



# Specification – MV Inductive Voltage Transformers

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\* This person will have the power to grant the process owner the authority and responsibility to manage the process from end to end.

\*\* Frequency period is dependent upon circumstances– maximum is 5 years from last issue, review, or revision whichever is the latest. If left blank, the default shall be 1 year unless otherwise specified.

Revision Control		
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<b>STAKEHOLDERS</b>	
<i>The following positions shall be consulted if an update or review is required:</i>	
Manager Engineering & Project Services	Asset Managers
Manager Systems & Network Planning	Manager Assets Services
Senior Manager Safety, Health and Wellbeing	

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# 1 SCOPE

This Specification sets out the technical (electrical and mechanical) requirements for the performance, testing and supply of medium voltage, voltage transformers for the distribution system only.

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.

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 1627.0, Metal finishing – Preparation and pre-treatment of surfaces – Method selection guide*, Standards Australia, 1997 (R2017)
- [3]. *AS/NZS 2312.1, Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – Paint coatings*, Standards Australia, 2014
- [4]. *AS 2650, Common specifications for high voltage switchgear and control gear standards*, Standards Australia, 2005
- [5]. *AS/NZS 4680, Hot dip galvanised (zinc) coatings on fabricated ferrous articles*, Standards Australia, 2006
- [6]. *AS/NZS 60529, Degrees of protection provided by enclosures (IP Code)*, Standards Australia, 2004
- [7]. *AS 61869.1, Instrument transformers – Part 1: General rules*, Standards Australia, 2021

- [8]. *AS 61869.3, Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*, Standards Australia, 2021
- [9]. *AS 62271.1, High voltage switchgear and controlgear – Common specifications*, Standards Australia, 2012
- [10]. *AS 62271.201, High-voltage switchgear and controlgear – Part 201: AC solid-insulation enclosed switchgear for rated voltages above 1 kV and up to and including 52 kV*, Standards Australia, 2019
- [11]. *AS 62271.301, High voltage switchgear and control gear – Dimensional standardisation of terminals*, Standards Australia, 2011

### 2.1.3 International Standards

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

- [12]. *IEC 60060.1, High-voltage test techniques – Part 1: General definitions and test requirements*, International Electrotechnical Commission, 2010
- [13]. *IEC 60812, Failure modes and effects analysis (FMEA and FMECA)*, International Electrotechnical Commission, 2018

### 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://saiglobal.com>.

## 2.2 Definitions and Abbreviations

For the purposes of this specification, definitions shall apply as in the relevant Australian Standards (AS 61869.1 [7] or AS 61869.3 [8]) with the addition of a few general definitions listed below in alphabetical order.

**Equipment:** Medium Voltage Instrument Voltage Transformer

## 3 REQUIREMENTS

### 3.1 General

The *Equipment* specified in this instruction is to be used for electrical measuring and protection of power transformers, outdoor busbars, overhead lines, cables, or any other equipment generally used in a distribution network.

Standard Horizon Power Voltage Transformers and descriptions are listed in Table 7 of Section 11.

The *Equipment* offered that is found on inspection not to conform to this Specification shall be replaced by the Vendor at no cost to Horizon Power.

### 3.2 Environmental Conditions

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

### 3.3 Technical Requirements

The *Equipment* shall be suitable for indoor and outdoor use and only connected in a phase to earth arrangement.

Indoor *Equipment* may be mounted within steel cubicles or form part of cable termination and must as a minimum meet AS 2650 [4], AS 62271.1 [9] and AS 62271.201 [10].

Outdoor *Equipment* may be mounted on steel or any other structure with acceptable insulation meeting AS 61869.1 [7].

The technical performance of the *Equipment* must as a minimum meet AS 61869.1 [7] and AS 61869.3 [8].

#### 3.3.1 Electrical Requirements

The *Equipment* shall be suitable for use on the 11 kV, 22 kV and 33 kV 3-phase 50 Hz distribution systems. The *Equipment* must be suitable for operation under the defined operating conditions and must meet the required performance requirements as set out in the table below:

**Table 1: Electrical Requirements**

Description	11 kV	22 kV	33 kV
Maximum system voltage kV	12	24	36
Lightning impulse withstand kV <sub>Peak</sub>	75	125	170
Power frequency withstand (60 sec.) kV <sub>r.m.s.</sub>	28	50	70
Secondary winding withstand voltage kV	3	3	3
Primary voltage kV	11/√3	22/√3	33/√3
Secondary voltage V	110/√3		
Secondary windings	Measurement & Protection		
Measurement class and burden	0.2/50 VA		
Voltage factor	1.9/30s		
Thermal limit	400 VA/4 A		
Protection class and burden	3P/50 VA		
Method of Earthing	Effective		

### 3.3.2 Mechanical Requirements

The *Equipment* design and manufacturing process must confirm that the performance characteristics of the *Equipment* is not affected by changes in the ambient conditions, such as temperature or humidity, (see Section 3.2 Environmental Conditions). The vendor shall submit the detailed design, materials used and manufacturing process of the *Equipment*.

The voltage transformer shall be suitable for use under the following conditions as set out in the table below:

**Table 2: Mechanical Requirements**

Description		11 kV	22 kV	33 kV
Creepage Indoor Installation ( $\geq 20$ mm/kV) <sup>1</sup>	mm	$\geq 240$	$\geq 480$	$\geq 720$
Creepage Outdoor Installation ( $\geq 31$ mm/kV) <sup>1</sup>	mm	$\geq 372$	$\geq 744$	$\geq 1116$
Class of Insulation (applicable for gas)		B	B	B
Secondary terminal box	IP	54	54	54

### 3.3.3 Mounting Requirements

The *Equipment* shall be supplied fully assembled ready for mounting. All metal work shall meet AS 1627 [2] having no burrs or sharp edges.

For outdoor applications, 4 holding down bolt holes arrange with maximum square 400 mm by 400 mm, diameter of the holes being.

**Note:** Manufacturer to provide adapter plate for outdoor applications if *Equipment's* base dimensions are different to required parameters.

The vendor shall submit complete detail and drawings of the pedestal mounting assembly.

### 3.3.4 Primary Terminals

The *Equipment* shall be provided with suitable terminals to connect to the line and earth in concordance with AS 62271.301 [11]. The terminals on the line side and on the earth side, shall be of stainless steel grade 304 or 316 and shall be supplied with all required nuts, bolts and washers.

The line terminal shall be 4 hole NEMA pad, and the earth terminal shall be 14 mm holes or M12 bolt/stud.

The vendor shall submit complete details and drawings of the line and earth terminals.

A warning label for the earthing terminal connection shall be fixed next to the VT secondary connection diagram. The label shall read:

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<sup>1</sup> See AS 61869.1 Table 6 [7]



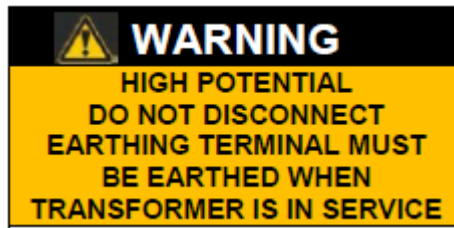


Figure 1 – Earth terminal Warning label

All ferrous nuts, bolts, washers and clamps used for any purpose other than for current carrying shall be hot dip galvanised.

All bolts, washers and clamps attached to current carrying parts shall be manufactured from stainless steel grade 304, and all nuts shall be from stainless steel grade 316.

All bolts and clamps, which may be required to carry an electrical current, shall be fitted with stainless steel spring washers.

### **3.4 Secondary Terminals**

All terminals shall be M6 and shall be fitted with a nut, spring washer and washer.

#### **3.4.1 Terminal Box (Out-door option)**

The secondary terminals for an outdoor application shall be housed in a terminal box rated to IP 54 in concordance with AS/NZS 60529 [6].

The terminal box shall be fitted with an internal M6 earth stud, and a conductive removable gland plate shall be provided with a M32 pre-punched, spot welded knock-out (suitable for a size #3 mechanical gland). The removable gland plate shall be inherently non-corrosive and shall not be coated, so that it will remain conductive.

A 16 A fuse shall be included for each phase of the voltage transformer's secondary circuits.

### **3.5 Lifting Facilities**

All outdoor *Equipment* shall be provided with suitable lifting lugs. Lifting instructions shall be fitted to the outside of the VT tank showing slinging method and centre of gravity. The label shall be etched on stainless steel.

### **3.6 Insulating Oil and Containment System**

All *Equipment* that has its insulating system sealed from the atmosphere shall allow for expansion with the use of stainless steel bellows and shall incorporate in their design facilities to monitor the condition of the equipment. The facilities shall include pressure release/explosion venting and oil level indication as a minimum. Moisture in the insulating system shall be less than 0.5%.

### 3.6.1 Oil Sampling Valve

An oil sampling valve shall be fitted at the bottom of the oil containment tank.

### 3.6.2 Oil Level Indication

An oil level indicator shall be fitted on the oil containment tank. The oil level indicator is to be clearly visible from ground level without the aid of optical devices and be suitably marked to indicate the correct level at 20 deg. C, 40 deg. C and 60 deg. C.

### 3.7 Painting and Galvanising

All painting and galvanising shall conform to AS/NZS 2312.1 [3] and AS/NZS 4680 [5] respectively. The galvanising coating shall be smooth, clean and of uniform thickness, free from defects.

### 3.8 Name Plate

*Equipment* shall be provided with a nameplate incorporating details in accordance with clause 6.13 of AS 61869.3 [8]. These details shall be clearly visible and preferably marked on the housing. The marking shall be permanent, weatherproof and corrosion proof.

The following minimum information shall be provided:

- 1) Manufacturer's name or trademark, type, and identification;
- 2) Type designation and arrangement;
- 3) Serial number;
- 4) Rated primary and secondary voltage;
- 5) Rated frequency;
- 6) Rated output and corresponding accuracy class;
- 7) Rated insulation level;
- 8) Rated voltage factor and corresponding rated time;
- 9) Class of insulation if different from Class B;
- 10) Temperature range;
- 11) Weight; and
- 12) On *Equipment* with more than one secondary winding, the use of each winding and its corresponding terminals.

## 4 PACKAGING REQUIREMENTS

The *Equipment* shall be suitably packaged, such that it is "fit for use" at any location in Horizon Power's operational area and specifically include all accessories needed. Packaging shall be capable of preventing damage whilst in storage and during transit to remote locations. The Vendor is required to nominate standard pack quantities and standard packs shall be clearly marked with the following information:

- 1) Manufacturer's name;
- 1) Manufacturer's part reference number;

- 2) Batch Number;
- 3) Horizon Power Order Number;
- 4) Horizon Power Stock Number;
- 5) *Equipment* description (voltage rating); and
- 6) Package weight.

Very strong consideration shall be given to appropriate packaging provided with any *Equipment* offered under this specification, with respects to satisfying the “fit for use” criteria mentioned above.

The combined height of the pallet and *Equipment* of a standard pack shall not exceed 1,050 mm.

Each shipment shall be provided with box labels stating the part, stock, and contract number as well as the routine test reports.

Each package is to have an identifying bar code and number which identifies as a minimum the:

- Manufacturer’s part number;
- Manufacturer;
- Factory of manufacture; and
- Month and year of manufacture.

The bar code should be code 128 and can be applied either by spray or on a plastic tag. The bar code and number does not have to be indelible beyond installation.

**Note:** The vendor is required to identify the cost of providing bar coding as specified in this Section separately from the other cost requirements of this specification.

## 5 STORAGE

The *Equipment* shall be capable of being stored without deterioration within the temperature range of -10°C to +45°C for no less than 24 months.

## 6 RELIABILITY

Vendors shall provide information on the reliability of the *Equipment* and the performance of the materials offered over an operational life of 50 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 details on Failure Mode and Effect Analysis, carried out in accordance with IEC 60812 [13]. Failure modes should be described; taking cantilever mechanical failure as an example, the failure may be excessive deflection, or brittle fracture. Electrical failure may be material damage such as puncture, polymer degradation, carbonisation, loss of hydrophobicity, etc.

Vendors may offer their standard *Equipment* but any variation to the foregoing standards must be clearly stated in writing at the time of the proposal. The products offered in the standing offer should be equal to or better in quality and performance than the existing items as listed under this Specification.

## 7 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.

## 8 ENVIRONMENTAL CONSIDERATIONS

Vendors are required to provide information on the environmental soundness of the design and the materials used in the manufacture of the items offered. Vendors shall provide a detailed outline of the steps that have been put in place to fulfil any obligations that may be required pursuant to the *Waste Avoidance and Resource Recovery Act 2001* and any amendments. In particular:

- a) Management of waste reduction;
- b) The use of re-usable packing; and
- c) Extended producer responsibility for the safe disposal of materials at the end of their life.

## 9 TESTS

### 9.1 Test Requirements

The Vendor shall prior to first delivery, complete the design, type, routine, sample and special tests and inspections as required by the relevant Australian or IEC standard.

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

**Note:** A condition of acceptance on imported products shall be completed to perform landing routine and sample tests completed in Australia on each batch imported. In these cases, each batch must obtain a passed landing test in order that the batch acceptance will be reflected on an acceptance list.

### 9.2 Test Certificates

At the time of submitting the offer on the tender, single copies of test certificates, in English, shall be provided and shall be clearly marked and contain a reference number. If all the required test certificates are not submitted the tender will be rated incomplete and may not be considered.

Electronic copies of type test certificates shall be arranged in the order set out in this Specification and shall be marked clearly with the identifier and description in the contents Section. Any extra test certificates shall be marked with "extra tests" and kept separate from the required test certificates.

All tests required by the relevant Australian or International standards shall be carried out. Test certificates shall be submitted in electronic format and shall be in Adobe Acrobat (.pdf) format.

### 9.3 Type Tests

The tests are intended to verify the main characteristics and suitability of the design, dimensions, materials, and method of manufacture (technology).

Certified type test results shall be submitted with the Proposal, these type tests shall include those outlined in AS 61869.1 [7] and AS 61869.3 [8]. The Vendor shall, in their evaluation submission, state which tests the *Equipment* have passed.

**Table 3: Type Tests**

Description	Standard
	AS 61869-1 & AS 61869-3 (Clause/s)
Temperature-rise tests	-1 (7.2.2)
Impulse voltage test on primary terminals	-1 (7.2.3)
Wet test for outdoor types <sup>2</sup>	-1 (7.2.4)
Electromagnetic Compatibility tests	-1 (7.2.5)
Accuracy tests	-3 (7.2.6)
Verification of the degree of protection by enclosure	-1 (7.2.7)
Enclosure tightness test at ambient temperature	-1 (7.2.8)
Pressure test for enclosure	-1 (7.2.9)
Short-circuit withstand capability test	-3 (7.2.301)

### 9.4 Routine Tests

Routine tests are intended to eliminate defective units and shall be carried out during the manufacturing process. Routine tests shall be carried out on every *Equipment* and should not consist of visual examination only, these routine tests shall include those outlined in AS 61869.1 [7] and AS 61869.3 [8].

The Vendor shall supply duly certified copies of the routine tests performed on the *Equipment* to Horizon Power, either prior to or upon delivery.

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<sup>2</sup> The test shall be performed in accordance with IEC 60060.1 [12]

**Table 4: Routine Tests**

Description	Standard
	AS 61869-1 & AS 61869-3 (Clause/s)
Power-frequency voltage withstand on primary terminals	-1 (7.3.1)
Partial discharge measurement	-1 (7.3.2)
Power-frequency voltage withstand between sections	-1 (7.3.3)
Power-frequency voltage withstand on secondary terminals	-1 (7.3.4)
Test for accuracy	-3 (7.3.5)
Verification of terminal markings	-1 (7.3.6)
Enclosure tightness test at ambient temperature	-1 (7.3.7)
Pressure test for enclosure	1 (7.2.9)
Visual Inspection	"Manufacturer's Standard"

## 10 DOCUMENTATION AND SAMPLES

### 10.1 Documentation to be provided with Proposals

Submitted proposals shall provide all documentation and information as requested in this specification, including any further relevant information on the *Equipment* offered. The proposal must be complete in all respects. Failure to comply may cause the proposal to be considered incomplete and hence informal.

The vendor shall provide an electronic version of all documents in Adobe Acrobat (.pdf) format containing the information detailed below with their offer:

- Any non-compliance of the Specification shall be detailed in the Technical Deviation schedule;
- All information provided in Technical Requirements shall be in English and measurement units shall be in metric units;
- Material Safety Data Sheets;
- CAD drawings (Micro station preferred DGN format) of all *Equipment* showing all critical dimensions;
- *Equipment* data sheets showing the weight, material type, protective coatings, mechanical & electrical properties (Combined Load Charts shall be included);
- Installation instructions included in the packaging; and
- A copy of the Vendor's current Quality Assurance accreditation and category.

Should the preferred vendor submit drawings for approval by Horizon Power, this will in no way exonerate it from being responsible for the correct and proper function of the *Equipment*.

## 10.2 Service history

Vendors shall state:

- Other Australian electricity supply authorities who have a service history of the items offered; and
- Contact details of those supply authorities who can verify the service performance claimed.

## 10.3 Training Materials

Training material in the form of drawings, instructions and/or audio-visuals must be provided for the items accepted under the offer.

Vendors shall state the availability of training materials which could include but is not limited to the following topics:

- Handling and storage;
- Application (particularly in areas of heavy coastal pollution);
- Installation;
- Maintenance;
- Environmental performance;
- Electrical performance;
- Mechanical performance;
- Disposal at the end of service life; and
- Production process and testing.

## 10.4 Samples

Samples of all proposed *Equipment* types are to be provided upon request of Horizon Power as part of the submitted proposals.

## 11

**EQUIPMENT LIST AND DESCRIPTION****Table 5: Standard Equipment list and descriptions**

<b>Specification Item No.</b>	<b>Description</b>
1.1	INDOOR VOLTAGE TRANSFORMER 11kV/ $\sqrt{3}$ // 110/ $\sqrt{3}$ , 50HZ, 12/28/75kV, 1M-0.2/50VA, 1P-3P/50VA
1.2	OUTDOOR VOLTAGE TRANSFORMER 11kV/ $\sqrt{3}$ // 110/ $\sqrt{3}$ , 50HZ, 12/28/75kV, 1M-0.2/50VA, 1P-3P/50VA
2.1	INDOOR VOLTAGE TRANSFORMER 22kV/ $\sqrt{3}$ // 110/ $\sqrt{3}$ , 50HZ, 24/50/125kV, 1M-0.2/50VA, 1P-3P/50VA
2.2	OUTDOOR VOLTAGE TRANSFORMER 22kV/ $\sqrt{3}$ // 110/ $\sqrt{3}$ , 50HZ, 24/50/125kV, 1M-0.2/50VA, 1P-3P/50VA
3.1	INDOOR VOLTAGE TRANSFORMER 33kV/ $\sqrt{3}$ // 110/ $\sqrt{3}$ , 50HZ, 36/70/170kV, 1M-0.2/50VA, 1P-3P/50VA
3.2	OUTDOOR VOLTAGE TRANSFORMER 33kV/ $\sqrt{3}$ // 110/ $\sqrt{3}$ , 50HZ, 36/70/170kV, 1M-0.2/50VA, 1P-3P/50VA



## 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# 37876745** 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
01/12/2022	0	Initial Document Creation

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

<b>DOCUMENT NUMBER</b>		HPC-8DJ-07-0007-2022					<b>QUALITY ASSURANCE</b>		<b>DM NUMBER</b>	
<b>DEVICE DESCRIPTION</b>		<b>LABEL MATERIAL NO.</b>					<b>MV VT PURCHASE</b>		<b>ASSET OWNER</b>	
		<b>ASSET ID/ STOCK NO</b>								
<b>MANUFACTURER</b>				<b>DIMENSION</b>						
<b>ITEM</b>	<b>OPERATION/EQUIPMENT/FACILITY</b>			<b>DOCUMENT REF.</b>	<b>WHO CHECKS</b>	<b>INITIAL</b>	<b>DATE/ TIME</b>	<b>QUALITY ASSURANCE CRITERIA</b>	<b>PASS Y/N</b>	<b>COMMENTS</b>
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	Voltage Transformer 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		
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		

ITEM	OPERATION/EQUIPMENT/FACILITY	DOCUMENT REF.	WHO CHECKS	INITIAL	DATE/TIME	QUALITY ASSURANCE CRITERIA	PASS Y/N	COMMENTS
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	Voltage Transformer/s 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 SCHEDULES A & B: ENQUIRY DOCUMENT

### C1 Technical Schedules

Completion of the listed schedules below by the vendor shall indicate the product offered is fully compliant with the nominated Clauses in this specification. All information provided shall be in English and measurement units shall be in metric units.


Any deviation from the specification shall be listed on the “Technical Deviation Schedule C”, provided in Appendix D with motivation to Horizon Power for consideration and written approval.

### C2 Technical Requirements

Schedule A: Purchaser’s specific requirements.

Schedule B: Particulars of *Equipment* to be supplied.

#### C2.1 Technical Schedules A and B for 11 kV Voltage Transformers

	SPECIFICATION ENQUIRY	HPC-8DJ-07-0007-2022
	VENDOR’S NAME	
	DATE	

#### TECHNICAL SCHEDULES A & B

#### ITEM 1.1: 11 kV Indoor Voltage Transformer

SCHEDULE A: Horizon Power’s specific requirements

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

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of voltage transformer	xxxxxx	
2.		Manufacturer’s/ vendor’s catalogue number	xxxxxx	
3.		Manufacturer’s/ vendor’s drawing number	xxxxxx	
4.	3.3.1	Electrical Requirements		
4.1		Rated voltage kV	11/√3	
4.2		Max. system voltage kV	12	
4.3		Lightning impulse withstand kV	75	
4.4		Power frequency withstand kV	28	
4.5		System frequency Hz	50	
4.6		System neutral earthing conditions	effective earth	
4.7		Voltage factor	1.9/30 s	
4.8		Thermal limit	400 VA/4 A	
4.9		Measurement winding	*****	

Item	Sub-clause	Description	Schedule A	Schedule B
4.10		Measurement voltage V	$110/\sqrt{3}$	
4.11		Measurement class and burden	0.2/50 VA	
4.12		Protection winding	*****	
4.13		Protection voltage V	$110/\sqrt{3}$	
4.14		Protection class and burden	3P/50 VA	
5.	3.3.2	Mechanical Requirements		
5.1		Minimum creepage distance ( $\geq 20$ mm/kV) mm	$\geq 240$	
5.2		Class of Insulation (applicable for gas)	*****	
5.3		Weight kg	*****	
5.4		Primary terminals	*****	

**ITEM 1.2: 11 kV Outdoor Voltage Transformer**


**SCHEDULE A: Horizon Power's specific requirements**

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

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of voltage transformer	xxxxxx	
2.		Manufacturer's/ vendor's catalogue number	xxxxxx	
3.		Manufacturer's/ vendor's drawing number	xxxxxx	
4.	3.3.1	Electrical Requirements		
4.1		Rated voltage kV	$11/\sqrt{3}$	
4.2		Max. system voltage kV	12	
4.3		Lightning impulse withstand kV	75	
4.4		Power frequency withstand kV	28	
4.5		System frequency Hz	50	
4.6		System neutral earthing conditions	effective earth	
4.7		Voltage factor	1.9/30 s	
4.8		Thermal limit	400 VA/4 A	
4.9		Measurement winding	*****	
4.10		Measurement voltage V	$110/\sqrt{3}$	

Item	Sub-clause	Description	Schedule A	Schedule B
4.11		Measurement class and burden	0.2/50 VA	
4.12		Protection winding	*****	
4.13		Protection voltage V	110/√3	
4.14		Protection class and burden	3P/50 VA	
5.	3.3.2	Mechanical Requirements		
5.1		Minimum creepage distance (≥31 mm/kV) mm	≥372	
5.2		Class of Insulation (applicable for gas)	*****	
5.3		Weight kg	*****	
5.4		Primary terminals	*****	
5.5		Secondary terminal box	IP54	
5.6		Secondary terminals	M6 studs	

## C2.2 Technical Schedules A and B for 22 kV Voltage Transformers

	SPECIFICATION ENQUIRY	HPC-8DJ-07-0007-2022
	VENDOR'S NAME	
	DATE	

### TECHNICAL SCHEDULES A & B

#### ITEM 2.1: 22 kV Indoor Voltage Transformer

**SCHEDULE A: Horizon Power's specific requirements**

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

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of voltage transformer	xxxxxx	
2.		Manufacturer's/ vendor's catalogue number	xxxxxx	
3.		Manufacturer's/ vendor's drawing number	xxxxxx	
4.	3.3.1	Electrical Requirements		
4.1		Rated voltage kV	22/√3	
4.2		Max. system voltage kV	24	
4.3		Lightning impulse withstand kV	125	

Item	Sub-clause	Description	Schedule A	Schedule B
4.4		Power frequency withstand kV	50	
4.5		System frequency Hz	50	
4.6		System neutral earthing conditions	effective earth	
4.7		Voltage factor	1.9/30 s	
4.8		Thermal limit	400 VA/4 A	
4.9		Measurement winding	*****	
4.10		Measurement voltage V	110/√3	
4.11		Measurement class and burden	0.2/50 VA	
4.12		Protection winding	*****	
4.13		Protection voltage V	110/√3	
4.14		Protection class and burden	3P/50 VA	
5.	3.3.2	Mechanical Requirements		
5.1		Minimum creepage distance (≥20 mm/kV) mm	≥480	
5.2		Class of Insulation (applicable for gas)	*****	
5.3		Weight kg	*****	
5.4		Primary terminals	*****	

**ITEM 2.2: 22 kV Outdoor Voltage Transformer**


**SCHEDULE A: Horizon Power's specific requirements**

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

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of voltage transformer	xxxxxx	
2.		Manufacturer's/ vendor's catalogue number	xxxxxx	
3.		Manufacturer's/ vendor's drawing number	xxxxxx	
4.	3.3.1	Electrical Requirements		
4.1		Rated voltage kV	22/√3	
4.2		Max. system voltage kV	24	
4.3		Lightning impulse withstand kV	125	
4.4		Power frequency withstand kV	50	

Item	Sub-clause	Description	Schedule A	Schedule B
4.5		System frequency Hz	50	
4.6		System neutral earthing conditions	effective earth	
4.7		Voltage factor	1.9/30 s	
4.8		Thermal limit	400 VA/4 A	
4.9		Measurement winding	*****	
4.10		Measurement voltage V	110/√3	
4.11		Measurement class and burden	0.2/50 VA	
4.12		Protection winding	*****	
4.13		Protection voltage V	110/√3	
4.14		Protection class and burden	3P/50 VA	
5.	3.3.2	Mechanical Requirements		
5.1		Minimum creepage distance (≥31 mm/kV) mm	≥744	
5.2		Class of Insulation (applicable for gas)	*****	
5.3		Weight kg	*****	
5.4		Primary terminals	*****	
5.5		Secondary terminal box	IP54	
5.6		Secondary terminals	M6 studs	

### C2.3 Technical Schedules A and B for 33 kV Voltage Transformers

	SPECIFICATION ENQUIRY	HPC-8DJ-07-0007-2022
	VENDOR'S NAME	
	DATE	

#### TECHNICAL SCHEDULES A & B

#### ITEM 3.1: 33 kV Indoor Voltage Transformer

**SCHEDULE A: Horizon Power's specific requirements**

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

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of voltage transformer	xxxxxx	



Item	Sub-clause	Description	Schedule A	Schedule B
2.		Manufacturer's/ vendor's catalogue number	xxxxxx	
3.		Manufacturer's/ vendor's drawing number	xxxxxx	
4.	3.3.1	Electrical Requirements		
4.1		Rated voltage kV	33/√3	
4.2		Max. system voltage kV	36	
4.3		Lightning impulse withstand kV	170	
4.4		Power frequency withstand kV	70	
4.5		System frequency Hz	50	
4.6		System neutral earthing conditions	effective earth	
4.7		Voltage factor	1.9/30 s	
4.8		Thermal limit	400 VA/4 A	
4.9		Measurement winding	*****	
4.10		Measurement voltage V	110/√3	
4.11		Measurement class and burden	0.2/50 VA	
4.12		Protection winding	*****	
4.13		Protection voltage V	110/√3	
4.14		Protection class and burden	3P/50 VA	
5.	3.3.2	Mechanical Requirements		
5.1		Minimum creepage distance (≥20 mm/kV) mm	≥720	
5.2		Class of Insulation (applicable for gas)	*****	
5.3		Weight kg	*****	
5.4		Primary terminals	*****	

**ITEM 3.2: 33 kV Outdoor Voltage Transformer**

**SCHEDULE A: Horizon Power's specific requirements**

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

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of voltage transformer	xxxxxx	
2.		Manufacturer's/ vendor's catalogue number	xxxxxx	

Item	Sub-clause	Description	Schedule A	Schedule B
3.		Manufacturer's/ vendor's drawing number	xxxxxx	
4.	3.3.1	Electrical Requirements		
4.1		Rated voltage kV	33/√3	
4.2		Max. system voltage kV	36	
4.3		Lightning impulse withstand kV	170	
4.4		Power frequency withstand kV	70	
4.5		System frequency Hz	50	
4.6		System neutral earthing conditions	effective earth	
4.7		Voltage factor	1.9/30 s	
4.8		Thermal limit	400 VA/4 A	
4.9		Measurement winding	*****	
4.10		Measurement voltage V	110/√3	
4.11		Measurement class and burden	0.2/50 VA	
4.12		Protection winding	*****	
4.13		Protection voltage V	110/√3	
4.14		Protection class and burden	3P/50 VA	
5.	3.3.2	Mechanical Requirements		
5.1		Minimum creepage distance (≥31 mm/kV) mm	≥1116	
5.2		Class of Insulation (applicable for gas)	*****	
5.3		Weight kg	*****	
5.4		Primary terminals	*****	
5.5		Secondary terminal box	IP54	
5.6		Secondary terminals	M6 studs	

## APPENDIX D TECHNICAL 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. Details of departure shall be provided in Schedule D Appendix E.

CLAUSE NUMBER		YES	NO	ATT.
3	Requirements			
3.1	General	<input type="checkbox"/>	<input type="checkbox"/>	
3.2	Environmental Conditions	<input type="checkbox"/>	<input type="checkbox"/>	
3.3	Technical Requirements			
3.3.1	<i>Electrical Requirements</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.2	<i>Mechanical Requirements</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.3	<i>Mounting Requirements</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.4	<i>Primary Terminals</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.4	Secondary Terminals	<input type="checkbox"/>	<input type="checkbox"/>	
3.4.1	<i>Terminal Box</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.5	Lifting Facilities	<input type="checkbox"/>	<input type="checkbox"/>	
3.6	Insulating Oil and Containment System	<input type="checkbox"/>	<input type="checkbox"/>	
3.6.1	<i>Oil Sampling Valve</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.6.2	<i>Oil Level Indication</i>	<input type="checkbox"/>	<input type="checkbox"/>	
3.7	Painting and Galvanising	<input type="checkbox"/>	<input type="checkbox"/>	
3.8	Name Plate	<input type="checkbox"/>	<input type="checkbox"/>	
4	Packaging Requirements	<input type="checkbox"/>	<input type="checkbox"/>	
5	Storage	<input type="checkbox"/>	<input type="checkbox"/>	
6	Reliability	<input type="checkbox"/>	<input type="checkbox"/>	
7	Safety	<input type="checkbox"/>	<input type="checkbox"/>	
8	Environmental Considerations	<input type="checkbox"/>	<input type="checkbox"/>	
9	Tests			
9.1	Test Requirements	<input type="checkbox"/>	<input type="checkbox"/>	
9.2	Test Certificates	<input type="checkbox"/>	<input type="checkbox"/>	
9.3	Type Tests	<input type="checkbox"/>	<input type="checkbox"/>	
9.4	Routine Tests	<input type="checkbox"/>	<input type="checkbox"/>	
10	Documentation and Samples			
10.1	Documentation to be provided with Proposals	<input type="checkbox"/>	<input type="checkbox"/>	
10.2	Service history	<input type="checkbox"/>	<input type="checkbox"/>	

CLAUSE NUMBER		YES	NO	ATT.
10.3	Training Materials	<input type="checkbox"/>	<input type="checkbox"/>	
10.4	Samples	<input type="checkbox"/>	<input type="checkbox"/>	

