CI/SfB
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Roads and Bridges Agrément Certificate No 93/R078
*Third issue**

Designated by Government to issue European Technical Approvals

LINFLEX FIN DRAIN AND GEOTEXTILE

Nappe drainante — chaussées
Dränmatte

Product

- *THIS CERTIFICATE RELATES TO LINFLEX FIN DRAIN AND GEOTEXTILE, FOR USE IN NARROW FILTER DRAINS FOR HIGHWAY DRAINAGE.*
- *The products are for use in edge-of-pavement drains for the collection and/or disposal of sub-surface water in accordance with the requirements of the Highways Agency (HA), who acts on behalf of the Department for Transport, the Scottish Executive Development Department, the Welsh Assembly Government, and the Department for Regional Development, and the conditions set out in the* Design Data *and* Installation *parts of the accompanying Detail Sheets.*
- *This Certificate does not cover pipes or backfill and surround material.*

These Front Sheets must be read in conjunction with the accompanying Detail Sheets, which provide information specific to particular products.

Highways Agency Requirements — Detail Sheet 1

1 Requirements

1.1 The general requirements for fin drains and the associated geotextiles used in narrow filter drains are given in the *Manual of Contract Documents for Highway Works*, Volume 1 (MCHW1), clauses 514 and 515, respectively.

1.2 Further information and guidance is given in MCHW, Volume 2 and Volume 3 (Drawings Nos F18, F19 and F20).

1.3 Additional site requirements may be included on particular contracts, and in general will be given in Appendix 5/4 of the contract documents.

Regulations

2 Construction (Design and Management) Regulations 1994 (as amended)
Construction (Design and Management) Regulations (Northern Ireland) 1995 (as amended)

Information in this Certificate may assist the client, planning supervisor, designer and contractors to address their obligations under these Regulations.

See sections: 1 *Description* and 2 *Delivery and site handling* of each Detail Sheet.

Bibliography

Manual of Contract Documents for Highway Works, Volume 1 : *Specification for Highway Works* : May 2001 edition

Manual of Contract Documents for Highway Works, Volume 2 : *Notes for Guidance on the Specification for Highway Works* : 2001

Manual of Contract Documents for Highway Works, Volume 3 : *Highway Construction Details* : May 2002, Drawing Nos F18, F19 and F20 (December 1991)

Conditions of Certification

3 Conditions

3.1 This Certificate:

(a) relates only to the product that is described, installed, used and maintained as set out in this Certificate;

(b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;

(c) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;

(d) is copyright of the BBA.

3.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, shall be construed as references to such publication in the form in which it was current at the date of this Certificate.

3.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabricating process(es) thereof:

(a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;

(b) continue to be checked by the BBA or its agents;

(c) are reviewed by the BBA as and when it considers appropriate; and

(d) remain in accordance with the requirements of the Highways Agency.

3.4 In granting this Certificate, the BBA makes no representation as to:

(a) the presence or absence of any patent or similar rights subsisting in the product or any other product;

(b) the right of the Certificate holder to market, supply, install or maintain the product; and

(c) the nature of individual installations of the product, including methods and workmanship.

3.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.

BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

In the opinion of the British Board of Agrément, Linflex Fin Drain and Geotextile are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 93/R078 is accordingly awarded to Polypipe Civils Ltd.

On behalf of the British Board of Agrément

Date of Third issue: 19th November 2002

Chief Executive

**Original Certificate issued on 14th December 1993. This version issued to include reference to the revised Ministry Departments, update to the Regulations and the addition of a* Bibliography.

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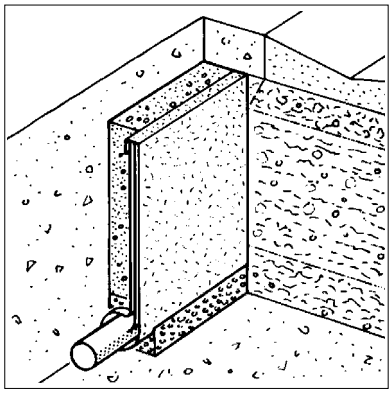
BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

Polypipe Civils Ltd

LINFLEX 6 FIN DRAIN

Roads and Bridges
Certificate No 93/R078
DETAIL SHEET 2
*Third issue**

Product



- *THIS DETAIL SHEET RELATES TO LINFLEX 6 FIN DRAIN, A FIN DRAIN TYPE 6 AS DEFINED IN THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS (MCHW), VOLUME 3, DRAWING NOS F18 AND F19.*
- *The product is for use as an edge-of-pavement drain for the collection and/or disposal of surface and sub-surface water in accordance with MCHW, Volume 1, clause 514.*
- *This Detail Sheet does not cover pipes or backfill and surround material.*

This Detail Sheet must be read in conjunction with the Front Sheets, which give the product's position regarding the Highways Agency (HA) requirements and the Conditions of Certification, *respectively.*

Technical Specification

1 Description

1.1 Linflex 6 Fin Drain consists of a composite of two layers of geotextile separated by a plastic core and incorporating a sleeve to accommodate the perforated or porous drainage pipe.

1.2 The geotextile is a non-woven fabric of heat-bonded polypropylene/polyethylene filaments.

1.3 The core is an extruded net of low-density polyethylene.

1.4 During manufacture the core and geotextile are cut to size, the geotextile is wrapped round the core and stitched in place. A sleeve at the base of the fin drain is provided to receive the appropriate pipe and may be fitted during manufacture or prior to installation on site. The product is labelled, rolled horizontally and inserted into a black polyethylene protective wrapper. The fin drain is available in standard sizes of:

depth[1] (mm)	600, 700, 800, 900, 1000, 1100, 1200, 1500, 2000[2]
length (m)	12.5

(1) Other depths may be manufactured to order.
(2) Maximum depth.

1.5 Continuous quality control is exercised throughout manufacture including checks on dimensions, continuity of stitching and visual checks for punctures or tears.

2 Delivery and site handling

2.1 The product is delivered to site in a black polyethylene protective wrapper bearing a label including the manufacturer's name, product details, batch number and the BBA identification mark incorporating the number of this Certificate.

2.2 The product should be stored on a clean, level surface and protected from direct heat and sunlight. The polyethylene wrapper should not be removed until immediately before installation.

2.3 In MCHW, Volume 1, sub-clause 514.12 it is required that the contractor supplies the resident engineer with information associated with the identification of the product. Polypipe Civils Ltd will make the appropriate information available on request.

Design Data

3 General

3.1 Linflex 6 Fin Drain, when installed in accordance with the requirements of MCHW, Volume 1, the manufacturer's instructions and the relevant parts of this Certificate, is satisfactory for use as an edge-of-pavement drain for the collection and/or disposal of sub-surface water.

3.2 The product is made from materials resistant to the deleterious effects of short-term exposure to ultraviolet light, degradation by acids, alkalis and other common chemicals and the effects of bacteria, fungi and moulds found in soil or highway construction materials.

3.3 In the event of accidental exposure to chemicals (including spillage of oil, petrol and diesel) the installed fin drain should be examined and assessed for possible damage. If necessary the fin drain should be replaced.

3.4 The fin drain should not be exposed to sunlight, or to any other source of UV radiation, for more than a cumulative period of 50 hours. Drains exposed for longer should be replaced, unless otherwise instructed, by the resident engineer.

4 Geotextile

4.1 The geotextiles used meet the requirements of MCHW, Volume 1, sub-clause 514.4 (i), (ii) and (iii).

4.2 The measured apparent opening size (O_{90}) of both geotextiles when tested in accordance with BS 6906-2 : 1989 are listed in Tables 1 and 2 respectively. Due to the nature of the geotextiles the apparent opening size (O_{90}) may vary. The measured apparent opening size of the geotextile used in each batch of Linflex 6 will be supplied and this value should be as stated in Appendix 5/4 of the contract documents.

4.3 The measured rate of flow through the geotextiles, normal to their principal plane when tested in accordance with BS 6906-3 : 1989, are listed in Tables 1 and 2 respectively. Due to the nature of the geotextiles, the rate of flow may vary. The measured flow rate of the geotextile used in each batch of Linflex 6 will be supplied and this value should be as stated in Appendix 5/4 of the contract documents.

5 Composite drain

5.1 The flow rate through each face of the composite, determined in accordance with a modified version of BS 6906-3 : 1989[1], was found to be more than 75% of the value for the geotextile alone. The product therefore meets the requirements of MCHW, Volume 1, sub-clause 514.5 (i).

(1) modification to:

- mounting of specimens in the apparatus
- direction of flow after normal passage through the geotextile.

The modifications agreed by the HA are necessary to allow measurement of normal plane flow through a geotextile filter layer attached to a three-dimensional drainage core (fin drain).

5.2 The long-term in-plane flow rate, determined in accordance with the requirements of MCHW, Volume 1, sub-clauses 514.14 and 514.15, was found to be 0.25 $lm^{-2}s^{-1}$. This value should be compared with that given in Appendix 5/4 of the contract documents.

6 Joints

The jointing employed in the system must comply with the requirements of MCHW, Volume 1, sub-clause 514.6.

7 Pipes

The drainage pipes used with Linflex 6 must be perforated or porous and must comply with the requirements of MCHW, Volume 1, sub-clause 501.3.

8 Backfill and surround material

These materials should comply with the requirements of MCHW, Volume 1, sub-clause 514.9.

Installation

9 Procedure

9.1 Linflex 6 Fin Drain must be installed in accordance with MCHW, Volume 1, sub-clause 514.11, Volume 3, Drawing Nos F18 and F19, and the manufacturer's instructions.

9.2 At joints in the drain, the geotextile should overlap by 150 mm and be stapled together using 30 mm copper staples at approximately 150 mm centres along the length of the joint.

9.3 If the pipe was not fitted during manufacture of the fin drain it should be installed in accordance with the instructions provided by Polypipe Civils Ltd.

9.4 If damage to the geotextile or core is sustained during installation, the damaged area should be cut out to the full depth of the fin drain and the two portions jointed (see section 9.2).

9.5 If the pipe is damaged in the sleeve, the whole 12.5 m length of pipe should be replaced, or the damaged section removed and replaced using a suitable connector.

Technical Investigations

The following is a summary of the technical investigations carried out on Linflex 6 Fin Drain.

10 Tests

Tests were performed on samples representative of the general manufactured product. The results of these tests, which are typical for the product, are summarised in Tables 1, 2 and 3.

11 Investigations

11.1 An examination was made of data on the product's resistance to:

deleterious effects of short-term exposure to ultraviolet light

degradation by acids, alkalis and other common chemicals (including oil, petrol and diesel)

the effect of bacteria, fungi and moulds found in soil or highway construction materials.

11.2 The manufacturing process was examined, including the methods adopted for quality control,

and details were obtained of the quality and composition of the materials used.

11.3 A site in progress was visited to examine the practicability of installation.

Table 1 Geotextile Terram (1000B)

Test (units)	Method[1]	Mean results	
		Machine	Cross
Tensile strength (kNm^{-1})	BS 6906-1	6.90	10.27
Elongation (%)	BS 6906-1	20.0	20.7
Puncture resistance (N)	BS 6906-4	1314	
Tear resistance (N)	ASTM D 4533-85	335	369
Pore size O_{90} (µm)	BS 6906-2	82.0	
Water flow ($lm^{-2}s^{-1}$)	BS 6906-3	79.5	
Breakthrough head (mm)	BS 6906-3	23	

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

Table 2 Geotextile (Bontec) 8/8

Test (units)	Method[1]	Mean results	
		Machine	Cross
Tensile strength (kNm^{-1})	BS EN ISO 10319	12.62	10.29
Elongation (%)	BS EN ISO 10319	40.3	46.3
Puncture resistance (N)	BS EN ISO 12236	1902	
Tear resistance (N)	ASTM D 4533-85	289.3	294.3
Pore size O_{90} (µm)	BS 6906-2	136	
Water flow ($lm^{-2}s^{-1}$)	BS 6906-3	183.6	
Breakthrough head (mm)	BS 6906-3	zero	

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

Table 3 Composite drain

Test (units)	Method[1]	Mean result
Flow rate through composite ($lm^{-2}s^{-1}$)	BS 6906-3 (modified)	71.7
Compression under shear and normal load (%)	MCHW, Vol 1, 514.14	5.92
Short-term equivalent load (kNm^{-2})	MCHW, Vol 1, 514.14	95
In-plane flow ($lm^{-2}s^{-1}$)	BS 6906-7	0.25

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

Bibliography

BS 6906-1 : 1987 *Methods of test for geotextiles — Determination of the tensile properties using a wide width strip*

BS 6906-2 : 1989 *Methods of test for geotextiles — Determination of the apparent pore size distribution by dry sieving*

BS 6906-3 : 1989 *Methods of test for geotextiles — Determination of water flow normal to the plane of the geotextile under a constant head*[1]

BS 6906-4 : 1989 *Methods of test for geotextiles — Determination of the puncture resistance (CBR puncture test)*

BS 6906-7 : 1990 *Methods of test for geotextiles — Determination of in-plane waterflow*

(1) Modified version used for testing flow rate (see section 5.1).

ASTM D 4533-85 *Standard test method for trapezoid tear strength of geotextiles*

BS EN ISO 10319 : 1996 *Geotextiles — Wide-width tensile test*

BS EN ISO 12236 : 1996 *Geotextiles and geotextile-related products — Static puncture test (CBR-Test)*

Manual of Contract Documents for Highway Works, Volume 1 : *Specification for Highway Works* : May 2001 edition

Manual of Contract Documents for Highway Works, Volume 3 : *Highway Construction Details* : May 2002, Drawing Nos F18 and F19 (December 1991)

BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

On behalf of the British Board of Agrément

Date of Third issue: 19th November 2002

Chief Executive

**Original Detail Sheet issued on 14th December 1993. This version issued to include additional geotextile and updated* Bibliography.

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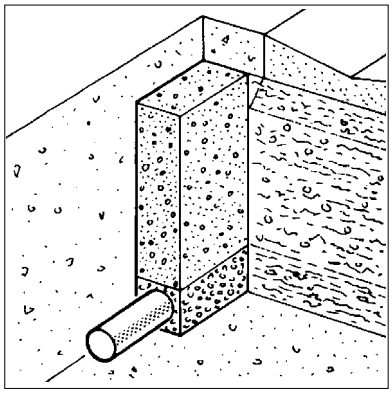
BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

Polypipe Civils Ltd

LINFLEX 8 (FOR USE IN A TYPE 8 NARROW FILTER DRAIN)

Roads and Bridges
Certificate No 93/R078
DETAIL SHEET 3
*Third issue**

Product



- *THIS DETAIL SHEET RELATES TO LINFLEX 8 (FOR USE IN A TYPE 8 NARROW FILTER DRAIN) AS DEFINED IN THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS (MCHW), VOLUME 3, DRAWINGS NOS F18 AND F20.*
- *The product is for use as part of an edge-of-pavement drain for the collection and/or disposal of sub-surface water in accordance with MCHW, Volume 1, clause 515.*
- *This Detail Sheet does not cover pipes or backfill and surround material.*

This Detail Sheet must be read in conjunction with the Front Sheets, which give the product's position regarding the Highways Agency (HA) requirements and the Conditions of Certification, *respectively.*

Technical Specification

1 Description

1.1 Linflex 8 consists of a pipe wrapped in a non-woven fabric of heat-bonded polypropylene/polyethylene filaments.

1.2 During manufacture the geotextile is cut to size, wrapped round the pipe and held in place by a plastic thread. A connector is fitted to one end of the pipe. The product is labelled, coiled, and inserted into a black polyethylene protective wrapper. The product is generally available in sizes of:

pipe diameter (mm)	60	80	100
pipe length(1) (m)	150	100	100

(1) Other lengths may be manufactured to order.

1.3 Continuous quality control is exercised throughout manufacture including checks on continuity of retaining thread and size of geotextile overlap, and visual checks for punctures or tears.

2 Delivery and site handling

2.1 The product is delivered to site in a black polyethylene protective wrapper bearing a label including the manufacturer's name, product details, batch number and the BBA identification mark incorporating the number of this Certificate.

2.2 The product should be stored on a clean, level surface and protected from direct heat and sunlight. The polyethylene wrapper should not be removed until immediately before installation.

2.3 In MCHW, Volume 1, sub-clause 514.12 it is required that the contractor supplies the resident engineer with information associated with the identification of the product. Polypipe Civils Ltd will make the appropriate information available on request.

Design Data

3 General

3.1 Linflex 8, when installed in accordance with the requirements of MCHW, Volume 1, the manufacturer's instructions and the relevant parts of this Certificate, is satisfactory for use as part of an edge-of-pavement drain for the collection and/or disposal of sub-surface water.

3.2 The geotextile is made from materials resistant to the deleterious effects of short-term exposure to ultraviolet light, degradation by acids, alkalis and other common chemicals and the effects of bacteria, fungi and moulds found in soil or highway construction materials.

3.3 In the event of accidental exposure to chemicals (including spillage of oil, petrol and diesel) the installed narrow filter drain should be examined and assessed for possible damage. If necessary the drain should be replaced.

3.4 The product should not be exposed to sunlight, or to any other source of UV radiation, for more than a cumulative period of 50 hours. Drains exposed for longer should be replaced, unless otherwise instructed, by the resident engineer.

4 Geotextile

4.1 The geotextile meets the requirements of MCHW, Volume 1, sub-clause 514.4 (i), (ii) and (iii).

4.2 The measured apparent opening size (O_{90}) of both geotextiles when tested in accordance with BS 6906-2 : 1989 are listed in Tables 1 and 2 respectively. Due to the nature of the geotextiles the apparent opening size (O_{90}) may vary. The measured apparent opening size of the geotextile used in each batch of Linflex 8 will be supplied and this value should be as stated in Appendix 5/4 of the contract documents.

4.3 The measured rate of flow through the geotextiles, normal to their principal plane when tested in accordance with BS 6906-3 : 1989, are listed in Tables 1 and 2 respectively. Due to the nature of the geotextiles, the rate of flow may vary. The measured flow rate of the geotextile used in each batch of Linflex 8 will be supplied and this value should be as stated in Appendix 5/4 of the contract documents.

5 Joints

The jointing employed in the system must comply with the requirements of MCHW, Volume 1, sub-clause 515.3.

6 Pipes

The drainage pipes used with Linflex 8 must comply with the requirements of MCHW, Volume 1, sub-clause 515.4.

7 Backfill and surround material

These materials should comply with MCHW, Volume 1, sub-clause 515.5.

Installation

8 Procedure

8.1 Linflex 8 must be installed in accordance with MCHW, Volume 1, sub-clause 515.7, Volume 3, Drawings Nos F18 and F20, and the manufacturer's instructions.

8.2 Joints between sections of pipe should be made by using the connector provided at one end of the pipe.

8.3 If damage to the geotextile or pipe is sustained, the damaged section should be cut out and reconnected using a suitable connector.

Technical Investigations

The following is a summary of the technical investigations carried out on Linflex 8.

9 Tests

Tests were performed on samples representative of the general manufactured product. The results of these tests, which are typical for the product, are summarised in Tables 1 and 2.

Table 1 Geotextile Terram (1000B)

Test (units)	Method[1]	Mean results	
		Machine	Cross
Tensile strength (kNm^{-1})	BS 6906-1	6.90	10.27
Elongation (%)	BS 6906-1	20.0	20.7
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Water flow ($lm^{-2}s^{-1}$)	BS 6906-3	79.5	
Breakthrough head (mm)	BS 6906-3	23	

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

Table 2 Geotextile (Bontec) 8/8

Test (units)	Method[1]	Mean results	
		Machine	Cross
Tensile strength (kNm^{-1})	BS EN ISO 10319	12.62	10.29
Elongation (%)	BS EN ISO 10319	40.3	46.3
Puncture resistance (N)	BS EN ISO 12236	1902	
Tear resistance (N)	ASTM D 4533-85	289.3	294.3
Pore size O_{90} (µm)	BS 6906-2	136	
Water flow ($lm^{-2}s^{-1}$)	BS 6906-3	183.6	
Breakthrough head (mm)	BS 6906-3	zero	

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

10 Investigations

10.1 An examination was made of data on the product's resistance to:

deleterious effects of short-term exposure to ultraviolet light

degradation by acids, alkalis and other common chemicals (including oil, petrol and diesel)

the effect of bacteria, fungi and moulds found in soil or highway construction materials.

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

10.3 A site in progress was visited to examine the practicability of installation.

Bibliography

BS 6906-1 : 1987 *Methods of test for geotextiles — Determination of the tensile properties using a wide width strip*

BS 6906-2 : 1989 *Methods of test for geotextiles — Determination of the apparent pore size distribution by dry sieving*

BS 6906-3 : 1989 *Methods of test for geotextiles — Determination of water flow normal to the plane of the geotextile under a constant head*(1)

BS 6906-4 : 1989 *Methods of test for geotextiles — Determination of the puncture resistance (CBR puncture test)*

(1) Modified version used for testing flow rate (see section 5.1).

ASTM D 4533-85 *Standard test method for trapezoid tear strength of geotextiles*

BS EN ISO 10319 : 1996 *Geotextiles — Wide-width tensile test*

BS EN ISO 12236 : 1996 *Geotextiles and geotextile-related products — Static puncture test (CBR-Test)*

Manual of Contract Documents for Highway Works, Volume 1 : *Specification for Highway Works* : May 2001 edition

Manual of Contract Documents for Highway Works, Volume 3 : *Highway Construction Details* : May 2002, Drawing Nos F18 and F20 (December 1991)

BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

On behalf of the British Board of Agrément

Date of Third issue: 19th November 2002

Chief Executive

**Original Detail Sheet issued on 14th December 1993. This version issued to include additional geotextile and updated* Bibliography.

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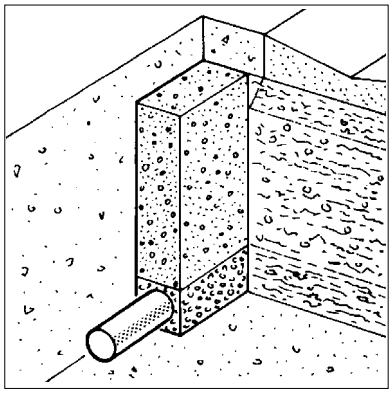
BBA BRITISH BOARD OF AGRÉMENT
TECHNICAL APPROVALS FOR CONSTRUCTION

Polypipe Civils Ltd

LINFLEX 9 (FOR USE IN A TYPE 9 NARROW FILTER DRAIN)

Roads and Bridges
Certificate No 93/R078
DETAIL SHEET 4
*Third issue**

Product



- *THIS DETAIL SHEET RELATES TO LINFLEX 9 (FOR USE IN A TYPE 9 NARROW FILTER DRAIN) AS DEFINED IN THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS (MCHW), VOLUME 3, DRAWINGS NOS F18 AND F20.*
- *The product is for use as part of an edge-of-pavement drain for the collection and/or disposal of sub-surface water in accordance with MCHW, Volume 1, clause 515.*
- *This Detail Sheet does not cover pipes or backfill and surround material.*

This Detail Sheet must be read in conjunction with the Front Sheets, which give the product's position regarding the Highways Agency (HA) requirements and the Conditions of Certification, *respectively.*

Technical Specification

1 Description

1.1 Linflex 9 consists of a non-woven fabric of heat-bonded polypropylene/polyethylene filaments.

1.2 The geotextile is trimmed to width and reeled onto cardboard cores and cut to length. The product is labelled, and inserted into a black polyethylene protective wrapper. The product is available in the standard size(1) of:

roll length (m) 100

roll width (m) 4.5

(1) Other sizes may be manufactured to order.

1.3 Quality control checks are carried out on incoming raw materials, during manufacture and on the final product. Tests on the final product include unit weight, tensile strength and permeability.

2 Delivery and site handling

2.1 The product is delivered to site in a black polyethylene protective wrapper bearing a label including the manufacturer's name, product details, batch number and the BBA identification mark incorporating the number of this Certificate.

2.2 The product should be stored on a clean, level surface and protected from direct heat and sunlight. The polyethylene wrapper should not be removed until immediately before installation.

2.3 In MCHW, Volume 1, sub-clause 514.12 it is required that the contractor supplies the resident engineer with information associated with the identification of the product. Polypipe Civils Ltd will make the appropriate information available on request.

Design Data

3 General

3.1 Linflex 9, when installed in accordance with the requirements of MCHW, Volume 1, the manufacturer's instructions and the relevant parts of this Certificate, is satisfactory for use as part of an edge-of-pavement drain for the collection and/or disposal of sub-surface water.

3.2 The geotextile is made from materials resistant to the deleterious effects of short-term exposure to ultraviolet light, degradation by acids, alkalis and other common chemicals and the effects of bacteria, fungi and moulds found in soil or highway construction materials.

3.3 In the event of accidental exposure to chemicals (including spillage of oil, petrol and diesel) the installed narrow filter drain should be examined and assessed for possible damage. If necessary the drain should be replaced.

3.4 The product should not be exposed to sunlight, or to any other source of UV radiation, for more than a cumulative period of 50 hours. Drains exposed for longer should be replaced, unless otherwise instructed, by the resident engineer.

4 Geotextile

4.1 The geotextile meets the requirements of MCHW, Volume 1, sub-clause 514.4 (i), (ii) and (iii).

4.2 The measured apparent opening size (O_{90}) of both geotextiles when tested in accordance with BS 6906-2 : 1989 are listed in Tables 1 and 2 respectively. Due to the nature of the geotextiles the apparent opening size (O_{90}) may vary. The measured apparent opening size of the geotextile used in each batch of Linflex 9 will be supplied and this value should be as stated in Appendix 5/4 of the contract documents.

4.3 The measured rate of flow through the geotextiles, normal to their principal plane when tested in accordance with BS 6906-3 : 1989, are listed in Tables 1 and 2 respectively. Due to the nature of the geotextiles, the rate of flow may vary. The measured flow rate of the geotextile used in each batch of Linflex 9 will be supplied and this value should be as stated in Appendix 5/4 of the contract documents.

5 Joints

The jointing employed in the system must comply with the requirements of MCHW, Volume 1, sub-clause 515.3.

6 Pipes

The drainage pipes used with Linflex 9 must comply with the requirements of MCHW, Volume 1, sub-clause 515.4.

7 Backfill and surround material

These materials should comply with the requirements of MCHW, Volume 1, sub-clause 515.5.

Installation

8 Procedure

8.1 Linflex 9 must be installed in accordance with the requirements of MCHW, Volume 1, sub-clause 515.7, Volume 3, Drawings Nos F18 and F20, and the manufacturer's instructions.

8.2 Joints between sections of geotextile should be made by using minimum 600 mm overlap secured with pins or mechanical ties.

8.3 If damage to the geotextile is sustained, the damaged section should be cut out and jointed (see section 8.2).

Technical Investigations

The following is a summary of the technical investigations carried out on the geotextile used in Linflex 9.

9 Tests

Tests were performed on samples representative of the general manufactured product. The results of these tests, which are typical for the product, are summarised in Tables 1 and 2.

Table 1 Geotextile Terram (1000B)

Test (units)	Method[1]	Mean results	
		Machine	Cross
Tensile strength (kNm^{-1})	BS 6906-1	6.90	10.27
Elongation (%)	BS 6906-1	20.0	20.7
Puncture resistance (N)	BS 6906-4	1314	
Tear resistance (N)	ASTM D 4533-85	335	369
Pore size O_{90} (µm)	BS 6906-2	82.0	
Water flow ($lm^{-2}s^{-1}$)	BS 6906-3	79.5	
Breakthrough head (mm)	BS 6906-3	23	

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

Table 2 Geotextile (Bontec) 8/8

Test (units)	Method[1]	Mean results	
		Machine	Cross
Tensile strength (kNm^{-1})	BS EN ISO 10319	12.62	10.29
Elongation (%)	BS EN ISO 10319	40.3	46.3
Puncture resistance (N)	BS EN ISO 12236	1902	
Tear resistance (N)	ASTM D 4533-85	289.3	294.3
Pore size O_{90} (µm)	BS 6906-2	136	
Water flow ($lm^{-2}s^{-1}$)	BS 6906-3	183.6	
Breakthrough head (mm)	BS 6906-3	zero	

(1) The test documents are detailed in the *Bibliography*. Numbers in the table refer to sections/parts of the various documents.

10 Investigations

10.1 An examination was made of data on the product's resistance to:

the deleterious effects of short-term exposure to ultraviolet light

degradation by acids, alkalis and other common chemicals (including oil, petrol and diesel)

the effects of bacteria, fungi and moulds found in soil or highway construction materials.

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

Bibliography

BS 6906-1 : 1987 *Methods of test for geotextiles — Determination of the tensile properties using a wide width strip*

BS 6906-2 : 1989 *Methods of test for geotextiles — Determination of the apparent pore size distribution by dry sieving*

BS 6906-3 : 1989 *Methods of test for geotextiles — Determination of water flow normal to the plane of the geotextile under a constant head*(1)

BS 6906-4 : 1989 *Methods of test for geotextiles — Determination of the puncture resistance (CBR puncture test)*

(1) Modified version used for testing flow rate (see section 5.1).

ASTM D 4533-85 *Standard test method for trapezoid tear strength of geotextiles*

BS EN ISO 10319 : 1996 *Geotextiles — Wide-width tensile test*

BS EN ISO 12236 : 1996 *Geotextiles and geotextile-related products — Static puncture test (CBR-Test)*

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