NHBC System Review

Technical document
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Version 1.5

NHBC

Contents

1.0 Scope

1.1 Legal

NHBC System Review is not an independent accreditation scheme or any form of performance guarantee, and third parties should engage with the relevant manufacturer on performance of their product. No document and/or information relating to NHBC System Review may be adapted, disclosed, or distributed to any third party. NHBC Services Ltd assumes no responsibility to any third party. Any third party who chooses to rely upon NHBC System Review certificate (or any documentation and/or information relating to the NHBC System Review Service) should do so entirely at their own risk and NHBC Services Ltd accepts no liability for any damage or loss, however caused, in connection with the use or reliance on any documentation and/or information relating to NHBC System Review.

1.2 Procedural

The NHBC System Review service provides confirmation, in writing, that an Innovative System (hereafter referred to as 'System') can meet the NHBC Standards. NHBC Services Ltd conducts a review of a System and, if deemed satisfactory, will provide a NHBC System Review Certificate to the System Owner and will publish the System Review Certificate for the System on the NHBC System Review webpage.

1.3 Compliance

The NHBC System Review service requires that the System Owner and the System should comply with the criteria set by NHBC Services Ltd as detailed within this document. The Service is intended solely to provide confidence that the System can meet the minimum requirements set out in the NHBC Standards and is not intended as evidence of performance for any other purpose. The service is an integral part of NHBC's Technical Risk Management (TRM).

1.4 Purpose

This document describes the requirements and scope of review of innovative systems commonly referred to as Modern Methods of Construction (hereafter referred to as 'MMC'). Such systems are defined by MHCLG under a seven-category framework, The framework can be found at **MMC-I-Pad-base_GOVUK-FINAL_SECURE.pdf**. The focus of the NHBC System Review Service is on Systems used to form the structure or envelope of a building but MMC systems could fall into one of the following categories.

- Category 1 – 3D primary structural systems (Volumetric)
- Category 2 – 2D primary structural systems (Panelised)
- Category 3 – Non systemised primary structure
- Category 4 – Additive manufacturing (3D printing)
- Category 5 – Non-structural assemblies & sub-assemblies
- Category 6 – Site based productivity improvements (Materials innovation)
- Category 7 – Site based process improvement (Digital Technology + Temporary Works)

The System may form a building individually or in conjunction with other elements or construction components. For example, the System may comprise a three-dimensional volumetric module, connected to other modules that may be structurally stable or rely on a site-erected structural core for stability. Alternatively, the System may comprise closed panel walls connected to a site erected structural frame.

The structural components of the System are generally prefabricated and assembled in a factory environment, usually from metal, timber or concrete or a combination of these materials.

Systems may be supplied with varying degrees of completion. Some components are standard across the System, whereas some non-standard components may be assembled in the factory but vary on different projects. Ancillary equipment is generally installed on site to complete the finished building.

The interface between standard, non-standard and ancillary equipment should be subject to assessment.

2.0 Definitions and abbreviations

MMC	Modern Methods of Construction.
MHCLG	Ministry of Housing, Communities and Local Government of the United Kingdom.
NHBC Review Certificate (the Certificate)	Certificate issued by NHBC Services Ltd stating that relying on the information provided by the System Owner, the System is expected to meet the requirements of the relevant NHBC Standards.
NHBC Standards	The NHBC Standards (as amended from time to time) that incorporate the Technical Requirements. The latest version can be found on the NHBC website. NHBC Standards - NHBC
Technical Requirements	The technical requirements for the design and construction of homes considered acceptable to NHBC that must be met by the builder / developer as described in the NHBC Standards.
Service	The NHBC System Review service, being an appraisal of a System against the requirements set out in this document and the Technical Requirements set out in the NHBC Standards.
System Owner	The party responsible for the design / manufacture and assembly of the System.
System Manual	Detailed technical information on the System complied by the System Owner. The System Manual contains all the relevant information, against which the Service is undertaken. It is a comprehensive document that describes the System, the declared performance of the System and the evidence to support the declared performance.
System	A method of construction that enables parts of buildings to be pre-assembled offsite in three-dimensional or two dimensional format. The systemised components are transported to site and connected together and to site-based elements, to form a building.
Standard Components	Components that are common to all buildings that use the System.
Non-standard Components	Components that are assembled as part of the System but vary for individual projects.
Ancillary Components	Components or equipment that is deemed necessary on site to form the completed home.
FPC	Factory Production Control.
QMS	Quality Management System.

3.0 NHBC System Review

Overview of the System Review Service

The System Owner will as a mandatory requirement of the NHBC System Review Service provide a System Manual that describes the System, which sets out the scope and limitations for the use of the System. It should provide a clear statement on the declared performance of the System which should include all supporting evidence to substantiate the declared performance of the System.

The System Manual should provide evidence that the System can meet the requirements of NHBC Standards and should include designs and specification in a clear and understandable format.

This document aims to provide guidance for reference purposes on how best to submit a System Manual to the NHBC System Review Team. The format and typical contents of a System Manual are detailed in **Appendix A**. Further guidance is available in Chapter 11.1 of the NHBC Standards.

- NHBC Standards - NHBC

As part of the NHBC System Review Service a high-level check of the System philosophy against selected relevant parts of the building regulations is conducted, covering the following Approved Documents for Dwellings Only.

Approved Document A	Approved Document K
Approved Document B	Approved Document L
Approved Document C	Regulation 7

* Or any alternative guidance used to demonstrate compliance with the Building Regulations in the nation where the System is being used.

The NHBC Registered Builder / Developer is responsible for ensuring that the homes they build meet the minimum requirements set by NHBC Standards and the Building Regulations.

4.0 System Manual Requirements

The System Manual should provide evidence that the System can meet the requirements of the NHBC Standards and should include designs and specifications in a clear and understandable format. The responsibilities for the design, manufacture and installation should be included within the System Manual.

The System Owner should cover the following performance criteria in the System Manual, where they apply to the System.

A) Structure	B) Fire
C) Moisture	D) Sound
E) Thermal	F) Co-ordination of MEP
G) Quality Management and Verification	H) Site Installation
I) Durability	J) Maintenance and Repair
K) Certification	

Refer to **Appendix A** of this document for an outline of the typical format and content for a System Manual.

4.1 Structure

The loadbearing capacities of pre-designed structural parts of the System should conform to EN 1990:2002 and other product-specific Eurocodes or British Standards as appropriate. Evaluation will normally be undertaken by structural calculations, supplemented, if necessary, by testing.

As the verification of mechanical resistance and stability of individual buildings will necessitate structural calculations on a case-by-case basis, the System Owner should supply a Structural Design Philosophy with supporting example calculations.

The example calculations should include checks to establish the resistance to the Ultimate Limit State (collapse) and the Serviceability Limit State (deflection), based on the maximum size that the System can de produced to.

Where evaluation by testing is required, the testing and evaluation shall be carried out by a body accredited by UKAS for the scope of work.

Reaction to loading

The design, structural performance and loadbearing capacity properties of the System should be such, that when used to construct a building in accordance with the agreed assembly instructions and design rules, the loadings that are liable to act on the System during construction and end use will not lead to any of the following.

- Collapse of the whole or part of the building
- Major deformations to an inadmissible degree
- Damage to other parts of the building where the System is installed or to any installed fittings or equipment as a result of major deformation to the load bearing construction.
- Damage by an event to an extent disproportionate to the original cause.

Serviceability

Loadbearing elements should have sufficient stiffness to avoid unacceptable deflections and dynamic effects from normal use. Elements constructed from Systems should have adequate resistance to loads imposed during manufacture, transportation, and installation.

Resistance to eccentric loads, including impact resistance

Mechanical resistance against dynamic loads should be explained based on existing knowledge related to the intended use of the System.

Where part of the System, consideration should be given to the protection of impact with glazing with which people are likely to come into contact whilst moving around a building. Refer to the NHBC Standards Chapter 6.7 for further guidance.

Differential movement

Buildings formed using Systems should take account of differential movement. Consideration should be given to the following:

- Design of joint details and accommodation of differing floor levels at thresholds, staircases, and lift shaft enclosures.
- Interfaces at the junctions between the cladding system and other elements of the building such as at wall and floor junctions and external door and window openings.
- Design of connecting brackets, anchors, and ties to accommodate movement.

Timber frame

Where the primary structure is timber, it will shrink as the timber dries out, reducing the overall height. The extent of the differential movement increases with the number of storeys, and the design should allow for differential movement between the timber frame and other elements of the building.

For timber frame volumetric systems, the shrinkage, and associated gaps to accommodate differential movement and settlement should be calculated by a specialist. For traditional timber frame structures refer to the guidance available in Chapter 6.2.8 of the NHBC Standards

Light steel frame (LSF)

The design for differential movement in LSF structures should be carried out in accordance with the information contained within the System Manual.

Refer to Chapter 6.10.20 and 6.10.21 of the NHBC Standards for further guidance regarding accommodation of differential movement to LSF structures.

4.2 Fire

The complete building elements which make up the System, (or where relevant, their components) should be tested in a format representing the proposed end use condition. In order to be classified according to the appropriate Part of BS EN 13501, the relevant test method for the corresponding fire resistance class should be used. Determination of the loadbearing capacity of the System elements, when exposed to fire, may also be undertaken by calculation based on relevant Eurocodes. The individual elements should either:

a) be in accordance with a specification or design that has been shown by a specific test to be capable of meeting that performance classification.

b) have been designed by using relevant design standards in order to meet that performance classification.

c) have been assessed by applying relevant test evidence, in lieu of carrying out a specific test, as being capable of meeting that performance classification.

A schedule of the fire performance characteristics should be included in the System Manual.

Means of escape

Where means of escape can be defined, for example where in standard house types or common configurations of a building, the means of escape should be in accordance with the national Building Regulations.

Reaction to fire

The reaction to fire performance of the individual components of the System shall be in accordance with national Building Regulations applicable to the product in its intended end use.

BS EN 13238 defines several standard substrates that produce test results representative of different end use applications. The classification for reaction to fire achieved during testing is only valid when the product is used within this direct field of application, i.e. when the product is fixed to a substrate of that class in its end use.

The standard substrate selected for testing should take account of the intended end use application (field of application) of the product and represent end use substrates that have a density of a minimum of 75% of the standard substrate's nominal density.

Resistance to fire

The resistance to fire performance of building elements constructed from the System should be in accordance with the national Building Regulations applicable to the System in its intended end use application. Fire resistance performance is classified with an REI value in minutes, where:

- R = Resistance to collapse (load bearing capacity)
- E = Resistance to fire penetration (integrity)
- I = Resistance to the transfer of excessive heat. (insulation)

Systems cannot assume a European class unless they have been tested and classified accordingly.

Fire compartmentation

Fire compartmentation is a function of its application and the relevant national building regulations. It is for the building designer to determine the suitability and position of individual compartmentation components.

Where compartmentation is reliant upon components incorporated in the System, (for example cavity barriers or fire stopping installed in building elements manufactured from the System), assessment will be made on the basis of the construction details provided by the System Owner.

4.3: Moisture

Vapour permeability and moisture resistance

The properties of a System should be such that there will be no threat to the occupants or their neighbours due to the presence of damp in the works (interstitial) or any surfaces of the works constructed from the System.

When designing for the risk of moisture in the external envelope, consideration should be given to a whole building assessment considering the ventilation and heating design, critical junctions of elements, weathering strategy and detailing, the materials and form of the external fabric, positioning of air and vapour control layers and air tightness layers and the likely in service external and internal climatic conditions depending on the geographical location and occupancy type.

An assessment should be undertaken in accordance with the method outlined in BS EN ISO 13788.

The following boundary conditions should be transposed into the assessment for the winter months of December, January, and February.

Internal relative humidity	External temperature	Internal temperature
>60% relative humidity	-2°C	21°C

If an assessment indicates condensation is likely to occur, then the designer should assess the likelihood of it causing damage to the materials used and if necessary, amend the design.

Water vapour resistance of relevant layers should be based upon:

- Design values given in EN 12524 or European technical specifications, or
- Tests according to EN ISO 15572 or European technical specifications.

Watertightness

The external envelope of a building constructed using the System, including joints should prevent leakage into the building of water from rain and melting snow for the defined exposure classification for the building.

Resistance of the building envelope to water leakage, including the impact of differential movement should be demonstrated based on the standard construction details for the System.

Dependent upon the design of the System, it may be necessary to consider the water tightness of the envelope before the final outer layer is applied e.g. brick skin. Temporary measures may be required at the factory or on site to ensure the System is watertight.

Where the System includes external cladding, NHBC Standards, Chapter 6.9 curtain walling and cladding systems requires that it should have certification confirming satisfactory assessment, undertaken by a UKAS accredited independent technical approval authority acceptable to NHBC. Where applicable, the certification should be in accordance with the CWCT standard for systemised building envelopes (or a suitable alternative acceptable to NHBC may be provided).

Resistance to moisture from the ground should be incorporated, including the use of suitable damp proof membranes, damp proof courses and other separation of the structure and internal environment from ground moisture. Construction details should consider sloping development sites and steps and staggers in the building's elevations and plan form.

Temporary weather protection

Temporary protection materials must be specified to ensure they are fit for purpose and achieve compliance with NHBC Technical Requirement R4 c) iii) proper protection during storage and v) protection against weather during construction, including excessive heat, cold, wetting and drying.

The System Manual should outline the design, methods, and requirements for protecting the System from exposure to weather and UV light during storage, transportation, and installation. The System Manual should include a clear statement covering:

- Maximum duration of exposure of the System following installation until permanent cladding is installed.
- Where appropriate be breathable to prevent accumulation of condensation which may have the potential to physically damage the System. The System Owner should provide means of suitable ventilation and demonstrate that intermittent quality checks are undertaken as part of the FPC procedure.
- Details of any openings required in the temporary weather protection material should be explicitly stated in the System Manual for lifting / installation / maintenance and connections. The System Owner should describe the process for ensuring continuity of the temporary protection measures post installation and during quality assurance checks (maintenance checks).
- The method for sealing between the elements and around the lifting points, as well as the choice of material selected, should be suitable for use in external conditions and extremes of temperatures. i.e. hot, cold, humid, damp, and wet conditions.
- Reference to the System Owners quality control processes and checks to ensure closing of temporary weather proofing (or removal of temporary weather proofing as appropriate), post installation is correctly executed.

The design of the temporary weather protection should prevent the risk of standing water on the tops of volumetric systems.

4.4 Sound

Resistance to the passage of sound is to be provided in the completed building to comply with the relevant parts of the national Building Regulations. The System Owner should state how this sound insulation performance is to be demonstrated. The performance of the System or assembly of the System may be evaluated by either.

a) Field testing of a completed building in accordance with national Building Regulations

b) Design in accordance with Robust Details. (Where plots are registered by this scheme)

Where the sound insulation performance is evaluated by field testing of a representative sample the anticipated sound insulation performance of building elements should be declared in the System Manual as estimated values for Airborne sound insulation and Impact noise level as expected in completed buildings.

The estimated values should be verified by assessment from a suitably qualified acoustic specialist and may use references to data for common construction designs given in national standards, textbooks or authoritative guides, provided that such data is based upon tests and classification in accordance with the EN ISO standard mentioned above.

Internal soil and waste systems

Soil and waste systems in bathrooms and ground floor stub-stacks should be in accordance with the national building regulations and sound proofed to limit transmission of noise. Refer to Chapter 8.1.10.3 of the NHBC Standards.

4.5 Thermal

Thermal transmittance

The external envelope should provide the necessary thermal insulation applicable to the intended use of the building. Thermal bridges, which may cause uncomfortably low temperatures or water vapour condensation affecting hygiene, health and the environment should be avoided.

Thermal transmittance (U -values) of the principal building elements should be determined using conventions set out in BR 443 Conventions for U-Value calculations and should be based on the whole element or System (e.g. in the case of a window, the combined performance of the glazing and frame).

To avoid thermal bridges consideration could be given to the:

a) Adoption of accepted design details as set out in formally recognised 'Accredited Construction Details' for the System: or

b) Use of construction joint details that have been calculated by a suitably qualified person following the guidance set out in BRE Report BR 497 Conventions for calculating linear thermal transmittance and temperature factors.

Air permeability

The external envelope should provide adequate airtightness to limit unnecessary energy losses and should be designed to prevent cold draughts.

Where applicable, a ventilation design philosophy statement should be documented in the System Manual to demonstrate that the method of ventilation of the home is suitable for its intended use.

Examination of the air permeability of the completed building is not included in the NHBC System Review Service but will be determined by on site testing in accordance with the national building regulations.

4.6 Co-ordination of MEP

The design of the System should ensure that all standard utility industry regulations and guidance is followed with due regard to the arrangement, specification, and commissioning of building services. Services and systems should be integrated into the System without compromising its structural integrity, (including allowance for differential movement), fire, moisture, or sound resistance qualities and should be suitable for the intended use of the building.

The method of commissioning services installed offsite in a factory environment should be detailed in the System Manual. Pressure Testing of pipework should be undertaken offsite where practicable.

Suitable access should be provided for site connections, inspection, and commissioning of services.

The System Manual should only include specific information on aspects of key services that are standard across the System.

Services supplied should be compliant with the requirements set out in Chapter 8 of the NHBC Standards.

4.7 Quality Management and Verification

Quality Management

Systems may be manufactured using a wide range of materials and design methodologies. It is therefore not possible to prescribe exact actions to be undertaken by the System Owner of the System for Factory Production Controls (FPC) in the evaluation of conformity.

Systems that are covered by a harmonised European Standard must be manufactured in accordance with the relevant standard applicable at that time.

The System Owner should create a Factory Production Control Plan (FPC - see Appendix B for an example control plan) to ensure, by direct or indirect methods, that the product specification remains unchanged from that described in the System Manual, allowing for normal tolerances on material properties and manufacturing processes and that the performance of the System is consistent with the System Manual.

The System Owners Quality Management System (QMS) should be certified by a UKAS accredited independent certification body acceptable to NHBC against the requirements of ISO 9001:2015.

The System Owner should demonstrate the following in the QMS.

- Control of production through the FPC, (this should include hold points and evidence of inspection, testing and commissioning).
- Clarity on the controls between design and fabrication to verify the System manufactured meets the design specification.
- Traceability of all materials and components used in the manufacture of the System.
- The process for identification of the proposed site and plot where the system will be used.
- A procedure for identifying non-conformities, their causation and action plans to prevent recurrences.
- A procedure for the quarantine of non-conforming Systems, materials and components to prevent their delivery to a site.
- A procedure for re-work where a remedial action has been identified.

Where it is deemed appropriate by the NHBC System Review Team a full-scale prototype of the System may be required. In some instances, a pilot site can be nominated, with a limited number of dwellings.

Verification and Identification

Documentation should be provided in a clear and understandable format which contains information that confirms the System has been manufactured, supplied, and installed in accordance with the System Manual, and reviewed design.

The Verification Report should be appropriate to the risk category of the System and should consider the activities listed in Table 4 of Chapter 11.1 of the NHBC Standards.

All components in the System should be identified. This will include dimensions, significant properties (e.g. mechanical, physical, and chemical etc), tolerances and the product standard or certification against which they have been assessed.

4.8 Site Installation

Installation Manual

The System Manual shall incorporate an installation manual that should, as a minimum, address:

- Roles and responsibilities for site operations
- Scope and limitations of use
- Delivery, transportation and storage requirements
- Pre-installation checks
- Permitted tolerances and remediation of disparities.
- Erection sequence, techniques and necessary equipment
- Method for connecting to substructure/ foundations (including interface with ground gas protection where required)
- Completion and verification of joints between building elements
- Incorporation of ancillary components
- Temporary bracing/ propping
- Methods and requirements for protecting the System from weather exposure and mechanical damage during storage and transportation.
- Sealing of temporary membranes and removal of temporary protection
- Requirement for correct connection of services such that fire protection and damp-proofing are not compromised.
- Method for testing and commissioning of services
- Remedial actions for damaged building elements

A fuller explanation can be found in Table 2 of NHBC Standards Chapter 11.1.9.

In addition, under NHBC rules for registered Builders and Developers, it may be necessary for access to be provided to inspect critical locations, including those that may be concealed. Therefore, the Installation Manual should include a generic set of RAMS for opening and reinstatement of the critical areas (floors, walls, ceilings, and roofs) of the System for Inspection.

Competence of installers

Installation of Systems should only be undertaken by trained and competent persons who are familiar with the System. Installers should understand the complexities of the System such as correct storage, handling, tolerances, and installation techniques. Installers should be provided with the System Manual, Installation Manual, Design Details, Specifications, and product data sheets.

Installers should hold a current and valid certificate confirming they have received training by the System manufacture, or supplier.

4.9 Durability

The suitability of a System or material for a specific purpose should be demonstrated by compliance with NHBC Technical Requirement R3.

The design of a building, built from the System should ensure that deterioration of materials and components, during its intended working life should not significantly affect the performance of the System in relation to fulfilling the Technical Requirements of the NHBC Standards.

The structure of a building should, unless specifically agreed otherwise in writing with NHBC, have a service life of at least 60 years. Individual components and assemblies that are not integral to the structure may have a lesser durability, typically not less than 20 years.

5.0 Maintenance and repair

Where appropriate the System Owner should provide guidance to the builder / developer to pass to the end user on the type and frequency of maintenance required to ensure the structure remains durable for the intended life span of the building. The System Owner should include a generic set of RAMS for inclusion in an Operation and Maintenance Manual (O&M) for the components of the System (where applicable).

Where parts of the System involve complex or novel materials or assemblies, it should be made clear in the guidance / RAMS, that only specialist operatives (or the original supplier) are permitted to work in the affected area of the building, otherwise the guarantees and warranties will become void. Similarly, information on the limits of, and methods for, carrying out repairs to non-traditional materials or types of construction should be given to the house builder / developer for inclusion in an O&M Manual.

6.0 Certification

The scope of the intended use and limitations declared for the System will be indicated on the System Review Certificate awarded to the System Owner.

Certification will be entered onto the NHBC System Review Webpage. The terms of use of the System Review certificate are set out in the terms and conditions that accompany the Engagement letter with the System Owner. The Engagement letter provides in detail the circumstances in which a System Review certificate can be withdrawn or discontinued.

The NHBC System Review certificate will be valid on the NHBC website for an initial twelve-month period. Thereafter, subject to an annual renewal fee, the System may continue to be certified if future changes to the System are reviewed and found to be compliant. A periodic review would be carried out at not more than two-year intervals where no changes to the System have been notified previously.

The standard form of the certificate is reproduced in **Appendix C** of this document.

Appendix A: System Manual – Typical format and content

Cover page(s)	• System owner name. • System name. • Document version number and revision number. • Document issue date. • Document owner. • Document status.
Revision history	• Version number and revision number / issue date / notes / document editor/ sign off.
Contents	• Reference codes. • Section headings and sub-sections. • Page numbers.
Scope and limitations	• Description of the System. • Scope of the offsite manufactured elements. • Intended use of the System. • Limitations of the System: geographic / environmental / number of storeys / dimensions / building type and shape. • Exclusions: Scope of what is not covered by the System. • Responsibility: Confirmation of who is responsible for the design and coordination of the System, certification of the System quality assurance and who has the overall responsibility for the delivery of the homes.
Typical or standard details	• Define whether the drawings are 'Standard' or 'Typical' Details and identify which materials/ components are part of the System to be reviewed and which are ancillary. • Include a schedule of the Detail drawings with issue date and revision history. • Provide details that convey weathertightness, buildability, structural path load, thermal efficiency, and performance in the event of a fire.
Material specifications	Specifications and third-party certification for all key materials that are critical to the performance of the System should be provided, such as: • Structural. • Protection for durability. • Sheathing boards. • Insulation. • AVCL / DPM / DPC and breather membranes. • Cavity barriers and fire stopping. • Windows and external doors. • Internal fire linings. Third party certification should be UKCA/UKNI/CE Marked or certified by an independent certification body belonging to the European cooperation for Accreditation (EA).

Evidence of performance (where applicable)	• Process for obtaining third party certification. • Structural design philosophy stating how loads are sustained and transferred to the ground as well as in transit/lifting. • Sample structural design calculations. • Condensation risk analysis (CRA). • Fire test report(s) demonstrating compliance with national building regulations. • Design philosophy for Means of Escape. • Resistance to the passage of sound. • Thermal transmittance: U-Values and Psi Values for typical and critical junctions. • UKCA/UKNI/CE Mark certificates for all materials. • Factory production control (FPC) which should include: - ISO 9001: 2015 certification. - Inspection and test plan. (See Appendix B) - Process flow chart of activities, including change control mechanism between design and manufacture. - Processes for identifying and acting on non-conformities. - Hold points and evidence of inspection. - Traceability of all components. - Identification of the proposed site for what is produced.
Site Installation Manual	• A summary of the contents of a Site Installation Manual are provided in Section 5.8 of this document.
Handover requirements	• Generic information on methods and limitations for future maintenance, repair and modification for inclusion in an O&M Manual for the benefit of homeowners/ occupiers.

Appendix B: Example - Control plan

Subject/type of control	Test or control methods	Criteria, if applicable	Minimum number of samples	Minimum frequency of control
Properties of structural components				
Structural profiles, framework etc.	See prEN 1090 -			
Structural connections	Documented in house method	As defined in national specifications	1	As defined in national specifications
Properties of core/insulation products				
Formulation	-	Supplier declaration	-	Every delivery
Density (in situ foams only)	Documented in house method	-	3	One every shift
Properties of face materials				
Material specification	-	Supplier declaration	-	Every delivery
Thickness	Suitably calibrated instruments	Conformity with ETA specification	3	Every delivery
Tensile strength	Documented in house method			
Properties of adhesives/adhesive joints (where applicable)				
Coverage (spread)	Documented in house method	Manufacturers declaration	-	Continuously
Density if viscosity	EN 542 or EN 12092	Manufacturers declaration	-	One every shift
Workshop conditions eg temperature	Suitably calibrated instruments	In accordance with adhesive supplier recommendations	-	Continuously
Tensile strength of bonded joint (after curing)	Documented in house method	Manufacturers declaration	-	One every shift
Properties of panels				
Dimensions – thickness, height, width, squareness, and flatness as relevant	Suitably calibrated instruments	Conformity with System Manual and approved project specific design	1	One every System
Compressive and tensile strength	Documented in house method		3	One every shift or change of System
Shear strength	Documented in house method		3	One every shift or change of System

Properties of assembled System				
Sealing of joints	Documented in house method	Visual check	3	Every System
Correct operation of windows and doors	Documented in house method	Visual check	1	Every System
Installation of cavity barriers and fire stopping	Documented in house method	Visual check	1	Every component
Lapping of membranes (AVCL and breather membrane)	Documented in house method	Visual check	1	Every System
Pressure testing of plumbing and services	Documented in house method	Visual check	1	Every System
Quality of finishes	Documented in house method	Visual check	1	Every System
Temporary protection materials and specifications	Documented in house method	Visual check	1	Every System

NHBC

System Review **certificate**

NHBC Services Ltd confirms that

System owner:

System name:

System manual:

has been reviewed by the NHBC System Review team and as detailed in the System Manual can meet the NHBC Technical Requirements, subject to the exclusions and limitations listed in this certificate.

This certificate is valid until such time as it is no longer published or authorised by NHBC. Readers are advised to check the validity and latest issue number of this certificate by either referring to our website at nhbc.co.uk/systemreview or contacting NHBC directly.

NHBC Services Ltd has undertaken a technical review of the System manual as set out in line with the NHBC System Review Technical Document for Innovative systems. The NHBC System Review Service is intended solely to provide confidence that the Innovative system meets NHBC Standards and is not intended as evidence of performance for any other purpose. Appraisal of the Innovative system against building regulations is not carried out as part of this Service.

NHBC reference: **First issued:**

Version number: **Revised on:**

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NHBC

NHBC reference:

System description

Exclusions and limitations

Additional requirements must be met in order for a new home to qualify for Buildmark cover. Buildmark cover for new homes will only be issued to Builders or Developers in accordance with the latest version of the NHBC Rules (a copy of which can be found at **nhbc.co.uk**).