



FENDER MARINE
— AUSTRALIA —





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AUSTRALIA

The only Western Australia Yokohama fender supplier.



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FENDERS

The commitment to quality is our top priority at Fender Marine Australia, therefore our manufacturer management system is ISO9001:2000/ISO14001:2004 and CCS certificated, complying with all expected standards in manufacturing of fender products. Our manufacturer's quality control centre comprises of all necessary machinery needed to perform individual specific testing on all products to supply the highest quality fenders to customers. Tests on all fender products prior to delivery include:

- Compression Test
- Tensile Test
- Ozone Resistance Test
- Abrasion Resistance Test

All rubber fenders are also routinely tested to verify consistent performance, quality and to meet the latest verification testing protocols defined by PIANC and ASTM. This ensures all rubber fenders meet the published Rated Performance Data. The factory is also approved by **BUREAU VERITAS** to **PIANC 2002 – Guidelines for the design of Fenders systems**
Appendix A: a procedure to determine and report the performance of marine fenders and ASTM D standard Test Methods of Vulcanised Rubber and Thermoplastic Elastomers/Tension.



Pneumatic Fender

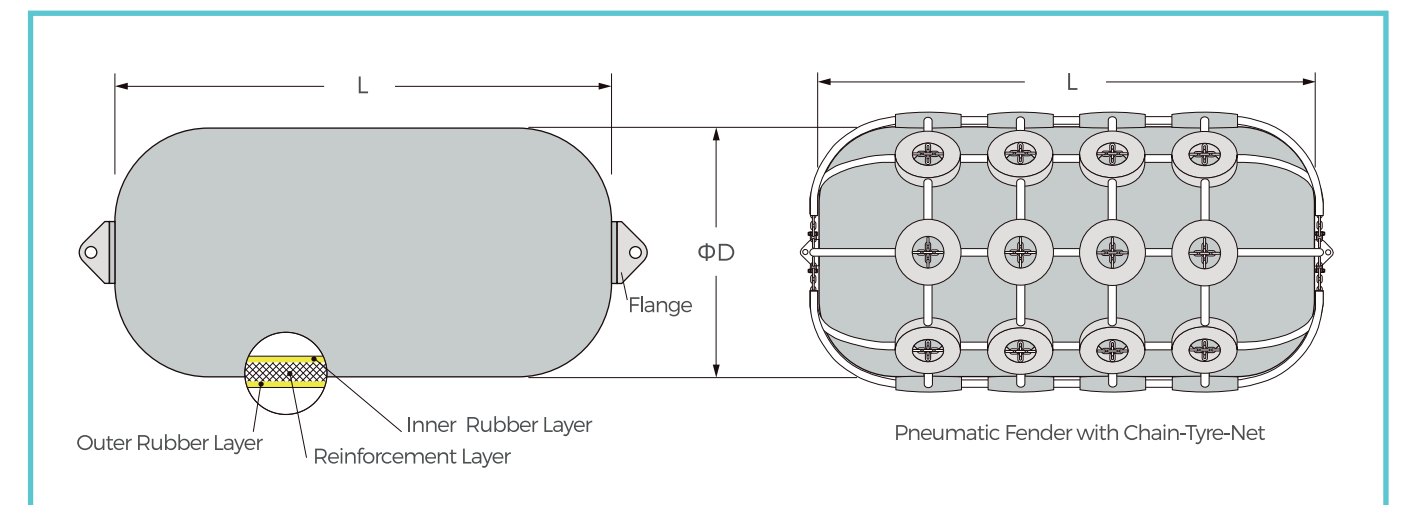
Pneumatic Rubber Fenders have been in use for around 50 years. It is the leading anti-collision device for marine application in the world. This compressed air filled rubber fender is used as a protective medium for ship-to-ship contact (STS), ship to quay (STQ) and ship-to-berthing (STB).

FEATURES

- Adjust performance by varying initial pressure
- Suitable for areas with large or small tides
- Maintains large clearances between hull and structure
- Optional chain-tyre nets for heavy duty applications
- Easy installation
- Very low reaction and hull pressure

APPLICATIONS

- Tankers, gas carriers and bulk cargo ships
- Fast ferries and aluminium hulled vessels
- Temporary or permanent installations
- Rapid response and emergency fendering
- As stand-off fenders to realign ships with shore facilities

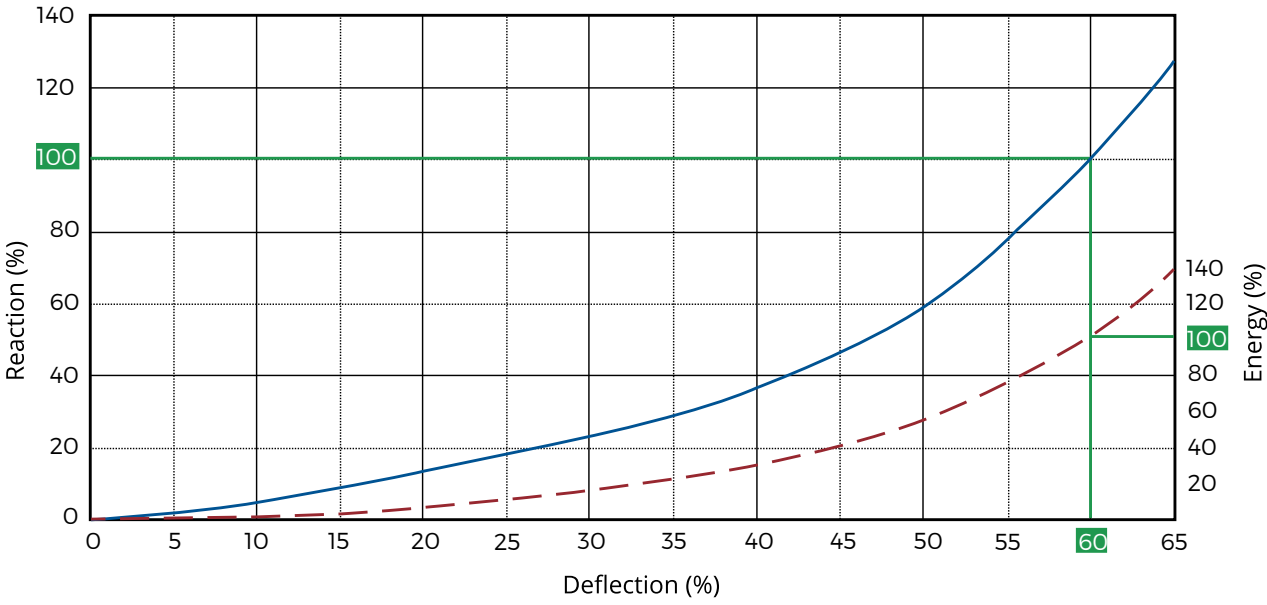


DIMENSIONS & RATED PERFORMANCE DATA

Initial Pressure	50kPA			80kPA		
Model DxL (mm)	Energy Absorption	Reaction Force	Hull Pressure	Energy Absorption	Reaction Force	Hull Pressure
FCQ 500x1000	6	64	132	8	85	174
FCQ 600x1000	8	74	126	11	98	166
FCQ 700x1500	17	137	135	24	180	177
FCQ 1000x1500	32	182	122	45	239	160
FCQ 1000x2000	45	257	132	63	338	174
FCQ 1200x2000	63	297	126	88	390	166
FCQ 1350x2500	102	427	130	142	561	170
FCQ 1500x3000	153	579	132	214	761	174
FCQ 1700x3000	191	639	128	267	840	168
FCQ 2000x3500	308	875	128	430	1150	168
FCQ 2500x4000	663	1381	137	925	1815	180
FCQ 2500x5500	943	2019	148	1317	2653	195
FCQ 3300x4500	1175	1884	130	1640	2476	171
FCQ 3300x6500	1814	3015	146	2532	3961	191
FCQ 3300x10600	3067	5257	158	4281	6907	208
FCQ 4500x9000	4752	5747	146	6633	7551	192
FCQ 4500x12000	6473	7984	154	9037	10490	202

The sizes listed above are partial and only for reference, other sizes besides the above [Units: kNm,mm,kN,kN/m]² can be customised. Contact us for specific model capacities and safety factors.

PERFORMANCE CURVE



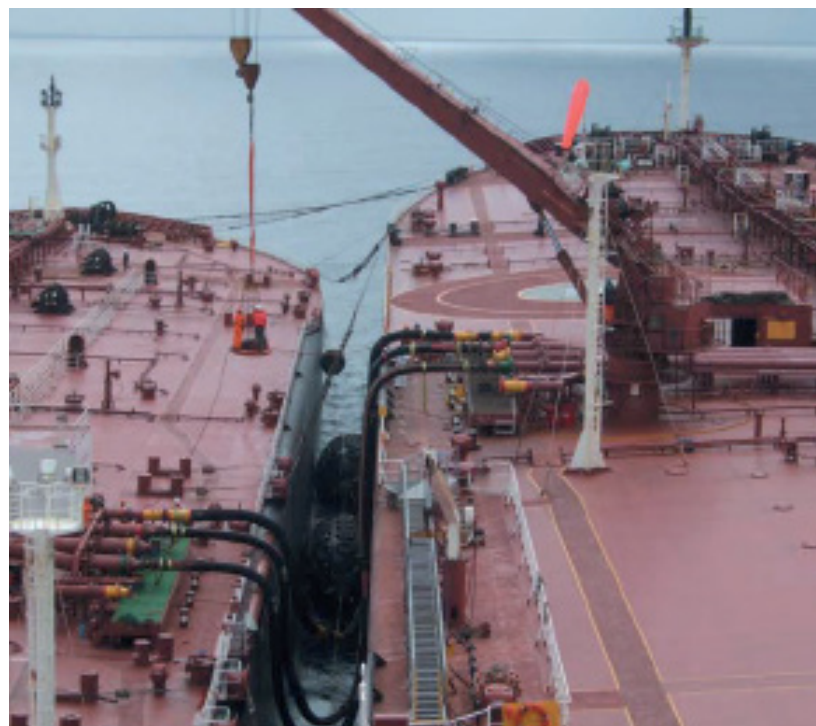
Fender Marine Australia – the only
Western Australia Yokohama fender supplier





The “Yokohama Pneumatic Rubber Fender” was developed in 1958 based on a rubber company’s technology for automobile tyres and rubber aircraft fuel tanks. Progress in the development of such floating pneumatic rubber fenders is closely related to the progress and development of ship technology, and has to continuously cope with progressively larger oil tankers such as VLCC’s, ULCC’s, large gas carriers, bulk carriers and floating structures. Floating pneumatic fenders are used world wide for ship-to-ship (STS) transfer operations, terminals and for all kinds of ships. Since its creation until today, more than 45,000 fenders have been supplied worldwide both for ship-to-ship and ship-to-dock operations serving our valuable customers. These fenders play a critical role in the safe operation of ship berthing and mooring.

SHIP-TO-SHIP (STS) OPERATIONS



Yokohama Pneumatic Fender (continued)

Advantages

The Yokohama Rubber Co., Ltd. confirms that all its Pneumatic Rubber Fenders fully comply with all requirements of ISO17357.

1. SAFETY AND RELIABILITY

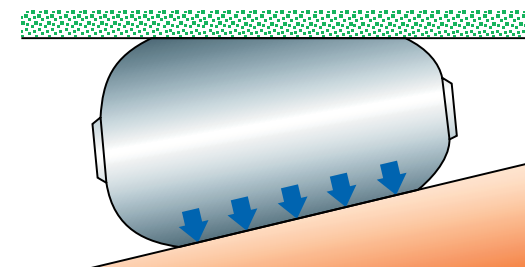
Fenders are constructed of several layers of strong tyre-cord, and are thus resistant to pressure and cutting.

2. NO DETERIORATION OR VARIATION IN PERFORMANCE

Fenders utilise the compressive elasticity of air, therefore performance deterioration due to fatigue is absent.

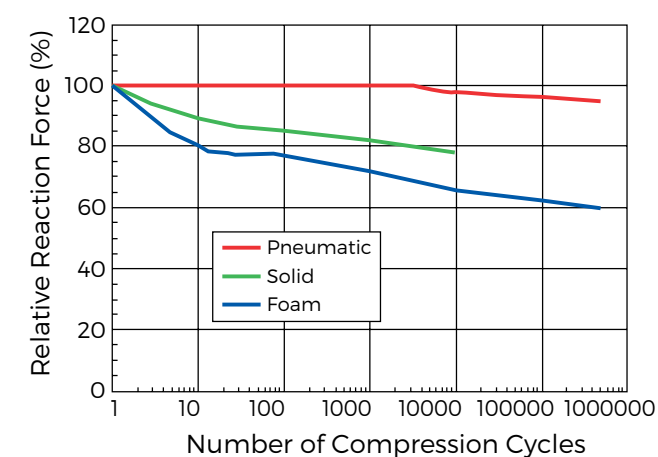
3. ADVANTAGES AT INCLINED BERTHING

Energy absorption does not decrease at inclined compression up to 15 degrees.



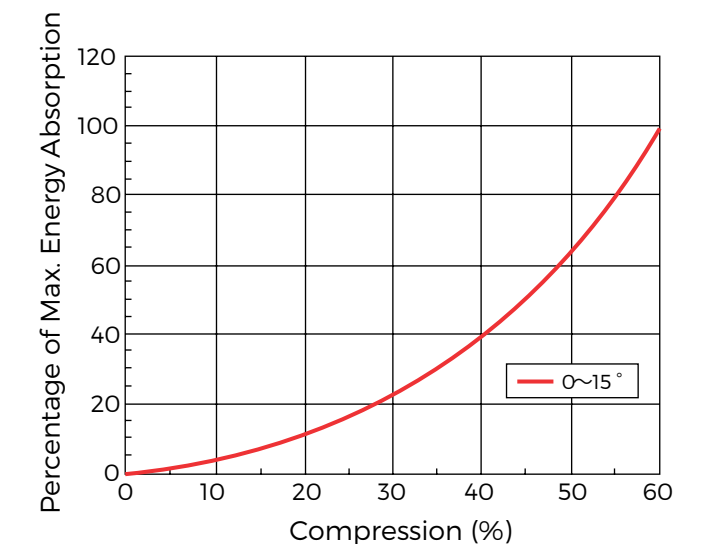
4. SOFT REACTION FORCE

The reaction force does not increase sharply even under excess load conditions.



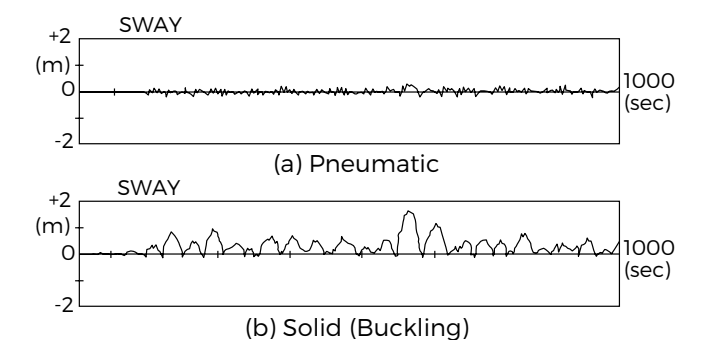
5. LOWER MOORING FORCES UNDER ROUGH CONDITIONS

The reaction force does not increase sharply even under excess load conditions.

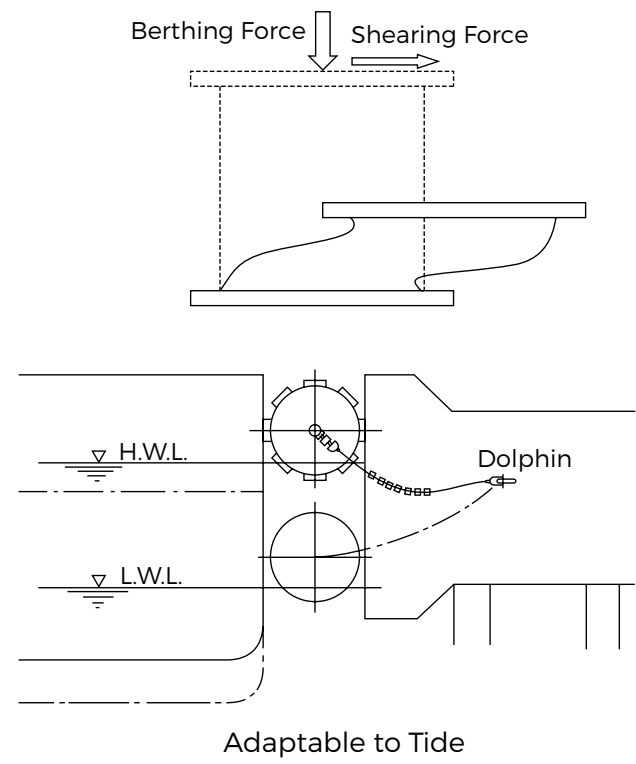


6. STRONG AGAINST SHEARING FORCE

Fenders are adequately reinforced using strong tyre-cord to cope against shearing and compression forces as well as internal pressure.



7. ADAPTABLE TO THE TIDE



8. SIMPLE AND LOW COST INSTALLATION

Fenders are adequately reinforced using strong tyre-cord to cope against shearing and compression forces as well as internal pressure.

9. LOW MAINTENANCE COST

10. SHIPPING COST MINIMISATION

Fenders are usually packed and shipped in containers or on pallets in vacuumed and folded down state.



DIMENSIONS AND PERFORMANCE TABLES

Pneumatic 50 Standard Sizes

Nominal Size		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	Weight of Net Type (Type I)			Weight of Sling Type (Type II)
									Approx. Weight of Net			
Diameter × Length									E	R	p	
(mm × mm)	(ft × ft)	(kPa)	(kNm)	(kN)	(kPa)	(kPa)	(kPa)	(kg)	(kg)	(kg)	(kg)	
500 × 1000	1.6 × 3	50	6	64	132	-	200	22	110	30	20	32
600 × 1000	2 × 3	50	8	74	126	-	200	25	120	30	22	36
700 × 1500	2.3 × 5	50	17	137	135	-	200	45	150	40	37	55
1000 × 1500	3 × 5	50	32	182	122	-	200	73	200	80	51	98
1000 × 2000	3 × 6.5	50	45	257	132	-	200	88	220	140	57	113
1200 × 2000	4 × 6.5	50	63	297	126	-	200	131	320	190	68	156
1350 × 2500	4.4 × 8	50	102	427	130	-	200	200	350	200	-	240
1500 × 3000	5 × 10	50	153	579	132	-	200	250	530	350	-	290
1700 × 3000	5.6 × 10	50	191	639	128	-	200	290	580	440	-	330
2000 × 3500	6.5 × 11.5	50	308	875	128	-	200	405	960	640	-	465
2500 × 4000	8 × 13	50	663	1381	137	175	250	902	1240	910	-	1080
2500 × 5500	8 × 18	50	943	2019	148	175	250	1090	1850	1160	-	1320
3300 × 4500	11 × 15	50	1175	1884	130	175	250	1460	1710	1270	-	1840
3300 × 6500	11 × 21	50	1814	3015	146	175	250	1870	2570	1910	-	2250
3300 × 10600	11 × 35	50	3067	5257	158	175	250	2560	4660	3300	-	3060
4500 × 9000	15 × 30	50	4752	5747	146	175	250	3940	5390	3520	-	-
4500 × 12000	15 × 40	50	6473	7984	154	175	250	4790	6990	5190	-	-

Pneumatic 50 Standard Sizes

Nominal Size		Initial Internal Pressure	Weight of Body
Diameter × Length			
(mm × mm)	(ft × ft)	(kPa)	(kg)
2000 × 6000	6.5 × 20	50	1000
2500 × 9100	8 × 30	50	2200
3300 × 6500	11 × 21	50	3000
3300 × 8600	11 × 28	50	3600
3300 × 10600	11 × 35	50	4100
4500 × 9000	15 × 30	50	5810
4500 × 12000	15 × 40	50	7680

Pneumatic 50 Standard Sizes

Nominal Size		Initial Internal Pressure	Guaranteed Energy Absorption (GEA)	Reaction Force at GEA	Hull Pressure at GEA	Testing Pressure	Weight of Sling Type (Type II)
Diameter × Length			E	R	p		
(mm × mm)	(ft × ft)	(kPa)	(kNm)	(kN)	(kPa)	(kPa)	(kg)
500 × 1000	1.6 × 3	80	8	85	174	250	24
1000 × 1500	3 × 5	80	45	239	160	250	65

Pneumatic 50 Standard Sizes

Nominal Size		Initial Internal Pressure	Guaranteed Energy Absorption (GEA)	Reaction Force at GEA	Hull Pressure at GEA	Testing Pressure	Weight of Sling Type (Type II)
Diameter × Length			E	R	p		
(mm × mm)	(ft × ft)	(kPa)	(kNm)	(kN)	(kPa)	(kPa)	(kg)
2500 × 9100	8 × 30	10	676	1901	88	40	1190
3300 × 12700	11 × 42	10	1565	3439	89	40	1930



DIMENSIONS AND PERFORMANCE TABLES

Pneumatic 50 Popular Non Standard Sizes

Nominal Size		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	Weight of Net Type (Type I)			Weight of Sling Type (Type II)
									Approx. Weight of Net			
Diameter × Length									E	R	p	
(mm × mm)	(ft × ft)	(kPa)	(kNm)	(kN)	(kPa)	(kPa)	(kPa)	(kg)	(kg)	(kg)	(kg)	
400 × 1500	1.3 × 5	50	6	87	151	-	200	23	-	-	33	
600 × 1200	2 × 4	50	10	93	132	-	200	28	-	-	39	
800 × 1200	2.6 × 4	50	16	116	122	-	200	48	240	-	58	
1200 × 1800	4 × 6	50	55	262	122	-	200	123	310	-	148	
1350 × 3500	4.4 × 11.5	50	152	641	141	-	200	255	600	-	295	
1500 × 2500	5 × 8	50	123	464	126	-	200	221	440	-	261	
2000 × 3000	6.5 × 10	50	255	727	122	-	200	367	900	-	427	
2000 × 4500	6.5 × 15	50	418	1188	137	-	200	480	1200	-	540	
2500 × 7700	8 × 25	50	1350	2951	157	175	250	1370	3020	-	1600	
3300 × 8600	11 × 28	50	2443	4138	154	175	250	2220	3710	-	2720	
4500 × 6400	15 × 21	50	3238	3796	133	175	250	3400	3900	-	-	

Note: 1. Figures on the table comply with requirements of ISO17357. 2. Weight of fender body and net may vary 10%. 3. Special sizes are available upon request.

Variations

TYPE I (Net Type)



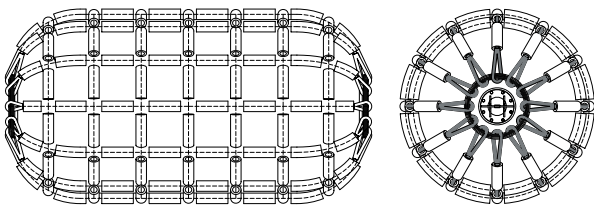
RUBBER SLEEVE NET



GREY BODY & CHAIN NET



FIBRE NET



TYPE II (Sling Type)



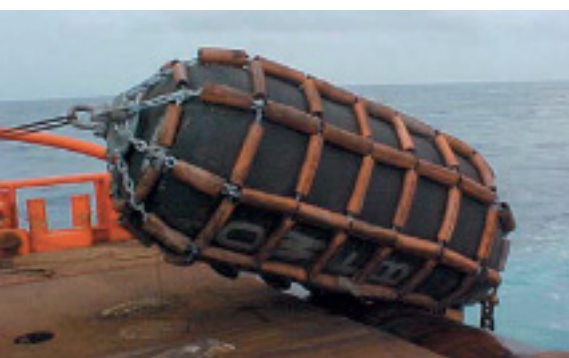
FLASHING LIGHT



LIGHT-WEIGHT



RUBBER JACKET (up to 2.0m dia)



Cone Fender



Cone Fender is the latest generation of “Cell Fender” combining excellent energy capacity with low reaction force to give the most efficient performance. The conical shape keeps the fender body stable under all combinations of axial, shear and angular loading. Hence, it is ideal for berths where large berthing angles and heavy impacts need to be accommodated. All Cone Fenders are single piece mouldings so they are robust, long lasting and easy to install. In most projects, the frontal frame is generally used in conjunction with the Cone Fender System. Generally the frontal frame consists of Steel Panel and UHMW PE facing pad. Cone Fenders also have been used with great success behind fender piles, in Parallel Motion Systems and for numerous other applications.

FEATURES

- Highly efficient shape
- Stable performance under large berthing angles and shear
- Versatile design suits various applications
- Choice of standard and intermediate compounds
- Easy installation

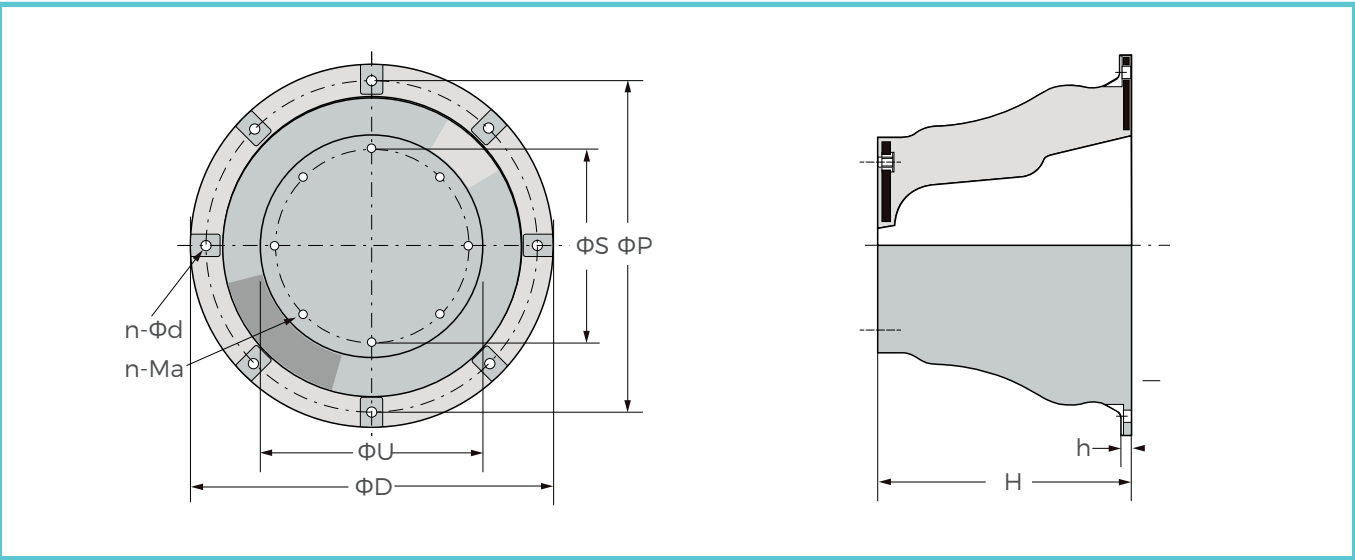
APPLICATIONS

- Tanker berths
- Container terminals
- RoRo and cruise berths
- Bulk terminals
- Dolphins and monopiles

DIMENSIONS

Model	H	h	ΦU	ΦD	ΦS	ΦP	n	n-Ma	n- Φd
FCO 300H	300	13.5	255	450	195	405	4	M16	20
FCO 350H	350	25	300	570	235	510	4	M20	25
FCO 400H	400	18	340	600	260	540	4	M20	25
FCO 500H	500	25	425	750	325	675	4	M24	30
FCO 600H	600	27	510	900	390	810	6	M24	30
FCO 700H	700	32	595	1050	455	945	6	M30	38
FCO 800H	800	36	680	1200	520	1080	6	M36	44
FCO 900H	900	41	765	1350	585	1215	6	M36	44
FCO 1000H	1000	45	850	1500	650	1350	6	M42	56
FCO 1050H	1050	55	1030	1680	900	1530	6	M36	44
FCO 1100H	1100	50	935	1650	715	1485	6	M42	50
FCO 1150H	1150	52	998	1725	750	1550	6	M42	56
FCO 1200H	1200	54	1020	1800	780	1620	8	M42	50
FCO 1300H	1300	59	1105	1950	845	1755	8	M48	60
FCO 1400H	1400	66	1190	2100	930	1890	8	M48	60
FCO 1600H	1600	72	1360	2400	1060	2160	8	M48	70
FCO 1800H	1800	78	1530	2880	1190	2430	10	M56	76
FCO 2000H	2000	80	1900	3200	1540	2920	10	M56	76

[Units: mm]

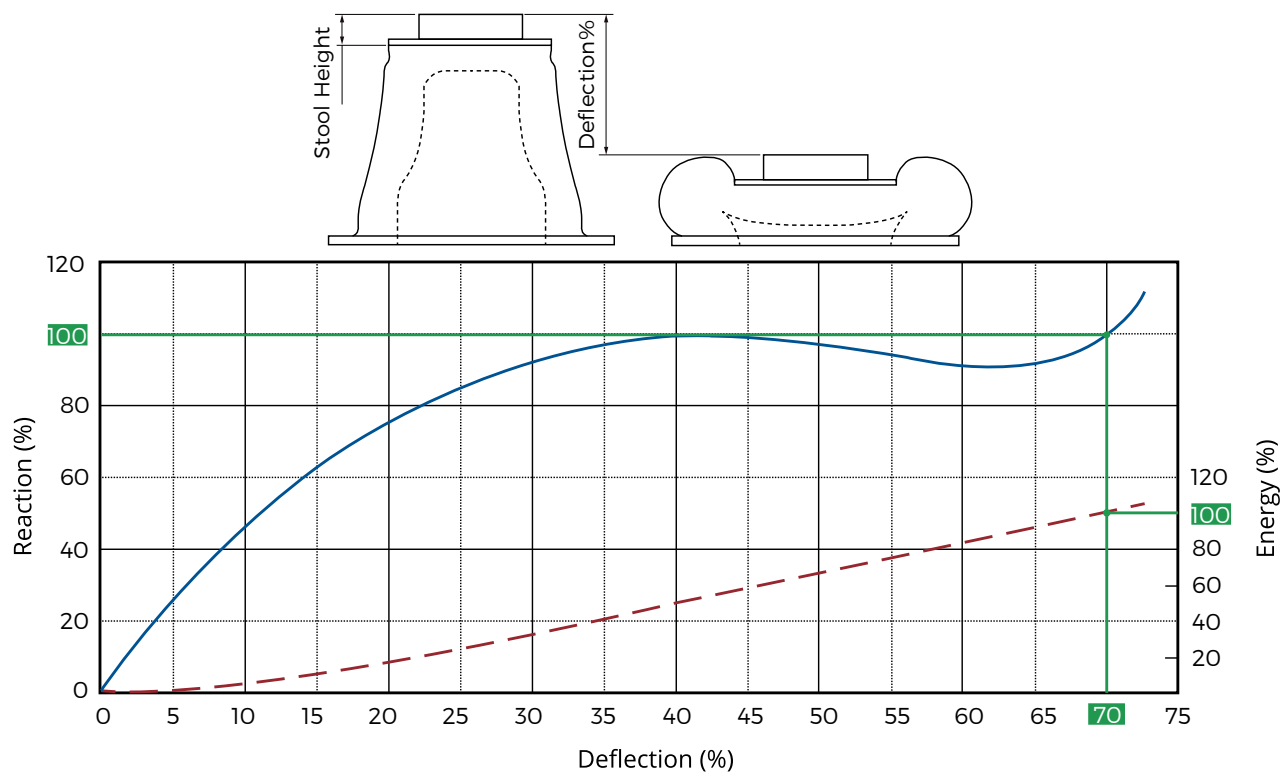


RATED PERFORMANCE DATA

	FCO 300H	FCO 350H	FCO 400H	FCO 500H	FCO 600H	FCO 700H	FCO 800H	FCO 900H	FCO 1000H	FCO 1050H	FCO 1100H	FCO 1150H	FCO 1200H	FCO 1300H	FCO 1400H	FCO 1600H	FCO 1800H	FCO 2000H
E0.9	7.8	12.6	18.8	36.9	63.6	118	173	250	335	388	446	509	579	735	918	1368	1947	2673
R	49.5	67.7	87.9	138	191	283	363	467	561	620	678	743	810	948	1100	1433	1817	2237
E1.0	9.1	14.1	21.2	41.4	70.7	131	192	278	371	431	495	565	644	817	1020	1520	2163	2970
R	54.5	74.7	98	154	212	314	403	518	624	688	753	825	900	1053	1223	1592	2019	2486
E1.1	9.3	14.5	21.8	42.6	72.7	135	198	285	381	442	508	580	661	839	1047	1561	2222	3049
R	56.4	77.2	101	159	218	322	415	531	641	706	774	847	924	1081	1255	1635	2073	2552
E1.2	9.5	14.9	22.4	43.8	74.7	139	203	292	391	454	522	595	678	860	1074	1602	2280	3128
R	58.2	79.6	104	164	224	331	426	544	656	724	794	868	948	1110	1288	1678	2128	2619
E1.3	9.7	15.4	23	45	76.8	142	209	299	401	465	535	610	696	882	1102	1643	2338	3208
R	60.0	82	108	169	230	339	438	558	673	743	815	890	972	1138	1321	1721	2182	2685
E1.4	9.9	15.8	23.6	46.3	78.8	146	215	306	411	477	549	625	713	904	1129	1684	2397	3287
R	61.8	84.4	111	174	236	347	450	571	689	761	835	912	997	1166	1353	1765	2236	2751
E1.5	10.1	16.2	24.2	47.5	80.8	149	220	313	421	488	562	640	731	926	1156	1726	2455	3366
R	63.6	86.9	114	179	242	356	462	584	706	779	855	933	1021	1194	1386	1808	2291	2818
E1.6	10.5	16.8	25	48.9	82.8	153	226	320	431	499	576	655	748	947	1183	1767	2514	3445
R	66.3	90.3	119	186	251	368	478	603	730	805	884	965	1055	1234	1433	1869	2369	2912
E1.7	10.9	17.4	25.9	50.3	84.8	156	231	327	441	511	589	670	765	969	1211	1808	2572	3524
R	68.9	93.7	123	193	259	380	494	622	753	831	914	997	1090	1274	1479	1931	2446	3007
E1.8	11.3	18	26.7	51.7	86.9	160	237	334	450	522	602	685	782	991	1238	1849	2630	3604
R	71.5	97.2	127	200	268	392	511	641	778	858	943	1029	1125	1315	1526	1992	2524	3102
E1.9	11.7	18.6	27.5	53.1	88.9	163	242	341	460	533	615	700	800	1013	1265	1890	2689	3683
R	74.1	100.6	132	207	276	404	527	661	802	884	972	1060	1159	1355	1573	2053	2602	3197
E2.0	12.1	19.2	28.3	54.5	90.9	167	247	348	470	545	629	715	817	1035	1292	1931	2747	3762
R	76.8	104	136	214	285	416	543	680	826	910	1001	1092	1194	1395	1620	2115	2680	3292
E2.1	12.3	19.6	28.9	56	93.9	171	254	359	483	559	645	735	839	1063	1327	1983	2822	3865
R	79.0	107	140	220	296	428	560	701	851	939	1032	1126	1231	1439	1671	2181	2764	3396
E2.2	12.5	20	29	57.4	97	175	261	368	496	574	662	754	860	1091	1362	2035	2897	3968
R	81.2	110	144	227	306	440	577	723	877	967	1063	1161	1268	1483	1721	2247	2848	3500
E2.3	12.7	20.4	30.1	58.8	100	179	267	378	509	589	679	774	882	1119	1398	2088	2972	4071
R	83.4	113	148	233	317	452	594	744	904	996	1094	1195	1304	1527	1772	2314	2932	3604
E2.4	12.9	20.8	30.7	60.2	103	183	274	387	522	604	696	793	904	1148	1433	2140	3047	4174
R	85.6	116	153	239	328	464	610	767	930	1025	1125	1229	1341	1571	1823	2380	3017	3708
E2.5	13.1	21.2	31.3	61.6	106	187	281	397	535	619	713	813	926	1176	1468	2193	3121	4277
R	87.9	119	157	245	338	476	627	788	955	1053	1156	1263	1378	1615	1874	2446	3101	3812
E2.6	13.3	21.6	32.1	63	109	191	287	406	547	634	730	833	947	1204	1503	2245	3196	4380
R	90.7	123	162	254	352	491	649	815	989	1090	1196	1308	1425	1671	1939	2531	3209	3945
E2.7	13.5	22	32.9	64.4	112	195	294	416	560	648	746	852	969	1232	1538	2298	3271	4483
R	93.5	127	167	262	365	506	670	843	1023	1127	1236	1352	1473	1728	2005	2617	3317	4078
E2.8	13.7	22.4	33.7	65.9	115	199	300	425	573	663	763	872	991	1260	1573	2350	3345	4586
R	96.4	131	172	270	379	522	691	871	1055	1163	1276	1396	1520	1784	2070	2702	3424	4211
E2.9	13.9	22.8	34.5	67.3	118	203	307	435	586	678	780	891	1013	1289	1608	2403	3420	4689
R	99.2	135	178	278	392	537	713	899	1089	1200	1316	1440	1567	1840	2135	2787	3532	4345
E3.0	14.1	23.2	35.4	68.7	121	207	313	444	599	693	797	911	1035	1317	1643	2455	3495	4792
R	102.0	139	183	286	406	552	734	926	1123	1237	1355	1485	1615	1897	2201	2872	3640	4478
E3.1	16.2	25.3	38.4	74.7	133	228	344	489	659	762	877	1003	1139	1448	1808	2701	3844	5271
R	112.1	153	201	314	446	607	808	1018	1235	1360	1491	1633	1776	2086	2421	3159	4005	4925

[Units: kNm, kN]

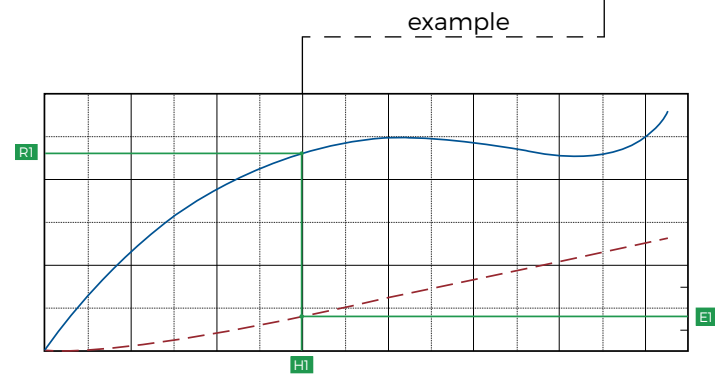
PERFORMANCE CURVE



INTERMEDIATE DEFLECTIONS

H(%)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	72.5
E(%)	0	1.1	4.1	8.4	16	23	30	40	50	58	67	74	82	94	100	105
R(%)	0	20	38	58	76	89	97	100	98	94	84	77	75	93	100	107

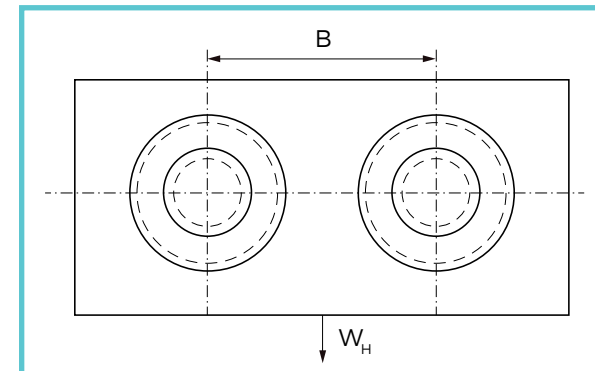
Nominal rated deflection may vary at RPD.



For example:
When deflection is 30%, then
H1=30%, R1=97%, E1=30%

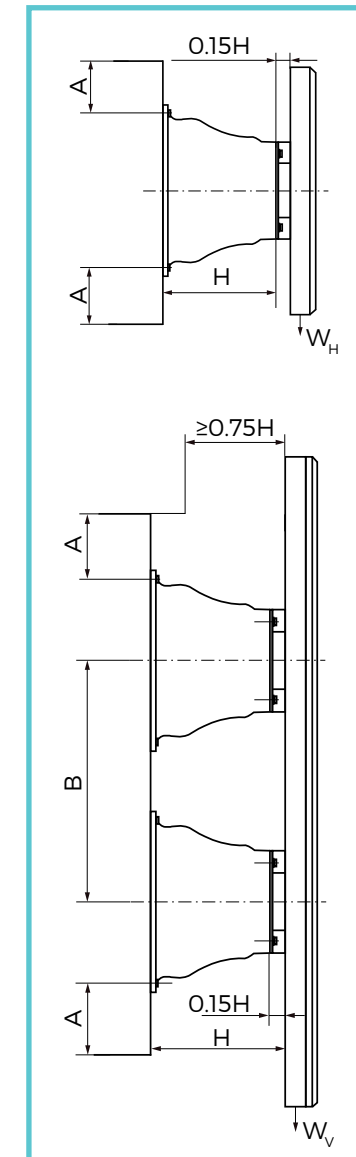
Reaction Force: $R_{(30\%)} = R \cdot R1 = R \cdot 97\%$
Energy Absorption: $E_{(30\%)} = E \cdot E1 = E \cdot 30\%$

CLEARANCES & WEIGHT SUPPORT



Model	A	B
FCO 500H	240	850
FCO 600H	240	1020
FCO 700H	300	1190
FCO 800H	360	1360
FCO 900H	360	1530
FCO 1000H	420	1700
FCO 1100H	420	1870
FCO 1150H	420	1955
FCO 1200H	420	2040
FCO 1300H	480	2220
FCO 1400H	480	2420
FCO 1600H	480	2820
FCO 1800H	430	3220
FCO 2000H	450	3600

[Units: mm]



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If in doubt,
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There must be
enough space
around and
between
Cone Fenders
and the steel
panel to allow
them to
deflect
without
interference.

The table is a guide to the permitted weight of frontal panel before additional support chains may be required.

Performance	Single or multiple horizontal ($n \geq 1$)	Single or multiple vertical ($n \geq 2$)
E1	$W_H \leq n \cdot 0.85 \cdot W$	$W_V \leq n \cdot 1.0 \cdot W$
E2	$W_H \leq n \cdot 1.0 \cdot W$	$W_V \leq n \cdot 1.25 \cdot W$
E3	$W_H \leq n \cdot 1.3 \cdot W$	$W_V \leq n \cdot 1.55 \cdot W$

[n=number of Cones; W=Cone weight; W_H =panel weight-single or multi-horizontal; W_V =panel weight-single or multi-vertical]



Proven *in*
PRACTICE.

Cell Fender



The Super Cell Fender is improved over the ordinary type. It is the most commonly used fender in the world. The circular mounting base of the Super Cell Fender makes it an extremely stable fender type.

Super Cell Fenders have high absorption energy per unit weight. Also among all types of compressed fenders, it has the lowest compression performance change. Super Cell Fenders are available in a wide range of sizes from 400H to 3000H. Super Cell Fenders have better overloading capacity than any other fender type.

FEATURES

- Low reaction force and high capability of energy absorption
- Due to its structure, it has the characteristic of higher force absorption and long usage life

- Good energy absorption to reaction force ratio (E/R)
- Good shear force resistance due to the large diameter of the fender flanges
- Come in a wide range of standard sizes

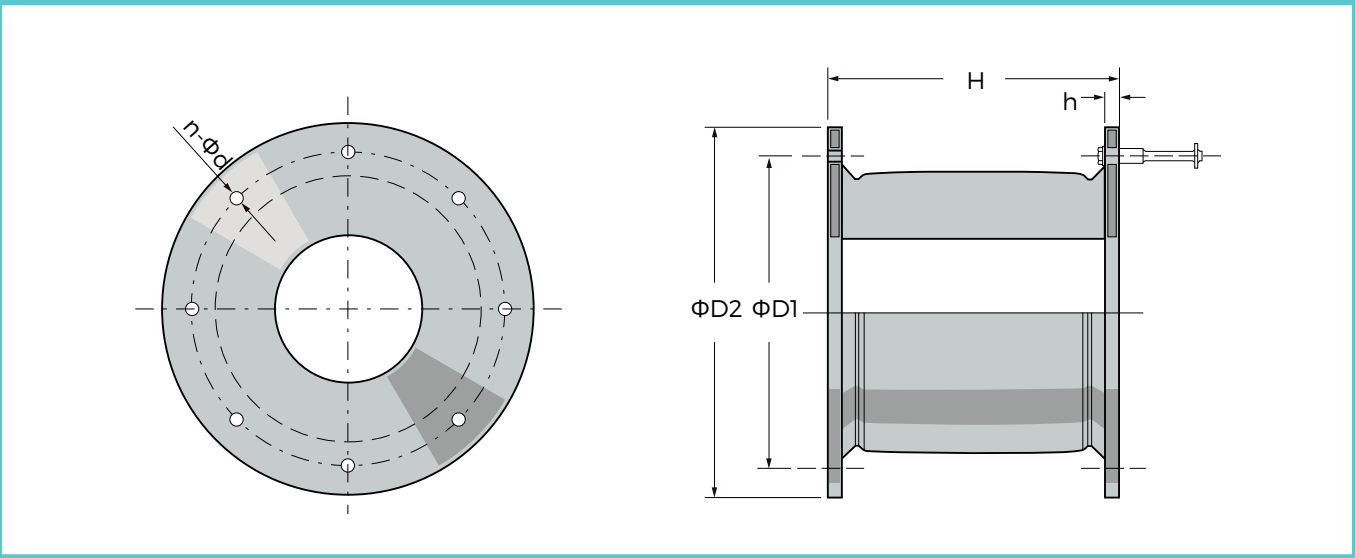
APPLICATIONS

- Oil and LNG facilities
- Container berths
- Bulk terminals
- RoRo and cruise terminals
- Multi-user berths
- Offshore platforms

DIMENSIONS

Model	H	ΦD1	ΦD2	h	n	Φd
FSC 400H	400	550	650	25	4	30
FSC 500H	500	550	650	25	4	32
FSC 630H	630	700	840	30	4	39
FSC 800H	800	900	1050	30	6	40
FSC 1000H	1000	1100	1300	35	6	47
FSC 1150H	1150	1300	1500	40	6	50
FSC 1250H	1250	1450	1650	45	6	53
FSC 1450H	1450	1650	1850	47	6	61
FSC 1600H	1600	1800	2000	50	8	61
FSC 1700H	1700	1900	2100	55	8	66
FSC 2000H	2000	2000	2200	55	8	74
FSC 2250H	2250	2300	2550	60	10	74
FSC 2500H	2500	2700	2950	70	10	90
FSC 3000H	3000	3150	3350	75	12	90

[Units: mm]

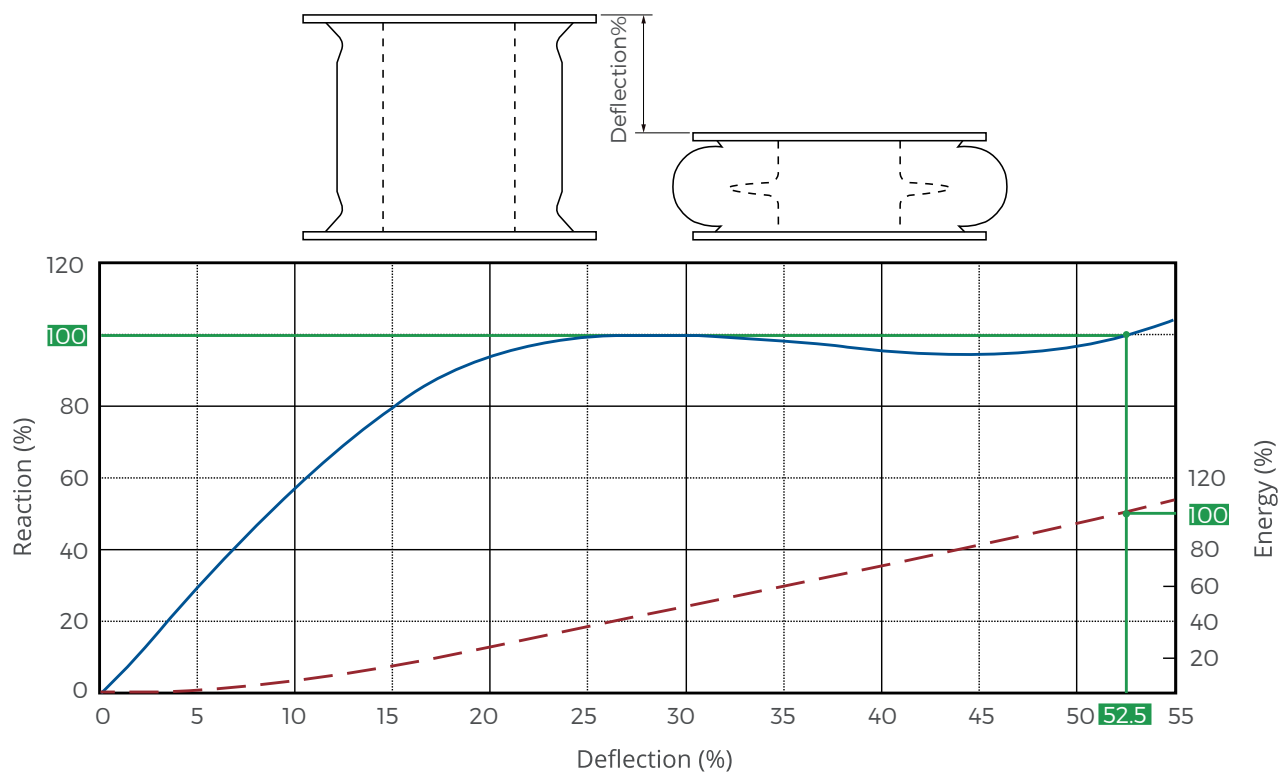


RATED PERFORMANCE DATA

	FSC 400H	FSC 500H	FSC 630H	FSC 800H	FSC 1000H	FSC 1150H	FSC 1250H	FSC 1450H	FSC 1600H	FSC 1700H	FSC 2000H	FSC 2250H	FSC 2500H	FSC 3000H
E0.9	9	17	34	68	137	208	266	417	560	671	1093	1835	2519	3757
R	51	80	125	192	311	412	486	654	797	899	1245	1857	2294	3277
E1.0	10	19	38	76	151	231	296	463	623	745	1215	2039	2798	4175
R	57	88	138	213	346	457	540	727	885	999	1383	2064	2548	3641
E1.1	11	20	41	81	161	245	315	492	662	792	1291	2148	2946	4408
R	60	94	147	228	367	486	573	773	941	1061	1469	2173	2683	3840
E1.2	11	22	43	86	170	260	333	521	700	839	1366	2256	3094	4641
R	64	99	156	242	389	514	607	820	996	1124	1556	2283	2818	4039
E1.3	12	23	46	91	180	274	352	550	739	886	1442	2364	3243	4874
R	67	105	164	257	410	543	641	866	1051	1187	1642	2392	2953	4238
E1.4	13	24	48	96	189	288	370	579	778	932	1518	2472	3391	5107
R	71	110	173	271	432	571	675	913	1107	1249	1728	2501	3088	4437
E1.5	13	25	51	101	199	303	389	608	817	979	1594	2580	3539	5340
R	75	116	182	286	453	600	709	959	1162	1312	1815	2611	3223	4636
E1.6	14	26	53	106	208	317	407	637	856	1026	1670	2688	3687	5573
R	78	122	191	300	475	628	743	1004	1218	1374	1901	2720	3358	4835
E1.7	14	27	55	111	218	332	426	666	894	1073	1746	2796	3835	5806
R	82	127	200	315	497	657	777	1048	1273	1437	1987	2829	3493	5034
E1.8	15	28	58	116	228	346	444	695	933	1119	1822	2904	3984	6039
R	85	133	208	329	519	685	810	1092	1328	1499	2073	2939	3628	5233
E1.9	16	29	60	120	237	361	463	723	972	1166	1898	3012	4132	6272
R	88	138	217	344	541	714	844	1137	1383	1562	2159	3048	3763	5432
E2.0	16	30	63	125	247	375	481	752	1011	1213	1974	3119	4280	6505
R	92	143	226	359	562	743	878	1181	1438	1625	2245	3157	3898	5631
E2.1	17	31	64	129	254	386	496	775	1041	1249	2033	3213	4408	6694
R	95	148	233	369	579	765	904	1217	1482	1673	2312	3252	4015	5797
E2.2	17	32	66	133	261	398	510	798	1071	1285	2092	3307	4536	6883
R	97	152	240	380	596	787	931	1252	1525	1722	2379	3347	4132	5963
E2.3	17	33	68	137	268	409	525	820	1102	1321	2152	3400	4665	7072
R	100	156	246	391	613	810	957	1287	1568	1770	2445	3442	4249	6129
E2.4	18	34	70	141	276	420	539	843	1132	1358	2211	3494	4793	7261
R	102	160	253	402	630	832	983	1323	1611	1819	2512	3536	4366	6295
E2.5	18	35	72	145	283	432	553	865	1162	1394	2270	3588	4921	7450
R	105	165	260	413	646	854	1010	1358	1654	1867	2579	3631	4483	6461
E2.6	19	36	74	149	291	443	568	888	1193	1430	2329	3681	5050	7639
R	108	169	266	424	663	877	1036	1394	1697	1916	2646	3726	4600	6626
E2.7	19	37	75	153	298	454	583	910	1223	1467	2388	3775	5178	7828
R	111	173	273	435	680	899	1062	1429	1741	1965	2712	3821	4717	6792
E2.8	20	38	77	157	306	465	597	933	1253	1503	2448	3868	5306	8016
R	114	177	280	446	696	921	1089	1465	1784	2013	2779	3915	4834	6958
E2.9	21	39	79	161	313	476	612	956	1283	1540	2507	3962	5435	8205
R	116	182	286	458	713	944	1115	1500	1827	2062	2846	4010	4951	7124
E3.0	21	39	81	165	321	487	627	978	1314	1576	2566	4055	5563	8394
R	119	186	293	469	730	966	1141	1535	1870	2111	2913	4105	5068	7289
E3.1	23	43	89	181	352	536	689	1075	1445	1733	2822	4461	6119	9234
R	130	205	322	515	803	1062	1256	1690	2057	2322	3204	4515	5575	8018

[Units: kNm, kN]

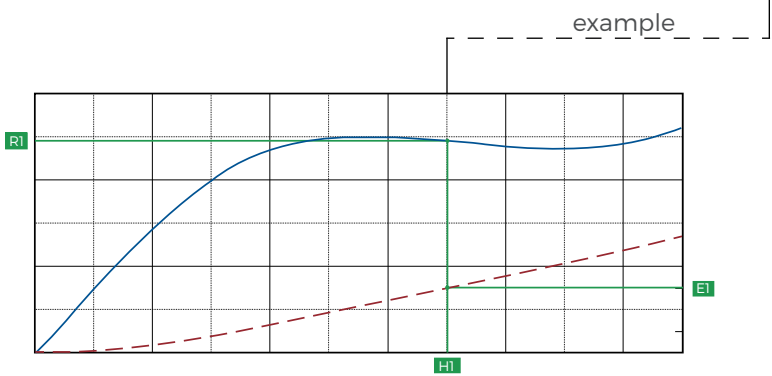
PERFORMANCE CURVE



INTERMEDIATE DEFLECTIONS

H (%)	0	5	10	15	20	25	30	35	40	45	50	52.5	55
E (%)	0	2	6.8	15	25	37	50	60	70	83	94	100	106
R (%)	0	30	58	80	93	98	99	97.5	95	96	97	100	106

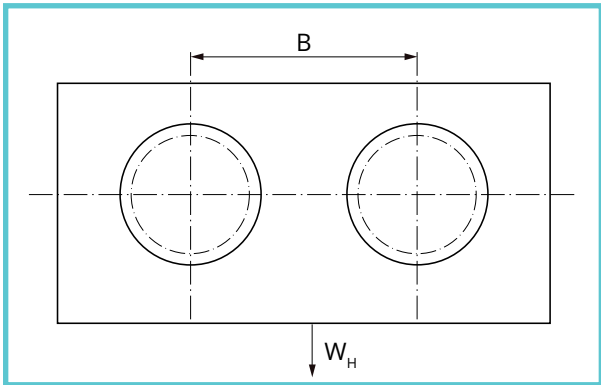
Nominal rated deflection may vary at RPD.



For example:
When deflection is 35%, then
H1=35%, R1=97.5%, E1=60%

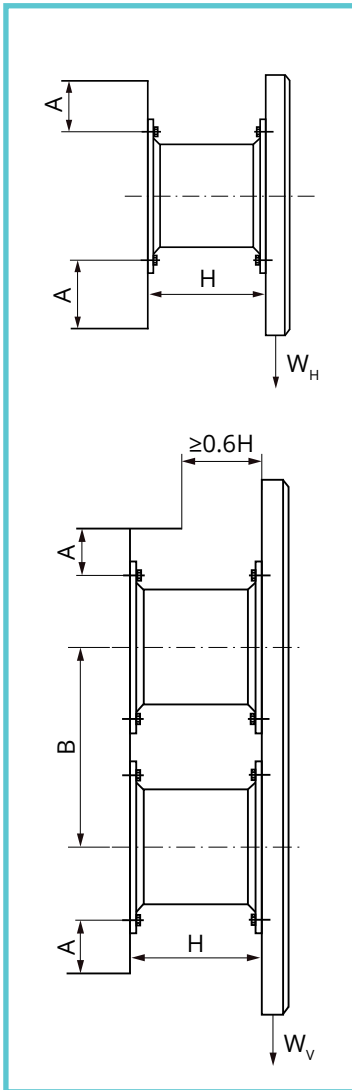
Reaction Force: $R_{(35\%)} = R \cdot R1 = R \cdot 97.5\%$
Energy Absorption: $E_{(35\%)} = E \cdot E1 = E \cdot 60\%$

CLEARANCES & WEIGHT SUPPORT



Model	A	B
FSC 400H	180	700
FSC 500H	185	700
FSC 630H	210	880
FSC 800H	230	1120
FSC 1000H	255	1500
FSC 1150H	280	1730
FSC 1250H	290	1870
FSC 1450H	350	2180
FSC 1600H	350	2400
FSC 1700H	380	2550
FSC 2000H	430	2880
FSC 2250H	430	3360
FSC 2500H	450	3730
FSC 3000H	510	4500

[Units: mm]



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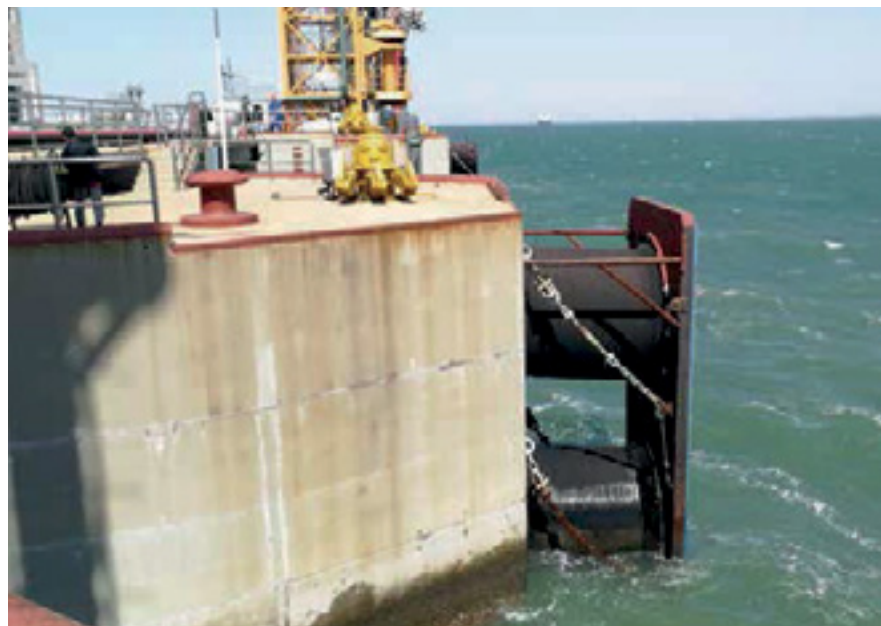
There must be
enough space
around and
between
Cell Fenders
and the steel
panel to allow
them to
deflect
without
interference.

The table is a guide to the permitted weight of frontal panel before additional support chains may be required.

Performance	Single or multiple horizontal	Single or multiple vertical	H (mm)
E1	$WH \leq n \cdot 0.95 \cdot W$	$WV \leq n \cdot 1.2 \cdot W$	≤ 800
E2	$WH \leq n \cdot 1.1 \cdot W$	$WV \leq n \cdot 1.45 \cdot W$	
E3	$WH \leq n \cdot 1.3 \cdot W$	$WV \leq n \cdot 1.75 \cdot W$	
E1	$WH \leq n \cdot 10 \cdot W0.6$	$WV \leq n \cdot 13.5 \cdot W0.6$	≥ 1000
E2	$WH \leq n \cdot 15 \cdot W0.6$	$WV \leq n \cdot 19 \cdot W0.6$	
E3	$WH \leq n \cdot 19 \cdot W0.6$	$WV \leq n \cdot 23.5 \cdot W0.6$	

[n=number of Cell; W=Cell weight; WH=panel weight-single or multi-horizontal; WV=panel weight-single or multi-vertical]

Tugboat Fender



Proven *in*
PRACTICE.

The function of the Tug Fender is not only absorbing the berthing energy but also resisting the strong pushing pressure exerted by the ship after berthing. Tug Fenders are robust under adverse conditions.

Tugs are classified into four types of fenders – each serving a particular function.

- **Tug Cylindrical Fenders** are fitted to the bow and/or stern of tugs and usually used for pushing against flared hulls and in open sea conditions.
- **D. Square** and **Wing Fenders** are often used as side beltings to protect the vessel during escort duties and when coming alongside.
- **W Fenders**, **M Fenders** and **Keyhole Fenders** provide a large contact surface for low hull pressures. The grooved surface provides exceptional grip.
- **Composite Fenders** (moulded rubber fender with vulcanised or bolted PE rubbing face) for work boats and special tugs.

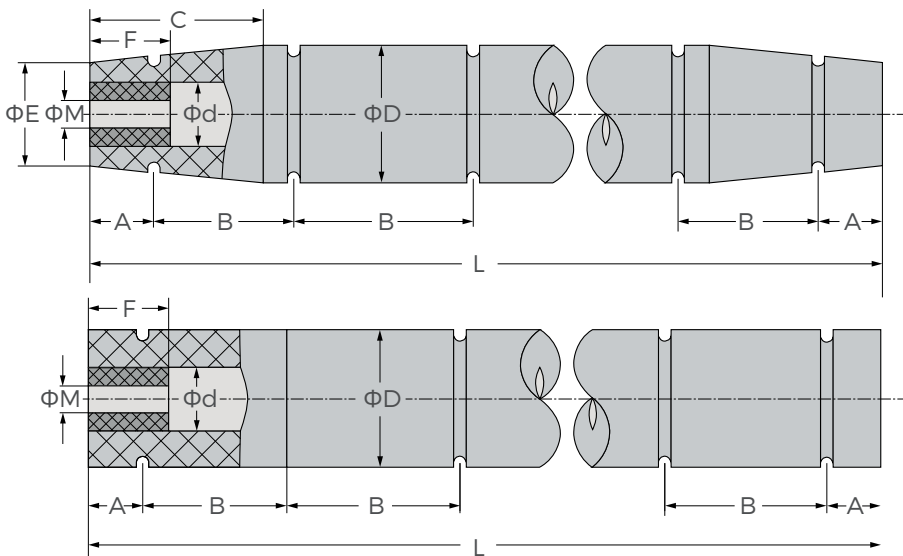
Tug Cylindrical Fender

The fender is attached by a chain running along the fender’s central bore and straps or chains in special grooves around the fender circumference. Fender ends may be tapered.

DIMENSIONS

Model D*d	E	Amax	Bmax	C	M	F
FTB 250x125	190	200	570	500	75	300
FTB 300x150	225	225	600	700	75	350
FTB 380x190	280	225	650	800	100	400
FTB 400x200	300	250	670	800	100	400
FTB 450x225	350	250	700	850	100	400
FTB 480x240	350	250	700	850	100	400
FTB 500x250	375	280	730	900	100	400
FTB 540x270	375	280	730	900	100	400
FTB 600x300	450	300	800	900	125	500
FTB 700x350	500	350	870	950	125	500
FTB 800x400	600	350	930	1000	125	500
FTB 900x450	675	350	1000	1100	150	500

[Units: mm]

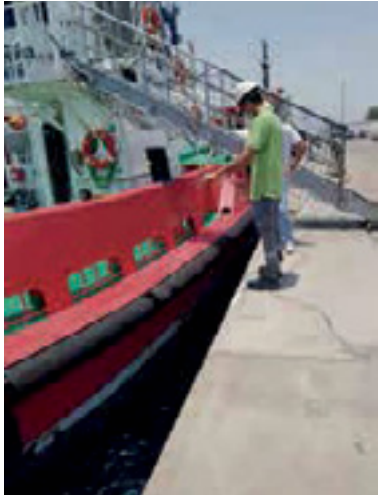
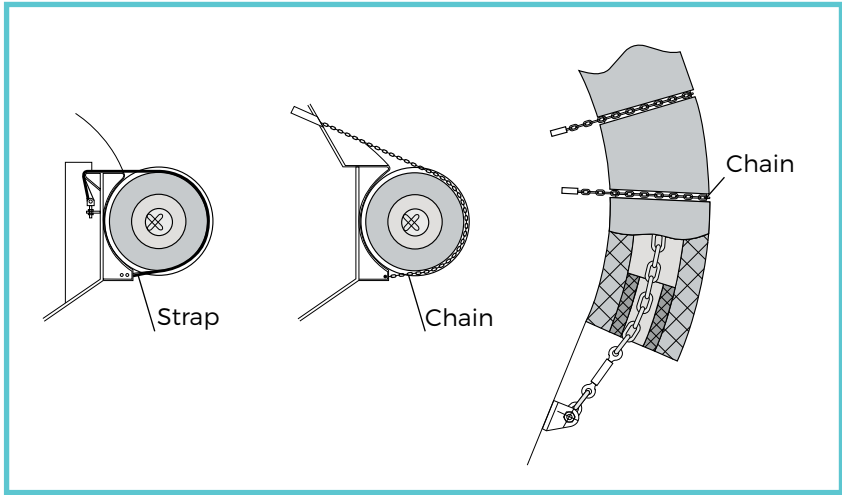


The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

Tug Cylindrical Fender

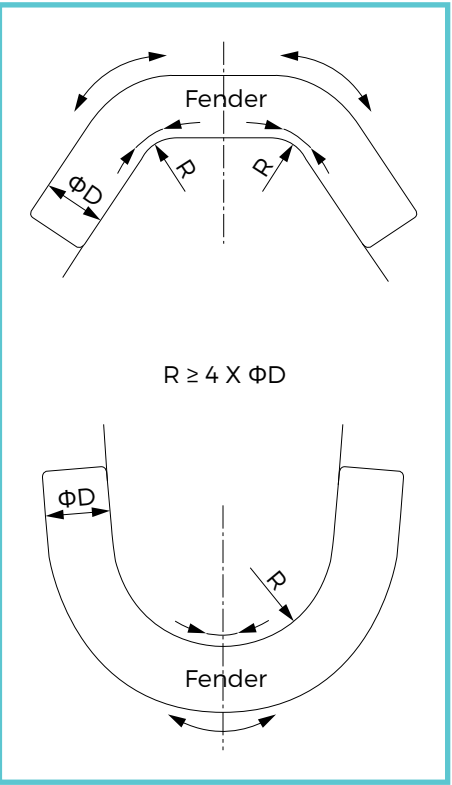
ACCESSORIES

Smaller Tug Cylindrical Fenders (≤500mm diameter) are usually fixed by a longitudinal chain through the bore of the fender, connected to the hull by turnbuckles to tension the chain. Larger Tug Cylindrical Fenders often use supplementary chains or straps around the fender.



CURVE RADIUS

Tug Cylindrical Fenders are made in straight lengths, but can be pulled around the bow or stern radius. The outside of the fender will be pulled while the inside will be compressed. Thus the outside of the fender is easily torn by sharp objects. The curve diameter should be paid attention on to avoid damage: $R = 4 \times \Phi D$.



Arch Fenders are being widely used in port facilities due to their high energy absorption, low reaction force and stable performance as well as high durability with simple structure. They are particularly useful for vessels with high allowable hull pressures and limited mounting space.

FEATURES

- Rugged single piece moulding for long service life
- Optional UHMW PE pad and steel frame
- Excellent shear resistance
- Large range of sizes and lengths
- Non-standard lengths, energy index

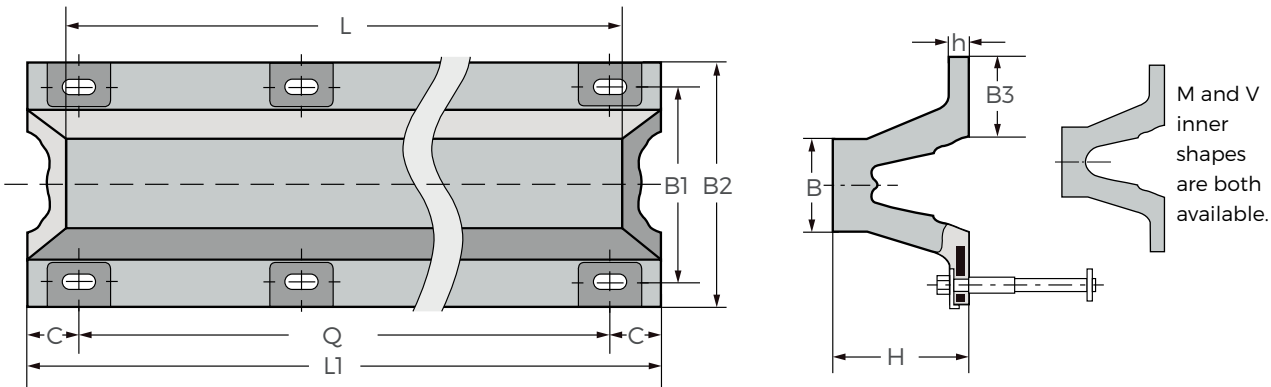
APPLICATIONS

- RoRo berths
- General cargo
- Workboat harbours
- Barge and tug berths

DIMENSIONS

Model	H	B	B3	h	B2	B1	L	L1	C	n	Q
FDA-A 150H	150	98	96	22.5	300	240	1000	1075	110	1	855
							1500	1575	112.5	2	675
							2000	2075	107.5	3	620
							2500	2575	110	3	785
							3000	3075	107.5	4	715
							3500	3575	110	5	671
FDA-A 200H	200	145	128	30	400	320	1000	1100	120	1	860
							1500	1600	1200	2	680
							2000	2100	120	3	620
							2500	2600	122.5	3	785
							3000	3100	120	4	715
							3500	3600	120	5	672
FDA-A 250H	250	164	160	30	500	410	1000	1125	130	1	865
							1500	1625	132.5	2	680
							2000	2125	132.5	3	620
							2500	2625	127.5	3	790
							3000	3125	127.5	4	715
							3500	3625	130	5	673
FDA-A 300H	300	225	195	33	600	490	1000	1150	140	1	870
							1500	1650	140	2	685
							2000	2150	137.5	3	625
							2500	2650	140	3	790
							3000	3150	145	4	715
							3500	3650	140	5	674
FDA-A 400H	400	300	260	40	800	670	1000	1200	150	1	900
							1500	1600	150	2	700
							2000	2200	147.5	3	635
							2500	2700	150	3	800
							3000	3200	150	4	725
							3500	3700	150	5	680
FDA-A 500H	500	375	325	45	1000	840	1000	1250	160	1	930
							1500	1750	160	2	715
							2000	2250	157.5	3	645
							2500	2750	160	3	810
							3000	3250	165	4	730
							3500	3750	160	5	686
FDA-A 600H	600	450	390	54	1200	1010	1000	1300	170	1	960
							1500	1800	170	2	730
							2000	2300	167.5	3	655
							2500	2800	170	3	820
							3000	3300	170	4	740
							3500	3800	170	5	682
FDA-A 800H	800	600	520	72	1600	1340	1000	1400	180	1	1040
							1500	1900	180	2	770
							2000	2400	180	3	680
							2500	2900	182.5	3	845
							3000	3400	180	4	760
							3500	3900	180	5	885
FDA-A 1000H	1000	750	650	90	2000	1680	1000	1500	200	1	1100
							1500	2000	200	2	800
							2000	2500	200	3	700

[Units: mm]



RATED PERFORMANCE DATA

Model	Super High Reaction Force				High Reaction Force				Standard Reaction Force				Low Reaction Force			
	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E
FDA-A150H	135	7.1	182	8.4	147	6.1	157	7.1	87.7	4.1	117	5.1	58	3.1	79.6	4.1
FDA-A200H	176	11.2	240	14.3	156	11.2	208	12.2	114	8.2	156	9.2	78.5	5.1	104	6.1
FDA-A250H	281	29	391	41.2	216	22.8	300	24	179	18.8	249	19.8	154	16.6	213	17.7
FDA-A300H	330	41.8	460	44.8	254	31.6	353	33.7	209	25.5	300	27.4	181	22.4	251	24.5
FDA-A400H	441	74.4	612	79.4	339	57.1	469	6.12	281	46.9	361	50	241	40.8	334	43.9
FDA-A500H	551	115	765	123	423	89.5	588	94.9	351	73.4	487	78.5	301	69.4	418	67.3
FDA-A600H	660	166	917	179	508	129	706	138	420	106	590	113	361	90.7	502	97
FDA-A800H	881	296	1224	317	677	228	940	254	561	189	779	202	481	162	669	173
FDA-A1000H	1101	463	1529	496	846	356	1176	381	703	295	975	317	602	253	835	271

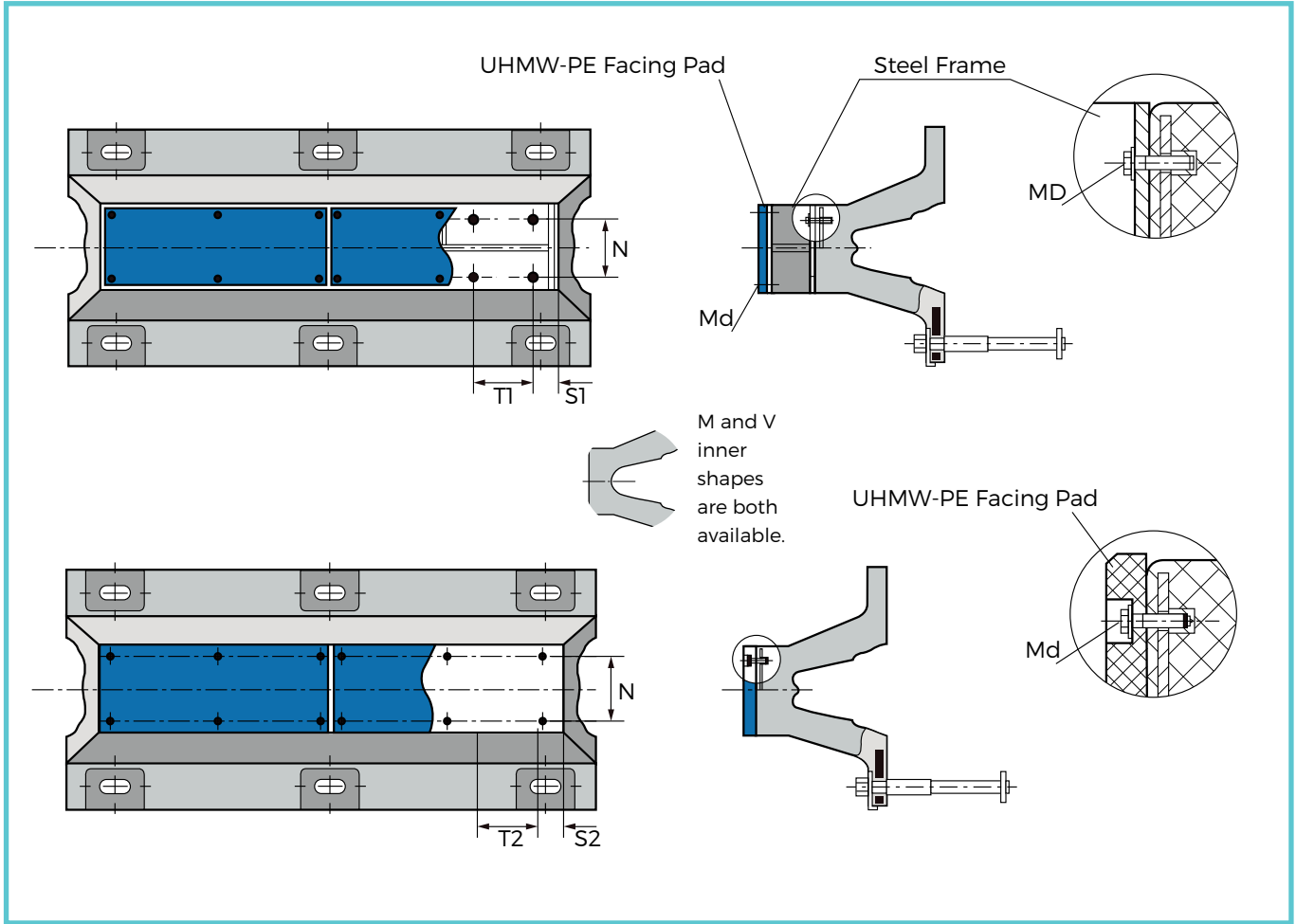
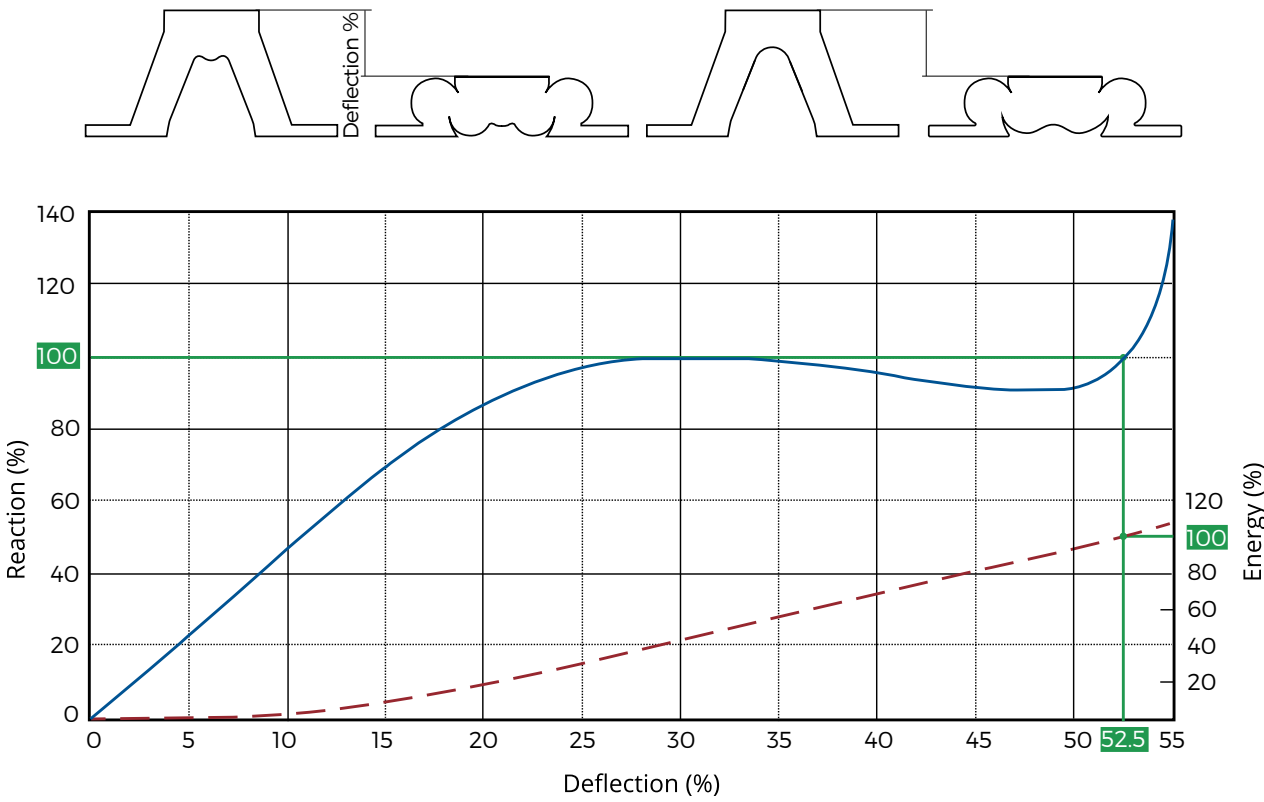
* Performance per metre length. [Units: kNm, kN]

DIMENSIONS

Model	N	Md	Steel Frame			UHMW-PE Facing Pad		Length
			T1	S1	MD	T2	S2	
FDA-B150H	0	M16	250~300	125	M16	300~400	60	≤ 3500
FDA-B200H	0	M16	250~300	125	M16	300~400	60	≤ 3500
FDA-B250H	64	M16	250~300	125	M20	300~400	60~85	≤ 3500
FDA-B300H	105	M16	250~300	125	M24	300~400	60~85	≤ 3500
FDA-B400H	180	M16	250~300	125	M27	300~400	60~85	≤ 3500
FDA-B500H	245	M16	250~300	125	M30	300~400	60~85	≤ 3500
FDA-B600H	310	M16	250~300	125	M30	300~400	60~85	≤ 3500
FDA-B800H	440	M16	250~300	125	M36	300~400	60~85	≤ 3500
FDA-B1000H	570	M16	250~300	125	M36	300~400	60~85	≤ 2000

* Larger bolts are required when connecting FAP fenders to steel panels. [Units: mm]

FDA-A PERFORMANCE CURVE

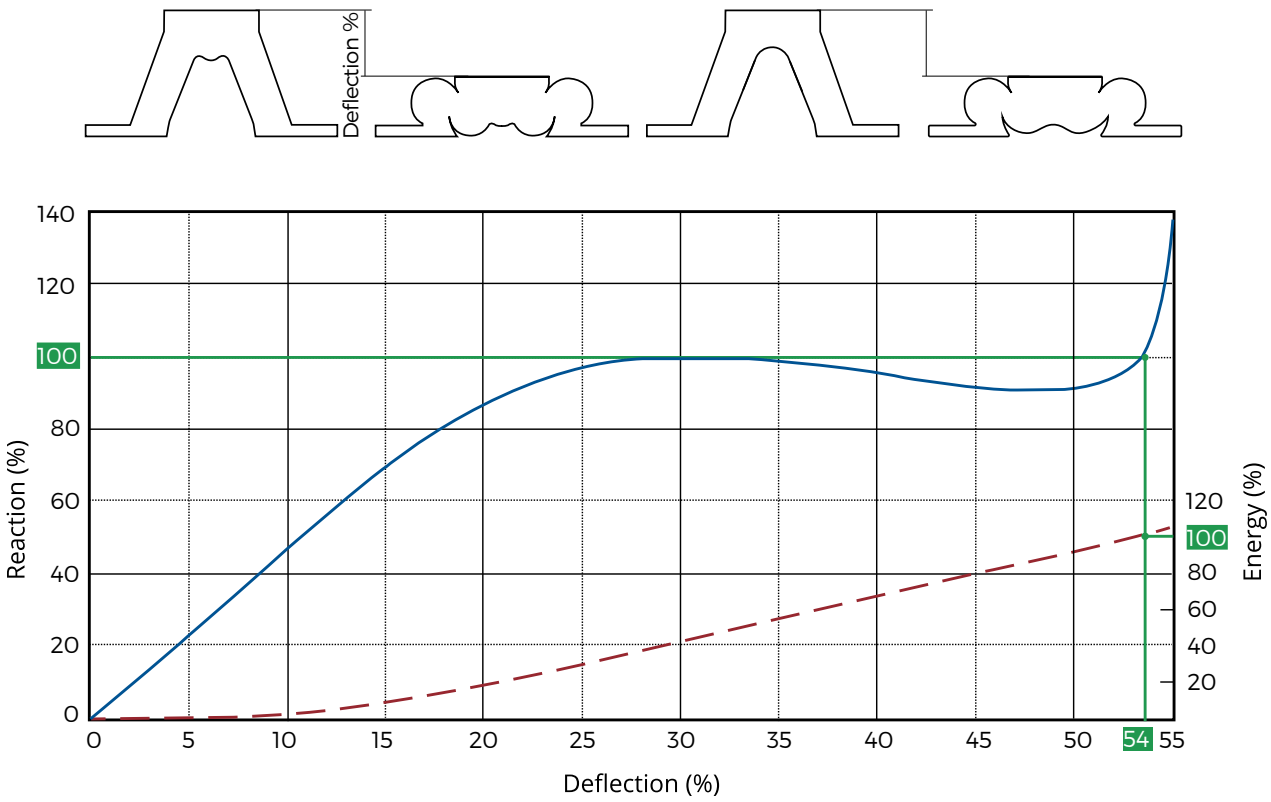


RATED PERFORMANCE DATA

Model	Super High Reaction Force				High Reaction Force				Standard Reaction Force				Low Reaction Force			
	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E
FDA-A150H	135	7.1	182	8.4	147	6.1	157	7.1	87.7	4.1	117	5.1	58	3.1	79.6	4.1
FDA-A200H	176	11.2	240	14.3	156	11.2	208	12.2	114	8.2	156	9.2	78.5	5.1	104	6.1
FDA-A250H	281	29	391	41.2	216	22.8	300	24	179	18.8	249	19.8	154	16.6	213	17.7
FDA-A300H	330	41.8	460	44.8	254	31.6	353	33.7	209	25.5	300	27.4	181	22.4	251	24.5
FDA-A400H	441	74.4	612	79.4	339	57.1	469	6.12	281	46.9	361	50	241	40.8	334	43.9
FDA-A500H	551	115	765	123	423	89.5	588	94.9	351	73.4	487	78.5	301	69.4	418	67.3
FDA-A600H	660	166	917	179	508	129	706	138	420	106	590	113	361	90.7	502	97
FDA-A800H	881	296	1224	317	677	228	940	254	561	189	779	202	481	162	669	173
FDA-A1000H	1101	463	1529	496	846	356	1176	381	703	295	975	317	602	253	835	271

* Performance per metre length. [Units: kNm, kN]

FDA-B PERFORMANCE CURVE



Proven *in*
PRACTICE.



Leg Fender which is also called Unit Element Fender or Element Fender is a high performance, modular system. It has been widely used across the world for decades. The construction of the Leg Fender is simple but very strong and durable. They can provide good protection for piers and docks.

FEATURES

- Modular design allows limitless setting out arrangements
- Efficiency buckling column profile for high energy and low reaction
- Excellent shear resistance in lengthwise plane
- Thicker section body means lower stresses
- Small bolt pockets do not trap water and are easy to access
- Leg Fender shields can be bolted from the front using asymmetric elements

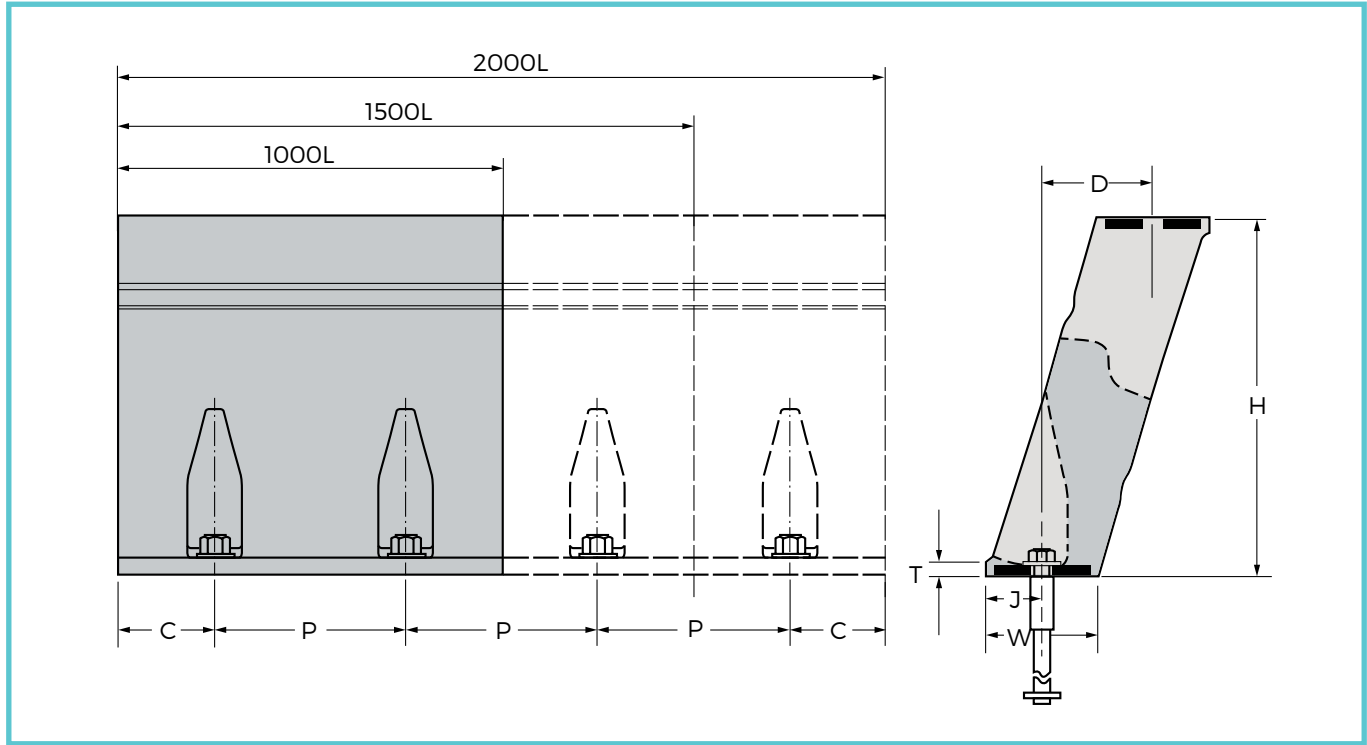
APPLICATIONS

- Container terminals
- Tanker berths
- RoRo and cruise terminals
- Dolphins and monopiles
- Bulk terminals
- General cargo facilities
- Small ship berths

DIMENSIONS

Model	H	J	W	T	D	L	C	P
FUE 300H	300		94		94		250	
FUE 400H	400		125		124		250	
FUE 500H	500		158		142		250	
FUE 550H	550		172		170		250	
FUE 600H	600		188		199		250	
FUE 750H	750		235		230		250	
FUE 800H	800		250		240		250	
FUE 1000H	1000		322		310		250	
FUE 1250H	1250		401		388		250	
FUE 1450H	1450		454		445		250	
FUE 1600H	1600		500		480		250	

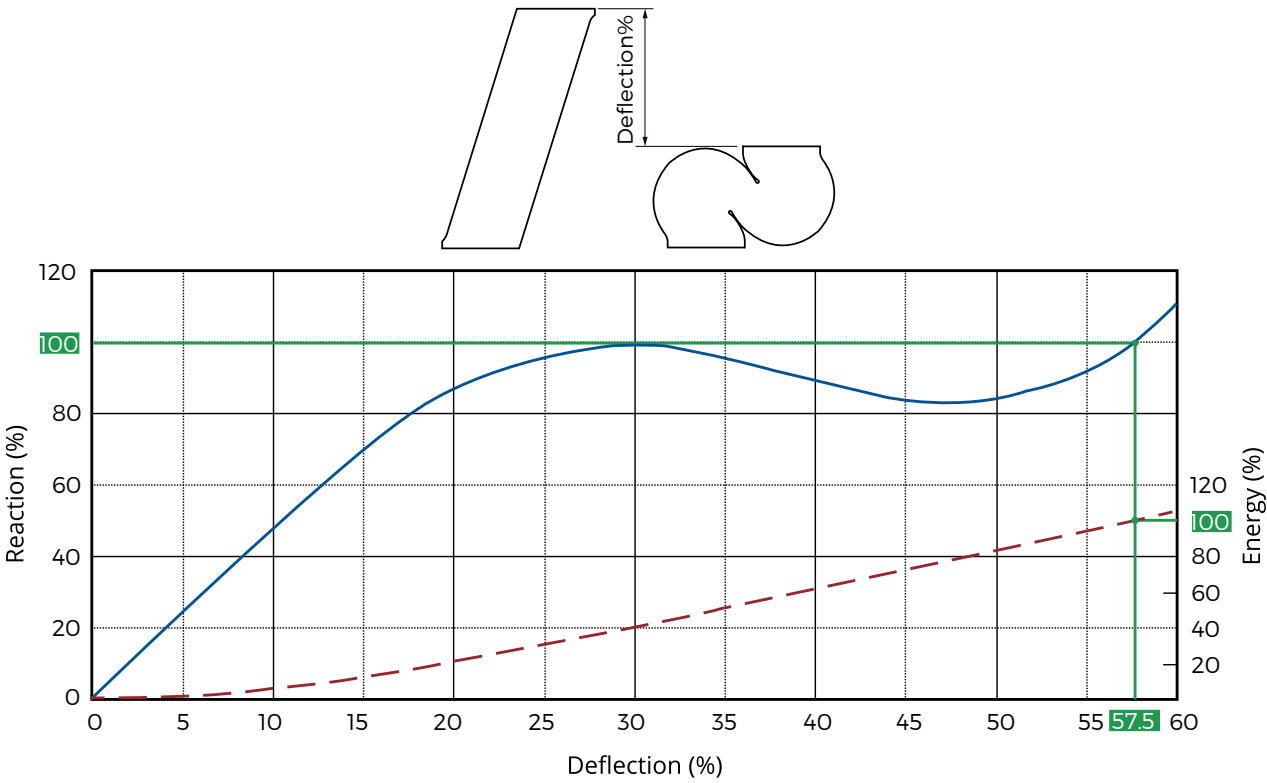
[Units: mm]



RATED PERFORMANCE DATA

	FUE 300H	FUE 400H	FUE 500H	FUE 550H	FUE 600H	FUE 750H	FUE 800H	FUE 1000H	FUE 1250H	FUE 1450H	FUE 1600H
E0.9	13	22	31	40	47	73	84	131	194	336	363
R	101	122	139	159	168	215	227	285	340	501	491
E1.0	13	23	36	44	52	81	93	147	215	342	373
R	106	127	156	172	187	238	251	317	378	511	505
E1.1	13	24	37	46	54	84	96	151	222	351	385
R	110	131	162	179	195	247	260	327	388	523	520
E1.2	14	25	39	47	56	87	99	156	229	359	396
R	112	136	169	186	203	254	268	338	402	535	535
E1.3	14	25	40	48	58	89	103	161	235	367	408
R	114	140	173	192	209	263	279	350	414	548	552
E1.4	15	26	41	49	59	92	107	166	242	374	419
R	119	146	178	198	215	270	286	361	426	558	566
E1.5	15	27	43	52	61	95	109	171	249	383	430
R	123	150	185	204	223	280	295	371	437	570	581
E1.6	15	28	44	54	63	99	113	175	255	390	441
R	125	153	191	209	229	287	304	382	448	581	596
E1.7	16	29	45	55	65	101	115	181	261	398	452
R	130	157	197	215	234	295	311	393	460	594	611
E1.8	16	29	45	56	67	104	119	187	268	406	464
R	132	162	202	222	242	303	323	403	471	606	627
E1.9	17	30	48	58	69	106	123	192	273	413	475
R	135	166	206	229	250	311	329	414	473	620	641
E2.0	17	31	49	59	71	110	125	196	281	422	486
R	138	170	213	234	255	321	337	424	487	631	657
E2.1	17	32	50	60	72	112	129	201	289	429	497
R	143	175	220	240	262	328	346	436	502	643	671
E2.2	18	33	52	63	74	115	131	206	298	437	508
R	145	180	224	246	270	337	354	448	518	654	687
E2.3	18	33	53	65	76	117	135	211	306	444	520
R	148	184	229	252	276	344	366	458	531	666	702
E2.4	19	34	54	66	78	120	139	215	315	452	530
R	152	188	236	258	281	353	372	469	547	678	718
E2.5	19	35	56	67	80	124	141	221	323	460	542
R	155	192	242	265	289	361	381	479	560	689	732
E2.6	19	36	57	69	82	126	145	227	331	469	553
R	158	198	248	272	297	369	390	490	576	702	747
E2.7	20	37	57	69	83	130	147	232	339	475	564
R	161	201	253	277	302	377	397	501	589	713	762
E2.8	21	37	59	71	85	131	151	236	349	483	576
R	171	205	257	283	309	385	409	511	604	725	778
E2.9	22	38	61	73	87	135	155	241	356	492	587
R	176	210	264	289	317	395	416	523	618	736	793
E3.0	22	39	62	76	89	137	158	246	365	500	598
R	179	216	271	294	322	402	424	535	633	749	808
E3.1	24	43	68	83	98	151	173	271	402	550	609
R	195	235	294	322	351	444	470	588	710	825	823

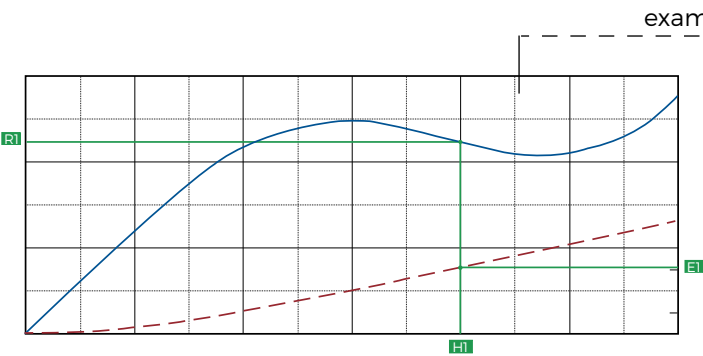
PERFORMANCE CURVE



INTERMEDIATE DEFLECTIONS

H (%)	0	5	10	15	20	25	30	35	40	45	50	55	57.5	60
E (%)	0	2	6	12	22	30	41	51	62	73	83	94	100	106
R (%)	0	24	47	71	87	96	100	97	90	84	85	92	100	112

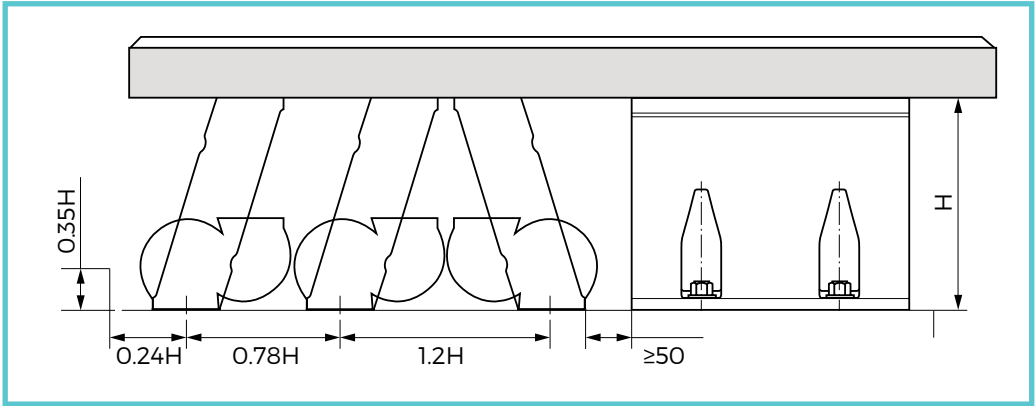
Nominal rated deflection may vary at RPD.



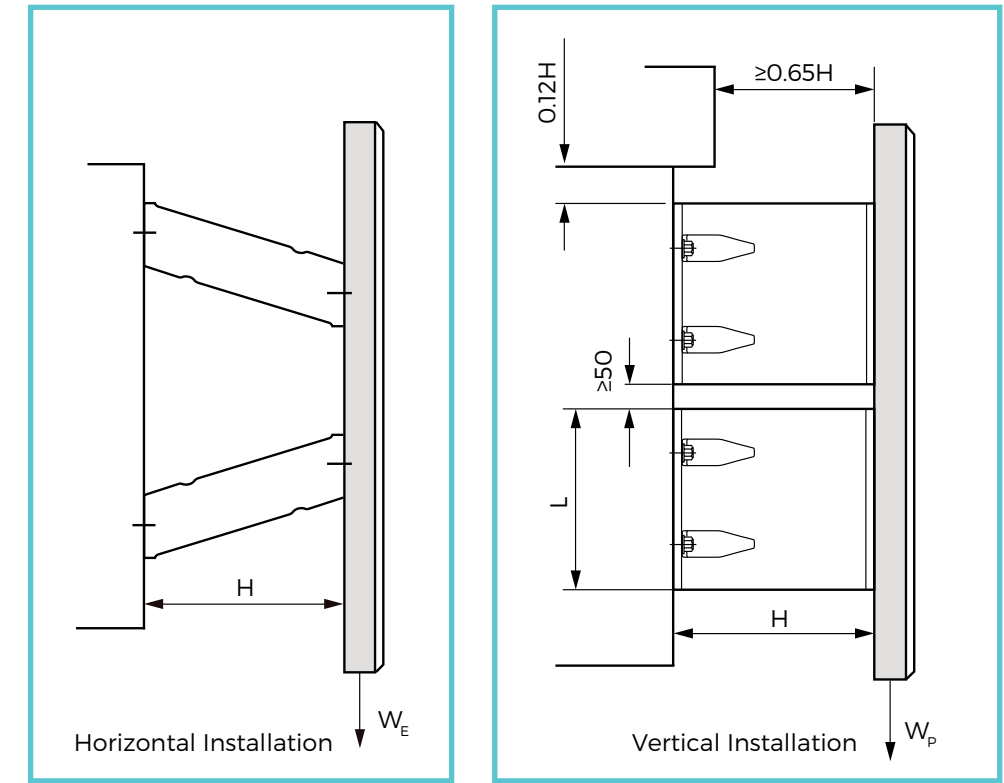
For example:
When deflection is 40%, then
H=40%, R=90%, E=62%

Reaction Force: $R_{(40\%)} = R \cdot R1 = R \cdot 90\%$
Energy Absorption: $E_{(40\%)} = E \cdot E1 = E \cdot 62\%$

CLEARANCES & WEIGHT SUPPORT



Distances given in here are for guidance. If in doubt, please ask.



There must be enough space around and between Element Fenders and the steel panel to allow them to deflect without interference.

The table is a guide to the permitted weight of frontal panel before additional support chains may be required.

Performance	Single or multiple horizontal	Single or multiple vertical
Compound A	$W_E \leq 1.0 \times H \times L$	$W_p \leq 1.78 \times H \times L$
Compound B	$W_E \leq 0.7 \times H \times L$	$W_p \leq 1.25 \times H \times L$

* per pair of elements



Proven *in* PRACTICE.

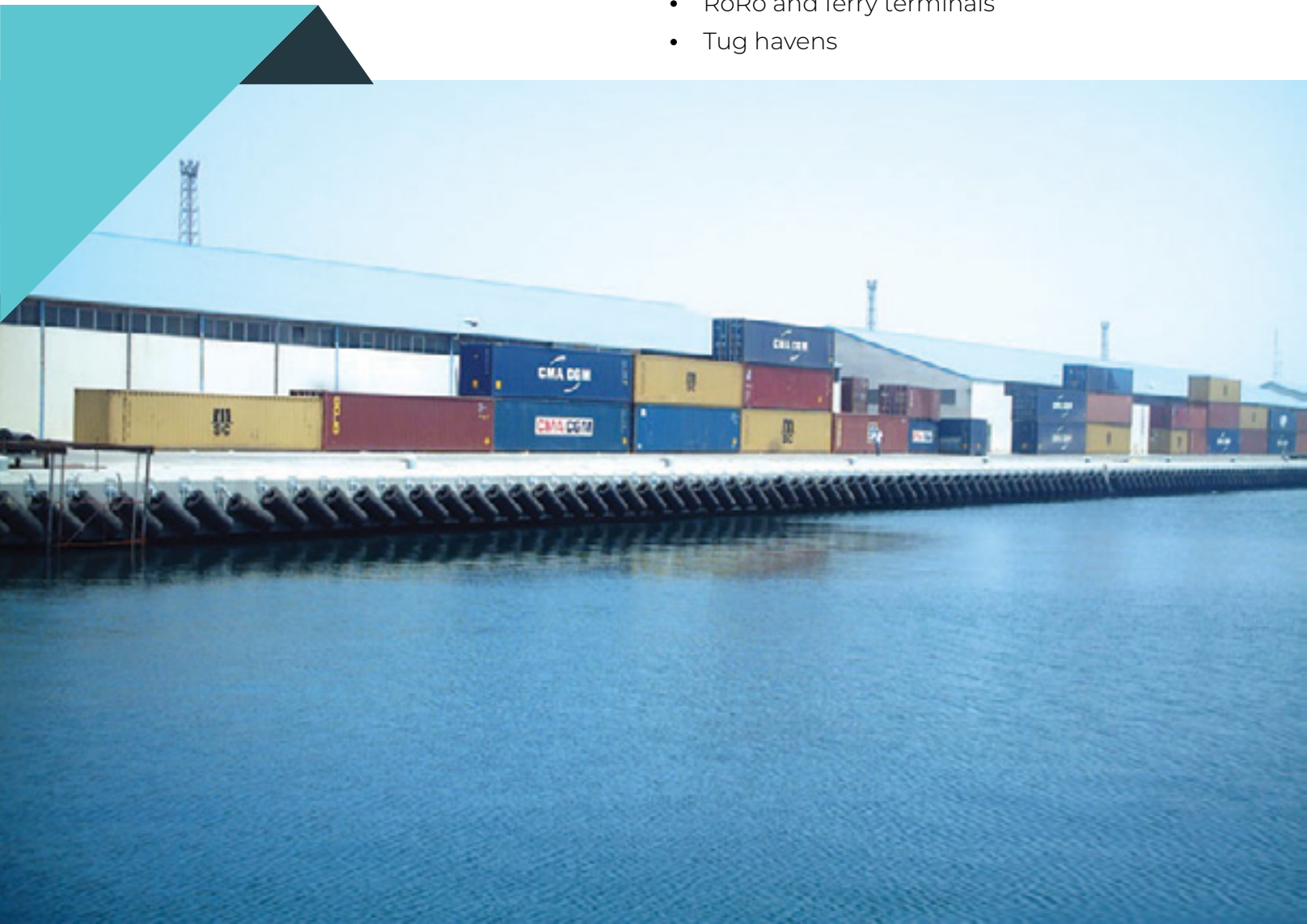
Cylindrical Fender is simple to install and operate which makes these units an economical solution for remote locations and for multi-user berths where vessel types cannot always be predicted. With advantages of progressive load-deflection, Cylindrical Fenders are suitable for both large and small vessels, and with a wide choice of sizes and diameter ratios. The performance of Cylindrical Fender can be closely matched to requirements in each case.

FEATURES

- Simple and economical design, easy to install
- Apply mounting systems to different structures and applications
- Sizes from 100mm to 2700mm diameter
- Resistant to abrasion after years of heavy use
- Progressive load-deflection characteristics

APPLICATIONS

- Bulk cargo berths
- General cargo quays
- Fishing and workboat berths
- Pontoons and floating structures
- RoRo and ferry terminals
- Tug havens



DIMENSIONS & RATED PERFORMANCE DATA

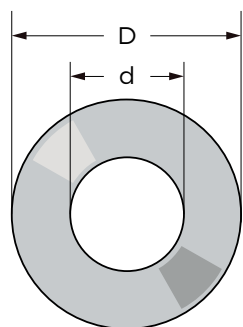
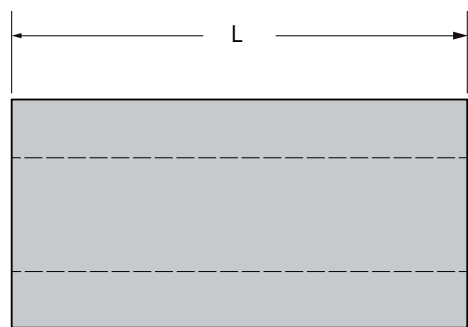
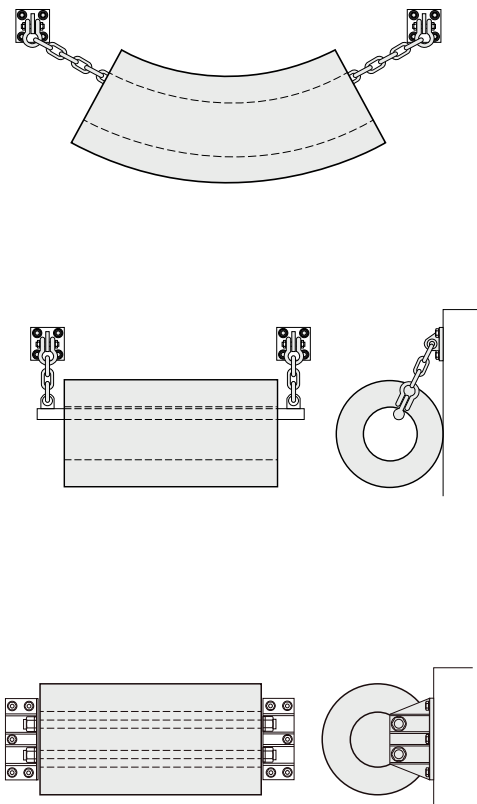
Model	L	ØD	Ød	Chain	U-Anchor	Typical Fixing Arrangements
FCY 150x75	<6000	150	75	Ø16	Ø40	
FCY 200x100		200	100	Ø18	Ø40	
FCY 250x125		250	125	Ø20	Ø40	
FCY 300x150		300	150	Ø24	Ø40	
FCY 350x175		350	175	Ø28	Ø40	
FCY 400x200		400	200	Ø28	Ø50	
FCY 500x250		500	250	Ø32	Ø50	
FCY 600x300	<6000	600	300	Ø36	Ø50	
FCY 700x350		700	350	Ø36	Ø50	
FCY 800x400	1000 1500 2000 2500 3000	800	400	Ø25 Ø28 Ø32 Ø34 Ø40	Ø55	
FCY 900x450	1000 1500 2000 2500 3000	900	450	Ø28 Ø30 Ø34 Ø38 Ø42	Ø60	
FCY 1000x500	1000 1500 2000 2500 3000	1000	500	Ø28 Ø30 Ø38 Ø40 Ø44	Ø60	
FCY 1100x550	1000 1500 2000 2500 3000	1100	550	Ø30 Ø32 Ø38 Ø40 Ø44	Ø65	
FCY 1200x600	1000 1500 2000 2500 3000	1200	600	Ø30 Ø32 Ø38 Ø42 Ø46	Ø65	
FCY 1300x650	1000 1500 2000 2500 3000	1300	650	Ø30 Ø32 Ø38 Ø42 Ø48	Ø65	
FCY 1400x700	1000 1500 2000 2500 3000	1400	700	Ø34 Ø38 Ø44 Ø48 Ø52	Ø65	
FCY 1500x750	1000 1500 2000 2500 3000	1500	750	Ø36 Ø40 Ø46 Ø48 Ø52	Ø65	
FCY 1600x800	1000 1500 2000 2500 3000	1600	800	Ø38 Ø40 Ø46 Ø50 Ø54	-	
FCY 1700x850	1000 1500 2000 2500 3000	1700	850	-	-	
FCY 1800x900	1000 1500 2000 2500 3000	1800	900	-	-	
FCY 1900x950	1000 1500 2000 2500 3000	1900	950	-	-	
FCY 2000x1000	1000 1500 2000 2500 3000	2000	1000	-	-	

The sizes listed are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

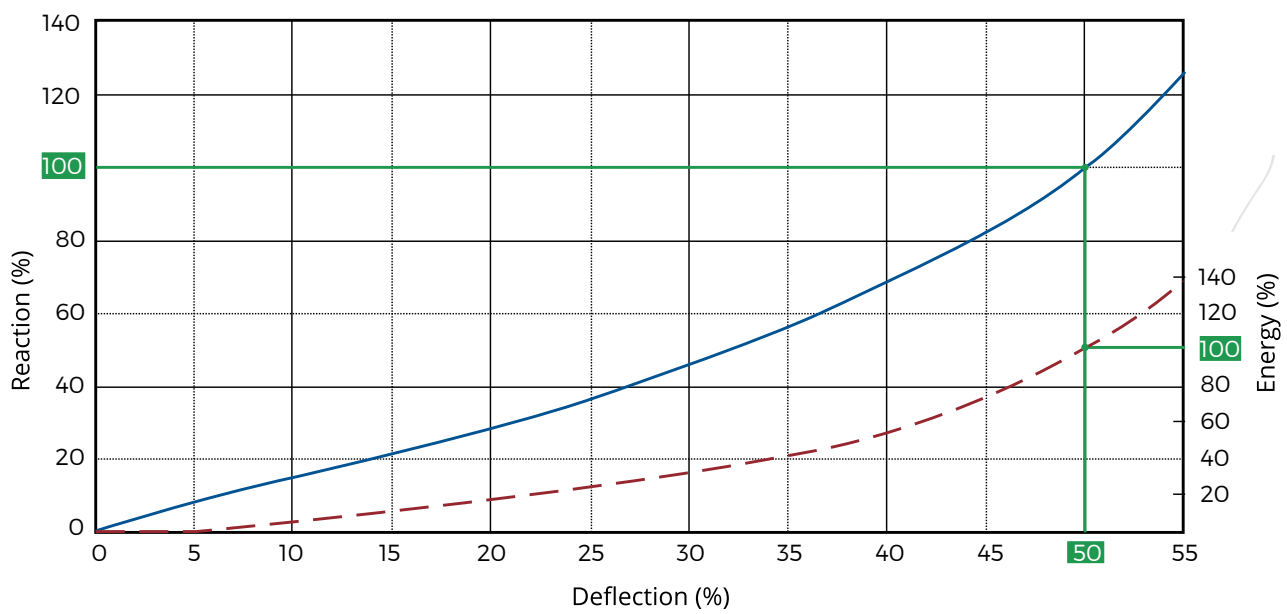
DIMENSIONS & RATED PERFORMANCE DATA

Model D* d (mm)	Deflection 50%			
	Compound A		Compound B	
	E (kNm)	R (kN)	E (kNm)	R (kN)
FCY 150x75	44	1.5	73	2.3
FCY 200x100	60	2.6	95	4.2
FCY 250x125	75	4	120	6.5
FCY 300x150	89	6	143	9
FCY 350x175	104	8	167	13
FCY 400x200	119	10	191	17
FCY 500x250	148	16	239	26
FCY 600x300	179	24	286	37
FCY 700x350	208	31	334	50
FCY 800x400	237	41	383	66
FCY 900x450	268	52	430	84
FCY 1000x500	297	64	479	103
FCY 1100x550	331	77	528	129
FCY 1200x600	363	95	574	152
FCY 1300x650	392	108	623	179
FCY 1400x700	422	128	670	208
FCY 1500x750	451	147	718	238
FCY 1600x800	48	176	776	282
FCY 1700x850	511	206	824	338
FCY 1800x900	541	247	872	406
FCY 1900x950	570	288	920	487
FCY 2000x1000	653	321	1054	584

Typical Fixing Arrangements

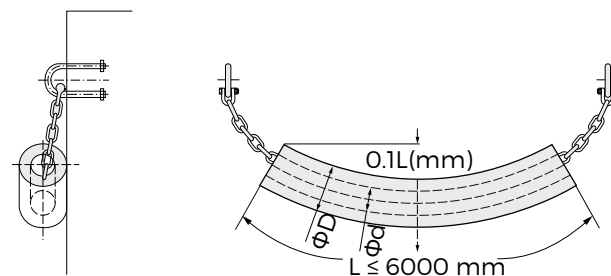


PERFORMANCE CURVE



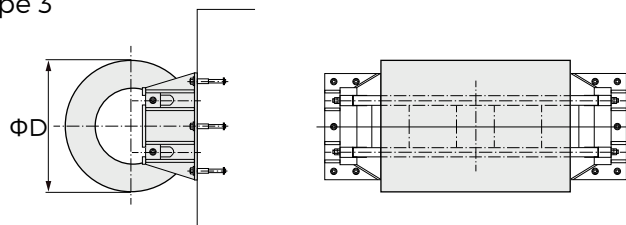
INSTALLATION FIXING DETAILS

Type 1



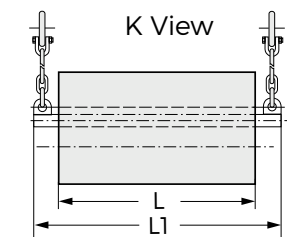
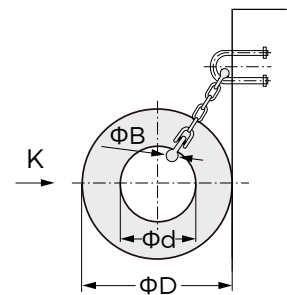
* Small cylindricals (≤φ500mm) are often suspended from chains connected to brackets or U-anchors on the quay wall.

Type 3



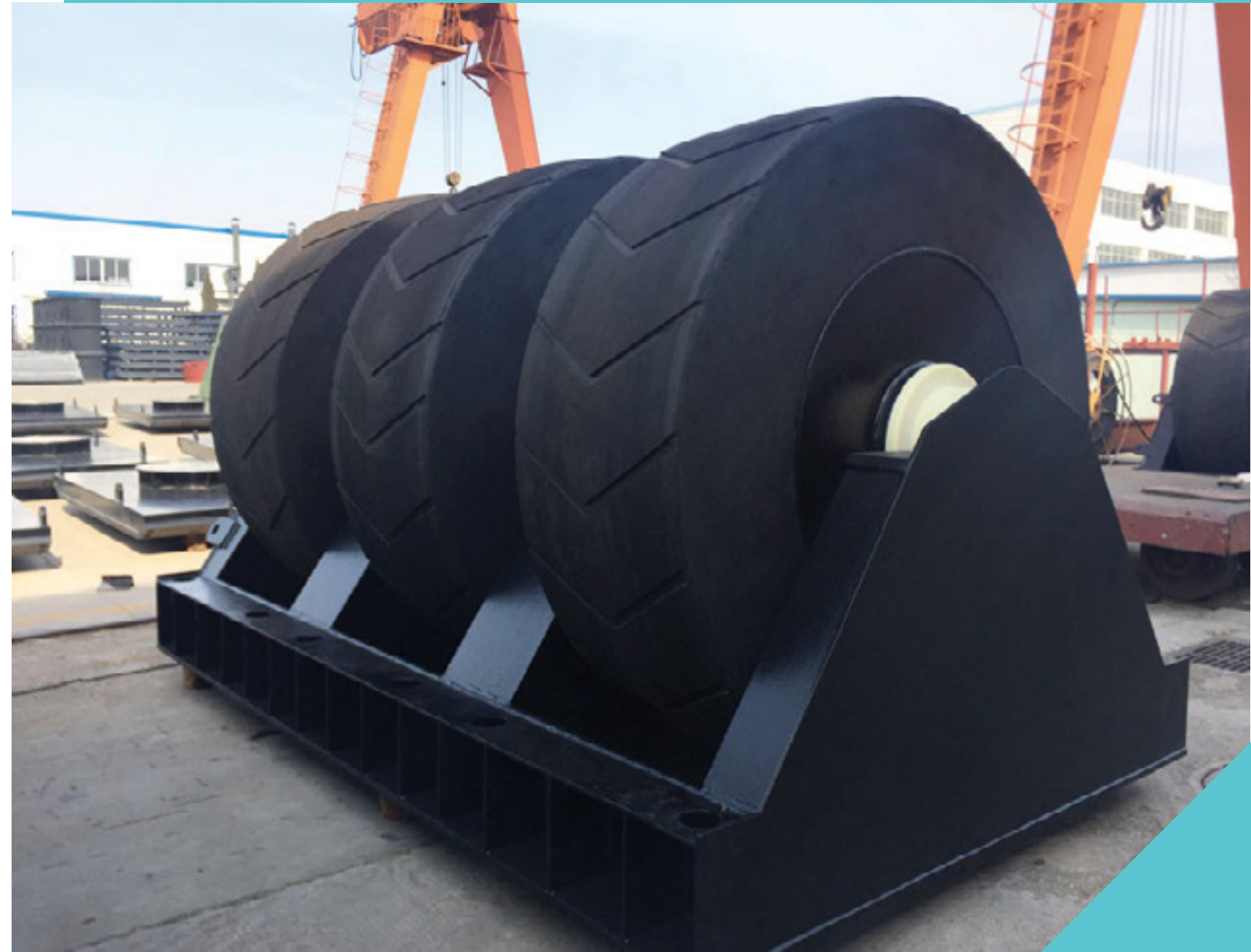
* Very large cylindrical rubber fenders (≥φ1600mm) may require special ladder brackets due to their weight. These are specially designed for each application.

Type 2



* Large cylindrical rubber fenders often use a central support bar connected at each end to chains which go back to brackets or U Anchors on the quay wall.

Wheel Fender

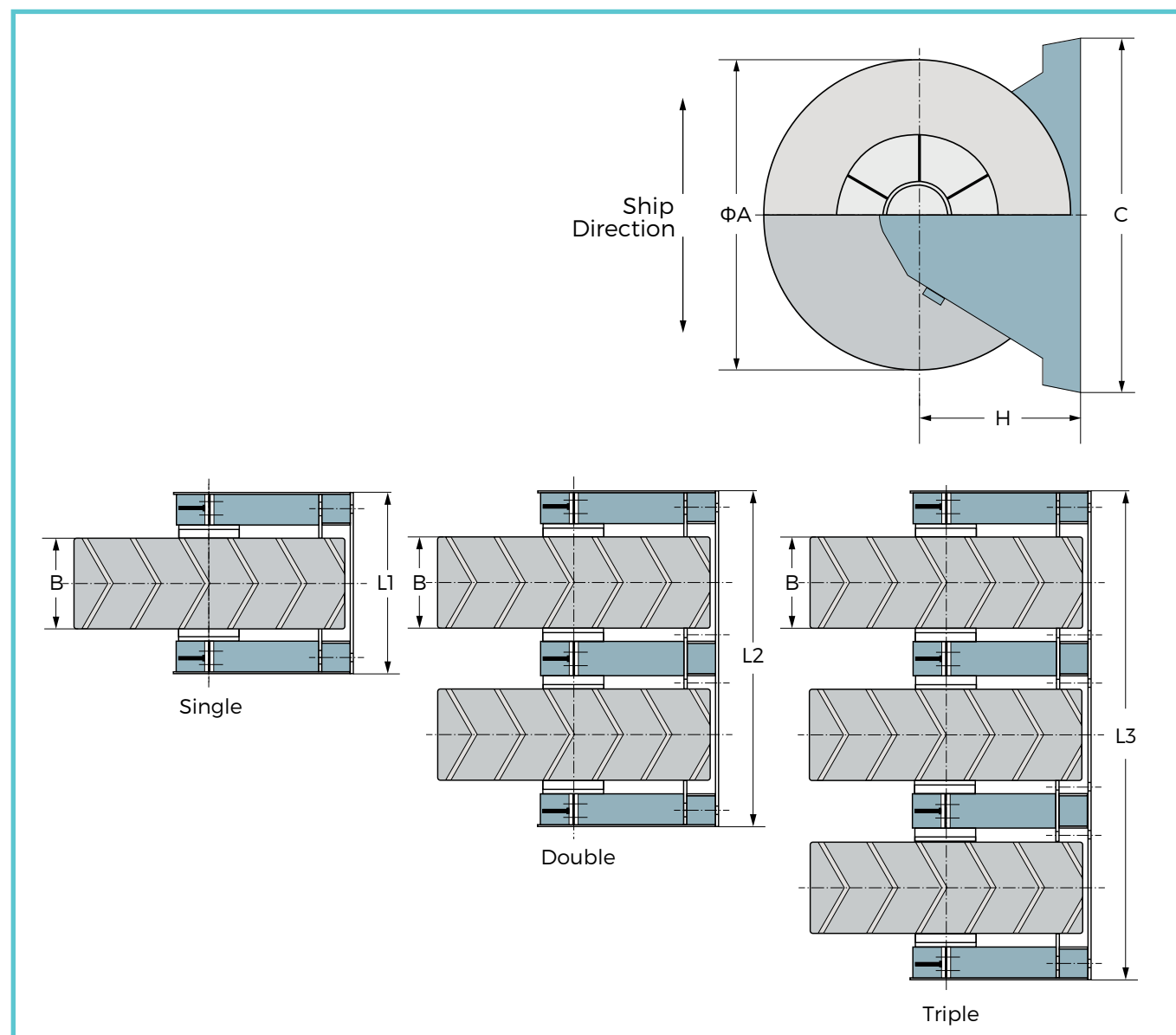


Wheel Fenders are widely used on exposed corners to help ships manoeuvre into berths and narrow channels such as locks and dry-dock entrances.

The Wheel Fender is mounted on a fixed axle supported by a special frame which allows the fender to rotate with the axle.

Wheel Fenders are commonly installed along the walls of dry-docks and other restricted M channels to help guide vessels and prevent hull damage.

Proven *in*
PRACTICE.



DIMENSIONS

Model	A	B	C	H	L1	L2	L3
FWL 600x200	600	200	695	320	420	770	1120
FWL 750x250	750	250	870	400	510	935	1360
FWL 900x300	900	300	1040	495	610	1120	1630
FWL 1200x400	1200	400	1380	640	820	1500	2180
FWL 1500x500	1500	500	1740	800	1010	1850	2690
FWL 1800x600	1800	600	2080	960	1210	2215	3220
FWL 2100x700	2100	700	2440	1155	1410	2590	3770
FWL 2400x800	2400	800	2770	1280	1610	2950	4290
FWL 2700x900	2700	900	3130	1440	1810	-	-
FWL 3000x1000	3000	1000	3480	1600	2010	-	-

The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

[Units: mm]

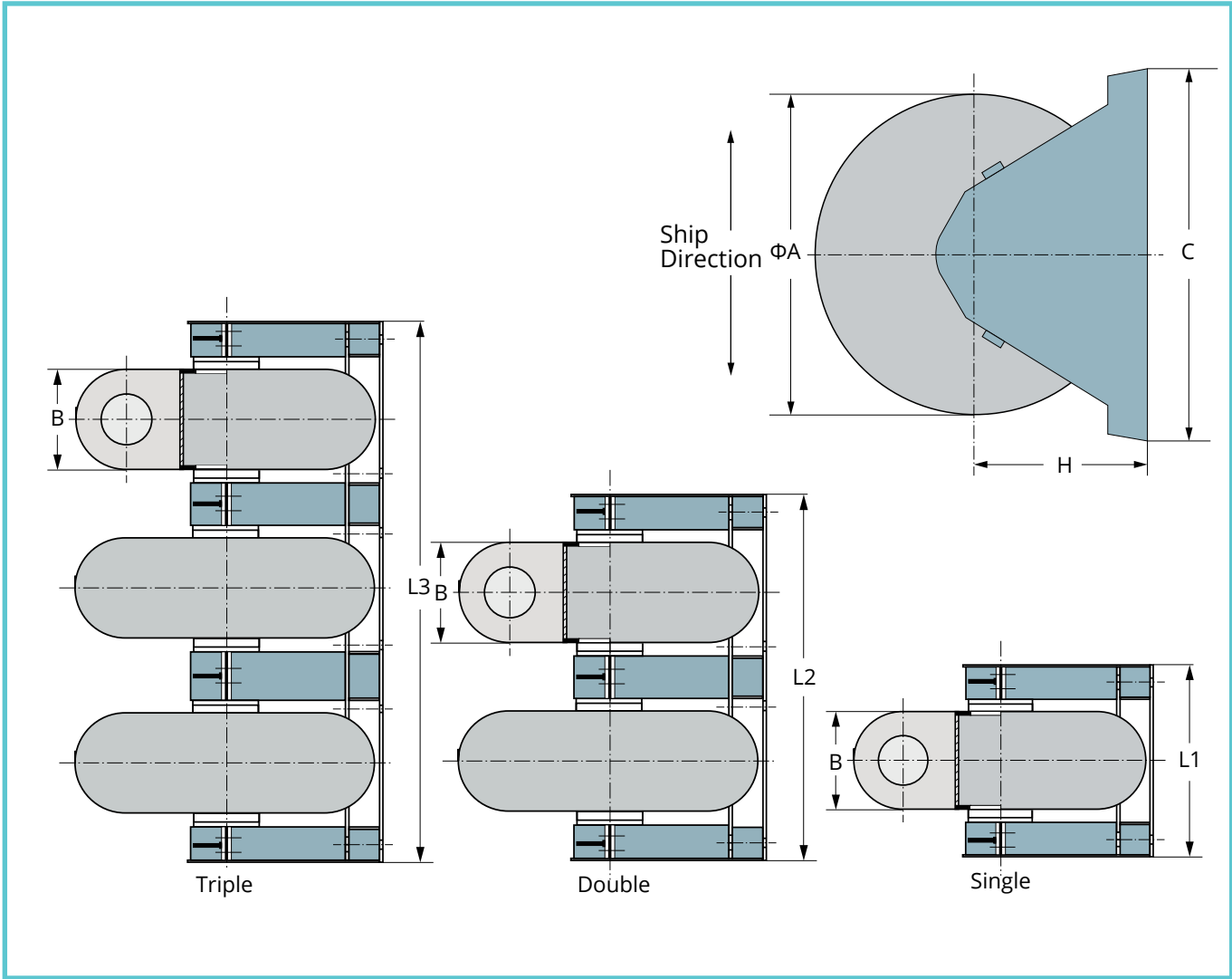
Roller Fender



Roller Fenders are widely used on exposed corners to help ships manoeuvre into berths and narrow channels such as locks and dry-dock entrances. There are two types of Roller Fenders and each has its own features and applicable conditions.

ROLLER FENDER TYPE A

Roller Fenders have two types, Roller Fender Type A and Roller Fender Type B. Type A can absorb part of impact energy while rotating with 20% deflection during berthing. outside of the fender is easily torn by sharp objects. The curve diameter should be paid attention on to avoid damage: $R = 4 \times \Phi D$.



DIMENSIONS

Model AxB	Single				Double		Triple	
	C	H	L1	Weight	L2	Weight	L3	Weight
FZD-A 600x200	695	320	420	128	770	246	1120	365
FZD-A 750x250	870	400	510	248	935	502	1360	736
FZD-A 900x300	1040	495	610	466	1120	877	1630	1292
FZD-A 1200x400	1380	640	820	1046	1500	2040	2180	3007
FZD-A 1500x500	1740	800	1010	2011	1850	3915	2690	5786
FZD-A 1800x600	2080	960	1210	3443	2215	6701	3220	9892
FZD-A 2100x700	2440	1155	1410	5612	2590	10927	3770	15898
FZD-A 2400x800	2770	1280	1610	8116	2950	15705	4290	23300
FZD-A 2700x900	3130	1440	1810	11595	-	-	-	-
FZD-A 3000x1000	3480	1600	2010	16011	-	-	-	-

[Units: mm, kg]

ROLLER FENDER TYPE A PERFORMANCE DATA

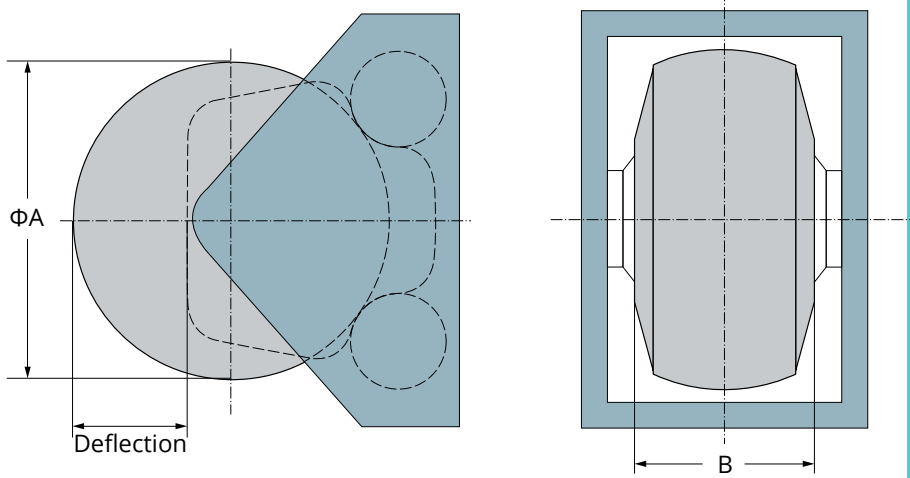
Model AxB (mm)	Max Deflection (mm)	Single		Double		Triple	
		Reaction (kN)	Energy (kNm)	Reaction (kN)	Energy (kNm)	Reaction (kN)	Energy (kNm)
FZD-A 600x200	125	68.3	2	137	5	206	7
FZD-A 750x250	159	107	5	214	9.2	321	14.3
FZD-A 900x300	185	154	8	308	16.3	462	24.5
FZD-A 1200x400	260	274	19.4	550	39.8	830	59.2
FZD-A 1500x500	325	427	38.8	860	77.5	1289	115
FZD-A 1800x600	390	620	66.3	1239	133	1860	200
FZD-A 2100x700	455	840	104	1680	208	2519	312
FZD-A 2400x800	510	1130	143	2199	286	3299	428
FZD-A 2700x900	578	1389	224	2779	448	4169	672
FZD-A 3000x1000	640	1710	308	3419	616	5128	924

[Units: mm,kN, kNm,]

Composite Fender

ROLLER FENDER TYPE B

Roller Fender Type B can rotate on three fixed axles, it has a sliding axle in front of two idler rollers to absorb the greatest possible energy during compression of the wheel into the casing.



ROLLER FENDER TYPE B RATED PERFORMANCE DATA

Model AxB (mm)	Max Deflection (mm)	Single		Double		Triple	
		Reaction (kN)	Energy (kNm)	Reaction (kN)	Energy (kNm)	Reaction (kN)	Energy (kNm)
FZD-B 1200x400	431	253	49	506	98	759	147
FZD-B 1500x500	541	396	96	792	191	1189	287
FZD-B 1800x600	650	570	165	1119	330	1710	495
FZD-B 2100x700	762	776	262	1549	524	2329	785
FZD-B 2400x800	851	1010	391	2020	781	3028	1170
FZD-B 2700x900	964	1279	557	2559	1110	3838	1670
FZD-B 3000x1000	1074	1579	764	3159	1529	4738	2289

[Units: mm,kN, kNm,]



Composite Fenders possess low-friction and wear resistant properties and are also the combination of rubber and UHMW PE by vulcanising method which makes the structure more reliable and stronger. Composite Fenders are widely applicated in jetties and wharves for small craft, etc. Fender Marine supplies a variety of customised sizes. If required, steel base plate also can be moulded in Composite Fenders.

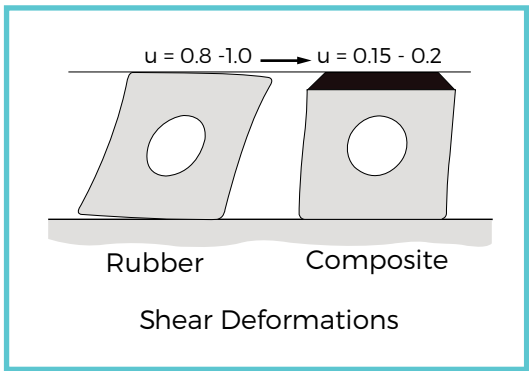
FEATURES

- Resilient rubber body
- Low-friction UHMW PE face
- Strong bond between joint
- Easily drilled and cut
- Professional size design

APPLICATIONS

- Pile guides on floating structures
- Jetties and wharves for small craft
- Mooring pontoons
- Narrow waterways

Please consult Fender Marine if any special requirements.



Model	E	R	Model	E	R
FCF-A 100x100	4.2	218	FCF-C 100x100	1.6	74
FCF-A 200x200	11.6	327	FCF-C 200x200	2.1	151
FCF-A 250x250	24.4	554	FCF-C 250x250	3	184
FCF-A 300x300	42	612	FCF-C 300x300	6	369

* Values are per metre.

[Units: kNm, kN]

D & Square Fenders



D Fenders

D and Square Type Fenders can be pre-curved, chamfered and drilled to aid installation at a relatively low cost and also can be cut to the length required. These fenders provide an excellent barrier against damage for all sizes and shapes of vessels. They are usually used for tugs, barges, workboats and pilot boats as side belting and protective fenders against heavy rubbing, brushing and pushing forms. These fenders also can be mounted into quays by means of anchor belts.

FEATURES

- Ideal for smaller quays and wharves
- Easy to install with a flat bar down the bore
- Can be supplied in long lengths and be cut to length, angle cut at the ends

APPLICATIONS

- Smaller jetties and wharves
- Workboats and service craft
- Mooring pontoon protection
- Inland waterways
- General purpose applications



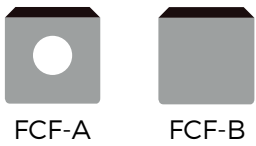
Square Fenders



DIMENSIONS

Model	A	B	ΦC	t	ΦD	E	F	G	H
FCF-A 100H	100	100	30	20	15	25	10	90~130	200~300
FCF-A 150H	150	150	65	25	20	30	12	110~150	250~350
FCF-A 165H	165	125	65	20	20	35	15	110~150	250~350
FCF-A 200H	200	200	75	25	25	45	20	130~180	300~400
FCF-A 200H	200	200	100	25	25	45	20	130~180	300~400
FCF-A 250H	250	250	100	30	30	50	25	140~200	350~450
FCF-A 300H	300	300	125	30	30	60	30	140~200	350~450

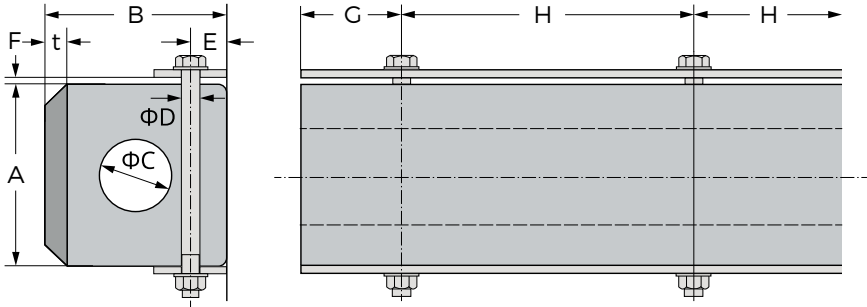
[Units: mm]



FCF-A

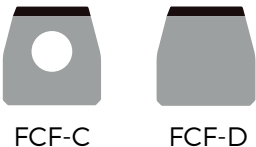
FCF-B

FCF-B Type Composite Fenders have the same dimensions with FCF-A Type.



Model	A	B	ΦC	a	b	c	t	ΦD	E	F	G	H
FCF-C 80H	80	80	42	60	40	44	10	15	25	6	90~130	200~300
FCF-C 100H	100	100	45	74	50	56	10	15	25	8	90~130	200~300
FCF-C 120H	120	120	62	88	60	67	12	20	30	10	110~150	250~350
FCF-C 150H	150	150	73	110	75	83	15	20	30	12	110~150	250~350

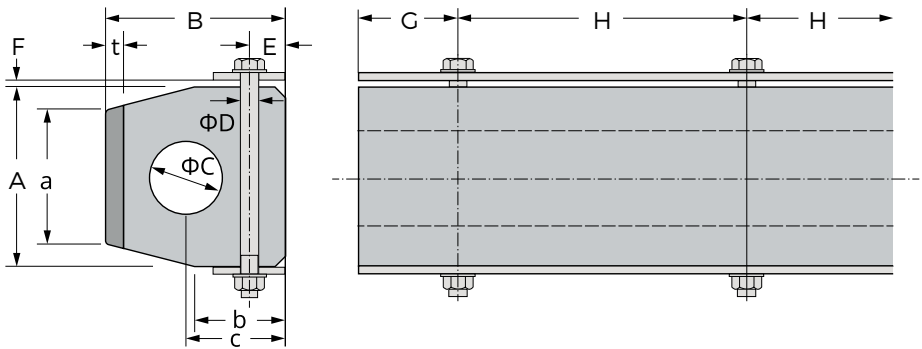
[Units: mm]



FCF-C

FCF-D

FCF-D Type Composite Fenders have the same dimensions with FCF-C Type.



The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

DIMENSIONS

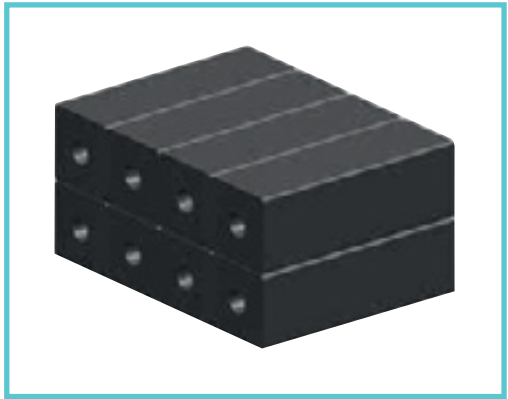
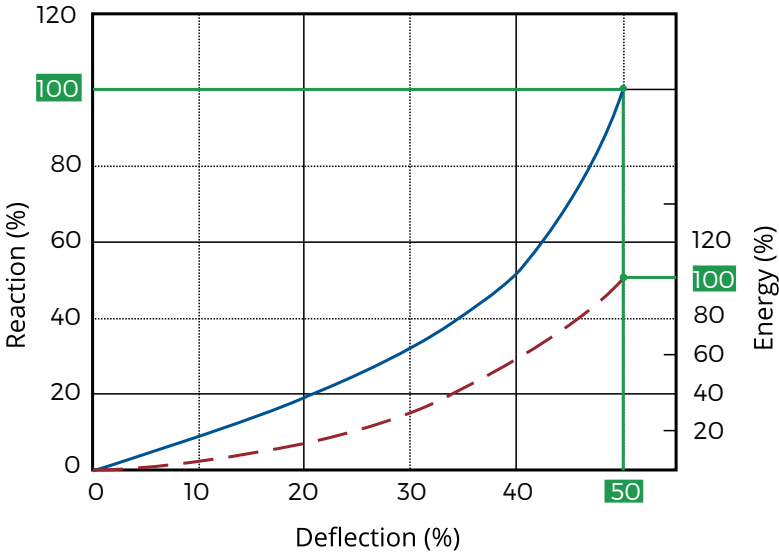
Model	H	ΦD	E	Φd	A	P	Flat Bar	M
FDC 100H	100	50	25	15	90-130	200-300	50x6	M12
FDC 150H	150	65	30	20	110-150	250-350	60x8	M16
FDC 200H	200	75	45	25	130-180	300-400	80x10	M20
FDC 250H	250	100	50	30	140-200	350-450	100x10	M24
FDC 300H	300	125	60	30	140-200	350-450	110x12	M24
FDC 350H	350	175	70	35	140-200	350-450	120x12	M30
FDC 400H	400	200	80	35	140-200	350-450	130x15	M30
FDC 500H	500	250	100	35	140-200	350-450	130x15	M36

[Units: mm]

RATED PERFORMANCE DATA

Model	Deflection 50%	
	E (kNm)	R (kN)
FDC 100	1.9	155
FDC 150	4.1	222
FDC 200	7.7	297
FDC 250	11.8	365
FDC 300	17.2	453
FDC 350	23.3	532
FDC 400	29.7	590
FDC 500	46.5	707

* Values are per metre.



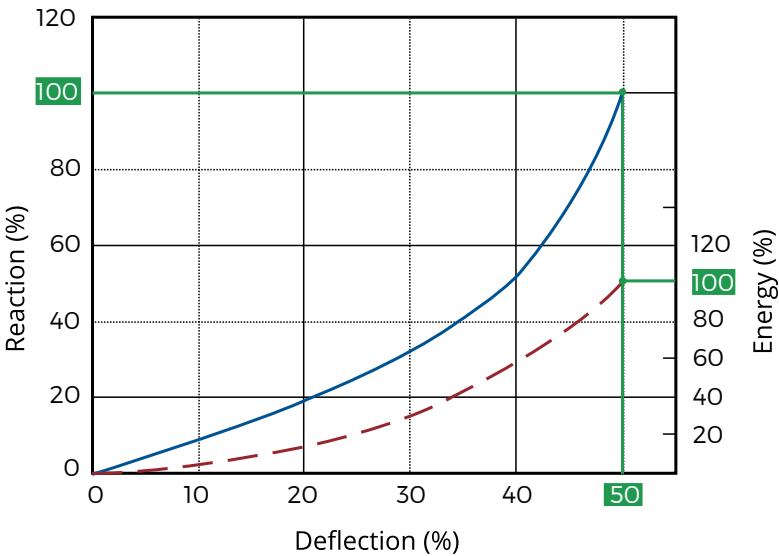
Model	H	ΦD	E	Φd	A	P	Flat Bar	M
FFO 100H	100	30	25	15	90-130	200-300	50x6	M12
FFO 150H	150	65	30	20	110-150	250-350	60x8	M16
FFO 200H	200	75	45	25	130-180	300-400	80x10	M20
FFO 250H	250	100	40	30	140-200	350-450	100x10	M24
FFO 300H	300	125	60	30	140-200	350-450	110x12	M24
FFO 350H	350	150	65	35	140-200	350-450	120x12	M30
FFO 400H	400	200	70	35	140-200	350-450	130x15	M30
FFO 500H	500	250	90	45	150-230	400-500	150x20	M36

[Units: mm]

The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

Model	Deflection 50%	
	E (kNm)	R (kN)
FFO 100	2.6	171
FFO 150	6.5	254
FFO 200	11.4	339
FFO 250	17.6	421
FFO 300	25.8	508
FFO 350	34.6	592
FFO 400	45.6	676
FFO 500	71.2	846

* Values are per metre.



DIMENSIONS

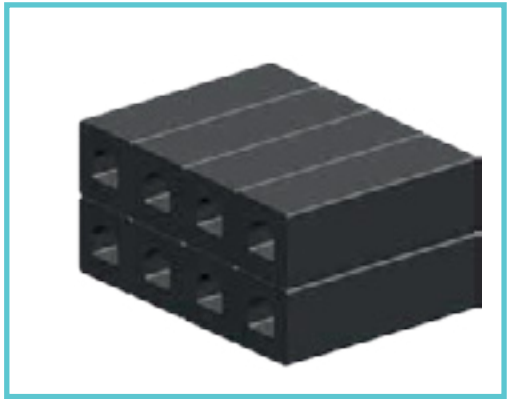
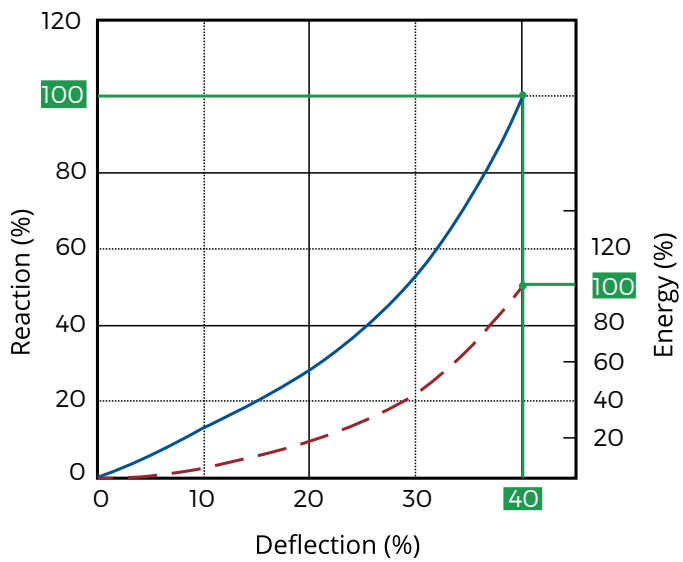
Model	H	B	Flat Bar	F	E	A	P	M
FDD 100H	100	25	40x5	15	30	90-130	200-300	M12
FDD 150H	150	37.5	50x8	20	40	110-150	250-350	M16
FDD 200H	200	50	70x10	25	50	130-180	300-400	M20
FDD 250H	250	62.5	90x12	30	60	140-200	350-450	M24
FDD 300H	300	75	100x12	30	60	140-200	350-450	M24
FDD 350H	350	87.5	130x15	35	75	140-200	350-450	M30
FDD 380H	380	95	140x15	35	75	140-200	350-450	M30
FDD 400H	400	100	150x15	35	75	140-200	350-450	M30
FDD 500H	500	125	180x20	45	90	160-230	400-500	M36

[Units: mm]

RATED PERFORMANCE DATA

Model	Deflection 40%	
	E (kNm)	R (kN)
FDD 100	1.3	75
FDD 150	3.2	113
FDD 200	5.8	150
FDD 250	9.2	187
FDD 300	13.3	225
FDD 350	17.8	263
FDD 400	23.3	300
FDD 500	36.3	375

* Values are per metre.

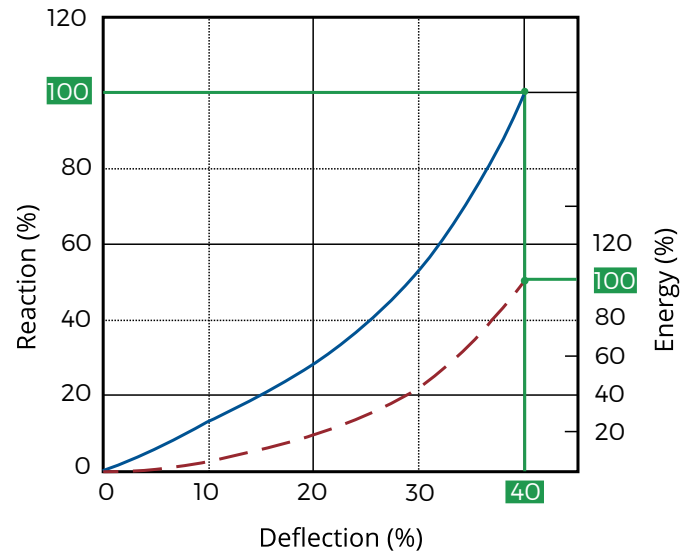


Model	H	B	Flat Bar	F	E	A	P	M
FSD 100H	100	25	40x5	24	30	90-130	200-300	M12
FSD 150H	150	37.5	50x8	32	40	110-150	250-350	M16
FSD 200H	200	50	70x10	40	50	130-180	300-400	M20
FSD 250H	250	62.5	90x12	48	60	140-200	350-450	M24
FSD 300H	300	75	100x12	48	60	140-200	350-450	M24
FSD 350H	350	87.5	130x15	60	75	140-200	350-450	M30
FSD 400H	400	100	150x15	60	75	140-200	350-450	M30
FSD 500H	500	125	180x20	72	90	160-230	400-500	M36

[Units: mm]

Model	Deflection 40%	
	E (kNm)	R (kN)
FSD 100	2.7	133
FSD 150	6.4	203
FSD 200	11.4	271
FSD 250	17.7	336
FSD 300	25.6	404
FSD 350	34.5	465
FSD 400	45.7	579
FSD 500	71.4	723

* Values are per metre.



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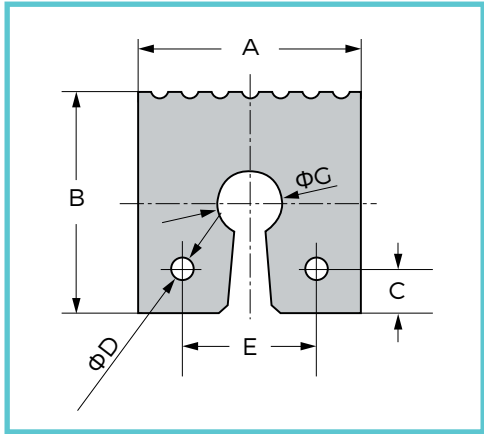
Keyhole Fenders have optional smooth or grooved faces to satisfy different friction requirements, and can be fitted with low-friction UHMW PE facings for heavy-duty applications.



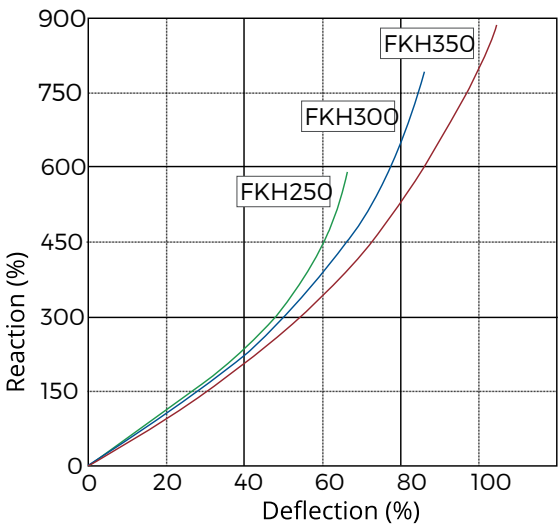
DIMENSIONS

Model	A	B	C	ΦD	ΦC	E	Lmax
FKH 200	200	200	35	28	90	130	3000
FKH 250	250	250	50	33	100	150	3000
FKH 300	300	300	60	33	115	180	3000
FKH 350	350	350	70	33	125	210	3000

[Units: mm]

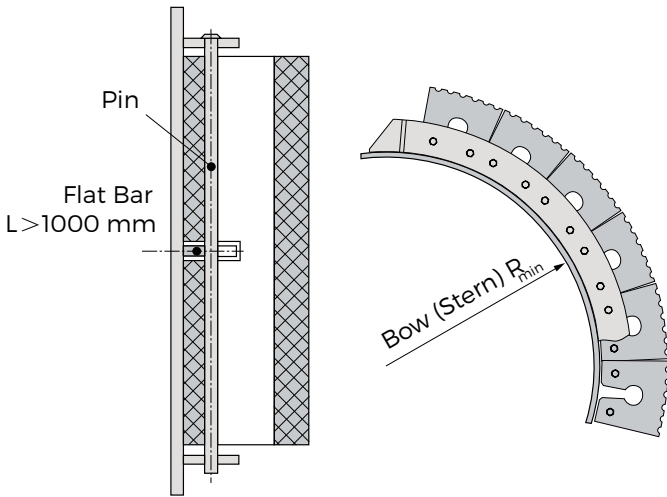


PERFORMANCE CURVE



The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

ATTACHMENT



W Fender

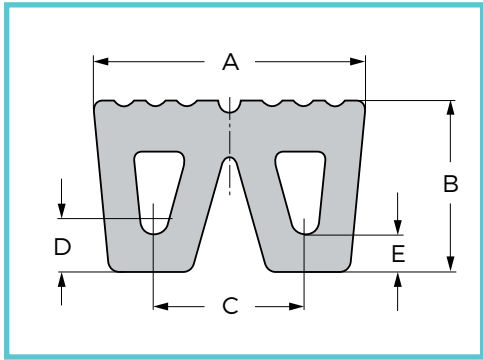


The W Fender is designed for extreme conditions. Its open bore profile makes installation simple for almost all hull shapes. W Fenders are fitted using pins that run through central bore holes.

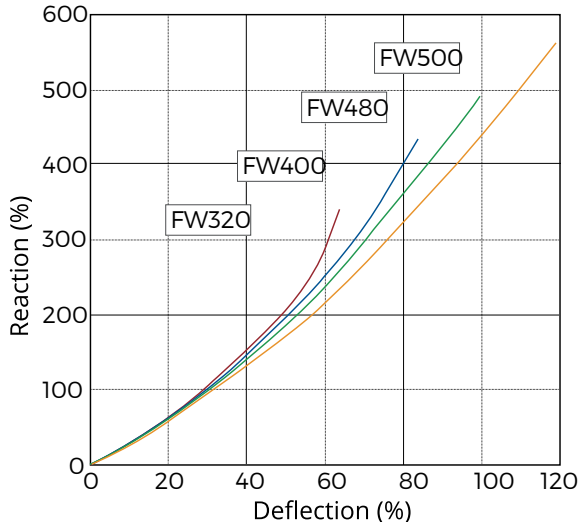
DIMENSIONS

Model	A	B	C	D	E	Lmax
FW 320	320	200	180	67	50	3000
FW 400	400	250	220	75	55	3000
FW 480	480	300	268	85	65	3000
FW 500	500	350	268	85	65	3000
FW 500	500	450	268	100	80	3000

[Units: mm]

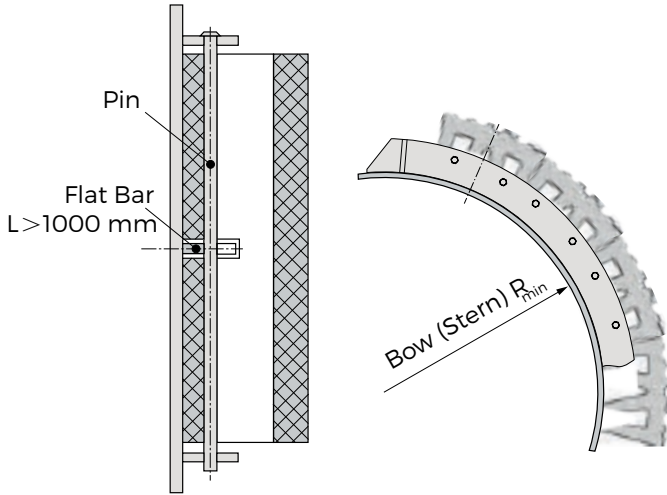


PERFORMANCE CURVE



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ATTACHMENT



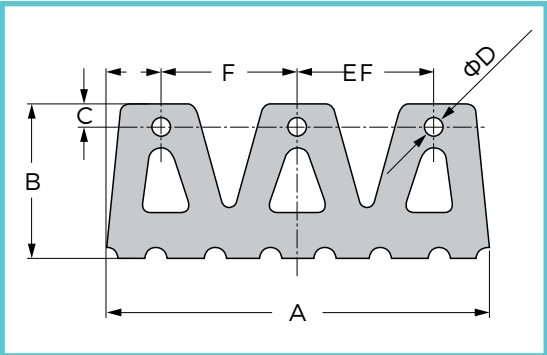


M Fenders have a low weight per contact area. They can be fitted around very tight curves, fixed with pins that run through central bore holes. They are grooved for a soft and flexible contact face, which firmly grips the vessel's hull.

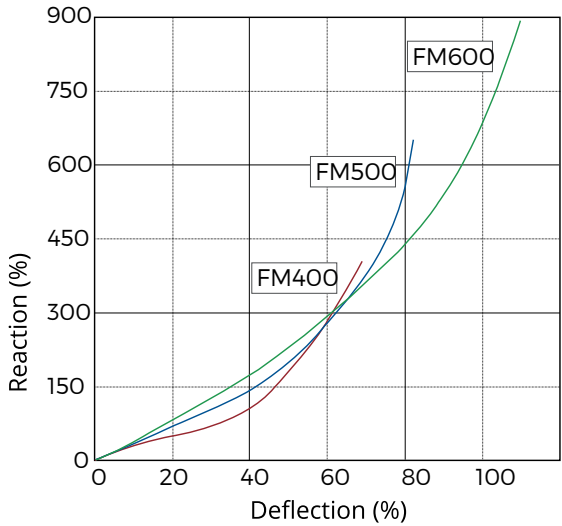
DIMENSIONS

Model	A	B	C	ΦD	E	F	Lmax
FM 400	400	200	40	23	50	150	3000
FM 500	500	250	50	27	60	190	3000
FM 600	600	300	60	33	70	200	3000

[Units: mm]

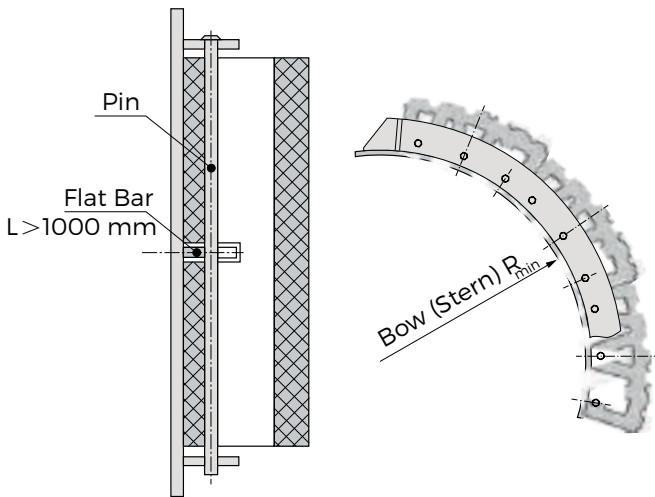


PERFORMANCE CURVE



The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

ATTACHMENT



Wing Fender



Wing Fenders are usually used for tugs and workboats. Instead of drilling the fender, the wings of the Wing Fender are retained by steel angles. Wing Fenders are jacked into the angles during installation and joints between adjacent sections are "plugged" to achieve a smooth and continuous contact face. Once fitted, the "wings" of the Wing Fender sit tightly within the angles making this arrangement very resistant to longitudinal and transverse shear.

FEATURES

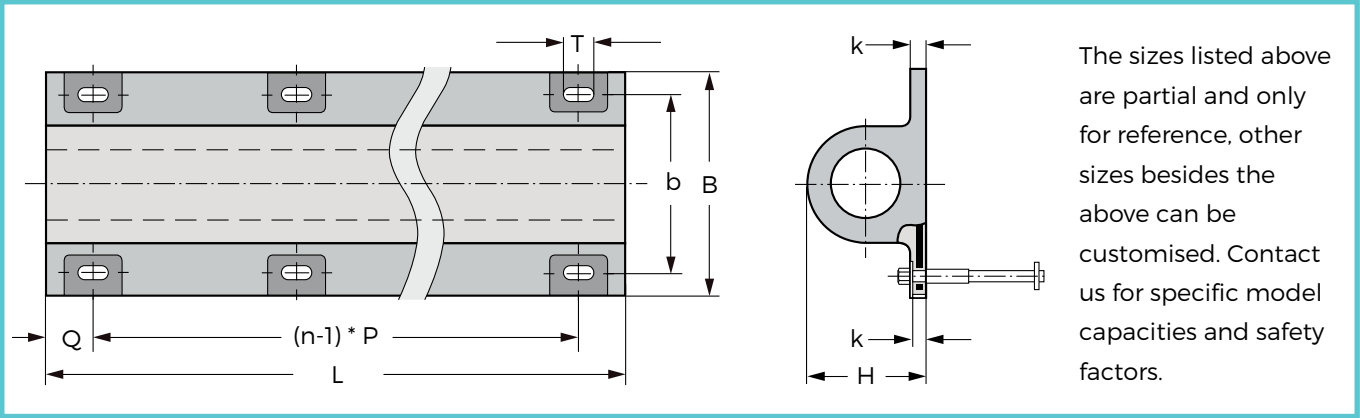
- Compact structure
- Easy installation
- Particularly applicable for framework quay

APPLICATIONS

- Jetties and wharves for small craft
- Workboat harbours
- General cargo quays
- Inland waterways

DIMENSIONS

Model	H	T	k	b	B	M	L	Q	n	P
FDO 280H	280	82	40	430	540	M36	1000	150	2	700
							1500	150	3	600
							2000	145	4	570
							2500	150	5	550
							3000	150	6	540
FDO 300H	300	82	40	490	600	M36	1000	150	2	700
							1500	150	3	600
							2000	145	4	570
							2500	150	5	550
							3000	150	6	540

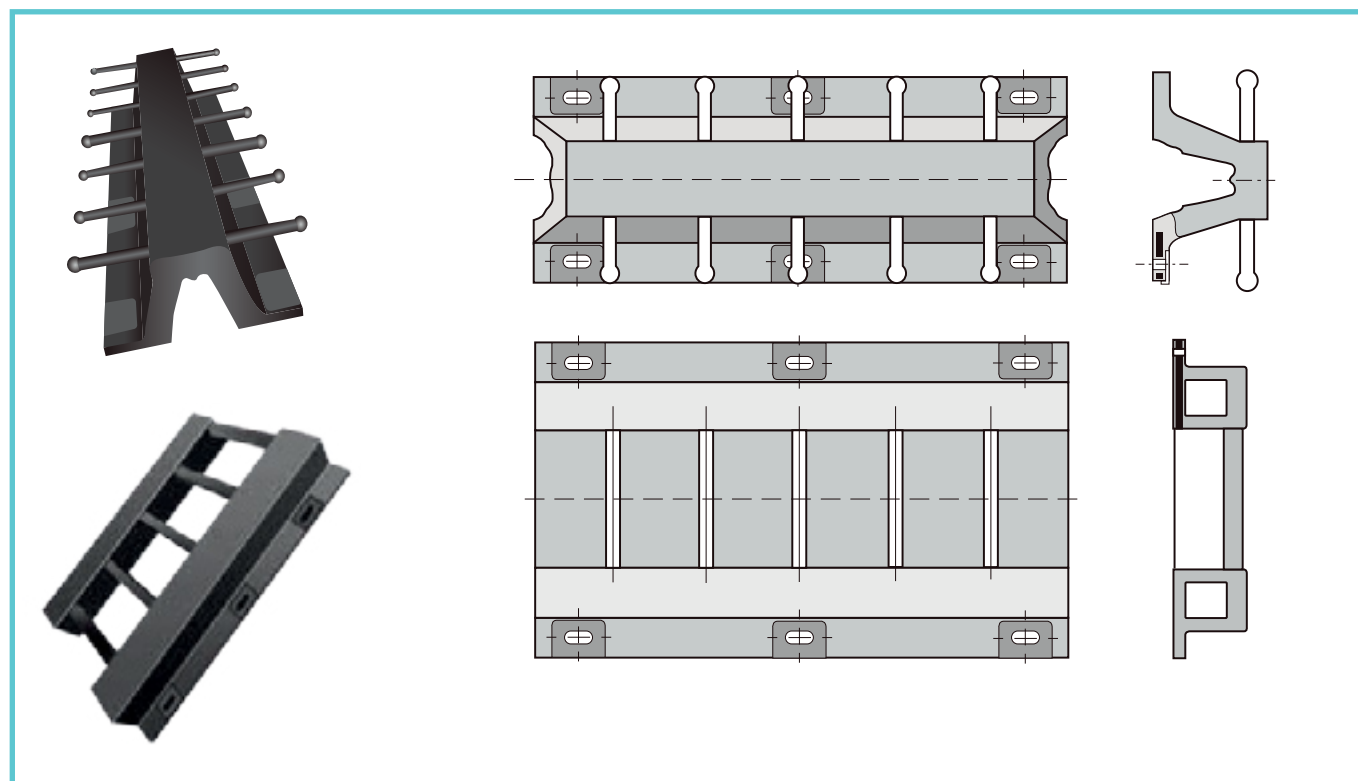


The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.



Rubber Ladders are very robust. They are flexible to reduce accidental damage and protect the wharf from small craft berthing. The modular Rubber Ladders are durable, tough and also have high corrosion resistance. They can withstand most accidental impacts from smaller vessels. They can function as fenders for small boats and also as ladders.

INSTALLATION AND DRAWING



Rubber ladders are highly customised products. Fender Marine can manufacture various types of ladders in accordance to customers' specifications.

Foam Fender



Foam Filled Fenders are versatile, robust and suitable for almost all applications. They are constructed of three parts providing an important function in the construction. The outside closed-cell polyethylene foam core absorbs the impact from severe operating conditions, while the inside skin of reinforced polyurethane elastomer resists wear and tear among austere condition.

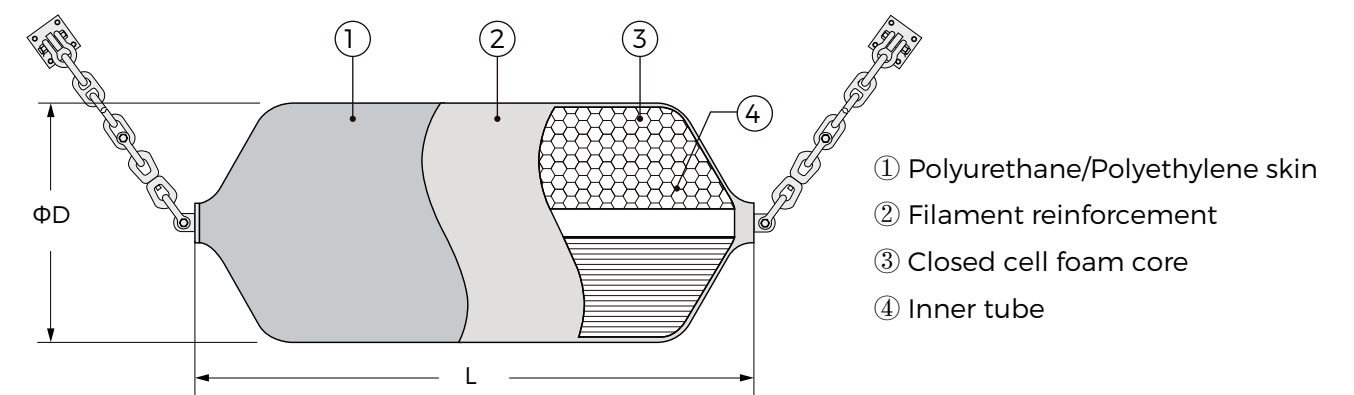
Foam Filled Fenders can be delivered in various sizes and types with or without chain-tyre net.

FEATURES

- High energy absorption and low reaction force
- Ultra-tough, unsinkable design
- Remain fully functional even if skin is punctured
- Easy installation and low maintenance
- Customised in various colours

APPLICATIONS

- Tankers, gas carriers and bulk cargo ships
- Fast ferries and aluminium hulled vessels
- Temporary or permanent installations
- Rapid response and emergency fendering
- As stand-off fenders to realign ships with shore facilities



Ship Launching Airbag

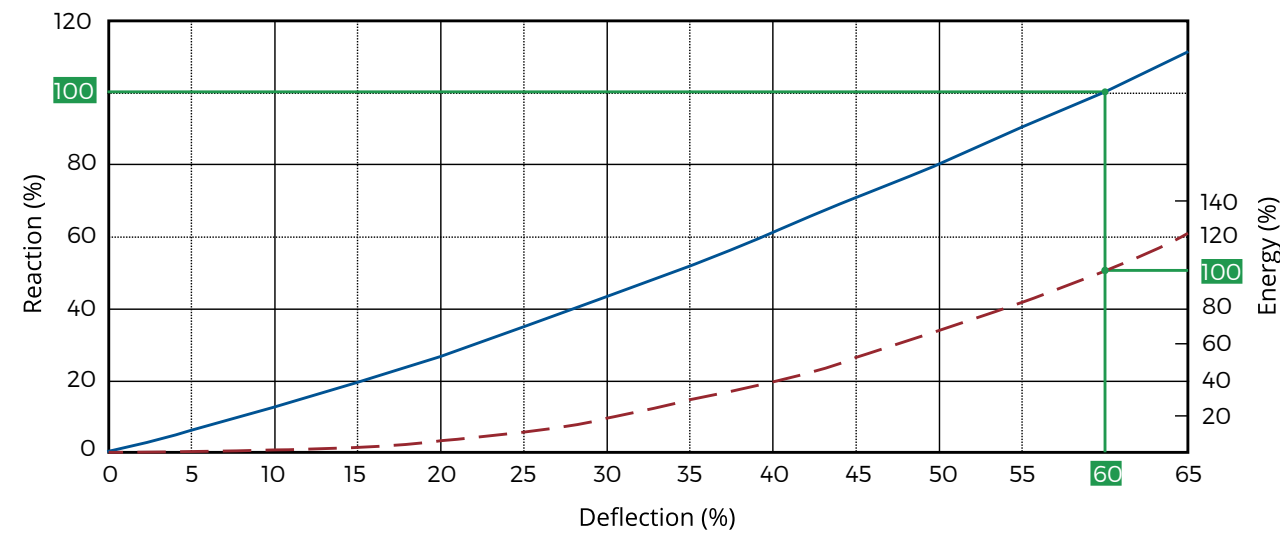
DIMENSIONS & RATED PERFORMANCE DATA

Model DxL (mm)	Low Capacity		Standard Capacity		High Capacity		Extra High Capacity		Super High Capacity	
	E	R	E	R	E	R	E	R	E	R
FPF 700x1500	26	134	15	80	33	175	249	249	65	343
FPF 1000x1500	47	175	28	102	62	229	329	329	122	449
FPF 1000x2000	69	257	41	151	89	332	480	480	178	658
FPF 1200x2000	92	283	54	169	119	369	534	534	236	734
FPF 1350x2500	154	422	91	249	199	548	792	792	393	1085
FPF 1500x3000	246	602	146	356	320	782	1119	1119	635	1548
FPF 1700x3000	285	624	169	369	370	809	1162	1162	732	1606
FPF 2000x3500	459	853	273	507	585	1088	1590	1590	1170	2175
FPF 2000x4000	545	1015	324	601	694	1290	1885	1885	1388	2581
FPF 2000x4500	630	1173	374	698	803	1493	2184	2184	1606	2986
FPF 2200x5000	839	1423	504	852	1091	1846	2699	2699	2182	3693
FPF 2200x6000	1041	1766	626	1058	1354	2293	3351	3351	2710	4585
FPF 3000x4900	1449	1770	870	1061	1885	2303	3364	3364	3769	4602
FPF 3000x6000	1927	2351	1155	1409	2505	3056	4470	4470	5008	6112
FPF 3300x4500	1483	1673	890	1004	1929	2171	3175	3175	3856	4346
FPF 3300x6500	2397	2704	1437	1621	3117	3515	5135	5135		

[Units: kNm,mm,kN,kN/m]



PERFORMANCE CURVE



Airbag launching technology is developed based on traditional slidaway and sliding plates, which possess extremely high bearing capacity and resistance to wear and salt water corrosion. Cushion design protects hull structure and paint free of damage. The characteristics of anti-bursting attributes to its special construction. Optional structure layout is available.

The flexibility of airbag makes ship launching and upgrading easy. Airbag is recognised as a better choice in saving investment of shipyard construction. The shipyard just requires a ramp rather than complex underwater engineering. It is also regarded as an important factor to be an environmental friendly berthing solution.

FEATURES

- Resilient to wear and twist
- High carrying capacity
- Optional structure layouts
- High flexibility and compressing capacity
- Economical and environmentally friendly

APPLICATIONS

- Shipwreck salvage
- Jack-up heavy
- Ship launching
- Caisson transportation

DIMENSIONS

Load-bearing Capacity Per Metre – 4 Cord Layers Type

Diameter (m)	Working Pressure (Mpa)	Working Height (m)	Bearing Capacity/m (kN/m)	Bearing Capacity/m (T/m)
0.8	0.17	0.5	80.11	8.17
		0.3	133.25	13.62
1.0	0.13	0.6	81.68	8.33
		0.3	142.94	14.59
1.2	0.11	0.7	86.39	8.82
		0.4	138.23	14.11
1.5	0.09	0.8	98.96	10.1
		0.5	141.37	14.42
1.8	0.08	1	100.53	10.26
		0.6	150.8	15.38
2.0	0.07	1	102.66	10.48
		0.6	143.68	14.66

Load-bearing Capacity Per Metre – 5 Cord Layers Type

Diameter (m)	Working Pressure (Mpa)	Working Height (m)	Bearing Capacity/m (kN/m)	Bearing Capacity/m (T/m)
0.8	0.21	0.5	98.96	10.1
		0.3	164.93	16.83
1.0	0.17	0.6	106.81	10.9
		0.3	186.92	19.07
1.2	0.14	0.7	109.96	11.22
		0.4	175.93	17.95
1.5	0.11	0.8	120.95	12.34
		0.5	172.79	17.63
1.8	0.09	1	113.09	11.54
		0.6	169.64	17.31
2.0	0.08	1	128.31	13.09
		0.6	179.62	18.33

Load-bearing Capacity Per Metre – 6 Cord Layers Type

Diameter (m)	Working Pressure (Mpa)	Working Height (m)	Bearing Capacity/m (kN/m)	Bearing Capacity/m (T/m)
0.8	0.24	0.5	113.1	11.54
		0.3	188.5	19.23
1.0	0.2	0.6	125.66	12.82
		0.3	219.91	22.44
1.2	0.17	0.7	133.51	13.62
		0.4	213.63	21.8
1.5	0.13	0.8	142.94	14.59
		0.5	204.2	20.84
1.8	0.11	1	138.22	14.1
		0.6	207.34	21.16
2.0	0.1	1	153.94	15.71
		0.6	215.49	21.99

Load-bearing Capacity Per Metre – 7 Cord Layers Type

Diameter (m)	Working Pressure (Mpa)	Working Height (m)	Bearing Capacity/m (kN/m)	Bearing Capacity/m (T/m)
0.8	0.29	0.5	136.66	13.94
		0.3	227.77	23.14
1.0	0.24	0.6	150.79	15.93
		0.3	263.89	26.93
1.2	0.2	0.7	157.08	16.03
		0.4	251.33	25.65
1.5	0.16	0.8	175.93	17.95
		0.5	251.33	25.65
1.8	0.13	1	163.36	16.67
		0.6	245.04	25
2.0	0.11	1	179.62	18.33
		0.6	251.42	25.66

DIMENSIONS

Load-bearing Capacity Per Metre – 8 Cord Layers Type

Diameter (m)	Working Pressure (Mpa)	Working Height (m)	Bearing Capacity/m (kN/m)	Bearing Capacity/m (T/m)
0.8	0.33	0.5	160.1	16.34
		0.3	252.45	25.76
1.0	0.26	0.6	164.2	16.76
		0.4	246.3	25.13
1.2	0.22	0.7	125.66	12.82
		0.4	278.77	28.45
1.5	0.17	0.8	199.14	20.32
		0.5	278.77	28.45
1.8	0.14	1	129.36	13.2
		0.6	278.77	28.45
2.0	0.13	1	205.3	20.95
		0.6	287.4	29.33

Load-bearing Capacity Per Metre – 9 Cord Layers Type

Diameter (m)	Working Pressure (Mpa)	Working Height (m)	Bearing Capacity/m (kN/m)	Bearing Capacity/m (T/m)
0.8	0.38	0.5	180.08	18.38
		0.3	284.02	28.98
1.0	0.3	0.6	184.7	18.85
		0.3	277.1	28.28
1.2	0.25	0.7	188.39	19.22
		0.4	313.6	32
1.5	0.2	0.8	223.97	22.85
		0.5	313.6	32
1.8	0.17	1	193.93	19.79
		0.6	313.6	32
2.0	0.15	1	230.9	23.56
		0.6	323.3	32.99





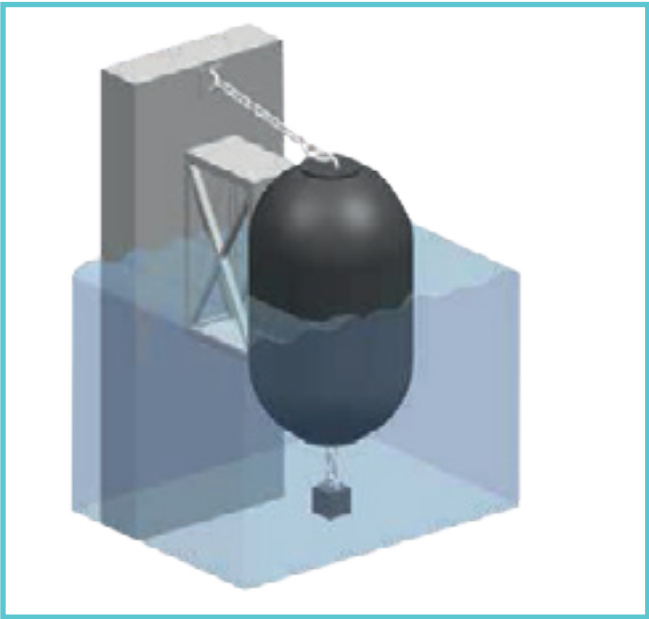
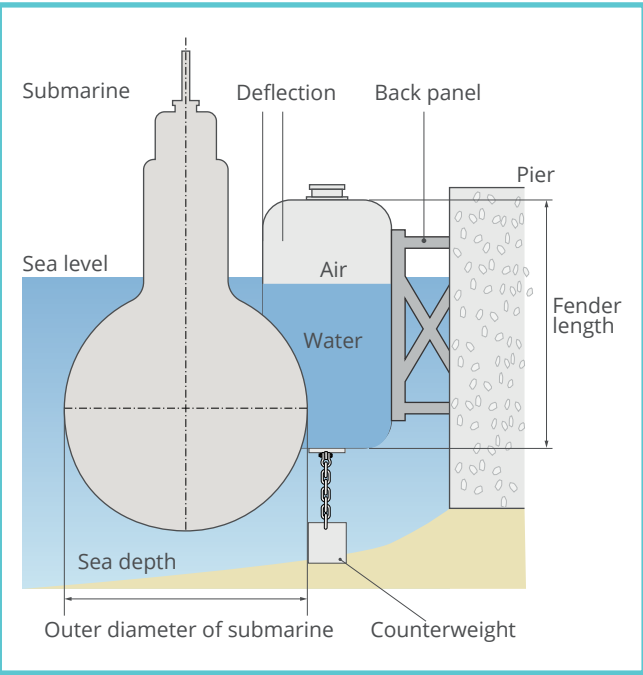
Fender Marine Hydro-Pneumatic Fenders make contact with vessels such as submarines below the water-line. Hydro-Pneumatic Fenders also can be used for vessel-to-vessel. Fenders are part-filled with water and ballasted to float vertically. Performance can be tuned by changing the water-to-air ratio and initial pressure.

FEATURES

- Very robust
- Easy assembly and installation
- Safe operation, no risk of bursting
- Puncture resistant

APPLICATIONS

- Navy
- Submarines
- Some fast ferries
- Semi-submersible oil rigs



Fender Marine Hydro-Pneumatic Fenders are customised for each type or class of submarine, depending on its water-air ratio, shape of the hull, berthing-type, energy absorption and jetty design, so it is strongly advised that a detailed study should be carried out for each case. Please ask Fender Marine for assistance.

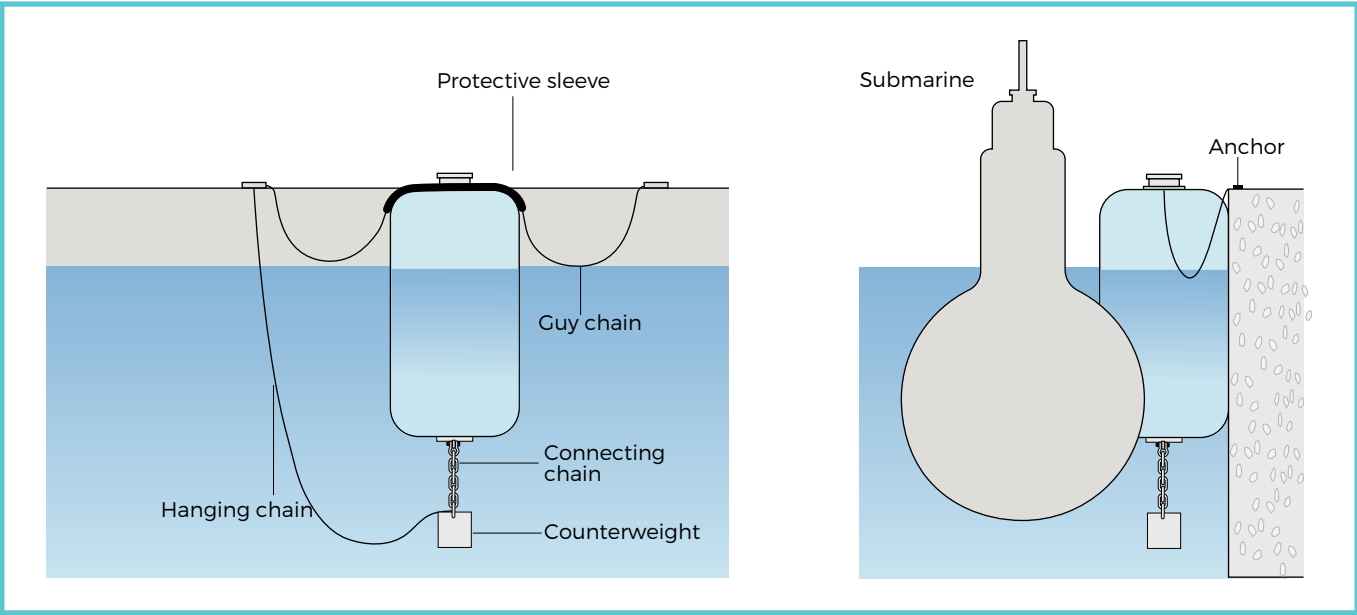
DIMENSIONS

Model	Air filled (no water)			Partially water filled		
	Water: Air	Energy kNm	Reaction kN	Water: Air	Energy kNm	Reaction kN
FHF 1700x7200	0 : 100	566	1774	65:35	135	599
FHF 2000x6000	0 : 100	653	1731	65:35	157	587
FHF 2500x5500	0 : 100	937	1996	65:35	225	673
FHF 3300x6500	0 : 100	1932	3106	65:35	622	1222
FHF 3300x10500	0 : 100	3151	5067	65:35	595	1250

[Units: mm]

The factors of vessel hull shape, water to air ratio, gas mixture (ie. N₂) as well as the initial pressure influence performances of Hydro-Pneumatic Fenders. Performances are given for an initial pressure of 7.1 psi and are indicative only. Please contact Fender Marine for specifications.

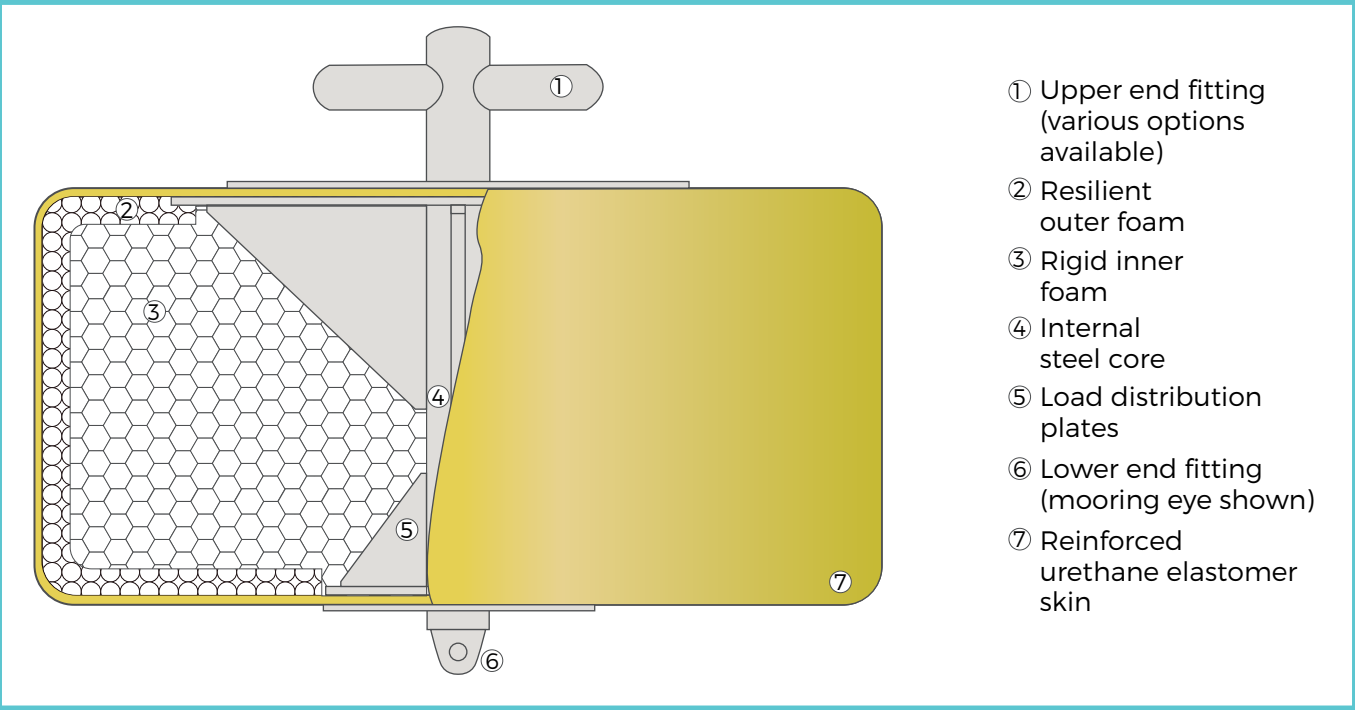
INSTALLATION



Openings at the upper and lower flanges allow water to charge and discharge. A pressure relief valve allows the controlled release of air in the event of overcompression.



Buoys are floating objects moored to the bottom to mark a channel or something (such as a shoal) lying under the water. Fender Marine provides a range of surface/subsurface products including Support Buoys, Utility Buoys, Pendant Buoys and Mooring Buoys with a wide variety of fittings and accessories as optional. Hot galvanised or painted forged eye, swivel eye, padeye, bail, quick release hook, pick-up tee or hawse pipe as well as hawse pipe and capture plates are all available. Fender Marine offers a comprehensive range of solutions for your installation project.



FEATURES

- Resilient surface and never sink or burst
- Robust construction and low collision
- High performance materials
- Easy installation and low maintenance
- Can be customised in various colours

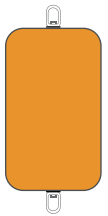
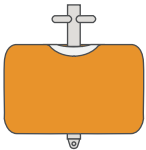
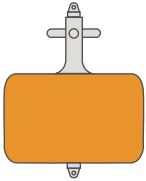
APPLICATIONS

- Offshore
- Inland waterways
- Navigation channels
- Suction/discharge dredging pipeline float

Buoy Fender (continued)

DIMENSIONS AND RATED PERFORMANCE

Generally, buoys are custom designed for each application. The following examples are of typical configurations. The sizes listed below are partial and only for reference, other sizes besides the above can be customised. Contact Fender Marine for specific model capacities and safety factors.

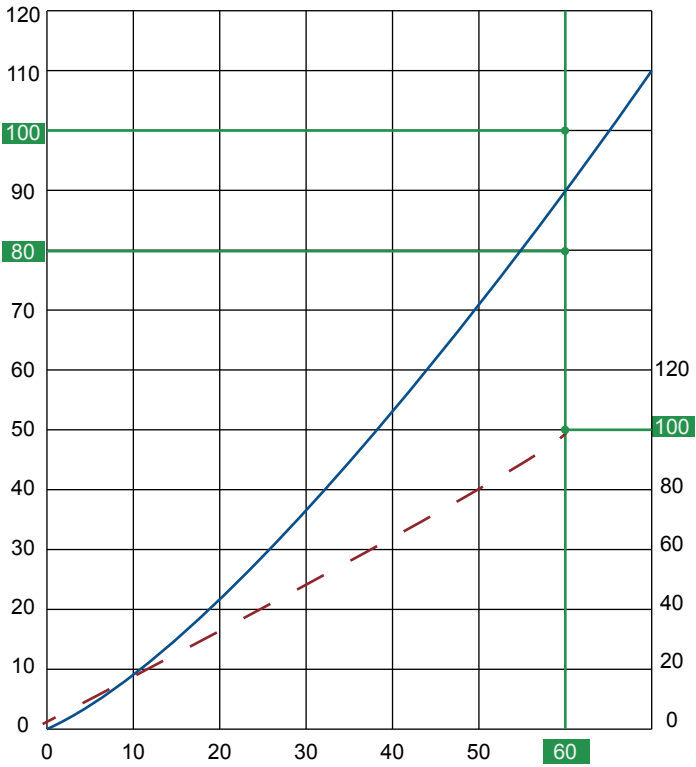
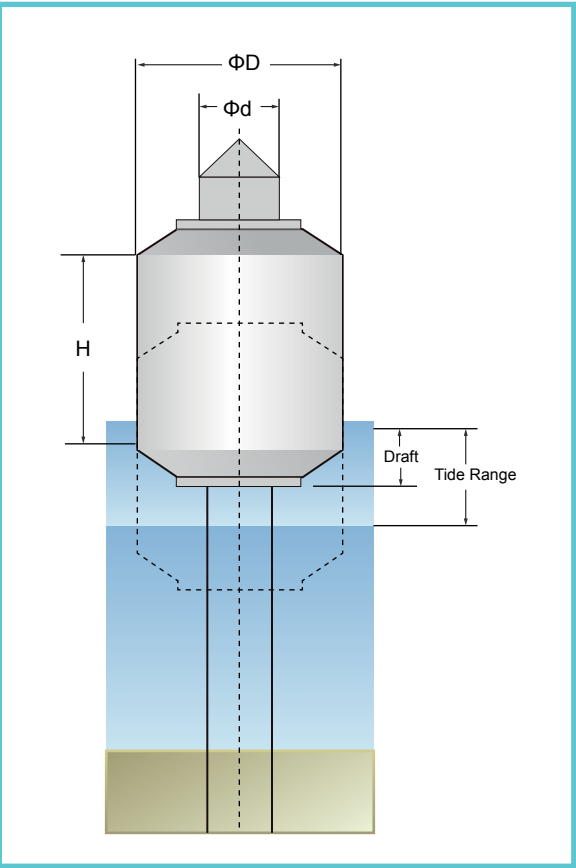
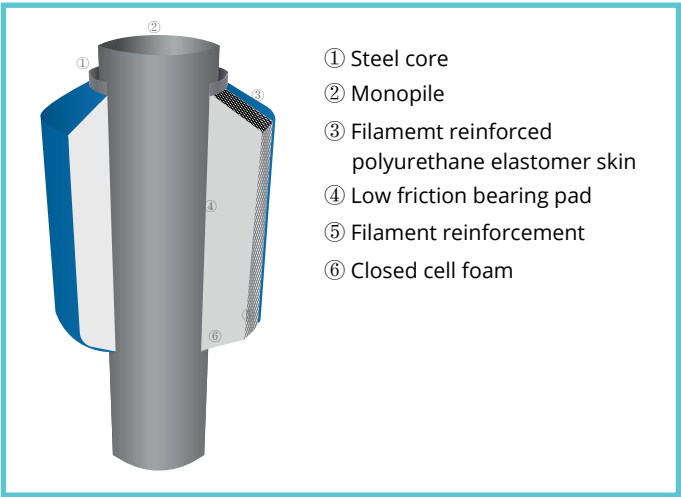
Type	Model	Net buoyancy (kg)	Buoy weight (kg)	Overall diameter (m)	Ht. flotation section (m)	Overall height (m)	Working load (tonne)
Support Buoys							
	FSB 400	400	150	0.9	n/a	0.9	10
	FSB 750	750	170	1.1	n/a	1.1	10
	FSB 1000	1000	290	1.2	n/a	1.2	18
	FSB 1500	1500	330	1.4	n/a	1.4	18
	FSB 2000	2000	460	1.5	n/a	1.5	18
	FSB 4000	4000	680	1.8	n/a	1.8	20
Utility Buoys							
	FUB 45	45	25	0.4	n/a	0.6	2.3
	FUB 90	90	30	0.5	n/a	0.8	2.3
	FUB 140	140	40	0.5	n/a	0.8	2.3
	FUB 225	225	60	0.6	n/a	0.9	3.4
	FUB 450	450	90	0.7	n/a	1.2	4.5
	FUB 700	700	110	0.8	n/a	1.5	4.5
	FUB 900	900	200	0.9	n/a	1.5	9.1
	FUB 1350	1350	340	1.2	n/a	1.9	9.1
Pendant Buoys							
	FPB 4500	4500	1000	1.7	2.5	2.5	68
	FPB 7000	7000	1300	1.9	2.8	2.7	68
	FPB 9000	9000	1700	2.1	3.1	3.0	68
	FPB 14000	14000	2300	2.4	3.6	3.2	68
	FPB 18000	18000	3000	2.6	3.9	3.4	91
	FPB 23000	23000	3900	2.8	4.1	3.6	91
Mooring Buoys							
	FMB 2250	2250	860	1.9	1.3	2.3	45
	FMB 5000	5000	1400	2.5	1.5	2.6	68
	FMB 7000	7000	1900	2.8	1.5	2.6	91
	FMB 9000	9000	2400	3.0	1.7	2.8	91
	FMB 11000	11000	2700	3.2	1.8	2.9	91
	FMB 14000	14000	3400	3.4	2.1	3.2	136
	FMB 16000	16000	3800	3.6	2.2	3.3	136
	FMB 18000	18000	4100	3.7	2.3	3.4	136
	FMB 22000	22000	4700	3.9	2.5	2.6	136
	FMB 34000	34000	6400	4.2	3.2	4.3	136
	FMB 45000	45000	8000	4.2	4.1	5.2	136

[Units: kg, mm, ton]

Donut Fender (continued)



Donut Fenders are the perfect choice for tidal zones berthing. The donut floats around a tubular pile which is easy to install and follows changes in the water level. It uses the same technology as Foam Filled Fenders with closed-cell polyethylene foam core to absorb impact and tough enough polyurethane elastomer to resist wear and tear. The Donut's durable low-friction bearings allow free movement with minimal maintenance.



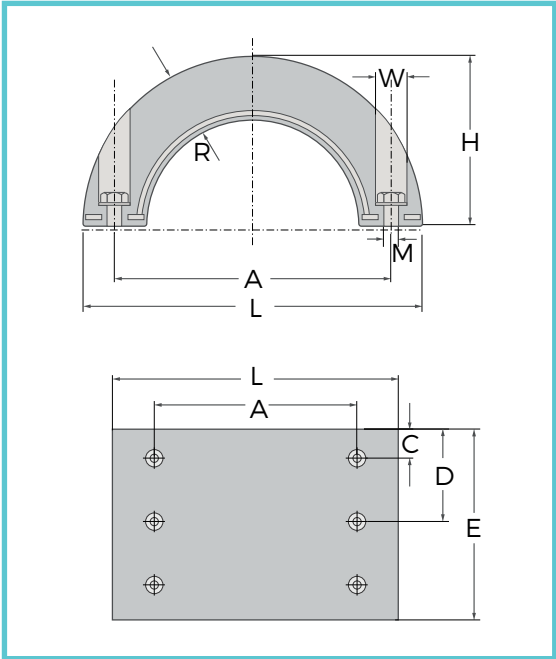
PERFORMANCE

Model	H m	Standard Capacity		High Capacity		Extra High Capacity		Super High Capacity		Ultra High Capacity	
		E	R	E	R	E	R	E	R	E	R
FDF 1400x600	0.6	5	81	10	130	14	198	21	297	28	404
	0.9	8	121	14	193	21	297	30	444	41	607
	1.2	11	158	18	261	28	395	41	593	55	809
	1.5	14	198	22	323	35	494	51	741	70	101
	1.8	16	238	28	391	41	593	60	890	83	1213
	2.1	19	279	32	453	48	692	71	1033	97	1415
	2.4	22	319	36	521	55	791	81	1182	111	1617
FDF 1500x800	0.6	7	94	11	153	17	229	24	346	33	472
	0.9	10	139	15	229	24	346	36	517	48	705
	1.2	14	184	21	306	32	463	48	692	64	943
	1.5	16	233	26	378	40	575	58	863	81	1177
	1.8	21	279	32	453	48	692	71	1033	97	1415
	2.1	23	323	37	530	55	809	82	1209	114	1649
	2.4	27	373	41	607	63	921	94	1380	129	1883
FDF 1800x900	0.6	10	108	17	176	25	265	36	395	50	539
	0.9	15	158	24	261	36	395	55	593	74	809
	1.2	19	211	32	346	48	525	72	791	99	1079
	1.5	25	265	40	431	60	661	90	984	123	1348
	1.8	29	319	48	521	72	791	108	1182	147	1617
	2.1	34	373	56	607	85	921	126	1380	173	1883
	2.4	40	422	63	692	96	1051	143	1577	197	2152
FDF 2100x1100	0.9	21	180	33	292	51	444	76	665	104	908
	1.2	26	238	46	391	67	593	101	890	138	1213
	1.5	33	297	56	490	85	741	128	1110	173	1514
	1.8	40	360	67	584	101	890	153	1330	208	1815
	2.1	47	418	78	683	119	1038	179	1554	242	2121
	2.4	53	477	89	782	135	1186	203	1775	277	2422
FDF 2300x1200	0.9	23	198	37	323	56	494	85	741	115	1011
	1.2	30	265	50	431	75	661	112	984	154	1348
	1.5	38	332	61	543	94	822	140	1231	192	1685
	1.8	45	400	74	651	112	989	165	1479	232	2017
	2.1	53	463	86	760	132	1150	197	1725	270	2354
	2.4	62	530	99	868	150	1316	226	1973	308	2692
FDF 2500x1400	0.9	27	220	46	360	68	543	103	813	139	1110
	1.2	37	292	60	477	90	723	136	1083	186	1483
	1.5	45	364	75	598	114	903	170	1356	233	1851
	1.8	55	436	90	714	136	1088	204	1626	280	2219
	2.1	64	512	105	835	159	1267	236	1896	326	2593
	2.4	74	584	121	952	183	1446	273	2170	373	2960
FDF 2700x1500	0.9	33	238	54	391	81	593	122	890	166	1213
	1.2	44	319	71	521	108	791	164	1182	222	1617
	1.5	55	400	89	651	135	989	203	1479	277	2017
	1.8	66	477	107	782	164	1186	243	1775	333	2422
	2.1	77	558	125	912	189	1384	284	2072	388	2826
	2.4	88	638	142	1042	217	1582	325	2367	444	3230

Energy (kJ) Reaction (kJ)



Semi-Circle Fenders are widely used for cylindrical structure protection. The inner and outer diameter can be bespoke in order to cope with special marine onshore structure. Soft rubber will reduce the collision between the vessel and the piles so as to avoid damage to both vessels and the quay structures.



DIMENSIONS

Model	L	H	E	A	C	D	W	M	R	holes
FSCY650x320x500	650	320	500	530	85	250	60	M28	203	6
FSCY1040x520x500	1040	520	500	790	100	250	95	M40	280	6

[Units: mm]

The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact Fender Marine for specific model capacities and safety factors.



Proven *in* PRACTICE.

Corner Fender



Berth corners are very difficult to protect. Corner Fenders are commonly available in D and Arch standard sizes and provide a simple and effective construction to prevent damage from small vessels. Other types of Corner Fender are optional such as Wheel Corner Fender.

FEATURES

- Protect exposed corners

- Simple design and easy to install
- Customised designs or shape available

APPLICATIONS

- Berth corners
- Locks and dry-dock entrances
- Pier heads

Harbour Panel

DIMENSIONS

CORNER ARCH FENDER DIMENSIONS

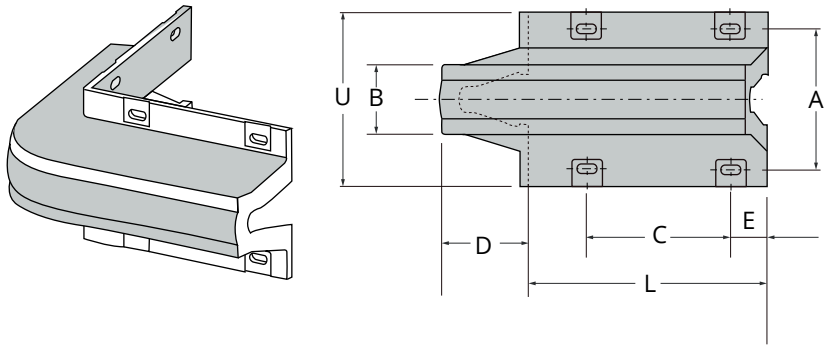
Model	D	L	U	A	B	E	C	Anchors/ Bolts
FDA 150	150	750+750	300	240	98	100	400	8
FDA 200	200	750+750	400	320	130	100	350	8
FDA 250	250	810+810	500	400	162	130	420	8
FDA 300	300	700+700	600	480	190	140	360	8
FDA 400	400	1000+1000	800	670	300	150	700	8
FDA 500	500	1000+1000	1000	840	375	160	400	8

Raw material is rubber *Other lengths available on request

[Units: mm]



Further possible corner protections:
Wheel Fenders, Roller Fenders,
Donut Fenders, Panel Systems



CORNER D TYPE FENDER DIMENSIONS

D	L	E	C	Anchors/ Bolts
FD 300	1000+1000	250	300	6
FD 400	1000+1000	150	450	8
FD 500	1150 +1150	350	300	6

Raw material is rubber *Other lengths available on request

[Units: mm]

As an important part of the whole marine fender system, the steel panels are used to distribute the reaction forces from the rubber units into the ship hull. They resist combinations of bending, shear and local buckling.

Two structures are available, “closed box panels” and “open box panels”. Therein, closed box structure, which is the most

popular type, is comprised of front and back plates plus a series of vertical and horizontal stiffening members. Optional lead-in bevels chamfers reduce the risk of obstacle damage.

Fender Marine can provide C5M class paint system for corrosion protection. If other special requirements, please feel free to contact us.



Sliding Fender



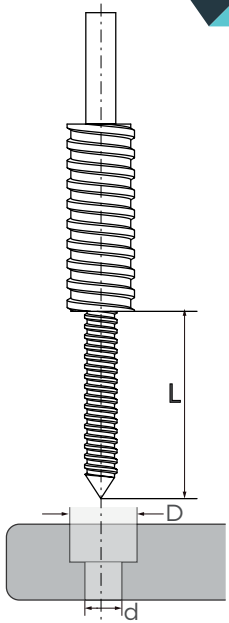
HD-PE Sliding Fenders are the perfect substitutes to quay wall protection due to the advantage of low friction and better wear resistance. HD-PE has the characteristic of non-splitting or non-decay and is totally resistant to borers. HD-PE is easy to machine and install onto concrete, steel or timber substrates. HD-PE is fully recyclable after its working life, and is a cost-effective alternative to tropical hardwoods,

FEATURES

- Fender pile rubbing strips
- Lock walls and entrances
- Pile protection
- Workboat beltings
- Facing strips for jetties and wharves

APPLICATIONS

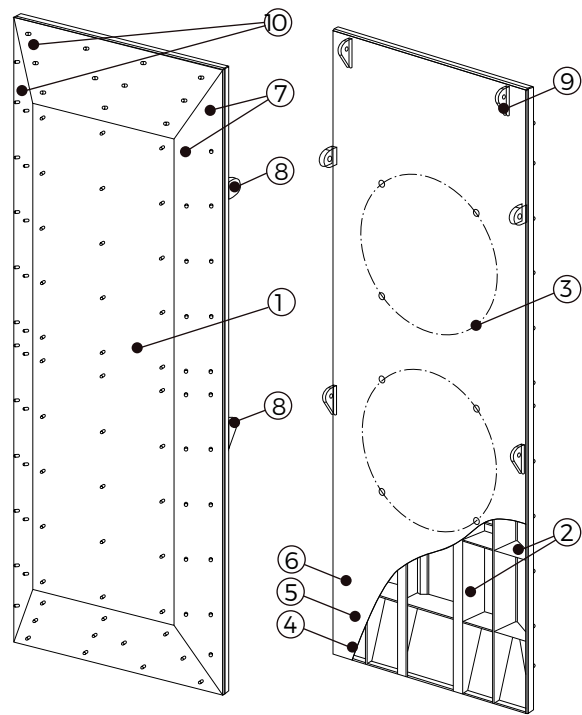
- Low friction coefficient
- High abrasion resistance
- UV and ozone resistant
- Non-rotting, split or crack
- Recyclable



STANDARD DRILLING DIMENSIONS

D	27	32	32	32	32	40	50	50	60	65	70	70	70
d	13	16	12	16	18	20	21	23	21	27	28	32	26
L	75	85	32	45	80	80	95	95	70	105	110	115	50

[Units: mm]



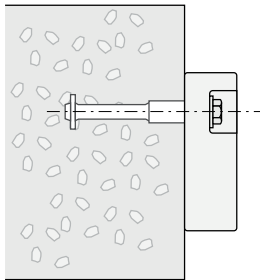
- ① Closed box steel structure
 - ② Internal structural members
 - ③ Blind boss fender connections
 - ④ Shot blasted steel (SA2.5)
 - ⑤ C5M modified epoxy paint*
 - ⑥ Polyurethane topcoat (RAL5005 blue)^①
 - ⑦ Studs for UHMW-PE face pads
 - ⑧ Chain brackets
 - ⑨ Lifting points
 - ⑩ Lead-in bevels and chamfers^②
- ^① Alternative colours on request
^② Other options available

STEEL PROPERTIES

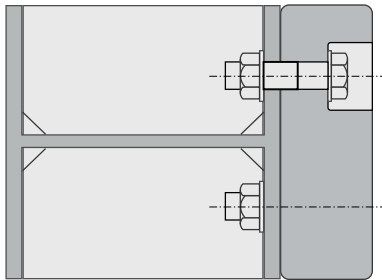
Standard	Grade	Yield Strength (min)	Tensile Strength (min)	Test Temperature of charpy impact test
		N/mm ²	N/mm ²	°C
GB/T 700	Q235B	235	375	20
	Q275B	275	490	20
GB/T 1591	Q355B	355	470	20
	Q355C	355	470	0
EN 10025	S235JR (1.0038)	235	360	-
	S275JR (1.0044)	275	420	-
	S355J2 (1.0577)	355	510	-20
	S355J0 (1.0553)	355	510	0
JIS G-3101	SS400	235	402	0
	SS490	275	402	0
	SM490	314	490	0
ASTM	A-36	250	400	0
	A-572	345	450	0

* The table above is for guidance only and is not comprehensive. Actual specifications should be consulted in all cases for the the full specifications of steel grades listed and other similar grades.

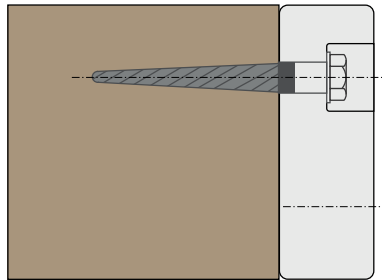
Concrete Structure



Steel Structure



Timber Structure



UHMW PE Sliding Plate

Ultra High Molecular Weight Polyethylene

UHMW PE is the best choice when the combination of very high impact and abrasion resistance with low-friction properties is needed. UHMW PE does not decay or rot. UHMW PE also comes in many thicknesses as per project requirements and can also be supplied in stand-alone applications without rubber fenders.

FEATURES

- Very low friction coefficient
- Excellent abrasion resistance
- UV and ozone resistant
- Does not rot, split or crack
- 100% recyclable

APPLICATIONS

- Fender panel face pads
- Wall protection
- Beltings on workboats

- Rubbing strips
- Arch and composite fender

PROPERTIES

TESTING ITEM	STANDARD VALUE	TESTING STANDARD
Molecular Weight g/mol	4.2 x 10 ⁶ (Min)	ASTM D6474
Density g/cm ³	≤0.95	ASTM D792
Intrinsic Viscosity dl/g	22.0 – 28.0	ASTM D4020
Tensile Strength at Yield N/m ² m	25.00 (Min)	ASTM D638
Elongation at Break %	300(Min)	ASTM D638
Hardness Shore D	63-66	ASTM D2240
IZOD Impact Strength	No Break	ASTM D256 A
Friction Coefficient	"0.15 Max (static) 0.14 Max (kinetic)"	ASTM D1894
Colour	As customer's request	/
UHMW PE Material	As customer's request	/

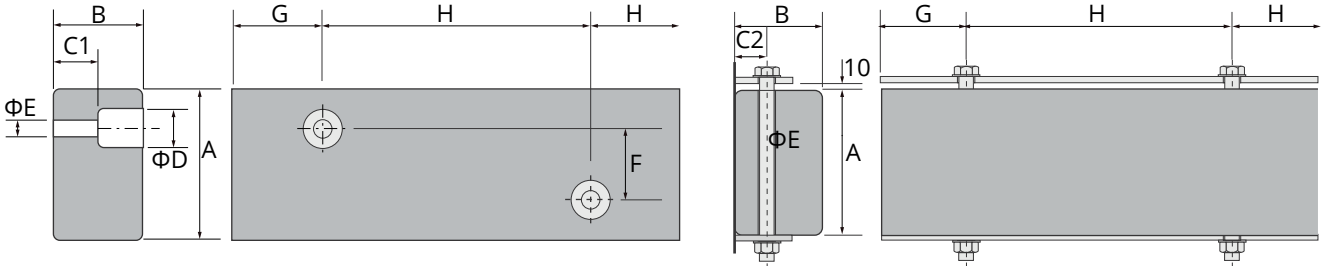
All values for black, UV stabilised material. Values for coloured materials will vary. Actual properties will be confirmed on order.

* Alternative test methods such as ASTM O638 give higher values circa 350%

DIMENSIONS

Model	A	B	L	C1	C2	D	E	F	G	H	Flat bar	Bolt size	Weight
FSF 50x50	50	50	5500	25	n/a	32	16	0	50-100	n/a	n/a	M12	2.4
FSF 60x60	60	60	5500	30	n/a	32	16	0	50-100	n/a	n/a	M12	3.4
FSF 70x50	70	50	2500	25	32	32	16	0	75-125	250-300	n/a	M12	3.3
FSF 70x70	70	70	6500	30	32	32	16	0	75-125	250-300	n/a	M12	4.6
FSF 80x60	80	60	5000	30	32	32	16	0	75-125	250-300	n/a	M12	4.5
FSF 100x50	100	50	5500	25	32	32	16	0	75-125	250-300	n/a	M12	4.7
FSF 100x65	100	65	5500	30	32	32	16	0	75-125	250-300	n/a	M12	6.1
FSF 100x100	100	100	6000	50	32	32	16	0	75-125	250-300	50x6	M12	9.3
FSF 120x80	120	80	5000	40	40	40	20	0	100-150	300-350	n/a	M16	8.9
FSF 120x120	120	120	6000	60	40	40	20	0	100-150	300-350	80x10	M16	13.4
FSF 140x70	140	70	5500	35	40	40	20	0-50	100-150	300-350	n/a	M16	9.1
FSF 160x70	160	70	5000	35	40	40	20	0-70	100-150	300-350	n/a	M16	10.4
FSF 160x160	160	160	6000	80	40	40	20	0-80	100-150	300-350	80x10	M16	24.1
FSF 170x120	170	120	5500	60	40	40	20	0-80	100-150	300-350	80x10	M16	19
FSF 180x70	180	70	5000	35	46	50	23	0-80	125-175	350-450	n/a	M20	11.7
FSF 180x180	180	180	6000	90	46	50	23	0-80	125-175	350-450	80x10	M20	30.2
FSF 190x110	190	110	5000	55	46	50	23	0-90	125-175	350-450	80x10	M20	19.4
FSF 200x75	200	75	5000	35	46	50	23	0-100	125-175	350-450	n/a	M20	14.0
FSF 200x100	200	100	6000	50	46	50	23	0-100	125-175	350-450	80x10	M20	18.6
FSF 200x150	200	150	5500	75	46	50	23	0-100	125-175	350-450	80x10	M20	27.9
FSF 200x200	200	200	6000	100	46	50	23	0-100	125-175	350-450	80x10	M20	37.6
FSF 250x150	250	150	6500	75	56	65	28	0-130	150-200	450-550	80x10	M24	34.8
FSF 250x160	250	160	5000	80	56	65	28	0-130	150-200	450-550	80x10	M24	37.2
FSF 250x250	250	250	5000	125	56	65	28	0-130	150-200	450-550	100x10	M24	58.1
FSF 300x100	300	100	5500	50	56	65	28	0-160	150-200	450-550	n/a	M24	27.9
FSF 300x210	300	210	5000	105	56	70	36	0-160	175-225	500-600	100x12	M30	58.6
FSF 300x300	300	300	5000	150	72	70	36	0-160	175-225	500-600	120x12	M30	84.6
FSF 440x160	440	160	2000	80	56	70	36	0-300	175-225	500-600	100x12	M30	66.8

[Units: mm]



The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.



HP Type Rubber Fender, a kind of protective device suitable for wharfs, can absorb the energy of ship collision and reduce the reaction force to ensure the stability and integrity of hull and wharf structure.

FEATURES

- Very robust
- Easy assembly and installation
- Low maintenance
- Low reaction force

APPLICATIONS

- General cargo facilities
- Workboat harbours
- Dolphins and monopiles

DIMENSIONS

Model	L	U	S	D	H	h	M
FHP800	1000	1000	1540	1700	800	40	M52
	1500						M52
	2000						M52
	2500						M52
	3000						M52
FHP1000	1000	1100	1740	1920	1000	50	M52
	1500						M52
	2000						M52
	2500						M52
	3000						M52

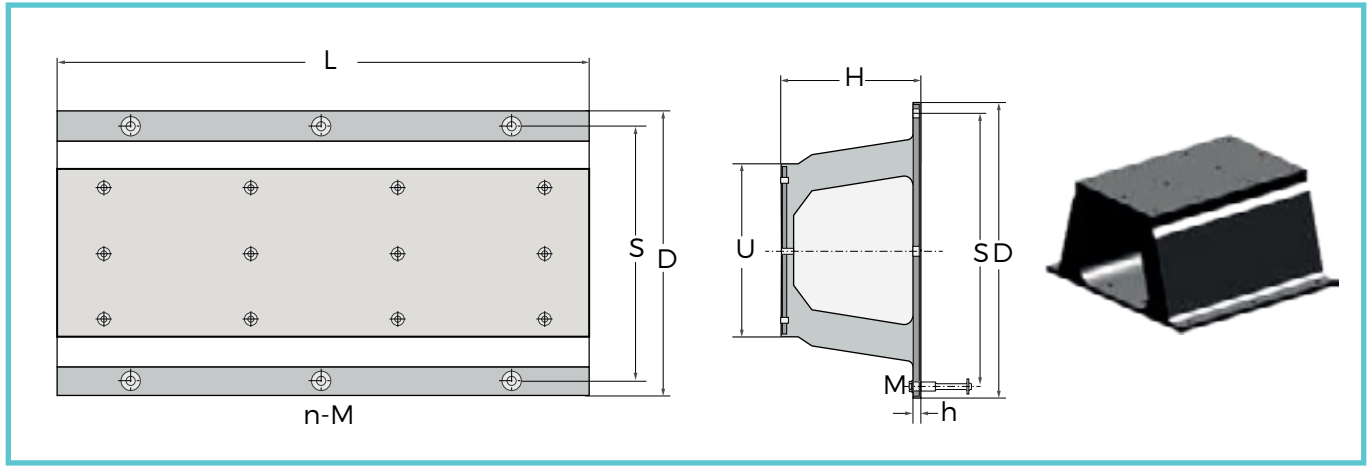
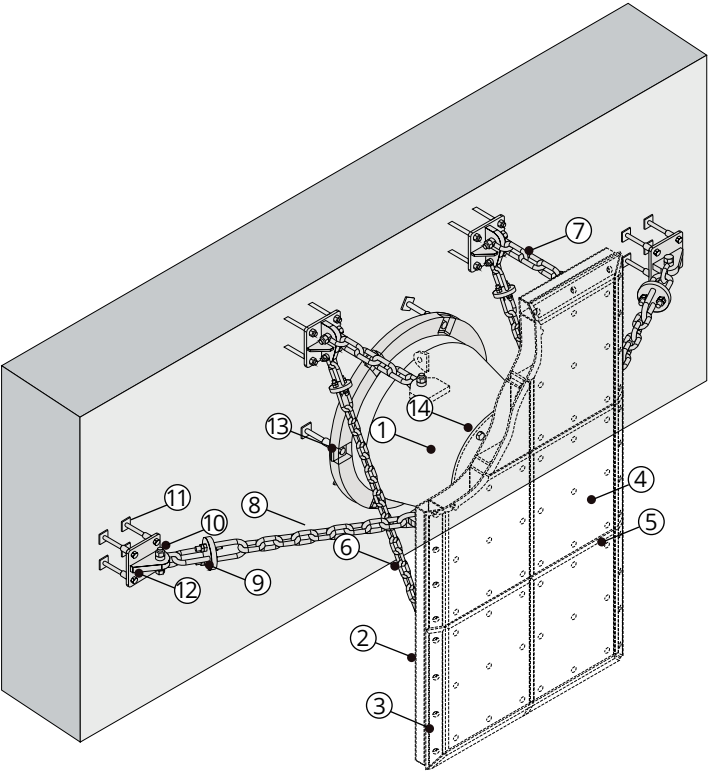
[Units: mm]

The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors. FHP with steel panel and UHWM PE or only with UHWM PE are both available.

Fender Accessories

High quality accessories and fixings to assemble and install fenders are an important part of each fender solution. Supplies include:

- ① Super Cone Fender
- ② Steel frontal frame
- ③ Chamfered edge on frontal frame
- ④ UHMW PE facing pads
- ⑤ Fixing bolts for UHMW PE pads
- ⑥ Weight chain
- ⑦ Tension chain
- ⑧ Shear chain
- ⑨ Chain tensioner
- ⑩ Chain shackle
- ⑪ Anchor
- ⑫ Bracket
- ⑬ Foot bolt
- ⑭ Head bolt





Chains

Chains play a role in suspending/supporting the fenders or controlling deflection geometry during vertical and horizontal shear. Fender Marine can supply chain system in accordance with DIN, BS and other international standards. There are choices

of open and stud link chains. Various chain lengths are also available to meet special requirements.

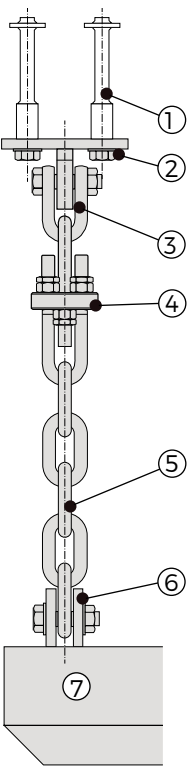
FEATURES

- Choice of open or stud link chains
- Various link lengths available
- Proof load tested and certified
- Galvanised as standard
- Variety of matched accessories

APPLICATIONS

- Large fender panels
- Cylindrical fenders
- Floating fender moorings
- Safety applications
- Lifting and installing

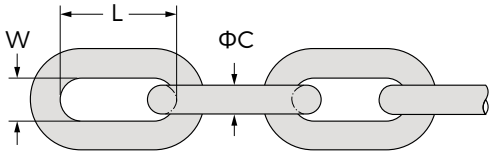
TYPICAL CHAIN SYSTEM



- ① Anchors and fixing bolts
- ② Chain bracket
- ③ Alloy D or bow-shackle with safety pin
- ④ Chain tensioner
- ⑤ Open or stud link chain
- ⑥ Frontal frame bracket
- ⑦ Frontal frame

Fender Accessories (continued)

OPEN LINK CHAINS

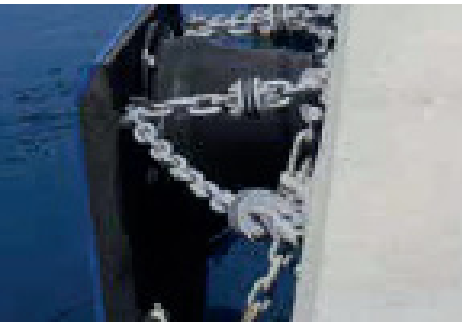
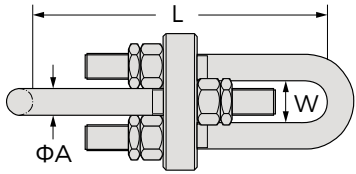


- * MBL = Minimum Breaking Load (kN)
- * NBL = Nominal Breaking Load (kN)
- * Tolerance: all dimensions ± 2.5%

ΦC	3.0D links			3.5D links			4.0D links			5.0D links			MBL	
	L	W	Weight	L	W	Weight	L	W	Weight	L	W	Weight	SL2	SL3
14	42	18	0.2	49	20	0.2	56	20	0.2	70	21	0.3	124	154
16	48	21	0.3	56	22	0.3	64	22	0.3	80	24	0.4	160	202
18	54	23	0.4	63	25	0.4	72	25	0.5	90	27	0.5	209	262
20	60	26	0.5	70	28	0.6	80	28	0.6	100	30	0.8	264	330
22	66	29	0.7	77	31	0.8	88	31	0.8	110	33	1	304	380
25	75	33	1.1	88	35	1.1	100	35	1.2	125	38	1.5	393	491
28	84	36	1.4	98	39	1.6	112	39	1.7	140	42	2	492	616
30	90	39	1.8	105	42	2	120	42	2.1	150	45	2.5	566	706
32	96	42	2.2	112	45	2.4	128	45	2.5	160	48	3	644	804
35	105	46	2.8	123	49	3.1	140	49	3.3	175	53	4	770	964
38	114	49	3.6	133	53	3.9	152	53	4.3	190	57	5.1	900	1130
40	120	52	4.2	140	56	4.6	160	56	5	200	60	6	1010	1260
45	135	59	6	158	63	6.5	180	63	7.1	225	68	8.5	1275	1590
50	150	65	8.2	175	70	8.9	200	70	9.7	250	75	12	1570	1960
55	165	72	11	193	77	12	220	77	13	275	83	16	1900	2380
60	180	78	14	210	84	15	240	84	17	300	90	20	2260	2770

[Units: mm, kg/link, kN]

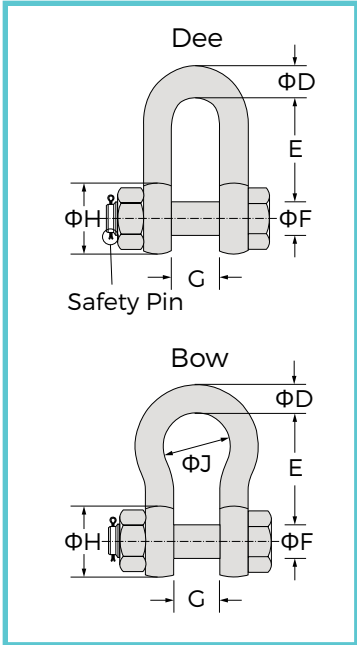
CHAIN TENSIONERS



Chain Size	ΦA	L	W	Weight
16	M16	200-240	40	2.7
18	M18	220-280	45	2.5
20	M20	235-305	50	5.3
22	M22	265-345	56	6.6
22	M24	280-370	60	8.8
25	M27	310-420	68	12
30	M30	345-465	76	17
32	M33	385-525	82	21
35	M36	420-560	90	27
40	M42	480-650	106	45
45	M48	545-745	120	64
50	M52	595-805	130	80
55	M56	640-880	140	99
60	M60	685-945	150	122
60	M64	730-1010	160	147

[Units: mm, kg]

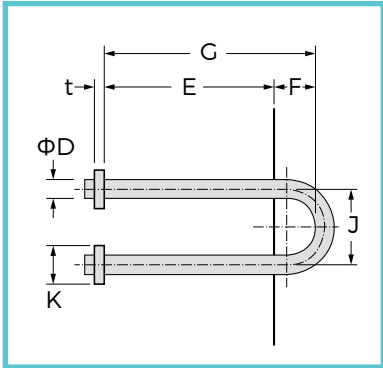
HIGH STRENGTH SHACKLES



ΦD	ΦF	ΦH	G	Dee Shackle (G2150)		Bow Shackle (G2130)			NBL
				E	Weight	E	ΦJ	Weight	
13	16	26	22	43	0.34	51	32	0.36	120
16	19	32	27	51	0.67	64	43	0.76	195
19	22	38	31	59	1.17	76	51	1.23	285
22	25	44	36	73	1.75	83	58	1.79	390
25	28	50	43	85	2.52	95	68	2.78	510
28	32	56	47	90	3.45	108	75	3.75	570
32	35	64	51	94	4.9	115	83	5.31	720
35	38	70	57	115	6.24	133	95	7.18	810
38	42	76	60	127	8.39	146	99	9.43	1020
45	50	90	74	149	14.24	178	126	15.38	1500
50	57	100	83	171	21.21	197	138	23.7	2100
57	65	114	95	190	28	222	160	29	2550
65	70	130	105	203	38.56	254	180	44.57	3330
75	80	150	127	230	56.36	330	190	69.85	5100
89	95	178	146	267	93	381	238	120.2	7200
102	108	204	165	400	145	400	275	153.32	9000

[Units: mm, kg, kN]

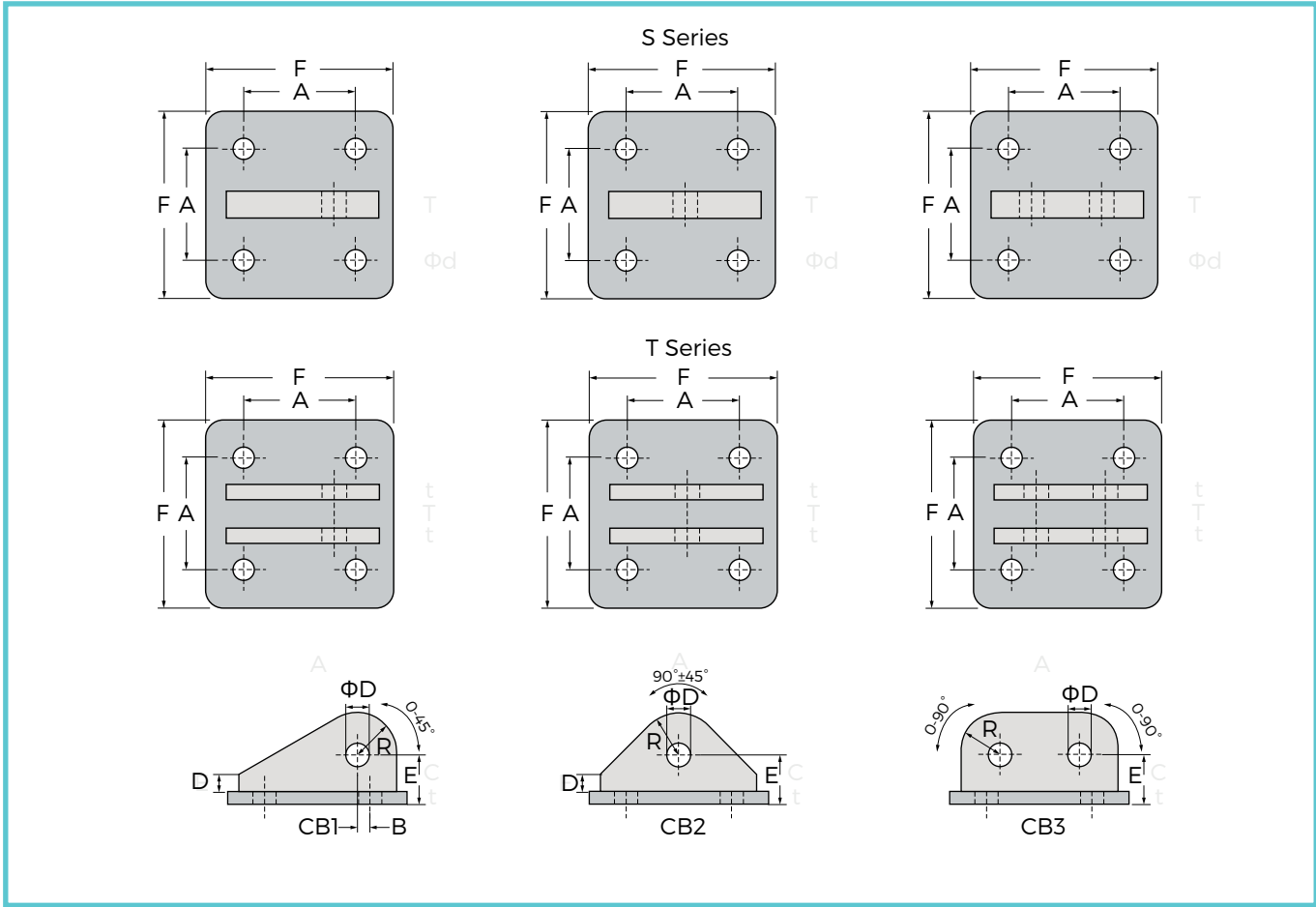
U ANCHORS



ΦD	E	F	G	J	K	t	Weight	NBL
26	260	60	320	104	50	12	3.4	209
30	300	70	370	120	50	15	5.1	264
34	340	70	410	136	60	15	7.3	304
36	360	70	430	144	60	20	8.6	393
42	420	90	510	168	70	20	14	492
44	440	100	540	176	80	20	16	566
48	480	100	580	192	80	25	21	644
50	500	110	610	200	90	25	24	770
56	560	120	680	224	100	30	33	900
60	600	130	730	240	110	30	41	1010
66	660	140	140	264	120	35	55	1275
74	740	160	160	296	130	40	77	1570

[Units: mm, kg, kN]

BRACKETS

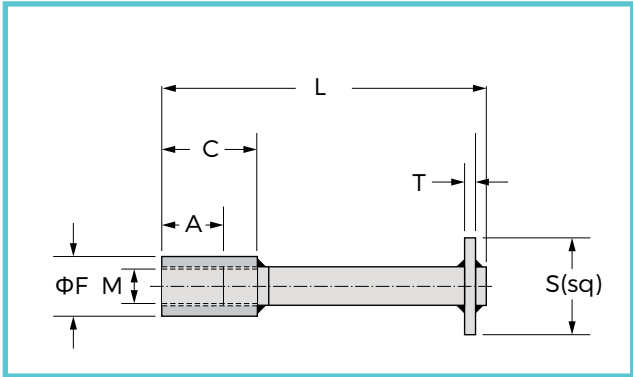


ΦD mm	A mm	B mm	E mm	Anchor mm	Type CB1&CB2 kg each	Type CB3 kg each
18	110	15	55	2/4 M20	6	7
20	110	15	55	2/4 M20	6	7
22	130	20	60	2/4 M20	9	10
24	130	20	60	2/4 M20	9	10
26	150	25	70	2/4 M24	14	16
28	160	25	80	2/4 M24	18	21
30	160	25	80	2/4 M24	18	21
32	190	35	90	2/4 M30	30	32
34	190	35	90	2/4 M30	30	32
36	210	35	95	2/4 M30	35	39
38	220	35	110	2/4 M36	47	53
40	220	35	110	2/4 M36	47	53
42	250	40	115	2/4 M36	61	69
44	260	40	120	2/4 M36	67	78
46	260	40	120	2/4 M42	67	78

[Units: mm, kN]

Fender Fixings

NEW CONCRETE ANCHORS



The New Concrete Anchor is a traditional cast-in anchor design used for installing fenders to new concrete. The New Concrete Anchor has a threaded socket, a long tail and a square anchor plate.

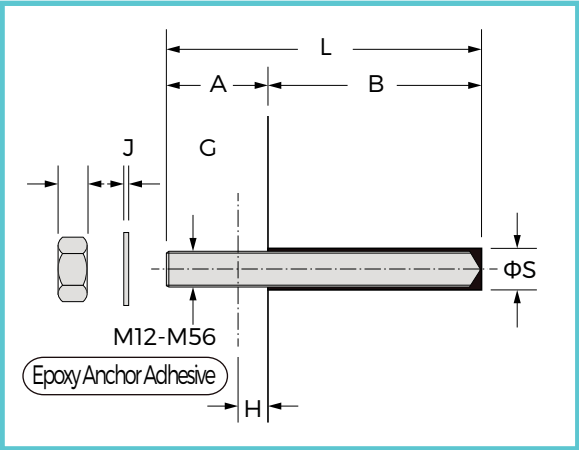
Thread	A	c	ΦF	L	S(sq)	T	Weight
M20	40	60	30	200	63	10	1.1
M22	44	66	32	225	63	10	1.4
M24	48	73	36	250	75	10	1.9
M27	54	84	40	265	75	10	2.4
M30	60	95	45	270	100	10	3.5
M36	72	112	54	320	100	12	5.5
M42	84	134	63	360	100	12	8.1
M48	96	156	72	400	100	15	12
M56	112	182	84	550	120	15	20
M64	128	208	100	600	130	20	30
M76	152	242	114	700	150	20	46

* Anchors available in mid steel, HDG, SS316 or super duplex [Units:mm, kg]

EXISTING CONCRETE ANCHORS

Thread	B	E	G	J	J(typ.)	ΦS	Capsule	Weight
M12	110	5-8	10	2.5	-	15	1 x C12	0.15
M16	140	6-9	13	3	175	20	1 x C16	0.26
M20	170	6-9	16	3	240	25	1 x C20	0.57
M24	210	8-12	19	4	270	28	1 x C24	0.92
M27	240	8-12	22	4	330	30	1 x C24	1.42
M30	280	8-12	24	4	360	35	1 x C30	1.91
M36	330	10-15	29	5	420	40	1 x C30	3.21
M42	420	14-21	34	7	500	50	2 x C30	5.21
M48	480	16-24	38	8	580	54	2 x C30 + 1 x C24	7.9
M56	560	18-27	45	9	-	64	4 x C30	13

* A = E+G+H+J, rounded up to nearest 10mm. [Units:mm, kg]
E = clear threads after assembly.
H = clamping thickness of fender.



Existing Concrete Anchor is used for installing fenders onto existing concrete or where cast-in anchors are unsuitable. The anchor is usually secured into a drilled hole using epoxy anchor adhesive.

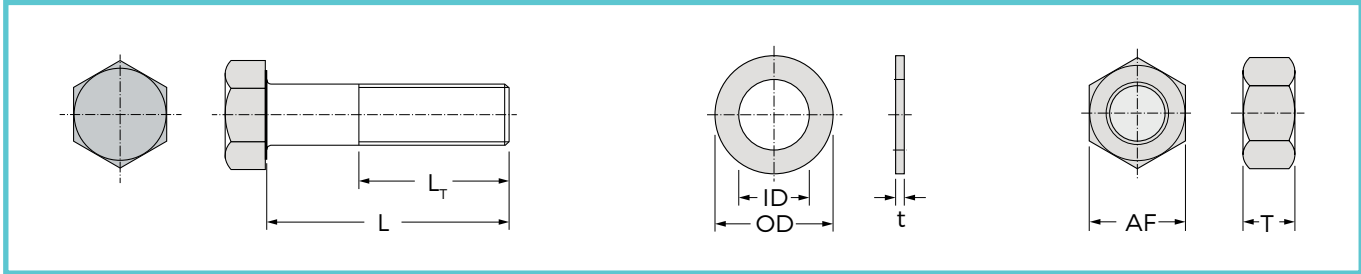
Fender Fixings

BOLTS, NUTS AND WASHERS

Size	Thread area* (mm ²)	Washers ①				Nuts ②			Typical Thread Lengths③		Thread Pitch
		OD	ID	t	Weight	AF	T	Weight	L≤125	L>125	
M16	157	30	18	3	0.01	24	13	0.04	38	44	2.0
M20	245	37	22	3	0.02	30	16	0.07	46	52	2.5
M24	353	44	26	4	0.03	36	19	0.12	54	60	3.0
M27	459	52	29	4	0.05	41	22	0.23	60	66	3.0
M30	561	56	33	4	0.06	46	24	0.24	66	72	3.5
M36	817	66	39	5	0.09	55	29	0.4	78	84	4.0
M42	1120	78	45	7	0.18	65	34	0.63	90	96	4.5
M48	1470	92	52	8	0.28	75	38	0.9	102	108	5.0
M56	2030	105	62	9	0.4	85	45	1.43	118	124	5.5
M64	2680	115	70	9	0.45	95	51	2.09	134	140	6.0

* Standard bolts given according to DIN933. [Units: mm, kg]
① Standard washers given according to DIN125. Larger OD washers available on request.
② Thread lengths may vary depending on standard. Other lengths available.
③ Standard nuts given according to DIN934.

Fenders must be properly fixed to operate correctly. Anchors are supplied to suit new or existing structures, in various strength ratings and with the choice of galvanised or various stainless steels.



	ISO 898 GALVANISED					ISO 356 STAINLESS STEEL	
Bolt Grade	4.6	4.8	5.8	8.8(1)	8.8(2)	A-50	A-70
Nut Grade	4	4	5	8	8	A-50	A-70
Tensile Strength (MPa)	400	420	520	800	830	500	700
Yield Strength (MPa)	240	340	420	640	660	210	450

* ALL FENDER ACCESSORY INFORMATION IS FOR GUIDANCE ONLY.
* FOR SPECIAL SIZES AND APPLICATIONS, PLEASE CONSULT WITH US.

Bollards

Spheroidal Graphite Iron and Cast Steel are materials available for bollards. All Bollards are designed with a proper factor of three for breaking load, anchor bolts and concrete pullout (given a 40MPa concrete). The berth designer is responsible for its final structure and steel reinforcement. Engineering calculations are provided with bollard group pullout forces shear loading and bolt tensions. More details and safety calculations can be provided on request, subject to extra cost.

TYPICAL DESIGN STANDARD

- BS 6349-2:2010, Structural use of steelwork
- BS EN 1993:2005, Design steel stucutres
- AS 3990-1993, Mechanical equipment-steelwork
- AISC Steel Construction Manuel, latest edition
- ACI 318, Appendix D, latest editon

Local codes and regulation can be applied.



Typical materials for bollards

Spheroidal Graphite Iron and Cast Steel are the commonest materials for bollards. Both can be used for various applications. Fender Marine Australia does not recommend gray cast iron.

SG IRON

Spheroidal Graphite Iron has high resistance to corrosion and is economical choice per weight. SG Iron is more suitable for warmer environments. SG Iron bollards tend to

weigh more due to a thicker cross-section. SG Iron can avoid coating damage and their surface allows for clearer cast-in details such as names and serial numbers.

CAST STEEL

Cast Steel copes better with cold climates. Minor repairs can be carried out by suitably qualified welders, and bollards may even be welded to existing steel structures. Regular inspection and maintenance may be required to ensure a long and trouble-free working life. Impact testing is strongly recommended for cold-weather applications.

MATERIAL PROPERTIES

The material properties given below are typical values, based on tests of sample pieces. If there any other special requirements please consult Fender Marine Australia.

Material	Standard	Grade	Tensile Strength		Yield Strength		Elongation
			MPa	ksl	MPa	ksl	%
SG Iron	ASTM A 536	65-45	450	65	310	45	12
Cast Steel	ASTM A27	65-35	450	65	240	35	24



Tee Bollard Double Bitt Bollard Kidney Bollard Single Bit Bollard Stag Horn Bollard Cleat Bollard

SAFETY FACTORS AND CALCULATIONS

Fender Marine Australia bollards and anchors are designed with a proper factor of three for breaking load, anchor bolts, and concrete pullout(given a 40MPa concrete). The berth's designer is responsible for its final structure and steel reinforcement. Engineering calculations are provided with bollard group pullout forces, shear loadings and bolt tensions. More details and detailed safety calculations can be provided on request, subject to extra cost.

TYPICAL DESIGN STANDARD

- BS 6349-2:2010, Structural use of steelwork
- BS EN 1993:2005, Design of steel structures
- AS 3990-1993, Mechanical equipment-steelwork
- AISC Steel Construction Manual, latest edition
- ACI 318, Appendix D, latest edition

Local codes and regulations also can be applied.

The Double Bitt Bollard carries on where the Single Bitt Bollard leaves off, allowing neighbouring vessels to moor cleanly on the same bollard. The angled heads are ideal for spring lines. The Double Bitt Bollard's small footprint will fit even when space is at a premium.

FEATURES

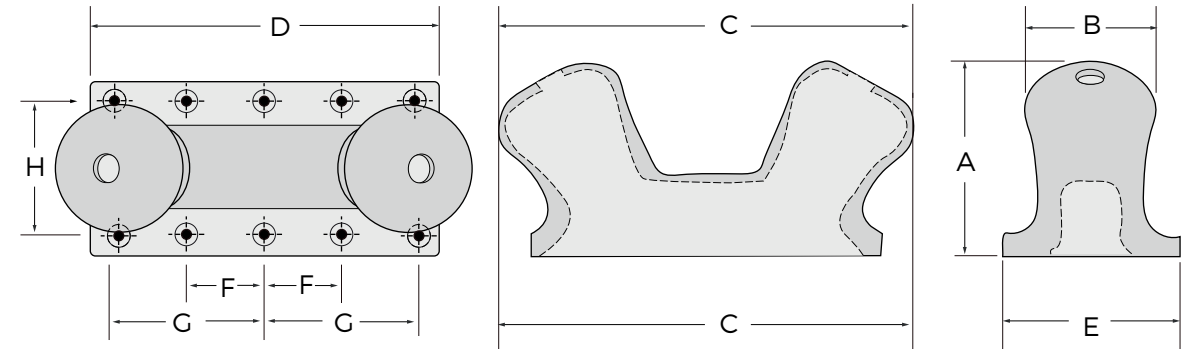
- Up to 300t capacity on request
- General purpose berths
- Accepts line from 2 vessels (within bollard capacity)
- Small footprint
- Can be filled with concrete
- Choice of materials to suit climate and application



DIMENSIONS

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	Bolt	
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Size	Qty
FBD20	278	185	590	524	262	74	222	182	M20	8
FBD30	318	217	685	596	298	86	258	218	M22	8
FBD50	381	262	825	702	351	102	306	261	M30	8
FBD75	470	318	1000	852	426	186	372	318	M36	10
FBD100	558	374	1178	1000	500	218	436	372	M42	10
FBD125	635	430	1355	1152	576	250	500	424	M42	10
FBD150	685	468	1473	1252	626	275	550	474	M48	10
FBD200	775	524	1650	1400	700	309	618	535	M56	10

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	Bolt	
	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	Size	Qty
FBD20	11	7 1/4	23 1/4	20 5/8	10 3/8	2 7/8	8 3/4	7 1/8	3/4	8
FBD30	12 1/2	8 1/2	27	23 1/2	11 3/4	3 3/8	10 1/8	8 5/8	7/8	8
FBD50	15	10 3/8	32 1/2	27 5/8	13 7/8	4	12	10 1/4	1 1/8	8
FBD75	18 1/2	12 1/2	39 3/8	33 1/2	16 3/4	7 3/8	14 5/8	12 1/2	1 1/4	10
FBD100	22	14 3/4	46 3/8	39 3/8	19 3/4	8 5/8	17 1/8	14 5/8	1 1/2	10
FBD125	25	16 7/8	53 3/8	45 3/8	22 5/8	9 7/8	19 3/4	16 3/4	1 3/4	10
FBD150	27	18 3/8	58	49 1/4	24 5/8	10 7/8	21 5/8	18 5/8	2	10
FBD200	30 1/2	20 5/8	65	55 1/8	27 1/2	12 1/8	24 3/8	21 1/8	2 1/4	10



The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

Tee Head Bollard

The Tee Head Bollard is the world's favourite design choice. It accommodates mooring lines from all vessel sizes and types, at higher angles than Single or Double Bitt models. It uses the minimum of valuable space along the quay.

FEATURES

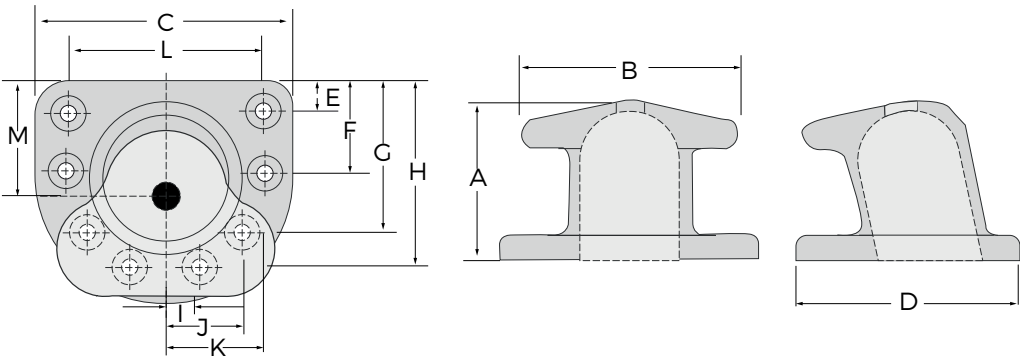
- Up to 300t capacity on request
- Accepts very steep lines
- Compact footprint
- Choice of materials to suit climate and application
- Perfect for multi-use facilities



DIMENSIONS

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Size	Qty
FBT10	240	304	380	330	50			230	107			280	140	M24	4
FBT15	270	333	416	339	55			255	90			306	131	M24	4
FBT20	282	349	436	359	55		229	304	0	137		325	141	M24	5
FBT30	294	364	455	379	60		235	319	0	145		335	152	M30	5
FBT50	390	456	570	482	70		305	412	0	186		430	197	M36	6
FBT75	445	520	650	550	75		290	442	125	242		500	225	M42	6
FBT100	492	616	770	630	85	297	475	545	0	193	295	600	245	M42	7
FBT125	511	669	836	715	100	351	541	615	0	207	313	636	297	M48	7
FBT150	530	718	898	748	110	358	559	638	0	219	334	678	299	M48	7
FBT200	598	765	956	825	120	347	557	687	111	290	358	716	347	M56	8
FBT250	730	930	1090	915	120	407	637	776	124	330	423	850	370	M64	10
FBT300	590	980	1200	925	129	328	510	784	122	312	438	950	328	M64	10

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	Size	Qty
FBT10	9 1/2	12	15	13	2			9	4 1/4			11	5 1/2	1	4
FBT15	10 5/8	13 1/8	16 3/8	13 3/8	2 1/8			10	3 1/2			12	5 1/8	1	4
FBT20	11 1/8	13 3/4	17 1/8	14 1/8	2 1/8		9	12	0	5 3/8		12 3/4	5 1/2	1	5
FBT30	11 5/8	14 3/8	17 7/8	14 7/8	2 3/8		9 1/4	12 1/2	0	5 3/4		13 1/4	6	1 1/8	5
FBT50	15 3/8	18	22 1/2	19	2 3/4		12	16 1/4	0	7 3/8		16 7/8	7 3/4	1 3/8	6
FBT75	17 1/2	20 1/2	25 5/8	21 5/8	3		11 3/8	17 3/8	4 7/8	9 1/2		19 3/4	8 7/8	1 5/8	6
FBT100	19 3/8	24 1/4	30 3/8	24 7/8	3 3/8	11 3/4	18 3/4	21 1/2	0	7 5/8	11 5/8	23 5/8	9 5/8	1 5/8	7
FBT125	20 1/8	26 3/8	32 7/8	28 1/8	4	13 7/8	21 1/4	24 1/4	0	8 1/8	12 3/8	25	11 3/4	1 7/8	7
FBT150	20 7/8	28 1/4	35 3/8	29 1/2	4 3/8	14 1/8	22	25 1/8	0	8 5/8	13 1/8	26 3/4	11 3/4	1 7/8	7
FBT200	23 1/2	30 1/8	37 5/8	32 1/2	4 3/4	13 5/8	21 7/8	27	4 3/8	11 3/8	14 1/8	28 1/4	13 5/8	2 1/4	8
FBT250	28 3/4	36 5/8	43	36	4 3/4	16	25 1/8	30 5/8	4 7/8	13	16 5/8	33 1/2	14 5/8	2 1/2	10
FBT300	23 1/4	38 5/8	47 1/4	36 1/2	5 1/8	12 7/8	20 1/8	26 7/8	4 7/8	12 1/4	17 1/4	37 3/8	12 7/8	2 1/2	10



The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

The Single Bitt Bollard is a proven favourite across the Americas. Our engineers have combined the well-known design with modern design techniques and FEA analysis to create a bollard that will work optimately for years to come.

FEATURES

- Up to 300t capacity on request
- General purpose berths
- High tidal ranges
- Designed for steep line angles



Kidney Bollard

The Kidney Bollard is a popular choice for warping operation along quay-sides, for limited tide ranges, and for low line angle. The wide range of sizes make it ideal for small vessel berths and larger bulk terminals alike.

FEATURES

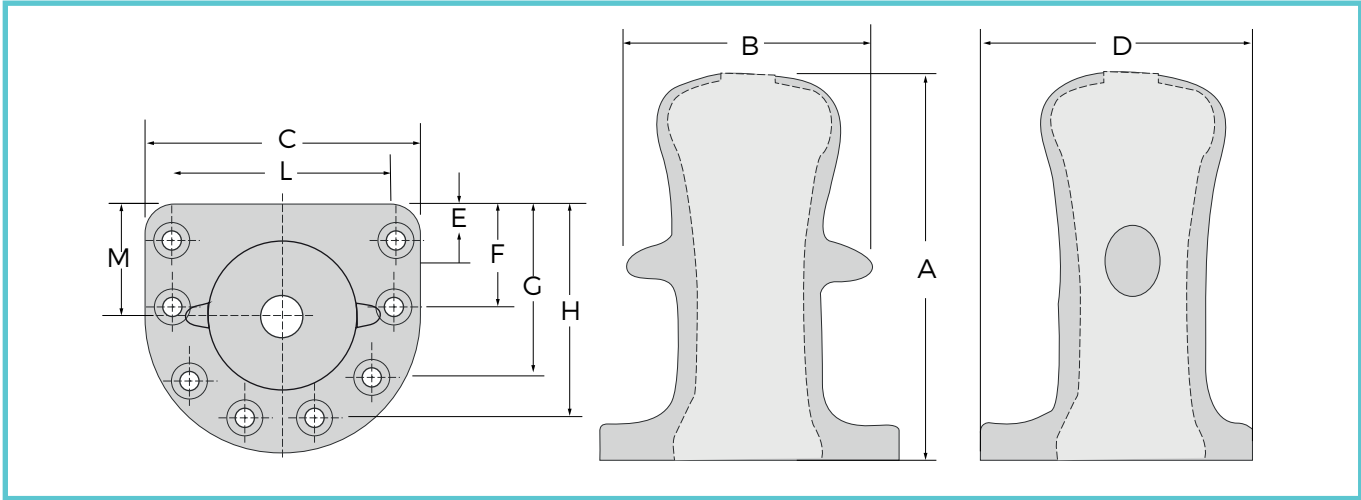
- Up to 300t capacity on request
- Ideal for lower line angles
- Used for warping along quays
- Choice of materials to suit climate and application



DIMENSIONS

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Size	Qty
FBS10	338	250	324	290	50			204	85			232	125	M24	4
FBS15	375	270	356	318	55			226	92			257	135	M24	4
FBS20	450	290	356	325	55		200	277	0	120		270	145	M24	5
FBS30	495	325	419	381	60		235	329	0	146		318	169	M30	5
FBS50	625	440	535	483	70		251	390	95	206		408	215	M36	6
FBS75	767	500	648	584	75		311	483	118	250		497	254	M42	6
FBS100	812	550	749	673	85	330	516	591	0	197	290	579	300	M42	7
FBS125	857	600	813	737	100	345	545	644	0	230	305	610	328	M48	7
FBS150	947	660	896	806	110	387	614	701	0	228	345	690	358	M48	7
FBS200	992	735	985	889	120	390	610	759	128	318	381	762	395	M56	8

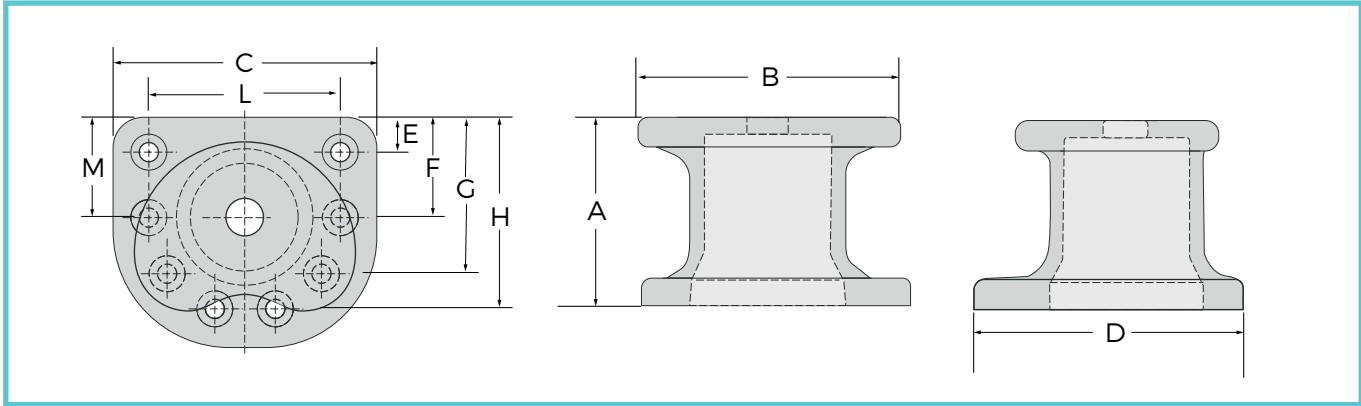
Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	Size	Qty
FBS10	13 1/4	9 7/8	12 3/4	11 3/8	2			8	3 3/8			9 1/8	4 7/8	1	4
FBS15	14 3/4	10 5/8	14	12 1/2	2 1/8			8 7/8	3 5/8			10 1/8	5 3/8	1	4
FBS20	17 3/4	11 3/8	14	12 3/4	2 1/8		7 7/8	10 7/8	0	4 3/4		10 5/8	5 3/4	1	5
FBS30	19 1/2	12 3/4	16 1/2	15	2 3/8		9 1/4	13	0	5 3/4		12 1/2	6 5/8	1 1/8	5
FBS50	24 5/8	17 3/8	21 1/8	19	2 3/4		9 7/8	15 3/8	3 3/4	8 1/8		16 1/8	8 1/2	1 3/8	6
FBS75	30 1/4	19 3/4	25 1/2	23	3		12 1/4	19	4 5/8	9 7/8		19 5/8	10	1 5/8	6
FBS100	32	21 5/8	29 1/2	26 1/2	3 3/8	13	20 3/8	23 1/4	0	7 3/4	11 3/8	22 3/4	11 7/8	1 5/8	7
FBS125	33 3/4	23 5/8	32	29	4	13 5/8	21 1/2	25 3/8	0	9	12	24	12 7/8	1 7/8	7
FBS150	37 1/4	26	35 1/4	31 3/4	4 3/8	15 1/4	24 1/8	27 5/8	0	9	13 5/8	27 1/8	14 1/8	1 7/8	7
FBS200	39	29	38 3/4	35	4 3/4	15 3/8	24	29 7/8	5	12 1/2	15	30	15 1/2	2 1/4	8



DIMENSIONS

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Size	Qty
FBK15	240	275	322	285	50			213	88			222	143	M24	4
FBK20	270	337	394	349	50		225	322	0	138		294	175	M24	5
FBK30	310	385	450	400	60		256	329	0	155		330	200	M30	5
FBK50	330	419	490	415	70		227	360	85	175		350	208	M36	5
FBK75	375	496	580	490	75	240	390	454	150	215		430	245	M36	7
FBK100	415	564	660	560	85	280	450	518	0	167	245	490	280	M42	7
FBK125	460	620	725	615	100	315	495	574	0	190	263	525	308	M48	7
FBK150	500	672	785	665	110	330	535	624	0	210	283	565	333	M48	7
FBK200	550	780	902	800	120	349	542	661	102	266	329	657	349	M56	8

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	Size	Qty
FBK15	9 1/2	10 7/8	12 5/8	11 1/4	2			8 3/8	3 1/2			8 3/4	5 5/8	1	4
FBK20	10 5/8	13 1/4	15 1/2	13 3/4	2		8 7/8	12 5/8	0	5 1/2		11 5/8	6 7/8	1	5
FBK30	12 1/4	15 1/8	17 3/4	15 3/4	2 3/8		10 1/8	13	0	6 1/8		13	7 7/8	1 1/8	5
FBK50	13	16 1/2	19 1/4	16 3/8	2 3/4		9	14 1/8	3 3/8	6 7/8		13 3/4	8 1/4	1 3/8	5
FBK75	14 3/4	19 1/2	22 7/8	19 1/4	3	9 1/2	15 3/8	17 7/8	5 7/8	8 1/2		16 7/8	9 5/8	1 3/8	7
FBK100	16 3/8	22 1/4	26	22	3 3/8	11	17 3/4	20 3/8	0	6 5/8	9 5/8	19 1/4	11	1 5/8	7
FBK125	18 1/8	24 3/8	28 1/2	24 1/4	4	12 3/8	19 1/2	22 5/8	0	7 1/2	10 3/8	20 5/8	12 1/8	1 7/8	7
FBK150	19 3/4	26 1/2	30 7/8	26 1/4	4 3/8	13	21 1/8	24 5/8	0	8 1/4	11 1/8	22 1/4	13 1/8	1 7/8	7
FBK200	21 5/8	30 3/4	35 1/2	31 1/2	4 3/4	13 3/4	21 3/8	26	4	10 1/2	13	25 7/8	13 3/4	2 1/4	8

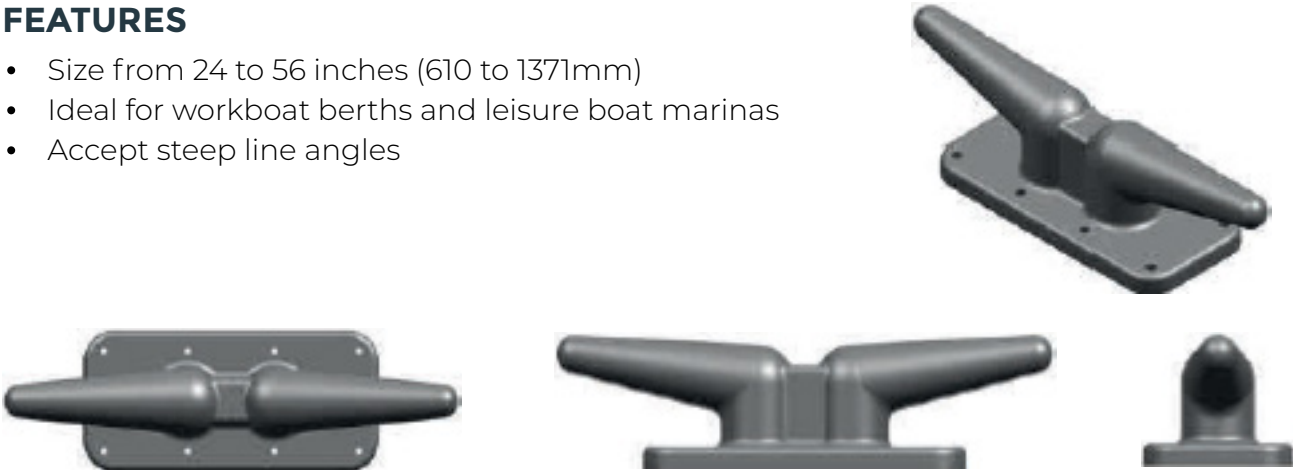


The sizes listed above are partial and only for reference, other sizes besides the above can be customised. Contact us for specific model capacities and safety factors.

Cleat Bollards are used in workboat berths and marines around the world. They are created with the same care, modern design methods and choice of materials as their larger cousins.

FEATURES

- Size from 24 to 56 inches (610 to 1371mm)
- Ideal for workboat berths and leisure boat marinas
- Accept steep line angles



Stag Horn Bollard

The Stag Horn Bollard takes the safe handling of multiple lines, steep rope angles and high loads to a new level. Perfect for multi-used jetties, high tidal ranges and any freeboard, the Stag Horn Bollard is ideal for vessels from bulk barges to passngr vessels and RoRo Ships.

FEATURES

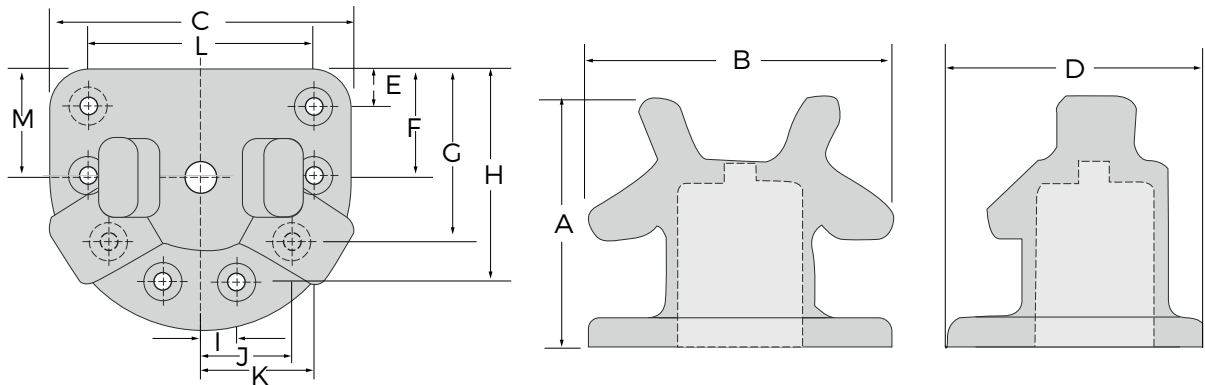
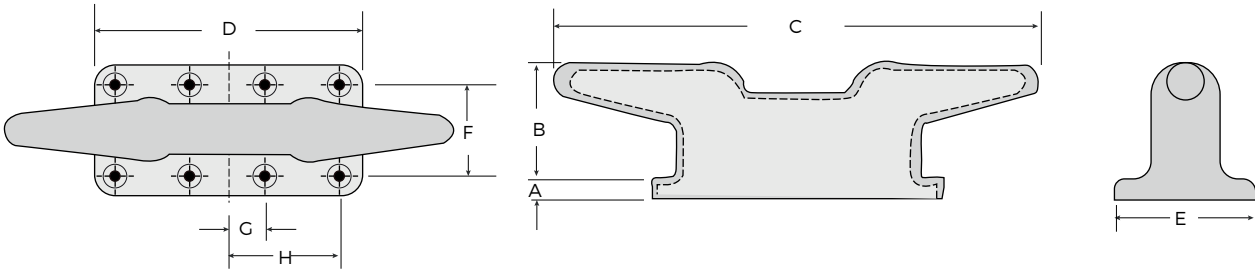
- Up to 300t capacity on request
- Accepts lines from two vessels (within bollard capacity)
- Very wide range of line angles to suit any vessel class
- Choice of materials to suit climate and application
- Perfect for multi-use facilities



DIMENSIONS

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Size	Qty
FBH10	335	315	375	325	50			240	100			275	138	M24	4
FBH15	360	350	415	360	55			259	109			305	153	M24	4
FBH20	385	390	450	390	55		237	335	0	154		340	165	M24	5
FBH30	435	450	485	420	60		255	360	0	165		365	178	M30	5
FBH50	470	560	590	510	70		328	440	0	195		450	215	M36	6
FBH75	565	645	648	560	75		300	452	125	241		498	236	M42	6
FBH100	645	740	745	645	85	322	493	560	0	185	283	575	273	M42	7
FBH125	665	800	823	710	100	353	537	610	0	200	307	623	299	M48	7
FBH150	685	856	900	775	110	386	593	675	0	225	345	700	325	M48	7
FBH200	770	915	925	800	120	338	539	663	106	277	343	685	338	M56	8
FBH250	810	930	1000	850	125	350	570	707	116	303	375	750	350	M64	8

Bollard Capacity(Ton)	A	B	C	D	E	F	G	H	I	J	K	L	M	Bolt	
	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)	Size	Qty
FBH10	13 1/4	12 3/8	14 3/4	12 3/4	2			9 1/2	4			10 7/8	5 1/2	1	4
FBH15	14 1/8	13 3/4	16 3/8	14 1/8	2 1/8			10 1/4	4 1/4			12	6	1	4
FBH20	15 1/8	15 3/8	17 3/4	15 3/8	2 1/8		9 3/8	13 1/4	0	6 1/8		13 3/8	6 1/2	1	5
FBH30	17 1/8	17 3/4	19 1/8	16 1/2	2 3/8		10	14 1/8	0	6 1/2		14 3/8	7	1 1/8	5
FBH50	18 1/2	22	23 1/4	20 1/8	2 3/4		12 7/8	17 3/8	0	7 5/8		17 3/4	8 1/2	1 3/8	6
FBH75	22 1/4	25 3/8	25 1/2	22	3		11 7/8	17 3/4	4 7/8	9 1/2		19 5/8	9 1/4	1 5/8	6
FBH100	25 3/8	29 1/8	29 3/8	25 3/8	3 3/8	12 5/8	19 3/8	22	0	7 1/4	11 1/8	22 5/8	10 3/4	1 5/8	7
FBH125	26 1/4	31 1/2	32 3/8	28	4	13 7/8	21 1/8	24	0	7 7/8	12 1/8	24 1/2	11 3/4	1 7/8	7
FBH150	27	33 3/4	35 1/2	30 1/2	4 3/8	15 1/4	23 3/8	26 5/8	0	8 7/8	13 5/8	27 1/2	12 3/4	1 7/8	7
FBH200	30 3/8	36	36 3/8	31 1/2	4 3/4	13 1/4	21 1/4	26 1/8	4 1/8	10 7/8	13 1/2	27	13 1/4	2 1/4	8
FBH250	31 7/8	36 5/8	39 3/8	33 1/2	4 7/8	13 3/4	22 1/2	27 7/8	4 5/8	12	14 3/4	29 1/2	13 3/4	2 1/2	8



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