



MMS

Heat Network Metering and Monitoring Standard

MMS 2025
DRAFT

Disclaimer

The technical contents of this document have been reviewed and consulted on through a series of technical workshops with participation from a range of experts from across the heat network industry.

This document has been issued in a draft format to give the sector early sight of the standards within this document, and due to its interaction with other HNTAS documentation. There may be changes to this document in future, such as those to:

- align terminology with that used in other HNTAS documentation;
- rectify errors in this draft version; or
- improve clarity of contents.

Additionally, there may be changes to this document to align with other aspects of HNTAS which are subject to public consultation, or are updated as a result of changes within HNTAS. The final version of this document, which will underpin the requirements set out through HNTAS, will be released before the launch of HNTAS.

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Foreword

The Heat Network Metering and Monitoring Standard (MMS) forms part of the UK Government's Heat Network Technical Assurance Scheme (HNTAS, Scheme) delivered by the Department of Energy Security and Net Zero, in partnership with the Scottish Government and Ofgem. The Department of Energy Security and Net Zero appointed FairHeat as technical author for this document.

The Scheme has been designed and developed in consultation with a range of experts across the heat network industry, culminating in a series of Technical Specifications and Assessment Procedures to facilitate the validation and verification of performance outcomes of elements within a Heat Network.

This Standard contains the requirements for Metering and Monitoring Systems for Heat Networks in the UK.

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i. Introduction

Reliable Metering and Monitoring Systems are fundamental for the measurement of heat network performance and reporting of KPIs as part of the Scheme. It is crucial that consumer protection is considered when setting up these systems, to ensure that data provided to end users is accurate, transparent, accessible, and handled in accordance with data protection principles.

Therefore, this Standard has been developed to establish a consistent approach to Metering and Monitoring Systems for Heat Networks in the UK, enabling accurate monitoring of network performance and sufficiently protecting consumers.

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ii. Scope

This document specifies the requirements for Metering and Monitoring Systems for Heat Networks in the UK.

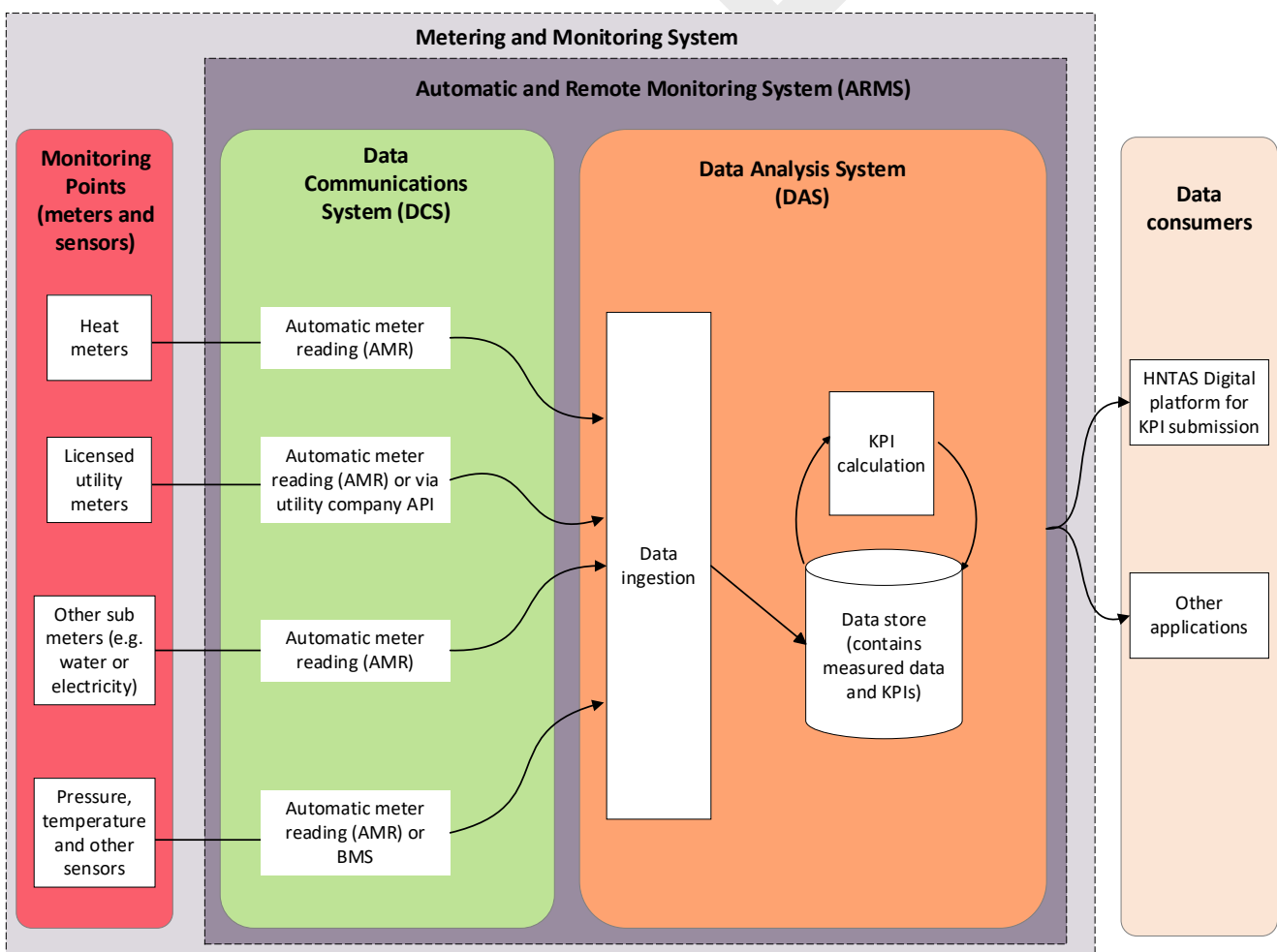
This Standard does not apply to networks not within scope of the Scheme.

This Standard also excludes the Consumer Connection and Consumer Heat System of ambient loop networks (often referred to as “fifth-generation” heat networks) or shared ground loop arrays. All other network elements, as defined by the Scheme, are in the scope of this Standard.

The Metering and Monitoring System is defined as the Monitoring Points and the Automatic and Remote Monitoring System (ARMS) required to measure, extract, record, and store data, as well as the systems required to transform raw data, calculate KPIs, and report to HNTAS. A summary of the functions and components of the Metering and Monitoring System is shown in Figure 1 below.

Metering and Monitoring Systems may operate across multiple heat network elements.

Figure 1: Summary of the Metering and Monitoring System functions



iii. Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1. BS EN 1434-1/6: Thermal energy meters
 - BS EN 1434-1:2022: Thermal energy meters – Part 1: General requirements (BSI, 2022).
 - BS EN 1434-6:2022: Thermal energy meters – Part 6: Installation, commissioning, operational monitoring and maintenance (BSI, 2022).
2. OIML R 75-1:2002: Heat meters – Part 1: General requirements (OIML, 2002).
3. MID (2014/32/EU): Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (recast) (EU, 2014).
4. DS/ISO 2859-1:1999: Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection. (ISO, 1999).
5. BS EN ISO 4064-1:2025: Water meters for cold potable water and hot water – Part 1: Metrological and technical requirements (BSI, 2025).
6. The Water Supply (Water Fittings) Regulations 1999: Statutory Instrument 1999 No. 1148 (UK, 1999).
7. IGEM/GM/6 Edition 3: Non-domestic meter installations (2nd and 7th Family Gases) (IGEM, 2014).
8. BS EN 50470-1/3: Electricity metering equipment
 - BS EN 50470-1:2006+A1:2018: Electricity metering equipment (a.c.) — Part 1: General requirements, tests and test conditions — Metering equipment (class indexes A, B, and C) (BSI, 2018).
 - BS EN 50470-3:2022: Electricity metering equipment — Part 3: Particular requirements — Static meters for AC active energy (class indexes A, B, and C) (BSI, 2022).
9. IEC 62052-11:2020: Electricity metering equipment – General requirements, tests and test conditions – Part 11: Metering equipment (IEC, 2020)

iv. Terms and definitions

For the purposes of this document, the terms and definitions given in Heat Network Technical Assurance Scheme – Terms and Definitions (HNTAS-TD) and the following table apply.

Table 1: Definition of terms used throughout this document

Term	Definition
Metering and Monitoring System	The Metering and Monitoring System refers to a heat network’s Monitoring Points and Automatic and Remote Monitoring Systems (ARMS). The Metering and Monitoring System is required to measure, extract, record and store data, as well as transform raw data, calculate KPIs, and report to the Code Manager.
Automatic and Remote Monitoring System (ARMS)	<p>All systems, infrastructure and associated equipment required for the:</p> <ul style="list-style-type: none"> • Extraction of data from Monitoring Points • Recording and storing of data from Monitoring Points at the required frequency in a centralised location • Transforming of raw data and calculation of KPIs • Reporting of KPIs to HNTAS <p>The ARMS will likely contain two components:</p> <ol style="list-style-type: none"> 1. Data Communications System (DCS) – typically an AMR, and/or BMS and/or equivalent system, which collect and extracts data from Monitoring Points at the necessary frequency. 2. Data Analysis System (DAS) – a system which undertakes data ingestion from the DCS, storage, KPI calculation and reporting <p>The ARMS may be one system or a combination of different systems. Whilst the requirements for billing are not in scope of HNTAS, consumption data collected via the ARMS will also typically be used by billing systems for billing of consumers.</p>
Key Performance Indicators (KPIs)	<p>Key Performance Indicators are used within HNTAS to measure performance.</p> <p>During the operating phases, a defined list of KPIs will need to be measured and reported to HNTAS at a defined frequency.</p> <p>During the design and construction phases, the KPIs are used to assess the suitability of the design and the construction of the heat network.</p> <p>The KPIs and the target levels are to be defined at Concept Design Stage, and updated and refined as the level of detail increases throughout the design. During commissioning and operation, the actual performance measured via KPIs, is used to demonstrate that performance is in line with the KPI targets, which is a condition of Certification.</p>

Term	Definition
Monitoring Points	<p>Defined points within a heat network element, that are required to measure specified data for measurement of KPIs.</p> <p>The monitoring points cover metering points (Thermal Energy Meters or utility meters) and sensors (temperature, pressure, water quality).</p>
Metering and Monitoring Strategy	<p>The Metering and Monitoring Strategy contains the description of how data required to calculate KPIs will be measured, extracted, recorded, and stored at the required read frequency, how the raw data will be transformed, and how KPIs will be calculated and reported.</p> <p>The strategy shall also include (at the level of detail necessary for the stage):</p> <ol style="list-style-type: none"> 1. Schedule of KPIs 2. Schedule of Monitoring Points 3. Data flow diagram 4. Schematic with labelled Monitoring Points 5. Monitoring Point labelling strategy
“Smart metering” systems/ Advanced meter infrastructure (AMI)	<p>The software, infrastructure and associated equipment that enable two-way communication between heat network suppliers and consumers.</p>
Thermal Energy Meters	<p>Thermal Energy Meters refer to heat meters, cooling meters and heat and cooling meters.</p>
Initiation Point	<p>The start of a Distribution Network. For example, the Energy Centre or Substation exit, or building entry point. Will contain a Monitoring Point.</p>
Termination Point	<p>The end points of a Distribution Network. For example, Consumer Connections or a Substation. Will contain a Monitoring Point.</p>
API	<p>Application Programming Interface</p>
MQTT	<p>Message Queuing Telemetry Transport</p>
SFTP	<p>Secure File Transfer Protocol</p>
TLS	<p>Transport Layer Security</p>

1. Monitoring Points

The required Monitoring Points for each element shall be provided in accordance with Annex A, to measure and report on all applicable KPIs.

1.1. Thermal energy meter specification

Thermal Energy Meters shall be specified in accordance with the following requirements.

- 1.1.1. Thermal Energy Meters shall be specified in accordance with BS EN 1434 or OIML R 75.
- 1.1.2. Thermal Energy Meters shall be at least accuracy Class 2 of the Measuring Instruments Directive (MID) (2014/32/EU), or equivalent UK standard, when enacted.
- 1.1.3. Clamp on temperature or flow sensors shall not be specified for use as a Monitoring Point.
- 1.1.4. The environmental classification of a Thermal Energy Meter shall be suitable for the installed location, in accordance with BS EN 1434 or OIML R 75.
- 1.1.5. Heat cost allocators (HCAs) shall not be used instead of Thermal Energy Meters, unless in exceptional cases where HCAs are proposed as a mitigation measure for non-conformities in metering.
- 1.1.6. Thermal Energy Meters shall be specified for the type and temperature of heat transfer fluid.
- 1.1.7. Thermal Energy Meters shall be selected to provide the required level of accuracy for the minimum and maximum flow rates predicted. Sizing the Thermal Energy Meter based on pipe size may mean that the meter is oversized and may not accurately measure heat during periods of low demand. As such, pipe reducers and expanders may be required to install correctly sized meters.
- 1.1.8. Where battery power is used on Thermal Energy Meters, a minimum battery lifetime of 10 years shall be specified, at the required read frequency outlined in Annex A.
- 1.1.9. Where mains electricity is used for the Thermal Energy Meter, non-volatile memory or battery back-up shall be included. The back-up shall enable the meter to continue functioning fully, not just power the time clock.
- 1.1.10. Thermal Energy Meters with pulsed outputs shall not be used.
- 1.1.11. Thermal Energy Meters with moving parts shall not be used.
- 1.1.12. The minimum static pressure stated by the Thermal Energy Meter manufacturer shall be met at all times for each meter. This requirement shall be taken into account in the overall hydraulic design. If cavitation occurs this can severely impact the accuracy of the meter.
- 1.1.13. Where the heat network provides both heating and cooling from the same system, a Thermal Energy Meter shall be specified which enables measurement of both heating and cooling separately, on separate registers.

1.2. Thermal Energy Meter installation

Thermal Energy Meters shall be installed in accordance with the following requirements.

- 1.2.1. Thermal Energy Meters shall be installed in line with BS EN 1434 and the manufacturer's instructions. This includes correct positioning and orientation of all meter components, the minimum length of straight pipe before and after the meter and ensuring that it is possible to easily access the meter and integrator for maintenance, calibration and taking readings. In particular, Thermal Energy Meter temperature sensors shall be correctly located in the flow and return, as marked on the sensors. Air ingress and particulates can also have a detrimental effect on the readings from heat (flow) meters.
- 1.2.2. All metering equipment shall be installed by a competent installer.
- 1.2.3. The Thermal Energy Meter enclosure shall be locked or tamper-proofed to ensure that the Thermal Energy Meter continues to record heat consumed at all times.
- 1.2.4. Thermal Energy Meters shall not be located in inaccessible locations (e.g. behind a ceiling or wall panel with no access hatch).
- 1.2.5. Thermal Energy Meters integrators/calculator units/displays shall be mounted in locations where operators and/or customers can easily and safely (without the use of ladder or other mobile platforms) read the kWh readings, temperature readings and the meter serial number. This may require the Thermal Energy Meter integrator/calculator unit or an additional screen to be located at an accessible level, which may be different to the Thermal Energy Meter and/or flow sensor.
- 1.2.6. Installed Thermal Energy Meters shall meet the tolerances which are stated as being the maximum permissible errors (MPE) for each of the accuracy classes.
- 1.2.7. Installed Thermal Energy Meters shall have been either stamped by, or on the authority of, a meter examiner appointed by the Secretary of State, or contain a MID/CE approval marking and associated serial number.
- 1.2.8. Records shall be taken for the installation/commissioning of Thermal Energy Meters. These records shall include the meter make, type, serial number and year of install.

1.3. Thermal Energy Meter maintenance

To ensure accuracy of Thermal Energy Meters over time, meters shall be maintained in accordance with the following requirements.

- 1.3.1. Thermal Energy Meters shall be maintained in accordance with BS EN 1434.
- 1.3.2. Records of installation/commissioning of Thermal Energy Meters shall be retained for the operational lifetime of the meter, for the sake of potential future recall and maintenance. These records shall be in accordance with 1.2.8.
- 1.3.3. Thermal Energy Meters shall be recalibrated or replaced 10 years after installation, except in the following scenarios:
 - 1.3.3.1. If system operators intend to retain Thermal Energy Meters for longer than 10 years, sampling and calibration testing shall be carried out 9 years after installation. If calibration testing is successful in accordance with 1.3.5, operators shall be permitted to retain meters for another 5 years (14 years overall).
 - 1.3.3.2. If system operators intend to retain Thermal Energy Meters for longer than 14 years, a second round of sampling and calibration testing shall be carried out 13 years after installation. If calibration testing is successful in accordance with 1.3.5, operators shall be permitted to retain meters for another 5 years (18 years overall).

- 1.3.4. Samples shall be selected, and sample acceptance numbers shall be set in accordance with DS/ISO 2859, using normal inspection (inspection level II) and an acceptable quality limit (AQL) of 4%.
- 1.3.5. Within a sample, the number of Thermal Energy Meters with error greater than twice the maximum tolerance permitted at initial verification, as specified in 1.2.6, shall not exceed the maximum acceptable number in accordance with 1.3.4.
- 1.3.6. Where Thermal Energy Meters are battery operated and retained for longer than 10 years, the batteries shall be replaced 1 year before the expected failure date. This includes battery back-up where applicable, as per 1.1.9.

1.4. Other utility meter specifications (water, gas electricity)

This section applies to meters other than Thermal Energy Meters. This includes water meters, gas meters and electricity meters. These meters shall be specified in accordance with the following requirements.

- 1.4.1. Water meters shall be specified in accordance with BS EN ISO 4064 and shall be suitable for the pressure and flow requirements of the system.
- 1.4.2. Where water meters are situated on pipework, which is potable, they are to be compliant with Regulation 4 of the UK Water Supply (Water Fittings) Regulations or Scottish Byelaws. WRAS approval demonstrates compliance with Regulation 4.
- 1.4.3. Gas meters shall be sized and specified in accordance with IGEM/GM/6 Edition 3.
- 1.4.4. Electricity meters shall be specified in accordance with BS EN 50470 or IEC 62052.

2. Automatic and Remote Monitoring System (ARMS)

The Automatic and Remote Monitoring System (ARMS) shall be specified in accordance with the following requirements.

For the purposes of this specification, where the ARMS is referred to, this refers to all systems and components contained within the ARMS, unless specified otherwise.

2.1. ARMS specification

The Automatic and Remote Monitoring System (ARMS) shall be specified in accordance with the following requirements.

For the purposes of this specification, where the ARMS is referred to, this refers to all systems and components contained within the ARMS, unless specified otherwise.

- 2.1.1. An ARMS shall be specified that records and stores monitoring data, and meets the requirements as set out below. The ARMS may be one system or a combination of separate Data Communication Systems (DCS) (e.g. AMR, BMS) and Data Analysis Systems (DAS).
- 2.1.2. The ARMS shall collect data from Monitoring Points, such as Thermal Energy Meters and sensors, and record and store this at the required reporting frequency outlined in, to enable KPIs to be calculated.
- 2.1.3. The ARMS shall be able to identify faults within the Metering and Monitoring System and report error codes to highlight these faults. This includes faults with the Monitoring Points or the ARMS itself.
- 2.1.4. The ARMS shall ensure multiple stakeholders are able to access the data throughout the lifespan of a heat network (commissioning and operation). Stakeholders who require access to the data shall be identified on a project basis and listed.
- 2.1.5. The ARMS shall be capable of storing and analysing data from Monitoring Points, at the required read frequency outlined in Annex A, for 2 years. Following this, a data thinning strategy may be implemented.
- 2.1.6. The ARMS shall have functionality which enables operators to set alerts to notify operators where selected KPIs are not within tolerances. The KPIs which are to have set alarms are to be specified by the operator.
- 2.1.7. An unencrypted DCS shall not be utilised as the communication protocol for the transfer of personal data beyond a consumer premises, in accordance with 2.3.4. Where a DCS is not capable of encryption, systems shall comply with 2.3.5 and 2.3.6.
- 2.1.8. The design of the DCS shall be produced. For wired networks this is expected to be a topology document. All metering points should be included on this design as well as any infrastructure to obtain the data (i.e. data loggers, routers, ISP connections). Where applicable, the design shall indicate the hydraulic relationships between Monitoring Points (parent-child relationships).

- 2.1.9. Where a wireless DCS is being used, consideration shall be given to the building characteristics and the impact on signal strength, to ensure the wireless data communication can operate. A connectivity/communication study to ensure that wireless meter readings can be transmitted successfully should be undertaken where risks are identified. This shall take account of both the vertical separation between dwellings and the materials used in the construction of the building.
- 2.1.10. Where a wired DCS is being used, consideration shall be given to the building characteristics in relation to the routing required and access for the wired network.
- 2.1.11. Data from utility meters may be read via the proprietary AMR and backhaul networks of suppliers or energy brokers. In these cases, the DCS shall have to obtain data from supplier or broker (e.g. via an open API) in order to cover all KPIs.
- 2.1.12. The DCS shall be capable of reading an extended meter register. The extended meter register at a minimum shall contain the minimum the data required by the Monitoring Point.
- 2.1.13. To prevent data loss in the case of DCS faults, Monitoring Point infrastructure shall be able to store data locally according to the following requirements:
 - 2.1.13.1. For Monitoring Points with a minimum required read frequency of 5 minutes, at minimum one day's worth of data shall be stored.
 - 2.1.13.2. For Monitoring Points with a minimum required read frequency of 30 minutes, at minimum 14 days' worth of data shall be stored.
 - 2.1.13.3. Data thinning procedures shall be implemented for data stored for longer than the periods specified in 2.1.13.1 and 2.1.13.2.
- 2.1.14. Within the Automatic and Remote Monitoring System (ARMS), Data Communications Systems (DCS) shall be compatible with Data Analysis Systems (DAS) from different parties and use an open protocol/API that enables access to all required data and allows interoperability with other suppliers' infrastructure, whilst ensuring access is restricted to authorised parties.
- 2.1.15. The DAS documented interface (e.g. API, SFTP, MQTT) shall be published.
- 2.1.16. The DAS shall operate in accordance with the imputation rules detailed in Annex B.

2.2. Data protection by design and by default

It is acknowledged that heat network data, in combination with a unique identifier such as a MAC address, is Personal Data in any context where the MAC address can be used to identify a Data Subject or domestic premise using reasonable methods likely to be available, in the context of the purpose for which the data is being accessed and processed. This includes methods reasonably likely to be available to authorised parties and different categories of threat actor in context of different types of threat objective.

It is acknowledged that, in providing the Services to a Consumer, the system operator may act in the capacity of a Data Controller in respect of the Personal Data.

The Personal Data which the system operator will Process as a Data Controller will relate to Heat Consumers and will include Personal Data which is included within messages sent and received by the Thermal Energy Meters and heat cost allocators via the heat network interface. The nature of such Personal Data will be that which is required or permitted to be included in such messages as described in this Standard. The full description of the subject matter, the nature and purpose of the processing, and the type of personal data is as described by this

Standard as a whole.

There is an obligation for the system operator and each Processor and Sub-Processor to not Process any Personal Data in any ways that Data Subjects would not reasonably expect.

The system operator and each Processor and Sub-Processor have an obligation to maintain, in accordance with Good Industry Practice, all such records and other information as necessary to demonstrate that it is complying with its obligations under this Standard.

System installers shall select systems that allow system operators to comply with their obligations of data protection by design and by default. The systems installed shall be specified in accordance with the following requirements.

- 2.2.1. Systems shall allow system operators to extract a copy of the personal data based on suitable search criteria such as unique identifiers in combination with a date range, in a commonly used, machine readable format (e.g., .csv).
- 2.2.2. Systems shall allow system operators to select which data items they wish to extract.
- 2.2.3. Systems shall be capable of securely erasing data.
- 2.2.4. Systems shall be capable of preventing data from being erased when manually instructed to do so.
- 2.2.5. Systems shall be capable of restricting processing when manually instructed to do so.
- 2.2.6. Systems shall produce sufficient event logs to enable the data controller to prove that the data has integrity.
- 2.2.7. Systems shall have robust access controls including the ability to implement role-based access and to mandate passwords meeting modern complexity requirements, in accordance with the following requirements:
 - 2.2.7.1. Systems shall use secure and robust methods for authenticating authorised users, in accordance with the following requirements:
 - 2.2.7.1.1. Systems processing personal data shall implement multi-factor authentication (MFA), for both user and administrative access.
 - 2.2.7.1.2. Role-based access control (RBAC) shall be implemented to ensure that access to data is granted based on user roles, with restrictions on access to personal data where unnecessary.
 - 2.2.7.2. Systems shall maintain event logs demonstrating who has accessed the system and when.
 - 2.2.7.3. Systems shall have detection capability to report attempts to gain access without authorisation.
 - 2.2.7.4. Systems shall include data loss prevention capabilities to prevent data being extracted by unauthorised parties.

2.3. Security of data processing

System installers shall select systems that allow system operators to comply with their obligations of secure data processing. The systems installed shall be specified in accordance with the following requirements.

- 2.3.1. The system installer will undertake a risk assessment setting out the inherent risks of varying impact and likelihood to the rights and freedoms of individuals, the controls implemented to address them and the current risk after the controls have been applied, demonstrating that such risks have been reduced to acceptable levels.
- 2.3.2. The risk assessment will consider the nature of the threats to the system, including the methods reasonably available to threat actors to identify individuals, in the context of their nature, capability and objectives.
- 2.3.3. The system installer shall select a heat network system that enables the system operator to comply with all its Data Protection obligations under this Standard and the Data Protection Legislation.
- 2.3.4. Systems shall be capable of encrypting data transmitted beyond the premise, in accordance with the following requirements:
 - 2.3.4.1. Encryption protocols shall be used to protect data during transfer outside the consumer premises for a single dwelling or microbusiness. This is not necessary where the transfer of data is limited to inside a single dwelling or microbusiness (i.e. within the Consumer Connection/Consumer Heat System).
 - 2.3.4.2. Encryption shall be mandatory for dwellings and microbusinesses, where any device or system has direct access to personal data. Encryption is therefore optional for bulk meters or sensors that do not contain or transfer personal data.
 - 2.3.4.3. Robust data communication protocols and encryption shall be implemented, such as MQTT plus TLS encryption, for meters and AMR devices used on heat networks.
 - 2.3.4.4. All encryption keys shall be securely managed using established key management practices (e.g., NIST 800-57 or ISO/IEC 11770 standards).
- 2.3.5. Systems not capable of encryption shall be protected by robust physical or other security measures to prevent unauthorised parties from accessing usable Personal Data, considering the outcomes from the risk assessment conducted under 2.3.1 and 2.3.2.
- 2.3.6. Systems not capable of encryption shall demonstrate the adequacy of their compensatory security controls by means of an independent security controls assessment.
- 2.3.7. Systems shall be capable of supporting appropriate business continuity and disaster recovery controls, such as regular backups to a different geographic location.
- 2.3.8. Systems shall be capable of applying access, intrusion detection and data loss prevention controls, in accordance with the following requirements:
 - 2.3.8.1. Systems shall have the functionality (e.g., such as checksums or cryptographic hash functions) to ensure the integrity of transmitted data and detect tampering.
 - 2.3.8.2. Monitoring tools shall be employed to automatically identify unauthorised access or anomalies in data transfer and usage.

3. “Smart metering”/Advanced meter infrastructure (AMI)

3.1. “Smart metering”/AMI specification

“Smart metering” systems/AMI installed shall be specified in accordance with the following requirements.

- 3.1.1. Information shall be provided to consumers on how to contact the heat network supplier via multiple communication methods, including email, phone, or letter as a minimum. Where required, this information shall be provided in accessible formats, such as Braille, large print, and in multiple languages.
- 3.1.2. An in-house display (IHD) shall be provided to consumers, in accordance with the following requirements:
 - 3.1.2.1. The IHD shall display energy consumption, updated at a minimum frequency of 30 minutes.
 - 3.1.2.2. The IHD shall display the current meter reading
 - 3.1.2.3. The IHD shall allow consumers to access the following billing information:
 - Current energy prices charged to the consumer by the heat network supplier
 - Information on the breakdown of tariff rates
 - Comparisons of the consumer’s current energy consumption from the heat network supplier with consumption for the same period in the previous year
 - Whether emergency credit is available for activation and the amount of emergency credit
 - 3.1.2.4. The IHD may be a physical device (whether part of the Monitoring Point/meter or a separate device), a web portal or consumer application displayed on a consumer’s mobile device. Where an IHD is a physical device, this shall be located internal to the consumer premises. Where information is displayed on a mobile device, consumers should have the option to request a physical device where required.
 - 3.1.2.5. Where the Monitoring Point (meter) is used for consumption billing, an IHD is required.
- 3.1.3. Systems shall have the capability to permit the bidirectional remote switching of payment mode between credit and prepayment billing. Where systems have the capability to enable remote disconnection and reconnection, the following requirements shall apply:
 - 3.1.3.1. Unencrypted data communications protocols with remote disconnection features shall not be permitted, to prevent unauthorised consumer disconnection.
 - 3.1.3.1.1. Systems not capable of encryption shall be protected by robust physical or other security measures to prevent unauthorised disconnection.

- 3.1.3.1.2. Systems not capable of encryption shall demonstrate the adequacy of their compensatory security controls by means of an independent security controls assessment.
- 3.1.3.2. Systems shall have the capability to define a non-disablement calendar to prevent heat supply disconnection for vulnerable consumers during specified periods.
- 3.1.4. Systems shall provide the data required by metering and billing systems to permit monthly bill statements to be automatically issued for the full range of payment methods provided (e.g. prepayment, debit/credit card, direct debit, app payments/mobile top up, and electronic transfer).

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4. Metering and Monitoring Strategy

4.1. Metering and Monitoring Strategy

This section is applicable to new and retrofitted/replacement Metering and Monitoring Systems. The Metering and Monitoring Strategy shall comply with the following requirements.

- 4.1.1. A Metering and Monitoring Strategy shall be developed to measure and monitor the performance of the overall heat network.
- 4.1.2. The Metering and Monitoring Strategy shall be updated in the event of any changes to the Metering and Monitoring System, to comply with the following requirements.
- 4.1.3. The Metering and Monitoring Strategy shall outline the boundary of the heat network and elements within the heat network which the Metering and Monitoring System is being applied to.
- 4.1.4. The Metering and Monitoring System shall be designed with the necessary Monitoring Points to enable all applicable KPIs to be calculated.
- 4.1.5. The required Monitoring Points, per element, are outlined in Annex A. These shall be specified as a minimum (where they are applicable to the heat network covered by the Metering and Monitoring System). Any additional Monitoring Points required to measure KPIs shall also be identified and included within the design.
- 4.1.6. Virtual Monitoring Points shall not be used. A virtual monitoring point is where the Monitoring Point data is estimated based on other monitoring points or calculated based on the difference between two or more data points, without the presence of a physical Monitoring Point (e.g. Thermal Energy Meter).
- 4.1.7. Communal areas containing circuits of heat emitters, or a single heat emitter, directly served from the Communal Distribution Network should be treated as a Distribution Network Termination Point and monitored as required by a Distribution Network Termination Point.
- 4.1.8. All non-residential Consumer Connections (e.g. commercial connections), Consumer Connections that have an undefined use at the time of design, or Consumer Connections which will be void for period of time shall contain a Monitoring Point. This shall be treated as a Distribution Network Termination Point / Consumer Connection boundary Monitoring Point and shall be monitored as required.
- 4.1.9. The Metering and Monitoring Strategy shall outline the data communications method to be used (e.g. wireless M-BUS network).
- 4.1.10. Meter and sensor data that originates in premises where information can be related to an identified or identifiable person (e.g. a dwelling) is personal data under GDPR. The Metering and Monitoring System Strategy shall document the technical measures that will be taken to ensure that the system complies with the GDPR requirements as set out in Sections 2.2 and 2.3.
- 4.1.11. The Metering and Monitoring Strategy shall contain a data flow diagram, which shall describe each step that the data takes (i.e. from the Monitoring Point to data at rest in a data centre). For each step, the diagram shall include the technical steps taken to maintain information security, with particular reference to GDPR where personal data is concerned. It should also include the documented interfaces (e.g. API) that allow stakeholders to interact with the ARMS in accordance with 2.1.15.

- 4.1.12. The Metering and Monitoring Strategy shall include a KPI schedule that contains:
- The identified applicable KPIs to be measured and reported by the Metering and Monitoring System
 - The targets for each KPI in operation (based on the level of information available at this stage)
 - The Monitoring Points required to measure each KPI
- 4.1.13. The Metering and Monitoring Strategy shall include a Monitoring Points schedule that contains:
- All Monitoring Points required (for the scope of the strategy - either element or network basis)
 - The type of Monitoring Point (meter, sensor etc)
 - A unique ID label for each Monitoring Point, which follows a determined naming convention
- 4.1.14. The Metering and Monitoring Strategy shall contain a schematic which outlines each Monitoring Point. Each Monitoring Point shall be labelled using the unique ID code.

Annex A: Required Monitoring Points

This section details the required Monitoring Points for measuring KPIs within each element of HNTAS (excluding the Consumer Heat System).

Energy Centre

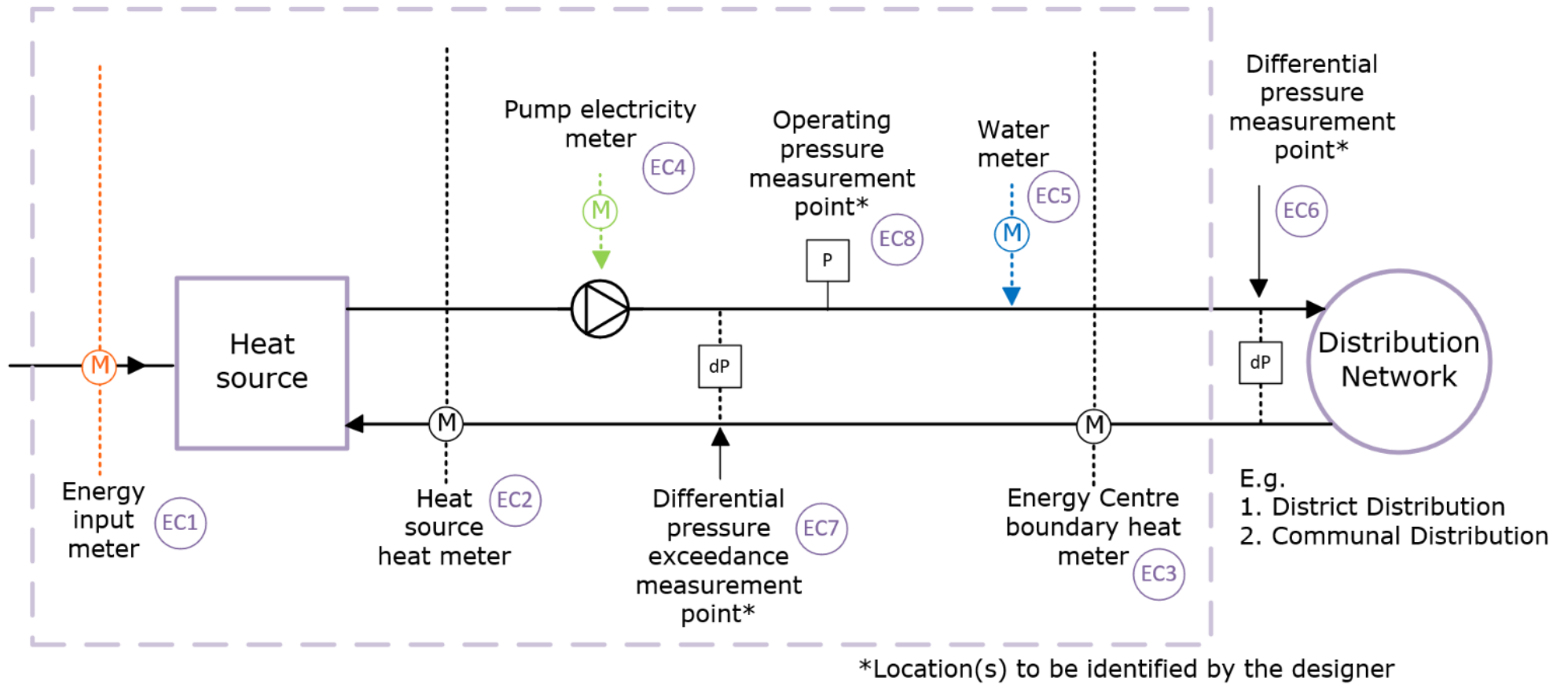
Table A.1: Required Monitoring Points for Energy Centre

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
EC1	Heat source energy input	Meter read (kWh) Note: Original measurement can be in different units (for example, m3). Conversion to be applied where different units for original measurement.	30 minutes	Energy (fuel) input for each type of heat source (for example, gas, electricity). If there are multiple heat sources that use the same input energy, sub-metering shall be required to determine the energy input into each different heat source. For example, electric boilers and heat pumps will require separate electricity meters. Likewise, gas boilers and CHPs will require separate gas meters.
EC2	Heat source	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l) Error Codes Note: Where used on ambient	5 minutes	Required for each type of heat source. Not required for each individual module or a same heat source. For example, only one meter required per bank of heat pumps, boilers etc.

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
		networks, meter shall be dual mode (heat and cool).		
EC3	Boundary	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l) Error Codes Note: Where used on ambient systems, meter shall be dual mode (heat and cool).	5 minutes	Required at the boundary of the Energy Centre, to determine the total heat delivered to the heat network.
EC4	Distribution pump set	Meter read (kWh)	30 minutes	Required to measure pump energy consumption. Required per pump set, rather than individual pumps when contained within pump set.
EC5	Water meter	Volume (m ³ or l)	30 minutes	Required to measure volume of top-up water entering the network.
EC6	Defined differential pressure measurement point	Differential pressure (kPa, bar)	5 minutes	Location is determined by the Designer on a project basis. Likely to be located externally to the Energy Centre at the index point(s) of the distribution network. Where this isn't the case, this differential pressure measurement may be within the Energy Centre (across the pumps).

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
EC7	Defined differential pressure exceedance measurement point	Differential pressure (kPa, bar)	5 minutes	Location shall be determined by the Designer on a project basis.
EC8	Defined operating pressure measurement point	Pressure (kPa, bar)	5 minutes	Location shall be determined by the Designer on a project basis.

Figure A.1: Diagram indicating required Energy Centre Monitoring Points

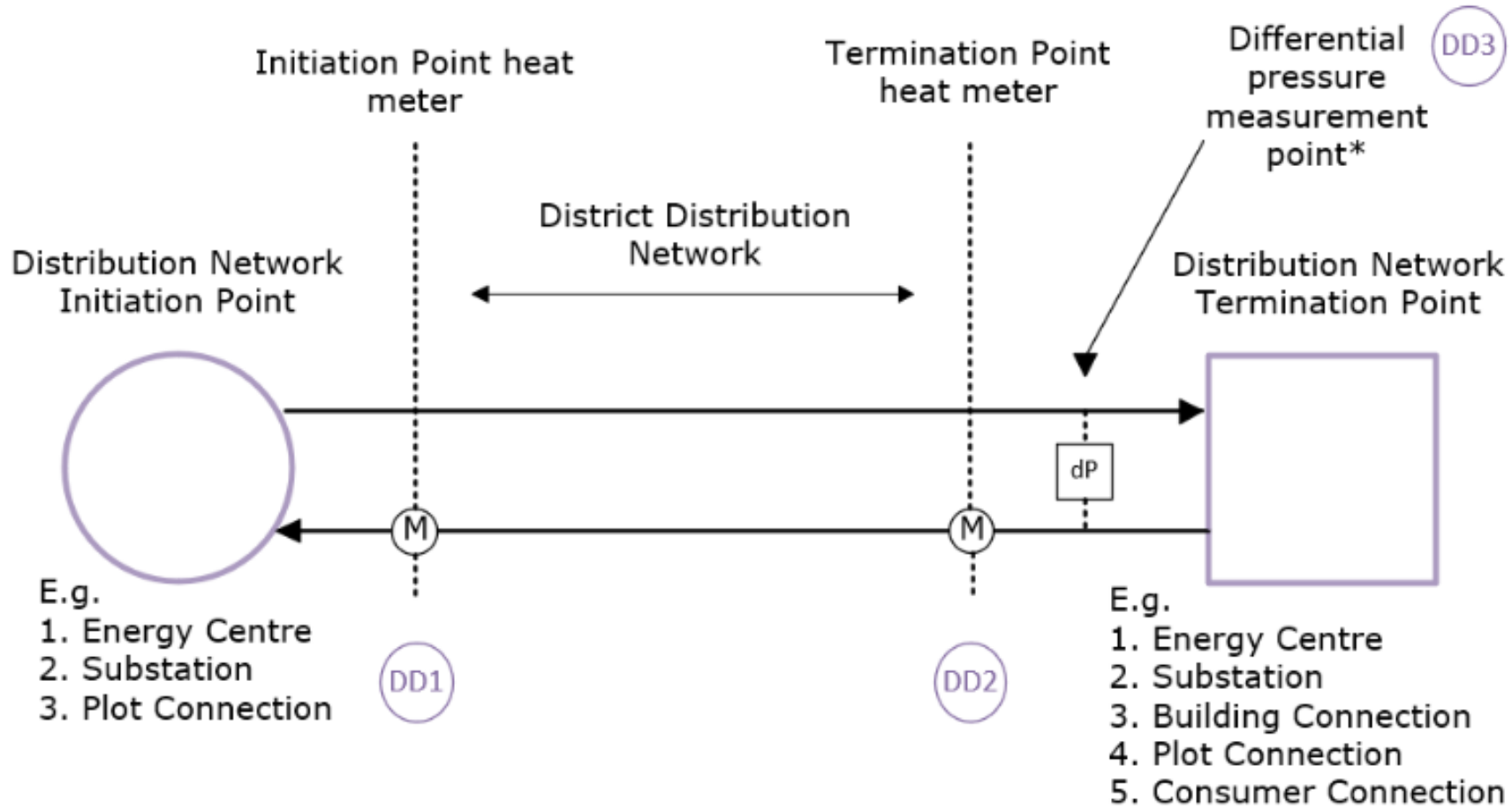


District Distribution Network

Table A.2: Required Monitoring Points for District Distribution Network

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
DD1	Distribution network initiation point	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	30 minutes	Can be the same measurement point as an Energy Centre boundary measurement point, Substation offtake measurement point, or a plot/building connection measurement point (where not a Substation).
DD2	Distribution network termination point	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	30 minutes	Can be the same measurement point as a Substation intake measurement point, or a plot/building connection measurement point (where not a Substation), or a Consumer Connection measurement point.
DD3	Defined differential pressure measurement point	Differential pressure (kPa, bar)	5 minutes	Location(s) shall be determined by the Designer on a project basis. Likely to be at the District Distribution Termination Point(s).

Figure A.2: Diagram indicating required District Distribution Network Monitoring Points



*Location(s) to be identified by the designer

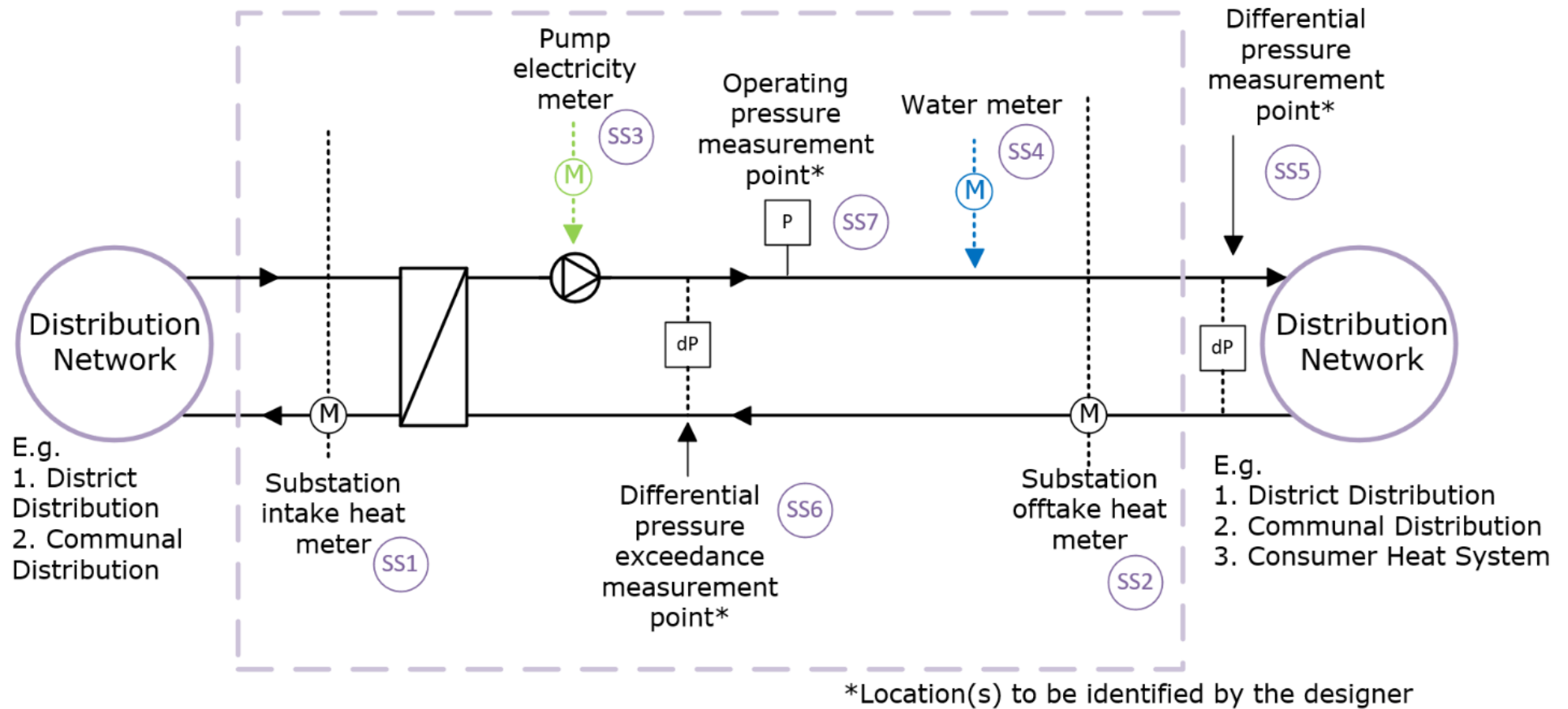
Substation

Table A.3: Required Monitoring Points for Substation

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
SS1	Boundary (intake)	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	5 minutes	Shall be located in the intake boundary to the Substation. To measure heat delivered to the Substation.
SS2	Boundary (offtake)	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	5 minutes	Shall be located in the offtake boundary to the Substation. To measure heat delivered to the network from Substation.
SS3	Network distribution pump	Meter read (kWh)	30 minutes	Required to measure pump energy consumption. Required per pump set, rather than individual pumps when contained within pump set.
SS4	Water meter	Volume (m ³ or l)	30 minutes	Required to measure volume of top-up water entering the network.

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
SS5	Defined differential pressure measurement point	Differential pressure (kPa, bar)	5 minutes	Location is determined by the Designer on a project basis. Likely to be located externally to the Substation at the index point(s) of the distribution network. Where this isn't the case, this differential pressure measurement may be within the Substation (across the pumps).
SS6	Defined differential pressure exceedance measurement point	Pressure (kPa, bar)	5 minutes	Location is to be determined by the Designer on a project basis.
SS7	Boundary (intake)	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	5 minutes	Shall be located in the intake boundary to the Substation. To measure heat delivered to the Substation.

Figure A.3: Diagram indicating required Substation Monitoring Points

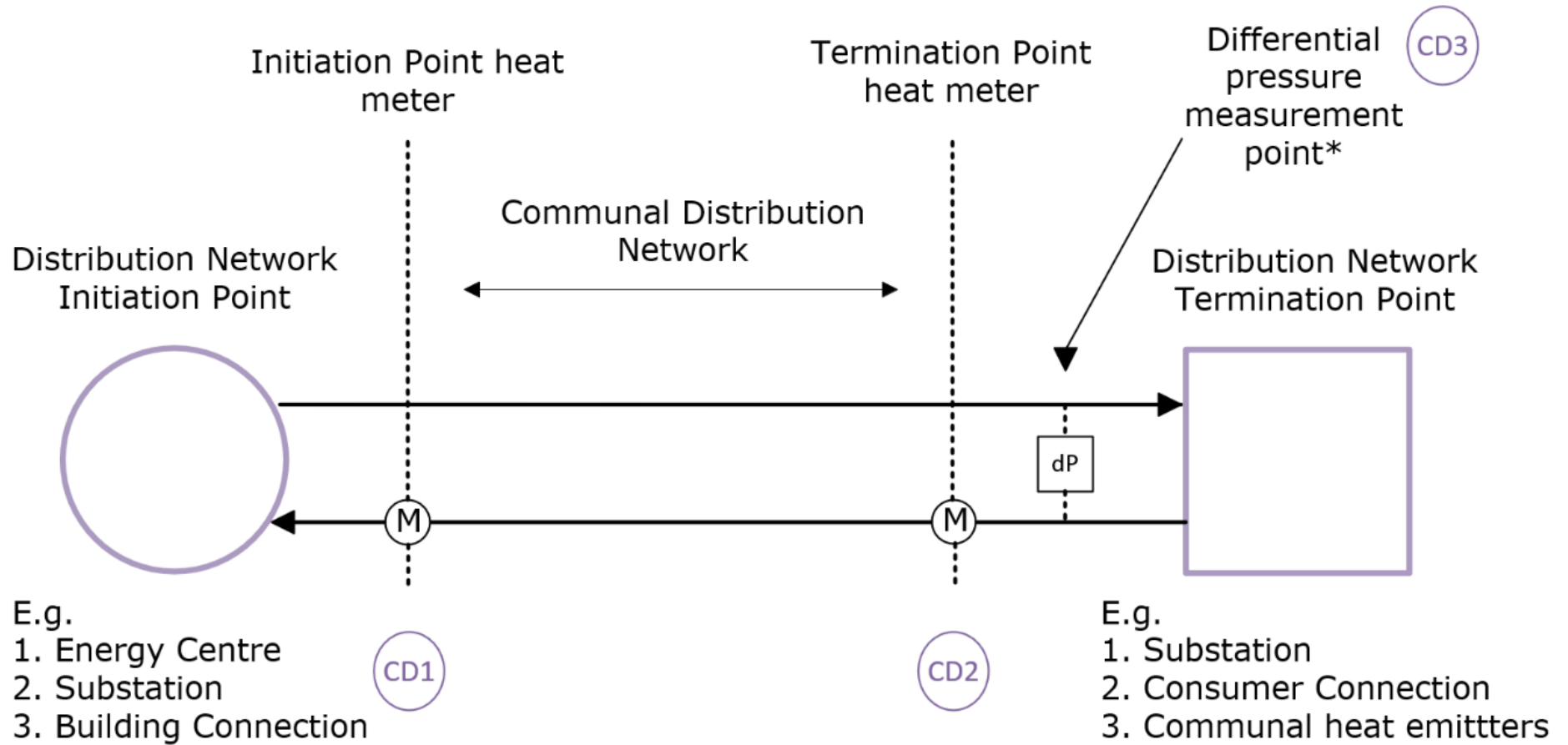


Communal Distribution Network

Table A.4: Required Monitoring Points for Communal Distribution Network

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
CD1	Communal Distribution Network initiation point	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	30 minutes	Can be the same measurement point as an Energy Centre boundary measurement point, Communal Distribution Network intake measurement point, or a plot/building connection measurement point (where not a Communal Distribution Network).
CD2	Communal Distribution Network termination point	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	30 minutes	Can be the same measurement point as a Communal Distribution Network offtake measurement point, a plot/building connection measurement point (where not a Communal Distribution Network), a Communal Distribution Network communal area measurement point, or a Consumer Connection measurement point.
CD3	Defined differential pressure measurement point	Differential pressure (kPa, bar)	5 minutes	Location is determined by the Designer on a project basis. Likely to be located at the top of riser(s) or index termination point(s).

Figure A.4: Diagram indicating required Communal Distribution Network Monitoring Points

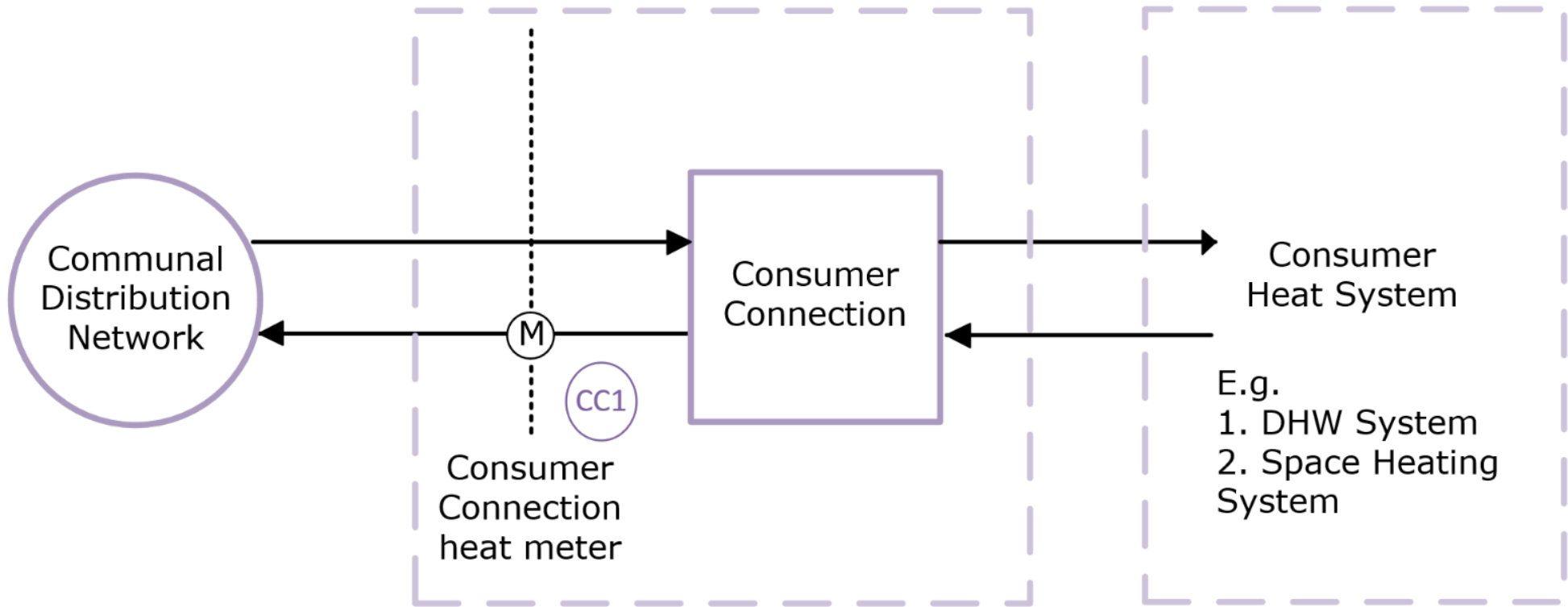


Consumer Connection

Table A.5: Required Monitoring Points for Consumer Connection

Monitoring Point ID	Monitoring Point description	Data required at Monitoring Point	Minimum frequency of reads	Further comments
CC1	Boundary (intake)	Meter read (kWh) Instantaneous power (kW) Flow rate (m ³ /h or l/s) Flow temperature (°C) Return temperature (°C) Volume (m ³ or l)	30 minutes	Shall be located on the intake boundary to the Consumer Connection. To measure heat delivered to the Consumer Connection. An example of this monitoring point would be a HIU heat meter.

Figure A.5: Diagram indicating required Consumer Connection Monitoring Points



Annex B: Data imputation rules

This section contains the imputation procedures for when data required for calculating KPIs becomes missing and requires substitution. These rules apply to the Data Analysis System (DAS) within the Automatic and Remote Monitoring System (ARMS).

Note that these rules are currently under development and are due to be included in a future version of this document.

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