Heat Network Technical Assurance Scheme

New Build Heat Networks

Technical Specification

Consumer Connection

Phase 2: Design

HNTAS-NB-TS-CC-P2

Version History

Revision	Notes	Date
V0.4	Draft issue	05/12/25

Disclaimer

The following HNTAS Code document is published in draft format. This document is intended to give the sector early sight of HNTAS requirements in their current stage of development for the purpose of facilitating sector understanding of the scheme.

Draft Code documents, including Technical Specifications and Assessment Procedures, 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. The content of this document is still in development and subject to change. Requirements should not be considered as fixed at this stage.

Changes which may be made to this document in future include those to:

- reflect learnings from the New Build and Existing network pilot programmes;
- align with aspects of HNTAS which are subject to public policy consultation;
- align with new requirements in TS1 and MMS;
- align the terminology of this document with that used in other HNTAS documentation;
- rectify errors in this draft version; and
- improve clarity of contents.

The Key Failures set out in the draft Code documents have been identified as a specific area for review, to ensure that:

- all Key Failures enable a binary assessment;
- Key Failures are only included for genuine issues presenting major risks to KPIs, and that moderate or lower risks are considered via non-conformity processes; and
- Key Failures do not duplicate Technical Requirements unless there is a clear justification to do so.

DESNZ will be welcoming feedback on the information in this document via a change management process. This process will run in parallel to the HNTAS policy consultation and DESNZ invites stakeholders to engage with both, once they are open. You can sign up to receive updates on future detailed draft technical documents as they are published by contacting: heatnetworks@energysecurity.gov.uk.

Please be advised that this document references other HNTAS draft Code documents which have not yet been published. References to other documents will also be subject to change following the publication of updated standards. The final version of this document will be released before the launch of HNTAS.

Note on Phase 4: Operation (initial) and Phase 5: Operation (ongoing)

The New Build Technical Specification and Assessment Procedures Overview (Phase 0) documents indicate that there are separate New Build Code Documents for Phase 4: Operation (initial) and Phase 5: Operation (ongoing).

These documents have since been consolidated to reduce the number of Code Documents, so the Phase 4: Operation documents cover requirements for New Build networks during both initial and ongoing operation.

This change does not impact the assessment of New Build networks in operation, which still occurs:

- after 1 year of operation; and
- after 2 years of operation.

Contents

Foreword

This Technical Specification forms part of the UK Government's Heat Network Technical Assurance Scheme (HNTAS, The Scheme) delivered by the Department for Energy Security and Net Zero, in partnership with the Scottish Government and Ofgem. The Department for 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 in the form of Technical Sub-Working Groups, 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 document specifies HNTAS Requirements for a Consumer Connection Element within a New Build Heat Network in Phase 2: Design.

This document sits within a series of Technical Specifications for a Consumer Connection, which features within a wider Code documentation structure, as outlined in Table 1.

This Technical Specification has been issued in draft format and will be updated prior to scheme launch.

For further information on the use of this document within the Heat Network Technical Assurance Scheme, please refer to the Heat Network Technical Assurance Scheme – New Build Heat Networks – Scheme Rules – Assessment Regime (HNTAS-NB-SR-XX-AS) document.

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Code Document Structure

Technical Specifications

Document Type	Element		Part/Phase				
			Overview	Phase 1: Feasibility	Phase 2: Design	Phase 3: Construction	Phase 4: Operation
			P0	P1	P2	P3	P4
Technical Specification	Energy Centre	EC	HNTAS-NB-TS-EC-P0	HNTAS-NB-TS-EC-P1	HNTAS-NB-TS-EC-P2	HNTAS-NB-TS-EC-P3	HNTAS-NB-TS-EC-P4
	District Distribution Network	DD	HNTAS-NB-TS-DD-P0	HNTAS-NB-TS-DD-P1	HNTAS-NB-TS-DD-P2	HNTAS-NB-TS-DD-P3	HNTAS-NB-TS-DD-P4
	Substation	SS	HNTAS-NB-TS-SS-P0	HNTAS-NB-TS-SS-P1	HNTAS-NB-TS-SS-P2	HNTAS-NB-TS-SS-P3	HNTAS-NB-TS-SS-P4
	Communal Distribution Network	CD	HNTAS-NB-TS-CD-P0	HNTAS-NB-TS-CD-P1	HNTAS-NB-TS-CD-P2	HNTAS-NB-TS-CD-P3	HNTAS-NB-TS-CD-P4
	Consumer Connection	CC	HNTAS-NB-TS-CC-P0	HNTAS-NB-TS-CC-P1	HNTAS-NB-TS-CC-P2	HNTAS-NB-TS-CC-P3	HNTAS-NB-TS-CC-P4
	Consumer Heat System	CH	HNTAS-NB-TS-CH-P0	HNTAS-NB-TS-CH-P1	HNTAS-NB-TS-CH-P2	HNTAS-NB-TS-CH-P3	N/A

Table 1: New Build Network Technical Specification structure

Scope

This document specifies the HNTAS Requirements for a Consumer Connection within a New Build Heat Network in Phase 2: Design.

A Consumer Connection is defined as a connection between a Distribution Network (either District or Communal) and a single Consumer Heat System, where the instantaneous hot water system is ≤ 70 kW and/or the heating/cooling system is ≤ 20 kW.

A detailed definition of the Consumer Connection is contained within the Heat Network Technical Assurance Scheme – New Build Heat Networks – Technical Specification – Consumer Connection – Overview (HNTAS-NB-TS-CC-P0) document.

New Build Heat Networks

There are two stages within Phase 2: Design, which are Stage 2: Developed Design and Stage 3: Technical Design. This is outlined in Figure 1.

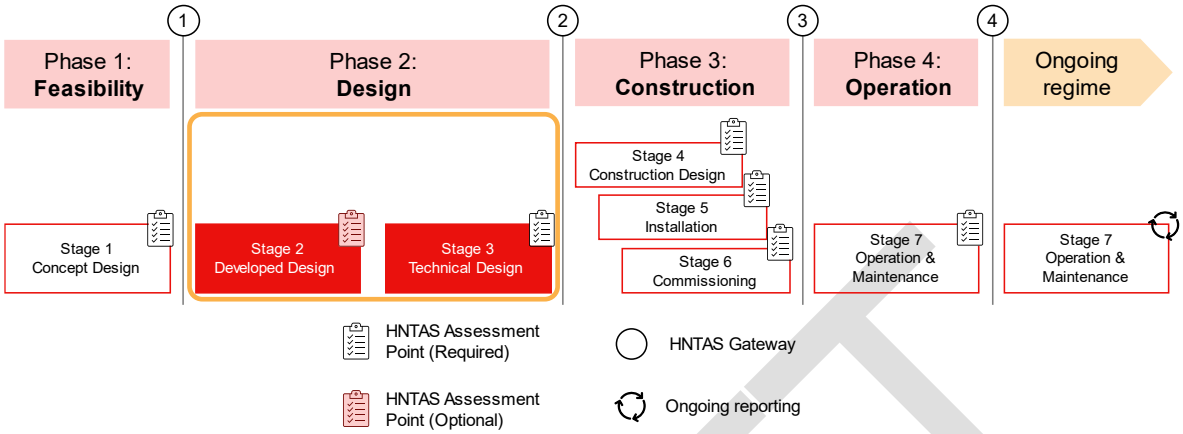

Figure 1: HNTAS New Build regime phases and stages

References

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.

- Heat Network Technical Standard (TS1) (HNTAS, 2025)
- Heat Network Metering and Monitoring Standard (MMS) (HNTAS, 2025)
- Heat Network Technical Assurance Scheme – New Build Heat Networks – Scheme Rules – Assessment Regime (HNTAS-NB-SR-XX-AS)
- Heat Network Technical Assurance Scheme – New Build Heat Networks – Technical Specification – Consumer Connection – Overview (HNTAS-NB-TS-CC-P0)

Informative references

The following informative references apply to this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- BESA UK HIU Test Regime (BESA, 2023, or latest edition)
- RIBA Plan of Work (RIBA, 2020)

Terms and Definitions

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

2. Requirements for Stage 2: Developed Design and Stage 3: Technical Design

2.1. Technical Requirements

The applicable HNTAS Technical Requirements in Table 2 shall be fulfilled.

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.1.	Peak heat demands and annual heat consumption shall be calculated in accordance with the applicable technical standard(s).	TS1 2.1.1 TS1 2.1.2 TS1 2.1.3 TS1 2.1.4 TS1 2.1.5 TS1 2.1.6 TS1 2.1.9 TS1 2.1.10 TS1 2.1.11 TS1 2.1.12 TS1 2.1.14 TS1 2.1.17 TS1 2.7.3 TS1 2.7.7	TS1 3.1.1 TS1 3.1.2 TS1 3.1.3 TS1 3.1.4 TS1 3.1.5 TS1 3.1.6 TS1 3.1.9 TS1 3.1.10 TS1 3.1.11 TS1 3.1.12 TS1 3.1.14 TS1 3.1.17 TS1 3.7.3 TS1 3.7.7	CC-S2-E01
2.1.2.	The use of direct or indirect connections shall be assessed in accordance with the applicable technical standard(s).	TS1 2.2.13	TS1 3.2.13	CC-S2-E06
2.1.3.	Where instantaneous domestic hot water has not been specified, the domestic hot water system options shall be assessed in accordance with the applicable technical standard(s).	TS1 2.2.10	TS1 3.2.10	CC-S2-E06
2.1.4.	The network keep-warm strategy shall be developed in accordance with the applicable technical standard(s).	TS1 2.2.18 TS1 2.2.19	TS1 3.2.18 TS1 3.2.19	CC-S2-E05 CC-S2-E07 CC-S2-E08
2.1.5.	Operating temperatures shall be determined in accordance with the applicable technical standard(s).	TS1 2.2.7 TS1 2.2.15 TS1 2.2.17 TS1 2.4.3 TS1 2.4.4 TS1 2.4.6	TS1 3.2.7 TS1 3.2.15 TS1 3.2.17 TS1 3.4.3 TS1 3.4.4 TS1 3.4.6	CC-S2-E02

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.6.	Working pressures shall be assessed in accordance with the applicable technical standard(s). *Note: it is expected that this assessment is undertaken with consideration for the other Elements present in the Heat Network.*	TS1 2.6.1 TS1 2.6.2 TS1 2.6.3 TS1 2.6.4	TS1 3.6.1 TS1 3.6.2 TS1 3.6.3 TS1 3.6.4	CC-S2-E03
2.1.7.	A pressure safety system shall be specified in accordance with the applicable technical standard(s).	TS1 2.6.7	TS1 3.6.7 TS1 3.6.13	CC-S2-E03 CC-S2-E04
2.1.8.	Where the Consumer Connection is a Heat Interface Unit, it shall be specified in accordance with the applicable technical standard(s). The Heat Interface Unit specified shall be registered under the BESA HIU Test Regime or an equivalent accredited independent HIU testing and registration scheme.	TS1 2.2.7 TS1 2.2.8 TS1 2.2.9 TS1 2.2.11 TS1 2.2.14 TS1 2.2.15	TS1 3.2.7 TS1 3.2.8 TS1 3.2.9 TS1 3.2.11 TS1 3.2.14 TS1 3.2.15 TS1 3.2.20	CC-S2-E09
2.1.9.	The domestic hot water system shall be specified in accordance with the applicable technical standard(s). The domestic hot water system shall ensure that that 45°C domestic hot water is generated within 15 seconds.	TS1 2.2.7 TS1 2.2.8 TS1 2.2.9 TS1 2.2.11 TS1 2.2.12 TS1 2.2.18 TS1 2.2.19 TS1 2.4.6 TS1 2.10.2 TS1 2.11.18	TS1 3.2.7 TS1 3.2.8 TS1 3.2.9 TS1 3.2.11 TS1 3.2.12 TS1 3.2.18 TS1 3.2.19 TS1 3.4.6 TS1 3.10.2 TS1 3.11.18	CC-S2-E09

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.10.	The Consumer Connection shall be selected and sized to deliver the calculated design space heating and domestic hot water demands at the minimum and maximum design operating temperatures of the Heat Network.	TS1 2.2.7 TS1 2.2.15 TS1 2.2.17 TS1 2.4.6	TS1 3.2.7 TS1 3.2.15 TS1 3.2.17 TS1 3.4.6	CC-S2-E09 CC-S2-E10
2.1.11.	The space heating pump shall be sized to satisfy the peak demand and pressure requirement of the space heating system, including the control valves.			CC-S2-E09 CC-S2-E10
2.1.12.	The hydraulic design and control philosophy of the Consumer Connection shall be developed in accordance with the applicable technical standard(s).	TS1 2.2.6 TS1 2.5.5 TS1 2.8.20 TS1 2.10.2 TS1 2.15.10	TS1 3.2.6 TS1 3.5.5 TS1 3.8.20 TS1 3.10.2 TS1 3.15.10	CC-S2-E07 CC-S2-E11
2.1.13.	The Consumer Connection shall include flushing bypasses in accordance with the applicable technical standard(s).	TS1 2.2.21	TS1 3.2.21	CC-S2-E07 CC-S2-E09

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.14.	The location of isolation valves shall be in accordance with: 1. the applicable technical standard(s); 2. the Consumer Connection emergency isolation requirements; 3. commissioning and Water Quality Strategy requirements; 4. Resilience Strategy requirements (where applicable).	TS1 2.15.10	TS1 3.15.10	CC-S2-E07 CC-S2-E08
2.1.15.	A repair and replacement strategy shall be developed in accordance with the applicable technical standard(s).	TS1 2.9.7 TS1 2.15.1 TS1 2.15.7	TS1 3.9.7 TS1 3.15.1 TS1 3.15.7	CC-S2-E14
2.1.16.	A Water Quality Strategy shall be developed in accordance with the applicable technical standard(s). *Note: it is expected that this is undertaken with consideration for the other Elements present in the Heat Network.*	TS1 2.11.1 TS1 2.11.2 TS1 2.11.3 TS1 2.11.5	TS1 3.11.1 TS1 3.11.2 TS1 3.11.3 TS1 3.11.5	CC-S2-E07 CC-S2-E09 CC-S2-E12
2.1.17.	A Water Quality Recording Programme shall be developed in accordance with the applicable technical standard(s). *Note: it is expected that this is undertaken with consideration for the other Elements present in the Heat Network.*	TS1 2.11.6 TS1 2.11.7 TS1 2.11.8 TS1 2.11.9 TS1 2.11.10 TS1 2.11.11 TS1 2.11.12 TS1 2.11.13	TS1 3.11.6 TS1 3.11.7 TS1 3.11.8 TS1 3.11.9 TS1 3.11.10 TS1 3.11.11 TS1 3.11.12 TS1 3.11.13	CC-S2-E07 CC-S2-E09 CC-S2-E12 CC-S2-E13

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.18.	The Consumer Connection shall be designed to minimise the entry of oxygen into the system.	TS1 2.11.20 TS1 2.11.24 TS1 2.11.28 TS1 2.11.29	TS1 3.11.20 TS1 3.11.24 TS1 3.11.28 TS1 3.11.29	CC-S2-E07
2.1.19.	The design of the Consumer Connection shall mitigate the risk posed by stagnation in the system.	TS1 2.11.25	TS1 3.11.25	CC-S2-E07 CC-S2-E08 CC-S2-E09 CC-S2-E12 CC-S2-E13
2.1.20.	Water quality equipment shall be specified in accordance with the applicable technical standard(s).	TS1 2.2.21 TS1 2.11.14 TS1 2.11.15 TS1 2.11.16 TS1 2.11.18 TS1 2.11.23	TS1 3.2.21 TS1 3.11.14 TS1 3.11.15 TS1 3.11.16 TS1 3.11.18 TS1 3.11.23	CC-S2-E07 CC-S2-E09
2.1.21.	Consumer Connection insulation shall be specified in accordance with the applicable technical standard(s).	TS1 2.2.15 TS1 2.2.16 TS1 2.13.6 Building Regulations Part L Volume 1 4.29 (2023) Building Regulations Part L Volume 2 4.26 (2023)	TS1 3.2.15 TS1 3.2.16 TS1 3.13.6 Building Regulations Part L Volume 1 4.29 (2023) Building Regulations Part L Volume 2 4.26 (2023)	CC-S2-E09 CC-S2-E11
2.1.22.	The Consumer Connection spatial requirements and layout shall be determined in accordance with the applicable technical standard(s).	TS1 2.2.22 TS1 2.9.7 TS1 2.15.1 TS1 2.15.7 MMS 1.2.1 MMS 1.2.5	TS1 3.2.22 TS1 3.9.7 TS1 3.15.1 TS1 3.15.7 MMS 1.2.1 MMS 1.2.5	CC-S2-E08
2.1.23.	An outline commissioning plan for the Consumer Connection shall be developed in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	TS1 3.2.20 TS1 3.8.2 TS1 3.17.5	CC-S2-E15

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.24.	The required items to be demonstrated, the performance criteria and methodology for Acceptance Testing shall be identified in accordance with the [HNTAS Acceptance Testing Standard]. The Consumer Connection design shall be able to facilitate the Acceptance Testing methodology. This requirement is only applicable at Stage 3.	N/A		CC-S2-E16
2.1.25.	Specialist Heat Network design items to be completed at the Construction Design stage shall be identified. A design specification for the specialist design items to be undertaken during the Construction Design stage shall be produced, which shall indicate the design and performance requirements of the item. The specification shall also outline any applicable HNTAS Technical Design standard(s). This requirement is only applicable at Stage 3.	N/A		CC-S2-E17
2.1.26.	Drawings and schematics shall be produced in accordance with the applicable technical standard(s).	TS1 2.17.3 TS1 2.17.4	TS1 3.17.3 TS1 3.17.4	CC-S2-E07 CC-S2-E08

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.27.	The Technical Parameters Schedule shall be completed with accurate information and references to relevant documentation.			CC-S2-E18

Table 2: Technical Requirements for the Consumer Connection at Stage 2: Developed Design and Stage 3: Technical Design

2.2. Performance Monitoring Requirements

The applicable Performance Monitoring Requirements in Table 3 shall be fulfilled.

Performance Monitoring Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.2.1.	The Metering and Monitoring Strategy shall be updated in accordance with the applicable technical standard(s).	TS1 2.12.1	TS1 3.12.1	CC-S2-E19
2.2.2.	The KPI Schedule shall be updated. The KPI Schedule shall contain: 1. the identified applicable KPIs to be measured and reported by the Metering and Monitoring System; 2. the thresholds for each KPI in operation (based on the level of information available at this stage); and, 3. the Monitoring Points required to measure each KPI.	TS1 2.12.1 MMS 4.1.12	TS1 3.12.1 MMS 4.1.12	CC-S2-E20

Performance Monitoring Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.2.3.	The Monitoring Points Schedule shall be updated. The Monitoring Points Schedule shall contain: 1. the required Monitoring Points to measure KPIs; 2. the location of each Monitoring Point (which identifies the applicable Element); and, 3. a unique ID code, which follows a determined naming convention.	TS1 2.12.1 MMS 4.1.13	TS1 3.12.1 MMS 4.1.13	CC-S2-E20 CC-S2-E21
2.2.4.	The Monitoring Points (all thermal energy meters, utility meters, and sensors for the Metering and Monitoring System) shall be sized and specified in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	TS1 3.12.2 TS1 3.12.3 TS1 3.12.4	CC-S2-E24 CC-S2-E25
2.2.5.	The Automatic and Remote Monitoring System (ARMS) shall be specified in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	TS1 3.12.5 TS1 3.12.6	CC-S2-E23

Performance Monitoring Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.2.6.	Diagram(s) indicating the flow of data between the Monitoring Points and the ARMS, in addition to any hierarchy of Monitoring Points, shall be produced. This requirement is only applicable at Stage 3.	N/A	TS1 3.12.1 MMS 4.1.11	CC-S2-E26
2.2.7.	Schematic(s) shall be produced which contain each Monitoring Point in the required location, each labelled with its unique ID code.	TS1 2.12.1 MMS 4.1.14	TS1 3.12.1 MMS 4.1.14	CC-S2-E07 CC-S2-E24

Table 3: Performance Monitoring Requirements for the Consumer Connection at Stage 2: Developed Design and Stage 3: Technical Design

2.3. Data Protection and Smart Metering Requirements

The applicable Data Protection and Smart Metering Requirements in Table 4 shall be fulfilled.

Data Protection and Smart Metering Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.3.1.	The Metering and Monitoring System shall allow system operators to comply with their obligations of data protection by design and by default in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	MMS 2.2	CC-S2-E27
2.3.2.	The Metering and Monitoring System shall allow system operators to comply with their obligations of secure data processing in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	MMS 2.3	CC-S2-E28
2.3.3.	A smart metering system or advanced meter infrastructure (AMI) shall be specified in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	MMS 3.1	CC-S2-E29

Table 4: Data Protection and Smart Metering Requirements for the Consumer Connection at Stage 2: Developed Design and Stage 3: Technical Design

2.4. Key Failures

The applicable Key Failures listed in Table 5 shall not be present.

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.4.1.	Inappropriate and/or inaccurate methodology used to estimate peak heat demand and annual heat demand.	Inaccurate estimation of size of the Consumer Connection (i.e. DHW and space heating plate heat exchangers), which impacts CapEx and spatial requirements.	CC-S2-E01
2.4.2.	Inappropriate selection of space heating and/or DHW temperature profiles given consumer requirements.	High DHW and space heating temperatures increase the required temperature from the Distribution Network, which increases heat losses and reduces the generation efficiency of the Heat Network. High DHW temperatures also generates scalding risks.	CC-S2-E02
2.4.3.	Inappropriate selection of DHW and space heating generation technology (e.g. DHW cylinders or recirculation systems where instantaneous DHW generation is feasible).	High return temperatures from DHW and space heating systems due to complex system selections.	CC-S2-E06
2.4.4.	Inappropriate and/or inaccurate methodology used to estimate the size of the Consumer Connection (i.e. DHW and space heating plate heat exchangers).	Oversized plate heat exchangers, increasing CapEx and reducing turbulent flow through plate heat exchanger, increasing risk of fouling. Performance of the Consumer Connection impacted during period of low demand (e.g. the Consumer Connection DHW temperature not stable or controlled with low flow rate) due to oversizing.	CC-S2-E10 CC-S2-E11

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.4.5.	Architectural consideration not given to DHW delivery strategy (for example, distance between DHW generation point and DHW outlets), to ensure acceptable DHW delivery times can be achieved.	Extended DHW delivery times due to long pipework distances between DHW generation point and DHW outlets, resulting in poor consumer outcomes.	CC-S2-E08
2.4.6.	Insufficient space and or inappropriate location for equipment maintenance. For example, lack of clearance surrounding HIU to allow for maintenance access.	Lack of access to the Consumer Connection equipment which prevents or limits repair and replacement.	CC-S2-E08
2.4.7.	System working pressures not considered when specifying the Consumer Connection equipment.	The Consumer Connection equipment pressure rating or differential pressure rating not sufficient given the system working pressures. This can result in equipment failure, void warranties and health and safety risks.	CC-S2-E03 CC-S2-E10
2.4.8.	Requirements for Acceptance Testing, both methodology and criteria, not considered and developed during the Technical Design stage.	The Consumer Connection design not having necessary features which facilitate the requirements for Acceptance Testing. Testing undertaken not sufficient to demonstrate expected operating conditions, which may prevent issue identification, diagnosis, and remedial works prior to operation.	CC-S2-E16
2.4.9.	Lack of consideration for the infrastructure required for ARMS during the Technical Design stage.	Inability to install infrastructure required for ARMS at the Installation stage.	CC-S2-E23

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.4.10.	Insufficient Metering and Monitoring Strategy, and Monitoring Points specified, to enable monitoring of applicable Elements and overall Heat Network performance.	Insufficient thermal energy meters and Monitoring Points to enable ongoing monitoring of performance of applicable Elements during operation, preventing ongoing KPI measurement, optimisation, and issue diagnosis.	CC-S2-E19
2.4.11.	ARMS specified not capable of being remotely accessed. Remote access is defined as the ability to download data from the ARMS at the required frequency, from a location that is not physically on-site.	Unable for relevant stakeholders (HNO, O&M contractors etc.) to access data remotely which makes performance analysis against KPIs, and ability to quickly identify issues and remedial actions more time intensive and costly. This also presents a risk of issues and remedial actions not being identified in a timely manner.	CC-S2-E23
2.4.12.	ARMS specified not capable of being accessed by multiple stakeholder/operatives.	Inability for all relevant stakeholders (HNO, O&M contractors, specialist contractors) to access data to analyse performance against KPIs and identify issues and remedial actions.	CC-S2-E23
2.4.13.	Metering and Monitoring System specified unable to measure, extract, record and store data as required within the ARMS specification and calculate KPIs.	Inability to access data, monitor performance against KPIs, identify issues and remedial actions.	CC-S2-E23

Table 5: Key Failures for the Consumer Connection at Stage 2: Developed Design and Stage 3: Technical Design

2.5. Evidence Requirements

The applicable Evidence Items listed in Table 6 shall be provided to demonstrate fulfilment with the Technical Requirements, Performance Monitoring Requirements, and avoidance of Key Failures.

Evidence Item		Detailed description and requirements
CC-S2-E01	Peak and annual heat demand calculations and schedule	Methodology, calculations, data, and assumptions used to estimate peak and annual heat demands shall be provided. To include a schedule outlining the expected peak and annual heat demand for each Consumer Connection type. Detail for each Consumer Connection to be outlined. Where the Consumer Connection is residential, an accommodation schedule outlining the dwelling, dwelling type, size (floor area), number of occupants, number of bathrooms. Where there are commercial connections the floor area and expected use should be outlined.
CC-S2-E02	Operating temperature assessment	Evidence containing the Consumer Connection operating temperatures. This shall outline the flow temperature and expected return temperatures during different modes of operation (DHW, space heating, standby). Rationale for the selected temperatures shall be provided. This shall consider the requirements of the network/end users (current and future), approach temperature requirements and the Consumer Connection performance. Any health and safety risks and mitigations shall also be outlined.
CC-S2-E03	System pressure assessment	Assessment of working pressures in the system. Shall include: • calculation of the System Maximum Working Pressure; • calculation of the Local Maximum Working Pressure; • identification of the risks that arise as a result of calculated working pressures; • assessment of the likelihood and impact of the identified risk; • mitigation of the risks posed by working pressures (where appropriate).
CC-S2-E04	Pressure safety system specification	Written description of the specification of the pressure safety system.

Evidence Item		Detailed description and requirements

		Shall outline:
		• the items used (e.g. Safety Relief Devices);
		• their locations in relation to:
		  ○ sources of pressure (e.g. heat generation sources, pressurisation equipment);
		  ○ isolation points.

CC-S2-E05	Keep-warm strategy for the Distribution Network	Evidence shall outline the required keep-warm strategy for the Distribution Network. Where the network is serving residential consumers, this will need to demonstrate compatibility with the required DHW delivery times. This requires coordination between the Distribution Network, Consumer Connection and Consumer Heat System Elements.
CC-S2-E06	Equipment selection assessment	Shall outline justification for selection of equipment within the Consumer Connection (e.g. indirect vs. direct connections, DHW provision). Only applicable for DHW provision where instantaneous DHW has not been selected. Justification should be technical, or client preference where applicable.
CC-S2-E07	Consumer Connection Schematic(s)	Schematic(s) to the detail as required by the applicable RIBA stage (RIBA, 2020). Schematic(s) shall contain the following: The items and hydraulic arrangement of the Consumer Connection. Note schematics which are part of manufacturers information are applicable. The Consumer Connection in relation to the Distribution Network and Consumer Heat System. Note schematics of other Elements which include the Consumer Connection are applicable.
CC-S2-E08	Consumer Connection Drawing(s)	Layout, plan, or elevation/cross-sectional drawings to the detail as required by the applicable RIBA stage (RIBA, 2020). Drawings shall indicate coordination with other building services and infrastructure (walls, ceiling voids etc.), demonstrating location of the Consumer Connection, access requirements and space for insulation. Expected to contain drawings for the following:

Evidence Item		Detailed description and requirements
		1. Utility cupboard (or alternative location of the Consumer Connection) layout and cross-sectional drawings. 2. Plan/layout drawings showing the location of the Consumer Connection in relation to the hot water services and hot water outlets 3. Plan/layout drawings showing the location of the Consumer Connection in relation to the space heating circuit and emitters. Where 3D drawings or models have been produced, these can also be provided to demonstrate compliance.
CC-S2-E09	Consumer Connection Specification(s)	Shall contain specification for HIU, CIU, dwelling heat pump, hot water system or any alternative Consumer Connection Technology. Specification shall provide a brief description of the intended system operation, the products to be used and the performance requirements. For the Consumer Connection, this specifically shall contain the following information where applicable: • DHW generation time; • Insulation requirements and standby heat losses; • Registration of BESA HIU test where the Consumer Connection is a HIU.
CC-S2-E10	Consumer Connection sizing calculations	Shall contain the calculations used to size the Consumer Connection for each Consumer Connection type. This shall include calculations for sizing of space heating pumps, plate heat exchangers, cylinders, and coils where applicable.
CC-S2-E11	Control Strategy	Description of control philosophy of the Consumer Connection during all modes of operation and interactions with external field equipment (e.g. thermostats).
CC-S2-E12	Water Quality Strategy	Documentation produced for each hydraulic system which includes information regarding the management of water quality in the system. Shall include: • the type of water quality system to be followed (e.g. Chemically Treated System or Depleted Water System); • the selection of the fill water source; • the selection of the material of plant, equipment, and distribution pipework (which, for retrofit

Evidence Item		Detailed description and requirements
		scenarios, should include consideration of its compatibility with the current existing system); • the specification for water treatment and conditioning (e.g. filtration, softening, demineralisation, chemical dosing etc.); • the presence of hydraulic breaks between distribution pipework and space heating circuits on the Consumer Heat Systems; • initial specification of the flushing methodology (e.g. closed loop pre-treatment cleaning (CPC) or flush-to-drain).
CC-S2-E13	Water Quality Recording Programme	Documentation produced regarding the recording of water quality parameters throughout the Heat Network. Should typically include: • the water quality parameters that will be recorded; • the method for recording water quality parameters (e.g. through online monitoring or laboratory sampling); • the locations at which the water quality parameters will be recorded; • the frequency and dates at which the water quality parameters will be recorded; • the process to be followed when the value of a water quality parameter has exceeded its control limits.
CC-S2-E14	Repair and replacement strategy	Evidence outlining the repair and replacement strategy. Shall aid justification of equipment and material selection, spatial and access requirements, and routing.
CC-S2-E15	Commissioning Plan	Outline commissioning plan containing: 1. a list of required commissioning activities; 2. the key criteria to be achieved during commissioning; 3. the time order of commissioning activities and interdependencies; 4. specific requirements that the construction commissioning plan has to adhere to.
CC-S2-E16	Acceptance Testing methodology and criteria	Shall outline: 1. a list of required parameters for testing;

Evidence Item		Detailed description and requirements
		2. the outline methodology to enable demonstration of required parameters; 3. any specific requirements for Construction Phase Acceptance Testing methodology and criteria. Shall outline where there are any differences for different Consumer Connection types.
CC-S2-E17	Specialist Construction Design Items Specification	Specification for the specialist Construction Design items. Shall include performance requirements and identify applicable HNTAS requirements based on the type of design item.
CC-S2-E18	Technical Parameters Schedule	Schedule which outlines all technical parameters in one location, with reference to applicable documents.
CC-S2-E19	Metering and Monitoring Strategy	The Metering and Monitoring Strategy shall contain a 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. The strategy shall also include: 1. a schedule of KPIs (Item CC-S2-E20); 2. a schedule of Monitoring Points (Item CC-S2-E21); 3. a Monitoring Points unique ID code naming methodology (Item CC-S2-E22); 4. a schematic with labelled Monitoring Points; 5. a data flow diagram (item CC-S2-E26); 6. an ARMS specification (item CC-S2-E23); 7. a Monitoring Points specification (thermal energy meters, utility meters, sensors) (item CC-S2-E24 & CC-S2-E25).
CC-S2-E20	KPI Schedule	A schedule of all KPIs required to be measured by the Metering and Monitoring System. The KPI Schedule shall contain: 1. the identified applicable KPIs to be measured and reported by the Metering and Monitoring System;

Evidence Item		Detailed description and requirements
		2. the thresholds for each KPI in operation (based on the level of information available at this stage); and, 3. the Monitoring Points required to measure each KPI.
CC-S2-E21	Monitoring Points Schedule	A schedule of all Monitoring Points required to measure KPIs. The Monitoring Points Schedule shall contain: 1. the required Monitoring Points to measure KPIs; 1. the location of each Monitoring Point (which identifies the applicable Element); and, 2. a unique ID code, which follows a determined naming convention.
CC-S2-E22	Unique ID code naming convention	Methodology used to label each Monitoring Point with a unique ID code.
CC-S2-E23	ARMS Specification	Shall provide description of the intended system operation and the materials, products to be used, standard of work required, performance requirements and the condition of which the work is to be executed.
CC-S2-E24	Monitoring Point Specification	Specification for each type of Monitoring Point (thermal energy meter, utility meter, sensors etc.) Shall provide description of the intended system operation and the materials, products to be used, standard of work required, performance requirements and the condition of which the work is to be executed.
CC-S2-E25	Meter sizing calculations	Shall outline the inputs, methodology and calculations used to size thermal energy meters for each Consumer Connection type.
CC-S2-E26	Data flow diagram(s)	Diagrams illustrating the route of data flow from the Monitoring Point to the ARMS, including hierarchy of Monitoring Points.
CC-S2-E27	Data Protection Compliance Statement	Shall contain evidence of how the Metering and Monitoring System(s) specified complies with the organisation's data protection obligations in accordance with the applicable technical standard(s).
CC-S2-E28	Data Security Risk Assessment	Shall contain an assessment of the risks to the system, including the methods reasonably available to threat actors to identify individuals, in the context of their nature, capability and objectives.

Evidence Item		Detailed description and requirements
		Shall include the controls implemented to address these risks, demonstrating that such risks have been reduced to an acceptable level.
CC-S2-E29	Smart Metering / AMI Specification Compliance Statement	Shall contain evidence of how the smart metering / AMI system has been specified in accordance with the applicable technical standard(s).

Table 6: Evidence Requirements for the Consumer Connection at Stage 2: Developed Design and Stage 3: Technical Design