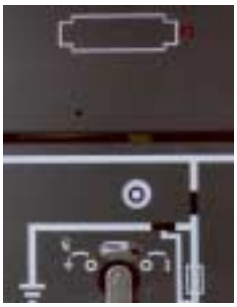
SafeLink

SF_6 Insulated Ring Main Unit

Installation and Operating Instructions

Switchgear Division
Auckland, New Zealand
SLMIO ver 2.12



Product Overview

ABB's type-tested SafeLink ring main unit (RMU) is an SF_6 insulated RMU utilising the latest developments in switchgear technology to provide a very compact switchgear solution. SafeLink is a completely sealed system with a stainless steel tank containing all live parts and switching functions. A hermetically sealed tank separated from the outside environment ensures a high level of reliability as well as personal safety and a virtually maintenance free system.

SafeLink is manufactured according to the latest environmental and quality standards. The ABB assembly plant is certified according to ISO9001 (Quality) and ISO14001 (Environmental). SafeLink equipment conforms to all applicable IEC standards.

This manual provides detailed information on the handling, installation, commissioning and operation of SafeLink.

The range of SafeLink products and the specifications of the equipment are subject to change without notice as product features and benefits are added.

For more information, or to discuss SafeLink operation, please contact your local ABB office or ABB Ltd, Switchgear Division in Auckland, New Zealand:

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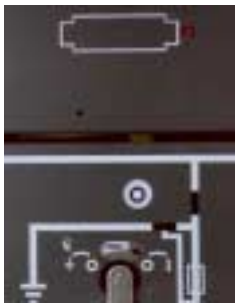
This manual provides detailed information on the handling, installation, commissioning and operation of SafeLink. It is not a repair manual nor should it be used for that purpose.

If equipment is not functioning in accordance with these instructions, suffering faults or damage, specific advice should be sought from your supplier.



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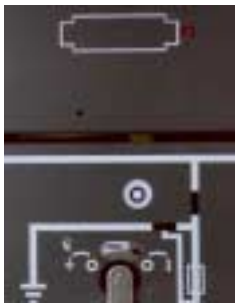

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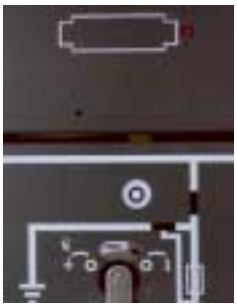


1 Introduction

This manual provides all details needed to install and operate the SafeLink ring main unit. The SafeLink unit is designed for use on distribution systems operating at up to 12kV. SafeLink is available in several configurations based on ring and fuse protected switches: e.g. CFC, CCC, CCF; where *C* denotes a load break switch and *F* a 200A switch-fuse combination.

SafeLink units can be supplied with direct busbar connections (D) in place of load break switches to allow SafeLink units to be joined. For example, units configured as CFD and DFC, when joined, will give two ring switches and two switch-fuse combinations.

Each switch is in the form of a three-position switch giving *on*, *off* and *earthed* conditions with respect to the connected cable. The status of each switch is indicated by the symbol visible in the round hole towards the top of the mimic panel and confirmed by the mimic diagram. Active flags in the diagram match the circuit condition with black confirming open switches and white indicating switches that are closed. Access to the cable box and fuse compartment is interlocked with the switch status.

The operating handle is designed to give a delay between switching operations. Insertion of the operating handle is controlled by a rotary selector, which has one of three possible states:

1. Handle access blocked.
2. Switching between *off* and *on* and switch-fuse *reset* possible.
3. Switching between *off* and *earth* possible.

The selector handle can be padlocked in any of these three positions.

General arrangement (Figure 2) and foundation plan (Figure 3) drawings are shown on page 4.

1.1 Technical Data

1.1.1 Physical Data

Dimensions
(SafeLink unit with ABB Stand)

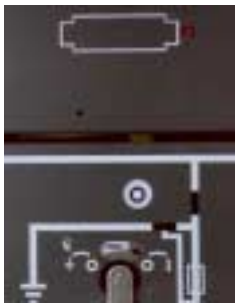
Width:	720mm
Height:	1350mm
Depth:	700mm
Weight:	250kg

Operating Conditions

Normal Ambient Temperature:	-25°C to +40°C
Altitude:	Up to 1000m above sea level
Installation:	Indoor or outdoor with an enclosure
Standard indoor RMU	IP43
Mounted in Outdoor Enclosure	IP55W

Insulating Gas

Type:	SF6 (*IEC 60376*)



Filling Pressure @ 20°C:	1.2bar abs
Quantity:	1kg approximately
Minimum Operating Pressure:	1.1bar abs

1.1.2 Electrical Data

General Ratings @ 1.1bar abs SF_6 Pressure

Rated Voltage:	12kV
Lightning impulse Voltage:	95/110kV BIL
Withstand Voltage:	28/32kV for 1 minute
Frequency:	50Hz
Rated Current:	400A or 630A
Withstand Current:	16kA rms or 20kA rms
Withstand Current Duration:	3sec
Recommended Maximum Cable Size:	300mm² 3-core cable 500mm² single-core cable

Load Break Switch
(E3, M2 rating to IEC 60265-1:1998)

Rated Current:	400A or 630A
Short Circuit Making Current:	40kA peak or 50kA peak

Switch-Fuse

Rated Current:	200A
Prospective Fault Withstand:	20kA rms
Max Transformer size:	1000kVA

Bushings

Series 400 (DIN 47632) with adapted in-line bolted connection

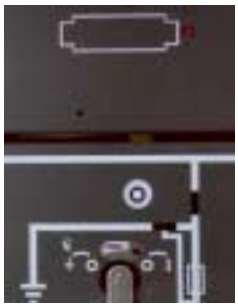
Rated Current:	630A

Fuses

DIN 43625
Max 100A ABB Type CEF 12kV or equivalent

Length:	292mm
Diameter:	87mm

Refer to Section 2.4 on page 10 for the fuse selection chart.



1.1.3 Rating Label

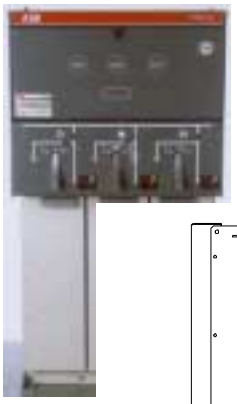
The rating label is integrated into the main mimic panel. This panel is UV stabilized, weather resistant polycarbonate. The label information satisfies the requirements of IEC 60298 and includes RMU configuration. The rating label includes a bar-coded serial No., which matches a similar label used to identify each tank throughout its production.

Figure 1: SafeLink rating label.

1.1.4 Standard Compliance

SafeLink has been tested to (and passed) the following standard tests in an ASTA accredited laboratory:

- IEC 60298 (1990-12)
  A.C. metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV.
- IEC 60265-1 (1998-01)
  High-voltage switches - Part 1: Switches for rated voltages above 1kV and less than 52kV.
- IEC 60420 (1990-10)
  High-voltage alternating current switch-fuse combinations.
- IEC 60129 (1984-01)
  Alternating current disconnectors and earthing switches.
- IEC 60694 (1996-05)
  Common specifications for high-voltage switchgear and controlgear standards.
- IEC 60137 (1995-12)
  Insulating bushings for alternating voltages above 1000V.
- IEC 60529 (1989-11)
  Degrees of protection provided by enclosures (IP Code).



1.2 Arrangement Drawings

1.2.1 General Arrangement

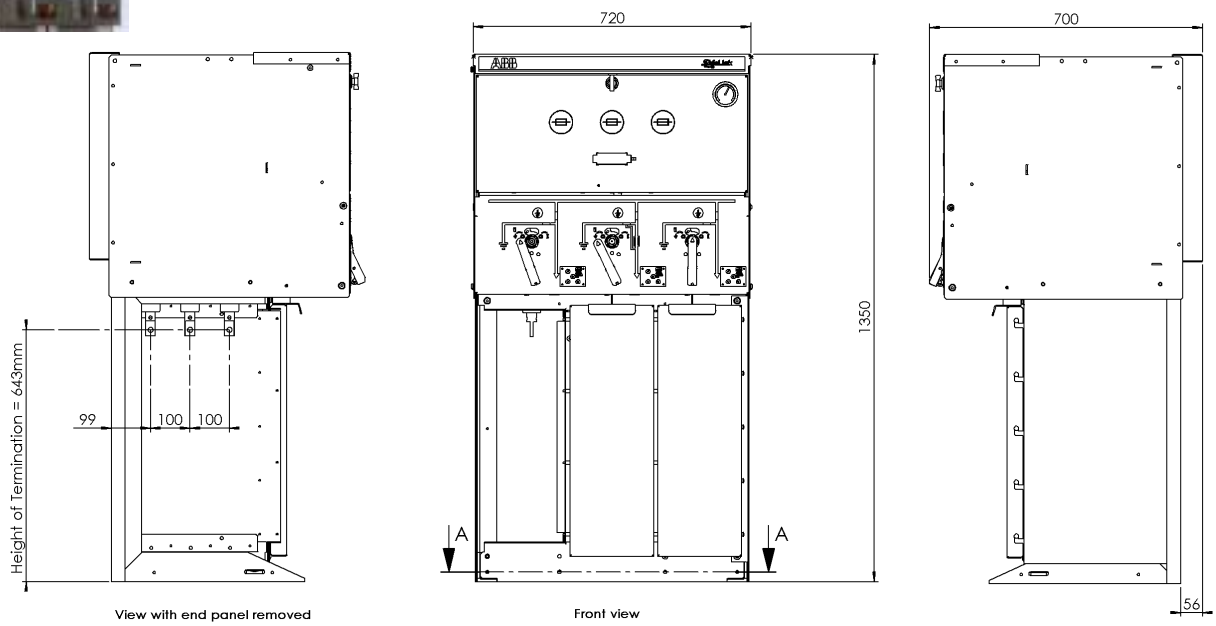


Figure 2: SafeLink general arrangement.

1.2.2 Foundation Plan

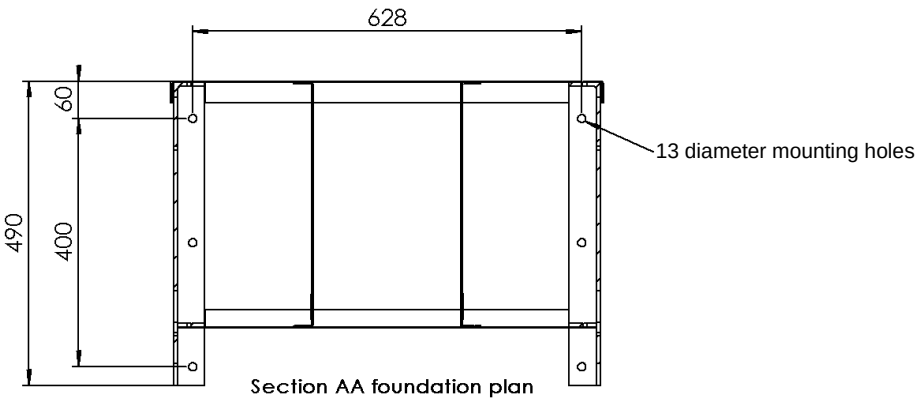
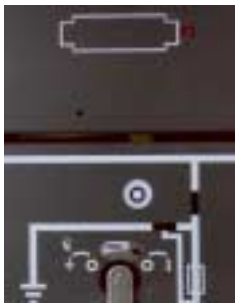


Figure 3: SafeLink foundation plan.



1.2.3 Schematic

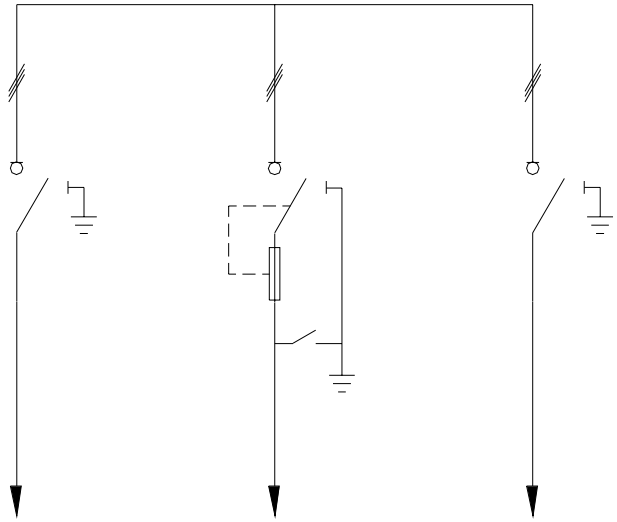
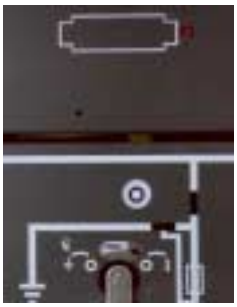


Figure 4: SafeLink schematic diagram; CFC configuration.

Note that the switch-fuse combination has three-phase tripping and, when the switch is earthed, both ends of the fuses are connected to earth.



2 Operation

The following sections describe the operating procedure for SafeLink. There are no parts within the SafeLink unit that require user attention other than the fuses and the gas density gauge.

Equipment suffering faults or damage must be returned to your supplier for servicing.

Ensure the gauge reads in the green area before switching.

2.1 Gas Density Gauge

During operation, the gas density of the SafeLink unit should be maintained in the green region. The gas pressure has been factory set to 1.2bar absolute (at 20°C). Each switch is filled with approximately 1kg of SF_6 gas.

The gas density gauge differs from a simple pressure indicator in that it is temperature compensated, thus giving accurate and reliable information wherever the SafeLink is installed.

Figure 5: SafeLink gas density gauge.

All units are tested for gas tightness during production to ensure any gas leakage rate is less than 0.5% per annum (maximum 3×10^{-6} mbarl/s using helium).

In rare circumstances, the SafeLink unit may need to be topped up with SF_6 gas (for instance to replace gas removed for sampling purposes). Gas filling is through a valve at the front of the unit. See section 3.3 on page 12 for further details.

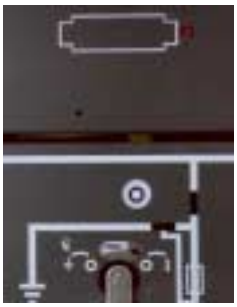
2.2 General Switch Operation

All switches (ring and fuse) have the same basic operating procedure. Select the operation desired with the rotary selector. The spring-loaded selector must engage with the location hole in the panel. Symbols to the right and left of the handle hole indicate the operations possible in the respective positions.

Access for the operating handle is controlled by a rotary selector that has one of three possible states:

1. Handle access blocked; no switching possible.
2. Switch able to operate from *off* to *on* (and vice versa)
3. Switch able to operate from *earth* to *off* (and vice versa).

The selector can be padlocked in any of these three positions.
From *off* status, selection of either *earth* or *main* switch operation is possible. From *on*



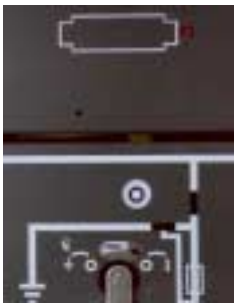
status, *earth* switch operation is not possible (the switch must first be returned to *off*). Likewise, from *earthed* status the *main* switch operation is not possible.
After selecting the desired operation insert the handle and rotate in the direction indicated by the symbols. For instance, to switch from *off* to *on* the handle is rotated clockwise. About 60° rotation is required for switch operation; internal stops provide limits to the movement. The operating handle has been designed to give a delay between operations either clockwise or anti-clockwise.

Figure 6: Front of SafeLink unit showing the mimic diagram and switches in (from left to right) the off, on, *and* earth *positions.*

The status of each switch is indicated by an active mimic diagram that changes to reflect the state of the switch. Black lines show that a switch is open, while white lines show the switch is closed. In addition, the status of each switch is indicated by a symbol (O, I or ⏚) for *off*, *on* and *earth* respectively.

Interlocks are provided to ensure that operators can perform switching operations only in the correct sequence; and to ensure that access to cable terminations and other high voltage areas are prevented when voltage is present.

Only when the switch has been earthed and the selector returned to the blocked position can the associated cable box cover be removed. Once the cover is removed, the interlock prevents the switch being closed until the cover is replaced. While the covers are removed, the switch can only be moved from *earth* to *off*, this allows for cable testing to be carried out. See Section 2.6 on page 11 for further details.



2.3 Switch-Fuse Reset

The operation of the switch-fuse is identical to the ring switch except when a fuse has blown. In which case, the striker initiates the automatic opening of the switch. This is indicated by the symbol "O" appearing on the mimic and the word "RESET" being shown above the handle hole. In addition to this, the fuse blown indication on the front of the SafeLink will show.

The arrow on the handle socket will indicate that the handle must be rotated anti-clockwise to reset the mechanism (the only possible action).

It is important to rotate the handle fully until the stop is felt, to reset the switch correctly.

2.3.1 Steps for Fuse Replacement

1. To gain access to the fuse compartment the switch must be in the earth position and the selector in the *blocked* position before the door can be opened. The door catch will not fully rotate and release the door unless these conditions are met. This ensures that the internal earthing of both ends of the fuse is in place before access is available.

   Rotate the fuse access door catch anti-clockwise to open.

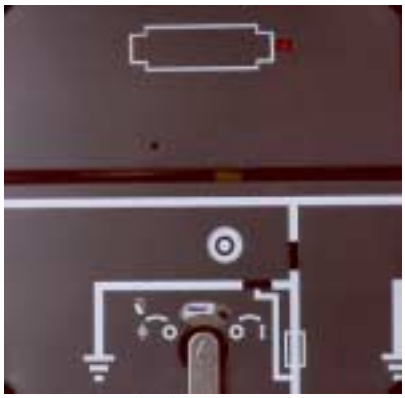
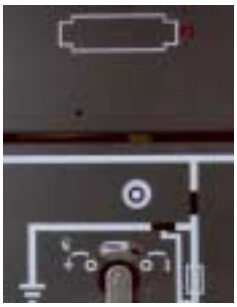


Figure 7: Front of SafeLink unit showing the mimic diagram for the switch-fuse following a fuse blow event. Note the word 'RESET' and the red fuse blown indicator are displayed.

2. Once the door is opened, the fuse canisters are visible. The blown fuse(s) will be indicated by the canister(s) with the extended white plastic pin(s). All three fuses should be replaced as a set.

Figure 8: Fuse door open and fuse canisters available.



3. Pull the red handle on the front of the canister fully downwards. This will allow the fuse assembly to be removed.

Figure 9: Central fuse assembly and fuse being withdrawn.

4. Release the fuse from the fuse assembly with a screwdriver.

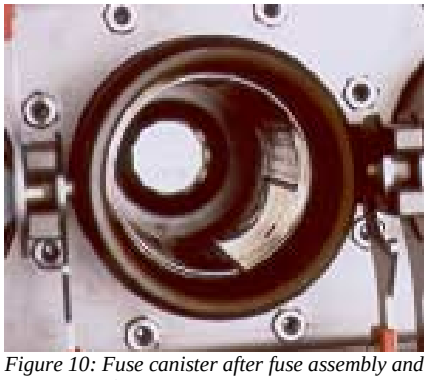
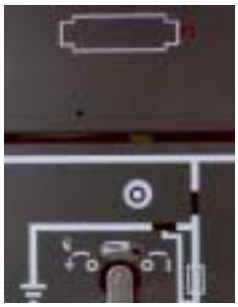


Figure 10: Fuse canister after fuse assembly and fuse have been removed.

5. Fit the new fuse into fuse assembly and tighten clamp. Carefully refit the fuse and fuse assembly into the canister. Do not overtighten the clamp screw.



2.4 Fuse Link Selection

Fuse links must have a barrel length of 292mm and dimensional compliance to DIN 43625. Fuse links are to comply to IEC 60282-1 with 'medium' striker energy, e.g. ABB CEF range or equivalent.

The SafeLink has been heat run tested to IEC 60298 under two conditions: with 400A and 630A maximum ring circuit currents. Under these conditions the maximum continuous heat dissipation from each fuse canister is 58W and 47W respectively.

The table below, based on ABB CEF backup fuses, gives maximum continuous fuse current values which are valid for ambient temperatures up to 40°C. Fuse links from other manufacturers may have markedly different heat generation figures. Where SafeLink is installed in high ambient temperature environments (over 40°C) please seek further advice from your local ABB agent; this may apply where the unit is installed in a padmount enclosure or similar.

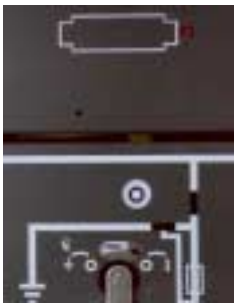
Fuse Link Rating (A)	Fuse Power Loss (W)	Ring current of 400A Max. Current (A), 58W	Ring current of 630A Max. Current (A), 47W
16	32	16	16
25	47	25	25
40	52	40	39
63	78	57	52
80	82	71	65
100	103	78	71
125*	125	85	79

*Switch-fuse combination not covered by IEC 60420 type-test certificate for fuse links greater than 100A.

For example:
If a 1000kVA, transformer with full load current of 52A is to be protected in an 11 kV, 630A ring circuit. Then a 63A fuse link can be used. Alternatively if a 130% overload of the transformer is required, then a 100A fuse link should be selected.

The figures quoted below are reproduced from the ABB CEF catalogue for line voltages of 10-12 kV.

Transformer Rating (kVA)	**100-125**	**160**	**200-250**	**315**	**400**	**500**	**630-800**	**1000**	**1250**	**1500**
Fuse Link (A)	16	16-25	25	25-40	40	40-63	63	63-80	80-100	100



2.5 Cable Box

The cable box has been designed to ensure that arc faults are contained. This is achieved using a double skin design on the side and front panels.

To gain access to the cable box the respective switch must first be in the *earth* position and the selector switch in the blocked position. This allows the cable box cover to be lifted off. This action also engages an interlock to prevent the switch being closed while the cover is removed.

When refitting the cable box covers ensure that the cover is pushed fully down onto the locating pins.

2.6 Cable Testing

Cable testing first requires that the cable box cover be removed as described above. The switch can be taken out of the *earth* position to the *off* position. To allow test connections to be made to the cable, the termination boots must be slid down to reveal the test points on the bushing stems above the terminations.

Once the cable box cover is removed, the switch cannot be turned to the *on* position. The switch must be returned to the *earth* position before the cover is refitted. The cover catch locks automatically once the switch is taken out of the *earth* position.

Cable testing should be carried out in accordance with the cable manufacturer's recommended practice.

It is important that the terminations be done in the manner outlined in section 5.3 on page 14.

3 Maintenance

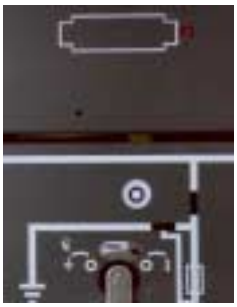
3.1 Environmental

The SafeLink switching enclosure is a gas-tight welded stainless steel compartment able to withstand a harsh environment. However, it is important that the base of the SafeLink installation be kept free of vegetation or other material to prevent corrosion of the stand and/or enclosure.

3.2 Maintenance

All components within the SF_6 insulated tank are maintenance free for the life expectancy of the unit. The tank is made of stainless steel.

Scratches or other damage to panels must be repaired.



Mechanical parts located outside the sealed tank are surface treated or made of corrosion resistant materials. These parts are lubricated during manufacture for the unit's life expectancy.

Units installed in extreme conditions are likely to require inspection depending on the nature of the environment.

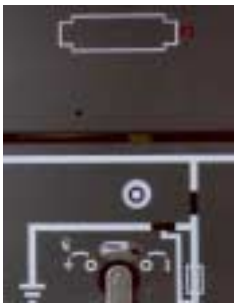
Where an outdoor enclosure is used, this should be checked periodically for scratches or corrosion and the base of the stand must be kept clear of vegetation and well ventilated.

3.3 Gas Sampling and Filling

The gas density gauge on the front of the SafeLink shows the density of SF_6 gas in the unit. All units are tested to ensure that any leakage rate is so low as to give a thirty-year service life. During switching, the arc formed will cause the gas to dissociate. Once the arc is extinguished the SF_6 reforms. A molecular sieve is fitted inside the switching enclosure to absorb any remaining ion products.

When samples are required these are taken through the *Dilo* fitting of the gas density gauge on the front of the unit in the fuse compartment. Therefore, the fused switch must be switched to the *earth* position and the selector placed in the blocked position. The sample must be taken with the sampling kit available from ABB. This will ensure that any gas escaping during the sampling process is minimised.

Gas is added through the same connection used to take samples. The ABB filling adaptor allows the pressure inside the switch to be monitored during filling. Full details are included with the filling adaptor.



4 Transport & Handling

4.1 Storage

SafeLink units must be stored under cover in a dry and well-ventilated area.

4.2 Transporting

SafeLink units are shipped from the factory filled with SF_6 gas and ready for installation. All units have passed routine tests before leaving the factory.

The switchgear is filled with SF_6 gas to a pressure of 0.2 bar above atmosphere at 20°C. Bolts, nuts, connections etc associated with sealing must not be adjusted.

The units are supplied packed on a pallet or concrete pad to allow forkhoist movement. Lifting eyes are also provided as standard. Where the unit is supplied with an enclosure this is generally supplied as a flat-pack to be fitted to the SafeLink following installation.

4.3 Inspection of Unit

On receipt of the unit, it should be checked for any visible signs of damage. Damage to paintwork, etc should be made good as soon as possible. Check that the gas density gauge is in the green region.

If there are any problems with your SafeLink unit please contact your ABB agent.

4.4 Dimensions & Weights

SafeLink with ABB stand:

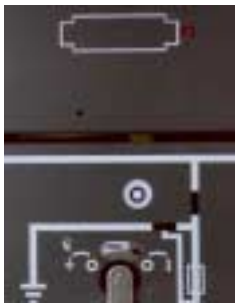
Width:	720mm
Height:	1350mm
Depth:	700mm
Weight:	250kg

Optional outdoor enclosure:

Width:	810mm
Height:	1384mm
Depth:	838mm
Weight:	80kg

Optional concrete mounting pad:

Width:	940mm
Height:	150mm
Depth:	850mm
Weight:	230kg
Rated Seismic Load:	Suitable for all areas in NZ



5 Installation

5.1 Foundations

The equipment shall be mounted on a concrete base designed to support the equipment weight of 250kg, plus 80kg for the outdoor enclosure if used. ABB is able to supply a suitable concrete base as an optional item. The base pad shall be mounted on a prepared and compacted base. The concrete base should be smooth and must be installed such that it is level. The maximum deviation in the height of the mounting pad must be less than 3mm in any direction, with a maximum deviation from horizontal of 1° in any direction.

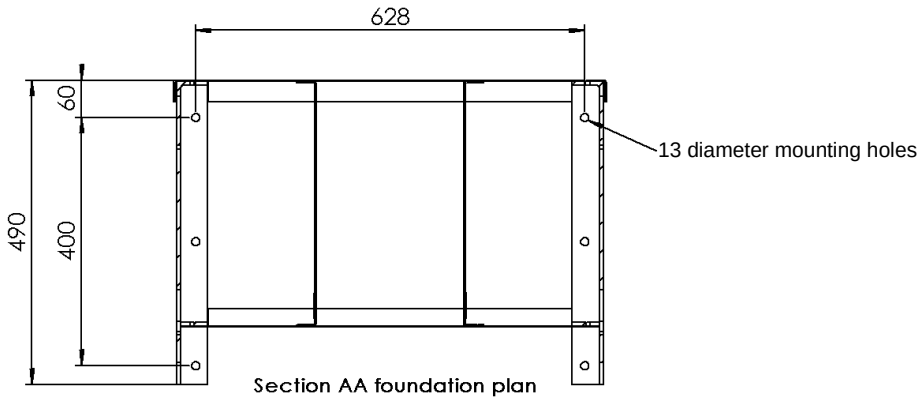


Figure 11: SafeLink foundation mounting plan.

The units are fastened to the concrete base by four M12 bolts. Ensure that there is free air movement around the stand and prevent build up of material (vegetation, bark, etc.) around the base of the stand.

5.2 Main Cable Boxes

The cable box compartment covers can be removed individually, while the side plates can also be removed for installation and commissioning. This allows all of the bushings to be exposed to give maximum cable termination room.

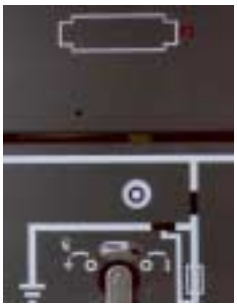
Options available are gland plates, cable support clamps, and their associated brackets.

5.3 Cable Connection

The maximum cable size that can be accommodated is 300mm² 3-core or 500mm² for single-core cables. The bushings for each switch are arranged front to rear. The cable should be prepared for jointing with red phase to the rear.

The cable-bushing stem has a 25mm wide pad and lugs should be fitted using M12 bolts tightened to a maximum of 72Nm.

Unused switches should be appropriately terminated with a blank termination.



5.3.1 Steps for Cable Connection

1. Ensure that the switch is in the earth position to allow the front cover to be removed. Each cable box is separated from the others so that work can be carried out within a single cable box if needed. When the extreme left and right switches are earthed the outside cable box plates can be removed.

2. Where the centre switch and one of the outside switches are turned to the earth position (for example during commissioning) the side plate between the two cable boxes can be removed to give more working space.

(a) *(b)*

Figure 12: Steps to install cabling. (a) Bolting lugs to the cable bushings; (b) Left hand cable termination completed.

5.4 Fuse Types and Replacement

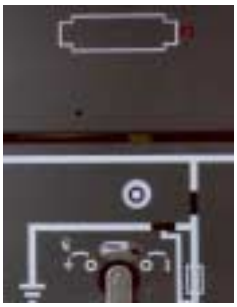
The fuses used must comply with IEC 60282-1:1994 *(High-voltage fuses - Part 1: Current-limiting fuses)* having a medium striker energy of 1J ± ½J. It is important that care is taken with the fuse alignment when installing small diameter fuses (ie less than 87mm). The fuse canister is completely sealed to IP65.

To replace a fuse, undertake the steps outlined in Section 2.3 on page 8. This section also details the switch-fuse reset procedure. Note that the switch will not remain in the closed position if a blown fuse is present.

Auxiliary switches are available to give an additional indication of the fuse trip status.

Avoid dirt on the rubber plug; do not apply grease. The fuse canister and tripping mechanism must be kept clean and dry.

Discard and replace all three fuses when any fuse has operated (refer to IEC 60282-1 & IEC 60420).



5.5 Outdoor Enclosure

The outdoor enclosure to suit the SafeLink attaches to the ring main unit. It is padlockable and no special tools are required for its installation—only an M8 socket and 4mm allen key are needed. Once installed all critical fixings are hidden. For access to the SafeLink unit, the top lifts up, and the door is hinged on the left.

The enclosure is supplied in a flat-pack form for retrofitting. Full instructions for assembly and mounting are supplied with each enclosure.

Figure 13: SafeLink unit mounted in its outdoor weather- and vandal-resistant enclosure.