

# TYPE APPROVAL CERTIFICATE

Certificate No:  
**TAK00000RD**  
Revision No:  
**5**

## This is to certify:

**That the Plastic Piping System, 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 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 GRVE plastic piping system is accepted for installation on all vessels classed by DNV.**

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

for **DNV**

This Certificate is valid until **2026-06-02**.

DNV local unit: **Essen**

Approval Engineer: **Hagen Markus**

**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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



## Product description

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

## Design Types

|                         |                                  |                            |                         |
|-------------------------|----------------------------------|----------------------------|-------------------------|
| FIBERDUR VE - Metric    | GRVE system non-conductive       | Additional liner of 0.5mm  | Metric inside diameters |
| FIBERDUR CS VE - Metric | GRVE system conductive (NAVICON) | Additional liner of 2.5mm  |                         |
| FIBERDUR VE - ISO       | GRVE system non-conductive       | Additional liner of 0,5 mm | ISO inside diameters    |
| FIBERDUR CSVE - ISO     | GRVE 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     |
|--|---------------------|---------------------|---------------------------------|------------------------------|
| VE 10, CS VE   | 25 - 1000           | 10                  | 3.0bar up to DN100 <sup>1</sup> | 1.0 up to DN100 <sup>1</sup> |
| VE 16, CS VE   | 25 - 1000           | 16                  |                                 |                              |
| VE 10 Fibermarine<br>CS VE Fibermarine                   | 25 - 1000           | 10                  | 3.0bar <sup>2</sup>             | 1,0                          |
| VE 16 Fibermarine<br>CS VE Fibermarine                   | 25 - 1000           | 16                  | 3.0bar <sup>2</sup>             | 1,0                          |
| VE 16 Fibermarine HighLine<br>CS VE Fibermarine HighLine | 25 - 1000           | 16                  | 12bar <sup>3</sup>              | 4,0 <sup>3</sup>             |

### Notes

<sup>1</sup> VE and CS VE pipes with DN>100 are not collapse resistant

<sup>2</sup> Full vacuum with safety factor 3:1, collapse pressure 3bar

<sup>3</sup> Full vacuum plus 3bar outside pressure with safety factor 3:1, collapse pressure 12bar

## Type overview – Fiberdur ISO Pipe VE16<sup>2</sup>

| Types                             | Nominal Diameter DN | Nominal Pressure PN | Collaps pressure    | External pressure rating |
|-----------------------------------|---------------------|---------------------|---------------------|--------------------------|
| VE 10, 16 ISO<br>CS VE 10, 16 ISO | 40-300              | 10, 16              | see table on page 3 |                          |

### Notes

<sup>2</sup> VE, CSVE 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 outside the pipe.  
 Safety factor: 3.

### Example VE 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<br>Inside Diameter ID | VE/CSVE<br>PN10 | VE/CSVE<br>PN16 | VE/CS VE Fibermarine<br>PN10, PN16 | VE/CSVE Fibermarine HighLine<br>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                                | 1.6                                  |
| 80  | 1.6             | 1.6             | 1.6                                | 1.6                                  |
| 100                                       | 1.6             | 1.6             | 1.6                                | 2.1                                  |
| 125                                       | 2.0             | 2.0             | 1.6                                | 2.8                                  |
| 150                                       | 1.6             | 2.4             | 2.0                                | 3.5                                  |
| 200                                       | 2.0             | 3.2             | 3.2                                | 4.9                                  |
| 250                                       | 2.4             | 3.6             | 3.8                                | 6.3                                  |
| 300                                       | 3.2             | 4.8             | 4.7                                | 7.8                                  |
| 350                                       | 4.0             | 5.6             | 5.7                                | 9.7                                  |
| 400                                       | 4.0             | 6.4             | 6.6                                | 10.6                                 |
| 450                                       | 4.8             | 7.2             | 7.6                                | 12.1                                 |
| 500                                       | 4.8             | 7.2             | 8.5                                | 13.5                                 |
| 600                                       | 5.6             | 8.8             | 10.2                               | 16.4                                 |
| 700                                       | 6.4             | 10.4            | 11.9                               | 19.2                                 |
| 800                                       | 7.2             | 12.0            | 13.7                               | 22.1                                 |
| 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<br>mm | Structural wall thickness<br>(S3)<br>mm | Collaps pressure<br>bar | External pressure rating<br>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 (-1.0bar):

Approved pressure outside the pipe is 0.9bar

Non - vacuum service (> 0bar):

Approved pressure outside is 1.9bar

### Application/Limitation

The Fiberdur GRVE piping systems, VE10 ISO and VE16 ISO, VE/CS VE 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 system VE10 ISO and VE16 ISO and VE/CS VE 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 GRVE piping systems of type VE10 Metric and VE16 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

| Temperature       | VE 10<br>CSVE 10 | VE 16<br>CSVE 16 | VE /CSVE<br>Fibermarine 10 | VE / CSVE Fibermarine 16<br>VE / CSVE Fibermarine HighLine 16 |
|-------------------|------------------|------------------|----------------------------|---|
|                   | bar              |                  |                            |   |
| - 50°C up to 65°C | 10               | 16               | 10                         | 16  |
| up to 80°C        | 6                | 10               | 6                          | 10  |
| up to 95°C        | 4                | 6                | 4                          | 6   |

### 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

VE/CS VE Fibermarine PN10, PN16 and VE/CSVE Fibermarine HighLine PN16, VE ISO

### Pipe joining methods

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

| Metric / ISO<br>Inside diameter<br>ID <sup>1</sup> | ISO inside pipe diameter<br>ID <sup>1</sup> | Fire<br>barrier | Design requirements  |
|--|---|-----------------|--|
| 25 up to 50  | 41,9 up to >53.9                            | 10 mm           | Design according to<br>TPR Fiberdur "Technical Bulletin 12".<br>Fire insulation for pipes and pipe<br>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 GRVE 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 GRVE conductive system is to be used.

| Piping system              | Electrically conductive |        |
|----------------------------|-------------------------|--------|
|                            | outside                 | inside |
| GRVE system non-conductive | no                      | no     |
| GRVE 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  $10^5 \Omega/m$ .

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  $10^6 \Omega$  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 GRVE piping systems of type VE 10 Metric and VE16 Metric pipe sizes > DN100 penetrate watertight bulkheads, one of the following two arrangements 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 VE/CS VE 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<br>GRP / Steel | Steel pipe length<br>mm |
|----------|-----------------------------------|---------------------------------------|--|-------------------------|
| DN       | Outer diameter <sup>1</sup><br>mm | Minimum total wall<br>thickness<br>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 VE/CSVE 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 traceability from the final product to this type approval certificate each pipe or pipe spool is to be marked by name plate at least with:

### Pipes

| Scope  |          | Example  |
|--|----------|--|
| Manufacturer's name and / or logo                                |          |    |
| Type designation / material of which the pipe or fitting is made |          | GRVE Fibermarine<br>GRVE ISO   |
| Size / dimensions  |          | DN400  |
| Type of joining method   |          | L=laminate system<br>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   |
| Date of fabrication and / or serial number                       |          | Barcode plus number<br><br>6192180400.1280720001 |

### Fittings

| Scope  |          | Example  |
|--|----------|--|
| Manufacturer's name and / or logo                        |          |    |
| Type designation / material of which the fitting is made |          | REDUCER-CONC.-GRVE DN600/400<br>Fibermarine®<br>GRVE DIN (Metric)  |
| Size / dimensions  |          | DN500/400  |
| Type of joining method                                   |          | L=laminate system<br>K=adhesion bonding system   |
| Nominal design pressure PN                               | internal | PN10   |
|  | external | PN-1   |
| Working pressure at max. service temperature             | internal | Up to 95°C<br>( appropriate WP see DNV certificate)  |
| Conductive / non-conductive                              |          | C / NC   |
| Date of fabrication and / or serial number               |          | Barcode plus number<br><br>6192180400.1280720001 |

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".





Job Id: **262.1-021415-9**  
Certificate No: **TAK00000RD**  
Revision No: **5**

### **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**