CONFIDENTIAL

Specification – Air Insulated Ring Main Unit Switchgear

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** Shall be the Process Owner and is the person assigned authority and responsibility for managing the whole process, end-to-end, which may extend across more than one division and/or functions, in order to deliver agreed business results.*

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STAKEHOLDERS *The following positions shall be consulted if an update or review is required:*	
Manager Engineering & Project Services	Asset Managers
Manager Systems & Network Planning	Manager Assets Services
Senior Manager Safety, Health and Wellbeing	Generation

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1 SCOPE

Ring Main Units (RMU) is a factory assembled metal enclosed set of medium voltage switchgear (hereby referred to as the '*Equipment*') utilised in a ring-type electrical distribution network. The RMU will be installed outdoors in a metal kiosk or inside a building with metering panels.

The specification sets out the technical (electrical and mechanical) requirements for the performance, testing and supply of RMU, Remote Terminal Unit (RTU), Metal Kiosk and Energy Metering Panel.

Approval in terms of this specification shall be obtained by one or a combination of the following:

a) Successful completion of the appropriate tests required by this specification by an independent and accredited test authority.

b) Provision test certificates from an independent and accredited test authority based upon an alternative specification, with test requirements at least equivalent to this specification.

NOTE: Verification of accreditation of the test authority shall be provided by NATA (National Association of Testing Authorities) accredited test house or by a test house possessing from a NATA MRA (Mutual Recognition Agreement) partner.

Tenderers must state any non-compliance with the specification in any tender submission and any alternative offers must be submitted in full and separately from any main offer.

2 NORMATIVE REFERENCES

2.1 Standards

2.1.1 Horizon Power Standards

[1] *Horizon Power Environmental Conditions*, standard number HPC-9EJ-01-0001-2013, available at http://horizonpower.com.au/contractors-suppliers/contractors/manuals-and-standards/ under the 'Standards' heading.

2.1.2 Australian Standards

The following standards are available at http://www.saiglobal.com.

[2] AS 1170.2:2021 – Structural design actions – Wind Actions.

[3] AS 1170.4:2007 – Structural design actions – Earthquake Actions in Australia.

[4] AS 1580.0:2004 – Paints and related materials – Methods of test Part 0: Introduction and list of methods.

[5] AS 2312.1:2014 – Guide to the Protection of Structural Steel against Atmospheric Corrosion by the use of Protective Coatings.

[6] AS 2700:2011 – Colour Standards for General Purposes.

[7] AS/NZS 3000:2018 – Electrical Installations – AS/NZ Wiring Rules.

[8] AS/NZS 3100:2022 – Approval and test specification – General requirements for electrical *Equipment*.

[9] AS/NZS 4680:2006 – Hot-dip galvanised (zinc) coatings on fabricated ferrous articles.

[10] AS/NZS 60137:2020 – Insulated bushings for alternating voltages above 1000 V

[11] AS 60265.1:2001 – High-voltage switches Part 1: Switches for rated voltages above 1 kV and less than 52 kV.

[12] AS 60529:2004 – Degrees of protection provided by enclosures (IP Code).

[13] AS 60890:2009 – A method of temperature-rise assessment by extrapolation for partially type-test assemblies (PTTA) of low-voltage switchgear and controlgear.

[14] AS 61869.1:2021 – Instrument Transformers Part 1: General requirements.

[15] AS 61869.2:2021 – Instrument Transformers Part 2: Additional requirements for current transformers.

[16] AS 61869.3:2021 – Instrument Transformers Part 3: Additional requirements for voltage transformers.

[17] AS 62271.1:2019 – High-voltage switchgear and controlgear Part 1 Common specifications for alternating current switchgear and controlgear.

[18] AS 62271.100:2019 – High-voltage switchgear and controlgear Part 100: Alternating current circuit breakers.

[19] AS 62271.102:2019 – High-voltage switchgear and controlgear Part 102: Alternating current disconnectors and earthing switches.

[20] AS 62271.105:2015 – High-voltage switchgear and controlgear Part 105: Alternating current switch fuse combinations for rated voltages above 1 kV up to and including 52 kV.

[21] AS 62271.200:2019 – High-voltage switchgear and controlgear Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.

[22] AS 62271.202:2019 – High-voltage switchgear and controlgear Part 202: High-voltage/low-voltage prefabricated substation.

2.1.3 International Standards

[23] DIN 43265:1973 – Current collector for contact rail; main dimensions.

[24] EN 50180-1:2015 – Bushings above 1 kV up to 52 kV and from 250 A to 3.15 kA.

[25] IEC 60282-1:2020 – High-voltage fuses – Part 1: Current-limiting fuses.

[26] IEC 62271-215:2021 – High-voltage switchgear and controlgear Part 213: Voltage detecting and indicating system.

2.1.4 Compliance with Standards

Various Standards are referenced in this Specification. The Standards have reference to the year they were published. If over the life of the Tender the Standards change, the Vendor is required to conform to the new edition of the Standard.

Unless otherwise specified herein, the *Equipment* shall be designed, manufactured and type and routine tested in accordance with the referenced Australian Standards, including all amendments. Where there is no Australian Standard equivalent, International Standards or Codes as defined in this specification shall be used. The specified documents contain provisions that, through reference in the text, constitute requirements of this Specification. At the time of publication of this Specification, the editions indicated were valid. Information on currently valid national and international standards may be obtained from the Australian Standards website – http://www.saiglobal.com.

2.2 Definitions and Abbreviations

For the purposes of this specification, definitions shall apply as in the relevant Australian Standards with the addition of the following general definitions:

***Equipment*:** Ring Main Unit switchgear and can be a combination of switch disconnector, fuse switch and circuit breaker panels/modules.

RTU: Remote Terminal Unit.

3 GENERAL TECHNICAL REQUIREMENTS

3.1 General

The RMU shall be supplied fully motorised and wired, ready for automation and telemetry. There shall not be any additional wiring required on site.

3.2 Outdoor Installation

The *Equipment* shall be suitable for outdoor mounting on a support stand and housed inside a metal kiosk, see section 4.14.

3.2.1 Configuration

For outdoor application, Horizon Power requires the following configurations:

1) Unitised 3-way and 4-way single side extensible.

2) Unitised 5-way non extensible.

3) 1-way non extensible.

4) 1-way double extensible.

5) RTU.

The Schedule of *Equipment* contained in Appendix G will provide the different combinations of outdoor installations used by Horizon Power.

All 3-way and 4-way unitised configurations shall be right side extensible, this will allow Horizon Power, when there is a need, to potentially connect a 1-way double extensible to form an extended 4-way or 5-way combination.

A unitised 5-way is the largest combination Horizon Power would use.

The 1-way non extensible shall be used to connect to a 3-way or 4-way right extensible to form a split bus configuration.

3.3 Indoor Installation

The *Equipment* can form part of an indoor installation as shown in Horizon Power's Distribution Construction Standards G3-22B. Pre-cast concrete tilt up building, transportable switch room or building basements are considered indoor installations. The *Equipment* shall be installed over a cable trench, mounted to floor brackets and shall arc vent into the cable trench.

3.3.1 Configuration

For an indoor installation. The following units are required:

1) 1-way double extensible.

2) 1-way metering unit.

3) 1 way non extensible.

4) RTU.

The indoor configuration will vary depending on project requirements.

3.4 Environment Conditions

The performance of the *Equipment* must meet the requirements set in Section 4.1 of the *Horizon Power Environmental Conditions [1].*

3.5 Electrical Requirements

The electrical requirement of *Equipment* type is shown in Appendix C.

3.6 Mechanical Verification

The RMU shall be built to and be able to withstand the Internal Arc test in accordance with *AS 62271.200 [21].*

4 SPECIFIC TECHNICAL REQUIREMENTS

4.1 Ring Main Unit

The RMU shall consist of a low voltage, main switch, busbar and cable termination compartments. The design shall be modularised with the electrically active parts of each compartment in suitably insulated and sealed housing to remain insensitive to moisture and dust ingress.

The low voltage compartment shall be sized adequately so relays, voltage presence and fault indicators can be mounted.

The switch compartment of the RMU shall feature a 3-position switch i.e. ‘Open’, ‘Close’ and ‘Earth’.

RMU feeder and metering panels up to 33 kV shall have 630 A, ‘Type C’, MV dead dead-break bushings in accordance with *EN 50180 [24]* and *AS/NZS 60137* [10] for connection of cables with screened separable connectors. For transformer panels, the dead break bushings shall be 200 A, ‘Type A’. Cable clamps shall be supplied in all cable compartments.

The *Equipment* must comply with Loss of Service Continuity level Category LSC2A as defined in *AS 62271.200 [21]*.

Switch-disconnectors and circuit breakers must be supplied fitted with motorisation and associated accessories. Circuit breakers must be supplied fitted with motor mechanism for charging of springs. Fuse-switch and earth-switches do not need to be motorised. The automated units must have facilities for remote control suitable for interfacing to Horizon Power’s Supervisory Control and Data Acquisition (SCADA) system Remote Terminal Unit (RTU). Motorised equipment and control must operate on 24 Vdc.

Each automated unit must be provided with a separate Local/Off/Remote switch with padlocking facility (preferably with 10 mm diameter hole for padlocking). Manual operation, if and when required, must not be impeded by the automation of the unit. Interlocking must be provided that prevents the motorised operation when a manual operation is being attempted or if the unit’s EARTH switch is in the "ON" position.

Each automated unit shall be fitted with the following for direct connection to the RTU:

1) 1 x 10 m pre-wired control cable with Harting plug for direct connection to the RTU socket,
2) 1 x set of 3 x split CT’s,
3) 1 x 10 m pre-wired CT cable (with shorting plug at RTU end of cable),
4) 1 x VT cable.

4.1.1 Internal Arc Classification

The *Equipment* main switch and busbar compartments shall have an internal arc classification of ‘A-FL’ in accordance with *AS 62271.200 [21]*. The design of the RMU shall not be reliant on operation of an arc suppression device to achieve IAC.

Horizon Powers preference for venting arc shall be:

1) Down into the cable termination compartment for outdoor applications.
2) Down into the switch room cable trench for indoor applications. If the Vendor vents using a duct system to the outside of the building, Horizon Power shall review the option.

NOTE: For outdoor installations, the metal kiosk shall have an IAC classification of IAC-AB in accordance with *AS 62271.202 [22]*. The kiosk, with the doors closed, must protect a trained operator and member of the public from an internal arc.

4.1.2 RMU Functions

The RMU shall have the following switchgear functions:

1) Switch-Disconnector and Earth Switch.

2) Fuse-switch and Earth Switches.

3) Circuit Breaker and Earth Switch.

4.1.3 Switch Disconnector and Earth Switch

Switch disconnectors and earth switches must be load-breaking and fault-making type and comply in all respects with *AS 60265.1 [11]* and *AS 62271.102 [19]*.

Each switch-disconnector must be provided with a three-position switch with the earth switch mechanically interlocked when earthing the isolated feeder cable. The design must prevent simultaneous closing of the main switch contacts and the earth switch contacts. The interlocking is detailed in Section 4.4.

The switch-disconnectors and earth switches must be three-phase, spring assisted and manually gang-operated. The earth switch contacts must be designed to close onto a fault and must have the same short circuit capacity as that of the main switch disconnector itself.

The front panel of each switch unit must incorporate a mimic display of the switching arrangement with clear signs to ensure a high level of safety in operation. The operating positions must be clearly marked, indicating the "ON" and "OFF" and 'EARTHED" position.

Local and remote controls must be provided to open and close the switch-disconnector. Interposing relays (or equivalent) fitted for switch-disconnector control (open / close). The switchgear must mechanically latch when the desired control position (open / close) position is reached. The following must be provided:

1) OPEN command (1 interposing relay) – operates on a pulsed control from the RTU;
2) CLOSE command (1 interposing relay) – operates on a pulsed control from the RTU;
3) Open / Close Circuit indication (2 auxiliary switches with opposite indicating contacts per unit);
4) Earth switch indication (1 auxiliary switch with opposite indicating contacts per unit) and
5) Local / Remote control indication (1 auxiliary switch).

The Vendor must make provision in the design for weatherproof cable grommets and a cable gland plate to allow all control, CT and VT cables to be connected between the RMU and RTU with particular emphasis on not affecting IAC compliance.

4.1.4 Fuse Switch and Earth Switch

The fuse-switch combinations and earth switches must comply in all respects with *AS 62271.1 [17]* and *AS 62271.105 [20]*.

Fuse-switches with High Rupture Capacity (HRC) fuse carriers must have a "trip all phases" device to disconnect all phases, due to the operation of one or more fuses.

The fuse-switches and earth switches must be three-phase, spring assisted and manually gang operated. The front panel of each switch unit must incorporate a mimic display of the switching arrangement with clear signs to ensure a high level of safety in operation. The operating positions must be clearly marked, indicating the "ON" and "OFF" position for both the fuse-switch and earthing switch.

The fuse carrier must remain effectively earthed on both sides during fuse replacement by the earth switch provided with the fuse-switch.

Fuse-switches must take fuses complying with *IEC 60282.1 [25]*, *AS 62271.105 [20]* and *DIN 43265 [23]*. Horizon Power's range of standard fuses is detailed in Appendix F.

The Vendor must detail the maximum allowable HRC fuse power loss (in Watts) values for the fuse-switch units under normal operation. These values must account for the entire range of environmental conditions detailed in Section 3.4 and should consider all *Equipment* configurations.

If an over-temperature tripping feature is incorporated with the HRC fuse tripping arrangement, then the operation of the feature must be detailed in the Vendor's Proposal.

It is acknowledged that in the case of fuse-switch combination units, separate fuse base fittings and/or adaptors may be required to suit Horizon Power's standard range of HRC fuses, which differ in rating and size (i.e. 292 mm for 6.6/11 kV, 442 mm for 11/22 kV and 537 mm for 33 kV applications).

The Vendor must offer and supply suitable fuse adaptors for use on dual rated (11 kV and 22 kV) *Equipment* and must submit details in the Proposal.

Any *Equipment* that requires mechanical modification (removal and/or fitment of components directly to the *Equipment*) to facilitate the installation of shorter fuses will not be considered. Preference will be given to fuse adaptors that fit directly to short length fuses.

4.1.5 Circuit Breaker, Switch Disconnector Earth Switch

The circuit breaker shall come with a switch disconnector, vacuum bottle and earth switch and shall be built in accordance with *AS 62271.100 [18]*. The CB shall be a fixed type and designed for interrupting full rated fault current and for making full fault current. The CB interrupting medium shall occur within a vacuum bottle.

The CB shall be supplied with protection relay that is self-powered requiring no auxiliary power to open all phases when a fault is detected.

The motor mechanism must automatically charge the springs once the auxiliary voltage is turned on, without need for any manual charging. The automated unit must be able to handle a lock out tag out system i.e. no unauthorised switching must be attempted when the earth switch is ON and "locked out" during maintenance.

The following must be provided:

1) OPEN command (1 interposing relay) – operates on a pulsed control from either the RTU or push button on unit;
2) CLOSE command (1 interposing relay) – operates on a pulsed control from either the RTU or push button on unit;
3) Open / Close Circuit indication (2 auxiliary switches with opposite indicating contacts per unit);
4) Disconnector & Earth switch indication (1 auxiliary switch with opposite indicating contacts per unit);
5) Motor control indication (1 auxiliary switch) and
6) Local / Remote control indication (1 auxiliary switch).

Factory fitted automated controls may be offered as an option.

4.1.5.1 Circuit Breaker Operating Mechanism

CBs must be trip-free and be equipped with a stored energy operating mechanism. Designed so that no harm shall be inflicted on the operator or damage shall be caused to any part of the switchgear, if the charged closing or charged opening mechanism is released when the circuit breaker changes state from CLOSE position to OPEN position and from OPEN position to CLOSE position respectively.

The CB must have mechanical indication of charge status of the operating mechanism, be manually chargeable by hand (using operating handle) and automatically chargeable through a motorisation device.

Manual charging of the mechanism shall override motorised charging when the manual charging handle is inserted in the charging handle keyhole and the charging motor power supply shall be electrically disconnected by the presence of the manual operating handle in position.

The operating mechanism of CBs must provide independent manual closing and stored energy tripping. Opening of the CB must be by local manual trip button, by protective relay circuit and by remote tripping signal. Closing movement must charge the opening mechanism of the circuit breaker. The CB must be fitted with an integrated push button for manual tripping.

The mechanism charging motor must be fitted to circuit-breaker and charge a discharged mechanism in no more than 3 minutes.

With the CB CLOSED and closing mechanism fully charged the CB shall be able to perform an OPEN-300 mS-CLOSE-OPEN operation sequence.

The electrically powered motorisation device must be capable of being set to automatically or manually charge the mechanism when discharged.

The mechanism charge motor must be rated at 24 Vdc and less than 100 W (continuous).

4.1.5.2 Circuit Breaker Operation

The CB shall be constructed in such a way that mechanical interlocks to prevent any unauthorised operations. The CB shall be connected; in series and mechanically interlocked, with a three position-independent operation switch disconnector and earth switch. This CB-switch disconnector shall have the following positions with mechanical mimic diagram indicators:

1) In Service (Closed) position.

2) Disconnected Out-of-Service (Opened) position.

3) Earthed (Earth On) position.

Each CB shall have 2 NO (Normally Open) & 2 NC (Normally Close) contacts besides the switch disconnector and earth switch contacts pre-wired to a terminal block on the switchgear panel isolated from the MV circuits suitable for connection to Remote Telecontrol Unit (RTU).

The CB shall be provided with an “anti-pumping” device to prevent repetitive closing of the CB due to a sustained close pulse in trip on fault situation.

The technical requirement of the CB is outlined in Appendix C.

4.1.5.3 Circuit Breaker Protection

A CB shall be utilised with protection relay to clear overcurrent and earth faults. It shall be of compact nature to be installed on the low voltage compartment of the RMU.

An overcurrent or earth fault detected in either one phase or three phase will result in all phases being disconnected from the network. The relay shall require no auxiliary power supply to trip all phases under fault.

The Vendor shall provide details in the Proposal of the protection system used, including the following:

1) CB and relay operating principle.

2) The rated operating sequence of the CB in accordance with *AS 62271.100 [18]*.

3) Characteristics curves for over-current and earth-fault protection conditions respectively.

4) Relay settings and programming methods.

5) Estimated lifespan of CB equipment and associated protection relays.

6) Maintenance parameters and intervals.

7) The maximum number of mechanical trip and close operations under different loading conditions e.g. under full load and under short circuit conditions allowed.

8) The operating times (i.e. Opening and Closing Times) of the CB unit in milliseconds.

The protection relay and associated electronics must operate under the environmental conditions as specified in *Horizon Power Environmental Conditions*, standard number HPC-9EJ-01-0001-2013 [1]

4.1.5.4 Circuit Breaker Labels

Special labels shall be provided for all RMU CB front panels. The labels shall be made of UV stabilised plastic with permanent black markings (yellow background). The labels shall be permanently attached next to the associated CB push buttons, status indicator windows and CB power and signal isolator MCB respectively.

Labels as follows:

1) CB TRIP – permanently attach label next to CB Trip Push Button

2) CB CLOSE – permanently attach label next to CB Close Push Button

3) 0 – CB OPEN – permanently attach label next to CB status indicator window

4) I - CB CLOSED – permanently attach label next to CB status indicator window

5) MOTOR ISOLATE – permanently attach label next to motor power isolator MCB

6) REMOTE ISOLATE – permanently attach label next to SCADA control isolator MCB

4.2 Indoor Metering

The energy metering unit is a requirement for indoor RMU installations. The metering unit will be connected on either side of a disconnector switch or circuit breaker unit.

4.2.1 Design

The metering unit comprises of a primary metering compartment and a meter marshalling compartment that is installed/located above the primary metering compartment.

Steel lifting lugs (of at least 3 mm thickness) must be provided on both sides of the metering unit that shall be suitable for lifting the metering unit primary and marshalling meter compartments. A suitable steel spreader beam shall be provided fixed to both lifting lugs to facilitate lifting and to prevent paintwork damage during lifting. The lifting eyelets and spreader beam shall be removable after installation as needed.

The surface preparation, finishing and painting specification and standards compliance requirements as applied to the equipment supplied shall be extended to include the metering unit. The colour scheme and surface finishing of the "marshalling cubicle" shall match the colour scheme and finishing of the Primary Metering Cubicle such that it shall blend in with the switchgear and metering equipment when installed.

Vendor must submit with the Proposal, dimensioned outline drawings, schematic, layout and wiring diagrams of the metering units for review by Horizon Power.

4.2.2 Primary Metering Compartment

The primary metering compartment shall house the Current Transformers (CT), Voltage Transformers (VT), associated main busbars and busbar coupling receptacles, it shall have a removable, sealable and lockable front panel to allow access during installation, testing, commissioning and maintenance.

4.2.3 Metering Marshalling Compartment/Enclosure

The marshalling cubicle must have a sealed and lockable marshalling enclosure that may be safely accessed from the front of the metering unit, with the main busbars live. The bottom of the marshalling cubicle must be located between 1.0 to 1.5 metres above ground level, for easy access to secondary terminations during commissioning and testing. Such ancillary equipment as panel heater wiring and fusing must be excluded from this cubicle. An earth stud must be provided with connection to the earth system via the main earth bar or conductor.

The marshalling cubicle must have two segregated compartments – Horizon Power compartment (left side) and Customer compartment (right side) respectively. Both compartments shall be independently accessible from the front via 2 non-removable doors hinged on the left and right sides respectively. Both doors shall be independently secured in the closed position.

Each compartment door shall open 115 degrees (max) from closed position towards the operator to give access to the inside of the enclosure and each door shall be independently secured with a non-lockable winged handle when closed.

Each compartment shall have a vertical 2-section equipment mounting plate made of durable insulating material (e.g. black melamine plastic) of 6 mm minimum thickness. The top half equipment mounting plate in both compartments shall be hinged and shall open towards the operator 75 degrees (max) to give access to the rear of the insulating plate, whilst the bottom half, the terminal block mounting plate shall be fixed and used to mount the termination block to be supplied and factory fitted by the Vendor.

The Horizon Power compartment shall house Horizon Power's metering termination block, revenue meter and associated telemetering equipment. The hinged top half equipment mounting plate shall be used to mount a CT energy meter and modem. A fuse carrier (SAFECLIP SC32) and corresponding fuse rated 6 A shall be provided for each VT (phase) secondary side for meter wiring and wired as per Meter Wiring Drawing in Appendix H.

The Customer compartment shall house the Customer's metering termination block and the Customer's own metering equipment. The hinged top half equipment mounting plate shall be left vacant. A fuse carrier and corresponding fuse rated 2 A shall be provided for each VT (phase) secondary side for meter wiring and wired as per Meter Wiring Drawing in Appendix H. A durable, UV stabilised, permanent and waterproof label shall be fitted to the outside of the customer compartment door and another label shall be fitted on the inside of the same door with the following words, "MAX VT FUSE 2 A".

Equipment in both compartments must be wired with ferrules numbered in accordance with Meter Wiring Drawing in Appendix H.

Suitably cut slots and holes for the metering and communications equipment wiring to pass through shall be provided on all four (4) items of hinged and fixed insulated mounting plates.

14 mm diameter hole cut-outs for mounting antennae for metering communications shall be provided on both sides of the cubicle roof such that the position of the hole shall be behind the equipment installed on the mounting hinged plate in its normal position with the cubicle doors closed. Durable removable plugs shall be fitted to these holes to keep out vermin, insects, spiders and dust.

The cubicle shall be fabricated from 2 mm (minimum thickness) continuously hot dipped zinc coated sheet steel.

4.2.4 Current Transformer

Current Transformers (CT's) are to be built in accordance with *AS 61869.1 [14]* and *AS 61869.2 [15]* and there shall be three CT's, one for each phase comprising of two cores, one for use by Horizon Power and the other for use by Horizon Power's Customer.

The accuracy requirements for both directions of current flow (P1 to P2 and P2 to P1), must be met at the meter marshalling terminals.

The technical requirement for the CT is shown in Appendix C.

4.2.5 Voltage Transformer

Voltage Transformers (VT's) shall be built in accordance with *AS 61869.1 [14]* and *AS 61869.3 [16]*. The VT must be suitable for operation with the high voltage star point connected to ground. Uniform insulated secondary star point brought out and terminated in the meter marshalling compartment as per drawing in Appendix H.

The accuracy must be met at the meter marshalling compartment terminals.

All connections from busbars to the VT(s) shall be rigid and self-supporting.

The technical requirement for the VT is shown in Appendix C.

4.2.6 Secondary Wiring

Secondary wiring shall be done in accordance with *AS/NZS 3000 [7]*. The standard wire used in Horizon Power is 4 mm^2 of stranded 7/0.85 mm copper cable, laid up and restrained such that it does not come in contact with any live parts of the circuit.

VT and all tapped CT secondary terminations must be wired out from their respective terminal boxes to the marshalling compartment in their respective colours for the individual phases they represent. The S1 terminals from the three CTs must be earthed locally to the main earth bar.

CT and VT wiring shall be wired directly from it's terminals within the primary metering compartment to the terminals within the meter marshalling enclosure, no intermediate terminals or connectors will be accepted. Insulated crimp type lugs/connectors shall not be used in any of the CT/VT secondary wiring terminations. Non insulated crimp connectors are permissible.

The terminals provided in the meter marshalling enclosure shall be of the Weidmuller type with the part numbers in Table 1. If Weidmuller isn't available, the Vendor must provide technical details in the Proposal of an equivalent, industry proven terminals.

Table 1: Terminal Types for Marshalling Enclosure

Type	Catalogue Number	Description
WTL 6/3	1018800000	Measuring disconnecting terminals
STB 21.6 BE	1071000000	Socket / Screw for Slider
WKS 1/2	1604270000	Slider 2 way
WKS 1/3	1604290000	Slider 3-way
WQV 6/2	1052360000	Earth Bridge 2 way

The terminals shall accommodate wire size up to 6 mm^2 and be provided with test plug sockets and short circuit bridges for the CT secondary taps.

Wire identification must be with white wire marking ferrules with engraved letters and numerals filled with non-deteriorating black paint, and must correspond with the wire references on Meter Wiring Drawing in Appendix H. Ferrules must be mounted as close as practicable to the termination point at both ends of the wire and assembled so that they may be read right-way-up from the normal viewing position.

Wiring must be installed such that it cannot suffer damage from stretching, pinching, fatigue or accidental interference during normal operation or maintenance. Mechanical barriers or protection must be installed to prevent such wire damage.

4.2.7 Terminal Markings of Instrument Transformer

The following terminal markings are required and must be clearly and indelibly marked or engraved and must be clearly visible from inside the MV chamber:

1) Voltage transformers (VT)
   a) Primary Winding:
      i) ‘A, N’ for Red Phase
      ii) ‘B, N’ for White Phase
      iii) ‘C, N’ for Blue Phase
   b) Secondary Winding:
      i) ‘a, n’ for Red Phase
      ii) ‘b, n’ for White Phase
      iii) ‘c, n’ for Blue Phase
   c) Phasing:

      Ensure that when ‘A’ is positive with respect to ‘N’, ‘a’ is positive with respect to ‘n’ and similarly for ‘B’ and ‘C’.

NOTE: Where 3 x single-phase electromagnetic VT’s are star-connected the terminals ‘N’ and ‘n’ form the primary and secondary star points respectively.

2) Current transformers (CT)
   a) Primary Winding: P1 to P2 in the normal direction of current flow. Labels are to be placed inside the adjacent marshalling cubicle walls to indicate orientation of current flow.
   b) Secondary winding: s1, s2, s3 - The polarity must be arranged so that current flow into terminal P1 induces current flow out of terminal s1.

4.2.8 Rating Plates of Instrument Transformer

Rating plates must be permanently attached to the CT’s and VT’s, copies of these labels must be securely attached to the inside of the metering cubicle, and these must be clearly visible while in service. The markings on these plates must comply fully with the requirements of *AS 61869.1 [14]*.

4.3 Insulating and Switching mediums

The RMU switch unit interrupters must be done in a vacuum bottle. The insulating medium in which busbar, switch disconnectors and the earth switch are in shall be pressured air capable of withstanding the voltage. SF_6 and bulk oil insulated *Equipment* will not be accepted.

4.3.1 Vacuum Interrupters

Vacuum Interrupters may be used for circuit breakers and switch-disconnectors. The contacts for vacuum interrupters must be positively driven in both the OPEN and CLOSE directions, and in no way be dependent on the interrupter vacuum. The vacuum bottles must be sealed for life. The Vendor must state the method by which Horizon Power may carry out in-situ tests on the integrity of vacuum in the bottles.

4.3.2 Air Pressure Gauge

Robust gauges indicating the pressure of air in the insulated compartments must be provided. The gauge must be easily read i.e. no covers must be removed to get access to the gauge. Horizon Power's preference is for a digital gauge which can display both pressure in the tank and temperature.

4.3.3 Loss of Insulating Medium

The *Equipment* shall be designed in such a way that if there is a complete loss of insulating medium, to safety isolate and allow Horizon Power to access, the *Equipment* shall be able to perform an on-load operation of either the switch disconnector or circuit breaker to the 'OPEN' position. This shall then permit the operation of the Earth Switch to the 'CLOSED' position.

4.4 Interlocks

4.4.1 General

The *Equipment* shall be supplied with mechanical interlocks to prevent mal operation and to ensure operator safety. The design of the interlock system must prevent the operator from physically overriding the interlock controls. The following requirements are expected of the interlock system:

1) It must not be possible to remove partially or completely the cable compartment covers unless the main switch has first been turned OFF, and then the earth switch turned ON.
2) Once the compartment cover has been removed, it must be possible to switch the earth switch OFF (for testing purposes).
3) It must not be possible to turn the main switch to the ON position while the cable compartment cover is removed at any time.

4.4.2 Circuit Breakers

The following interlocks apply for circuit breakers:

1) It must not be possible for the circuit breaker to undertake an operation without first completing a prior operation.

2) It must not be possible to mechanically close the circuit breaker unless the following conditions are met:
   a) Cable compartment cover/door is closed (except under testing)
   b) Circuit breaker earth switch is open
   c) Circuit breaker disconnector switch is closed
   d) Lever interlocks for disconnector and earth switches are in the correct position
   e) Lever operating handle for both disconnector and earth switches is removed
   f) Circuit breaker protection relay (if operated) reset
3) It must not be possible to electrically close the circuit breaker unless the following conditions are met:
   a) Stored energy mechanism is fully charged
   b) Conditions of point 5 above are met
   c) Local/Off/Remote switch is selected to local or remote
4) It must not be possible to operate the circuit breaker's disconnector switch unless the circuit breaker is open.
5) It must not be possible to operate the circuit breaker's earth switch unless the circuit breaker's disconnector switch is open.

4.4.3 Switch Disconnector and Fuse Switch

The following interlocks apply for switch disconnectors:

1) It must not be possible to mechanically close the switch-disconnector unless the following conditions are met:
   a) Cable compartment cover/door is closed (except under testing)
   b) Switch-disconnector earth switch is open
   c) Lever interlocks for earth switch is in the correct position
   d) Lever operating handle for earth switch is removed
2) It must not be possible to electrically close the switch-disconnector unless the following conditions are met:
   a) Conditions of point 9 above are met
   b) Local/Off/Remote switch is selected to local or remote
3) It must not be possible to operate the switch-disconnector's earth switch unless the switch-disconnector is open.
4) It must not be possible to access the fuse chamber unless the upstream and downstream earth switch has been turned ON.
5) It must not be possible to mechanically close the fuse switch unless the following conditions are met:
   a) Fuse holder is not placed correctly or if any fuse is blown
   b) Fuse cover is not properly closed

c) Cable compartment cover/door is closed (except under testing)

d) Fuse switch earth switch upstream and downstream is open

e) Lever interlocks for earth switch is in the correct position

f) Lever operating handle for earth switch is removed

6) The following additional requirements apply if the unit offered has two independent manual operating mechanisms for switch-disconnector and earth switches:

a) It must not be possible to operate the earth switch to ON/OFF unless the ON/OFF switch of the switch-disconnector is in the OFF position.

b) It must not be possible to operate the switch-disconnector to ON/OFF unless the earth switch is in the OFF position.

4.5 Padlocking

The *Equipment* must have robust padlocking facilities for locking each switch operating handle entries in the “ON” or “OFF” position. This provision includes switch-disconnector, fuse-switch, CB and earth switch. These locking facilities must prevent inadvertent operator switching as well as unauthorised switching (e.g. by vandals).

The padlocking facilities must have a minimum 10 mm diameter hole for attaching the padlock at the lips of the operating handle entries. The padlocking facility material must be robust and compatible with the life of the extensible RMU.

The Local/Off/Remote switches for both the circuit breaker and switch-disconnector will also require padlocking facilities.

4.6 Voltage Presence Indication

A voltage presence indicator shall be mounted in a location easily observed by the Operator on each unit/panel. The voltage presence indicator is self-powered and is a permanent voltage indication of all phases of each unit/panel and is built in accordance with *IEC 62271.215 [26]*. High contrast displays shall be used as to be visible in strong light (sunlight) conditions.

The voltage presence indicators shall have test points to allow phasing out of the *Equipment*.

The Vendor shall provide information of the voltage presence indicators in their Proposal.

4.7 Phase Fault Indicators

Integrated overcurrent and earth fault indication by Fault Indicators must be supplied on the switch-disconnectors of extensible ring main switchgear (MV fuse switches or circuit breakers are excluded from this requirement). These must have the following features:

1) Locally settable overcurrent and earth fault current thresholds;

2) Locally adjustable automatic timer reset (2-4 hrs) and remote override reset via SCADA;

3) Local visual indication of individual phase faults and separate earth fault indication;

4) Voltage free relay terminals (auxiliary switches) for connection to SCADA for:

   a) Over-current phase fault indication for fault on any of 3 phases (1 aux. switch)

   b) Earth fault indication (1 aux. switch).

Fault Indicators that require an internal battery to perform the functions specified in (1) to (4) above will be considered. However, the Vendor must state the type, capacity (estimated operating lifespan at both 25°C and 45°C), voltage of battery used, and the method of replacement (whether by soldering or by plug-in connectors).

Local indication of a fault must be prominent, either by brightly coloured flags or ultra-bright Light Emitting Diodes (LEDs). The indication must remain active until the Fault Indicator is reset automatically, or via SCADA. The Fault Indicator must be supplied with a facility to connect a low current external indicator (e.g., LED). Vendor must provide details of voltage and current output available for such an external indicator that uses the internal battery supply.

Three CT's required for overcurrent (O/C) and earth fault (E/F) detection in ring switch function shall be supplied fitted on the cable bushings. Fault Indicators requiring a fourth CT for detection of earth faults (E/F) are not acceptable.

The Vendor must submit technical data sheets and functional description of the Fault Indicators (and associated CT's) or current pickup sensors with the Proposal.

The Vendor may offer as an alternative Fault Indicators that meet the requirements of this clause and offer additional features, such as load current monitoring, harmonic currents, load current alarms, etc. The Vendor must indicate this as "Alternative Proposal" in their Proposal and submit detailed information of the features and accuracy of measurements.

4.8 Termination Facilities

Only cable terminating arrangements that offer a fully insulated design on all circuits with no exposed live parts will be considered.

The *Equipment* must have cable bushings that meet the requirements of *AS/NZS 60137 [10]* for each phase in the switchgear functions as listed in Table 2.

Table 2: Termination Facilities

Switch Type	Termination Type
Switch Disconnector & Circuit Breaker	Terminations must be of the sealed push on elbow type, 630 A (DIN style bushing, M16 screw type bolted, dead break connection – Type C)
Fuse switch	Terminations must be of the sealed push on elbow or straight connector type, 200 A (DIN style bushing, plug-in, dead break connection – Type A)

4.9 Cable Connections and Support

The cable compartment of the *Equipment* shall be dry type and suitable for accepting 3 x 1 core aluminium or copper XLPE insulated cables with sizes shown in Table 3.

The *Equipment* must be equipped with facilities for earthing and testing of all connecting cables. There must be adequate clearances so that MV testing of a feeder or transformer cable may be carried out with safety for both the tester and *Equipment* when all other parts on the switchgear are energised at the system voltage.

Table 3: Standard Cable Type and Size

Application	Service Voltage	Cable Description
Ring Feed Circuits	≤ 22 kV	24 kV 3x1core 400 mm^2 Aluminium TR-XLPE/XLPE insul DBT PVC/HDPE sheathed with Termite Protection 24 kV 3x1core 240 mm^2 Copper TR-XLPE/insul DBT PVC/HDPE sheathed with Termite Protection 24 kV 3x1core 95 mm^2, 185mm^2 Aluminium TR-XLPE/XLPE insul DBT PVC/HDPE sheathed with Termite Protection
Ring Feed Circuits	33 kV	36 kV 3x1core 185 mm^2 Aluminium TR-XLPE/XLPE insul DBT PVC/HDPE sheathed with Termite Protection
Transformer Circuits	≤ 22 kV	24 kV 3x1core 35 mm^2 Aluminium TR-XLPE/ XLPE insul DBT PVC/HDPE sheathed with Termite Protection
Transformer Circuits	33 kV	36 kV 3x1core 50 mm^2 AL TR-XLPE/XLPE insul DBT PVC/HDPE sheathed with Termite Protection

The cable compartment must have a bottom plate and cable clamp. The bottom plate must be of split gland plate type with cable entry holes. Cable clamps must be fixed to the bottom plate at the base of the cable compartment for all switch functions.

Suitable rubber bushings must be supplied fitted to each cable entry hole, to cater for the cables specified in Table 3, preventing cables from coming in contact with the sharp edges of the gland plate hole.

Cable gland holes must be vertically aligned with the bushing centres from left to right. The hole centres must be positioned just in front of the bushing, to facilitate perpendicular termination of the cable into the bushing.

Cable supports must be provided for supporting the weight of the cables. Cable supports must be capable of forward and backward adjustment and left to right adjustment to ensure the cable is correctly aligned with the bushings at any gland plate.

4.10 Earthing

The RMU, Energy Metering unit and RTU shall be supplied with earth bonding to the respective support stand main copper earth bar.

There shall be 2 earth connection points provided on all associated RMU, Energy Metering unit, Remote Terminal Unit (RTU) and outdoor kiosk for earth cable termination onto the main copper earth bar.

The Vendor shall supply 2 x 70 mm^2 cable lugs for the RMU, RTU, metering unit and kiosk.

The earth bar provided by the Vendor shall have enough space to accommodate the cable screens and substation earthing cable.

4.11 Name Plate

A nameplate must be provided for each item of *Equipment*, labelled in accordance with *AS 62271.1 [17]* and *AS 62271.200 [21]*, and fitted such that it is clearly visible on the front of the panel. The true rating of each of the component parts must be marked by etching or stamping on the plate. The serial number must also be etched or stamped on this plate.

The rating plate must be made of stainless steel and must be permanently fitted - by means of rivets or firmly bolted down using stainless steel bolts. Stick-on, glued-on or painted-on nameplate labels are NOT acceptable.

The following information shall be included on the nameplate:

1) Horizon Power stock code
2) Year of manufacture
3) Switchgear configuration
4) Manufacturer serial no.
5) Applicable Standard, Internal Arc Classification and Accessibility Type (note: “AS 62271-200 IAC-AFL” or equivalent applicable IEC Standard. The words “IAC-AFL” or “IAC-AFLR” whichever is applicable shall be included on the label)
6) Rated voltage (U_r)

7) Rated lightning impulse withstand voltage (U_p)
8) Rated power frequency withstand voltage (U_d)
9) Rated frequency (f_r)
10) Rated normal current (I_r) for main circuits
11) Rated short-time withstand current (I_k) for main and earthing circuits
12) Rated peak withstand current (I_p) for main and earthing circuits
13) rated duration (t_k) of short circuit for main and earthing circuits (s)
14) Rated filling level (Pa or kg) of filled compartments (p_{re})

The Vendor must also provide a blank circuit identification label for each unit of switch-disconnector, fuse-switch, circuit breaker and metering panel. The blank identification label must be made of durable weatherproof and UV stabilised material of white colour which is removable for labelling by Horizon Power.

If the Vendor has a method of identification and tracking using barcoding, the Vendor shall submit to Horizon Power for review.

4.12 Surface Protection

All internal and external surfaces of the RMU, RTU and Energy Metering unit shall be treated with a coating which provides protection against corrosion induced by water, salt laden atmosphere and pollutants define in *Horizon Power Environmental Conditions*, standard number HPC-9EJ-01-0001-2013 [1].

The RMU, RTU and Energy Metering unit suitable for C3H in accordance with *AS 2312.1 [5]*.

The Vendor must state in its Proposal the intended surface protection methods of the *Equipment* including base material selection and surface preparation (e.g. galvanising, painting, greasing, etc.). The estimated life of the protective coating must also be specified.

The Vendor must provide details of all tests (accelerated aging, salt spray, fog, impact, etc.) that prove the effectiveness of the proposed protective coating. All testing must be carried out in accordance with *AS 1580.0 [4]* or equivalent international standards.

4.13 Remote Terminal Unit (RTU)

The RTU shall electrically connect to the switchgear SCADA inputs and outputs via a standard interchangeable and withdrawable cable and connector solution. Cable connectors shall be suitably keyed or shaped to ensure correct connection. Cables shall be clearly marked as to their function.

The RTU shall, optionally, monitor physical analogue inputs (via analogue to digital converters or similar) and then process and present the value of these inputs for eventual communication to a master device.

The RTU shall (via its communications interface), accept, process and send controls to it's physical outputs (a contact or similar). The RTU shall have the facility to send controls as either latching or pulse (pulse period shall be configurable via the SCADA protocol or via an RTU setting, and shall be settable from 1 second to 10 seconds in 1 second increments).

The RTU shall have sufficient inputs and outputs to meet the requirements of this specification.

The RTU shall have the facility to buffer, ready for transmission to a master, at least 100 digital input change of state or analogue change of value events. If the buffer reaches capacity, the oldest events shall be overwritten.

The RTU shall maintain one internal real-time clock. This real-time clock shall be used for all internal functions and for time-tagging events for presentation via a SCADA protocol. This real-time clock shall be settable from the configuration software or via a SCADA protocol. The real-time clock shall maintain time and date information. The real time clock shall provide resolution to 1 millisecond.

The RTU shall be rated to operate without failure or error within the temperature range -5 °C to +50°C, 10% to 95% humidity (non-condensing).

The RTU shall present an Ethernet interface for SCADA communications purposes, with (at minimum) handshaking lines for RTS, CTS and DCD.

The RTU shall present a Ethernet or USB interface for connection to a PC running the configuration software.

The configuration and communications interfaces shall be physically separate interfaces.

The RTU shall provide, at minimum, physical LED (or similar) indication of the status of:

1) RTU power supply health
2) RTU health (watchdog)

4.13.1 Remote Terminal Unit and Motorisation

The automation equipment shall be powered from a low voltage DC supply that is ultimately powered from a 240 Vac single phase supply (AC supply by others). The RTU and 240 Vac power supply unit shall meet the requirements of Class II equipment in accordance with *AS 3100 [8]* for supply by 240 Vac Active and Neutral with no earth connection.

The motorisation equipment shall be powered from a low voltage DC supply. The Vendor shall state in the Proposal if this cannot be achieved and provide details of any alternatives.

An auxiliary DC supply shall be provided to power either a radio or modem (supplied by others).

The RTU offered by the Vendor has AC input supply that is not earthed to the RTU and is insulated to 10 kV with respect to the enclosure earth.

4.13.2 Remote Terminal Unit Battery Back-up Supply

All automation and motorisation equipment shall have a battery charger and battery system, to power the *Equipment* in the event of failure of the AC supply.

Batteries shall be sealed and maintenance free, and shall be suitably rated for the proposed environment.

The batteries shall be suitably rated to:

1) power the RTU and radio / modem for a minimum period of twelve (12) hours; and
2) to perform ten (10) open / close operations within that period.

4.13.3 Remote Terminal Unit Physical Requirements

The RTU and all associated accessories shall be supplied housed in an outdoor enclosure that meets the requirements of *Horizon Power Environmental Conditions [1].*

The RTU equipment enclosure should physically fit within the proposed *Equipment* enclosures and sufficient space shall be provided within the RTU equipment enclosure to mount a radio or modem (dimensions not exceeding 200 x 150 x 50 mm) and cable management around the radio or modem. The RTU equipment enclosure shall provide sufficient space on a gland plate to cater for entry of an antenna coaxial cable.

4.13.4 Remote Terminal Unit Modularity

The RTU shall consist of a base unit that can be extended (via I/O modules or similar) to cater for any other switchgear configurations.

For configuration purposes and for communications interfaces, the RTU shall present as one logical unit – i.e. (a) only one configuration file (or database, etc.) should be necessary for the RTU, regardless of it's physical configuration; and (b) the RTU shall present one aggregated communications interface, over which all data shall be passed, regardless of the modular makeup of the RTU.

4.13.5 Remote Terminal Unit Software

The RTU shall be configurable through configuration software that can be installed on a PC. The configuration software shall be compatible with the latest version of Microsoft Windows.

The configuration software shall communicate to the RTU over either a Ethernet port or USB.

The configuration software shall provide the ability to:

1) Read, enter and modify RTU settings on-line (to the RTU) and off-line (to and from a file on the PC).
2) Manage the RTU on-line, when the PC is connected to the RTU. The minimum management of the device shall include: the status of the RTU and it's components; the status of the physical inputs and outputs; the status of the communications link; and the ability to force inputs and outputs.
3) Download firmware to the RTU.

There shall be a minimum of one level of password protected entry on the configuration software before a user may set parameters or values.

The Vendor shall provide DNP3/Modbus over IP in the RTU, offered at no additional cost to Horizon Power.

The RTU can be configured via webserver on-board which can be connected to by standard web browser on the PC i.e. no configuration software needs to be installed.

4.13.6 Remote Terminal Unit Communications

The RTU shall support the DNP3 protocol over an Ethernet port and shall, at minimum, operate as a DNP level 1 slave as per the DNP User Group specifications and certification procedures.

The RTU shall support the DNP3 protocol over a TCP (or UDP) over IP link.

The RTU shall provide the following functionality for the SCADA communications Ethernet port:

1) Provide a setting for RTS pre-transmit time, variable from a value of 10 mS to 1 second, in 10 mS increments;
2) Act as a DTE;
3) Operate at any one of 1200, 2400, 4800, 9600 and 19200 bits per second, and provide a setting for the operational speed;
4) Provide settings that allow the utilisation (or not) of the Ethernet hardware handshaking functionality provided by RTS, CTS and DCD, in any combination.

The RTU communications facilities shall properly parse and act upon back-to-back DNP3 data link frames from a master device.

The RTU shall provide the facility, via the configuration software, to undertake DNP3 point address mapping. The aim of this facility is: (i) to present a contiguous list of points starting at point index 0, for all data types; and (ii) to provide the ability to present only a subset of all available data.

The RTU shall store analogue inputs as: (i) 16-bit or (ii) 32-bit, but with facilities to scale the analogue input to a value that fits into the least significant 16 bits.

The RTU shall provide settings, on a per-point basis, for analogue input deadbands (to drive change of event reporting).

Software modification is required on the RTU offered by Preferred Vendor such that the RTU can present all analogue inputs appropriately scaled into a 16-bit DNP3 analogue input object; or present all analogue inputs as a 32-bit value, but scale the value into the least significant 16 bits. The Vendor shall complete software modifications within 8 weeks from date of tender award.

4.14 Kiosk and Support Stand

For outdoor application, the *Equipment* shall be housed in a kiosk that is robust, low profile and vandal proof, which is mounted on a support stand. The kiosk and support stand shall be designed and tested in accordance with *AS 62271.202 [22]*.

4.14.1 Kiosk

The Kiosk shall be constructed out of marine grade aluminium or stainless steel that is impervious to corrosion when placed Horizon Power's operating environment.

The kiosk will be capable of housing up to 5 switch combinations.

The thickness of the metal shall be a minimum of 2.5 mm, the Vendor must ensure the final design meets structural and performance requirements. The enclosure shall have a ingress protection (IP) rating of IP44 or better in accordance with *AS 60529 [12]*. The IP rating shall not hinder performance of the Arc Fault Classification as detailed in section 4.1.1.

The kiosk supplied shall only house the RMU and RTU, a kiosk design to house a RMU, distribution transformer and low voltage switchboard will not be considered.

The Vendor must submit drawings with the Proposal of the kiosk offered showing length, depth and height dimensions of each component.

The Vendor shall provide factory fitted rated lifting eyes for the kiosk, these shall remain on the kiosk after installation.

There shall be earthing points on either side of the kiosk to allowing connection to the main earth bar located on the support stand.

4.14.1.1 Ventilation

Sufficient natural ventilation must be provided to allow adequate airflow inside the kiosk, to prevent high temperature and humidity. The Vendor shall prove using calculations outlined in *AS 60890 [13]* or by using a Finite Element Analysis software package, the effectiveness of the cooling system. The maximum heat risk inside the kiosk with addition of the ambient temperature shall not exceed the operating temperature of the *Equipment*.

If ventilation louvers are provided, they must be of a similar IP rating to that of the kiosk and must not allow horizontal rain and/or water spray from nearby water sprinklers to enter the kiosk.

The vendor must comment on the effectiveness of the ventilation in regulating the temperature within the kiosk, within the operating limits of *Equipment*, considering the insolation and ambient air temperature provided *Horizon Power Environmental Conditions*, standard number *HPC-9EJ-01-0001-2013 [1].*

4.14.1.2 Vermin Screen

Removable stainless steel wire mesh screen (fitted flush against any ventilation louvers or openings) must be provided on the inside of the kiosk. The wire mesh screens must allow natural airflow ventilation, but act as a physical barrier preventing vermin and vegetation from entering the cubicle.

The Vendor must recommend in the Proposal the optimum pore size of the wire mesh screen. The screen must easily detach for cleaning or replacement, without the need to remove the kiosk from the support stand.

4.14.1.3 Kiosk Doors

The kiosk door must be 3-point lockable, earthed doors to allow access to the *Equipment*, for ease of operation and maintenance. The kiosk door must prevent unauthorised access to the *Equipment*, i.e. the kiosk must be vandal-proof and child-proof. The minimum diameter hole for a padlock must be 10 mm.

The 3-point locking system must be of Selectrix EMKA type (or equivalent) with a stainless steel flush mounting handle, having the padlock hasp incorporated into the handle. Doors with separate hasps and handle systems will not be accepted. It must not be possible to unlock the 3-point locking system without removing the padlock.

All hinges must be manufactured from stainless steel 316 and must have a minimum pin diameter of 10 mm.

Door seals must comprise a neoprene (or identical non sticking poly material) section, held in a metal channel on the door, and compressed by a dished edge on the fixed enclosure, when the door is closed.

A robust door restraint must be provided to hold each door in the 90° open position. The restraint must use a captive design so that it cannot be inadvertently disengaged. The restraint must be self-storing in the sense that it will prevent a closed door from rattling.

4.14.1.4 Kiosk Roof

The double skinned roof design of the kiosk must be gently sloping from the centre, to enable water to run off and not accumulate anywhere on the roof surface. Kiosk designs incorporating piano type hinges anywhere along the roof section of the kiosk will NOT be considered.

A mounting bracket shall be provided on the kiosk roof for mounting an antenna for communications. A removable blanking plate shall be provided fitted to the antennae mounting bracket. The whole assembly shall be waterproof and vandal proof.

Kiosk designs incorporating roofs that can be lifted open will only be considered if such designs have:

1) Been proven to meet Internal Arc Classification (IAC) by way of test reports
2) Gas struts to assist opening and closing

3) A second means of securing the roof open that does not rely on any gas struts

4) Vandal proof design, and

5) Proven to be free from water ingress problems.

4.14.2 Support Stand

The support stand must have removable front sections to allow cable terminations. There must be no fixed horizontal member on the support stand at the front that impedes the termination of cables into the ring main switchgear. The support stand is shown in Appendix H.

The support stand arrangement must be designed to withstand the maximum weight of the *Equipment* installed (along with transport frame), including cables and terminations as per the arrangement requirements in Section 4.14.3. This includes the situation where the front cable covers of the support stand are removed.

If horizontal cable support bars are required to be provided underneath the cable compartments, it must be possible to remove the support bars without any deflection or distortion to the equipment. Also, it must not affect the removal and refitting of cable gland plates or the bottom plates.

The handles of the cable covers for the support stand must be made of galvanised steel and must be suitable for rough handling. Two accessible holes of minimum 50 mm diameter must be provided on the left and right side of the support stand with protected edges, to allow insulated earth cables from the copper bar on the kiosk to the main copper earth bar located in the support stand.

The support stand must have a minimum height of 1100 mm to provide adequate clearance for termination of cables.

The support stand must be constructed of 3 mm galvanised mild steel with 6 mm minimum thickness legs. The vendor must ensure that the final design meets structural and performance requirements detailed in this specification.

The arc filter compartment in the support stand shall be supplied with closed type gland plates to prevent direct venting into the cable trench for outdoor installation.

The Vendor must submit drawings with the Proposal of the support stand offered showing length, depth and height dimensions of each component.

The vendor must provide full structural calculations of the support stand design, and centre of gravity details when installed on stand (without support stand top cover), within three (3) weeks from the date of Notice of Acceptance of Proposal.

If the *Equipment* offered does not meet the specific requirements of this section, the Vendor must detail in the Proposal, any alternative design that meets the intent of the requirement to the satisfaction of Horizon Power.

4.14.2.1 Kiosk and Stand Earthing

The support stands must provide a means for earth bonding the switchgear and kiosk. A hard drawn copper earth bar complete with pre-drilled holes equally spaced at 50 mm suitable for M10 bolts and mounted to the support stand must be provided. This earth bar and all connection shall be easily accessible from the front of the kiosk with the doors opened.

The copper earth bar cross-sectional area must be no smaller than 40 mm wide x 6 mm thick and must be the length of the support stand. The copper earth bar must be tinned at the points where it is secured to the support stand ends.

The main copper earth bar shall be of adequate cross-sectional area and rated to carry 25 kA for 1 second at 12 kV and 24 kV and at 36 kV it shall carry 16 kA for 1 second. The earth bar shall be installed for the length of the support stand and shall be tinned at points where it is secured to the support stand ends.

There must be two (2) earth connection points provided for the kiosk and all associated switchgear equipment. The location of main terminal earth bar must be such that short earth cable connections can be made to any other earth connection points.

4.14.3 Kiosk and Support Stand Arrangements

Kiosks and support stands must be supplied and delivered assembled together in matching pairs of two sizes. One size of kiosk and support stand must be designed for installation of a 3-way or a 4-way ring main switchgear along with the transport frames. The other size of kiosk and stand matching pair must be suitable for installation of a 4-way or a 5-way ring main switchgear, along with the transport frames. A single size kiosk for all switchgear arrangements may also be offered by the Vendor.

Suitable provisions must be made in the support stand design for retrospective fitment of one extensible switchgear function on a 3-way or 4-way unit, without removal of the ring main switchgear and MV cables.

Table 4: Kiosk and Support Stand Arrangements

RMU Configuration	Proposed Kiosk Size	Corresponding Support Stand Size
3-way (i.e. 3+0, 2+1)	4-way	4-way
4-way (i.e. 4+0, 2+2, 3+1)	5-way	5-way
5-way (i.e. 2+3, 3+2)	5-way	5-way

Each kiosk and support stand must be designed to securely support the ring main switchgear, without the need for extra components to be supplied.

The support stand must be designed to securely self-support all configurations of RMU which may have differing widths e.g. 3-way (3+0) and (2+1), 4-way (4+0), (2+2), and (3+1) and 5-way (2+3) and (3+2) RMUs. A means of securely self-supporting the right side of the RMU for all configurations during the installation and in-service stages must be provided.

For any void or opening created in the support stand due to the shorter width of an extensible RMU, a blanking plate must be provided to close the opening. The blanking plate design must not require the supply of additional components.

The blanking plate must meet the maximum loading requirements of the RMU, plus a 120 kg person standing on the blanking plate(s). The blanking plates must be of the same depth as the cable compartment base and fitted to the support stand in order to cover the holes in front. The blanking plates must be marked on each plate from left to right as follows: 3+0, 2+1, 4+0, 2+2, 3+1, 2+3.

The front and rear ends of blanking plates must be supported underneath e.g., by front cover and back panel. They must be able to withstand the overpressure sustained during an internal fault without causing any damage to the support stand or associated installations.

The Vendor shall provide factory fitted lifting eyes for all kiosks. The Preferred Vendor shall install bolt lifting eyes at the lifting hole points in the kiosk at the factory and they shall remain on the kiosk while in service. The lifting eyes on the kiosk roof shall be designed and capable of lifting the full weight of kiosk and stand together. The lifting eyes shall not be utilised as earthing points at any time.

4.14.4 Kiosk and Support Stand Surface Finish

The metal surface of the kiosk must be protected by the application of a painting system suitable for severe marine environments. A durability of C4H or C5 in accordance with *AS 2312 [5]* is required. The external colour is 'Bottle Green' as per *AS 2700 [6]*.

The steel support stand shall be hot dip galvanised to *AS 4680 [9]*.

Any panels or components that are assembled by fastening must ensure proper electrical contact is made and maintained when in service. This contact must exist between the corresponding panels or components to ensure an equipotential support stand.

The Vendor must, in their Proposal, detail the process to ensure proper electrical contact is made and maintained when in service. It may be necessary to electrically bond assembled (not welded) panels or components with 70 mm^2 PVC V-90 green/yellow copper cable.

4.14.5 Coupling of Kiosk and Support Stand

The kiosk and support stand must be designed for easy installation and removal of the kiosk (and/or the complete kiosk and support stand) in situ, to facilitate switchgear installation and replacement.

The Vendor must provide details on how the kiosk must be fixed to the support stand as the rear section inside the kiosk is normally inaccessible after installation.

4.14.6 Kiosk and Support Stand Dimensions

As the ring main switchgear unit is to be installed in ground-mount kiosks (non-walkable) of low profile and compact construction, the *Equipment* must have minimum dimensions and be of low mass and vandal-proof. Preference must be given to *Equipment* (kiosk included) having minimum dimensions that do not exceed the following:

1) Maximum height:
    a) 1,800 mm for 12/24 kV *Equipment*; and

b) 2,200 mm for 36 kV *Equipment*

2) Maximum depth:

a) 1,000 mm for 12/24 kV *Equipment*; and

b) 1,500 mm for 36 kV *Equipment*

3) Maximum width:

a) 2,500 mm for 12/24 kV *Equipment*; and

b) 2,700 mm for 36 kV *Equipment*

4) All 3, 4 and 5-way extensible RMU's shall preferably have the same common width - i.e. 2+1 and 3+0 RMU's shall be of the same width. Likewise 4+0, 3+1, 2+2 RMU's shall be of the same width and 3+2 and 2+3 RMU's shall be of the same width respectively.

It is acknowledged that metering units, when used on indoor applications for connection to adjacent switch units, may need to be wider and/or deeper.

5 PACKAGING

The *Equipment* must be supplied in suitable packaging which ensures that there is no deformation to any part of the switchgear during transportation. The *Equipment* must not be supplied on cardboard, non-waterproof fibreboard, or other footings that deform, soften, or disintegrate on contact with water and high humidity preventing the use of fork-lift to handle the *Equipment.*

The Vendor is required to nominate standard pack quantities and standard packs must be clearly marked with the following information:

1) Manufacturer's name
2) Manufacturer's part reference number
3) Horizon Power Order Number
4) Horizon Power Stock Number
5) Gross weight in kg
6) Nett weight in kg
7) Date of manufacture
8) Manufacturer's Serial Numbers of all packaged equipment (to facilitate traceability)

In addition, the package must contain:

a) An installation instruction.

b) All necessary components and consumables required to complete the installation in accordance with the instruction i.e. accessory components, cleaning kit and earthing kit;

c) Material Safety Data Sheets (MSDS)

5.1 Transport Frames

Transport frames must be provided for all switchgear in either the 4-way or the 5-way configuration, to prevent deformation of the *Equipment* and its functionality during handling, lifting or transportation. The areas served by Horizon Power typically require *Equipment* to be transported over large distances by road (unsealed in some remote areas) some as long as 3,000 km. The frame must be designed such that it is installed with the unit.

The transport frames must be:

1) Designed so as to maintain the structural integrity and the IAC classification of the *Equipment*.

2) Have removable front section to facilitate installation of cables (indoor installation).

3) Galvanised mild steel with the same finishing as that of the support stand (Section 4.14.2).

4) Designed to withstand the maximum weight of the *Equipment*, the cables and terminations as per the arrangement requirements in Section 3.2 and 3.3.

5) For example, a transport frame designed for 4-way kiosk must be able to handle the maximum weight of a 3+1 or a 4+0 configuration (whichever is maximum), irrespective of whether it was installed as a 3-way unit.

6) Able to accommodate 3-way and 4-way extensible ring main switchgear that can be extended by one extensible switchgear function (fuse switch or a switch disconnector on the transport frames).

7) Fastened only onto the stand and not the kiosk at any point. Designs must ensure that removal of kiosk does not require repositioning of the transport frames in any way.

Vendors must submit details of the handling, lifting or transportation instruction for such a design with the Proposal. Separate designs and installation instructions along with details of centre of gravity details must be provided for cases with and without the extensible unit attached to the transport frame.

6 TESTING REQUIREMENTS

The Vendor shall provide all type reports completed in accordance with the relevant Australian and International Standard in a globally recognised testing laboratory such as KEMA and CESI. If the *Equipment* does not have all type tests completed, then the *Equipment* will not be considered.

6.1 Type Test

The *Equipment* shall complete all Type tests outlined in *AS 62271.1 [17]*, *AS 62271.102 [19]*, *AS 62271.105 [20]*, and *AS 62271.200 [21].* These tests shall be provided to Horizon Power for verification and acceptance.

The metal kiosk shall have mechanical tests in accordance with *AS 62271.202 [22]*. The kiosk shall be capable of withstanding Wind Region 'D' conditions with third party Mechanical Engineering certification provided in accordance with AS *1170.2 [2]* and *AS 1170.4 [3].*

The type tests shall be conducted at a third party internationally recognised testing laboratory.

Where units are offered of a similar design to those previously tested, consideration may be given to accepting previous type test reports, however the Vendor must substantiate their claims.

Any modification, resulting from a type test failure or a change of design instigated by the Vendor or change of design to comply with Specification, which could affect the results of earlier type tests, shall require a repeat of such earlier type tests at the Vendor's cost.

6.1.1 Internal Arc-Fault Containment Test

The Vendor must show the switch disconnector, circuit breaker, fuse switch and energy metering unit have passed the IAC test and achieved 'IAC-AFR' in accordance with *AS 62271.200 [21]*. Front and rear with accessibility Type A is restricted to authorised personnel only.

The outdoor IAC test for the switchgear in *kiosk* must be carried out in accordance with *AS 62271.202 [22]* and achieve 'IAC-ABFLR'. Front, lateral and rear of the kiosk is accessible by authorised personnel and general public. The Vendor shall perform the test on a switchgear combination with at least two switch disconnectors and one fuse switch unit (2+1 configuration).

Any design modification done to the *Equipment*, associated *kiosks* and *support stands* in order to meet the specification must comply with the IAC test requirements. These tests will have to be carried out by the vendor at their own cost.

If the various tests associated with fault levels as stated in Appendix C have not been carried out on the design offered, the Vendor must state what tests it guarantees to have made. The Vendor must also state the testing authority, and must demonstrate that the tests carried out to meet the requirements of this Specification.

6.1.2 Submersion in Water

Horizon Power ensures that necessary countermeasures are taken when switchgear is installed in flood prone or low-level areas. However, in the unlikely event that the switchgear gets submerged in water, the Vendor shall prove the switchgear's capability of switching under water submersion.

6.1.3 Impact Test for Cyclone Rating of Kiosk

An impact test must be carried out on the kiosk unit complete with doors, covers and ventilation openings as described in Section 2.5.8 of *AS 1170.2 [2]*. The kiosk must the pass the test for the maximum wind speed, as per the operating conditions in Section 3.4. The doors must be kept closed during the period of the test.

Details of any visible effects and the position of the impacts on the RMU must be recorded by photographs and included in the test report. This is not limited to deformation on any part of the kiosk and support stand and includes door hinges and tabs.

6.2 Routine Test

For every order, the *Equipment* shall be routine tested in accordance with *AS 62271.1 [17]*. The following functions shall be routine tested with the respective standards:

1) Switch disconnector as per *AS 62271.102 [19]*

2) Fuse switch disconnector as be *AS 62271.105 [20]*

3) Circuit Breaker as per *AS 62271.100 [18]*

4) CT's and VT's of the Energy Metering as per *AS 61869.2 [15]* and *AS 61869.3 [16].*

6.2.1 CT and VT Accuracy

The accuracy of the CT's shall be tested from 25% to 100% rated burden and 200% of rated current for each ratio in both directions of the marshalling enclosure terminals.

The accuracy of the VT's shall be tested from 0 to 100% rated burden at the marshalling enclosure terminals.

7 DOCUMENTATION

7.1 Drawings

The final drawings submitted (in Microstation and PDF), shall include the following details:

1) Removable blanking plates (individually marked for all 3-way, 4-way and 5-way switchgear combinations specified) showing mounting and attachment holes,
2) Holes (of specified size) showing positioned for kiosk and support stand fixing,
3) Individual blanking plate attachment holes (of specified size) on support stand,
4) Attachment holes (of specified size) on support stand for mounting 3-way, 4-way and 5-way switchgear,
5) Earth bonding points on kiosk and support stand,
6) Hole details on main copper earth bar on support stand for termination of earthing cables,
7) Rectangular 45 x 130 mm hole cut-outs on front left and right sides of support stand for earth cables from RMU and kiosk to pass through to the void space beneath the RMU in the support base,

8) 3-point locking mechanism showing details of locking points at the top and bottom,
9) Removable Mullion bar showing attachment points for removal of the mullion to facilitate cable installation,
10) Cable support structure showing attachment points for cable clamps on the RMU and on the kiosk support base respectively,
11) Removable Vermin Filter of pore size 16 mm^2 (4 x 4 mm^2) showing details of attachment,
12) Door stay arms showing details of arm lock at maximum door opening,
13) Method of arc venting,
14) The support stand shall include dimensions of cable entry opening at the front and rear,
15) Drawings of kiosk showing lifting points on kiosk roof and on the left and right sides of the support stand,
16) Drawings of switchgear showing lifting eyes,
17) Drawings of meter panel showing lifting lugs,
18) Details of bolting arrangement of kiosk to support stand,
19) Details of ventilation louvers on the left side panel and right-side panel and on each of the front door panels of the kiosk shall be provided,
20) Details of the cable compartment covers shall be provided showing the covers support at the RMU base and the anchor points at the RMU body,
21) Details of the support stand showing the RMU supported on the sides and rear with the front “drawers” (i.e. 3 x steel panels with 2 x handles per panel) removed from the support stand and mullion bar removed from the kiosk,
22) In the 5-way universal kiosk in addition to the front blanking plates for the individual cable compartments corresponding to the 3-way, 4-way and 5-way RMU’s drawings of the kiosk and support stand shall also show the rear blanking plate(s) on the support stand,
23) Each blanking plate shall be marked with the corresponding RMU configuration that applies to it.

7.2 Test Certificates

A complete set of routine test reports (in PDF) shall be submitted for each order. The following information shall be displayed on the test certificate:

1) The Manufacturer’s name
2) Switchgear Model
3) Combination (e.g. 1+0, 2+1, 2+2, etc.)
4) Stock Code

7.3 Installation and Operation Maintenance Manuals

Manuals shall be supplied (in PDF) to enable the erection and maintenance of the *Equipment* to be performed in a safe and efficient manner and shall be prepared specifically for the *Equipment* delivered. The manual shall include the following information:

1) A concise description of each type of *Equipment*, together with a complete *Equipment* performance specification. The function and operation of each part and circuit and any tool or accessory supplied.

2) Detailed installation procedures/instructions.

3) Complete set of drawings applicable to the *Equipment*.

4) Recommended routine maintenance, parts replace schedule and testing program.

5) Fault finding procedure including a table listing fault identification, possible cause and resolution.

6) Recommended method of disposal at end-of-life cycle.

7) Material Safety Data Sheet.

8 SPARES

Separate prices are required with the offer for the following:

1) Any spares necessary for the continuous operation of each item of *Equipment*; and

2) Any special tools or handling *Equipment* required for installation and/or maintenance must be stated in Appendix E of the enquiry document.

All spares must be labelled with manufacturer's part number.

It is required that the validity period of the Proposal, as far as spares are concerned, be extended until such time as Horizon Power places an order for spares.

9 SAMPLES

For the purpose of evaluation and familiarisation, *Equipment* sample may be requested by Horizon Power prior to first order. The Vendor shall supply the following samples free of charge within 4 weeks of request:

1) A switch disconnector, fuse switch or circuit breaker panel

2) Remote Terminal Unit (RTU)

3) Protection Relay

4) Kiosk and support stand

5) Fault and voltage presence indicator.

APPENDIX A REVISION INFORMATION

(Informative) Horizon Power has endeavoured to provide standards of the highest quality and would appreciate notification of errors or queries.

Each Standard makes use of its own comment sheet which is maintained throughout the life of the standard, which lists all comments made by stakeholders regarding the standard.

A comment sheet found in **DM #43170307**, can be used to record any errors or queries found in or pertaining to this standard. This comment sheet will be referred to each time the standard is updated.

Date	Rev No.	Notes
26/08/2024	0	First Issue

APPENDIX B QUALITY ASSURANCE (TO BE COMPLETED BY STORES)

DOCUMENT NUMBER	HPC-8DJ-07-0008-2023		**QUALITY ASSURANCE**	**DM NUMBER**	
DEVICE DESCRIPTION	**LABEL MATERIAL NO.**		***EQUIPMENT* & KIOSK PURCHASE**	**ASSET OWNER**	
	ASSET ID/ STOCK NO				
MANUFACTURER		**DIMENSION**			

ITEM	OPERATION/*EQUIPMENT*/FACILITY	DOCUMENT REF.	WHO CHECKS	INITIAL	DATE/ TIME	QUALITY ASSURANCE CRITERIA	PASS Y/N	COMMENTS
1	LABELLING							
1.1	Name of Manufacturer					*******		
1.2	Manufacturer's part reference number					*******		
1.3	Horizon Power Order Number					*******		
1.4	Horizon Power Stock Number					*******		
1.5	RMU/Kiosk description					*******		
1.6	Package Weight					*******		
2	CONTENTS							
2.1	Installation Instructions					Clear, Legible and in English		
2.2	Bill of Materials					Clear, Legible and in English		

ITEM	OPERATION/*EQUIPMENT*/FACILITY	DOCUMENT REF.	WHO CHECKS	INITIAL	DATE/ TIME	QUALITY ASSURANCE CRITERIA	PASS Y/N	COMMENTS
2.3	Material Safety Data Sheets (if required)					Clear, Legible and in English of all materials		
2.4	Accessories (if required)					As per Bill of Materials		
2.5	Test and Inspection Reports					As per Standards referenced in the specification.		
3	PACKAGING							
3.1	Suitably stacked and secured on pallet					Packages suitably packed and prevented from coming loose		
3.2	Physical damage					Packages do not show puncture marks or other signs of damage		
3.3	RMU/Kiosk in suitable packaging					Strong enough to prevent mechanical damage		
3.4	Packaging clearly labelled					Each package easily identifiable		
3.5	Items Individually Marked					Items clearly designated and marked		

SYMBOLS AND ABBREVIATIONS								
H = HOLD POINT	S = SUPERVISOR							
W = WITNESS POINT	T = TECHNICIAN, EL = ELECTRICIAN	REVISION						
V = VERIFICATION POINT	E = ENGINEER	DATE						
S/C = SUBCONTRACTOR	PM = PROJECT MANAGER	APPROVED BY						

APPENDIX C TECHNICAL SCHEDULE

C1 TECHNICAL SCHEDULES

Completion of the listed schedules below by the Vendor shall indicate the product offered is fully compliant.

The Vendor shall confirm compliance to the Specification by completing the form in Appendix D, any deviation from the Specification shall be listed on in Appendix E for Horizon Power to approve.

C1.1 RING MAIN UNIT FOR 12/24 KV

Item No	Description	Unit	Horizon Power	Vendor Schedule
1	**GENERAL**			
1.1	System highest voltage	kV	12/24	
1.2	Nominal system voltage	kV	11/22	
1.3	Frequency	Hz	50	
1.4	Lightning impulse withstand voltage	kV	150	
1.5	Power frequency withstand	kV	50	
1.6	Rated short time withstand current	kA/1s	25	
1.7	Internal arc classification		A-FL	
1.8	Paint system for corrosion category as per AS 2312		C3H	
1.9	Continuity of service		LSC2A	
2	**BUSBAR SYSTEM**			
2.1	Rated current (rms)	A	630	
2.2	Rated short time withstand current	kA/1s	25	
3	**SWITCH DISCONNECTOR**			
3.1	Function		Feeder	
3.2	Rated normal current (rms)	A	630	
3.3	Power frequency withstand voltage (1 min rms)	kV	50	
3.4	Lightning impulse withstand voltage (peak)	kV	150	
3.5	Rated short-time withstand current (rms)	kA/1s	25	

Item No	Description	Unit	Horizon Power	Vendor Schedule
3.6	Rated Peak withstand current	kA	50	
3.7	Making capacity (peak)	kA	50	
3.8	Short-circuit breaking capacity	kA	25	
3.9	Load breaking capacity	A	630	
3.10	Suitable cable types and maximum cable sizes supported		3x1core 400 mm^2 Aluminium XLPE insul PVC/HDPE sheathed 3x1core 240 mm^2 Copper XLPE insul PVC/HDPE sheathed 3x1core 95 mm^2 & 185 mm^2 Aluminium XLPE insul PVC/HDPE sheathed	
3.11	General purpose switch class (AS 60265.1)		M2/E3	
3.12	Minimum number of mechanical switching operations at rated short circuit current	no.	5	
3.13	Padlocking facility provided with minimum padlock hole size	mm	10	
3.15	Facilities for voltage indication (via LED lamp) and phase concordance provided per 3-ph feeder		Yes	
3.16	Over-current and earth-fault indicator (self powered and remote telemetry ready) provided per 3-ph feeder		Yes	
3.17	Gear motor for SW/DC (Switch-disconnector) control - Voltage (DC)	V	24	
3.18	Gear motor for SW/DC (Switch-disconnector) control - Inrush power consumption	W	400	
3.19	Gear motor for SW/DC (Switch-disconnector) control - Continuous power consumption	W	100	

Item No	Description	Unit	Horizon Power	Vendor Schedule
3.20	LOCAL / OFF / REMOTE switch to isolate power supply to individual SW/DC (switch-disconnector) motor circuit. (with padlocking facility for 10 mm dia padlock) shall be provided		Yes	
3.21	Switchgear main electric circuits degree of protection (IPxx)		IP64	
3.22	Switchgear drive mechanism degree of protection (IPxx)		IP2X	
3.23	Switchgear MV cable compartment (with access cover closed) degree of protection)		IP3X	
3.24	Auxiliary terminals for RTU/SCADA remote status indication and switchgear remote Open – Close controls are provided		Yes	
4	**EARTH SWITCH**			
4.1	Earth-Switches are provided for Switch-disconnectors, Fuse-Switches and Circuit Breakers (if offered) panels		Yes	
4.2	Earth-Switches provide on both sides of fuse (including effective earthing of the fuse carrier during fuse replacement)		Yes	
4.3	Power frequency withstand voltage (1-min rms)	kV	50	
4.4	Lightning impulse withstand voltage (peak)	kV	150	
4.5	Rated short-time withstand current	kA/1s	25	
4.6	Rated Peak withstand current	kA	50	
4.7	Busbar Current Rating	A	630	
4.8	Stranded earth conductor size	mm^2	70/150	
4.9	General purpose switch class (AS 60265.1)		M1/E3	
4.10	Minimum number of mechanical switching operations at rated short circuit current	no.	5	
4.11	Padlocking facility provided with minimum padlock hole size	mm	10	
4.12	Auxiliary terminals for RTU/SCADA remote status indication are provided		Yes	

Item No	Description	Unit	Horizon Power	Vendor Schedule
5	**FUSE SWITCH**			
5.1	Function		Transformer	
5.2	Rated current (rms)	A	200	
5.3	Power frequency withstand voltage (1-min rms)	kV	50	
5.4	Lightning impulse withstand voltage (peak)	kV	150	
5.5	Rated short-time withstand current (rms)	kA/1s	25	
5.6	Rated Peak withstand current	kA	50	
5.7	Making capacity (peak)	kA	50	
5.8	Short-circuit breaking capacity	kA	20	
5.9	Load breaking capacity	A	200	
5.10	Suitable cable types and maximum cable sizes supported		3x1c 35 mm^2 Al, w/HD Cu screen, XLPE insul PVC/HDPE sheathed	
5.11	Trip all 3-phases device fitted to trigger on fuse operation		Yes	
5.12	General purpose switch class (AS 60265.1)		M1/E1	
5.13	Minimum number of mechanical switching operations at rated normal (200 A) current load	no.	10	
5.14	Minimum number of mechanical switching operations at rated short circuit current	no.	5	
5.15	Padlocking facility provided with minimum padlock hole size	mm	10	
5.16	Fixed facilities for voltage indication and phase concordance provided per 3-ph feeder		Yes	
5.17	Switchgear main electric circuits degree of protection (IPxx)		IP67	
5.18	Switchgear drive mechanism degree of protection (IPxx)		IP3X	

Item No	Description	Unit	Horizon Power	Vendor Schedule
5.19	Switchgear MV cable compartment (with cover closed) degree of protection (IPxx)		IP3X	
5.20	Auxiliary terminals for RTU/SCADA remote status indication		Yes	
6	**CIRCUIT BREAKER**			
6.1	Function		Feeder / Transformer	
6.2	Circuit Breaker Type		Vacuum	
6.3	3-pole 3-phase ganged Open and Close operation		Yes	
6.4	Rated current (rms)	A	200/630	
6.5	Power frequency withstand voltage (1-min rms)	kV	50	
6.6	Lightning impulse withstand voltage (peak)	kV	150	
6.7	Rated short-time withstand current (rms)	kA/1s	25	
6.8	Rated Peak withstand current	kA	50	
6.9	Making capacity (peak)	kA	50	
6.10	Short-circuit breaking capacity	kA	20	
6.11	Load breaking capacity	A	200/630	
6.12	Cable charging breaking current		31.5	
6.13	Line charging breaking current		10	
6.14	CB rated Operating sequence (Duty cycle)		0-300ms-CO-3min-CO	
6.15	Stored energy operating capacity of a fully charged closing mechanism		0 – 300ms – CO (Starting from Open to Close to Open)	
6.16	Breaking (Opening) time	ms	<80	
6.17	Making (Closing) time	ms	<75	

Item No	Description	Unit	Horizon Power	Vendor Schedule
6.18	Suitable cable types and maximum cable sizes supported		3x1c 35 mm^2 Al, w/HD Cu screen, XLPE insul PVC/HDPE sheathed	
6.19	Trip all 3-phases device fitted to trigger on Circuit Breaker operation			
6.20	Circuit breaker class (AS 62271-100)		E1/C1/M1	
6.21	Minimum number of mechanical switching operations at rated short-circuit current	no.	5	
6.22	Padlocking facility provided with minimum padlock hole size	mm	10	
6.23	Fixed facilities for voltage indication and phase concordance provided per 3-ph feeder		Yes	
6.24	Manual and motorisation of CB spring charging provided		Yes for manual and motorised	
6.25	Motorisation motor voltage (DC)	Vdc	24	
6.26	Motorisation motor inrush power consumption (DC)	W	500	
6.27	Motorisation motor continuous power consumption (DC)	W	70	
6.28	Switchgear main electric circuits degree of protection (IPxx)		IP67	
6.29	Switchgear drive mechanism degree of protection (IPxx)		IP3X	
6.30	Switchgear MV cable compartment (with access cover closed) degree of protection (IPxx)		IP3X	
6.31	Self powered protection relay to trip Open Circuit Breaker is provided		Yes	
6.32	Auxiliary terminals for RTU/SCADA remote status indication are provided		Yes	
7	**Energy Metering Unit**			
7.1	Continuous primary busbar rating	A	630	

Item No	Description	Unit	Horizon Power	Vendor Schedule
7.2	Continuous primary load rating	A	400	
7.3	Rated short-time withstand current	kA/1s	20	
7.4	Rated Peak withstand current	kA	50	
7.5	Current Transformer Ratio	no.	200/100/1 A	
7.6	Current Transformer Output (VA) at unity burden	VA	15	
7.7	Current Transformer Accuracy Class		0.5S, ext 200% in both directions	
7.8	Voltage Transformer Ratio	no.	11/√3 kV: 110/√3 V 22/√3 kV: 110/√3 V	
7.9	Voltage Transformer Output (VA) per phase	VA/ph	50	
7.10	Voltage Transformer Accuracy Class		0.5M	
7.11	Metering Panel (with access cover closed) degree of protection (IPxx)		IP3X	
7.12	Durable permanent waterproof UV stabilised label fitted to Marshalling Cubicle Customer Compartment door on both sides of door.		“MAX VT FUSE 2A”	
8	**KIOSK AND SUPPORT STAND**			
8.1	Maximum height	mm	1800	
8.2	Maximum depth	mm	1000	
8.3	Maximum width	mm	2500	
8.4	Aluminium sheet thickness	mm	Min 3	
8.5	Galvanised mild steel thickness	mm	Min 3	
8.6	Use of stainless steel nutserts and bolts and hinges used in the stand and kiosk? Grade.		YES, 316 grade	
8.7	Paint System for Corrosion Category as per AS 2312		C4H	
8.8	Vermin screen type		Aluminium	

Item No	Description	Unit	Horizon Power	Vendor Schedule
8.9	IP rating of kiosk, when installed		IP45	
8.10	Double skin roof		Yes	
8.11	IAC Classification		AB-FLR	

C1.2 RING MAIN UNIT FOR 36 KV

Item No	Description	Unit	Horizon Power	Vendor Schedule
1	**GENERAL**			
1.1	System highest voltage	kV	36	
1.2	Nominal system voltage	kV	33	
1.3	Frequency	Hz	50	
1.4	Lightning impulse withstand voltage	kV	200	
1.5	Power frequency withstand	kV	70	
1.6	Rated short time withstand current	kA/1s	16	
1.7	Internal arc classification		A-FL	
1.8	Paint system for corrosion category as per AS 2312		C3H	
1.9	Continuity of service		LSC2A	
2	**BUSBAR SYSTEM**			
2.1	Rated Current (rms)	A	630	
2.2	Rated short time withstand current	kA/1s	16	
3	**SWITCH DISCONNECTOR**			
3.1	Function		Feeder	
3.2	Rated normal current (rms)	A	630	
3.3	Power frequency withstand voltage (1 min rms)	kV	70	
3.4	Lightning impulse withstand voltage (peak)	kV	200	
3.5	Rated short-time withstand current (rms)	kA/1s	16	

Item No	Description	Unit	Horizon Power	Vendor Schedule
3.6	Rated Peak withstand current	kA	70	
3.7	Making capacity (peak)	kA	40	
3.8	Short-circuit breaking capacity	kA	16	
3.9	Load breaking capacity	A	630	
3.10	Suitable cable types and maximum cable sizes supported		3x1core 185 mm^2 Aluminium XLPE insul PVC/HDPE sheathed 3x1core 240 mm^2 Copper XLPE insul PVC/HDPE sheathed	
3.11	General purpose switch class (AS 60265.1)		M2/E3	
3.12	Minimum number of mechanical switching operations at rated short circuit current	no.	5	
3.13	Padlocking facility provided with minimum padlock hole size	mm	10	
3.15	Facilities for voltage indication (via LED lamp) and phase concordance provided per 3-ph feeder		Yes	
3.16	Over-current and earth-fault indicator (self powered and remote telemetry ready) provided per 3-ph feeder		Yes	
3.17	Gear motor for SW/DC (Switch-disconnector) control - Voltage (DC)	V	24	
3.18	Gear motor for SW/DC (Switch-disconnector) control - Inrush power consumption	W	400	
3.19	Gear motor for SW/DC (Switch-disconnector) control - Continuous power consumption	W	100	
3.20	LOCAL / OFF / REMOTE switch to isolate power supply to individual SW/DC (switch-disconnector) motor circuit. (with padlocking facility for 10 mm dia padlock) shall be provided		Yes	

Item No	Description	Unit	Horizon Power	Vendor Schedule
3.21	Switchgear main electric circuits degree of protection (IPxx)		IP64	
3.22	Switchgear drive mechanism degree of protection (IPxx)		IP2X	
3.23	Switchgear MV cable compartment (with access cover closed) degree of protection)		IP3X	
3.24	Auxiliary terminals for RTU/SCADA remote status indication and switchgear remote Open – Close control are provided		Yes	
4	**EARTH SWITCH**			
4.1	Earth-Switches are provided for Switch-disconnectors, Fuse-Switches and Circuit Breakers (if offered) panels		Yes	
4.2	Earth-Switches provide on both sides of fuse (including effective earthing of the fuse carrier during fuse replacement)		Yes	
4.3	Power frequency withstand voltage (1-min rms)	kV	70	
4.4	Lightning impulse withstand voltage (peak)	kV	200	
4.5	Rated short-time withstand current	kA/1s	16	
4.6	Rated Peak withstand current	kA	70	
4.7	Busbar Current Rating	A	630	
4.8	Stranded earth conductor size	mm^2	70/150	
4.9	General purpose switch class (AS 60265.1)		M1/E3	
4.10	Minimum number of mechanical switching operations at rated short circuit current	no.	5	
4.11	Padlocking facility provided with minimum padlock hole size	mm	10	
4.12	Auxiliary terminals for RTU/SCADA remote status indication are provided		Yes	
5	**FUSE SWITCH**			
5.1	Function		Transformer	
5.2	Rated current (rms)	A	200	

Item No	Description	Unit	Horizon Power	Vendor Schedule
5.3	Power frequency withstand voltage (1-min rms)	kV	70	
5.4	Lightning impulse withstand voltage (peak)	kV	200	
5.5	Rated short-time withstand current (rms)	kA/1s	16	
5.6	Rated Peak withstand current	kA	40	
5.7	Making capacity (peak)	kA	40	
5.8	Short-circuit breaking capacity	kA	16	
5.9	Load breaking capacity	A	200	
5.10	Suitable cable types and maximum cable sizes supported		3x1c 50 mm^2 Al, w/HD Cu screen, XLPE insul PVC/HDPE sheathed	
5.11	Trip all 3-phases device fitted to trigger on fuse operation		Yes	
5.12	General purpose switch class (AS 60265.1)		M1/E1	
5.13	Minimum number of mechanical switching operations at rated normal (200 A) current load	no.	10	
5.14	Minimum number of mechanical switching operations at rated short circuit current	no.	5	
5.15	Padlocking facility provided with minimum padlock hole size	mm	10	
5.16	Fixed facilities for voltage indication and phase concordance provided per 3-ph feeder		Yes	
5.17	Switchgear main electric circuits degree of protection (IPxx)		IP67	
5.18	Switchgear drive mechanism degree of protection (IPxx)		IP3X	
5.19	Switchgear MV cable compartment (with cover closed) degree of protection (IPxx)		IP3X	
5.20	Auxiliary terminals for RTU/SCADA remote status indication		Yes	

Item No	Description	Unit	Horizon Power	Vendor Schedule
6	**CIRCUIT BREAKER**			
6.1	Function		Feeder / Transformer	
6.2	Circuit Breaker Type		Vacuum	
6.3	3-pole 3-phase ganged Open and Close operation		Yes	
6.4	Rated current (rms)	A	200/630	
6.5	Power frequency withstand voltage (1-min rms)	kV	50	
6.6	Lightning impulse withstand voltage (peak)	kV	200	
6.7	Rated short-time withstand current (rms)	kA/1s	16	
6.8	Rated Peak withstand current	kA	40	
6.9	Making capacity (peak)	kA	40	
6.10	Short-circuit breaking capacity	kA	16	
6.11	Load breaking capacity	A	200/630	
6.12	Cable charging breaking current	A	50	
6.13	Line charging breaking current	A	10	
6.14	CB rated Operating sequence (Duty cycle)		0-300ms-CO-3min-CO	
6.15	Stored energy operating capacity of a fully charged closing mechanism		0 – 300ms – CO (Starting from Open to Close to Open)	
6.16	Breaking (Opening) time	ms	<80	
6.17	Making (Closing) time	ms	<75	

Item No	Description	Unit	Horizon Power	Vendor Schedule
6.18	Suitable cable types and maximum cable sizes supported		3x1core 185 mm^2 Aluminium XLPE insul PVC/HDPE sheathed 3x1core 240 mm^2 Copper XLPE insul PVC/HDPE sheathed	
6.19	Trip all 3-phases device fitted to trigger on Circuit Breaker operation		Yes	
6.20	Circuit breaker class (AS 62271-100)		E1/C1/M1	
6.21	Minimum number of mechanical switching operations at rated short-circuit current	no.	5	
6.22	Padlocking facility provided with minimum padlock hole size	mm	10	
6.23	Fixed facilities for voltage indication and phase concordance provided per 3-ph feeder		Yes	
6.24	Manual and motorisation of CB spring charging provided		Yes for manual and motorised	
6.25	Motorisation motor voltage (DC)	Vdc	24	
6.26	Motorisation motor inrush power consumption (DC)	W	500	
6.27	Motorisation motor continuous power consumption (DC)	W	70	
6.28	Switchgear main electric circuits degree of protection (IPxx)		IP67	
6.29	Switchgear drive mechanism degree of protection (IPxx)		IP3X	
6.30	Switchgear MV cable compartment (with access cover closed) degree of protection (IPxx)		IP3X	
6.31	Self powered protection relay to trip Open Circuit Breaker is provided		Yes	

Item No	Description	Unit	Horizon Power	Vendor Schedule
6.32	Auxiliary terminals for RTU/SCADA remote status indication are provided		Yes	
7	**Energy Metering Unit**			
7.1	Continuous Primary Busbar Rating	A	630	
7.2	Continuous Primary Load Rating	A	400	
7.3	Rated short-time withstand current	kA/1s	16	
7.4	Rated Peak withstand current	kA	40	
7.5	Current Transformer Ratio	no.	200/100/1 A	
7.6	Current Transformer Output (VA) at unity burden	VA	15	
7.7	Current Transformer Accuracy Class		0.5S, ext 200% in both directions	
7.8	Voltage Transformer Ratio	no.	33/√3 kV: 110/√3 V	
7.9	Voltage Transformer Output (VA) per phase	VA/ph	50	
7.10	Voltage Transformer Accuracy Class		0.5M	
7.11	Metering Panel (with access cover closed) degree of protection (IPxx)		IP3X	
7.12	Durable permanent waterproof UV stabilised label fitted to Marshalling Cubicle Customer Compartment door on both sides of door.		“MAX VT FUSE 2A”	
8	**KIOSK AND SUPPORT STAND**			
8.1	Maximum height	mm	2200	
8.2	Maximum depth	mm	1500	
8.3	Maximum width	mm	2700	
8.4	Aluminium sheet thickness	mm	Min 3	
8.5	Galvanised mild steel thickness	mm	Min 3	
8.6	Use of stainless steel nutserts and bolts and hinges used in the stand and kiosk? Grade?		YES, 316 grade	

Item No	Description	Unit	Horizon Power	Vendor Schedule
8.7	Paint system for corrosion category as per AS 2312		C4H	
8.8	Vermin screen type		Aluminium	
8.9	IP rating of kiosk, when installed		IP45	
8.10	Double skin roof		Yes	
8.11	IAC Classification		AB-FLR	

APPENDIX D TECHNICAL SPECIFICATION COMPLIANCE

The Vendor shall indicate below whether this offer is fully compliant with the nominated clause in this Specification. A YES shall ONLY be indicated if the offer is 100% compliant with the relevant Clause. If NO is indicated and supporting documents are submitted, then mark the ATT box with the attachment number. Details of departure shall be provided in Appendix E

CLAUSE NUMBER		YES	NO	ATT.
3	General Technical Requirements			
3.1	General	☐	☐	☐
3.2	Outdoor Installation	☐	☐	☐
3.2.1	*Configuration*	☐	☐	☐
3.3	Indoor Installation	☐	☐	☐
3.3.1	*Configuration*	☐	☐	☐
3.4	Environment Conditions	☐	☐	☐
3.5	Electrical Requirements	☐	☐	☐
3.6	Mechanical Verification	☐	☐	☐
4	Specific Technical Requirements			
4.1	Ring Main Unit	☐	☐	☐
4.1.1	*Internal Arc Classification*	☐	☐	☐
4.1.2	*RMU Functions*	☐	☐	☐
4.1.3	*Switch Disconnector and Earth Switch*	☐	☐	☐
4.1.4	*Fuse Switch and Earth Switch*	☐	☐	☐
4.1.5	*Circuit Breaker, Switch Disconnector and Earth Switch*	☐	☐	☐
4.1.5.1	*Circuit Breaker Operating Mechanism*	☐	☐	☐
4.1.5.2	*Circuit Breaker Operation*	☐	☐	☐
4.1.5.3	*Circuit Breaker Protection*	☐	☐	☐
4.1.5.4	*Circuit Breaker Labels*	☐	☐	☐
4.2	Indoor Metering	☐	☐	☐
4.2.1	*Design*	☐	☐	☐
4.2.2	*Primary Metering Compartment*	☐	☐	☐
4.2.3	*Metering Marshalling Compartment/Enclosure*	☐	☐	☐
4.2.4	*Current Transformer*	☐	☐	☐
4.2.5	*Voltage Transformer*	☐	☐	☐
4.2.6	*Secondary Wiring*	☐	☐	☐
4.2.7	*Terminal Markings of Instrument Transformers*	☐	☐	☐
4.2.8	*Rating Plate of Instrument Transformer*	☐	☐	☐

CLAUSE NUMBER		YES	NO	ATT.
4.3	Insulating and Switching Medium	☐	☐	☐
4.3.1	*Vacuum Interrupters*	☐	☐	☐
4.3.2	*Air Pressure Gauge*	☐	☐	☐
4.3.3	*Loss of Insulating Medium*	☐	☐	☐
4.4	Interlocks	☐	☐	☐
4.4.1	*General*	☐	☐	☐
4.4.2	*Circuit Breakers*	☐	☐	☐
4.4.3	*Switch Disconnectors and Fuse Switch*	☐	☐	☐
4.5	Padlocking	☐	☐	☐
4.6	Voltage Presence Indications	☐	☐	☐
4.7	Phase Fault Indicators	☐	☐	☐
4.8	Termination Facilities	☐	☐	☐
4.9	Cable Connections and Support	☐	☐	☐
4.10	Earthing	☐	☐	☐
4.11	Name Plate	☐	☐	☐
4.12	Surface Protection	☐	☐	☐
4.13	Remote Terminal Unit (RTU)	☐	☐	☐
4.13.1	*Remote Terminal Unit and Motorisation*	☐	☐	☐
4.13.2	*Remote Terminal Unit Battery Back-up Supply*	☐	☐	☐
4.13.3	*Remote Terminal Unit Physical Requirements*	☐	☐	☐
4.13.4	*Remote Terminal Unit Modularity*	☐	☐	☐
4.13.5	*Remote Terminal Unit Software*	☐	☐	☐
4.13.6	*Remote Terminal Unit Communications*	☐	☐	☐
4.14	Kiosk and Support Stand	☐	☐	☐
4.14.1	*Kiosk*	☐	☐	☐
4.14.1.1	*Ventilation*	☐	☐	☐
4.14.1.2	*Vermin Screen*	☐	☐	☐
4.14.1.3	*Kiosk Doors*	☐	☐	☐
4.14.1.4	*Kiosk Roof*	☐	☐	☐
4.14.2	*Support Stand*	☐	☐	☐
4.14.2.1	*Kiosk and Stand Earthing*	☐	☐	☐
4.14.3	*Kiosk and Support Stand Arrangements*	☐	☐	☐
4.14.4	*Kiosk and Support Stand Surface Finish*	☐	☐	☐
4.14.5	*Coupling of Kiosk and Support Stand*	☐	☐	☐

CLAUSE NUMBER		YES	NO	ATT.
4.14.6	*Kiosk and Support Stand Dimensions*	☐	☐	☐
5	Packaging	☐	☐	☐
5.1	Transport Frames	☐	☐	☐
6	Testing Requirements			
6.1	Type Test	☐	☐	☐
6.1.1	*Internal Arc-Fault Containment Test*	☐	☐	☐
6.1.2	*Submersion in Water*	☐	☐	☐
6.1.3	*Impact Test for Cyclone Rating of Kiosk*	☐	☐	☐
6.2	Routine Test	☐	☐	☐
6.2.1	*CT and VT Accuracy*	☐	☐	☐
7	Documentation			
7.1	Drawings	☐	☐	☐
7.2	Test Certificates	☐	☐	☐
7.3	Installation, Operation and Maintenance Manual	☐	☐	☐
8	Spares	☐	☐	☐
9	Samples	☐	☐	☐

APPENDIX E DEPARTURES FROM TECHNICAL SPECIFICATION

The Vendor shall nominate the Clause and describe the departure:

CLAUSE NO.	DEPARTURE

APPENDIX F STANDARD FUSES

MV fuses for ground-mount switchgear

System Voltage	Fuse Rating (A)	Horizon Power Standard 3-phase Transformer Sizes (kVA)	HP Stockcode
SIBA Air HRC	(For use with non-extensible RMU and extensible RMU switchgear)		
7.2 kV	31.5	100/160/200	
	50.0	315	
	100.0	630	
	160.0	1000	
	Fuse Extender (set)		XA2355
12 kV	25.0	100/160/200	
	31.5	315	
	50.0	630	
	80.0	1000	
	Fuse Extender (set)		XA2355
24 kV	10.0	100/160/200	
	16.0	315	
	31.5	500/630	
	40.0	1000	
36 kV	6.3	50/63/160	
	8.0	315	
	20.0	630	
	40.0	1000	

APPENDIX G SCHEDULE OF *EQUIPMENT*

ITEM No	CONFIG	DESCRIPTION	EXTENSIBILITY	VOLTAGE	CURRENT
1	3+0	3-WAY UNIT; EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS	RIGHT SIDE EXT	12/24KV	SWDC - 630A
2	2+1	3-WAY UNIT; EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS 1 x FUSE SWITCH	RIGHT SIDE EXT	12/24KV	SWDC - 630A FSW – 200A
3	2+2	4-WAY UNIT; EXTENSIBLE 2 x AUTOMATED SWITCH DISCONNECTORS 2 x FUSE SWITCH	RIGHT SIDE EXT	12/24KV	SWDC - 630A FSW – 200A
4	3+1	4-WAY UNIT; EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS 1 x FUSE SWITCH	RIGHT SIDE EXT	12/24KV	SWDC - 630A FSW – 200A
5	4+0	4-WAY UNIT; EXTENSIBLE 4 x AUTOMATED SWITCH DISCONNECTORS	RIGHT SIDE EXT	12/24KV	SWDC - 630A

ITEM No	CONFIG	DESCRIPTION	EXTENSIBILITY	VOLTAGE	CURRENT
6	2+3	5-WAY UNIT; NON-EXTENSIBLE 2 x AUTOMATED SWITCH DISCONNECTORS 3 x FUSE SWITCH	NON EXT	12/24KV	SWDC - 630A FSW – 200A
7	3+2	5-WAY UNIT; NON-EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS 2 x FUSE SWITCH	NON EXT	12/24KV	SWDC - 630A FSW – 200A
8	1+0	1 x AUTOMATED SWITCH DISCONNECTOR	DOUBLE EXT	12/24KV	SWDC - 630A
9	1+0	1 x AUTOMATED CIRCUIT BREAKER	DOUBLE EXT	12/24KV	CB – 630A
10	0+1	1 x FUSE SWITCH	DOUBLE EXT	12/24KV	SWDC – 200A
11	0+1	1 x AUTOMATED CIRCUIT BREAKER	DOUBLE EXT	12/24kV	CB – 200A
12	0+1	1 x METERING UNIT	DOUBLE EXT	12KV	CT: 100-200/1A 0.5S ext 200%. 15VA VT: 11/√3 kV: 110/√3 V, 0.5M, 50VA/PH
13	0+1	1 x METERING UNIT	DOUBLE EXT	24KV	CT: 100-200/1A 0.5S ext 200%. 15VA

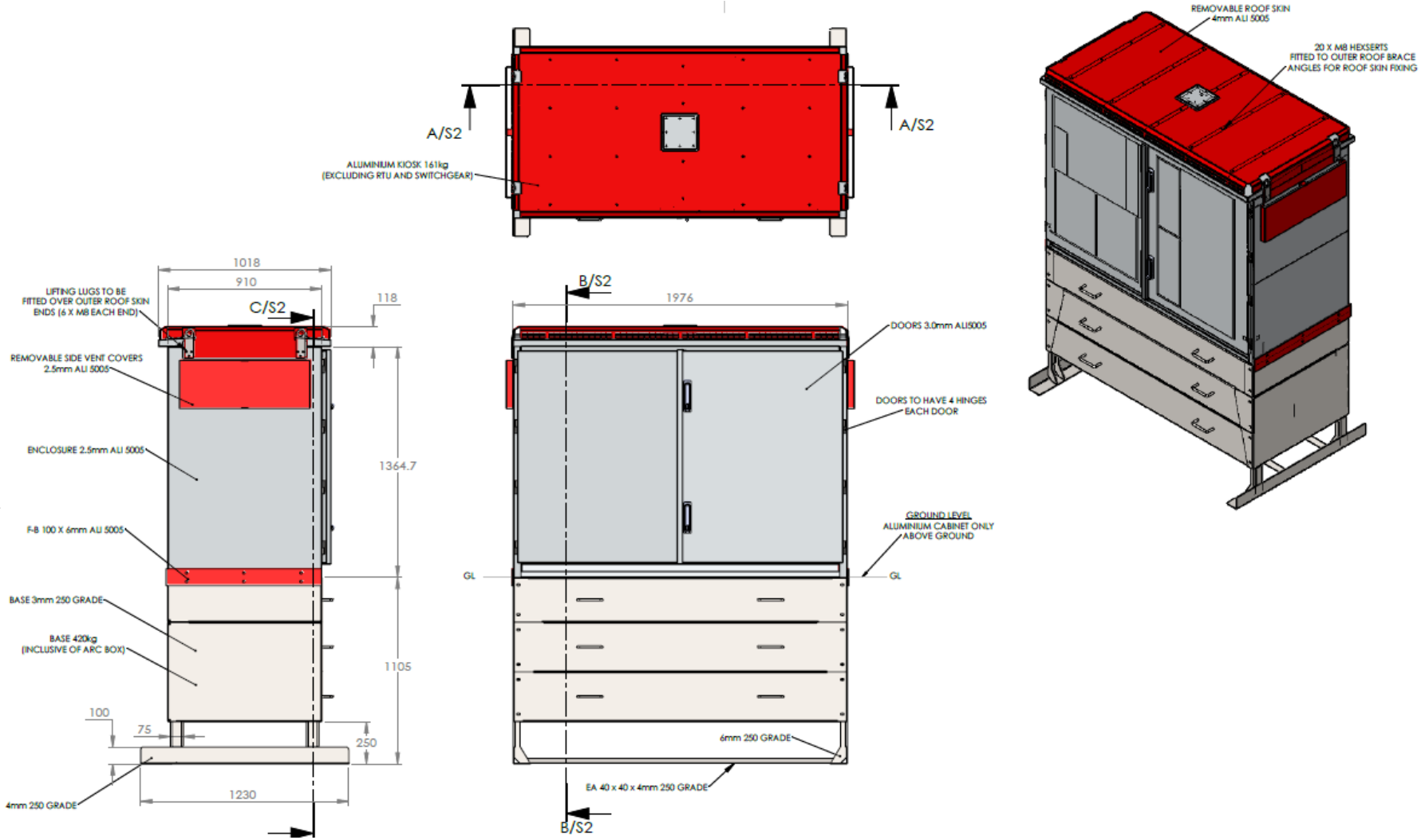
ITEM No	CONFIG	DESCRIPTION	EXTENSIBILITY	VOLTAGE	CURRENT
					VT: 22/√3 kV: 110/√3 V, 0.5M, 50VA/PH
14	3+0	3-WAY UNIT; EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS	RIGHT SIDE EXT	36KV	SWDC - 630A
15	2+1	3-WAY UNIT; EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS 1 x FUSE SWITCH	RIGHT SIDE EXT	36KV	SWDC - 630A FSW – 200A
16	2+2	4-WAY UNIT; EXTENSIBLE 2 x AUTOMATED SWITCH DISCONNECTORS 2 x FUSE SWITCH	RIGHT SIDE EXT	36KV	SWDC - 630A FSW – 200A
17	3+1	4-WAY UNIT; EXTENSIBLE 3 x AUTOMATED SWITCH DISCONNECTORS 1 x FUSE SWITCH	RIGHT SIDE EXT	36KV	SWDC - 630A FSW – 200A
18	4+0	4-WAY UNIT; EXTENSIBLE 4 x AUTOMATED SWITCH DISCONNECTORS	RIGHT SIDE EXT	36KV	SWDC - 630A
19	3+2	5-WAY UNIT; NON-EXTENSIBLE	NON EXT	36KV	SWDC - 630A

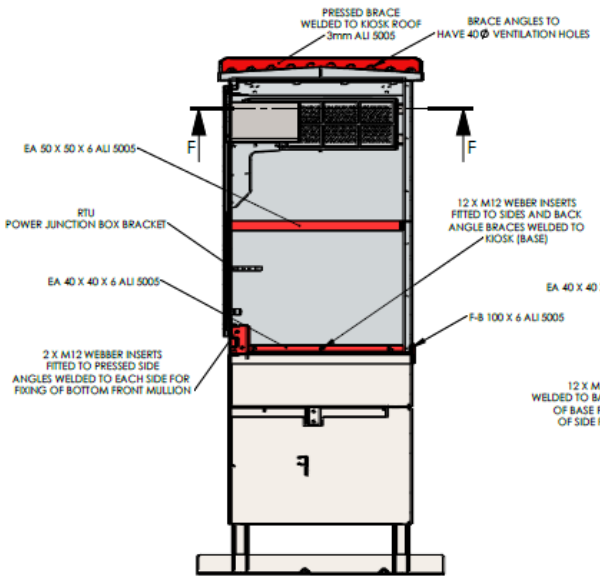
ITEM No	CONFIG	DESCRIPTION	EXTENSIBILITY	VOLTAGE	CURRENT
		3 x AUTOMATED SWITCH DISCONNECTORS 2 x FUSE SWITCH			FSW – 200A
20	1+0	1 x AUTOMATED SWITCH DISCONNECTOR	DOUBLE EXT	36KV	SWDC - 630A
21	1+0	1 x AUTOMATED CIRCUIT BREAKER	DOUBLE EXT	36KV	CB - 630A
22	0+1	1 x FUSE SWITCH	DOUBLE EXT	36KV	FSW – 200A
23	0+1	1 x AUTOMATED CIRCUIT BREAKER	DOUBLE EXT	36KV	CBtx - 200A
24	0+1	1 x METERING UNIT	DOUBLE EXT	36KV	CT: 100-200/1A 0.5S ext 200%. 15VA VT: 33/√3 kV: 110/√3 V, 0.5M, 50VA/PH
25	MOTOR	COMPLETE MOTORISATION KIT	RETROFITTABLE SWDC KIT – CT, , MOTOR, ETC	12/24KV	
27	FUSE EXT	FUSE EXTENDERS FOR 11KV FUSES		12KV	
28	4WAY	4 WAY KIOSK + SUPPORT STAND	-	12/24KV	
29	5WAY	5 WAY KIOSK + SUPPORT STAND		12/24KV	

ITEM No	CONFIG	DESCRIPTION	EXTENSIBILITY	VOLTAGE	CURRENT
30	5WAY	5 WAY KIOSK + SUPPORT STAND		36KV	
31	RTU	REMOTE TERMINAL UNIT – CONTROL AND TELEMETRY		12/24/36KV	INDIVIDUAL RTU COMPONENTS TO BE CONFIRMED

APPENDIX H DRAWINGS

H1 12/24KV 4-AND 5 WAY KIOSK AND SUPPORT STAND





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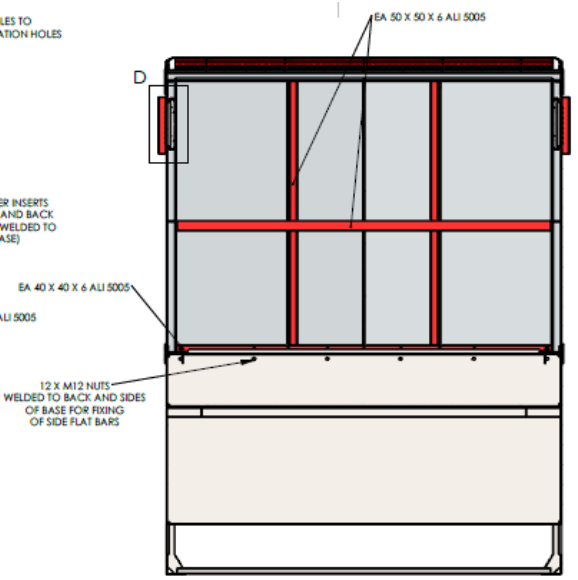

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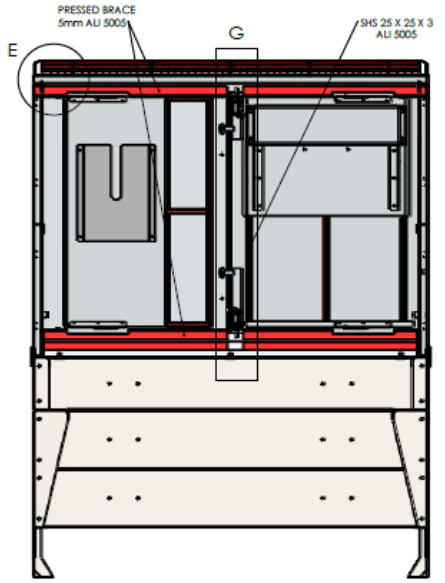

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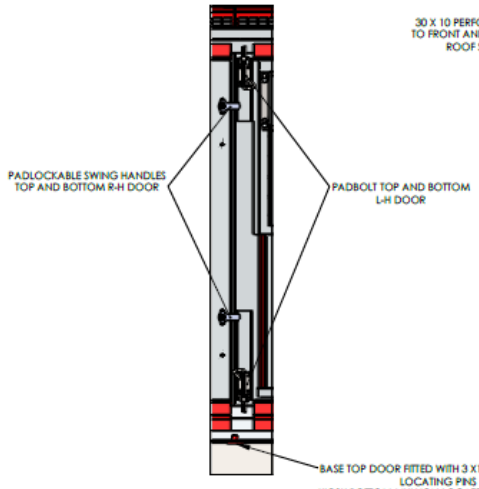

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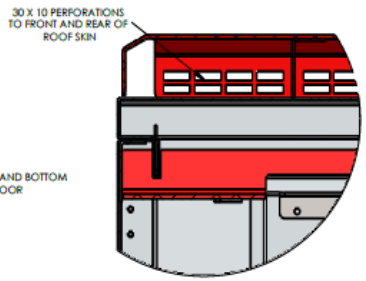

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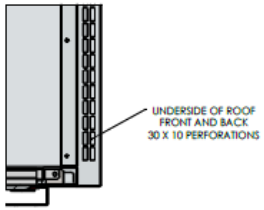

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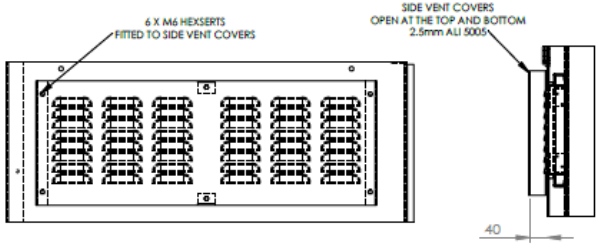
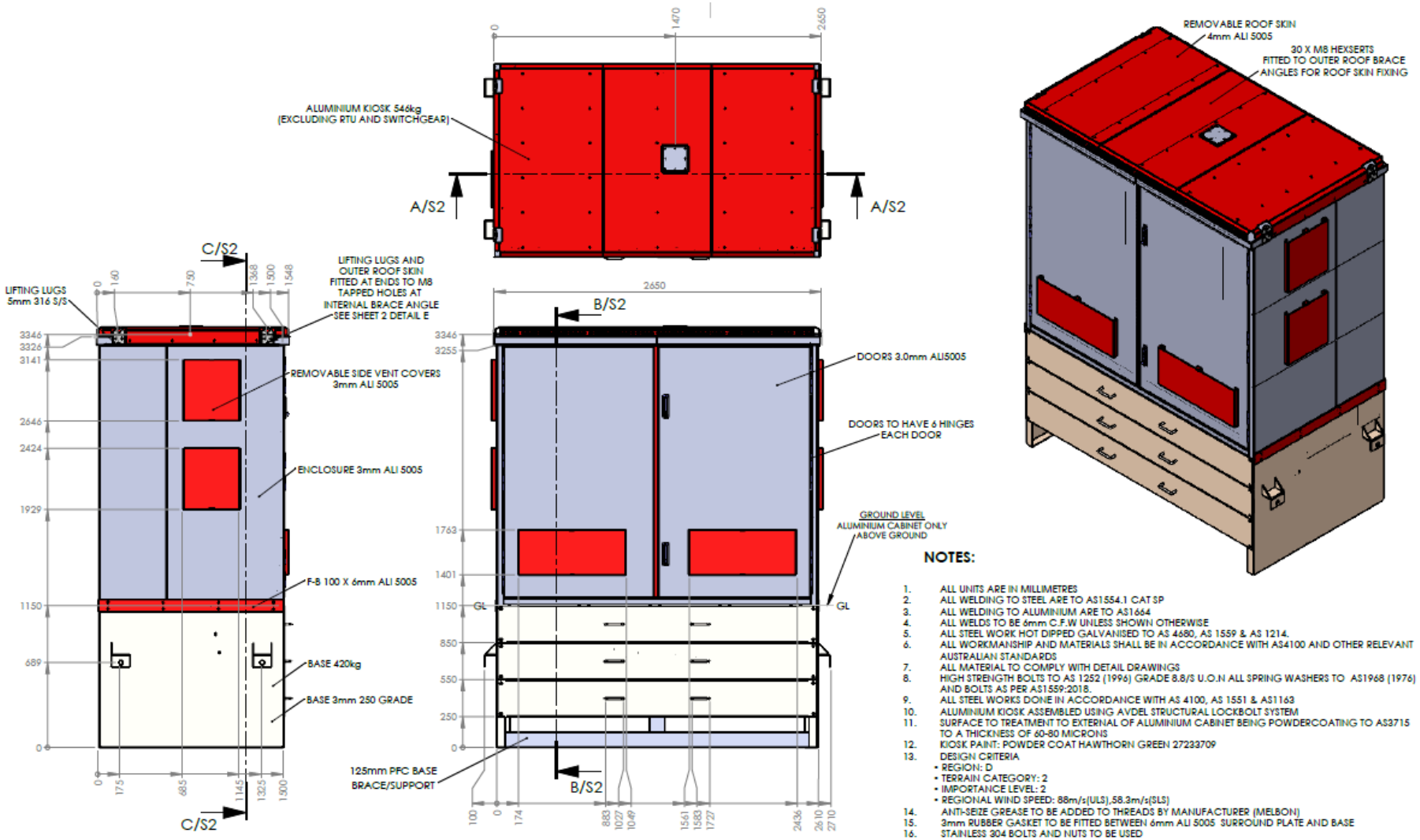


DETAIL D
SCALE 1 : 10

H2 36KV 5 WAY KIOSK AND SUPPORT STAND



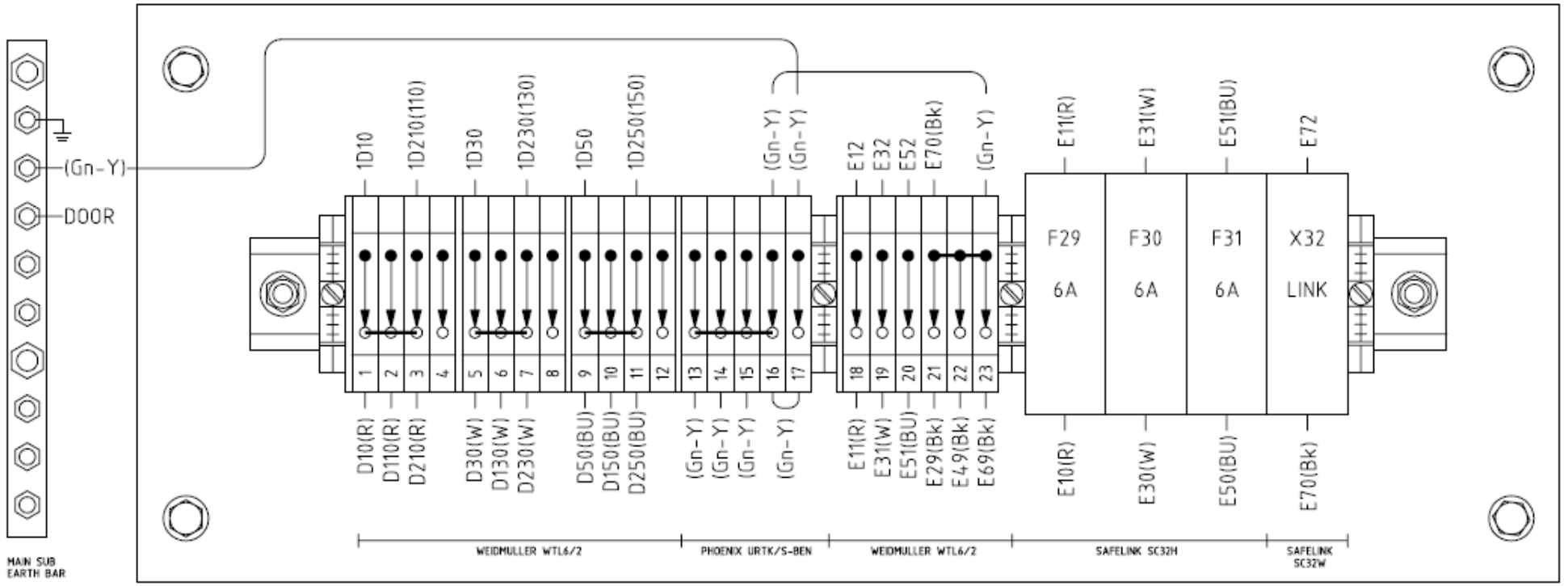
NOTES:

1. ALL UNITS ARE IN MILLIMETRES
2. ALL WELDING TO STEEL ARE TO AS1554.1 CAT SP
3. ALL WELDING TO ALUMINIUM ARE TO AS1664
4. ALL WELDS TO BE 6mm C.F.W UNLESS SHOWN OTHERWISE
5. ALL STEEL WORK HOT DIPPED GALVANISED TO AS 4680, AS 1559 & AS 1214.
6. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS4100 AND OTHER RELEVANT AUSTRALIAN STANDARDS
7. ALL MATERIAL TO COMPLY WITH DETAIL DRAWINGS
8. HIGH STRENGTH BOLTS TO AS 1252 (1996) GRADE 8.8/S U.O.N ALL SPRING WASHERS TO AS1968 (1976) AND BOLTS AS PER AS1559:2018.
9. ALL STEEL WORKS DONE IN ACCORDANCE WITH AS 4100, AS 1551 & AS1163
10. ALUMINIUM KIOSK ASSEMBLED USING AVDEL STRUCTURAL LOCKBOLT SYSTEM
11. SURFACE TO TREATMENT TO EXTERNAL OF ALUMINIUM CABINET BEING POWDERCOATING TO AS3715 TO A THICKNESS OF 60-80 MICRONS
12. KIOSK PAINT: POWDER COAT HAWTHORN GREEN 27233709
13. DESIGN CRITERIA
    - REGION: D
    - TERRAIN CATEGORY: 2
    - IMPORTANCE LEVEL: 2
    - REGIONAL WIND SPEED: 88m/s(ULS),58.3m/s(SLS)
14. ANTI-SEIZE GREASE TO BE ADDED TO THREADS BY MANUFACTURER (MELBON)
15. 3mm RUBBER GASKET TO BE FITTED BETWEEN 6mm ALI 5005 SURROUND PLATE AND BASE
16. STAINLESS 304 BOLTS AND NUTS TO BE USED

H3 INDOOR ENERGY METERING UNIT

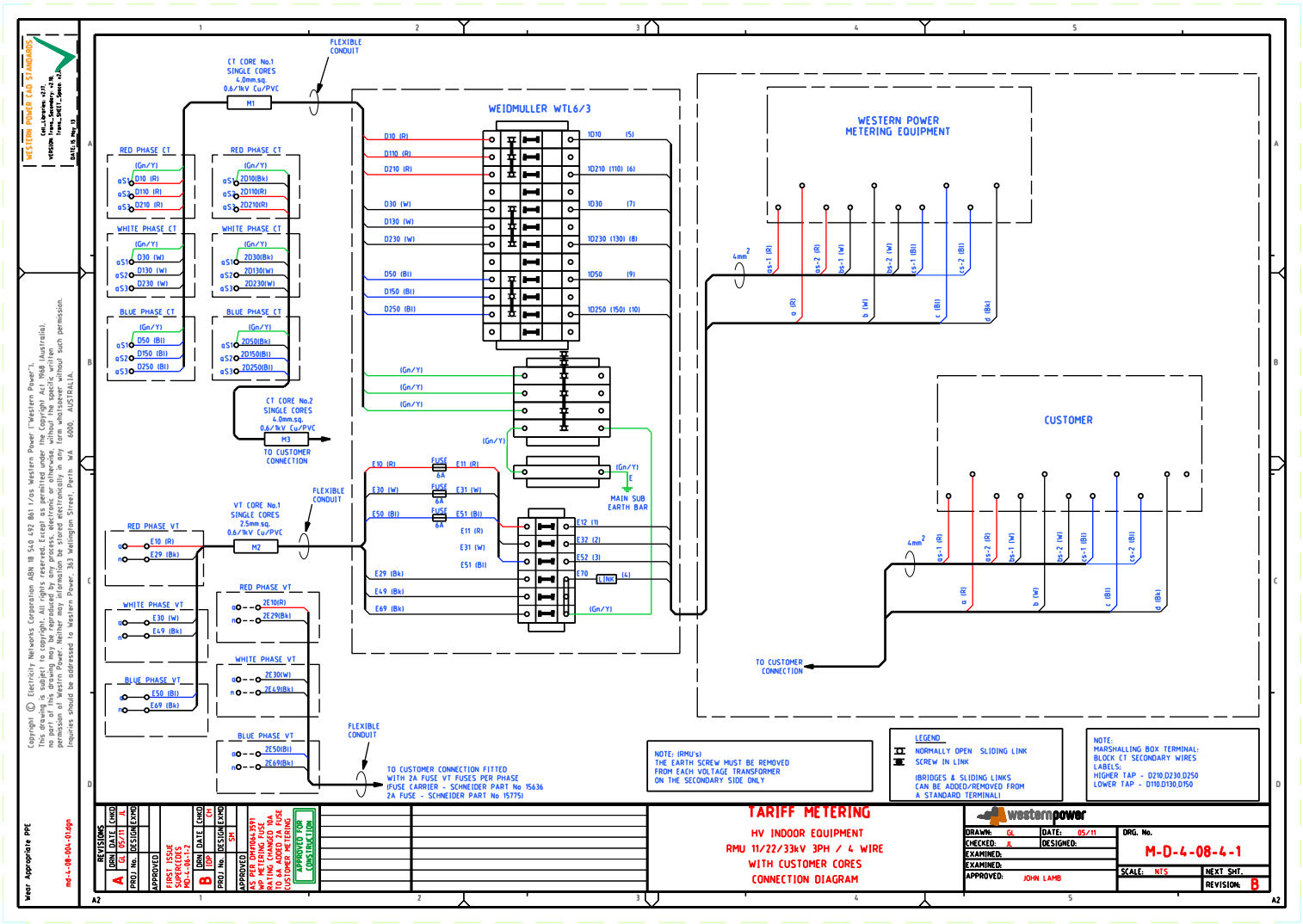
H3.1 METERING MARSHALLING COMPARTMENT

H3.2 HORIZON POWER METERING TERMINAL BLOCK

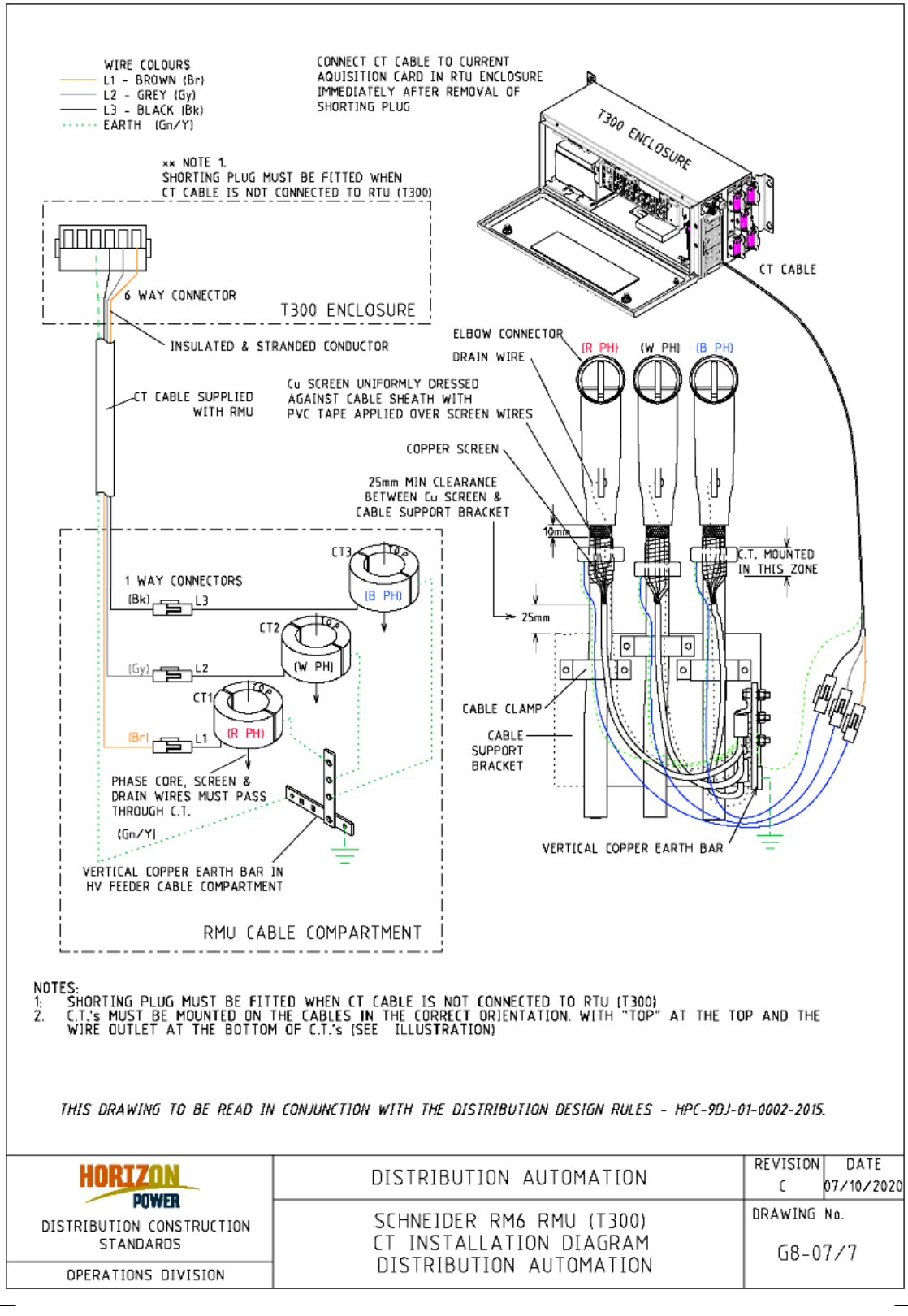


DETAIL A : TERMINAL ARRANGEMENT IN SEALABLE LV COMPARTMENT FOR WESTERN POWER-LEFT HAND SIDE

H3.3 INDOOR METERING CONNECTION DIAGRAM



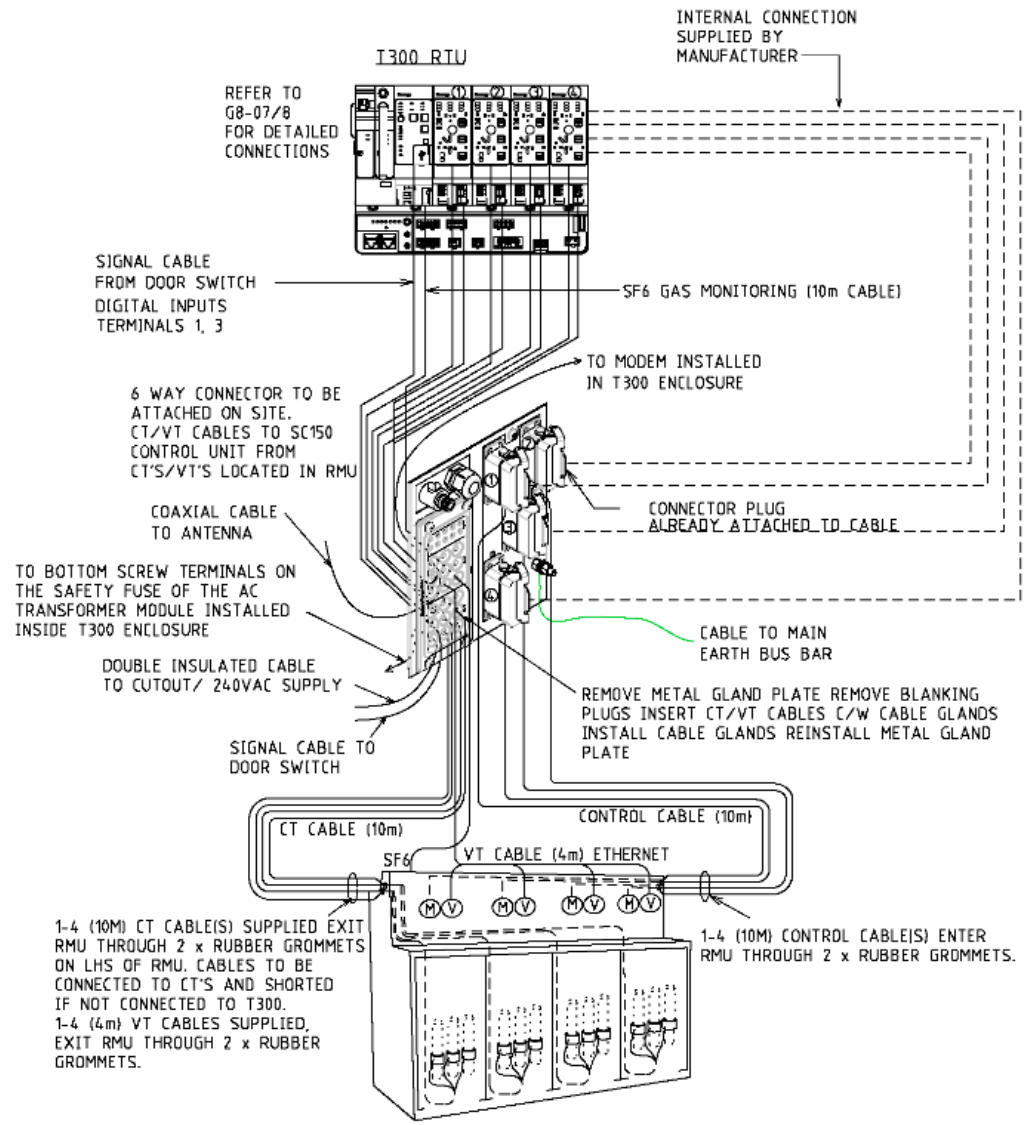
H3.4 RTU WIRING



NOTES:
1. SHORTING PLUG MUST BE FITTED WHEN CT CABLE IS NOT CONNECTED TO RTU (T300)
2. C.T.'s MUST BE MOUNTED ON THE CABLES IN THE CORRECT ORIENTATION. WITH "TOP" AT THE TOP AND THE WIRE OUTLET AT THE BOTTOM OF C.T.'s (SEE ILLUSTRATION)

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DISTRIBUTION DESIGN RULES - HPC-9DJ-01-0002-2015.

HORIZON POWER DISTRIBUTION CONSTRUCTION STANDARDS OPERATIONS DIVISION	DISTRIBUTION AUTOMATION SCHNEIDER RM6 RMU (T300) CT INSTALLATION DIAGRAM DISTRIBUTION AUTOMATION	REVISION C	DATE 07/10/2020
		DRAWING No. G8-07/7	



NOTES:
1: T300, MODEM, AND ANTENNA TO BE INSTALLED BY OT.
2: CT CABLES OF INSTALLED CT'S ARE TO BE SHORTED IF NOT CONNECTED TO T300.

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DISTRIBUTION DESIGN RULES - HPC-9DJ-01-0002-2015.

HORIZON POWER DISTRIBUTION CONSTRUCTION STANDARDS OPERATIONS DIVISION	DISTRIBUTION AUTOMATION SCHNEIDER RM6 RMU (T300) CONNECTION DRAWING INSTALLATION DETAILS	REVISION C DATE 07/10/2020 DRAWING No. G8-07/6