

Ausgrid Chamber Substation indoor switchgear

**installation, operation and
maintenance
instructions**
version 1.6 / February 2009

Details of revision

Version	Comment	Date
1.0	First Draft Issue	May 2006
1.1	Includes comments and corrections from customer	July 2006
1.2	Includes additional comments from customer	August 2006
1.3	Information on securing SA Neutral earthing cable added	August 2006
1.4	Design changes incorporated	April 2007
1.5	AG Comments	August 2007
1.6	Details of Busway Chamber added	February 2009

	Page
GENERAL DESCRIPTION	4
Introduction	4
Weights and dimensions	4
Lifting instructions	5
INSTALLATION	7
Installation of panels	7
Removal of lifting lugs	7
Connection of panels	7
Fitting of main busbars	8
Fitting of Earth bar	10
Main cable connection	10
Fitting of Busbar Ventilation Roof	11
Fitting of Busway Top Chamber	12
Fitting of End Plates	14
Fitting of Surge arrester end panel	15
Auxiliary wiring ducts	17
Kit contents	18
Surge arrester end panel kit (EEAABB)	20
OPERATION	21
Operation of circuit breaker	21
Test point access	28
ARCHITECTURE	29
Circuit breaker incoming panels	29
Customer Cable Supply panels	30
1600A Fused Distributor panel	31
Customer Busbar Supply panels	32
Bus-section panel	33
Fused Distributor panel	34
MAINTENANCE	35
routine maintenance	35
general maintenance	36

General description

General description

Introduction

These instructions cover all operations concerning handling, installation, operation and maintenance of the Chamber Substation panels for Ausgrid.



The range comprises:-

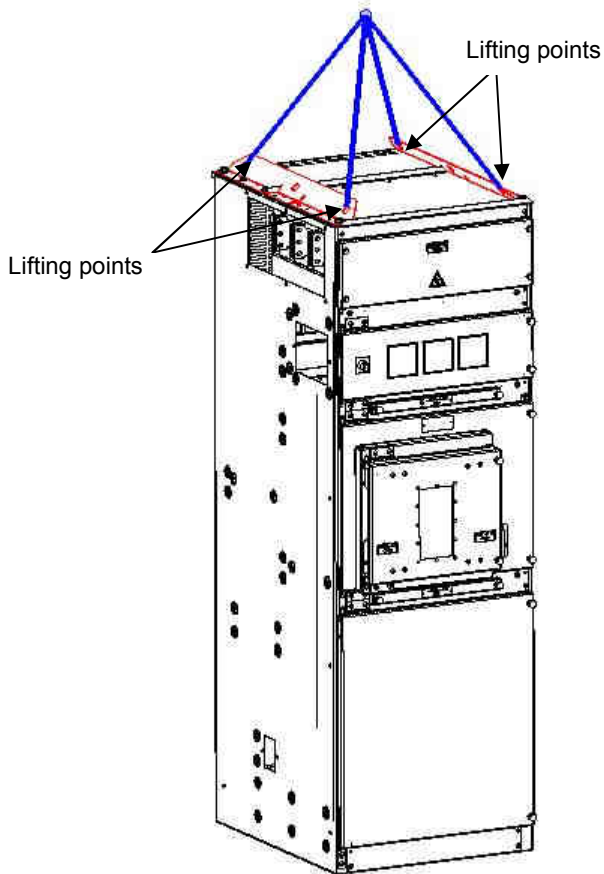
- 3000A Incoming Type 1 & 2
- 2000A Incoming Type 1 & 2
- 3000A Bus-section
- 3000A Customer supply – switch – cable Types 1 & 2
- 3000A Customer supply – circuit breaker – cable Types 1 & 2
- 3000A Customer supply – switch – busbar Types 1 & 2
- 3000A Customer supply – circuit breaker – busbar Types 1 & 2
- 3000A Customer supply – link – busbar
- 1600A distributor panel
- Fused distributor panel

Weights and dimensions

unit(s)	Standard W x H x D	Fused distributor W x H x D	Bus-section W x H x D
average dimensions (mm)	650 x 1943 x 779	650 x 1943 x 779	950 x 1943 x 779
With busbar ventilation chamber fitted	650 x 2243 x 779	650 x 2243 x 779	950 x 2243 x 779
average weight (kg) (packed)	650	430	890
Maximum weight (kg)* (packed)	720	450	910

* Maximum weight includes for a single freestanding unit that includes all available options.

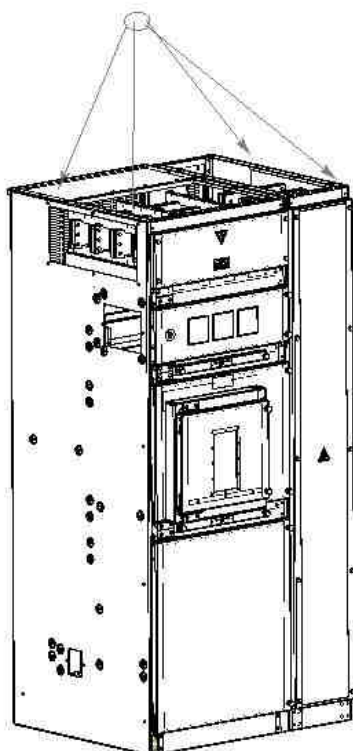
Lifting instructions



Note: Lifting Chains/ropes should be positioned at 500mm from the lifting points as shown.

Important: during the lifting operation, all four lifting points must be used.

Maximum mass = 720kg



Note: Lifting Chains/ropes should be positioned at 700mm from the lifting points as shown.

Important: during the lifting operation, all four lifting points must be used.

Maximum mass = 910kg

Storage	The equipment is suitable for indoor use only. It is therefore necessary to protect the equipment from the environment before and during erection/commissioning. Should the busbar chamber or cable box become exposed to the elements, they should be thoroughly cleaned prior to energising.
Offloading	All units are offloaded using the lifting lugs that are fitted to the units as standard and should be offloaded using an overhead crane (see diagrams on previous page.).
Storage	These units are designed for indoor use only and must not be left outdoors. They should be stored in a warm, dry switchroom and protected against dust and debris.
Ancillary kits	The ancillary kits (cubicle jointing kit, cubicle end plate kit) are either supplied loose with each unit, fastened to the panel, or secured in the cable box.

Installation

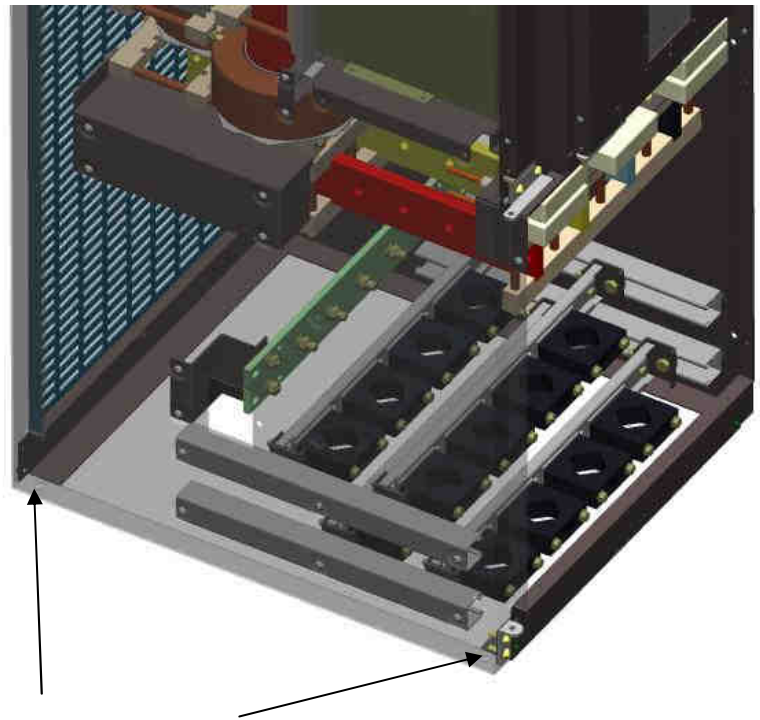
Installation of panels

Panels are to be installed on supporting steel beams over a concrete pit, in accordance with the requirements of Ausgrid Network Standards: NS 114 for 11kV, or NS 229 for 33kV.

The supporting beam tolerance is $\pm 1\text{mm}$ over 1 metre.

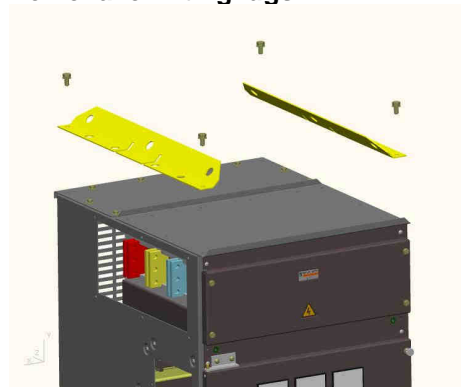
Line up the first panel in position and attach to supporting beams using M12 bolts, drilling through the supporting beams through the fixing holes at the front and rear of the unit. Finger tighten the bolts (do not over-tighten). Manoeuvre the next panel into position and repeat.

All fixing bolts should be tightened once all panels are in place.



Fixing holes are in each corner of units

Removal of lifting lugs



The lifting lugs are removed by undoing the 4 x M12 bolts in the corners of the unit. The lifting lugs can then be removed

The front top cover should then be removed and saved for later fitting as part of the ventilation chamber.

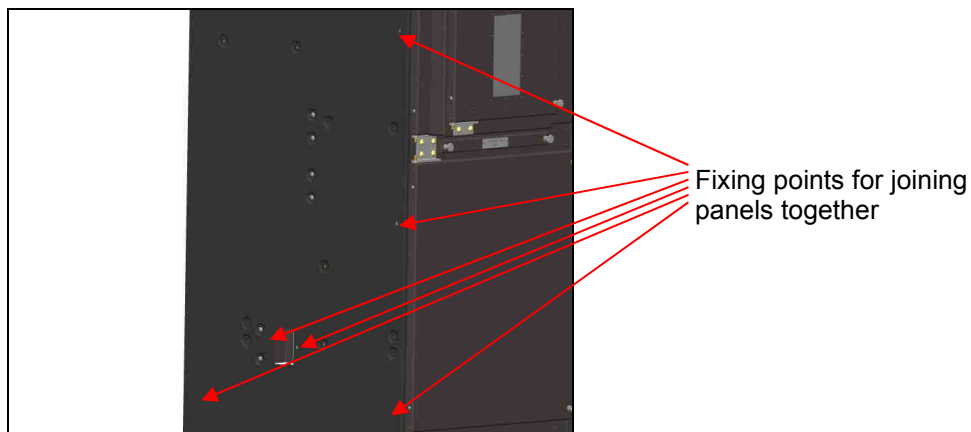
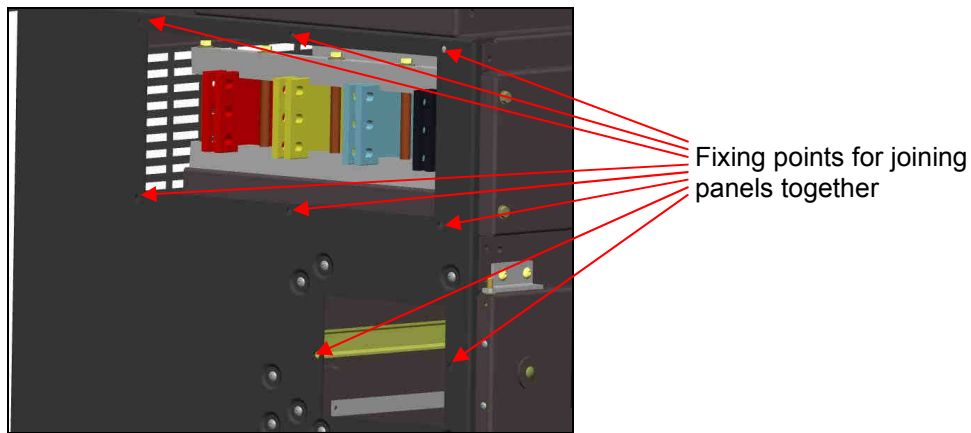
The rear top cover should remain in place. The rear M12 bolts should then be refitted to ensure the internal arc rating is maintained.

Connection of panels

There are 14 holes designed in to each side panel to join the units together. It is important to maintain the internal arc rating of the equipment that each fixing point is used. Not using a fixing point may result in a failure of the internal arc protection in the event of a failure.

To join panels together a fixing kit EEAJK1 should be used. Each fixing kit provides sufficient loose fixing to join panels together and to interconnect the busbars. When joining panel on to the left-hand side of a bus-section the fixing kit EEAJK1 is not required as each bus-section comes with its own special kit for this joint. However these instructions should still be followed to join the panels together.

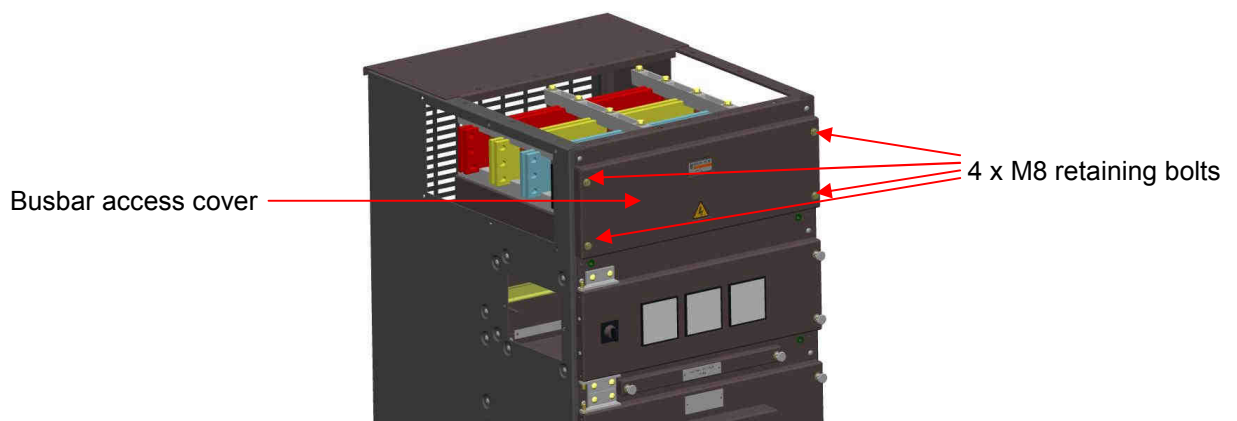
The locations of the holes are shown in the following photographs. Access to the fixing holes can be achieved by opening the front doors of the panels.



Fitting of main busbars

The busbars between panels should be joined together before the ventilation roof is fitted to ease access to the busbars.

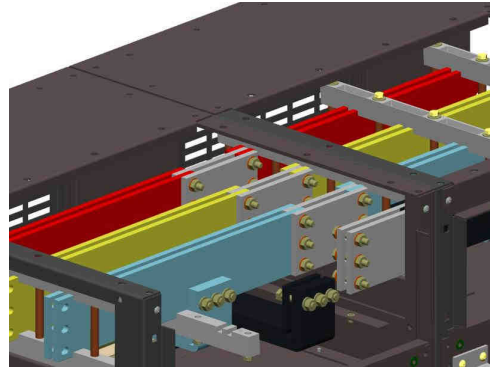
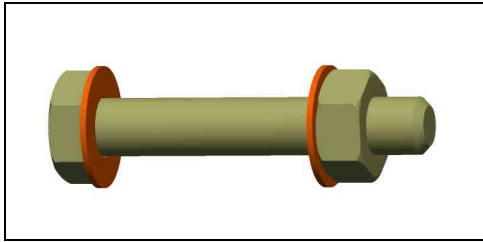
The busbar access panel is removed by undoing the 4 x M8 retaining bolts and then removing the cover.



The busbar supports should then be loosen but not removed to ease the fitting of the busbar joints. This is done by loosening the 5 nuts on top of each busbar support.

The busbar links and nuts and bolts required can be found as part of kit EEAJK1

The links should be fitted as shown (towards the front) to each busbar in turn starting with the busbar farthest from the front. The M10 x 60 bolts should be fitted with the head towards the front of the panel. Each bolt head and nut should have a belville washer fitted as shown bellow.



The bolts should be tightened using a torque wrench to 46Nm to ensure a good electrical connection.

The busbar access panel is re-fitted by reversing the process used to remove it.

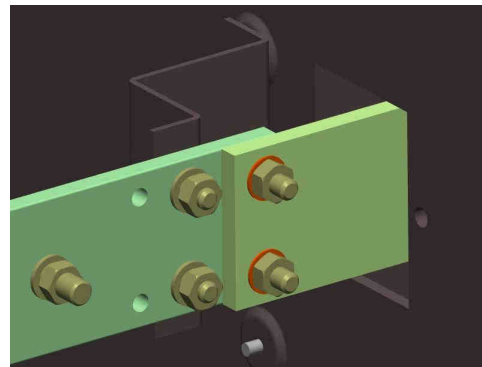
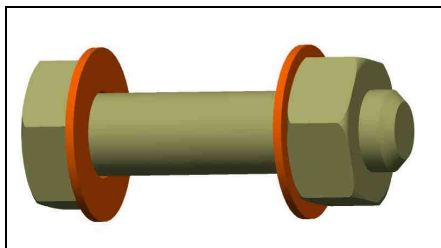
Fitting of Earth bar

The earth bar can be fitted by gaining access through the cable termination chamber. The earth link and nuts and bolts required can be found as part of kit EEAJK1.

The earth bar is located at the bottom of each panel. All panels should have the earth bars connected together.



The earth links should be fitted as shown (towards the front) to earth bar. The M10 x 40 bolts should be fitted with the head towards the front of the panel. Each bolt head and nut should have a belville washer fitted as shown below.



The bolts should be tightened using a torque wrench to 46Nm to ensure a good electrical connection.

Main cable connection

All units are fitted with dry type cable connections suitable for accepting a cable lug type termination.

The bolt fitting the cable lug to the termination should be tightened using a torque wrench to torque 75Nm

Ensure that the cable clamp supports the cable before tightening the cable lug to the cable termination. This will ensure that not all of the weight of the cable is taken by the circuit breaker chassis.

note:

1. On incomer panels, Customer Disconnect panels and 1600A fused Distributor panels the Red (L1) phase bushing is on front left of the unit.
2. On Fused Distributor panels the phases are arranged Red (L1) left rear, White (L2) right rear and Blue (L3) front middle.

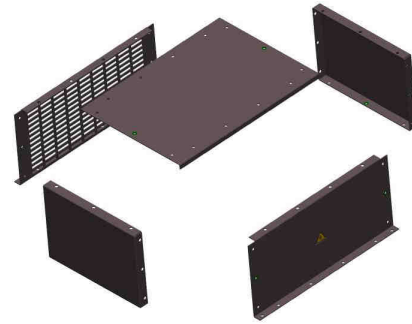
Fitting of Busbar Ventilation Roof

The Busbar Ventilation top cover is supplied already fitted to the unit, this will have been removed while removing the lifting lugs and should not be used.

The Busbar Ventilation roof is supplied un-assembled. The ventilation roof comprises of two sides, a front panel, a rear-ventilated panel and a roof.

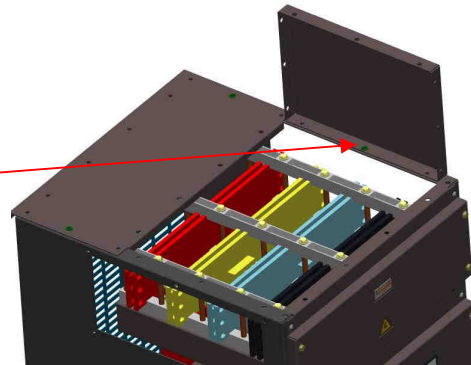
The components, including all the M12 bolts, M8 bolts, earthing washers, c form washers and spring washers, required to assemble the roof are supplied as part of the main panel.

The sides should be fitted first ensuring that the earthing washer is fitted.

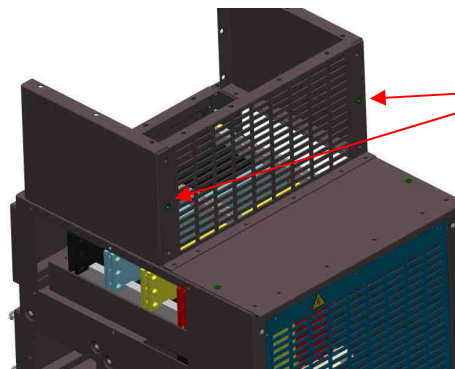


Earthing washer should be fitted here

Procedure should be repeated for other side.



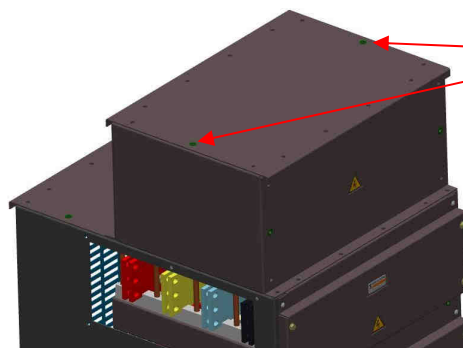
The rear-ventilated panel should then be fitted, earthing washers should be used in two locations, one per bolt.



Earthing washers should be fitted here

The front cover should also be fitted with earthing washers in a similar location.

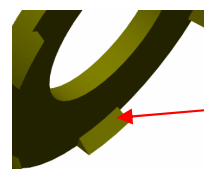
The roof should then be fitted. Two earthing washers should also be fitted.



Earthing washers should be fitted here

note:

When fitting Earthing Washers they should be fitted with the serrated edge to the panel to ensure they are able to make a good electrical connection.



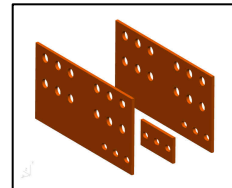
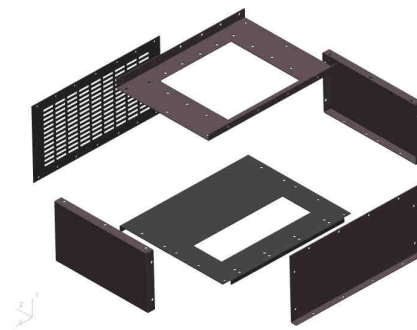
Serrated edge of Earthing washer

Fitting of Busway Top Chamber

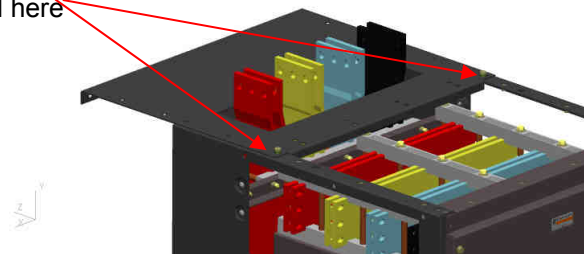
The Outgoing Busway Top Chamber is supplied un-assembled. The Busway Top Chamber comprises of two sides, a front panel, a rear-ventilated panel, a top cover, a bottom plate and the copper connections.

The components, including all the M12 bolts, M8 bolts, earthing washers, c form washers and spring washers, required to assemble the roof are supplied as part of the main panel.

The bottom plate should be fitted first ensuring that the earthing washer is fitted.

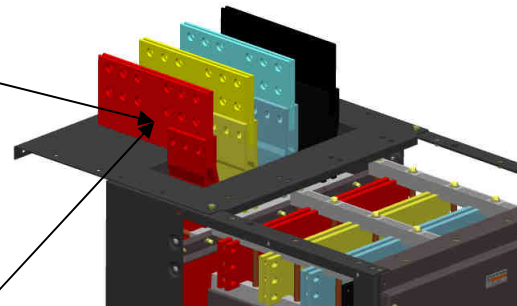
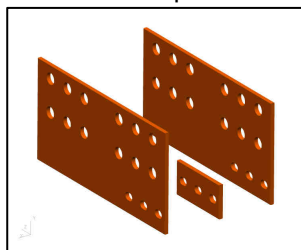


Earthing washers should be fitted here

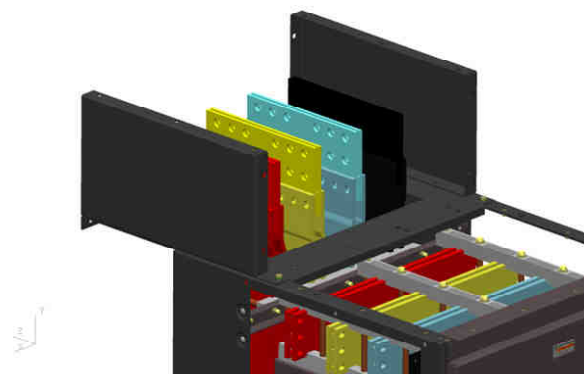


The copper connection should then be fitted before the sides to allow full access to the connections.

The copper connections are made up of three individual components. All three should be fitted to all phases and neutral.

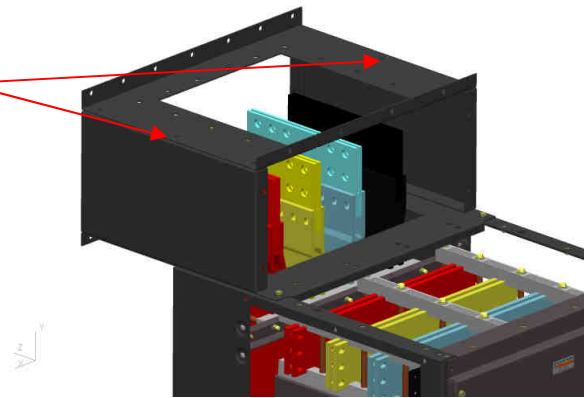


The sides to the chamber should then be fitted ensuring that the earthing washes are fitted.



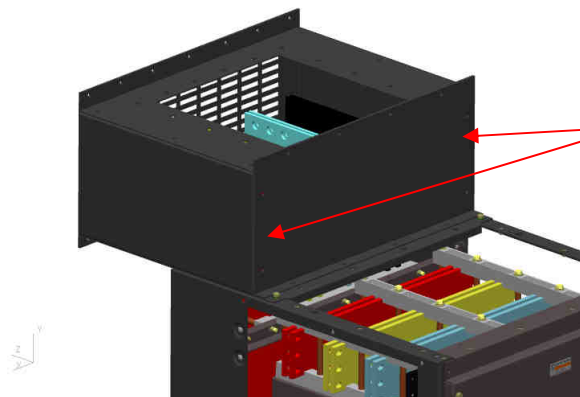
The top chamber cover should then be fitted. Two earthing washers should be fitted,

Earthing washers should be fitted here



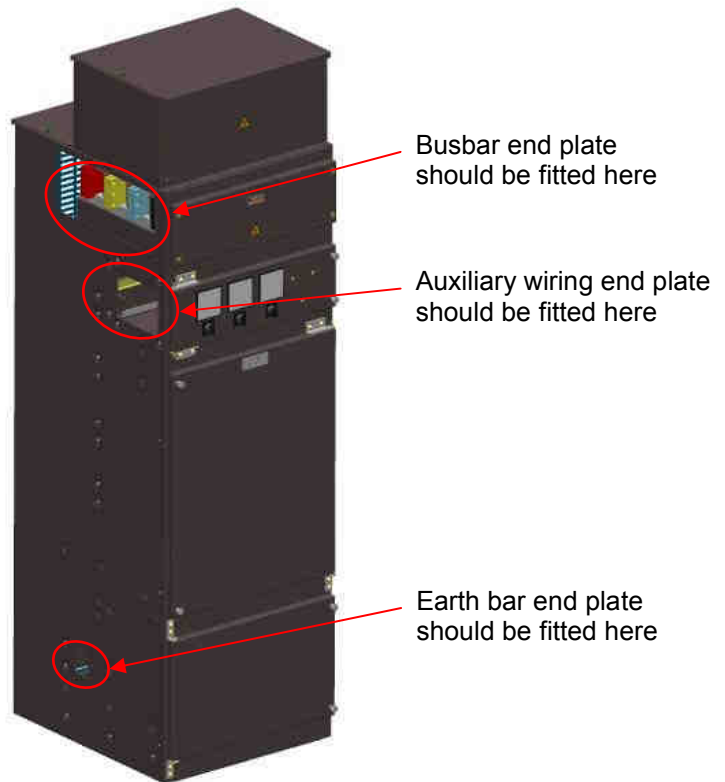
The front and rear-ventilated panel should then be fitted, earthing washers should be used in two locations, one per bolt.

Earthing washers should be fitted here



Fitting of End Plates

The end plates should be fitted to the panels that are on either end of the substation. There are three end plates to be fitted, one for the busbar aperture, one for the earth bar aperture and one for the auxiliary wiring aperture. The busbar endplate is made up of two parts, the polycarbonate plate should be sandwiched between the panel and the steel plate on the outside. The polycarbonate end plate must be fitted to ensure the internal arc rating of the panel is maintained.



All M8 bolts, washers, spring washers and nuts required are provided as part of the EEAEP1 kit. When fixing the Busbar endplate, the Earth bar endplate and the auxiliary end plate one of the fixing used should be fitted with earthing washers on both the inside of the panel and on the outside of the endplate.

Fitting of Surge arrester end panel

The surge arrester end panel can be fitted to either the left hand or right hand side. The end panel kit (EEAABB) is supplied normal built to be fitted to the right hand side and will need to be re-assembled if it is required to fit the unit to the left hand side. The surge arresters are supplied as a part of the EEAABB kit.

To fit the surge arrester panel the cover first need to be removed. This is done by removing the 10 x M8 bolts. If the surge arrester needs to be fitted to the left hand side then the fuse fittings should be removed and refitted the opposite way up.

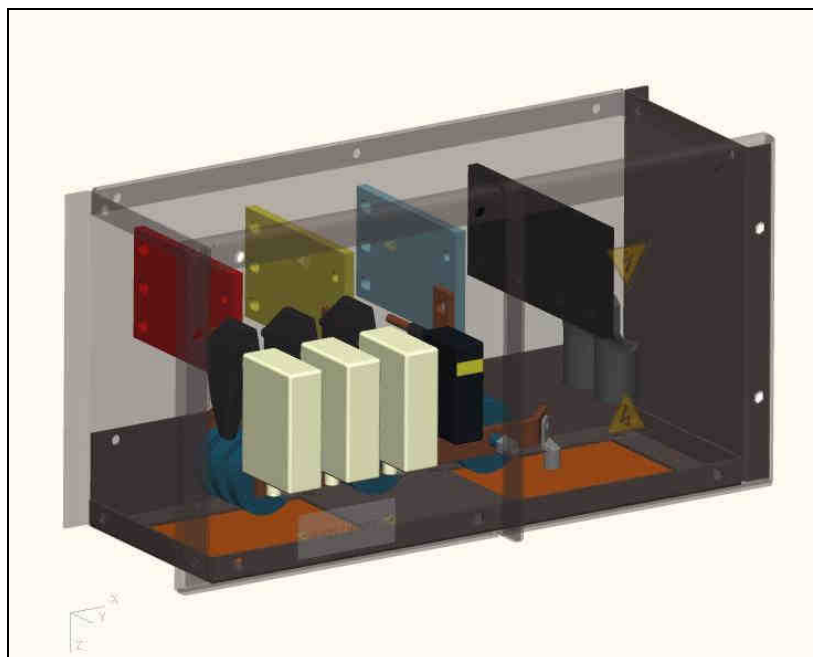
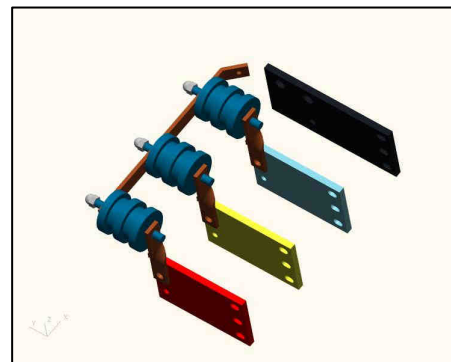
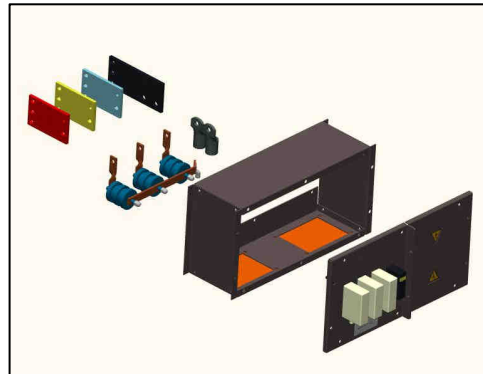
The busbar extensions should then be fitted using the M10 x 60mm bolts fitted in the same way as the busbar jointing kit is fitted (see page 8) and tighten using a torque wrench to a torque of 46Nm.

Once main housing for the surge arresters should then be fitted to the panel using the 6 x M8 bolts provided.

The surge arrester should then be fitted as shown in the picture using cable to connect the surge arresters to the relevant busbar extension.

The panel covers then need to be refitted, as the panel with the fuses is fitted the cable from the fuses should also be fitted to the relevant busbar extension so as to give the correct phase indication.

A semitransparent model of the surge arrester panel is shown so as to indicate were to fit the cable lugs to allow for correct operation.



The cable from the neutral to the substation earth should be run down the outside of the panel that the Surge arrester panel has been fitted to. To secure the cable, cleats should be used to fasten the cable to the side of the unit using the fixing points normally used for securing two units next to each other.

note:

The panel shown is a fused distributor, other panels types have the same fixing points.



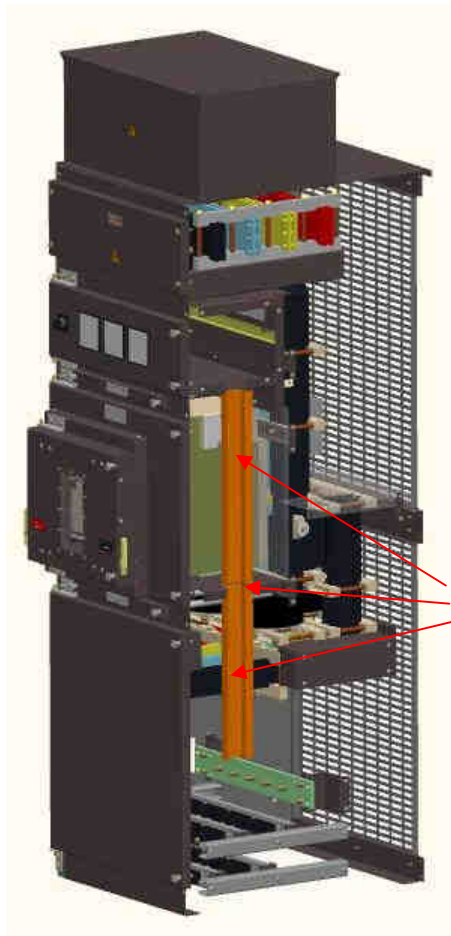
Fixing points to be used for cleating earthing cable to side of panel.

Auxiliary wiring ducts

Two cable ducts are provided on all panels except the bus-section panels. There is a cable duct on each side of the panels that allows auxiliary wiring to be routed from the cable box to the auxiliary wiring panel.

Auxiliary wiring for bus-sections should be routed through the panels that are situated on either side of the units and passed through the auxiliary wiring aperture.

The auxiliary wiring should be pulled up to the auxiliary wiring panel from the cable box by using a draw wire.



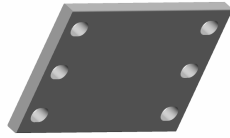
Auxiliary wiring duct shown on right hand side of panel, left hand side duct similar.

Kit contents

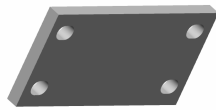
Below is a list of the contents of each optional kit.

Cubicle jointing kit (EEAJK1)

The following is included in this kit :



8 busbar links



1 earth link



24 M10 x 60 Hex HD bolts



4 M10 x 40 Hex HD bolts



56 M10 Belville washers 41260430



28 M10 Full Nuts



14 M8 x 20 Hex HD bolts



28 M8 B form washers



14 M8 spring washers



14 M8 Full nuts

Cubicle end plate kit (EEAEP1)

The following is included in this kit :



1 polycarbonate busbar end plate



1 steel busbar end plate



1 steel LV auxiliary end plate



1 steel earth end plate



6 M8 x 30 Hex HD bolts



4 M8 x 20 Hex HD bolts



6 M8 earthing washers



8 M8 form B washers



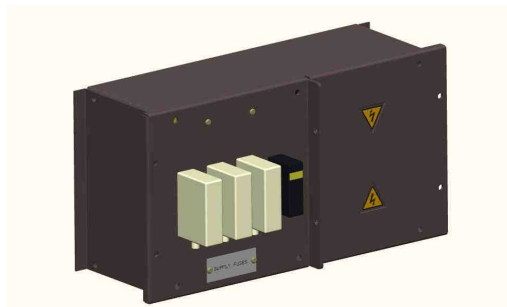
10 M8 spring washers



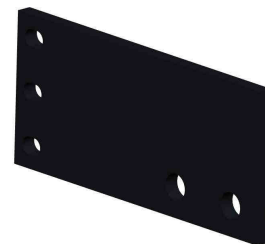
10 M8 Full nuts 41200080

Surge arrester end panel kit (EEAABB)

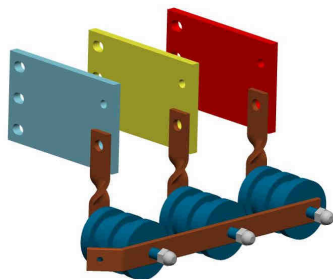
The following is included in this kit :



1 off Pre-assembled housing (assembled ready to fit on right hand side)



1 off Neutral busbar



1 off Pre-assembled surge arresters and busbars (assembled ready to fit on right hand side)



4 off fuse (link) stud insulating shroud

Note: *The pre-assembled housing includes the cable to connect fuse links to busbars.*

Operation

Due to the fact that the panels have an internal arc rating the normal operating procedures for the Masterpact NW should not be followed. The following instructions should be used when operating the Masterpact to ensure that the internal arc rating of the switchboard is maintained.

Warning The doors must be closed and the knurled screws fully tightened to maintain the internal arc fault capability.

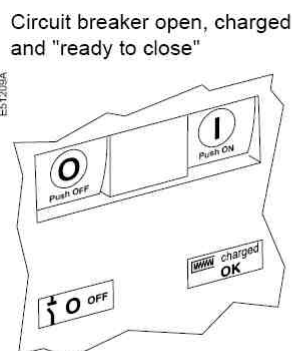
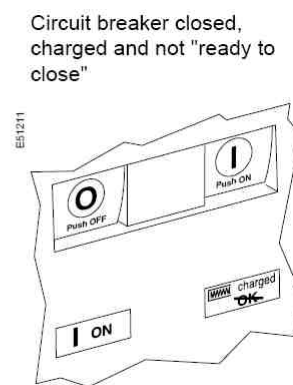
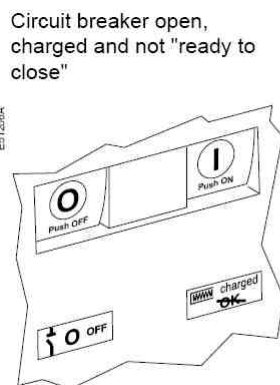
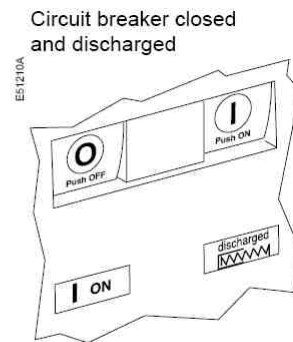
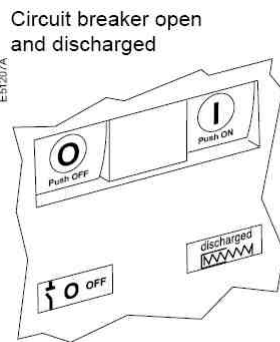
Operation of circuit breaker

The Masterpact indications can be seen through the window on the front of the panel.

The open and close operations of the circuit breaker are done using the open and close levers on the front panel.



understanding the controls and indications



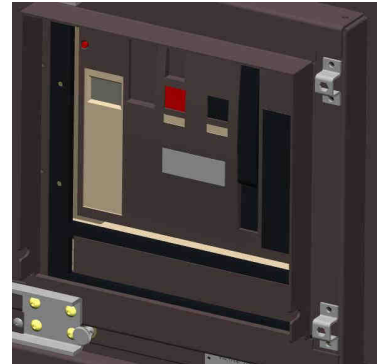
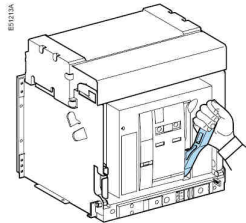
charging the circuit breaker

The springs in the circuit breaker operating mechanism must be charged to store the energy required to close the main contacts. The springs may be charged manually using the charging handle or the optional MCH gear motor.

Manual charging:

To charge the circuit breaker the front access panel must first be opened.

Pull the handle down seven times until you hear a "clack".



Do not close or open the Masterpack with the front access panel open.

Automatic charging:

If the MCH gear motor is installed, the spring is automatically recharged after each closing.

closing the circuit breaker

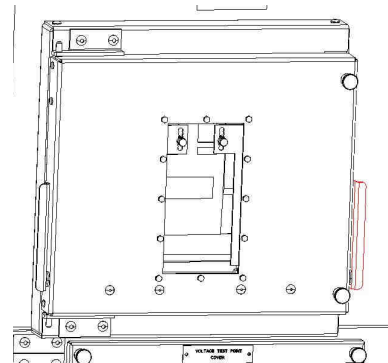
Closing (i.e. turning the circuit ON) is possible only if the circuit breaker is "ready to close".

The prerequisites are the following:

- device open (OFF)
- springs charged
- no opening order present.

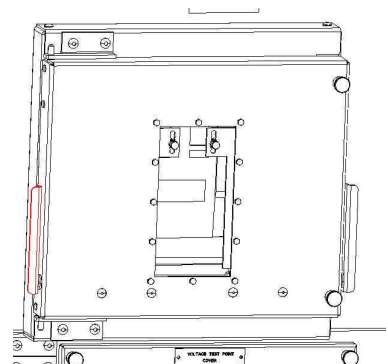
If the circuit breaker is not "ready to close" when the order is given, stop the order and start again when the circuit breaker is "ready to close".

With the front access panel closed push the ON lever (right hand side lever), the circuit breaker should close immediately.



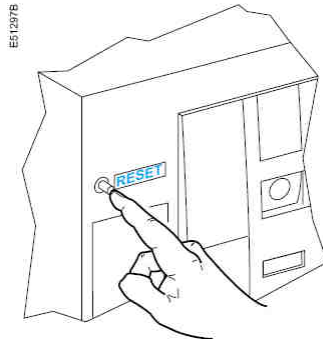
opening the circuit breaker

With the front access panel closed push the OFF lever (Left hand side lever), the circuit breaker should open immediately.



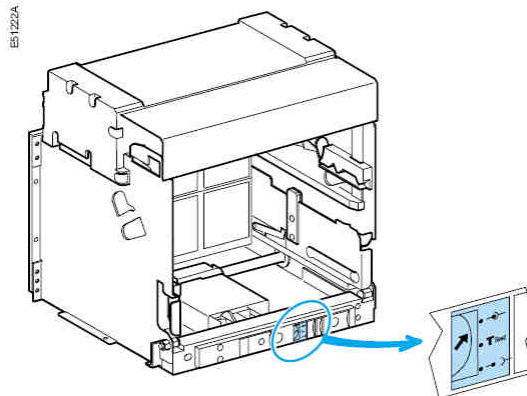
resetting after a fault trip

If the circuit breaker is not equipped with the automatic reset option then the breaker must be reset manually. This is done by opening the front access panel and pressing the reset button, which is located at the top right hand corner of the Masterpact circuit breaker.

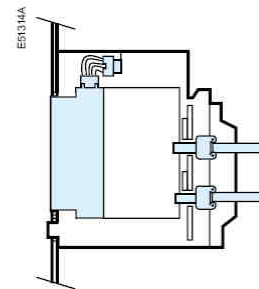
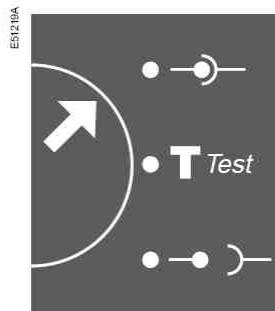


identifying the circuit breaker position in the chassis

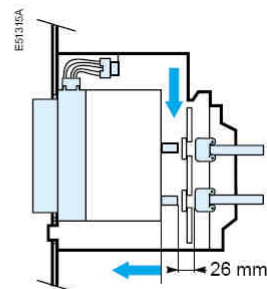
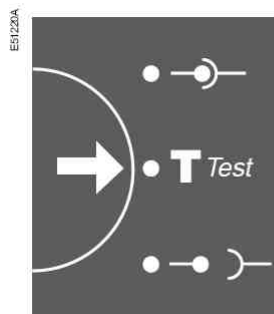
The indicator on the front signals the position of the circuit breaker in the chassis.



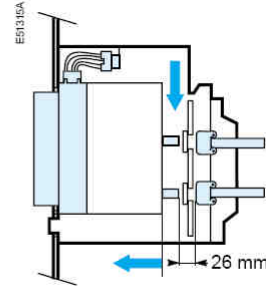
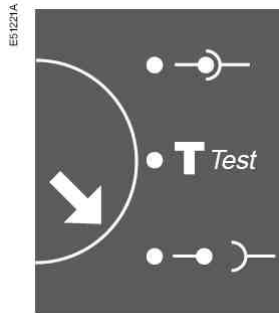
- “connected” position



- “test” position



- “disconnected” position



Due to the fact that a plug-in control lead is used the only difference between the circuit breaker being in the “test” position or the “disconnected” position is that the circuit breaker can be withdrawn when in the “disconnected” position. The plug-in control lead can be removed with the circuit breaker is in the “disconnected” position but it is easier to remove the plug-in control lead when the circuit breaker is in the racked out position (see below on how to rack out the circuit breaker).

racking

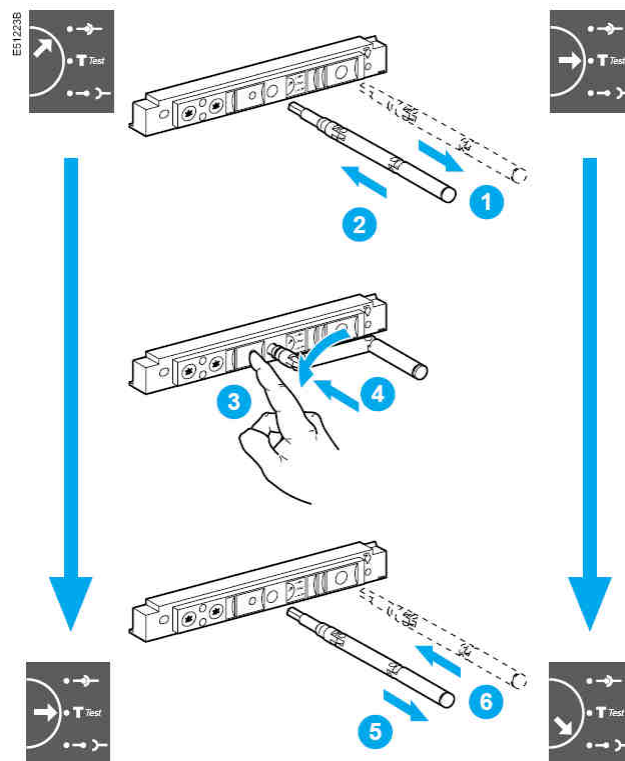
Prerequisites

To connect and disconnect Masterpact, the crank must be used. The locking systems, padlocks and the racking interlock all inhibit use of the crank.

Withdrawing the circuit breaker from the "connected" to "test" position, then to "disconnected" position

The circuit breaker is in "connected" position.

The circuit breaker is in "test" position.

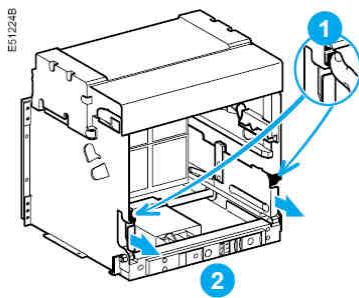


The circuit breaker is in "test" position. Remove the crank or continue to "disconnected" position.

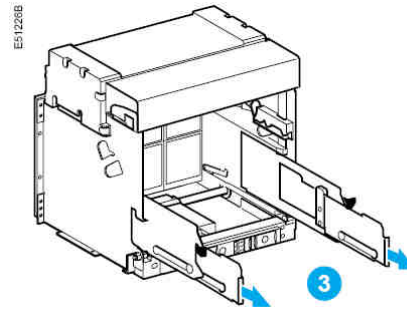
The circuit breaker is in "disconnected" position.

removing the rails

Press the release tabs and pull the rails out.

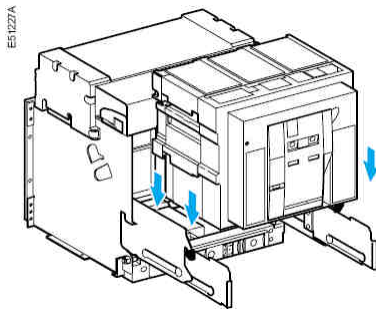


To put the rails back in, press the release tabs and push the rails in.

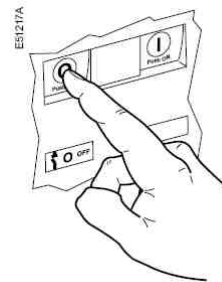


inserting Masterpact

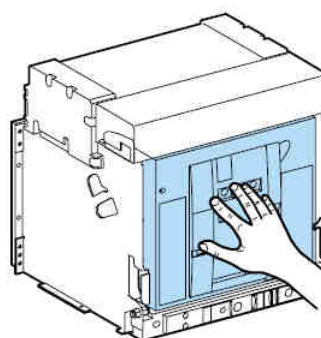
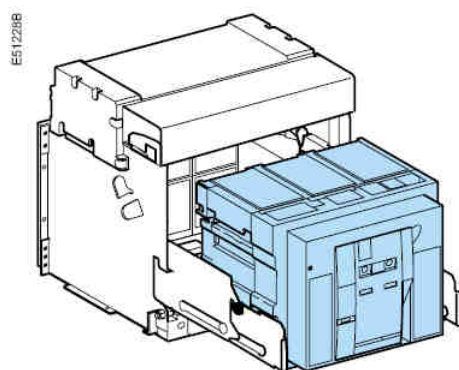
Position the circuit breaker on the rails. Check that it rests on all four supports.



Open the circuit breaker.



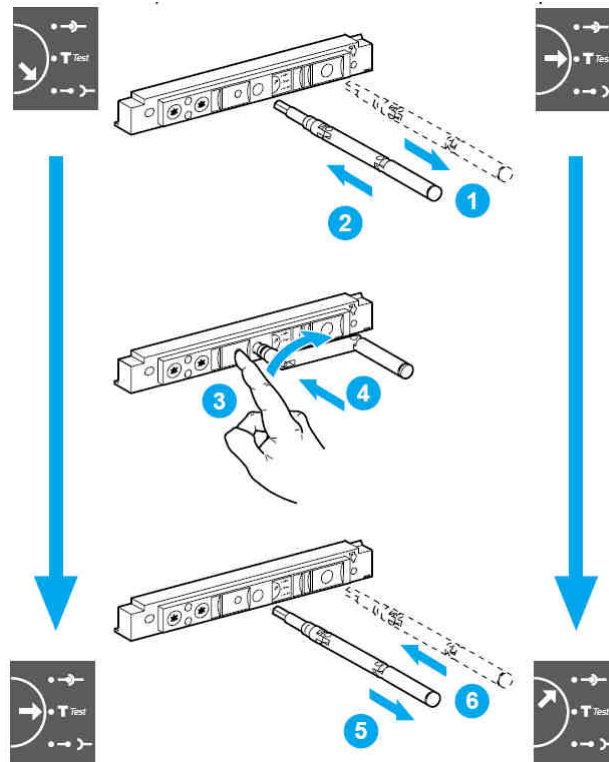
While the circuit breaker is still in the racked out position the plug-in control lead should then be plugged into the circuit breaker. Push the circuit breaker into the chassis, taking care not to push on the control unit.



Racking the circuit breaker from the "disconnected" to "test" position, then to "connected" position

The device is in "disconnected" position

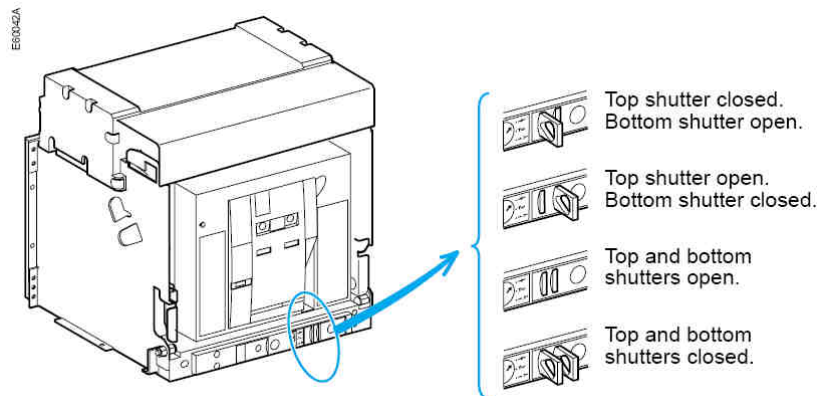
The device is in "test" position.



The device is in "test" position. Remove the crank or continue to "connected" position.

The device is in "connected" position.

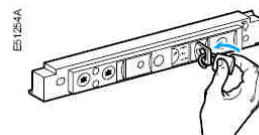
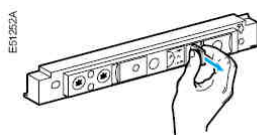
Padlocking or position indication on the front



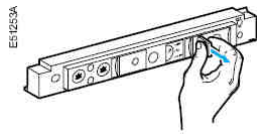
Locking

Pull out the left-hand tab to lock the top shutter.

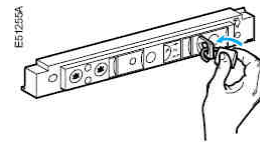
Insert a padlock (shackle 5 to 8 mm).



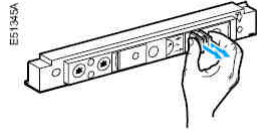
Pull out the right-hand tab to lock the bottom shutter.



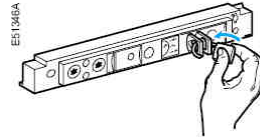
Insert a padlock (shackle 5 to 8 mm).



Pull out both tabs to lock both shutters.

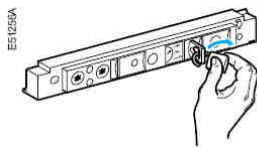


Insert a padlock (shackle 5 to 8 mm).

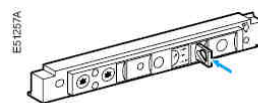


Unlocking

Remove the padlock.



Release the tab(s).



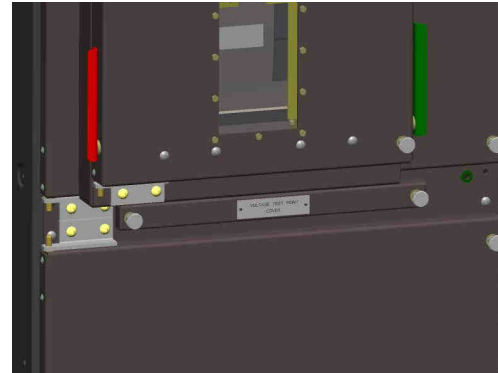
Test point access

On all panels that have circuit breakers or inline switches test points are integrated in to the panel design. An upper test point allows access to the busbar side of the circuit. A lower test point allows access to the cable side of the circuit.

On a bus-section the test access points allow access to the busbars on both sides of the circuit breaker. The upper test point allows access to the left-hand busbar while the lower test access allows access to the right hand busbar.



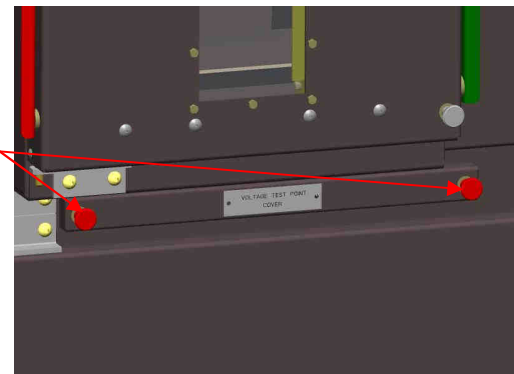
Upper test point access



Lower test point access

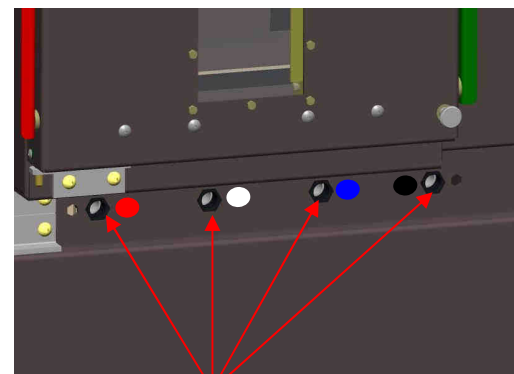
Access to the test points is achieved by loosening both the test points securing fasteners.

Test access fastening points



Once the fasteners have been loosened the test access cover can be removed to reveal the test access points.

The access points should only be used with the test probes approved by Energy Australia. Use of any other test probe could result in exposure to live parts.



Test access points

The test access cover is fitted by reversing the process to remove the cover.

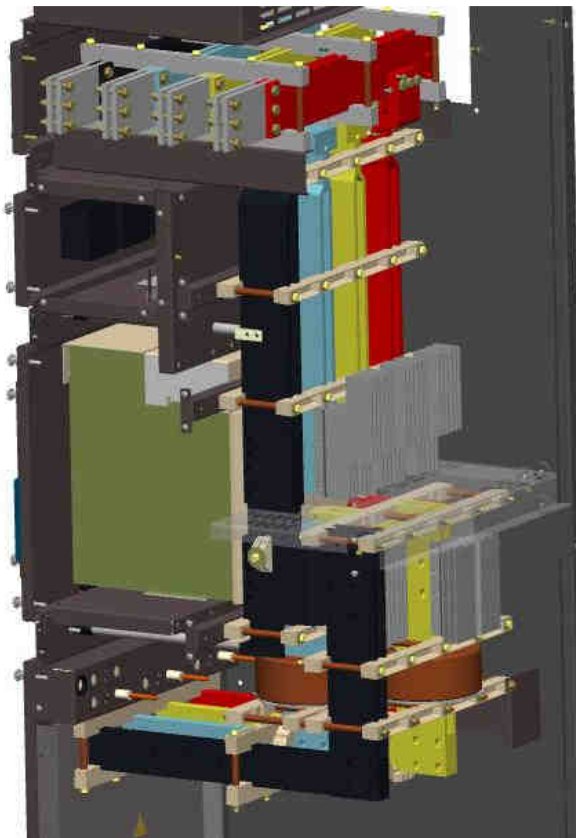
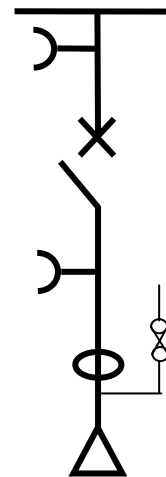
Architecture
Circuit breaker incoming panels

The circuit breaker panels consist of a withdrawable Masterpact circuit breaker and CTs. The panel allows cables to be connected through the circuit breaker to the busbars.

The panels are used as supply to the switchboard.

The panel also provides test point access to both the busbar and cable side of the circuit breaker.

It should be noted that on some incoming panels a 63A "Dead board fuse" supply is included in the design.

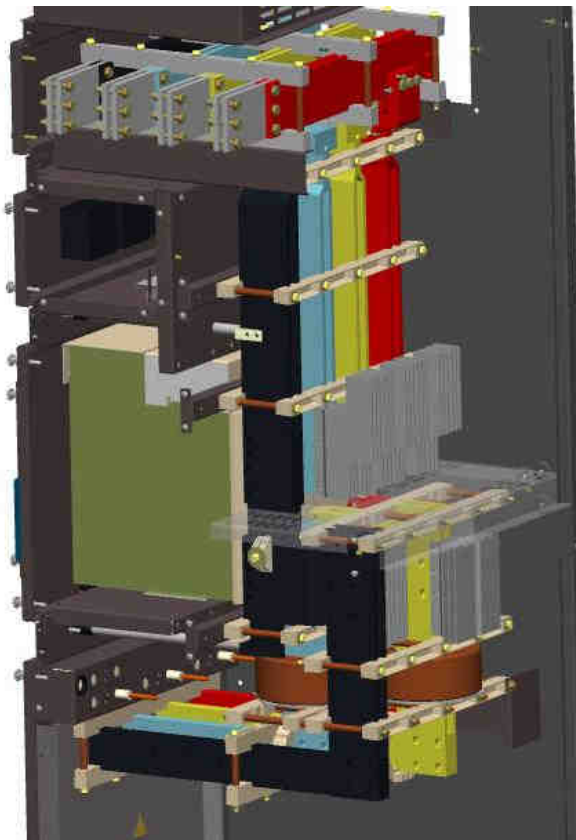
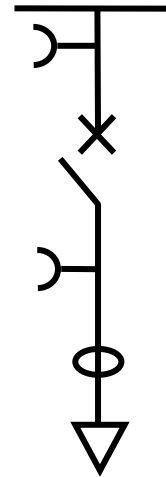


Customer Cable Supply panels

The circuit breaker panels consist of a withdrawable Masterpact circuit breaker and CTs. The panel allows cables to be connected through the circuit breaker to the busbars.

The panel is used for isolating customer supplies.

The panel also provides test point access to both the busbar and cable side of the circuit breaker.

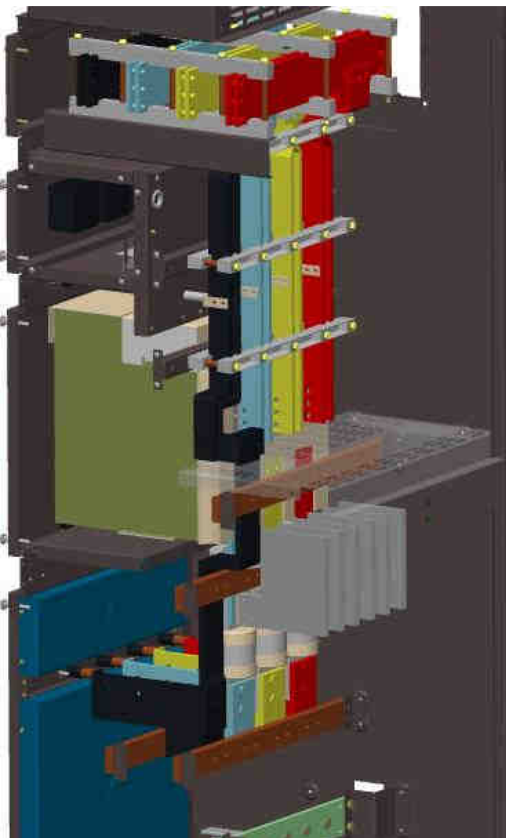
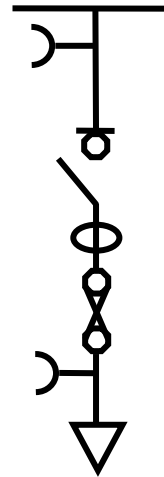


1600A Fused Distributor panel

The 1600A Fused Distributor panel consist of a withdrawable Masterpact circuit breaker and large fuses in series. The panel allows outgoing cables to be connected through the circuit breaker and fuses to the busbars.

The panel can be fitted with 1600A, 1200A or 1000A fuses.

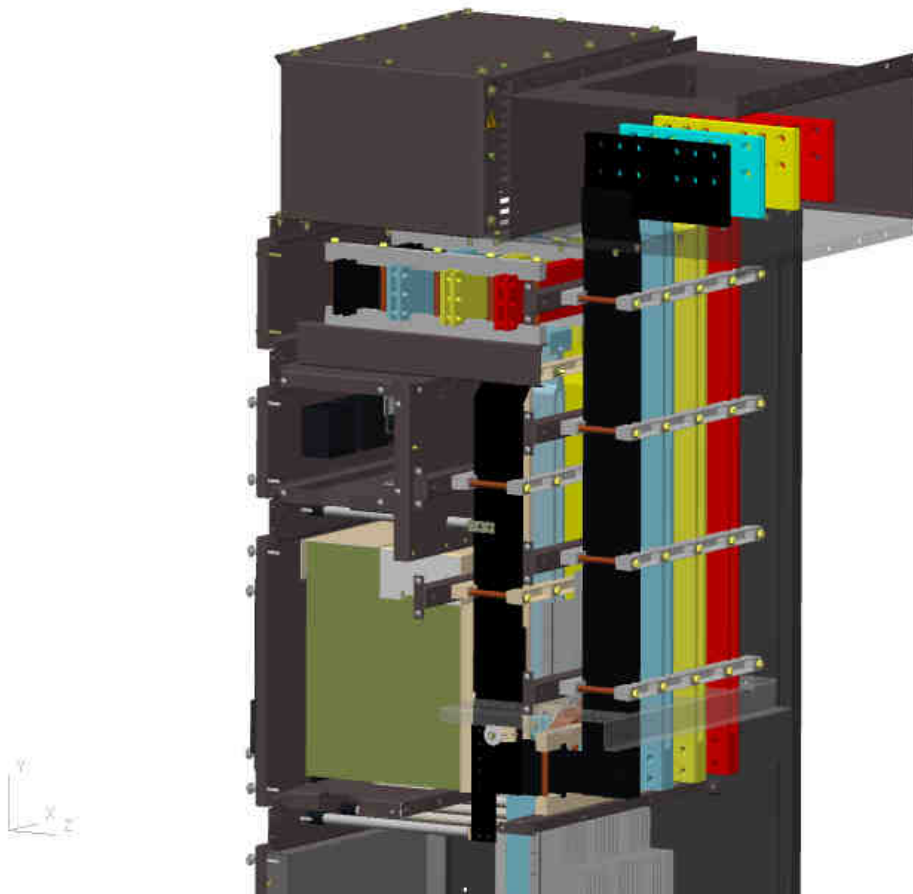
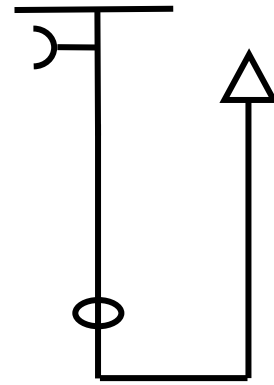
The panel also provides test point access to both the busbar and cable side of the fuses.



Customer Busbar Supply panels

The Busbar Supply panel provides a direct busbar connection to the busbars with out any form overload or short circuit of protection. The panel does provide CT in the out going circuit.

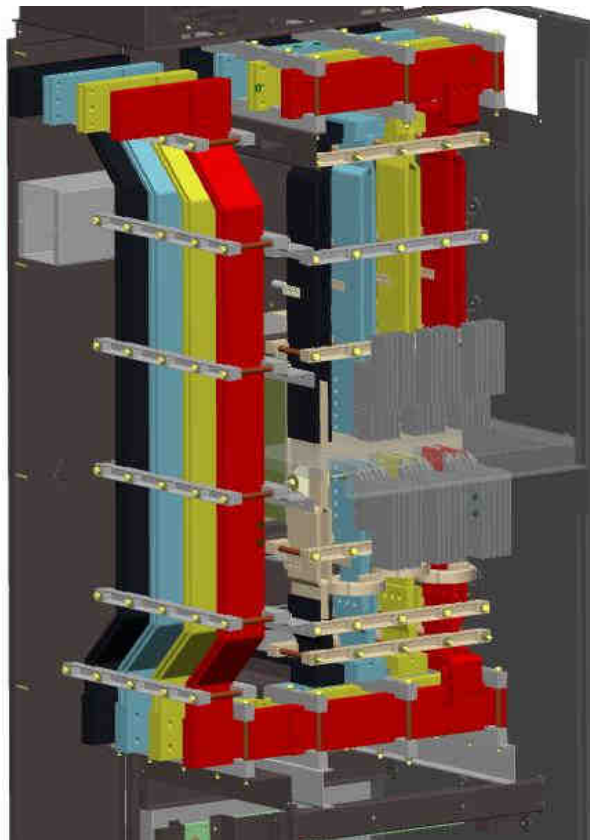
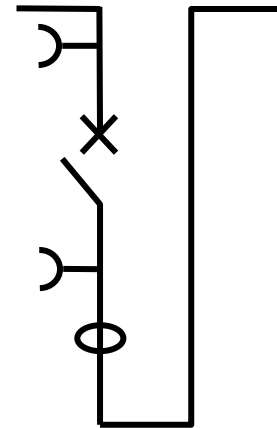
The panel also provides test point access.



Bus-section panel

The Bus-section panel consist of a withdrawable Masterpact circuit breaker and indication CT. The panel allows the busbar to be sectioned in to separate isolated parts or to be part of the same circuit.

The panel also provides test point access to both the busbar and cable side of the circuit breaker.

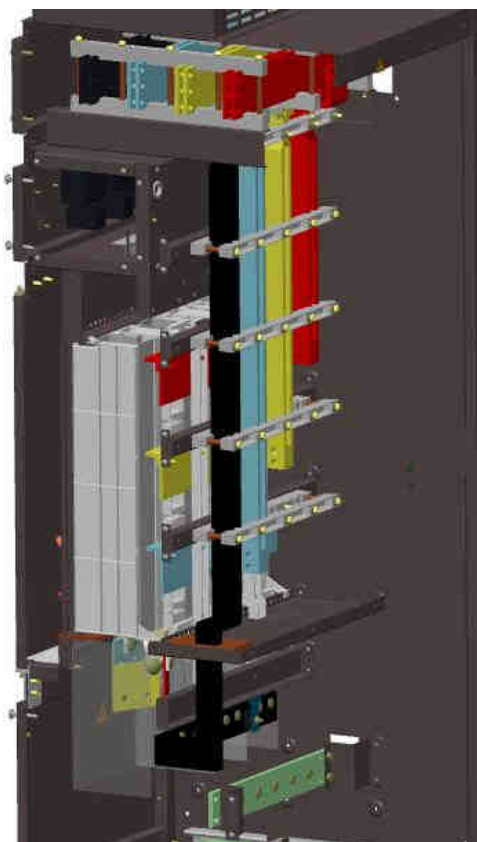
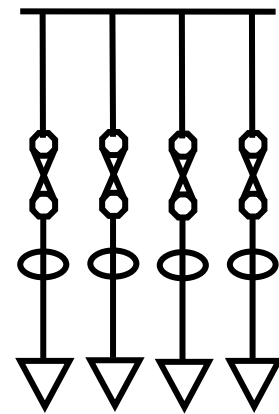


Fused Distributor panel

The Fused Distributor panel consists of a maximum of four SAIF fuseways and indication CTs. The panel allows the outgoing circuits to be connected to the busbars with each fuseway providing individual phase operation for each three-phase fuseway.

The possible combinations of fuseways that can be fitted are:

1. Four 400Amp SAIF Fuseways.
2. Two 800Amp SAIF Fuseways.
3. One 800Amp SAIF Fuseway and two 400Amp SAIF Fuseways.



Maintenance

routine maintenance recommendations

Routine maintenance will depend on the conditions to which the unit is subjected and to the relevant local codes and practice. Periodic inspection of the

substation and equipment will be necessary to establish the conditions to which the units are subjected.

Periodic inspections required

Interval	Operations
each year	<ul style="list-style-type: none"> open and close the device locally and remotely, successively using the various auxiliaries test the operating sequences test the control unit using v see the user manual the mini test kit of the control unit
every two years or when the control-unit maintenance indicator reaches 100	<ul style="list-style-type: none"> check the arc chutes check the main contacts check the tightness of connections check the disconnecting-contact clusters

Parts requiring replacement, depending on the number of operating cycles

The following parts must be replaced periodically to lengthen the service life of the device (maximum number of operating cycles).

Part	Intervening entity
arc chutes	<ul style="list-style-type: none"> user
main contacts	<ul style="list-style-type: none"> inspection: user replacement: Schneider After Sales Support
MCH gear motor	<ul style="list-style-type: none"> user
mechanical interlocks	<ul style="list-style-type: none"> user
connecting-rod springs	<ul style="list-style-type: none"> Schneider After Sales Support
MX/MN/XF	<ul style="list-style-type: none"> user

Part replacement must be programmed on the basis of the data below, listing the service life of the various parts in numbers of O/C cycles at the rated current.

Number of O/C cycles at the rated current

Type of circuit breaker	Maximum service life	Service life of various parts			
		Arc chutes	Main contacts	Connecting-rod springs, MCH	MX/XF releases
NW08 to NW16 types N1/H1/H2	25000	10000	10000	12500	12500
NW08 to NW16 type L1	25000	3000	10000	12500	12500
NW20 types H1/H2	20000	440 V: 8000 690 V: 6000	440 V: 8000 690 V: 6000	10000	12500
NW20 to NW25 type H3	20000	2000	440 V: 8000 690 V: 6000	10000	12500
NW20 type L1	20000	3000	10000	10000	12500
NW25 to NW40 types H1/H2	20000	440 V: 5000 690 V: 2500	440 V: 5000 690 V: 2500	10000	12500
NW32 to NW40 type H3	20000	1250	440 V: 5000 690 V: 2500	10000	12500
NW40b to NW63 types H1/H2	10000	1500	1500	5000	12500

general maintenance

housing

Check all external fixings, labels and earth connections are present and tight.

Check inside the cable compartment, busbar system and auxiliary terminal compartment for heavy deposits of dust, ingress of water or contamination by animal or plant life.

Clean the units thoroughly and touch up paint work as necessary.