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**Agrément Certificate**

**12/4923**

Product Sheet 1

## PECAVOID EXPANDED POLYSTYRENE GROUND HEAVE PRODUCTS

### PECAVOID CELLULAR VOID FORMERS

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to Pecavoid<sup>(2)</sup> Cellular Void Formers, expanded polystyrene (EPS) void formers for use in limiting the pressure exerted on in-situ, reinforced, suspended concrete floors or piled ground beams by expansion of clay soils (clay heave).

(1) Hereinafter referred to as 'Certificate'.

(2) Pecavoid is a registered trade mark.

#### 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

**Design** — the safe-load and fail-load capacities of the products have been assessed. Each grade has adequate strength to support a specified depth of wet concrete during construction and will collapse under its specified fail-load, limiting the upward pressures experienced during periods of clay heave (see section 6).

**Durability** — the products will continue to perform effectively as void formers for the life of the building (see section 9).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are 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: 28 July 2016

Originally certificated on 29 June 2012

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](http://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.

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## Regulations

In the opinion of the BBA, Pecavoid Cellular Void Formers, 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):

	<b>The Building Regulations 2010 (England and Wales) (as amended)</b>	
<b>Requirement:</b>	<b>A2</b>	<b>Ground movement</b>
<b>Comment:</b>	The products help prevent expansion of clay soils impairing the stability of the building. See section 4.1 of this Certificate.	
<b>Regulation:</b>	<b>7</b>	<b>Materials and workmanship</b>
<b>Comment:</b>	The products are acceptable. See section 9 and the <i>Installation</i> part of this Certificate.	
	<b>The Building (Scotland) Regulations 2004 (as amended)</b>	
<b>Regulation:</b>	<b>8(1)</b>	<b>Durability, workmanship and fitness of materials</b>
<b>Comment:</b>	The products can contribute to a construction satisfying this Regulation. See section 9 and the <i>Installation</i> part of this Certificate.	
<b>Regulation:</b>	<b>9</b>	<b>Building standards applicable to construction</b>
<b>Standard:</b>	<b>1.1(b)</b>	<b>Structure</b>
<b>Comment:</b>	The products contribute to meeting the relevant requirements of this Standard, with reference to clause 1.1.1 <sup>(1)(2)</sup> . See section 4.1 of this Certificate.	
<b>Standard:</b>	<b>7.1(a)(b)</b>	<b>Statement of sustainability</b>
<b>Comment:</b>	The products 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.	
		(1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).
	<b>The Building Regulations (Northern Ireland) 2012 (as amended)</b>	
<b>Regulation:</b>	<b>23</b>	<b>Fitness of materials and workmanship</b>
<b>Comment:</b>	The products are acceptable. See section 9 and the <i>Installation</i> part of this Certificate.	
<b>Regulation:</b>	<b>30</b>	<b>Stability</b>
<b>Comment:</b>	The products contribute to satisfying the relevant requirements of this Regulation. See section 4.1 of this Certificate.	

### Construction (Design and Management) Regulations 2015

### Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, Principal Designer/CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section: **3** *Delivery and site handling* (3.4) of this Certificate.

## Additional Information

### NHBC Standards 2016

NHBC accepts the use of Pecavoid Cellular Void Formers, provided they are installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapters 4.2 (4.2.7 to 4.2.10) *Buildings near trees*, 4.3 *Strip and trench fill foundations* and 4.4 *Raft, pile, pier and beam foundations*.

## Technical Specification

### 1 Description

1.1 Pecavoid Cellular Void Formers consist of a cellular expanded polystyrene (EPS) compressible base in a range of different grades, depths and sizes, with three different options for the integrally-bonded polypropylene top (see Figure 1 and Table 1). The products are available in a reduced depth range, denoted in the product code by the letters 'RD', and a standard range, denoted by 'C'.

1.2 Details of the six product types available are:

- Pecavoid RDB / Pecavoid CB — incorporating a 4.5 mm thick twin-wall polypropylene top, for use under reinforced concrete ground beams
- Pecavoid RD+ / Pecavoid CS — incorporating a 2 mm polypropylene top sheet and a 50 mm thick EPS panel, for use under suspended, reinforced concrete floor slabs
- Pecavoid RDS / Pecavoid CL — incorporating a 10 mm thick twin wall polypropylene top, for use under suspended, reinforced concrete floor slabs.

Figure 1 Pecavoid Cellular Void Formers

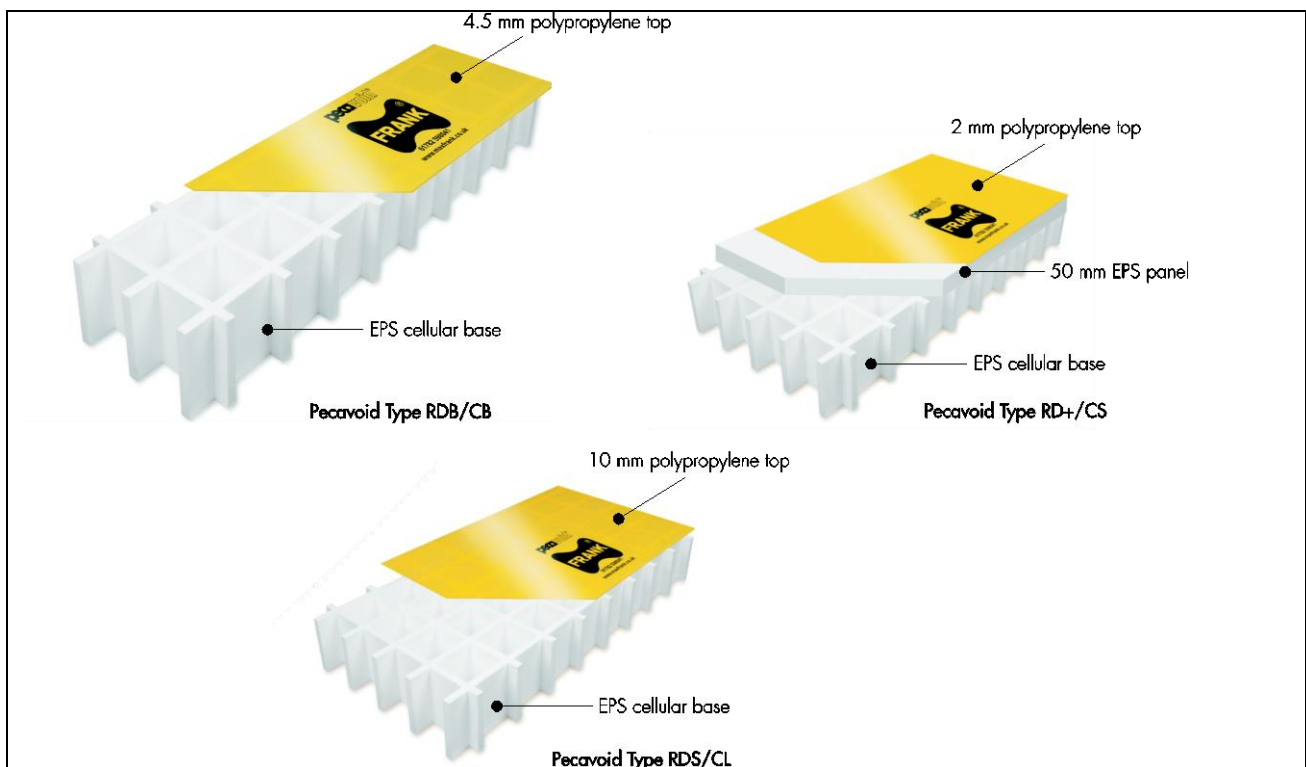


Table 1 Pecavoid Cellular Void Formers — nominal dimensions and grades

Product type	Available product sizes (mm)			Available grades
	Length	Width	Depth (overall)	
RDB	2400	300 to 1200	85, 155 or 220	9/13, 10/15, 13/19, 15/22
RD+	2400	1200	130, 200 or 265	8/12, 9/13, 10/15, 13/19, 15/22
RDS	2400	1200	90, 160 or 225	8/12, 9/13, 10/15, 13/19, 15/22
CB	2400	300 to 1200	100, 175, 250 or 300	10/15, 15/22
CS	2400	1200	150, 225, 300 or 350	8/12, 10/15, 15/22
CL	2400	1200	105, 180, 255 or 305	8/12, 10/15, 15/22

1.3 The product grade indicates the safe-load and fail-load capacity of the product (see Table 2). Each grade is designed to support its specified safe-load for a period of 16 hours with limited compression, and to collapse when subjected to its specified fail-load, so as to provide the minimum declared height of void (see section 6).

Table 2 Product grades and associated safe- and fail-loads

Grade	Safe load (kN·m <sup>-2</sup> )	Fail load (kN·m <sup>-2</sup> )
8/12	8	12
9/13	9	13
10/15	10	15
13/19	13	19
15/22	15	22

1.4 The thickness of the legs and cell size for the EPS base varies according to product size and grade.

## 2 Manufacture

2.1 The cellular bases are fabricated from sheets of EPS, hot-wire cut to the required dimensions and profile dependent on product size and grade. Once the cellular base has been assembled, the appropriate topping is bonded into position with the Certificate holder’s proprietary adhesive.

2.2 Each product carries a label bearing details of the product type, grade, depth, width and date of manufacture (see Figure 2) and the BBA logo incorporating the number of this Certificate.

Figure 2 Label



2.3 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 being operated by the manufacturer are being maintained.

2.4 The management system of Max Frank Limited has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by BM Trada Certification (Certificate No 7005).

### 3 Delivery and site handling

3.1 The products are delivered to site shrink-wrapped in polythene and banded on polystyrene pallets or skids. Each pack carries a label bearing the Certificate holder's name, product description and the BBA logo incorporating the number of this Certificate. Each delivery is accompanied by a delivery note, and handling and installation instruction sheet.

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

3.3 Contact with solvents and organic based materials should be avoided.

3.4 The products must not be exposed to flame or ignition. Careful consideration should also be given to the management of fire risk when in storage.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Pecavoid Cellular Void Formers.

### Design Considerations

#### 4 General



4.1 Pecavoid Cellular Void Formers are satisfactory for use either under reinforced concrete ground beams or under suspended reinforced concrete floor slabs, and are effective in limiting the pressure caused by expansion of clay soils (clay heave). The structural floor or beam must, in addition to normal design criteria, be designed to accommodate the maximum upward forces owing to clay heave (see sections 6.6 and 6.7).

4.2 The products must not be used on the vertical faces of concrete foundations.

4.3 Use of the products below the groundwater table, or on sites where hazardous gases such as methane or radon may be encountered, is outside the scope of this Certificate.

#### 5 Practicability of installation

5.1 The products are designed to be installed by a competent general builder, or a contractor, experienced with these types of products.

5.2 Adequate supervision must be maintained to ensure correct installation (see section 11).

## 6 Design

6.1 The appropriate product for each project is specified by product type, product grade and product depth.

### Product type

6.2 Product types are selected according to the intended use and project specification (see section 1.2).

### Product grade

6.3 The appropriate product grade is selected according to the maximum thickness of wet concrete that the Pecavoid Cellular Void Former will be required to support during construction of the project (see Table 3).

**Table 3 Maximum permissible slab/beam thicknesses**

Product grade	Maximum concrete thickness <sup>(1)</sup> (mm)
8/12	260
9/13	300
10/15	340
13/19	460
15/22	540

(1) Calculations of the maximum concrete thickness include an allowance of 1.5 kN-m<sup>-2</sup> for imposed load including heaping.

6.4 It is normal for these types of products to experience some compression during concrete pouring. This will normally be less than 10 mm, dependent on the depth of the concrete and the method and rate of placement. Once the concrete has been poured, subsequent creep deflections will be minimal.

### Product depth

6.5 The appropriate product depth is selected to ensure that its specified compression under fail-load is equal to, or greater than, the maximum anticipated ground movement owing to clay heave as established from site investigations (see Table 4). Further guidance on predicted ground movements in shrinkable soils is given in Chapter 4.2 of *NHBC Standards 2016*.

**Table 4 Maximum permissible slab/beam thicknesses**

NHBC volume change potential	Void required (minimum product compression at fail load) (mm)	Required depth for product legs (mm)	Pecavoid nominal product depth (mm)					
			RDB	CB	RD+	CS	RDS	CL
Low	50	95	–	100	–	150	–	105
		80	85	–	130	–	90	–
Medium	100	170	–	175	–	225	–	180
		150	155	–	200	–	160	–
High	150	245	–	250	–	300	–	255
		215	220	–	265	–	225	–
N/A	200	295	–	300	–	350	–	305

### Upward pressure on slabs, beams and overall structure

6.6 In addition to the normal downward-acting loads, the suspended floor slabs, the ground beams, the connection between the slab and ground beams and, where piles are used, the pile/ground beam connections, should be designed to take account of the upward pressure that will be transferred through the product during periods of clay heave.

6.7 The ultimate upward pressure to be resisted ( $P_{ult}$ ) should be determined as:

$$P_{ult} = (Y_Q \times PFL) - (Y_G \times G_k)$$

where:

PFL is the product fail-load (see Tables 1 and 2)

$G_k$  is the self-weight of the slab or beam, including concrete blinding (when used)

$Y_Q$  and  $Y_G$  are partial factors in accordance with BS EN 1992-1-1 : 2004 and BS EN 1990 : 2002 and their UK National Annexes, where  $Y_Q = 1.5$  and  $Y_G = 0.9$ .

### Temporary loads during construction

6.8 Provided that the recommendations given in sections 11 and 12 are satisfied, the products will adequately resist normal foot traffic and other short-term loads normally associated with installation, and can be used without further protection.

6.9 Concentrated loads beneath reinforcement spacers can be high during the construction phase, and the designer should specify appropriate measures in the design to ensure that these loads are commensurate with the safe loads/fail load capacity of the Pecavoid Cellular Void Formers. These may include:

- the use of fibre-reinforced concrete line spacers<sup>(1)</sup> specifically designed to distribute such concentrated loads
- where plastic spacers are to be used, the use of the spacers with large base areas sufficient to ensure that the resultant concentrated loads are appropriate for the load-carrying of the product
- in all cases, positioning of spacers at appropriate centres to ensure that the maximum imposed load beneath each spacer is commensurate with the grade of Pecavoid product used
- provision of a 50 mm thickness of concrete blinding on top of the products where heavy reinforcement is proposed, or where the reinforcement will be subjected to significant point loads from foot traffic or other imposed loading.

(1) Available from the Certificate holder.

## 7 Thermal performance

Although Pecavoid Type RD+ and Pecavoid Type CS will contribute to the thermal insulation of the floor, they have not been assessed by the BBA for this purpose.

## 8 Maintenance

The products are confined within the structure of the floor and do not require maintenance.

## 9 Durability



The products are dimensionally stable under varying conditions of temperature and humidity. They are rot-proof and water-resistant and will remain effective for the life of the building.

## 10 Reuse and recyclability

The products contain EPS, which can be recycled.

### 11 General

11.1 Adequate supervision must be maintained and, if required, the Certificate holder's specialists, experienced in site practice and installation of the material, will attend the site to provide demonstrations to ensure correct installation.

11.2 Normal precautions for handling EPS materials should be taken to avoid damaging the products during off loading, storage, handling and installation.

### 12 Procedure

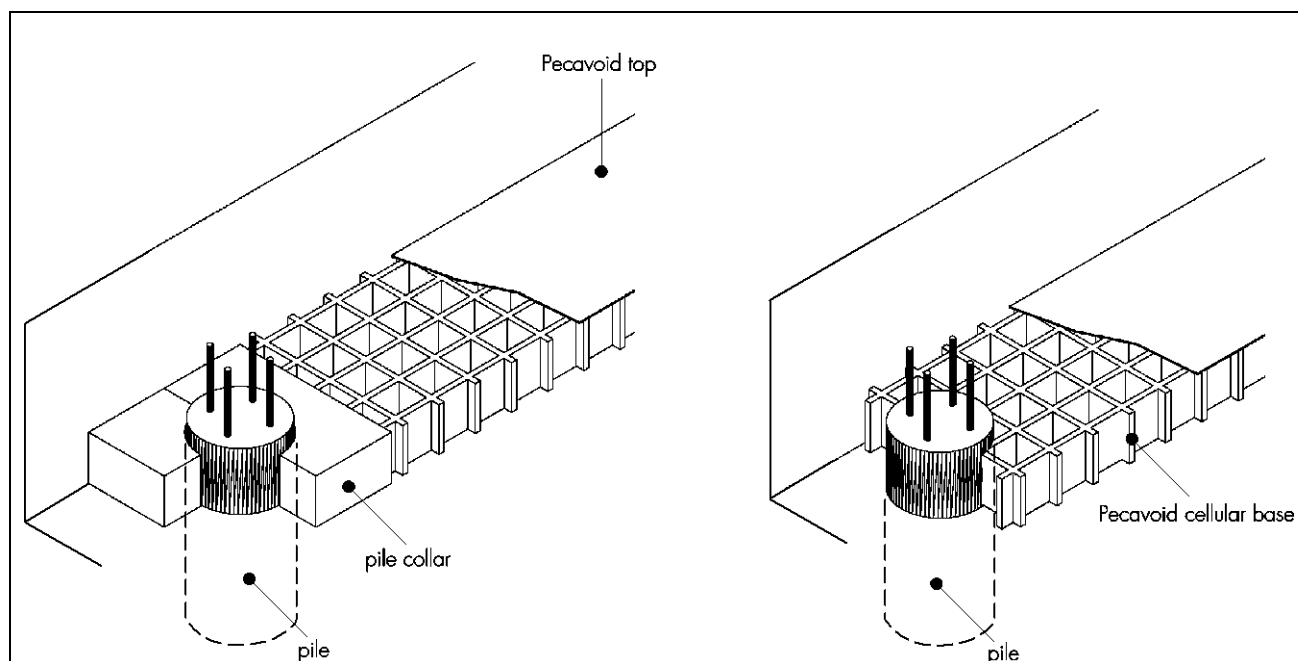
12.1 The foundation should be flat, evenly compacted and blinded with concrete to ensure that the cell legs are evenly distributed when placed.

12.2 The products should be placed into position with care. Any products with cell damage must be replaced.

12.3 Any necessary cutting should be carried out with a fine-toothed saw to avoid cell leg damage. Cut edges should have remaining exposed legs of no more than 50 mm.

12.4 Piles should project above the products to the Design Engineer's specification. A tight fit around piles is essential; alternatively, pile collars should be used (see Figure 3).

*Figure 3 Typical piled ground beam detail*



12.5 It is essential that wet concrete grout is retained and not allowed to fill the voids. The joints between products should therefore be sealed with formwork tape, unless a DPM layer is placed on top and edges are sealed.

12.6 Close inspection for gaps around piles and side formwork must be carried out before concreting.

12.7 A concrete blinding may be specified above the products where heavy grades of Pecavoid are proposed.

12.8 Heaping of concrete must be avoided when pouring concrete. If a pump or skip is used, it must be kept as close to the slab reinforcement as possible.



12.9 During construction, good working practice such as the use of spreader boards should be used to reduce the imposed load transmitted to the products (see section 6.8).

## Technical Investigations

### 13 Tests

Tests were carried out and the results assessed to determine:

- dimensional accuracy
- ability to withstand short-term foot traffic loading, concentrated loads from rebar spacers and other anticipated short-term construction loads
- ability to withstand the design safe-load for 16 hours
- that, when the load is increased beyond the safe-load, the product compresses to the required amount under a load not exceeding its specified fail-load.

### 14 Investigations

14.1 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.

14.2 An assessment was made of the practicability of installation, including site handling and storage.

14.3 An assessment was made of the products' performance characteristics and durability.

## Bibliography

BS EN 1990 : 2002 + A1 : 2005 *Eurocode : Basis of structural design*

NA to BS EN 1990 : 2002 + A1 : 2005 UK National Annex to *Eurocode : Basis of structural design*

BS EN 1992-1-1 : 2004 + A1 : 2014 *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

NA + A2 : 14 to BS EN 1992-1-1 : 2004 + A1 : 2014 UK National Annex to *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

### 15 Conditions

#### 15.1 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.

15.2 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.

15.3 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.

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

15.5 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.

15.6 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.