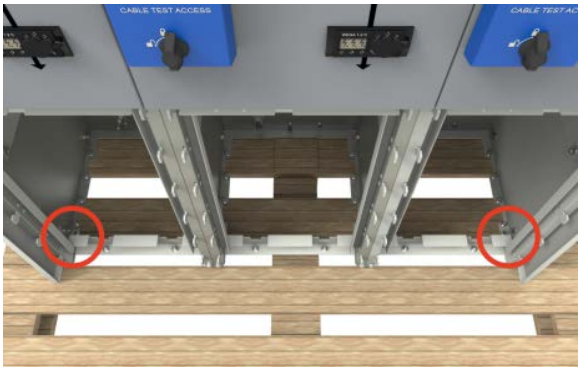
3 : Remove all the cable box covers from the unit.

Note: All functions must be switched to "Earth On" before the cable box covers can be removed. See "section 15.1 Removing Cable Box Front Panels" on page 47

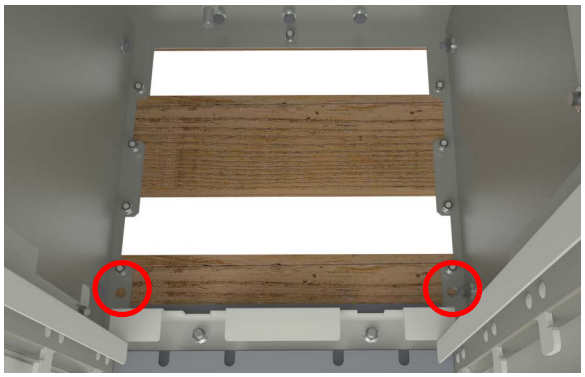
For Gland Plate Removals see options below.

- Refer to "section 15.2.1 Cable Clamp and Gland Removal - Circuit Breaker Function." on page 48
- Refer to "section 15.3.1 Cable Clamp and Gland Removal - Switch Function." on page 50.

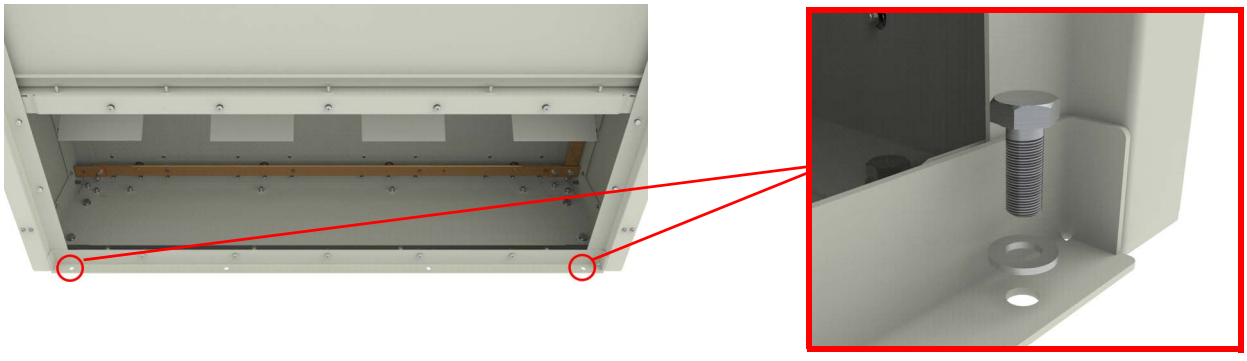
4 : With access to the 2x mounting holes, at the front of the unit, the 2 bolt fixings can be removed.



Note: If the split gland plate is fitted, then remove the front clamping nuts also.



5 : Located at the rear of the unit are the remaining fixings in place, shown below (see "section 13.4 Aegis Unit Floor Mounting Details" on page 32 for hole positions). Remove the bolt fixings from the pallet to free the unit.



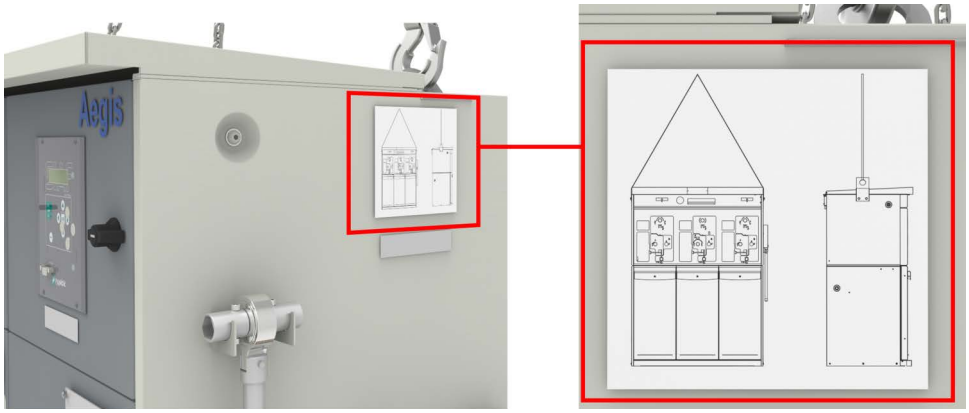
6 : Unscrew and remove the bolts from pallet.

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

9.8 Lifting Options

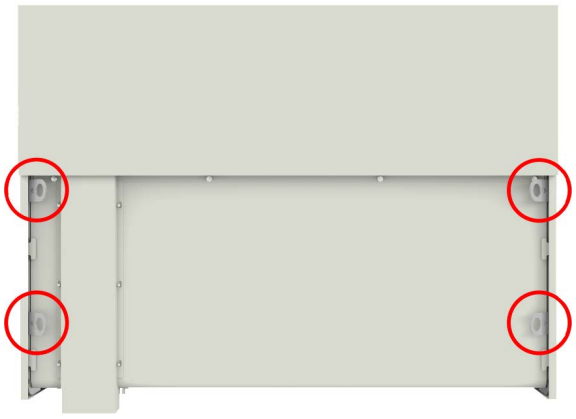
9.8.1 Lifting Label Location

Slinging label is located on the right hand side of the unit, as shown below.

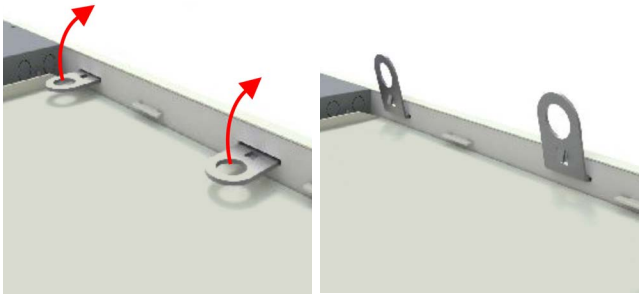


9.8.2 Lifting Hooks- Indoor Unit

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



2 : Pull the unit's hooks up so that they are vertical.



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

4 : The unit can now be crane lifted.

9.8.3 Lifting Lugs - Outdoor Unit

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

2 : Lifting lugs are pre installed ready for lifting

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

4 : The unit can now be crane lifted.

9.9 Packaging

After unpacking, the remaining materials (plastic cover and wooden pallets) must be sorted and recycled appropriately. When unpacking, check the functioning of Aegis 36 units (see LIOM16-015 Operating & Maintenance manual for further information).

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

9. STORAGE

⚠ CAUTION

Units are shipped with all covers closed and bolted.

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.

Storage Guide

Keep dry

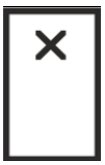
Handle with care

This way up

Keep away from direct sunlight

Storage Temp

Do not step on



High centre of gravity

Do not stack

The unit must be kept under it's original packaging throughout it's whole storage period.

⚠ 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 (AF & AFL)

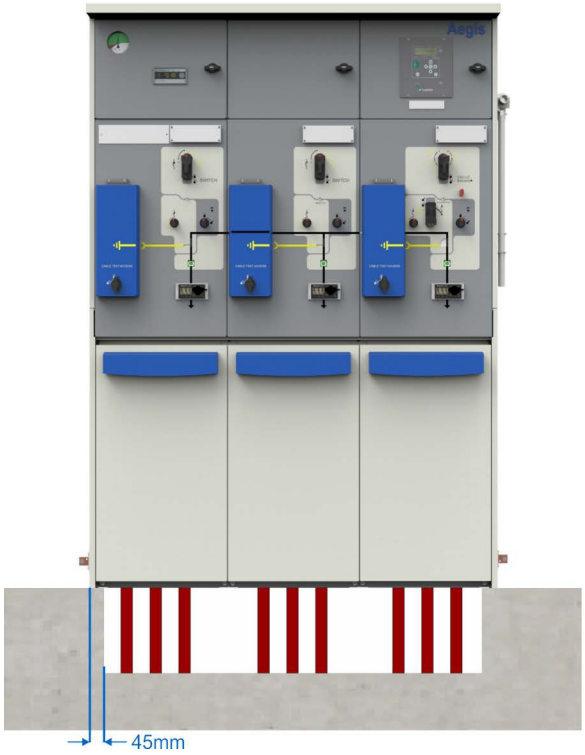
* Consult Lucy Electric for a reduced ceiling height.

11.2 Trench Details

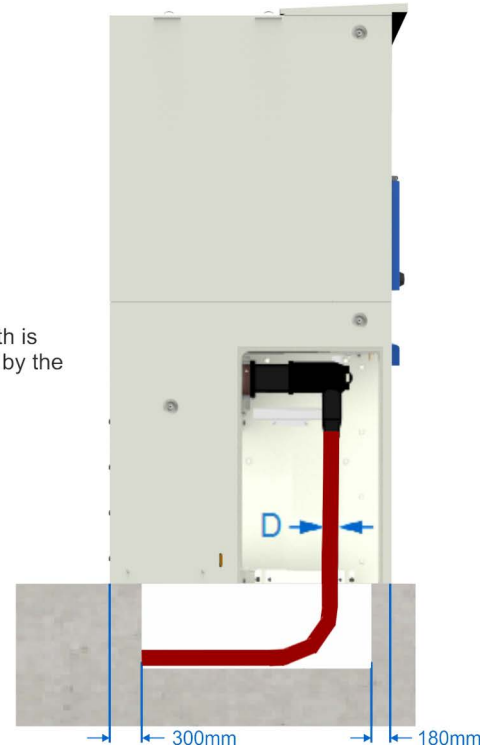
For trench fixing layout, refer to contract drawing.

Cables can be routed from the left, right, front or rear via a trench. The size of the trench is determined by which type of units are being installed.

For trench depth, contact cable supplier for information on the cable curvature.
If a trench is not used, then a raised plinth can be supplied as an option.

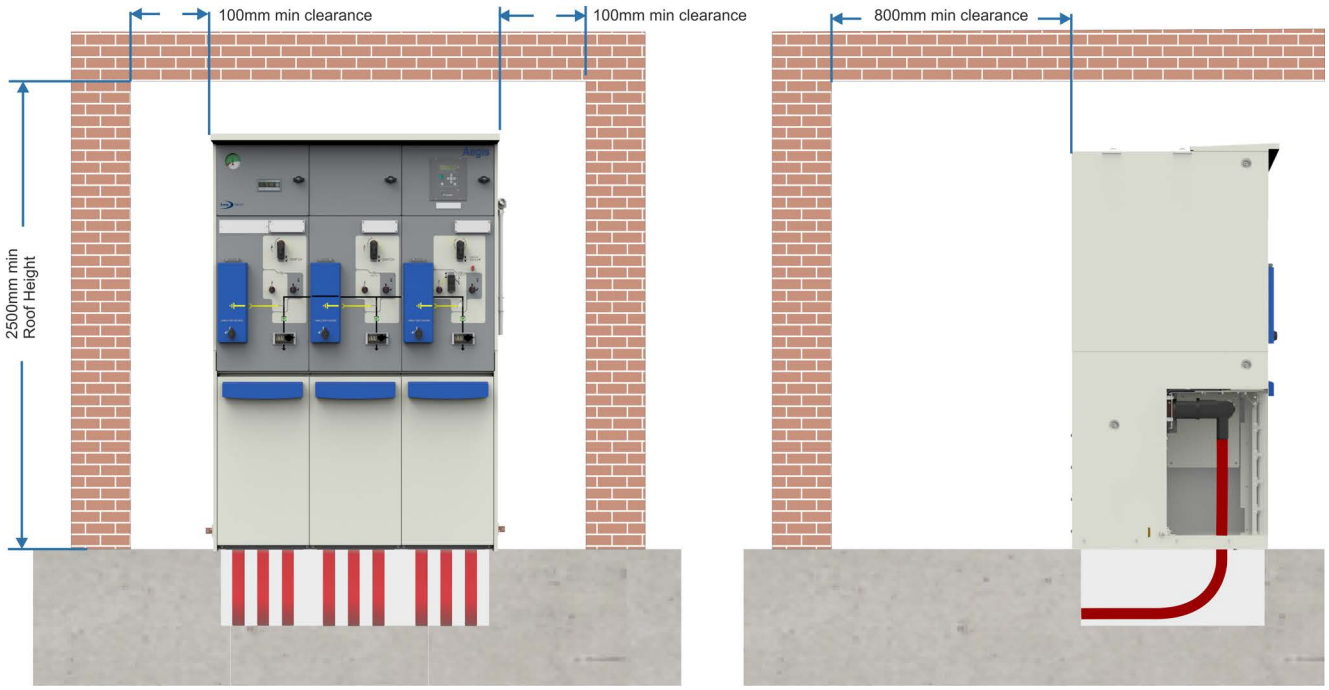


Trench depth is determined by the cable size



11.3 Substation Position Clearance For Unit Type (AF)

* Consult Lucy Electric for a reduced ceiling height.



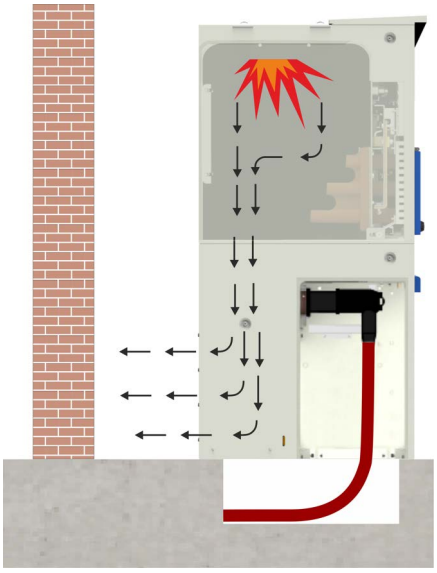
11.4 Internal arc gas evacuation via the back of the unit (AF/AFLR)

This symbol indicates the evacuation direction of the exhaust gases after ignition of the internal arc.

This symbol indicates the internal arc ignition

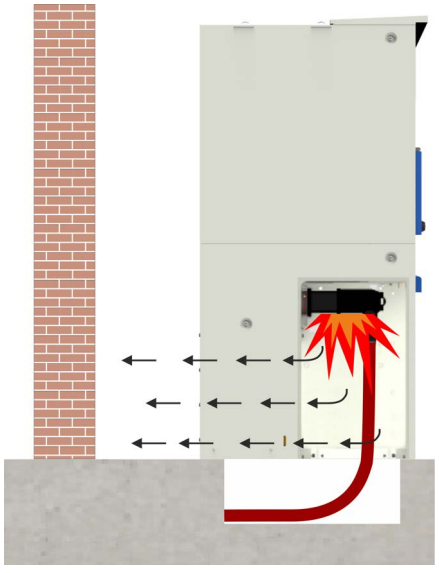
AF Tank Arcing - Trench Venting
Internal arc ignition inside the tank

Internal arc Reaction - Max 36kV - 25kA 1 sec.



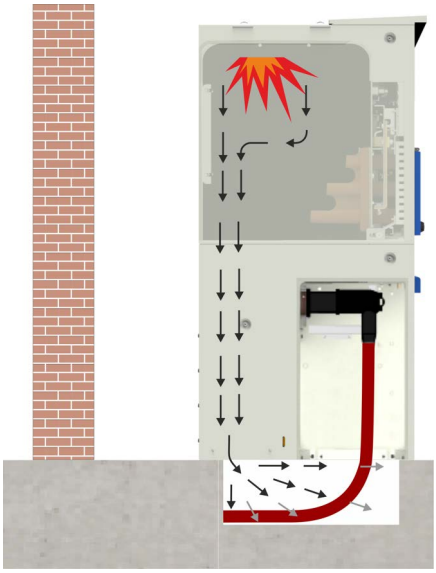
AF Cable Box Arcing - Trench Venting
Internal arc ignition inside the cable box

Internal arc Reaction - Max 36kV - 25kA 1 sec.



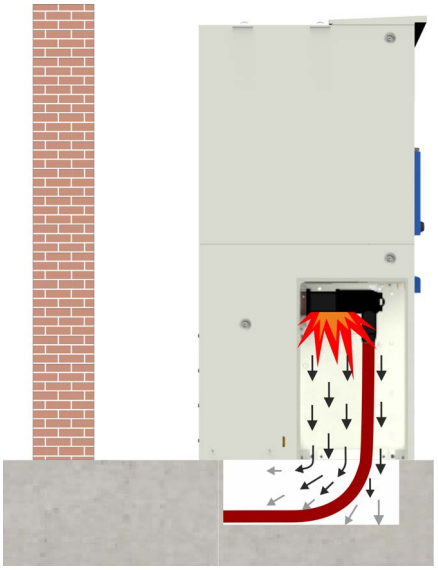
AFLR Tank Arcing - Trench Venting
Internal arc ignition inside the tank

Internal arc Reaction - Max 36kV - 25kA 1 sec.



AFLR Cable Box Arcing - Trench Venting
Internal arc ignition inside the cable box

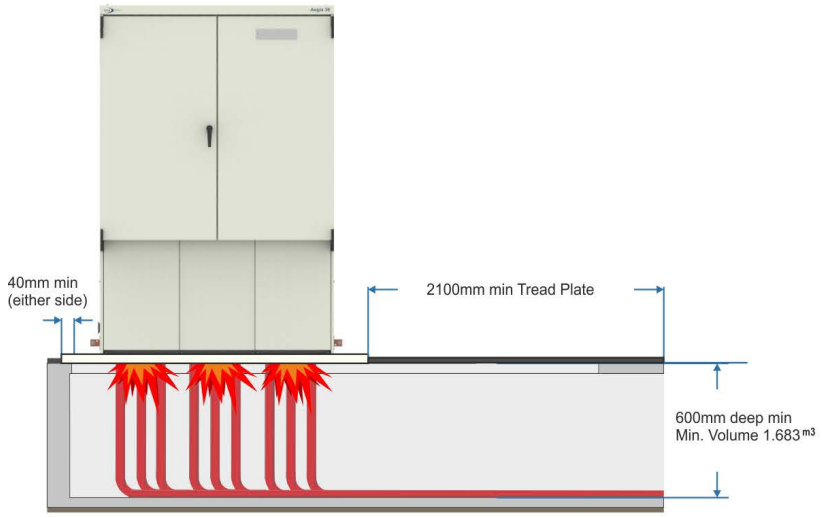
Internal arc Reaction - Max 36kV - 25kA 1 sec.

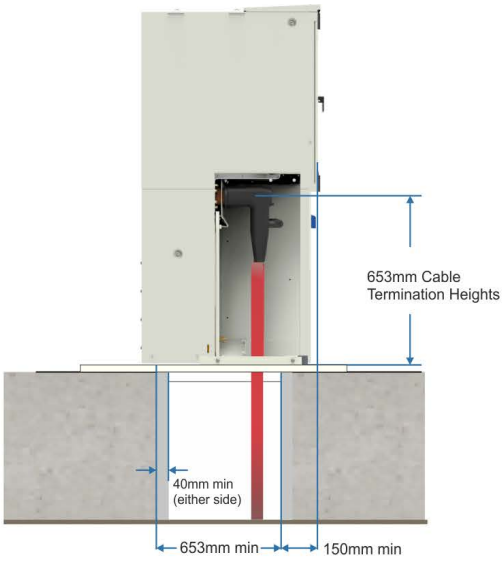


11.4.1 AFLR Trench Details - Outdoor

Cables can be routed from the left, right, front or rear via a trench. The size of the trench is determined by which types of units are being installed.

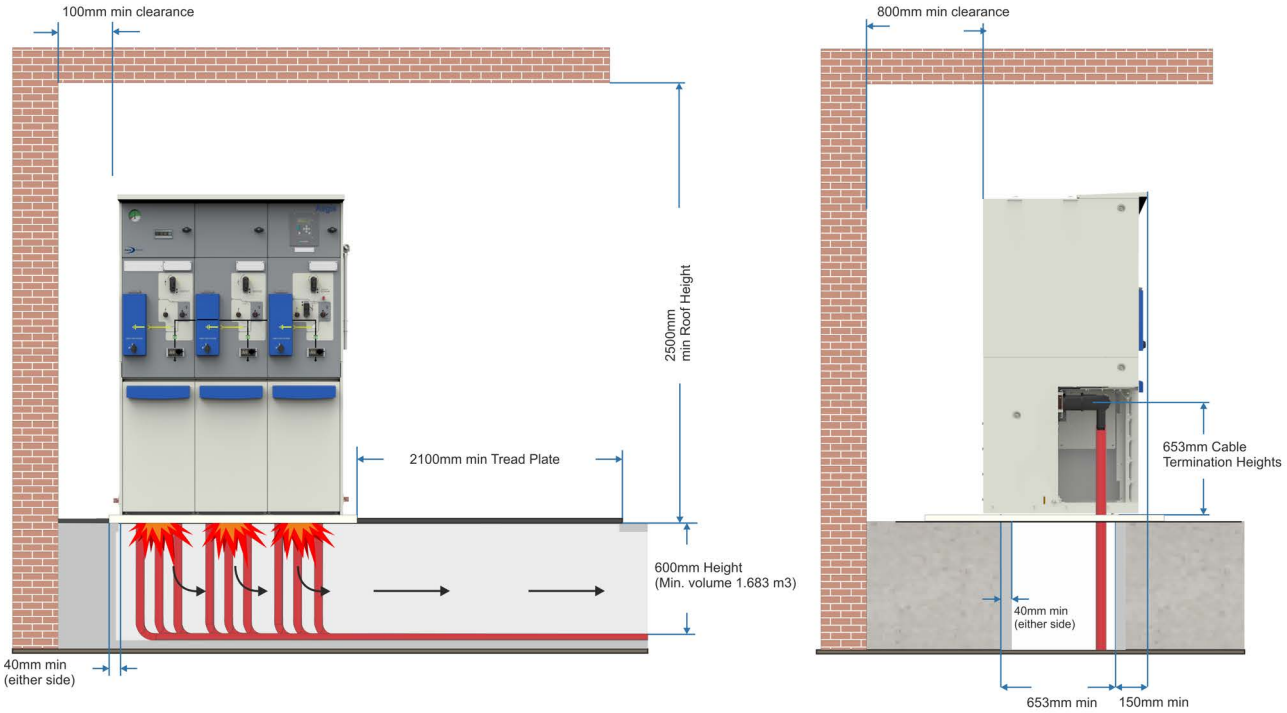
For trench depth, contact cable supplier for information on the cable curvature.





11.4.2 AFLR Trench Details - Indoor

For trench fixing layout, refer to contract drawing. Cables can be routed from the left or right via a trench.

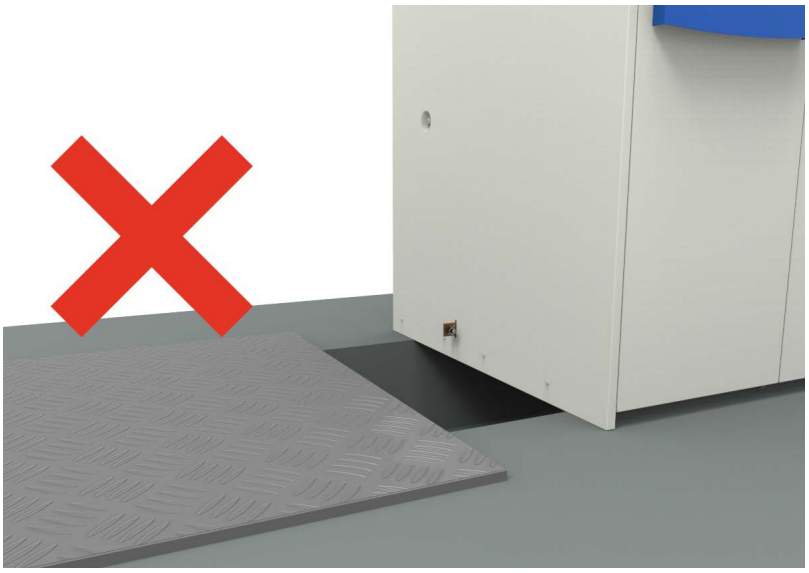


11.4.3 Tread plates

WARNING

Tread plates are to be securely fixed to the floor and are to be fitted hard up against the Aegis unit leaving no gaps.

Ensure any exposed trench around the Aegis unit is covered with Tread Plate, as any gaps will affect the integrity of the Aegis unit AFLR class rating.



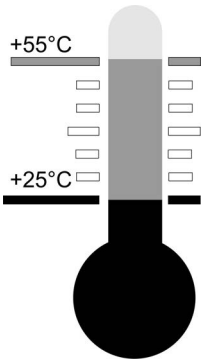
12. INSTALLATION RECOMMENDATIONS

12.1 Operating Conditions

WARNING

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

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



12.2 Installation recommendations

DANGER

DO NOT OPERATE THE UNIT IF IT IS DAMAGED.

CAUTION

Condensation can cause problems with the Aegis 36 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.

CAUTION

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

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 SF6 gas

Before installation and energising, check that the SF_6 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 Aegis 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 Aegis 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

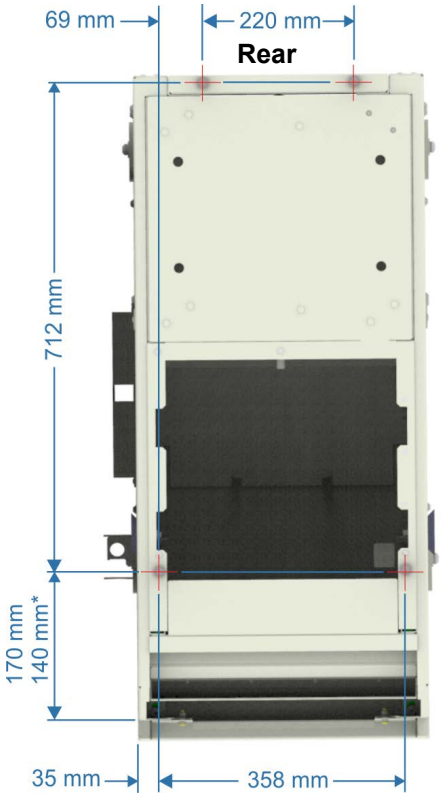
The concrete plinth must have no unevenness of greater than 7mm over a length of 2m and a width of 1m.

The Aegis unit MUST BE bolted to the floor in all four fixing points.

When mounting the unit to the floor a few items must be temporarily removed to access the four mounting holes, See “Removing unit from pallet” on page 21.

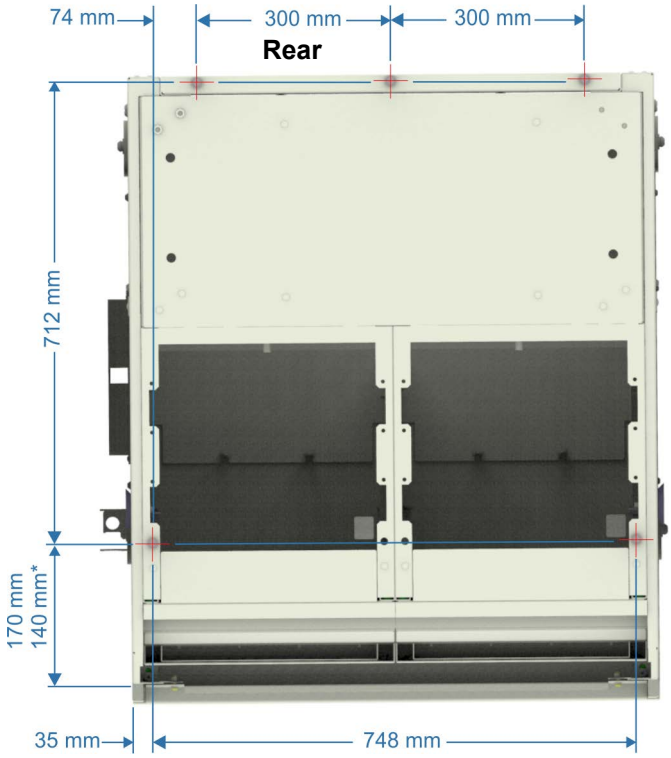
Prepare the ground for floor mounting by marking out, then drilling the required holes to suit the M10 bolts supplied.

13.4.2 1-Way Units



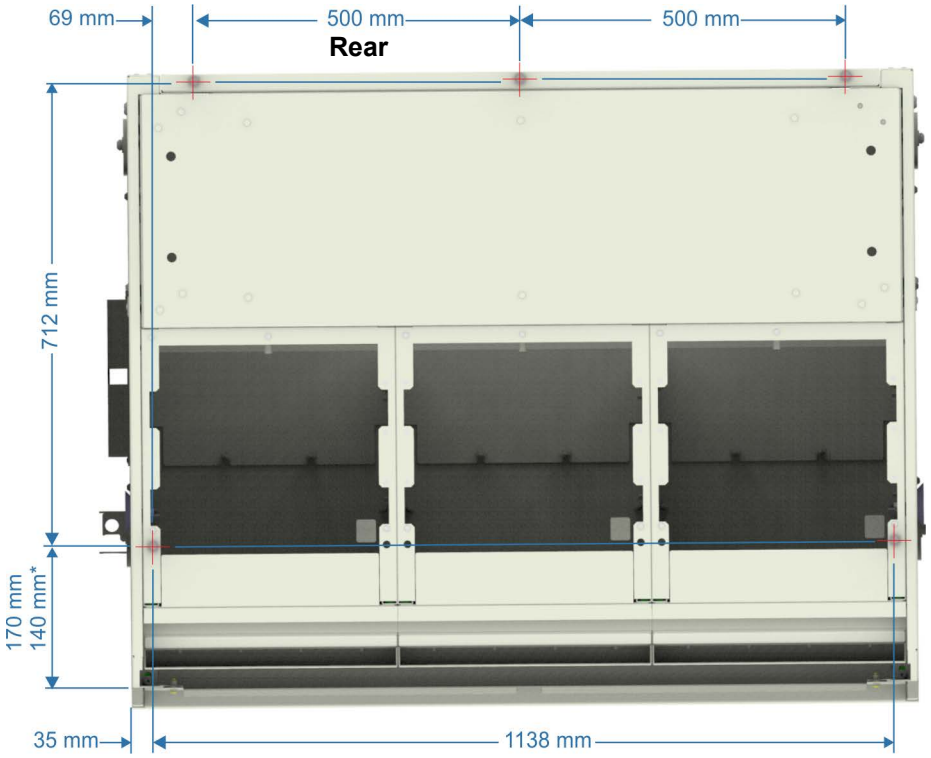
*** Extensible Unit - 170mm**
Non Extensible Unit - 140mm

13.4.3 2-Way Units



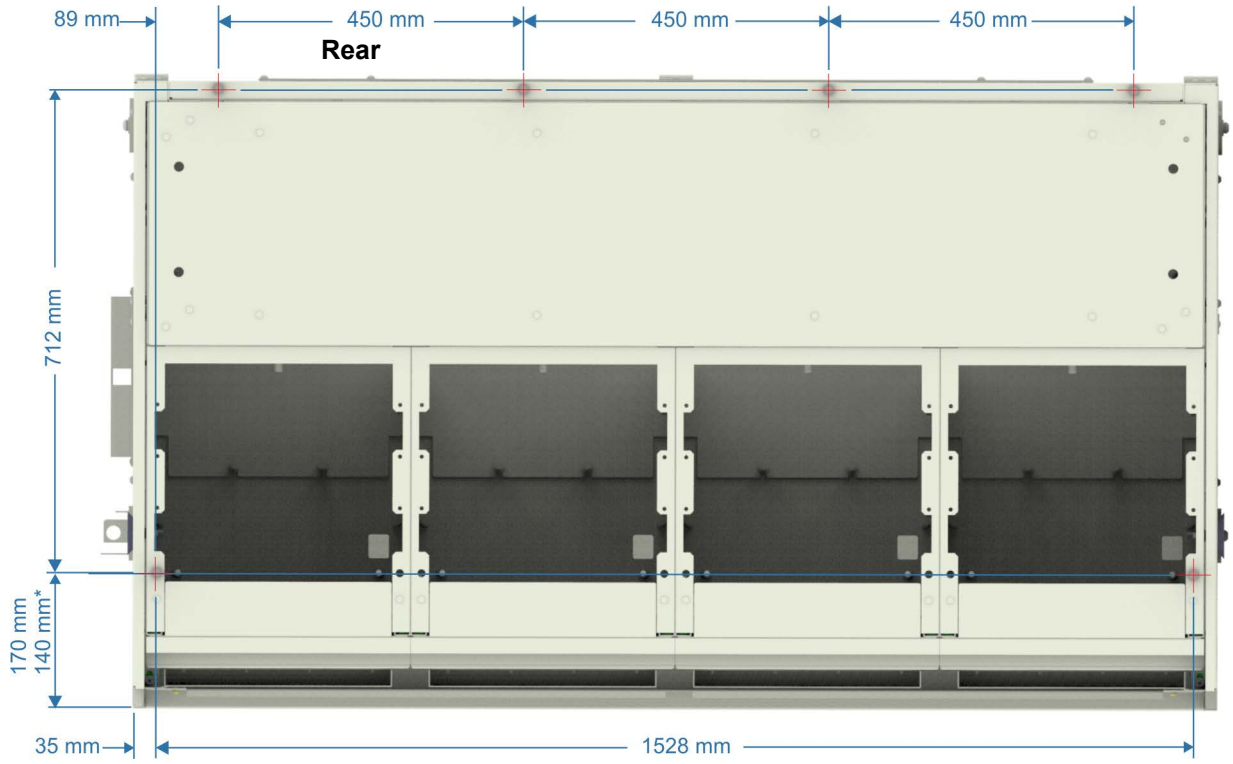
*** Extensible Unit - 170mm**
Non Extensible Unit - 140mm

13.4.4 3-Way Units



*** Extensible Unit - 170mm**
Non Extensible Unit - 140mm

13.4.5 4-Way Units



*** Extensible Unit - 170mm**
Non Extensible Unit - 140mm

13.5 LV Panels

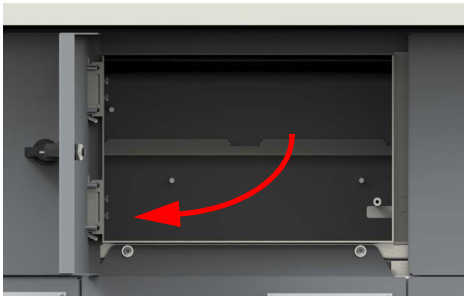
The LV panels located at the front of the unit and houses the terminals for all customer options including switch actuators, pressure switch, Protection relay and EFI etc.

To get access to the LV area the door can be opened as per the below procedure.

1 : The LV panel handle will require unlocking (if fitted) and will require a key to unlock.

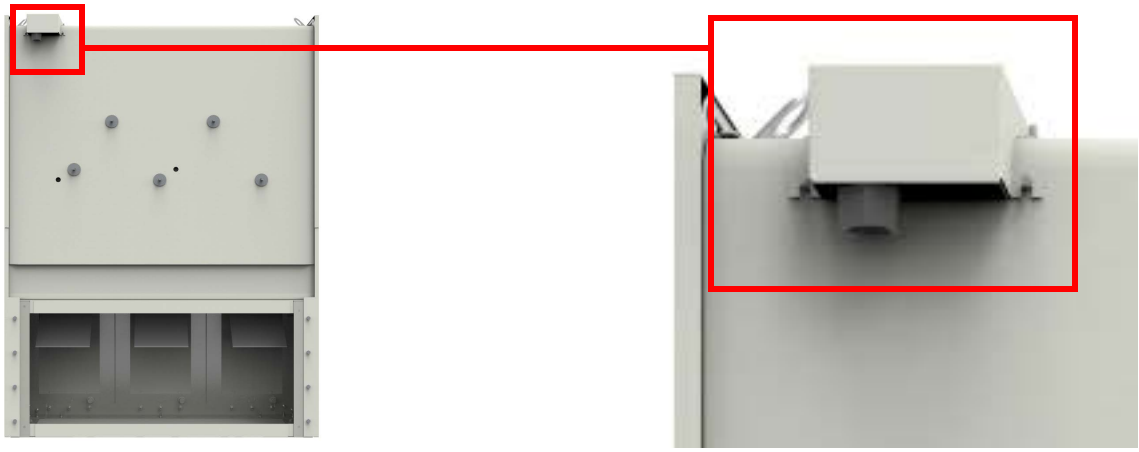
2 : Turn the handle clockwise to unlock the LV panel.

3 : To access the LV area, pull on the handle to release and open the door.



13.6 LV Connections - Indoor

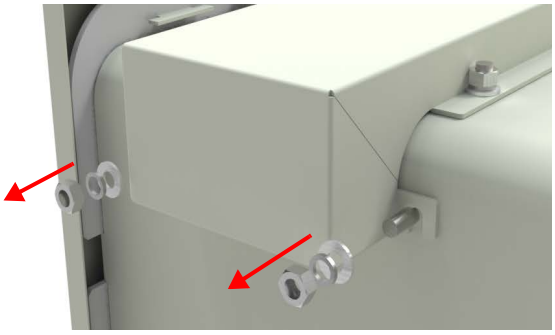
1 : On the top side of the unit, Locate the LV connection channel entries.



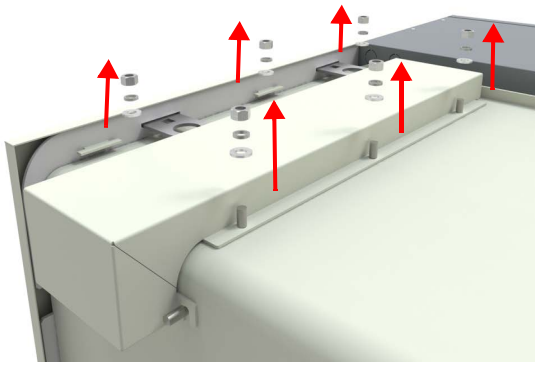
13.6.1 Cable Channel Removal

1 : The cable channel can be found on top of the unit and overhangs the rear side.

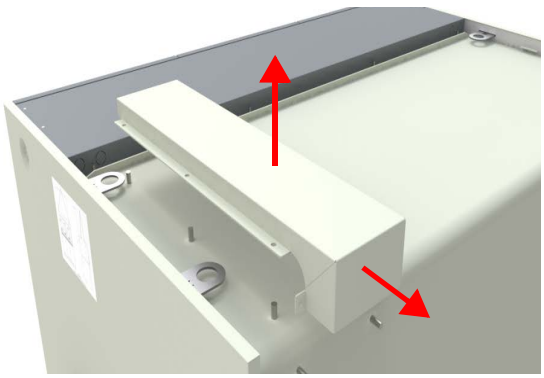
2 : Unscrew and remove the nut, flat washer, and spring washer in 2 places found on end of the cable channel.



3 : Unscrew and remove fixings at the 6 locations, (see image below).

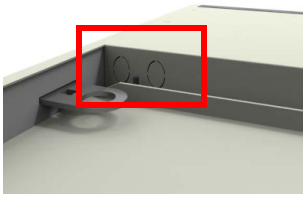


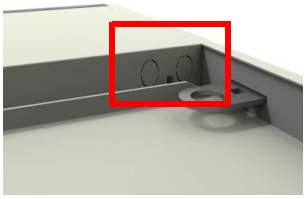
4 : Lift and slide the customer channel off the surface, cabling can now be installed.



13.6.2 LV Cable installation

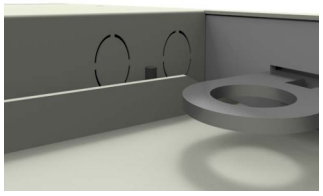
1 : Knock-outs are found on the rear marshalling box panel on the top side of the unit.

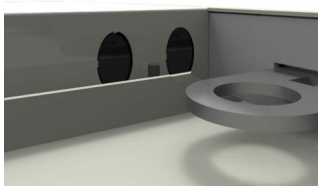




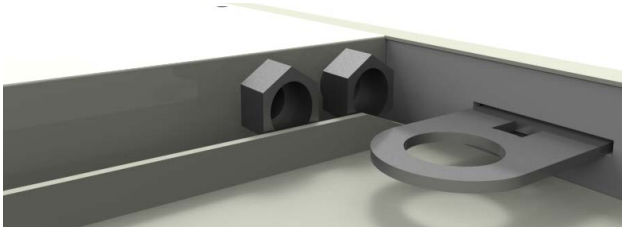
2 : To remove the chosen circular knock-out, punch through with the appropriate tool.

Note: Ensure that all debris on the unit is removed and cleaned thoroughly.





3 : Install the LV glands through the punched circular knock-out and install the rear lid panel

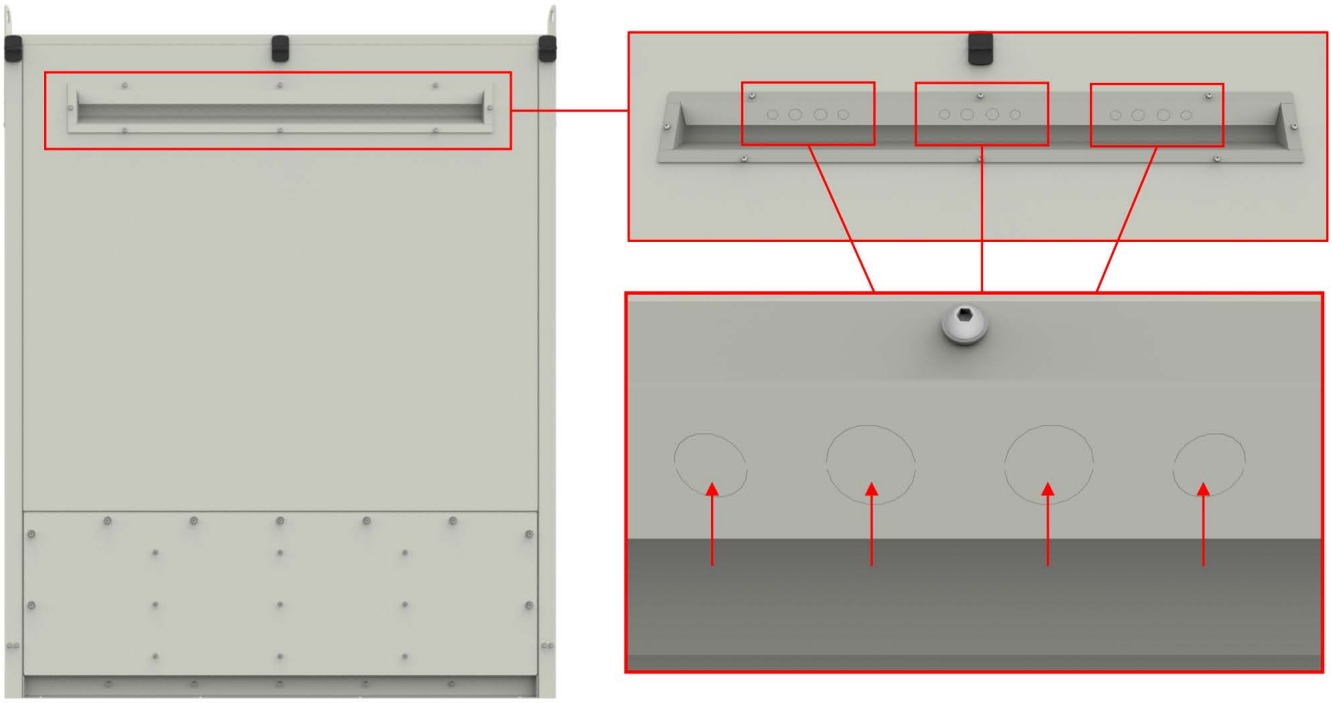


Note: Ensure cable channel is refitted after installing LV cables.

13.7 LV Connections - Outdoor

1 : On the rear side of the unit, locate the LV connection knockouts, found at the top of the unit.

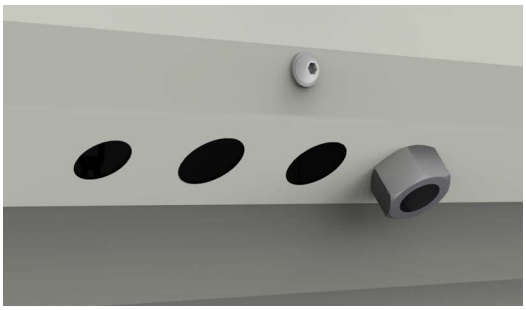
2 : Knockouts are found along the rear lid panel as shown in the image below.



3 : To remove the chosen circular knockouts, punch through with the appropriate tool.

Note: Ensure that any debris that is within the rear lid panel is removed and cleaned off thoroughly.

4 : Install the gland through the punched circular knockout and install the rear lid panel



14. COMMISSIONING TESTS

WARNING

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

14.1 Operation Tests

Before commencing commissioning, conduct a few operations on the unit. Operate each function ON - OFF - EARTH-ON. See LIOM16-063 Operation & Maintenance manual for further information.
Before commencing commissioning, conduct a few operations on the unit. Operate each function **ON - OFF - EARTH**. See LIOM16-015 Operating & Maintenance manual for further information.

14.2 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:

- Load Break Switch to adjacent Load Break Switch.
- Load Break Switch to adjacent Circuit Breaker.
- Circuit Breaker to adjacent Circuit Breaker (if applicable).

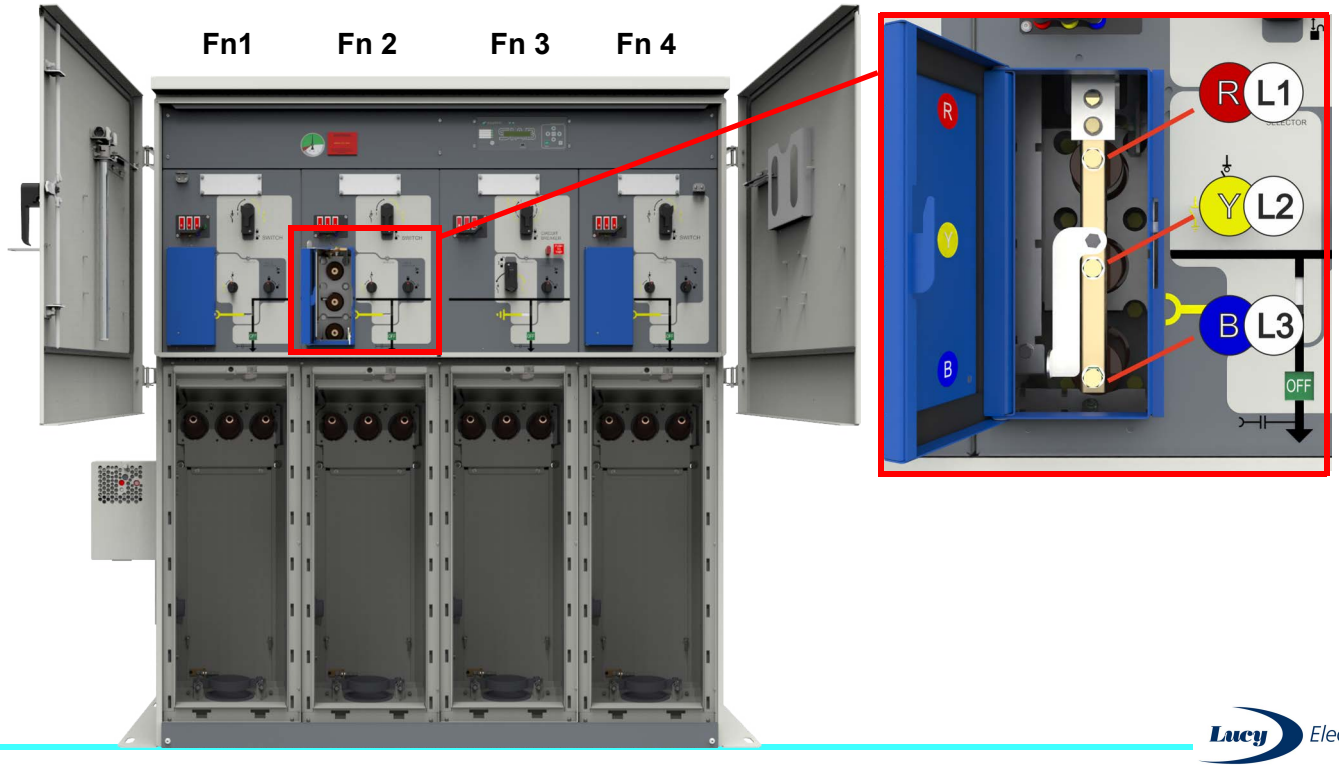
These readings taken are to be compared with the following maximum values.

Resistance Test Values		Switch Cable Bushing to Cable Bushing				Circuit Breaker Cable Bushing to Cable Bushing			
Function (Fn)		1		2		3		4	
		SW	CB	SW	CB	SW	CB	SW	CB
1	SW			227	236	255	263	242	291
	CB			249	257	276	285	304	312

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.

Function 1 Function 2 Function 3 Function 4



14.3 Power Frequency Testing

These test values are to IEC 62271-1.
Conduct tests as follows:

- Ensure unit has correct gas pressure.
- 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).

WARNING

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

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 (Table 14.2, "Main Circuit Resistance Tests," on page 41).

CAUTION

Ensure appropriate screened insulations boots are used when HV testing

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 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 Fuse Switch must be in the 'ON' position, and the following tests are taken through the cable terminals.

WARNING

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

Image Views are from front with cable box covers removed

4 Way Unit				
	Test 1	**Test 2**	**Test 3**	**Test 4**
Fn1	Closed	Closed	Closed	Open
Fn2	Closed	Closed	Open	Closed
Fn3	Closed	Closed	Open	Closed
Fn4	Closed	Closed	Open	Open
Voltage	U1, W1	V1	U1, V1, W1	U2, V2, W2
Earth	Frame V1	Frame W1, U1	Frame U2, V2, W2, U3, V3, W3	Frame U1, V1, W1, U4, V4, W4

14.6 Secondary Wiring Insulation Resistance Testing

Insulation resistance testing is conducted at 1kV in accordance with international standards.
In addition to this, the Aegis 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.

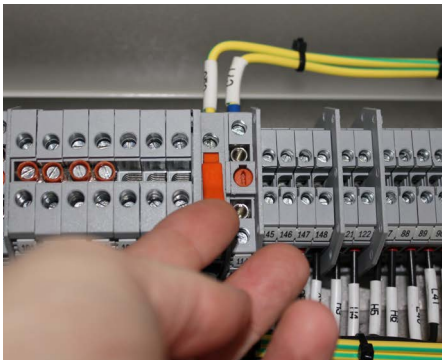
14.6.1 1kV test.

- Remove the earth link (see below).
- 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 Marshalling box for approx 2 seconds.
- Any indication of continuity should be investigated and rectified

14.6.2 Removal of the Earth link

1 : Position of earth link

2 : Lift link with finger.



3 : Rotate the link completely away from the terminal.

14.7 DAT TLF Protection Test

The commissioning tests for DAT TLF protection can be taken from the LIOM16-066 Aegis DAT Time Limit Fuse (TLF) Setup Manual.

14.8 Current Transformer Tests

14.8.1 Test Voltage Checks

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

Voltage Test	Rated Voltage				
	12kV	17.5kV	24kV	Duration	Fit insulation caps & adaptors
1 & 2	22.4 kV	30.4 kV	40 kV	1 Minute	Yes
3, 4	25.6 kV	36 kV	48 kV	1 Minute	Yes

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

14.9 Relay Type Protection Tests

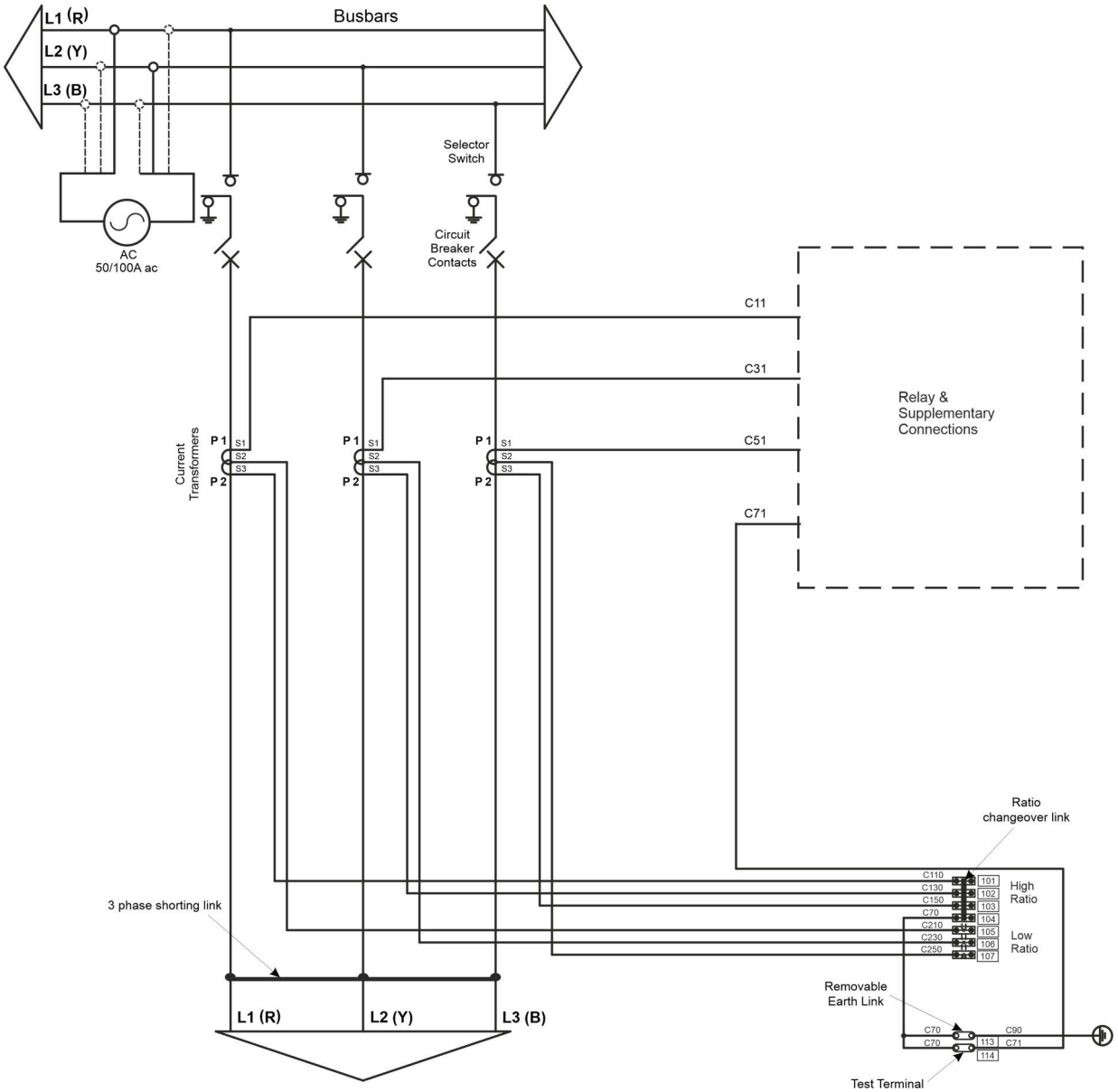
INFORMATION

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 diagram supplied with each unit.

14.9.1 Relay Primary Injection Test - Overcurrent Test

- Ensure the load 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 to the relay setting and CT ratio.
- Repeat for each phase.

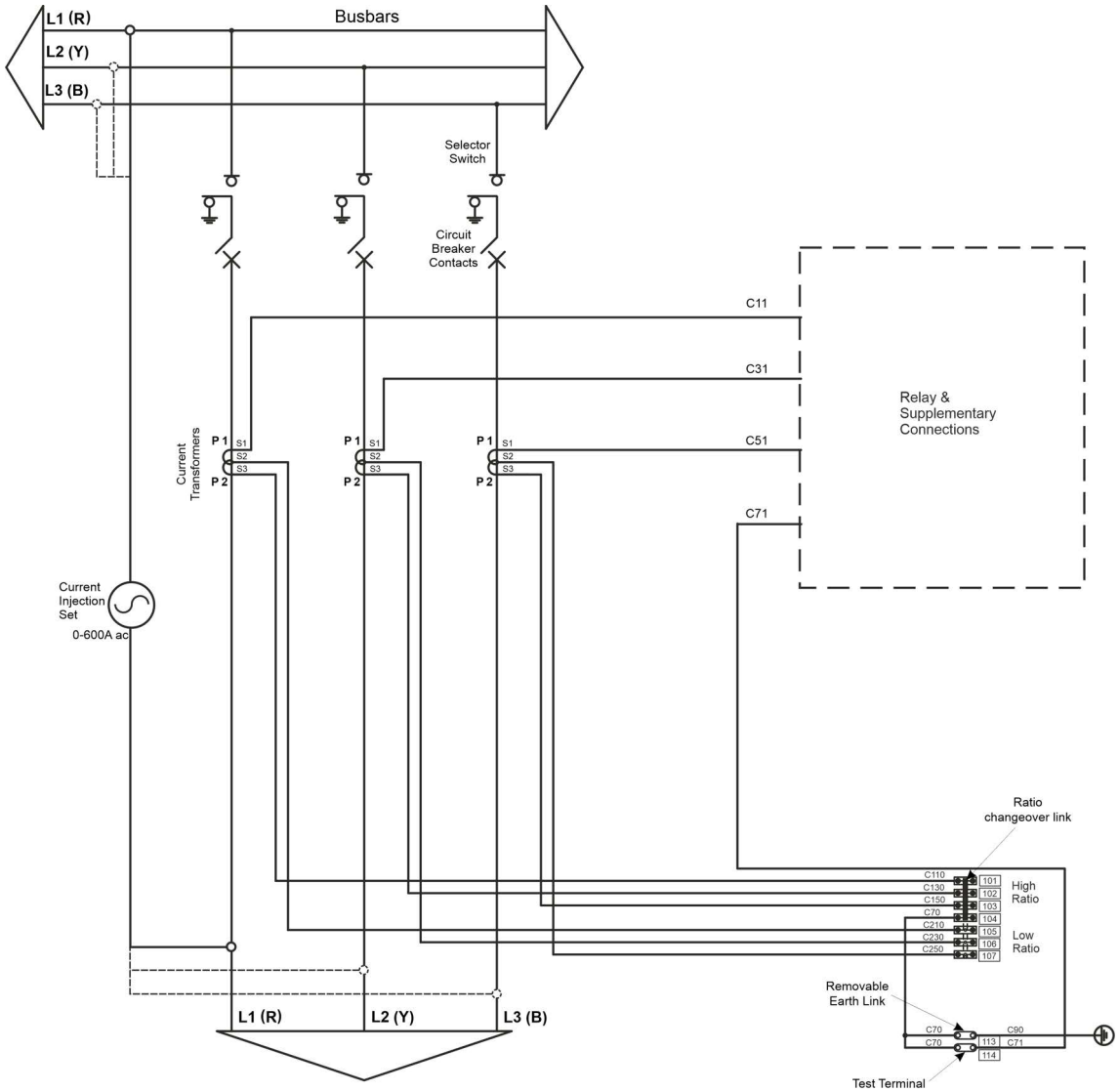
Repeat for each ratio - values to be recorded if necessary.



14.10 Relay Primary Injection Test - Earth Fault Test

- Ensure the load 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.



14.10.1 Relay Secondary Injection Tests - Overcurrent and Earth Fault Test

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

14.11 Current Transformer Tests

14.11.1 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 LV compartment, 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 (LV fascia 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 front LV fascia, ensuring it is correct as per the LV compartment 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).

14.11.2 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 LV compartment 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 LV compartment.
- 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 LV compartment, the CT ratio label on the LV compartment 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.

14.12 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 cover (see LIOM16-015 Operating & Maintenance manual for further information).

Apply a test voltage of 72kV DC for 15 Minutes/ 58kV AC for 30 minutes at VLF 0.1 HZ (or as specified by network owner) to earth. Repeat tests on the other ring switch. See LIOM16-006 Aegis DC Pressure Testing manual for further information.

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.

14.13 VPIS

14.13.1 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.

WARNING

The following checks should be made during commissioning where applicable.

14.13.2 Pickup voltage

For a 17.5kV unit this value will be below 7kV.

- 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).

14.13.3 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 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 for any indication of voltage. There should be no indication on the other phases.

14.13.4 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.

14.14 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.

Note:

- **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.**

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

14.16 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 **LIOM16-063 Operating & Maintenance manual, section 'Earth & Test Access.**

Refer to document guide: **LIOM-16-009 Aegis 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.

15. GLAND PLATES

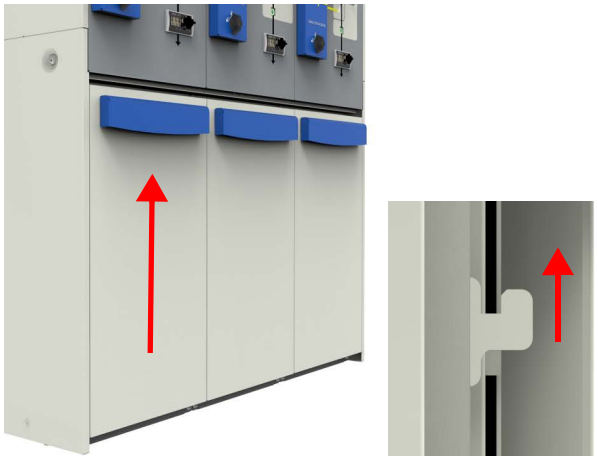
15.1 Removing Cable Box Front Panels

Ensure the relevant Circuit Breaker or Switch is in the **'EARTH ON'** position (see LIOM16-015 Operating & Maintenance manual for further information).

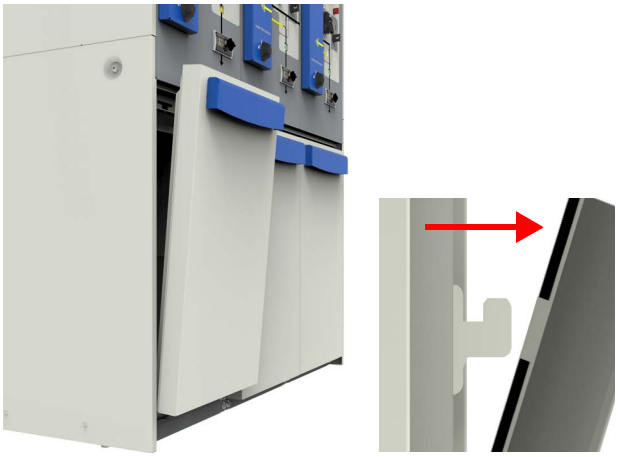
INFORMATION

Cable box front panel is mechanically interlocked. To prevent removal of cable box front panel, fit padlock through Test & Cable Box selector.

1 : Lift the front panel.



2 : Pull the panel handle away from the unit.



3 : Panel can now be removed and it is possible to access the cable box

INFORMATION

Relevant function cannot be removed from 'EARTH ON' until the cable box front panel is refitted.

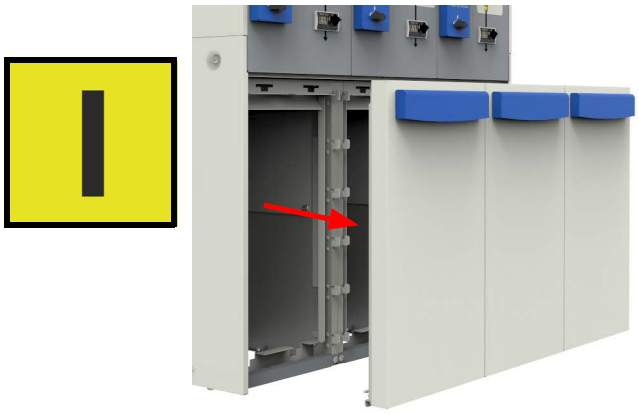
15.2 3 Single Core Cable, Clamps and Glands Plates

15.2.1 Cable Clamp and Gland Removal - Circuit Breaker Function.

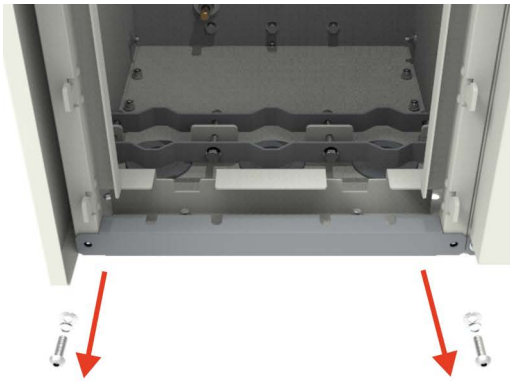
CAUTION

Ensure steps (see "section 9.7 Removing unit from pallet" on page 21) have been completed before continuing with the gland plate removals.

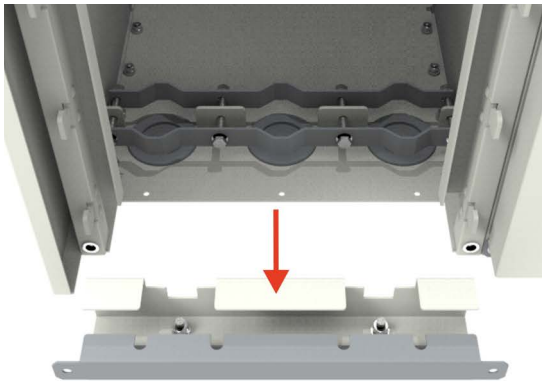
1 : Begin this procedure only when the relevant function is in the **'EARTH ON'** position and cable box doors have been removed.



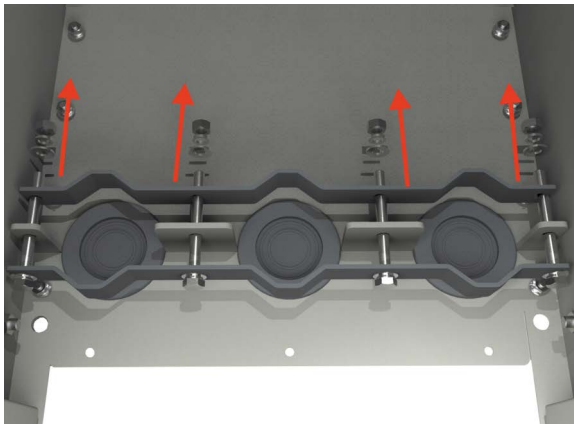
2 : To remove the deflector from cable box remove M8 Button head screw along with 2 x Plain Washers and 2 x Spring Washers in two places.



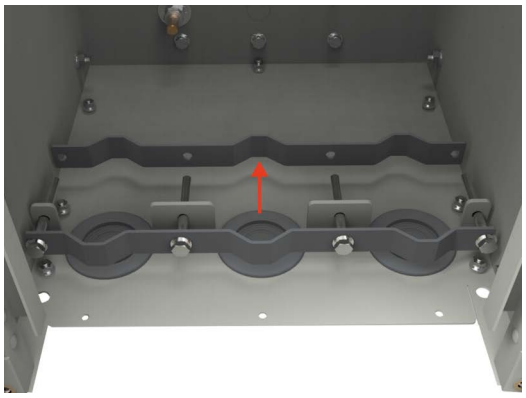
3 : The deflector can be removed by pulling and sliding out.

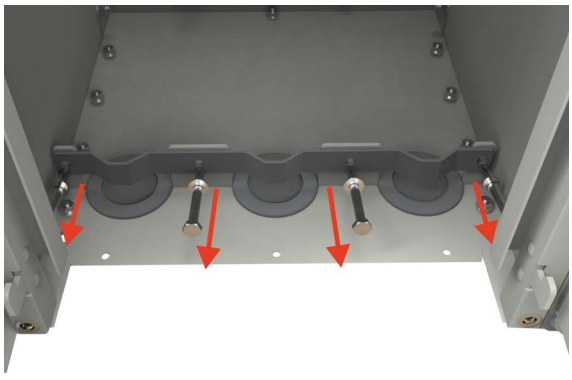


4 : Unscrew and remove the Nut, Plain Washer and Spring Washer from the M8 bolt in 4 places.



5 : The front and rear cable clamp can now be removed from the cable box. Remove M8 bolt, Plain Washer and Spring Washer in 4 places.

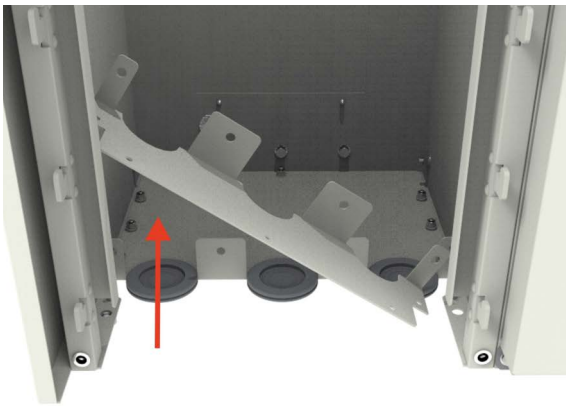




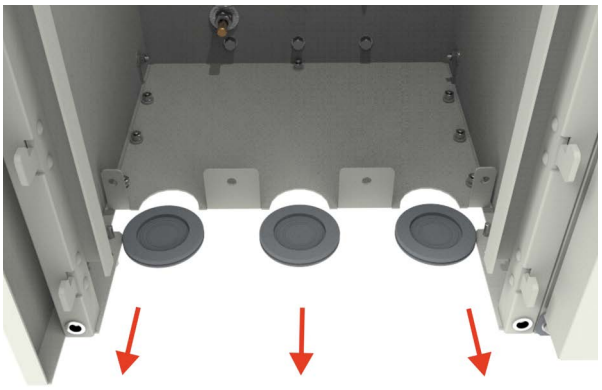
6 : The front and rear cable clamp is now free and can be removed.

7 : Remove CB front gland plate by removing Nut, plain Washer and spring Washer from the M6x16 clinch studs in 2 places.

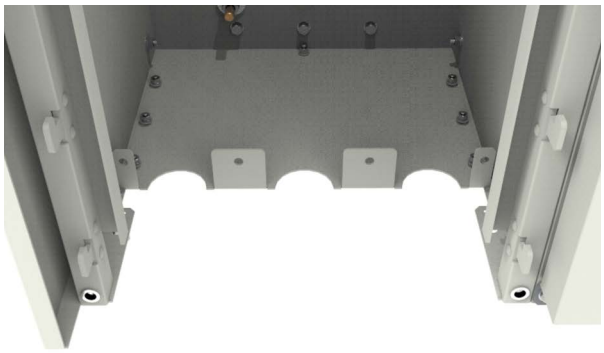
8 : Lift out the CB front gland plate.



9 : Pull away to remove grommet in 3 places.



10 : Once the gland plate has been removed cabling can begin.



INFORMATION

The “EARTH” point is located at the rear of the cable box near the bottom and showing itself through the back plate.

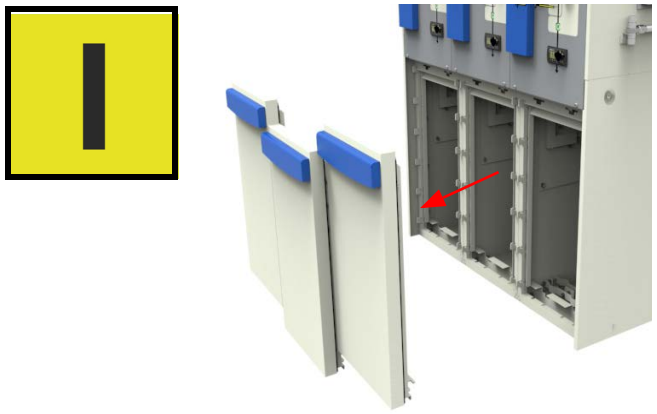
15.3 Single 3 Core Cable, Clamps and Glands Plates

15.3.1 Cable Clamp and Gland Removal - Switch Function.

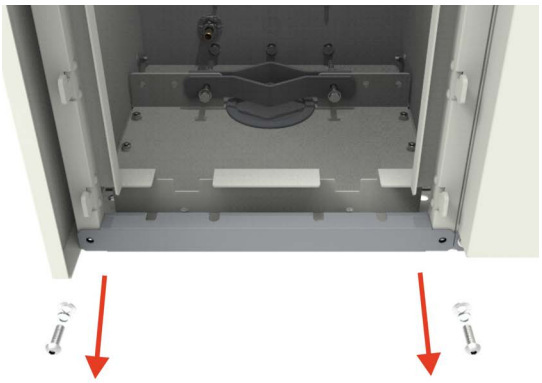
CAUTION

Note: Ensure steps (see "section 9.7 Removing unit from pallet" on page 21) have been completed before continuing with the gland plate removals.

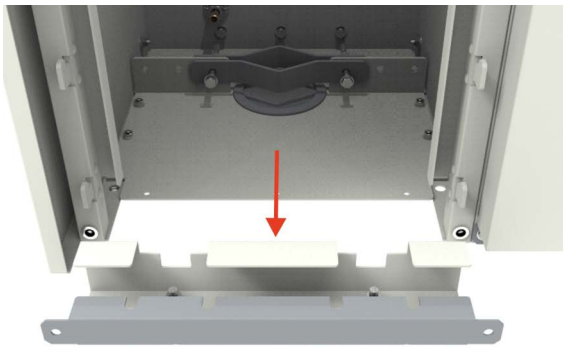
1 : Begin this procedure only when the relevant function is in the **'EARTH ON'** position and cable box doors have been removed.



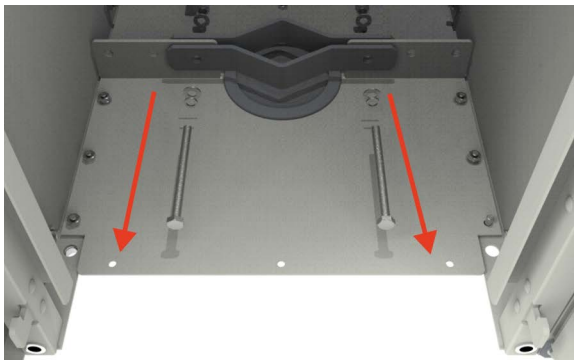
2 : To remove the deflector from cable box remove M8 Button head screw (suitable Allen key required), Plain Washer and Spring Washer in 2 places.



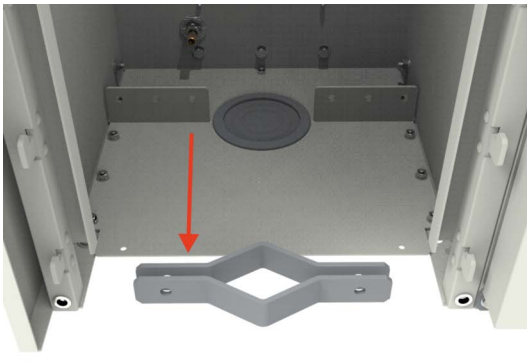
3 : The deflector can be removed by pulling and sliding away from the cable box.



4 : Remove and unscrew Nut, Plain Washer and Spring Washer from the M8 bolts in 2 places to release the cable clamps.

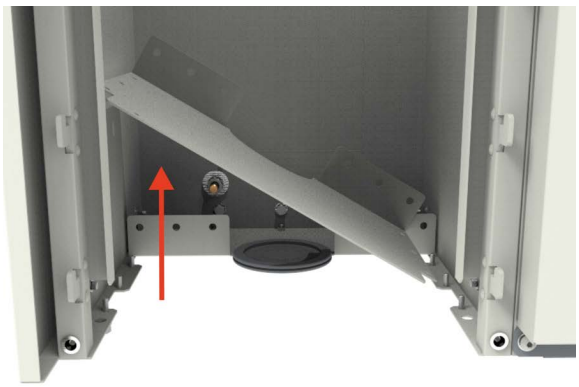


5 : The front and rear cable clamp can now be removed from the cable box.

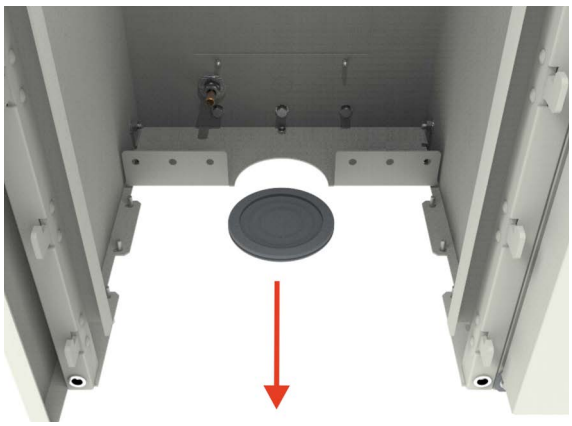


6 : Remove CB front gland plate by removing Nut, Plain Washer, spring Washer from the M6x16 clinch stud in 6 places.

7 : Lift out the CB front gland plate.



8 : Lift and pull to remove grommet.



9 : With the gland plate removed, cabling can then be installed.

INFORMATION

The EARTH point is located at rear of the cable box near the bottom and showing itself through the back plate.

16. CABLE CONNECTING RECOMMENDATIONS

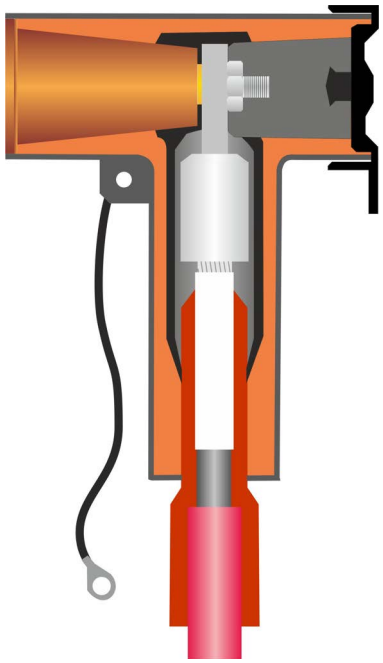
16.1 Cable Terminations

The bushings for each switch and circuit breaker are located at the front of the unit. All sets of the bushing are type ‘C’ with in-line bolted connections M16 threaded in accordance with EN50181.
The bushings are accessible by removing the interlocked cable box covers at the front of the unit.
The maximum cable size that can be used are:

- 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.

The following Plug-In Type cable termination can be used with the Aegis 36:



The bushings for each switch and circuit breaker are located at the front of the unit. All sets of the bushing are type ‘C’ with in-line bolted connections M16 threaded in accordance with EN50181.

The bushings are accessible by removing the interlocked cable box covers at the front of the unit (see LIOM16-015 Operating & Maintenance manual for further information).

The maximum cable sizes that can be used are 500mm² (Three Core Cable) and 300mm² (Single core cable).

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

Assembly instruction of screened connector must be followed as per respective manufacturer's instructions.

Terminal Torque Setting
M16 copper thread or into copper - 75Nm

CAUTION

Due to the electrical stresses at 36kV, heat shrink termination shall not be suitable for use on this equipment. It is our recommendation that screened termination should only be used. For further details please contact Lucy Electric.

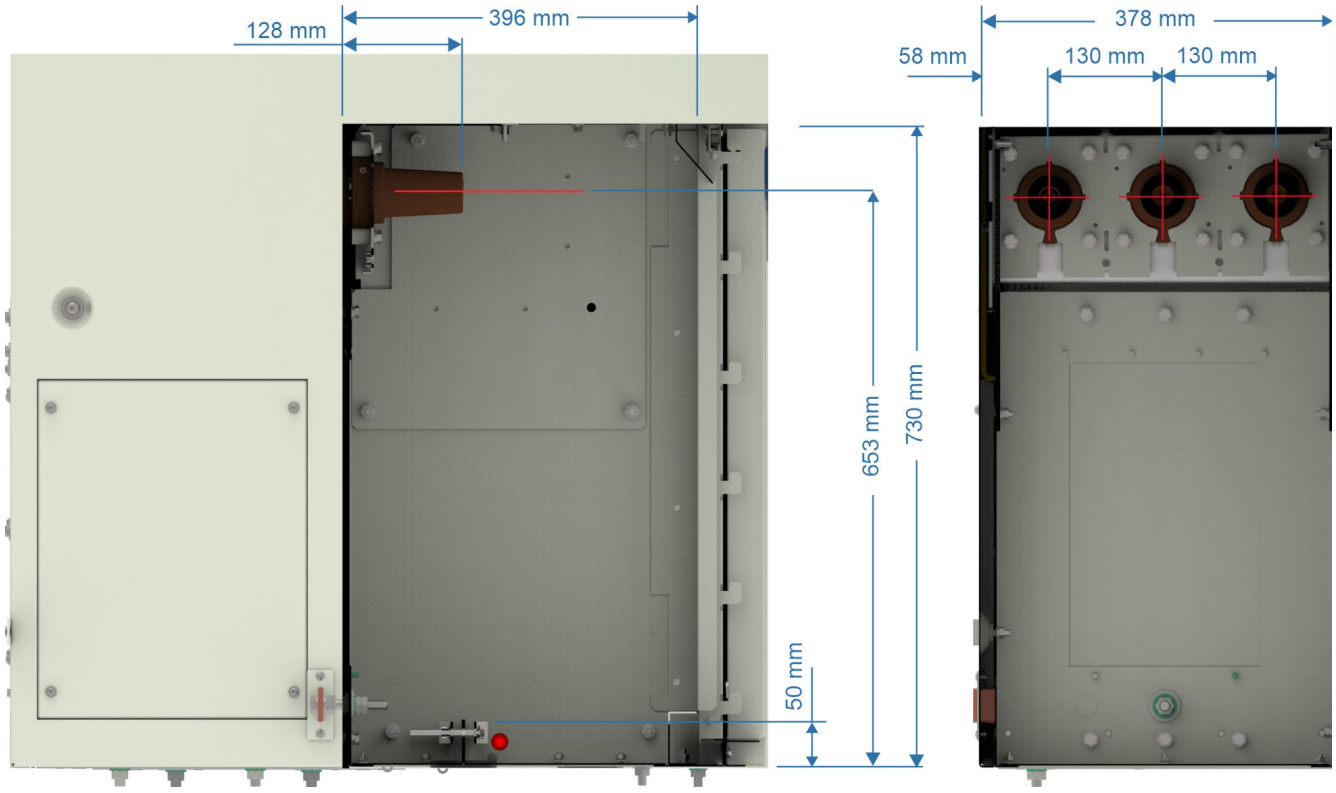
INFORMATION

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.

16.2 Cable Area Dimensions



16.3 Cable Connecting Recommendations

The Aegis 36 unit cable connecting recommendations are:

- 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 cable has been installed correctly, ensure no load is exerted on the bushings by installing the cable clamps (see "section 16.4 Cable Installation - Single 3-core" on page 59, or "section 16.4.1 3 Single Core Cable Installation" on page 61 and "section 17. Cable Mounted CT Assembly" on page 64).

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

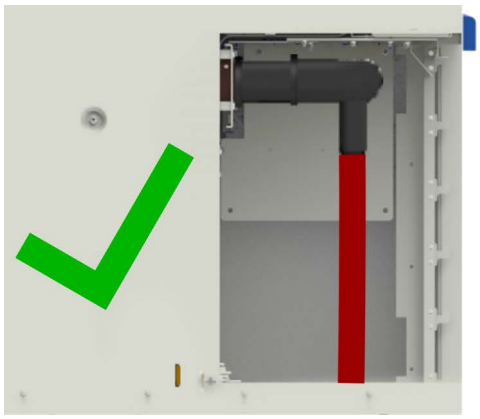
DANGER

Cable box panel is interlocked, to prevent removal of the panel fit padlock through Test & Cable Box selector.

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

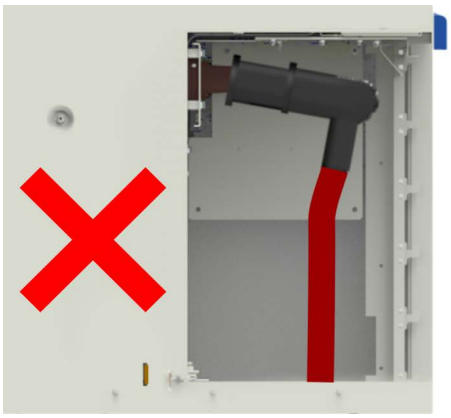
Correct Assembly

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

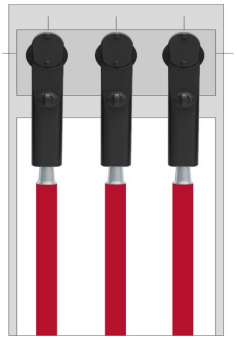


Incorrect Assembly

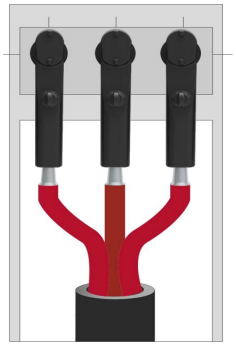
The cable termination must not pull on the bushing, as this can damage the Aegis 36 unit and lead to gas leakage.



3 Single-core Cables



Single 3-core Cables



WARNING

Cables must be clamped securely inside the cable box using the gland plate and cable clamp to avoid any mechanical loading stress on the bushings.

INFORMATION

If cable mounted CT's are being fitted, refer to "section 17. Cable Mounted CT Assembly" on page 64 **before commencing cable connections**

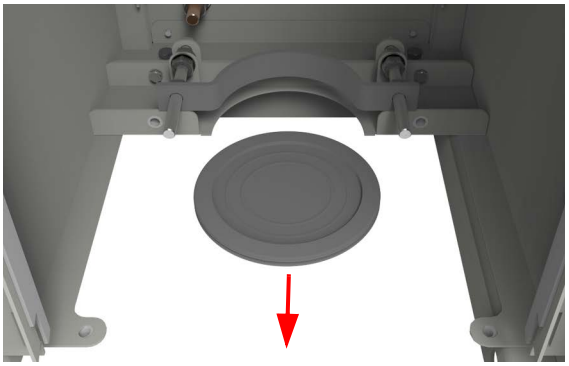
16.4 Cable Installation - Single 3-core

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

1 : To begin, ensure the panel of the chosen cable box has been removed, see section 9.7 Removing unit from pallet on 20.

2 : Remove the front half of the gland plate, refer to instruction section 15.2.1 Cable Clamp and Gland Removal - Circuit Breaker Function. on 52.

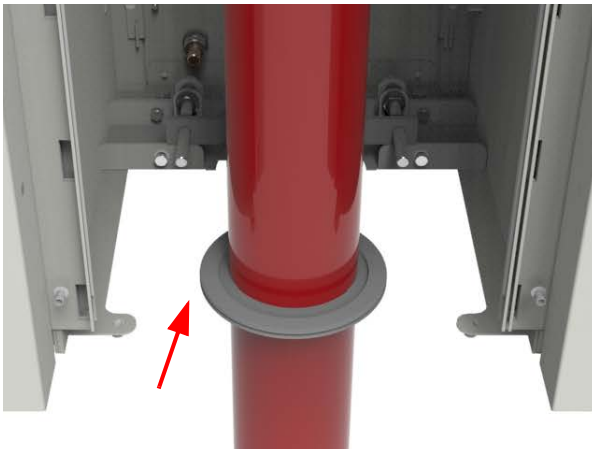
1 : Remove grommets, front half of the gland plate and front cable clamp.



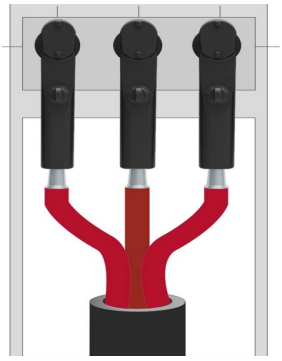
2 : Cut grommet as per cable diameter.

3 : Slide the grommet over cable and pull down to the gland plate.

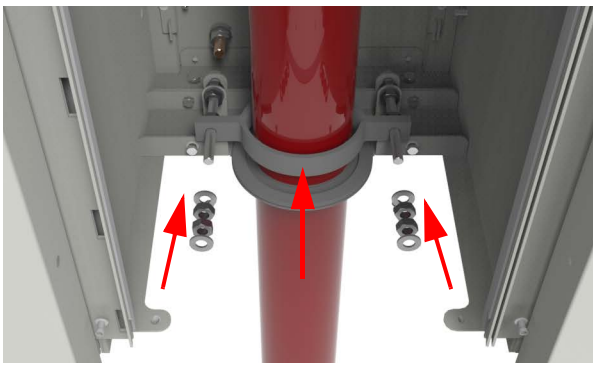
4 : Feed incoming cable up into the cable box and cut to length.



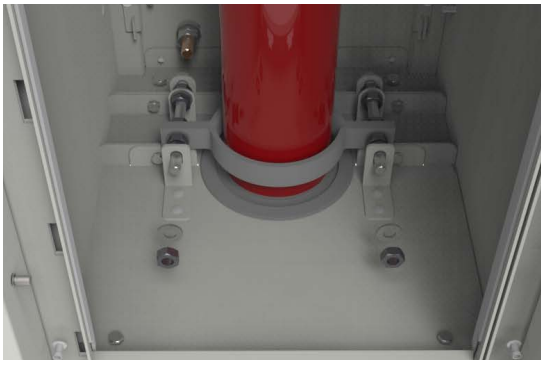
5 : Fit the end termination to the incoming cable as per manufactures instructions.



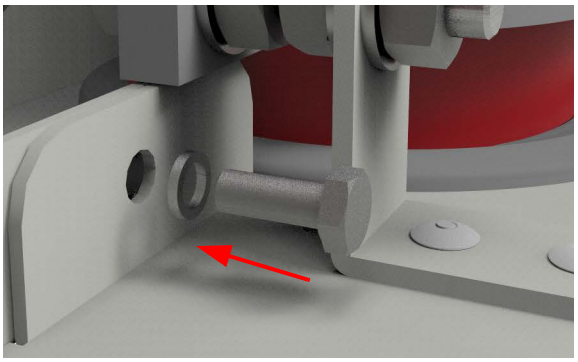
6 : Refit front cable clamp, nuts, and washers.



7 : Refit the front end gland plate, washers and nuts.



8 : Locate the M6 screws that are sitting behind the front gland clamp support panel and screw the two supplied M6 screws on either side.

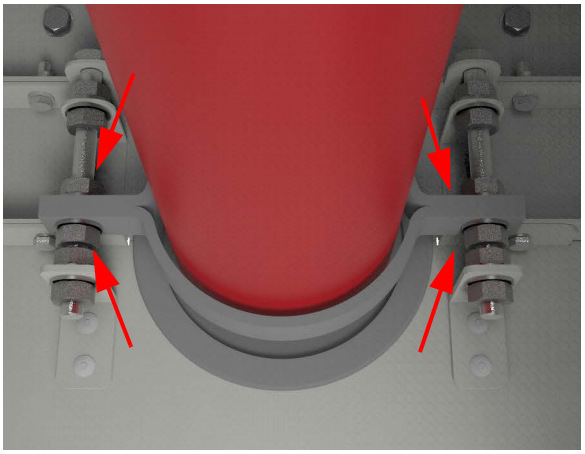


9 : Align the front and rear cable clamps through the joining gland plate holes, then Install M8 bolts, Flat Washers and Spring Washer and Nuts in 2 places.

10 : Adjust the Nuts either side to tighten the clamp grip on the cable, ensure that the cables are centrally positioned about each gland hole.

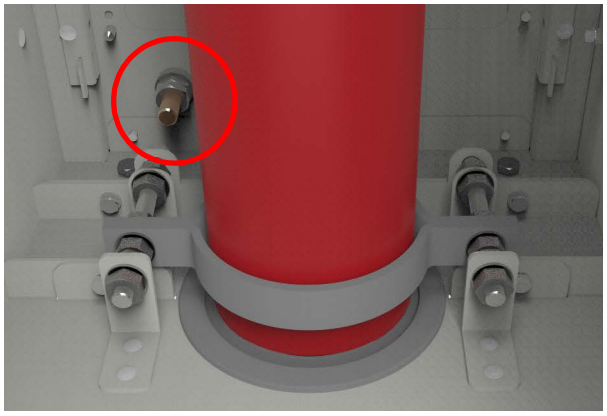
INFORMATION

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



INFORMATION

Earth point located at the back plate



INFORMATION

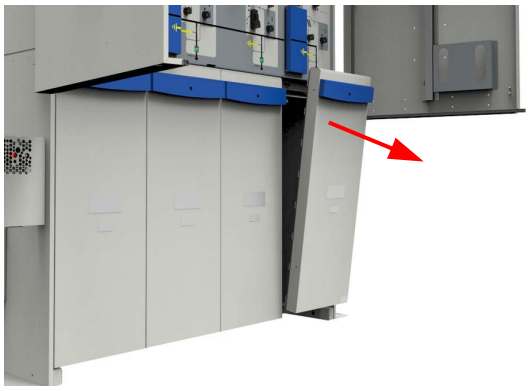
Once the unit is completely cable terminated, ensure the unit plinth is refitted, see section 9.7 Removing unit from pallet on 20 **and conduct in reverse order.**

16.4.1 3 Single Core Cable Installation

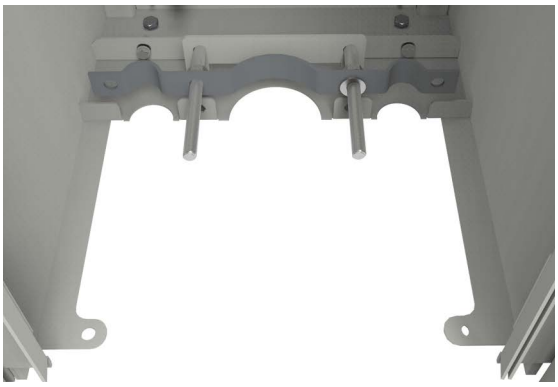
INFORMATION

Note: This procedure is based on the 3 single core cable system.

1 : To begin, ensure the panel of the chosen cable box has been removed, see section 15.1 Removing Cable Box Front Panels on 51.



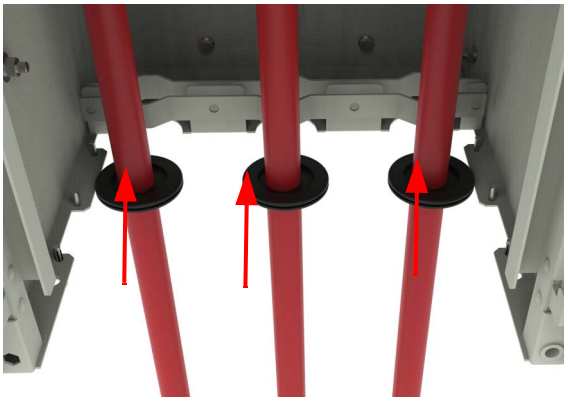
2 : Remove the front half of the gland plate, see section 16.4.1 3 Single Core Cable Installation on 61.
Remove grommets, the front half of the gland plate and front cable clamp.



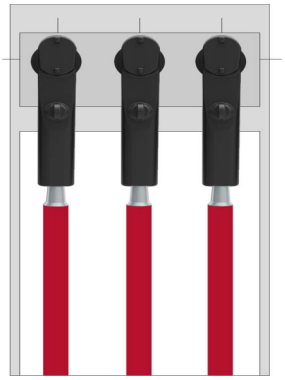
3 : Retrieve the grommet from the gland plate, cut to the correct diameter. Repeat this process for all cables are to be fitted within the cable box.

4 : Slide the grommet over cable and pull down to the gland plate.

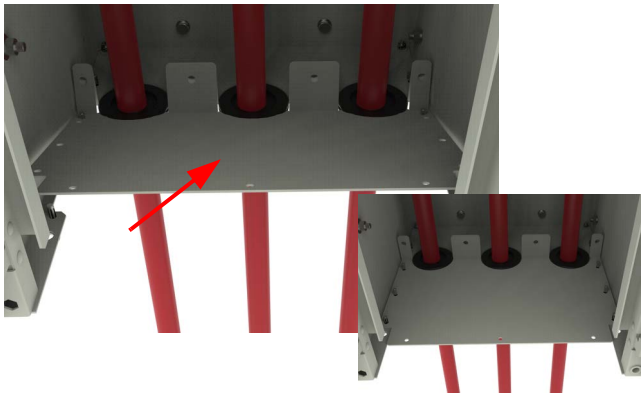
5 : Feed incoming cables up into the cable box and cut to length.



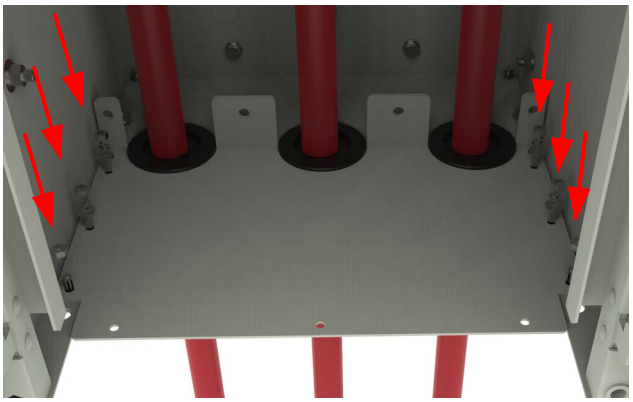
6 : Fit the end termination boot to the incoming cables as per manufactures instructions.



7 : Refit the front half of the gland plate, ensuring the grommets fit into both half's of the gland plate.



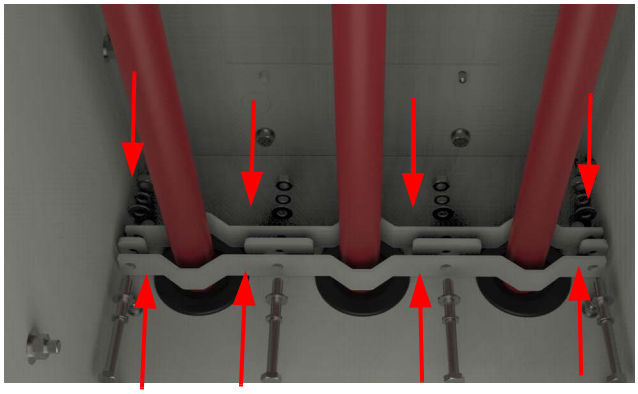
8 : Secure gland plate half using the six M6 nuts, washers and spring washers.



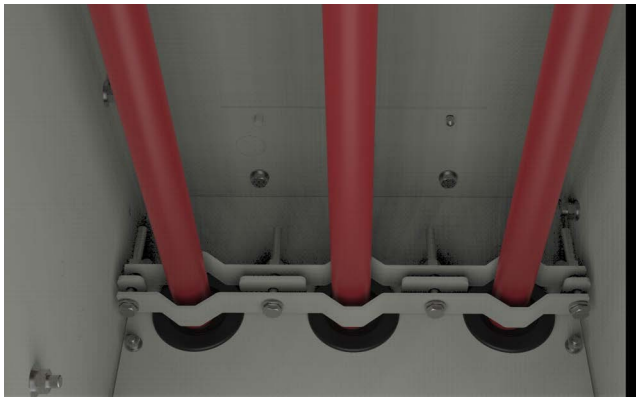
INFORMATION

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

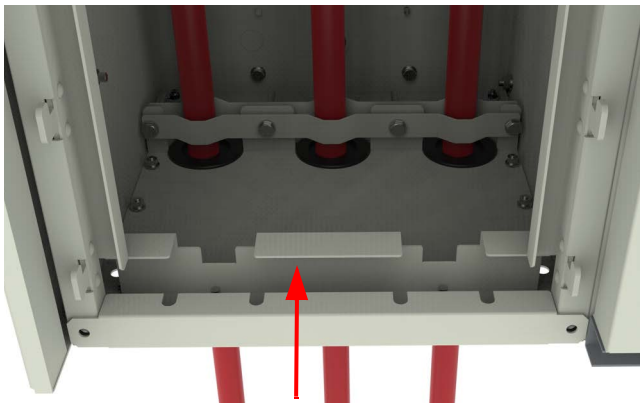
9 : Refit the two clamp brackets either side of the cables and secure using the four M8 x 80 long bolts, nuts, washers and spring washers.



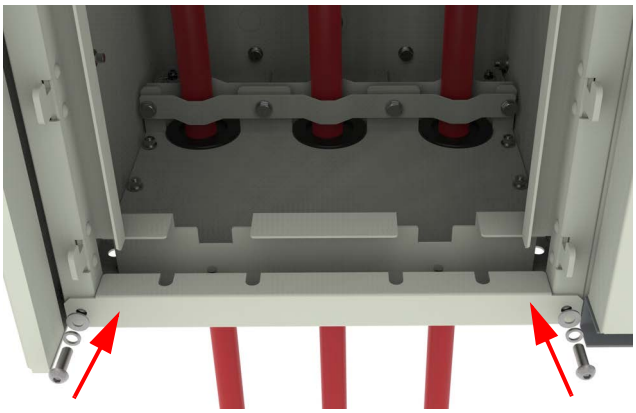
10 : Ensure the clamp brackets take the weight of each cable.



11 : Refit the front deflector from the front.



12 : Secure using the two M8 x 25 long button head screws, washers and spring washers.



INFORMATION

Earth point located at the back plate

WARNING

Once the unit is completely cable terminated, ensure the unit plinth is refitted, (see section 9.7 Removing unit from pallet on 20**) and conduct in reverse order.**

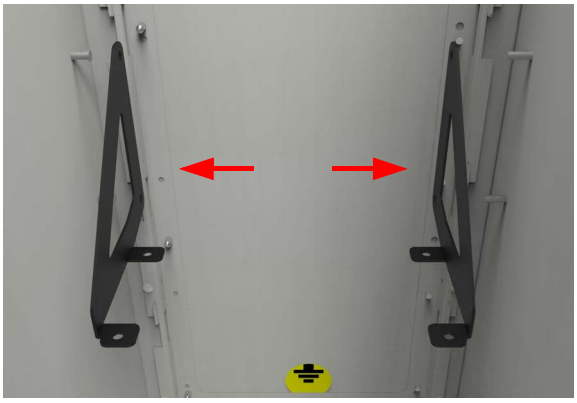
17. CABLE MOUNTED CT ASSEMBLY

17.1 Cable Mounted Short Type CT Assembly Fitting

INFORMATION

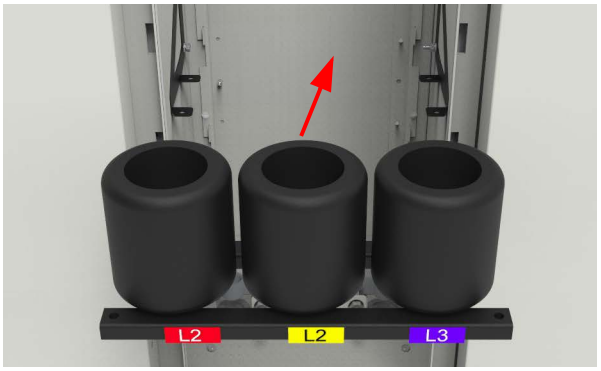
For cable mounted CT assembly, the following procedure must be followed when terminating cables at the site.
Ensure there is support placed under the CT throughout the procedure to fix the CT to prevent possible damage.

1 : Locate the CT holding brackets supplied, install the brackets by slotting them over the two fixed cable box studs on either side. of the cable box with mounting lips facing outwards as shown below.

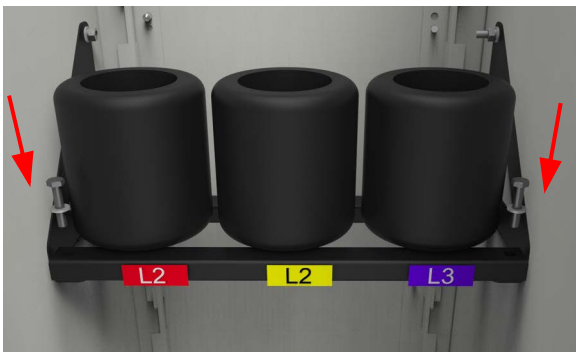


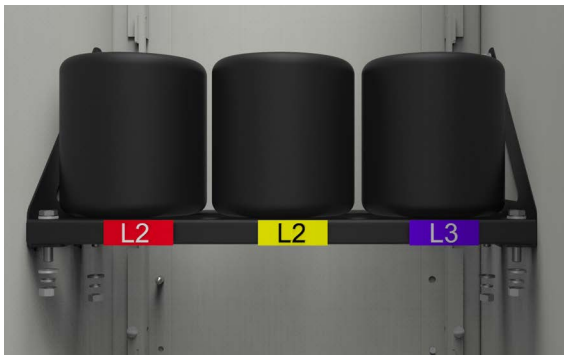
2 : Secure the CT brackets by screwing the supplied washers and the two nuts onto the fixed studs which are holding the brackets.

3 : Bring the CT into the cable box and position horizontally across the mount brackets, ensure the labels are facing the cable box door.



4 : Secure the CT by screwing in the fixings supplied at either end of the two rails, these include 4 x M10 bolts that are inserted from the underside.





INFORMATION

Ensure all fixtures are tightened and secured.

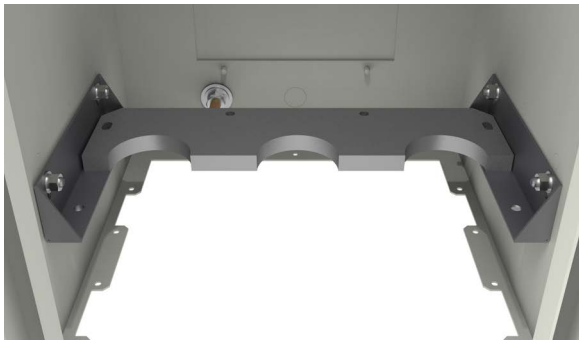
Removal of the cable mounted CT assembly in the reverse of this procedure.

17.2 Cable Mounted Long Type CT Assembly Fitting

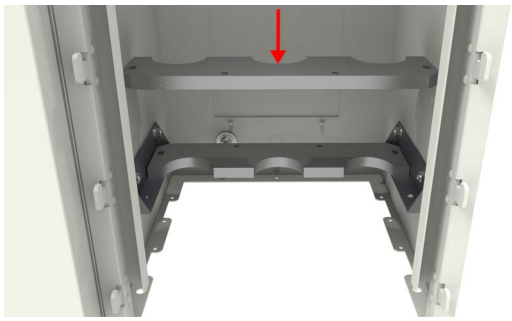
1 : Remove Gland plate and front deflector, see “section 15.1 Removing Cable Box Front Panels” on page 47.

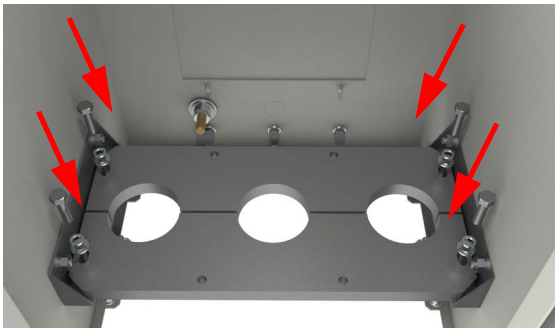
2 : Remove all termination cables from the cable box, for a clear workspace to install CTs.

3 : Place the rear CT base plate on to the CT mounting bracket.



4 : Install the front CT support plate and secure using the fixings in locations indicated in the image below.

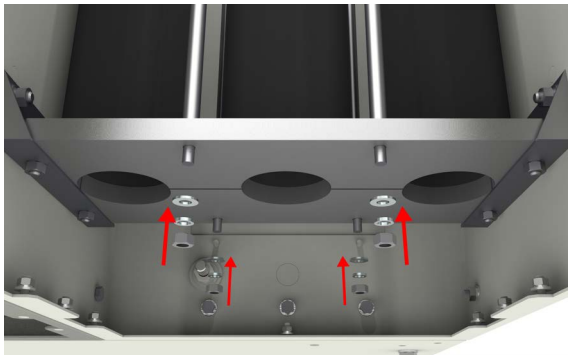




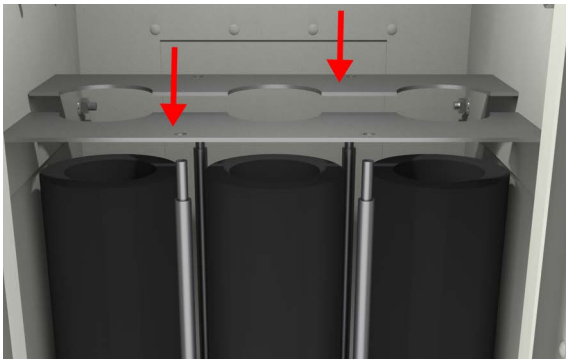
5 : Long cable mount C.Ts can now be installed by laying on the C.T support plate.

6 : C.T mounting rods can now be installed into the bottom support plate.

7 : Fit all fixings for the C.T mounting rods, these are located at the bottom of the CTs underneath the C.T support plate.



8 : Install the top C.T support plates.



9 : Install the C.T clamps by fitting onto C.T mounting rods.

10 : Carefully fix each C.T clamp plate by screwing the four fixings.

Removal of the cable mounted CT assembly is the reverse of this procedure.

18. END-OF-SERVICE-LIFE

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

18.1 SF6

WARNING

Note: This equipment contains the fluorinated greenhouse gas sulphur hexafluoride (SF_6) covered by the Kyoto Protocol with a global warming potential. SF_6 shall be recovered and not released into the atmosphere.

For further information on use and handling of SF6 (see IEC 62271-4:2013 High-voltage switchgear and control gear - Part 4 Use and handling of sulphur hexafluoride (SF6)**).**

The SF6 gas must be removed professionally from the switchgear by a gas handling expert before recycling can commence.

18.2 Switchgear Unit Recycling

Once the switchgear unit is free from SF6 gas, it can then be dismantled by trained and competent personnel, then all component parts sorted and recycled. All parts must be disposed of 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.

18.3 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 SF_6 gas handling and 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 Customer Service response centre:

Tel: +44 (0) 1844 267 267

Fax: +44 (0) 1844 267 223

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Lucy Electric

Aegis 36

Operating and Maintenance Manual

engineering intelligent solutions

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 operation and maintenance procedures for the Aegis 36 range. Produced in March 2022, this manual applies to the Aegis 36 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

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

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

Note: This manual MUST be readily available whenever the unit is handled or operated.

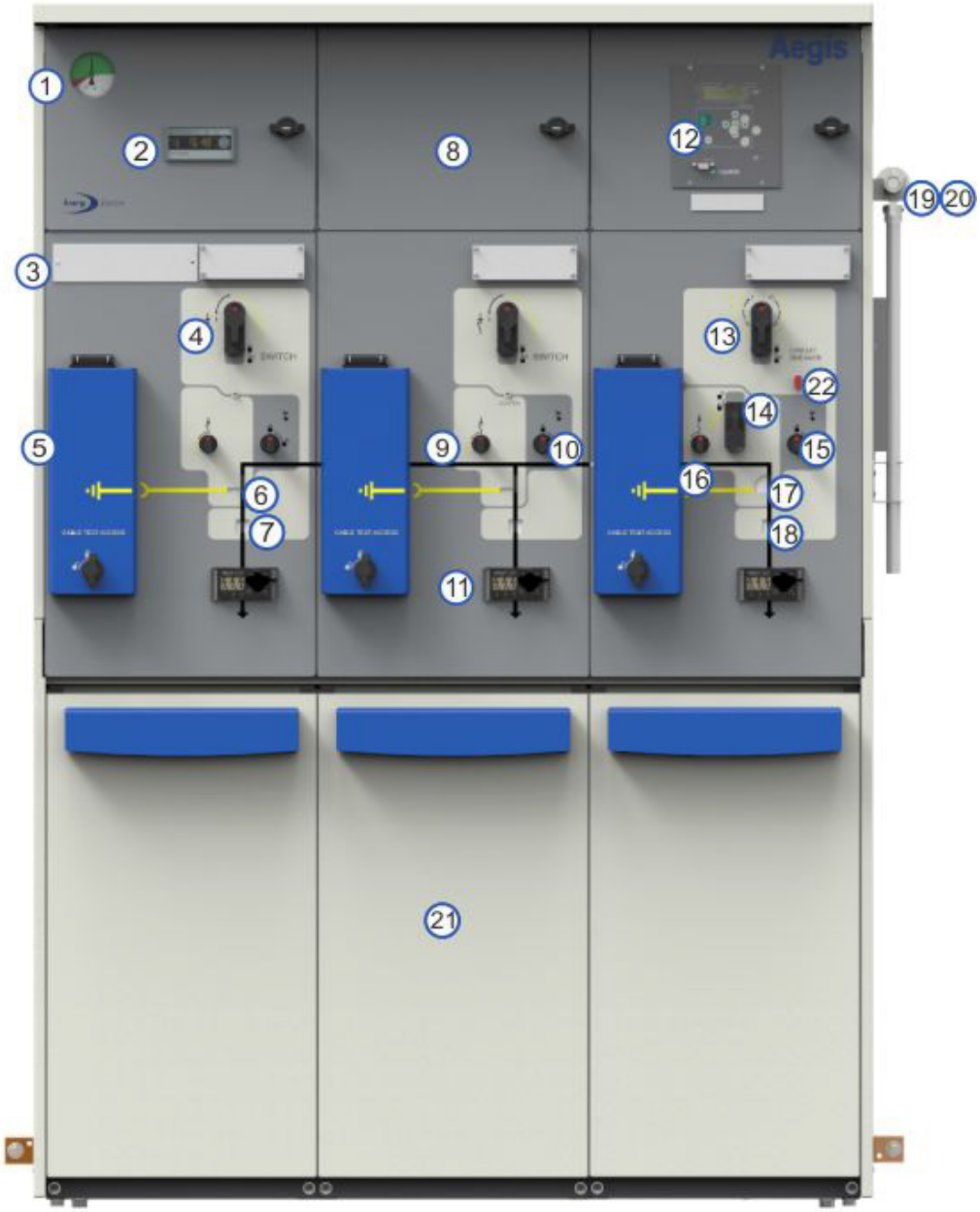
If this equipment suffers from any fault or damage, contact the manufacturer and/or supplier immediately.

- 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 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. Many PPE suppliers provide Flash resistant or Arc Flash clothing for this purpose.

Note: This equipment contains the fluorinated greenhouse gas sulphur hexafluoride (SF6) covered by the Kyoto Protocol with a global warming potential. SF6 shall be recovered and not released into the atmosphere.

For further information on use and handling of SF6, See IEC 62271-4:2013 High-voltage switchgear and control-gear – Part 4: Handling procedures for sulphur hexafluoride (SF6).

3. FRONT PANEL LAYOUT



Legend:

1 : Gas Pressure Indication
2 : Earth Fault Indicator
3 : Rating Plate
4 : Load Switch Operation Collar
5 : Earth & Test Access Cover
6 : Load Switch Selector Indication Window
7 : Load Switch Position Indication Window
8 : LV Panels
9 : Load Switch Selector
10 : Load Switch Cable Test & Cable Box Interlock
11 : Voltage Detection System
12 : Protection Relay
13 : Circuit Breaker Operation Collar
14 : Circuit Breaker Disconnector Collar
15 : Circuit Breaker Cable Test & Cable Box Interlock
16 : Circuit Breaker Disconnector Selector
17 : Disconnector Position Indication Window
18 : Circuit Breaker Position Indication Window
19 : Operation Handle
20 : Document Holder
21 : Cable Compartment
22 : Push-to-trip Button

4. LINE DIAGRAMS

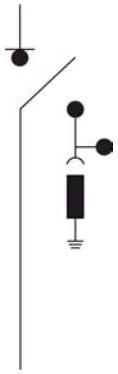
INFORMATION

All line diagrams shown are examples only.

4.1 Non-Extensible Functions.

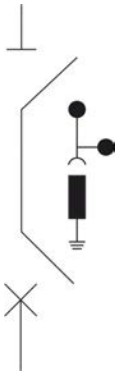
4.1.1 Single Function L: Load Break Switch 630A

Incoming/outgoing unit with load switch disconnector.



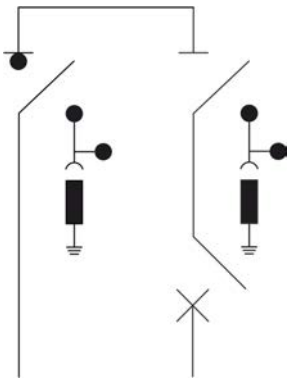
4.1.2 Singe Function V: Circuit Breaker 630A

Transformer protection unit with vacuum circuit breaker.



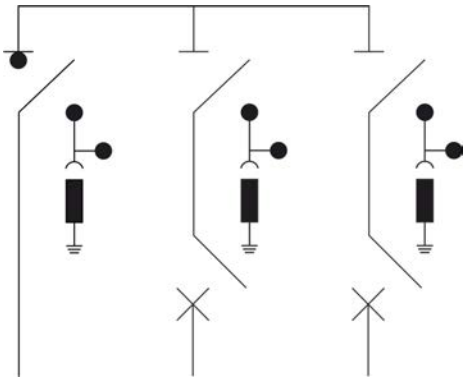
4.1.3 2-Way (LV)

Example of a 2-Way configuration.



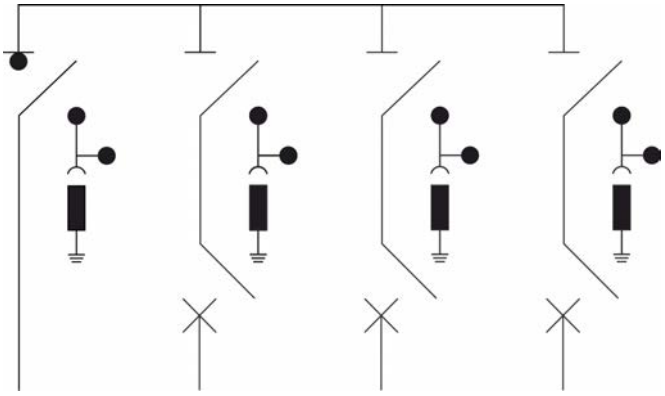
4.1.4 3-Way (LVV)

Example of 3-Way configurations.



4.1.5 4-Way (LVVV)

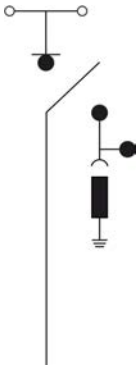
Example of a 4-Way configuration.



4.2 Extensible Functions.

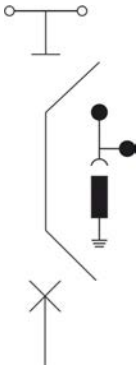
4.2.1 Single Function L: Load Break Switch 630A

Incoming/outgoing unit with load switch disconnector.



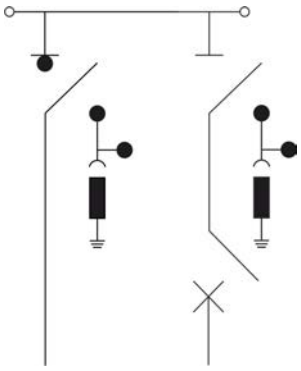
4.2.2 Single Function V: Circuit Breaker 630A

Transformer protection unit with vacuum circuit breaker.



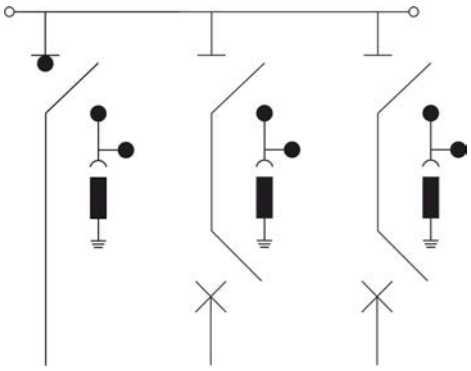
4.2.3 2-Way (LV)

Example of a 2-Way configuration.



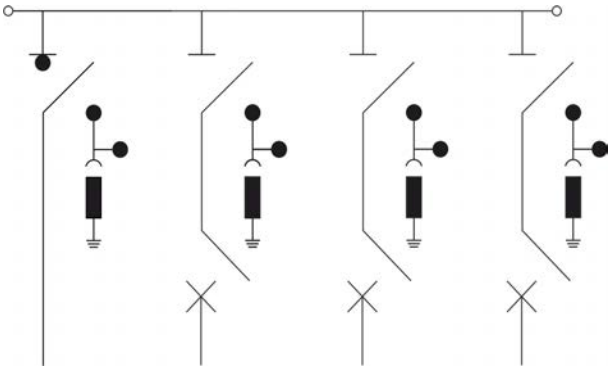
4.2.4 3-Way (LVV)

Example of 3-Way configurations.



4.2.5 4-Way (LVVV)

Example of a 4-Way configuration.



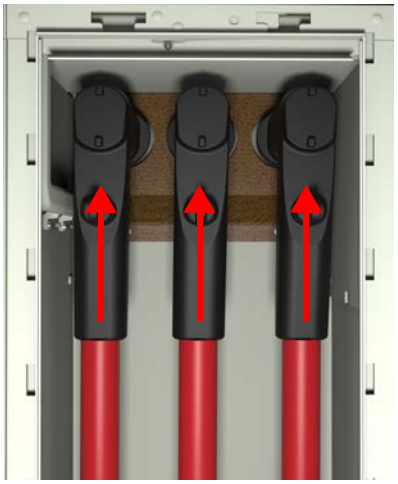
5. PRIOR TO ENERGISING

5.1 Earth Connections

Check that the Aegis 36 unit is connected to the substation Earth.

5.2 Bushing Connectors and Insulating Caps

Check that the connection bushings are fitted with screened connectors or with screened insulating caps (dead ends).



5.3 Pressure check of the unit in operation

WARNING

Pressure gauge needle must be in the **'GREEN'** zone.
If pressure gauge needle in the **'Red'** zone the **unit must not be energised and should be replaced immediately** contact Lucy electric for further information.

CAUTION

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.

6. AEGIS 36 OPERATION

6.1 Obtaining the Operating Handle (Indoor Unit)

1 : When facing the front of the Aegis 36 the operating handle is located on the right side of the unit.
2 : Detach handle from support brackets by lifting.

6.2 Obtaining the Operating Handle (Outdoor Unit)

1 : The operating handle is located inside the front door of the unit.
2 : Detach handle from support brackets by lifting.

INFORMATION

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

INFORMATION

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

6.3 Operation Indication Symbols

INFORMATION

The Aegis 36 unit has standard indications symbols that are used in this manual. These may be different to unit supplied, depending on country and/or customer.
This does not affect the operation on the unit.

Refer to the short-form supplied with the unit for specific indication symbols.

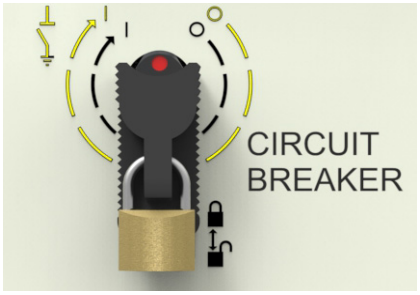
CAUTION

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 operations.

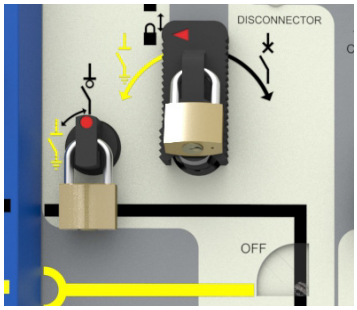
6.4 Circuit Breaker Operation

6.4.1 Padlocking to Prevent Operation

1 : Lock the Circuit Breaker slide cover in position using a padlock as shown below.

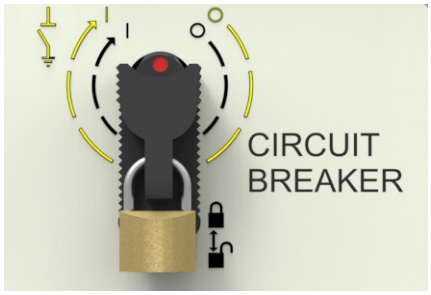


2 : Lock the Disconnector Selector and Disconnector slide cover in position using padlocks as shown below.

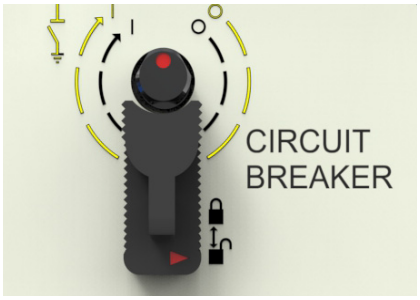


6.4.2 Circuit Breaker from ‘OFF’ to ‘ON’

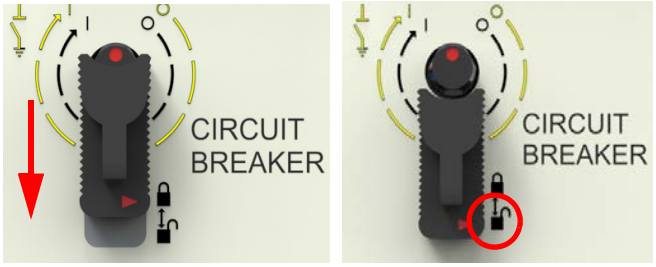
1 : Remove ‘Circuit Breaker’ padlock if fitted.



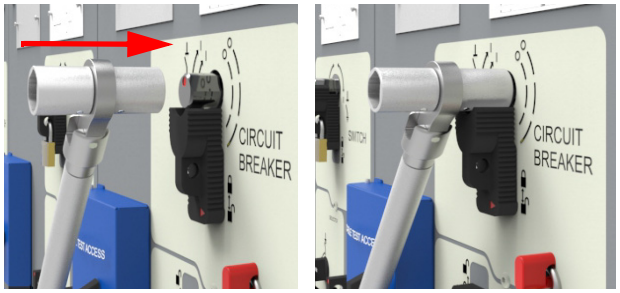
Note: Unlock and locked symbols.



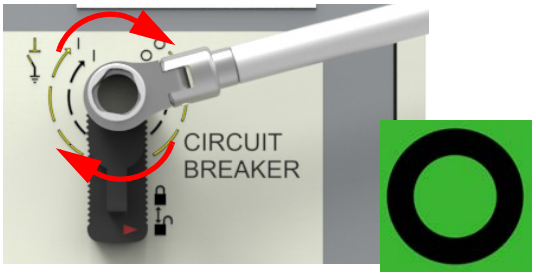
2 : Pull Down and Hold the CB Slide cover into the unlock position (if motorized the Slide cover will stay Down).



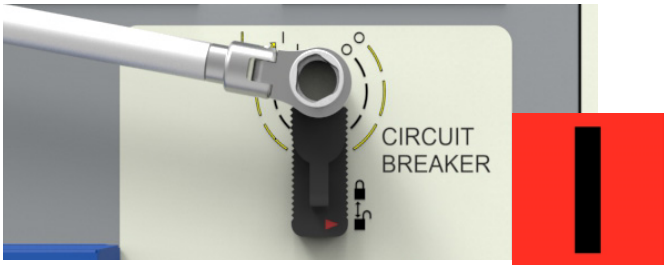
3 : Insert operating handle onto ‘Circuit Breaker’ boss.



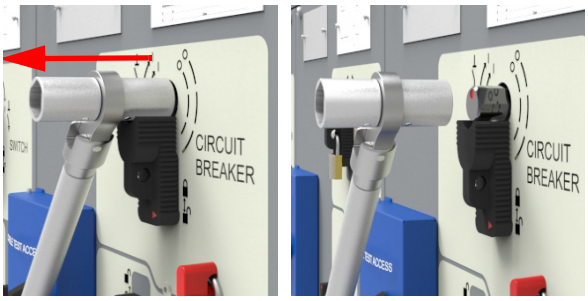
4 : Rotate clockwise one full revolution.



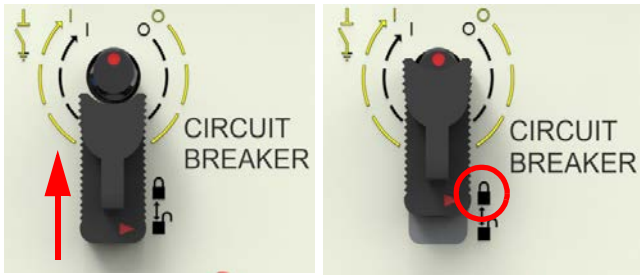
5 : At the end of the revolution the ‘Circuit Breaker’ will close **‘ON’**. **Note: Indication now displays ‘ON’.**



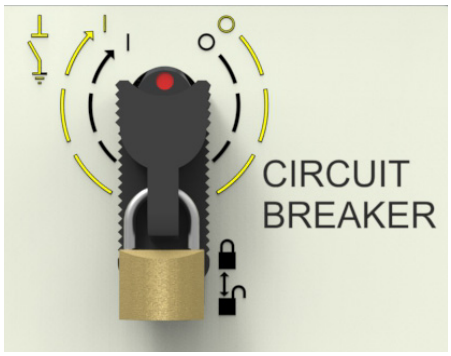
6 : Remove operating handle from Circuit Breaker boss.



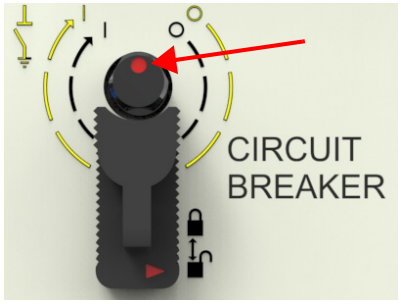
7 : Push the operating ‘Circuit Breaker’ slide cover up into the locked position (Only applicable when motorized otherwise it will autocratically return).



8 : (Optional) Padlock ‘Circuit Breaker’ slide cover.



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

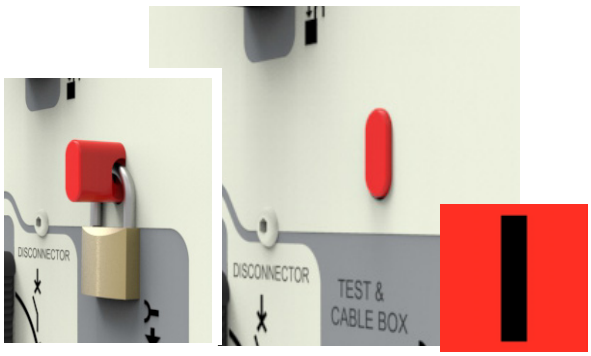


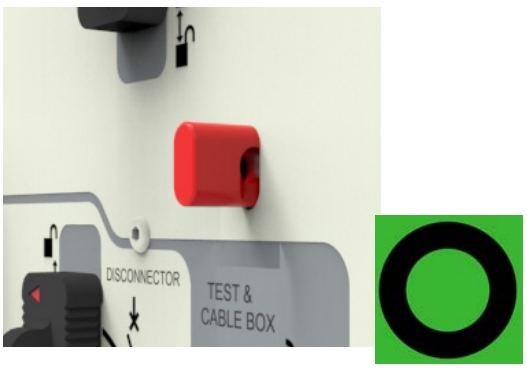
6.4.3 Circuit Breaker from ‘ON’ to ‘OFF’

1 : Remove padlock if fitted from ‘CB MECH OFF BUTTON’ and Press in the ‘CB MECH OFF BUTTON’ (red button) to trip.
Note: Do not use excessive force on the ‘CB MECH OFF BUTTON’ (red button).

2 : Then release, once the ‘CB MECH OFF BUTTON’ has been released.

3 : **(Optional)** secure the ‘CB MECH OFF BUTTON’ using a padlock.

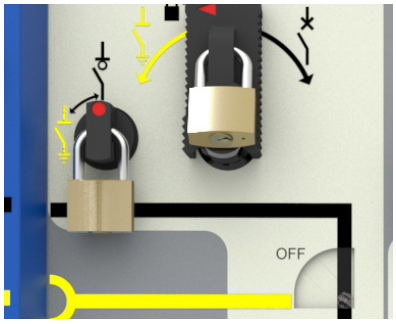




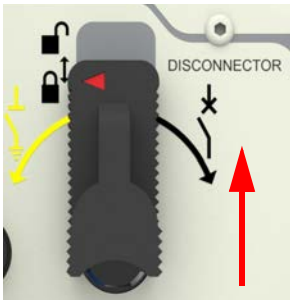
6.4.4 Circuit Breaker ‘OFF to ‘EARTH ON’

Note: For this operation, the circuit breaker must be in it’s ‘OFF’ position and the Disconnector in the ‘ON’ position.

1 : Remove padlock if fitted.

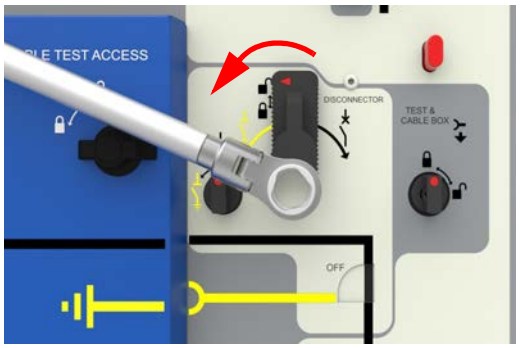


2 : Push the Disconnector Slide Cover UP and HOLD to unlock.

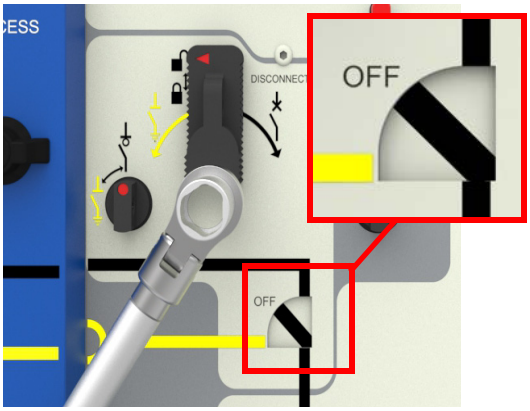


3 : Insert operating handle onto the ‘Disconnector’ Boss.

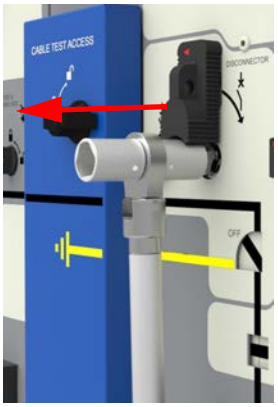
4 : Rotate Disconnector handle anti-clockwise to 60° from **‘ON’** to **‘OFF’.**

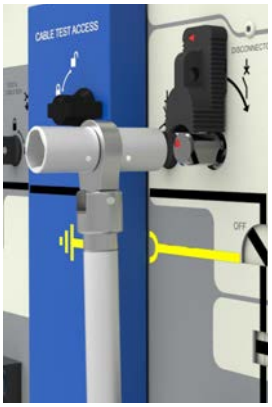


Note: Mimic display now shows disconnector connection to ‘OFF’ position.

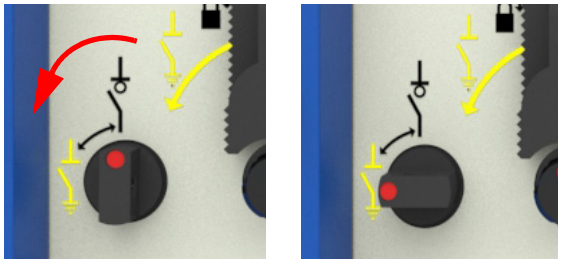


5 : Remove operating handle from the ‘Disconnector’ Boss.

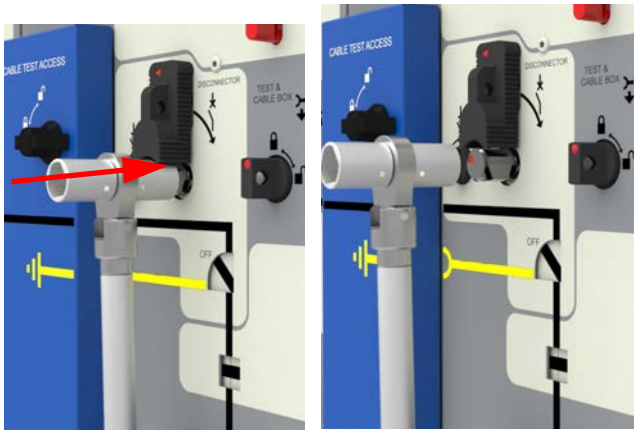




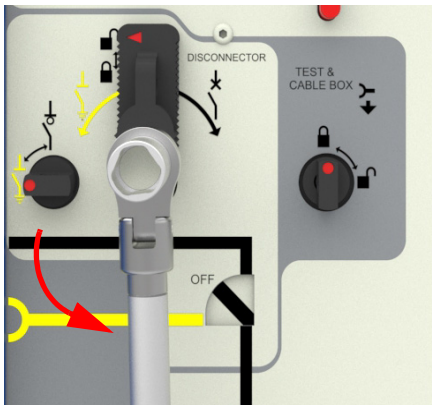
6 : Rotate the Disconnector Selector anti-clockwise 90° to **'EARTH**'



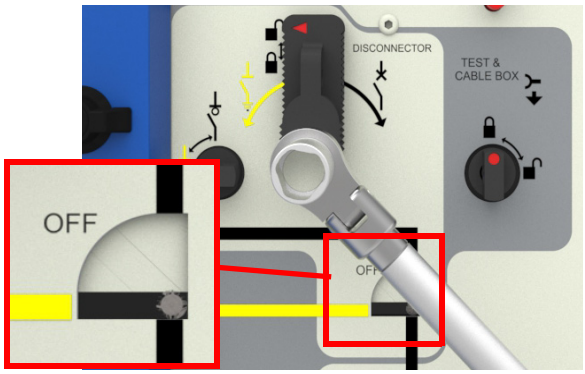
7 : Insert operating handle onto the 'Disconnector' Boss.



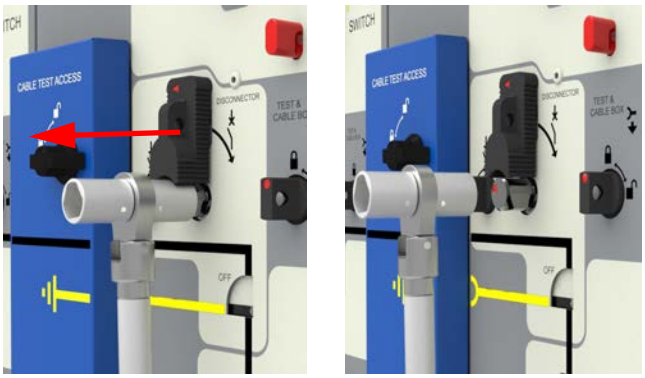
8 : Rotate the handle anti-clockwise 60° from **'OFF'** to **'EARTH ON'**.



Note: Mimic display now shows disconnector connection to 'EARTH ON'

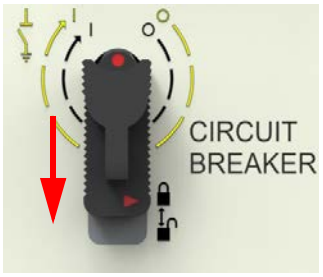


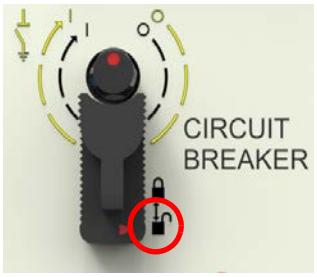
9 : Remove operating handle from the 'Disconnector' Boss.



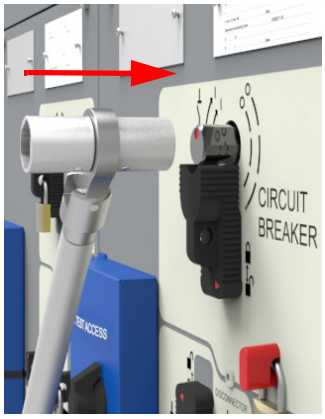
10 : Pull the 'Disconnector' Slide Cover down to lock.

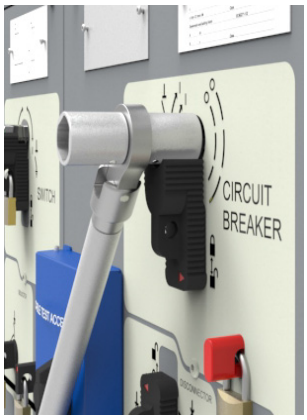
11 : Pull down the operating ‘Circuit Breaker’ slide cover into the unlocked position and hold if not motorised.



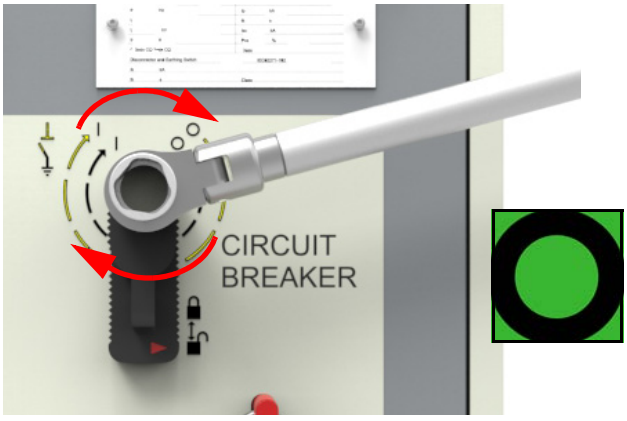


12 : Insert operating handle onto ‘Circuit Breaker’ boss.



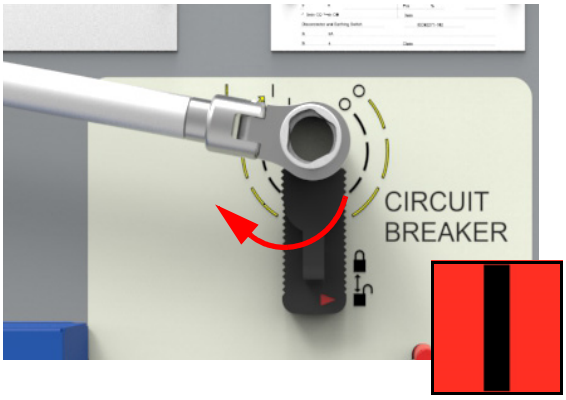


13 : Rotate clockwise one full revolution.

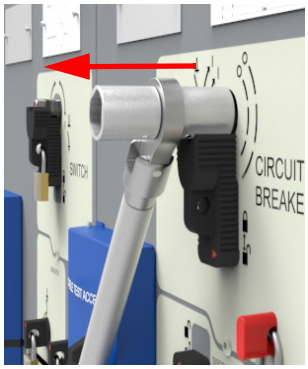


14 : At the end of the revolution the ‘Circuit Breaker’ will close **‘ON’**.

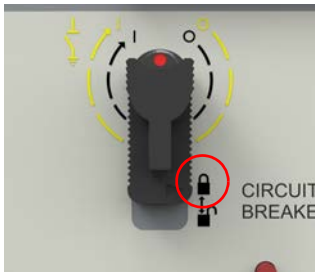
Note: Indication now displays ‘ON’.



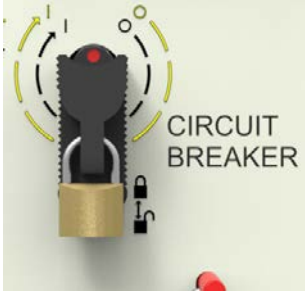
15 : Remove operating handle from Circuit Breaker boss.

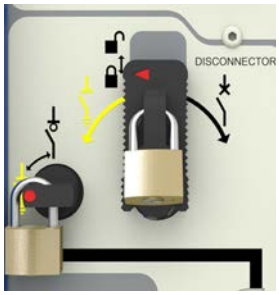


16 : Push the operating ‘Circuit Breaker’ slide cover up into the locked position if not motorised.



17 : (Optional) secure all unused operating covers and Selectors using padlocks.

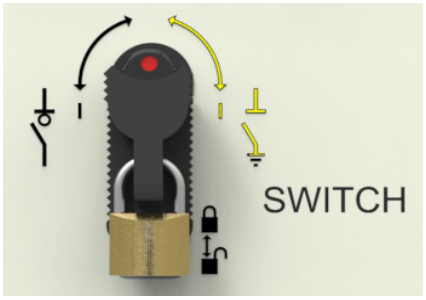




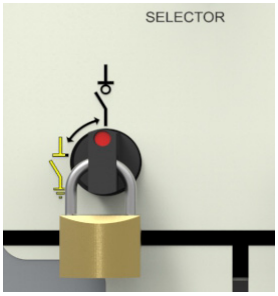
6.5 Load Switch Operation

6.5.1 Padlocking to Prevent Operation

1 : Lock '**Load Switch'** Slide Cover in position using a padlock as shown below.

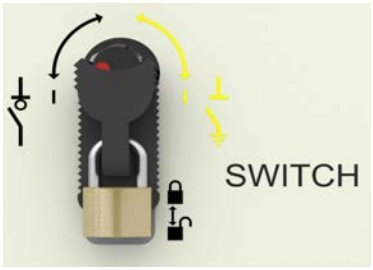


2 : Lock the **'Selector'** in position using a padlock as shown below

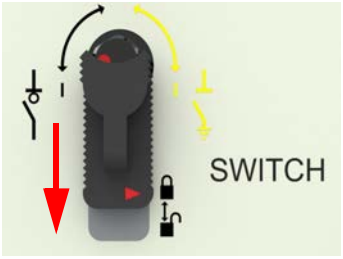


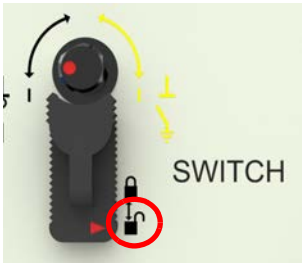
6.5.2 Load Switch 'ON' to 'OFF'.

1 : Remove the padlock if fitted.

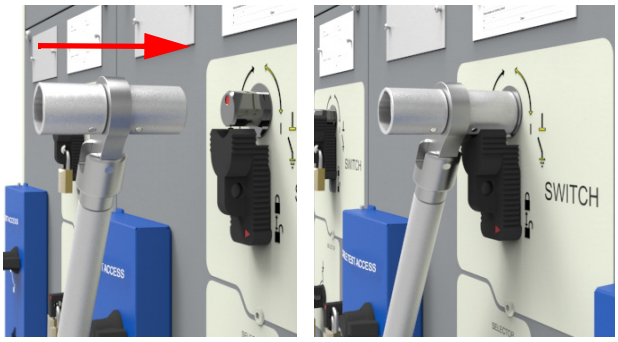


2 : Pull down the 'Load Switch' Slide Cover to unlock and hold if motorised.

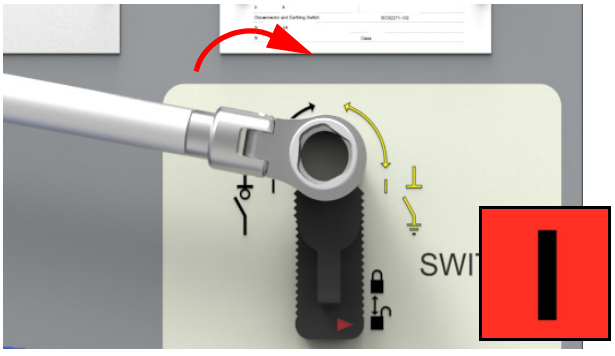




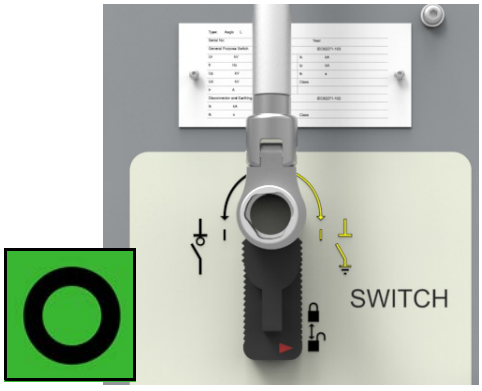
3 : Insert handle on to the 'Load Switch' Boss.



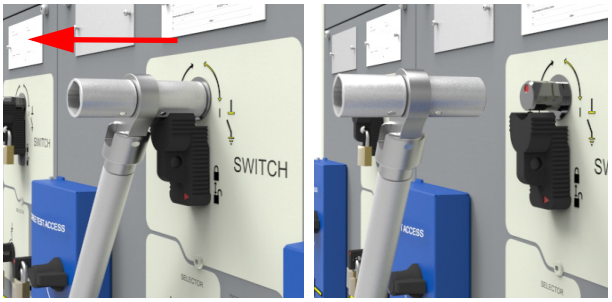
4 : Rotate 120° clockwise to **'OFF'.**



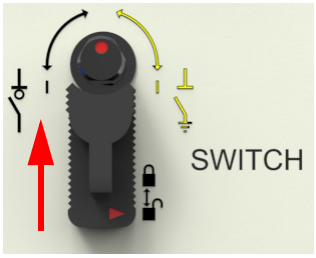
Note: Indication now displays 'OFF'.

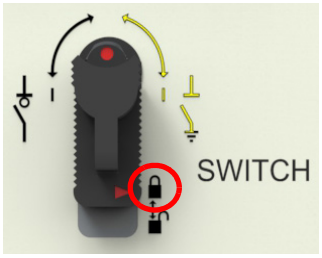


5 : Remove operating handle from Load Switch Boss.

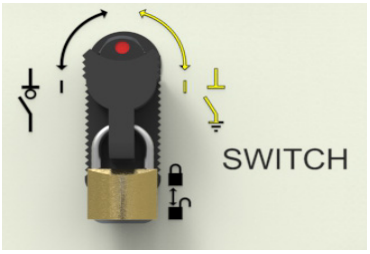


6 : Push up the Slide Cover to lock, (Optional) secure using a padlock.



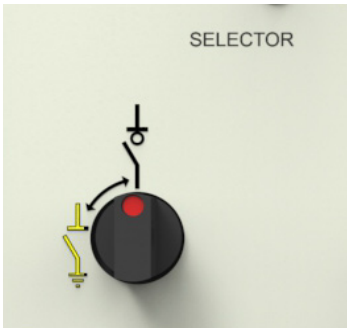


7 : (Optional) Secure ‘Load switch’ Slide Cover using a padlock.

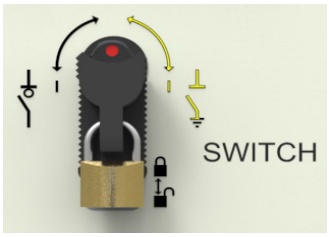


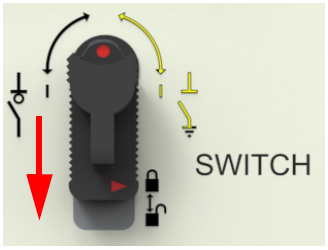
6.5.3 Load Switch ‘OFF’ to ‘ON.

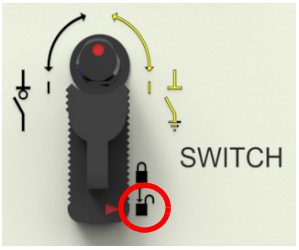
1 : Ensure that the ‘Selector’ is in the **‘ON/OFF’** position.



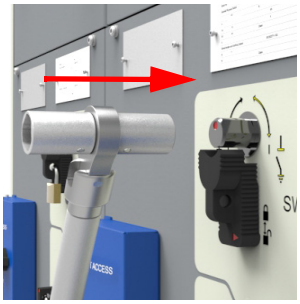
2 : Remove padlock if fitted and pull down the ‘Load Switch’ Slide Cover to unlock.



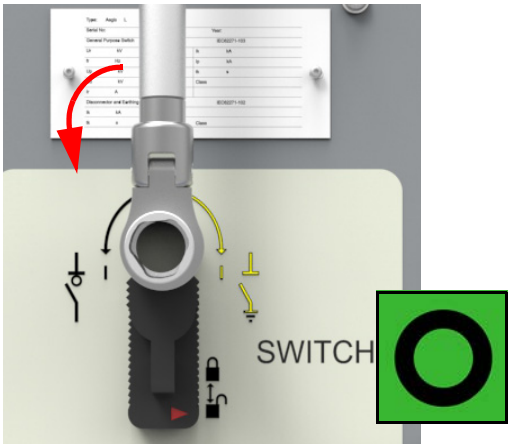




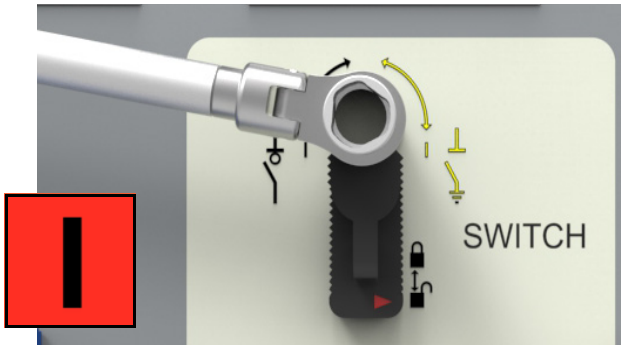
3 : Insert handle on to the ‘Load Switch’ Boss.



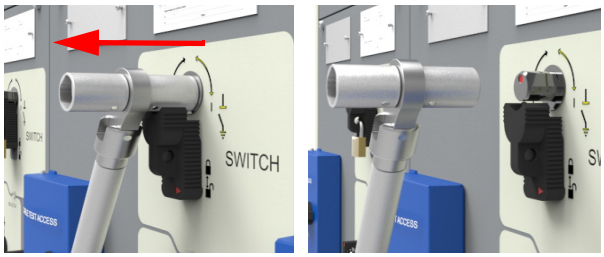
4 : Rotate Operating handle anti-clockwise 120° until switch closes **‘ON’**.



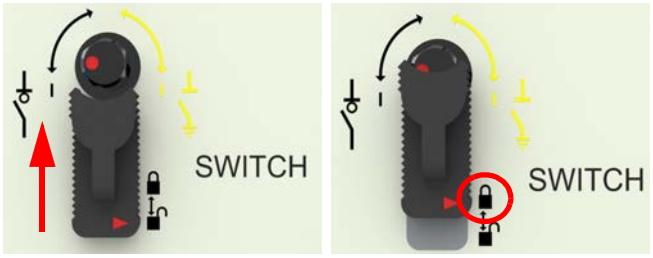
5 : At the end of the 120° turn the ‘Load Switch’ will be **‘ON’**. **Note: Indication now displays ‘ON’**



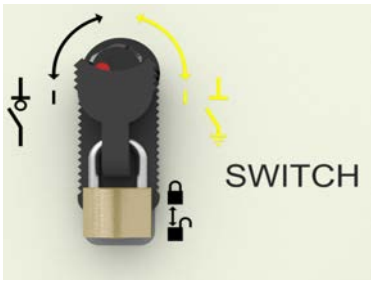
6 : Remove handle from the ‘Load Switch’ Boss.



7 : Push up the Slide Cover to lock.



8 : (Optional) Secure ‘Load switch’ Slide Cover using a padlock.



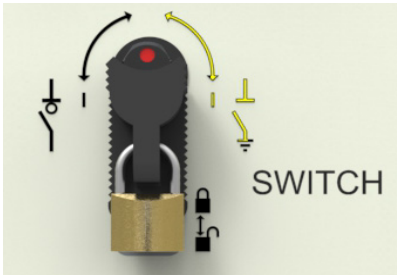
6.5.4 Load Switch ‘OFF’ to ‘EARTH ON’

Note: For this operation, ensure the load switch is in the ‘OFF’ position. See section “6.5.2 Load Switch ‘ON’ to ‘OFF’.” on page 15.

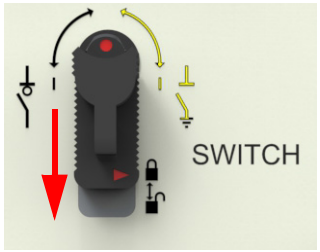
1 : Remove padlock if fitted from ‘selector’.

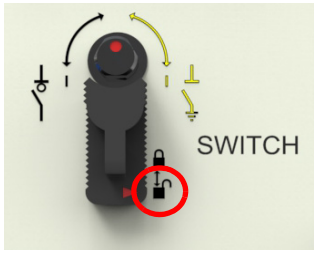
2 : Rotate the selector (by hand) anti clockwise to **‘EARTH ON’.** To prevent opening of Earthing switch, fit padlock through Selector.

3 : Remove padlock if fitted.

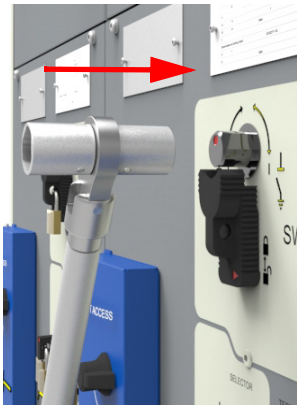


4 : Pull down ‘Load Switch’ Slide Cover to unlock and hold if not motorised.

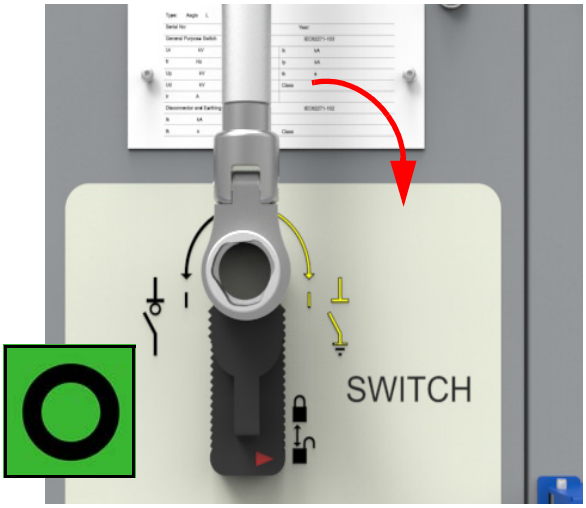




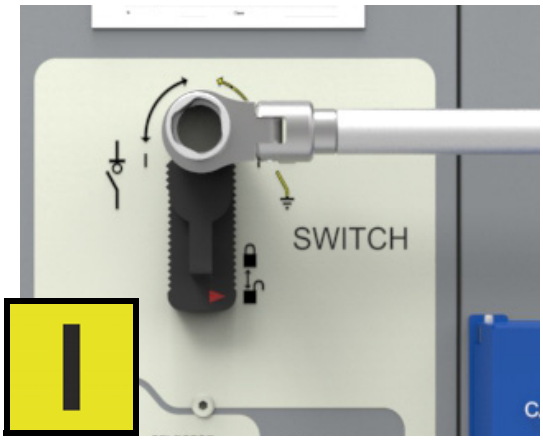
5 : Insert operating handle onto ‘Load Switch’ Boss.



6 : Rotate operating handle 120° clockwise until the switch closes **‘EARTH ON’**.



Note: Indication now displays ‘EARTH ON’.



7 : Once the Switch is in **‘EARTH ON’** remove the handle and secure with a padlock.

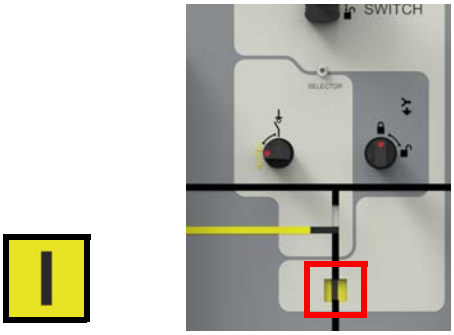
7. EARTH TEST CABLE INSTRUCTIONS

INFORMATION

This procedure is for earth & cable testing function cables when earth & test facility is available.

7.1 Opening of Cable test access door

1 : Ensure respective function is in Earth condition. For steps to achieve Earth condition for SW/CB see **“Load Switch ‘OFF’ to ‘EARTH ON’” on page 17** or **“Circuit Breaker ‘OFF to ‘EARTH ON’” on page 12**.

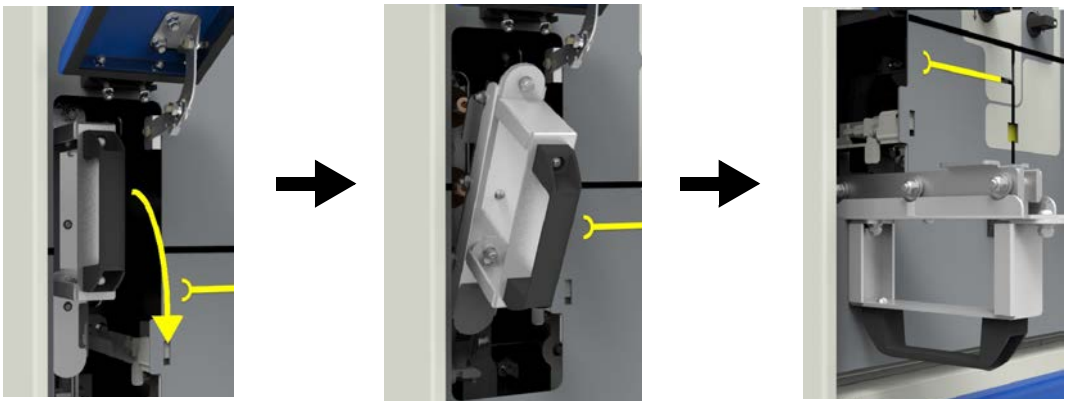


2 : Remove necessary padlocks if present. and Rotate the ‘Test & Cable Box’ clockwise 90° to unlock position.

3 : Unlock the cable test door by rotating the handle anti-clockwise 90° to unlock position.

4 : Open the cable test door upwards and push the stopper link to adjust it so that the door stays in open position.

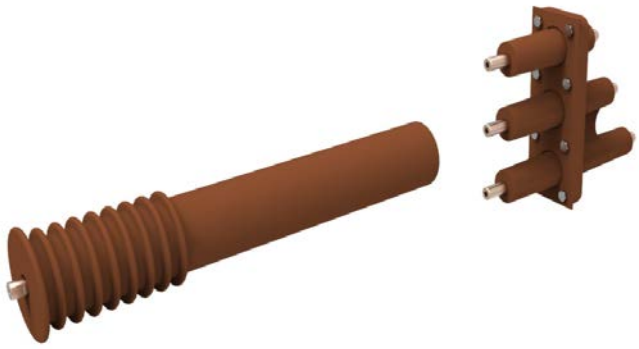
5 : Pull the handle of cable test arrangement out and down (towards you). Bring the handle down to rest horizontally.



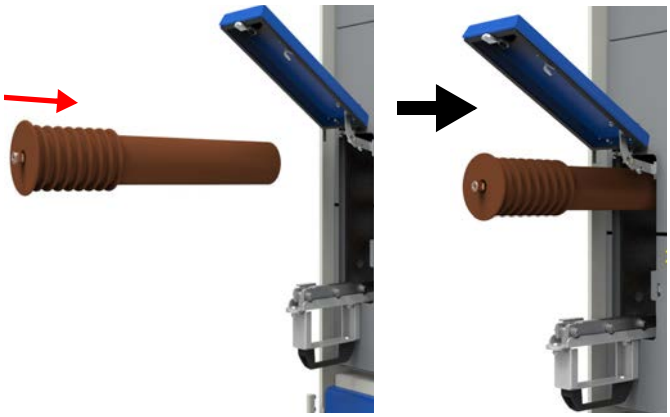
7.2 Insert test plug assembly

⚠ CAUTION Ensure the bushing are kept clean during and after this procedure.

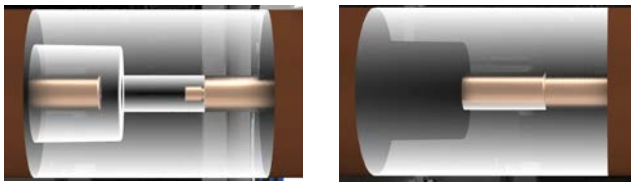
1 : Take care of proper cleanliness of the bushing while assembly.
Only the test plug and bushing view shown for clarity.



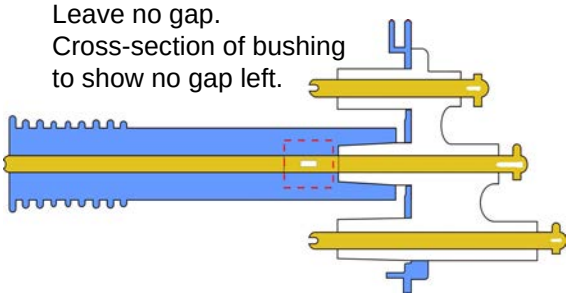
2 : Insert ‘Cable Earth & Test’ Test Plug assembly by hand on respective earth bushing for testing. Use lubricant Molycote (33 Medium) grease as applicable.



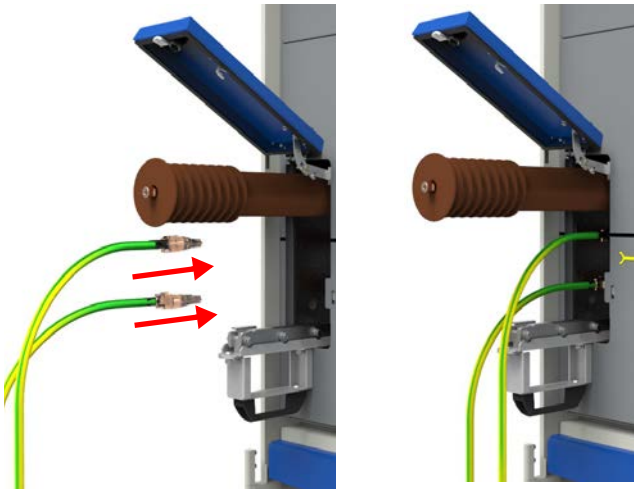
3 : Test Plug is shown and make sure full engagement of M6 thread onto bushing as shown below.



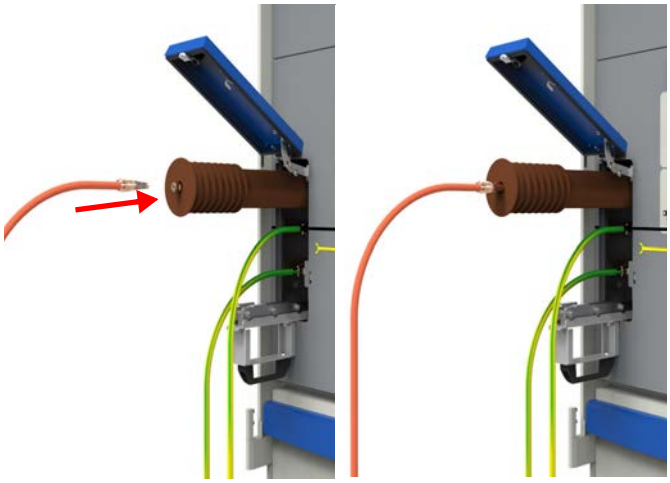
Leave no gap.
Cross-section of bushing to show no gap left.



4 : Connect earth to the remaining phases using crocodile clips.



5 : Also apply earth connection to the tank Apply test voltage to the test probe.



7.3 Closing of Cable test access door

1 : Ensure Cable Test arrangement is closed properly.

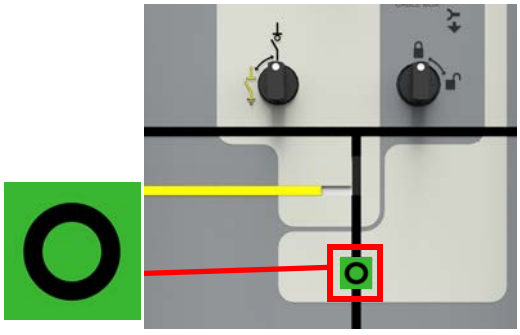
2 : Push the door slightly upwards and adjust the stopper link to close the door downwards.

3 : Rotate the “Cable Test Access selector” clockwise 90° to lock position.

4 : Rotate the “test & cable box selector” anticlockwise 90° to lock position.

5 : Add padlocks to unused operating controls.

6 : The function can now be made ‘**OFF’**.
To achieve **OFF** for SW/CB refer Instruction Operation manual.



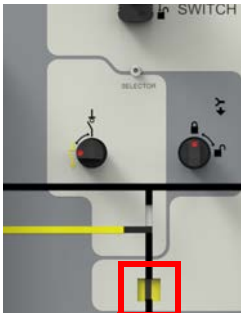
7.4 Removing Cable Box Front Panels

For this operation, ensure the relevant Circuit Breaker or Switch is in the **'EARTH ON'** position **See section "Load Switch 'OFF' to 'EARTH ON'" on page 17 OR "Circuit Breaker 'OFF to 'EARTH ON'" on page 12.**

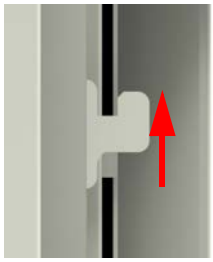
INFORMATION

Cable box front panels interlocked. To prevent removal of 'Cable Box' fit padlock through Test & Cable Box Selector.

1 : The relevant function must be in '**EARTH ON**' and the Test & Cable Box selector in the unlocked position, refer to **"Opening of Cable test access door" on page 19**.



2 : Lift the front panel.



3 : Pull the panel handle away from the unit.

4 : Panel can now be removed and it is possible to access the cable box

Refitting of the cable box front panels is a reversal of this procedure.

INFORMATION

Relevant function cannot be removed from 'EARTH' until the cable box panel is refitted.

CAUTION

If the Test & Cable Box selector does not return to full lock position, then the cable box panel is not fitted properly and will require checking.

8. CABLE TEST PROCEDURE (FOR NON-EARTH & TEST VARIANT)

INFORMATION

This procedure is for cable testing load switch function cables when no dedicated earth & test facility is fitted.

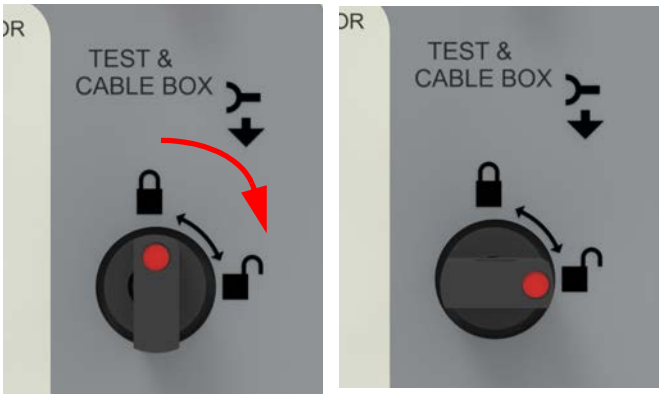
DANGER

Be aware that this procedure enables operation of the function with the cable box front panel removed.

8.1 Load Switch Function

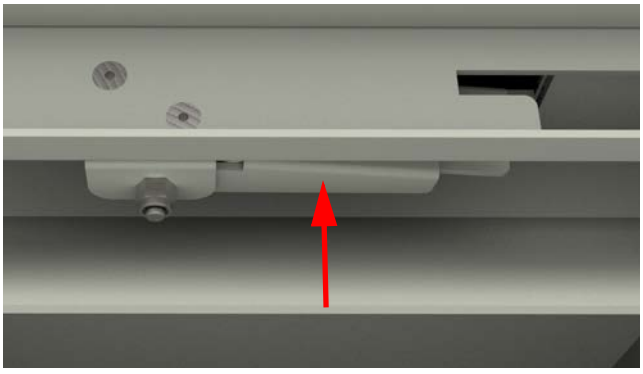
1 : Ensure the Load Switch function is in 'EARTH ON' condition.
For steps to achieve 'EARTH ON' condition see **"section 6.5.4 Load Switch 'OFF' to 'EARTH ON'" on page 17**.

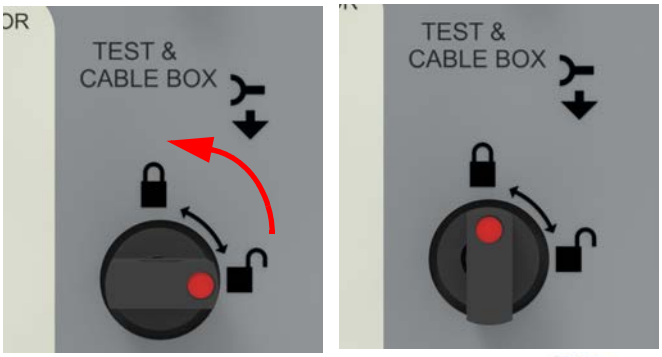
2 : Rotate the "test & cable box selector" clockwise 90° to unlock position.



3 : Remove the cable compartment cover. See **"section 7.4 Removing Cable Box Front Panels" on page 22** for more details.

4 : Push the flap behind the T slot of cable compartment top sheet. This flap should be accessed from the area below the T slot of cable cover lock entry.
With the flap pushed to a few degrees (5°-10°), rotate the "test & cable box selector" anticlockwise 90° to lock position. (This step is done to bypass the cable box interlock only for cable testing)



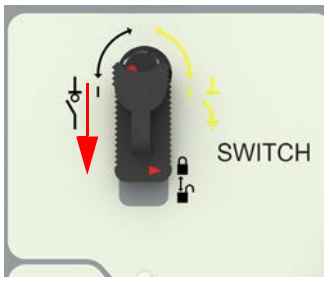


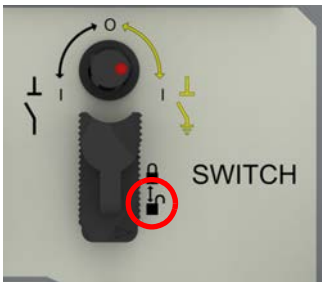
5 : Access the screened cable connector to test the cables.

Approach the connector manufacturer for suitable arrangement of HV testing which is compatible with the assembled screened connector.

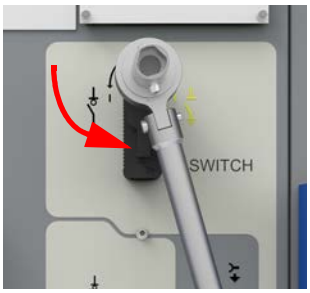
Refer connector's catalogue for dismantling and re-assembly and also refer cable manufacturer's catalogue for cable testing process.

6 : Pull down the function slide cover to unlock.

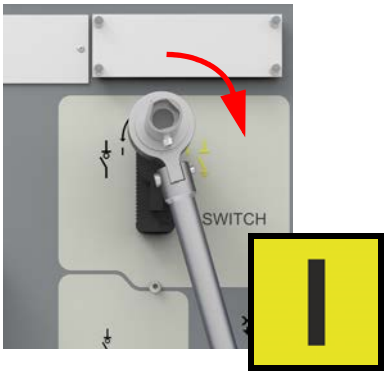




7 : Insert handle on to the Load Switch boss. Rotate 120° anti-clockwise from 'EARTH ON' to 'OFF'.



8 : After testing is complete, pull down the 'Load Switch' Slide cover to unlock and insert handle on to the Load Switch boss. Rotate 120° clockwise from 'OFF' to 'EARTH ON'.



9 : Rotate the "test & cable box selector" clockwise 90° to unlock position.

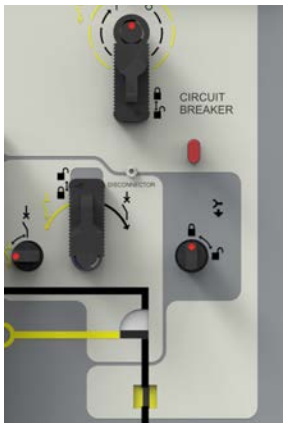
10 : Put the cable compartment cover back in place.

11 : Rotate the "test & cable box selector" anticlockwise 90° to lock position.

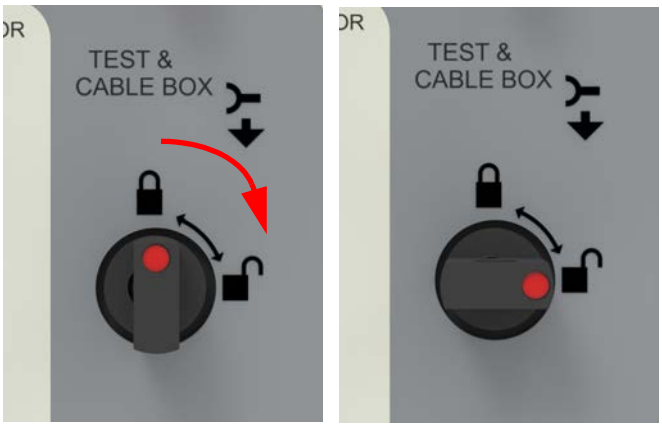
The function can now be made '**OFF'.**

8.2 Circuit Breaker Function

1 : Ensure Disconnector is in earthed position and CB is '**ON**'. For steps to achieve Earth condition see **"section 6.4.4 Circuit Breaker 'OFF to 'EARTH ON'" on page 12**.

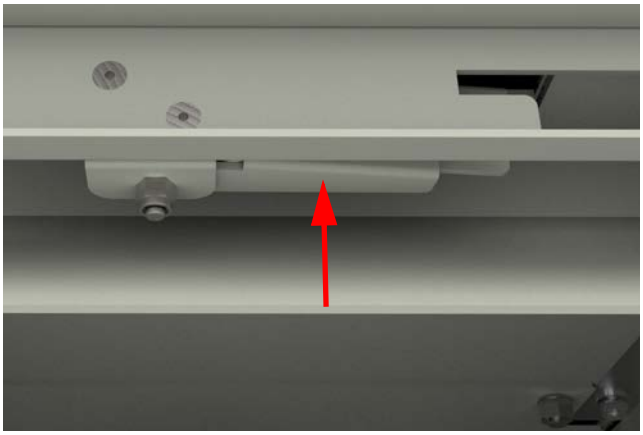


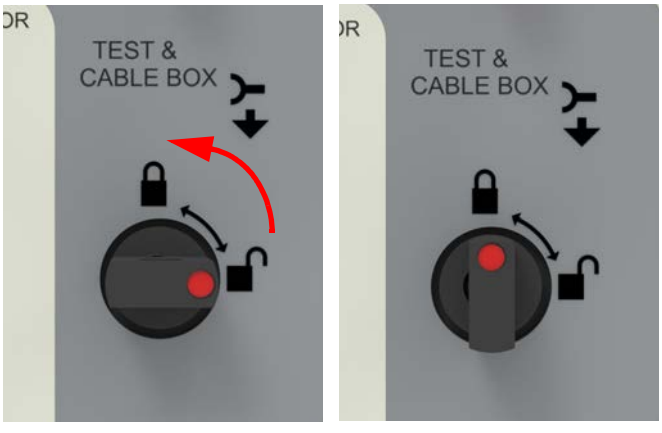
2 : Rotate the "test & cable box selector" clockwise 90° to unlock position.



3 : Remove the cable compartment cover. See **"section 7.4 Removing Cable Box Front Panels" on page 22** for more details.

4 : Push the flap behind the T slot of cable compartment top sheet. This flap should be accessed from the area below the T slot of cable cover lock entry.
With the flap pushed to a few degrees (5°-10°), rotate the "test & cable box knob" anticlockwise 90° to lock position.
(This step simulates the cable box front panel fitted and should only be carried out for cable testing when no dedicated earth & test access is fitted.)





5 : Access the screened cable connector to test the cables.

Approach the connector manufacturer for suitable arrangement of HV testing which is compatible with the assembled screened connector.

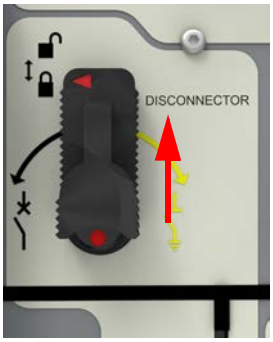
Refer connector's catalogue for dismantling and re-assembly and also refer cable manufacturer's catalogue for cable testing process.

6 : Press and release the 'CB Mech OFF Button' for tripping the CB. CB is now '**OFF'**.

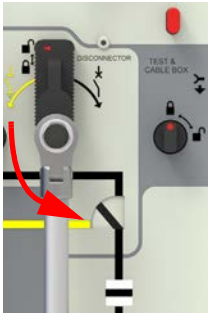
7 : Push 'Disconnector Slide Cover' upwards to unlock.

8 : Insert operating handle onto the Disconnector Boss.Rotate handle clockwise 60° from 'Earth' to '**OFF**'.

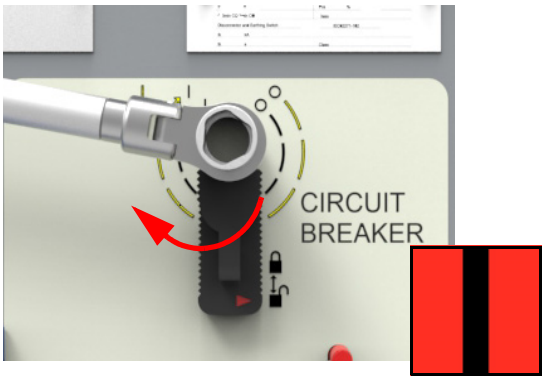
9 : After testing is complete, push 'Disconnector Slide Cover' upwards to unlock.



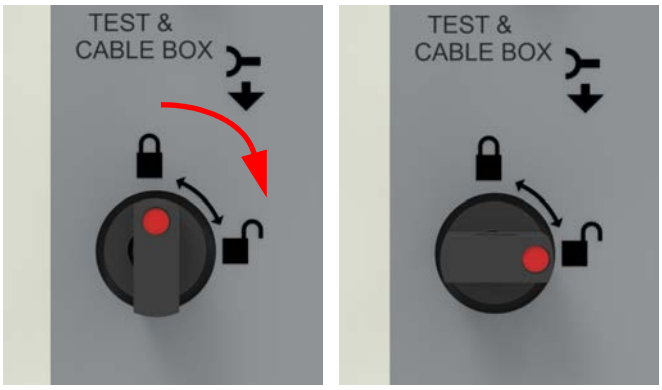
10 : Insert operating handle onto the Disconnector Boss. Rotate handle anti-clockwise 60° from '**OFF**' to '**EARTH ON**'.



11 : Insert operating handle onto ‘Circuit Breaker’ boss and rotate clockwise one full revolution to operate CB to ‘**ON’**. Rotate the “test & cable box knob” clockwise 90° to unlock position.

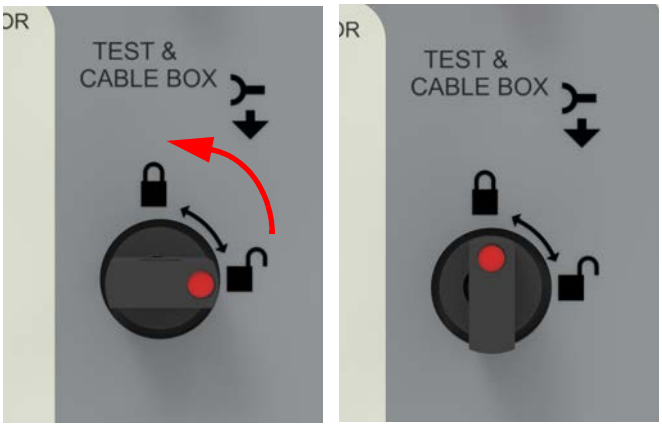


12 : Rotate the “test & cable box selector” clockwise 90° to unlock position.



13 : Put the cable compartment cover back in place.

14 : Rotate the “test & cable box selector” anticlockwise 90° to lock position.



15 : The CB function can now be made ‘**OFF’**.

9. MAINTENANCE

9.1 Preventative Maintenance

INFORMATION

Cleaning - Use Cloth material for specific areas of the Aegis 36 unit Panelling.

9.2 Unit panelling

The risk of using high pressure cleaning processes are damaging to the life of the Aegis 36 unit. Lucy Electric cannot therefore guarantee the reliability of the Aegis 36 equipment that have been cleaned in this manner.

Clean using a dry cloth

CAUTION

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

9.3 Unit Maintenance

9.3.1 Maintenance warning

WARNING

LUCY ELECTRIC RECOMMENDS BELOW IN ADDITION TO THE ABOVE WORKING PRACTICES:

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

9.3.2 Operating conditions

‘Ideal’ in service conditions

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

‘Standard’ in-service conditions

- Unit is to be installed and commissioned in accordance with manufacturers instructions.
- Humidity to be below 60%.
- Unit to be used indoors or outdoors, but not subjected to extreme weather conditions e.g.: ice, snow, dust storms, heavy rain etc.
- Ambient temperature to be between -25°C and 40°C.
- No regular or thick covering of leaves or debris.
- No contact with chemical agents.
- No infestation of any animals.
- No contact with any plant life.
- No foundation movements.
- No damage to the unit of any kind.

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

9.4 Maintenance schedule

The following is the recommended maintenance schedule for the Aegis 36 unit.

Gas Enclosure: No routine maintenance required.

Unit Exterior:

- Check all external fixings are present and tight.
- Check all labels are present.
- Check all earth connections are present.
- Check the operation of the unit (including interlocks with the unit isolated).
- Clean the unit thoroughly.
- Touch-up paint work as necessary.
- Check that the SF6 gas indicator is in the green zone. If the indicator is in the red zone, then refer to **See “section 9.5.1 SF6 Gas Leakage”.**

Outdoor clad units:

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

9.5 SF6 Issues

9.5.1 SF6 Gas Leakage

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

INFORMATION

A circuit breaker can still operate safely under gas pressure is zero conditions.

9.6 Maintenance Checklist

1

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

2

Mechanical Operating Mechanisms
Check for rust on moving parts.
Reasons:
Condensation and humidity presence.
Solutions:
Find and rectify the source of the condensation.
Replace the operating mechanism if required.

3

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

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

10. END-OF-SERVICE-LIFE

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

10.1 SF6

Note: This equipment contains the fluorinated greenhouse gas sulphur hexafluoride (SF_6) covered by the Kyoto Protocol with a global warming potential. SF_6 shall be recovered and not released into the atmosphere.

For further information on use and handling of SF6 (see IEC 62271-4:2013 High-voltage switchgear and control gear - Part 4 Use and handling of sulphur hexafluoride (SF6)**).**

The SF6 gas must be removed professionally by a gas handle expert from the switchgear before recycling can commence.

10.2 Switchgear Unit Recycling

Once the switchgear unit is free from SF6 gas, it 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.

10.3 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 SF_6 gas handling and 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 Customer Service response centre:

Tel: +44 (0) 1844 267 267

Fax: +44 (0) 1844 267 223

Email: customer.service@lucyelectric.com

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