Test Report

Report No	285/005181
Licence/Certificate No	AP02569
Client	Fibrelite Composites Limited Snaygill Industrial Estate Keighley Road Skipton North Yorkshire BD23 2QR
Authority & date	BSI Product Certification Form PCE002 Dated 20 July 1998 Contract No 20282 Sample ID 39934
Items tested	Composite Manhole Tops
Specifications	BS EN 124:1994 PAS 26:1998 Type Test for product certification
Results	Pass - See Summary of Results on Page 2
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Authorized by	D T Gall
Issue Date	21 AUGUST 1998
Conditions of issue	This Test Report is issued subject to the conditions stated in current issue of *Test Leaflet 1* 'General conditions relating to acceptance of testing'. The results contained herein apply only to the particular sample/s tested and to the specific tests carried out, as detailed in this Test Report. The issuing of this Test Report does not indicate any measure of Approval, Certification, Supervision, Control or Surveillance by BSI of any product. No extract, abridgement or abstraction from a Test Report may be published or used to advertise a product without the written consent of the General Manager, BSI Product Services, who reserves the absolute right to agree or reject all or any of the details of any items or publicity for which consent may be sought.

TESTING, EXAMINATION AND ASSESSMENT OF COMPOSITE MANHOLE TOPS SUBMITTED AS TYPE TESTING SAMPLES

INTRODUCTION

At the request of BSI Product Certification the composite manhole tops detailed below, submitted on behalf of Fibrelite Composites Limited were tested and assessed against the requirements of BS EN 124:1994 and PAS 26:1998 as indicated on the following pages of this Report
This request was made on Form PCE002 dated 20 July 1998 Contract No 39934.
It is emphasized that assessments were not made against the other clauses of the Specification.

The tests and assessments contained in this Report were undertaken by BSI Product Services from June 1998.

TEST ITEMS

Sample No	Class	Manufacturer's code	Component Description
1	C250	FL10	Composite manhole top
2	C250	FL36	Composite manhole top
3	C250	FL76	Composite manhole top

SUMMARY OF RESULTS

The test items met the requirements of those clauses of the Specification, or parts thereof, against which assessments were made.

Reference should be made to clause 9 of BS EN 124 and Clause 5 of PAS 26 for Sample Nos 1 to 3.

SAMPLE NO: 1

BS EN 124:1994

COMPONENT DESCRIPTION: Class C250, Type FL10, Manhole cover and frame

EXAMINATION AND TEST

CLAUSE **ASSESSMENT**

4. CLASSIFICATION

The manhole top was designated class C250

5. PLACE OF INSTALLATION

The manhole top was intended for installation in a Group 2 area (appropriate area as defined in PAS 26)

6. MATERIALS

6.1 General

6.1.3 Other materials

The manhole top was made from a composite material.
The manhole top was also subjected to the additional tests and assessments as detailed in pages 12 to 18 of this Report (PAS 26:1998).

EXAMINATION AND TEST (CONTINUED)

CLAUSE **ASSESSMENT**

7. DESIGN REQUIREMENTS

7.1 General

The manhole top was free of defects which might impair its fitness for use.

7.3 Clear openings of manhole tops for man entry

	Actual
Clear opening (mm)	765 x 765

7.5 Total clearance

	Specified	Actual
Total clearance, a (mm)	9 max	2.4

7.6 Seatings

The manufacture of the manhole top was such as to ensure the compatibility of its seating. Pass

7.8 Securing of the cover/grating within the frame

The cover was secure within its frame.
This was achieved by means of the seating arrangement.
This arrangement was designed so as to allow opening of the cover by means of usual tools Pass

7.12 Surface condition

For information: Not applicable - see clause 4.3 of PAS 26 (skid resistance)

7.13 Loosening and opening of covers and gratings

Provision for the effective loosening and for the opening of the cover was made by means of one closed keyway incorporated in the cover

7.15 Frame bearing area

The frame bearing area was designed in such a way that it provided an adequate contribution to stability under working conditions.

	Specified	Actual
Bearing pressure in relation to test load (N/mm^2)	7.5 max	1.26

EXAMINATION AND TEST (CONTINUED)

CLAUSE			ASSESSMENT
8.	**TESTING**		
8.3.1	**Measurement of permanent set of the cover or grating after the application of 2/3 of the test load**		
	(167 kN) **Specified**	**Actual**	
	Permanent set (mm) 2.55 max	0.53	Pass
	For information		
	Clear opening (mm)	765 x 765	
8.3.2	**Application of the test load**		
	The unit was capable of withstanding a test load of 250kN without cracking		Pass
9.	**MARKING**		
	The marking on the unit was not intended to comply with the requirements of this clause.		
	For information:		
	(marked on cover) Fibrelite Pat Nos US 4662777 US 4726707 Euro 0147050		
	There was no marking on the frame.		
	See also clause 5 of PAS:26 (page 18 of this Report)		

SAMPLE NO: 2

BS EN 124:1994

COMPONENT DESCRIPTION: Class C250, Type FL36, Manhole cover and frame

EXAMINATION AND TEST (CONTINUED)

CLAUSE	**ASSESSMENT**

4. CLASSIFICATION

The manhole top was designated class C250

5. PLACE OF INSTALLATION

The manhole top was intended for installation in a Group 2 area (appropriate area as defined in PAS 26)

6. MATERIALS

6.1 General

6.1.3 Other materials

The manhole top was made from a composite material.
The manhole top was also subjected to the additional tests and assessments as detailed in pages 12 to 18 of this Report (PAS 26:1998).

EXAMINATION AND TEST (CONTINUED)

CLAUSE **ASSESSMENT**

7. DESIGN REQUIREMENTS

7.1 General

The manhole top was free of defects which might impair its fitness for use. Pass

7.3 Clear openings of manhole tops for man entry

	Actual
Clear opening (mm)	902 dia

7.5 Total clearance

	Specified	Actual
Total clearance, a (mm)	9 max	8.0

7.6 Seatings

The manufacture of the manhole top was such as to ensure the compatibility of its seating.

7.8 Securing of the cover/grating within the frame

The cover was secure within its frame.
This was achieved by means of the seating arrangement.
This arrangement was designed so as to allow opening of the cover by means of usual tools

7.12 Surface condition

For information: Not applicable - see clause 4.3 of PAS 26 (skid resistance)

7.13 Loosening and opening of covers and gratings

Provision for the effective loosening and for the opening of the cover was made by means of one closed keyway incorporated in the cover

7.15 Frame bearing area

The frame bearing area was designed in such a way that it provided an adequate contribution to stability under working conditions.

	Specified	Actual
Bearing pressure in relation to test load (N/mm^2)	7.5 max	1.26

EXAMINATION AND TEST (CONTINUED)

CLAUSE **ASSESSMENT**

8. TESTING

8.3.1 Measurement of permanent set of the cover or grating after the application of 2/3 of the test load

(167 kN)	**Specified**	**Actual**
Permanent set (mm)	3.01 max	0.59

For information

Clear opening (mm)	902 dia

8.3.2 Application of the test load

The unit was capable of withstanding a test load of 250kN without cracking

9. MARKING

The marking on the unit was not intended to comply with the requirements of this clause.

For information:

(marked on cover)
Fibrelite FL36 PROTECTED BY US
GRANTED PATENT APPLICATIONS
C ALL RIGHTS RESERVED
MADE IN THE UK A

There was no marking on the frame.

See also clause 5 of PAS 26:1998 (page 18 of this Report)

SAMPLE NO: 3

BS EN 124:1994

COMPONENT DESCRIPTION: Class C250, Type FL76, Sealed manhole cover and frame

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT
4.	**CLASSIFICATION** The manhole top was designated class C250	
5.	**PLACE OF INSTALLATION** The manhole top was intended for installation in a Group 2 area (appropriate area as defined in PAS 26)	
6.	**MATERIALS**	
6.1	**General**	
6.1.3	**Other materials** The manhole top was made from a composite material. The manhole top was also subjected to the additional tests and assessments as detailed in pages 12 to 18 of this Report (PAS 26:1998).	Pass

EXAMINATION AND TEST (CONTINUED)

CLAUSE **ASSESSMENT**

7. DESIGN REQUIREMENTS

7.1 General

The manhole top was free of defects which might impair its fitness for use. Pass

7.3 Clear openings of manhole tops for man entry

	Actual
Clear opening (mm)	760 x 760

7.5 Total clearance

	Specified	Actual
Total clearance, a (mm)	9 max	3.6

7.6 Seatings

The manufacture of the manhole top was such as to ensure the compatibility of its seating.

7.8 Securing of the cover/grating within the frame

The cover was secure within its frame.
This was achieved by means of the seating arrangement.
This arrangement was designed so as to allow opening of the cover by means of usual tools

7.12 Surface condition

For information: Not applicable - see clause 4.3 of PAS 26 (skid resistance)

7.13 Loosening and opening of covers and gratings

Provision for the effective loosening and for the opening of the cover was made by means of one closed keyway incorporated in the cover

7.15 Frame bearing area

The frame bearing area was designed in such a way that it provided an adequate contribution to stability under working conditions.

	Specified	Actual
Bearing pressure in relation to test load (N/mm^2)	7.5 max	1.17

EXAMINATION AND TEST (CONTINUED)

CLAUSE **ASSESSMENT**

8. TESTING

8.3.1 Measurement of permanent set of the cover or grating after the application of 2/3 of the test load

(167 kN)	**Specified**	**Actual**
Permanent set (mm)	2.53 max	0.23

For information

Clear opening (mm)	760 x 760

8.3.2 Application of the test load

The unit was capable of withstanding a test load of 250kN without cracking

9. MARKING

The marking on the unit was not intended to comply with the requirements of this clause.

For information:

(marked on cover)
Fibrelite FL76 PROTECTED BY US
GRANTED PATENT APPLICATIONS
C ALL RIGHTS RESERVED
MADE IN THE UK

There was no marking on the frame.

See also clause 5 of PAS 26:1998 (page 18 of this Report)

PAS 26:1998 Manhole tops intended for use on service station forecourts and pavement areas

EXAMINATION AND TEST

CLAUSE		ASSESSMENT
3	**Materials**	
3.1	**Composite and plastics material** The material from which the manhole top was produced comprised a composite material cover and aluminium frame, to enable manufacture of a manhole top conforming to BS EN 124 (See pages 3 to 11 of this Report) and the other requirements of PAS 26 as applicable.	
3.1.1	**Hardness** Samples were cut from the manhole cover and tested in accordance with BS 2782-10:Method 1001.	

	Specified	Actual	
Mean Barcol Hardness	35 min	36.9*	Pass

* Mean hardness of 10 readings on top of cover and 10 readings on bottom of cover.

3.1.2 **Tensile properties**

Samples were cut from the manhole cover and tested in accordance with BS 2782-10:Method 1003. For each test two sets of samples were cut at 90° to each other.

	Specified	Actual Mean	
σ_f (MPa)	222 min	233.0	Pass
E_f (GPa)	15 min	15.65	Pass

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT

3.1.3 Flame resistance

Material samples were manufactured, in accordance with BS 476-7 clause 4.3.1, and were tested in accordance with BS 476-7.

	Specified	Actual*
Fire rating achieved (min)	Class 2	Class 2

*LPC Test Report No TE91221 dated 18 June 1998 refers.

3.1.4 Chemical resistance

Two sets of samples were cut from a manhole top and tested in accordance with BS 903-A18. The samples were weighed before commencing the conditioning.

One set of samples were conditioned for seven days at 23 ± 2°C in reference solution 60% volume toluene, 40% volume enheptane and the other set of samples were conditioned for seven days at 23 ± 2°C in diesel. The samples were subsequently tested in accordance with clause 3.1.2 of PAS 26.

FL 10 samples - reference solution toluene/enheptane	**Specified**	**Actual mean**
Change in mass (%)	0.5 max	+0.140
Change in flexural strength (%)	-20 max	+19.6
Change in flexural modulus (%)	-30 max	-1.58

FL 10 samples - diesel	**Specified**	**Actual mean**
Change in mass (%)	0.5 max	+0.168
Change in flexural strength (%)	-20 max	+10.8
Change in flexural modulus (%)	-30 max	-4.41

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT

3.1.5 Surface resistivity

Samples were cut from a manhole top and tested in accordance with BS 2050: Appendix A 4.1

The surface resistivity was less than $1k\Omega/cm^2$

FL10 sample	Specified	Actual
Surface resistivity ($k\Omega/cm^2$)	1 max	0.0144

3.2 Composite material

3.2.1 Weathering resistance

Samples were cut from the bottom surface of a manhole top, and cycled in accordance with BS 7413 Appendix H. Tests were in accordance with BS 2782:Part 5:Method 540E

The samples met the requirements of clauses 3.2.2 and 3.2.3 — Pass

3.2.2 Aged flexure

Samples were cut from a manhole top and tested in accordance with BS 2782:Part 10:Method 1005.

The change of flexural strength and flexural modulus was not more than -30% and -40% respectively.

BSI Report No 285/000184 refers

3.2.3 Colour fastness

Samples were cut from a manhole top and tested in accordance with BS 1006:A02 . Five representative test pieces were retained and stored in a dark, dry place at (20 ± 5)°C for later comparison with the exposed test pieces. The colour change was equal to or not less than 3 to 4 on the grey scale.

BSI Report No 285/000184 refers

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT
4	**Performance**	
4.1	**Stress relief** A manhole top was tested in accordance with BS EN 295-3:1991, 16.3 at a temperature of (150 ± 5)°C for 1 h. **FL 10 manhole top:** There were no visible defects, blistering, cracks or delaminations	
4.2	**Impact resistance** A manhole top was conditioned at a temperature of -20 ± 2°C for 1 h. A 4.5 ± 0.1 kg indenture with a 50 ± 1mm diameter hemispherical end was dropped from a height of 1m ± 10mm onto the manhole top. **FL 10 manhole top:** There was no visible cracking	
4.3	**Skid resistance** A manhole top was tested in accordance with BS 812:Part 114. The skid resistance (dry condition) was not less than 55.	

FL 36 manhole top	**Specified**	**Actual mean**
Skid resistance	55 min	68.9

4.4	**Fuel exposure resistance**	
4.4.1	**Petrol exposure** 500 ± 10mL of reference solution 60% volume toluene, 40% volume enheptane was poured over a manhole top. This was repeated at 24 hourly intervals for 30 days. After the 30 day period the manhole top was tested in accordance with BS EN 124:1994, clause 8.3.1. The manhole top met the requirements for permanent set specified in BS EN 124:1994, clause 8.3.1.	

FL 76 manhole top	**Specified**	**Actual**
Permanent set (mm)	2.53 max	0.48

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT

4.4.2 Diesel exposure

500 ± 10mL of grade 50-53 CN diesel fuel (commercial grade - EN 590) was poured over a manhole top. This was repeated at 24 hourly intervals for 30 days. After the 30 day period, the manhole top was tested in accordance with BS EN 124:1994, 8.3.1.

The manhole top met the requirements for permanent set specified in BS EN 124:1994, clause 8.3.1.

FL 76 manhole top	**Specified**	**Actual**
Permanent set (mm)	2.53 max	0.04

4.5 Thermal stability

4.5.1 A manhole top was conditioned at 60 ±2°C for 30 days. After the 30 day period the manhole top was allowed to cool to ambient conditions and was tested in accordance with clause 4.2.

The manhole top showed no visible cracking

FL 10 manhole top	**Specified**	**Actual**
Cold impact at -20°C	No cracking	No cracking

4.5.2 A manhole top was conditioned at 60 ± 2°C for 30 days. After the 30 day period the manhole top was allowed to cool to ambient conditions and was tested in accordance with BS EN 124:1994, clause 8.3.1.

The manhole top met the requirements for permanent set specified in BS EN 124:1994, clause 8.3.1.

FL 10 manhole top	**Specified**	**Actual**
Permanent set (mm)	2.53 max	0.60

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT

4.6 Water ingress resistance

The manhole top was tested as follows:

A water reservoir was created over the sealing arrangement of the manhole top to a depth of 50 ± 5mm for 7 h.

FL 76 manhole top:
The sealing arrangement showed no visible sign of leakage through the seal.

With the reservoir remaining above the sealing arrangement a load of 5 ± 0.2 tonnes was applied at a rate of between 1kN/s and 5kN/s through a test block as specified in BS EN 124:1994, clause 8.2.2. Once the load was achieved, it was released immediately.

FL 76 manhole top:
The sealing arrangement showed no visible sign of leakage through the seal

4.7 Creep resistance

A manhole top was loaded to the permanent set load specified in BS EN 124:1994, clause 8.3.1 for 60 -0/+ 1min. The manhole top was allowed to recover for 5 -0.5/+ 0min after complete removal of the load. The manhole top was tested in accordance with BS EN 124:1994, clause 8.3.1.

The manhole top met the requirements for permanent set specified in BS EN 124:1994, clause 8.3.1.

FL 10 manhole top	**Specified**	**Actual**
Permanent set (mm)	2.53 max	0.76

EXAMINATION AND TEST (CONTINUED)

CLAUSE		ASSESSMENT
4.8	**Dynamic load** A manhole top was loaded at a rate between 1kN/s and 5kN/s to achieve a load of 10 ± 0.2 tonnes. The load was released and repeated for 10,000 cycles. Upon completion of the 10,000 cycles the manhole top met the requirements of permanent set specified in BS EN 124:1994, clause 8.3.1.	

FL 10 manhole top	**Specified**	**Actual**
Permanent set (mm)	2.53 max	0.99

5	**Marking** Manhole tops shall, in addition to markings in accordance with BS EN 124:1994, clause 9, also bear the following marking: PAS 26:1998 (as the marking of this Product Assessment Specification). The manufacturer's representative provided evidence of the proposed PAS 26/EN 124 marking of the units The proposed marking meets the requirements of PAS 26/EN 124.	