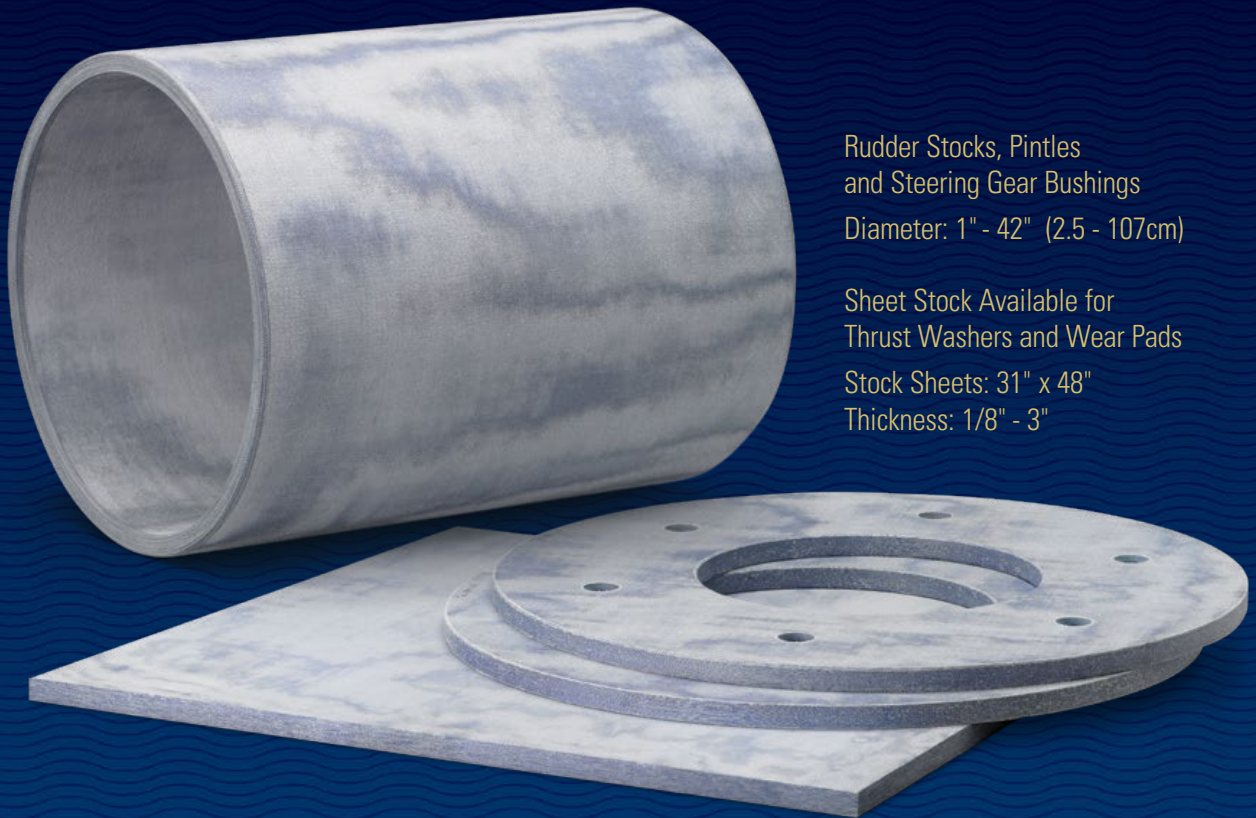


**DURAMAX<sup>®</sup>**

# DuraBlue<sup>®</sup> Composite Rudder Bushing

- ▶ Greaseless, Self-Lubricating, Pollution Free
- ▶ Extremely Long Life
- ▶ High Load Capability & Ultra Low Friction



Rudder Stocks, Pintles  
and Steering Gear Bushings  
Diameter: 1" - 42" (2.5 - 107cm)

Sheet Stock Available for  
Thrust Washers and Wear Pads  
Stock Sheets: 31" x 48"  
Thickness: 1/8" - 3"

## PRODUCT INFORMATION AND SELECTION GUIDE

Duramax Marine<sup>®</sup> is an ISO 9001:2015 Certified Company

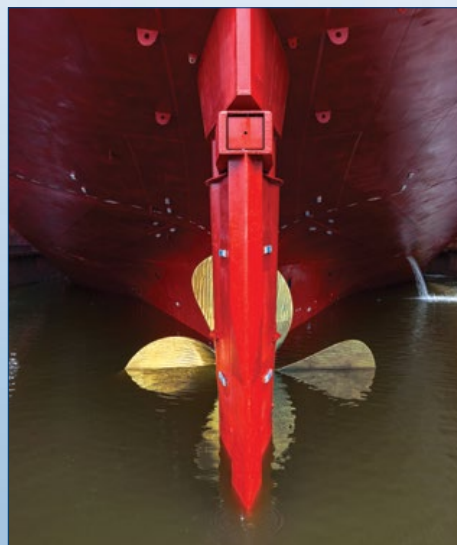
**DURAMAX MARINE<sup>®</sup>**



# Duramax® DuraBlue® Composite Rudder Bushings, Thrust Washers and Wear Pads.

High performance, pollution free, engineered technology.

Duramax Marine®, the world leader in water lubricated bearing technology, offers an engineered, dimensionally stable rudder bushing and thrust washer designed to outperform competitive products. DuraBlue® needs no lubrication and is exceptionally wear-resistant, with an extremely long wear life. DuraBlue® composite material has a low coefficient of friction value of 0.1 to 0.2, resulting in no stick-slip during rudder operation. DuraBlue® is also available in standard sheet stock and custom machined components for use in wear pad marine applications.



Virtually no swelling in seawater

High strength-to-weight ratio

Self-lubricating formulation for dry running

Proprietary fiber matrix extends wear life

Very low thermal coefficient of expansion





# DuraBlue® Is An Engineered Composite Material.

## DuraBlue® needs no lubrication

Duramax® DuraBlue® has a proprietary lubrication formulation integrated evenly in its resin system. Needs no grease or oil, eliminating the risk of costly marine pollution fines. It will operate wet running, or run dry over extended periods of time without lubrication.

## DuraBlue® is chemical and corrosion resistant

DuraBlue® remains stable in chemical solutions and not affected by many solvents, inorganic solutions, fat and weak acids. It is non-metallic, non conductive and corrosion resistant.

## DuraBlue® is dimensionally stable

### **Minimum thermal expansion and contraction.**

DuraBlue® has a low thermal expansion rate in high and low temperature environments. Unlike polyurethane rudder bushings that have a wide range of thermal expansion and contraction rate that can affect the interference needed to hold the bushing in place.

### **Experiences no swell and is abrasion resistant.**

The DuraBlue® has virtually no swell when operating in salt or fresh water environments with an absorption rate of <0.5%. Resists abrasion and wear in the harshest of conditions.



### ***Duramax Marine® maintains a commitment to the environment.***



*With this in mind, our DuraBlue® composite material is designed for use without grease. However we do acknowledge that some engineers still prefer using grease or other lubricants in their oscillating machinery. DuraBlue® composite materials are completely unaffected by grease, oil or other lubricants.*

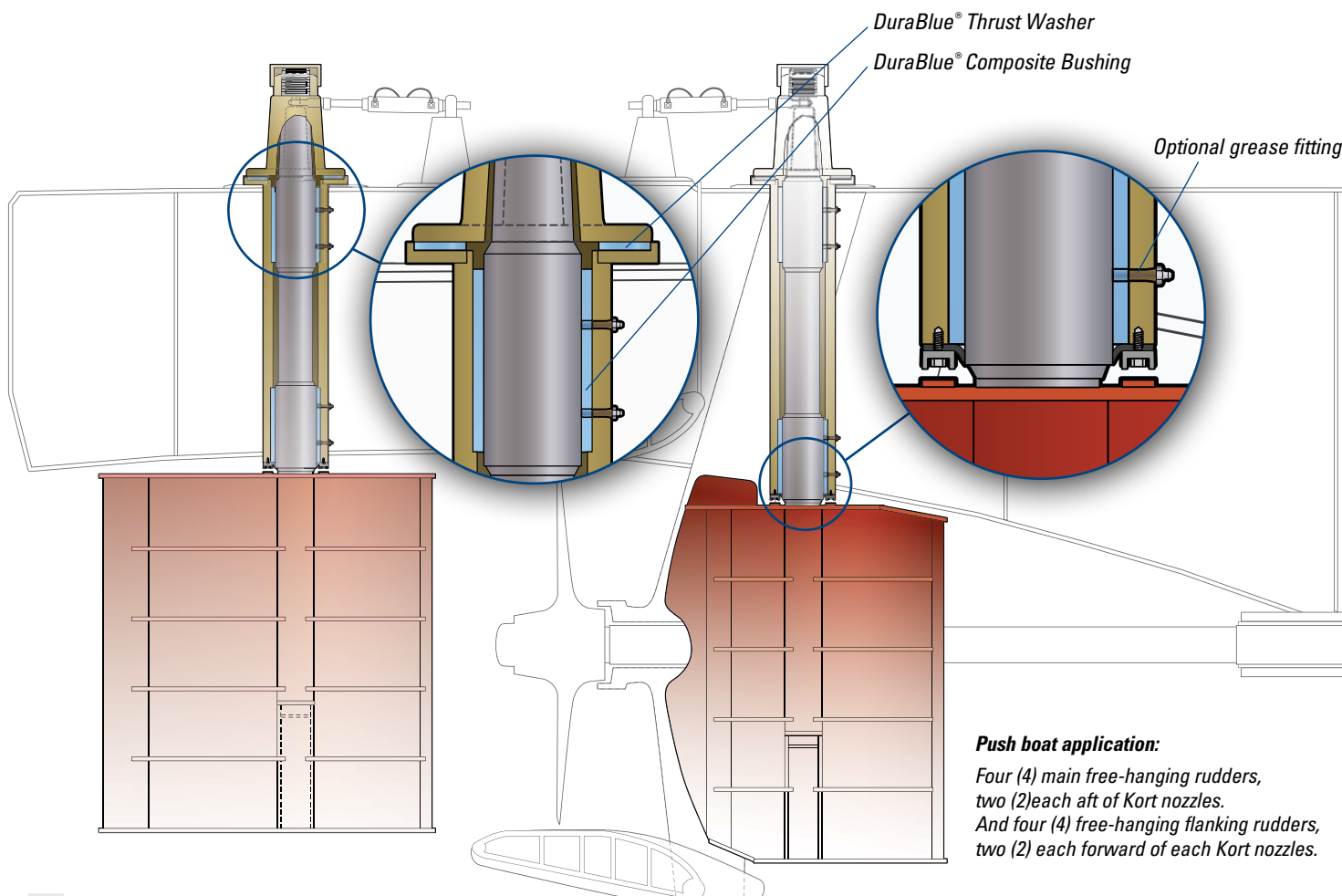
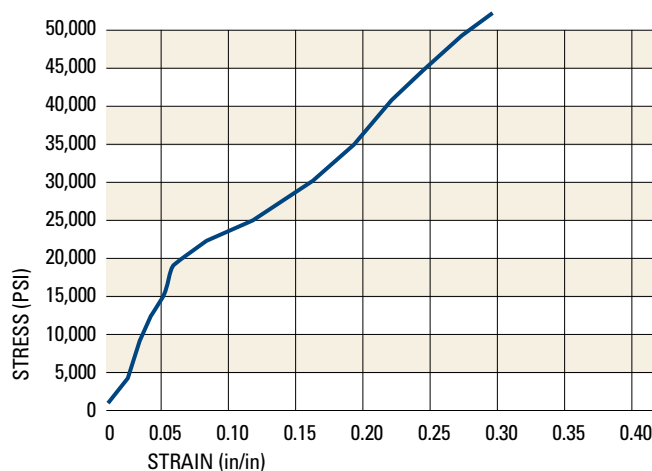
DuraBlue® Composite physical properties are excellent for rudder applications.

PROPERTY	UNIT		VALUE	
Compressive Strength (ASTM D695)	MPa	Psi	> 207	> 35,000
Shear Strength (ASTM D2344)	MPa	Psi	> 13.8	> 2,000
Modulus of Elasticity (ASTM D638)	MPa	Psi	> 3,102	> 450,000
Hardness (ASTM D785)	Rockwell "R"		> 110	
Density (ASTM D792)	10 <sup>3</sup> kg/m <sup>3</sup>	lb/in <sup>3</sup>	1.25	0.045
Water Absorption (ASTM D570)	%		< 0.5	
Coefficient of Thermal Expansion (ASTM D696)	10 <sup>-6</sup> /°C	10 <sup>-6</sup> /°F	43	24
Chemical Resistance	NA		Good	
Color	NA		Blue	
Maximum Temperature (ASTM D648)	°C	°F	100	212
Minimum Temperature	°C	°F	< -200	< -328
Advised Maximum Working Temperature	°C	°F	80	176
Typical Friction Value	NA		0.1 – 0.2	
General Wear Resistance	NA		Very Good	
Resistance Against Abrasive Wear	NA		Good	
Deflection*	in		< 0.010	

\*after 24 hour at 15 N/mm<sup>2</sup>

#### Duramax® DuraBlue® compression test

An independent laboratory static compression test on the DuraBlue® composite material showed it exceeded 51,000 PSI.



#### Push boat application:

Four (4) main free-hanging rudders, two (2) each aft of Kort nozzles.  
And four (4) free-hanging flanking rudders, two (2) each forward of each Kort nozzles.



# DuraBlue® Is A Cost-Effective Rudder Bushing Solution.

## Absorbs stresses and high impact loads

Duramax® DuraBlue® rudder bushings are light in weight and engineered to better absorb the stresses and high impact loads associated with rudder applications than metal material alternatives like bronze, brass, nylon and other urethane based products. DuraBlue® also works well with all corrosion resistant materials: 316 Stainless Steel, Inconel, Monel, Stellite and Gunmetal.

DuraBlue® bushings can better handle the damaging effects of misalignment and offers extremely smooth operation with specific pressure of up to 25N/mm<sup>2</sup>. A 4 to 32 micro inch surface finish is recommended to extend bushing life.

## Tolerant to edge loading

The DuraBlue® bushing is stable even with misalignments and tolerates edge loading. It is an engineered fiber composite material that maintains a high compression strength. It is lightweight and resists damage or fracture. With a high strength-to-weight ratio.

## Easy installation

Duramax® DuraBlue® rudder bushings can be easily machined to exact specifications at the shipyard to fit your application. It is installed with an interference fit or bonded in place using approved epoxy adhesive. Freezing the bushing in liquid nitrogen or dry ice will allow for easy fitting of bushing into housing. As the bushing returns to normal temperature and increases in size, the proper interference with the housing will be obtained. It can also be installed using a draw bar or press fitted into place.

Housing should be provided with a chamfer edge to prevent shaving the bushing when press fitting. Retain bushing with a shoulder at one end once bushing is fitted. A keeper ring can be used for additional axial security.





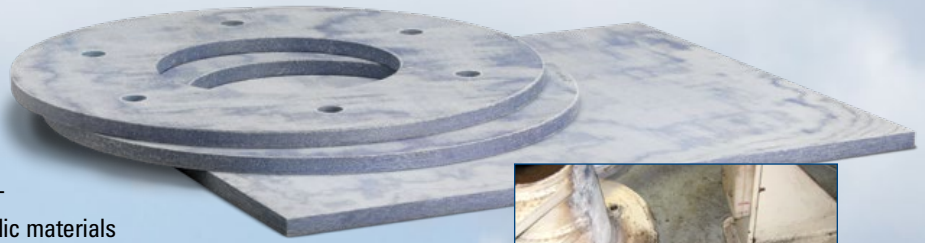
# DuraBlue® Thrust Washers and Wear Pads.

DuraBlue® is an engineered thermoset composite solution that is excellent for thrust washer and wear pad applications. DuraBlue® composite thrust washers are an environmentally friendly, cost-effective, grease-free alternative to traditional metallic materials such as brass. They can also be used in place of PTFE, UHMW, Cast Nylon and other Phenolics and composite materials.

DuraBlue® composites are a cost-effective choice. It is easily machined and has great dimensional stability with high load capabilities. They will give you exceptional wear life and cause minimal wear of counter face alloys.

## Suitable for high load applications

DuraBlue® composite engineered fabrics are impregnated with thermosetting resins, with solid lubricants dispersed evenly, along with proprietary additives. It has a low coefficient of friction and high load capacity that's excellent for thrust washers and wear pad applications when operating with intermittent or oscillating movements.



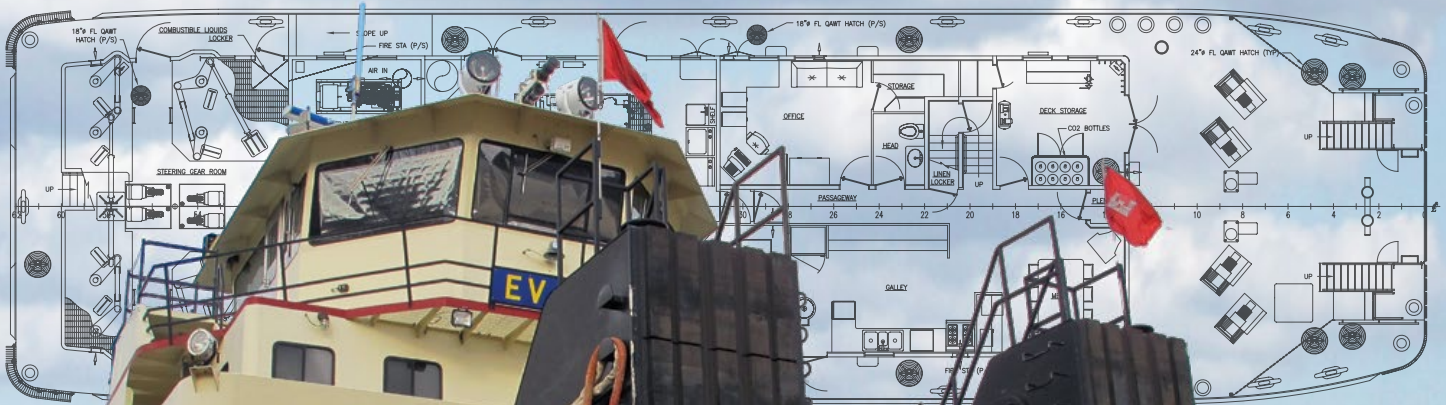
## Flexible bonding ability

DuraBlue® can be bonded to itself and metals such as bronze, brass, aluminum, and stainless steel using a two-part epoxy resin adhesive. Call your Duramax® DuraBlue® specialist for detailed instructions.



## Custom inserts for easy fastening

DuraBlue® composite wear pads can be held in place with countersunk screws and keeper plates. Wear pads can be held in place by metal inserts imbedded into the composite. Flat head screws, helicoils and Keenserts® can be used to fasten wear pads in place.





# DuraBlue® Custom Fit To Match Your Application.

## DuraBlue® bushings in sizes to fit your exact need

Bushings are available in these sizes: 1 inch - 42 inch (2.5 – 107 cm) outside diameter. Larger sizes upon request.

## DuraBlue® custom thrust washers and wear pads

DuraBlue® sheet stock is available in standard 31 inch x 48 inch stock; 1/8 inch to 3 inches thick. Larger sizes upon request. Duramax® will custom machine DuraBlue® thrust washers and wear pads to your engineered drawings and specific application.

## Quick response and short lead times

Duramax® DuraBlue® specialists can provide immediate response to your custom bushing and thrust washer needs. Using your engineer's drawings, we will deliver your custom machined products to meet your specifications and agreed upon deadline for both replacement and new vessel construction.

## DuraBlue® bushings and washers are easily machined



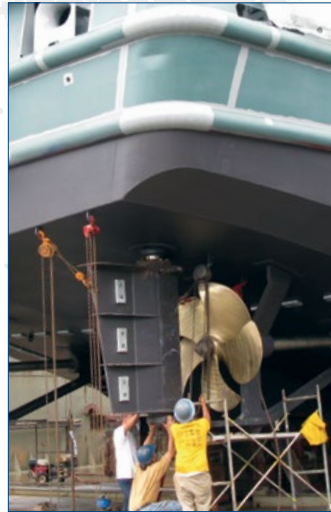
Use conventional machining techniques as used on bronze, but machined dry without coolant. A tungsten carbide-tipped tool should be used to maintain a fine smooth finish. DuraBlue® composite materials are non-toxic, but advisable to use adequate dust extraction while machining.

## The Duramax® Edge: Unmatched Quality

Every person at Duramax Marine® is focused on delivering the highest, most consistent quality of product and technical support in the marine industry. Quality that has set performance records unmatched by any other products in the industry around the world.

## Worldwide reach

Duramax Marine® has a long history of delivering engineered product solutions for maintenance problems, earning the trust of marine professionals around the world. Our global technical support team and distributor network of product experts are always available for customers where ever they are needed.





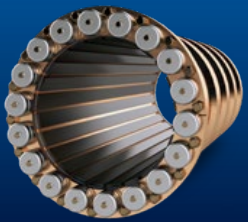
INNOVATION.  
EXPERIENCE.  
RESULTS.

Duramax Marine® is committed to providing excellence in every product we manufacture. Our Johnson Cutless® marine and industrial bearings, heat exchangers, impact protection systems and sealing systems are known worldwide for their engineered quality and dependable performance. Please contact the factory for information on any of the following Duramax Marine® products:



## JOHNSON CUTLESS® WATER-LUBRICATED BEARING SYSTEMS

Johnson Cutless® Sleeve and Flanged Bearings



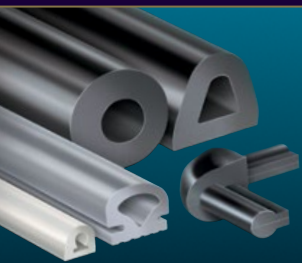
## DURAMAX® ADVANCED WATER-LUBRICATED BEARING SYSTEMS

Johnson® Demountable Stave Bearings  
ROMOR® I Stave Bearings and Segmental Housings  
ROMOR® C- Partial Arc Bearings  
DMX® Polymer Alloy Bearings  
DuraBlue® Bearings, Rudder & Pintle Bushings, Thrust Washers, and Wear Pads  
Industrial Pump Bearing Systems



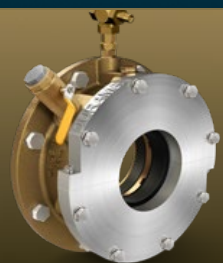
## DURAMAX® HEAT EXCHANGE SYSTEMS

DuraCooler® Keel Coolers  
Duramax® Demountable Keel Coolers  
Duramax® BoxCoolers



## DURAMAX® IMPACT PROTECTION SYSTEMS

Johnson® Commercial Dock Bumpers, Fenders & Tow Knees  
LINERITE® Composite Batterboard Systems



## DURAMAX® SHAFT SEALING SYSTEMS

DryMax® Shaft Seal  
Duramax® Mechanical Shaft Seal  
Johnson® Heavy-Duty Air Seal Stuffing Boxes  
Duramax® Ultra-X® High Performance Compression Packing

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