



**Ergon Energy Corporation Limited**

# **Technical Specification for 24kV Cable Entry Transformers**

**ETS02-03-02**

# Technical Specification for 24kV Cable Entry Transformers

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# Technical Specification for 24kV Cable Entry Transformers

## 1. Purpose and Scope

This Specification sets out the technical requirements for the design, manufacture, testing at works and delivery of 24 kV cable entry transformers

Item No.	Ergon Energy IIN	Item Description
1	2404650	TRANSFORMER, Distribution, Cable Entry Distribution Transformer with HV Cable Box and LV Bushings, 22 kV/433-250 V, 500kVA, 3 Ph, 50 Hz, ONAN, Technical Specification ETS02-03-02 Item 1
2	2404649	TRANSFORMER, Distribution, Cable Entry Distribution Transformer with HV Cable Box and LV Bushings, 22 kV/433-250 V, 1000kVA, 3 Ph, 50 Hz, ONAN, Technical Specification ETS02-03-02 Item 2
3	2408011	TRANSFORMER, Distribution, Cable Entry Distribution Transformer with HV Cable Box and LV Bushings, 22 kV/433-250 V, 1500kVA, 3 Ph, 50 Hz, ONAN, Technical Specification ETS02-03-02 Item 3
4	TBA	LV cable box with accessories to suit Item 1, 22kV 500 kVA transformer
5	TBA	LV cable box with accessories to suit Item 2, 22kV 1000 kVA transformer
6	TBA	LV cable box with accessories to suit Item 3, 22kV 1500 kVA transformer

Specific requirements for each item are detailed in **Attachment 1**.

All the above items require the provision for remote Low Voltage monitoring functionality as detailed in Technical Specification TS-481 LV Transformer Monitoring Capability Requirements for Pole Top and Ground Type Transformers and as specified in this technical specification. These items will be complete with all ancillary equipment.

## 2. References

### 2.1 Applicable Standards

Transformers shall be designed, manufactured and tested in accordance with the following Australian Standards and all amendments issued prior to the date of closing of tenders except where varied by this Specification.

Standard	Title
AS 1170	Structural design actions
AS 1194	Winding wires – Enamelled round copper winding wires
AS 1767	Insulating oil for transformers and switchgear. <b>Note:</b> additional testing and compliance requirements apply this technical specification
AS 1856	Electroplated coatings - Silver
AS 1940	The storage and handling of flammable and combustible liquids
AS/NZS 2312	Guide to the protection of structural steel against atmospheric corrosion
AS 2374	Power Transformers
AS 2602	Paints for Steel Structures
AS 2700	Colour standards for general purposes
AS 4360	Risk Management

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AS 4398	Insulators – Ceramic and glass – Station post type for indoor and outdoor use – Voltages greater than 1000 V ac
AS 4680	Hot-dipped galvanized coatings on fabricated ferrous articles
AS/NZS ISO 9001	Quality Management Systems
AS 60044.1	Instrument transformers – Current transformers
AS 60076	Power transformers
AS/NZS 60137	Insulated bushings for alternating voltages above 1000 V
AS 60270	High Voltage test techniques – Partial discharge measurements
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS 62103	Electronic equipment for use in power installations

The Tenderer is to prove plant performance to the Purchaser's satisfaction. Should inconsistencies be identified between Standards and/or this specification, the Tenderer/Supplier shall immediately refer such inconsistencies to the Purchaser for resolution.

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 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 specification drawings are associated with this document.

### 3.2 Specification Drawings

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

- A3 889843-01 22 kV Padmounted Substation and Cable Entry Transformers.

### 3.3 Drawings by the Tenderer

**Tenderers shall submit with the offer two (2) copies of each of the following drawings for each of the transformers offered.**

General arrangement drawings will include:

- Centre lines and centre of gravity
- Location of lifting points & any associated lifting equipment required
- An electrical clearance table
- Table showing total mass etc and oil volume
- Overall and other relevant dimensions eg height of LV and HV bushings from the bottom of the transformer.
- HV and LV cable boxes including all accessories
- Details of the rating and terminal marking plates for all transformers.
- Detail of LV monitoring connection box mounting

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Drawings shall be to scale and in accordance with AS 1100. The contract number shall be shown in the title block of all contract drawings.

The successful Tenderers shall submit drawings in accordance with Clause 16 of the specification.

## 4. Service Conditions

The transformers shall be suitable for mounting outdoors on level ground without additional enclosures and shall be designed to comply with AS 1170 and to withstand the service conditions of Clause 1.2 of AS60076.1 with the following additions:

<b>Solar radiation level:</b>	1 100 W/m <sup>2</sup> with high ultra violet content
<b>Precipitation:</b>	Tropical summer storms with high winds, and an annual rainfall in excess of 1 500 mm.
<b>Humidity:</b>	Extended periods of relative humidity in excess of 90%
<b>Pollution:</b>	Areas of coastal salt spray and industrial pollution with equivalent salt deposit densities in the range 2.0 to 3.0 g/m <sup>2</sup> .
<b>Wind velocity:</b>	210 km/hr

Tenderers are to suitably de-rate switchgear installed in the HV and LV compartments to compensate for the increased temperatures inside the cubicle, with allowance for 40°C ambient air temperature and full loading of the transformer.

### 4.1 System Conditions

Each unit shall be suitable for use under the following system conditions.

<b>Highest System Voltage</b>	(kV)	24
<b>Number of phases</b>		3
<b>Impulse Withstand Voltage</b>	(kV peak)	150
<b>Power Frequency Withstand Voltage</b>		50
<b>Nominal System Voltage</b>	(kV)	22
<b>System Earthing</b>		Effectively earthed

## 5. Design and Construction

### 5.1 Fasteners

All bolts (fasteners, etc.) and nuts shall be to Australian Metric Standards. Hot dip galvanised bolts and nuts complete with stainless steel washers under the nut and bolt head shall be used to secure the transformer tank lid, where a bolted lid design is used. All other bolts, nuts and washers shall be stainless steel with the bolts and nuts being of different grades, i.e. 304/316 to assist in preventing binding. "Never seez" or equivalent shall be applied to the threads of all stainless steel bolts. Bolts shall be hexagon head (unless this is impractical and alternative is approved by the Purchaser). The bearing

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surface of all bolt heads and nuts shall be parallel to the surface onto which they tighten. Where necessary, angled washers shall be provided to meet this requirement.

## 5.2 Loading Of Transformers

The transformers shall be suitable for loading in accordance with AS 2374.7. No component of the transformer (for example; bushings, tapping switch) will impose restrictions on the loading capabilities.

Details of any limitations to loading above 'normal cyclic' are to be attached to the Tenderers response to **Attachment 2**.

## 5.3 Transformer Minimum Energy Performance Levels

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.

## 5.4 Transformer Winding Connections

### 5.4.1 General

All transformers shall have electrically separate high voltage and low voltage windings. Winding connections shall be in accordance with AS 60076.1 and shall conform to vector group Dyn11.

## 5.5 Transformer Tapping Arrangements

5.5.1 Each transformer shall be capable of off-circuit tap changing by means of an externally operated switch. The tapping switch shall be located near the top of the transformer for ease of access and to readily facilitate unloading of the transformer.

The tapping switch shall be located near the top of the transformer for ease of access and to readily facilitate unloading of the transformer. A suitable vandal proof pad lockable enclosure shall be provided for the tap switch.

5.5.2 Seven tappings shall be provided on the high voltage winding. The principal tapping shall correspond to rated voltage. The tapping range for each applicable rating shall be as detailed in **Attachment 1 - "Specific Requirements"** with step voltages of 2.5%.

5.5.3 The tapping selector switch shall be capable of being locked in to each of the seven positions. The locking arrangement shall be such that it is not possible to lock the switch between taps. A seven position tap switch shall be provided. However, if a tap selector switch with more than seven positions (via extra undefined positions) is used, it shall be provided with stop pins (or similar) to prevent tap rotation into non-tap positions. Stop pins shall be of the permanently fixed type i.e. bolts, etc. shall not be used.



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

5.5.5 Tap position No. 1 shall correspond to the full winding in circuit.

5.5.6 The tap position selector switch shall be manufactured in such a way that it may be assembled only in the correct manner, not 180° out of adjustment. This shall be done so no inadvertent open or short circuit can occur due to incorrect assembly following out of tank repair/inspection.

5.5.7 A sealing gland shall 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.

## 5.6 Sound Level

The design and construction of each transformer shall be such that the sound level, measured in accordance with AS/NZS 60076.10, shall be no greater than the 'standard limit' as per figure A1 - Sound power levels, in Annexure ZA.

## 5.7 Impedance Voltage Of The Transformer

The impedance voltage at rated current on principal tapping shall be as specified in **Attachment 1 - Specific Requirements**.

## 5.8 Cooling Of The Transformer

5.8.1 The method of cooling each transformer shall be ONAN.

5.8.2 Each transformer shall be supplied with standard mineral insulating oil that meets the requirements of AS 1767. The oil shall be new, supplied direct from the oil refinery and its bulk delivery shall be certified to contain less than 1 ppm of PCBs. The Supplier shall follow approved quality procedures to ensure that the oil cannot be contaminated while under their control. **The Tenderer shall supply full identification of the oil offered.**

5.8.3 Details of the oil offered are to be submitted with the Tender.

## 5.9 Drying Out and Oil Filling of the Transformer Before Delivery

The transformers shall be thoroughly dried out at the manufacturer's works and shall be delivered filled with oil to the correct level and ready for service. All transformers shall be vacuum filled. The degree of vacuum applied to the production units shall be identical to that applied to the units which are type tested. The moisture content of the oil shall be less than 25 ppm at time of filling.

## 5.10 Radio and Television Interference

The design and construction of each transformer shall be such that it will not cause unacceptable radio or television interference.

## 5.11 Transformer Hv Terminals

The position of the HV terminals shall be in accordance with the requirements of **Drawing No. A3 889843-01**.

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Transformers shall be provided with bushing wells and bushing plug inserts (Elastimold catalogue K1601 PC-S1 / K1501A1 or equivalent) suitable for connecting the incoming transformer cables using Elastimold deadbreak elbows type 156LR-WX.

5.11.1 The taught string metal to metal clearance of the bushing external terminals shall not be less than 330mm phase to phase and 280mm phase to earth.

5.11.2 A cable cleat bar manufactured from P3300x200 long 'Unistrut' or equivalent shall be fitted to the tank of all items and positioned appropriately to support the incoming cable.

## 5.12 Weatherproof Cover For Hv Terminals

5.12.1 The transformers shall be fitted with a removable weatherproof cover over HV terminals to suit the deadbreak elbows specified in Clause 5.11.2.

5.12.2 The cover shall be manufactured from steel and have a bottom opening for cable entry and be reversible, without requiring modification. Lifting handles shall be provided for ease of installation and removal. The protective coating and colour shall be similar to that of the transformer. The cover shall be bonded to the transformer tank.

5.12.3 All necessary fasteners for attachment of the cover to the transformer shall be included.

5.12.4 A dimensioned drawing of the proposed cover shall be included with the Tender.

## 5.13 Transformer Lv Terminals

5.13.1 The transformer LV phase terminals shall be mounted such that Electric and Magnetic Fields associated with the equipment are minimised. The terminal palms shall be in a vertical configuration. The terminals shall be spaced to allow a bushing mounted current transformer to be fitted to each phase. With current transformers fitted over the bushings, it is required that there shall be a clear space between current transformers of 45 (+20, -5) mm. That part of the bushing within the tank shall be readily accessible with the tank cover removed.

5.13.2 The LV bushings shall be designed and manufactured taking into account the specified transformer ratings and environmental conditions. Suitable allowance shall be made for the overload duty of the transformers. Bushing stems, nuts and washers made of steel are unacceptable. For all transformer, the terminal palm shall be drilled with 16mm for 1 hole palms and 13mm for 2 hole palms. The minimum external taut string metal to metal clearances shall be 100mm phase to phase and 60mm phase to earth.

5.13.3 The LV bushings shall comply with the relevant requirements of AS 1265. All porcelain components shall be glazed in a silver grey colour N42 to AS 2700 and fully vitrified.

5.13.4 The part of each LV bushing within the tank shall be completely covered with oil when the transformer is cold with an outside temperature of 15°C.

5.13.5 The neutral on the LV side of the transformer shall be brought out unearthed and insulated in a similar manner to the phase terminals.

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## 5.14 Lv Cable Box

- 5.14.1 Air insulated cable boxes suitable for fitment over the LV bushings utilising the mounting studs described in Clause 5.15.3.8 below shall be provided for all transformers ratings as additional items.
- 5.14.2 The cable box shall maintain the clearances given in Clause 5.13.5 and have a detachable undrilled aluminium or stainless steel gland plate.
- 5.14.3 The cable box shall be supplied complete with all necessary accessories, supports and flexible connections suitable for termination of single or multiple 300mm<sup>2</sup> Copper or Aluminium cables as required. Additionally a 'unistrut' or equivalent type cable support bracket to accommodate up to 4 x 300mm<sup>2</sup> cables per phases and 2 x 300mm<sup>2</sup> cables for the neutral shall be provided. The bracket shall be suitable for attachment to the mounting lugs provided on the tank (clause 5.15.3.8) and shall be clear of the transformer cooling fins. All necessary nuts, bolts, etc for the mounting of the bracket shall be provided. The bracket design and attachment shall be to the Purchaser's satisfaction.
- 5.14.4 The Purchaser prefers that Low Voltage cable box dimensions/designs be equivalent and interchangeable, while meeting all minimum statutory clearance requirements, for any designs of cable entry transformers where the Tenderer produces ranges of 11 kV, 22 kV and 33 kV ground mounted distribution transformers. The protective coating and colour shall be similar to that of the transformer.

**Note:** The mounting arrangement of the CT support brackets may need to be varied, depending upon the cable box supplied.

- 5.14.5 Detail drawings of the cable boxes offered, including a list of accessories such as supports and flexible connections (expansion joints), shall be submitted with the Tender.

## 5.15 Transformer Construction

### 5.15.1 General

- 5.15.1.1 The transformers shall be of robust construction and shall be capable of being transported, installed, removed or dismantled for repair by accepted methods without damage. The capability of being transported must be interpreted in Australian context regarding the distances and state of the roads.
- 5.15.1.2 Transformers shall be of the sealed tank construction type.
- 5.15.1.3 Sealed transformers shall be in accordance with AS 60076.1, Clause 8.2, but not pressurised, nor incorporate gases other than air. Diaphragm sealing is not acceptable.

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## 5.15.2 Core and Windings

- 5.15.2.1 Tenderers may offer transformers with either copper or aluminium windings.
- 5.15.2.2 HV connection to the tapping switch shall be by means of bolted or crimped connections. Spade type connectors are not acceptable.
- 5.15.2.3 The core and winding assembly shall be supported by the main tank and not by the cover.
- 5.15.2.4 Means shall 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.
- 5.15.2.5 The core and all metalwork shall be electrically bonded to the tank. The bonding of 3 phase core/cores shall be brought to one point only.
- 5.15.2.6 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.

## 5.15.3 Tanks and Lids

- 5.15.3.1 All surfaces shall be sloped to prevent the accumulation of water.
- 5.15.3.2 On the external areas of the tank, welding of horizontal and vertical joints shall be on both sides of the joint. Welding in all cases shall be continuous.
- 5.15.3.3
- 5.15.3.4 All seams shall be electrically welded and they shall be oil tight.
- 5.15.3.5 All metal work shall be electrically bonded to the tank to permit earthing by the Purchaser. If a part cannot be adequately bonded it shall be constructed from a suitable insulating material instead of metal.
- 5.15.3.6 The tanks shall be so designed that with a top oil temperature of 105°C, the oil level in the tank will be below the tank lid flange.
- 5.15.3.7 The tanks shall be designed to withstand without permanent distortion at least the internal pressure due to maximum permissible overload. This pressure may be calculated from temperature/ volume change of expansion space while neglecting flexing of walls or it may be established experimentally, at Contractor's preference.
- 5.15.3.8 The tank lids shall, be capable of supporting up to 100 kg of a person's weight without permanent deformation.
- 5.15.3.9 The cover of each tank shall be bolted or clamped using suitable gaskets and surfaces to achieve a seal which prevents moisture ingress, oil leaks and the exchange of air between the inside of the tank and the external atmosphere.
- 5.15.3.10 The tank shall incorporate all mounting studs necessary for the fitment of an LV cable box. It will also incorporate two mounting lugs located approx. 450mm above ground level for attachment of the LV cable support bracket. (Refer clause 5.14.1).

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## 5.15.4 Joints and Gaskets

- 5.15.4.1 All joints shall be oil tight. Holes shall not be punched through dovetail joints in gaskets.
- 5.15.4.2 Gaskets shall be manufactured from synthetic rubber or a synthetic and cork composition which is resistant to both corona discharge and transformer oil (including additives if applicable). Gaskets exposed to UV radiation shall be UV stabilised oil resisting synthetic rubber or a synthetic rubber and cork composition. All gasket seals should last the intended life of the transformer.

## 5.16 Transformer Fittings

Transformers shall be supplied with fittings as detailed below:

### 5.16.1 Rating and Terminal Marking Plates

- 5.16.1.1 The rating/terminal marking plates shall be in accordance with Clause 7 and Appendix ZB of AS60076.1 and shall include a Voltage Vector Diagram. In addition it shall state:
  - That the transformer is 'sealed'
  - Temperature rises (even though normal values apply)
  - Type of insulating oil (mineral oil/environmentally friendly insulating fluid)
  - Impedance on principal tap only
  - Statement that the transformer complies with AS2374.1.2
  - Total mass and the separate masses of transformer, cubicle, plinth, switchgear and "untanking mass".
- 5.16.1.2 All quantities on the rating and terminal marking plates shall be stated in metric units.
- 5.16.1.3 The Contract No. and the Purchaser's structured plant number (SPN) shall be shown on the plate or on a separate tag permanently attached in close proximity to rating/terminal marking plate. 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).
- 5.16.1.4 The rating and terminal marking plates shall be located on the side of the transformer near the tapping switch in a position that can be easily and safely read when the transformer is in service.
- 5.16.1.5 The rating and diagram plates shall be manufactured from either brass, brass alloy or stainless steel with the lettering etched or otherwise formed in relief and coloured black (except for values which vary from nameplate to nameplate) such that the lettering is in sharp contrast with the background.
- 5.16.1.6 The terminal marking plate shall show a diagram of windings and internal connections, a legend (where applicable) stating which tappings are connected at each of the seven tapping selector switch positions as well as a voltage vector diagram.

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## 5.16.2 Lifting Installation and Transport Facilities

5.16.2.1 Fully rated lifting and hold down points will be provided on the transformer to facilitate the hoisting and holding down during transport and these shall be clearly marked with a permanent label or stencilled.

Two lifting lugs marked "Transformer Lifting Point" with a minimum hole diameter of 28 mm will be provided, suitable for lifting the transformer. These lugs will be positioned to allow centre lifting and cater for a maximum included angle for slings of 120°. They 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.

All parts of the transformer which must be removed for inspection or repair shall be fitted with lifting facilities suitable for use with slings and shackles. For the main tank cover, at least two Grade 304 stainless steel lifting lugs with M24 holes (minimum) marked "Cover Lifting Points" shall be provided.

5.16.2.2 Transformers shall be fitted with wheels that enable them to be moved forwards, backwards and sideways. Jacking points shall be provided to facilitate changing the direction of the wheels. The wheelbase and wheel height shall be such that the transformer may be rolled from one level surface to another 530 mm higher, using a ramp 4 m long, without any portion of the transformer fouling. Towing holes shall be located on the frame such that it is possible to connect a cable to winch the transformer along. The wheels shall be suitable for running in 152 mm x 76 mm channels.

## 5.16.3 Oil Level Indicator

A clear glass oil level indicator is required on all transformers and shall be of the flush type and fitted to a perfectly flat surface. It shall be of sufficient length to show the oil level over the designed operating temperature range of the transformer. The correct oil level at 15°C shall be clearly and indelibly marked on the gauge. A rigid metal frame shall surround and adequately support the glass and gasket so as to prevent oil leaks. Gauges using material other than glass shall not be accepted unless the Tenderer can demonstrate that they will not be cracked, blurred or distorted by aging over a 25 year period. The oil level indicator shall be positioned to allow easy inspection.

## 5.16.4 Thermometer Pocket

A thermometer pocket is not required.

## 5.16.5 Oil Draining

An oil drain valve is required on 1000kVA transformers only.

The drain valve shall have a 25 mm BSP internal thread fitted with a flanged plug and shall be of the metallic sealing gate type. The valve shall 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 shall be located in a position easily accessible through an open door. The actual valve location shall be to the satisfaction of the Purchaser.

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## 5.16.6 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,

Gaskets or thread sealing shall be used to prevent water drops being inhaled into the transformer.

## 5.16.7 Transformer Earthing Connections

A lug shall be provided at each corner of the transformer tank, suitable for connection to a 70mm<sup>2</sup> cable. M12 stainless steel bolts, nuts and washers shall be used for connections to both the transformer tank and the substation earth bar. In addition an earth stud shall also be provided adjacent to the HV bushings to facilitate earthing of the HV cable screens.

## 5.16.8 Marking of Transformer Terminals

The appropriate designating letter assigned to the windings and tappings in accordance with AS 60076.1 shall be permanently marked on the tank adjacent to the respective terminals. The use of adhesives to attach marking plates will not be accepted. The markings shall be accompanied by stencilled letters on the tank adjacent to the stamped letters. Each letter shall be black, 30 mm high and have a body width of not less than 6 mm.

## 5.16.9 Tank Marking

The transformer capacity, the Purchaser's identification number and the structured plant number shall be stencilled in black on the tank where it can be easily seen. Each character shall be 75 mm high and have a body width of not less than 12 mm.

## 5.16.10 HV Cable Support

A Unistrut P3300 cable support bracket shall be provided mounted on the transformer tank approximately 600mm below the transformer HV terminals.

## 5.17 Protective Coatings

5.17.1 The Purchaser requires all internal and external surfaces to be treated with a coating which provides protection against corrosion induced by water, salt laden atmosphere and low levels of industrial pollutants.

5.17.2 As the estimated service life of the transformer is 35 years, the Purchaser requires a coating system to provide "Long term" durability as defined in Clause 1.6 of AS2312 for structural steel. Metallic components other than structural steel shall be provided with a coating system having performance equivalent to or superior to that stated above.

5.17.3 Finished coatings shall be oil resistant, heat resistant and non-corrosive.

5.17.4 Exterior coatings shall be suitable for use in an Atmospheric Corrosivity Category E-M environment as defined in Clause 2.3 of AS 2312.

The resulting surface coating inside the transformer tank shall not react with insulating oil.

# Technical Specification for 24kV Cable Entry Transformers

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5.17.5 The external surface of transformer shall be rivergum G62 to AS 2700.

5.17.6 All coatings (except the interior surface of the transformer) shall be capable of being maintained on-site.

5.17.7 The materials used and method of application shall be suitable for the base metal to be coated, shall be supplied by a reputable manufacturer and shall be applied in accordance with the recommendations for this particular application.

5.17.8 The Tenderer shall provide evidence supporting the performance of the offered coating under the conditions defined above including details of all tests performed in accordance with AS 1580.

Details are to be attached to the Tenderers response to **Attachment 2**.

The successful Tenderer shall provide details on the method of protective coating repair to allow the Purchaser to carry out field maintenance. **(NOTE: Maintenance would not be scheduled for at least ten (10) years.)**

Details are to be attached to the Tenderers response to **Attachment 2**.

## 5.18 Options

The Purchaser may require the following option on all or some of the transformers.

### 5.18.1 Distribution Transformer Low Voltage (LV) Monitoring Capability Requirements

Please refer to requirements in Technical Specification TS-481 LV Transformer Monitoring Capability Requirements for Pole Top and Ground Type Transformers.

The above LV Monitoring sub-system requirements are in lieu of Panel-Mount style, Analogue Maximum Demand Indicator requirements.

On all Items the following provisions shall be made in accordance with TS-481.

- Extended range Current Transformers (CTs). CTs to allow for the Emergency Cyclic Rating of Distribution Transformer kV.A rating as per AS 2374.7. (Refer to Section 2 of TS-481).
- A connection box and associated components shall be provided in accordance with the requirements of TS-481 Section 3. The position of the connection box must be to the Purchaser's requirements.

**The Tenderer shall provide full details of equipment offered. Attachments 1 and 2 of TS-481 are to be completed and accompany the Tender document.**

## 5.19 Comparison of Tenders

5.19.1 Guaranteed load and no-load loss figures are to be specified in **Attachment "1"** and also relate to any and all corresponding optional and or alternative items to **Attachment "1"** items.

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



# Technical Specification for 24kV Cable Entry Transformers

5.19.3 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" and also relate to any and all corresponding optional and or alternative items to Attachment "1" items. 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.**

5.19.4 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.

## 6. Performance and Testing

### 6.1 Type Tests on Each Design

The following type tests are required on each design:

No.	TRANSFORMER	AS / CLAUSE NO.
1.	Temperature Rise Test The test of temperature rise shall be carried out with the transformer mounted inside the fully assembled closed cubicle.	AS 2374.2-Clause 5
2.	Impulse-Voltage Withstand Test	AS/NZS 60076.3-Clause 13
3.	Impulse-Voltage Withstand Test including Chopped Wave Test	AS/NZS 60076.3-Clause 14
4.	Sound Level Tests	AS/NZS 60076.1.10
5.	Short Circuit Tests	AS 2374.5

### 6.2 Routine Tests on Each Transformer

The following tests, as specified in the following standards, or elsewhere in the specification, shall be carried out on applicable components if fitted:

No.	TRANSFORMER	AS 60076/AS 2374 CLAUSE NO.
1.	Measurement of Winding Resistance	Part 1 - Clause 10.2
2.	Ratio and Phase Relationship Checks	Part 1 - Clause 10.3
3.	Impedance Voltage, Short Circuit Impedance and Load Losses	Part 1 - Clause 10.4
4.	No-Load Loss and Currents	Part 1 - Clause 10.5
5.	Induced Over-Voltage Withstand	Part 3 - Clause 12

# Technical Specification for 24kV Cable Entry Transformers



6.	Separate - Source Voltage Withstand	Part 3 - Clause 11
7.	Insulation Resistance	Part 3 - Clause 16
8.	Pressure Test on Sealed Transformers	Clause 6.9 of specification

## 6.3 Prototype Units

Type tests shall be performed on a single prototype unit of each transformer rating (for each style if different designs used) **which shall be identical to the production units in all respects relating to materials, design and manufacture.** As such, Tenderers shall guarantee that the prototype units will not undergo any process or treatment which the remaining transformers purchased on the contract would not undergo. All type testing costs shall be included in the tender prices for the transformers. Additional separate costs for prototype testing shall not be accepted.

Where applicable (e.g. temperature rise tests) the prototype units of each rating/style shall be complete units, including a LV switchboard, a HV RMU and cubicle.

Tenderers shall advise the period of time required to develop to production stage the prototype unit of each rating, in calendar weeks from initial advice of tender acceptance. The Purchaser shall take into account the periods quoted in the evaluation of the tender.

Where units are offered of an identical design to previously type tested units, such type tests will be accepted by the Purchaser. However, if a unit was type tested in a different tank, a repeat temperature rise and impulse test is required. Tenderers shall provide sufficient evidence to the satisfaction of the Purchaser that previous type tests are applicable to designs offered. The acceptance of previous type test results will be solely at the Purchaser's discretion, based on the evidence supporting the previous type tests conducted.

## 6.4 Repeat Type Tests

As type tests are to be performed on prototype units, any modification required as a result of a type test failure or change of design instigated by the Supplier or change of design to comply with the specification which could affect the results of earlier type tests shall require a repeat of such earlier type tests. Any repeat type tests to provide compliance with the Standard's requirements shall be to the Supplier's cost.

## 6.5 Temperature Rise Type Test

The transformers to undergo the temperature rise test shall be the fully assembled prototype units, including LV and HV switchgear. Extrapolations of temperature rise for guaranteed load and no-load losses shall be incorporated in the test report to verify conformance. During the test, additional means of sealing such as overtensioning of bolts shall not be carried-out. Also, tap switch operation shall be free, i.e. not overtightened during the test. Oil leaks during temperature rise tests would constitute failure of the unit.

## 6.6 Overload Temperature Rise Type Test

Tenderers are required to conduct a temperature rise test on the same unit which underwent the temperature rise type test of Clause 6.5 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. The results of this test shall be incorporated in the test reports for temperature rise. During the overload test, the LV switchgear assembly shall be fitted with 400 A fuses to the 400 A fuse switches, 630 A fuses to the 630 A fuse switch and 2 X 800A fuses to the 1260A fuse switch. All load terminals of the assembly shall be short circuited allowing overload currents to flow (1.45

# Technical Specification for 24kV Cable Entry Transformers

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times txf normal rated load). Record temperatures of 'a' phase load contact on each fuse switch. Tenderers shall state in the schedules the designed top oil/winding temperature rise for this condition. Oil leaks during temperature rise tests would constitute failure of the test.

## 6.7 Short Circuit Type Tests

A short-circuit test in accordance with AS 2374, Part 5 shall be carried out on transformers. Should a unit fail test, subsequent tests to provide compliance with the Standard's requirements shall be to the supplier's costs. If required by the Purchaser, a visual inspection of the unit on return shall be conducted in the presence of the Purchaser's representative.

## 6.8 Routine Pressure Tests

To prove the sealed transformers are adequately sealed, the following routine test shall be required on each fully assembled transformer.

Establish and monitor internal transformer pressure. The test pressure shall equal the maximum pressure stated on the rating plate.

If, after 30 minutes, the pressure has not dropped more than 2 kPa, the transformer will be considered to have passed the test.

Ambient temperature variation shall be within  $\pm 2^{\circ}\text{C}$ .

## 6.9 Partial Discharge Tests

All insulation composed of synthetic material shall be subject to tests for the measurement of partial discharge in accordance with the provision of AS 60270. Such tests shall demonstrate that the insulation is free of discharges of magnitude greater than 20 pC, when subjected to a test voltage of 15 kV. Reports of these tests shall be supplied with test reports of other routine tests. Where the synthetic material insulation has a long history of proven performance, the Purchaser may consider accepting batch testing providing sufficient data is forwarded to support the claims made about the material.

## 6.10 Current Transformer Type Tests

Type tests shall be conducted in accordance with AS 60044.1. Tests shall be carried out on current transformers of identical design to those offered and the test certificate shall be supplied with the Tender.

Details are to be attached to the Tenderers response.

## 6.11 Batch Tests

6.11.1 All conductors shall have been inspected and tested in accordance with AS 1194.

6.11.2 The dielectric strength of oil shall be tested in accordance with AS 1767.

## 6.12 Porosity Tests

Porosity tests shall be carried out by the Supplier or their subcontractor for porcelain components in accordance with the requirements of Clause 5.6 of AS 4398, Part 2.

# Technical Specification for 24kV Cable Entry Transformers

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## 6.13 Acceptance Tests

The Purchaser reserves the right to repeat any or all tests (subject to AS 2374 and AS 60076 provisions) during its acceptance test stage.

## 6.14 Witnessing of Tests

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

6.14.2 The Supplier shall give the Purchaser not less than one weeks notice (local)/two weeks (interstate) of when each and every type test will be carried out.

## 6.15 Test Certificates

6.15.1 Two certified copies of all test results shall be supplied to the Purchaser.

One copy of the appropriate test results including work sheets which provide enough information to repeat calculations shall accompany each transformer delivered to the Purchaser. The other copy shall be forwarded by electronic mail to [inventory.nameplatedata@ergon.com.au](mailto:inventory.nameplatedata@ergon.com.au), along with the completed **Attachment 6** returned as a MS excel document.

6.15.2 Payment of the contract value shall not become due and payable unless and until the certified test results showing that the plant complies with the specification and that the manufacturer's guarantees are within the tolerances specified, have been received by the Purchaser.

6.15.3 All test certificates shall state the manufacturer's serial number, the corresponding Purchaser's structured plant number, the order number, contract number, item number and guaranteed losses.

## 7. Risk Assessment

### 7.1 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)

### 7.2 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. 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.

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## 7.3 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.

## 8. Quality Assurance

### 8.1 Documentary Evidence

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

## 9. Samples

### 9.1 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.

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

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

## 10. Packaging and Marking

### 10.1 General

### 10.2 Method of Preservation And Packaging

The packaging of the transformers by the suppliers must ensure that they are capable of being delivered undamaged giving due consideration to the quantity, distance of transportation and the preferred method of handling at each location.

### 10.3 Marking of Goods for Delivery

Delivery documents accompanying transformers to be delivered shall contain the following information:

- The Purchaser's Contract number
- The Purchaser's Order number against which the plant is being supplied.
- Item description
- Quantity

# Technical Specification for 24kV Cable Entry Transformers

This information will be provided to the Supplier on each order issued by the Purchaser on the contract.

## 11. Service Performance

Tenderers shall 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.

## 12. Reliability

### 12.1 Service Life

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

### 12.2 Evidence in Support of Reliability

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

## 13. Training

### 13.1 Training Material

The successful Tenderer is required to provide training material in the form of manuals to the Purchaser's requirements.

### 13.2 Detailed Installation, Operation and Maintenance Manuals

Within ten (10) weeks of placing of the order, the successful tenderer shall supply to the Purchaser two (2) copies of a detailed installation, operation and maintenance manual incorporating the following information:

- 13.2.1 A complete winding specification to the satisfaction of the Purchaser which will enable repairs to be carried out.
- 13.2.2 A detailed list of all component parts including manufacturers part numbers.
- 13.2.3 One copy of each of the drawings called for in Clause 16.
- 13.2.4 A detailed maintenance section which is designed to achieve the expected asset life; including reference to:
  - a) Repair procedures for surface coatings
  - b) Special precautions during disassembly and reassembly (including bushings)

# Technical Specification for 24kV Cable Entry Transformers

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- c) Relevant special requirements for reassembly (e.g. nut/bolt tensions, crimp connections, welding, etc.)
- d) Handling
- e) Disposal at end of service life.

## 14. 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.

## 15. Information to be Provided

### 15.1 Specific Technical Requirements

**Attachment 2** is a schedule of the technical details Tenderers are required to complete and return with their tender. Successful Tenderers may be asked to provide, on completion of prototype testing, additional information per Part "B" - Plant Details of **Attachment 2**.

### 15.2 Tenderers shall submit with the offer two (2) copies of drawings specified in Clause 3.2.

### 15.3 Checklist of Supporting Documentation

Additionally, information specified in this document as required to be submitted with the tender, including but not limited to:

- **Attachment 1** - Options.
- **Attachment 4** – Risk Assessment
- **Attachment 5** – Technical Documentation Checklist
- **Attachment 3** - Options
- Reliability, Environmental Considerations & Service History

Tenderers are required to complete the above Attachments and return them with their tender.

### 15.4 Documentation to be Supplied during the Course of the Contract

Within six (6) weeks of the placing of the order, the successful tenderer shall supply three (3) copies of the following:

#### 15.4.1 A dimensioned outline drawing for each rating of transformer with:

- (a) Centre-lines and centres of gravity
- (b) An electrical clearance table
- (c) Overall dimensions

#### 15.4.2 A drawing showing the rating and terminal marking plates for each rating of transformer (may be incorporated in the outline drawing).

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- 15.4.3 A comprehensive set of cable box detail drawings and cable installation instructions shall be provided giving full details, where applicable, of:
- (a) Cable lug disposition within the box,
  - (b) Additional cable connection insulation requirements,
  - (c) Minimum air clearances.
- 15.4.4 The Purchaser will approve only drawings or sections thereof which relate directly to integration with the Purchaser's supplied equipment.
- 15.4.5 Drawings shall be to scale and in accordance with AS 1100. The contract number shall be shown in the title block of all contract drawings.
- 15.4.6 The supplier shall amend the drawings as directed and resubmit them for approval within fourteen (14) days.)
- 15.4.7 An inspection and test plan for transformers shall be provided and the Purchaser's comments (if any) shall be incorporated prior to manufacturing the prototypes for each unit.

## 16. Quality of Drawings

### 16.1 Drawing Title Block

16.1.1 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.

16.1.2 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. C /**  
**PLANT SPECIFIC e.g. 24kV CABLE ENTRY TRANSFORMERS**  
**MANUFACTURE TYPE e.g. 11000/433V 500 kV.A**  
**DRAWING FUNCTION e.g. GENERAL ARRANGEMENT**

### 16.2 Drawing Revisions

16.2.1 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'.

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".

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.

16.2.2 The revision block for each revision will 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.



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## 16.3 Drawings in Electronic Format

16.3.1 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 24kV Cable Entry Transformers



## 17. Attachment 1 – Specific Requirements

### THE FOLLOWING TABLES DETAIL SPECIFIC DESIGN AND PERFORMANCE CRITERIA FOR ITEMS COVERED BY THIS SPECIFICATION

This part of the specification sets out the technical requirements for items using (A) General Descriptions; and (B) Detailed Requirements in Table Format.

#### (A) General Descriptions

Item No.	ERGON ENERGY IIN	Item Description
1	2404650	TRANSFORMER, Distribution, Cable Entry Distribution Transformer with HV Cable Box and LV Bushings, 22 kV/433-250 V, 500kVA, 3 Ph, 50 Hz, ONAN, Technical Specification ETS02-03-02 Item 1
2	2404649	TRANSFORMER, Distribution, Cable Entry Distribution Transformer with HV Cable Box and LV Bushings, 22 kV/433-250 V, 1000kVA, 3 Ph, 50 Hz, ONAN, Technical Specification ETS02-03-02 Item 2
3	2408011	TRANSFORMER, Distribution, Cable Entry Distribution Transformer with HV Cable Box and LV Bushings, 22 kV/433-250 V, 1500kVA, 3 Ph, 50 Hz, ONAN, Technical Specification ETS02-03-02 Item 3
4	TBA	LV cable box with accessories to suit Item 1, 22kV 500 kVA transformer
5	TBA	LV cable box with accessories to suit Item 2, 22kV 1000 kVA transformer
6	TBA	LV cable box with accessories to suit Item 3, 22kV 1500 kVA transformer

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## (B) (1) DETAILED REQUIREMENTS - TRANSFORMER

REF.	PARTICULARS	UNITS	ITEMS 1	ITEMS 2	ITEM 3
1.	Rated power	kV.A	500	1000	1500
2.	Number of phases		3		
3.	Rated frequency	Hz	50		
4.	Rated voltage ratio	V	22000/433		
5.	Vector group		Dyn11		
6.	Method of cooling		ONAN		
7.	Type of transformer		Sealed		
8.	Insulation level				
8.1	HV winding impulse voltage withstand	kV peak	150		
8.2	Power frequency voltage withstand	kV rms	50		
8.3	Power frequency voltage withstand of LV winding	kV rms	10		
9.	Impedance voltage at rated current on principle tapping	%	4.0	5.0	6.25
10.	Tapping range		0 ± 2½% ± 5% + 7½% + 10%		
11.	HV bushings		Bushing wells and plug inserts (Elastimold cat.K1601 PC-S1/K1501A1 or equivalent) suitable for use with Elastimold non-load break elbows K156LR-WX		
12.	LV bushings – Current rating of stem and terminal palms	A	To suit specified ratings including overload requirements of transformers		
13.	Mean sound power level	dB(A)	61.5	65.7	77
15.	Clearance in air (minimum)				
15.1	LV phase-to-phase	mm	100		
15.2	LV phase-to-earth (and neutral)	mm	60		

## (B) (2) DETAILED REQUIREMENTS LV CURRENT TRANSFORMERS

Refer TS-481

## (B) (3) DETAILED REQUIREMENTS CONNECTION BOX DETAILS

Refer TS-481

# Technical Specification for 24kV Cable Entry Transformers



## 18. Attachment 2 – Technical Details to be provided by Tenderers

THE FOLLOWING TABLES DETAIL PARAMETERS TO BE PROVIDED BY THE TENDERER FOR ALL ITEMS COVERED BY THIS SPECIFICATION

**(A) GUARANTEED PERFORMANCE  
(1) IN RELATION TO ATTACHMENT 1**

REF.	ITEM NO.	DO THE TRANSFORMERS CONFORM TO ALL THE SPECIFIED CRITERIA LISTED IN ATTACHMENT 1	
		YES/NO	IF "NO" THEN STATE ALL NON-CONFORMANCES
1.	1.		
	2.		
	3		
	4		
	5		
	6		

**(A) GUARANTEED PERFORMANCE  
(2) FOR TRANSFORMERS**

REF	PARTICULARS	UNITS	ITEM 1 (500kVA)	ITEM 2 (1000kVA)	ITEM 3 (1500kVA)
1	Losses on principal tap at 75°C:				
1.1	Load	W			
1.2	No Load	W			
1.3	Efficiency at 50% load	%			
2.	Temperature rise limits during overload condition				
2.1	Top oil	°C			
2.2	Winding	°C			
3.	Ability to withstand short circuit				
3.1	Symmetrical short circuit current withstand capacity	p.u			
3.2	Duration of the symmetrical short circuit current	s			
3.3	Hot spot winding temperature rise at the end of withstand period	°C			
3.4	Number of terminal				

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REF	PARTICULARS	UNITS	ITEM 1 (500kVA)	ITEM 2 (1000kVA)	ITEM 3 (1500kVA)
	short-circuits which the transformer will withstand without permanent winding deformation				
3.5	Permissible variation in short circuit impedance between phases	%			
4.	Minimum insulation resistance at 20°C (1 kV test after 1 minute) for				
4.1	HV winding	M ohms			
4.2	LV winding	M ohms			
4.3	Core	M ohms			
5.	Continuous permissible overvoltage at any tap	%			
6.	Method of oil filling adopted				

**(A) GUARANTEED PERFORMANCE  
(3) FOR THE LOW VOLTAGE CURRENT TRANSFORMERS**

Please complete and return Attachment 1 of TS-481.

**(A) GUARANTEED PERFORMANCE  
(4) FOR THE CONNECTION BOX ENCLOSURE**

Please complete and return Attachment 2 of TS-481.

**(A) GUARANTEED PERFORMANCE  
(5) GENERAL**

REF	PARTICULARS	UNITS	ALL ITEMS
1.0	Protective coating (all particulars to be submitted with tender documents)		
1.1	Paint Reference number per AS 2312		
1.2	Minimum total thickness of protective coating to steel components	mm	
2.	Are details of the protective coating included with tender documentation?	YES/NO	
3.	Are typical General Arrangement drawings included with tender documentation?	YES/NO	
4.	Is warranty for the protective coating included with tender documentation?	YES/NO	

# Technical Specification for 24kV Cable Entry Transformers

5.	In the event of being successful, does the Tenderer agree to complete the following Section "B" - Plant Detail – questions and supply the responses to the Purchaser within six weeks of being awarded the contract? (Only for successful items)	YES/NO	
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## (B) PLANT DETAILS

### (1) TRANSFORMER

**Note:** Not required to be submitted with the tender

REF.	PARTICULARS	UNITS	RESPONSE REQUIRED FOR ALL ITEMS AWARDED TO THE SUCCESSFUL TENDERER
1.	Dimensions		
1.1	Length (parallel to plane of core)	mm	
1.2	Width (transverse to plane of core)	mm	
1.3	Height	mm	
2.	Mass		
2.1	Total complete with all fittings filled out with oil and ready for service	kg	
2.2	Core and windings	kg	
3.	Insulating oil (required to fill to correct level of 15°C)		
3.1	Mass	kg	
3.2	Volume	litre	
3.3	PCB free	YES/NO	
4.	HV bushings		
4.1	Make		
4.2	Type		
4.3	Current rating	A	
4.4	Total creepage length	mm	
4.5	Gasket material		
4.6	Gasket thickness	mm	
5.	LV bushings		
5.1	Make		
5.2	Type		
5.3	Current rating	A	
5.4	Total creepage length	mm	
5.5	Gasket material		
5.6	Gasket thickness	mm	

# Technical Specification for 24kV Cable Entry Transformers

6.	HV windings		
6.1	Type		
6.2	Conductor material		
6.3	Shape of conductor		
6.4	Mass	kg	
6.5	Conductor insulation material	A/mm <sup>2</sup>	
6.6	Current density	A/turn	
6.7	Rated volts per turn		
7.	LV windings		
7.1	Type		
7.2	Conductor material		
7.3	Shape of conductor		
7.4	Mass	kg	
7.5	Conductor insulation material	A/mm <sup>2</sup>	
7.6	Current density		

## (B) PLANT DETAILS

### (1) TRANSFORMER - Continued

REF.	PARTICULARS	UNITS	RESPONSE REQUIRED FOR ALL ITEMS AWARDED TO THE SUCCESSFUL TENDERER
8.	Core type		
8.1	Type		
8.2	Trade name and grade of electrical steel		
8.3	Country of supply		
8.4	Mass	kg	
8.5	Flux density	T	
8.6	Specific loss	W/kg	
9.	Impedance voltage components at rated current on principal tapping		
9.1	Resistance voltage	%	
9.2	Reactance voltage	%	
10.	Regulation		
10.1	Unity p.f.	%	
10.2	0.8 p.f.	%	
11.	Degree of dryness achieved prior to oil filling	%	
12.	Vacuum withstand capacity		
12.1	Tank	kPa	
12.2	Radiators	kPa	
13.	Clamping pressures on coils prior to oil filling	kPa	

# Technical Specification for 24kV Cable Entry Transformers



14.	Design withstand pressure of tank	mPa	
15.	Short time overload rating (from rated load at rated ambient temperature)		
15.1	2-hour emergency rating	kV.A	
15.2	8-hour emergency rating	kV.A	
15.3	24-hour emergency rating	kV.A	

NAME OF TENDERER:

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

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

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



# Technical Specification for 24kV Cable Entry Transformers



## 19. Attachment 3 - Options

THE FOLLOWING OPTIONS SHALL BE PROVIDED BY THE TENDERER FOR ALL ITEMS COVERED BY THIS SPECIFICATION

### OPTIONS AND RECOMMENDED SPARES

REF.	PARTICULARS	PRICE \$A (FIS)
1	<b>OPTIONS:</b> Tenderers shall advise the price of the following which shall include all required accessories.	
1.1	Provision of LV Monitoring capability including all associated items and installation	
1.1(a)	500kVA transformer	
1.1(b)	1000kVA transformer	
1.1(c)	1500kVA transformer	
2.	<b>RECOMMENDED SPARES:</b> Tenderers shall advise the price for items listed below and also add recommended spares for the transformers together with pricing.	
	<b>DESCRIPTION</b>	<b>PRICE EACH \$A</b>
	<b>DELIVERY PERIOD IN WORKING WEEKS</b>	
2.1	Provision of spare LV cable box complete with flexible connectors and all other accessories and fasteners necessary for mounting to the transformer	
2.1(a)	500kVA transformer	
2.1(b)	1000kVA transformer	
2.1(c)	1500kVA transformer	
2.2	Provision of spare weatherproof cover for HV cable terminals complete with fasteners necessary for mounting to the transformer	
2.2(a)	500kVA transformer	
2.2(b)	1000kVA transformer	
2.2(c)	1500kVA transformer	
2.2(c)	1500kVA transformer	

NAME OF TENDERER:

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

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

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

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## 20. Attachment 4 – Risk Assessment

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

REF.	PARTICULARS	RESPONSE
1.	Have Risk Assessments been carried out on equipment tendered which meet the requirements of AS/NZS 4360 (Yes/No)	
2.	Have copies of such risk assessments been included with the tender (Yes/No)	
3.	What is the weight of the components to be moved (for example - cable box covers/drawout circuit breaker trucks)?	
4.	How often do the components have to be moved?	
5.	Are space restrictions associated with:	
5.1	Manual/materials handling tasks	
5.2	Installation/maintenance	
5.3	Operating procedures?	
6.	Is there provision for the use of mechanical lifting devices?	
7.	Is the load stable?	
8.	What is the level of coupling? (poor/fair/good) (e.g. are operating handles fitted with grips)	
9.	What are the push/pull/rotational forces required to operate the equipment:	
9.1	When new?	
9.2	During life expectancy?	
10.	Do "above ground" work surfaces have adequate fall protection (e.g. slip resistant surface, hand rails)?	
11.	Do the work positions require undesirable postures such as:	
11.1	Bending	
11.2	Stretching	
11.3	Twisting	
12.	What postures are required to be sustained over what period of time?	
13.	What movements are repetitive and for what duration?	
14.	What are the sound pressure levels (expressed in dB(A))?	
15.	What hazardous substances are used/produced (including after failure) such as:	

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## RISK ASSESSMENT (CONT'D)

REF.	PARTICULARS	RESPONSE
15.1	Dust	
15.2	Gas	
15.3	Fume	
15.4	Emissions	
15.5	Mist	
15.6	Liquid	
15.7	Solids	
16.	Are the hazardous substances controls compatible with normal operational requirements?	
17.	Is a Safety Data Sheet for all hazardous substances provided?	
18.	What are the expected hazardous changes/by-products associated with the deterioration of a substance?	
19.	Is there any possible contact with energised components?	
20.	What are the levels of radiation emitted?	
21.	When in service, are any normally accessible areas hot/cold enough to be a hazard?	
22.	Are there any biological hazards?	
23.	Are there any mechanical hazards (e.g. nip in points, exposed moving components)?	
24.	Are mechanical hazards appropriately controlled (e.g. guarding, lock-outs)?	
25.	Are load limits established and clearly identified?	
26.	Are gauges clearly visible and easily interpreted?	
27.	Are control movements consistent with established Australian conventions (e.g. switch "UP" position is "OFF")?	
28.	What is the degree of whole body or hand/arm vibration? (Hz)	
29.	Are projectiles generated?	
30.	Are special tools required/identified/supplied?	
31.	What are the hazards associated with equipment failure?	

NAME OF TENDERER:

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

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

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

# Technical Specification for 24kV Cable Entry Transformers



## 21. Attachment 5 – Technical Document Checklist

This schedule details parameters referred to within the body of the specification for which a response by suppliers is requested. This schedule shall be completed and submitted with the offer. Copies of certificates etc are to be provided in electronic format, eg “pdf”. **Has the following information been provided with the tender documentation?**

PARTICULARS	CLAUSE	ANSWER (Yes/No)
Drawings of all items Tendered	3.3	
Any limitation to loading above “normal cyclic”	5.2	
The Tenderer shall supply full identification of the transformer oil offered	5.8.2	
Are transformer LV terminals mounted such that EMFs associated with the equipment are minimised	5.13.1	
Details of LV cable boxes including accessories	5.14	
Evidence supporting the performance of coating system.	5.17.8 & <b>Attachment 2</b>	
Details of protective coating repairs	5.17.8	
Details of LV monitoring accessories including attachments 1 and 2 of TS-481	5.18.1	
Type test certificates	6	
Risk assessment documentation	<b>7 &amp; Attachment 4</b>	
QA Certification of Supplier and Manufacturer.	8	
Availability of samples for evaluation	9	
Service history details and contact names and telephone numbers	11	
Reliability information	12	
Availability of training materials	13	
Comments on environmental soundness of equipment and MSDS for chemical substances	14	
Has the required EMF information been provided with the Tender?	14	
Availability of drawings and information as required	15.2	
Completed <b>Attachment 2</b>	15.1	
Completed <b>Attachment 3</b>	15.3	

NAME OF TENDERER:

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

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

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

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## 22. Attachment 6 – Transformer Name Plate Details

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				

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## 23. Drawing – 889843-01 (0C)

