Heat Network Technical Assurance Scheme

New Build Heat Networks

Technical Specification

Energy Centre

Phase 3: Construction

HNTAS-NB-TS-EC-P3

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 3: Construction.

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.

Authors

Lucy Sherburn (FairHeat)

Jake Adamson (FairHeat)

Gareth Jones (FairHeat)

Technical Sub-Working Group Members

Beata Blachut (SAV)

Ghassan Beldawi (L&Q)

Tom Brennan (AECOM)

Bruce Geldard (Metropolitan)

Thanos Gkouletsos (Switch2)

Ewan Jures (WSP)

Geoff Miller (SSE)

Pete Mills (Bosch/MEHNA)

Soulla Paphitis (Danfoss)

Gavin Poyntz (Ramboll)

Ricky Stevens (Orchard Plumbing)

Dan Staunton (FairHeat)

Ewelina Szura (Anthesis)

Dave Turner (Camden Council)

Ruben Vos (Vattenfall)

Peter Russett (FVB)

David Wilkinson (Vital Energi)

Christopher O'Keeffe (Thermamech)

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 3: Construction.

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 three stages within Phase 3: Construction, which are Stage 4: Construction Design, Stage 5: Installation, and Stage 6: Commissioning. This is outlined in Figure 1.

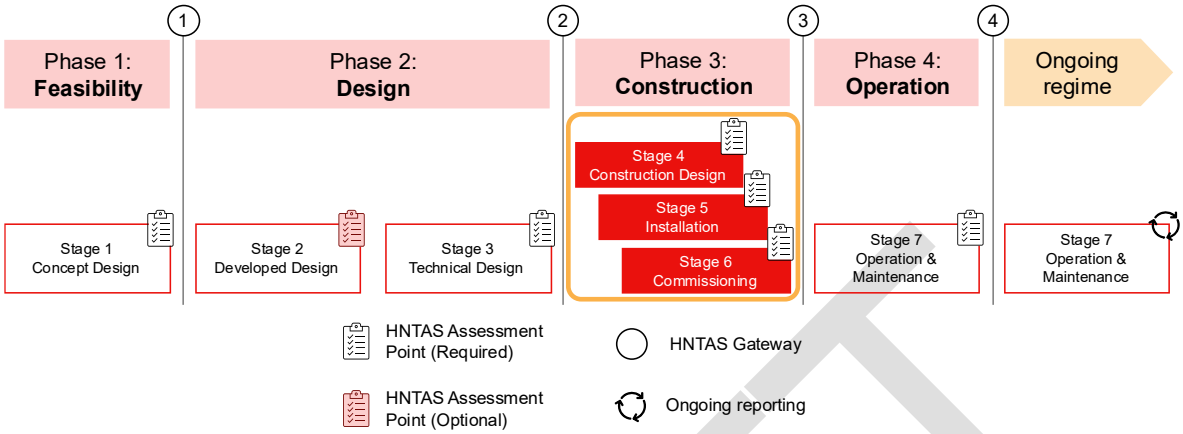

Figure 1: HNTAS New Build regime phases and stages

Sequence of activities within Phase 3: Construction

During Phase 3: Construction, there are three Stages which typically overlap. Within these three Stages, there are multiple activities that are precedent on one another (and hence need to be completed prior to other activities commencing).

For example:

- prior to the installation of equipment, Technical Submittals need to be produced;
- prior to the commissioning of equipment:
  - the necessary equipment needs to be installed;
  - pre-commissioning cleaning activities need to be completed;
  - commissioning methodologies need to be produced.

Figure 2 illustrates an example sequence of activities for a typical project. This illustrates the activities of both the Responsible Party and the Assessor. Prior to the activities being undertaken, the Responsible Party and the Assessor shall agree:

- the sequence of activities; and
- where mid-stage assessments are necessary.

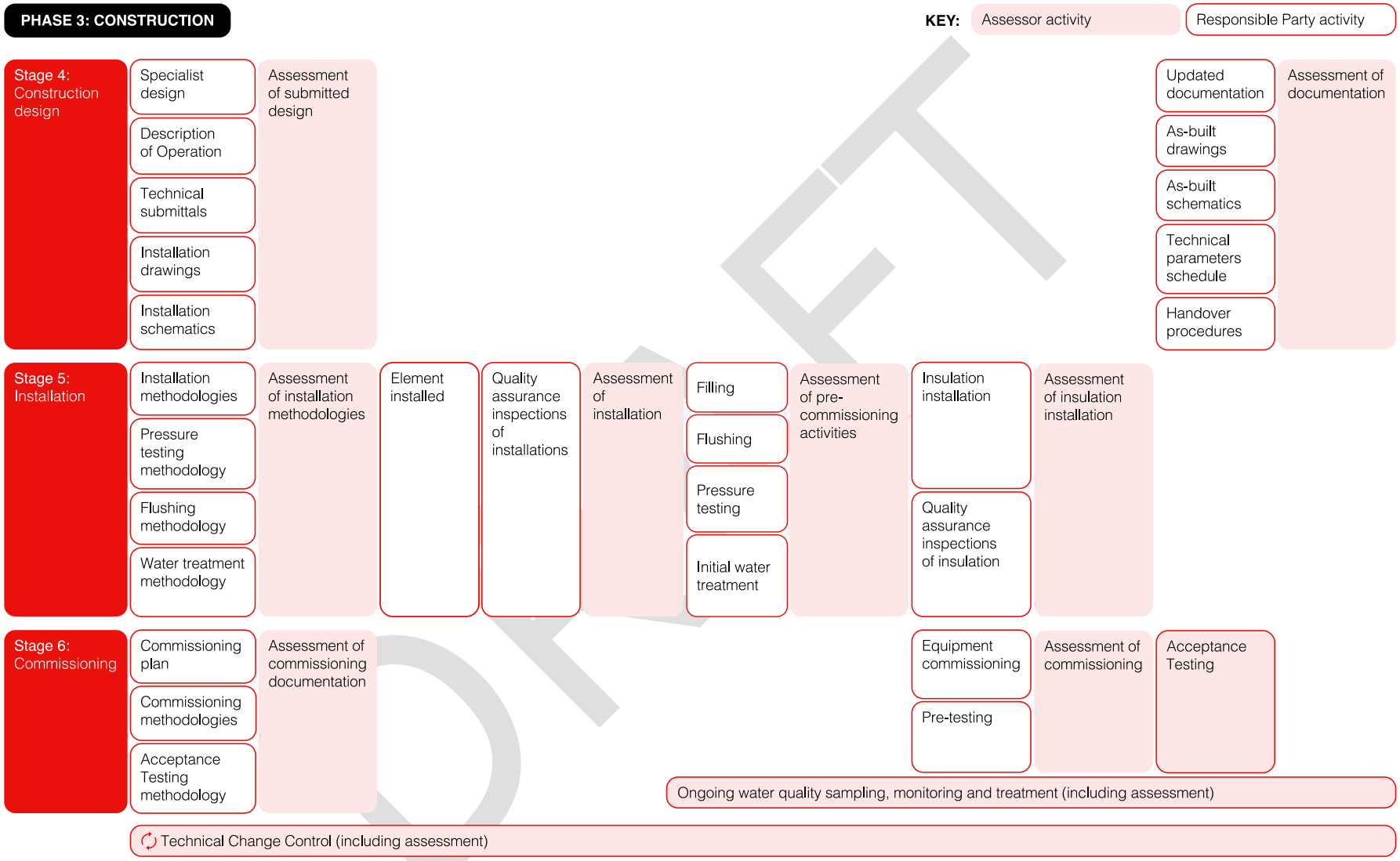

Figure 2: Example sequence of activities during Construction Phase, with activities of a Responsible Party and Assessor outlined

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)
- BS 5970:2012: Thermal Insulation of Pipework, Ductwork, Associated Equipment and Other Industrial Installations in the Temperature Range of -100 °C to +870 °C – Code of Practice (BSI, 2012)

Informative references

There are no informative references in this document.

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.

4. Requirements for Stage 4: Construction Design

4.1. Technical Requirements

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

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
4.1.1.	Specialist Heat Network design items undertaken during the Construction Design stage shall be undertaken in accordance with: 1. the specification and performance requirements outlined within the Assessed Technical Design; and 2. any identified HNTAS Technical Requirements at the Technical Design stage which are applicable to the specialist contractor design item.		EC-S4-E01
4.1.2.	Prior to the procurement of equipment, Technical Submittals shall be produced in accordance with the applicable technical standard(s).	TS1 4.6.1 TS1 4.6.2 TS1 4.6.3 TS1 4.9.3 TS1 4.13.1 TS1 4.17.3	EC-S4-E13
4.1.3.	The design of the pressure safety system(s) shall be developed in accordance with the applicable technical standard(s).	TS1 4.6.4 TS1 4.6.5	EC-S4-E11
4.1.4.	The pressure characteristics of the system shall be documented 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 4.6.6	EC-S4-E23
4.1.5.	The Description of Operation shall be developed to sufficiently communicate the operating procedures for the Energy Centre in accordance with the applicable technical standard(s).	TS1 4.8.1	EC-S4-E02

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
4.1.6.	The Description of Operation shall be supplemented with a points schedule, which shall contain all points (inputs and outputs). Each applicable point shall contain a label, which can be referenced to the associated Installation Schematic and the Description of Operation.	TS1 4.17.2	EC-S4-E03 EC-S4-E15
4.1.7.	The Resilience Strategy shall be updated throughout the Construction Phase in accordance with the applicable technical standard(s).	TS1 4.9.1 TS1 4.9.2 TS1 4.9.5	EC-S4-E23
4.1.8.	The repair and replacement strategy shall be updated in accordance with the applicable technical standard(s).	TS1 4.9.6 TS1 4.15.1	EC-S4-E23
4.1.9.	A filling, flushing, and water treatment/conditioning methodology shall be produced in accordance with the applicable technical standard(s).	TS1 4.11.1 TS1 4.11.2 TS1 4.11.4	EC-S4-E17
4.1.10.	The design of the Energy Centre shall include suitable provision of flushing points. This provision shall ensure that no "dead legs" are left un-flushed, and that all sensitive equipment can be bypassed during the flushing process.		EC-S4-E14 EC-S4-E15
4.1.11.	Water Quality documentation shall be updated in accordance with the applicable technical standard(s). This shall include: • the Water Quality Strategy; • the Water Quality Recording Programme.	TS1 4.11.1 TS1 4.11.2	EC-S4-E23
4.1.12.	A methodology for pipework pressure testing shall be developed in accordance with the applicable technical standard(s).	TS1 4.14.1	EC-S4-E18
4.1.13.	Prior to the installation of the Energy Centre, installation drawings and schematics shall be produced in accordance with the applicable technical standard(s).	TS1 4.17.4	EC-S4-E14 EC-S4-E15

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
4.1.14.	Changes to the design of the system which arise during the Construction Phase shall be controlled in accordance with the Technical Change Control Procedure.		
4.1.15.	Changes shall be documented in accordance with the Technical Change Control Procedure in the Change log.		EC-S4-E16
4.1.16.	Agreed changes during the Construction Phase shall be reflected in Installation documentation. This includes drawings, models, specifications, schedules, and Technical Submittals.		EC-S4-E19
4.1.17.	Following the installation of the Energy Centre, as-installed drawings and schematics shall be produced in accordance with the applicable technical standard(s). The as-installed drawings and schematics shall be affixed to the wall of each plant room.	TS1 4.17.5 TS1 4.17.6	EC-S4-E21
4.1.18.	Following the installation and commissioning of the Energy Centre, the Technical Parameters Schedule shall be completed with accurate information and references to relevant documentation.		EC-S4-E20
4.1.19.	Energy Centre documentation shall be updated throughout the Construction Phase in accordance with the applicable technical standard(s).	TS1 4.12.4 TS1 4.17.1 TS1 4.17.4	EC-S4-E23
4.1.20.	Prior to handover, written procedures outlining the implementation of the Disaster Recovery Plan shall be provided in accordance with the applicable technical standard(s).	TS1 4.9.5	EC-S4-E23
4.1.21.	An O&M manual shall be produced in accordance with the applicable technical standard(s). *Note: it is expected that the O&M manual is produced with consideration for the other Elements present in the Heat Network.*	TS1 4.17.2	EC-S4-E22

Table 2: Technical Requirements for the Energy Centre at Stage 4: Construction Design

4.2. Performance Monitoring Requirements

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

Performance Monitoring Requirement		Applicable technical standard(s)	Evidence Requirement(s)
4.2.1.	Prior to the procurement of equipment, thermal energy meters and other utility meters shall be specified in accordance with the applicable technical standard(s).	TS1 4.12.1 MMS 1.1 MMS 1.4	EC-S4-E09 EC-S4-E10
4.2.2.	Prior to the procurement of equipment, the Automatic and Remote Monitoring System (ARMS) shall be specified in accordance with the applicable technical standard(s).	TS1 4.12.2 MMS 2.1	EC-S4-E08
4.2.3.	The KPI schedule shall be updated throughout the Construction Phase. 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); 3. the Monitoring Points required to measure each KPI.	TS1 4.12.4 MMS 4.1.12	EC-S4-E05
4.2.4.	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); 3. a unique ID code, which follows a determined naming convention.	TS1 4.12.4 MMS 4.1.13	EC-S4-E06

Performance Monitoring Requirement		Applicable technical standard(s)	Evidence Requirement(s)
4.2.5.	The Metering and Monitoring Strategy shall be updated throughout the Construction Phase in accordance with the applicable technical standard(s).	TS1 4.12.4	EC-S4-E04

Table 3: Performance Monitoring Requirements for the Energy Centre at Stage 4: Construction Design

4.3. Key Failures

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

Key Failure		Outcome to avoid	Evidence Requirement(s)
4.3.1.	Project-specific information is not used when undertaking specialist design items. For example, the incorrect use of temperatures, pressures, flow rates etc.	Specialist design items not compatible with the network or unsuitable due to different design information being utilised.	EC-S4-E01
4.3.2.	Equipment specified is not in accordance with the design criteria of the Assessed Technical Design. For example, the equipment specified does not have sufficient temperature/pressure rating for the temperature/pressure profile of the network, a lower pipework grade specified, or the thermal conductivity of the specified insulation differs to the design requirement.	Installed equipment may not be suitable to operate at the design and operating criteria. This may reduce the performance of the Energy Centre, increased risk of KPI thresholds not being achieved and could put equipment at greater risk of premature failure. Lower pipework specification could result in the installed pipework not being suitable for Technical Design characteristics of the wider network, which could increase the risk of premature failure.	EC-S4-E13
4.3.3.	Material of equipment specified is not compatible with the water treatment strategy. For example, equipment specified contains materials which requires a different pH range to that required by the other specified equipment and/or specified in the water treatment strategy.	Equipment not operating within required water quality parameters, leading to risk of equipment failure and/or poor water quality, risking KPIs not being achieved.	EC-S4-E13
4.3.4.	Technical Submittal does not contain sufficient project specific or equipment specific design information. Examples of missing information include	Increased risk of equipment procurement that is not in accordance with the Assessed Technical Design. Increased risk that equipment will be commissioned and operated to criteria which differs to	EC-S4-E13

Key Failure		Outcome to avoid	Evidence Requirement(s)
	operating temperature/pressures, pressure/temperature ratings, materials of equipment, differential pressure requirement (e.g. valves), maximum/minimum flowrates, design capacity, specific commissioning/operating set points.	the Technical Design requirement, which could lead to KPI thresholds not being achieved.	
4.3.5.	Sequencing strategies outlined with the Description of Operations would result in unstable heat provision to consumers. For example, a sequencing strategy of heat generation equipment that would result in unstable temperatures, or a sequencing strategy of distribution pumps resulting in insufficient network differential pressure during operations.	Unstable performance of the Energy Centre during commissioning and operation. This may result in KPI thresholds not being achieved.	EC-S4-E02
4.3.6.	Control System points schedule does not contain all required points.	Control System points are not installed and commissioned as the control strategy required, which could result in the Energy Centre not operating as the design required.	EC-S4-E03
4.3.7.	Metering and Monitoring System is not in line with the Metering and Monitoring Technical Design. Specifically, it does not contain the following: • The required Monitoring Points to measure KPIs • The ability measure, extract, record, and	Network specified and installed does not have the ability to measure, extract, record and store the necessary performance data at the required frequency or is unable to calculate the KPIs. Risking the ability to monitor performance and report on KPIs.	EC-S4-E04 EC-S4-E05 EC-S4-E06 EC-S4-E07 EC-S4-E08 EC-S4-E09 EC-S4-E10 EC-S4-E12

Key Failure		Outcome to avoid	Evidence Requirement(s)
	store data at the required frequency • The ability to calculate and report on KPIs		
4.3.8.	Equipment specified for Monitoring Point (e.g. thermal energy meter, utility meter, sensor) not compatible with ARMS.	ARMS unable to extract data from Monitoring Point, and therefore cannot record and store the necessary data to calculate KPIs.	EC-S4-E08 EC-S4-E09
4.3.9.	Heat and utility meters sized incorrectly.	Inaccurate measurement of performance data due to incorrect sizing of heat and/or utility meter.	EC-S4-E10
4.3.10.	Thermal energy meter not correctly specified for heat transfer fluid.	Inaccurate measurement of performance data due to inappropriate specification of thermal energy meter.	EC-S4-E09
4.3.11.	Changes to the Technical Design are not managed appropriately, resulting in design changes (e.g. equipment specification, pipework routing etc.) that does not conform with the Technical Design intent.	Changes that are not signed-off may negatively impact the performance of the Energy Centre, which could lead to construction of the Heat Network not being in accordance with the design intent, which could risk KPI thresholds not being achieved.	EC-S4-E16 EC-S4-E19
4.3.12.	As-installed schematics and drawings do not accurately reflect the installation.	Inaccurate documentation being used during operation and maintenance, inhibiting the ability to effectively operate, and undertake maintenance and replacement of the Energy Centre over its lifecycle.	EC-S4-E20

Table 4: Key Failures for the Energy Centre at Stage 4: Construction Design

4.4. 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-S4-E01	Specialist design documentation	Design documentation of specialist design items. Contents will be dependent on the design item, but shall include, where applicable, specification, calculations, schematics, and drawings.
EC-S4-E02	Description of Operation	Detailed overview of the network controls strategy. Shall detail: • Control strategy for each piece of equipment, with set points where applicable • How equipment will be sequenced, including the points used for sequencing and any further criteria, such as time intervals, that shall be implemented for equipment sequencing. • Equipment changeover schedule • Automated equipment exercising regimes • Anti-stagnation control • Water quality parameter values and sensor details (if applicable) • Remote monitoring login details
EC-S4-E03	Description of Operation points schedule	A points schedule outlining all points that are to be monitored by the Control System (BMS or equivalent) shall be included. Data logging frequency shall be specified for each point The nomenclature for each point shall be clear so that each point is distinct. For sensors, each sensor shall be identifiable to its label on-site, on the Control System and on schematics and drawings. This shall include: • Meters • Sensors • Faults and alarms • Set points for equipment controlled by the Control System • Enable/disable status

Evidence Item		Detailed description and requirements
		• Emergency shut off status.
EC-S4-E04	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. KPI Schedule (item EC-S4-E05) 2. Monitoring Points Schedule (item EC-S4-E06) 3. Monitoring Points unique ID code naming methodology (item EC-S4-E07) 4. Schematic with labelled Monitoring Points 5. Data flow diagram (item EC-S4-E12) 6. ARMS specification (item EC-S4-E08) 7. Monitoring Points specification (thermal energy meters, utility meters, sensors) (items EC-S4-E09 & EC-S4-E10)
EC-S4-E05	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) 3. The Monitoring Points required to measure each KPI
EC-S4-E06	Monitoring Points Schedule	A schedule of all Monitoring Points required to measure KPIs. The Monitoring Points Schedule shall contain: 1. All required Monitoring Points to measure KPIs 2. Location of each Monitoring Point (which identifies the applicable Element)

Evidence Item		Detailed description and requirements
		3. A unique ID code, which follows a determined naming convention 4. Serial number 5. Postal address and plot number 6. Photographic evidence of point and on-site label 7. Communications address for ARMS 8. Date commissioned 9. Initial reading 10. Date of last calibration
EC-S4-E07	Unique ID code naming convention	Methodology used to label each Monitoring Point with a unique ID code.
EC-S4-E08	ARMS Specification	Shall provide a 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-S4-E09	Monitoring Point Specification	Specification for each type of Monitoring Point (thermal energy meter, utility meter, sensors etc.). Shall provide a 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-S4-E10	Meter sizing calculations	Shall outline the inputs, methodology and calculations used to size pipework applicable meters.

EC-S4-E11	Pressure safety system specification	Written description of the specification of the pressure safety system.
		Shall outline:
		• the items used (e.g. Safety Relief Devices);
		• setpoints of the items used;
		• their locations in relation to:
		  ○ sources of pressure (e.g. heat generation sources, pressurisation equipment);
		  ○ isolation points.

Evidence Item		Detailed description and requirements
EC-S4-E12	Data flow diagram(s)	Diagrams illustrating the route of data flow from the Monitoring Point to the ARMS, including hierarchy of Monitoring Points.
EC-S4-E13	Technical submittals	Documentation for all equipment that is intended to be procured. Shall contain the site-specific design information used to inform the equipment selection and required for installation, commissioning and operation of equipment. Shall include a cover page detailing the reviewers' names, revision number, status and date of approval of the technical submittal.
EC-S4-E14	Installation drawings	The installation drawings shall contain information needed by tradespeople on site to install the works and the following: • The precise locations and sizes of all items of equipment and pipework, using specific objects representing actual intended or procured equipment, in positions that have been spatially coordinated between engineering services, architecture and structure. • All supports and fixings required to install the works. • Spatial allowances for installation and commissioning methodologies, and access for maintenance and replacement. • Where applicable, any required builders works details and manufacturer drawings shall be produced in accordance with the Technical Design.
EC-S4-E15	Installation schematics	The Installation Schematics shall contain information needed by tradespeople on site to install the works and the following: • All functional, sensing, control and measuring items to be installed. This includes flushing provision, air vents and drainage provision, isolation valves, sensors (pressure, temperature, flow). • All pipework sizes, pressures and flow rates adjusted for any changes during construction. All items shall be labelled with references to schedules.
EC-S4-E16	Change log	Log of all changes to the Technical Design.

Evidence Item		Detailed description and requirements
EC-S4-E17	Filling, flushing, and water treatment/conditioning methodology	Filling methodology detailing the: • methodology for sampling of mains water; • parameter limits for initial fill water quality; • approximate volume of network to be filled. Flushing methodology detailing: • type of flushing to be carried out (e.g. closed loop or open loop); • methodology for isolating sensitive equipment from the flushing process; • duration network shall be flushed for; • flushing velocity required; • methodology for providing circulation; • methodology for measuring the flushing velocity; • methodology for draining and disposing of contaminated water. Treatment/conditioning methodology detailing the: • method of water treatment/conditioning; • type of chemicals/biocides/inhibitors to be used (if applicable); • duration of treatment/conditioning.
EC-S4-E18	Pressure testing methodology	Methodology detailing how the Energy Centre will be pressure tested. This shall provide detail for all types of pressure test to be carried out. For each type of pressure test, this shall include: • the type of pressure test; • the design pressure; • the test pressure; • the method for achieving the test pressure; • the duration of the pressure test. A methodology for pressure testing of equipment that has been tested by the manufacturer is not required. Confirmation from the manufacturer that the equipment has been pressure tested is acceptable. This shall detail the pressure the equipment has been pressure tested to.

Evidence Item		Detailed description and requirements
EC-S4-E19	Installation documentation with changes outlined	Updated installation drawings and schematics with changes to the design reflected on the documentation.
EC-S4-E20	Technical Parameters Schedule	Schedule which outlines all technical parameters in one location, with reference to applicable documents.
EC-S4-E21	As-installed drawings and schematics	Final as-built drawings and schematics reflecting the exact installation of the Energy Centre. Any changes made during the installation that deviate from the Installation schematics and drawings shall be reflected.
EC-S4-E22	O&M manual	Documentation containing all relevant information for the operation and maintenance of the system. Shall include contents as set out in TS1 4.17.2.

EC-S4-E23	Updated documentation throughout Construction Phase	Updated revisions of all Energy Centre documentation, including:
		• Description of Operation - all changes made during the construction phase to the controls philosophy shall be reflected in the updated revision. This typically includes:
		  ○ Controls set points
		  ○ Points labelling
		  ○ Alarms
		  ○ High/low limits
		• Control System points schedule
		• Energy Centre drawings
		• Energy Centre schematic
		• System pressure assessment
		• Resilience Strategy, including:
		  ○ Disaster Recovery Plan, including written procedures outlining its implementation
		• Repair and replacement strategy
		• Water Quality Strategy
		• Water Quality Recording Programme
		• Metering and Monitoring Strategy
		• Monitoring Points Schedule
		• KPI Schedule
		• Data flows diagram

Table 5: Evidence Requirements for the Energy Centre at Stage 4: Construction Design

5. Requirements for Stage 5: Installation

5.1. Technical Requirements

The applicable HNTAS Technical Requirements in Table 6 shall be fulfilled.

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
5.1.1.	The Energy Centre, including the Metering and Monitoring System, shall be installed in accordance with the Assessed Construction Design.		EC-S5-E01
5.1.2.	The Energy Centre, including the Metering and Monitoring System, shall be installed in accordance with the applicable technical standard(s).	TS1 5.12.1 TS1 5.12.2 TS1 5.14.4 TS1 5.14.5 TS1 5.14.6 TS1 5.16.1 TS1 5.16.5	EC-S5-E01
5.1.3.	Ancillary equipment shall be installed in accordance with the applicable technical standard(s).	TS1 5.15.1	EC-S5-E01
5.1.4.	All persons performing installation activities shall have received training and certification.		
5.1.5.	Quality assurance inspections shall be undertaken and documented throughout each stage of the installation process to confirm that requirements 5.1.1 - 5.1.3 are fulfilled. Photographs (where applicable) shall be clearly presented with no blur.		EC-S5-E02
5.1.6.	The Energy Centre shall be filled and treated/conditioned in accordance with the applicable technical standard(s).	TS1 5.11.1 TS1 5.11.2 TS1 5.11.4 TS1 5.11.6 TS1 5.11.7	EC-S5-E05 EC-S5-E06
5.1.7.	Pressure testing of pipework shall be carried out in accordance with the Assessed pressure testing methodology and the applicable technical standard(s).	TS1 5.14.13	EC-S5-E03 EC-S5-E04
5.1.8.	The Energy Centre shall be flushed in accordance with the applicable technical standard(s).	TS1 5.11.3 TS1 5.11.5 TS1 5.11.8	EC-S5-E05 EC-S5-E06

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
5.1.9.	The risk to water quality posed by stagnation shall be assessed and mitigated in accordance with the applicable technical standard(s).	TS1 5.11.9 TS1 5.11.10	EC-S5-E05 EC-S5-E06
5.1.10.	Energy Centre insulation shall be installed in accordance with the Assessed Construction Design.		EC-S5-E07
5.1.11.	Energy Centre insulation shall be installed in accordance with the applicable technical standard(s).	TS1 5.13.1 TS1 5.13.2 TS1 5.13.3 TS1 5.13.4	EC-S5-E07
5.1.12.	Energy Centre pipework shall be labelled upon completion of the insulation and cladding installation in accordance with the applicable technical standard(s).	TS1 5.14.10	EC-S5-E07
5.1.13.	Quality assurance inspections of the installation of the Energy Centre insulation shall be undertaken and documented prior to cladding or covering by building finishes in accordance with the applicable technical standard(s).	TS1 5.13.5	EC-S5-E08

Table 6: Technical Requirements for the Energy Centre at Stage 5: Installation

5.2. Performance Monitoring Requirements

The Metering and Monitoring System shall be installed in accordance with the Technical Requirements set out in Section 5.1.

5.3. Key Failures

The applicable Key Failures listed in Table 7 shall not be present.

Key Failure		Outcome to avoid	Evidence Requirement(s)
5.3.1.	Incorrect plumbing during installation (e.g. plate heat exchangers being plumbed in co-current arrangement, rather than counter-current, thermal stores plumbed in parallel rather than in series).	Network unable to operate as per the design intent, impacting the ability to achieve KPIs.	EC-S5-E01 EC-S5-E02
5.3.2.	No mechanism installed to ensure even flow between heat generation modules (e.g. reverse return).	Preferential flow through heat generation equipment with a lower pressure loss, which could reduce the heat output from modules during peak conditions.	EC-S5-E01 EC-S5-E02
5.3.3.	Additional bypasses present, or not installed as per design. This includes: 1. Low loss headers, fixed/flow-controlled bypass across flow and return, equipment located across flow and return (e.g. dosing pot) 2. Permanent/fixed flushing bypasses (as opposed to temporary flushing points)	Bypasses installed that are not required, which could increases return temperatures if the bypasses are left open, which would increase network flow rates and energy consumption.	EC-S5-E01 EC-S5-E02
5.3.4.	Dead legs larger than three pipe diameters installed.	Stagnant areas of water which can increase risk of bacterial growth, reducing the water quality of the Energy Centre and the network.	EC-S5-E01 EC-S5-E02

Key Failure		Outcome to avoid	Evidence Requirement(s)
5.3.5.	Ancillary equipment to aid with commissioning, operation, and maintenance of network (including water quality maintenance) not installed as per the design and specification (e.g. vent and drain provision, strainers, isolation valves, gauges, test points).	Lack of flushing points, isolation, and drainage available during pre-commissioning activities. Lack of maintainability of Heat Network in operation. Air vents not installed at network high points could lead to the formation of air pockets. Drain cocks not installed at network low points which would not allow for safe drainage of the network at its low points.	EC-S5-E01 EC-S5-E02
5.3.6.	Spatial requirements not allowed for during installation in relation to: 1. Ensuring sufficient and safe maintenance requirements for all equipment (including ancillary equipment and thermal energy meters) 2. Ensuring sufficient access and egress routes for maintenance and replacement	Lack of maintainability and ability for replacement of Heat Network in operation. Equipment installed at high-level would create a health and safety risk for operators during maintenance activities.	EC-S5-E01 EC-S5-E02
5.3.7.	Incorrect or insufficient equipment and/or pipework support installed.	Premature equipment failure due to insufficient support installed. Pipework creep as a result of unsupported equipment and pipework. Increased maintenance requirements due to equipment failure, such as pump bellows. A lack of support on pumps could cause significant vibration and noise.	EC-S5-E01 EC-S5-E02

Key Failure		Outcome to avoid	Evidence Requirement(s)
5.3.8.	Pressurisation unit, expansion provision and/or vacuum degassing unit not installed as per design and/or manufacturers. This includes not providing the required minimum separation distance between connections to the network and using the incorrect connections.	Pressurisation and expansion system, and/or vacuum degasser unit not operating correctly, risking outages and network downtime.	EC-S5-E01 EC-S5-E02
5.3.9.	Pressure testing done incorrectly, or not done at all. For example, the pressure reached is lower or higher than the test pressure required.	Increased likelihood of equipment failure due to incorrect pressure testing, or no testing at all. This could result in increased REPEX.	EC-S5-E03 EC-S5-E04
5.3.10.	Monitoring Points installed in an inaccessible location (e.g. behind ceiling panel/wall without access hatch), or Monitoring Point display located with poor accessibility (at height), preventing safe access, maintenance, and replacement.	Lack of maintainability and ability for replacement of Monitoring Points in operation. Equipment installed at high-level creating a health and safety risk for operators during maintenance activities.	EC-S5-E01 EC-S5-E02
5.3.11.	Monitoring Points not installed, or not installed in the correct location as per the design. Most commonly includes bulk thermal energy meters (e.g. block level, Energy Centre and Substation thermal energy meters).	Unable to measure the required performance data due to Monitoring Points not being installed. Where Monitoring Points are installed but not as per the design intent, this could lead to inaccurate data being recorded.	EC-S5-E01 EC-S5-E02
5.3.12.	Monitoring Points not installed correctly, to enable complete accurate readings to be made.	Unable to measure or inaccurate performance data being measured.	EC-S5-E01 EC-S5-E02

Key Failure		Outcome to avoid	Evidence Requirement(s)
	For example, temperature sensors not installed correctly, flow sensor installed on incorrect pipework and/or incorrect orientation, manufacturers requirements in relation to proximity to adjacent valves/pipework bends not followed, spool pieces not used during install.		
5.3.13.	Infrastructure not installed to enable all required Monitoring Points to connect to the ARMS.	ARMS unable to extract data from Monitoring Point, and therefore cannot record and store the necessary data to calculate KPIs.	EC-S5-E01 EC-S5-E02
5.3.14.	Not all required Monitoring Points are connected to the ARMS. Most commonly occurs for bulk meters (e.g. block level, Energy Centre and Substation thermal energy meters) and utility meters.	ARMS unable to extract the required data from all Monitoring Points, and therefore cannot record and store the necessary data to calculate KPIs.	EC-S5-E01 EC-S5-E02
5.3.15.	Sensors not installed as per design (e.g. pressure sensors, temperature sensors, ambient temperature sensors).	Insufficient sensors installed within Energy Centre to enable the hydraulic design and controls intent to work as intended. This could result in unstable flow temperatures and a lack of heat provision to the network due to the missing sensors. This would also result in a lack of performance monitoring available in Energy Centre.	EC-S5-E01 EC-S5-E02
5.3.16.	Insulation thickness and/or material not installed as per design specification.	Increased heat losses as a result of the incorrect material or thickness installed. This could result in the network heat losses not meeting the KPI threshold.	EC-S5-E07 EC-S5-E08

Key Failure		Outcome to avoid	Evidence Requirement(s)
5.3.17.	Poor insulation installation workmanship, including: 1. Missing insulation on pipework/valves/ancillaries 2. Damaged insulation 3. Overtightened pipe supports 4. Vapour seal not complete 5. Incorrect bore size of insulation	Increased heat losses as a result of poor installation. This could result in the network heat losses not meeting the KPI threshold.	EC-S5-E07 EC-S5-E08
5.3.18.	Inappropriate installation of pipe supports: 1. Direct pipe supports installed, and when installed, BS 5970 (BSI, 2012) "non-preferred option" for pipe hanger insulation not followed 2. Incorrect material installed 3. Non-pre insulated pipe supports installed 4. Incorrect spacing of pipe supports 5. Standard density of insulation used as pipe support	Use of incorrect pipework supports, or not using pipework supports at all could result in, for example, elevated heat losses and or pipework creep over time.	EC-S5-E07 EC-S5-E08
5.3.19.	Poor coordination of pipework meaning that the design insulation specification cannot be installed.	Increased heat losses from areas where insulation thickness has been reduced. Insulation becoming damaged as a result of poor installation could result in an inconsistent vapour seal. This could result in the heat losses not meeting the KPI threshold.	EC-S5-E01 EC-S5-E02

Key Failure		Outcome to avoid	Evidence Requirement(s)
5.3.20.	Protective cladding not installed on insulation.	Damage to insulation during maintenance activities. This could increase heat losses from the network, and result in the heat losses not achieving the KPI threshold.	EC-S5-E07 EC-S5-E08
5.3.21.	Inadequate labelling of plant, ancillary equipment, and pipework.	Increased difficulty in knowing which equipment has been maintained and/or serviced in operation, which could lead to pieces of equipment not being maintained, resulting in premature failure. Inadequate labelling of pipework could present confusion throughout the network between flow and return pipework, which could result in pipework being plumbed incorrectly further downstream.	EC-S5-E01 EC-S5-E02 EC-S5-E07 EC-S5-E08
5.3.22.	Energy Centre floor not, or incorrectly, painted and sealed.	Excessive dust build up at major equipment such as pumps. This could void warranties due to the presence of dust and may result in premature equipment failure.	EC-S5-E01 EC-S5-E02

Table 7: Key Failures for the Energy Centre at Stage 5: Installation

5.4. Evidence Requirements

The applicable Evidence Items listed in Table 8 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-S5-E01	Installation offered for inspection	The installation shall be offered following completion of the install for an inspection.
EC-S5-E02	Quality assurance inspection records	Shall include inspection records, photographs of the installed Energy Centre, a snagging log with remedial actions undertaken to fix these, justification for non-compliances with requirements. Photographs shall presented clearly with no blur. Where equipment has been installed, close-up photographs shall be provided of the installation. Where equipment has a visible setting or set point, photographs shall ensure that this setting is clearly visible.
EC-S5-E03	Pressure testing activities offered for witnessing	The pressure testing activities shall be offered for on-site witnessing.
EC-S5-E04	Pressure testing certification	Certification for each pressure test shall be provided, which provides, as a minimum: • the type of pressure test; • the date of test; • the design pressure; • the test pressure; • the time the test commenced; • the time the test pressure was reached; • the duration held at test pressure; • the name of the operative performing the test; • the pressure gauge calibration certificate.
EC-S5-E05	Water treatment/conditioning activities offered for witnessing	The water treatment/conditioning activities shall be offered for on-site witnessing.
EC-S5-E06	Water treatment records	Records for the filling, flushing, and sampling of the network shall be provided. This shall include: Filling: Date system was filled, number of fill water samples, location of fill water samples, value of each fill water parameter.

Evidence Item		Detailed description and requirements
		Flushing: type of flushing, date of flushing, equipment isolated or removed from the network during flushing, time flushing was commenced, duration network was flushed for, required flushing velocity, flushing velocity reached, method of velocity measurement, flushing circulation methodology, confirmation that contaminated water was drained and disposed of correctly. Treatment/conditioning: type, date and duration of activities, type of chemicals/biocides/inhibitors used (if applicable). Sampling: Date samples were taken, type of samples taken, number of samples taken, location of samples taken, value of each parameter of sampled water.
EC-S5-E07	Installation of insulation offered for inspection	The installation of the insulation in an Energy Centre shall be offered to the Assessor for an inspection following completion of the install.
EC-S5-E08	Quality assurance inspection records (insulation installation)	Shall include inspection records, photographs of the installed Energy Centre, a snagging log with remedial actions undertaken to fix these, justification for non-compliances with requirements. Photographs shall be presented clearly with no blur.

Table 8: Evidence Requirements for the Energy Centre at Stage 5: Installation

6. Requirements for Stage 6: Commissioning

6.1. Technical Requirements

The applicable HNTAS Technical Requirements in Table 9 shall be fulfilled.

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
6.1.1.	A commissioning plan shall be produced with appropriate coordination with the other Elements present in the Heat Network in accordance with: • the commissioning plan produced during the Construction Design Stage; and • the applicable technical standard(s).	TS1 6.17.2 TS1 6.17.4 TS1 6.17.5	EC-S6-E01
6.1.2.	Commissioning methodologies for the Energy Centre, including the Metering and Monitoring System, shall be developed in accordance with the applicable technical standard(s). These shall include commissioning methodologies for all equipment that requires commissioning.	TS1 6.8.1 TS1 6.8.2 TS1 6.8.4 TS1 6.12.5 TS1 6.17.1 TS1 6.17.2	EC-S6-E02
6.1.3.	The Energy Centre, including the Metering and Monitoring System, shall be commissioned in accordance with the commissioning methodologies and the applicable technical standard(s). The commissioning shall allow the Energy Centre to operate within acceptable thresholds for all applicable KPIs.	TS1 6.8.1 TS1 6.8.2 TS1 6.8.4 TS1 6.8.5 TS1 6.8.6 TS1 6.8.13 TS1 6.12.5	EC-S6-E05 EC-S6-E06
6.1.4.	The control system shall be checked to ensure that sensors are working correctly in accordance with the applicable technical standard(s).	TS1 6.8.3 TS1 6.12.3	EC-S6-E07 EC-S6-E08 EC-S6-E09
6.1.5.	Water quality parameters shall be recorded after pre-commission cleaning activities via: • sampling; and • continuous monitoring where applicable for the system, prior to practical completion in accordance with the applicable technical standard(s).	TS1 6.11.1 TS1 6.11.3 TS1 6.11.4	EC-S6-E03

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
6.1.6.	Water quality KPIs shall be maintained within acceptable limits in accordance with the applicable technical standard(s).	TS1 6.11.2	EC-S6-E04
6.1.7.	Prior to Acceptance Testing, a methodology and criteria shall be produced in accordance with the applicable technical standard(s).	TS1 6.8.15	EC-S6-E10
6.1.8.	Pre-testing shall be carried out prior to the Acceptance Test. The aim of pre-testing is to carry out trial Acceptance Tests to identify any performance problems with the Energy Centre operation that would result in non-conformance with the applicable technical standard(s). Where issues are identified during pre-testing, these shall be resolved and recorded in a failure log. A pre-testing report shall be produced, containing the failure log, which demonstrates the performance of the Energy Centre achieves the required criteria as outlined within the [HNTAS Acceptance Testing Standard].	TS1 6.8.1 TS1 6.8.4 TS1 6.8.5 TS1 6.8.7 TS1 6.8.8 TS1 6.8.9 TS1 6.8.10 TS1 6.8.16	EC-S6-E11
6.1.9.	Acceptance Testing of the Energy Centre shall be undertaken in accordance with the applicable technical standard(s) to demonstrate that the Energy Centre operates in accordance with its design intent, Description of Operation, and acceptable thresholds for all applicable KPIs.	TS1 6.8.1 TS1 6.8.4 TS1 6.8.7 TS1 6.8.8 TS1 6.8.9 TS1 6.8.10 TS1 6.8.16	EC-S6-E12
6.1.10.	After the Acceptance Test, performance data shall be provided to demonstrate the performance during the Acceptance Test. The data shall be in its raw form as a minimum, and in a usable format (e.g. .csv, .xlsx)		EC-S6-E13

Technical Requirement		Applicable technical standard(s)	Evidence Requirement(s)
6.1.11.	As new phases of a Heat Network are brought become operational, an assessment shall be carried out to determine if a full Acceptance Test is necessary to confirm that the system can operate in all modes of operation with the additional heat demands of the new phase. An additional Acceptance Test might be necessary if the heat demand of new phase is significant compared to the heat demand that the Energy Centre has been tested and certified. Where this is necessary, requirements 6.1.7 - 6.1.10 shall be met. If a full Acceptance Test is not required, it shall be demonstrated that the distribution pumps can meet the minimum differential pressure requirement at the index point(s) of the system.	TS1 6.8.10 TS1 6.8.11	EC-S6-E14 *As necessary:* EC-S6-E10 EC-S6-E11 EC-S6-E12 EC-S6-E13
6.1.12.	The condition of equipment and pipework shall be determined, and remedial actions undertaken where necessary, in accordance with the applicable technical standard(s).	TS1 6.16.1 TS1 6.16.2 TS1 6.16.3 TS1 6.16.4 TS1 6.16.5 TS1 6.16.6	EC-S6-E15
6.1.13.	The handover procedures shall be followed in accordance with the applicable technical standard(s).	TS1 6.17.8 TS1 6.17.9 TS1 6.17.10	EC-S6-E18

Table 9: Technical Requirements for the Energy Centre at Stage 6: Commissioning

6.2. Performance Monitoring Requirements

The applicable Performance Monitoring Requirements in Table 10 shall be fulfilled.

Performance Monitoring Requirement		Applicable technical standard(s)	Evidence Requirement(s)
6.2.1.	Monitoring Points shall be clearly labelled with references in accordance with the applicable technical standard(s) and that match the Monitoring Points Schedule and KPI Schedule.	TS1 4.12.1 TS1 4.12.4 MMS 4.1.13	EC-S6-E16
6.2.2.	Commissioning checks shall be carried out on all Monitoring Points in accordance with the applicable technical standard(s). The check shall also to ensure that all data required to enable KPIs to be calculated and reported during Acceptance Testing is available on the ARMS before Acceptance Testing and what is being recorded at the Monitoring Point is being correctly reported to the ARMS. The checks shall ensure that: • the data required for all applicable KPIs to be calculated and reported during Acceptance Testing is available on the ARMS prior to Acceptance Testing; and • measurements taken at each Monitoring Point are correctly extracted, recorded, transformed, and reported by the ARMS.	TS1 4.12.2 TS1 6.8.14 TS1 6.12.1 TS1 6.12.2	EC-S6-E17

Table 10: Performance Monitoring Requirements for the Energy Centre at Stage 6: Commissioning

6.3. Key Failures

The applicable Key Failures listed in Table 11 shall not be present.

Key Failure		Outcome to avoid	Evidence Requirement(s)
6.3.1.	Failure to develop realistic commissioning plan which allows sufficient time for commissioning and/or failure to appoint personnel to carry out commissioning.	Insufficient time to carry out commissioning of the Energy Centre and lack of competent persons to commission equipment, which could lead to the Energy Centre not performing as the design intended and KPIs not being achieved.	EC-S6-E01
6.3.2.	Pressure mitigation measures not commissioned properly (e.g. high pressure shut offs not set correctly, pump speed limits not implemented).	This can result in maximum differential pressure or pressure rating of equipment being exceeded, risking equipment failure & void warranties. May also present health and safety risk to operatives.	EC-S6-E05 EC-S6-E06 EC-S6-E12
6.3.3.	Energy Centre temperatures not commissioned to design set points (e.g. heat generation temperature set point, three-port valve threshold temperature set point, differing set points between generation modules).	Equipment not performing as per design intent. This can result in KPI thresholds not being met due to the equipment not operating in accordance with the design. This can reduce the overall Energy Centre efficiency due to incorrect temperature set point(s).	EC-S6-E05 EC-S6-E06 EC-S6-E12
6.3.4.	Pressurisation unit not commissioned in-line with the design requirements (for example, incorrect set point).	Set point lower than design criteria can result in air ingress into the network, which can impact water quality and the performance of equipment. A set point higher than design criteria can cause high operating pressures, risking equipment pressure ratings and causing health and safety risks.	EC-S6-E05 EC-S6-E06 EC-S6-E12

Key Failure		Outcome to avoid	Evidence Requirement(s)
6.3.5.	Controls not implemented as per Description of Operations, implemented poorly and/or not optimised during the commissioning stage (e.g. network pump control strategy not implemented properly, shunt pump flowrate set excessively, three port valves not tuned correctly to design parameters).	Energy Centre not operating as per design intent. Examples include reduced network efficiency due to high return temperatures and increased parasitic energy consumption due to increased network flow rates.	EC-S6-E13
6.3.6.	Commissioning that requires optimisation during the commissioning phase not optimised to meet the Description of Operations (e.g. PICVs not tuned correctly to design parameters, heat generation sequencing time intervals not optimised).	Energy Centre not operating as per design intent. This could, for example, lead to reductions in flow temperature due to heat generation equipment not being enabled when it is needed, or equipment cycling when they enable and disable too quickly.	EC-S6-E13
6.3.7.	Not all required Monitoring Points are connected to the ARMS. Most commonly occurs for bulk meters (e.g. block level, Energy Centre and Substation thermal energy meters) and utility meters.	ARMS unable to extract the required data from all Monitoring Points, and therefore cannot record and store the necessary data to calculate KPIs.	EC-S6-E05 EC-S6-E06 EC-S4-E07
6.3.8.	Missing, unclear, or incorrectly labelled control system points and Monitoring Points physically on-site, within O&M documentation and on the ARMS. Examples include incorrect sensor naming and meter naming.	Difficulty in identification of control system points and Monitoring Points for future O&M operatives, risking the ability to be able to accurately measure performance and report on KPIs.	EC-S6-E16
6.3.9.	Incorrectly allocated meters (serial number of meter is allocated to the wrong meter).	Incorrectly allocated data to meter, resulting in inaccurate representation of Monitoring Point.	EC-S6-E16

Key Failure		Outcome to avoid	Evidence Requirement(s)
6.3.10.	Monitoring Points not producing reasonable and expected data.	Unable to accurately monitor performance and risks falsely being able to achieve or not achieve KPI thresholds.	EC-S6-E17
6.3.11.	Monitoring Points not communicating with ARMS.	ARMS unable to extract, record and store data from Monitoring Point, and therefore KPIs cannot be calculated, and performance monitored.	EC-S6-E17
6.3.12.	ARMS not operational and connected to all required Monitoring Points prior to acceptance test.	Unable to measure, extract, record, and store data during acceptance test, which prevents being able to calculate KPIs to demonstrate acceptable performance prior to handover to achieve Certification.	EC-S6-E17
6.3.13.	Insufficient testing and demonstration of Energy Centre operation prior to handover (including proving alarms/fault integration and emergency features with BMS).	Energy Centre not operating as per design intent. Safety risk due to alarms and shut offs not tested.	EC-S6-E10 EC-S6-E11 EC-S6-E13
6.3.14.	Energy Centre performance not tested in all modes of operation.	Performance issues during network operation. For example, unstable flow temperatures during transition of heat demand, which could reduce the reliability of the Energy Centre and result in KPIs not being achieved.	EC-S6-E10 EC-S6-E11 EC-S6-E13
6.3.15.	Poor water quality management during construction phase (lack of sampling, analysis and issue identification and rectification).	This can result in, for example, reduced equipment efficiency due to poor water quality, increased equipment failure rate due to poor water quality and increased maintenance requirement due to poor water quality.	EC-S6-E03 EC-S6-E04

Key Failure		Outcome to avoid	Evidence Requirement(s)
6.3.16.	Energy Centre not fully circulated during long construction phases.	Poor water quality due to lack of circulation in Energy Centre and increased risk of bacteria growth due to stagnant water.	EC-S6-E03 EC-S6-E04
6.3.17.	Insufficient and/or incorrect O&M documentation and handover to system operator (e.g. inaccurate as-built drawings, inaccurate setpoints on Description of Operation, missing information from O&M manual).	Unclear system requirements to O&M contractor. System maintenance not carried out in accordance with system requirements.	EC-S6-E18
6.3.18.	Metering and Monitoring System documentation not included within the O&M manual. This includes all design documentation, updated to reflect any changes during construction. These are Metering and Monitoring Strategy, KPI schedule, Monitoring Point schedule, schematics, data flow diagrams.	Difficulty in understanding installed Metering and Monitoring System for future O&M operatives, risking the ability to be able to accurately measure performance and report on KPIs.	EC-S6-E17 EC-S6-E18

Table 11: Key Failures for the Energy Centre at Stage 6: Commissioning

6.4. Evidence Requirements

The applicable Evidence Items listed in Table 12 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-S6-E01	Commissioning plan	A document outlining the intended plan and programme for commissioning of the Energy Centre. This shall include the critical path for commissioning of the Energy Centre. Where updates are made to the programme, the updated commissioning plan shall be made available. *Note the commissioning plan may be a wider Heat Network commissioning plan that contains multiple Elements.*
EC-S6-E02	Commissioning methodology	Methodology for the commissioning of equipment that requires commissioning procedures. Methodology shall include all specific criteria that the equipment is to be commissioned to. This shall include, for example, temperature, pressure and/or flow rate set points for equipment.
EC-S6-E03	Water quality sampling schedule	A schedule outlining the intended dates that samples shall be taken for monitoring the water quality of the Energy Centre and network it shall provide heat to. *This may be provided as part of the Water Quality Recording Programme for the system.*
EC-S6-E04	Water quality sample results	Results shall be provided for all water quality samples taken, clearly outlining the sample location for each set of results. Results shall also be provided to show the trends for each water quality parameter over time. This shall be in a format where the trend and minimum/maximum limits (where applicable) can be identified (e.g. graphical format).
EC-S6-E05	Energy Centre equipment commissioning certificates	Commissioning certificates for any equipment that requires a commissioning procedure. This shall outline the required design criteria for the equipment that requires commissioning and the final commissioned value for each criteria.
EC-S6-E06	Energy Centre equipment commissioning activities offered for witnessing (e.g. heat pump commissioning)	Commissioning activities for the Energy Centre shall be offered for on-site witnessing.

Evidence Item		Detailed description and requirements
EC-S6-E07	Control System points schedule	A schedule outlining all points that are to be monitored by the Control System. The nomenclature for each point shall be clear so that each point is readily identifiable. This shall include meters, sensors, faults and alarms, set points for equipment controlled by the Control System, emergency shut off status.
EC-S6-E08	Control System commissioning and points check record sheet	A document containing a register of all Control System points which details the status of each point following a test to demonstrate the functionality of each point.
EC-S6-E09	Control System points check offered for witnessing	The Control System points check shall be offered for on-site witnessing.
EC-S6-E10	Acceptance testing methodology	Methodology outlining the intended procedure for demonstrating the Energy Centre performance and criteria for achieving performance.
EC-S6-E11	Pre-testing report	A report following completion of pre-testing shall be provided. This shall demonstrate the performance of the Energy Centre is acceptable for Acceptance Testing to be undertaken. The report shall contain a failure log of any issues identified and resolved during pre-testing.
EC-S6-E12	Acceptance Test offered for witnessing	The Energy Centre Acceptance Test shall be offered for on-site witnessing.

EC-S6-E13	Acceptance Test data	Performance data required to demonstrate fulfilment with the requirements of the Acceptance Test shall be provided for the entire duration of the Energy Centre Acceptance Test.
		For example, this includes:
		• Temperature sensors
		• Pressure sensors
		• Control valve positions
		• Alarms
		• Equipment enable signals
		• Thermal energy meter readings, including:
		  ○ Flow temperature
		  ○ Return temperature
		  ○ Power

Evidence Item		Detailed description and requirements
		○ Flow rate ○ Utility meter consumption Data shall be provided in both its raw format as minimum. This shall be provided electronically in a useable file type (e.g. .csv, .xlsx).
EC-S6-E14	*As necessary:* Written justification as to whether an additional Acceptance Test is required, or whether previous test certificate is sufficient	Evidence of written justification outlining if an additional Energy Centre Acceptance Test is required shall be provided. This justification is required when the expected peak demand for an Energy Centre is increased due to a network expansion.
EC-S6-E15	Condition Log	To include all basic asset data and condition data for all Heat Network equipment within the Energy Centre, including: • asset name; • asset ID; • asset classification code; • asset classification description; • asset criticality; • asset maintainer; • asset location; • asset install date; • asset condition grade; • asset priority grade; • whether asset is beyond economic repair; • asset operational status; • date of last condition survey; and • remaining life expectancy (years).
EC-S6-E16	Photographic evidence of labelled Monitoring Points	Photographic evidence shall be provided for each labelled Monitoring Point within the Energy Centre. The photograph shall clearly show the on-site labelling which corresponds to the as-built Energy Centre schematics and layout drawings.
EC-S6-E17	Monitoring Points Commissioning Record Sheet	Commissioning record evidencing check of each Monitoring Point.
EC-S6-E18	Evidence demonstrating	Written sign-off from the organisation responsible for carrying out operation and maintenance activities

Evidence Item		Detailed description and requirements
	Operator handover sign-off	that they accept that all handover procedures meet HNTAS requirements and that they accept responsibility for the operation and maintenance of the Energy Centre going forward.

Table 12: Evidence Requirements for the Energy Centre at Stage 6: Commissioning