

Electricity Specification 501

Issue 4 October 2021

Metering Current and Voltage Transformers



Amendment Summary

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1 Scope

This Electricity Specification (ES) specifies the test requirements for metering Current Transformers and Voltage Transformers to enable meters to be calibrated in accordance with the Balancing and Settlement Code (BSC) and associated Codes of Practice.

This ES refers only to electromagnetic measurement transformers complying with BS EN 60044-1 and BS EN 60044-2 and used for metering purposes on the network owned by Electricity North West Limited (Electricity North West) as distribution licensee.

Measurement transformers complying with other standards will be subject to individually agreed criteria.

2 Definitions

Approval	Sanction by the Electricity North West Protection Policy Manager that specified criteria have been satisfied
Contractor	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.
CT	Current Transformer
Specification	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Supplier	Any person or person's firm or company who supplies goods to Electricity North West or to its 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.
VT	Voltage Transformer

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 Electricity North West Protection Policy Manager, and receipt of a written agreement to the proposed change from the Electricity North West Protection Policy Manager.

3.2 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 Protection 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 Protection Policy Manager, compliance with this Specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Protection 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 Protection Policy Manager.

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

3.3 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 Protection 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 Protection 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 Protection Policy Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Protection 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 Protection 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.

3.4 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 Protection Policy Manager will, if requested, confirm agreement to this prior to receipt of the information.

3.5 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 Protection 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 Protection Policy Manager.

3.6 Minimum Life Expectancy

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

3.7 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.

4 Tests - General

The specified tests are in addition to those required for conforming compliance to BS EN 60044-1 and BS EN 60044-2.

The selection of CTs and VTs shall be in accordance with the requirements of [Appendix A](#).

Test voltages and currents used for the determination of measurement errors shall be 50Hz sinusoidal. Items subject to tests from 3 phase supplies shall be connected (L1 – L2 – L3) to a supply with anti-clockwise phase rotation. Tests shall be carried out at a temperature within the permitted limits of the declared temperature.

Tests shall be carried out on assembled units, unless previously agreed in writing. An assembled unit means a unit where the installation of measurement transformers and secondary wiring is complete and configured for use on the system and will not be disturbed by any subsequent actions, except for the removal of an isolatable VT. Test equipment shall be connected to externally accessible primary connections or test bushings and to the switchgear secondary circuit terminals at the point where the metering multicore cable would be connected.

Test equipment used shall be calibrated to verifiable standards to ensure errors in measurements are within the tolerances permitted by the Balancing and Settlement Code. Evidence that test equipment used is suitably calibrated and within its calibration expiry date shall be provided to the Electricity North West Protection Policy Manager, if requested.

5 Tests Certificates

Certificates produced for tested measurement transformers shall enable traceability to the test equipment used.

Separate CT and VT certificates shall be provided. The test results for all metering CTs fitted in one item of plant shall be recorded on one certificate. Where a polyphase VT is composed of single phase units the test results for all metering VTs comprising the polyphase unit shall be recorded on one certificate. The certificates shall not include the results of tests on any other items of equipment.

The format of the certificate shall be agreed and shall include: the name and address of the laboratory carrying out the tests, the date of the tests, the name of the operative carrying out the tests, the serial number(s) of measurement transformers, the standard applicable, the class of the measurement transformer, its ratio(s), its rated output, the measured errors and the uncertainty of measurements.

For metering CTs and associated secondary wiring tested as part of a fully assembled LV metered service unit, the supplier shall record the commissioning tests and checks carried out in an agreed format. The preferred format for recording the checks and tests is given in Electricity North West document CP510, Appendices A and B.

Certificates shall record the results of tests specific to CTs and VTs. (See [sections 6, 7 and 8](#)).

Where tests are required at various burdens the burden used for the tests shall be recorded (VA and pf).

Where measurement transformers are multi-ratio and it is possible to select a given ratio using more than one portion of winding the certificate shall clearly indicate the part of the winding for which errors were determined.

All certificates shall be clearly legible and each individual error must be suffixed by the sign + or -. Ratio errors shall be expressed as % and shall be of the format N.nnn (the % sign will be omitted). Phase angle errors shall be expressed in minutes and be of the format (N)N.nn. Results shall always include the decimal point, preceded if necessary by a zero.

5.1 Provision of Certificates

The manufacturer shall retain a copy of all test certificates. A copy of the certificates shall be placed in an envelope and attached to the switchgear in an agreed location. A further copy of the certificates shall be sent electronically, preferably in Adobe Acrobat format, to the P283 commissioning mailbox (P283commissioning@enwl.co.uk).

6 Tests on Current Transformers

Transformer details shall be recorded from markings on the transformer. Where CT details also appear on a switchgear label the label details shall be checked and confirmed.

Checks shall be carried out to ensure that an individual CT is fitted on the appropriate phase and correctly located to record the required power flow. Polarity and CT ratio tests shall be carried out to confirm the CT terminal marking and the correct marking of secondary wiring. The certificate shall include confirmation that these checks and tests have been carried out with satisfactory results.

Secondary wiring continuity and insulation resistance tests shall be carried out. The certificate shall include confirmation that these tests have been carried out with satisfactory results.

Tests shall be carried out with burdens of 5VA, 10VA and 15VA (pf 0.8 lag). If any of these burdens exceeds the rated output of the CT, that test shall be omitted and a test shall be carried out at a burden equal to the rated output of the CT.

For multi ratio CTs the tests shall be carried out on all available ratios. Ratio and phase angle errors shall be determined at the following points, 120%, 100%, 50%, 20%, 10%, 5% and 1% of rated current.

7 Tests on Voltage Transformers

Transformer details shall be recorded from markings on the transformer. Where VT details appear on a switchgear label the label details shall be checked and confirmed. The type and rating of the primary and secondary fuses shall be recorded.

The resistance of all windings shall be measured and recorded.

Higher voltage and lower voltage windings (between windings and from the winding to the core / earth) shall be pressure tested. The certificate shall include confirmation that this test has been carried out with satisfactory results.

Phasing and correct location to record the required power flow shall be confirmed. Polarity and VT ratio tests shall be carried out to confirm the VT terminal marking and the marking of secondary wiring is correct. The certificate shall include confirmation that these checks have been carried out with satisfactory results.

Where tested as part of the switchgear, secondary wiring continuity, insulation resistance tests and the checks on the marking of the secondary wiring shall be carried out. The certificate shall include confirmation that these checks and tests have been carried out with satisfactory results.

As a minimum, testing shall include the VT secondary fuses in circuit. The preferred option is to include all switchgear secondary circuit wiring up to and including the proposed connections to the metering multicore cable.

Tests shall be carried out at rated primary voltage.

Where the VT has multiple secondary windings, tests shall be carried out with all windings, other than the winding under test, having a connected burden of 0VA. All tests shall then be repeated with all other secondary windings having a connected burden equal to the rated output of the winding to which the burden is to be connected.

Where the VT is multi ratio, tests shall be carried out on all available ratios. The certificate shall clearly indicate the rated primary voltage for which the VT remains connected at the completion of the tests.

Ratio and phase angle errors shall be determined with connected burdens of 0VA, 5VA, and at rated output of the metering winding (pf 0.8 lag).

8 Test of Associations Between Current Transformers and Voltage Transformers

Tests shall be carried out to confirm that the relationships between voltages and currents are correct, ie that the L1 CT is associated with L1 voltage, etc. for each set of CTs and VTs. The certificate shall include confirmation that these checks and tests have been carried out with satisfactory results.

9 Documents Referenced

DOCUMENTS REFERENCED	
Health and Safety at Work Act 1974	
Control of Substances Hazardous to Health Regulations 2002	
Manual Handling Operations Regulations 1992	
ISO 9000	Quality Systems – Guide to Dependability Programme Management
BS EN ISO 14001	Environmental management systems. Requirements with guidance for use
BS EN 60044-1	Instrument Transformers. Current Transformers.
BS EN 60044-2	Instrument Transformers. Voltage Transformers
CP510	Commissioning of Measurement Transformers connected to Tariff Metering Equipment
CP311	Equipment Approval Policy and Process

10 Keywords

Metering; CT; VT

Appendix A – Proposed Metering Information for Switchgear Specifications – Metering CTs and VTs

Table A1 – Allowable Loads (in MVA) for Shown CT Primary Rating

CT Primary Rating (A)*	132kV	33kV	11kV	6.6kV	230V
50	Up to 11	Up to 2.8	Up to 0.9	Up to 0.5	Up to 0.19
100	11 – 22.8	2.8 – 5.7	0.9 – 1.9	0.5 – 1.1	0.19 – 0.39
200	22.8 – 45.6	5.7 – 11.4	1.9 – 3.8	1.1 – 2.3	0.39 – 0.79
400	45.6 – 91.4	11.4 – 22.8	3.8 – 7.6	2.3 – 4.5	0.79 – 1.59
600	91.4 – 137	22.8 – 34	7.6 – 11.4	4.5 – 6.8	1.59 – 2.39
1000	137 – 228	34 – 57	11.4 – 19	6.8 – 11.4	2.39 – 3.98
1500	228 – 343	57 – 85	19 – 28.5	11.4 – 17	3.98 – 5.97
2000	343 – 457	85 – 114	28.5 – 38	17 – 22.8	5.97 – 7.96

*This is the rating in ampere of the primary winding and not the turns ratio.

These loads are calculated up to 100% of primary rating value.

For 1A and 5A secondaries the maximum multicore length of double 2.5sqmm core for 15VA CTs is 40m for 132/33/11/6.6kV connections.

For expected lengths greater than 40m, contact the Electricity North West Protection Policy Manager for advice.

The current Balancing and Settlement Code recognised standard for CTs is BS EN 60044-1.

The current Balancing and Settlement Code recognised standard for VTs is BS EN 60044-2.

A2 – Minimum Accuracy Classes for CTs and VTs

BALANCING AND SETTLEMENT CODE CODE OF PRACTICE	MINIMUM ACCURACY CLASS		LOAD
	CTS	VTS	
1	0.2S	0.2	Exceeding 100MVA
2	0.2S	0.5	Not exceeding 100MVA
3	0.5S	1.0	Not exceeding 10MVA
5	0.5S	1.0	Up to & including 1MVA

A3 – CT and VT Requirements

BALANCING AND SETTLEMENT CODE CODE OF PRACTICE	CTS	VTS
1	2 sets of CTs	2 VT windings
2		Dedicated metering VT winding
3		
5		

VT secondaries should be separately fused as close as practicable to the VT for:-

- (a) Main Meters.
- (b) Check Meters
- (c) Any other burdens

If a common mode fault such as a fuse failure could cause incorrect voltages on both Main and Check meters, a voltage monitoring alarm shall be provided for voltage imbalance of 5% or more for Code of Practice 1 and 2 (normally built into the meter panel).

Appendix B– 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:

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:

Name:

Company:

Signature:

SECTION-BY-SECTION CONFORMANCE

Section	Section Topic	Conformance Declaration Code	Remarks * (must be completed if code is not C1)
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	Product Conformity		
4	Tests - General		
5	Test Certificates		
6	Tests on Current Transformers		
7	Tests on Voltage Transformers		
8	Tests of Associations Between Current Transformers and Voltage Transformers		

* Applicable specifications shall be stated in the Remarks column where alternatives are quoted within a section. The Remarks column shall also be used to indicate cases where the products or services exceed the quoted specifications.

Additional Notes: