

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Plastic Pipes, Fibre Reinforced Thermosetting

with type designation(s)

Fiberdur VE - GRVE system, Fiberdur CS VE - GRVE system

Issued to

TPR Fiberdur GmbH & Co. KG

Aldenhoven, Germany

is found to comply with

DNV GL rules for classification – Ships

DNV GL class programme DNVGL-CP-0070 – Type approval – Fibre reinforced thermosetting plastic piping systems

Application :

The Fiberdur GRVE piping system is type approved for application in piping systems as listed in "Table 1 - Fire endurance requirements matrix" of DNV GL Rules Pt.4, Ch.6, Section 2.

Approved installation locations are where "0" or "L3" is specified. Refer to certificate.

Low flame spread capability tested according to ASTM D635.

The Fiberdur GRVE plastic piping system is accepted for installation on all vessels classed by DNV GL.

Issued at **Hamburg** on **2017-02-02**

This Certificate is valid until **2021-02-18**.

DNV GL local station: **Essen**

for **DNV GL**

Approval Engineer: **Hagen Markus**

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Olaf Drews
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 Vinylester Resin Pipe and Fittings
Conductive and Non-Conductive.

Design Types

FIBERDUR VE=GRVE system (VE system additional liner of 0.5mm)
FIBERDUR CSVE=GRVE system (CS VE additional liner of 2.5mm)

Product names

VE=GRVE Conductive (NAVICON) and non conductive	Nominal Diameter range DN	Nominal Pressure PN
VE CS VE	50 - 1000	10
VE CS VE	50 - 1000	16
VE Fibermarine CS VE Fibermarine	50 - 1000	10
VE Fibermarine CS VE Fibermarine	50 - 1000	16
VE Fibermarine HighLine CS VE Fibermarine HighLine	50 - 1000	16

Remarks

- VE and CS VE pipes with DN>100 are not collapse resistant
- The Fibermarine pipe withstand full vacuum with safety factor 3:1, collapse pressure 3 bar
- The Fibermarine HighLine withstand full vacuum plus 3bar outside pressure with safety factor 3:1, collapse pressure 12bar

Pipes

Structural wall thickness (excl. internal liner 0.5 or 2.5 and topcoat 0.3mm)

DN	VE 10 CS VE [mm]	VE 16 CS VE [mm]	VE Fibermarine PN10,16 CS VE Fibermarine PN10,16 collapse pressure 3 bar [mm]	VE Fibermarine HighLine PN16 CS VE Fibermarine HighLine PN16 collapse pressure 12 bar [mm]
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	15.9	25.4
1000	9.6	14.4	17.6	28.3

Fittings

Elbows (22,5°, 30°, 45°, 60°, 90°), tees, reducing tees, reducers, flanges.

Joining methods

Conical to Cylindrical and Conical to Conical pipe adhesive bonded joint.

Application/Limitation

The Fiberdur GRVE piping system is type approved for application in piping systems as listed in "Table 1- Fire endurance requirements matrix" of DNV GL Rules Pt.4, Ch.6, Section 2.
Approved installation locations are where "0" or "L3" is specified. Appropriate footnotes are to be observed.

Maximum internal operating pressure

Temperature [°C]	VE 10 CSVE 10	VE 16 CSVE 16	VE Fibermarine 10 CSVE Fibermarine 10	VE Fibermarine 16 CSVE Fibermarine 16 VE Fibermarine HighLine 16 CSVE Fibermarine HighLine 16
from -50 up to 60	10	16	10	16
at 80	6	10	6	10
at 95	4	6	4	6
<i>Remark:</i> Between 60°C and 95°C the maximum allowable pressure is to be determined by linear interpolation.				

Extent of Type Tests applicable to piping system dependent on application

Fire endurance Level

Fire Endurance Level 3 according to IMO Resolution A.753 (18), Appendix 2 includes the following sizes and pipe connections.

Type of connection	Size range DN	Fire Barrier ¹
Conical to Cylindrical pipe adhesive bonded joint	25 up to 50	10 mm
	> 50 up to 100	5 mm
	> 100 up to 152	2.5 mm
	> 152	None

Footnote¹ Final layer of VE / glass laminates

Remarks

- Straight pipes shall be delivered from the manufacturer with the protective coating on.
- In considering fire protection coatings, such characteristics as thermal expansion, resistance against vibrations, and elasticity shall be taken into account for each installation.

Flame spread

Surface flame spread characteristics determined by ASTM D635:2006.

Smoke and toxicity

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

Electrical conductivity

The Fiberdur VE = GRVE system non-conductive is limited for installation in non-gas hazardous areas where as the GRVE conductive piping system is approved for installation in gas hazardous areas. Conductivity test is to be carried out after installation of piping system on board ship.

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.

Design and Installation of piping systems

For the design and installation of piping systems the following fiberdur® documents issued by TPR Fiberdur GmbH & Co. KG. are to be observed:

- "PLANNING WITH FIBERDUR", Edition 07/2011
- "INSTRUCTION FOR HANDLING AND INSTALLATION", Edition 07/2011
- "Procedure application Favuseal on top of GRP pipe & fittings", Edition 07-1-2015

In addition the installation conditions specific to the ship as well as IMO 753-(18) are to be observed.

Approved bulkhead penetration

The TPR Fiberdur bulkhead penetration according to "Test report Bulkhead penetration 80mm and 600mm", dated December 2016, is type approved for penetration of GRVE pipes (conductive and non-conductive) through watertight / gastight bulkhead penetration.
Water tightness up to 2,5 bar , Gas tightness up to 30 mbar.

In case of plastic pipes pass through watertight bulkheads or decks, the watertight integrity of the bulkhead or deck is to be maintained.

On passenger vessels, where the watertight bulkhead is also a fire division, the requirements of the SOLAS Chapter II - 1, Regulation 13.2.3. are to be observed.

Design

Components

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

Dimensions

DN	Outer Diameter [mm]	Minimum total wallthickness [mm]	GRP / Length steel pipe relation	Length of steel pipe [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		250-375
300	315	8.5	>=1.0 times diameter of GRVE pipe	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

Job Id: **262.1-021415-3**
Certificate No: **TAK00000RD**

Approved bulkhead penetration (continuation)

REMARKS

1. The air gap between outside GRP pipe and inside Steel pipe shall be between 15 and 25 mm.
2. The minimum wall thickness of the steel pipes shall be 12.5 mm
3. Due to outer pressure rating of 2.5 bar of the GRP pipe penetrating, the bulkhead penetration must have at least a wallthickness according to VE Fibermarine Highline 16.

Type Approval documentation

Type Tests carried out

Production Testing

Each batch shall be subjected to product tests according to Fiberdur Instruction QIP AA014, Rev. B.

Marking of product

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

- manufacturer's name and / or logo
- type designation
- the design standards that the pipe or fitting is manufactured in accordance with
- material of which the pipe or fitting is made
- size / dimensions
- pressure ratings (internal and external) - nominal
- design pressure (internal and external) - if different from nominal
- temperature rating
- conductive / non - conductive
- date of fabrication and / or serial number

Marking of product (continuation)

Labels with the following text shall be attached to flanges which shall be joined by bolting:
"APPLY BOLTING TORQUE ACCORDING TO MANUFACTURER'S RECOMMENDATION".

The marking:

- shall be carried out in such a way that it is visible, legible and indelible,
- is to enable traceability to the DNV GL Type Approval Certificate.

Periodical assessment

For retention of the type approval certificate periodical assessments shall be carried out at production places by DNVGL surveyor.

The objective of the periodical assessment is to verify that the design and production conditions for the type approval have not been altered.

Main scope of the assessment:

- verification of the production and quality control system
- review of quality control documentation of recent deliveries
- review of drawings in production to verify any design changes which may have an impact on data specified in the type approval certificate, performance and range of application
- verification of the product marking

Periodical assessment is to be performed after 2 years and after 3.5 years.

A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE