



Specification – Technical Requirements for Metering MV CT-VT Units

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1 SCOPE

This specification covers Horizon Power's requirements for the manufacture, testing and supply of medium-voltage overhead and ground mounted energy metering CT-VT units used on AC systems up to and including 33 kV.

Tests prescribed will evaluate the performance of these CT-VT units and shall comply with this specification.

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 of 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 accreditation from a NATA MRA (Mutual Recognition Agreement) partner.

2 NORMATIVE REFERENCES

2.1 Standards

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. Information on currently valid national and international standards and specifications can be obtained from SAI Global – Standards On-Line data base or equivalent standards database.

Table 1: List of Applicable Standards

STANDARD	DESCRIPTION
AS 1243	Voltage Transformers for Measurement and Protection
AS 1767.1	Insulating Oil for Transformers and Switchgear
AS 1931 Parts 1 & 2	High Voltage Testing Techniques - General Definitions and Test Requirements
AS 2312	Guide to the Protection of Iron and Steel against Exterior Atmospheric Corrosion
AS 2700	Colour Standards for General Purposes
AS/NZS 3000	Electrical Installations (known as Australian/New Zealand Wiring Rules)
AS 4436	Guide for Selection of Insulators in respect of Polluted Conditions
AS 60044-3	Instrument Transformers - Combined Transformers
AS 60137	Insulated Bushings for Alternating Voltages above 1000 V

STANDARD	DESCRIPTION
AS 60529	Degrees of Protection provided by Enclosures for Electrical Equipment

Other applicable documents:

WA Electricity Industry Metering Code 2012

2.2 Definitions and Abbreviations

For the purposes of this specification the following definitions apply:

2.2.1 Definitions

- 1) **Aerial:** The method of MV and LV termination of the equipment to an overhead distribution system.
- 2) **Air-filled enclosure:** A metallic enclosure designed to protect the ends of the cables and bushings, providing a weatherproof enclosure with a minimum rating of IP54.
- 3) **Equipment:** means all equipment, accessories and terminations necessary to form a complete CT-VT in relation to this specification.

2.2.2 Abbreviations

- 1) AC: Alternating Current
- 2) AMF: Approved Manufacturing Facility
- 3) AS: Australian Standard
- 4) CT-VT: Current Transformer Voltage Transformer
- 5) LV: Low Voltage < 1000 volts ac
- 6) MV: Medium Voltage >1000 volts ac; <35 000 volts ac

2.3 Drawings

The drawings listed below forms part of this specification, see Appendix G:

- 1) HPA-SD-E-00030-01 (Aerial Connection 3 phase)
- 2) HPA-SD-E-01020-01 (Pad-Mount 3 phase)
- 3) HPA-SD-E-01020-02 (Pad-Mount 3 phase internals)
- 4) HPA-SD-E-01020-03 (Pad-Mount 3 phase wiring)
- 5) HPA-SD-E-01020-04 (Pad-Mount termination board)
- 6) HPA-SD-S-00001-01 (Bracket and Clamp for Aerial Mounting)

3 REQUIREMENTS

3.1 Power System Particulars

3.1.1 *Rated Voltages*

The rated voltages considered in this specification shall be:

- 1) 6.6-11 kV (three phase)
- 2) 22 kV(three phase)
- 3) 33 kV(three phase)

3.1.2 *Fault Rating*

The Maximum design fault currents are as follows:

- 1) 13.1 kA rms / 1 second for 33 kV and 22 kV systems
- 2) 18.1 kA rms / 1 second for 11 kV and 6.6 kV systems

Equipment that is rated for operation in conditions with a three (3) second fault duration will be considered favourably.

3.1.3 *Nominal System Frequency*

The nominal system frequency is 50 Hz.

3.1.4 *System Insulation Levels*

The system Basic Impulse Insulation Levels (BIL) are as follows:

Table 2: System Insulation Levels

Nominal System Voltage (kV rms)	System Highest Voltage (kV peak)	Lightning Impulse Withstand Voltage (kV peak)	Power Frequency withstand Voltage (kV peak)
6.6	7.2	75	20
11.0	12.0	95	28
22.0	24.0	150	50
33.0	36.0	200	70

Notwithstanding the nominal system BIL for each distribution level, the minimum system design level insulation creepage length is 31 mm/kV as defined by AS 4436 for Very Heavy pollution areas.

3.2 Service Conditions

3.2.1 *Environmental Conditions*

The Equipment shall be suitable for use throughout the state of Western Australia in conditions where a wide range of solar radiation, pollution (salt bearing and industrial) and wind velocities are experienced. The Equipment shall also be suitable for continuous operation under the following environmental conditions:

Table 3: Environmental Conditions

Condition	Requirement
Air Temperature:	55°C maximum -5°C minimum
Black Body Temperature in sunlight:	80°C maximum
Relative Humidity:	0% to 100%, wet/condensing
Maximum Intensity of Solar Radiation:	1.1 kW/m ²
Maximum Wind Velocities:	240 km/hr North West cyclonic gust
Pollution:	Wind borne dust deposits may accumulate over a number of months followed by high humidity with heavy dew or light rain.
Salt:	At points along a 4 km wide West Coast strip, salt deposits can reach levels as high as 40 mg/100 cm ² per month.
Isokeraunic Levels:	Activity varies from 60-80 thunder days per year in the Kimberley, to 30 thunder days per year in the Pilbara, and 5-10 thunder days per year along the South Coast.
Altitude:	Not exceeding 1000 m above mean sea level.
Treatment:	Live line washing with water having a resistivity above 600 Ω.cm

3.2.2 Service Requirements

The Equipment shall be suitable for use throughout Horizon Power’s distribution network systems in terms of dimensions, mass and connection. The Equipment shall be designed/configured to suit existing limitations and standard practices for electrical terminations and personnel access.

Accordingly all Equipment shall:

- 1) fall within the length, width and height limitations;
- 2) be of equivalent mass; and
- 3) adhere to the existing termination arrangements and positions

as shown on the reference drawings listed in Section 2.3.

While the offered equipment may vary in terms of dimensions and mass from those currently procured by Horizon Power, any proposed changes in the physical characteristics should be identified in Appendix E, Departures from Specifications. All material changes should also be noted where they may affect other equipment and/or an overall life cycle evaluation.

3.2.3 Safety

Vendors shall provide information on the inherently safety of the Equipment for the conditions under which it will be used, accessed and maintained.

4 CT-VT UNIT DESIGN AND CONSTRUCTION

4.1 General

CT-VT Units shall be adequately braced to withstand all mechanical shocks which may occur under working conditions including those produced by short circuits and also stress resulting from transport, lifting by slings and forces arising from the connection of cables and overhead conductors.

All sharp points on the CT-VT unit's exterior surfaces will be removed to prevent injury. All fixings shall conform to Australian metric standards and shall be galvanised mild steel unless otherwise specified. Compatible materials shall be used for all fixings to prevent corrosion.

Reference drawings of CTVT Units are listed in Section 2.3.

4.2 Tank

The internal tank of the CT-VT unit and all parts shall be designed to eliminate air pockets whilst the outside surfaces shall be designed to prevent the accumulation of water.

The tank shall be filled with an oil insulating medium and be oil tight.

External surface welding of horizontal and vertical joints shall be on both sides of the joint and in all cases shall be continuous.

All metal work will be electrically bonded to the tank to permit earthing by the Purchaser. If a part cannot be adequately bonded it will be constructed from a suitable insulating material instead of metal.

4.3 Bushings

Bushings shall be in compliance with AS 60137, except where "Non-Load break" type terminals have been specified. The particular requirements for bushings/terminations are detailed in Section 5.5.

Bushings shall be capable of operating under high levels of salt, dust and industrial pollution as detailed in Table 3 and shall comply with Section 3.1.4.

The vendor shall provide information on methods taken to prevent the long-term erosion of the MV bushing gasket by leakage currents.

Where medium voltage bushings are supplied with a higher impulse level than the windings of the voltage transformers, arc-gaps should be used to protect the windings and the gap setting should be stated.

4.4 Joints and Gaskets

All bolted joints shall be rendered oil tight by the use of neoprene cork gaskets or other sealing methods. Where tank covers are bolted rather than fully welded, the sealing method must be submitted to Horizon Power for review.

4.5 **Insulating Medium**

Air-insulated CT-VT units shall not be considered, The CT-VT unit shall be supplied filled with oil to AS 1767.1 with a minimum breakdown voltage of 50 kV and a high flash-point (250 degree C minimum).

4.6 **Housing and Corrosion Protection**

All internal and external surfaces be protected against corrosion. All exposed metal surfaces shall be protected by the application of a painting system at least equivalent to ISO 9223 Category C4-C5 in Table B1 and suitable for severe marine environments as specified in AS 2312.

Colours shall be to AS 2700 or equivalent as detailed below:

4.6.1 **Aerial CT-VT Units**

The Vendor shall provide two options concerning the protection of the exterior surfaces for the Aerial CT-VT Units:

- 1) Hot-dip Galvanising of the CT-VT Unit; or
- 2) Painting of CT-VT Unit with Paint Colours:
 - a) 11-6.6 kV - N42 Storm Grey;
 - b) 22 kV - N42 Storm Grey;
 - c) 33 kV – G33 Lettuce;

4.6.2 **Ground-mounted CT-VT Units**

The colour of the exterior of the CT-VT Unit shall be Hawthorn Green – CAMTECT AG692. Coatings for all Ground Mounted Transformers shall contain an anti-graffiti additive.

4.7 **CT-VT Unit Fittings**

CT-VT Units shall be supplied with fittings as detailed below.

4.7.1 **Lifting Lugs/Eyes**

Two lifting lugs/eyes shall be provided for lifting the CT-VT unit complete with oil.

4.7.2 **Rating Plates**

Rating plates shall be stainless steel and clearly legible for the life of the CT-VT unit and located as indicated on the appropriate Drawings listed in Section 2.3.

All rating plates shall incorporate a diagram of connections and shall provide details of the voltage and current transformers. The markings on these plates shall comply fully with the requirements of AS 60044 Part 1 Section 10 and Part 2 Section 11.

4.7.3 Terminal Markings

- 1) The medium voltage terminals shall have the following markings punched or otherwise indelibly marked on the terminals. These terminal markings shall be painted on the tank adjacent to the medium voltage bushings in letter sizes not less than 50 mm in height.

Table 4: MV Terminal Markings

Marking	Red Phase	White Phase	Blue Phase	Neutral Phase
MV Terminal (Voltage and Current) - Start	A1	B1	C1	N
MV Terminal (Current) - Finish	A2	B2	C2	

- 2) The low voltage terminals are to be legibly and indelibly marked or engraved.

Table 5: LV Terminal Markings

Marking	Red Phase	White Phase	Blue Phase	Neutral Phase
LV Terminal (Voltage)	a	b	c	n
LV Terminal (Current) - Start	as1	bs1	cs1	
LV Terminal (Current) – First Tapping	as2	bs2	cs2	
LV Terminal (Current) – Second Tapping	as3	bs3	cs3	
Any further LV current tapplings would continue with markings 4, 5, etc.				

The terminal markings shall be so applied that at the instant when current through the primary winding is from A1 to A2 the direction of the secondary current through the external circuit providing the burden is from as1 to as2.

NOTE: Where 3 x single-phase electromagnetic VT's are star-connected the terminals A1, B1, C1 and a1, b1, c1 form the primary and secondary star points.

4.7.4 Earthing Bracket

A corrosion-resistant bare metal earthing bracket, sized at least 50 x 40 x 5 mm with an M14 hole drilled near the centre of the bracket, shall be provided near the bottom of the tank, as close as practicable vertically below the LV neutral terminal.

The bracket shall be fitted with an M12 x 40 mm Grade 316 Stainless Steel bolt, nut, locknut and two flat washers. The earth bracket shall be fully welded along one of the 40 x 5 mm sides directly to the tank, i.e. there are to be no bolted connections in the electrical path between the bracket and the tank.

4.7.5 External Markings

In addition to nameplate markings, the Purchaser's identification number shall be stencilled in black numerals onto the tank where it can be easily seen from the ground. Each numeral shall be 75 mm high and have a body width of not less than 12 mm.

DANGER signs as per AS/NZS 3000 shall be fixed to the MV and LV panels of all CT-VT Units which can provide access to high voltage parts. Wording on signs at these locations shall consist of letters not less than 12 mm high and shall contain the words '**DANGER — HIGH VOLTAGE**'.



Picture 1 – 'DANGER HIGH VOLTAGE' sign

4.8 Electrical Requirements

4.8.1 General

The CT-VT units shall have a continuous primary rating of:

- 1) 400 A for 33 kV & 22 kV; or
- 2) 630 A for 11 kV & 6.6 kV

and be equipped as detailed in sub-clauses set out below, be wired with ferrules numbered in accordance with the drawings listed in Section 2.3.

Dimensioned outline drawings, schematic circuit, layout and wiring diagrams for shall be submitted for approval by Horizon Power.

4.8.2 Tap Switch (where specified)

Where specified, for dual ratio CT-VT units, the voltage change from nominal to a second primary voltage shall be facilitated by the provision of an externally operated standard 2 position "Off-Circuit" tap-changing switch with a tap position indicator.

The switch mechanism shall be positive in action such that it cannot be maintained midway between full step positions. The operating handle shall be mounted in a position as shown on the appropriate drawing listed in Section 2.3, and shall be capable of being locked in any position.

A sealing gland shall be provided on the switch operating shaft where it passes through the tank to prevent “breathing” or “leaking” along the shaft.

4.8.3 Earthing

The metallic sub-frame of the CT-VT units shall be welded to the tank.

The core of the voltage and current transformers shall be effectively bonded to the tank, unless the current transformers are of toroidal form, in which case they shall be effectively insulated.

An earthing terminal or terminals shall be provided within the terminal box of the CT-VT units.

Removable links shall be provided to connect the White phase of the secondary winding of the voltage transformer (terminal b) and the starts (terminals as1, bs1 and cs1), of the Red, White and Blue phases of the secondary windings of the current transformers to the earthing terminal or terminals within the terminal box of the CT-VT unit.

4.8.4 Internal CT & VT Core and Primaries

The Vendor shall provide information as to the quality of steel laminations used in the cores of the current and voltage transformers to maintain the initial accuracy and performance of the CT-VT unit.

The medium voltage windings of the voltage transformers shall be insulated from the tank with the winding ends brought out to MV terminal bushings.

The medium voltage windings of the voltage transformers shall be star connected and brought out to a neutral bushing and connected to the earth terminal with an earth link.

The phase end of the medium voltage winding of the red phase voltage transformer shall be brought out to the same terminal bushing as the start end of the medium voltage winding of the red phase current transformer.

The phase end of the medium voltage winding of the white phase voltage transformer shall be brought out to the same terminal bushing as the start end of the medium voltage winding of the white phase current transformer.

The phase end of the medium voltage winding of the blue phase voltage transformer shall be brought out to the same terminal bushing as the start end of the medium voltage winding of the blue phase current transformer.

4.8.4.1 Current Transformer

1) Secondary Windings

The secondary windings of the current transformers including the tapped connections shall be brought out through oil-tight fittings to terminal bushings which comply with AS 60137.

- 2) Class

In accordance with AS 60044 Part 1 and the Electricity Industry Metering Code, the current transformers shall be Class 0.5 to suit the Type 3 Metering.
- 3) Rating

The current transformers shall be:

 - a) 100-200/1 A ratio
 - b) rated at 15 ohms per phase
 - c) rated output of 15 VA
 - d) rated short time current of 25 kA for 1 second
 - e) have a thermal limit current of not less than 200% of rated current, and
 - f) have the current ratio change by tapped secondary with all ratios brought out to terminals within the terminal box

4.8.4.2 Voltage Transformer

- 1) Secondary Windings

The low voltage windings of the voltage transformers shall be star connected inside the tank with the phase ends and neutral brought out through oil-tight fittings to terminal bushings which comply with As 60137. The star point (neutral) shall be insulated from the tank and connected to a separate neutral terminal.
- 2) Class

In accordance with AS 60044 Part 2 and the Electricity Industry Metering Code, the voltage transformers shall be Class 0.5 to suit Type 3 Metering.
- 3) Rating

The voltage transformers shall be:

 - a) secondary output of $110/\sqrt{3}$ Volts (i.e. 63.5 V per phase)
 - b) rated at 48 millisiemens per phase;
 - c) rated output of 200 VA per phase;
 - d) voltage factor of 1.5; and
 - e) uniformly insulated.

5 AERIAL CT-VT UNIT REQUIREMENTS

5.1 General

The aerial CT-VT units shall be so designed and constructed that it suitable outdoor operation, either pad-mounted or on a cross-arm fitted to a single pole (refer to Section 2.3 for list of applicable drawings), where all similar parts are interchangeable.

5.2 Lifting Lugs/Eyes

In addition to Section 4.7.1, two additional lifting lugs/eyes shall be provided for removing the internal assembly from the tank. The lifting lugs/eyes shall be so positioned that slings used for lifting do not foul insulators, terminals, windings etc.

5.3 CT-VT Mounting Brackets

All pole-mounted CT-VT Units shall be equipped with standard-pole-mounting brackets welded to the rear wall of the CT-VT tank. It shall be possible to pass a body belt between the pole and the CT-VT tank.

The brackets and tank wall shall be of adequate strength to limit distortion to 3%, when mounted in the service position. Both the top and bottom brackets shall be able to carry the total weight of the CT-VT unit separately.

In addition, two clamps and four threaded rods (M20 x 250 mm) shall be supplied. Each threaded rod shall be supplied with two nuts, two flat washers and one spring washer. The clamps, threaded rods, flat washers, spring washers and nuts shall be hot dipped galvanised in accordance with AS 4680.

Configurations and dimensions of relevant drawings are listed in Section 2.3.

5.4 Surge Arrestor Brackets

Brackets shall be attached adjacent to each MV bushing to enable the Purchaser to mount surge arresters. The surge arrester brackets shall be used as the connection point for the arrester earth. The brackets shall have a corrosion-resistant, bare metal connecting zone which has the capability to conduct fault current through the surge arrester.

The brackets shall be constructed to accommodate the mounting of polymeric surge arresters, fitted with an M12 earthing stud with a minimum exposed stud length of 45 mm. The arresters shall be mounted onto the bracket either directly or via their integral insulating bracket.

Mounting details shall be as shown on the applicable drawings listed in Section 2.3. The mounting bracket shall have a length of 200 mm with the mounting hole located 20 mm from the outer end of the bracket. The mounting arrangements shall be shown in dotted lines on typical general arrangement drawing submitted with the tender.

5.5 Bushings

Refer to Section 4.3.

5.6 Secondary Cable

The CT-VT unit shall be fitted with a suitable secondary cable that meets the following criteria:

- 1) fifteen meter length of 12 core secondary cable to bring all connections to the meter foot panel with spade or crimp lug terminations.
- 2) cores of the cable will have a minimum conductor size of 4 mm².
- 3) each core will be individually numbered to identify the connection within the terminal box of the metering tank.
- 4) UV stabilised double insulated PVC/PVC insulation.
- 5) terminated at the metering tank by a suitable weatherproof cable gland.

5.7 Terminal Box

A terminal box rated at IP54 as per AS 60529 shall be provided on a vertical side of the tank which is not intended to be mounted against a pole or which has the medium voltage bushings on it.

The secondary terminals of the voltage and current transformers are to be housed in the terminal box.

The entry hole for the external cable shall be on the lower side of the terminal box and suitable for a 32 mm diameter cable gland.

6 GROUND MOUNTED CT-VT UNIT REQUIREMENTS

6.1 General

The termination of cables shall be facilitated by the provision of conically shaped bushings (preferably to DIN 47636 or equivalent), enabling the use of dead-break plug-in and disconnectable (fixed by screws/bolts) elbow or straight connectors. The cable sealing end arrangement on the fused tee-off circuit may also be in the form of a slip-on termination kit within a track-proof fuse encapsulated plug-in connector system.

It is essential that the cable terminating arrangement on all circuits provides for a fully insulated design, with no exposed live parts.

6.2 Lifting Lugs/Eyes

Refer to Section 4.7.1, though the lifting lugs/eyes shall be removable without leaving voids that could capture water.

6.3 MV/LV Cubicle

The cubicles box shall be rated for IP54 as per AS 60529 with a provision for sealing facilities and house the following:

- 1) MV Compartment:
 - a) Three Universal Bussing Wells for connection to the incoming line;
 - b) Three Universal Bussing Wells for connection to the outgoing circuit;
 - c) Oil Level Gauge; and
 - d) MV Earth Bar (minimum of 16 holes)
- 2) LV Compartment
 - a) CT and VT secondary terminations;
 - b) Marshalling terminals of a Universal type that will accommodate a wire size up to 6 mm² and provided with test plug sockets and short-circuit plugs for the CT's secondary taps;
 - c) VT fuse arrangement;
 - d) Eight 6 mm studs with nuts suitably placed to mount the metering mounting board (to be supplied by Horizon Power). The layout of the mounting board shall be as shown in Drawing HPA-SD-E-01020-03 Shown in Appendix G and listed in Section 2.3; and
 - e) LV Earth Bar.

The LV Cubicle shall be so located that:

- a) It is accessible at all times with the unit in operation; and

- b) It is between 1000 mm and 1500 mm above ground level for easy access to secondary terminals.

The LV Cubicle shall not contain any such ancillary equipment such as wiring and fusing for panel heaters, etc.

6.4 Secondary Wiring

All wiring within the CT-VT unit shall be 4 mm² of stranding 7/0.85 mm, so laid and restrained as per AS/NZS 3000 Clause 3.9.8.3, that there is no possibility of it coming into contact with any live apparatus.

CT and VT secondary terminations shall be wired out from their respective terminal boxes to the marshalling enclosure, with all CT taps being brought out.

Terminals or intermediate connectors between CT's/VT's terminal boxes and marshalling shall not be used.

Insulated crimp type lugs/connectors are **NOT TO** be used in any of the CT-VT secondary wiring terminations, non-insulated crimp connectors are permissible.

CT terminals as1, bs1 and cs1 shall be earthed, wired up to the LV Earth Bar.

7 STORAGE

The Equipment shall be capable of being stored without deterioration within the temperature range of - 10 °C to + 45 °C for at least 24 months.

8 RELIABILITY

Vendors shall provide information on the reliability of the Equipment and the performance of the materials offered over **an operational life of 45 years** under the specified field of application and conditions of service.

Information provided shall evidence the claimed reliability and performance for the Equipment offered, including information on Failure Mode and Effect Analysis.

9 SAFETY

Material Safety Data Sheets (MSDS) applicable for each different Equipment or chemical ingredient in the Equipment which is considered harmful to personnel or environment in any manner, shall be supplied with the Proposal.

10 ENVIRONMENTAL CONSIDERATIONS

Vendors shall provide information on the environmental soundness of the design and the materials used in the manufacture of the Equipment offered. In particular, information must address such issues as recyclability and disposability at the end of service life as well as disposability of materials supplied.

11 TESTS

11.1 Test Requirements

Prior to delivery, the units shall have completed the type, routine and accuracy tests and inspections as required by the relevant Australian Standards and as required by AS 60044.3 Chapter 6.

The passing of such tests shall not prejudice the right of Horizon Power to reject the Equipment if it does not comply with the Specification when installed.

11.1.1 Type Tests

Representative selection of CT-VT units shall be Type tested in accordance with this specification and the AS 60044.3 Section 6.2. Horizon Power reserves the right to witness Type Tests and shall be given advance notice by the Vendor to be available to witness such tests.

Type Testing shall be undertaken by a NATA (National Association of Testing Authorities) accredited test house or by a test house possessing accreditation from a NATA MRA (Mutual Recognition Agreement) partner. A formal report covering the outcome of the testing shall be made available to Horizon Power.

Evidence shall be submitted by the Vendor indicating that all type tests required by the relevant Australian Standards listed in Table 1 have been satisfactorily carried out on CT-VT units of an identical design. Vendor to provide proof of NATA accreditation of Test Facility.

Where CT-VT units have been tested to International Standards only, sufficient type test evidence shall be submitted to confirm equivalence of CT-VT units performance to the relevant Australian standard.

Accuracy tests shall include current flow in both directions through the current transformer of the CT-VT Unit

- 1) Current transformers shall be tested in accordance with AS 60044.1 Sections 11.4 & 11.5.
- 2) Voltage transformers shall be tested in accordance with AS 60044.2 Sections 12.3 & 12.4.

11.1.2 Routine Tests

Individual Routine tests shall be applied to each individual CT-VT unit in accordance with this specification and the AS 60044.3 Section 6.3. Horizon Power reserves the right to witness an agreed program of Routine Tests to assure of the competence of the manufacturing facility to deliver consistently conforming CT-VT units. The Vendor shall in all cases make all necessary provisions with the testing and/or manufacturing facilities to enable witnessing to take place. An Inspection and Test Plan (ITP) shall be provided to Horizon Power prior witnessing of tests.

All routine tests performed on a batch of CT-VT units shall be submitted to Horizon Power prior to first delivery of that batch CT-VT units.

12 DOCUMENTATION AND SAMPLES

12.1 Type Test Certificates/Reports

Test certificates, test reports or any other supporting documents supplied as evidence for compliance to relevant standards or safety instructions shall be made available in English for review by Horizon Power.

12.2 Samples

Any deviations between the Equipment supplied as a sample to Horizon Power and the Equipment offered in the Proposal shall be detailed by the Vendor.

12.2.1 Test Samples

For the purpose of evaluation, test samples may be requested by Horizon Power. Each sample shall be labelled with a robust tag stating:

- 1) Vendor Name;
- 2) Equipment Number;
- 3) Stock Code; and
- 4) Appropriately identified in Appendix F of this Specification.

When requested, the Vendor shall supply Horizon Power test samples free of charge and within 4 weeks of the request.

APPENDIX A – REVISION INFORMATION


(Informative) Horizon Power has endeavoured to provide standards of the highest quality and would appreciate notification if any errors are found or even queries raised.

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: 3676809** can be used to record any errors or queries found in or pertaining to this standard, which can then be addressed whenever the standard gets reviewed.

Date	Rev No.	Notes
27/09/2013	0	Original Issue


APPENDIX B – QUALITY ASSURANCE (TO BE COMPLETED BY STORES)

DOCUMENT NUMBER		HPC-8DJ-16-0002-2013					QUALITY ASSURANCE		DM NUMBER	
DEVICE DESCRIPTION		LABEL MATERIAL NO.					METERING CTVT UNIT PURCHASE		ASSET OWNER	
		ASSET ID/ STOCK NO			DIMENSION					
MANUFACTURER										
ITEM	OPERATION/EQUIPMENT/FACILITY		DOCUMENT REF.	WHO CHECKS	INITIAL	DATE/TIME	QUALITY ASSURANCE CRITERIA	PASS Y/N	COMMENTS	
1										
1.1	Name of Manufacturer						*****			
1.2	Week & Year of Manufacture						*****			
1.3	Horizon Power Order Number						*****			
1.4	Horizon Power Stock Number						*****			
1.5	Name Plate						*****			
1.6	Physical Appearance									
1.6.1	Paint Colour/Galvanising						Aerial – Galvanised or N42 Storm Grey (11 & 22 kV), G33 Lettuce (33kV) Ground Mount – Hawthorn Green See Section 4.6			
1.6.2	Paint/Galvanising Chips						*****			

1.6.3	Physical Damage (dents, corrosion, cracks in welding, etc.)					*****		
1.6.4	Oil Leaks					*****		
1.6.5	Oil Level (if applicable)					Full		
1.6.6	Bushings (chips, hairline cracks, oil leaks, etc.)					*****		
1.6.7	Door Appearance (if applicable)					*****		
1.7	Earth Stud (not painted)					Stainless steel M12 bolt, nut, lock nut and two flat washers		
1.8	Mounting Brackets on Aerial Transformer (damaged, bent, etc.)					Two clamps and four threaded rods (M20 x 250 mm). Each threaded rod shall have two nuts, two flat washers and one spring washer.		
1.9	Packaging							
1.9.1	Aerial Transformers					Box Crated on pallet with plastic stretch wrap covering		
1.9.2	Ground Mounted					Plastic stretch wrap covering and pallet (if required)		
1.10	Batch Number					*****		
2	DOCUMENTATION							
2.1	Material Safety Data Sheets					Clear, Legible and in English		
2.2	Transformer Documentation & Drawings					Clear, Legible and in English		
2.3	Safety Instructions					Clear, Legible and in English		
2.5	Test and Inspection Reports					Clear, Legible and in English		

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 – SCHEDULES A & B: ENQUIRY DOCUMENT

	SPECIFICATION ENQUIRY	HPC-8DJ-16-0002-2013
	VENDOR'S NAME	
	DATE	

TECHNICAL SCHEDULES A & B


ITEM 1: Aerial CT-VT Unit

VOLTAGE	6.6-11 kV	6.6-11 kV	22 kV	22 kV	33 kV	33 kV	
ITEM	1.1	1.2	1.3	1.4	1.5	1.6	
SIZE	50-100 1A	100-200 1A	50-100 1A	100-200 1A	50-100 1A	100-200 1A	

SCHEDULE A: Horizon Power's specific requirements

SCHEDULE B: Particulars of equipment to be supplied (to be completed by Vendor)

Item	Clause	Description	Schedule A	Schedule B
		Distribution Standard Buyers Guide drawing	HPA-SD-E-	xxxx
1	3.3.2	Service Conditions		
1.1		Dimensions		
		Length	mm	xxxx
		Width	mm	xxxx
		Height	mm	xxxx
1.2		Mass	kg	xxxx
1.3		Terminal arrangements and positions	(Yes/No)	xxxx
2		Design and Construction		
2.1	4.1	Tank Bracing	(Yes/No)	xxxx
2.2	4.2	Tank		xxxx
2.3	4.3	Bushings		xxxxx
		Profile		xxxxx
		Bushing Material		xxxx
		Creepage	mm/kV	xxxx
		Stem Diameter		
		Stem Type	Threaded	
		Stem Material	Copper	
		Manufacture	xxxx	
2.4	4.5	Insulating Medium	Oil	xxxx
2.5	4.6.1	Housing and Corrosion Protection	xxxx	
3		Configuration Detail		
3.1		Configuration	3 Phase/4 Wire	xxxxx
3.2		Primary Star Point Earthing	Yes - External	xxxxx
3.3		Secondary Star Point Earthing	Yes - External	xxxxx
3.4		Current Transformer		xxxxx
		Type	Type	
		Accuracy		
		50-100/1A	Class	0.5
		100-200/1A	Class	0.2
		Burden	VA	7.5
		Short time current withstand level – 1 s.	kA	12

	SPECIFICATION ENQUIRY	HPC-8DJ-16-0002-2013
	VENDOR'S NAME	
	DATE	

TECHNICAL SCHEDULES A & B

ITEM 2: Ground-mounted CT-VT Unit

VOLTAGE	6.6-11 kV	6.6-11 kV	22 kV	22 kV	33 kV	33 kV	
ITEM	2.1	2.2	2.3	2.4	2.5	2.6	
SIZE	50-100 1A	100-200 1A	50-100 1A	100-200 1A	50-100 1A	100-200 1A	

SCHEDULE A: Horizon Power's specific requirements

SCHEDULE B: Particulars of equipment to be supplied (to be completed by Vendor)

Item	Clause	Description	Schedule A	Schedule B
		Distribution Standard Buyers Guide drawing	HPA-SD-E-0002	xxxx
1	3.3.2	Service Conditions		
1.1		Dimensions Length mm Width mm Height mm	xxxx xxxx xxxx	
1.2		Mass kg	xxxx	
1.3		Terminal arrangements and positions (Yes/No)	xxxx	
2		Design and Construction		
2.1	4.1	Tank Bracing (Yes/No)	xxxx	
2.2	4.2	Tank	xxxx	
2.3	4.3	Bushings Profile Bushing Material Creepage mm/kV Stem Diameter Stem Type Stem Material Manufacture	xxxx xxxx Threaded Copper xxxx	xxxxx xxxxx
2.4	4.5	Insulating Medium	Oil	xxxx
2.5	4.6.1	Housing and Corrosion Protection	xxxx	
3		Configuration Detail		
3.1		Configuration	3 Phase/4 Wire	xxxxx
3.2		Primary Star Point Earthing	Yes - External	xxxxx
3.3		Secondary Star Point Earthing	Yes - External	xxxxx
3.4		Current Transformer Type Accuracy 50-100/1A Class 100-200/1A Class Burden VA Short time current withstand level – 1 s. kA	Type 0.5 0.2 7.5 12	xxxxx

APPENDIX D – SCHEDULE C: COMPLIANCE DOCUMENT

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

CLAUSE NUMBER		YES	NO	ATT.
1.	SCOPE			
2.	NORMATIVE REFERENCES			
2.1	Standards			
2.2	Definitions and Abbreviations			
2.2.1	<i>Definitions</i>			
2.2.2	<i>Abbreviations</i>			
2.3	Drawings			
3	REQUIREMENTS			
3.1	Power System Particulars			
3.1.1	<i>Rated Voltages</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.2	<i>Fault Rating</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.3	<i>Nominal System Frequency</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.4	<i>System Insulation Levels</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2	Service Conditions			
3.2.1	<i>Environmental Conditions</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.2	<i>Service Requirements</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.3	<i>Safety</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	CT-VT UNIT DESIGN AND CONSTRUCTION			
4.1	General	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2	Tank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Bushings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4	Joints and Gaskets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.5	Insulating Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.6	Housing and Corrosion Protection			
4.6.1	<i>Aerial CT-VT Units</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.6.2	<i>Ground-mounted CT-VT Units</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.7	CT-VT Unit Fittings			
4.7.1	<i>Lifting Lugs/Eyes</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.7.2	<i>Rating Plate</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.7.3	<i>Terminal Markingss</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CLAUSE NUMBER		YES	NO	ATT.
4.7.4	<i>Earthing Bracket</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.7.5	<i>External Markings</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8	Electrical Requirements			
4.8.1	<i>General</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8.2	<i>Tap Switch (where specified)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8.3	<i>Earthing</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8.4	<i>Internal CT & VT Core and Primaries</i>			
4.8.4.1	<i>Current Transformer</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8.4.2	<i>Voltage Transformer</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	AERIAL CT-VT UNIT REQUIREMENTS			
5.1	General	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Lifting Lugs/Eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.3	CT-VT Unit Mounting Brackets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Surge Arrestor Brackets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Bushings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.6	Secondary Cable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.7	Terminal Box	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	GROUND MOUNTED CT-VT UNIT REQUIREMENTS			
6.1	General	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.2	Lifting Lugs/Eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.3	MV/LV Cubicle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4	Secondary Wiring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	STORAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	RELIABILITY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	SAFETY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	ENVIRONMENTAL CONDITIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	TESTS			
11.1	Test Requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.1.1	<i>Type Tests</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

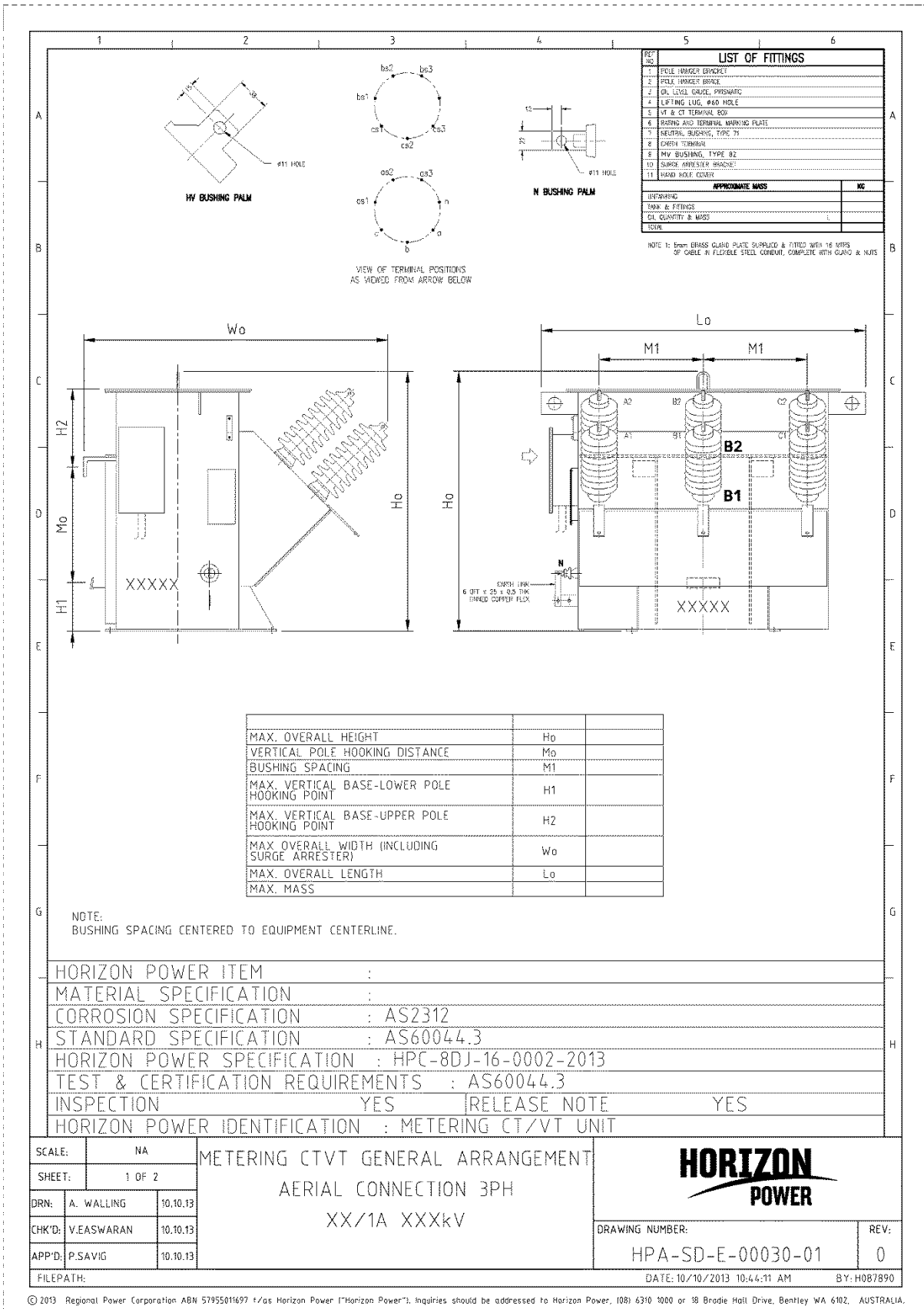
CLAUSE NUMBER		YES	NO	ATT.
11.1.2	<i>Routine Tests</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	DOCUMENTATION AND SAMPLES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.1	Type Test Certificates/Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.2	Samples	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.2.1	<i>Tests Samples</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

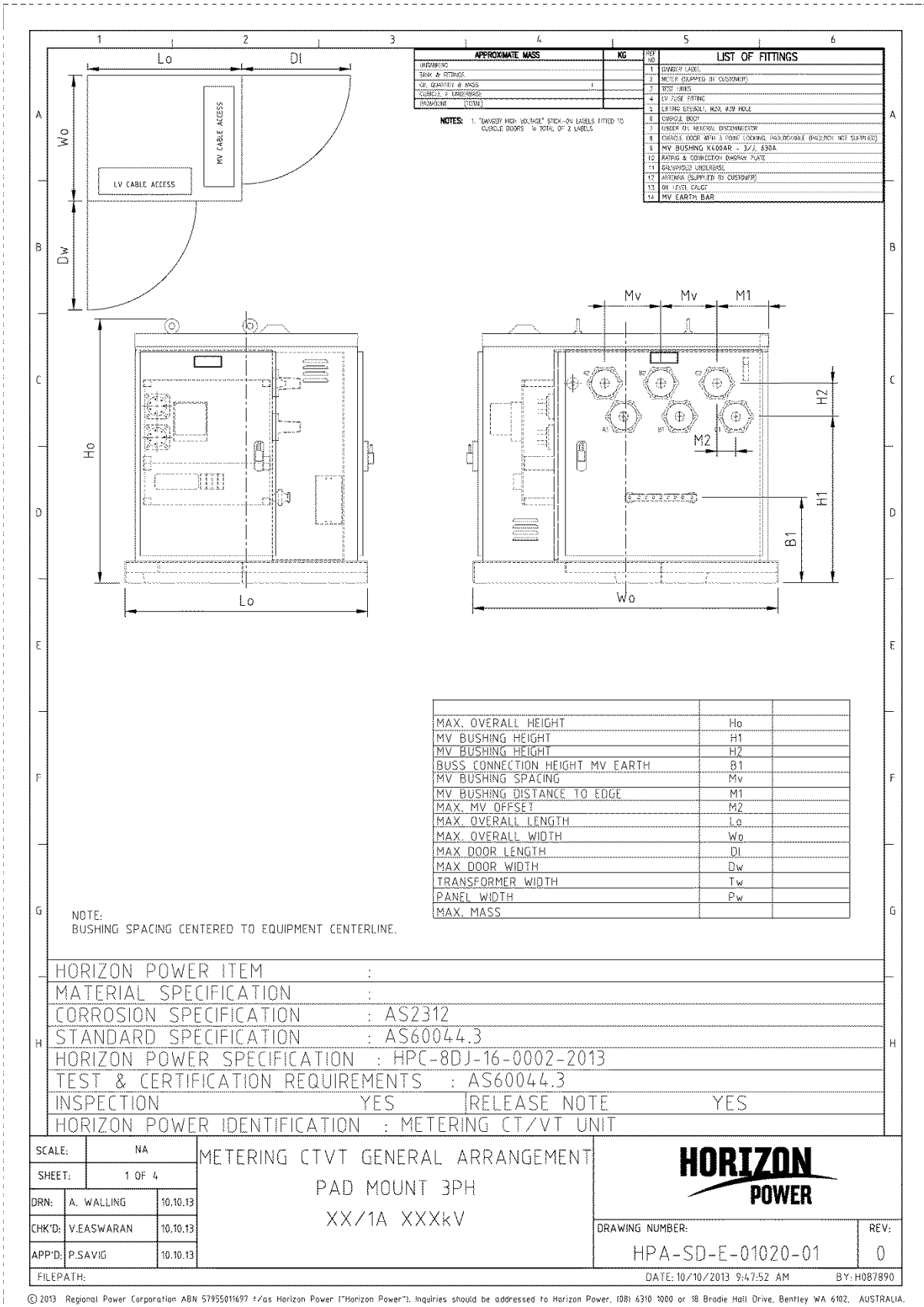
APPENDIX F – CT-VT UNIT DESCRIPTION

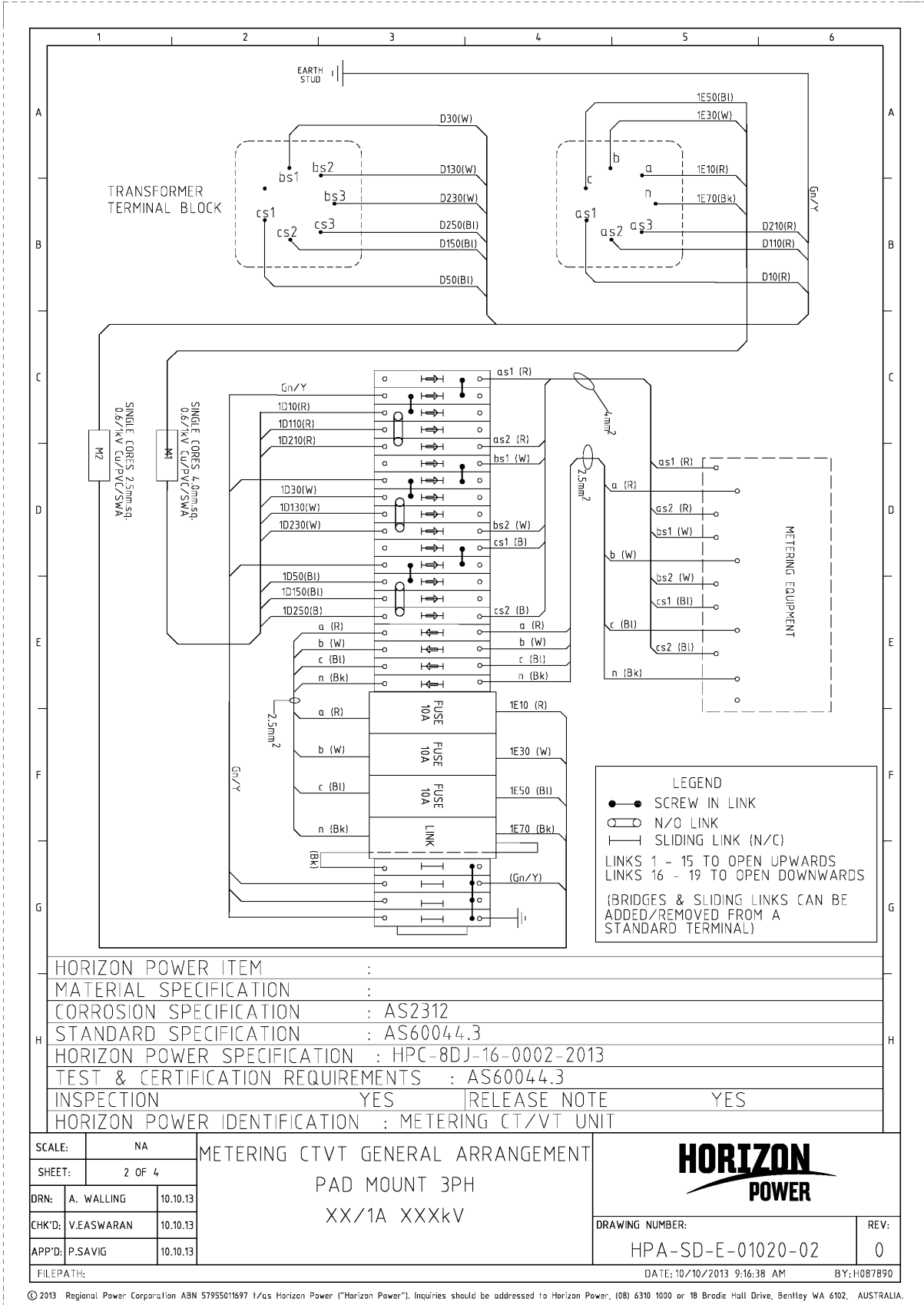
ITEM	DESCRIPTION	DISTRIBUTION STANDARD DRAWING
1	Aerial CT-VT Unit	
1.1	Short Description: METERING UNIT, 6.6-11KV; 3PH; 50/100 1A; 4WIRE Technical Description: METERING UNIT, 6.6-11KV; 3PH; 50/100 1A; 4WIRE AERIAL CONN; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-00030-01
1.2	Short Description: METERING UNIT, 6.6-11KV; 3PH; 100/200 1A; 4WIRE Technical Description: METERING UNIT, 6.6-11KV; 3PH; 100/200 1A; 4WIRE AERIAL CONN; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-00030-01
1.3	Short Description: METERING UNIT, 22KV; 3PH; 50/100 1A; 4WIRE Technical Description: METERING UNIT, 22KV; 3PH; 50/100 1A; 4WIRE AERIAL CONN; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-00030-01
1.4	Short Description: METERING UNIT, 22KV; 3PH; 100/200 1A; 4WIRE Technical Description: METERING UNIT, 22KV; 3PH; 100/200 1A; 4WIRE AERIAL CONN; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-00030-01
1.5	Short Description: METERING UNIT, 33KV; 3PH; 50/100 1A; 4WIRE Technical Description: METERING UNIT, 33KV; 3PH; 50/100 1A; 4WIRE AERIAL CONN; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-00030-01
1.6	Short Description: METERING UNIT, 33KV; 3PH; 100/200 1A; 4WIRE Technical Description: METERING UNIT, 33KV; 3PH; 100/200 1A; 4WIRE AERIAL CONN; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-00030-01
2	Ground-mount CT-VT Unit	
2.1	Short Description: METERING UNIT, 6.6-11KV; 3PH; 50/100 1A; 4WIRE Technical Description: METERING UNIT, 6.6-11KV; 3PH; 50/100 1A; 4WIRE PAD-MNT; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-01020-01
2.2	Short Description: METERING UNIT, 6.6-11KV; 3PH; 100/200 1A; 4WIRE Technical Description: METERING UNIT, 6.6-11KV; 3PH; 100/200 1A; 4WIRE PAD-MNT; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-01020-01
2.3	Short Description: METERING UNIT, 22KV; 3PH; 50/100 1A; 4WIRE Technical Description: METERING UNIT, 22KV; 3PH; 50/100 1A; 4WIRE PAD-MNT; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-01020-01
2.4	Short Description: METERING UNIT, 22KV; 3PH; 100/200 1A; 4WIRE Technical Description: METERING UNIT, 22KV; 3PH; 100/200 1A; 4WIRE PAD-MNT; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-01020-01
2.5	Short Description: METERING UNIT, 33KV; 3PH; 50/100 1A; 4WIRE Technical Description: METERING UNIT, 33KV; 3PH; 50/100 1A; 4WIRE PAD-MNT; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-01020-01

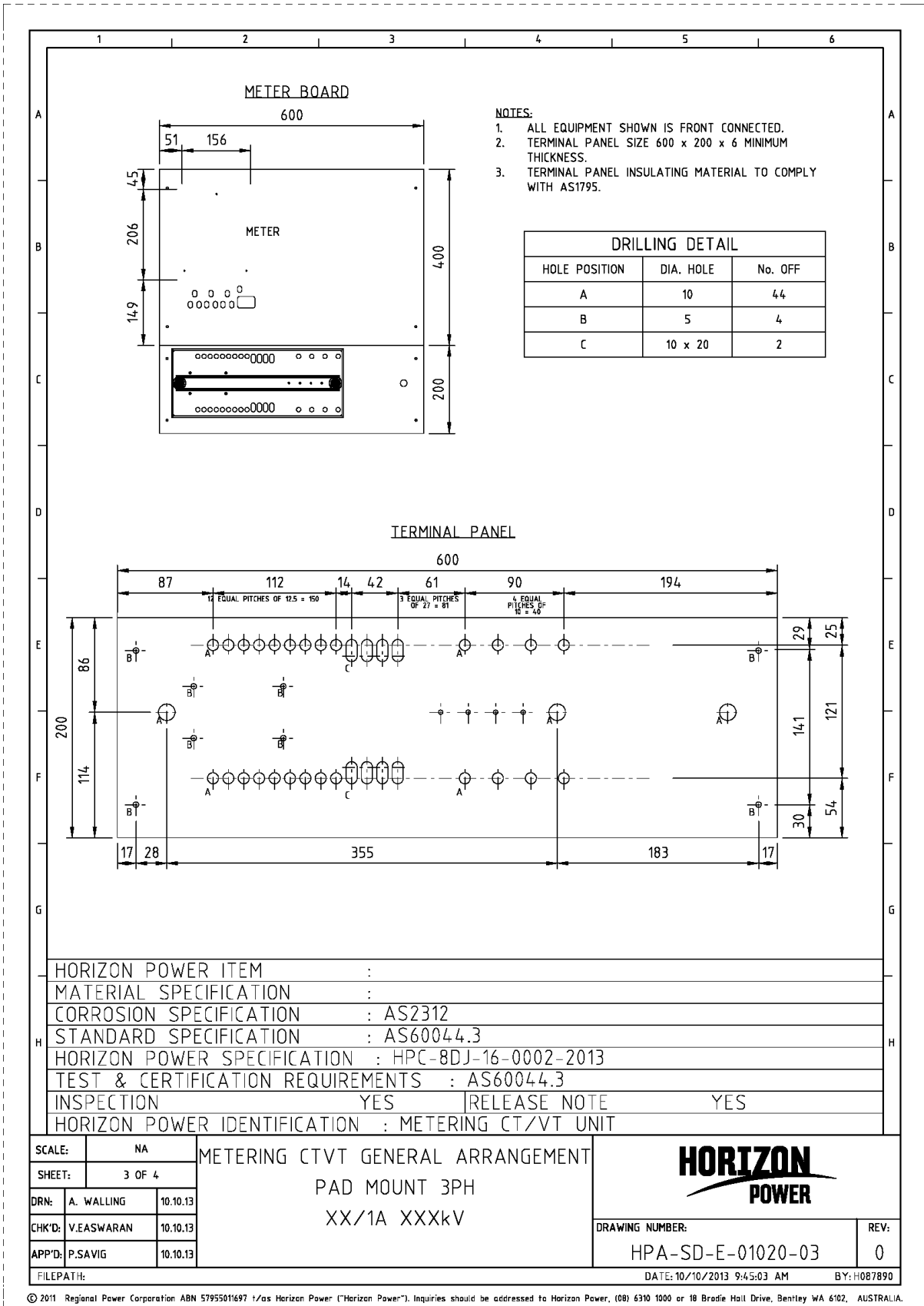
ITEM	DESCRIPTION	DISTRIBUTION STANDARD DRAWING
2.6	Short Description: METERING UNIT, 33KV; 3PH; 100/200 1A; 4WIRE Technical Description: METERING UNIT, 33KV; 3PH; 100/200 1A; 4WIRE PAD-MNT; 110V/SEC; CLASS ME2; ACCURACY RT6	HPA-SD-E-01020-01

APPENDIX G – SPECIFICATION DRAWINGS









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