



**Ergon Energy Corporation Limited**

**Joint Ergon Energy/Energex**

# **Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)**

**JTS02-02-01**

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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## 1. Purpose and Scope

This technical specification covers the design, manufacture, testing at works and supply of 3 phase, 50 Hz, 11 kV/433-250 V fully assembled rectangular type padmounted distribution substations. The following items are required:

Item	Rating (k.VA)	HV Switchgear		LV Switchboard		
		RMU <sup>1</sup>	None <sup>2</sup>	Type A	Type B	Type C
1	315	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
2	500	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
3	750	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
4	750	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
5	1000	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
6	315		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
7	500		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
8	750		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
9	1000		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>

**Items 1 to 5** require high- and low-voltage switchgear. **Items 6 to 9** require low-voltage switchgear only.

**All items 1 to 9** require (Remote) Low-voltage Monitoring capability requirements as detailed in Technical Specification TS-479 LV Transformer Monitoring Capability Requirements for Pad Mount and Dry Type Transformers and as specified in this technical specification.

**Item 4** is a 750 kV.A rectangular padmounted distribution substations design, preferably of a low loss design, that can fit into the Purchaser's existing 500 kV.A rectangular padmounted distribution substation footprint

These items will be complete with all ancillary equipment.

<sup>1</sup> Refer to TECHNICAL SPECIFICATION TS 440 FOR 12 kV Oil-less Ring Main Unit Switchgear – Item 1 for Ring Main Unit Details.

<sup>2</sup> No HV switchgear to be fitted.

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## 2. References

### 2.1 Applicable Standards

Unless specified otherwise, all equipment must comply with all current Queensland Health & Safety Acts/Regulations and Australian/International Standards including all current amendments and parts, in particular:

Standard	Name
AS 1767	Insulating oil for transformers and switchgear
AS 1940	The storage and handling of flammable and combustible liquids
AS 2067	Substations and high voltage installations exceeding 1 kV a.c.
AS 2312	Guide to the protection of structural steel against atmospheric corrosion
AS 2374	Power Transformers
AS 2700	Colour standards for general purposes
AS 3947.3	Low-voltage switchgear and controlgear – Switches, disconnectors, switch-disconnectors and fuse combination units
AS 4360	Risk Management
AS 4680	Hot-dipped galvanized coatings on fabricated ferrous articles
AS/NZS ISO 9001	Quality Management Systems
AS 60076	Power transformers – General
AS/NZS 60137	Insulated bushings for alternating voltages above 1000 V
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS 60947	Low-voltage switchgear and controlgear - General rules
AS 62103	Electronic equipment for use in power installations
AS 62271.202	High-voltage switchgear and controlgear Part 202: High-voltage/low-voltage prefabricated substation
AS 62271.301	High voltage switchgear and controlgear - Dimensional standardization of terminals

Although it is the intent of the Purchaser at this time (subject to change without notice at the Purchaser's discretion) to adopt and rely upon AS 62271.202 as the main guiding standard of plant compliance for the items of this technical specification, the Tenderer is required to note any and all differences between AS 62271.202 and individual respective product standards for item components as offered for the Purchaser's consideration.

The Tenderer is to prove plant performance to the Purchaser's satisfaction. Any acceptance of plant regarding the standards to be complied with, whether AS 62271.202 solely and in entirety, or in conjunction with, or solely and in entirety by other individual and separate respective product standards, or by equivalent standards or other, will be at the Purchaser's discretion.

**Note:** Any standards as referenced in AS 62271.202 must be interpreted, as preferred by the Purchaser, to be the current Australian Standards equivalents or modified equivalents as primary reference, else then, in order of preference, the current IEC standard followed by a current other standard.

If the equipment offered does not comply with Australian Standards, but complies with International Standards, eg IEC, then detailed descriptions will be given in English of the

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differences between the apparatus offered and the Australian Standards specified requirements.

**Note:** The Purchaser will not accept equipment that does not comply in full with all relevant Queensland Health & Safety Acts/Regulations.

## 3. Drawings

### 3.1 Drawings by the Purchaser

The following drawings are included and form part of this specification:

Drawing No.	Name
02-02-01	Transformers Padmounted - 315/500/750/1000 kV.A, 11 kV/433-250 V Dimensional Limitations
02-02-01	Transformers Padmounted - 315/500/750/1000 kV.A, 11 kV/433-250 V Reinforced Concrete Plinth Dimensional Limitations
<b>02-02-05</b>	Transformers Padmounted - "Danger - High Voltage" and "Station" Sign Layout
02-02-12	Padmount Identification Sign
02-02-16	General Arrangement/Dimensional limitations
04-04-03	Neutral Bar Electricity Supply Pillars Manufacturing Details
897447-01	"Danger High Voltage" Sign
7468-A4-22	ENERGEX Foundation – Uniculvert type
7470-A4-3/3	ENERGEX Foundation – Pier type
5005 – 1&2	ERGON Foundation – Uniculvert type
5009 – 1&2	ERGON Foundation – Pier type
973682-01	Ergon Energy Corporation Ltd, Network Hardware, 11kV Padmounted Substation Precast Concrete Support Culvert General Dimensions

## 4. Service Conditions

The Purchaser's 11 kV system is 3 phase, 3 wire, 50 Hz. The substations may be installed in effectively earthed and non-effectively earthed situations. When installed in non-effectively earthed situations, significant voltage variations (up to line to neutral voltage) may be produced at the neutral terminal during an earth fault.

The substations will be suitable for outdoor use at ground level in locations accessible to the public.

The service conditions will be in accordance with Clause 1.2 of AS 60076.1, Part 1, with the following exception that the maximum air temperature will be 40°C and the average daily and annual air temperature will not exceed 35°C and 25°C respectively.

Although the transformer maximum air temperature will be 40°C per above Clause 4.3, the High-voltage/low-voltage prefabricated substation items and all components are preferred by the Purchaser to meet AS 62271.202 Clause 2.2.3 with a preferred temperature range for items in this technical specification of -5degC to +50degC for very hot climates.

The ambient air is not materially polluted by dust, smoke, corrosive or flammable gases and vapours; however, some substations may be installed in locations close to ocean beaches

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that are subject to windborne salt spray. The mean relative humidity can vary between 40% and 90%.

Where not addressed and or specified by another Australian Standard or in another technical specification or Annexure or Attachment or other applicable document(s) as noted in this technical specification; any electronic equipment (EE) component part(s) of the High-voltage/low-voltage prefabricated substation items whether in the enclosure or otherwise must comply with AS 62103.

Any and all electronic equipment components shall be Fit for Purpose including in alignment with the above noted Clause 4 Service Conditions this technical specification, and required to function despite the failure of any air conditioning or forced air plant servicing the items in this technical specification. Under AS 62103 Table 7 – Climatic conditions, this is deemed to be EE that conforms to Type C (due to AS 62103 Table 7 NOTE 3), D (In storage) and E (During transport).

## 5. Design and Construction - General

### 5.1 Performance Parameters

Design and construction performance parameters are detailed in this specification and supplemented by **Attachment 1**.

### 5.2 General

In alignment with the Purchaser's previously accepted design type:

- The Purchaser prefers High-voltage/low-voltage prefabricated substations which are cable-connected,
- Be fitted with a single transformer

5.2.1 The substations will be of aesthetic design and suitable for installation in public areas. They will be weatherproof, rodent/bird proof and have all exterior surfaces finished flush and free from protrusions of any kind except hinges and lifting lugs.

5.2.2 The overall design will ensure against unauthorised access to the energised components inside, as well as against danger to the public in the event of a component failure or contact with exposed transformer radiators.

5.2.3 The substations will be robust; they will be suitably stiffened and braced to prevent distortion or damage under service conditions or during handling and transport. All sharp points will be removed to prevent injury.

5.2.4 All bolts nuts and washers (fasteners, studs, lifting lugs etc.) will be to Australian Metric Standards and be stainless steel Grade 316 or 304. Compatibility, with regard to corrosion prevention, between the fasteners will be observed. To prevent binding, different grade stainless steel nuts and bolts<sup>3</sup> will be used together with anti-seizing lubricant on all bolt threads. Tamper proof bolts will be used for all unenclosed components.

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<sup>3</sup> For example, 316 grade bolts and washers fitted with 304 grade nuts.



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- 5.2.5 All metal work will be electrically bonded to permit earthing by the Purchaser. If a part cannot be adequately bonded it will be constructed from a suitable insulating material instead of metal. All earth straps will have a minimum cross-sectional area of 40 mm<sup>2</sup> copper conductor.
- 5.2.6 The spacing of all adjacent parts will allow reasonable room for their proper inspection, cleaning, painting and operation in service.
- 5.2.7 A 'Very long term' corrosion protection system, if not inherent in the construction materials chosen, suitable for use in a 'Category E-M, Very High Marine' atmospheric environment (as per AS 2312) is required for all internal and external surfaces. Finished coatings will be heat resistant and non-corrosive. Exterior coatings will be coloured storm grey, N42 to AS 2700. Other long term corrosion protection systems, as used as standard in the industry, may be considered by the Purchaser.

## 5.3 Functional Arrangement / Limiting Dimensions

- 5.3.1 Drawing 02-02-01 details the Purchaser's dimensional limitations and HV Terminal position for the substations, with the exception that the substation height dimension has been relaxed and the substation height shall not exceed a maximum of 1670mm (equivalent to the maximum dimensional height limitation of the Purchaser's Square Type PMTs – enclosure + plinth total height maximum). The transformer fins (only) of Items 3, 5, 8 and 9 are permitted to protrude 200 mm each side. Drawing 02-02-01 shows four hinged doors are required, all hinged on their left side.

However, the Purchaser may consider alternatives that may exceed these dimensional limitations while maintaining a compact footprint as optimally as possible while satisfying all other requirements of this technical specification.

Any alternatives that exceed dimensional limitations are to have full information and details provided by the Tenderer as to deemed affects on installation and any impacts (e.g. civil footing designs as noted in this technical specification, especially with respect to changes in the centre of gravity of plant, and related earthing grid and or step-touch potential requirements).

The Purchaser has a preference for designs that, regardless of KVA rating, can be exchanged/ replaced without the necessity to alter or remake existing high voltage and/or low voltage terminations. Please note that past requirements for interchangeability were applicable to the transformer only, and are not required for this technical specification.

- 5.3.2 Drawing 02-02-02 details the concrete plinth base dimensions that align with the above dimensional limitations of the substations, which are standard for all transformer ratings. The position of holding down bolts for the transformers, High-voltage and Low-voltage switchgear are in accordance with the dimensions shown on the drawing.
- 5.3.3 Any offered substation dimensions that vary from the 5.2.1 Purchaser dimensions or other proposed changes must require the Tenderer to comment on all affects and any and all changes required to the concrete plinth base, position of holding down bolts or other.

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## 5.4 Loading

The transformers will be suitable for loading in accordance with AS 2374. 7. No part of the substation (for example; bushings, tapping switch, leads, switchgear or enclosure) will impose restrictions on the loading capabilities.

## 5.5 Sound Level

The design and construction of each substation will be such that the sound level will be no greater than the applicable 'reduced limit' as per Appendix AA of AS 2374.6.

## 5.6 Radio and Television Interference

The design and construction of each substation will be such that it must not cause any radio or television interference.

## 6. Design and Construction - Transformer

### 6.1 Oil Preservation System - Type

Sealed tank type construction will be used; however, the transformers will not be pressurised or incorporate gases other than air. Diaphragm sealing is not acceptable.

### 6.2 Tanks and Lids

6.2.1 All surfaces will be designed to prevent the accumulation of water. All seams will be electrically welded and oil tight. On the external areas of the tank, welding of horizontal and vertical joints will be on both sides of the joint. Welding in all cases will be continuous.

6.2.2 The tanks will be designed so that with a top oil temperature of 105°C, the oil level in the tank will be below the tank lid flange.

6.2.3 The lid of the transformer will be capable of being removed without having to take off other components first and will be capable of supporting up to 100 kg of a person's weight without permanent deformation.

### 6.3 Joints and Gaskets

All joints will be oil tight. All gaskets/seals will be designed to last the intended life of the transformer. Joints in gaskets will not occur at bolt holes.

### 6.4 Core and Windings

6.4.1 All transformers will have electrically separate high and low voltage windings connected to comply with vector group Dyn11 of AS 60076.

6.4.2 The core and winding assembly will be supported by the main tank and not by the cover.

6.4.3 Means will be provided at both the top and bottom of the core and coil assembly for locating the transformer core centrally in the tank and securing it in position to prevent movement, particularly during transport.

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6.4.4 The core and all metalwork will be electrically bonded to the tank. The bonding will be brought to one point only.

6.4.5 The insulation between the core and the frame will have a resistance no lower than 50 M $\Omega$  after assembly, and will withstand 2.5 kV for one minute. The core and frame will then be electrically connected together at one point only.

## 6.5 Tappings

6.5.1 Seven tappings will be provided on the high voltage winding. The tapping range for each unit will be +10% to -5% of rated voltage with a tapping step of  $\pm 2.5\%$ . Tap position 1 will correspond to the full winding in circuit.

6.5.2 Each transformer will be capable of off-circuit tap changing by means of an externally operated seven position tapping switch. The tapping switch will have a permanent overload capability of 50%.

6.5.3 The tapping switch will be positioned within the LV compartment at a convenient height and must be able to be operated by an operator standing outside the side door of the LV compartment.

6.5.4 The tapping switch will be capable of being locked in each position. The locking arrangements will be such that it is not possible to lock the switch between taps.

6.5.5 Each tapping selector switch position will be identified by a number clearly and indelibly stamped onto either the switch operating handle or the transformer tank.

6.5.6 A sealing gland will be provided on the tapping selector switch operating shaft where it passes through the transformer tank to prevent any breathing or leaking along the shaft.

## 6.6 Impedance Voltage

The impedance voltage at rated current on principal tapping will be as specified in **Attachment 1**.

## 6.7 Cooling

The method of cooling each transformer will be ONAN.

## 6.8 Insulating Oil

6.8.1 The transformers will be delivered filled (to cold oil level) with mineral insulating oil complying with: AS 1767.1, and be proven to be non-corrosive by Method B of ASTM D1275-06 Standard Test Method for Corrosive Sulphur in Electrical Insulating Oils and, IEC 62535 Ed. 1.0: Insulating liquids – Test method for detection of potentially corrosive sulphur in used and unused insulating oil. The quality of Mineral Insulating oil at time of filling (i.e. on release from supplier) must have a moisture content of less than 20 ppm and  $\geq 50$  kV Breakdown Voltage.

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6.8.2 Any and each insulating oil offered will be certified as polychlorinated biphenyl-free (PCB-free) in accordance with the definition of PCB-free in the Environmental Protection (Waste Management) Regulations 2000 (Qld). Analysis shall be conducted in a laboratory certified by NATA for the appropriate analyses. The Tenderer will supply full specifications and test results for any and each oil offered.

## 6.9 Bushings and Terminals - Transformer

### 6.9.1 HV Terminals

A cast epoxy pad type termination is required. The termination will be capable of accepting a Holec 502-0024 termination kit (or similar).

The distance between the top of the base and the bottom of the HV terminals must be 760 (+20) mm (refer Drawing 02-02-16) in correlation to, and in accordance with, the other preferred dimensions as specified in this technical specification.

### 6.9.2 LV Terminals

All terminal palms will comply with AS 62271.301. They will be copper with their contact surfaces tinned or silver plated. Both surfaces will be used as contact surfaces.

The bushings will comply with the relevant requirements of AS AS/NZS 60137. All porcelain components will be glazed and fully vitrified.

The part of each LV bushing within the tank will be completely covered with oil when the transformer is cold (with an outside temperature of 15°C), and will be readily accessible with the tank cover removed.

The taut string metal to metal clearances of the lugged bushing terminals will be not less than 100 mm, phase to phase, and 60 mm phase to earth. *Note. Tenderers are encouraged to review the disposition of the LV bushings on the transformers with a view to minimising the EMF levels associated with the equipment.*

The neutral connection to the star point on the secondary winding will be brought out of the tank unearthed and insulated in the same manner as the phase terminals.

### 6.9.3 Marking of Terminals

The terminals will be marked in accordance with AS 60076. The use of adhesives to attach marking plates will not be accepted.

## 6.10 Minimum Power Efficiency (MEPS)

All transformers must meet or exceed the minimum power efficiency levels specified in Table 1 of AS 2374.1.2 - 2003 Minimum Energy Performance Standard (MEPS). Transformers with efficiencies not meeting or improving performance upon these MEPS levels are unacceptable.

During the term of the Contract, the Purchaser reserves the right to negotiate with the Supplier to enhance the transformer power efficiency levels to meet any future amendments to the MEPS requirement of AS2374.1.2.

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## 6.11 Comparison of Tenders

6.11.1 Guaranteed load and no-load loss figures are to be specified in **Attachment 1**.

6.11.2 Load losses are to be corrected to a reference temperature of 75°C.

6.11.3 In evaluating the tenders, the Purchaser will capitalise the guaranteed losses and so determine the economic advantages of the transformers offered. Capitalisation of losses will be based on the guaranteed losses at the required power rating for each item as stated in **Attachment 1**. Load losses will be those specified on the principal tapping. For this contract, the following values will be used for the purpose of making a fair economic comparison:

- F (No-load loss) = \$ 6 300 / kW
- C (Load loss) = \$ 1 800 / kW

F and C are the \$/kW capitalisation figures for the no-load and load losses respectively.

6.11.4 As specified in AS 60076.1, the maximum allowable tolerance for the total losses for all transformers to be supplied under this contract is +10%. For any transformer, the maximum allowable tolerance for either the no-load loss or load loss is +15%, provided that the total loss meets the above requirement of +10%. Where the total loss exceeds the +10 % tolerance or either the no-load loss or load loss exceeds the +15 % tolerance, the Purchaser reserves the right to reject the unit. As an alternative, the unit may be accepted with the application of Liquidated Damages as described in the Liquidated Damages portion of the Standing Order.

## 7. Design and Construction – Enclosure and Base

### 7.1 Enclosure

#### 7.1.1 General

Drawings 02-02-01 and 02-02-02 detail preferred enclosure dimensions, however, as noted previously, allowances for interchangeability of transformers are now no longer required and henceforth any notations on drawings regarding same can be ignored.

The design of the enclosure will be such that it is not possible to contact energised parts through air vents or other openings using pieces of wire or other means. A degree of protection of at least IP46 in accordance with AS 60529 is required for the HV and LV compartments.

The enclosure will be manufactured from marine grade aluminium MF 5052-H32 or equivalent) or 3CR12 steel (or better).

The enclosure will be bolted by its internal return edge to the base. Access to the bolts will be possible in the event of the need to change an enclosure in the field. The lower edge of the enclosure will not overhang the edge of the base.

Sufficient ventilation will be provided for reliable operation of the substation. This means that the ventilation and thermal design of the entire prefabricated substation and each compartment part will be such that the ambient temperature inside the substation must not be higher than the limits fixed for the components in their respective product standards (and

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as per the Service Conditions stated in this technical specification), when the substation is operating fully loaded including up to Emergency Cyclic Rating as per AS 2374.7.

De-rating of components is not preferred. Air ducts will be provided in that part of the enclosure covering the transformer radiators. Such ducts will have a degree of protection IP1X in accordance with AS 60529.

Any pop rivets used will be made from "Monel" or stainless steel. Any hinges will be manufactured from grade 316 stainless steel and will have a minimum hinge pin diameter of 10 mm.

Any seams (eg. door returns, door stay location brackets, etc) will be fully seam welded.

All surfaces (covers, etc.) will be sloped to prevent the accumulation of water. Condensation within the substation will be prevented from dripping on the switchgear.

The prefabricated substation which complies with the maximum outer dimensions outlined in Section 5.2.1 shall preferably be designed to conform with the internal arc withstand requirements of AS 62271.202, Annex A, A.2.3 Prefabricated substations classified IAC-A, for an IAC classification test prospective arc fault current of 20 kA for 1 second for 11 kV HV Switchgear including Cable Box.

The Tenderer shall outline how the design meets the IAC Classification or outline development plans including timelines to meet the IAC Classification. The Purchaser reserves the right to negotiate a transition to the IAC compliant item that meets the limiting dimensions.

Submissions with marginal increases in dimensions to accommodate the IAC classification may also be considered provided such padmounted substations can be retrofitted to the existing network. Acceptance of the increase in dimensions will be at the Purchaser's discretion.

## 7.1.2 Doors

Four hinged, lift-off doors shall be provided as shown on **Drawing 02-02-01**. The doors will be located a minimum of 30 mm above the surface of the base. Removable door sills and gutters will be provided on both end doors to facilitate the laying in of cables. It is preferred that side doors have the sills and gutters welded.

Doors will be fully recessed into and sit flush with the enclosure panel mullions. They will have a return edge, not less than 24 mm, for adequate strength and stiffness. It will not be possible to pry open the doors by inserting a screw driver or similar object and gain unauthorised access to the switchgear compartments. The thickness of the door material will be not less than 2.0 mm.

A suitable door seal material will be provided to prevent chafing and damage to painted surfaces around the door and frame.

All doors will be fitted with 3-point locking to all items; the doors will be padlockable to ensure unauthorised entry is not possible and the successful Tenderer will supply and fit the locking handle to accommodate the Purchaser's approved padlocks. Pad-lock holes will accommodate the Purchaser's approved padlocks having a shackle diameter of 8.7mm. The locking points and pad-lock will not bear on a painted surface of the door or frame in such a way that paint will be removed thereby causing corrosion.

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The successful Tenderer will provide a temporary means to ensure doors remain locked closed during transport and associated handling. The means adopted will be acceptable to the Purchaser.

A robust door restraint will be provided to hold each door in the 95° open position. The restraint will be of a captive design so that it cannot be easily removed and will be self storing when the door is closed such that it cannot rattle. With the door in this position, operation of the HV switchgear will be possible without endangering operators' hands, etc.

All doors will be fitted with a recessed door-pull. Each end door will be fitted with a document holder.

If the operating handles for the HV switchgear cannot be mounted in a suitable location on the switchgear itself, then a suitable frame complete with cushioning (to prevent noise from vibrations, etc.) will be provided on the HV enclosure door. Labels identifying the operating handles will be fitted if deemed necessary by the Purchaser.

## 7.1.3 Lid

The enclosure will be provided with an easily removable lid, secured to the enclosure by an internal fixing arrangement that allows ease of lid removal and replacement.

Any holding down brackets for the lid will be welded in place or form part of the framework of the enclosure. If hold down bolts are used with such brackets then they will be fitted with captive washers/wing nuts (or similar captive device) to provide ease of access (and ensure loose components cannot be lost at site).

Instructions to remove the lid will be provided with each Item by the Supplier.

Interchangeability requirements with the existing transformers are no longer required.

The lid will be provided with two Grade 304 stainless steel lifting lugs with 25 dia. holes to facilitate handling.

## 7.2 Base

The base will be constructed from reinforced concrete and will conform to the external dimensions of the padmounted transformer with dimensions shown on **Drawing 02-02-02**. It will be capable of supporting the total mass of the substation when supported only at its extreme ends. In addition, the base complete with HV and LV switchgear will be capable of being lifted via the transformer.

The base will be suitable for mounting on the Purchaser's standard foundations (refer to drawings 7468-A4, 7470-A4, 5005 – 1&2 and 5009 – 1&2 & Ergon Energy Padmounted Substation Support Uniculvert/ culvert as per sketches provided).

A removable block similar to that detailed in **Drawing 02-02-02** or similar facility to provide similar functionality will be provided for cabling purposes and must be a tight fit into the base. It will provide protection against the entry of solid foreign objects greater than 1 mm thickness. The weight of each removable block will be a maximum of 15 kg. Adequate strength will be maintained, internal cavities are permitted. It will also be designed so:

- That extra packing is not required to prevent entry of solid foreign objects.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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- That it is totally interchangeable between either end of the same padmount (where similar cutouts are provided at each end) or another padmount plinth for the same contract item.
- That when fitted it does not extend above the top of the plinth.
- That access for cabling-up purposes is not impeded by narrow keyway openings. The Purchaser requires a minimum opening of 460 mm for access, however, variations in the HV end may be permissible depending upon the type of HV switchgear offered.

Details of proposal should be forwarded with the tender for appraisal, and would be subject to the Purchaser's approval. Any variations in design during prototype inspection would be to the Tenderer's cost.

The supplier will provide an Engineer's Certified Design Certificate for the base.

All substation components (transformer, switchgear, enclosure etc) will be securely bolted down using M12 stainless steel concrete inserts and all inserts will be electrically bonded to the concrete reinforcement.

## 8. Design and Construction – High & Low Voltage Switchgear

### 8.1 High Voltage Switchgear

The high voltage switchgear must comply with Item 1 of ENERGEX technical specification TS 440 12 kV Oil-less Ring Main Unit Switchgear. The scope for switchgear applies to padmounted distribution transformers and does not include for all the optional requirements intended for stand alone HV switchgear.

Suitably rated leads and terminations will be fitted between the transformer terminals and the switchgear.

The high voltage switchgear will be bonded to the station earth using (green/yellow) PVC insulated 70 mm<sup>2</sup> copper cable.

A cable support bracket constructed from S1000 FSS Supa Strut, or equivalent will be included to help restrain the HV cables entering the substation. For items 1 to 5, the bracket may be incorporated into the switchgear or the substation base. The bracket will be located so that it does not interfere with the laying in of cables. For items 6 to 9, that is, items not having High-voltage switchgear fitted, the bracket will be fitted to the transformer tank in accordance with the requirements of **Drawing 02-02-01**.

For all items in Attachment 1 offered, where the items require Insulation boots for High-voltage terminations to comply to the 95kV BIL requirement, such Insulating Boot Kits must be integral to the offered item, with the kits to satisfactorily allow for each and every Cable/ Feeder Isolator termination as allowed for by each item.

### 8.2 Low Voltage Switchboard

#### 8.2.1 General

The switchboard will be dead front and be designed such that all installation, maintenance and repair activities can be easily performed without the need to access the rear or approach live terminals. The switchboard design will allow for the replacement of individual switchgear units while the busbars remain energised. It will be possible to terminate all outgoing circuits from the front of the switchboard.



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The switchboard frame will be constructed from S1000 FSS Supa Strut, or equivalent. It will include a cable support bracket. The minimum distance from the top of the cable support bracket to the hole centre of the lowest LV terminal will be 425 mm.

Sufficient space will be provided on the switchboard (or switches) for the attachment of operating labels to the switches and phasing labels for the LV busbars. The operating labels will be 80 mm long x 35 mm wide and the phasing labels 20 mm long x 20 mm wide. The labels for the transformer switch-disconnector and LV busbars will be supplied fitted to the switchboard. The transformer switch-disconnector is to be labelled "Transformer Isolator". The busbar will be labelled 'a', 'b', 'c' (top to bottom).

All solid insulating materials used will be fire resistant. They will not ignite spontaneously and will cease to smoulder or melt immediately on removal of the heat source.

A suitable conducting grease will be applied to all electrical connections of the LV switchboard and associated cable connections.

Busbar configurations designed to minimise EMF levels are preferred.

Full details of the LV switchboards, including the LV Metering / Monitoring arrangements, will be provided by the Tenderer and will be subject to approval by the Purchaser. Any minor costs associated with modifications to suit the Purchaser will be provided at no cost.

## 8.2.2 Switchgear

Vertically arranged, DIN type switchgear complying with AS 3947.3/IEC 60947.3 is required. The switchgear will have minimum utilisation categories at 500 V of AC22B for DIN1 250A and DIN2 400A, AC 21B for DIN3 630A. It will provide three phase switching, single pole operation is unacceptable. It is preferred that all Low-voltage switchgear including the LV Transformer Isolator / Disconnecter be a minimum utilisation category at 500 V of AC22B however a lower performance utilisation category minimum AC21B at 500 V may be considered by the Purchaser for DIN3 630A switchgear and the LV Transformer Isolator / Disconnecter only.

The switchgear will be suitable for isolation and will be padlockable to accommodate the Purchaser's approved padlocks. It will be possible to close and lock the LV compartment door with all switches locked in their open positions.

The electrical contacts of all switchgear will be silver plated copper. The silver plating will be in accordance with AS 1856 and have a thickness no less than .010 mm. All silver plated parts are to be guaranteed to be free from verdigris under the specified service conditions.

## 8.2.3 Busbars

The busbar system of all switchboards will be rated for a minimum short circuit current of 38 kA.

To allow for a range of switchgear and prevent binding between operating handles, 185 mm busbar centres will be used and a 10 mm gap will be provided between all switches.

All holes will be predrilled with "nutserts" (or equivalent) fitted and all spare holes will be fitted with switchgear mounting bolts. Removable insulating covers will be provided over all unused/spare switch positions.

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## 8.2.4 Transformer Switch-Disconnecter

A switch-disconnector<sup>4</sup> will be used to provide isolation between the transformer and the switchboard busbars. It will be located on the extreme left hand end of the switchboard.

A rear connected, fixed link type switch-disconnector is required. It will be capable of continuously carrying 150% of the transformer's rated current at an ambient temperature of 55o C.

Up to two switches may be ganged together to achieve the required rating.

To limit the stresses on the transformer's LV bushings and help prevent leaks, flexible leads will be used to connect the switch-disconnector to the transformer. The leads will have a temperature rating of 110o C (or better).

## 8.2.5 Circuit Fuse-Switch-Disconnectors

Fuse-switch-disconnectors will be used to protect and switch outgoing cable circuits and will be mounted to the right of the transformer switch-disconnector. Two types are required, a unit capable of accepting up to 400 A DIN size 2 fuses and a unit capable of accepting up to 630 A DIN size 3 fuses. The 630 A rated unit will also be capable of accepting DIN size 2 fuses.

The switches will be capable of continuously carrying 400 A and 630 A respectively at an ambient temperature of 55o C. Equally rated bases are required for both units to enable the Purchaser to uprate the 400 A units to 630 A at a later date (if required).

Fuse-switch-disconnectors will be capable of being fitted or removed with the bus bars energised.

Each switch will have terminals suitable for the termination of up to 2 x 240 mm<sup>2</sup> aluminium cables (fitted with 45 mm wide lugs) per phase. It is essential that the electrical connections be of compatible materials. Tinned aluminium terminals are not acceptable. The hole centres of the lowest phase terminals will be 470+/-3 mm above the top of the base.

M12 stainless steel nuts, bolts and belleville washers for cable termination will be supplied with each switch.

## 8.2.6 Insulation Level of Cable Terminations

An insulation level of 2500 V rms will be maintained between phases of each unit and adjacent units when the switch is terminated with uncovered lugs to suit the maximum cable size. The maximum cable lug dimensions are overall length 140 mm, palm width 45 mm. Insulating barriers of fire resistant material would be acceptable for this purpose.

The switches will be supplied fitted with insulating covers to fit over the cable terminations.

## 8.2.7 Type B Switchboards

Type B switchboards will be used to connect up to four outgoing circuits as standard. They may also be used to connect single customers (with large consumer's mains). To enable this, the units will come complete with right angle adaptor brackets provided for direct mounting to the busbar system of the customer's cables.

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<sup>4</sup> A bottom connected fuse-switch-disconnector will be used on 100 kV.A units.

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Provision will be made for accepting 6 x 300mm<sup>2</sup> cables per phase (2 x 300 mm<sup>2</sup> cables per adaptor bracket – 1 off cable either side of each adaptor bracket). Adaptors will be stepped outward from the busbar, so that the highest/ top most busbar adaptor bracket is the furthest outward protruding and allows 2 x 300 mm<sup>2</sup> cables per phase per bracket and allows that three such adaptor brackets may sit vertically above one another, per busbar phase, while maintaining clearance between cables in all cases.

The adaptors and associated bolts will be supplied with each switchboard in a plastic bag safely and securely attached to the switchboard frame, with safe access available even if the plant is energised.

## 8.2.8 Type C Switchboards

Type C switchboards will be used to connect single customers (with large consumer's mains) as standard, the units will come complete with right angle adaptor brackets provided for direct mounting to the busbar system of the customer's cables.

Provision will be made for accepting 6 x 300 mm<sup>2</sup> cables per phase (2 x 300 mm<sup>2</sup> cables per adaptor bracket – 1 off cable either side of each adaptor bracket). Adaptors will be stepped outward from the busbar, so that the highest/ top most busbar adaptor bracket is the furthest outward protruding and allows 2 x 300 mm<sup>2</sup> cables per phase per bracket and allows that three such adaptor brackets may sit vertically above one another, per busbar phase, while maintaining clearance between cables in all cases.

Provision will be made for alternator connection (in accordance with Clause 8.2.10) on the busbars between the right angle adaptor brackets.

**Note:** For both switchboards (B & C), the insulating cover(s) to be provided over the busbar system will allow for these brackets plus cables. To cater for network circuit connections, the covers need to also cater for a mixture of switch units plus cables connected to the busbar (ie. split sections to cater for any combination).

## 8.2.9 Earth and Neutral Bars

The LV switchboard will be fitted with a neutral bar and an earth bar. The neutral and earth bars will be supported on insulators and attached to the switchboard frame. The insulators will provide an insulation level of at least 6 kV between the bars and the frame.

All holes in the bars will be fitted with "nutserts" (or equivalent) suitable for M12 bolts.

A short section of bar (with the same cross-section as the neutral and earth bars) will be used to bond the earth and neutral bars. This bond will be located at the far right hand end of the switchboard.

The earth bar will have eight holes to allow for the connection of equipment and cable earths. It will not impede clear cable access to LV terminals and will not hinder connection of neutrals of outgoing circuits to the neutral bar.

A tinned copper neutral bar will be provided with hole centres at least 450 mm above the top of the base to allow for the connection of the transformer neutral, LV surge arresters, LV feeder cables and large consumer's mains.

The neutral bar will extend around the left hand side of the switchboard to allow for the connection of large consumer's mains. Four holes will be provided in the extension.

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The neutral bar will extend around the right hand side of the switchboard to allow for the connection of LV surge arresters. Three holes will be provided in the extension.

Six additional holes will be provided to allow for the connection of the transformer neutral, LV earth bar link and outgoing LV feeder cables.

The additional holes provided for the outgoing feeder cables will be positioned clear of (and not behind) phase terminations. Short (black) insulated bridging cables fitted with M12 lugs may be provided between the neutral bar and the front of the switchboard for this purpose.

## 8.2.10 Earth Bonds

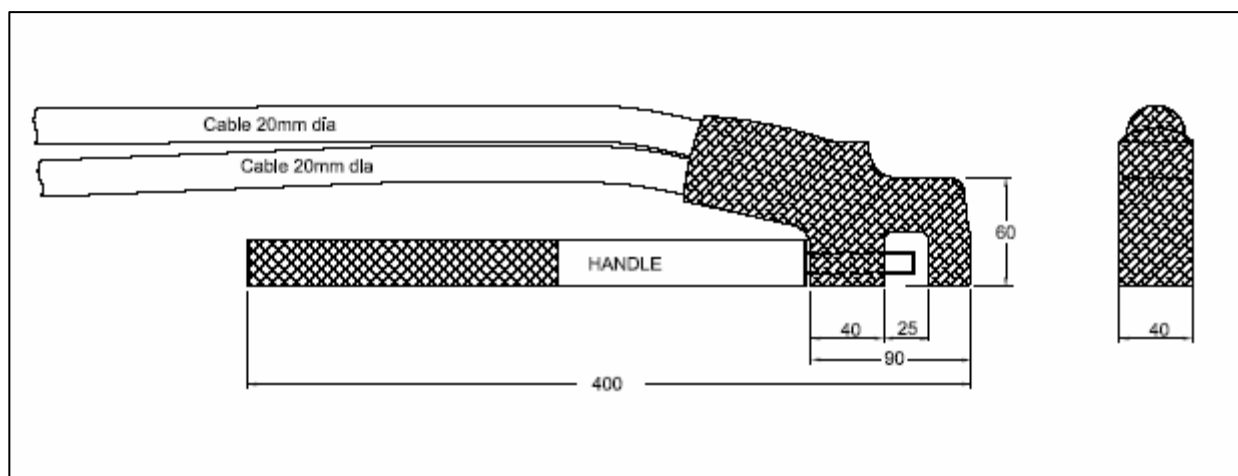
The switchboard frame and earth bar will be bonded to the station earth using separate cables and connections. Green/yellow PVC insulated cables with 70 mm<sup>2</sup> copper conductors will be used for this purpose. M12 lugs and bolts will be used for all connections.

The bond between the earth bar and the station earth will be easily accessible to allow its removal (by the Purchaser if required). This bond will be used to reconfigure the substation earthing system and will be labelled "For Separate Earthing Remove This Cable".

## 8.2.11 Alternator Connection Point

Bare busbar Alternator connection points (no lug holes are required for the Alternator Connection points only) on each phase busbar and neutral will be provided to allow clearance connection of the cables of an alternator set in the following manner:

The connection point on units rated to 500 kV.A will be suitable for use with a clamp each phase busbar and neutral busbar and earth busbar, as shown following:



750 and 1000 kV.A units will have provision to accommodate two standard clamps (as shown above) per phase each phase busbar and two each neutral busbar and provision for one off earth clamp on the earth busbar. Staggered connection points may be required. The Tenderer must allow for clearance connection regarding cable bends and clamp positions such that any and each clamp does not foul any adjacent applied clamp or other part(s) of the plant and equipment and that all statutory clearances are maintained in any possible clamp attachment configuration.

The connections will be located behind a removable insulating cover.

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## 8.2.12 Low Voltage Surge Arresters

The Purchaser requires the substations to be supplied fitted with low voltage surge arresters. The arresters will comply with Item 1 requirements of Specification TS449 LV - 132kV Surge Arresters and TS449 General Requirements

The arresters will be fitted between each LV phase and the extension on the neutral bar. Red conductor colour PVC insulated, 50 mm<sup>2</sup> Cu cable complying with AS/NZS 5000.1 will be used to bridge the arresters to the transformer terminals. If surge arresters are not bolted straight to the Main neutral bar, black conductor colour PVC insulated, 50 mm<sup>2</sup> Cu cable complying with AS/NZS 5000.1 will be used to bridge the arresters to the Main neutral bar.

The arresters will be located so that they can be easily replaced, even when all outgoing cable circuits are in place and energised. Each arrester will be taken to its own termination point on the neutral bar (that is, one M12 bolt will be used for each arrester lead).

## 8.2.13 Distribution Transformer Low-voltage (LV) Monitoring Capability Requirements

Technical Specification TS-479 LV Transformer Monitoring Capability Requirements for Pad Mount and Dry Type Transformers is the base document for the requirement in lieu of LV Current Transformers and Maximum Demand Indicator system.

The Scope of supply for this tender is limited to:

- The supply and installation of the LV Metering CT's
- The supply and installation of the Housing and Fitment – including Voltage takeoff wiring, fuses and test links.

The scope of supply does not include:

- The LV Monitoring Meters
- The Communications Equipment
- The Antenna

The equipment tendered shall be designed for future site fitting of a Low-voltage monitor / meter for every item Attachment 1 and as detailed in TS-479.

The Purchaser requires minimum accessible space to mount future communications and LV monitoring equipment in addition to the space requirement for the LV meter outlined in TS-479

The additional space requirement approx the size of a Quality of Supply Monitoring Box 540 mm (height) x 270 mm (width) x 180 mm (depth) would be adequate to allow for a Data Concentrator as a possible alternative and or additional future metering equipment requirement.

Such possible future enclosure would have an approximate minimum total weight {enclosure and LV Monitor and associated equipment} of 8 kg. Preference is for the unit to be door mounted if possible on the LV compartment door, or Manufacturer nominated location.

The mounting must have adequate strength and rigidity to support all present and future component requirements.

Any Voltage and current wiring provided must be correctly rated for electrical duty and must be flexible if requiring to cross over moving parts such as the door hinge.

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The Tenderer shall include in the design the provision for the installation of a future antenna including mounting brackets and fastening points for the antenna cabling.

## 8.2.14 Auxiliary Services Board

All low voltage switchboards will incorporate an auxiliary services board. The board will be located on the lower right hand side of the main switchboard and be accessible from the side door of the LV compartment.

The auxiliary services board will consist of an insulated panel fitted with:

- One RCD protected 10 A GPO
- One neutral link (to **Drawing 04-04-03**)
- Three single phase surface mounted fuse carriers type Nilson NSH 1002 BFBW (or equivalent).

The auxiliary board will be supplied from the bottom of the closest circuit fuse-switch disconnecter, not the busbar (this may necessitate a flag type lug). The cables used to connect it will be a minimum of 25 mm<sup>2</sup>

The outgoing side of the fuses mounted on the auxiliary board will be labelled 'a', 'b', 'c'.

**Note:** For the Auxilliary Services Board, the insulating cover(s) to be provided over the Auxilliary Services Board will allow for a barrier between the operator and the LV area / LV live parts. To cater for network circuit connections, the covers need to also cater for the ultimate fully fitted arrangement.

## 8.2.15 Switchboard Configurations

The switchboards will be configured (left to right) as follows:

Type A Switchboard (315 & 500 kV.A units)

- 1 x Transformer Switch-Disconnecter
- 1 x 630 A Circuit Fuse-Switch-Disconnectors
- 3 x 400 A Circuit Fuse-Switch-Disconnectors
- 1 x Alternator Connection Point

Type B Switchboard (750 kV.A units)

- 1 x Transformer Switch-Disconnecter
- 4 x 630 A Circuit Fuse-Switch-Disconnectors
- 1 x Alternator Connection Point
- 3 x Right Angled Adaptor Brackets (in plastic bag)

Type C Switchboard (1000 kV.A units)

- 1 x Transformer Switch-Disconnecter
- 4 x Space for Extra Circuit Fuse-Switch-Disconnectors (with staggered right angled adaptor brackets and provision for alternator connection)

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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## 9. Design and Construction - Fittings

### 9.1 Rating and Designation Plates

Each unit will be supplied with a rating plate complying with AS 60076 and AS 2374. In addition, the Purchaser's contract number and transformer number will be included. The rating plate will also include:

- A statement of compliance with AS 2374.1.2 (including the Australian Standard reference year complied to e.g. AS 2374.1.2-2003)
- The total substation weight in kg

The rating plate will be located in a readily viewable position in the low voltage enclosure. It will be made from stainless steel (or non-ferrous metal) and be clearly marked.

**Note:** The transformer number is designated as the structured plant number (SPN) in Ergon Energy. The SPN will be nominated in the purchase orders to the successful Tenderer and it will be an eight digit number prefixed by two alphas (e.g. TD 12345678 for the distribution transformers).

### 9.2 Lifting and Transport Facilities

Clearly marked (with a permanent label or stencil), fully rated lifting and hold down points will be provided on the substations to facilitate the hoisting (filled with oil) and holding down during transport.

Four lifting lugs marked "Substation Lifting Point" with a minimum hole diameter of 26 mm will be provided suitable for lifting the transformer. These lugs will be arranged so that any slings attached do not foul any part of the transformer and when suspended by them, the transformer will hang without tilting.

The lugs shall be suitable for lifting the substation, complete with transformer, HV and LV switchgear, enclosure and base as one assembly, both without the lid and also with the lid in its service position.

The lugs will be arranged so that they protrude through the lid and that lifting devices attached to the transformer face towards a common centre. Although a four point lift is required, the design will be such that any two diagonally opposite lifting points can take the load. Provision will be made to reduce the angle of tilt of the complete substation during lifting to less than 3 using equal length lifting chains

All parts of the substation weighing in excess of 15 kg that will be removed for inspection or repair will be fitted with lifting points suitable for use with shackles and slings. For the main tank cover, at least two lifting lugs with M24 holes (minimum) will be provided.

Additionally the Purchaser prefers the padmounted substations to be moved safely using a forklift via the padmounted substation plinth. If this is deemed possible Tenderers are required to nominate the minimum rating / SWL / type of the forklift to be used and provide training / documentation for carrying out this work. Such additional Lifting points in the plinth to facilitate forklifting of the substations and centre of gravity shall be clearly marked on the plinth, including any safety markings on the plinth to advise of safe forklift to be used e.g. ">=5T {forklift symbol} only" or similar as required.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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## 9.3 Station Earthing Points

A station earthing point will be provided in a readily accessible position in the HV compartment and the LV compartment. The earthing points will consist of two M12 x 40 mm stainless steel earthing studs complete with nuts and washers fitted with a copper bar 25 mm x 3 mm. The bar will have 5 holes with sufficient clearance for M12 bolts. Two of the holes will be used for mounting on the studs and three vacant positions for earth bond cables.

The space between holes will be adequate to allow spanners, etc. to be used with all cables connected.

Additional earth studs/flags will be provided where necessary to permit the earthing of the enclosure and steel base (where fitted) to the transformer tank

All earthing studs/flags will be welded directly to the transformer tank.

## 9.4 Transformer Oil Level Indicator

Oil level indication will be provided by a permanent marking on the inside of the tank.

A flush type external oil level indicator will also be provided. It will indicate the oil level over the designed operating temperature range of the transformer. The cold oil level will be clearly and indelibly marked on the indicator.

## 9.5 Transformer Oil Draining

An oil drain valve is required only on 1000kVA transformers. – Item 5 & 9.

The drain valve will have a 25 mm BSP internal thread fitted with a flanged plug and shall be of the metallic sealing gate type. The valve will be positioned so that all sludge and thick oil can be drained from the bottom of the tank and that clear access is provided to operate the valve.

The drain valve will be located in a position easily accessible through an open door. The actual valve location will be to the satisfaction of the Purchaser.

## 9.6 Transformer Thermometer Pocket

Thermometer pockets are not required.

## 9.7 Transformer Filler Cap

Transformers shall be fitted with a filler cap on the transformer within the cubicle LV end/side as near as possible to the edge of the transformer, such that a pipe for draining oil can be inserted to the bottom of the tank and if moisture enters it would drop to the bottom of the tank.

## 9.8 Transformer Tank Markings

The transformer capacity and the Purchaser's identification number will be stencilled in black on the upper left hand corner of the fixed panel beside the side door of the LV compartment. Each character will be 75 mm high and have a body width of not less than 12 mm.

The Purchaser's structured plant number for the transformer will also be stencilled below the identification number in a similar manner.



# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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## 9.9 Signs and Labels

High voltage danger signs and a padmounted substation sign will be supplied fitted to the enclosure as shown on **Drawing 02-02-05**.

The high voltage danger signs will conform to the requirements of Clause 4.2.3 of AS 1319 and **Drawing 897447-01**.

The padmounted substation sign will conform to the requirements of **Drawing 02-02-12**. After installation, the Purchaser will apply stick on letters to the sign to identify the substation number.

## 10. Additional Requirements

Tenderers will advise full details in **Attachment 2** for each of the following Additional Requirements:

### 10.1 Maximum Demand Indicators (MDIs) – Moving Needle Analogue Type

The Purchaser requires that MDIs are supplied in conjunction with Clause 8.2.13 requirements of this technical specification.

The MDIs must have an accuracy class 3 and will be scaled in primary values to at least 120% of the transformer's full load rating and have a driving and a resettable pointer. Each MDI will be labelled (A, B or C phase as appropriate) with an additional label "TRANSFORMER LOADING" identifying the origin of the readings.

The MDIs must be connected via the testing/ shorting facility arrangements provided under Clause 8.2.13 and be mounted in a readily accessible position for reading and resetting.

Tenderers will advise in the applicable pricing schedule the price to delete this MDI Additional Requirement from the item.

### 10.2 Improved Internal Arc Containment (IAC) Rating

The specification currently requires a minimum IAC rating of AF. The Purchaser requests the Tenderer to comment on any improved IAC rating that could be achieved.

## 11. Performance and Testing

### 11.1 Type Test Compliance

11.1.1 The following type tests will be conducted on each design:

#### Transformer tests, as specified in AS 2374 and 60076

- Temperature Rise Test
- Overload Temperature Rise Test (refer Clause 11.3)
- Impulse Voltage Withstand Test (refer Clause 11.4)
- Impulse Voltage Withstand Test Including Chopped Wave Test
- Sound Level Tests
- Short Circuit Tests

#### High Voltage Switchgear

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- All type tests specified in ENEREX technical specification TS 440 12 kV Oil-less Ring Main Unit Switchgear.

## Low Voltage Switchboard tests as specified in AS 3439.1

- Verification of Temperature Rise Limits including the Tenderer's additional technical information of verification of performance at an increased Ambient air temperature of 55o C under the specified loading conditions in this technical specification
- Verification of Dielectric Properties
- Verification of the Short Circuit Withstand Test
- Verification of the Effectiveness of the Protective Circuit
- Verification of the Clearance and Creepage Distances
- Verification of the Mechanical Operation
- Verification of the Degree of Protection

The Purchaser reserves the right to negotiate with the successful Tenderer a fee schedule to obtain type tests to AS 62271.202 as a complete unit or as component functional parts, including:

- Dielectric tests
- Temperature-rise tests
- Short-time and peak withstand current tests on main and earthing circuits
- Functional tests
- Verification of the degree of protection
- Calculations and mechanical tests
- Internal arcing test
- Electromagnetic compatibility test (EMC)
- Special Tests e.g. sound level of a prefabricated substation

11.1.2 All units of the same design will be identical in all respects relating to materials, design and manufacture.

11.1.3 A copy of the type test certificates will be provided, free of charge, to the Purchaser for each item purchased against this specification and prior to the first delivery of each item. If an item has not been previously tested, the Purchaser will allow the tests to be performed on purchased units at the Suppliers expense.

11.1.4 Where units are offered of a similar design to those previously tested, consideration may be given (in accordance with AS 2374.1, Clause 3.11.2) to accepting previous type test reports. Tenderers will state if such tests exist. Tenderers may be requested (during the tender evaluation period) to substantiate their claims with written engineering evaluation. Such evaluation will provide all relevant details so that the Purchaser can establish the validity of existing type tests.

11.1.5 A list of all accessories that have been satisfactorily tested with the substations offered, giving details of the manufacturer and product identification, is to be provided with the tender.

## 11.2 Routine Tests

11.2.1 The following routine tests will be carried out on every substation supplied:

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## Transformer tests, as specified in AS 2374 and AS 60076

- Measurement of winding resistance
- Measurement of voltage ratio and check of voltage vector relationship
- Measurement of impedance voltage, short circuit impedance and load loss
- Measurement of no-load loss and current
- Calculated MEPS efficiency.
- Separate-source voltage withstand
- Induced over-voltage withstand
- Insulation resistance
- Pressure test (refer Clause 11.5)

## High Voltage Switchgear

- All routine tests specified in ENERGEX technical specification TS 440 12 kV Oil-less Ring Main Unit Switchgear.
- Low Voltage Switchboard tests as specified in AS 3439.1
- Inspection of Assembly including Inspection of Wiring and, if necessary, Electrical Operation Test
- Dielectric Test
- Checking of Protective Measures and of the Electrical Continuity of the Protective Circuits
- Verification of Insulation Resistance
- Complete Substation
- Transformer High Voltage d.c. resistance with links inserted in place of fuses via ring main cable terminals.

The Purchaser reserves the right to negotiate with the successful Tenderer a fee schedule to obtain routine tests to AS 62271.202 as a complete unit or as component functional parts, including :

- To meet general Routine test requirements
- Dielectric test on the High Voltage interconnection
- Voltage withstand tests on auxiliary circuits
- Functional tests
- Verification of correct wiring
- Tests after assembly on site

## 11.3 Temperature Rise Type Test

The transformers to undergo the temperature rise test will be the fully assembled units, including LV and HV switchgear. Extrapolations of temperature rise for guaranteed load and no-load losses will be incorporated in the test report to verify conformance. During the test, sealing around thermometers, etc. will be adequate to ensure the units are sealed during the test. Also, tap switch operation will be free (that is, not overtightened) during the test. Oil leaks during temperature rise tests will constitute failure of the unit.

## 11.4 Overload Temperature Rise Type Test

Tenderers are required to conduct a temperature rise test on the same unit that underwent the temperature rise type test (refer to Clause 11.3) to verify that the maximum hot spot winding temperature of 140°C is not exceeded when the ambient is 20°C for an overload condition of 1.45 times the normal rated load on any tapping for up to 2 hours after continuous operation at 0.6 times the normal rated load.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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The results of this test will be incorporated in the test reports for temperature rise.

During the overload test, the LV switchgear assembly will be fitted with 400 A fuses to the 400 A fuse switches and 630 A fuses to the 630 A switches. All load terminals of the assembly will be short circuited allowing overload currents to flow (1.45 times normal rated load). Record temperatures of 'A' phase or the top most (whichever is vertically the highest) load contact on each fuse switch.

Tenderers will state in the schedules the designed top oil/winding temperature rise for this condition.

Oil leaks during temperature rise tests will constitute failure of the test.

## 11.5 Routine Pressure Tests

To prove that transformers have been adequately sealed, a routine pressure test will also be performed. Each transformer will be pressurised to not less than 30 kPa with dry air. If after 30 minutes, the pressure has not dropped more than 2 kPa, the transformer is considered to have passed the test.

## 11.6 Acceptance Tests

11.6.1 Subsequent to delivery and before approval is given for full payment, the equipment may be tested by the Purchaser to prove that it conforms with the requirements of this specification.

11.6.2 Any equipment showing evidence of failure to comply with the requirements of this specification will be liable to rejection.

## 11.7 Witnessing of Tests

11.7.1 The Purchaser reserves the right to witness all type tests and randomly witness routine testing.

11.7.2 The supplier will give the Purchaser reasonable notice of when each and every type test will be carried out.

## 11.8 Routine Test Certificates

11.8.1 One copy of the routine test results will accompany each unit delivered. A second soft copy will be forwarded to the Purchaser's Supervising Officer or Purchaser's nominated contact for the contract via electronic mail. (For Ergon Energy: [inventory.nameplatedata@ergon.com.au](mailto:inventory.nameplatedata@ergon.com.au))

All test certificates will include the manufacturer's serial number. On allocation, the Purchaser's transformer number (structured plant number), the order number, contract/item number, specification number and guaranteed losses/efficiency will be added to the certificate, or attachment to the test report. The test certificates will also be accompanied with a completed Attachments 4 and 5 returned electronically as MS Excel documents.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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## 12. Risk Assessment

### 12.1 Compliance

The Tenderer warrants (without limiting any other warranties or conditions implied by law) that all Goods have been produced, sold and delivered to the Principal in compliance with all applicable laws (including all workplace health and safety and electrical safety legislation, codes of conduct and the Principal's Workplace Health & Safety and Electrical Safety Conditions).

### 12.2 Formal Risk Assessment

Tendered items will be subjected to a formal risk assessment prior to acceptance. The Advisory Standard for Plant requires the Tenderer to perform a risk assessment and provide the resultant documentation to the Purchaser with their tender.

### 12.3 Risk Assessment Documentation

Where risk assessment documentation is not provided with the tenders, or does not meet the required standard, such tenders may be rejected or will have their price loaded with the estimated costs associated with the Purchaser conducting the assessments. Any documented risk assessment which accompanies the tender will meet the requirements of AS/NZS 4360:1995 Risk Management as a minimum standard and address the five main steps of the process. It is preferred that the risk assessment methodology uses an energy model to identify hazards.

### 12.4 Hazards

The risk assessment/s will identify hazards to the corporation's personnel, public and property associated with:

- a) The installation of the equipment
- b) The operation and maintenance of the equipment during life expectancy
- c) Dismantling/ disposal of equipment at end of life.
- d) The 'Risk Assessment' schedule included with this specification is to be completed by the Tenderer. Note the schedule contains a generic set of questions designed to cover all of the Purchaser's plant and materials and the tenderer is only required to complete those items applicable to the product offered. Where required by some questions, full details to support answers will be furnished.

## 13. Quality Assurance

### 13.1 Documentary Evidence

Tenderers are required to submit evidence that the design and manufacture of the transformers is in accordance with AS/NZS ISO 9001.

## 14. Samples

### 14.1 Production Samples

Samples of typical units may be required during the tender assessment period. Samples would normally only be required from tenderers who have previously not supplied transformers to the Purchaser.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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When samples are required, production samples will be delivered freight free, suitably packaged and labelled including reference to the Contract Number.

The Purchaser may at its discretion either buy the samples at the tendered price or return the samples to the respective tenderer after the contract has been awarded.

## 15. Service Performance

### 15.1 Tenderers will state:

- (a) The period of service achieved by the items offered within Australian service conditions
- (b) Australian electricity supply authorities who have a service history of the items offered
- (c) Contact names and phone numbers of relevant employees of those supply authorities who can verify the service performance claimed.

In the absence of relevant Australian Service performance, the information required in (a), (b) and (c) above will be stated for service history in overseas countries. Priority will be given to performance in environments similar to those described above.

## 16. Reliability

### 16.1 Service Life

Tenderers are required to comment on the reliability of the equipment and the performance of the materials offered for a service life of 35 years under the specified system and environmental conditions.

### 16.2 Evidence in Support of Reliability

Such comments will include evidence in support of the reliability and performance claimed including information on Failure Mode and Effect Analysis.

## 17. Environmental Considerations

Tenderers are required to comment on the environmental soundness of the design and material used in the manufacture of the items offered. In particular, comments should address such issues as recyclability and disposal at end of service life.

Tenderers are required to provide with the tender, EMF levels at transformer normal maximum load assuming a balanced and evenly spread load over each circuit. Such EMF levels are required at a point midway along each side, and diagonally out from each corner, at a distance of 1m above and beyond the base.

## 18. Information to be Provided

### 18.1 Drawings and Information to be Submitted with the Tender

18.1.1 To enable the Purchaser to properly evaluate the equipment being offered, (in addition to the completed attachments) Tenderers will submit the following information with their tender:

- a) A list showing similar equipment supplied to or on order from other Australian Electricity Supply Authorities.
- b) General arrangement drawings of the substations offered including details of the transformers, enclosures, bases and LV switchboard layouts.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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- c) Type test certificates for the transformers offered, or transformers of similar design and rating (if available).
- d) Typical loading curves (for loading transformers in accordance with AS 2374, Part 7)
- e) Short circuit test details for equipment of similar design and rating.
- f) Typical installation and maintenance manuals.
- g) Full details of the protective coatings offered.
- h) A list of all departures of the tender from this specification.
- i) Comment and associated documentation required regarding additional lifting capability of substations by plinth using a forklift.

## 18.2 Additional Information

The Purchaser may require additional information to be provided for tender analysis purposes and such information will be provided within 7 days of the request.

## 18.3 Drawings and Information to be provided by the Supplier

18.3.1 Within three months from the signing of the agreement document with the Successful Tenderer, the Supplier will provide three copies of drawings and information necessary to enable the Purchaser to examine the general design and arrangement.

18.3.2 With each Item the Supplier will provide a copy of the Routine Test Report, a copy of the Switchgear Operating Instructions (if applicable), a copy of the lid removal instruction and (if required) a copy of the Purchaser's Receiving Inspection and Test Instruction (RITI). The Purchaser will provide the RITIs for the Supplier to copy and insert into the document holder to be provided with each Item.

## 18.4 Purchasers Comments

The Purchaser will comment on drawings supplied under this contract in relation to how the equipment interfaces with the Purchaser's design, construction, operation, maintenance and other requirements.

## 18.5 Supplier Responsibility

Comments about drawings by the Purchaser will not in any way absolve the Supplier of responsibility for the safety and reliability aspects of the plant or equipment supplied. The Supplier will amend the drawings as directed and resubmit them to the Purchaser within one week.

18.5.1 In the event of the Supplier proceeding with work before such comment has been given in writing, any necessary alterations and modifications will be carried out at the Supplier's own expense. These drawings and information will include the following:

- (a) A fully dimensioned general arrangement drawing(s) for each substation rating showing:
  - Details of the transformer
  - Details of the enclosure
  - Details of the base including an Engineer's Certified Design Certificate for the base
  - Low voltage switchboard layout
  - All electrical clearances
  - Terminal/bushing heights and terminal palm details

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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- (b) Centre-lines and centre of gravity for lifting by both crane/ suspended lift and also forklift, including forklift requirements, where capability of lifting by forklift exists
- Lifting (with maximum sling angle identified) and tie down points
  - Mass
  - List of all components with the suppliers' catalogue/part number
- (c) A drawing showing the rating and terminal marking plates for each transformer rating.
- (d) Erection, testing and maintenance information - the following information with particular reference to the equipment being supplied to this specification shall be provided:
- A comprehensive description of the substation, its construction, operation and performance capabilities.
  - A tabulation of the guaranteed electrical and mechanical performance characteristics of the equipment.
  - Detailed procedure for receiving, handling and storage
  - Pre-energisation checks on components and assemblies
  - Repair procedures for surface coatings
  - Special precautions during disassembly and reassembly (including bushings)
  - Relevant special requirements for reassembly (eg. nut/bolt tensions, crimp connections, welding, etc.)
  - Routine maintenance recommendations
  - Disposal at end of service life

**Note:** Each erection and testing procedure will be illustrated by clearly identifiable and labelled photographs, drawings or similar, acceptable to the Purchaser.

## 19. Quality Of Drawings

### 19.1 Drawing Title Block

19.1.1 The drawing title will be a concise description of the contents of the drawing; it will contain a sufficient number of distinct lines each describing an aspect of the drawing so that all lines together represent an accurate and complete description.

19.1.2 The title will be designed so that it reads from the general to the particular, top to bottom, as indicated in the following example:

CONTRACT NO.  
PLANT SPECIFIC eg PADMOUNTED DISTRIBUTION SUBSTATION  
MANUFACTURE TYPE eg 11000/433V 500 kV.A  
DRAWING FUNCTION eg GENERAL ARRANGEMENT

### 19.2 Drawing Revisions

19.2.1 A revision space will be provided on each drawing sheet. The original issue of the drawing is usually indicated as an 'A'; the first revision is therefore 'B'.

19.2.2 Revision descriptions should be as brief and concise, as possible and where appropriate should indicate the previously existing situation, eg "Section 'B' dimension 1028 mm was 1044 mm".



# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

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19.2.3 It is preferred that standard industry practice, for example, such as on circuitry drawing revisions, where there are numerous revisions on the same drawing it will be necessary to highlight the revision note with a 'cloud effect' or similar highlighting, and similarly each correspondingly revised area of the drawing.

19.2.4 The revision block for each revision will preferably contain:

- a) The revision letter in prominent display.
- b) A brief description of the revision.
- c) The draftsman's initials.
- d) An approval signature and date.

## 19.3 Drawings in Electronic Format

19.3.1 Tenderers will also provide drawings in electronic format to AS 1102 and AS 1103. The Purchaser has a preference for MICROSTATION format however AutoCAD format is also acceptable.

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



## SPECIFIC REQUIREMENTS & TECHNICAL DETAILS TO BE PROVIDED BY TENDERER

THE FOLLOWING TABLES DETAIL SPECIFIC DESIGN AND PERFORMANCE CRITERIA FOR ITEMS COVERED BY THIS SPECIFICATION AND PARAMETERS TO BE PROVIDED BY THE TENDERER FOR ITEMS COVERED BY THIS SPECIFICATION.

### 20. Attachment 1 – Specific Requirements / Guaranteed Particulars

The Tenderer will complete this attachment and guarantee the particulars provided. Attach additional sheets as necessary.

Ref.	Particulars	Unit	Specified Value/ Response	Guaranteed Performance
				All Items
<b>(A) Substation (Common requirements for all Items)</b>				
1.	Manufacturer of complete transformer and country of manufacture	-		
2.	Lifting & Transport Facilities			
2.1	<ul style="list-style-type: none"> <li>Clearly Marked with Permanent Label or Stencil?</li> </ul>	Yes/No		
2.2	<ul style="list-style-type: none"> <li>Fully Rated?</li> </ul>	Yes/No		
3.	Protective Coating	-		
3.1	<ul style="list-style-type: none"> <li>Are full details of protective coating included with tender documents?</li> </ul>	Yes/No		
3.2	<ul style="list-style-type: none"> <li>Time to first maintenance</li> </ul>	Years		
4.	Maximum Dimensions			
4.1	<ul style="list-style-type: none"> <li>Width (including base)</li> </ul>	mm		
4.2	<ul style="list-style-type: none"> <li>Length</li> </ul>	mm		
4.3	<ul style="list-style-type: none"> <li>Height (including base) maximum, interchangeability requirements have changed</li> </ul>	mm		
5.	Guard provided over transformer radiators	Yes/No		
6.	All bolts (fasteners, studs, etc.) nuts and washers 316/304 grade stainless steel?	Yes/No		
7.	Tamper proof bolts used for all unenclosed components accessible to the public ?	Yes/No		
8.	Serviceable life expectancy	Years		
9.	Inspection free interval	Years		
10.	Maintenance free interval	Years		

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

Ref.	Particulars	Unit	Specified Value/ Response	Guaranteed Performance
				All Items
1.	Oil Preservation System - Type	-		
2.	Service	-		
3.	Rated frequency	Hz		
4.	Number of phases	-		
5.	Vector Reference Group	-		
6.	Rated voltage	-		
6.1	• Primary Voltage	V		
6.2	• Secondary Voltage (No Load)	V		
7.	Method of cooling			
8.	Loading Suitable for loading in accordance with AS 2374, Part 7.	Yes/No		
9.	Normal Loading Curves Supplied with Tender (corrected for maximum ambient temperature)	Yes/No		
10.	Maximum Ambient Temperature	° C		
11.	Tappings 7 HV winding tappings, rated +10% to -5% of rated voltage, 2.5% steps, off-circuit.	Yes/No		
12.	Insulation Level:			
12.1	• HV winding impulse voltage withstand	kV peak		
12.2	• Power frequency voltage withstand of HV winding	kV rms		
12.3	• Power frequency voltage withstand of LV winding	kV rms		
13.	HV Terminals	-		
13.1	• Cast epoxy pad type capable of accepting a Holec 502-0024 termination kit (or similar)?	Yes/No		
13.2	• HV terminal height above base	mm		
14.	Clearances in air (minimum)			
14.1	• LV phase-to-phase	mm		

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

Ref.	Particulars	Unit	Specified Value/ Response	Guaranteed Performance
				All Items
14.2	<ul style="list-style-type: none"> <li>LV phase-to-earth (and neutrals)</li> </ul>	mm		
15.	Insulating oil	-		
15.1	<ul style="list-style-type: none"> <li>Does it comply with AS 1767 and non-corrosive as per Clause 6.8?</li> </ul>	Yes/No		
15.2	<ul style="list-style-type: none"> <li>Type</li> </ul>	-		
15.3	<ul style="list-style-type: none"> <li>Brand of oil used</li> </ul>	-		
15.4	<ul style="list-style-type: none"> <li>Method of filling</li> </ul>	-		
15.5	<ul style="list-style-type: none"> <li>PCB in oil detection limit</li> </ul>	ppm		
16.	Material thickness			
16.1	<ul style="list-style-type: none"> <li>Tank sides/floor</li> </ul>	mm		
16.2	<ul style="list-style-type: none"> <li>Lid</li> </ul>	mm		
16.3	<ul style="list-style-type: none"> <li>Fins</li> </ul>	mm		
17.	Maximum deflection of side walls	mm		

<b>(B) LV Switchboard (Common requirements for all Items)</b>				
1.	Dead front operation	Yes/No		
2.	Busbar short circuit rating	kA		
3.	Busbar mounting centres	mm		
4.	Gap provided between switches	mm		
5.	All switchgear complying with AS 3947.3	Yes/No		
6.	400 A switches capable of only accepting DIN 2 fuses?	Yes/No		
7.	630 A switches capable of accepting DIN 2 & 3 fuses?	Yes/No		
8.	All switches padlockable?	Yes/No		
9.	Circuit-fuse-disconnectors able to be installed and or removed live?	Yes/No		
10.	Distance between hole centre of lowest phase terminals and base	mm		
11.	Minimum thickness of silver plating switch contacts.	mm		

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12.	Has the Tenderer completed all schedules in Technical Specification TS-479 LV Transformer Monitoring Capability Requirements for Pad Mount and Dry Type Transformers, and provided full details and information as required by same	Yes/No		
<b>(C) Enclosure and Base (Common requirements for all Items)</b>				
1.	Enclosure Material	-		
2.	Enclosure Material Thickness	mm		
3.	Enclosure IP Rating	-		
4.	Minimum clear door opening	mm		
5.	Enclosure fitted with removable lid?	Yes/No		
6.	Base	-		
6.1	• Material	-		
6.2	• Removable sections for cable entries?	Yes/No		
6.3	• Height	mm		
6.4	• Suitable for all standard foundations?	Yes/No		

Ref.	Particulars	Unit	Specified Value			Guaranteed Performance		
			Items 1 & 6	Items 2 & 7	Items 3 & 8	ITEMS 1 & 6	ITEMS 2 & 7	ITEMS 3 & 8
<b>(D) Specific Parameters</b>								
1.	Rated Power (ONAN rating)	kVA						
2.	Impedance Voltage	%						
3.	Sound Level As per 'reduced limit' of Appendix AA of AS2374.6	dB(A)						
4.	Overall substation mass Complete with all fittings filled with oil and ready for service	kg						
5.	Does this transformer comply with AS 2374.1.2 (MEPS)	Yes/No						
6.	No Load Loss	kW						

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



Ref.	Particulars	Unit	Specified Value			Guaranteed Performance		
			Items 1 & 6	Items 2 & 7	Items 3 & 8	ITEMS 1 & 6	ITEMS 2 & 7	ITEMS 3 & 8
7.	Load Loss	kW						
8.	Calculated MEPS efficiency	%						
9.	Temperature rise limits:							
9.1	Top oil	°C						
9.2	Winding	°C						
10.	Minimum insulation resistance at 200C (1 kV test after 1 minute) for:							
10.1	HV winding	MΩ						
10.2	LV winding	MΩ						
10.3	Core	MΩ						
11.	Insulating oil (required to fill to correct level at 15°C)	litre						
12.1	Positive Sequence Impedance	$Z = R + j.X$						
12.2	Positive Sequence Impedance	$Z = A(x \text{ deg})$						
13.1	Zero Sequence Impedance as vector coordinates	$Z = R + j.X$						
13.2	Zero Sequence Impedance	$= A(x \text{ deg})$						

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Ref.	Particulars	Unit	Specified Value			Guaranteed Performance		
					Item 4			Item 4
<b>(E) Specific Parameters</b>								
1.	Rated Power (ONAN rating)	kVA						
2.	Impedance Voltage	%						
3.	Sound Level As per 'reduced limit' of Appendix AA of AS2374.6	dB(A)						
4.	Overall substation mass Complete with all fittings filled with oil and ready for service	kg						
5.	Does this transformer comply with AS 2374.1.2 (MEPS)	Yes/No						
6.	No Load Loss	kW						
7.	Load Loss	kW						
8.	Calculated MEPS efficiency	%						
9.	Temperature rise limits:							
9.1	Top oil	°C						
9.2	Winding	°C						
10.	Minimum insulation resistance at 20°C (1 kV test after 1 minute) for:							
10.1	HV winding	MΩ						
10.2	LV winding	MΩ						
10.3	Core	MΩ						
11.	Insulating oil (required to fill to correct level at 15°C)	litre						
12.1	Positive Sequence Impedance	$Z_{\square\square R}$ $\square j.X_{\square}$						
12.2	Positive Sequence Impedance	$Z = A(x \text{ deg})$						
13.1	Zero Sequence Impedance	$Z_{\square\square R}$ $\square j.X_{\square}$						

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



Ref.	Particulars	Unit	Specified Value			Guaranteed Performance		
					Item 4			Item 4
13.2	Zero Sequence Impedance	$Z = A(x \text{ deg})$						

Ref.	Particulars	Unit	Specified Value		Guaranteed Performance		
			Items 5 & 9		Items 5 & 9		
<b>(F) Specific Parameters</b>							
1.	Rated Power (ONAN rating)	kVA					
2.	Impedance Voltage	%					
3.	Sound Level As per 'reduced limit' of Appendix AA of AS2374.6	dB(A)					
4.	Overall substation mass Complete with all fittings filled with oil and ready for service	kg					
5.	Does this transformer comply with AS 2374.1.2 (MEPS)	Yes/No					
6.	No Load Loss	kW					
7.	Load Loss	kW					
8.	Calculated MEPS efficiency	%					
9.	Temperature rise limits:						
9.1	Top oil	OC					
9.2	Winding	OC					
10.	Minimum insulation resistance at 20OC (1 kV test after 1 minute) for:						
10.1	HV winding	MΩ					
10.2	LV winding	MΩ					
10.3	Core	MΩ					
11.	Insulating oil (required to fill to correct level at 15°C)	litre					
12.1	Positive Sequence Impedance	$Z_{\square\square R}$ $\square j.X_{\square}$					
12.2	Positive Sequence Impedance	$Z = A(x \text{ deg})$					
13.1	Zero Sequence Impedance	$Z_{\square\square R}$ $\square j.X_{\square}$					
13.2	Zero Sequence Impedance	$Z = A(x \text{ deg})$					



# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



<b>(G) Quality Assurance</b>			
1.	Does the Tenderer have a quality assurance system?	YES/NO	
2.	List the QA Standards that the Tenderer's Quality Assurance System conforms to.  Attach documentation including capability statement.		
3.	Do all local and overseas Subcontractors (if any) have Quality Assurance Systems?	YES/NO	
4.	List all major Subcontractors and  List the QA Standards that the Subcontractors' Quality Assurance Systems conform to.  Attach documentation including capability statement.		
5.	Has the Tenderer attached the documentation requested in Refs 2 and 4 above.	YES/NO	
<b>(H) Traceability</b>			
1.	Sub-components incorporating traceability – for all Tendered main, optional and alternative items - please list:		

NAME OF TENDERER:

ADDRESS OF TENDERER: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ FOR AND ON BEHALF OF TENDERER

DATE: \_\_\_\_\_

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



## 21. Attachment 2 – Additional and Special Requirements

The Tenderer will list here and provide full details and supporting information for each of the Additional and Special Requirements as detailed in Clause 8 and 10.

Ref.	Particulars			Has the Tenderer included full details and information ? Yes / No
<b>Special Requirement</b>				
8.2.13	<b>LV Monitoring Capability Requirement</b>			
		CT Class	CT Ratio	
	315kVA			
	500kVA			
	750kVA			
	1000kVA			
<b>Additional Requirements</b>				
10.1	<b>Maximum Demand Indicator</b>			
10.2	<b>Improved IAC Rating</b>			

NAME OF TENDERER:

ADDRESS OF TENDERER: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ FOR AND ON BEHALF OF TENDERER

DATE: \_\_\_\_\_

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



## 22. Attachment 3 – Risk Assessment

The Tenderer will complete the relevant items (as applicable):

Ref.	Particulars	Response
1.	Has the plant tendered been designed and manufactured in compliance with the Queensland Workplace Health and Safety Plant Code of Practice and can documentary evidence be provided?	
2.	Does the design of substation, and the recommended methods for: Assembly, erection, operation, testing, inspection, maintenance of repairs, comply with the requirements of the Queensland Workplace Health and Safety Plant Code of Practice.	
3.	Has a risk assessment been performed on the plant tendered, which meets the requirements of AS/NZS 4360?	
4.	A copy of the above mentioned risk assessment will be included with the tender.	
5.	<b>Mechanical Design Considerations</b>	
5.1	Is the plant designed to provide fault containment?	
5.2	Is guarding provided for protection from moving parts, sharp edges, hot/cold surfaces, etc?	
5.3	Are AC and DC secondary terminals protected by insulation?	
5.4	Is the plant designed to allow for routine maintenance without encroaching upon electrical approach limits?	
5.5	Is access to the plant necessary above 2.0 metres in height?	
5.6	If yes to 5.6 confirm compliance with the Queensland Workplace Health and Safety Codes of Practice and noted Major Hazards such as Risk Management and Work at Heights respectively.	
5.7	What is the three dimensional clearances required for installation, operation, maintenance and testing of the plant.	
5.8	Indicate if there is any special stability requirements for transportation, installation, operation and maintenance of the plant.	
5.9	Is safe access provided for normal operational conditions?	
6.	<b>Ergonomic Considerations:</b>	
6.1	When designing the plant what ergonomic standards were adopted for the following conditions:	
6.2	(a) Working in confined spaces?	
6.3	(b) Operating forces, eg opening and closing switches?	
6.4	(c) Undesirable posture, eg installing HV cabling?	
6.5	(d) Access to components for installation, operation and maintenance?	

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)

Ref.	Particulars	Response
7.	<b>Manual Handling Considerations:</b>	
7.1	Is special lifting/handling equipment provided/required for individual components with a mass in excess of 15 kg?	
7.2	Is labelling provided on individual components with a mass in excess of 15 kg?	
7.3	Are lifting points/handles provided for individual components with a mass in excess of 15 kg?	
7.4	Are lifting points/handles provided to ensure a balanced lift?	
8.	<b>Hazardous Substance Considerations:</b>	
8.1	What hazardous substances are used/produced (including after failure):	
8.2	Are normal hazardous substance controls compatible with operational requirements?	
8.3	Is a Safety Data Sheet available for all hazardous substances contained within the plant?	
8.4	What are the expected hazardous substance changes/by products associated with the deterioration of a substance?	
8.5	What are the hazards associated with handling hazardous substances after plant failure?	
9.	<b>Environmental Considerations:</b>	
9.1	Does the plant contain components which could cause an environmental hazard should plant failure occur?	
9.2	If yes to 9.1 please list these components	
9.3	Can the tenderer demonstrate that the plant is designed to limit the extent of environmental hazard should plant failure occur?	
9.4.	Do all symbols and labels provided on the plant conform to the requirements of the Queensland Workplace Health and Safety Plant Code of Practice?	
9.5	What hazards, if any, are created should the plant be left in short or long term storage?	
9.6	Indicate if special training, unique for this plant, is required.	
9.7	Has the required EMF information (refer clause 16.2) been provided with the tender?	

NAME OF TENDERER:

ADDRESS OF TENDERER: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ FOR AND ON BEHALF OF TENDERER

DATE: \_\_\_\_\_

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



## 23. Attachment 4– Rating Plate Details for Transformer

Ergon Energy Structured Plant Number (Available from Purchase Order):					
CONTRACT NO	CONTRACT-NO				
MANUFACTURER OF THE TX	MAKE-TX				
TOTAL WEIGHT (KG)	MASS-TOTAL				
MASS OF THE TX CORE (KG)	MASS-TX-CORE				
NUMBER OF PHASES	PHASE-NO				
SERIAL NUMBER	SERIAL_NUMBER				
COOLING FOR TX 1ST RATING	TX-COOLING-1				
TX COPPER LOSSES (KW)	TX-CU-LOSS				
TX HV MAX CURRENT (A)	TX-HV-MAX-A				
TX IRON LOSSES (KW)	TX-IRON-LOSS				
TX LV MAX CURRENT (A)	TX-LV-MAX-A				
1ST RATING OF TX (MVA)	TX-RATING-1				
NUMBER OF TAPS IN TX	TX-TAP-NO				
TAPPING RANGE FOR TX TAP RANGE	TX-TAP-RANGE				
VECTOR GROUP	VECTOR-GROUP				
TOTAL VOLUME OF OIL (L)	VOL-OIL-TOT				
PRIMARY VOLTAGE (KV)	VOLT-PRI-KV				
SECONDARY VOLTAGE (KV)	VOLT-SEC-KV				
YEAR OF MANUFACTURE	YOM				

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



## 24. Attachment 5 – Rating Plate Details for the Ring Main Unit

Ergon Energy Structured Plant Number (Available from Purchase Order):					
AMPS-RATED	RATED CURRENT (A)				
CB-BK-CAP-EQ	CB EQUIVALENT BREAK CAP (KA)				
CB-FAULT-RAT	CB FAULT RATING				
CONTRACT-NO	CONTRACT NO				
INSUL-MEDIUM	INSULATING MEDIUM				
INTER-MEDIUM	INTERUPTING MEDIUM				
LIGHT-IMPULS	LIGHT IMPULSE WITHSTAND (KVP)				
MAKE-CB	MANUFACTURER				
MASS-TOTAL	TOTAL WEIGHT (KG)				
MODEL	MODEL NO				
PRODUCT	PRODUCT				
PROTECT-TYPE	PROTECTION-TYPE				
SERIAL_NUMBER	SERIAL NUMBER				
SF6-QUANTITY	QUANTITY OF SF6 (KG)				
SU-TYPE	SWITCH UNIT TYPE				
VOLT-RATED	RATED VOLTAGE (KV)				
YOM	YEAR OF MANUFACTURE				

SIGNATURE OF TENDERER: \_\_\_\_\_

NAME OF TENDERER:

ADDRESS OF TENDERER: \_\_\_\_\_

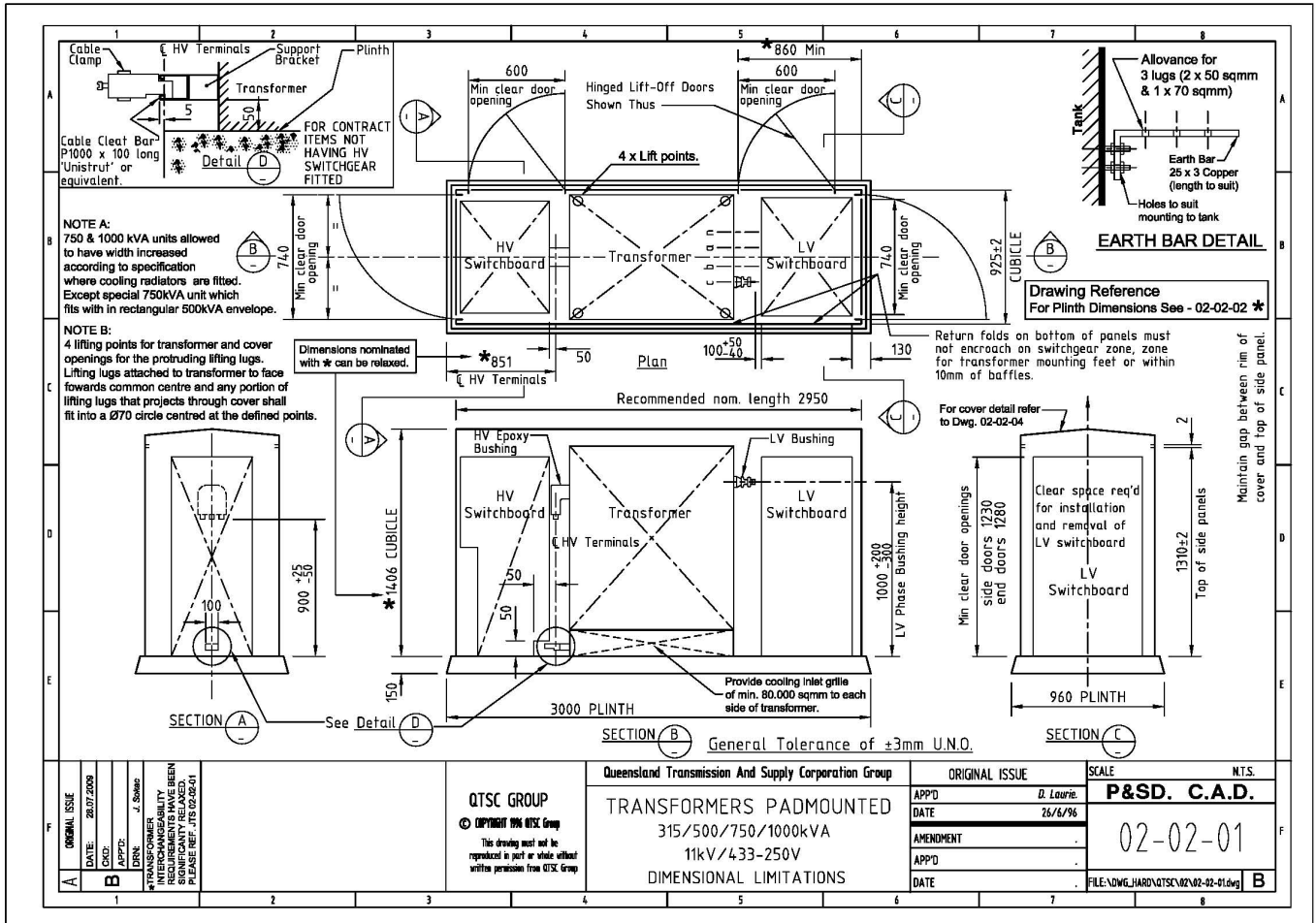
SIGNATURE: \_\_\_\_\_ FOR AND ON BEHALF OF TENDERER

DATE: \_\_\_\_\_

# Technical Specification for 12kV Padmounted Distribution Substations (Rectangular Type)



## 25. Attachment 6- Drawing 02-02-01 B



<b>ORIGINAL ISSUE</b> DATE: 28.07.2009 DCD: J. Sweeny APPD: J. Sweeny DRN: J. Sweeny *TRANSFORMER RELIABILITY REQUIREMENTS HAVE BEEN SIGNIFICANTLY RELAXED. PLEASE REF. JTS02-02-01	<b>DTSC GROUP</b> © COPYRIGHT 1998 DTSC Group This drawing must not be reproduced in part or whole without written permission from DTSC Group	Queensland Transmission And Supply Corporation Group		<b>ORIGINAL ISSUE</b>	<b>SCALE</b>	<b>N.T.S.</b>
		<b>TRANSFORMERS PADMOUNTED</b> 315/500/750/1000kVA 11kV/4.33-250V DIMENSIONAL LIMITATIONS		APPD: D. Laurie DATE: 26/6/96	<b>P&amp;SD. C.A.D.</b>	
				<b>AMENDMENT</b> APPD: DATE:	02-02-01	
					FILE:DWG\HARD\DTSC\02-02-01.dwg	<b>B</b>