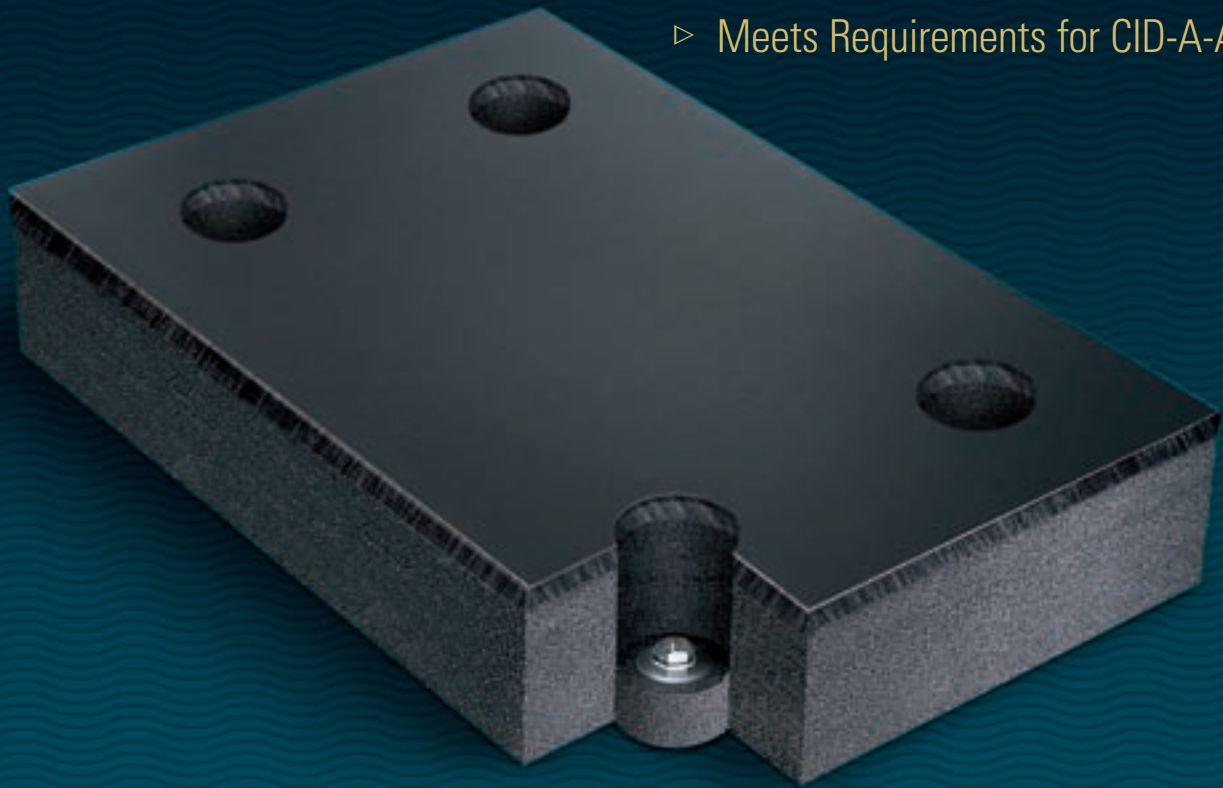


DURAMAX[®]

LINERITE[®]

Composite Batterboard System

- ▷ Low Friction UHMW-PE Face
- ▷ Impact-absorbing Core
- ▷ Meets Requirements for CID-A-A-59001



PRODUCT INFORMATION AND SELECTION GUIDE

DURAMAX MARINE[®]

LINERITE® Has Earned The Trust Of The U.S. Navy.

A batterboard has always been a necessary part of any marine structure or vessel. As the name implies, its purpose is to absorb repeated impacts that would otherwise damage marine substructures or vessels. Wood batterboard has traditionally fulfilled this need.

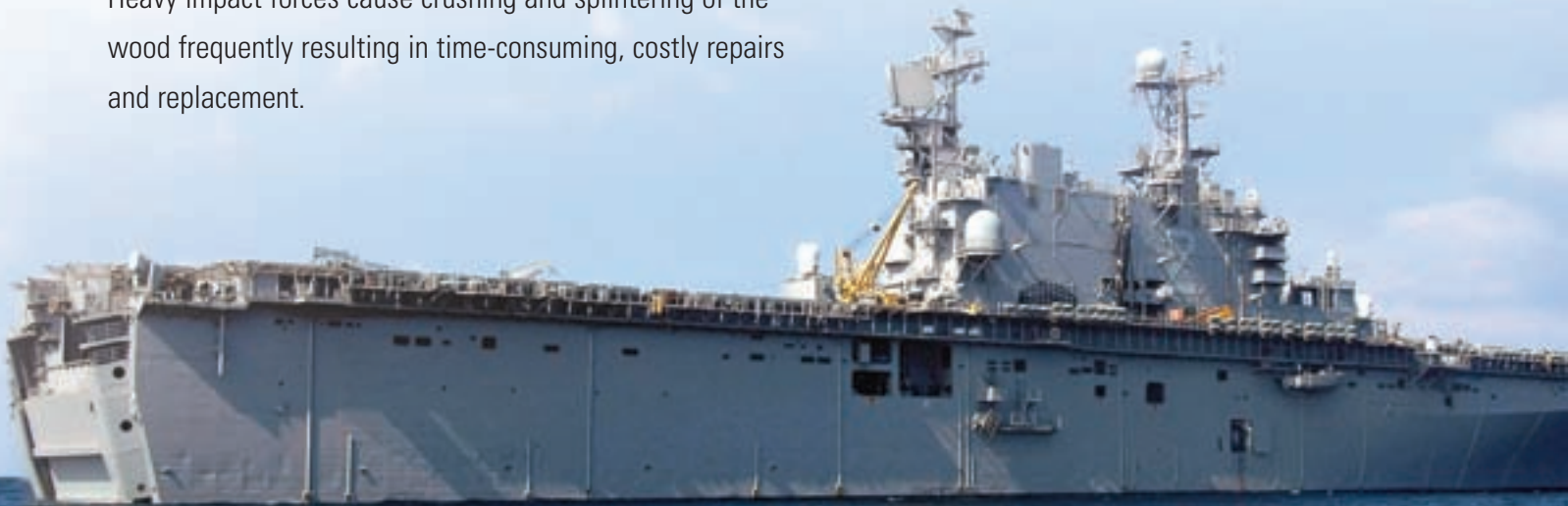
However, wood performance has never been ideal, because of the sacrificial manner in which it dissipates impact forces and resists wear.

Light impacts can cause green fractures in wood, evidenced by a cracking sound. Visually, the wood appears as it did before the blow. Structurally there has been irreversible damage. It will never absorb an impact at its original efficiency.

Heavy impact forces cause crushing and splintering of the wood frequently resulting in time-consuming, costly repairs and replacement.

LINERITE® BATTERBOARD:

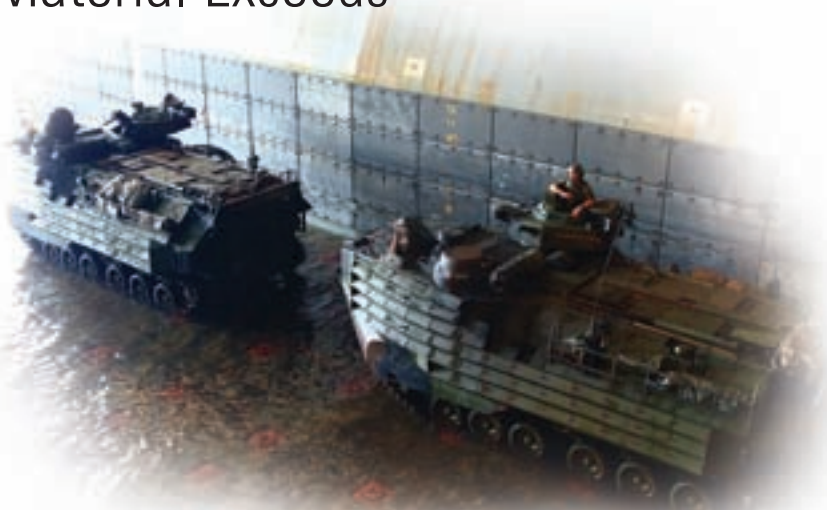
- ▶ Increases ship survivability
- ▶ Reduces foreign object damage
- ▶ Reduces damage to landing craft
- ▶ Be maintenance free, reducing sailor man hours
- ▶ Lowers shipyard labor for new installations



The Ultimate Batterboard Material Exceeds Military Requirements

A superior performing substitute to wood timbers, LINERITE® was designed and tested for use by the U.S. Navy to protect the well decks of amphibious assault ships from heavy impact damage.

An LHD, LPD and LHA carries amphibious assault vehicles, landing craft and marines to their destination.



Real Life Impact Testing Was Conducted Comparing Wood Timbers and LINERITE®.

Before tests were conducted, numerous calculations were performed, including the effects of entrapped water as well as the cylinder of water pushing the assault craft with a larger effective mass. It was concluded LINERITE® had to be engineered to withstand the repeated impacts of a fully-loaded LCU 1610 weighing 390 tons, traveling 3 knots, generating impact energy of 98,455 in/lbs.

Tests were conducted on full-scale batterboard panels using frame and bulkhead assemblies that duplicated existing LSD-41 ship construction. A 4,018 lb. impact cart was used to simulate the impact of an LCU 1600 Class landing craft.



Variable conditions were simulated during the tests:

- ▶ Landing craft speeds
- ▶ Angle of approach
- ▶ Wind and wave conditions

TESTS RESULTS: Wood timbers proved to be only good for one severe impact.

The first test was run at 30 mph with a travel direction of 15 degrees. The impactor plowed through the wood, fracturing the timbers into small pieces. One of the bolts holding the impacted board was bent and ripped out.



TESTS RESULTS: LINERITE® Batterboard Impact System Met All R&D Objectives.

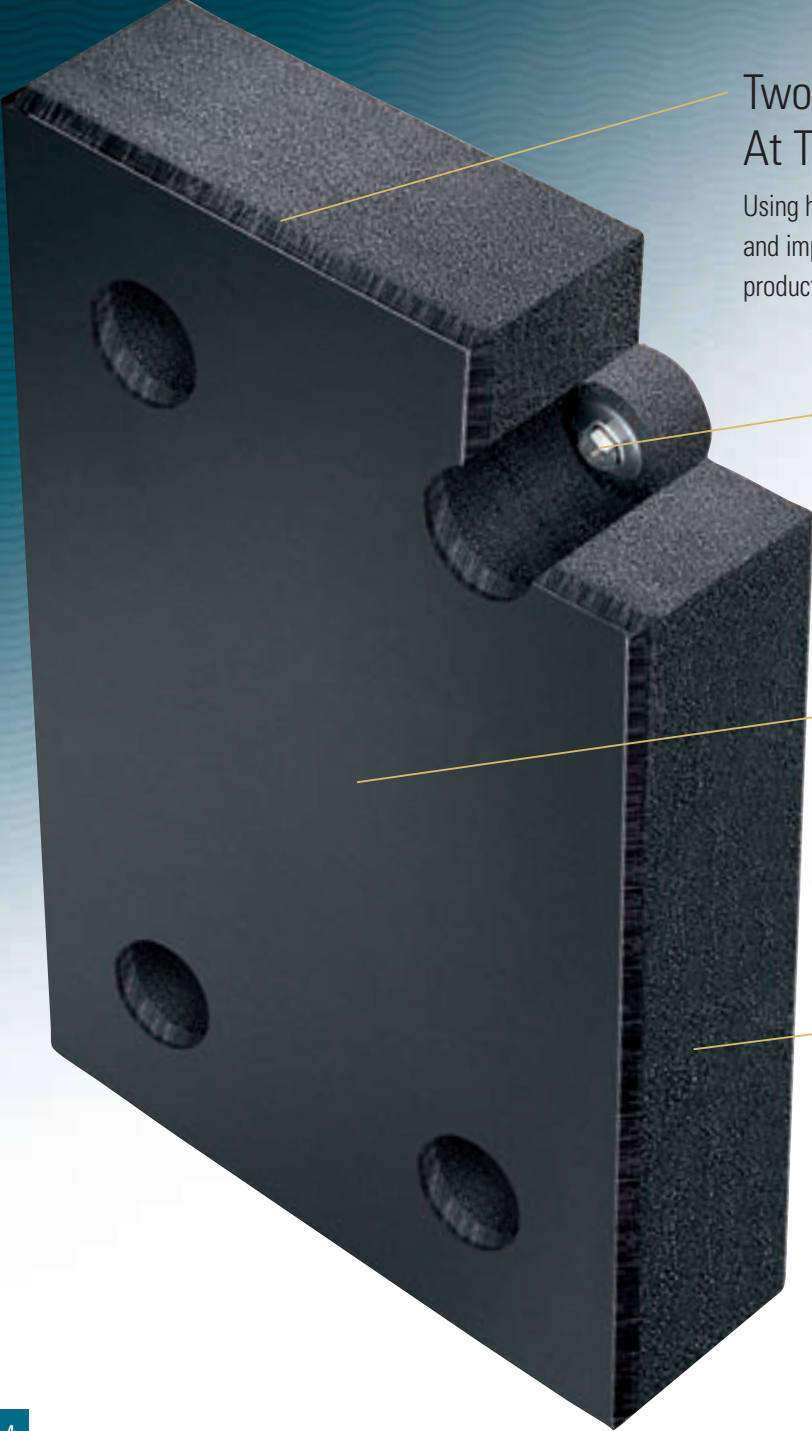
On the same test in which the wood failed, LINERITE® with its unique energy absorbing composite design proved to be an indestructible layer of protection. Eight separate impact tests were performed at increased velocities. The LINERITE® batterboard always returned to its original shape and dimension.



The Ultimate Batterboard.

LINERITE® composite batterboard is an engineered product designed specifically for high frictional wear applications where heavy impacts occur. It absorbs impact energy like no other material and provides a nearly indestructible layer of protection.

It is a unique, relatively hard and dense material that is a long-lasting, highly effective, environmentally friendly batterboard that is infinitely superior to traditional batterboard materials.



Two Integral Materials Fused Together At The Molecular Level.

Using heat and extreme pressure, the LINERITE® UHMW-PE facing and impact-absorbing core is blended into a remarkable composite product structure that is virtually impossible to separate.

Recessed Stud Fastener System Prevents Shearing.

Custom fabricated recessed mounting holes reduce bolt stress and prevent dangerous shearing of bolts or studs during impact.

0.12 Low-Coefficient Of Friction UHMW-PE Facing.

The Ultra High Molecular Weight Polyethylene (UHMW-PE) facing layer material protects and extends the wear life of your vessel, pilings and dock structure.

Proprietary Energy Absorbing Composite Core

Unlike straight UHMW-PE plastic panels which transfer impact energy directly to the substructure causing damage, LINERITE® with its superior energy absorption protects the substructure and vessel from damage.

Two LINERITE® configurations engineered to meet application requirements

Linerite is manufactured using 2 formulations to meet the performance requirements of the application. The 2 formulations are identified as **CID LINERITE** and **Standard LINERITE**.

CID LINERITE

Linerite was developed for use inside the well decks of US NAVY amphibious support vessels. The U.S. NAVY CID–A-A-59001 (commercial item description) establishes the performance and quality assurance requirements for shipboard use of synthetic batterboard materials. The key specifications included in the CID are:

- ▶ Coefficient of Friction
- ▶ Impact resistance
- ▶ Flame spread
- ▶ Smoke density
- ▶ Resilience

CID Linerite exceeds all requirements of CID–A-A-59001.

Standard LINERITE

Standard Linerite was developed as a lower cost alternative to meet budgetary constraints of replacing wood timbers in outdoor batterboard applications where enhanced flame retardant characteristics were unnecessary. The robust flame retardant features in Linerite CID are not typically required in most outdoor applications.

LINERITE PERFORMANCE COMPARISONS				
	Test	CID Requirement	CID LINERITE	Standard LINERITE
FRICITION	Coefficient of Friction - surface ASTM-D-1894	0.20	0.19	0.12
IMPACT RESISTANCE	Impact Strength ASTM-D-256 method A unnotched	≥45 inch-pounds/inch	131	166
	Cracks or breaks	No	No	No
FLAME	Flame Spread Index ASTM-E-162	≤25	14	85
	Drips	No	No	Yes
SMOKE	Smoke Density - ASTM-E-662			*Contact Duramax Marine
	Flaming	≤450	118.2	
	Smoldering		97.8	
RESILIANCE	Resilience - ASTM-2632	≤25% rebound	11%	11%
OTHER PERFORMANCE FACTORS	Molecular Weight of UHMW-PE Surface Layer	≥3.1 x 10 ⁶	>3.1 x 10 ⁶	>3.1 x 10 ⁶
	Water Absorbtion (by wt.)		Negligable	Negligable
	Operating Temperature	-20 to 125° F	No Effect	No Effect
	Marine Organisms		No Effect	No Effect
	Oil Exposure		No Effect	No Effect
	Withstands Repeated Heavy Impact		Yes	Yes
	Weight per ft ² (1/2" Thick Surface Layer)			
	2" Thick		10.77 lb.	10.77 lb.
	3.5" Thick		19.4 lb.	19.4 lb.

Structural Integrity: Spans for mounting braces - LINERITE can be used in unsupported spans of up to 36". Spans greater than 36" require a supporting substructure.

LINERITE® Optimizes Energy Absorption When Deflected – While Reducing Reactive Force.

This proprietary designed protection system greatly reduces the transfer of energy to the substructure. And, unlike solid rubber with its low energy absorption, there is no “sling shot effect” that could cause damage to the vessel.

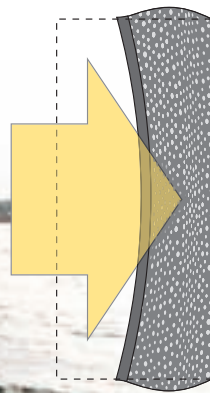
Energy-Absorbing Composite Core With Low Reaction Force.

LINERITE® HAS A PROPRIETARY DESIGNED CORE

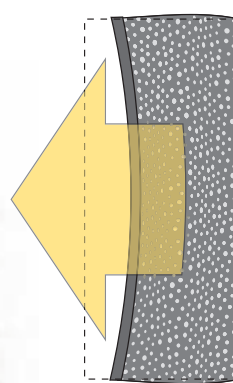
that combines a thermoset elastomer and plastic creating a resilient alloy layer with a very low reaction force.



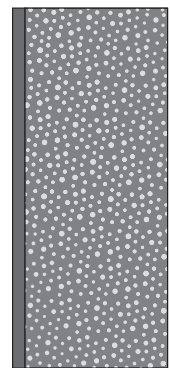
SUPERIOR ENERGY ABSORPTION
Absorbs force with room to bulge on impact



DELAYED ELASTIC RESPONSE
Returns To Original Dimension in 5 Sec. – 1 Hr.



VIRTUALLY INDESTRUCTIBLE
Withstands repeated heavy loads & impacts



UHMW-PE Facing With 0.12 Low-Coefficient Of Friction.

Unlike some manufacturers that use recycled materials that reduce impact strength and wear life of the batterboard, the LINERITE® facing is virgin UHMW-PE with an extremely low coefficient of friction.

ABRASION RESISTANT

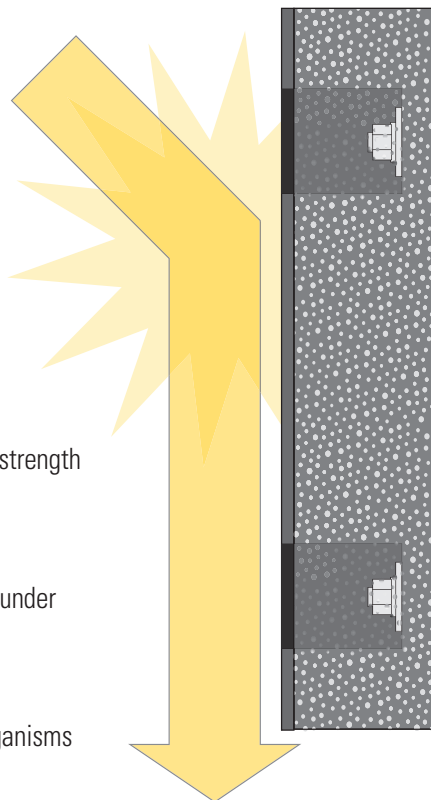
Low coefficient of friction and high impact strength reduces batterboard wear.

VIRTUALLY UNBREAKABLE

Resists cracking, tearing or breaking down under heavy loads.

LONG LIFE IN TOUGH CONDITIONS

Resists corrosion, unaffected by marine organisms and extreme weather.



Recessed Stud Fastening System Protects Against Damage and Injury.

NO EXPOSED FASTENERS

that can be sheared off causing serious injury and damage.

BOLT STRESS IS REDUCED

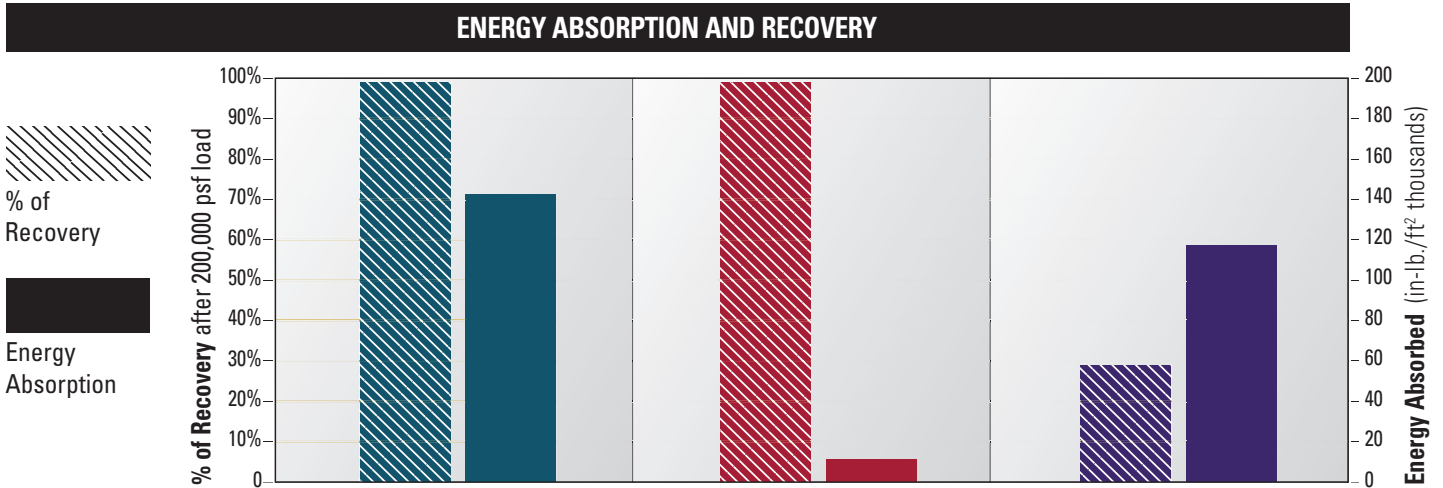
because the LINERITE® core composite compresses upon impact – unlike solid rubber that bulges around its fasteners causing them to shear off or potentially becoming dangerous projectiles.

TIGHT INSTALLATION of LINERITE®

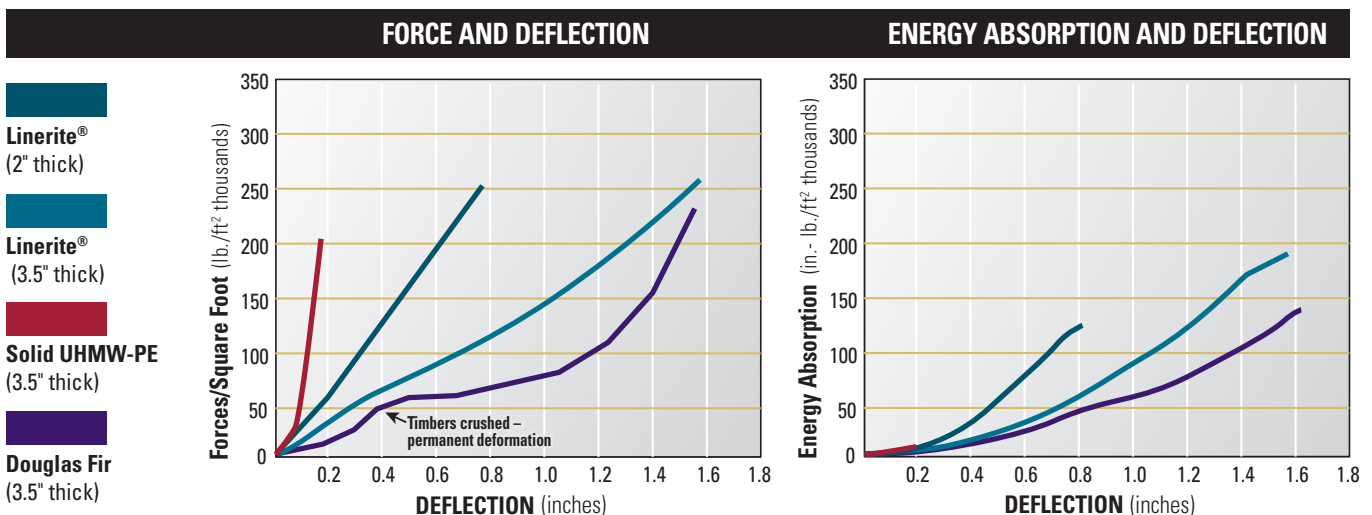
to substructure is assured. Mounting fasteners can be tightened against the dense alloy core to form a tight long-lasting bond.

Engineered For Unmatched Impact Performance.

When it comes to impact performance, LINERITE® Composite Batterboard absorbs impact energy and withstands repeated high-impact blows far better and longer than wood, or any other standard batterboard material.



	LINERITE®	Solid UHMW-PE Panels	Wooden Timbers
ENERGY ABSORPTION	High-energy absorption	Low energy absorption	Good energy absorption
TRANSFER OF IMPACT ENERGY	Absorbs repeated impacts assuring substructure protection	Transfers energy to substructure causing damage	Only good for one severe blow, then loses favorable characteristics
ELASTIC RESPONSE	Delayed response. No sling shot effect	High rebound. Produces undesirable sling shot effect	Starts losing original elastic efficiency after first impact
RECOVERY	Returns to original shape in 5 seconds to 1 hour	Stays hard, absorbs relatively no energy force	Irreversible damage
LIFE CYCLE	Almost indestructible	Recycled UHMW-PE reduces wear life	Crush and splinter upon impact



LINERITE® Has a Lower Life-cycle Cost Than Wood.

LINERITE® Composite Batterboard provides a nearly indestructible layer of protection and requires minimal maintenance. Unlike wood, that leaches chemicals into the environment, LINERITE® is friendly to the environment. It is the superior performing substitute for wood that is sacrificial in nature, requiring repair and replacement.

LINERITE® Vs. Wooden Timbers Comparison Chart



	LINERITE®	Wooden Timbers
Water Absorption	0.02%	100%
Oil Exposure	Just wash down	Needs replacement
Marine Organism	Inert	Shortens life
Chemicals	Just wash down	Deteriorates
Freezing Temperatures	Unaffected	Cracks
Flame Spread	14	34
Environmental Safety	Environmentally friendly	Leaches harmful chemicals
Maintenance	Practically none	High maintenance
Service Life	Virtually indestructible	replaced often

LINERITE® Reduces Maintenance Costs On 49' BUSL U.S. Coast Guard Buoy Tender.

Wood batterboard on the buoy tender has been replaced with LINERITE® because of the sacrificial manner in which wood dissipates impact forces and resists wear. Impacts, oil, biological and chemical action does irreversible damage to wood, causing it to be maintained and replaced far too often.



LINERITE®



WOODEN TIMBERS

Perfect System For a Variety of Marine Applications.

TYPICAL APPLICATIONS

INCLUDE:



- ▶ Dock facings
- ▶ Bridge fenders
- ▶ Wharf, pier and lock fenders
- ▶ Dry dock walls and side rails
- ▶ Pipeline fenders
- ▶ Floating docks
- ▶ Piling Facing
- ▶ Wing walls
- ▶ Offshore pump station fenders
- ▶ Boat rails and gunnels
- ▶ Ferry terminals
- ▶ Canal lock walls
- ▶ Canal lock door panels
- ▶ Vessel well decks
- ▶ Bilge block facings
- ▶ Passenger ferry
- ▶ Commercial crab fishing vessels

U.S. Coast Guard Chooses LINERITE® For Well Deck.

When the U.S. Coast Guard replaced the well deck pads on their 87' Protector Class vessel, they chose LINERITE®. Its low friction and energy absorption characteristics made it the perfect material to use in this tough working environment. The LINERITE® was custom fabricated for quick installation.

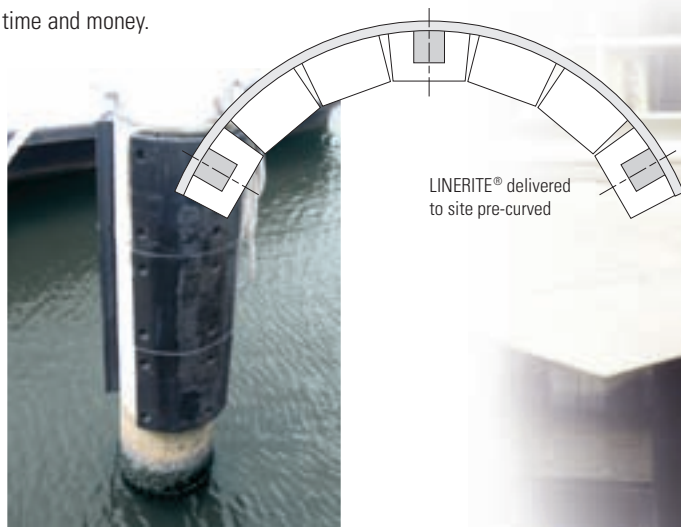


LINERITE® Can Be Designed and Manufactured For Custom Applications.

Our impact protection system expert will work with you to meet your specific application requirements. They will design and build a custom size and thickness, create a special configuration, or manufacture a face surface to match a custom color.

Pre-curved for easy installation

Duramax® will engineer an impact system that will perfectly match your application. This will save installation time and money.



Custom sizes upon request

LINERITE® can be manufactured to the right length, width and thickness, and then drilled to meet your installation requirements.



Custom color

LINERITE® UHMW-PE facing comes in black and yellow as standard colors. The face material can be manufactured to match any custom color.



Methods Of Installing LINERITE® To Match Your Application.

Consult with a Duramax® impact protection system expert to discuss your method of installation. Then, Duramax® will prepare LINERITE® to fit that mounting method and your specifications.

Custom mounting holes

Our recessed stud fastening system is custom fabricated to fit your application perfectly, making on-site installation easy and less costly. And, LINERITE® is lightweight making it easy to handle.



Standard sizes in stock

LINERITE® is readily available in standard sizes. Our LINERITE® expert will consult with you to help select the right size for your specific application.

STANDARD SIZES AVAILABLE:

LENGTH	WIDTH	THICKNESS
6'	3'	2' and 3 1/2"
6'	4'	2' and 3 1/2"
4'	4'	2' and 3 1/2"

Can be cut and fabricated to desired dimensions

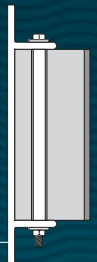
Examples of mounting installations



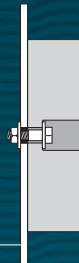
Angle iron mounting



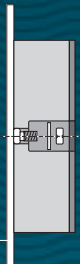
Welded mounting



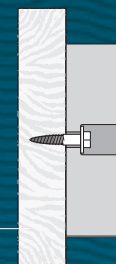
Nut and bolt through steel



Welded stud to steel



Lag bolt in wood



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
DX 490 Rudder Bushings



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
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
Weatherstrip Door Gaskets, Window Channel and Hatch Cover Gaskets
LINERITE® Composite Batterboard Systems



DURAMAX® SHAFT SEALING SYSTEMS

Duramax® Shaft Seal Systems
Johnson® Heavy-Duty Air Seal Stuffing Boxes
Duramax® Ultra-X™ High Performance Compression Packing
Johnson® Strong Boy Stern Castings and Stuffing Boxes

© 2007 Duramax Marine®
17990 Great Lakes Parkway
Hiram, Ohio 44234 U.S.A.
PHONE 440.834.5400
FAX 800.497.9283 USA & Canada
or 440.834.4950
info@DuramaxMarine.com
www.DuramaxMarine.com

DURAMAX MARINE®

