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# Moducell V2.2
# Low Voltage Modular Demountable Switchboards

**Technical Reference Guide**

# Mayfield's Moducell has been designed and **verified to provide an increased level of security for operators.**

Mayfield's Moducell V2.2 Low Voltage switchboard is an Australian made enclosed demountable modular switchboard that has been designed and verified for motor control, power distribution and circuit protection whilst providing increased safety for operators.

Mayfield's Moducell V2.2 main busbar chamber is located at the rear of the single sided configuration and the middle of the double sided configuration in either the top, centre or bottom of the board. This allows for heat dissipation and greater flexibility in switchboard design, by eliminating the need for a bus tie joggle tier and allowing both bottom and top cable entry.

The modular construction provides multifunctionality and immense flexibility within the switchboard as well as decreasing shutdown times during site upgrades and switchboard extensions.

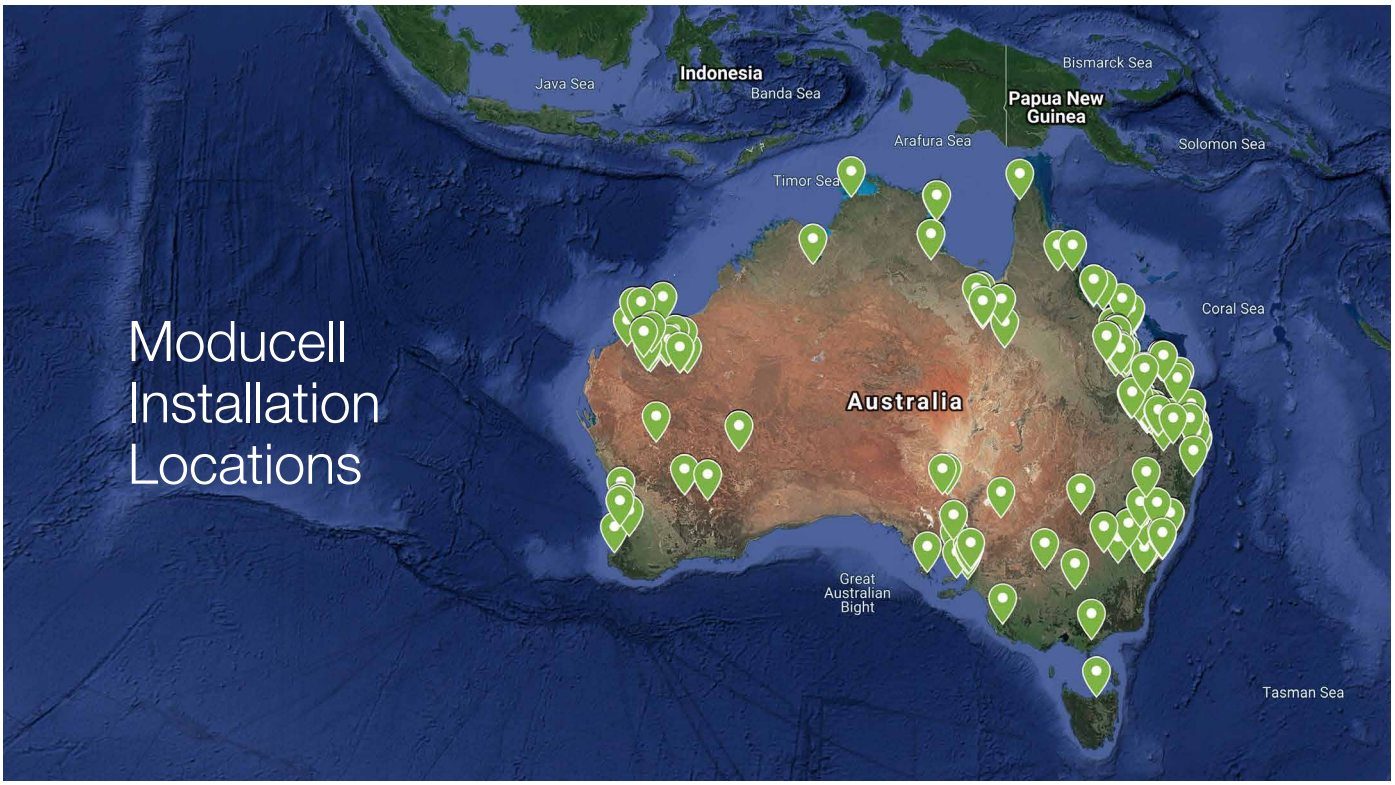
Moducell can be configured in a single sided, double sided, indoor (IP41, IP54), outdoor (IP66) or compact (decreased height) versions.

In the unlikely event of an internal arc fault in a functional unit, heat and pressure is vented upward via arc chutes incorporated into the standard Moducell design to ensure that any flash is forced away from the operator.

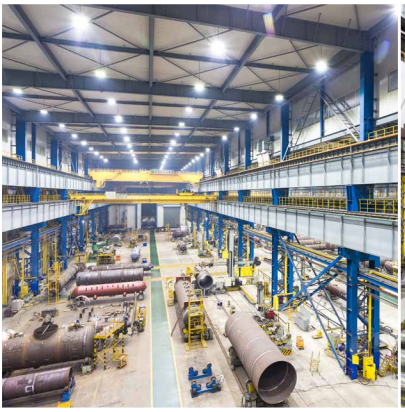
Optional safety features are offered with Moducell, including; ACB operation 'behind closed doors' which allows for the operation of ACB's behind a full metal cover and powdercoated busbars which is designed to reduce the probability of the initiation of an arcing fault.

The dropper (vertical) busbar chambers are fitted with a segregation cover, which has been pre-punched with every possible module insertion point. This ensures that fitting new modules or even re-configuring the whole tier arrangement can be done without any modification work required to the dropper chamber segregation cover.

Moducell switchboards have been installed on hundreds of sites across Australia and south east Asia over the past 20 plus years which provides end users with the confidence that Moducell will provide performance, reliability and longevity. This confidence is reinforced by Mayfield's extensive list of Moducell verification tests (type tests).



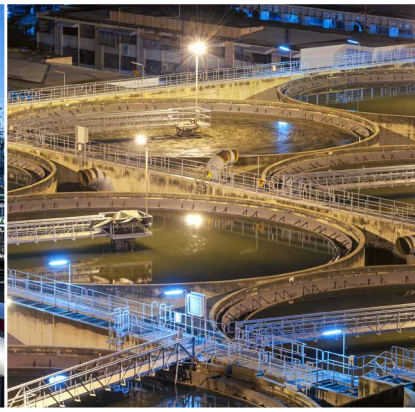
# The Moducell installation base **is across all industry sectors in Australia**



HEAVY INDUSTRY

MINERAL AND METALS PROCESSING

OIL & GAS



WATER & WASTE WATER

MINING

INFRASTRUCTURE

POWER GENERATION & TRANSMISSION

RENEWABLE ENERGY

## INTELLIGENCE

Programmable
Adjustable
3D Design Capable
Flexibility

## CONFIDENCE

AS/NZS 61439:2016 Verified
Field Proven
Dedicated Product Support

## PERFORMANCE

Verified Design Ratings
Enhanced Operator Safety

# Moducell V2.2 **features.**

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## STANDARD FEATURES

Type tested arrangement (tested to AS/NZS 61439.1:2016)

Protection against the occurrence and the effects of internal arc faults (tested to AS/NZS 61439.1:2016, Appendix ZD)

Modular construction

Manufactured with 2.0mm zinc anneal or stainless steel

IP42, IP54, IP66 standard versions

Colour – any readily available powder coat colour

Operational voltage ≤1000VAC

Fault level withstand ≤100kA

Internal arc fault protection ≤ 80kA, 690VAC

Three off main busbar zones to allow for high currents with lower operating temperatures and greater flexibility

Vertical dropper busbars are standard 4-pole arrangement.

Main busbars are extensible at both ends

Plugin demountable modules

Modules come standard with 4-pole bus plug arrangement

Standard modules interchangeable between IP42, IP54 & IP66 versions

Single and double-sided configuration (true double-sided construction)

Top and/or bottom horizontal full length cable zones

Top and/or bottom cable entry

Vertical cables zones available in standard 300 and 400mm width

Front and rear cable connection versions available

PLC/ DCS tiers in various widths – 600, 700, 800, 900, 1,000, 1,200mm. Sliding doors are available on some arrangments.

IP54 version height – 2,260mm (shorter 2,000mm version available)

IP66 version height – 2,160mm

Single-sided front connection version depth – 600mm

Double-side front connection version – 960mm

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## OPTIONS TO FURTHER ENHANCE SAFETY AND VERSATILITY

Constructed from 2.0mm zinc anneal, 304 and 316 stainless steel

Operation behind closed doors for Air Circuit Breakers

Fully-insulated main horizontal and vertical dropper bus system

Arc barriers between tiers in main bus zone

Arc detection sensors and relays in main horizontal and vertical dropper busbar zones

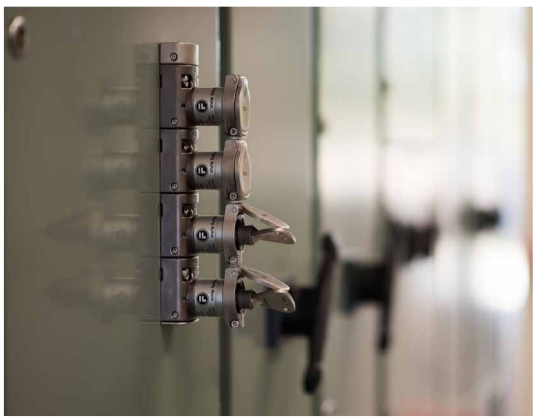
Thermographic monitoring windows

Automatic bus plug shutter assemblies for insertion points on vertical busbars

Insulated dummy bus plugs for unused insertion points on vertical busbars

Live line indicator units available for connection in standard modules

Advanced thermal monitoring management systems


# Enhanced operator safety.

We design and manufacture Moducell switchboards as if our lives depended on it.

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**INCREASED SECURITY**
AGAINST ARCING FAULTS

**ACB PROTECTION UNIT RESET PUSHBUTTON**
INSERT INSULATED ROD TO OPERATE

**ACB OPEN & CLOSE PUSHBUTTONS**
INSERT INSULATED ROD TO OPERATE

**ACB PROTECTION VIEWING WINDOW**

**ACB RACKING**
INSERT ACB RACKING HANDLE TO FULLY WITHDRAW OR FULLY ENGAGE ACB WITH COVER IN PLACE

## THE BENEFITS OF MAYFIELD'S MODULAR MODUCELL SWITCHBOARD

Tested modular compartment sizes for a range of ratings

Serial Communications across multiple protocols are available

Interchangeability and ease of replacement to reduce shutdown times for upgrades

Temperature monitoring capabilities

Integral Form 1 distribution board design.

Live Line Indication

## WE ARE ABLE TO OFFER STANDARD STARTER MODULES BASED ON ANY OR ALL OF THE FOLLOWING DESIGN REQUIREMENTS

Voltage Rating

Fault Level Withstand Rating Preferred Equipment

Preferred Communications Protocol

Fuse Switch/Moulded Case Circuit Breaker, Motor Circuit Breaker

Physical Size restraints Protection Functions Metering Functions Programmable I/O Individual or Grouped HMI

## OUR STANDARD MODULES HAVE THE FOLLOWING FEATURES

Plug in Demountable

Form 4b construction

Arc Proof Door Equipment Plate (Removable)

## OPTIONAL FEATURES

Busbar Shutters

Arc Proof Door Equipment Plate Plug and Socket

Control wiring test function with starter isolated from main busbar

Real time temperature sensing

## ADVANTAGES OF OUR PLUG-IN DEMOUNTABLE STARTERS

### Tested & field proven

Solid mounting and fixing of starter in MCC tier

Starter door remains attached to the MCC tier

Tested with equipment from multiple vendors

Quickly and easily upgraded or resized


# Moducell V2.2 offers a comprehensive range of standard tier types **to suit most applications required in both power distribution and motor control.**

## TIER TYPES

Incomer ACB tiers – 600, 700, 800, 900, 1,000,1,200mm widths

Incomer ACB tiers c/w supply authority metering – 700, 800, 900, 1,000, 1,200mm widths

Incomer MCCB tiers – 400 (single-sided only), 500, 600, 700, 800mm widths

Incomer MCCB tiers c/w supply authority metering – 700, 800mm widths

Bustie ACB tiers – 500, 600, 700, 800, 900, 1,000, 1,200mm widths

Bustie MCCB tiers – 400 (single-sided only), 500, 600, 700, 800mm widths

Bus joggle tiers – 400 (single-sided only), 500, 600, 700, 800mm widths

Cable to bus tiers – 400 (single-sided only), 500, 600, 700, 800mm widths

Multi-drive tiers front connect – 800, 900mm widths

Multi-drive tiers rear connect – 600mm width

Single full height drive tiers – 400 (single sided only), 500, 600, 700, 800mm widths

Single ACB feeder tiers –500, 600, 700, 800, 900, 1,000, 1,200mm widths

Double ACB feeder tiers (requires side or rear cable zone on single-sided version) – 500, 600, 700, 800mm widths

Single MCCB feeder tiers – 400 (single-sided only), 500, 600, 700, 800mm widths

Double MCCB feeder tiers (requires side or rear cable zone on single-sided version) – 400 (single-sided only), 500, 600, 700, 800mm widths

PLC/ DCS tiers – 800, 900, 1,000, 1,200mm widths

Side cable zone – 300, 400mm widths

Note: all tiers (except as noted) are available in single-sided and double-sided configurations.

ACB Tier

Dual Stack ACB Tier

Multi-Drive Tier

PLC Tier

Single Drive Tier

# ACB Tiers:
# The following tables give ACB tier widths based on ACB current ratings.

| ACB TIER WIDTHS - SINGLE SIDED | ACB RATING | TIER WIDTHS FOR 3-POLE | TIER WIDTHS FOR 4-POLE |
|---|---|---|---|
| | 630A | 600, 700 | 700 |
| | 800A | 600, 700 | 700 |
| | 1,000A | 600, 700 | 700 |
| | 1,200A | 600, 700 | 700 |
| | 1,600A | 700 | 700 |
| | 2,000A | 800 | 800 |
| | 2,500A | 800 | 800 |
| | 3,200A | 1,200 | 1,200 |
| | 3,500A | N/A | N/A |
| | 4,000A | N/A | N/A |
| | 4,500A | N/A | N/A |
| | 5,000A | N/A | N/A |

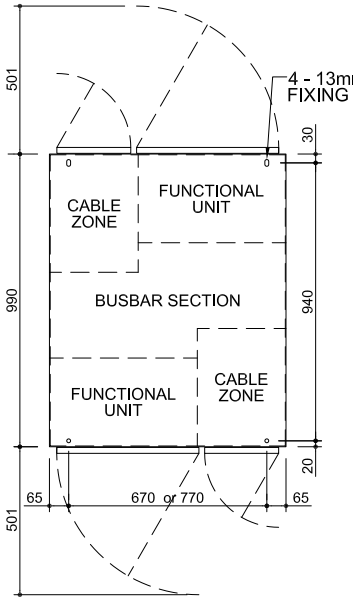
| ACB TIER WIDTHS - DOUBLE SIDED | | | |
|---|---|---|---|
| | 630A | 600, 700 | 700 |
| | 800A | 600, 700 | 700 |
| | 1,000A | 600, 700 | 700 |
| | 1,200A | 600, 700 | 700 |
| | 1,600A | 700 | 700 |
| | 2,000A | 800 | 800 |
| | 2,500A | 800 | 800 |
| | 3,200A | 1,000 | 1,000 |
| | 3,500A | 1,200 | 1,200 |
| | 4,000A | 1,200 | 1,200 |
| | 4,500A | 1,200 | 1,200 |
| | 5,000A | 1,200 | 1,200 |

| ACB TIER WIDTHS - SINGLE SIDED (MUST HAVE ADDITIONAL SIDE OR REAR CABLE ZONE) | | | |
|---|---|---|---|
| | 2 X 630A | 600, 700 | 700 |
| | 2 X 800 | 600, 700 | 700 |
| | 2 X 800 | 600, 700 | 700 |
| | 2 X 800 | 600, 700 | 700 |

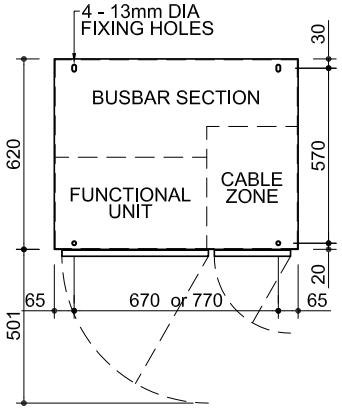
| ACB TIER WIDTHS - DOUBLE SIDED (ACBS ON ONE SIDE ONLY) | | | |
|---|---|---|---|
| | 2 X 630A | 600, 700 | 700 |
| | 2 X 800A | 600, 700 | 700 |
| | 2 X 800A | 600, 700 | 700 |
| | 2 X 800A | 600, 700 | 700 |

# Multi-drive tiers.

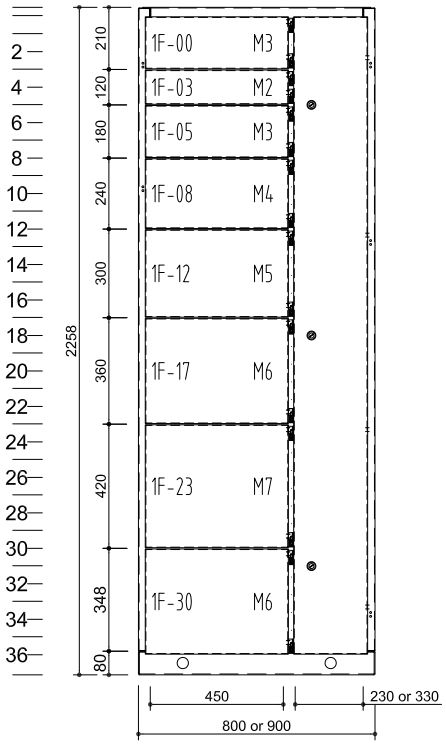
The standard IP54 version has 33 modular spaces available and an additional 3 modular spaces used as a segregated horizontal cable zone. The IP66 and compact versions have 27 modular spaces.



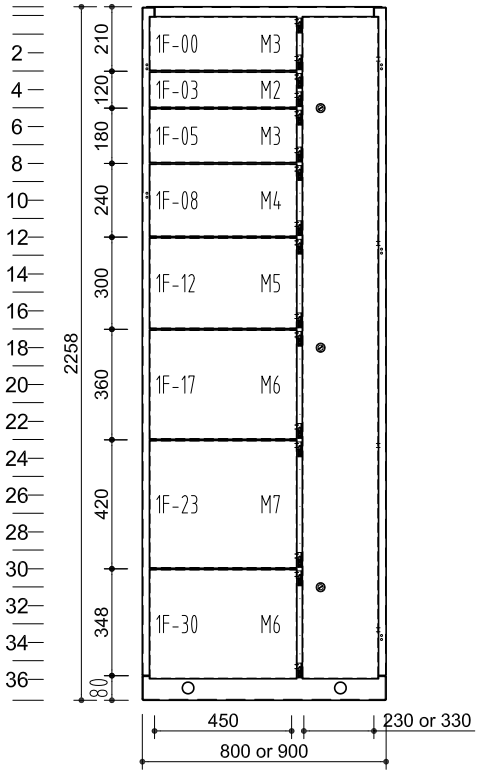

FOUNDATION PLAN




FOUNDATION PLAN



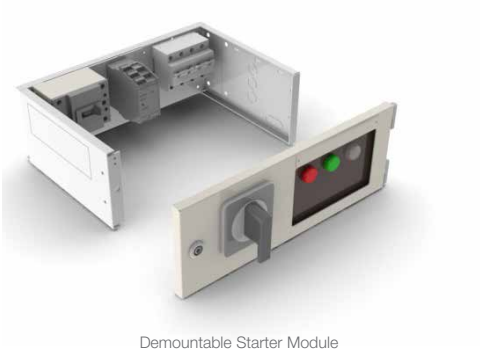

FRONT VIEW




FRONT VIEW

# Modules:

**The following tables provide guidance on module sizing for various kW and current ratings based on type 2 coordination of electrical components. Sizing may vary depending on the selection of original equipment manufacturer components and the control equipment required. Consult Mayfield for typical module layouts.**



Demountable Starter Module

| MOTOR STARTER RATING | DOL STARTER NON REVERSING | DOL STARTER REVERSING | VSD FEEDER |
|---|---|---|---|
| 0-30kW MCCB/ Contactor/TOL or MPR | 02 | 02 | 02 |
| 15-37kW MCCB/ Contactor/TOL or MPR | 03 | 04 | 03 |
| 45-75kW MCCB/ Contactor/TOL or MPR | 05 | 08 | 05 |
| 90-110kW MCCB/ Contactor/TOL or MPR | 13 | 13 | 13 |
| 132-160kW MCCB/ Contactor/TOL or MPR | 16 | FULL TIER-400MM WIDE | 16 |
| >160kW MCCB/ Contactor/TOL or MPR | FULL TIER-400MM WIDE | FULL TIER-400MM WIDE | FULL TIER-400MM WIDE |

| FEEDER RATING | MCCB FEEDER | FUSE SWITCH FEEDER | CONTRACTOR CONTROLLED FEEDER |
|---|---|---|---|
| up to 125A | 03 | 04 | REFER FACTORY |
| up to 250A | 03 | 06 | REFER FACTORY |
| up to 400A | 09 | 10 | REFER FACTORY |
| up to 630A | 18 | 18 | REFER FACTORY |
| greater than 800A | FULL TIER-400MM WIDE | FULL TIER-400MM WIDE | FULL TIER-400MM WIDE |

| DISTRIBUTION BOARD | WITH MAIN SWITCH | WITHOUT MAIN SWITCH |
|---|---|---|
| 18-POLE 250A | N/A | 06 |
| 30-POLE 250A | 10 | N/A |
| 42-POLE 250A | 12 | 10 |
| 48-POLE 250A | N/A | 12 |
| 60-POLE 250A | 16 | N/A |
| 72-POLE 250A | N/A | 16 |

| MODULE SIZE | HEIGHT IN MM | MODULE SIZE | HEIGHT IN MM |
|---|---|---|---|
| 02 | 120 | 11 | 660 |
| 03 | 180 | 12 | 720 |
| 04 | 240 | 13 | 780 |
| 05 | 300 | 14 | 840 |
| 06 | 360 | 15 | 900 |
| 07 | 420 | 16 | 960 |
| 08 | 480 | 17 | 1,020 |
| 09 | 540 | 18 | 1,080 |
| 10 | 600 | | |

# Moducell Technical Specifications.

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### RATED OPERATIONAL VOLTAGE (Ue)

The Moducell V2.2 is tested for connection to and operation at a Rated Operational Voltage (Ue) of 1,000V +10% / -6%, 3-Phase, 50Hz

### RATED FAULT LEVEL

The Moducell V2.2 is rated for the following fault capacities:
50kA for 1 second
50kA for 3 seconds
63kA for 1 second
65kA for 3 seconds
80kA for 1 second
100kA for 1 second

### RATED OPERATIONAL CURRENT

The following standard busbar arrangements and ratings are based on an ambient temperature of 35°C and an allowable temperature rise of 60°C as per the requirements of Table 2 of AS/NZS 61439.1:2016.

(These ratings are based on test results and calculation using the values and derating factors from the 'Copper for Busbars'publication from the Copper Development Association and enclosure derating values from AS3000 - 1991 Table 3.)

### MAIN HORIZONTAL BUSBAR SYSTEM RATINGS

**1,250A** - 1 x 80 x 10mm HDHC natural copper busbar
**1,500A** - 1 x 100 x 10mm HDHC natural copper busbar
**1,600A** - 1 x 120 x 10mm HDHC natural copper busbar
**2,000A** - 2 x 80 x 10mm HDHC natural copper busbar
**2,500A** - 2 x 100 x 10mm HDHC natural copper busbar
**3,000A** - 2 x 120 x 10mm HDHC natural copper busbar
**3,200A** - 3 x 100 x 10mm HDHC natural copper busbar
**3,600A** - 3 x 120 x 10mm HDHC natural copper busbar
**4,000A** - 2 parallel sets of 2 x 80 x 10mm HDHC natural copper busbar
**5,000A** - 2 parallel sets of 2 x 120 x 10mm HDHC natural copper busbar

### DROPPER VERTICAL BUSBAR SYSTEM RATINGS

**700A** - 1 x 50 x 6.3mm HDHC tinned copper busbar
**800A** - 1 x 63 x 6.3mm HDHC tinned copper busbar
**1,000A** - 1 x 80 x 6.3mm HDHC tinned copper busbar
**1,250A** - 1 x 80 x 10mm HDHC tinned copper busbar

### FORM OF INTERNAL SEPARATION

The Moducell V2.2 is available with the following forms of internal separation:
Form – 1, 2a, 2b, 3a, 3b, 4a, 4b

### DEGREE OF PROTECTION

The Moducell V2.2 is available with the following degrees of protection:
IP Rating – IP54, IP66

Moducell IP66 outdoor modular switchboard with sunshields and roof

# Construction.

| ITEM | DESCRIPTION |
|---|---|
| **TYPE OF CONSTRUCTION** | MODULAR, DEMOUNTABLE |
| **ENCLOSURE MATERIAL** | 2.0MM ZINC ANNEAL STEEL |
| | 2.0MM 304 STAINLESS STEEL |
| | 2.0MM 316 STAINLESS STEEL |
| **DOOR HINGES TYPES** | LIFT OFF PINTLE HINGES (CHROME PLATED BRASS) |
| **DOOR LATCHING POSITION** | 8MM² INSERT, BOLTED LOCKS, CHROME PLATED BRASS (AVAILABLE AS AN INCREASED SECURITY MEASURE) |
| | 8MM² INSERT, QUARTER TURN LOCKS (CHROME PLATED BRASS) |
| | 8MM² INSERT, QUARTER TURN LOCKS (CHROME PLATED BRASS) FOR CABLE ZONE DOORS |
| **DOOR SEAL DETAILS** | RETAINED NEOPRENE RUBBER |
| **DOOR SWING** | 170 DEGREES |
| **DOOR INTERLOCKING** | DOOR INTERLOCKED WITH SWITCHING DEVICE |
| | BOLTED LIFT OFF COVERS (8MM HEX METAL THREADS) |
| | 80MM HIGH, 3.0MM THICK GALVABOND STEEL: POLYESTER POWDERCOATED (MINIMUS THICKNESS OF 70MICRONS) |
| **ARRANGEMENT** | DOUBLE SIDED, |
| | SINGLE SIDED |
| **STARTER/FEEDER MODULES** | PLUG IN DEMOUNTABLE |
| **PROTECTION AGAINST LIVE PARTS** | IP2X |
| **MULTI-DRIVE TIER CABLE ZONES** | FULL HEIGHT AVAILABLE IN 300 AND 400MM WIDE OPTIONS |
| **CABLE CONNECTION** | FRONT AND REAR OPTIONS |
| **CABLE ENTRY** | TOP AND BOTTOM OPTIONS |
| **GLAND PLATE MATERIAL & THICKNESS** | ALUMINIUM, 4.0MM STANDARD (OPTIONS - 6MM ALUMINIUM, 4MM AND 6MM BRASS) |
| **FUTURE EXTENSION** | LEFT AND RIGHT HAND END OPTIONS |
| **COATING** | ZINC ANNEAL: POLYESTER POWDERCOAT (MINIMUM THICKNESS OF 70 MICRONS) |
| | STAINLESS STEEL: NATURAL OR POWERCOATED |
| **COATING COLOURS** | FRAMES AND PLINTH: METALLIC CHARCOAL |
| | INTERNAL SUPPORTS, MOUNTING PANS, MODULES AND ESCUTCHEONS: GLOSS WHITE |
| | EXTERNAL DOORS AND COVERS: GENERALLY ANY READILY AVAILABLE POWDERCOAT COLOUR |

## TYPE TESTING

In recent years a much greater emphasis has been placed on operator safety and protection when working around, and more importantly when operating, electrical switchgear.

Revisions to the Australian Standards for Low Voltage switchgear and control gear assemblies have reflected this trend, with much greater emphasis being placed on the switchgear itself to provide a better level of protection to the operators in the event of a fault occurring.

## FACTORY ACCEPTANCE TESTING

All Moducell V2.2 power distribution switchboards and motor control centres undergo stringent factory acceptance testing prior to dispatch. All testing and recording of test results is done in accordance with the requirements of AS/NZS 3000 & AS/NZS 3017 and our quality assurance system.

## TYPE TESTS

The Moducell V2.2 has been type tested in accordance with the requirements of AS/NZS 61439.1:2016 - 'Low-voltage Switchgear and Controlgear Assemblies – Part 1: Type Tested and Partially Type Tested Assemblies'.

## TYPE TESTING HAS BEEN CONDUCTED AT -

Testing and Certification Australia (TCA), Sydney Australia.
Safety in Mines Testing and Research Station (SIMTARS), Brisbane Australia
Institut "Prüffeld für elektrische Hochleistungstechnik" GmbH (IPH), Berlin Germany
(Type tests conducted in Australia are NATA certified)
(Type tests conducted in Germany are ASTA certified)
Bureau Veritas

## TEMPERATURE RISE LIMITS (10.10)

Temperature rise limits have been verified by test for Incomer ACBs, busbar arrangements and outgoing functional units of various ratings.
Dielectric Properties (10.9)
Rated Operational Voltage (Ue) - 1,000VAC
Rated Insulation Voltage (Ui) – 1,000VAC
Rated Impulse Withstand Voltage – 12kV

## SHORT CIRCUIT WITHSTAND (10.11)

50kA for 1 second on the horizontal and vertical bus systems
50kA for 3 seconds on the horizontal and vertical bus systems
63kA for 1 second on the horizontal and vertical bus systems
65kA for 3 seconds on the horizontal and vertical bus systems
80kA for 1 second on the horizontal and vertical bus systems
100kA for 1 second on the horizontal and vertical bus systems

## EFFECTIVENESS OF THE PROTECTIVE CIRCUIT (10.5, 10.5.2, 10.5.3)

Effective connection between exposed conductive parts and the protective circuit (10.5.2) – Verified
Protective earth busbar – 60kA rms for 0.2s, 132kA peak

Rated conditional short-circuit current (10.5.3) protective circuit of the incoming 3200A ACB unit – 50kA at 240V, pf=0.25
Rated conditional short-circuit strength of protective circuit

(10.5.3) – 39kA rms at 240V, pf=0.25
Rated peak and short-time withstand current of the protective circuit – 39kA rms for 0.2s, 81.9kA pk

## CREEPAGE DISTANCES AND CLEARANCES (10.4)

Verified -
Rated Insulation Voltage (U_i) – 1,000VAC
Rated Impulse Withstand Voltage – 12kV
Material Group of II
Pollution Degree of 3

## STRENGTH OF MATERIAL AND PARTS (10.2)

Corrosion testing severity A (10.2.2.2)
Corrosion testing severity B (10.2.2.3)
Resistance to abnormal heat (10.2.3.2)

## MECHANICAL OPERATION (10.13)

Verified -
Demountable drive starter/ feeder module with module shutter and actuator fitted to assembly

## DEGREE OF PROTECTION AND INTERNAL SEPARATION (10.3)

Degree of protection for enclosure - IP54
Degree of protection for enclosure - IP66
Form of separation – Form 4a

## INCREASED SECURITY AGAINST THE OCCURRENCE OR THE EFFECTS OF INTERNAL ARCING FAULTS

When required the Moducell V2.2 can be manufactured to ensure increased operator safety in the event of an internal arcing fault.

The Moducell V2.2 has undergone extensive testing of outgoing functional units in accordance with the requirements of AS/NZS 61439.1:2016, Annex ZD.

## STANDARD TESTS (AS DEFINED BY AS/NZS 61439.1:2016 ANNEX ZC & ZD) –

Outgoing Functional Units 50kA @ 415VAC
Outgoing Functional Units 50kA @ 690VAC
Outgoing Functional Units 65kA @ 415VAC
Outgoing Functional Units 80kA @ 690VAC

## SPECIAL TESTS (AS DEFINED BY AS/NZS 61439.1:2016 ANNEX ZC & ZD) -

Outgoing Functional Units (Line side of protective device) 65kA@ 415VAC
ACB Incomer (Line side of protective device) 65kA @ 415VAC
Horizontal Main Busbar Chamber 65kA @ 415VAC
Light & Power Distribution Section (Outer door open, inner escutcheon closed) 65kA

# Test Report

Number 103657

Ausgrid Testing & Certification

**Apparatus** Selected incoming cabling compartments of a 415/690 V (Ue) 50 Hz, switchgear and controlgear assembly incorporating a three-phase horizontal busbar system and four incoming air circuit-breaker (ACB) units.

**Designation** IP54 Moducell v.2.2 14900 Type Test board 1

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 4 to 8 December 2014

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested generally* in accordance with:

**Australian Standard 3439.1:2002 Annex ZD and Client's instructions**

* See Test Conditions 6, 7 and 8.

***Tests***

***Internal arcing-fault tests (Annex ZD)***

**Special internal arcing fault tests - Panel 1F-03** : **50kA, 690V, pf = 0.25**
Incoming unit (ACB open) Test No. 9060.005

**Special internal arcing fault tests - Panel 2F-03** : **50kA, 415V, pf = 0.25**
Incoming unit cable compartment, (ACB open), Front access only Test No. 9060.009
Incoming unit cable compartment, (ACB closed), Front access only Test No. 9060.010
Incoming unit cable compartment, (ACB closed), Access front, rear and sides, all mullion and frame holes sealed. Test No. 9060.011

***Conclusion***

The selected cabling compartments, Panel 1F-03 and Panel 2F-03, withstood the special internal arcing tests above in accordance with Annex ZD of AS 3439.1 for operator protection.
Tests No. 9060.005 and 011 also validated operator protection for access at rear and sides up to a height of 2.0 m. Tests No. 9060.009 and 010, validate operator protection for front access only.



This Test Report comprises this front sheet, Addendum page A, 12 pages, 1 diagram, 6 oscillograms, 38 photographs, 3 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

21/8/2017
Date of Issue



# Test Report

Number 103659

Ausgrid Testing & Certification

**Apparatus** Selected compartments of two test arrangements, A2 and A3, of a 415 V (Ue) 50 Hz, switchgear and controlgear assembly incorporating three-phase horizontal and vertical busbar systems, two 2500 A incoming air circuit-breaker units, two incoming/outgoing air circuit-breaker units and one outgoing modular plug-in feeder L&P DB unit.

**Designation** Moducell v2.2 IP54 Test Board 2

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 27 September 2012 to 28 March 2013

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested generally* in accordance with:

**Australian Standard 3439.1:2002 Annex ZD and Client's instructions**

* See Test Conditions 6, 7 and 8

***Internal arcing-fault tests (Annex ZD)***

**Special internal arcing fault tests** : 65 kA rms at 415 V
L&P DB 250 A MCCB unit compartment (A2) for a designated duration of 0.3s, maintained for 3.1 ms
800 A ACB unit compartment (A2) for a designated duration of 0.3s, maintained for 44.3 ms
1250 A ACB unit compartment (A2) for a designated duration of 0.3s, maintained for 29.6 ms
Incoming 2500 A Terasaki unit No. 1 compartment (A2) for a duration of 0.3s
Incoming 2500 A Terasaki unit No. 1 compartment (A3) for a duration of 0.3s
800 A ACB unit compartment (A3) for a duration of 0.3s
Incoming 2500 A Siemens unit No. 1 compartment (A3) for a duration of 0.3s

**Conclusion**
The unit compartments withstood the special internal arcing tests above in accordance with Annex ZD of AS 3439.1 and Client's instructions for operator protection. The special internal arcing tests on the L&P DB 250 A MCCB, 800 A ACB (A2) and 1250 A ACB unit compartments did not sustain for the designated durations however withstood the tests for the test durations achieved.



This Test Report comprises this front sheet, Addendum page A, 16 pages, 1 diagram, 8 oscillograms, 50 photographs, 4 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

21/8/2017
Date of Issue



# Test Report

Number 103666

Ausgrid Testing & Certification

**Apparatus** Two three-phase vertical busbar systems in a 440 V / 1000 V / 12 kV (Ue/Ui/Uimp), 50 Hz, low voltage assembly each incorporating an air circuit-breaker (ACB) functional unit. The vertical busbar systems are connected to a main horizontal three-phase and neutral busbar system.

**Designation** IP54 MODUCELL v2.2

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court
Edinburgh SA 5111 Australia

**Date of Tests** 22 July 2013

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested generally* in accordance with:

**Australian Standard 3439.1 : 2002, Clause 8.2.3**

* See Test Condition 3 and 5.

***Tests***

***Verification of short-circuit withstand strength (8.2.3)***

**Short-circuit withstand strength tests** (8.2.3.2.3 b)

Tier 2 – Three-phase vertical busbars : 100kA rms for 1 s, 220kA peak
Tier 3 – Three-phase vertical busbars : 100kA rms for 1 s, 220kA peak

**Conclusion**
The Tier 2 and Tier 3 three-phase vertical busbar systems withstood the short-circuit withstand strength tests in accordance with AS 3439.1 : 2002, clause 8.2.3 with the ACB functional units bypassed.



This Test Report comprises this front sheet, Addendum page A, 9 pages, 1 diagram, 2 oscillograms, 14 photographs, 4 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

24/8/2017
Date of Issue



# Certificate

*of Selected Type Tests*

Ausgrid Testing & Certification

Number 103667

**Apparatus** The main horizontal three phase and neutral busbar system, one functional unit fitted with a 3200 A ACB and its connection phase busbars, two vertical three phase and neutral busbar systems and the protective circuit of a 690 V/1000V/ 12 kV (Ue/Ui/Uimp), 50 Hz low voltage assembly.

**Designation** MODUCELL v2.2

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 21 to 23 March 2011

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to a series of proving tests in accordance with:

**AS/NZ 3439.1: 2002, Clause 8.2.2, 8.2.3, 8.2.4.2 and 8.2.5**

The results are shown in the Test Record and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard and to justify the rating assigned by the manufacturer as stated below.

***Verification of dielectric properties(Clause 8.2.2)*** : 690 V/1000 V/12 kV (Ue/Ui/Uimp)
***Short-circuit withstand strength (Clause 8.2.3)***
**Rated peak and short-time withstand current (Clause 8.2.3.2.3 b)**
Vertical phase busbars Tier 2 (1-80mm x 6.3mm tinned cu bar) : 50 kA rms for 3 s, 105 kA peak
Vertical phase busbars Tier 3 (1-80mm x 10mm tinned cu bar) and 3200 A ACB functional unit and its connection busbars Tier 1 : 65 kA rms for 3 s, 143 kA peak
Main horizontal phase busbars (1-80mm x 10mm cu bar) : 65 kA rms for 3 s, 143 kA peak
**Rated peak and short-time withstand current (Clause 8.2.3.2.3 d)**
Vertical neutral busbar Tier 2 (1-80mm x 6.3mm tinned cu bar) : 30 kA rms for 3 s, 63 kA peak
Vertical neutral busbar Tier 3 (1-80mm x 10mm tinned cu bar) : 39 kA rms for 3 s, 81.9 kA peak
Main horizontal neutral busbar (1-80mm x 10mm cu bar) : 39 kA rms for 3 s, 81.9 kA peak
***Verification of the short-circuit strength of the protective circuit by test (8.2.4.2)***
Rated conditional short-circuit strength of protective circuit : 39 kA rms at 240 V, pf = 0.25
Rated peak and short-time withstand current of the protective circuit : 39 kA rms for 0.2s, 81.9 kA pk
1–32mm x 6.3mm bare cu bar
***Verification of clearances and creepage distances (8.2.5)*** : Verified



This Certificate comprises this front sheet, Addendum page A, 18 pages, 1 diagram, 8 oscillograms, 13 photographs, 9 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

8/11/2017
Date of Issue



# Test Report

Number 103669

Ausgrid Testing & Certification

**Apparatus** A 415 V / 800 V / 12 kV (Ue / Ui / Uimp), 50 Hz low voltage assembly comprising a main horizontal three phase and neutral busbar system, one vertical three phase system, two vertical three phase and neutral busbar systems, one incoming ACB unit, two outgoing MCCB units with Kerpan busplugs and one protective circuit.

**Designation** MODUCELL v2.2

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 25 to 27 May 2011

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested in accordance with:

**AS/NZ 3439.1: 2002, Clauses 8.2.2.4, 8.2.3 and 8.2.4.2.**

***Tests***

***Verification of dielectric properties (8.2.2.4)***
Complete assembly 800V ( Ui ) : Verified
Main busbar system only 1000V ( Ui ) : Verified
***Verification of short-circuit withstand strength (8.2.3)***
**Rated conditional short-circuit current tests (8.2.3.2.3 a)**
Outgoing 250 A MCCB unit with 400A plug-in : 100 kA rms at 415 V, pf = 0.2
Outgoing 250 A MCCB unit with 250A plug-in
**Short-circuit strength tests (8.2.3.2.3 b)**
Main horizontal phase busbars (1 x 80mm x 10mm Cu) : 100 kA rms for 1 s, 220 kA peak
Vertical phase busbars - Tier 3 (1 x 80mm x 10mm Cu)
**Short-circuit strength tests (8.2.3.2.3 d)**
Main horizontal neutral busbar (1 x 80mm x 10mm Cu) : 60 kA rms for 1 s, 132 kA peak
Vertical neutral busbar - Tier 3 (1 x 80mm x 10mm Cu)
***Verification of the effectiveness of the protective circuit (8.2.4)***
**Verification of short-circuit withstand strength of the protective circuit by test (8.2.4.2)**
Protective earth busbar (1 x 32mm x 6.3mm Cu) : 60 kA rms for 0.2 s, 132 kA peak

***Conclusion***
The assembly withstood the tests in accordance with the selected clauses of the Standard. See Test Results for details.



This Test Report comprises this front sheet, Addendum page A, 17 pages, 1 diagram, 7 oscillograms, 29 photographs, 9 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

31/8/2017
Date of Issue



# Certificate

*of Short-circuit Rating*

Ausgrid Testing & Certification

Number 103671

**Apparatus** Two main horizontal three phase busbar systems, three vertical phase busbar systems, one incoming ACB, three outgoing ACB units and one horizontal neutral bar arrangement of a three tier 1000 V / 1000 V / 12 kV (Ue/Ui/Uimp), 50 Hz low voltage assembly.

**Designation** MODUCELL v2.2

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 24 March to 13 May 2009

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to a series of proving tests in accordance with:

**AS/NZ 3439.1: 2002, Clause 8.2.2 and 8.2.3**
**and IEC 60439-1:2004 Clause 8.2.9**

The results are shown in the Test Record and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard and to justify the rating assigned by the manufacturer as stated below.

For ratings assigned by the manufacturer and proven by the tests see page 1.



This Certificate comprises this front sheet, Addendum page A, 16 pages, 1 diagram, 6 oscillograms, 10 photographs, 12 drawings and no other sheets as detailed on page 2.

A. J. McClelland
Authorised Signatory

Manager - LCTS

30/11/2017
Date of Issue



# Test Report

Number 103673

Ausgrid Testing & Certification

**Apparatus** A 415 V (Ue) 50 Hz, power switchgear and controlgear (PSC) assembly incorporating three phase horizontal and vertical busbar systems, one incoming air circuit-breaker unit, one incoming/outgoing air circuit-breaker unit, fifteen outgoing modular plug-in DOL motor starter units and seven outgoing modular plug-in feeder units.

**Designation** Moducell v2.2 IP54 Test Board 1

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 4 to 16 November 2011

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested in accordance with:

**AS/NZ 3439.1: 2002, Clause 8.2.1 and IEC 61439-2:2011, Clauses 8.101, 10.10.2.3.5**

***Tests***

**Verification of temperature-rise limits :**

Test at 2740 A rating when the incoming unit was ventilated and with rated current in outgoing unit numbers 2, 3, 4, 5, 6, 7 with the limits according to IEC 61439-2 applied.
Test at 2500 A rating when the incoming unit was ventilated and rated current in vertical busbars of panels 3 and 4 and limits according to AS 3439-1 applied.
Test at 2350 A rating when the incoming unit was not ventilated and with rated current in outgoing unit numbers 2, 3, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24 with the limits according to IEC 61439-2 applied.

**Form of Separation 4a.**

***Conclusion***

The assembly met the requirements of the Standards for the form of separation 4a and the temperature-rise tests with the configurations and current ratings as outlined within the Test Record pages. The tests verified the rated currents as detailed in Tables 1A, 1B and 1C of this Test Report. The various ventilation configurations and test currents are detailed on the drawings and in the Test Record pages.



This Test Report comprises this front sheet, Addendum page A, 35 pages, 57 photographs, 25 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

31/8/2017
Date of Issue



# Test Report

Number 103675

Ausgrid Testing & Certification

**Apparatus** A 415 V (Ue) 50 Hz, switchgear and controlgear assembly incorporating three-phase horizontal and vertical busbar systems, one incoming air circuit-breaker unit and five outgoing ACB units.

**Designation** 4500 A Main Switchboard

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 12 to 16 June 2009

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested in accordance with:

**AS/NZ 3439.1: 2002 and IEC 60439-1:2004, Clause 8.2.1**

***Tests***

Verification of temperature-rise limits :

Nine temperature-rise tests with various ventilation configurations were performed to the requirements of AS/NZ 3439.1:2002.

Two temperature-rise tests with various ventilation configurations were performed to the requirements of IEC 60439-1:2004.

***Conclusion***

The assembly met the requirements of the Standards with the ventilation configurations and current ratings as outlined within the Test Record pages. The tests verified the rated currents as detailed in Tables 1A and 1B of this Test Report. The various ventilation configurations and test currents are detailed on the drawings and in the Test Record pages.



This Test Report comprises this front sheet, Addendum page A, 78 pages, 48 photographs, 18 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

31/8/2017
Date of Issue



# Test Report

Number 103674

Ausgrid Testing & Certification

**Apparatus** A 415 V (Ue) 50 Hz, power switchgear and controlgear (PSC) assembly incorporating three-phase horizontal and vertical busbar systems, one incoming air circuit-breaker unit, one incoming/outgoing air circuit-breaker unit, three outgoing modular plug-in DOL motor starter units and one outgoing modular plug-in feeder unit.

**Designation** Moducell v2.2 IP54 Test Board 2

**Vendor** Mayfield Industries Pty Limited
3 Gidgie Court Edinburgh SA 5111 Australia

**Dates of Tests** 21 and 22 November 2011

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Test Report has been tested in accordance with:

**AS/NZ 3439.1: 2002, Clause 8.2.1 and**
**IEC 61439-2:2011, Clauses 8.101, 10.10.2.3.5 and 10.10.2.3.7 b)**

***Tests***

**Verification of temperature-rise limits :**

Test at 2500 A rating when the incoming unit was ventilated and limits according to IEC 61439-2 applied.
Test at 2250 A rating when the incoming unit was not ventilated and with rated current in outgoing unit numbers 3, 4, 5 and 6 and limits according to IEC 61439-2 applied.
Test at 2100 A rating when the incoming unit was not ventilated and the limits according to AS 3439-1 applied.
Test at 2500 A rating when the incoming unit was ventilated and rated current in vertical busbars of panels 3 and 4 and limits according to IEC 61439-2 applied.

**Form of Separation 4a.**

***Conclusion***

The assembly met the requirements of the Standards for the form of separation 4a and the temperature-rise tests with the configurations and current ratings as outlined within the Test Record pages. The tests verified the rated currents as detailed in Tables 1A, 1B and 1C of this Test Report. The various ventilation configurations and test currents are detailed on the drawings and in the Test Record pages.



This Test Report comprises this front sheet, Addendum page A, 23 pages, 22 photographs, 24 drawings and no other sheets as detailed on page 1.

A. McClelland
Authorised Signatory

Manager - LCTS

31/8/2017
Date of Issue

Mayfield is committed to play a leading role for local manufacturing to be globally competitive. Our determination is to create world-class solutions for client needs for safety, with uninterrupted power.

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