



**TYPE APPROVAL CERTIFICATE**  
No. **MAC107119XG**

**This is to certify** that the product identified below is in compliance with the regulations herewith specified.

<i>Description</i>	<b>Glass Reinforced Epoxy and Glass Reinforced Vinylester pipes and fittings</b>
<i>Type</i>	<b>GRE &amp; GRVE system</b>
<i>Applicant</i>	<b>TPR FIBERDUR GMBH &amp; CO. KG. GALILEO-ALLEE 6 52457 ALDENHOVEN GERMANY</b>
<i>Manufacturer</i>	<b>TPR FIBERDUR GMBH &amp; CO. KG.</b>
<i>Place of manufacture</i>	<b>GALILEO-ALLEE 6 52457 ALDENHOVEN GERMANY</b>
<i>Reference standards</i>	<b>Part C, Chapter 1 Appendix 3 of RINA Rules</b>

*Issued in* **HAMBURG** on **June 6, 2019**. *This Certificate is valid until* **March 7, 2022**

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**RINA Services S.p.A.**  
**Giuseppe Russo**

This certificate consists of this page and 3 enclosures.

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GRE & GRVE system

### Reference documents:

Document for GRE type approval issued on 21.01.2016  
Document for GRVE type approval issued on 22.12.2015  
Document for CS VE Fiberdur CSVE type approval issued on 07.01.2015  
Fiberdur Catalogue issued in November 2011  
Instruction for handling and installation  
Efectis Fire Endurance Test Reports no. R-0248, no. R-1026, no. R-1027 and R-1028 (IMO Re. A.753(18))  
Sintef Flame Spread Test Reports no. 102010.50/07.171 and 102010.50/11.074 (ASTM D635)  
Fiberdur Axial Tensile Test Reports  
Fiberdur Electrical Conductivity Test Reports (ASTM D-257-07)  
Fiberdur Short-term and Long-term Pressure Test Reports (ASTM-1599 and ASTM-1598)  
Wavin Repox & Fiberdur Impact Resistance Test Reports (ASTM-2444)  
Fiberdur External Load Test Report  
Temperature Limitations Regression Curve based on ASTM D2992  
Laminating and Bonding Assembly Procedures  
Bulkhead Penetration Water & Gas Tightness Test Report filed for information under RINA dwg no HMMC-13351

### Technical characteristics:

#### GRE System:

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

#### Design Types:

Fiberdur EP = GRE system (additional liner of 0.5mm)

Fiberdur CS EP = GRE system (additional liner of 2.5mm)

#### Product names:

EP=GRE conductive and non conductive	Diameter [DN]	Design Pressure [bar]
EP & CS EP	25 - 1000	10 & 16
EP Fibermarine & CS EP Fibermarine	25 - 1000	10 & 16
EP Fibermarine HighLine & CS EP Fibermarine HighLine	25 - 1000	16

The Fibermarine pipe can withstand a full vacuum with a 3:1 safety.

The Fibermarine HighLine can withstand a full vacuum + 3 bar outside pressure with a 3:1 safety.

Applicable wall thickness of pipes, type of fittings, joining methods and maximum internal operating pressure as per Fiberdur catalogue.

Working temperature from -50°C to 100°C.

#### GRVE System:

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

#### Design Types:

Fiberdur VE = GRVE system (additional liner of 0.5mm)

Fiberdur CS VE = GRVE system (additional liner of 2.5mm)

#### Product names:

VE=GRVE conductive and non conductive	Diameter [DN]	Design Pressure [bar]
VE & CS VE	25 - 1000	10 & 16
VE Fibermarine & CS VE Fibermarine	25 - 1000	10 & 16
VE Fibermarine HighLine & CS VE Fibermarine HighLine	25 - 1000	16

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The Fibermarine pipe can withstand a full vacuum with a 3:1 safety.

The Fibermarine HighLine can withstand a full vacuum + 3 bar outside pressure with a 3:1 safety.

Applicable wall thickness of pipes, type of fittings, joining methods and maximum internal operating pressure as per Fiberdur catalogue.

Working temperature from -50°C to 95°C.

### **Approved bulkhead penetration:**

The bulkhead penetration, according to "Test report Bulkhead penetration 80mm and 600mm" filed for information under RINA dwg no. HMMC-13351, is type approved for penetration of GRVE pipes (conductive and non-conductive) through water-tight / gas-tight bulkheads.

Water tightness up to 2,5 bar , Gas tightness up to 30 mbar.

### **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 wall thickness [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	158,0	4,3		225-300
200	210,0	5,7		300-400
250	263,0	7,1		250-375
300	315,0	8,5	≥1,0 times diameter of GRVE pipe	300-450
350	367,0	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

### **Remarks:**

1. The air gap between outside GRP pipe diameter and inside Steel pipe diameter 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 wall thickness according to VE Fibermarine Highline 16.

### **Fields of application:**

The fields of application are shown in the Table 1 of Part C, Chapter 1, Appendix 3 of RINA Rules, where "L3" or "0" is indicated. Requirements for electrical conductivity in para. 2.3.4 of the a.m. Rules are also to be taken into account.

### **Acceptance conditions:**

The arrangement on board is to be carried out according to the Manufacturer specifications and the RINA Rules as applicable.

The media conveyed through the piping have not to affect the properties of the piping itself.

Where pipes pass through "A" and "B" class divisions, arrangements are to be made to ensure that fire endurance is not impaired. These arrangements are to be tested in accordance with "Recommendations for Fire Test Procedures for "A" and "B" and "F" Bulkheads" (IMO Resolution A.754(18) as amended).

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When the piping pierces watertight bulkhead or decks, the watertight integrity of the bulkhead or deck is to be maintained. If the bulkhead or deck is also a fire division and destruction by fire of plastic pipes may cause the inflow of liquid from tanks, a metallic shut-off valve operable from above the freeboard deck is to be fitted at the bulkhead or deck.

Before installation on board pipes and fittings are to be tested by the Manufacturer as per para. 4.2 and after installation on board according to para. 4.3 of the Part C, Chapter 1, Appendix 3 of RINA Rules.

The installation on board ships built according to the "Rules for the construction and Classification of high speed crafts" of RINA is subject to the satisfactory outcome of tests foreseen by IMO Resolution A.753(18).

### **Remarks:**

The pipes and fittings are to be marked. The marking is to include at least the following information:

- Pressure rating;
- Temperature rating;
- Product and Manufacturer name;
- The design standards which the pipes and fittings are manufactured in accordance with;
- The material of which the pipes and fittings are made;
- Conductive or non-conductive.

This Certificate has replaced the Type Approval Certificate no. MAC051817XG.

**HAMBURG June 6, 2019**