

Bondstrand™ Marine Piping Systems





Bondstrand Marine Pipe Systems

Historically, ship owners have faced the grim reality of continuously replacing most metal piping because of severe corrosion. This results in piping systems costing multiple times the original investment over the life of the vessel since steel and other metal pipe systems are very costly to maintain and replace.

Bondstrand Glassfiber Reinforced Epoxy (GRE) systems are cost-effective, maintenance-free and light weight solutions designed to provide a corrosion-free and erosion-free operation during the service life of the vessel.

The many advantages of Bondstrand GRE pipe systems

Durable and corrosion resistant

Bondstrand GRE piping is highly resistant to corrosion caused by saltwater, chemicals, residues and bacteria. Similarly, it resists external corrosion even in aggressive marine environments.

Lightweight – easy to install

Bondstrand GRE pipe weighs only a quarter that of steel pipe and is easy to install without the need of heavy installation equipment.

Low installation and operating costs

Installation costs of Bondstrand GRE pipe systems are lower than those for carbon steel, resulting in comparable total installed cost when product costs are factored in. Lower operating costs, due to superior hydraulic performance, reducing energy costs, are realized

KEY ADVANTAGES

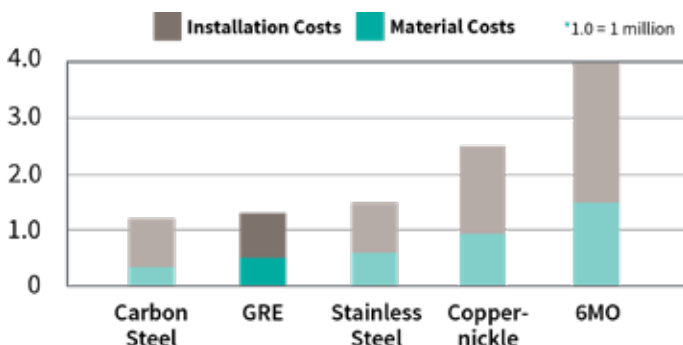
- Long Service Life
- Low Life-Cycle Cost
- Retrofit Solution
- Easy to Install
- Light Weight
- Corrosion Resistant

COST COMPARISON

CONVENTIONAL STEEL MECHANICAL SYSTEMS

TOTAL INSTALLED COST EQUALS TRADITIONAL STEEL PIPING

A comparison of costs clearly shows the typical savings during the service life of the piping system.



with Bondstrand. Additionally, should system modifications or repairs be necessary, they can be performed without disrupting the vessel operation as not “hot work” (welding) is required.

Wide range of pipe systems

NOV Fiber Glass Systems offers a complete range of pipe systems in a variety of diameters and pressure classes for many different applications. Pipe systems are available in diameters up to 1000 mm (40 inch) and standard lengths up to 12 m (40 ft.).

No contamination

Bondstrand GRE does not rust or scale and is resistant to marine fouling. These features also contribute to the cost savings and reduced needs for maintenance.

WIDE RANGE OF SOLUTIONS

Bondstrand GRE is available for a wide variety of demanding on-board applications for internal and external pressure, as well as conductive requirements.

- Air and equipment cooling circulating water
- Ballast/segregated ballast
- Brine
- Chlorinated systems
- Crude oil washing
- Deck hot air drying (cargo tanks)
- Drainage/sanitary service/sewage
- Eductor systems
- Electrical conduit
- Exhaust piping
- Fire mains and sprinkler systems
- Inert gas effluent
- Main engine cooling
- Petroleum cargo lines (cargo tanks)
- Portable discharge lines
- Scrubbers
- Steam condensate
- Tank cleaning (salt water system)
- Dry deluge systems

PRODUCT OVERVIEW

(External pressure rating according to IMO Regulations)

| Series | Characteristics | Joining System | Nominal Pipe Size | | Maximum Operating Temperature | | Maximum Operating Temperature | |
|------------------------|---|----------------|-------------------|------------|-------------------------------|-----|-------------------------------|-------------------|
| | | | in | mm | F | C | psi | bar |
| Bondstrand 2000M | A standard epoxy system for applications where corrosion resistance and external pressures are of paramount importance. | Quick-Lock™ | 1 - 6 | 25 - 150 | 250 | 121 | 250 | 17.2 |
| | | Taper/Taper | 8 - 40 | 200 - 1000 | 250 | 121 | 250 | 17.2 |
| Bondstrand 2400 Series | An epoxy system for applications where internal pressure, corrosion resistance and light weight are the primary performance criteria. Product selection determined by internal pressure requirements. | Taper/Taper | 2 - 40 | 50 - 1000 | 200 | 93 | 350 ⁽¹⁾ | 25 ⁽¹⁾ |
| Bondstrand 7000M* | An epoxy system with high strength conductive filaments incorporated in the wall of the pipes to prevent accumulation of static electricity. | Quick-Lock™ | 1 - 6 | 25 - 150 | 200 | 93 | 250 | 17.2 |
| | | Taper/Taper | 8 - 40 | 200 - 1000 | 200 | 93 | 250 | 17.2 |

** Conductive version of Bondstrand 2000M

(1) 2425 Bondstrand Series

Note: All systems are available with a fire-protection layer.

IMO Requirements

IMO recognizes the increasing interest to use materials other than steel for ships. In 1993, IMO developed guidelines (Res. A.753 [18]) to provide acceptance criteria for plastic materials in piping systems. Bondstrand GRE pipe used for marine and offshore applications are type approved by major certifying bodies.

Engineering Capabilities

With manufacturing locations all over the world, FGS has experienced teams of engineers supporting the customer with design, engineering, training, spool making and installation. Services include general calculations such as support span, thrust loads, joint strength, collapse pressure and internal pressure ratings. Assistance in design drawings, stress and hydraulic analyses, drawings from isometrics, support detailing and material takeoffs is offered. We offer supervision and/or survey of installation, special product design for custom made parts, expertise on international specification work to obtain approval authorities, field service, and training to certify installers.

Prefabrication

Bondstrand GRE systems are assembled using industrially manufactured components. Spools can be pre-fabricated at the yard or can be supplied from FGS spooling operation or one of the network partners, limiting the need for adhesive bonded joining on board. If spacing is a constraint, FGS offers custom made spools to meet specific dimensions and our team of piping engineers and fabricators can assist to ensure the custom-made spools are designed and fabricated to meet the design requirements. Pre-fabricated spools will reduce the number of field joints and provide greater reliability because of the high quality joints and testing at our factory. Installers that are trained and certified by FGS according to IMO standards can handle the complete installation.

Retrofit

Ships operate in seawater which is one of the most corrosive environments. Corroded steel and metal piping constantly needs to be replaced during the lifetime of the vessel. Often certain pipe is treated as consumables and Bondstrand GRE addresses these problems. Over the years, numerous steel, cunifer and other piping materials used in engine rooms, ballast systems, inert gas systems and vent lines have been replaced successfully with Bondstrand pipe, the solution that lasts the lifetime of the vessel. FGS is positioned to competitively replace existing piping offering long-term solutions, reduced downtime, no painting required, and improved flow characteristics.



FIRE ENDURANCE

Epoxy pipe

Under IMO Rules, Bondstrand Marine products can be used for normally water filled systems without additional passive fire protection. Fire exposure will cause the outer surface of the pipe to char, but the functionality of the systems remains.

Additional fire protection

Depending on the level of fire endurance, enhanced fire protection solutions are available by use of standard products with added passive fire protection.



Fire Endurance requirements matrix

according to IMO A.753 [18]

- Bondstrand approved systems
- Not applicable
- Not allowed

| | Machinery spaces of Category A | Other machinery spaces and pump rooms | Cargo pump rooms | Ro-ro cargo holds | Other dry cargo holds | Cargo tanks | Fuel oil tanks | Ballast water tanks | Cofferdams void spaces pipe tunnel and ducts | Accommodation service and control spaces | Open decks |
|---|--------------------------------|---------------------------------------|------------------|-------------------|-----------------------|-------------|----------------|---------------------|--|--|------------|
| CARGO (flammable cargoes f.p <60°C) | | | | | | | | | | | |
| Cargo lines | | | L1 | | | | | | | | L1 |
| Crude oil washing lines | | | L1 | | | | | | | | L1 |
| Vent lines | | | | | | | | | | | |
| INERT GAS | | | | | | | | | | | |
| Water seal effluent lines | | | | | | | | | | | |
| Scrubber effluent lines | | | | | | | | | | | |
| Main lines | | | L1 | | | | | | | | L1 |
| Distribution lines | | | L1 | | | | | | | | L1 |
| FLAMMABLE LIQUIDS (f.p. > 60°C) | | | | | | | | | | | |
| Cargo lines | | | L1 | | | | | | | | L1 |
| Fuel oil | | | L1 | | | | | | | L1 | L1 |
| Lubricating | | | L1 | | | | | | | L1 | L1 |
| Hydraulic oil | | | L1 | | | | | | | L1 | L1 |
| SEAWATER | | | | | | | | | | | |
| Bilge main and branches | L1 | L1 | L1 | | | | | | | | L1 |
| Fire main and water spray | L1 | L1 | L1 | | | | | | | | L1 |
| Foam system | L1 | L1 | L1 | | | | | | | L1 | L1 |
| Sprinkler system | L1 | L1 | | | | | | | | | |
| Ballast | | | | | | | | | | L2 | L2 |
| Cooling water, essential services | | | | | | | | | | | L2 |
| Tank cleaning services fixed machines | | | | | | | | | | | |
| Non essential systems | | | | | | | | | | | |
| FRESH WATER | | | | | | | | | | | |
| Cooling water, essential services | | | | | | | | | | | |
| Condensate return | | | | | | | | | | | |
| Non essential systems | | | | | | | | | | | |
| SANITARY / DRAINS / SCUPPERS | | | | | | | | | | | |
| Deck drains (internal) | L1 | L1 | | L1 | | | | | | | |
| Sanitary drains (internal) | | | | | | | | | | | |
| Scuppers and dischargers (overboard) | | | | | | | | | | | |
| SOUNDING / AIR | | | | | | | | | | | |
| Water tanks / dry spaces | | | | | | | | | | | |
| Oil tanks (f.p. > 60°C) | | | | | | | | | | | |
| MISCELLANEOUS | | | | | | | | | | | |
| Control air | L1 | L1 | L1 | L1 | L1 | | | | | L1 | L1 |
| Service air (non essential) | | | | | | | | | | | |
| Brine | | | | | | | | | | | |
| Auxiliary low pressure steam (≤ 7 bar) | L2 | L2 | | | | | | | | | |

JOINING SYSTEMS



Quick™ Lock - An adhesive-bonded joint with straight spigot and tapered bell. The integral pipe stop in the Quick-Lock bell provides accurate laying lengths in close tolerance piping. Available in sizes 50-400 mm (2-16 in).



Taper x Taper - An adhesive-bonded joint with matching tapered male and female ends offering superior joint strength by controlled adhesive thickness. Available in sizes 50-1000 mm (2-40 in).



FLANGES - One-piece flanges and Van Stone-type flanges with loose flange rings. Available in sizes 25-1000 mm (1-40 in).



Double O-Ring - A mechanical joint offering quick assembly between male and female ends. Two “O” rings are employed to provide sealing. Available in sizes 50-900 mm (2-36 in).



Double O-Ring Expansion Coupling - A mechanical coupling provides an excellent seal. This coupling – available with Quick-Lock and Taper connections – is configured with a Key-Lock adaptor and a Double O Ring adaptor.

Double O-Ring adaptor - Employed with two elastomeric O-rings in Nitrile Butadine Rubber (NBR) or Ethylene Propylene Rubber (EPDM)

Key-Lock adaptor - Employed with a nylon locking key and two elastomeric O-rings.

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