BOOMARINE SUPPLIES

BOOMARINE SUPPLIES LTD.

PNEUMATIC FENDER

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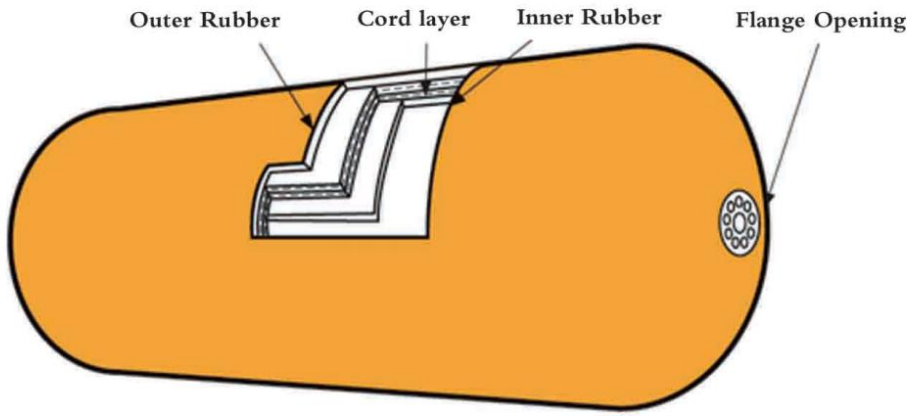
INTRODUCTION

Fender which is made of synthetic-cord-reinforced rubber sheet with compressed air inside, at initial pressure of 50kpa or 80kpa, to enable it to float on the water and work as a shock absorber between two ships, or between ships and berthing structures when they come alongside each other on the water.

CONSTRUCTION

The pneumatic fender is constructed of an inner rubber, synthetic-tyre-cord layer and outer rubber. All of those shall be vulcanized firmly and proven by compress test. Outer rubber layer that covers the outside of the fender to protect the cord layers and the inner liner rubber from abrasion and other external forces. Inner rubber Layer of a rubber membrane that seals the pressurized air inside the fender. Synthetic-tyre-cord layer for reinforcement layer made of synthetic-tyre-cord fabric, which maintains the internal air pressure of the fender. Fender of diameter 2500mm and larger shall be equipped with a safety valve for releasing excess internal pressure when the fenders are over-compressed accidentally. Fenders are smaller than 2500mm in diameter, can be equipped with a safety valve if required.



FENDER TYPES

Fender types include net-type and sling type.

Net-type fenders shall be covered by a tyre net, fibre net, or rubber net. Each end of longitudinal chains, ropes, or fibres shall be linked together with one or two rings, which shall be connected with a guy-chain or guy-rope. Usually these nets will be fitted with used tyres or rubber sleeves to provide additional protection to the fender body.

Sling type

rubber net type

fibre net type

tyre net type

INITIAL INTERNAL PRESSURE &PERFORMANCE

a) Initial internal pressure 50kpa b) Initial internal pressure 80kpa

Pneumatic 50 fender size and performance requirements(table1)

Nominal size dia.x length (mm)	Initial internal pressure kpa	Guaranteed energy absorption (GEA)	Reaction force at GEA Deflection (R)	Hull pressure(internal pressure) at GEA deflection (P)
		Min. Value at deflection 60±5% KJ	Tolerance ±10% KN	Reference value Kpa
500 x 1000	50	6	64	132
600 x 1000	50	8	74	126
700 x 1500	50	17	137	135
1000 x 1500	50	32	182	122
1000 x 2000	50	45	257	132
1200 x 2000	50	63	297	126
1350 x 2500	50	102	427	130
1500 x 3000	50	153	579	132
1700 x 3000	50	191	639	128
2000 x 3500	50	308	875	128
2500 x 4000	50	663	1381	137
2500 x 5500	50	943	2019	148

3300 x 4500	50	1175	1884	130
3300 x 6500	50	1814	3015	146
3300 x 10600	50	3067	5257	158
4500 x 9000	50	4752	5747	146
4500 x 12000	50	6473	7984	154

Pneumatic 80 fender size and performance requirements(table2)

Nominal size dia.x length (mm)	Initial internal pressure kpa	Guaranteed energy absorption (GEA)	Reaction force at GEA Deflection (R)	Hull pressure(internal pressure) at GEA deflection (P)
		Min. Value at deflection 60±5% KJ	Tolerance ±10% KN	Reference value Kpa
500 x 1000	80	8	85	174
600 x 1000	80	11	98	166
700 x 1500	80	24	180	177
1000 x 1500	80	45	239	160
1000 x 2000	80	63	338	174
1200 x 2000	80	88	390	66
1350 x 2500	80	142	561	170
1500 x 3000	80	214	761	174
1700 x 3000	80	267	840	168
2000 x 3500	80	430	1150	168
2500 x 4000	80	925	1814	180
2500 x 5500	80	1317	1653	195
3300 x 4500	80	1640	2476	171
3300 x 6500	80	2532	3961	191

3300 x 10600	80	4281	6907	208
4500 x 9000	80	6633	7551	192
4500 x 12000	80	9037	10490	202

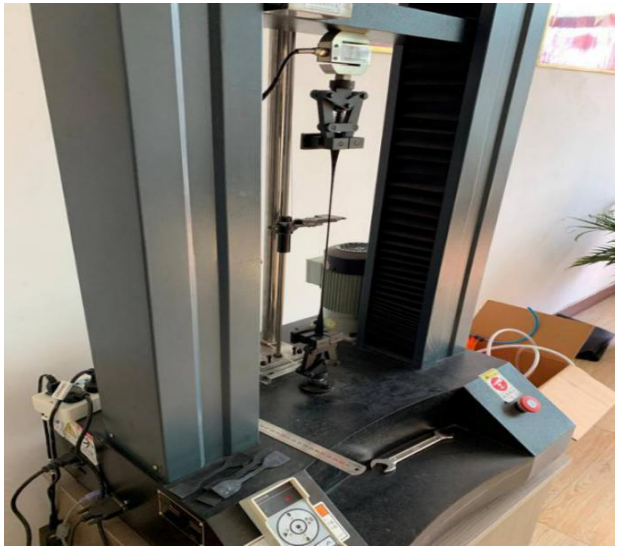
Outer and Inner Rubber Material Requirements (table 3)

Test item	Test method	Required Value	
		Outer rubber	Inner rubber
Before aging	ISO17357-1-2014 GB/T 21482-2008	-	-
1.1 tensile strength		⩾18Mpa	⩾10Mpa
1.2 elongation		⩾400%	⩾400%
1.3 hardness		60±10	50±10
After aging		(70℃±1℃， 22h）	(70℃±1℃， 22h）
tensile strength		⩾80% of the original property	⩾80% of the original property
2.2 elongation		⩾80% of the original property	⩾80% of the original property
2.3 hardness		Not to exceed the original property by more than 8	Not to exceed the original property by more than 8
Tear		400N/cm or more	No requirement
Notes: if the color of the outer cover is not black, the material requirements will differ from those in this table.			

TEST &INSPECTION

1). Material Test

The material test for outer rubber and the inner rubber shall be conducted in accordance with the specification given in table 3, and the results shall satisfy the requirements given in table 3.



2). Dimensional checking

The dimensions of all the fenders shall be inspected at the initial internal pressure and the results shall be within the following tolerances:
Length: +10%， -5%

3). Air-leakage test

The air-leakage test shall be conducted on all fenders at initial pressure for more than 30min, and the test results shall confirm that there is no air leakage.

4). Compression Test

The compression test shall be conducted in accordance with the specification given in table 1&2, and the results shall satisfy the requirements given in table 1&2.

How to select a suitable pneumatic rubber fender?

In order to calculate a suitable fender arrangement it is necessary to calculate the berthing energy of a ship which must be absorbed by the fender at the point of contact.

Here is a quick reference for choosing a suitable pneumatic rubber fender:

PETROLEUM				
Equivalent Displacement Coefficient(C)	Relative Velocity	Berthing Energy	Suggested Fenders	Typical Pneumatic Rubber Fender
Tonnes	m/s	Tonnes.m	Quantity	D x L (m)
1,000	0.30	2.4	3 or more	1.0 x 2.0
3,000	0.30	7.0		1.5 x 3.0
6,000	0.30	14.0		2.5 x 5.5
10,000	0.25	17.0		2.5 x 5.5
30,000	0.25	40.0	4 or more	3.3 x 6.5
50,000	0.20	48.0		3.3 x 6.5
100,000	0.15	54.0		3.3 x 6.5
150,000	0.15	71.0	5 or more	3.3 x 6.5
200,000	0.15	93.0		3.3 x 6.5
330,000	0.15	155.0	6 or more	4.5 x 9.0
500,000	0.15	231.0		4.5 x 9.0

LIQUEFIED GAS				
Equivalent Displacement Coefficient(C)	Relative Velocity	Berthing Energy	Suggested Fenders	Typical Pneumatic Rubber Fender
Tonnes	m/s	Tonnes.m	Quantity	D x L (m)
1,000	0.30	4	3	1.0 x 2.0
3,000	0.30	12	3	1.5 x 3.0
5,000	0.30	24	3	2.0 x 3.5
8,000	0.25	25	3	2.0 x 3.5
20,000	0.25	61	3	3.3 x 6.5
40,000	0.20	74	4	3.3 x 6.5
80,000	0.15	78	4	3.3 x 6.5

NOTE: the table should be interpreted using the following formula:

C=2 x Displacement ship A x Displacement ship B/(displacement A + Displacement ship B)

If the C is between two coefficients, the fender size shall be selected for larger coefficient in the tables.

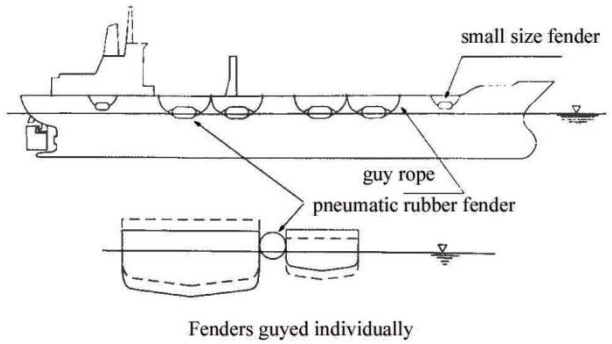
APPLICATIONS & INSTALLATION

The fenders are used primarily for two applications: Ship-to-Ship and Ship-to-Dock. For ship-to-ship application the fenders are used to berth or moor two vessels side by side (double-banking) in port or at sea. For ship-to-dock application the fenders are used to berth a vessel alongside a dock or wharf.

Ship-to-Ship (STS) Operation

Fenders used in STS transfer operation offshore are divided into two categories:

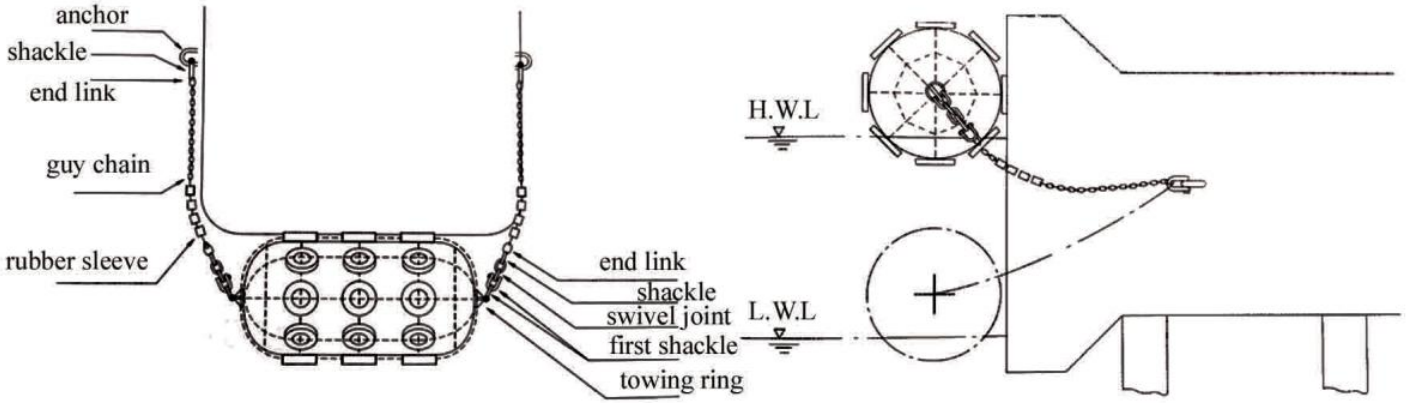
1. Primary fenders which are positioned along the parallel body of the ship to afford the max. Possible protection while alongside.
2. Secondary fenders which are used to protect bow and stern plating from inadvertent contact if the ships get out of alignment during mooring and unmooring. It is important that secondary fenders are properly secured and it may be necessary to move secondary fenders prior to unmooring if the likely points of contact have changed due to changes in the freeboards of the two ships. Meanwhile, secondary fenders should be light in weight because they must often be hauled well above the waterlines and located in positions with limited access to lifting gear or support points. So it may help if fenders can be moved quickly to counter possible inadvertent contact.



Fenders guyed individually

Ship-to-Dock(STD) Operation

Beside used for STS operation, pneumatic rubber fenders also used for dock and wharf protection. Compared with traditional solid rubber fenders, pneumatic rubber fenders have a perfect energy absorption and soft reaction force. Meanwhile, as floating rubber fenders, they could be adaptable to tide changes. Nowadays, pneumatic rubber fenders are widely used in some large shipyards, docks and ocean platforms.



INFLATION OPERATION

HOW TO KEEP THE PNEUMATIC FENDERS?

1. keep the fender away from sharp objects, in case damage the fender body

2. Keep away from acid, oil, and other organic solvents

3. If fenders are not used for a long time, they should be washed to clean, dried, and properly compressed air inflated. Put them in a dry, cool, and ventilated area.

4. The storage area should be far away from the heat source.

5. Don't put heavy objects on the fender when the fender not in use.

6. Fender in normal usages should be checked the inner pressure every 3 months, meanwhile, air valve core should be replaced every 6 months.

MAINTANCE &TOOLS

Tool Box								
Pressure gage	Air hose	Wrench	Quick coupling	Valve core	Sand paper	Brush	Repair rubber	Quick adhesive