

CURRENT TRANSFORMERS, VOLTAGE TRANSFORMERS AND COMBINED INSTRUMENT TRANSFORMERS FOR SETTLEMENT METERING

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PURPOSE AND SCOPE

This Specification defines the functional and performance requirements for current and voltage transformers provided for the Settlement (Tariff) Metering of supplies connected to the National Grid (NG) UK Electricity Transmission System. It supports the more general requirements defined in TS 1, TS 2.01, TS 2.02 and TS 2.09.

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS

- 1.1.1 All CTs, VTs and CT/VTs for Settlement Metering shall comply with TS 1, TS 2.01, and TS 2.02.
- 1.1.2 Metering transformers may be of the combined CT/VT type, or individual current and voltage transformer types. It is permissible for the complete current transformer assembly to include other cores for measurement and protection purposes.
- 1.1.3 Separate CTs shall also comply with the requirements of TS 3.02.04
- 1.1.4 Separate VTs shall also comply with the requirements of TS 3.02.05.
- 1.2 Combined type (CT/VT) Transformers**
 - 1.2.1 The CT part of the combined unit shall meet the relevant requirements of TS 3.02.04.
 - 1.2.2 The VT part of the combined unit shall meet the relevant requirements of TS 3.02.05.

- 1.2.3 Combined transformers shall comply with BS EN 60044-3.
- 1.2.4 Combined transformers shall comprise two current transformer cores and one voltage transformer comprising two secondary windings, each being of an accuracy class as defined in Section 2.1
- 1.2.5 Secondary terminal boxes shall be mounted on each transformer to accommodate necessary alarm equipment, secondary terminal connections, fuses and links.
- 1.2.6 Secondary terminals and connections shall be suitable for their required purpose regarding rating, reliability and the effects of environmental conditions and corrosion.
- 1.2.7 The secondary terminal boxes shall be provided with a degree of protection conforming to at least IP54 classification as defined in BSEN 60529 as required by TS 1.
- 1.2.8 Primary and secondary terminal markings, secondary terminal wiring and rating plate markings shall be in accordance with BS EN 60044-3.
- 1.2.9 Facilities shall be provided to enable the terminal box, where the CT and VT secondary terminals are situated, to be locked and for the application of a wire security seal.
- 1.2.10 All oil filled CT/VTs shall be fitted with an oil sample valve, situated at the base of the CT/VT unit, suitable for taking oil samples for Dissolved Gas Analysis (DGA) in accordance with BS EN 60567. The sample valve shall be situated on the earthed base tank of the equipment. Valves where the oil is extracted by using a hypodermic needle are not suitable.
- 1.2.11 For oil filled equipment the manufacturer shall state the type of insulating oil used, together with a supporting statement providing evidence that the oil is suited to the required application.
- 1.2.12 Oil filled equipment fitted with an expansion system shall be provided with a permanent visual indication of the volume of oil present. The status of the indicator shall be visible from ground level.
- 1.2.13 For oil filled equipment fitted with an internal expansion system ie gas cushion or diaphragm, and/ or where an external indicator is impractical, means shall be provided to permanently display the internal oil pressure. The status of the indicator should be visible from ground level.
- 1.2.14 Resin impregnated post-type voltage transformers shall be provided with an effective and supervised means of protecting the primary winding. If fuses are to be used then their condition should be continuously monitored.
- 1.2.15 An insulation test terminal (test tap) shall be provided for the purpose of performing capacitance and dielectric loss ($\tan \delta$) measurements of the primary insulation during routine maintenance. The test terminals shall be suitably identified.

2 PERFORMANCE REQUIREMENTS

2.1 General performance requirements for CTs, VTs and CT/VTs

- 2.1.1 All instrument transformers for Settlement Metering shall comply with the primary ratings detailed in TS 1, TS 2.01 and TS 2.02.
- 2.1.2 All combined transformers shall in addition comply with BS EN 60044-3.

- 2.1.3 The voltage transformer and current transformer parts of combined measurement transformers shall comply generally with the requirements of TS 3.02.05 and TS 3.02.04 respectively, with the exception of accuracy requirements which are given in Tables 1 and 2 of this specification.

Rated Voltage	420kV	300kV	145kV	72.5kV	36kV	Below 36kV
Accuracy Class:						See note 1
Circuit rated capacity >100 MVA	0.2	0.2	0.2	0.2	0.2	
Circuit rated capacity <100 MVA	0.5	0.5	0.5	0.5	0.5	
Rated Secondary Burden per winding - (VA)	15	15	15	15	15	
Transformation Ratio kV/V	396/ $\sqrt{3}$:1 10/ $\sqrt{3}$	275/ $\sqrt{3}$:1 10/ $\sqrt{3}$	132/ $\sqrt{3}$:1 10/ $\sqrt{3}$	66/ $\sqrt{3}$: 110/ $\sqrt{3}$	33/ $\sqrt{3}$: 110/ $\sqrt{3}$	
Voltage Factor, PU - BS EN 60044	1.5 PU, 30 secs	1.5 PU, 30 secs	1.5 PU, 30 secs	1.9 PU, 30 secs	1.9 PU, 30 secs	

Table 1 - Voltage Transformer Performance Requirements

Rated Voltage	420kV	300kV	145kV	72.5kV	36kV	Below 36kV
Accuracy Class	0.2S	0.2S	0.2S	0.2S	0.2S	See note 4
Rated Output Per Secondary Winding	5	5	5	5	5	
Rated Secondary Current (A)	1	1	1	1	1	
Rated Continuous Secondary Current, Thermal, all Tappings (A)	1	1	1.5	1.5	1.5	
Extended Secondary Current, Accuracy (A)	1.5	1.5	1.5	1.5	1.5	
Transformation Ratio	See Appendix C					
Maximum Rated Continuous Thermal Primary Current (A) (see note 2)	4000	2500 or 3150	2000 or 2500	2000	4000	
Rated Primary Thermal Currents (A)						
- 6 hrs 10°C ambient	-	-	-	2100	-	
-30min 10°C ambient	-	-	-	2400	-	
(see note 3)						

Table 2 - Current Transformer Performance Requirements

Notes:

- 1 Applications at NG Primary System voltages below 36kV are site specific.
- 2 For all ratios, the maximum rated continuous thermal primary current shall be defined as Rated continuous secondary current (thermal) x Rated transformation ratio.
- 3 The manufacturer shall demonstrate, by test, that the specified rated short duration primary thermal currents can be withstood, within the permissible temperature rise limits, following the steady state operation of the measurement transformer at rated continuous primary current at an ambient temperature of 10°C.
- 4 For applications at NG System Voltages below 36kV, the requirements are site specific.

3 TESTING REQUIREMENTS

3.1 Type Tests requirements for CT/VTs

- 3.1.1 Combined Transformers to BS EN 60044-3, TS 3.02.04, TS 3.02.05 plus the accuracy requirements of Appendix B.
- 3.1.2 For voltage transformers using a gas insulation system, a leakage test on the gas system shall be performed by the supplier to demonstrate compliance with TS 2.02

3.2 Additional Type Tests

- 3.2.1 If the transformer is fitted with a ferroresonance -damping device, the manufacturer shall demonstrate, by test, the satisfactory performance of the complete equipment.
- 3.2.2 Radio Interference - Radio interference voltage tests to BS EN 60694 are to be performed on open-terminal CT/VT transformers.
- 3.2.3 A multi-chopped impulse test on all oil filled inductive voltage transformers and capacitive voltage transformers rated 72.5kV and above shall be performed. The test method is given in Appendix A.
- 3.2.4 Temperature Rise - The thermal time constant of all equipment shall be determined on both rising and falling temperature.
- 3.2.5 For oil filled equipment, oil samples for DGA shall be taken before and after the dielectric type tests and shall comply with 3.10.3.
- 3.2.6 Routine tests shall be performed before and after all type tests.

3.3 Type Tests requirements for separate CTs

- 3.3.1 Separate CTs shall be type tested to the relevant requirements of TS 3.02.04 plus the accuracy requirements of Appendix B.

3.4 Type Tests requirements for separate VTs

- 3.4.1 Separate VTs shall be type tested to the relevant requirements of TS 3.02.05 plus the accuracy requirements of Appendix B.

3.5 Routine Tests requirements for CTs, VTs and CT/VTs

- 3.5.1 CT/VTs shall be routine tested in accordance with BS EN 60044-3, and the relevant sections of TS 3.02.04 and TS 3.02.05