



**COMPOSITE  
WATERFRONT  
SOLUTIONS**

## **HARBORCAMEL™**

*Tough and durable,  
the industry's leading  
floating log fender*

# HARBORCAMEL™

*A durable and virtually maintenance free camel*

HarborCamel™, is a fiberglass reinforced polymer (FRP) log camel designed to transfer vessel impact energy into multiple vertical fender piles.

HarborCamel™ features a high-density polyethylene (HDPE) exterior shell which exhibits excellent abrasion resistance while protecting your vessel from impact and scuff damage.



## SIZING

HarborCamels™ are available in custom sizes up to 42" in diameter. Our most commonly requested sizes are 16", 18", 24", 30", and 36". HarborCamels™ are available in custom sizes up to 75' in length. Our most commonly requested length is 50'.

## BUOYANCY

HarborCamels™ float with a high freeboard, typically 50%, a feature appreciated by many of our clients due to higher visibility while berthing.

## CONNECTION

A variety of mooring options are available, from traditional stainless steel hawse pipes, to eye bolt style connections, as well as all-composite attachments. We can help develop a solution that works for your specific project.

## PERFORMANCE

HarborCamel™ has an FRP wall which is designed to absorb the radial compression asserted on the camel during impact. Wall thicknesses vary depending on the sizes of the vessels and the energy absorption required.

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***"CWS IS OUR GO TO SUPPLIER BECAUSE THEY ARE FORWARD THINKING AND EASY TO WORK WITH ON DEVELOPING DESIGN IMPROVEMENTS. ALL WEAR AND CORROSION ISSUES HAVE BEEN VIRTUALLY ELIMINATED BECAUSE TWO STAINLESS STEEL EYE BOLTS AND CHAIN WITH A ROLLER SYSTEM WERE ADDED IN LIEU OF THE HAWSE PIPE. HERE IN SAN DIEGO, THE U.S. NAVY HAS ADOPTED THIS CHANGE INTO ALL CURRENT AND IN-PROGRESS CAMEL DESIGN PROJECTS."***

TIM MEYER, MARATHON CONSTRUCTION CORPORATION



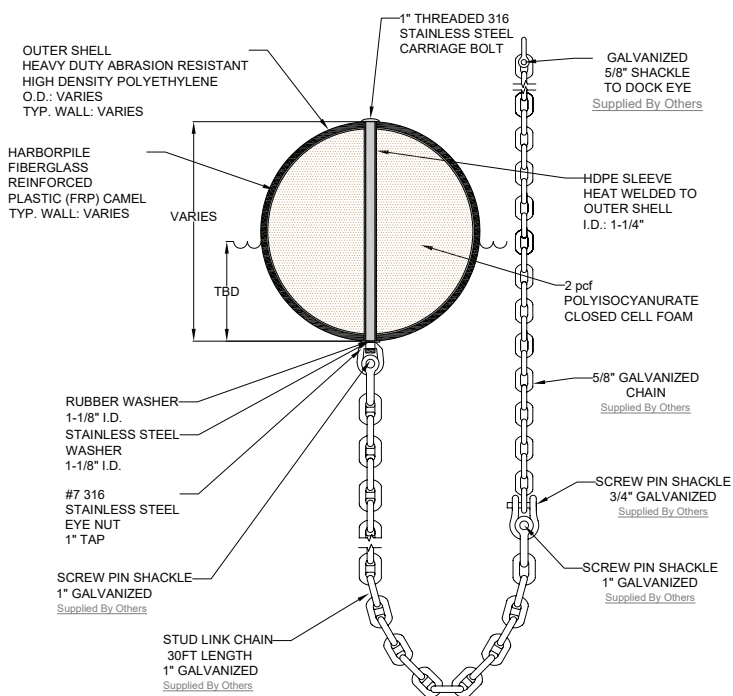
## EACH HARBORCAMEL™ IS CUSTOM DESIGNED TO EXCEED RADIAL COMPRESSION STRESSES DUE TO VESSEL IMPACT.

Ports, Harbors, and Piers around the world use HarborCamels™ for their fendering needs. Our products assist with berthings by absorbing and distributing the energy and momentum of the oncoming vessel and protecting the structure to which they are attached. Composite Waterfront Solutions' HarborCamels™ have been praised for their generous freeboard.

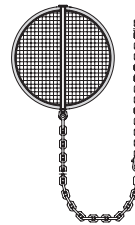
### MOORING ATTACHMENT STYLES

The most common mooring attachment styles are Hawse and Eyebolt, as illustrated below. Contact us today to speak with one of our representatives, who would be happy to assist with any questions.

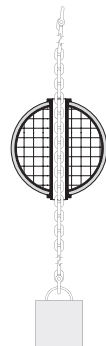
#### CAMEL ATTACHMENT DETAIL



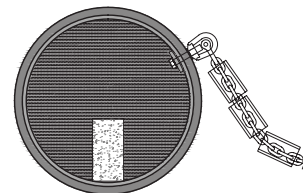
#### EYEBOLT MOORING ATTACHMENT



#### HAWSE PIPE STYLE ATTACHMENT



#### DOUBLE EYEBOLT MOORING ATTACHMENT



HarborCamels™ feature an abrasion resistant HDPE sleeve, protecting vessels and providing long service life. It has been approved and installed for the U.S. Navy, as well as for customers from Maine to California, to Alaska. Many aspects of the camel can be customized. We can work with you to decide on the best length, diameter, and mooring attachment style for your needs.



CHARACTERISTIC CRUSH STRENGTH OF CAMEL (LB/FT):FORCES APPLIED PERPENDICULAR TO THE CAMEL AXIS	INITIAL FAILURE ONSET	ULTIMATE LOAD CAPACITY
18" OD x 0.4" FRP Wall Thickness	5,871	7,463
18" OD x 1.0" FRP Wall Thickness	8,854	14,599
24" OD x 0.4" FRP Wall Thickness	4,851	7,415
24" OD x 0.8" FRP Wall Thickness	8,231	12,077
36" OD x 0.4" FRP Wall Thickness	4,213	3,697
36" OD x 0.8" FRP Wall Thickness	7,005	7,766

Notes:

1. Table based on characteristic values per ASTM D7290; proper safety factors are required.
2. Tests performed on 6" wide sections of camel, containing polystyrene foam fill and HDPE outer sleeve

ROUND CAMEL FRP LAMINATE PROPERTIES	
Longitudinal Tension Strength per ASTM D3039, psi (Mpa)	76,900 (530)
Longitudinal Compression Strength per ASTM D6641, psi (Mpa)	72,000 (496)
Hoop Tension Strength per ASTM D3039, psi (Mpa)	25,300 (174)
Hoop Compression Strength per ASTM D6641, psi (Mpa)	34,700 (239)
Inplane Shear Strength per ASTM D7078, psi (Mpa)	22,300 (154)
Estimated Longitudinal Full Section Flexural Modulus, psi (Mpa) <sup>2</sup>	3.47E+06 (23,890)
Shear Modulus, psi (Mpa) <sup>2</sup>	8.49E+05 (5,854)
Density, lb/in <sup>3</sup> (kg/m <sup>3</sup> ) <sup>3</sup>	0.068 (1,882)
Fiber Volume Fraction, % <sup>3</sup>	~50%

Notes:

1. All mechanical properties based on coupon testing average values of representative flat plates
2. Estimated Full Section Flexural Modulus based on the average of Tension and Compression Moduli.
3. Density and Fiber Volume Fraction based on theoretical values for the laminate architecture



814-839-4186 • 214 Industrial Lane, Alum Bank, PA 15521

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