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METERING CODE FOUR

CODE OF PRACTICE

Calibration and Testing Requirements for Metering Equipment Registered with the Pooling and Settlements Administrator.

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AMENDMENT RECORD SHEET

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1. INTRODUCTION

This Code of Practice complements and expands on the requirements for calibrating, testing and maintaining of records for metering equipment covered by the Pooling and Settlement (P & S) Agreement. This document should be read in conjunction with the P & S Agreement and the Metering Codes of Practice.

2. OBJECT AND FIELD OF APPLICATION

2.1 The following directions apply to any apparatus used for testing metering equipment registered with the Settlement System Administrator where the test is pursuant to the Pooling and Settlement Agreement and the records are to be kept for the purposes of that Agreement.

2.2 These directives shall apply to all meters except that where meters are certified under the Electricity Act 1989, the initial calibration and testing shall be done to comply with the Act.

2.3 These directions also apply to calibration and testing carried out on metering equipment at the manufacturer's works whilst in the course of production.

2.4 These directions do not specify the frequency of calibration or site accuracy checks. These details are covered in the Metering Codes of Practice.

2.5 The test house or laboratory or on-site test facilities need only satisfy the requirements for the accuracy class of the meters they intend to calibrate or test.

2.6 These directions shall have an effective date of no later than the 1 April 1993 and are not retrospective.

3. APPLICATION TO CODES OF PRACTICE

These directions specify overall accuracy limits for meters including those in which compensations for Instrument Transformer errors and/or power transformer losses have been applied. These limits are either equal to or lower than the equivalent limits applicable to the entire metering system, specified in the Codes of Practice.

Where the limits are lower the difference is a recognition that in practice the error at the metering point or commercial interface will be greater than the error of the meter alone.

4. DEFINITIONS

4.1 "the Director" means the Director General of Electricity Supply.

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4.11 A "blank calibrated meter" is a meter which has been calibrated to accurately reflect VT and CT secondary circuit power with no allowance for any VT or CT errors.

4.12 A "compensated meter" is a meter which has been calibrated to accurately measure power in the primary circuit and has had compensation levels deliberately set into the meter to cover VT and CT errors, and/or losses in power transformers.

5. REFERENCE STANDARDS

5.1 Reference standards, other than standard CTs and VTs, shall be maintained at the appropriate reference temperature ±2°C.

5.2 Reference standard CTs and VTs shall be verified by an accredited laboratory at intervals not exceeding 60 months. Where records are made available to an authorised agent of the Settlement System Administrator (SSA), which show either a negligible or predictable deviation from previous calibrations, then the period between calibration can be increased.

5.3 Other reference standards, unless directly maintained by radio communication, shall be verified at an accredited laboratory at intervals dependent on their specifications but in no case less frequently than at 24 months.

5.4 During periods of use (i.e. between calibrations at accredited laboratories) evidence shall be produced and made available to an authorised agent of the SSA to substantiate the stability of the reference standard.

6. AC/DC TRANSFER STANDARD

6.1 AC/DC transfer standard shall be maintained at the appropriate reference temperature ±2°C.

6.2 AC/DC transfer standards shall be verified at an accredited laboratory at intervals dependent on their specifications but normally no less frequently than at 24 months.

Where records are made available to an authorised agent of the SSA, which show either negligible or predictable deviation from previous calibrations, then the period between calibration can be increased up to a period of 5 years.

6.3 During periods of use (i.e. between calibration at an accredited laboratory) the AC/DC transfer standard shall be calibrated against reference standards prior to use.

9. APPARATUS REQUIREMENT

9.1 The apparatus defined above shall be used in the calibration and testing of metering equipment as a necessary part of demonstrating compliance of the measurements with the P & S Agreement.

9.2 These directions do not require all of this apparatus to be at the same site.

(1) Reference standards and AC/DC transfer standards are not considered as mobile standards and should remain in one place as far as possible and only be moved for verification at an accredited laboratory.

(2) Where AC transfer standards and working standards have to move to another site to be calibrated then these standards should be considered as mobile and calibrated at the appropriate frequency.

10. VERIFICATION OF APPARATUS

10.1 When standards (reference, AC/DC transfer, AC transfer and working) are employed to calibrate and test metering equipment covered under these directions, they should have a permanent signed record of calibration or verification for which the date is in compliance with the periods required.

10.2 The record shall state the accuracy and uncertainty of measurement for that standard.

10.3 AC transfer and working standard records should also include an overall accuracy and uncertainty of measurement statement for that standard with respect to the "True Value". Uncertainty should be determined using the current NAMAS directive (NIS3003), "The Expression of Uncertainty in Electrical Measurement", for all of the calibration chain. The record should include information which will enable the route back to a true value to be obtained in order to provide an auditable system.

10.4 Test equipment used for on-site checking for accuracy under these directions shall have a record produced quoting accuracy and overall uncertainty of that test equipment in the laboratory.

10.5 Permanent signed records of the cross checks applied to reference standards shall be kept.

12. ACCURACY REQUIREMENTS FOR THE TESTING OF MEASUREMENT TRANSFORMERS

12.1 Normally, measurement transformers will only be tested for accuracy initially (i.e. immediately after manufacture).

Evidence shall be available, usually in the form of a test certificate, to show that a measurement transformer complies with its accuracy class.

12.2 The apparatus defined in clauses 5 to 8 shall be used as necessary to provide traceable measurement of the measurement transformer errors.

The accuracy test results shall demonstrate compliance with the required limits including the measurement uncertainty, which shall be determined to a confidence level of 95% or greater.

12.3 Test certificates for new measurement transformers shall provide full details of the burden conditions under which the errors are measured.

13. INSPECTION OF CERTIFICATES, RECORDS AND TESTING

13.1 Testing houses shall make available, on request, all apparatus test reports, records and certificates required to be kept by these directions for inspection by an authorised agent of the SSA.

13.2 Testing houses shall make available, on request, working procedures for inspection by an authorised agent of the SSA.

13.3 The Operator's representative on site shall make available, on request, working procedures for inspection by an authorised agent of the SSA.

13.4 Testing houses shall co-operate with an authorised agent of the SSA during a technical audit and allow such as witnessing, verification and repeat tests on any meter or standard in the testing house for which that testing house produces a record required under these directions.

13.5 The Operator's representative on site shall co-operate with an authorised agent of the SSA during a technical audit. The supervisor should allow such as witnessing, verification and where reasonably practicable repeat tests on any meter at that site which requires a record under these directions.

14. TEST HOUSE QUALITY ASSURANCE

14.1 All test houses shall have a quality assurance system in operation. Preferably this system shall be in accordance with BS5750 Part 3 minimum (or ISO 9003) but other quality assurance systems may be acceptable.

TABLE 1

Standards of accuracy and overall uncertainty for laboratory calibration and testing of active energy meters.

Class of Meter 2.0 and 2.0s

VALUE OF CURRENT %	POWER FACTOR	MAXIMUM OVERALL UNCERTAINTY %	PERCENTAGE ERROR LIMITS OF METER INCLUDING UNCERTAINTY
5 to 120	1	±0.4	±1.9
10 to 120	0.5 lagging	±0.6	±1.9
10 to 120	0.8 leading	±0.6	±1.9

Class of Meter 0.5 and 0.5 s

VALUE OF CURRENT %	POWER FACTOR	MAXIMUM OVERALL UNCERTAINTY %	PERCENTAGE ERROR LIMITS OF METER INCLUDING UNCERTAINTY
5 to 120	1	±0.1	±0.5
10 to 120	0.5 lagging	±0.12	±0.6
10 to 120	0.8 leading	±0.12	±0.6

Class of Meter 0.2 s

VALUE OF CURRENT %	POWER FACTOR	MAXIMUM OVERALL UNCERTAINTY %	PERCENTAGE ERROR LIMITS OF METER INCLUDING UNCERTAINTY	
			BLANK CALIBRATED METER	COMPENSATED METER
5 to 120	1	±0.06	±0.2	±0.25
10 to 120	0.5 lagging	±0.09	±0.3	±0.4
10 to 120	0.8 leading	±0.09	±0.3	±0.4

TABLE 3

Standards of accuracy and overall uncertainty for laboratory calibration and testing of reactive energy meters.

Class of Meter 3.0

VALUE OF CURRENT %	POWER FACTOR	MAXIMUM OVERALL % UNCERTAINTY	PERCENTAGE ERROR LIMITS OF METER INCLUDING UNCERTAINTY
20 TO 120	ZERO	± 1.0	± 3.0
20 TO 120	0.866 lead	± 1.5	± 3.5
20 to 120	0.866 lag	± 1.5	± 3.5

Class of Meter 2.0

VALUE OF CURRENT %	POWER FACTOR	MAXIMUM OVERALL % UNCERTAINTY	PERCENTAGE ERROR LIMITS OF METER INCLUDING UNCERTAINTY
20 to 120	Zero	± 0.5	± 2.0
20 to 120	0.866 lead	± 1.0	± 2.5
20 to 120	0.866 lag	± 1.0	± 2.5

APPENDIX 1

VOLTAGE AND CURRENT BALANCE

Polyphase meters shall be calibrated and tested in the laboratory/test house under the following conditions of voltage and current balance.

Polyphase meter conditions	Active Energy Meters		Reactive Energy Meters
	Class 0.2 & 0.5	Class 2.0	Class 2.0 & 3.0
Each of the voltages between line and neutral or between any two lines shall not differ from the average corresponding voltage by more than	±1.0%	±1.5%	±1%
Each of the currents in the conductors shall not differ from the average current by more than	±1.0%	±2.5%	±2%
The phase displacements of each of these currents from the corresponding line-to-neutral voltage, irrespective of the power factor, shall not differ from each other by more than	2°	3°	2°

REFERENCE CONDITIONS FOR ACTIVE METERS

Class 0.2 and 0.5 Meters

INFLUENCE QUANTITY	REFERENCE VALUE	PERMISSIBLE TOLERANCE
Ambient temperature	Reference temperature or, in its absence, 23°C	±2°C
Working position	As indicated by the manufacturer (1)	±3°
Voltage	Reference voltage (2)	±1%
Frequency	Reference frequency (3)	±0.5%
Waveform	Sinusoidal voltage and current	Distortion factor less than 2%
Magnetic induction of external origin at reference frequency	Magnetic induction equal to zero (4)	0.0025 mT

(1) Position required by certain mechanical components, if they are incorporated, as for example transmitting devices in the form of Hg-reed or registers.

(2) The reference conditions for voltage apply to both the measuring circuit and auxiliary supply(ies).

(3) The reference conditions for frequency apply to both the measuring circuit and the auxiliary supply(ies), if not dc.

(4) This magnetic induction is that at the place of test without the presence of the meter and its connections.

APPENDIX 2B

REFERENCE CONDITIONS FOR ACTIVE METERS

Class 2.0 Meters

Influence quantities	Reference value	Tolerance
Ambient temperature	Reference temperature or, if not indicated, 23°	>15°C to <30°C
Meter position	Vertical	±3°
Voltage	Reference voltage	±1.5%
Frequency	Reference frequency 50Hz	±0.5%
Voltage and current waveform	Sinusoidal form	Distortion factor <5%
External magnetic induction at the reference frequency	Zero	Induction value that does not produce a relative error variation of more than ±0.3%

APPENDIX 3

REFERENCE CONDITIONS FOR REACTIVE METERS

Influence quantity	Reference Value	Permissible Tolerances for meters of class	
		2.0	3.0
Ambient temperature	Reference temperature or, in its absence, 23°C	>15°C to <30°C	
Voltage	Reference voltage	±1.0%	±1.0%
Frequency	Reference frequency	±0.5%	±0.5%
Wave-form	Sinusoidal voltages and currents	Distortion factor less than: 3%	3%
Magnetic induction of external origin of the reference frequency	Magnetic induction equal to zero	Induction value which causes a variation of error not greater than: ±0.3% but should in any case be smaller than 0.05 mT (1)	±0.3%

(1) The test consists of:

(a) for a single-phase meter, determining the errors first with the meter normally connected to the mains and then after inverting the connections to the current circuits as well as to the voltage circuits. Half of the difference between the two errors is the value of the variation of error. Because of the unknown phase of the external field, the test should be made at 0.1 Ib at unity power factor and 0.2 Ib at 0.5 power factor;

(b) for a three-phase meter, making three measurements at 0.1 Ib at unity power factor, after each of which the connections to the current circuits and to the voltage circuits are changed over 120° while the phase sequence is not altered. The greatest difference between each of the errors so determined and their average value is the value of the variation of error.