

Substation Design Instruction

Compact category 1 LV switchgear

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Substation Design Instruction

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SDI 250 Compact category 1 LV switchgear

Contents

1.0	PURPOSE	4
2.0	SCOPE	4
3.0	REFERENCES	4
4.0	DEFINITIONS AND ABBREVIATIONS	4
4.1	General definitions	4
5.0	ACTIONS	4
5.1	General	4
5.2	Electrical specification	5
5.2.1	<i>Insulation level (all equipment)</i>	<i>5</i>
5.2.2	<i>Current ratings (fuse strips)</i>	<i>5</i>
5.2.3	<i>Derating factors</i>	<i>5</i>
5.2.4	<i>Derating labels</i>	<i>5</i>
5.2.5	<i>In service current ratings</i>	<i>5</i>
5.3	Feeder fuse isolators	6
5.4	Standard isolator	8
5.5	Distribution boards	9
5.5.1	<i>Four feeder distribution board (centre standard Compact isolator)</i>	<i>9</i>
5.6	Internal arrangement of conductors	10
5.7	Assembling a board	11
5.8	Accessories	13
5.8.1	<i>Extraction handle</i>	<i>13</i>
5.8.1.1	<i>General</i>	<i>13</i>
5.8.1.2	<i>Shrouded extraction handle</i>	<i>13</i>
5.8.1.3	<i>Modified extraction handle</i>	<i>14</i>
5.8.2	<i>Fuse link (DIN) blade</i>	<i>14</i>
5.8.3	<i>Solid link (DIN) blade</i>	<i>14</i>
5.8.4	<i>Single auxiliary fuse</i>	<i>14</i>
5.8.5	<i>End cover and screws</i>	<i>14</i>

5.8.6	<i>Fuse contacts</i>	15
5.8.6.1	<i>Fuse contact cover</i>	15
5.8.6.2	<i>Fuse contact shroud</i>	15
5.8.7	<i>Distribution board frame</i>	16
5.9	Labelling	16
5.9.1	<i>Switchgear labelling</i>	16
5.10	Cable connections	17
5.10.1	<i>Cable sizes</i>	17
5.11	Operating single line diagrams	17
5.12	Drawings	17
6.0	AUTHORITIES AND RESPONSIBILITIES	18
7.0	DOCUMENT CONTROL	18

1.0 PURPOSE

To set out in detail the application and installation of Compact category 1 LV switchgear.

Note: This switchgear is no longer approved for use on Endeavour Energy's network. This instruction is for reference purposes only.

2.0 SCOPE

This instruction includes the technical requirements for electrical, mechanical and operational parameters and sets out only equipment purchased and installed on Endeavour Energy's network.

Although Endeavour Energy has both bolted (BS) and blade (DIN) fuse links in service, this instruction covers only the blade links, which have been purchased since June 1974.

3.0 REFERENCES

- Company Policy 9.2.5 - Network Asset Design
- Company Policy 9.2.10 – Network Asset Ratings
- Company Policy 9.7.1 - Network Asset Construction
- Company Policy 9.8.3 - Network Operations
- Company Policy 9.9.1 - Network Asset Maintenance
- Branch procedure - PAE1004 Product Approval Process
- Earthing Design Instruction - EDI 100 - Distribution earthing design, construct and test
- Equipment Technical Specification ETS 0069 – Distribution indoor and padmount substation low voltage switchgear
- Equipment Technical Specification ETS 0071 – Distribution fuses
- Mains Construction Instruction MCI 0006 – Underground distribution : Construction Standards manual
- Mains Design Instruction MDI 0028 - Underground distribution network design
- Substation Design Instruction SDI 101 – Distribution substations general details and minimum requirements
- Substation Design Instruction SDI 255 – GEC category 2 low voltage switchgear
- Network Management Plan December - 2013 Review
- *Electricity Supply Act 1995 (as amended)*
- *Work Health and Safety Act 2011 (NSW)*
- ENA National Electricity Network Safety Code (Doc. 01-2008)
- *Occupational Health and Safety Regulation, 2001*
- *Occupational Health and Safety Act 2000*
- AS/NZS 3947:2001 - Low-voltage switchgear and controlgear - Switches, disconnectors, switch-disconnectors and fuse-combination units

4.0 DEFINITIONS AND ABBREVIATIONS

4.1 General definitions

Note: A full list of definitions is contained in SDI 101.

5.0 ACTIONS

5.1 General

Compact switchgear is a fully encapsulated modular low voltage distribution system, single phase manually operated, comprising an off-load isolator and fused feeder units. The units are designed to be readily assembled from basic modules into any circuit configuration.

5.2 Electrical specification

5.2.1 Insulation level (all equipment)

	Busbars	Incoming isolator	Feeder fuse isolator
Rated voltage	440V	440V	440V
1.2/50 impulse withstand:	15kV	15kV	15kV
Power frequency withstand	2.5kV	2.5kV	2.5kV
Rated frequency	50Hz	50Hz	50Hz
Insulation resistance at 1kV DC	20MΩ	20MΩ	25MΩ

5.2.2 Current ratings (fuse strips)

	Busbars	Incoming isolator	Feeder fuse isolator
Emergency break current (at 0.7 pf lag)	-	-	300A
Rated normal current	1250A	1250A	440A
Allowable current in service	-	Refer table 5.2	Refer table 5.2
Rated one sec. withstand current	49kA	43kA	In excess of fuse I _{pt}
Rated peak withstand	110kA	100kA	In excess of 30kA
Emergency make current			
a) on to load	-	-	400A
b) on to fault	-	-	43Ka

5.2.3 Derating factors

The rated currents of switchgear are determined under standard test conditions specified in AS/NZS 3947, but these have little relation to conditions encountered in- service in Endeavour Energy. Enclosure in a cubicle, attachment to other units, and high ambient temperatures all contribute to the need to derate equipment.

The accompanying table gives the maximum allowable continuous current ratings for Compact isolators and feeder units under various service conditions. Failure to observe these limitations could result in serious damage or destruction of equipment.

5.2.4 Derating labels

Labels shall be fitted to the front of the equipment that states the maximum rating of the equipment in line with the installation condition indicated in clause 5.2.5 below.

5.2.5 In service current ratings

Service location	Switchboard configuration	Incoming isolator (nameplate 1250A)	Feeder fuse isolator (nameplate 400A)	
			400A fuse-links	250A fuse-links
Padmount substation	Incomer + 0 or 1 feeder	900A	270A	200A
	Incomer + 2 or 3 feeders	850A	250A	200A
	Incomer + 4 feeder	800A	200A	180A

Note: Feeder loads must be monitored to check that total current does not exceed the rating of the incoming isolator.

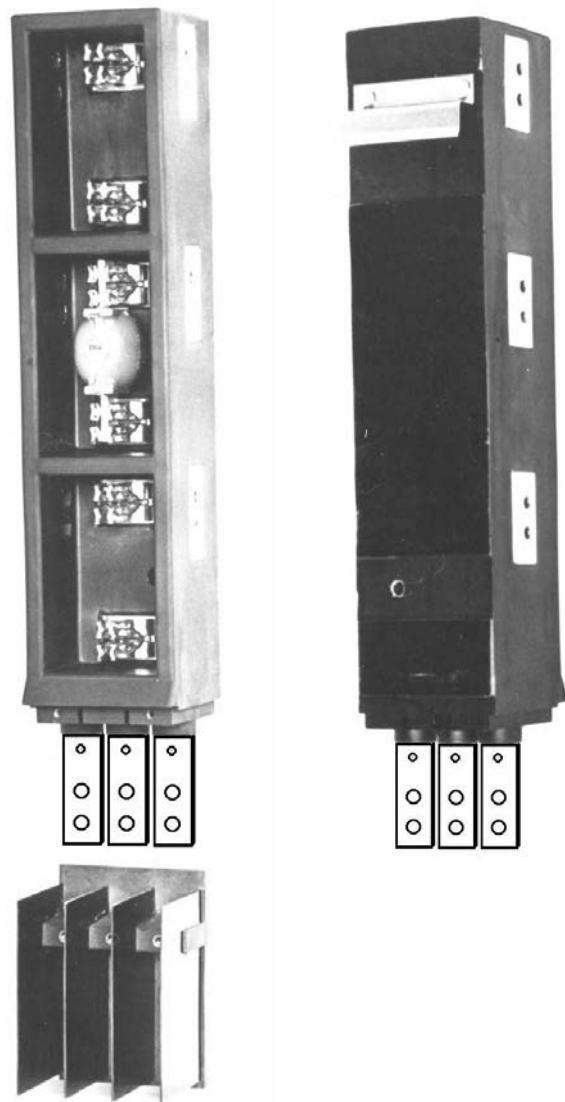
5.3 Feeder fuse isolators

Two versions of feeder fuse isolator generally are installed on the network.

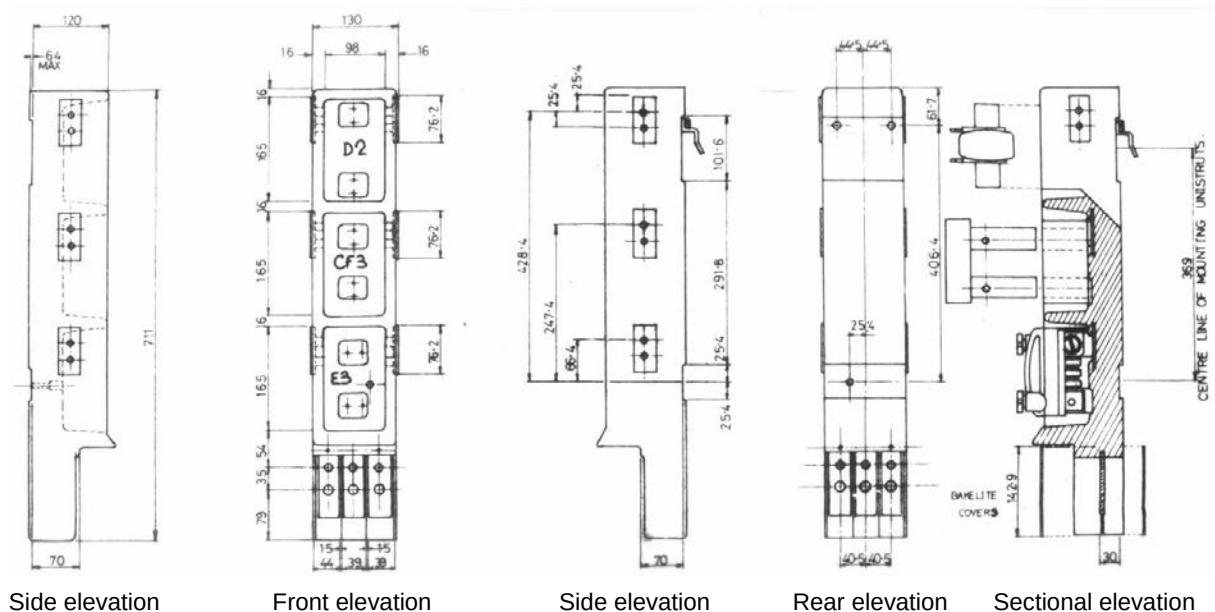
Front connected (DIN)

The front connected isolator, as the name suggests, allows cables to be terminated from the front and bottom of the strip. The switchgear is suitable for a maximum cable size of 240mm² fitted with copper or aluminium lugs.

The feeder fuse isolator can be fitted with DIN size 2 fuse links.



Front connected (DIN)
Front view Rear view



Side elevation

Front elevation

Side elevation

Rear elevation

Sectional elevation

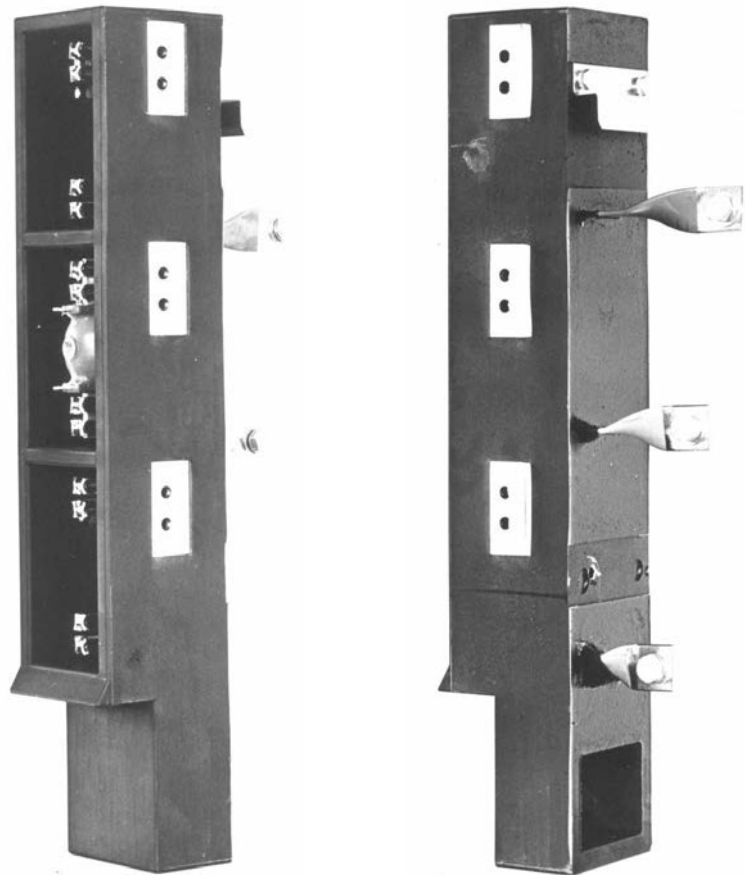
Compact category 1 LV switch

Amendment no. 6

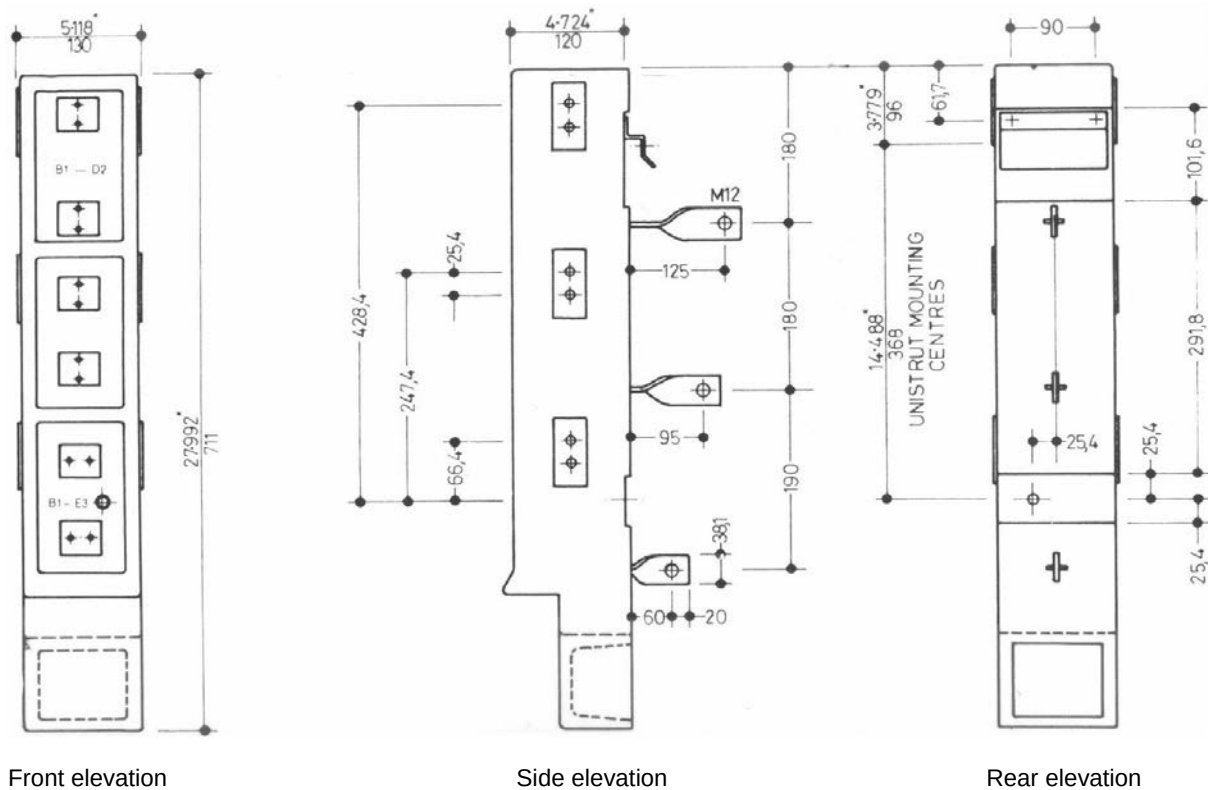
Back connected (DIN)

These units were used when cabling was too large for front connected strips, or where more than two cables for each phase are used. There is no restriction on cable sizes. The switchgear is suitable for copper or aluminium lugs.

The feeder fuse isolator can be fitted with DIN size 2 fuse links.

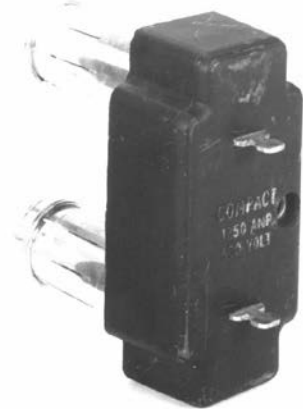
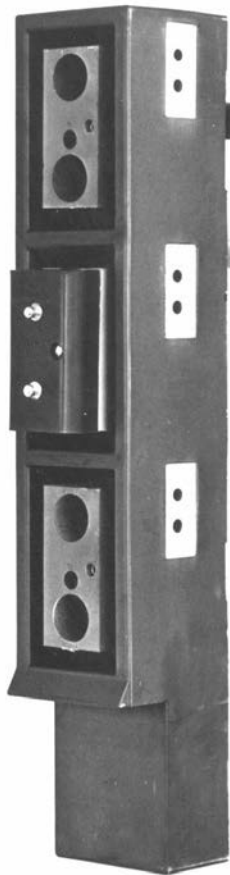


Front view Rear view



5.4 Standard isolator

The standard isolator is suitable for connection from the rear. The isolator is designed for installation with feeder fuse isolators in a switchboard.



There are three types of links

Pre-1976

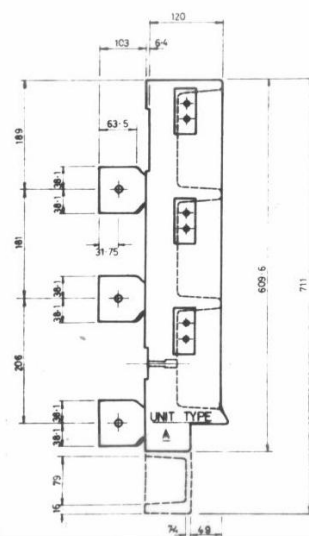
Link fitted with round extraction pins.

1976 to Oct 1982

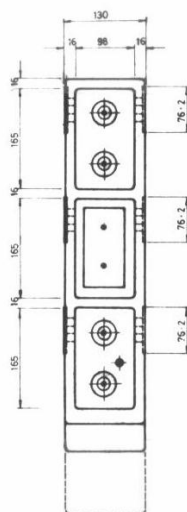
Link with DIN fuse extraction pins.

Post Oct 1982

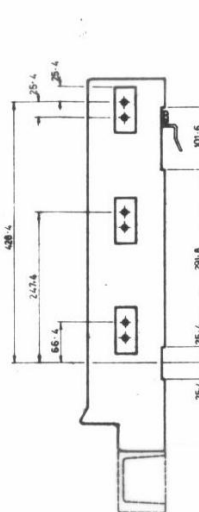
Links have stainless steel springs fitted. These can be identified by indentation in epoxy (top centre). Type 1 and 2 links, which have had springs replaced with stainless steel, have a saw cut in epoxy above the top extraction pin.



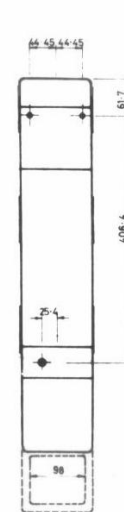
Side elevation with connection flags



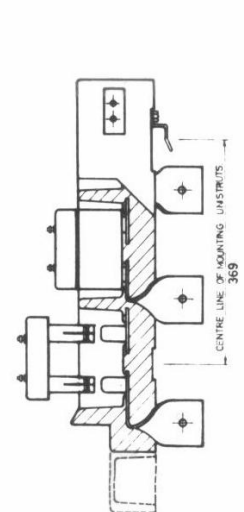
Front elevation one link fitted



Side elevation w/o connections flags



Rear elevation w/o connection flags



Sectional elevation

5.5 Distribution boards

5.5.1 Four feeder distribution board (centre standard Compact isolator)

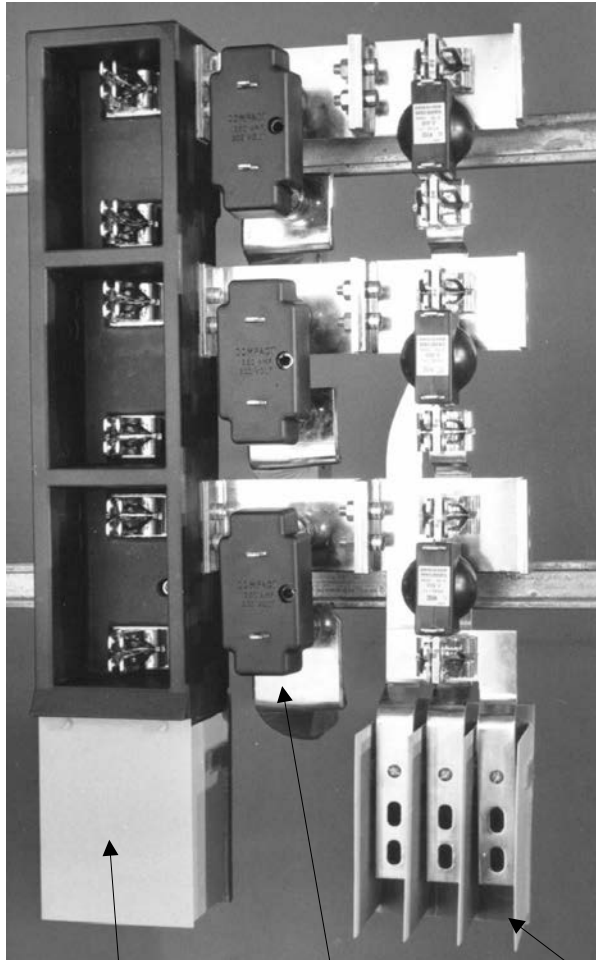
These boards consist of one rear connected incoming isolator and four front connected feeder fused isolators assembled on Unistrut rails. A three feeder board can be constructed by removal of a feeder fused isolator.



5.6 Internal arrangement of conductors

To illustrate the arrangement of the conductors within an encapsulated distribution board, the unit shown below was assembled using two feeder isolators (one complete and one without polyester resin) and one isolator (without polyester resin).

Front view

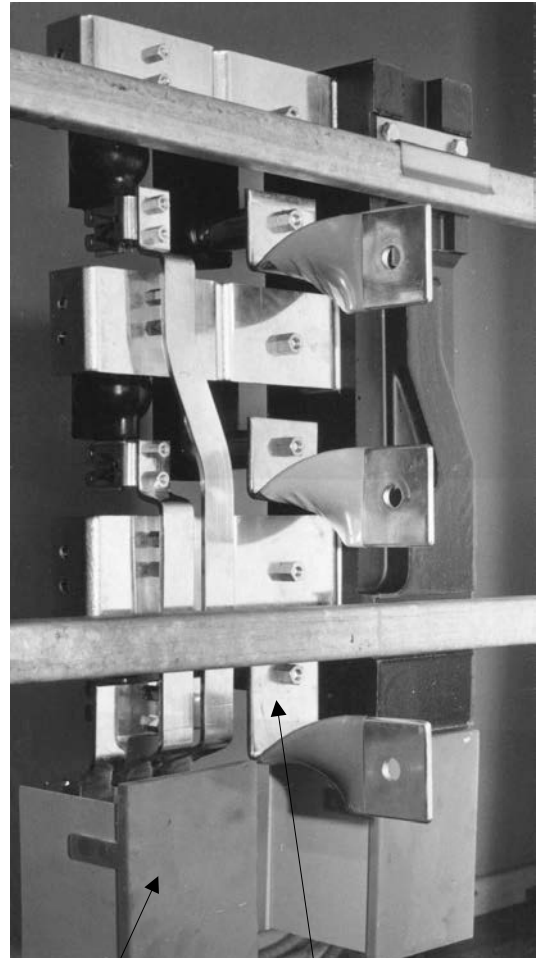


Front connected
feeder fuse
isolator complete

Back connected
isolator busbars,
contacts and
isolating link only

Front connected feeder
fuse isolator busbars,
contacts, fuse links and
cable shroud only

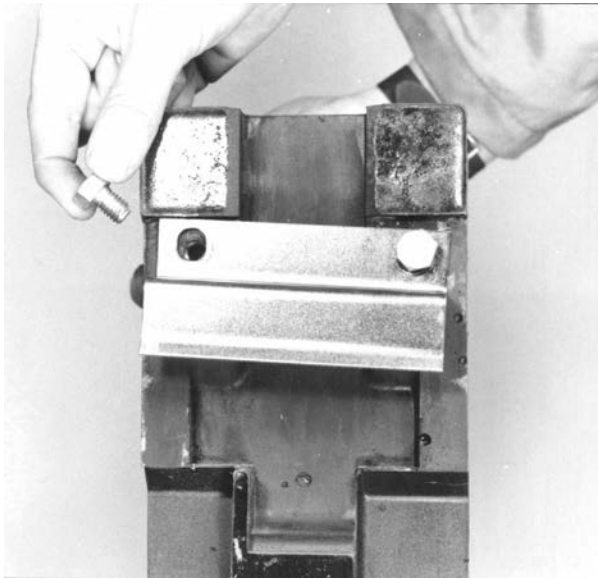
Rear view



Back connected
isolator busbars,
contacts and
isolating link only

5.7 Assembling a board

The following steps indicate the typical process to assemble a new strip onto a frame.



Attach top hanging bracket to back of new fuse/isolator strip



Hang fuse strip over top *Unistrut* support frame bracket



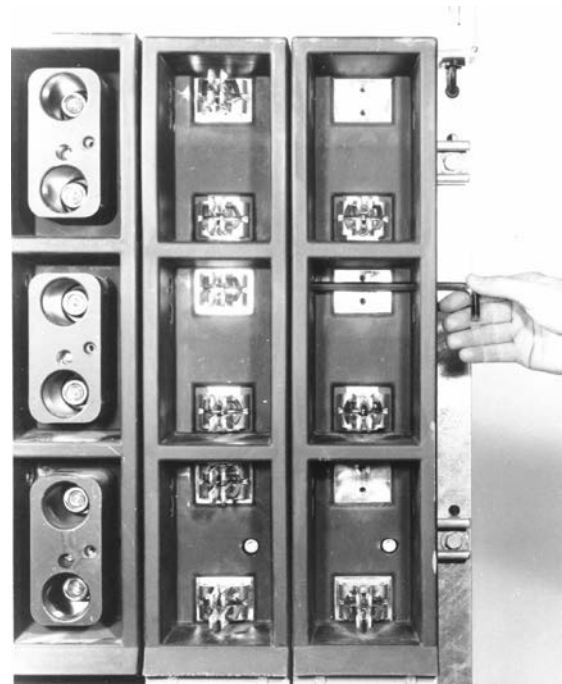
Push fuse strips together and lightly clamp bottom frame securing bolt



Remove top fuse contact from each phase to allow good access to busbar connections



Hold first of two nuts (for each phase)
into busbar nut recess and insert
busbar connection bolts from
the other side



Tighten busbar connection bolts
progressively and evenly across all
three phases using an *allen* key

After the units have been bolted together and the busbar connections have been tightened,
the bottom frame securing bolt can be tightened.

Once completed, all the fuse contacts can be re-installed.

5.8 Accessories

5.8.1 Extraction handle

5.8.1.1 General

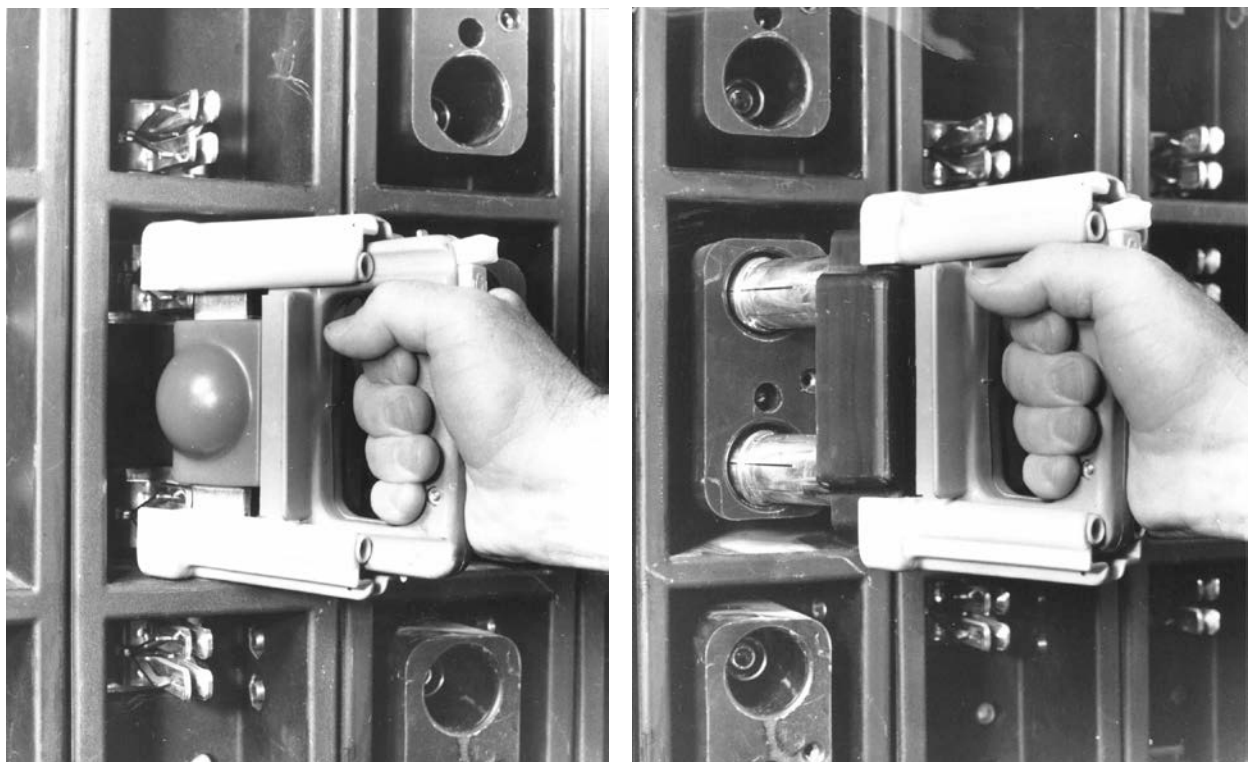
Two types of handles are available for fitting or removing isolator links and or fuse links.



5.8.1.2 Shrouded extraction handle

These should be used on all DIN fuses and isolator links fitted with DIN extraction pins.

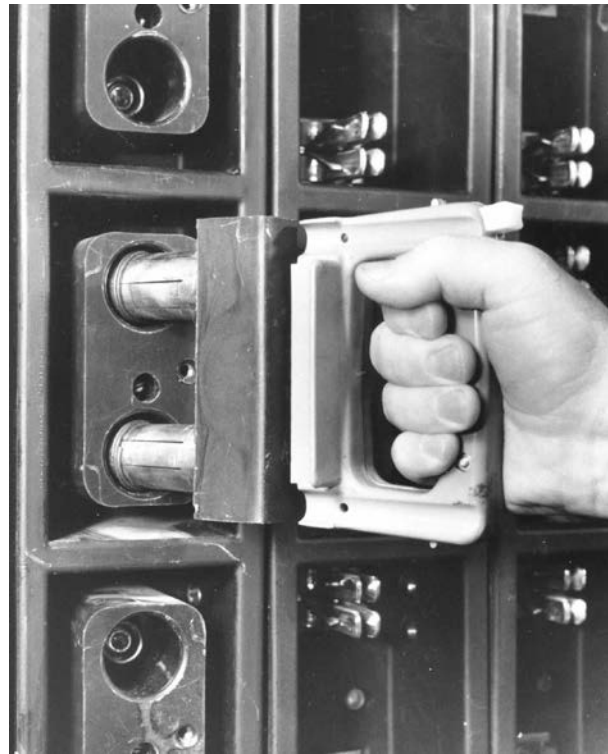
Gloves shall be worn during any live operations, gloves not shown here are for demonstration purposes only.



5.8.1.3 Modified extraction handle

These should be used on isolator links fitted with round extraction pins on units supplied prior to 1975.

Gloves shall be worn during any live operations, gloves not shown here are for demonstration purposes only.



5.8.2 Fuse link (DIN) blade

250A Stock code - 1143874

315A Stock code - 1013130

400A Stock code - 1013166

5.8.3 Solid link (DIN) blade

400A Stock code - 1548866

5.8.4 Single auxiliary fuse

30A mounted on the left hand side only. Used for street light control or GPO take off.



5.8.5 End cover and screws

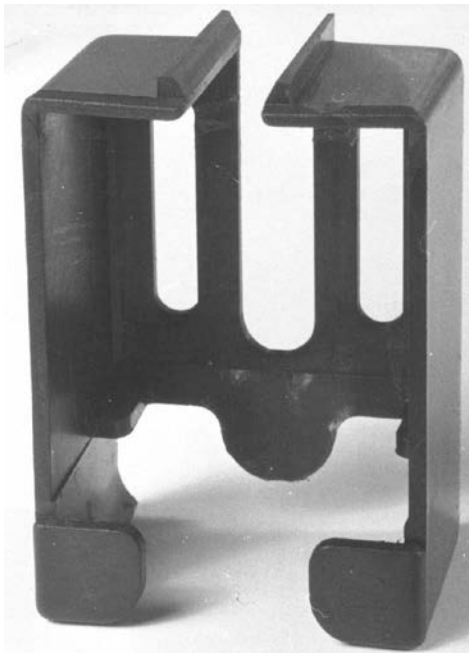
For insulating exposed busbars on ends of distribution boards, cut to length if auxiliary fuse unit (5.8.4) fitted. Insulated screws must be used.



5.8.6 Fuse contacts

5.8.6.1 Fuse contact cover

Mount over extraction pins of fuse link as shown. This is superseded by 2 off fuse contact shrouds (refer 5.8.6.2).



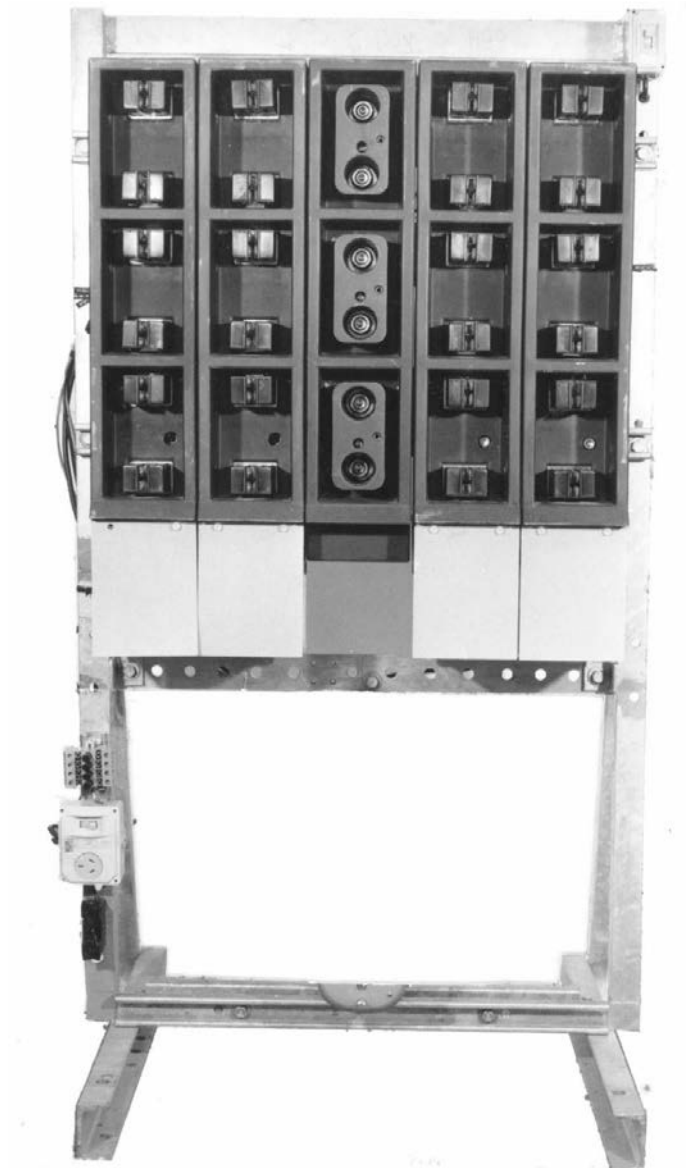
5.8.6.2 Fuse contact shroud

Fitted over each fuse contact to prevent accidental contact when fuse link is fitted or removed.

5.8.7 Distribution board frame

Frame fabrication details, refer Drawing no. 016659 (1 sheet)

General arrangement, refer Drawing no. 016619 (3 sheets)



**General view showing equipment mounted on frame
(street light control panel omitted for clarity)**

5.9 Labelling

5.9.1 Switchgear labelling

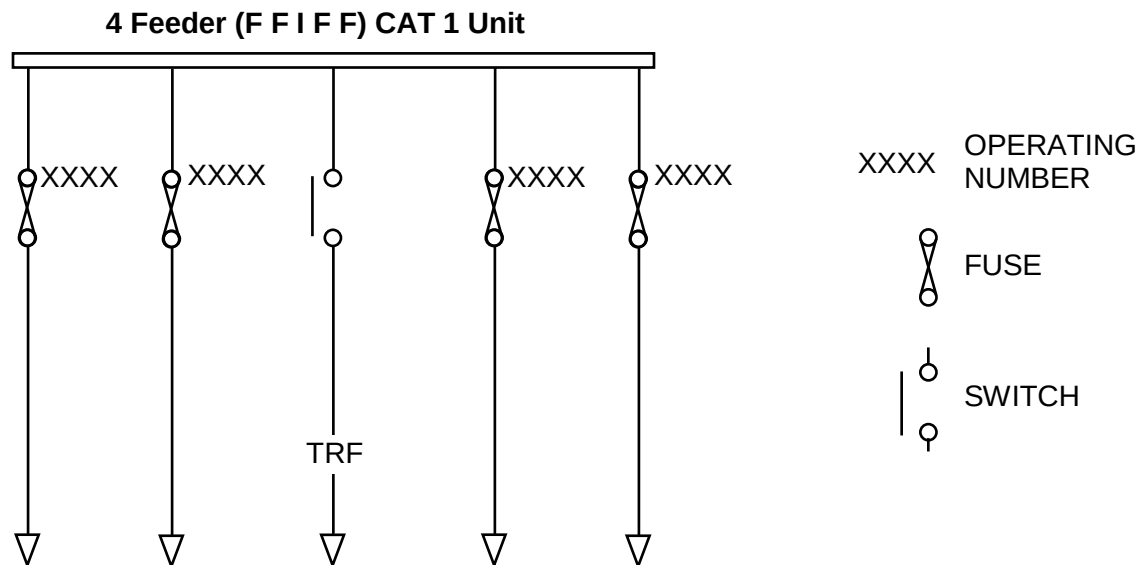
Labels to identify the LV switch number are to be fitted to the front lower area of the board.

5.10 Cable connections

5.10.1 Cable sizes

The preferred maximum size of cable that can be accommodated is three core or single core cables up to 240mm², however, cable sizes up to 300mm² can be accommodated if required.

5.11 Operating single line diagrams



5.12 Drawings

The following drawings form part of this instruction:

Drawing	Amend.	Title
016619/1	E	LV frame Compact Category 1 General Arrangement
016619/2	A	LV frame Compact Category 1 General Arrangement
016619/3	F	LV frame Compact Category 1 General Arrangement
016659	M	LV frame Compact Fabrication Details
017562	A	LV isolator 1000A back connected general arrangement
017563	A	LV isolator 1000A back connected connection detail
017564	A	Fuse strip type B1-CF general arrangement
017565	A	Fuse strip type F1-C general arrangement
040289	A	Fuse strip type B1-CLT general arrangement
040686	A	Fuse strip type B1-D2 general arrangement
040782	A	Fuse strip type FB1/D2/CF3 (Cont 15/74) GA
040783	A	Fuse strip type B1-CLT (Cont 15/74) GA
078239	B	LV Equipment Cable Lug Critical Dimensions

6.0 AUTHORITIES AND RESPONSIBILITIES

Chief Engineer has the authority and responsibility for approving this instruction and approving variations to the requirements of this instruction.

Manager Primary Systems has the authority and responsibility for endorsing and recommending changes and revisions to this instruction.

Network Substations Manager, Primary Systems has the authority and responsibility for revising and updating this instruction in accordance with Company Policy and Procedures.

Regional Managers have the authority and responsibility for:

- appointing a Responsible Officer to any project when required by this procedure; and,
- developing a process for implementing the requirements of this instruction.

Manager Network Connections has the authority and responsibility for confirming that the network installations made by external employees or organisation are checked and tested in accordance with this Standard.

Accredited Service Providers have the authority and responsibility for confirming that their employees have available and use the latest issue of this instruction and other related Standards.

7.0 DOCUMENT CONTROL

Documentation content coordinator Network Substation Manager

Documentation process coordinator Standards Process Coordinator