CODE OF PRACTICE FOR THE METERING OF ELECTRICITY TRANSFERS BETWEEN THE NATIONAL GRID COMPANY plc AND NON-EMBEDDED DIRECT CONSUMERS USING THE NATIONAL METERING SYSTEM AT COMMERCIAL BOUNDARIES (KNOWN AS THE "FINAL METERING SCHEME")

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CONTENTS

Code of Practice for the Metering of Electricity Transfers between the National Grid Company plc and Non-Embedded Direct Consumers using the National Metering System at Commercial Boundaries (known as the "Final Metering Scheme")

FOREWORD

This Engineering Recommendation superseded Metering Code A - "Code of Practice for the Metering of Electricity Transfers between the National Grid Company and Public Electricity Suppliers using the National Interim Metering System". As with that document, it does not include arrangements between National Grid Company plc (NGC) or Public Electricity Suppliers (PESs) and Generators, or the metering of customers of PESs, or Generators, or the metering of Externally Interconnected Parties.

For the purposes of this Code, the terms "PES", "Generator" and "Externally Interconnected Parties" shall have the meaning given those expressions in the Pooling and Settlement Agreement ("PSA").

Details of the National Metering System at Commercial Boundaries are provided in a Functional Description referenced "Draft Specification EM40".

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 wit 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 Electricity transfers between NGC and Non-Embedded Direct Consumers 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 Equipment 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 an 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 System ("IMS") referred to in

Metering Code A 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 new companies. This new system will provide the quantitative electrical measurements necessary to support Settlement to a greater accuracy to improve 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 Specification 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
CEGB Standard 993908 (TPS 9/14)	Specification for test terminal blocks
Metering Code A	Code of Practice for the Metering of Electricity Transfers between the National Grid Company plc and Public Electricity Suppliers using the National Interim Metering Scheme
Metering Code B	Code of Practice for the Metering of Electricity Transfers between the National Grid Company plc and Public Electricity Suppliers using the National Metering System at Commercial Boundaries (known as "Final Metering Scheme")

CEGB Draft Specification EM40 (expected to be superseded in the period between the Effective Date and the FMS Date)	Metering at the Commercial Boundaries with Consumers
CEGB Specification (Issue 1, 17th March, 1989) (expected to be superseded in the period between the Effective Date and the FMS Date (as defined in the PSA))	Communication Protocol Definition for links between the IMS Projects and the Central Data Collection System
PTS 261	The technical content of Primary Transmission Scheme 261, which sets out the IMS
PTS 271	The technical content of 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 energy 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 reactive 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 is 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 plant or apparatus of the PES from the plant or apparatus of NGC (see also Appendix B). The verb "Import" and its respective tenses shall be construed accordingly

4.11 **Export**

An Electricity flow from plant or apparatus of the PES to the plant or apparatus of NGC (see also Appendix B). 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.

4.13 **Commercial Interface**

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

At the lower voltage side of 400/275kV connected transformers.

4.14 **Metering Point**

The physical location at which electricity is metered.

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 amounts 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 by either manual or automatic means.

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, having been amended by basic mathematical process according to agreed algorithms.

4.19 **Verified Data**

Demand Values which, having been automatically checked, are considered satisfactorily 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 dial 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 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.

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 **Bulk Supply Point (BSP)**

An historical term to describe 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.

4.26 **Grid Supply Point (GSP)**

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

4.27 **Interrogation Unit**

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

4.28 **PSTN/CIN**

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

4.29 **The National Interim Metering Scheme (IMS)**

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

4.30 **The National Metering Scheme at Commercial Boundaries (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:-

(a) average value of kW

(b) 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 ERROR AT STATED POWER FACTOR	
Current expressed as percentage of rated measuring current		Power Factor	Limits of error
	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 ERROR AT STATED POWER FACTOR UNDER BALANCED PRIMARY SYSTEM CONDITIONS	
Current expressed as percentage of rated measuring current		Power Factor	Limits of error
	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. In the case of Active Energy this additional error should not exceed ± 0.1%.

5.2.3 **Accuracy of Records**

The amount of 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 register or 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 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 of 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 +/- 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 System pursuant to the PSA and in relevant Connection and Use of System Agreements.

5.4 **Compensation for Losses**

Compensation shall be made in CDCS software for losses where the point of measurement and the commercial boundary do not coincide. For Active Power, this will depend on direction of flow and will be subject to agreement between the Parties concerned. For Reactive Power, the treatment of compensation for losses shall be as determined by the Executive Committee. Values of such adjustments shall be recorded in the Agreed Procedures (as listed in Schedule 16 to the PSA) and in relevant Connection and Use of System Agreements.

5.5 **Grid Sites with Secondary Voltage levels less than 132kV**

Accuracy limits of the metering equipment will be as specified above, but the use of combined instrument transformers will not be practicable. In such cases, separate VTs and CTs used will be

to the Class standards required in order to meet these system accuracies. (See section 6.2)

6. FACILITIES TO BE PROVIDED

(Note - The National Metering System is described fully in the draft Standard of which extracts are provided for information purposes in Appendix A. It is intended that this draft document is to be superseded. However, basic details are reproduced below for ease of reference.)

6.1 Meters

Meters shall be to IEC 687, and to CEGB EM27. Watthour Meters shall be to at least 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 the National System, each Meter shall have a pair of contacts for use by the Supplier. Meters shall be labelled according to the criteria of Appendix B.

6.2 Current Transformers

Current Transformers for use with tariff metering shall be of a minimum standard of accuracy in accordance with BS 3938, Class 0.1 and a secondary rated burden of not less than 7.5VA per winding.

There shall be two current transformer secondary windings per phase available solely for metering and each winding shall be separately cabled to the metering cubicle.

The secondary current shall be 1 amp.

6.3 Voltage Transformers

Voltage transformers for use with tariff metering shall be of a minimum standard of accuracy in accordance with BS 3941, Class 0.2 with a secondary rated burden of not less than 15VA per winding.

There shall be two voltage transformer secondary windings per phone available for metering purposes each supplying the functional requirements of the Main and Check meter circuits separately, the details of which are set out in Appendix A.

NOTE: Combined instrument transformer units which comply to Specification CEGB - HV88 (1988) may be used.

6.4 **Data Collection**

Data collection will be by means of Outstations connected to Collector Stations. Collector Stations 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 extracts from CEGB Draft Specification EM40. See Appendix A or such Specification as superseded it (see Note in Section 6 above).

Data collection procedures are detailed in the Agreed Procedures.

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.

6.5 **Ownership**

All metering equipment, metering ancillary equipment, instrument transformers, interface and control equipment will be registered into Settlement as required by the PSA. Each Metering System must have a Registrant and an Operator as required by the provisions of Clause 56 of the PSA. For the purposes of this Code, the terms "Registrant" and "Operator" shall have the definitions ascribed to them in the PSA.

Equipment installed, owned and maintained by PESs 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 the FMS.

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 per the relevant sections of the Specifications will be made available to the Registrant, 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 C 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 the period for recalibration for each type of Meter with the Registrant. Reference should be made to Appendix C.

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. See also Appendix C.

7.2 **Measuring 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.

7.2.2 **Periodic Calibration**

Regular calibration checks on this equipment are not considered necessary.

7.3 **Test Access to Metering Equipment**

Test terminal block 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 in accordance with the provisions of Clause 56.9.3 of the PSA.

7.4.2 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 in accordance with the provisions of the PSA.

7.5 Testing Procedures

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

7.6 Test on New or Replacement Equipment

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

8. DATA TRANSMISSION ROUTES AND PROCESSING

(Diagram 1 represents the overall system in block form)

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 Outstation.

The result of the raw 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 (generally a longer time period obtains) after which it will be overwritten. During this period, it can be retrieved.

Details of the physical arrangements of Outstations and further technical information are contained in Appendix A.

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 Station**

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 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 System shall be in accordance with the provisions of the PSA and the Agreed Procedures referred to therein.

9.2 **Access at the Metering Point**

The Operator may, at a Metering Point, interrogate the data collection Outstation using a portable computer, known as 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, 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.

9.3 **Access at Shared Sites**

PESs collection systems which interface with FMS Meters shall not endanger or interfere with the security of data passing to the CDCS.

10. MISSING OR DEFECTIVE DATA AND CONTINGENCY ARRANGEMENTS

The Agreed Procedures listed in Schedule 16 to the PSA cover the following operational consideration 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.

APPENDIX A

EXTRACTS RELEVANT TO DISTRIBUTION METERING FROM A DRAFT SPECIFICATION FOR "METERING AT COMMERCIAL BOUNDARIES WITH CONSUMERS" ISSUED AS SPECIFICATION EM40 BY THE NATIONAL GRID COMPANY plc

OVERVIEW

Fig 1 is a common arrangement at grid supply points and can be ganged to cover for greater numbers of grid transformers.

There are three single phase combined instrument transformers per circuit. Each transformer has two voltage windings and two current transformers. These connections are cabled to a common marshalling kiosk dealing with the 3 phases.

Since the VTs are used both for auxiliary supplies and for measurement performance, two cables are run back to the standard metering cubicle for each purpose, for each phase and for each winding.

Each CT winding is cables separately back to the cubicle.

The cabling from the marshalling kiosk is run to the metering subracks located in the metering cubicle. Two subracks are provided per metered circuit. Each subrack contains an active and reactive bi-directional energy meter. Provision is made on the front of the cubicle for the testing and isolation of measurement supplies.

Each meter has three bi-directional outputs, two of which are used for NGC purposes and one is made available for customer use.

Each of the bi-directional pairs of contacts for NGC use are connected into data collector outstations. There are two of these, so that failure of either will still leave one, with main 1 and main 2 meter totals in memory. Both of the data collector outstations may be locally interrogated in case of loss of telecommunication facility.

Each data collector outstation is connected, via a modem to a telephone line over which it may be interrogated daily. The telephone connection is normally via the PSTN, but corporate telephone systems may be used where they are available.

Each data collector outstation contains a clock, synchronised to a central clock and counts meter pulses over a half hour (or other) period. These half hour demands are stored for retrieval at daily intervals.

Retrieval of the half hour demands is by an Area Collector Station. There are four of these located at strategic points around the NGC system. In case of failure, arrangements are made for transfer of one Area Collectors' outstation to another for interrogation.

The Area Collector is equipped with a radio clock and uses this as a time source for synchronising outstation clocks.

After outstation checks are complete the 48 half hour demand period totals for each GSP are transferred to the CDCS where they were used for tariff, statistical and operational purposes.

INSTRUMENT TRANSFORMERS

(These details are given in Section 6.2 in the test of this Code of Practice).

INSTRUMENT TRANSFORMER CONNECTIONS

Current Transformers

Current transformer connections : 2 cores per phase per CT = 12 cores
Maximum load burden per CT per phase (ie loop resistance) = 6 ohms.

Voltage Transformers

The VTs in addition to performing a measurement function also provide an auxiliary supply to the meters and metering voltage failure alarm relays. These two supplies are segregated at the marshalling kiosk via separate fuses and run back to the metering cubicle as separate conductors. For each set of 3 phase windings a minimum of 10 conductors are required for connection between the marshalling kiosk and the metering cubicle. The allocation of these conductors is as follows:-

Measurement supply : 3 phases (tow conductors) from each
= 6 conductors + 1 neutral conductor

Auxiliary supply : 3 phases = 3 conductors

Note that conductor doubling on the measurement phase supplies is used to alleviate measurement lead burden errors. The total cabling requirement for the two three phase voltage windings is 20 conductors.

The lead burden error on the measuring and auxiliary supplies shall not exceed 0.1 and 1 VA respectively.

General

This arrangement must be retained for the life of the equipment. No additional burden shall be placed on these supplies.

METERS

Four solid state energy meters, approved by NGC and conforming to the requirements of CEGB EM27 shall be used for each circuit.

Two meters, mounted in a common subrack shall be connected to one set of three phase VT and CT windings to read active and reactive energy. This meter group,group 1, shall be known as:

Active Main 1 meter and
Reactive Main 1 meter

Immediately below meter group 1 shall be mounted a second sub-rack containing two more meters approved by NGC and conforming to the requirements of CEGB EM27. These shall be connected to the other set of three phase VT and CT windings to read active and reactive energy.

This meter group, group 2, shall be known as:

Active Main 2 meter and
Reactive Main 2 meter

Meter groups 1 and 2 shall be of different manufacture. (To avoid the possibility of type faults).

METER OUTPUT FOR CUSTOMERS

Each meter contains a pair of contacts for the customers' use (import and export energy or reactive energy). These contacts are provided via interposing relays.

Prior to any connection from external customer owned equipment to the interposing contacts, full details of the proposed connection circuits shall be supplied to NGC for approval. No connection shall be made without prior approval from NGC in writing and thereafter no change shall be made to that circuit without the approval of NGC. Any violation of these conditions may result in the disconnection of external circuits entirely at the discretion of NGC.

DATA COLLECTOR OUTSTATION

Data collector outstations shall be capable of counting and storing meter impulses and shall store pulse counts as half hour totals (initially). They shall be capable of interrogation the "clean" contact outputs from the meters. Power for the interrogation shall be supplied from the outstation.

The demand period over which pulses are summed shall be variable from 5 minutes up to 30 minutes.

An internal clock shall be provided which can be synchronised from the area collector station.

Communications with the outstation will normally be via a telephone circuit and modem (to be included) and will take place once per day. However, storage for at least 10 days shall be provided to allow for failure of communication links. Also a second port shall be provided for connection at a dedicated interrogation unit. The interrogation unit may be either a purpose built device or a programmed portable

computer. If the program of the interrogation unit is not firmware installed then copies of the software shall be provided for reloading purposes.

The outstation shall be capable of accepting at least 16 inputs and shall have the facility of summing selected inputs if this shall be required.

The outstation shall provide two watchdog alarm outputs (two sets of closing contacts). These contacts will be used for alarm indication in the cubicle, and remotely through the substation alarm scheme.

The outstation, as delivered, shall be capable of being personalised from either the remote or local access ports.

The communications protocol and information format is not specified but it shall be compatible with the associated Area Collector Station and shall be proven to be reliable and accurate established either by previous use or by appropriate tests.

Two outstations will be used for security and these shall be of different manufacture.

VOLTAGE FAILURE RELAY

Voltage (Fuse) failure relay shall be provided for and connected to each three phase set of voltage transformer secondary windings. Alarm outputs from these relays shall operate indicator lamps on the metering cubicle and shall be connected via the substation alarm scheme to alert staff to metering failures.

COMMUNICATIONS

Communications between the outstation and Area Collector Station shall normally be via the PSTN. Two lines shall be provided and wherever possible these shall take separate routes into the substation. Most sites are "hot" and appropriate measures shall be taken to ensure safety and reliability of the communications system under high voltage interference conditions.

Calls will normally be made on a routine basis every 24 hours and at night. However, manually initiated calls may be made at any time.

Exceptionally it may be possible to use a corporate communication system and this is possible if advantages accrue. However, this will give a mixture of pulse and tone dialling.

CUBICLES

Adequate cubicles shall be provided, the construction of which are to be to the approval of the NGC Engineer. The general arrangement shall be in line with Fig 1, but deviation will be permissible at the discretion of the NGC Engineer.

Lockable doors shall be provided at the front and rear of the cubicle to provide security to the wiring and equipment within the cubicle.

AREA COLLECTOR STATIONS

Area Collector Stations shall be provided in four locations within the NGC areas. At each location two collectors will be required each to match the appropriate outstations. A supplier will be required to supply the outstations and the matching collectors so that two supplies will be needed at each location. The collectors shall have enough spare capacity to collect outstation information normally collected by a similar but out-of-service collector at one of the other locations.

The area collector shall pass information daily to the CDS via a protocol and in a format to be agreed.

COMMUNICATION TO CDCS

Communication between the Area Collector and the CDCS shall be via dedicated data links which must be capable of transferring the data collected each day in less than 5 minutes. After weekends an Bank Holidays, the data to be transferred may be up to five times as much and it is acceptable that more time will be required, but this should be minimised.

In case of failure of this link it shall be possible to transfer the information over the PSTN at a slower rate which would be acceptable.

INDICATOR LAMP

The cubicle shall be equipped with six indicator lamps which are clearly visible without opening the cubicle door. They may either be mounted above door level or they may be visible through a transparent section high in the door.

The indicator lamps will be driven from the four voltage failure alarm relays and the "watchdog" associated with each data collector unit.

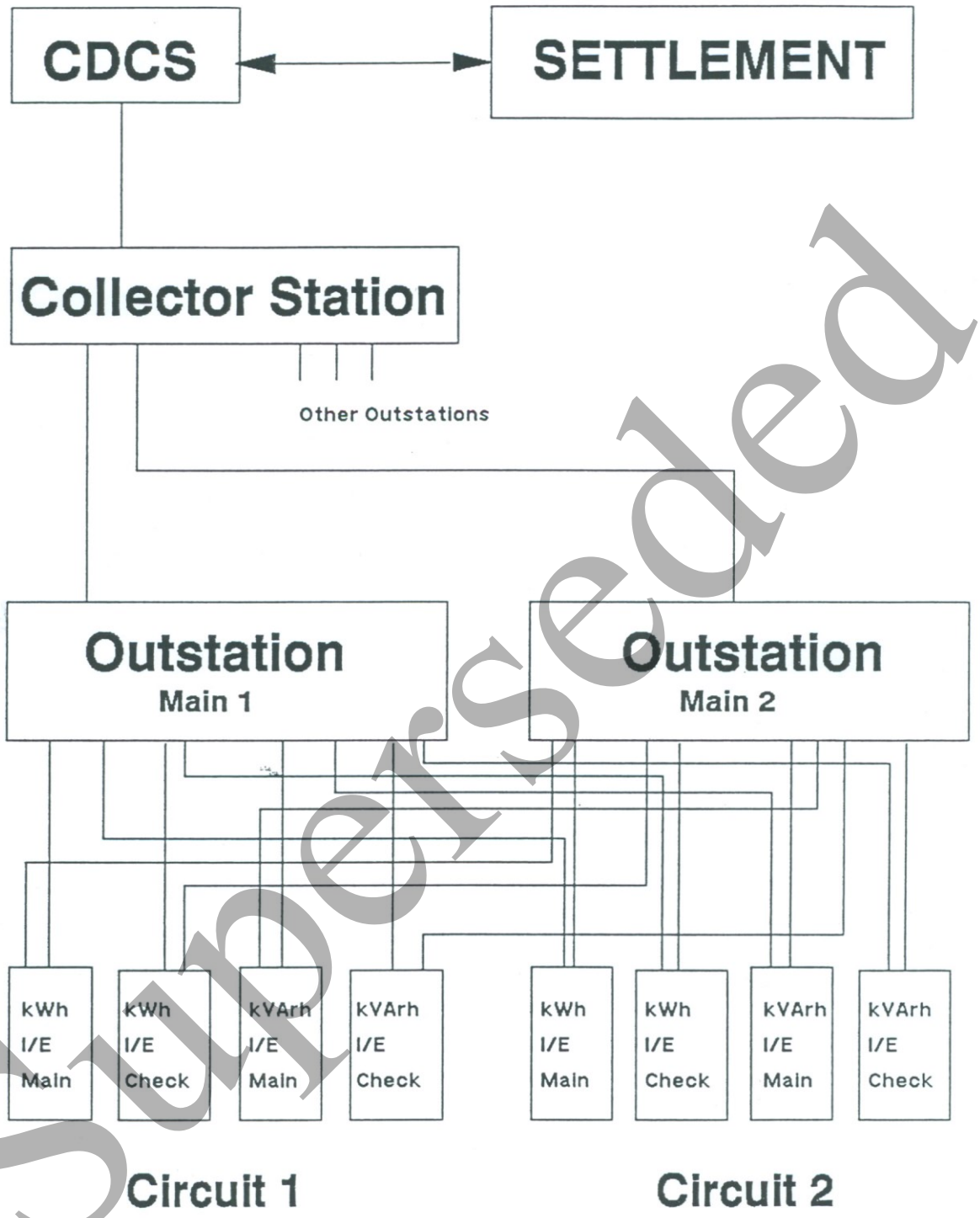

Figure 1: Final Metering Scheme

APPENDIX B

LABELLING OF METERS FOR IMPORT AND EXPORT

B1 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. Accordingly, Meters (or suitable labelling panels etc.) shall be labelled in accordance with this Appendix B.

B2 **ACTIVE ENERGY**

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

Active Energy is considered to be Exported when it flows from the PES into the system of NGC. This will normally only occur where generators are connected directly to the system of the PES, or that system is used to interconnect two or more supply points. The Meter(s) registering this Active Energy should be labelled "Export".

B3 **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 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.

APPENDIX C

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 within the required system accuracy limits set out in section 5.2.1 above, but indicates that it will not be capable of remainig within those limits until the next test according to the intervals stated above, then the interval of routing test shall be reviewed.

1.1.2 Routine tests will be carreid 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 carreid out:-

(a) when 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:-

Watthour 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 recommendation 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 in section 7.1.3 above.