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# Rolling Back Government: Lessons from New Zealand

## Maurice P. McTigue

Maurice P. McTigue is a distinguished visiting scholar at the Mercatus Center at George Mason University, where he directs the government accountability project. Previously, he was a member of the New Zealand Parliament and New Zealand's ambassador to Canada, and was closely involved in New Zealand's deregulation of labor markets, deregulation of the transportation industry, and restructuring of the fishing industry through the creation of conservation incentives. He also served as Minister of Employment, Minister of State Owned Enterprises, Minister of Railways, Minister of Works and Development, Minister of Labour and Minister of Immigration. Among his many honors, Mr. McTigue is a recipient of the Queen's Service Order, bestowed by Queen Elizabeth II in a ceremony at Buckingham Palace. In the U.S., he was recently appointed to the Office of Personnel Management Senior Review Committee, formed to make recommendations for human resources systems at the Department of Homeland Security. He also sits on the Performance Management Advisory Committee for the Commonwealth of Virginia.

The following is adapted from a lecture delivered on February 11, 2004, on the Hillside campus, during a five-day seminar on "The Conditions of Free-Market Capitalism," co-sponsored by the Center for Constructive Alternatives and the Ludwig von Mises Lecture Series.

If we look back through history, growth in government has been a modern phenomenon. Beginning in the 1850s and lasting until the 1920s or '30s, the government's share of GDP in most of the world's industrialized economies was about six percent. From that period onwards—and particularly since the 1950s—we've seen a massive explosion in government share of GDP, in some places as much as 35-45 percent. (In the case of Sweden, of course, it reached 65 percent, and Sweden nearly self-destructed as a result. It is now starting to dismantle some of its social programs to remain economically viable.) Can this situation be halted or even rolled back? My view, based upon personal experience, is that the answer is "yes." But it requires high levels of transparency and significant consequences for bad decisions—and these are not easy things to bring about.

What we're seeing around the world at the moment is what I would call a silent revolution, reflected in a change in how people view government

accountability. The old idea of accountability simply held that government should spend money in accordance with appropriations. The new accountability is based on asking, "What did we get in public benefits as a result of the expenditure of money?" This is a question that has always been asked in business, but has not been the norm for governments. And those governments today that are struggling valiantly with this question are showing quite extraordinary results. This was certainly the basis of the successful reforms in my own country of New Zealand.

New Zealand's per capita income in the period prior to the late 1950s was right around number three in the world, behind the United States and Canada. But by 1984, its per capita income had sunk to 27th in the world, alongside Portugal and Turkey. Not only that, but our unemployment rate was 11.6 percent, we'd had 23 successive years of deficits (sometimes ranging as high as 40 percent of GDP), our debt had grown to 65 percent of GDP, and our credit ratings were continually being downgraded. Government spending was a full 44 percent of GDP, investment capital was exiting in huge quantities, and government controls and micro-management were pervasive at every level of the economy. We had foreign exchange controls that meant I couldn't buy a subscription to *The Economist* magazine without the permission of the Minister of Finance. I couldn't buy shares in a foreign company without surrendering my citizenship. There were price controls on all goods and services, on all shops and on all service industries. There were wage controls and wage freezes. I couldn't pay my employees more—or pay them bonuses—if I wanted to. There were import controls on the goods that I could bring into the country. There were massive levels of subsidies on industries in order to keep them viable. Young people were leaving in droves.

### Spending and Taxes

When a reform government was elected in 1984, it identified three problems: too much spending, too much taxing and too much government. The question was how to cut spending and taxes and diminish government's role in the economy. Well, the first thing you have to do in this situation is to figure out what you're getting for dollars spent. Towards this end, we implemented a new policy whereby money wouldn't simply be allocated to government agencies; instead, there would be a purchase contract with the senior executives

of those agencies that clearly delineated what was expected in return for the money. Those who headed up government agencies were now chosen on the basis of a worldwide search and received term contracts—five years with a possible extension of another three years. The only ground for their removal was non-performance, so a newly-elected government couldn't simply throw them out as had happened with civil servants under the old system. And of course, with those kinds of incentives, agency heads—like CEOs in the private sector—made certain that the next tier of people had very clear objectives that they were expected to achieve as well.

The first purchase that we made from every agency was policy advice. That policy advice was meant to produce a vigorous debate between the government and the agency heads about how to achieve goals like reducing hunger and homelessness. This didn't mean, by the way, how government could feed or house more people—that's not important. What's important is the extent to which hunger and homelessness are actually reduced. In other words, we made it clear that what's important is not how many people are on welfare, but how many people get off welfare and into independent living.

As we started to work through this process, we also asked some fundamental questions of the agencies. The first question was, "What are you doing?" The second question was, "What should you be doing?" Based on the answers, we then said, "Eliminate what you shouldn't be doing"—that is, if you are doing something that clearly is not a responsibility of the government, stop doing it. Then we asked the final question: "Who should be paying—the taxpayer, the user, the consumer, or the industry?" We asked this because, in many instances, the taxpayers were subsidizing things that did not benefit them. And if you take the cost of services away from actual consumers and users, you promote overuse and devalue whatever it is that you're doing.

When we started this process with the Department of Transportation, it had 5,600 employees. When we finished, it had 53. When we started with the Forest Service, it had 17,000 employees. When we finished, it had 17. When we applied it to the Ministry of Works, it had 28,000 employees. I used to be Minister of Works, and ended up being the only employee. In the latter case, most of what the department did was construction and engineering, and there are plenty of people who can do that

without government involvement. And if you say to me, "But you killed all those jobs!"—well, that's just not true. The government stopped employing people in those jobs, but the need for the jobs didn't disappear. I visited some of the forestry workers some months after they'd lost their government jobs, and they were quite happy. They told me that they were now earning about three times what they used to earn—on top of which, they were surprised to learn that they could do about 60 percent more than they used to! The same lesson applies to the other jobs I mentioned.

Some of the things that government was doing simply didn't belong in the government. So we sold off telecommunications, airlines, irrigation schemes, computing services, government printing offices, insurance companies, banks, securities, mortgages, railways, bus services, hotels, shipping lines, agricultural advisory services, etc. In the main, when we sold those things off, their productivity went up and the cost of their services went down, translating into major gains for the economy. Furthermore, we decided that other agencies should be run as profit-making and tax-paying enterprises by government. For instance, the air traffic control system was made into a stand-alone company, given instructions that it had to make an acceptable rate of return and pay taxes, and told that it couldn't get any investment capital from its owner (the government). We did that with about 35 agencies. Together, these used to cost us about one billion dollars per year; now they produced about one billion dollars per year in revenues and taxes.

We achieved an overall reduction of 66 percent in the size of government, measured by the number of employees. The government's share of GDP dropped from 44 to 27 percent. We were now running surpluses, and we established a policy never to leave dollars on the table: We knew that if we didn't get rid of this money, some clown would spend it. So we used most of the surplus to pay off debt, and debt went from 63 percent down to 17 percent of GDP. We used the remainder of the surplus each year for tax relief. We reduced income tax rates by half and eliminated incidental taxes. As a result of these policies, revenue increased by 20 percent. Yes, Ronald Reagan was right: lower tax rates do produce more revenue.

### **Subsidies, Education, and Competitiveness**

...What about invasive government in the form of subsidies? First, we need to recognize that the main problem with subsidies is that they make

people dependent; and when you make people dependent, they lose their innovation and their creativity and become even more dependent.

Let me give you an example: By 1984, New Zealand sheep farming was receiving about 44 percent of its income from government subsidies. Its major product was lamb, and lamb in the international marketplace was selling for about \$12.50 (with the government providing another \$12.50) per carcass. Well, we did away with all sheep farming subsidies within one year. And of course the sheep farmers were unhappy. But once they accepted the fact that the subsidies weren't coming back, they put together a team of people charged with figuring out how they could get \$30 per lamb carcass. The team reported back that this would be difficult, but not impossible. It required producing an entirely different product, processing it in a different way and selling it in different markets. And within two years, by 1989, they had succeeded in converting their \$12.50 product into something worth \$30. By 1991, it was worth \$42; by 1994 it was worth \$74; and by 1999 it was worth \$115. In other words, the New Zealand sheep industry went out into the marketplace and found people

who would pay higher prices for its product. You can now go into the best restaurants in the U.S. and buy New Zealand lamb, and you'll be paying somewhere between \$35 and \$60 per pound.

Needless to say, as we took government support away from industry, it was widely predicted that there would be a massive exodus of people. But that didn't happen. To give you one example, we lost only about three-quarters of one percent of the farming enterprises—and these were people who shouldn't have been farming in the first place. In addition, some predicted a major move towards corporate as opposed to family farming. But we've seen exactly the reverse. Corporate farming moved out and family farming expanded, probably because families are prepared to work for less than corporations. In the end, it was the best thing that possibly could have happened. And it demonstrated that if you give people no choice but to be creative and innovative, they will find solutions.

New Zealand had an education system that was failing as well. It was failing about 30 percent of its children—especially those in lower socio-economic areas. We had put more and more money into education for

20 years, and achieved worse and worse results.

It cost us twice as much to get a poorer result than we did 20 years previously with much less money. So we decided to rethink what we were doing here as well. The first thing we did was to identify where the dollars were going that we were pouring into education. We hired international consultants (because we didn't trust our own departments to do it), and they reported that for every dollar we were spending on education, 70 cents was being swallowed up by administration. Once we heard this, we immediately eliminated all of the Boards of Education in the country. Every single school came under the control of a board of trustees elected by the parents of the children at that school, and by nobody else. We gave schools a block of money based on the number of students that went to them, with no strings attached. At the same time, we told the parents that they had an absolute right to choose where their children would go to school. It is absolutely obnoxious to me that anybody would tell parents that they must send their children to a bad school. We converted 4,500 schools to this new system all on the same day.

Continued on page B-85

The previous article by Maurice P. McTigue comes to you courtesy of Imprimus, Hillsdale College's award-winning monthly speech digest. With nearly 800,000 readers, it is also America's fastest-growing journal of opinion. Do you have friends and business associates who would be interested in receiving Imprimus?



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FORTRESS Model	FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
Boat Length feet	16-27	28-32	33-38	39-45	46-51	52-58	59-68	69-150
Boat Length meters	5-8	8-10	10-12	12-14	14-15	16-18	18-21	21-46
Anchor Weight lbs.	<b>4</b>	<b>7</b>	<b>10</b>	<b>15</b>	<b>21</b>	<b>32</b>	<b>47</b>	<b>69</b>
Anchor Weight kg	<b>1.8</b>	<b>3.2</b>	<b>4.5</b>	<b>6.8</b>	<b>9.5</b>	<b>14.5</b>	<b>21.3</b>	<b>31.3</b>
Replaces Steel Anchors lbs.	6-9	10-13	14-18	19-28	33-50	50-65	70-90	100-170
Replaces Steel Anchors kg	3-4	5-6	6-8	9-13	15-23	23-29	32-41	45-77

In test after test conducted around the world, no other anchor has set faster or could match the holding power of the FORTRESS anchor. FORTRESS anchors are manufactured from a hardened Aluminum Magnesium Alloy, making them stronger and lighter than competitive steel anchors.

FORTRESS is the only anchor that is Type Approved by the American Bureau of Shipping (ABS).

- Sizes for boats up to 150 feet (46 meters).
- Lifetime Parts Replacement Warranty
- Adjustable fluke angle for soft mud.
- Disassembles for easy storage
- 90 day money back guarantee.
- Rust proof and non-magnetic.
- Tough anodized finish.
- No welds to fail.



**NOT JUST STRONGER, LIGHTER!**

## Guardian UTILITY ANCHORS

Guardian Model	G-5	G-7	G-11	G-16	G-23	G-37	G-55	G-85	G-125
Boat Length feet	12-16	17-22	23-27	28-33	34-41	42-47	48-53	54-62	63-72
Boat Length meters	4-5	5-7	7-8	8-10	10-12	12-14	14-16	16-19	19-22
Anchor Weight lbs.	<b>2.5</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>13</b>	<b>18</b>	<b>29</b>	<b>42</b>	<b>65</b>
Anchor Weight kg	<b>1.1</b>	<b>1.8</b>	<b>2.7</b>	<b>3.2</b>	<b>5.9</b>	<b>8.2</b>	<b>13.2</b>	<b>19.1</b>	<b>29.5</b>
Replaces Steel Anchors lbs.	4-6	6-9	10-13	14-18	19-28	33-50	50-65	70-90	100-170
Replaces Steel Anchors kg	2-3	3-4	5-6	6-8	9-13	15-23	23-29	32-41	45-77

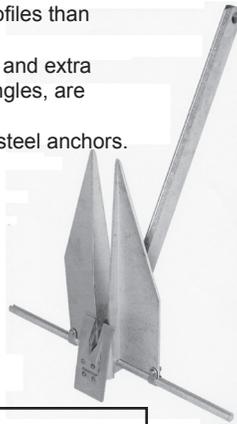
Guardian Anchors are manufactured from the same hardened Aluminum-Magnesium Alloy as FORTRESS, making them stronger and lighter than competitive steel anchors. Guardian Anchors are engineered for fast setting and strong holding power.

Guardian Anchors use slightly smaller extrusion profiles than FORTRESS.

Also, several FORTRESS precision machining steps and extra features, such as anodizing and adjustable fluke angles, are eliminated.

The result is a very affordable alternative to heavy steel anchors.

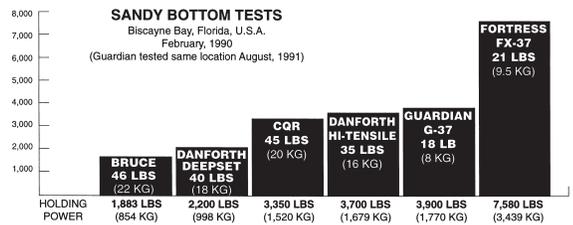
- Sizes for boats up to 72 feet (22 meters).
- One Year Parts Replacement Warranty
- Disassembles for easy storage
- 90 day money back guarantee.
- Rust proof and non-magnetic.
- No welds to fail.



### Test #2:

#### The Biscayne Bay Sandy Bottoms Test

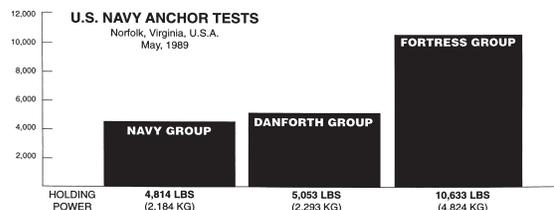
Verified by E. S. Maloney, author of "Chapman Piloting, Seamanship & Small Handling", (often called "The Boater's Bible"). These tests were conducted under controlled conditions in one of the world's most common bottoms: coarse-grain sand. The tests compared the results of tests of 6 of the most popular anchors of similar sizes, using a 70 ft. commercial tug boat as the test vessel. This test was witnessed by nearly a dozen editors of major boating magazines, as well as representatives from competing anchor manufacturers.



### Test #1:

#### The United States Navy Comparative Anchor Tests

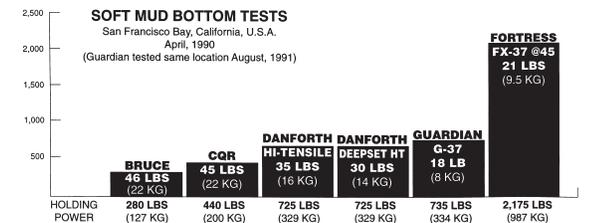
Conducted by the U.S. Navy at the Little Creek Naval Amphibious Base in Norfolk, Virginia in May 1989. These tests were in support of a special Navy project to find lightweight, high performance anchors for its high-tech fleet of 90 ft. long "LCAC" Assault Hovercraft. Several sizes and types of anchor designs were tested, including several Navy design fluke anchors, such as the "Stato", "NAV-Moor" and "LWT" which are not available to the public. These anchors weighed up to 300 lbs. The tests were conducted in a variety of bottoms over a two day period. In every test, the FORTRESS anchors set faster and outperformed all other anchors!



### Test #3:

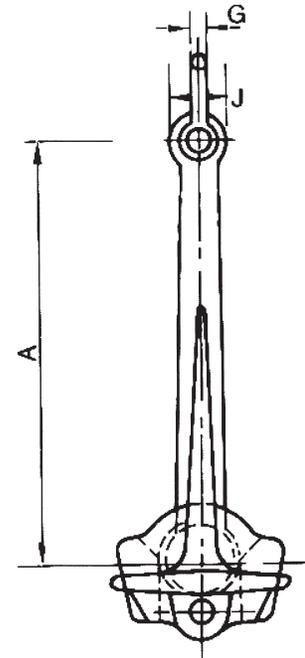
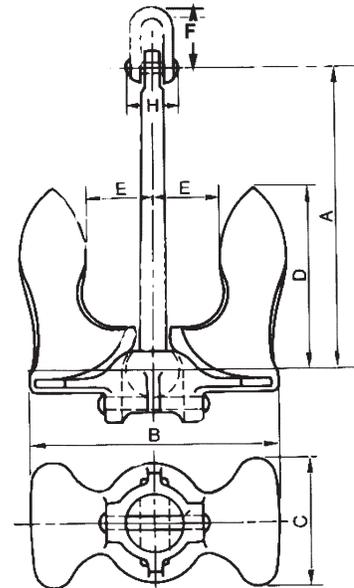
#### The San Francisco Bay Muddy Bottoms Test

Sponsored by a major U.S. marine equipment supplier, the Soft Mud Anchor Tests were also verified by E. S. Maloney and witnessed by boating journalists and competing manufacturers. The Soft Mud Tests served to illustrate the dramatic effects differing bottom types can have upon various anchor designs. These tests also marked the debut of FORTRESS' revolutionary adjustable shank-fluke angle feature, which provided a whopping 263% holding power increase in soft mud!



# ANCHORS - STOCKLESS

Anchor Weight	A	B	C	D	E	F	G	H	J	Proof Test
200	27	18	9-1/2	15-1/8	5-1/8	5-1/2	1	5	4	8300
300	32	23-1/4	11-11/16	17-3/16	6-11/16	5-1/2	1	5	4-1/2	10900
400	32	25-3/4	13	19	7	5-1/2	1	5	4-1/2	10300
500	35	26-1/2	14	20	7	7	1-1/4	6	5-1/2	15000
700	38	29-1/2	15-5/8	23-1/2	8-1/8	7	1-1/4	6	5-3/4	18700
775	38	32	16-7/8	24-3/4	8-5/8	7	1-1/4	6	5-3/4	20500
900	42	32	17	34	9	7-1/2	1-1/2	6-1/2	6-1/2	22300
1000	42	33-5/8	18	25-1/8	9-3/4	7-1/2	1-1/2	6-1/2	6-1/2	24100
1260	46	36-3/8	18-3/4	28-3/8	9-7/8	8-1/2	1-3/4	7-1/2	6-3/4	28800
1430	49	39	20	28-7/8	10-3/4	9-3/4	2	8-1/2	7	31700
1540	49	40	20-1/2	30-1/2	11	9-3/4	2	8-1/2	7	33600
1600	49	40	20-1/2	30-1/2	11	9-3/4	2	8-1/2	7	34600
1750	52	41-1/2	21	33-1/4	11-3/8	9-3/4	2	8-1/2	7-1/4	37150
1875	52	43	22	34-3/4	12	9-3/4	2	8-1/2	7-1/4	38400
1950	52	43	22	34-3/4	12	9-3/4	2	8-1/2	7-1/4	40550
2100	58	44-3/4	23	33-3/8	12-1/8	9-3/4	2	8-1/8	7-1/2	43050
2500	58	44-3/4	23-1/4	33-3/8	12-1/8	9-3/4	2	8-1/2	7-1/2	49650
3000	64	47	25-1/2	36	12-3/4	12	2-1/2	10	8-3/4	57700
4000	70-5/8	53-1/4	27-1/2	39-1/4	14-1/2	12	2-1/2	10	9-1/2	72600
4500	70-5/8	56-3/4	29	42	15	12	2-1/2	10	9-1/2	79700
5000	76	57-1/2	30	42	15-5/8	15	3	12	10-1/4	86500
6000	76	63-1/2	33-1/4	47	17-1/4	15	3	12	10-1/4	99100
6300	76	63-1/2	33-1/4	47	17-1/4	15	3	12	10-1/4	102700
6500	82	63-1/2	33	47-5/8	17-1/4	15	3	12	10-3/4	105100
6750	82	65	33-3/4	48-3/4	17-5/8	15	3	12	10-3/4	107900
7000	82	66-5/8	34-3/4	49-3/4	18	15	3	12	10-3/4	110700
7600	82	67-1/2	34-3/4	49-3/4	18-3/8	15	3	12	10-3/4	117300
8100	93-1/2	66-1/4	34-1/4	48-7/8	18-1/4	17	3-1/2	13-1/4	11-1/2	122500
8600	93-1/2	68-1/2	35-3/4	50-1/2	18-1/2	17	3-1/2	13-1/4	11-1/2	127500
9000	96	70-1/4	36-3/8	51-3/4	19-1/8	17	3-1/2	13-1/4	11-1/2	131400
10000	96	75-1/2	39	58	21	19	4	14-3/4	12	140400
11000	96	75-1/2	39	58	21	19	4	14-3/4	12	148500
12000	96	76-3/4	40	58	20-3/4	19	4	14-3/4	12	156100
13000	98	76-3/4	40	58	20-3/4	19	4	14-3/4	12	163500
14000	103	80-1/2	44	60	22-1/4	19	4	14-3/4	13	170500
15000	103	86	46	65	24	19	4	14-3/4	13	176800
16000	108	86	46	65	24	19	4	14-3/4	13	182800
18000	112	88-1/4	48-1/4	65-5/8	24-3/4	22	4-1/2	16-3/4	13	194200
18900	112	88-1/4	48-1/4	65-5/8	24-3/4	22	4-1/2	16-3/4	13	198800
20000	112	96	50	72	26	22	4-1/2	16-3/4	14	204300
25000	120	103	53-3/4	77-1/2	28	22	4-1/2	16-3/4	15	227000
30000	128	110	57-1/4	82-1/2	29-7/8	24	5	18-3/4	16	247600
35000	135	116	60	87	31-1/2	25	5	19	17	265600
40000	140	121	63	91	21	26	5-1/2	20	17-1/2	278200
45000	147	126	65	94	34	27	5-1/2	21	18	287550
50000	152	131	68	99	35	28	6	21-1/2	19	292600

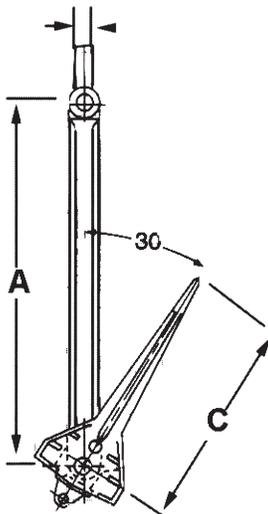
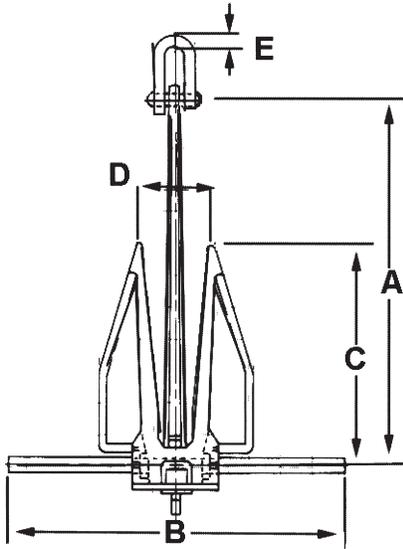


\*Specifications are in pounds and inches.

Love is grand;  
divorce is a hundred grand.

# ANCHORS - WORKBOAT

## PROOF TEST LOAD FOR SUPERIOR HOLDING POWER ANCHORS



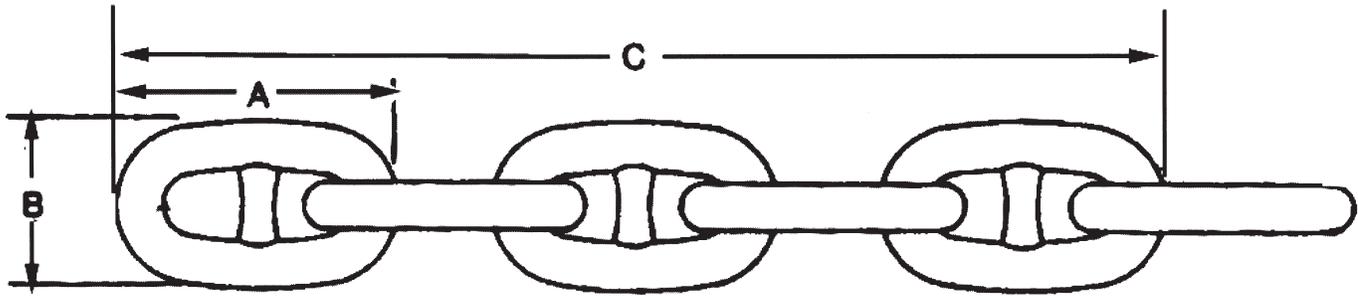
Anchor Weight	A	B	C	D	E	Proof Test
8	20	19	11-1/2	1-1/2	3/8	300
16	25	23-3/4	14-1/2	1-7/8	1/2	560
30	30-1/4	28-3/4	17-1/2	1-7/8	1/2	1000
50	34-3/4	33	20	2-3/8	5/8	1500
75	38	36	22	2-1/2	3/4	2070
100	41-1/2	39-1/2	24	3-3/8	7/8	2608
150	46-3/4	44-1/2	27	4	7/8	4200
200	52-1/2	45-1/2	33	6-1/8	7/8	10100
300	56	48-1/2	36-3/4	13/12	1-1/8	13000
500	63	54-1/2	39-3/4	15-1/8	1-1/2	18300
750	67-1/2	58-1/2	44-11/16	16-1/2	1-1/2	24100
1000	72	62	45-3/8	18-3/4	2	30000
1500	77	70-7/8	51-3/16	19-3/8	2	41000
2000	83	71-3/4	52	22-5/8	2-1/2	52500
2500	89	84-1/2	59	13-7/8	2-1/2	62500
3000	94	89	59	14-3/8	3	72500
4000	104	98-3/4	65-1/2	15-3/8	3	90500
5000	112	106-1/2	70-1/2	18	3-3/8	105500
6000	118	112	74	18-5/8	3-3/4	121500
8000	129	122-1/2	77-3/8	20-1/4	4-1/8	145500
10000	138	131	87	21-7/8	4-1/2	165500
12000	145	145	91	23	4-3/4	183000
14000	152	152	95-3/4	24	5	198000
16000	160	160	101	25-1/4	5-1/4	210000
20000	172	163	108-3/8	27-1/4	5-5/8	233000
30000	197	187	112	31-1/4	6-1/2	278000
35000	207	196	118	33	6-1/2	289500
40000	216	205	123	34-1/2	7	296000
50000	232	222	133	37-1/2	7-1/2	309500
60000	246	235	141	40	7-1/2	321000
70000	258	247	148	42	8	336000
80000	271	259	156	44	8	349400
90000	282	269	162	46	8-1/2	362900
100000	293	280	168	48	8-1/2	376000

\*Specifications are in pounds and inches.

DIMENSIONS VARY AMONG MANUFACTURERS.  
PLEASE CONTACT US FOR SPECIFIC DIMENSIONS.

I am in shape.  
Round is a shape.

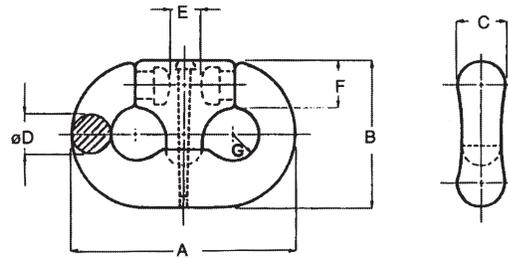
# STUD LINK ANCHOR CHAIN



CHAIN SIZE		DIMENSIONS					TEST REQUIREMENTS				No. of links per 15-Fathom Shot
Inches	mm	Link Length A	Link Width B	Length over 5-links C	Grip Radius D	Weight per 15fm shot (Approx.)	Grade 2		Grade 3		
							Proof Load	Break Load	Proof Load	Break Load	
3/4	19	4-1/2	2-5/8	16-1/2	1/2	480	34000	47600	47600	68000	357
11-3/16	20	4-7/8	2-7/8	17-7/8	1-17/32	570	39800	55700	55700	79500	329
7/8	22	5-1/4	3-1/8	19-1/4	37/64	660	46000	64400	64400	91800	305
15/16	24	5-5/8	3-5/16	20-5/8	5/8	760	52600	73700	73700	105000	285
1	25	6	3-9/16	22	21/32	860	59700	83600	83600	119500	267
1-1/16	27	6-3/8	3-3/4	23-3/8	11/16	970	67200	94100	94100	135000	251
1-1/8	29	6-3/4	4	24-3/4	25/32	1080	75000	105000	105000	150000	237
1-3/16	30	7-1/8	4-1/4	26-1/8	25/32	1220	83400	116500	116500	167000	225
1-1/4	32	7-1/2	4-1/2	27-1/2	25/32	1350	92200	129000	129000	184000	213
1-5/16	33	7-7/8	4-3/4	28-7/8	7/8	1490	101500	142000	142000	203000	203
1-3/8	34	8-1/4	4-15/16	30-1/4	7/8	1630	111000	155000	155000	222000	195
1-7/16	36	8-5/8	5-1/16	31-5/8	15/16	1780	120500	169000	169000	241000	187
1-1/2	38	9	5-3/8	33	63/64	1940	131000	183500	183500	262000	179
1-9/16	40	9-3/8	5-5/8	34-3/8	1-1/32	2090	142000	198500	198500	284000	171
1-5/8	42	9-3/4	5-7/8	35-3/4	1-1/16	2240	153000	214000	214000	306000	165
1-11/16	43	10-1/8	6-1/16	37-1/8	1-3/32	2410	166500	229000	229000	327000	159
1-3/4	44	10-1/2	6-5/16	38-1/2	1-5/32	2590	176000	247000	247000	352000	153
1-13/16	46	10-7/8	6-1/2	39-7/8	1-3/16	2790	188500	264000	264000	377000	147
1-7/8	48	11-1/4	6-3/4	41-1/4	1-1/4	2980	201000	281000	281000	402000	143
1-15/16	50	11-5/8	7	42-5/8	1-9/32	3180	214000	299000	299000	427000	139
2	51	12	7-3/16	44	1-5/16	3360	227000	318000	318000	454000	133
2-1/16	52	12-3/8	7-7/16	45-3/8	1-3/8	3570	241000	337000	337000	482000	129
2-1/8	54	12-3/4	7-5/8	46-3/4	1-27/64	3790	255000	357000	357000	510000	125
2-3/16	56	13-1/8	7-7/8	48-1/8	1-15/32	4020	269000	377000	377000	538000	123
2-1/4	58	13-1/2	8-1/8	49-1/2	1-1/2	4250	284000	396000	396000	570000	119
2-5/16	59	13-7/8	8-5/16	50-7/8	1-17/32	4490	299000	418000	418000	598000	117
2-3/8	60	14-1/4	8-9/16	52-1/4	1-9/16	4730	314000	440000	440000	628000	113

Time may be a great healer, but it's a lousy beautician.

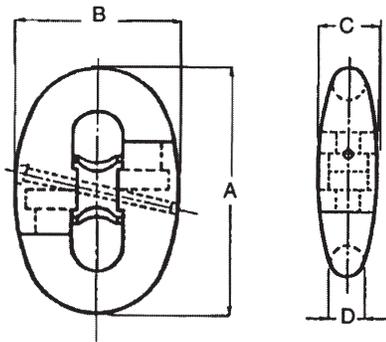
# FITTINGS - DETACHABLE CHAIN LINK



CHAIN SIZE		A	B	C	D	E	F	G	GRADE 3		Wt. Lbs.
Inches	mm								Proof Test in Pounds	Break Test in Pounds	
3/4	19	4.1/2	2.29/32	15/16	3/4	7/8	15/16	1/2	48,000	75,000	2.1
13/16 - 7/8	21 - 22	5.1/4	3.3/8	1.3/32	7/8	1.1/8	1.3/32	19/32	64,000	98,000	3.4
13/16 - 1	24 - 25	6	3.7/8	1.1/4	1	1.5/32	1.1/4	21/32	84,000	129,000	5.1
1.1/16-1.1/8	27 - 29	6.3/4	4.3/8	1.13/32	1.1/8	1.1/4	1.13/32	3/4	106,000	161,000	7.2
1.3/16 - 1.1/4	30 - 32	7.1/2	4.27/32	1.9/16	1.1/4	1.15/32	1.9/16	27/32	130,000	198,000	9.9
1.5/16 - 1.3/8	33 - 34	8.1/4	5.5/16	1.23/32	1.3/8	1.5/8	1.23/32	29/32	157,000	235,000	13.3
1.7/16 - 1.1/2	36 - 38	9	5.13/16	1.7/8	1.1/2	1.3/4	1.7/8	1	185,000	280,000	17.3
1.9/16 - 1.5/8	40 - 42	9.3/4	6.5/16	2	1.5/8	1.31/32	2	1.1/16	216,000	325,000	22.0
1.11/16 - 1.3/4	43 - 44	10.1/2	6.25/32	2.1/4	1.3/4	2.1/16	2.3/16	1.5/32	249,000	390,000	27.5
1.13/16 - 1.7/8	46 - 48	11.1/4	7.1/4	2.1/2	1.7/8	2.5/32	2.11/32	1.15/64	285,000	432,000	32
1.15/16 - 2	50 - 51	12	7.3/4	2.1/2	2	2.5/16	2.1/2	1.5/16	322,000	488,000	36
2.1/16 - 2.1/8	52 - 54	12.3/4	8.1/4	2.21/32	2.1/8	2.1/2	2.21/32	1.13/32	362,000	548,000	44
2.3/16 - 2.1/4	56 - 58	13.1/2	8.23/32	2.13/16	2.1/4	2.5/8	2.13/16	1.1/2	403,000	610,000	52
2.5/16 - 2.3/8	59 - 60	14.1/4	9.7/32	3.1/16	2.3/8	2.3/4	2.15/16	1.9/16	447,000	675,000	61
2.7/16 - 2.1/2	62 - 64	15	9.11/16	3.1/8	2.1/2	2.7/8	3.1/8	1.21/32	492,000	744,000	71
2.9/16 - 2.5/8	66 - 67	15.3/4	10.3/16	3.1/4	2.5/8	3.1/16	3.1/16	1.3/4	540,000	813,000	82
2.11/16 - 2.3/4	68 - 70	16.1/2	10.5/8	3.7/16	2.3/4	3.3/16	3.7/16	1.13/16	590,000	885,000	95
2.13/16 - 2.7/8	71 - 73	17.1/4	11.1/8	3.19/32	2.7/8	3.11/32	3.3/8	1.29/32	640,000	965,000	107
2.15/16 - 3	75 - 76	18	11.5/8	3.3/4	3	3.17/32	3.3/4	1.31/32	693,000	1,045,000	120
3.1/16 - 3.1/8	78 - 79	18.3/4	12.1/8	4	3.1/8	3.5/8	3.11/16	2.3/64	748,000	1,128,000	138
3.3/16 - 3.1/4	81 - 83	19.1/2	12.5/8	4.1/16	3.1/4	3.5/8	4.1/16	2.5/32	804,100	1,210,000	161
3.5/16 - 3.3/8	84 - 86	20.1/4	13.3/32	4.7/32	3.3/8	3.15/16	4.7/32	2.1/4	862,200	1,296,000	177
3.7/16 - 3.1/2	87 - 89	21	13.9/16	4.3/8	3.1/2	4.1/16	4.3/8	2.19/64	922,000	1,383,100	195
3.9/16 - 3.5/8	90 - 92	21.3/4	14	4.9/16	3.5/8	4.3/16	4.9/16	2.5/16	1,021,000	1,566,000	215
3.11/16 - 3.3/4	94 - 95	22.1/2	14.1/2	4.11/16	3.3/4	4.11/16	4.11/16	2.7/16	1,120,000	1,750,000	256
3.13/16 - 3.7/8	97 - 98	23.1/4	15	5	3.7/8	4.1/2	4.3/4	2.5/8	1,205,000	1,863,400	271
3.15/16 - 4	100 - 102	24	15.1/2	5.3/16	4	4.5/8	4.15/16	2.11/16	1,298,000	1,966,000	288

Never be afraid to try something new.  
Remember, amateurs built the ark, professionals built the Titanic.

# FITTINGS - KENTER JOINING SHACKLE



$$A = 6d$$

$$B = 4.2d$$

$$C = 1.5d$$

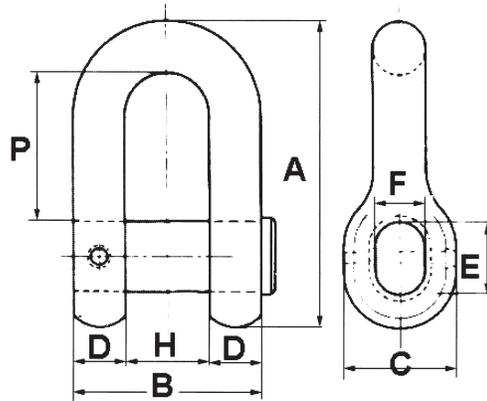
$$D = 1.0d$$

NOMINAL DIAMETER (D)		A	B	C	WEIGHT		GRADE 3	
inches	mm				inches	inches	lbs	kg
3/4	19	4-1/2	3-1/4	1-1/4	2.40	1.09	47600	68000
7/8	22	5-1/4	3-3/4	1-1/4	3.80	1.75	64400	91800
15/16	24	5-3/4	4	1-1/2	4.60	2.10	73700	105000
1	25	6	4-1/4	1-1/2	4.80	2.50	83600	119500
1-1/8	29	6-3/4	4-3/4	1-3/4	10.50	4.80	105000	150000
1-1/4	32	7-1/2	5-1/4	2	11.00	5.00	129000	184000
1-3/8	34	8-1/4	5-3/4	2	14.30	6.50	155000	222000
1-7/16	36	8-3/4	6	2-1/4	17.60	8.00	169000	241000
1-1/2	38	9	6-1/4	2-1/4	19.80	9.00	183500	262000
1-5/8	42	9-3/4	6-3/4	2-1/2	26.50	12.00	214000	306000
1-3/4	44	10-1/2	7-1/4	2-3/4	30.90	14.00	247000	352000
1-13/16	46	11	7-1/2	2-3/4	33.10	15.00	264000	377000
1-7/8	48	11-1/4	8	2-3/4	39.70	18.00	281000	402000
2	51	12	8-1/2	3	46.30	21.00	318000	454000
2-1/8	56	12-3/4	9	3-1/4	52.90	24.00	357000	510000
2-1/4	58	13-1/2	9-1/2	3-1/2	68.00	31.00	396000	570000
2-3/8	60	14-1/4	10	3-1/2	75.00	34.00	440000	628000
2-7/16	62	14-3/4	10-1/4	3-3/4	79.40	36.00	462000	660000
2-1/2	64	15	10-1/2	3-3/4	83.80	38.00	484000	692000
2-5/8	67	15-3/4	11	4	90.40	41.00	530000	758000
2-3/4	70	16-1/2	11-1/2	4-1/4	115.70	52.40	578000	826000
2-7/8	73	17-1/4	12	4-1/4	132.30	60.00	628000	897000
3	76	18	12-1/2	4-1/2	154.30	70.00	679000	970000
3-1/2	89	21	14-3/4	5-1/4	249.10	113.00	900000	1285000
4	102	24	16-3/4	6	359.40	163.00	1143000	1632000

Conscience is what hurts when everything else feels so good.

# FITTINGS - ANCHOR JOINING

## "D" TYPE SHACKLE



- A - 8.7 d
- B - 5.2 d
- C - 3.1 d
- D - 1.4 d
- E - 1.8 d
- F - 1.4 d
- H - 2.4 d
- P - 4.6 d

SIZE inches	mm	A	B	C	D	E	F	H	P	Weight Lbs.	Weight Kg.
3/4	19	6-1/2	3-7/8	2-3/8	1	1-3/8	1	1-3/4	3-1/2	5.5	2.5
7/8	22	7-5/8	4-1/2	2-3/4	1-1/4	1-5/8	1-1/4	2-1/8	4	8.4	3.8
1	25	8-3/4	5-1/4	3-1/8	1-3/8	1-3/4	1-3/8	2-3/8	4-5/8	13.2	6
1-1/8	29	9-3/4	5-7/8	3-1/2	1-5/8	2	1-5/8	2-3/4	5-1/8	18.5	8.4
1-1/4	32	10-7/8	6-1/2	3-7/8	1-3/4	2-1/4	1-3/4	3	5-3/4	24.9	11.3
1-3/8	35	12	7-1/8	4-1/4	1-7/8	2-1/2	1-7/8	3-1/4	6-3/8	34.2	15.5
1-1/2	38	13	7-3/4	4-5/8	2-1/8	2-3/4	2-1/8	3-5/8	6-7/8	43.7	19.8
1-5/8	41	14-1/8	8-1/2	5	2-1/4	2-7/8	2-1/4	3-7/8	7-1/2	56.9	25.8
1-3/4	44	15-1/4	9-1/8	5-3/8	2-1/2	3-1/8	2-1/2	4-1/4	8	70.3	31.9
1-7/8	48	16-3/8	9-3/4	5-7/8	2-5/8	3-3/8	2-5/8	4-1/2	8-5/8	85.5	38.8
2	51	17-3/8	10-3/8	6-1/4	2-3/4	3-5/8	2-3/4	4-3/4	9-1/4	105.8	48
2-1/8	54	18-1/2	11	6-5/8	3	3-7/8	3	5-1/8	9-3/4	125.7	57
2-1/4	57	19-5/8	11-3/4	7	3-1/8	4	3-1/8	5-3/8	10-3/8	147.7	67
2-3/8	60	20-5/8	12-3/8	7-3/8	3-3/8	4-1/4	3-3/8	5-3/4	10-7/8	176.6	80.1
2-1/2	64	21-3/4	13	7-3/4	3-1/2	4-1/2	3-1/2	6	11-1/2	204.1	92.6
2-5/8	67	22-7/8	13-5/8	8-1/8	3-5/8	4-3/4	3-5/8	6-1/4	12-1/8	234.6	106.4
2-3/4	70	23-7/8	14-1/4	8-1/2	3-7/8	5	3-7/8	6-5/8	12-5/8	267.6	121.4
2-7/8	73	25	15	8-7/8	4	5-1/8	4	6-7/8	13-1/4	310.2	140.7
3	76	26-1/8	15-5/8	9-1/4	4-1/4	5-3/8	4-1/4	7-1/4	13-3/4	350.5	159

\*Dimensions are in inches.

Talk is cheap  
because supply exceeds demand.

# POLYPROPYLENE ROPE

## Monofilament

Yellow, Yellow/Yellow/Black, All Black, Yellow w/2 Blue Tracers, All Blue

Dia.	Length	Yellow w/2 Blue Tracers	All Yellow Item No.	Blue	Black	2 Yellow 1 Black
1"	x 600'	701200	300200	301230	301105	301038
1"	x 1200'	701205	300205			
1-1/8"	x 600'	701210	300210			
1-1/4"	x 600'	701220	300220		301118	301040
1-5/16"	x 600'					
1-1/2"	x 600'	701235	300236			301042
						301043
1-5/8"	x 600'		300242			
1-3/4"	x 600'		300247			301044
2"	x 600'	701250	300251			301045
						301046
2-1/4"	x 600'					301052
2-1/2"	x 600'		300261			301047
2-5/8"	x 600'					301048
3"	x 600'		300271			
3-1/4"	x 600'					
4"	x 600'		300291			301054

Even if you are on the right track, you'll get run over if you just sit there.

## FILM POLYPROPYLENE ROPE

### Yellow

Item No.	Description
400130	1" x 600'
400138	1-1/8" x 600'
400140	1-1/4" x 600'
400155	1-1/2" x 600'
	1-3/4" x 600'
400200	2" x 600'
	2-1/4" x 600'
400210	2-1/2" x 600'
	3" x 600'

## SUPER STRENGTH BLUE STEEL™ POLY ROPE

- **Put Up:**  
1-1/4" x 600' & Smaller on Reels  
1-1/2" x 600' & Larger on Coils
- **Special Note:**  
720' coils are "8" Braid & includes 6' eye with chaffing gear at each end

### CWC Brand Hi Strength Coextrusion Polyolefin

Item No.	Size	Approx. Wt. per 100'	Average Tensile Strength
402115	1" x 600'	19.2	24,300
402120	1-1/8" x 600'	26.2	31,600
402125	1-1/4" x 600'	29.6	34,600
402135	1-1/2" x 600'	43.3	48,500
402142	1-5/8" x 600'	52.6	60,000
402145	1-3/4" x 600'	65.1	70,000
402150	2" x 600'	83.4	87,800
402160/63	2-1/4" x 600'	112.7	112,700
402170	2-1/2" x 600'	128.6	128,700
	2-5/8" x 600'	145.4	145,000
402195	3" x 600'	187.7	185,200

### "8" Braid Super Blue Steel™ Poly

Item No.	Size	Approx. Wt. per 100'	Average Tensile Strength
402137	1-1/2" x 600'	53 Lb.	50,860 Lb.
402143	1-5/8" x 600'	56	60,000
402146/47	1-3/4" x 600'	65.5	74,700
402155/56	2" x 600'	80.2	91,400
402165/66	2-1/4" x 600'	108.5	120,600
402180/81	2-1/2" x 600'	124.4	137,800
402188/89	2-5/8" x 600'	141.1	155,000
402200/01	3" x 600'	178.1	197,100
402210	3-1/4" x 600'	220	238,600
402225	4" x 600'	314.5	336,600
	4-1/2" x 600'	426.9	456,900
	5" x 600'	481.4	515,200

## NYLON ROPE

### White, 3 Strand

Item No.	Description
315140	1" x 600'
315145	1" x 1200'
315150	1-1/8" x 600'
315160	1-1/4" x 600'
315200	1-1/2" x 600'
	1-5/8" x 600'
315217	1-3/4" x 600'
315220	2" x 600'
315230	2-1/4" x 600'
315235	2-1/2" x 600'
315240	2-5/8" x 600'
315250	3" x 600'

An optimist thinks that this is the best possible world.  
A pessimist fears that this is true.

## ICE BLUE STEEL™ COMBO ROPE

ICE BLUE STEEL™ rope is ideal for very high strength mooring lines, head ropes, net ropes or any application where you need the floatability and the durability of a combo rope.

### Blended Polyester/Hi-Strength Blue Steel™

3 Strand Item No.	8 Braid Item No.		mm	Weight (Lbs./100 Ft)	Breaking Avg.(Lbs.)	Strengths Min. (Lbs.)	Price
403300		3/8" Dia.	10	3.6	4,675	4,250	Prices
		7/16" Dia.	11	5.0	5,896	5,360	On
403302		1/2" Dia.	12	6.4	7,216	6,560	Request
		9/16" Dia.	14	8.2	9,075	8,250	
403304		5/8" Dia.	17	10.4	11,308	10,280	
403305		3/4" Dia.	18	14.0	14,674	13,340	
		7/8" Dia.	22	20.0	20,229	18,390	
403310		1" Dia.	24	24.3	24,640	22,400	
403314		1-1/8" Dia.	28	32.0	32,450	29,500	
403315		1-1/4" Dia.	30	37.0	37,400	34,000	
403320	403420	4-1/2" Cir.	36	56.0	54,000	48,000	
	403425	5-1/2" Cir.	44	78.3	76,000	69,200	
403330/31	403430	6" Cir.	48	99.0	95,900	87,200	
		6-1/2" Cir.	52	112.1	109,100	99,200	
403335	403435/37	7" Cir.	56	133.7	130,300	118,400	
403340/41	403440	7-1/2" Cir.	60	149.6	145,800	132,600	
	403445	8" Cir.	64	168.5	164,100	149,200	
		8-1/2" Cir.	68	198.4	184,400	167,700	
403350	403450	9" Cir.	72	212.0	206,800	187,800	
		10" Cir.	80	260.7	254,000	230,900	
		11" Cir.	88	313.8	305,600	277,800	
		12" Cir.	96	370.8	358,900	326,300	

#### CONSTRUCTION:

##### Core Yarns:

##### **BLUE STEEL™ POLY**

The widely used Super Hi - Strength Poly Floating Line. Made from high tenacity coextrusion Polyolefin yarn.

##### Cover Yarns:

##### **POLYESTER HIGH TENACITY**

Abrasion resistance, high melting point, high U.V. resistance with excellent wet and dry strength and minimal 0 to 1% water absorption.

## POLYPLUS - POLY/DAC - PLUS 3

### Blended Polyester / Polypro Rope

Poly/Dac Item No.	Poly Plus Item No.	Plus 3 Item No.	Description
325120	755120	325820	1" x 600'
	755125		1" x 1200'
325130	755130	325830	1-1/8" x 600'
325140	755140	325840	1-1/4" x 600'
325147	755150	325845	1-1/2" x 600'
325157	755160	325850	1-5/8" x 600'
325167	755165	325855	1-3/4" x 600'
325173	755200	325860	2" x 600'
325182	755205	325865	2-1/4" x 600'
325187	755210	325870	2-1/2" x 600'
325191	755215	325875	2-5/8" x 600'
325197	755220	325880	3" x 600'

- Poly/Dac: White color with two black tracers. All sizes are on reels.
- PolyPlus-Plus 3: White Color with two red tracers. Sizes: 1/4" through 1-1/4" on reels. 1-1/2" and larger on coils. Reels are special order with upcharge.

Politicians and diapers have one thing in common. They should both be changed regularly and for the same reason.



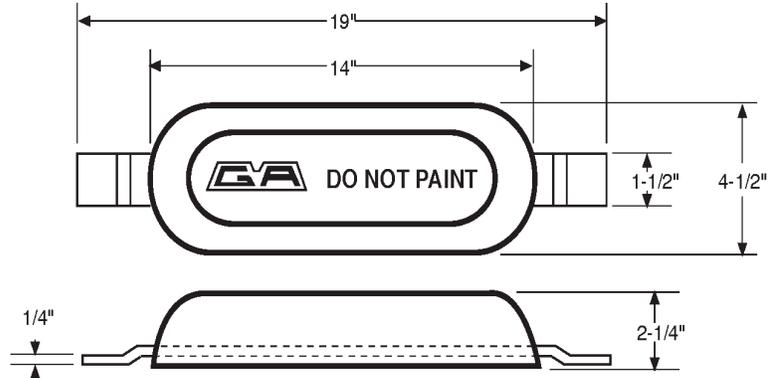
# Zinc Hull Anodes



## GA-26

Contains single galvanized steel longitudinal strap. Can be bolted or welded to hull. Particularly suited for smaller ships, coastal vessels, harbor tugs, etc.

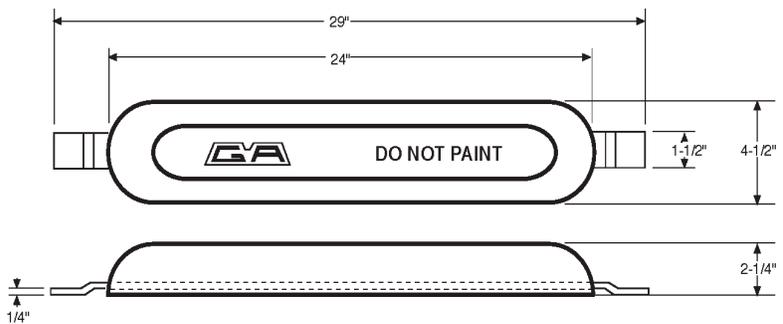
Weight	26 lbs	11.8 kg
Width	4 1/2"	114 mm
Height	2 1/4"	57 mm
Length	14"	356 mm
Current Rating	1 (amp-yrs)	



## GA-48

Contains single longitudinal galvanized steel strap for welding to hull. Particularly suited for major ships, 10,000 DWT and upward.

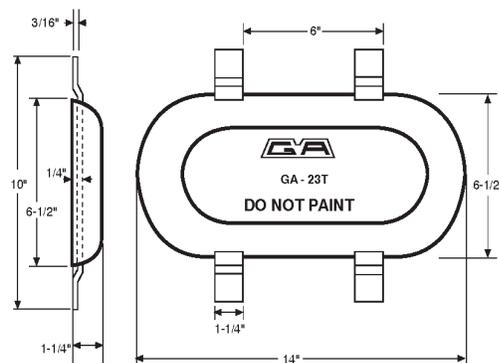
Weight	48 lbs	21.8 kg
Width	4 1/2"	114 mm
Height	2 1/4"	57 mm
Length	24"	61 mm
Current Rating	2 (amp-yrs)	



## Tapered GA-23T

Contains two cast-in galvanized steel mounting straps.

Weight	22.5 lbs	10.2 kg
Width	6 1/2"	165 mm
Height	1 1/4"	32 mm
Length	14"	356 mm
Current Rating	1 (amp-yrs)	



There will always be death and taxes; however, death doesn't get worse every year.



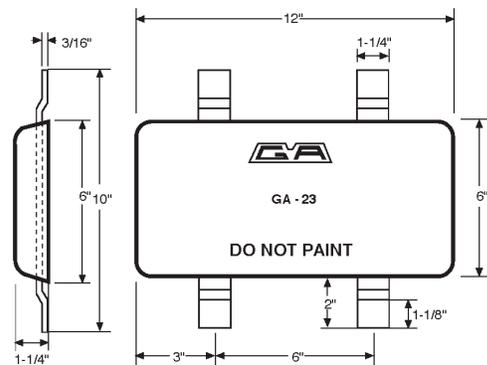
# Zinc Hull Anodes



## Military Anodes

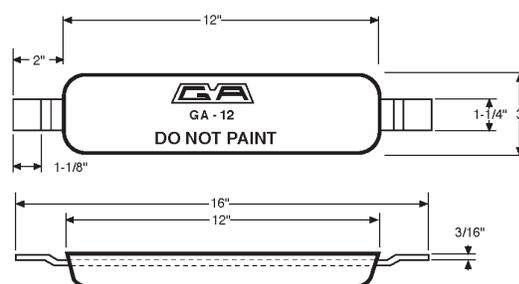
The anodes shown here conform to the latest modification of MIL-A-18001.

Anodes in this series contain two cast-in galvanized steel mounting straps (brass mounting straps are also available) or two cast-in cored holes on 6" centers. (GA-23C & GA-42C)



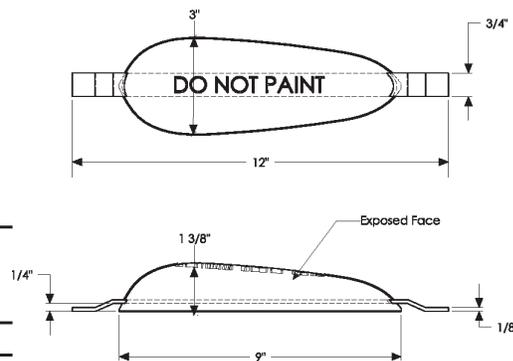
Product Number	Mil. Spec.	Wt.		W		H		L		Current Rating (amp-yrs)
		Lbs	Kg	in	mm	in	mm	in	mm	
GA-23	ZHS-23	22	10	6	152	1 1/4	32	12	30	1
GA-23C	ZHC-23	22	10	6	152	1 1/4	32	12	30	1
GA-42	ZHS-47	42	19	6	152	2 1/2	64	12	30	1
GA-42C	ZHC-47	40	18	6	152	2 1/2	64	12	30	1

These anodes contain a single cast-in galvanized steel mounting strap measuring 3/16" x 1 1/4" x 16".  
Option: Holes in straps



Product Number	Mil. Spec.	Wt.		W		H		L		Current Rating (amp-yrs)
		Lbs	Kg	in	mm	in	mm	in	mm	
GA-12	ZSS-12	11	5	3	76	1 1/4	3	12	30	0.5
GA-24	ZSS-24	22	10	3	76	2 1/2	6	12	30	1.0

A teardrop-shaped anode containing a single, cast-in galvanized steel strap.



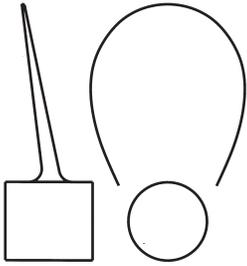
Product Number	Mil. Spec.	Wt.		W		H		L		Current Rating (amp-yrs)
		Lbs	Kg	in	mm	in	mm	in	mm	
GA-TD6	ZTS	5	2.3	3	76	1 1/4	32	9	41	0.25

In just two days,  
tomorrow will be yesterday.



## Standard Propeller Designs

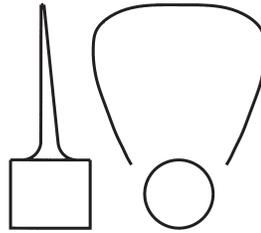
(Available in 3, 4, & 5 Blades)



### "Answer"

**.67 DAR in four blades**

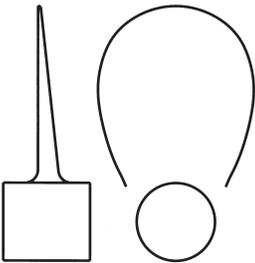
This design provides good performance in moderate horsepower / diameter ratios. Aft rake provides improved smoothness of operation by increasing hull and skeg clearance.



### "Dominator"

**.81 DAR in four blades**

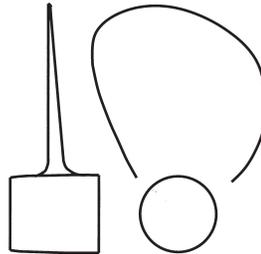
This high area blade design provides a propeller solution when horsepower are high and diameter is limited by a particular hull design.



### "Pusher"

**.7 DAR in four blades**

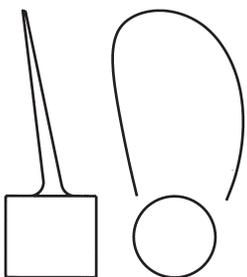
This design provides surface appropriate for moderate horsepower / diameter ratios. Elliptical blade shape and no rake configuration enhance backing performance desired in river push boat operations.



### "Cruiser"

**.68 DAR in four blades**

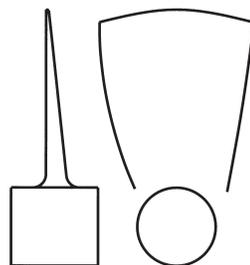
This higher skew design is appropriate for the faster pleasure and commercial passenger vessels. This propeller is designed with heavier root sections to support the demands of current higher horsepower engines.



### "Sound - B"

**.5 DAR in four blades**

This modified troost BB design provides smooth ahead performance by using moderate skew and rake of the propeller blades. Long slim blades help optimize the propeller performance.



### "Kaplan"

**Blade area ratio varies**

The kaplan propeller with its full blade width at the tip of the blades is designed to provide good performance in nozzle installations. Blade numbers and area ratios are adjusted to the particular vessel needs.

Available in Stainless Steel, Bronze and Nickle Aluminum Bronze.

## Amazing Coincidences

### WHAT GOES AROUND...

"In 1965, at age four, Roger Lausier was saved from drowning off a beach at Salem, Mass., by a woman named Alice Blaise. Nine years later, in 1974, on the same beach, Roger paddled his raft into the water and pulled a drowning man from the water. The man was Alice Blaise's husband."

-The Book of Lists

# TITAN



**3 TO 5 BLADES  
30" - 160" DIAMETER**

**TITAN offers you:**

#### PERFORMANCE

- ▶ Hard working propeller.
- ▶ Built to take heavy demands of tugs, workboats & heavy duty vessels.
- ▶ Greater thrust in a smaller diameter.

#### HEAVY-DUTY

- ▶ Blade sections are larger than standard propellers for vessels with limited propeller space.
- ▶ 3, 4 or 5 blades from 30" up to 160" diameter.

4 Blades 0.67 Dsr. Diam.	W (kg)	Max Blade Width (in)	Area per blade (in <sup>2</sup> )
30	52	11.5	118
32	60	12.6	135
34	70	13.0	152
36	80	13.8	170
38	93	14.0	190
40	115	15.4	210
42	130	16.1	232
44	146	16.9	255
46	164	17.7	278
48	183	18.4	303
50	217	19.2	329
52	240	20.0	356
54	265	20.7	384
56	291	21.5	413
58	336	22.3	443
60	367	23.1	474
62	400	23.8	506
64	445	24.6	539
66	481	25.4	573
68	521	26.1	608
70	585	26.9	645
72	630	27.7	682
74	676	28.4	720
76	739	29.2	760
78	791	30.0	800
80	846	30.8	842

The specifications on the table may vary according to customer needs. In the interest of continuous development and research, RICE PROPULSION reserves the right to modify any specifications stated herein.



We have a full line of Propellers and Nozzles to meet any requirement. Our engineering & development department is at your service to assist you to determine the ideal propeller for your boat.

# NAUTILUS

## 3 TO 5 BLADES 30" - 160" DIAMETER

The Nautilus propeller is one of our latest developments. Its skewed design reduces the propeller pressure pulses to minimum level, allowing the smoothest and quietest operation.

It is ideal for applications where underwater noise and vibration requirements are critical.

### NAUTILUS offers you:

#### PERFORMANCE

- ▶ Low noise and vibration.
- ▶ Smooth and quiet operation.

#### MED-HIGH SPEED

- ▶ Blade area ratio may vary to meet your requirements.
- ▶ 3, 4 or 5 blades, ISO Class S, from 30" to 60" in dia., Class I and II up to 150" in dia.

4 Blades 0.5 Dar. Diam.	W (kg)	Max Blade Width (in)	Area per blade (in <sup>2</sup> )
30	38	8.4	88
32	43	8.9	101
34	50	9.5	113
36	65	10.1	127
38	73	10.6	142
40	82	11.2	157
42	104	11.8	173
44	115	12.3	190
46	126	12.9	208
48	239	13.4	226
50	153	14.0	245
52	176	14.6	265
54	192	15.1	286
56	209	15.5	308
58	237	16.2	330
60	257	16.8	353
62	278	17.4	377
64	301	17.9	402
66	326	18.5	428
68	351	19.1	454
70	410	19.6	481
72	439	20.2	509
74	470	20.7	538
76	529	21.3	567
78	563	21.9	597
80	599	22.4	628

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# DELFIN



**3 TO 5 BLADES  
30" - 160" DIAMETER**

**DELFIN offers you:**

### PERFORMANCE

- ▶ Most Versatile.
- ▶ Based on famous B-Troost Series.
- ▶ Used Worldwide on fishing, supply and workboats.

### POWER

- ▶ Blade area may vary without changing the number of blades to obtain greater thrust or more speed.
- ▶ 3 to 7 hydro-dynamic cross-section blades, with integrated hub shapes.

4 Blades 0.5 Dar. Diam.	W (kg)	Max Blade Width (in)	Area per blade (in <sup>2</sup> )
30	32	8.1	88
32	43	8.7	101
34	49	9.2	113
36	56	9.8	127
38	64	10.3	142
40	82	10.9	157
42	91	11.4	173
44	107	12.0	190
46	113	12.5	208
48	126	13.1	226
50	152	13.9	245
52	167	14.1	265
54	183	14.7	286
56	200	15.2	308
58	235	15.8	330
60	255	16.3	353
62	276	16.9	377
64	307	17.4	402
66	331	18.0	428
68	357	18.5	454
70	406	19.1	481
72	435	19.6	509
74	465	20.2	538
76	510	20.7	567
78	544	21.1	597
80	579	21.8	628

The specifications on the table may vary according to customer needs. In the interest of continuous development and research, RICE PROPULSION reserves the right to modify any specifications stated herein.



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# KAPLAN



## 3 TO 5 BLADES 30" - 160" DIAMETER

The Kaplan propeller is another example of our most advanced technology.

This propeller is designed to be used with a nozzle in order to give shrimpers and workboats more thrust, by considerably increasing the efficiency of propellers carrying heavy loads while working at low speeds.

### KAPLAN offers you: PERFORMANCE

- › Advanced technology.
- › High efficiency with nozzle.
- › More thrust from propellers carrying heavy loads at low speeds.
- › Mn Bze, Stainless Bze or Aqualloy.

**With our leading technology,  
we can offer you more efficient  
systems.**

4 Blades 0.5 Dar. Diam.	W (kg)	Max Blade Width (in)	Area per blade (in <sup>2</sup> )
39	78	10.8	149
41	86	11.3	165
43	94	11.9	182
45	108	12.5	199
47	127	13	217
49	137	13.6	236
51	159	14.1	255
53	172	14.7	276
55	197	15.2	297
57	211	15.8	319
59	228	16.4	342
61	252	16.9	365
63	281	17.5	390
65	309	18	415
67	348	18.6	441
69	370	19.1	467
71	394	19.7	495
73	446	20.2	523
75	473	20.8	552
77	501	21.4	582
79	565	21.9	613
83	730	23	676
87	807	24.2	743
91	941	25.3	813
95	1032	26.4	886
99	1189	27.5	962

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# KA-SPEED

**3 TO 5 BLADES**  
**30" - 160" DIAMETER**  
**KA-SPEED**  
**offers you:**

## PERFORMANCE

- ▶ Reduced force-excitation level of the propeller.
- ▶ Better blade stress distribution.
- ▶ Smooth and silent operation (better than Kaplan propellers).
- ▶ Blade area ratio according to your needs.

The Ka-Speed was developed by adding the advantages of skewed propellers to the traditional Kaplan style.

It was conceived to be installed into our Rice Speed Nozzle\* for best performance, but it may also be installed in a Kort nozzle.

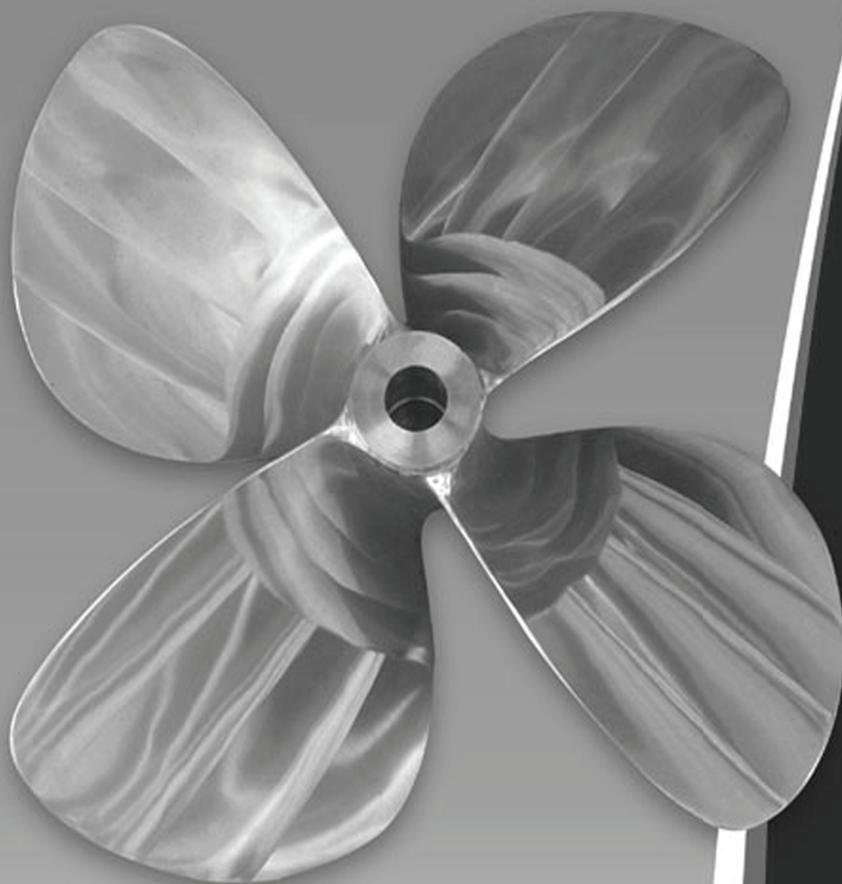
\*U.S. Patent No. 5799394

4 Blades 0.5 Dar. Diam.	W (kg)	Max Blade Width (in)	Area per blade (in <sup>2</sup> )
39	90	10.8	149
41	98	11.3	165
43	108	11.9	182
45	119	12.5	199
47	147	13	217
49	160	13.6	236
51	173	14.1	255
53	188	14.7	276
55	204	15.2	297
57	230	15.8	319
59	249	16.4	342
61	268	16.9	365
63	289	17.5	390
65	333	18	415
67	357	18.6	441
69	382	19.1	467
71	408	19.7	495
73	436	20.2	523
75	493	20.8	552
77	524	21.4	592
79	557	21.9	613
83	742	23	676
87	820	24.2	743
91	957	25.3	813
95	1050	26.4	886
99	1209	27.5	962

The specifications on the table may vary according to customer needs. In the interest of continuous development and research, RICE PROPULSION reserves the right to modify any specifications stated herein.

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# CRUCERO



## **3 TO 5 BLADES 30" - 60" DIAMETER CRUCERO offers you:**

**PERFORMANCE, COMFORT  
AND EFFICIENCY.  
A WAY OF LIFE AT RICE.**

Designed for pleasure craft and crew boats, our Crucero propeller has become one of our most popular models.

The Crucero will help your boat reach its top performance levels and planning velocity while eliminating hull-damaging vibrations.

It provides a smooth and comfortable ride for you and your passengers.

4 Blades 0.67 Dar. Diam.	W (kg)	Max Blade Width (in)	Area per blade (in <sup>2</sup> )
30	42	11.7	117
32	52	12.5	134
34	64	13.2	151
36	76	14.0	169
38	83	14.8	189
40	87	15.6	209
42	95	17.1	231
44	111	17.9	253
46	122	18.7	277
48	141	19.5	302
50	154	20.3	327
52	176	21.1	354
54	190	21.9	382
56	205	22.7	410
58	222	23.6	440
60	249	24.4	471

The specifications on the table may vary according to customer needs. In the interest of continuous development and research, RICE PROPULSION reserves the right to modify any specifications stated herein.

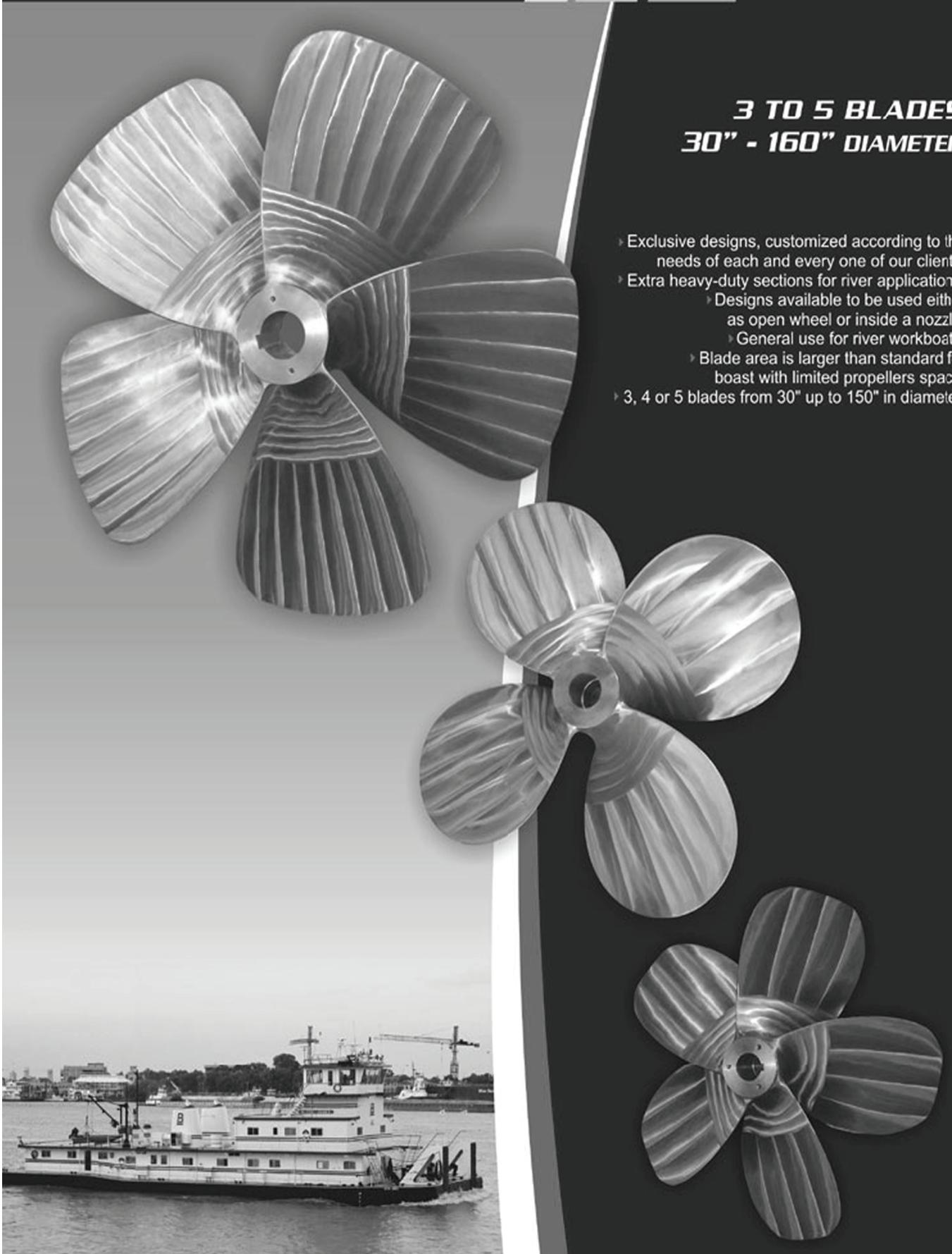
We have a full line of Propellers and Nozzles to meet any requirement. Our engineering & development department is at your service to assist you to determine the ideal propeller for your boat.



# **HEAVY DUTY RIVER PROPELLERS**

**3 TO 5 BLADES  
30" - 160" DIAMETER**

- › Exclusive designs, customized according to the needs of each and every one of our clients.
- › Extra heavy-duty sections for river applications.
  - › Designs available to be used either as open wheel or inside a nozzle.
  - › General use for river workboats.
- › Blade area is larger than standard for boats with limited propellers space.
- › 3, 4 or 5 blades from 30" up to 150" in diameter.





# RICE NOZZLES

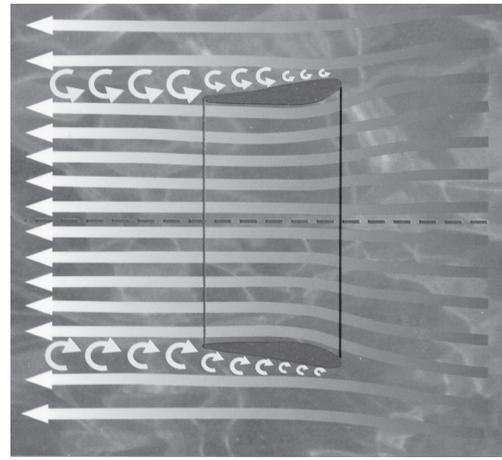
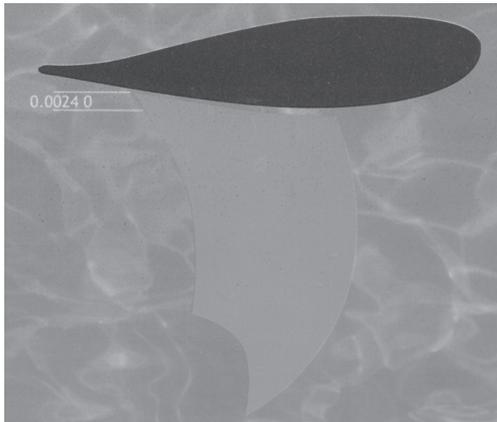
## More Power in your boat without further modifications!

The benefits of Nozzle Systems on low speed boats are out of the question. It is proven that in tugboats they provide up to 40% more bollard pull than an open propeller, using the same power plant on the same boat. For fishing boats in the 3-4 knot range you may gain up to 30% more power.

At **Rice Propulsion**, committed to our continuous research & development philosophy, we revised the Kort Nozzle, developed in the 30's and still in use in some boats with no significant modifications. We came with our new patented\* design that changed everything: from the method of fabrication to the nozzle section, thus resulting a considerable reduction in the drag coefficient.

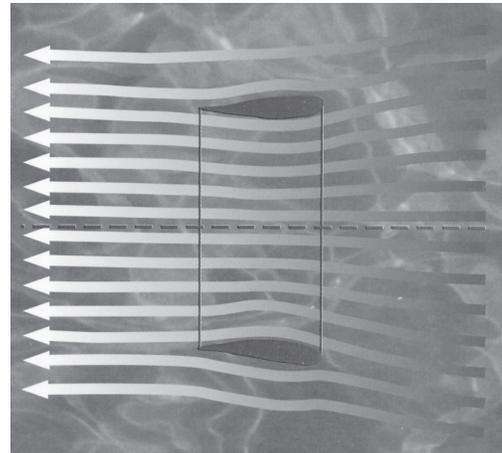
Due to this hydrodynamic profile combined with the work area of the propeller in the center of the **Rice Nozzle\*** (approximately 40% smaller than the area of the entrance of the nozzle), the acceleration and mass of the water flow through the inside of the nozzle are increased by 40%. Therefore, the propeller pitch required to impulse this mass of water is higher than the one used in Kort Nozzles.

With this increase in the propeller pitch, water leaves the nozzle faster, dropping pressure substantially in the inside of the nozzle and creating a differential with the outside surface. Because of this pressure difference, a force is created on the external surface of the NOZZLE that is always perpendicular to this surface. Because of the design of the outside trail part of the NOZZLE, the horizontal component of this force creates an additional thrust of the NOZZLE, increasing the total thrust of the vessel.



Kort 19<sup>a</sup> profile: Drag coef. = 0.17

When nozzle sections from a Kort 19-A and a Rice Nozzle\* are compared, the drag coefficient of our nozzle is 17 times lower. This is because of the Rice Speed Nozzle\* section profile that was selected from NASA air wing sections with high lift/low drag coefficient, conditions that allow maximum thrust/speed possible.



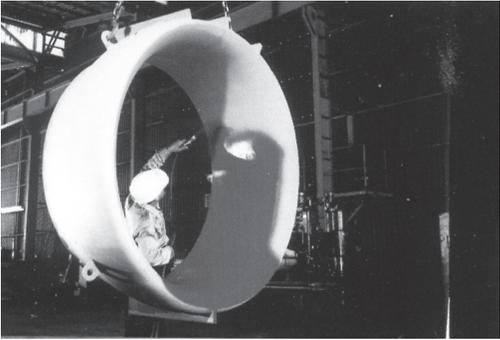
Rice Speed profile: Drag coef. = 0.01

When redesigning our Nozzle System, we also decreased roundness tolerances, allowing us to reduce the tip propeller clearance from 0.6% to 0.4%, increasing the efficiency of the Propeller-Nozzle unit.

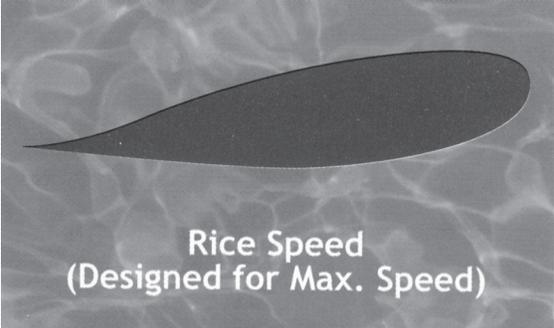
\*US PATENT # 5799394



# RICE NOZZLES



## Rice Speed Nozzle\*



Rice Speed  
(Designed for Max. Speed)

The **Rice Speed Nozzle\*** is designed to obtain additional speed to the boat. When compared to any Kort-19<sup>a</sup> system you obtain:

- 3% more bollard pull
- 12% more free running speed
- 6 - 8% fuel savings

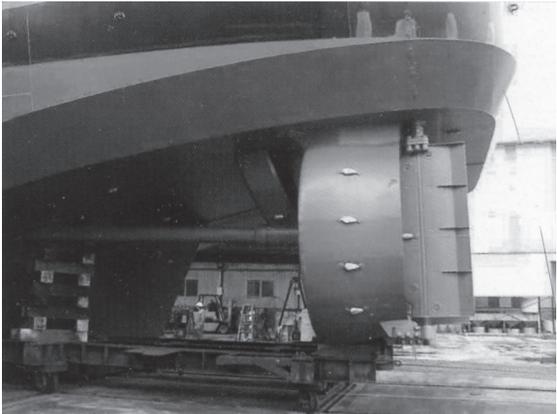
## Rice Thrust Nozzle\*



Rice Thrust  
(Designed for Max. Thrust)

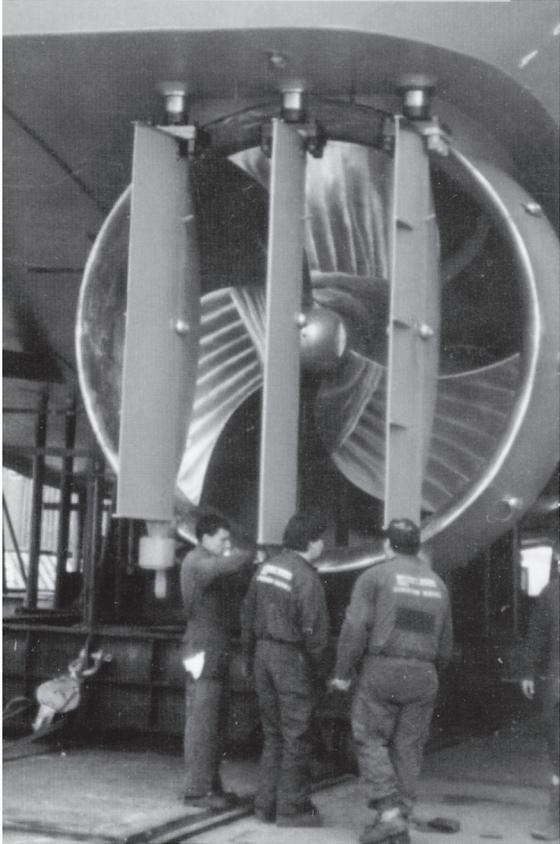
The **Rice Thrust Nozzle\*** is designed to obtain more bollard pull. When compared to any Kort-37 system you gain:

- 8 - 13% more bollard pull
- 8 - 10% more free running speed
- 8 - 12% fuel savings



\*US PATENT # 5799394

## HIGH ASPECT RATIO TRIPLE RUDDERS



To improve maneuverability to the **Rice Nozzle Systems** we have incorporated the high aspect ratio triple rudders. All together will provide the most efficient, conventional propulsion system available in the market that will satisfy you for years.



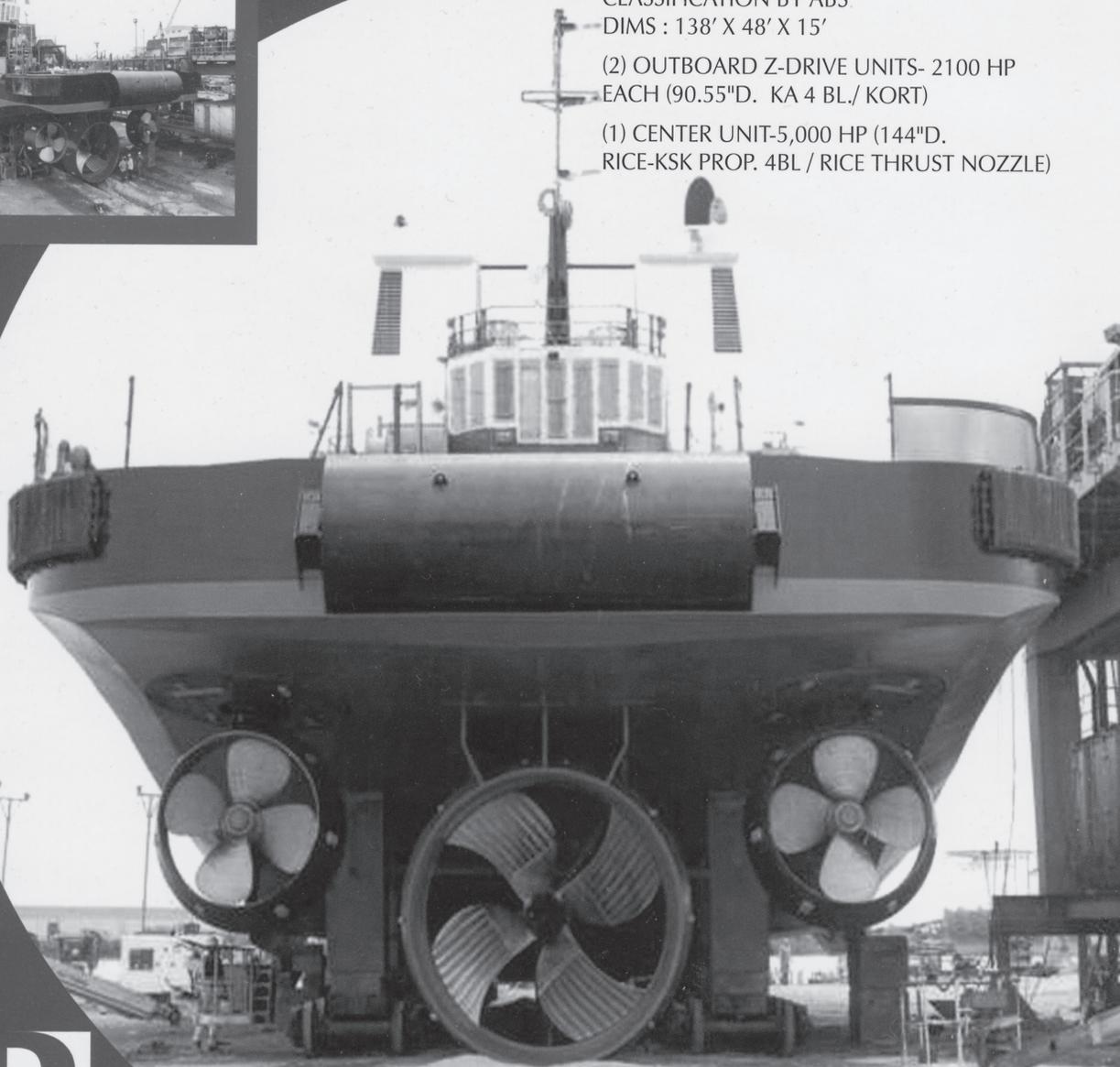
**\*31.8Lb/hp OF BOLLARD PULL  
NOBODY DOES IT BETTER THAN  
RICE THRUST  
NOZZLE SYSTEM**

U.S. PATENT # 5799394

BUILDER : BENDER SHIPBUILDING  
VESSELS : "SIDNEY, DEVIN & KELLY CANDIES"  
CLASSIFICATION BY ABS  
DIMS : 138' X 48' X 15'

(2) OUTBOARD Z-DRIVE UNITS- 2100 HP  
EACH (90.55"D. KA 4 BL./ KORT)

(1) CENTER UNIT-5,000 HP (144"D.  
RICE-KSK PROP. 4BL / RICE THRUST NOZZLE)



**RICE**  
**R**  
METALMEC  
RICE NOZZLES

**BOLLARD PULL TRIALS RESULTS:**

- TOTAL BOLLARD PULL (ALL ENGINES): 260050Lbs.
- TOTAL PERFORMANCE: 28.27 Lbs/Hp (12.61 Kg/Hp)
- RICE SYSTEM BOLLARD PULL (ALONE):159000 Lbs
- RICE SYSTEM PERFORMANCE: 31.8 Lbs/Hp (14.2 Kg/Hp)
- TOTAL FREE RUNNING SPEED (ALL ENGINES): 13.3KNOTS
- RICE SYSTEM FREE RUNNIG SPEED (ALONE): 11.7 KNOTS
- PERFORMANCE CERTIFICATES AVAILABLE IN FILE





## RIVER H-D NOZZLES

The new H-D River Nozzles by Rice is designed to meet the heavy demands of river service. If you work your boat on the river you already know that they encounter extraordinary problems due to the erosion from river sand and shallow operations. Extraordinary problems call for extraordinary solutions.

**RICE HAS THAT SOLUTION:**  
A NOZZLE DEVELOPED FOR THIS  
PARTICULAR APPLICATION.

### ADVANTAGES:

- **EXTENDED LIFE AND DURABILITY**  
Superior construction and design combines on all stainless steel shell with heavier internal components to yield the best performance in the most demanding conditions.
- **WELDINGS.** All internal and external welding is continuous and in compliance with ABS regulations. All factory welders are ABS and Germanischer Lloyd certified.
- **EASY INSTALATION.** Qualified naval



- architects will adapt the nozzle design to your hull and provide all necessary installation information to the shipyard.
- **EXTRA SMOOTH SS INNER SHELL.** Rice H-D nozzles have an extremely smooth stainless steel inner shell to minimize any cavitation that may be caused by turbulence.
- **FUEL SAVINGS.** Rice offers propeller and nozzle sizing service free of charge according to vessel and power specifications to get the lowest possible level of fuel consumption.
- **RELIABILITY.** You can expect top quality, fast deliveries and the lowest prices for similar construction in the market. Your nozzles are always delivered on time.
- **QUALITY CONTROL.** Rice is an ISO 9001 certified nozzle manufacturer and committed to offer you the best product on the market.

### More Amazing Coincidences

#### Survivor

“On three separate occasions—in 1664, 1785, and 1860—there were shipwrecks where only one person survived the accident. Each time that one person’s name was Hugh Williams.”

-The Book of Useless Information

# PSS SHAFT SEAL PACKLESS SEALING SYSTEM

- **DRIPLESS OPERATION**

**Eliminates Needless Bilge  
Pumping**

- **LOW MAINTENANCE**

**No More Packing and  
Repacking**

- **REDUCED COST**

**Eliminates Shaft Wear  
and Minimizes  
Corrosion**



## How does the PSS Shaft Seal work?

The PSS Shaft Seal is a mechanical face seal. The seal is created between the flat surfaces of the rotating stainless steel collar, the stationary carbon flange and a rubber bellows. The rubber bellows is attached to the vessels stern tube (note: specify stern tube diameter when ordering) with hose clamps and the carbon flange is attached to the front side of the rubber bellows with hose clamps. The stainless steel collar is fit on the shaft in front of the carbon flange. The stainless steel collar is then used to compress the rubber bellows before the collar is secured to the shaft with set screws. This compression (pre-load) maintains contact between the faces and allows the PSS to compensate for the thrust from the propeller. The carbon flange is bored larger than the shaft diameter, allowing it to “float” around the shaft and thus compensate for most misalignment and vibration problems. The stainless steel collar is sealed to the shaft by two o-rings that are recessed into the bore of the collar. These o-rings rotate with the shaft and stainless steel collar and do not experience wear during operation.

### Warning!

All mechanical seals look very similar. There is, however, a big difference in materials used in the components and subsequently in the way the seals will perform.

## What makes the PSS Shaft Seal different and why is it considered the best on the market?

### 1. HIGH DENSITY CARBON/GRAPHITE FLANGE

This space age composite is machined to shape. The face is then lapped to 4 light bands. Once installed and operational the carbon/graphite face will actually polish the stainless steel rotor face during the initial minutes of operation. This polishing process ensures a perfect seal and eliminates the necessity of a spray guard. The high density of this composite greatly increases its impact and wear resistance. At a maximum operating temperature of 500° F, the carbon guards against most overheating situation, unlike other designs. The carbon/graphite flange should never need replacing under normal operation conditions. Some Captains have recorded over 40,000 engine hours on their PSS Shaft Seals.

### 3. BELLOWS

The nitrile bellows is resistant to petroleum based products and set retention. It provides the best combination of durability, strength and elasticity. The stern tube end of the bellow is available in 1/4” increments. Both shaft and stern tube diameters are necessary when ordering.

### 4. DOUBLE HOSE CLAMPS

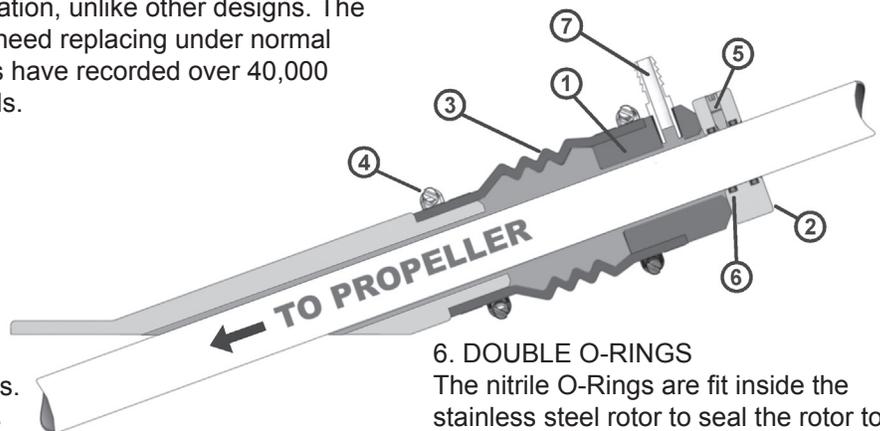
Two stainless steel hose clamps are used to secure the bellow at both the stern tube and flange ends.

### 5. DOUBLE ALLEN HEAD SET SCREWS

Allen head set screws with cupped ends are threaded into the rotor and secured to the propeller shaft. A second set screw is then threaded into each hole to secure the first screw and to prevent it from possibly backing out. The set screws also have an anti-vibration treatment applied.

### 2. STAINLESS STEEL ROTOR

The one-piece stainless steel (Type 316) rotor is slid down the shaft and is secured with double set screws, after compression is applied to the bellows. Precision tolerances are maintained by computer controlled lathes. The stainless steel rotor should never need replacing under normal operating conditions.



### 6. DOUBLE O-RINGS

The nitrile O-Rings are fit inside the stainless steel rotor to seal the rotor to the propeller shaft. Nitrile is the material used due to its superior resistance to petroleum products, temperature variations and resistance to tearing. These O-rings are stationary and do not wear.

### 7. NYLON HOSE BARB FITTING

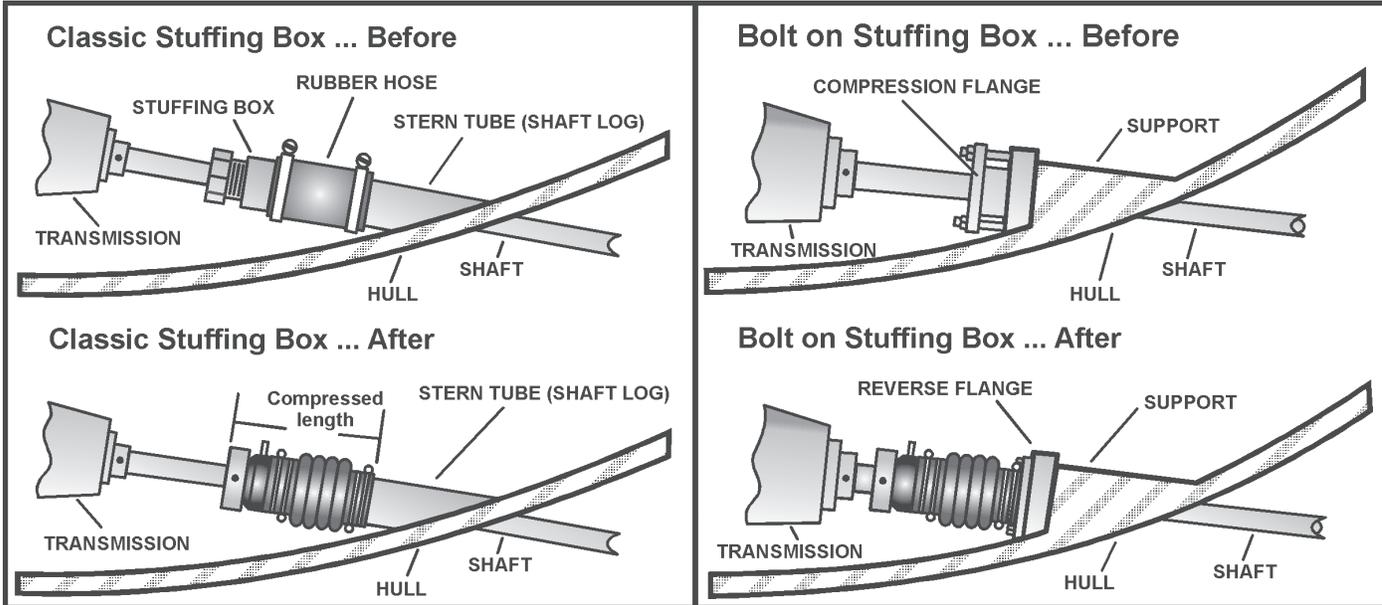
The nylon hose barb fitting is threaded into the carbon flange. The barb fitting is used to plumb water to the seal or to run a vent line.

## STEP .1 SHAFT SELECTION

Carefully measure your shaft diameter. We have PSS Shaft Seals to fit both metric shafts and S.A.E shafts.

## STEP 2. STERN TUBE OUTSIDE DIAMETER

The stern tube is also known as the shaft log. Select the type of stuffing box currently installed on your boat from the drawing below, and measure the stern tube outside diameter.



SHAFT DIAMETER	Stern Tube Diameters (specify one) O.S. (OVER SIZED) Requires larger bellow and carbon cuff reducer.	COMPRESSED LENGTH 
3/4", 7/8" 20mm, 22mm	1 1/4", 1 1/2", 1 3/4", 2", 2 1/4" O.S. (2 1/2")	6 1/4" (6 3/4")
1", 1 1/8" 25mm, 28mm, 30mm	1 1/4", 1 1/2", 1 3/4", 2", 2 1/4" O.S. (2 1/2")	6 1/4" (6 3/4")
1 1/4", 1 3/8" 32mm, 35mm	1 3/4", 2", 2 1/4", 2 1/2" O.S. (2 3/4", 3", 3 1/4", 3 1/2")	6 1/2" (7 3/4")
1 1/2" 38mm, 40mm	2", 2 1/4", 2 1/2", 2 3/4", 3", 3 1/4", 3 1/2" O.S. (3 3/4", 4")	8 1/8" (8 1/4")
1 3/4" 45mm	2 1/4", 2 1/2", 2 3/4", 3", 3 1/4", 3 1/2" O.S. (3 3/4", 4")	8 1/8" (8 1/4")
2" 50mm, 55mm	2 1/2", 2 3/4", 3", 3 1/4", 3 1/2" O.S. (3 3/4", 4")	8 1/8" (8 1/4")
2 1/4", 2 1/2" 60mm, 65mm	3 1/4", 3 1/2", 3 3/4", 4" O.S. (4 1/4", 4 1/2", 4 3/4", 5")	8 1/2" (9 1/8")
2 3/4" 70mm	4", 4 1/4", 4 1/2", 4 3/4", 5" O.S. (5 1/4", 5 1/2", 5 3/4", 6")	9 1/4" (9 5/8")
3" 75mm, 80mm	4", 4 1/4", 4 1/2", 4 3/4", 5" O.S. (5 1/4", 5 1/2", 5 3/4", 6")	9 1/4" (9 5/8")
3 1/4", 3 1/2" 85mm, 90mm	4 1/2", 4 3/4", 5", 5 1/4" 5 1/2", 5 3/4", 6"	9 3/4"
3 5/8", 3 3/4" 95mm	4 1/2", 4 3/4", 5", 5 1/4" 5 1/2", 5 3/4", 6"	9 3/4"

PSS Shaft Seals are available up to 6" (150mm) shaft diameters as standard. **Over 6" Call for quote.** When ordering please supply shaft and stern tube Diameter.

# AQUALOY 22

## AQUALOY 22 HIGH STRENGTH

Aqualoy 22 and High Strength 22 offer the best combination of corrosion resistance and strength for any marine shaft application and is superior to Type 316 and Monel 400 in both corrosion resistance and strength. Although highly corrosion resistant, cathodic protection is recommended to avoid galvanic corrosion in salt and brackish water environments. It is an ideal choice for pleasure craft due to its ability

to resist corrosion when sitting idle in seawater for long periods of time. Aqualoy 22 High Strength provides the same corrosion resistance as the Aqualoy 22 but also offers the strength of Aqualoy 17 in 2-1/4" through 6" diameter. It is ideal for those vessels requiring higher strength shafts while maintaining the highest possible corrosion resistance available.

### Chemical Composition

Carbon, Max.	.06
Manganese, Max.	4.00 - 6.00
Phosphorus, Max.	.04
Sulfur, Max.	.03
Silicon, Max.	1.00
Molybdenum	1.50 - 3.00
Chromium	20.50 - 23.50
Nickel	11.50 - 13.50
Nitrogen	0.20 - 0.40
Columbium	0.10 - 0.30
Vanadium	0.10 - 0.30
Iron	Balance

### Physical Properties (AQUALOY 22 is non-magnetic)

Density at 75F (24C)	0.285 lbs/in <sup>3</sup> (7.88 gm/cm <sup>3</sup> )
Modulus of Elasticity	
<i>Tension</i>	28,900,000 psi (199,000 Mpa)
<i>Torsion (Rigidity)</i>	10,800,000 psi (72,900 Mpa)
Poisson's Ratio	.0312

### Minimum Mechanical Properties

	3/4" to 1-1/4"	Over 1-1/4" to 2"	Over 2" to 2-1/2"	Over 2-1/2" to 3"	Over 3" to 12"	High Strength 2-1/4 to 6"
Ultimate Tensile Strength, psi (Mpa)	145,000 (1000)	135,000 (931)	120,000 (827)	115,000 (793)	100,000 (689)	130,000 (896)
0.2% Yield Strength, psi (Mpa)						
<i>Tension</i>	130,000 (896)	105,000 (724)	95,000 (655)	75,000 (517)	55,000 (379)	105,000 (724)
<i>Torsion</i>	86,600 (597)	70,000 (483)	63,300 (434)	50,000 (345)	36,600 (252)	70,000 (483)
Elongation, % in 2" (50.88mm)	18	20	20	25	30	15
Reduction of Area, %	45	50	50	50	50	45
Impact Charpy V-Notch	80	100	100	100+	100+	100
(Typical) ft-lbs (J)	(108)	(136)	(136)	(136+)	(136+)	(136)

AQUALOY 22 meets the following specifications (Analysis Only): ASTM A 276, ASTM A 479 and AMS 5764.

# AQUALOY 19

Nitrogen strengthened, Aqualoy 19 is an austenitic alloy and is non-magnetic. Applications include sportfishermen and other pleasure crafts as well as workboats where better corrosion resistance is neces-

sary. To avoid galvanic corrosion in salt or brackish water, installation of Navy grade zinc anodes is recommended.

### Chemical Composition

Carbon, Max.	.08
Manganese, Max.	2.00
Silicon, Max.	1.00
Chromium	18.00 - 20.00
Nickel	8.00 - 10.50
Phosphorus, Max.	.04
Nitrogen	0.20 - 0.30
Sulfur, Max.	.03
Iron	Balance

### Physical Properties (AQUALOY 19 is non-magnetic)

Density at 75F (24C)	0.286 lbs/in <sup>3</sup> (7.916 gm/cm <sup>3</sup> )
Modulus of Elasticity	
<i>Tension</i>	29,000,000 psi (199,949 Mpa)
<i>Torsion (Rigidity)</i>	11,200,000 psi (76,140 Mpa)
Poisson's Ratio	.0295

## Aqualoy 19 Minimum Mechanical Properties

	Up to 1-1/2"	Over 1-1/2" to 2"	Over 2" to 2-1/2"	Over 2-1/2" to 3"	Over 3" to 12"
Ultimate Tensile Strength, psi (Mpa)	130,000 (896)	115,000 (793)	105,000 (724)	100,000 (690)	95,000 (655)
0.2% Yield Strength, psi (Mpa)					
<i>Tension</i>	105,000 (724)	85,000 (586)	60,000 (414)	55,000 (379)	50,000 (345)
<i>Torsion</i>	70,000 (483)	57,000 (393)	40,000 (276)	36,600 (252)	33,000 (228)
Elongation, % in 2" (50.88mm)	20	25	30	35	35
Reduction of Area, %	55	55	55	55	55
Impact Charpy V-notch	100+	100+	100+	100+	100+
(Typical) ft-lbs (J)	(136+)	(136+)	(136+)	(136+)	(136+)

Note: if higher mechanical properties are required, please inquire.

## AQUALOY 17

Aqualoy 17 has the highest strength and hardness of all stainless steel boat shafting alloys over 2 inches in diameter. Corrosion resistance is comparable to Type 304. Vessel applications include tugs, trawlers, crew boats, patrol boats and other workboats due to its high strength in the larger diameters. To avoid galvanic corro-

sion, cathodic protection is recommended for salt or brackish water environments. Navy grade zinc anodes, properly installed, should provide satisfactory protection against galvanic corrosion. For sizes over 8" in diameter, please inquire.

### Chemical Composition

Carbon, Max.	.07
Manganese, Max.	1.00
Phosphorus, Max.	.04
Sulfur, Max.	.03
Silicon, Max.	1.00
Chromium	15.00 - 17.00
Nickel	3.50 - 5.00
Copper	3.00 - 5.00
Columbium + Tantalum	0.15 - 0.45
Iron	Balance

### Physical Properties (Aqualoy 17 is magnetic)

Density at 75F (24C)	0.284 lbs/in <sup>3</sup> (7.87 gm/cm <sup>3</sup> )
Modulus of Elasticity	
<i>Tension</i>	29,100,000 psi (200,600 Mpa)
<i>Torsion (Rigidity)</i>	11,270,000 psi (77,700 Mpa)
Poisson's Ratio	.0291

### Minimum Mechanical Properties

For 3/4" through 8"	
Ultimate Tensile Strength, psi (Mpa)	135,000 (931)
0.2% Yield Strength, psi (Mpa)	
<i>Tension</i>	105,000 (724)
<i>Torsion</i>	70,000 (483)
Elongation, % in 2" (50.88mm)	16
Reduction of Area, %	50
Impact Charpy V-notch	50
(Typical) ft-lbs (J)	(68)
Hardness Typical	
<i>Rockwell</i>	C28/37
<i>Brinell</i>	277/352

AQUALOY 17 meets the following specifications (Analysis and Mechanical Properties for H1150 only): AMS-5643 and ASTM-A-564.

## Still More Amazing Coincidences

### SECRET-AGENT KID

"James Bond, 15, a pupil at Argoed High School, North Wales, and a candidate for examinations in 1990, was given the examination number 007 by a computer quirk."

-The World's Most Incredible Stories

# DURAMAX® MARINE LLC

## DURAMAX® "490" RUDDER BUSHINGS

DURAMAX® hard rubber bushings are molded from a nitrile composition formulated to withstand the rugged "impact" service encountered in ship's rudder steering system. They possess high rigidity for maximum stability, while still retaining a degree of resiliency required to dampen peak shock loads.

DURAMAX® bushings are molded with full length internal lubricant grooves. Grease, oil or water serve equally well as lubricants. DURAMAX® solid rubber bushings are resistant to deterioration by hydrocarbons, acids, salt water and electrolysis.

ALL DIMENSION IN INCHES



PART NO.	CODE NO.	I.D.* SIZE	O.D.* SIZE	FULL LENGTH	I.D. ACROSS WATER GROOVES	NETWEIGHT FULLLENGTH (POUNDS)
812100038	DX150	1.458	2.352	11	1.625	1.10
812100044	DX175	1.700	2.595	13	1.970	1.50
812100051	DX200	1.958	3.076	15	2.200	2.50
812100057	DX225	2.180	3.329	7.50	2.575	2.30
812100064	DX250	2.442	3.681	9	2.750	2.70
812100070	DX275	2.708	3.923	10	2.970	3.00
812100076	DX300	2.952	4.205	11	3.390	4.00
812100083	DX325	3.198	4.429	12	3.600	4.00
812100089	DX350	3.437	5.192	13	3.760	7.50
812100095	DX375	3.669	5.182	14	4.050	3.50
812100102	DX400	3.933	5.450	15	4.285	7.50
812100108	DX425	4.167	5.684	16	4.550	9.00
812100114	DX450	4.429	6.026	17	4.685	11.00
812100121	DX475	4.650	6.010	18	5.050	10.00
812100127	DX500	4.933	6.682	19	5.310	15.00

CAUTION: \*Duramax® Bushings are supplied with molded I.D. and O.D. dimensions which allow ample material for finish machining. However, the finish bore should not remove more than 70% of the lubricant groove depth. IN ADDITION TO THE PRESS FIT, DURAMAX® BUSHINGS MUST BE MECHANICALLY SECURED WITH SET SCREWS.

# DURAMAX® "490" RUDDER BUSHINGS



**DURAMAX**  
non-metallic bushings



**DURAMAX "490" PRODUCT REPORT**

**PHYSICAL PROPERTIES:**

1. Material: DURAMAX
2. Deformation: Load PSI: 225, Deflection: .004", Temperature: 72° F; 300, .0045", 72° F; 15,000, Elastic Limit: 72° F
3. Compressive Strength: 3000 PSI
4. Tensile: 810 Tensile
5. Expansion and Contraction: Configuration: 800", 1000", -20° F; 100% Recovery; Aging: Liquid, Temp. 100° F; Vol. Change %: 70 hrs. ASTM #3 OH 212° F +4.3%; 70 hrs. ASTM #3 OH 100° F +less than 1%; 70 hrs. ASTM #3 OH 72° F Negligible; 70 hrs. H<sub>2</sub>O 212° F +2.6%; 70 hrs. H<sub>2</sub>O 100° F Negligible
7. Range of working temperature: -20° to +180° F continuous service.

## MACHINING I.D. - O.D. CLEARANCES AND ALLOWANCES

**TABLE X-Running Clearances**

NOM. ID	2	3	4	5	6	7	8	9	10	11	12	13	14
ALLOWANCES	.012	.013	.014	.015	.016	.017	.018	.019	.020	.021	.022	.023	.024

**TABLE Y- Thermal Factor**

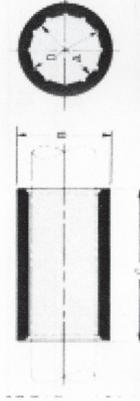
NOM. ID	2	3	4	5	6	7	8	9	10	11	12	13	14
ALLOWANCES	.004	.006	.008	.010	.012	.014	.016	.018	.020	.022	.024	.026	.028

**TABLE Z**

NOM. ID	2	3	4	5	6	7	8	9	10	11	12	13	14
ALLOWANCES	.005	.005	.005	.005	.005	.005	.008	.008	.008	.010	.010	.010	.010

To determine total I.D. Clearance-add Tables X, Y and Z.  
To determine total O.D.-add Tables Y and Z in same column.

EXAMPLE: B' I.D. = 8.000" +.018" = 8.018" Y +.016" = 8.034" Z +.008" = 8.042" I.D. Bore  
12" O.D. = 12.000" +.016" = 12.016" Z +.008" = 12.024" O.D.



# Duramax<sup>®</sup> Ultra-X<sup>™</sup>

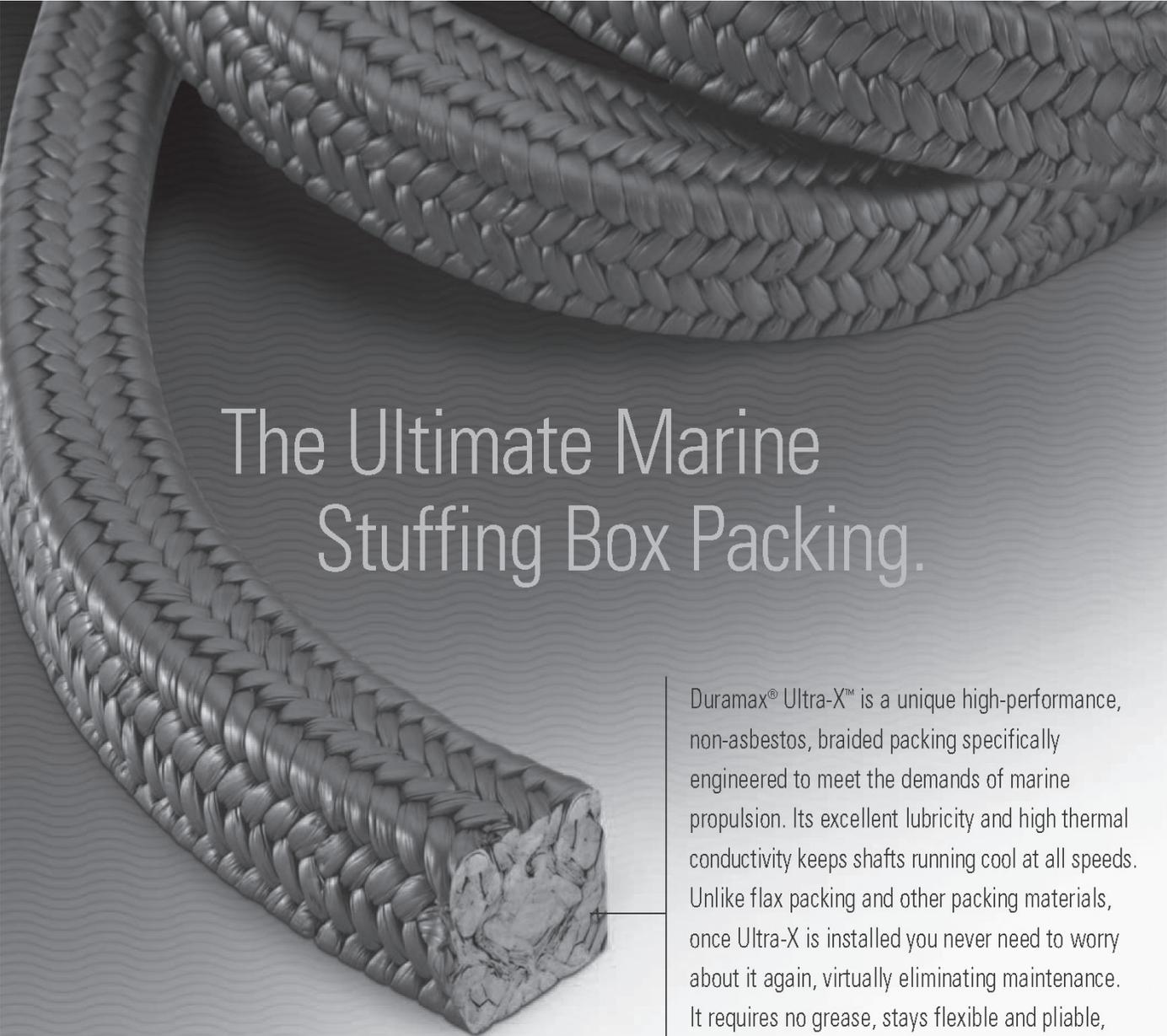
## High Performance Compression Packing

- ▷ Engineered Specifically for Heavy-Duty Marine Service
  - Stern Tube Stuffing Boxes
  - Bulkhead Stuffing Boxes
  - Rudder Stuffing Boxes
- ▷ 300% Lower Friction than Flax Packing
- ▷ Superior Thermal Conductivity
- ▷ Outlasts Flax more than 5 to 1



PRODUCT INFORMATION AND SELECTION GUIDE

**DURAMAX MARINE<sup>®</sup>**



# The Ultimate Marine Stuffing Box Packing.

Duramax® Ultra-X™ is a unique high-performance, non-asbestos, braided packing specifically engineered to meet the demands of marine propulsion. Its excellent lubricity and high thermal conductivity keeps shafts running cool at all speeds. Unlike flax packing and other packing materials, once Ultra-X is installed you never need to worry about it again, virtually eliminating maintenance. It requires no grease, stays flexible and pliable, will not harden, swell or become brittle – virtually eliminating costly damage caused by extensive shaft scoring and wear.

## Key Features of Duramax® Ultra-X™ Packing Material

- ▶ **Dissipates frictional heat:** Over five times more thermally conductive than flax and PTFE
- ▶ **Grease-free installation:** Self-lubricating and conformable, easy to install and remove after use.
- ▶ **Virtually eliminates shaft scoring:** Stays pliable, never hardens or becomes abrasive, even at high shaft speeds
- ▶ **Leakage practically eliminated:** Doesn't shrink, keeps bilge drier and free of oily contaminants
- ▶ **Lasts over 5 times longer than other packing:** Doesn't get consumed in use, holds its shape and dimension

## Engineered Specifically for the Marine Industry.

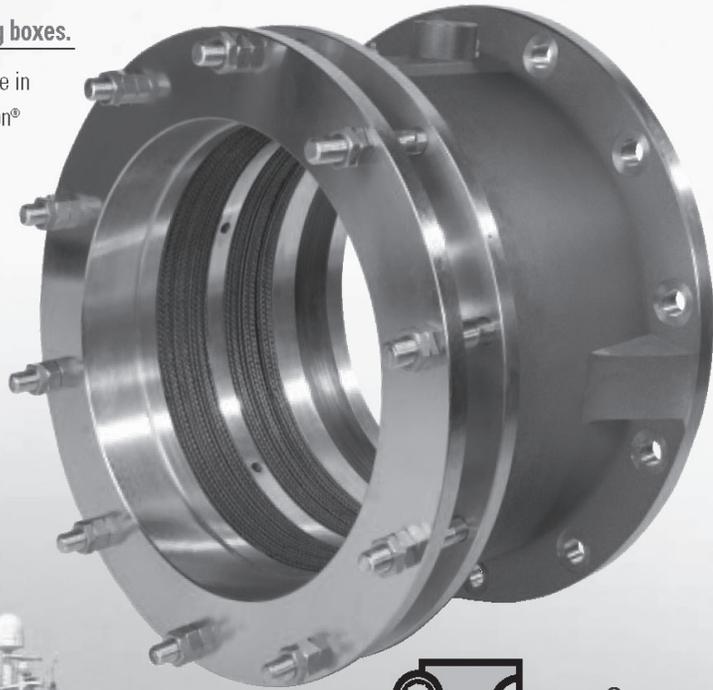
You can use Duramax® Ultra-X™ with confidence knowing it is a product of Duramax Marine®, manufacturer of Johnson® Heavy-Duty Stuffing Boxes, the most recognized, highest quality stuffing boxes in the marine industry. Duramax Marine® is also the world leader in water-lubricated bearing technology. We keep your propulsion systems moving full steam ahead.

### Designed for optimum performance in all marine stuffing boxes.

Duramax® Ultra-X packing is engineered for optimal performance in all marine applications. It complements the operation of Johnson® Cutless® bearings and helps meet the demands of marine propulsion.

### Lasts more than 5X longer than flax and PTFE packing.

Ultra-X is designed to eliminate the high cost of packing failure. It will reduce your downtime and maintenance costs – not to mention eliminating expensive equipment replacement costs.

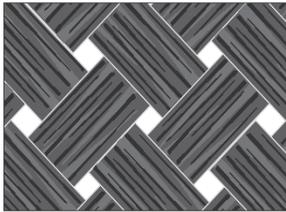


# What is Duramax® Ultra-X™ High-Performance Packing?

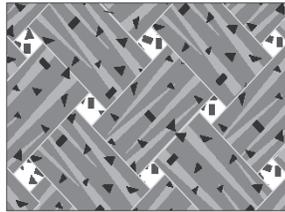


## Imbided Graphite vs. Loose Blending of Graphite.

Duramax Marine® uses unique patented manufacturing technology to encapsulate graphite particles and impregnate specialized lubricants into expanded PTFE strands. It greatly outperforms competitors' packing that loosely blends graphite particles between the strands during the braiding process.



Imbided graphite in Duramax Ultra-X Fiber



Loose graphite in standard PTFE braiding

Duramax® Ultra-X™ is a braided hydrophobic fiber packing. Because of its composition and design it lasts more than 5X longer and outperforms all flax and PTFE packings in marine stern tube, rudder and bulkhead applications.

---

▶ **Expanded PTFE:**

Outperforms standard flax and PTFE

---

▶ **High tensile strength:**

Will not get consumed in use

---

▶ **Graphite imbided/silicone impregnated:**

Lowest friction of any marine packing

---

▶ **Self-lubricating:**

Virtually needs no water for lubrication

---

▶ **Stays pliable:**

Never gets brittle, hard or abrasive

---

▶ **High thermal conductivity:**

Over 5 times more thermally conductive than flax and PTFE

---

▶ **Grease-free installation:**

Easy to cut and handle. Conforms easily

---

▶ **Lowlife-cycle cost:**

Virtually eliminates maintenance, shaft scoring & replacement

---

## Eliminates Equipment Damage Caused by Other Packings.

Duramax® Ultra-X™ is engineered so you will never experience packing failure that causes excessive shaft scoring. It always runs cool and always stays pliable. It never gets hard and abrasive, so expensive shaft repair or replacement is a thing of the past. Unlike flax, Duramax® Ultra-X is not consumed in use, which means you don't need to constantly adjust the gland or add more rings of packing to maintain your seal. Ultra-X eliminates the headaches associated with other type packing materials by lowering maintenance and operating costs thus reducing downtime.

There are competitors with lower priced "Look-alike" black PTFE fiber packing. Many of these look-alike packings use pure PTFE which is known for its thermal expansion. Besides having low tensile strength the thermal expansion of this material creates high heat and friction which results in significant shaft scoring and loss of seal. Duramax Ultra-X will simply work as well or better than any other braided packing designed for marine applications.

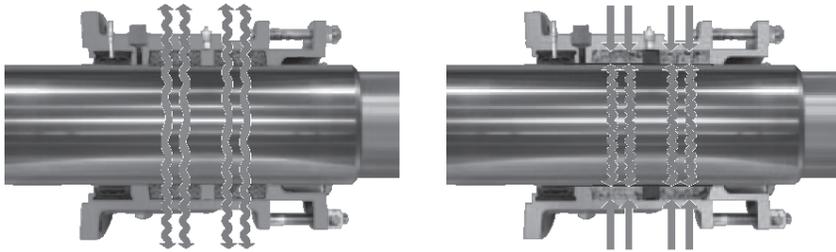


Duramax® Ultra-X eliminates excessive shaft scoring that causes leaking, packing replacement and equipment damage.

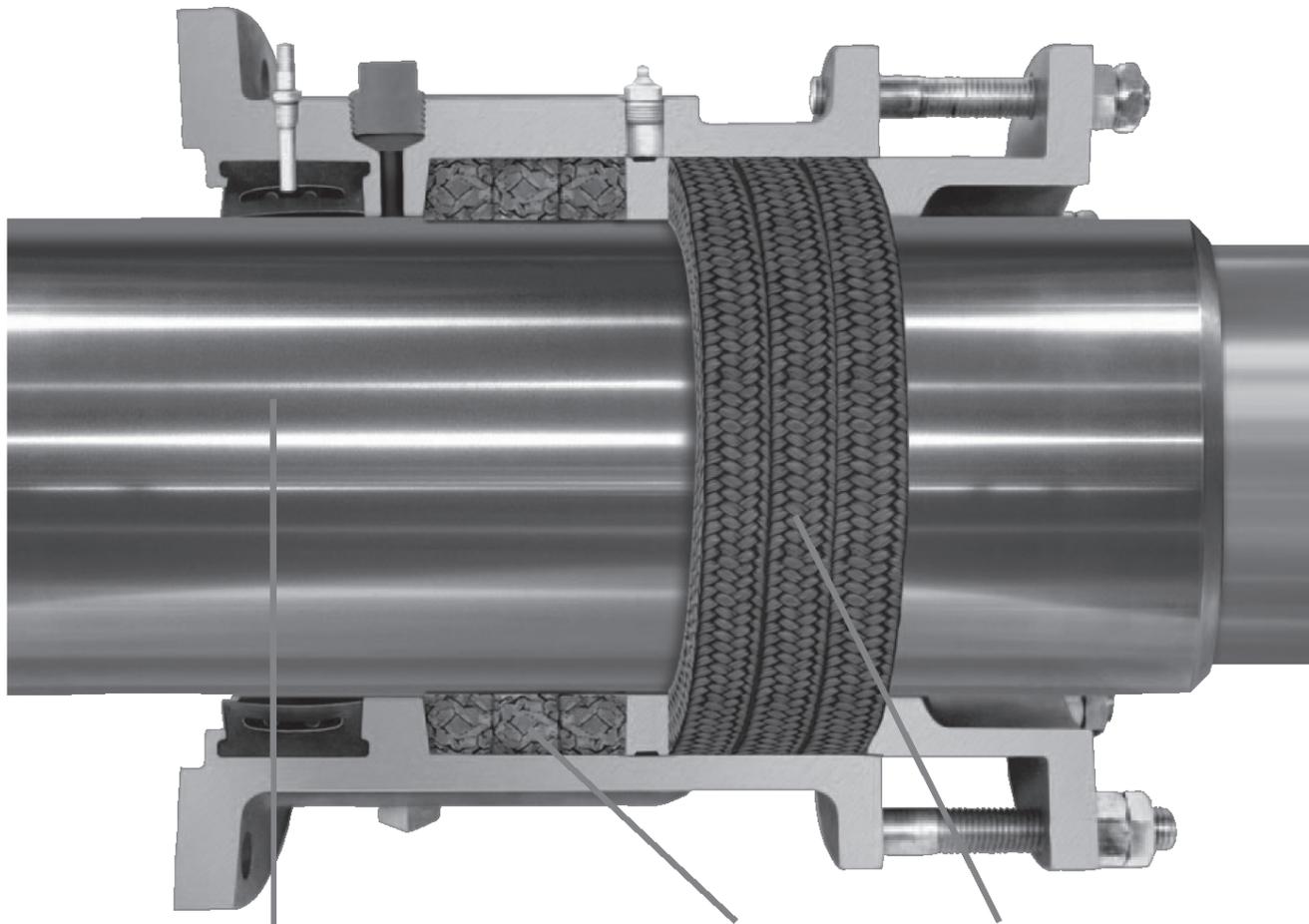
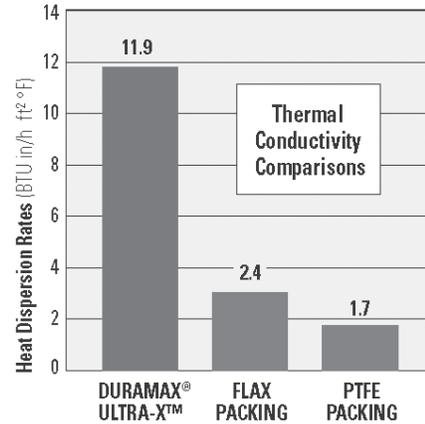
# Always Runs Cool, Even at High Shaft Speeds.

## Transfers frictional heat to stuffing box.

Duramax® Ultra-X™ dissipates frictional heat from the shaft transferring it to the stuffing box, which functions as a heat sink, lowering the temperature of the shaft and packing at all shaft speeds. In contrast, flax packing acts as an insulator, trapping frictional heat that can cause shaft damage and loss of seal.



**Duramax® Ultra-X Packing** transfers heat to stuffing box. **Flax packing** acts as insulator trapping heat to shaft.



## Minimizes shaft wear and equipment damage.

Ultra-low friction Duramax® Ultra-X always remains pliable. Flax and PTFE packing will harden, get brittle and consumed in use, resulting in shaft scoring and costly replacement. Abrasives will not embed into Ultra-X packing unlike flax with its sticky lubricants which actually act as a holder for abrasives causing shaft damage.

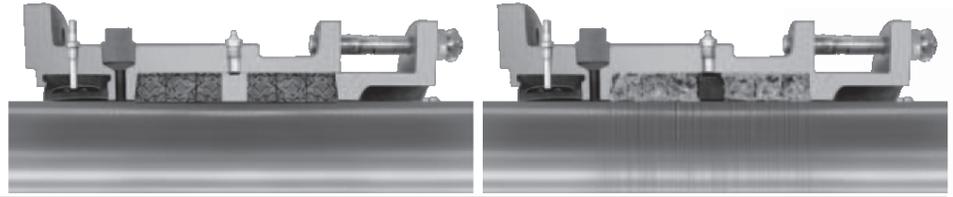
## Practically eliminates a dripping stuffing box.

Ultra-X experiences no shrinkage, keeps its shape and dimension, and requires virtually no water for lubrication. Keeps bilge dry and clean of oily contaminants.

## Experiences no packing failure.

Duramax® Ultra-X experiences no thermal expansion. It is not consumed during operation, so it never needs additional rings before the next scheduled haul out. This eliminates the need for constant gland adjustments.

# Duramax® Ultra-X™ VS. FLAX



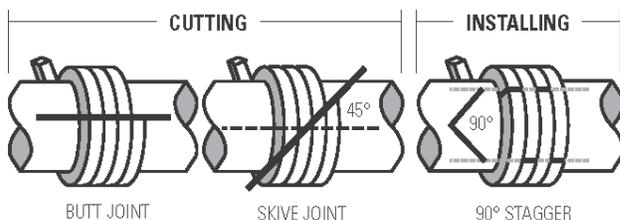
	<b>DURAMAX® Ultra-X</b>	<b>FLAX</b>
Ease of Installation	Pliable, conforms easily for clean, tight seal	Messy to handle, cut and install
Lubrication	Self-lubricating, virtually no water needed	Requires water
Replacement	Stays flexible and pliable, easy to remove	Dries out, gets brittle, difficult to remove
Operating Condition	Stays pliable, non-abrasive	Hardens, becomes brittle and abrasive
Resistance to Overheating	Maximum temperature 550°F	Maximum temperature 150°F
Thermal Expansion	Virtually none	Will experience swelling
Leakage	Practically eliminated	Will experience leakage
Heat Dispersion	11.9 BTU in/h ft² °F	2.4 BTU in/h ft² °F
Environment	No oily contaminated water in bilge, no EPA issues	Needs holding tanks or remediation
Maintenance	Once installed, needs no maintenance	Need to add rings when consumed
Equipment Damage	Virtually eliminates shaft scoring and wear	Gets hard and abrasive causing costly damage
Longevity	Normally lasts until scheduled haul out	Consumed or destroyed at high shaft speeds

## Easy Installation.

### Easy to handle and cut

Duramax® Ultra-X is a welcome replacement for messy flax packing. It cuts cleanly and easily. Just cut the rings to the proper lengths and install with no grease needed. Ultra-X does not require grease in stern tube applications where water is present. In bulkhead stuffing boxes it is recommended that grease is added to aid in lubricating the packing. Grease will not harm Ultra-X packing.

To cut Ultra-X packing to the proper length, wrap the packing on a mandrel that matches the shaft or use part of the shaft that is outside the stuffing box. Rings can be cut with butt (square) or skive (diagonal) joints. Joints of successive rings should be staggered – at least 90 degrees apart.



### Conforms quickly for a leak-proof seal.

Duramax® Ultra-X packing is soft and pliable. It conforms easily to the stuffing box gland and packing areas.

### One adjustment, then never worry about it again.

Once Ultra-X is in place, tighten the gland follower. After a short run-in period, make one adjustment - then never worry about it again. Ultra-X will normally last until the next haul out, without much more than an occasional glance at its drip rate.

### Easy to remove for repacking.

Unlike flax and PTFE that hardens and becomes brittle, Duramax® Ultra-X isn't destroyed in use. It always stays pliable and easy to remove.

# Trouble Free Operation.

## Meets Environmental Requirements.

When using Duramax® Ultra-X™ your bilge will be free of contaminants. It needs virtually no water for lubrication, and it doesn't shrink - practically eliminating a stuffing box drip. It makes it easy to comply with environmental requirements that regulate overboard pumping of polluted bilge water.

## Ultra-X Is the Most Versatile and Cost Effective.

Compared to other packing options, the life cycle cost of Duramax® Ultra-X is much lower. With the high cost of shaft repair or replacement due to other packing failures, why settle for less. Durability, long service life, and consistent high performance makes Duramax® Ultra-X your most cost-effective packing solution on the market.

## Backed By Duramax® Marine.

Duramax® Ultra-X will assure you the highest performance of any braided packing on the market today – whether it's in a Johnson® Heavy-Duty Stuffing Box or any other marine stuffing box you are currently using. Like all Duramax Marine® products, it is designed to reduce your maintenance costs, operating costs and reduce downtime – and is backed up by a team of Duramax Marine® product experts to answer any questions or solve your maintenance problems.



## Available in 16 Standard Sizes.

Size*	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"	1-3/8"	1-1/2"
Approx. FT/LB	67	35	20	13	9.5	7	5	4	3.2	2.3	1.8	1.4	1.2	1	.9	.7

- ▶ Duramax Ultra-X comes packed standard on spools of: 1, 3, 5 and 10 pounds.
- ▶ Bulk spools of 25 and 35 pounds are also available.

\*Custom size packing is available upon request.

**Duramax Marine® Engineering Solutions you can trust.**



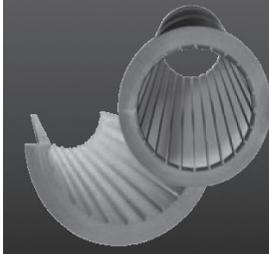
INNOVATION.  
EXPERIENCE.  
RESULTS.

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:



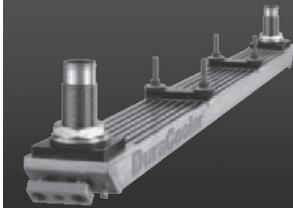
## JOHNSON CUTLESS® WATER-LUBRICATED BEARING SYSTEMS

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

# DURAMAX MARINE®

# DURAMAX® Ultra-X™

HIGH PERFORMANCE MARINE PACKING

## Installation Instructions

The following steps are important for maximum service life.

**1. PREPARATION:** Remove old packing from stuffing box. Clean box and shaft thoroughly. Examine shaft or sleeve for wear or scoring. Replace if wear is excessive.

**2. IMPORTANT: MAKE SURE PACKING IS THE PROPER SIZE.** To determine correct size, first measure the diameter of the shaft (at position where packing will operate). Then measure the internal diameter of the stuffing box (for the OD of the ring). Subtract the ID measurement from the OD measurement and divide by 2. The result is the required size. Ultra-X Packing is available in any size from 1/4" to 1-1/2".

**3. ALWAYS CUT THE PACKING INTO SEPARATE RINGS.** Never wind packing into stuffing box. Rings can be cut with butt (square) or skive (diagonal) joints. **IMPORTANT: IF POSSIBLE CUT EACH RING ON A MANDREL,** with the same diameter of the shaft in the stuffing box area, to keep proper joint angle. **Note: If there is no shaft wear, rings can be cut using the shaft outside the stuffing box.** Rings should be cut to correct size - or service life could be reduced. When cutting rings, hold packing tightly on the mandrel, but don't stretch packing excessively. Ultra-X can easily be cut with a sharp utility knife.

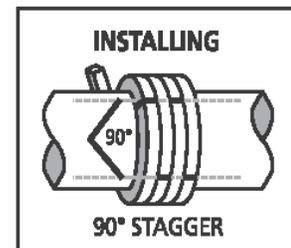
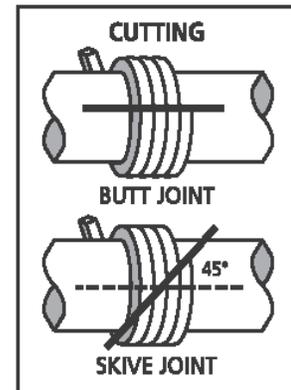
**4. INSTALL ONE RING AT A TIME.** Make sure packing is clean of any dirt from handling. Joints of successive rings should be staggered – at least 90 degrees apart. Each ring should be seated firmly using tamping tool. When the packing rings can be reached by the nose of the gland, tamping should be supplemented by the gland.

**5. BREAK-IN PROCEDURE IS CRITICAL TO INSURE LONG PACKING LIFE.** After the last ring is installed, take up bolts finger tight. Do not jam the packing into place by excessive gland loading. Make sure gland bolts are taken up evenly. Stopping leakage at this point will cause the packing to burn up. For proper break-in Ultra-X must be packed loosely for the first 5-10 hours of operation.

**6. AFTER THE INITIAL BREAK-IN PERIOD THE GLAND MAY BE TIGHTENED TO THE DESIRED LEAKAGE.**

**Operation NOTES:** Because of the superior thermal conductivity of Ultra-X, the stuffing box may run hotter when compared to traditional flax packing. This is normal. Ultra-X packing minimizes shaft wear and scoring by transferring frictional heat to the stuffing box which acts as a heat sink. Flax packing acts as an insulator keeping harmful heat on the shaft.

Ultra-X does not require grease in stern tube applications where water is present. In bulkhead stuffing boxes it is recommended that grease is added to aid in lubricating the packing. Grease will not harm Ultra-X packing.



**Duramax® Ultra-X™ is designed for use in any marine stuffing box.**

Duramax Ultra-X will assure you the highest performance of any braided marine packing on the market today – whether it's in a Johnson® Heavy-Duty Stuffing Box or any other marine stuffing box.

**Unmatched high performance in both salt water or fresh water environments.**

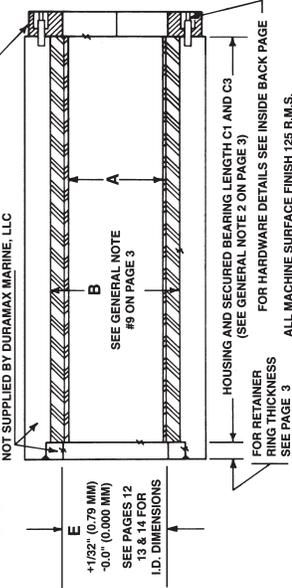
Ultra-X is engineered to operate in all marine environments. Its unique imbedded construction eliminates the potential for galvanic corrosion making it safe for any marine application.



**GUTLESS BEARINGS**

FOR COMPRESSION HEAD DETAILS & DRILLING DIAGRAM SEE PAGES 12, 13, & 14

RETAINER RING AND BEARING HOUSING NOT SUPPLIED BY DURAMAX MARINE, LLC



# Demountable Rubber Stave Bearing Dimensions

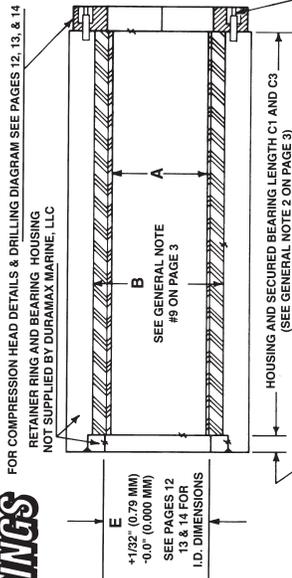
O.D. SHAFT OR SLEEVE JOURNAL	BEARING CODE SIZE	REFERENCE PART NUMBER	HOUSING BORE (BEARING O.D.) (SEE GENERAL NOTE 1 ON PAGE 3)		HOUSING AND SECURED BEARING LENGTH (SEE ORIGINAL NOTE 2 ON PAGE 3)				NORMAL SHAFT CLEARANCE (SECURED BEARING)	
			INCHES	MM	C1 (FULL LENGTH)	C3 (HALF LENGTH)	MM	INCHES	MM	INCHES
2 1/2"	L-0212-0312 x 4	2600	3.500	88.900	10	254.001	5	127.000	.012-.023	.305-.584
3"	L-0300-0412 x 4	2600-032	4.500	114.300	14	355.601	7	177.800	.012-.023	.305-.584
3 1/2"	L-0312-0412 x 4	2601	5.500	139.700	17	431.801	8 1/2	215.900	.015-.024	.381-.610
4"	L-0400-0512 x 4	2603	6.125	155.575	19	482.601	9 1/2	241.300	.015-.024	.381-.610
4 1/4"	L-0412-0618 x 4	2605	6.500	165.100	21	533.401	10 1/2	266.701	.018-.030	.457-.762
4 1/2"	L-0424-0618 x 4	2606	7.500	190.500	23	584.201	11 1/2	292.101	.018-.030	.457-.762
5"	L-0500-0612 x 4	2609	8.000	203.200	25	635.001	12 1/2	317.501	.018-.030	.457-.762
5 1/2"	L-0514-0612 x 4	2610	8.500	215.900	27	685.801	13 1/2	342.901	.020-.032	.508-.813
6"	L-0600-0800 x 6	2611	9.250	234.950	29	736.601	14 1/2	368.301	.020-.034	.508-.864
6 1/2"	L-0612-0812 x 6	2612	10.250	260.351	32	812.802	16	406.401	.020-.034	.508-.864
6 3/4"	L-0624-0812 x 6	2613	11.000	279.901	35	889.002	17 1/2	444.501	.022-.038	.559-.965
7"	L-0700-0914 x 6	2615	11.750	298.451	38	965.202	19	482.601	.024-.040	.609-1.016
7 1/2"	L-0712-1014 x 6	2616	12.750	323.851	41	1041.400	20 1/2	520.701	.026-.042	.660-1.067
8"	L-0800-1014 x 6	2618	13.750	349.250	44	1117.600	22	558.801	.026-.042	.660-1.067
8 1/4"	L-0814-1100 x 8	2619	14.500	368.301	47	1193.800	23 1/2	596.901	.027-.043	.686-1.092
8 1/2"	L-0812-1100 x 8	2620	15.500	393.700	50	1270.000	25	635.001	.028-.044	.711-1.178
8 3/4"	L-0824-1100 x 8	2621	16.250	412.750	53	1346.200	26 1/2	673.101	.029-.045	.737-1.143
9"	L-0900-1134 x 8	2622	17.250	438.150	56	1422.400	28	711.201	.029-.045	.737-1.143
9 1/4"	L-0914-1134 x 8	2623	18.250	463.551	59	1498.600	29 1/2	749.301	.029-.045	.737-1.143
9 1/2"	L-0924-1134 x 8	2624	18.250	463.551	59	1498.600	29 1/2	749.301	.029-.045	.737-1.143
9 3/4"	L-0934-1234 x 8	2625	19.250	488.951	62	1574.800	31 1/2	787.401	.030-.046	.762-1.168
10"	L-1000-1234 x 8	2626	20.000	508.000	65	1651.000	32 1/2	825.502	.030-.046	.762-1.168
10 1/4"	L-1014-1234 x 8	2627	20.500	520.700	68	1727.200	34	863.602	.030-.046	.762-1.168
10 1/2"	L-1024-1234 x 8	2628	21.250	539.751	71	1803.400	35 1/2	901.702	.030-.046	.762-1.168
10 3/4"	L-1034-1234 x 8	2629	22.000	558.801	74	1879.600	37	939.802	.030-.046	.762-1.168
11"	L-1100-1334 x 10	2630	22.750	577.850	77	1955.800	38 1/2	977.902	.030-.046	.762-1.168
11 1/4"	L-1114-1334 x 10	2631	23.500	596.900	80	2032.000	40	1016.000	.030-.046	.762-1.168
11 1/2"	L-1124-1334 x 10	2632	24.250	615.950	83	2108.200	41 1/2	1054.100	.030-.046	.762-1.168
11 3/4"	L-1134-1334 x 10	2633	25.000	635.001	86	2184.400	43	1092.200	.030-.046	.762-1.168
12"	L-1200-1512 x 10	2634	25.750	654.051	89	2260.600	44 1/2	1130.300	.030-.046	.762-1.168
12 1/4"	L-1214-1512 x 10	2635	26.500	673.100	92	2336.800	46	1168.400	.030-.046	.762-1.168
12 1/2"	L-1224-1512 x 10	2636	27.250	692.150	95	2413.000	47 1/2	1206.500	.030-.046	.762-1.168
12 3/4"	L-1234-1512 x 10	2637	28.000	711.201	98	2489.200	49	1244.600	.030-.046	.762-1.168
13"	L-1300-1614 x 10	2638	28.750	730.250	101	2565.410	50 1/2	1282.700	.030-.046	.762-1.168
13 1/4"	L-1314-1614 x 10	2639	29.500	749.300	104	2641.610	52	1320.800	.030-.046	.762-1.168
13 1/2"	L-1324-1614 x 10	2640	30.250	768.350	107	2717.810	54 1/2	1358.900	.030-.046	.762-1.168
13 3/4"	L-1334-1714 x 12	2641	31.000	787.400	110	2794.010	56 1/2	1397.000	.030-.046	.762-1.168
14"	L-1400-1714 x 12	2642	31.750	806.450	113	2870.210	58 1/2	1435.100	.030-.046	.762-1.168
14 1/4"	L-1414-1814 x 12	2643	32.500	825.500	116	2946.410	60 1/2	1473.200	.030-.046	.762-1.168
14 1/2"	L-1424-1814 x 12	2644	33.250	844.550	119	3022.610	62 1/2	1511.300	.030-.046	.762-1.168
14 3/4"	L-1434-1814 x 12	2645	34.000	863.600	122	3098.810	64 1/2	1549.400	.030-.046	.762-1.168



**GUTLESS BEARINGS**

FOR COMPRESSION HEAD DETAILS & DRILLING DIAGRAM SEE PAGES 12, 13, & 14

RETAINER RING AND BEARING HOUSING NOT SUPPLIED BY DURAMAX MARINE, LLC



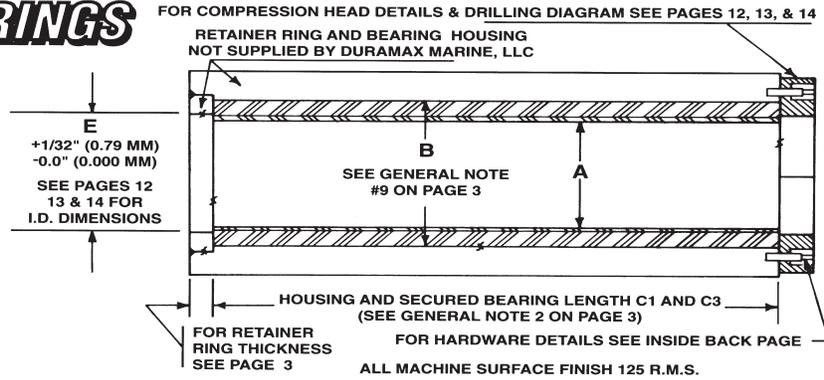
# Demountable Rubber Stave Bearing Dimensions

O.D. SHAFT OR SLEEVE JOURNAL	BEARING CODE SIZE	REFERENCE PART NUMBER	HOUSING BORE (BEARING O.D.) (SEE GENERAL NOTE 1 ON PAGE 3)		HOUSING AND SECURED BEARING LENGTH (SEE ORIGINAL NOTE 2 ON PAGE 3)				NORMAL SHAFT CLEARANCE (SECURED BEARING)	
			INCHES	MM	C1 (FULL LENGTH)	C3 (HALF LENGTH)	MM	INCHES	MM	INCHES
15"	L-1500-1900 x 12	2646	19.000	482.601	62	1574.800	31	787.400	.030-.046	.762-1.168
15 1/4"	L-1514-1900 x 12	2647	20.000	508.000	65	1651.000	32 1/2	825.502	.030-.046	.762-1.168
15 1/2"	L-1512-1900 x 12	2648	20.500	520.700	68	1727.200	34	863.602	.030-.046	.762-1.168
15 3/4"	L-1534-2000 x 12	2649	21.250	539.751	71	1803.400	35 1/2	901.702	.030-.046	.762-1.168
16"	L-1600-2000 x 12	2650	22.000	558.801	74	1879.600	37	939.802	.030-.046	.762-1.168
16 1/4"	L-1612-2000 x 12	2651	22.750	577.850	77	1955.800	38 1/2	977.902	.030-.046	.762-1.168
16 1/2"	L-1614-2000 x 12	2652	23.500	596.900	80	2032.000	40	1016.000	.030-.046	.762-1.168
16 3/4"	L-1624-2000 x 12	2653	24.250	615.950	83	2108.200	41 1/2	1054.100	.030-.046	.762-1.168
17"	L-1700-2012 x 12	2654	25.000	635.001	86	2184.400	43	1092.200	.030-.046	.762-1.168
17 1/4"	L-1714-2114 x 14	2655	25.750	654.051	89	2260.600	44 1/2	1130.300	.030-.046	.762-1.168
17 1/2"	L-1712-2114 x 14	2656	26.500	673.100	92	2336.800	46	1168.400	.030-.046	.762-1.168
17 3/4"	L-1734-2114 x 14	2657	27.250	692.150	95	2413.000	47 1/2	1206.500	.030-.046	.762-1.168
18"	L-1800-2200 x 14	2658	28.000	711.201	98	2489.200	49	1244.600	.030-.046	.762-1.168
18 1/4"	L-1814-2200 x 14	2659	28.750	730.250	101	2565.410	50 1/2	1282.700	.030-.046	.762-1.168
18 1/2"	L-1812-2200 x 14	2660	29.500	749.300	104	2641.610	52	1320.800	.030-.046	.762-1.168
18 3/4"	L-1834-2234 x 14	2661	30.250	768.350	107	2717.810	54 1/2	1358.900	.030-.046	.762-1.168
19"	L-1900-2234 x 14	2662	31.000	787.400	110	2794.010	56 1/2	1397.000	.030-.046	.762-1.168
19 1/4"	L-1914-2234 x 14	2663	31.750	806.450	113	2870.210	58 1/2	1435.100	.030-.046	.762-1.168
19 1/2"	L-1912-2312 x 14	2664	32.500	825.500	116	2946.410	60 1/2	1473.200	.030-.046	.762-1.168
19 3/4"	L-1934-2312 x 14	2665	33.250	844.550	119	3022.610	62 1/2	1511.300	.030-.046	.762-1.168
20"	L-2000-2312 x 14	2666	34.000	863.600	122	3098.810	64 1/2	1549.400	.030-.046	.762-1.168
20 1/4"	L-2014-2414 x 14	2667	34.750	882.650	125	3175.010	66 1/2	1587.500	.030-.046	.762-1.168
20 1/2"	L-2012-2414 x 14	2668	35.500	901.700	128	3251.210	68 1/2	1625.600	.030-.046	.762-1.168
20 3/4"	L-2034-2414 x 14	2669	36.250	920.750	131	3327.410	70 1/2	1663.700	.030-.046	.762-1.168
21"	L-2100-2500 x 16	2670	37.000	939.800	134	3403.610	72 1/2	1701.800	.030-.046	.762-1.168
21 1/4"	L-2114-2500 x 16	2671	37.750	958.850	137	3479.810	74 1/2	1739.900	.030-.046	.762-1.168
21 1/2"	L-2112-2500 x 16	2672	38.500	977.900	140	3556.010	76 1/2	1778.000	.030-.046	.762-1.168
21 3/4"	L-2134-2534 x 16	2673	39.250	996.950	143	3632.210	78 1/2	1816.100	.030-.046	.762-1.168
22"	L-2200-2534 x 16	2674	40.000	1016.000	146	3708.410	80 1/2	1854.200	.030-.046	.762-1.168
22 1/4"	L-2214-2612 x 16	2675	40.750	1035.050	149	3784.610	82 1/2	1892.300	.030-.046	.762-1.168
22 1/2"	L-2212-2612 x 16	2676	41.500	1054.100	152	3860.810	84 1/2	1930.400	.030-.046	.762-1.168
22 3/4"	L-2234-2612 x 16	2677	42.250	1073.150	155	3937.010	86 1/2	1968.500	.030-.046	.762-1.168
23"	L-2300-2612 x 16	2678	43.000	1092.200	158	4013.210	88 1/2	2006.600	.030-.046	.762-1.168
23 1/4"	L-2314-2714 x 16	2679	43.750	1111.250	161	4089.410	90 1/2	2044.700	.030-.046	.762-1.168
23 1/2"	L-2312-2714 x 16	2680	44.500	1130.300	164	4165.610	92 1/2	2082.800	.030-.046	.762-1.168
23 3/4"	L-2334-2714 x 16	2681	45.250	1149.350	167	4241.810	94 1/2	2120.900	.030-.046	.762-1.168
24"	L-2400-2800 x 18	2682	46.000	1168.400	170	4318.010	96 1/2	2159.000	.030-.046	.762-1.168
24 1/4"	L-2414-2800 x 18	2683	46.750	1187.450	173	4394.210	98 1/2	2197.100	.030-.046	.762-1.168
24 1/2"	L-2412-2800 x 18	2684	47.500	1206.500	176	4470.410	100 1/2	2235.200	.030-.046	.762-1.168
24 3/4"	L-2434-2834 x 18	2685	48.250	1225.550	179	4546.610	102 1/2	2273.300	.030-.046	.762-1.168
25"	L-2500-2834 x 18	2686	49.000	1244.600	182	4622.810	104 1/2	2311.400	.030-.046	.762-1.168
25 1/4"	L-2514-2834 x 18	2687	49.750	1263.650	185	4699.010	106 1/2	2349.500	.030-.046	.762-1.168
25 1/2"	L-2512-2912 x 20	2688	50.500	1282.700	188	4775.2				



# CUTLESS BEARINGS

## Demountable Rubber Stave Bearing Dimensions



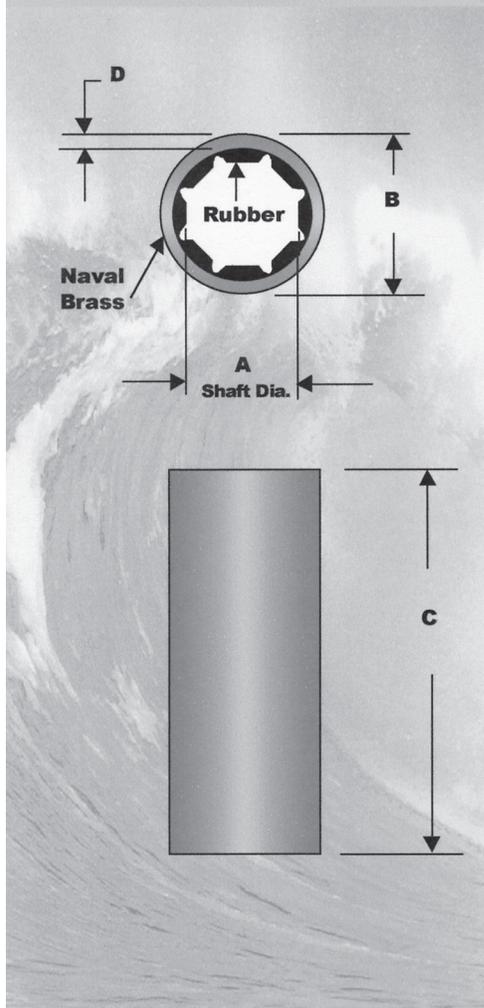
O.D. SHAFT OR SLEEVE JOURNAL		BEARING CODE SIZE	REFERENCE PART NUMBER	HOUSING BORE (BEARING O.D.) (SEE GENERAL NOTE 1 ON PAGE 3)		HOUSING AND SECURED BEARING LENGTH (SEE ORIGINAL NOTE 2 ON PAGE 3)				NORMAL SHAFT CLEARANCE (SECURED BEARING)	
A				B		C1 (FULL LENGTH)		C3 (HALF LENGTH)		INCHES	MM
INCHES	MM			INCHES	MM	INCHES	MM	INCHES	MM		
26 1/4	666.750	L-2614-3014 x 20	2691	30.250	768.353	107	2717.81	53 1/2	1358.90	.052-.070	1.321-1.778
26 1/2	673.100	L-2612-3014 x 20	2692								
26 3/4	679.450	L-2634-3014 x 20	2693								
27	685.801	L-2700-3100 x 20	2694	31.000	787.403	110	2743.21	55	1397.00	.055-.073	1.397-1.854
27 1/4	692.150	L-2714-3100 x 20	2695								
27 1/2	698.500	L-2712-3100 x 20	2696								
27 3/4	704.850	L-2734-3134 x 20	2697	31.750	806.453	113	2870.21	56 1/2	1435.10	.056-.074	1.422-1.880
28	711.201	L-2800-3134 x 20	2698								
28 1/4	717.550	L-2814-3134 x 20	2699								
28 1/2	723.900	L-2812-3212 x 20	2600-001	32.500	825.503	116	2946.41	58	1473.20	.059-.077	1.499-1.956
28 3/4	730.250	L-2834-3212 x 20	2600-002								
29	736.601	L-2900-3212 x 20	2600-003								
29 1/4	742.950	L-2914-3314 x 22	2600-004	33.250	844.553	119	3022.61	59 1/2	1511.30	.059-.077	1.499-1.956
29 1/2	749.300	L-2912-3314 x 22	2600-005								
29 3/4	755.650	L-2934-3314 x 22	2600-006								
30	762.003	L-3000-3400 x 22	2600-007	34.000	863.602	122	3098.81	61	1549.40	.060-.080	1.524-2.032
30 1/4	768.353	L-3014-3400 x 22	2600-008								
30 1/2	774.703	L-3012-3400 x 22	2600-009								
30 3/4	781.053	L-3034-3434 x 22	2600-010	34.750	882.653	125	3175.01	62 1/2	1587.50	.063-.083	1.600-2.108
31	787.403	L-3100-3434 x 22	2600-011								
31 1/4	793.753	L-3114-3434 x 22	2600-012								
31 1/2	800.103	L-3112-3512 x 24	2600-013	35.500	901.703	128	3251.21	64	1625.60	.064-.084	1.626-2.134
31 3/4	806.453	L-3134-3512 x 24	2600-014								
32	812.803	L-3200-3512 x 24	2600-015								
32 1/4	819.153	L-3214-3614 x 24	2600-016	36.250	920.752	131	3327.41	65 1/2	1663.70	.064-.084	1.626-2.134
32 1/2	825.503	L-3212-3614 x 24	2600-017								
32 3/4	831.853	L-3234-3614 x 24	2600-018								
33	838.203	L-3300-3700 x 24	2600-019	37.000	939.802	134	3403.61	67	1701.80	.067-.087	1.702-2.210
33 1/4	844.553	L-3314-3700 x 24	2600-020								
33 1/2	850.903	L-3312-3700 x 24	2600-021								
33 3/4	857.253	L-3334-3734 x 24	2600-022	37.750	958.852	137	3479.81	68 1/2	1739.90	.068-.088	1.727-2.235
34	863.603	L-3400-3734 x 24	2600-023								
34 1/4	869.953	L-3414-3734 x 24	2600-024								
34 1/2	876.303	L-3412-3812 x 26	2600-025	38.500	977.902	140	3556.01	70	1778.00	.071-.091	1.803-2.311
34 3/4	882.653	L-3434-3812 x 26	2600-026								
35	889.004	L-3500-3812 x 26	2600-027								
35 1/4	895.354	L-3514-3914 x 26	2600-028	39.250	996.952	143	3632.21	71 1/2	1816.10	.071-.091	1.803-2.311
35 1/2	901.703	L-3512-3914 x 26	2600-029								
35 3/4	908.054	L-3534-3914 x 26	2600-030								

### WHICH GENDER...?

- ZIPLOC BAGS - male, because they hold everything in, but you can always see right through them.
- SWISS ARMY KNIFE - male, because even though it appears useful for a wide variety of work, it spends most of its time just opening bottles.
- KIDNEYS - female, because they always go to the bathroom in pairs.
- SHOE - male, because it is usually unpolished, with its tongue hanging out.
- COPIER - female, because once turned off, it takes a while to warm up.
- TIRE - male, because it goes bald and often is over inflated.
- HOT AIR BALLOON - male, because to get it to go anywhere you have to light a fire under it... and, of course, there's the hot air part.
- SPONGES - female, because they are soft and squeezable and retain water.
- WEB PAGE - female, because it is always getting hit on.
- SUBWAY - male, because it uses the same old lines to pick people up.
- HOURLASS - female, because over time, the weight shifts to the bottom.
- HAMMER - male, because it hasn't evolved much over the last 5,000 years, but it's handy to have around.
- REMOTE CONTROL - female... HA! You thought we'd say male. But consider: it gives men pleasure, he'd be lost without it, and while he doesn't always know the right buttons to push, he keeps trying.

# JOHNSON & MORSE BEARINGS AVAILABLE

## STANDARD BRASS SLEEVE SERIES



Morse Marine Bearings  
Metso Minerals Industries, Inc.

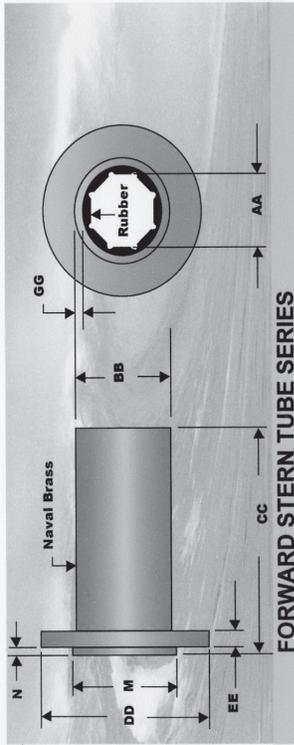
PART NO.	CODE NAME	UNIT WT.	SHAFT DIA. (A)	OUTSIDE DIA. (B)	LENGTH INCH (C)	METAL WALL (D)
E00100	ALBACORE	0.50	3/4	1-1/4	3	1/8
E00200	BLENNY	0.31	7/8	1-1/4	3-1/2	1/16
E00300	BARRACUDA	0.69	7/8	1-3/8	3-1/2	1/8
E00400	BASS	0.75	7/8	1-1/2	3-1/2	1/8
E00500	BETTA	0.13	1	1-1/4	3	1/32
E00600	BLACKFISH	0.31	1	1-1/4	4	1/32
E00700	BLOATER	0.38	1	1-3/8	4	1/16
E00800	BONITO	0.81	1	1-1/2	4	1/8
E00900	BROADBILL	0.88	1	1-5/8	4	1/8
E01000	BULLHEAD	1.25	1	2	4	1/8
E01100	CAMA	0.50	1-1/8	1-1/2	4-1/2	1/16
E00650	CARIBE	0.47	1	1-1/4	6	1/32
E01200	CARP	1.00	1-1/8	1-5/8	4-1/2	1/8
E01300	CATFISH	1.19	1-1/8	1-3/4	4-1/2	1/8
E01400	CHOBIE	1.38	1-1/8	2	4-1/2	1/8
E01500	CHOGSET	0.50	1-1/4	1-1/2	5	1/8
E01600	CHUB	1.13	1-1/4	1-3/4	5	1/8
E01700	COD	1.50	1-1/4	2	5	1/8
E01800	CROAKER	1.75	1-1/4	2-1/8	5	1/8
E01900	DEVILFISH	1.44	1-3/8	1-7/8	5-1/2	1/8
E02000	DOGFISH	1.69	1-3/8	2	5-1/2	1/8
E02100	DOLPHIN	1.75	1-3/8	2-1/8	5-1/2	1/8
E02200	EEL	2.13	1-3/8	2-3/8	5-1/2	1/8
E02300	FLAMEN	1.13	1-1/2	2	4-3/8	1/8
E02400	FLATFISH	1.63	1-1/2	2	6	1/8
E02500	FLOUNDER	2.19	1-1/2	2-3/8	6	1/8
E02600	GAR	1.88	1-5/8	2-1/8	6-1/2	1/8
E02700	GRAYBACK	2.75	1-5/8	2-5/8	6-1/2	1/8
E02800	GROUPE	2.38	1-3/4	2-3/8	7	1/8
E02900	HADDO	2.81	1-3/4	2-5/8	7	1/8
E03000	HAKE	3.00	1-7/8	2-5/8	7-1/2	1/8
E03100	HALIBUT	3.69	1-7/8	2-15/16	7-1/2	1/8
E03200	HERRING	3.06	2	2-5/8	8	1/8
E03300	KINGFISH	3.88	2	3	8	1/8
E03350	LAMPREY	4.85	2	3	10	1/8
E03400	MACKEREL	3.69	2-1/8	2-15/16	8-1/2	1/8
E03500	MANTA	4.50	2-1/8	3-1/8	8-1/2	1/8
E03650	MARGATE	4.90	2-1/4	3	9	1/8
E03600	MARLIN	3.94	2-1/4	2-15/16	9	1/8
E03700	MINNOW	4.44	2-1/4	3-1/8	9	1/8
E03800	MUDFISH	5.44	2-1/4	3-3/8	9	1/8
E03900	MULLET	5.44	2-3/8	3-3/8	9-1/2	1/8
E04000	MUSKY	4.63	2-1/2	3-1/8	10	1/8
E04100	PERCH	5.50	2-1/2	3-3/8	10	1/8
E04200	PICKEREL	5.75	2-5/8	3-3/8	10-1/2	1/8
E04300	PICUDA	5.63	2-3/4	3-3/8	11	1/8
E04150	PIKE	6.47	2-1/2	3-1/2	10	1/8
E04400	PINFISH	6.88	2-3/4	3-3/4	11	1/8
E04500	PORGY	7.13	2-7/8	3-3/4	11-1/2	1/8
E04600	RAY	7.06	3	3-3/4	12	1/8
E04700	REDFIN	7.94	3	4	12	1/8
E04800	REDFISH	9.25	3-1/8	4-1/4	12-1/2	1/8
E04900	ROCKFISH	8.13	3-1/4	4	13	1/8
E05000	SALFISH	9.38	3-1/4	4-1/4	13	1/8
E05100	SALMON	10.63	3-3/8	4-1/2	13-1/2	1/8
E05200	SANDFISH	9.56	3-1/2	4-1/4	14	1/8
E05300	SAWFISH	10.25	3-1/2	4-1/2	14	1/8
E05400	SCULPIN	10.81	3-5/8	4-1/2	14-1/2	1/8
E05500	SHAD	11.00	3-3/4	4-1/2	15	1/8
E05600	SHARK	17.56	3-3/4	5	15	3/16
E05700	SILVERFISH	18.19	3-3/4	5-1/4	15	3/16
E05800	SMELT	20.00	3-7/8	5-1/4	15-1/2	3/16
E05900	SNAPPER	18.25	4	5	16	3/16
E06000	SOCKEYE	19.63	4	5-1/4	16	3/16
E06100	SPEARFISH	20.06	4-1/8	5-1/4	16-1/2	3/16
E06200	SQUIT	22.00	4-1/4	5-1/2	17	3/16
E06300	STREAKER	24.31	4-3/8	5-3/4	17-1/2	3/16
E06400	SUCKER	22.00	4-1/2	5-1/2	18	3/16
E06500	SUNFISH	24.63	4-1/2	5-3/4	18	3/16
E06600	SWORDFISH	34.00	4-5/8	6-1/8	18-1/2	1/4
E06700	TARPON	34.00	4-3/4	6-1/8	19	1/4
E06800	TROUT	33.00	4-7/8	6-1/8	19-1/2	1/4
E06900	WAHOO	35.00	5	6-1/8	20	1/4
E07000	WALLEYE	39.00	5	6-1/2	20	1/4
E07100	WANDTAIL	44.00	5-1/4	6-3/4	21	1/4
E07200	WAP	48.00	5-1/4	7	21	1/4
E07300	WARFISH	57.00	5-3/8	6-3/4	21-1/2	1/4
E07400	WARSAW	62.00	5-3/8	7	21-1/2	1/4
E07500	WHITEFISH	59.00	5-1/2	7	22	1/4
E07600	WINDFISH	44.50	5-5/8	7	22-1/2	1/4
E07700	YELLOWTAIL	48.00	5-3/4	7	23	1/4
E07800	YOWLING	52.00	5-7/8	7-1/2	24	1/4
E07900	ZANCLUS	55.00	6	7-1/2	24	1/4

I am having an out of money experience.

# JOHNSON & MORSE BEARINGS AVAILABLE

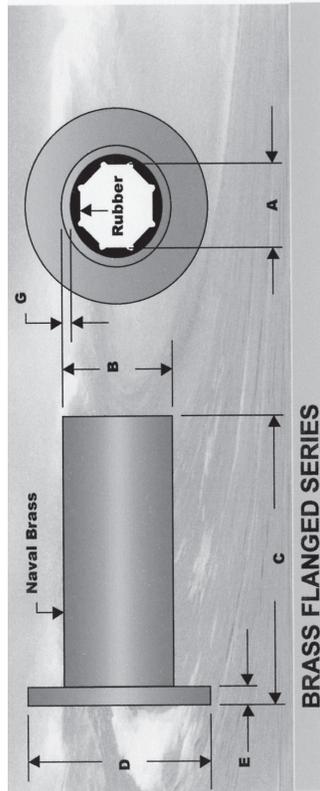
Part Number	Code Name	Unit Wt. Lbs.	Shaft Dia. A	O.D. B	Length C	Met. Wall G	Flange D x E
E23900	Yanqui	545	12-1/4"	15"	46-1/2"	5/8"	18-3/4x3/4
E24000	Yapok	545	12-1/2"	15-1/4"	47-1/2"	5/8"	19X3/4
E24100	Yarborough	550	12-3/4"	15-1/2"	48-1/2"	5/8"	19-1/4x3/4
E24200	Yataghan	563	13"	15-7/8"	50"	11/16"	19-5/8x7/8
E24300	Yoeman	610	13-1/4"	16-1/8"	51"	11/16"	19-7/8x7/8
E24400	York	640	13-1/2"	16-3/8"	52"	11/16"	20-1/8x7/8
E24500	Zephyr	650	13-3/4"	16-5/8"	53"	11/16"	20-3/8x7/8
E24600	Zeppelin	675	14"	16-7/8"	54"	11/16"	20-5/8x7/8
E24700	Zeppo	701	14-1/4"	17-1/8"	55"	11/16"	20-7/8x7/8
E24800	Zircon	754	14-1/2"	17-1/2"	56"	3/4"	21-1/4x7/8
E24900	Zodiac	775	14-3/4"	17-3/4"	57"	3/4"	21-1/2x7/8
E25000	Zulu	795	15"	18"	58"	3/4"	21-3/4x7/8

Non-standard sizes, materials and special features are available upon request.



Part Number	Unit Wt. Lbs.	Shaft Dia. AA	O.D. BB	Length CC	Met. Wall GG	Flange DD x EE	Pilot M x N
FB1300	75	6"	7-3/4"	15"	3/8"	11-3/8x9/16	8x3/8
FB1400	77	6-1/4"	8"	15"	3/8"	11-3/8x9/16	8x3/8
FB1500	91	6-1/2"	8-3/8"	15"	7/16"	13-1/2x5/8	8-5/8x3/8
FB1600	99	6-3/4"	8-3/4"	15"	7/16"	13-3/4x5/8	9x3/8
FB1700	116	7"	9"	17-1/2"	7/16"	13-3/4x5/8	9x3/8
FB1800	122	7-1/4"	9-1/4"	17-1/2"	7/16"	14-1/8x5/8	9-5/8x3/8
FB1900	123	7-1/2"	9-5/8"	17-1/2"	7/16"	14-1/2x5/8	10x3/8
FB2000	126	7-3/4"	9-7/8"	17-1/2"	1/2"	14-1/2x5/8	10x3/8
FB2100	145	8"	10-1/4"	20"	1/2"	14-7/8x5/8	10-3/8x3/8
FB2200	150	8"	10-1/2"	20"	1/2"	14-7/8x5/8	10-3/8x3/8
FB2300	157	8-1/4"	10-1/2"	20"	1/2"	15-1/4x5/8	10-3/4x3/8
FB2400	162	8-1/2"	10-3/4"	20"	1/2"	15-1/4x5/8	10-3/4x3/8
FB2500	170	8-3/4"	11"	20"	1/2"	15-5/8x3/4	11-1/8x3/8
FB2600	193	9"	11-1/4"	22-1/2"	1/2"	16x3/4	11-1/2x3/8
FB2700	200	9-1/4"	11-1/2"	22-1/2"	1/2"	16x3/4	11-1/2x3/8
FB2800	205	9-1/2"	11-3/4"	22-1/2"	1/2"	16-3/8x3/4	11-7/8x3/8
FB2900	217	9-3/4"	12-1/8"	22-1/2"	9/16"	16-7/8x3/4	12-3/8x3/8
FB3000	240	10"	12-3/8"	25"	9/16"	16-7/8x3/4	12-3/8x3/8
FB3100	244	10-1/4"	12-5/8"	25"	9/16"	17-7/8x3/4	12-3/4x3/8
FB3200	247	10-1/2"	12-7/8"	25"	9/16"	18-1/4x3/4	13-1/8x3/8
FB3300	270	10-3/4"	13-1/8"	25"	9/16"	18-1/4x3/4	13-1/8x3/8
FB3400	300	11"	13-1/2"	27-1/2"	9/16"	18-5/8x3/4	13-1/2x3/8
FB3500	312	11-1/4"	13-3/4"	27-1/2"	9/16"	19x3/4	13-7/8x3/8
FB3600	326	11-1/2"	14-1/8"	27-1/2"	5/8"	19x3/4	13-7/8x3/8
FB3700	335	11-3/4"	14-3/8"	27-1/2"	5/8"	19-3/8x3/4	14-1/8x3/8
FB3800	360	12"	14-3/4"	30"	5/8"	19-3/4x3/4	14-1/2x3/8

All materials meet U.S. Navy Specification MIL-B-17901B(SH) Class II



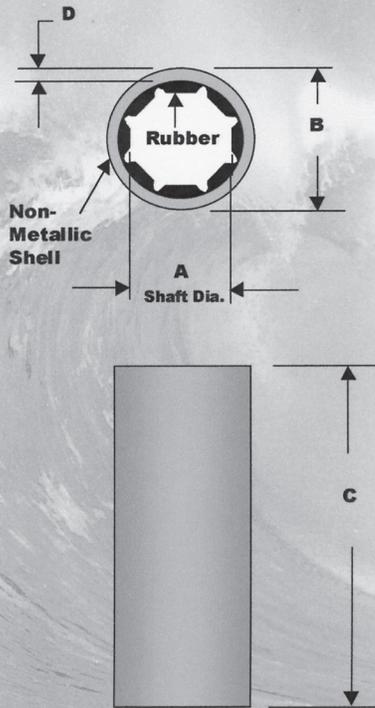
Part Number	Code Name	Unit Wt. Lbs.	Shaft Dia. A	O.D. B	Length C	Met. Wall G	Flange D x E
E20100	Abalone	29	3"	4-1/4"	12"	1/2"	6-3/4x1/2
E20200	Barnacle	30	3-1/4"	4-1/2"	13"	1/2"	7x1/2
E20300	Crab	38	3-1/2"	4-7/8"	14"	1/2"	7-3/8x1/2
E20400	Crawfish	45	3-3/4"	5-1/2"	15"	1/2"	7-3/4x1/2
E20500	Lobster	50	4"	5-1/2"	16"	1/2"	8x1/2
E20600	Mussel	55	4-1/4"	5-3/4"	17"	1/2"	8-1/4x1/2
E20700	Nautilus	63	4-1/2"	6"	18"	1/2"	8-7/8x1/2
E20800	Octopus	66	4-3/4"	6-1/4"	19"	1/2"	9-1/8x1/2
E20900	Oyster	81	5"	6-3/4"	20"	9/16"	9-5/8x9/16
E21000	Prawn	88	5-1/4"	6-7/8"	21"	9/16"	9-7/8x9/16
E21100	Scallop	95	5-1/2"	7-1/4"	22"	9/16"	10-1/4x9/16
E21200	Seahorse	98	5-3/4"	7-1/4"	23"	9/16"	10-1/4x9/16
E21300	Shrimp	109	6"	7-3/4"	24"	9/16"	11x9/16
E21400	Bark	101	6-1/4"	8"	22-1/2"	9/16"	10-5/8x9/16
E21500	Brig	125	6-1/2"	8-3/8"	23-1/2"	9/16"	11x9/16
E21600	Canoes	135	6-3/4"	8-3/4"	24-1/2"	9/16"	11-3/8x9/16
E21700	Caravel	142	7"	9"	25-1/2"	9/16"	11-5/8x9/16
E21800	Clipper	150	7-1/4"	9-1/4"	26-1/2"	9/16"	11-7/8x9/16
E21900	Corsair	168	7-1/2"	9-5/8"	27-1/2"	9/16"	12-1/4x9/16
E22000	Corvette	187	7-3/4"	9-7/8"	28-1/2"	9/16"	12-1/2x9/16
E22100	Cutter	200	8"	10-1/4"	29-1/2"	5/8"	13-1/4x5/8
E22200	Cutterline	232	8"	10-1/2"	29-1/2"	5/8"	13-1/4x5/8
E22300	Dogger	230	8-1/4"	10-1/2"	30-1/2"	5/8"	13-1/2x5/8
E22400	Frigate	235	8-1/2"	10-3/4"	31-1/2"	5/8"	13-3/5x5/8
E22500	Galleon	240	8-3/4"	11"	32-1/2"	5/8"	14x5/8
E22600	Gondola	255	9"	11-1/4"	33-1/2"	3/4"	14-1/4x3/4
E22700	Ketch	275	9-1/4"	11-1/2"	34-1/2"	3/4"	14-5/8x3/4
E22800	Outrigger	278	9-1/2"	11-3/4"	35-1/2"	3/4"	14-7/8x3/4
E22900	Sampán	350	9-3/4"	12-1/8"	36-1/2"	3/4"	15-1/4x3/4
E23000	Schooner	355	10"	12-3/8"	37-1/2"	3/4"	15-1/2x3/4
E23100	Scooter	360	10-1/4"	12-5/8"	38-1/2"	3/4"	15-7/8x3/4
E23200	Shallop	365	10-1/2"	12-7/8"	39-1/2"	3/4"	16-1/8x3/4
E23300	Sloop	365	10-3/4"	13-1/8"	40-1/2"	3/4"	16-3/8x3/4
E23400	Smack	438	11"	13-1/2"	41-1/2"	3/4"	17-1/4x3/4
E23500	Snow	432	11-1/4"	13-3/4"	42-1/2"	3/4"	17-1/2x3/4
E23600	Taritan	496	11-1/2"	14-1/8"	43-1/2"	3/4"	17-7/8x3/4
E23700	Yacht	486	11-3/4"	14-3/8"	44-1/2"	3/4"	18-1/8x3/4
E23800	Yaw	529	12"	14-3/4"	45-1/2"	3/4"	18-1/2x3/4

All materials meet U.S. Navy Specification MIL-B17901B(SH) Class II

The real art of conversation is not only to say the right thing at the right time, but also to leave unsaid the wrong thing at the tempting moment.

# JOHNSON & MORSE BEARINGS AVAILABLE

## STANDARD NON-METALLIC SERIES



**Morse Marine Bearings**  
**Metso Minerals Industries, Inc.**

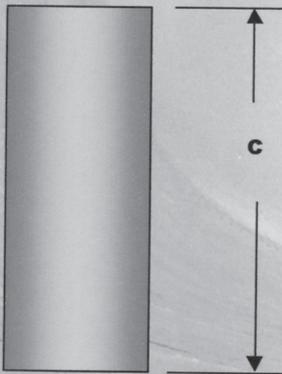
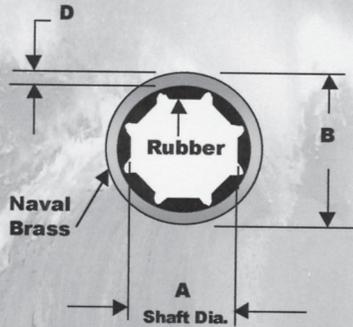
PART NO.	CODE NAME	UNIT WT.	SHAFT DIA. (A)	OUTSIDE DIA. (B)	LENGTH INCH (C)	SHELL WALL (D)
EF0100	ADDER	0.13	3/4	1-1/4	3	1/8
EF0200	AGII	0.19	7/8	1-3/8	3-1/2	1/8
EF0300	ANCHOVY	0.19	7/8	1-1/2	3-1/2	1/8
EF0350	ANABLEPS	0.15	1	1-1/4	4	1/32
EF0375	ARROWANA	0.17	1	1-3/8	4	1/16
EF0400	ANGEL	0.19	1	1-1/2	4	1/8
EF0500	BARBEL	0.25	1	1-5/8	4	1/8
EF0600	BILLFISH	0.50	1	2	4	1/8
EF0650	BLOODFIN	0.40	1-1/8	1-1/2	4-1/2	1/16
EF0700	BLUEFISH	0.25	1-1/8	1-5/8	4-1/2	1/8
EF0800	BONE	0.31	1-1/8	1-3/4	4-1/2	1/8
EF0900	BREAM	0.44	1-1/8	2	4-1/2	1/8
EF0950	BIRCHARDI	0.46	1-1/4	1-1/2	5	1/32
EF1000	BRILL	0.25	1-1/4	1-3/4	5	1/8
EF1100	BURBOT	0.50	1-1/4	2	5	1/8
EF1200	CAPELIN	0.63	1-1/4	2-1/8	5	1/8
EF1300	CHIRUS	0.44	1-3/8	1-7/8	5-1/2	1/8
EF1400	CISCOES	0.50	1-3/8	2	5-1/2	1/8
EF1500	COAL	0.63	1-3/8	2-1/8	5-1/2	1/8
EF1600	CONEY	0.81	1-3/8	2-3/8	5-1/2	1/8
EF1700	CORBINA	0.50	1-1/2	2	6	1/8
EF1800	CRAIG	0.50	1-1/2	2-3/8	6	1/8
EF1900	CRAMP	0.50	1-5/8	2-1/8	6-1/2	1/8
EF2000	DIDON	1.13	1-5/8	2-5/8	6-1/2	1/8
EF2100	DORADE	0.81	1-3/4	2-3/8	7	1/8
EF2200	GERRES	1.00	1-3/4	2-5/8	7	1/8
EF2300	GILTHEAD	1.00	1-7/8	2-5/8	7-1/2	1/8
EF2400	GLOBE	1.50	1-7/8	2-15/16	7-1/2	1/8
EF2500	GOBIE	0.94	2	2-5/8	8	1/8
EF2600	GUPPY	1.56	2	3	8	1/8
EF2700	HADDOCK	1.31	2-1/8	2-15/16	8-1/2	1/8
EF2800	HAYHO	1.88	2-1/8	3-1/8	8-1/2	1/8
EF2900	HOLIA	1.38	2-1/4	2-15/16	9	1/8
EF3000	HOOPID	1.81	2-1/4	3-1/8	9	1/8
EF3100	HORNED	2.19	2-1/4	3-3/8	9	1/8
EF3200	JUREL	2.13	2-3/8	3-3/8	9-1/2	1/8
EF3300	LAUNCE	1.44	2-1/2	3-1/8	10	1/8
EF3400	LOACH	1.75	2-1/2	3-3/8	10	1/8
EF3500	LUMP	1.81	2-5/8	3-3/8	10-1/2	1/8
EF3600	MIDGE	1.75	2-3/4	3-3/8	11	1/8
EF3700	MONDA	2.63	2-3/4	3-3/4	11	1/8
EF3800	MORAY	2.56	2-7/8	3-3/4	11-1/2	1/8
EF3900	NUMB	2.38	3	3-3/4	12	1/8
EF4000	OARFISH	3.00	3	4	12	1/8
EF4100	OX	3.75	3-1/8	4-1/4	12-1/2	1/8
EF4200	ONO	2.75	3-1/4	4	13	1/8
EF4300	PADDLE	3.50	3-1/4	4-1/4	13	1/8
EF4400	PIPE	4.13	3-3/8	4-1/2	13-1/2	1/8
EF4500	PLAICE	3.88	3-1/2	4-1/4	14	1/8
EF4600	PILOT	4.00	3-1/2	4-1/2	14	1/8
EF4700	PIPER	3.50	3-5/8	4-1/2	14-1/2	1/8
EF4800	SPRAT	3.13	3-3/4	4-1/2	15	1/8
EF4900	SALTIE	5.81	3-3/4	5	15	3/16
EF5000	SOLE	7.13	3-3/4	5-1/4	15	3/16
EF5100	SARDINE	6.38	3-7/8	5-1/4	15-1/2	3/16
EF5200	SKATE	4.75	4	5	16	3/16
EF5300	SKITTLE	6.38	4	5-1/4	16	3/16
EF5400	STAR	5.63	4-1/8	5-1/4	16-1/2	3/16
EF5500	SAND	7.13	4-1/4	5-1/2	17	3/16
EF5600	SPOTTED	8.81	4-3/8	5-3/4	17-1/2	3/16
EF5700	STING	6.13	4-1/2	5-1/2	18	3/16
EF5800	STRUGEON	8.13	4-1/2	5-3/4	18	3/16
EF5900	STERLET	10.50	4-5/8	6-1/8	18-1/2	1/4
EF6000	SEA	10.00	4-3/4	6-1/8	19	1/4
EF6100	SCALD	9.31	4-7/8	6-1/8	19-1/2	1/4
EF6200	SCARINA	8.50	5	6-1/8	20	1/4
EF6300	SCOMBER	12.25	5	6-1/2	20	1/4
EF6400	SEACAL	13.25	5-1/4	6-3/4	21	1/4
EF6500	SHANNY	15.75	5-1/4	7	21	1/4
EF6600	SKIPJACK	12.00	5-3/8	6-3/4	21-1/2	1/4
EF6700	SCAD	14.00	5-3/8	7	21-1/2	1/4
EF6800	TUNNY	13.50	5-1/2	7	22	1/4
EF6900	SKIPPY	12.63	5-5/8	7	22-1/2	1/4
EF7000	SNOOK	12.25	5-3/4	7	23	1/4
EF7100	SPINOUS	18.00	5-7/8	7-1/2	24	1/4
EF7200	SERRONO	16.00	6	7-1/2	24	1/4

It's frustrating when you know all the answers, but nobody bothers to ask you the questions.

# JOHNSON & MORSE BEARINGS AVAILABLE

## STANDARD BRASS SLEEVE BEARINGS

### CODE CONVERTER



Morse Marine Bearings  
Metso Minerals Industries, Inc.

PART NO.	CODE NAME	SHAFT DIA. (A)	OUTSIDE DIA. (B)	LENGTH INCH (C)	METAL WALL (D)	Duramax Code
E00100	ALBACORE	3/4	1-1/4	3	1/8	Able
E00200	BLENNY	7/8	1-1/4	3-1/2	1/16	Acid
E00300	BARRACUDA	7/8	1-3/8	3-1/2	1/8	Apex
E00400	BASS	7/8	1-1/2	3-1/2	1/8	Atom
E00500	BETTA	1	1-1/4	3	1/32	
E00600	BLACKFISH	1	1-1/4	4	1/32	Back
E00700	BLOATER	1	1-3/8	4	1/16	Bait
E00800	BONITO	1	1-1/2	4	1/8	Bale
E00900	BROADBILL	1	1-5/8	4	1/8	Band
E01000	BULLHEAD	1	2	4	1/8	Base
E01100	CAMA	1-1/8	1-1/2	4-1/2	1/16	Beam
E00650	CARIBE	1	1-1/4	6	1/32	
E01200	CARP	1-1/8	1-5/8	4-1/2	1/8	Belt
E01300	CATFISH	1-1/8	1-3/4	4-1/2	1/8	Bend
E01400	CHOBIE	1-1/8	2	4-1/2	1/8	Bill
E01500	CHOGSET	1-1/4	1-1/2	5	1/8	Bird
E01600	CHUB	1-1/4	1-3/4	5	1/8	Bird
E01700	COD	1-1/4	2	5	1/8	Bite
E01800	CROAKER	1-1/4	2-1/8	5	1/8	Blow
E01900	DEVILFISH	1-3/8	1-7/8	5-1/2	1/8	Boat
E02000	DOGFISH	1-3/8	2	5-1/2	1/8	Bold
E02100	DOLPHIN	1-3/8	2-1/8	5-1/2	1/8	Bond
E02200	EEL	1-3/8	2-3/8	5-1/2	1/8	Boot
E02300	FLAMEN	1-1/2	2	4-3/8	1/8	
E02400	FLATFISH	1-1/2	2	6	1/8	Boss
E02500	FLOUNDER	1-1/2	2-3/8	6	1/8	Brad
E02600	GAR	1-5/8	2-1/8	6-1/2	1/8	Brew
E02700	GRAYBACK	1-5/8	2-5/8	6-1/2	1/8	Brim
E02800	GROUPER	1-3/4	2-3/8	7	1/8	Brow
E02900	HADDO	1-3/4	2-5/8	7	1/8	Buck
E03000	HAKE	1-7/8	2-5/8	7-1/2	1/8	Bulb
E03100	HALIBUT	1-7/8	2-15/16	7-1/2	1/8	Bull
E03200	HERRING	2	2-5/8	8	1/8	Call
E03300	KINGFISH	2	3	8	1/8	Calm
E03350	LAMPREY	2	3	10	1/8	
E03400	MACKEREL	2-1/8	2-15/16	8-1/2	1/8	Came
E03500	MANTA	2-1/8	3-1/8	8-1/2	1/8	Cape
E03650	MARGATE	2-1/4	3	9	1/8	
E03600	MARLIN	2-1/4	2-15/16	9	1/8	Care
E03700	MINNOW	2-1/4	3-1/8	9	1/8	Cart
E03800	MUDFISH	2-1/4	3-3/8	9	1/8	Case
E03900	MULLET	2-3/8	3-3/8	9-1/2	1/8	Cook
E04000	MUSKY	2-1/2	3-1/8	10	1/8	Cord
E04100	PERCH	2-1/2	3-3/8	10	1/8	Corn
E04200	PICKEREL	2-5/8	3-3/8	10-1/2	1/8	Crab
E04300	PICUDA	2-3/4	3-3/8	11	1/8	Crow
E04150	PIKE	2-1/2	3-1/2	10	1/8	
E04400	PINFISH	2-3/4	3-3/4	11	1/8	Curd
E04500	PORGY	2-7/8	3-3/4	11-1/2	1/8	Cure
E04600	RAY	3	3-3/4	12	1/8	Dane
E04700	REDFIN	3	4	12	1/8	Dare
E04800	REDFISH	3-1/8	4-1/4	12-1/2	1/8	Dark
E04900	ROCKFISH	3-1/4	4	13	1/8	Darn
E05000	SAILFISH	3-1/4	4-1/4	13	1/8	Dell
E05100	SALMON	3-3/8	4-1/2	13-1/2	1/8	Dike
E05200	SANDFISH	3-1/2	4-1/4	14	1/8	Dine
E05300	SAWFISH	3-1/2	4-1/2	14	1/8	Dock
E05400	SCULPIN	3-5/8	4-1/2	14-1/2	1/8	Dole
E05500	SHAD	3-3/4	4-1/2	15	1/8	Done
E05600	SHARK	3-3/4	5	15	3/16	Dove
E05700	SILVERFISH	3-3/4	5-1/4	15	3/16	Draw
E05800	SMELT	3-7/8	5-1/4	15-1/2	3/16	Dull
E05900	SNAPPER	4	5	16	3/16	Earn
E06000	SOCKEYE	4	5-1/4	16	3/16	Ease
E06100	SPEARFISH	4-1/8	5-1/4	16-1/2	3/16	Echo
E06200	SQUIT	4-1/4	5-1/2	17	3/16	Edit
E06300	STREAKER	4-3/8	5-3/4	17-1/2	3/16	Eise
E06400	SUCKER	4-1/2	5-1/2	18	3/16	Epic
E06500	SUNFISH	4-1/2	5-3/4	18	3/16	Edge
E06600	SWORDFISH	4-5/8	6-1/8	18-1/2	1/4	Even
E06700	TARPON	4-3/4	6-1/8	19	1/4	Ever
E06800	TROUT	4-7/8	6-1/8	19-1/2	1/4	Evil
E06900	WAHOO	5	6-1/8	20	1/4	Face
E07000	WALLEYE	5	6-1/2	20	1/4	Fact
E07100	WANDTAIL	5-1/4	6-3/4	21	1/4	Fade
E07200	WAP	5-1/4	7	21	1/4	Fare
E07300	WARFISH	5-3/8	6-3/4	21-1/2	1/4	Fear
E07400	WARSAW	5-3/8	7	21-1/2	1/4	Felt
E07500	WHITEFISH	5-1/2	7	22	1/4	Find
E07600	WINDFISH	5-5/8	7	22-1/2	1/4	Flat
E07700	YELLOWTAIL	5-3/4	7	23	1/4	Fork
E07800	YOWLING	5-7/8	7-1/2	24	1/4	Fuel
E07900	ZANCLUS	6	7-1/2	24	1/4	Gale

A day without sunshine is like night.

**FOR HEAVY-DUTY  
SERVICE AT FORWARD  
STERN TUBE LOCATION**

Sizes - 2-1/2" to 15" (63.50 to 381.00mm)

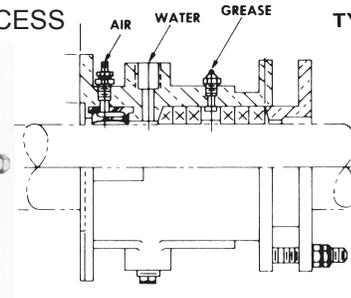
Ruggedly built of highest quality cast naval bronze, with extra-thick fillet-reinforced flanges and precision machining, Johnson heavy-duty stuffing boxes qualify for the most demanding service. Emphasis in design is on extra strength at critical stress-points, and on equitable stressdistribution through mounting and gland flanges.

(\*) Standard units are of cast bronze; also available in cast aluminum or mild steel.

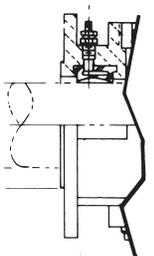
**FIG. 1786-IR - WATER-GREASE LUBRICATION, WITH "AIR-SEAL"**

For use with water-lubricated stern tube bearings. Fig. 1786-IR is fitted with inflatable "AirSeal" ring; also inlets for water lubrication to bearings, and "zerk" fitting with lantern-ring for grease lubrication of packing.

TYPE 1 - FEMALE RECESS



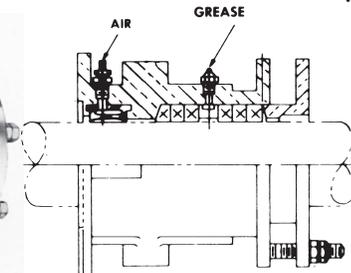
TYPE 2 - MALE PILOT



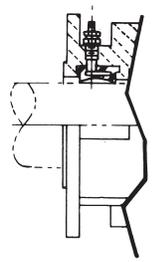
**FIG. 1787-IR - GREASE LUBRICATION, WITH "AIR-SEAL"**

Identical to Fig. 1786-IR, but does not include inlets for water lubrication. Suitable for a short stern-tube where a forward bearing is not used. Includes "zerk" fitting and lanternring for grease-lubrication of packing.

TYPE 3 - FEMALE RECESS



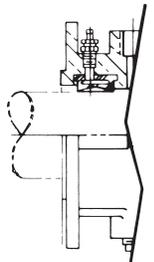
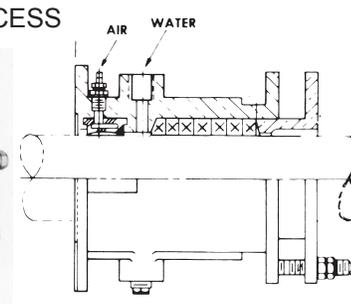
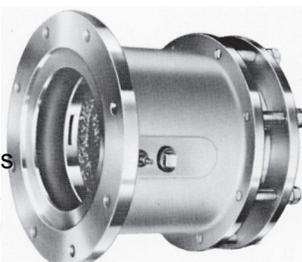
TYPE 4 - MALE PILOT



**FIG. 1788-IR - WATER LUBRICATION ONLY, WITH "AIR-SEAL"**

Fitted with water inlet for bearing lubrication. Does not include grease fitting or lanternring; packing gland accommodates seven rings of packing as opposed to six for greaselubricated glands. For use with self-lubricated packing.

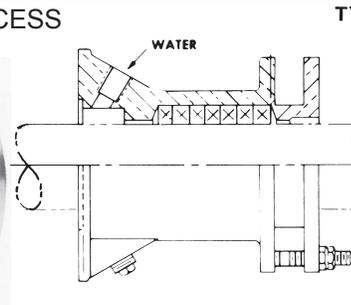
TYPE 5 - FEMALE RECESS



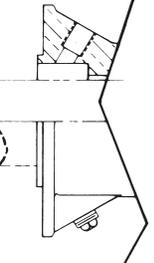
**FIG. 1789 - WATER LUBRICATION**

Lower in cost, does not include "Air-Seal" feature nor packing grease fitting, but is otherwise the equal of the foregoing models. Water inlet delivers water to stern tube bearings.

TYPE 7 - FEMALE RECESS



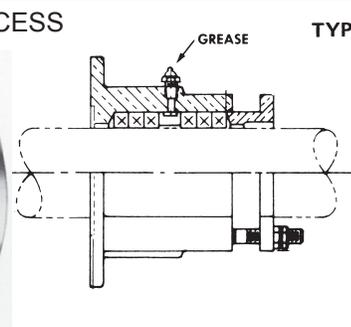
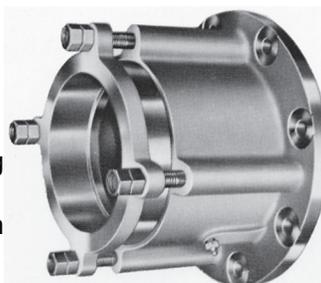
TYPE 8 - MALE PILOT



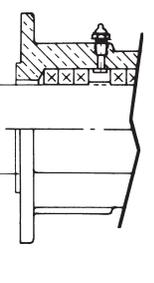
**FIG. 1790 - GREASE LUBRICATED 2-1/2" to 7-3/4" (63.50 to 196.85mm)**

For vessels with shafts up to 7-3/4" (196.85 mm) this economical unit offers high efficiency at moderate cost. Equipped with grease-fitting, lantern-ring and space for six rings of packing. Four glandstuds are mounted in ridges cast in barrel, providing high strength for gland compression.

TYPE 9 - FEMALE RECESS



TYPE 10 - MALE PILOT



**More and more commercial vessels are discovering they're staying at work  
on the water longer (and out of expensive dry dock) thanks to the...  
PROPELLER SHAFT SEAL SYSTEM**

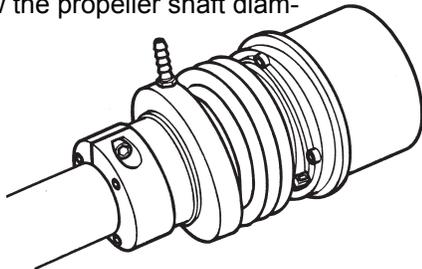
The Duramax Shaft Seal System is readily adaptable to nearly all inboard propulsion systems with shafts from 3/4" to 2" in diameter. It is ideal for retrofit or OEM.

Boats and ships using Duramax shaft seals stay at work longer... because the seals last longer. They're watertight, corrosion resistant and never need repacking. Shafts last longer because the Duramax system eliminates shaft wear at the seal and reduces vibration.

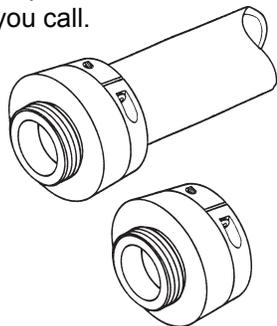
The Duramax system makes pumping out your bilge (except for rain water and spray) a thing of the past. Duramax seals (unlike stuffing boxes) keep water out... leaving the bilge clean and dry. Duramax is also helping captains and owners avoid costly federal water pollution fines. That's because the Duramax Shaft Seal System is leak free, unlike the messy old-fashioned stuffing boxes it replaces.

The Duramax Shaft Seal System is showing up on trawlers, crew boats, ferries, work boats, shrimpers, tugboats, pusher boats... everywhere there's a job to be done on the water.

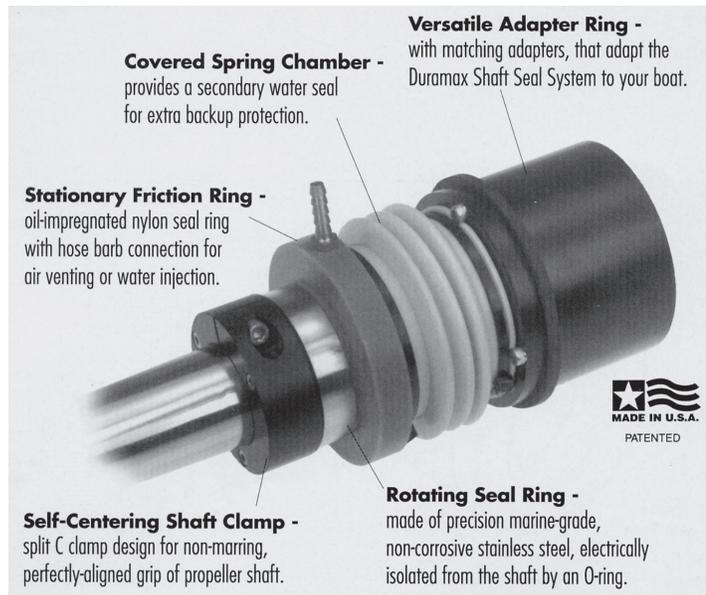
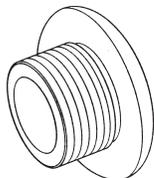
The **Shaft Seal Assembly** is the main body of the Duramax Shaft Seal System. To determine which assembly to order, know the propeller shaft diameter when you call.



To determine which **Stern Tube Clamp Adapter** to order, know the propeller shaft and stem tube diameters when you call.



The **Thru-Hull Adapter** is used for new construction and for major overhauls or retrofit. To determine which thru-hull adapter to order, know the propeller shaft diameter when you call.



**Covered Spring Chamber** - provides a secondary water seal for extra backup protection.

**Stationary Friction Ring** - oil-impregnated nylon seal ring with hose barb connection for air venting or water injection.

**Self-Centering Shaft Clamp** - split C clamp design for non-marring, perfectly-aligned grip of propeller shaft.

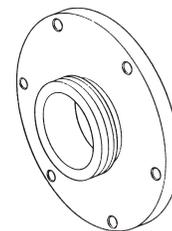
**Versatile Adapter Ring** - with matching adapters, that adapt the Duramax Shaft Seal System to your boat.

**Rotating Seal Ring** - made of precision marine-grade, non-corrosive stainless steel, electrically isolated from the shaft by an O-ring.

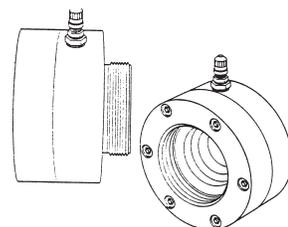
To determine which Hose Adapter to order, know the propeller shaft and stern tube diameters when you call.



The **Flange Adapter** is used for new construction and for major overhauls or retrofit. To determine which flange adapter to order, know the propeller shaft and flange diameter when you call.



The **Air Seal Adapter** is the ultimate protection for your vessel. It is the first line of defense in the event of shaft seal catastrophe. The air seal bladder can be pumped up with air to completely seal off any water flow into the boat. It is a damage control device and is not to be used when the shaft is turning. To determine which air seal adapter to order, know the propeller shaft diameter when you call.



## STEERING PARTS & ACCESSORIES

### RUDDER PORTS — A & B Series

Outside Mount

PART NUMBER	SHAFT SIZE	FLANGE SIZE	FLANGE ANGLE	BARREL LENGTH	WEIGHT, EACH
OORP100A	1"	3 1/2" sq.	90°	3 3/4"	4.0 lbs
OORP113A	1 1/8"	3 1/2" sq.	90°	3 3/4"	4.0 lbs
OORP125A	1 1/4"	4 1/2" sq.	90°	6"	6.0 lbs
OORP125B	1 1/4"	4 1/2" sq.	85°	6"	6.0 lbs
OORP125B12	1 1/4"	4 1/8" sq.	12°	6 1/8"	6.22 lbs
OORP125B19	1 1/4"	4" sq.	19°	2 1/4"	3.5 lbs
OORP125B23	1 1/4"	4 1/4" sq.	23°	4 1/2"	6.0 lbs
OORP138B	1 3/8"	4 1/2" sq.	85°	6"	6.0 lbs
OORP138B12	1 3/8"	4 1/8" sq.	12°	6 1/8"	6.0 lbs
OORP138A	1 3/8"	4 1/2" sq.	90°	6"	6.0 lbs
OORP150A	1 1/2"	5 1/8" sq.	90°	5"	14.3 lbs
OORP150B12	1 1/2"	4 1/8" sq.	12°	7"	6.94 lbs
OORP175A	1 3/4"	5 1/8" sq.	90°	5"	15.0 lbs
OORP200A	2"	5 1/8" sq.	90°	5"	18.0 lbs
OORP200B9*	2"	5 3/4" sq.	9°	5 1/8"	12.0 lbs
OORP200B12	2"	5 3/4" sq.	12 1/2°	6 5/16"	11.0 lbs
OORP225A	2 1/4"	6" sq.	90°	6 1/16"	22.5 lbs
OORP250A	2 1/2"	6" sq.	90°	6 1/16"	21.0 lbs
OORP275A	2 3/4"	6 3/4" sq.	90°	6 1/2"	32.0 lbs
OORP300A	3"	6 3/4" sq.	90°	6 1/2"	30.0 lbs



A - Series



B - Series

A - Series are 90°. B - Series are angled.  
\*Manganese Bronze

### RUDDER COLLAR

Cast Bronze

PART NUMBER	SHAFT SIZE	WEIGHT, EACH
OORC100	1"	0.43 lbs
OORC113	1 1/8"	0.75 lbs
OORC125	1 1/4"	0.63 lbs
OORC138	1 3/8"	1.20 lbs
OORC150	1 1/2"	1.13 lbs
OORC175	1 3/4"	1.16 lbs
OORC200	2"	2.90 lbs
OORC225	2 1/4"	3.00 lbs
OORC250	2 1/2"	2.80 lbs
OORC275	2 3/4"	6.00 lbs
OORC300	3"	5.50 lbs



### RUDDER PORT — Oval Flange

Cast Bronze

PART NUMBER	SHAFT SIZE	BOLT SIZE	LENGTH UNDER FLANGES	BASE SIZE	WEIGHT, EACH
OORPO100	1"	3/8"	3"	2 1/4 x 4 3/8"	3.00 lbs
OORPO113	1 1/8"	3/8"	3"	2 1/4 x 4 3/8"	2.85 lbs
OORPO125	1 1/4"	3/8"	4 1/4"	3 x 5 3/4"	5.00 lbs
OORPO138	1 3/8"	3/8"	4 1/4"	3 x 5 3/4"	5.00 lbs
OORPO150	1 1/2"	1/2"	3 3/4"	3 1/2 x 7"	6.00 lbs



### TILLER ARMS — Bolt & Keyway Type

Malleable Iron - Manganese Bronze

PART NUMBER IRON	PART NUMBER BRONZE	SHAFT SIZE	OVERALL LENGTH	C TO C DIM.	KEYWAY	WEIGHT, EACH
33TA10X60M	10TA10X600	1"	9 1/4"	6"	1/4"	1.45 lbs
33TA10X70M	10TA10X700	1"	9 1/4"	7"	1/4"	1.45 lbs
33TA11X60M	10TA11X600	1 1/8"	9 1/4"	6"	1/4"	1.40 lbs
33TA11X70M	10TA11X700	1 1/8"	9 1/4"	7"	1/4"	1.40 lbs
33TA12X60M	10TA12X600	1 1/4"	8 1/2"	6"	1/4"	3.00 lbs
33TA12X70M	10TA12X700	1 1/4"	9 1/4"	7"	1/4"	2.60 lbs
33TA12X90M	10TA12X900	1 1/4"	11 1/2"	9"	1/4"	2.80 lbs
33TA13X60M	10TA13X600	1 3/8"	8 1/2"	6"	1/4"	2.60 lbs
33TA13X70M	10TA13X700	1 3/8"	9 1/4"	7"	1/4"	2.60 lbs
33TA13X90M	10TA13X900	1 3/8"	11 1/2"	9"	1/4"	2.80 lbs
33TA15X60M	10TA15X600	1 1/2"	8 1/2"	6"	3/8"	4.00 lbs
33TA15X10M	10TA15X100	1 1/2"	15 3/4"	10"	3/8"	5.00 lbs
33TA17X10M	10TA17X100	1 3/4"	15 3/4"	10"	3/8"	5.00 lbs
N/A	10TA20X100	2"	15 3/4"	10"	3/8"	5.50 lbs
N/A	10TA22X170	2 1/4"	17"	13 1/2"	1/2"	7.00 lbs
N/A	10TA25X170	2 1/2"	17"	13 1/2"	1/2"	7.00 lbs

### DIETING

I went on a fourteen-day diet, but all I lost was two weeks.

Minutes at the table don't put on weight—it's the seconds.

My doctor has the greatest diet of all: eat all you want, chew-but don't swallow.

If you cheat on your diet—you gain in the end.

The second day of a diet is always easier than the first-by the second day you're off it.

I told the doctor I get very tired when I go on a diet. So he gave me pep pills. You know what happened? I ate faster.

## SHAFT LOG SELF-ALIGNING

Logs Only  
Cast Bronze

BASE TYPE	PART NUMBER	SHAFT SIZE	BASE SIZE	HOSE I.D.	WEIGHT, EACH
A	OOSLL100A	1"	5 <sup>3</sup> / <sub>4</sub> x 3"	1 <sup>3</sup> / <sub>4</sub> "	2.0 lbs
A	OOSLL113A	1 <sup>1</sup> / <sub>8</sub> "	5 <sup>3</sup> / <sub>4</sub> x 3"	1 <sup>3</sup> / <sub>4</sub> "	2.0 lbs
A	OOSLL125A	1 <sup>1</sup> / <sub>4</sub> "	6 <sup>1</sup> / <sub>2</sub> x 3"	2 <sup>1</sup> / <sub>4</sub> "	2.9 lbs
B	OOSLRL125	1 <sup>1</sup> / <sub>4</sub> "	6 x 4"	2 <sup>1</sup> / <sub>4</sub> "	4.0 lbs
B	OOSLRL138	1 <sup>3</sup> / <sub>8</sub> "	7 x 4 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>2</sub> "	6.9 lbs
B	OOSLRL150	1 <sup>1</sup> / <sub>2</sub> "	7 x 4 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>2</sub> "	6.9 lbs
B	OOSLRL175	1 <sup>3</sup> / <sub>4</sub> "	8 <sup>1</sup> / <sub>4</sub> x 6"	3"	9.8 lbs
B	OOSLRL200	2"	8 <sup>1</sup> / <sub>4</sub> x 6"	3"	9.8 lbs
B	OOSLRL225	2 <sup>1</sup> / <sub>4</sub> "	6 x 10"	3 <sup>1</sup> / <sub>2</sub> "	12.0 lbs
B	OOSLRL250	2 <sup>1</sup> / <sub>2</sub> "	6 x 10"	3 <sup>1</sup> / <sub>2</sub> "	12.0 lbs



A - Oval Base



B - Rectangular Base

## SHAFT LOG – Square Base, Complete Assembly

Cast Bronze

PART NUMBER	SHAFT SIZE	BASE SIZE	LENGTH	C. TO C. BASE HOLES	HOSE I.D. SIZE	HOLE SIZE	WEIGHT, EACH
OOSLS125G	1 <sup>1</sup> / <sub>4</sub> "	3 <sup>1</sup> / <sub>16</sub> " sq	3 <sup>3</sup> / <sub>4</sub> "	2 <sup>3</sup> / <sub>8</sub> "	2"	1/4" c.s.	5 lbs
OOSLS138G	1 <sup>3</sup> / <sub>8</sub> "	4 <sup>5</sup> / <sub>8</sub> " sq	3 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>8</sub> "	2 <sup>5</sup> / <sub>8</sub> "	1/2" c.s.	9 lbs
OOSLS150G	1 <sup>1</sup> / <sub>2</sub> "	4 <sup>5</sup> / <sub>8</sub> " sq	3 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>8</sub> "	2 <sup>5</sup> / <sub>8</sub> "	1/2" c.s.	9 lbs



## SHAFT LOG - Complete Assembly

Cast Bronze

PART NUMBER	SHAFT SIZE	ANGLE	BASE LENGTH	WIDTH	OVERALL LENGTH	HOSE I.D.	WEIGHT, EACH
OOSL100X	1"	12°	11"	3"	16 <sup>1</sup> / <sub>8</sub> "	1 <sup>1</sup> / <sub>2</sub> "	4.70 lbs
OOSL100	1"	13°	12 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>2</sub> "	19 <sup>1</sup> / <sub>4</sub> "	1 <sup>3</sup> / <sub>4</sub> "	7.00 lbs
OOSL113	1 <sup>1</sup> / <sub>8</sub> "	13°	12 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>2</sub> "	19 <sup>1</sup> / <sub>4</sub> "	1 <sup>3</sup> / <sub>4</sub> "	7.00 lbs
OOSL113H*	1 <sup>1</sup> / <sub>8</sub> "	12°	14"	4 <sup>1</sup> / <sub>4</sub> "	21"	2 <sup>1</sup> / <sub>4</sub> "	10.30 lbs
OOSL125	1 <sup>1</sup> / <sub>4</sub> "	12°	20 <sup>1</sup> / <sub>2</sub> "	4 <sup>1</sup> / <sub>2</sub> "	28"	2 <sup>1</sup> / <sub>4</sub> "	15.20 lbs
OOSL138	1 <sup>3</sup> / <sub>8</sub> "	12°	24"	5 <sup>1</sup> / <sub>4</sub> "	33"	2 <sup>1</sup> / <sub>2</sub> "	17.75 lbs
OOSL138L	1 <sup>3</sup> / <sub>8</sub> "	8°	28 <sup>1</sup> / <sub>2</sub> "	5 <sup>1</sup> / <sub>4</sub> "	36 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>2</sub> "	21.00 lbs
OOSL150**	1 <sup>1</sup> / <sub>2</sub> "	12°	24"	5 <sup>1</sup> / <sub>4</sub> "	33"	2 <sup>1</sup> / <sub>2</sub> "	17.75 lbs
OOSL150L**	1 <sup>1</sup> / <sub>2</sub> "	8°	28 <sup>1</sup> / <sub>2</sub> "	5 <sup>1</sup> / <sub>4</sub> "	36 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>2</sub> "	21.00 lbs
OOSL175**	1 <sup>3</sup> / <sub>4</sub> "	9°	32 <sup>1</sup> / <sub>2</sub> "	7"	41"	3"	31.50 lbs
OOSL175L**	1 <sup>3</sup> / <sub>4</sub> "	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	56"	3 <sup>1</sup> / <sub>2</sub> "	48.00 lbs
OOSL200**	2"	9°	32 <sup>1</sup> / <sub>2</sub> "	7"	41"	3"	31.50 lbs
OOSL200L**	2"	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	56"	3 <sup>1</sup> / <sub>2</sub> "	48.00 lbs
OOSL225**	2 <sup>1</sup> / <sub>4</sub> "	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	56"	3 <sup>1</sup> / <sub>2</sub> "	51.00 lbs
OOSL250**	2 <sup>1</sup> / <sub>2</sub> "	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	56"	3 <sup>1</sup> / <sub>2</sub> "	51.00 lbs



\*Heavy  
\*\*These parts are made in Right & Left Hand Threads

## SHAFT LOG – Square Base, Log Only

Cast Bronze

PART NUMBER	SHAFT SIZE	BASE SIZE	C. TO C.	HOSE I.D. SIZE	HOLE SIZE	WEIGHT, EACH
OOSLLR125G	1 <sup>1</sup> / <sub>4</sub> "	3 <sup>1</sup> / <sub>16</sub> " sq	2 <sup>3</sup> / <sub>8</sub> "	2"	1/4" c.s.	2 lbs
OOSLLR138G	1 <sup>3</sup> / <sub>8</sub> "	4 <sup>5</sup> / <sub>8</sub> " sq	3 <sup>1</sup> / <sub>8</sub> "	2 <sup>5</sup> / <sub>8</sub> "	1/2" c.s.	5 lbs
OOSLLR150G	1 <sup>1</sup> / <sub>2</sub> "	4 <sup>5</sup> / <sub>8</sub> " sq	3 <sup>1</sup> / <sub>8</sub> "	2 <sup>5</sup> / <sub>8</sub> "	1/2" c.s.	5 lbs



## SHAFT LOG – Log Only

Cast Bronze

PART NUMBER	SHAFT SIZE	ANGLE	BASE LENGTH	WIDTH	OVERALL LENGTH	HOSE I.D.	WEIGHT, EACH
OOSLL100X	1"	12°	11"	3"	14 <sup>1</sup> / <sub>2</sub> "	1 <sup>1</sup> / <sub>2</sub> "	3.00 lbs
OOSLL100	1"	13°	12 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>2</sub> "	17"	1 <sup>3</sup> / <sub>4</sub> "	4.50 lbs
OOSLL113	1 <sup>1</sup> / <sub>8</sub> "	13°	12 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>2</sub> "	17"	1 <sup>3</sup> / <sub>4</sub> "	4.50 lbs
OOSLL113H*	1 <sup>1</sup> / <sub>8</sub> "	12°	14"	4 <sup>1</sup> / <sub>4</sub> "	18 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>4</sub> "	7.63 lbs
OOSLL125	1 <sup>1</sup> / <sub>4</sub> "	12°	20 <sup>1</sup> / <sub>2</sub> "	4 <sup>1</sup> / <sub>2</sub> "	25 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>4</sub> "	9.50 lbs
OOSLL138	1 <sup>3</sup> / <sub>8</sub> "	12°	24"	5 <sup>1</sup> / <sub>4</sub> "	30 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>2</sub> "	15.00 lbs
OOSLL138L	1 <sup>3</sup> / <sub>8</sub> "	8°	28 <sup>1</sup> / <sub>2</sub> "	5 <sup>1</sup> / <sub>4</sub> "	34"	2 <sup>1</sup> / <sub>2</sub> "	16.00 lbs
OOSLL150	1 <sup>1</sup> / <sub>2</sub> "	12°	24"	5 <sup>1</sup> / <sub>4</sub> "	29 <sup>1</sup> / <sub>2</sub> "	2 <sup>1</sup> / <sub>2</sub> "	15.00 lbs
OOSLL150L	1 <sup>1</sup> / <sub>2</sub> "	8°	28 <sup>1</sup> / <sub>2</sub> "	5 <sup>1</sup> / <sub>4</sub> "	34"	2 <sup>1</sup> / <sub>2</sub> "	16.00 lbs
OOSLL175	1 <sup>3</sup> / <sub>4</sub> "	9°	33"	6 <sup>1</sup> / <sub>2</sub> "	38 <sup>1</sup> / <sub>2</sub> "	3"	25.50 lbs
OOSLL175L	1 <sup>3</sup> / <sub>4</sub> "	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	53"	3 <sup>1</sup> / <sub>2</sub> "	39.00 lbs
OOSLL200	2"	9°	33"	6 <sup>1</sup> / <sub>2</sub> "	38"	3"	25.50 lbs
OOSLL200L	2"	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	53"	3 <sup>1</sup> / <sub>2</sub> "	39.00 lbs
OOSLL225	2 <sup>1</sup> / <sub>4</sub> "	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	53"	3 <sup>1</sup> / <sub>2</sub> "	39.00 lbs
OOSLL250	2 <sup>1</sup> / <sub>2</sub> "	7°	46 <sup>1</sup> / <sub>4</sub> "	7 <sup>1</sup> / <sub>2</sub> "	53"	3 <sup>1</sup> / <sub>2</sub> "	39.00 lbs

\*Heavy



## MOTOR ACCESSORIES



### PROPELLER KEYS

Naval Bronze in One Foot Lengths

PART NUMBER	SIZE	PART NUMBER	SIZE
KEYS18x1FT	3/16"	KEYS50x1FT	1/2"
KEYS25x1FT	1/4"	KEYS56x1FT	9/16"
KEYS31x1FT	5/16"	KEYS62x1FT	5/8"
KEYS37x1FT	3/8"	KEYS75x1FT	3/4"
KEYS43x1FT	7/16"		

Also available in  
Stainless Steel

# PACKING BOX

Complete Assembly

PART NUMBER	SHAFT SHAFT	HOSE SIZE	WEIGHT, EACH
OOPB75	3/4"	1 1/2"	1.75 lbs
OOPB88	7/8"	1 3/4"	1.75 lbs
OOPB100	1"	1 3/4"	1.75 lbs
OOPB100FG	1"	2"	1.90 lbs
OOPB100X	1"	1 1/2"	1.75 lbs
OOPB100225	1"	2 1/4"	2.30 lbs
OOPB113	1 1/8"	1 3/4"	1.75 lbs
OOPB113FG	1 1/8"	2"	1.90 lbs
OOPB113H	1 1/8" hvy	2 1/4"	2.80 lbs
OOPB125	1 1/4"	2 1/4"	2.87 lbs
OOPB125FG	1 1/4"	2"	2.30 lbs
OOPB138	1 3/8"	2 1/2"	3.37 lbs
OOPB150*	1 1/2"	2 1/2"	3.37 lbs
OOPB175*	1 3/4"	3"	8.00 lbs
OOPB200*	2"	3"	8.00 lbs
OOPB175-L	1 3/4"	3 1/2"	9.00 lbs
OOPB200-L	2"	3 1/2"	9.00 lbs
OOPB225*	2 1/4"	3 1/2"	12.00 lbs
OOPB250*	2 1/2"	3 1/2"	12.00 lbs
OOPB275	2 3/4"	4 1/2"	31.00 lbs
OOPB300*	3"	4 1/2"	30.00 lbs



A complete assembly includes all parts own (2 clamps). The nut, stud and body are finely machined cast bronze. Hose is 5-ply marine exhaust hose. Clamp is all stainless steel up to and including 1 1/4" hoses. Larger sizes have heavy duty malleable iron clamp with rustproof plating.

## PACKING BOX – Two Bolt Type w/Hose & Clamps

Cast Bronze

PART NUMBER	SHAFT SIZE	OVERALL LGTH	STUD SIZE	HOSE I.D. SIZE	WEIGHT, EACH
OOPBS125G	1 1/4"	7 3/16"	3/8" -16	2"	3 lbs
OOPBS138G	1 3/8"	8 5/16"	3/8" -16	2 5/8"	4 lbs
OOPBS150G	1 1/2"	8 5/16"	3/8" -16	2 5/8"	4 lbs



## PACKING BOX – Self-Aligning Bolt Type

Cast Bronze

PART NUMBER	FOR HOSE I.D.	SHAFT SIZE	WEIGHT, EACH
OOPB125G	2 1/4"	1 1/4"	4.0 lbs
OOPB138G	2 1/2"	1 3/8"	4.0 lbs
OOPB150G	2 1/2"	1 1/2"	4.0 lbs
OOPB175G	3"	1 3/4"	8.5 lbs
OOPB200G	3"	2"	8.5 lbs
OOPB225G	3 1/2"	2 1/4"	11.0 lbs
OOPB250G	3 1/2"	2 1/2"	11.0 lbs
OOPB200GH	3 1/2"	2"	22.0 lbs
OOPB225GH	3 1/2"	2 1/4"	22.0 lbs
OOPB250GH	3 1/2"	2 1/2"	22.0 lbs
OOPB275GH	4"	2 3/4"	31.0 lbs
OOPB300GH	4"	3"	31.0 lbs
OOPB300GH45	4 1/2"	3"	27.0 lbs

Furnished with Hose and Clamps.



Brain cells come and brain cells go, but fat cells live forever.

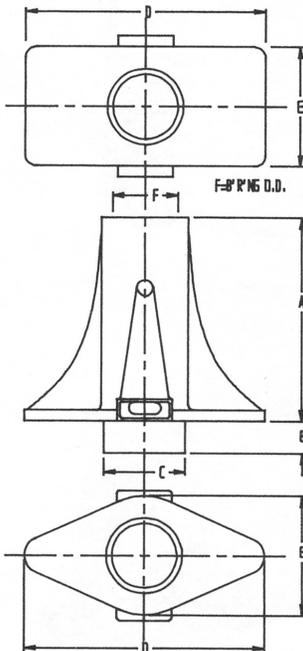
## TOURNAMENT OVAL STUFFING BOX RUDDER PORTS

PART NUMBER	SHAFT DIA.	BASE SIZE	OVERALL LENGTH	HOLES DRILLED	WEIGHT, EACH
2875	3/4"	4"	2 1/8"	7/16"	1.4 lbs
2876	1"	4 1/8"	2 1/8"	7/16"	2.0 lbs
2877	7/8"	4 1/8"	2 1/8"	9/16"	2.0 lbs



## TOURNAMENT REGULAR RUDDER PORT

PART NUMBER	SHAFT DIA.	BASE SIZE	OVERALL LENGTH	HOLES DRILLED	WEIGHT, EACH
2902	1 1/4"	4 x 4"	6"	3/8"	4.4 lbs
2903	1 3/8"	4 x 4"	6"	3/8"	4.2 lbs
2904	1 1/2"	4 x 4"	6"	3/8"	4.5 lbs



## TOURNAMENT BRONZE STERN CASTINGS

Housing Only

PART NUMBER	SHAFT SIZE	FLANGE TYPE	DIMENSIONS						WEIGHT
			A	B	C	D	E	F	
10118	1 1/8"	OVAL	5 1/8"	3/4"	2 1/8"	5 3/8"	2 3/4"	1 3/4"	4.9 lbs
10122	1 3/8"	OVAL	6 3/16"	7/8"	2 3/8"	6 1/2"	3"	2 1/8"	6.0 lbs
10124	1 1/2"	OVAL	6 3/16"	1"	2 5/8"	7"	3 1/2"	2 3/8"	10.2 lbs
10020	1 1/4"	RECT	5 3/8"	7/8"	2 3/8"	5 3/4"	3"	1 7/8"	6.2 lbs
10022	1 3/8"	RECT	6 3/16"	1"	2 1/2"	6 1/2"	3 1/4"	2"	7.2 lbs
10024	1 1/2"	RECT	6 13/16"	1"	2 3/4"	3 1/2"	7"	2 3/8"	12.0 lbs
10032	2"	RECT	9"	1 1/4"	3 3/8"	9 1/4"	4 1/2"	2 5/8"	20.5 lbs
10036	2 1/4"	RECT	10"	1 1/2"	3 3/4"	10 5/8"	5 1/4"	3"	30.8 lbs
10040	2 1/2"	RECT	11"	1 5/8"	4"	11 1/2"	5 3/4"	3 3/8"	38.5 lbs
10044	2 3/4"	RECT	12"	1 3/4"	4 1/2"	12 3/4"	6 3/8"	3 5/8"	45.8 lbs
10048	3"	RECT	12 7/8"	2"	4 3/4"	14 7/8"	7"	3 3/4"	55.0 lbs
10056	3 1/2"	RECT	15"	2 1/2"	5 1/4"	15 1/2"	8"	4 1/2"	75.0 lbs

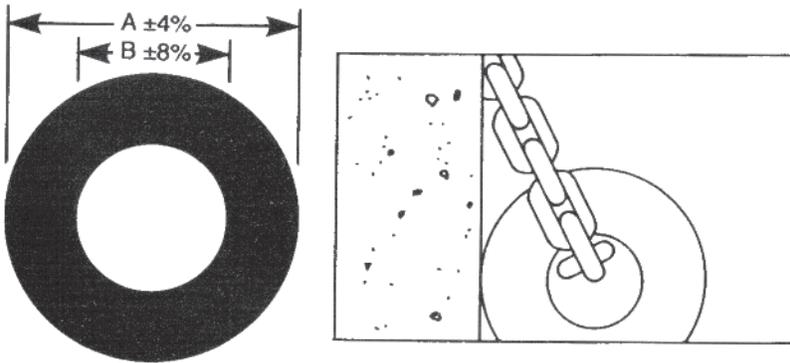
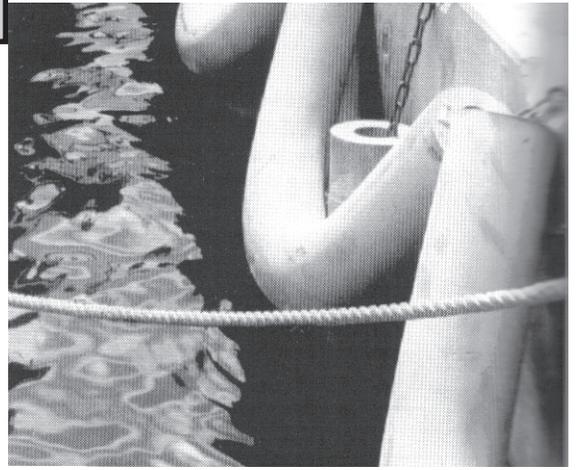
Holes are drilled in Flange only when specified.

Age doesn't always bring wisdom. Sometimes age comes alone.

## STANDARD CYLINDRICAL FENDERS

The inherent lateral flexibility of Cylindrical fenders give them the widest range of mounting options available. They may be draped, suspended, or strung on chains to provide protection through tidal changes or where substantial vessel draft variations are anticipated.

Where straight mounting is desired, a metal bar through the bore will provide the lateral stiffness required. They may also be curved to meet special contours on structures or vessels.

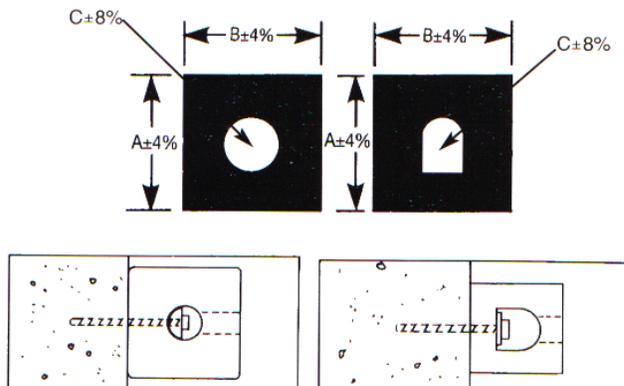


STANDARD CYLINDRICAL					
O.D.	A	I.D.	B	APPROX. LBS./FT.	APPROX. Kg/M
	MM		MM		
3"	76	1-3/8"	35	3	4
5"	127	2-1/2"	64	8	11
7"	178	3"	76	16	24
7"	178	3-1/2"	89	15	22
7"	178	5"	127	10	14
8"	203	3-1/2"	89	21	31
8"	203	4"	102	19	29
9"	229	3"	76	29	43
10"	254	5"	127	30	45
12"	305	4"	102	51	76
12"	305	6"	152	43	65
15"	381	5"	127	80	120
15"	381	7-1/2"	191	68	101
18"	457	6"	152	116	172
18"	457	9"	229	98	145
21"	533	10-1/2"	267	133	198
24"	610	12"	305	173	258
27"	686	13-1/2"	343	220	327
28"	711	14"	356	236	351

## RECTANGULAR FENDERS

The Rectangular profile is the most rigid of our rubber fender designs. It may be surface mounted where tidal actions are not a consideration and where berthing angles are low. It may be mounted horizontally or vertically behind timbers to provide extra cushioning where dock loading must be kept low.

It can be precurved during extrusion for solid mounting on vessels. This versatility in protecting both structures and vessels is enhanced by a wide range of available sizes.

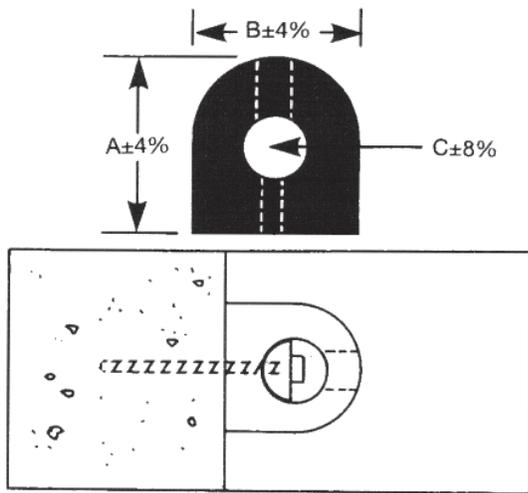
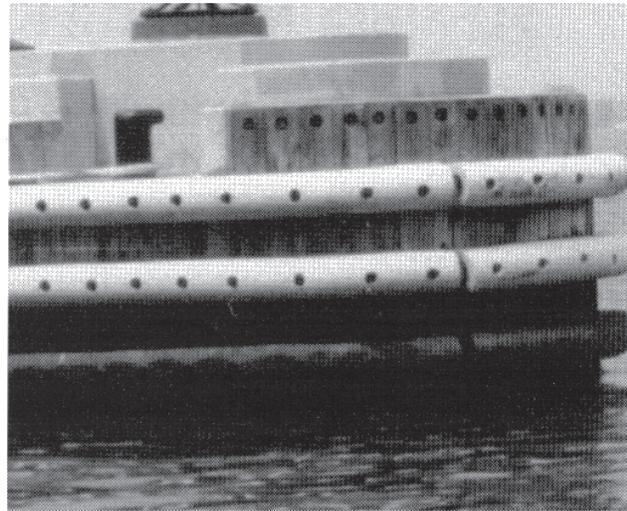


## RECTANGULAR

Height A		Width B		"C" Bore		Weight	
mm	in.	mm	in.	mm	in.	kg/m	lbs./ft.
89	3-1/2"	114	4-1/2"	25	1"	11	8
127	5"	152	6"	64	2-1/2"	19	13
127	5"	165	6-1/2"	64	2-1/2"	21	14
152	6"	254	10"	76	3"	40	27
178	7"	254	10"	76	3"	48	32
203	8"	203	8"	76x76	3"	43	29
203	8"	203	8"	76	3"	43	29
203	8"	254	10"	76	3"	55	37
203	8"	254	10"	76x76	3"	55	37
254	10"	254	10"	102	4"	67	45
254	10"	254	10"	102x102	4"	65	44
254	10"	305	12"	102	4"	82	55
254	10"	305	12"	102x102	4"	80	54
254	10"	305	12"	127	5"	76	51
305	12"	305	12"	102	4"	100	67
305	12"	305	12"	127	5"	95	64
305	12"	305	12"	152x152	6"	85	57
305	12"	305	12"	152	6"	88	59
305	12"	356	14"	152	6"	106	71
356	14"	356	14"	152	6"	128	86
356	14"	356	14"	152x152	6"	125	84
356	14"	356	14"	178x178	7"	116	78
406	16"	406	16"	152	6"	173	116
457	18"	457	18"	254	10"	187	126
508	20"	508	20"	204	8"	266	179

# D-SHAPED FENDERS

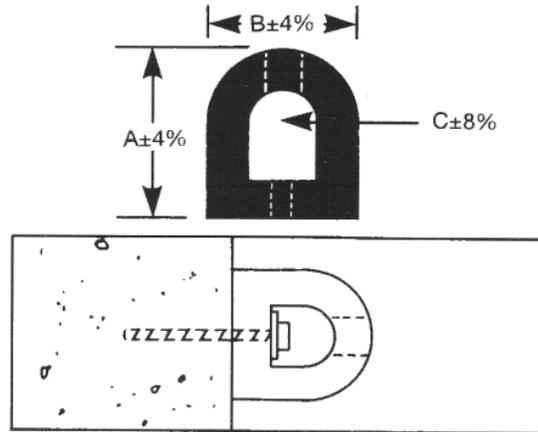
We manufacture D-Series fenders with either a cylindrical or a "D" shaped bore to provide for varying mounting requirements. Designed for use on tugs and barges, they offer long term durability for applications where repeated compression cycles are encountered in pushing service. They also offer the excellent physical characteristics needed to handle the high loading which occurs both on initial contact, and throughout the service cycle.



**"D" SERIES**  
Cylindrical Bore

A HEIGHT		B WIDTH		C BORE		APPROX.	
IN	MM	IN	MM	IN	MM	LBS/FT	KG/M
5	127	6½	165	2½	64	12	18
6	152	5	127	2½	64	11	17
6	152	6	152	3	76	13	19
6	152	8	203	3	76	17	26
8	203	8	203	3	76	26	38
8	203	10	254	3	76	32	47
10	254	10	254	4	102	39	58
10	254	12	305	4	102	47	70
12	305	12	305	5	127	56	83
14	356	14	356	6	152	75	112
14	356	18	457	Double 3	Double 76	104	155

Standard production lengths available up to 20 ft.  
Contact factory if longer lengths are required.



**"D" SERIES**  
"D" Shaped Bore

SIZE		A HEIGHT		B WIDTH		C BORE		APPROX.	
IN	MM	IN	MM	IN	MM	IN	MM	LBS/FT	KG/M
3	76	2½	67	3¾	81	2¾	60x41	2	3
4	102	4	102	4	102	2x2	51x51	5	8
4½	114	3½	98	4¾	113	2½	75x41	6	9
5	127	5	127	5	127	2	51x51	10	14
6	152	6	152	6	152	3	76x76	12	18
8	203	8	203	8	203	4	102x102	22	33
10	254	10	254	10	254	4	102x102	38	57
12	305	12	305	12	305	6	152x152	49	73
14	356	14	356	14	356	7	178x178	67	100

Standard production lengths available up to 20 ft.  
Contact factory if longer lengths are required.

## DIAMOND

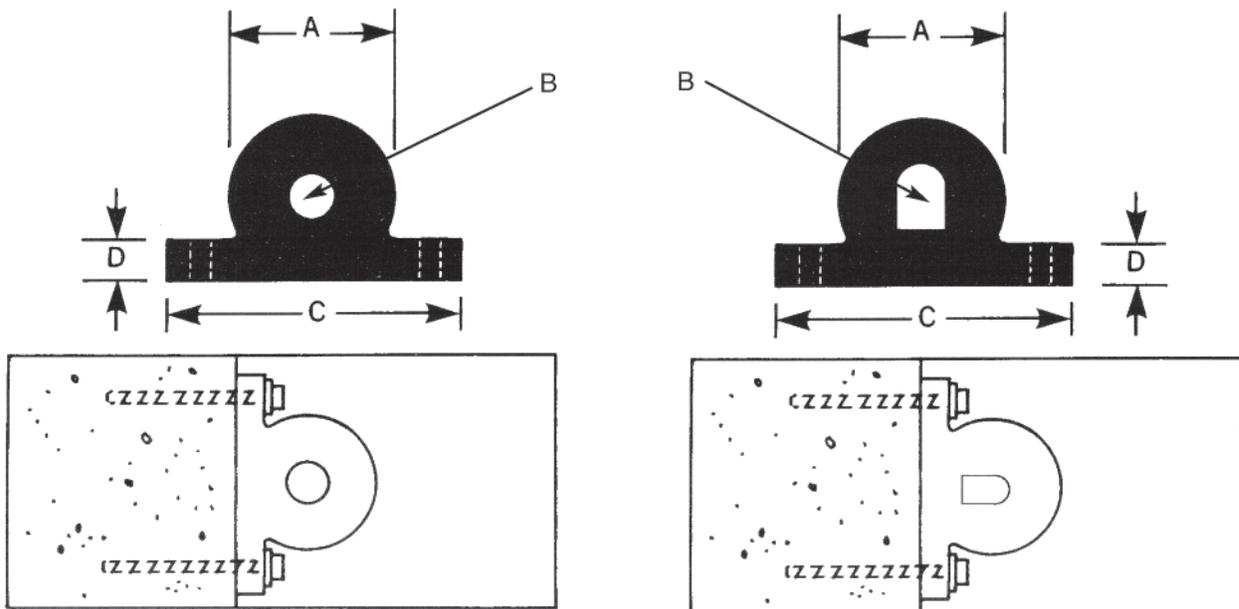
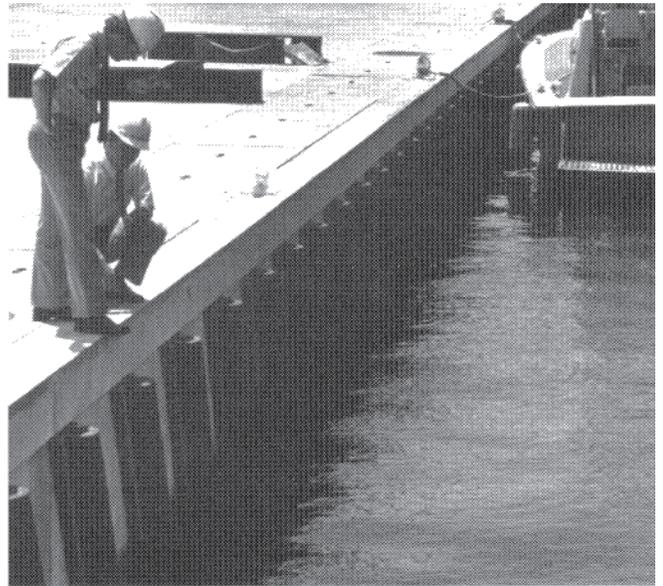
A diamond is a chunk of coal that made good under pressure.

## DIPLOMACY

A diplomat is a man who can convince his wife she looks vulgar in diamonds-and fat in a mink coat.

## WING TYPE FENDERS

Wing Type fenders are designed for vessel mounting. They combine the impressive energy absorption capabilities of a cylindrical design with the convenience of wing mounting. They are available from 3" to 12" O.D. to tailor the protection to the vessel's size and purpose: from pleasure craft through pilot boats, heavy tugs, barges and ferries.



### WING TYPE

A O.D.		B BORE		C FLANGE BASE WIDTH		D FLANGE THICKNESS		APPROX. LBS/FT KG/M	
IN	MM	IN	MM	IN	MM	IN	MM	LBS/FT	KG/M
3	76	1	25	6	152	<sup>3</sup> / <sub>4</sub>	19	5	7
4	102	2	51	6½	165	1	25	7	10
4	102	1	25	6½	165	1	25	8	12
6	152	2	51	9½	241	1½	38	18	25
6	152	3	76	9	229	1½	38	15	22
6	152	4	102x102	9½	241	1½	38	16.6	24.4
8	203	4	102	12	305	2	51	27	40
10	254	3	76	16	406	2½	64	49	73
10	254	4	102	16	406	2½	64	46	68
12	305	6	152	18	457	3	76	61	91

Standard production lengths available up to 20 ft.  
Contact factory if longer lengths are required.

# TRAPEZOIDAL DOCK FENDERS

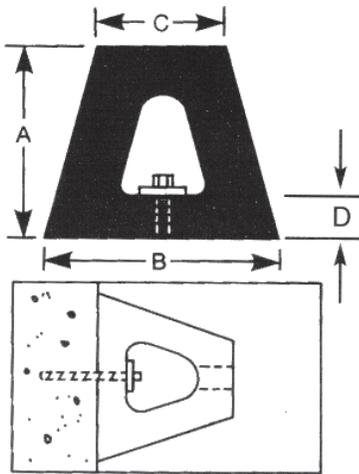


Trapezoidal dock fenders have high energy absorption and low reaction load transmission characteristics similar to V-Series fenders. However, the engineering of the Trapezoidal base results in a smoother loading curve and more uniform deceleration. This produces an efficiency which allows a smaller section of Trapezoidal fender to absorb a greater amount of impact than other cross sections.

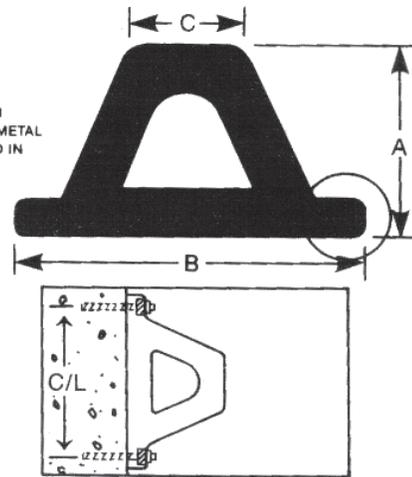
Two types of Trapezoidal fender are available to offer installation and design flexibility.

The "R-Series" is designed for mounting directly to open faced structures using a steel bar through the bore. They may also be used behind, or on the face of, conventional timbering.

A "W-Series" Trapezoidal fender is extruded with wings which can incorporate an optional external mounting groove. They are installed with metal mounting bars.



OPTION:  
AVAILABLE WITH  
GROOVES AND METAL  
BARS FASTENED IN  
PLACE.



**TRAPEZOIDAL — "R" SERIES**  
Inside Bar Mounted

Code	A Height		B Base		C Top		D Base		Approx.	
	IN	MM	IN	MM	IN	MM	IN	MM	LBS/FT	KG/M
10R	10	254	12-3/4	324	5-1/2	140	2-1/4	57	37	55
13R	13	330	16-5/8	422	7-3/8	187	2-3/4	70	61	91
15R	15	381	19-1/8	486	8-5/8	219	2-3/4	70	81	121
17R	17	432	21-5/8	549	9-7/8	251	2-7/8	73	104	155
20R	20	508	23-1/4	590	11-1/4	286	3-3/4	95	138	205

Standard production lengths available up to 20 ft.  
Contact factory if longer lengths are required.

**TRAPEZOIDAL — "W" SERIES**  
Metal Bar Mounted

Code	A Height		B Base		A Top		Approx.		C/L	
	IN	MM	IN	MM	IN	MM	LBS/FT	KG/M	IN	MM
10W	10	254	18-1/2	470	5-1/2	140	44	65	15	381
13W	13	330	21-1/2	546	7-3/8	187	68	101	18	462
15W	15	381	24-3/4	629	8-5/8	219	93	138	21	539

Standard production lengths available up to 20 ft.  
Contact factory if longer lengths are required.

## EDUCATION

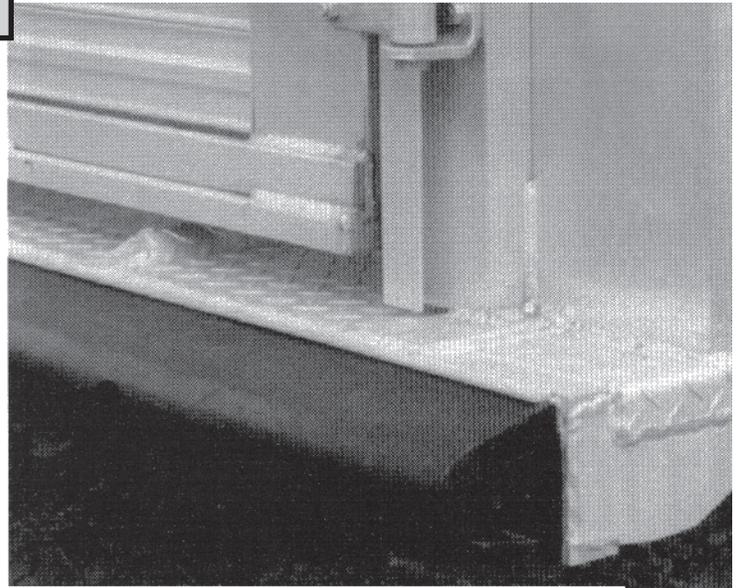
A self-taught man usually has a poor teacher and a worse student.

Educate a man and you educate an individual—educate a woman and you educate a family.

*Agnes Cripps*

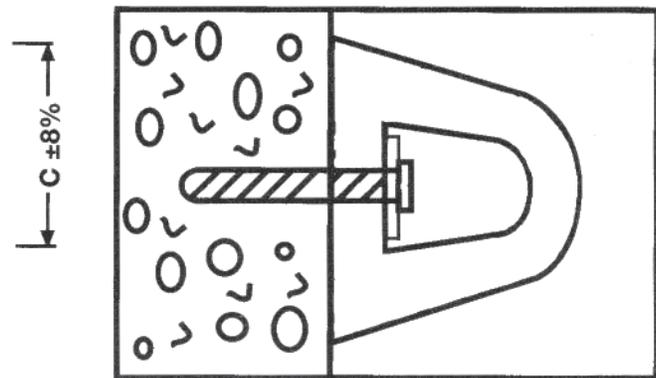
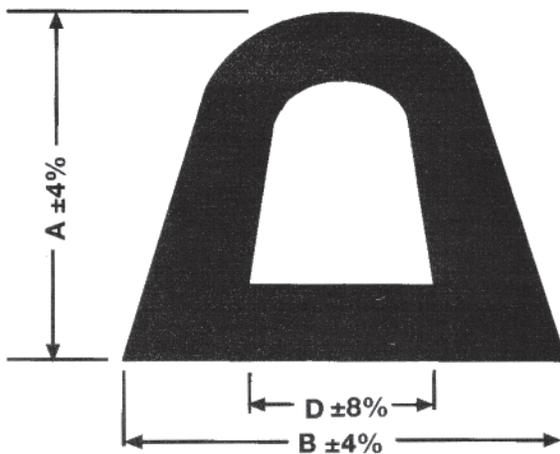
## M-SERIES FENDERS

M-Series fenders offer protection for small vessel dock structures as well as having many industrial uses. They can protect trucks, loading docks and industrial property. They can be easily moved to meet changing conditions.



### M-SERIES

CODE	A		B		C		D		E	
	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
M-2	2	51	2-1/4	57	1	25	1-1/4	32	3/8	9
M-4	3-3/4	96	4-1/2	115	2	51	2	51	1-1/2	38
M-6	6	152	6-3/4	172	2-7/8	73	3	76	2-3/8	60



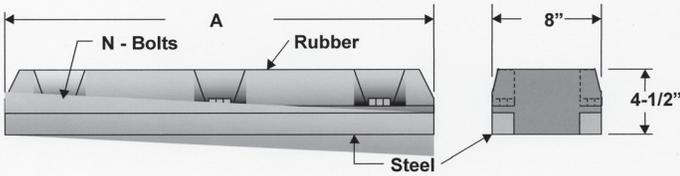
Surely the shortest commencement address in history—and for me one of the most memorable—was that of Dr. Harold E. Hyde, president of New Hampshire's Plymouth State College. He reduced his message to the graduating class to these three ideals: "Know yourself—Socrates. Control yourself—Cicero. Give yourself—Christ." *Walter T. Tatara*

If you think education is expensive—try ignorance. *Derek Bok*

Educate men without religion and you make them but clever devils. *Duke of Wellington*

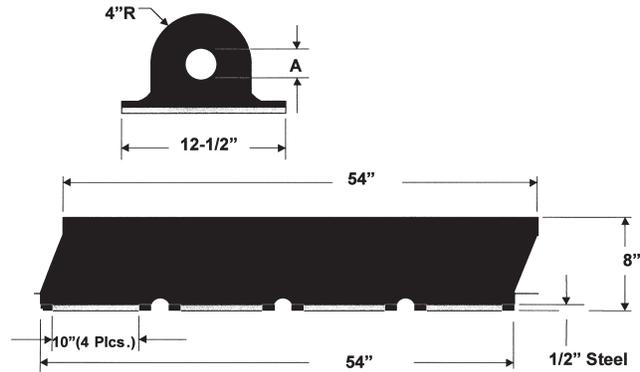
## HEAVY DUTY D-MODULAR BUMPERS

### PUSHNEE BOLT-ON BUMPERS



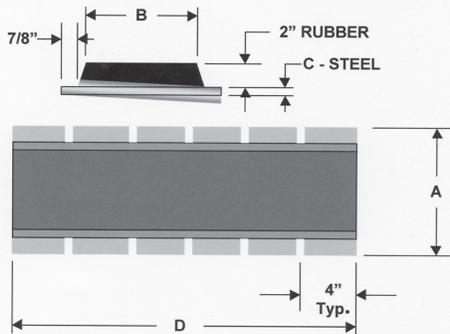
PART No.	A	N	Wt. Lbs.
E42007	36"	6	110
E42011	17-1/2"	4	55

Bolt-On Bumpers are supplied with weld-on mounting bars and mounting bolts. Just position the mounting bars. Weld the bars in place and attach the rubber bumper element.



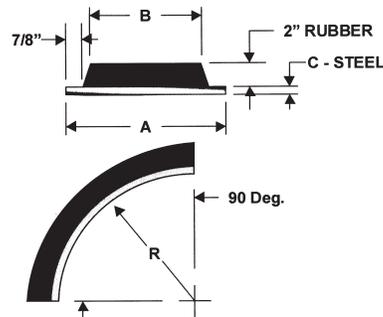
PART No.	A	Wt. Lbs.
E44300	4"	133
E44311	2"	168

### FLEXNEE MODULAR WELD-ON BUMPERS



PART No.	A	B	C	D	Wt. Lbs.
E42075	10	7	3/4	36	75
E43075	10	7	3/4	48	99
E42076	10	7	1/2	36	60
E43076	10	7	1/2	48	80
E42077	10	7	1/4	36	42
E43077	10	7	1/4	48	55

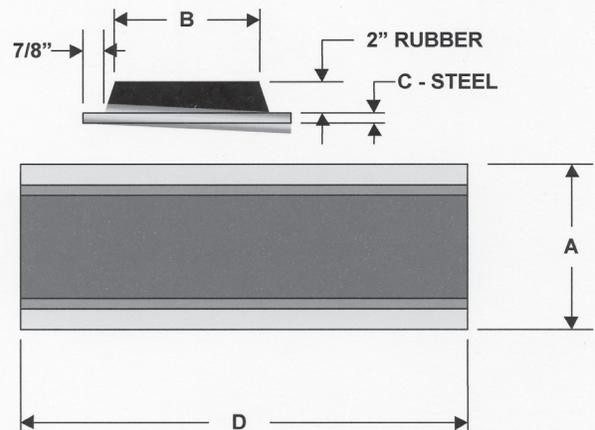
### Curved Style PUSHNEE WELD-ON BUMPERS



PART No.	A	B	C	R	Wt. Lbs.
E42012	10	7	3/4	18	100
E42049	10	7	1/2	18-1/4	70
E42050	10	7	1/4	18-1/2	43

### Flat Single Style

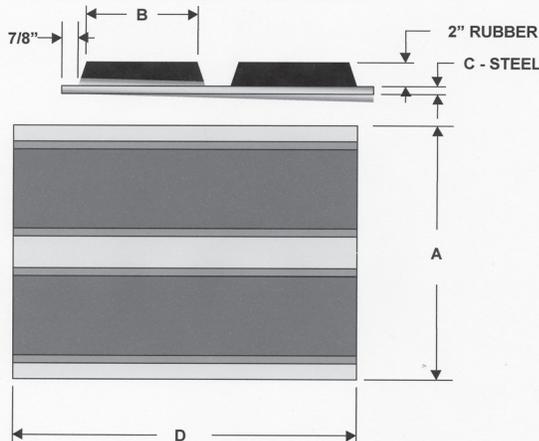
### PUSHNEE WELD-ON BUMPERS



PART No.	A	B	C	D	Wt. Lbs.
E42000	10	7	3/4	36	100
E43000	10	7	3/4	48	133
E42010	10	7	1/2	36	77
E43010	10	7	1/2	48	103
E42004	10	7	1/4	36	50
E43004	10	7	1/4	48	67
E42005	13-1/2	10-1/4	3/4	36	138
E42041	13-1/2	10-1/4	1/2	36	110
E42042	13-1/2	10-1/4	1/4	36	75

### Flat Double Style

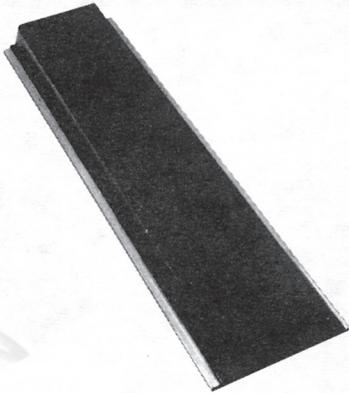
### PUSHNEE WELD-ON BUMPERS



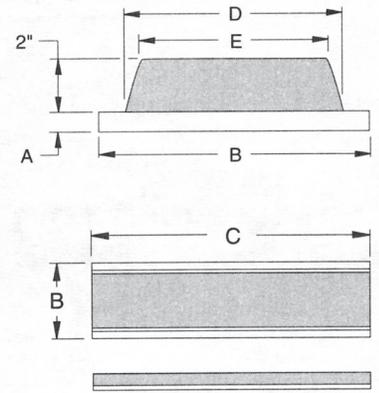
PART No.	A	B	C	D	Wt. Lbs.
E42002	20	7	3/4	36	200
E43002	20	7	3/4	48	267
E42034	20	7	1/2	36	150
E43034	20	7	1/2	48	200
E42035	20	7	1/4	36	100
E43035	20	7	1/4	48	133

# TOW-KNEE PUSHER PLATES

## SINGLE TOW - KNEES



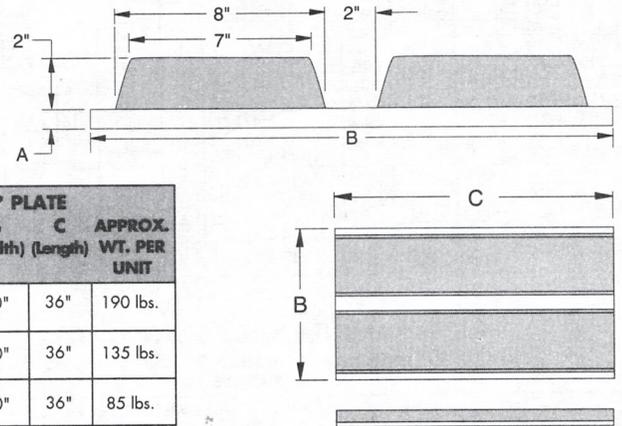
PART NUMBER	STEEL * PLATE			RUBBER		APPROX. WT. PER UNIT
	A (Thick-ness)	B (Width)	C (Length)	D (Base Width)	E (Surface Width)	
DB - 1408	3/4"	10"	36"	8"	7"	90 lbs.
DB - 1409	1/2"	10"	36"	8"	7"	65 lbs.
DB - 1410	1/4"	10"	36"	8"	7"	50 lbs.
DB - 1508	3/4"	13-1/2"	36"	11-1/4"	10-1/4"	130 lbs.
DB - 1509	1/2"	13-1/2"	36"	11-1/4"	10-1/4"	90 lbs.
DB - 1510	1/4"	13-1/2"	36"	11-1/4"	10-1/4"	70 lbs.



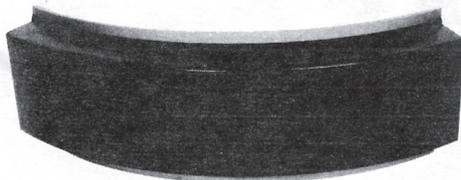
## DOUBLE TOW - KNEES



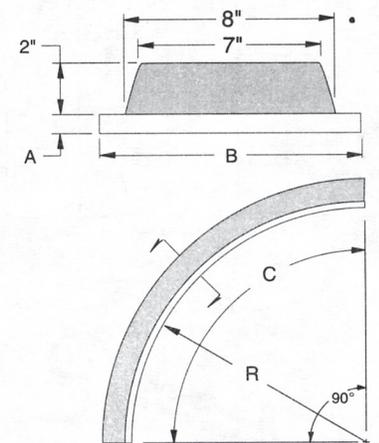
PART NUMBER	STEEL * PLATE			APPROX. WT. PER UNIT
	A (Thick-ness)	B (Width)	C (Length)	
DB - 1608	3/4"	20"	36"	190 lbs.
DB - 1609	1/2"	20"	36"	135 lbs.
DB - 1610	1/4"	20"	36"	85 lbs.



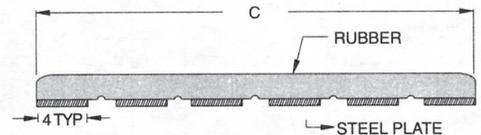
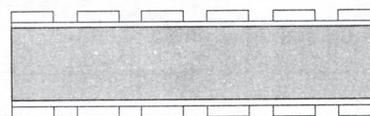
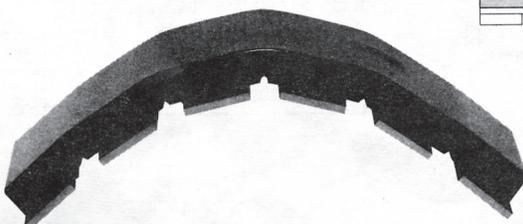
## PRECURVED TOW - KNEES



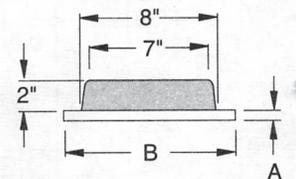
PART NUMBER	R Radius	STEEL * PLATE			APPROX. WT. PER UNIT
		A (Thick-ness)	B (Width)	C (Length)	
DB - 1708	18"	3/4"	10"	28-1/4"	80 lbs.
DB - 1709	18-1/4"	1/2"	10"	28-5/8"	60 lbs.
DB - 1710	18-1/2"	1/4"	10"	29-1/16"	40 lbs.



## SEGMENTED TOW - KNEES



PART NUMBER	R Radius	STEEL * PLATE			APPROX. WT. PER UNIT
		A (Thick-ness)	B (Width)	C (Length)	
DB - 1909	VARIABLE	1/2"	10"	35 - 1/2"	53 lbs.

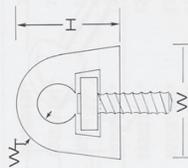


\*Aluminum plates available on special request

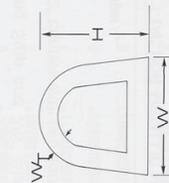


**DURAMAX® MARINE, LLC**

**100 SERIES — "D" SHAPE**

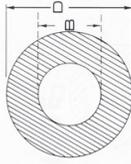


CODE NO./COLOR	J.R. PART NO.	BASE WIDTH W	HEIGHT H	WALL THKNS. WT	WT./FT.	PRICE/FT.	LENGTH UP TO
DB-50 BLACK	802005001	2 1/8"	2"	7/16"	1.3 LBS.		60 FT.
DB-50 B GREY	802005002	"	"	"	1.6		"
DB-50C WHITE	802005003	"	"	"	1.6		"
DB-75 BLACK	802007501	3 1/8"	2 7/8"	11/16"	2.8		60 FT.
DB-75B GREY	802007502	"	"	"	3.4		"
DB-75C WHITE	802007503	"	"	"	3.4		"
DB-100 BLACK	802009001	4 1/4"	3 7/8"	3/4"	4.6		60 FT.
DB-100B GREY	802009002	"	"	"	5.3		"
DB-100C WHITE	802009003	"	"	"	5.3		"

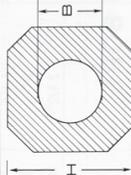


DB-101 BLACK	802010101	4 1/4"	3 7/8"	3/4"	4.6 LBS.		60 FT.
DB-115 BLACK	802011501	4 1/2"	3 3/4"	3/4"	4.7		60'
DB-125 BLACK	802012501*	6 3/4"	6"	1 1/2"	13.6		20'
DB-150 BLACK	802015001*	9 1/2"	8"	1 1/2"	19.5		20'

**200 SERIES — CYLINDRICAL BORE**



CODE NO.	J.R. PART NO.	OUTSIDE DIAMETER D	BORE B	WT./FT.	PRICE/FT.	LENGTH UP TO
DB-202	802020201	3"	1"	3.2 LBS.		60 FT.
DB-203	802020301	3"	1 1/2"	2.7		60'
DB-205	802020501	5"	2 1/2"	8		30'
DB-206	802020601*	7"	3"	16		20'
DB-207	802020701*	7"	3 1/2"	15.5		20'
DB-208	802020801*	8"	4"	18.2		20'
DB-210	802021001*	10"	5"	32		20'
DB-212	802021201*	12"	6"	46		20'
DB-215	802021501*	15"	7 1/2"	67		20'
DB-218	802021801*	18"	9"	96.7		10'



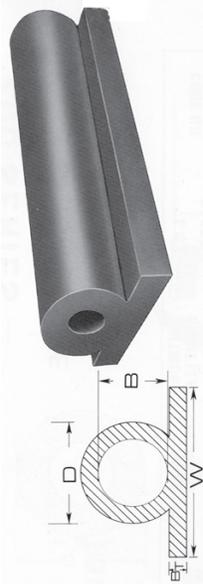
**300 SERIES — RECTANGULAR BORE**

CODE NO.	J.R. PART NO.	HEIGHT H	WIDTH W	BORE B	WT./FT.	PRICE/FT.	LENGTH UP TO
DB-302	802030201	2"	4"	SOLID	3.9 LBS.		60 FT.
DB-303	802030301	3 1/2"	4 1/2"	1"	8		60'
DB-304	802030401	5"	5"	2 1/2"	9.8		60'
DB-305	802030501	5"	6 1/2"	2 1/2"	13		40'
DB-305A	802030511	5 1/2"	6"	2 1/2"	13.9		40'
DB-306	802030601*	6"	6 1/2"	2 1/2"	17.4		20'
DB-306A	802030611*	6"	6"	2 7/8"	14.6		20'
DB-306B	802030621*	6"	7"	2 1/2"	18		20'
DB-307	802030701*	7"	10"	3"	34.1		20'
DB-307A	802030711*	7"	10"	3 1/2"	30		20'
DB-308	802030801*	8"	8"	3"	28.2		20'
DB-309	802030901*	8"	10"	3"	39.5		20'
DB-309A	802030911*	9"	10"	SOLID	50.7		20'
DB-310	802031001*	10"	10"	4"	42.4		20'
DB-311	802031101*	10"	12"	4"	60		20'
DB-312	802031201*	12"	12"	5"	65		20'
DB-313	802031301*	12"	12"	4"	68.5		20'
DB-314	802031401*	14"	14"	6"	83		20'



# 400 SERIES

## WING TYPE "O" BORE



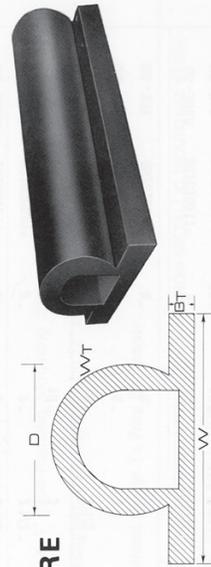
CODE NO.	J. R. PART NO.	BASE WIDTH W	BASE THICKNESS BT	OUTSIDE DIAMETER D	BORE B	WT./FT.	PRICE PER FT.	LENGTH UP TO
DB-404	802040401	4"	1/2"	2 1/2"	1"	3.5 LBS.		60 FT.
DB-405	802040501	5"	1/2"	2 1/2"	1"	4		60'
DB-406	802040601	6"	3/4"	3"	1"	5.3		60'
DB-407	802040701	6 1/2"	1"	4"	2"	7		60'
DB-408	802040801	6 1/2"	1"	4"	1"	8.9		60'
DB-409	802040901	9"	1 1/2"	6"	3"	14.4		20'
DB-410	802041001	9 1/2"	1 1/2"	6"	2"	16.2		20'
DB-412	802041201	12"	2"	8"	4"	27		20'
DB-416	802041601*	16"	2 1/2"	10"	4"	46		20'

## WING TYPE SOLID BORE



CODE NO.	J. R. PART NO.	BASE WIDTH W	BASE THICKNESS BT	RADIUS R	WT./FT.	PRICE PER FT.	LENGTH UP TO
DB-460	802046001*	10"	1 1/4"	4"	13.6 LBS.		20 FT.

## WING TYPE "D" BORE



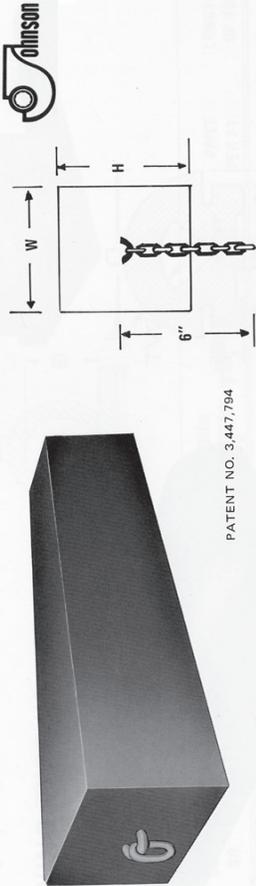
CODE NO.	J. R. PART NO.	BASE WIDTH W	BASE THICKNESS BT	OUTSIDE DIAMETER D	WALL THICKNESS WT	WT./FT.	PRICE PER FT.	LENGTH UP TO
DB-440	802044001*	9 1/2"	1 1/2"	6"	1"	14.9 LBS.		20 FT.

# 500 SERIES -- FAN NOSE



CODE NO.	COLOR	J. R. PART NO.	BASE WIDTH W	BASE THKNS. BT	OUTSIDE DIAMETER D	P	WALL THKNS. WT	WT./FT.	PRICE	LGTH. UP TO
DB-503	BLACK	802050301								
DB-503*	WHITE	802050303	2 1/2"	17/32"	3"	1/4"	5/8"	2.5 LBS.		60 FT.
DB-503*	GREY	802050302								
DB-504	BLACK	802050401								
DB-504*	WHITE	802050403	3 3/4"	25/32"	4 1/4"	1/4"	3/4"	3.2		60'
DB-504*	GREY	802050402								
DB-506	BLACK	802050601								
DB-506*	WHITE	802050603	5 7/16"	1"	6"	5/16"	1"	9.0		40'
DB-506*	GREY	802050602								
DB-508	BLACK	802050801*								
DB-508*	WHITE	802050803*	7 1/4"	1 3/16"	8"	3/8"	1 1/2"	15.5		20'
DB-508*	GREY	802050802*								
DB-510	BLACK	802051001*								
DB-510*	WHITE	802051003*	9 1/4"	1 11/16"	10"	3/8"	1 1/2"	24.8		20'
DB-510*	GREY	802051002*								
DB-512	BLACK	802051201*								
DB-512*	WHITE	802051203*	11"	2"	12"	9/16"	2"	28.6		20'
DB-512*	GREY	802051202*								

## 600 SERIES — RECTANGULAR CHAIN



PATENT NO. 3,447,794

CODE NO.	J. R. PART NO.	BASE WIDTH W	HEIGHT H	CHAIN SIZE	WT. PER FOOT	PROOF COIL CHAIN LOAD LIMIT	PRICE PER FOOT	ALLOY CHAIN LOAD LIMIT	PRICE PER FOOT
DB-604*	802060401*	5"	5"	5/16"	14 LBS.	1750 LBS.	CONTACT	4250 LBS.	CONTACT
DB-605	802060501*	6 1/2"	5"	5/16"	18	1750	FACTORY	4250	FACTORY
DB-606	802060601*	6 1/2"	6"	3/8"	22	2450		6600	
DB-608*	802060801*	8"	8"	1/2"	36	4250		11250	
DB-609	802060901*	10"	8"	5/8"	46	6375	FOR	16500	FOR
DB-610	802061001*	10"	10"	5/8"	65	6375		16500	
DB-612	802061201*	12"	12"	5/8"	85	6375	PRICES	16500	PRICES
DB-614	802061401*	14"	14"	5/8"	110	6375		16500	

## 700 SERIES — CYLINDRICAL CHAIN



PATENT NO. 3,447,794

CODE NO.	J. R. PART NO.	OUTSIDE DIAMETER "D"	CHAIN SIZE	APPROX. WT. PER FOOT	PROOF COIL CHAIN LOAD LIMIT	PRICE PER FOOT	ALLOY CHAIN LOAD LIMIT	PRICE PER FOOT
DB-705*	802070501*	5"	5/16"	12 LBS.	1750 LBS.	CONTACT	4250 LBS.	CONTACT
DB-706	802070601*	6"	3/8"	16	2450	FACTORY	6600	FACTORY
DB-707	802070701*	7"	1/2"	23	4250		11250	
DB-708	802070801*	8"	5/8"	30	6375	FOR	16500	FOR
DB-709*	802070901*	9"	5/8"	37	6375		16500	
DB-710*	802071001*	10"	3/4"	47	9125		23000	
DB-711*	802071101*	11"	3/4"	55	9125	PRICES	23000	PRICES
DB-712	802071201*	12"	1"	68	12400		38750	

## 800 SERIES — CORNER GUARD



CODE NO.	J. R. PART NO.	BASE WIDTH W	BASE THKNS. BT	WING LENGTH X	OUTSIDE DIAMETER Y	WT. / FT.	PRICE PER FT.	LGTHS. UP TO
DB-809	802080901*	5 9/16"	1 1/2"	2"	3"	21 LBS.		10 FT.

## 900 SERIES — RECTANGULAR "D"



CODE NO.	J. R. PART NO.	BASE WIDTH W	HEIGHT H	BORE B	RADIUS R	WT. / FT.	PRICE PER FT.	LGTHS. UP TO
DB-906	802090601	5"	6"	2 1/2"	2 1/2"	10.9 LBS.		40 FT.
DB-908	802090801*	8"	8"	3"	4"	25		20'
DB-909	802090901*	8"	10"	3"	4"	34		20'
DB-910	802091001*	10"	10"	3"	5"	42		20'
DB-910A	802091011*	10"	10"	4"	5"	39		20'
DB-912	802091201*	12"	12"	4"	6"	66		20'
DB-912A	802091211*	12"	12"	5"	6"	65		20'
DB-914	802091401*	14"	14"	6"	7"	75		20'

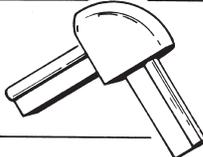


# 90° MOLDED INSERT CORNER

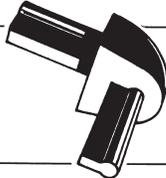
## FOR DB-50 BUMPER

DB - 51	BLACK	J. R. PART NO.	802005101		
DB - 52	GREY	" " "	802005202		
DB - 53	WHITE	" " "	802005303		

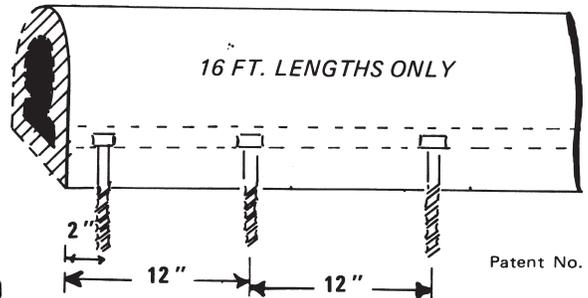
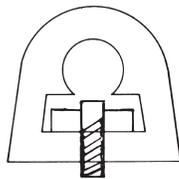
## FOR DB-75 BUMPER

DB - 76	BLACK	J. R. PART NO.	802007601		
DB - 77	GREY	" " "	802007702		
DB - 78	WHITE	" " "	802007803		

## FOR DB-100 BUMPER

DB - 103	BLACK	J. R. PART NO.	802009301		
DB - 104	GREY	" " "	802009402		
DB - 105	WHITE	" " "	802009503		

## SPECIAL ASSEMBLY SERVICE AVAILABLE



Patent No. 3,225,731

### DB-60 STRIP BUMPER (SPECIFY COLOR)

DB 50 furnished complete with 3/8" X 1" Non-metallic Mounting Strip and 3/8" Stainless Steel Studs protruding 2-1/2" beyond Base (Nuts Excluded). Studs spaced on 12" centers with two additional Studs added 2" from each end.

J.R. Part No. 802006000

Add Additional Charge To Price Of Bumper . . . . .

### DB-80 STRIP BUMPER

J.R. Part No. 802008000

DB 75 FURNISHED WITH 3/8" x 1-1/4" NON-METALLIC MOUNTING STRIP, 3/8" STAINLESS STUDS.

### DB-110 STRIP BUMPER

J.R. Part No. 802009500

DB 100 FURNISHED WITH 3/8" x 1-3/4" NON-METALLIC MOUNTING STRIP, 1/2" STAINLESS STUDS





**A NEW GENERATION IN GIANT MARINE FENDERS!  
IT'S HARD NOT TO BE IMPRESSED WITH JIM BUOY'S NEW  
LINE OF SUPER GIANT MARINE FENDERS!**

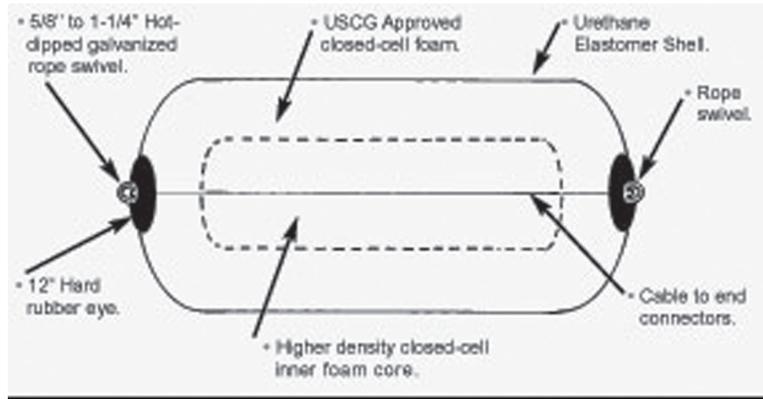
Not an inflatable but a 98% closed-cell inner foam core that will never Blow-out or sink - even bullet holes will not materially affect its function! Often referred to in the industry as the "hull saver", Jim Buoy's unique design is not simply a roll of foam but is a carefully crafted, quality product incorporating the same U.S. Coast Guard Approved foam used in the Jim-Buoy Industrial Life Preservers. The end product is a rugged fender that provides "stop-gap" compression when hard hit time after time; not only protecting the ship from damage but the dock and *even the fender itself!*



**Giant Marine Fenders**

**HIGHLY RESISTANT TO ABRASIONS AND PUNCTURES.**

Encased in an outer covering of "Elastomic Skin" (up to 5/16" thick material, some reinforced with nylon mesh) plus a urethane skin base, the Jim Buoy Giant Marine Fenders are extremely resilient and able to flex with the rigors of high energy berthing over and over again, providing the user with extended service under all conditions. All Models may be mounted vertically or float horizontally. Models up to 24" diameter feature a 1" thru-hole that provides easy access for tethering while the larger models are furnished with a specially designed "end cap" that incorporates a 5/8" or 1-1/4" shaft and galvanized steel rope swivel for maximum strength at this critical area of stress (see illustration below).



The diagram at left clearly shows the many advanced design features found in Jim Buoy's new Giant Marine Fenders - *proven features gained from Jim Buoy's many years of experience in the manufacture of high quality marine products!*

**End Cap/ Swivel Assembly**  
 Galvanized steel swivel assembly allows free movement in all directions and provides quick and secure rope attachment features on models #236, #248 and #260

**Installation Tips** - Fenders vertically when coming along side another ship or dock allowing the line from the lower end of the Fender to be free. After the ship's lines are secure, pull the Fender to a horizontal position. Use additional Fenders during rough weather.

**Repair Service** - If your fender is damaged by misuse or eventual "wear and tear", repair kits are available from Jim Buoy. Arrangements may also be made for Jim Buoy to recondition them to near-new condition and return to owner as needed - please inquire for complete details.

SPECIFICATIONS							
Model #	Dia.	Lth.	Thru-hole size material	Rec. vessel size	Stand-Off distance	colors	Ship Wt.
214	14"	44"	1" PVC	-	8"	Wht., Org, Blk	21 lbs
218	18"	50"	1" PVC	-	12"	Wht., Org, Blk	31 lbs.
224	24"	53"	1" PVC 5/8" gal.	- 500-700	14"	Wht., Org, Blk	50 lbs
236	36"	60"	shaft w/swivel 1-1/4" gal.	tons	24"	White/Black	150 lbs
248	48"	96"	shaft w/swivel 1-1/4" gal.	2500 tons	30"	White/Black	230 lbs
260	60"	96"	shaft w/swivel	5000 tons	36"	White/Black	320 lbs

# Marine Guard™ Foam-Filled Marine Fenders

*These foam-filled marine fenders are on the leading edge of fendering technology and innovation. They utilize state-of-the-art materials and processes, which are unsurpassed in the industry.*

*Today's vessels demand the absolute best protection for berthing operations. This Product is entrusted more and more each day to guard marine investments worldwide with our 'made-to-fit' foam-filled fendering systems.*

## CONSTRUCTION FEATURES

### Marine Guard™ Fenders' Skin

*The Marine Guard™ fender's protective coating is composed of a nylon filament reinforced polyurethane skin. This thick, durable and resilient coating is exclusively engineered and manufactured.*

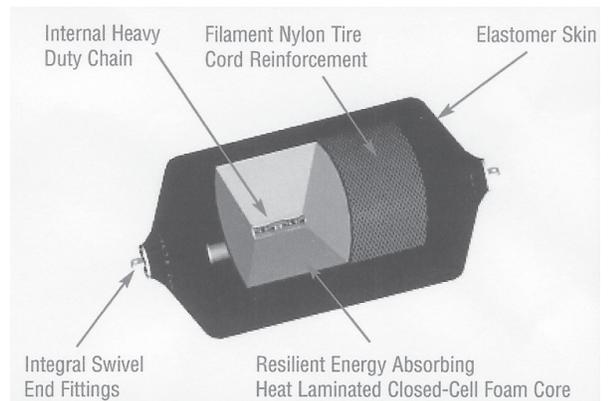
*Our proprietary formulation, the most advanced in the industry, offers the best resistance to salt water, UV and Ozone degradation, while offering the utmost in strength and resiliency.*

*The tensile and tear strengths, as well as hydrolytic stability, of our polyurethane elastomer surpasses that of similar urethane products and is far superior to that of the rubber composition found in pneumatic and buckling fenders.*

### Foam Core

*The foam core is constructed entirely of 100% closed-cell foam. The foam core is the energy absorbing part of the fender and yields much less reaction force than pneumatic and buckling type fenders.*

*Unlike pneumatic fenders, Marine Guard™ and Marine Cushion™ foam-filled fenders cannot experience catastrophic failure if the skin is punctured.*



**Anger**  
**Never go to bed mad. Stay up and fight.**  
**Phyllis Diller**

**The greatest remedy for anger is delay**  
**Seneca**

**Anger is a stone cast into a wasp's nest.**  
**Malabar proverb**

**Animals**  
**To his dog, every man is Napoleon;**  
**hence the constant popularity of dogs.**  
**Aldous Huxley**

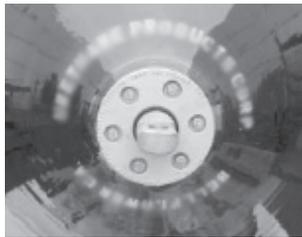
## Swivel End Fittings

Marine Guard's™ integral swivel end fittings are constructed of the highest quality stainless steel or hot-dipped galvanized steel. The swivel end fittings are designed to provide a point of attachment while not impeding in the functionality of the fender. Lateral and longitudinal compressions are not affected by the swivel end fittings or their internal housings and the swivels will continue to function even while the fender is fully compressed.

## Internal Chain

The end fittings of Marine Guard™ foam-filled fenders are internally connected with a heavyduty, stud-link chain.

This feature provides superior pull through strength, increased tensile strength and a distribution of energies and stresses. Since a pneumatic fender does not have this feature, it does not offer the same pull through strength as a Marine Guard™ fender.



## APPLICATIONS



### Versatile & Easy Installation

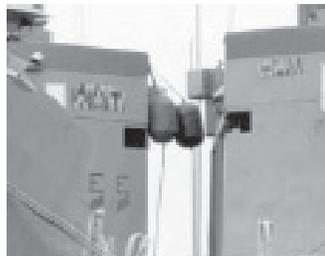
The Marine Guard™ foam-filled fender design allows easy installation in a variety of ways, either fixed (horizontally or vertically) or floating.

In general, there are three ways of attaching a Marine Guard™ foam-filled fender.

- 1) A fixed fender: Using double chain attachments, the fender is held permanently in a fixed position. The fender may be mounted horizontally or vertically in this manner.
- 2) As a fixed/floating fender: Attached with fixed mounting chains, allowing the fender to rise and lower with small tidal fluctuations.
- 3) A floating fender: Using a sliding sleeve or ring around steel piles, allowing the fender to float freely where extreme tidal fluctuations occur.



**A floating fender with sliding sleeve and chain attachments.**



**A fixed fender with double chain**



**attachments  
A floating fender with fixed chain attachments**

# PERFORMANCE FEATURES

## High Energy Absorbing

*Marine Guard™ foam-filled fenders have both a high-energy absorption and low reaction force. They absorb up to 40% more energy than equally sized pneumatic fenders.*

*Marine Guard™ foam-filled fenders are fully functional even if the skin is punctured*

## Low Reaction Force

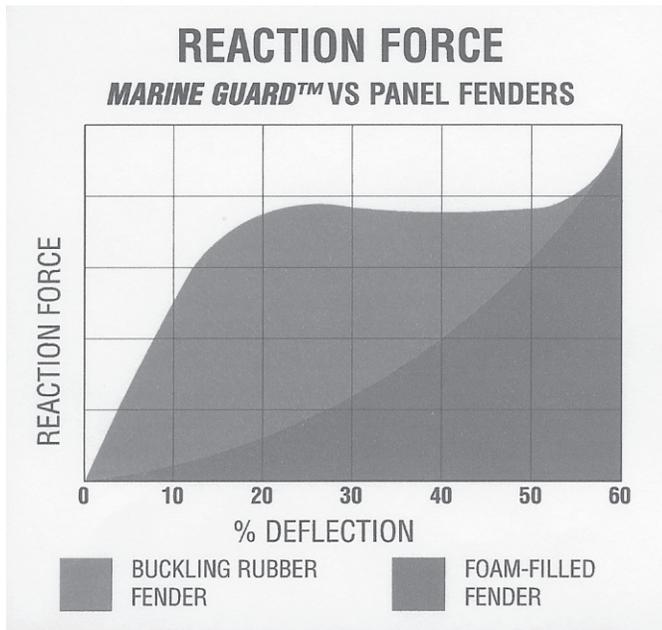
*Marine Guard™ foam-filled fenders are designed and constructed to absorb energy at a higher rate and experience a substantially lower reaction force than pneumatic or buckling fenders.*

*As depicted in the graph below, buckling rubber fenders (graphed in red) reach nearly 80% of its reaction force within the first 25% of compression. Marine Guard™ foam-filled fenders have a gradual, sloping reaction force curve (graphed in blue) and experience less than 20% reaction force at the same 25% compression.*

*Typically, fenders do not experience the total rated energy absorption during normal docking procedures meaning less fender compression. This equates to 80% the reaction force of the vessel's hull pressure will be experienced almost every time it docks wherever buckling style fenders are used.*

*Buckling style fenders will have a greater negative impact on docks, piers, wharves and vessels. A cost analysis would show reduced maintenance expenditures over time. Marine Guard™ foam-filled*

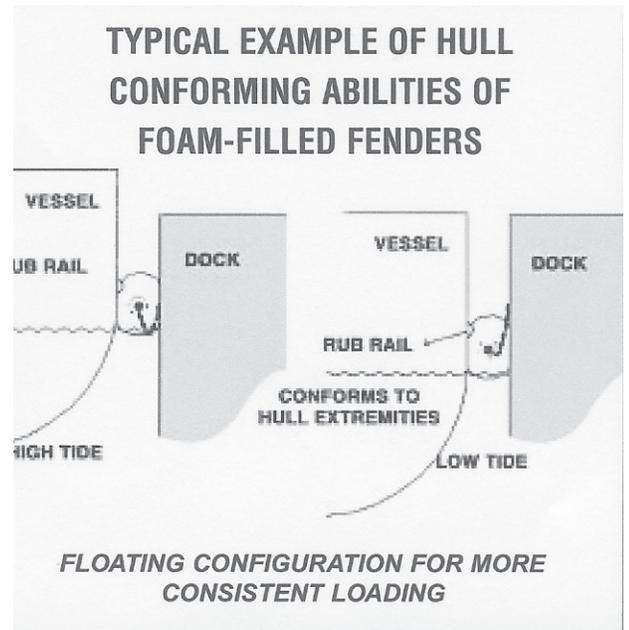
## Low Maintenance



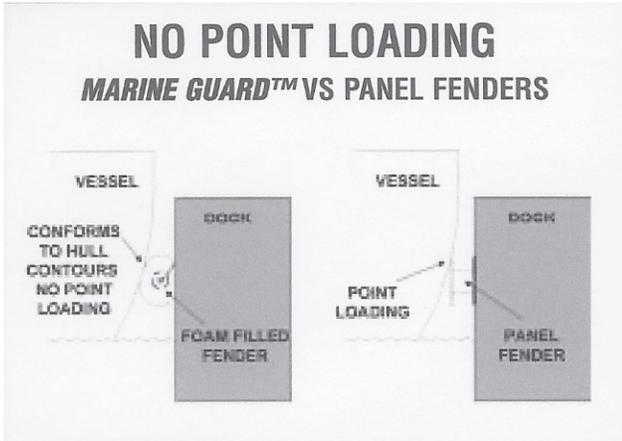
*Unlike pneumatic fenders, there are no air pressure relief or inflation valves to maintain. Just install the fenders and expect many years of hassle free, dependable service.*

## Unsinkable

*Marine Guard™ foam-filled fenders are constructed of closedcell foam, making them virtually unsinkable. This design will not explode or sink and it retains its energy absorbing and standoff capabilities even if the skin has been damaged fenders are the best protection for your investment!*

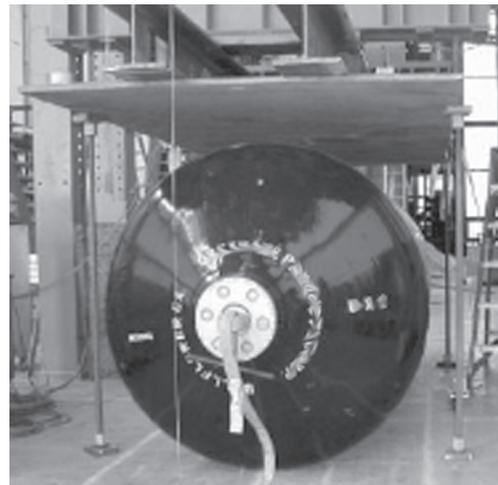
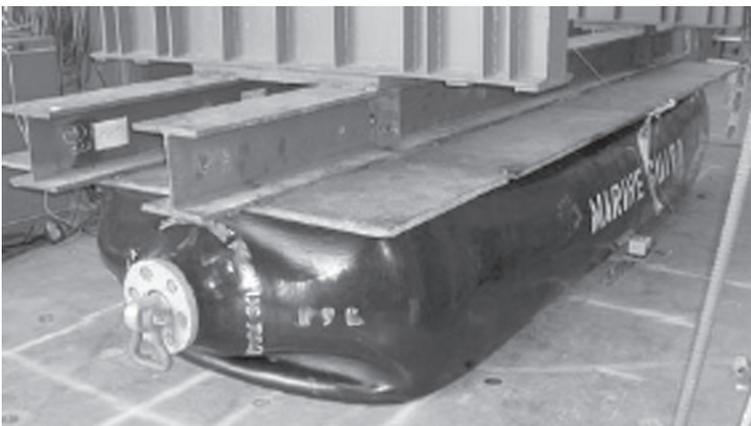


# Laboratory Tested



## Laboratory Tested

*Marine Guard™ fenders are tested for quality and performance by independent testing laboratories. Our stringent quality control programs ensure our customers receive a fender of the highest quality, reliability and performance. These programs meet all requirements of the U.S. Military Quality Assurance Specification MIL-I-45208.*



**FENDER TEST AT 60% COMPRESSION**  
Performed at University of California San Diego  
CLP Structural Research Laboratories

# MARINE GUARD FOAM FILLED FENDERS PERFORMANCE DATA

FENDERS		STANDARD CAPACITY				HIGH CAPACITY				EXTRA HIGH CAPACITY				SUPER HIGH CAPACITY			
SIZE		ENERGY ABSORPTION		REACTION FORCE		ENERGY ABSORPTION		REACTION FORCE		ENERGY ABSORPTION		REACTION FORCE		ENERGY ABSORPTION		REACTION FORCE	
ENGLISH	METRIC	ft - kips		ton-m		ft - kips		ton-m		ft - kips		ton-m		ft - kips		ton-m	
ft x ft	m x m	ft - kips	ton-m	kips	ton	ft - kips	ton-m	kips	ton	ft - kips	ton-m	kips	ton	ft - kips	ton-m	kips	ton
2 x 4	0.6 x 1.2	11	2	20	9	14	2	26	12	21	3	38	17	29	4	52	24
2 x 6	0.6 x 1.8	18	3	33	15	23	3	43	20	34	5	63	29	47	7	86	39
2 x 8	0.6 x 2.4	25	4	47	21	33	5	61	28	48	7	89	40	65	9	122	55
2 x 10	0.6 x 3.0	32	4	60	27	42	6	78	35	61	8	114	52	83	11	156	71
3 x 5	0.9 x 1.5	31	4	45	20	40	6	59	27	59	8	86	39	81	11	117	53
3 x 6	0.9 x 1.8	39	5	48	22	51	7	62	28	74	10	91	41	101	14	125	57
3 x 8	0.9 x 2.4	55	8	68	31	72	10	88	40	105	15	129	59	143	20	177	80
3 x 10	0.9 x 3.0	71	10	88	40	92	13	114	52	135	19	167	76	185	26	229	104
3 x 12	0.9 x 3.7	87	12	108	49	113	16	140	64	165	23	205	93	226	31	281	127
3 x 14	0.9 x 4.3	103	14	128	58	134	19	166	75	196	27	243	110	268	37	333	151
4 x 6	1.2 x 1.8	60	8	56	26	78	11	73	33	114	16	106	48	156	22	146	66
4 x 8	1.2 x 2.4	89	12	83	38	116	16	108	49	169	23	158	72	231	32	216	98
4 x 10	1.2 x 3.0	118	16	111	50	153	21	144	65	224	31	211	96	307	42	289	131
4 x 12	1.2 x 3.7	146	20	136	62	190	26	177	80	277	38	258	117	380	53	354	161
4 x 16	1.2 x 4.9	203	28	189	86	264	37	246	112	386	53	359	163	528	73	491	223
4 x 20	1.2 x 6.1	260	36	242	110	338	47	315	143	494	68	460	209	676	93	629	285
5 x 8	1.5 x 2.4	135	18	100	45	176	24	130	59	257	36	190	86	351	49	260	118
5 x 10	1.5 x 3.0	180	25	134	61	234	32	174	79	342	47	255	116	468	65	348	158
5 x 12	1.5 x 3.7	225	31	167	75	293	41	217	98	428	59	317	144	585	81	434	197
5 x 14	1.5 x 4.3	269	37	200	91	350	48	260	118	511	71	380	172	699	97	520	236
5 x 16	1.5 x 4.9	313	43	233	106	407	56	303	137	595	82	443	201	814	113	606	275
5 x 18	1.5 x 5.5	357	49	266	121	464	64	346	157	678	94	505	229	928	128	692	314
6 x 12	1.8 x 3.7	300	41	186	84	390	54	242	110	570	79	353	160	780	108	484	220
6 x 14	1.8 x 4.3	364	50	225	102	473	65	293	133	692	96	428	194	946	131	585	265
6 x 16	1.8 x 4.9	427	59	265	120	555	77	345	156	811	112	504	229	1,110	154	689	313
6 x 18	1.8 x 5.5	491	68	305	138	638	88	397	180	933	129	580	263	1,277	177	793	360
6 x 20	1.8 x 6.1	554	77	344	156	720	100	447	203	1,053	146	654	297	1,440	199	894	406
7 x 14	2.1 x 4.3	487	67	259	117	633	88	337	153	925	128	492	223	1,266	175	673	305
7 x 16	2.1 x 4.9	574	79	305	138	746	103	397	180	1,091	151	580	263	1,492	206	793	360
7 x 18	2.1 x 5.5	660	91	351	159	858	119	456	207	1,254	173	667	303	1,716	237	913	414
7 x 20	2.1 x 6.1	747	103	397	180	971	134	516	234	1,419	196	754	342	1,942	269	1,032	468
7 x 22	2.1 x 6.7	833	115	443	201	1,083	150	576	261	1,583	219	842	382	2,166	300	1,152	523
8 x 14	2.4 x 4.3	619	85	288	130	805	111	374	170	1,176	163	547	248	1,609	223	749	340
8 x 16	2.4 x 4.9	733	101	341	155	953	132	443	201	1,393	193	648	294	1,906	264	887	402
8 x 18	2.4 x 5.5	847	117	394	179	1,101	152	512	232	1,609	223	749	340	2,202	305	1,024	464
8 x 20	2.4 x 6.1	961	133	447	203	1,249	173	581	264	1,826	253	849	385	2,499	346	1,162	527
8 x 22	2.4 x 6.7	1,075	149	500	227	1,398	193	650	295	2,043	283	950	431	2,795	387	1,300	590
9 x 16	2.7 x 4.9	890	123	368	167	1,157	160	478	217	1,691	234	699	317	2,314	320	957	434
9 x 18	2.7 x 5.5	1,032	143	427	194	1,342	186	555	252	1,961	271	811	368	2,683	371	1,110	503
9 x 20	2.7 x 6.1	1,175	163	486	220	1,528	211	632	287	2,233	309	923	419	3,055	423	1,264	573
9 x 22	2.7 x 6.7	1,318	182	545	247	1,713	237	709	322	2,504	346	1,036	470	3,427	474	1,417	643
10 x 16	3.0 x 4.9	1,081	150	402	182	1,405	194	523	237	2,054	284	764	347	2,811	389	1,045	474
10 x 18	3.0 x 5.5	1,258	174	468	212	1,635	226	608	276	2,390	331	889	403	3,271	452	1,217	552
10 x 20	3.0 x 6.1	1,435	198	534	242	1,866	258	694	315	2,727	377	1,015	460	3,731	516	1,388	630
10 x 22	3.0 x 6.7	1,612	223	600	272	2,096	290	780	354	3,063	424	1,140	517	4,191	580	1,560	708
10 x 24	3.0 x 7.3	1,811	250	674	306	2,286	316	850	386	3,341	462	1,244	564	4,572	632	1,702	772
11 x 18	3.4 x 5.5	1,482	219	501	265	1,927	267	651	295	2,816	389	952	432	3,853	533	1,303	591
11 x 20	3.4 x 6.1	1,696	241	573	279	2,141	296	745	338	3,223	446	1,090	494	4,410	610	1,491	676
11 x 22	3.4 x 6.7	1,910	264	646	293	2,483	343	840	381	3,629	502	1,227	557	4,966	687	1,680	762
12 x 24	3.7 x 7.3	2,595	358	850	385	3,374	467	1,105	501	4,931	682	1,615	733	6,747	933	2,210	1,002
13 x 26	4.0 x 7.9	3,240	448	985	447	4,212	583	1,281	581	6,156	851	1,872	849	8,424	1,165	2,561	1,162
14 x 28	4.3 x 8.5	4,000	553	1,130	513	5,200	719	1,469	665	7,600	1,051	2,147	974	10,400	1,438	2,938	1,333

\*ACTUAL VALUES MAY VARY PLUS OR MINUS 15% DUE TO VARIATIONS IN MATERIALS, TEMPERATURES, TOLERANCES AND SPEED OF COMPRESSION

# Marine Cushion™

## Foam-Filled Marine Fenders

*Marine Cushion™ foam-filled fenders are constructed with the same quality materials and technology as our Marine Guard™ foam-filled fenders. Their proven reliability provides superior and dependable protection to out perform other types of fenders in the toughest marine environments.*

### Marine Cushion™ External Chain & Tire Net

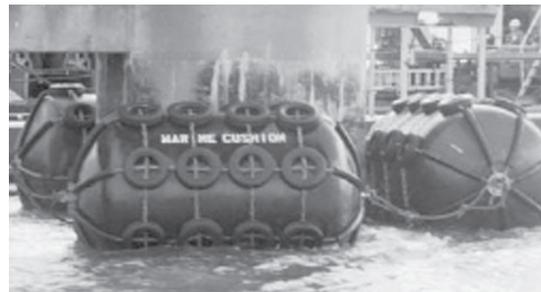
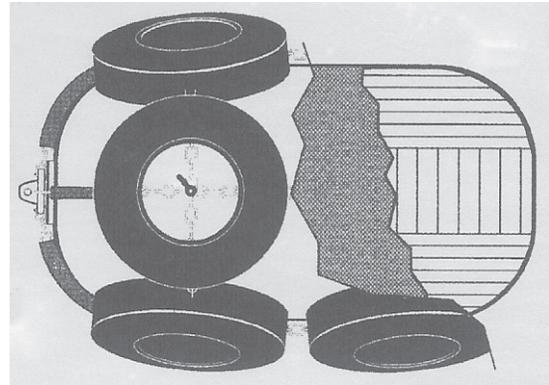
*The fender's chain & tire nets are constructed with only the toughest materials. Aircraft tires are used exclusively in the net construction along with heavy-duty chains and mounting hardware. All metal pieces are hot-dipped galvanized for excellent corrosion resistance and every chain intersection is secured with a shackle. Heavy-duty rubber tubing is used over the exposed lengths of chain to guard against abrasion.*

### Marine Cushion™ Fenders Skin

*Like Marine Guard™ fenders, the Marine Cushion™ skin is made of a tough polyurethane coating. Nylon tire cord is also continually wound around the fender as the coating is applied, embedding the filament into the skin.*

### Marine Cushion™ Foam Core

*The internal foam core is constructed of a 100% closedcell, resilient, energy absorbing foam. Heat lamination of the foam makes the core a single solid piece of foam with the laminated bond, between layers of foam, being stronger than the foam itself. No adhesives are ever used in the fabrication process, which will degrade over time and yield an inferior product.*



*Marine Cushion's™ external chain & tire net surrounding the fender produces superior longitudinal strength and abrasion protection. By transferring tensile loads to the external net through the end fittings, stress on the fender is minimized. Like Marine Guard™ fenders, the Marine Cushion™ foam-filled fenders have high energy absorption and low reaction force characteristics, making the choice simple when berthing operations are being considered. We take the headache out of deciding which fender to choose by making the best fender available.*



# STANDARD CAPACITY MARINE CUSHION FOAM FILLED FENDERS

## ENGLISH SIZES

FENDERS		STANDARD CAPACITY			
SIZE		ENERGY ABSORPTION @ 60% COMPRESSION		REACTION FORCE @ 60% COMPRESSION	
ENGLISH	METRIC	ft - kips	ton-m	kips	ton
ft x ft	m x m				
3 x 6	0.92 x 1.83	36	5	56	25.4
4 x 8	1.22 x 2.44	85	12	98	44
5 x 10	1.53 x 3.05	165	23	152	68
5 x 16	1.53 x 4.88	262	36	243	110
6 x 12	1.83 x 3.66	282	39	217	98.4
7 x 14	2.13 x 4.27	445	62	294	133
8 x 12	2.44 x 3.66	465	64	268	121
8 x 16	2.44 x 4.88	661	91	381	173
9 x 14	2.75 x 4.27	729	101	373	169
9 x 18	2.75 x 5.49	937	130	480	218
10 x 16	3.05 x 4.88	976	135	450	204
10 x 20	3.05 x 6.10	1,280	177	590	267
11 x 18	3.35 x 5.49	1,389	192	581	263
11 x 22	3.35 x 6.71	1,697	235	711	322
12 x 24	3.70 x 7.30	2,196	304	844	383
13 x 26	3.96 x 7.90	2,784	385	987	447
14 x 28	4.27 x 8.53	3,379	467	1,128	511

## METRIC SIZES

FENDERS		STANDARD CAPACITY			
SIZE		ENERGY ABSORPTION @ 60% COMPRESSION		REACTION FORCE @ 60% COMPRESSION	
METRIC	ENGLISH	ft - kips	ton-m	kips	ton
m x m	ft x ft				
1.00 x 1.50	3.3 x 4.9	33	5	47	21
1.00 x 2.00	3.3 x 6.6	48	7	67	30
1.20 x 2.00	3.9 x 6.6	64	9	76	34
1.35 x 2.50	4.4 x 8.2	103	14	109	49
1.50 x 3.00	4.9 x 9.8	155	21	146	66
1.70 x 3.00	5.6 x 9.8	196	27	162	73
2.00 x 3.50	6.6 x 11.5	317	44	222	101
2.00 x 4.00	6.6 x 13.1	371	51	259	117
2.20 x 4.50	7.2 x 14.8	500	69	321	146
2.50 x 4.00	8.2 x 13.1	541	75	305	138
2.50 x 5.50	8.2 x 18.0	794	110	447	203
3.00 x 6.00	9.8 x 19.7	1,213	168	571	259
3.30 x 4.50	10.8 x 14.8	1,007	139	430	195
3.30 x 6.50	10.8 x 21.3	1,581	219	675	306
3.30 x 10.6	10.8 x 34.8	2,774	384	1,184	537
4.20 x 8.40	13.8 x 27.6	3,322	459	1,109	503

Above information is for our Standard Capacity Marine Cushion foam filled marine fenders. Actual values for all sizes may vary plus or minus 15% from stated values due to variations in material properties, temperature, dimensional tolerance and speed of compression. Marine Cushion foam filled marine fenders are also available in Low Reaction, High, Extra High and Super High Capacity models.

## OTHER TOUGH QUALITY PRODUCTS



Floating Monopile Donut Fenders



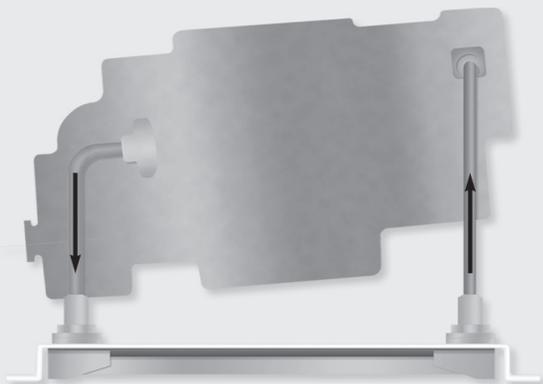
Pile Coatings



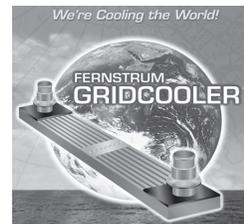
Resilient Buoys and Floats

## A Brief History of Keel Cooling

Keel cooling first appeared in the early 1800s when someone hung a copper tube over the edge of a boat to condense steam. It later evolved into pieces of channel, welded onto the hull. These channel cooling systems offered important advantages over raw water cooling. They eliminated silt and sand buildup in engine jackets and protected engines against salt water corrosion. Unfortunately, their sheer bulk reduced a ship's capacity and increased its drag. They were also prone to seaweed foulup. Clearly, a more compact and streamlined cooler was needed. This led to packaged keel coolers and the R.W. FERNSTRUM success story.



Engine jacket water is piped directly to the Fernstrum GRIDCOOLER® keel cooler, which cools the water and then sends it back to the engine. The GRIDCOOLER® keel cooler is in constant contact with the sea water for transfer of heat.



## Engineered Keel Cooling

When you choose a Fernstrum GRIDCOOLER® keel cooler, you're getting more than well-built hardware. You're getting the most cost-effective, dependable form of keel cooling available — backed by decades of experience. We're proud of our reputation, and we work hard to keep it.

To ensure that you get precisely what you need, we begin by asking a lot of questions. We'll need to know your engine make and model number, horsepower and rpm rating, heat rejection, freshwater flow rate, and the temperature requirements of the water entering and leaving the cooler. If you don't have all this information, we'll get it for you —

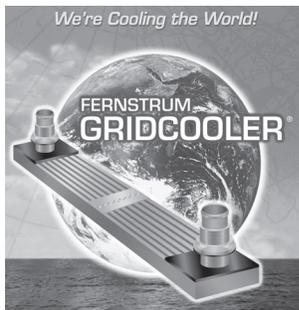


Ongoing product research and development studies ensure continual improvement in efficiency, durability and quality.

we maintain current files on all major marine engine manufacturers. We'll also need your vessel's hull design, its maximum speed at full rated power, and the maximum water temperature in which it will operate. With this data, we can determine exactly what size GRIDCOOLER® keel coolers your vessel will need — under its most severe operating conditions.

## Quality and Testing Methods

- Only the finest quality materials are used in manufacturing a Fernstrum GRIDCOOLER® keel cooler. Much of the materials used have metallurgical specifications proprietary to Fernstrum, based on decades of manufacturing experience - enhancing the durability and performance of the product.
- Quality control begins as soon as material is received. All material is 100 percent inspected. No random sampling methods are used. After inspection, raw material is assigned lot numbers for traceability throughout the manufacturing process.
- For customer protection, each unit is assigned its own serial number and inspection sheet. The inspection sheet tracks material lot numbers and the results of all testing throughout production. Additionally, employee identification is recorded for each step through the production process.
- Experienced craftsmen use only the-finest silver brazing alloys. Less expensive materials do not meet Fernstrum's high quality standards.
- Multiple quality assurance checks are made throughout the production process - including two separate underwater air tests to assure the integrity of brazed or welded joints.
- Cleanup by sandblasting is done in a specially constructed semiautomatic blasting cabinet.
- Ultrasonic testing is used to check the brazed joints of each unit to assure that every GRIDCOOLER® keel cooler is of superior strength. Each unit is checked for dimensional accuracy, square and straightness.
- On successful completion of all quality checks, each unit receives its own Quality Assurance tag - your assurance of excellence!
- Each unit is carefully boxed in a triple-corrugated, weather resistant fiberboard. Special wood crating is available for long-term storage upon request.
- Each GRIDCOOLER® keel cooler is shipped with all the gaskets, washers and nuts necessary for installation, as well as with installation suggestions.



## Custom Configurations

The Fernstrum GRIDCOOLER® is available in standard as well as many custom configurations to accommodate installation and maintenance concerns. Custom designs are a Fernstrum specialty and are limited only by imagination. We are happy to discuss your application and assist in designing or determining a custom configuration that adds value to your cooling system. Some of the more common configurations are listed.

**E-SERIES\* GRIDCOOLER\*** keel coolers have zinc anodes mounted at the ends of the units. This modification is available upon request at no additional charge and works well for fishing vessels where entanglement of nets is a concern.

**EXTENDED NOZZLES** may be ordered for vessels with thick hulls.

**L-SERIES\* GRIDCOOLER\*** keel coolers (shown here in multi-pass configuration) with extended support plates reduce the number of hull penetrations needed for installation.

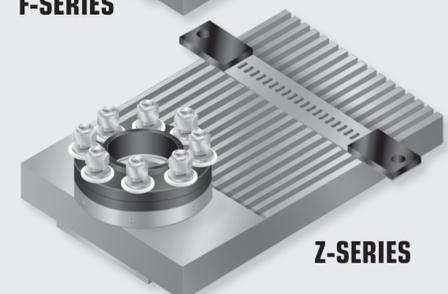
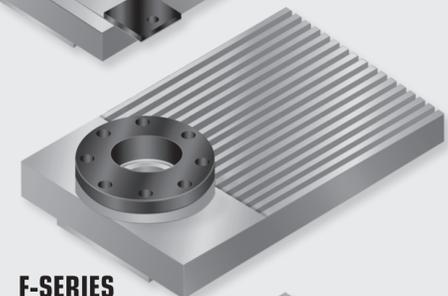
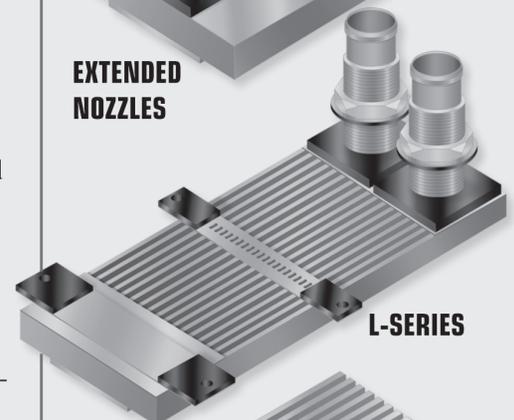
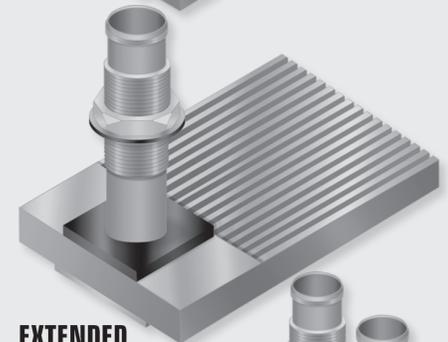
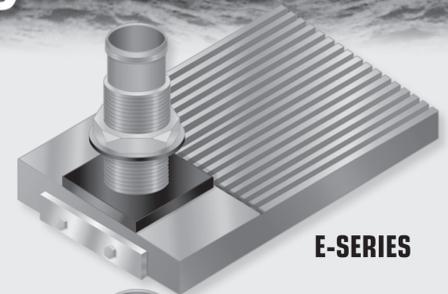
**F-SERIES\* GRIDCOOLER\*** keel coolers have flange connections and may eliminate the need for cofferdams.

**Z-SERIES\* GRIDCOOLER\*** keel coolers have lower profile flange connections with all mounting hardware and mating flanges included. Custom insulators provide isolation from the hull, if necessary. L-Series support plates are included as standard in this configuration. This patent-pending design eases installation on double hulled vessels and may eliminate the need for cofferdams.

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**MATERIALS** — Fernstrum GRIDCOOLER\* keel coolers are available in either 90/10 copper-nickel or marine grade aluminum rectangular tubing. Copper/nickel units have natural anti-foulant properties. The tubing is very ductile, so it can be slightly bent or twisted to conform to the ship's hull. Aluminum units are made of alloys that are compatible with vessels having aluminum hulls.

**COMPRESSION SEALING HARDWARE** is available upon request to help assure a leak-free seal at the nozzles and is recommended for customers utilizing cofferdams in their installation.



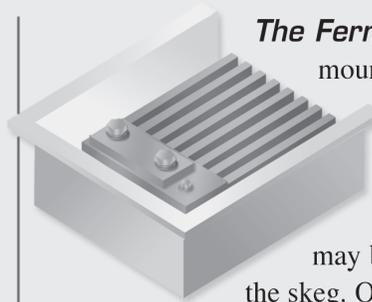
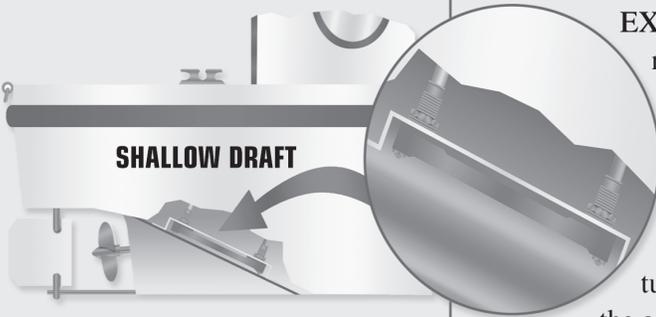
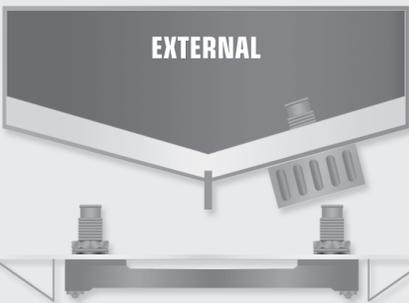
## Boudreaux meets a man on his Hawaiian vacation.

Boudreaux goes to Hawaii on vacation.

Down at de pool, a man sits down next to Boudreaux. Boudreaux says. "Hey, how you doing? My name is Boudreaux and I'm here on vacation. My house caught eetself on fire. I got a leettle extra from de insurance company. Dat's how I came here on dis vacation." "Well that's interesting," responded the man "I'm here from California. My house flooded. I used the extra insurance money for this vacation."

"Mais dats good," said Boudreaux "but let me axe you one ting. How de heck did you start de flood?"

## Common Installations



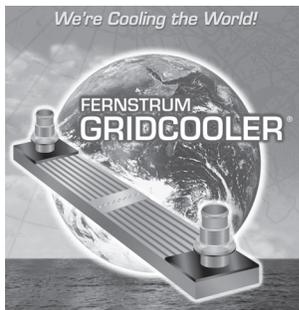
The **Fernstrum GRIDCOOLER®** keel cooler can be mounted almost anywhere on a ship's hull, giving the flexibility to match the installation to the hull design and operating conditions of any boat. For example; on shallow draft river work boats, the GRIDCOOLER® unit may be mounted on the side of the hull or beside the skeg. On towboats, the GRIDCOOLER® unit may be installed near the propeller to take advantage of its slipstream during heavy towing. On fast moving vessels, the unit is normally recessed along side the keel. See the Fernstrum GRIDCOOLER® keel cooler installation guide for more information.

**RECESSED** — Recessing a GRIDCOOLER® keel cooler streamlines the installation and greatly increases protection from damage. Independent tests conducted at the Vienna Model Test Basin have shown that drag is negligible when GRIDCOOLER® keel coolers are recessed into a ship's hull. If possible, the ends of the recess should be flared to allow a free flow of water over the entire cooler.

**EXTERNAL** — If the GRIDCOOLER® keel cooler can't be recessed, fairing blocks and side plates may be used for protection and streamlining.

**SHALLOW DRAFT** — Because of their compact size, Fernstrum GRIDCOOLER® keel coolers may be mounted along the keel or skeg, or even in the rake or tunnel of shallow draft river boats. This takes advantage of the additional water current created by the propeller.

**SIDE MOUNTED** — GRIDCOOLER® keel coolers may be side mounted to avoid damage due to running aground or if there isn't room for a bottom mount to the hull.



**Aspiration**

Make no little plans; they have no magic to stir men's blood. Make big plans, aim high in hope and work. Daniel H. Burnham

**Aspirin**

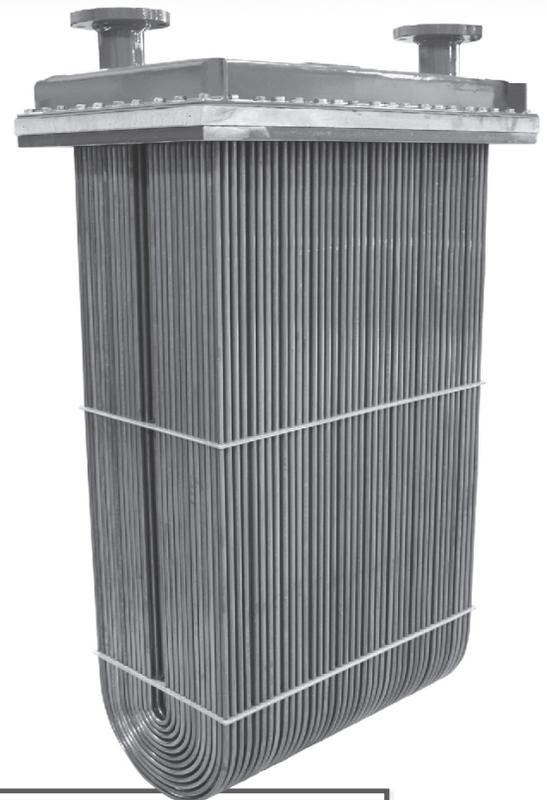
They now have a pill that's half aspirin and half glue. It's for people who get splitting headaches.



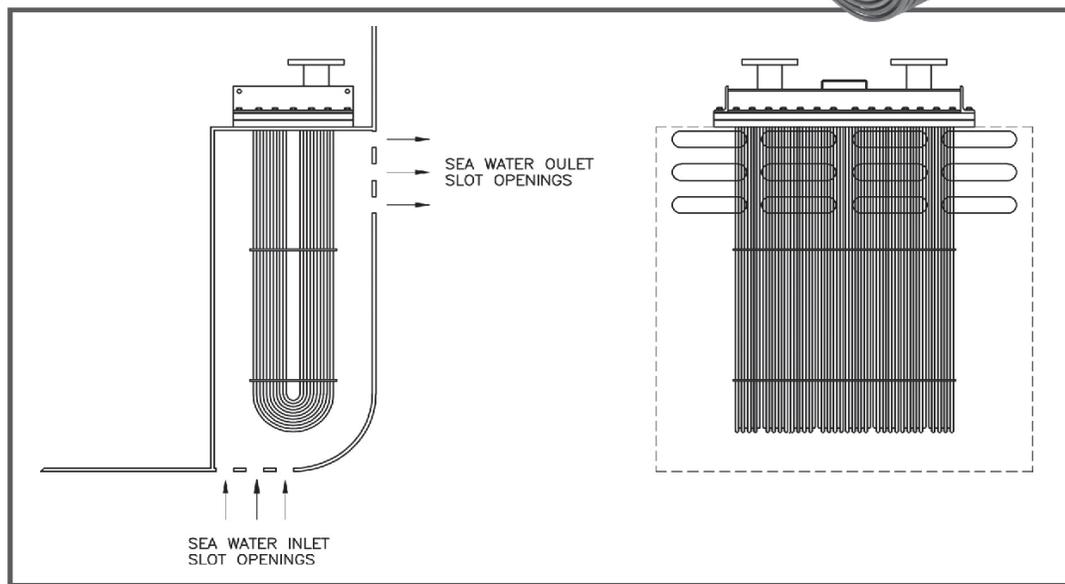
The Weka - FERNSTRUM Boxcoolers are a compact heat exchanger that is mounted in a sea chest within the confines of the ship's hull. This mounting configuration offers excellent protection from submerged obstacles, and also allows flexibility in sizing. Openings in the side and bottom of the sea chest allow heat to be exchanged to the seawater, through convection. This eliminates the need for a raw water pump and strainers, typical of an inboard heat exchanger.

It is important to note that the Weka - FERNSTRUM Boxcooler units are constructed of a 90-10 Copper Nickel, this provides a boxcooler with inherent Anti-Foulant capability. This eliminates the need for expensive Impressed Current Anti-Fouling (ICAF) systems with heavy consumable copper anodes that are supplied with coated boxcoolers. Not only are the ICAF systems expensive to install, they can be difficult to maintain due to their location in the enclosed sea chest underneath the coated boxcooler unit.

Exclusive to the Weka - FERNSTRUM Copper Nickel Boxcooler units are the Weka Protector Type T<sup>®</sup> and the Weka Guard. This equipment helps to minimize potential damage to the boxcooler by means of stray electrical currents and keeps the surface of the tubes free from corrosion. By doing this, the copper nickel boxcooler maintains its inherent anti-fouling capabilities and the tubes are protected from marine growth.



**Installation Example**



The three great philosophical questions that all philosophers concern themselves with are these:

Where did I come from (the question of origin)?

Why am I here (the question of purpose)?

Where am I going (the question of destiny)?

## Origins

One of the many problems with evolutionary thought is this: How did nonliving chemicals manage to organize themselves so as to spring to life? Many believe that life began with a very simple life-form and gradually developed into more complex life forms. The truth is, there is no such thing as a "simple" life-form. Even the most simplistic living organisms are very complex. Let's consider a hypothetical simple cell, so simple that none like I'm going to describe actually exist in our world. Our hypothetical simple cell would need a vast number of internal parts- at least 239 protein molecules, each containing 445 amino acids, all of which are made up of 10 to 20 atoms. Of the hundreds of different amino acids, only 20 are used in proteins, and they cannot simply float around randomly. All 445 of them must be lined up single file, in perfect sequential order, for the protein to function. For a single cell to spring to life, 445 amino acids would have to accidentally line up perfectly, not once, but 239 times to form 239 proteins to spontaneously become a living cell. All things considered, a single cell contains as much data as all the individual letters in the world's largest library- that's about a trillion bits of information. So much for the "simple" single cell.

Let's assume no supernatural designer was needed for this elaborate process of spontaneous generation. Let's crunch the numbers and apply the laws of probability to the spontaneous generation of a single living cell through this illustration. Suppose you number ten pennies from one to ten and place all ten of them in your pocket. When you reach into your pocket and randomly select a penny, the odds of picking a specific penny are 1 in 10. But the odds of pulling the pennies out in sequential order, replacing each penny after it is selected, are 1 in 10 billion. That means you could try to randomly select ten pennies in proper sequence 10 billion times before getting it right. That could take years. Now compare that to the odds of the simple cell getting organized by itself, and the impossibility of the task become pretty obvious.

continued (end of Section D)