Metering & Data Exchange Code

Metering and Data Exchange Code
Version Record

Version	Issue Date	Changes	Approved by
1.0	Jan 1999	Original	**DOE (as the then RSB)**
2.0	Jun 2003	Format and content review	**DOE (as the then RSB)**
3.0	Dec 2007	Comprehensive review by Bureau & **Panel** members	**DOE (as the then RSB)/TRANSCO**
3.1	Nov 2015	Comprehensive review by Bureau & **Panel** members	**DOE (as the then RSB)/TRANSCO**
4.0	Jan 2017	Revise Calibration/ Verification requirement and Introduce Temporary Connection's definition & requirements.	**DOE (as the then RSB)/TRANSCO**
5.0	Dec 2021	Modifications made to reflect transfer of System Operator activities from TRANSCO to EWEC and cessation of TRANSCO's responsibilities under MDEC	**DOE**

THE METERING AND DATA EXCHANGE CODE

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PREFACE

METERING AND DATA EXCHANGE CODE

1. The restructuring and privatisation of the Water and Electricity sector into the; Generation, Transmission and Distribution entities, required the flow of electricity, and water between these separate entities to be properly accounted for at the boundaries between them so that financial transactions which become due can be settled.

2. Pursuant to Article 39 of Law No (2) of 1998 concerning the Regulation of the Water and Electricity Sector of the Emirate of Abu Dhabi, it is the duty of the Abu Dhabi Transmission and Despatch Company to develop a system for the settlement of payments due to and from the providers of water and electricity capacity and output.

3. This **Code** has been designed to ensure that, by specifying minimum technical, design and operational criteria, the rules for metering, data collection, and data exchange shall enable all **licensees *to*** comply with their statutory obligations.

4. Each **Licensed Operator** shall ensure that there is installed, a **Metering System** which is registered with **System Operator,** and which complies with the provisions of this **Code** as close as may be reasonably practicable to the **commercial boundary** at each **Licensed Operator** site.

5. The **Code** is divided into the following sections:

- **General Conditions** are intended to ensure that the various sections of the **Metering and Data Exchange Code** work together and include provisions relating to data collection, testing, sealing, access and the establishment of a **Metering and Data Exchange Code Review Panel**;
- **Electricity Metering** deals with metering equipment specifications and accuracy requirements for different types of **Defined Metering Points** on the interconnected generation, transmission and distribution system;
- **Water Metering** deals with metering equipment specifications and accuracy requirements for different types of **Defined Metering Points** on water production and storage plant, water trunk mains and water distribution mains;
- **Gas Metering** deals with metering equipment specifications and accuracy requirements for different types of **Defined Metering Points** on electricity generation and water desalination plant;

- **Back Up Fuel Oil Metering** deals with metering equipment and accuracy requirements for different types of **Defined Metering Points** on electricity generation and water desalination plant;
- **Data Collection** deals with outstation and communications requirements and their configuration;
- **Data Exchange** provides for the collection, processing and supply of data by **System Operator** in order for the sums of money to be calculated to and from each party in relation to sales of water, electricity, production capacity and associated matters and fuel gas and oil;
- **Testing, Commissioning and Calibration** deals with all matters relating to the testing and calibration of **metering equipment**; and
- Supporting documents e.g. **Procedures** and Guidelines which provide further explanation and facilitate implementation of the **Code.**

6. Compliance with the **Code** and its associated **Procedures** will be a pre-requisite for market participation and mandatory for all **Licensed Operators** in the developing market. This condition shall not apply where a dispensation has been sought and granted.

7. **System Operator** shall issue further guidelines and **Procedures** from time to time to clarify or further explain aspects of the **Code**.

8. Where compliance with the **Code** is stated, this also means compliance with any supporting **Procedures**. For the avoidance of doubt, in the event of conflict between the provisions of this **Code** and the provisions of the **Procedures** the **Code** provision shall apply. This condition shall not apply where a dispensation has been sought and granted.

9. For Production Companies, compliance with the metering requirements of the **PWPA/PPA/WPA** shall apply. If there are found to be any inconsistencies between the conditions set out in the **PWPA/PPA/WPA** and those set out in the **Code**, then the more onerous condition of the two shall apply.

10. Good Industry Practice is an evolving science and revisions of the **Code** shall be released from time to time to reflect this.

11. Compliance with the requirements of the **Code** shall apply to all **Metering Equipment** and **Metering Systems** designed or procured subsequent to the issue of any new revision of the **Code**

12. Compliance with the requirements of the **Code** shall apply to all **Metering Equipment** and **Metering Systems** installed prior to the issue of any new revision of the **Code**. **Licensed Operators** shall seek either temporary or

limited-life-of-plant dispensations for such **Metering Equipment** where any new provision of the Code is considered impractical.

Metering & Data Exchange Code

Section 1
Glossary and Definitions

Section 1 Glossary and Definitions
Amendment Record

SECTION 1 - GLOSSARY AND DEFINITIONS

In this **Metering and Data Exchange Code ("Code")** the following words and expressions shall bear the following meanings:

Accredited Laboratory	A calibration/testing laboratory accredited to ISO/IEC 17025 or equivalent, and accredited by a recognised international accreditation agency e.g. UKAS.
Active Energy	The electrical energy produced, flowing or supplied by an electrical circuit during a time interval, and being the integral with respect to time of the instantaneous ***Active Power***, measured in units of watt-hours or standard multiples thereof: 1,000 Wh = 1 kWh 1,000 kWh = 1 MWh
Active Power	The product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof: 1,000 W = 1 kW 1,000 kW = 1 MW
Actual Metering Point	The physical location at which **Electricity** or **Water** or **Gas** or **Back Up Fuel Oil** is metered.
Apparent Energy	The integral with respect to time of the **Apparent Power**.
Apparent Power	The product of voltage and current measured in units of volt-amperes (VA) and standard multiples thereof: 1,000 VA = 1 kVA 1,000 kVA = 1 MVA
Approved Laboratory	An accredited calibration/testing laboratory that has been approved by the **DOE**.
Back Up Fuel Oil	Secondary fuel supply provided in case of failure of primary fuel supply.
Central Despatch	The process of scheduling and issuing direct instructions by **System Operator** referred to in [Condition 21] of the **Transmission Licence**.

Code	This Metering and Data Exchange Code.
Commercial Boundary, Connection point or Interface Point	The physical point as defined in an interface agreement, where assets carrying traded quantities change ownership from one party to another e.g. the exact point on a water pipeline.
Connection Agreement	The agreement for connection envisaged in [Condition 14 of the **Transmission Owner**'s **Transmission Licence**.
Customer	Any person to whom **Water** and / or **Electricity** is provided.
Data Exchange System	The systems established pursuant to this **Code** by **System Operator** and **Transmission Owner** to enable them to perform their statutory duties to develop systems to collect meter data and for the payment of an amount due to or from providers of water and electricity capacity and output.
DCVS	The Data Collection and Validation System. The system used by **System Operator** in conjunction with the associated **Settlement Instation** to acquire and process settlement metering data
Demand Period	The period over which **Electricity**, **Water**, **Gas** and **Back Up Fuel Oil** are integrated to produce **Demand Values** for **Settlement** purposes. Unless the context requires otherwise, each **Demand Period** shall be of 60 minutes duration, one of which shall finish at 24:00 hours.
Demand Values	In the case of **Electricity** expressed in MW, M*va*r or MVA, which for a 1 hour **Demand Period** will equal the value of MWh, M*va*rh or MVAh recorded during any **Demand Period**. In the case of **Water**, **Gas** or **Back up Fuel Oil** expressed in m^3/hr recorded during any **Demand Period**. The **Demand Values** are hourly demands and these are identified by the time of the end of the **Demand Period**.
Desalination Company	An entity which is authorised to desalinate **Water** under a licence or an exemption pursuant to the **Law**.

Distribution Company	An entity which is authorised to distribute Electricity and/or Water under a licence or an exemption pursuant to the **Law**.
DMP	The **Defined Metering Point** is the physical location at which the overall accuracy requirements as stated in this **Metering and Data Exchange Code** are to be met. The **DMPs** for each quantity measured are defined in the relevant section of the **Metering and Data Exchange Code**.
DOE	The Abu Dhabi Department of Energy (the legal successor of the Regulation and Supervision Bureau.
Electricity	**Active Energy** and **Reactive Energy**.
Embedded Generator	An entity which is authorised to generate **Electricity** under a licence or an exemption pursuant to the **Law** and whose **Generating Units** are directly connected to a **Distribution Company** system or network.
Full Scale Flow Rate	The rate of flow of a **Water** or **Gas Meter** corresponding to full scale reading of the **Meter**.
Gas	Natural gas.
Generating Company	An entity which is authorised to generate **Electricity** under a licence or an exemption pursuant to the **Law**.
Generating Unit	Any apparatus which produces **Electricity**.
Good Industry Practice	In relation to any undertaking and any circumstances, the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking under the same or similar circumstances.
Law	**Law No (2)** of 1998 as amended by Law No (19) of 2007
Law No (2)	Law No (2) of 1998 concerning the Regulation of the Water and Electricity Sector in the Emirate of Abu Dhabi as amended from time to time;

LDC	The location used for the purpose of control and operation of the **Transmission System** and the **Water Trunk Mains System**.
Licensed Operator	The holder of a licence issued pursuant to Article (82) of the **Law**.
LIU	A hand held unit known as a **Local Interrogation Unit** or portable computer which can enter **Outstation** parameters and extract information from the **Outstation** and store this for later retrieval.
Meter	A device for measuring quantities of **Electricity**, **Water**, **Gas** or **Back Up Fuel Oil.**
Metering Equipment	**Meters**, primary measurement equipment, metering alarms, circuitry and their associated data collection **Outstations** and wiring which are part of the measuring equipment at or relating to a site.
Meter Register	A device, normally associated with a **Meter**, from which it is possible to obtain a reading of the quantity of **Electricity** or **Water** or **Gas** or **Back Up Fuel Oil** that has been supplied.
Metering System	A collection of **Metering Equipment** that as a complete set allows data to be transmitted to the **Settlement Instation**.
Non-Embedded Customer	A Customer, except for a **Distribution Company**, receiving **Electricity** or **Water** direct from the **Transmission System** or **Water Trunk Mains System** (as applicable) irrespective of from whom it is supplied.
Outstation	On-site equipment which receives and stores data from **Meters**, and may perform some processing of the data before transmitting the metering data to the **Settlement Instation** on request. These functions may be facilitated in one or more separate units or be integral with the **Meter**.
Panel	The **Code** Review Panel with the functions set out in the **General Conditions** of this **Code**.

Power Factor	The ratio of **Active Power** to **Apparent Power** expressed as the cosine of the phase angle between the voltage and the current.
PPA	Power Purchase Agreement which is used by the **Procurer** as a contractual document for the purchase of power.
Procedure	A procedure approved by the **Panel** and issued by **System Operator** to interested parties which supplements the **Code**.
Procurer	The Emirates Water and Electricity Company. (EWEC).
Production Company	An entity which is authorised to generate **Electricity** and/or desalinate **Water** under a licence or an exemption pursuant to the **Law**.
PSTN	The Public Switched Telephone Network (i.e. ETISALAT).
PWPA	Power and Water Purchase Agreement which is used by the **Procurer** as a contractual document for the purchase of power and water from **Production Companies**.
Rated Measuring Current	The rated primary current of current transformers used for the purposes of measurement.
Reactive Energy	The integral with respect to time of the instantaneous **Reactive Power,** measured in units of var-hours or standard multiples thereof: 1,000 varh = 1 kvarh 1,000 kvarh = 1 Mvarh
Reactive Power	The product of voltage and current and the sine of the phase angle between them measured in units of volt-amperes reactive and standard multiples thereof: 1,000 var = 1 kvar 1,000 kvar = 1 Mvar

Rule Curve	A polynomial expression relating **Storage Water Level** to the total volume of **Water** in a storage tank.
Schedule Day	The period from 05:00 hours in the **Settlement Day** until 05:00 hours in the next following **Settlement Day**.
Settlement	The calculation of payments which become due to and from the providers of Water and Electricity capacity and output.
Settlement Day	The period from 00:00 to 24:00 in each day local UAE time.
Settlement Instation	A computer-based system which collects or receives data on a routine basis from an Outstation.
Settlement Period	A period of 60 minutes ending on the hour in each hour during a **Schedule Day**.
Settlement Quality Meter Data	Meter data acquired from **Meters** and associated **Outstations** appropriately verified.
Settlement Run	The process at a particular point in time of calculating **Settlement** using the **Data Exchange System**.
ST	The Standard Temperature (15 degrees celsius) at which the volume of Back up Fuel Oil is expressed.
ST&P	The Standard Temperature and Pressure (~~0~~***15*** degrees Celsius and 1.01324 Bar) at which the volume of **Gas** is expressed.
Steam Generating Unit	Any apparatus which produces steam using **Gas** or **Back Up Fuel Oil** as fuel.
Storage Water Level	The level of **Water** in a storage tank from which the total volume of **Water** currently in storage can be evaluated from **Rule Curves**.
System Operator	An entity that is authorised by licence to operate (as system operator) the high voltage **Electricity** and **Water** transmission networks in Abu Dhabi.

Transmission Control Protocol/Internet Protocol TCP/IP	A protocol where internet protocol is used for routing packets of information.
Transmission Licence	A licence issued pursuant to [Article 82] of the Law authorising the **Transmission Owner** or **System Operator** to transmit or otherwise participate in the transmission of **Water** and **Electricity**.
Transmission Owner	An entity that is authorised by licence to construct, own and maintain the high voltage **Electricity** and **Water** transmission networks in Abu Dhabi.
Transmission System	The system consisting of high voltage overhead lines and underground cables owned by **Transmission Owner** and/or operated by **System Operator** and used for the transmission of electricity from one **Power Station** to a sub-station or to another **Power Station** or between sub-stations or to or from any **External Interconnection**, and includes any plant and apparatus and meters owned by **Transmission Owner** or operated by **System Operator** in connection with the transmission of electricity.
UTC	Coordinated Universal Time, maintained by the International Bureau of Weights and Measures (BIPM).
Water	Potable water produced by **Water Producers**.
Water Producer	An entity which is authorised to produce **Water** under a licence or an exemption pursuant to the **Law.**
Water Production Unit	Any apparatus which produces **Water**.
WPA	Water Purchase Agreement which is used by the **Procurer** as a contractual document for the purchase of water.
Water Trunk Mains System	The network of trunk mains, pumping stations and associated **Water Production Units** that constitutes the water transmission system operated by the **System Operator**.

Construction of References

In the **Code**:

a) A Table of Contents and headings has been inserted for convenience only and are not to be construed as being part of the **Code;**

b) Unless the context otherwise requires, all references to a particular Section, Clause, Appendix or Schedule shall be a reference to that Section, Clause, Appendix or Schedule in or to that part of the **Code** in which the reference is made;

c) Unless the context otherwise requires, the singular shall include the plural and vice versa, references to any gender shall include all other genders and references to persons shall include any individual and any other entity, in each case whether or not having a separate legal personality;

d) References to the words "include" or "including" are to be construed without limitation to the generality of the preceding words;

e) References to "in writing" or "written" include typewriting, printing, and other modes of reproducing words in a legible and non-transitory form;

f) Where the **Glossary and Definitions** refers to any word or term which is more particularly defined in the **Code**, the definition in that part of the **Code** will prevail over the definition in the **Glossary and Definitions** in the event of any inconsistency; and

g) A cross-reference to another document or part of the **Code** shall not of itself impose any additional or further or co-existent obligation or confer any additional or further or co-existent right in the part of the text where such cross-reference is contained.

Metering & Data Exchange Code

Section 2
General Conditions

Section 2 General Conditions
Amendment Record

SECTION 2 - GENERAL CONDITIONS

1. INTRODUCTION

1.1 Purpose

The following quantities shall be measured and recorded by **Metering Equipment** installed, operated and maintained as set out in this **Code** and as further clarified in the supporting **Procedures** authorised under this **Code**;

- **Electricity** (MWh and Mv*a*rh) exported or imported
- **Water** (m^3) exported or imported
- **Gas** (m^3 corrected to **ST&P**) consumed
- **Back Up Fuel Oil** (m^3 actual and corrected to **ST**) consumed

1.2 Objective

The objective of the **Code** is to ensure that by specifying minimum technical, design and operational criteria and basic rules for metering and data collection, **Licensed Operators, Transmission Owner** and **System Operator** are able to comply with their licence obligations.

1.3 Scope

The **Code** applies to **System Operator** and the following parties:

- **Production Companies** (including **Embedded Generators**)
- The **Procurer**
- **Distribution Companies** (including **Non-Embedded Customer** sites)
- The **Transmission Owner**

1.4 General Obligations

1.4.1 **Licensed Operators** shall:

a) Ensure there is a **Metering System** installed, complying with the provisions of this **Code** as close as may be reasonably practicable to the **Commercial Boundary**, at each **Licensed Operator** site. (**Metering Equipment** at **Licensed Operator** sites constructed prior to the existence of the **Code** (Jan 1999) might not be situated at the **Commercial Boundary**. In such cases, loss adjustment factors must be applied subject to a dispensation application (which demonstrates to the reasonable satisfaction of the **DOE,** that such loss adjustment factors have been correctly derived and have been accepted by **System Operator** in writing).

b) Comply with the obligations imposed by the **Code**

c) Provide, own, install, commission, register, maintain, repair, replace, inspect and test each metering installation in respect of which it is the **Licensed Operator**

d) Allow appropriate site access to **Metering Equipment** by **Transmission Owner** and **System Operator** personnel pursuant to of their duties under the **Code**.

e) Cooperate with **Transmission Owner** and/or **System Operator** by completing any appropriate **Code** related tests, trials and audits either in collaboration with them or under their guidance

f) Maintain appropriate auditable records of all **Metering Equipment**

g) Be liable to the imposition of sanctions in accordance with Section 2, Clause 7 of the **Code**

1.4.2 **System Operator** shall:

a) Establish and administer a process for the registration of metering

b) Maintain and operate facilities necessary for **Settlement**. The obligation from this sub-paragraph b) does not apply to those facilities for communications between the relevant **Outstations** and the **Settlement Instation.**

c) Establish metering related policies, **Procedures** and standards in support of the **Code** including but not limited to registration, testing and calibration, sealing, loss adjustments, data security, inspection, testing and audit of metering installations and measurement error correction

d) Initiate any end to end testing required prior to registration of a metering installation with the involvement of **Transmission Owner** if required in respect of communications between the relevant **Outstation** and the **Settlement Instation**,

e) Initiate and perform initial sealing of a metering installation and maintain and audit ongoing sealing related activities

f) Periodically inspect and read each registered **Meter** for reconciliation purposes

g) Prevent access to information recorded by the settlement system in respect of each metering installation by any person other than the persons entitled to such information

h) Due diligence audit of **Code** compliance of **Licensed Operators** facilities and records

i) Coordinate and administer the activities of the **Panel**

Transmission Owner shall :

j) Provide a communication interface to **Metering Equipment** (to a termination point agreed with the **Licensed Operator**) that enables the reliable transfer of all **Settlement** data to the settlement system

1.4.3 **Distribution Companies** in addition to their obligations as a **Licensed Operators**, shall be responsible for the provision and maintenance of metering systems at **Non-Embedded Customer** sites. **Transmission Owner** will facilitate any necessary communications interface.

2. REGISTRATION

2.1 Introduction

Each **Licensed Operator** is required to register in writing with **System Operator** the **Metering System** at each site where such **Licensed Operator**:

- Exports and/or imports **Electricity** from/to its own **User** System
- Exports and/or imports **Water**Consumes **Gas**
- Consumes **Back Up Fuel Oil**

Registration information shall include the respective identities of the **Licensed Operator**, loss adjustment details whether by meter biasing or software and full technical description of the **Metering Equipment** at the **DMP**, single line drawings of the installation and all applicable calibration/approval documentation applying to the specified equipment in accordance with the **Procedures**. Such registration shall be subject to **System Operator** confirmation that the **Metering System** is compliant with the **Code**.

A **Metering System** shall be registered before **System Operator** is required to take such **Metering System** into account for the purposes of **Settlement** in accordance with the **Procedures**.

Each **Metering System** which **System Operator** shall take into account for the purposes of **Settlement** shall be set out in the register.

2.2 Maintenance of Register and Documents

System Operator shall keep such a register up to date, noting changes to **Licensed Operators Metering Equipment** and any site disconnections as notified to it pursuant to this **Code**. **System Operator** shall also record in the Register any other information regarding each **Metering System** as may be reasonably required by the **DOE** and make such a Register available for audit and inspection.

System Operator shall retain copies of all **Procedures** and any other documentation referred to in such **Procedures**, and shall provide a copy of all or any thereof to any **Licensed Operator** as a matter of course and upon request.

2.3 Metering Dispensations

If, for financial reasons or reasons of practicality, **Metering Systems** or parts thereof, to which this **Code** applies, do not comply with some or all of the requirements of the **Code**, the **Licensed Operator** of such **Metering System** may make a dispensation application to the **DOE.** Such application should be made in writing (and on the appropriate form) and the response to any such application shall also be in writing. The **DOE** shall notify **System Operator** of such application in accordance with **Procedures**.

System Operator shall be responsible for maintaining an up to date register of all metering dispensation applications together with their approval status

MDEC panel members shall be informed of the outcome of such applications in accordance with **Procedures**

3. DATA COLLECTION

3.1 General

System Operator shall:

- Collect
- Validate
- Estimate
- Substitute

data relating to quantities of:

- **Electricity** and/or ***Water*** imported or exported by any **Licensed Operator**
- The availability of generation and desalination units
- **Gas** and/or **Back Up Fuel Oil** consumed by **Production Companies.**

as may be required to enable calculations to be made for the amounts due to and from each party in accordance with the provisions of this Clause and Section 7 of this **Code.**

Estimation of the above mentioned metering/settlement data by **System Operator** shall be in accordance with relevant **Procedures**.

Further details of the data to be collected by **System Operator** and the obligations of **Licensed Operators** to provide the same are contained in Sections 7 and 8 of the **Code**.

System Operator shall collect all such data as is available from data collection **Outstations** either by means of remote interrogation or by means of manual, local interrogation on-site.

Subject to any dispensation granted by the **DOE** under Section 2, Clause 2.3, **System Operator** will not be obliged to accept meter data from a **Licensed Operator** unless the data is produced by **Metering Equipment** that is registered in accordance with Section 2, Clause 2 of this **Code**.

3.2 Provision and Maintenance of Communications

For the purposes of remote interrogation **Transmission Owner** shall enter into, manage and monitor contracts to make available all communication lines by which information is passed from data collection **Outstation** to **Settlement Instation**. In the event of any fault or failure on such communication lines or any error or omission in such data or all necessary data not being available from data collection **Outstations, System Operator** shall collect such data by manual on-site interrogation in accordance with the relevant **Procedures**.

4. DESCRIPTION OF METERING EQUIPMENT

4.1 General

Metering Equipment and its component parts shall comply as a minimum with the standards referred to or set out in this **Code**. The **DOE** shall keep under review the need for any new standards for **Metering Equipment** which are not set out in the **Code** and shall determine any such standards, when appropriate and may issue them as supplementary additions to the **Code**.

The **DOE** shall have the sole right to resolve any dispute or uncertainty regarding applicable codes *and* standards for **Metering Equipment**.

Metering Systems comprising **Metering Equipment** shall use such communication protocols as defined by the relevant **Procedures** and Sections 7 & 8 of the **Code**.

4.2 Compliance

Metering Systems should comply with the standards required by the **Code**, accordingly each **Licensed Operator** shall use the reasonable endeavours to comply with this **Code**. Any dispensation shall have been sought and been granted in accordance with the **Procedures**

The **Metering System** comprising any **Metering Equipment** shall be accurate within the prescribed limits for such **Metering Equipment** referred to or set out in the **Code**.

The accuracy limits referred to in the **Code** shall be applied after adjustments have been made to **Metering Equipment** to compensate for any errors due to any secondary metering equipment and connections thereto. Characteristics of individual meters and secondary metering equipment are specified in this **Code** for each of the categories referred to therein.

4.3 Proper Order

Each **Licensed Operator** shall, at its own cost and expense, keep in good working order, repair and condition, all **Metering Equipment** in respect of which it is the **Licensed Operator.** This shall be done to the extent necessary to allow the correct registration, recording and transmission of the requisite details of the quantity of **Electricity** or **Water** or **Gas** or **Back Up Fuel Oil** measured by the relevant meter. No modifications shall be undertaken unless specifically requested by the **Licensed Operator** and approved by **System Operator** in accordance with the Procedures.

4.4 Sealing

The **Licensed Operator** of each **Metering System** shall ensure that the **Metering Equipment** he is responsible for is sealed in line with the **Procedures** at all times.

System Operator shall arrange for all **Metering Equipment**, data collection **Outstations** and their associated communications equipment to be sealed following registration or any test or inspection thereof except where agreed as impractical in the reasonable opinion of **System Operator** having regard to the physical configuration at each site and after consultation with the **Licensed Operator**.

No seals applied shall be broken or removed except in the presence of, or with the consent of **System Operator**, unless such removal is essential and consent cannot be sought. **System Operator** shall be informed forthwith thereafter.

No one shall remove any seal whatsoever on **Metering Equipment** without the prior consent of the **Licensed Operator** of such **Metering Equipment** and the approval of **System Operator. System Operator** shall not incur any liability under this **Code** in the event that it cannot perform any of its duties hereunder due to any such consent being withheld save that it shall inform the **DOE** immediately thereafter.

The **Licensed Operators** shall ensure, to the extent that it is in their control to do so, that physical access to **Metering Equipment** registered under this **Code** is restricted to those personnel who are required to have such access for the proper performance of their duties and have received permission for such access. In addition all **Metering Equipment** must be made secure, if necessary by making the lock and keys subject to similar access restrictions. Each **Licensed Operator** shall endeavour to prevent damage to the seals, for that **Metering Equipment** located on its **Sites** and shall promptly inform **System Operator** if it becomes aware that those seals have been damaged. .

System Operator shall control the issue of their own seals and sealing pliers, and shall keep an accurate register of all such pliers and the authorised persons to whom they are issued. **System Operator** shall annually inspect all records and the condition of pliers in accordance with the **Procedures**.

Whilst it is recognised that the sealing of an **electricity meter** is easily defined it is more complex to detail the sealing requirements of transducers or other associated equipment that does not have ready provision for applying such seals. Such detail will be provided within the Procedures as will the control of electronic seals (such as passwords and/or encryption keys).

5. INSPECTION, TESTING AND CALIBRATION

5.1 Calibration of Metering Equipment

Each **Licensed Operator** shall ensure that all **Metering Equipment** which is registered with **System Operator** shall be calibrated in order to meet the accuracy requirements in accordance with the **Code**. **System Operator** shall be granted access to all such **Metering Equipment** and any other plant or apparatus on any site in order to inspect the basis of any adjustments made to **Metering Equipment**.

For meters, calibration shall be undertaken by the relevant **Licenced Operator** using working standards which have traceability to suitable reference standards which have been verified at an **Accredited Laboratory**. Such equipment shall have been verified at least once in the 12 months preceding its use. For all measured parameters such calibrations shall be completed with equipment of known documented performance in line with the **Procedures**.

No calibration adjustment shall be carried out to any **Metering Equipment** outside of an internationally **Accredited Laboratory** with traceability of calibration techniques i.e. ISO 17025.

5.2 Site Verification Testing

Each **Licensed Operator** shall carry out a routine test of the accuracy and/or verification of performance of all **Metering Equipment** in respect of which it is the **Licensed Operator**. Such testing where practicable should be carried out in situ on the overall system rather than individual component parts. In some instances e.g. water flow meters, it may be impractical to achieve levels of accuracy commensurate with in-situ adjustment of parameters but it is expected that performance data can be obtained to provide measurement confidence or schedule corrective actions.

Note: Where using such performance assessments if an uncertainty of measurement better than +/-5% cannot be obtained such meters should be scheduled for testing at a third party test facility and be removed from service at the earliest opportunity.

The **Licensed Operator** shall also carry out a test of the accuracy or verification of performance of all **Metering Equipment** in respect of which it is the **Licensed Operator** and which replaces defective or inaccurate **Metering Equipment** as soon as is reasonably practicable after its installation. Such **Licensed Operator** will give **System Operator** 15 days prior written notice of the date, time, place and nature of every such test and **System Operator** shall have the right to attend such test should it so require. All such tests shall be in line with the **Procedures**.

Should **System Operator** have reason to believe that the **Metering Equipment** which a **Licensed Operator** is required to maintain for the purposes of this **Code,** is not performing within the prescribed limits of accuracy, **System Operator** shall (but without being obliged to serve such notice) normally serve 15 days notice to the relevant

Licensed Operator, inspect such **Metering Equipment** and make such tests as **System Operator** shall deem necessary to determine its accuracy or performance. Where necessary this may require scheduled removal for such an activity although such work would be in full consultation with the **Licensed Operator**. The costs of any such test shall be borne by the **Licensed Operator** responsible for the maintenance of the relevant **Metering Equipment**.

5.3 Records

Each **Licensed Operator** shall maintain a record relating to each **Metering System** with regard to the calibration and verification testing of the **Metering Equipment**. This shall include; dates and results of any tests, readings, adjustments or inspections carried out and the dates on which any seal was applied or broken, the reason for any seal being broken and the persons attending any such tests, readings, inspections or sealing.

Such records shall also include any other details as may be reasonably required by **System Operator**. Any such records shall be complete and accurate and retained for the life of the relevant item of **Metering Equipment**.

5.4 Inspection and Readings

System Operator shall ensure that all **Metering Systems** comprising any **Metering Equipment** which is registered with it for the purposes of the **Data Exchange System** is inspected and read by it or on its behalf not less than once in every 3 months. The purpose for this reading is to reconcile demand period data with cumulative register readings for the same period. General checks carried out at the same time will identify:

- Missing seals
- Damage
- Potential interference
- Any other issues for concern

Meter reading schedules shall be agreed annually as stated in the **Procedures**. **System Operator** and the **Licensed Operator** shall keep written reports of all such inspections and readings which shall be available for inspection and audit by the **DOE**.

6. ACCESS

Each **Licensed Operator** shall grant to each of **System Operator** employees, its agents, contractors and nominees of the **DOE** the right to enter upon and through and remain upon any part of such **Licensed Operator** property to the extent necessary for the purposes of this **Code**.

The right of access provided for in this Clause includes the right to bring on to such **Licensed Operator** property such vehicles, plant, machinery and maintenance or other materials as shall be reasonably necessary for the purposes of this **Code**.

Each **Licensed Operator** shall ensure that all reasonable arrangements and provisions are made and/or revised from time to time as and when necessary or desirable to

facilitate the safe exercise of any right of access granted with the minimum of disruption, disturbance and inconvenience.

System Operator and **Transmission Owner** shall not incur any liability under this **Code** in the event that it cannot perform any of its duties hereunder due to access to **Metering Equipment** being denied to it or its nominated representative, save that **System Operator** shall inform the **DOE** as soon as is practicable thereafter.

7. DEFECTIVE METERING EQUIPMENT

7.1 General

If at any time, any **Metering Equipment** or any part thereof, is destroyed or damaged or otherwise ceases to function, or is found to be outside the prescribed limits of accuracy, the **Licensed Operator** shall promptly adjust, renew or repair the same or replace any defective component so as to ensure that the relevant **Metering Equipment** is back in service and operating within the prescribed limits of accuracy as quickly as is reasonably practicable in all the circumstances.

7.2 Sanctions for Failure to Comply

In the event that a **Licensed Operator** cannot or does not comply with its obligations to repair, adjust or replace or renew any defective component pursuant to Section 2, Clause 7.1, **System Operator** shall have the right to carry out any such repair, adjustment, replacement or renewal and to recover its own costs and expenses thereon from such **Licensed Operator** forthwith on demand.

System Operator shall report any persistent failure to comply with the provisions of this Clause to the **DOE** in accordance with Clause 10 of this Section of the **Code**. The rectification process on any **Code** non-compliance shall be determined by the **DOE**.

7.3 Meter Failure

If at any time any **Metering Equipment** ceases to function or is found to be outside the prescribed limits of accuracy then until the date of adjustment, replacement, repair or renewal of such **Metering Equipment** the meter readings shall be deemed to be those determined to be most appropriate in accordance with **Procedures**.

7.4 Discrepancies

It is acknowledged that, in transmitting metered data, impulses representing quantities of **Electricity** ***or*** **Water** ***or*** **Gas** *or* ***Back Up Fuel Oil*** may be lost between the relevant meter and the data collector **Outstation** giving rise to inaccuracies in hourly values notwithstanding that the **Metering Equipment** is complying with the standards required by this **Code**. In such circumstances any differences between **Electricity**, **Water**, **Gas or Back Up Fuel Oil** flows recorded on meters and the total of the hourly values recorded in the **Data Exchange System** will be noted at the time that the meter is inspected and read and will be dealt with as provided in the relevant **Procedure**.

8. DUTY OF GOOD FAITH AND STANDARD OF CONDUCT

System Operator and each **Licensed Operator** shall at all times in its dealings with the other parties to this **Code** and the **DOE**:

- Act in good faith;
- Act in accordance with **Good Industry Practice**.

9. THE METERING AND DATA EXCHANGE CODE REVIEW PANEL

System Operator shall establish and maintain the **Panel**, which shall be a standing body to carry out the functions referred to in Section 2, Clause 9.1.

9.1 Objectives

The **Panel** shall:

- Keep the **Code** and its working under review
- Review all suggestions for amendments to the **Code** which the **DOE** or any **Licensed Operator** may wish to submit to **System Operator** for consideration by the **Panel** from time to time
- Publish recommendations as to amendments to the **Code** that **System Operator** or the **Panel** feels are necessary or desirable and the reasons for the recommendations
- Publish **Procedures** supporting the **Code** implementation
- Issue guidance in relation to the **Code** and its implementation, performance and interpretation when asked to do so by any **Panel** member
- Take due account of **PWPA/PPA/WPA** contracts and ensure harmonisation of requirements
- Consider what changes are necessary to the **Code** arising out of any unforeseen circumstances referred to it by **System Operator**
- Constitute working groups Chaired by an appropriate **Panel** member to assist in any of the above

9.2 Membership

The **Panel** shall consist of:

- **System Operator** who may appoint the **Panel** Chairman and up to two other active Panel members, plus a non-active member to act as **Panel** Secretary for production of minutes, etc
- The **DOE** who may appoint the Deputy Chairman and one additional **Panel** member
- The **Procurer** who may appoint one **Panel** member

- **Production Companies**, may appoint one **Panel** member to represent each of the **Production Companies**. However, **System Operator** may invite additional members from other **Embedded Generator** and/or **Non-Embedded Customer**.
- Each **Distribution Company** who may appoint one **Panel** member.
- The **Transmission Owner** who may appoint one **Panel** member.

All of the above **Panel** members shall be appointed according to the rules issued pursuant to Section 2, Clause 9.3, and the **Procedures**.

Via written notification to the Panel Chairman, any Panel member may appoint its own deputy or appoint its own replacement member.

9.3 Rules

The **Panel** shall establish and comply at all times with its own rules and **Procedures** relating to the conduct of its business, which shall be approved by the **DOE**.

9.4 Consultation

System Operator shall consult, in writing, all **Licensed Operators** which are liable to be materially affected in relation to all proposed amendments to the **Code** and shall submit all proposed amendments to the **Code** to the **Panel** for discussion prior to such consultation.

10. DISPUTES

In the event that **System Operator** is able to resolve a dispute regarding **Metering Equipment** to the satisfaction of all parties in dispute, such resolution may be implemented as soon as is reasonably practicable without further approval of the **DOE**. In the event that **System Operator** is unable to resolve any dispute regarding **Metering Equipment** or any issue relating to compliance with the **Code** to the satisfaction of all parties in dispute, then it shall be referred to the **DOE**.

Where any matter in dispute is required to be provisionally determined for the purposes of any **Settlement Run** it shall be determined provisionally by **System Operator**.

Any testing of **Metering Equipment** required to settle a dispute will be carried out by the relevant **Licensed Operator** on the relevant **Metering Equipment** mounted in its operational position in the presence of **System Operator** acting on behalf of the **DOE**. All test equipment will have current calibration certificates traceable to appropriate National or International standards and testing will be carried out in accordance with the **Code** and any applicable **Procedures**.

Metering Equipment which fails any test whilst in its operational position shall be tested under laboratory conditions.

In addition to **System Operator,** the **DOE** will be entitled to witness tests taken as a result of a dispute, including tests confirming the calibration of test equipment or the

inspection of evidence of valid calibration, as appropriate. Affected **Licensed Operators** may also nominate 1 person each to attend/witness such tests

11. INFORMATION

All **Licensed Operators** shall give to **System Operator** all such information regarding **Metering Equipment** as **System Operator** shall reasonably require for the proper functioning of the **Data Exchange System** including information regarding the dates and time periods for installation of new **Metering Equipment** and the dates and periods when **Metering Equipment** is out of service.

System Operator shall provide each **Licensed Operator** with a written report of the running of the **Data Exchange System** for each **Settlement Period**.

12. OWNERSHIP OF METERING DATA

The **Licensed Operator** of any **Metering Equipment** shall own the data acquired there from. **System Operator** is authorised to use the same as may be permitted pursuant to this **Code**.

13. NOTICES

Any notice of a new **Licensed Operator** or a change in a **Licensed Operator** or any form of acknowledgement required under this **Code** shall be given to such person as may from time to time be nominated to receive such notification by **System Operator**.

14. POLICING

System Operator shall actively monitor compliance with the obligations of **Licensed Operators** under this **Code** which shall comprise the carrying out of audit visits to **Licensed Operator** sites and the reporting of adverse findings of such audit visits to the **DOE**.

Rectification process of any **Code** non-compliance shall be determined by the **DOE** and in line with the **Procedures**.

Metering & Data Exchange Code

Section 3
Electricity Metering

Section 3 Electricity Metering
Amendment Record

SECTION 3 - ELECTRICITY METERING

1. INTRODUCTION

This section of the **Code** defines the minimum specification and requirements for the **Metering Equipment** to be used for the measurement and recording of electricity transfers at **DMPs**.

For the purpose of the **Code** the rated circuit capacity (in MVA) shall determine the minimum specification of **Metering Equipment** used. The rated circuit capacity shall be determined by the lowest rated primary plant (e.g. transformer rating, line rating, etc) of the circuit to be measured. The **Metering Equipment** provision and minimum specification requirements shall anticipate any future up-rating consistent with the installed primary plant, where appropriate. The primary plant maximum continuous ratings shall be used in this assessment.

2. SCOPE

This section of the **Code** specifies the type of **Metering Systems** that shall be employed, and the facilities that shall be provided for the measurement and recording of the quantities required for **Settlement** purposes.

The **Metering Equipment** requirements for electricity transfers are dependent on the capacity of the circuit. These circuit capacities are categorised and defined as follows:

- **E1** – Greater than 100 MVA
- **E2** - Greater than 10 MVA but less than (or equal to) 100 MVA
- **E3** - Greater than 1 MVA but less than (or equal to)10 MVA
- **E4** – less than (or equal to) 1 MVA

Dispensations from the requirements of the **Code** may be sought from the **DOE** as defined in the **Procedures** and the **Licensed Operator's** licence.

3. REFERENCES

The following documents *may be* referred to in the text *of the **Code**:*

3.1 International Standards

3.1.1 IEC 62052-11 - Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment

3.1.2 IEC 62052-21 - Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 21: Tariff and load control equipment

3.1.3 IEC 62053-11 - Electricity metering equipment (a.c.) - Particular requirements - Part 11: Electromechanical meters for active energy (classes 0,5, 1, and 2)

3.1.4 IEC 62053-21 - Electricity metering equipment (a.c.) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)

3.1.5 IEC 62053-22 - Electricity metering equipment (a.c.) - Particular requirements - Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)

3.1.6 IEC 62053-23 - Electricity metering equipment (a.c.) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)

3.1.7 IEC 60145 var-hour (reactive energy) meters

3.1.8 IEC 62056-21 - Electricity metering – Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange

3.1.9 IEC 60044-1 - Instrument Transformers - Part 1: Current Transformers

3.1.10 IEC 60044-2 - Instrument Transformers - Part 2: Inductive voltage Transformers

3.1.11 IEC 60044-3 - Instrument Transformers - Part 3: Combined Transformers

3.1.12 IEC 60044-5 - Instrument Transformers - Part 5: Capacitor voltage Transformers

3.1.13 IEC 60044-7 - Instrument Transformers - Part 7: Electronic voltage Transformers

3.1.14 IEC 60044-8 - Instrument Transformers - Part 8: Electronic current Transformers

3.1.15 ISO/IEC 17025 - General requirements for the competence of testing and calibration laboratories

4. MEASUREMENT CRITERIA

4.1 Measured Quantities and Demand Values

4.1.1 Measured Quantities

For each separate **DMP** the following energy measurements are required for **Settlement** purposes:

a) Import and export MWh

b) Import and export Mvarh

4.1.2 Demand Values

For each **Demand Period** for each circuit the following Demand Values shall be provided:

a) Import and export MW

b) Import and export Mvar

4.2 Accuracy Requirements

4.2.1 Overall Accuracy

The overall accuracy of the energy measurements at or referred to the **DMP** shall at all times be within the limits of error as set out in Schedule 1.

Evidence to verify that these overall accuracy requirements are met shall be available for inspection by **System Operator**.

4.2.2 Compensation for Measurement Transformer Error

All **Meters** shall be compensated for the errors of their associated measurement transformers and the leads to/from the **Meters**.

The compensation calculations, and the values applied to the **Meters** shall be recorded by the **Licensed Operators** in the relevant **Connection Agreement** and shall be available, along with the latest **Meter** and measurement transformer test certificates, for inspection by **System Operator** upon request.

Such compensations shall be achieved within the **Meter** by either:

a) A single calculated error or 'offset' which is a single error programmed into the meter which is applied internally at defined test points on the error curve; or

b) A series of calculated errors programmed into the meter for each test point on the error curve and applied as such by the meter.

4.2.3 Compensation for Power Transformer and Line Losses

Where the **Actual Metering Point** and the **DMP** do not coincide, the **Metering System** does not comply with the **Code**. Where justified and approved by the **DOE** a dispensation may be granted which will require compensation for power transformer and/or line losses to be submitted and applied to meet the overall accuracy at the **DMP**.

The compensation may be achieved either within the **Metering Equipment** or by software within the **Data Exchange System**.

Where compensation is applied the values used shall be recorded in the **Connection Agreement** and supporting evidence to justify the compensation criteria shall be available for inspection by **System Operator**.

5. METERING EQUIPMENT CRITERIA

5.1 General

Metering Equipment provided for certain capacity circuits (see Table 1 & 2 below) shall be dual redundant systems i.e. main and check others will require only main equipment.

For clarity, although the **Code** identifies separate items of **Metering Equipment**, nothing in it prevents such items being combined to perform the same task, provided the requirements of this **Code** are met. For example a single combined VT/CT unit or a combined **Meter** and **Outstation** (see Section 7), may be used where main and check requirements can still be met.

Metering Equipment other than outdoor measurement transformers, shall be accommodated in a clean and dry environment.

Table 1

Circuit capacity	**Measurement Transformers**			
	Main & Check		Accuracy class	
	Current	Voltage	Current	Voltage
Greater than 100 MVA	Main & Check	Main & Check	0.2S	0.2
Greater than 10 MVA but less than (or equal to) 100 MVA	Main & Check	Main	0.2S	0.2
Greater than 1 MVA but less than (or equal to) 10 MVA	Main	Main	0.2	0.5
Less than (or equal to) 1 MVA	Main	Main	0.5	0.5

5.2 Measurement Transformers

For each circuit, current transformers (CT) and voltage transformers (VT) shall meet the requirements set out in the **Code**.

Additionally, where a combined unit measurement transformer (VT & CT) is provided the 'Tests for Accuracy' as covered in IEC 60044-3 covering mutual influence effects shall be met.

The terms "current transformer" and "voltage transformer" used below do not preclude the use of other measuring techniques with a performance equal to that specified for such measurement transformers. Such devices shall be approved by the **DOE** before use.

5.2.1 Current Transformers

Current transformers shall meet the requirements of IEC 60044-1.

The minimum standard of accuracy (irrespective of the secondary current rating of the current transformers) shall be provided as per Table 1.

For certain circuit capacities, main and check current transformers shall be provided as per Table 1. In this case, two current transformers or one current transformer with two or more secondary core sets can be used.

The current transformers or core supplying main **Meters** shall be dedicated to that purpose only. For circuits which require only a main current transformer, then the same current transformer can be utilized for both main & check meter.

The current transformers supplying check **Meters** may be used for other purposes provided the overall accuracy requirements are met and evidence of the value of the additional burden is available for inspection by **System Operator**.

Once installed and commissioned, the additional burden shall not be modified without prior notification to **System Operator**, and evidence of the value of the modified additional burden shall be available for inspection by **System Operator**.

CT test certificates showing errors at the overall working burden or at burdens which enable the working burden errors to be calculated shall be available for inspection by **System Operator**.

The total burden on each current transformer shall not exceed the rated burden of such CT.

For the purpose of this **Code**, the use of summation current transformers shall not be permitted.

The use of interposing current transformers is permitted provided the overall **Metering System** accuracy is maintained.

5.2.2 Voltage Transformers

Voltage transformers shall meet the requirements of IEC 60044-2.

For certain circuit capacities, main and check voltage transformers shall be provided as per Table 1. Where this is so, two voltage transformers or one voltage transformer with two or more secondary winding sets can be used.

The VT secondary winding supplying main **Meters** shall be dedicated to that purpose only. For circuits which require only one voltage transformer, then the same voltage transformer can be utilized for both main & check meter.

The VT secondary winding supplying check **Meters** may be used for other purposes provided the overall accuracy requirements are met and evidence of the value of the additional burden is available for inspection by **System Operator**.

The additional burden shall not be modified without prior notification to **System Operator**, and evidence of the value of the modified additional burden shall be available for inspection by **System Operator**.

A VT test certificate(s) showing errors at the overall working burden(s) or at burdens which enable the working burden errors to be calculated shall be available for inspection by **System Operator**.

The total burden on each secondary winding of a VT shall not exceed the rated burden of such secondary winding.

Separately fused (or separately MCB protected) VT supplies shall be provided for each of the following where required by the **Code**:

a) The main **Meter**

b) The check **Meter**

c) Any additional burden

Such fuses (or MCBs) shall be located as close as practicable to the VT.

Fuse or MCB rating discrimination shall be taken into account for VT supplies to all **meters**.

Fuse and/or MCB contact resistance should also be taken into account when calculating VT burden.

5.2.3 Measurement Transformers Installed as part of existing **Metering Equipment.**

All **Metering Equipment** commissioned on or after 1st January 2000 shall comply with the requirements of the **Code**. Where **Metering Equipment** commissioned prior 1st January 2000 has measurement transformers which do not comply fully with Section 3, Clauses 5.2.1 and 5.2.2 then such measurement transformers may be used providing all of the following requirements and the overall performance requirements as defined in Schedule 1, Table 1 are met:

a) All Metering Systems shall use measurement transformers as detailed in Section 3, Clauses 5.2.1 and 5.2.2, by, no later than, 1st January 2010.

Where this date cannot be met, dispensation shall have been sought and granted by 1st Jan 2010.

b) Where subsequently a significant alteration to the primary plant (e.g. a switchgear change) is carried out in the intervening years, new measurement transformers as detailed in Section 3, Clauses 5.2.1 and 5.2.2, shall be provided.

c) Where measurement transformers supply burdens other than **Metering Equipment** used for **Settlement** purposes, evidence of the value of the additional burdens shall be available for inspection by **System Operator**. The additional burden shall not be modified without prior notification to **System Operator**, and evidence of the value of the modified additional burden shall be available for inspection by **System Operator**.

d) Separately fused VT supplies shall be provided for each of the following:

i) The main **Meters**;

ii) The check **Meters**; and

iii) Any additional burden.

Such fuses shall be located as close as practicable to the VT.

e) Where a common mode fault, such as a VT fuse failure, could cause incorrect voltages on both the main and check **Meters** a voltage monitoring relay shall be provided at or adjacent to the associated **Meter** panel. The relay operating sensitivity shall enable detection of a voltage unbalance of 5% or more (expressed as a percentage of nominal voltage). The relay shall incorporate a time delay feature so as to avoid spurious operation.

A VT failure alarm shall be produced at a manned point normally within 24 hours of the fault detection.

A spare channel on the **Outstation** or any other available means may be used to transmit the alarm.

5.3 Testing Facilities

Separate test terminal blocks or equivalent facilities shall be provided for main **Meters** and for check **Meters** of each circuit. The test facilities shall be nearby the associated **Meters** and enable on site verification testing to take place (see Section 9, Clause 4.3).

5.4 Meters

5.4.1 General

Meters can be integrated **Active/Reactive Energy Meters** having multi rate, multi function capability.

The quantities defined in Section 3, Clause 4.1.1 shall be measured and displayed by both main and check **Meters**.

All **Meters** shall be labelled or otherwise be readily identifiable in accordance with Schedule 3.

All **Meters** shall include a non-volatile **Meter Register** of cumulative energy for each measured quantity. This may require the installation of a separate auxiliary power supply to power the electronics of the **Meter** thus enabling it to function when the associated VT is de-energised.

The **Meter Register** shall not roll-over more than once within the normal **Meter** reading cycle. (see section 2 clause 5.4)

Meters which provide data to separate **Outstations** shall for this purpose provide two outputs per measured quantity solely for this purpose.

Meters that have an internal time clock shall have this facility disabled unless it can be synchronised by Settlement Instation/Outstation. Time stamping of all data required for **Settlement** purposes, including alarms and failure events (as defined elsewhere in the **Code**), will only be carried out by the **Outstation**. The **Outstation** will then be synchronised to **Settlement Instation** time as part of the data collection process operated by **System Operator**.

5.4.2 Active Energy Meters shall:

a) meet the requirements of IEC 62053-22 or IEC 62053-11 as appropriate and the appropriate accuracy class as set out in Table 2; and

b) be configured such that the number of measuring elements is equal to or one less than the number of primary system conductors. These include the neutral conductor, and/or the earth conductor where system configurations enable the flow of zero phase sequence energy.

5.4.3 Reactive Energy Meters shall:

a) Meet the requirements of the IEC 62053-23 or IEC 60145 as appropriate and the appropriate accuracy class as set out in Table 2.

Circuit capacity	**Meters**			
	Main & Check		Accuracy class	
	MWh	MVArh	MWh	MVArh
Greater than 100 MVA	Main & Check	Main & Check	0.2S	2.0
Greater than 10 MVA but less than (or equal to) 100 MVA	Main & Check	Main & Check	0.2S	2.0

Greater than 1 MVA but less than (or equal to) 10 MVA	Main & Check	Main	0.5S	3.0
Less than (or equal to) 1 MVA	Main	Main	1.0	3.0

Table 2

5.5 Facilities for Information

Where required by the **Licensed Operator**, **Metering Equipment** shall be capable of providing at least two outputs per metered quantity. These outputs shall be provided direct from the **Meter** in the form of voltage free pulsed output and be proportional to the consumption quantities. The pulse rate at the **Meter** full load rating shall be such that 2000 or more pulses are produced in a **Demand Period**. Where also required the **Meter** shall additionally be equipped with dual serial (RS232/485) ports identically configured to provide independent data paths to dual redundant **Outstations**.

5.6 Sealing

All **Metering Equipment** shall be capable of being sealed in accordance with the **Code** and supporting **Procedures**.

5.7 Temporary Connection & Mobile Sub-Stations

Temporary electricity connections may be required for some urgent site activities. This can be for a generation unit back feed, temporary labour camp or any temporary power demand. Also, in some remote areas, mobile substation may be required. For such connections, some relaxation from the **Code** can be provided as long as the connection is not required more than five (5) years.

MDEC meters need to be installed on this temporary connection and mobile substations, however integration to LDC settlement system is not mandatory since data can be collected manually from site. Data storage facility shall be provided at site which allows a storage capacity of 24 periods per day for a minimum of 40 days for all Demand Values as per Clause 4.1.5 of Section 7 of the **Code**.

6. ASSOCIATED FACILITIES

6.1 Additional Features

Additional features may be incorporated within or associated with the **Metering Equipment** provided they do not interfere with or reduce the integrity of the **Settlement** process.

SCHEDULE 1 - METERING SYSTEM AND METER ACCURACY REQUIREMENTS

This Schedule sets out the overall accuracy requirements for the following **Metering Systems** and the associated **Meters**:

1. ACTIVE ENERGY

Condition	**Limit of Errors at Stated Power Factor**				
	Power Factor	**Metering System**(3)			
Current expressed as a percentage of Rated Measuring Current		**E1**	**E2**	**E3**	**E4**
120% to 10% inclusive	Unity	±0.5%	±1.0%	±1.5%	
100% to 20% inclusive	Unity				±1.5%
Below 20% to 5%	Unity				±2.5%
Below 10% to 5%	Unity	±0.7%	±1.5%	±2.0%	
Below 5% to 1% (1)	Unity	±1.5%	±2.5%		
100% to 10% inclusive	0.5 lag and 0.8 lead				±2.5%
120% to 10 inclusive	0.5 lag and 0.8 lead	±1.0%	±2.0%	±2.5%	
Meter: Accuracy Class to: IEC 62053-22(2)		**0.2S**	**0.2S**	**0.5S**	
Accuracy Class to: IEC 62053-21 or IEC 62053-11(2)					**1.0**

2. REACTIVE ENERGY

Condition	**Limit of Errors at Stated Power Factor**				
	Power Factor	**Metering System**			
Current expressed as a percentage of Rated Measuring Current		**E1**	**E2**	**E3**	**E4**
120% to 10% inclusive	Zero	±4.0%	±4.0%	±4.0%	
100% to 20% inclusive	Zero				±4.0%
120% to 20% inclusive	0.866 lag and 0.866 lead	±5.0%	±5.0%	±5.0%	
100% to 20%	0.866 lag and 0.866 lead				±5.0%
Meter: Accuracy Class to: IEC 60145 or IEC 62053-23(2)		**2.0**	**2.0**	**3.0**	**3.0**

Notes:

(1) - This requirement shall only apply where energy transfers to be measured by the import **Meter** and/or the export **Meter** during normal operating conditions is such that the rated measuring current will be below 5% (excluding zero) for periods equivalent to 10% or greater per annum.

(2) - The **Meters** metrological properties shall have been confirmed as complying with such standards by an appropriate body e.g. The approved laboratories of OFGEM, KEMA, NMI, PTB, etc.

(3) - For the avoidance of doubt, in the event of conflict between the provisions of Schedule 1 and the provisions of the respective IEC standard, the document containing the higher level of standard shall apply. Evidence to verify that these overall accuracy requirements are met shall be available for inspection by **System Operator** if required.

SCHEDULE 2 - DEFINED METERING POINTS

For transfers of electricity between the following parties the **DMP** shall be at one of the following locations:

1. For transfers between the **Transmission Owner Electricity System** and a single **Distribution Company** where no other party is connected to the busbar, the **DMP** shall be at the lower voltage side of the transmission system connected transformer.
2. For transfers between the **Transmission Owner Electricity System** and a single **Distribution Company** where other parties are connected to the busbar, the **DMP** shall be at the circuit connections to that **Distribution Company**.
3. For transfers between the **Transmission Owner Electricity System** and more than one **Distribution Company** connected to the same busbar, the **DMP** shall be at the circuit connections of each **Distribution Company** to such busbar.
4. For transfers between **Distribution Companies** not including a connection to the **Transmission System**, the **DMP** shall be at the point of connection of the two **Distribution Companies**.
5. For transfers between the **Transmission Owner Electricity System** and **Generating Companies**, the **DMP** shall be at the high voltage side of the generator transformers and station transformer(s).
6. For transfers between a **Generating Company** and another **Generating Company** at an adjacent site the **DMP** shall be at a point of connection to be agreed by the **Generating Companies**.
7. For transfers between **Distribution Companies** and **Generating Companies**, the **DMP** shall be at the point of connection of the generating station to the **Distribution Company**.
8. For transfers between the **Transmission Owner Electricity System** and a **Non-Embedded Customer**, the **DMP** shall be at the point of connection to the **Transmission System** in accordance with the relevant connection agreement. Typically this will be on the lower voltage side of the transmission system connected transformer.
9. For transfers between the **Transmission Owner Electricity System** and an adjacent country or Emirate (or visa versa), that is not licensed by the **DOE**, the **DMP** shall be the defined geographical boundary point as defined in UAE or international law.

Note:

Each Generating Unit which is subject to Central Despatch shall have metering which identifies uniquely the Electricity transfers of the despatched unit. Such metering shall perform to a standard as agreed with **The Procurer**.

SCHEDULE 3 - LABELLING OF METERS FOR IMPORT AND EXPORT

A standard method of labelling **Meters**, test blocks, etc, is necessary for import and export. The required labelling shall be as follows:

1. ACTIVE ENERGY

Meters or **Meter Registers** shall be labelled (or identifiable from the meter display) *as* "Import" or "Export" based on "Import" and "Export" being from the viewpoint of the **Licensed Operator** of the **Metering System**.

2. REACTIVE ENERGY

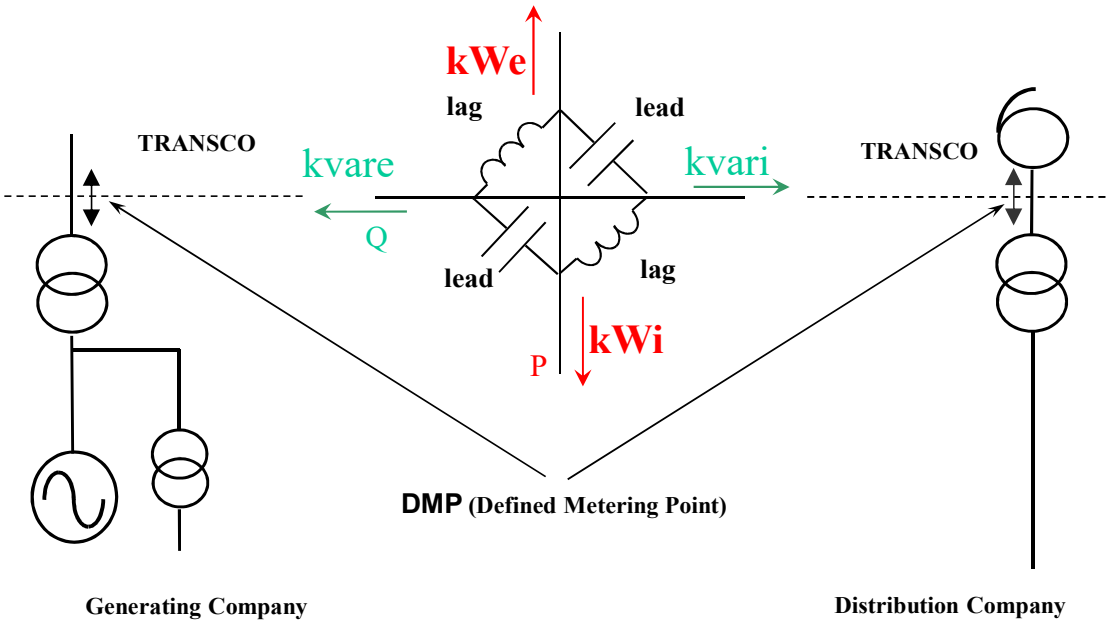
Within the context of this Code the relationship between **Active Energy** and **Reactive Energy** can be established by means of the power factor. The following table gives the relationship:

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

Meters or **Meter Registers** for registering import **Reactive Energy** should be labelled "Import" and those for registering export **Reactive Energy** should be labelled "Export".

3. CONVENTION & QUADRATURE

The following schematic (over page) depicts and illustrates the aforementioned convention for import and export and the aforementioned relationship between Active Energy, Reactive Energy and power factor.


kWe
lag
lead
TRANSCO
kvare
kvari
TRANSCO
Q
lead
lag
P
kWi
DMP (Defined Metering Point)
Generating Company
Distribution Company

Metering & Data Exchange Code

Section 4
Water Metering

Section 4 Water Metering
Amendment Record

SECTION 4 - WATER METERING

1. INTRODUCTION

This section of the **Code** defines the minimum specification and requirements for the **Metering Equipment** to be used for the measurement and recording of water transfers at **DMPs**.

For the purpose of the **Code** the **Full Scale Flow Rate** of a **Meter** shall be determined by the item of primary plant which limits the flow to a maximum value. The **Metering Equipment** provision and minimum specification requirements shall anticipate any future up-rating consistent with the installed primary plant, where appropriate.

2. SCOPE

This section of the **Code** specifies the type of **Metering Systems** that shall be employed, and the facilities that shall be provided for the measurement and recording of the quantities required for the purposes of **Settlement** or **Central Despatch.**

The **Metering Equipment** requirements for **water** transfers are dependant upon the maximum water flow rate. These capacities are categorised and defined as follows:

- W1 – for maximum flow rate greater than 100m^3/hr (This will typically be for pipeline DN greater than 100mm bore)
- W2 – for maximum flow rates less than (or equal to) 100m^3/hr (This will typically be for pipeline DN equal to or less than 100mm bore)
- W3 - Storage tank water levels only

Dispensations from the requirements of the **Code** may be sought from the **DOE** as defined in the **Procedures** and the **Licensed Operator's** licence.

3. REFERENCES

The following documents are referred to in the text:

3.1 International Standards

3.1.1 ISO 4064: Measurement of Water Flows in Closed Conduits - Meters for Cold Potable Water (Parts 1, 2 and 3)

3.1.2 OIML R 49 – Water Meters Intended for the Metering of Cold Potable Water

3.1.3 ISO 7066-1- Measurement of Liquid Flow – Assessment Of Uncertainty In The Calibration And Use Of Flow Measurement Devices.

3.1.4 BS EN 14154-1- Water meters. General requirements

4. MEASUREMENT CRITERIA

4.1 Measured Quantities and Demand Values

4.1.1 Measured Quantities

For each separate **DMP** and water storage facility the following measurements are required for Settlement Purposes

a) Water in m^3 (cumulative cubic metres)

b) Storage Water Levels in m (meters)

c) Demand Values in $m^{3/}hr$

For each **Demand Period** for each **DMP** the **Demand Value** in m^3/hr shall be provided.

4.2 Accuracy requirements

4.2.1 Overall Accuracy

The overall accuracy of the water flow measurement at or referred to the **DMP** shall at all times be within the limits of error as set out in Schedule 4.

Evidence to verify that these overall accuracy requirements are met shall be available for inspection by **System Operator** and **The Procurer**.

4.2.2 Error Compensation

To achieve the overall accuracy requirements it may be necessary to compensate **Meters** for the errors of the measuring elements. Values of the compensation shall be recorded and evidence to justify the compensation criteria, including wherever possible test certificates, shall be made available for inspection by **System Operator**.

5. METERING EQUIPMENT CRITERIA

5.1 General

For clarity, although the **Code** identifies separate items of **Metering Equipment**, nothing in it prevents such items being combined to perform the same task provided the requirements of the **Code** are met.

5.2 On Site Verification Testing Facilities

Test pipe work shall be provided to facilitate in-situ meter testing &/or verification (Section 9 refers).

It is recognised that it may not be practical to carry out in-situ testing at the performance level required to confirm that the required accuracy is being maintained. However, facilities shall be provided to enable confidence checking of the meter performance or other appropriate testing to determine if the meter performance has reached such a point where corrective action is necessary.

Such facilities may include insertion meter probe tapping, provision of accessible pipe work to enable use of clamp-on ultra-sonic techniques or facilities for drop-testing from storage tanks. Electronic simulation devices may also be used in this process if appropriate. The purpose of such testing will be to determine if performance degradation justifies removal for calibration testing by a suitable **Accredited Laboratory** according to **Procedures.**

5.3 Meters

Water Meters shall meet the general requirements of ISO 4064/OIML R49 and the accuracy classes set out in Schedule 4 of this Section.

All **Meters** shall include a non-volatile/non-resettable **Meter Register** of cumulative water flow. The **Meter Register** shall not roll-over more than once within the normal **Meter** reading cycle (see Section 2, clause 5.4)

Meters which provide data to separate **Outstations** shall for this purpose provide two outputs per measured quantity.

Where required by the **Licensed Operator**, **Metering Equipment** shall be capable of providing one voltage free pulse output per metered quantity. These outputs may be provided either direct from the **Meter** or from an isolating relay supplied by such **Meter**. The pulse rate at the **Meter Full Scale Flow Rate** shall be such that 2000 or more pulses are produced in a **Demand Period**.

5.4 Sealing

All **Metering Equipment** shall be capable of being sealed in accordance with the **Code** and the **Procedures**.

5.5 Temporary Connection

Temporary water connections may be required for some urgent site activities. This can be for flushing and testing of newly installed pipeline (water, oil or gas), temporary labour camp or any temporary water demand. For such connections, some relaxation from the **Code** can be provided as long as the connection is not required more than five (5) years.

MDEC flowmeter need to be installed on this temporary connection. In case there is no secure power supply available on site then a mechanical meter can be utilised.

For settlement purpose, settlement data shall be collected manually from site on a monthly basis. Integration to LDC settlement system is not mandatory for temporary connection, however, if the temporary connection is foreseen for a period more than a year then a data storage facility shall be provided at site which allows a storage capacity of 24 periods per day for a minimum of 40 days for all Demand Values as per Clause 4.1.5 of Section 7 of the **Code**.

6. ASSOCIATED FACILITIES

6.1 Additional Features

Additional features may be incorporated within or associated with the **Metering Equipment** provided they do not interfere with or reduce the integrity of the **Settlement** process.

SCHEDULE 4 - METERING SYSTEM AND METER ACCURACY REQUIREMENTS

This Schedule sets out the overall accuracy requirements for the following **Metering Systems** and associated **Meters**. They shall comply with the general requirements of the latest revision of ISO 4064/***OIML R49*** which applies to **Water Meters** irrespective of technology.

1. METERING SYSTEM OVERALL ACCURACY

Condition	**Limit of Errors (as % of Flow Rate)**	
	Metering System	
Flow rate range	W1	W2
Q_2 to Q_4	+/- 1%	+/- 2%
Q_1 to Q_2	+/- 4%	+/- 5%
Meter Accuracy (supplier certified) Q_2 to Q_4	+/- 0.5%	+/- 1%
Q_1 to Q_2	+/- 3%	+/- 3%

Notes:

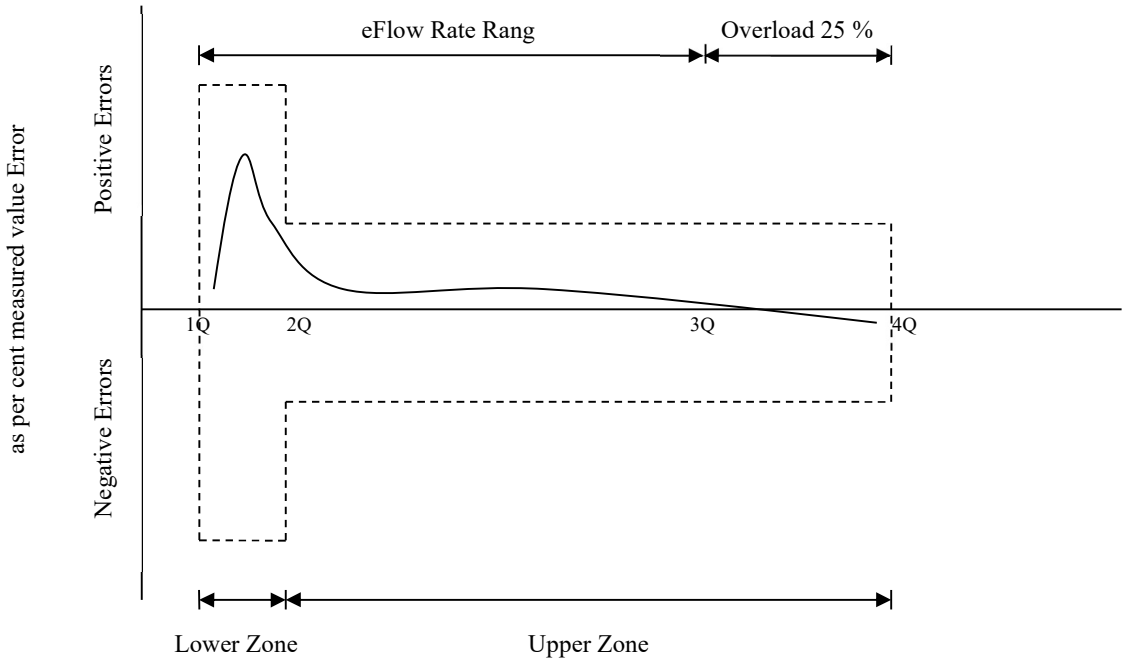
(1) – In general, all new installations from the **Code** effective date shall use only Electromagnetic Flow Meters, specified to be in conformity with the **Code** and in line with procedures, in order to maximise the performance advantages of these devices. Permitted exceptions to this will be where low fluid conductivity precludes their use. In such cases, Ultrasonic **Meters** shall be used or, where power supply is not possible, Mechanical **Meters** may be used, categorised according to W2 performance limits. Such alternatives shall be subject to approval through the dispensation procedure.

(2) - Accuracy figures quoted are minimum requirements.

(3) - Range should be chosen to match operational flow with the preferred normal flow value residing in the upper flow zone it is expected that for any chosen **meter** 90% of flow throughput will be in this upper zone.

(4) It is expected that in line with good working practice, flowmeters will be sized such that Q3 equates to a water velocity in the **meter** of approximately 3m/sec and that Q1 equates to a velocity in the meter of 0.1 m/sec. Meter factor settings outside the norm shall be acceptable providing accuracy requirements of the **Code** are met.

(5) W3 **meters** (Storage Water Level) shall be accurate to +/- 1% Full Scale Deflection



Terminology

The flow rate characteristics of a **Meter** (in compliance with ISO 4064) are defined by the values of Q_1, Q_2, Q_3 & Q_4. *A* **Meter** shall be designated by the numerical value of Q_3 in m^3/hr and the ratio (rangeability) of Q_3/Q_1

Q_1 is the minimum flow rate at which the **Meter** is required to operate within prescribed error.

Q_2 is the flow rate that occurs between the permanent flow rate Q_3, and the minimum flow rate Q_1 – the lower flow zone.

Q_3 is the permanent flow rate and is the highest flow rate that the **Meter** is required to operate in a satisfactory manor within prescribed accuracy.

Q_4 is the overload flow rate and is the highest flow rate that the **Meter** will be called on to operate for short periods of time and shall be 1.25 Q_3.

The lower flow zone should be no greater than 10% of the operational flow range

SCHEDULE 5 - DEFINED METERING POINTS

For transfers of **Water** between the following parties the **DMP** shall be at one of the following locations:

1. For transfers between the **Water Trunk Mains System** and a single **Distribution Company** where no other parties are connected to the pipe work, the **DMP** shall be at the point of connection of the **Distribution Company** to the **Water Trunk Mains System**.
2. For transfers between the **Water Trunk Mains System** and a single **Distribution Company** where other parties are connected to the pipe work, the **DMP** shall be at the point of connection to that **Distribution Company**.
3. For transfers between **Distribution Companies** not including a connection to the **Water Trunk Mains System**, the **DMP** shall be at the point of connection of the two **Distribution Companies**.
4. For transfers between **Water Production Units** and associated **Water** production reserve storage, the **DMP** shall be upstream of the gate valve, the downstream flange of which forms point of connection between the **Water Production Units** and associated **Water** production reserve storage.
5. For transfers between **Water** producer reserve storage and the **Water Producer** pumping station, the **DMP** shall be upstream of the gate valve, the downstream flange of which forms the point of connection between **Water** producer reserve storage and the **Water Producer** pumping station.
6. For transfers between **Water Producer** pumping station and the **Water Trunk Mains System**, the **DMP** shall be upstream of the gate valve, the downstream flange of which forms the point of connection between the **Water Producer** pumping station and the **Water Trunk Mains System**. Each **Water** trunk main which is subject to **Central Despatch** shall have **Metering Equipment** which identifies uniquely the water transfers of the **Water** trunk main.
7. For transfers between **Water Producer** pumping station and the **Distribution Company's Water** main system, the **DMP** shall be upstream of the gate valve, the downstream flange of which forms the point of connection between the **Water Producer** pumping station and the **Distribution Company's Water** main system. Each **Water** distribution main which is subject to **Central Despatch** shall have **Metering Equipment** which identifies uniquely the water transfers to the **Water** distribution main.
8. For transfers between a **Water Producer** and another **Water Producer** at an adjacent site by means of balance lines the **DMP** shall be at the point of connection to be agreed by the **Water Producers**.
9. For transfers between the **Water Trunk Mains System** and a **Non-Embedded Customer**, the **DMP** shall be at the point of connection to the **Transmission System**.

10. For transfers between the **Water Trunk Mains System** and an adjacent country or Emirate (or visa versa), that is not licensed by the **DOE**, the **DMP** shall be the defined geographical boundary point as defined in UAE or international law.

Note :

1) Although not a **DMP**, each **Water** Production Unit which is subject to **Central Despatch** shall have metering which uniquely identifies the water transfers of the despatched unit. Such metering shall perform to a standard agreed with **The Procurer**.
2) Although not a **DMP**, each **Water** storage tank shall have a transducer which uniquely identifies The Storage Water Level in that tank. Such transducers shall perform to the W3 standard.

Metering & Data Exchange Code

Section 5
Gas Metering

Section 5 Gas Metering
Amendment Record

SECTION 5 - GAS METERING

1. INTRODUCTION

This section of the **Code** defines the minimum specification and requirements for the **Metering Equipment** to be used for the measurement and recording of gas transfers at **DMPs**.

For the purpose of the **Code** the **Full Scale Flow Rate** of a **Meter** shall be determined by the item of primary plant which limits the flow to the maximum value. The **Metering Equipment** provision and minimum specification requirements shall anticipate any future up-rating consistent with the installed primary plant, where appropriate.

2. SCOPE

This section of the **Code** specifies the type of **Metering Equipment** that shall be employed, and the facilities that shall be provided for the measurement and recording of the quantities required for the purposes of **Settlement** or **Central Despatch.**

The **Metering Equipment** requirements for **Gas** transfers are dependant on the capacity of the pipeline. These pipeline capacities are categorised and defined as follows:

- **G1** – Greater than 150,000 m³/hour
- **G2** – Greater than 50,000 m³/hour but less than (or equal to) 150,000 m³/hour
- **G3** – Greater than 15,000 m³/hour but less than (or equal to) 50,000 m³/hour
- **G4** – less than (or equal to) 15,000 m³/hour

Flow is defined for line conditions.

Dispensations from the requirements of the **Code** may be sought from the **DOE** as defined in the **Procedures** and the **Licensed Operator's** licence.

3. REFERENCES

The following documents are referred to in the text:

3.1 International Standards

3.1.1 BS EN 12261:2002 Gas Meters - Gas Turbine Meters

3.1.2 ISO 9951:1993 Measurement of gas flow in closed conduits - Turbine Meters

3.1.3 AGA Report No. 7, Measurement of Natural Gas by Turbine Meter (2006)

3.1.4 AGA Report No. 8, Compressibility factor of Natural Gas and Related Hydrocarbon Gases

3.1.5 AGA Report No. 9, Measurement of Natural Gas by Multipath Ultrasonic Flowmeters (1998)

3.1.6 AGA Report No. 10, Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases

4. MEASUREMENT CRITERIA

4.1 Measured Quantities and Demand Values

4.1.1 Measured Quantities

For each separate **DMP** the following measurements are required for **Settlement** purposes in order to obtain the Standard Gas Volume and to compute the Heat values (all values to be expressed in appropriate SI Units):

a) Gas quantity in m³ under line conditions

b) Gas Temperature in degrees Celsius

c) Gas Pressure in Bar

d) Gas compressibility

e) Specific Heat Values – (Lower and Higher Specific Heat Values) – obtained as agreed with **The Procurer**

4.1.2 Demand Values

For each **Demand Period** and for each **DMP** the following values shall be provided:

a) Gas quantity in m³ corrected to **ST&P**

b) Gas Temperature in degrees Celsius *(^{O}C)*

c) Gas Pressure in Bar (Gauge)

4.1.3 Gas Analysis and Properties

The required thermal values of the gas shall be derived based on the Standard Gas Volume and the Heat Value of the Gas.

The Standard Gas Volume will be computed at **ST&P**. For the purpose of this **Code**:

a) Standard Pressure is 1.01324 bar

b) Standard Temperature is 15 degrees Celsius

(The equipment shall be capable of using other base conditions as required under the **PWPA/PPA/WPA** with the **Procurer**).

The gas composition data to arrive at the gas compressibility valve shall be inferred either through on line device (preferred method) such as a gas chromatograph in the **Production Company's** premises or can be a default value(s) agreed initially and entered into the associated computation device. This value shall then be periodically reviewed and updated at intervals to be agreed between the **Gas** supplier, **The Procurer** and **Licensed Operator**, in line with the **Procedures**.

4.2 Accuracy requirements

4.2.1 Overall Accuracy

The overall accuracy of the gas flow measurements at or referred to the **DMP** shall at all times be within the limits of error as set out in Schedule 6.

Evidence to verify that these overall accuracy requirements are met shall be available for inspection by **System Operator** and **the Procurer.**

4.2.2 Error Compensation

To achieve the overall accuracy requirements it may be necessary to compensate **Meters** for the errors of the measuring elements. Values of the compensation shall be recorded and evidence to justify the compensation criteria, including wherever possible test certificates, shall be available for inspection by **System Operator** and **the Procurer**.

5. METERING EQUIPMENT CRITERIA

5.1 General

For clarity, although the **Code** identifies separate items of **Metering Equipment**, nothing in it prevents such items being combined to perform the same task provided the requirements of this **Code** are met.

The main plant **Gas Metering System** to be used for **Settlement** purposes shall consist of at least a main and check **Metering System** to be provided for the whole of the plant downstream of the terminal flange from the **Gas** supplier's connection. The installation shall be in 'Z' type configuration so they can be used independently or in series together. Approval for all such installations shall be sought from **The Procurer.**

A minimum of one (main) **Metering System** shall be installed for all other metering – in accordance with the **PWPA/PPA/WPA** and as agreed with the **Procurer.**

For each **DMP** a gas flow measurement corrected to **ST&P** shall be provided.

The corrected flows as required by the applicable **PWPA/PPA/WPAs** shall be transmitted to the designated **Outstation**.

5.2 Transmitters

To determine accurate gas flow measurement, certain quantities shall be measured using a device other than a **Meter** e.g. a transmitter. The following quantities shall be measured at the most appropriate position in the natural gas flow stream in order to achieve the most accurate results:

- Flow
- Pressure
- Temperature

Outputs from the transmitters shall typically be 4-20mA signals and as required by the:

- **Licensed Operator** for local registration
- **Outstation**

The accuracy of transmitters shall be taken into account when designing the whole **Metering System** i.e. taking into account the overall **Metering System** accuracy requirements of the **Code**.

Transmitters shall be designed for safe operation with hazardous area classification appropriate to the application.

5.3 Gas Chromatographs

The gas chromatograph shall be interfaced with the main **Metering System's** flow computer and used in flow calculation and correction as required by the **PWPA/PPA/WPAs**.

Gas chromatographs and any associated ancillary equipment shall be installed and maintained as recommended by the manufacturer to ensure ongoing accuracy and robustness of results. (Note: The frequency of re-calibration shall be as recommended by the manufacturer or as agreed with the **Procurer**)

5.4 Flow Computers

To achieve the desired accuracy, a flow computer shall be used which takes data from the field transmitters, converts the parameters, and calculates necessary flow rates and integrated totals corrected to **ST&P**. It shall record the results based on the corrected values and the input data such as gas composition, density/specific gravity and other parameters as required by the flow formulae. Displays shall be provided for compensated flow rate, pressure, temperature and totalized flow. (Note: It is recognised that some of the above parameters are not measured at site but are provided by ADNOC and input as parameters in the equipment at site ie: the flow computer. Such parameters to be as agreed with **The Procurer**)

The flow computer for metering shall be able to provide all the input data and output reports in printed form and/or soft copies. Preferred units shall be SI measured in volumetric, heat or weight quantities corrected to **ST&P** conditions.

Data storage capacity shall be a minimum of seven calendar days.

Compressibility factors of natural gas, etc, shall be computed by using AGA 8.

5.5 Meters

As previously indicate (Clause 5.1), the main and check **Meters** of the main plant **Metering System** shall be installed in a 'Z' type configuration and be approved by **The Procurer.**

Gas Meters shall meet the accuracy classes set out in Schedule 6. They shall provide transmission of un-aggregated demand data to the associated **Outstation** where this is not integral with the **Meter**.

All **Meters** shall include a non-volatile **Meter Register** of cumulative **Gas** flow. The **Meter Register** shall not roll-over more than once within the normal **Meter** reading cycle.

Meters which provide data to separate **Outstations** shall for this purpose provide two outputs per measured quantity.

Where required by the **Licensed Operator**, **Metering Equipment** shall be capable of providing one voltage free pulse output per metered quantity. These outputs may be provided either direct from the **Meter** or from an isolating relay supplied by such **Meter**. The pulse rate at the **Meter** full load rating shall be such that 2000 or more pulses are produced in a **Demand Period**.

The flow measurement device may be selected by order of merit from but not necessarily restricted to one of the following:

- Ultrasonic multi-path flow **Meter** in compliance with AGA 9
- Turbine flow **Meter** in compliance with AGA 7 and/or ISO 9951

Meters using other technology may be used subject to approval by the **DOE** and the **Procurer**

Orifice plate **Meter** shall not be acceptable as a means of measuring **Gas** for the purposes of the **Code**. Other technology types shall only be used according to the conditions for which they are recommended.

The measuring devices shall be designed, installed and calibrated taking into account the required accuracy over the total flow range and applied according to listed standards and the **Procedures**.

5.6 Sealing

All **Metering Equipment** shall be capable of being sealed in accordance with the **Code** and the **Procedures**.

6. ASSOCIATED FACILITIES

6.1 Additional Features

Additional features may be incorporated within or associated with the **Metering Equipment** provided they do not interfere with or reduce the integrity of the **Settlement** process.

SCHEDULE 6 - METERING SYSTEM AND METER ACCURACY REQUIREMENTS

This Schedule sets out the overall accuracy requirements for the following **Metering Systems**:

1. METERING SYSTEM OVERALL ACCURACY

Condition	**Limit of Errors**			
	Metering System			
Flow expressed as a percentage of Full Scale Flow Rate	**G1**	**G2**	**G3**	**G4**
Between 50% and 120%	±0.8%	±1.0%	±1.2%	±1.5%
Between 10% and 50%	±1.0%	±1.5%	±2.0%	±2.5%
Between 1% and 10%	N/A	N/A	N/A	N/A

Note: N/A signifies no applicable requirement for **Code** purposes**.**

SCHEDULE 7 - DEFINED METERING POINTS

For transfers of gas between the following parties the **DMP** shall be at the following locations:

1. For transfers between the **Gas** supplier and a production site belonging to a **Licensed Operator/Production Company,** the **DMP** shall be at the **Commercial Boundary** between the **Gas** supplier and the site. This can comprise a single or multiple metering points as ~~to~~ agreed between the **Licensed Operator/Production Company** and the **Procurer**
2. The **Gas** supplier **Meter** shall not generally be acceptable as the **DMP**. However, for older plants owned by **Licensed Operators** with **Metering Equipment** installed and operating before the **Code Effective Date** and which is not in accordance with this **Code** the **Licensed Operator** may apply for exemption from compliance with the **Code** for a period to be agreed with **the Procurer**. In such cases metering data from the **Gas** supplier metering stations may be used for **Settlement** purposes.

Note – For individual items of gas consuming plant (such as a boiler or a gas combustion turbine) subject to **Central Despatch**, metering shall be installed which uniquely identifies the consumption of that individual item of plant. Such metering shall perform to a standard as agreed with **the Procurer**

Metering & Data Exchange Code

Section 6
Back Up Fuel Oil Metering

Section 6 Back Up Fuel Oil Metering
Amendment Record

SECTION 6 - BACK UP FUEL OIL METERING

1. INTRODUCTION

This section of the **Code** defines the minimum specification and requirements for the **Metering Equipment** to be used for the measurement and recording of liquid fuel oil transfers at **DMPs**.

For the purpose of the **Code** the **Full Scale Flow Rate** of a **Meter** shall be determined by the item of primary plant which limits the flow to the maximum value. The **Metering Equipment** provision and minimum specification requirements shall anticipate any future up-rating consistent with the installed primary plant, where appropriate.

2. SCOPE

This section of the **Code** specifies the type of **Metering Equipment** that shall be employed, and the facilities that shall be provided for the measurement and recording of the quantities required for the purposes of **Settlement or Central Despatch**.

The **Metering Equipment** requirements for **Back Up Fuel Oil** transfers are dependant on the consumption rate at the **DMP**. These consumption rates are categorised and defined as follows:

- **F1** - Max flow rate greater than 25 m³/hour
- **F2** - Max flow rate less than (or equal to) 25 m³/hour

Dispensations from the requirements of the **Code** may be sought from the **DOE** as defined in the **Procedures** and the **Licensed Operator's** licence.

3. REFERENCES

The following documents are referred to in the text:

3.1 International Standards

3.1.1 API Manual of Petroleum Measurement Standards

3.1.2 BS 7405:1991 – Guide to Selection and Application of Flow meters

3.1.3 OIML R117 Measuring systems for liquids other than water

4. MEASUREMENT CRITERIA

4.1 Measured Quantities & Demand Values

4.1.1 Measured Quantities

For each separate **DMP** the following measurements are required for **Settlement** purposes in order to obtain the **Back Up Fuel Oil** flow converted to **ST** conditions:

a) **Back Up Fuel Oil** quantity in m³ under ***actual*** line conditions

b) **Back Up Fuel Oil** quantity in m³ corrected to **ST**

c) **Back Up Fuel Oil** Temperature in degrees Celsius

d) **Back Up Fuel Oil** Pressure in Bar Gauge

4.1.2 Demand Values

For each **Demand Period** and for each **DMP** the following values shall be provided:

a) **Back Up Fuel Oil** quantity in m³ corrected to **ST**

b) **Back Up Fuel Oil** Temperature in degrees Celsius

c) **Back Up Fuel Oil** Pressure in Bar Gauge

d) Density/Specific Gravity

4.2 Accuracy Requirements

4.2.1 Overall Accuracy

The overall accuracy of the oil flow measurements at or referred to the **DMP** shall at all times be within the limits of error as set out in Schedule 8.

Evidence to verify that these overall accuracy requirements are met shall be available for inspection by **System Operator** and **The Procurer**.

4.2.2 Error Compensation

To achieve the overall accuracy requirements it may be necessary to compensate **Meters** for the errors of the measuring elements. Values of the compensation shall be recorded and evidence to justify the compensation criteria, including wherever possible test certificates, shall be available for inspection by **System Operator** and **the Procurer**.

5. METERING EQUIPMENT CRITERIA

5.1 General

For clarity, although the **Code** identifies separate items of **Metering Equipment**, nothing in it prevents such items being combined to perform the same task provided the requirements of the **Code** are met.

Metering Equipment shall be designed to allow on-site verification tests.

5.2 Transmitters

To determine accurate fuel oil flow measurement, certain quantities shall be measured using a device other than a **Meter** e.g. a transmitter. As a minimum the following quantities shall be measured at the most appropriate position in the fuel oil flow stream in order to achieve the most accurate results: (Note: the actual parameters required shall be as defined by and agreed with **the Procurer**)

- Flow
- Pressure
- Temperature
- Density

Outputs from the transmitters shall typically be 4-20mA signals and as required by the:

- **Licensed Operator** for local registration
- **Outstation**

The accuracy of transmitters shall be taken into account when designing the whole **Metering System** i.e. taking into account the overall **Metering System** accuracy requirements of the **Code**.

Transmitters shall be designed for safe operation with hazardous area classification appropriate to the application.

5.3 Flow Computers

To provide the desired compensation and accuracy a flow computer shall be used which takes data from the field transmitters, converts the parameters and calculates necessary volume/mass flow rates and integrated totals. It shall record the results based on the corrected values and the input data such as temperature, pressure, density and other parameters as required by the flow formulae. Displays shall be provided for compensated flow rate, pressure, temperature and totalized flow. Output data for interfacing to the **Outstation** shall be either discrete 4-20mA signals or a suitable digital protocol which is in compliance with Section 7 and approved by:

- **Transmission Owner** for compatibility with its communications infrastructure between the **Outstation** and **Instation**
- **System Operator** for all other issues relating to digital protocols.

As indicated the required flow data is for fuel consumed and this shall take account of measured fuel returned to the associated bulk storage tank.

5.4 Meters

Check meters shall not be required provided that the main delivery point meter – i.e the single meter between the tanker delivery point or other delivery points (e.g. pipelines; ship unloading) and the storage tank farm is subject to periodic verification tests by suitable third party service providers and provided that the Procurer has been invited to witness such tests.

Back Up Fuel Oil Meters shall meet the accuracy classes set out in Schedule 8. They shall provide transmission of un-aggregated demand data to the associated **Outstation** where this is not integral with the **Meter**.

All **Meters** shall include a non-volatile **Meter Register** of cumulative fuel oil flow. The **Meter Register** shall not roll-over more than once within the normal **Meter** reading cycle.

Meters which provide data to separate **Outstations** shall for this purpose provide two outputs per measured quantity.

Where required by the **Licensed Operator**, **Metering Equipment** shall be capable of providing one voltage free pulse output per metered quantity. These outputs may be provided either direct from the **Meter** or from an isolating relay supplied by such **Meter**. The pulse rate at the **Meter** full load rating shall be such that 2000 or more pulses are produced in a **Demand Period**.

For each **DMP** a **Back Up Fuel Oil** flow measurement corrected to **ST** and compensated for returned flow to storage tank farm shall be provided. The flow measurement device(s) may be selected from following by order of merit but not necessarily restricted to one of the following:

- Coriolis Mass Flow (Volume flow measurement shall be required)
- Turbine Flowmeter in compliance with ISO 9951
- Positive Displacement Meter

Meters using other technology may be used subject to approval by the **DOE**.

The measuring devices shall be of fiscal metering quality, designed, installed and calibrated taking into account the required accuracy over the total flow range and applied according to listed standards or the **Procedures**.

5.5 Sealing

All **Metering Equipment** shall be capable of being sealed in accordance with the **Code** and the **Procedures**.

5.6 Temporary Connection / Emergency Diesel generator connection

Temporary BUF meter connections may be required for some urgent site activities. This can be for flushing and testing of newly installed oil pipeline. Also for Emergency Diesel Generator (EDG) BUF meter is required but not used most of the time mainly because it is required only for emergency purpose in case of black out and need to run EDG to start the plant / revive the grid. The frequency of running EDG is very less and for such connections, some relaxation from the **Code** can be provided as long as the connection is not required more than five (5) years.

MDEC flowmeter need to be installed on this temporary connection. In case there is no secure power supply available on site then a mechanical meter can be utilised.

For settlement purpose, settlement data shall be collected manually from site on a monthly basis from the cumulative counter available with the meter. Integration to LDC settlement system is not mandatory for temporary connection, because the cumulative counter reading is always available locally and can be used for billing purpose in case required.

6. ASSOCIATED FACILITIES

6.1 Additional Features

Additional features may be incorporated within or associated with the **Metering Equipment** provided they do not interfere with or reduce the integrity of the **Settlement** process.

SCHEDULE 8 - METERING SYSTEM AND METER ACCURACY REQUIREMENTS

This Schedule sets out the overall accuracy requirements for the following **Metering Systems**:

1. METERING SYSTEM OVERALL ACCURACY

Condition	**Limit of Errors**	
	Metering System	
Flow expressed as a percentage of Full Scale Flow Rate	**F1**	**F2**
Between 50% and 120%	±0.8%	±1.0%
Between 10% and 50%	±1.0%	±1.5%
Between 1% and 10%	N/A	N/A

Note: N/A signifies no applicable requirement for **Code** purposes**.**

SCHEDULE 9 - DEFINED METERING POINTS

For consumption of **Back Up Fuel Oil** the **DMP** shall be at one or more of the following locations:

1. For transfers between the bulk supply tank and **Steam Generating Units**, the **DMP** shall be at the metering station agreed between **the Procurer** and the **Licensed Operator**.
2. For transfers between the bulk supply tank and **Gas Turbine Generating Units**, the **DMP** shall be at the metering station agreed between **the Procurer** and the **Licensed Operator**.

Note:

(1) Although not deemed a **DMP** for **Settlement** purposes, the **Licensed Operator** is responsible for installing and maintaining metering in line with the requirements of the **Code**, which uniquely identifies the quantity of **Back Up Fuel Oil** delivered to the **Licensed Operators** site. This is referred to as the main delivery point meter/meters. Such metering shall be to a standard as agreed with **The Procurer** and be used to verify consumption of the plant.

(2) Each Gas Turbine Generating Unit which is subject to **Central Despatch** shall have metering which identifies uniquely the Back Up Fuel Oil consumption of the Gas Turbine Generating Unit. Such metering shall be to a standard as agreed with **The Procurer**

(3) Each Steam Generating Units which is associated with desalination units and/or Generating Units subject to **Central Despatch** shall have Metering Equipment which identifies uniquely the back up fuel oil consumption of the Steam Generating Boiler. Such metering shall be to a standard as agreed with **The Procurer**

Metering & Data Exchange Code

Section 7
Data Collection

Section 7 Data Collection
Amendment Record

SECTION 7 - DATA COLLECTION

1. INTRODUCTION

This section of the **Code** defines the minimum specification and requirements for the **Metering Equipment** to be used for the storage and onward transmission of data for the purposes of **Settlement** or **Central Despatch.**

Settlement data stored in **Outstations** is then transmitted to/collected by **System Operator** and used by the **Procurer** to determine the payments due to and from each party pursuant to contracts between them.

2. SCOPE

Licensed Operators have an obligation to ensure that pre-defined **Settlement** data is available to be collected by **System Operator**, either locally or remotely, on demand.

Outstation system requirements and the data that is to be stored in them are defined in this section of the **Code**.

Dispensations from the requirements of the **Code** may be sought from the **DOE** as defined in the **Procedures** and the **Licensed Operator's** licence.

3. REFERENCES

The following documents are referred to in the text:

3.1 International Standards

3.1.1 IEC 62056-21 - Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange

4. DATA STORAGE AND COLLECTION CRITERIA

4.1 Outstation

4.1.1 Configuration

Where identified in **the Code** duplicate **Outstation** systems i.e. main- **outstation** system and check-**outstation** system, shall be provided which can be interrogated by **Settlement Instations** using separate/independent communication lines in accordance with **Procedures**.

These duplicate dual redundancy **Outstation** systems shall be organised/connected to enable the storage of all required quantities i.e. **Electricity**, **Water**, **Gas** and **Back Up Fuel Oil**, or as separate duplicate systems at a location local to the respective **Meters**.

Outstations shall be configured such that each main-**outstation** and each check-outstation stores all of the available main and check **Meter** data for all associated measured quantities. Where practicable, main-**outstations** and check-**outstations** shall be configured identically. Two or more main-**outstations** or two or more check-**outstations** may be cascaded on to the same communication line. Cascading shall be

limited such that a single communications failure is restricted to the loss of main-**outstation** data or check-**outstation** data (but not both).

In the case of **Meters** with integral **Outstation** facilities (i.e. a **Meter** storing its own data) the cascading on to one communication line shall be limited such that a *single* communications failure is restricted to the loss of main or check **Meter** data (but not both).

4.1.2 Facilities

The **Outstation** data shall be to a format and protocol specified by the **Code**.

Facilities shall be provided to select a relevant demand period from one of the following values: 60; 30; 20; 15; 10; 5; 1 minutes with in each case one demand period ending on the hour.

Normally, data will be collected by the **Settlement Instation** by a routine hourly interrogation. Repeat or adhoc collections of metering data shall also be possible throughout any part of any day.

4.1.3 Displays

The **Outstation** shall have the ability to display the following information locally:

a) Power values

b) Energy values

c) Alarms and events

d) The Maximum demand (MD) i.e. the highest Demand Value for all the quantities recorded per programmable charging period, i.e. monthly or statistical review period

e) The cumulative MD for all the quantities recorded

f) Number of MD resets

MD shall be resettable at midnight of the last day of the charging period and also resettable for part chargeable period demands. If a manual reset button is used then this shall be sealable.

4.1.4 Power Supplies

A secure power supply shall be provided to each **Outstation** system with separate fusing for each **Outstation**.

Where a separate modem associated with the **Outstation** system is used, then it shall be provided with a secure supply separately fused. Alternatively, line or battery powered modem types may be used.

In the event of an **Outstation** or modem supply failure, an alarm signal shall be generated and connected to an appropriately monitored point.

4.1.5 Data storage

Data storage facilities for metering data shall as a minimum include:

a) A storage capacity of 24 periods per day for a minimum of 40 days for all **Demand Values**

b) The stored **Demand Values** shall be integer values of:

i) MW or Mvar for **Electricity**

ii) m³/hr for **Water**, **Gas** and **Back Up Fuel Oil**

or pulse counts, and have a resolution of better than ±0.1% (at full load or full scale flow rate)

c) The accuracy of the:

i) Energy values

ii) m³ values

if derived from **Demand Values** shall be within ±0.1% (at full load) of the amount of energy or flow measured by the associated Meter

d) The value of any**:**

i) **Electricity** flow

ii) **Water** flow

iii) **Gas** flow

iv) **Back Up Fuel Oil** flow

measured in a **Demand Period** but not stored in that **Demand Period** shall be carried forward to the next **Demand Period**

e) Where a separate **Outstation** is used, cumulative register values shall be provided in the **Outstation** which can be set to match and increment with the **Meter Registers**

f) In the event of an **Outstation** power supply failure, the **Outstation** shall protect all data stored up to the time of the failure, and maintain the time accuracy in accordance with Section 7, Clause 4.1.6

g) Partial Demand Values, those in which an outstation supply failure and/or restoration occurs, and zero Demand Values associated with an outstation supply failure, shall be marked so that the Data Collection Instation can identify them.

h) To cater for continuous supply failures, the clock, calendar and all data shall be supported for a period of 10 days without an external supply connected.

i) Any "read" operation shall not delete or alter any stored metered data; and

j) An **Outstation** shall provide any portion of the data stored upon request by an instation.

It should be noted that data from other metered variables (Sections 4, 5, 6 & 8 of the **Code**) may also need to be catered for by **Outstations** according to **System Operator** and **The Procurer** requirements.

4.1.6 Time

The **Outstation** time shall store data always in UTC time: however to allow easy comparison the display should be local Abu Dhabi time.

Time synchronisation of the **Outstation** shall normally only be performed by communication with the **Settlement Instation**. However, where large adjustments are required e.g. during commissioning or fault conditions, an **LIU** may be used.

The overall limits of error for the time keeping allowing for a failure to communicate with the **Outstation** for an extended period of 10 days shall be:

a) The completion of each Demand Period shall be at a time which is within ±5 seconds of **UTC**.

b) The duration of each **Demand Period** shall be within ±0.1%, except where time synchronisation has occurred in a **Demand Period**.

4.1.7 Monitoring Facilities

Outstation monitoring facilities shall be provided which report each of the following conditions:

a) Error in **Outstation** functionality;

b) Battery monitoring (where battery fitted); and

c) **Outstation** access via the interrogation port which changes any data.

The above shall be tagged to the relevant **Demand Period** in which the event occurred and retrievable via the local interrogation facility.

In addition, all of the above shall be reported, as a minimum, via a common alarm indication via the remote interrogation facility.

4.1.8 Communications

Outstations shall accommodate both local and remote interrogation facilities, from separate ports.

The reprogramming of data shall only be possible through access at a suitable security level.

The reading of data shall only be possible through access at a suitable security level.

The following metering data shall be transferable on request during the interrogation process:

a) **Demand Values** as defined in Section 7, Clause 4.1.5 for all main and check **Meters**

b) Cumulative measured quantities as defined in Section 7, Clause 4.1.5 for main and check **Meters**; **Electricity**, **Water**, **Gas** and **Back Up Fuel Oil**

c) Alarm indications (see Section 7, Clause 4.1.7)

d) **Outstation** time and date

e) The applicable data of Section 8, Schedule 10

4.1.9 Local Interrogation facilities

An interrogation port shall be provided for each **Outstation** which shall be either an optical port as physically defined by IEC 62056 or an RS232/485 serial port. This local port shall be used to facilitate the following:

a) Commissioning, configuration, maintenance and fault finding;

b) Transfer of metering data and alarms; and

c) Time setting

4.1.10 Local Interrogation - protocol

The communications protocol for local interrogation shall be as defined by IEC 62056-21 or be as otherwise agreed with **System Operator.**

4.1.11 Remote interrogation

Independent communication lines shall be provided to each **Outstation** system for remote interrogation purposes.

Error checking facilities shall be provided for the communications between the **Outstations** and the **Settlement Instation**.

Interrogation of an **Outstation** shall be possible using one or more of the following media:

a) Public switched telephone networks (e.g. ETISALAT)

b) Radio data networks

c) **Transmission Owner** private network

d) Mains signalling / power line carrier

e) Low power radio

f) Satellite

In addition any further media may be used as specified by the **Code**.

The actual media employed shall be in accordance with the requirements of the **Code**.

The data shall be to a format and protocol specified by the **Code**.

4.2 Sealing

All **Metering Equipment** shall be capable of being sealed in accordance with the **Code** and it's supporting **Procedures**.

5. ASSOCIATED FACILITIES

5.1 Additional Features

Additional features may be incorporated within or associated with the **Metering Equipment** provided they do not interfere with or reduce the integrity of the **Settlement** process.

An output pulse which commences coincident with the end of each **Demand Period** and lasts for a duration of between 0.5 and 10 seconds may be provided if required.

The pulse shall be provided by voltage free outputs.

Section 8
Data Exchange

Section 8 Data Exchange
Amendment Record

SECTION 8 – DATA EXCHANGE

1. INTRODUCTION

This section of the **Code** contains the mandatory rules for data exchange between **Licensed Operators, System Operator** and others for the purpose of allowing those persons to determine the amounts due to and from each other pursuant to contracts between them.

2. SCOPE

This section of the **Code** specifies the types of data that shall be collected by **System Operator**, the types of data that **System Operator** shall supply to other parties, and rules in relation to the development, operation and maintenance of appropriate computer systems and other systems required for data exchange purposes. It also draws together the requirements for **Settlement** and non **Settlement** data deemed necessary for the efficient operation, monitoring and management of the associated **Settlement Metering System**.

3. DATA REQUIREMENT, TRANSMISSION ROUTES AND PROCESSING

3.1 Data Collection Instation

System Operator shall be responsible for the installation, future development, maintenance and ongoing operation of the **Settlement Instations**.

The **Settlement Instations** are the means whereby data is collected from **Outstations**. Dual redundant instations shall be provided in line with security requirements of the **Settlement Metering System**. The two redundant **Settlement Instations** shall be connected via two hubs to the same internal Local Area Network as the **DCVS** (see below). The **Settlement Instation** shall facilitate connection to outstations via the fibre optic communications network or other appropriate connection media selected by **Transmission Owner**. At the **Settlement Instation** basic data integrity checks shall be completed before onward transmission of acquired data to the **DCVS**.

3.2 Data Collection and Validation System

System Operator shall be responsible for the installation, future development, maintenance and ongoing operation of the **DCVS**

The **DCVS** is the system that collects data via the **Settlement Instation** and other **Settlement** system components from **Licensed Operators Outstations**, remotely over a communications link. This system will be used by **System Operator** to collect, validate and consolidate all metering data required for **Settlement** purposes via **Data Collection Instations** or by other communication means (i.e. manual) defined in the **Code**. The system provides ***Electricity***, **Water**, **Gas** and **Back Up Fuel Oil** flow data measured over variable intervals and **Settlement Periods** (1hour) as appropriate (fuel model data at 6 minute intervals or other period as appropriate to the individual **Generating Company**) and various other alarm and status flags. In all instances, consumption and demand data will be obtained directly from measured values via appropriate **Outstations**. However,

where necessary, measured values shall be subject to calculation and compensation through electronic means in order to generate adequate **Settlement** quality data for use in the **Settlement** system.

Meter data from **Licensed Operators Metering Equipment** shall be made available to **System Operator DCVS** via the **Settlement Instation** either via approved data servers/**Outstations** with the proviso that the data is delivered to the **DCVS** in a raw, unedited and disaggregated form. **System Operator** shall provide access to verified data according to **Procedures**.

3.3 Data To Be Collected

Data to be collected by the **Instation** and other means will consist of raw, disaggregated **Meter** period data and **Production Company** settlement related plant data as ASCII flat files. It shall include as a minimum the data set listed in Schedule 10 in this section of the **Code**. In summary this will cover:

- Cumulative net electrical energy and cumulative net **Water** produced at each defined point of generation/production.
- Cumulative net electrical energy and cumulative net **Water** supplied at each defined point of supply.
- Cumulative metering data for the consumption of **Gas** used in the production of electrical energy and **Water** at each point of generation/production.
- Cumulative metering data for the consumption of back up fuel used in the production of electrical energy and **Water** at each point of generation/production.
- Processed operating and alarm data to meet **System Operator** and **the Procurer** needs. (see Schedule 10)

For each registered meter **System Operator** shall collect **Meter** period data relating to all main and check **Meters** (if applicable) and the corresponding **Outstation** registers as defined by the applicable section of the **Code** applying to the metered variable. **System Operator** shall record and store all **Meter** period data collected from the **Metering Systems**. The data items recorded shall include but not be limited to the following:

- Date and Time of Reading
- **Metering System** Identifier
- **Settlement** Date
- **Outstation** ID
- Channel No
- Measurement Variable (**Electricity**, **Water,** etc)
- Main/Check **Meter** data

- **Settlement Period**
- **Meter** Reading Volume
- **Meter** Reading Status (valid/invalid/unavailable)

3.4 Manual Data Collection

System Operator shall make provision to collect the **Meter** period data manually, by visit to site, where collection of **Meter** data via **Transmission Owner**'s communication link is not possible. **Meter** data will be collected manually using an **LIU** and the information collected will be uploaded into the **Settlement Instation**.

3.5 Data Quality

System Operator shall ensure that all incoming data is fit for purpose, meets a deemed level of quality and is of the correct format. **System Operator** shall check all **Outstation** clocks, at each retrieval of metered data and synchronise to the **Settlement Instation UTC** clock as necessary and as further defined in Section 7, Clause 4.1.6. For files received electronically, data shall be checked to ensure that it is of the correct format, including the following checks:

- All records within a data file, and fields within a record, are in the correct sequence and correctly delineated.
- All records and fields defined as mandatory are present in the data.
- The length of the field is not outside the minimum and maximum allowed.
- No field contains a value outside its specified range of values.

Other data checks shall be carried out according to the **Procedures**.

3.6 Data Verification

One of the primary functions of the **DCVS** is to verify that the quality of the incoming data is to **Settlement** standards and to automatically correct data errors or compensate for lack of data as far as practicable. **System Operator** shall apply detailed algorithms and procedures to complete this task which shall provide for three levels of verification:

- First level verification shall consist of basic quality checks which confirm that the data has been collected in the expected format and is stored in the **DCVS** database in the correct raw form.
- Second level verification performs integrity checks to ensure that data is within an acceptable and plausible range and shall include comparison of main and check data.
- Third level verification shall be used when second level checks fail to confirm that data values are reasonable and shall use whatever alternative data is reasonable to derive appropriate data.

The main objective here shall be to detect and correct problems as early as possible and before any data is transferred for further levels of processing.

When **Meter** reading data is either not available or is deemed invalid **System Operator** shall include such detail in its reports to the relevant **Licensed Operator.**

3.7 Data Estimation

At the beginning of a new day, data shall be estimated to cater for values missing from the previous day and **System Operator** shall develop suitable algorithms to manage the various scenarios envisaged and shall ensure such data is entered. On use of such algorithms or manual procedures **System Operator** shall provide an Estimated Data Report to the affected **Licensed Operator** showing the date affected and details of the estimation. The **Transmission Owner** will cooperate with **System Operator** as required for data estimation, including providing suitable operational metering at all Transmission Substations

3.8 Metering Database

System Operator shall establish and maintain a metering database containing metering data transferred from each registered **Settlement Meter**. The database shall include original **Meter** registration details as well as periodic manual readings and any necessary substitutions, estimations and calculated values for each **DMP**.

3.9 Ownership of Metering Data

The metering data recorded in the metering data base with respect to a registered **Meter** is confidential information and will only be made available to:

- The **Licensed Operator** of the registered **Meter**
- **The Procurer** (verified data only)

The **Licensed Operator** shall own the processed data derived from the raw data acquired from its systems by **System Operator** and may provide to any person access to and use of such data with the proviso that such access and/or use shall not interfere with **Settlement** or would otherwise be inconsistent with giving effect to the code.

3.10 Access to and Use of Metering Data

The **Licensed Operator** of each **Metering System** shall provide access to and authorise the use of metering data by:

- **Transmission Owner**; and
- **System Operator**

System Operator shall have complete authority over all rights of access to (and has authority to deny access to) the **Settlement Instation/DCVS** including servers (where used), interface equipment, and software needed to collect the relevant information for **Settlement**, billing and related purposes. Each **Licensed Operator** acknowledges this **System Operator** authority as a condition of **System Operator** controlled grid service and participation. Access to processed data and reports shall be as defined in the **Procedures**.

3.11 Format for Data Submission

Licensed operators must ensure that the meter data obtained by **System Operator** from their outstations is raw, unedited and disaggregated **Meter** data in kW, kWh, kVAR, kVARh, m^3 or m^3/hr values as appropriate. File formats and data protocols shall be as approved by **System Operator**.

System Operator shall be responsible for the collection, validation, estimation, **substitution** of that **Meter** data in order to produce **Settlement Quality Meter Data** as described in Section 8 Clause 3.5

3.12 Frequency of Recording and Collecting Data (Periodicity)

Subject to any dispensation granted by **System Operator** meter data must be recorded for each hourly period or other agreed period of a settlement day. **Meter** data will be collected regularly by the **Settlement Instation** in accordance with this and frequency of collection shall be determined by **System Operator** from time to time.

3.13 Data Retention

System Operator shall maintain on-line all raw, verified, disaggregated and processed meter data for a given settlement day for a period of not less than 18 months. Longer term off line archive of not less than 5 years shall also be maintained.

3.14 Security

System Operator, Transmission Owner and Licensed Operators shall utilise dual redundant systems and equipment where applicable and in line with specific use to ensure data security and reliability of service. **System Operator** and **Transmission Owner** shall create, operate, maintain and regularly test an effective disaster recovery procedure. This procedure shall include maintaining day to day data collection from **Outstations** and ensuring security and integrity of the whole **Settlement** system in case of a catastrophic failure or disaster.

3.15 Timekeeping

System Operator shall set the **DCVS**, **Settlement Instation** and any associated clock in accordance with the **UTC** clock with periodic checks and adjustment as necessary. All **Outstation** clocks shall be checked at each retrieval of metered data and synchronised to the **Settlement Instation UTC** as necessary according to the following process:

- If an **Outstation** clock is less than 5 seconds out compared with the **Settlement Instation UTC** clock, the **Outstation** clock will not be reset.
- If an **Outstation** clock has drifted by between 5 and 30 seconds, the clock will be reset without issuing a report. If this is discovered to happen regularly on a long term basis then a report should be issued to the **Licensed Operator** for corrective action.
- If an **Outstation** clock has drifted by 30 or more seconds, the clock will be reset and a report shall be issued to the **Licensed Operator** for corrective action and investigation.

It shall be acceptable for the **Settlement Instation** to synchronise the **Outstation** clock as appropriate so long as the overall synchronisation process is traceable to the **Settlement Instation** calibration procedure.

In some cases larger corrections to the **Outstation** clock might only be achievable using the **LIU**. In these cases, **System Operarator** is responsible for carrying out these corrections on site as soon as is reasonably practicable.

In all the above scenarios, maintenance of clock accuracy and any correction applied to any **Outstation** or **Settlement Instation** clocks shall be auditable.

4. DATA COLLECTION METHODOLOGY

System Operator have the responsibility to collect, validate and record data relating to active and reactive imported/exported power and energy, imported/exported **Water**, **Gas** and **Back Up Fuel Oil** used and other data as defined, from **Licensed Operators** by remote interrogation or manual on-site interrogation in accordance with the terms of this **Code**.

4.1 Communication Routes

For the purposes of remote interrogation by **System Operator** , the **Transmission Owner** may use its own data communications network, or failing this, shall enter into, manage and monitor contracts to provide for the provision and maintenance of all data links by which data is passed from **Outstation** to **Settlement Instation**.

In each case, the prime considerations shall be security of data transfer, reliability and adherence to national and/or international communications standards and protocols.

The core system will comprise the **Transmission Owner** owned fibre optic network comprising of two independent fibre optic backbone architectures. These link most operational facilities and shall be supplemented with alternative systems as necessary.

The availability of the communications infrastructure is critical and heavy reliance is placed on it. It is the responsibility of **Transmission Owner** to ensure that its communications infrastructure is robust, adequate, and available and **Transmission Owner** shall continue to develop this infrastructure to ensure inherent path redundancy. Communication routes will not be dedicated to metered data and network flexibility will be retained by **Transmission Owner** to ensure optimum service. **Transmission Owner** shall use reasonable endeavours to maintain the availability of the communications infrastructure between **Outstations** and **Settlement Instation**, and specifically focus on restoring communications links to minimise the need for manual meter reads. **System Operator** shall inform **Transmission Owner** as soon as it is unable to collect meter data, and suspects that failure is a result of a communications fault.

In the event of any fault or failure on such communication lines or any error or omission in data transmitted **System Operator** shall, retrieve such data by manual on-site interrogation or it shall estimate such data in accordance with Section 8, Clause 3.7 of the **Code** and the **Procedures**.

4.2 Data Communication System

This system provides secure transmission of electronic data files between the **Licensed Operators Metering Systems** and **System Operator** via either:

a. a compatible **Meter** data **Outstation**: and

b. a compatible **Meter** data **Settlement Instation**

System Operator shall provide the facilities referred to in point (b) of this Clause to an instation termination point agreed with the **Transmission Owner**. The **Licensed Operator** shall provide the facilities referred to in point (a) of this clause to an outstation termination point agreed with the **Transmission Owner**. The **Licensed Operator** shall be responsible for any additional **Outstations** required and/or facilities required to link any agreed communications termination point to the associated **Outstations**.

4.3 Communications Protocol

The basis for communications protocol shall be to meet industry and international standards to maximise interoperability. The primary protocol for major plant SCADA interfacing shall push ASCII flat files from **Outstation** to **Settlement Instation** using File Transfer Protocol. For other smaller site locations having lower data transmission requirements **System Operator** shall establish a suite of approved protocols to maximise the flexibility of the system. **Licensed Operators** shall ensure all new **Meters**/**Outstations** put forward for registration under the **Code** use only **System Operator** approved protocols. To preserve security and flexibility any protocol(s) adopted shall ensure:

- Authentication of the client and the server
- Confidentiality of exchanged data from unauthorised reading
- Ability to implement separate security level access to defined meter facilities/data.
- A truly multi-vendor approach to system implementation

4.3.1 Meter to Outstation

System Operator and/or **Licensed Operators** shall ensure that data collection **Outstations** provided or installed by them are equipped with the appropriate protocols for all associated **Meters**. Additional protocol capability of **Settlement Instations** will be added by **System Operator** as appropriate. **Licensed Operators** shall be required to submit to **System Operator** appropriate evidence that any submitted protocol is in line with published standards.

Where **Meter** and **Outstation** are discretely separate devices inter device data communication shall be by either **System Operator** approved protocol, discrete analogue (4-20mA) signals, unit value pulses and/or Serial RS232/485 otherwise in accordance with the **Code** and chosen as appropriate to ensure required data is passed from **Meter** to **Outstation** in a secure and reliable manner. Dual redundancy of such communication links shall be observed as appropriate.

4.3.2 Outstation to Settlement Instation

System Operator, Licenced Operator and **Transmission Owner** shall ensure that its data collection systems are equipped with the appropriate protocols for all approved integrated **Meter**/**Outstation** or **Outstations** registered. Additional protocol capability will be added by **System Operator** as appropriate with the concept being adopted of a "multi-vendor" approach to interoperability to allow as wide a range of **Metering Systems**/**Outstations** to be integrated into the **Settlement** system as is deemed practical.

5. DATA TO BE REPORTED

System Operator shall be responsible for developing reporting procedures and issuing on a regular basis reports in an agreed format to **Licensed Operators**.

5.1 Report To Distribution Companies

System Operator shall forward **Meter** period data for all **DMPs** to the relevant **Licensed Operator**. Such reports will be defined by **System Operator** in the **Procedures** and will be generated on an agreed periodic basis covering each **Settlement Day** in the period.

This report shall list as a minimum, total hourly quantities of:

- **Electricity** Supplied
- **Water** Supplied

5.2 Report To Generation Companies

System Operator shall forward meter period data for all **DMPs** to the relevant **Licensed Operator**. Such reports will be defined by **System Operator** in the **Procedures** and will be generated on an agreed periodic basis covering each **Settlement Day** in the period.

This report shall list, as a minimum, total hourly quantities of:

- **Electricity** generated/consumed
- **Water** generated/consumed
- **Gas** consumed
- **Back Up Fuel Oil** consumed

5.3 Report to the Procurer

This shall be a combination of Section 8, Clauses 5.1 and 5.2 and shall list, as a minimum, total hourly quantities of:

- **Electricity**
- **Water**

Supplied to **Distribution Companies** and:

- **Electricity** generated/consumed

- **Water** generated/consumed
- **Gas** consumed
- **Back Up Fuel Oil** consumed

from/by **Production Companies**.

The final list of reported parameters to be as agreed with The Procurer.

SCHEDULE 10 – DATA REQUIREMENT

A) Electricity Metering

	Data	Unit of Measurement
	Meter Data as Defined by MDEC	
1	Active Energy Consumption (Export)	MWh
2	Active Energy Consumption (Import)	MWh
3	Reactive Energy Consumption (Export)	MVArh
4	Reactive Energy Consumption (Export)	MVArh
5	Active Power (Import)	MW
6	Active Power (Export)	MW
7	Reactive Power (Import)	MVAr
8	Reactive Power (Export)	MVAr
9	Maximum Demand (MD) for MW	MW
10	Maximum Demand (MD) for MVA	MVA
11	Multi-Rate Cumulative Active Energy	MWh
12	Error in Outstation Functionality	Alarm Indication
13	Battery/Power Supply Monitoring	Alarm Indication
14	Interrogation Port Access which changes data	Alarm Indication
15	The Outstation Time & Date	Alarm Indication
16	Common mode fault voltage relay	Alarm Indication

B) Water Metering

	Data	Units of Measurement
	Meter Data as Defined by MDEC	
	a) From Water Metering System	
1	Storage Top Water Level	Metre
	b) From Each Water Flow Meter at Each DMP	
2	Cumulative Water Consumption	m^3
3	Water Demand Value (Flow Rate)	m^3/hr
4	Error in Outstation Functionality	Alarm Indication
5	Battery/Power Supply Monitoring	Alarm Indication
6	Interrogation Port Access which changes data	Alarm Indication
7	The Outstation Time & Date	Alarm Indication

C) Gas Metering

	Data	Unit of Measurement
	Meter Data as Defined by MDEC	
1	Cumulative gas quantity (Corrected to ST&P)	m^3
2	Gas Temperature	Degrees Celsius
3	Gas Pressure	Bar
4	Gas Demand Quantity (Corrected to ST&P)	m^3/hr
5	Battery/Power Supply Monitoring	Alarm Indication
6	Interrogation Port Access which changes data	Alarm Indication
7	The Outstation Time & Date	Alarm Indication

D) Back Up Fuel Oil Metering

	Data	Unit of Measurement
	Meter Data From Each FO Flow Meter at DMP	
1	Cumulative FO Quantity	m^3
2	FO Temperature	Degrees Celsius
3	FO Pressure	Bar
4	FO Demand Quantity	m^3/hr
5	Battery/Power Supply Monitoring	Alarm Indication
6	Interrogation Port Access which changes data	Alarm Indication
7	The Outstation Time & Date	Alarm Indication

Procurer Specific Data Requirement for Settlement and Planning Purposes (Rev 0)

E) From Each Production Company - Six/Fifteen Minute Data to run project specific fuel model

	Data	Unit of Measurement
1	Mode of Operation as per PWPA/PPA/WPA	
2	Combustion Turbines in Service by Unit	Flag
3	Heat Recovery Steam Generators in Service by Unit	Flag
4	Power Output from GTs by Unit (Gross & Net)	MW
5	Power Output by STs by Unit (Gross & Net)	MW
6	Steam Turbines in Service, by Unit	Flag
7	Fuel Consumption at GT by Units	MBtu
8	Fuel Consumption at HRSG by Unit	MBtu
9	MSF Unit on Line by Units	Flag
10	Ambient Temperature	Degrees Celsius
11	Relative Humidity	%
12	Sea Water Temperature	Degrees Celsius
13	Atmospheric Pressure	mbar

F) From Each Production Company - Hourly Data

	Data	Unit of Measurement
	a) Unit wise from Production Company	
1	Generation by Type of Fuel	MWh
2	Fuel Consumption	
	Natural Gas	MScft
	Back Up	m^3
3	Auxiliary Consumption	MWh
4	Ambient Temperature	Degrees Celsius
5	Ambient Pressure	mbar
6	Relative Humidity	%
	b) Unit wise Boiler Data	
7	Steam Production	Tons
8	Fuel Consumption	
	Natural Gas	MScft
	Back-Up Fuel	Gallons
9	Boiler Efficiency (Calculated Value)	%

	Data	Unit of Measurement
	c) Unit wise Distiller Data	
10	Distillate Production	MIG
11	Condensate Return	Tons
12	Unit GOR	Ratio
13	Heat Consumption	MBtu
14	Auxiliary Consumption	MWh
	d) Station Common Data	
15	Auxiliary Energy Consumption	MWh
16	Station Net Energy Generation	MWh
17	Internal Consumption of Water	m^3
18	Tank Level Adjustment	m^3
19	Station Net Water Production	m^3

G) From Each Production Company – Monthly Operating Report

	Data	Unit of Measurement
	a) For Power	
1	Gross Energy Generation by Fuel from each unit	MWh
2	Net Energy Generation by Fuel from each unit	MWh
3	Total Fuel and Type of Fuel Consumption by Unit	MScft/Gallons
4	Fuel Consumption for Power & Power Heat Rate	kCal/kWh
5	Running Hours of each turbine	Duration hrs
6	Each Derating by Unit	Duration
7	Unit wise/station wise fuel efficiency	%
8	Generation by type of Prime Mover	MWh
9	GD/Plant Wise Gross & Net energy Generation	MWh
10	Total Fuel Consumption for Energy/Water Production	MBtu
11	Outage for Each Unit	
	Trip	Number/Reason
	Forced Maintenance	Duration/Reason
	Planned Maintenance	Duration/Reason
	Stand By on request by LDC	Duration
12	Startup	
	Hot	Number
	Warm	Number
	Cold	Number
13	Ramp-up Characteristics	MW/min

14	Primary Response	MW/Sec
	Data	**Unit of Measurement**
15	Power Factor	Ratio
	b) For Water	
1	Gross Production by unit	m^3
2	Net Production by unit	m^3
3	Running Hours of each unit	Duration hrs
4	Derating by Unit	Duration hrs
5	Net Production on Back up Fuel	m^3
6	Fuel consumption for water and water heat rate	MBtu kCal/G
7	Outage of each unit	
	Trip	Number/Reason
	Forced Maintenance	Duration/reason
	Planned Maintenance	Duration
	Stand By on request by LDC	Duration
8	Startup	
	Hot	Number
	Warm	Number
	Cold	Number
	Boiler Data	
9	Steam Production	Tons
10	Fuel Consumption	
	Natural Gas	MScft
	Back Up Fuel	Gallons
11	Total Running Hours	Duration
12	Boiler Efficiency	%

H) From Production Company - Event Driven Data

	Data	Unit of Measurement
1	Early Power Period (EPP1, EPP2 or EPP3)	Date/time
2	Availability Notice Status (yes/no)	O or Y
3	Outage Mode Determination (Manual/Automatic)	OM code
4	Despatch Shut Down Power Unit	Date/time
5	Despatch Shut Down water Unit	Date/time
6	Start Early Power Period	Date/time
7	Start of Derate/Outage Power	Date/time
8	End of derate/Outage Power	Date/time
9	Start of derate/Outage Water	Date/time
10	End of Derate/Outage Water	Date/time
11	Net Power Capacity – Availability Notice (other than outage mode)	MW
12	Net Dependable Water Capacity	Date/time
13	Start each despatch outage, power unit	Date/time
14	End each despatch outage, power unit	Date/time
15	Despatch outage start time, each distiller unit	Date/time
16	Despatch outage end time, each distiller unit	Date/time

I) List of Production Companies which shall supply data to the Procurer

	Production Companies	
1	Al Mirfa Power Company	
2	Taweelah Asia Power Company	
3	Bainounah Power Company	
4	Emirates CMS (TWA2) Power Company	
5	GTTPC (TWA1)	
6	Shuweihat (S1) Power Company	
7	Arabian Power Company	
8	Emirates SembCorp Water and Power Company	
9	Takreer	

Metering & Data Exchange Code

Section 9
Testing, Commissioning and Calibration

Section 9 Testing, Commissioning and Calibration
Amendment Record

SECTION 9 –TESTING, COMMISSIONING and CALIBRATION

1. INTRODUCTION

This section of the **Code** defines the minimum specification and requirements for the testing, commissioning and calibration of all **Metering Equipment** referred to in the **Code.**

2. SCOPE

This section of the **Code** specifies the type testing and verification of accuracy that **Metering Systems** shall be subjected to periodically. This testing shall include:

- Initial calibration
- **On site verification testing**
- **Laboratory re-calibration**

Dispensations from the requirements of this **Code** may be sought from the **DOE** as defined in the **Licensed Operator's** licence.

3. REFERENCES

The following documents are referred to in the text:

3.1 International Standards

3.1.1 IEC 62052-11 - Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment

3.1.2 ISO/IEC 17025 - General requirements for the competence of testing and calibration laboratories

3.1.3 ISO 4064-3: Measurement of Water Flows in Closed Conduits - Meters for Cold Potable Water, Part 3: Test methods and equipment

3.1.4 OIML R49 – Water meters intended for the metering of cold potable water, Part 2: Test methods

4. CALIBRATION, TESTING AND COMMISSIONING

4.1 Initial Calibration of Metering Equipment

4.1.1 General

All **Metering Equipment** used for **Settlement** purposes shall have been tested and calibrated using traceable standards and be issued with a suitable calibration certificate for the specified operating range of the quantity to be measured. The initial laboratory testing and calibration of **Metering Equipment** shall be in an appropriately administered, internationally recognised, quality system environment in accordance with ISO 17025 (normally the accredited facility of the manufacturer) and have been issued with appropriate calibration certificate.

4.1.2 Witnessing

System Operator, Transmission Owner, **The Procurer** and the **DOE** shall have the right to witness the testing and calibration of all **Metering Equipment** before installation and subsequently. A minimum period of notice shall be given to the above parties prior to any testing and/or calibration taking place:

- 15 days for activities taking place within Abu Dhabi Emirate
- 30 days for activities taking place outside of Abu Dhabi Emirate.

4.1.3 Electricity

All new **Meters** shall be supplied with traceable calibration certificates for the range of energy to be measured or range of transformer supplying such installation. Where necessary if further calibration/adjustment is required this should be completed in accordance with manufacturers' recommendations, either by the manufacturer or by suitably accredited third party service providers and in accordance with the requirements of IEC 62052-11 using traceable working standards. Compensation factors shall be applied to take account of verified current and voltage transformer errors and errors due to losses in primary transformers where required to simulate the measurement of energy at each **DMP**. All related data should be retained for inspection.

4.1.4 Water

All new **Meters** shall be provided with a traceable calibration certificate for the range of flows to be measured The calibration, testing and commissioning of **Water Meters** shall be in accordance with manufacturers recommendations and with ISO 4064 where applicable. In situ-calibration is a **Meter** technology dependent task and is difficult to achieve where original calibration accuracy is to be proved. Lower level accuracy testing may be achieved on site using such techniques as drop testing, dilution gauging or reference **Meter** comparison but results should be restricted to confidence checks only and used to justify further off site action in line with **Procedures**.

4.1.5 Gas

Meters, Measuring instruments, associated transmitters and any flow computer shall be subject to initial calibration and shall be supplied with calibration certificates of accuracy

from a third party facility approved for fiscal measurement proving or suitably accredited for the purposes of the calibration undertaken.

Measuring Instruments shall have performance verified in accordance with manufacturers' recommendations prior to use.

4.1.6 Back Up Fuel Oil

Meters and associated transmitters shall be supplied with calibration certificates of metering accuracy from a third party facility approved for fiscal measurement proving.

Meters shall have performance verified in accordance with the manufacturers recommendations prior to use.

4.2 Re-Calibration facilities (other than flow/electricity meters)

If re-calibration facilities and equipment are provided by the **Licensed Operator** (e.g. certified instruments or gauges for pressure and temperature transmitter re-calibrations on site) then such facilities shall be used. Where in general re-calibration facilities are not available locally then re-calibration of **Meters** and other equipment will be carried out at suitable off site facilities as detailed in the **Code**. Re-calibration of **settlement meter** shall only be undertaken at suitably accredited facilities

4.3 On-Site Verification Testing facilities

4.3.1 General

When designing a metering installation, due regard should be made to facilitate the future in-situ/on-site testing of **Meters** and other such **Metering Equipment**, as is required by the **Code**. Failure to provide such in-situ/on-site testing facilities will result in the **Licensed Operator** having no choice but to remove such **Metering Equipment** for laboratory testing.

Provision of testing facilities also means having the ability/flexibility of plant to reconfigure networks, pipelines, etc, to allow **Metering Equipment** to be taken out of service without disruption to production or fuel supplies.

4.3.2 **Electricity**

Separate testing facilities e.g. *secondary injection* test terminal blocks or equivalent facilities, shall be provided for:

a) Main **Meters**

b) Check **Meters**

c) Current transformers

d) Voltage transformer(s), of each circuit.

4.3.3 Water

Appropriate test pipe work shall be provided to facilitate on site verification testing of the **Meter**. Such test pipework should also enable efficient removal of meters for off site re-calibration whilst minimising any disruption to metered flow.

4.3.4 Gas

Appropriate test pipe work shall be provided to facilitate on site verification testing of the **Meter**. Such test pipework should also enable efficient removal of meters for off site re-calibration whilst minimising any disruption to metered flow.

4.3.5 Back Up Fuel Oil

Appropriate test pipe work shall be provided to facilitate on site verification testing of the **Meter**. Such test pipework should also enable efficient removal of meters for off site re-calibration whilst minimising any disruption to metered flow.

4.4 Commissioning

4.4.1 General

A commissioning programme, as detailed in the **Procedures**, shall be created and performed on all new **Metering Equipment** which is to be used to provide metering data for **Settlement** purposes. Where replacement **Metering Equipment** is fitted as part of an existing **Metering System** a commissioning programme covering the changes shall also be conducted.

The **Licensed Operator** shall provide such evidence as **System Operator** may require to confirm that, following its commissioning, **Metering Equipment** shall meet the requirements of the **Code**. This evidence must include a signed and dated commissioning record.

4.4.2 Electricity

See **Procedures** for detail.

4.4.3 Water

See **Procedures** for detail.

4.4.4 Gas

See **Procedures** for detail.

4.4.5 **Back Up Fuel Oil**

See **Procedures** for detail.

4.5 Testing and Re-Calibration Procedures

4.5.1 Meters

Meter re-calibration/on site verification shall be carried out in accordance with the **Procedures.**

In situ-calibration is a **Meter** technology dependent task and is difficult to achieve where original calibration accuracy is to be proved. Lower level accuracy testing may be achieved on site using such techniques as drop testing, dilution gauging or reference **Meter** comparison but results should be restricted to confidence checks only and used to justify further off site action in line with **Procedures**.

Re calibration of **Meters** shall only be undertaken by suitably accredited test facilities. (Normally the accredited facilities of the original manufacturer or the accredited facilities of a third party test laboratory..

4.5.2 Outstations

Outstation testing shall include:

- Routine battery replacement
- Periodic alarm simulation
- Other vital functionality tests

4.6 Frequency of testing and calibration

4.6.1 Meters

Meters shall be re-calibrated once every 5 years and on site tested for performance verification no less frequently than once every 2 years or such period as otherwise detailed in Schedule 11 and having due regard to an acquired knowledge of the performance of a particular design of meter and the nature of its function and installation (production/distribution, above/below ground) Such testing shall be in accordance with Procedures.

Such testing and any associated adjustment shall only be completed where traceable working standards have been used. Adjustment using the results of un-verified working standards is not allowed. No site re-calibration adjustments shall be allowed.

4.6.2 Outstations

Outstations shall be tested at a frequency recommended by the manufacturer but no less often than once every five years.

4.6.3 Measurement transformers

Measurement transformers supplied with known characteristics which are within the requirements of the Code are not required to be periodically recalibrated.

Measurement transformers for which calibration records do not exist shall undergo a recalibration test. Compensation for measurement transformer errors shall be taken into account when calibrating a **Meter**.

Measurement transformers suspected of malfunction or inaccurate measuring shall be retested.

SCHEDULE 11 – METERING EQUIPMENT TESTING FREQUENCY

Metering Equipment Type	Metering Equipment Function.	Frequency of testing	
		On-site Verification*1)2)	Full Calibration check (Laboratory) *1)
Electricity meter	All	2 years	5 years
Water meter	Production/above ground	2 years	5 years
	Distribution/below ground	5 years	10 years
Gas meter	All	2 years	5 years
Back Fuel Oil meter	All	2 years	5 years

Note:

1) Off-site calibration can be replaced with on-site verification for the models that are approved by the **DOE**. List of approved models will be updated as per the **Procedure**.

2) For meters that will be subject to verification only without calibration (see note 1), the frequency of verification will be every 2 years for the first 10 years from the initial calibration date, and then yearly starting year 11.

3) On-site verification can be allowed for a total of fifteen (15) years from the date of initial calibration date.