Heat Network Technical Assurance Scheme

New Build Heat Networks

Technical Specification

Energy Centre

Phase 2: Design

HNTAS-NB-TS-EC-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 an Energy Centre Element within a New Build Heat Network in Phase 2: Design.

This document sits within a series of Technical Specifications for an Energy Centre, 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 an Energy Centre within a New Build Heat Network in Phase 2: Design.

An Energy Centre is defined as a plant room that contains heat generation equipment; and/or equipment connecting to an energy source; or a Substation which contains heat generation equipment (e.g. building connection with heat pumps or top-up boilers).

A detailed definition of the Energy Centre is contained within the Heat Network Technical Assurance Scheme – New Build Heat Networks – Technical Specification – Energy Centre – Overview (HNTAS-NB-TS-EC-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.

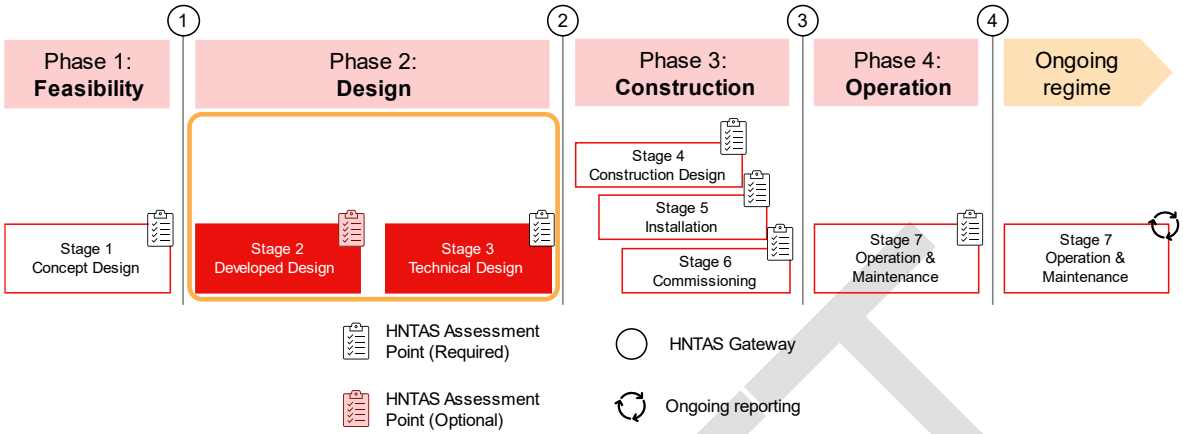

Figure 1: HNTAS New Build regime phases and stages

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 – Energy Centre – Overview (HNTAS-NB-TS-EC-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.

- 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 2.1.7 TS1 2.1.8 TS1 2.1.9 TS1 2.1.10 TS1 2.1.11 TS1 2.1.12 TS1 2.1.13 TS1 2.1.15 TS1 2.1.16 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 3.1.7 TS1 3.1.8 TS1 3.1.9 TS1 3.1.10 TS1 3.1.11 TS1 3.1.12 TS1 3.1.13 TS1 3.1.15 TS1 3.1.16 TS1 3.1.17 TS1 3.7.3 TS1 3.7.7	EC-S2-E01
2.1.2.	Operating temperatures shall be determined in accordance with the applicable technical standard(s).	TS1 2.4.1 TS1 2.4.3 TS1 2.4.4 TS1 2.4.7 TS1 2.4.10 TS1 2.4.11 TS1 2.8.3 TS1 2.8.11	TS1 3.4.1 TS1 3.4.3 TS1 3.4.4 TS1 3.4.7 TS1 3.4.10 TS1 3.4.11 TS1 3.8.3 TS1 3.8.11	EC-S2-E02
2.1.3.	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	EC-S2-E03

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.4.	A pressure safety system shall be specified in accordance with the applicable technical standard(s).	TS1 2.6.7 TS1 2.6.8 TS1 2.6.9 TS1 2.6.10 TS1 2.6.11 TS1 2.6.14	TS1 3.6.7 TS1 3.6.8 TS1 3.6.9 TS1 3.6.10 TS1 3.6.11 TS1 3.6.12 TS1 3.6.13 TS1 3.6.14	EC-S2-E03 EC-S2-E04
2.1.5.	Heat generation equipment and thermal storage shall be specified and sized in accordance with the load requirements (annual, peak, and minimum load) and the applicable technical standard(s).	TS1 2.7.4 TS1 2.7.5 TS1 2.7.7 TS1 2.7.10 TS1 2.8.4 TS1 2.8.5 TS1 2.8.7	TS1 3.7.4 TS1 3.7.5 TS1 3.7.7 TS1 3.7.10 TS1 3.8.4 TS1 3.8.5 TS1 3.8.7	EC-S2-E01 EC-S2-E05 EC-S2-E06
2.1.6.	Thermal storage shall be specified, sized, and designed in accordance with the applicable technical standard(s).	TS1 2.7.2 TS1 2.8.11 TS1 2.8.12 TS1 2.8.13 TS1 2.8.14 TS1 2.8.15 TS1 2.8.16 TS1 2.8.17 TS1 2.8.18 TS1 2.9.10	TS1 3.7.2 TS1 3.8.11 TS1 3.8.12 TS1 3.8.13 TS1 3.8.14 TS1 3.8.15 TS1 3.8.16 TS1 3.8.17 TS1 3.8.18 TS1 3.9.10	EC-S2-E07 EC-S2-E08 EC-S2-E10 EC-S2-E11 EC-S2-E12
2.1.7.	The Energy Centre network distribution pumps shall be specified and sized in accordance with the applicable technical standard(s).	TS1 2.8.25 TS1 2.8.26 TS1 2.8.27 TS1 2.10.3	TS1 3.8.25 TS1 3.8.26 TS1 3.8.27 TS1 3.10.3	EC-S2-E07 EC-S2-E08 EC-S2-E10 EC-S2-E11
2.1.8.	All other Energy Centre equipment shall be specified and sized in accordance with the operating conditions (e.g. flow rate, demand, temperature, pressure) specific to the Energy Centre.			EC-S2-E07 EC-S2-E08

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.9.	The Energy Centre pipework shall be specified and sized in accordance with the operating conditions (e.g. flow rate, demand, temperature, pressure) specific to the Energy Centre and the applicable technical standard(s).	TS1 2.16.1 TS1 2.16.2	TS1 3.16.1 TS1 3.16.2	EC-S2-E09 EC-S2-E11
2.1.10.	The hydraulic design and control philosophy, including an initial description of operation (DesOps), of the Energy Centre shall be developed in accordance with the applicable technical standard(s).	TS1 2.8.1 TS1 2.8.3 TS1 2.8.6 TS1 2.8.7 TS1 2.8.10 TS1 2.8.19 TS1 2.8.21 TS1 2.8.22 TS1 2.8.23 TS1 2.8.24	TS1 3.8.1 TS1 3.8.3 TS1 3.8.6 TS1 3.8.7 TS1 3.8.10 TS1 3.8.19 TS1 3.8.21 TS1 3.8.22 TS1 3.8.23 TS1 3.8.24	EC-S2-E02 EC-S2-E05 EC-S2-E10 EC-S2-E11 EC-S2-E12
2.1.11.	The Energy Centre ancillary equipment shall be specified in accordance with the applicable technical standard(s).	TS1 2.10.3 TS1 2.15.3 TS1 2.15.4 TS1 2.15.12	TS1 3.10.3 TS1 3.15.3 TS1 3.15.4 TS1 3.15.12	EC-S2-E07 EC-S2-E08 EC-S2-E10 EC-S2-E11 EC-S2-E12
2.1.12.	The Energy Centre bypasses, if required, shall be sized, selected, and located in accordance with the applicable technical standard(s).	TS1 2.10.1 TS1 2.10.3 TS1 2.10.4	TS1 3.10.1 TS1 3.10.3 TS1 3.10.4	EC-S2-E07 EC-S2-E08 EC-S2-E10 EC-S2-E12
2.1.13.	Carbon dioxide emissions shall be calculated in accordance with the applicable technical standard(s).	TS1 2.7.15	TS1 3.7.15	EC-S2-E21
2.1.14.	The energy supply to the Energy Centre (including electrical requirements) shall be determined in accordance with the applicable technical standard(s).	TS1 2.7.8 TS1 2.7.9 TS1 2.8.8	TS1 3.7.8 TS1 3.7.9 TS1 3.8.8	EC-S2-E23

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.15.	A Resilience Strategy shall be developed in accordance with the applicable technical standard(s). This shall include the production of a Disaster Recovery plan using the relevant information available. *Note: it is expected that this is undertaken with consideration for the other Elements present in the Heat Network.*	TS1 2.9.1 TS1 2.9.2 TS1 2.9.5 TS1 2.9.6 TS1 2.9.7	TS1 3.9.1 TS1 3.9.2 TS1 3.9.5 TS1 3.9.6 TS1 3.9.7	EC-S2-E19 EC-S2-E20
2.1.16.	A repair and replacement strategy shall be developed in accordance with the applicable technical standard(s).	TS1 2.9.7 TS1 2.9.8 TS1 2.15.1 TS1 2.15.2	TS1 3.9.7 TS1 3.9.8 TS1 3.15.1 TS1 3.15.2	EC-S2-E12 EC-S2-E13 EC-S2-E17
2.1.17.	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 2.11.4 TS1 2.11.5	TS1 3.11.1 TS1 3.11.2 TS1 3.11.3 TS1 3.11.4 TS1 3.11.5	EC-S2-E07 EC-S2-E12 EC-S2-E14
2.1.18.	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	EC-S2-E07 EC-S2-E12 EC-S2-E14 EC-S2-E15
2.1.19.	The Energy Centre 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	EC-S2-E07

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.20.	The design of the Energy Centre shall mitigate the risk posed by stagnation in the system.	TS1 2.11.25 TS1 2.11.27	TS1 3.11.25 TS1 3.11.27	EC-S2-E11 EC-S2-E12 EC-S2-E13 EC-S2-E14 EC-S2-E15
2.1.21.	Water quality equipment shall be specified in accordance with the applicable technical standard(s).	TS1 2.11.14 TS1 2.11.15 TS1 2.11.16 TS1 2.11.17 TS1 2.11.18 TS1 2.11.19 TS1 2.11.21 TS1 2.11.22 TS1 2.11.23 TS1 2.11.27	TS1 3.11.14 TS1 3.11.15 TS1 3.11.16 TS1 3.11.17 TS1 3.11.18 TS1 3.11.19 TS1 3.11.21 TS1 3.11.22 TS1 3.11.23 TS1 3.11.27	EC-S2-E07 EC-S2-E11 EC-S2-E12 EC-S2-E13 EC-S2-E14
2.1.22.	The Energy Centre insulation shall be specified in accordance with the applicable technical standard(s).	TS1 2.13.1 TS1 2.13.2 TS1 2.13.7 TS1 2.13.8 TS1 2.13.9 TS1 2.13.10 TS1 2.13.13 TS1 2.16.18	TS1 3.13.1 TS1 3.13.2 TS1 3.13.7 TS1 3.13.8 TS1 3.13.9 TS1 3.13.10 TS1 3.13.13 TS1 3.16.18	EC-S2-E22
2.1.23.	The Energy Centre ventilation strategy shall be developed in accordance with the applicable technical standard(s).	TS1 2.14.1 TS1 2.14.3	TS1 3.14.1 TS1 3.14.3	EC-S2-E27
2.1.24.	The Energy Centre spatial requirements and layout shall be determined to provide sufficient space to fulfil: • the spatial requirements for all equipment (e.g. heat generation equipment, water quality equipment, ancillary equipment); • access and egress requirements; • the requirements set out in the applicable technical standard(s).	TS1 2.7.2 TS1 2.9.8 TS1 2.13.2 TS1 2.15.1 TS1 2.15.2 TS1 2.15.5 MMS 1.2.1 MMS 1.2.5	TS1 3.7.2 TS1 3.9.8 TS1 3.13.3 TS1 3.15.1 TS1 3.15.2 TS1 3.15.5 MMS 1.2.1 MMS 1.2.5	EC-S2-E11 EC-S2-E12 EC-S2-E13 EC-S2-E14 EC-S2-E16 EC-S2-E17 EC-S2-E18 EC-S2-E19

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.25.	An outline commissioning plan for the Energy Centre shall be developed in accordance with the applicable technical standard(s). This requirement is only applicable at Stage 3.	N/A	TS1 3.8.2 TS1 3.17.5	EC-S2-E24
2.1.26.	The required items to be demonstrated, the performance criteria, and the methodology for Acceptance Testing shall be identified in accordance with the [HNTAS Acceptance Testing Standard]. The Energy Centre design shall be able to facilitate the Acceptance Testing methodology. This requirement is only applicable at Stage 3.	N/A		EC-S2-E25
2.1.27.	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		EC-S2-E28

Technical Requirement		Applicable technical standard(s)		Evidence Requirement(s)
		Stage 2	Stage 3	
2.1.28.	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	EC-S2-E12 EC-S2-E13
2.1.29.	The Technical Parameters Schedule shall be completed with accurate information and references to relevant documentation.			EC-S2-E29

Table 2: Technical Requirements for the Energy Centre 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	EC-S2-E30
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	EC-S2-E31

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	EC-S2-E31 EC-S2-E32 EC-S2-E33
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	EC-S2-E35 EC-S2-E36
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	EC-S2-E34

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	EC-S2-E37
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	EC-S2-E12 EC-S2-E32

Table 3: Performance Monitoring Requirements for the Energy Centre at Stage 2: Developed Design and Stage 3: Technical Design

2.3. Key Failures

The applicable Key Failures listed in Table 4 shall not be present.

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.3.1.	Inappropriate and/or inaccurate methodology used to estimate peak demand and annual heat consumption.	Oversized or undersized Energy Centre equipment.	EC-S2-E01
2.3.2.	Inappropriate selection of temperature profiles at the Energy Centre given the end user requirements and heat generation technology selection.	Temperatures being set that do not match the requirements of the Heat Network. Examples include: 1. the Energy Centre outlet temperature being set higher than necessary to supply the network required temperature, resulting in higher heat losses and increased energy consumption. 2. temperature profiles not being able to match the requirements of the network currently and in any future scenarios.	EC-S2-E02
2.3.3.	Inappropriate and/or inaccurate sizing of equipment, including under sizing of thermal storage and buffer vessels.	Oversized or undersized equipment, which impacts the following: • CapEx costs. • ability to maximise benefit of low carbon heat source through thermal storage. • ability to prevent short cycling of heat generation equipment • spatial requirements.	EC-S2-E06 EC-S2-E07 EC-S2-E08
2.3.4.	Equipment selected without considering minimum load and equipment turndown requirements.	Equipment selected that cannot operate at minimum load, resulting in increased equipment wear and shorter lifespan.	EC-S2-E06 EC-S2-E07 EC-S2-E08

Key Failure		Outcome to avoid	Evidence Requirement(s)
		For example, not considering the use of a modular approach to ensure turndown can be achieved.	
2.3.5.	Lack of network pressure assessment undertaken and/or incorrect calculation of network pressures and/or network volume, resulting in: • high operating pressures within tall buildings due to lack of hydraulic breaks. • incorrectly sized expansion and pressurisation provision. • working pressure of network exceeding pressure rating of equipment. • differential pressure exceeding differential pressure rating of equipment.	Network pressures within the network exceeding pressure ratings of equipment during operation. Unreliable Heat Network due to pressurisation unit and expansion provision not being fit for purpose or set points calculated correctly.	EC-S2-E03 EC-S2-E07
2.3.6.	Unnecessary hydraulic breaks in the Energy Centre. This refers to hydraulic breaks which are not required for either contractual separation or pressure breaks.	Unnecessary plate heat exchangers and associated equipment within an Energy Centre without justified reason for inclusion. Justified reasons would include for pressure requirements or contractual requirements. The addition of hydraulic breaks results in increased outlet temperatures at heat generation equipment, increased points of failure, increased maintenance requirements and higher CapEx.	EC-S2-E03 EC-S2-E07 EC-S2-E12

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.3.7.	Insufficient consideration given during the early design development to controls intent, equipment selection and sensor requirements and/or locations (e.g. ambient sensors, pressure sensors, temperature sensors).	Over complex or novel hydraulic arrangements which will not result in stable flow temperatures and efficient operation. Insufficient sensors specified within the Energy Centre to enable hydraulic design to operate as intended.	EC-S2-E10 EC-S2-E11 EC-S2-E12
2.3.8.	Insulation specification not sufficient to meet requirements for above ground pipework. This includes specification of insulation material, thicknesses, pipe support detail, and detail of insulation of valves, flanges and other equipment.	Inadequate insulation material and thickness specified to meet requirements, resulting in high heat losses. Lack of information within specification of pipe supports, which can specifically result in the following outcomes at the Installation stage, which increase heat losses: • direct pipe supports; • incorrect material used; • non pre-insulated pipe supports used; • incorrect spacing of pipe supports.	EC-S2-E22
2.3.9.	Insufficient ancillary equipment to aid with commissioning and maintenance. For example (but not limited to), flushing provision, vent and drain provision, isolation valves, gauges, and test points.	Difficulties with flushing and other commissioning activities, in addition to difficulties of maintaining the Heat Network in operation. For example, large drain downs of pipework and reduced heat supply due to lack of isolation valves.	EC-S2-E12
2.3.10.	Energy Centre bypasses present, and to be opened or controlled in a way that increases flow rate and return temperature. This includes: • low loss headers;	Bypasses specified (and subsequently installed) that are not required, which increases return temperatures and flow rates.	EC-S2-E07 EC-S2-E08 EC-S2-E12

Key Failure		Outcome to avoid	Evidence Requirement(s)
	• fixed/flow-controlled bypass across flow and return; • equipment located across flow and return (e.g. dosing pot); • fixed flushing bypasses rather than temporary flushing points.		
2.3.11.	Insufficient water quality equipment specified to meet the water treatment strategy and ensure water quality can be maintained during operation; examples include (but not limited to): • strainers; • air vents; • drain cocks; • side stream filtration units; • dosing provision; • air/dirt separation; • vacuum degasser; • water quality monitoring equipment.	Poor water quality within Heat Network due to lack of specification (and subsequently installation) of water quality equipment.	EC-S2-E07 EC-S2-E08 EC-S2-E12 EC-S2-E14
2.3.12.	Resilience Strategy not developed and provision for resilience not included within design. For example, connections not included in design to allow temporary plant connections and spatial considerations not given for temporary plant.	No ability to provide temporary heat generation to the Energy Centre in case of Energy Centre failure, which will result in network downtime.	EC-S2-E12 EC-S2-E19

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.3.13.	No consideration given to electrical infrastructure requirements and local grid capacity within operating models and spatial requirements.	Progressing with design without confirmation that electrical grid capacity can deliver the electrical load required for the Energy Centre operation, specifically relevant to electric heat generation solutions.	EC-S2-E08 EC-S2-
2.3.14.	Spatial requirements not accurately determined or inappropriate. Note this includes internal and external spatial requirements. Spatial requirements are to consider: • space required for all equipment (heat generation, water treatment equipment, ancillary equipment etc.); • maintenance requirements for all equipment; • equipment replacement requirements; • access and egress requirements; requirements for insulation (ensuring enough space for required thickness); • spatial requirements for thermal storage; • requirements for Resilience Strategy.	As changes to spatial allocations are limited once passed the Technical Design stage, assessment needs to be accurately undertaken to avoid underestimating spatial requirements. The impact of underestimating spatial requirements can result in lack of space for equipment, installation requirements, maintenance requirements, access and egress, and health and safety requirements. Additionally, equipment that requires maintenance shall not be located at high level, as this creates health and safety risks for Heat Network operators and increased risk of insufficient maintenance programme.	EC-S2-E12 EC-S2-E13 EC-S2-E14 EC-S2-E16 EC-S2-E19

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.3.15.	Insufficient consideration given to environmental impacts of heat generation (e.g. cold air plumage, acoustics, etc.)	Specifically for air source heat pumps, impacts of cold air plumage, acoustics, refrigerant use need to be considered as this can impact coefficient of performance, Energy Centre location, techno-economic feasibility etc.	EC-S2-E26
2.3.16.	Requirements for Acceptance Testing, both methodology and criteria, not considered and developed during the Technical Design Stage.	The Energy Centre 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.	EC-S2-E25
2.3.17.	No water meters specified on water top-up connection within the Energy Centre.	Unable to monitor top up water and, therefore, leaks from the Energy Centre and Distribution Network being served, making the Heat Network less reliable and more susceptible to interruptions.	EC-S2-E12 EC-S2-E35
2.3.18.	No energy meters, or sub-energy meters, specified on each individual heat source type. For example, electricity meters not specified to meter the electricity input into heat sources (e.g. heat pumps). Additionally, sub-meters not specified where there are more than one type of heat generation using the same energy input (e.g. electric boilers and heat pumps, or CHP and gas boilers).	Inability to measure and record energy input into each individual heat source, or virtual meters being used. This can prevent the ability to accurately monitor the performance of each heat source and calculate KPIs.	EC-S2-E12 EC-S2-E35

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.3.19.	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.	EC-S2-E34
2.3.20.	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 Element during operation, preventing ongoing KPI measurement, optimisation, and issue diagnosis.	EC-S2-E30 EC-S2-E31 EC-S2-E32
2.3.21.	ARMS specified not capable of being remotely accessed. Remote access is defined as the ability to download data from the ARMS system 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.	EC-S2-E34
2.3.22.	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.	EC-S2-E34
2.3.23.	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.	EC-S2-E30
2.3.24.	A BMS used as the only and/or main Metering and Monitoring System, which is unable to meet the specification of the ARMS.	Inability to access data, monitor performance against KPIs, identify issues and remedial actions.	EC-S2-E34

Key Failure		Outcome to avoid	Evidence Requirement(s)
2.3.25.	Meters incorrectly specified, sized, and located. This applies to thermal energy, electricity, and gas meters.	Meters not operating as intended and recording inaccurate data.	EC-S2-E35 EC-S2-E36
2.3.26.	ARMS specified does not contain functionality to allow automated alarms to notify operators where KPIs or other performance metrics are not being achieved. *Note not all KPIs need to be alarmed and is the decision of the operator which KPIs are alarmed.*	Failures occurring which are not identified and resolved for long periods of time.	EC-S2-E34

Table 4: Key Failures for the Energy Centre at Stage 2: Developed Design and Stage 3: Technical Design

2.4. Evidence Requirements

The applicable Evidence Items listed in Table 5 shall be provided to demonstrate fulfilment with the Technical Requirements, Performance Monitoring Requirements, and avoidance of Key Failures.

Evidence Item		Detailed description and requirements
EC-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 end consumer and the overall Energy Centre. For annual heat demands, rationale for occupancy patterns shall be outlined. Sensitivity analysis shall be provided where applicable.
EC-S2-E02	Operating temperature assessment	Evidence containing the Energy Centre operating temperatures. This shall include the network distribution temperature, expected return temperature, and temperatures across circuits within the Energy Centre. Rationale for the selected temperatures shall be provided. This shall consider the requirements of the network/end users (current and future), requirements of heat generation equipment, heat losses, pumping energy, and any associated costs. Any health and safety risks and mitigations shall be outlined (for example, high temperature cut off devices/control strategy).
EC-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).
EC-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.

EC-S2-E05	Operating Model	A model outlining the predicted heat demand on the network on an hourly basis, and how heat generation equipment and thermal storage are expected to operate to meet the network demand. All inputs and assumptions shall be outlined.
EC-S2-E06	Heat generation equipment and thermal storage sizing calculations	Calculations showing sizing of heat generation equipment and thermal storage. All inputs, assumptions, and outputs to be outlined. Shall demonstrate how equipment meets load requirements. May be used in combination with the operating model.
EC-S2-E07	Energy Centre equipment specification (inc. bypasses)	Written description of each item related to the Heat Network within the Energy Centre. Shall outline the requirements of the product and/or material to be used in addition to the performance requirements. Specification shall be produced for all major plant items. May be contained within larger specification (e.g. Mechanical Specification).
EC-S2-E08	Equipment sizing calculations	Calculations, methodology and assumptions used to size equipment, including thermal storage, electrical infrastructure, and bypasses. Shall indicate equipment redundancy requirements.
EC-S2-E09	Pipework sizing calculations	Shall outline the inputs, methodology and calculations used to size pipework within the Energy Centre.
EC-S2-E10	Control Strategy	Description of control philosophy within the Energy Centre. To contain all Monitoring Points, sensors, alarms, and faults.
EC-S2-E11	Energy Centre Specification(s)	Specification is a document which is to provide a brief 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.

Evidence Item		Detailed description and requirements
		May incorporate, mechanical, electrical, insulation, equipment, metering and monitoring, water treatment, and controls specification.
EC-S2-E12	Energy Centre Schematic	Schematic(s) to the detail as required by the applicable RIBA stage. The schematic(s), or a separate schematic(s), shall include the locations of the Monitoring Points as required by the Metering and Monitoring Strategy, with the unique ID code included.
EC-S2-E13	Energy Centre Drawings	Drawing(s) to the detail as required by the applicable RIBA stage. This includes: • layout drawings; • elevation/cross-sectional drawings; • 3D drawings; • 3D model (where used). The drawings, or a separate drawing, shall include the locations of the Monitoring Points as required by the Metering and Monitoring Strategy, with the unique ID code included.
EC-S2-E14	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 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).
EC-S2-E15	Water Quality Recording Programme	Documentation produced regarding the recording of water quality parameters throughout the Heat Network. Should typically include:

Evidence Item		Detailed description and requirements
		• 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.
EC-S2-E16	Maintenance spatial requirements strategy	Evidence justifying spatial requirements and layout selection. This shall demonstrate that the allowed footprint accommodates the requirements of the Energy Centre. Can be in the format of annotated drawings or small report. Expected to outline how equipment access/maintenance clearances/requirements have been met and justification of where equipment is not accessed at floor height.
EC-S2-E17	Repair and replacement strategy	Evidence outlining repair and replacement strategy. Shall be used to aid justification of equipment selection, spatial requirements, and layout.
EC-S2-E18	Access and egress strategy	Evidence outlining access and egress strategy within the Energy Centre. Shall be used to justify selected access and egress routes.
EC-S2-E19	Resilience Strategy	Shall outline the Resilience Strategy for the Heat Network, including: • system- and equipment- level threats; • the risk score of each threat with no resilience measures in place; • the redundancy and recovery measures implemented; • the risk score of each threat with resilience measures in place; • any residual risks associated with each threat; • the Disaster Recovery Plan; • the critical spares log; • the plant replacement strategy.

Evidence Item		Detailed description and requirements
EC-S2-E20	Disaster Recovery Plan	Documentation which details the procedures required in the event of a major incident on the Heat Network. Should include (but not be limited to) details outlining: • how temporary heat will be provided to consumers in the event of a shutdown to the system; • the assumed response time for restoring heat supply following shutdown of the system; • the required sizing of temporary plant; • where temporary heat connections are included in the design; • where temporary plant could be located; • any air quality and/or planning restrictions associated with the potential temporary plant provision; • the information (timing and reason) given to consumers in advance of a major outage (where known); and • contact details of who to contact in the event of an emergency; and • any utility supply provisions.
EC-S2-E21	Carbon dioxide emissions assessment	An assessment on the total carbon dioxide emissions. The calculation shall include heat losses from the network and parasitic electricity use.
EC-S2-E22	Insulation Specification	Description of the insulation requirements. Shall include intended material and thicknesses of insulation required to meet heat loss requirements.
EC-S2-E23	Energy Supply calculations and connection confirmation	Evidence containing energy supply connection calculations and confirmation. For example, electrical grid connection size acceptance by the DNO where electric heat generation solutions used.
EC-S2-E24	Commissioning plan	Outline commissioning plan containing: • a list of required commissioning activities; • the key criteria to be achieved during commissioning; • the time order of commissioning activities and interdependencies; • any specific requirements for the Construction Phase commissioning plan.
EC-S2-E25	Acceptance Testing	Shall outline: • the list of required parameters for testing;

Evidence Item		Detailed description and requirements
	methodology and criteria	• an outline methodology to enable demonstration of required parameters; • any specific requirements for Construction Phase Acceptance Testing methodology and criteria.
EC-S2-E26	Assessments in relation to environmental considerations	Evidence type will depend on heat generation type. Examples include evidence of cold air plumage survey, acoustic surveys, assessments of NOx and other emissions. Outcomes of the applicable assessment shall be summarised.
EC-S2-E27	Energy Centre ventilation design	Shall include ventilation schematic and applicable sizing calculations (louvers, attenuation, fans, ducts).
EC-S2-E28	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.
EC-S2-E29	Technical Parameters Schedule	Schedule which outlines all technical parameters in one location, with reference to applicable documents.
EC-S2-E30	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 EC-S2-E31); 2. a schedule of Monitoring Points (item EC-S2-E32); 3. a Monitoring Points unique ID code naming methodology (item EC-S2-E33); 4. a schematic with labelled Monitoring Points; 5. a data flow diagram (item EC-S2-E37); 6. an ARMS specification (item EC-S2-E34); 7. a Monitoring Points specification (thermal energy meters, utility meters, sensors) (item EC-S2-E35 & EC-S2-E36).

Evidence Item		Detailed description and requirements
EC-S2-E31	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; 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.
EC-S2-E32	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; 2. the location of each Monitoring Point (which identifies the applicable Element); and, 3. a unique ID code, which follows a determined naming convention.
EC-S2-E33	Unique ID code naming convention	Methodology used to label each Monitoring Point with a unique ID code.
EC-S2-E34	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.
EC-S2-E35	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.
EC-S2-E36	Meter sizing calculations	Shall outline the inputs, methodology and calculations used to size pipework applicable meters.
EC-S2-E37	Data flow diagram(s)	Diagrams illustrating the route of data flow from the Monitoring Point to the ARMS, including hierarchy of Monitoring Points.

Table 5: Evidence Requirements for the Energy Centre at Stage 2: Developed Design and Stage 3: Technical Design