



Marine Fenders & Ship Launching Airbags

Qingdao Florescence Marine Supply Co., Ltd

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Website: www.fendercore.com

Email: info91@florescence.cc

Tel: 0086-532-8689155 Ext:802

Add: 27th Floor, 10-2 Building, Optical Valley Software Park,
Emeishan Road No. 396, Qingdao, China.

 **Since 1992**

 **Top 3**
Manufacturer

 **Standard**
ISO 9001:2015

 **NAVY Supplier**

 **Global**
Cooperation

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FLORESCENCE Mission

To promote the clients' sustainable growth, to assist clients to become bigger and stronger, strive for country prosperity.

FLORESCENCE Vision

To become a leader in global industrial innovation and trade.

FLORESCENCE Value

Client-oriented, mutual benefits, honesty & responsibility.

ABOUT OUR COMPANY

Factory established in 1992, Qingdao Florescence Marine Supply Co., Ltd (Subsidiary of Qingdao Florescence Co., Ltd) specializes in manufacturing **pneumatic rubber fenders, foam fenders, various ship dock rubber fenders, and ship launching & salvage rubber airbags.**

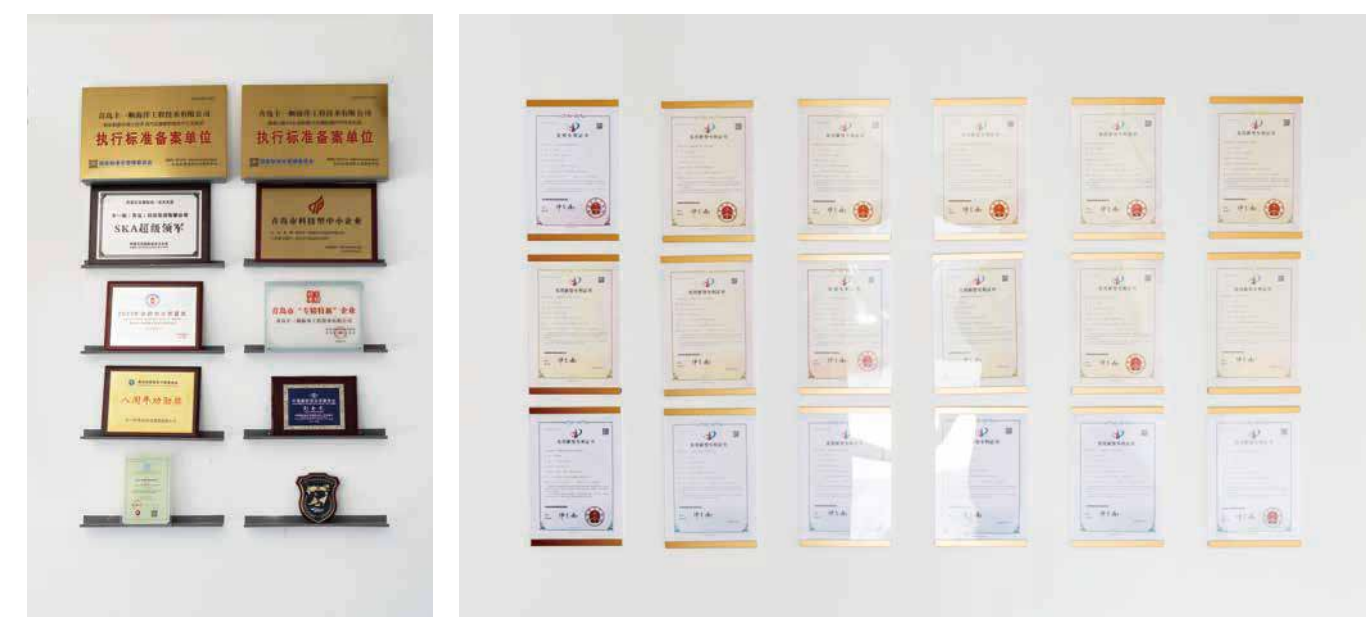
FLORESCENCE products are designed, manufactured, and tested per ISO 9001:2015 requirements. And every unit is robustly built to the stringent requirements of ship surveyors such as **CCS, BV, RS, ABS, LR, etc.**

We serve as a supplier to the navies of numerous countries, including **Bangladesh, Greece, France, Thailand, and the Philippines, etc**

FLORESCENCE considers our clients as a part of the team, treating them as partners. We are always together with them on each step of the way, from finding the solutions of fender using and ship launching to the manufacturing and installation operations on site. Our rich experience has earned us a reputation as a dependable partner in many ports and shipyards around the world.



CERTIFICATE

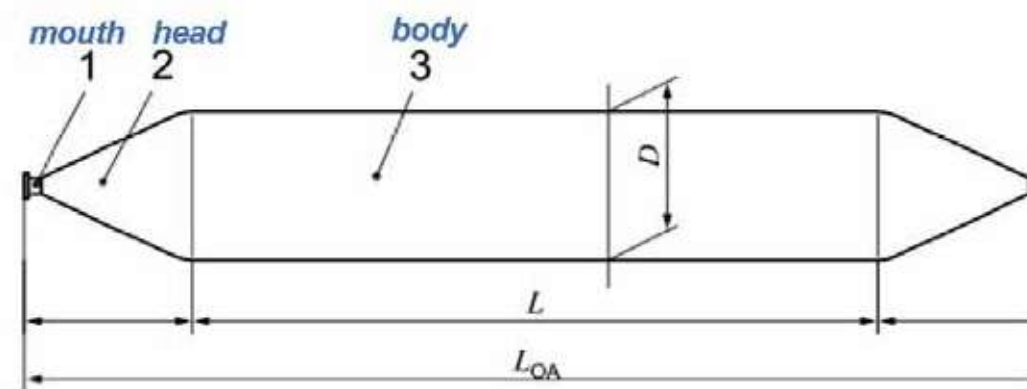


Ship Launching Airbag

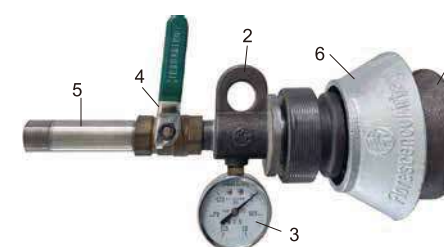
Florescence ship rubber airbag complies with ISO 14409. Ship airbag can be used to launch and upgrade a ship up to 100,000DWT. Comparing to the traditional slipway launching method, the ship launching airbag is much environmental, because ship airbag can launch a ship at any seaside, there's no need to worry about the construction of launching facilities; besides, the marine airbag need little maintenance and can be used repeatedly.

Structure

Please see the picture 1 of Florescence launching rubber airbag structure. It is composed by airbag body and terminal iron part. The airbag body is composed by natural rubber and strength fiber material through vulcanization processing; The terminal iron part is made of cast iron, it is combined closely with the bag body; One end is for pulling when move the airbag, and the other end is for charging and discharging the air. All the fittings in picture 2 and 3



Structure of ship launching airbag



- 1.Terminal iron
- 2.Three-way connecting tube
- 3.Pressure gauge
- 4.Valve
- 5.Hose joint
- 6.Protective cover



- 1.Pulling ring
- 2.Terminal iron
- 3.Protective cover

Features

- ① Airbags of different sizes are in stock
- ② Provide repair kit and on site instruction
- ③ Long service life, can be reused many times
- ④ Wear resistance and anti aging
- ⑤ Good raw material and cord fabric
- ⑥ Do no harm to the environment. Time & money saving
- ⑦ Need no more than air compressors, winches and ropes
- ⑧ Much cheaper and more portable than other methods

Applications

- ① For ship launching/upgrading/docking/landing
- ② For salvaging sunken ship or heavy objects
- ③ For hoisting and transporting heavy goods up to 10,000 tonnes structure on land
- ④ For floating use to improve the draft
- ⑤ Pneumatic rubber core for architecture engineering (culvert making)
- ⑥ Container for storing and transporting gas, chemical liquid and pure water for voyage



Rubber material requirements

NO.	Test item		Required value	Test method
1	Tensile strength, MPa		≥18	ISO 37
2	Elongation at break, %		≥400	ISO 37
3	Hardness, °(Shore A)		60±10	ISO 7619-1
4	Tear strength, N/cm		≥400	ISO 34-1
5	Compression set, %(70°C ± 1°C, 22 h)		≤30	ISO 815-1
6	After thermal ageing at 70°C +1°C, 96 h	Holding of pull lengthening, %	≥80	ISO 188
7		Holding of elongation at break, %	≥80	ISO 188
8		Change of hardness, °(Shore A)	≤8	ISO 7619-1
9	Static ozone ageing at 40°Cx 96 h [ozone concentration (50 ± 5)× 10 ⁻³], extension 20 %		No crack	ISO 1431-1

Safety precaution

Over Pressure Control:

Strictly control the operating pressure, over pressure is forbidden.

The Slipway Requirements:

The slipway should be ground or cement concrete, according to the tonnage of different ships.

Avoid Sharp Objects:

Make sure no sharp objects on slipway and ship. Keep it smooth and clean to avoid puncture of airbags.

Avoid Distortion And Overweight:

Avoid distortion in the length direction during rolling and avoid overweight load after air charging.

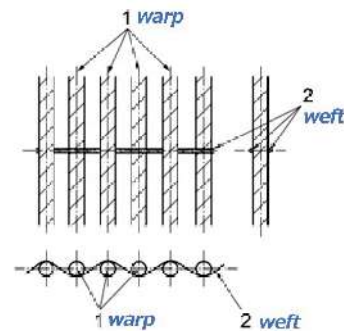
Storage

- When the airbags are not to be used for a long time, they should be drained, cleaned, dried, coated with talcum powder.
- The airbags should be maintained in a dry ventilated room and be protected from light.
- The airbags should be in a relaxed condition free from tension, compression or other deformation.
- The airbags should be kept away from any heat source.
- The airbags should be protected from acids, alkalis, oils or organic solvents.

Materials

Florescence airbag is constructed of an outer rubber layer, one or more synthetic-tyre-cord layers, and an inner rubber layer. The arrangement of synthetic-tyre-cord reinforcement layers is shown in the picture below, all materials shall be vulcanized firmly.

Prior to the airbag production, the outer and inner rubber layers shall be tested to meet criteria in the following table in accordance with the test methods given in the international standard list in the table. While only one satisfactory sample per batch is required for test numbers 1 to 3, all others test numbers 4 to 9 annually. If the first sample fails, two additional samples should be tested. If the additional samples pass the test requirements, the materials will be deemed to have passed the test. Otherwise, the materials will be deemed to have failed the test and another batch of materials shall be selected.



Specifications

Size Range: (Other customized sizes are also available)

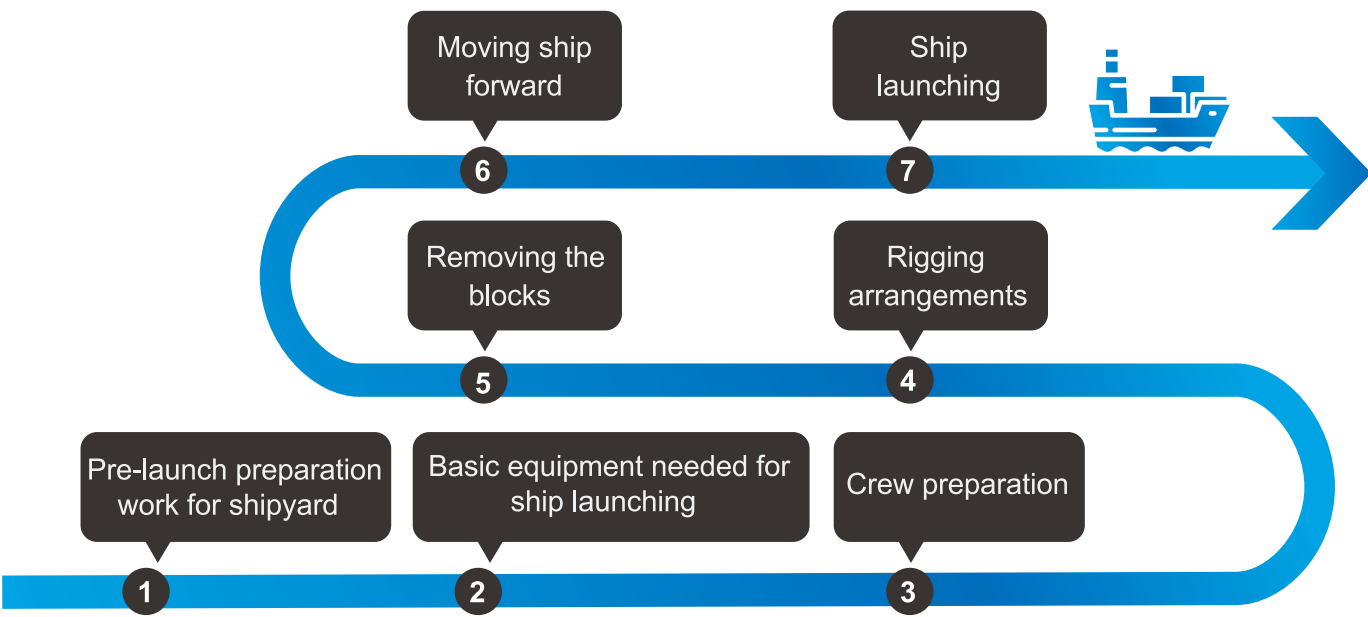
Diameter (D):	From 0.6m to 2.8m	Total Length (TL):	From 7.0m to 31.0m
Effective Length (EL):	From 5.0m to 28.0m	Standard Number of Layers:	Usually 3-12 layers

Guaranteed working pressure

Type	D=0.8m	D=1.0m	D=1.2m	D=1.5m	D=1.8m	D=2.0m
FL3 layers	0.13Mpa	0.10Mpa	0.09Mpa	0.07Mpa	0.06Mpa	0.05Mpa
FL4 layers	0.17Mpa	0.13Mpa	0.11Mpa	0.09Mpa	0.08Mpa	0.07Mpa
FL5 layers	0.21Mpa	0.17Mpa	0.14Mpa	0.11Mpa	0.09Mpa	0.08Mpa
FL6 layers	0.25Mpa	0.20Mpa	0.17Mpa	0.13Mpa	0.11Mpa	0.10Mpa
FL7 layers	0.29Mpa	0.23Mpa	0.20Mpa	0.15Mpa	0.13Mpa	0.12Mpa
FL8 layers	0.33Mpa	0.26Mpa	0.23Mpa	0.17Mpa	0.15Mpa	0.14Mpa
FL9 layers	0.37Mpa	0.29Mpa	0.26Mpa	0.19Mpa	0.17Mpa	0.16Mpa
FL10 layers	0.41Mpa	0.32Mpa	0.29Mpa	0.21Mpa	0.19Mpa	0.18Mpa

Procedure

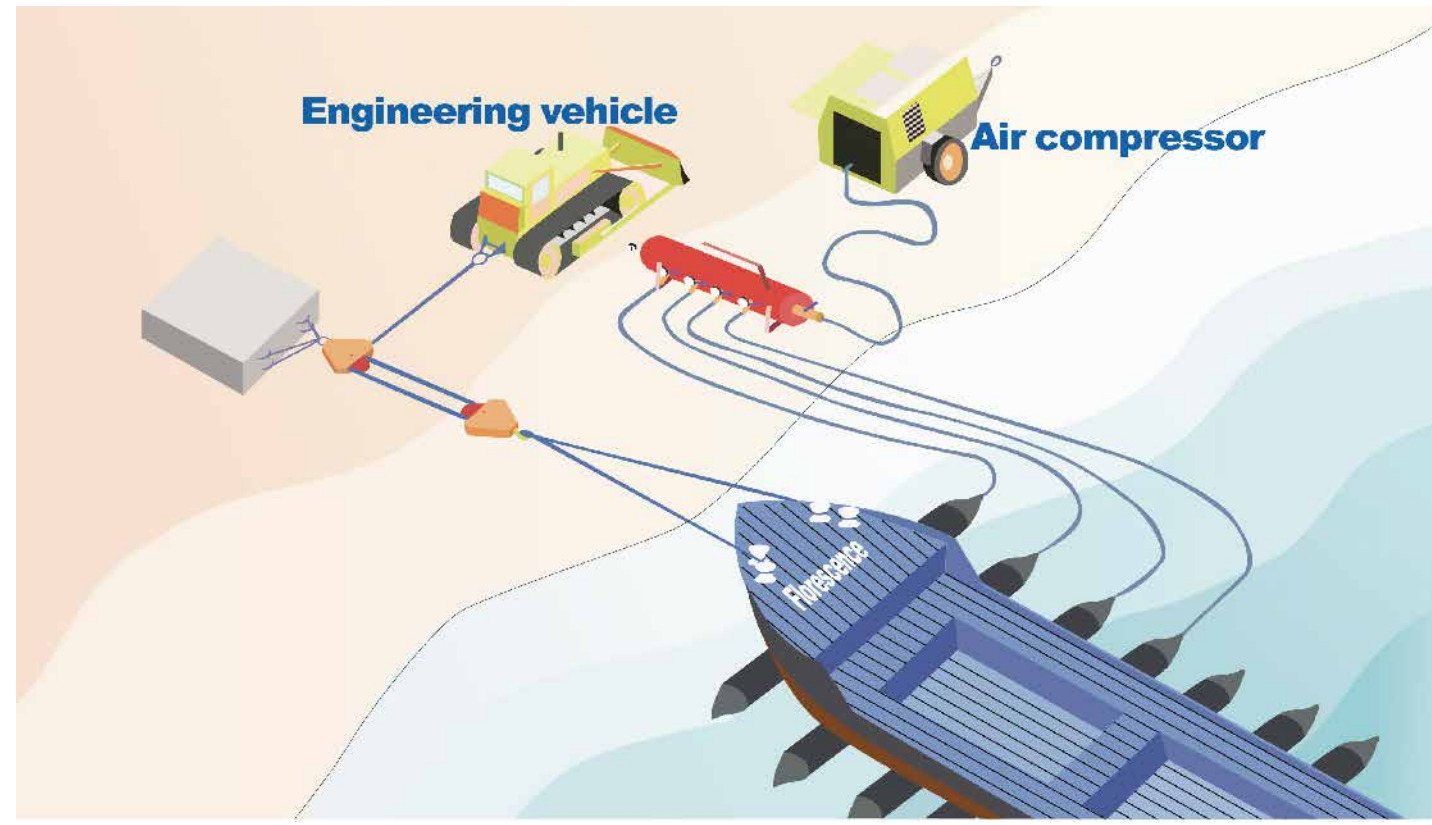
Of Launching Ships By Rubber Airbags



Requirements

Of Launching Ships And Relevant Equipment

Ship	Ramp way	Winch	Air compressor
The engineering work under water line shall wholly be finished, especially valves and those equipment that are to be installed at the openings under ship water-line. The installation should be approved by inspection. Burrs, welds, etc. on the bottom or appendages of the ship should all be worn away. All the welds on the shell plate must pass inspection and tightness test. The main dimensions of the ship should be measured up and marked the load line. All the paint work of the shell plate has been finished.	The ramp way should be cleaned and be clear of sharp things during airbags rolling. The ramp way should be leveled and the level error from left to right should less than 80mm. The ground bearing capacity should be relatively equalized. The ramp way made of mud land, sanded land, sands or concrete, however, its bearing capacity should be twice as big as the working pressure of airbags. The slope of ramp way is to be determined according to the size of the launching ship and is generally no bigger that 1/7. Even if the airbags are at the lowest working height, the bottom of the ship should not touch the ground. The ramp way should extend into water for certain length.	In general, winch veering speed is about 9-13m/min. The moving speed of a ship should be no more than 6m/min with the control of hauling force of winch wire. If the ship weight is less than 200t, the moving speed can be increased properly. The wires must be checked and replaced regularly.	The type and capacity of the air compressor is to be selected according to the total volume of all the airbags provided for ship launching, airbag inflating time and the air pressure.



MARINE SALVAGE AIRBAG

Marine salvage airbag is widely used to rescue sunken ships, salvage heavy objects, float marine projects, etc.

It is evolved from ship launching airbag while improved for salvage purpose. Compared with PVC bag, it is much stronger and can be reused many times. The salvage airbag can be used up to 30m underwater, and its buoyancy capacity is 3tons to 120tons per airbag.



Pneumatic Rubber Fender

Pneumatic rubber fender has 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).

Yokohama pneumatic rubber fender can be delivered in various sizes and types. Chain and tyre net (CTN) type is usually recommended to protect the fender body, but sling type or body only is also available.

Structure

Florescence pneumatic rubber fender is constructed of four parts.

1.Outer rubber

Rubber layer that covers the outside of the fender to protect the cord layers and the inner liner rubber from abrasion and other external forces.

2.Cord layers

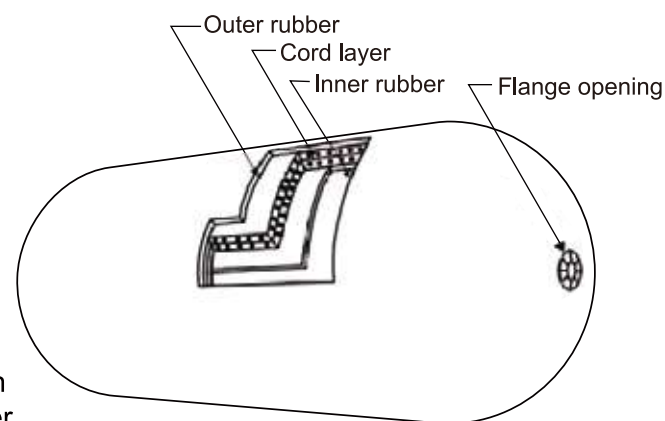
Layer made of synthetic-tyre-cord fabric, which maintains the internal air pressure of the fender.

3. Inner rubber

Liner of a rubber membrane that seals the pressurized air inside the fender.

4. Flange opening

Steel flange which is mounted on the fender, to which an air valve or safety valve can be adapted.



Two types

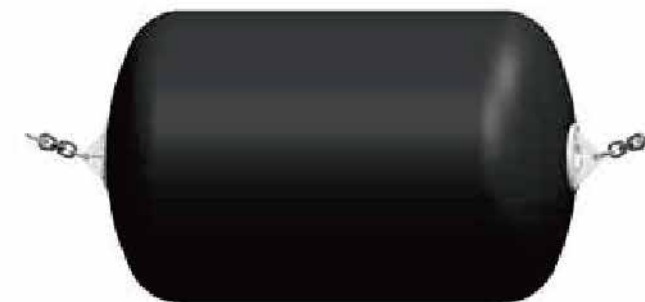
A) Net type

The net type fender is consisted of fender body, tires, chains and rubber sleeves.



B) Sling type

The sling fender is designed for use without a protective net.



Features

- ① High energy absorption with low reaction force
- ② Light weight, portable and floatable, can be installed and replaced easily
- ③ Heavy duty and long service life over 10 years
- ④ Supplied as sling type (body only) or with chain and tire net for protection of the fender body
- ⑤ Suitable for locations with large and small tidal differences

Applications

- ① Offshore platforms
- ② Oil and gas tankers
- ③ Fast ferries and aluminium vessels
- ④ Temporary and permanent installations
- ⑤ Rapid response and emergencies
- ⑥ In ports with extreme tidal variations
- ⑦ Fishing vessels, transport ships and ocean trawlers

Rubber hose for better hull protection

Rubber hoses are used to protect chains in order to avoid any damage to fender's and the ship's hull

Internal initial pressure

Standard: 50Kpa and 80Kpa

Towing ring and swivel

The fenders are fitted with a towing ring and swivel in galvanized steel



ISO17357 complied

Florescence fenders comply with the requirements of ISO17357, ensuring good performance and high quality floating pneumatic fenders for safe berthing operations

Chain and tire net for protection

Truck and aircraft tires are all available



Initial Pressure

There are two initial pressure ratings for Florescence Marine Pneumatic Fender:

- 1.Pneumatic 50 (Initial pressure 50 Kpa)
- 2.Pneumatic 80 (Initial pressure 80 Kpa)

Specifications

FL Specification	Initial Internal Pressure 50kpa		Initial Internal Pressure 80kpa	
	D*L(MM)	R(KN)	GEA(KJ)	R(KN)
500*1000	64	6	85	8
600*1000	74	8	98	11
700*1500	137	17	180	24
1000*1500	182	32	239	45
1000*2000	257	45	338	63
1200*2000	297	63	390	88
1350*2500	427	102	561	142
1500*3000	579	153	761	214
1700*3000	639	191	840	267
2000*3000	750	265	985	368
2000*3500	875	308	1150	430
2500*4000	1381	663	1815	925
2500*5500	2019	943	2653	1317
3000*5000	2104	1210	2709	1571
3000*6000	2583	1485	3292	1888
3300*4500	1884	1175	2476	1640
3300*6500	3015	1814	3961	2532
3300*10600	5257	3067	6907	4281
4500*6500	4150	3432	5453	4790
4500*9000	5747	4752	7551	6633
4500*12000	7984	6473	10490	9037

FL Pneumatic Rubber Fender for Large Vessels			
Vessel Tonnage (DWT)	Speed (M/S)	Energy (KJ)	Fender Size D*L (MM)
200000	0.15	1890	3300x6500
150000	0.15	1417	3300x6500
100000	0.15	945	3000x6000
85000	0.17	1031	3000x5000
50000	0.18	680	2500x5500
40000	0.20	672	2500x5500
30000	0.22	609	2500x4000
20000	0.25	525	2500x4000
15000	0.26	425	2500x4000
10000	0.28	329	2000x4000
5000	0.33	228	2000x3500

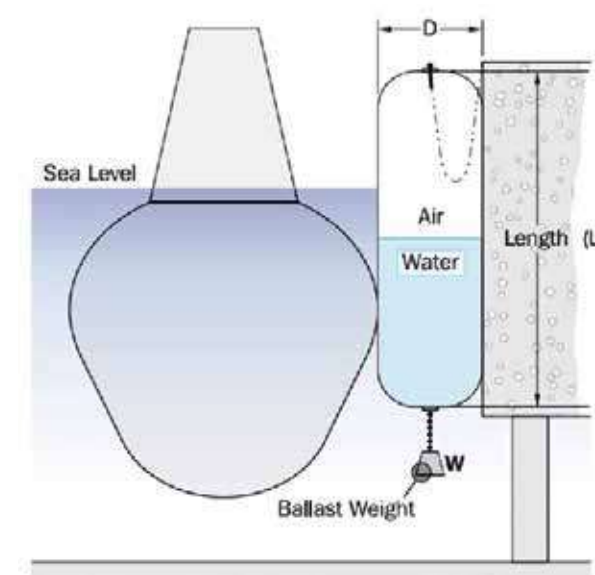
FL Pneumatic Rubber Fender for Medium and Small Vessels		
Vessel Tonnage (DWT)	Size (D*L) mm	Recommend Vessel
50	500*1000	Fishing vessel
100	700*1500-1000*1500	Fishing vessel
200	1000*1500-1200*2000	Fishing Vessel, Tugboat
300-500	1200*2000-1500*2500	Fishing Vessel, Tugboat
1000	1500*2500-1500*3000	Tugboat,Transport Ship
3000	2000*3000-2000*3500	Ocean Trawler,Transport Ship
10000	2000*3500-2500*4000	Transport Ship

Hydro-Pneumatic Fender

Florescence hydro-pneumatic fender is a special configuration of the pneumatic fender developed for submarine, catamarans, semi-submersible platforms and drilling rigs. They contact fenders be low waterline, require a unique solution. Hydro-pneumatic fender is specially adapted to this application. The fender body is partially water-filled, then pressurized with air and ballasted to make it stand vertically, fender draft and performance can be tuned by altering the water: air ratio and inflation pressure.



Structure



Specifications

Fender size (mm)	Without water 60% deflection		Without water 45% deflection		
	Energy (kJm)	Reaction (kN)	Ratio water/air %	Energy (kJm)	Reaction (kN)
1700x7200	560	1810	65/35	134	611
2000x6000	647	1766	65/35	155	599
2500x5500	928	2037	65/35	226	687
3300x6500	1913	3169	60/40	616	1247
3300x10600	3120	5170	55/45	589	1275

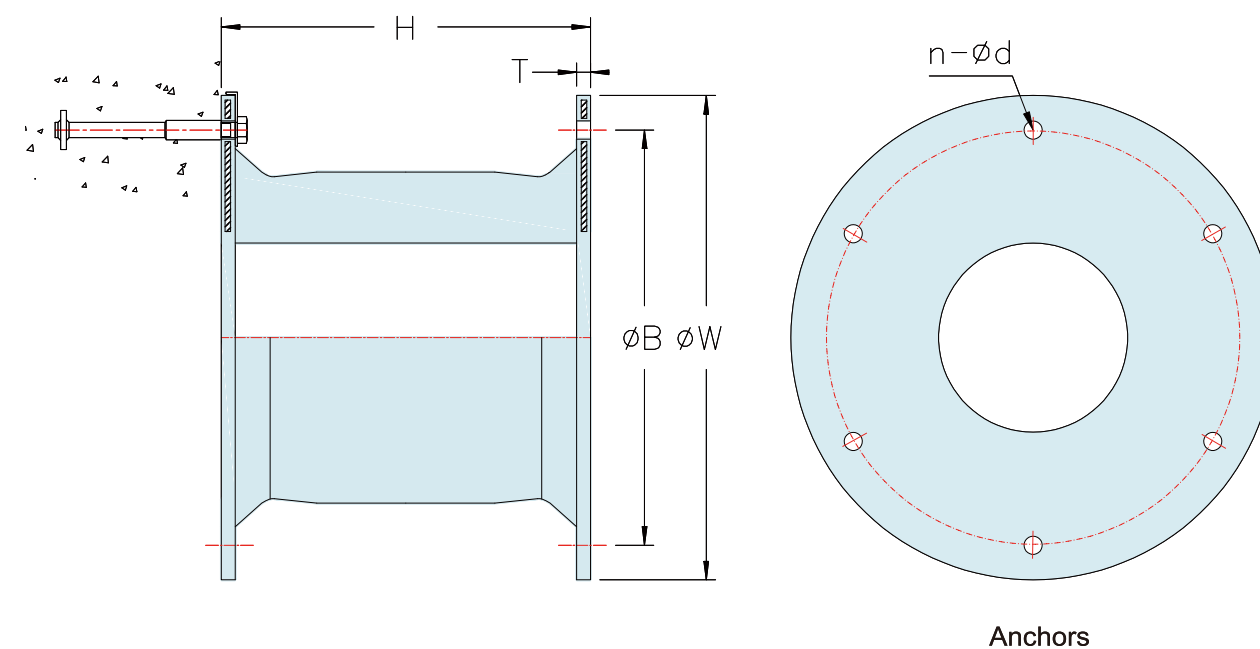
Remark: Other customized sizes are also available. Performance tolerance is $\pm 10\%$

FL Super Cell Fender

- Provide good energy capability, high deflection
- Match up with frontal panel and low friction PE pad
- Strong and well designed
- Low hull pressure, reduced shear force
- Suitable for a wide range of berthing applications



Specification



FL Specification	H	T	ϕB	ϕW	ϕd	Anchors	Weight
500H	500	25	550	650	32	4- M 24	112
630H	630	30	700	840	39	4- M 30	231
800H	800	30	900	1050	40	6- M 33	410
1000H	1000	35	1100	1300	47	6- M 39	822
1150H	1150	40	1300	1500	50	6- M 42	1220
1250H	1250	45	1450	1650	53	6- M 45	1488
1450H	1450	47	1650	1850	61	6- M 52	2330
1600H	1600	50	1800	2000	61	8- M 52	3022
1700H	1700	55	1900	2100	66	8- M 56	3730
2000H	2000	55	2000	2200	74	8- M 64	5258
2250H	2250	60	2300	2550	74	10- M 64	7452
2500H	2500	70	2700	2950	74	10- M 64	10755
3000H	3000	75	3150	3350	90	12- M 76	18582

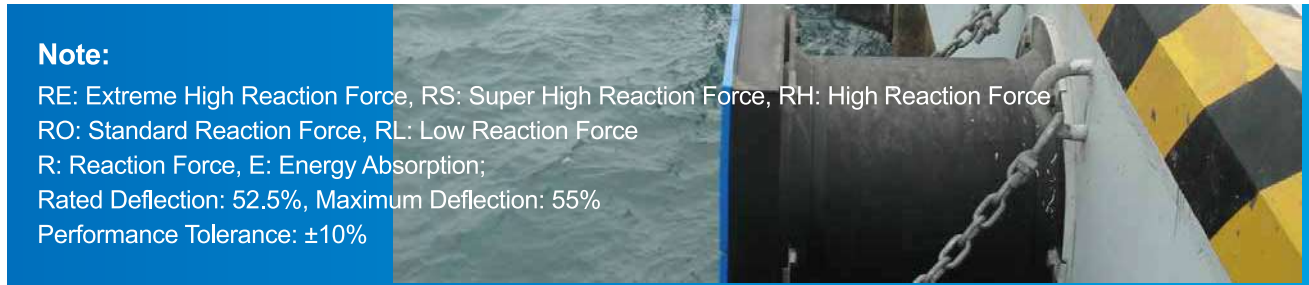
[Units: mm]

FL Specification			Performance												
			500H	630H	800H	1000H	1150H	1250H	1450H	1600H	1700H	2000H	2250H	2500H	3000H
RE	52.5%	R	182	290	464	737	975	1153	1551	1885	2131	2941	4145	5118	
		E	40	80	163	324	492	632	987	1326	1591	2591	4095	5618	
	55 %	R	210	309	493	784	1037	1225	1649	2007	2266	3136	4406	5441	
		E	43	85	173	343	521	669	1045	1405	1685	2743	4337	5949	
RS	52.5%	R	162	258	412	655	865	1022	1376	1676	1892	2619	3679	4543	
		E	36	72	145	287	437	561	876	1177	1413	2300	3628	4987	
	55 %	R	187	274	437	696	920	1087	1464	1781	2012	2783	3911	4829	
		E	38	76	153	304	463	594	928	1247	1495	2435	3848	5280	
RH	52.5%	R	140	224	355	567	750	886	1193	1453	1640	2270	3188	3937	5687
		E	30	62	125	249	379	486	760	1020	1224	1994	3150	4322	7456
	55 %	R	160	237	378	603	798	942	1269	1544	1743	2413	3390	4182	6619
		E	32	67	132	264	401	516	804	1080	1300	2111	3336	4576	7521
RO	52.5%	R	108	172	275	436	578	682	918	1120	1262	1746	2454	3028	4314
		E	23	47	96	191	295	375	585	786	945	1535	2425	3330	5676
	55 %	R	125	182	292	463	614	725	976	1189	1342	1856	2607	3220	5099
		E	25	50	102	203	309	396	619	832	997	1624	2566	3520	6028
RL	52.5%	R	86	138	211	349	462	546	735	894	1009	1398	2085	2574	3677
		E	18	38	75	153	233	299	468	628	753	1227	2060	2826	4897
	55 %	R	99	147	225	372	491	581	781	950	1073	1485	2216	2737	4217
		E	19	40	78	163	247	316	495	665	798	1299	2180	2992	5193

[Units: kN, kNm]

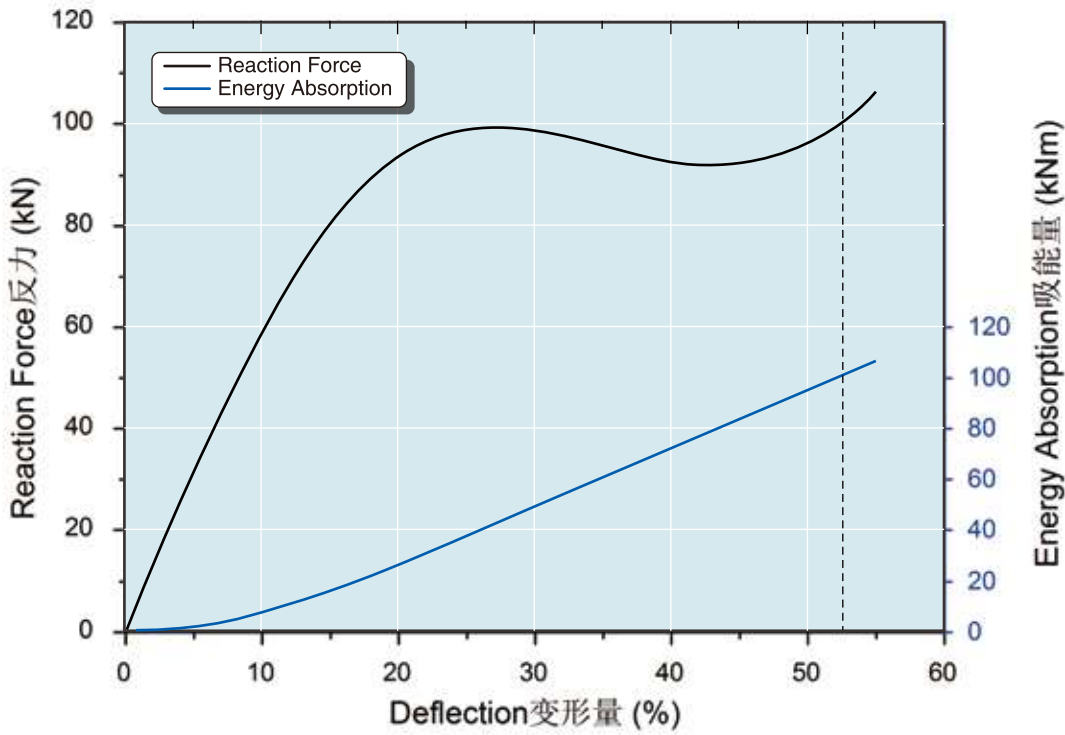
Note:

RE: Extreme High Reaction Force, RS: Super High Reaction Force, RH: High Reaction Force
RO: Standard Reaction Force, RL: Low Reaction Force
R: Reaction Force, E: Energy Absorption;
Rated Deflection: 52.5%, Maximum Deflection: 55%
Performance Tolerance: ±10%



PIANC factors					
Angular compression Factor		Temperature Factor		Velocity Factor	
Angle(deg ree)	AF	Temperature(°C)	TF	Time(second)	VF
0	1.000	50	0.882	1	1.005
3	0.977	40	0.926	2	1.002
5	0.951	30	0.969	3	1.001
8	0.909	23	1.000	4	1.001
10	0.883	10	1.056	5	1.000
15	0.810	0	1.099	6	1.000
20	0.652	-10	1.143	8	1.000
		-20	1.186	≥10	1.000
		-30	1.230		

Performance Curve



Fender Assembly & Accessories

A cell fender system includes rubber fender, frontal panel, facing pad, fasteners, cast-in anchors, chain systems, etc.



Main Accessories and Applications



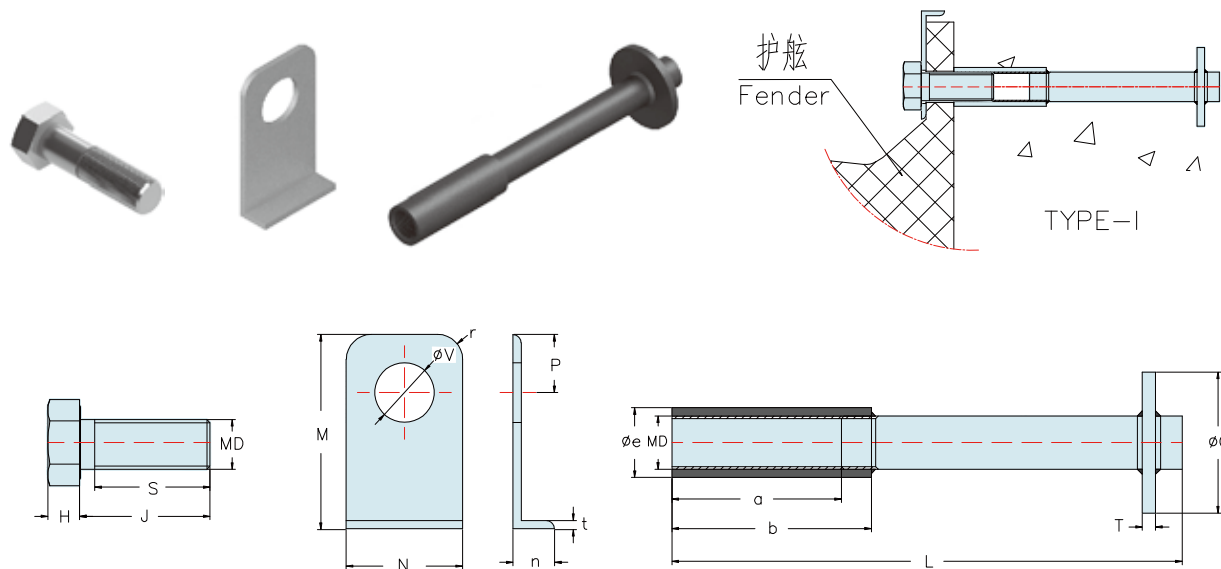
No.	Description		Application	Material
1	Rubber Fender		Absorb ship impact energy to protect dock and vessels	Rubber,SS400
2	Cast-in Anchors	Anchor Ferrule & Bolt	For fender fixing to dock	Stainless Steel, SS400 H.D.G
		U Anchor	Holding chains	SS400 Painted(or H.D.G)
3	Frontal Panel		Bear the force caused by fender buffer, increase the contact area with ship and lessen hull pressure.	SS400 Painted(or hot zinc/aluminum spraying)
4	Facing Pad		Reduce friction coefficient to protect hull	UHMW-PE
5	Link Bolt & Nut		For fender fixing to Front panel or other parts	Stainless Steel, SS400 H.D.G
6	Chain System	Weight Chain	Support the steel panel and prevent excessive drooping of the system	SS400,CM490 HDG or painted
		Tension Chain	Limit fenders deflection while fender local part under strain	SS400,CM490 HDG or painted
		Shear Chain	Prevent fedners system from shear deflection	SS400,CM490 HDG or painted



Note:
The following accessories including anchors, bolts and nuts, etc, are all standard models, special specifications, please contact the design department.

Anchor Bolt-I

Used for installing fenders to new concrete.

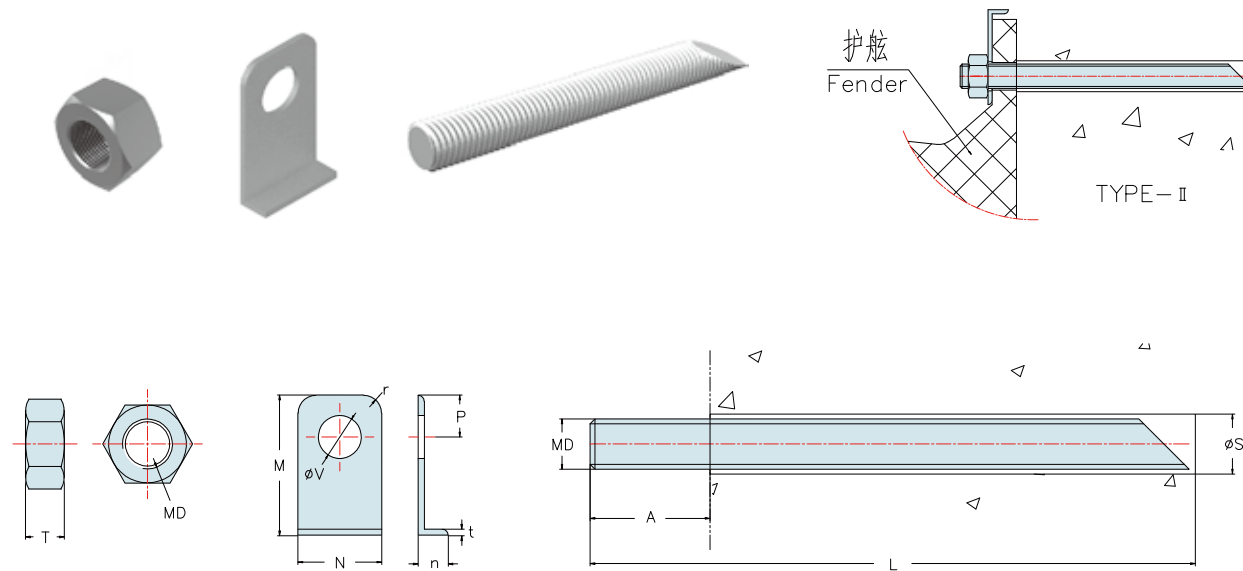


FL Specification	Hex Bolt				L-Washer								Anchor Nut			Anchor Rod .Plate		
	MD	H	J	S	N	n	M	P	t	V	r	a	b	e	T	L	G	
500H	M24	17	70	55	60	22	83	25	5	28	15	75	100	36	6-10	300	75	
630H	M30	19	75	60	65	20	110	33	5	34	15	75	105	38	8-12	330	85	
800H	M33	23	85	70	70	25	117	35	5	36	15	85	120	42	8-12	360	85	
1000H	M39	26	95	75	80	26	148	40	6	43	25	85	125	49	8-12	430	95	
1150H	M42	26	100	80	85	28	151	43	6	46	25	85	125	55	12-16	500	105	
1250H	M45	30	110	90	90	31	153	45	6	49	30	95	140	59	12-16	500	125	
1450H	M52	35	120	95	100	31	158	50	6	56	30	100	150	69	12-16	570	135	
1600H	M52	35	120	95	100	34	158	50	6	56	30	100	150	69	12-16	570	140	
1700H	M56	35	135	110	110	40	165	55	8	63	30	105	165	75	16-20	620	140	
2000H	M64	40	150	125	116	38	165	58	8	70	40	125	190	79	16-20	700	150	
2250H	M64	40	150	125	120	43	195	60	8	70	40	125	190	79	16-20	700	150	
2500H	M64	40	170	125	125	50	202	65	10	70	50	125	190	79	16-20	700	175	
3000H	M76	50	190	145	140	55	207	70	10	84	50	135	210	95	20-24	800	175	

[Units: mm]

Anchor Bolt-II

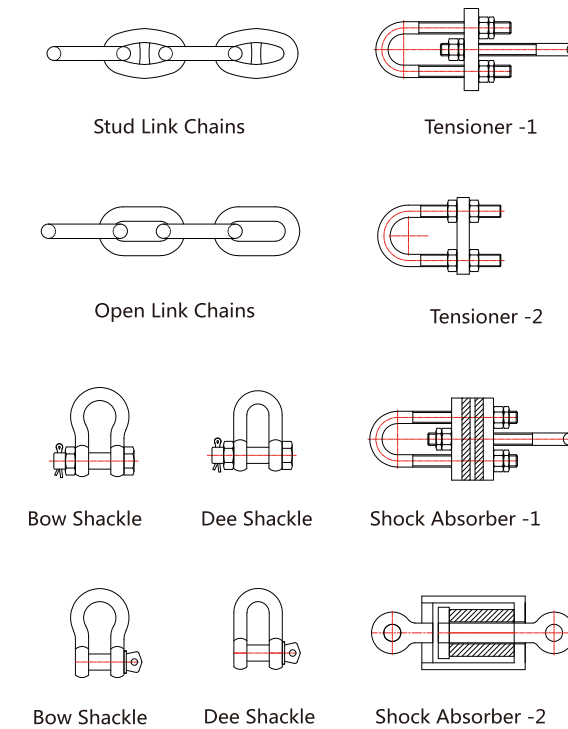
Used for installing fenders onto existing concrete or where cast-in anchors are unsuitable.



FL Specification	Anchor Bolt				Nut	L-Washer						
	MD	A	L	ΦS	T	N	n	m	p	t	V	r
500H	M24	60	280	30	22	60	22	83	25	5	28	15
630H	M30	70	360	38	26	65	20	110	33	5	34	15
800H	M33	75	400	42	28	70	25	117	35	5	36	15
1000H	M39	85	460	50	32	80	26	148	40	6	43	25
1150H	M42	95	510	55	34	85	28	151	43	6	46	25
1250H	M45	105	550	60	36	90	31	153	45	6	49	30
1450H	M52	115	630	65	42	100	31	158	50	6	56	30
1600H	M52	115	630	65	42	100	34	158	50	6	56	30
1700H	M56	125	680	68	45	110	40	165	55	8	63	30
2000H	M64	130	780	75	51	116	38	165	58	8	70	40
2250H	M64	140	780	75	51	120	43	195	60	8	70	40
2500H	M64	150	780	75	51	125	50	202	65	10	70	50
3000H	M76	180	940	88	64	140	55	207	70	10	84	50

[Units: mm]

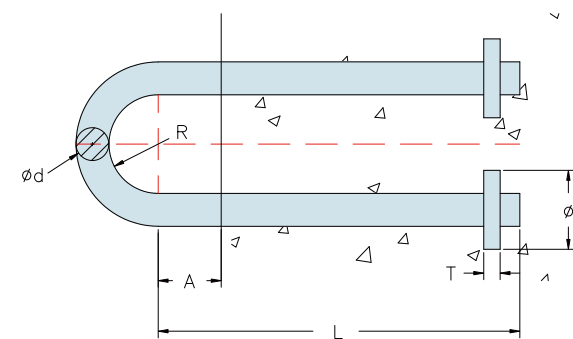
Structure and specification of Chains



FL Specification	Links	Shackle	Tensioner
500H	Φ20	Φ22	M30
630H	Φ20	Φ22	M30
800H	Φ25	Φ25	M36
1000H	Φ28	Φ32	M39
1150H	Φ32	Φ32	M42
1250H	Φ34	Φ36	M45
1450H	Φ36	Φ38	M48
1600H	Φ38	Φ38	M52
1700H	Φ40	Φ42	M56
2000H	Φ42	Φ45	M56
2250H	Φ42	Φ45	M56
2500H	Φ46	Φ50	M60
3000H	Φ46	Φ50	M60
Material	GR. U2 HDG, GR. U3 HDG.	GR. S HDG	SS400HDG

[Units: mm]

U Anchor



FL Specification	Φd	R	L	A	T	ΦG
500H	40	70	600	60	20~30	100
630H	40	70	600	60	20~30	100
800H	50	80	650	70	20~30	110
1000H	55	90	730	70	20~30	120
1150H	60	100	780	70	25~35	140
1250H	60	100	780	70	25~35	140
1450H	60	100	780	70	25~35	140
1600H	65	105	830	70	25~35	150
1700H	65	105	830	70	25~35	150
2000H	70	115	880	70	25~35	160
2250H	70	115	880	70	25~35	160
2500H	80	120	930	70	25~35	160
3000H	80	120	930	80	25~35	160

[Units: mm]

Note:

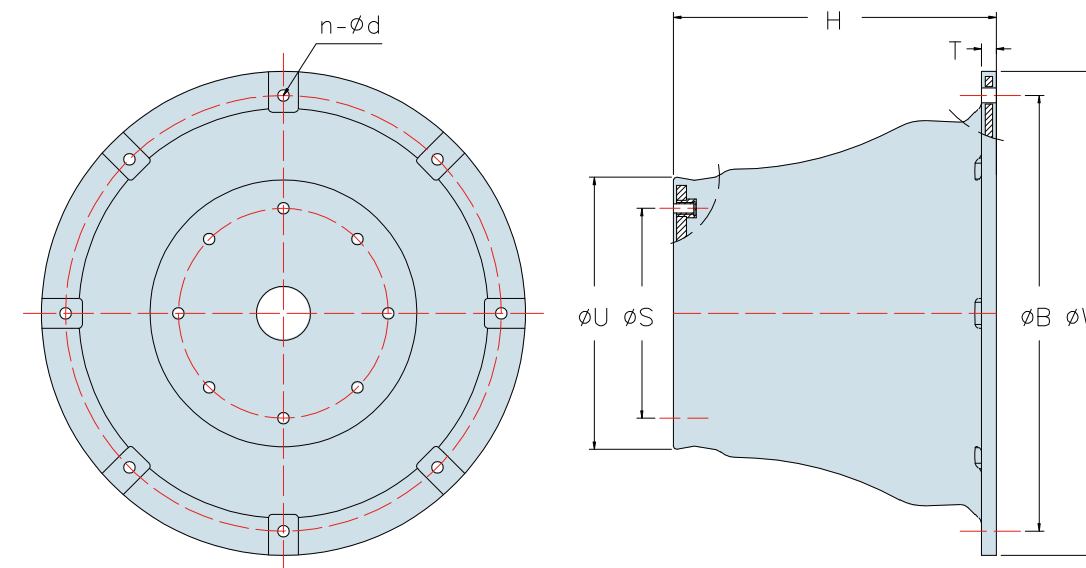
All chain and accessories information is for guidance only. Every chain design should be checked to confirm suitability for the intended application. For special sizes and applications, please contact us.

FL Super Cone Fender

Florescence Super cone rubber fender is the 3rd generation product of cell type fender.

- Cone fenders have the highest energy to reaction ratios of any fender currently in use
- Match up with frontal panel and low friction PE pad
- Suitable for all kinds of wharf

Specification



FL Specification	H	T	ϕU	ϕS	ϕB	ϕW	ϕd	Anchors	Weight
500H	500	25	425	325	675	750	30	4-M24	142
600H	600	27	510	390	810	900	30	6-M24	232
700H	700	32	595	455	945	1050	38	6-M30	393
800H	800	36	680	520	1080	1200	44	6-M36	540
900H	900	41	765	585	1215	1350	44	6-M36	752
1000H	1000	45	850	650	1350	1500	50	6-M42	1022
1100H	1100	50	935	715	1485	1650	50	6-M42	1510
1150H	1150	52	998	750	1550	1725	50	6-M42	1601
1200H	1200	54	1020	780	1620	1800	50	8-M42	1960
1300H	1300	59	1105	845	1755	1950	60	8-M48	2403
1400H	1400	66	1190	930	1890	2100	60	8-M48	3060
1600H	1600	72	1360	1060	2160	2400	70	8-M48	4605
1800H	1800	78	1530	1190	2430	2700	76	10-M56	6608
2000H	2000	80	1900	1540	2920	3200	76	10-M56	9200

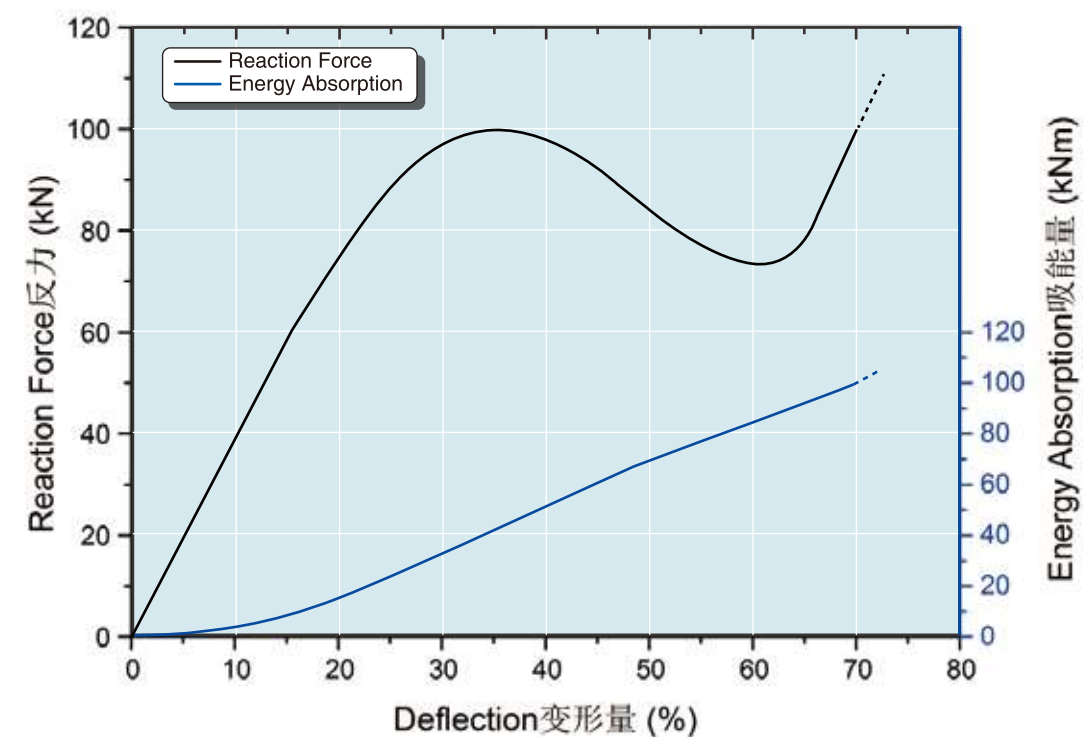
[Units: mm]

Performance

FL Specification		500H	600H	700H	800H	900H	1000H	1100H	1150H	1200H	1300H	1400H	1600H	1800H	2000H
Performance															
RS	R(kN)	340	480	655	862	1078	1339	1490	1764	1760	2125	2255	3130	3750	4260
	E(kNm)	80	155	232	368	480	669	840	1029	1110	1585	1686	2420	3530	4630
RH	R(kN)	270	382	525	706	862	1078	1150	1395	1400	1705	1804	2268	3000	3540
	E(kNm)	65	125	180	294	395	541	650	880	880	1310	1349	1935	2830	3800
RO	R(kN)	195	285	380	510	640	785	930	1050	1120	1340	1445	1815	2400	2980
	E(kNm)	46	94	150	225	310	435	495	660	710	1043	1079	1548	2260	3190
RL	R(kN)	165	230	310	410	510	630	800	830	890	1125	1150	1420	1910	2655
	E(kNm)	37	75	120	180	252	350	408	530	560	750	860	1230	1800	2830

[Units: kN, kNm]

Performance Curve



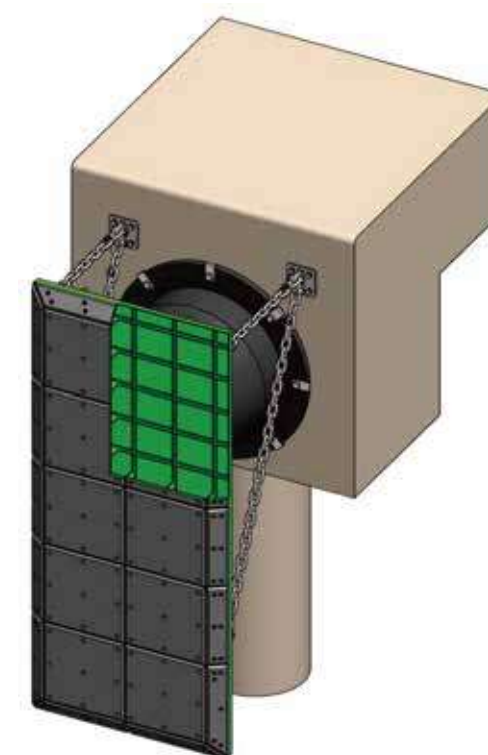
Note:

RS:Super high Reaction Force, RH: High Reaction Force
RO:Standard Reaction Force, RL:Low Reaction Force
R:Reaction Force, E:Energy Absorption;
Rated Deflection: 70%
Performance toleranc: ±10%

Pianc Factors					
Angular compression Factor		Temperature Factor		Velocity Factor	
Angle(deg ree)	AF	Temperature(°C)	TF	Time (second)	VF
0	1.000	50	0.882	1	1.050
3	1.039	40	0.926	2	1.020
5	1.055	30	0.969	3	1.012
8	1.029	23	1.000	4	1.005
10	1.000	10	1.056	5	1.000
15	0.856	0	1.099	6	1.000
20	0.739	-10	1.143	8	1.000
		-20	1.186	≥10	1.000
		-30	1.230		

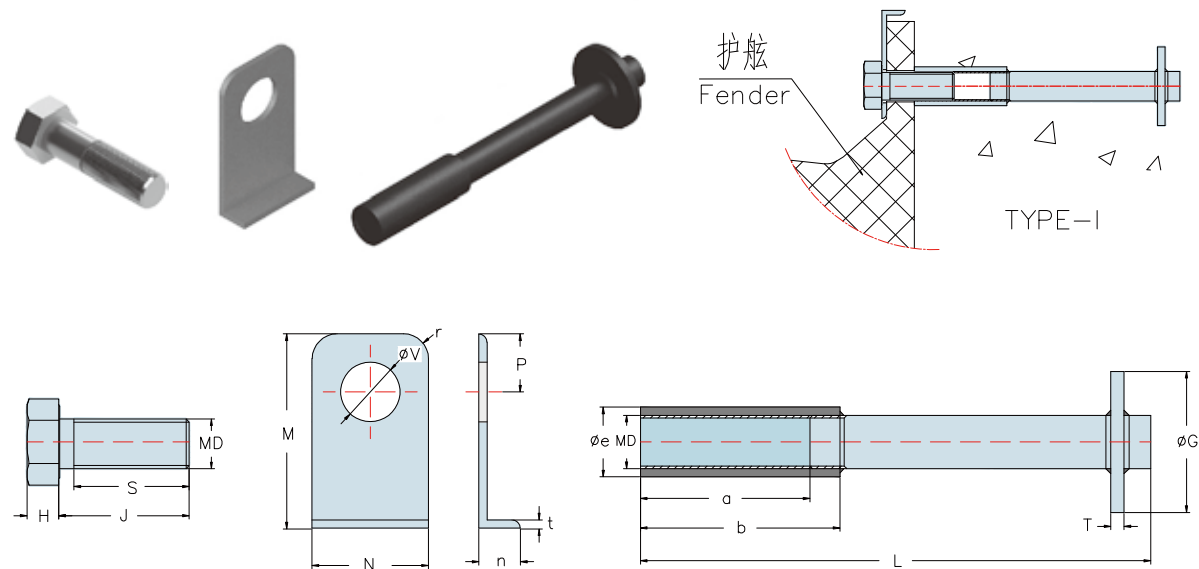
Fender Assembly & Accessories

A super cone fender system includes rubber fender, steel frontal panel, face pad, fasteners, cast-in anchors, chain systems, etc.



Anchor Bolt- I

Used for installing fenders to new concrete.

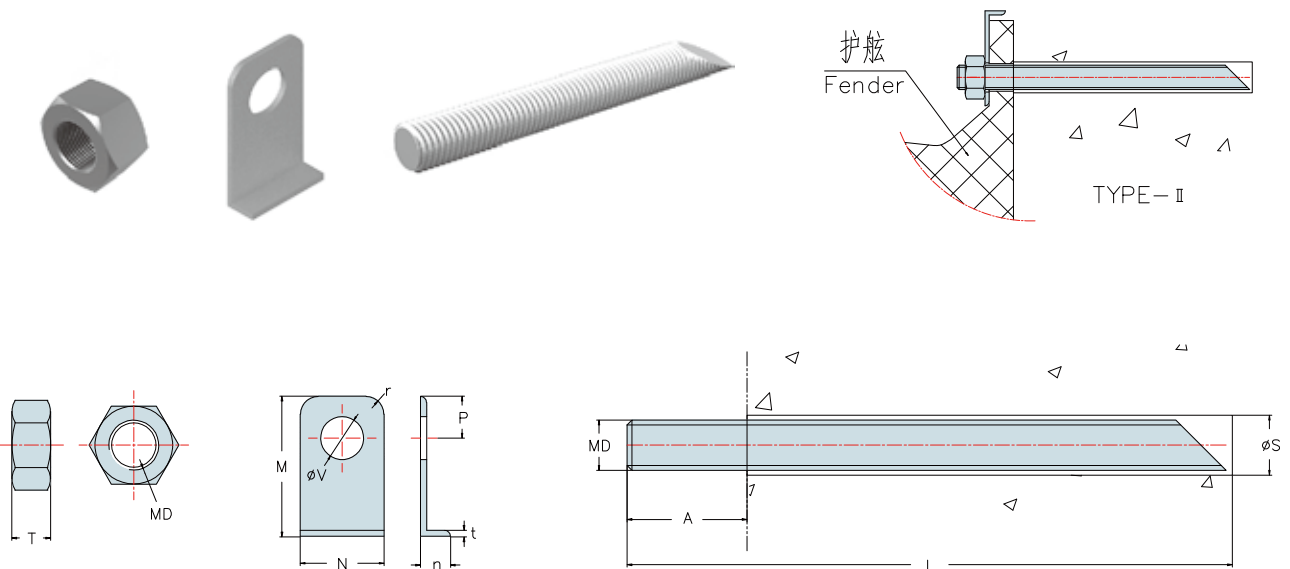


FL Specification	Hex Bolt				L-Washer							Anchor Nut			Anchor rod, Board		
	MD	H	J	S	N	n	M	P	t	V	r	a	b	e	T	L	G
500H	M24	15	60	55	55	20	69	25	4	28	15	60	90	36	6	240	75
600H	M24	15	65	60	60	20	83	30	5	28	15	65	100	36	6	240	75
700H	M30	19	70	65	65	20	93	33	5	34	15	70	105	39	10	300	80
800H	M36	23	85	70	70	24	102	35	5	40	15	85	120	44	10	360	85
900H	M36	23	90	75	70	24	113	37	6	40	15	85	120	44	10	360	85
1000H	M42	26	95	85	85	26	126	43	6	46	25	95	125	59	12	420	100
1100H	M42	26	100	90	85	26	134	43	6	46	25	95	130	59	12	420	100
1150H	M42	26	100	90	90	28	142	46	6	46	25	95	130	59	12	420	100
1200H	M42	26	110	95	90	31	144	46	8	46	25	100	140	59	12	420	100
1300H	M48	30	120	95	105	31	158	52	8	52	30	100	150	64	12	480	115
1400H	M48	30	120	95	110	31	165	52	8	52	30	100	150	64	12	480	120
1600H	M48	30	135	110	115	34	190	52	10	52	30	105	165	64	16	480	135
1800H	M56	35	135	110	115	40	207	60	10	60	30	105	165	78	16	560	140
2000H	M56	35	150	130	120	45	212	60	10	60	30	105	165	78	16	560	140

[Units: mm]

Anchor Bolt- II

Used for installing fenders onto existing concrete or where cast-in anchors are unsuitable.

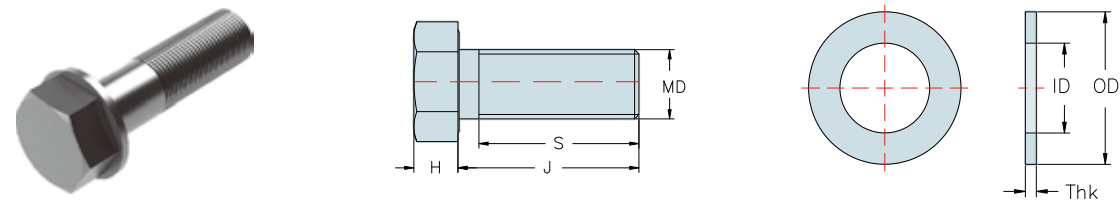


FL Specification	Anchor Bolt				Nut		Washer						
	MD	A	L	φS	T	N	n	M	P	t	V	r	
500H	M24	55	280	30	20	55	20	73	28	5	28	15	
600H	M24	55	280	30	20	55	20	80	28	5	28	15	
700H	M30	65	360	38	24	65	20	93	33	5	34	15	
800H	M36	75	440	46	29	70	24	102	35	5	40	15	
900H	M36	80	440	46	29	70	24	111	35	6	40	15	
1000H	M42	95	510	55	32	85	26	126	43	6	46	25	
1100H	M42	95	510	55	32	85	26	134	43	6	46	25	
1150H	M42	95	510	55	32	85	28	139	43	6	46	25	
1200H	M42	105	510	55	32	85	31	144	43	8	46	25	
1300H	M48	115	580	60	36	95	31	158	50	8	52	30	
1400H	M52	120	600	65	40	110	34	170	55	8	56	30	
1600H	M56	135	680	68	43	120	34	192	60	10	60	30	
1800H	M56	140	680	68	43	120	34	207	60	10	60	30	
2000H	M56	160	680	68	43	130	45	212	60	10	60	30	

[Units: mm]

Connection Accessories

Used for fixing steel flange onto the top of the cone fender.

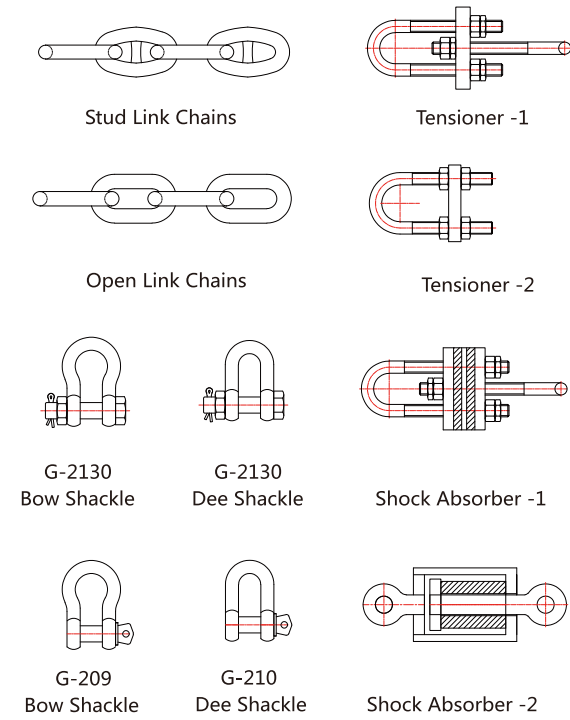


FL Specification	Hex Bolt			Round Washer		
	MD	J	S	OD	ID	Thk
500H~600H	M24	50	40	44	26	4
700H	M30	55	45	56	33	4
800H	M36	65	50	66	39	5
900H	M36	75	50	66	39	5
1000H~1100H	M42	90	70	78	45	8
1150H~1200h	M42	100	80	78	45	8
1300H	M48	110	90	92	52	8
1400H	M48	120	90	92	52	8
1600H	M48	140	100	92	52	8
1800H	M56	140	100	105	62	10
2000H	M56	140	100	105	62	10

[Units: mm]



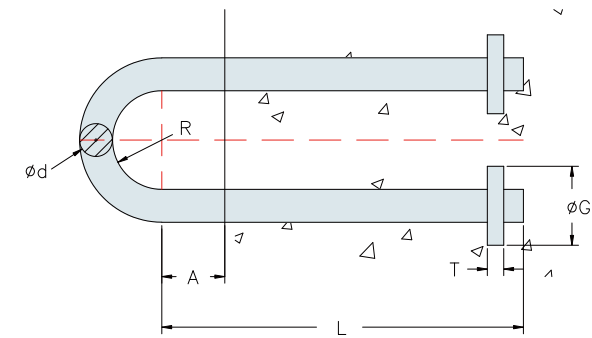
Connection Accessories



FL Specification	Links	Shackle	Tensioner
500H	Φ20.5	Φ22	M24
600H	Φ20.5	Φ22	M24
700H	Φ24	Φ28	M27
800H	Φ28	Φ32	M33
900H	Φ32	Φ35	M36
1000H	Φ34	Φ38	M39
1100H	Φ36	Φ38	M42
1150H	Φ36	Φ38	M42
1200H	Φ38	Φ45	M45
1300H	Φ38	Φ45	M45
1400H	Φ40	Φ45	M48
1600H	Φ44	Φ50	M52
1800H	Φ50	Φ50	M60
2000H	Φ55	Φ64	M64
Material	GR. U2 HDG, GR. U3 HDG.	GR. S HDG	SS400 HDG

[Units: mm]

U Anchor



FL Specification	Φd	R	L	A	T	ΦG
500H	40	70	600	50	20~30	100
600H	45	70	600	50	20~30	100
700H	50	80	650	50	20~30	
800H	55	90	730	70	20~30	120
900H	60	100	780	70	25~35	140
1000H	60	100	780	70	25~35	140
1100H	60	100	780	70	25~35	140
1150H	65	105	830	70	25~35	150
1200H	65	105	830	70	25~35	150
1300H	65	105	830	70	25~35	150
1400H	65	105	830	70	25~35	150
1600H	70	115	880	80	25~35	160
1800H	70	120	880	80	25~35	160
2000H	80	120	930	80	25~35	160

[Units: mm]

Note:

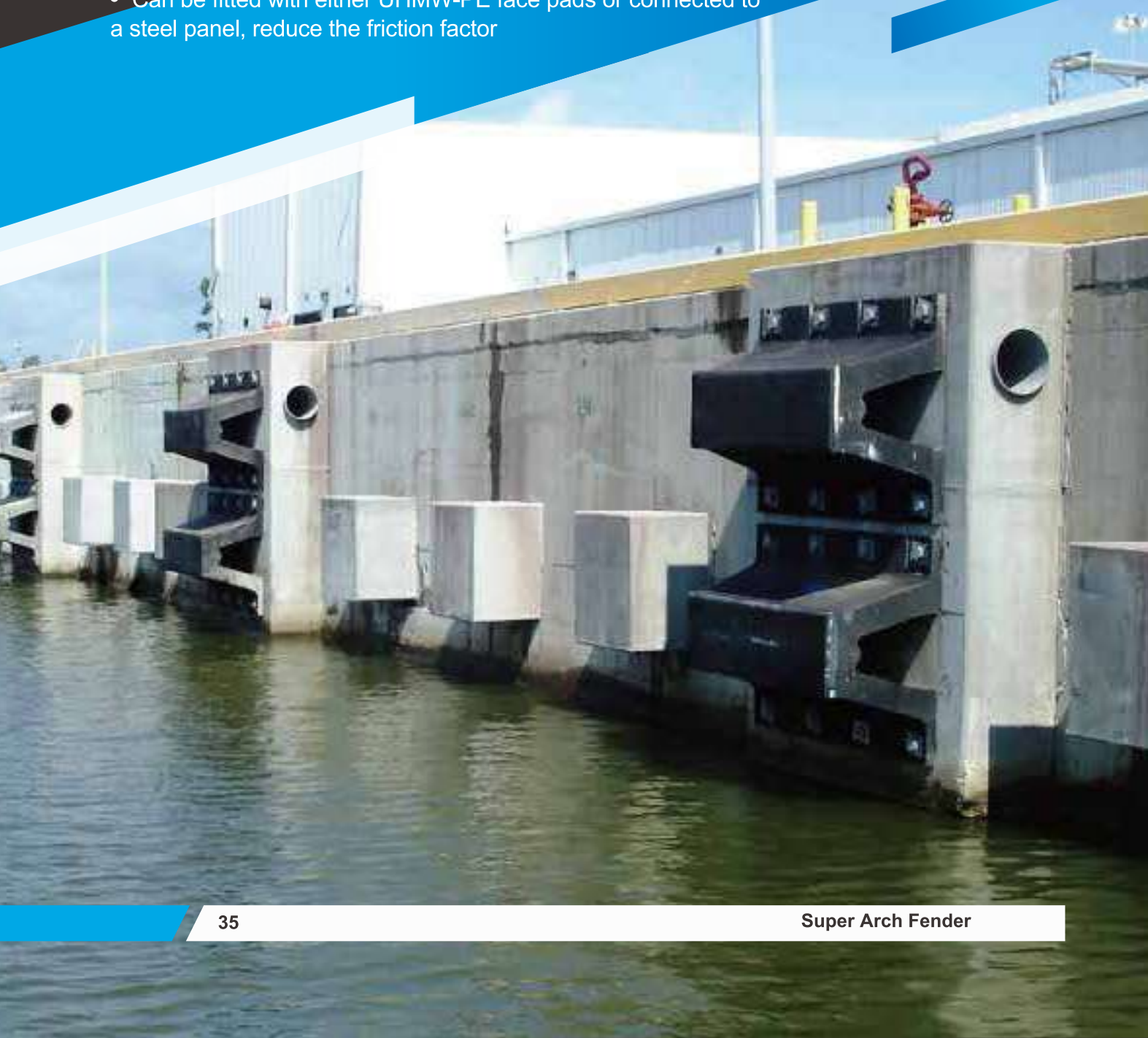
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For special sizes and applications, please contact us.

FL

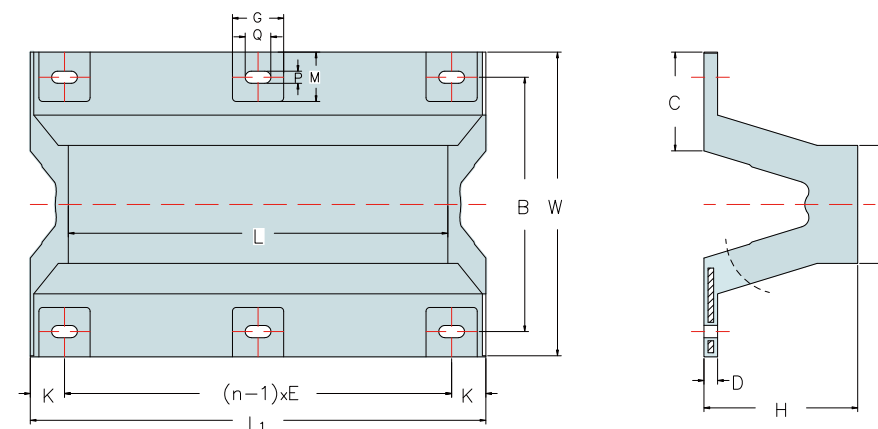
Super Arch Fender

Florescence super arch fender is modified from the traditional V type arch fender.

- High energy absorption and low reaction force
- Strong and hard wearing
- Excellent shear performance
- Large range of standard sizes
- Can be fitted with either UHMW-PE face pads or connected to a steel panel, reduce the friction factor



Dimension



FL Specification	H	W	B	F	C	D	P	Q	M	G
150H	150	300	240	98	96	22	25	50	55	95
200H	200	400	320	150	128	24	29	58	75	105
250H	250	500	410	187	160	30	32	64	90	125
300H	300	600	490	225	195	33	35	70	105	140
400H	400	800	670	300	260	40	41	82	120	165
500H	500	1000	840	375	325	45	47	94	140	180
600H	600	1200	1010	450	390	54	50	100	160	195
800H	800	1600	1340	600	520	72	68	136	260	270
1000H	1000	1850	1550	650	580	52	54	108	300	290

[Units: mm]

Specification

FL Specification	150H						200H					
L	1000	1500	2000	2500	3000	3500	1000	1500	2000	2500	3000	3500
L1	1075	1575	2075	2575	3075	3075	1100	1600	2100	2600	3100	3600
n	2	3	4	4	5	6	2	3	4	4	5	6
E	855	675	620	785	715	671	860	680	620	785	715	672
K	110	112.5	107.5	110	107.5	110	120	120	120	122.5	120	120
Weight (kg)	36	57	74	91	109	128	61	92	124	153	181	210

[Units: mm]

Specification

FL Specification	250H						300H					
L	1000	1500	2000	2500	3000	3500	1000	1500	2000	2500	3000	3500
L1	1125	1625	2125	2625	3125	3625	1150	1650	2150	2650	3150	3650
n	2	3	4	4	5	6	2	3	4	4	5	6
E	865	680	620	790	715	673	870	685	625	790	715	674
K	130	132.5	132.5	127.5	132.5	130	140	140	137.5	140	145	140
Weight (kg)	86	130	171	225	269	310	126	178	234	308	370	432

[Units: mm]

FL Specification	400H						500H					
L	1000	1500	2000	2500	3000	3500	1000	1500	2000	2500	3000	3500
L1	1200	1700	2200	2700	3200	3700	1250	1750	2250	2750	3250	3750
n	2	3	4	4	5	6	2	3	4	4	5	6
E	900	700	635	800	725	680	930	715	645	810	730	686
K	150	150	147.5	150	150	150	160	160	157.5	160	165	160
Weight (kg)	206	302	390	510	636	738	326	460	601	806	955	1110

[Units: mm]

FL Specification	600H						800H					
L	1000	1500	2000	2500	3000	3500	1000	1500	2000	2500	3000	3500
L1	1300	1800	2300	2800	3300	3800	1400	1900	2400	2900	3400	3900
n	2	3	4	4	5	6	2	3	4	4	5	6
E	960	730	655	820	740	692	1040	770	680	845	760	885
K	170	170	167.5	170	170	170	180	180	180	182.5	180	180
Weight (kg)	481	680	883	1102	1342	1580	875	1227	1585	2042	2410	2800

[Units: mm]

FL Specification	1000H				
L	1000	1500	2000	2500	3000
L1	1500	2000	2500	3000	3500
n	2	3	4	4	5
E	1100	800	700	860	775
K	200	200	200	210	200
Weight (kg)	1402	1910	2440	2950	3480

[Units: mm]

Performance

FL Specification			150H	200H	250H	300H	400H	500H	600H	800H	1000H
Performance											
RS	52.5%	R(kN)	129	170	270	325	430	540	645	864	1080
		E(kNm)	7	11	28	41	73	113	163	290	450
	55%	R(kN)	174	230	375	450	600	750	895	1200	1490
		E(kNm)	8	14	30	44	78	120	175	310	486
RH	52.5%	R(kN)	112	150	208	248	330	415	495	664	830
		E(kNm)	6	12	22	31	55	87	125	223	349
	55%	R(kN)	151	202	288	345	460	575	690	922	1150
		E(kNm)	7	13	23	33	60	93	135	239	374
RO	52.5%	R(kN)	84	112	172	206	275	344	412	550	688
		E(kNm)	4	10	18	26	46	72	104	185	289
	55%	R(kN)	113	152	239	286	382	478	572	764	956
		E(kNm)	5	11	19	28	49	77	111	198	310
RL	52.5%	R(kN)	56	75	148	175	235	295	354	472	590
		E(kNm)	3	6	16	22	40	62	89	159	248
	55%	R(kN)	76	105	205	245	328	410	492	655	820
		E(kNm)	4	7	17	24	43	66	95	170	265

Note:

RS: Super high Reaction Force, RH: High Reaction Force

RO: Standard Reaction Force, RL: Low Reaction Force

R: Reaction Force, E: Energy Absorption.

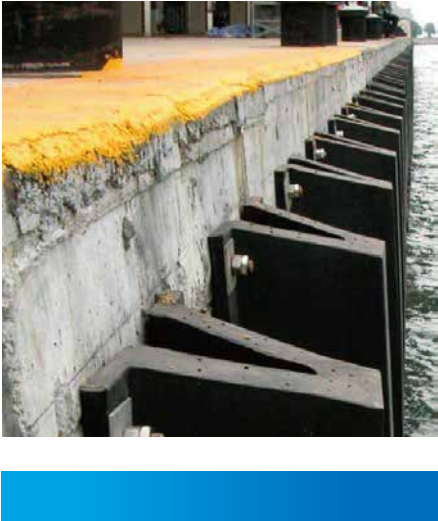
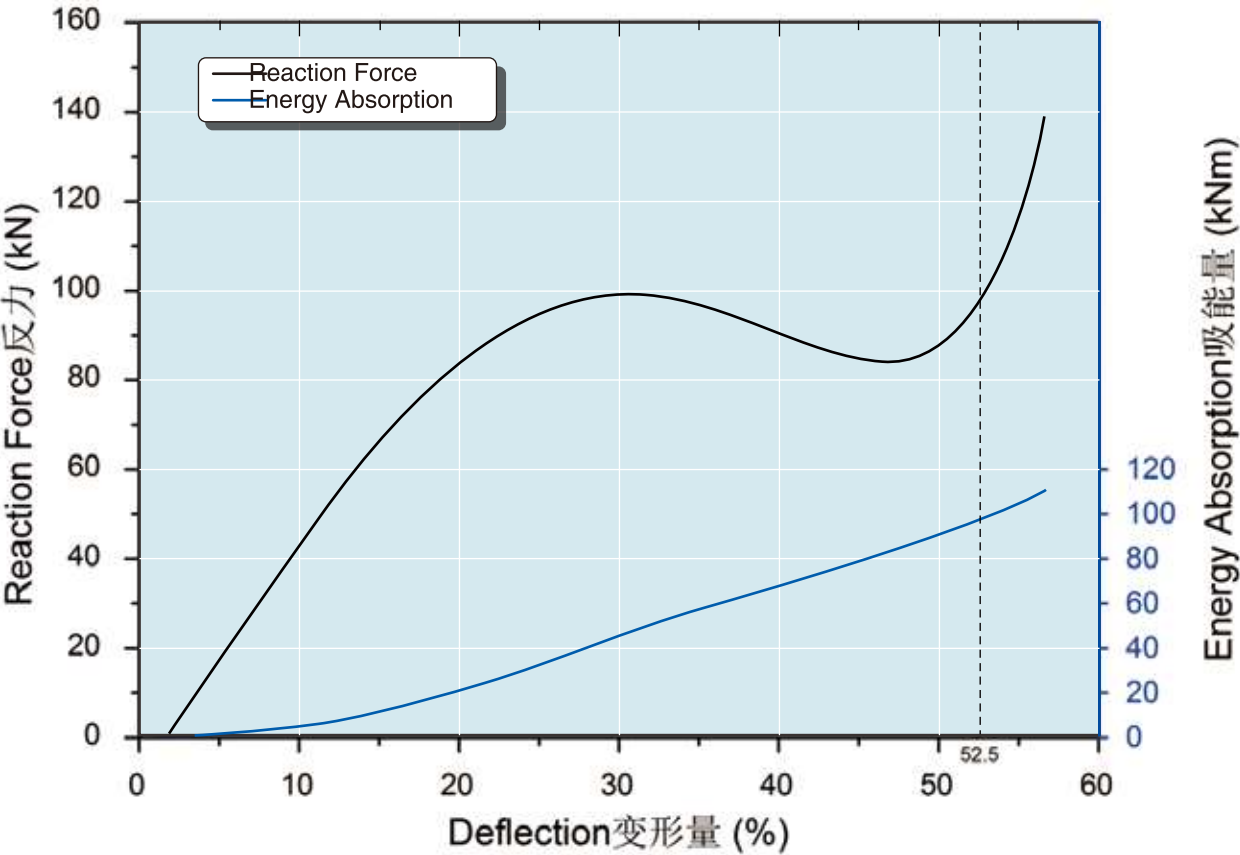
Rated Deflection: 52.5%, Maximum Deflection: 55%. *150H: Rated Deflection: 45%

Performance tolerance: ± 10%

The performance mentioned above is the performance for per meter length fender, Dynamic performance in different length shall be calculated by times the multiple of 1000mm length.

PIANC factors					
Angular compression Factor		Temperature Factor		Velocity Factor	
Angle(dgree)	AF	Temperature(°C)	TF	Time (second)	VF
0	1.000	50	0.882	1	1.014
3	0.963	40	0.926	2	1.005
5	0.952	30	0.969	3	1.004
8	0.939	23	1.000	4	1.003
10	0.924	10	1.056	5	1.003
15	0.817	0	1.099	6	1.002
20	0.535	-10	1.143	8	1.000
		-20	1.186	≥10	1.000
		-30	1.230		

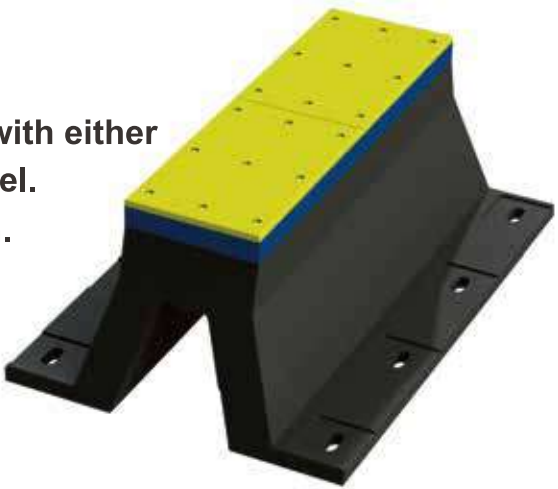
Performance Curve



FL Super Arch Fender-B

Features

Florescence Super Arch Fender-B can be fitted with either UHMW-PE face pads or connected to a steel panel. Superior abrasion-resistance and strong enough. Prolong the service life of fender.



Performance

FL Specification			150H	200H	250H	300H	400H	500H	600H	800H	1000H
Performance											
RS	50%	R(kN)	181	241	257	326	413	511	613	831	1015
		E(kNm)	7	13	24	35	64	102	133	265	417
RH	50%	R(kN)	155	208	196	242	316	401	462	621	788
		E(kNm)	6	11	19	27	49	78	108	200	312
RO	50%	R(kN)	116	157	165	200	261	354	386	510	655
		E(kNm)	5	8	15	21	41	64	83	150	262
RL	50%	R(kN)	78	103	144	158	229	269	299	456	539
		E(kNm)	3	6	12	16	31	54	71	126	221

Note:

RS: Super high Reaction Force, RH: High Reaction Force

RO: Standard Reaction Force, RL: Low Reaction Force

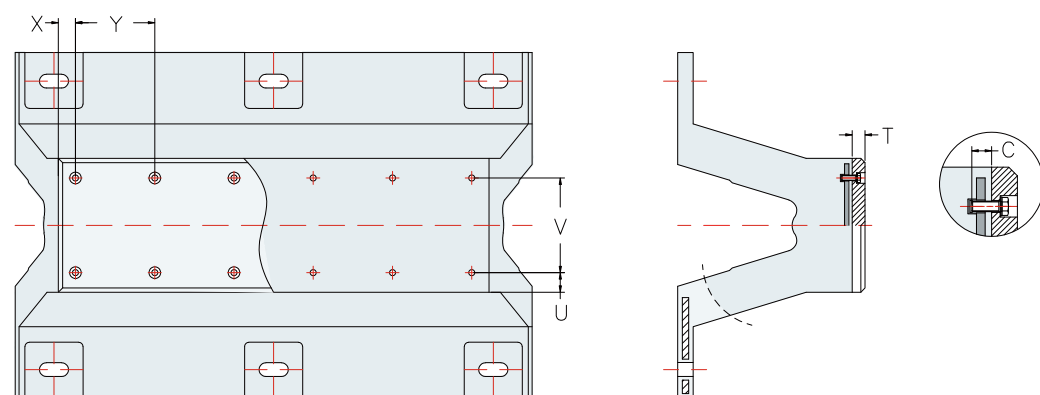
R: Reaction Force, E: Energy Absorption.

Rated Deflection: 50%

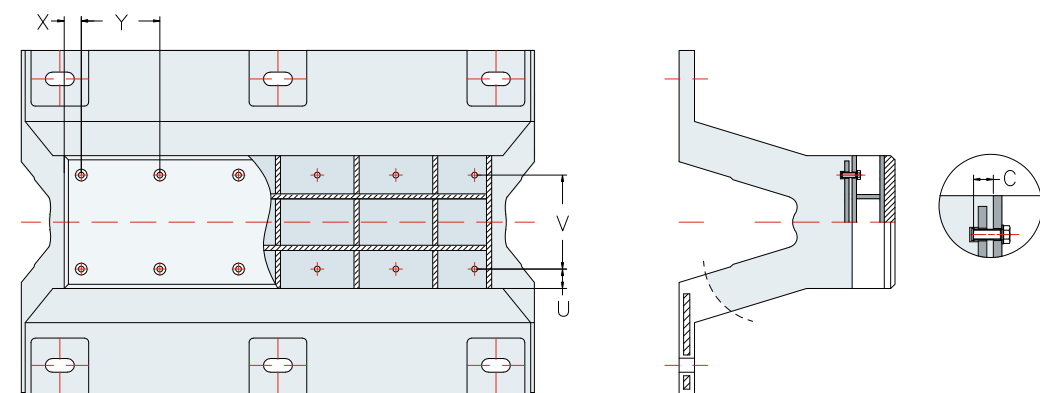
Performance tolerance: ±10%

The performance mentioned above is the performance for per meter length fender. Dynamic performance in different length shall be calculated by times the multiple of 1000mm length.

Dimension



Fixing with PE Pad



Fixing with Frontal Panel

FL Specification	U	V	C	Face Pad				Steel Frame		
				X	Y	T	Bolt Size	X	Y	Bolt Size
150H	49	0	20~30	60~70	300~410	30	M16	70~150	250~300	M16
200H	65	0	30~45	60~70	300~410	30	M16	70~150	250~300	M16
250H	50	64	30~45	60~85	300~410	30	M16	70~150	250~300	M20
300H	60	105	30~45	65~85	300~410	40	M16	70~150	250~300	M24
400H	60	180	30~50	65~85	300~410	40	M16	70~150	250~300	M27
500H	65	245	30~50	65~85	300~410	50	M20	70~150	250~300	M30
600H	70	310	35~60	65~85	300~410	50	M20	70~150	250~300	M30
800H	80	440	50~70	65~85	300~410	60	M24	70~150	250~300	M36
1000H	90	570	50~70	65~85	300~410	60	M24	70~150	250~300	M36

[Units: mm]

Data given in the above diagram are for guidance. If in doubt, please contact us.

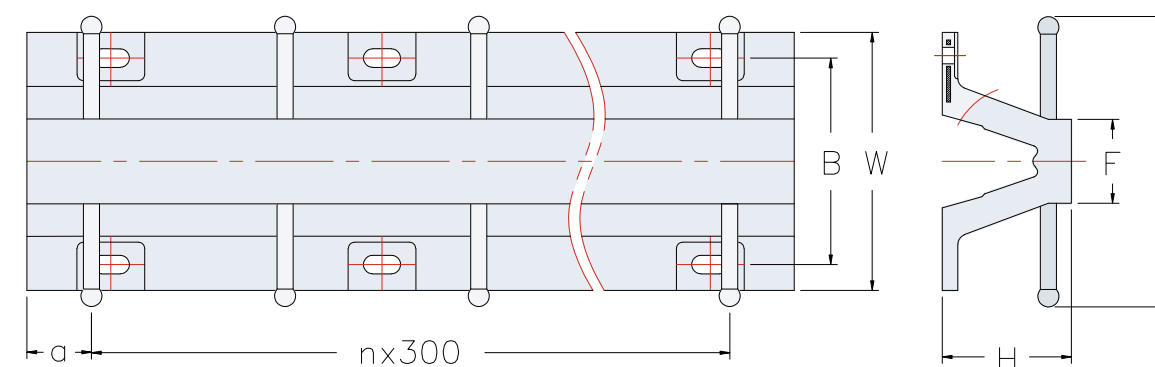
FL Rubber Ladder

Features

Can be functioned as fender and ladder.

Same installation holes pitch with Supper Arch fender and can be replaced with each other.

Easy for installation and maintenance with long service life.



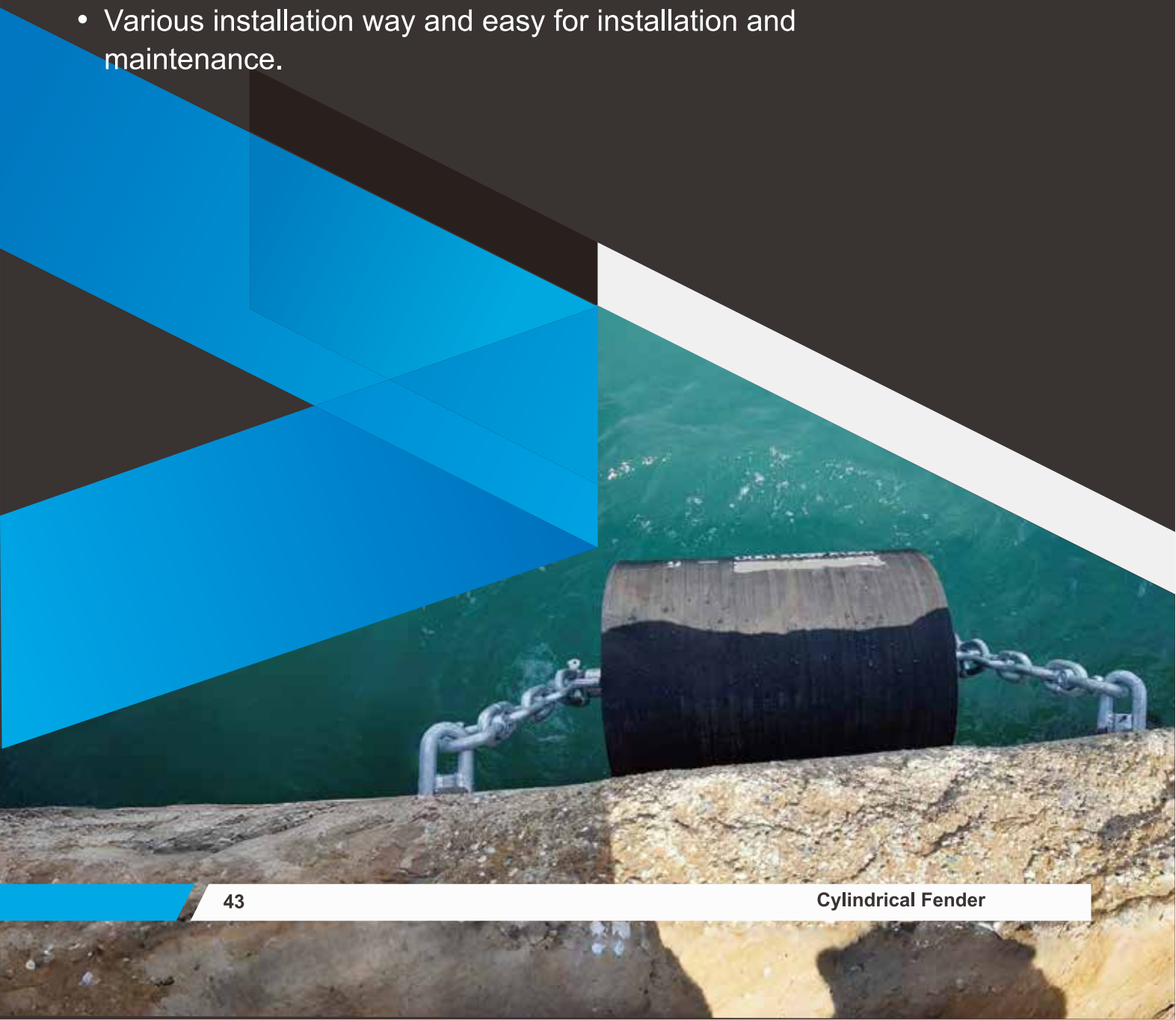
FL Specification	H	B	W	F	V	a
200H	200	320	400	150	450	150~200
250H	250	410	500	187	484	150~200
300H	300	490	600	225	545	150~200
400H	400	670	800	300	620	150~200
500H	500	840	1000	375	695	150~200

[Units: mm]

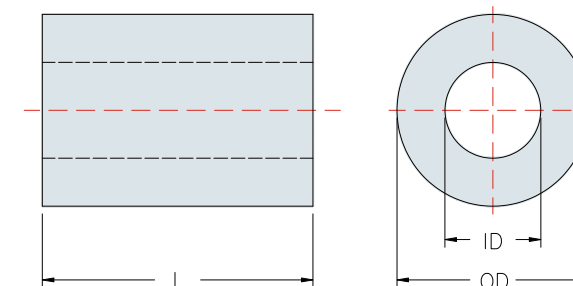
Data given in the above diagram are for guidance. If in doubt, please contact us. Other specifications are available upon to customer's request.

FL Cylindrical Fender

- Low reaction force, moderate surface pressure, and reasonable energy absorption.
- Stronger adaptability for longitudinal and crosswise motion of ships during berthing.
- Applicable for ships with different sizes and all sorts of docks.
- Various installation way and easy for installation and maintenance.



Specification



FL Specification OD×ID (mm)	Standard Reaction Force		High Reaction Force		Weight (kg)
	R(kN)	E(kNm)	R(kN)	E(kNm)	
150×75	44	1.5	73	2.3	17
200×100	60	2.6	95	4.2	31
250×125	75	4	120	6.5	48
300×150	89	6	143	9	69
350×175	104	8	167	13	94
400×200	119	10	191	17	123
500×250	148	16	239	26	191
600×300	179	24	286	37	275
700×350	208	31	334	50	376
800×400	237	41	383	66	490
900×450	268	52	430	84	620
1000×500	297	64	479	103	766
1100×550	331	77	528	129	926
1200×600	363	95	574	152	1102
1300×650	392	108	623	179	1294
1400×700	422	128	670	208	1501
1500×750	451	147	718	238	1723
1600×800	481	176	776	282	1960
1700×850	511	206	824	338	2213
1800×900	541	247	872	406	2481
1900×950	570	288	920	487	2765
2000×1000	653	321	1054	584	3063

[Units: mm]

Note:

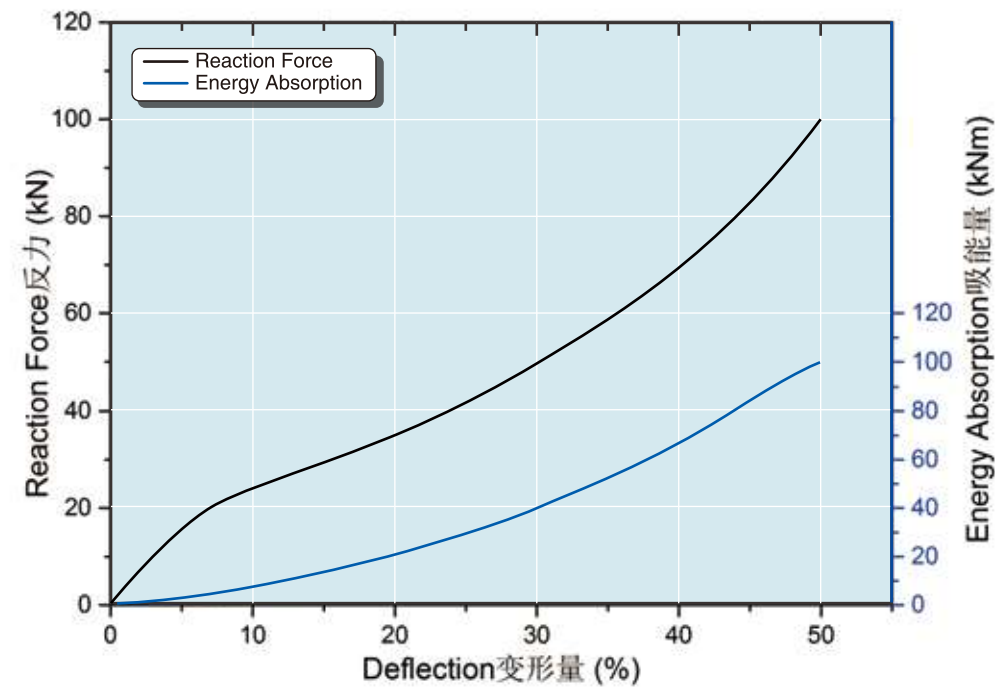
Rated Deflection: 50%

Performance tolerance: ±10%

R: Reaction Force, E: Energy Absorption.

The performance mentioned above is the performance for per meter length fender. Dynamic performance in different length shall be calculated by times the multiple of 1000mm length.

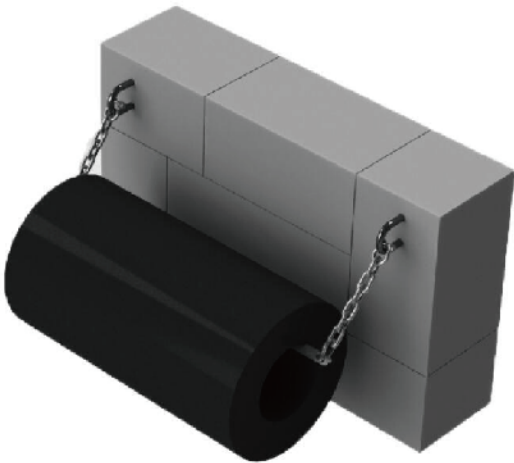
Performance Curve



U Anchor

FL Specification	Φd	L	R	ΦG	T
100~400	40	600	70	100	20~30
400~700	50	650	80	110	20~30
700~900	55	730	90	120	20~30
900~1100	60	780	100	140	25~35
1100~1500	65	830	105	150	25~35
1500~2000	70	880	115	160	25~35

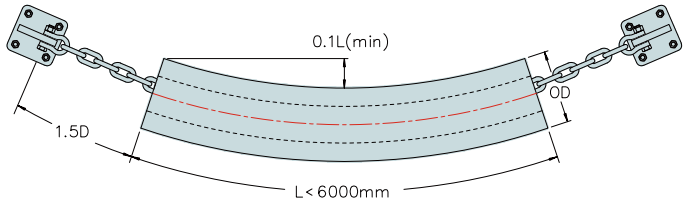
[Units: mm]



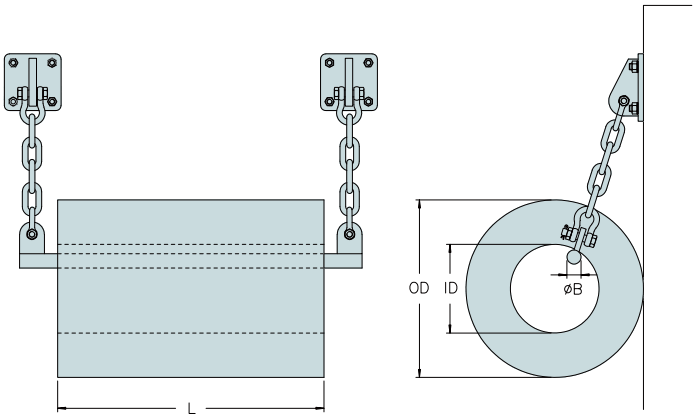
Note:

The value specified in the above table is for reference only.
 The final drawing is subject to the data provided by the customers.

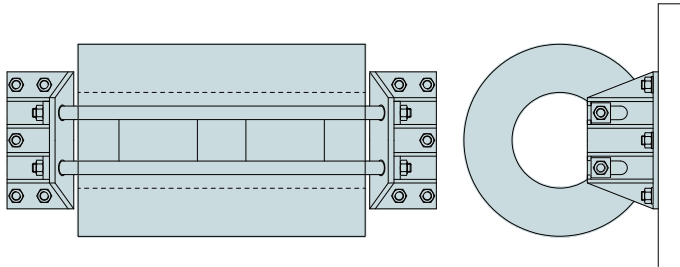
Cylindrical Fender Installation & Accessories



Small cylindricals ($\leq \Phi 600\text{mm}$) are often suspended from chains connected to brackets or U-anchors on the quay wall.



Large cylindricals ($\Phi 900\text{-}\Phi 1600\text{mm}$) often use a support bar connected at each end to chains which go back to brackets or U-anchors on the quay wall.



Very large cylindricals ($\geq \Phi 1600\text{mm}$) may require special ladder brackets due to their weight. These are specially designed for each application.

Small cylindricals

OD	ID	Chain	Shackle
100	50	14	16
150	75	16	16
200	100	18	19
250	125	20	22
300	150	24	28
350	175	26	28
400	200	28	35
500	250	32	38
600	300	36	44
700	350	36	44

[Units: mm]

Large cylindricals

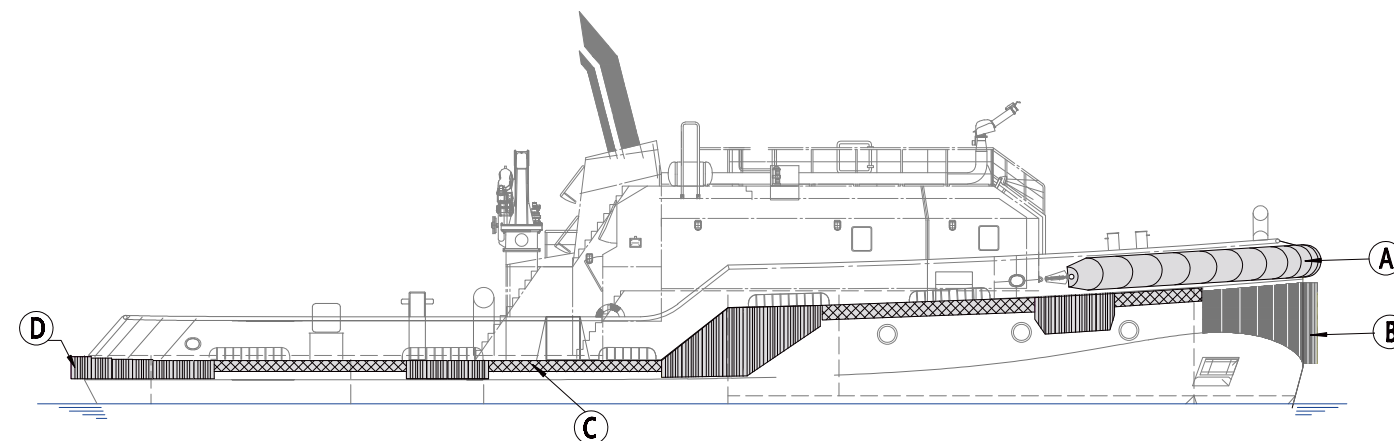
OD	ID	L	ΦB	Chain	Shackle
800 900	400 450	1000	35	24	28
		1500	45	28	35
		2000	55	32	38
		2500	65	34	44
		3000	70	40	50
1000 1100	500 550	1000	45	28	35
		1500	55	32	38
		2000	65	38	44
		2500	75	40	50
		3000	85	44	50
1200 1300	600 650	1000	50	28	35
		1500	65	34	44
		2000	75	40	50
		2500	85	44	50
		3000	100	50	56
1400 1500	700 750	1000	65	38	44
		1500	70	38	44
		2000	80	44	50
		2500	90	48	56
		3000	100	52	64
1600	800	1000	75	40	50
		1500	80	40	50
		2000	90	46	50
		2500	110	48	56
		3000	120	54	64

[Units: mm]

Florescence Tugboat Fender are mainly used at all kinds of harbor tugboats, installed at bow, board and aft. Rubber Fenders adopts integral molding vulcanization workmanship to obtain good performance, long service life and easy installation.



Tug fenders introduction



Tug fenders must work under more extreme conditions than any other fender type. Tugs may be fitted with many types of fender each type serving a particular application.

When selecting fenders designers should consider contact loads, pushing angles, friction and etc.

A Cylindrical fenders: Fitted to the bow/stern of tugs and usually used to push against flared hulls and in open sea conditions.

B Pushing fenders: Keyhole, Square and W-and M-fenders provide large contact surfaces for low hull pressures. Their grooved surfaces provide exceptional grip.

C Side beltings: D, Square and Composite fenders are often used as side beltings to protect the vessel during escort duties and when coming alongside.

D Stern of tugs: Usually use Cylindrical fenders or any other types.



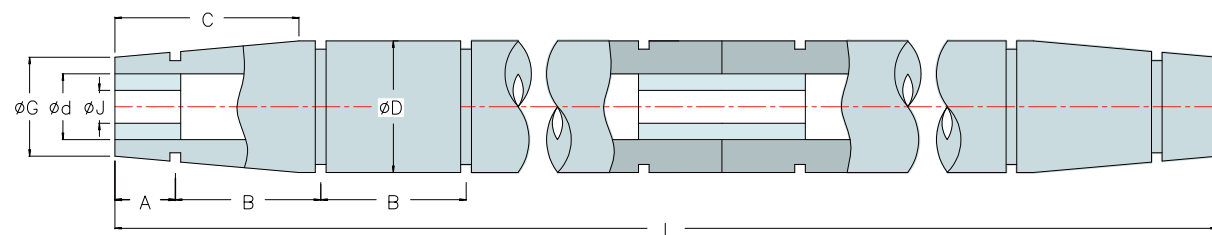
Contact FL office for further information and advice.

FL Tug Cylindrical Fender

Florescence Tug cylindrical fender are often used as the primary pushing fenders on the bow or stern of tugs, but are equally good for pushing flat-sided vessels. Tug fender can be fixed on the hull by the chain or straps, easey of installation. Tapered ends are also available.



Specification

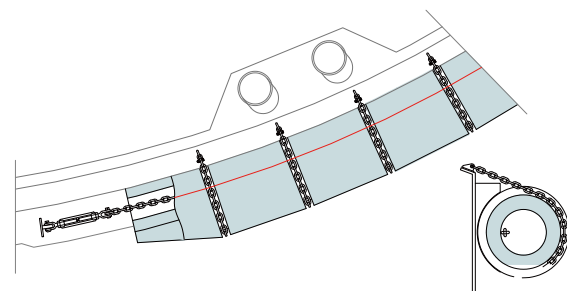


ΦD	Φd	A _{max}	B _{max}	C	ΦG	ΦJ	Weight
250	125	200	570	500	190	75	48
300	150	225	600	700	225	75	69
350	175	250	650	800	250	85	94
400	200	300	670	800	300	100	123
450	225	300	700	850	350	100	155
500	250	300	730	900	375	100	191
600	300	350	800	900	450	125	276
800	400	350	930	1000	600	125	490
900	450	350	1000	1100	675	150	620
1000	500	350	1060	1200	750	150	766

[Units: mm, kg/m]

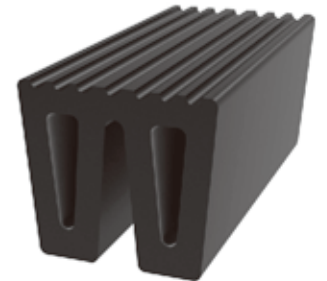
Attachment:

Smaller 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 fenders often use supplementary chains or straps around the fender.



FL W-Fender

Florescence W-Fender has a unique 'open bore' design which makes installation very simple. The flexible legs allow W-Fenders to be curved around most hull shapes. It have been developed for use as push-pads for tugs, and are also ideal for protecting the berthing section of a pontoon or bridge piles.

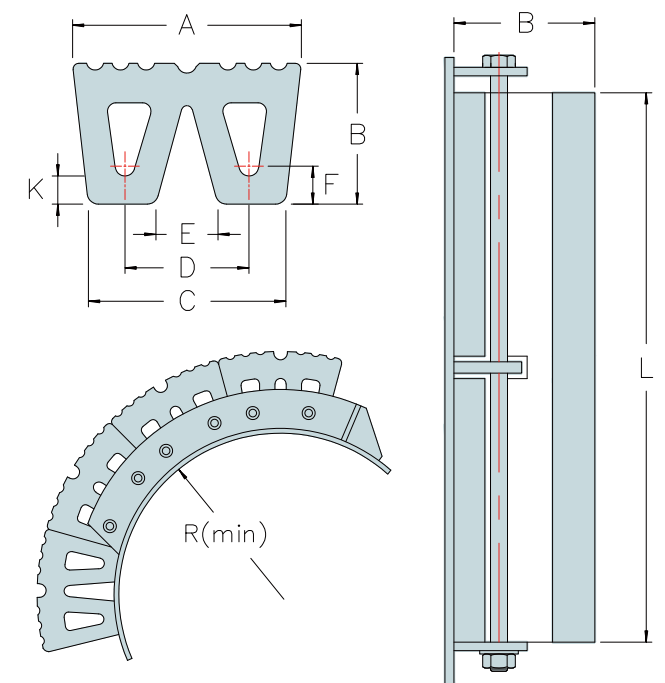
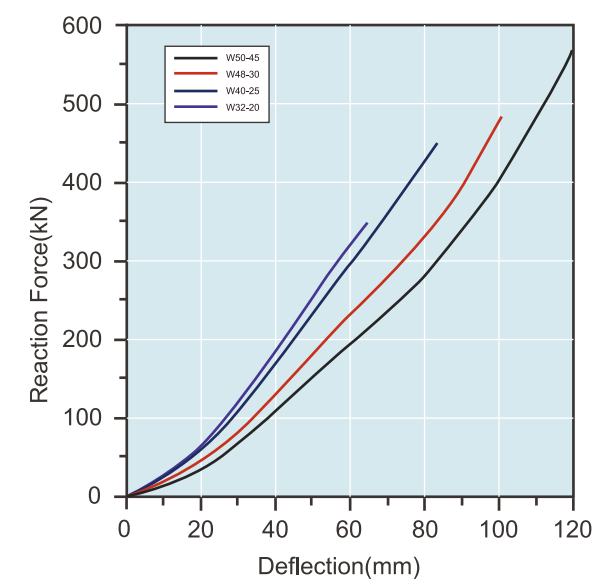


Type	A	B	C	D	E	F	K	L _{max}	Weight
W32-20	320	200	280	180	100	67	50	3000	59
W40-25	400	250	350	230	110	55	40	3000	88
W48-30	480	300	420	270	145	90	65	3000	130
W50-45	500	450	420	270	145	100	75	3000	192

[Units: mm, kg/m]

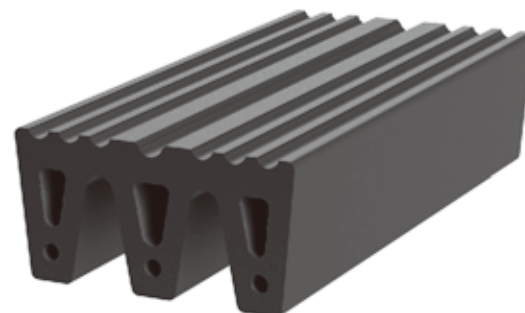
Pin	Flat Bar	R _{max}
Φ 25	100×20	600
Φ 30	120×20	800
Φ 40	140×20	900
Φ 40	150×20	1000

[Units: mm]



FL M-Fender

Florescence M-Fender have a large and flexible contact surface which exerts a low pressure during pushing operations. The triple legs give a strong attachment to the tug.



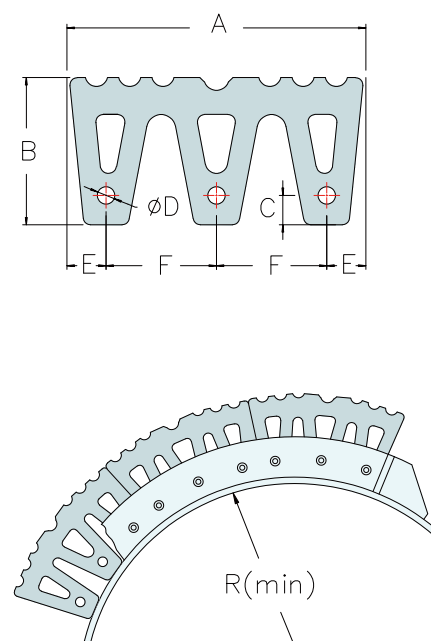
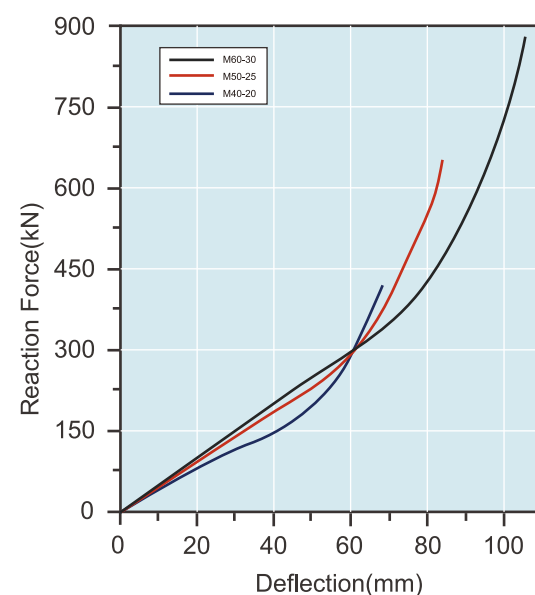
Specification

Type	A	B	C	ΦD	E	F	L _{Max}	Weight
M40-20	400	200	40	23	50	150	3000	60
W50-25	500	250	50	27	60	190	3000	95
M60-30	600	300	60	33	70	230	3000	140

[Units: mm, kg/m]

Pin	Flat Bar	R _{Max}
Φ 20	100×16	440
Φ 24	125×20	550
Φ 30	150×20	650

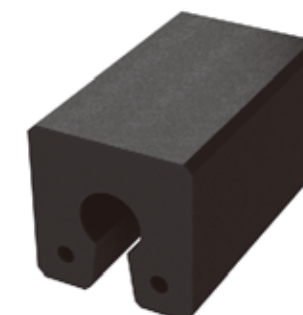
[Units: mm]



M- Fender

FL Keyhole Fender

Florescence Keyhole Fender is heavy-duty designed. There is a choice of grooved or flat surface fenders depending on the required friction levels. It can also be made as Composite fenders with integral UHMW-PE faces.



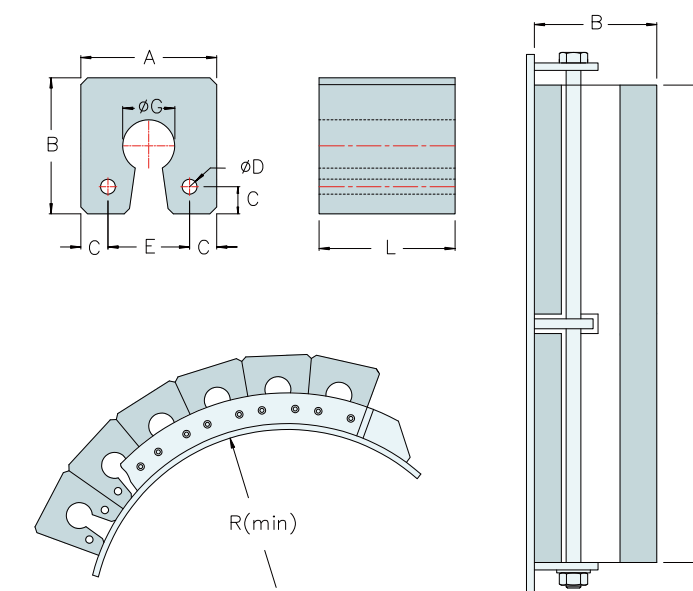
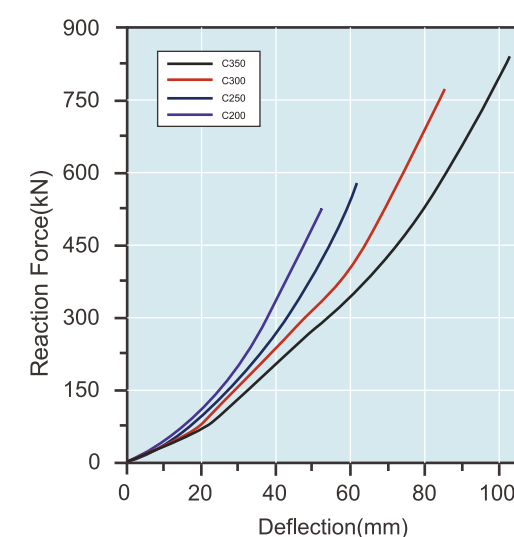
Specification

Type	A	B	C	ΦD	E	ΦG	L _{Max}	Weight
C200	200	200	35	28	130	90	3000	35
C250	250	250	50	33	150	100	3000	58
C300	300	300	60	33	180	115	3000	86
C350	350	350	70	33	210	125	3000	127

[Units: mm, kg/m]

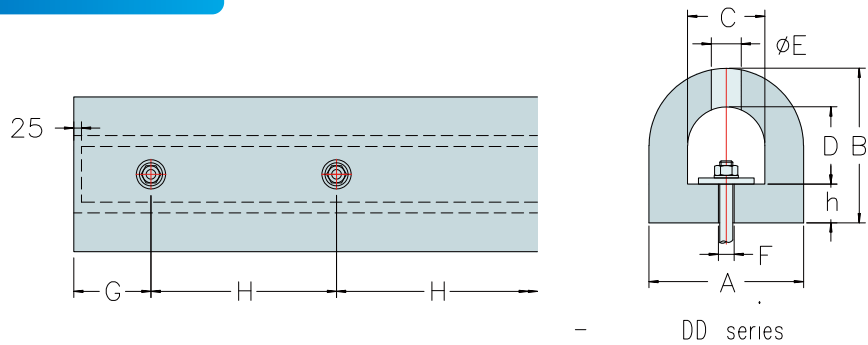
Pin	Flat Bar	R _{Max}
Φ 25	100×16	450
Φ 30	125×20	600
Φ 30	150×20	800
Φ 30	174×25	1000

[Units: mm]



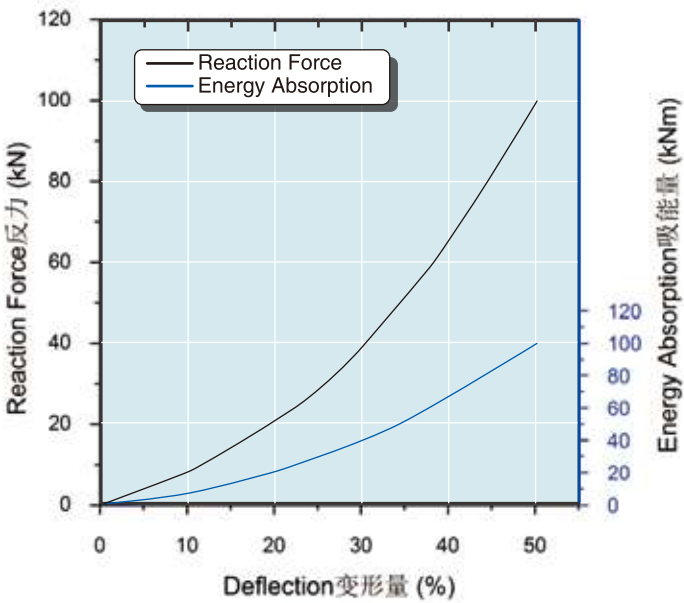
Keyhole Fender

Specification



FL Specification	A	B	C	D	h	ΦE	ΦF	G	H	Flat bar	Bolt size	Weight
DD100	100	100	50	50	25	40	20	100-150	200-300	40×8	M16	8.7
DD150	150	150	75	75	37.5	50	25	100-150	200-400	60×10	M20	19.6
DD200	200	200	100	100	50	60	30	100-150	300-500	80×14	M24	34.8
DD250	250	250	125	125	62.5	65	33	100-200	300-500	90×14	M27	54.4
DD300	300	300	150	150	75	65	35	100-200	300-600	110×16	M30	78
DD350	350	350	175	175	87.5	80	38	100-250	300-600	130×16	M33	107
DD400	400	400	200	245*	55*	80	40	100-250	300-600	135×18	M36	128
DD400	400	400	200	200	100	80	40	100-250	300-600	150×16	M36	140
DD500	500	500	250	250	250	95	45	100-250	400-600	180×20	M42	218

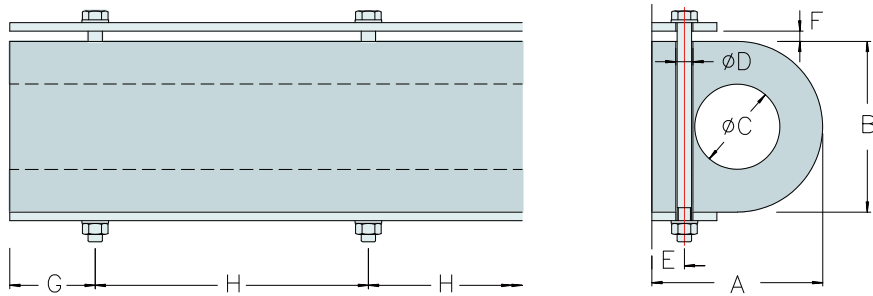
[Units: mm, kg/m]



FL Specification	R	E
DD100	77	1.4
DD150	115	3.2
DD200	150	5.7
DD250	191	8.8
DD300	230	12.9
DD350	268	17.6
DD400	306	23
DD500	383	35.9

[Units: kN, kNm]

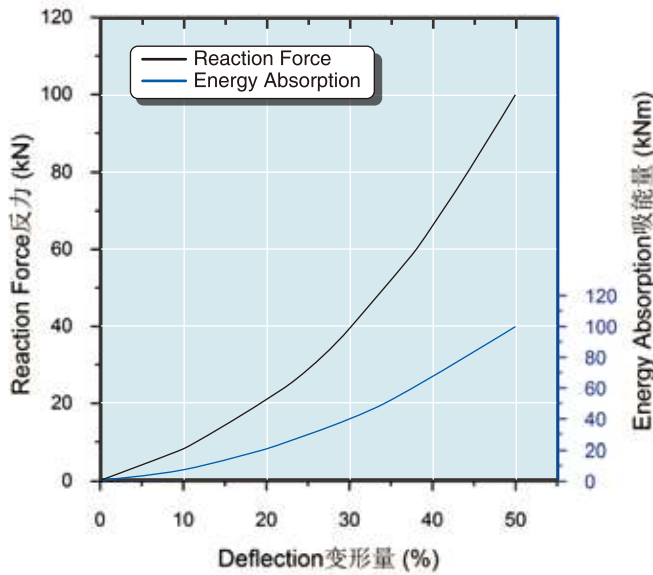
Specification



FL Specification	A	B	ΦC	ΦD	E	F	G	H	Flat bar	Bolt size	Weight
DC100	100	100	30	20	25	10	100-150	200-300	50×6	M16	10.7
DC150	150	150	65	27	30	12	100-150	200-400	60×8	M20	21.8
DC200	200	200	75	30	35	15	100-150	300-500	80×10	M24	40.7
DC250	250	250	100	33	45	20	100-200	300-500	100×12	M27	62.3
DC300	300	300	125	36	55	25	100-200	300-600	110×12	M30	89
DC350	350	350	150	40	65	25	100-250	300-600	120×12	M30	119
DC400	400	400	200	45	75	30	100-250	300-600	130×16	M36	145
DC500	500	500	250	50	95	30	100-250	400-600	130×16	M42	226

[Units: mm, kg/m]

Note:
The value specified in the above table is for reference only. The final drawing is subject to the data provided by the customers.

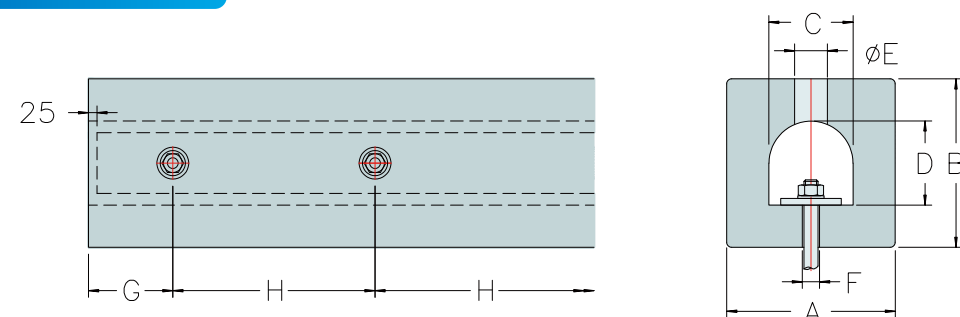


FL Specification	R	E
DC100	160	1.9
DC150	240	4.1
DC200	320	7.2
DC250	395	11.5
DC300	480	15.8
DC350	556	21.3
DC400	635	29
DC500	792	45

[Units: kN, kNm]

FL Square Fender

Specification

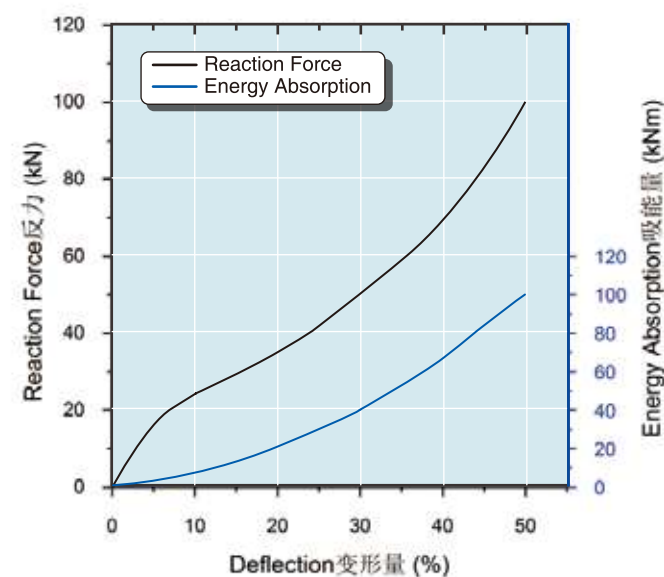


FL Specification	A	B	C	D	ΦE	ΦF	G	H	Flat bar	Bolt size	Weight
SD100	100	100	50	45	30	15	100-150	200-300	40×8	M12	10.5
SD150	150	150	70	65	40	20	100-150	200-400	60×10	M16	24
SD200	200	200	90	95	60	30	100-150	300-500	80×14	M24	42
SD250	250	250	120	120	65	33	100-200	300-500	90×14	M27	65
SD300	300	300	125	135	65	35	100-200	300-600	110×16	M30	97
SD350	350	350	175	175	80	38	100-250	300-600	130×16	M33	124
SD400	400	400	200	200	80	40	100-250	300-600	150×18	M36	162
SD500	500	500	250	250	95	46	100-250	400-600	180×20	M42	252

[Units: mm, kg/m]

Note:

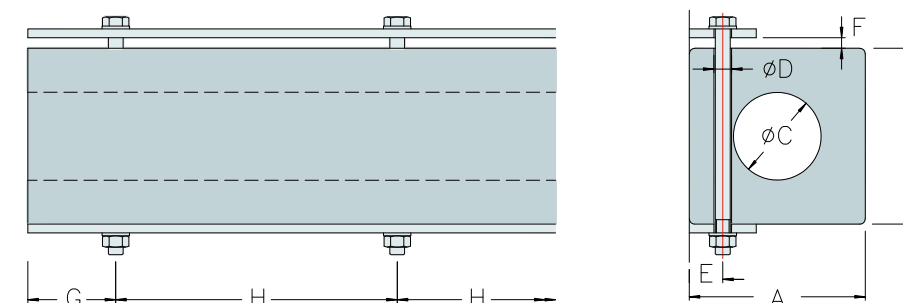
The value specified in the above table is for reference only. The final drawing is subject to the data provided by the customers.



FL Specification	R	E
SD100	140	2.6
SD150	210	6.3
SD200	279	11.2
SD250	346	17.5
SD300	418	25.3
SD350	476	34
SD400	595	45
SD500	745	69

[Units: kN, kNm]

Specification

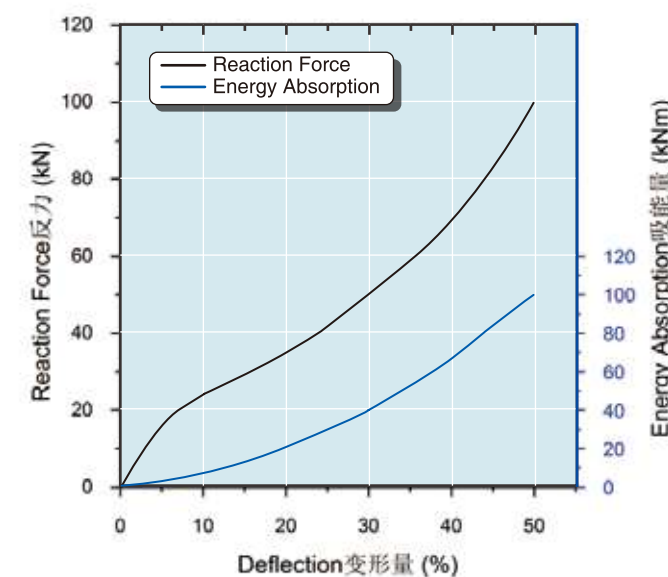


FL Specification	A	B	ΦC	ΦD	E	F	G	H	Flat bar	Bolt size	Weight
SC100	100	100	30	20	25	10	100-150	200-300	50×6	M12	12.1
SC150	150	150	65	27	30	12	100-150	200-400	60×8	M16	24.9
SC200	200	200	75	30	35	15	100-150	300-500	80×10	M24	46.3
SC250	250	250	100	33	45	20	100-200	300-500	100×12	M27	71
SC300	300	300	125	36	55	25	100-200	300-600	110×12	M30	101
SC350	350	350	150	40	65	25	100-250	300-600	120×12	M30	136
SC400	400	400	200	45	75	30	100-250	300-600	130×16	M36	167
SC500	500	500	250	50	95	30	100-250	400-600	130×20	M42	261

[Units: mm, kg/m]

Note:

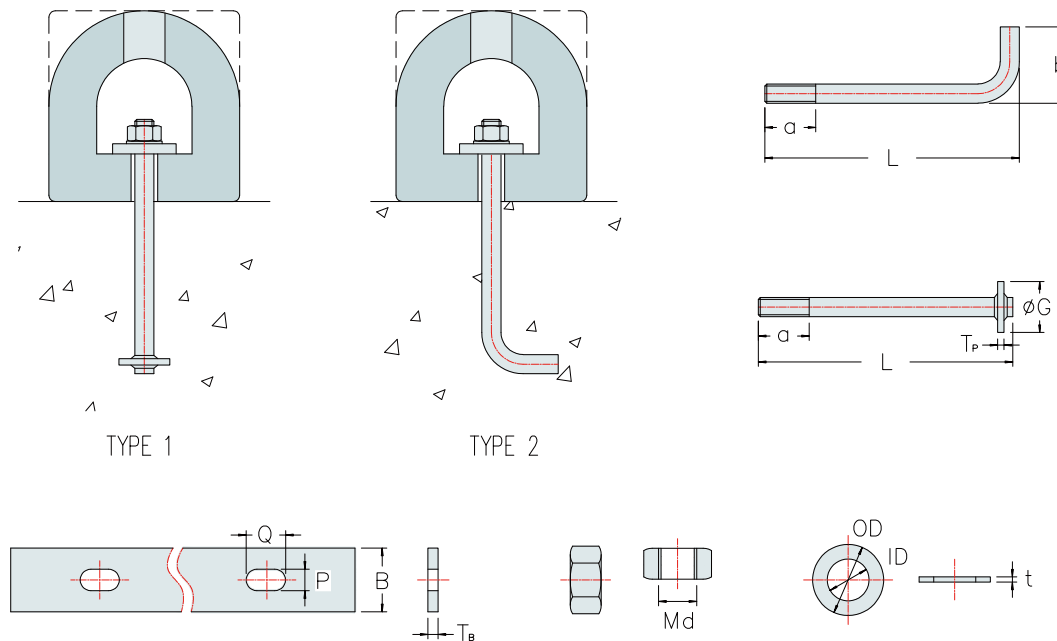
The value specified in the above table is for reference only. The final drawing is subject to the data provided by the customers.



FL Specification	R	E
SC100	175	2.6
SC150	263	6.3
SC200	355	11.1
SC250	436	17.4
SC300	521	25.1
SC350	610	34
SC400	713	44
SC500	875	68

[Units: kN, kNm]

Metal Accessories



FL Specification	Hex Nut & Washer				Flat Bar			Anchor Bolt			Anchor plate	
	Md	OD	ID	t	B×T _b	P	Q	a	b	L	T _p	G
100H	M12	24	14	2.5	40×8	14	24	60	45	180	6-8	50
150H	M16	30	18	3	60×10	18	32	60	45	200	6-8	55
200H	M24	44	26	4	80×14	28	48	70	55	350	8-10	55
250H	M27	50	30	4	90×14	31	54	80	65	350	8-10	80
300H	M30	56	33	4	110×16	34	60	80	85	400	8-10	80
350H	M30	56	33	4	120×16	34	60	80	85	400	8-10	80
400H	M36	66	39	5	135×18	40	72	90	85	500	10-12	85
500H	M42	78	45	8	160×20	46	84	100	100	600	10-12	100

[Units: mm]

Note:

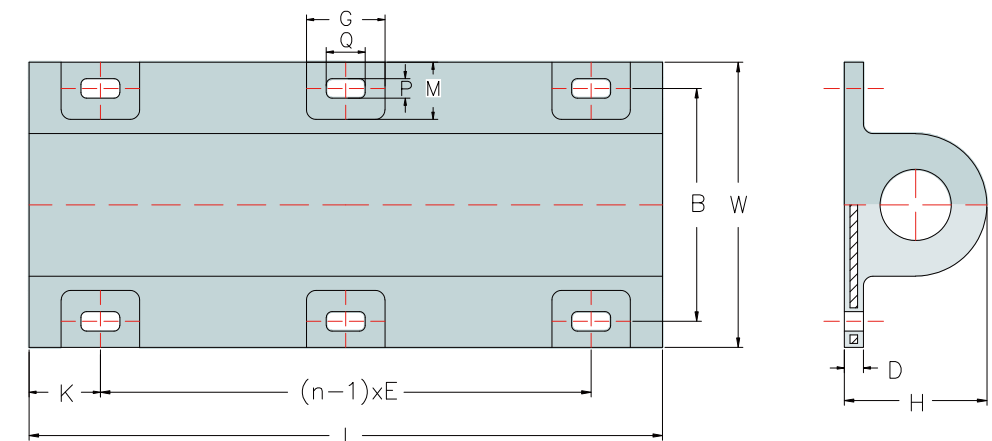
All accessory information is for guidance only.
 Every chain design should be checked to confirm suitability for the intended application.
 For special sizes and applications, please contact us.

FL DO Fender

Florescence DO Fender is a new type of rubber fender developed from D type fender, it enlarge fender bottom width to get embedded steel frame plate inside and to be fix to the port structure with double row bolts, therefore it get stronger installation strength and longer service life than D type fender.



Specification



FL Specification	H	W	B	D	P	Q	G	M	Weight (kg)
DO 280×540	280	540	430	40	41	82	165	120	125
DO 300×540	300	540	430	40	41	82	165	120	130
DO 300×600	300	600	490	40	41	82	165	120	144

FL Specification	280×540 300×540 300×600				
L	1000	1500	2000	2500	3000
n	2	3	4	4	5
E	700	600	570	550	540
K	150	150	145	150	150

[Units: mm]

Performance

FL Specification		200×200	300×300	300×360
Performance				
Rated Deflection: 50%	R(kN)	375	398	
	E(kNm)	14	16	

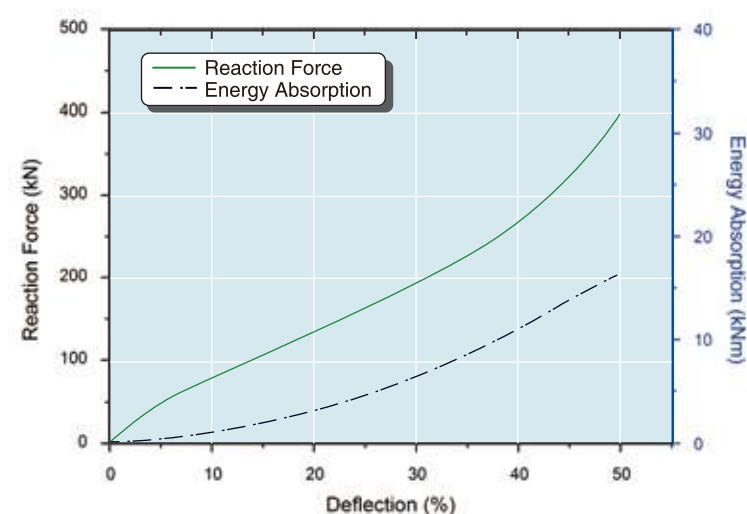
Note:

R: Reaction Force, E: Energy Absorption.

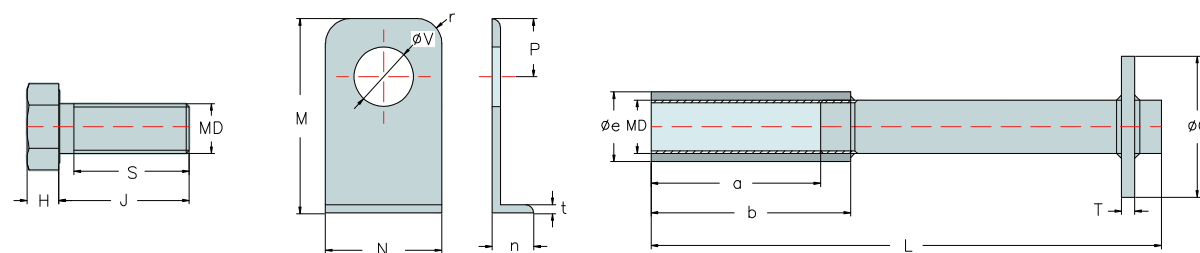
Rated Deflection: 50%

Performance tolerance: ±10%

The performance mentioned above is the performance for per meter length fender, dynamic performance in different length shall be calculated by times the multiple of 1000mm length.



Anchors

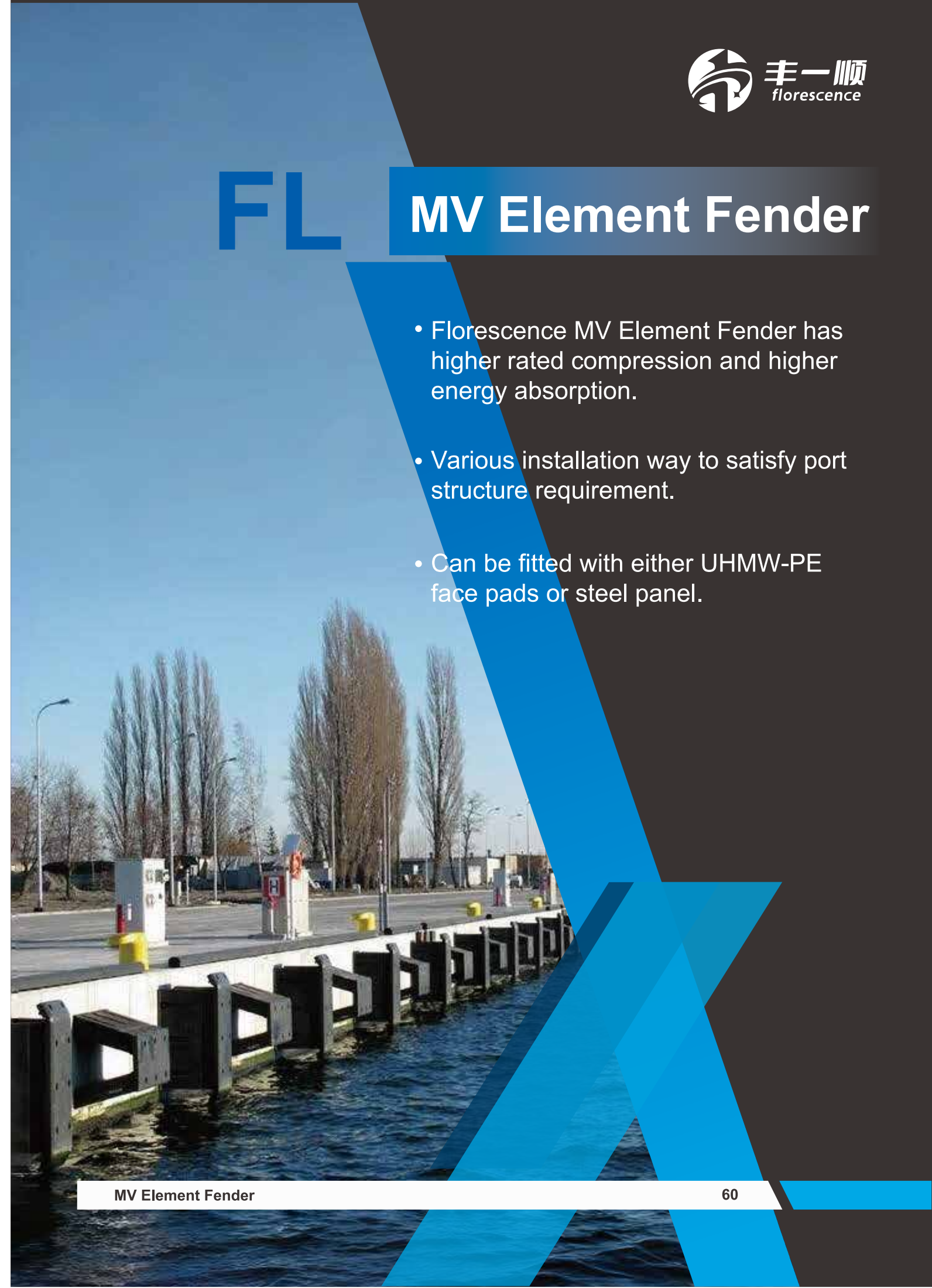


Hex Bolt				L-Washer							Anchor Nut		Anchor Rod , Plate			
MD	H	J	S	N	n	M	P	t	V	r	a	b	e	T	L	G
M36	23	95	80	119	22	126	62	6	43	25	85	125	49	10	360	85

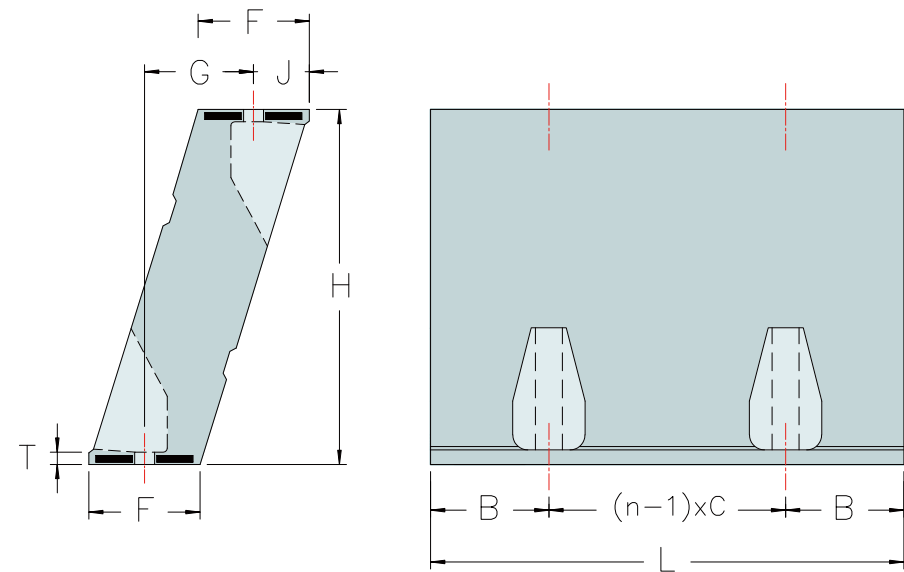
[Units: mm]

FL MV Element Fender

- Florescence MV Element Fender has higher rated compression and higher energy absorption.
- Various installation way to satisfy port structure requirement.
- Can be fitted with either UHMW-PE face pads or steel panel.



Specification



FL Specification	H	F	J	G	T	L	B	C	n	Bolt	Weight
300H	300	94	47	94	15	600-2500	150	500	2-5	M20	39
400H	400	125	63	124	17	750-2500	125-250	500	2-5	M24	70
500H	500	158	87	142	20	750-2500	125-250	500	2-5	M30	110
550H	550	172	87	170	20	750-2000	125-250	500	2-4	M30	135
600H	600	188	87	199	20	750-2000	125-250	500	2-4	M30	156
700H	700	225	113	217	26	800-2000	125-250	500	2-4	M30	210
750H	750	235	118	230	26	800-2000	125-250	500	2-4	M36	243
800H	800	250	129	240	26	800-2000	125-250	500	2-4	M36	285
1000H	1000	322	162	310	31	800-2000	150-350	500	2-4	M42	430
1250H	1250	401	202	388	36	800-2000	150-375	500	2-4	M48	655
1450H	1450	454	228	445	41	900-2000	200-350	500	2-4	M48	835
1600H	1600	500	257	480	50	1000-2000	250-350	500	2-4	M56	1110

[Units: mm, kg]

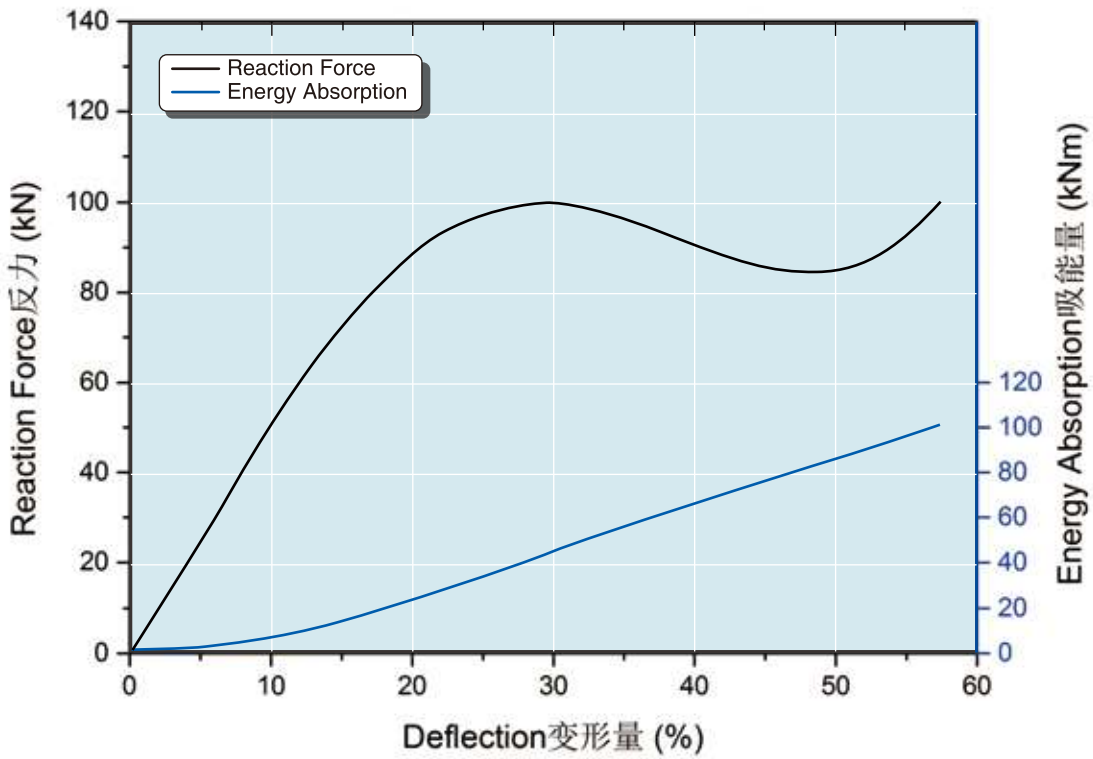
Note:
 Data given in the above diagram are for guidance. If in doubt, please contact us.
 Other specifications are available upon to customer' s request.

Performance

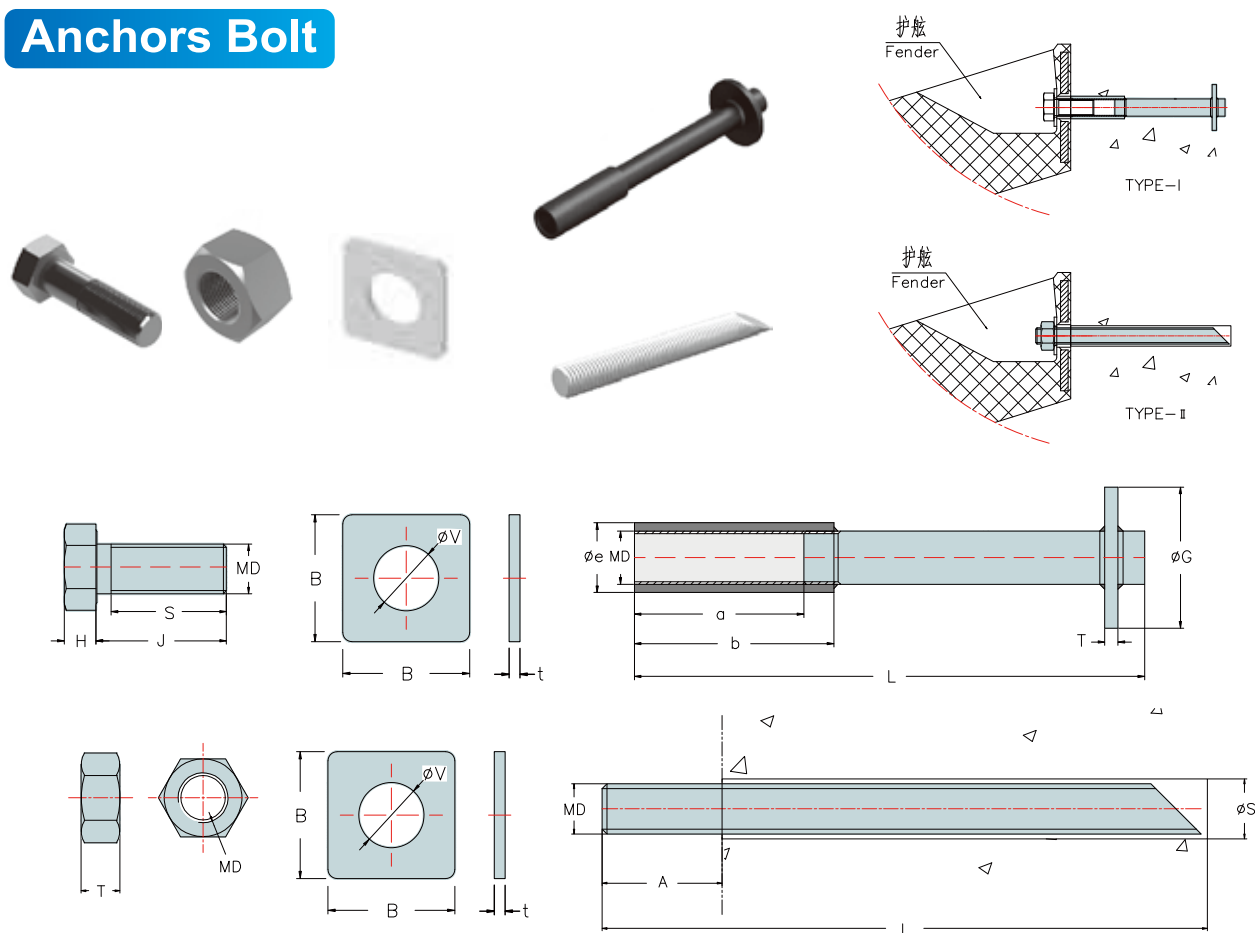
FL Specification			300H	400H	500H	550H	600H	700H	750H	800H	1000H	1250H	1450H	1600H
Performance														
RO	57.5%	R(kN)	120	150	185	210	224	260	282	299	375	467	543	605
		E(kNm)	15	27	42	53	62	83	96	110	172	268	361	440
RH	57.5%	R(kN)	172	215	267	294	320	375	405	428	534	667	775	855
		E(kNm)	22	39	61	75	89	120	137	156	245	383	516	629

Note:
 R: Reaction Force, E: Energy Absorption. RH: High Reaction Force, RO: Standard Reaction Force
 Rated Deflection: 57.5%
 Performance tolerance: ± 10%
 The performance mentioned above is the performance for per meter length fender. Dynamic performance in different length shall be calculated by times the multiple of 1000mm length.

Performance Curve



Anchors Bolt

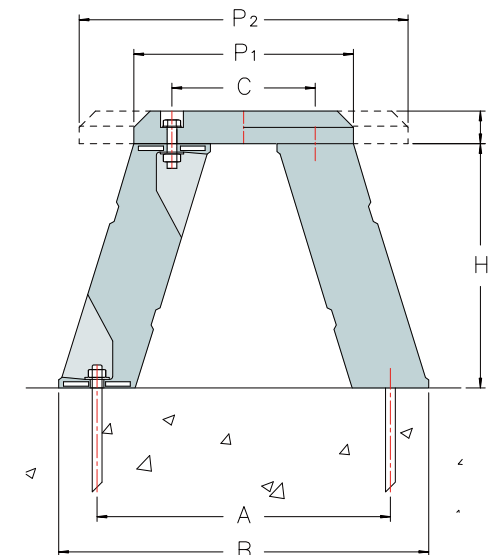


FL Specification	Hex Bolt				Washer			Anchor Bolt			Anchor Nut			Anchor Rod Plate		
	MD	H	J	S	B	t	V	A	L	ΦS	a	b	e	T	L	G
300H	M24	15	60	55	55	5	28	50	280	30	60	90	36	6	240	75
400H	M24	15	65	60	55	5	28	50	280	30	65	100	36	6	240	75
500H	M30	19	70	65	65	5	34	60	360	38	70	105	39	6	300	80
550H	M30	19	70	65	65	5	34	60	360	38	70	105	39	9	300	85
600H	M30	19	70	65	65	6	34	60	360	38	70	110	39	9	300	85
700H	M36	23	85	70	75	6	40	75	440	46	85	125	47	9	360	95
750H	M36	23	85	70	75	6	40	75	440	46	85	125	47	9	360	95
800H	M36	23	85	70	75	6	40	75	440	46	85	125	47	9	360	95
1000H	M42	26	95	85	90	6	46	80	510	55	95	130	59	12	420	100
1250H	M48	30	105	95	100	8	52	95	580	60	105	150	64	12	480	115
1450H	M48	30	110	95	110	8	52	100	580	60	110	150	64	12	480	115
1600H	M56	35	135	110	120	10	62	125	680	68	120	165	69	16	560	140

[Units: mm]

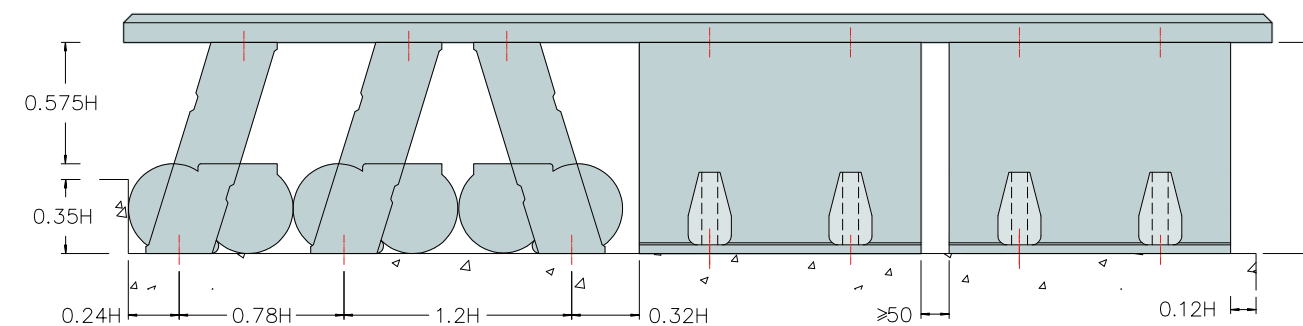
FL MV Element Fender

MV Element Fender can be mounted horizontally or vertically. There must be enough space around and between fenders and the steel panel to allow them to deflect without interference. Distances given in the diagram are for guidance.



H	T _{min}	A	B	C	P ₁	P ₂	Fixings
300	70	360	454	172	270	410	M24
400	80	480	606	232	360	550	M24
500	90	600	774	316	460	670	M30
550	90	660	834	320	500	750	M30
600	90	720	894	322	530	840	M30
700	100	840	1066	406	640	960	M36
750	100	900	1136	440	680	1040	M36
800	100	960	1218	480	730	1100	M36
1000	120	1200	1524	580	900	1370	M42
1250	120	1500	1904	724	1140	1710	M48
1450	140	1740	2196	832	1300	2000	M48
1600	160	1920	2434	960	1460	2200	M56

[Units: mm]



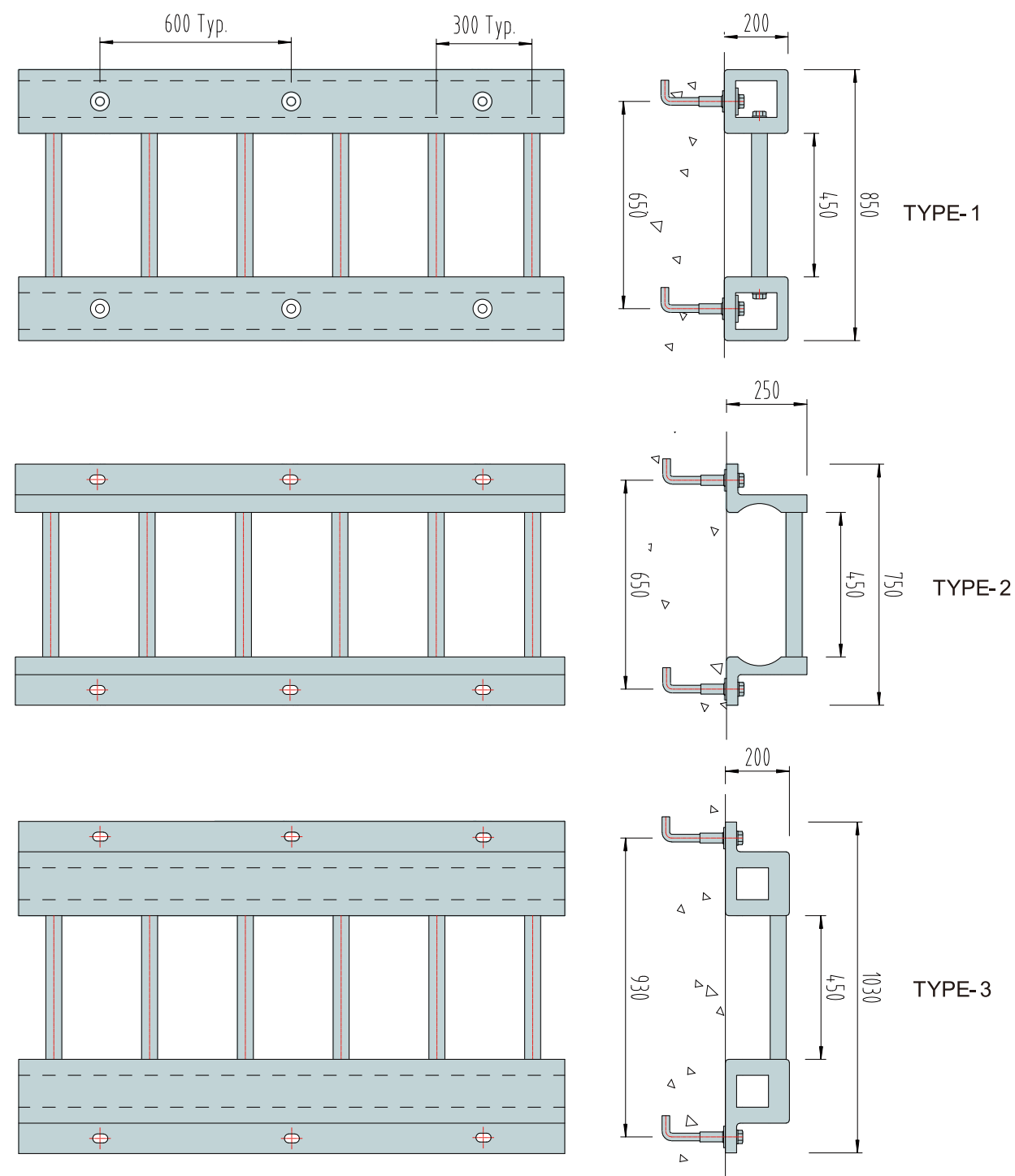
FL

Rubber Ladder

Florescence Rubber ladder is flexible, corrosion resistant and can withstand most accidental impacts from smaller vessels.

It's reliable and easy for installation and maintenance.

Specification



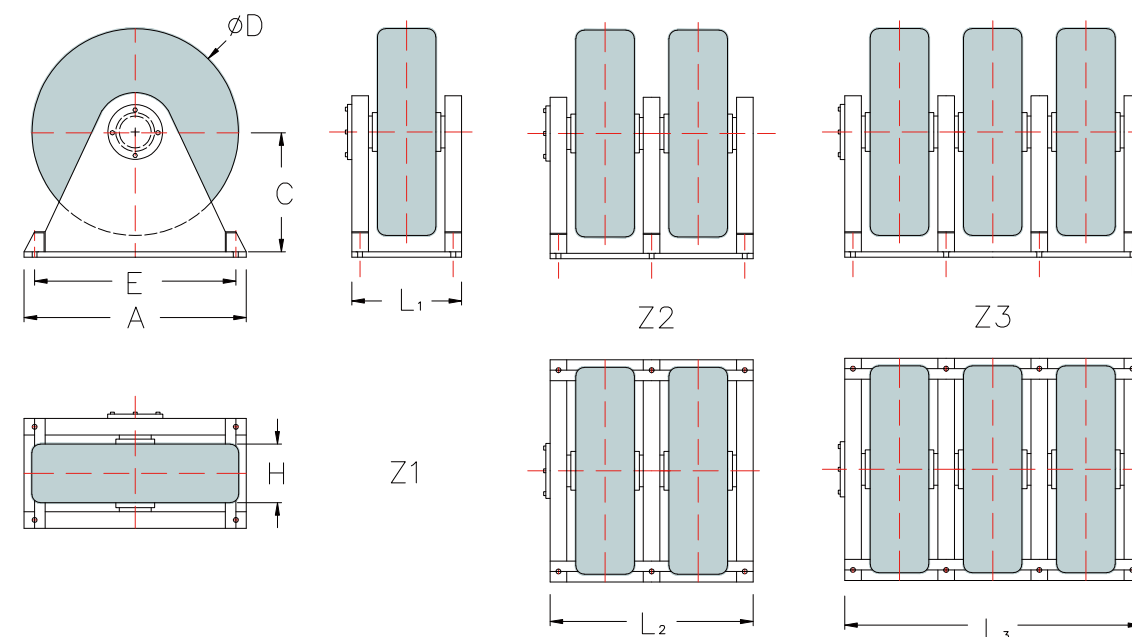
Note: Other specification is available upon request.

FL Roller Fender

The main character of roller fenders is the fender will roll with ship movement, and has deflection to absorb the impact energy. Applicable for dockyard, water gate, other restricted waterway, protruding corner etc.

Specification

Z-A



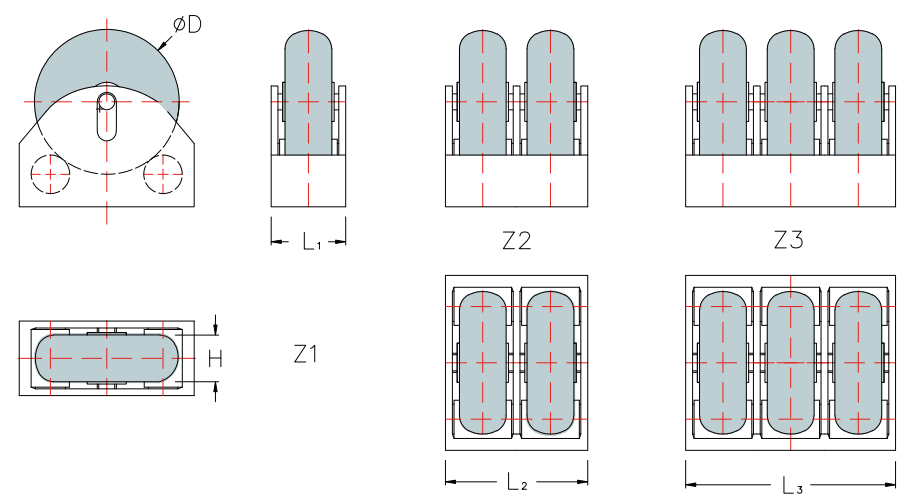
Types A×B(mm)	FL Specification					Z ₁		Z ₂		Z ₃		Note
	D	H	A	E	C	L ₁	Weight	L ₂	Weight	L ₃	Weight	
600×200	600	200	695	620	320	420	127	770	245	1120	365	Other Specification available upon request.
750×250	750	250	870	775	400	510	249	935	560	1360	820	
900×300	900	300	1040	930	480	610	465	1120	878	1630	1291	
1200×400	1200	400	1380	1240	640	820	1045	1500	2041	2180	3005	
1500×500	1500	500	1740	1550	800	1010	2011	1850	3915	2690	5784	
1800×600	1800	600	2080	1860	960	1210	3441	2215	6701	3220	9891	
2100×700	2100	700	2440	2205	1155	1410	5610	2590	10925	3770	15895	
2400×800	2400	800	2770	2480	1280	1610	8115	2950	15701	4290	23300	

[Unit: mm,kg]

Performance

Types A×B(mm)	Max.Deflection (mm)	Z ₁		Z ₂		Z ₃	
		R kN	E kJm	R kN	E kJm	R kN	E kJm
600×200	125	67	2	134	5	202	7
750×250	159	105	5	210	9	315	14
930×300	185	151	8	302	16	453	24
1200×400	260	269	19	539	39	814	58
1500×500	325	419	38	843	76	1264	113
1800×600	390	608	65	1215	130	1823	196
2100×700	455	823	102	1647	204	2470	306
2400×800	510	1108	140	2156	280	3234	420

Z-B



Types A×B(mm)	D (mm)	H (mm)	Max.Deflection (mm)	Z ₁		Z ₂		Z ₃	
				R kN	E kJm	R kN	E kJm	R kN	E kJm
1200×400	1200	400	431	248	48	496	96	744	144
1500×500	1500	500	541	388	94	776	187	1166	281
1800×600	1800	600	650	559	162	1117	323	1676	485
2100×700	2100	700	762	761	257	1519	514	2283	770
2400×800	2400	800	851	990	383	1980	766	2969	1147

Note:
Performance tolerance: ± 10%
Other specification are available upon request.
R: Reaction force, E: Energy absorption.

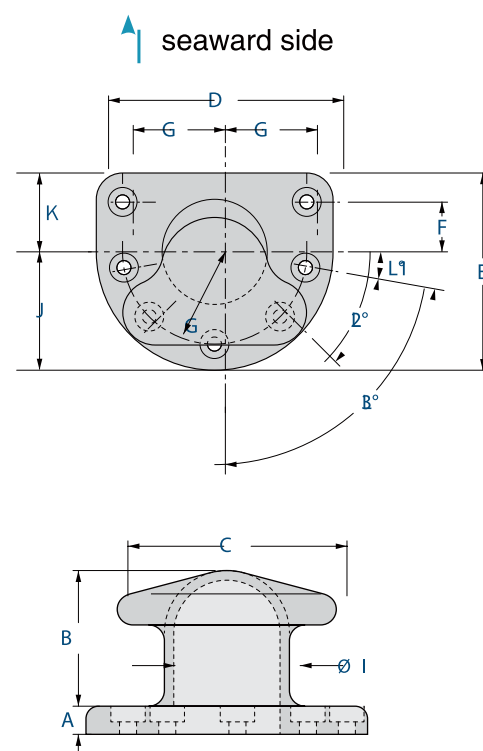
Marine Bollard

The bollard is designed and selected according to the berth capacity and the structure of the wharf to meet the requirements of safety, reliability and ease of use for ships leaving the dock, berthing, shifting and turning around.

Tee Bollard

Features

- General purpose applications up to 300 tons
- Suitable for steeper rope angles



FL Dimension	Bollard capacity (tons)											
	10	15	22.5	30	50	80	100	125	150	200	250	300
A	32	40	40	40	50	70	80	80	90	90	120	155
B	205	235	255	255	350	380	410	410	435	500	610	670
C	220	340	350	350	500	550	600	600	700	800	930	980
D	216	410	430	450	640	640	790	850	900	1000	1090	1200
E	236	335	355	375	540	550	640	700	750	850	915	925
F	75	80	90	100	150	160	175	175	200	225	250	200
G	65	155	165	175	250	250	325	325	350	375	425	475
ØI	120	160	180	200	260	280	350	350	400	450	500	500
J	118	205	215	225	320	320	395	425	450	500	545	600
K	118	130	140	150	220	230	245	275	300	350	370	325
L1°	-	30°	30°	30°	30°	15°	10°	10°	10°	-	5°	23°
L2°	-	-	-	-	-	45°	40°	40°	40°	36°	34°	26°
L3°	-	60°	60°	60°	60°	-	80°	80°	80°	72°	68°	52°
Bolts	M20	M24	M30	M30	M36	M42	M42	M48	M48	M56	M64	M64
Bolt Length	450	500	500	500	500	800	800	900	1000	1000	1375	1550
P	47	55	55	55	65	85	95	95	105	105	135	170
Quantity	4	5	5	5	5	6	7	7	7	8	8	10

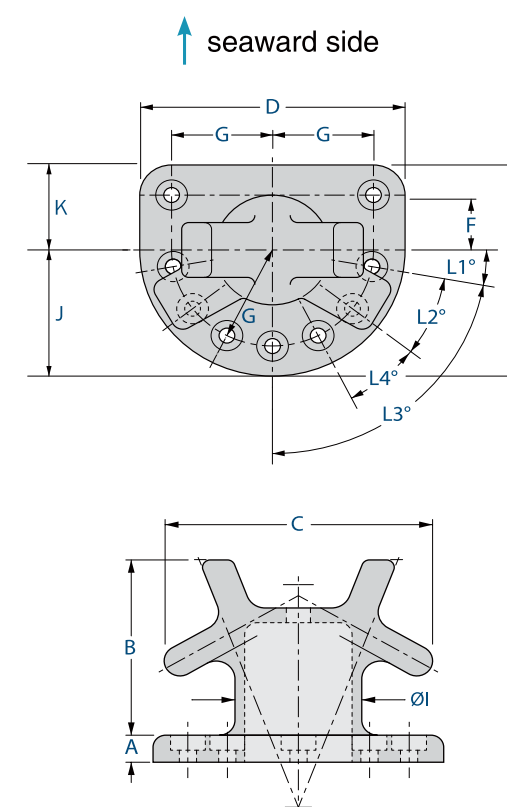
P = bollard base recess mounting depth including grout

[Units: mm]

Horn Bollard

Features

- General purpose applications up to 250 tons
- Suitable for steep rope angles
- Two lines may share a single bollard (subject to bollard capacity)



FL Dimension	Bollard capacity (tons)								
	15	30	50	80	100	125	150	200	250
A	40	40	50	70	80	80	90	90	120
B	370	410	500	520	570	595	585	660	690
C	400	440	600	660	750	775	850	930	930
D	410	480	640	650	800	820	920	1000	1000
E	335	405	540	560	650	670	770	850	850
F	80	100	150	160	175	175	200	225	225
G	155	175	250	250	325	325	350	375	375
ØI	160	200	260	300	350	375	400	450	450
J	205	240	320	325	400	410	460	500	500
K	130	165	220	235	250	260	310	350	350
L1°	30°	30°	30°	15°	10°	10°	10°	-	-
L2°	-	-	-	45°	40°	40°	40°	36°	36°
L3°	30°	60°	60°	-	80°	80°	80°	-	-
L4°	-	-	-	-	-	-	-	36°	36°
Bolts	M24	M30	M36	M42	M42	M48	M48	M56	M64
Bolt Length	500	500	500	800	800	900	1000	1000	1375
P	55	55	65	85	95	95	105	105	135
Quantity	5	5	5	6	7	7	7	8	8

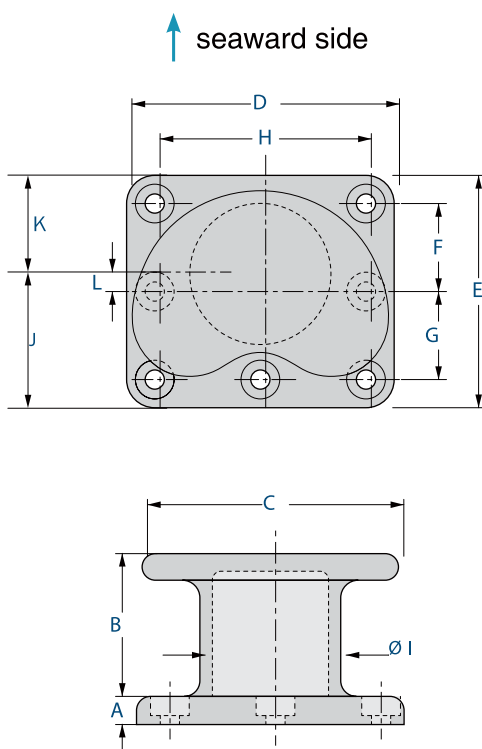
P = bollard base recess mounting depth including grout

[Units: mm]

Kidney Bollard

Features

- General purpose applications up to 200 tons
- Avoid steep rope angles where possible
- Suitable for warping operations



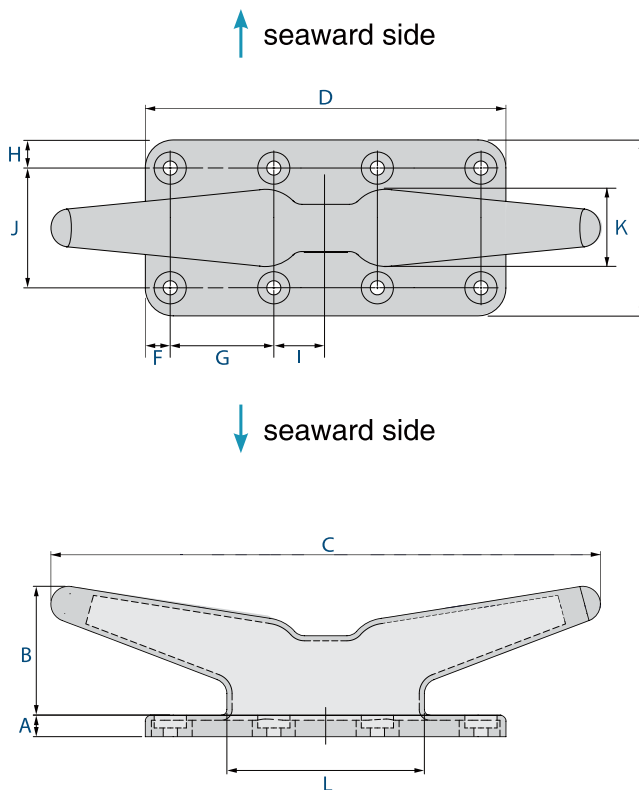
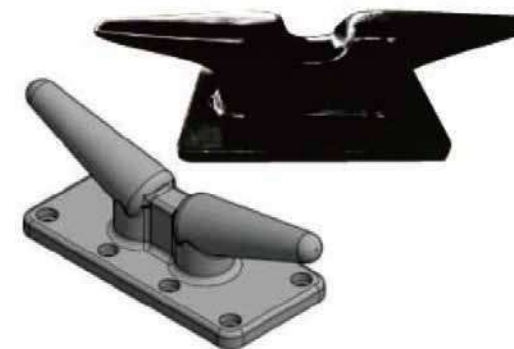
FL Dimension	Bollard capacity (tons)							
	15	30	50	80	100	125	150	200
A	40	40	50	70	70	80	80	90
B	260	280	320	330	350	375	405	435
C	340	370	480	530	550	640	728	800
D	320	360	540	560	590	680	760	1000
E	320	360	540	460	490	580	660	850
F	-	-	-	-	175	210	250	300
G	-	-	-	-	175	210	250	300
F+G	220	260	400	320	350	420	500	600
H	220	260	400	420	450	520	600	750
ØI	160	200	260	280	300	325	400	450
J	160	180	270	280	295	340	380	475
K	160	180	270	180	195	240	280	375
L	-	-	-	-	50	50	50	50
Bolts	M24	M30	M36	M42	M42	M48	M48	M56
Bolt Length	500	500	500	800	800	1000	1000	1000
P	55	55	65	85	85	95	95	105
Quantity	4	4	4	5	7	7	7	7

P = bollard base recess mounting depth including grout [Units: mm]

Cleat Bollard

Features

- General purpose applications up to 35 tons
- Suitable for steep rope angles
- Suitable for small wharves or jetties and marinas



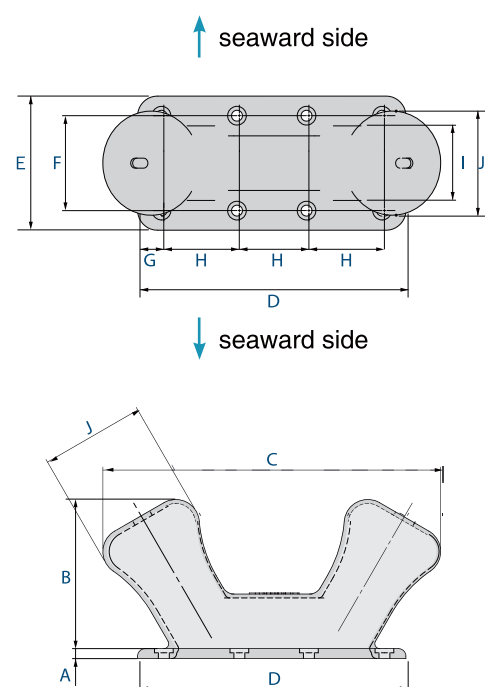
FL Dimension	Bollard capacity (tons)				
	15	20	25	30	35
A	30	40	45	45	50
B	165	180	210	250	270
C	510	665	810	960	1120
D	410	510	610	660	840
E	220	280	310	310	400
F	40	50	50	45	60
G	165	205	255	190	240
H	40	50	50	45	60
J	140	180	210	220	280
K	90	110	130	150	170
L	235	280	325	370	430
Bolt	M20	M24	M24	M24	M30
Bolt Length	350	460	460	460	460
P	45	55	60	60	65
Quantity	6	6	6	8	8

P = bollard base recess mounting depth including grout [Units: mm]

Double Bitt Bollard

Features

- General purpose applications up to 200 tons
- Suitable for mooring multiple lines (subject to bollard capacity)
- Concrete filled (optional)



FL Dimension	Bollard capacity (tons)							
	20	30	50	75	100	125	150	200
A	20	20	25	40	50	60	60	60
B	300	350	420	510	600	700	750	840
C	680	780	950	1140	1330	1535	1670	1860
D	540	610	720	870	1020	1170	1270	1430
E	280	310	360	440	520	590	640	720
F	190	220	270	330	390	440	490	530
G	45	45	45	55	65	75	75	95
H	150	180	210	190	222.5	255	280	310
I	150	180	210	250	300	340	370	410
J	210	240	310	350	410	470	510	570
Bolt	M20	M22	M30	M36	M42	M42	M48	M56
Bolt Length	300	300	450	500	600	750	850	1070
P	35	35	40	55	65	75	75	75
Quantity	8	8	8	10	10	10	10	10

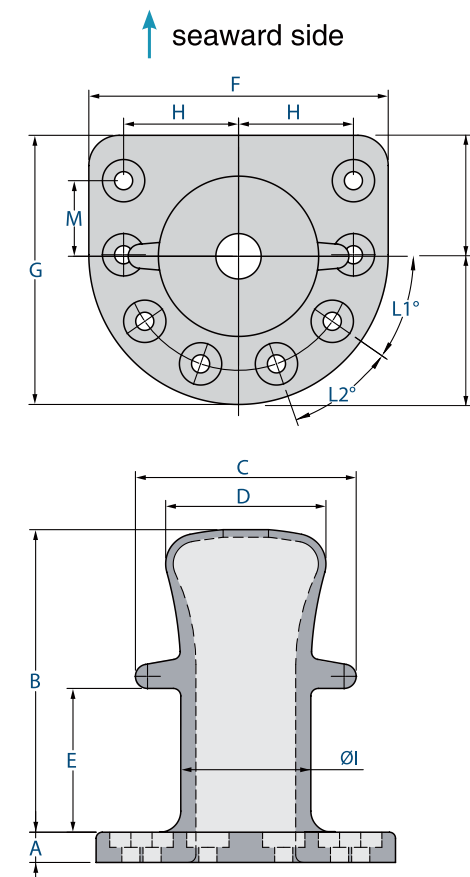
P = bollard base recess mounting depth including grout

[Units: mm]

Single Bitt Bollard

Features

- General purpose applications up to 200 tons
- Suitable for steep rope angles
- Two lines may share a single bollard (subject to bollard capacity)
- Concrete filled (optional)



FL Dimension	Bollard capacity (tons)						
	15	30	50	75	100	150	200
A	45	60	70	80	80	100	110
B	370	490	630	740	790	900	1000
C	260	340	450	500	550	650	750
D	220	260	340	390	415	460	530
E	145	160	260	285	325	380	465
F	360	420	530	650	760	900	990
G	315	380	480	580	685	810	890
H	130	160	205	250	290	345	380
ØI	160	200	260	290	320	370	430
J	180	210	265	325	380	450	495
K	135	170	215	255	305	360	395
M	75	120	155	180	215	255	280
L1°	45°	24°	11°	11°	5°	5°	35
L2°	-	66°	51°	51°	43°	43°	36
Bolts	M24	M30	M36	M42	M48	M56	M56
Bolt Length	400	500	600	600	750	1000	1000
P	60	75	85	95	95	115	125
Quantity	4	5	6	6	7	7	8

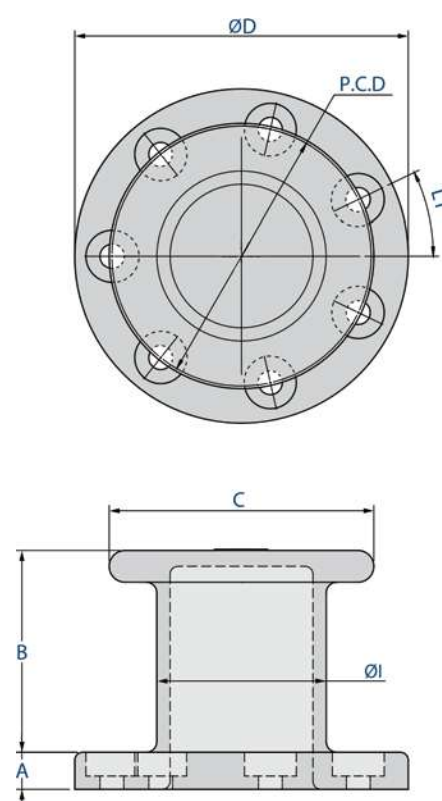
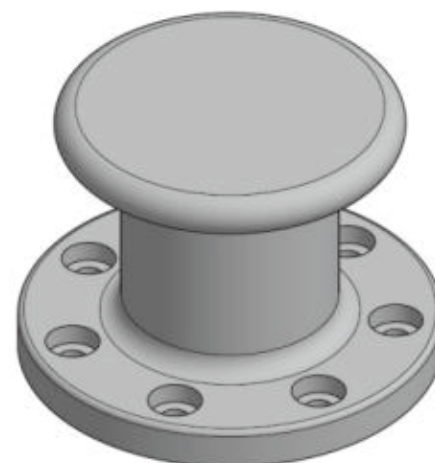
P = bollard base recess mounting depth including grout

[Units: mm]

Pillar Bollard

Features

- General purpose applications up to 200 tons
- Avoid steep rope angles where possible
- Suitable for warping operations
- 360 degree horizontal line angle use
- Can be utilized from all sides of jetty



FL Dimension	Bollard capacity (tons)							
	10	15	30	50	75	100	150	200
A	35	40	50	60	70	70	80	90
B	180	280	320	350	380	410	450	480
C	200	300	390	430	500	580	680	740
ØD	270	420	500	580	630	700	800	900
P.C.D	190	300	365	450	490	550	600	700
ØI	125	200	240	280	320	360	400	450
L1°	-	-	-	13°	13°	26°	-	-
Bolt	M20	M24	M36	M36	M42	M48	M56	M64
Bolt Length	350	400	550	800	1000	1000	1000	1000
P	50	55	65	75	85	85	95	105
Quantity	4	4	4	7	7	7	8	8

P = bollard base recess mounting depth including grout

[Units: mm]

Accessories



L-Washer



U Ring



U Plate



Steel Bar



Frontal Panel



Chain



Nut



Bolt



Resin Bolt



Dogbone Shackle



UHMW-PE Pad



Shackle



Flat Bar



Round Washer



Cast-in Nut



Swivel