BARGE BUMPER SYSTEMS

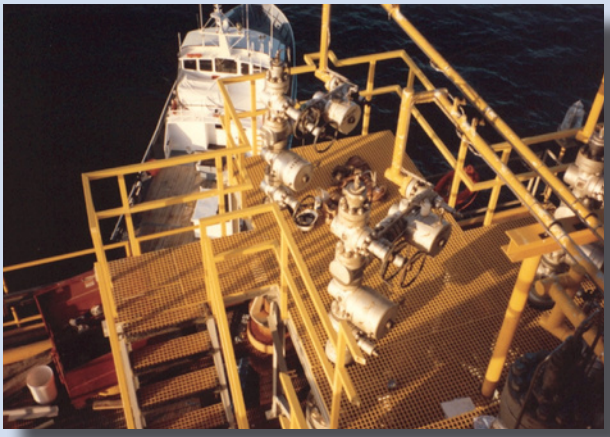
AIMS COMPOSITES

AIMS Composites is a world leader in offshore vortex induced vibration (VIV) suppression, engineered fiberglass structural systems, and platform dock fendering systems. Since 1982, AIMS has been the leader in supplying, engineering, and fabricating fiberglass grating and structural systems. AIMS supplies a full line of platforms, dock fenders, fiberglass signs, vortex breakers, VIV suppression products, blast panels, and mudmats. In addition, we are a leading supplier of fiberglass handrail and stair systems, as well as and other specialty fiberglass products.

AIMS prides itself on its ability to take the customer project from the initial design and engineering phase to the implementation and installation of the finished product.

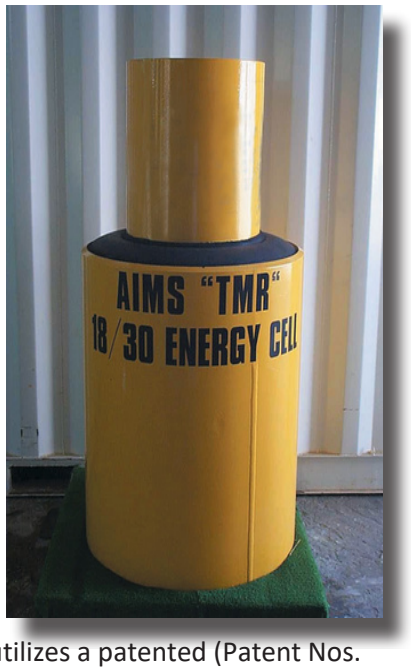
In an effort to continually improve services, AIMS actively seeks expansion opportunities within the United States and in overseas markets. In 1993, we purchased Teledyne Monarch Rubber's platform fender product line, moved the product tooling to Houston, and began manufacturing and marketing a platform fender product line, i.e., energy cells, rubstrips, and barge bumpers. In 2017, AIMS began fabricating aluminum structures and handrails.

To market our products and services around the world, AIMS forms partnerships with local companies in various countries, including Malaysia, Australia, Korea, Singapore, India, United Arab Emirates, Nigeria, Brazil, and Mexico. Everywhere there is offshore oil and gas, you will find AIMS International.



AIMS Composites provides the design and fabrication of platform and dock fendering systems for the offshore oil and gas industry, which includes:

• Energy Cells (compression bonded) • Boat Landing Rub Strips (urethane) • Barge Bumper Sleeves • Conductor Stabilizers (conductor centralizers) • Custom Rubber and Urethane Products



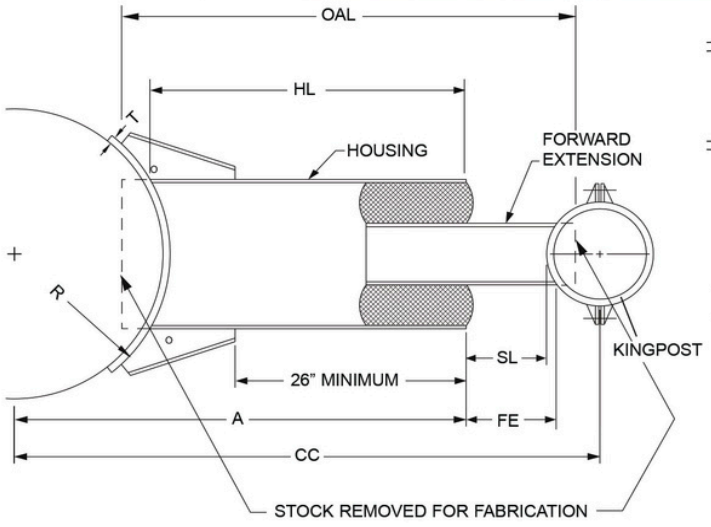
Energy Cells

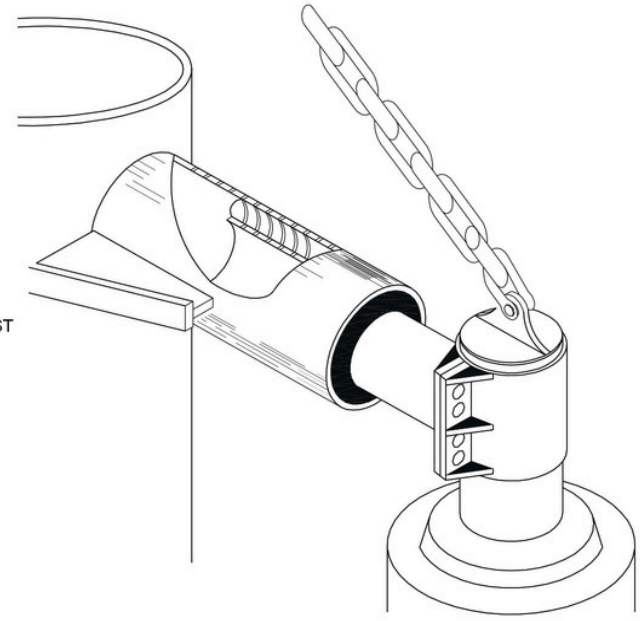
The purpose of a platform fendering system is to manage the kinetic energy transmitted from a berthing vessel to the jacket leg of an offshore structure. The kinetic energy is converted to potential energy and then back to kinetic with some minor losses (heat) that accelerates the vessel in the opposite direction. The reaction to that impact is managed by the energy cell at either end of the barge bumper system. The AIMS "TMR" Compression Bonded Energy Cells (formerly Teledyne Monarch Rubber) utilizes a patented (Patent Nos. 4,408,931 and 4,477,302) manufacturing process that provides a constant bond-in-compression. This patented bond-in-compression feature eliminates many of the problems associated with conventional energy cells, among them – poor rubber-to-metal bonding, limited axial and lateral deflection, and pullout. (See Figures 1, 2, and 3.)

This rubber-to-metal bonding problem has been solved by a manufacturing process that yields the advantage of having the rubber compressed with a constant force against the bonding surface, complementing an already superior adhesive system.

Utilizing a superior grade of natural rubber in conjunction with the patented “bond-in-compression” manufacturing process, the AIMS "TMR" Compression Bonded Energy Cell is capable of greater deflection and higher energy absorption than conventional cells in both the axial and lateral modes. This is achieved through the design of the rubber annulus and the unique bonding process. (Refer to Performance Curves and Figures 1, 2, and 3.)

All of AIMS' compounds are U.V. stabilized and ozone resistant. The rubber utilized in our energy cells is a natural rubber compound, providing high elongation in conjunction with high shear and tensile strengths. Ask about our “Cold Weather” compound for sub-freezing conditions.





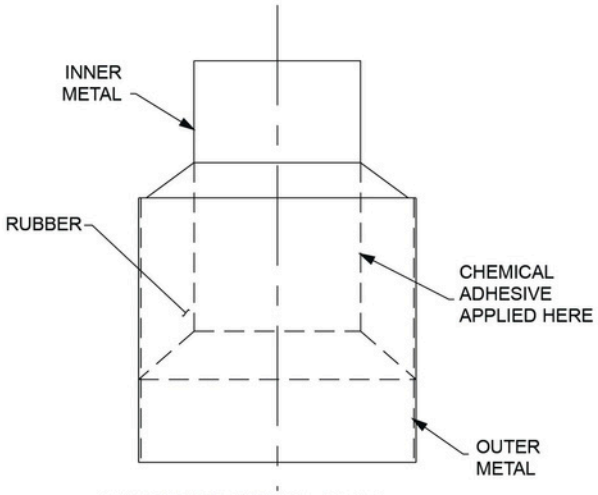
HL	=	HOUSING LENGTH (OUTER METAL)
SL	=	STROKE LENGTH
CC	=	CENTER-TO-CENTER JACKET LEG TO KINGPOST
FE	=	FORWARD EXTENSION OF INNER METAL
OAL	=	OVERALL LENGTH

Method of Manufacture - Energy Cells

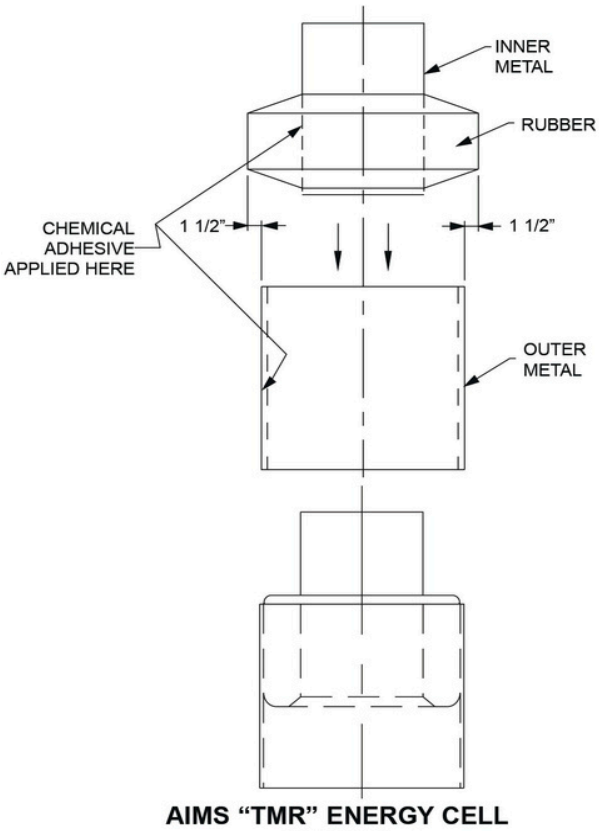
CONVENTIONAL ENERGY CELLS - Manufactured by Competitors

Both the inner metal and outer metals are placed in a mold, which provides for the annulus and which also keeps the pipes parallel. These metals have both been sandblasted and coated with a rubber adhesive. Uncured natural rubber compound is placed into the mold annulus formed by the inner and outer metals. After the annulus is filled with rubber, the cap of the mold is installed. The cell is then placed in an autoclave—on a heat table, in a hot oil bath, or some other environment—to effect the curing of the rubber, as well as activating the chemical bond between the rubber and the inner and outer metals. The rubber is heated at a temperature of approximately 300° F for six hours. The molds are then broken apart, the product removed, and the manufacturing process completed. There is, however, a shrinkage phenomenon with rubber – it shrinks as it cools after the curing process. The rubber ID tends to "shrink-fit" onto the inner metal, however, the OD tends to shrink and pull away from the outer metal. This shrinkage phenomenon can be as much as 2-4% of the rubber thickness. This places the rubber in a radial state of tension, places the chemical bond in a radial state of tension, and weakens the energy cell. (See Figure 2A.)

Teledyne Monarch Rubber engineered this "weak link" out of their "bonded-in-compression" energy cells – now the AIMS "TMR" Compression Bonded Energy Cells.



CONVENTIONAL CELL
FIGURE 1A



AIMS "TMR" ENERGY CELL
FIGURE 1B

BOND-IN-COMPRESSION ENERGY CELLS - Manufactured by AIMS

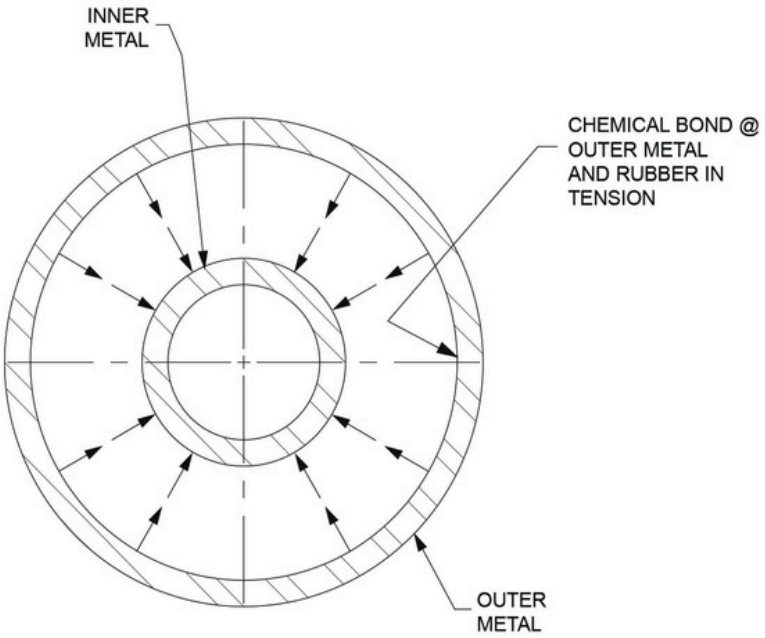
Uncured natural rubber compound is mandrel wrapped onto the inner metal, which has already been sandblasted and coated with a rubber adhesive system. The inner metal and uncured rubber are placed into a compression mold where it is steam heated for 6 hours at 300 degrees F. Afterwards, the cured part is removed from the mold. The same rubber shrinkage phenomenon occurs at this point. The rubber ID shrink-fits onto the inner metal, and the rubber OD also decreases. Even after shrinkage, the OD of the rubber is approximately 3" larger than the diameter of the outer metal it is to be "squeezed" into. The outer metal is then blasted and painted with an adhesive system.

Using a hydraulic press and a guide funnel, the rubberized inner metal is "squeezed" into the outer metal. After this, the rubber-to-outer metal bond is activated (oven-heated), and this completes the manufacturing process. The main difference between the AIMS "TMR" Energy Cell and the competitor's conventional cell is that the rubber in the AIMS cell is in a radial state of compression, not radial tension. The result is a more efficient energy cell that outperforms the cells of our competition.

Annulus - States of Stress

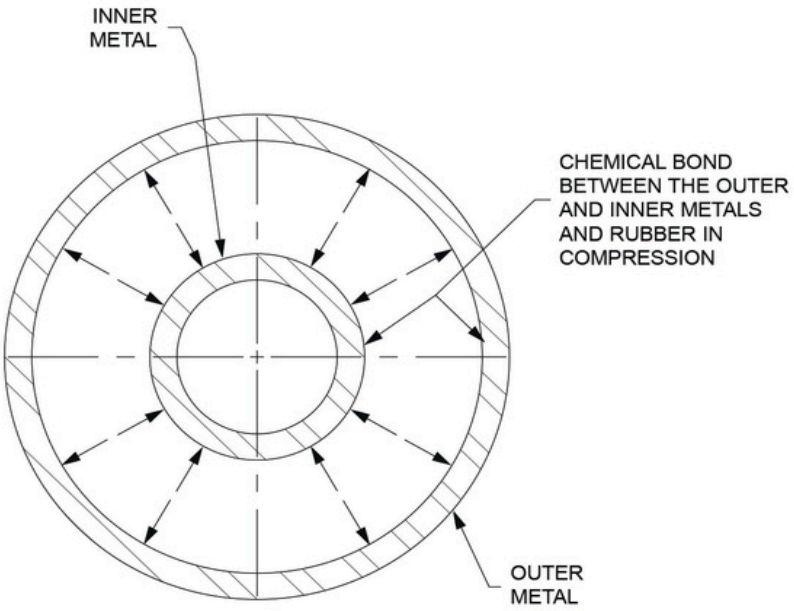
Rubber "shrink-fits" onto the inner metal, but actually wanting to shrink and pull away from the outer metal.

COMPETITOR'S CONVENTIONAL CELL
FIGURE 2A

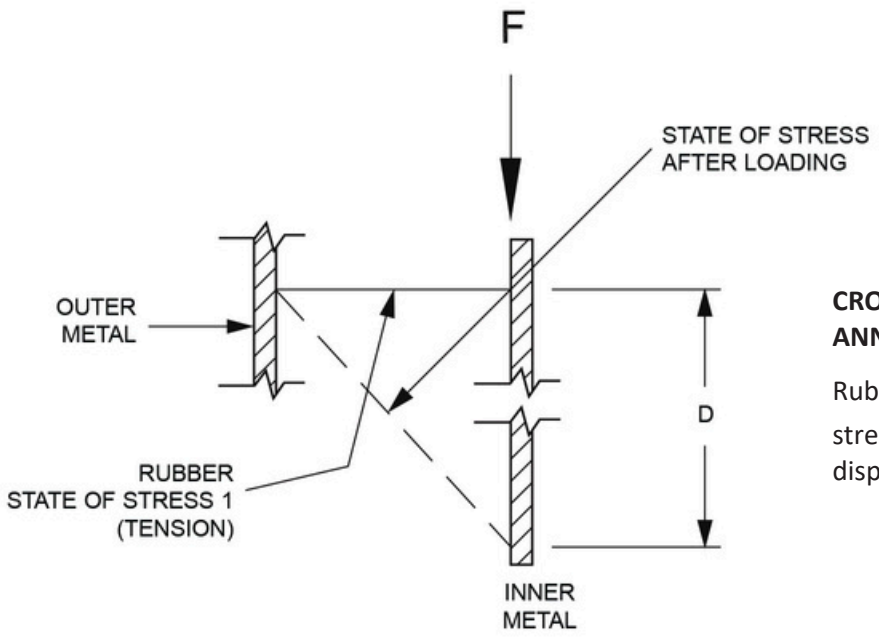


Because the OD of the rubberized inner metal is larger than the diameter of the outer metal, the insertion of the inner metal into the outer metal forces the rubber into a radial state of compression.

AIMS "TMR" ENERGY CELL
FIGURE 2B



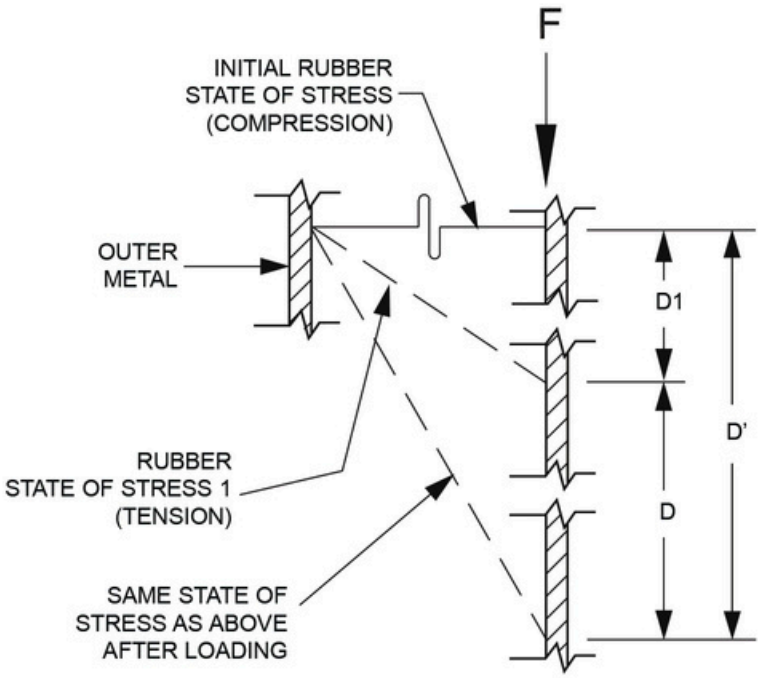
The AIMS "TMR" Cell Absorbs More Energy



CONVENTIONAL CELL
FIGURE 3A

CROSS SECTION OF A RUBBER FIBER IN THE ANNULUS OF A CONVENTIONAL CELL

Rubber is in a residual state of tension (State of stress 1); thus, when a load "F" is applied, a total displacement "D" is obtained.



AIMS "TMR" ENERGY CELL
FIGURE 3B

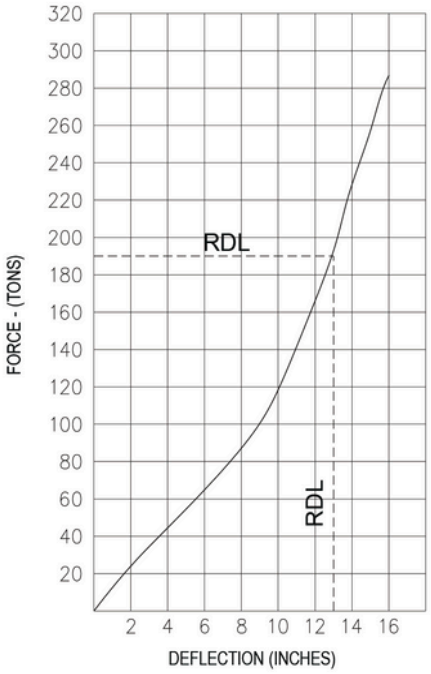
CROSS SECTION OF A RUBBER FIBER IN THE AIMS "TMR" CELL ANNULUS

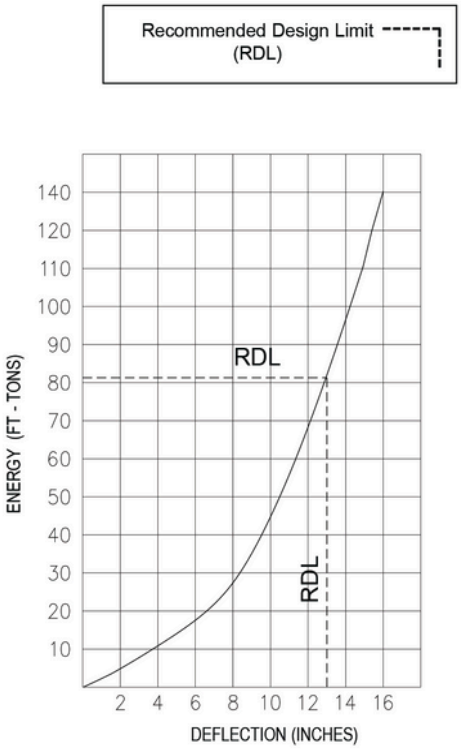
The rubber is in a relaxed state of stress since it is in compression in the annulus. The same load "F" will initially deflect the rubber a distance of "D1" – the deflection that will move the rubber to a point, creating the same State of Stress 1 the Conventional cell began. From that point forward, the AIMS "TMR" cell will deflect the same distance "D" due to the load "F". Thus the total deflection of the AIMS "TMR"Cell is D1+D=D'. Since kinetic energy is a function of force acting through a distance, and since the AIMS "TMR" deflection due to load "F" (D1) is larger than "D" (the deflection of the conventional cell due to load "F"), the AIMS "TMR" cell absorbs more energy. In short, it deflects more for the same load. The net result is that the berthing load transferred into the jacket structure is reduced by using the AIMS "TMR" Cell.

AIMS "TMR" Energy Cells - Type 18/30

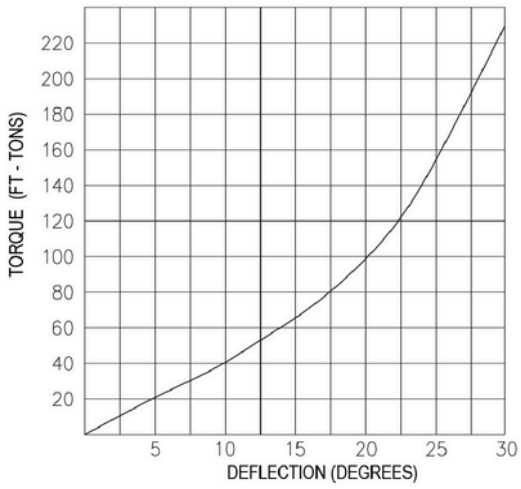
TYPE 18/30 AXIAL MODE

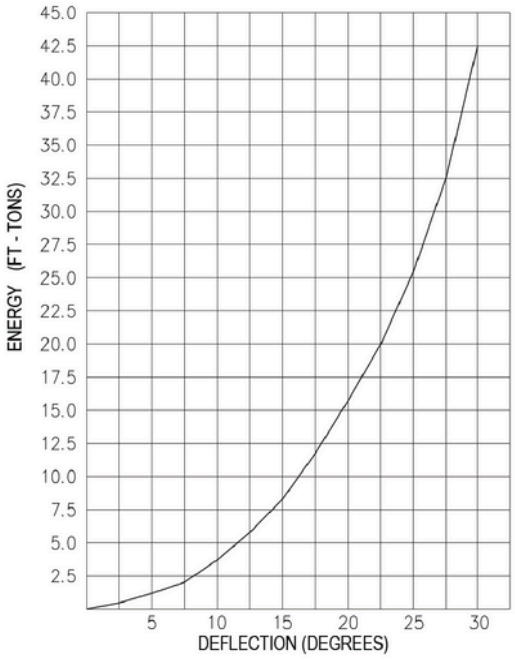
NOTE: These curves are the average results from stroking 14 different energy cells.





TYPE 18/30 LATERAL MODE



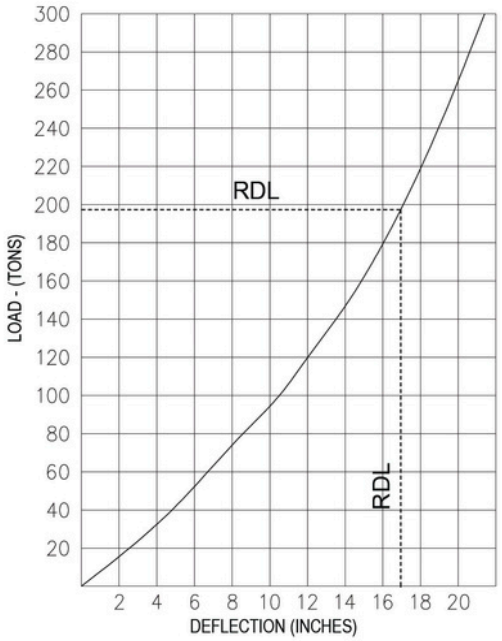


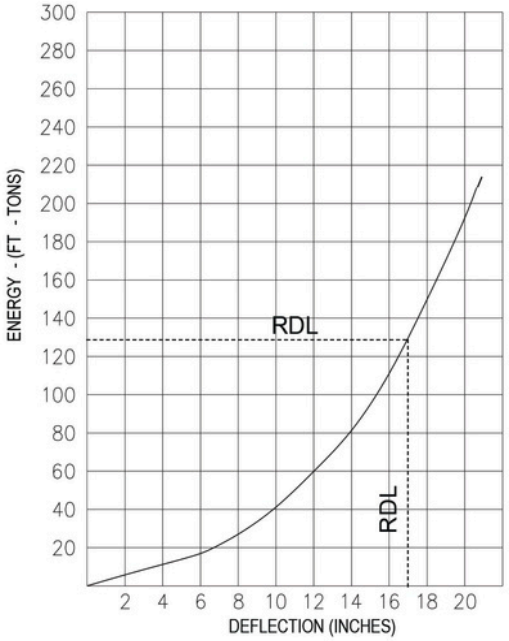
SL = 13" (SUGGESTED)
FE = 21" MAXIMUM
HL = AS REQUIRED (25" MINIMUM)
HOUSING MATERIAL 30"ø x 0.750 or 30” ø x 0.625
FORWARD EXTENSION MATERIAL=18” ø x 0.750

AIMS "TMR" Energy Cells - Type 20/36

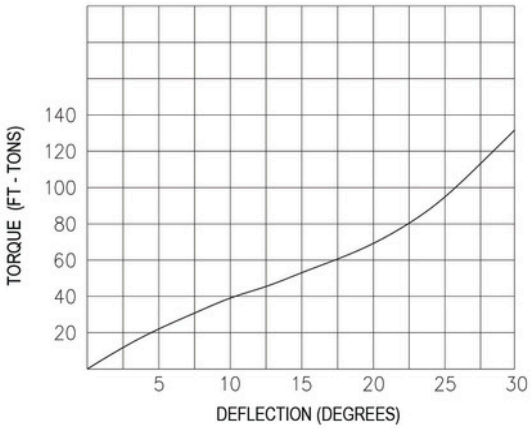
TYPE 20/36 AXIAL MODE

Recommended Design Limit (RDL)





TYPE 20/36 LATERAL MODE

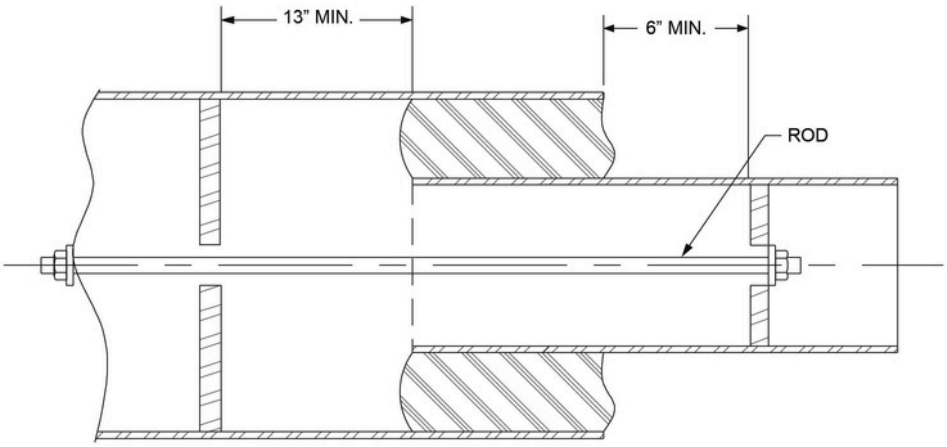


SL = 17" (SUGGESTED)
FE = 28" MAXIMUM
HL = AS REQUIRED (28" MINIMUM)
HOUSING MATERIAL 36"ø x 1.0
FORWARD EXTENSION MATERIAL=20" ø x 1.00

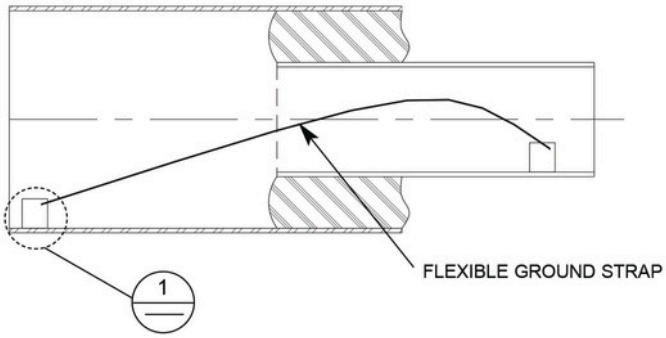
Optional Features

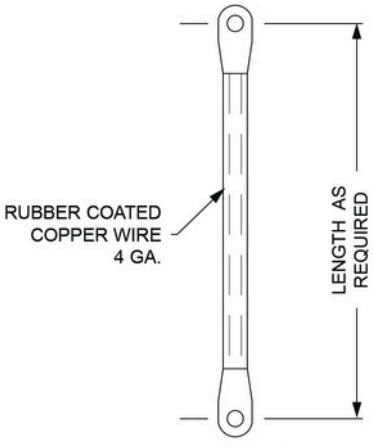
ANTI-PULLOUT FEATURE

This patented feature is available for all energy cells. It minimizes damage to the energy cell as well as the barge bumper system in pullout situations. The system can be designed to accommodate any pullout load.

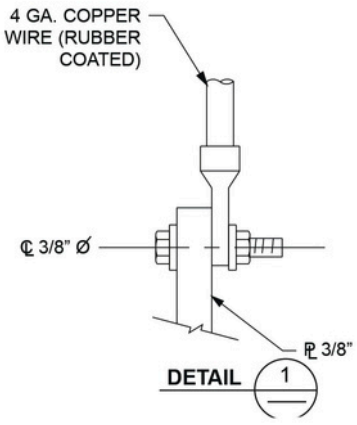


AIMS FLEXIBLE GROUND STRAP





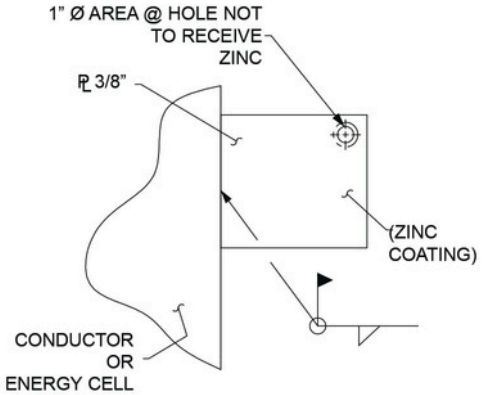
FLEXIBLE GROUND STRAP



DETAIL 1

FOR ENERGY CELLS AND CONDUCTOR STABILIZERS

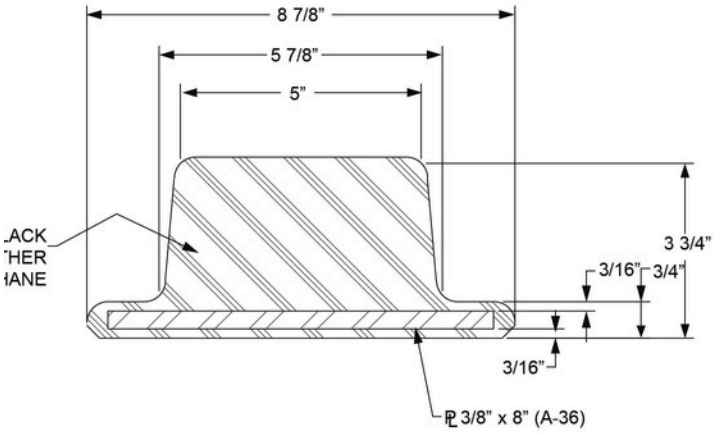
It is a proven fact that corrosion on the lower end of the barge bumper system on the kingpost side of the lower energy cell is much more severe than corrosion on the jacket leg side of the system. This is because the rubber isolates the kingpost from the cathodic protection of the structure. Use of the AIMS Flexible Ground Strap provides a means for the kingpost to draft from the cathodic protection system by electrically connecting the two.

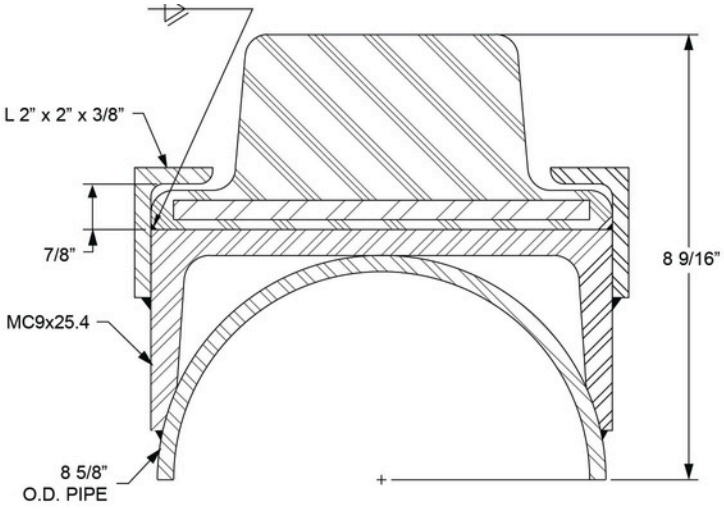


GROUND PLATE AT CONDUCTOR OR ENERGY CELL

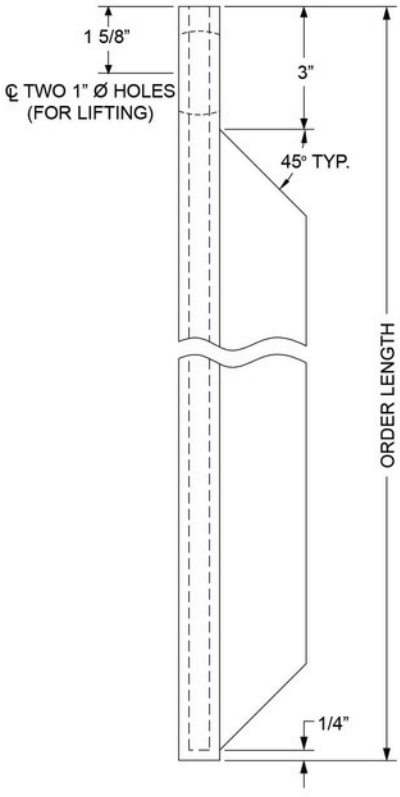
AIMS "EP" Urethane Rubstrips

AIMS has selected polyurethane as the primary rubstrip material because of its high tensile strength; resistance to abrasion, tear and cut, good weathering properties, and very low coefficient of friction. The function of a rubstrip is to provide a contact surface for the boat landing and prevent the scraping of steel hulls and the deterioration of protective coatings of structural members and service vessels. To accomplish this objective and to provide flexibility of design, AIMS offers both fixed and replaceable rubstrip designs.





Type EP Rubstrip was designed as a replaceable rubstrip and is the perfect substitute for extruded rubber systems. The tough polyurethane elastomer totally encapsulates the steel plate to provide the ultimate in corrosion protection without the addition of costly protective coatings.



WEIGHTS	
3-0" ELASTOMER	= 10.2 LB/FT
MC9 CHANNEL	= 25.4 LB/FT
L2" x 2" x 3/8"	= 3.92 LB/FT (x 2 req'd)
℄ 3/8 x 8"	= 10.2 LB/FT

PHYSICAL PROPERTIES OF AIMS URETHANE RUBSTRIP	
DUROMETER:	95 SHORE A
TENSILE STRENGTH:	5000 PSI
TEAR RESISTANCE:	400 LB/IN
ELONGATION AT BREAK:	500%

COEFFICIENT OF FRICTION VS. STEEL
WET: .02
DRY: .1

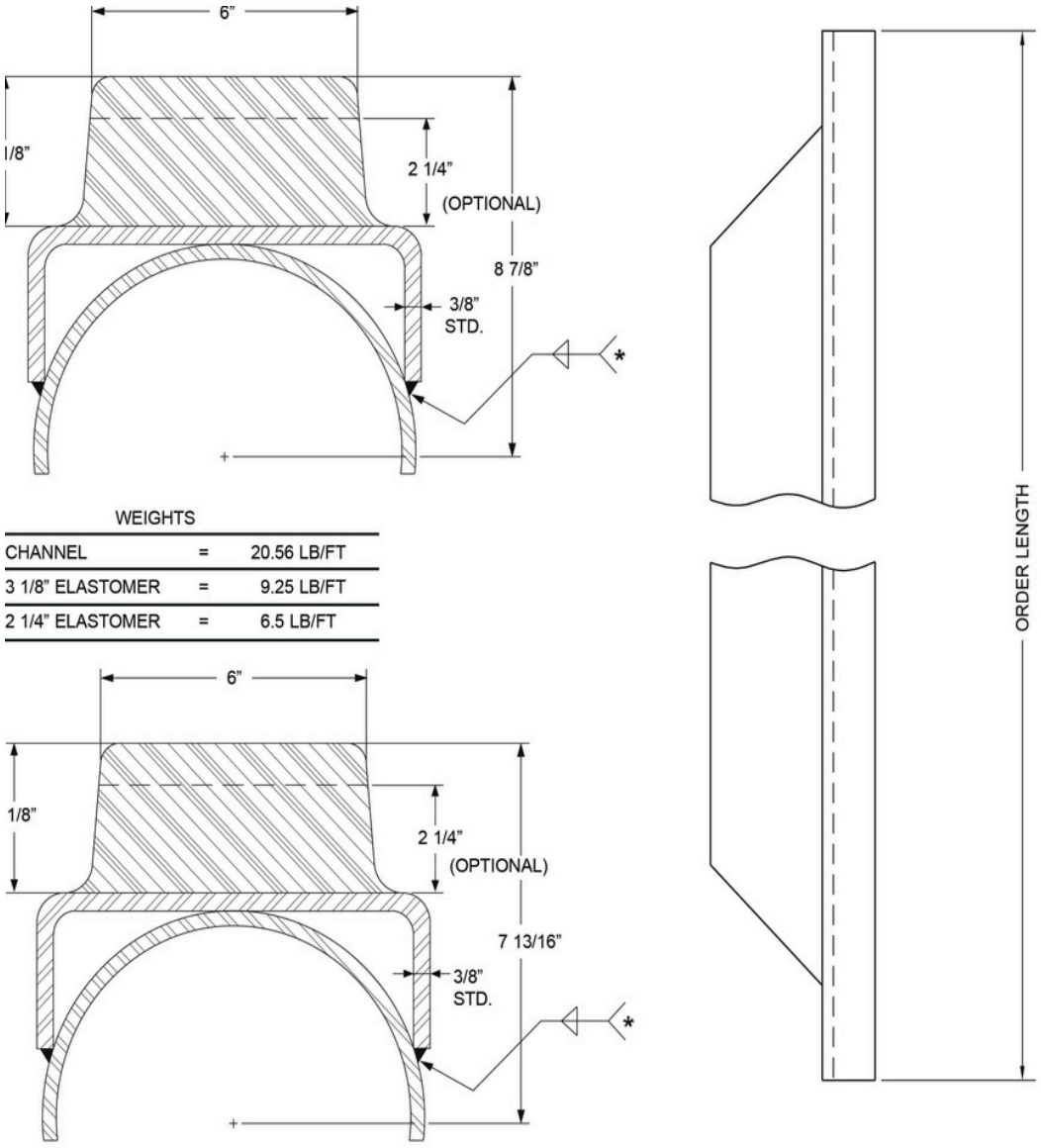
AIMS CP-8 and CP-10 Urethane Rubstrips

Types CP-8 and CP-10 Fixed Rubstrips are installed over the vertical tubular members of a boat landing. Composed of a tough, durable polyurethane, these rubstrips are bonded to a specially formed 3/8" plate (or to channel) which is, in turn, welded to the vertical facing pipe of a boat landing, typically an 8-5/8" O.D. or a 10-3/4" O.D. pipe. The plate is designed so that the web and flanges all contact the pipe, thus increasing section modulus to minimize local deformations. Seal plates are strongly recommended at both the top and bottom.

The thickness of the urethane can be ordered as 2-1/4" or 3-1/8".

Type CP Rubstrips can be manufactured to a wide range of dimensions to meet any requirements.

**A special welding procedure is required to protect bond area from temperature extremes.*



WEIGHTS

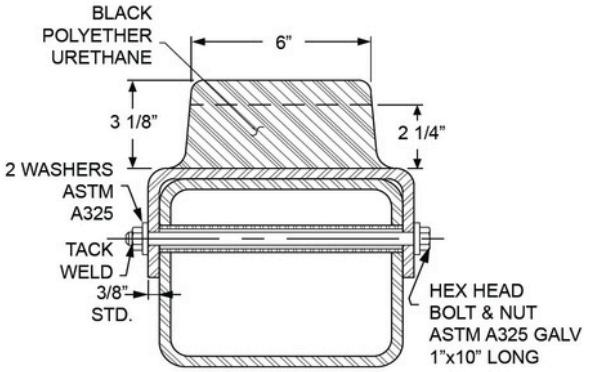
CHANNEL 3 1/8"	=	18 LB/FT
ELASTOMER 2 1/4"	=	9.25 LB/FT
ELASTOMER	=	6.5 LB/FT

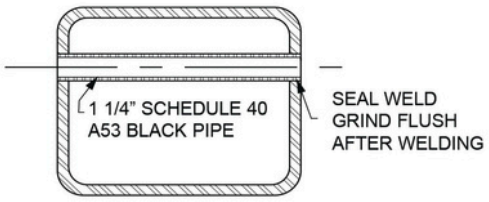
AIMS C-TS Urethane Rubstrips

AIMS Type C-TS Rubstrip was developed to meet the need for a replaceable rubstrip. It features a polyurethane-bonded-to-steel rubstrip that fastens to a 7"x7"x1/2" square tube. In the typical installation, the rubstrip is bolted above the water line with three bolts only and retained below the water by an angle welded to the 7"x7"x1/2" tube. If bolts are used the entire length of the rubstrip, the angle retainer in Detail “A” can be deleted. The thickness of the rubstrip can be either 2 1/4” or 3 1/8”.

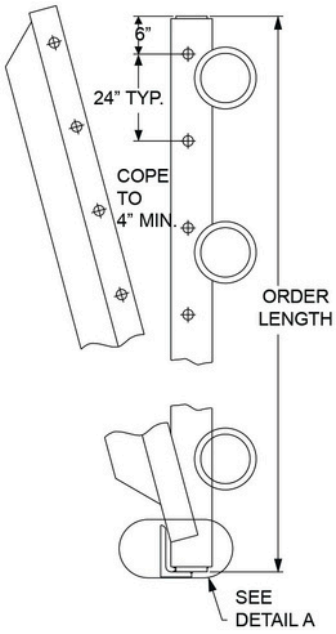
AIMS has the ability to furnish the entire rubstrip assembly, which insures proper fit of the rubstrip channel to the support tubing.

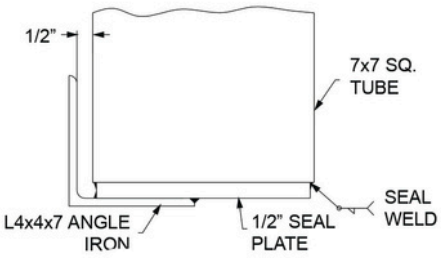
Different bolt patterns and lower retaining designs are available, as are optional stainless steel bolts, fasteners, and sleeves.

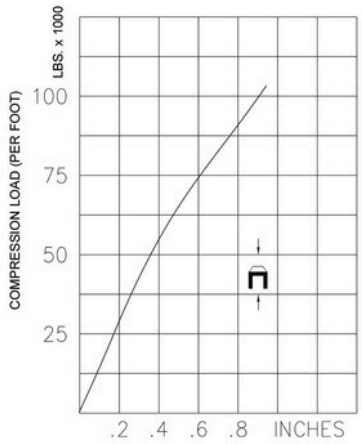


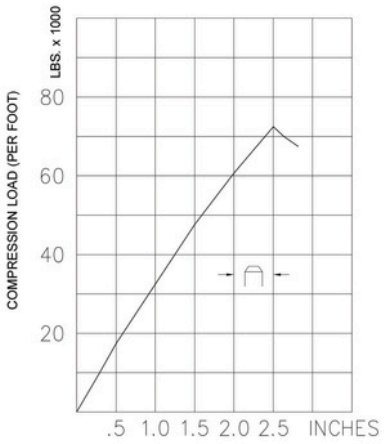


WEIGHTS		
TS7x7x1/2	=	42.0 LB/FT
CHANNEL 7 3/4”x3 7/8”	=	18.4 LB/FT
2 1/4” ELASTOMER	=	6.5 LB/FT
3 1/8” ELASTOMER	=	9.25 LB/FT



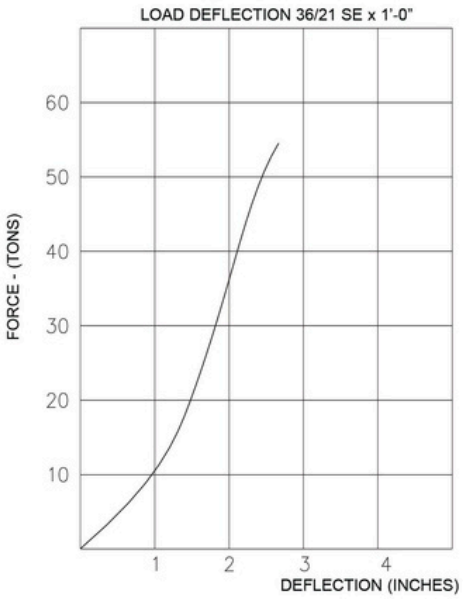


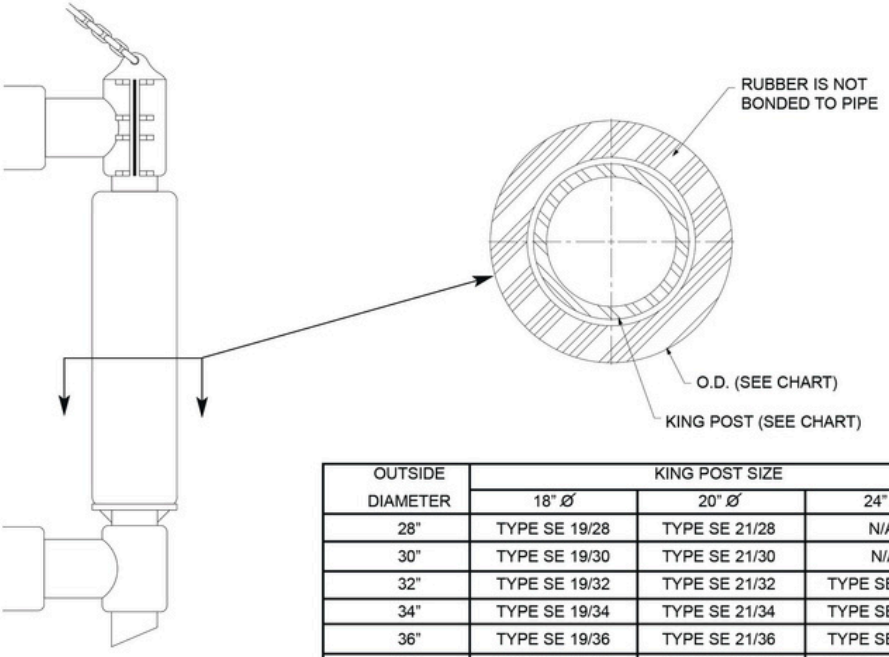




Barge Bumpers

The **Type SE** is a continuous single element barge bumper that provides a reliable, cost effective approach to barge bumper systems. It is available to fit 18", 20", or 24" kingposts with a variety of outside diameter and length dimensions available. (Refer to Size Chart.)

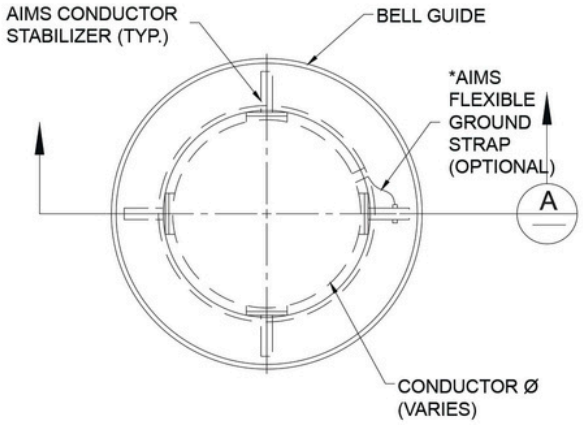


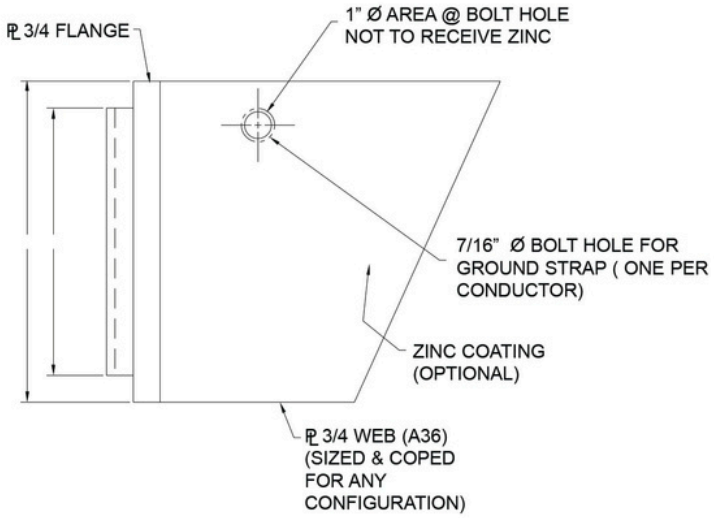


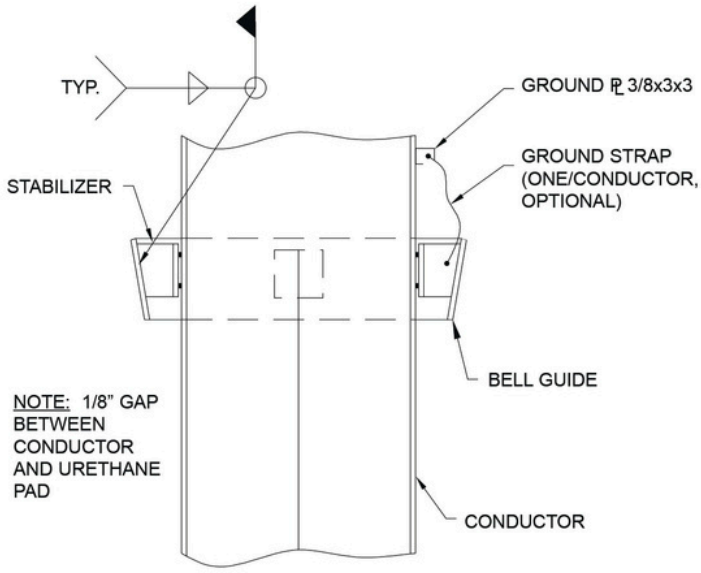
OUTSIDE DIAMETER	KING POST SIZE		
	18" Ø	20" Ø	24" Ø
28"	TYPE SE 19/28	TYPE SE 21/28	N/A/
30"	TYPE SE 19/30	TYPE SE 21/30	N/A
32"	TYPE SE 19/32	TYPE SE 21/32	TYPE SE 25/32
34"	TYPE SE 19/34	TYPE SE 21/34	TYPE SE 25/34
36"	TYPE SE 19/36	TYPE SE 21/36	TYPE SE 25/36
38"	TYPE SE 19/38	TYPE SE 21/38	TYPE SE 25/38
40"	TYPE SE 19/40	TYPE SE 21/40	TYPE SE 25/40

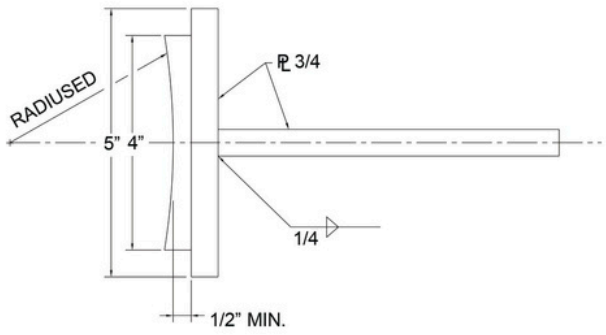
Please note that barge bumpers of any size and length are available and that you are not limited to the above sizes.

AIMS Conductor Stabilizers









SEE "OPTIONAL FEATURES" SECTION FOR DETAILS OF FLEXIBLE GROUND STRAP

Market Applications

AIMS' products and services have been successfully used in various applications in many different industries. Wherever there is value placed on safety, eliminating maintenance expenditures, ease of installation, and long service life, AIMS should be consulted. The following are industries and locations where our products are found:

Offshore Drilling & Production Facilities

wellhead access platforms around wells & vessels, stair towers, grating systems, electrical cable trays, mudmats

Petrochemical Plants & Refineries

walkways & platforms around vessels and equipment, stair towers, trench grating

Industrial & Municipal Wastewater Facilities

walkways & catwalks in and around clarifiers, settling basins, and platforms used as storage areas

Pulp & Paper Mills

walkways & catwalks in and around their waste water plants, including bleaching and washing areas

Metal Plating & Mining Facilities

platforms in processing areas, catwalks, stair towers, and storage areas

Commercial Warehouses

grating systems for additional storage areas and mezzanines

Beverage & Food Processing Plants

grating systems & platforms in and around wash-down areas, access platforms, and storage areas

Hi-tech Computer Industry Facilities

grating systems in clean rooms and etching areas

Water Park & Recreational Facilities

trench grating in and around pools, structural systems for flowing streams

Cooling Tower Industry

access walkways & towers, de-misters

Federal & State Parks

bridges & erosion control

Valuable features of AIMS' products for these and other industries include:

- Excellent corrosion resistance and elimination of maintenance
- Lightweight and ease of installation
- High strength-to-weight ratio
- Excellent non-skid characteristics, safety, and ergonomics
- Fire resistance
- Electrical and thermal non-conductivity
- Durability and long service life
- Great return on investment

AIMS Composites

... dedicated to customer service and support

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