

**Vita Cellular Foams (UK) Ltd
t/a Kay Metzeler**

Brook Street
Chelmsford
Essex CM1 1UQ



Tel: 01245 342101 Fax: 01245 342122
e-mail: epssales@vcfuk.com
website: www.kay-metzeler.com

**Agrément Certificate
92/2797**
Product Sheet 1

KAY METZELER CLAY HEAVE PROTECTION

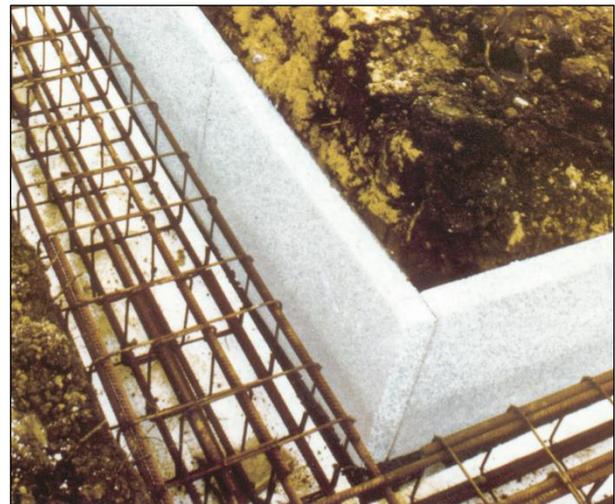
CLAYLITE COMPRESSIBLE FILL

This Agrément Certificate Product Sheet⁽¹⁾ relates to Claylite Compressible Fill, a low-density expanded polystyrene (EPS) board for limiting the pressure exerted on reinforced concrete ground beams or on the vertical face of concrete foundations, caused by the expansion of clay soils (clay heave) during the life of the structure.

(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

Resistance to pressure — the product has adequate short-term load resistance to support the weight of the reinforced concrete prior to setting and restrict the pressure on the hardened concrete caused by expansion of clay soils (see section 6).

Durability — the product will continue to perform effectively as a compressive material to reduce the effects of clay heave for the life of the building (see section 8).



The BBA has awarded this Certificate to the company named above for the product described herein. This product 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

Brian Chamberlain
Head of Technical Excellence

Claire Curtis-Thomas
Chief Executive

Date of Second issue: 18 July 2017

Originally certificated on on 16 October 1996

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk
Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

British Board of Agrément

Bucknalls Lane
Watford
Herts WD25 9BA

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tel: 01923 665300
fax: 01923 665301
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Claylite Compressible Fill, 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:	A2	Ground movement
Comment:		The product helps to reduce the pressure exerted on reinforced concrete beams, or on the vertical face of concrete foundations, caused by the expansion of clay soil. See sections 6.1 and 6.2 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The product is acceptable. See section 8 and the <i>Installation</i> part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The product can contribute to a construction satisfying this Regulation. See section 8 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1(b)	Structure
Comment:		The product contributes to satisfying the relevant requirements of this Standard, with reference to clause 1.1.4 ⁽¹⁾⁽²⁾ . See sections 6.1 and 6.2 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The product can contribute to meeting 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.
Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the product 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)(iii)	Fitness of materials and workmanship
Comment:	(b)(i)	The product is acceptable. See section 8 and the <i>Installation</i> part of this Certificate.
Regulation:	30	Stability
Comment:		The product contributes to satisfying the relevant requirements of this Regulation. See sections 6.1 and 6.2 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 section: 3 *Delivery and site handling* (3.2) of this Certificate.

Additional Information

NHBC Standards 2017

NHBC accepts the use of Claylite Compressible Fill, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards, Chapters 4.2 (4.2.7 to 4.2.10) Building near trees, 4.3 Strip and trench fill foundations and 4.4 Raft, pile, pier and beam foundations.*

Technical Specification

1 Description

1.1 Claylite Compressible Fill consists of green coloured low-density expanded (EPS) polystyrene boards.

1.2 The boards are available in standard sizes⁽¹⁾ of:

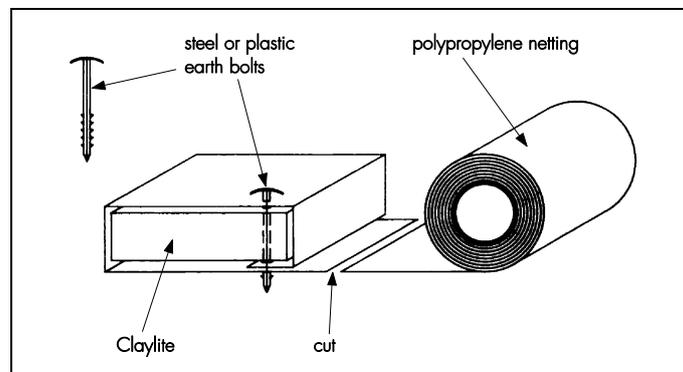
- thickness (mm) 50, 75, 100, 125, 150, 175, 200, 300
- length (mm) 2400
- width (mm) 600, 1200.

(1) Other sizes within the above ranges are available on request.

1.3 The Firm Fix System (see Figure 1) is an ancillary item for use with Claylite Compressible Fill to hold the boards in position during installation. The Firm Fix system comprises of:

- 300 and 380 mm long polypropylene and steel earth bolts
- heavy duty polypropylene netting.

Figure 1 Claylite Compressible Fill and the Firm Fix system



2 Manufacture

2.1 The EPS board is manufactured from blocks using bead expansion moulding processes and wire cutting.

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 Kay Metzeler has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by BSI (Certificate FM10541).

3 Delivery and site handling

3.1 Claylite Compressible Fill board packs are normally delivered to site wrapped in polythene. Each pack carries a label bearing the Certificate holder's name, product description, installation instructions and the BBA logo incorporating the number of this Certificate.

3.2 The boards must be stored flat and protected from high winds and prolonged exposure to sunlight.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Claylite Compressible Fill.

Design Considerations

4 General

4.1 Claylite Compressible Fill, when designed and installed in accordance with the recommendations of this Certificate, is effective in reducing the pressure exerted on ground beams in piled foundation construction and on the vertical face of trench-fill foundations up to two metres deep caused by the expansion of clay soils (clay heave) during the life of the structure.

4.2 It is essential that the correct minimum thickness is calculated from the expected expansion and that the product is installed in accordance with the *Installation* part of this Certificate.

4.3 It is important that the whole of the underside of concrete members are protected with Claylite Compressible Fill to prevent differential loading on the member and that the boards are carefully trimmed around the piles.

4.4 Claylite Compressible Fill must not be used below in-situ concrete floor slabs.

4.5 The following information is necessary to enable the required thickness of Claylite Compressible Fill to be calculated:

For ground beams and pile caps

- the maximum likely vertical ground movement due to clay heave (H mm) established from the site investigation
- the acceptable upward pressure on the concrete (P kN·m⁻²) as used in the design of the concrete foundation.

For trench-fill foundations

- the expected lateral movement due to clay heave (H mm) established from the site investigation
- the maximum acceptable lateral pressure on the foundation as used by the designer of the foundation, W kN·m⁻² (W must not normally exceed 40 kN·m⁻²).

4.6 The thickness of Claylite Compressible Fill (see Figure 2) is established by:

- finding the value of the compressive strain (C %) from the graph shown in Figure 3 (using design value for P or W, see section 4.5), and
- calculating the thickness of Claylite Compressible Fill required (T mm) (see section 6) from the formula:

$$T = 100 \frac{H}{C} + l$$

Figure 2 Determination of thickness

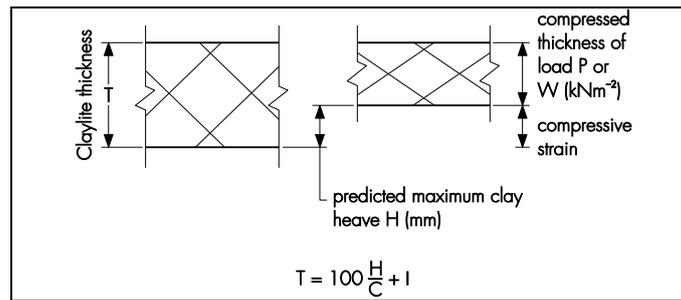
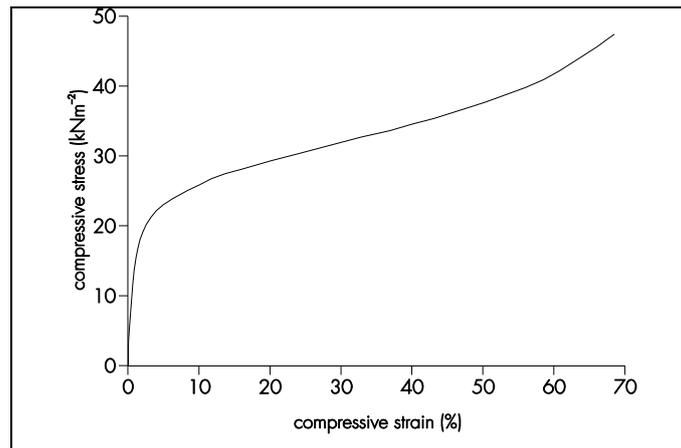


Figure 3 Compressible strain



5 Practicability of installation

The product is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.

6 Resistance to pressure



6.1 The pressure transmitted/strain relationship of Claylite Compressible Fill is given in the graph shown in Figure 3, based on a strain rate of 2% per day.

6.2 Claylite Compressible Fill must not be used where the depth of in situ concrete is greater than 600 mm in ground beam construction.

6.3 Test data indicates that, when loaded to 22.5 kN·m⁻² (ie the maximum depth of concrete plus a 300 mm allowance for concrete heaping), for a period of 15 minutes, a 200 mm thick board of Claylite Compressible Fill compresses by 3%. When selecting the thickness using the procedures given in section 4, an instantaneous deflection allowance (I) of 10 mm should be added to the thickness if T is greater than 100 mm.

6.4 Test data indicates that when a 200 mm thick specimen is loaded to 15 kN·m⁻² (ie 600 mm of concrete), the deflection from 15 minutes after applying the load to 16 hours is less than 2 mm.

7 Maintenance

As the product is confined underneath the concrete ground beams and placed at the vertical face of deep trench foundations and has suitable durability (see section 8), maintenance is not required.

8 Durability



Claylite Compressible Fill is dimensionally stable under varying conditions of temperature and humidity. The product is rot-proof, unaffected by water and will remain effective as a compressible fill for the life of the building.

9 Reuse and recyclability

The product comprises EPS that can be recycled.

Installation

10 General

10.1 The excavations for the ground beams or foundations must be carried out generally in accordance with BS 6031 : 2009 paying particular attention to safety procedures.

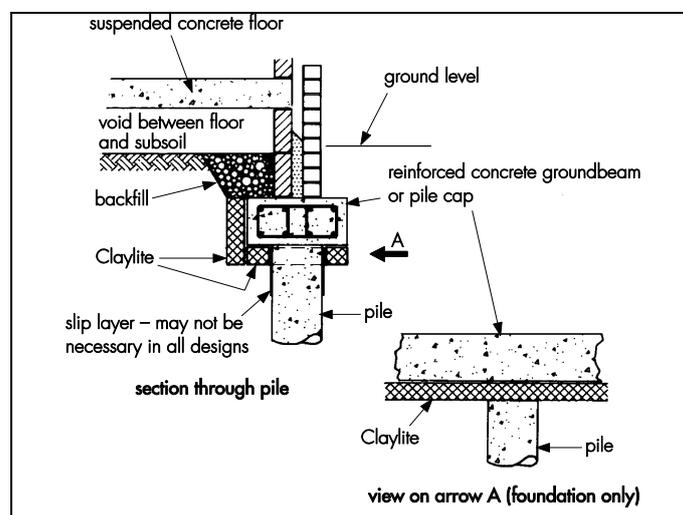
10.2 All fixing should be carried out from outside the trench. Precautions should be taken to ensure the face of the excavation does not collapse during installation of the product, for example by bridging the trench.

10.3 Adequate supervision of the installation must be maintained and Kay Metzeler specialists must have right of access to the site to ensure the product is being installed correctly.

11 Procedure

11.1 The product can be installed under ground-beams and pile caps in piled construction, and must be installed as shown in Figure 4.

Figure 4 Detail of pile and ground beam



11.2 The trenches are excavated as normal, but taking account of the required thickness of Claylite Compressible Fill.

11.3 The bottom of the excavation must be flat, even and properly compacted. In certain situations this may require blinding the trench bottom with concrete or granular material.

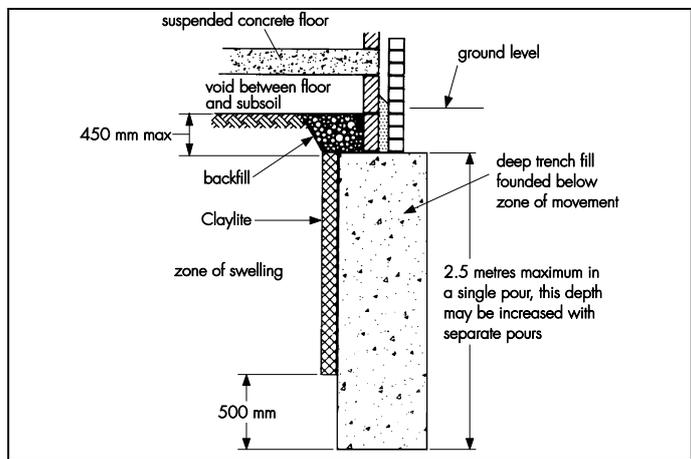
11.4 Claylite Compressible Fill is laid closely butted on the prepared excavation, ensuring that the whole area of the ground beam is covered. Small gaps between boards should be filled with EPS pieces or must be backfilled with as-dug or granular material.

11.5 Where concrete piles protrude into the trench, the boards should be cut to suit with a fine-toothed saw.

11.6 Sufficient brick or concrete spacing blocks must be used to ensure that the correct depth of concrete cover to the reinforcement is achieved. The quantity and type of spacers must ensure that the load transmitted to the product does not exceed $15 \text{ kN}\cdot\text{m}^{-2}$, therefore, preventing penetration into the board (typically 75 x 75 mm blocks at 500 mm centres).

Vertical faces of trench-fill foundations (see Figure 5)

Figure 5 Detail of trench fill



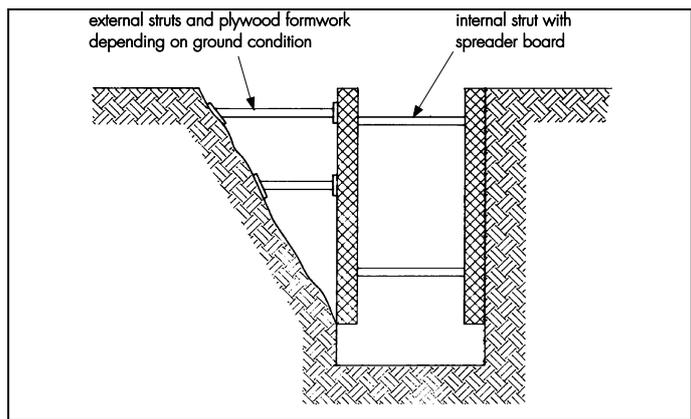
11.7 The excavation must be founded below the movement zone of the clay and the board positioned 500 mm above the trench bottom, in accordance with NHBC requirements.

11.8 To ensure the product remains in the correct position and to prevent breakage, the boards should be adequately supported on both faces prior to concreting (see Figure 6).

11.9 Internal support must be provided in the form of struts with adequate spreader plates.

11.10 External support may be provided by the face of the excavation except in flinty or boulder clay, where sharp projections may cause damage and/or where the trench sides do not provide adequate support (see Figure 6).

Figure 6 Typical installation

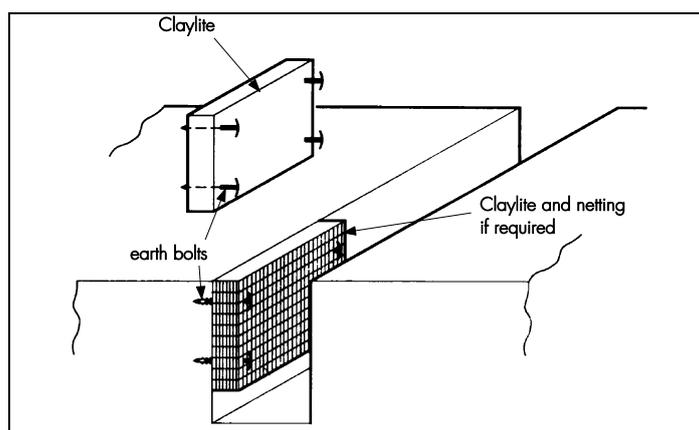


11.11 Claylite Compressible Fill must be adequately restrained to prevent uplift during concrete placement.

11.12 Small infill panels must be securely fixed in position.

Vertical faces of trench-fill foundations using the Firm Fix system (see Figure 7)

Figure 7 Vertical faces of trench fill using the Firm Fix system



11.13 The Firm Fix System which is an ancillary item (section 1.3) consists of earth bolts and polypropylene netting. In neat, smooth-walled trenches, the bolts can be used alone to replace the internal struts.

11.14 The earth bolts are inserted through the boards at a distance of 300 mm from each corner, with additional earth bolts at the centre if necessary. The boards are positioned against the trench walls and the bolts are hammered into the trench walls.

11.15 The plastic earth bolts are for use in soft clays. Where these are unsuitable, ie in dry, hard clay, the metal bolts should be used.

11.16 Where trench walls are uneven or friable, the complete Firm Fix System should be used. This prevents fractured boards dislodging and uplifting during concrete placement.

11.17 Prior to installation of the boards into the trench, the netting is wrapped around the board leaving an overlap. The netting should be cut with scissors or snips. The bolts are pushed through the boards (300 mm from each corner) securing the netting and overlap. The bolts should protrude approximately 75 mm beyond the overlapped netting to ensure the netting is fully tensioned.

11.18 The boards are positioned against the trench wall and the bolts are driven into the earth.

Technical Investigations

12 Tests

Tests were carried out and the results assessed to determine:

- density
- dimensional accuracy
- effect of density on pressure transmitted
- the pressure transmitted through the board when subjected to constant strain of 2% per day
- load capacity
- reduction in pressure transmitted when subjected to 50% compression
- compression under sustained loading.

13 Investigations

13.1 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.

13.2 Site visits were carried out to assess the practicability of installation, including site handling and storage.

13.3 An assessment was made of the performance characteristics and durability of the product.

Bibliography

BS 6031 : 2009 *Code of practice for earthworks*

BS EN ISO 9001 : 2008 *Quality management Systems*

14 Conditions

14.1 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 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.

14.2 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.

14.3 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.

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

14.5 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.

14.6 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.