

Substation Design Instruction

Merlin Gerin VM6 12kV switchgear

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SUBSTATION DESIGN INSTRUCTION

ASSET STANDARDS & DESIGN

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SDI 202 MERLIN GERIN VM6 12KV SWITCHGEAR

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1.0 PURPOSE

To provide technical and reference information to assist with the safe design, installation, commissioning, operation and decommissioning of 150 Merlin Gerin VM6 switchgear.

2.0 SCOPE

This instruction provides information and reference documentation to assist in the safe design, installation, commissioning, operation and decommissioning of the Merlin Gerin VM6 switchgear manufactured and supplied by Merlin Gerin (acquired by Schneider Electric since 1988). This instruction is applicable only with the standard units installed in Endeavour Energy's distribution and transmission network.

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: Mains Construction Instruction MCI 0006 - Underground distribution: Construction standards manual;
- Earthing design, construction and testing: Earthing Design Instruction EDI100 - Distribution earthing design, construct and test;
- Specification for new equipment: Equipment Technical Specification ETS 0068 - Distribution indoor and padmount substation 12-24kV switchgear ;
- general details and minimum requirements and Mains Design Instruction MDI 0028 - Underground distribution network design ;
- Testing and commissioning: Substation Design Instruction SDI 120 - Testing and commissioning for distribution systems and Division Procedure GNV 1044 - Commissioning Network Electrical Assets;
- Ongoing maintenance requirements: Substation Maintenance Instruction SMI 101 - Minimum requirements for maintenance of distribution equipment and Substation Maintenance Instruction SMI 212 - HV switch and switch fuse units ;
- Standard drawing requirements: Standard Asset Data SAD 0001 - Project drawing standards;
- SF6 Management: Environmental Management Standard EMS 0007 – Waste Management and Substation Maintenance Instruction SMI 122 - Use and handling of sulphur hexafluoride (SF6);
- Disposal: Company Procedure GSU 0012 - Selection and Approval of a Disposal Method; and
- This document should be read in conjunction with the manufacturer's installation instructions: Merlin Gerin – MV distribution factory built assemblies – VM6 system 3 to 24kV.

3.0 REFERENCES

Internal

Company Policy (Network) 9.1.7 – Commissioning Network Electrical Assets

Company Policy (Network) 9.2.5 – Network Asset Design

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 (Network) GAM 0114 Granting dispensations for engineering documents

Company Procedure (Procurement & Logistics) GSU 0012 - Selection and Approval of a Disposal Method

Division Procedure (Network) GNV 1026 – Equipment Register

Division Procedure (Network) GNV 1044 – Commissioning Network Electrical Assets

Division Procedure (Network) GNV 1061 – Transmission and High Voltage Distribution Network Switching

Branch Procedure (System Control) NCB 4352 – Merlin Gerin Vercors M6 Type C12 and QM 11/24kV switchgear
Earthing Design Instruction EDI 100 – Distribution Earthing Design
Environmental Management Standard EMS 0007 – Waste Management
Equipment Technical Specification ETS 0068 – Distribution indoor and padmount substation 12-24kV 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
Standard Asset Data SAD 0001 – Project drawing standards
Substation Design Instruction SDI 120 - Testing and commissioning for distribution systems
Substation Maintenance Instruction SMI 101 – Minimum requirements for maintenance of distribution equipment
Substation Maintenance Instruction SMI 122 – Use and handling of sulphur hexafluoride (SF6)
Substation Maintenance Instruction SMI 212 – HV switch and switch fuse units

External

Work Health and Safety Act 2011 (NSW)
Work Health and Safety Regulation 2017 (NSW)
Electricity Supply (Safety and Network Management) Regulation 2014
AS 5577:2013 – Electricity network safety management systems
ENA National Electricity Network Safety Code (Doc 01-2008)
AS 60265.1: 2001 - High voltage switch – switches for rated voltages above 1kV & less than 52 kV
AS 62271.1-2012 - High voltage switchgear and control gear – common requirements
AS IEC 62271.105:2015 High voltage alternating current switch fuse combinations
Merlin Gerin general installation and operation manual

4.0 DEFINITIONS AND ABBREVIATIONS

ASP

An individual or single entity accredited in accordance with part 3 of the *Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)*

Ellipse

Endeavour Energy's asset database

IM

switch unit

QM

switch fuse unit

SF6

sulphur hexafluoride gas

5.0 ACTIONS

5.1 General

Merlin Gerin VM6 switchgear consists of air insulated cubicles of sheet metal construction, equipped with SF₆ switchgear. The switch and switch fuse combinations are extendable in the field and are suitable for indoor use only.

The production of this switchgear ceased in 1992 but some spare parts are available from Schneider Electric. Currently this switchgear is installed in less than 10 distribution indoor sub stations and in two zone substations.

Merlin Gerin VM6 switchgear shall not be used in new projects.

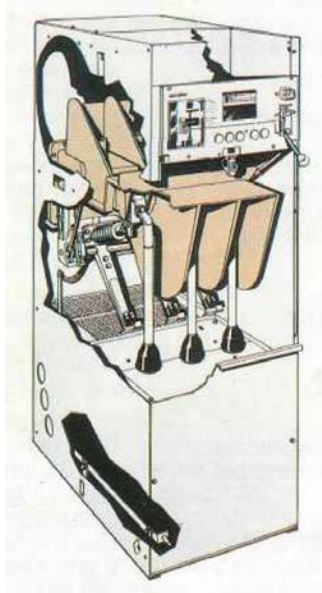


Figure 1 – Internal view



Figure 2 – Installed QM and IM unit

5.2 Electrical specification

	IM Switch unit		QM Switch fuse unit	
Insulation level (all equipment)				
Rated voltage	12kV	24kV	12kV	24kV
50Hz one (1) minute withstand -	28kV	50kV	28kV	50kV
1.2/50 impulse withstand:				
- phase to phase and phase to earth	95kV	125kV	95kV	125kV
- across switch and fuse	95kV	125kV	95kV	125kV
Switch, fuse switch* combination¹ and busbar				
Rated voltage	12kV	24kV	12kV	24kV
Rated normal current	630A		400A ¹	
Rated current of busbars	630A		630A	
Rated one (1) sec. withstand current	20kA	16kA	20kA ¹	16kA ¹

¹ These values relate only to switch - fuse combinations when they are fitted with solid links. When fitted with fuse-links, the fuse characteristics would apply.

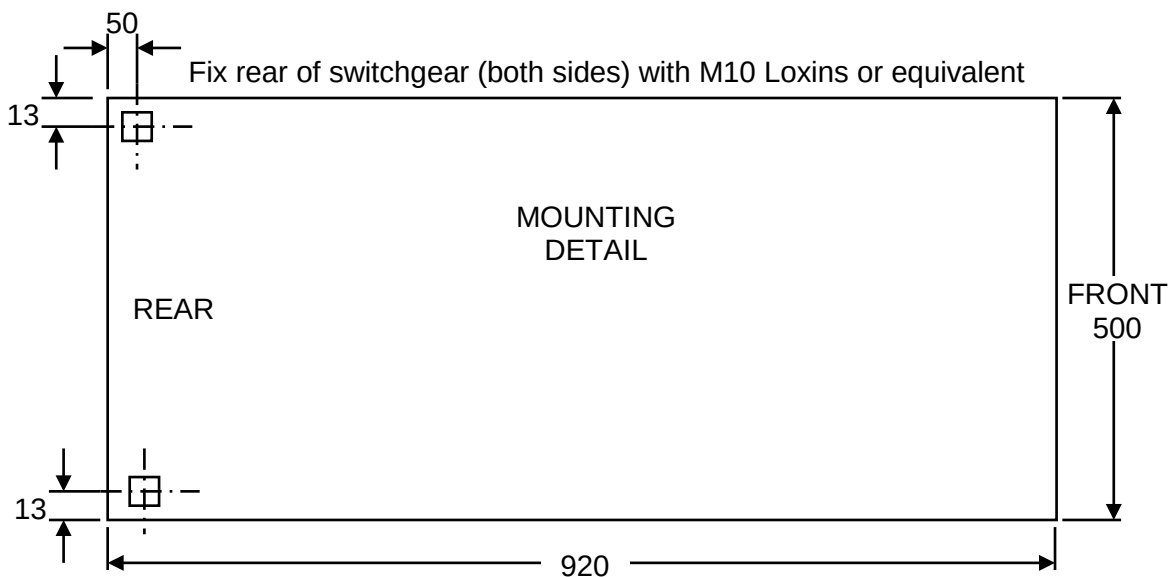
Rated peak withstand current and rated making capacity	52.5kA	40kA	52.5kA ¹	40kA ¹
Rated breaking capacity:				
- Mainly active load at 0.7pf	630A		400A	
- Closed loop at 0.3pf	630A		1000A	
- Cable charging	10A		10A	
- Line charging	1.5A		2.5A	
- Transformer off load	-	-	10A	
Fuse carrier				
Rated voltage	-	-	12kV	24kV
Rated normal current	-	-	400A	400A
Rated peak withstand current	-	-	52.5kA	40kA

**Will accommodate current limiting fuse links to AS 1033.2 - fuse link type I.*

5.3 Dimensions

Height	1500mm	Mass	Switch unit	150kg
Depth	920mm		Switch fuse unit	170kg
Width	500mm	SF₆	0.5 bar gauge at 20 °C	

5.3.1 Floor mounting dimensions



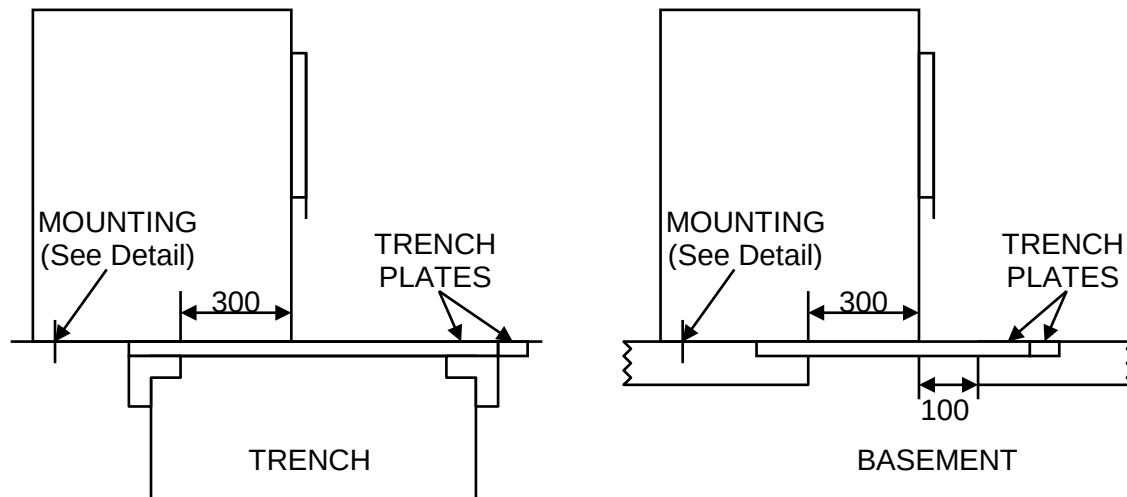


Figure 3 – Floor mounting dimensions

5.4 IM switch unit

The VM6, IM switch unit consists of the following basic equipment:

- switch-disconnector (with CIT operating mechanism);
- three phase busbars;
- earthing switch;
- neon voltage indicators; and,
- one or three current transformers.

Optional equipment includes auxiliary contact box and operating mechanism.

The VM6 switch-disconnector is a load break switch using the SF₆ puffer principal. The switch-disconnector provides positive break indication, as defined by AS 62271.1-2012, incorporating a contact position indicating device and a guard ring connected to earth, to prevent any discharge phenomenon across the isolating distance.

The enclosure is filled with SF₆ gas at a relative pressure of 0.5 bars. Each enclosure is sealed after filling. The high level of gas tightness meets the *sealed for life* IEC standard.

Single or three core cables are suitable for connection to the switch unit. Depending on the cross sectional area, several cables can be connected in parallel. The IM unit is suitable for six cables - two to each phase - each of maximum size of 240mm², or three cables - one to each phase - each of maximum size of 300mm².

The switch unit can be fitted with a low voltage compartment containing the operating mechanisms for both the switch and earthing switch. This compartment is accessible without it being necessary to de-energise the cables or busbars.



Figure 4 – Bus bar compartment



Figure 5 – CIT operating mechanism

CIT operating mechanism (tumbler type) – opening and closing by lever.

5.5 QM switch fuse unit

The VM6, QM switch fuse unit consists of the following basic equipment:

- switch-disconnector (with CI1 operating mechanism);
- three phase busbars;
- twin blade earthing switch;
- three fuses;
- neon voltage indicators; and,
- one or three current transformers.

Optional equipment includes auxiliary contact box and operating mechanism. The switch of the switch/fuse unit is identical to the switch unit in clause 5.4.

Single or three core cables are suitable for connection to the switch fuse unit. The QM unit is suitable for three cables - two to each phase - each of maximum size 50mm².



Figure 6 – CI1 operating mechanism

CI1 operating mechanism – Charging of the mechanism by a lever and automatic closing of the switch on completion of charging.

Opening by push button.

5.6 Cabling

5.6.1 Transformer

Flexible cables are used to couple the switchgear to the transformer. They provide fast and efficient connection/disconnection without specialised cable jointing techniques. The technical detail for this cable is shown below:

Type of insulation:	XLPE with PVC cable sheath
Type of screen:	Semi-conductor tape with overlapped copper wire
Voltage rating:	12kV/28kVrms/95kVpeak
Conductor:	16mm ² copper
Overall diameter of cable:	25mm
Length:	4000mm
Minimum bending radius:	200mm

5.6.2 Feeder

Maximum cross-section on each phase: 300mm² (refer to Mains Construction Instruction MCI 0006 – Underground distribution: Construction standards manual).

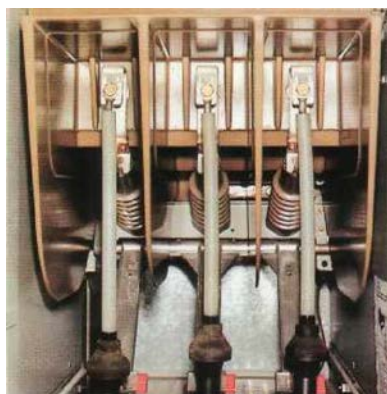


Figure 7 – Cable connection compartment

5.7 Anti-condensation heaters

Anti-condensation heaters are usually not required.

5.8 Spares

The following spares are currently available from Schneider Electric:

Model	Part Number	Material Description
		BOTTOM OF THE CUBICLE
QM	1789512	REAR PART OF CUBICLE
QM	1790582	CONNECTION MV 3X6 VM6 OR SM6
QM	1790583	CONNECTION MV 3X8 (VM6)
QM	1792527	CONNECTION MV 3X10 (VM6)
QM	1792528	CONNECTION MV 3X12 (VM6)
QM	1793149	SCREEN
QM	1793451A	VM6 HEATING RESISTOR (4)
QM	1795207	D SCREEN CLAMP
QM	1795871	CLAMP
QM	3724660A	KIT 90 FOR QM CUBICLE FUSARC 292 (4)
QM	3724660B	KIT 90 FOR QM CUBICLE FUSARC 442 (4)
QM	3724662A	KIT 90 QM CUBICLE SOLEFUSE (4)
QM	9011494T1	SCREEN VM6 (4)
QM	9011496L1	VM6 BLOWN FUSE TRIPPING MECHANISM (4)
		BUS BAR COMPARTMENT
QM	1783104	BUSBAR ROOF
QM	1788413	BUS BAR 630A
QM	1788431	BUS BAR 630A VM6
		CT'S COMPARTMENT
QM	3724601	INTERCONNECTION FUSE TRANSFORMER
QM	9017453	CT K51 50/5A 30VA CL0.5 7.2/24KV (4)
QM	9017454	CT K51 (100/5A-30VA-CL0.5 7.2/24KV
		EARTHING ISOLATING SWITCH
QM	1792272	DISCONNECTING CONTACT FINGER (4)
QM	1783087	CAPACITOR INSULATOR (4)
QM	1787177	STOP
		FRONT FACE
QM	1733002	NEON LAMP
QM	1783603	SMALL DOOR
QM	1783694	STOPGAP
QM	1786400EC	FRONT PANEL

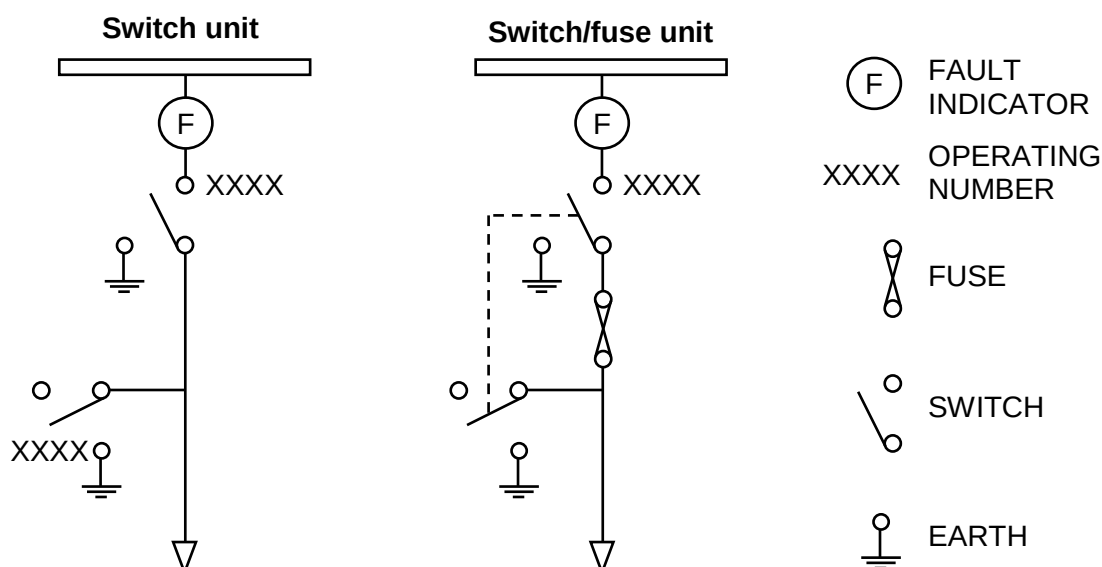
Model	Part Number	Material Description
QM	1786426B	SWITCH CONTROL LEVER (4)
QM	1790255	VIP TERMINAL BLOCK 3-7.2KV REPLACED BY SPK0001VM6 (1)
QM	1790256	VIP TERMINAL BLOCK 10-17.5KV (1)
QM	1791589	INSPECTION GLASS
QM	1795304	RACKING PLATE
QM	9012253J1	1 CT ADDING FOR PM-QM WITH SOLEFUSE
QM	SPK0001VM6	VIP TERMINAL BLOCK 3-7.2KV (1)
		FUSE EQUIPMENT
QM	1788827	VM6 SIGNALLING INDICATOR COVER
QM	1795867	BLOWN FUSE INDICATOR
QM	3724836B	BLOWN FUSE ROD KIT (4)
QM	9011494V1	FUSE CLAMP SOLEFUSE VM6 (4)
QM	9011494P1	LOWER OR UPPER CLIP DIN VM6 (4)
QM	9013320A1	VM6 SOLEFUSE LINK (2) (4)
QM	9013320B1	VM6 SPARE PART FUSARC ROD (2) (4)
		LV BOX
QM	1790267	TEST BOX STATIMAX
QM	1793103AA	DOOR (VM6)
QM	5100150117	RELAY 4RT 110VDC
QM	51259934A1	KIT RELAY BASE 7A
QM	9013873	BOX STATIMAX 1A
QM	9013874	BOX STATIMAX 5A
QM	9013875	PLATE STATIMAX 1A (FRONT PLATE)
		LV COMPARTMENT
QM	1783732	MOTOR 110VDC
QM	1785030	COIL 110VDC/220VAC (REPLACED BY SPK0011SM6)
QM	1786523	OPERATING HANDLE EARTHING SWITCH
QM	25727255	RELAY 5A 110VDC (4)
QM	3725158	PRINTED CIRCUIT SUPPORT
QM	3725161	PRINTED CIRCUIT BOARD
QM	674227A	MITOP (REPLACEMENT) (4)
QM	9011292A1	MECHANISM CI1 (PUFFER) (3)
QM	9011292B1	MECHANISM CI2 (PUFFER) (3)
QM	9011496H1	2 CONTACTS BLOCK VM6

Model	Part Number	Material Description
QM	9012265L1	MICROSWITCH FOR MINI U AND MITOP (4)
QM	9012267G1	OPERATING MECHANISM CI1 >11/1980VM6 (ROTARY) (3) (4)
QM	9012267H1	OPERATING MECHANISM CI2 >11/1980 VM6 (ROTARY) (3) (4)
QM	9012266E1	5 AUXILIARY CONTACT BLOCK (4)
QM	9012266F1	12 AUXILIARY CONTACT BLOCK (4)
QM	9012266L1	9 AUXILIARY CONTACT BLOCK (4)
QM	9012266T1	LV FRONT PLATE PLAIN L=500
QM	9015346A1	SET OF SPRINGS FOR CI1/CI2 (4)
QM	9015614D1	RESISTOR FOR INDIRECT UNDERVOLTAGE RELEASE 100 TO 138VDC
QM	SPK0011SM6	COIL 110VDC/220VAC (REPLACED BY SPK0011SM6)
		MISCELLANEOUS
QM	1786135	WIRING PASS (REPLACED WITH SPK0000VM6)
QM	1795370	TERMINAL BLOCK SUPPORT
QM	558965	CLAMPING STRAP
QM	SPK0000VM6	WIRING PASS

5.9 Operating notes

For operating information refer to Branch Procedure NCB 4352 – Merlin Gerin Vercors M6 Type C12 and QM 11/24kV switchgear.

5.10 Operating single line diagrams



5.11 Maintenance

All routine maintenance must be carried out in accordance with SMI 101 – Minimum requirements for maintenance of distribution equipment.

5.12 Decommissioning

Disposal of equipment must be registered onto the equipment register (refer to GNV 1026 - Equipment Register) and disposed with an approved method (refer to GSU 0012 - Selection and Approval of a Disposal Method).

6.0 AUTHORITIES AND RESPONSIBILITIES

The **Manager Asset Standards & Design** has the authority and responsibility for approving this instruction and approving variations to the requirements of this instruction.

The **Substation Assets Manager** has the responsibility for revising and updating this instruction in accordance with Company Policy and Procedures.

Regional Managers have the responsibility for determining that all designs carried out by Regional employees conform to the requirements of this instruction.

The **Manager Network Connections** has the responsibility for determining that 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 : Substation Assets Manager

Documentation Distribution Coordinator : Branch Process Coordinator