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

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

CONTENTS

Code of Practice for the Metering of Electricity Transfers Between The National Grid Company plc and Externally Interconnected Parties using the National Interim Metering Scheme

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 in April 1973. It does not include arrangements between The National Grid Company plc (NGC) or Public Electricity Suppliers ("PESs") and Generators (both as defined in the PSA) which are dealt with in other Codes in the suite.

Details of the National Interim Metering System (IMS) are provided in a Functional Description issued by CEGB Transmission Division in November 1988. The IMS will ultimately be replaced by a new National System (FMS), and a further Code of Practice will then apply for energy transfers in this category.

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 documents referred to in them, 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 NGC and Externally Interconnected Parties ("EIPs") 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.

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

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 993619 (TPS 6/19) 1985	Application of Metering to Tariff Circuits

CEGB Standard 993908 (TPS 9/14) 1983	Test Facilities for Current and Voltage Transformer Secondary Circuits
CEGB Specification EM21 (1982)	Electricity Meters, Induction Type
CEGB Specification EM24 (1980)	Cubicle for Accommodating Metering Equipment and Transducers
CEGB Specification EM27 (1986)	Static Energy Meters
CEGB Specification EM28 (1980)	Metering Information Tape Recording Equipment (MITRE)
CEGB Design Memorandum 099/101 (TDM 6/5) 1979	Definitions of Import and Export in Relation to Instrumentation and Metering
ESI 50-18	Design and Application of Ancillary Electrical Equipment
Engineering Recommendation M24	Code of Practice for the Metering of Supplies from the CEGB
CEGB Functional Description (issue 1 November 1988)	The National Interim Metering Scheme.
CEGB Specification	Modified Mitre Unit
CEGB Specification	OSME Unit
CEGB Specification	CM10 Unit
CEGB Specification (Issue 1; 17 March 1989	Communication Protocol Definition of links between the IMS projects and the Central Data Collection system
PTS 261	Technical content of CEGB Primary Transmission Scheme 261, which sets out the IMS
PTS 271	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.

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, supplement or complement those in the PSA and are included for purposes of clarification.

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 active 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 shall be 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 the EIP's external system from the NGC Transmission System. The verb "Import" and its respective tenses shall be construed accordingly. (See also Appendix A).

3.11 Export

An Electricity flow from the EIP's external system to the NGC Transmission System . The verb "Export" and its respective tenses shall be construed accordingly. (See also Appendix A).

3.12 Summation

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.

3.13 Commercial Interface

For the purposes of this Code, the relevant physical locations at which commercial interfaces occur are as follows:-

on circuits (system links) between NGC and an EIP at the defined commercial interface.

3.14 Metering Point

The physical location at which Electricity is metered.

3.15 Meter

A device for measuring Electricity.

3.16 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.

3.17 Raw Data

Demand Values collected from the Outstations and which have <u>not</u> been altered.

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

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, have 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 Reconciled Data

Demand Values upon which monthly Settlements will be made, and which may include Validated Data where Meter reading is carried out monthly.

3.22 Validated Data

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

3.23 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.

3.24 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).

3.25 Interrogation Unit

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

3.26 Collector Station

The computer based equipment located at a few selected sites in the country, 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 station.

3.27 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.

3.28 PSTN/CTN

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

3.29 The National Interim Metering Scheme (IMS)

The National Metering Scheme as set out in PTS 261, in effect as at the Effective Date and continuing until the FMS Date (as defined in the PSA).

3.30 The National Final Metering Scheme (FMS)

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

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 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 (where appropriate)

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 attain overall accuracy of equipment (comprising Meters and measuring transformers) at the point of measurement within the limits of error in the tables below.

i Active Energy Meters

TABLE 1

Conditions of Test		Limits of Error at Stated Power Factor	
Current expressed as a percentage of the rated measuring current		Power Factor	Limit of Error
	125% to 20% inclusive	1.0	± 1.0%
Below	20% to 10% inclusive	1.0	± 1.5%
Below	10% to 5% inclusive	1.0	± 2.0%
	125% to 20% inclusive	0.5 lag and lead	± 2.0%
Below	20% to 10% inclusive	0.5 lag and lead	± 2.5%

ii Reactive Energy Meters

TABLE 2

Conditions of Test		Limits of Error at Stated Power Factor	
Current expressed as a percentage of the rated measuring current		Power Factor	Limit of Error Under Primary System balanced Conditions
	125% to 5% inclusive	Zero	± 4%
	125% to 20% inclusive	0.866 lag and lead	± 4%
Below	20% to 10% inclusive	0.866 lag and lead	± 5%

These limits shall be maintained for the prescribed callibration period of the Meter as defined in Section 6.1.3

4.2.2 Accuracy at the Commercial Interface

Where the point of measurement is not at the Commercial Interface, values will be adjusted to reflect the values as if measured at the Commercial Interface. Due to the nature of these adjustments, there will be an uncertainty between adjusted and "true" values. This is expected to increase the limits of error as set out above by up to +/-1% in some half hour periods. For varhour metering, no such adjustments will be made.

4.2.3 Accuracy of Records

The amount of Active Energy or Reactive Energy supplied during each declared Demand Period obtained from recorded readings shall be within +/-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.

4.2.4 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 time keeping which must allow for failure to communicate with the Outstation for an extended period of 10 day shall be:-

4.2.3.1 the commencement of each Demand Period shall be at a time which is within +/-10 seconds of the true time;

4.2.3.2 the duration of each Demand Period shall be within +/-0.03% of the true duration.

4.3 Compensation for Measuring Transformers Errors

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

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

4.4 Compensation for Primary Transformer Losses

Compensation shall be made, as necessary, for losses in primary transformers, as defined in the relevant Connection and Use of System Agreements between the parties concerned, and may be either in the meter calibration or in the final computed figures.

5 FACILITIES TO BE PROVIDED AT METERING POINTS

(Note - The Functional Description of the Interim Metering System and CEGB Standard 993619 (TPS 6/19) give technical details of metering systems and equipment, to which reference should be made. Basic details are reproduced below for completeness.)

5.1 Meters

Meters shall be in accordance with Specification CEGB-EM21 or EM27 and the following shall be provided on each circuit used to furnish the supply:

i Main Active Energy Meter for Import

ii Check Active Energy Meter for Import

iii Main Active Energy Meter for Export

iv Check Active Energy Meter for Export

v	Reactive Energy Meter for Import	)
		)where
vi	Reactive Energy Meter for Export	)appropriate

Half-hourly demands of Active Energy Imported and Exported and Reactive Energy Imported and Exported shall be made available in a manner suitable for processing by the appropriate information collection system.

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

5.2 Current Transformers

Current transformers for use with tariff metering shall preferably be to BS 3938, Class 0.2, and have a rating of not less than 15 VA. Installations using existing instrument transformers may be retained subject to the requirements for Meter accuracy being met.

Metering current transformers shall be used solely for supplying the Meters.

The secondary current shall be either 1 or 5 amps.

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

The total burden shall not exceed the rating of the current transformer.

5.3 Voltage Transformers

Voltage transformers for use with tariff metering shall be to BS 3941, Class 1.0, and have a rating of not less than 100 VA. Installations using existing transformers may be retained subject to the requirements for Meter accuracy being met. Metering voltage transformers may be shared with other duties in so far as this does not affect accuracy of the Meters. The metering suite shall be fed by a separate, fused set of leads from the voltage transformer.

5.4 Interfacing Equipment

Interfacing units shall be designed and supplied according to relevant specifications in force.

An indication of impulsing state shall be available on each unit.

5.5 Communication/Transmission Medium

Communications from Metering Point to Collector Station shall be via PSTN, or occasionally, via CTN.

5.6 Ownership

All metering, metering ancillary equipment, instrument transformers, interfacing and control equipment in connection with the IMS will be registered into Settlement as required by the PSA which will specify at each site the Registrant and Operator (both as defined in the PSA) of the equipment.

6 CALIBRATION AND TESTING OF EQUIPMENT

6.1 Meters

6.1.1 Initial Calibration

(Note - For the IMS in many cases existing Meters will be utilised, and hence initial calibration will already have been carried out).

Meters shall be supplied calibrated according to the requirements of Specification CEGB - EM21 or EM27 as to accuracy, to the relevant requirements of such Specifications and with errors biased to take account of voltage and current transformer errors and, where applicable, primary transformer losses.

The results of routine tests carried out as per relevant sections of the specifications will be made available in accordance with Clause 56.9.3 of the PSA with other records as in 6.1.2 below.

6.1.2 Checking and Recalibration prior to the Effective Date

Metering equipment will have been subject to volume inspection and recalibration under procedures established by the CEGB. These procedures and the periods attributable to particular Meter types for recalibration, have varied between CEGB Field Engineering Units. Meters may be checked on site to ensure that the accuracy remains within the limits laid down within this Code of Practice.

Records relating to these periodic checks or recalibrations shall be transferred by the CEGB before the Effective Date to the Operator of the Metering System who will make them available to the Registrant and/or Settlement System Administrator as required by the provisions of the PSA.

6.1.3 Subsequent Checking and Recalibration

It shall be the objective, within three months of the Effective Date for the Settlement System Administrator to check, and affix a seal to that Metering Equipment required to be sealed pursuant to the PSA. In this context, checking shall include a thorough inspection of Metering Equipment and connections thereto.

Historic records will indicate priorities in subsequent Meter recalibration, and schedules of proposed recalibration will be provided by the Operator. Site Checking and Recalibration will continue in accordance with the table below except that the need for further recalibration will be reviewed within six months prior to the FMS Date.

Records of inspections and work carried out will be kept to a form approved by the Settlement System Administrator.

Table 3 - Site Checking

Site checking of Meters shall continue to be carried out with the following frequencies from the date of the last site check.

Meter Type		Check Frequency (years)
Ferranti	FLF	3
	FMF	5
	FNF	5
GEC	E72F	3
CFH	FN	2
	KTA	2
L&G	(all)	5

otherwise Meters shall be recalibrated in accordance with Table 4.

Table 4 - Periodicity of Recalibration

The following recalibration periods shall be adopted:-

Manufacturer	Meter Type	Recalibration Period (years)
Ferranti	(FLF	3
	(FMF	6
	(FNF	10
GEC	E72F	6
L & G	All	10
C & H	(FN	3
	(KTA	3

6.1.4 Tests Following Disputes

Where site tests are required to settle a dispute, Method (a) (injecting into measuring circuits) as specified clause 56.15.2(a) of the PSA shall be preferred. 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.

6.2 Measuring Transformers

6.2.1 Initial Calibration

The IMS will use existing measuring transformer equipment, which will have been supplied with known characteristics within the specifications of relevant British 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 will be included with those records referred to in 6.1.2 above.

6.2.2 Periodic Calibration

Calibration checks on measuring transformers within the anticipated time for which the IMS will be in operation is not considered practicable or necessary in those cases where calibration records are readily available. In those cases where no calibration records exist, recalibration will be carried out.

6.3 Test Access to Metering Equipment

Where provided, test terminal blocks in accordance with CEGB Standard 993908 (TPS 9/15) shall be used to facilitate Meter testing and voltage and current transformer monitoring on site. Otherwise, existing arrangements will continue.

6.4 Data Logging and Processing Equipment

6.4.1 Initial Tests

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

6.4.2 Periodic Tests/Maintenance

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

6.5 Testing Procedures

A programme of any 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 provisions of the PSA.

6.6 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.

7. DATA TRANSMISSION ROUTES AND PROCESSING

7.1 Meter(s) to Site Operations

Data from Meters will be fed continuously and either directly or, where necessary, via a Meter interface unit, to the respective site Outstation.

Logic calculations carried out on the data by the Outstations may include

i Summation of two or more inputs.

ii Subtraction of one input or one Summation from another input or Summation.

iii Division of an input, a Summation, or an output, by an interger, generally 15 or less.

iv Multiplication of an input, sometimes associated with a division to give a fraction.

v Coding of the output, generally into 11 bit Teletype code, with even parity and parity checking.

vi Counting in Demand and/or Cumulative Logic.

vii Scaling to convert each impulse to an appropriate count consistent with its impulse value.

Not all these forms will occur in any one equipment, and other forms may be required. Details shall be recorded in relevant agreed procedures. The result of the Raw Data and Processed Data collected is stored in memory and remains stored on site after interrogation by the Collector Stations depending upon the capacity of the equipment, for a minimum of 9 days after collection (generally a longer time period obtains) after which it may be overwritten. During this period it can be retrieved.

7.2 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.

7.3 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 transfer may take place, initiated manually, following investigation of reports.

CEGB Specification: Communications Protocol Definition of Links between the IMS projects and the Central Data Collection System includes details of requirements for data transmission. The Central Data Collection System holds data collected, and these will be 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.

8. ACCESS TO DATA

8.1 General

Access to data and physical access to Metering Points, Data Collections Stations and the Central Data Collection System shall be in accordance with the provisions of the PSA and the Agreed Procedures referred to therein under Schedule 16, save as below.

8.2 Access at Metering Points

The Operator shall have physical access to the Metering System which it 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 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 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 an unique Outstation identification number.

9. 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

10. NOTIFYING/SETTLING OF DISPUTES

The relevant clauses of the PSA shall govern the procedures for notifying and setting of disputes.

APPENDIX A

LABELLING OF METERS FOR IMPORT AND EXPORT

A1 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 Energy, and Import and Export Reactive Energy.

A2 ACTIVE ENERGY

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

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

A3 REACTIVE ENERGY

Flows of Reactive Energy are independent of the relative positions of generators and loads, but depend on the characteristics of generators, transmission and distribution systems and loads.

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	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".

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