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PRODUCT REQUIREMENTS FOR

SMART METERING SYSTEMS

PART 1: GENERAL SYSTEM ARCHITECTURE

MARCH 2010

CONTENTS

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SMART METERING SYSTEMS - PART 1: GENERAL SYSTEM ARCHITECTURE

INTRODUCTION

This document describes the British Gas smart meter system requirements for phase 3 of the smart metering trial using information captured from various sources including discussions with some manufacturers and phases 1 and 2 of the trial. This document is expected to change as phase 3 of the trial progresses. This document concentrates on requirements that are applicable to all components in a smart metering system.

This document is part of a series of specifications as follows:

- Part 1: General System Architecture;
- Part 2: Gas meter;
- Part 3: Electricity meter;
- Part 4: Telecommunications hub;
- Part 5: In-home display.

This document shall be read in conjunction with all other documents in this series.

1. SCOPE

1.1 This document defines the minimum, general, British Gas product requirements for:

a) Smart gas metering systems with a flow capacity not exceeding 6m^3/hr;

b) Smart electricity metering systems, having single phase with a capacity not exceeding 100A;

c) Gas and electricity consumption data capture, transmission, retention, display and query;

d) Reception and utilisation of external data and commands;

e) Smart metering commissioning equipment.

Note: The term "system" includes in-home display (IHD) units, communication hubs, etc.; it does not include "head-end" systems; e.g. billing and data computer systems, although reference to these may be included.

1.2 All parts that constitute a smart metering system are referred to as "components" throughout this document. Examples of components are, but not limited to:

a) Gas meters;

b) Electricity meters;

c) In-home displays (IHDs);

d) Comms hubs.

1.3 All clauses throughout this document apply, in principle, to all components making up a smart metering system in a consumer's home. In some cases a component may have specific

requirements; in such cases further details can be found in the other parts of this document series as listed in the introduction.

2. REFERENCES

2.1 This suite of documents makes references to the documents listed in Appendix A. Unless otherwise specified, the latest edition of the documents applies, including all amendments.

3. DEFINITIONS

3.1 The requirements and definitions applying to this suite of documents are listed in 0.

4. COMPLIANCE WITH EUROPEAN COMMUNITY DIRECTIVES

4.1 Components (and, where applicable, any ancillary equipment; e.g., transducers, and commissioning equipment etc.) shall comply with all relevant European Directives in force at the time of purchase or that will come into force within 12 months from the purchase date. Current Directives that may be relevant include:

a) ATEX (Equipment explosive atmospheres) 94/9/EC;

b) EMC (Electro Magnetic Compatibility) 89/336/EEC;

c) LVD (Electrical equipment designed for use within certain voltage limits(Low Voltage Directive)) 2006/95/EC;

d) MID (Measuring Instruments Directive) 2004/22/EC;

e) WEEE (Waste Electrical and Electronic Equipment) 2003/108/EC amending 2002/96/EC;

f) RoHS The Restriction of Hazardous Substances Directive 2002/95/EC;

g) R&TTE (Radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity 1999/5/EC;

h) 2008/103/EC amending Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators as regards placing batteries and accumulators on the market (The “Batteries Directive”).

i) Packaging and Packaging Waste Directive 94/62/EC

j) AS/NZS 4665 Minimum Energy Performance Standard (MEPS) Performance of External Power Supplies

Note 1: Directives and their scope are in a continual state of flux; the above list is believed to be relevant at the time of writing but may change. It is an obligation on the manufacturer to comply with all relevant directives and inform British Gas if they believe the above list is incomplete.

4.2 The manufacturer shall not incorporate hazardous substances (as in the meaning of the RoHS Directive) in the construction of components and there shall be no emissions of any toxic hazards in normal use.

Note: Irrespective of whether equipment may, or may not, be required to meet the RoHS Directive, British Gas takes the view that equipment ought not to incorporate hazardous substances in its construction.

4.3 With regard to the Batteries Directive, the manufacturer shall pay particular attention when importing batteries, and shall advise of its obligations.

4.4 The manufacturer shall provide Declarations of Conformity that components meet the requirements of the relevant Directives.

4.5 The manufacturer should provide evidence supporting their Declarations of Conformity in the form of test certificates from approved Notified Bodies, and technical construction files.

4.6 All components where applicable shall display the CE mark.

5. SAFETY

5.1 **General requirements**

5.1.1 Components, and where applicable, modules (see section 6.4) shall be designed so as not to present a hazard to any person including the installer and the consumer. There shall be no sharp edges, points or gaps that may cause injury during installation, maintenance, module exchange (where applicable) or normal day to day operation by the consumer.

5.1.2 All components shall have all electrical parts and terminal connectors (e.g. power supply terminals, plugs and sockets etc.) inaccessible and/or insulated and protected such as to prevent inadvertent contact by the installer or consumer.

5.1.3 Electricity meters shall be manufactured to conform to protective class II as defined in BS EN 50470.

5.1.4 Where a consumer's supply (gas or electric) has been interrupted for any reason, any faults within the smart metering system shall not cause the restoration of the supply.

Note 1: Methods of interrupting the consumer's supply are described in section 11; they are referred to as "shut-off" mechanisms throughout this document.

Note 2: It is accepted that failure of the shut-off mechanism itself may cause a restoration but this risk may be minimised with appropriate precautions. Also see clause 11.8.

5.1.5 The smart metering system shall be designed such that, if a meter has interrupted the consumer's supply, the restoration of this supply cannot occur without the local intervention of the consumer.

5.1.6 Where a loss of supply has occurred for reasons outside of the control of the meter (e.g. network failure) the meter shall retain the setting of the shut-off device prior to the supply loss, when the supply is restored.

5.2 **Flammability**

5.2.1 All external surfaces of components shall not support combustion. The material shall have a flammability rating of V-0 in accordance with BS EN 60707.

5.2.2 Case materials shall be subjected to the flame test to BS EN 60695−11−5. The flame test shall be applied to edges, corners and faces of casings, each for a period of 30 seconds.

5.3 **Intrinsic safety requirements**

5.3.1 Gas meters shall meet, as a minimum, the requirements for use in a hazardous area classification zone 2 (ATEX category 3) as defined in BS EN 60079−10-1.

5.3.2 Any part of the smart metering system that is directly wired to, and/or is physically attached to, or is intended to be within 150 mm of, the gas meter shall meet, as a minimum, the requirements for use in a hazardous area classification zone 2 (ATEX category 3) as defined in BS EN 60079−10-1.

6. GENERAL REQUIREMENTS

6.1 General

6.1.1 The overall concept of the British Gas smart metering system is for gas and electricity meters to include additional functionality, i.e. beyond that of simply recording the cumulative consumption of gas and electricity. Such additional functionality shall include two-way communications with a head-end system via a Wide Area Network (WAN). This should be achieved via a local comms hub located in the consumer's premises; see section 9.

6.1.2 The smart metering system shall be designed to have an operational life of at least 20 years.

6.1.3 Meters shall be capable of storing data locally (e.g. meter readings), which shall be uploaded to the head-end system at either pre-configurable times and recurrences (push) or when prompted by a command (pull).

6.1.4 The smart metering system shall be capable of supporting two different suppliers in the same home as well as switching between suppliers, in smart mode. Each individual supplier's data shall be stored securely and shall not be made available to the other supplier.

6.1.5 The smart metering system shall be capable of supporting WAN communications to all mainland UK properties.

6.1.6 The smart metering system shall support General Packet Radio Service (GPRS) radio communication for the WAN.

6.1.7 The smart metering system should support alternative WAN communications technology for use in areas of limited or no GPRS coverage.

6.1.8 The smart metering system shall incorporate a Home Area Network (HAN) communications system between locally mounted components; see section 9. The HAN shall be capable of supporting the smart metering system in all UK homes (e.g. communal meter housing in blocks of flats, large homes and buildings with solid internal walls, new builds with foil lined walls).

6.1.9 The smart metering system shall use Zigbee (2.4GHz) and communicate using Smart Energy Profile (SEP) and any private extensions necessary to support the functional requirements for the HAN radio communications.

6.1.10 The smart metering system should support alternative HAN communications technology for use in buildings where high attenuation of radio signals is experienced and the use of repeater devices/signal boosters, etc. is not possible.

6.1.11 Meters shall be capable of supporting ad hoc requests for readings, configurations, logging, and balances from the head-end system and shall respond within 10 seconds.

Note: Ad hoc requests for gas meters may include a time delay between the request, and the response to the request, to allow for them not being permanently in a state that allows for communications to take place (e.g. due to battery life considerations).

6.1.12 The smart metering system shall include the ability to interact with the consumer via an in-home display.

6.1.13 The smart metering system shall include both credit and pre-payment/PAYG functionalities (see section **Error! Reference source not found.**).

6.1.14 Meters shall incorporate a mechanism by which the following outcomes can be obtained:

a) Interrupt the supply to the consumer;

b) Load limit the supply into the consumer (electric only in both pre-payment/PAYG and credit modes);

c) Switch mode between credit and pre-payment/PAYG (also see section 10);

d) Take no action.

6.2 **System energy usage**

6.2.1 All components of the smart metering system shall be designed so as to minimise their energy usage, and as a minimum, the combined energy usage of components powered by the mains supply shall meet the requirements of BS EN 50470-3:2006.

6.3 **Marking: Identification and serial numbers**

6.3.1 All components of a smart metering system shall be uniquely identifiable both electronically, and mechanically. This shall be achieved by:

a) Affixing a label or marking plate to the component showing:

1) An indelible, unique serial number;

2) In the case where modular construction is employed (see clause 6.4), a means to identify individual modules;

3) Year of Manufacture;

b) Affixing a label or marking plate to the component showing an indelible, unique bar code that includes the component serial number and Smart Meter Variant Code which shall be identical to that shown on the label or marking plate. The barcode standard should be selectable to meet MAP/MAM requirements;

c) Within the memory of each component, permanently storing the following:

1) Component serial number which shall be identical to that shown on the label or marking plate;

2) The (Media Access Control) MAC address of the component;

3) Master key / install code (used to manage network connections);

d) Within the memory of each component, storing the following:

1) Internet Protocol (IP) address;

2) Meter Point Administration Number (MPAN) or
Meter Point Administration Number (MPRN) as applicable.

3) Pre-payment/PAYG PAN.

6.3.2 It shall be possible for these unique identifiers to be transmitted securely, confirmed and synchronised across all components as appropriate, and to the head-end system; also see sections 17.2 and 0.

Note: This information will also need to be made securely available to aid with, for example, a change of supplier.

6.3.3 All components of the smart metering system shall be branded as property of the asset owner; e.g.; British Gas.

6.4 **Modular construction**

6.4.1 It is permissible for individual smart metering components to be constructed in a modular fashion. Such construction shall not compromise safety, metrology or security; also see clause 5.1.1 and section 17.1). In the case of metrology, the method of construction shall form part of the acceptance testing of the component by a Notified Body; also see clauses 4.4 and 4.5.

6.4.2 If any conditions are imposed by the manufacturer by virtue of the modular construction, these shall be agreed in writing with British Gas.

6.4.3 All modular components of meters or of Metering Systems should be suitably protected from interference or tamper. Wherever relevant this means protected by the meter seals. Therefore the use of slots, flaps or hatches that could compromise the physical or electrical integrity of the module or the meter itself is not acceptable without an appropriate sealing mechanism.

6.4.4 Modules shall be capable of replacement without requiring interruption to the supply of energy and in the case of gas meters, in a zone 2 (ATEX category 3) hazardous area as defined in BS EN 60079−10-1.

6.4.5 Where modular construction is used it shall be clearly identifiable as such by the use of a modified serial number and model name; see clause 6.3.1.

6.4.6 Any diagnostic information within a component's alerts or logs derived from the operation of an individual module shall include information that identifies the individual module; see 18.3.

7. ENVIRONMENT

7.1 **Contaminants**

7.1.1 The surface finish of all smart metering components shall resist dirt, chemical effects and ultraviolet light which may occur in a typical domestic environment, and be easy to clean using non-abrasive household cleaners.

7.2 **Noise**

7.2.1 Components should not emit an audible sound level (including ultrasonic that may affect domestic pets) that may cause a nuisance in a domestic environment, unless it is signalling to indicate a specific agreed function (but see section 8).

8. ERGONOMICS

8.1 The operation and interaction with smart metering systems should be possible by persons with specialist needs; in particular those suffering from reduced vision, hearing or manual dexterity.

Note: It is appreciated that persons with severe impairment of sight will be unable to fully interact with the displays on both the meter and IHD.

8.2 Components shall incorporate means to differentiate important controls; e.g. buttons that are used to restore the supply (also see section 11) by touch.

Note: This may be by Braille or similar raised surfaces.

8.3 All button presses should be accompanied by audible tones to assist in the confirmation that the actuation has been satisfactorily achieved (also see section 11).

8.4 Messages that are displayed on meters shall be a combination of symbols or simple text in English. A variant of the smart meter system is one where the IHD should use the Welsh language. Other languages may be considered with the written agreement of British Gas.

8.5 Messages displayed on components other than meters shall, as a minimum, be a combination of symbols or text in English.

8.6 All operations should avoid the use of:

a) Multi-level menus of more than two levels;

b) Multiple button pushes in various combinations.

8.7 All operations should be easy to undertake such that an installer can describe the functionality to all types of consumer.

8.8 No component shall interfere with, or impede, the operation of any other component or meter specific tasks (e.g. the reading of a meter index).

8.9 Components of the Smart Metering System shall be designed to facilitate swift battery changes, which should be completed within five minutes.

9. OVERALL SYSTEM ARCHITECTURE

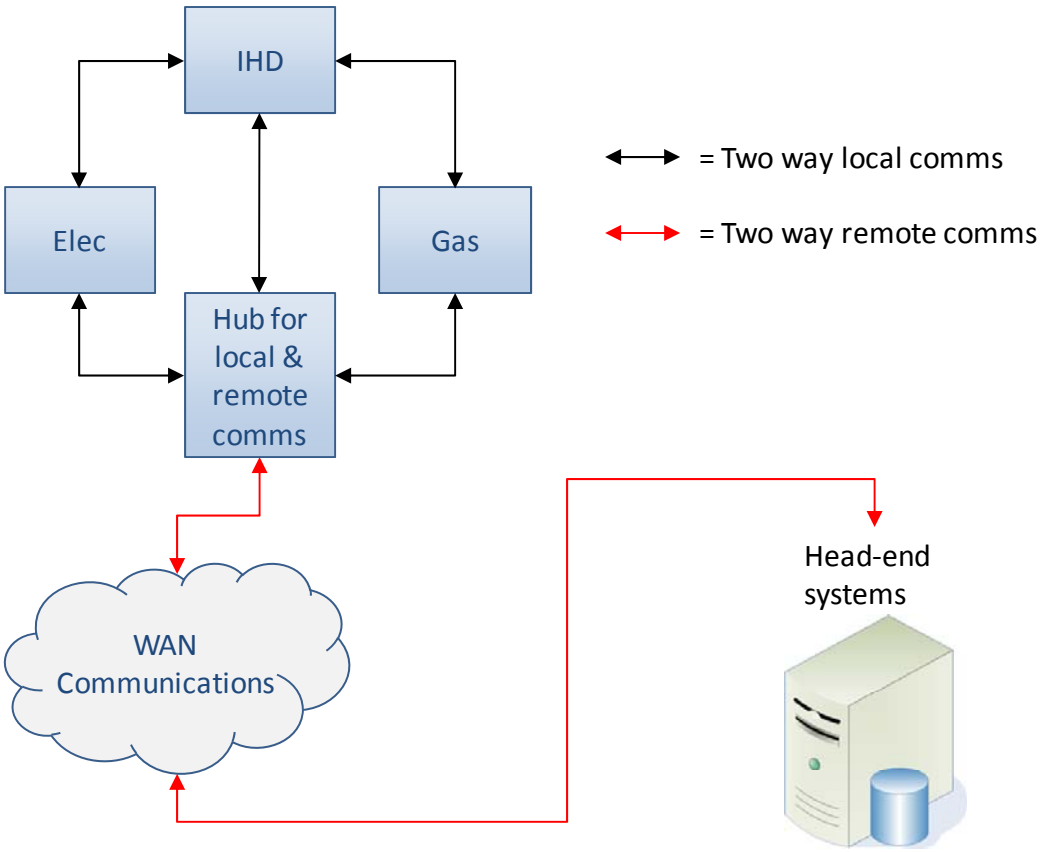


Figure 1 System architectures

9.1 The system architecture shall allow remote two way communications from head-end systems to the local system through the WAN via a local comms hub. This comms hub combines local and remote communicating technology. This system may also include an IHD that may communicate with each meter and/or the comms hub. Such local communications are via a Home Area Network (HAN). The system shall support multiple gas and electricity meters (up to 4 supply meters) and shall also support a single fuel meter configurations. In the scenario where there are multiple meters, there will be one IHD.

Note: See section 19 for further information.

9.2 All components connected to the HAN shall be Zigbee Smart Energy Profile (SEP) certified as a minimum, with proprietary extensions being managed separately.

9.3 Proprietary extensions to certified Zigbee command set profiles (where required) shall be managed jointly between the meter manufacturer and British Gas.

9.4 The complete smart metering system shall not rely upon an IHD to deliver its core functional requirements.

9.5 The hub shall be designed such that it can be independent of the electricity meter and be installable either live-side or load-side of the electricity meter. In the case of load-side installation, the hub shall be capable of maintaining communications in the event of disconnection or power failure.

Note: Industry regulations may change to indicate a preferential solution to the location of the comms hub when a gas only solution is being applied.

9.6 The smart metering system should incorporate the facility to link additional Zigbee SEP certified and British Gas compliant components to the HAN under head-end system control with a consumer's HAN or a secondary communications channel to provide enhanced functionality.

9.7 The smart metering system shall be able to incorporate a meter(s) that can measure electricity generated and /or exported; see Figure 2 to support export metering and Feed in Tariffs (FITs). While the design of a generation meter falls outside the scope of this requirements specification, it is expected that 3rd Party generation meters shall use Zigbee SEP to communicate with other functional devices via the HAN.

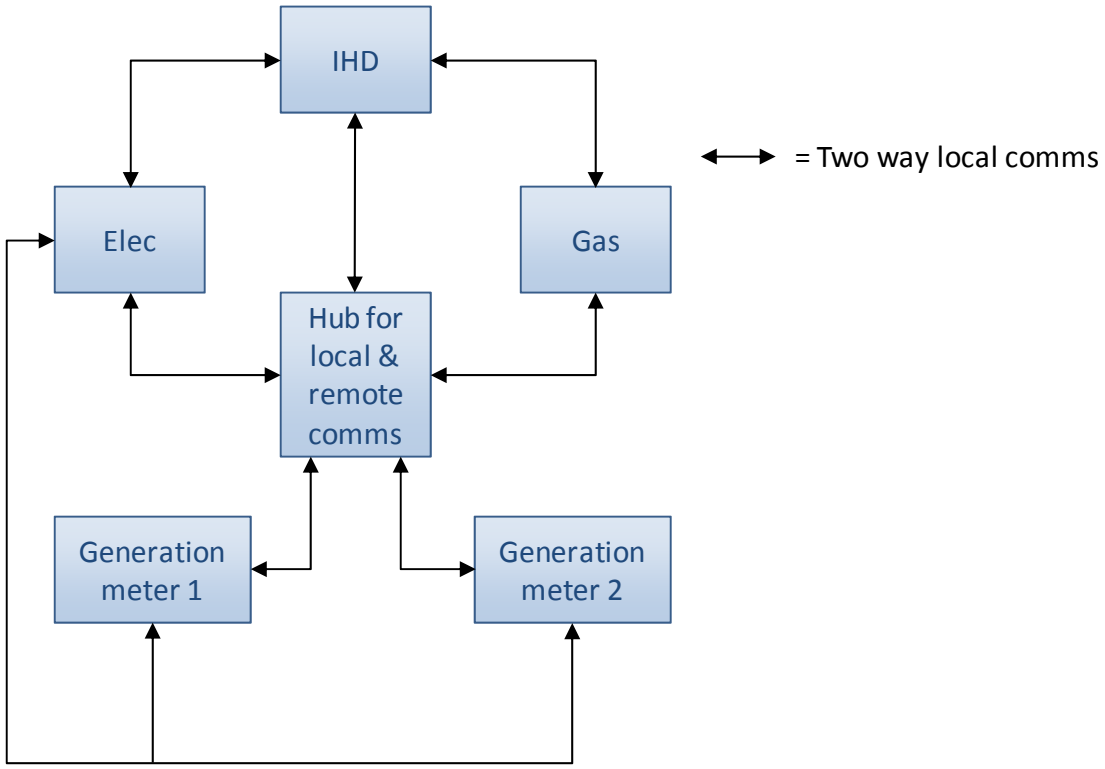


Figure 2 Example generation and export system architecture

10. MODES OF OPERATION

10.1 Meters shall be capable of operating in five distinct modes:

a) Commissioning;

b) Credit– operating using the 48x1 or 8x8 Tariff options;

c) Pre-payment/Pay as you go (PAYG) Mode (48x1 and 8x8 tariff options);

d) Suppressed functionality mode (recoverable remotely):

1) Credit mode single rate configuration;

2) Pre-payment/PAYG mode single rate configuration.

3) No WAN mode, no messages, alerts, reads, profiles communicated to head-end;

4) AMR mode – obtain automated meter readings only;

5) Reduced or no IHD communications.

e) Non-Smart 'dumb' mode (not recoverable remotely) – No HAN and where only basic ('eyeball') functionality is maintained.

10.2 All mode switching shall only be possible using secure communications or internal firmware following specific routines and rules to be agreed in writing with British Gas.

Note: Also see clause19.1.8.

10.3 All meter functionality shall be available to authorised personnel, using an appropriate password, both locally in all modes of operation and remotely in the case of Commissioning, Credit and Pre-payment/PAYG modes, and regardless of the interrupt status of the consumer.

10.4 It shall not be possible for a consumer to switch a meter between any modes.

10.5 It shall be possible for meters to be switched into, and out of, commissioning mode locally by authorised personnel, using an appropriate password.

Note: See section 0 for further detail on commissioning. The rest of this section 10 details only credit and pre-payment/PAYG modes of operation.

10.6 It shall be possible for meters to be switched between credit and pre-payment/PAYG modes, locally, or remotely, by authorised personnel, using an appropriate password, and by the meter itself where it cannot gain access to core systems and is applying internal routines/credit rules to be agreed in writing with British Gas.

Note: Also see clause19.1.8

10.7 It shall be possible for the mode change to have a start date in the future upon which date the meter acts and changes the mode.

10.8 Following a change of mode between credit and pre-payment/PAYG, the meter's mode of operation shall be communicated to the head-end system.

10.9 The meter shall store the ten most recent mode changes between credit and pre-payment/PAYG together with their start date of change over and current meter reading (totalised consumption).

Note: Meters will include the facility to hold a current and future tariff simultaneously. This is to ensure that a mode switch initiated by the meter itself (e.g. due to a loss of communications) will allow the meter to run correctly in the new mode without intervention from the head-end systems.

10.10 By default, meters shall display the current mode of operation. In addition, this mode of operation shall also be shown on the IHD where available.

Note: An IHD component may not be present in some installations.

11. INTERRUPT AND RESTORE CAPABILITY

11.1 The smart metering system shall support interruption and re-enabling of the consumer's gas or electricity (as appropriate) supply on local or remote instruction from authorised personnel.

Note: This feature is referred to a "shut-off mechanism" throughout these documents.

11.2 The smart metering system shall be designed to ensure any restoration of supply meets the safety requirements of clause 5.1.5.

11.3 The meter display shall function when the consumer's supply is disabled and shall indicate the status of the shut-off mechanism.

11.4 The status of the shut-off mechanism shall be transmitted to the IHD.

11.5 The shut-off mechanism shall be inaccessible to the consumer.

11.6 The shut-off mechanism shall be designed to operate reliably throughout the life of the meter assuming:

a) It is used to interrupt the supply for a minimum of 10,000 operations;

b) It remains unused for up to ten years before operating.

11.7 Any failure of the shut-off mechanism to operate shall generate a fault event that shall be transmitted to the head-end system; see section 18.

11.8 Any failure of parts within a meter shall not cause the shut-off mechanism to open. The manufacturer shall provide written evidence that shows the design methodology used to satisfy this requirement.

11.9 It shall be possible for a consumer to self restore in an interruption scenario only where they are a pay as you go consumer and have been interrupted due to a lack of credit or emergency credit, and have satisfied the rules in section 13.37.

11.10 The metering system shall record the time/date and trigger information of any changes to the interrupt/restore status of any switch(es) and/or valve(s).

12. FUNCTIONALITY AND CONFIGURATION

12.1 The smart metering system shall be configurable locally or remotely by authorised personnel. This shall allow the following information to be read, suppressed, and/or updated as appropriate for the operating mode of the meter on both meter and IHD displays:

a) Tariff structure (e.g., to change Time of Use (ToU) register parameters);

b) Tariff rates;

c) Tariff tiers;

d) Pricing information;

e) Time period for block tariffs (see clause 16.19);

f) Date and time;

g) Daylight saving hours between 0 and 3 hours adjustment;

h) Debt (see clause 13.21);

i) Credit – remaining credit, low credit thresholds, emergency credit values;

j) Recovery rate of debt (see clause 13.29);

k) Interrupt Status;

l) Non-interrupt periods (see clause13.33);

m) Emergency credit (see clause13.9) ;

n) Load management (electricity only; see Part 3: Electricity meters: 16. Load Management);

o) Reading scheduling (push);

p) Mode of operation (see section 10);

q) Currency conversion: pounds Sterling to Euros and vice versa (both the conversion rate and date and time to update to be configurable);

r) Send system status information to the head-end including;

1) Alerts information (see section 18);

2) Configuration information;

3) Signal quality information (both long and short range as applicable).

s) Data transmission times;

t) Data transmission intervals;

u) Data recording intervals;

v) Configuration of alarms;

w) Consumer data e.g. MPRN/MPAN;

x) Component data (e.g. serial number and MAC address);

y) Install code;

z) Supplier information;

aa) Conversion factors (CO2, CV and PTZ conversion factor).

12.2 Following any configuration changes, a message shall be generated and stored locally, and should be sent to the head-end if configured to do so.

12.3 Any such messages shall be configurable as requiring ad hoc or scheduled acknowledgments to the head-end system.

12.4 It shall be possible to keep the smart metering system's data and configuration details synchronised with the head-end system. Full synchronisation shall take place during installation and commissioning, see section 20.2.4. Throughout the life of the system, regular, configurable, synchronisation events of configurable data shall be possible. Examples of, but not limited to, information that should be regularly synchronised include:

a) Clock time;

b) Credit levels;

c) Total meter reading;

d) Tariff information;

e) Configuration details;

f) PTZ conversion factor;

g) Calorific value.

12.5 The smart metering system shall update its information from the meters to the IHD and to the comms hub (via the HAN) as often as is reasonably practicable, but with due consideration of battery life of a gas meter. Notwithstanding this, the updates should be at least every 30 minutes for gas and at least every 5 seconds for electricity.

12.6 The smart metering system shall allow for the change of energy supplier remotely without removing components.

12.7 **Configurable meter rules**

12.7.1 The smart meter system shall be capable of continuing to operate (within the HAN) when communications to the head-end system is lost, albeit with the loss of the functionality that would be given by such communications.

12.7.2 Where communications to the head-end are lost (e.g. due to WAN, HAN or comms hub failure), the smart meter system shall itself be capable of applying the consumer's tariff structure to the gas and electricity consumptions and to decrement the (pre-payment/PAYG mode) credit balance.

12.7.3 Whichever type of communications has been lost, the IHD shall immediately display a message telling the consumer to contact a service centre number after a configurable time has elapsed with no restoration of communication, also see section 18.

12.7.4 Where communications from a meter(s) to the head-end are lost, the smart meter system shall be capable of applying configurable rules to govern the switch to pre-payment/PAYG mode and eventual interruption of supply in the event that the loss of communications continues beyond a configurable period, set per consumer treatment flag value.

12.7.5 Once the loss of communications has exceeded the configurable period as per the consumer's treatment flag, the rules are to be applied as follows:

a) An alert shall be triggered dependent on the type of communications loss. There are two scenarios:

1) Loss of WAN: this shall cause:

i) An alert to be sent to the meter(s) and a message to be sent to the IHD stating failure to re-establish communication;

ii) An alert to be stored by the comms hub for future transmission to the head-end;

2) Loss of HAN: this shall cause an alert in the comms hub which shall be sent immediately to the head-end.

b) If the meter(s) is not in pre-payment/PAYG mode, it shall be switched to pre-payment/PAYG mode after a configurable time;

c) The meter(s) shall then operate as per the normal business rules for pre-payment/PAYG mode i.e. offering emergency credit, consulting the consumer treatment flag, interrupting supply.

12.7.6 The smart metering system shall allow the configuration rules shown in this section (i.e. 12.7) to be updateable remotely and locally by authorised personnel.

Note: It is anticipated that these rules and consumer profiles will be centrally generated within the head-end system, and that they will vary over time and will be updated accordingly.

13. PRE-PAYMENT/PAYG

13.1 During normal operation the smart meter system shall synchronise all payment information with head-end systems.

13.2 In the case of gas meters, the smart meter system shall be capable of generating energy values and related monetary values from the metrological reading of the meter. It should do this by performing a calculation using indicative values of CV and PTZ conversion factor that are synchronised with the head –end system.

Note: Other methods of energy determination may be agreed in writing with British Gas.

13.3 Meters shall, where configured to do so, interrupt the consumer from the incoming supply when there is no credit or emergency or friendly credit.

13.4 The smart metering system shall not use a token slot type mechanism for the adding of credit.

13.5 Meters and IHDs shall generate an audible sound and/or visual message when running out of credit and it shall be possible to mute the sound.

13.6 The low credit value at which a warning is generated shall be configurable both locally and remotely, with a default setting of £2.

13.7 Just prior to reaching the low credit value as described in clause 13.6, the meter should obtain the latest credit balance position from the head-end system.

Note: This allows the head-end System to react to the low credit scenario by checking the presence of an e-Wallet and sending a 'credit' where available.

13.8 Where, for whatever reason, the latest credit information as described in clause 13.7, is not obtained, the meter shall continue to use the most current information held within its memory.

13.9 The meter shall be configurable such that, when the meter is about to run out of credit, it shall prompt the consumer to accept the use of emergency credit, where this is available. If this is not accepted, nor credit added, and is in an interrupt period, the supply shall be interrupted; also see clause 13.33.

13.10 Meters shall generate visual message when running in emergency credit mode.

Note: The visual messages described in clauses 13.5 and 13.10 are different to allow consumers to distinguish between them.

13.11 Meters shall communicate that emergency credit has been invoked to the IHD.

13.12 Meters shall have the facility to interrupt the supply before accepting emergency credit.

13.13 The level of emergency credit and non-interrupt periods shall be configurable by authorised personnel (default value of £2).

13.14 Where supply is enabled at the moment of entering a non-interrupt period, supply shall continue during the non-interrupt period regardless of the credit balance of the meter. In the

case of a meter that is already interrupted, the non-interrupt period shall not cause the meter to restore the connection.

13.15 All meter functionality shall be available irrespective of whether there is a credit balance on the meter.

Note: This means that a meter will continue to accurately measure consumption, receive local and remote commands and follow them, register alerts, maintain all communications channels, and allow mode switching if so commanded, etc. In the case where the lack of credit has caused the shut-o ff device to operate, all the meter's functionality will still be in operation (including local/remote configuration of the meter by authorised personnel) but the meter will not be allowing the consumption of energy.

13.16 When operating in pre-payment/PAYG mode meters shall provide all functions currently available for pre-payment/PAYG consumers, including but not limited to:

a) An emergency credit facility;

b) Manage the available credit on the meter based on the credit purchased and tariff settings.

13.17 Meters shall accept a manual application of an (encrypted one-time) credit locally from a consumer or authorised personnel in instances where payments have not reached the meter. Such an application of credit shall be logged by the meter.

13.18 It shall be possible to apply and remove credits to meters remotely, in addition to emergency credit as described in clause 13.9. Such an application and removal of credit shall be logged by the meter.

Note: This may include "friendly credit" over and above emergency credit, ad hoc discretionary credit, an alternative to clause 13.17 as a method of amending a failure to record the input of a credit, etc. Removal of credits may be required to correct the mistaken addition of credit.

13.19 The meter system shall be able to accept credit sent to a specific meter from the head-end System. This credit shall be added to the credit balance on the meter instantaneously.

Note: This is a result of the scenario detailed in 13.7

13.20 Meters shall validate all applications of credit locally and remotely to prevent the application of a single credit transaction more than once.

13.21 It shall be possible to apply debits to a meter at any time such that debt recovery can take place. Debt can be applied during commissioning of the metering system.

13.22 There shall be 3 types of debt recovery rates that can be independently configurable, and shall be applicable to the consumer's credit balance (does not apply to recovery of emergency and friendly credit):

a) Type 1;

b) Type 2;

c) Type 3.

13.23 The names of the types of debt shall be configurable remotely and locally by authorised personnel.

13.24 The recovery hierarchy of types of debt shall be as follows:

1) Type 1;
2) Type 2;
3) Type 3.

13.25 Debt recovery shall be configured to be taken using three methods:

a) Collect a set amount over Days/Week/Month, with monies recovered at configurable time/day/week/month (time based recovery);
b) Collect a configurable percentage of the credit balance where this is less than the debt recovery amount due (consumption/balance based recovery);
c) Re-attempt debt collection of a defined amount over a configurable amount of times until the debt recovery is up-to-date.

13.26 Each type of debt can be recovered using any of the detailed methods of debt recovery in section 13.25.

13.27 The application of the debt recovery rates shall commence at a configurable start date (HHMM/DD/MM/YY) and recovered monies shall be subtracted from a configurable debt balance. The recovery shall continue at the specified rate until the debt balance for that debt type has been reduced to zero.

13.28 The three types of debt shall be displayed on the meter and IHD, with associated debt register, remaining debt, recovery rate and time, and totalised debt.

13.29 The debt recovery rate and the times that debt is recovered, shall be remotely configurable.

13.30 Debt recovery shall be independent of vends.

Note: This means that debt will be recovered on, for example, a daily basis whether or not a consumer uses energy, or adds further credit.

13.31 The debt recovery rates, and any changes to them, shall be displayed on the meter and IHD.

13.32 The meter shall store the history of the last 10 debts recovered (of each type) from the meter balance/vend and synchronise this data with the Head-end system.

13.33 It shall be possible to apply consumer treatment rules/categorisation to a consumer's meter, which are remotely managed. Examples of treatment rules are:

a) Vulnerable consumers (interrupt should be permanently disabled);
b) Non-interrupt periods (friendly credit):
    1) Hours of the day;
    2) Days of the week;
    3) A minimum of ten special days (e.g. Christmas day, etc);
    4) Seasonal.

13.34 The meter shall store up to 100 treatment rules and be able to apply these to either energy type.

13.35 Meters shall continue to supply energy in the situation where credit or emergency credit run out during configurable non-interrupt periods. The balance value can drop below the limit of emergency credit during a non-interrupt period.

13.36 At the end of the non-interrupt period, if the meter is still without credit or emergency credit (no vends have taken place) the consumer (except for vulnerable consumers) shall be interrupted.

13.37 To restore the supply after an interruption, sufficient credit shall be provided to:

a) Repay the full value of all emergency and friendly credit used;

b) Repay any charges (where applicable) that were generated whilst emergency credit was active such as debt recovery;

c) A positive credit balance is on the interrupted meter after the above deductions.

13.38 It shall be possible for a consumer to see the payment history. The payment history retained in meters and being capable of being displayed locally in the meter and IHD shall, as a minimum, include:

a) The last five payments in pre-payment/PAYG mode;

b) Dates, times and amounts associated with the last five payments.

13.39 Meters shall support, as a minimum, balances in the range of, and including ± £9,999,999.999. It shall be possible to change the maximum possible credit balance remotely, subject to the constraints of the size of the credit balance field.

13.40 Meters shall support, as a minimum, pre-payment/PAYG payment transactions (vend) the range of, and including ± £9,999,999.999. It shall be possible to change the maximum possible credit balance remotely, subject to the constraints of the size of the pre-payment/PAYG payment transactions (vend) field.

13.41 Meters shall hold a 19 digit unique number (payment reference number of pre-payment/PAYG PAN), issued by head-end systems on mode change that shall be referenced when credit is added. This number can be updateable by the Head-end system.

13.42 Meters and IHDs shall state the required funds needed to satisfy the requirements in section 13.37.

14. CREDIT METER PAYMENTS

14.1 The smart meter system shall synchronise all payment information with the head-end system.

14.2 Meters and the IHD shall display the fact that a payment has been successfully made together with the amount paid and date of the transaction.

14.3 It shall be possible for a consumer to see the payment history. The payment history retained in meters and being capable of being displayed locally in the meter and IHD shall, as a minimum, include:

a) The last five payments or credit added.

b) The amount of any managed debt (energy and non-energy);

c) The reduction of, and the expected clearance date of, managed debt;

d) Dates and times associated with payments;

e) Payments amounts and fuel type.

14.4 It shall be possible for the consumer to see an estimated monetary value of their consumption since their last bill.

14.5 The meter shall display the day of the billing period (I.e. Day 4 of 30). Billing periods can be monthly or quarterly, and shall be configurable locally and remotely by authorised personnel.

15. REAL TIME CLOCKS

15.1 All components shall have an internal date and time clock, operating in GMT time, or alternatively, components shall have a means of having immediate access to a central clock within the local smart metering system. It shall be possible to update the real time clock(s) from the head-end system.

15.2 Clocks shall be provided with a back-up battery. This shall allow the clock to continue working in the event of a power loss due to a power cut (electricity) or the removal of a battery during routine maintenance (gas), or running down due to being disconnected from a power source (IHD).

15.3 The back-up battery shall provide sufficient power to sustain the clock for not less than one month continuously, with an overall back-up time of 12 months and a service life the same as the component in which they are situated (i.e. where they have not exhausted their capacity they should still be capable of operation at the end of the service life of the component).

Note 1: Back-up batteries may also be used for other purposes and these will be described in each of the other parts to this series of documents. In such cases battery life will need to be calculated using load information for the other purposes in addition to the requirements of clause15.3.

Note 2: Back-up batteries shall support scenarios where the electricity meter and IHD are without power for sustained periods of time. (e.g. pre installation storage).

15.4 The clock accuracy shall be as follows:

a) Relative time MPE < 0.01%;

b) Absolute time MPE < 3 minutes.

Note 1: 'Relative time' means the time between the instigation of a measuring action and its completion. This also includes the length of time a register is used before changing to the next; e.g. the term "Half hourly" means 30 minutes with an MPE of $\leq$ 0.01%.

Note 2: 'Absolute time' means the time value within an instrument that replicates UTC (Coordinated Universal Time). The half hourly register change may take place at, for example, any time between noon and three minutes past, this being throughout the life of the meter if the internal clock were not to be synchronised.

15.5 The clock shall be used to time stamp meter read, logs events and transactions in GMT.

15.6 The smart meter system shall be capable of:

a) Displaying time in BST;

b) Managing leap years through its life;

c) Maintaining a log of clock resets and faults.

16. TARIFFS AND PRICING

16.1 Meters shall be configurable to operate as a multi rate meter (Time of Use (ToU)).

16.2 Meter tariffs, tariff tiers and tariff rates shall be configurable locally or remotely by authorised personnel.

Note: Also see section 12.

16.3 Meters shall record interval data over configurable time periods where the interval period is 30 minutes or smaller.

16.4 Meters shall be capable of supporting multiple tariff structures e.g. Critical Peak Pricing (CPP; see 16.11) and export pricing (electricity only) in addition to the 48 x 1 ToU and 8 x 8 basic tariffs.

16.5 Gas meters shall support the following tariff structure:

a) Single rate tariff £/kWh;

b) 48 x 1 (ToU) tariff;

c) 8 x 8 tariff.

16.6 Electricity meters shall support the following tariff structure with optional/mandatory peak pricing:

a) Single basic tariff £/kWh (import and export);

b) 48 x 1 (ToU) tariff (import and export);

c) 8 x 8 tariff (import and export).

16.7 Tariff and price updates shall be date bound to an 'effective from date and time' where appropriate. Meters shall be capable of receiving the next tariff update in advance and apply the changes when the 'effective from date and time' (DD/MM/YYYY HH:MM) condition is met.

16.8 Each register and appropriate tier shall be clearly labelled with a configurable identifier that is appropriate to its use.

16.9 Meters shall be capable of being configured to support individual tariff structures (i.e. 48x1 rates for electricity differ from the 48x1 rates for gas).

16.10 Meters shall be capable of operating in different tariff structures to each other (I.e. Electricity operating using the 8x8 structure and gas operating using the 48x1 structure).

16.11 **Critical Peak Pricing (CPP) (electricity only)**

16.11.1 Electricity meters shall be capable of accepting a command to enter a period of Critical Peak Pricing (CPP).

16.11.2 Meters shall be capable of accepting a command to react immediately or to react to a future-dated CPP period.

16.11.3 The CPP period shall be a configurable time period expressed in from and to date and time (From DD/MM/YYYY HH:MM and To DD/MM/YYYY HH:MM), and it shall be possible to set the period for each separate CPP event.

16.11.4 It shall also be possible for the CPP event to be a future or recurring time period set in the meter.

16.11.5 It shall be possible to associate 2 tiers (1 threshold and 2, all other consumption) with each CPP event.

16.11.6 It shall be possible to set unit rate prices for each of the 2 tiers for each CPP event, either set at each event or set up in advance on the meter.

16.11.7 It shall be possible to record the consumption on the meters split as per the 2 tiers for each CPP event; where there is more than one CPP event between scheduled meter reading submission, the consumption for each CPP event shall be recorded separately.

16.11.8 It shall be possible for the consumer to accept or reject a CPP event where this option is available via the meter and via the IHD, and to send the consumer's response back to the head-end systems.

16.11.9 It shall be possible for there to be CPP events where the consumer is not given the option to accept or reject.

16.11.10 It shall be possible to notify the consumer on the IHD and on the meter in advance of the CPP event, whether this is already set up on the meters or not.

16.11.11 CPP shall be available in addition to the 48x1 and 8x8 tariff structures.

16.12 **48 x 1 Time of Use**

16.12.1 This configuration is described as follows:

a) 48 (ToU) cumulative import (consumption) registers;

b) 48 (ToU) cumulative export registers (electricity only);

c) Each ToU register shall be associated with a rate, whose value shall be configurable remotely;

d) The meter shall be capable of recording up to 200 ToU switches with the following parameters:

1) Start time (definable in hours and minutes; thus a minute is the smallest interval possible);

2) ToU register to use;

3) Days of week;

4) Months of year, or from DD/MM (a mapping uses one or other method but both shall be possible);

5) Use of auxiliary (relay) switch i.e. a capability to control switched loads in line with ToU rate switching times (electric only)

Example 1: 10.00 Mon January maps to Rate Register 1

17.00 Mon January maps to Rate Register 2

Example 2: 10.00 01/ 01/01 maps to Rate Register 1

e) CPP supersedes the 48x1 tariff structure whiles the CPP valid from and to time period is in effect.

16.12.2 The price for each ToU register (import and export) and ToU switching mappings shall be configurable locally or remotely by authorised personnel.

16.13 **8x8**

16.13.1 This configuration is described as follows:

a) There are three main inputs into this pricing configuration:

1) Mappings to ToU registers (Rate registers);

2) Tier threshold rules (Tiers);

3) Cost per unit for cumulative register for Rate register/Tier.

b) Cumulative readings, cumulative costs and cost per unit registers shall be arranged as a matrix of 8 x 8 as illustrated in Figure 3;

c) The meter shall be capable of recording up to 50 ToU switches with the following parameters:

1) Start time (definable in hours and minutes; thus a minute is the smallest interval possible);

2) ToU register to use;

3) Days of week;

4) Months of year, or from DD/MM (a mapping uses one or other method but both shall be possible);

5) Use of an auxiliary (relay) switch i.e. a capability to control switched loads in line with ToU rate switching times (electric only).

d) Tier thresholds are values at which the accumulation of units moves to the next tier. These thresholds are valid over the threshold period.

e) Tier threshold periods shall be capable of being smaller than billing periods e.g. a tier threshold of five units daily may be applied to a monthly billed consumer;

f) Tier threshold values shall be capable of referring to a rule (value and period) e.g. a tier threshold value could be the total of Registers 1 and 2 month-to-date.

		Rates (dependent on ToU mapping)							
		R1	R2	R3	R4	R5	R6	R7	R8
Tiers (Thresholds dependent on tier rules such as amount of energy used)	T1	£/kWh	e.g. £0.5/kWh						
	T2								
	T3								
	T4								
	T5								
	T6								
	T7								
	T8								

Figure 3 Illustration of rate and tier combination

		Rates							
		R1	R2	R3	R4	R5	R6	R7	R8
Tiers	T1	kWh	e.g. 10kWh						
	T2								
	T3								
	T4								
	T5								
	T6								
	T7								
	T8								

Figure 4 Illustration of rate and tier combination cumulative register

16.14 Rate registers, ToU mappings, and Tier rules shall be configurable locally or remotely by authorised personnel.

16.15 Tier and Rate register, cumulative rate registers and total consumption shall be extractable to head-end systems on command.

16.16 The meters shall be capable of supporting a standing charge, with an associated configurable period e.g. daily, weekly, etc, and an associated recovery frequency for pre-pay e.g. daily, weekly, etc.

16.17 The meter display shall clearly identify which unit rate price is currently active as a financial value. For gas, the metering system shall use an indicative calorific value and an indicative volume conversion value to calculate energy values in kWh in order to provide an experience consistent with electricity and as a basis for calculating the monetary value; see clause 13.2.

16.18 Meters shall display currency value using the correct currency symbol (£ or €).

16.19 Meters shall be capable of resolving block tariffs over a configurable period, the minimum period being one day, for both gas and electricity.

16.20 Meters shall synchronise tariff and consumption data with the IHD at a move to a next price, given a tier threshold or time of use switch and/or 30 minutes for the gas meter.

16.21 CPP supersedes the 8x8 tariff structure whiles the CPP valid from and to time period is in effect (electric only).

16.22 **Export Tariffs**

16.22.1 The primary electricity meter shall have a separate register to record net export, and separately display gross generation as an energy value (kWh).

16.22.2 Export tariffs shall credit consumer's balance on the meter via a negative rate when operating in pre-payment/PAYG mode.

16.22.3 There shall be associated discounts based on gross generation and this shall be applied to the balance on the meter when in pre-payment/PAYG mode, or a discounted value on the IHD when operating in credit mode.

17. SECURITY

17.1 **Mechanical anti-tamper measures**

17.1.1 In addition to the metrological seals described in Parts 2 and 3: Gas meters and Electricity meters: Display, components shall be designed to resist any form of tampering. This shall also include any modules that may be used in the assembly of any component of the smart metering system; see section 6.4.

17.1.2 Anti-tamper measures shall include, as appropriate, the use of mechanical security seals, and anti-tamper switches that generate tamper alerts that shall be communicated to the head-end system.

17.1.3 Where compartments are used (e.g. for batteries, comms modules, etc.) the compartments shall be protected as described in clause 17.1.2, but in addition, the opening of such compartments shall not allow access to any circuit boards or mechanisms that could compromise the physical or electrical integrity of the component or module.

17.1.4 All anti-tamper mechanisms shall be capable of being reset by authorised personnel.

17.1.5 Where any component incorporates a module or is of modular construction, the construction method shall not compromise security features or anti-tamper measures. This shall also be the case during a module exchange.

17.2 **Data security**

17.2.1 All data exchanges across all parts of the smart metering system shall be made using data encryption; e.g. data transfers involving the e-wallet (see clause).

17.2.2 All Zigbee components shall use a network key.

17.2.3 Access to data or configuration of the meter shall only take place where:

a) Access has been authorised;

b) Communication is encrypted.

17.2.4 Data encryption shall employ AES 128 bit encryption.

Note 1: This may impact on the use of the Zigbee Smart Energy Profile.

Note 2: Proprietary methods of encryption are not acceptable.

17.2.5 All cryptographic protocols that require the generation and use of secret values (e.g. public/private keypairs) shall use a pseudo random number generator (PRNG).

17.2.6 The smart metering system shall be able to remotely disassociate any component in the network including, but not limited to, the meters, in-home display and the comms hub.

17.2.7 The manufacturer shall provide British Gas the method by which the encryption is generated.

17.2.8 A gas meter and an electricity meter shall use different encryption keys (for establishing and maintaining communications).

Note: This is to enable the transfer of meters, when a consumer has requested a change of supplier, particularly of one fuel. Following a change of supplier, each supplier's equipment will only pair within the appropriate system.

17.2.9 The key used for installation (install code) should be loaded using another communications channel other than the HAN (out-of-band) at the time of installation.

17.2.10 The storage of keys shall be secure at all points.

17.2.11 Any security data, once written into the memory of a component, shall not be capable of being read without a means of authentication and authorisation.

17.2.12 Source node authentication shall be implemented.

17.2.13 The HAN shall be secure. Only authorised components shall be allowed to connect to the HAN.

17.2.14 The WAN shall be secure. Only authorised components shall be allowed to connect to the WAN.

17.2.15 Components shall be pre-configured with a temporary link key (install code).

17.2.16 Components shall be Smart Energy Profile certified.

Note: At the time of writing, the IEEE 802.15.4 layer 2 security mechanism conflicts with Smart Energy Profile. It would therefore be prudent to use Smart Energy to allow interoperability with other components, provide the application security and then adopt/upgrade to Zigbee IP, which will introduce MAC security.

17.2.17 All security methods, including keys, shall be configured to allow the transfer of assets (one or both meters or other components on the HAN) from one supplier to another. This transfer shall itself be secure.

17.2.18 Any components using Power Line Carrier (PLC) for local communications shall use encryption and authentication.

Note: This is likely to impact on the Standard governing PLC and smart components.

17.2.19 All types of debugging/JTAG (Joint Test Action Group) shall be removed prior to delivery.

17.2.20 Sniffing (tapping) plaintext keys/passwords/certificates shall not be possible via the bus, or other interface.

17.2.21 All methods of communicating with the meter locally that involve data collection functionality or configuration changes, or any other function that may affect the functioning of the meter, shall only be possible by authorised personnel and such changes shall:

a) Require the breaking of appropriate mechanical seals; and/or

b) Require the use of an hand held terminal with out-of-band password communication or require the input of a password where an hand held terminal is not available;

   1) All passwords shall be strong and complex (. see Appendix F for definition);

   2) Passwords shall be re-settable remotely (please refer to Appendix F for requirements);

c) Require the use of “hashed” and thus valid data (please refer to Appendix F for definition);

d) Shall be protected and unique;

e) Store details of any changes made together with a date and time stamp.

17.2.22 It shall be possible to temporarily disable HAN and/or WAN communications under head-end control following the detection of a security breach that may compromise the head-end.

17.2.23 Full smart meter system functionality shall be recoverable, under local or head-end control, following the disabling of communications described in clause 17.2.22.

18. EVENTS, EXCEPTIONS, ALERTS, FAULTS AND TAMPERS

18.1 The smart metering system shall be capable of recognising a number of exceptions or events, upon which it shall:

a) Recognise that an event has occurred;

b) Record the event;

c) Take configurable action.

18.2 System events (alerts or faults or tampers) shall be date and time stamped and stored in non-volatile memory (in an alert log or logs), in the component where the alert originated.

18.3 In the case of a component constructed in a modular fashion, the events described in clause 18.2 shall also include a means of identifying the individual module where the alert originated.

18.4 Event logs shall be capable of recording and storing event data sufficient to support both business processes and meter warranty management through the life of the meter system.

18.5 Event logs shall retain their data on decommissioning / un-pairing / change of supply of the meter.

18.6 The occurrence of an event shall, where configured, be transmitted to the head-end system immediately upon occurrence, or, in cases involving loss of power, as soon as is reasonably practicable.

18.7 Alerts shall be configurable into groups or classes (e.g. low / medium / high).

Note: A non exhaustive lists of alerts appears in clauses 18.9 and 18.11.

18.8 Each event, group or class of events shall have configurable rules for treatment (e.g. transmit immediately to the head-end, transmit on next transaction, suppress but retain in meter log) and for actions resulting when the alert occurs (e.g. interrupt supply, flag to consumer via meter and via IHD, switch to pre-payment/PAYG mode).

18.9 As a minimum, the following faults should be detected and processed:

Note: The following outlines key requirements; a more detailed list is given in Appendix B.

a) Low battery;

b) Battery about to expire;

c) Clock time invalid;

Note: Clock errors may also be due to an external tamper; see 18.11h).

d) Internal memory error (both program and RAM);

e) Memory capacity reached;

f) Unexpected hardware resets;

g) Measurement errors;

h) HAN and WAN communications errors;

i) Faults with the meter shut-off mechanisms;

j) Unexpected program operation.

18.10 The smart metering system should incorporate some ability to undertake remote fault diagnostics, for example on detection of an event associated with HAN or WAN communications

18.11 As a minimum, the following tampers should be detected and processed:

Note: The following outlines key requirements; a more detailed list is given in Appendix B.

a) Removal of sealed components' covers;

b) Power loss/removal of battery;

c) Strong magnetic field detected;

d) Incorrect protocol or passwords (including SIM PIN) entered (e.g. via interface in the comms hub);

e) Multiple attempts at entering information relating to billing; e.g. vend codes;

f) Unusual HAN traffic;

g) Reverse flow/current;

Note: Account will need to be taken for electricity meters associated with micro-generation.

h) Unexpected change of clock time;

Note: Clock errors may also be due to a fault; see clause 18.9c).

i) Loading or attempted loading of unsigned code to a component including unauthorised changes to the Zigbee and GSM/GPRS firmware;

j) Malformed/unauthenticated communications between local components and from the hub to the head-end;

k) Abuse via other channels (e.g. Malformed SMS sent individually or chained together);

l) Removing SIM;

m) Failed connection attempts to any component by unauthorised components

18.12 The configuration settings for all events (including faults, tampers and alerts) should be bound by a start and end date.

19. DATA COMMUNICATIONS

19.1 **General**

19.1.1 All parts of the smart metering system shall incorporate appropriate methods of communicating data. These may be categorised as follows:

a) Long range, two way communications with the head-end systems, designated as WAN (Wide Area Network);

b) Short range, two way communications, between local components (e.g. meters and comms hub, and/or meters and IHD, etc.) designated as HAN (Home Area Network);

c) Short range, two way communications, between components and the HHT.

19.1.2 All communications shall continue to be fully functional irrespective of the mode of operation of meters; see section 10.

19.1.3 All configuration, retrieval and removal of data from all components shall be capable of being carried out by authorised personnel remotely and locally.

19.1.4 All communications shall be secure; see section 17.2.

19.1.5 It shall be possible to increase the range of both WAN and HAN. Provision should be made for external antennas and/or signal boosters/repeaters. Connections to such components should be simple and tamper-resistant.

Note: This provision applies to both the HAN and the WAN. External antennas may improve reception of mobile phone network signals where, for example, the meter is located in a cellar. The use of signal boosters/repeaters may similarly improve communications between meters and the IHD where the two are located a long distance apart.

19.1.6 All communications shall employ means by which the receipt of any data stream shall cause an "acknowledge" signal (where required and configured) to be transmitted back to the original sender (including where the message is received in the comms hub for eventual re-transmission to other components).

19.1.7 The smart metering system shall incorporate a mechanism whereby, in the event of a communications failure, it will re-try. The timings and number of re-tries shall be remotely configurable by authorised personnel and each component shall have different 'communication retry' rules. I.e. A continuous retry is required from the communication hub whereas the gas meter need only retry for a configurable amount of time.

19.1.8 Where communications to the head-end system have been lost the configurable rules given in section 12.7 shall be applied.

19.1.9 Each component within the smart metering system should be capable of responding in real time to remote commands.

Note: It is accepted that this may not be possible in the case of gas meters, because of the power constraints imposed by battery operation; also see clause 19.1.11

19.1.10 The times when data exchanges are initiated shall be configurable by authorised personnel both locally and remotely.

19.1.11 In the case of gas meters provision shall be made to initiate an immediate and/or pre-determined time to "wake up". Examples of such a means include, but are not limited to:

a) Provision to accept a command, during a normal data transfer (typically a daily update of meter reading to the head-end system), to enable it to wake up at a specific time when it may receive further instructions;

b) The ability of a button push or series of button pushes on the meter to instigate an immediate wake up.

19.2 **Communications to Hand Held Terminal (HHT)**

19.2.1 The components within the metering system (comms hub, meters, IHD) shall be configurable locally using the HHT; such local interrogation should be via Zigbee or a local programming port; e.g. an optical port – often known as an IEC port – as specified in BS EN 62056-21.

20. INSTALLATION, COMMISSIONING AND DECOMMISSIONING

20.1 All components of the smart metering system shall be capable of being installed, bound, unbound, commissioned, and decommissioned without the use of a HHT.

20.2 **Commissioning**

20.2.1 As far as is practicable, the smart metering system should be "plug and play"; i.e. components should identify each other and "pair" with as little installer input as possible.

20.2.2 Where an installer is required to enter any information (e.g. MPRN or MPAN) the mechanism for entry shall be as simple as possible, the digits shall be displayed without the need to scroll, and any data entry errors shall be easily corrected.

20.2.3 During any pairing operation, the smart meter system shall be resistant to other components interfering with the correct pairing process.

20.2.4 Irrespective of 20.2.1, it shall be possible to leave all parts of the smart metering system fully operational. I.e. not in commissioning mode, by a single installer. This requires the meters, comms hub and IHD to be installed, tested, and commissioned and all relevant data communicated, updated and synchronised between the head-end and the local smart metering system. This data shall include, but is not limited to:

a) Unique identifiers (e.g. serial numbers, MAC address, IP address, MPRN/MPAN, etc.);

b) Meter readings held in all registers;

c) Mode for each meter (i.e. pre-payment/PAYG or credit);

d) All configuration details of all smart metering components;

e) HAN and WAN signal strength;

f) Tariff information:

1) Tariff structure;

2) Rates.

g) Debt recovery and other financial information;

h) Billing time synchronisation;

Note: An example is if the billing system is at day 49 in the billing period, then any credit smart meter would also be set to day 49.

20.2.5 During the installation procedure, messages shall be displayed on appropriate components to indicate how far the procedure has advanced. The manufacturer shall provide details of approximate times to complete each stage of the procedure.

Note: This information will help an installer determine whether or not the installation procedure has locked up.

20.2.6 During the installation procedure the smart meter's unique identifiers shall be checked with equivalent data in the head-end system. If there is a discrepancy an error shall be flagged to the installer.

20.2.7 The smart metering system shall be designed such that the installation procedure shall normally be achievable in as short a time as possible, without the installer resorting to telephone calls to any office based support staff.

Note: Exceptions to normally achievable includes:

- No Hand Held Terminal;
- Poor signal/ situations requiring antennas;
- Gas meter not co-located;
- Gas only installation.

20.2.8 Following a successful installation the meter system shall be switched to credit or pre-payment/PAYG mode and shall display appropriate messages e.g. "Welcome".

Note: The appropriate mode and message will be determined by the head-end system and will be transmitted to the smart meter system during the installation procedure.

20.2.9 The smart meter system shall allow for individual components to be installed and commissioned independently. Where a component is changed, it shall be possible to apply the old component's configuration to the new component.

Note: This will allow for a single component change for "upgrade" purposes or replacement due to a fault, or a complete system change.

20.3 All processes shall be able to be carried out without a HHT by authorised personnel.

20.4 **Hand Held Terminal (HHT)**

Note: It is assumed that the metering engineer has a Hand Held Terminal (HHT) that has barcode reading, wireless communication, and optical probe functionality. However, all processes are required to be able to be carried out without a HHT, by authorised personnel.

20.4.1 The manufacturer shall specify the software and communication interfaces required to complete the following operations:

a) Determine WAN signal quality; e.g. mobile phone operator's signal quality;

b) Aid the placement of, and gauge the effectiveness of, any external WAN antennas that may be required in areas of poor signal quality;

c) Determine the signal quality existing between the comms hub and all meters and the IHD, in both directions;

d) Determine the signal quality existing between the IHD and all meters, in both directions;

e) Aid the placement of, and gauge the effectiveness of, any additional signal boosters or repeaters by identifying any signal dead spots.

Note 1: It is expected the HHT will include a display for alpha numeric and graphical information.

Note 2: Only where all communications functionality has been satisfactorily proven will a smart meter system be installed.

20.4.2 In addition to the requirements of clause 20.4.1, the HHT software shall be capable of interacting with components, particularly meters, to enable the local commissioning procedures to be undertaken. As a minimum the HHT software shall:

a) Interpret (read bar-coded) serial numbers and installation code from each of the meter system elements;

b) Transfer the installation codes for each component to the comms hub via a secure link;

c) Highlight for the purposes of managing the installation process, key stages in the installation process including the set-up of the metering system;

d) Report on exceptions to the installation process and guide installers through resolution.

20.4.3 The system should be able to diagnose faults during the commissioning process; also see clause 24.3.

20.5 **Decommissioning**

20.5.1 Two types of decommissioning are considered: complete removal of a component and Change of Supplier (CoS) Loss. In both cases, a retrieval of all consumption readings, credits and debits held on an individual meter, together with the details of the component being decommissioned shall occur and the data sent directly to the head-end system. In the case of a removal of a component, this data may also be retrieved locally using the HHT.

20.5.2 Removal of Metering System or Individual Component

20.5.2.1 Authorised personnel shall be able to decommission a smart metering system either as a whole or each component separately.

Note: In the case of a change to an IHD, this may be carried out by the consumer subject to British Gas authorisation

20.5.3 Changing the Meter Mode at Change of Supplier (CoS) Loss

20.5.3.1 Components shall be capable of being cleared of British Gas specific information but the consumer specific load profile information shall remain. Where components include registers that form “the measurement result that serves as the basis for the price to pay” these register shall not be cleared.

20.5.3.2 Authorised personnel shall be able to configure a component such that it may be left in a safe state. In the case of meters they shall be capable of being left in one of two possible modes (as defined at 10.1) suitable for subsequent take over by another supplier:

a) Suppressed functionality (recoverable);

b) No Smart 'Dumb' mode with no HAN (not recoverable).

20.5.4 **Fault analysis**

20.5.4.1 Any component (except the comms hub) shall be replaceable through the decommissioning and commissioning processes. In the case where the comms hub requires replacement, the HAN may need to be reset.

20.5.4.2 The HHT software shall be able to interact and extract all meter data in the event of a communication or software fault/error.

20.6 **Firmware upgrade**

20.6.1 The HHT software shall support all required functionality to upgrade firmware on all smart meter system components (see section 21.2).

21. SOFTWARE

21.1 **General**

21.1.1 All software used in all components shall follow a structured design following a functional design plan. This structure should be available to British Gas.

21.1.2 Software should follow the WELMEC Software Guide 7.2, as appropriate.

21.1.3 Software should be verified by independent consultants and their report provided to British Gas.

21.1.4 All software shall be identified by version number, and version control processes shall be used by the manufacturer. The manufacture shall employ quality control processes. All such process shall be accredited by independent means as meeting the requirements of BS EN ISO 9001, BS EN ISO 9002, BS ISO/ IEC 90003 or equivalent.

21.1.5 The manufacturer shall supply all necessary software that may be required to be installed on laboratory computers to assist in the evaluation of the smart metering system.

21.1.6 Non-metrological software in the metering system shall not affect the operation of the metrology within the meter.

21.2 **Firmware**

21.2.1 The smart metering system shall support remote and local firmware upgrades, including roll-back where an update fails. All major meter system components which are capable of firmware upgrade shall have the facility to do so remotely and independently of each other; this includes, but is not limited to, mobile communications firmware, Zigbee firmware and tariff capabilities.

21.2.2 Memory capacity shall be sufficient to account for the loss of memory capacity through the warranted life of the meter without loss of meter functionality.

21.2.3 It shall not be possible to change any part of the firmware relating to the metrological functionality, either accidentally, or intentionally.

21.2.4 With the exception of metrology firmware, it shall be possible to both patch upgrade and completely over-write a component's firmware.

21.2.5 All firmware upgrades shall only be possible by authorised personnel and following the use of a password; this applies to both locally and remotely applied upgrades.

21.2.6 The firmware upgrade process should incorporate a mechanism whereby there is a roll-back to the existing firmware during the process and, given this, the existing firmware shall be retained within the smart metering component until the new version is successfully installed.

21.2.7 Following a firmware upgrade, the affected component part of the smart metering system shall:

a) Automatically restart, without a site visit to restart the component;

b) Confirm status to the head-end system at configurable points through the process. Following a firmware upgrade, the affected component part of the smart metering system shall indicate it is functioning correctly;

c) If required, restart following a remote or locally initiated manual command.

21.2.8 In the event of a failure to upgrade, the firmware shall revert to the original version, either automatically or by virtue of a remote command. It shall not require a site visit to revert to previous versions of firmware.

21.2.9 The firmware version should be stored within the device and be made available to the Head-end system if requested.

22. EMC

22.1 Components (including modules and any remote transducers or actuators that the smart metering system may incorporate) shall meet the requirements relating to Class E1 as defined in the Measuring Instruments Directive (i.e. "instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in residential, commercial and light industrial buildings").

22.2 Components shall be tested using the following pass/fail criteria:

a) Before each test the components shall be fully functioning and working correctly and all displays shall be displaying;

b) Influence quantities appropriate for each component (See EMC in the other four parts of this document series) shall be applied in turn and the components shall remain fully functioning and working correctly and all displays shall remain displaying;

c) After the application of each of the influence quantities the components shall remain fully functioning and working correctly and all displays shall remain displaying.

22.3 Where radio transmitting devices are included in a component, due consideration shall be taken of any potential interference they may cause with the basic operation of the component itself, and any other component located nearby.

Note: This also includes the possibility that a component incorporating both long and short range radio transmitters could fail testing if both transmitters operate simultaneously. Unless simultaneous operation is guaranteed not to occur, tests involving simultaneous transmission will be required.

22.4 Components shall meet the radio interference suppression requirements of BS EN 55022 (or equivalent), class B.

22.5 Any radio transmitting devices (both long range to the WAN and short range to the HAN) shall comply with the appropriate ETSI test Standard.

23. MAINTENANCE AND RELIABILITY

23.1 The smart metering system shall be designed to have an operational life of at least 20 years.

23.2 Battery life shall be at least 10 years..

23.3 The manufacturer shall use recognised industry standards (e.g., Siemens-norm SN 29500, MIL-HDBK-217F, or others acceptable to British Gas) to provide details of mean time between failure (MTBF) analysis calculations which shall be provided to British Gas.

23.4 The smart metering system shall be factory sealed and be maintenance free with the exception of:

a) Battery changing;

b) Exchange of purpose designed modules within components;

c) Exchange of individual components.

24. DOCUMENTATION

24.1 **Technical and functional specification documentation**

24.1.1 The manufacturer shall provide a detailed technical and functional specification including dimensioned engineering drawings and accompanying specifications (where appropriate) of all components comprising the smart metering system. The specifications shall provide all the information required to allow British Gas to:

a) Configure its head-end to support all functionality from its internal systems;

b) Define suitable business processes;

c) Develop other components (such as enhanced IHDs) that are interoperable with the manufacturer’s components;

d) Develop storage solutions for palletted components delivered to regional stores;

e) Develop storage solutions for components in transit between stores, consumer's premises and returns under warranty or for evaluation/repair.

24.1.2 The documentation should cover the following aspects at a high level of detail:

a) Each component making up the metering system;

b) The metering system architecture and inter-dependencies of each component;

c) HAN used for local communications;

d) HAN architecture including allocation of the controller;

e) Origination, flow, and storage of data in the HAN;

f) Dependencies on HAN devices;

g) Process for replacing/re-pairing HAN devices;

h) How the metering system will link to the British Gas head-end system and the command sets/protocols available;

i) Meter system error handling and reporting;

j) Identification of the root cause of alerts and exceptions complete with resolution path;

k) Installation, removal and maintenance procedures;

l) Firmware upgrades;

m) Tariff structure capabilities and limitations;

n) Individual component packaging details;

o) Component packaging details for bulk delivery;

p) Minimum packaging requirements for safe return to manufacturer.

24.1.3 The manufacturer shall specify how frequently data is passed/updated between a meter and the IHD. This specification shall include all data types being passed between the IHD and the meters. A full explanation shall be provided for the frequencies quoted; e.g., battery life limitations etc.

24.1.4 The manufacturer shall provide detailed documentation to describe the method by which meter reads, in kWh and cubic metres, will be retrieved to the British Gas head-end system for:

a) Scheduled reads;

b) On-demand reads.

24.2 **Configuration information**

24.2.1 The meter manufacturer shall provide full information relating to the requirements for configuration of each component of the metering system including the following:

a) Data items and characteristics configured at the time of manufacture;

b) Data items and characteristics unchangeable after manufacture;

c) Data items and characteristics configurable remotely after manufacture;

d) Data items and characteristics configurable locally after manufacture;

e) Documentation of commissioning tools and processes used to update data items and characteristics both remotely and locally;

f) Information required from British Gas for each component prior to manufacture;

g) How long before manufacture commences this information is required.

24.3 **Alerts information**

24.3.1 The manufacturer shall provide a separate and complete list of alerts reported by the metering system components, HAN and WAN communications. Each list item shall detail:

a) Report type (fault/alert/exception);

b) Report code;

c) Code description;

d) Originating component;

e) Cause(s) of the report code;

f) Recommended corrective action(s);

g) Who should carry out the corrective action(s);

h) Decision tree to identify the root cause of each alert;

i) At what point in each decision tree a site visit is required to resolve the root cause of a fault.

24.3.2 The manufacture shall provide outline fault diagnostic information.

Note: A single fault can often generate several fault codes. In such cases, analysis of the code set can show that many codes are irrelevant; in such cases the requirement is sufficient information to identify the key fault. It is expected that some on-board fault diagnostics may be carried out in the meters; also see clause 18.10

24.3.3 The manufacturer shall provide detailed instructions to enable simple repairs to be carried out.

Note: It is accepted that only simple repairs may be carried out on-site and no repairs relating to metrology will ever be attempted.

24.4 **Commissioning documentation**

24.4.1 The manufacturer shall provide detailed installation and commissioning process documentation for use by meter workers as part of their training and during field operations. This shall include full documentation for the HHT.

24.5 **User operating manual**

24.5.1 An operating manual in digital form, for use by the consumer, for the meter and IHD, in a clear and easily understood form, shall be provided. These instructions shall be in multiple languages as agreed with British Gas. Jargon and unfamiliar terms should not be used, or where absolutely necessary, should be kept to a minimum and should be defined within the manual.

24.5.2 The manufacturer shall provide detailed and complete end user manual content for consumer operation of all consumer provided functionality. The user manual should cover all meter system components:

a) Electricity meter;

b) Gas meter;

c) IHD;

d) Comms hub;

e) Linking of these components to the HAN.

24.5.3 This documentation shall form the core of British Gas branded consumer manuals.

25. PACKAGING AND STORAGE

25.1 Packaging shall not be liable to cause injury to operatives.

25.2 Packaging should be recyclable wherever practicable (also see clauses **Error! Reference source not found.** and 4.3).

25.3 No single package shall exceed 25 kg in weight.

25.4 Following manufacture, all smart metering components (in the manufacturer's possession) shall be stored under cover and not be exposed to excessive dust or water contamination.

25.5 All smart metering components shall be protected against damage during the storage and delivery process. In particular, the inlet and outlet connections of gas meter shall be protected to prevent the ingress of foreign particles.

25.6 Where required, a complete "kit" of all smart metering components should be available in one package.

25.7 Where multiple packages are loaded together on one pallet, the packages shall all be of the same type and, if appropriate, contain components having the same version number in both hardware and software.

25.8 The loaded pallets should be strapped and then covered in shrink wrap type waterproof materials.

25.9 Package dimensions to be supplied.

25.10 Labelling requirements, including bar-coding, to be provided.

25.11 All packaging shall be clearly labelled with the following:

a) Handle with care;

b) This way up;

c) The weight in kilograms;

d) The contents;

e) Any labels required under COSSH (Control of Substances Hazardous to Health Regulations 2002);

25.12 The recommended method of lifting (as required by the Manual Handling Regulations).

APPENDIX A REFERENCES

This series of documents makes reference to the documents listed below (see clause 2.1).

A.1 British, European and Global Standards

BS EN 437	-	Test gases – Test pressures – Appliance categories
BS 746:2005 +A1:2009	-	Specification for gas meter unions and adaptors
BS EN 1359: 1999 +A1:2006	-	Gas meters- diaphragm gas meters
BS 6400 - 1	-	Specification for installation, exchange, relocation and removal of gas meters with a maximum capacity not exceeding 6 m^3/h – Part 1: Low pressure (2^{nd} family gases)
BS 7856		Code of practice for Design of alternating current, watthour meters for active energy (classes 1 and 2)
BS 8499:2009	-	Specification for domestic gas meter boxes and meter bracket
BS EN 14236	-	Ultrasonic domestic gas meters
BS EN 50360	-	Product Standard to demonstrate the Compliance of Mobile Phones with the Basic Restrictions related to Human Exposure to Electromagnetic Fields
BS EN 50371	-	Generic Standard to demonstrate the compliance of low power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields
BS EN 50470	-	Electricity metering equipment (a.c.) - Part 1: General requirements, tests and test conditions - Metering equipment (class indexes A, B and C) Part 2: Particular requirements - Electromechanical meters for active energy (class indexes A and B) Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)
BS EN 55022	-	Limits and methods of measurement of radio interference characteristics of information technology equipment
BS EN 60079–10-1	-	Electrical apparatus for explosive gas atmospheres — Part 10-1: Classification of hazardous areas

BS EN 60529	-	Specification for degrees of protection provided by enclosures (IP code)
BS EN 60695–11-5	-	Fire hazard testing : Test flames — Needle-flame test method — Apparatus, confirmatory test arrangement and guidance
BS EN 60707	-	Flammability of solid non-metallic materials when exposed to flame sources – List of test methods
BS EN 60730 - 1	-	Automatic electrical controls for household and similar use —: General requirements
BS EN 60950-1	-	Information technology equipment — Safety —Part 1: General requirements
BS EN 61000-4-2	-	Electromagnetic compatibility - electrostatic discharge immunity test
BS EN 61000-4-3	-	Electromagnetic compatibility - radiated, RF, electromagnetic immunity test
BS EN 61000-4-4	-	Electromagnetic compatibility - Testing and measurement techniques — Electrical fast transient/burst immunity test
BS EN 61000-4-5	-	Electromagnetic compatibility - Testing and measurement techniques — Surge immunity test
BS EN 61000-4-6	-	Electromagnetic compatibility - Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields
BS EN 61000-4-8	-	Electromagnetic compatibility - power frequency magnetic filed immunity test
BS EN 61000-4-9	-	Electromagnetic compatibility - pulsed magnetic field immunity test
BS EN 61000-4-14	-	Electromagnetic compatibility - Testing and measurement techniques — Voltage fluctuation immunity test
BS EN 61000-4-28	-	Electromagnetic compatibility - Testing and measurement techniques — Variation of power frequency, immunity test
BS EN 61036	-	Alternating current static watt-hour meters for active energy (classes 1 and 2)
BS EN 62056-21	-	Electricity metering — Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange
BS EN ISO 9001	-	Quality systems - model for quality assurance in design/ development, production, installation and servicing

BS EN ISO 9002	-	Quality systems - model for quality assurance in production, installation and servicing
BS ISO/ IEC 90003	-	Software engineering. Guidelines for the application of ISO 9001:2000 to computer software
BS 6400	-	Installation of domestic sized gas meters
BS 7856	-	Code of practice for Design of alternating current, watthour meters for active energy (classes 1 and 2)
IEEE 802.15.4	-	IEEE Standard for Information Technology- Part 15.4: Wireless MAC and PHY Specifications for Low Rate Wireless Personal Area Networks (WPANs)
IEEE 1149.1	-	Standard Test Access Port and Boundary-Scan Architecture

A.2 ETSI Standards

EN 300 328		Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive
EN 301 511	-	Global System for Mobile communications (GSM); Harmonized EN for mobile stations in the GSM 900 and GSM 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC)
EN 301 489-01	-	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC)standard for radio equipment and services; Part 1: Common technical requirements
EN 301 489-07	-	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and

		ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
EN 301 489-17	-	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for 2,4 GHz wideband transmission systems, 5 GHz high performance RLAN equipment and 5,8 GHz Broadband Data Transmitting Systems
EN 301 489-24	-	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
EN 301 908-01	-	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS), Repeaters and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 1: Harmonized EN for IMT-2000, introduction and common requirements, covering the essential requirements of article 3.2 of the R&TTE Directive
EN 301 908-02	-	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS), Repeaters and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD and E-UTRA FDD) (UE) covering the essential requirements of article 3.2 of the R&TTE Directive

A.3 Council and European Parliament

1999/519/EC	-	Council Recommendation on the Limitation of Exposure of the General Public to Electromagnetic Fields

A.4 Institution of Gas Engineers and Managers publications

IGEM/GM/7	-	7A – Electrical connections for gas metering equipment 7B – Hazardous area classification for gas metering equipment

A.5 WELMEC

WELMEC	-	Software Guide 7.2 (Measuring Instruments Directive 2004/22/EC)

A.6 Reliability models

MIL-HDBK-217F	-	Military Handbook: Reliability Prediction of Electronic Equipment
Siemens-norm **SN 29500**	-	Failure rates of components, expected values (2004), based on IEC 61709

A.7 Acts of Parliament

The Disability Discrimination Act (DDA) 1995

A.8 Definitions

The definitions applying to this document are given below (see clause 3.1).

Description		Definition for the purposes of these Recommendations
Shall	-	Indicates a clause or requirement is mandatory, without deviation
Should	-	Indicates a clause or requirement is the preferred option. However, an alternative option may be offered if it can be shown that it offers the same, or enhanced, performance to that specified in the clause or requirement.
Alert	-	Collective term relating to the detection of events and the sending of warning messages relating to them. Events shall be due to: faults, tampers and exceptions
APN	-	Access Point Name. The name used to identify the type of service that is provided in the packet data connection in GPRS in the GSM mobile network.
Authorised Personnel		Any system or person who has been authorised by British Gas to carry out an activity on the metering system.
Back-up battery	-	Secondary source of electrical power, operating over the short term, for all component parts of the smart metering system. *Note: Although the term "battery" is used, there are other technologies that may also be suitable for this purpose; e.g., "super caps".*

Base conditions	-	Fixed conditions used to express the volume of gas independently of the measurement conditions. In the UK they are: T = 15°C P = 1013.25 mbar (absolute)
Block Tariff		A tariff structure that uses tier thresholds with different unit prices during a billing period.
BST	-	British Summer Time
Component (As in component of a smart metering system	-	). Main constituent parts that make up a smart metering system; e.g.: gas and electricity meters, communication hub, IHD.
CLI	-	Calling Line Identity
CMO	-	Commercial Meter Operator
CoP	-	Code of Practice
CPP		Critical Peak Pricing – an independent temporary price change for electricity supply during a time of peak demand.
CPS	-	Consumer Payment Scheme
CSA	-	Consumer service agent (e.g. at a call centre)
Consumer	-	End user of energy as supplied through a gas or electricity meter
Consumer's supply	-	In the case of gas: Gas as provided from the outlet of ECV into the consumer's premises via the smart gas meter. In the case of electricity: Electricity as provided from the outlet of the main service fuse into the consumer's premises via the smart electricity meter.
CV	-	Calorific Value (of gas)
DDoS	-	Distributed Denial of Service
e-Wallet		A container of money/funds held in the British Gas billing system (via head-end) for each customer (if appropriate). The e-Wallet can be topped up with additional funds when necessary.
ECV	-	Emergency Control Valve
EDGE	-	Enhanced Data for Global Communication
Emergency credit	-	One-off extension of the value at which the consumer would normally be interrupted. It is controlled from the head-end system

ESMA	-	European Smart Metering Alliance
ESP	-	Energy Services Portal
ETSI	-	European Telecommunications Standards Institute
Exception	-	Difference between data held within a component and that held within the head-end system; e.g. a meter records it is configured with software V0.9, but the head-end system records the meter as using V1.0
Fault	-	Failure within a component such as to compromise its performance. This may be minor; e.g. a temporary communications failure; or major e.g. a gas meter battery about to expire
FIFO	-	First In First Out
Firmware	-	Computer instructions and data that is stored in non-volatile memory and which cannot be changed during the normal operation of the component in which it resides. *Note: So called "firmware updates" may be regarded as an abnormal mode of operation that occurs infrequently.*
FIT		Feed in Tariff – an associated tariff based on the cost per unit of electricity that is exported (via the primary meter).
GMT	-	Greenwich Mean Time
GPRS	-	General Packet Radio Service
GSM	-	Global System for Mobile communications
HAN	-	Home Area Network
Head-end (system)	-	Office based system, including databases etc. that hold all meter and billing information, and software that can interact with the consumer's smart meter system
HHT		Hand Held Terminal
IHD	-	In-Home Display
IP (address)		Internet Protocol
Installer	-	Person or persons who physically installs, configures, commissions or repairs equipment, as appropriate, in a consumer's premises *Note: This may also include persons remote from the site involved with sending configuration data over the air.*
J	-	Joule

JTAG	-	Joint Test Action Group *Note: This is the common name used for the IEEE Standard IEEE 1149.1 used to define test ports/terminals used for testing printed circuit boards.*
kg	-	Kilogram
kV	-	Kilovolt
kW	-	Kilowatt
LF	-	Low Frequency
M2M	-	Machine to Machine
MAC (address)	-	Media Access Control
Main battery	-	Primary source of long term electrical power in a battery powered component of the smart metering system; e.g. the gas meter.
MAM	-	Meter Asset Manager
Module	-	Sub assembly of a component that may be capable of on-site exchange; e.g. a comms module
Modulus (of a number)		Absolute value without regard to sign
MO(P)	-	Meter Operator
MPAN	-	Meter Point Administration Number
MPRN	-	Meter Point Reference Number
MPE	-	Maximum Permissible Error. Modulus of extreme values of an error permitted by specifications, regulations etc. for a given measuring instrument
MTBF	-	Mean Time Between Failures
Notified Body	-	Organisation that has been nominated by a member state and Notified by the European Commission. A Notified Body will be nominated based on designated requirements, such as knowledge, experience, independence and resources to conduct conformity assessments (to European Standards) of components.
NMO	-	National Measurement Office (formerly National Weights and Measures Laboratory)
P	-	Pressure (of gas)

Pairing	-	Means by which the local components of a smart metering system agree to communicate with each other and establish a connection. Typically this is achieved by exchanging a passkey between the components. The passkey is a code shared by the components, which proves that they have agreed to pair with one other. Other components that may attempt interfering communications are prevented from so doing because they will not have the passkey and thus cannot pair.
PAYG	-	Pay As You Go. Variation of pre-payment/PAYG but possibly having different rules applied to the interruption and restoration of the supply. In the case of gas, CV and a PTZ conversion factor is taken into consideration.
PIN	-	Personal Identification Number
PLC	-	Power Line Carrier
P_{max}	-	Maximum working pressure
Pre-payment/PAYG	-	System whereby a consumer pays for energy before it is supplied. Rules are applied to the interruption and restoration of the supply. In the case of gas, CV and a PTZ conversion factor is taken into consideration.
Pressure absorption	-	The difference between the pressures measured at the inlet and outlet connections of a gas meter whilst the meter is operating.
PRNG		Pseudo Random Number Generator
Protective class II	-	EN 62052−11:2003 defines this as: “meter with a case of insulating material in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions”.
PTZ conversion	-	Means by which the volume increments measured by a gas meter at a set of conditions of P, T and Z are converted to volume increments as if it were operating at base conditions.
Q_{max}	-	The maximum flowrate: the highest flowrate at which a gas meter provides indications that satisfy the requirements regarding MPE
Q_{min}	-	The minimum flowrate: the lowest flowrate at which a gas meter provides indications that satisfy the requirements regarding MPE
RAM	-	Random Access Memory
Re-pairing	-	Following the loss of communications between components (e.g. due to a fault), the automatic re-establishment of pairing.

Rate	-	A means of charging differing amounts for energy consumed, based on the time of day the consumption occurred (i.e. units consumed between midnight and 05:59:59 to be charged at x pence, units consumed between 06:00:00 to 23:59:59 charged at y pence).
Remote communication		Communication (two way) from a Head-end system to a smart metering system, and from the metering system to the Head-end system.
SED	-	Supply end date
SEP		Smart Energy Profile (Zigbee) requirement document
SIM	-	Subscriber Identity Module
Smart Meter Variant Code	-	A means to identify components that are a variation from a standard system; e.g.: a semi-concealed gas meter; a polyphase domestic electricity meter; an electricity meter having a contactor for an additional circuit etc.
SMS	-	Short Message Service
SSD	-	Supply start date
T	-	Temperature
Tariff	-	A table of fixed prices (for amount of energy consumed by a consumer) that is made up of various rates and tiers.
Tamper	-	The detection of deliberate interference with a component; e.g. connecting a meter in reverse
Tier	-	A means of charging differing amounts for energy consumed, based on the quantity of energy consumed (i.e. the first 100 units to be charged at x pence, the next 500 units to be charged at y pence).
ToU	-	Time of Use
Vend Code	-	Encrypted numeric code used to transfer a payment to meter. *Note: This can be transferred remotely or entered locally to the metering system. Normally contains the monetary value plus any unique identifiers required by the meter to ensure individuality.*
War-dialling/war-driving	-	Technique of automatically scanning for telephone numbers (dialling) to search for computers or searching for wireless networks from a moving vehicle. Unprotected equipment can then be hacked.
WAN	-	Wide Area Network
WELMEC	-	Western European Legal Metrology Cooperation: an organisation of legal metrologists.
Z	-	Compressibility. Value that expresses the variation of real gas properties from the ideal gas law. For meters operating on a typical gas supply pressure of 21 mbar, this value is taken to be 1.

APPENDIX B DETAILED LIST OF EVENTS

B.1 Commissioning

B.1.1 Power up – Indicates that the component is powered again after a complete power down.

B.1.2 Event log cleared – Indicates that the event log was cleared. This is always the first entry in an event log. It is only stored in the affected event log. Date and time stamp – only activated by authorised personnel

B.2 Operation

B.2.1 Manual disconnection - Indicates that the disconnector has been manually disconnected.

B.2.2 Manual connection - Indicates that the disconnector has been manually connected.

B.2.3 Remote disconnection - Indicates that the disconnector has been remotely disconnected.

B.2.4 Local disconnection - Indicates that the disconnector has been locally disconnected (i.e. via the limiter).

B.2.5 Limiter threshold exceeded - Indicates that the limiter threshold has been exceeded.

B.2.6 Limiter threshold ok - Indicates that the monitored value of the limiter dropped below the threshold.

B.2.7 Limiter threshold changed - Indicates that the limiter threshold has been changed.

B.2.8 Valve alarm - Indicates that a valve alarm has been registered.

B.2.9 Maximum demand value exceeded – indicates that the maximum demand value has been exceeded.

B.2.10 Under-voltage – an under-voltage was detected.

B.2.11 Over-voltage – an over-voltage was detected.

B.2.12 Voltage normal – indicates voltage normal again e.g. after an over-voltage.

B.2.13 Profile cleared – indicates one or more profiles were cleared.

B.3 Software/firmware

B.3.1 Firmware ready for activation - Indicates that the new firmware has been successfully downloaded and verified, i.e. it is ready for activation.

B.3.2 Firmware activated - Indicates that a new firmware has been activated.

B.3.3 Patch failure - Patch cannot be executed.

B.4 Tariffs and billing

B.4.1 ToU activated - Indicates that the passive ToU has been activated.

B.4.2 8x8 tariff activated.

B.4.3 Single rate tariff activated.

B.4.4 Asynchronous billing period reset – An asynchronous billing period reset has occurred, i.e. manual billing reset or billing reset via command.

B.4.5 Synchronous billing period reset - An internal scheduled billing reset occurred

B.5 Faults and errors

B.5.1 Replace Battery - Indicates that the battery shall be exchanged due to the expected end of life time.

B.5.2 10% Battery life remaining.

B.5.3 Last Gasp – battery failure.

B.5.4 Battery voltage low - Indicates that the battery voltage is low.

B.5.5 Program memory error - Indicates a physical or a logical error in the program memory.

B.5.6 RAM error – Indicates a physical or a logical error in the RAM.

B.5.7 NV memory error – Indicates a physical error in the non volatile memory.

B.5.8 Measurement system error - Indicates a logical or physical error in the measurement system.

B.5.9 Communication error - Indicates a communication problem when reading the meter.

B.5.10 Communication ok - Indicates that the communication with the meter is ok again.

B.5.11 Error register cleared – Indicates that the error register was cleared. – as above (error register has been cleared) all flags cleared.

B.5.12 Alarm register cleared – Indicates that the alarm register was cleared.

B.5.13 Watchdog error – Indicates a watch dog reset or a hardware reset of the microcontroller.

B.5.14 Disconnector failure – Indicates the DCU failure to (1) drive charged enough in 5s or (2) current flow was detected although the DCU should have disconnected the premises.

B.5.15 Current with no voltage – Indicates that current is flowing where no voltage is applied. Usually indicates fraud.

B.5.16 Incorrect polarity – Indicates wrong mains connection. Usually indicates fraud or wrong installation.

B.5.17 Measurement SW changed – On command calculated flying checksum over the measurement firmware is not equal to the stored checksum. Usually indicates fraud, i.e. measurement part of the firmware has been tampered.

B.6 Tampers

B.6.1 Terminal cover removed - Indicates that the terminal cover has been removed.

B.6.2 Terminal cover closed - Indicates that the terminal cover has been closed.

B.6.3 Strong DC field detected - Indicates that a strong magnetic DC field has been detected.

B.6.4 No strong DC field anymore - Indicates that the strong magnetic DC field has disappeared.

B.6.5 Meter cover removed - Indicates that the meter cover has been removed.

B.6.6 Meter cover closed - Indicates that the meter cover has been closed.

B.6.7 'n' times wrong password - Indicates that a user tried to gain access with a wrong password (intrusion detection).

B.6.8 Fraud attempt – indicates a fraud attempt has been attempted.

B.7 Communications

B.7.1 Communication error HAN - Indicates a communication problem with the paired IHU or any other home area components.

B.7.2 Communication ok HAN - Indicates that the communication with the paired IHU or any other home area components is ok again.

B.7.3 Communication error Remote Com - Indicates a communication problem with the backhaul office (GSM/GPRS or PLC).

B.7.4 Communication ok Remote Com - Indicates that the communication with the backhaul office is ok again.

B.8 Clock

B.8.1 Daylight saving time enabled - Indicates the regular change from and to daylight saving time. The time stamp shows the time before the change. This event is not set in case of manual clock changes and in case of power failures.

B.8.2 Daylight saving time disabled - Indicates the regular change from and to daylight saving time. The time stamp shows the time before the change. This event is not set in case of manual clock changes and in case of power failures.

B.8.3 Clock adjusted (old date/time) - Indicates that the clock has been adjusted. The date/time that is stored in the event log is the old date/time before adjusting the clock.

B.8.4 Clock adjusted (new date/time) - Indicates that the clock has been adjusted. The date/time that is stored in the event log is the new date/time after adjusting the clock.

B.8.5 Clock invalid - Indicates that clock may be invalid, i.e. if the power reserve of the clock has exhausted. It is set at power up.

B.9 Decommissioning

B.9.1 Power down - Indicates a complete power down of the component. Please note that this is related to the component and not necessarily to the network.

B.10 Discount

B.10.1 Discount applied – indicates that a discount has been applied successfully to the consumer's meter.

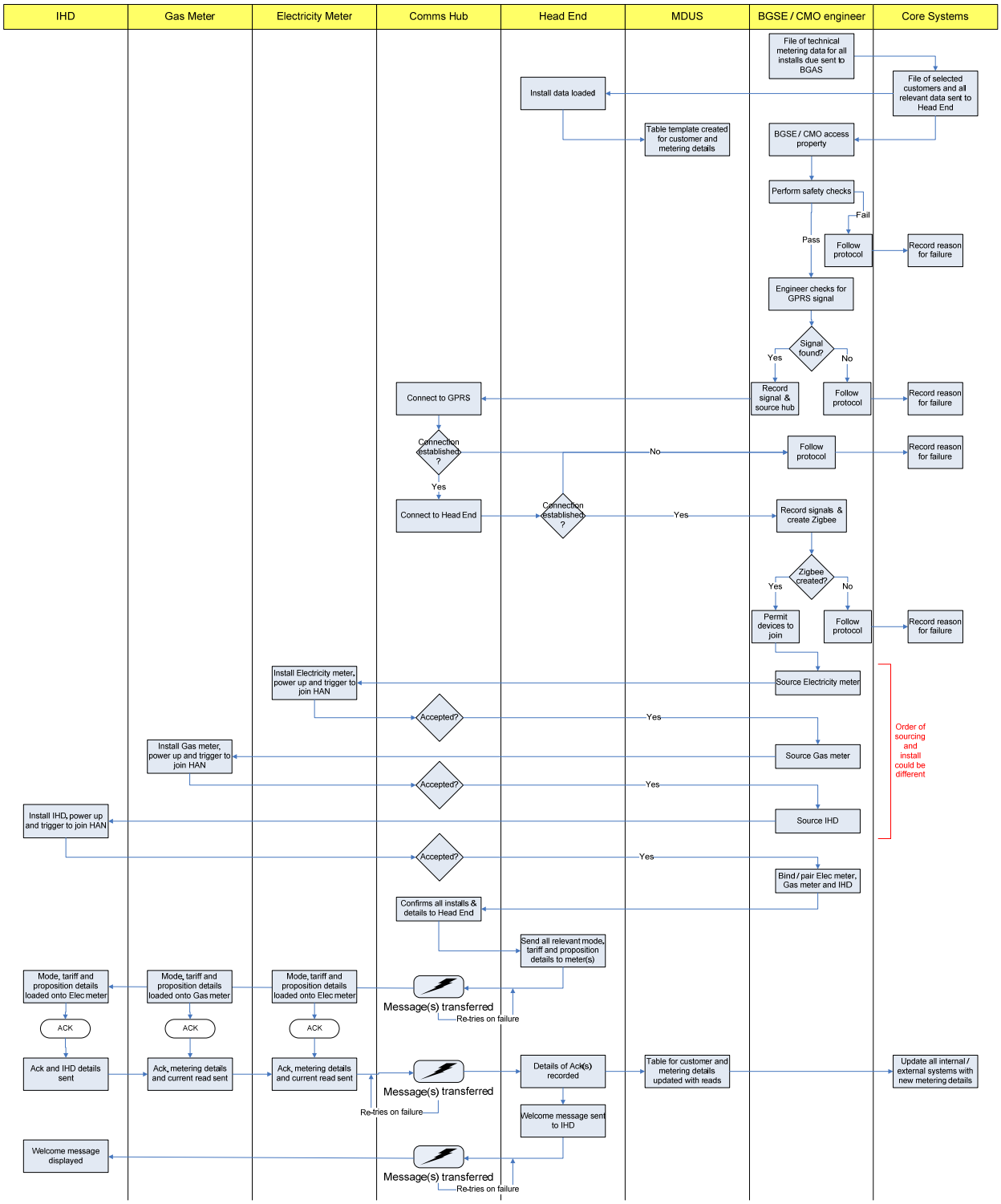
B.11 DNO – data

B.11.1 Power factor below threshold – Indicates power factor has fallen under the set threshold for a period longer than the delay time.

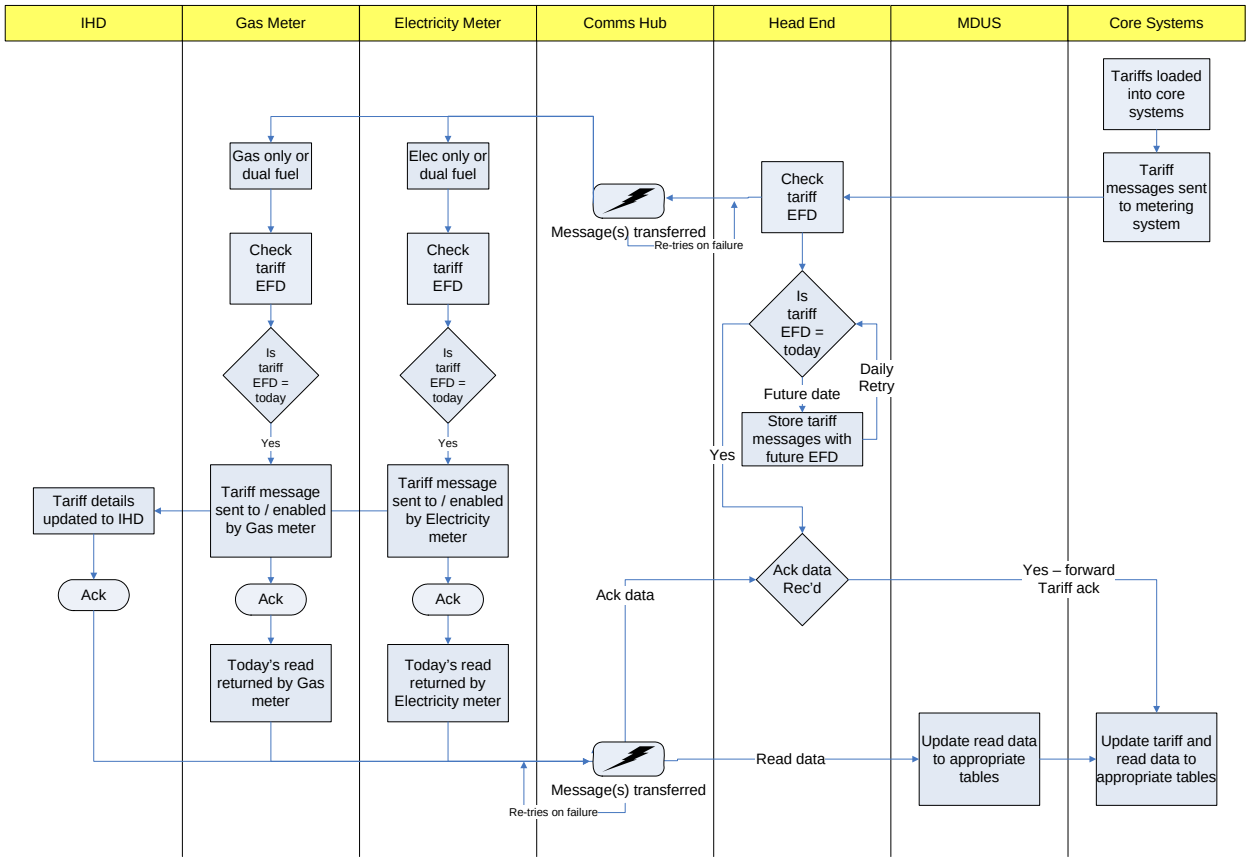
B.11.2 Power factor above threshold again - Indicates power factor is again (after being under) over the set threshold for a period longer than the delay time.

APPENDIX C PROCESS FLOW DIAGRAMS

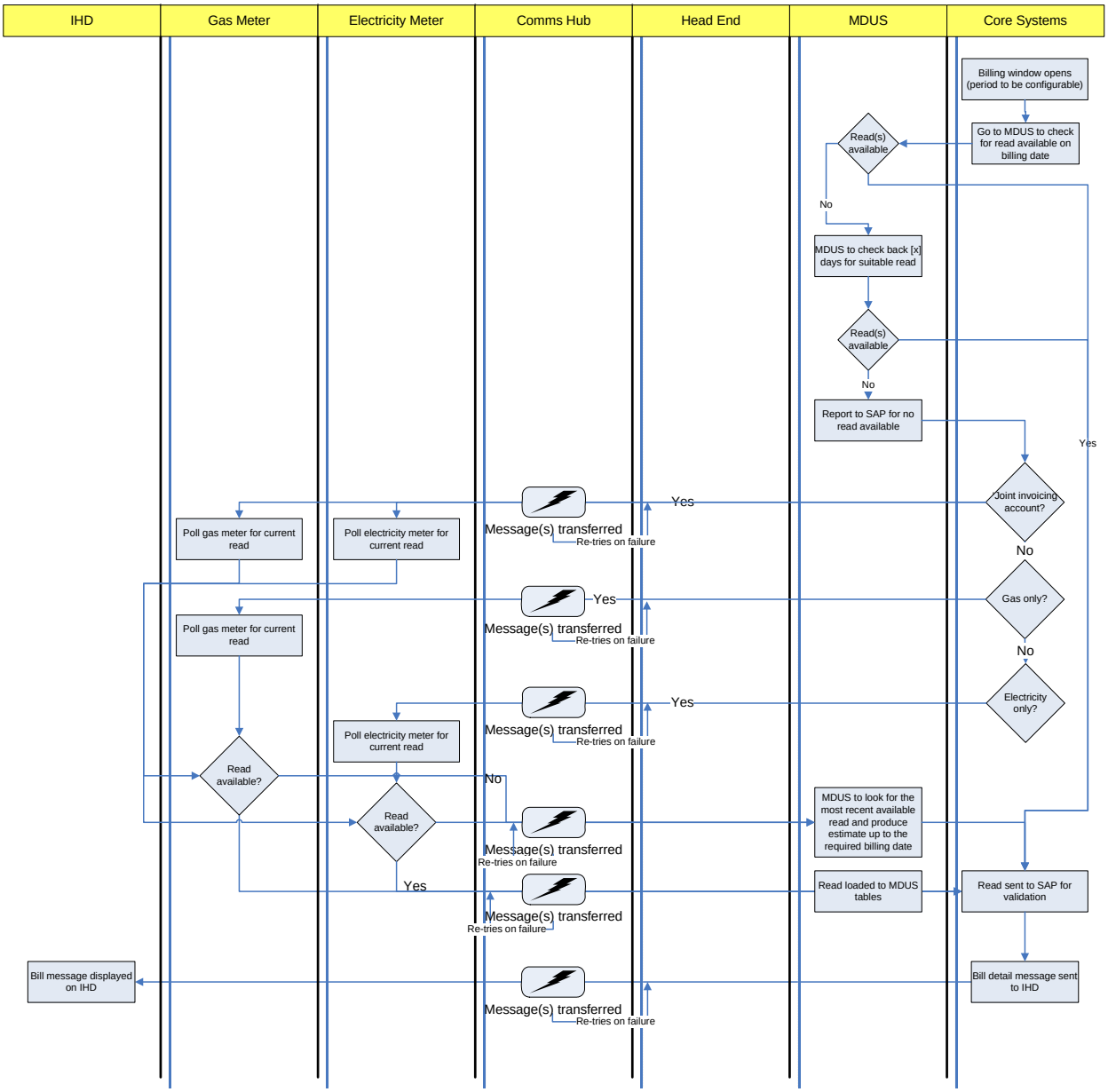
C.1 Installation & Commissioning Process Map



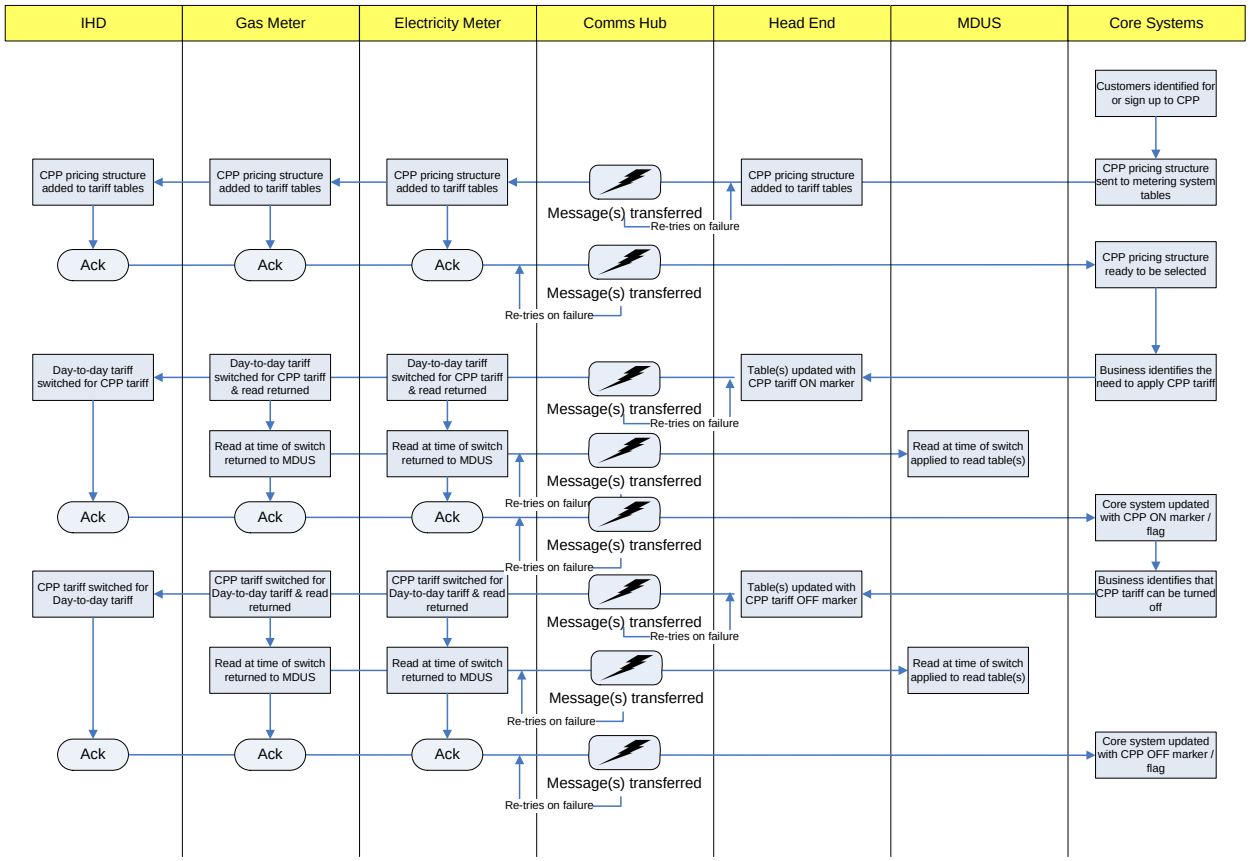
C.2 Update Tariff/Rate Process Map



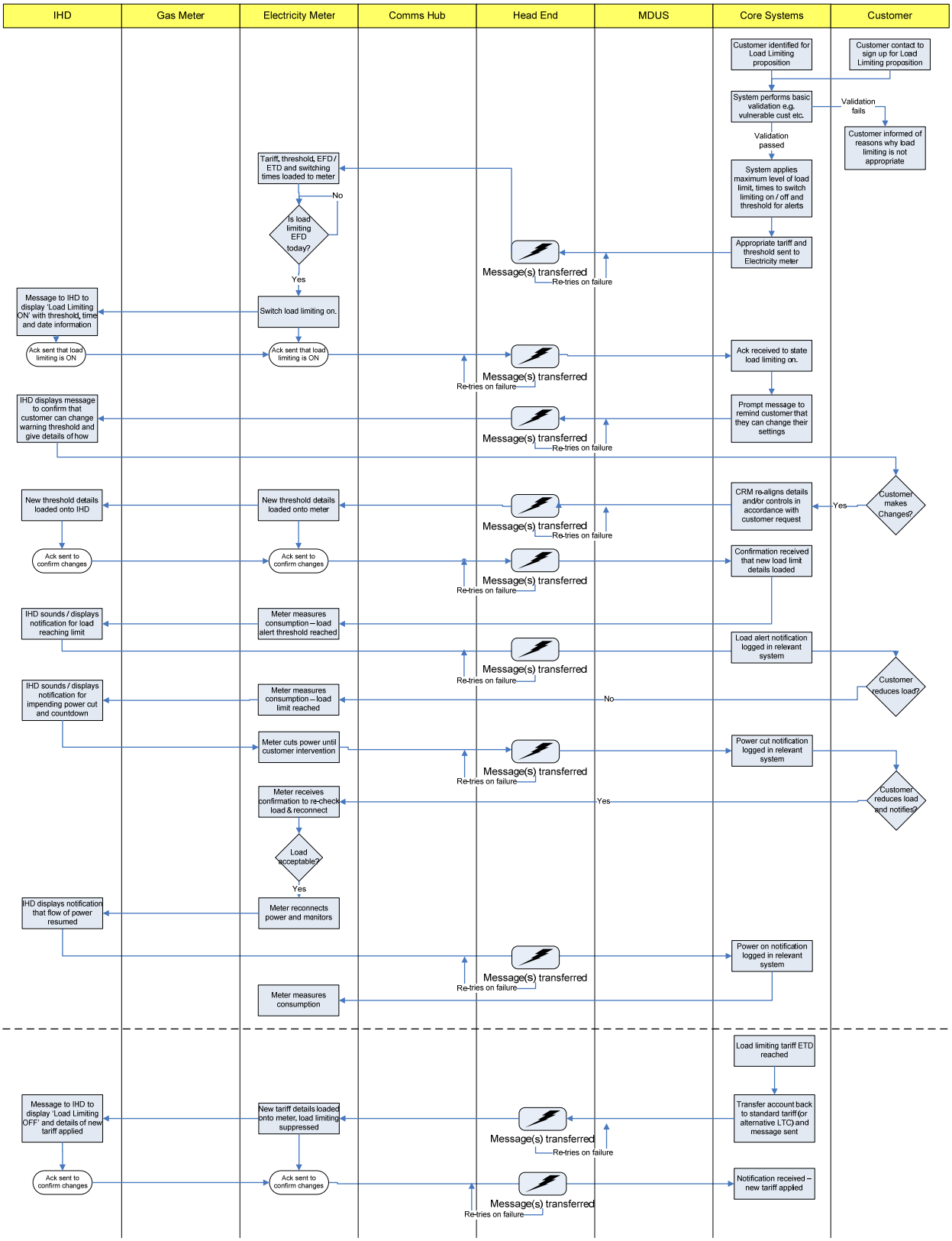
C.3 Billing Process Map



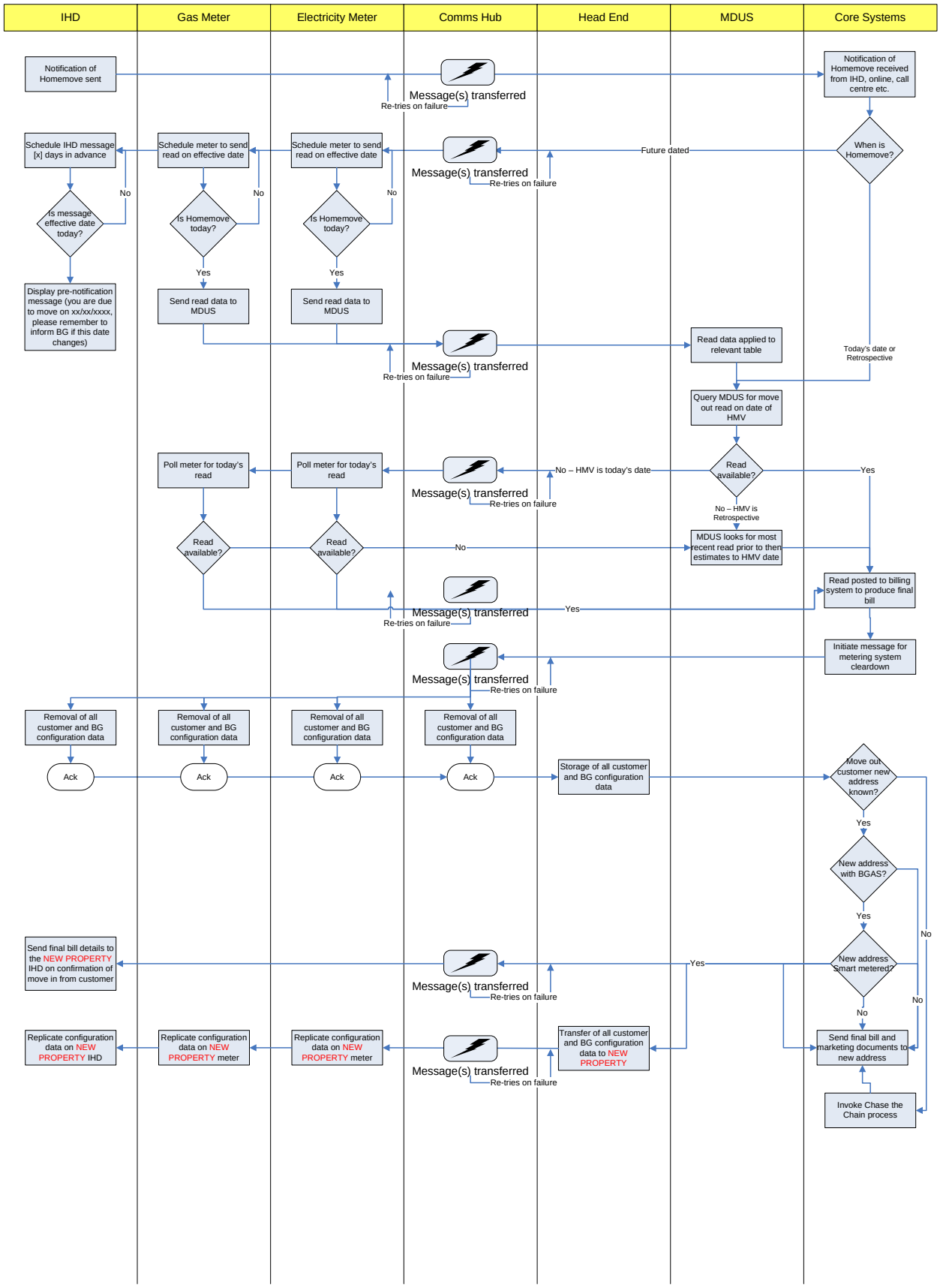
C.4 Critical Peak Pricing Process Map



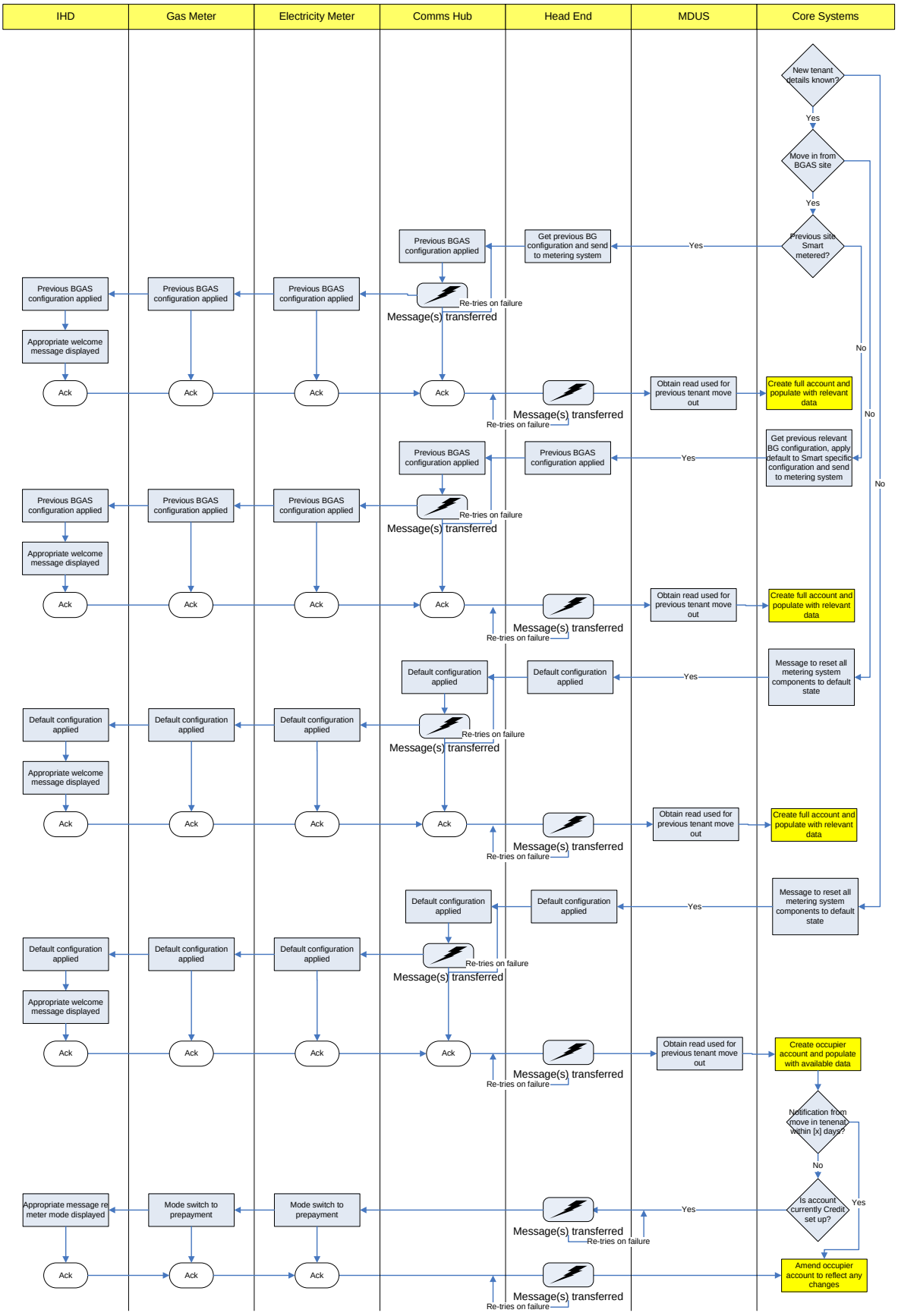
C.5 Load Limiting Process Map



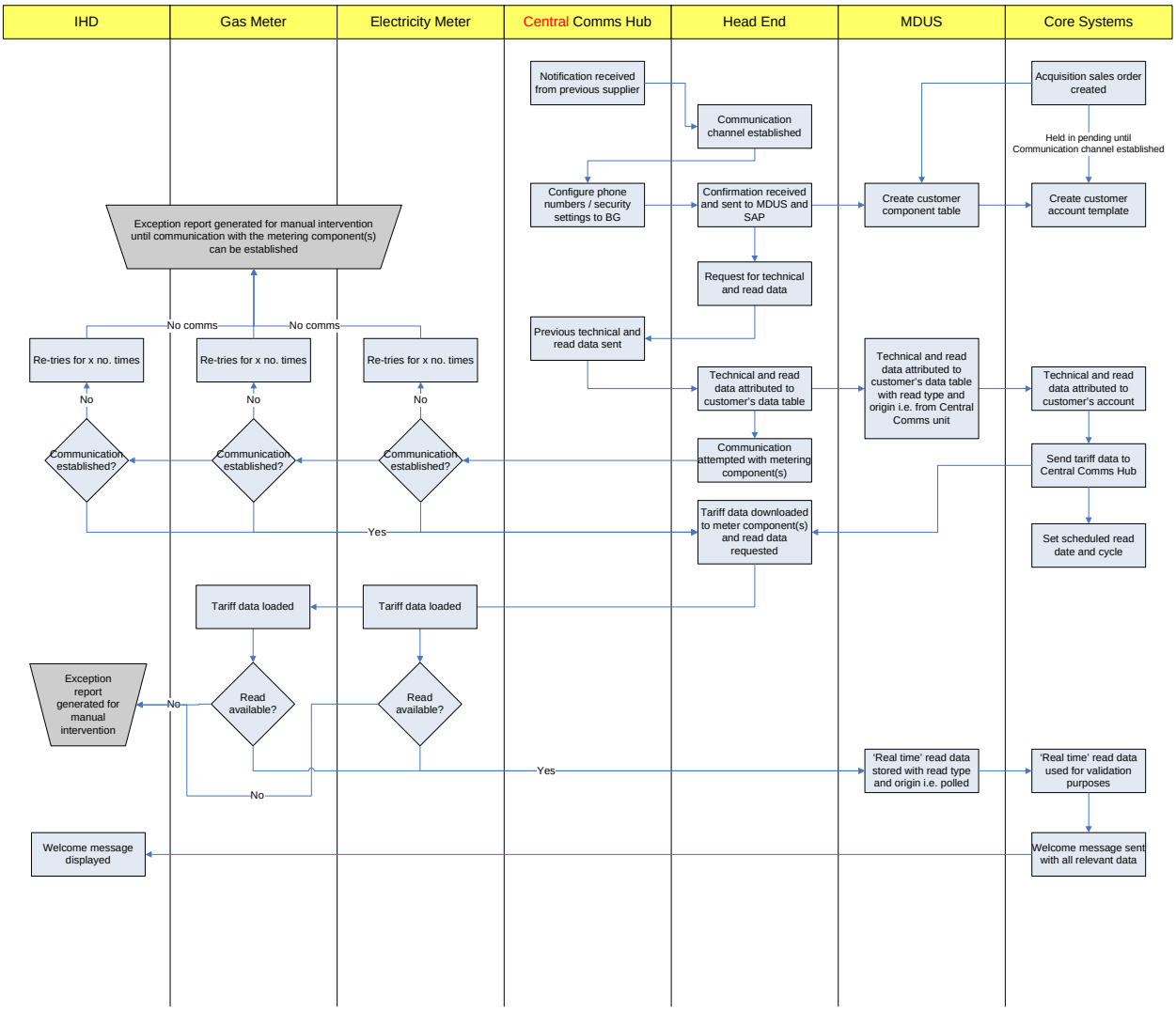
C.6 Homemove: Move out



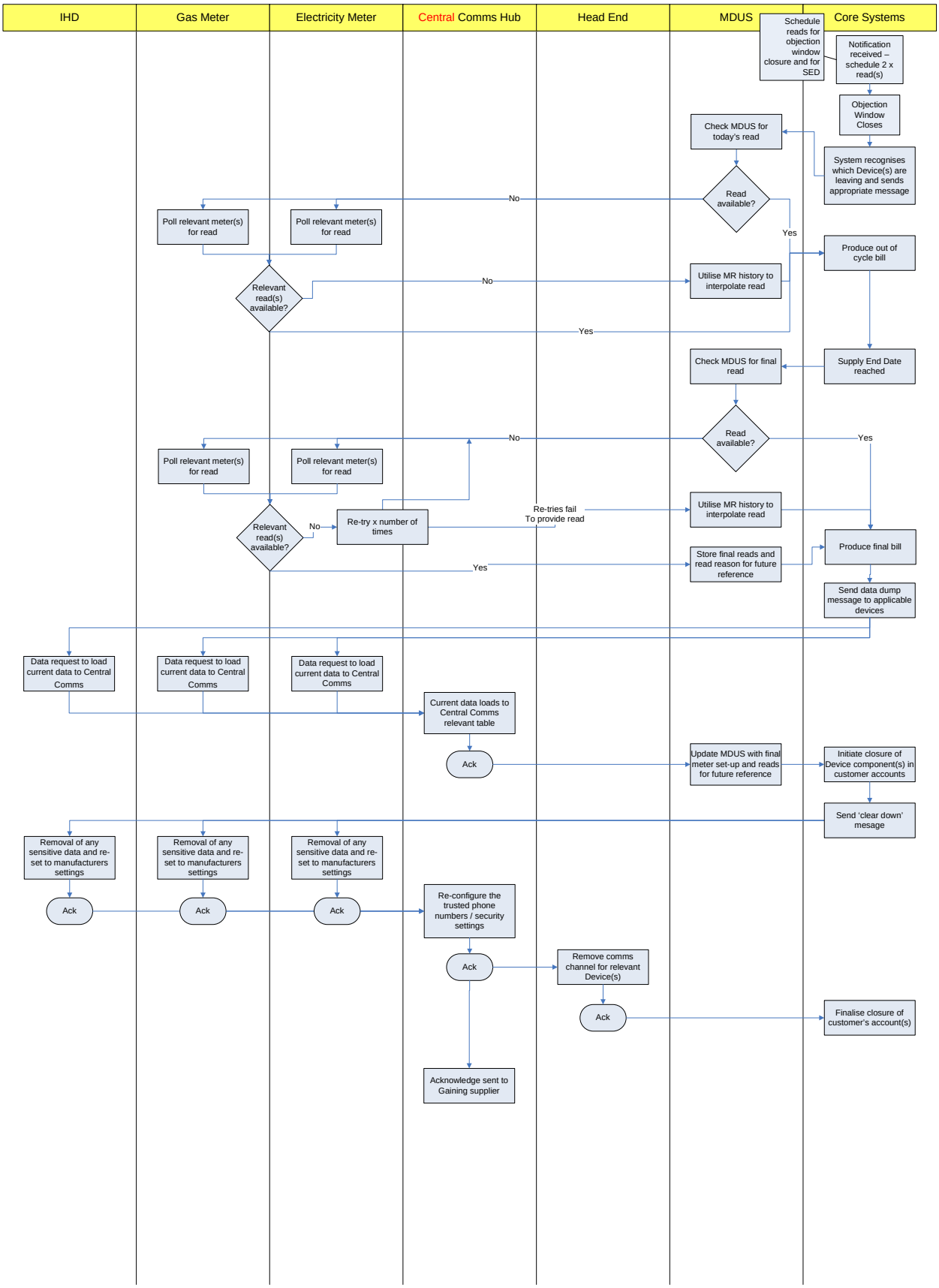
C.7 Homemove: Move in



C.8 Join


IHD
Gas Meter
Electricity Meter
Central Comms Hub
Head End
MDUS
Core Systems
Notification received from previous supplier
Communication channel established
Acquisition sales order created
Held in pending until Communication channel established
Configure phone numbers / security settings to BG
Confirmation received and sent to MDUS and SAP
Create customer component table
Create customer account template
Exception report generated for manual intervention until communication with the metering component(s) can be established
Request for technical and read data
No comms
No comms
Previous technical and read data sent
Re-tries for x no. times
Re-tries for x no. times
Re-tries for x no. times
Technical and read data attributed to customer's data table with read type and origin i.e. from Central Comms unit
Technical and read data attributed to customer's account
No
No
No
Technical and read data attributed to customer's data table
Communication established?
Communication established?
Communication established?
Communication attempted with metering component(s)
Send tariff data to Central Comms Hub
Yes
Tariff data downloaded to meter component(s) and read data requested
Set scheduled read date and cycle
Tariff data loaded
Tariff data loaded
Exception report generated for manual intervention
Read available?
Read available?
No
Yes
'Real time' read data stored with read type and origin i.e. polled
'Real time' read data used for validation purposes
No
Welcome message displayed
Welcome message sent with all relevant data

C.9 Leave


IHD
Gas Meter
Electricity Meter
Central Comms Hub
Head End
MDUS
Core Systems
Schedule reads for objection window closure and for SED
Notification received – schedule 2 x read(s)
Objection Window Closes
Check MDUS for today's read
System recognises which Device(s) are leaving and sends appropriate message
Read available?
No
Yes
Poll relevant meter(s) for read
Poll relevant meter(s) for read
Produce out of cycle bill
Relevant read(s) available?
No
Utilise MR history to interpolate read
Yes
Check MDUS for final read
Supply End Date reached
Read available?
No
Yes
Poll relevant meter(s) for read
Poll relevant meter(s) for read
Re-tries fail
To provide read
Utilise MR history to interpolate read
Relevant read(s) available?
No
Re-try x number of times
Produce final bill
Store final reads and read reason for future reference
Yes
Send data dump message to applicable devices
Data request to load current data to Central Comms
Data request to load current data to Central Comms
Data request to load current data to Central Comms
Current data loads to Central Comms relevant table
Ack
Update MDUS with final meter set-up and reads for future reference
Initiate closure of Device component(s) in customer accounts
Send 'clear down' mesage
Removal of any sensitive data and re-set to manufacturers settings
Removal of any sensitive data and re-set to manufacturers settings
Removal of any sensitive data and re-set to manufacturers settings
Ack
Ack
Ack
Re-configure the trusted phone numbers / security settings
Ack
Remove comms channel for relevant Device(s)
Ack
Finalise closure of customer's account(s)
Acknowledge sent to Gaining supplier

APPENDIX D SECURITY OF THE HAND HELD TERMINAL (HHT)

The main body of the document includes the possibility of using an Hand Held Terminal (HHT) to facilitate the commissioning process. The following requirements to ensure the security of the HHT and thus the commissioning process and the smart metering system have been captured during the course of the Phase 3 meter specification and are included below for completeness and subsequent hand-over to the BGSE team to deliver:

D.1 Security of Hand Held Terminal (HHT)

D.1.1 The installation and commissioning of a smart metering system shall require the use of HHT as described in section 20.3. Such equipment shall be made secure to avoid its use by unauthorised personnel.

D.1.2 Prior to use, the smart metering system shall employ a mechanism whereby the HHT shall be verified and failing such verification, the HHT shall not be capable of interacting with the smart metering system.

D.1.3 The HHT shall be authorised for use for limited periods, after which it shall cease to function unless revalidated by authorised personnel in conjunction with re-synchronisation with the head-end system. The duration of the limited time period shall be with the written agreement of British Gas.

D.1.4 Revalidation and re-synchronisation shall be possible at any time, the following of which shall allow the HHT to function for the full term of the limited time period as described in clause D.1.3.

D.1.5 It shall be possible to disable the HHT remotely.

D.1.6 The interface between the comms hub and the hand-held terminal is to be confirmed

D.1.7 Any data held on the HHT shall be retained in the event of any battery failure or removal. This data shall be retained for a minimum of six months.

D.1.8 Before any data is extracted from the smart metering system where such an extraction will mean the permanent loss of data, the HHT shall check it has sufficient memory capacity to accommodate all the transferred data. If such capacity is not available, the transfer shall not begin and a warning message shall be displayed.

D.1.9 The HHT shall incorporate a mechanism to ensure that, before any changes are made to the smart metering system, the head-end system, the HHT and smart meter system are in synchronisation.

Note: This mechanism will ensure that a meter worker will not accidentally alter a meter that is different from the one expected by the head-end system. Such cross-checking may be by comparison of the serial numbers described in clause 6.3.2, MAC addresses, MPRN etc. This will also include supplier codes to avoid the accidental decommissioning of meters not belonging to British Gas.

D.2 Handheld Terminal - Engineer codes, Usernames and Passwords

D.2.1 Access to the metering system and configuration should be controlled by the use of a unique engineer code.

D.2.2 Additionally, there should be roles and profiles to enforce the rights, permissions and abilities of the user to conduct specific activities i.e. a profile to:

1) read data

2) change the configuration of the metering system

APPENDIX E PASSWORDS

F.1 Component and Privileged Access Codes/Passwords

b) Passwords should be changed every 60 days where they are for the execution of privileged actions e.g. required for the local (and remote) configuration of smart metering components.

c) It should be unique across all components.

d) Passwords must be kept confidential and distributed securely to only those that have a need to know, for the period required to complete the job e.g. when an engineer installs a meter set.

e) Passwords must be changed whenever there is a possibility of disclosure.

f) Passwords must have a minimum length of 10 lowercase and uppercase alpha and numeric characters - at least two of which must be non-consecutive numbers.

g) Passwords must not be based on:

1) Dictionary words, or other real names.

2) Dates or any aspect of the calendar.

3) Family names or initials.

4) Vehicle registration numbers.

5) Serial meter numbers or other hardware serial numbers.

6) Company names or associated references.

7) Telephone numbers.

8) User ID, group ID or codes associated with the system.

9) More than two consecutive identical characters.

10) All-numeric or all-alphabetic sequences.

F.2 Frequency of password and key change:

h) Keys and passwords will need to be changed more frequently on identification of any weakness, or compromise in the authentication and encryption mechanism protecting the components and application layer.

i) The frequency of key change will need to be increased on identification of a vulnerability/weakness in the cryptographic protection. The frequency of change shall be based on its ability to provide interim protection, whilst the vulnerability is addressed in the cryptographic suite/libraries.

ENDNOTES

History

First published as	Release Date
Working draft	March 2009
Split to five documents	Sept 2009
Amended version	15 October 2009
Final Version	29 March 2010

Key changes

Section	Amendments
	New document

Comments

Comments and queries regarding the technical content of this product requirement document should be directed to:

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