

Tyree Low Voltage Switchgear

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1. Purpose

To provide technical information to assist with the application, installation and operation of Tyree LV switchgear.

This instruction provides information to assist in the design, application, installation and operation of substations that use Tyree LV switchgear. The instruction deals only with the standard units approved by Endeavour Energy for use in the network. The instruction does not include the substation mounting and earthing, for which an appropriate document must be referred. The switchgear comply with the technical requirements of ETS 0069.

Instructions from the manufacturer must be consulted for details of individual components, operation, safety and maintenance of the components. Instructions from Tyree are attached to, and form an integral part of, this document.

2. References

External Regulations		
Electricity Supply Act 1995 (NSW)		
NSW Work Health and Safety Act 2011		
Electricity Supply (General) Regulation 2014 (NSW)		
Work Health and Safety Regulation 2011 (NSW)		
ENA National Electricity Network Safety Code (Doc 01-2019)		
National Electricity (NSW) Law 1997		
National Electricity Rules		

External Standards		
Standard No.	Year	Title
ENA Doc 01	2019	ENA National Electricity Network Safety Code
AS 2067	2016	Substations and high voltage installations exceeding 1kV a.c
AS 3000	2018	Electrical Installations
AS 5577	2013	Electricity network safety management systems
AS 61869.2	2021	Instrument transformers – Part 2: Additional Requirements for current transformers
IEC 60269.1	2024	Low voltage fuses. Part 1: General requirements
IEC 60269.2	2013	Low voltage fuses. Part 2.1: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)-section 1 to V1: Examples of types of standardized fuses

AS 60529	2004	Degrees of protection provided by enclosures (IP Code)
AS/NZS IEC 60947.1	2021	Low-voltage switchgear and controlgear – General rules
AS/NZS IEC 60947.2	2015	Low-voltage switchgear and controlgear – Circuit Breakers
AS/NZS IEC 60947.3	2023	Low-voltage switchgear and controlgear – Low-voltage switchgear and controlgear
AS 61439.1	2016	Low-voltage switchgear and controlgear assemblies – General Rules
AS 61439.2	2016	Low-voltage switchgear and controlgear assemblies – Power switchgear and controlgear assemblies
AS 61439.5	2016	Low-voltage switchgear and controlgear assemblies – Assemblies for power distribution in public networks
0805-0518A	2025	Technical manual - Pronutec triver+ – 1 pole switching LV switchgear installation & operation manual

Company Policies and Procedures

Company Policy (Network) 9.2.2 – Network Protection

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

Earthing Design Instruction EDI 100 – Distribution Earthing Design, Construct and Test

Equipment Technical Specification ETS 0069 – Distribution indoor and padmount substation low voltage switchgear

Drawing no. 076733 – Padmount substation LV switchgear compartment separate earth

Company Standards

Earthing Design Instruction EDI 100	Distribution earthing design
Environmental Management Standard EMS 007	Waste Management
Substation Design Instruction SDI 120	Testing and commissioning for distribution systems
Substation Maintenance Instruction SMI 101	Minimum requirements for maintenance of distribution equipment

3. Definitions and Abbreviations

Term	Definition
ASP	Accredited Service Provider, or “ASP, means a person who has been accredited through a ministerially-recognised accreditation scheme to undertake contestable work.
Common or combined earthing	A common or combined earthing system is one in which the HV distribution and low voltage electrical equipment is earthed to a common terminal bar. This is achieved by connecting the MEN system to the HV and LV earth at the distribution substation or other distribution asset.
CT	Current Transformer
LV	Low voltage – a voltage exceeding 50V AC but less than 1000V AC
MDI	Maximum Demand Indicator
Separate Earthing	A system where the HV and LV earths are electrically separate.

4. Actions

4.1 General

Tyree's LV switchgear is frame mounted LV distribution switchgear. Standard components, such as fuse switch strips, isolators, circuit breakers and load break switches, are assembled together to make switchgear configurations specified by Endeavour Energy. Only type tested components in accordance with AS/IEC standards are used in the manufacture of switchgear assemblies.

Temperature rise tests have also been carried out on the fully assembled switchgear in a padmount substation. The switchgear has passed the specified test requirements. The switchgear can be used in a padmount substation as well as in an indoor substation.

4.1.1 Switchgear identification codes

Table 1 shows the range of manufacturer approved switchgear type codes.

Table 1: Switchgear identification codes

Ref no.	Configuration	Stock Code
Category 1 to ETS 0069		
SGI010	Tyree DWG 4500-0146 Endeavour 1548429 Fuse, fuse, disconn., gen, fuse, fuse	1000005301
4305-0099	NH-3 DISCONNECTOR, 1000A (ENDEAVOUR CAT1 INCOMER)25kA/1s, 1x3 POLE SWITCHABLE (1 HANDLE), REAR ENTRY, PRONUTEC# 438.75.16.08.00VE-K	N/A
4305-0100	NH-3 DISCONNECTOR, 1000A (ENDEAVOUR CAT1 GEN. SET)1x3 POLE SWITCHABLE (1 HANDLE), BOTTOM ENTRY, PRONUTEC# 438.75.13.04.02VE	N/A
4305-0101	NH-2 FUSE SWITCH, 400A (ENDEAVOUR CAT 1/2)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 438.52.10.03.15	1000005917
4305-0102	NH00 FUSE SWITCH, 160A (ENDEAVOUR AUX.)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 443.51.12.01.02	N/A
Category 2 to ETS 0069		
SGI021	Tyree DWG 4500-0147 Endeavour 1548437 Fuse, fuse, disconn., gen, fuse, fuse	1000005303
4305-0101	NH-2 FUSE SWITCH, 400A (ENDEAVOUR CAT 1/2)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 438.52.10.03.15	1000005917
4305-0102	NH00 FUSE SWITCH, 160A (ENDEAVOUR AUX.)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 443.51.12.01.02	N/A
4305-0103	NH-3 DISCONNECTOR, 2000A (ENDEAVOUR CAT2 INCOMER)31kA/3s, 1x3 POLE SWITCHABLE (2 HANDLE), REAR ENTRY, PRONUTEC# 438.77.90.08.00VE-K	N/A

4305-0104	NH-3 DISCONNECTOR, 2000A (ENDEAVOUR CAT2 GEN. SET)1x3 POLE SWITCHABLE (2 HANDLE), BOTTOM ENTRY, PRONUTEC# 438.77.85.73.02VE	N/A
Category 2 to ETS 0069		
SGI022	Tyree DWG 4500-0148 Endeavour 1548445 Fuse, disconnecter, gen, fuse	1000005302
4305-0101	NH-2 FUSE SWITCH, 400A (ENDEAVOUR CAT 1/2)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 438.52.10.03.15	1000005917
4305-0102	NH00 FUSE SWITCH, 160A (ENDEAVOUR AUX.)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 443.51.12.01.02	N/A
4305-0103	NH-3 DISCONNECTOR, 2000A (ENDEAVOUR CAT2 INCOMER)31kA/3s, 1x3 POLE SWITCHABLE (2 HANDLE), REAR ENTRY, PRONUTEC# 438.77.90.08.00VE-K	N/A
4305-0104	NH-3 DISCONNECTOR, 2000A (ENDEAVOUR CAT2 GEN. SET)1x3 POLE SWITCHABLE (2 HANDLE), BOTTOM ENTRY, PRONUTEC# 438.77.85.73.02VE	N/A
Type 1 to ETS 0069		
SGI031-B	TYPE 1 - Tyree DWG 4500-0149 Endeavour 1548452	1000005304
SGI031	TYPE 1 - Tyree DWG 4500-0149 Endeavour 1548452 (Pre 2022)	1000005304
4305-0102	NH00 FUSE SWITCH, 160A (ENDEAVOUR AUX.)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 443.51.12.01.02	N/A
4305-0106	Load break SW 2000A	N/A
4305-0107	Load Break Switch handle	N/A
4305-0276	MCCB 1250A 3 Pole 50kA SCHNEIDER	N/A
4305-0136	MCCB 1250A 3 Pole 50kA ABB (Pre 2022)	N/A
Type 2 to ETS 0069		
SGI032	Tyree DWG 4500-0150 Endeavour 1548460	1000005305
4305-0102	NH00 FUSE SWITCH, 160A (ENDEAVOUR AUX.)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 443.51.12.01.02	N/A
4305-0106	Load break SW 2000A	N/A
4305-0107	Load Break Switch handle	N/A
4305-0108	MCCB 2500A 3 Pole 85kA Terasaki	N/A
Type 3 to ETS 0069		
SGI033	Tyree DWG 4500-0150 Endeavour 1550102	1000005386
4305-0102	NH00 FUSE SWITCH, 160A (ENDEAVOUR AUX.)3x1 POLE SWITCHABLE, BOTTOM ENTRY, PRONUTEC# 443.51.12.01.02	N/A

4305-0110	Load break SW 3150A	N/A
4305-0107	Load Break Switch handle	N/A
4305-0109	MCCB 3200A 3 Pole 85kA Terasaki	N/A
Type 4 to ETS 0069		
SGI034	Tyree DWG 4500-0151 Endeavour 1563634	1000006288
4305-0111	NH00 FUSE SWITCH, 160A Horizontal	N/A
4305-0106	Load break SW 2000A	N/A
4305-0107	Load Break Switch handle	N/A
4305-0105	MCCB 1250A 3 Pole 85kA	N/A
Type 5 to ETS 0069		
SGI034	Tyree DWG 4500-0152 Endeavour 1563634	1000005306
4305-0110	Load break SW 3150A	N/A

4.1.2 Technical specifications common to all types

Tyree LV switchgear is designed for the following ratings:

Table 2: Common LV Tyree switchgear specifications

Description	Rating
Applicable standards	AS60947.1, AS60947.2, AS60947.3 & AS61439.1, AS61439.5
Number of phases	Three (3)
Rated Voltage:	400Vac
• Operational (Ue)	50 Hz
• PF withstand for one minute	3kV
• PF withstand for 10 sec	12.7kV
Mode of operation	Manual
Type of installation	Stationary
External design	Enclosed
Degree of protection	IP XXB
Utilisation category:	B - infrequent operation
• New equip. to ETS0069	AC22B
Rated duty	Uninterrupted - Continuous
Earthing system	Common ¹ and separate
Operation	Manual

Note:

1. The current standard switchboards supplied by Tyree are suitable for use on a common or separately earthed system. If a switchboard is to be used on a separate earth system, it is necessary to remove the N/E link from the neutral bar to the LV support frame.

4.1.3 Typical LV switchboard frame sizes

Tyree LV switchgear dimensions are shown in the following table:

Table 3: Tyree LV Switchgear Dimensions

Switchgear	Height ² (mm)	Width (mm)	Depth (mm)	Weight (kg)
Category 1	1395	723	713	150
Category 2	1395	723	718	225
Category 2B	1395	723	718	210
Type 1	1395	723	718	195
Type 2	1395 (size 14 – as shipped) 1545 ³ (size 16 – as shipped)	723	718	285
Type 3	1545	723	698	395
Type 4	1395	723	630	225
Type 5	1545	723	623	295

Note:

- Height is adjustable by +25, -50mm.
- Type 2 is shipped to suit size 16 enclosure. This can be lowered to suit size 14 enclosure if required.

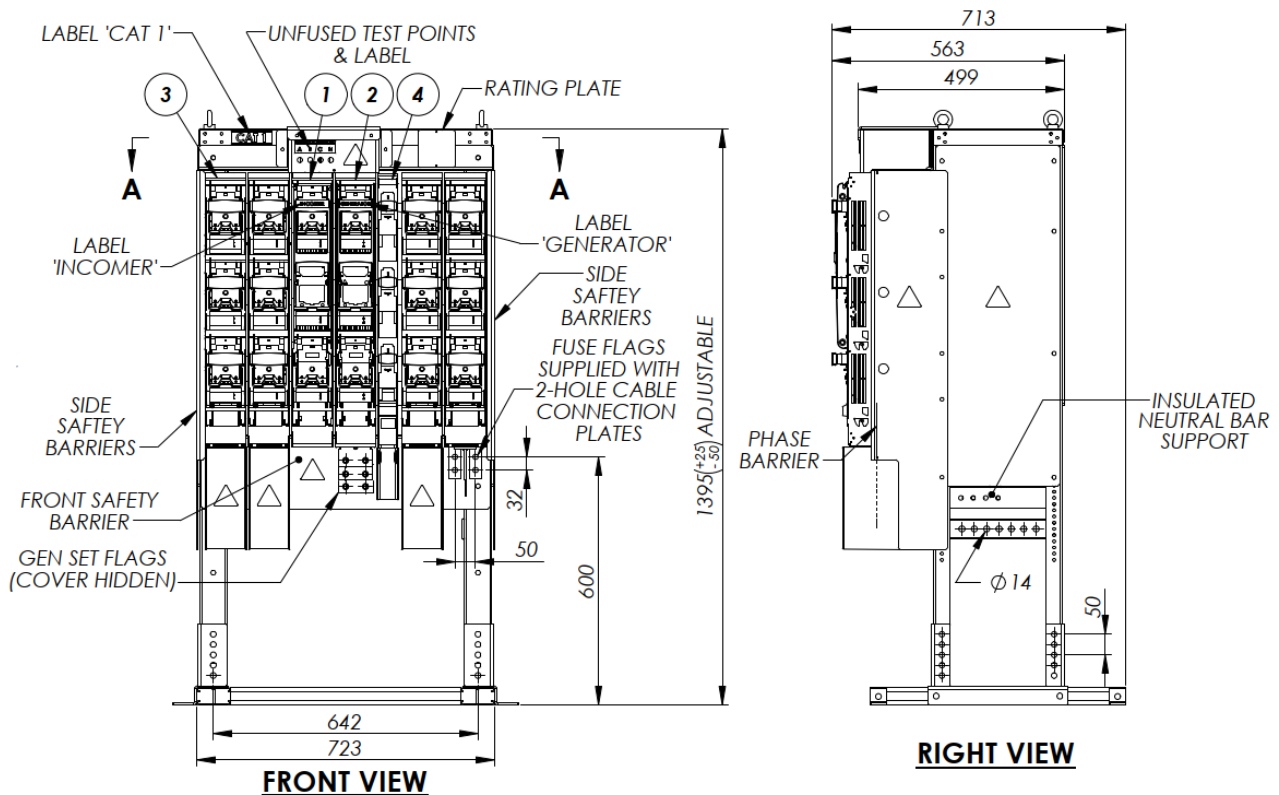


Figure 1: Cat 1 LV switchboard frame size

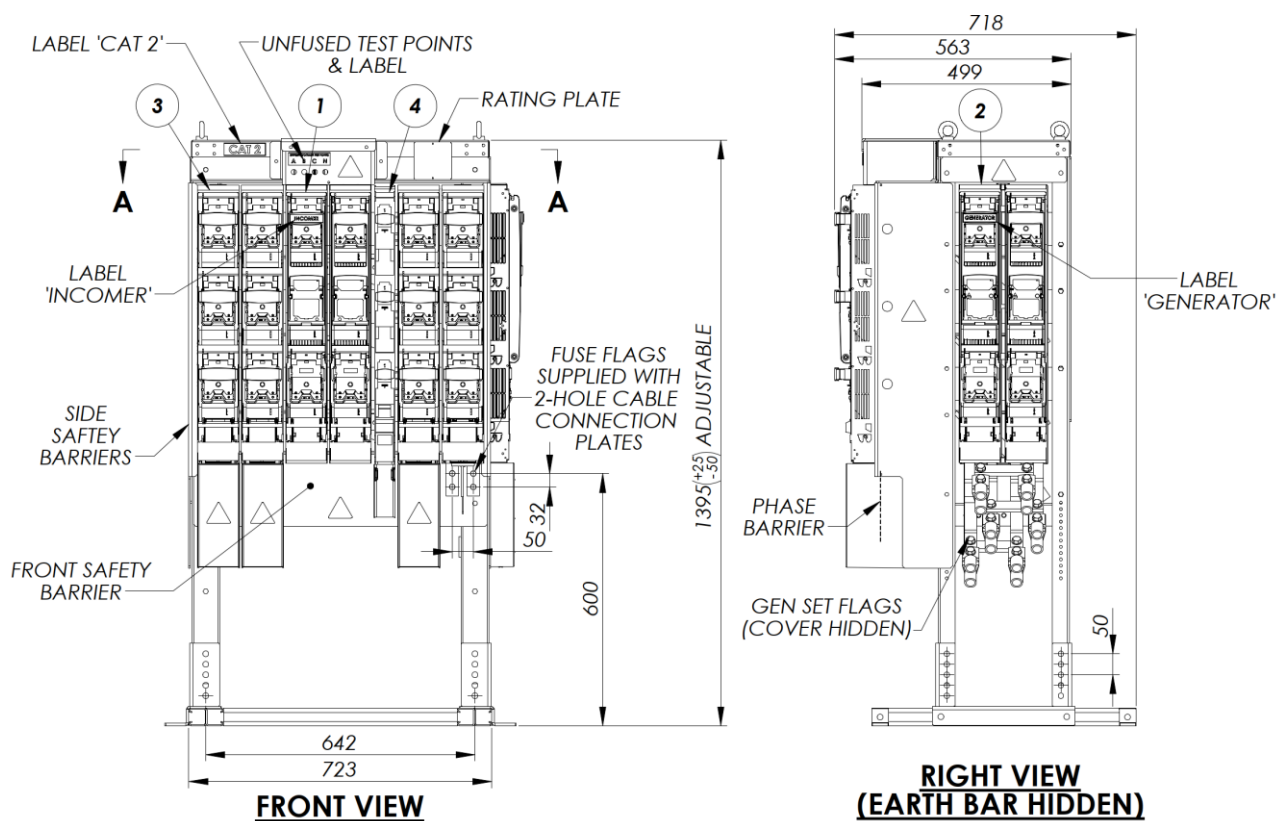


Figure 2: Cat 2/2B LV Switchboard frame size

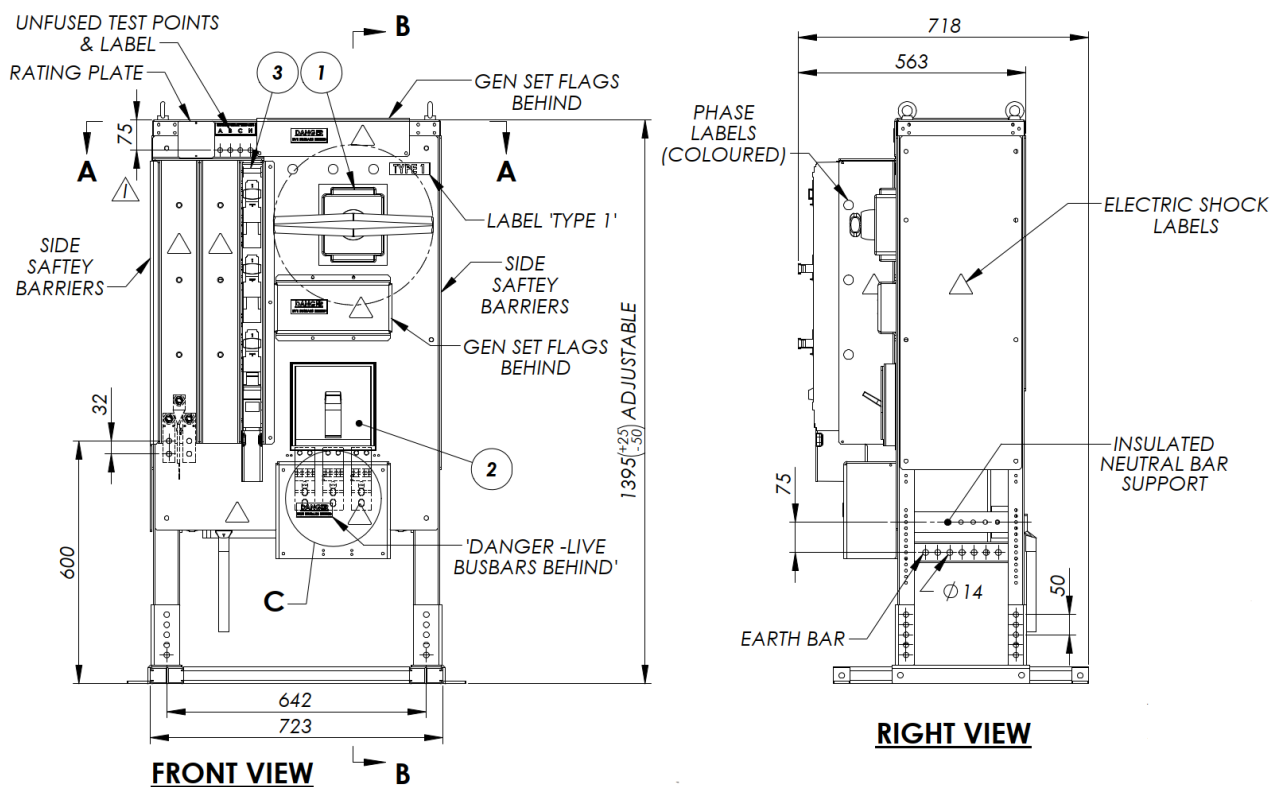


Figure 3 Type 1 LV Switchboard frame size

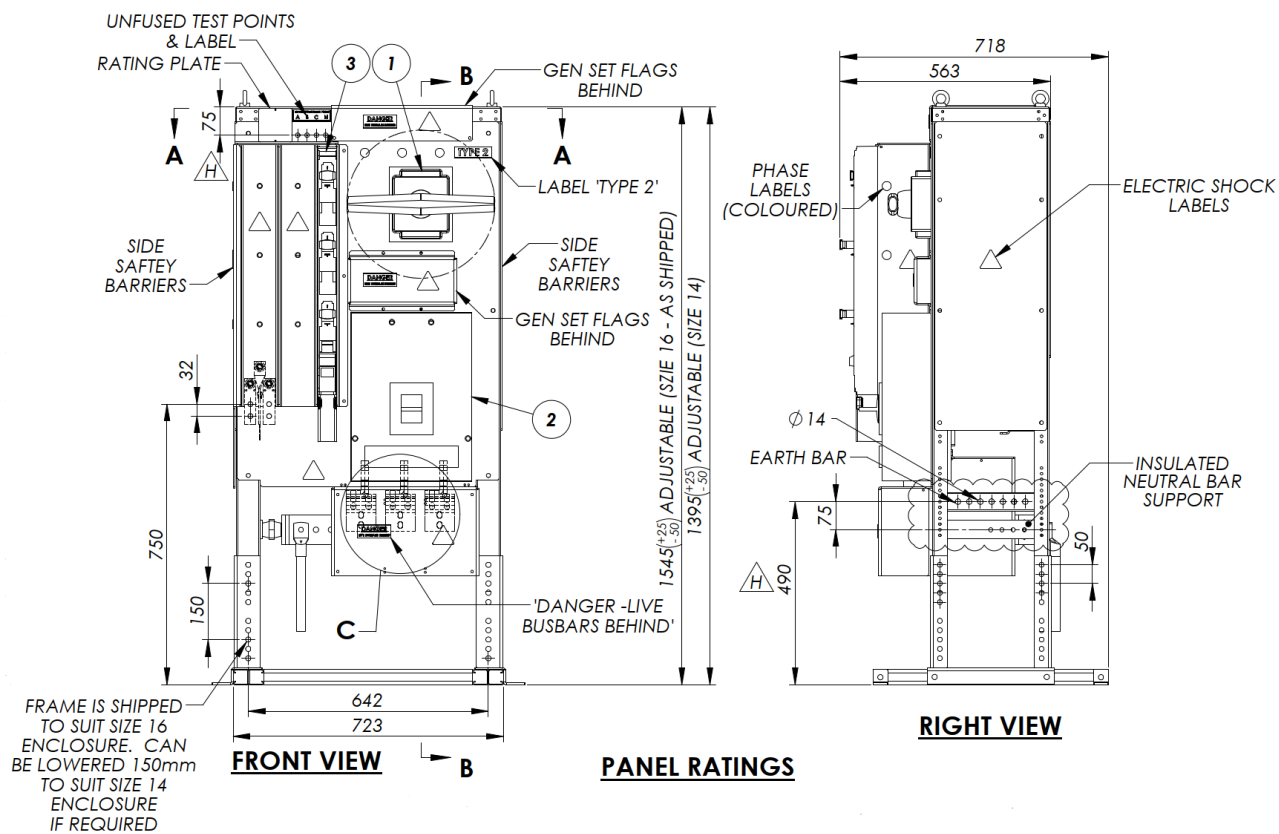


Figure 4: Type 2 LV Switchgear panel frame size

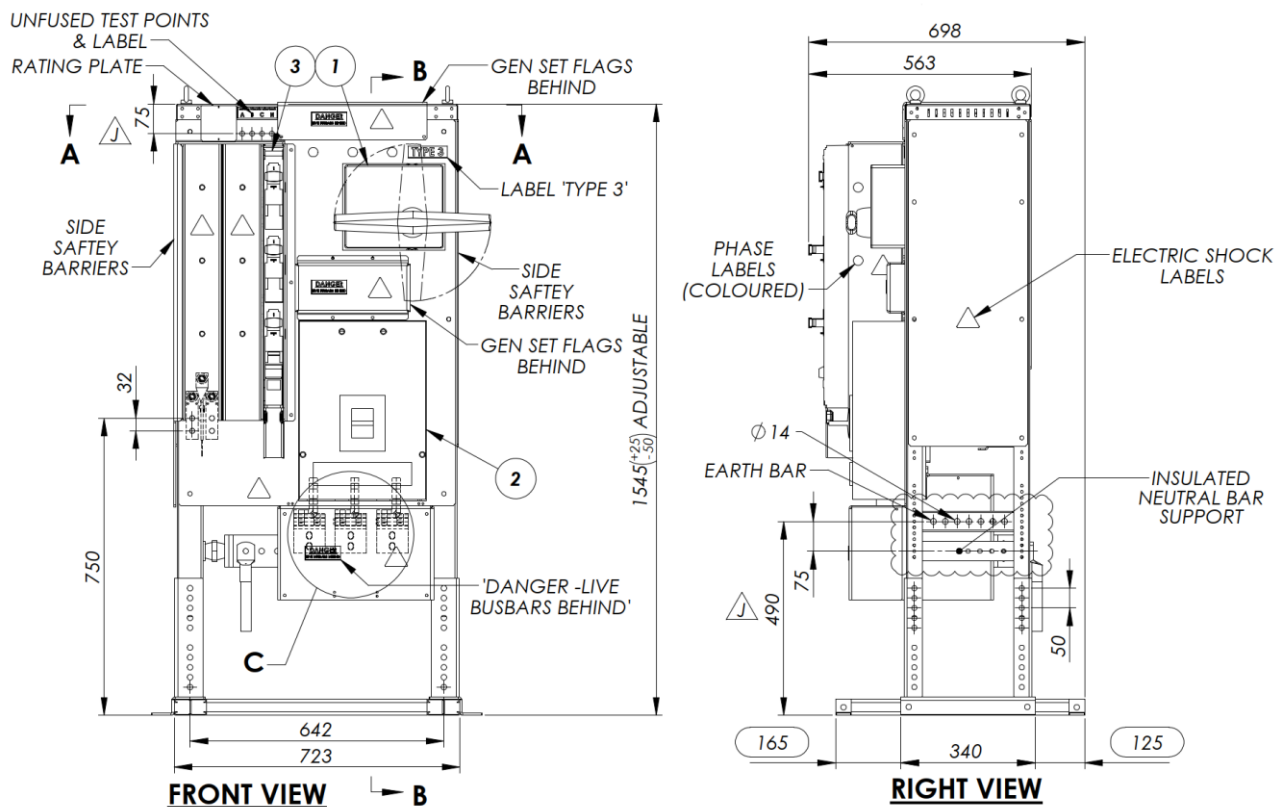


Figure 5: Type 3 LV Switchgear panel frame size

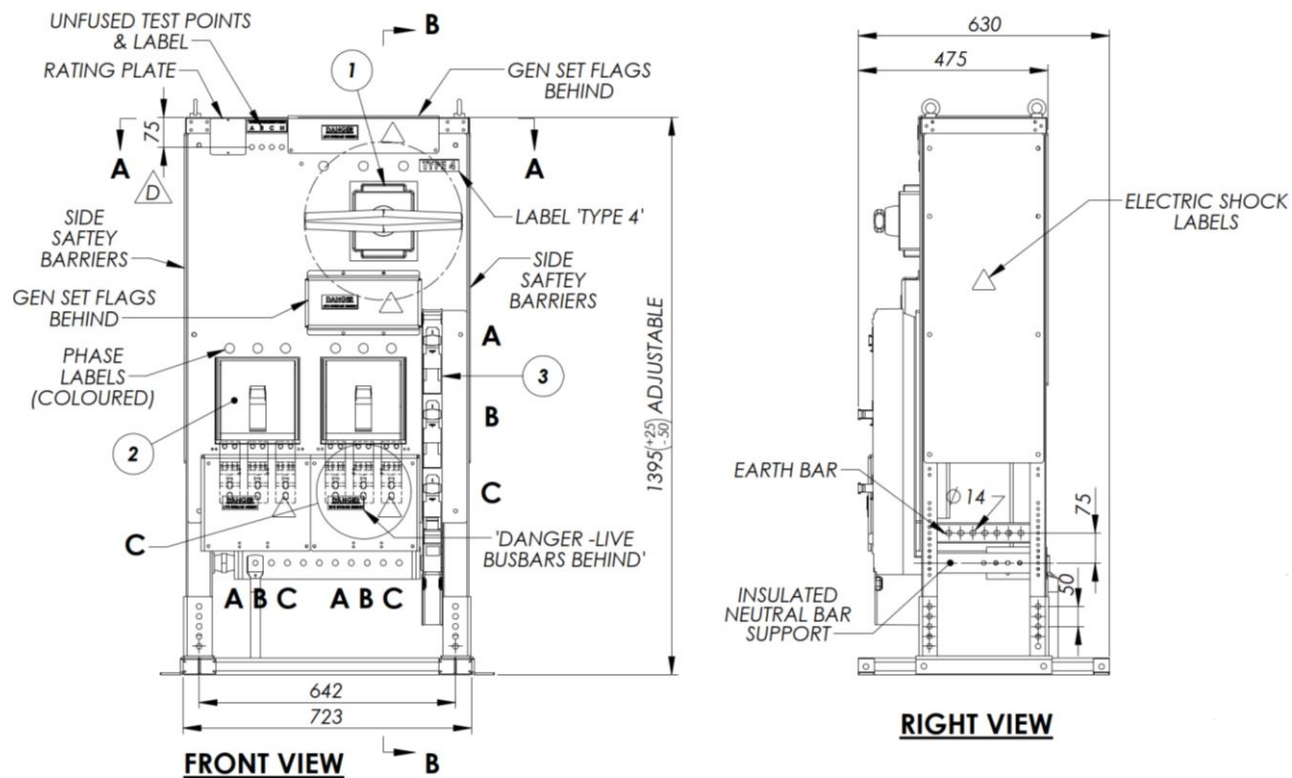


Figure 6: Type 4 LV Switchgear panel frame size

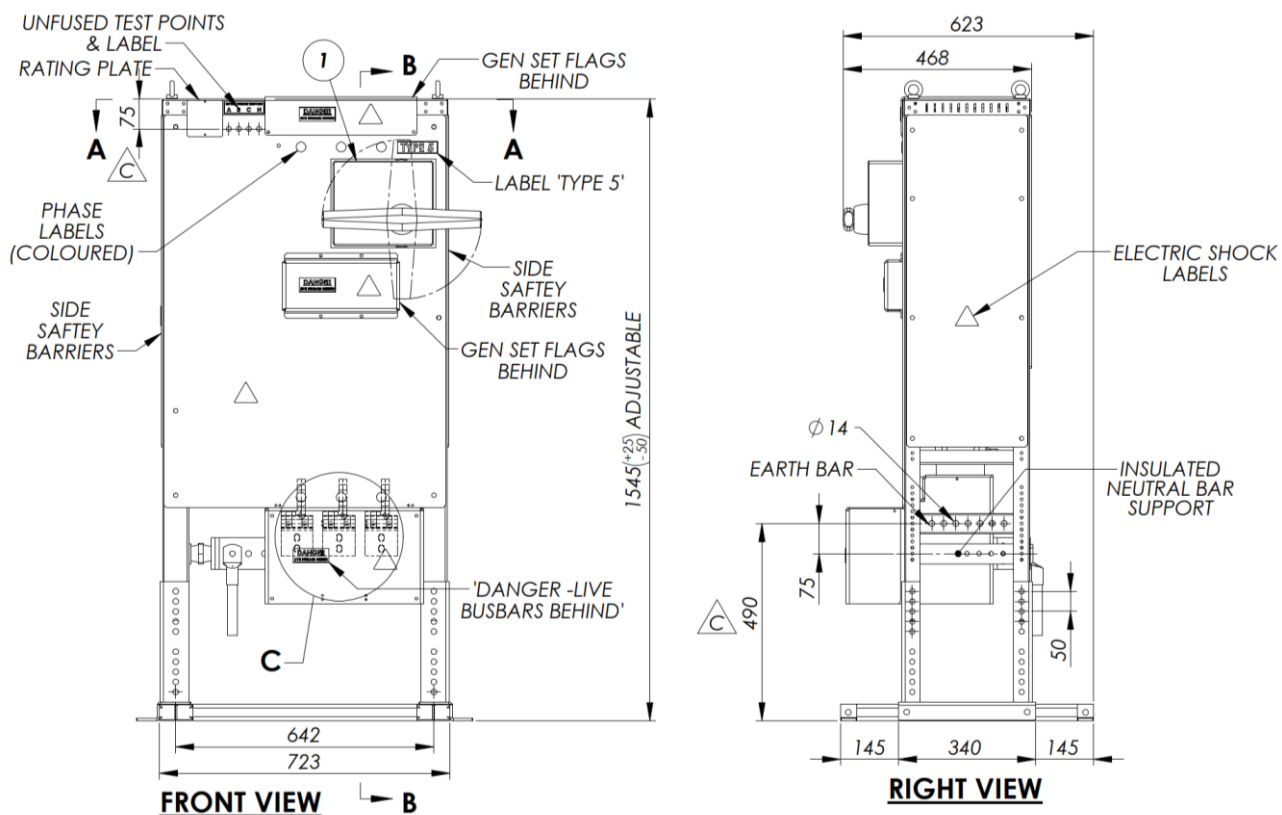


Figure 7: Type 5 LV Switchgear panel frame size

4.1.4 HV and LV frame earthing

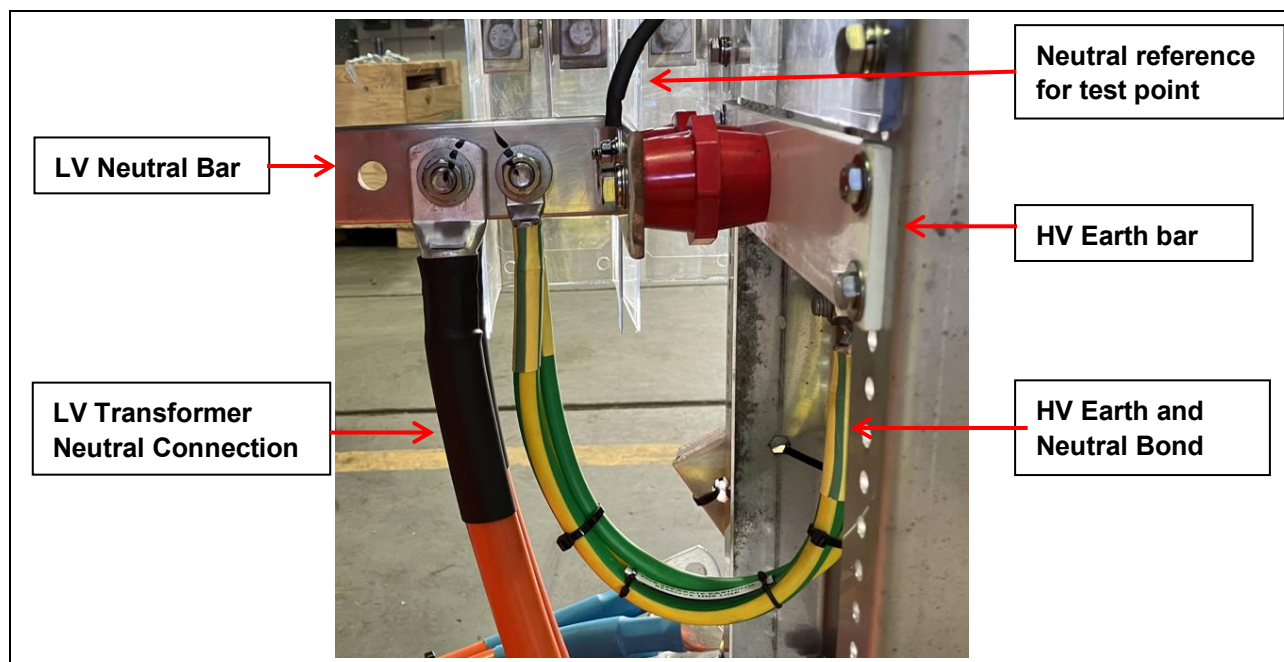


Figure 8: LV frame neutral bar and HV earth bar connection

4.1.5 Switch operating handles

Fuse strips are fitted with operating handles which hold the fuse and protect the operator from arcing. The fuses are switched with a double break action.

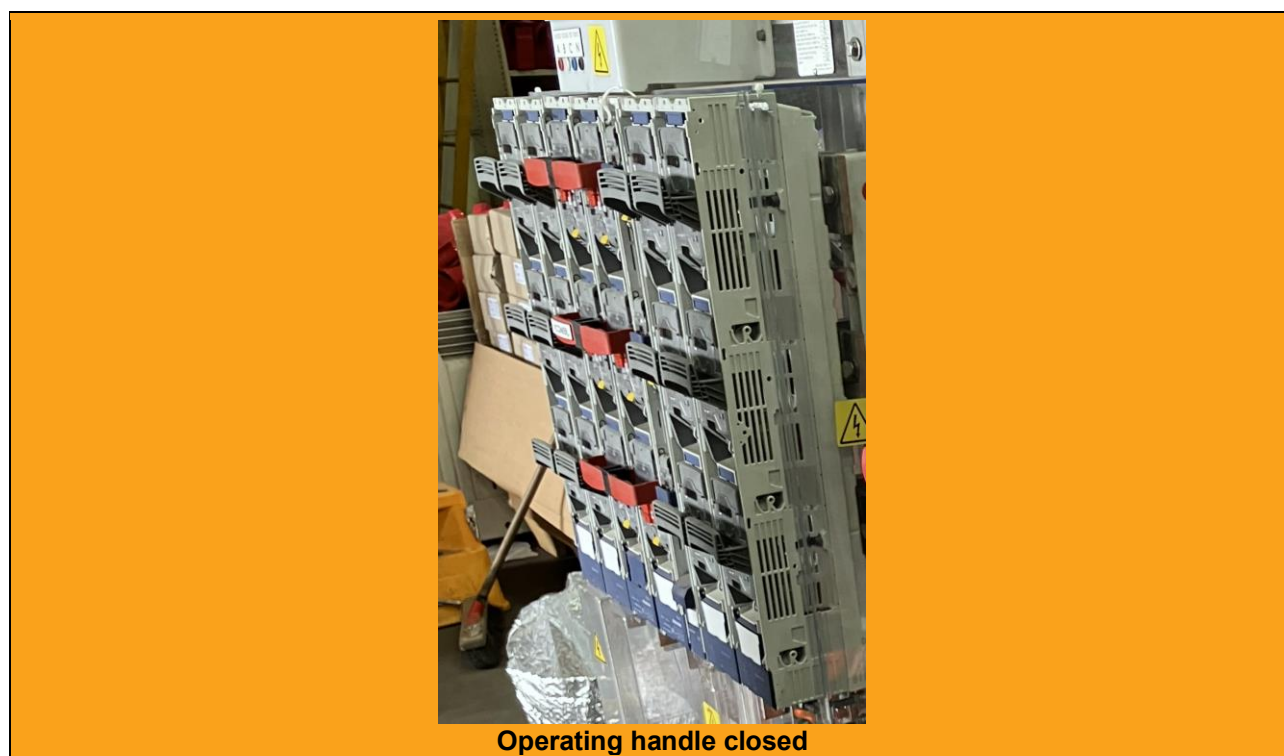


Figure 9: Switch operating handles - Post 2021

Incoming isolators can be locked to prevent inadvertent operation and to increase the through fault ratings. Locking and unlocking is carried out using the inbuilt locking mechanism or approved padlock.

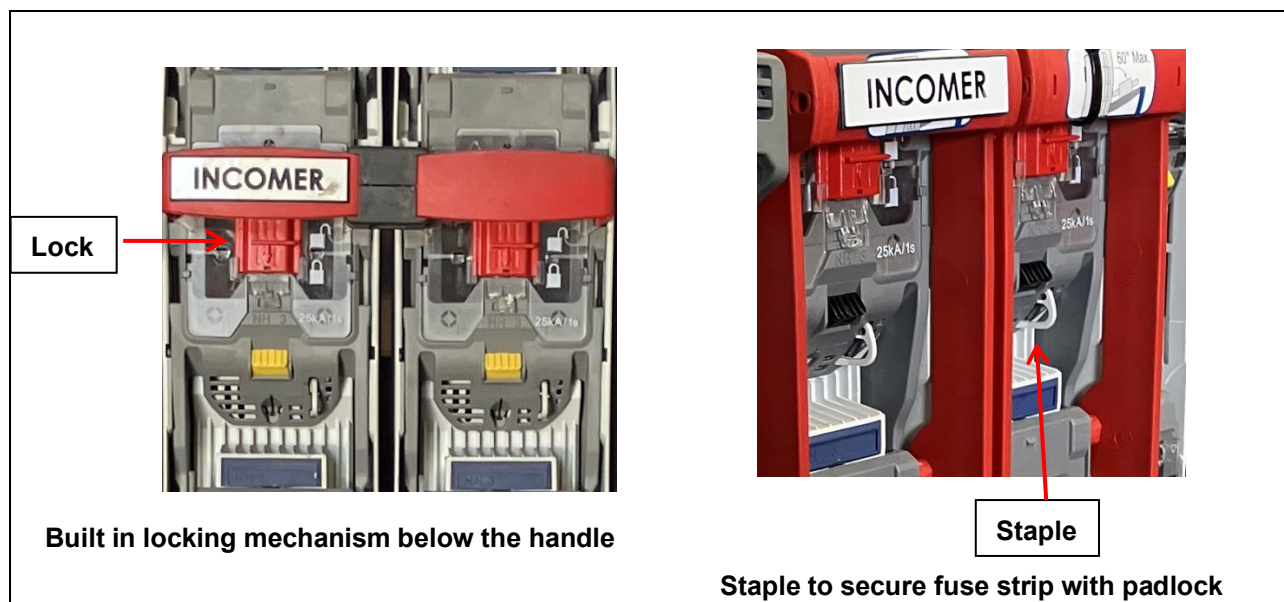


Figure 10: Isolator locking

4.1.6 Adjustable frame

The Tyree LV switchgear is mounted on an adjustable frame. Minor adjustments can be made to the height; the body of the switchgear can be moved forward or backward along the full length of the feet.



Figure 11: Adjustable mounting frames

4.1.7 Feeder cable connection plate

Feeder cables must be connected using two (2) hole lugs and the supplied connection plate for all new LV switchgear terminations. This plate is suitable for up to 2 x 240mm cable feeder lugs, they provide a solid surface and allows connections to be tightened without the need to hold the bolt head from turning. The Feeder cable connection plate is made up of 2 x M10 x 50mm bolts welded to a 6mm plate.

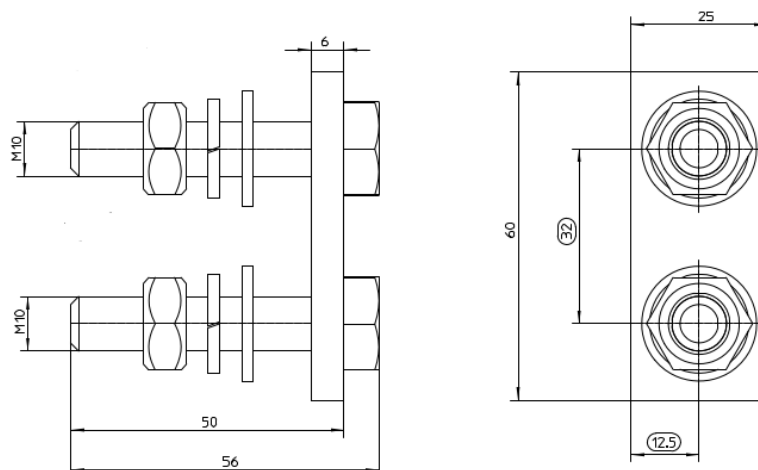


Figure 12: Feeder cable connection plate

4.1.8 Equipment rating labels

Labels will be fitted to the front of each fuse strip, isolator or circuit breaker which states the maximum rating of the piece of equipment in line with the individual equipment category.

4.1.9 Safety barriers

When working in or around any HV or LV switchgear care must be taken not to touch or insert any object into an area which may be alive. Insulated safety barriers are installed in the front, rear, side and on flags by Tyree to achieve a safe working environment. An additional phase barrier is installed between phase flags. Care must be taken to ensure that flag is installed if displaced during cable termination or transport.

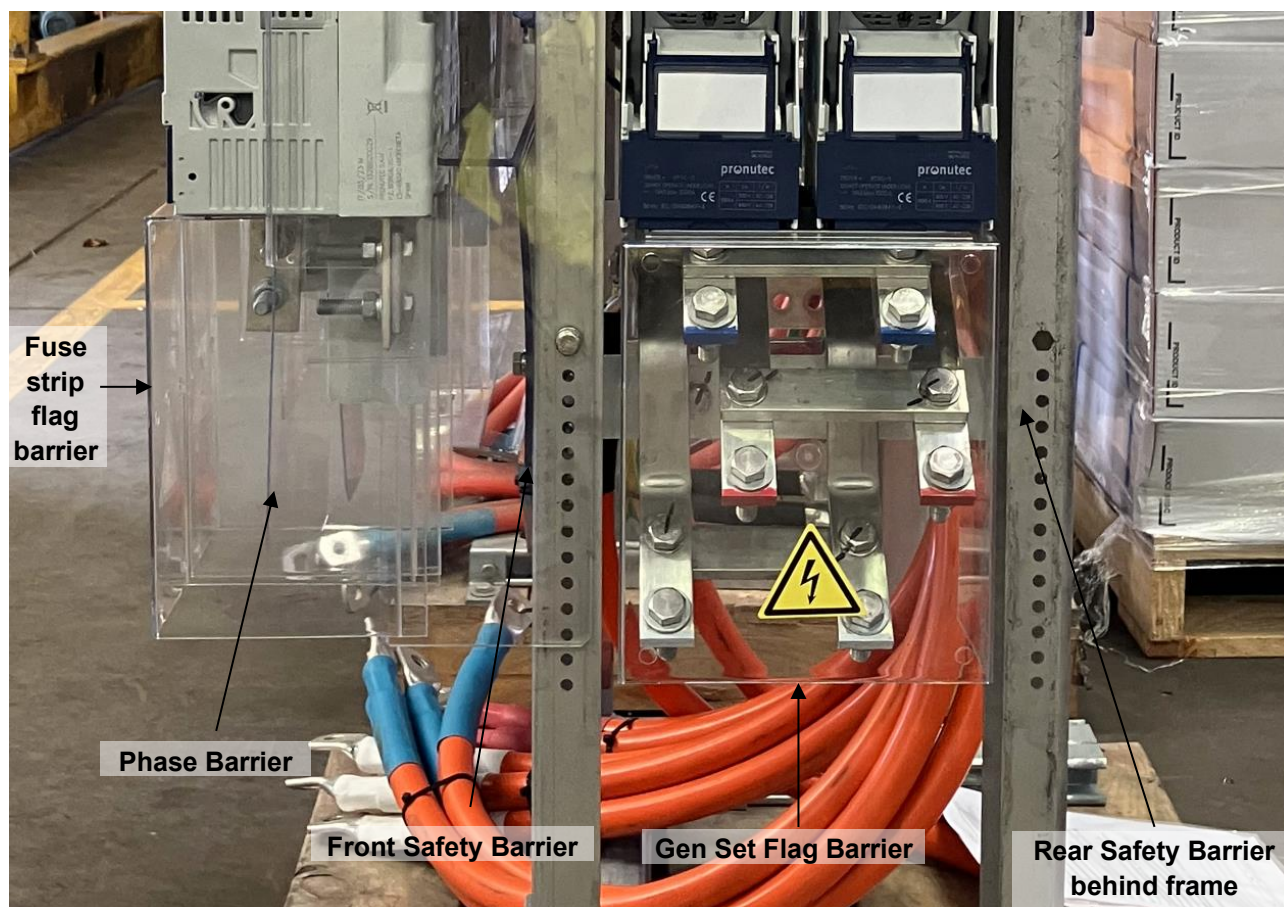


Figure 13: Safety barriers

Fuse strip barrier

This permanent clear barrier is required on Cat 1 & 2 switchgear so that no contact will occur when connecting and disconnecting generator incoming leads to the generator isolation strip.

The barrier slides into position from the front.

Phase barrier

To prevent inadvertent contact between each phase flag connection on the bottom of the fuse strip, a permanent clear barrier must be fitted.

The barrier slides over “A” phase flag. No screws are required.

4.2 Category 1 – 750A fused switchboard

NOTE: Category 1 – 750A fuse switchboards are designed for use on transformer sizes up to and including 500kVA.

The Tyree Category 1 low voltage switchgear is of a modular construction. The switchgear is supplied fully assembled and wired by the manufacturer as a four (4) fused feeder distribution board. However, individual switch strips can be purchased from Tyree. Facilities have been made for the connection of an emergency generator set without disconnection of the power supply to customers.

The following standard items are mounted on a Category 1 switchboard.

Table 4: Cat 1 LV switchgear standard items

Item	Qty
3Ø isolator switch strip to serve as incomer from transformer	1
3Ø isolator switch strip to serve as incomer from stand-by generator	1
3Ø fuse switch strip to serve as distribution feeders	4
3Ø auxiliary fuse strip for street lighting complete with 63A NH00 fuse links	1
2 x 240 mm ² /phase copper SDI X-HF-110 flexible rubber cable complete with lugs (phase)	3
1 x 240 mm ² copper SDI X-HF-110 flexible rubber cable complete with lugs (neutral)	1
Copper bar with perforation for external/internal neutral and earth connections	2
Tags to facilitate connection/synchronisation of stand-by generator	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	1

4.2.1 Reference drawings/catalogues

Table 5: Cat 1 LV switchgear reference drawings

Description	Ref no.	Rating
Gen. switch strip	4305-0099	940A
Disc. switch strip	4305-0100	940A
Fuse switch strip	4305-0101	400A
Aux. fuse switch strip	4305-0102	160A
Full sw/bd (4 fdrs)	4500-0146	-
Tx to sw/bd cables	2x240mm	110°

Equipment ratings shown above are based on a 500kVA transformer rating and designed and tested to operate at overload values up to 130% based on 400V.

Equipment has been rated to account for higher temperatures inside a padmount cubicle that can be encountered on a hot day and with a fully loaded transformer. Therefore, it is possible that the rating plate on the individual item may show a higher value. However, the switchgear must not be loaded beyond the maximum current rating given above.

4.2.2 Operations/features

The fuse switch and disconnecting switches are suitable for single-phase operation only.

The fuses switch strips are suitable for 250A DIN Size 2 fuses. **Do not use a higher rating fuse unless approval is given by the Asset Engineering Manager.** Feeder load must be monitored so that the total current does not exceed the continuous maximum current as above. Tyree does not supply fuses as a part of the switchboard.

Tags are provided for synchronisation of an emergency generator without loss of supply to the customers (refer to GAN 0095 for instruction on generator synchronization).

The switches are provided with their own handles. Separate handles are not needed.

4.2.3 External cabling

The switchgear is designed for termination of external cables with sizes up to 2 x 240mm² for each phase on the fuse switch strips. Please refer to Section 4.1.7 for cable connection detail.

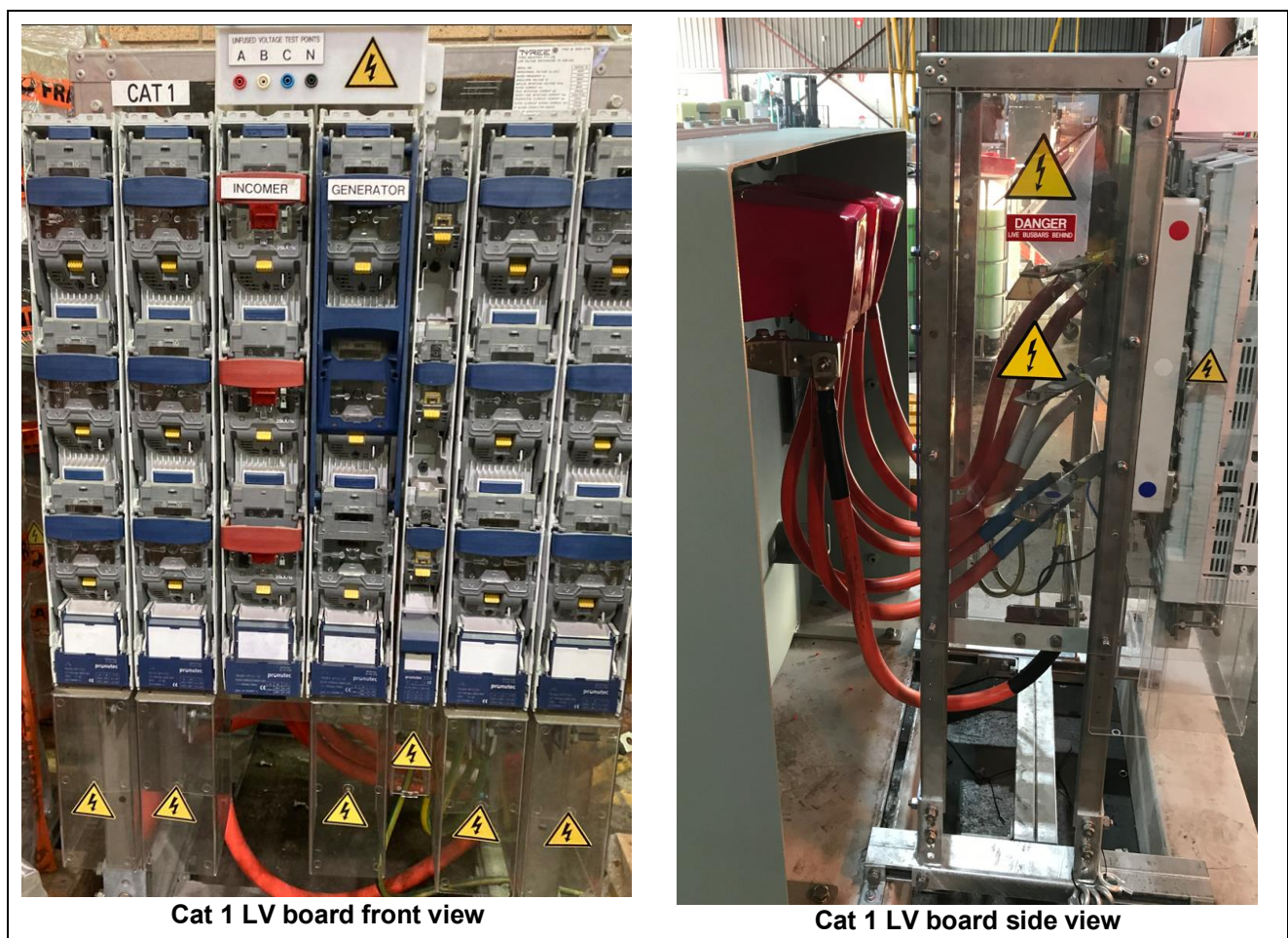


Figure 14: Cat 1 LV switchgear

4.3 Category 2 / 2B – 1400A fused switchboard

NOTE: Category 2 – 1400A fuse switchboards are designed for use on transformer sizes up to and including 1000kVA.

The Tyree Category 2 switchgear is of a modular construction. The switchgear is supplied fully assembled and wired by the manufacturer as a two (2) or four (4) fused feeder distribution board. However, individual

switch strips can be purchased from Tyree. Facilities have been made for the connection of an emergency generator set without disconnection of the power supply to customers.

The following standard items are mounted on a Category 2 switchboard.

Table 6: Cat 2 LV switchgear standard items

Item	Qty
3Ø isolator switch strip to serve as incomer from transformer	1
3Ø isolator switch strip to serve as incomer from stand-by generator	1
3Ø fuse switch strip to serve as distribution feeders	4
3Ø auxiliary fuse strip for street lighting complete with 63A NH00 fuse links	1
4 x 240 mm ² /phase Cu SDI X-HF-110 flexible rubber complete with lugs (phase)	3
2 x 240 mm ² Cu SDI X-HF-110 flexible rubber complete with lugs (neutral)	1
Copper bar with perforation for external/internal neutral and earth connections	1
Tags to facilitate connection/synchronisation of stand-by generator	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	1

4.3.1 Reference drawings/catalogues

Table 7: Cat 2 LV switchgear reference drawings

Description	Ref no.	Rating
Gen. switch strip	4305-0103	2000A
Disc. switch strip	4305-0104	2000A
Fuse switch strip	4305-0101	400A
Aux. fuse switch strip	4305-0102	160A
Full sw/bd (2 fdrs)	4500-0148	-
Full sw/bd (4 fdrs)	4500-0147	-
Tx to sw/bd cables	4x240mm	110°

Equipment has been rated to account for higher temperatures inside a padmount cubicle that can be encountered on a hot day and with a fully loaded transformer. Therefore, it is possible that the rating plate on the individual item may show a higher value. However, the switchgear must not be loaded beyond the maximum current rating given above.

4.3.2 Operations/features

- The fuse switch and disconnecting switches are suitable for single-phase operation only.
- The fuse switch strips are suitable for 400A DIN Size 2 fuses. **Do not use a higher rating fuse.** Feeder load must be monitored so that the total current does not exceed the continuous maximum current as above. Tyree does not supply fuses as a part of the switchboard.
- Busbar tags are provided for synchronisation of emergency generator without loss of supply to the customers (refer to GAN 0095 for instruction on generator synchronization).
- The switches are provided with their own handles. Separate handles are not needed.

4.3.3 External cabling

The switchgear is designed for termination of external cables with sizes up to 2 x 240mm² for each phase on the fuse switch strips. Please refer to Section 4.1.7 for cable connection detail.



Front View (Pre 2021)

Figure 15: Cat 2 LV switchgear

4.4 Type 1 – 795A circuit breaker switchboard

NOTE: Type 1 – 795A Circuit breaker switchboard can be used on transformer sizes up to and including 1000kVA.

The Tyree Type 1 - 795A circuit breaker switchboard is of a modular construction. The switchgear is supplied fully assembled and wired by the manufacturer as a circuit breaker only switchboard. This switchboard is usually to be used when demand of a single customer exceeds 400A but is less than 795A.

Provision exists to mount two (2) additional Cat 2 400A fuse switch strips at a later date. However in this case, the load supplied through the switchboard must not exceed 1400A or 1000kVA. Individual switch strips can be purchased from Tyree. Facilities are made for the connection of an emergency generator set without disconnection of power supply to customers.

The following standard items are mounted on a Type 1 – 795A circuit breaker switchboard.

Table 8: Type 1 LV CB switchgear standard items

Item	Qty
3Ø incoming switch LBS Telergon S5-20003PD0	1
3Ø outgoing MCCB SCHNEIDER NS1250N ML5.0 - May 23 onwards	1
Provision only to add 2 x 400 A fuse switch strip at a later date	2
3Ø auxiliary fuse strip for street lighting complete with 63A NH00 fuse links	1
4 x 240 mm ² /phase Cu SDI X-HF-110 flexible rubber complete with lugs (phase)	3
2 x 240 mm ² Cu SDI X-HF-110 flexible rubber complete with lugs (neutral)	1
Copper bar with perforation for external/internal neutral and earth connections	1
Tags to facilitate connection/synchronisation of emergency generator	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	1

4.4.1 Reference drawings/catalogues

Table 9: Type 1 LV CB switchgear reference drawings

Description	Ref no.	Rating
Incoming Switch LBS	4305-0106	2000A
MCCB	4305-0136	1250A
Fuse switch strip	4305-0101	400A
Aux Fuse switch strip	4305-0102	126A
Switchboard	4500-0149	1590A
Tx to sw/bd cables	4x240mm	110°

4.4.2 Operations/features

- Moulded case circuit breakers (MCCB) T7S of ABB make is used in the switchgear. The MCCBs are provided with an integrated electronic protection trip unit PR232/P. 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 operating device, that is, all three (3) phases are operated simultaneously. This is clearly indicated on the circuit breaker front panel. The circuit breaker can be operated simply by pushing the operating handle up or down. Further details on application, setting procedures, operation and maintenance are provided in the manufacturer's instructions.
- The fuse switch strips, if provided, are suitable for single-phase operation only.
- Only Cat 2 400A fuse switch strips with 400A DIN size 2 fuses are to be used. **Do not use a higher rating fuse.** Feeder load must be monitored so that the total current does not exceed the continuous maximum current as above. Tyree does not supply fuses as a part of switchboard.
- Tags are provided for synchronisation of an emergency generator to the circuit breaker load only without loss of supply to the customers (refer to GAN 0095 for instruction on generator synchronization).
- The switches are provided with their own handles. Separate handles are not needed.

4.4.3 External cabling

The switchgear is designed for termination of external cables as follows:

- Up to 4 x 630 mm² Cu or Al for each phase on the circuit breakers.
- Up to 2 x 240 mm² Cu or Al for each phase on the fuse switch strips (if provided).

Please refer to Section 4.1.7 for cable connection detail.



Front View



MCCB 1250A 3 Pole 50kA ABB (Pre 2022)



MCCB 1250A 3 Pole 50kA ABB (Pre 2022)

Figure 16: Type 1 LV CB switchgear

4.5 Type 2 – 1400A circuit breaker switchboard

NOTE: Type 2 – 1400A Circuit breaker switchboard can be used on transformer sizes up to and including 1000kVA.

The Tyree Type 2 - 1400A circuit breaker switchboard is of a modular construction. The switchgear is supplied fully assembled and wired by the manufacturer as a circuit breaker only switchboard. This switchboard is usually to be used when demand of a single customer exceeds 735A but is less than 1400A.

However, a provision exists to mount up to two (2) additional Cat 2 400A fuse switch strips at a later date. The load supplied through the switchboard must not exceed 1400A or 1000kVA. Individual switch strips can be purchased from Tyree. Facilities are made for the connection of an emergency generator set to circuit breaker load only, without disconnection of power supply to customers.

The following standard items are mounted on Type 2 – 1400A circuit breaker switchboard.

Table 10: Type 2 LV CB switchgear standard items

Item	Qty
3Ø incoming switch LBS	1
3Ø outgoing MCCB	1
Provision only to add 2 x 400 A fuse switch strip at a later date	2
3Ø auxiliary fuse strip for street lighting complete with 63A NH00 fuse links	1
4 x 240 mm ² /phase Cu SDI X-HF-110 flexible rubber complete with lugs (phase)	3
2 x 240 mm ² Cu SDI X-HF-110 flexible rubber complete with lugs (neutral)	3
Copper bar with perforation for external/internal neutral and earth connections	3
Tags to facilitate connection/synchronisation of emergency generator	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	1

4.5.1 Reference drawings/catalogues

Table 11: Type 2 LV CB switchgear reference drawings

Description	Ref No.	Rating
Incoming Switch LBS	4305-0106	2000A
MCCB	4305-0108	2500A
Fuse switch strip	4305-0101	400A
Aux Fuse switch strip	4305-0102	126A
Switchboard	4500-0149	1590A
Tx to sw/bd cables	4x240mm	110°

Equipment has been rated to account for higher temperatures inside a padmount cubicle that can be encountered on a hot day and with a fully loaded transformer. Therefore, it is possible that the rating plate on the individual item may show a higher value. However, the switchgear must not be loaded beyond the maximum current rating given above.

4.5.2 Operations/features

- Moulded case circuit breakers (MCCB) Tembreak of Terasaki make are used in the switchgear. The MCCBs are provided with an integrated electronic protection trip unit. 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 operating device, that is, all three (3) phases are operated simultaneously. This is clearly indicated on the circuit breaker front panel. The circuit breaker can be operated simply by pushing the operating handle up or down. Further details on application, setting procedures, operation and maintenance are provided in the manufacturer's instructions.
- The fuse switch strips, if provided, are suitable for single-phase operation only.
- Only Cat 2 400A fuse switch strips with 400A DIN size 2 fuses are to be used. **Do not use a higher rating fuse.** Feeder load must be monitored so that the total current does not exceed the continuous maximum current as above. Weber does not supply fuses as a part of the switchboard.

- Tags are provided for synchronisation of emergency generator, to the circuit breaker loads only, without loss of supply to the customers (refer to GAN 0095 for instruction on generator synchronisation).
- The switches and circuit breakers are provided with their own handles. Separate handles are not needed.

4.5.3 External cabling

The switchgear is designed for termination of external cables as follows;

- Up to 4 x 630 mm² Cu or Al for each phase on the circuit breakers.
- Up to 2 x 240 mm² Cu or Al for each phase on the fuse switch strips (if provided).

These cables are to be fitted with the standard lugs. Lugs are to be secured using M12 high tensile bolts tensioned to 45Nm.



Front View



MCCB 2500A 3 Pole 85kA Terasaki

Figure 17: Type 2 LV CB switchgear

4.6 Type 3 – 2100A circuit breaker switchboard

NOTE: Type 3 – 2100A circuit breaker switchboard can be used on transformer sizes up to and including 1500kVA.

The Tyree Type 3 - 2100A circuit breaker switchboard is of a modular construction. The switchgear is supplied fully assembled and wired by the manufacturer as a circuit breaker only switchboard. This switchboard is usually to be used when demand of a single customer exceeds 1400A but is less than 2100A.

A provision exists to mount up to two (2) additional Cat 2 400A fuse switch strips at a later date. The load supplied through the switchboard must not exceed 2100A or 1500kVA. Individual switch strips can be purchased from Tyree. Facilities are made for the connection of an emergency generator set without disconnection of power supply to customers.

The following standard items are mounted on Type 3 – 2100A circuit breaker switchboard.

Table 12: Type 3 LV CB switchgear standard items

Item	Qty
3Ø incoming switch LBS	1
3Ø outgoing MCCB	1
Provision only to add 2 x 400 A fuse switch strip at a later date	2
3Ø auxiliary fuse strip for street lighting complete with 63A NH00 fuse links	1
4 x 240 mm ² /phase Cu SDI X-HF-110 flexible rubber complete with lugs (phase)	3
2 x 240 mm ² Cu SDI X-HF-110 flexible rubber complete with lugs (neutral)	3
Copper bar with perforation for external/internal neutral and earth connections	3
Tags to facilitate connection/synchronisation of emergency generator	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	1

4.6.1 Reference drawings/catalogues

Table 13: Type 3 LV CB switchgear reference drawings

Description	Ref no.	Rating
Incoming Switch LBS	4305-0110	3150A
MCCB	4305-0108	3200A
Fuse switch strip	4305-0101	400A
Aux Fuse switch strip	4305-0102	126A
Switchboard	4500-0149	2300A
Tx to sw/bd cables	4x240mm	110°

Equipment has been rated to account for higher temperatures inside a padmount cubicle that can be encountered on a hot day and with a fully loaded transformer. Therefore, it is possible that the rating plate on the individual item may show a higher value. However, the switchgear must not be loaded beyond the maximum current rating given above.

4.6.2 Operations/features

- Moulded case circuit breakers (MCCB) Tembreak of Terasaki make are used in the switchgear. The MCCBs are provided with an integrated electronic protection trip unit. 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 operating device, that is, all three (3) phases are operated simultaneously. This is clearly indicated on the circuit breaker front panel. The circuit breaker can be operated simply by pushing the operating handle up or down. Further details on application, setting procedures, operation and maintenance are provided in the manufacturer's instructions.
- The fuse switch strips, if provided, are suitable for single-phase operation only.
- Only Cat 2 400A fuse switch strips with 400A DIN type Size 2 fuses are to be used. **Do not use a higher rating fuse.** Feeder load must be monitored so that the total current does not exceed the continuous maximum current as above. Weber does not supply fuses as a part of switchboard.
- Busbar tags are provided for synchronisation of emergency generator without loss of supply to the customers (refer to GAN 0095 for instruction on generator synchronization).
- The switches and circuit breakers are provided with their own handles. Separate handles are not needed.

4.6.3 External cabling

The switchgear is designed for termination of external cables as follows:

- Up to 4 x 630 mm² Cu or Al for each phase on the circuit breakers.
- Up to 2 x 240 mm² Cu or Al for each phase on the fuse switch strips (if provided).

Please refer to Section 4.1.7 for cable connection detail.



Front View



MCCB 3200A 3 Pole 85kA Terasaki

Figure 18: Type 3 LV CB switchgear

4.7 Type 4 – 1400A circuit breaker switchboard

NOTE: Type 4 – 1250A Circuit breaker switchboard can be used on transformer sizes up to and including 1000kVA.

The Tyree Type 4 - 1250A circuit breaker switchboard is of a modular construction. The switchgear is supplied fully assembled and wired by the manufacturer as a circuit breaker only switchboard. This switchboard is usually to be used when demand of two (2) single customers exceeds 400A but is less than 735A. There is no provision to mount additional 400A fuse switch strips. The load supplied through the switchboard must not exceed 1400A or 1000kVA. Facilities are made for the connection of an emergency generator set without disconnection of power supply to customers.

The following standard items are mounted on a Type 4 – 1400A circuit breaker switchboard.

Table 14: Type 4 LV CB switchgear standard items

Item	Qty
3Ø incoming switch LBS	1
3Ø outgoing MCCB	2
3Ø auxiliary fuse strip for street lighting complete with 63A NH00 fuse links	1
4 x 240 mm ² /phase Cu SDI X-HF-110 flexible rubber complete with lugs (phase)	3
2 x 240 mm ² Cu SDI X-HF-110 flexible rubber complete with lugs (neutral)	3
Copper bar with perforation for external/internal neutral and earth connections	3
Tags to facilitate connection/synchronisation of emergency generator	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	1

4.7.1 Reference drawings/catalogues

Table 15: Type 4 LV CB switchgear reference drawings

Description	Ref no.	Rating
Incoming Switch LBS	4305-0110	2000A
MCCB	4305-0108	1250A
Aux Fuse switch strip	4305-0102	126A
Switchboard	4500-0149	1590A
Tx to sw/bd cables	4x240mm	110°

Equipment has been rated to account for higher temperatures inside a padmount cubicle that can be encountered on a hot day and with a fully loaded transformer. Therefore, it is possible that the rating plate on the individual item may show a higher value. However, the switchgear must not be loaded beyond the maximum current rating given above.

4.7.2 Operations/features

- Moulded case circuit breakers (MCCB) T7S of ABB make is used in the switchgear. The MCCBs are provided with an integrated electronic protection trip unit. The circuit breakers are positive action type, that is, the breaker can be either in *open* or *closed* position. The circuit breaker is a three-phase operation device, that is, all three (3) phases are operated simultaneously. This is clearly indicated on the circuit breaker front panel. The circuit breaker can be operated simply by pushing the operating handle up or down. Further details on application, setting procedures, operation and maintenance are provided in the manufacturer's instructions.
- Tags are provided for synchronisation of an emergency generator to the circuit breaker load only without loss of supply to the customers (refer to GAN 0095 for instruction on generator synchronization).
- The switches and circuit breakers are provided with their own handles. Separate handles are not needed.

4.7.3 External cabling

The switchgear is designed for termination of external cables as follows:

- Up to 4 x 630 mm² Cu or Al for each phase on the circuit breakers.
- Up to 2 x 240 mm² Cu or Al for each phase on the fuse switch strips (if provided).

Please refer to Section 4.1.7 for cable connection detail.

4.8 Type 5 – 2100A load break switch switchboard

NOTE: Type 5 – 2100A load break switch switchboard must only be used on 1500kVA transformer.

The Tyree Type 5 – 2100A load break switch switchgear is supplied fully assembled and wired by the manufacturer as a load break switch only switchboard. The use of load break switch is to be restricted to single customer substations where the demand of the customer exceeds 1400A and necessary protection is provided at the customer's LV switchboard (refer to ETS0069 for details on use of load break switch). Use of the load break switch will be subject to Endeavour Energy's approval for each and every installation. No provision exists to mount additional fuse switch strips distributors at a later date. Facilities are made for the connection of an emergency generator set without disconnection of power supply to customers.

The following standard items are mounted on Type 5 – 2100A load break switch switchboard.

Table 16: Type 5 LV LBS switchgear standard items

Item	Qty
3Ø OETL3150 of Control and Switchgear-up to 2013	1
2500/5A current transformers for maximum demand indicator-up to 2013	3
15 minutes delay maximum demand indicator fully wired to the CTs	3
4 x 240 mm ² /phase copper super stranded cable complete with lugs (phase)	3
2 x 240 mm ² copper super stranded cable complete with lugs (neutral)	1

Copper bar with perforation for external/internal neutral and earth connections	1
Tags to facilitate connection/synchronisation of emergency generator	1
Space for street light control (to be mounted and wired by Endeavour Energy, if required)	1
Busbars, covers, shrouds to complete	1
Stainless steel or galvanised box section frame	

4.8.1 Reference drawings/catalogues

Table 17: Type 5 LV LBS switchgear reference drawings

Description	Ref no.	Rating
Load Break Switch	4305-0110	3150A
Sw/bd	4500-0153	2300A
Tx to sw/bd cables	4x300mm	110°

Equipment has been rated to account for higher temperatures inside a padmount cubicle that can be encountered on a hot day and with a fully loaded transformer. Therefore, it is possible that the rating plate on the individual item may show a higher value. However, the switchgear must not be loaded beyond the maximum current rating given above.

4.8.2 Operations/features

- Load break switch of Telergon make is used in the switchboard. The switch is positive action type, that is, the switch can be either in *open* or *closed* position. The switch is a three-phase device, that is, all three (3) phases are operated simultaneously. This is clearly indicated on the switch front panel. The switch can be operated simply by pushing the operating handle up or down. Further details on application, setting procedures, operation and maintenance are provided in the manufacturer's instructions.
- Busbar tags are provided for synchronisation of emergency generator without loss of supply to the customers (refer to GAN 0095 or instruction on generator synchronization).
- The switch is provided with its own handle. Separate handles are not needed.

4.8.3 External cabling

The switchgear is designed for termination of external cables as follows:

- Up to 4 x 630 mm² Cu or Al for each phase on the circuit breakers.

Please refer to Section 4.1.7 for cable connection detail.

5. AUTHORITIES AND RESPONSIBILITIES

General Manager Future Grid & Asset Management has the authority and responsibility for:

- Making all decisions concerning compliance in respect of this Standard.
- Delegating any of these authorities and responsibilities to the **Head Of Asset Management & Digital**.

Head Of Asset Management & Digital has the authority and responsibility for:

- Approving this Standard, including any variations
- Reviewing this Standard and making recommendations to the **General Manager Future Grid & Asset Management**.
- Making recommendations concerning compliance in respect of this Standard.

Asset Engineering Manager has the responsibility for:

- Clarifying all the technical aspects of this Standard with stakeholders.
- Updating the relevant actions required and outlined in this Standard.

Head of Field Operations have the responsibility for confirming that all designs carried out by Regional employees conform to the requirements of this instruction.

Head of Customer Network Solutions have the responsibility for confirming that all designs carried out by Level 3 ASPs conform to the requirements of this instruction.

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

