



Electricity Specification 344

Issue 2 December 2008

132kV High Accuracy Metering Current and Voltage Transformers

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Approved for issue by the Technical Policy Panel

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Issue and Amendment Summary

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<p>1 01/11/05</p>	<p>Issue 1 Clarification of CT and VT requirements Prepared by: S. Stelfox Approved by the Technical Policy Panel and signed on its behalf by:</p>
<p>0 10/12/08</p>	<p>Issue 2 Latest template applied. Document updated to reflect latest standards. Definitions added. Prepared by: G Bryson Approved by the Technical Policy Panel and signed on its behalf by:</p>

132KV HIGH ACCURACY METERING CURRENT AND VOLTAGE TRANSFORMERS

1. SCOPE

This Specification details the requirements for the purchase of 132kV open terminal combined High Accuracy Metering (HAM) Current Transformers (CT) and Voltage Transformers (VT) by Electricity North West Limited, hereinafter referred to as Electricity North West for use on the 132kV, 50Hz, solidly earthed, three phase system.

2. DEFINITIONS

Approval	Sanction by the Engineer that specified criteria have been satisfied.
Contract	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.
Contractor	The Tenderer (may be one or more) whose Tender has been approved and accepted by Electricity North West.
Engineer	Policy and Implementation Manager, Central Engineering Services (Electricity North West) or his successor or such person specifically nominated on his behalf.
Specification	The Specification and schedules (if any) agreed by the parties for the purpose of the Contract.
Supplier	Any person or person's firm or company who supply goods to Electricity North West or Electricity North West contractor.
Tender	An offer in writing to execute work or supply goods at a fixed price.
Tenderer	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.
Words	Words importing persons shall include firms and corporations; words importing the singular only, also include the plural, and vice versa where the context requires.
Work:	All materials, labour and actions required to be provided or performed by the Contractor under the Contract.
Writing:	Any manuscript, typewritten or printed statement under seal or hand as the case may be.

3. GENERAL REQUIREMENTS FOR APPROVALS AND TESTING

3.1 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 Engineer, and receipt of a written agreement to the proposed change from the Engineer.

3.2 Electricity North West Technical Approval

- 3.2.1 The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Engineer, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.
- 3.2.2 Alternatively, the Tenderer may submit technical reports and other data that he considers will demonstrate, to the satisfaction of the Engineer, compliance with this specification. Acceptance of this evidence shall be at the discretion of the Engineer but will not be unreasonably withheld.
- 3.2.3 Approval shall be 'factory specific' and is not transferable to another factory without the written approval of the Engineer.
- 3.2.4 The Supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311.

3.3 Quality Assurance

- 3.3.1 The Tenderer shall confirm whether or not approval is held in accordance with a Quality Assurance Scheme accredited under ISO 9000. If not, he 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.
- 3.3.2 The right is reserved for the Engineer to require, from time to time, the repeat of such tests as he may deem to be reasonably necessary to demonstrate continued compliance with the Specification.
- 3.3.3 The Tenderer shall submit, with his 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 Engineer, fitness for installation and service.
- 3.3.4 The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Engineer, be reasonably required for inspection and/or retention as quality control samples. The Engineer will confirm the requirement for samples at the time of Tendering.
- 3.3.5 The right is reserved for the Engineer to make, from time to time, such inspections of the Tenderer's facilities as he may deem to be reasonably necessary to ensure compliance with this Specification and any Contract of which it forms a part.
- 3.3.6 The Tenderer shall submit, with his 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.

3.4 Formulation

The Tenderer shall submit, with his 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 etc 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 he requires it to remain confidential and the Engineer will, if requested, confirm his agreement to this prior to receipt of the information.

3.5 Identification Markings

- 3.5.1 The Tenderer shall submit, with his 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 Engineer, and shall in all cases include the Electricity North West Approved Description and Commodity Code Number.
- 3.5.2 The Tenderer shall submit, with his 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 Engineer.

3.6 Minimum Life Expectancy

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

3.7 Manufacturers Already Approved

Clauses 3.2.1, 3.2.2, 3.3.1, 3.3.3, 3.3.4, 3.4 and 3.5 will be waived in the case of products already approved.

3.8 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.

4. REQUIREMENTS FOR TYPE AND ROUTINE TESTING.

The Engineer shall set out the requirement of the following tests to be carried out by the Supplier at the Suppliers' cost.

4.1 Requirement for type tests at the 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 Engineer.

These may or may not be destructive tests.

4.2 Requirement for routine tests at the Suppliers' premises

These tests shall be carried out on every individual unit or component, as specified.

The results of these tests shall be supplied to Electricity North West with each unit purchased.

A copy of the results shall be supplied in Adobe Acrobat (pdf) format.

5. TECHNICAL AND PERFORMANCE REQUIREMENTS

Except where modified by requirements specified elsewhere in this document, switchgear shall be designed, manufactured and tested to comply fully with the requirements of:

ENA TS 41-37 "Switchgear for use on 66kV to 132 kV Distribution Systems"

BS EN 62271-1 "High Voltage Switchgear and Controlgear – Part 1: Common Specifications"

BS EN 60044-1 “Instrument Transformers - Current Transformers”

BS EN 60044-2 “Instrument Transformers – Inductive Voltage Transformers”

Electricity North West Specification ES501 “Metering Current and Voltage Transformers”

5.1 Voltage Transformer Winding Characteristics

VTs shall comply with BS EN 60044-2. The required ratings for the VTs are detailed below:

- Transformation Ratio = $132000/\sqrt{3} : 110/\sqrt{3}$
- The voltage factor is 1.5 for a duration of 30s.
- Accuracy Classes and ratings are as follows:
 - For supply capacity >100MVA - Class 0.2, 15VA/winding
 - For supply capacity ≤100MVA - Class 0.5, 30VA/winding

The VT for larger capacity supplies shall have two secondary windings, one dedicated to the main meter and the other for the check meter. The check meter winding may also be used for other purposes but in that situation the rating of the winding must be capable of supplying the additional equipment.

The VT for lower capacity supplies may have a single winding but this can only be used to supply the main and check meters. If two windings are provided then they shall be used as described above for larger capacity supplies with the same caveat on winding rating when supplying additional equipment.

The secondary windings shall be subject to a 3kV power frequency withstand voltage routine test.

5.2 Current Transformer Winding Characteristics

CTs shall comply with BS EN 60044-1. The required ratings for the CTs are detailed below:

- The transformation ratio will be specified in Schedule D
- The accuracy class and rating are as follows:
 - For supply capacity >100MVA – Class 0.2S 15VA(5A Secondary)
7.5VA(1A Secondary)
 - Separate CT windings are required for main and check metering circuits
 - For supply capacity ≤100MVA – Class 0.2S 7.5VA
 - Separate CT windings are not required for main and check metering circuits

5.2.1 Dual Ratio CTs

Where dual ratio CTs are specified in Schedule D, the performance specification as detailed above shall be provided for the low ratio tapping unless specified.

5.2.2 CT Ratings

All current transformers shall fully match the ratings of the primary equipment they are associated with. These ratings include long time thermal, short time emergency and fault ratings.

For example, A 1000/500:1 metering CT associated with a 2000A circuit breaker shall have a rating of $I_{\text{thermal}} = 200\%$.

5.2.3 Magnetisation, core loss and secondary resistance curves

Magnetisation, core loss and secondary resistance curves shall be provided for each type and rating of CT used in the construction of the equipment. Where CTs are tapped or otherwise multi-ratio, curves shall be provided for all available combinations.

5.3 Bushings

Bushings shall comply with BS EN 60137.

The creepage distances and the colour of the bushings / insulators shall be as specified in Schedule D.

5.4 132kV System Characteristics

The HAM CT & VTs shall be suitable for use on the Electricity North West 132kV system, with the following parameters.

▪ Maximum System Voltage	145kV
▪ Power Frequency withstand voltage	275kV
▪ Lightning Impulse withstand voltage	650kV _{peak}
▪ Frequency	50Hz

5.5 Multicore cables and Fuse boxes.

Multicore cables external to the HAM CT & VTs will be provided by others.

The terminal box shall be bottom entry and shall be provided with a removable un-drilled gland plate.

Fuse boxes will be provided by others.

Locking shall be implemented by means of removable padlocks, which shall be supplied by Electricity North West. Padlocks shall be in accordance with the requirements detailed in ES309.

5.6 Environment, operating conditions and duty

The normal service conditions shall be as defined in ENA TS 41-37. No special anti-pollution measures are required.

5.7 Metalwork and Finish colour

The Tenderer shall agree the finish colour of the HAM CTs & VTs with the purchaser.

The HAM CTs & VTs tank shall not be susceptible to rust and shall not require repainting during the service life of the HAM CTs & VTs. The tank shall be stainless steel or aluminium with a suitable surface coating.

5.8 Oil Sampling and Indication

Permanent provision shall be made to enable an oil sample to be taken. The Tenderer should state the amount of oil that can be removed before refilling becomes necessary.

An oil level indicator shall be provided.

5.9 Special Tools

Requirements for special tools and equipment necessary for the erection, operation, testing and maintenance of the HAM CTs & VTs shall be detailed and provided by the manufacturer.

5.10 Support Structure

The support structures will be provided by others.

5.11 HV Terminals

The HV terminals shall be of the aluminium pad type and shall have four 19mm diameter holes on a 127mm pitched circle diameter (PCD). The HV connector and bolts will be provided by Electricity North West.

5.12 Secondary Wiring

5.12.1 Ferruling

All wiring shall be clearly and indelibly marked with cable numbering and ferrules at each point of termination. These shall be clearly identified on the wiring diagrams such that all internal wiring is unambiguously identifiable.

All control and internal wiring shall be easily identifiable and traceable throughout the circuit schematic and wiring diagrams.

Wiring shall be fitted with interlocking numbered ferrules. Ferrules shall be fitted at both ends of the wire unless the wire is individually routed and less than 100mm long. It shall be necessary to disconnect the termination to remove the ferrules.

Ferruling shall be to ENA TS 50-19.

5.12.2 Terminals and Terminal Blocks

Conductor ends for connections shall be fitted with a crimped, hooked palm type termination device having an insulated shank or other approved method of termination that ensures that a connection cannot be loosened under different thermal or vibration conditions.

Terminals having different voltages shall be separated. The voltage shall be marked on the terminals. All terminals shall be fully segregated and insulated from adjacent terminals so that inadvertent contact is prevented. Sufficient spare terminals shall be provided to cater for spare cores on multicore cables.

All terminal blocks provided within the control cubicle, for multicore cable terminations, shall be able to accept a hooked palm type crimp termination. Whilst insulation displacement type terminal blocks will be accepted for internal cubicle wiring, these shall not be permitted for multicore terminations.

All terminal blocks used for CT wiring shall have a locking screw termination. Ring crimps or hooked palm type with spring loaded terminal shall be used throughout.

All terminal blocks, terminals, CT wiring and crimps proposed for use shall be subject to approval by Electricity North West prior to contract award.

5.12.3 Internal Wiring

The insulation shall be LS0H.

5.12.4 External Wiring

Multicore and auxiliary cables external to the circuit breaker are outside the scope of this specification.

5.12.5 CT Marshalling

CT marshalling boxes are outside the scope of this specification.

6. ERECTION AND SITE ASSEMBLY

The Tenderer shall include for delivery and offloading. Installation and commissioning of the HAM CTs & VTs will be carried out by others.

7. DRAWINGS

Standard versions of all the following drawings shall be supplied at the tender stage.

At contract plus 2 months, the following drawings shall be submitted for approval.

- (i) General Arrangement Drawings showing
 - Full dimensions
 - Weights and static and dynamic loads
 - Support structure interface information
 - Holding down / Fixing information
 - Terminal details
- (ii) Circuit diagrams / wiring diagrams.
- (iii) Rating plate and Label diagram.

Within four weeks of final commissioning the following drawings shall be supplied.

- (i) Contract drawing list with number, title and revision of each drawing.
- (ii) Two paper prints of each drawing and equivalent AutoCad 2000 (dwg) and Adobe Acrobat (pdf) format files.

Notes on drawings and drawing format:

- (a) Orthographic drawings shall use metric units and be reproduced to a scale that is declared on each print. The scale for general arrangement drawings shall not be less than 1 to 50 and that for detail drawings shall not be less than 1 to 20.
- (b) All drawing, schematic and wiring diagrams shall comply with UK ESI convention and be produced on conventional format up to a maximum A1 paper size. AC and DC schemes shall be depicted as comprehensively on one drawing as possible. Multi-page A4 **is not** acceptable.
- (c) Drawings shall be submitted for approval by the Purchaser on paper in duplicate. They shall also be accompanied by equivalent AutoCad 2000 (dwg) format files on a CDROM.
- (d) The name of the site, the drawing number and the date and number of revision shall be marked on all drawings. All drawings shall be numbered according to a logical scheme.

8. INSTALLATION, OPERATION AND MAINTENANCE MANUALS

All necessary installation, operation and maintenance manuals shall be supplied within two months of the award of the contract, including recommended schedules of inspection and maintenance. Final versions of the manuals shall be provided in Adobe Acrobat (pdf) format.

9. CONFORMANCE WITH SPECIFICATION

Electricity North West welcomes innovation and alternatives to traditional designs that still meet the functional requirements of this Specification.

The Tenderer shall complete the clause conformance declaration in Appendix B.

The Tenderer shall include using Schedule B, any variations from this specification, including those which in which opinion enhance the performance of the equipment.

10. DOCUMENTS REFERENCED

Health and Safety at Work etc Act 1974.

Health and Safety Manual Handling Operation Regulations 1992

Control of Substances Hazardous to Health Regulations 2002

BS EN ISO 9000 – Quality Management and Quality Assurance Standards

BS EN 14001 – Environmental Management Systems

BS EN 60044-1 – Instrument Transformers. Current Transformers

BS EN 60044-1 – Instrument Transformers – Inductive Voltage Transformers

BS EN 60137 – Insulated bushings for alternating voltages above 1 kV

BE ES 62271-1 – High Voltage Switchgear and Controlgear – Part 1: Common Specifications

ENA TS 41-37 – Switchgear for use on 66kV to 132 kV Distribution Systems

EPD311 – Approval of Equipment

CP311 – Equipment Approval Process

ES501 – Metering Current and Voltage Transformers

10. KEYWORDS

132kV; CT; Metering; VT

APPENDIX A

SCHEDULES OF INFORMATION

Schedule A – Ratings

Schedule B – List of Variations from the Specification

Schedule C – Recommended Tools and Spare Parts

Schedule D – General Particulars of Definite Work

SCHEDULE A - RATINGS

Schedule A1 – Current Transformers - to be completed by Tenderer for each type

1.	<p><u>METERING - CIRCUIT</u></p> <p>Highest equipment voltage</p> <p>Insulation level</p> <p>Frequency</p> <p>Rated continuous primary thermal current</p> <p>Rated primary/secondary currents</p> <p>Rated output</p> <p>Class of accuracy</p> <p>Rated accuracy limit factor</p> <p>Short time current and duration</p> <p>Rated primary current</p> <p>Nominal turns ratio</p> <p>Knee point emf V_k</p> <p>Maximum secondary winding resistance at 75° C</p> <p>Exciting current at $V_k/2$</p>	<p>kV</p> <p>kV</p> <p>Hz</p> <p>A</p> <p>A</p> <p>VA</p> <p>A</p> <p>s</p> <p>A</p> <p>V</p> <p>Ω</p> <p>V</p>	
2.	<p><u>METERING - CIRCUIT</u></p> <p>Highest equipment voltage</p> <p>Insulation level</p> <p>Frequency</p> <p>Rated continuous primary thermal current</p> <p>Rated primary/secondary currents</p> <p>Rated output</p> <p>Class of accuracy</p> <p>Rated accuracy limit factor</p> <p>Short time current and duration</p> <p>Rated primary current</p> <p>Nominal turns ratio</p> <p>Knee point emf V_k</p> <p>Maximum secondary winding resistance at 75° C</p> <p>Exciting current at $V_k/2$</p>	<p>kV</p> <p>kV</p> <p>Hz</p> <p>A</p> <p>A</p> <p>VA</p> <p>A</p> <p>s</p> <p>A</p> <p>V</p> <p>Ω</p> <p>V</p>	
3.	<p><u>METERING - CIRCUIT</u></p> <p>Highest equipment voltage</p> <p>Insulation level</p> <p>Frequency</p> <p>Rated continuous primary thermal current</p> <p>Rated primary/secondary currents</p> <p>Rated output</p> <p>Class of accuracy</p> <p>Rated accuracy limit factor</p> <p>Short time current and duration</p> <p>Rated primary current</p> <p>Nominal turns ratio</p> <p>Knee point emf V_k</p> <p>Maximum secondary winding resistance at 75° C</p> <p>Exciting current at $V_k/2$</p>	<p>kV</p> <p>kV</p> <p>Hz</p> <p>A</p> <p>A</p> <p>VA</p> <p>A</p> <p>s</p> <p>A</p> <p>V</p> <p>Ω</p> <p>V</p>	

Schedule A2 - Voltage transformers (to be completed by Tenderer)

1.	Type (reference of voltage transformer)		
2.	Method of transformation (winding configuration)		
3.	Transformation ratio		
4.	Rated output per phase	For protection & instrumentation	VA
5.	Class of accuracy		
6.	Rated output per phase	For metering	VA
7.	Class of accuracy		
8.	Voltage factor		
9.	Rated time		s
10.	Electrostatic capacity of each capacitor, line to earth		pF
11.	Insulating medium		
12.	Total volume of insulating medium, per single phase unit		litre
13.	Weight of complete unit ready for service		kg

SCHEDULE C – TOOLS AND SPARE PARTS

i) List of tools recommended for use with each installation

DESCRIPTION	PRICE EACH £	TOTAL PRICE £

ii) Recommended spare parts, to be ordered at the discretion of the company

DESCRIPTION	PRICE EACH £	TOTAL PRICE £

SCHEDULE D – GENERAL PARTICULARS OF DEFINITE WORK

(Relevant details to be completed by Purchaser)

Item	Description	
1	Site Name	
2	Site Grid Reference	
3	Number of Units	
4	Rating (Amps)	
5	Colour of Bushings / Insulators	
6	CT Ratios	
7	Order of CTs	
8	Creepage Distance	25mm/kV / 31mm/kV *
9	Short Circuit Current and Duration	
10	Thermal Current Rating	

* delete as appropriate

APPENDIX B

SELF-CERTIFICATION CONFORMANCE DECLARATION

CLAUSE BY CLAUSE CONFORMANCE WITH SPECIFICATION

The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes.

Conformance declaration codes

- N/A = Clause is not applicable/appropriate to the product/service
- C1 = The product/service conforms fully with the requirements of this clause
- C2 = The product/service conforms partially with the requirements of this clause
- C3 = The product/service does not conform to the requirements of this clause
- C4 = 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 :

Assessor

Name:

Company

Signature

Date

Clause / Sub-clause		Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not Cs1)
3	1	Product not to be changed		
3	2	Electricity North West Technical Approval		
3	3	Quality Assurance		
3	4	Formulation		
3	5	Identification Markings		
3	6	Minimum Life Expectancy		
3	7	Manufacturers already approved		
3	8	Product conformity		
4	1	Requirement for type tests at the Suppliers' premises		
4	2	Requirement for routine tests at the Suppliers' premises		
5		Technical and Performance Requirements		
5	1	Voltage Transformer Winding Characteristics		
5	2	Current Transformers Winding Characteristics		
5	3	Bushings		
5	4	132kV System Characteristics		
5	5	Multicore cables and Fuse boxes		
5	6	Environment, operating conditions and duty		
5	7	Metalwork & Finish Colour		
5	8	Oil Sampling and Indication		
5	9	Special Tools		
5	10	Support Structure		
5	11	HV Terminals		
5	12.1	Ferruling		
5	12.2	Terminals and Terminal Blocks		
5	12.3	Internal Wiring		
5	12.4	External Wiring		
5	12.5	CT Marshalling		
6		Erection and Site Assembly		
7		Drawings		
8		Installation, Operation and Maintenance Manuals		
9		Conformance with Specification		

Clause / Sub-clause	Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not Cs1)
Schedule A	Ratings		
Schedule B	List of Variations from the Specification		
Schedule C	Tools and Spare Parts		

Additional Notes: