

Substation Design Instruction

Schneider Electric (Merlin Gerin) Compact CM/NS low voltage circuit breaker

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Substation Design Instruction

PRIMARY SYSTEMS

Document No	:	SDI 254
Amendment No	:	6
Approved By	:	MPS
Approval Date	:	11/01/2016
Review Date	:	11/01/2019

SDI 254 SCHNEIDER ELECTRIC (MERLIN GERIN) COMPACT CM/NS LOW VOLTAGE CIRCUIT BREAKER

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1.0 PURPOSE

To provide the technical and reference information to assist with the safe design, installation, commissioning, operation and decommissioning of compact CM/NS low voltage moulded case circuit breakers supplied and manufactured by Schneider Electric (previously known as Merlin Gerin).

2.0 SCOPE

This instruction provides information and reference documentation to assist in the safe design, installation, commissioning, operation and decommissioning of the Schneider Electric (Merlin Gerin) Compact CM/NS low voltage moulded case circuit breakers manufactured and supplied by Schneider Electric (previously known as Merlin Gerin).

This instruction does not give details on low voltage switchboard mounting and earthing, for which an appropriate document should be consulted.

Note: This circuit breaker is no longer approved for use in new installations on Endeavour Energy's network. This instruction is for reference purposes only.

Units removed from the Network are to be disposed of according to Company Procedure GSU 0006 Disposal of surplus goods and equipment:

The scope of this document provides reference to the various lifecycle stages of the switchgear and therefore should be read in conjunction with:

- mounting and construction requirements: refer Mains Construction Instruction MCI 0006 – Underground distribution: Construction standards manual;
- earthing design, construction and testing: refer Earthing Design Instruction EDI 100 – Distribution earthing design, construction and test;
- specification of new equipment: refer Equipment Technical Specification ETS 0069 – Distribution indoor and padmount substation low voltage switchgear and ETS 0077 – Padmount substation cubicles;
- general details and minimum design requirements: refer Substation Design Instruction SDI 101 – Distribution substation general details and minimum requirement and Mains Design MDI 0028 – Underground distribution network design;
- testing and commissioning: refer Substation Design Instruction SDI 120 – Testing and commissioning for distribution systems and Division Procedure Network GNV 1044 – Commissioning network electrical assets;
- ongoing maintenance requirements: refer Substation Maintenance Instruction SMI 101 – Minimum requirement for maintenance of distribution equipment; and
- standard drawing requirements: Standard Asset Data SAD 0001 – Project drawing standards.

This document shall be read in conjunction with the manufacturer's installation instructions available on the Endeavour Energy standards website (document numbers SDI254S01, SDI254S02, SDI254S03 and SDI254S04).

3.0 REFERENCES

Company Policy (Network) 9.1.7 – Commissioning Network Electrical Assets
Company Policy (Network) 9.2.2 – Network Protection
Company Policy (Network) 9.2.5 – Network Asset Design
Company Policy (Network) 9.2.10 – Network Asset Ratings
Company Policy (Network) 9.7.1 – Network Asset Construction
Company Policy (Network) 9.8.3 – Network Operations
Company Policy (Network) 9.9.1 – Network Asset Maintenance
Company Procedure GSU 0006 – Disposal of surplus goods and equipment
Division Procedure GNV 1044 – Commissioning Network Electrical Assets
Earthing Design Instruction EDI 100 – Distribution earthing design, construction and test
Equipment Technical Specification ETS 0069 – Distribution indoor and padmount substation low voltage switchgear
Equipment Technical Specification ETS 0077 – Padmount substation cubicle specification
Protection Design Instructions (PDI)
Mains Construction Instruction MCI 0006 – Underground distribution construction standards manual
Mains Design Instruction MDI 0028 – Underground distribution network design
Standard Asset Data SAD 0001 – Project drawing standards
Substation Design Instruction SDI 101 – Distribution substation general details and minimum requirements
Substation Design Instruction SDI 120 – Testing and commissioning for distribution systems
Substation Maintenance Instruction SMI 101 – Minimum requirement for maintenance of distribution equipment
Instructions manual (Endeavour Energy standards document no. Substation Design Instruction SDI 254S01- Compact CM1250-2500)
Installation manual (Endeavour Energy standards document no. Substation Design Instruction SDI254S02 - Compact NS1600b-3200)
MCCB Schneider Electric catalogue (Endeavour Energy standards document no. SDI254S03)
Micrologic control units 2.0 and 5.0 User manual (Endeavour Energy standards document no. SDI254S04)
Network Management Plan (2013 Review)
NSW Work Health and Safety Act 2011
NSW Work Health and Safety Regulation 2011
AS ISO 1000 – The international system of units (SI) and its application
AS 1824.1 – Insulation co-ordination - Definitions, principles and rules
AS 2629 – Separable insulated connectors for power distribution systems above 1kV
AS 2700 – Colour standards for general purposes
AS 60044.1-2007 – Instrument transformers – Current transformers
AS 60947.2 – Low voltage switchgear and controlgear Part 2: Circuit breakers
AS/NZS 3000 – Electrical Installations (known as the Aust. and NZ Wiring Rules)
ENA National Electricity Network Safety Code (Doc. 01-2008)

4.0 DEFINITIONS AND ABBREVIATIONS

CB

Circuit breaker

CT

Current transformer

LED

Light emitting diode

LV

Low voltage

LVCB

Low voltage circuit breaker

5.0 ACTIONS

5.1 General

5.1.1 Introduction

The Schneider Electric (previously known as Merlin Gerin) Compact CM/NS low voltage circuit breaker is a moulded case circuit breaker. It is used to protect the low voltage distribution network. It is designed to be mounted on LV switchboards and used in indoor or padmount substations. Endeavour Energy has previously purchased the Compact CM1250, Compact CM1600 and Compact CM2500 circuit breakers. These breakers were superseded by the new NS range from Schneider Electric.

A large number of these circuit breakers are installed on Endeavour Energy's system and will continue to be in use for a long time. These instructions aim to provide technical information and long-term support.

5.1.2 Product approval

Compact LVCB's from Schneider Electric are no longer approved for use in new installations on Endeavour Energy's network. The product approval numbers in the table below are provided for reference purposes only.

Table 1: Compact low voltage circuit breakers from Schneider Electric

Schneider part number	Description	Designated network	Approval no.
EQE-25264-D	Circuit Breakers fuse strips and boards Type 2 - 1400 A with NS 3200N CB2,3	415V	390030
EQE-25264-D	Circuit Breakers fuse strips and boards Type 3 - 2100 A with NS 3200N CB,3	415V	390031

5.1.3 Technical features

5.1.3.1 Protection

Compact CM circuit breakers are provided with ST CM 2 trip unit. Available settings are:

Long time delay protection

- Pick up setting I_r 0.5, 0.6, 0.7, 0.8, 0.9, 1.0 times I_n
- Tripping between 1.05 and $1.25 \times I_r$

Short time and instantaneous protection

- Pick up setting $I_m =$ 2,4, 6 and 8 times I_r
- Accuracy $\pm 10\%$

• Time setting	O	A	B	C
• Maximum re-settable delay (ms)	0	35	125	225
• Maximum breaking time (ms)		50	120	220
				330

All the compact CM circuit breakers incorporate an instantaneous protection set at 35kA rms, in addition to the above described protection.

Selection of pick-up current settings

The trip current pick-up setting is adjustable in multiples of the current transformer rating (I_n) as follows:

Compact CM	1250	1600	2500
Phase CT I_n	1250	1600	2500

The adjustment of pick up settings is common to all the poles simultaneously.

Compact NS circuit breakers are provided with *Micrologic* 5.0 control unit. Available settings are:

Long time delay protection

- Pick up setting I_r 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95, 0.98, 1 times I_n
- Tripping between 1.05 and 1.20 x I_r

Short time protection

- Pick up setting I_{sd} = 1.5, 2, 2.5, 3, 4, 6, 8 and 10 times I_r
- Accuracy $\pm 10\%$
- Time setting 0 0.1 0.2 0.3 0.4
- Maximum re-settable delay (ms) 20 80 140 230 350
- Maximum breaking time (ms) 80 140 200 320 500

Instantaneous protection

- Pick up setting I_i = 2, 3, 4, 6, 8, 10, 12 and 15 times I_n
- Accuracy $\pm 10\%$
- Maximum re-settable delay (ms) 20
- Maximum breaking time (ms) 50

The setting for all CBs shall be entered from the specific CB protection settings listed in Section 7 of MCI 0006 Underground Distribution: Construction standard manual.

5.1.3.2 Dimensions

The different ratings of Compact CM / NS circuit breakers are dimensionally the same.

Table 2: Dimensions of compact CM and NS circuit breakers

Dimensions	Compact CM	Compact NS
Width (overall)	418mm	420mm
Height (overall)	430mm	330mm
Depth (with handle)	451mm	368mm
Depth (without handle)	337mm	160mm

5.1.3.3 Cable terminations

The Compact CM/NS circuit breaker is suitable for termination of a maximum of 4 x 630 sq. mm cables on each phase. The cables must be supported on the *Unistrut* rail provided on a frame and in a culvert.

These cables are to be fitted with standard lugs. Cable lugs must conform to Drawing no. 078239. Lugs are to be secured using M12 high tensile bolts, tensioned to 45Nm.

5.1.3.4 Safety barriers

Safety barrier/shrouds must be installed on incoming and outgoing cable connections to protect operators from accidental touch. Safety barriers/shrouds can be fabricated from sheet metal or insulating polycarbonate sheets.

Further description, operation and maintenance instructions on the LVCB are set out in manuals, guides and instructions provided by the manufacturer.

5.1.4 Technical specifications

The specifications of the low voltage circuit breaker are as follows:

Table 3: Specifications for compact CM and NS circuit breakers

Description	Rating				
Circuit breaker type	CM 1250	CM 1600	CM 2500	NS2500N	NS3200N
Applicable standards	IEC	IEC	IEC	IEC	IEC
Number of phases	3	3	3	3	3
Rated voltage:	660 V	660 V	660 V	690 V	690 V
Rated current	1250A	1600A	2500A	2500A	3200A
Rated breaking capacity	50 kA	50 kA	50 kA	65kA	65kA
Rated peak making capacity	110 kA	110 kA	110 kA	130kA	130kA
Maximum break time	50 ms	50 ms	50 ms	50 ms	50 ms
Degree of protection	IP 40	IP 40	IP 40	IP 40	IP 40
Insulation level 1min PF withstand	3000 V	3000 V	3000 V	3000 V	3000 V

For further information, refer to the documentation provided by the manufacturer.

5.1.5 De-rating of circuit breakers

The nominal rated current of a circuit breaker is defined under standard test conditions. These conditions may be very different to those prevailing in the field. The circuit breaker is normally de-rated to lower current ratings to compensate for adverse field conditions.

The table below gives the maximum allowable continuous current ratings for Compact CM/NS circuit breakers under various service conditions.

Table 4: De-rating of compact CM and NS circuit breakers

Maximum allowable current ratings					
Circuit breaker type	CM 1250	CM 1600	CM 2500	NS2500N	NS3200N
Breaker installation:	De-rating label to be affixed to CB				
• Indoor substation	1100A	1300 A	1600 A	1600 A	2100 A
• Padmount substation without louvres	900 A	1100 A	1300 A	1300 A	-
• Padmount substation with louvres	950 A	1160A	1370 A	1370 A	-
• Separate cubicle	1000 A	1200 A	1450 A	1450 A	-

It is important to de-rate the breakers to the maximum allowable current ratings as indicated in table 4 above. Failure to observe these limitations could result in serious damage or fire and destruction of equipment/substation.

5.1.6 Labelling

A label, in accordance with table 4 above, shall be affixed to the front of the CB to indicate to field staff what the de-rated value of the equipment is for the installed location. If the CB frame is relocated then the label will need to be re-assessed, and possibly replaced, in line with table 4.

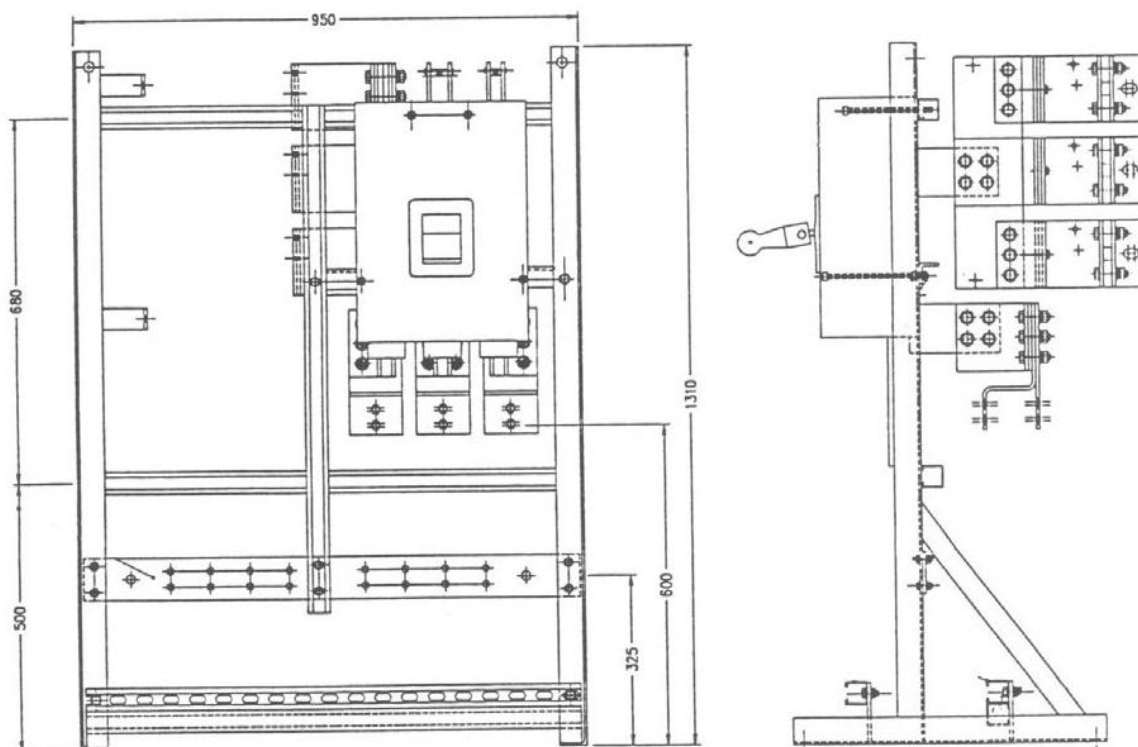
5.2 Installation

5.2.1 General

The Schneider Electric (Merlin Gerin) compact CM/NS LVCB is usually mounted in type 1, type 2 and type 3 LV switchboards. These switchboards can be mounted in a padmount substation or in an indoor substation. Earthing of the LVCB shall comply with Earthing Design Instruction EDI 100 – Distribution earthing design, construction and test, and commissioning shall be performed in accordance with Substation Design Instruction SDI 120 – Testing and commissioning for distribution systems. Installation should be performed safely with all relevant authorisations, training, safe work method statements and all relevant Safe Work and WorkCover codes of practice.

Fig. 1 Typical installation of Compact CM/NS LVCB

Typical installation is shown in figure 1 below:



5.2.2 Reference drawings

Drawing no.	Am.	Drawing title
052754	P	Single LVCB General Arrangement
052756	G	Single LVCB Mounting and Connection of Fuse Disconnectors
078239	B	Low Voltage equipment Cable Lug Critical Dimensions.

Site frontages shall be of sufficient size to allow the ultimate intended capacity to be delivered.

5.3 Operation

The Compact CM circuit breaker is provided with an integrated protection trip unit, ST -CM2, and the Compact NS circuit breaker is provided with a *Micrologic* 5.0 control unit.

Note: Operational setting on the protection trip units shall be obtained from Endeavour Energy's Protection Design Group prior to commissioning.

The circuit breakers are positive action, that is, the breaker can be either in *open* or *closed* position. The circuit breaker is a three-phase positive operating device (all the three phases are operated simultaneously). This is clearly indicated on the circuit breaker front panel.

It provides a positive break indication, that is, the operating handle can indicate only the *OFF* or *ON* position if all the contacts are positively open and separated by the necessary isolating distances. Each circuit breaker has an integrated solid state protection trip unit.

The circuit breaker can be operated by pushing the operating handle up or down. Further details on application, setting procedures, operation and maintenance are provided in the manufacturer's instructions. These are attached to this instruction.

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 to this instruction; and
- revisions to this instruction.

Network Substations Manager 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 determining whether all designs carried out by regional employees conform to the requirements of this instruction.

Manager Network Connections has the authority and responsibility for determining whether all designs carried out by Level 3 ASPs conform to the requirements of this instruction.

Accredited Service Providers have the responsibility to determine that the latest issue of any instruction or drawing relevant to or listed in this manual is available and used during the design of any project.

7.0 DOCUMENT CONTROL

Documentation Content Coordinator : Network Substations Manager

Documentation Distribution Coordinator : Branch Process Coordinator