



## Floating Fenders

### Yokohama Floating Fenders – Pneumatic 50/80

Yokohama began manufacturing floating pneumatic fenders in 1958. Since then, more than 60,000 Yokohama fenders have been supplied into ship-to-quay and ship-to-ship applications worldwide. Put quite simply, over the course of the past half-century more people have put their faith in Yokohama fenders than in any other brand of pneumatic fender. And that faith has been justified by the durability and longevity of the fenders – providing an outstanding return on the investment which their owners have made in them.

ISO 17357 is now firmly established within the marine industry as the international standard for the manufacture, testing and performance of pneumatic rubber fenders.

Over the years Fendercare Marine has discovered that although other manufacturers may be claiming full compliance to ISO 17357, it can be demonstrated that in certain cases irregularities have been found where fenders that have been supplied as compliant do not in fact comply with the standard in one or more of the following criteria:

- incomplete material tests
- hydrostatic pressure test wrongly conducted or failed
- incorrect evaluation of angular and durability tests
- incorrect reinforcement material used
- rubber specifications not meeting ISO 17357 requirements
- certificates out of date or non-existent

Drawings and picture references are for illustration purposes only.

Yokohama can demonstrate compliance to PIANC 2002 for floating pneumatic fenders. Further information can be supplied on request.

### Advantages

#### Safe for excess load

The reaction force of a floating pneumatic fender does not increase sharply even under excess load. Therefore, these fenders perform extremely well under such conditions and, as a result, protect ships and mooring facilities.

#### No deterioration or variation in performance

Because pneumatic fenders use the compressive elasticity of air, there is no performance deterioration due to fatigue. The performance of these fenders remains unchanged at extremely low temperatures, even below  $-50^{\circ}\text{C}$ .

#### Safety and reliability

Yokohama pneumatic rubber fenders are constructed using several layers of strong tyre cord and are therefore extremely resistant to pressure and cutting. The larger sizes (2.5m dia upward) are fitted with a safety valve to prevent accidents in the event of over compression.



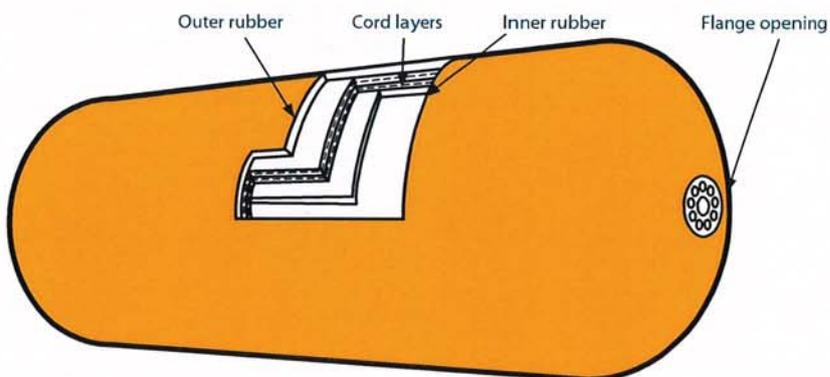
### Construction

The fender body is constructed of an inner rubber layer, reinforcing cord layers and an outer rubber layer. All of these layers are vulcanised together and then proven by hydraulic pressure test.

The outer skin rubber compound is designed and manufactured to be able to withstand both strenuous use including abrasion during adverse weather conditions whilst protecting the cord layers and inner rubber.

The synthetic tyre cord layers are arranged at optimum angles designed to distribute load and stress evenly. The inner rubber compound is designed to be completely airtight, utilising a compound equivalent to that of an inner tube of a car tyre.

To provide maximum strength and safety, the outer skin of a hydro-pneumatic fender is thicker than a normal surface fender.



Typical cut section of fender wall

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Properties of Outer and Inner Rubber Material				
Test Item		Inspection Methods	Outer Rubber	Inner Rubber
Before ageing	Tensile strength	ISO 37:1994	18 Mpa or more	10 Mpa or more
	Elongation	ISO 37:1994	400% or more	400% or more
	Hardness	ISO 7619:1997	60±10 (Durometer hardness Type A)	50±10 (Durometer hardness Type A)
After ageing test method ISO188:1998 70±1°C x 96 hrs	Tensile strength	ISO 37:1994	Not less than 80% of the original property	Not less than 80% of the original property
	Elongation	ISO 37:1994	Not less than 80% of the original property	Not less than 80% of the original property
	Hardness	ISO 7619:1997	Not to exceed the original property by more than 8	Not to exceed the original property by more than 8
Tear resistance		ISO 34-1:1994	400 N/cm or more	No requirement
Compression test		ISO 815:1991	30% (70±1°C for 22hrs) or less	No requirement
Static ozone ageing test		ISO 1431-1:1989	No cracks after elongation by 20% and exposure to 50pphm at 40°C for 96 hrs	No requirement

### Simple and low cost installation

The weight of the fender is supported by the water on which it floats. Fenders can, therefore, be moored simply by means of a guy rope or chain at minimal cost. They can be removed easily to another position when not in use and transferred to alternative mooring points as required.

### Chain and tyre net

In the vast majority of cases, a chain and tyre net will be fitted to a pneumatic fender to protect the body from damage by sharp objects or via the absorption of sheer loads during berthing. The better the net, the more protection it will offer.

From experience in using these fenders ourselves, we have developed a unique high protection net system which offers more protection to the body of the fender than any other net available in the market today – thereby potentially extending the life of the fender.



Fender fitted with Fendercare Marine designed nets



Fender fitted with competitor's net

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We have the widest possible experience of the varying needs of a protective net and offer a range to meet all needs:

- lightweight nets to meet ship's crane and davit limitations
- heavy duty nets to cope with harsh sea conditions and high snatch loads
- double nets to offer stand-off options
- non-marking tyre nets for navy and cruise ship applications
- rope nets for ultra lightweight applications
- stainless steel nets for non-magnetic requirements

All Fendercare Marine nets are designed with ease of maintenance in mind. The net is built in sections so it remains easy and cost effective to repair, should a specific area of the net sustain damage.

### Identification

Each fender has the following markings:

- identification requirements
- international standard number and applicable year
- size (diameter and length)
- initial internal pressure
- date of manufacture
- name of manufacturer
- individual serial number
- type of reinforcement layer

### RFID tagging system

Radio Frequency Identification (RFID) is now fitted to all Yokohama fenders. A tag is buried in both ends of the fender enabling easy reading however they are positioned. This RFID tag was introduced so you can identify the individual fender should the standard markings become unreadable. It will also assist in the maintenance of records and inventories over the long-term.

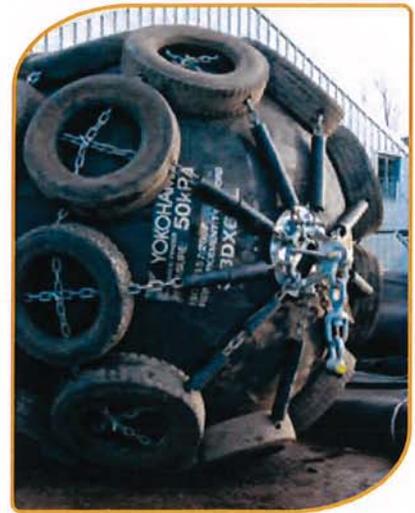
Fendercare Marine are able to supply the RFID Tagging Reader as an optional extra. This reader can read all RFID tags mounted on fenders manufactured to this specification.

Fendercare Marine also maintains a database of all Yokohama fenders that are sold worldwide and can therefore assist in returning fenders to their rightful owners, should they become lost or stolen.

### Certification

Each fender is supplied with a certificate, detailing the following:

- material for rubber and fitting metal
- satisfactory results of tests
- record of compression test
- dimension and weight
- record of serial number and RFID tag number



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Technical Performance Table									
Pneumatic 50 (Metric) Standard Sizes									
Nominal Size Diameter x Length	Initial Internal Pressure	Guaranteed Energy Absorption (GEA)	Reaction Force at GEA	Hull Pressure at GEA	Safety Valve Setting Pressure	Testing Pressure	Approx. Fender Body Weight	Approx. Weight of Net	Weight of Sling Type (Type II)
mm x mm	kPa	kNm	kN	kPa	kPa	kPa	kg	kg	kg
500 x 1000	50	6	64	132	-	200	22	160	32
700 x 1500	50	17	137	135	-	200	45	185	55
1000 x 1500	50	32	182	122	-	200	73	250	98
1000 x 2000	50	45	257	132	-	200	88	385	113
1200 x 2000	50	63	297	126	-	200	131	430	156
1350 x 2500	50	102	427	130	-	200	200	675	240
1500 x 3000	50	153	579	132	-	200	250	795	290
1700 x 3000	50	191	639	128	-	200	290	830	330
2000 x 3500	50	308	875	128	-	200	405	1165	465
2000 x 4500	50	418	1188	137	-	200	480	1700	540
2500 x 4000	50	663	1381	137	175	250	902	1745	1080
2500 x 5500	50	943	2019	148	175	250	1090	2765	1320
3300 x 4500	50	1175	1884	130	175	250	1460	2650	1840
3300 x 6500	50	1814	3015	146	175	250	1870	3840	2250
3300 x 10600	50	3067	5257	158	175	250	2560	6755	3060
4500 x 9000	50	4752	5747	146	175	250	3940	7365	-
4500 x 12000	50	6473	7984	154	175	250	4790	9875	-

- Note: 1. Figures on the table comply with requirements of ISO 17357.  
 2. Weight of fender body and net may vary ±10%. Net weights are based on Fendercare Marine's standard design.  
 3. Special sizes are available upon request.

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