Use of FRP in the Offshore Industry

Fiber Glass Systems | NOY

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Composites charting the way through Marine, Offshore and Energy Transition

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Agenda

Overview of NOV Why use composites in Maritime? Offshore Applications

- Semi submersibles, TLPs & SPARS
- FPSO
- Fixed Platforms

Offshore Products

- Gratings
- Handrails
- Structures

Regulations and Standards GRE Piping (*time dependant*)

Overview - Our Structure



Overview - Global Presence



Why use Composites in Maritime?

Increased Safety

- No corrosion failures from hidden degradation
- Improved efficiency

Reduced Weight – 1/3 (Structures) 1/6 (Piping) that of steel

- 66% weight saving
- Lower weight = CAPEX & OPEX savings
- Less mechanical handling, faster install

Lower Lifetime Costs

- Reduced maintenance
- Significant OPEX, TOTEX savings.
- Predictability

Lower Retrofit Costs

- Replacing original corroded products often cheaper than steel.
- No hot works
- Reduce PoB

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Reduced Total Cost of Ownership





1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Offshore Applications - Semi Submersibles, TLPs & SPARs



Products

Grating – Topside Grating – Wave Zone Handrails – Topside Handrails – Wave Zone Ladders & Gates Platforms / Walkways / Stairs Impact Protection Wind / Weather Walls / Sunshades Custom items

Offshore Applications - FPSO



Products

Grating – Topside Handrails – Topside Ladders & Gates Platforms / Walkways / Stairs Impact Protection Wind / Weather Walls / Sunshades Custom items

Offshore Applications - Fixed Platforms



Products

Grating – Topside Grating – Wave Zone Handrails – Topside Handrails – Wave Zone Ladders & Gates Platforms / Walkways / Stairs **Impact Protection** Wind / Weather Walls / Sunshades Jacket Mudmats **Custom items**

Fiberglass Systems

Range of Gratings, Handrails and Structures to reduce weight and maintenance

Duragrid[®] Phenolic FRP Grating

- Provides resilient surface to dynamic loads such as wheels and impact
- Lightweight, 1/3 that of steel grating
- Meets ASTM F3059 Wheel and Impact load requirements

MARRS[®] Offshore FRP Handrail – Offshore

- Circa 11kg per metre (3 rail configuration)
- 1.5kN/m load capability
- Minimal deflection (< 30mm at 0.74kN load)
- Proven 25 year phenolic FRP technology
- Excellent fire reaction and fire integrity

FRP Profiles for Tertiary Structures – Offshore

- Robust, with solid rung profile
- Proven 25 year phenolic FRP technology
- Excellent fire performance and integrity
- Minimal maintenance



For Fire Integrity Applications









FRP Grating - Topside

Pultruded FRP Grating

- Assembled from "pultruded" profiles, uni-directional
- 60 70 % reinforcement content
- High strength to weight ratio, lower deflection
- Resilient bearing bar surface
- Excellent "Fire Reaction" properties
- Self extinguishing, low combustibility
- Low smoke, low toxicity (IMO regs)
- ASTM F3059 fully compliant
- Approved by ABS, DNV, Lloyds, BV, etc.
- Proven over 25 years offshore





MARRS® Offshore FRP Handrail

Low weight

- Circa 15kg per metre (3 rail configuration)
 Structural
- 1.5kN/m load capability
- NORSOK compliant
- Minimal deflection (< 30mm at 0.74kN load)
- Robust

Materials

- Proven 25 year phenolic FRP technology
- Excellent fire reaction and fire integrity
- Minimal maintenance

Versatile

- New build or retrofit
- Horizontal or sloped for stairs 2 or 3 mid rail

Post Connection Options



Handrail safety and ergonomics – MARRS Offshore Fully Complies to:





NORSOK Requirements C002, N003, S001:

- Round top rail only
- Continuous smooth hand grip, even over posts
- Shall not cause hinderance or injury
- Tested to static electricity (EN 13463)
- Low smoke and fumes
- UV and saliferous environment resistant
- Extreme temperature testing

FRP Structural Access



Many more....



FRP Ladders



FRP Hop Ups



FRP Mud Troughs



FRP Safety Gates

FRP (Fiber Reinforced Polymer) Marine & Offshore Tertiary Structural Systems

Product	Service and Locations	Qualifications and Approval			Type Approval
Phenolic Grating	Open Deck or semi enclosed areas Platforms, Catwalks & Access Areas Other fire critical applications, such as means of escape Access for firefighting Emergency operation or rescue	USCG PFM 2-98 (1998)	ASTM F-3059 2017	NORSOK	ABS, BV, DNV- GL, Lloyds, etc
Phenolic Handrail	Open Deck or semi enclosed areas Platforms, Catwalks & Access Areas Other fire critical applications, such as means of escape Access for firefighting Emergency operation or rescue	ISO BS EN 14122-3	OSHA 1910.23	NORSOK C-002 and N-003	ABS
Phenolic Ladders	Project by project based on risk-based approach	Designed from first principles, as steel equivalent			N/A
Phenolic Stairs	Project by project based on risk-based approach	Designed from first principles, as steel equivalent			N/A
Access Platforms	Project by project based on risk-based approach	Designed from fi	N/A		

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Certificates and Approvals

Fiber Glass Systems offers a wide variety of products to meet the specifications of these and other distinguished regulatory entities:

- Alberta Boilers Safety Associates (ABSA)
- American Bureau of Shipping (ABS)
- American National Standards Institute (ANSI)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)
- American Water Works Association (AWWA)
- ASTM International
- British Standard European Standard ISO (BS EN)
- Bureau Veritas (BV)
- Det Norske Veritas Germanischer Lloyd (DNV GL)
- Factory Mutual (FM)

- Lloyd's Register
- NSF International
- Technical Standards & Safety Authority (TSSA)
- Underwriters Laboratories (UL/ULC)
- United Kingdom Ministry of Defence (UK MoD)
- United States Coast Guard (USCG)
- United States Department of Defense (Military Specifications)
- United States Department of Transportation (DOT)
- United States Food & Drugs Administration (FDA)

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Marine Pipe Manufacturing

3 Components

- Resin

- Aromatic Amine Cured Epoxy
 200°F (93°C)/250°F(121°C)
- Curing Agent
- Glass Fibers
- Filament Winding Process



Where is it used?

- Ballast Water in tank
- •Stripping Lines
- Ballast water in Machinery space
- •Sea water cooling in machinery space
- •Vents
- •Grey Water
- Inert Gas effluent line
- •Scrubber Systems
- Overboard Drains





Bondstrand Product Series







General Purpose – All Offshore Water Services

- Diameter Range 25 mm 1500 mm
- Pressure Rating from 10 bar to 75 bar for Specific Applications
- Min temp 45 deg ⁰C Max temp + 93 (121) deg ⁰C
- Qualified to ISO, NORSOK, ASME B31.3, TOTAL PVV 178, Shell Dep, etc.
- IMO L1, IMO L2, IMO L3, IMO L3 WD, JF 30, JF 60
- Engineering Support e.g. Pipe supports centres, GRE 24" dia @ 20 bar spans 12.4 m whereas CuNi 24" dia @ Sch 20 spans around 9.0 m.



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Piping Cost Comparison SDSS vs GRE

Bondstrand 2000M vs Super Duplex Stainless Steel	2000M	SDSS
Materials Supply Costs	\$254,684.00	\$1,093,763.44
Fabrication Costs	\$230,295.00	\$467,150.00
<u>Total</u>	<u>\$484,979.00</u>	\$1,560,913.44
1-16" Diameter Range 1,215m of pipe 1027 fittings		

Bondstrand 2000M vs Super Duplex Stainless Steel



Sector Sector

Thank you

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