

CODE OF PRACTICE FOR
THE METERING OF ELECTRICITY TRANSFERS
BETWEEN THE NATIONAL GRID COMPANY PLC
AND EXTERNALLY INTERCONNECTED PARTIES
OVER ALTERNATING CURRENT INTERCONNECTIONS
USING THE NATIONAL FINAL METERING SCHEME

Superseded

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Superseded

Code of Practice for the Electricity Transfers between
The National Grid Company plc and Externally Interconnected Parties
over Alternating Current Interconnections using the
National Final Metering Scheme

FOREWORD

This Engineering Recommendation supersedes Metering Code H - "Code of Practice for the Metering of Electricity Transfers between The National Grid Company plc and Externally Interconnected Parties over Alternating Current Interconnections using the National Interim Metering Scheme.

Details of the National Metering System at Commercial Boundaries are provided in a Functional Description/Standard referenced "Draft Specification EM40". NGC Settlements Limited, as Settlement System Administrator (as defined in the PSA) shall retain copies of, inter alia, all Codes of Practice in this suite together with copies of all documents referred to therein, in accordance with the provisions of the Pooling and Settlement Agreement (PSA).

1 SCOPE

This Code of Practice determines the practices that shall be employed, and the facilities that shall be provided for the measurement of Electricity transfers between The National Grid Company plc (NGC) and Externally Interconnected Parties (EIPs) over Alternating Current Interconnections and for recording measured quantities for Settlement.

It complements and expands on the metering provisions (Clause 56) of the PSA, to which reference should be made. In particular, it complements provisions relating to accuracy of measurement and the corresponding Metering Performance Specifications set out in Schedule 15 to the PSA. It should also be read in conjunction with the relevant Agreed Procedures for, inter alia, operation of the data collection systems as specified in Schedule 16 to the PSA.

NGC Settlements Limited as Settlement System Administrator (as such term is defined in the PSA) shall retain copies of, inter alia, all Codes of Practice in this suite, together with copies of documents referred to in them, in accordance with the provisions of the PSA.

In the event of inconsistency between the provisions of this Code of Practice and the PSA, the provisions of the PSA shall prevail.

2 GENERAL

The National Interim Metering Scheme (IMS) referred to in Metering Code H had known technical limitations which were unavoidable in order to meet the short timescales necessary for implementation at the Effective Date, and proposals were therefore made for a new system which would overcome these limitations. This was initially referred to as the "Final Metering Scheme" (FMS), and sought to establish new metering points at the true commercial boundaries of the companies created on the Effective Date for the generation and supply of Electricity. This new system will provide the quantitative electrical measurements necessary to

support Settlement to a greater accuracy to improved reliability and with less resort to data modification than the IMS.

3. REFERENCES

The following documents may be referred to in the text:

IEC 687 Precision Meters of Class 0.5S and 0.2S

British Standard BS 3938: 1973 Current Transformers

British Standard BS 3941: 1975 Voltage Transformers

CEGB Specification EM27 (1986) Static Energy Meters

CEGB Design Memorandum 099/101 (TDM 6/5) 1979 Definitions of Import and Export in Relation to Instrumentation and Metering

CEGB Specifications HVS8 (1988) Post Type Combined Unit Instrument Transformers for Tariff Metering of the 132kV System

ESI 50-18 Specification for Design and Application of Ancillary Electrical Equipment

Metering Code H Code of Practice for the Metering of Electricity Transfers between The National Grid Company plc and Externally Interconnected Parties over Alternating Current Interconnections using the National Interim Metering Scheme

PTS261 the technical content of CEGB Primary Transmission Scheme 261, which sets out the IMS

PTS271 the technical content of CEGB Primary Transmission Scheme 271 which sets out the FMS

NOTE: All references to standards given in the text are to current versions. Where equipment is in use which was designed and built to earlier versions of these standards there is no implied requirement to update this equipment.

4 DEFINITIONS

Except where otherwise specified herein the definitions in British Standards 205, 1991 and 4727 Part 1, and British Standards for equipment shall apply as appropriate. The following definitions, which also apply, complement or expand upon definitions contained within the PSA and are included for the purposes of clarification.

4.1 Electricity

Active Energy and/or Reactive Energy

4.2 Active Energy

Active Energy is that part of the Electricity supply capable of performing work. Unless otherwise stated it includes Electricity flows in both directions.

4.3 Reactive Energy

Reactive Energy is that part of the Electricity supply which cannot perform work, (the reactive voltampere hours). Unless otherwise stated it includes Electricity energy flows in both directions.

4.4 Active Power

Active Power is the rate at which Active Energy is supplied.

4.5 Reactive Power

Reactive Power is the rate at which Reactive Energy is supplied.

4.6 Demand Period/Integrating Period

The period over which Active Energy and Reactive Energy are integrated to produce Demand Values. For Settlement purposes at the Effective Date, the demand period shall be 30 minutes.

4.7 Demand Values

Average values of Active Power and Reactive Power over a Demand Period. The demand values are half hour demands and these are identified by the time of the end of the Demand Period.

4.8 Meter Demand

A demand registered by a single Meter.

4.9 Total Demand

A demand derived either from the Summation of one or more Meter Demands of similar quantities or from other total demands.

4.10 Import

An Electricity flow to the External System of the EIP from the Transmission System of NGC (see also Appendix A). The verb "Import" and its respective tenses shall be construed accordingly.

4.11 Export

An Electricity flow from the External System of the EIP to the Transmission System of NGC (see also Appendix A). The verb "Export" and its respective tenses shall be construed accordingly.

4.12 Summation

Summation means the algebraic addition of two or more flows of Electricity either simultaneously, or for impulse summation, within the minimum number of impulses for correct operation.

For the purpose of addition, Import flows are termed positive and Export flows are termed negative.

(NOTE - It is intended within the FMS that any Summation or similar manipulation will be carried out by Settlement and that data from sites will be passed from individual metering points to the Central Data Collection System).

4.13 Commercial Interface

For the purposes of this Code the commercial interface is at the point of connection between the system of the EIP and the NGC Transmission System.

4.14 Metering Point

The physical location at which Meters are installed.

4.15 Meter

A device for measuring Electricity.

4.16 Meter Register

A device, normally associated with a Meter or summator, from which it is possible to obtain the amount of Active Energy, or the amount of Reactive Energy that has been supplied in a circuit or circuits.

4.17 Raw Data

Demand Values collected from the outstations and which have not been altered.

The values may have had automatic checks applied to them and be marked with flags describing their status relative to the checks.

4.18 Processed Data

Demand Values which have been amended by basic mathematical processes according to agreed algorithms.

4.19 Verified Data

Demand Values which, having been automatically checked, are considered satisfactory for commercial use.

4.20 Modified Data

Demand Values which are edited or substituted values where the Raw Data has been established as incorrect or missing.

4.21 Validated Data

Demand Values which are ultimately regarded as being correct on the basis of aligning with the Meter Register advances.

4.22 Outstation

The site equipment which receives and stores pulses from the individual Meters, may perform some processing of the data and transmits the metering data to the Collector Station on request.

4.23 Collector Station

The computer based equipment which collects data from the Outstations. Normally, this is carried out automatically each night but manual interrogation during the day is also possible.

The metering data are stored, tested, modified when necessary and transmitted on a daily basis to the Central Data Collection System.

4.24 Central Data Collection System (CDCS)

The computer system located at a central point which contains a national data base which is regularly updated from the collector stations to which it has dedicated communications links.

4.25 Interrogation Unit

A hand held unit which can extract information from the Outstation and store this for later retrieval.

4.26 PSTN/CTN

The Public Switched Telephone Network/The appropriate ESI Corporate Telephone Network.

4.27 The National Interim Metering Scheme (IMS)

The National Metering Scheme as set out in PTS261 in effect as at the Effective Date and continuing until the FMS Date (as defined in the PSA).

4.28 The National Final Metering Scheme ("FMS")

The National Metering Scheme as set out in PTS 271, coming into effect at the FMS Date.

5 MEASUREMENT CRITERIA

5.1 Quantities to be Measured

The outputs from current and voltage transformers shall provide, for each circuit

- (i) Import kWh
- (ii) Export kWh
- (iii) Import kVArh
- (iv) Export kVArh

In addition, integration of the measured values over the Demand Period shall provide, for each circuit

- i average value of kW
- ii average value of kVar

5.2 Accuracy

5.2.1 Overall Accuracy of Equipment

Meters shall be so calibrated, taking account of errors due to measuring transformers, as to achieve the overall accuracy of equipment (comprising Meters and measuring transformers) at the point of measurement within the limits of error as below:

i Active Energy Measurement

Conditions of Test	Limits of errors at Power Factor	
Current expressed as percentage of rated measuring current	Power Factor	Limits of Errors
125% to 10% inclusive	1.0	+/- 0.5%
Below 10% to 5% inclusive	1.0	+/- 0.7%
125% to 10% inclusive	0.5 lag and lead	+/- 1.0%

ii Reactive Energy Measurement

Conditions of Test	Limits of errors at Power Factor	
Current expressed as percentage of rated measuring current	Power Factor	Limits of Errors under primary system balanced conditions
125% to 10% inclusive	Zero	+/- 1.0%
125% to 10% inclusive	0.866 lag and lead	+/- 1.5%

These limits shall be maintained for the prescribed calibration period of the meter, as set out in Section 7.1.3.

5.2.2 Accuracy at the Commercial Interface

In the majority of cases, the point of measurement coincides with the Commercial Interface. Where it does not, loss adjustments shall be made and an uncertainty between adjusted and "true" values will result, which will effectively widen the limits of error in the Tables above (see 5.4).

5.2.3 Accuracy of Records

The amount of Active Energy or Reactive Energy supplied during each declared Demand Period obtained from recorded readings shall be within $\pm 1\%$ (at full load) of the amount obtained by reading the appropriate Meter Register or Meter Registers at the beginning and end of the Demand Period.

5.2.4 Accuracy of Time Keeping

The long term time keeping accuracy shall be based upon the Outstation (Clause 6.3) receiving a time signal from the Collector Station which is synchronised to true time by using a "Rugby" (Warwickshire) Radio clock.

The overall limits of error for the time keeping which must allow for failure to communicate with the Outstation for an extended period of 10 days shall be:

5.2.4.1 The commencement of each Demand Period shall be at a time which is within ± 10 seconds of the true time.

5.2.4.2 The duration of each Demand Period shall be within $\pm 0.03\%$ of the true duration.

5.3 Compensation for Measuring Transformer Errors

Compensation shall be made for the errors of current and voltage transformers, in the Meter calibration.

Values of the compensation criteria shall be recorded in the details submitted upon registration of the Metering Equipment pursuant to the PSA and in relevant Connection and Use of Settlement Agreements.

5.4 Compensation for Line Losses

Compensation shall be made in CDCS software for losses in lines where the point of measurement and the Commercial Interface do not coincide. For Active Power, this will depend on direction of flow and will be subject to agreement. For Reactive Power, treatment of compensation for line losses shall be as determined by the Executive Committee. Values of such adjustments shall be recorded in the Agreed Procedures pursuant to the PSA and in relevant Connection and Use of System Agreements.

6. FACILITIES TO BE PROVIDED AT METERING POINTS

6.1 Meters

Meters shall be to IEC 687, and to CEGB EM27. Watt hour Meters shall be to Class 0.2S, and reactive (var-hour) Meters shall be to at least Class 0.5S with appropriate adjustments to power factor.

On each circuit main and check Active Energy and Reactive Energy Meters for both Import and Export will be installed. This will be achieved by the use of bi-directional Meters (four in all), as follows

- i Main Active Energy Meter
- ii Check Active Energy Meter
- iii Main Reactive Energy Meter
- iv Check Reactive Energy Meter

In addition to the two pairs of contacts providing pulses for Settlement, each Meter shall have a pair of contacts for use by the EIP(s), accessible via interposing relays. (see Section 9).

Meters shall be labelled according to the criteria of Appendix A.

6.2 Instrument Transformers

Instrument transformers shall be to BS 3938 and BS 3934 providing the following facilities:-

Number of voltage transformer secondary windings per pole	2
Number of current transformer per pole	2
Class accuracy of VT	0.2
Class accuracy of CT	0.1
VT secondary routed burden per winding	15VA
CT rated secondary current	1A
CT secondary rated burden	7.5VA

6.3 Data Collection Outstations

Data collection will be by means of Outstations connected to Collector Stations, which will, in turn, be connected to the Central Data Collection System.

At each site, Outstations will be duplicated and will be of different manufacture for increased security.

Data collection equipment is fully specified in CEGB Draft Specification EM 40.

Data collection procedures are detailed in the Agreed Procedures specified in Schedule 16 to the PSA.

The Demand Period shall be selectable over the following range, 30, 20, 15, 10 and 5 minutes. For any selected value in this range one Demand Period shall commence on the hour.

6.4 Ownership

Equipment installed, owned and maintained by EIPs for the purposes of collecting Raw Data for internal use may be installed at a Metering Point by agreement with NGC. Such equipment shall be so installed as not to endanger or interfere with operation of Settlement.

7 CALIBRATION AND TESTING OF EQUIPMENT

7.1 Meters

7.1.1 Initial Calibration

Meters shall be supplied calibrated according to the requirements of Specification CEGB - EM27 as to accuracy, and will be adjusted to take account of voltage and current transformer errors.

The results of routine tests carried out by the Operator (as defined in the PSA) as per relevant sections of the Specifications will be made available to the Registrant (as defined in the PSA), who will, in turn, make them available to a representative of the Settlement System Administrator. The opportunity of witnessing such tests shall be offered to relevant parties, as provided in the PSA.

7.1.2 Periodic Checks

The calibration of Meters shall be checked on site in accordance with the provisions set out in Appendix B to ensure that the accuracy remains within the limits laid down within this Code of Practice.

7.1.3 Periodic Calibration

There is currently no experience of the periods after which Static Meters should be replaced. The Operator will take a test sample of 20% of each type of Meter on a rolling schedule during each period of 10 years and then the Settlement System Administrator will, from the results of the periodic calibration sample tests, agree with the Registrant the period of calibration for each type of Meter. For methods of test, see Appendix B.

7.1.4 Tests Following Disputes

Following dispute, testing procedures shall be as specified within the PSA, using method (a) (injection into the measuring circuits) as specified in Clause 56.15.2(a)

of the PSA. Tests shall be made of the whole range of the Meter, taking test points at 5%, 10%, 20%, 50%, 100% and 125% of the rated measuring current at unity power factor and at 0.5 lagging and leading power factor.

7.2 Instrument Transformers

7.2.1 Initial Calibration

Measuring transformer equipment shall be supplied with known characteristics within the specifications of the relevant standards to allow calibration of Meters to ensure overall system accuracy within the limits laid down in this Code of Practice.

Records of these characteristics shall be recorded as 5.3.

7.2.2 Periodic Calibration

Regular calibration checks on this equipment are not considered necessary.

7.3 Test Access to Metering Equipment

Test terminal blocks in accordance with CEGB Standard 993908 (TPS 9/14) shall be used to facilitate Meter testing and voltage and current transformer monitoring on site.

7.4 Data Logging and Processing Equipment

7.4.1 Initial Tests

Equipment for data logging and processing will be supplied and tested according to the relevant NGC specification including type, routine works and routine site tests. Access to the results of these tests will be made available to the relevant parties in accordance with the provisions of the PSA.

7.4.2 Periodic Tests/Maintenance

The need for periodic tests is not foreseen. Maintenance will be carried out and the Schedules used will be available for inspection.

7.5 Testing Procedures

A programme of periodic tests shall be agreed between the Registrant and Operator. The intention to conduct particular tests, shall be notified to the Settlement System Administrator by the Operator in accordance with the relevant provisions of the PSA.

7.6 Tests on Replacement Equipment

The opportunity will be given to witness comparable tests on any replacement equipment in accordance with the provisions of Clause 56.9.2(a) of the PSA.

8. DATA TRANSMISSION ROUTES AND PROCESSING

8.1 Meter(s) to Site Outstations

Data from Meters will be fed continuously to the respective site Outstation.

Summation calculations may be carried out on the data by the Outstations.

The result of the Raw Data and Processed Data collected will be stored in memory and remain on site after interrogation by the Collector Station for a minimum period of 10 days after collection after which it may be overwritten. During this period, it can be retrieved.

8.2 Site Outstation to Collector Station

Data from Outstations will be collected by the respective Collector Station by daily dial up. Further data transfers may take place, initiated manually. Automatic checking procedures are carried out on the data collected from Outstations and the results are reported at the Collector Station.

8.3 Collector Station to Central Data Collection System

Data from Collector Stations is transferred automatically each day. This data will normally relate to the previous day, but on occasion might cover two or more days in particular cases. If necessary, further data transfers may take place on any day, initiated manually, following investigation of reports.

The Central Data Collection System holds data collected, and these will be made available to the respective Parties as provided for in Schedule 9 to the PSA. The data will be used by the Settlement System Administrator for the purposes of Settlement.

9 ACCESS TO DATA

9.1 General

Access to data and physical access to Metering Points, Data Collection Stations and Central Data Collection Systems shall be in accordance with the provisions of the PSA and the Agreed Procedures referred to therein.

9.2 Access at Metering Points

The Operator shall have physical access to the Metering System which he operates which will include the ability at a Metering Point to interrogate the data Collection Outstation using a portable computer, known as an Interrogation Unit (IU). The IU can be used as a fault finding tool and in exceptional circumstances when communications from the Collector Station fail for an extended period (BT line fault) can be used to retrieve the stored data.

Only staff nominated by the Operator and authorised by the Settlement System Administrator may operate an IU and interrogation of a given Outstation requires use of a unique Outstation identification number.

10 MISSING OR DEFECTIVE DATA AND CONTINGENCY
ARRANGEMENTS

Schedule 16 to the PSA specifies Agreed Procedures which cover the following operational considerations of the Data Collection systems:

- Sources of missing or defective data
- Detection of defects
- Defect Procedures
- Validation of Data
- Reconciliation of discrepancies
- Estimation Procedures

11 NOTIFYING/SETTLING OF DISPUTES

The relevant clauses of the PSA shall govern the procedure for notifying and settling of Disputes.

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APPENDIX A

LABELLING OF METERS FOR IMPORT AND EXPORT

A1 The terms Import and Export are defined in sub-clauses 4.10 and 4.11 and it is considered desirable to recommend a standard method of labelling Meters (or suitable labelling panels etc.), and to establish the relationship between Import and Export Active Energy, and Import and Export Reactive Energy.

A2 ACTIVE ENERGY

Active Energy is considered to be Imported when it flows from NGC's Transmission System to the External System of the EIP. The Meter(s) registering this Active Energy should be labelled "Import".

Active Energy is considered to be Exported when it flows from the External System of the EIP into the Transmission System of NGC. The Meter(s) registering this Active Energy should be labelled "Export".

A3 REACTIVE ENERGY

Within the context of this Code of Practice the relationship between Active Energy and reactive energy can best be established by means of the power factor. The following table gives the relationship:-

Flow of Active Energy	Power Factor	Flow of Reactive Energy
Import	Leading	Export
Import	Unity	Zero
Export	Lagging	Export
Export	Leading	Import
Export	Unity	Zero

Meters for registering Import Reactive Energy should be labelled "Import Reactive" and those for registering Export Reactive Energy should be labelled "Export Reactive".

Note: This convention is based on "Import" and "Export" being from the viewpoint of the Registrant of the Metering System.

APPENDIX B

RECOMMENDATIONS FOR PERIODIC TESTING AND RECALIBRATION OF METERS

1 TESTING

1.1 A routine test of calibration will be carried out on all Meters registered with the Settlement System Administrator at an interval not exceeding 5 years.

1.1.1 Where the test of calibration finds that a Meter is not within the required system accuracy limits set out in 5.2.1 above but indicates that it will not be capable of remaining within those limits until the next test according to the intervals stated above, then the interval of routine tests shall be reviewed.

1.1.2 Routine tests will be carried out on site either at the prevailing load or by injection into the measuring transformer secondary circuits.

1.2 Other Calibration Tests

A test of calibration will be carried out when:-

- (a) the Meter Operator believes that the Meter is not performing to its required accuracy;
- (b) under the metering provisions of the PSA (Clause 56.9.2) where either the Settlement System Administrator or a third party believes that the Meter is not performing to its required accuracy.
- (c) following a dispute as to the values recorded by a Meter as set out in Clause 56.15.2 of the PSA.

For those tests where the method of Clause 56.15.2(a) (injection into the measuring circuits) is used, measurement of accuracy shall be carried out over the whole range of the Meter at the following test points:-

Watt-hour Meters: - 5%, 10%, 20%, 50%, 100% and 125% of rated measuring current at unity power factor.

- 20%, 50%, 100% and 125% of rated measuring current at 0.5 power factor lagging and leading.

Var-hour Meters: - 10%, 20%, 50%, 100% and 125% of rated measuring current at zero power factor.

- 20%, 50%, 100% and 125% of rated measuring current at 0.866 power factor lagging and leading.

2 RECALIBRATION (REFURBISHMENT) PERIODS

2.1 Static Meters

There is insufficient experience in the operation of Static Meters currently available to enable recommendations as to specific intervals between recalibration.

Recalibration in this context shall mean removal from site, refurbishment and recalibration in a test laboratory (where such practice is practicable or economic) before further use.

Recommendations for appropriate intervals between recalibration shall be made for each type of Meter following results of the sampling tests, as required by Section 7.1.3 above.

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