

Substation Design Instruction

Terasaki Tembreak LV moulded case circuit breakers

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Substation Design Instruction

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SDI 253 Terasaki Tembreak LV moulded case circuit breakers

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1.0 PURPOSE

To set out in detail the application and installation of Terasaki Tembreak moulded case LV circuit breakers.

2.0 SCOPE

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

This switchgear is generally supplied as a component installed on a distribution frame with other fuse strips and the like, for use as a LV supply from a distribution substation.

The Terasaki Tembreak range of circuit breakers covers ratings from 400 to 2500 Amps.

Only the XS400SE, XS1250NE/SE and XS2500NE amp CB units will be covered here. For more details, refer to the manufacturer's manual (Terasaki/NHP Manual Part C section 5).

3.0 REFERENCES

- Company Policy 9.2.2 - Network Protection
- 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 9.9.1 - Network Asset Maintenance
- ETS 0069 – Distribution indoor and padmount substation low voltage switchgear specification
- 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
- Network Management Plan December 2013 Review
- ENA National Electricity Network Safety Code (Doc.01-2008)
- *Work Health and Safety Act 2011(NSW)*
- Terasaki/NHP Manual Part C section 5 MCCB ratings
- Terasaki/NHP Manual Part C section 5 MCCB selection
- Terasaki/NHP Manual Part C section 6 MCCB accessory selection
- Terasaki/NHP Manual Part C section 7 MCCB tech data & dims
- Terasaki/NHP Manual Part C section 8 MCCB accessory tech data
- AS 2184 – Low voltage switchgear and controlgear - Moulded-case circuit-breakers for rated voltages up to and including 600 V a.c. and 250 V d.c.
- AS 60947 – Low-voltage switchgear and control gear - Circuit-breakers

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

The Terasaki Tembreak moulded case range of circuit breakers covers ratings from 400 to 2500 Amps. However, Endeavour Energy usually purchases only the 1250 and 2500 Amp circuit breaker. There are some special units installed with 400 Amp CBs as a trial to replace fuse strips.

The circuit breaker is supplied mounted on a frame, complete with flexible connections to the transformer. The circuit breaker is suitable for mounting in a padmount or indoor substation.

5.2 Electrical specification

5.2.1 Insulation level (all equipment)

	XS400SE	XS1250NE/SE	XS2500NE
Rated voltage (tested up to 660V)	440V	440V	440V
1.2/50 impulse withstand:	8kV	8kV	8kV
Rated frequency	50Hz	50Hz	50Hz

5.2.2 Current ratings (fuse strips)

	XS400SE	XS1250NE/SE	XS2500NE
Rated normal current	400	1250	2500
Breaking capacity at 440V (I _{cu} /I _{cs})	42/21	65/49	85/64
Short circuit making current (I _{cu} /I _{cs})	42/21	65/49	85/64
Rated withstand current (kA-0.3sec)	5	15	42

5.2.3 Derating factors

The rated currents of switchgear are determined under standard test conditions specified in AS 2184 and AS 60947, which 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 this switchgear 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 circuit breaker, which states the maximum rating of the circuit breaker, in line with the installation condition indicated in clause 5.2.5 below.

5.2.5 In service current ratings

	XS400SE ⁽³⁾	XS1250NE/SE ⁽⁴⁾	XS2500NE
Indoor sub (CB only)	-	850	1700
Indoor sub (CB + fuse strips)	-	815	1630
Pad sub (CB only - with louvre)	-	766	1531
Pad sub (CB + fuses - with louvre)	-	734	1468
Pad sub (CB only – no louvre)	-	727	1453
Pad sub (CB + fuses - no louvre)	-	697	1393
Pad sub (4 x CBs as trial no louvre)	320	-	-

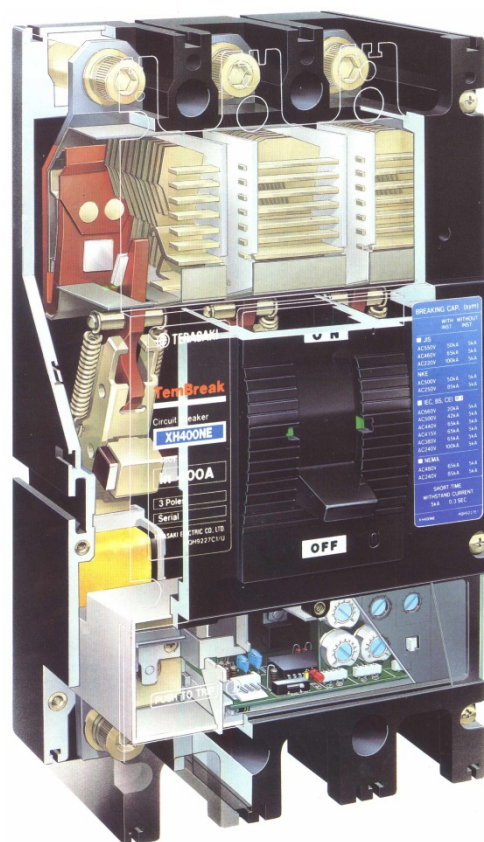
Note:

- 1) Feeder loads must be monitored to check that total current does not exceed these ratings.
- 2) The louvered cubicle consists of the installation of one louvered door to the LV end of a cubicle. The louver is manufactured from horizontal 2-stage louvres that are approximately 800mm wide x 400mm high and are located at the top and bottom of the door.
- 3) XS400SE values extrapolated from the 2500A test results and to suit 4 feeder

arrangement.

4) XS1250NE/SE values extrapolated from the 2500A test results

5.3 Circuit breaker arrangement



5.4 Dimensions

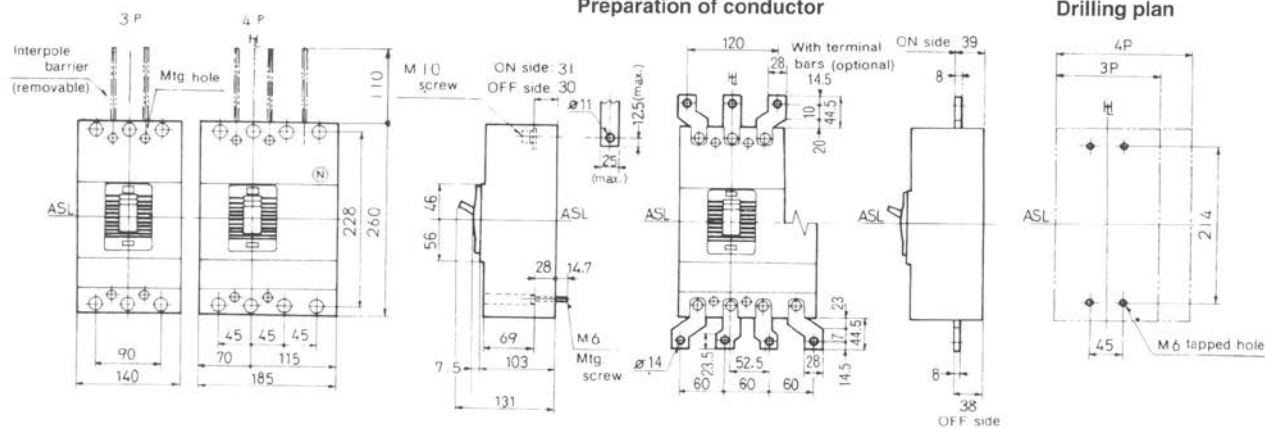
5.4.1 XS400SE

Front connected (standard)

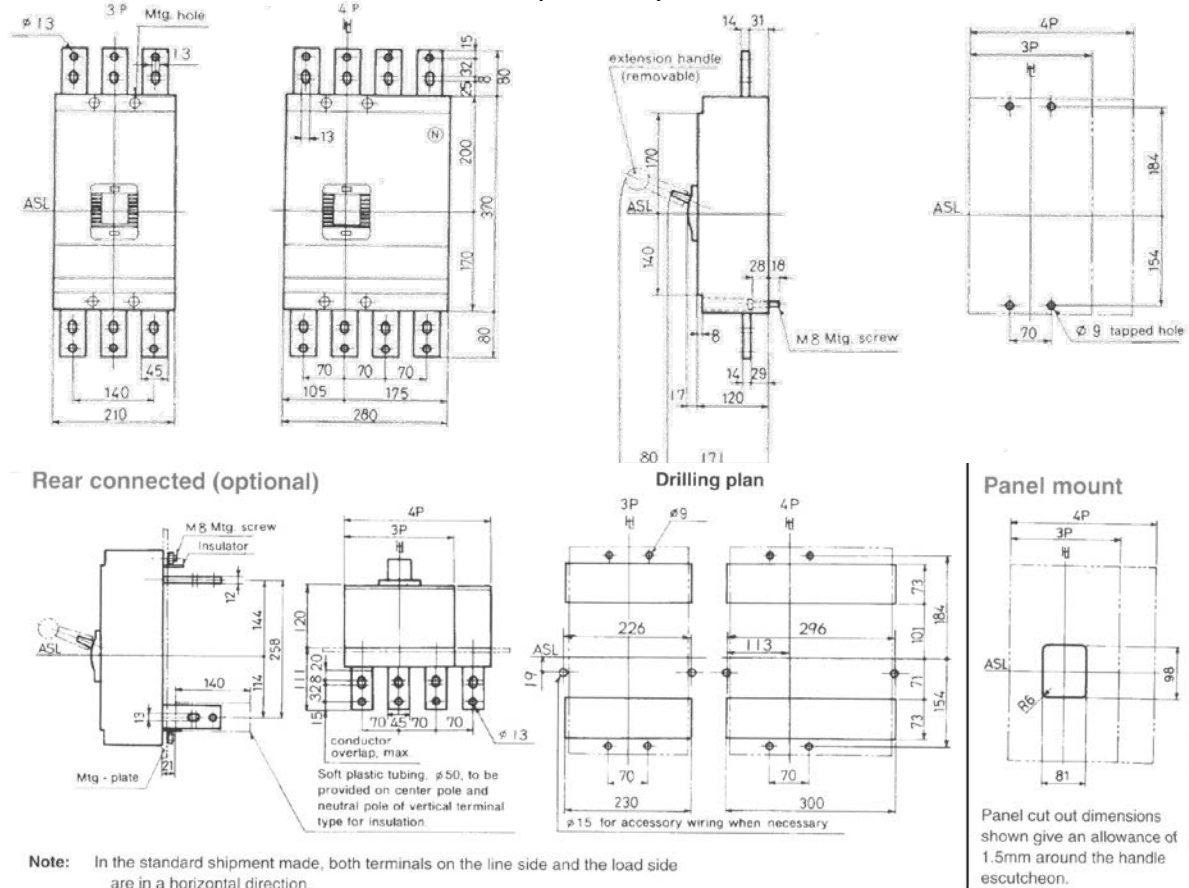
(optional)

Preparation of conductor

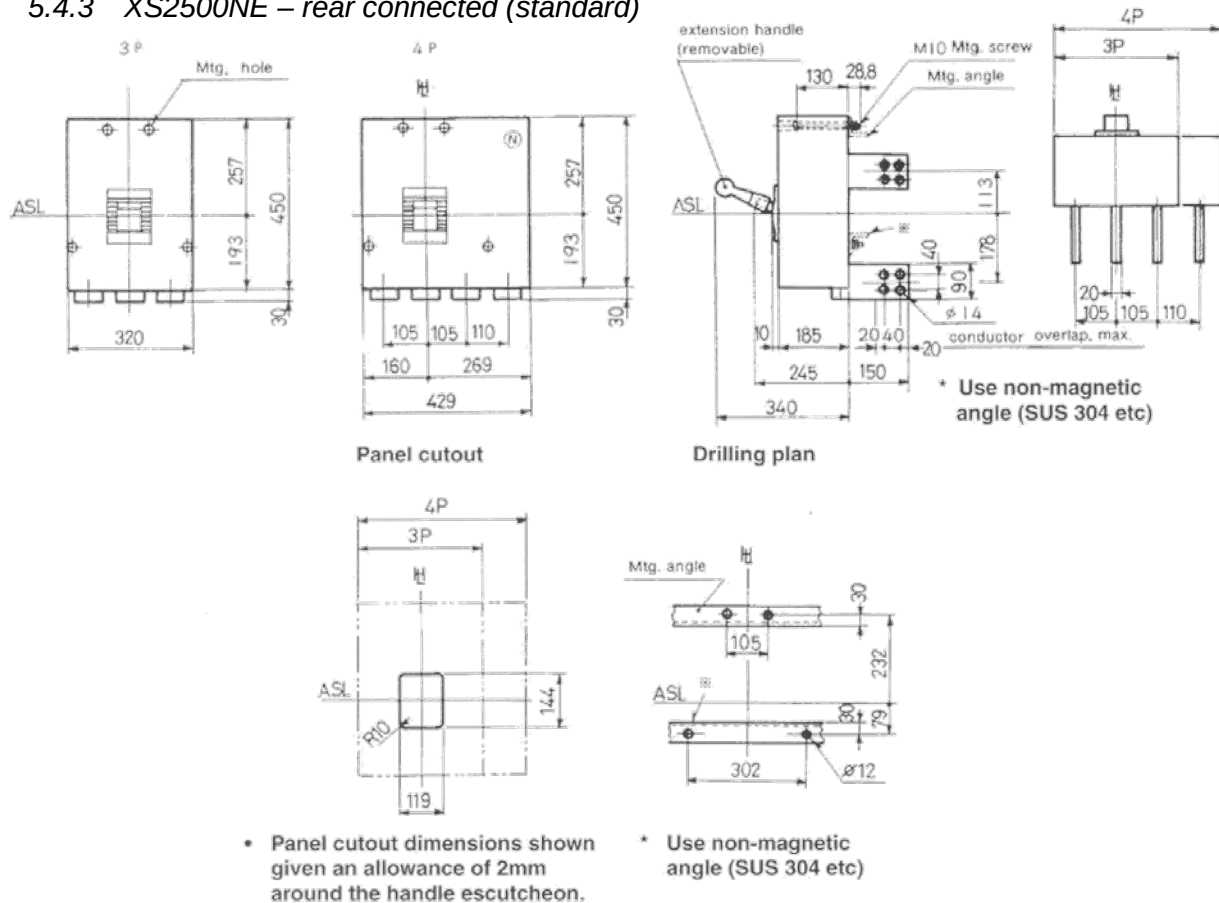
Drilling plan



5.4.2 XS1250NE/SE – front connected (standard)

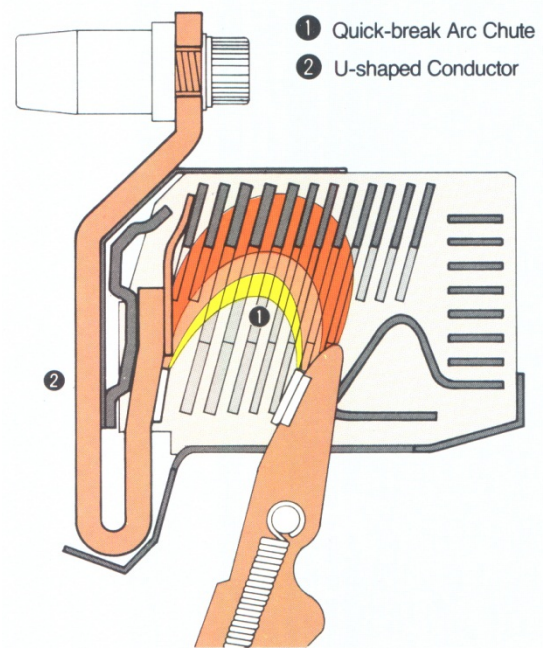


5.4.3 XS2500NE – rear connected (standard)



5.5 Operation

The Tembreak range of circuit breakers (CB) all achieve high speed, highly efficient breaking of the arc. The features include U shaped conductors, dual repulsive contacts and quick break arc chutes (to quickly quench and extinguish ionised gases).

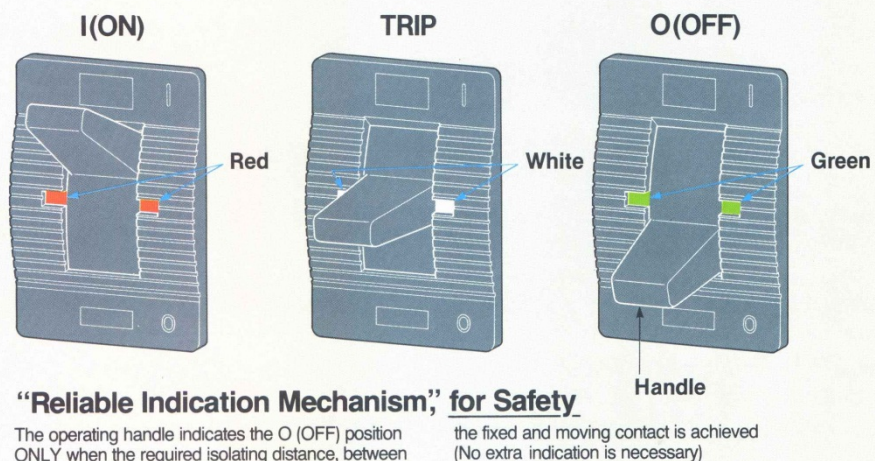


Features of the CB include the contact status indicator.

A coloured strip either side of the operating handle showing the status of the CB.

Contact Status Indication

International symbols are used (colour coded) for status indication; I (ON) Red, TRIP, White, O (OFF) Green.



5.6 Electronic trip unit

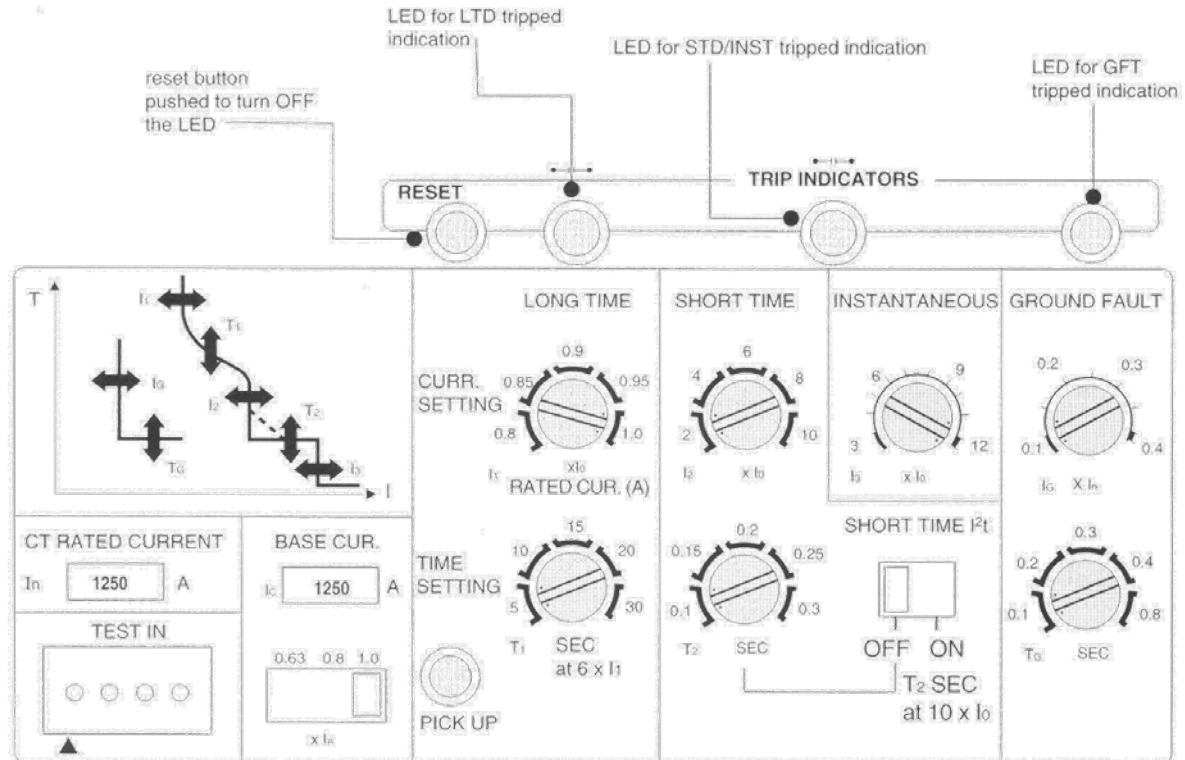
5.6.1 Settings

- | | |
|---|------------------------------------|
| • Base current (I _o) | (A) 0.63 - 0.8 - 1.0 |
| • Long time delay pickup current (I ₁) | (A) 0.8 - 0.85 - 0.9 - 0.95 - 1.0* |
| • Long time delay time setting (T ₁) | (S) 5 - 10 - 15 - 20 - 30* |
| • Short time delay pick up current (I ₂) | (A) 2 - 4 - 6 - 8* - 10 |
| • Short time delay time setting (T ₂) | (S) 0.1 - 0.15 - 0.2* - 0.25 - 0.3 |
| • Short time delay I ₂ T ramp (I ₂ T) | On - Off |
| • Instantaneous trip pick up current (I ₃) | (A) 3 12* (adjustable) |

* Standard settings by manufacturer.

Note: Endeavour Energy's circuit breakers are not installed with ground fault and pre trip alarm features.

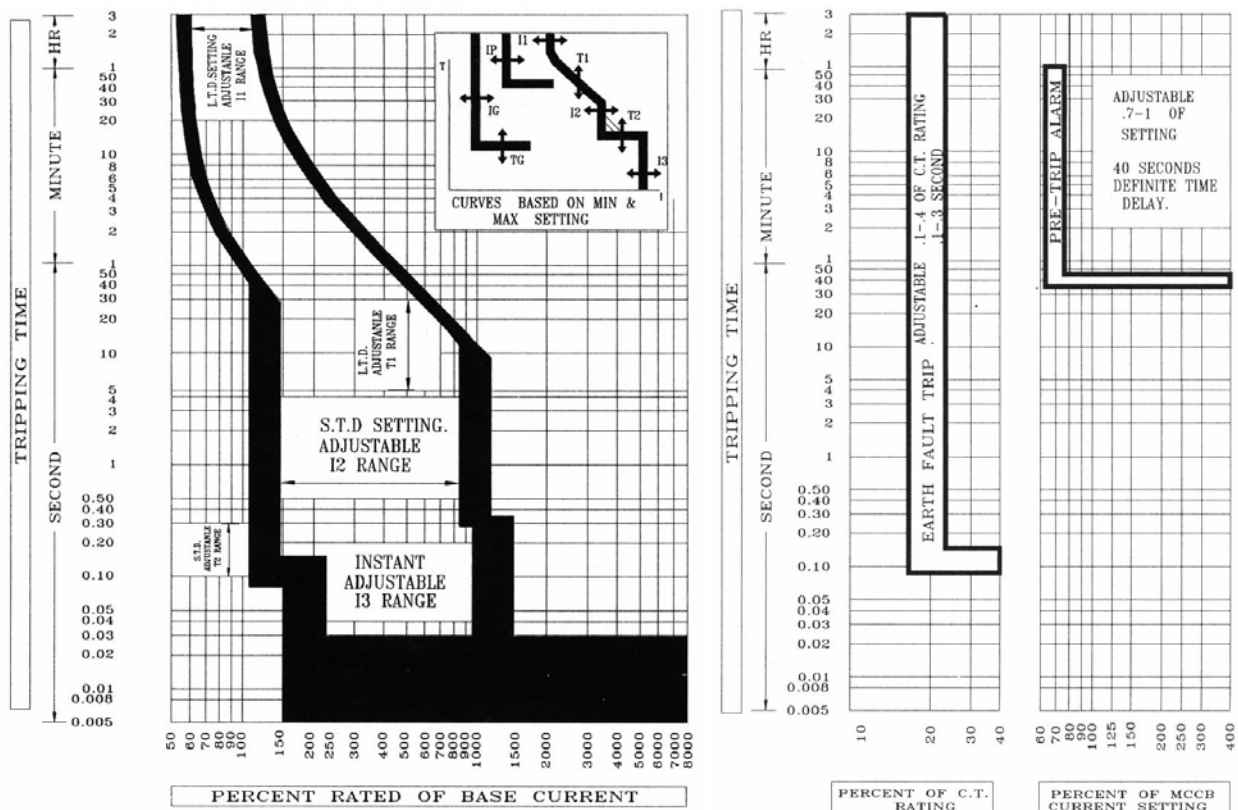
5.6.2 Electronic trip panel layout



PICK UP
LED turns on when LTD function picks up. In case PTA is fitted, this LED flickers when PTA function picks up. (separate control power required).

Example XS1250NE

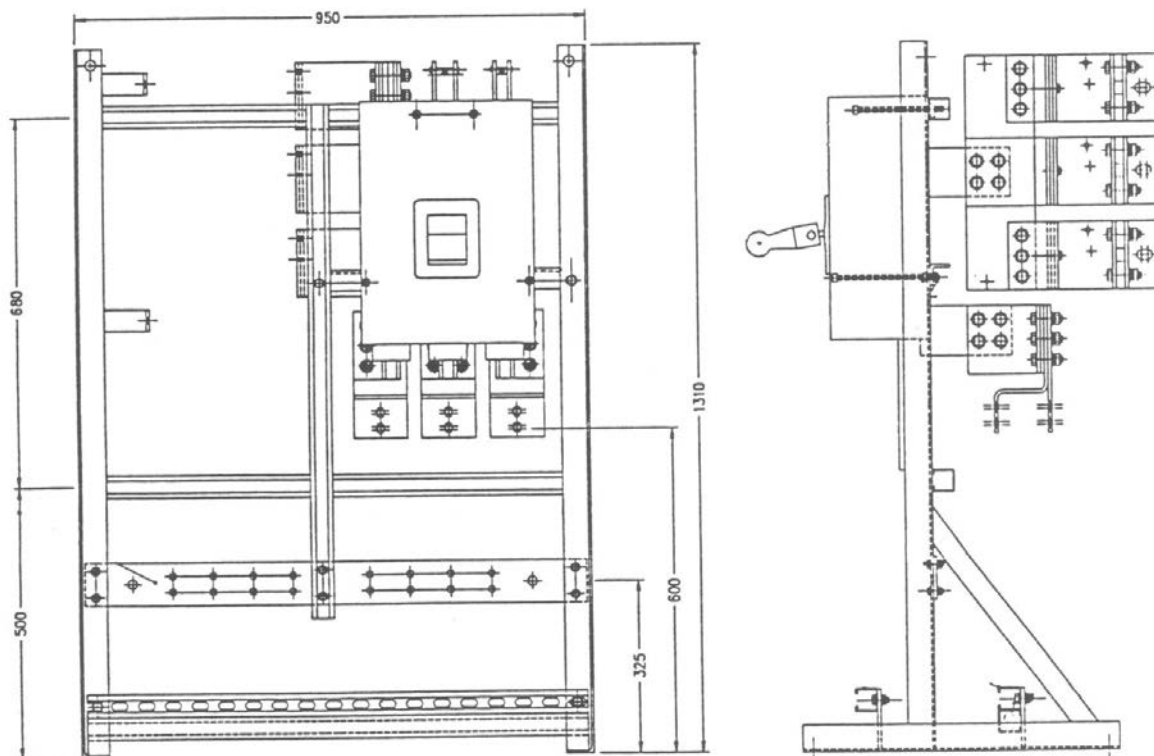
5.6.3 Trip curve range



5.7 Circuit breaker frame mounting

The frames on which the CBs are fitted vary between manufacturers. The frame shown below is typical of older installations (1250A and 2500A units) and is used only for reference purposes (the 400A fuse units would be arranged 4 in a row like a LV fuse board).

For typical new frame designs refer to Drawing No. 077555 – Low Voltage Circuit Breaker Frame Critical Dimensions.



5.8 Labelling

5.8.1 Switchgear labelling

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

5.9 Cable connections

5.9.1 Cable sizes

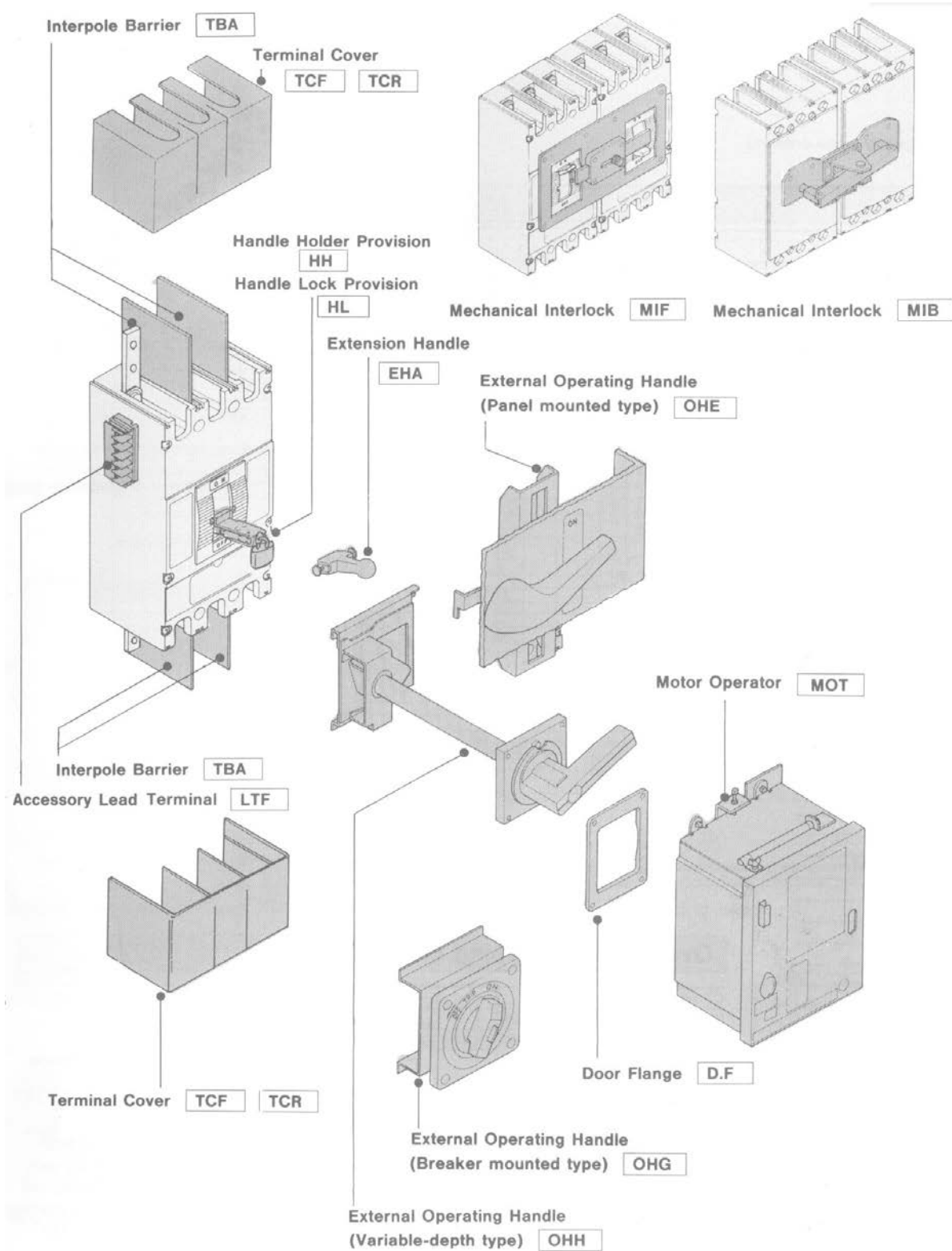
Provision has been made for a maximum of four (4) cables for each phase, each of maximum size 630mm². The lugs should comply with the dimensions shown on Drawing no. 078239.

5.9.2 Cable clamping

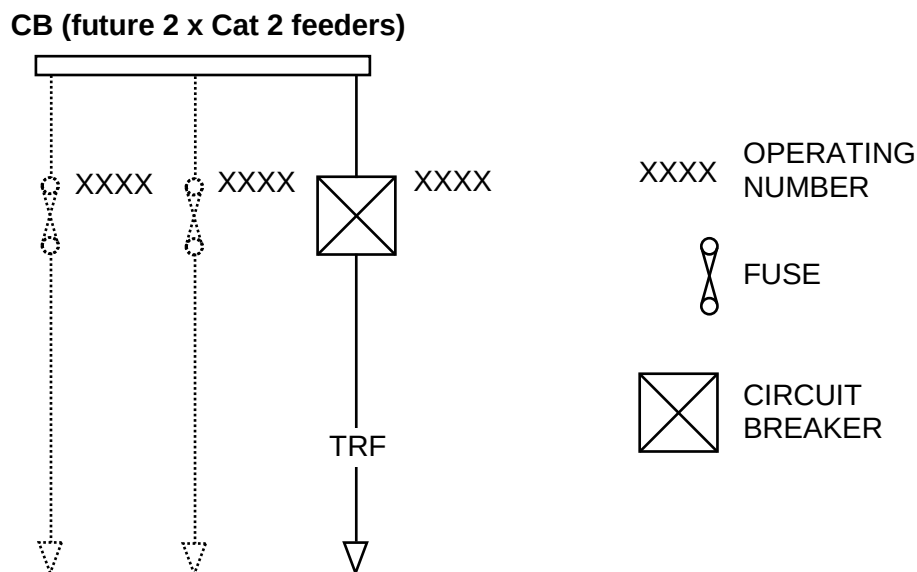
Suitable cable clamps are to be used to secure cables to the Unistrut rail provided at the bottom of each unit. Refer to Mains Construction Instruction MCI 0006 - Underground distribution: Construction Standards manual, for cable termination details.

5.10 Accessories

The accessories shown below can be ordered from the manufacturer if required.



5.11 Operating single line diagrams



5.12 Drawings

Drawing	Amend.	Title
077555	H	Low Voltage Circuit Breaker Frame Critical Dimensions
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