TYPE APPROVAL CERTIFICATE

Certificate No:
TAK000008A
Revision No:
4

This is to certify:

That the Plastic Piping System, Fibre Reinforced Thermosetting

with type designation(s)
Fiberdur EP - GRE system, Fiberdur CS EP - GRE system

Issued to
TPR Fiberdur GmbH & Co. KG.
Aldenhoven, Germany

is found to comply with
DNV rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV-OS-D101 – Marine and machinery systems and equipment, Edition July 2021
DNV class programme DNV-CP-0070 – Type approval – Fibre reinforced thermosetting plastic piping systems

Application :

Essential and non - essential systems according to DNV-RU-SHIP Pt.4 Ch.6 - Table 1 - Fire Endurance Matrix.
External pressure rating up to 4bar see certificate.
Fire endurance level L3.
The Fiberdur GRE plastic piping system is accepted for installation on all vessels classed by DNV.

Issued at **Hamburg** on **2024-06-18**

This Certificate is valid until **2026-06-02**.
DNV local unit: **Essen**

Approval Engineer: **Hagen Markus**

for **DNV**

Digitally Signed By: Klinger, Sven
Location: DNV GL SE Hamburg, Germany
Signing Date: 24.06.2024

Sven Klinger
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

Filament Wound Fibre Reinforced Thermosetting Epoxy Resin Pipe and Fittings, Conductive and Non-Conductive.

Design Types

FIBERDUR EP - Metric	GREP system non-conductive	Additional liner of 0.5mm	Metric inside diameters
FIBERDUR CS EP - Metric	GREP system conductive (NAVICON)	Additional liner of 2.5mm	
FIBERDUR EP - ISO	GREP system non-conductive	Additional liner of 0,5 mm	ISO inside diameters
FIBERDUR CS EP - ISO	GREP system conductive Navicon	Additional liner of 2,5 mm	

Standard fittings

Elbows (22,5°, 30°, 45°, 60°, 90°), tees, reducing tees, coupling (adhesive bonding), reducers.

Joining methods

Lamination joining, Conical to Cylindrical, Conical to Conical pipe adhesive bonded joint, Key-lock joints type RSLJ (10 bar, up to 65°C) and flange connections.

Type overview - Metric

Types	Nominal Diameter DN	Nominal Pressure PN	Collaps pressure	External pressure rating
EP 10, CS EP	25 - 1000	10	3.0bar up to DN100[1]	1.0 up to DN100[1]
EP 16, CS EP	25 - 1000	16		
EP 10 Fibermarine CS EP Fibermarine	25 - 1000	10	3.0bar[2]	1,0
EP 16 Fibermarine CS EP Fibermarine	25 - 1000	16	3.0bar[2]	1,0
EP 16 Fibermarine HighLine CS EP Fibermarine HighLine	25 - 1000	16	12bar[3]	4,0[3]

Notes
[1] EP and CS EP pipes with DN>100 are not collapse resistant
[2] Full vacuum with safety factor 3:1, collapse pressure 3bar
[3] Full vacuum plus 3bar outside pressure with safety factor 3:1, collapse pressure 12bar

Type overview – Fiberdur ISO Pipe EP16[2]

Types	Nominal Diameter DN	Nominal Pressure PN	Collaps pressure	External pressure rating
EP 10, 16 ISO CS EP 10, 16 ISO	40-300	10, 16	see table on page 3	

Notes
[2] EP, CSEP 10 & 16 ISO pipes have the same wall thickness.

Definition of external pressure rating

External pressure rating is the summ of vacuum pressure inside the pipe and pressure out side the pipe.
Safety factor: 3.

Example EP 10 Fibermarine Metric size – External pressure rating 1bar
Application: Vacuum (full) pressure service (-1 barg):
Approved pressure outside the pipe is 0 bar that means pipe routing within tanks is not approved.

Non-vacuum service (+barg): Approved pressure outside is 1.0 bar, routing in tanks is approved.

Dimensions Pipes - Metric inside diameters

Nominal structural wall thickness in mm (excl. internal liner 0.5 or 2.5 and top coat 0.3mm)

Nominal Diameter DN Inside Diameter ID	EP/CS EP PN10	EP/CS EP PN16	EP/CS EP Fibermarine PN10, PN16	EP/CS EP Fibermarine HighLine PN16
25	1.6	1.6	1.6	1.6
40	1.6	1.6	1.6	1.6
50	1.6	1.6	1.6	1.6
65	1.6	1.6	1.6	1.9
80	1.6	1.6	1.6	2.3
100	1.6	1.6	1.8	2.9
125	2.0	2.0	2.3	3,6
150	1.6	2.4	2.7	4,3
200	2.0	3.2	3.6	5.7
250	2.4	3.6	4.5	7.1
300	3.2	4.8	5.3	8,5
350	4.0	5.6	6.2	9.9
400	4.0	6.4	7.1	11.3
450	4.8	7.2	8.0	12.7
500	4.8	7.2	8.8	14.2
600	5.6	8.8	10.6	17.0
700	6.4	10.4	12.4	19.8
800	7.2	12.0	14,1	22.6
900	8.0	12.8	15.4	24.9
1000	9.6	14.4	17.2	27.8

Dimensions Pipes - ISO inside diameters

Nominal structural wall thickness in mm (excl. internal liner 0.5 or 2.5 and top coat 0.3mm)

DN	Inside Diameter ID mm	Structural wall thickness (S3) mm	Collaps pressure bar	External pressure rating bar
40	41.9	2.0	12.0	4.0
50	53.9	2.0	12.0	4.0
65	67.9	2.0	12.0	4.0
80	83.0	2.0	7.5	2.5
100	107.1	2.4	6.3	2.1
125	131.8	4.1	12.0	4.0
150	160.1	3.8	6.9	2.3
200	209.4	4.3	5.7	1.9
250	262.8	4.7	3.8	1.3
300	312.2	6.1	3.15	1.05

External pressure rating is the summ of vacuum inside the pipe and pressure out side the pipe.

Example DN 200

Vacuum pressure service (-1.0barg): Approved pressure outside the pipe is 0.9bar
Non - vacuum service (> 0barg): Approved pressure outside is 1.9bar

Application/Limitation

The Fiberdur GREP piping systems, EP10 ISO and EP16 ISO, EP/CS EP Fibermarine and Fibermarine HighLine, are type approved for application in piping systems as listed in “Table 1- Fire endurance requirements matrix” specified in DNV-RU-SHIP Pt.4 Ch.6, Section 2.

Approved installation locations where “0” or “L3” is specified in the matrix. Appropriate footnotes are to be observed. Not approved for installation locations where “NA” or “X” is indicated.

In addition piping system system EP10 ISO and EP16 ISO and EP/CS EP Fibermarine and Fibermarine HighLine are approved for exhaust gas scrubber systems acc. to DNV-RU-SHIP Pt.6 Ch.2 Section 7 Exhaust Cleaning Systems for the reduction of NOx or Sox – ER.

For installation on Offshore units the requirements specified in DNV-OS-D101 Marine and machinery systems and equipment are to be observed.

The GREP piping systems of type EP10 Metric and EP16 Metric with sizes > DN100 are not external pressure resistant and are therefore not approved for the use in piping systems as listed in DNV-RU-SHIP Pt.4 Ch.6 Section 2 “Table 1 - Fire endurance requirement matrix” and exhaust gas scrubber systems, except non-essential piping systems.

Maximum internal operating pressure

Media temperature	EP/CS EP10 [bar]	EP/CS EP 16 [bar]	EP/CS EP Fibermarine 10/16 [bar]	EP/CS EP Fibermarine HighLine 16 [bar]
- 50°C up to + 80°C	10	16	10/16	16
up to 95°C	8	13	8/13	13

Extent of Type Tests applicable to piping system dependent on application
Fire endurance Level 3 according to IMO Resolution A.753 (18), Appendix 2

Piping system types

EP/CS EP Fibermarine PN10, PN16 and EP/CS EP Fibermarine HighLine PN16, EP ISO

Pipe joining methods

Conical to Cylindrical pipe adhesive bonded joint
Fire barrier acc. to Technical Bulletin 12

Metric / ISO Inside diameter ID[1]	ISO inside pipe diameter ID[1]	Fire barrier	Design requirements
25 up to 50	41,9 up to >53.9	10 mm	Design according to TPR Fiberdur “Technical Bulletin 12”. Fire insulation for pipes and pipe connections.
≥ 50 up to 100	≥ 53.9 up to 107.1	5 mm	
≥ 100 up to 125	≥ 107.1 up to 131.8	2.5 mm	
≥ 150	≥160.1	None	

Flange connection

Fire insulation with metal sheet cover

Reference
"Technical Bulletin 25 – Procedure application A60 Rockwool and Metal Shielding on top of GRP Flanges"

Flange types	Inside pipe diameter ID mm
GRE collar with metallic loose flange	50 up to 1000
GRE fixed flange connection	

Fire insulation with pads

References
"Technical Bulletin 25a - Procedure application of Insulation pads for L3 Flange connections"
"Dimensional sheet of the insulation pad"

Flange types	Inside pipe diameter ID mm
GRE collar with metallic loose flange	50 up to 1000
GRE fixed flange connection	

Installation of fire barrier

The fire protective layers shall be applied during spool building or installation by the responsible installer or contractor. For each application piping system characteristics as thermal expansion, resistance against vibrations, and elasticity shall be considered.

Flame spread

Surface flame spread characteristics is determined by ASTM D635-HB : 2006.

Smoke and toxicity

The Fiberdur GREP piping system is not tested with respect to smoke and toxicity characteristics.

Electrical conductivity

For installation in gas hazardous areas or conveying non- conductive fluids, the GRE conductive system is to be used.

Piping system	Electrically conductive	
	outside	inside
GRE system non-conductive	no	no
GRE conductive	yes	yes

Where conductive piping is required, the resistance per unit length of the pipe, bends, elbows, fabricated branch pieces etc., should not exceed 10^5 Ω/m.
After installation, the conductivity of the piping system shall be measured, and the resistance to earth from any point in the piping system shall not exceed 10^6 Ω to earth.
Reference: DNV-RU-SHIP Pt.4 Ch.6 – Sec. 9 and 10.

Passenger vessels

For application on passenger vessels additional requirements specified in the Rules and Regulations of the appropriate flag state authority may have to be observed.

Installation

For the design and installation of piping systems the following documents issued by TPR Fiberdur are to be observed:

Instruction	Edition
"Planning with Fiberdur"	05/2021
"Assembly Instruction for Lamination"	03/2022
"Assembly Instruction for Adhesive Bonding Technology"	03/2022
"SITE INSTALLATION MANUAL" (Pipe-Fitters Manual)	11/2018
"Technical Bulletin 12 - Procedure application Favuseal on top of GRP pipe & fittings"	11/2020
"Technical Bulletin 25 – Procedure application A60 Rockwool and Metal Shielding on top of GRP Flanges"	04/2021
"Technical Bulletin 25a - Procedure application of Insulation pads for L3 Flange connections"	03/2024

In addition, the DNV-RU-SHIP Pt.4 Ch.6 – Section 10 – [4 Installation of Plastic Piping Systems] is to be observed.

Bulkhead and Deck pipe penetration

General

When plastic pipes pass through watertight bulkheads or decks, the watertight integrity of the bulkhead or deck is to be maintained by installation of external pressure resistant pipe types specified in tables on page 2.
External pressure resistance level required by water head or/and vacuum in the pipe is to be observed.

In general pipe penetration through watertight bulkheads or decks as well as through fire divisions shall be type approved unless the penetration pipe is welded into the bulkhead/deck.

Plastic pipes passing watertight bulkheads or decks which are also a fire division, and a fire may cause flooding of watertight compartments, the watertight integrity of the bulkhead or deck is to be maintained by a metallic shut-off valve fitted at the bulkhead or deck. The operation of this valve shall be provided from above the freeboard deck.

Refer to DNV-RU-SHIP Pt.4 Ch.6 Section 3 – [1.4 Fittings on watertight bulkheads].

Special cases

Non external pressure resistance pipe dimensions

In case GREP piping systems of type EP 10 Metric and EP16 Metric pipe sizes > DN100 penetrate watertight bulkheads, one of the following two arragements shall be applied:

a) a steel spool piece of 900mm in length, preferable 450mm on each side, with wall thickness acc. to DNV-RU-SHIP Pt.4 Ch.6 Sec. 9 [1.2.1] is arranged at the watertight penetration.
A remote operated emergency shut off valve shall be arranged between the steel spool piece and the plastic pipe on one side. This valve shall be of safe to close type, or else the control including hydraulic piping and electric cables must be routed inboard of B/5, but preferably to CL, before being routed longitudinally. On the opposite side the plastic pipe shall be flanged or similar to the steel spool piece.
or:
b) two manual valves, one each side of the steel spool piece in a) are arranged, under the provision that these valves are easily accessible.

Reference: DNV-RU-SHIP Pt.4 Ch.6 Section 2 – [1.7.6].

Passenger vessels – SOLAS Ch. II-1 – Reg. 13.2.3

On passenger vessels, where the watertight bulkhead is also a fire division, pipe penetration design shall comply to MSC.429(98), Section Reg. 13.2.3 are to be observed.

TPR Fiberdur type tested design for watertight / gastight bulkhead pipe penetration.

This type approval certificate includes TPR Fiberdur bulkhead penetration designed according to "Test report Bulkhead penetration 80mm and 600mm, December 2016".

Range of application: Pipe penetration through water tight divisions on passenger and non-passenger vessels.

The penetration is type tested according to DNV CP-0165 for penetration of watertight and gastight divisions. Water tightness up to 2.5 bar, Gas tightness up to 30 mbar.

The following conditions applies

- GRP pipes of type EP/CS EP Fibermarine or Fibermarine HighLine shall be used, depending on the level of external pressure resistance required, under consideration of vacuum condition inside the pipe.
- The air gap between outside GRP pipe and inside Steel pipe shall be between 15 and 25 mm.
- The minimum wall thickness of the steel sleeve shall be 12.5 mm.

Dimensions of water – gas tight pipe penetration

GRP pipe			Relation of pipe length GRP / Steel	Steel pipe length mm
DN	Outer diameter[1] mm	Minimum total wall thickness mm		
80	84.8	2.3	≥1.5 times diameter of GRVE pipe	120-160
100	104.8	2.9		150-200
125	130.6	3.6		190-250
150	158	4.3		225-300
200	210	5.7		300-400
250	263	7.1	≥1.0 times diameter of GRVE pipe	250-375
300	315	8.5		300-450
350	367	9.9		350-525
400	420.6	11.3		400-600
450	474.6	12.7		450-675
500	526.3	14.2		500-750
600	630.2	17.0		600-900

Design details watertight / gastight bulkhead penetration

Components

Primer	Phillyclad 7 CZ primer
Epoxy Resin	Chockfast Orange PR-610TCF
Sealant	Phillybond Orange
Processing temperature	>16°C up to 25°C

Type Approval documentation

Type Tests carried out

- Internal pressure short term and long-term test
- Water and gas tightness tests on bulkhead penetration
- External pressure test on EP/CSEP and ISO pipes acc. to ASTM D 2924, Fig 2- Procedure B
- External load acc. to CP-070
- Electrical conductivity acc. to CP-070
- Load deformation acc. to ASTM D2412
- Bonding Procedure Qualification test acc. to ASTM D 1598/ASTM D 2992
- HDT test acc. to ISO 75-2:2013
- Axial tensile strength acc. to ASTM D 2105-14
- Fire endurance test acc. to IMO Res. 753(18) Appendix 2 - L3 on pipe joints
- Surface flammability (flame spread) acc. to ASTM D635.

Production Places

Manufacturing place	Scope of products
TPR Fiberdur GmbH & Co. KG., D-52457 Aldenhoven	Pipes and Fittings
FIBERDUR S.R.L, 669 Dorobantilor Blvd., Warehouse C3(B2), Braila, Braila County, Romania.	Fittings

Production Testing

Each batch of pipes and fittings shall be subjected to product tests according to Fiberdur Instruction QIP AA014, Rev. B and “Quality Handbook – FIBERDUR S.R.L. Braila”.

Marking of product

To ensure traceabilty from the final product to this type approval certificate each pipe or pipe spool is to be marked at least with:

Pipes

Scope		Example
Manufacturer's name and / or logo		
Type designation / material of which the pipe or fitting is made		GREP Fibermarine HighLine 16
Size / dimensions		DN200
Type of joining method		L=laminate system, K=adhesion bonding system
Nominal design pressure PN	internal	PN16
	external	PN -4
Working pressure at max. service temperature	internal	WP16bar@80°C, >80°C see DNV certificate
Conductive / non-conductive		C / NC
Barcode plus number		

Fittings

Scope		Example
Manufacturer's name and / or logo		
Type designation / material of which the fitting is made		REDUCER-CONC.-GREP DN600/400 Fibermarine®, GREP DIN (Metric)
Size / dimensions		DN500/400
Type of joining method		L=laminate system, K=adhesion bonding system
Nominal design pressure PN	internal	PN10
	external	PN-1
Working pressure at max. service temperature	internal	Up to 95°C, (appropriate WP see DNV certificate)
Conductive / non-conductive		C / NC
Barcode plus number		

In addition, labels with the following text shall be attached to flanges which shall be joined by bolting:
“APPLY BOLTING TORQUE ACCORDING TO MANUFACTURER'S RECOMMENDATION”.

Periodical assessment

For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment to verify that the conditions for the Type Approval are complied with. Refer to the Class Programme DNV-CP-0338, Section 4.

In addition, burst pressure testing on pipe spools made of different pipe/fitting sizes and fitting types to be carried out in the course of renewal of the certificate.

To check the validity of this certificate, please look it up in https://approvalfinder.dnv.com

End of certificate