

# Electricity Specification 321

Issue 10      September 2021

## Pole Mounted Distribution Transformers



## Amendment Summary

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## 1 Foreword

This specification sets out the technical requirements for the purchase of Pole Mounted Distribution Transformers by Electricity North West Limited (Electricity North West), for connection to its network.

## 2 Scope

This specification covers pole mounted single phase transformers of ratings between 25kVA and 100kVA and three phase transformers with ratings in the range 50kVA to 200kVA operating at system voltages of 6,600V and 11,000V, for continuous service at 50 Hz. It covers two winding oil immersed naturally cooled transformers.

## 3 Definitions

<b>Approval</b>	Sanction by the Electricity North West Plant Policy Manager that specified criteria have been satisfied
<b>Contract</b>	The agreement between Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.
<b>Contractor</b>	The person or person's firm or company, including personal representatives, successors and permitted assigns, who's Tender has been accepted by Electricity North West.
<b>Specification</b>	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
<b>Sub-Contractor</b>	Any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the Electricity North West Plant Policy Manager, and the legal representatives, successors and assigns of such person.
<b>Supplier</b>	Any person or person's firm or company who supplies goods to Electricity North West or to its Contractor.
<b>Tender</b>	An offer in writing to execute work or supply goods at a fixed price.
<b>Tenderer</b>	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.
<b>Pole Mounted Transformer</b>	For the purposes of this Specification, pole mounted distribution transformers shall be classified according to the following definition.

A transformer with a rating between 25kVA and 200kVA, intended for mounting on overhead line support structures and connected to the distribution system via open bushings.

## 4 Compliance with Standards

The equipment shall be in accordance with the requirements of IEC 60076, except where otherwise stated. References to Energy Networks Association (ENA) Technical Specifications (TS) 35-1 Parts 1 and 4 are provided to clarify the critical interfaces where connections of a specific method are required.

Tenderers are requested to confirm that the equipment complies with the Electromagnetic Compatibility (EMC) Directive or to state those items that are not considered a requirement for EMC Conformity.

## 5 General Requirements for Approvals and Testing

### 5.1 Product not to be Changed

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Electricity North West Plant Policy Manager, and receipt of a written agreement to the proposed change from the Electricity North West Plant Policy Manager.

### 5.2 Electricity North West Technical Approval

The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

Alternatively, technical reports and other data may be submitted that the Tenderer considers will demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, compliance with this Specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Plant Policy Manager but will not be unreasonably withheld.

Approval shall be 'factory specific' and is not transferable to another factory without the written Approval of the Electricity North West Plant Policy Manager.

The Supplier and product shall comply with all the relevant requirements of Electricity North West document CP311.

### 5.3 Quality Assurance

The Tenderer shall confirm whether or not Approval is held in accordance with a quality assurance scheme accredited under ISO 9000. If not, the Tenderer shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

The right is reserved for the repeat of such tests, from time to time, that the Electricity North West Plant Policy Manager may deem to be reasonably necessary to demonstrate continued compliance with the Specification.

The Tenderer shall submit, with the Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, fitness for installation and service.

The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Plant Policy Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Plant Policy Manager will confirm the requirement for samples at the time of Tendering.

The right is reserved for inspections to be made of Tenderer's facilities, from time to time, as deemed reasonably necessary by the Electricity North West Plant Policy Manager to ensure compliance with this Specification and any Contract of which it forms a part.

The Tenderer shall submit, with the Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001 - Environmental Management Systems.

## **5.4 Formulation**

The Tenderer shall submit, with the Tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 2002, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that it is to remain confidential, and the Electricity North West Plant Policy Manager will, if requested, confirm agreement to this prior to receipt of the information.

## **5.5 Identification Markings**

The Tenderer shall submit, with the Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Plant Policy Manager and shall in all cases include the Electricity North West approved description and commodity code number.

The Tenderer shall submit, with the Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Health and Safety Manual Handling Operation Regulations 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Electricity North West Plant Policy Manager.

## **5.6 Minimum Life Expectancy**

The minimum life expectancy of all products covered by this Specification is 40 years.

## **5.7 Product Conformity**

Preference will be given to those Suppliers who can provide suitable product conformity certification to a recognised or specified standard, or an equivalent certification.

## 6 Requirements for Type and Routine Testing

The Electricity North West Plant Policy Manager shall set out the requirement of the following tests to be carried out by the Supplier at the Supplier's cost.

### 6.1 Requirement for Type Tests at Suppliers Premises

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the Electricity North West Plant Policy Manager.

These may or may not be destructive tests.

### 6.2 Requirement for Routine Tests at the Supplier's Premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the Electricity North West Plant Policy Manager.

The results of these tests may be required to be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined by the Electricity North West Plant Policy Manager.

### 6.3 Requirement for On-site Tests

These will normally be included within the scope of on site commissioning but may be included if appropriate.

**NOTE:** Further details of the tests required are provided in [Section 12](#).

## 7 Principal Characteristics

### 7.1 Rated Power

Transformer rated powers shall comply with the ratings provided in [Appendix A, Table A1](#). Cyclic and overload capabilities of the transformers shall comply with the requirements of IEC 60354 Loading Guide for Transformers, unless otherwise stated.

### 7.2 Rated Voltage

Transformers shall comply with the no-load voltage ratios specified in [Appendix A, Table A1](#).

### 7.3 Tapping Range

Tappings are required on all single and three phase transformers on the higher voltage windings for a variation of the no-load primary voltage of  $\pm 2.5\%$  and  $\pm 5\%$ .



## 7.4 Tapping Method

Tap changing shall be carried out with the transformer in the de-energised state by means of an externally operated, self-positioning tapping switch or by easily accessible captive links under oil, switch position number 1 shall correspond with the maximum +% tapping.

Tap selector switches shall be capable of being securely locked in any position rendering the switch inoperable. The locking method shall be by a padlock of 4.5mm diameter shackle.

## 7.5 Windings and Connections

High voltage windings and wire wound low voltage windings shall preferably be of copper construction.

LV windings utilising the foil (or sheet) design shall preferably be of copper construction.

Alternative designs which offer HV windings manufactured from aluminium wire or strap conductor and LV windings manufactured from aluminium foil will be acceptable subject to the Tenderer clearly demonstrating a satisfactory service history over a significant period of time, subject to the approval of the Electricity North West Plant Policy Manager.

Where the Tenderer is offering LV windings of the foil or sheet type, details of the interturn insulation and lead attachment method shall be provided with the Tender.

Three phase transformers require to be connected Delta-Star in accordance with Vector group reference Dyn11 of IEC 60076.

All windings shall terminate in outdoor bushings to IEC 60137.

## 7.6 Losses

Tenderers shall ensure that all Three Phase Pole Mounted Transformers comply with the losses as stated within the European Union Commission Regulation for Transformers No 548/2014 as part of the European Union Ecodesign Directive (2009/125/EC).

Pole Mounted Transformer losses shall be in accordance with the following [Tables 1, 2 and 3](#):

**Table 1 – Single Phase Pole Mounted Transformer Losses**

TRANSFORMER RATING (kVA)	NUMBER OF PHASES	IRON LOSS (W)	COPPER LOSS (W)
25	1	70	525
50	1	110	800
100	1	170	1,250

**Table 2 – Three Phase Pole Mounted Transformer Losses for Asset Replacement Only**

TRANSFORMER RATING (kVA)	NUMBER OF PHASES	IRON LOSS (W)	COPPER LOSS (W)
25	3	70	725
50	3	90	875
100	3	145	1475
200*	3	310	2333

**Table 3 – Three Phase Pole Mounted Transformer Losses for New Construction**

TRANSFORMER RATING (kVA)	NUMBER OF PHASES	IRON LOSS (W)	COPPER LOSS (W)
25	3	63	600
50	3	81	750
100	3	130	1250
200*	3	225	2015

These loss values in [Tables 1, 2](#) and [3](#) above shall be taken as the guaranteed losses. The tolerances shall be measured in accordance with IEC 60076 for single phase pole mounted transformers and the European Union Commission Regulation for all three phase pole mounted transformers being:

- (a) Load Losses – The measured value shall not be greater than the declared value by no more than 5%.
- (b) No Load Losses – The measured value shall not be greater than the declared value by no more than 5%.

The total actual losses for transformers supplied in any one year will be monitored. Overall losses exceeding the tolerances in IEC 60076 for single phase pole mounted transformers European Union Commission Regulation for Transformers No 548/2014 and European Union Ecodesign Directive (2009/125/EC) will be subject to a penalty requiring a refund of the same percentage on the total value of transformers supplied.

Tenderers shall complete the Schedules in Appendix for all sets of losses and HV voltages and return with their Tender.

\*200kVA losses are via linear interpolation as stated in the Eco Design Directive.

## 7.7 Sound Power Level

The sound power level derived from measurements made in accordance with IEC 60076-10 shall not exceed the values given in [Appendix A Table A1](#).

## 7.8 Impedances

The guaranteed impedances measured on the principal tap position shall be as stated in Table [A1 of Appendix A](#), subject to the tolerances specified in IEC 60076.

## 7.9 Insulation Levels for Pole Mounted Transformers

Completed transformers arranged for service shall be capable of withstanding the test voltages stated in [Table A2 of Appendix A](#).

## 7.10 Flux Density

The maximum flux density in any magnetic part shall not exceed 1.9 Tesla with a system voltage of 110% and at a frequency of 47 Hz. Transformers shall not over flux under these conditions.

# 8 Rating and Connection Plates – Marking of Terminals

## 8.1 Rating and Connection Plates

Transformers shall be fitted with a rating plate generally in accordance with section 8 of ENA TS 35-1 Part 1.

A connection plate is required to show the winding connections and tapings and shall be generally in accordance with section 8 of ENA TS 35-1 Part 1. The connection plate may be part of the rating plate.

Rating and connection plates shall be of durable and non-corrodible material and shall be securely fixed to suitable supports without forming water traps. The use of adhesives is not permitted as a means of fixing the rating and connection plate.

## 8.2 Marking of Terminals

Terminals shall be clearly marked and identified. The phase markings shall be c, b, a, yn, A, B, C, left to right when facing the terminals. All other methods of marking shall be subject to the approval of the Electricity North West Plant Policy Manager. Phase colours shall not be used.

# 9 Oil

Transformers shall be supplied complete with the first filling of insulating oil, unless otherwise specified. For testing and commissioning, the oil shall be naphthenic base and comply with the requirements of IEC 60296 with the following additions:

- (a) Gassing tendency shall be less than 5mm<sup>3</sup>/min
- (b) Polycyclic aromatics shall be less than 3%
- (c) Additives shall not be used
- (d) It shall be certified free from Polychlorinated Biphenyls (PCB).
- (e) Corrosive sulphur and potentially corrosive sulphur content shall be classified as “Non-corrosive” as determined by the test methods prescribed in IEC 62535 and ASTM D 1275B.

For compatibility, the oil shall conform to the requirements of Electricity North West' current type of oil, particulars of which shall be obtained from Electricity North West at the Contract stage. In the event that the oil to be supplied is other than the Electricity North West' standard oil, the Contractor shall substantiate its compliance with IEC 60296 and that there will be no long term detriment to the mixing of oils as a result of chemical reaction between additives from his oil and additives from Electricity North West' oil.

Electricity North West reserves the right to enter into a separate contract for the supply of insulating oil for use in any transformers ordered as a result of this enquiry. The names of oil suppliers should be stated and alternative prices less oil quoted in the price schedules.

Should this method be adopted it is envisaged that Electricity North West will order oil to be delivered in reasonable bulk quantities to the works of the Tenderer, free of charge. The timing of such delivery or deliveries to be negotiated.

Where free breathing transformers are offered, oil levels shall provide sufficient coverage of all live parts at an oil temperature of  $-10^{\circ}\text{C}$  without compromising the integrity of the transformer.

## 10 General Construction and Fittings

### 10.1 General Construction

Transformers shall normally be free-breathing and without conservators, although transformers of alternative designs may be acceptable subject to approval.

Single phase transformers of 50kVA or less shall be designed for single bolt fixing, generally in accordance with ENA TS 35-1 Part 4 Fig. 1.

LV bushings taken out of the top of the transformer are not acceptable.

Lifting fittings shall be positioned to facilitate lifting in a reasonably upright position.

The maximum height from the base of the transformer to the top of the bushing should not exceed the dimension "A" detailed in Figures 1, 2, and 3 of ENA TS 35-1 Part 4.

Single phase 50kVA transformers shall be suitable for two or three wire operation in accordance with ENA TS 35-1 Part 4, and delivered configured for two wire operation.

Split single phase 100kVA transformers shall be configured to give 250-0-250 with 500V across the outer phase terminals.

In addition to ENA TS 35-1 Part 4 Electricity North West requires a "true" 100kVA single phase pole mounted transformer. Tenderers shall complete the Appendices for both split and true single phase 100kVA transformers.

### 10.2 Tank Covers

Tank covers shall be designed and constructed to prevent the ingress and accumulation of water. Fixings shall be suitably protected to prevent corrosion.

### 10.3 Gaskets

All gaskets shall be capable of providing a service life of 40 years without leaking.

Gasket compression shall be limited so that the compressed thickness is not less than 50% of the uncompressed thickness.

### 10.4 Fittings

All pole mounted transformers shall be equipped with the following items of equipment:

- (a) Earthing terminal
- (b) Rating plates
- (c) Surge Arrestors (as detailed in [Section 10.7](#) below) and associated copper bar.
- (d) Lifting lugs
- (e) Tapping switch handle (where appropriate)

Pole mounted transformers which are designed to be free breathing shall have the following additional equipment:

Plain weatherproof breathing device as detailed in ENA TS 35-1 Part 1 Fig. 2 or similar.

Pole mounted transformers that are designed to be hermetically sealed shall have the following additional equipment:

- (f) Filler pipe fitted
- (g) Pressure relief device
- (h) Drain/Sampling valve suitable for filling transformer from the bottom.

### 10.5 Radiators

Pole mounted transformers which have plain tanks (i.e. no cooling fins or radiators) are preferred.

Where necessary, integral cooling fins provided as part of the main tank construction are acceptable as an alternative to separate panel type radiators.

Where panel type radiators are offered, these shall be provided with flanges for attachment to the main tank.

## 10.6 Bushings, Connections and Clearances

The minimum external air clearances shall be as follows.

VOLTAGE (kV)	LIVE METAL TO EARTH FLASHOVER DISTANCE (MM)	AIR END CREEPAGE DISTANCE (MM)	PHASE TO PHASE CLEARANCE (MM)
<1.1	58	90	77
7.2/12	203	300*	254
24	266	600*	305

\*based on 25mm/kV according to type III of IEC 60137

### NOTE:

Live metal to earth clearances are to be achieved with arcing horns removed.

Connections to the transformer are to be in accordance with ENA TS 35-1 Part 4.

## 10.7 Overvoltage Protection

Each transformer shall be fitted with surge arrestors to Electricity North West Electricity Specification (ES) 340 on the HV terminations and the LV neutral termination. The mounting arrangement shall be agreed with the Electricity North West Plant Policy Manager.

The linking copper bar from the HV bushing to the Surge Arrestor shall be supplied with the transformer. The linking bar shall allow for the Electricity North West Shroud to be fitted during installation. The details of the shroud is found in ES400S12.

The type of surge arrestors to be fitted on the HV terminations will be specified by the Electricity North West Protection Policy Manager.

The Bowthorpe TVC surge arrestor shall be fitted on the LV neutral termination.

## 11 Cleaning and Painting

Cleaning and painting shall be in accordance with ENA TS 35-1 Part 1, section 15.1 as a minimum requirement.

Where the Tenderer proposes an alternative method of protection that can be demonstrated to have a superior performance, then this will be acceptable subject to approval. Tenderers are requested to provide details of service experience of departures from the requirements of ENA TS 35-1 Parts 1 and 4.

Where the tenderer is offering tanks which are hot dipped galvanised, no further painting is required. The tenderer shall offer the colour which reflects the most economic offer. This will be subject to approval by the Electricity North West Plant Policy Manager.

## 12 Testing

Electricity North West reserves the right to witness any of the routine or type tests. This will comprise a minimum of all tests on the first of a new design from any factory will be witnessed by Electricity North West. The Contractor shall cover travelling, accommodation and other reasonable expenses incurred whilst two Electricity North West representatives are witnessing the type tests. The Contractor shall provide a minimum of four weeks notice of any intended type testing elements.

Electricity North West also reserves the right to return at random one unit of each type or design supplied to the factory for repeat witnessed type tests where all costs shall be covered by the Contractor.

Electricity North West reserves the right to witness routine tests on any subsequent units.

Routine tests as specified in IEC 60076 are required to be carried out on all transformers. Test results shall be provided on test certificates with key parameters included in the transformer rating plate. One copy of the routine test data should be supplied in electronic format to the Policy and Standards Manager at Electricity North West Policy and Standards Section (address shown on this enquiry).

Type tests in addition to routine tests shall be carried out on the first unit of any design and shall include lightning impulse tests in accordance with IEC 60076, including chopped impulses. The sequence being 1 Reduced Full Wave, 1 100% Full Wave, 1 Reduced Chopped Wave, 2 115% Chopped Waves, 2 100% Full Waves, based on the basic lightning impulse level as defined in [Appendix A](#) of this specification.

Temperature rise tests shall be carried out as part of the type test program and shall be carried out on the most onerous tap position.

Sound pressure level tests shall be carried out in accordance with IEC 60076-10 as part of the type test program.

Calculations demonstrating the short circuit withstand capabilities of the transformers units may be accepted in lieu of short circuit tests subject to the approval of the Electricity North West Plant Policy Manager.

## 13 Tender Information

Tenderers are requested to complete the Schedules provided in [Appendices B, C](#) and [D](#) of this specification. During the tender assessment process further information may be requested from the Tenderers.

## 14 Drawings

General arrangement drawings shall be provided electronically in pdf and .dxf or .dwg file format for each design type. Where requested by the purchaser, the Tenderer may be required to provide more detailed drawings showing construction details or any associated features or fittings.

## 15 Tools and Equipment

Any specialist tools and equipment which may be required to operate and maintain the transformer shall be supplied as part of the contract. The quantity of each type of tool or equipment required shall be subject to agreement between the purchaser and supplier.

## 16 Training

The contract shall include for any training required as a consequence of the introduction of new types of transformer. Tenderers shall detail the level of training support offered.

## 17 System Parameters

The impedance of the transformers has been chosen to ensure that the system fault level on the low voltage side of the transformers shall not exceed 25MVA.

## 18 Documents Referenced

DOCUMENTS REFERENCED	
European Union Commission Regulation for Transformers No 548/2014	
European Union Ecodesign Directive (2009/125/EC).	
Health and Safety at Work Act 1974	
Control of Substances Hazardous to Health Regulations 2002	
Manual handling Regulations 1992	
IEC 60076	Power Transformers
IEC 60076-10	Power Transformers: Determination of Sound Levels



<b>IEC 60354</b>	Loading Guide for Transformers
<b>IEC 60137</b>	Insulated Bushings for Alternating Voltages above 1kV
<b>IEC 60296</b>	Unused mineral insulating oils for transformers and switchgear
<b>IEC 62535</b>	Insulating liquids. Test method for detection of potentially corrosive sulphur in used and unused insulating oil
<b>ISO 9000</b>	Quality Systems – Guide to Dependability Programme Management
<b>BS EN 14001</b>	Environmental Management Systems
<b>BS 381c</b>	Specification for Colours for Identification, Coding and Special Purposes
<b>ENA TS 35-1 Part 1</b>	Distribution transformers – Common clauses
<b>ENA TS 35-1 Part 4</b>	Distribution transformers – Pole mounted transformers
<b>ES340</b>	Surge arrestors
<b>ES400S12</b>	Permanent shrouding for overheadline structures
<b>CP311</b>	Equipment Approval Policy and Process

## 19 Keywords

Transformer; pole; distribution

## Appendix A – Ratings

**Table A1 – Transformer Ratings**

VOLTAGE RATIO	kVA RATING	IMPEDANCE	SOUND POWER LEVEL (DB(A))
6600/250V Single Phase	25	4.5%	45
	50	4.5%	45
	100	4.5%	48
11000/250V Single Phase	25	4.5%	45
	50	4.5%	45
	100	4.5%	48
6600/433-250V Three Phase	25	4.5%	45
	50	4.5%	45
	100	4.75%	48
	200	4.75%	52
11000/433-250V Three Phase	25	4.5%	45
	50	4.5%	45
	100	4.75%	48
	200	4.75%	52

**NOTE:**

- (a) The above no-load secondary voltages are chosen so as to facilitate provision of the following nationally declared low voltages.
- (b) Sound Power Levels are maximum values. Refer to IEC 60076-10 for correlation between sound power level and sound pressure measurements.
- (c) Impedance voltages are corrected to 75°C and expressed as a percentage of normal voltage.

**Table A2 – Insulation Levels for Pole Mounted Transformers**

HIGHEST VOLTAGE FOR EQUIPMENT UM(r.m.s.) kV	NOMINAL SYSTEM VOLTAGE kV	RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE kV (PEAK)	POWER FREQUENCY WITHSTAND VOLTAGE kV (r.m.s.)
1.1	0.433/0.250	-	3*
7.2	6.6	60	20
12	10.75/11	95	28
24	20/21.75	150	50

\* Suppliers may be required on a small number of limited applications to ensure that the transformers shall be capable of withstanding an AC voltage of 27kV rms applied between the LV winding and the tank and also the LV winding and HV winding (with HV winding earthed).





## Appendix C – Technical Schedules

### 6.6kV Pole Mounted Transformers

Item No.	Item	Single Phase				Three Phase			
		25	50	100 Split	100 True	25	50	100	200
1	Guaranteed no-load loss 6.6kV (watts)								
2	Guaranteed load loss @75°C, 6.6kV (watts)								
3	Impedance @75°C, 6.6kV (% on rating) (i) on nominal tap (ii) on maximum tapping (iii) on minimum tapping								
4	Maximum flux density in any magnetic component (Tesla)								
5	Type of core steel used Weight, thickness, grade?								
6	Core construction details eg step lapped, bolted, banded etc								
7	HV windings (i) type (ii) conductor material (ii) insulation type								
8	LV windings (i) type (ii) conductor material (ii) insulation type								
9	Current Density (i) in HV winding A/mm <sup>2</sup> (ii) in LV winding A/mm <sup>2</sup>								
10	Type of Tap Changer eg rotary, linear, terminals etc.								
11	Tank details eg welded steel, corrugated etc.								
12	Guaranteed sound power level dB(A)								
13	Quantity of Oil (litres)								
14	Weight of tank and fittings (kg)								

15	Weight of core and winding assembly (kg)								
16	Weight of copper (kg)								
17	Total Transformer Weight (kg).								
18	Tank construction (i) Material (ii) Thickness of sides (iii) Thickness of base (iv) Thickness of cover								
19	Type of Radiators Bolt on or integral with tank								
20	Overall dimensions (i) Length (ii) Width (iii) Height								
21	Oil Preservation system eg free breathing, sealed, hermetically sealed								
22	Oil head space filler material								
23	Tender drawing reference number								

**11kV Pole Mounted Transformer**

Item No.	Item	Single Phase				Three Phase			
		25	50	100 Split	100 True	25	50	100	200
1	Guaranteed no-load loss 11kV (watts)								
2	Guaranteed load loss @75°C, 11kV (watts)								
3	Impedance @75°C, 11kV (% on rating) (i) on nominal tap (ii) on maximum tapping (iii) on minimum tapping								
4	Maximum flux density in any magnetic component (Tesla)								
5	Type of core steel used Weight, thickness, grade?								
6	Core construction details eg step lapped, bolted, banded etc								
7	HV windings (i) type (ii) conductor material (ii) insulation type								
8	LV windings (i) type (ii) conductor material (ii) insulation type								
9	Current Density  (iii) in HV winding A/mm <sup>2</sup>  (iv) in LV winding A/mm <sup>2</sup>								
10	Type of Tap Changer eg rotary, linear, terminals etc.								
11	Tank details eg welded steel, corrugated etc.								
12	Guaranteed sound power level dB(A)								
13	Quantity of Oil (litres)								
14	Weight of tank and fittings (kg)								



15	Weight of core and winding assembly (kg)								
16	Weight of copper (kg)								
17	Total Transformer Weight (kg)								
18	Tank construction (v) Material (vi) Thickness of sides (vii) Thickness of base (viii) Thickness of cover								
19	Type of Radiators Bolt on or integral with tank								
20	Overall dimensions (iv) Length (v) Width (vi) Height								
21	Oil Preservation system e.g. free breathing, sealed, hermetically sealed								
22	Oil head space filler material								
23	Tender drawing reference number								

## Appendix D – Conformance Declaration

### SECTION-BY-SECTION CONFORMANCE WITH SPECIFICATION

The Tenderer shall declare conformance or otherwise for each product/service or range of products/services, section-by-section, using the following Conformance Declaration Codes.

#### Conformance Declaration Codes:

<b>N/A =</b>	Clause is not applicable/appropriate to the product/service.
<b>C1 =</b>	The product/service conforms fully with the requirements of this clause.
<b>C2 =</b>	The product/service conforms partially with the requirements of this clause.
<b>C3 =</b>	The product/service does not conform to the requirements of this clause.
<b>C4 =</b>	The product/service does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

**Manufacturer:**

**Product/Service Description:**

**Product/Service Reference:**

**Name:**

**Company:**

**Signature:**

**SECTION-BY-SECTION CONFORMANCE**

Section	Section Topic	Conformance Declaration Code	Remarks * (must be completed if code is not C1)
4	Compliance with Standards		
5.1	Product not to be Changed		
5.2	Electricity North West Technical Approval		
5.3	Quality Assurance		
5.4	Formulation		
5.5	Identification Markings		
5.6	Minimum Life Expectancy		
5.7	Product Conformity		
6.1	Requirements for Type Tests at the Supplier's Premises		
6.2	Requirement for Routine Tests at the Supplier's Premises		
6.3	Requirement for On Site Tests		
7.1	Rated Power		
7.2	Rated Voltage		
7.3	Tapping Range		
7.4	Tapping Methods		

<b>7.5</b>	<b>Windings and Connections</b>		
<b>7.6</b>	<b>Losses</b>		
<b>7.7</b>	<b>Sound Power Level</b>		
<b>7.8</b>	<b>Impedances</b>		
<b>7.9</b>	<b>Insulation Levels</b>		
<b>7.10</b>	<b>Flux Density</b>		
<b>8.1</b>	<b>Rating and Connection Plates</b>		
<b>8.2</b>	<b>Marking of Terminals</b>		
<b>9</b>	<b>Oil</b>		
<b>10.1</b>	<b>General Construction</b>		
<b>10.2</b>	<b>Tank Covers</b>		
<b>10.3</b>	<b>Gaskets</b>		
<b>10.4</b>	<b>Fittings</b>		
<b>10.5</b>	<b>Radiators</b>		
<b>10.6</b>	<b>Bushings, Connections and Clearances</b>		
<b>10.7</b>	<b>Over Voltage Protection</b>		
<b>11</b>	<b>Cleaning and Painting</b>		
<b>12</b>	<b>Testing</b>		
<b>13</b>	<b>Tender Information</b>		
<b>14</b>	<b>Drawings</b>		
<b>15</b>	<b>Tools and Equipment</b>		

<b>16</b>	<b>Training</b>		
<b>17</b>	<b>System Parameters</b>		
<b>Appendix A</b>	<b>Ratings</b>		
<b>Appendix B</b>	<b>Schedules to be Completed by the Tenderer</b>		
<b>Appendix C</b>	<b>Technical Schedule to be Completed by the Tenderer</b>		

**Additional Notes:**