Code of Practice for the Metering of Electricity Transfers between The National Grid Company plc and Generating Companies using the National Final Metering Scheme

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FOREWORD

This document is one of a suite of Codes of Practice which supersedes Engineering Recommendation M24 "Code of Practice for the Metering of Supplies from the Central Electricity Generating Board", issued on April 1973.

This Code of Practice covers the requirements of the Final Metering Scheme (which supersedes the Interim Metering Scheme) in respect of Founder Generators and new generating stations which will be constructed after the Effective Date, (as defined in the Pooling and Settlement Agreement (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.

1 SCOPE

This Code of Practice determines the practices that shall be employed, and the facilities that shall be provided, for the measurement of Energy Transfers between NGC and Generators and for recording measured quantities for Settlement. It also applies to Founder Generators embedded in PES networks unless it is agreed between the Founder Generator and the PES that Metering Code F will be used.

1.1 It complements and expands on the metering section of the PSA to which reference should be made.

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

1.3 In particular, this Code complements Clause 56 of the PSA (in respect of the provisions relating to accuracy of measurement) and the corresponding Metering Equipment Performance Specifications set out in Schedule 15 to the PSA.

1.4 It should also be read in conjunction with the relevant Agreed Procedures for, inter alia, operating of the data collection systems as specified in Schedule 16 to the PSA.

2 REFERENCES

The following documents may be referred to in the text:

British Standard BS 3938: 1973	Current Transformers
British Standard BS 3941: 1975	Voltage Transformers
CEGB Standard 993908 (TPS 9/14) 1983	Test Facilities for Current and Voltage Transformer Secondary Circuits
IEC Publication 687 (1980)	Static Watt hour Meters. Metrological specifications for Classes 0.2S and 0.5S.
E.E.S. (1989)	Electronic Equipment Specifications
CEGB PTS 261	The technical content of Primary Transmission Scheme 261, which sets out the Interim Metering Scheme
CEGB PTS 271	The technical content of Primary Transmission Scheme 271, which sets out the Final Metering Scheme

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.

3 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, and are included for the purposes of clarification to complement or expand upon definitions contained within the PSA.

3.1 Electricity

Active Energy and/or Reactive Energy.

3.2 Active Energy

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

3.3 Reactive Energy

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

3.4 Active Power

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

3.5 Reactive Power

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

3.6 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 is 30 minutes.

3.7 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.

3.8 Meter Demand

A demand registered by a single Meter.

3.9 Total Demand

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

3.10 Import

An Electricity flow to plant or apparatus of a generating company from the plant or apparatus of NGC or a PES system. The verb "Import" and its respective tenses shall be construed accordingly.

3.11 Export

An Electricity flow from plant or apparatus of a generating company to the plant to apparatus of NGC or a PES system. The verb "Export" and its respective tenses shall be construed accordingly.

3.12 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 negative and Export flows are termed positive.

3.13 Commercial Interface

For the purposes of this Code, the relevant physical locations at which commercial interfaces occur are at the higher voltage side of main generator and station transformers.

3.14 Meter

A device for measuring Electricity.

3.15 Metering Point

The physical location on the electrical system at which primary measurements for metering are made.

3.16 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.

3.17 Raw Data

Demand Values collected from the Outstations and which have not been altered by either manual or automatic means.

3.18 Processed Data

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

3.19 Verified Data

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

3.20 Modified Data

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

3.21 Validated Data

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

3.22 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.

3.23 Collector Station

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

3.24 Central Data Collection Systems ("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.

3.25 Bulk Supply Point ("BSP")

A Metering Point normally at 66kV or below which formed the boundary between CEGB and Area Electricity Boards prior to the handover of 132kV assets.

3.26 Grid Supply Point ("GSP")

The usual interface between the 400/275kV Grid System and the distribution system of a PES.

3.27 Interrogation Unit ("IU")

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

3.28 PSTN/CTN

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

3.29 The National Interim Metering Scheme ("IMS")

The National Metering Scheme as set out in PTS 261 which comes into effect on the Effective Date (as defined in the PSA) and shall subsist until the commissioning of the National Final Metering Scheme.

3.30 The National Final Metering Scheme ("FMS")

The National Metering Scheme as set out in PTS 271 which comes into effect on the FMS Date (as defined in the PSA).

3.31 The National Settlement System

The system for reconciliation of all pooling arrangements between PES(s), Generators and other Pool Members (as defined in the PSA).

3.32 PArh Meter

A phase advanced reactive Meter used instead of Import or Export reactive Meters (VArh). Reactive Power/Reactive Energy is calculated in accordance with the following formula:-

$$VAr - (\sqrt{3} \times Watts - 2\ PAr)$$

PArh Meters are not referred to in this Code.

3.33 Reconciled Data

Demand values upon which monthly Settlements will be made, and which will include Validated Data where Meter reading is carried out monthly (or as otherwise agreed).

3.34 Interfacing Unit

A unit which interfaces between the Meter output and the Outstation to provide two (or more) outputs (e.g. to provide an additional output from a Meter with only one set of output contacts).

3.35 Limits of Error

"Limits of Error" wherever applied within this document shall be interpreted to read "Equal to but not greater than" i.e. "less than or equal to:" the value(s) quoted in percentage terms and should be read as $\geq$ +/- x.yz%."

4 MEASUREMENT CRITERIA

4.1 Quantities to be Measured

The outputs from current and voltage transformers shall provide, for the majority of circuits.

(i) Import MWh

(ii) Export MWh

(iii) Import MVArh

(iv) Export MVArh

In addition, timing of the measured values over the demand period shall provide for each circuit the following, or multiples thereof.

(i) average value of kW

(ii) average value of kVAr

4.2 Accuracy

4.2.1 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 of rated measuring current	Power Factor	Limits of Errors
125% to 10% inclusive	1.0	± 0.5%
Below 10% to 5% "	1.0	± 0.7%
125% to 10% "	0.5 lag and lead	± 1.0%

(ii) Reactive Energy Measurement

Conditions of Test	Limits of Errors at Power Factor under primary system balanced conditions	
Current expressed as of rated measuring current	Power Factor	Limits of Errors
125% to 10% inclusive	Zero	± 4%
125% to 10% inclusive	0.866 lag and lead	± 4.5%

The limits of error for Reactive Energy measurement apply to Power Stations of Founder Generators existing or under construction at the Effective Date (as defined in the PSA). For new installations the "new meters" (as defined in Part E of Schedule 15 of the PSA) shall be calibrated to achieve an accuracy in accordance with that Schedule.

4.2.2 Accuracy of Meters

All Meters shall meet class 0.2 requirements. When compensation for external losses and errors are applied to a Meter the class 0.2 accuracy limits shall apply in relation to the Meter characteristic as determined by the applied loss/error compensation. The accuracy class of the Meter should be sustained for environmental conditions in accordance with EES 1989 Class B3.

4.2.3 Accuracy at the Commercial Interface

Where the point of measurement does not coincide with the Commercial Interface then loss adjustments shall be made to the Meter to compensate for losses occuring between the point of measurement and the Commercial Interface. This loss adjustment will produce an additional error between the adjusted value and the true value which will not exceed ± 0.1% in the case of Active Energy. In these circumstances the Meter will be calibrated using best endeavours to keep the overall accuracy of Metering Equipment (as defined in the PSA) to that specified in Clause 4.2.1 of this Code of Practice.

4.2.4 Accuracy of Records

The amount of Active Energy or Reactive Energy supplied during each declared demand period obtained from recorded readings shall generally be within ± 1% (at full load) of the amount obtained by reading the appropriate register or registers at the beginning and end of the demand period.

4.2.5 Accuracy of Time Keeping

The long term time keeping accuracy shall be based upon the outstation receiving a timing 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 timekeeping which must allow for failure to communicate with the outstation for an extended period of 10 days shall be:-

(i) The commencement of each demand period shall be at a time which is within ± 10 seconds of the true time.

(ii) The duration of each demand period shall be within ± 0.03% of the true duration.

4.3 Compensation for Measuring Transformer Errors

Compensation shall be made for the errors of current and voltage transformers in the Meter calibration by the generating companies, their servants or agents. The record of the computed errors and compensation set shall be available for inspection pursuant to the PSA.

Values of compensation criteria which have been recorded will be submitted to the Settlement Systems Administrator pursuant to the PSA.

4.4 Compensation for Primary Transformer Losses

Compensation shall be made for losses in primary transformers by the generating companies, their servants or agents.

The metering sub-committee of the Executive Committee will be informed of the procedures used to calculate and install the compensation for primary transformer loss. If the methods are

disputed then the dispute will be escalated using Agreed Procedures agreed pursuant to the PSA.

The record of the computed loss and the compensation set shall be available for inspection pursuant to the PSA.

Values of compensation criteria which have been recorded will be submitted to the Settlement System Administrator pursuant to the PSA.

5 FACILITIES TO BE PROVIDED AT METERING POINTS

5.1 Meters

Meters shall be of a minimum standard of accuracy of a Class 0.2 bi-directional Static meters in accordance with IEC Publication 687 (1980).

The following generally shall be provided:-

Generators, station transformers and auxiliary gas turbines:

(i) Main Active Energy Meter for Import/Export

(ii) Check Active Energy Meter for Import/Export

(iii) Main Reactive Energy Meter for Import/Export

(iv) Check Reactive Energy Meter for Import/Export

The following metering is required only if the Metering Point does not measure net output of the generating unit:-

Unit transformers:

(i) Main Energy Meter for Import/Export

(ii) Check Energy Meter for Import/Export

(iii) Main Reactive Energy Meter for Import/Export. It should be noted that commercial arrangements might change in such a way that it would be prudent for space to be provided for such Meters.

(iv) Check Reactive Energy Meter for Import/Export. It should be noted that commercial arrangements might change in such a way that it would be prudent for space to be provided for such Meters.

5.2 Current Transformers

Current transformers for use with tariff metering shall be of a minimum standard of accuracy in accordance with BS3938 class 0.1.

The winding supplying the main Meter shall be dedicated for metering purposes. The winding supplying the check Meter can be used for other purposes so long as such uses do not degrade the accuracy outside the limits quoted in clause 4.2.1 of this Code of Practice.

Common return leads for two or more current transformer secondary circuits shall not be permitted.

For installations under construction or existing at transfer date current transformers for use with tariff metering of generators shall where reasonably practicable be to BS 3938 class 0.1. Installations using existing instrument transformers may be retained. Wherever possible Efficiency and Test CT's will be used for the main Meters. Efficiency and Test CT's should, where reasonably practicable, have no other permanently connected load. Any load connected shall not degrade the accuracy outside the limits quoted in Clause 4.2.1 of this Code of Practice.

Where a CT circuit has an additional burden not associated with main or check meters, this additional burden shall not be modified in any way without obtaining the approval of the Settlement System Administrator.

For existing installations check Meters may be connected to the same or different CT's.

5.3 Voltage Transformers

Voltage transformers for use with tariff metering shall be of a minimum standard of accuracy of a class 0.2 voltage transformer to BS 3941 at the working burden.

The winding supplying the main Meter shall be dedicated for metering purposes. The winding supplying the Check Meter can be used for other purposes. Any load connected shall not degrade the accuracy outside the limits quoted in clause 4.2.1 of this Code of Practice.

The metering suite shall be fed by a separate, fused set of leads from the voltage transformer.

For installations under construction or existing at the Effective Date (as defined in the PSA), voltage transformers for use with tariff metering shall where practicable be to BS3941 class 0.2 at the working burden. Installations using existing transformers may be retained. Whenever possible efficiency and test V.T.s will be used for the main meter and should where practicable have no other permanently connected load. Any load connected will not degrade the accuracy outside the limits quoted in clause 4.2.1 of this Code of Practice.

Existing metering voltage transformers may be shared with other duties in so far as this does not degrade the accuracy outside the limits quoted in clause 4.2.1 of this Code of Practice. Capacitor voltage transformers used for metering Reactive Energy will have a working burden which does not exceed its rating.

Where a VT circuit has an additional burden not associated with main or check meters, this additional burden shall not be modified in any way without obtaining the approval of the Settlement System Administrator.

For existing installations, check Meters may be connected to the same or different V.T.s providing they are separately fused.

5.4 Outstation Equipment

Main and check metering data will be collected in different Outstations except where Outstations are duplicated, when main and check data will be collected in both. Where data from more than one Meter is collected in an Outstation, duplicate Outstations shall be provided.

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

5.5 Communications/Transmission Medium

Outstations which collect data from more than one Meter will be duplicate, and identical information from the Meters will be transmitted to both. Where outstations collect data from only one Meter then the main and check metering data will have independent communication routes. Linkage of several Outstations is allowed provided that main and check metering data is each available on separate telecommunication circuits. The communication path from the generating station will be by a means which will be agreed between the generating company and the Settlement System Administrator.

5.6 Voltage Failure Relay

Voltage (fuse) failure relays shall be provided which will provide a metering "voltage failure" alarm on loss of voltage supply to any Meter.

5.7 Ownership

Each Metering System (as defined in the PSA) shall have a Registrant and Operator appointed pursuant to the PSA.

6 CALIBRATION AND TESTING OF EQUIPMENT

6.1 Meters

6.1.1 Initial Calibration

Meters shall be calibrated and compensation applied to take account of voltage and current transformer errors and, where applicable, primary transformer losses.

The results of calibration tests will be held by the Operator (as defined in the PSA) and shall be made available in accordance with clause 56.9.3 of the PSA.

6.1.2 Periodic Calibration and Accuracy Check

The frequency of tests shall be based on an acquired knowledge of the performance of the particular design of Meter. See Appendix A.

6.2 Measuring Transformers

6.2.1 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.

For installations under construction or existing at the Effective Date (as defined in the PSA) existing measuring transformer equipment will wherever practicable be used which will have been supplied with known characteristics within the specifications of relevant standards to allow calibration of Meters.

Where records are not available which quantify the measurement errors then on site calibration will be carried out.

6.2.2 Periodic Calibration

Calibration checks on measuring transformers are not proposed.

6.3 Outstation Equipment

6.3.1 Initial Tests

Tests will be carried out to establish that the recorded energy displayed on the Outstations register is within +/- 0.1% of that recorded on the Meter during a period of not less than 1 month.

In addition, tests will be carried out to establish that the summated demands stored in the Central Collector equal, within ± 0.1%, the energy recorded by each Meter.

6.3.2 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 DATA TRANSMISSION ROUTES AND PROCESSING

7.1 Meter(s) to Site Outstations

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

The data collected is stored in memory and remains stored on site after the interrogation by the Collector Stations. It may also be retrieved for a maximum of 10 days after data is initially received and stored, after which it may be overwritten.

7.2 Site Outstation to Collector Station

Data from Outstations will be collected by the Settlement System Collector Station by daily dial up.

Automatic checking procedures are carried out on the data collected from Outstations and the results are reported at the Collector Station. Data is flagged and transferred to the CDCS.

7.3 Collector Station to CDCS

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.

The CDCS holds data collected, and these are available for inspection by the relevant parties. The data are also passed to the National Settlements System and, after validation and processing to conform to the configuration required by the various contracts, form the basis of financial Settlements.

8 ACCESS TO ASPECTS OF DATA

8.1 Data

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.

8.2 Access at Metering Points

The Operator may, at a Metering Point, 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 (e.g. a BT line fault), can be used to retrieve the stored data.

Only staff both 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.

9 MISSING OR DEFECTIVE DATA AND CONTINGENT ARRANGEMENTS

The Agreed Procedures listed in Schedule 16 to the PSA 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

10 NOTIFICATION/SETTLEMENT OF DISPUTES

As validation is available daily to the generating companies then disputes are likely to originate from that exercise. The generating companies will channel the dispute through their own Energy Management Centre to the Settlement System Administrator where the dispute will be dealt with using Agreed Procedures agreed pursuant to the PSA.

10.1 Testing following a Dispute

Testing to settle a dispute will be the responsibility of the Operator (as defined in the PSA) who will arrange for testing on equipment mounted in its operational position. Performance will be compared with previously calibrated test equipment by one of the following methods in the presence of the Settlement System Administrator or his nominee:-

(a) By injecting into the measuring circuits (ie excluding the primary current and voltage transformers) and comparing the readings or records over a sufficient period to ensure a reliable comparison.

(b) By operating the calibrated test equipment from the same primary current and voltage transformers as the measuring equipment, under operating conditions. The registrations and recordings of the two equipments shall be compared over a testing period of such length as will ensure that the conditions of test are similar to the normal conditions of operation and will ensure a reliable comparison.

(c) Using any other method which has been agreed with the Settlement System Administrator.

Representatives of the PES(s) will be entitled to witness tests taken as a result of a dispute, including calibration tests of the equipment to be used.

10.2 Testing following a belief that the metering equipment is not within the prescribed accuracy

Testing as described in 10.1 will be carried out by the Settlement System Administrator or the Operator (as defined by the PSA) of the Meter. The cost of the test will be borne by the party described in clause 56.9.2 of the metering section of the PSA.

11 SUBMISSION TO ARBITRATION

Failure of the agreed procedures and the Executive Committee to resolve a dispute will result in that dispute ascending to the independent arbiter.

The generating company will refer the matter to the Electricity Supply Industry Arbitration Association pursuant to the PSA and Agreed Procedures agreed pursuant thereto.

APPENDIX A

Guidelines for the Periodic Test of Calibration and Recalibration of Meters

1 TEST OF CALIBRATION (ACCURACY CHECK)

1.1 A routine 'test of calibration' using procedures described in 10.1 will be carried out on all Meters registered with the Settlement System Administrator at an interval not exceeding 5 years.

1.2 Where the 'test of calibration' shows a Meter type not to be capable of sustaining the accuracy class for the period quoted in Clause 1.1 of this Appendix then the routine 'test of calibration' period for that Meter will be reviewed.

1.3 A 'test of calibration' will be carried out when:-

(a) The Meter Operator (as defined in the PSA) believes that the Meter is not performing to its required accuracy.

(b) Under the metering section of the Pooling and Settlement Agreement 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.

2 RECALIBRATION OF METERS

There is no experience currently for meters presently available which meet an accuracy Class 0.2S Meters to IEC 687 to enable recommendations as to specific intervals between recalibration (recalibration in this context might imply complete refurbishment).

2.1 Periodic Calibration

The Operator will take a test sample to 20% of each type of Meter on a rolling schedule during each period of 10 years and then the Settlement System Administrator will, with the results of the periodic calibration checks, agree with the Registrant (as defined in the PSA) the period of calibration for each type of Meter.

APPENDIX B

LABELLING OF METERS FOR IMPORT AND EXPORT

1. The terms Import and Export are defined in sub-clauses 3.10 and 3.11 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. Accordingly, Meters (or suitable labelling panels etc.) shall be labelled in accordance with this Appendix B.

2 Active Energy

Active Energy is considered to be Imported when it flows to the plant or apparatus of a generating company from the plant or apparatus of NGC or a PES System. The Meter(s) registering this Active Energy should be labelled "Import".

Active Energy is considered to be Exported when it flows from the plant or apparatus of a generating company to the plant or apparatus of NGC or a PES System. The Meter(s) registering this Active Energy should be labelled "Export".

3 Reactive Energy

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

Flow of Energy	Power Factor	Flow of Reactive Energy
Import	Lagging	Import
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.