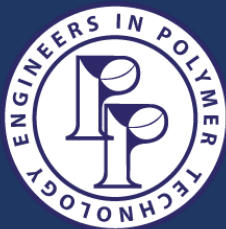




PPI – Marine Fendering Systems[®]

PRODUCT INFORMATION AND SELECTION GUIDE



**Polymer Products Impex Private
Limited**

“35 Years of Excellence”

**Your Trusted Partner in Rubber based
engineering solutions**

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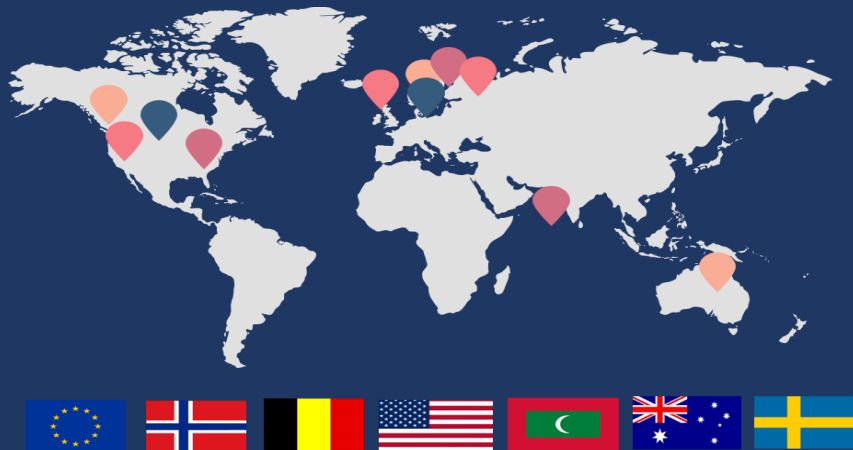
Our History

Polymer Products Impex (Private) Limited (“PPI”) was **established over 35 years ago** and is one of Sri Lanka’s leading manufacturing companies specializing in the design and manufacture of engineered rubber and bonded metal/rubber composite products for marine, construction, power, irrigation, transportation, household, automotive and general industrial markets.

PPI’s products are exported worldwide having **achieved the status of ‘Approved Supplier’ to several major global companies including 3M**. PPI partners with its clients to deliver customized rubber product solutions utilizing in-depth technical knowledge, specialised material formulations and the latest technologies. Manufacturing processes at PPI include moulding, extrusion, fabrication with post bonding, metal and fabric reinforcing and assembly.

ISO 9001 certification (international quality standard) is testimony to PPI’s commitment to offering the highest quality. The manufacturing facility’s environmental management is certified according to the international **environmental standard ISO 14001**. This commitment to international standards has allowed PPI to be appointed as an **exclusive supplier to the world’s largest innovations company in 3M**. One of the main products in this portfolio includes respiratory hoses used widely across a number of safety applications by 3M including in welding masks as outlined below.

The material development and manufacturing process was developed solely by PPI. The company has **passed 3M audits and earned the status as ‘Approved Supplier’ to 3M globally**. In addition to over two decades of export experience supplying products to the following countries, PPI also supplies highly technical rubber products to the mining and oil and gas industry in Australia.



Just as PPI is dedicated to providing innovative and technical rubber product solutions, the company is equally devoted to ensuring its products, employees and sites are following the commitment to socially responsible business activities. PPI fully embraces the policies and principles of the UN Global Compact which is a public-private strategic policy initiative for businesses committed to aligning operations and strategies with ten universally accepted principals in the area of human rights, labour, environment and anti-corruption.

OUR CAPABILITIES

PPI's engineers and chemists work in partnership with its clients to produce cost effective rubber-based solutions. The company's extensive experience in tool design, 3D drawing and prototype capability can verify design and performance parameters before committing to full scale tooling and production of rubber products. Various elastomers such as NR, SBR, CR, CPE, CSM EPDM, EPM, IIR, FKM, NBR, NBR/PVC, Q, ACM and AEM are developed to achieve superior performance as well as conformance to international requirements such as Reach and FDA. PPI's products are designed to meet unique characteristics including requirements in conductivity, anti-static, flame retardant, odorant, food grade and resistance to different environmental conditions.

PPI observes and adheres to strict quality requirements during the production process by means of its Quality Assurance Systems, whilst the manufacturing processes are subject to continuous in-process inspections. ISO 9001 Certification is testimony to Polymer Products Impex (Pvt) Ltd commitment to offering the highest quality products.

The company also has a state of the art and complete testing laboratory to measure: tensile properties including rubber to metal bonding, hardness, creep, relaxation and compression set, thermal properties, rheological properties, rubber compound characteristics (dispersion and specific gravity) as well as yarn testing.

partners with its clients in to deliver customized rubber product solutions utilizing in-depth technical knowledge, specialized material formulations and the latest technologies. Some examples of the products PPI manufactures are provided below:



PPI MARINE FENDERING SYSTEM

In today's competitive business environment and rising operating costs, the any industry cannot afford to have berthing facility, pier, jetty or any other commercial facilities out of service because of damage caused by improper fendering/damping systems. For this reason, a good understanding of the latest in fendering technology could prove to be an industrial operator's competitive edge in attracting future business and retaining existing business. Trust PPI Marine Fendering systems to inform you of the latest fendering technology and recommend the appropriate fendering system for your Berthing facility/pier/jetty or to your vessel. Our engineers can design the perfect system, then custom fabricate it for quick and easy installation. Or, for a unique application, we will custom design and manufacture a special fendering solutions. For years, our highly effective, reliable fendering solutions have been used in a large variety of military, marine, transportation, highway and bridge, and industrial applications around the world.

Unlike suppliers who use reclaim rubber and other lower cost compounds to make their products, PPI Marine Rubber Fenders are manufactured using only highest-quality Natural rubber grades and superior synthetic rubber compounds with proven performance. There is a difference.

PPI Specialized Marine fender rubber's outstanding properties are unaffected by ozone, which can cause cracking in traditional rubber compounds such as natural rubber and butyl, particularly under stress. Our Rubber formulations have much greater resistance to sunlight and oxidation. When exposed to natural elements, PPI Compounds should outlast other rubber compounds by a substantial margin. It can perform up to 5x longer resulting in substantial savings on replacement costs. Unless your Dock Bumpers and Fenders are made from PPI Specialized rubber, you're getting an inferior product.

Benefits of using PPI Bumper Protection

- PPI Rubber Bumpers are virtually maintenance free
- Provides maximum protection against vehicle damages to the Berthing facilities and to vessels
- Eliminates costly repairs to severe shocks/damages to berthing and Vessel structures
- Constructed to last long and provide years of protection
- Anchored through thick steel angles to provide stability
- Performs on any vessel or dock in any type of weather condition

PPI MARINE FENDER SOLUTIONS

Since the inception PPI has specialized in the manufacture of a comprehensive range of high-quality Fenders, Fender accessories and components. Our engineering and manufacturing expertise deliver world-class rubber fender solutions that are built to withstand the harshest conditions. Our focus is on high performance, low maintenance products to ensure we deliver our clients solutions that improve plant/facility availability, reduce downtime and minimize maintenance expenditure. PPI has developed a diverse and market leading range of bumper systems to suit all applications and provide protection to your commercial vessels, buildings, loading bays, berths and other structures.

Our range of diverse rubber fender options are designed to be applied on any environment. PPI can both extrude and mould any fender product as per the standard sizes or for custom sizes as per the customer request.

PPI delivers world-class products manufactured to withstand the harshest conditions. Our high performing products are designed to minimize the costs associated with the major repairs of the truck berths without compromising performance.

D FENDERS

D fenders are the commonly used rubber bumpers across the world, and they are produced by means of extrusion and molding in an extensive range of designs and sizes. The flat back of this type of fender



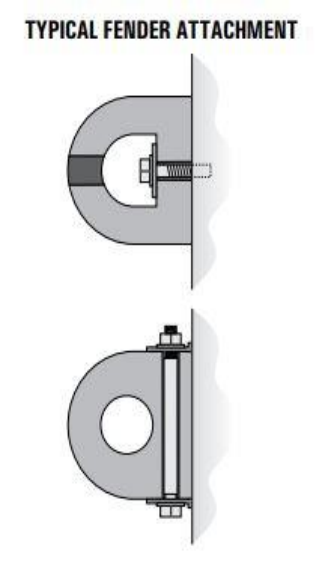
facilitates the easy installation of D fenders on various surfaces for the protection of ships and docks.

PPI produces a wide range of D fenders in the most common sizes. D fenders are kept in stock in all sizes for fast delivery. Non-standard sizes and customer specific versions can also be produced with short lead times. Smaller D fenders are also available in longer lengths and in various colours (non-marking).

For optimum installation all fenders can be pre-processed by PPI as follows:

- pre-curved to the desired radius
- cut to length
- beveled ends
- provided with mounting holes

In addition to the standard range with fenders, at PPI, we also deliver many custom-made fenders. Fenders in different sizes and shapes and with special mounting methods, colors and non-marking characteristics.



Selecting the right size and style.

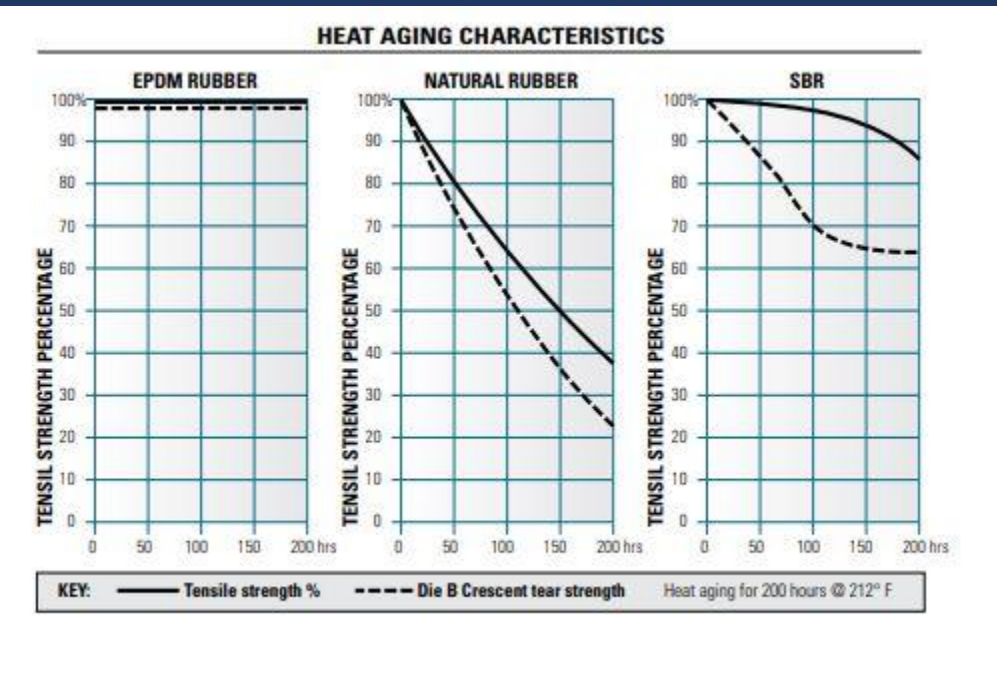
Our fender experts are always available to give you design assistance when you need it. We will recommend the correct geometry, fender cross section and size for your specific application.

Custom fabricating for easy installation.

With our custom fabrication we can eliminate on-site installation problems. We can angle-cut, slot and custom fabricate the fender to fit your requirements. Our fender experts will work with your specs to custom drill holes to match stud size and spacing.

Recommended bolt spacing and type of attachment.

Bolt size and spacing are determined by the size of fender, fender usage and mounting arrangements.



Impact Protection Systems are ozone resistant.

A PPI Bumper system can last 4x longer than SBR or butyl fenders. Ozone can cause cracking in these lower cost compounds particularly under stress. PPI Bumper systems resists sunlight, oxidation, seawater and many chemicals.

Generic Fenders in the Market



PPI Specialized Fenders



Fenders That Stand Tough In Tough Industrial Environments

Locally available and imported cheaper fenders deteriorates rapidly in natural industrial environments. PPI bumpers outlasts traditional bumpers by substantial margin offering cost effectiveness and superior quality to the client.

Customized Cutting to fit unique applications.

Our fender specialists have the equipment and experience to angle-cut, slot and custom fabricate your new fendering to match your installation requirements. Selected profiles are also available in longer lengths/continuous reels.

Custom Designed Extrusions, any shape, any style, any size

When your dock or vessel demands a unique fendering system, Duramax Marine® can custom engineer and manufacture the shape, style, and size your application requires. One of our engineers will work with you closely to help match your specs and design a custom system for your application.

Customized Hole Drilling eliminates on-site installation hassles

Without the right tools and equipment, hole drilling in the field can be a difficult task. Save time and effort by letting us custom fabricate your bumper to fit your specific application. We will custom drill the fender to match the exact size of studs and space the holes to match your stud size and spacing. It makes the installation of your new fendering system quick and easy

There are three standard types apart from a wide array of customized D fenders available:

- DD fender with a D-shaped inner chamber
- DC fender with an O-shaped inner chamber
- Solid D fender without an inner chamber

PPI produces a wide range of D fenders in the most common sizes. D fenders are kept in stock in all sizes for fast delivery. Non-standard sizes and customer specific versions can also be produced with short lead times. Smaller D fenders are also available in longer lengths and in various colours (non-marking).

PP Wing Type Fenders

Wing type fenders are an extension of the D fenders which are developed further. They are often used as an alternative for the protection of Vessel walls, docks and piers. This type of fender is generally mounted in a profile, which creates a bumper that is highly resistant to various forces. PP wing fenders are easy install and replace when necessary.



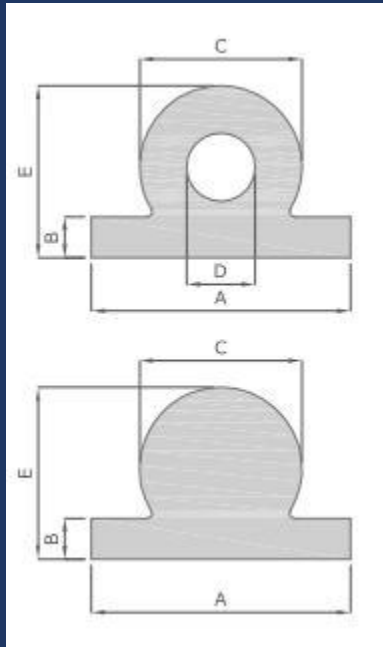
Figure 1: PPI Manufactured Wing Type fenders for Sri Lankan and Export Markets

TYPES OF WING FENDERS

Standard Wing fenders have an O shaped inner chamber, but in some cases wing fenders are produced without an inner chamber. (Solid) PP produces fenders in a standard range and most common sizes are kept in stock and could be delivered under short notice. Customer specific sizes and designs of wing fenders or fenders in different colors other than black (Non marking) can also be produced under short period of time.



Figure 2: O Type inner and Solid Bulb Wing Type Fenders produced by PP



FIXING AND INSTALLATION

Wing type fenders are usually mounted between two steel angles, which is strong type of construction that is also easy to install. This type of fenders can also be attached by means of two rows of screws or it can be glued on with a special sealant.

We can provide the required mounting holes. Wing fenders can also be produced and vulcanized with special radius so that it fits perfectly to a bow or stern of a ship. Most wing fenders can be provided with specific lengths and either ends can be beveled.

MOST COMMON APPLICATIONS OF WING TYPE FENDERS

Wing type fenders are most commonly used in various sizes and designs in,

- a) Work boats b) Pilot Boats c) Tugboats
- d) Quays e) Piers f) Warehouses

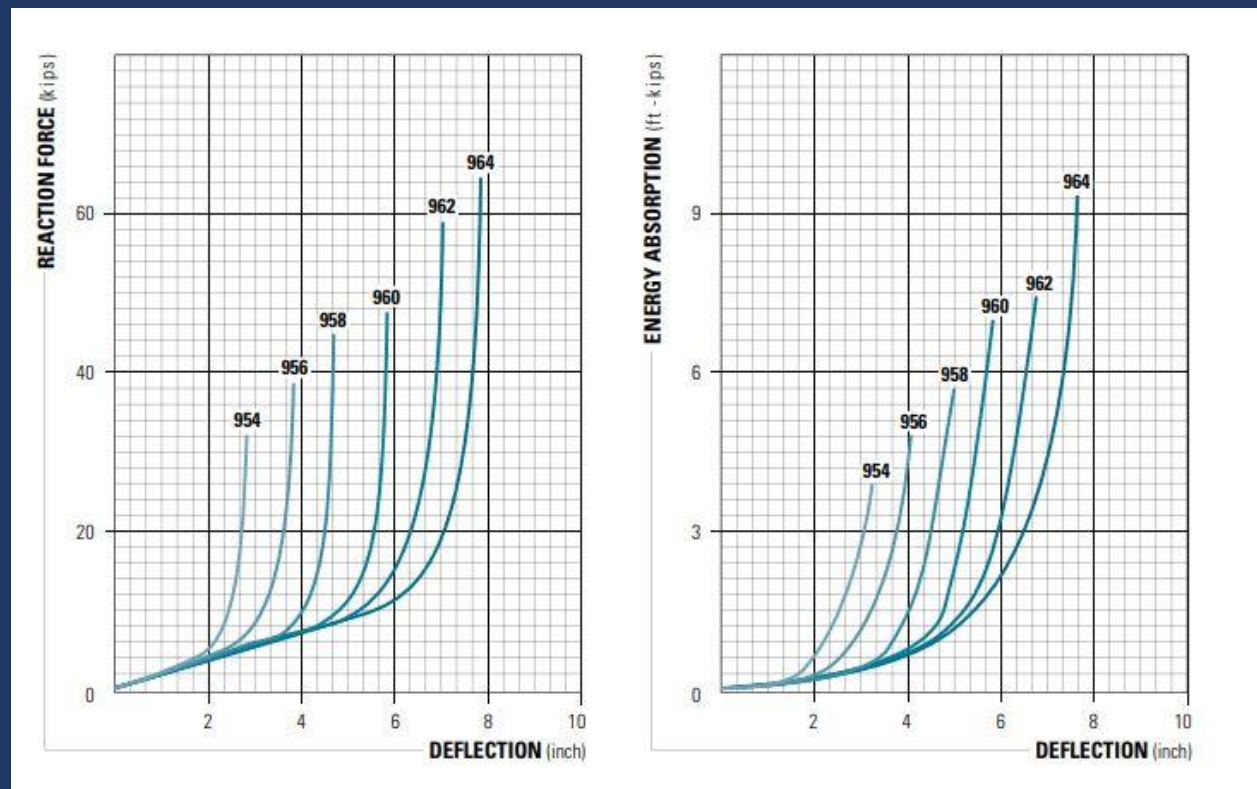
Following table includes the standard PP wing fender sizes that can be made to order within very short period. Furthermore, PP has the ability to make custom sized fenders upon client request with very short lead times.

A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (Kg/m) with Bore	Weight (Kg/m) Solid
180	25	100	50	100	11	13
215	30	150	75	150	20	26
245	30	150	75	150	21	27
280	40	200	100	200	36	40
320	40	200	100	200	38	48
370	50	250	125	250	57	72
410	50	250	125	250	60	78

PP WING TYPE FENDER PRODUCT PERFORMANCE

PP Wing type fenders can be fitted by means of bolts and or strips in various manners: horizontally, vertically or diagonally. The mounting holes required are made through the side or through the top and bottom of the fender. PPI finishes the fenders in accordance with your requirements and drawings. Wing type fenders can also be produced vulcanized with required radiuses, which allow them to be fitted properly to a circular bow or stern. Wing type fenders can be provided in specified lengths and the ends can be bevelled.

Solid or O shaped Inner Wing type fenders are designed for general purpose. Mount by drilling an access hole through the top of the Bulb and a base hole through the flat part of the Wing type Fender. Offered in three colors: black, non-marking grey and white



Elastomer Properties

PPI Rubber fenders are manufactured from the highest quality Natural Rubber (NR) and optionally synthetic rubber compound-based compounds which meet or exceed the performance requirements of ASTM D2000 M3AA614Z1 (Z1= 65 +/- 5). Typical Performance of the PPI Impact protection polymer compounds are listed in the table below.

Property	Test Method	Specification
Original Properties:		
Color		Black (Default) Any other color could be provided
Hardness (IRHD)	AS1683.15.2, ASTM D2240, BS903A.Z	65 ± 5
Tensile strength at failure	AS1683.11, ASTM D412, BS903A.Z	> 21 MPa
Elongation at failure	AS1683.11, ASTM D412, BS903A.Z	> 450%
Tensile strength after heat aging for 96 hr at 70°C	AS1180.3, ASTM D573, BS903A.Z	> 80% of tensile strength before aging
Water absorption for 168 hr at 20°C	ASTM D471	< 5% (by weight)
Resistance to ozone cracking for 100pphm at 20% strain at 40°C for 96hr	AS1683.13B, ASTM D395, BS903A/6A	No cracks
Compression set after 22hr at 70°C	AS1683.13B, ASTM D395, BS903A/6A	< 30%
Tear resistance	AS1683.12, ASTM D624, BS903A.3	> 70 kN/m
Abrasion resistance	AS1683.21, ASTM D1630, BS903A.9	< 0.5 ml

** If a report is required on the rubber specifications it could be provided under a special request.



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