



# Specification – HV Surge Arrester

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Document Control		
<b>Author</b>	<b>Name:</b> Paul Savig <b>Position:</b> Senior Standards Engineer	
<b>Reviewed By</b>	<b>Name:</b> Tadeusz Bloch <b>Position:</b> Senior Electrical Engineer	
<b>Document Owner</b> <i>(May also be the Process Owner)</i>	<b>Name:</b> Johnathan Choi <b>Position:</b> Plant and Standards Manager	
<b>Approved By *</b>	<b>Name:</b> Victor Cheng <b>Position:</b> Manager Engineering and Project Services	
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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.

\*\* 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.

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STAKEHOLDERS	
<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
<i>Manager Health and Safety</i>	

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# 1 SCOPE

This Specification sets out the technical (electrical and mechanical) requirements for the performance, testing and supply of high voltage surge arresters for the transmission 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 1111.1 ISO metric hexagon bolts and screws – Product grade C – Bolts*, Standards Australia, 2015
- [3]. *AS 1111.2 ISO metric hexagon bolts and screws – Product grade C – Screws*, Standards Australia, 2015
- [4]. *AS 1307.2 Surge arresters – Metal oxide surge arresters without gaps for a.c. system*, Standards Australia, 1996 (R2015)
- [5]. *AS 1627.0 Metal finishing – Preparation and pre-treatment of surfaces – Method selection guide*, Standards Australia, 1997 (R2017)
- [6]. *AS/NZS 1768 Lightning protection*, Standards Australia, 2007
- [7]. *AS/NZS 2344 Limits of electromagnetic interference from overhead a.c. powerlines and high voltage equipment installations in the frequency range 0.15 to 3000 MHz*, Standards Australia, 2016

- [8]. *AS 2650 Common specifications for high voltage switchgear and control gear standards*, Standards Australia, 2005
- [9]. *AS 2700S Colour standards for general purposes – (T33) Smoke Blue*, Standards Australia, 2011
- [10]. *AS/NZS 4680 Hot dip galvanised (zinc) coatings on fabricated ferrous articles*, Standards Australia, 2006
- [11]. *AS/NZS 7000 Overhead line design – Detailed procedures*, Standards Australia, 2016
- [12]. *AS 60038 Standard voltages*, Standards Australia, 2012
- [13]. *AS IEC 60437 Radio interference test on high-voltage insulators*, Standards Australia, 2005
- [14]. *AS 62271.1 High voltage switchgear and controlgear – Common specifications*, Standards Australia, 2012
- [15]. *AS 62271-203 High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*, Standards Australia, 2011
- [16]. *AS 62271-301 High voltage switchgear and control gear – Dimensional standardisation of terminals*, Standards Australia, 2011
- [17]. *AS (ISO) 1000 The international system of units (SI) and its application*, Standards Australia, 1998

### 2.1.3 International Standards

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

- [18]. *IEC 60060-1, High-voltage test techniques – Part 1: General definitions and test requirements*
- [19]. *IEC 60060-2, High-voltage test techniques – Part 2: Measuring systems*
- [20]. *IEC 60068-2-11:1981, Environmental testing – Part 2-11: Tests – Test kA: Salt mist*
- [21]. *IEC 60068-2-14, Environmental testing – Part 2-14: Tests – Test N: Change of temperature*
- [22]. *IEC 60099.4 Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*, International Electrotechnical Committee, 2014
- [23]. *IEC 60812 Analysis techniques for system reliability—Procedure for failure mode and effects analysis (FMEA)*, International Electrotechnical Committee, 2006
- [24]. *IEC/TS 60815 Selection and dimensioning of high-voltage insulators intended for use in polluted conditions*, International Electrotechnical Committee, 2008

### 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 1307.2 [4] & IEC 60099.4 [22]) with the addition of a few general definitions listed below in alphabetical order.

**Equipment:** Surge Arrester

**EE:** Effective Earthing

**Max.:** maximum

**NS:** Non-shattering

**PCD:** Pitch circle diameter

**SCL/SLL:** Specified continuous/long-term load

**SSL:** Specified short-term load

**TOV:** Temporary Over Voltages are **undamped or little damped power-frequency over-voltages of relatively long duration** (i.e., seconds, even minutes). These over-voltages are typically caused by faults to ground, resonance conditions, load rejection, energisation of unloaded transformers, or a combination of these.

## 3 REQUIREMENTS

### 3.1 General

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

Standard Horizon Power Surge Arresters 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].

#### 3.2.1 Limits of Radio Interference Voltage

The radiated radio disturbance from the *Equipment* must comply with Section 8.14 of IEC 60099.4 [22]

### 3.3 Technical Requirements

The *Equipment* shall be suitable for outdoor use and only connected in a phase to earth arrangement. Outdoor *Equipment* may be mounted on steel or any other structure and be bonded to earth.

The technical performance of the *Equipment* must as a minimum meet AS 1307.2 [4] and IEC 60099.4 [22].

#### 3.3.1 Electrical Requirements

The *Equipment* shall be suitable for use on the 66 kV, 132 kV and 220 kV 3-phase 50 Hz transmission systems and have non-linear voltage-current characteristics. 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		66 kV	132 kV	220 kV
Maximum system voltage	kV	72.5	145	245
Lightning impulse withstand (8/20 $\mu$ s wave)	kV <sub>Peak</sub>	325	650	1050
Power frequency withstand (1 min)	kV <sub>RMS</sub>	140	275	460
Max. prospective short circuit current (kA/1 second)	kA	65	65	65
System neutral earthing conditions		EE	EE	EE
<b>Duty Requirements</b>				
Max. continuous operating voltage <sup>1</sup>	kV	43.9	87.9	146.3
Max. residual voltage across surge arrester <sup>2</sup>	kV <sub>Peak</sub>	282	565	940
Min. rated voltage	kV	54.9	109.9	183.2
Nominal (8/20 $\mu$ s impulse) discharge current, I <sub>n</sub>	kA	10	10	10
TOV	kV	61.5	123.1	205.2
Duration of temporary over voltage	s	2	2	2
Long duration current impulse	$\mu$ s	2000	2000	2000
Line discharge class		3	3	3
Minimum energy capability (2 impulses) in kJ/kV (Ur)		5	5	5
High current pressure relief test current (0.2 sec)	kA	50	50	50

<sup>1</sup> using 5% harmonic content and maximum system voltage, U<sub>c</sub>

<sup>2</sup> at surge diverter assuming a 10kA 8/20  $\mu$ s impulse current



### 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 arrester should be non-shattering (Class NS) as stated in AS 1307.2 [4]. Means shall be provided to either pressure relieve (see Section 3.4) or otherwise prevent the arrester from shattering, in case of arrester malfunctions. Failure of the arrester must be easily visible from outside without any electrical testing.

The surge arrester shall be metal oxide assembled in its housing in such a way that there is no air gap between the block and the housing walls. This is required to preclude any pressure build-up within the housing. The housing must be impervious to moisture and dust, and have proven performance under specified conditions.

The preferred housing of the arresters shall be light grey silicone rubber, similar to smoke blue colour T33 to AS 2700S [9]. Other colours may be acceptable at the discretion of Horizon power's representative.

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

**Table 2: Mechanical Requirements**

Description		66 kV	132 kV	220 kV
Creepage ( $\geq 31$ mm/kV)	mm	$\geq 2046$	$\geq 4092$	$\geq 6820$
Pressure relief class		<b>NS</b>	<b>NS</b>	<b>NS</b>
Cantilever strength (SCL/SLL)	kNm	$\geq 2.5$	$\geq 2.5$	$\geq 2.5$
Cantilever strength (SSL)	kNm	$\geq 4$	$\geq 4$	$\geq 4$
Housing		silicon	silicon	silicon
Colour		grey	grey	grey

### 3.3.3 Mounting Requirements

The *Equipment* shall be supplied fully assembled ready for mounting. The vendor shall specify the maximum permissible terminal loads relevant for installation and service, such as cantilever, torque, and tensile loads.

The *Equipment's* mounting base shall have a pitch circle diameter (PCD) of 120 mm, with 4 holes  $\varnothing 18$ , tapped size M16 with a depth of 20 mm.

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

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

### 3.3.3.1 Line Mounting

The *Equipment* installed on lines shall be suitable for mounting vertically upright or inverted, horizontally or at any angle in between. The *Equipment* shall be supplied with all accessories required for pole mounting.

The line mounted *Equipment* must have an automated disconnecting device for when the *Equipment* fails that is quick and effective. The disconnection device nor the failed *Equipment* must not lead to any interference with other live parts. The disconnection must be clearly visible from the ground.

### 3.3.3.2 Substation Mounting

The *Equipment* installed in substations is usually mounted on steel support structures in a switchyard. The *Equipment* shall be supplied with all accessories required for pedestal mounting.

The substation mounted *Equipment* must be insulated to allow the installation of a surge counter, see Section 3.3.3.3 Surge Counter – Option below.

### 3.3.3.3 Surge Counters - Option

Surge counters shall be of static components with the electromechanical type counter and suitable for continuous service without requiring any auxiliary source. They shall be robust and capable of withstanding repeatedly without damage, the maximum discharge current of the arrester.

A leakage current detector should be provided as an integral part of surge counter. The value of leakage current beyond which the operation is abnormal shall be clearly marked in red colour.

Internal parts shall be unaffected by atmospheric conditions on site and be designed to allow the recording device to be read without exposing the internal parts to the atmosphere.

Terminals shall be 14 mm hole to connect cable lugs for 95 mm<sup>2</sup> or 120 mm<sup>2</sup> cables or 50 mm x 3 mm copper straps for both line and earth side. Terminals shall be Type 1 in concordance with AS 62271-301 [16].

**Table 3: Counter Requirements**

General		
Housing		IP67
Short-circuit capability as per IEC 60099-4	kA	65
Power supply		self-driven
Surge Registry		
Minimum counting threshold (8/20 $\mu$ s)	A	$\leq 200$
Surge count memory capacity		9999 – (wrap around)
Time resolution	s	<0.5

Leakage current measurement		
Leakage current range	$\text{mA}_{\text{PEAK}}$	0.1 to 50
Frequency range	Hz	48 to 62

### 3.3.4 Terminals

The *Equipment* shall be provided with suitable terminals to connect to the line and earth in concordance with AS 62271-301 [16]. The terminals on the line side and the earth side, shall be Type 5, stainless steel grade 304 or 316 and shall be supplied with all required nuts, bolts, and washers. Line terminal palms shall be suitable to withstand a Dynamic force of 2.5 kNm.

The line terminals shall be suited for stranded conductors up to 61/3.25 AAC or 95 mm<sup>2</sup> copper cable. The earth terminals shall be 14 mm hole or M12 stud to connect cable lugs for 95 mm<sup>2</sup> or 120 mm<sup>2</sup> cables or 50 mm x 3 mm copper straps. The vendor shall submit complete details and drawings of the line and earth terminals.

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.

### 3.3.5 Grading Rings

The *Equipment* shall be provided with external grading rings that maintain a uniform and acceptable voltage stress along the entire length of the *Equipment*. These rings shall be included with the delivery of the *Equipment*.

## 3.4 Pressure Relief

The *Equipment* shall be provided with a device to release excessive amounts of internal pressure to ensure that the housing does not explode nor create any hazard to nearby personnel or equipment.

The design of the pressure relief shall be such that the operation of the device shall be determinable from ground level. Pressure relief devices shall be tested to AS 1307.2 [4].

## 3.5 Painting and Galvanising

All painting and galvanising shall conform to this specification and to AS/NZS 4680 [10]. The galvanising coating shall be smooth, clean and of uniform thickness, free from defects.

### 3.6 Name Plate

*Equipment* shall be provided with a nameplate incorporating details in accordance with clause 3.1 of AS 1307.2 [4]. 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) Continuous operating voltage
- 2) Rated voltage
- 3) Rated frequency
- 4) Nominal discharge current
- 5) Pressure relief rated current in  $kA_{RMS}$
- 6) Manufacturer's name or trademark, type, and identification
- 7) Year of manufacture
- 8) Serial number

## 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 [23]. 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 test certificates shall be submitted in electronic format and shall be in Adobe Acrobat (.pdf) format.

### 9.3 Required Tests

Tests that shall be performed on the *Equipment* with follow-up documentation are as follows:

- Type tests;
- Routine tests;
- Acceptance tests;
- Batch tests.

All tests required by the relevant Australian or International standards shall be carried out. The requirements for these are outlined in Appendix E Test Certificates

### 9.4 Type Tests

The tests are intended to verify the main characteristics and suitability of the design, dimensions, materials, and method of manufacture (technology). When a *Equipment* is subjected to the type tests, the results shall be considered valid for the whole class of *Equipment* which are represented by the one tested and having the following characteristics:

- a) same materials for the core, and housing and same manufacturing method;
- b) same material for the end fittings, same design, and same method of attachment;

- c) same or greater minimum layer thickness of the housing material over the core (including a sheath where used) \*;
- d) same or smaller ratio of all mechanical loads to the smallest core diameter between fittings \*;
- e) same or smaller ratio of the highest system voltage to insulation length \*; and
- f) same or greater diameter of the core.

The tested *Equipment* shall be identified by a drawing giving all the dimensions with the manufacturing tolerances. Subsequently, if there are small variations in the design data of not more than 15 % for characteristics marked with \*, the tests do not need to be repeated.

Certified type test results shall be submitted with the Proposal. The Vendor shall, in their evaluation submission, state which tests the *Equipment* have passed.

**Table 4: Type Tests**

Description	Standard
	AS 1307.2 Clause/s
Insulation withstand tests	5.1 & 7.2
Residual voltage tests	5.3 & 7.3
Long duration current impulse withstand test	5.8 & 7.4
Operating duty tests	5.9 & 7.5
Pressure relief test	5.11 & 7.8
Partial discharge test	5.4
Seal test	5.5 & 7.7.2
Power frequency voltage versus time characteristics	5.10
	IEC 60099.4 Clause/s
Bending moment test	10.8.11
Weather ageing test	10.8.17
Radio interference voltage test	8.14

## 9.5 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.

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

**Table 5: Routine Tests**

Description	Standard
	AS 1307.2 Clause/s
Measurement of reference voltage	6.2
Residual voltage tests	8.1 (b)
Partial discharge test	8.1 (c)
	IEC 60099.4 Clause/s
Seal test	9.1 e)

## 9.6 Acceptance Tests

*Equipment* shall be acceptance tested to Clause 8.2 of AS 1307.2 [4]. Two percent or two surge arresters, whichever is the greater, shall be selected as samples for lot sizes of less than 300 surge arresters. For lot sizes greater than 300, the sample sizes specified in the relevant Australian Standard shall be applicable.

**Table 6: Acceptance Tests**

Description	Standard
	AS 1307.2 Clause/s
Measurement of power frequency voltage at the reference current	8.2.1 (a)
Lightning impulse residual voltage	8.2.1 (b)
Partial discharge test	8.2.1 (c)
Special thermal stability test	8.2.2
Seal leakage test	8.2.3



## 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 7: Standard *Equipment* list and descriptions

Specification Item No.	Description
1	POST TYPE POLE MOUNTED SURGE ARRESTER 66 kV METAL OXIDE GAPLESS POLYMER/COMPOSITE/SILICON OUTDOOR NDC-10kA STATION SM CLASS NS SCL/SLL – 2.5kNm SSL – 4kNm
2	POST TYPE PEDESTAL MOUNTED SURGE ARRESTER 66 kV METAL OXIDE GAPLESS POLYMER/COMPOSITE/SILICON OUTDOOR NDC-10kA STATION SM CLASS NS SCL/SLL – 2.5kNm SSL – 4kNm
3	POST TYPE POLE MOUNTED SURGE ARRESTER 132 kV METAL OXIDE GAPLESS POLYMER/COMPOSITE/SILICON OUTDOOR NDC-10kA STATION SM CLASS NS SCL/SLL – 2.5kNm SSL – 4kNm
4	POST TYPE PEDESTAL MOUNTED SURGE ARRESTER 132 kV METAL OXIDE GAPLESS POLYMER/COMPOSITE/SILICON OUTDOOR NDC-10kA STATION SM CLASS NS SCL/SLL – 2.5kNm SSL – 4kNm
5	POST TYPE POLE MOUNTED SURGE ARRESTER 220 kV METAL OXIDE GAPLESS POLYMER/COMPOSITE/SILICON OUTDOOR NDC-10kA STATION SM CLASS NS SCL/SLL – 2.5kNm SSL – 4kNm
6	POST TYPE PEDESTAL MOUNTED SURGE ARRESTER 220 kV METAL OXIDE GAPLESS POLYMER/COMPOSITE/SILICON OUTDOOR NDC-10kA STATION SM CLASS NS SCL/SLL – 2.5kNm SSL – 4kNm
7	SURGE ARRESTER SURGE COUNTER 65KA RATED 10A THRESHOLD

## 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# 23049637** 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
3/03/2022	0	Initial Document Creation

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

<b>DOCUMENT NUMBER</b>		HPC-8DJ-25-0001-2025					<b>QUALITY ASSURANCE</b>		<b>DM NUMBER</b>	
<b>DEVICE DESCRIPTION</b>		<b>LABEL MATERIAL NO.</b>					<b>INSULATOR 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	Batch Number						*****			
1.4	Horizon Power Order Number						*****			
1.5	Horizon Power Stock Number						*****			
1.6	Surge Arrester description						*****			
1.7	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			

ITEM	OPERATION/EQUIPMENT/FACILITY	DOCUMENT REF.	WHO CHECKS	INITIAL	DATE/TIME	QUALITY ASSURANCE CRITERIA	PASS Y/N	COMMENTS
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	Surge Arrester/s in suitable packaging					Strong enough to prevent mechanical damage		
3.4	Packaging clearly labelled					Each package easily identifiable as per Section 4		
3.5	Items Individually Marked					Items clearly designated and marked as per Section 3.8		
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 66 kV Surge Arresters

	SPECIFICATION ENQUIRY	HPC-8DJ-25-0001-2021
	VENDOR’S NAME	
	DATE	

#### TECHNICAL SCHEDULES A & B

##### ITEM 1: 66 kV Post Pole Mounted Surge Arrester

Item	Sub-clause	Description		Schedule A	Schedule B
1.		Manufacturer/ vendor of insulator		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	66	
4.2		Max. system voltage	kV	72.5	
4.3		Lightning impulse withstand (8/20 $\mu$ s wave)	kV	325	
4.4		Power frequency withstand	kV	140	
4.5		Max. prospective short circuit current (kA/1 sec.)	kA	65	
4.6		System frequency	Hz	50	
4.7		System neutral earthing conditions		effective earth	
4.8		Max. continuous operating voltage	kV	43.9	
4.9		Max. residual voltage	kV	282	
4.10		Min. rated voltage	kV	54.9	

Item	Sub-clause	Description	Schedule A	Schedule B
4.11		Nominal discharge current (kA <sub>Peak</sub> ) kA	10	
4.12		Temporary overvoltage kV	61.5	
4.13		Duration of temporary over voltage sec.	2	
4.14		Long duration current impulse μs	2000	
4.15		Line discharge class	3	
4.16		Energy discharge capability kJ/kV	5	
4.17		High current pressure relief test current (0.2 sec) kA	50	
5.	3.3.2	Mechanical Requirements		
5.1		Class	outdoor	
5.2		Minimum creepage distance (≥31 mm/kV) mm	2046	
5.3		Pressure relief class	NS	
5.4		Cantilever strength (SCL/SLL) kNm	≥2.5	
5.5		Cantilever strength (SSL) kNm	≥4	
5.6		Housing	silicon	
5.7		Colour	grey	
5.8		Length mm	*****	
5.9		Weight kg	*****	
6.	3.3.3	Mounting Requirements		
6.1		Line terminal connection	Type 5	
6.2		Ground terminal connection	Type 5	

**ITEM 2: 66 kV Post Pedestal Mounted Surge Arrester**


Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of insulator	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	66	

Item	Sub-clause	Description	Schedule A	Schedule B
4.2		Max. system voltage kV	72.5	
4.3		Lightning impulse withstand (8/20 $\mu$ s wave) kV	325	
4.4		Power frequency withstand kV	140	
4.5		Max. prospective short circuit current (kA/1 sec.) kA	65	
4.6		System frequency Hz	50	
4.7		System neutral earthing conditions	effective earth	
4.8		Max. continuous operating voltage kV	43.9	
4.9		Max. residual voltage kV	282	
4.10		Min. rated voltage kV	54.9	
4.11		Nominal discharge current (kA <sub>Peak</sub> ) kA	10	
4.12		Temporary overvoltage kV	61.5	
4.13		Duration of temporary over voltage sec.	2	
4.14		Long duration current impulse $\mu$ s	2000	
4.15		Line discharge class	3	
4.16		Energy discharge capability kJ/kV	5	
4.17		High current pressure relief test current (0.2 sec) kA	50	
5.	3.3.2	Mechanical Requirements		
5.1		Class	outdoor	
5.2		Minimum creepage distance ( $\geq 31$ mm/kV) mm	2046	
5.3		Pressure relief class	NS	
5.4		Cantilever strength (SCL/SLL) kNm	$\geq 2.5$	
5.5		Cantilever strength (SSL) kNm	$\geq 4$	
5.6		Housing	silicon	
5.7		Colour	grey	
5.8		Length mm	*****	
5.9		Weight kg	*****	
6.	3.3.3	Mounting Requirements		
			pedestal	



Item	Sub-clause	Description	Schedule A	Schedule B
6.1		Line terminal connection	Type 5	
6.2		Ground terminal connection	Type 5	

## C2.2 Technical Schedules A and B for 132 kV Surge Arresters

	SPECIFICATION ENQUIRY	HPC-8DJ-25-0001-2021
	VENDOR'S NAME	
	DATE	

### TECHNICAL SCHEDULES A & B

#### ITEM 3: 132 kV Post Pole Mounted Surge Arrester

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of insulator	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	132	
4.2		Max. system voltage kV	145	
4.3		Lightning impulse withstand (8/20 $\mu$ s wave) kV	650	
4.4		Power frequency withstand kV	275	
4.5		Max. prospective short circuit current (kA/1 sec.) kA	65	
4.6		System frequency Hz	50	
4.7		System neutral earthing conditions	effective earth	
4.8		Max. continuous operating voltage kV	87.9	
4.9		Max. residual voltage kV	565	
4.10		Min. rated kV	109.9	
4.11		Nominal discharge current (kA <sub>Peak</sub> ) kA	10	
4.12		Temporary overvoltage kV	123.1	
4.13		Duration of temporary over voltage sec.	2	
4.14		Long duration current impulse $\mu$ s	2000	


Item	Sub-clause	Description	Schedule A	Schedule B
4.15		Line discharge class	3	
4.16		Energy discharge capability kJ/kV	5	
4.17		High current pressure relief test current (0.2 sec) kA	50	
5.	3.3.2	Mechanical Requirements		
5.1		Class	outdoor	
5.2		Minimum creepage distance ( $\geq 31$ mm/kV) mm	4092	
5.3		Pressure relief class	NS	
5.4		Cantilever strength (SCL/SLL) Nm	$\geq 2.5$	
5.5		Cantilever strength (SSL) Nm	$\geq 4$	
5.6		Housing	silicon	
5.7		Colour	grey	
5.8		Length mm	*****	
5.9		Weight kg	*****	
6.	3.3.3	Mounting Requirements		
6.1		Line terminal connection	Type 5	
6.2		Ground terminal connection	Type 5	

**ITEM 4: 132 kV Post Pedestal Mounted Surge Arrester**

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of insulator	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	132	
4.2		Max. system voltage kV	145	
4.3		Lightning impulse withstand (8/20 $\mu$ s wave) kV	650	
4.4		Power frequency withstand kV	275	
4.5		Max. prospective short circuit current (kA/1 sec.) kA	65	

Item	Sub-clause	Description	Schedule A	Schedule B
4.6		System frequency Hz	50	
4.7		System neutral earthing conditions	effective earth	
4.8		Max. continuous operating voltage kV	87.9	
4.9		Max. residual voltage kV	565	
4.10		Min. rated kV	109.9	
4.11		Nominal discharge current (kA <sub>Peak</sub> ) kA	10	
4.12		Temporary overvoltage kV	123.1	
4.13		Duration of temporary over voltage sec.	2	
4.14		Long duration current impulse $\mu$ s	2000	
4.15		Line discharge class	3	
4.16		Energy discharge capability kJ/kV	5	
4.17		High current pressure relief test current (0.2 sec) kA	50	
5.	3.3.2	Mechanical Requirements		
5.1		Class	outdoor	
5.2		Minimum creepage distance ( $\geq 31$ mm/kV) mm	4092	
5.3		Pressure relief class	NS	
5.4		Cantilever strength (SCL/SLL) Nm	$\geq 2.5$	
5.5		Cantilever strength (SSL) Nm	$\geq 4$	
5.6		Housing	silicon	
5.7		Colour	grey	
5.8		Length mm	*****	
5.9		Weight kg	*****	
6.	3.3.3	Mounting Requirements		
6.1		Line terminal connection	Type 5	
6.2		Ground terminal connection	Type 5	

## C2.3 Technical Schedules A and B for 220 kV Surge Arresters

	SPECIFICATION ENQUIRY	HPC-8DJ-25-0001-2021
	VENDOR'S NAME	
	DATE	

### TECHNICAL SCHEDULES A & B ITEM 5: 220 kV Post Pole Mounted Surge Arrester

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of insulator	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	220	
4.2		Max. system voltage kV	245	
4.3		Lightning impulse withstand (8/20 $\mu$ s wave) kV	1050	
4.4		Power frequency withstand kV	460	
4.5		Max. prospective short circuit current (kA/1 sec.) kA	65	
4.6		System frequency Hz	50	
4.7		System neutral earthing conditions	effective earth	
4.8		Max. continuous operating voltage kV	146.3	
4.9		Max. residual voltage kV	940	
4.10		Min. rated kV	183.2	
4.11		Nominal discharge current (kA <sub>Peak</sub> ) kA	10	
4.12		Temporary overvoltage kV	205.2	
4.13		Duration of temporary over voltage sec.	2	
4.14		Long duration current impulse $\mu$ s	2000	
4.15		Line discharge class	3	
4.16		Energy discharge capability kJ/kV	5	
4.17		High current pressure relief test current (0.2 sec) kA	50	
5.	3.3.2	Mechanical Requirements		


Item	Sub-clause	Description	Schedule A	Schedule B
5.1		Class	outdoor	
5.2		Minimum creepage distance ( $\geq 31$ mm/kV) mm	6820	
5.3		Pressure relief class	NS	
5.4		Cantilever strength (SCL/SLL) Nm	$\geq 2.5$	
5.5		Cantilever strength (SSL) Nm	$\geq 4$	
5.6		Housing	silicon	
5.7		Colour	grey	
5.8		Length mm	*****	
5.9		Weight kg	*****	
6.	3.3.3	Mounting Requirements	pole	
6.1		Line terminal connection	Type 5	
6.2		Ground terminal connection	Type 5	

**ITEM 4: 132 kV Post Pedestal Mounted Surge Arrester**

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of insulator	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	220	
4.2		Max. system voltage kV	245	
4.3		Lightning impulse withstand (8/20 $\mu$ s wave) kV	1050	
4.4		Power frequency withstand kV	460	
4.5		Max. prospective short circuit current (kA/1 sec.) kA	65	
4.6		System frequency Hz	50	
4.7		System neutral earthing conditions	effective earth	
4.8		Max. continuous operating voltage kV	146.3	

Item	Sub-clause	Description	Schedule A	Schedule B
4.9		Max. residual voltage kV	940	
4.10		Min. rated kV	183.2	
4.11		Nominal discharge current (kA <sub>Peak</sub> ) kA	10	
4.12		Temporary overvoltage kV	205.2	
4.13		Duration of temporary over voltage sec.	2	
4.14		Long duration current impulse $\mu$ s	2000	
4.15		Line discharge class	3	
4.16		Energy discharge capability kJ/kV	5	
4.17		High current pressure relief test current (0.2 sec) kA	50	
5.	3.3.2	Mechanical Requirements		
5.1		Class	outdoor	
5.2		Minimum creepage distance ( $\geq 31$ mm/kV) mm	6820	
5.3		Pressure relief class	NS	
5.4		Cantilever strength (SCL/SLL) Nm	$\geq 2.5$	
5.5		Cantilever strength (SSL) Nm	$\geq 4$	
5.6		Housing	silicon	
5.7		Colour	grey	
5.8		Length mm	*****	
5.9		Weight kg	*****	
6.	3.3.3	Mounting Requirements		
6.1		Line terminal connection	Type 5	
6.2		Ground terminal connection	Type 5	

## C2.4 Technical Schedules A and B for Surge Counter

	SPECIFICATION ENQUIRY	HPC-8DJ-25-0001-2021
	VENDOR'S NAME	
	DATE	

### TECHNICAL SCHEDULES A & B

#### ITEM 7: Surge Counter

Item	Sub-clause	Description	Schedule A	Schedule B
1.		Manufacturer/ vendor of surge counter	xxxxxx	
2.		Manufacturer's/ vendor's catalogue number	xxxxxx	
3.		Manufacturer's/ vendor's drawing number	xxxxxx	
4.	3.3.3.3	Electrical Requirements		
4.1		Power supply	Self powered	
4.2		Minimum counting threshold (8/20 $\mu$ s)	A $\leq 200$	
4.3		Time resolution	s 0.5	
4.4		Short-circuit capacity (IEC 60099-4)	kA 65	
4.5		Leakage current range	$mA_{PEAK}$ 0.1 to 50	
4.6		Frequency range	Hz 48 to 62	
5.	3.3.3.3	Mechanical Requirements		
5.1		Housing	IP67	
5.2		Counter (wrap around)	9999	
6.		Mounting Requirements		
6.1		Line terminal connection	Type 1	
6.2		Ground terminal connection	Type 1	

## 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"/>	
3.2.1	Limits of Radio Interference Voltage	<input type="checkbox"/>	<input type="checkbox"/>	
3.3	Technical Requirements			
3.3.1	Electrical Requirements	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.2	Mechanical Requirements	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.3	Mounting Requirements	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.3.1	Line Mounting	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.3.2	Substation Mounting	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.3.3	Surge Counters	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.4	Terminals	<input type="checkbox"/>	<input type="checkbox"/>	
3.3.5	Grading Rings	<input type="checkbox"/>	<input type="checkbox"/>	
3.4	Pressure Relief	<input type="checkbox"/>	<input type="checkbox"/>	
3.5	Painting and Galvanising	<input type="checkbox"/>	<input type="checkbox"/>	
3.6	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	Required Tests	<input type="checkbox"/>	<input type="checkbox"/>	
9.4	Type Tests	<input type="checkbox"/>	<input type="checkbox"/>	
9.5	Routine Tests	<input type="checkbox"/>	<input type="checkbox"/>	
9.6	Acceptance Tests	<input type="checkbox"/>	<input type="checkbox"/>	
10	Documentation and Samples			



CLAUSE NUMBER		YES	NO	ATT.
10.1	Documentation to be provided with Proposals	<input type="checkbox"/>	<input type="checkbox"/>	
10.2	Service history	<input type="checkbox"/>	<input type="checkbox"/>	
10.3	Training Materials	<input type="checkbox"/>	<input type="checkbox"/>	
10.4	Samples	<input type="checkbox"/>	<input type="checkbox"/>	

