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**PRODUCT REQUIREMENTS FOR
SMART METERING SYSTEMS
PART 2: GAS METERS**

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PRODUCT REQUIREMENTS FOR SMART METERING SYSTEMS - PART 2: GAS METERS

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 for gas meters within a smart metering system.

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

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

This document shall be read in conjunction with Part 1: General System Architecture, and should be read in conjunction with all other documents in this series.

1. SCOPE

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

- a) A smart gas meter with a flow capacity not exceeding 6m³/hr;
- b) Gas consumption data capture, transmission, retention, display and query;
- c) Reception and utilisation of external data and commands.

2. REFERENCES

2.1 This suite of documents makes references to the documents listed in Appendix A of Part 1: General System Architecture. Unless otherwise specified, the latest edition of the documents applies, including all amendments.

3. DEFINITIONS

3.1 The requirements and definitions applying to this document are listed in Appendix B of Part 1: General System Architecture.

4. BRITISH LEGISLATION AND STANDARDS

4.1 Legislation

4.1.1 Gas meters shall be stamped under The Gas Act 1986. Before 30 October 2006 the following secondary legislation/regulations, supporting The Gas Act, set out the metrology requirements:

- a) The Gas (Meters) Regulations 1983 (SI 684:1983) - for meters applicable to national requirements; and

- b) The Measuring Instruments (EEC Requirements) Regulations 1988 (SI 186:1988) - for meters applicable to European requirements.

Following implementation of the European Measuring Instruments Directive (MID), on 30th October 2006, modified requirements are now in place. The Measuring Instruments (Gas Meters) Regulations 2006 (SI 2647:2006) implements MID in Great Britain. Under the SI 2647:2006 all new meter designs (and subsequent production of that type) are required to be conformity assessed by a notified body, designated by an EU Member state, to ensure it meets the requirements of MID. All meters conforming to MID shall bear the “M” and “CE” markings plus the identification number of the notified body that dealt with the conformity assessment.

Where a gas meter is put into use in accordance with SI 2647:2006, and bears the appropriate markings, it is then deemed to be stamped and therefore compliant with The Gas Act 1986.

Note: Also see clause 9.4.2.

- 4.1.2 The manufacture shall provide written proof from a Notified Body, acceptable to Ofgem/NMO, of the meter conforming to the requirements of the MID..

- 4.1.3 Gas meters shall, at least, meet the accuracy requirements “Class 1,5” as defined in the MID.

4.2 Standards

- 4.2.1 Gas meters shall meet the requirements of BS EN 1359:1999 + A1 2006 or BS EN 14236 as appropriate.

- 4.2.2 Gas meters shall also include, and meet the requirements of, the following optional features from the standards described in clause 4.2.1:

- a) Pressure measuring point on the outlet boss of the meter as described in clause 6.5.1 of BS EN 1359 and clause 7.1.1 of BS EN 14236;
- b) Insulating feet (where appropriate to protect the meter from electrical contact with extraneous conducting surfaces) as described in clause 6.5.2 of BS EN 1359;
- c) Magnetic index drive (if appropriate) as described in clause 6.5.3 of BS EN 1359;
- d) Resistance to high ambient temperatures as described in clause 6.5.5 of BS EN 1359 and clause 7.2.1 of BS EN 14236.

- 4.2.3 Gas meter bosses shall have threads conforming to BS 746.

- 4.2.4 Gas meters shall be constructed to meet the dimensional requirements as specified in BS 6400-1 and have the distance between meter boss connection centres of 152.4 mm.

- 4.2.5 All tests specified in this product requirements document and the appropriate standards described in clause 4.2.1, shall be carried out with the shut-off mechanism as described in section 9.5.7 assembled within the meter.

5. SAFETY

5.1 General requirements

- 5.1.1 Where a consumer’s gas supply 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 9.5.7; they are referred to as “shut-off” mechanisms throughout this document.

Note 2: Failure of the shut-off mechanism itself may cause a restoration but this risk may be minimised with appropriate precautions.

- 5.1.2 Gas meters shall not be capable of restoring consumer's supply following an interruption by the meter without the local intervention of the consumer; see section 9.5.7.
- 5.1.3 Where a loss of supply has occurred for reasons outside of the control of the gas 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 **Intrinsic safety requirements**
- 5.2.1 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.

6. GENERAL REQUIREMENTS

- 6.1 The gas meter shall measure, record and totalise the volume of 2nd family gas as defined in BS EN 437, passed in cubic metres (m³), at metering conditions. The gas meter shall be constructed in a manner so as to prevent foreign matter present in the gas network from interfering with the normal operation of the meter.
- 6.2 The meter's capacity shall be 6 m³/h at a nominal pressure of 21 mbar.
- 6.3 Diaphragm meters shall utilise a measuring can of at least 1.2 litres.
- 6.4 The gas meter shall support interruption of the gas supply using an internal shut-off mechanism; see section 9.5.7. This shut-off may occur in various circumstances including switching modes (see Part 1: General System Architecture: Mode of Operation) and during pre-payment/PAYG operations (see Part 1: General System Architecture: Installation, Commissioning and Decommissioning).
- 6.5 The total pressure absorption of a gas meter, including the shut-off mechanism and any other device that may impede gas flow, shall not exceed 2 mbar when the meter and additional devices are passing air at 6 m³/h.
- 6.6 The gas meter and any additional modules that may be mounted on the meter shall meet the installation requirements of BS 6400 and be compatible with typical housings found in the UK including surface mount, semi-concealed and built in meter boxes. The accommodation of the meter and any additional modules with which the meter is directly associated, shall not require major changes or extensions to the meter box.

Note: for further information on meter housings see BS 8499.

6.7 Labels

- 6.7.1 In addition to the labelling information as described in Part 1: General System Architecture, gas meter labels shall also be provided that give the following information:
- a) Smart Meter Variant Code;
 - b) Unit of Measurement;
 - c) Q_{max} ;
 - d) P_{max} ;
 - e) Pulse Value;

- f) Instructions describing the correct procedure for restoring the supply; e.g. including information to ensure appliances are turned off etc.
- g) Gas emergency procedure (i.e. in the event of leaks and giving the emergency service telephone number 0800 111 999).

6.8 **Colour**

- 6.9 The colour of gas meter cases should be neutral; e.g.: white, cream, light grey etc. and be with the written agreement of British Gas.

7. **ENVIRONMENT**

- 7.1 This section imposes additional requirements to those described in Part 1: General System Architecture: Environment.

7.2 **Temperature and humidity**

- 7.2.1 Gas meters, shall be suitable for use over the ambient temperature range -25 °C and +55 °C (assuming dry gas) and relative air humidity between 30% and 100% condensing with a gas temperature range of 40 K.

7.3 **Ingress protection**

- 7.3.1 Gas meters shall be so constructed such that the collection of water is prevented and should provide the degree of protection equivalent to, as a minimum, IP55 in accordance with BS EN 60529.

Note: Lower IP ratings may be used in conjunction with additional means of avoiding the build up of water or condensation within the gas meter. These methods are to be with the written agreement of British Gas.

8. BATTERIES

8.1 Main batteries

- 8.1.1 Main batteries within gas meters and any additional modules used for pre-payment/PAYG functionality and/or communications should have an in-service life of at least ten years use in pre-payment/PAYG mode.
- 8.1.2 The manufacturer shall identify and produce a list of all meter functionalities and their associated power requirements together with the internal discharge characteristics of the battery to determine battery life time. This information shall be made available to British Gas.
- 8.1.3 As the battery approaches the end of its life, the gas meter shall respond by following a set of configurable rules; e.g.:
- a) When a configurable period of remaining main battery lifetime is breached, the gas meter shall generate a “low battery” alert;
 - b) When a second configurable period of remaining main battery lifetime is breached the gas meter shall, subject to configuration, generate a “battery fail” alert and, subject to configuration, close the shut-off mechanism;
 - c) When the battery fail alert has been triggered, battery life shall be prioritised as follows:
 - 1) Safety;
 - 2) Metrology;
 - 3) Data-logging;
 - 4) Communications;
 - 5) Valve operation.

Note 1: Also see Part 1: General System Architecture: Events, Exceptions, Alerts, Faults and Tamperers.

Note 2: Operation of the shut-off mechanism may be inhibited in some cases; e.g. vulnerable consumers.
 - d) Upon battery failure the meter shall send a ‘last gasp’ alert to Head End Systems.
- 8.1.4 Removal of the main battery in a gas meter shall cause the shut-off mechanism to close, unless locally overridden by authorised personnel, using an appropriate password.
- 8.1.5 All batteries used in the smart meter system shall be leak resistant to BS EN 60086-1, BS EN 60086-4 Li or equivalent, and shall remain leak resistant over the operational life of the meter while operating over the temperature range -25 °C to +55 °C.
- 8.1.6 Main batteries shall be integral with the gas meter but in a compartment, separated from all the internal mechanisms of the gas meter.
- 8.1.7 It shall be possible to change any battery without disturbing the metrological seal.
- 8.1.8 The main battery in a gas meter or additional module intended to be located on, or within 150 mm of a gas meter, shall be replaceable within, at least, a zone 2 hazardous area as defined in BS EN 60079-10-1; see section 5.2.
- 8.1.9 It shall not be possible to connect the main battery in reverse polarity.

- 8.1.10 It shall be possible for authorised personnel to easily exchange any main batteries within five minutes without removing the gas meter from a standard installation. This shall be possible where the access to the meter is restricted to the side upon which the index is affixed.
- 8.1.11 Where it is the intention that batteries are exchanged during the life of the gas meter, the battery housing shall include a label where it is possible for authorised personnel to record the battery exchange dates.

8.2 **Back-up batteries**

- 8.2.1 Gas meters shall include back-up batteries, or similar as appropriate, to maintain low level functionality (e.g. real time clocks) during temporary power losses, e.g. during exchange of the main meter battery.
- 8.2.2 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 gas meter (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 meter); the assumption is that clock runs on main battery before installation.
- 8.2.3 Batteries shall be leak resistant.

9. **DISPLAYS**

- 9.1 All meter displays shall default to the English language. Other languages such as Welsh may be considered with the written agreement of British Gas.
- 9.2 All displays shall be clear to read and easy to understand and:
- a) Have dimensions of alpha numeric characters of, at least, 4.95 mm x 2.4 mm (height x width);
 - b) Be possible to be read clearly and correctly, within an angle of 45° horizontally, and 22° vertically, from normal to the window.
- 9.3 All displays should have a method of improving visibility in poor lighting conditions and shall be backlit. The display backlight shall be capable of configuration:
- a) To operate or not;
 - b) To turn off after a configurable duration.
- 9.4 **Metrologically controlled display**
- 9.4.1 Gas meters shall incorporate a clear and unambiguous display that provides a totalised reading of consumption accessible without tools that serves as the basis for the price to pay; this shall be in units of m³.
- 9.4.2 The meter display shall be protected by a seal (mechanical and/or electronic as appropriate; see Part 1: General System Architecture: Security) and access to the display shall not be possible without breaking the seal.
- 9.4.3 This display shall be under the the metrological seal. All other modules of the meter shall not be behind this metrological seal.

Note: Not including other modules behind the metrological seal allows unimpeded access for any future maintenance. Such access may be prevented by other seals under the control of MAMs, British Gas etc.

- 9.4.4 The metrologically controlled display shall not be capable of being reset.
- 9.4.5 Where the metrological display is also used for other purposes (see clause 9.5) then its default condition shall be showing the most recent cumulative consumption. Where a consumer has ceased interacting with the meter the display shall return to showing the default condition within 30 seconds of the last consumer interaction.
- 9.4.6 The display of a gas meter may be blanked to conserve battery life. In such cases the display shall revert to showing the default condition upon a first consumer interaction. The display shall remain un-blanked for a minimum period of 30 seconds following the last interaction.
- 9.4.7 The display shall incorporate a facility to check that it is working correctly (e.g. by demonstrating that all segments can be blanked and displayed).
- 9.4.8 Decimal points shall be clear and unambiguous and numbers following the decimal point shall be clearly identifiable (e.g. by a different colour, background etc.).
- 9.4.9 The display of gas consumption shall have a minimum of 8 numerical characters and the last 3 numerical characters shall be decimal places indicating thousandths of a cubic metre, e.g. 99999.000 and display leading zeros.
- 9.4.10 The metrological display should be fully functional over the temperature range -25 °C to +55 °C.

9.5 **Meter displays**

- 9.5.1 In addition to the metrological display, the meter shall display other information. This can be by utilising the metrologically controlled display for other functions or using a separate display.
- 9.5.2 Where only one display is used for all functions (i.e. the metrologically controlled display and other functions) the display shall meet the requirements of clause 9.4.5.
- 9.5.3 The meter display shall be used to provide a means to enable pre-payment/PAYG functionality as described in Part 1: General System Architecture: Pre Payment, to be achieved.
- 9.5.4 The meter display shall, as a minimum, display:
- a) A means by which a consumer may determine their current gas usage;
 - b) Current gas usage with sufficient resolution to calculate low flow rates for appliance testing;
 - c) Current mode of operation (see Part 1: General System Architecture: Mode of Operation);
 - d) The status of the supply shut-off mechanism;
 - e) The consumer's tariff, tariff name and tariff version;
 - f) For pre-payment/PAYG consumers, any additional billing information; e.g.:
 - 1) Emergency credit;
 - 2) Managed debt:
 - i) Energy & non-energy debts;

- ii) Recovery amount;
 - iii) Recovery frequency.
 - 3) The amount of time left before credit runs out at current energy usage;
 - 4) The current account balance; e.g. how much credit is available.
- 9.5.5 The meter shall provide means by which a consumer can acknowledge meter generated messages which shall take the form of Yes/No/Clear responses.

Note: These transactions will be mimicked on the IHD.

- 9.5.6 Where a meter system generated message requires a response it shall remain indefinitely until a response has been given.
- 9.5.7 Where too much information is required to be accessed during a consumer interaction, this shall be displayed by means of easily scrolling through the information.

10. INTERRUPT AND RESTORE CAPABILITY

- 10.1 This section shall be read in conjunction with Part 1: General System Architecture: Interrupt and Restore Capability.
- 10.2 A gas meter shall be capable of remote interruption of the consumer's gas supply and provide for the remote enabling of the gas supply through the use of a valve; also see clauses 5.1.2 and 10.6.
- Note: Such operation would include the consumer running out of credit on a meter operating in pre-payment/PAYG mode, or a specific interrupt instruction from authorised personnel.*
- 10.3 All of the meter's functionality (other than the allowance of gas to pass) shall operate as normal, irrespective of whether the valve is opened or closed.
- Note: This is to allow authorised personnel to change the mode of operation, monitor alarms, download meter readings etc.*
- 10.4 The valve shall be suitable for long term operation in a typical gas environment found in the Great Britain.
- 10.5 The valve, when closed, shall not pass more than 5 dm³/h at an inlet pressure of 75 mbar.
- 10.6 The opening of the valve shall be inhibited by the use of an interlock. It shall require direct operation (e.g., by pressing a button) to deactivate the interlock, following the receipt and acknowledgment, by the meter, of an enabling command.
- 10.7 When an attempt is made to restore the gas supply, the meter should check if gas flows at the time of the restoration attempt. If gas flow is detected, the display should show a message to warn the consumer that an appliance may be switched on. The level of gas flow at restoration that generates a message shall be configurable.
- Note: This is to allow for appliances where gas will flow safely, e.g. self-igniting boilers.*
- 10.8 The meter should only complete the enabling of the gas supply when the flow is below the level as described in clause 10.7 at the time of the restoration attempt.

11. EVENTS, EXCEPTIONS, ALERTS, FAULTS AND TAMPERS

11.1 This section shall be read in conjunction with Part 1: General System Architecture: Events, Exceptions, Alerts, Faults and Tamperers.

11.2 Reverse flow

11.2.1 Gas meters other than diaphragm shall detect reverse flow.

Note: Reverse flow is deemed to be a volume of greater than or equal to Q_{min} for 30 seconds when continuously measured for a period of 30 seconds.

11.2.2 Reverse flow (equalling a volume of Q_{min} for 30 seconds), when detected, shall be stored separately, and the separate measured quantity and a tamper alert shall be transmitted to the head-end system. All normal registers shall still advance.

12. DATA STORAGE AND MEMORY

12.1 General

12.1.1 The memory shall be non-volatile meaning that during the loss of power to the memory it shall have a minimum retention time equal to that of the operational design life of the meter over the temperature ranges as specified in section 7.2

12.1.2 The memory shall be capable of being read from, and written to, over the temperature range specified in section 7.2.

12.1.3 Where the data is continually being updated, the data storage shall operate on an over-write First In First Out (FIFO) principle.

12.1.4 All data held in memory shall be accessible, both locally and remotely, by authorised personnel.

12.1.5 All data, with the exception of the current meter reading and serial numbers should be capable of being individually reset by authorised personnel. Such an action shall only be possible with the use of a password and the action shall generate an event flag in the meter.

Note: Some resetting is likely to be required during the life of the meter; e.g. a change of supplier.

12.2 Meters

12.2.1 The gas meter shall incorporate on-board memory that, as a minimum, shall be of sufficient size to store the following:

- a) The currently operating firmware of the meters together with the previous version, if applicable;
- b) The current meter reading (considered part of the metrological functionality; see section 4);
- c) Time period interval data (e.g. 30 minute intervals) continuously for 120 days;

Note: British Gas wish to investigate various time periods (e.g. down to one minute) but it is also understood that shorter time periods will require an increased resolution in the recording of consumption.

- d) A configurable number of days of daily meter reads taken at a set time of day; and
- e) A minimum of 120 days of daily totalised consumptions at each rate based on the daily reads; and

Note: 180 days is preferable

- f) A minimum of 6 months of continuous half hourly interval data for energy consumption;
- g) The most recent 40 meter events in the fault log;
- h) The most recent 40 meter events in the tamper log;
- i) Time and date stamp for each data item;
- j) Meter details:
 - 1) Serial number
 - 2) Smart Meter Variant Code;
 - 3) MAC address;
 - 4) MPRN;
 - 5) Install code;
 - 6) Gas Supplier information.

13. DATA COMMUNICATIONS

13.1 General

13.1.1 The gas meter shall communicate to the comms hub and the IHD using Zigbee (2.4 GHz) and communicate using Smart Energy Profile (SEP) and any private extensions necessary to support our functional requirements.

13.1.2 Where devices and modules used for the purpose of communications are contained within the gas meter, they should be self contained, identifiable, and allow for their removal and replacement by authorised personnel:

- a) Without removing the gas supply to the meter;
- b) In a zone 2 (ATEX category 3) hazardous area as defined in BS EN 60079–10-1.

Note: This is to allow for the upgrading of the communications parts of the system, without changing the meter, in the event of new technologies becoming available in the future.

13.1.3 The gas meter 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 13.1.4.

13.1.4 Gas meters shall include a means 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.

13.2 Communications to Hand Held Terminal (HHT)

13.2.1 The meter shall be configurable locally using a HHT via the comms hub. 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.

13.2.2 The meter shall also be configurable locally without the use of a HHT by authorised personnel.

14. EMC

14.1 This section shall be read in conjunction with Part 1: General System Architecture: EMC.

14.2 The following lists the influence quantities that shall be applied to the gas meter:

- a) Voltage transients on signal lines (if applicable):
 - 1) The gas meter shall be tested in accordance with BS EN 61000-4-4 (or equivalent) level 3;

- b) Electrostatic discharges:
 - 1) The gas meter shall be tested in accordance with BS EN 61000-4-2 (or equivalent) using 10 contact discharges at severity level 3 (6 kV) at intervals of 10 s to each of:
 - i) The conductive surfaces;
 - ii) A horizontal and;
 - iii) A vertical coupling plane.
 - 2) The gas meter shall be tested in accordance with BS EN 61000-4-2 (or equivalent) using 10 air discharges at severity level 3 (8 kV) at intervals of 10 s to insulating surfaces. During the test, the inlet boss of the gas meter shall be connected to the ground plane used during the test;
 - c) Radio frequency electromagnetic fields:
 - 1) The gas meter shall be tested in accordance with test level 3 of BS EN 61000-4-3 (or equivalent).
 - d) Conducted radio frequency electromagnetic fields on signal lines (if applicable):
 - 1) The gas meter shall be tested in accordance with class 2 of BS EN 61000-4-6 (or equivalent);
 - e) Surges on signal lines (if applicable):
 - 1) The gas meter shall be tested in accordance with class 1 of BS EN 61000-4-5 (or equivalent);
 - f) Power frequency magnetic fields:
 - 1) The gas meter shall be subjected to test level 3 of BS EN 61000-4-8 (or equivalent) for 15 minutes;
 - g) Pulse magnetic field immunity test:
 - 1) The gas meter shall be subjected to test level 3 of BS EN 61000-4-9 (or equivalent) for 15 minutes.
 - h) High intensity, static magnetic fields:
 - 1) A magnet of diameter 25mm and field strength of at least 6000 gauss at the surface of the magnet shall be applied to all faces of any the gas meter that directly relates to the billing process;
- 14.3 The gas meter shall meet the radio interference suppression requirements of BS EN 55022 (or equivalent), class B.
- 14.4 Any radio transmitting devices (e.g. to the HAN) shall comply with the appropriate ETSI test Standard.

ENDNOTES

History

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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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