



Specification – Technical Requirements for Distribution Reclosers

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1 SCOPE

This Specification details the requirements for the design and supply of outdoor pole mounted Automatic Control Recloser (ACR) and control circuit box for rated voltages from 6.6 kV up to and including 33 kV.

Tests prescribed will evaluate the performance of the equipment, 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. All standards and specifications are subject to revision, and vendors are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. 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 1125	Conductors in insulated electric cables and flexible cords
AS 2312-2002 (incl. Amdt 1:2004)	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS 1824.1-1995 (incl. Amdt.1-1997)	Insulation coordination: Part 1 – Definitions, principles, and rules
AS 60137	Insulated bushings for alternating voltages above 1000 V
AS 1931.1	High voltage testing techniques Part 1 - General definitions and test requirements
AS 2067	Switchgear assemblies and ancillary equipment for alternating voltages above 1 kV.
AS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)

STANDARD	DESCRIPTION
AS/NZS 4680	Hot-Dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles
AS 60044.1	Instrument Transformers – Part 1: Current transformers
AS 60044.2	Instrument Transformers – Part 2: Inductive voltage transformers
AS 60265.1	High-voltage switches – Part 1: Switches for rated voltages above 1 kV and less than 52 kV
AS 60269	Low voltage fuses
AS 60270	High voltage test techniques – Partial discharge measurements
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS 62271.1 - 2012	High Voltage switchgear and controlgear – Part 1: Common specifications
AS 62271.100	High voltage switchgear and controlgear – Part 100: High-voltage alternating-current circuit-breakers
AS 62271.111 (IEEE C37.60)	High Voltage switchgear and controlgear – Part 111: Automatic circuit recloser and fault interrupters for alternating current systems up to 38 kV
AS 62271-301	High voltage switchgear and control gear – Dimensional standardisation of terminals
IEC 60255	Measuring relays and protection equipment

Where Equipment offered has only been tested for compliance in accordance to International Standards, Vendors shall state in the Proposal (with supporting documentation) whether it complies with the equivalent Australian Standards.

2.2 Definitions and Abbreviations

For the purposes of this specification the following definitions apply:

2.2.1 Definitions

- 1) **Equipment:** shall collectively refer to various components (tank, circuit breaker, current transformers, instrument transformers, ancillary equipment and circuitry) that form the pole mounted recloser unit.

2.2.2 Abbreviations

- 1) AS: Australian Standard
- 2) ACR: Automatic Control Recloser
- 3) CB: Circuit Breaker
- 4) CT: Current Transformer
- 5) IAC: Internal Arc Classification
- 6) kV: kilo Volts (1,000 volts)
- 7) LED: Light Emitting Diode
- 8) LV: Low Voltage <1000 volts AC
- 9) MV: Medium Voltage >1000 volts AC; <36 000 volts AC
- 10) MVA: Mega Volt Amp reactive (1,000,000 Volt Amp reactive)
- 11) MW: Mega Watts (1,000,000 Watts)
- 12) pf: power factor

- 13) pu: per unit
- 14) SCADA: Supervisory Control and Data Acquisition
- 15) VT: Voltage Transformer

2.2.3 Drawings

The Drawings listed below form part of this Specification. (Refer Schedule F of the Specification)

HPA-SD-E-0007-01	RECLOSER GENERAL ARRANGEMENT - SURGE ARRESTOR APPLICATION
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3 REQUIREMENTS

3.1 Power System Particulars

The Equipment shall be suitable for continuous connection to a power system with the characteristics covered below.

3.1.1 Design Fault Levels

The Equipment must be rated to withstand:

- 1) 12.5 kA rms / 3 second for 33 & 22 kV systems
- 2) 16 kA rms / 3 second for 11 kV 6.6 kV systems

3.1.2 Nominal System Frequency

The nominal system frequency is 50 Hz.

3.1.3 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 _{rms})	Lightning Impulse withstand Voltage (kV _{peak})	Power Frequency withstand Voltage (kV _{rms})
6.6	7.2	60	20
11.0	12.0	75	28
22.0	24.0	150	50
33.0	36.0	170	70

3.1.4 Standard Operating 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 be suitable for continuous operation under the following environmental conditions:

Table 3: Additional Operating Requirements

Condition	Requirement
Maximum and Minimum Air temperatures	Refer HPC-9EJ-01-0001-2013 Environmental Conditions for requirements.
Relative Humidity:	
Maximum Wind Velocities:	
Isokeraunic Levels:	

Vendors shall submit with the Proposal, documentation (evidence, test reports, etc.) to demonstrate that the Equipment offered meets the environmental service conditions. Vendors shall clearly state in the Proposal, any Equipment that does not meet the environmental service conditions and provide the maximum environmental service conditions the Equipment if capable of withstanding.

3.1.5 Clearances & Insulation

The minimum electrical clearance between phase-phase and phase–earth for all high voltage parts of the Equipment shall be not less than that specified in AS 2067.

4 POLE MOUNTED RECLOSER

4.1 General Requirements

The Equipment shall consist of:

- 1) Tank – housing the primary devices (circuit-breaker, current transformers, voltage transformers etc.)
- 2) Control unit – housing the secondary devices (protection, SCADA/ communication devices etc.)

It shall be possible to apply standard 22 kV rated reclosers on 6.6 kV and 11 kV networks, without any hardware modifications.

It shall be possible to easily configure the recloser control unit, by means of user selectable software changes only, for application on 6.6 kV, 11 kV, 22 kV and 33 kV networks.

The recloser shall only use the following interrupting mediums:

- 1) Vacuum; or
- 2) SF₆,

Oil shall NOT be used either as an insulating or interrupting medium.

The vendor shall ensure that the Equipment is designed to readily facilitate installation without the need for special fixing plates, temporary secondary wiring arrangements or other accessories and state:

4.2 Design and Construction

4.2.1 Tank Design

The tank shall be of a metal clad design in accordance with IEC 62271.111 (IEEE C37.60). The tank shall be strong enough to support the vibration of the re-closer during an arc fault event.

All exposed internal and external surfaces to be cleaned, prepared and treated with a coating system suitable for severe marine environments corrosion category E-M in accordance with AS 2312-2002. It is not expected that the Equipment will require re-coating during its anticipated lifespan.

The tank shall be perfectly sealed and dielectric fluid tight as described in AS 62271-111, with all fittings in place to operate under all operating conditions. The expected operating life with regards to leakage performance shall be specified by the Vendor.

All surfaces will be designed to prevent the accumulation of water. All seams shall be electrically welded. Welding in all cases will be continuous. On the external areas of the tank, welding of horizontal and vertical joints shall be on both sides of the joint. All metal work shall be electrically bonded to the tank. If a part cannot be adequately bonded it will be constructed from a suitable insulating material instead of metal.

The Vendor shall state in its Proposal:

- 1) the intended surface protection methods of the tank including base material selection and surface preparation (e.g. galvanising, painting, greasing, etc.),
- 2) the estimated life of the protective coating shall also be specified, and
- 3) the details of all tests (accelerated aging, salt spray, fog, impact, etc.) that prove the effectiveness of the proposed protective coating. All testing shall be carried out in accordance with AS 1580.0-2004 or equivalent international standards.

4.2.1.1 Internal Breaker

The breaker shall be housed within either:

- a stainless steel tank, or
- hot dip galvanized steel tank to AS 4680,

providing adequate arc fault containment.

4.2.1.2 Internal Arc Classification

Where phase conductors or switching components share a common metallic enclosure, in which there is risk of overpressure due to phase to phase internal arcing, the design shall be internal fault tested in accordance with AS 62271.200.

Internal fault testing shall allow for Accessibility Type C (pole mount gear) as defined by AS 62271.200 Annex A2 and state the minimum admissible installation height with reference to the base of the switch, in accordance with that standard. The tank shall satisfy an Internal Arc Classification C for the specified test current and duration.

The prospective three phase test current shall be equal to the rated short time withstand current.

4.2.1.3 Interrupting Medium

The interrupting medium shall be vacuum for the ACRs. The vacuum bottles shall be sealed for life. The tightness of the sealed bottles shall meet the requirements of IEC 62271.111.

Vendors shall outline the precautions and tests carried out during manufacture to ensure the long term maintenance of the vacuum and long term integrity of the vacuum bottles. The Vendor shall specify the lifetime performance of these systems and if they have to be replaced within the operating life of the ACR. Vendors shall guarantee the number of circuit breaker operations at rated short circuit current before replacement of the vacuum bottle is necessary.

The contacts for the interrupter shall be positively driven in both the open and closed directions and in no way be dependent on the interrupter vacuum.

The level of x-rays emitted shall meet requirements of AS 62271-1. Vendors shall state if it is possible for Horizon Power to carry out in-situ tests on the integrity of vacuum in the bottles.

If the switching action of the contactor cannot be completed when activated by a pulse contact of 200 ms, Vendor shall provide a time delayed action to ensure that the started action is completed.

The Vendor shall maintain the same make and type of vacuum bottle for all circuit breakers of the same rating throughout the Standing Offer period. The make and type of vacuum bottles shall not be changed without the prior approval of Horizon Power.

Tenders shall state the consequences of loss of vacuum on:

- the voltage withstand capability of an open circuit switch,
- the ability of the ACR to switch load current, and
- the ability of the ACR to switch fault current.

4.2.1.4 Insulation Medium

Horizon Power supports minimising the greenhouse gas emissions in all its operations and encourages Vendors to provide SF₆ gas free option as an insulation medium for the recloser. However as this technology is still in the evolution stage, Horizon Power will still accept submission from Vendors with SF₆ gas as the insulation medium. The Vendor may also provide both as an option in its offer.

The SF₆ gas used shall comply with the requirements of AS 62271-111 and AS 62271-200. In addition the Vendor shall guarantee, in his quotation, that processing/recycling of the contaminated SF₆ gas is possible through its organization. Vendors service organization shall be capable of overhauling the unit without any danger for the environment and recycling of the SF₆ gas. The circuit breaker shall be serviceable, by Vendors organization at site.

4.2.1.4.1 Enclosure Requirements

Each enclosure containing SF₆ / "SF₆ free medium" be provided with:

- 1) A pressure indicator having a green and red indicating field.
- 2) Lockable check/ non-return valve for filling and bleeding purposes.

- 3) A minimum pressure switch, this switch shall be wired into the circuit breakers control system, it shall prevent closing and tripping under adverse conditions.

The minimum pressure switch shall operate directly a lockout relay with a flag indicator, preventing operation of the circuit breaker and activating the external alarm indication.

4.2.1.4.2 Non-return Requirements

The non-return valve shall facilitate the following:

- 1) The removal of a defective indicator while the equipment is in service,
- 2) If SF6 is used, reclamation of the gas at Equipment end of life.

The Vendor shall state in Technical Schedule if a gas non-return valve is NOT provided.

4.2.1.5 Tank Pressure Relief

Pressure relief facilities shall be provided to enable the tank unit to withstand safely the effects of excessive pressure rise due to an internal fault. Details of how the pressure relief is achieved and how its effectiveness has been proved shall be provided in the tender documentation.

4.2.2 Surge Arrestor Bracket

Mounting brackets for surge arresters with the dimensions shown in drawing HPA-SD-E-00007-01 shall be provided on the source side and load side of the ARC unit's tank. Brackets shall be attached to the tank adjacent to each MV bushing to enable mounting of surge arresters. 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 (min 14 mm dia. hole) earthing stud with a minimum exposed stud length of 36 mm. The arresters shall preferably be mounted onto the bracket directly. Clearances between the ARC tank/metalwork and surge arresters shall be such that phase to ground clearances are achieved. The arresters shall be mounted parallel to and in the same plane as the associated phase insulator. The surge arrester brackets shall be used as the connection point for the arrester earth. Bolts and nuts associated with the support structures shall be hot-dip galvanized.

See Drawing HPA-SD-E-00007-01 for details. The mounting arrangements shall be shown in dotted lines on typical general arrangement drawing submitted with the tender.

4.2.3 Bushing and Terminals

All bushings shall comply with AS/NZS 60137 and the Operating Conditions stated in this technical specification. The bushings shall be of high quality glazed porcelain, or cyclo aliphatic epoxy resin bushings and silicon bushing. Where porcelain components are supplied, they shall be glazed and fully vitrified.

Notwithstanding the nominal system's Basic Insulation Level (BIL) at each distribution level (see Section 3.1.3), the minimum system design level for insulation creepage length is 31 mm/kV as specified in AS 4436 for Very Heavy pollution areas. A dimensioned drawing of the bushing (and boot if applicable) shall be supplied with the tender.

Terminal compression lugs shall be fitted to the free ends of the terminals to allow for connections to the source/load side jumpers (150 mm² ABC) and the surge arresters. The palm of the lug shall be suitable for connection to aluminium or copper based components using an M12 stainless steel fastening, and the barrel shall be compatible with the cable core material. The interface between the lug and the cable insulation shall be fitted with a mastic lined heat shrinkable sleeve or similar to prevent the ingress of moisture into the cable.

The bushings shall be provided with insulating terminal covers to protect the ACR and prevent flashover due to animals, wind borne debris etc.

All terminal palms shall be arranged vertically and shall comply with AS 62271.301. They will be copper and their contact surfaces will be tinned or silver plated. Both sides may be used as contact surfaces.

Precautions shall be taken to prevent the long-term erosion of the MV bushing gasket by leakage currents. This may be done so by providing a path for leakage currents by the application of conductive paint around the perimeter of the gasket, by a metal shorting strip between the bushing side of the gasket and the tank side of the gasket or by another approved method.

4.2.4 Earthing

All metal components of the ACR shall be electrically bonded. The bonding method shall have a current carrying capability equivalent to that of 50 mm², stranded, copper conductor.

The recloser tank shall be fitted with an external M12 earth stud, complete with a nut, lock nut and serrated washer. It shall include a clamping arrangement that can accommodate a 70 mm earth copper conductor.

The control (umbilical) cable shall be adequately earthed to shield the control equipment against electrical interference. The cabinet should be suitably shielded so that an externally mounted 3G / GSM / CDMA antenna should not interfere with the normal operation of the equipment. Where minimum distance requirements for the mounting of an antenna apply, these should be stated.

4.2.5 ACR Tank Pole Mounting Frame

The tank shall be supplied with a steel mounting frame suitable for mounting on a single pole - mainly steel (A-frame or tapered round poles) but can be concrete or timber tapered poles in exceptional cases.

Suitable insulation shall be provided for the mounting frame to eliminate rapid corrosion of steel pole in the contact areas.

The mounting brackets shall have minimum two slotted mounting holes sufficient for M20 bolts in order to mount the recloser to the pole (see HPA-SD-E-00007-01).

In addition the Vendor shall detail in its proposal whether appropriate clamping is available for the recloser to secure the unit to a pole without using bolts through the poles.

The bracket and tank wall are to be of adequate strength to limit distortion, when mounted. Both the top and bottom bracket shall be suitable to carry the total weight of the tank. Adequately rated lifting lugs shall be provided and placed such that the recloser can be lifted in a safe manner (i.e. as a balanced load) using a single hook without damage.

The minimum clearances to the structure shall be as indicated on the drawing. HPA-SD-E-00007-01.

4.2.6 Operating Mechanism

This Equipment shall be suitable for three phase tripping and reclosing. Tripping energy shall be supplied from a spring mechanism automatically tensioned when the switch unit is closed.

The operating mechanism should be capable of performing of minimum 30,000 full load operations the sequence of opening and closing as specified in this specification.

Further, the operating mechanism shall be capable:

- 1) To provide means whereby circuit breaker can be closed rapidly without any lag at all currents from zero to rated making current capacity.
- 2) To hold the circuit breaker in closed position by toggles or latches till the tripping signal is received.
- 3) To allow the circuit breaker to open without delay immediately on receiving tripping signal. To give optimum contact level characteristics (time versus stroke).
- 4) To perform the auto reclosing cycle.
- 5) To perform the related functions such as, indication, control, alarm, lock out on low pressure.
- 6) The mechanism shall be capable to open and close the three phases of the equipment simultaneously.

4.2.6.1 Operating Sequence

In the event of a fault on the section of the line controlled by a ACR, the ACR shall automatically open, and after a minimum dead time it shall reclose and remain closed should the line be no longer faulty. (Auto Reclose set to ON). Should the fault persist, the ACR shall again disconnect the section of line being controlled.

The ACR shall be capable of not less than three automatic reclose operations at rated short circuit current should the fault persist and then lock out in the open position until reset by hand or remote control. If the fault is of a transient nature the equipment shall remain closed, and the operating mechanism shall automatically reset.

The rated operating sequence shall be the following in accordance with AS 62271.111: O – 0.5 s – CO – 2 s – CO – 5 s – CO.

The number of operations to lockout shall be adjustable in any combination of instantaneous and time-delayed trips up to a maximum of four with a minimum dead time of 0.5 seconds for the first operation.

4.2.6.2 Manual Operation and Operation Counter

The ACR shall make provision for independent manual operation using a manual operating lever. It shall be possible to operate the lever from ground level using a standard hot line stick as described in AS 62271.1111. Clear indication shall be provided to an operator standing on the ground as to the status of the recloser main contacts. This shall be by an indicator mechanically linked to the switching mechanism and shall be clearly visible to the personnel standing on the ground.

The colours shall remain vivid for the products working life. Painted symbols are unacceptable. The automatic re-closing shall be locked out after the manual tripping.

An operation counter shall be provided. It shall be readable locally and at remote end with the re-closer in operation. The operating counter shall be well protected against moisture ingress. The number of operations shall also be readable through the control unit.

4.2.7 Recloser Control Unit

4.2.7.1 Cabinet Design and Construction

The control cabinet shall be manufactured from stainless steel 316. The construction shall be vandal proof such that it shall not be easy to force the door open when it is locked and padlocked.

Cabinets shall be protected from dust and water ingress to achieve an IP rating of IP 54 or better. Cabinets shall be designed and internally treated to prevent moisture condensation. The cabinet shall be fitted with an external M12 earthing stud with a nut, lock-nut and a serrated washer for earthing purposes.

All metal components of the control cabinet shall be electrically bonded.

4.2.7.2 Cabinet Door

The cabinet shall have a hinged door. The door shall be fitted with a robust fastening arrangement which can be locked with a padlock that has a shackle of 9 mm diameter (Lockwood 334 series). Means shall be provided to either secure the door in a fully open position (90 or more), or to easily remove (without the use of tools) the door completely during maintenance or similar activities.

Good electrical contact shall be maintained between the door and the rest of the cabinet at all times (excluding the condition when the door is completely removed).

A document pocket shall be provided on the inside of the door for the storage of documentation.

4.2.7.3 Internal Construction

The Vendor shall ensure that the equipment housed in the control cabinet can withstand the internal heating effect at the higher temperature ranges given in Section 3.1.4. The Vendor shall supply documentation in support of this.

Provision shall be made:

- 1) for a facility to terminate a 240 V AC mains auxiliary power supply (normal operation of the control for the device and the communications media).
- 2) for 2 x surge/lightning arrestors

- 3) in the top of the cabinet for an equipment compartment whereby Horizon Power may be able to mount it's remote control communication equipment in accordance with the SCADA requirements (Analogue, Digital or CDMA for Next G). This shall also include supply for the communication equipment. Refer to Appendix G.

4.2.7.4 Mounting Bracket

The cabinet shall be supplied with a mounting bracket made of stainless steel, or as a minimum be hot-dip galvanized in accordance with AS 4680.

The mounting bracket shall be suitable to be installed on Horizon Power's standard steel poles and existing A frame steel poles. The holes shall be designed such that it will be possible to slide the cabinet into position without having to remove the pole mounting bolts.

The mounting bracket shall have at least two sets of vertically spaced slots in addition to mounting bolt slots for mounting by means of straps.

The control cabinet shall be mounted below the switchgear tank and shall be easily removable for maintenance purposes.

4.2.7.5 Cable Entry

The cabinet shall make provision for bottom entry of the control cables and at least three additional cables (one being the external antenna cable). The cabinet shall be pre-punched with at least one 21 mm and one 32 mm hole. The holes shall be suitably blanked off.

4.2.7.6 Control Cable

An ultraviolet resistant cable, minimum 7 m long, shall be provided to connect the recloser tank to the recloser control. It shall be adequately screened against electrostatic and electromagnetic interference, which can cause malfunctioning of the protection or control equipment. This cable shall connect into both the recloser tank and the control cabinet by means of plug and socket arrangements. Robust, multi-pin, weatherproof connectors shall be provided on both ends of the control cable.

It shall be possible to disconnect the control cable at the recloser control while the recloser tank is energised, without causing damage or mal-operation. Care shall be taken to ensure that CTs are not open circuited.

4.2.7.7 Power Supplies

The main power supply to the control unit shall be through an external power source (auxiliary supply) and there shall be a backup battery supply as well.

The capacity of the power supply shall be rated to power all the electronic modules, operate the ACR (tripping and closing) and power the data communication equipment.

Details of the recloser control's power consumption shall be provided in the tender documentation. The maximum current drain (considering the inputs to be in a "worst case" configuration regarding power consumption) and any inrush current parameters shall be stated.

Details of the power requirements for a close operation shall be provided in the tender documentation.

4.2.7.7.1 Main Power Supply Requirements

The output voltage of the external power source shall be 240 V AC at a frequency of 50 Hz.

The device shall provide a visual indication, on the control panel and in the event log, of the status of the mains supply. A supply fail function shall be provided; it shall operate an alarm output for the user.

The control unit shall be able to withstand loss or restoration of the supply voltage and under voltage conditions.

4.2.7.7.2 Voltage/Current Excursions

The power supply shall include the necessary over-current protection to protect the supply from current excursions.

The use of fuses for over-current protection on the auxiliary input circuit(s) is not acceptable.

Information on the methods used to protect against transient over-current conditions shall be provided in the tender documentation.

The power supply shall include the necessary surge arresters and/or voltage limiting devices to inhibit damage due to voltage surges. The surge arrestor shall be rated to withstand voltage spikes across it due to a short circuit on the LV supply.

4.2.7.7.3 Battery Backup Supply

A 12 V DC backup power supply suitable for a minimum period of 48 hours shall be provided, in order that the recloser shall operate from the battery supply during failure of auxiliary supply for high reliability (this includes communications).

The battery shall be rated to operate and provide backup supply for the specified period under the temperature conditions in Section 3.1.4. The chargeable battery shall have a life span of not less than 5 years.

The recloser shall be prevented from closing if the battery does not have enough stored energy to open the circuit-breaker for a protection trip condition. Details must be stated in the tender documentation.

4.2.7.8 Technical Features

The control unit shall include the following technical features:

- 1) Self-diagnostic features
- 2) LCD with high degree of resolution and legibility, valid for life span of ACR & password protected key pad for programming purpose
- 3) Event log and load profile logging facilities
- 4) Processing of feedback from voltage and current sensors from the system. Sensing VTs or any suitable aid for loop automation
- 5) RS232/ USB ports for remote communication supporting Modbus and DNP3 protocols.
- 6) WSOS (Windows Switchgear Operating System) programmability

- 7) Downloading facility locally and at remote end. Preferably USB ports shall be provided to download the information locally. RS232 ports may be provided instead of USB ports however this needs to be specified in the submission.
- 8) Suitable to accommodate additional programmable I/O modules - Non-volatile memory with enough capacity capable to record at least 150 events including distinction between local and supervisory functions and reporting of system events and display 30 different events with date and time.

4.2.8 Protection & Control Functions

The following protective features shall be built into the ACR control unit. All protection functions shall have full directional capabilities.

The ratio of drop-off current to pick up current shall be at least 95% for all protection functions. ($I_{drop-off} / I_{pick-up}$).

4.2.8.1 Overcurrent Protection (IEC IDMT –ANSI –Definite Time and User defined curves)

The protection system shall provide:

- 1) Overcurrent protection on all three phases of the circuit supplied by the recloser. Each of up to four shots in a reclose sequence shall have an independent curve time (modifier) and curve modifier settings and a common OC setting.
- 2) The over-current trip pick up setting range shall be selectable between 10 and 1260 amps in step sizes of not greater than 1 A.
- 3) Delayed protection operation shall be possible by selecting an IDMT protection element with Normal inverse (NI), very inverse (VI) or Extremely inverse (EI) curve or a definite time protection element with time delay from 0.05 to 10 seconds in accordance with IEC 60255 and IEC 62271-111. Traditional recloser curves shall be included in the operation as well.

4.2.8.2 Earth Fault Protection (IEC IDMT –ANSI –Definite Time and User defined curves)

The protection system shall provide:

- 1) Earth fault protection on all three phases of the circuit supplied by the recloser. Each of up to four shots in a reclose sequence shall have an independent curve, time (modifier) and curve modifier settings and a common E/F setting.
- 2) The earth fault trip pick up setting range shall be selectable between 10 and 1260 amps in step sizes of not greater than 1 A.
- 3) Delayed protection operation shall be possible by selecting an IDMT protection element with Normal inverse (NI), very inverse (VI) or Extremely inverse (EI) curve or a definite time protection element with time delay from 0.05 to 10 seconds in accordance with IEC 60255 and IEC 62271-111. Traditional recloser curves shall be included in the operation as well.

4.2.8.3 Instantaneous Overcurrent and Earth Fault Protection

High set Instantaneous element shall be provided for over current and earth fault protection with the following settings available:

- 1) It shall be possible to enable or disable the element. When enabled it shall be active simultaneously as an overlay with all selected elements.
- 2) Trip setting which can be set in multiples from 1 to 30 times (in steps of 0.1) the normal pick up level setting.

- 3) A definite time delay to be able to be applied to the High set, setting values from instantaneous to 2.0 seconds in steps not greater than 0.05 seconds.

4.2.8.4 Sensitive Earth Fault Protection

The protection system shall provide sensitive earth fault protection on the circuit supplied by the recloser. The sensitive earth fault setting shall be applicable to all shots in the sequence; alternatively four settings shall be available to specify the SEF setting at each shot.

- 1) The trip pick up value shall be programmable between 1 and 20 amps in not more than 1 A steps.
- 2) The SEF shall have definite time operation with the time to trip adjustable between 1 and 30 seconds in steps not greater than 0.1 second.

4.2.8.5 Negative Sequence Overcurrent Protection

The NPS function shall:

- 1) Be user selectable to operate the following outputs:
 - a) alarm output only,
 - b) trip output only,
 - c) both the alarm and the trip outputs.
- 2) The primary pick-up setting range shall be selectable from 1 to 20 amps in step sizes not greater than 0,5 A.
- 3) The time delay shall be a definite time, selectable from instantaneous to 10 s, in steps not greater than 1 s (At present the standard trip time setting for recloser is 2 seconds to allow for adequate grading between upstream and downstream protection devices).
- 4) The NPS function shall be blocked if O/C, E/F or SEF function's starter picks up.
- 5) The NPS reset time shall be instantaneous.

4.2.8.6 Undervoltage and Overvoltage Protection

The protection feature shall be programmed so that it does NOT trip the breaker automatically.

- 1) The protection function shall be user selectable to operate the following outputs:
 - a) alarm output only,
 - b) trip output only,
 - c) both the alarm and the trip outputs,
 - d) breaker close blocking when measured voltage is outside the under- and over-voltage settings,
- 2) The protection system shall provide for under voltage protection with auto reclose with following features:
 - a) Trip setting from 0.5 to 0.8 pu voltage in steps of 0.01 pu min.
 - b) Definite time delay 0 to 60.0 sec in steps of 0.1 sec
 - c) Reset 1.0 sec to 10 seconds in steps of 0.5 seconds
 - d) Selection of any one phase Under Voltage, or any two phases Under Voltage to trip
- 3) The protection system shall provide for over voltage protection with auto reclose with following features:
 - a) Trip setting from 1.1 to 1.5 pu voltage in steps of 0.01pu min
 - b) Definite time delay 0 to 60.0 sec in steps of 0.1 sec
 - c) 1 sec to 10 seconds in steps of 0.1 seconds

- d) Selection of any one phase Over Voltage, or any two phases Over Voltage to trip
- e) Reclose single shot delayed after voltage comes into normal range (normal reclaim time to apply)
- f) Reclose time 1 to 300 seconds after good volts

4.2.8.7 Under-frequency and Over-frequency Protection

Preference shall be given to relays with the following frequency protection functionality. Over frequency protection feature is not compulsory however will be looked upon favourably.

The frequency protection function shall have an over -and an under-frequency setting and a DTL timer.

- 1) As the power system frequency drops below the set under-frequency level the DTL timer shall start and initiate a trip and lockout on timing out. Similarly, as the frequency exceeds the set over-frequency level a trip and lockout shall be initiated.
- 2) A user selectable blocking function should be provided that will prevent the breaker from closing when the measured frequency is outside the under- and over-frequency settings.
- 3) A user selectable auto-reclosing function should be provided that will allow auto-reclosing of the breaker after the frequency has returned to normal, only if the breaker tripped as a result of an under- or over-frequency condition. In addition, a user settable timer should be provided for setting an auto-reclose time delay on return of normal frequency. The time delay shall be settable with a range of 0 s to 300 s in steps of 30 s.

4.2.8.8 Auto-reclose Operation Parameters

The number of sequential trips to reach lockout shall be selectable to the following options (1, 2, 3 or 4).

- 1) The Auto Reclose feature shall have the option to Enable/Disable it for the individual protection functions (Overcurrent/ Earth Fault/ SEF etc.).
- 2) The reset time shall be selectable from 5 s to 180 s in 1 s steps.
- 3) Dead times shall be separately selectable for SEF and the combination of overcurrent and earth fault functions. The dead time between each successive reclosure shall be independently selectable from 0.5 s to 5 s (in steps no greater than 0.5 s) for the first reclosure and from a minimum of 2 s up to a maximum of 1800 s (in steps no greater than 1 s) for subsequent reclosures.
- 4) A close instruction initiated locally or remotely during a dead time shall result in lockout if the fault is still present upon closure.

4.2.8.9 Cold Load Pick-up (CLP)

The recloser shall incorporate a 'cold load' pick up feature to increase the probability of a successful close operation following a period of supply interruption to the feeder being supplied by the recloser. The CLP feature shall modify the OC curves. It shall not modify the EF or SEF curves.

- 1) The CLP feature shall be able to be programmed IN or OUT of service.
- 2) When Programmed IN service, this feature shall automatically apply to all supervisory initiated close operations and by operator selection, be available for local manually initiated close operations.

4.2.9 Control Functions

The following control features shall be provided:

- 1) Trip/Close
- 2) Local/Remote control
- 3) Auto reclose –ON/OFF
- 4) User configurable no. of reclose cycles before locking out
- 5) Settable dead time

4.2.10 Metering Functions

The measurement functions to be covered shall be as described below. All measurements shall be carried out using the 3-phase 4 wire method.

- 1) Instantaneous rms current in each phase and earth
- 2) RMS voltage P-P and P-N for the each phase
- 3) Active Power (kW)
- 4) Reactive Power (kVAr)
- 5) Active Energy (kWh)
- 6) Reactive Energy (kVArh)
- 7) Maximum demand for the items indicated above. It shall be capable of being reset from the operator keyboard
- 8) Power factor
- 9) Frequency

In addition the control unit shall have the facility to record the number and time of outages. The information shall be accessible locally or remotely. The following parameters shall be recorded:

- 10) Number of operations
- 11) Cumulative number of outages
- 12) Cumulative duration of outages
- 13) Time and duration of each outage

4.2.11 Software

The software provided for the ACR shall become the property of Horizon Power and there shall be no restrictions on the number of PCs it is installed on. The software shall be capable of running on Microsoft Windows 7 operating system and be backward compatible to Microsoft XP operating system.

Where required, Horizon Power will take all reasonable precautions to ensure the software shall not be passed onto third parties. The tender price for the ACR units shall include all software necessary for the proper functioning of the equipment as described in this specification. Any software upgrades carried out during the course of the contract shall be supplied to the purchaser free of charge.

4.2.12 **Nameplates**

A nameplate shall be provided for each item of Equipment, labelled in accordance with IEC 62271.111 and as described in AS 62271.1-2012. It shall be fitted such that it is clear of live parts in a position that is clearly visible. Bushing terminals shall be clearly marked on the source and load side. The true rating of each of the component parts shall be marked by etching or stamping on the plate. The serial number shall also be etched or stamped on this plate. The rating plate shall be made of stainless steel and shall be permanently fitted by means of rivets or firmly bolted down using stainless steel bolts. Stick-on, glued-on or painted-on nameplate labels are NOT acceptable.

5 **STORAGE**

Components shall be capable of being stored without deterioration within the temperature range in Section 3.1.4 for at least 24 months.

6 **RELIABILITY**

Vendors shall comment on the reliability of the Equipment and the performance of the materials offered over an **operational life of 30 years** under the specified field of application and conditions of service.

Comments shall provide evidence in support of the claimed reliability and performance for the Equipment offered, including information on Failure Mode and Effect Analysis.

6.1 **Life Cycle Model**

The Vendor shall provide a life cycle model of the ACR offered to illustrate inspection schedules and maintenance required during the operational life of the equipment. Maintenance intervals shall be in line with the minimum number of switching operations for the individual units given in Appendix C. The Vendor shall also specify of any additional maintenance/ inspection cycles required due to continuous operation in high temperatures as described in Section 3.2.

7 **SAFETY**

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

7.1 **Environmental Considerations**

Vendors shall comment on the environmental soundness of the design and the materials used in the manufacture of the Equipment offered. In particular, comments should address such issues as recyclability and disposability at the end of service life as well as disposability of used or unused materials supplied.

7.2 **End of Life Management**

The successful Vendor shall undertake to reclaim and recycle the SF₆ gas remaining in the switchgear and dispose of toxic by-products within the SF₆ chamber along with the other parts of the equipment in an environmentally responsible manner at the end of the service life of the equipment.

The Vendor shall submit a proposal for end of life management with the tender Proposal. The proposal shall include all costs associated with carrying out the tasks above. The Vendor shall be required to compensate Horizon Power the scrap value of the disposed switchgear and all recovered SF₆ gas at rates to be agreed by both parties.

8 TESTS

8.1 Type Tests

Certificates of type tests shall be submitted to Horizon Power. The Vendor should also submit evidence of any cyclic loading tests performed on the Equipment offered.

The ACR shall have been type tested in accordance with, and found to comply with, the requirements of IEC 62271-111 (IEEE C37.60).

All protection curves shall have been type tested in accordance with, and found to comply with, the requirements of the following relevant specifications: IEC 60255 and IEC 62271-111.

The circuit breaker shall be type tested in accordance with the requirements of AS 62271.100

8.2 Routine Tests

8.2.1 General

The following routine tests, in accordance with IEC 62271-111 (IEEE C37.60), shall be carried out as a normal requirement of the contract on each ACR.

- 1) Calibration
- 2) Control, secondary wiring and accessory device test
- 3) Dielectric withstand test; 1-min. dry power-frequency
- 4) Partial discharge test
- 5) No load mechanical operation test
- 6) Gas leak test

8.2.2 Circuit Breaker

The vendor shall carry out the routine tests required on the circuit breaker by AS 62271.100

8.2.3 Current and Voltage Transformers

All current transformers shall be routine tested as prescribed in AS 60044.1, and all voltage transformers shall be routine tested as prescribed in AS 60044.2.

8.2.4 Insulation Tests

- 1) Bushing insulation shall be routine tested as prescribed in AS 60137.
- 2) All insulation composed of synthetic material shall be subject to tests for the measurement of partial discharge in accordance with the provision of AS 60270. Such tests shall demonstrate that the insulation is free of discharges of magnitude greater than 20 pC, when subject to a test voltage of 23 kV rms. Reports of these tests shall be supplied with test reports of other routine tests. If the required level of discharge magnitude cannot be achieved, the levels that can be guaranteed shall be stated in.

Horizon Power reserves the right to witness any test. The Vendor shall provide at least 7 days' notice of when each and every test is to be carried out.

One certified copy of all test results shall be supplied to Horizon Power immediately after the completion of the tests.

9 DOCUMENTATION

NOTE: All documentation shall be in English.

9.1 Installation Instructions

Installation instructions shall:

- a) be unique to the rated voltage and the type for which the accessory has been designed;
- b) be supported by legible illustrations, that clearly indicate the application and assembly of all components of the accessory;
- c) reference the bill of materials by utilising the short description and by quoting the relevant part number at least once when describing the components;
- d) indicate a date of issue and revision number.

9.2 Electrical Drawings

The vendor shall supply the following electrical drawings

- a) Single Line Diagram
- b) Schematic Drawings
- c) Protection Block Logic Diagram

9.3 Bill of Materials (BOM)

The bill of materials shall provide the following information for each component:

- a) a short description;
- b) the quantity;
- c) a part number.

9.4 Type Test Certificates/Reports

- 1) Type test certificates and reports shall be submitted with a tender.
- 2) The type test reports shall include an installation instruction and bill of materials that form an integral part of the test report issued by the test authority.

10 MARKING/PACKING

The Equipment shall be suitably packaged, such that it is “fit for use” at any location in Horizon Power’s operational area. Packaging shall be capable of preventing damage whilst in storage and during transit to remote locations.

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

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

- 1) Manufacturer’s name
- 2) Manufacturer’s part reference number
- 3) Horizon Power Order Number
- 4) Horizon Power Stock Number
- 5) Gross weight in kg
- 6) Nett weight in kg
- 7) Date of manufacture
- 8) Manufacturer’s Serial Numbers of all packaged equipment (to facilitate traceability)
- 9) Total mass (in kg) of SF₆ gas in all equipment.

In addition the package shall contain:

- a) an installation instruction;
- b) all necessary components and consumables required to complete the installation in accordance with the instruction i.e. accessory components, cleaning kit and earthing kit;
- c) accessories required for programming the control unit (if not sent separately); and
- d) Material Safety Data Sheets (MSDS).

11 SPARE EQUIPMENT

Separate prices are required with the offer for the following:

- 1) Any spares necessary for the continuous operation of each item of Equipment; and
- 2) Any special tools or handling equipment required for installation and/or maintenance shall be stated in Appendix H of the enquiry document.

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

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

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 **CS 10#: 2372709** 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
16/02/2015	0	First Issue

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

DOCUMENT NUMBER		HPC-8DJ-07-0003-2014					QUALITY ASSURANCE		CS10# NUMBER	
DEVICE DESCRIPTION		LABEL MATERIAL NO.								DISTRIBUTION TRANSFORMER PURCHASE
		ASSET ID/ STOCK NO								
MANUFACTURER				DIMENSION						
ITEM	OPERATION/EQUIPMENT/FACILITY			DOCUMENT REF.	WHO CHECKS	INITIAL	DATE/TIME	QUALITY ASSURANCE CRITERIA	PASS Y/N	COMMENTS
1										
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	Rating Plate Voltage							*****		
1.6	Physical Appearance									
1.6.1	Paint Colour/Galvanising 1. Recloser 2. Control Unit							*****		
1.6.2	Paint Chips 1. Recloser 2. Control Unit							*****		

1.6.3	Physical Damage					*****		
1.7	Packaging (if not already assembled)					Fit for transport to site		
2	DOCUMENTATION							
2.1	Material Safety Data Sheets					Clear, Legible and in English		
2.2	Recloser Documentation & Drawings					Clear, Legible and in English		
2.3	Test and Inspection Reports					Clear, Legible and in English		
2.3.1	Recloser					*****		
2.3.2	Circuit Breakers					*****		
2.3.3	Insulation Tests					*****		
2.4	Software and Accessories					All necessary cables for data transfer provided		
SYMBOLS AND ABBREVIATIONS								
H = HOLD POINT	S = SUPERVISOR							
W = WITNESS POINT	T = TECHNICIAN, EL = ELECTRICIAN	REVISION						
V = VERIFICATION POINT	E = ENGINEER	DATE						
S/C = SUBCONTRACTOR	PM = PROJECT MANAGER	APPROVED BY						

APPENDIX C – TECHNICAL REQUIREMENTS FOR RECLOSER

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
1.0 GENERAL						
	System highest voltage	kV (rms)	12	24	36	<input type="checkbox"/>
	Nominal system Voltage	kV (rms)	11	22	33	<input type="checkbox"/>
	Lightning impulse withstand voltage	kV (peak)	75	150	170	<input type="checkbox"/>
	Power frequency withstand voltage (1-minute) (rms)	kV-min (rms)	28	50	70	<input type="checkbox"/>
	Rated frequency	Hz	50	50	50	<input type="checkbox"/>
	Internal arc withstand (1s) (rms)	kA/1 s	18.4	18.4	13.1	<input type="checkbox"/>
	Rated current (rms)	A	630	630	630	<input type="checkbox"/>
	Rated short-time withstand current (3 s) (rms)	kA/1 s	16	12.5	12.5	<input type="checkbox"/>
	Rated making current		16	12.5	12.5	<input type="checkbox"/>
2.0 OPERATION						
	Minimum number of interruptions at rated short circuit current (up to X/R = 5) without requiring maintenance or inspection		100	100	100	<input type="checkbox"/>
	Minimum number of load break operations at rated current before maintenance required		3000	3000	3000	<input type="checkbox"/>
	Required interrupting medium		Vaccum	Vaccum	Vaccum	<input type="checkbox"/>
	Rated transformer magnetising breaking current	A	As per AS 62271.111	As per AS 62271.111	As per AS 62271.111	<input type="checkbox"/>
	Rated cable charging breaking current	A	As per AS 62271.111	As per AS 62271.111	As per AS 62271.111	<input type="checkbox"/>
	Rated operating sequence (total number of trips/counts to lock out)		4	4	4	<input type="checkbox"/>
	Maximum break time	Sec	0.05	0.05	0.05	<input type="checkbox"/>

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
	Mechanical life - minimum number of close/open operations - without inspection	A	3000	3000	3000	<input type="checkbox"/>
	Nominal system voltage (for HV closing solenoid operation - if applicable)	kV	11	22	33	<input type="checkbox"/>
	HV bushings creepage length	no.	341	682	1023	<input type="checkbox"/>
	Minimum taut string metal to metal clearance in air					<input type="checkbox"/>
	Phase to phase	mm				<input type="checkbox"/>
	Phase to ground	mm				<input type="checkbox"/>
	Phase to Structure	m				<input type="checkbox"/>
3.0 PROTECTION REQUIREMENTS						
	Directional Control					
	Integrated Voltage source		Y	Y	Y	<input type="checkbox"/>
	Direction control selectable		Y	Y	Y	<input type="checkbox"/>
	Time delayed over-current and Earth Fault	-	-	-	-	-
	Phase Current setting range	A	10 to 1260	10 to 1260	10 to 1260	<input type="checkbox"/>
	Earth Current setting range	A	10 to 1260	10 to 1260	10 to 1260	<input type="checkbox"/>
	Current setting step size		1	1	1	<input type="checkbox"/>
	Time multiplier range		0.05 to 2.0	0.05 to 2.0	0.05 to 2.0	<input type="checkbox"/>
	Time multiplier step size		0.01	0.01	0.01	<input type="checkbox"/>
	Minimum Operate time		0 to 2	0 to 2	0 to 2	<input type="checkbox"/>
	Minimum Operate time – step size	s	0.01	0.01	0.01	<input type="checkbox"/>
	Additional delay time	s	0 to 2	0 to 2	0 to 2	<input type="checkbox"/>
	Additional delay time – step size		0.01	0.01	0.01	<input type="checkbox"/>

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
	Time current characteristic	-	Selectable between a definite time, standard inverse curve (type A, IEC 60255-4) and a very inverse curve (type B, IEC 60255-4) and Extreme Inverse Curve	Selectable between a definite time, standard inverse curve (type A, IEC 60255-4) and a very inverse curve (type B, IEC 60255-4) and Extreme Inverse Curve	Selectable between a definite time, standard inverse curve (type A, IEC 60255-4) and a very inverse curve (type B, IEC 60255-4) and Extreme Inverse Curve	<input type="checkbox"/>
	High set Instantaneous O/C and E/F		-	-	-	-
	Current setting range		1 to 30 times over current setting	1 to 30 times over current setting	1 to 30 times over current setting	<input type="checkbox"/>
	Current setting step size		0.1 times over current setting	0.1 times over current setting	0.1 times over current setting	<input type="checkbox"/>
	Time delay range	s	0 s (i.e. min. op time) to 2	0 s (i.e. min. op time) to 2	0 s (i.e. min. op time) to 2	<input type="checkbox"/>
	Time delay step size	s	0.05	0.05	0.05	<input type="checkbox"/>
	Sensitive earth fault					
	Current setting range	A	1 to 20	1 to 20	1 to 20	<input type="checkbox"/>
	Current setting step size		1	1	1	<input type="checkbox"/>
	Time Delay range	s	1.0 to 30	1.0 to 30	1.0 to 30	<input type="checkbox"/>
	Time delay step size	s	0.1	0.1	0.1	<input type="checkbox"/>
	Negative Phase Sequence Over current					
	User Selectable operation (Alarm/Trip/Both)		Y/N	Y/N	Y/N	<input type="checkbox"/>
	Current setting range	A	1 to 20	1 to 20	1 to 20	<input type="checkbox"/>
	Current setting step size		0.5	0.5	0.5	<input type="checkbox"/>

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
	Time delay range	s	0 s (i.e. min. op time) to 10	0 s (i.e. min. op time) to 10	0 s (i.e. min. op time) to 10	<input type="checkbox"/>
	Time delay step size	s	1	1	1	<input type="checkbox"/>
	Under Voltage					
	User Selectable operation (Alarm/Trip/Both)		Y/N	Y/N	Y/N	<input type="checkbox"/>
	Under voltage Trip		0.5 to 0.8	0.5 to 0.8	0.5 to 0.8	<input type="checkbox"/>
	Under voltage Trip Time		0 to 60	0 to 60	0 to 60	<input type="checkbox"/>
	Under voltage reset		0.8 to 1.0	0.8 to 1.0	0.8 to 1.0	<input type="checkbox"/>
	Time delay step size	s	0.1	0.1	0.1	<input type="checkbox"/>
	Over Voltage					
	Over voltage Trip		1.1 to 1.5	1.1 to 1.5	1.1 to 1.5	<input type="checkbox"/>
	Over voltage Trip time		0 to 60	0 to 60	0 to 60	<input type="checkbox"/>
	Over voltage reset		1.0 to 1.2	1.0 to 1.2	1.0 to 1.2	<input type="checkbox"/>
	Time delay step size	s	0.1	0.1	0.1	<input type="checkbox"/>
	Circuit Breaker Fail		Y	Y	Y	<input type="checkbox"/>
	Over/Under Frequency					
	Time delay range	s	0 to 300	0 to 300	0 to 300	<input type="checkbox"/>
	Time delay step size	s	30	30	30	<input type="checkbox"/>

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
	Reclose Time					
	Each reclose time independent		Y	Y	Y	<input type="checkbox"/>
	Reclose time		0.5 to 180	0.5 to 180	0.5 to 180	<input type="checkbox"/>
	Reclose reset time		5 to 180	5 to 180	5 to 180	<input type="checkbox"/>
	Number of trips to lockout		Up to 4	Up to 4	Up to 4	<input type="checkbox"/>
	Reclose Blocking Manual & Supervisory		Y	Y	Y	<input type="checkbox"/>
	Cold Load Pickup (CLP)		Y	Y	Y	<input type="checkbox"/>
	CLP Controllable local & Remote		Y	Y	Y	<input type="checkbox"/>
	CLP Modify Curve		Y	Y	Y	<input type="checkbox"/>
	CLP Modify Pickup value		Y	Y	Y	<input type="checkbox"/>
	CLP Detects Loss of Supply		Y	Y	Y	<input type="checkbox"/>
	Manual Trip no Reclose		Y	Y	Y	<input type="checkbox"/>
	Multiple Setting Groups		Y	Y	Y	<input type="checkbox"/>
	Fully Independent		Y	Y	Y	<input type="checkbox"/>
	Setting Group Change Controllable local & Remote		Y	Y	Y	<input type="checkbox"/>
	Metering					
	Instantaneous RMS current in each phase		Y	Y	Y	<input type="checkbox"/>

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
	Phase voltages		Y	Y	Y	<input type="checkbox"/>
	Watts and VArS		Y	Y	Y	<input type="checkbox"/>
	Active and Reactive Energy		Y	Y	Y	<input type="checkbox"/>
	Maximum demand measurements		Y	Y	Y	<input type="checkbox"/>
	Event Recorder		Y	Y	Y	<input type="checkbox"/>
	Store at least the last 50 events		Y	Y	Y	<input type="checkbox"/>
	OC and E/F independent separate trip sequences		Y	Y	Y	<input type="checkbox"/>
	External Protection Trip Initiate					<input type="checkbox"/>
4.0 CONTROL UNIT						
	Degree of protection of control unit in accordance with AS 60529.		IP 54	IP 54	IP 54	<input type="checkbox"/>
	Battery type					<input type="checkbox"/>
	Battery voltage					<input type="checkbox"/>
	Auxiliary supply voltage	V	110 V and 240 V (DC & AC)	110 V and 240 V (DC & AC)	110 V and 240 V (DC & AC)	<input type="checkbox"/>
	Warranty period					<input type="checkbox"/>
	Software					
	No restrictions to PC numbers		Y	Y	Y	<input type="checkbox"/>
	Set, Upload, Control & Analyse		Y	Y	Y	<input type="checkbox"/>

ITEM	REQUIREMENTS	UOM	RECLOSER OPERATING AT 11 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 22 kV NOMINAL SYSTEM VOLTAGE	RECLOSER OPERATING AT 33 kV NOMINAL SYSTEM VOLTAGE	CHECKLIST FOR VENDOR TO COMPLETE**
	Fully function Local and Remote		Y	Y	Y	<input type="checkbox"/>
	Microsoft Windows 7 capable					<input type="checkbox"/>

APPENDIX D – 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 Appendix F.

CLAUSE NUMBER		YES	NO	ATT.
3	REQUIREMENTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1	Power System Particulars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.1	Design Fault Levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.2	Nominal System Frequency			
3.1.3	System Insulation Levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1.4	Standard Operating Conditions			
3.1.5	Clearances & Insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	POLE MOUNTED RECLOSER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.1	General Requirements			
4.2	Design and Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1	Tank Design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.1	Internal Breaker	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.2	Internal Arc Classification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.3	Interrupting Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.4	Insulation Medium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.4.1	Enclosure Requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.4.2	Non-Return Requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1.5	Tank Pressure Relief	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.2	Surge Arrestor Bracket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.3	Bushing and Terminals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.4	Earthing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.5	ACR Pole Mounting Frame	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.6	Operating Mechanism	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.6.1	Operating sequence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.6.2	Manual Operation and Operation counter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7	Recloser Control Unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.1	Cabinet Design and Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.2	Cabinet Door			

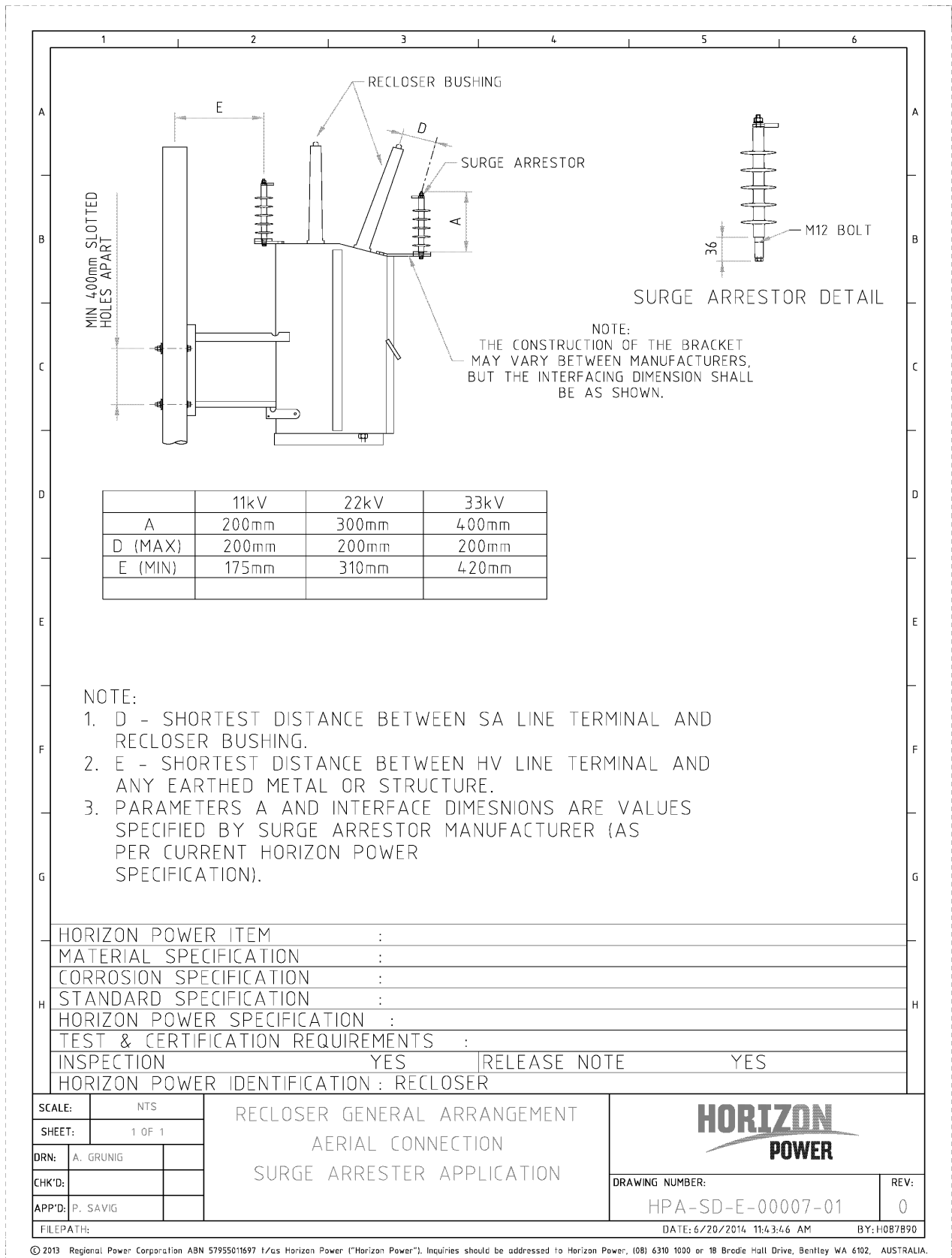
CLAUSE NUMBER		YES	NO	ATT.
4.2.7.3	Internal Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.4	Mounting Bracket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.5	Cable entry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.6	Control cable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.7	Power supplies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.7.1	Main Power Supply Requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.7.2	Voltage/Current Excursions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.7.3	Battery Backup Supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.7.8	Technical features	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.8	Protection & Control functions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2.8.1	Overcurrent Protection			
4.2.8.2	Earth Fault Protection			
4.2.8.3	Instantaneous Overcurrent and Earth Fault Protection			
4.2.8.4	Sensitive Earth Fault Protection			
4.2.8.5	Negative Sequence Overcurrent Protection			
4.2.8.6	Undervoltage and Overvoltage Protection			
4.2.8.7	Under-frequency and Over-frequency Protection			
4.2.8.8	Auto-reclose Operation Parameters			
4.2.8.9	Cold Load Pick-up (CLP)			
4.2.9	Control Functions			
4.2.10	Metering Functions			
4.2.11	Software			
4.2.12	Nameplates			
5	STORAGE			
6	RELIABILITY			
6.1	Life Cycle Model			
7	SAFETY			
7.1	Environmental Considerations			
7.2	End of Life Management			
8	TESTS			
8.1	Type Tests			

CLAUSE NUMBER		YES	NO	ATT.
8.2	Routine Tests			
8.2.1	General			
8.2.2	Circuit Breaker			
8.2.3	Current and Voltage Transformers			
8.2.4	Insulation Tests			
9	DOCUMENTATION			
9.1	Installation Instructions			
9.2	Electrical Drawings			
9.3	Bill of Materials (BOM)			
9.4	Type Test Certificates/Reports			
10	MARKING/PACKING			
11	SPARE EQUIPMENT			

Specification No.: _____ Vendor's Signature: _____

Vendor's Company Name: _____ Date: _____

APPENDIX F – DRAWINGS



APPENDIX G – SCADA REQUIREMENTS

1) Overview

Horizon Power requires that all Pole Mounted Reclosers be either connected to Horizon Power SCADA HMI's ('Always On' communications), or have the facility for local PC based connection.

The following provides the details of what exists and what is required to achieve the above.

- a) Horizon Power provide the following applications for remote control and monitoring from these SCADA HMI:
 - GE PowerOn Fusion
 - Schneider Electric Citect SCADA.
- b) Horizon Power uses these PC based applications for the local and remote configuration and diagnostics tasks.
 - Schneider Electric WSOS4 and WSOS5.
 - ABB WinISD.

2) Communications

- a) The device shall provide for the following communication ports:
 - I. A control and monitoring port for communications to the remote SCADA HMI using DNP3 tele control protocol.
 - II. A diagnostic and configuration port for communications to the PC based application.
 - III. The above ports shall be easily configured to provide a range of required interfaces.
 - IV. Preferred ports to be provided are serial RS232 and Ethernet.
 - V. The number and the type of ports provided shall be specified.
- b) The device shall support communications over these interface media:
 - I. VHF/UHF radio.
 - II. Serial modems (IP web configuration) on the Telstra mobile network.
 - III. Ethernet modems (IP web configuration) on the Telstra mobile network.
 - IV. Satellite modems.
 - V. Fibre Optic modems.
 - VI. Any other alternative communications media supported shall be specified.

3) Control and Monitoring Telecontrol Protocol

The preferred telecontrol is DNP3 protocol to the remote SCADA HMI:

- a) DNP3 shall meet or exceed the requirements of DNP3 – 2001 implementation as described in the most recent version of the DNP User Group Document "DNP V3.00 Subset Definitions".

- b) A complete DNP3 Device Profile Document as described in the "DNP3 Subset Definitions" is to be provided.
- c) The use of other telecontrol protocol must be approved by Horizon Power SCADA

4) PC Based Application Software

The device systems shall be supplied with configuration and diagnostic software that meets the following requirements:

- a) Supplied software is to be compatible with the software that is supported by Horizon Power's business which is WINDOWS 7 Enterprise.
- b) The software supplied with the system shall be documented comprehensively, with all the features and functions specified.
- c) The software should be menu driven and user friendly to the extent that only basic computer knowledge should be required to operate it.
- d) The software shall have an auto-install feature whereby a setup program will prompt for options and the software will automatically be extracted to the appropriate directories with program groups and icons created.
- e) The software shall maintain backup files of the configuration information. It shall be possible to store these backup files on a Horizon Power server.
- f) A list of minimum computer hardware requirements shall be provided with the specification.
- g) Horizon Power shall be given a Horizon Power wide license agreement for the software offered. The price of the software should be included in the price of the device system.
- h) Specific aspects like bug fixes, new firmware releases and version control of software/firmware will be specified.

5) Security

This section highlights the need for password control to prevent unauthorised operations to the devices:

- a) Tele control – permission to change communications settings to a device.
- b) Protection/Detection – permission to change protection/detection settings to a device.
- c) Operation – permission for open / close control operations of the device.
- d) System – permission to open files for a particular device.
- e) Details of what password control is provided.

6) Portable Testing and Training Equipment

The following describes Horizon Power SCADA requirements for portable testing equipment:

- a) The test set shall replicate the control and monitoring functions of the device.
- b) The test set shall provide the two communications ports described above.
- c) Testing of analogue signals amps and volts to be provided for.

- d) A portable Testing and Training set which provides for secondary current injection can be incorporated in the above test set or as a separate test set.
- e) The test set or sets will be ordered separately by Horizon Power.

7) General Requirements

The following describes Horizon Power requirements for the SCADA communications media installation to the device:


- a) Horizon Power will arrange the install of the communications media and associated hardware.
- b) Horizon Power will arrange the required configurations to the device and commission the device to the SCADA HMI.

8) Technical Support

From time to time technical support for either the supplied software or hardware is required by Horizon Power SCADA this section highlights that need to provide details of how this can be achieved:

- a) Comprehensive manuals for the product.
- b) List of contact details for support.
- c) Website.
- d) Email notifications of product updates of software and firmware.
- e) Notifications of changes to product supplied to be communicated to Horizon Power SCADA.

APPENDIX H – IMPACT ASSESSMENT

	Impact Assessment		
	Document Title:	Distribution Recloser Specification	
	Document No:	HPC-8DJ-07-0003-2014	Revision No: 0
	CS No:		
Activity		Detail	
1. What training is required to implement this specification?		If any, would be around equipment, this will need to be included in Tender.	
2. Who will require training?		Operational Staff	
3. What equipment will be required for training?		General Tools used by OPS	
4. What special tools/equipment will be required for training?		Depend on Tender submission	
5. Time period for training to be completed		Max 3 days	
6. Does the document affect the budget?		No	
7. Time period for implementation of requirements after training is completed.		Nil	
8. Were the critical points in the document determined?		N/A	
Business Change Control		Total Implementation period	30 days
		Total training cost	Zero (covered in Contract)
		Total cost of tools/equipment	Zero (covered in Contract)
		Total cost involved	Zero
Comments: This specification is for Tendering purposes, as there are already similar equipment in the field			
Documentation will be minimal.			
Assessment Compiled by:		Recommended by (Functional Responsibility)	
Name:	Paul Savig	Name:	
Designation:	Senior Standards Engineer	Designation:	
Department:	Asset Management Services	Department:	
Date:		Date:	