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CONTENTS

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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 in April 1973. It does not include arrangements between National Grid Company plc ("NGC") and Public Electricity Suppliers ("PESs"), or between NGC or PESs and Generators, or the metering of Externally Interconnected Parties, which are dealt with in other Codes in the suite. For the purposes of this Code, the terms "Second Tier Supplier", "PES", "Generator" and "Externally Interconnected Parties" shall have the definitions ascribed to them in the Pooling and Settlement Agreement ("PSA").

Technical details of the metering arrangements are contained in a "Specification for the Metering and Data Collection Equipment of Second Tier Supplies of 1MW and above" (the "Specification") produced by Area Electricity Boards and circulated prior to the Effective Date. This document formed the basis of agreement by Parties to the PSA that PESs would operate such systems as Second Tier Agents (as defined in the PSA) of the Settlement System Administrator.

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 and equipment that shall be employed to meter the supplies to Second Tier Customers (as defined in the PSA). 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

Background

For the first four years after the Effective Date customers with

a demand of 1MW and over may be supplied by Second Tier Suppliers. In order to provide correct billing arrangements for these supplies and those of the local PES, special arrangements have been made for the collection and use of the consumption data of these customers.

The specification referred to above describes a proposed data collection system which shall be used to collect metering consumption data from customers of Second Tier Suppliers. Categories of customers which can be supplied by Second Tier Suppliers are divided into two groups which shall apply after the Effective Date and a metering class and accuracy level has been defined for each group.

For the purposes of this Code, Group 1 customers comprise:-

(a) all existing customers who opt for a second tier supply contract; and

(b) all newly connected customers up to 10MW who opt for a Second Tier supply contract.

For the purposes of this Code, Group 2 customers comprise:-

(a) all newly connected customers of 10MW and over who opt for a Second Tier supply contract; and

(b) existing customers of 10MW and over who opt for a Second Tier supply contract where a significant alteration to the primary equipment is carried out (e.g. a switchgear change).

3. REFERENCES

The following documents may be referred to in the text:-

BS 3938:1973	Current Transformers
BS 3941:1975	Voltage Transformers
BS 5490	Classification of Protection by Enclosures
BS 5685:(part1):1979	Watt-hour electricity meters
BS 5685:(part4):1986	Class 3 var-hour electricity meters
CEGB EES 1989	General specification for Electronic Equipment
ER S3/1	ESI recommendation for the use of metering CTs in switchgear
IEC 687	Specification for Electricity meters

Specification for the Metering and Data Collection Equipment of Second Tier Supplies of 1MW and above	Specification produced by Area Boards
PTS 261	The technical content of Primary Transmission Scheme 261, which sets out the Interim Metering Scheme
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.

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, supplement or complement those in 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 as at the Effective Date, the demand period shall be 30 minutes.

4.7 *Demand Values*

Average values of Active and Reactive Power over a Demand Period. The Demand Values 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*

This is an Electricity flow to the system of a Second Tier Supplier or a customer of a Second Tier Supplier from the distribution system of a PES or direct from the transmission system of NGC. The verb "Import" and its respective tenses shall be construed accordingly.

4.11 *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.

4.12 *Commercial Interface*

The point of connection of the Second Tier Supplier or the Customer of the Second Tier Supplier to the system of the PES or NGC.

4.13 *Metering Point*

The physical location at which Electricity is metered.

4.14 *Meter*

A device for measuring Electricity.

4.15 *Static Meter*

A device for measuring Electricity which does not have an electro-mechanical measuring element.

4.16 *Meter Register*

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

4.17 *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 Central Collector Station on request.

4.18 *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.

4.19 *Verified Data*

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

4.20 *Validated Data*

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

4.21 *Central Collector Station*

The computer based equipment located at a central site which collects data from the Outstations.

4.22 *PSTN/CTN/PTN*

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

4.23 *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).

4.24 *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) Lagging kVArh

(iii) Leading kVArh.

NOTE: Where Second Tier Suppliers also have the capacity to generate, they should refer to the appropriate Codes of Practice.

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 (both lagging and leading).

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 in the tables below:-

Group 1

(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*
100% to 10% inclusive	1.0	+/- 1.0%
Below 10% to 5% inclusive	1.0	+/- 2.0%
100% to 20% inclusive	0.5 lag & lead	+/- 1.5%

(ii) Reactive Energy Measurement

Conditions of Test	*Limits of error at Stated Power Factor under primary system balanced conditions*	
Current expressed as percentage of rated measuring current	*Power Factor*	*Limits of Error*
100% to 10% inclusive 100% to 20% inclusive	Zero 0.866 lag & lead	+/- 4.0% +/- 4.0%

Group 2

(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*
100% to 10% inclusive Below 10% to 5% inclusive 100% to 20% inclusive	1.0 1.0 0.5 lag & lead	+/- 0.5% +/- 1.0% +/- 1.0%

(ii) Reactive Energy Measurement

Conditions of Test	*Limits of error at Stated Power Factor under primary system balanced conditions*	
Current expressed as percentage of rated measuring current	*Power Factor*	*Limits of Error*
100% to 10% inclusive 100% to 20% inclusive	Zero 0.866 lag & lead	+/- 1.0% +/- 1.5%

These limits shall be maintained for the prescribed calibration period of the Meter, as set out in section 7.2.2.

5.2.2 **Existing Connections at Effective Date**

Prior to providing a second tier supply the Meters

shall either be tested on site to confirm that they comply with the accuracies required or Meters complying with the accuracies as in Group 1 above shall be installed. Where the Customer's demand is 10 MW or above, Meters complying with Group 2 above shall be fitted at the earliest opportunity (e.g. during a switchgear change).

5.2.3 **Accuracy at the Commercial Interface**

The point of measurement will be at or close to the Commercial Interface, obviating any need for Meter adjustments. Limits of error as in the Tables above shall apply.

5.2.4 **Accuracy of Records**

The amount of Active Energy or Reactive Energy supplied during any 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.

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

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

5.2.5.2 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, during the Meter calibration.

Compensation values shall be recorded in the details submitted upon registration of the Metering System pursuant to the PSA and the relevant Connection and Use of System Agreements.

6. FACILITIES TO BE PROVIDED

(Note: the Specification referred to above contains full details

of the meter equipment. Basic details are reproduced here for ease of reference.)

6.1 **Meters**

Watthour Meters shall be in accordance with BS 5685 Part 1 or IEC 687 and be to the following Class:-

(a) Group 1 - Class 2
(b) Group 2 - Class 0.5 or Class 0.5S.

Reactive (varhour) Meters shall be in accordance with BS 5685 Part 4 or comply with relevant parts of IEC 687 and be to the following Class but measured at zero power factors instead of unity power factor:-

(aa) Group 1 - Class 3
(bb) Group 2 - Class 0.5S.

The following shall be provided for each circuit used to furnish supply:-

(i) Main Active Energy Meter

(ii) Check Active Energy Meter

(iii) Reactive (lagging) Energy Meter

(iv) Reactive (leading) Energy Meter

Meters (iii) and (iv) may be combined as a bi-directional Meter.

Meters (i), (ii), (iii) and (iv) shall have reverse running stops fitted, if electromechanical.

All Meters shall be approved under paragraph 2 of Schedule 7 to the Electricity Act 1989.

6.2 **Current Transformers**

Current transformers shall be in accordance with BS 3938 and to Engineering Recommendation S3/1 and to the following minimum Class and minimum rating:-

(a) Group 1 - Class 0.5 V.1.0., Rating 7.5VA
(b) Group 2 - Class 0.2, Rating 15VA.

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

The secondary current shall be 1 amp or 5 amp.

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

The total burden, including test equipment, shall not exceed the rating of the current transformer.

6.3 Voltage Transformers

Voltage transformers, where required, shall be in accordance with BS 3941 and to the following minimum Class at the working burden:-

(a) Group 1 - Class 1.0
(b) Group 2 - Class 0.5.

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

6.4 Data Collection Outstations

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

Data collection shall be by means of a proven system which will collect the required quantities per circuit and transfer them to a central station for processing into total kWh and kVArh lag and lead values for transfer to a mainframe computer.

The Specification referred to in "Foreword" above gives further details.

6.5 Communication/transmission medium

Communications from a Metering Point to a Collector Station shall be via PSTN, or other communication systems to an equivalent standard.

6.6 Ownership

All metering equipment, metering ancillary equipment, instrument transformers, interfacing 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.

7. CALIBRATION AND TESTING OF EQUIPMENT

7.1 Meters

7.1.1 Initial Calibration

Meters shall be supplied calibrated according to the

requirements BS 5685 or IEC 687 and within the accuracy limits as detailed in section 5.2.1.

7.1.2 **Periodic Calibration and Checks**

The calibration of Meters will be checked on site to ensure that the accuracy remains within the limits laid down within this Code of Practice.

Checking and calibration of Meters shall be carried out as set out in Appendix A.

In respect of Static Meters, there is currently no experience of periods after which they 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 the then 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. For further details, see Appendix A.

Records of checks and the work carried out under recalibration shall be kept to a form approved by the Settlement System Administrator.

7.2 **Measuring Transformers**

7.2.1 **Initial Calibration**

7.2.1.1 **Existing Connections at Effective Date**

Measuring transformer equipment will have been supplied with, or can be tested to provide a record of, the errors. These errors shall be used when calibrating the Meters to achieve the overall accuracy as required in this Code of Practice.

7.2.1.2 **New Connections at Effective Date**

Measuring transformer equipment shall be supplied with known characteristics within the specifications of 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 tests on this equipment are not considered necessary.

Second Tier Metering Fig.1

Collection System

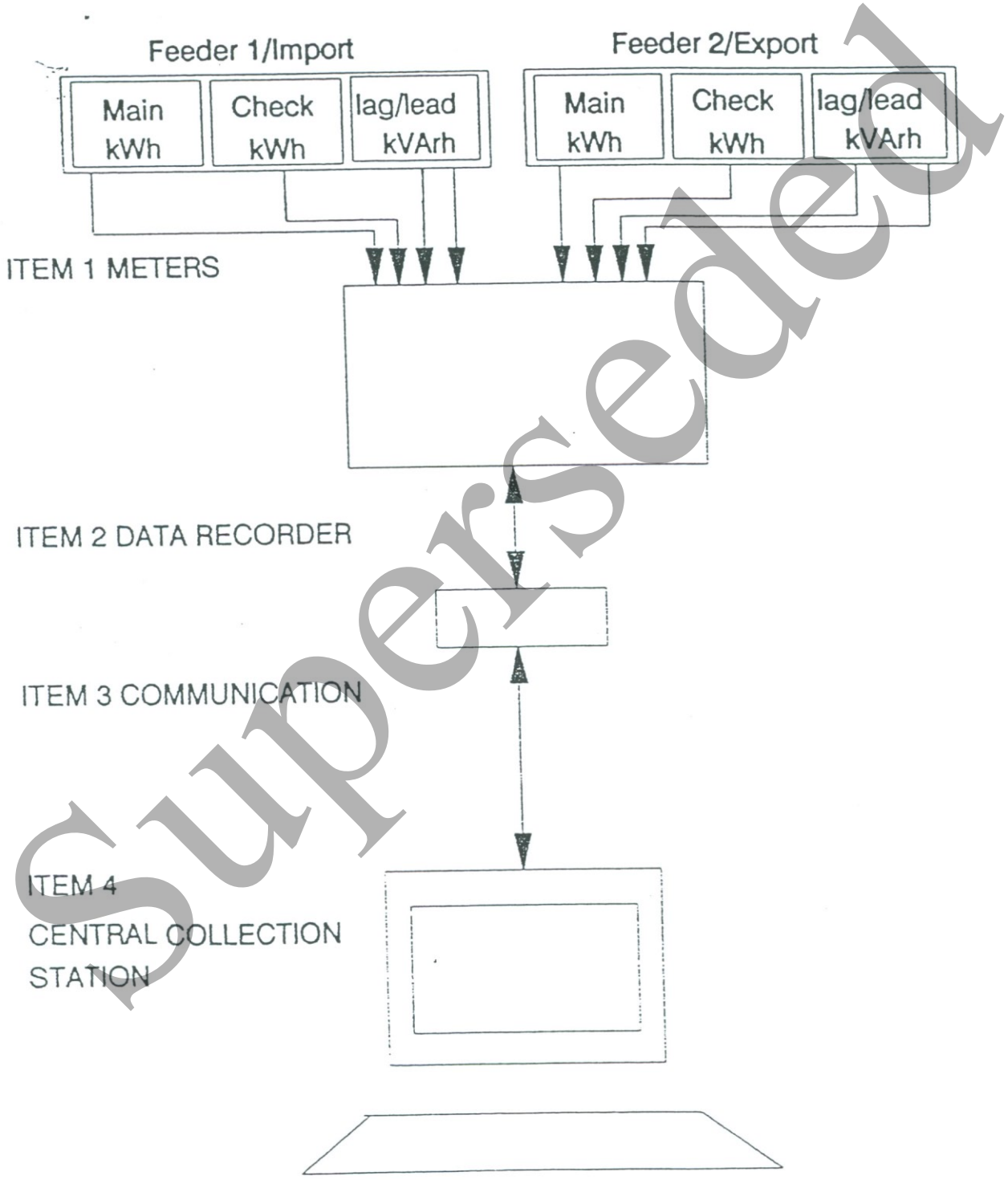

Fig2

Second Tier Metering Specification

Specification for DEC/VAX Transfer file.

Interface file layouts

1) In-station meter readings

a) Header record [x = alpha numeric, 9 = numeric]

record type	x (1)	H(eader)
in-station ID	x (2)	
reading date	YYYYMMDD	
time periods in day	9 (2)	

b) Detail records per site.

record type	x (1)	D(etail)
site-meter-ID	x (6)	
kWh	9 (6)	Signed
kWh edit flag	x (1)	
kVArh lag	9 (6)	
kVArh lag edit flag	x (1)	
kVArh lead	9 (6)	
kVArh lead edit flag	x (1)	

c) Trailer record

record type	x (1)	T(railer)
record count	9 (8)	
hash total	9 (12)	

The file to be named YYMMDDII.Dat where YYMMDD is the DATE of the DATA and II the IN-STATION ID

The file shall be in ASCII format with variable length records delimited by carriage returns.

7.3 Test Access to Metering Equipment

Suitable metering test blocks shall be provided to facilitate meter testing and voltage and current transformer monitoring on site.

7.4 Data Logging and Processing Equipment (Outstations)

7.4.1 Initial Tests

Equipment for data logging and processing shall be supplied and tested according to the required specification arising from the data collection system to which it is connected. Before installation it shall be tested for correct operation to ensure that all channels are receiving data accurately and displays, batteries etc. are working correctly.

7.4.2 Periodic Tests

Maintenance shall be carried out according to the manufacturer's specification and the schedules used shall be available for inspection.

7.5 Communication and Central Collection Station

7.5.1 Initial Tests

Tests of the Communication and Central Collection Station shall be carried out to ensure satisfactory operation of computer equipment.

7.5.2 Periodic Tests.

It is not considered necessary to carry out periodic tests on this equipment due to the daily verification and validation procedures which are adopted. Maintenance shall be carried out according to the manufacturer's specification and the schedules used will be available for inspection.

7.6 Testing Procedures

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

8. DATA TRANSMISSION ROUTES AND PROCESSING

(Reference should be made to Diagram 1.)

8.1 **Meter(s) to Outstations**

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

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

The result of the Raw Data and Processed Data collected will be stored in memory and remain on site after interrogation by the Central Collector Station for a minimum period of 10 days.

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.

9. ACCESS TO DATA

9.1 **General**

Access to data and physical access to Metering Points, Data Collection 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.

9.2 **Access at the Metering Point**

In addition to the automatic data collection arrangements, access to data at the Metering Point may be from the site Outstation via a local interrogation facility. This facility will enable the recording of readings, the examination of status information, demand values and other features, but values held in the outstation units shall not be altered by the interrogation (ie the integrity of data stored on site shall not be affected).

Only staff both nominated by the Operator and authorised by the Settlement System Administrator may operate a local interrogation facility and interrogation of a given Outstation will require use of a unique Outstation identification number.

10. MISSING OR DEFECTIVE DATA AND CONTINGENCY ARRANGEMENTS

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

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

- Reconciliation of discrepancies
- Estimation Procedures

11. NOTIFYING/SETTLING OF DISPUTES

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

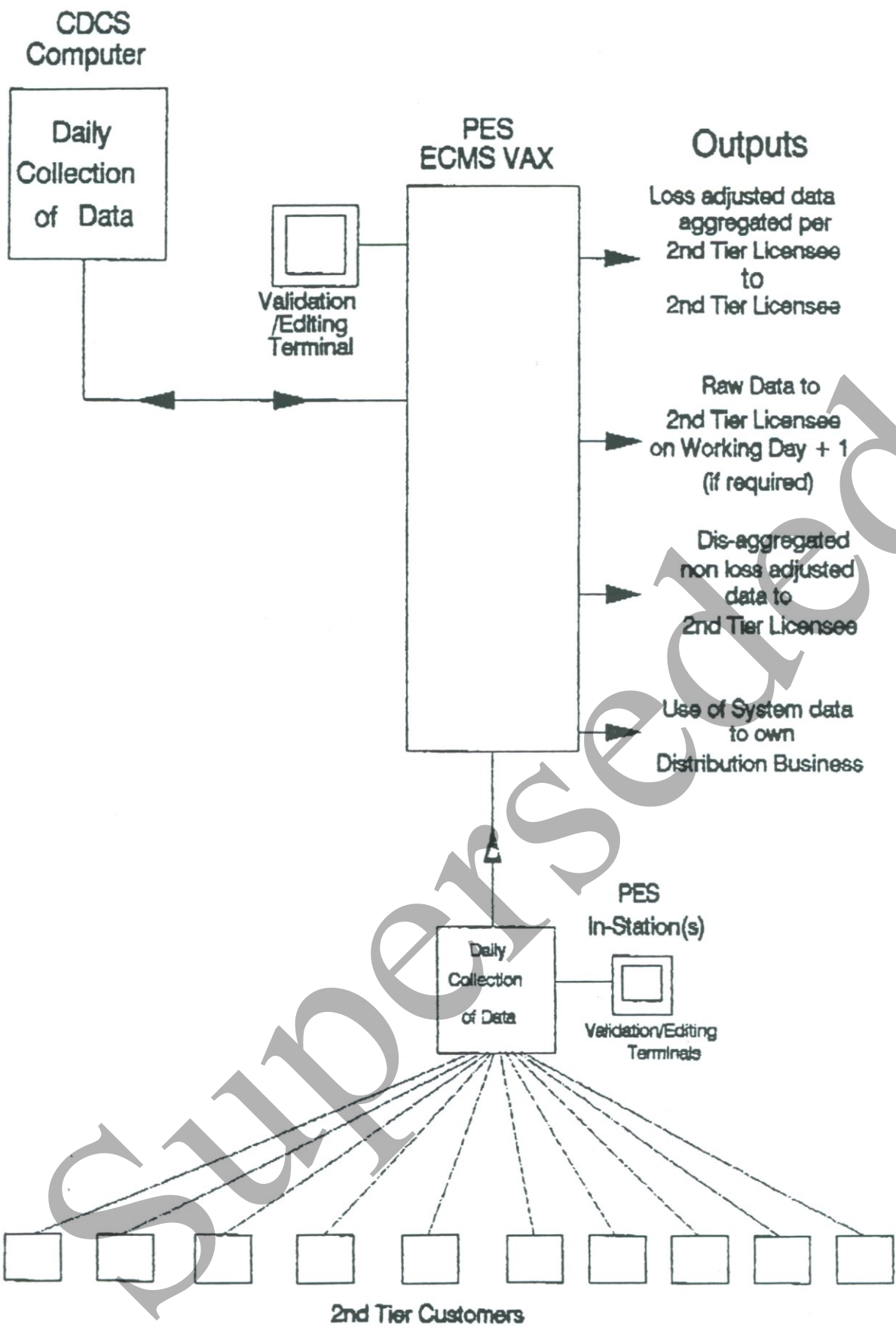

Diagram.1 PES Data Collection System for 2nd Tier Customers

APPENDIX A

RECOMMENDATIONS FOR CALIBRATION AND TESTING OF METERS

1. **Class 2 Meters to BS 5685**

Meters shall be subject to calibration at 10 yearly intervals.

There shall be no requirement for intermediate calibration checks within this period.

2. **Class 0.5 Meters to BS 5685**

Meters shall be subject to calibration at 10 yearly intervals.

There shall be intermediate on site checks to establish overall system accuracy as specified in section 5.2.1 at 5 years after installation.

3. **Class 0.5S Meters to IEC 687**

3.1 **Test of Calibration (Accuracy Check)**

3.1.1 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.

3.1.2 Where the test of calibration shown a Meter type not to be capable of sustaining the accuracy class for the period quoted in section 5.2.1 above then the routine test of calibration period for that Meter shall be reviewed.

3.1.2 A test of calibration will be carried out:-

(a) When the Operator of the Meter believes that the Meter is not performing to its required accuracy; or

(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.

3.2 **Recalibration**

There is currently no experience for Meters presently available in this Class to enable recommendations as to specific intervals between recalibration (recalibration in this context might imply complete refurbishment).

4. Method of Tests

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

4.2 In respect of Static Meters, recalibration sampling tests should be carried out over the whole range of the Meter at such test points as the Executive Committee shall determine.