

BBA Certificate

Zemdrain[®] MD

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issued by: BBA, UK

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Agrément Certificate

20/5726

Product Sheet 2 Issue 1

ZEMDRAIN FORMWORK LINERS

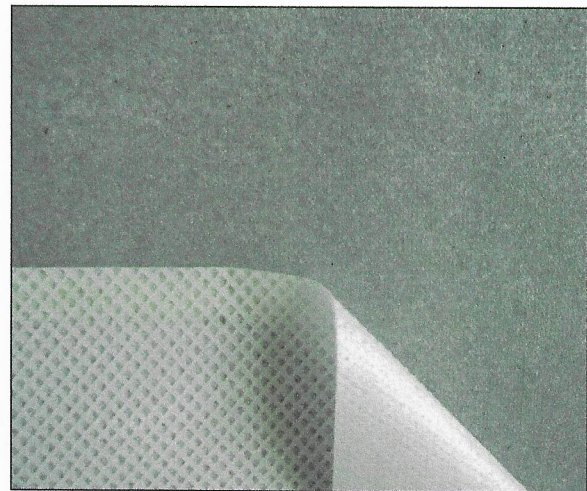
ZEMDRAIN MD

This Agrément Certificate Product Sheet⁽¹⁾ relates to Zemdrain MD, a filter fabric laminated to a plastic grid, for use as a formwork liner to enhance the durability and surface appearance of cast concrete.

(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

Properties of the resultant concrete — when compared with equivalent concrete cast without the product, concrete cast against Zemdrain MD has enhanced resistance to carbon dioxide, ingress of chloride ions, and sulfate and frost attack; and reduced permeability; enhanced surface tensile strength; and enhanced surface hardness (see section 6).

Behaviour in relation to fire — the product melts at 165°C and therefore direct exposure to heat should be avoided (see section 7).

Durability — when compared with equivalent concrete cast without the product, cured concrete cast using controlled permeability formwork (CPF) has been shown to have enhanced properties with increased durability (see section 9).

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

Date of First issue: 21 February 2020

Hardy Giesler
Chief Executive Officer

Certificate amended on 15 November 2022 to amend tensile test results.

The BBA is a UKAS accredited Inspection Body (No.4345).

This certificate has been amended on 19 January 2023 as part of a transition of The BBA Agrément Certificate scheme delivered under the BBA's ISO/IEC 17020 accreditation. Sections marked with the symbol † are not issued under accreditation.

Readers MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon

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Regulations

In the opinion of the BBA, the use of Zemdrain MD is not subject to the national Building Regulations.

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 (3.1) of this Certificate.*

Technical Specification

1 Description

1.1 Zemdrain MD is a filter fabric laminated to a plastic grid which can be tensioned to most conventional types of formwork.

1.2 When tested by the BBA, the product was found to have following nominal characteristics:

| | |
|--|------|
| Weight ($\text{g}\cdot\text{m}^{-2}$) | 589 |
| Thickness at 200 kPa (mm) | 1.47 |
| Tensile strength (kN/m) | |
| longitudinal | 24 |
| transverse | 17 |
| Air permeability ($\text{mm}\cdot\text{s}^{-1}$ @200Pa) | 223 |
| Mean pore size, O_{90} (μm) | 71. |

1.3 The fabric is a white non-woven spunbond product of 100% polypropylene, continuous filaments that are thermally and mechanically bonded. It has an additional surface bonding step (point bonder treatment). The fabric is functioning as a drainage and filtration layer, with its pore size and structure being designed to retain cement particles while allowing water and air to pass through. The fabric is fixed with the point bonder treated side to a polypropylene grid on one side through heat lamination.

1.4 When fresh concrete is placed and vibrated in contact with the product, excess water and entrapped air are drained from the concrete surface. Once the concrete is cured, the liner is removed. The liner will assist with curing when in place on the concrete before removal.

2 Manufacture

2.1 The product is manufactured from spunbond polypropylene continuous fibres that are laid down on a belt in four layers and then thermally and mechanically bonded with an additional point bonding on one side. A polypropylene grid is added to one side of the polypropylene fabric through heat lamination.

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.

3 Delivery and site handling

3.1 The product is delivered in rolls, wrapped in polythene, bearing a self-adhesive label showing the Certificate holder's name and roll identification number.

3.2 The product is supplied in a roll width of 2.5 m and a length of 35 m, weighing 59 kg.

3.3 The rolls should be stored either vertically or horizontally, on a smooth, clean surface. Opened rolls should be protected from direct sunlight. Formwork liner already installed should not be exposed to sunlight for periods exceeding two weeks.

Assessment and Technical Investigations

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

Design Considerations

4 General

4.1 Zemdrain MD is satisfactory for use as a formwork liner for cast concrete, and reduces the risk of cracks and microcracks normally associated with the early drying of a concrete surface.

4.2 The product is multi use; it may be used up to three times in total, provided it is not damaged by previous use.

4.3 Test results show that the product satisfies the criteria of BS 6920-1 : 2014, conforms with the requirements of the Water Regulations Advisory Scheme (WRAS) Tests of Effect on Water Quality, and is suitable for use with cold, but not hot, water.

5 Practicability of installation

The formwork liner is designed to be installed by operatives experienced with this type of product. The level of supervision during the installation should be sufficient to ensure the quality of workmanship as described in BS 8000-0 : 2014, BS 8500-1 : 2015, BS 8500-2 : 2015, BS EN 206 : 2013 and BS EN 13670 : 2009.

6 Properties of the resultant concrete

6.1 Tests were carried out to determine the comparative properties of concrete produced with and without Zemdrain MD on one side, and the results are listed in Table 1. The concrete used was a C35/45 grade concrete with a Portland cement content of $360 \text{ kg}\cdot\text{m}^{-3}$ and water/cement ratio of 0.43.

Table 1 Tests on panels and cores

| Test | Zemdrain concrete | Control | Test method |
|---|---------------------------|----------------------------|-------------------|
| Surface hardness – stripped after 24 hours | | | BS EN 12504-2 |
| First use | 48 | 37 | |
| Second use | 46 | 35 | |
| Third use | 45 | 36 | |
| Surface tensile test (pull-off) (N/mm ²) – stripped after 24 hours | | | BS 1881-207 |
| First use | 6.0 | 2.4 | |
| Second use | 6.0 | — | |
| Third use | 5.9 | — | |
| ISAT (ml · m ⁻² · s ⁻¹) | | | BS 1881-208 |
| 10 mins, first use | 0.3154 | 0.9123 | |
| 10 mins, second use | 0.8026 ⁽¹⁾ | 0.7372 | |
| 10 mins, third use | 0.5856 | 0.7702 | |
| 30 mins, first use | 0.2178 | 0.6154 | |
| 30 mins, second use | 0.5083 ⁽¹⁾ | 0.4881 | |
| 30 mins, third use | 0.4102 | 0.4930 | |
| 60 mins, first use | 0.1577 | 0.4893 | |
| 60 mins, second use | 0.3739 ⁽¹⁾ | 0.3484 | |
| 60 mins, third use | 0.3150 | 0.3874 | |
| Carbonation resistance (mm) | 0.0 | 6.3, 4.7 | BS EN 13295 |
| Chloride resistance (m ² · s ⁻¹) | | | BS EN 12390-11 |
| First use | 2.065 x 10 ⁻¹² | 5.28 x 10 ⁻¹² | |
| Second use | 3.732 x 10 ⁻¹² | 14.775 x 10 ⁻¹² | |
| Third use | 5.501 x 10 ⁻¹² | 11.132 x 10 ⁻¹² | |
| Sulfate strain (‰) | 0.256 | 0.289 | SIA 262/1 |
| Depth of penetration of water under pressure (mm) | | | BS EN 12390-8 |
| First use | 6.0 | 39 | |
| Second use | 17.5 | 30 | |
| Third use | 25.0 | 24 | |
| Freeze/thaw resistance (weight loss (g · m ⁻²)) | | | DD CEN/TS 12390-9 |
| First use: | | | |
| 4 cycles | 29.9 | 150.37 | |
| 14 cycles | 53.59 | 1245.95 | |
| 22 cycles | 97.42 | 2394.52 | |
| 28 cycles | 157.67 | 2965.92 | |
| Second use: | | | |
| 4 cycles | 20.18 | 417.69 | |
| 14 cycles | 43.97 | 2107.89 | |
| 22 cycles | 93.25 | 3130.85 | |
| 28 cycles | 140.46 | 3764.33 | |
| Third use: | | | |
| 4 cycles | 29.16 | 522.05 | |
| 14 cycles | 92.54 | 2185.50 | |
| 22 cycles | 214.59 | 3059.44 | |
| 28 cycles | 341.42 | 3580.73 | |

(1) Obtained result not considered.

6.2 The conclusions drawn from the tests carried out are that, when compared to equivalent concrete cast without the product, concrete cast against Zemdrain MD:

- has an enhanced resistance to carbon dioxide and ingress of chloride ions
- has an enhanced resistance to frost attack and sulfate attack
- has reduced permeability for the first and second use
- has an enhanced surface tensile strength and surface hardness.

7 Behaviour in relation to fire

7.1 The product melts at 165°C. Direct exposure to heat should therefore be avoided.

7.2 Care should be taken not to damage the liner when welding or steel cutting.

8 Maintenance

As the product is used as a temporary lining to formwork, no maintenance is required.

9 Durability

9.1 The product enhances the durability and surface appearance of concrete, significantly reducing the permeability of the concrete by reducing blowholes and other surface defects.

9.2 When compared with equivalent concrete cast without the product, cured concrete cast using the product has been shown to have enhanced properties and hence increased durability.

10 Reuse and recyclability

The product is made from polypropylene, which can be recycled.

Installation

11 General

11.1 Zemdrain MD must only be specified and used strictly in accordance with this Certificate and the Certificate holder's instructions.

11.2 The product must be correctly tensioned in accordance with section 12.

11.3 The product is used with Portland cement or blended Portland cement concretes of all accepted grades.

11.4 The Certificate holder should be consulted for advice on design, and on the suitability of any proposed admixtures.

11.5 Some colour variation of the concrete surface may occur.

11.6 Form oils or release agents must not be used with the product.

12 Fixing

12.1 The product must be tensioned or glued over the face of the backing formwork in accordance with the Certificate holder's instructions. It is important that the product is tensioned in both the longitudinal and transverse directions, to avoid the formation of folds.

12.2 The liner should continue under the formwork to ensure the adequate dispersal of water.

13 Tests

13.1 Tests were carried out and the results assessed to determine the effect of concrete cast against Zemdrain MD in relation to:

- pore size
- weight
- thickness
- air permeability
- tensile strength.

13.2 An assessment was made of the following data from independent laboratories:

- surface hardness and strength
- ISAT water absorption
- resistance to carbonation, chloride, sulfate and freeze-thaw
- resistance to water under pressure.

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 of the product.

Bibliography

BS 1881-207 : 1992 *Testing concrete — Recommendations for the assessment of concrete strength by near-to-surface tests*

BS 1881-208 : 1996 *Testing concrete — Recommendations for the determination of the initial surface absorption of concrete*

BS 6920-1 : 2014 *Suitability of non-metallic materials and products for use in contact with water intended for human consumption with regard to their effect on the quality of the water — Specification*

BS 8000-0 : 2014 *Workmanship on construction sites — Introduction and general principles*

BS 8500-1 : 2015 + A2 : 2019 *Concrete — Complementary British Standard to BS EN 206 — Method of specifying and guidance for the specifier*

BS 8500-2 : 2015 + A2 : 2019 *Concrete — Complementary British Standard to BS EN 206 — Specification for constituent materials and concrete*

BS EN 206 : 2013 + A1 : 2016 *Concrete — Specification, performance, production and conformity*

BS EN 12390-8 : 2009 *Testing hardened concrete — Depth of penetration of water under pressure*

BS EN 12390-11 : 2015 *Testing hardened concrete — Determination of the chloride resistance of concrete, unidirectional diffusion*

BS EN 12504-2 *Testing concrete in structures — Non-destructive testing — Determination of rebound number*

BS EN 13295 : 2004 *Products and systems for the protection and repair of concrete structures — Test methods — Determination of resistance to carbonation*

BS EN 13670 : 2009 *Execution of concrete structures*

CEN/TS 12390-9 : 2006 *Testing hardened concrete — Freeze-thaw resistance — Scaling*

SIA 262/1 : 2013 *Civil engineering; Concrete Structures – Supplementary specifications; Swiss engineer and architect association (Ed), 2013*

Conditions

1 This Certificate:

- relates only to the product 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.

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.

3 This Certificate will be displayed on the BBA website, and the Certificate Holder is entitled to use the Certificate and Certificate logo, provided that the product 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.

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

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

6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product which is contained or referred to in this Certificate is the minimum required to be met when the product 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.