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Agrément Certificate
20/5808
Product Sheet 1

INSULATED CONCRETE FORMWORK SYSTEM

THERMOMUR

This Agrément Certificate Product Sheet(1) relates to Thermomur, an insulated concrete formwork system comprising expanded polystyrene (EPS) elements with integral web spacers. Thermomur, as permanent insulated formwork, is used, with height restrictions, in the formation of load-bearing and non-load-bearing reinforced concrete external, internal and separating walls in domestic and commercial buildings.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Structural performance — the system components have adequate strength to resist the loads associated with installation (see section 6).
Thermal performance — the system contributes to the overall thermal performance of the wall construction (see section 7).
Risk of condensation — walls, wall junctions and openings can adequately limit the risk of condensation (see section 9).
Behaviour in relation to fire — the system's EPS components are not classified as non-combustible materials and their use is restricted in some cases (see section 13).
Durability — the system will have a service life in excess of 60 years (see section 16).

The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

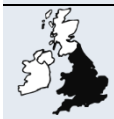
On behalf of the British Board of Agrément

Date of First issue: 6 October 2020

Hardy Giesler
Chief Executive Officer

Regulations

In the opinion of the BBA, Thermomur, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	**B3(4)**	**Internal fire spread (structure)**
Requirement:	**B4(1)**	**External fire spread**
Comment:		The system can satisfy these Requirements. See section 13.1 of this Certificate.
Requirement:	**C2(2)**	**Resistance to moisture**
Comment:		The system can adequately limit the risk of surface condensation and contribute to minimising the risk of interstitial condensation. See sections 9.1, and 9.3 to 9.5 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		The system can contribute to satisfying this Requirement, although additional insulation will be required for dwellings in Wales. See sections 7 and 8.1 of this Certificate.
Regulation:	**7(1)**	**Materials and workmanship**
Comment:		The system is acceptable. See section 16 and the *Installation* part of this Certificate.
Regulation:	**7(2)**	**Materials and workmanship**
Comment:		The system is restricted by this Regulation. See sections 13.1 and 13.2 of this Certificate.
Regulation:	**26**	**CO_2 emission rates for new buildings**
Regulation:	**26A**	**Fabric energy efficiency rates for new dwellings (applicable to England only)**
Regulation:	**26A**	**Primary energy consumption rates for new buildings (applicable to Wales only)**
Regulation:	**26B**	**Fabric performance values for new dwellings (applicable to Wales only)**
Comment:		The system can contribute to satisfying these Regulations but compensating fabric and/or services measures will be required for dwellings. See sections 7 and 8.1 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Durability, workmanship and fitness of materials**
Comment:		The system can contribute to a construction satisfying this Regulation. See sections 15 and 16 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	2.1	Compartmentation
Standard:	2.2	Separation
Standard:	2.3	Structural Protection
Comment:		The system is restricted by these Standards, with reference to clauses 2.1.12(2), 2.2.4(2), 2.2.5(2), 2.2.6(1), 2.2.7(1), 2.2.8(1) and 2.3.2(1)(2). See sections 13.1, 13.3 and 13.8 of this Certificate.
Standard:	2.4	Cavities
Comment:		The system is restricted by this Standard, with reference to clauses 2.4.2(1)(2), 2.4.4(1) and 2.4.6(2). See sections 13.1 and 13.3 of this Certificate.

Standard:	2.6	Spread to neighbouring buildings
Comment:		The system is restricted by this Standard, with reference to clauses 2.6.5[(1)] and 2.6.6[(2)]. See sections 13.1 and 13.3 of this Certificate.
Standard:	3.15	Condensation
Comment:		Walls can adequately limit the risk of surface condensation, with reference to clauses 3.15.1[(1)(2)] and 3.15.4[(1)(2)] of this Standard. Walls can contribute to minimising the risk of interstitial condensation, with reference to clauses 3.15.1[(1)(2)] and 3.15.5[(1)(2)] of this Standard. See sections 9.2 to 9.5 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Comment:		The blocks can contribute to satisfying this Standard when compensating fabric and/or services measures are taken, with reference to clauses 6.1.1[(1)], 6.1.2[(1)] and 6.1.6[(1)]. See sections 7 and 8.1 of this Certificate.
Standard:	6.2	Building insulation envelope
Comment:		The system can contribute to satisfying this Standard, although additional insulation will be required for dwellings, with reference to clauses 6.2.1[(1)(2)], 6.2.3[(1)], 6.2.4[(2)] and 6.2.5[(2)]. See sections 7 and 8.1 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The EPS components of the system can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. See sections 6.8 and 6.9 of this Certificate.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		Comments in relation to the system under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	**23(a)(i)**	**Fitness of materials and workmanship**
Comment:	**(iii)(b)(i)**	The system is acceptable. See section 16 and the *Installation* part of this Certificate**.**
Regulation:	**29**	**Condensation**
Comment:		The blocks can contribute to minimising the risk of interstitial condensation. See sections 9.3 to 9.5 of this Certificate.
Regulation:	**35(4)**	**Internal fire spread — Structure**
Comment:		The system is restricted by this Regulation. See section 13.1 of this Certificate
Regulation:	**36(a)**	**External fire spread**
Comment:		The system is restricted by this Regulation. See sections 13.1 and 13.2 of this Certificate.
Regulation:	**39(a)(i)**	**Conservation measures**
Regulation:	**40(2)**	**Target carbon dioxide emission rate**
Comment:		The system can contribute to satisfying these Regulations. See sections 7 and 8.1 of this Certificate.

Construction (Design and Management) Regulations 2015
Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 3 *Delivery and site handling* (3.4) and 18 *General* (18.23) of this Certificate.

Technical Specification

1 Description

1.1 Thermomur comprises elements of two EPS leaves, separated by high-density polyethylene (HDPE) plastic rails moulded into the EPS during the manufacturing process. The EPS leaves are between 50 and 200 mm thick and have a density of 23 to 27 kg·m³ depending on the grade of EPS.

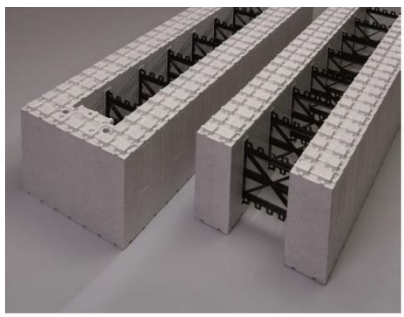
1.2 Thermomur is available in the ranges given in Table 1.

Table 1 Thermomur range

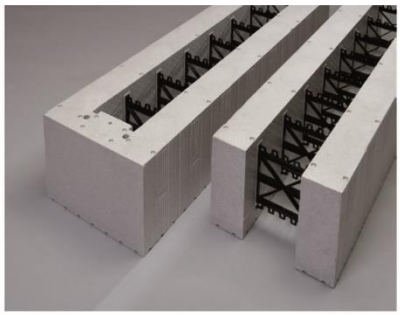
Name	EPS type	Internal EPS leaf (mm)	External EPS leaf (mm)	Concrete core (mm)
250x	white	50	50	150
350	white	100	100	150
350 Super	grey	100	100	150
350 HD	white	75	75	200
450	white	200	100	150

1.3 The different elements of Thermomur interlock and build horizontally and vertically into a tight, rigid formwork (see Figure 1). The wall is formed by placing or pouring concrete into the formwork.

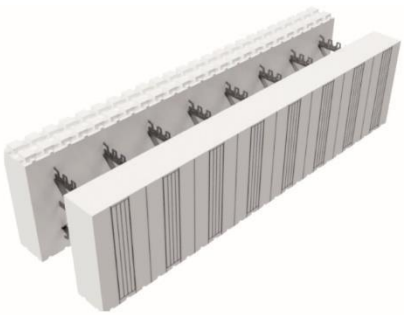
Figure 1 350 Thermomur elements



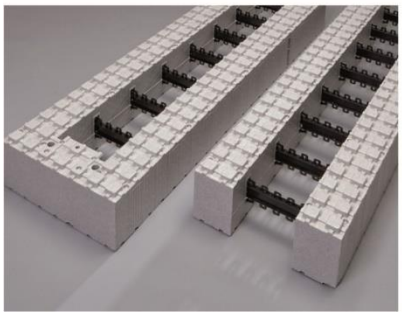
350 standard block



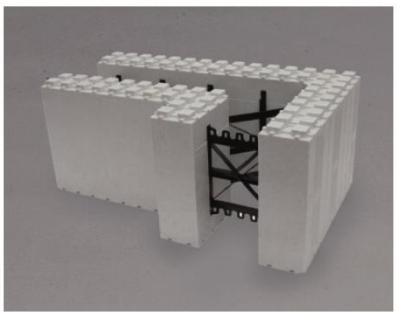
350 top block



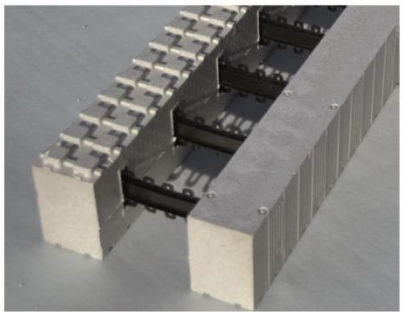
DPC block



350 half block



350 corner block



350 DPC half block

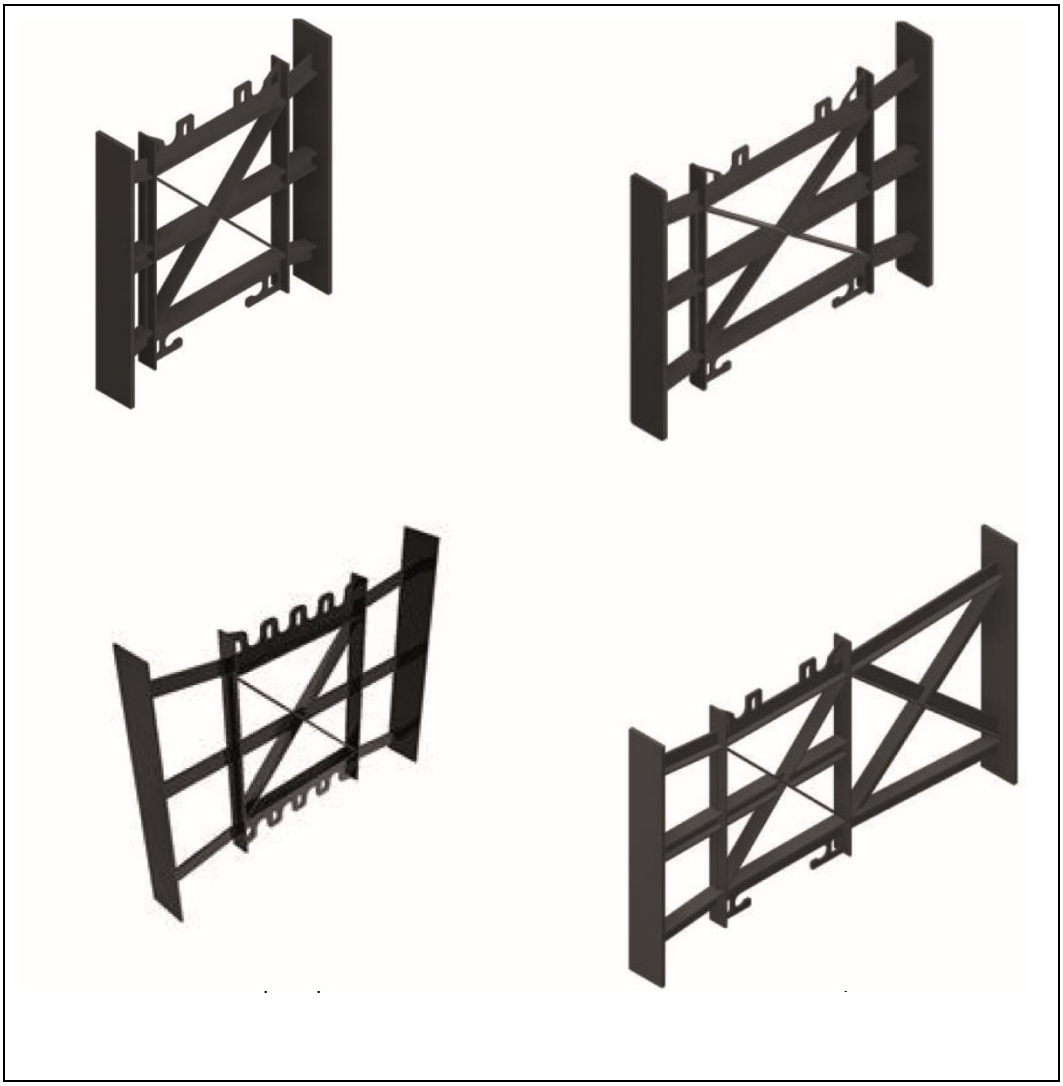
1.4 The formwork components are detailed in Table 2.

Table 2 Components

Components	Types	Length (mm)	Width (mm)	Height (mm)
Thermomur 250x standard	open/closed	1200	250	300
Thermomur 250x half block	open/closed	1200	250	150
Thermomur 250x corner	left/right	500 + 650	250	300
Thermomur 250x top block	open/closed	1200	250	300
Thermomur 250x top block corner	left/right	500 + 650	250	300
Thermomur 250X height adjustable strip	—	1200	50	50
Thermomur 250X end closure	—	2400	150	36
Thermomur 350 standard block	open/closed	1200	350	300
Thermomur 350 corner block	left/right	750 + 450	350	300
Thermomur 350 top block	open/closed	1200	350	300
Thermomur 350 top block corner	left/right	750 + 450	350	300
Thermomur 350 half block	open/closed	1200	350	150
Thermomur 350 DPC block	open	1200	350	300
Thermomur 350 DPC block internal corner	left/right	750 + 450	350	300
Thermomur 350 DPC block external corner	left/right	750 + 450	350	300
Thermomur 350 DPC half block	open	1200	350	150
Thermomur 350 DPC half block int. and ext. corner	open/closed	1200	350	150
Thermomur 350 height adjustable strip	—	1200	100	50
Thermomur 350 end closure	—	2400	350/150	65/45
Thermomur 350 Super standard block	open/closed	1200	350	300
Thermomur 350 Super corner block	left/right	750 + 450	350	300
Thermomur 350 Super half block	open/closed	1200	350	150
Thermomur 350 Super top block	open/closed	1200	350	300
Thermomur 350 Super DPC block standard	open/closed	1200	350	300
Thermomur 350 Super DPC block corner	left/right	750 + 450	350	300
Thermomur 350 HD standard	open	1200	350	300
Thermomur 350 HD corner	left/right	750 + 450	350	300
Thermomur 350 HD top block	open	1200	350	300
Thermomur 350 HD top block corner	left/right	750 + 450	350	300
Thermomur 350 HD half block	open	1200	350	150
Thermomur 350 HD DPC block	open	1200	350	300
Thermomur 350 HD DPC block corner	left/right	750 + 450	350	300
Thermomur 350 HD DPC block internal corner	left/right	750 + 450	350	300
Thermomur 350 HD DPC block external corner	left/right	750 + 450	350	300
Thermomur 350 HD height adjustable strip	—	1200	75	50
Thermomur 350 HD end closure	—	2400	350/200	65/45
Thermomur 450 standard block	open	1200	450	300
Thermomur 450 half block standard	open	1200	450	150
Thermomur 450 block internal corner	left/right	450 + 700	450	300
Thermomur 450 block external corner	left/right	550 + 700	450	300
Thermomur 450 top block	open	1200	450	300
Thermomur 450 end closure	—	2400	450/150	65/45

1.5 The blocks consist of EPS leaves connected by HDPE plastic ties and rails (spacers). The spacers are vertical and serve as fixing points for the fastening of gypsum, plywood or wood battens to the blocks. The distance between the spacers in longitudinal and vertical directions of the formwork is 150 and 300 mm respectively. The type of spacer varies according to the concrete core width, as shown in Figure 2.

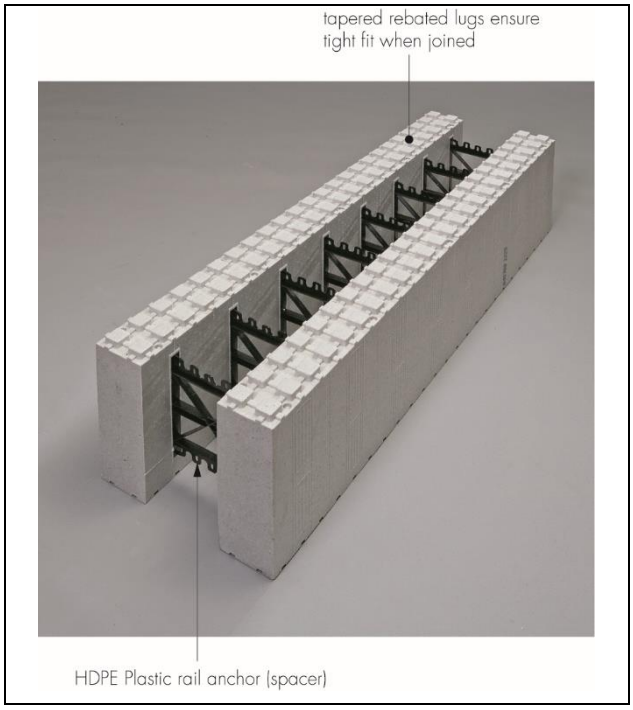
Figure 2 Spacers



1.6 The spacers accommodate steel reinforcement, if required. Two horizontal reinforcing bars are placed in alternate blocks throughout the height of wall. Vertical reinforcement is woven down through the horizontal reinforcement, and holds it in place without the need for mechanical fixings. The Certificate holder recommends using the Jackon Reinforcement Holder (outside the scope of this Certificate) for reinforcement placement. Further details can be found in the Certificate holder's installation manual.

1.7 Upper and lower surfaces interlock to form a flush fit when joined together (see Figure 3). The interlocking design of the horizontal joints allows the elements to be reversible and to resist concrete slurry seepage through the horizontal joints.

Figure 3 Method of jointing (perpendicular)



1.8 The formwork requires temporary support during concrete filling and until the concrete has gained sufficient strength to allow the wall to become stable.

1.9 The Certificate holder recommends a minimum concrete strength class of C20/25 or higher, with consistence class S4 in accordance with BS EN 206-1 : 2000 and BS EN 12350-2 : 2019. The aggregate size must be at least 4 mm and must not exceed 16 mm. It is recommended that a concrete pump and concrete vibrator are used. If the concrete is too viscous, an admixture complying with BS EN 934-2 : 2009 or BS EN 480-1 : 2014 can be added. Specific concrete mixes are dependent on individual requirements and are outside the scope of this Certificate.

1.10 Components and finishes specified for use with the system, but outside the scope of this Certificate, are:

- concrete core — as specified in section 1.9
- steel reinforcement, where required — should comply with BS 4449 : 2005
- external masonry — may be of brickwork or stonework fixed in accordance with the provisions of BS EN 1996-2 : 2006 or BS 8298-1 : 2010, BS 8298-2 : 2010 and BS 8298-3 : 2010, as appropriate
- brickwork/stonework ties to BS EN 845-1 : 2013
- bracing and alignment support system as supplied by the Certificate holder
- waterproofing membrane as required (see section 12.2)
- external render — in accordance with BS EN 13914-1 : 2016 and suitable for use with the system
- acrylic render — suitable for use with the system
- brick slip systems with third-party certification — the Certificate holder's advice should be sought
- cladding — timber, cement board or metal sheet
- internal finish — typically 12.5 mm thick plasterboard or a dry-lined finish, with or without a plaster skim coat, conforming to BS EN 1992-1-2 : 2004
- frame ties — type 6, stainless steel frame ties can be screwed into the web of the spacers for walls up to 10 m high and in areas likely to experience low wind loads.

2 Manufacture

2.1 The elements are manufactured from EPS in accordance with BS EN 13163 : 2012.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials

- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Jackon AS has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by DNV GL (Certificate 185977-2015-AQ-NOR-NA).

3 Delivery and site handling

3.1 Good site practice should be observed to prevent damage to the system components.

3.2 The system components are supplied loose or on pallets, bearing a label with details including component type and dimensions, and the BBA logo incorporating the number of this Certificate.

3.3 The system components should be stored upright and protected from damage and UV light.

3.4 Care must be taken when handling the EPS components to avoid damage and contact with solvents or materials containing volatile organic components, such as newly treated timber. The elements must not be exposed to open flame or other ignition sources.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Thermomur.

Design Considerations

4 Use

4.1 Thermomur is for use in loadbearing and non-loadbearing internal or external and separating walls, in commercial or domestic buildings subject to structural and fire considerations and building use (evaluation of construction below the ground is outside the scope of this Certificate).

4.2 The system provides permanent formwork for in-situ concrete walls and contributes to the thermal insulation of the finished construction. BBA has assessed Thermomur for use above the damp-proof course (dpc) level; use below the dpc is outside the scope of this Certificate.

4.3 The system is for use with the internal and external finishes as per the Certificate holder's recommendation.

4.4 Walls formed from the system are subject to design and supervision by a suitably qualified and competent individual, and adherence to structural design to British or European Standards (see section 6.1).

5 Practicability of installation

Construction of the system is carried out by trained operatives experienced with this type of system, in accordance with the Certificate holder's installation manual.

6 Structural performance

General

6.1 Walls formed from the system that are subject to the national Building Regulations should be designed in accordance with the relevant recommendations of BS 8102 : 2009 and the limit state design principles set out in BS EN 1990 : 2002, to the loadings in BS EN 1991-1-1 : 2002, BS EN 1991-1-2 : 2002, BS EN 1991-1-3 : 2003, BS EN 1991-1-4 : 2005, BS EN 1991-1-5 : 2003, BS EN 1991-1-6 : 2005 and BS EN 1991-1-7 : 2006. The design of concrete structures must be to BS EN 1992-1-1 : 2004 and BS EN 1992-1-2 : 2004. A suitably qualified individual such as a Chartered Structural

Engineer must also ensure that foundations (outside the scope of this Certificate) are adequate to support the intended loads.

6.2 Walls formed from the system that are not subject to the national Building Regulations, should also be designed in accordance with the Standards listed in section 6.1.

6.3 The concrete is not easily examined after casting. Hence, as specified in BS EN 1992-1-1 : 2004, Chapters 4 and 8, care must be taken to ensure full compaction. Compaction may be checked by removal, observation and replacement of a section of EPS panel. Attention should be given to areas adjacent to formed openings.

6.4 The concrete must be placed in layers of 0.90 m at a maximum vertical concreting rate of 1.0 m·h. Particular care is necessary to maintain alignment during concrete filling, and the alignment must be checked between lifts. Propping systems used in conjunction with the system must be checked prior to and during the concrete pour, to ensure that stability and alignment is maintained.

6.5 Use of a concrete pump and concrete vibrator is recommended by the Certificate holder.

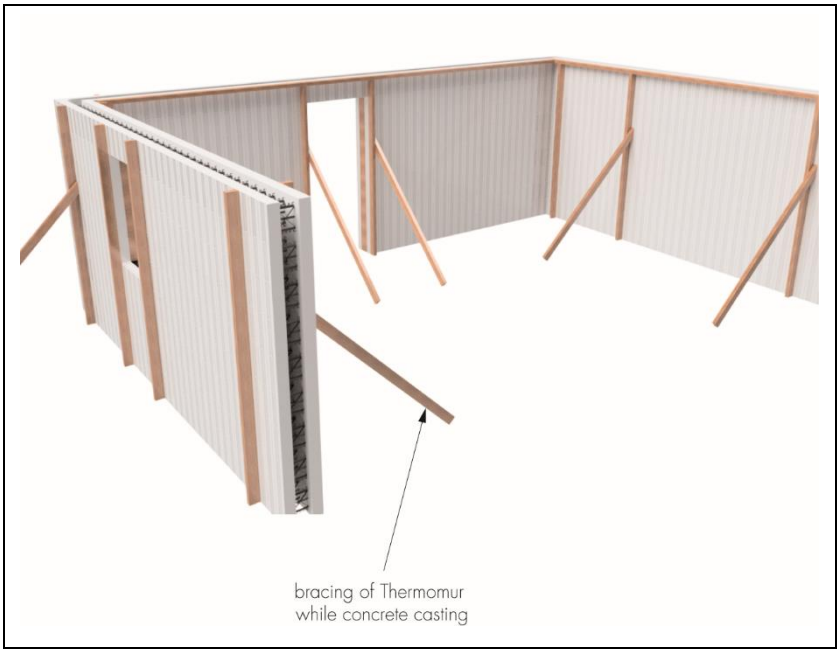
6.6 Heavy attachments or finishes, fixed either internally or externally, must be attached via support systems designed to take account of the applied load using suitable fixings or plates either fixed or cast into the concrete core.

6.7 Particular attention should be given to the type of concrete mix used, to ensure segregation does not occur and the wet concrete is allowed to flow freely around formed openings and through congested areas of reinforcement. It is recommended that a pumpable concrete of grade C20/C25, with a minimum cement content of 300 kg·m^{-3}, a maximum water-cement ratio of 0.7 and aggregate with a maximum size of 16 mm and not less than 4 mm, is used. Slump should be tested in accordance with BS EN 12350-2 : 2019. Guidance is given in the installation manual, or can be requested from the Certificate holder.

6.8 The nominal concrete cover to reinforcement must be adequate for the environmental exposure condition of the concrete, using the correct location of the polypropylene spacer.

6.9 To achieve structurally stable formwork during the construction process, the system must be braced sufficiently to resist the loads imparted on the system by wet concrete, wind loads and other construction loads acting on both faces of the wall. The Certificate holder recommends a specific propping/support system (see Figure 4), designed to give lateral support during the pouring of the concrete and at the curing stage.

Figure 4 Propping/support system



6.10 Attention is drawn to the need for accurate levelling of the foundation and initial setting out of the propping/ support system (see sections 18.13 and 18.14), which should prevent the need for significant adjustments to be made.

7 Thermal performance

7.1 Calculations of thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2017 and BRE Report BR 443 : 2006, using the declared thermal conductivity (λ_D) values given in Table 3.

Table 3 Declared thermal conductivity (λ_D)

Name	Density ($kg \cdot m^{-3}$)	Declared thermal conductivity ($W \cdot m^{-1} \cdot K^{-1}$)
250x	23	0.035
350	23	0.035
350 Super	23	0.031
350 HD	27	0.035
450	27	0.035
HDPE plastic rails anchors (spacer)	958	0.48

7.2 The U value will depend on the construction of the wall, the finish and the number and type of fixings used. As an example, a construction comprising (external to internal):

- minimum 8 mm thick external render coat applied directly to the outer face (λ = 1.0 $W \cdot m^{-1} \cdot K^{-1}$), EPS, reinforced concrete (max 1% steel, λ = 2.299 $W \cdot m^{-1} \cdot K^{-1}$), EPS, finished internally with 12.5 mm thick dense plasterboard bonded to the EPS (λ = 2.5 $W \cdot m^{-1} \cdot K^{-1}$), achieves the U values with render shown in Table 4
- 102.5 mm thick brick external skin (λ = 0.77 $W \cdot m^{-1} \cdot K^{-1}$) and 50 mm clear air cavity (R = 0.18 $m^{-2} \cdot K.W^{-1}$), EPS, reinforced concrete (max 1% steel, λ = 2.299 $W \cdot m^{-1} \cdot K^{-1}$), EPS, finished internally with 12.5 mm thick dense plasterboard bonded to the EPS (λ = 2.5 $W \cdot m^{-1} \cdot K^{-1}$), achieves the U values with brickwork shown in Table 4.

Table 4 Example U values for Thermomur

Name	U values with 8 mm render[1] ($W \cdot m^{-2} \cdot K^{-1}$)	U values with 102.5 mm brickwork[1] ($W \cdot m^{-2} \cdot K^{-1}$)
250x	0.34	0.31
350	0.17	0.16
350 Super	0.15	0.15
350 HD	0.21	0.20
450	0.12	0.11

(1) See section 7.2 for full build-up.

7.3 Thermomur has been shown to achieve the R values (thermal resistance) given in Table 5 when excluding the internal and external surface resistances. These were calculated with a reinforced concrete (max 1% steel, λ = 2.30 $W \cdot m^{-1} \cdot K^{-1}$).

Table 5 Example R values for Thermomur, without surface finishes or surface resistances

Name	EPS type	R value[1] ($m^{-2} \cdot K.W^{-1}$)
250x	white	2.72
350	white	5.59
350 Super	grey	6.25
350 HD	white	4.12
450	white	8.20

(1) See section 7.3 for full build-up.

Junctions

7.4 The system can contribute to maintaining continuity of thermal insulation at junctions with other elements and minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations.

8 Airtightness

8.1 The wall formed from the system can achieve adequate resistance to unwanted air infiltration provided there is effective sealing around junctions**.**

8.2 Completed buildings are subject to pre-completion testing in accordance with the national Building Regulations.

8.3 Completed buildings in Scotland are only subject to pre-completion airtightness testing if the target air permeability of the proposed building is less than 10 $m^3 \cdot h^{-1} \cdot m^{-2}$, or if the figure is between 10 and 15 $m^3 \cdot h^{-1} \cdot m^{-2}$, and the designer does not wish to use the 15 $m^3 \cdot h^{-1} \cdot m^{-2}$ default figure in the proposed dwelling, in accordance with the national Building Regulations.

9 Risk of condensation

Surface condensation

9.1 Walls will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.7 $W \cdot m^{-2}K^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in section 7.4.

9.2 For buildings in Scotland, wall constructions will be acceptable when the thermal transmittance (U value) does not exceed 1.2 $W \cdot m^{-2}K^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in BS 5250 : 2011, Annex G. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

Interstitial condensation

9.3 Walls will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Annexes D and G, and the relevant guidance.

9.4 Calculations to BS 5250 : 2011 show that the risk of interstitial condensation of the external walls given as examples in section 7.2 of this Certificate will be minimal. Vapour build-up may form large drops, but these will dissipate during the summer months. A vapour check such as minimum 500 gauge polyethylene is recommended between the system and the internal plasterboard for Thermomur 250x, 350HD, 350 and 350 Super. An additional vapour control layer (vcl) is not required for Thermomur 450.

9.5 The minimum grade of the insulation is EPS 150. The water vapour diffusion resistance factor (μ) for the EPS has been taken from BS EN 13163 : 2012, Table F2 and is 60 μ (equivalent to a vapour resistivity of 300 $MN \cdot s \cdot g^{-1} \cdot m^{-1}$).

10 Sound insulation

10.1 Separating walls with a concrete core density greater than 2000 $kg \cdot m^{-3}$ and thickness of 150 mm, together with a single layer of plasterboard on each side, will achieve a minimum mass per unit area for the core of 300 $kg \cdot m^{-2}$. When used in conjunction with suitable framing, lining and flanking details, the wall can satisfy the requirements of a Type 3 wall, as described in the England and Wales Regulations, Approved Document E.

10.2 Separating walls are subject to pre-completion testing in accordance with the documents supporting the national Building Regulations.

10.3 Internal walls and walls flanking separating walls in new dwellings, and rooms for residential purposes, should have a minimum mass per unit area, excluding finishes, in excess of 120 $kg \cdot m^{-2}$.

11 Weathertightness

Resistance to rain ingress is provided by the external finishes but this has not been assessed by the BBA and is outside the scope of this Certificate. Care should be taken to ensure the design and construction comply with the relevant good practice described in the applicable codes and the Certificate holder's installation manual.

12 Damp-proofing and waterproofing

12.1 The system's elements will not transmit moisture by capillary action. Concrete walls formed with the system should be constructed using the specified concrete recommended by the Certificate holder (see sections 1.9 and 6.9).

12.2 Use of the system below the ground to resist the effect of hydrostatic head or ground water ingress has not been assessed and is outside the scope of this Certificate. However, for general guidance, when used below ground or at formation level (eg basements or retaining walls), waterproofing membranes compatible with EPS should be used. A suitable collector drain and backfilling medium should be provided to eliminate the build-up of hydrostatic head behind the wall, where required. The Certificate holder should be consulted for advice on suitable waterproofing materials and methods of waterproofing.

13 Behaviour in relation to fire

13.1 The EPS components of the system are not classified as 'non-combustible' or 'of limited combustibility'.

13.2 In England, Wales and Northern Ireland, the system should not be used in external walls of buildings with a floor more than 18 m above the ground.

13.3 In Scotland, the system may be used without boundary restrictions, as external walls of buildings with no floor more than 18 m above the ground, provided it is installed with an outer leave of masonry at least 75 mm thick, and has a cavity barrier around all openings in the wall and at the top of the wall head. For other constructions, the system should not be used 1 m or less from a boundary or in a building with a storey more than 11 m above the ground. Additional restrictions apply to separating elements.

13.4 Designers should refer to the relevant national Building Regulations and guidance for detailed conditions of use, particularly in respect of requirements for fire resistance, cavity closers and barriers, fire stopping of service penetrations and combustibility limitations for other materials and components used in the overall wall construction.

13.5 To limit the risk of fire spread between floors in buildings subject to the national Building Regulations, fire barriers (outside the scope of this Certificate) must be installed at each floor level. Fire barriers must completely seal the cavity and be chased into the outer EPS formwork.

13.6 The risk of fire spread over the internal wall surface will depend on the finishes used. The relevant requirements of the national Building Regulations must be observed. Internal finishes are outside the scope of this Certificate.

13.7 Fire resistance values for various concrete wall thicknesses formed using the elements are given in BS EN 1992-1-2 : 2004, Table 5.4. Fire resistance values achievable using the system are set out in Table 6 of this Certificate. For reinforced concrete walls designed in accordance with BS EN 1992-1-1 : 2004, fire resistance values for various concrete wall thicknesses set out in BS EN 1992-1-2 : 2004, Table 5.4, can be used subject to cover and design load considerations (see Table 6 of this Certificate). For unreinforced walls acting as fire walls, the minimum thickness requirements set out in BS EN 1992-1-2 : 2004, Clause 5.4.2, must be taken into account. This assessment does not take

account of any additional protection provided by the internal and external finishes. The use of the formwork with the specified finishes will not reduce the fire resistance of the concrete wall.

Table 6 Minimum concrete core thickness for loadbearing reinforced concrete walls[1]

Standard fire resistance	Minimum dimensions (mm) Wall thickness/axis[2]			
	μfi[3] = 0.35		μfi[3] = 0.7	
	wall exposed on one side	wall exposed on two sides	wall exposed on one side	wall exposed on two sides
REI 30	100/10[4]	120/10[4]	120/10[4]	120/10[4]
REI 60	110/10[4]	120/10[4]	130/10[4]	140/10[4]
REI 90	120/20[4]	140/10[4]	140/25	170/25

(1) Taken from BS EN 1992-1-2 : 2004, Table 5.4.
(2) Centre of reinforcement to nearest exposed surface.
(3) The definition of μfi is given in BS EN 1992-1-1 : 2004, Clause 5.3.2(3).
(4) Normally, the cover specified in BS EN 1992-1-1 : 2004 will control this distance.

13.8 For buildings in Scotland, completed walls with appropriate finishes can satisfy the required durations of fire resistance and, therefore, may be used in separating walls. Where external walls are one metre or less from a relevant boundary, the construction should comply with the relevant exceptions on the use of combustible materials permitted by the guidance supporting the Building Regulations in Scotland.

13.9 Care must be taken to ensure that all detailing at junctions, including internal wall/floor junctions, adequately maintains the required periods of fire resistance; any cavities formed in the completed walls or service entry points are appropriately fire stopped; and detailing around any openings provide sufficient protection to the EPS. The EPS on the interior face should be discontinuous across wall/floor junctions.

14 Proximity of flues and appliances

When installing the system in close proximity to certain flue pipes and/or heat-producing appliances, the guidance in the documents supporting the national Building Regulations must be followed.

15 Maintenance and repair

Minor repairs to the formwork can be carried out prior to concrete pouring using suitable expanded foam, to reduce leakage of wet concrete and maintain the thermal integrity of the EPS.

16 Durability

16.1 The EPS formwork will have a service life in excess of 60 years, provided it is protected from damage by the external and internal finishes of the wall construction (constituting a mild exposure environment), and these are adequately maintained.

16.2 The HDPE plastic rails will have a durability compatible with the EPS, if similarly protected.

17 Reuse and recyclability

The system components are made from EPS, which can be recycled.

Installation

18 General

18.1 Installation of Thermomur should be carried out by trained operatives or installers.

18.2 In general, concrete is placed by pump using concrete from batching plants. Small volumes can also be placed by hand or skip with adapted neck or pump, if necessary.

18.3 Suitably durable and mechanically adequate fixings must be used for all structural elements and must be post-drilled or cast into the concrete core. The EPS forming each of the system components must not be used as a structural medium. In specifying wall fixings carrying vertical loads, consideration should be given to the effect of bending between the face of the concrete core and outer edge of the EPS.

18.4 Consideration should be given at the design stage to the incorporation of wall fixings, support brackets, service entry points, ducting, pipework and other building elements, to minimise post-construction cutting out or chasing of the concrete core. Other detailing can also be incorporated in the construction of the formwork subject to the Certificate holder's recommendations. In carrying out any cutting or modifications to the system, care must be taken not to damage or weaken the formwork elements that could result in the loss of integrity or overall stability of the temporary construction. Cold bridging effects must also be considered where any services pass through the wall construction.

18.5 Minor repairs to the system can be carried out prior to concrete pouring using expanding foam to reduce leakage of wet concrete and maintain the thermal integrity of the EPS.

18.6 The preparation, installation and support of the system, and application of any specified finishes, must be in accordance with the Certificate holder's installation manual.

Foundation

18.7 The foundation must be level, smooth finished and within a tolerance limit in any direction. Any out-of-tolerances must be made good prior to placement of formwork.

18.8 A damp-proof membrane is laid through the wall or under the slab (depending on the detailing) to prevent the ingress of dampness during the construction process. The external detail must be such that protection is provided to cover at least 150 mm above the external ground level.

Erection of Thermomur Insulated Concrete Formwork blocks

18.9 The forms may be readily cut with a cutting torch or appropriate saw as specified in the Certificate holder's installation manual. For ease of construction, used blocks must not be shorter than 250 mm. For short adaptations, this can be done by cutting two elements, eg in 600 mm lengths.

18.10 Where the specified elevation height is not a multiple of the standard form height, adjustment may be made by cutting the bottom course of the forms, or trimming the top off the highest course of forms as described in the Certificate holder's installation manual.

18.11 The sequence of erection of the forms and recommendations on joints are given in the Certificate holder's installation manual.

18.12 The forms must be suitably restrained and sealed on the footing/slab in accordance with the Certificate holder's installation manual.

Restraint and propping

18.13 It is essential that effective bracing and propping of walls takes place during construction to ensure stability, level, straightness and plumb of walls. The Certificate holder is able to provide three alternative systems for bracing, as described in the Certificate holder's installation manual (outside the scope of this Certificate). Bracing and alignment systems should be located at a distance of approximately 2.5 m and each side of door and window openings.

18.14 Where stability could be compromised, consideration should be given to additional bracing. Final checks for plumb and level are made during and after the placement of the concrete.

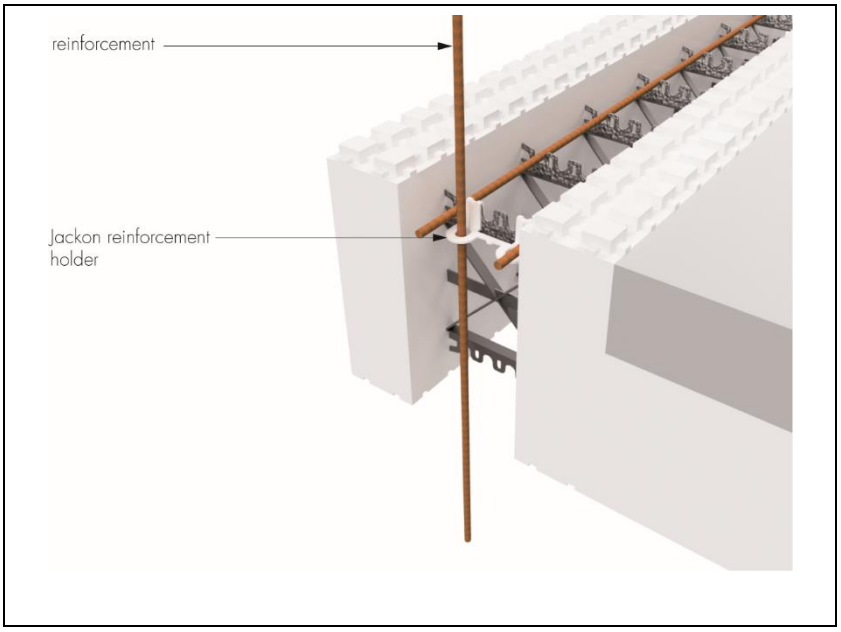
Reinforcement

18.15 All reinforcement should be accurately positioned to ensure that the minimum required concrete cover is provided. Starter, dowel bars and bar lapping lengths, where required, must be to the engineer's design and in accordance with BS EN 1992-1-1 : 2004. If polyethylene spacers are cut or modified during construction, additional form support will be required.

18.16 If required, all horizontal/vertical reinforcement with the appropriate lap length is laid as described in the Certificate holder's installation manual. At corners subject to soil pressure, extra reinforcement is needed.

18.17 The quantities of reinforcement placed within the system are dependent on design and detail requirements (see section 6). Horizontal reinforcement (see Figure 5) can be placed in the centre or adjacent to core edges using the Jackon Reinforcement Holder (outside the scope of this Certificate). In plain walls, appropriate horizontal reinforcement should be provided at lintels in accordance with engineering requirements, and the reinforcing bars must extend an anchorage length past the opening, to suit the bar diameter.

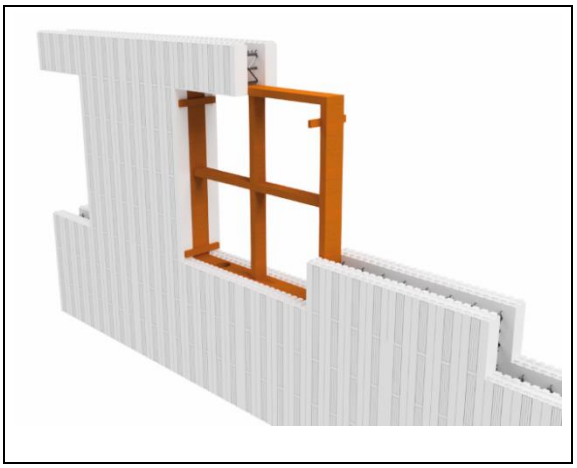
Figure 5 Typical reinforcement layout



Windows and doors

18.18 Window and door openings are formed during construction of the formwork with EPS closers or timber (see Figure 6) located around openings to seal them during concrete pouring. To ensure that the opening remains square, the opening should be braced in accordance with the Certificate holder's installation manual.

Figure 6 Frame closer to openings



Concrete placement

18.19 Prior to the concrete pour, a check should be carried out on the system to ensure conformity with design and layout, correct alignment, and that bracings and props are secured. Reinforcement should be checked for correct cover distance and rigidity. Horizontal joints should also be protected for concrete overspill.

18.20 The concrete mix and slump must be checked to ensure they are to specification, in accordance with normal practice.

18.21 Concrete placement should start from corners and continue all the way around. Casting of walls should be done in two operations. A maximum casting height of 3 block courses should be achieved in the first round and then cast up to the sixth course all the way round, before finally filling completely, in accordance with the Certificate holder's installation manual.

18.22 The concrete must be placed in layers of 0.90 m at a maximum vertical concreting rate of 1.0 m·h. The concrete may fall freely only up to a maximum height of 2 m; beyond that, the concrete must be placed by discharge pipes or concreting tubes with a maximum diameter of 100 mm, and must be led directly to the place of installation.

Electrical installation

18.23 Electrical services can be fixed within the formwork by cutting chases into the EPS using a router, knife, saw or hot-wire knife. Any services introduced should conform to the national Building Regulations and Health and Safety requirements. Further details on fixing methods can be obtained from the Certificate holder.

Wall penetrations

18.24 Openings or ducts for service penetrations can be positioned within the formwork prior to concrete pouring.

Internal finishes

18.25 A range of internal finishes can be applied or fixed directly to the system. These should be screw-fixed into the spacer flanges or glued to the EPS using compatible adhesive.

18.26 Penetrations through the concrete, such as pipe entries or formwork ties, must also be securely sealed to maintain watertightness. The advice of the Certificate holder should be sought on suitable details.

External finishes

18.27 External cladding systems are outside the scope of this Certificate. Further details of suitable systems can be obtained from the Certificate holder.

Heavy wall loads

18.28 All structural point loads should be supported by the concrete core and not the spacer flanges. Typical methods include the use of timber blocks screwed or bolted into the concrete core, or cast-in anchor bolts and metal plates. Further details can be obtained from the Certificate holder.

Construction of T-junction

18.29 For construction of a T-junction, a 150 mm slot in the Thermomur sidewall is cut, so that the concrete will have contact the whole way through (see Figure 7). 350 mm is removed from the next course, so that the block can be inserted into the sidewall and so there will be a bond with the course below. For the second course and above, the Certificate holder recommends the removal of 50 mm from every course. Extra reinforcement must be added around T-corners to prevent bulging during casting (see Figure 8). Further details can be found in the Certificate holder's installation manual.

Figure 7 Slot for T-junction construction

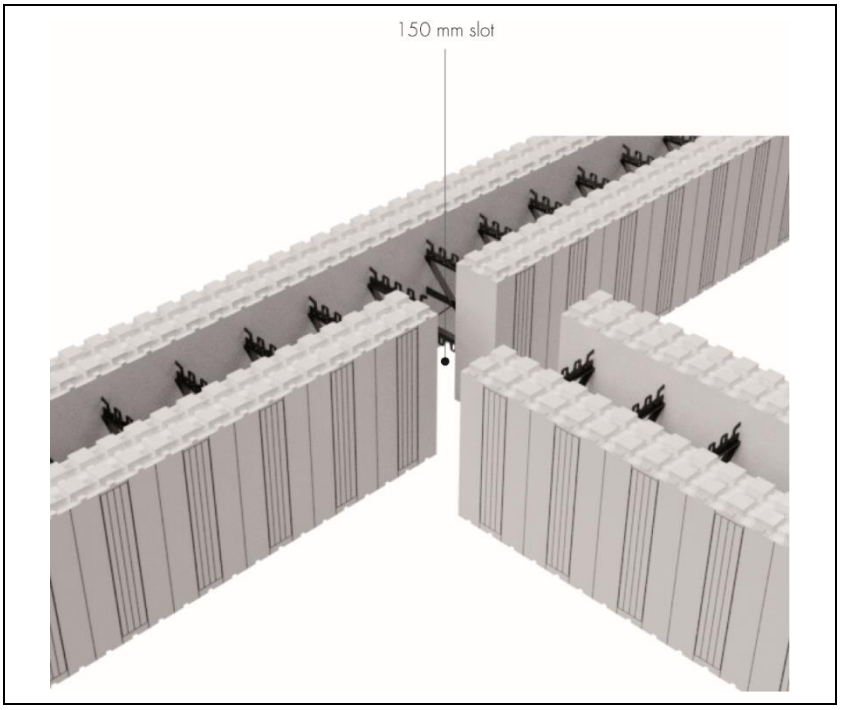
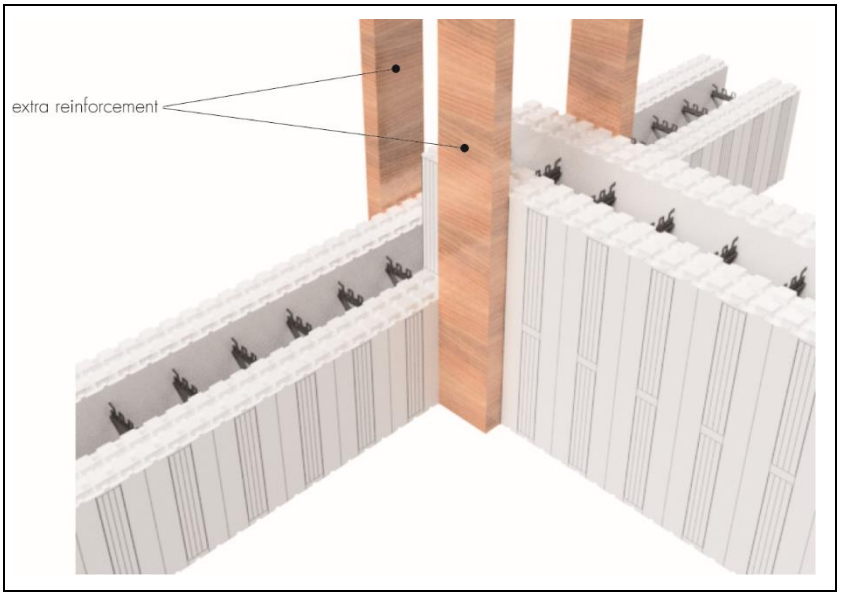


Figure 8 Extra reinforcement during concrete casting of T-junction



Technical Investigations

19 Tests

Tests on Thermomur were carried out in broad accordance with the requirements of ETAG 009 : 2002 as part of normal construction under site conditions. Observations were made on the resistance to filling pressure and efficiency of filling using pumped concrete. The overall stability of formwork due to the head of wet concrete was also observed.

20 Investigations

20.1 A site visit was carried out to witness the installation process including construction of forms, placement of reinforcement, pouring of concrete and performance of form tie/spacers.

20.2 An assessment was made on technical data relating to airtightness, fire and thermal performance.

20.3 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

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BS EN 1991-1-6 : 2005 *Eurocode 1 : Actions on structures — General actions — Actions during execution*
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Conditions of Certification

21 Conditions

21.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

21.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

21.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

21.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

21.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

21.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.