PRODUCTS

SHIBATAFENDERTEAM

on the safe side

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SHIBATAFENDERTEAM GROUP.

The ShibataFenderTeam Group is the leading international fender manufacturer with 50+ years of group experience in fender production, +100,000 fenders in service and 90+ years of experience in the production of rubber products. Shibata Industrial, headquartered in Japan, is responsible for rubber production and R&D, generating a revenue of about 120 million USD with +360 employees in Japan. ShibataFenderTeam, headquartered in Germany, handles design manufacturing (steel, foam, PE) and international sales, generating a revenue of about 55million USD with their +80 employees around the world. The SFT Group offers consulting, engineering, manufacturing, after sales service and testing. Our regional offices facilitate the local contact to customers and are located in the US, Malaysia, Spain and The Netherlands. They are supported by a large network of well-established local representatives on six continents. Direct contact between all our employees and partners plays a vital role in our group's development.

Providing safety critical fender systems, the ShibataFenderTeam Group has a strong focus on manufacturing all major components in-house, ensuring highest quality and reliability at our own production facilities in Europe and Asia. Our experience has earned us a reputation as a dependable partner in the international ports, harbors and waterways market.

PRODUCT RANGE & CAPABILITIES.

Overview of our wide product range and fender sizes. For more information and special products, please visit our website at www.sft.group

- Moulded and Extruded Rubber Fender units up to single weights of 18.5 t
- Foam Fenders with diameters up to 4.5 m and 10 m long
- Buoys for various applications up to 4.5 m diameter
- Pneumatic Fenders with diameters up to 3.3 m and 9.0 m long
- HD-PE Sliding Fenders up to 300 mm x 300 mm cross-section and 6 m long
- Steel constructions with single unit weights up to 30 t
- Many special products for marine applications which exploit our knowledge of rubber steel polyurethane and polyethylene

WHY SHIBATAFENDERTEAM.

Shibata.

A pioneer in fender design and manufacturing for over 50 years, with one of the industry's longest proven track record in fender supplies. Founded in 1923 for the production of rubber boots, our mother company Shibata Industrial has diversified its portfolio into other rubber products and gained an extensive knowledge and expertise in rubber products since then.

Fender.

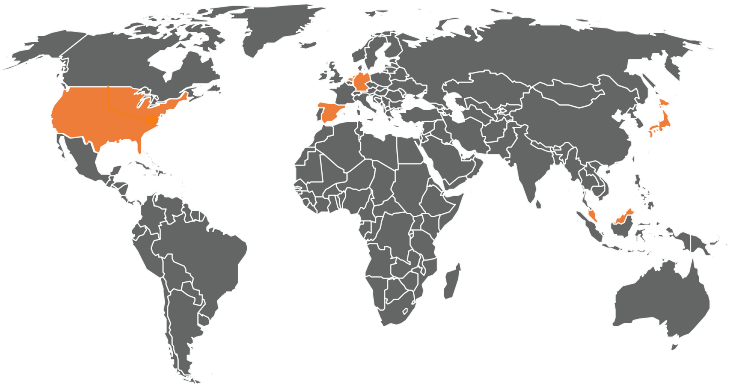
Fenders are meant to create a safe environment for ships and passengers while protecting port infrastructures and all personnel working there – reliably during the design life and beyond. We are true specialists in the design, manufacturing, and sale of fenders and fender systems.

Team.

Our international team of fender experts and partners all share one thing – the passion for this product and the market. The trust placed in our team is one more reason to strive for excellence in all we do and it is also the foundation of any partnership. As your partner for any upcoming project, our team focuses on individual solutions to meet your project needs.

LOCAL

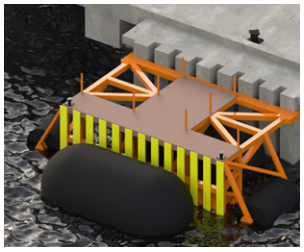
Offices and representatives worldwide



SOLUTIONS.

CUSTOMIZED

- High quality fenders and designs

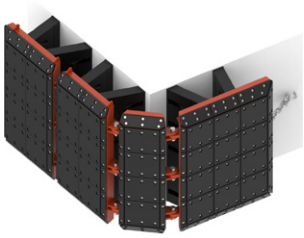


ENGINEERED

- Expertise and responsible

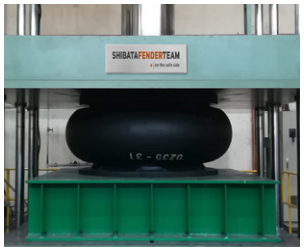
EXPERIENCED

- > 120,000 fenders in service



TRUSTED

- In-house production and testing facilities



Consulting.

- Assistance with unbiased project specifications
- Detailed and extensive design input at an early project stage
- Drawings and suggestions for the installation
- Guidance for engineering companies, operators and other stakeholders through every stage of the project and beyond
- Expertise provided by our offices and global network of local agents
- Global support adhering to local standards and regulations

Engineering.

- Value engineering providing excellent customized solutions
- Detailed design, drafts work and structural analyses prepared by in-house engineering team
- Long proven track record in the marine construction industry
- Holistic approach to fender system design by an experienced manufacturer

Manufacturing.

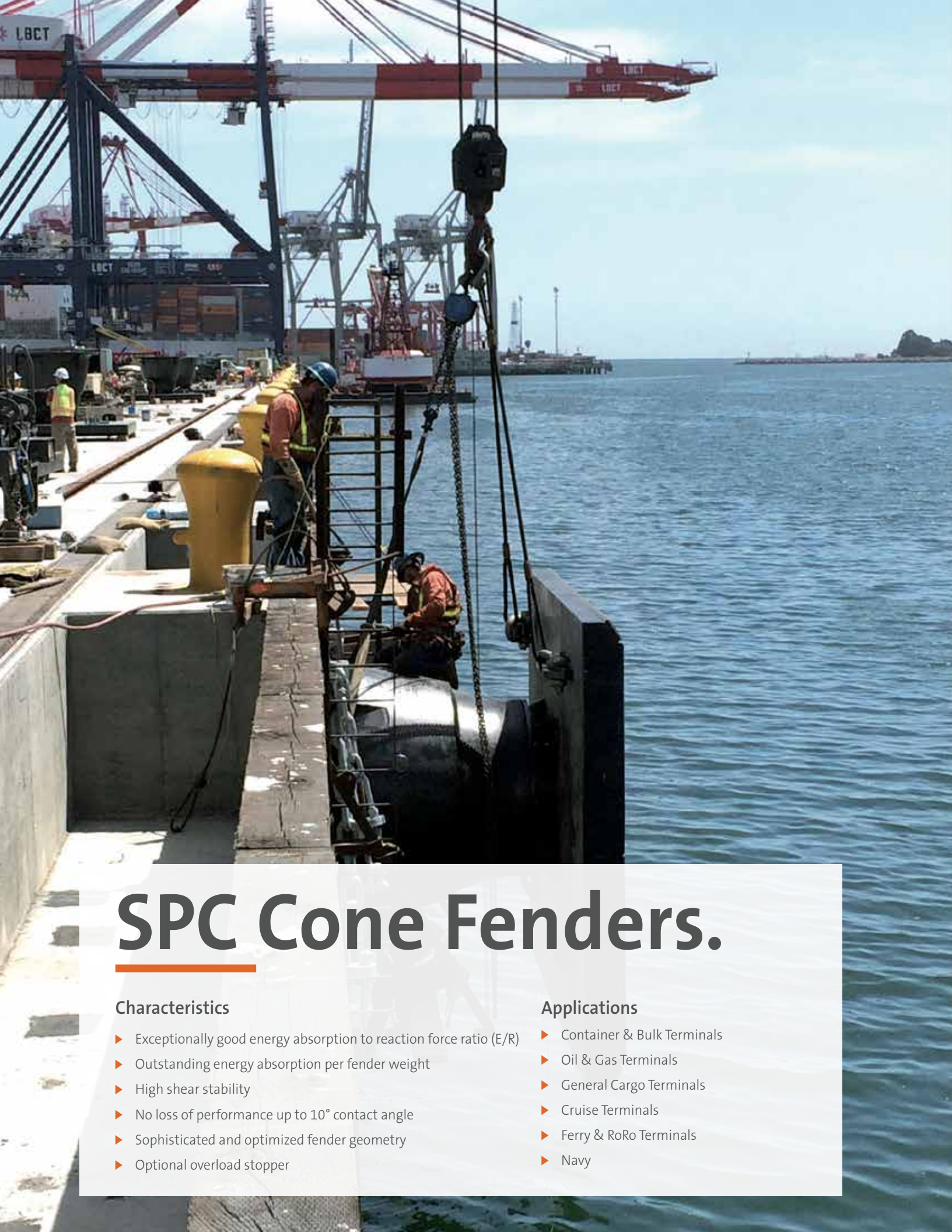
- Company owned manufacturing facilities in Europe and Asia
- In-house production facilities for rubber fenders, steel panels, related hardware, HD-PE profiles and foam fenders
- Buy-in items are purchased from pre-approved and reputable suppliers only
- Manufacturing strictly in accordance with SFT specifications, drawings, calculations and quality requirements
- Quality management system as per ISO 9001 and ISO 14001

After Sales Service.

- Global support and assistance during commissioning, installation, throughout the service life of the fender system and/or maintenance works
- Product liability insurance
- Site assessment including customized maintenance plans

Testing.

- Testing every single fender we manufacture is a vital part of our business
- All products are designed, manufactured and tested in accordance with PIANC 2002, BS 6349, EAU 2012, EC 3, DIN 18800, BS 5950 and AISC
- Testing equipment meets the most stringent industry standards
- Type approvals according to PIANC for standard range of marine and foam fenders



SPC Cone Fenders.

Characteristics

- Exceptionally good energy absorption to reaction force ratio (E/R)
- Outstanding energy absorption per fender weight
- High shear stability
- No loss of performance up to 10° contact angle
- Sophisticated and optimized fender geometry
- Optional overload stopper

Applications

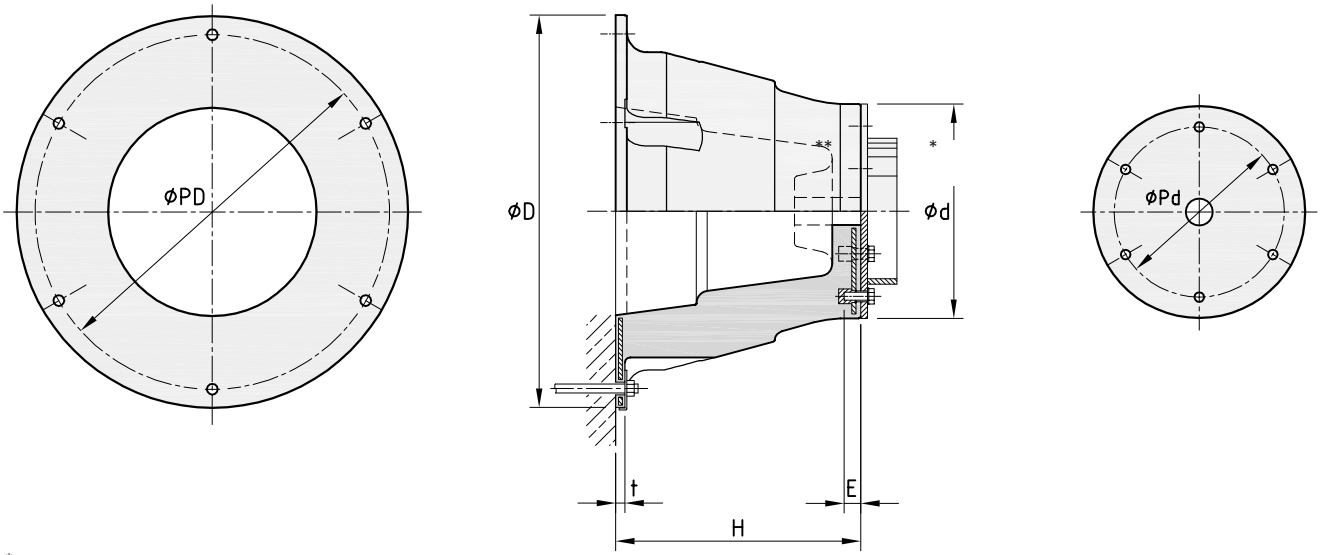
- Container & Bulk Terminals
- Oil & Gas Terminals
- General Cargo Terminals
- Cruise Terminals
- Ferry & RoRo Terminals
- Navy

SPC FENDER DIMENSIONS

Fender Size	H [mm]	Ø D [mm]	Ø d [mm]	t [mm]	E [mm]	Ø PD [mm]	Ø Pd [mm]	Anchors / Bolts	Weight* [kg]
SPC 300	300	500	262	16	38	440	210	4 x M20	35
SPC 350	350	575	306	19	38	510	245	4 x M20	53
SPC 400	400	650	350	22	38	585	280	4 x M20	75
SPC 500	500	820	435	24	45	730	350	4 x M24	149
SPC 600	600	900	525	24	45	810	420	4 x M24	251
SPC 700	700	1,120	615	28	72	1,020	490	4 x M30	395
SPC 800	800	1,280	700	30	72	1,165	560	6 x M30	592
SPC 900	900	1,450	785	35	72	1,313	630	6 x M30	850
SPC 1000	1,000	1,600	875	37	82	1,460	700	6 x M36	1,128
SPC 1100	1,100	1,760	963	40	102	1,605	770	6 x M42	1,484
SPC 1150	1,150	1,850	1,010	41	102	1,550	805	6 x M42	1,714
SPC 1200	1,200	1,920	1,050	46	102	1,750	840	8 x M42	1,938
SPC 1300	1,300	2,080	1,140	50	105	1,900	910	8 x M48	2,413
SPC 1400	1,400	2,240	1,225	54	105	2,040	980	8 x M48	2,915
SPC 1600	1,600	2,560	1,400	64	105	2,330	1,120	8 x M48	4,357
SPC 1800	1,800	2,880	1,575	74	120	2,620	1,260	10 x M56	6,203
SPC 2000	2,000	3,090	1,750	85	120	2,920	1,400	10 x M56	8,069

Intermediate or larger sizes available upon request | Anchors are standard sizes, subject to changes
* Weight without stopper

SPC FENDER DRAWING



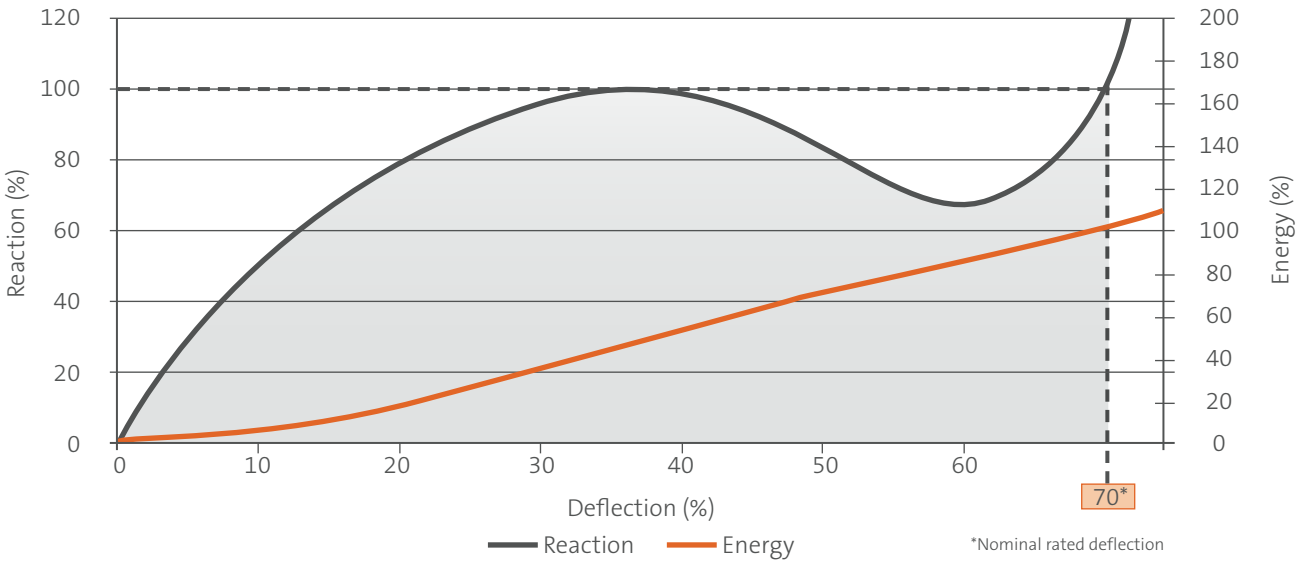
* Steel panel spool piece
** Optional overload stopper shown

PERFORMANCE TABLE SPC FENDERS (RPD = Rated Performance Data in acc. with PIANC)

Fender Size		E/R	Rubber Grades									
			G 0.9	G 1.0	G 1.1	G 1.2	G 1.3	G 1.4	G 1.5	G 1.6	G 1.7	G 1.8
SPC 300	E_A	0.16	9	**9**	10	10	10	11	11	12	12	12
	R_F		55	**57**	60	62	65	68	70	73	76	78
SPC 350	E_A	0.17	14	**14**	15	16	16	17	18	18	19	20
	R_F		75	**78**	81	85	89	92	96	99	103	106
SPC 400	E_A	0.21	21	**21**	22	23	24	25	26	27	28	29
	R_F		98	**102**	106	111	115	120	125	129	134	138
SPC 500	E_A	0.26	40	**42**	44	46	47	49	51	53	55	57
	R_F		153	**159**	166	173	180	188	195	202	209	217
SPC 600	E_A	0.31	69	**72**	75	79	82	85	88	92	95	98
	R_F		220	**229**	239	249	260	270	281	291	302	312
SPC 700	E_A	0.36	111	**114**	120	125	130	136	141	146	151	156
	R_F		300	**312**	325	340	354	368	382	397	411	425
SPC 800	E_A	0.42	165	**170**	179	187	194	202	210	218	226	233
	R_F		392	**407**	425	444	462	481	500	518	537	555
SPC 900	E_A	0.47	234	**243**	254	265	277	288	299	310	321	332
	R_F		496	**515**	538	562	585	609	632	656	680	703
SPC 1000	E_A	0.52	321	**333**	349	364	379	394	410	425	440	455
	R_F		612	**636**	665	694	723	752	781	810	839	868
SPC 1100	E_A	0.57	427	**443**	465	484	504	524	546	566	586	606
	R_F		741	**767**	805	840	875	910	945	980	1,015	1,050
SPC 1150	E_A	0.60	487	**506**	529	552	575	599	622	645	668	691
	R_F		810	**841**	879	918	956	995	1,033	1,072	1,110	1,149
SPC 1200	E_A	0.62	554	**575**	601	628	654	680	706	733	759	785
	R_F		882	**916**	958	1,000	1,042	1,083	1,125	1,167	1,209	1,251
SPC 1300	E_A	0.68	706	**732**	766	799	833	866	900	933	967	1,000
	R_F		1,030	**1,070**	1,118	1,167	1,216	1,265	1,314	1,363	1,412	1,461
SPC 1400	E_A	0.74	881	**914**	956	998	1,040	1,082	1,123	1,165	1,207	1,249
	R_F		1,201	**1,247**	1,304	1,361	1,418	1,475	1,532	1,589	1,646	1,703
SPC 1600	E_A	0.84	1,316	**1,364**	1,426	1,489	1,551	1,616	1,682	1,744	1,807	1,869
	R_F		1,567	**1,628**	1,702	1,780	1,855	1,929	2,004	2,078	2,152	2,227
SPC 1800	E_A	0.94	1,874	**1,942**	2,031	2,120	2,208	2,301	2,395	2,483	2,572	2,661
	R_F		1,984	**2,061**	2,156	2,255	2,350	2,445	2,539	2,633	2,729	2,823
SPC 2000	E_A	1.04	2,570	**2,664**	2,786	2,908	3,029	3,157	3,285	3,407	3,529	3,650
	R_F		2,450	**2,544**	2,661	2,784	2,901	3,018	3,135	3,252	3,369	3,485

Performance values for single units | Energy Absorption (E_A) in kNm, Reaction Force (R_F) in kN | Nominal rated deflection is 70 %, max. deflection is 74 % | Actual deflection at Rated Performance Data may vary | Properties, tolerances, and testing standards can be found on pages 123 ff.

GENERIC PERFORMANCE CURVE SPC FENDERS



Rubber Grades													Fender Size
G 1.9	G 2.0	G 2.1	G 2.2	G 2.3	G 2.4	G 2.5	G 2.6	G 2.7	G 2.8	G 2.9	G 3.0	G 3.1	
13 81	**13** **83**	14 86	14 89	14 91	15 94	15 96	16 99	16 102	16 104	17 107	**17** **110**	18 112	SPC 300
20 110	**21** **113**	22 117	22 121	23 124	24 128	24 131	25 135	25 138	26 142	27 146	**27** **149**	28 153	SPC 350
30 143	**31** **148**	32 152	33 157	34 162	35 166	36 171	37 176	38 180	39 185	40 190	**41** **194**	42 199	SPC 400
59 224	**61** **231**	63 238	65 246	66 253	68 260	70 268	72 275	74 282	76 289	78 297	**80** **304**	82 311	SPC 500
102 323	**105** **333**	108 344	111 354	115 365	118 375	121 385	125 396	128 406	131 417	135 427	**138** **438**	141 448	SPC 600
162 439	**167** **454**	172 468	177 482	183 496	188 511	193 525	198 539	203 553	209 568	214 582	**219** **596**	224 610	SPC 700
241 574	**249** **593**	257 611	265 630	272 648	280 667	288 686	296 704	304 723	311 741	319 760	**327** **779**	335 797	SPC 800
343 727	**354** **750**	365 774	376 797	388 821	399 844	410 868	421 891	432 915	443 939	454 962	**465** **986**	476 1,009	SPC 900
471 897	**486** **926**	501 955	516 984	531 1,013	547 1,043	562 1,072	577 1,101	592 1,130	608 1,159	623 1,188	**638** **1,217**	653 1,246	SPC 1000
627 1,085	**647** **1,120**	667 1,156	687 1,191	707 1,226	728 1,262	748 1,297	768 1,332	788 1,367	809 1,402	829 1,437	**849** **1,473**	869 1,508	SPC 1100
714 1,187	**737** **1,225**	760 1,264	784 1,302	807 1,341	830 1,379	853 1,418	876 1,456	899 1,495	922 1,533	945 1,571	**969** **1,610**	992 1,648	SPC 1150
812 1,293	**838** **1,335**	864 1,377	890 1,418	917 1,460	943 1,502	969 1,544	996 1,586	1,022 1,628	1,048 1,670	1,074 1,712	**1,101** **1,753**	1,127 1,795	SPC 1200
1,034 1,510	**1,067** **1,559**	1,101 1,608	1,134 1,656	1,168 1,705	1,201 1,754	1,234 1,803	1,268 1,852	1,301 1,901	1,335 1,950	1,368 1,999	**1,402** **2,048**	1,435 2,097	SPC 1300
1,291 1,760	**1,332** **1,817**	1,374 1,874	1,416 1,931	1,458 1,988	1,499 2,045	1,541 2,102	1,583 2,159	1,625 2,216	1,667 2,273	1,708 2,330	**1,750** **2,387**	1,792 2,444	SPC 1400
1,931 2,301	**1,994** **2,376**	2,056 2,495	2,118 2,524	2,181 2,599	2,243 2,673	2,305 2,747	2,368 2,882	2,430 2,896	2,442 2,971	2,555 3,045	**2,617** **3,119**	2,673 3,190	SPC 1600
2,750 2,918	**2,838** **3,013**	2,927 3,108	3,016 3,202	3,105 3,297	3,194 3,392	3,282 3,486	3,371 3,581	3,460 3,676	3,549 3,771	3,637 3,865	**3,726** **3,960**	3,806 4,050	SPC 1800
3,772 3,602	**3,894** **3,719**	4,016 3,836	4,137 3,953	4,259 4,070	4,381 4,187	4,503 4,304	4,624 4,421	4,746 4,538	4,868 4,655	4,990 4,772	**5,111** **4,889**	5,221 5,000	SPC 2000

General Cargo Terminal | Gdansk | Poland

Middle Harbor | Long Beach, CA | USA

CORRECTION FACTORS

FENDER PERFORMANCE AT INTERMEDIATE DEFLECTION

Deflection of original fender height [%]	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	72	73	74
Energy Absorption of original value [%]	0	1	5	10	17	25	34	44	53	62	71	78	85	92	100	104	107	110
Reaction Force of original value [%]	0	27	48	65	79	90	97	100	99	93	84	73	68	76	100	132	148	165

TEMPERATURE FACTOR

Temperature [°C]	-60	-50	-40	-30	-20	-10	0	10	23	30	40	50	60
Correction Factor	Contact your local SFT office for special compound consultation			1.559	1.375	1.182	1.083	1.034	1.000	0.976	0.945	0.918	0.917

VELOCITY FACTOR

Compression Time [s]	1	2	3	4	5	6	7	8	10
Correction Factor	1.050	1.020	1.012	1.005	1.000	1.000	1.000	1.000	1.000

ANGLE FACTOR

Compression Angle [°]	0	3	6	9	10	12	15	20
Energy Absorption of original value [%]	100	100	100	100	100	96	92	80
Reaction Force of original value [%]	100	100	100	100	100	100	100	100

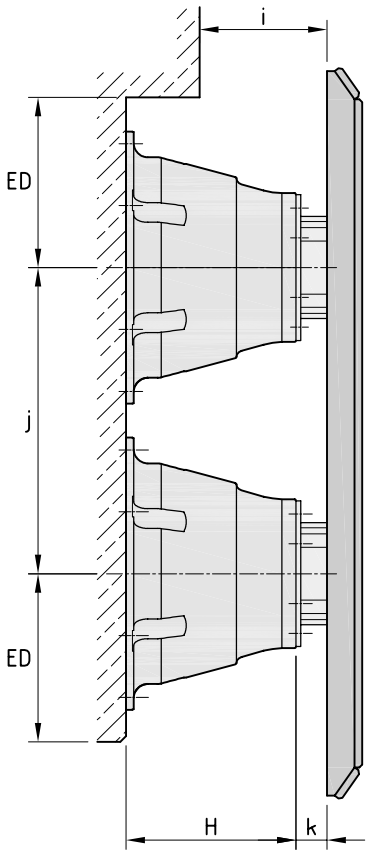
Correction Factors in strict accordance to PIANC 2002 Appendix A | Properties, tolerances, and testing standards can be found on pages 123 ff.

INSTALLATION CLEARANCES

Fender Size	H [mm]	i [mm]	j [mm]	k [mm]	ED [mm]
SPC 300	300	225	540	45	≥ 300
SPC 350	350	263	630	53	≥ 350
SPC 400	400	300	720	60	≥ 400
SPC 500	500	375	900	75	≥ 500
SPC 600	600	450	1,080	90	≥ 600
SPC 700	700	525	1,260	105	≥ 700
SPC 800	800	600	1,440	120	≥ 800
SPC 900	900	675	1,620	135	≥ 900
SPC 1000	1,000	750	1,800	150	≥ 1,000
SPC 1100	1,100	825	1,900	165	≥ 1,100
SPC 1150	1,150	863	2,070	175	≥ 1,150
SPC 1200	1,200	900	2,160	180	≥ 1,200
SPC 1300	1,300	975	2,340	195	≥ 1,300
SPC 1400	1,400	1,050	2,520	210	≥ 1,400
SPC 1600	1,600	1,200	2,880	240	≥ 1,600
SPC 1800	1,800	1,350	3,240	270	≥ 1,800
SPC 2000	2,000	1,500	3,600	300	≥ 2,000

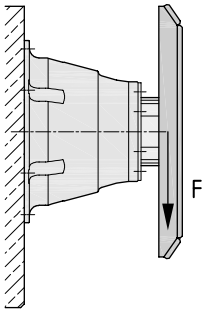
The fender system design should allow for:

- increased diameter of SPC Fenders during compression [j]
- sufficient clearance of front panel [i]
- minimum edge distance for anchoring and to other protrusions [ED]
- angular compression
- spool piece [k]



WEIGHT SUPPORT CAPACITY

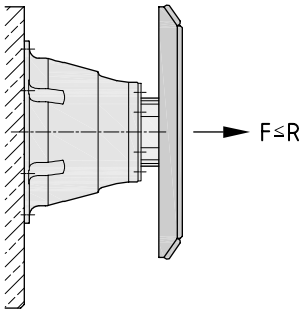
Due to its geometry, the SPC Fender can support a front panel with at least the same weight as the fender body itself. For panels with a higher weight, SFT recommends the use of weight support chains.*



Mauritius Container Terminal | Port Louis | Mauritius

TENSION

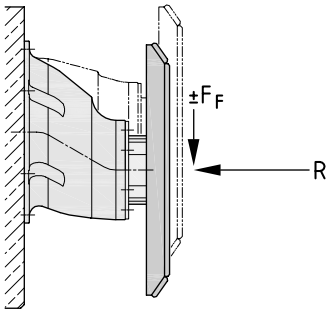
Tension chains are recommended, especially when tensile loads might exceed the rated reaction force of the rubber fender.*



Oil Terminal | Pepel Island | Sierra Leone

SHEAR

SPC Fenders are very stable against horizontal and vertical shear forces. However, depending on the application and layout of the system, shear chains might become necessary. *



Cruise Terminal | Dubai | UAE

* For detailed advice, please contact your local SFT office
SFT generally recommends the use of properly designed suspension chain systems to support the fender's performance and reduce the risk of damages

CSS Cell Fenders.

Characteristics

- Easy assembly & installation
- Good shear force resistance
- Cost-effective: large footprint leads to a good load distribution over the frontal panel, which results in a lighter panel construction
- Very robust
- 40 years proven track record

Applications

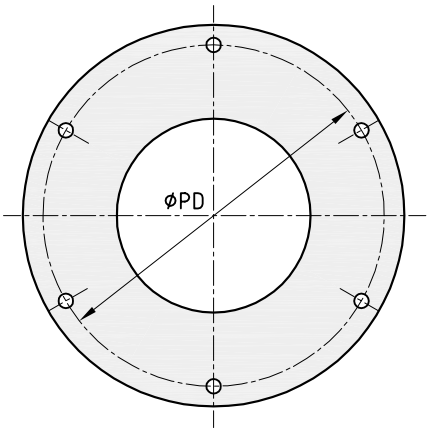
- Container & Bulk Terminals
- Oil & Gas Terminals
- General Cargo Terminals
- Cruise Terminals
- Ferry & RoRo Terminals
- Navy

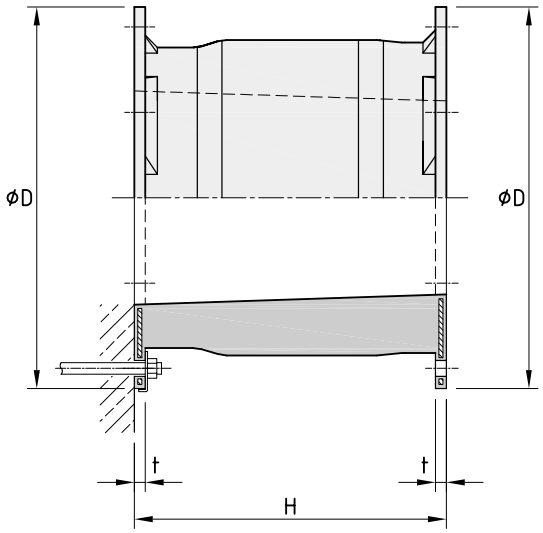
CSS FENDER DIMENSIONS

Fender Size	H [mm]	Ø D [mm]	t [mm]	Ø PD [mm]	Anchors / Bolts	Weight [kg]
CSS 300	300	390	10	330	4 x M16	21
CSS 400	400	650	25	550	4 x M24	78
CSS 500	500	650	25	550	4 x M24	112
CSS 600	600	780	25	660	4 x M30	185
CSS 800	800	1,050	27	900	6 x M30	443
CSS 1000	1,000	1,230	32	1,100	6 x M36	742
CSS 1150	1,150	1,440	37	1,300	6 x M42	1,119
CSS 1250	1,250	1,600	40	1,450	6 x M42	1,499
CSS 1450	1,450	1,820	42	1,650	6 x M48	2,267
CSS 1600	1,600	1,960	45	1,800	8 x M48	2,951
CSS 1700	1,700	2,100	50	1,900	8 x M56	3,400
CSS 2000	2,000	2,200	60	2,000	8 x M64	4,500
CSS 2250	2,250	2,550	65	2,300	10 x M64	7,300
CSS 2500	2,500	2,950	70	2,700	10 x M64	10,760
CSS 3000	3,000	3,350	100	3,150	12 x M76	18,600

Intermediate or larger sizes available upon request

CSS FENDER DRAWING



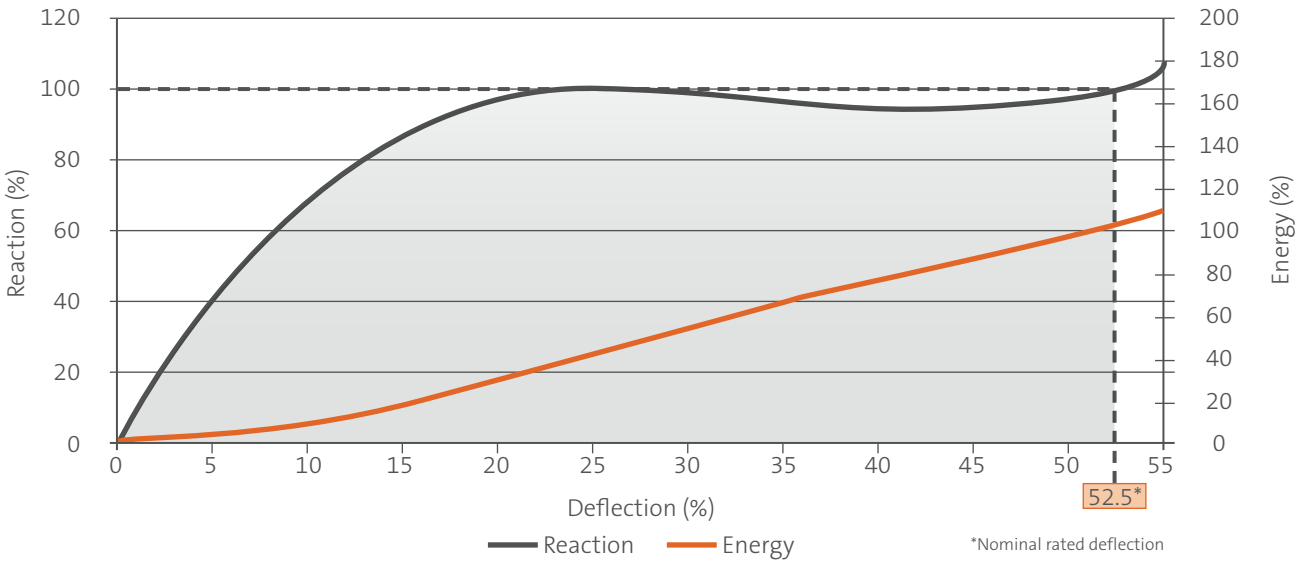


PERFORMANCE TABLE CSS FENDERS (RPD = RATED PERFORMANCE DATA IN ACC. WITH PIANC)

Fender Size		E/R	Rubber Grades G 0.9	G 1.0	G 1.1	G 1.2	G 1.3	G 1.4	G 1.5	G 1.6	G 1.7	G 1.8
CSS 300	E_A	0.13	4	**4**	4	5	5	5	5	5	6	6
	R_F		29	**31**	32	34	36	37	39	41	43	46
CSS 400	E_A	0.17	9	**10**	10	11	12	12	13	13	14	15
	R_F		50	**56**	59	63	67	70	74	77	81	84
CSS 500	E_A	0.22	18	**19**	20	21	22	23	24	25	27	28
	R_F		83	**87**	91	96	100	105	109	115	122	128
CSS 600	E_A	0.30	31	**33**	35	36	38	40	41	44	46	49
	R_F		119	**126**	132	138	144	151	157	166	176	185
CSS 800	E_A	0.35	75	**79**	82	86	90	94	98	104	110	116
	R_F		211	**223**	234	245	256	267	279	295	312	329
CSS 1000	E_A	0.44	145	**153**	161	168	176	184	191	203	214	226
	R_F		331	**348**	366	383	401	418	435	462	488	514
CSS 1150	E_A	0.51	222	**233**	245	257	268	280	291	309	326	344
	R_F		438	**461**	484	507	530	553	576	610	645	679
CSS 1250	E_A	0.55	284	**299**	314	329	343	359	374	396	419	441
	R_F		517	**544**	571	598	626	653	680	720	761	802
CSS 1450	E_A	0.64	444	**467**	490	514	537	560	584	619	654	689
	R_F		694	**732**	768	805	842	878	915	969	1,024	1,078
CSS 1600	E_A	0.70	596	**628**	659	690	721	753	785	832	879	926
	R_F		846	**891**	937	982	1,027	1,073	1,118	1,185	1,251	1,318
CSS 1700	E_A	0.75	714	**751**	789	827	864	902	940	997	1,054	1,110
	R_F		961	**1,010**	1,059	1,108	1,157	1,206	1,255	1,332	1,404	1,484
CSS 2000	E_A	0.88	1,165	**1,226**	1,287	1,348	1,408	1,469	1,530	1,622	1,714	1,806
	R_F		1,322	**1,393**	1,463	1,534	1,604	1,675	1,746	1,860	1,953	2,057
CSS 2250	E_A	0.99	1,659	**1,746**	1,832	1,918	2,005	2,091	2,177	2,309	2,440	2,571
	R_F		1,676	**1,765**	1,854	1,942	2,030	2,118	2,207	2,338	2,469	2,601
CSS 2500	E_A	1.10	2,544	**2,826**	2,976	3,026	3,275	3,425	3,575	3,724	3,874	4,024
	R_F		2,317	**2,574**	2,711	2,847	2,983	3,120	3,256	3,392	3,528	3,665
CSS 3000	E_A	1.32	3,915	**4,131**	4,347	4,536	4,752	4,968	5,157	5,481	5,778	6,102
	R_F		2,979	**3,132**	3,294	3,447	3,609	3,762	3,915	4,158	4,392	4,626

Performance values for single units | Energy Absorption (E_A) in kNm, Reaction Force (R_F) in kN | Nominal rated deflection is 52.5 %, max. deflection is 55 % | Actual deflection at Rated Performance Data may vary | Properties, tolerances, and testing standards can be found on pages 123 ff.

GENERIC PERFORMANCE CURVE CSS FENDERS



Rubber Grades													Fender Size
G 1.9	G 2.0	G 2.1	G 2.2	G 2.3	G 2.4	G 2.5	G 2.6	G 2.7	G 2.8	G 2.9	G 3.0	G 3.1	
6 48	**7** **50**	7 52	7 54	7 55	8 57	8 58	8 60	8 61	8 63	9 64	**9** **66**	9 67	CSS 300
15 88	**16** **91**	16 94	17 97	17 99	18 102	18 104	19 107	19 110	20 112	20 115	**21** **118**	23 129	CSS 400
30 135	**31** **141**	32 146	33 150	34 154	35 159	36 163	37 167	38 171	39 176	40 180	**41** **184**	42 189	CSS 500
51 195	**54** **204**	55 210	57 217	59 223	60 229	62 235	64 241	65 247	67 253	68 259	**70** **265**	72 271	CSS 600
122 345	**128** **362**	132 373	136 385	140 400	144 407	148 418	151 428	155 439	158 450	162 460	**166** **471**	169 481	CSS 800
238 540	**249** **566**	257 583	264 601	272 618	280 636	287 653	295 670	302 686	309 703	316 719	**324** **736**	331 752	CSS 1000
361 714	**379** **748**	390 765	402 794	413 817	425 840	436 863	448 885	459 907	470 920	481 942	**492** **973**	504 995	CSS 1150
464 843	**486** **884**	501 911	516 938	531 965	546 993	561 1,020	575 1,045	590 1,071	604 1,096	618 1,122	**633** **1,147**	647 1,173	CSS 1250
724 1,132	**759** **1,187**	782 1,224	806 1,261	829 1,298	852 1,336	876 1,373	899 1,408	922 1,444	945 1,479	968 1,514	**991** **1,550**	1,020 1,584	CSS 1450
973 1,385	**1,020** **1,451**	1,051 1,495	1,083 1,538	1,114 1,580	1,145 1,624	1,177 1,667	1,206 1,710	1,236 1,753	1,265 1,797	1,295 1,840	**1,324** **1,883**	1,353 1,926	CSS 1600
1,169 1,561	**1,226** **1,638**	1,263 1,687	1,300 1,736	1,338 1,784	1,375 1,834	1,412 1,883	1,448 1,932	1,482 1,980	1,518 2,030	1,553 2,079	**1,589** **2,128**	1,624 2,177	CSS 1700
1,898 2,161	**1,991** **2,265**	2,052 2,334	2,112 2,403	2,173 2,471	2,234 2,540	2,295 2,609	2,354 2,675	2,413 2,742	2,471 2,809	2,530 2,875	**2,589** **2,942**	2,648 3,009	CSS 2000
2,703 2,732	**2,834** **2,864**	2,922 2,952	3,011 3,040	3,099 3,128	3,187 3,275	3,275 3,305	3,358 3,389	3,440 3,474	3,523 3,558	3,604 3,642	**3,687** **3,727**	3,770 3,808	CSS 2250
4,173 3,801	**4,323** **3,937**	4,452 4,056	4,582 4,174	4,712 4,292	4,841 4,410	4,971 4,528	5,101 4,647	5,230 4,765	5,360 4,883	5,490 5,001	**5,619** **5,119**	6,181 5,631	CSS 2500
6,426 4,860	**6,723** **5,094**	6,939 5,247	7,128 5,409	7,344 5,562	7,560 5,724	7,749 5,877	7,965 6,030	8,154 6,174	8,343 6,327	8,532 6,471	**8,748** **6,624**	8,937 6,768	CSS 3000

LNG Terminal | Yamal | Russia

Chemical Product Jetty | Stenungsund | Sweden

CORRECTION FACTORS

FENDER PERFORMANCE AT INTERMEDIATE DEFLECTION

Deflection of original fender height [%]	0	5	10	15	20	25	30	35	40	45	50	52.5	55
Energy Absorption of original value [%]	0	2	8	17	28	39	50	62	72	83	94	100	106
Reaction Force of original value [%]	0	39	70	88	96	100	99	97	96	95	97	100	107

TEMPERATURE FACTOR

Temperature [°C]	-60	-50	-40	-30	-20	-10	0	10	23	30	40	50	60
Correction Factor	Contact your local SFT office for special compound consultation			1.559	1.375	1.182	1.083	1.034	1.000	0.976	0.945	0.918	0.917

VELOCITY FACTOR

Compression Time [s]	1	2	3	4	5	6	7	8	10
Correction Factor	1.050	1.020	1.012	1.005	1.000	1.000	1.000	1.000	1.000

ANGLE FACTOR

Compression Angle [°]	0	3	5	8	10	15	20
Energy Absorption of original value [%]	100	98.7	97.8	96.8	95.0	87.6	85.5
Reaction Force of original value [%]	100	100	100	100	100	100	100

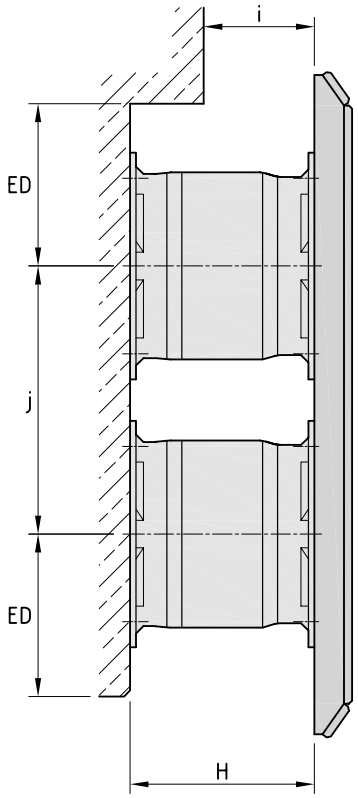
Correction Factors in strict accordance to PIANC 2002 Appendix A | Properties, tolerances, and testing standards can be found on pages 123 ff.

INSTALLATION CLEARANCES

Fender Size	H [mm]	i [mm]	j [mm]	ED [mm]
CSS 300	300	180	450	460
CSS 400	400	240	600	480
CSS 500	500	300	750	510
CSS 600	600	360	900	570
CSS 800	800	480	1,200	700
CSS 1000	1,000	600	1,500	850
CSS 1150	1,150	690	1,725	990
CSS 1250	1,250	750	1,875	1,060
CSS 1450	1,450	870	2,175	1,200
CSS 1600	1,600	960	2,400	1,270
CSS 1700	1,700	1,020	2,550	1,470
CSS 2000	2,000	1,200	3,000	1,560
CSS 2250	2,250	1,350	3,375	1,710
CSS 2500	2,500	1,500	3,750	1,910
CSS 3000	3,000	1,800	4,500	2,240

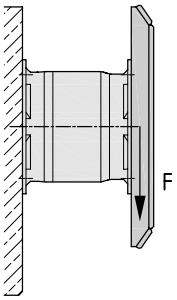
The fender system design should allow for:

- increased diameter of CSS Fenders during compression [j]
- sufficient clearance of front panel [i]
- minimum edge distance for anchoring and to other protrusions [ED]
- angular compression



WEIGHT SUPPORT CAPACITY

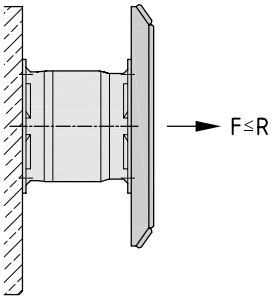
The CSS Fender can support a significant static load. As a rule of thumb, we recommend to add weight support chains if the panel weight exceeds the weight of the rubber body.*



Barbours Cut Container Terminal | Houston, TX | USA

TENSION

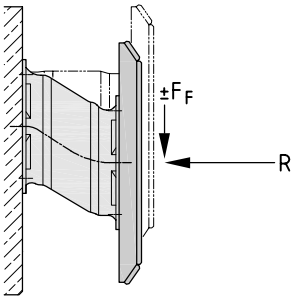
Tension chains are recommended, especially when tensile loads might exceed the rated reaction force of the rubber fender.*



RoRo Facility | Portland, TX | USA

SHEAR

CSS Fenders are stable against horizontal and vertical shear forces. However, depending on the application and layout of the system shear, chains might become necessary. *



Lumut Port | Vale Lumut | Malaysia

* For detailed advice, please contact your local SFT office
SFT generally recommends the use of properly designed suspension chain systems to support the fender's performance and reduce the risk of damages

FE Element Fenders.

Characteristics

- Good energy absorption to reaction force ratio (E/R)
- High energy absorption per fender weight
- Modular and compact design with small footprint
- Vertical and horizontal mounting, typically in pairs
- Pile Fender design may use single units
- Easy maintenance & replacement

Applications

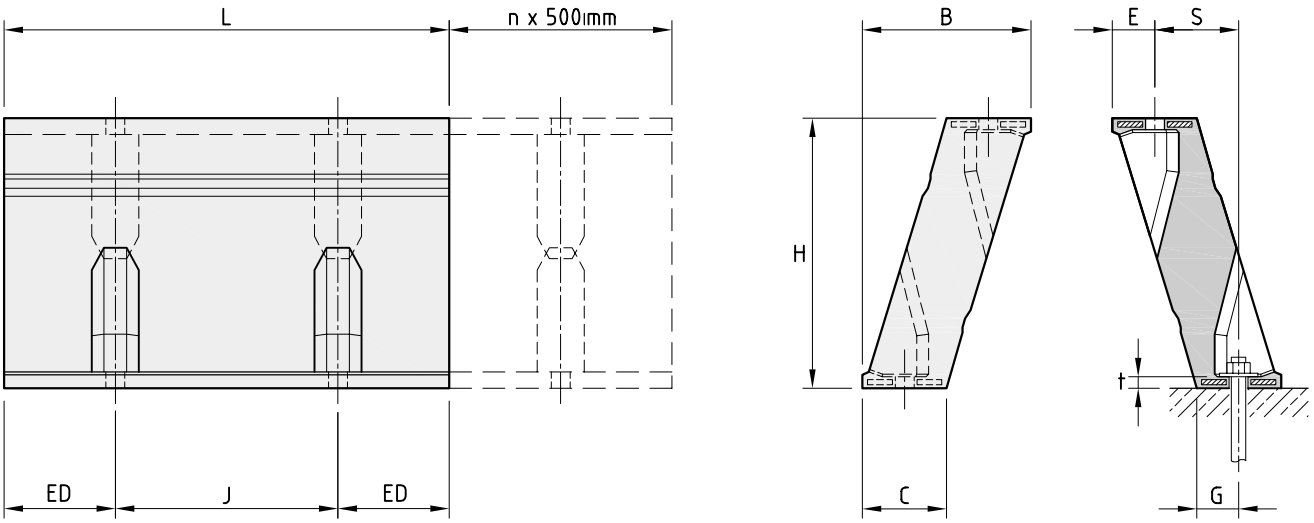
- Container & Bulk Terminals
- General Cargo Terminals
- RoRo Terminals
- Navy
- Barge

FE FENDER DIMENSIONS

Fender Size	L [mm]	H [mm]	B [mm]	C [mm]	S [mm]	E [mm]	t [mm]	G [mm]	ED [mm]	J [mm]	Anchors / Bolts	Weight [kg/m]
FE 250	1,000	250	158	80	78	40	17	40	50	300	M20	30
FE 300	1,000	300	187	94	93	47	17	47	100	400	M20	46
FE 400	1,000	400	250	125	124	63	17	62	250	500	M24	66
FE 500	1,000	500	316	158	142	87	20	71	250	500	M30	111
FE 550	1,000	550	344	172	170	87	20	85	250	500	M30	132
FE 600	1,000	600	373	188	199	87	20	101	250	500	M30	153
FE 700	1,000	700	443	225	217	113	26	112	250	500	M36	222
FE 750	1,000	750	466	235	230	118	26	117	250	500	M36	239
FE 800	1,000	800	498	250	240	129	26	121	250	500	M36	268
FE 900	1,000	900	569	289	279	145	31	144	250	500	M42	367
FE 1000	1,000	1,000	634	322	310	162	31	160	250	500	M42	454
FE 1200	1,000	1,200	762	390	372	195	36	195	250	500	M48	625
FE 1250	1,000	1,250	792	401	388	202	36	199	250	500	M48	639
FE 1400	1,000	1,400	870	440	430	220	41	220	250	500	M48	846
FE 1450	1,000	1,450	901	454	445	228	41	226	250	500	M48	873
FE 1600	1,000	1,600	1,002	507	480	261	50	246	250	500	M56	1,114
FE 2000*	1,000	2,000	1,318	585	733	–	52	–	–	–	M42	1,840

Also available in different bolt-layouts and with different geometries to replace Element Fenders of other manufacturers
* Shape differs from standard fender drawing

FE FENDER DRAWING

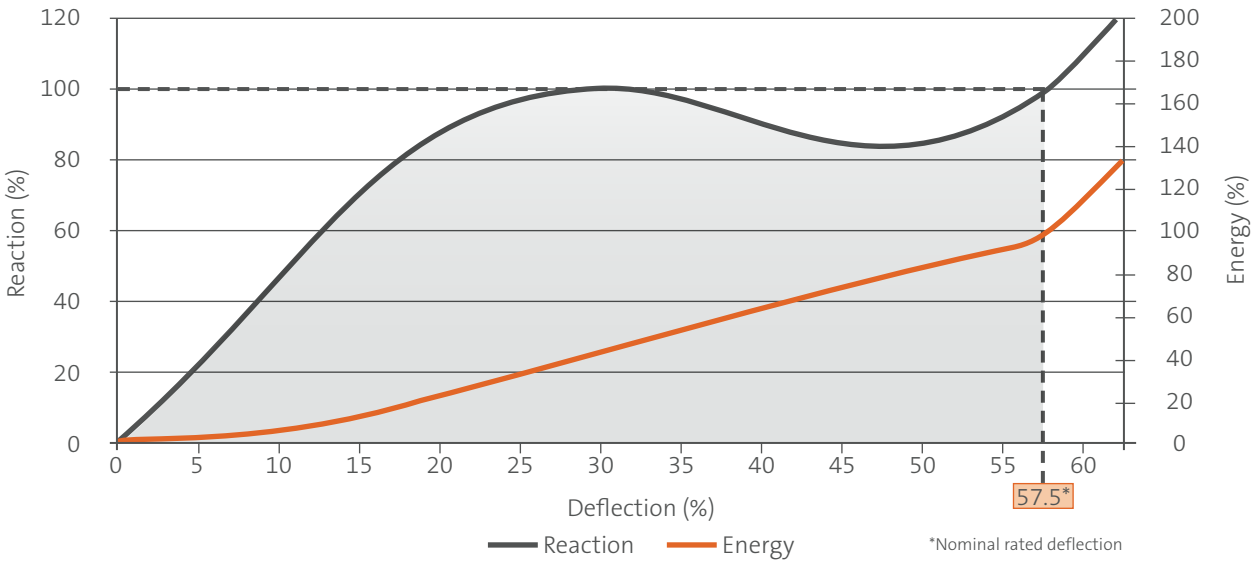


PERFORMANCE TABLE FE FENDERS (RPD = RATED PERFORMANCE DATA IN ACC. WITH PIANC)

Fender Size		E/R	Rubber Grades G 0.9	G 1.0	G 1.1	G 1.2	G 1.3	G 1.4	G 1.5	G 1.6	G 1.7	G 1.8
FE 250	E_A	0.10	8.7	**9.0**	9.3	9.6	9.9	10	11	11	11	11
	R_F		79	**82**	86	89	93	96	100	103	107	110
FE 300	E_A	0.12	13	**13**	13	14	14	15	15	15	16	16
	R_F		102	**106**	109	112	115	119	122	125	129	132
FE 400	E_A	0.18	22	**23**	24	25	25	26	27	28	29	29
	R_F		122	**126**	131	135	140	144	148	153	157	162
FE 500	E_A	0.23	32	**36**	37	39	40	41	43	44	45	46
	R_F		139	**157**	162	168	173	179	185	190	196	202
FE 550	E_A	0.25	40	**44**	46	47	49	50	52	53	55	56
	R_F		160	**173**	179	185	192	198	204	210	216	222
FE 600	E_A	0.28	47	**52**	54	56	58	59	61	63	65	67
	R_F		168	**188**	195	202	209	215	222	229	235	242
FE 700	E_A	0.32	63	**70**	73	75	78	80	83	85	88	90
	R_F		212	**219**	227	235	243	251	259	266	274	282
FE 750	E_A	0.34	73	**81**	84	87	89	92	95	98	101	103
	R_F		215	**238**	246	254	262	270	279	287	295	303
FE 800	E_A	0.37	84	**93**	96	99	103	106	109	112	115	119
	R_F		227	**251**	259	268	278	286	295	303	311	322
FE 900	E_A	0.41	106	**118**	122	126	130	134	138	142	146	150
	R_F		259	**285**	295	305	314	324	334	344	354	363
FE 1000	E_A	0.46	131	**146**	151	156	161	166	171	176	181	186
	R_F		285	**317**	328	338	349	360	371	382	393	403
FE 1200	E_A	0.54	186	**207**	213	220	226	232	239	245	251	257
	R_F		344	**378**	389	401	412	424	435	446	458	469
FE 1250	E_A	0.57	194	**216**	222	229	235	242	249	255	261	268
	R_F		340	**378**	389	402	413	426	437	448	460	471
FE 1400	E_A	0.64	257	**286**	294	303	311	320	328	336	345	353
	R_F		402	**447**	455	469	482	495	509	530	539	548
FE 1450	E_A	0.67	336	**343**	351	359	367	374	382	390	398	406
	R_F		501	**511**	523	535	547	558	570	582	594	605
FE 1600	E_A	0.74	363	**374**	385	396	408	419	430	441	452	464
	R_F		491	**505**	520	535	551	566	581	596	611	627
FE 2000	E_A	1.00	565	**581**	598	614	630	647	663	680	696	712
	R_F		565	**581**	598	614	630	647	663	680	696	712

Performance values for single units of 1,000 mm length | Energy Absorption (E_A) in kNm, Reaction Force (R_F) in kN | Nominal rated deflection is 57.5 %, max. deflection is 62.5 % | Actual deflection at Rated Performance Data may vary | Properties, tolerances, and testing standards can be found on pages 123 ff.

GENERIC PERFORMANCE CURVE FE FENDERS



Rubber Grades													Fender Size
G 1.9	G 2.0	G 2.1	G 2.2	G 2.3	G 2.4	G 2.5	G 2.6	G 2.7	G 2.8	G 2.9	G 3.0	G 3.1	
12 113	**12** **117**	12 120	13 124	13 127	13 131	14 134	15 138	15 141	15 145	15 148	**15** **148**	17 163	FE 250
17 135	**17** **138**	17 142	18 145	18 148	19 151	19 155	19 158	20 161	21 172	22 176	**22** **179**	24 196	FE 300
30 166	**31** **170**	32 175	33 179	33 184	34 188	35 192	36 197	37 201	37 205	38 210	**39** **214**	43 235	FE 400
48 207	**49** **213**	50 219	52 224	53 230	54 236	56 241	57 247	58 253	59 258	61 264	**62** **270**	68 294	FE 500
58 228	**60** **234**	61 240	63 246	64 253	66 259	67 265	69 271	70 277	72 283	73 289	**75** **295**	83 323	FE 550
69 249	**71** **255**	72 262	74 269	76 276	78 282	80 289	82 296	83 302	85 309	87 316	**89** **322**	98 352	FE 600
93 290	**95** **298**	98 306	100 313	103 321	105 329	108 337	110 345	113 353	115 361	118 368	**120** **376**	132 413	FE 700
106 311	**109** **320**	112 328	115 336	117 344	120 352	123 361	126 369	129 377	131 385	134 394	**137** **402**	151 443	FE 750
122 329	**125** **337**	128 345	131 354	135 365	138 372	141 381	144 389	147 397	151 408	154 416	**157** **424**	173 470	FE 800
154 373	**159** **383**	163 393	167 402	171 412	175 422	179 432	183 442	187 451	191 461	195 471	**199** **481**	219 529	FE 900
191 414	**196** **425**	201 436	206 447	211 458	216 469	221 479	226 490	231 501	236 512	241 523	**246** **534**	271 587	FE 1000
264 481	**270** **492**	278 507	286 522	294 537	302 552	311 567	319 582	327 597	335 612	343 627	**351** **642**	386 706	FE 1200
273 473	**281** **487**	289 502	298 517	306 531	315 546	323 560	331 575	340 589	348 604	356 618	**365** **633**	402 710	FE 1250
362 562	**370** **575**	381 592	392 610	404 627	415 644	426 662	437 679	448 696	460 713	471 731	**482** **748**	530 823	FE 1400
413 620	**421** **631**	429 643	437 654	444 666	452 678	460 689	468 701	475 713	483 724	491 736	**499** **748**	549 825	FE 1450
475 641	**486** **657**	497 671	508 686	520 702	531 718	542 732	553 747	564 762	576 778	587 793	**598** **808**	609 823	FE 1600
729 729	**745** **745**	761 761	778 778	794 794	810 810	827 827	843 843	859 859	876 876	892 892	**909** **909**	925 925	FE 2000

Bridge Protection Guidewall | Stockholm | Sweden

Ferry Terminal | Galtby | Finland

CORRECTION FACTORS

FENDER PERFORMANCE AT INTERMEDIATE DEFLECTION

Deflection of original fender height [%]	0	5	10	15	20	25	30	35	40	45	50	55	57.5	62.5
Energy Absorption of original value [%]	0	2	7	14	24	32	41	56	66	76	85	95	100	113
Reaction Force of original value [%]	0	31	58	78	92	97	100	96	90	85	84	92	100	130

TEMPERATURE FACTOR

Temperature [°C]	-30	-20	-10	0	10	23	30	40	50	60
Correction Factor	1.559	1.375	1.182	1.083	1.034	1.000	0.976	0.945	0.918	0.917

VELOCITY FACTOR

Compression Time [s]	1	2	3	4	5	6	7	8	10
Correction Factor	1.020	1.010	1.010	1.000	1.000	1.000	1.000	1.000	1.000

ANGLE FACTOR

Compression Angle [°]	0	2	4	6	8	10	12	14	16	18	20
Energy Absorption of original value [%]	100	96	94	92	90	88	86	84	82	80	78
Reaction Force of original value [%]	100	96	94	92	90	88	86	84	82	80	78

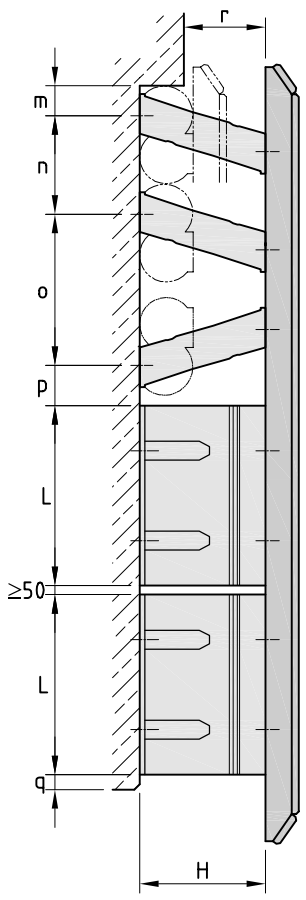
Correction Factors in strict accordance to PIANC 2002 Appendix A | Properties, tolerances, and testing standards can be found on pages 123 ff.

INSTALLATION CLEARANCES

Fender Size	L [mm]	H [mm]	m [mm]	n [mm]	o [mm]	p [mm]	q [mm]	r [mm]
FE 250	1,000	250	60	195	300	80	30	163
FE 300	1,000	300	72	234	360	96	36	195
FE 400	1,000	400	96	312	480	128	48	260
FE 500	1,000	500	120	390	600	160	60	325
FE 550	1,000	550	132	429	660	176	66	358
FE 600	1,000	600	144	468	720	192	72	390
FE 700	1,000	700	168	546	840	224	84	455
FE 750	1,000	750	180	585	900	240	90	488
FE 800	1,000	800	192	624	960	256	96	520
FE 900	1,000	900	216	702	1,080	288	108	585
FE 1000	1,000	1,000	240	780	1,200	320	120	650
FE 1200	1,000	1,200	288	936	1,440	384	144	780
FE 1250	1,000	1,250	300	975	1,500	400	150	813
FE 1400	1,000	1,400	336	1,092	1,680	448	168	910
FE 1450	1,000	1,450	348	1,131	1,740	464	174	943
FE 1600	1,000	1,600	384	1,248	1,920	512	192	1,040
FE 2000	1,000	2,000	425	1,500	2,100	575	250	1,200

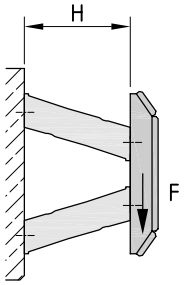
The fender system design should allow for:

- increased dimension of FE Fender during compression [n, o, p]
- sufficient clearance of front panel [r]
- minimum edge distance for anchoring and to other protrusions [m, q]
- angular compression

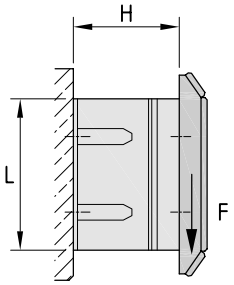


WEIGHT SUPPORT CAPACITY AND SHEAR RESISTANCE

The weight support capacity and shear resistance of the FE Fender is depending on the orientation of the elements versus the static load respectively the shear load. When the fenders are mounted horizontally, they can only support a limited amount of weight, respectively resist a limited vertical shear force. We typically allow for a maximum of 50% of the weight of the rubber units and recommend chain suspension if shear loads are expected to act contrary to the orientation of the fender.

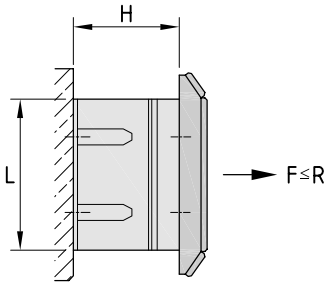


When the fenders are mounted vertically, the weight support capacity is far higher, i.e. at least twice the weight of the rubber units. However, the resistance against horizontal shear forces is limited.



TENSION

Tension chains are recommended, especially when tensile loads might exceed the rated reaction force of the rubber fender.*



Vopak Terminal | Freeport | Bahamas

Ferry Terminal | Hirtshals | Denmark

Pier 1 | North Kingstown, RI | USA

* For detailed advice, please contact your local SFT office
SFT generally recommends the use of properly designed suspension chain systems to support the fender's performance and reduce the risk of damages

Special Element Fenders.

Characteristics

- Economical alternative to steel panels
- Flexible fender system
- Low friction facing

Applications

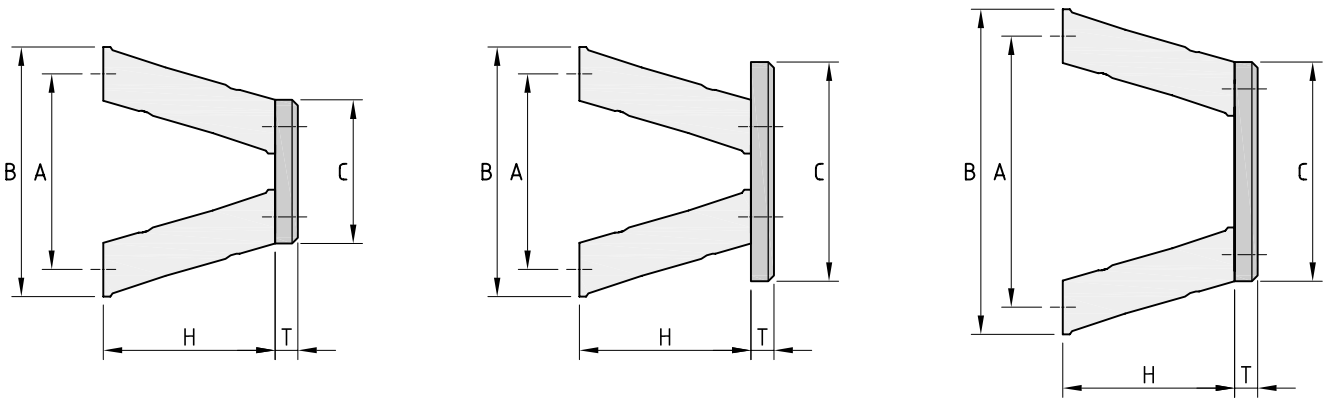
- Container & Bulk Terminals
- Jetties and berths for small to medium size vessels
- Bulk Terminals
- General Cargo Terminals
- Navy

SPECIAL ELEMENT FENDER DIMENSIONS

Fender Size	H [mm]	Type 1 A [mm]	Type 1 B [mm]	Type 1 C [mm]	Type 2 A [mm]	Type 2 B [mm]	Type 2 C [mm]	Type 3 A [mm]	Type 3 B [mm]	Type 3 C [mm]	T [mm]	Anchors / Bolts	Weight* [kg/m]
FE-S 250	250	300	380	230	300	380	320	390	470	320	70	M20	30
FE-S 300	300	360	454	270	360	454	410	500	594	410	70	M20	46
FE-S 400	400	480	606	360	480	606	500	620	746	500	80	M24	66
FE-S 500	500	600	774	460	600	774	660	800	972	660	90	M30	111
FE-S 550	550	660	834	500	660	834	750	910	1,084	750	90	M30	132
FE-S 600	600	720	894	530	720	894	800	990	1,164	800	90	M30	153
FE-S 700	700	840	1,066	640	840	1,066	930	1,130	1,356	930	100	M36	222
FE-S 750	750	900	1,136	680	900	1,136	1,010	1,230	1,466	1,010	100	M36	239
FE-S 800	800	960	1,218	730	960	1,218	1,170	1,400	1,658	1,170	100	M36	268
FE-S 1000	1,000	1,200	1,524	910	1,200	1,524	1,330	1,620	1,944	1,330	120	M42	454
FE-S 1250	1,250	1,500	1,904	1,130	1,500	1,904	1,660	2,030	2,434	1,660	120	M48	639

Larger sizes available upon request
* Weight for single FE Fender unit

SPECIAL ELEMENT FENDER DRAWING WITHOUT BELT DEFLECTOR



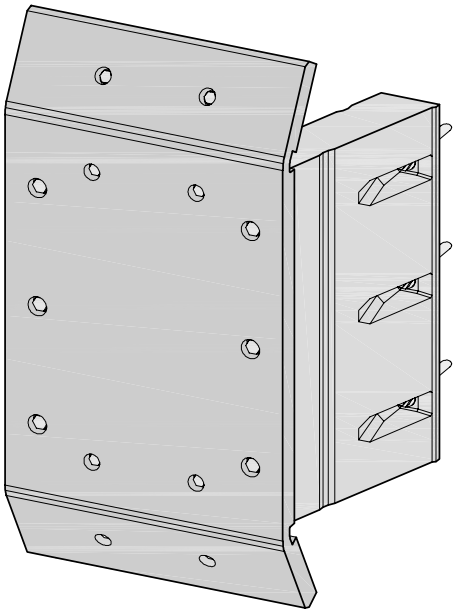
Sifferdok | Gent | Belgium

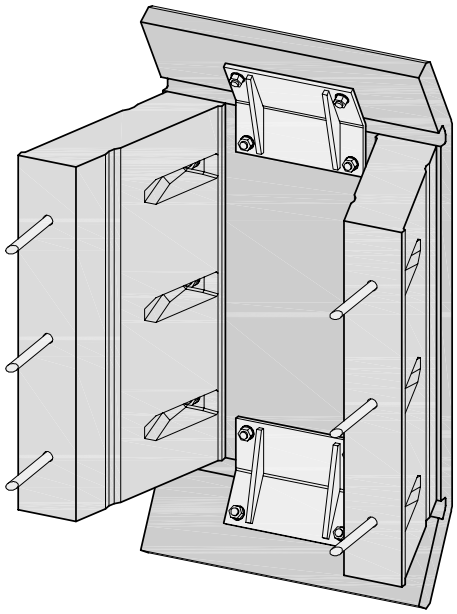
Punta del Este | Montevideo | Uruguay

Toft Pier | Shetland Islands | United Kingdom

Ferry & RoRo Terminal | Malmö | Sweden

SPECIAL ELEMENT FENDER DRAWING WITH BELT DEFLECTOR





Northern Berth 16 | Gdynia | Poland

Parallel Motion Fenders.

Characteristics

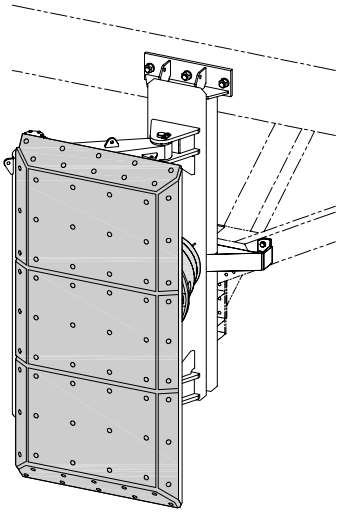
- Equal energy absorption capacity at any impact level
- The torsion resistant arm of the system allows only parallel panel movements and eliminates a second ship/panel contact
- Reaction forces could be substantially lower for back-to-back rubber unit configuration
- Lower reaction forces lead to lower hull pressure and lighter berth substructures, which reduces the overall project cost

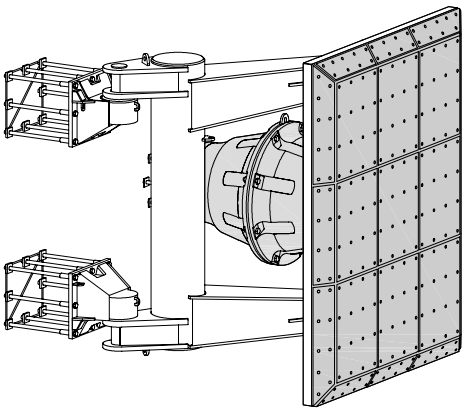
Applications

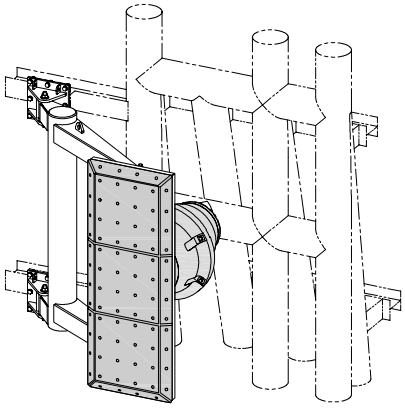
- Bulk Terminals
- Oil & Gas Terminals
- Ferry & RoRo Terminals
- Monopiles
- Load sensitive structures

Parallel Motion Fenders are highly customized systems. Therefore, no standard dimensions and values can be provided. Please contact us for detailed information, calculations and assistance for the design.

PARALLEL MOTION FENDER DRAWING







Ferry Terminal | Gotland Island | Sweden

Oil Terminal | Labuan | Malaysia

Ferry & RoRo Terminal | Gedser | Denmark

Pile Fenders.

Characteristics

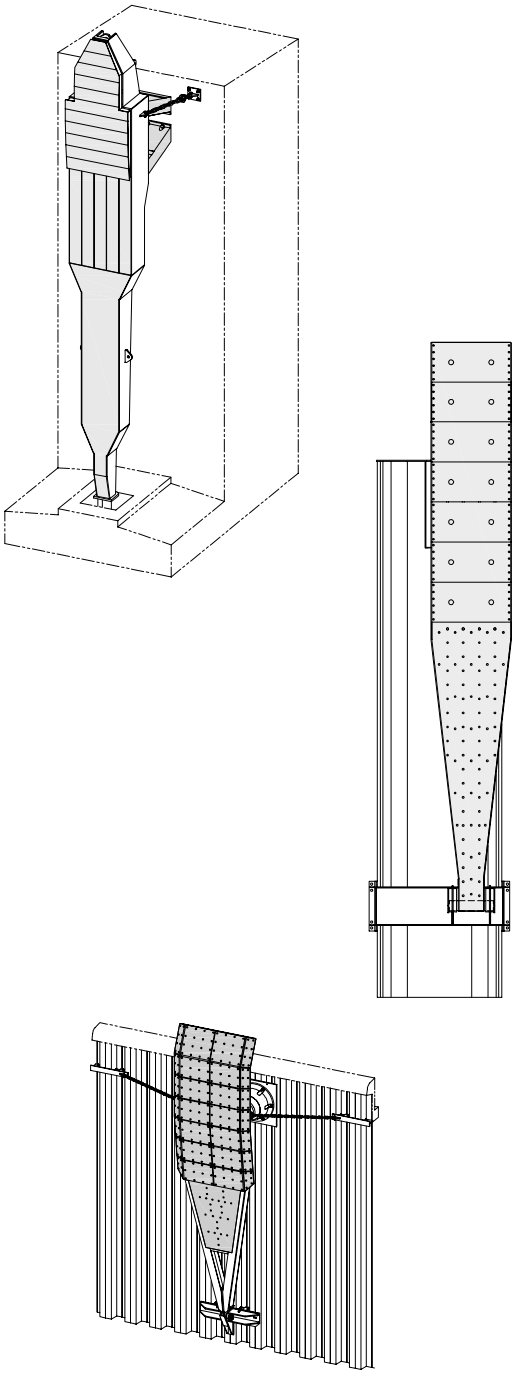
- Single ship / panel contact design
- Potential savings in substructures with existing quay walls
- Can cope with high impact levels and low deck levels

Applications

- Container & Bulk Terminals
- Oil & Gas Terminals
- Ferry & RoRo Terminals
- Terminals with sheet pile walls or pile structures with small concrete capping beams

Pile Fenders are highly customized systems. Therefore, no standard dimensions and values can be provided. Please contact us for detailed information, calculations and assistance for the design.

PILE FENDER DRAWING



Ferry Terminal | Rostock | Germany

Ferry Terminal | IJmuiden | The Netherlands

V Fenders.

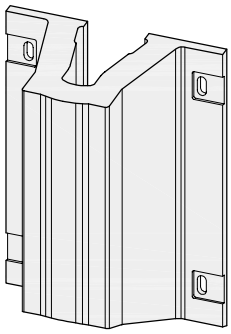
Characteristics

- Suitable for a wide range of applications
- Very robust, durable and requires low maintenance
- High shear resistance in the longitudinal direction
- Can be installed both, vertically and horizontally
- Suitable for turning dolphins & pivot points

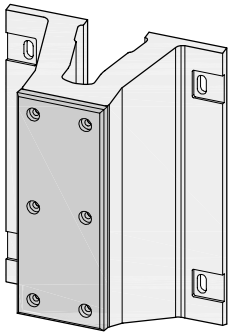
Typical Applications

- General Cargo Terminals
- Bulk Terminals
- Tug Boat Berth
- Multipurpose Terminals
- RoRo Ramps
- Passenger Terminals

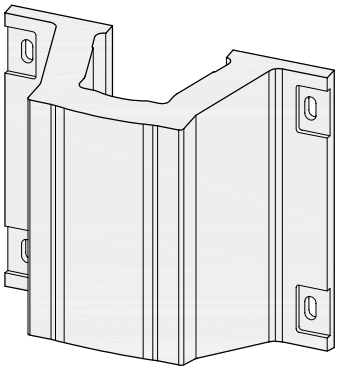
V FENDER DRAWINGS



SX FENDER



SX-P FENDER



SH FENDER

Ferry & RoRo Terminal | Kapellskär | Sweden

Waterland Terminal | Amsterdam | The Netherlands

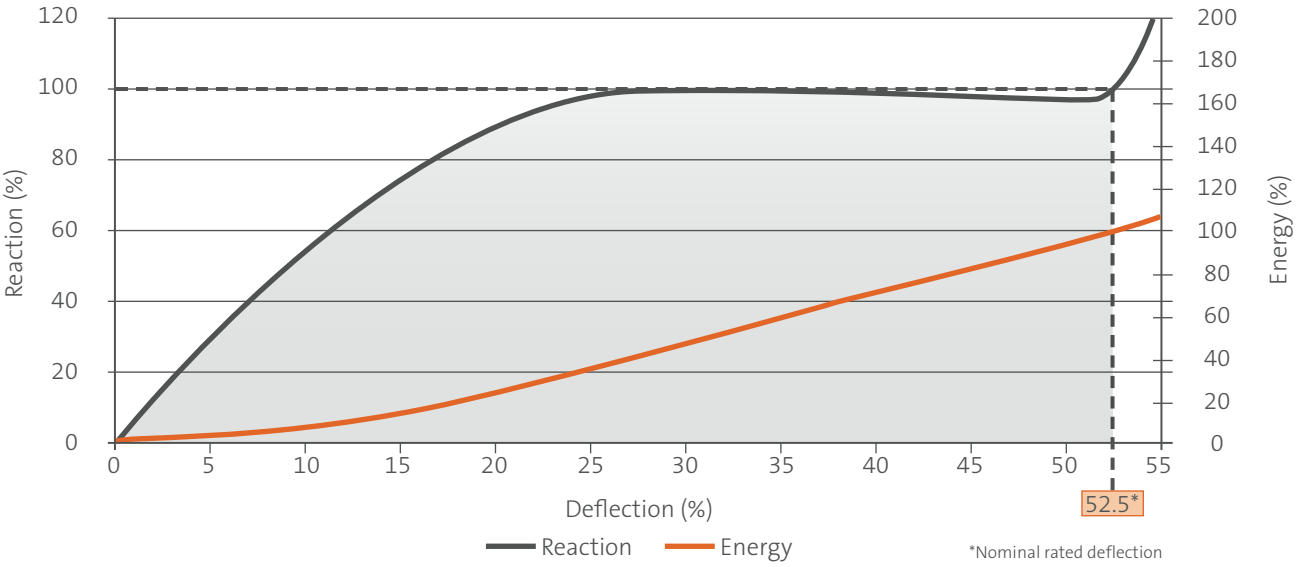
Turning Dolphin | Muuga | Estonia

PERFORMANCE TABLE V FENDERS (RPD = RATED PERFORMANCE DATA IN ACC. WITH PIANC)

Fender Size		E/R	Rubber Grades G 0.9	G 1.0	G 1.1	G 1.2	G 1.3	G 1.4	G 1.5	G 1.6	G 1.7	G 1.8
250	E_A	0.11	14	**14**	15	16	16	17	18	18	19	20
	R_F		129	**135**	141	148	154	161	167	174	180	187
300	E_A	0.13	20	**21**	21	22	23	24	25	26	27	28
	R_F		155	**163**	171	171	186	194	202	209	217	225
400	E_A	0.17	35	**36**	38	40	42	43	45	47	49	50
	R_F		207	**217**	227	238	248	258	269	279	289	299
500	E_A	0.21	54	**57**	60	62	65	68	70	73	76	79
	R_F		258	**271**	284	297	310	323	336	348	361	374
600	E_A	0.25	78	**82**	86	90	94	98	101	105	109	113
	R_F		311	**326**	341	357	372	388	403	418	434	449
800	E_A	0.34	138	**145**	152	159	166	173	180	187	194	201
	R_F		412	**433**	454	474	495	515	536	557	577	598
1000	E_A	0.42	217	**228**	239	250	260	271	282	293	303	314
	R_F		516	**542**	568	594	620	645	671	697	723	749

Performance values for single units of 1,000 mm length | Energy Absorption (E_A) in kNm, Reaction Force (R_F) in kN | Nominal rated deflection is 52.5 % | Actual deflection at Rated Performance Data may vary | Properties, tolerances, and testing standards can be found on pages 123 ff.

GENERIC PERFORMANCE CURVE V FENDERS



Tug Boat Berth | Lumut | Malaysia

Rubber Grades													Fender Size
G 1.9	G 2.0	G 2.1	G 2.2	G 2.3	G 2.4	G 2.5	G 2.6	G 2.7	G 2.8	G 2.9	G 3.0	G 3.1	
20 193	**21** **200**	22 206	22 212	23 219	24 225	24 232	25 238	26 245	26 251	27 258	**28** **264**	28 270	250
29 232	**30** **240**	31 248	32 255	33 263	34 271	35 279	36 286	37 294	38 302	39 309	**40** **317**	41 325	300
52 310	**54** **320**	55 330	57 341	59 351	61 361	62 372	64 382	66 392	68 402	69 413	**71** **423**	73 433	400
81 387	**84** **400**	87 413	89 426	92 439	95 452	97 465	100 477	103 490	106 503	108 516	**111** **529**	114 542	500
117 465	**121** **480**	125 495	129 511	133 526	137 542	140 557	144 572	148 588	152 603	156 619	**160** **634**	164 649	600
208 618	**215** **639**	221 660	228 680	235 701	242 721	249 742	256 763	263 783	270 804	277 824	**284** **845**	291 866	800
325 775	**336** **801**	346 826	357 852	368 878	379 904	389 930	400 956	411 981	422 1,007	432 1,033	**443** **1,059**	454 1,085	1000

CORRECTION FACTORS

FENDER PERFORMANCE AT INTERMEDIATE DEFLECTION

Deflection of original fender height [%]	0	5	10	15	20	25	30	35	40	45	50	52.5	55
Energy Absorption of original value [%]	0	2	6	14	24	35	47	59	71	82	94	100	107
Reaction Force of original value [%]	0	27	54	76	91	98	99	100	100	98	98	100	125

TEMPERATURE FACTOR

Temperature [°C]	-30	-20	-10	0	10	23	30	40	50	60
Correction Factor	1.559	1.375	1.182	1.083	1.034	1.000	0.976	0.945	0.918	0.917

VELOCITY FACTOR

Compression Time [s]	1	2	3	4	5	6	7	8	≥ 10
Correction Factor	1.014	1.005	1.004	1.003	1.003	1.002	1.000	1.000	1.000

ANGLE FACTOR

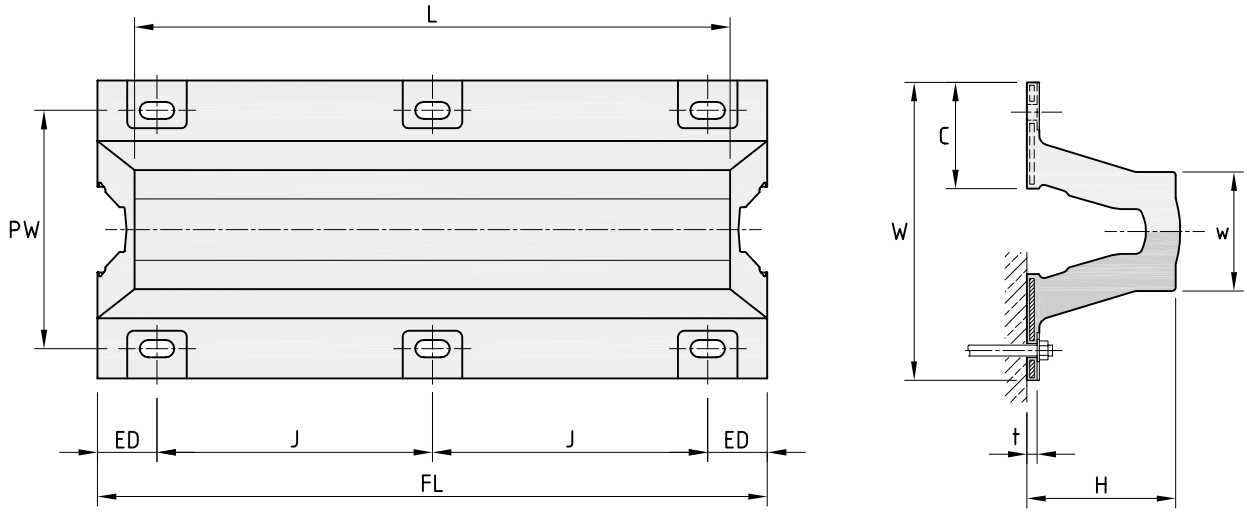
Compression Angle [°]	0	3	5	8	10	15	20
Energy Absorption of original value [%]	100	96	95	94	92	82	54
Reaction Force of original value [%]	100	100	100	100	100	100	100

Passenger Terminal | Sochi | Russia

SX FENDER DIMENSIONS

Fender Size	H [mm]	W [mm]	w [mm]	t [mm]	C [mm]	PW [mm]	Fixing
SX 250	250	500	200	18	178	400	M24
SX 300	300	600	240	23	213	480	M30
SX 400	400	800	320	27	285	640	M36
SX 500	500	1,000	400	29	358	800	M36
SX 600	600	1,200	480	34	425	960	M42
SX 800	800	1,500	640	38	520	1,300	M48
SX 1000	1,000	1,800	800	47	610	1,550	M48

SX FENDER DRAWING



Turkmenbashi International Seaport | Turkmenbashi | Turkmenistan

AVAILABLE STANDARD LENGTHS

Fender Size	L [mm]	ED [mm]	J [mm]	FL [mm]	An-chors	Weight [kg]
SX 250	1,000	113	1 x 900	1,125	4	88
	1,500	113	2 x 700	1,625	6	129
	2,000	118	3 x 630	2,125	8	169
	2,500	113	3 x 800	2,625	8	211
	3,000	113	4 x 725	3,125	10	251
	3,500	113	5 x 680	3,625	12	293
SX 300	1,000	125	1 x 900	1,150	4	122
	1,500	125	2 x 700	1,650	6	178
	2,000	130	3 x 630	2,150	8	234
	2,500	125	3 x 800	2,650	8	290
	3,000	125	4 x 725	3,150	10	345
	3,500	125	5 x 680	3,650	12	402
SX 400	1,000	150	1 x 900	1,200	4	206
	1,500	150	2 x 700	1,700	6	298
	2,000	155	3 x 630	2,200	8	389
	2,500	150	3 x 800	2,700	8	482
	3,000	150	4 x 725	3,200	10	573
	3,500	150	5 x 680	3,700	12	666
SX 500	1,000	175	1 x 900	1,250	4	332
	1,500	175	2 x 700	1,750	6	475
	2,000	180	3 x 630	2,250	8	617
	2,500	175	3 x 800	2,750	8	762
	3,000	175	4 x 725	3,250	10	904
	3,500	175	5 x 680	3,750	12	1,048
SX 600	1,000	200	1 x 900	1,300	4	476
	1,500	200	2 x 700	1,800	6	676
	2,000	205	3 x 630	2,300	8	875
	2,500	200	3 x 800	2,800	8	1,076
	3,000	200	4 x 725	3,300	10	1,276
SX 800	1,000	250	1 x 900	1,400	4	840
	1,500	250	2 x 700	1,900	6	1,175
	2,000	255	3 x 630	2,400	8	1,510
	2,500	250	3 x 800	2,900	8	1,848
	3,000	250	4 x 725	3,400	10	2,183
SX 1000	1,000	300	1 x 900	1,500	4	1,363
	1,500	300	2 x 700	2,000	6	1,879
	2,000	305	3 x 630	2,500	8	2,395
	2,500	300	3 x 800	3,000	8	2,918
	3,000	300	4 x 725	3,500	10	3,434

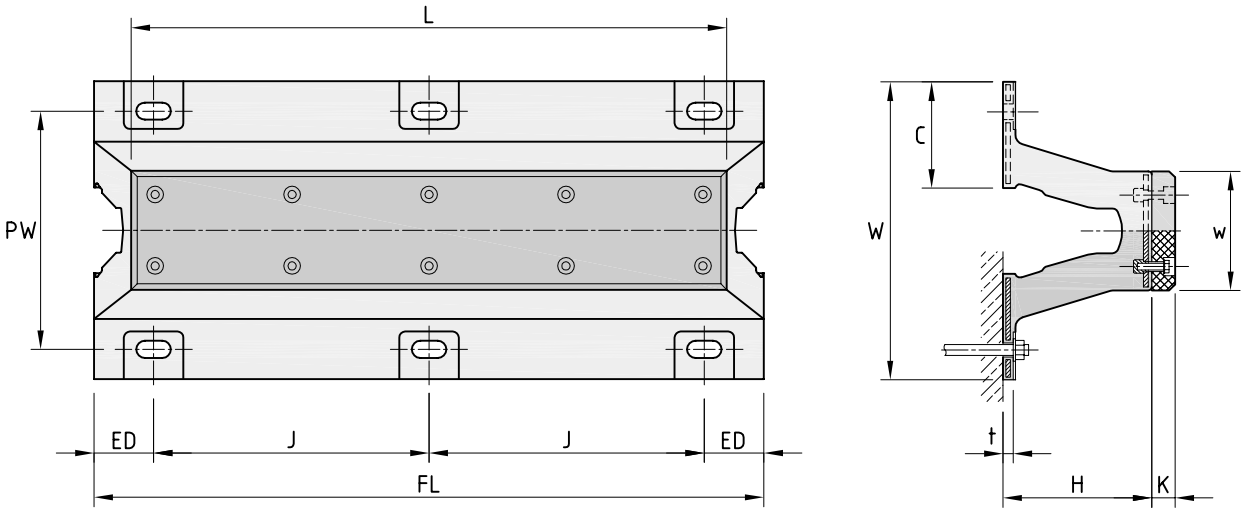
Passenger Terminal | Rijeka | Croatia

Quay No. 16 | Muuga | Estonia

SX-P FENDER DIMENSIONS

Fender Size	H [mm]	W [mm]	w [mm]	t [mm]	C [mm]	PW [mm]	K [mm]	Anchors / Bolts	PE Bolts
SX-P 250	250	500	200	18	178	400	40	M24	M16
SX-P 300	300	600	240	23	213	480	40	M30	M20
SX-P 400	400	800	320	27	285	640	40	M36	M20
SX-P 500	500	1,000	400	29	358	800	50	M36	M24
SX-P 600	600	1,200	480	34	425	960	50	M42	M24
SX-P 800	800	1,500	640	38	520	1,300	60	M48	M30
SX-P 1000	1,000	1,800	800	47	610	1,550	80	M48	M36

SX-P FENDER DRAWING



Margate Bridge | Margate City, NJ | USA

AVAILABLE STANDARD LENGTHS

Fender Size	L [mm]	ED [mm]	J [mm]	FL [mm]	An-chors	Weight [kg]
SX-P 250	1,000	113	1 x 900	1,125	4	102
	1,500	113	2 x 700	1,625	6	150
	2,000	118	3 x 630	2,125	8	198
	2,500	113	3 x 800	2,625	8	246
	3,000	113	4 x 725	3,125	10	294
	3,500	113	5 x 680	3,625	12	343
SX-P 300	1,000	125	1 x 900	1,150	4	140
	1,500	125	2 x 700	1,650	6	204
	2,000	130	3 x 630	2,150	8	269
	2,500	125	3 x 800	2,650	8	334
	3,000	125	4 x 725	3,150	10	398
	3,500	125	5 x 680	3,650	12	464
SX-P 400	1,000	150	1 x 900	1,200	4	230
	1,500	150	2 x 700	1,700	6	333
	2,000	155	3 x 630	2,200	8	437
	2,500	150	3 x 800	2,700	8	541
	3,000	150	4 x 725	3,200	10	645
	3,500	150	5 x 680	3,700	12	749
SX-P 500	1,000	175	1 x 900	1,250	4	369
	1,500	175	2 x 700	1,750	6	531
	2,000	180	3 x 630	2,250	8	693
	2,500	175	3 x 800	2,750	8	856
	3,000	175	4 x 725	3,250	10	1,018
	3,500	175	5 x 680	3,750	12	1,181
SX-P 600	1,000	200	1 x 900	1,300	4	524
	1,500	200	2 x 700	1,800	6	748
	2,000	205	3 x 630	2,300	8	972
	2,500	200	3 x 800	2,800	8	1,198
	3,000	200	4 x 725	3,300	10	1,422
SX-P 800	1,000	250	1 x 900	1,400	4	916
	1,500	250	2 x 700	1,900	6	1,291
	2,000	255	3 x 630	2,400	8	1,665
	2,500	250	3 x 800	2,900	8	2,043
	3,000	250	4 x 725	3,400	10	2,420
SX-P 1000	1,000	300	1 x 900	1,500	4	1,475
	1,500	300	2 x 700	2,000	6	2,048
	2,000	305	3 x 630	2,500	8	2,621
	2,500	300	3 x 800	3,000	8	3,201
	3,000	300	4 x 725	3,500	10	3,775

Passenger Terminal | Sochi | Russia

Ethanol Jetty | Stenungsund | Sweden

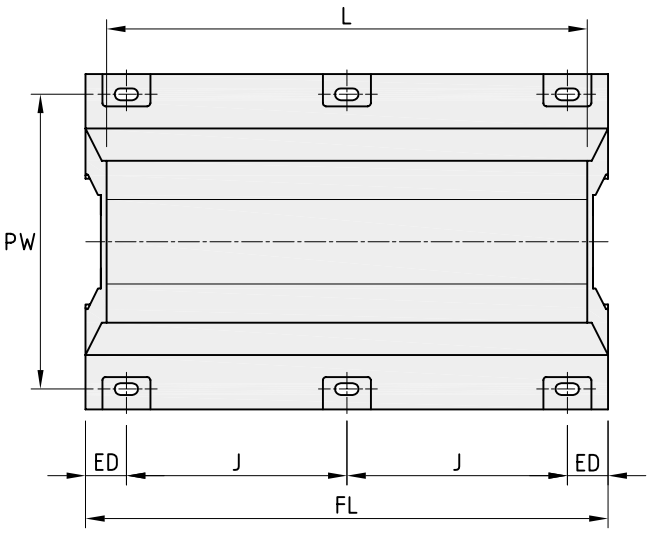
Bulk Terminal | Murmansk | Russia

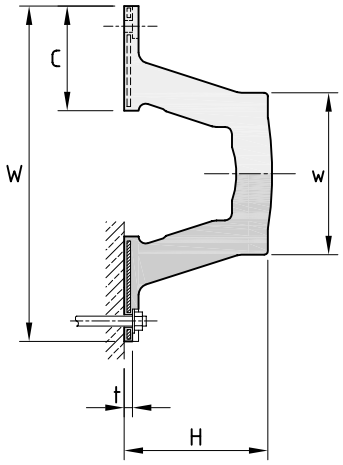
SH FENDER DIMENSIONS

Fender Size	H [mm]	W [mm]	w [mm]	t [mm]	C [mm]	PW [mm]	Fixing
SH 400	400	1,000	450	27	325	850	M30
SH 500	500	1,200	560	30	380	1,040	M36
SH 600	600	1,400	675	35	438	1,230	M42
SH 800	800	1,800	900	40	550	1,600	M48
SH 1000	1,000	2,200	1,125	40	663	2,000	M48

SH Fenders also available with PE facing (SH-P Fenders) | Available sizes upon request

SH FENDER DRAWING





Toyotakaai | Zeebrugge | Belgium

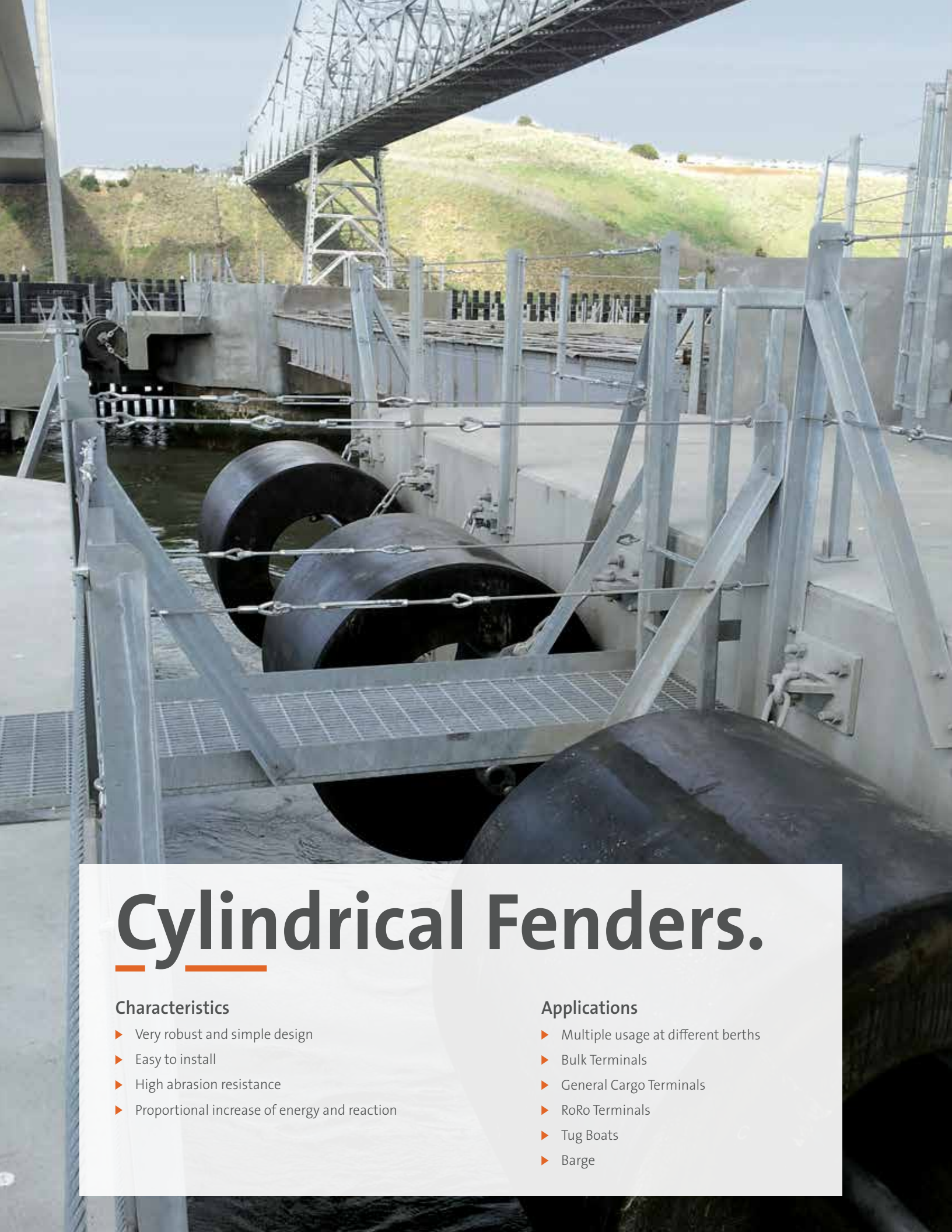
AVAILABLE STANDARD LENGTHS

Fender Size	L [mm]	ED [mm]	J [mm]	FL [mm]	An-chors	Weight [kg]
SH 400	1,000	135	1 x 850	1,120	4	247
	1,500	140	2 x 670	1,620	6	361
	2,000	160	3 x 600	2,120	8	475
	2,500	140	3 x 780	2,620	8	589
	3,000	160	4 x 700	3,120	10	703
	3,500	160	5 x 660	3,620	12	816
SH 500	1,000	150	1 x 850	1,150	4	389
	1,500	155	2 x 670	1,650	6	566
	2,000	175	3 x 600	2,150	8	743
	2,500	155	3 x 780	2,650	8	920
	3,000	175	4 x 700	3,150	10	1,097
	3,500	175	5 x 660	3,650	12	1,274
SH 600	1,000	165	1 x 850	1,180	4	552
	1,500	170	2 x 670	1,680	6	800
	2,000	190	3 x 600	2,180	8	1,047
	2,500	170	3 x 780	2,680	8	1,294
	3,000	190	4 x 700	3,180	10	1,542
SH 800	1,000	195	1 x 850	1,240	4	945
	1,500	200	2 x 670	1,740	6	1,357
	2,000	220	3 x 600	2,240	8	1,768
	2,500	200	3 x 780	2,740	8	2,180
	3,000	220	4 x 700	3,240	10	2,591
SH 1000	1,000	225	1 x 850	1,300	4	1,426
	1,500	230	2 x 670	1,800	6	2,030
	2,000	250	3 x 600	2,300	8	2,634
	2,500	230	3 x 780	2,800	8	3,238
	3,000	250	4 x 700	3,300	10	3,842

Boudewijnkanaal | Zeebrugge | Belgium

Boudewijnkanaal | Zeebrugge | Belgium

Oil Terminal | Muuga | Estonia



Cylindrical Fenders.

Characteristics

- Very robust and simple design
- Easy to install
- High abrasion resistance
- Proportional increase of energy and reaction

Applications

- Multiple usage at different berths
- Bulk Terminals
- General Cargo Terminals
- RoRo Terminals
- Tug Boats
- Barge

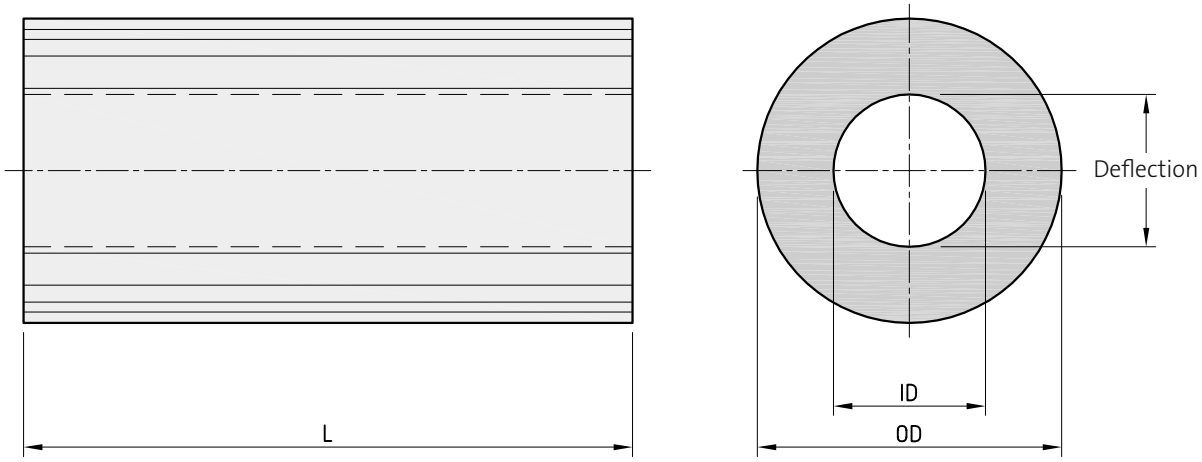
CYLINDRICAL FENDER DIMENSIONS AND PERFORMANCE VALUES

Fender Size OD x ID [mm]	E [kNm/m]	R [kN/m]	P [kN/m²]	Weight [kg/m]
100 x 50	0.8	43	547	7
125 x 65	1.3	51	500	11
150 x 75	1.8	65	552	16
175 x 75	2.7	92	781	24
200 x 100	3.3	86	547	29
250 x 125	5.1	108	550	45
300 x 150	7.4	129	547	65
380 x 190	11.8	164	550	105
400 x 200	13.1	172	547	116
450 x 225	16.6	194	549	147
500 x 250	28.0	275	700	181
600 x 300	40.0	330	700	255
800 x 400	72.0	440	700	453
900 x 450	86.0	470	700	573
1,000 x 500	112.0	550	700	707

Fender Size OD x ID [mm]	E [kNm/m]	R [kN/m]	P [kN/m²]	Weight [kg/m]
1,100 x 600	131.0	541	574	800
1,200 x 600	162.0	660	700	1,018
1,300 x 700	184.0	650	591	1,131
1,400 x 700	220.0	770	700	1,386
1,400 x 800	208.0	649	516	1,245
1,500 x 750	253.0	825	700	1,591
1,500 x 800	246.0	760	605	1,517
1,600 x 800	288.0	880	700	1,810
1,600 x 900	273.0	757	535	1,650
1,800 x 900	364.0	990	700	2,290
2,000 x 1,000	432.0	1,060	700	2,827
2,000 x 1,200	415.0	871	517	2,414
2,200 x 1,200	524.0	1,083	575	3,204
2,400 x 1,200	647.0	1,321	700	4,073
2,700 x 1,300	818.0	1,486	605	5,278

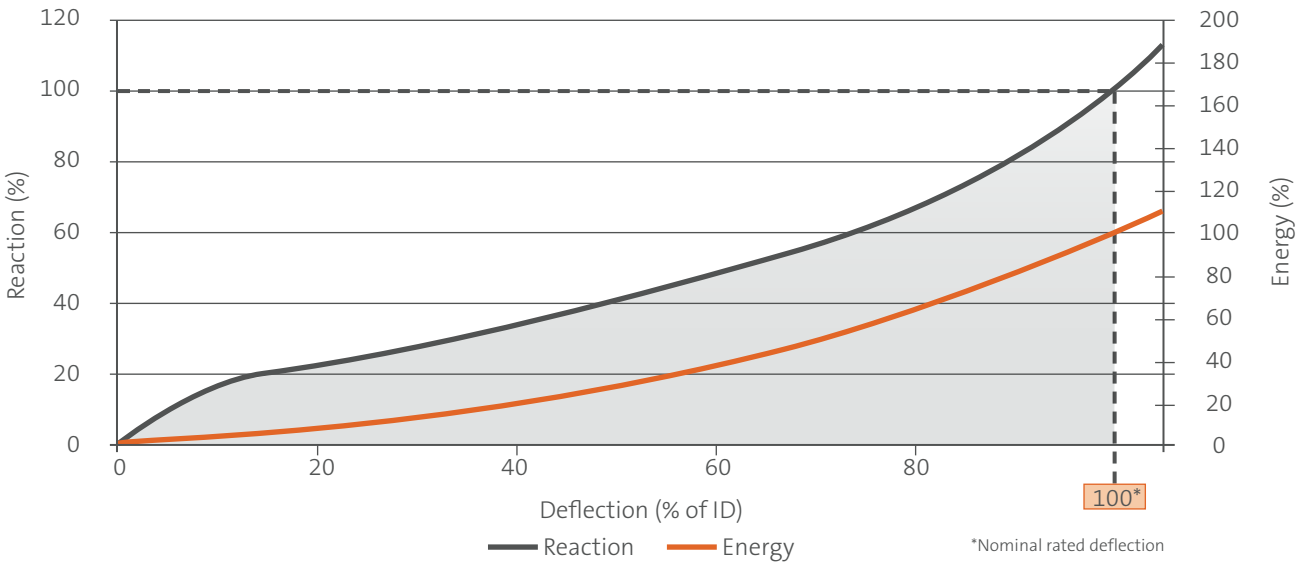
Performance values for single units of 1,000 mm length | Nominal rated deflection is 100 % of ID | Actual deflection at Rated Performance Data may vary | Certain sizes available as molded fenders | Intermediate sizes available upon request

CYLINDRICAL FENDER DRAWING



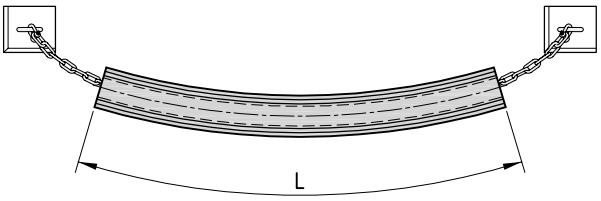
Bulk Terminal | Kaliningrad | Russia

GENERIC PERFORMANCE CURVE CYLINDRICAL FENDERS



FIXING DETAILS – SMALL CYLINDRICALS

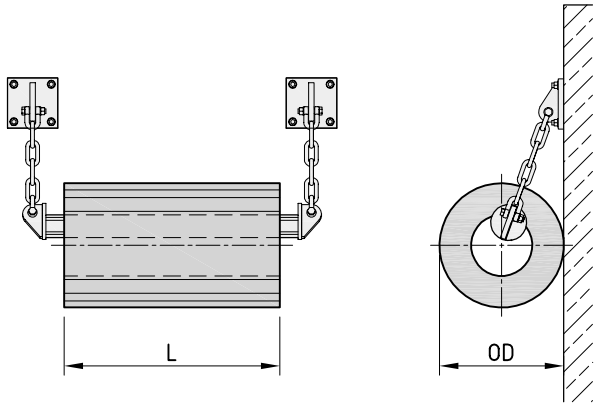
Small cylindricals (OD ≤ 600 mm) are often suspended from chains, connected to brackets or U Anchors on the quay wall. We recommend rubber sleeves over the chain to extend the lifetime of the fender.



Constanta South Port | Constanta | Romania

FIXING DETAILS – LARGE CYLINDRICALS

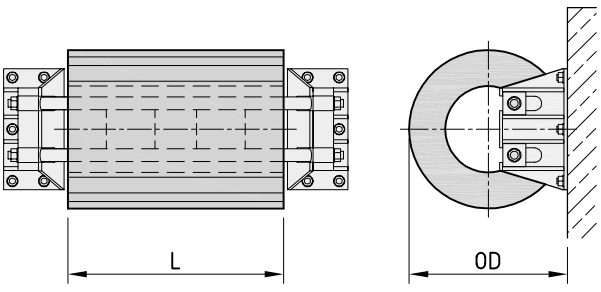
Large cylindricals (OD 600 mm – 1,600 mm) often use a central support bar connected at each end to chains which are fixed to brackets or U Anchors on the quay wall.



Burchardkai | Hamburg | Germany

FIXING DETAILS – VERY LARGE CYLINDRICALS

Very large cylindricals (OD ≥ 1,600 mm) may require special ladder brackets due to their weight. These are specially designed for each application.



Krögerwerft | Schacht-Audorf | Gemany

Ocean Guard Fenders.

Characteristics

- Proportional increase of energy and reaction
- Extremely robust
- No performance loss and unsinkable even if damaged
- Smaller skin damages can easily be repaired on site
- Low hull pressure and non-marking Polyurethane skin

Applications

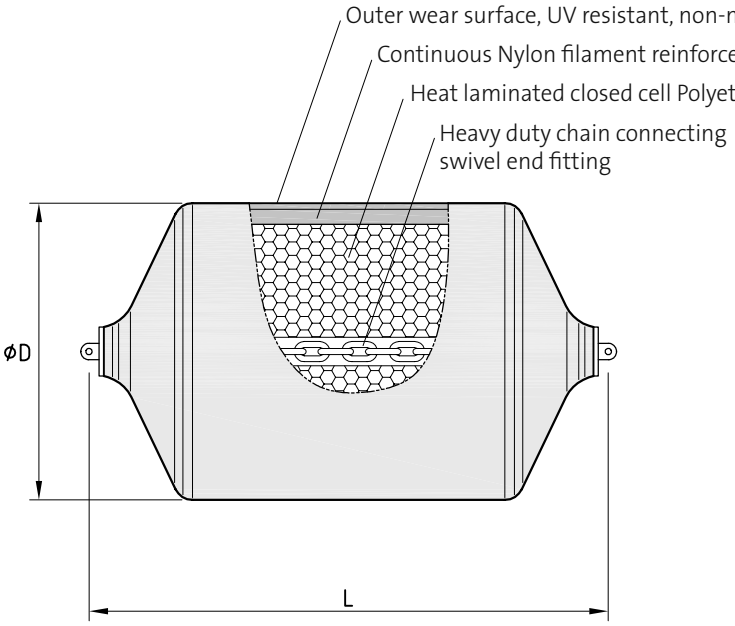
- Navy vessel berths and cruise terminals
- Ship-to-ship operations
- Ship-to-shore operations
- Oil & Gas Terminals

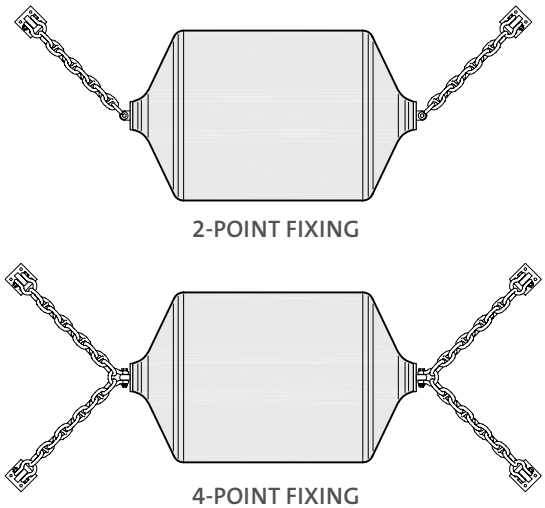
OCEAN GUARD FENDER DIMENSIONS AND PERFORMANCE VALUES

Fender Size D x L [mm]	Low Capacity				Standard Capacity				High Capacity				Chains / Shackles* [mm]
	Energy [kNm]	Reaction [kN]	Pressure [kN/m²]	Weight [kg]	Energy [kNm]	Reaction [kN]	Pressure [kN/m²]	Weight [kg]	Energy [kNm]	Reaction [kN]	Pressure [kN/m²]	Weight [kg]	
700 x 1,500	20	78	104	148	29	133	172	159	39	174	224	170	19
1,000 x 1,500	28	128	104	203	49	174	172	225	62	227	224	247	19
1,000 x 2,000	41	147	104	248	68	254	172	281	88	329	224	314	19
1,200 x 2,000	54	167	104	352	91	280	172	395	118	365	224	438	25
1,350 x 2,500	91	245	104	528	152	418	172	601	198	543	224	675	25
1,500 x 3,000	140	343	104	716	232	578	172	831	301	752	224	946	32
1,700 x 3,000	170	369	104	821	282	619	172	967	366	805	224	1,113	32
2,000 x 3,500	273	507	104	1,292	455	845	172	1,534	592	1,099	224	1,776	38
2,000 x 4,000	324	605	104	1,496	540	1,006	172	1,784	701	1,308	224	2,071	38
2,000 x 4,500	374	699	104	1,702	624	1,161	172	2,018	811	1,508	224	2,334	38
2,500 x 4,000	455	716	104	2,152	802	1,197	172	2,536	1,042	1,557	224	2,920	50
2,500 x 5,500	720	1,072	104	2,801	1,201	1,789	172	3,406	1,562	2,327	224	4,011	50
3,000 x 4,900	859	1,063	104	3,317	1,431	1,508	172	4,037	1,861	2,309	224	4,757	65
3,000 x 6,000	1,111	1,379	104	4,317	1,852	2,296	172	5,264	2,408	2,986	224	6,210	65
3,300 x 4,500	900	1,015	104	3,739	1,499	1,691	172	4,482	1,950	2,198	224	5,225	65
3,300 x 6,500	1,454	1,638	104	5,338	2,423	2,732	172	6,594	3,150	3,551	224	7,851	65

Intermediate sizes and different foam capacities available upon request | Above mentioned sizes are indicative and may change during final design process
* For standard capacity

OCEAN GUARD FENDER DRAWING



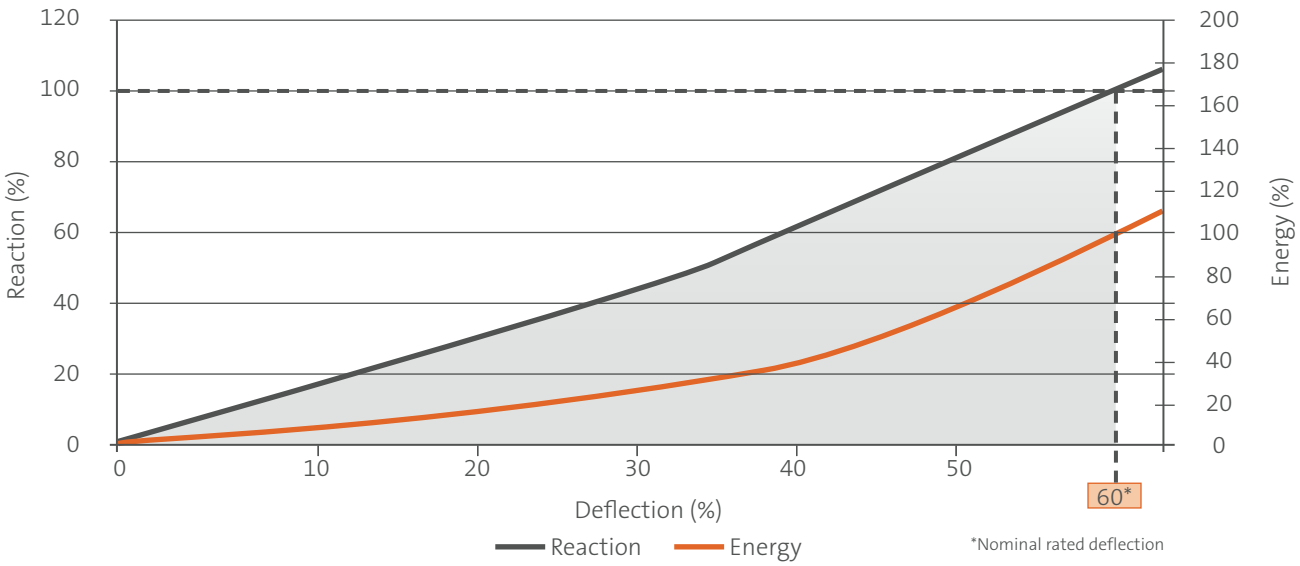


2-POINT FIXING

4-POINT FIXING

Naval Base | Doha | Qatar

GENERIC PERFORMANCE CURVE OCEAN GUARD FENDERS



Cruise Terminal | Valetta | Malta

Port of Miami | Miami, FL | USA

Ocean Cushion Fenders.

Characteristics

- Proportional increase of energy and reaction
- Extremely robust
- No performance loss and unsinkable even if damaged
- Smaller skin damages can easily be repaired on site
- Optional aircraft tires

Applications

- Ship-to-shore operations with very rough and uneven surfaces
- Heavy duty ship-to-ship lightering operations

OCEAN CUSHION FENDER DIMENSIONS AND PERFORMANCE VALUES

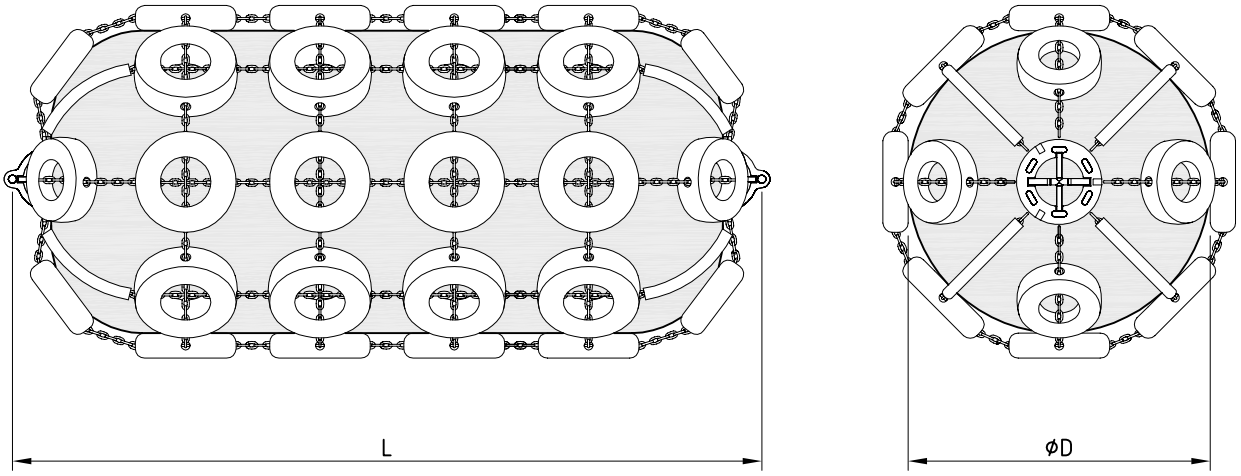
Fender Size D x L [mm]	Overall Diameter* [mm]	Low Capacity				Standard Capacity				High Capacity			
		Energy [kNm]	Reaction [kN]	Pressure [kN/m²]	Weight** [kg]	Energy [kNm]	Reaction [kN]	Pressure [kN/m²]	Weight** [kg]	Energy [kNm]	Reaction [kN]	Pressure [kN/m²]	Weight** [kg]
1,000 x 2,000	1,300	39	177	104	393	69	294	172	445	98	422	224	473
1,200 x 2,000	1,600	49	206	104	474	88	334	172	529	128	481	224	585
1,350 x 2,500	1,800	88	284	104	646	137	481	172	736	206	677	224	826
1,500 x 3,000	2,000	128	392	104	882	216	647	172	1,018	304	912	224	1,154
1,700 x 3,000	2,200	157	432	104	968	265	716	172	1,139	383	1,010	224	1,309
2,000 x 3,500	2,500	255	589	104	1,546	432	991	172	1,823	628	1,393	224	2,098
2,000 x 4,000	2,500	304	687	104	1,837	500	1,148	172	2,160	726	1,619	224	2,424
2,200 x 4,500	2,700	402	853	104	2,275	677	1,432	172	2,719	981	2,011	224	3,163
2,500 x 4,000	3,000	441	814	104	1,642	736	1,354	172	2,125	1,069	1,913	224	2,607
2,500 x 5,500	3,000	647	1,197	104	2,678	1,079	1,991	172	3,387	1,560	2,796	224	4,096
3,000 x 6,000	3,500	991	1,521	104	3,506	1,648	2,541	172	4,606	2,384	3,581	224	5,707
3,300 x 4,500	3,800	824	1,148	104	3,075	1,373	1,913	172	3,980	1,982	2,698	224	4,886
3,300 x 6,500	3,800	1,285	1,805	104	4,580	2,148	3,002	172	6,017	3,110	4,228	224	7,295
4,200 x 8,400	4,800	2,708	2,972	104	10,363	4,513	4,934	172	13,372	6,533	6,955	224	16,381

Intermediate sizes and different foam capacities available upon request | Above mentioned sizes are indicative and may change during final design process

* Subject to availability of suitable tires

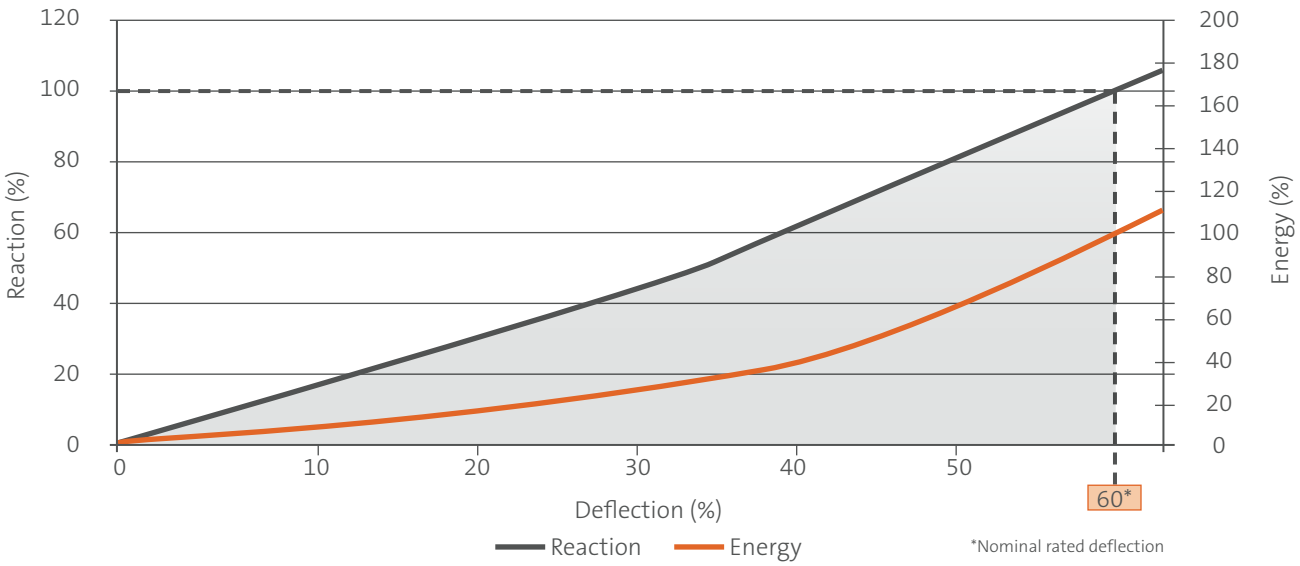
** Total weight (fender body including chain & tire net)

OCEAN CUSHION FENDER DRAWING

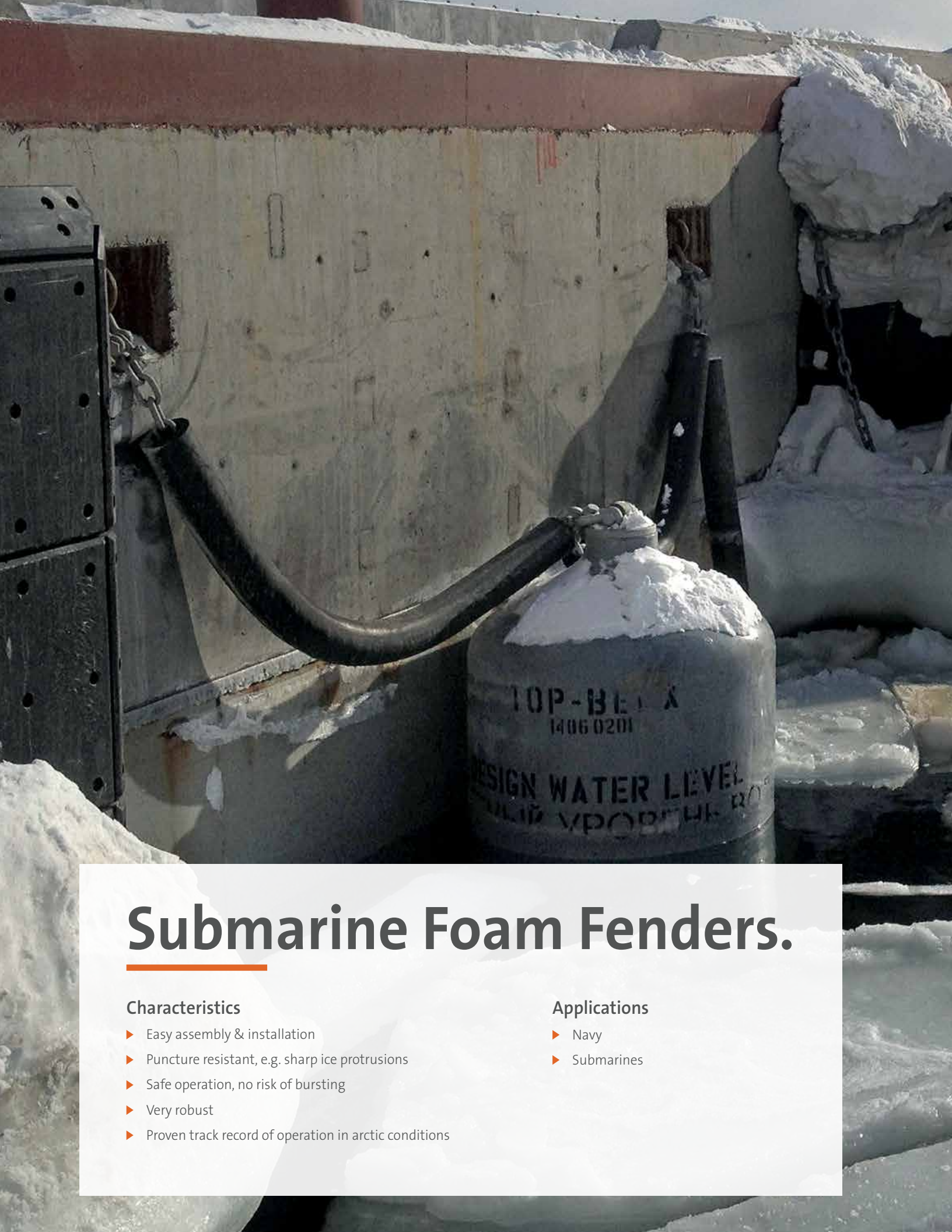


Ship-to-Ship Fender

GENERIC PERFORMANCE CURVE OCEAN CUSHION FENDERS



Kaiserschleuse | Bremerhaven I Germany



Submarine Foam Fenders.

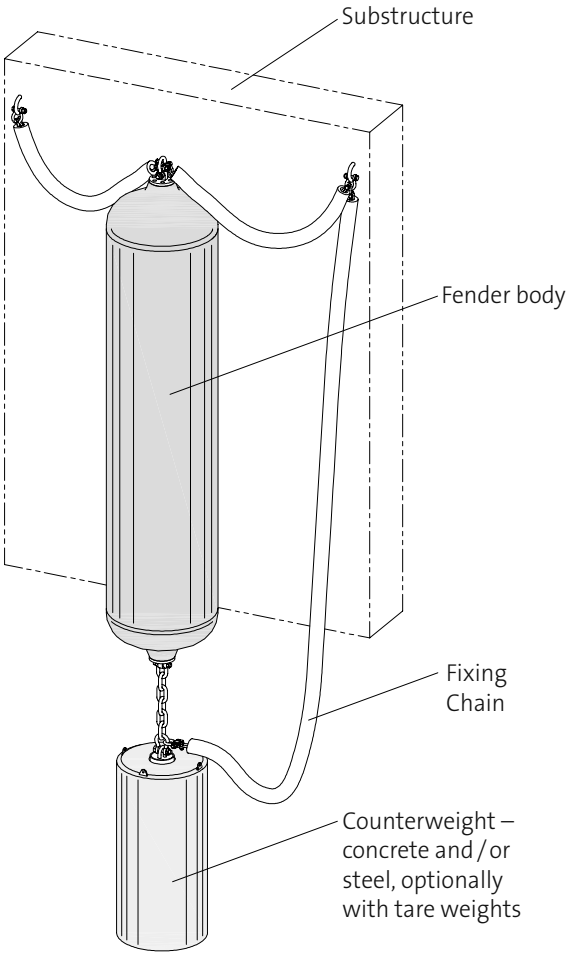
Characteristics

- Easy assembly & installation
- Puncture resistant, e.g. sharp ice protrusions
- Safe operation, no risk of bursting
- Very robust
- Proven track record of operation in arctic conditions

Applications

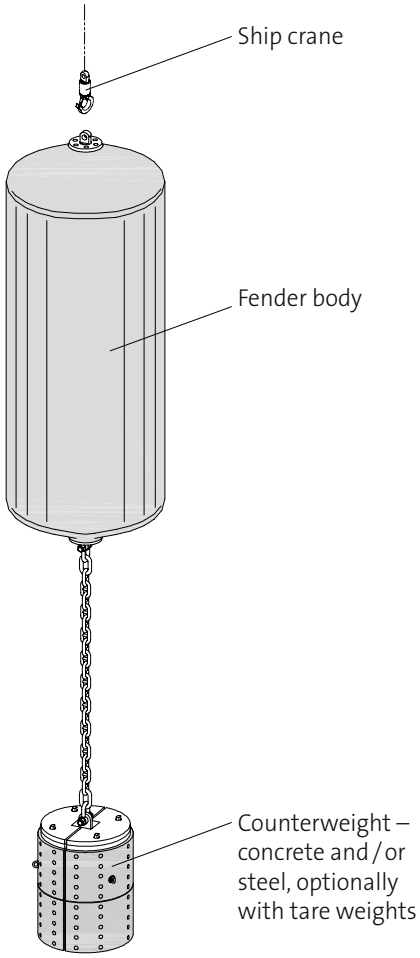
- Navy
- Submarines

SHIP-TO-SHORE OPERATION

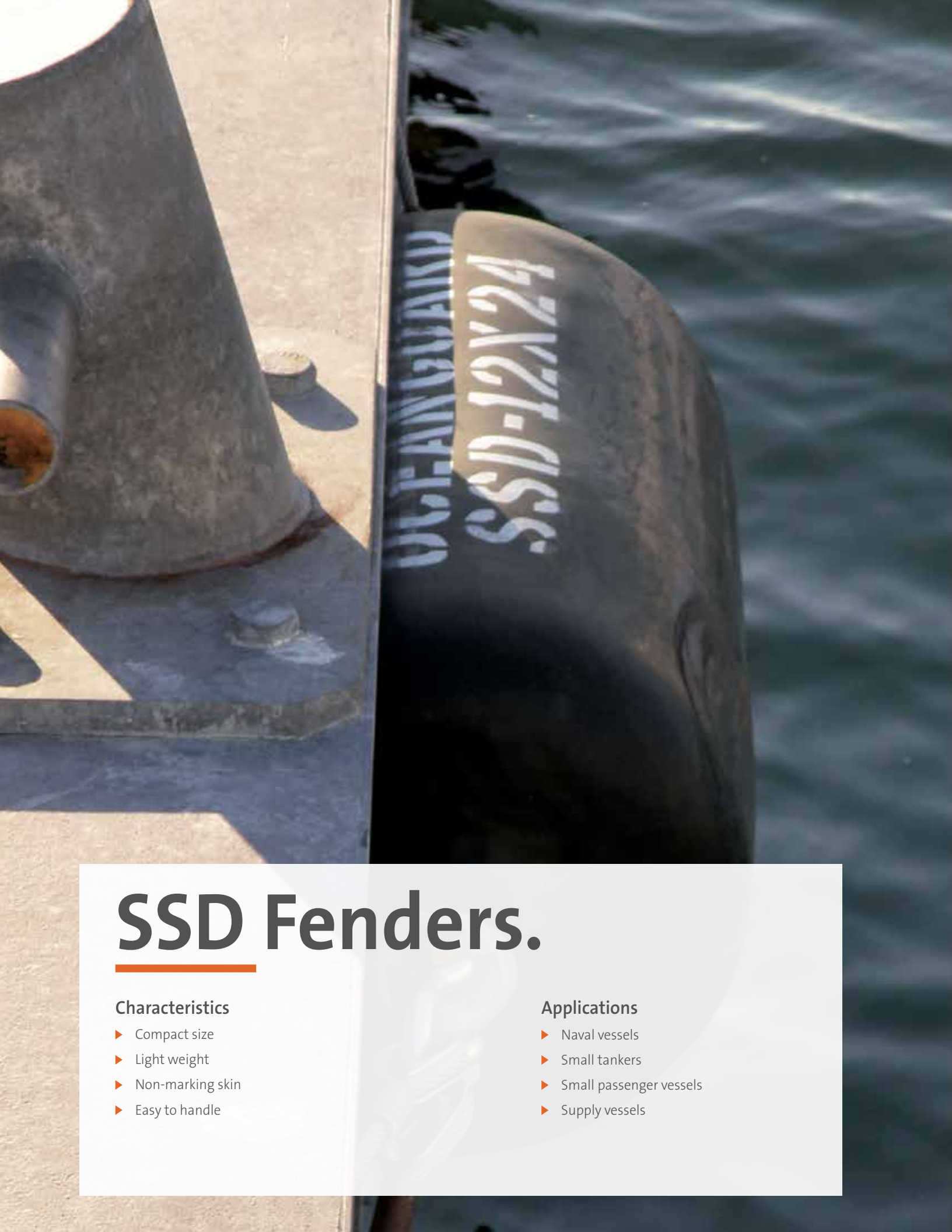


Ship-to-Shore Fenders

SHIP-TO-SUBMARINE OPERATION



Ship-to-Submarine Fenders



SSD Fenders.

Characteristics

- Compact size
- Light weight
- Non-marking skin
- Easy to handle

Applications

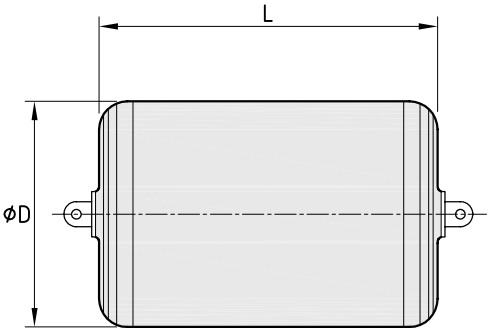
- Naval vessels
- Small tankers
- Small passenger vessels
- Supply vessels

SSD FENDER DIMENSIONS AND PERFORMANCE VALUES

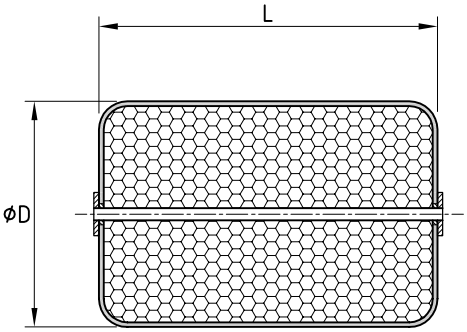
Fender Size D x L [mm]	Low Capacity			Enhanced Capacity			Standard Capacity			Hardware* [mm]
	Energy [kNm]	Reaction [kN]	Weight [kg]	Energy [kNm]	Reaction [kN]	Weight [kg]	Energy [kNm]	Reaction [kN]	Weight [kg]	
400 x 900	4.3	48.5	20.4	5.8	64.5	21.8	7.2	80.8	23.6	13
500 x 900	6.8	60.5	26.8	9.0	80.5	29.0	11.3	100.8	31.7	13
500 x 1,000	7.1	63.6	28.6	9.4	84.6	31.7	11.7	106.0	34.5	13
500 x 1,200	8.7	78.3	33.1	11.5	104.1	36.3	14.4	130.5	39.9	13
600 x 900	9.2	69.8	33.6	12.3	92.9	37.2	15.3	116.4	41.3	13
600 x 1,200	12.3	92.5	41.7	16.4	123.0	46.7	20.5	154.2	51.7	13
900 x 1,200	27.8	141.4	73.5	37.0	188.1	84.8	46.2	235.7	96.1	16
900 x 1,500	34.8	176.6	87.5	46.3	234.9	102.0	57.9	294.3	116.1	16
1,000 x 1,500	40.8	191.3	102.0	54.3	254.4	120.2	67.9	318.8	137.9	16

Above mentioned sizes are indicative and may change during final design process | Performance based on 60 % nominal rated deflection
* For standard capacity

SSD FENDER DRAWING



WITH INTERNAL CHAIN



WITH THROUGH PIPE

Navy Base | Norfolk, VA | USA

Navy Base | Norfolk, VA | USA

Donut Fenders.

Characteristics

- Proportional load deflection curve
- Low shear forces
- Self-adjusting to changing water levels
- Low installation costs
- Generally maintenance free
- Individual drafts can be controlled by counterweights

Applications

- Locks and dry dock entrances, corner protection, turning dolphins
- areas with large tidal variations or bridge protections
- Other monopile structures
- Submarine jetties

DONUT FENDER DIMENSIONS

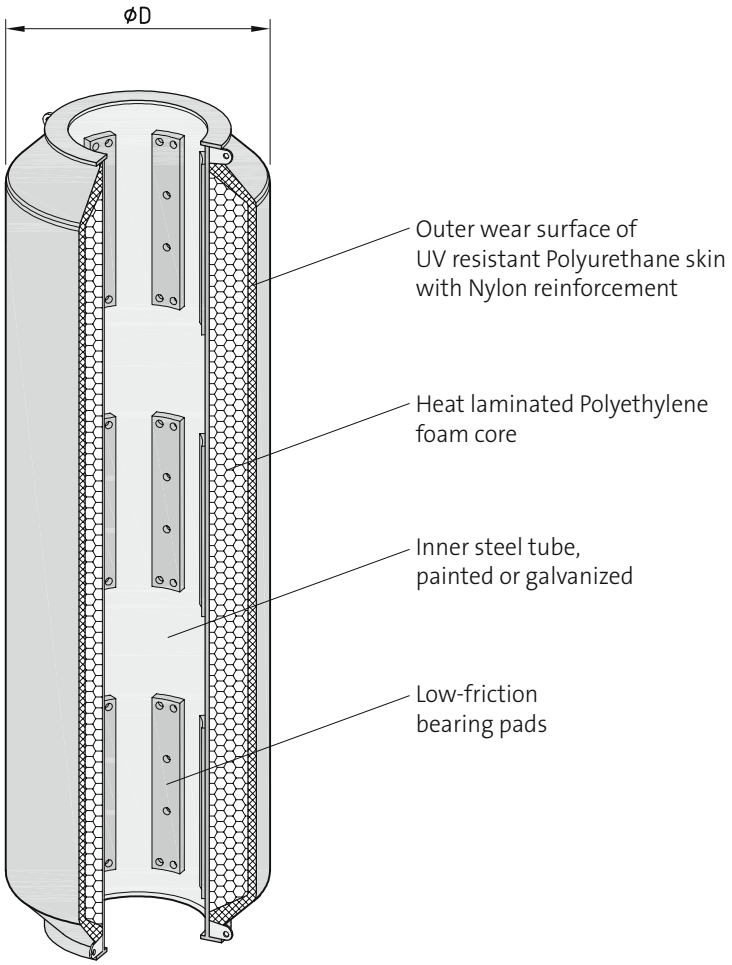
Fender Size D [mm]	Max. Pile Diameter [mm]	Low Capacity*		Standard Capacity*		High Capacity*	
		Energy [kNm]	Reaction [kN]	Energy [kNm]	Reaction [kN]	Energy [kNm]	Reaction [kN]
900	457	1.5	40	2.4	69	3.8	110
1,270	610	4.2	68	7.2	116	11.3	182
1,450	710	5.4	77	9.2	131	14.4	206
1,520	762	6.2	82	10.5	140	16.5	220
1,780	914	8.3	95	14.1	162	22.1	254
1,910	995	9.6	103	16.4	175	25.7	275
2,030	1,067	10.9	109	18.6	186	29.2	292
2,210	1,185	13.1	120	22.3	204	35.0	320
2,290	1,219	13.9	124	23.6	210	37.1	330
2,490	1,345	16.5	135	28.0	229	44.0	360
2,540	1,372	17.2	138	29.3	234	46.0	367
2,790	1,524	20.8	151	35.3	256	55.4	402
2,970	1,639	23.6	161	40.1	273	63.0	429
3,050	1,676	24.8	165	42.1	280	66.1	440
3,300	1,829	29.1	179	49.5	304	77.7	477
3,450	1,933	32.1	188	54.6	319	85.7	501
3,530	1,981	33.6	192	57.2	327	89.8	513
3,810	2,134	38.8	206	65.9	350	103.5	550
3,960	2,241	42.4	215	72.1	366	113.2	575
4,060	2,286	44.2	220	75.1	374	117.9	587
4,220	2,388	47.8	229	81.3	389	127.6	611

Intermediate sizes and different foam capacities available upon request
* Value for height = 1,000 mm

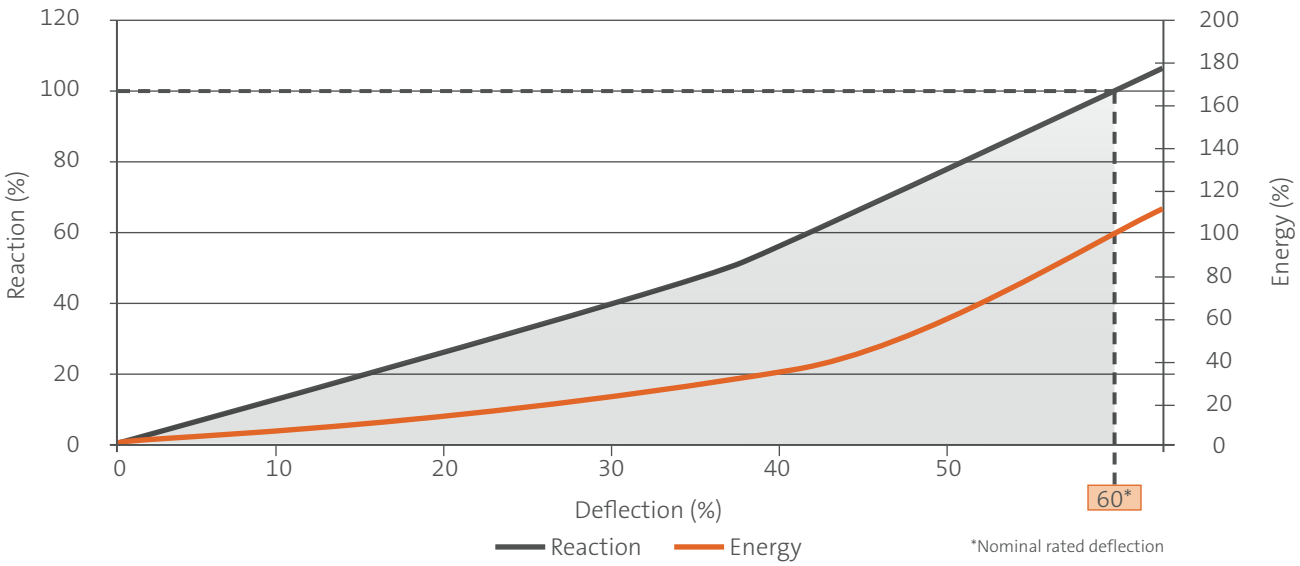
SeaLink Terminal | Auckland | New Zealand

Ferry Terminal | Sejerø | Denmark

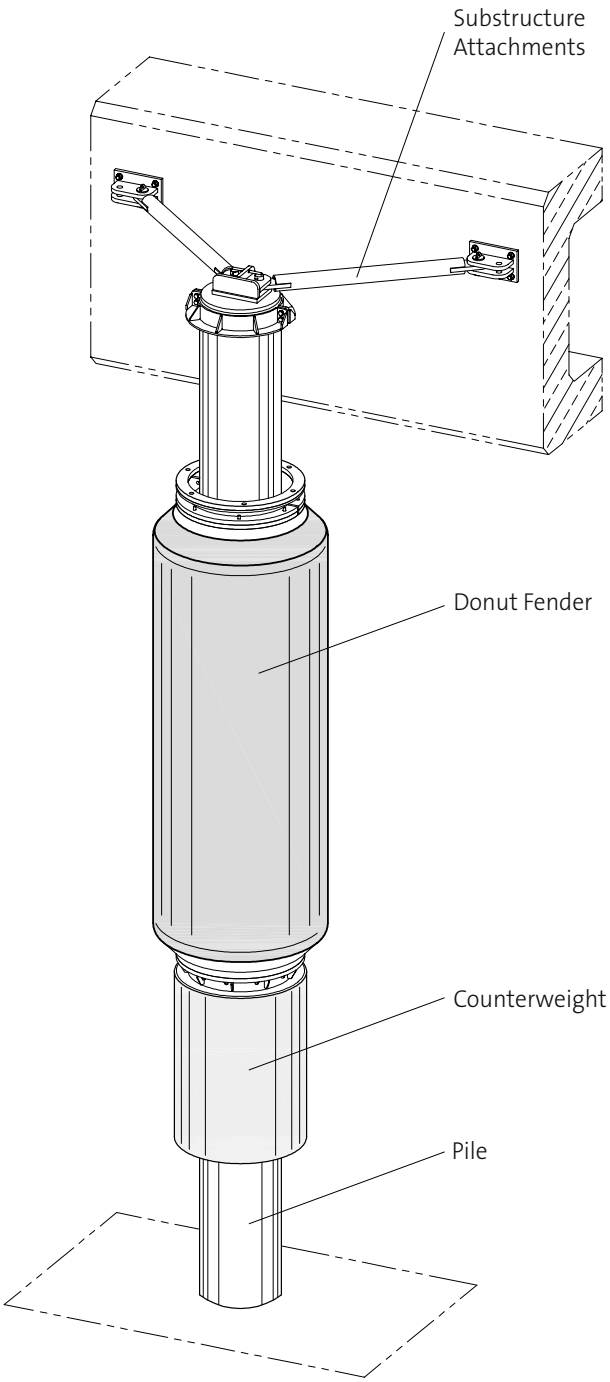
DONUT FENDER DRAWING



GENERIC PERFORMANCE CURVE DONUT FENDERS



DONUT FENDER DRAWING WITH COUNTERWEIGHT



Navy Base | Eckernförde | Germany

Floating Systems.

Characteristics

- Unsinkable foam filled construction
- Highly visible PU skin
- Low maintenance and long-life construction
- Customized sized and overall length
- Can be deployed with anchoring buoys
- Unsinkable construction

Buoy Applications

- Mooring
- Marking
- Navigational Aids

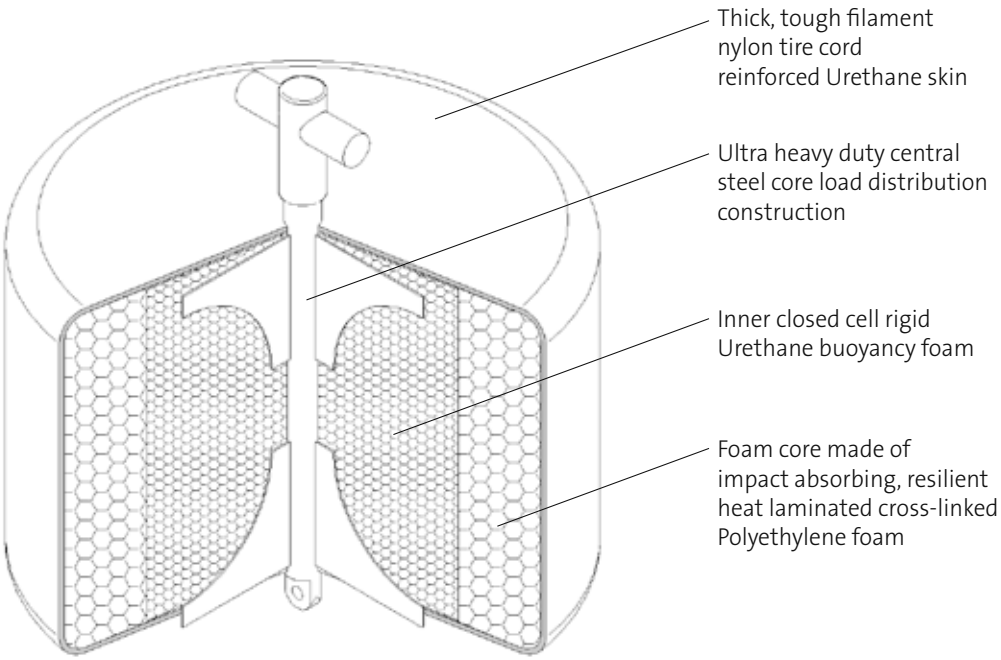
Barrier Applications

- Protect new weirs in case a ship gets off course
- Demarcation barriers
- Physically restrict entry in sensitive areas

OCEAN GUARD BUOYS

The ShibataFenderTeam Group offers a wide range of Ocean Guard Buoys for mooring and navigation applications in all marine environments from shallow waters to offshore applications. Our buoys have a customized design, are unsinkable, highly visible and require only low maintenance.

TYPICAL BUOY DRAWING



For technical details and dimensions, please visit our Buoy section on our website.

Coming soon:
SFT Buoys and Barriers brochure.

Mooring Buoy

BUOY TYPES

MOORING BUOY

SUPPORT BUOY

UNIVERSAL BUOY

UTILITY CYLINDRICAL BUOY

PENDANT BUOY

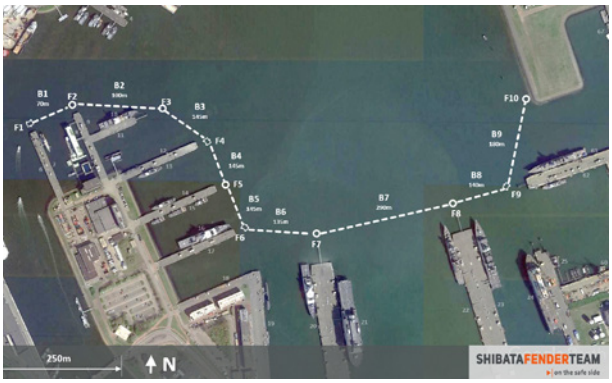
CHAIN THROUGH BUOY

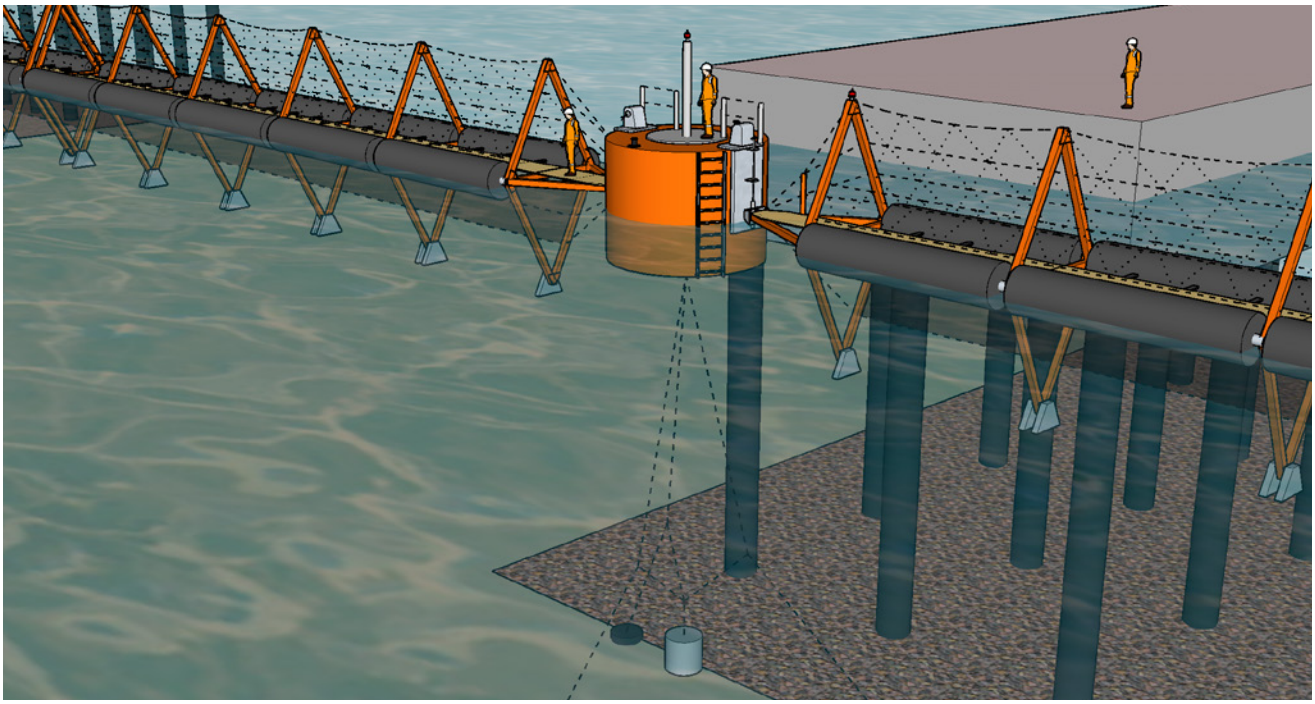
NAVIGATIONAL BUOY

MARKER BUOY

FLOATING BARRIERS

ShibataFenderTeam Ocean Guard Floating Barriers are bespoke barrier systems for demarcation, security and entry restriction applications in all marine environments from shallow to offshore. There is no standard range of floating barriers because each project is different. However our experienced team of engineers offers free of charge in-house design service to match project related needs.





Typical Security Barrier Layout

Canal Seine-Nord Europe | Oudenaarde | Belgium

Pneumatic Fenders.

Characteristics

- Proportional increase of energy and reaction
- Low hull pressure
- Economical solution
- Easily deflateable to be used in different locations and to be stored on deck of vessels
- Built as per ISO 17357-1:2014

Applications

- In ports with extreme tidal variations
- Ship-to-ship operations
- Oil & Gas (typically FSRU)
- Temporary berthing

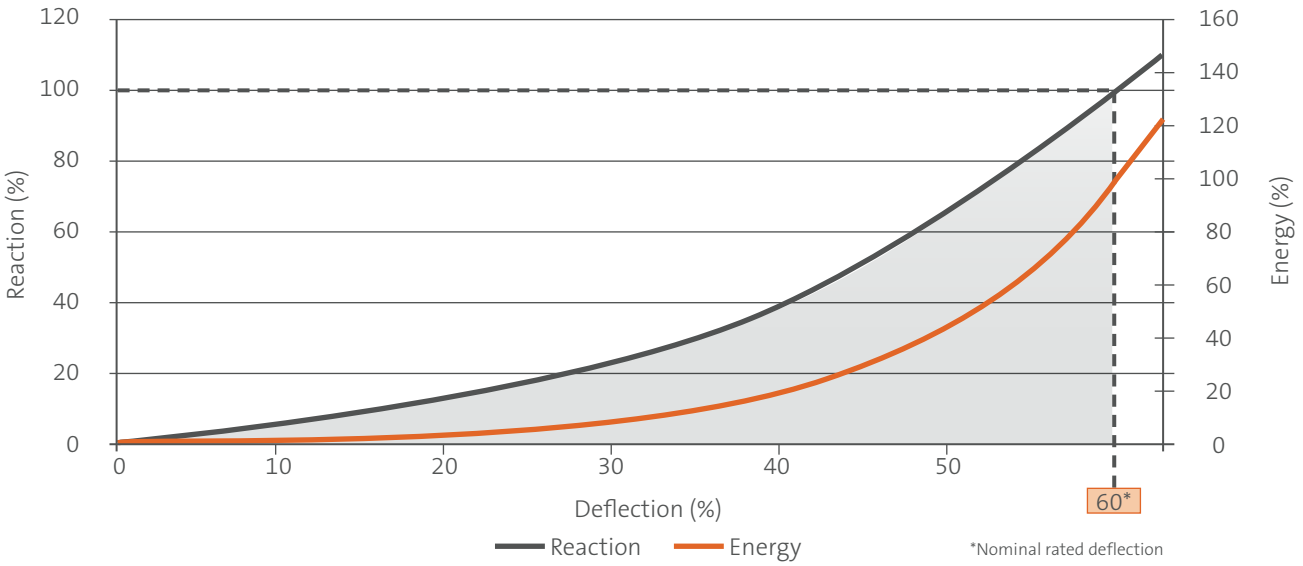
Read more in our Pneumatic Fender Manual

PNEUMATIC FENDER DIMENSIONS AND PERFORMANCE VALUES

Fender Size D x L [mm]	Initial Pressure 0.5 kg / cm²			Initial Pressure 0.8 kg / cm²			Weight		
	Guaranteed energy absorption (GEA) [kNm]	Reaction force at GEA deflection [kN]	Hull pressure at GEA deflection [kN/m²]	Guaranteed energy absorption (GEA) [kNm]	Reaction force at GEA deflection [kN]	Hull pressure at GEA deflection [kN/m²]	Fender Body [kg]	Chain & tire net [kg]	Total* [kg]
500 x 1,000	6	64	132	8	85	174	25	55	80
600 x 1,000	8	74	126	11	98	166	30	65	95
700 x 1,500	17	137	135	24	180	177	45	100	145
1,000 x 1,500	32	182	122	45	239	160	60	110	170
1,000 x 2,000	45	257	132	63	338	174	75	150	225
1,200 x 2,000	63	297	126	88	390	166	110	180	290
1,350 x 2,500	102	427	130	142	561	170	170	210	380
1,500 x 3,000	153	579	132	214	761	174	220	400	620
1,700 x 3,000	191	639	128	267	840	168	250	520	770
2,000 x 3,500	308	875	128	430	1,150	168	360	670	1,030
2,500 x 4,000	663	1,381	137	925	1,815	180	650	830	1,480
2,500 x 5,500	943	2,019	148	1,317	2,653	195	860	1,050	1,910
3,300 x 4,500	1,175	1,884	130	1,640	2,476	171	1,100	1,600	2,700
3,300 x 6,500	1,814	3,015	146	2,532	3,961	191	1,660	2,300	3,960
3,300 x 10,600	3,067	5,257	158	4,281	6,907	208	3,000	4,700	7,700
4,500 x 9,000	4,752	5,747	146	6,633	7,551	192	3,800	3,680	7,480
4,500 x 12,000	6,473	7,984	154	9,037	10,490	202	7,000	8,570	15,570

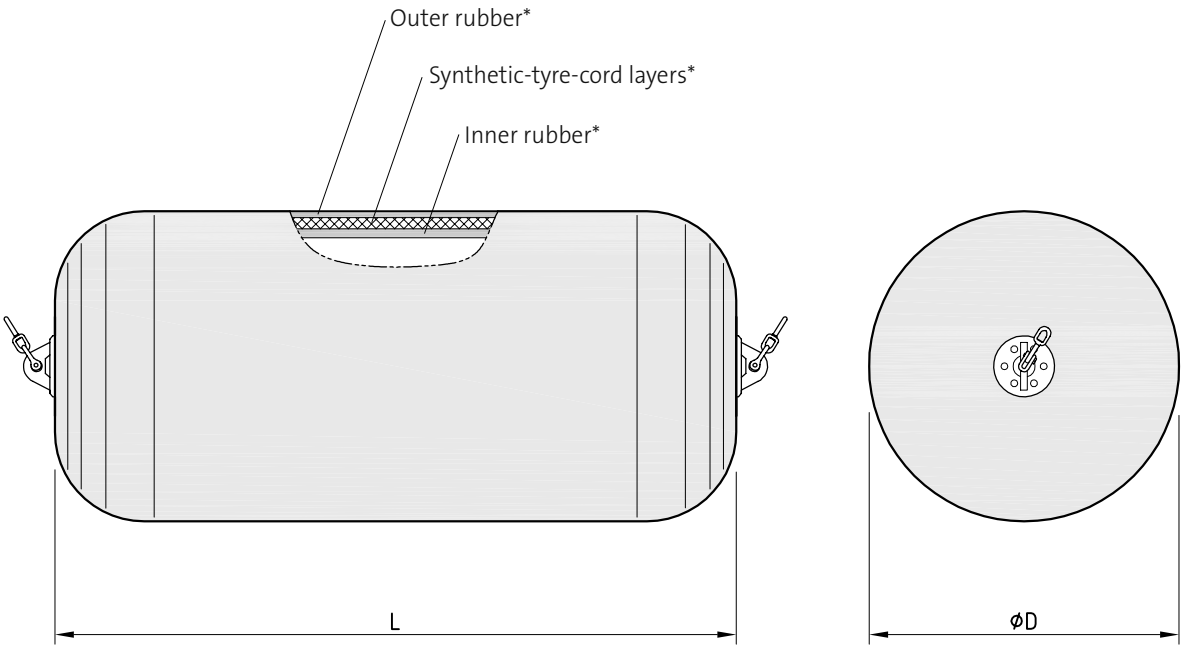
* Total weight (fender body including chain & tire net)

GENERIC PERFORMANCE CURVE PNEUMATIC FENDERS



Standard manufacturing and performance tolerance: Energy: 100 % | Reaction: 100 % ± 10 % | Deflection: 60 % ± 5%

SLING-TYPE DRAWING

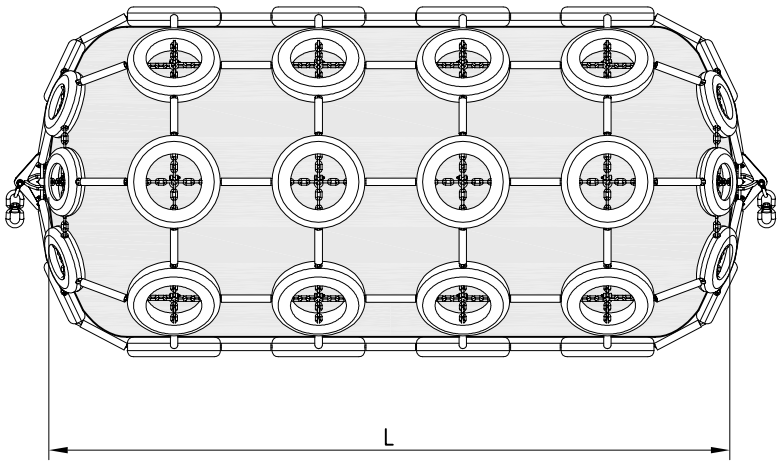


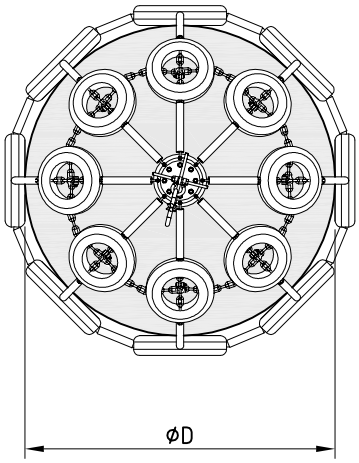
* Not to scale

Seenotretter | Sassnitz | Germany

Navy Base | Guam | USA

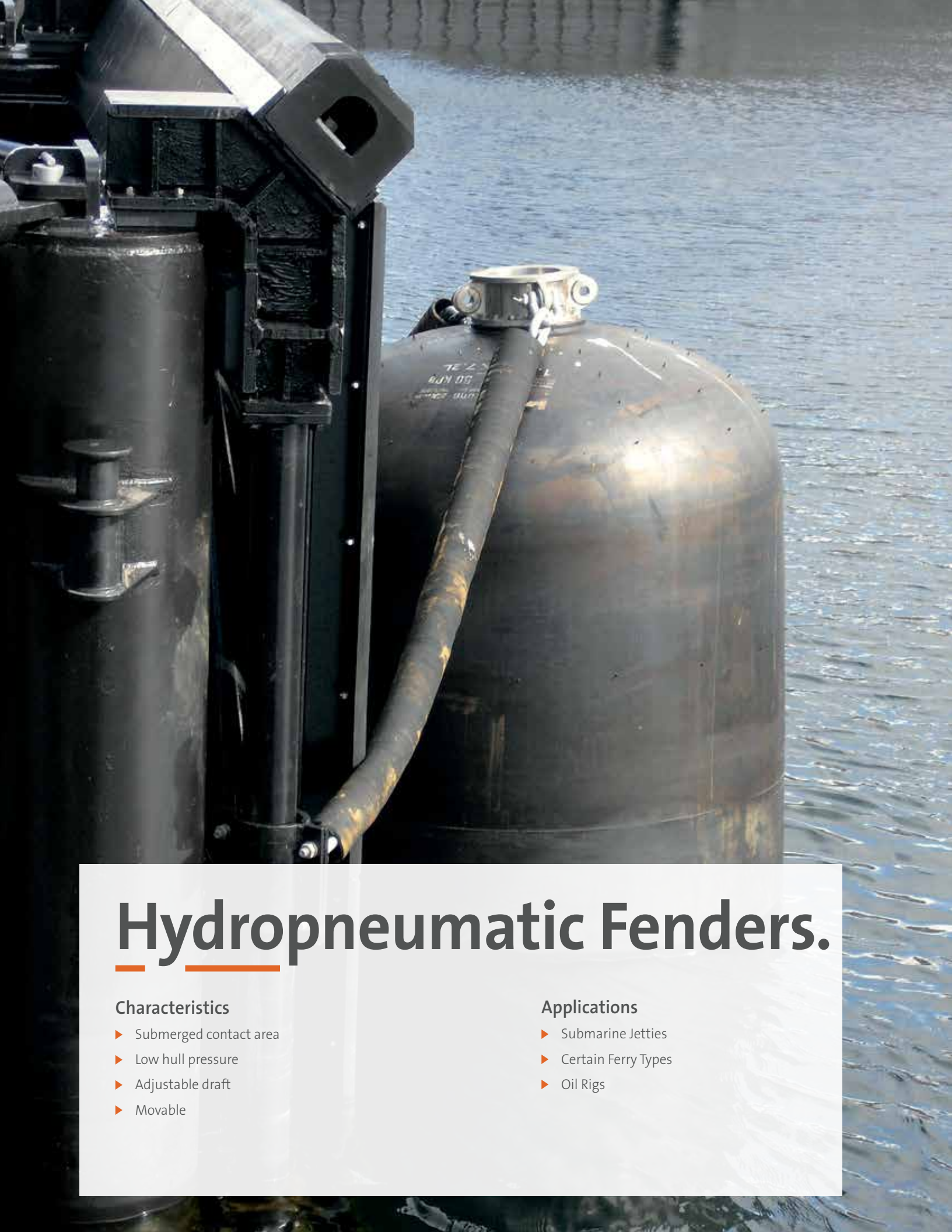
CHAIN & TIRE NET TYPE DRAWING





Ponto Colombo T7 | Genova | Italy

Cruise Terminal | Rostock | Germany



Hydropneumatic Fenders.

Characteristics

- Submerged contact area
- Low hull pressure
- Adjustable draft
- Movable

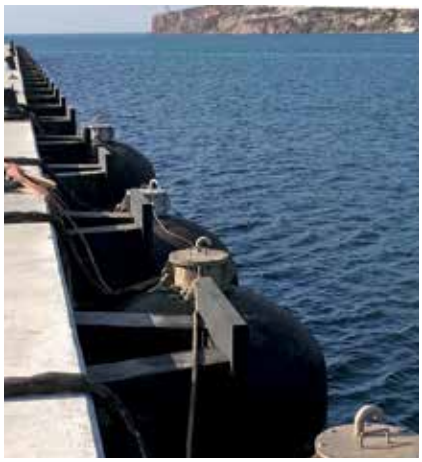
Applications

- Submarine Jetties
- Certain Ferry Types
- Oil Rigs

HYDROPNEUMATIC FENDER DIMENSIONS AND PERFORMANCE VALUES

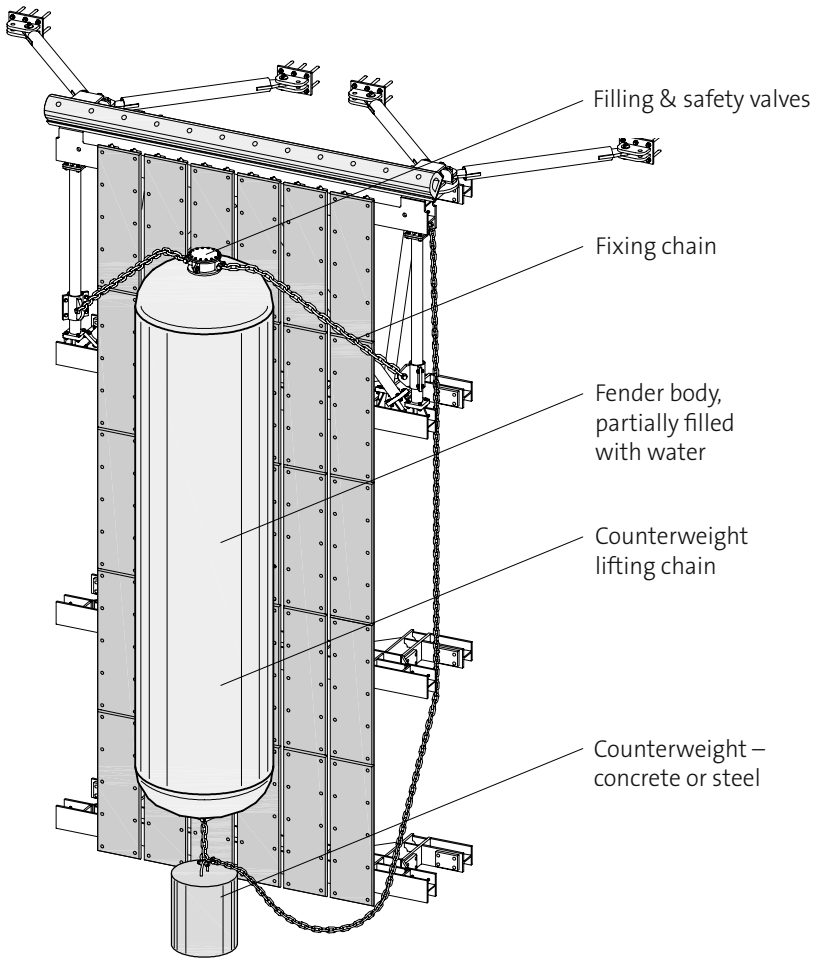
	Without water 60 % deflection		Filled with water 45 % deflection		
Fender Size [mm]	Energy [kNm]	Reaction [kN]	Ratio water / air [%]	Energy [kNm]	Reaction [kN]
1,700 x 7,200	560	1,810	65 / 35	134	611
2,000 x 6,000	647	1,766	65 / 35	155	599
2,500 x 5,500	928	2,037	65 / 35	223	687
3,300 x 6,500	1,913	3,169	60 / 40	616	1,247
3,300 x 10,600	3,120	5,170	55 / 45	589	1,275

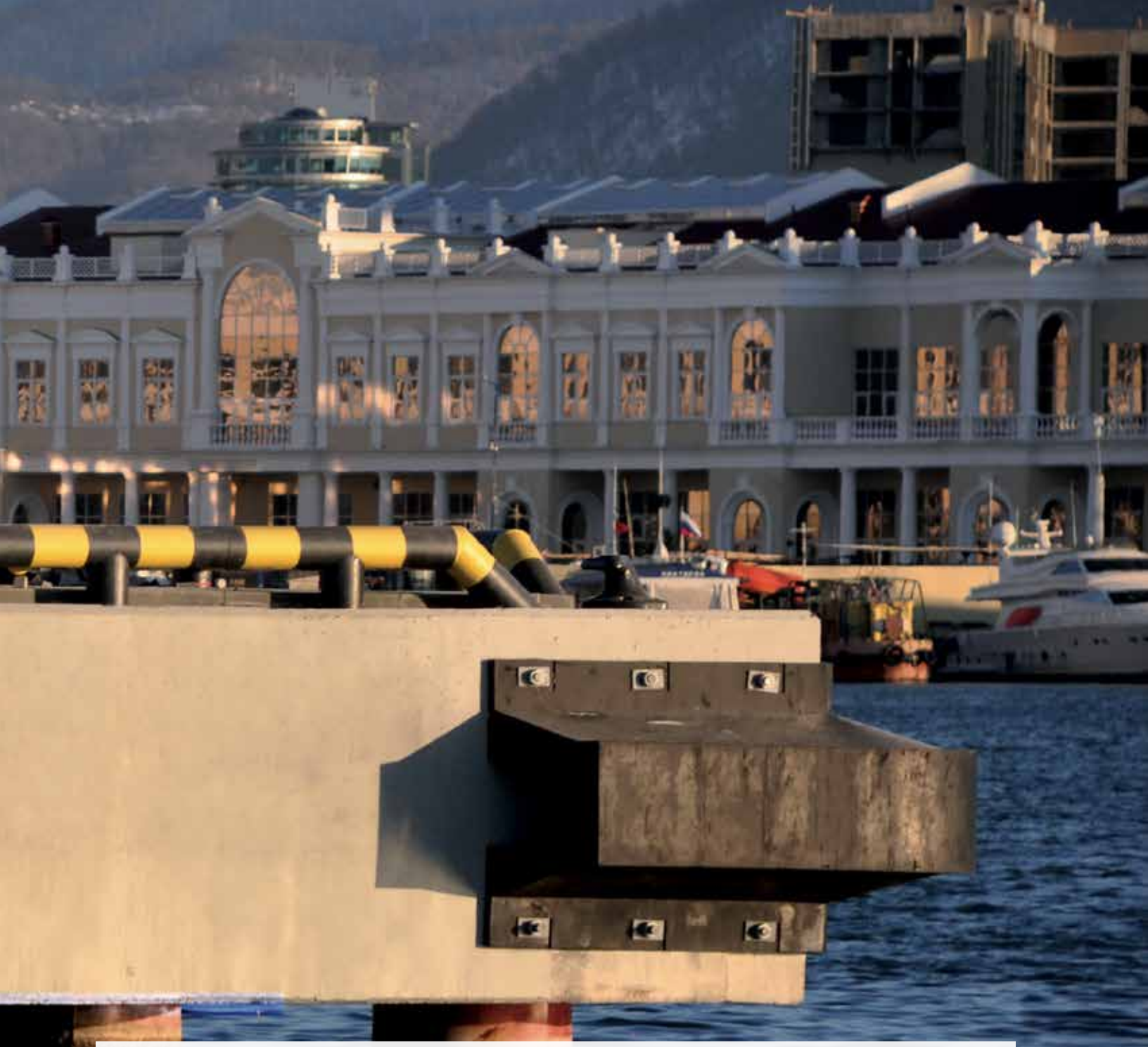
Standard tolerance of ± 10 %



FOCA | Izmir | Turkey

HYDROPNEUMATIC FENDER DRAWING WITH CUSTOMIZED SUBSTRUCTURE





Corner Fenders.

Characteristics

- Protect exposed corners
- Simple design and easy to install
- Customized designs available
- Highly visible as colored PU option
- Available in PU and rubber

Applications

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

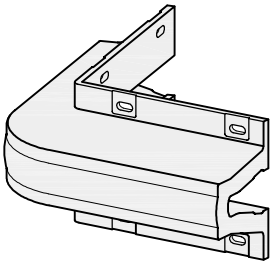
CORNER V FENDER DIMENSIONS

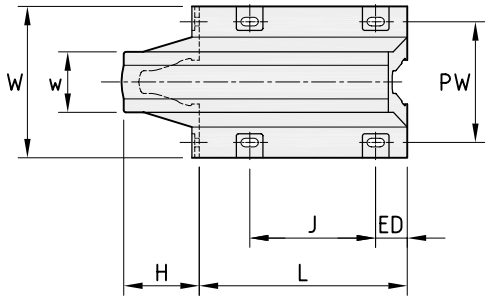
H [mm]	L* [mm]	W [mm]	PW [mm]	w [mm]	ED [mm]	J [mm]	Anchors/ Bolts	Weight [kg]
150	750 + 750	300	240	98	100	400	8	52
200	750 + 750	400	320	130	100	350	8	94
250	810 + 810	500	400	162	130	420	8	142
300	700 + 700	600	480	190	140	360	8	208
800	1,900 + 1,900	1,500	1,300	640	250	650	12	2,955

Made from rubber or PU
* Other lengths available upon request

Coast Guard Terminal | Puerto Rico

CORNER V FENDER DRAWING





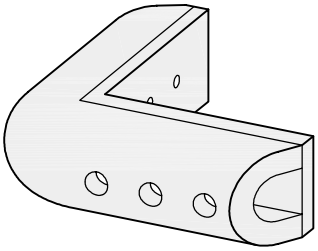
CORNER PU FENDER DIMENSIONS

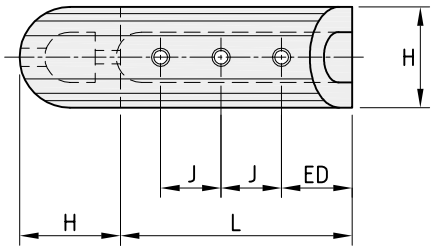
H [mm]	L [mm]	ED [mm]	J [mm]	Anchors/ Bolts	Weight [kg]
300	1,000 + 1,000	250	300	6	250
500	1,150 + 1,150	350	300	6	664

Optionally made from rubber

Kaiserschleuse | Bremerhaven | Germany

CORNER PU FENDER DRAWING





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

Roller Fenders.

Characteristics

- Guiding system & energy absorption
- Typically maintenance free
- Multipurpose use
- No friction due to fender rotation

Applications

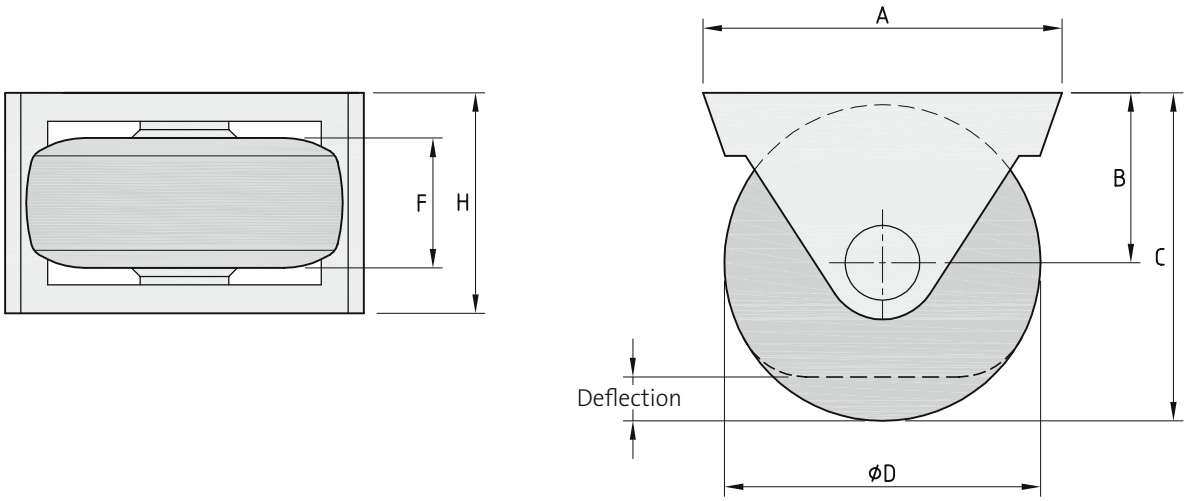
- Entrance to locks, dry docks and other narrow or exposed areas

ROLLER FENDER DIMENSIONS AND PERFORMANCE VALUES

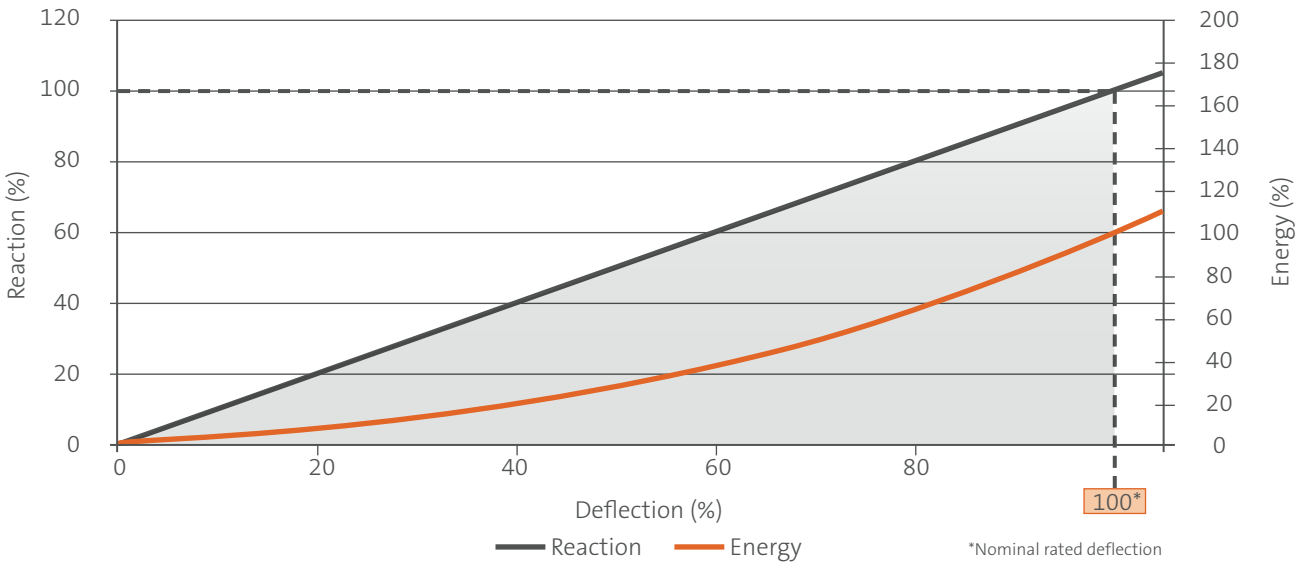
Fender Type	A [mm]	B [mm]	C [mm]	Ø D [mm]	H [mm]	F [mm]	Energy [kNm]	Reaction [kN]	Deflection [mm]	Pressure [bar]
RF 110 x 45	1,250	610	1,150	1,080	800	460	13	175	152	5.5
RF 130 x 50	1,530	740	1,400	1,320	950	510	22	200	230	3.5
RF 140 x 60	1,600	765	1,450	1,370	1,000	610	20	210	205	3.5
RF 175 x 70	2,050	975	1,850	1,750	1,250	690	37	345	225	4.8
RF 200 x 75	2,300	1,110	2,100	1,980	1,400	765	100	765	270	5.5
RF 250 x 100	3,000	1,425	2,700	2,550	1,800	895	170	1,000	345	5.5

Above mentioned sizes are indicative and may change during final design process

ROLLER FENDER DRAWING



GENERIC PERFORMANCE CURVE ROLLER FENDERS



Wheel Fenders.

Characteristics

- Higher energy absorption compared to Roller Fenders due to triple deflection
- Multipurpose use
- Guiding system & energy absorption
- Typically maintenance free
- No friction due to fender rotation

Applications

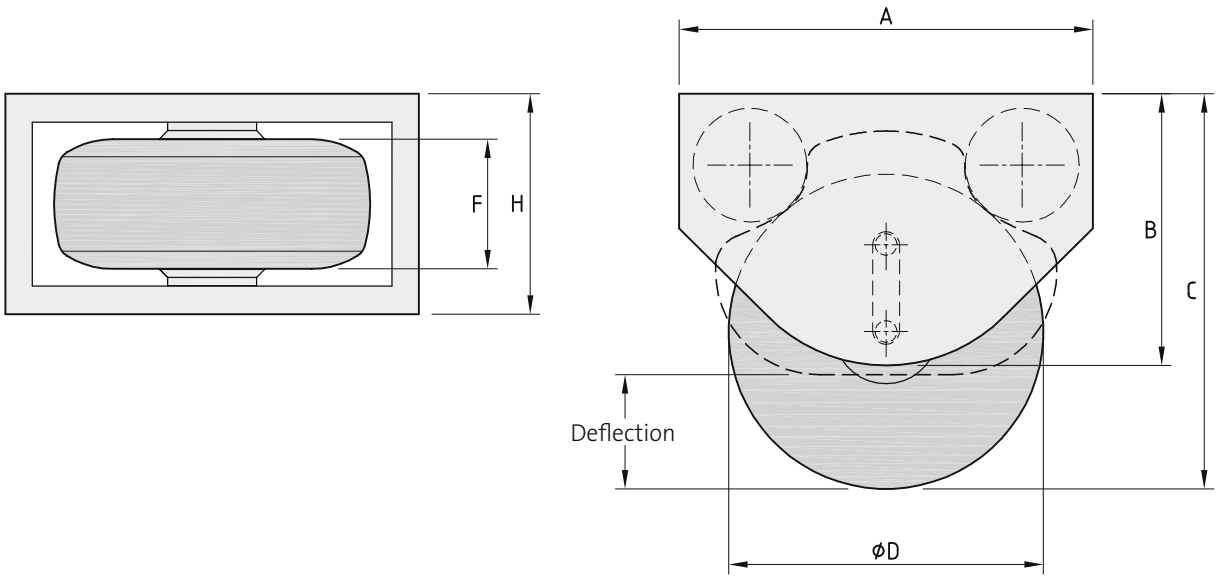
- Entrance to locks, dry docks and other narrow or exposed areas

WHEEL FENDER DIMENSIONS AND PERFORMANCE VALUES

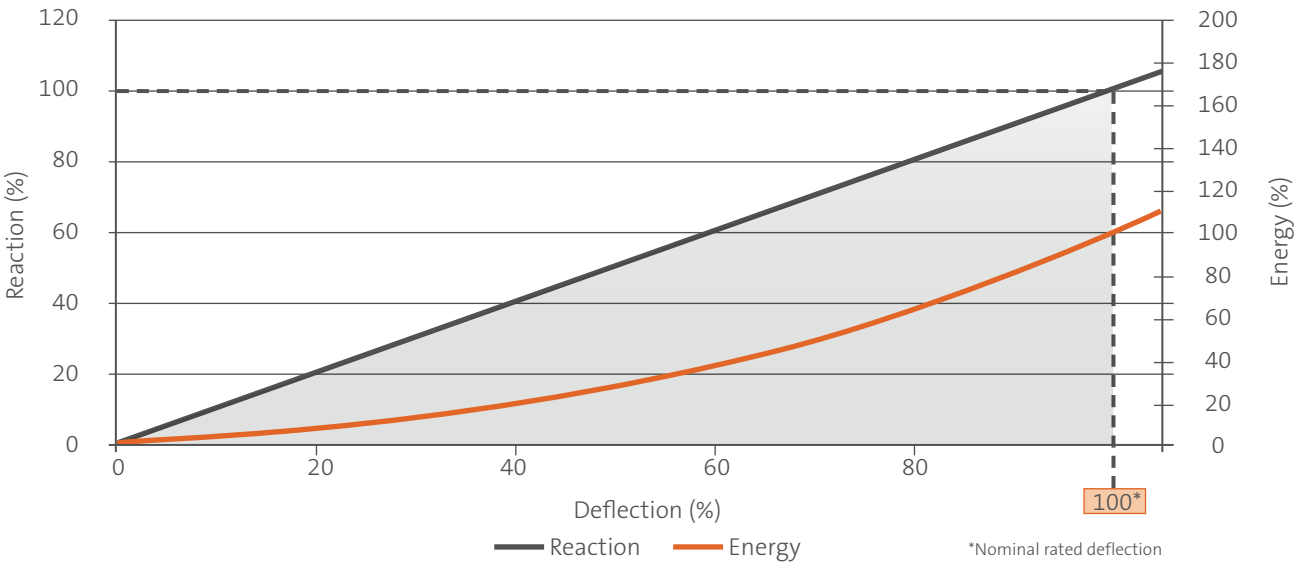
Fender Type	A [mm]	B [mm]	C [mm]	Ø D [mm]	H [mm]	F [mm]	Energy [kNm]	Reaction [kN]	Deflection [mm]	Pressure [bar]
WF 110 x 45	1,700	1,000	1,450	1,080	900	460	33	150	400	5.5
WF 130 x 50	2,000	1,200	1,750	1,300	1,000	510	61	220	500	3.5
WF 175 x 70	2,650	1,500	2,200	1,750	1,150	690	100	315	600	4.8
WF 200 x 75	2,750	1,750	2,550	1,980	1,250	760	220	590	700	5.5
WF 250 x 100	3,350	2,200	3,200	2,550	1,600	970	440	920	925	5.5
WF 290 x 110	4,200	2,500	3,750	2,900	1,700	1,020	880	1,300	1,200	5.8

Above mentioned dimensions are indicative and may change during final design process

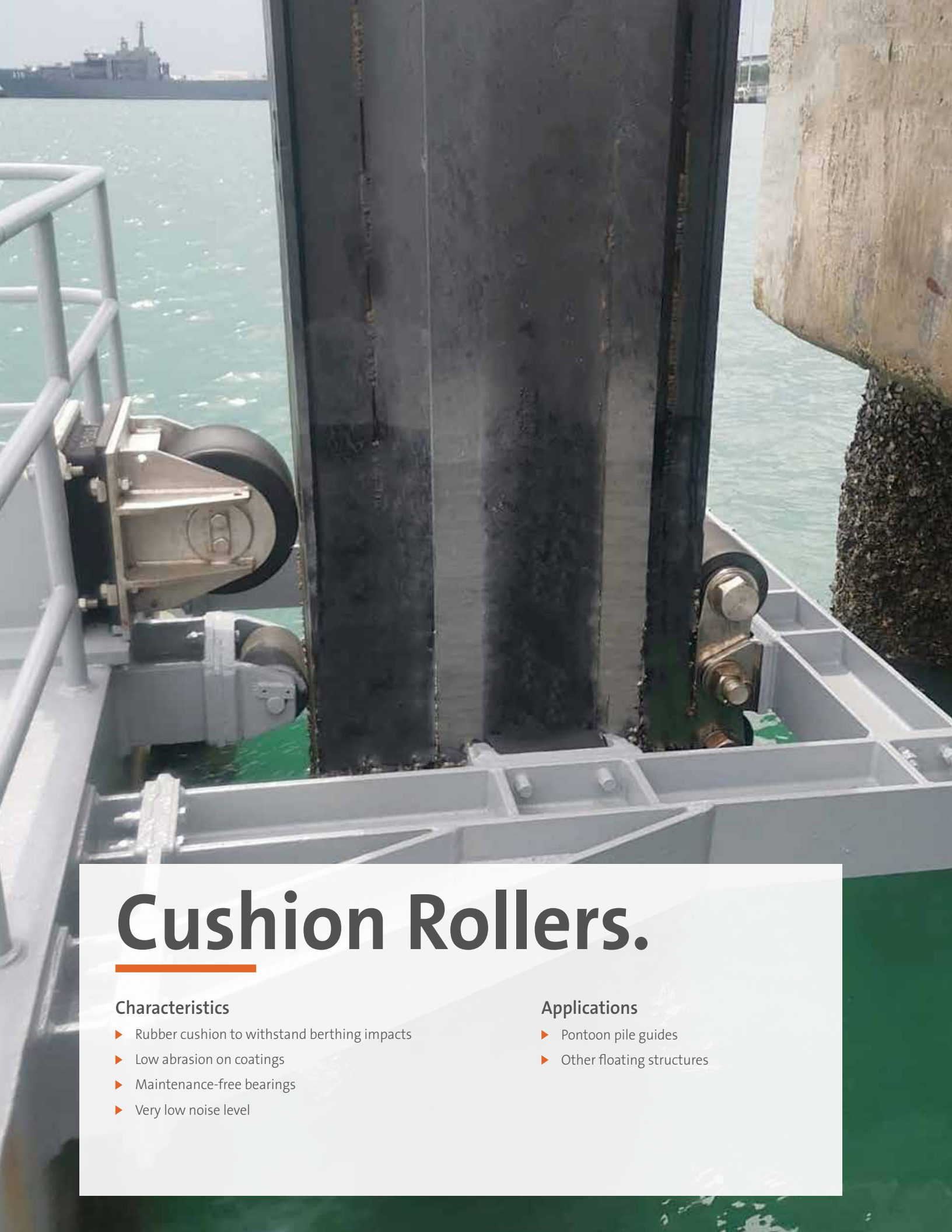
WHEEL FENDER DRAWING



GENERIC PERFORMANCE CURVE WHEEL FENDERS



*Nominal rated deflection



Cushion Rollers.

Characteristics

- Rubber cushion to withstand berthing impacts
- Low abrasion on coatings
- Maintenance-free bearings
- Very low noise level

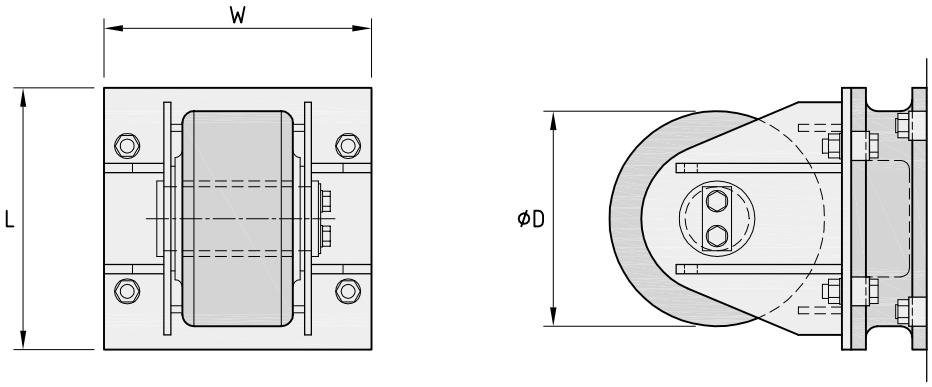
Applications

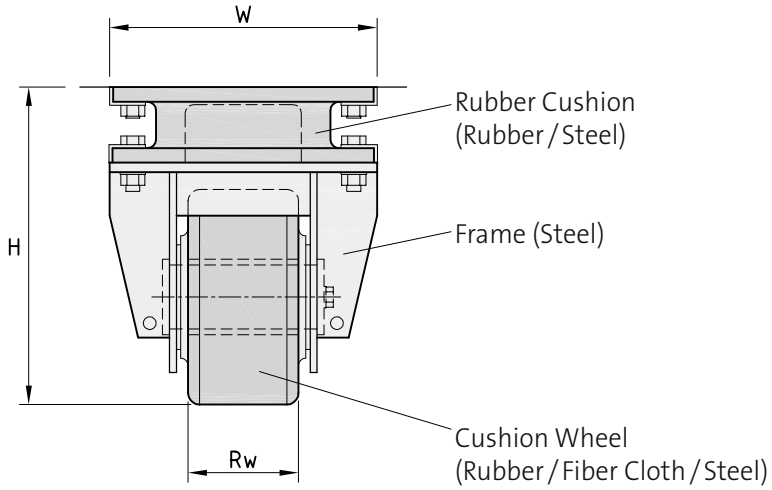
- Pontoon pile guides
- Other floating structures

CUSHION ROLLER DIMENSIONS

Fender Type	W [mm]	L [mm]	Ø D [mm]	H [mm]	Rw [mm]	Design Load [kN]	Anchors / Bolts	Weight [kg]
CR 10	450	450	370	542	125	100	M20	130
CR 15	460	450	370	542	190	150	M20	150
CR 20	530	450	370	546	250	200	M24	190
CR 25	630	450	370	546	320	250	M24	241
CR 30	630	450	370	546	320	300	M30	243
CR 35	630	450	370	546	320	350	M30	245

CUSHION ROLLER DRAWING





Extruded Fenders.

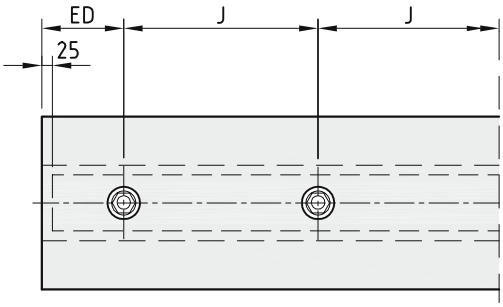
Characteristics

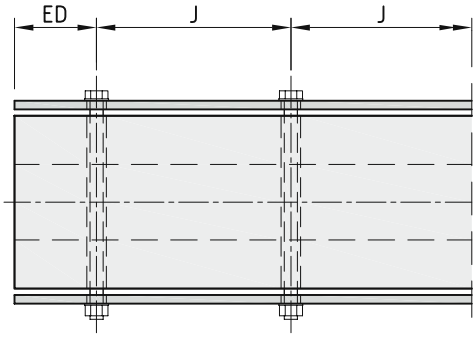
- Simple & easy installation
- Customized sizes
- Wide range of applications

Applications

- Marinas
- Multipurpose fendering
- Tug Boats and Workboats
- Small boat berths

TYPICAL FIXING DETAILS

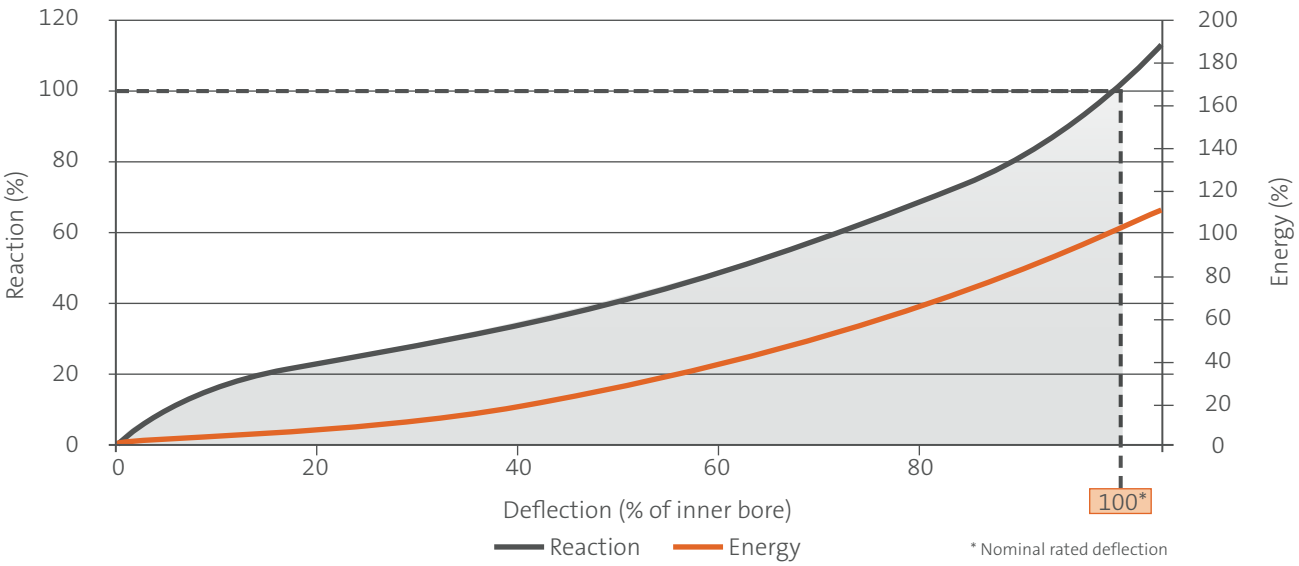




Husavik | Iceland

Den Helder | The Netherlands

GENERIC PERFORMANCE CURVE EXTRUDED FENDERS



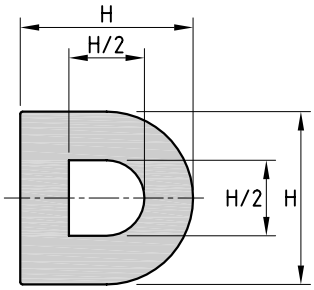
D FENDERS.

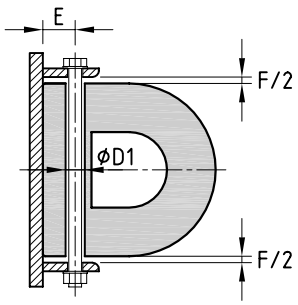
DD FENDER DIMENSIONS AND PERFORMANCE VALUES

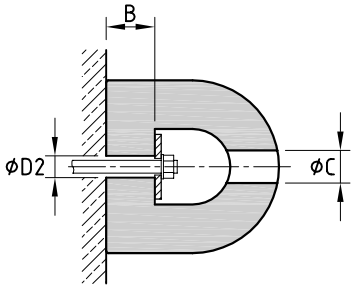
H [mm]	B [mm]	C [mm]	D1 [mm]	D2 [mm]	E [mm]	F [mm]	J* [mm]	ED* [mm]	Flat Bar [mm]	An-chors	Weight [kg/m]	Energy [kNm]	Reaction [kN]
100 x 100	25.0	30	18	24	25	10	200–300	90–130	40 x 5	M12	8.3	1.4	77
150 x 150	37.5	40	24	32	30	12	250–350	110–150	50 x 8	M16	18.0	3.2	115
200 x 200	50.0	50	30	40	45	15	300–400	130–180	70 x 10	M20	32.0	5.7	153
250 x 250	62.5	60	36	48	50	20	350–450	140–200	90 x 12	M24	50.0	8.9	191
300 x 300	75.0	60	36	48	60	25	350–450	140–200	100 x 12	M24	72.0	12.9	230
350 x 350	87.5	75	45	60	70	25	350–450	140–200	130 x 15	M30	103.6	17.6	268
380 x 380	95.0	75	45	60	80	30	350–450	140–200	140 x 15	M30	122.1	20.0	286
400 x 400	100.0	75	45	60	80	30	350–450	140–200	150 x 15	M30	128.0	23.0	306
500 x 500	125.0	90	54	72	90	40	400–500	160–230	180 x 20	M36	200.0	35.9	383

* For fixing details see p. 83 | Performance values for single units of 1,000 mm length

DD FENDER DRAWING



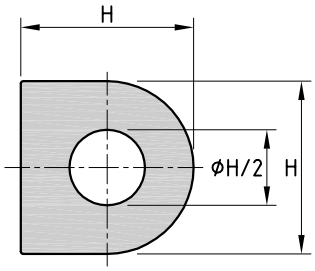


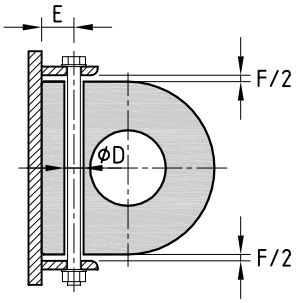


DC FENDER DIMENSIONS, PERFORMANCE VALUES AND DRAWING

H [mm]	D [mm]	E [mm]	F [mm]	J* [mm]	ED* [mm]	An-chors	Weight [kg/m]	Energy [kNm]	Reaction [kN]
100 x 100	18	25	10	200–300	90–130	M12	9.9	1.9	157
150 x 150	24	30	12	250–350	110–150	M16	20.0	4.2	235
200 x 200	30	45	15	300–400	130–180	M20	37.4	7.5	314
250 x 250	36	50	20	350–450	140–200	M24	57.2	11.7	392
300 x 300	36	60	25	350–450	140–200	M24	81.3	16.9	471
350 x 350	45	70	25	350–450	140–200	M30	109.5	22.9	549
400 x 400	45	80	30	350–450	140–200	M30	142.0	29.4	628
500 x 500	54	90	40	400–500	150–230	M36	208.0	46.0	785

* For fixing details see p. 83 | Performance values for single units of 1,000 mm length





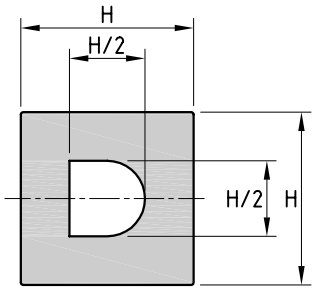
SQUARE FENDERS.

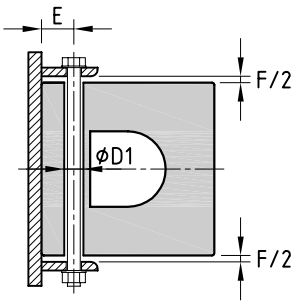
SD FENDER DIMENSIONS AND PERFORMANCE VALUES

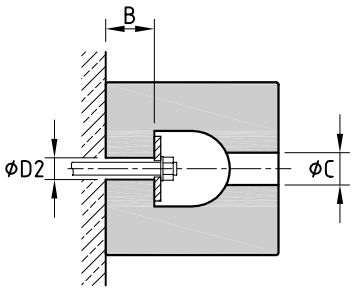
H [mm]	B [mm]	C [mm]	D1 [mm]	D2 [mm]	E [mm]	F [mm]	J* [mm]	ED* [mm]	Flat Bar [mm]	An-chors	Weight [kg/m]	Energy [kNm]	Reaction [kN]
100 x 100	25.0	30	18	24	25	10	200–300	90–130	40 x 5	M12	9.5	2.7	136
150 x 150	37.5	40	24	32	30	12	250–350	110–150	50 x 8	M16	22.1	6.4	206
200 x 200	50.0	50	30	40	45	15	300–400	130–180	70 x 10	M20	38.7	11.3	275
250 x 250	62.5	60	36	48	50	20	350–450	140–200	90 x 12	M24	59.3	17.6	343
300 x 300	75.0	60	36	48	60	25	350–450	140–200	100 x 12	M24	85.0	25.5	412
350 x 350	87.5	75	45	60	70	25	350–450	140–200	130 x 15	M30	116.0	34.3	471
400 x 400	100.0	75	45	60	80	30	350–450	140–200	150 x 15	M30	148.5	45.2	589
500 x 500	125.0	90	54	72	90	40	400–500	160–230	180 x 20	M36	232.1	70.7	736

* For fixing details see p. 83 | Performance values for single units of 1,000 mm length

SD FENDER DRAWING



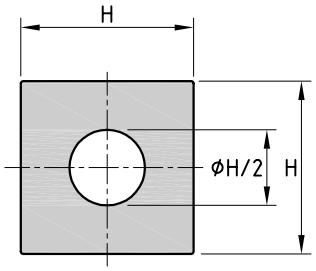


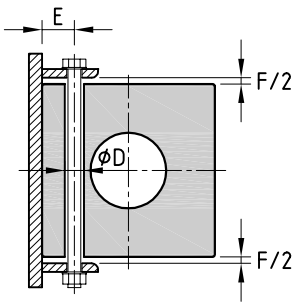


SC FENDER DIMENSIONS, PERFORMANCE VALUES AND DRAWING

H [mm]	D [mm]	E [mm]	F [mm]	J* [mm]	ED* [mm]	An-chors	Weight [kg/m]	Energy [kNm]	Reaction [kN]
100 x 100	18	25	10	200–300	90–130	M12	11.1	2.7	173
150 x 150	24	30	12	250–350	110–150	M16	22.9	6.4	259
200 x 200	30	45	15	300–400	130–180	M20	42.6	11.3	345
250 x 250	36	50	20	350–450	140–200	M24	65.3	17.7	431
300 x 300	36	60	25	350–450	140–200	M24	92.9	25.5	518
350 x 350	45	70	25	350–450	140–200	M30	117.6	34.3	604
400 x 400	45	80	30	350–450	140–200	M30	153.6	45.1	690
500 x 500	54	90	40	400–500	150–230	M36	240.1	70.5	863

* For fixing details see p. 83 | Performance values for single units of 1,000 mm length





Komposite Fenders.

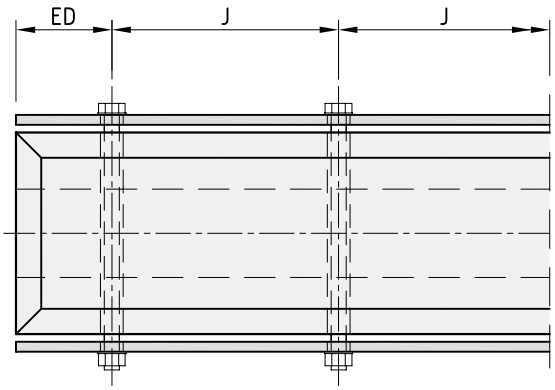
Characteristics

- Combined energy absorption with low friction
- Supplied cut and drilled for easy and quick installation if required

Applications

- Marinas
- Landing platforms
- Tug Boats
- Small boat berths

TYPICAL FIXING DETAILS



Offshorebasis Cuxhaven LP 8 | Germany

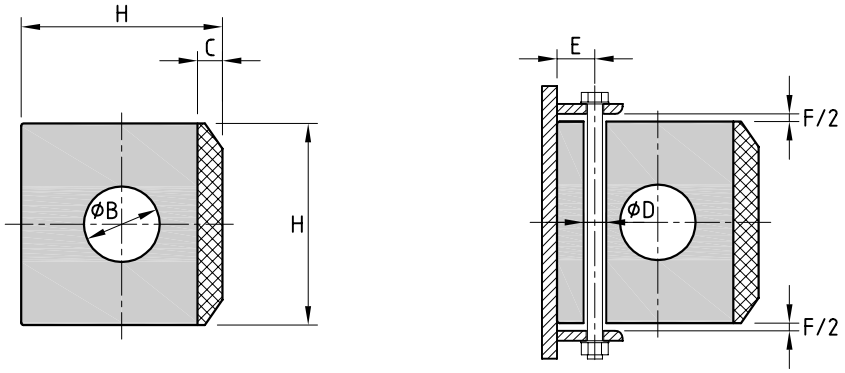
Naval Base | Doha | Qatar

KF-A FENDER DIMENSIONS

H [mm]	B [mm]	D [mm]	E [mm]	F [mm]	C [mm]	J* [mm]	ED* [mm]	Anchors	Weight [kg/m]
100 x 100	30	18	25	10	20	200–300	90–130	M12	10.3
150 x 150	65	24	30	12	20	250–350	110–150	M16	21.5
200 x 200	75	30	45	20	25	300–400	130–180	M20	40.2
250 x 250	100	36	50	25	30	350–450	140–200	M24	60.2
300 x 300	125	36	60	30	30	350–450	140–200	M24	92.1

* For fixing details see p. 87

KF-A FENDER DRAWING

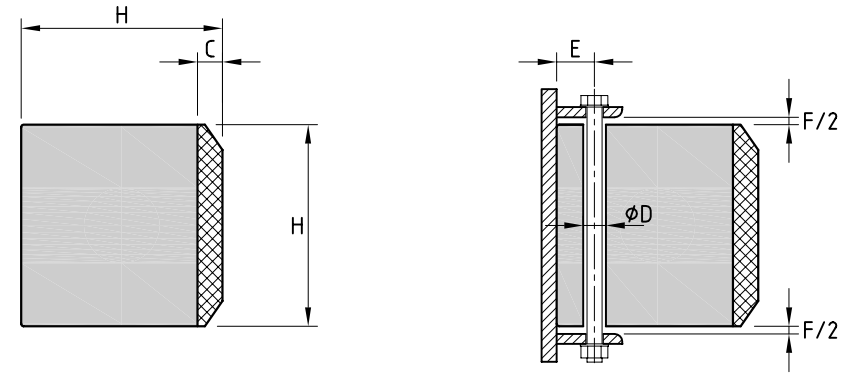


KF-B FENDER DIMENSIONS

H [mm]	D [mm]	E [mm]	F [mm]	C [mm]	J* [mm]	ED* [mm]	Anchors	Weight [kg/m]
100 x 100	18	25	10	20	200–300	90–130	M12	11.1
150 x 150	24	30	12	20	250–350	110–150	M16	27.0
200 x 200	30	45	20	25	300–400	130–180	M20	48.0
250 x 250	36	50	25	30	350–450	140–200	M24	75.0
300 x 300	36	60	30	30	350–450	140–200	M24	108.0

* For fixing details see p. 87

KF-B FENDER DRAWING

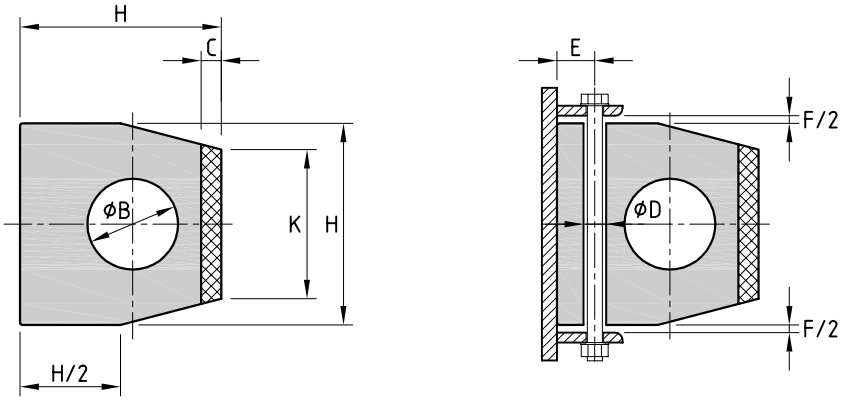


KF-C FENDER DIMENSIONS

H [mm]	B [mm]	K [mm]	D [mm]	E [mm]	F [mm]	C [mm]	J* [mm]	ED* [mm]	Anchors	Weight [kg/m]
80 x 80	42	60	18	25	6	10	200–300	90–130	M12	5.4
100 x 100	45	74	18	25	8	10	200–300	90–130	M12	8.4
120 x 120	62	88	24	30	10	12	250–350	110–150	M16	12.2
150 x 150	73	110	24	30	12	15	250–350	110–150	M16	19.7

* For fixing details see p. 87

KF-C FENDER DRAWING

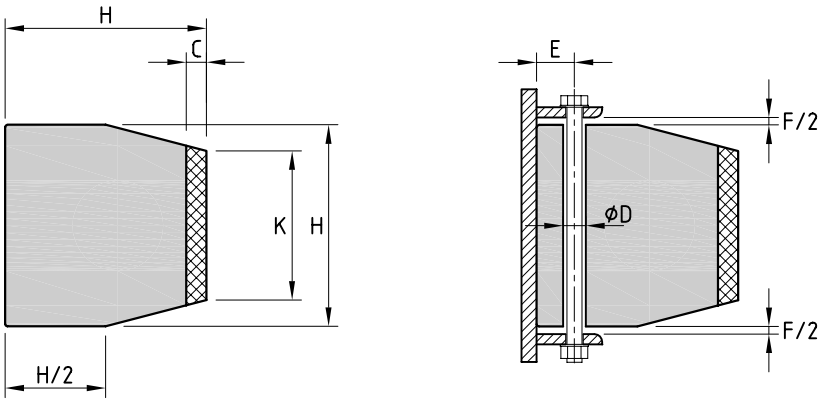


KF-D FENDER DIMENSIONS

H [mm]	K [mm]	D [mm]	E [mm]	F [mm]	C [mm]	J* [mm]	ED* [mm]	Anchors	Weight [kg/m]
80 x 80	60	18	25	6	10	200–300	90–130	M12	7.0
100 x 100	74	18	25	8	10	200–300	90–130	M12	11.0
120 x 120	88	24	30	10	12	250–350	110–150	M16	15.8
150 x 150	110	24	30	12	15	250–350	110–150	M16	24.8

* For fixing details see p. 87

KF-D FENDER DRAWING



Tug Boat Fenders.

Characteristics

- High abrasion resistance
- Non-marking navy grey color optional
- Light weight
- Ideal for tight corners

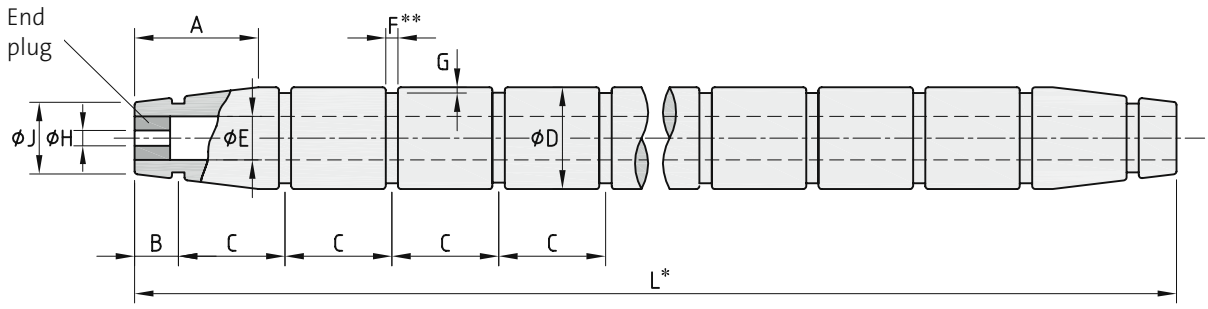
Applications

- Tug Boats
- Icebreakers
- Work & supply boats
- Other applications & structures like bridge and pile protection

BOW & STERN FENDERS.

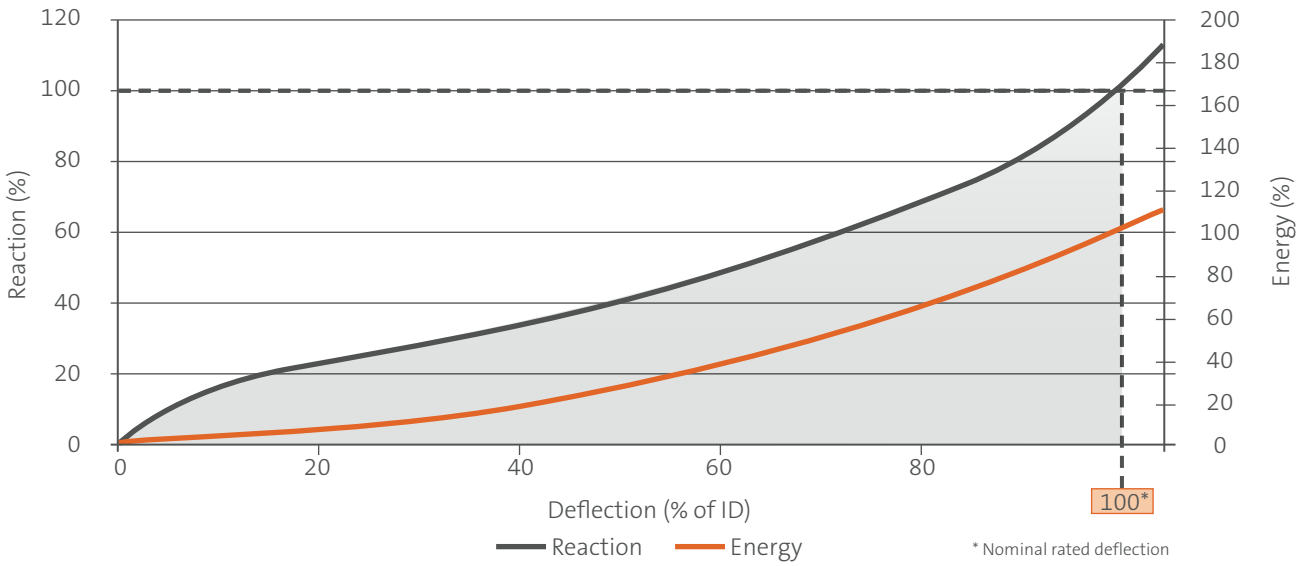
CYLINDRICAL TUG BOAT FENDER DIMENSIONS

Ø D [mm]	Ø J [mm]	Ø E [mm]	Ø H [mm]	A [mm]	B [mm]	C [mm]
200	150	100	75	500	150	530
250	190	125	75	500	200	570
300	225	150	75	700	225	600
350	260	175	100	800	250	630
400	300	200	100	800	300	670
500	375	250	100	900	300	730
600	450	300	125	900	350	800
700	525	350	125	1,000	350	860
800	600	400	125	1,000	350	930
900	675	450	150	1,100	350	1,000
1,000	750	500	150	1,200	350	1,060



* 2 – 13 meters in one section or plug joint for longer lengths (longer single lenghts available upon request)
** dimensions of fixing recess (F & G) vary depending on size and type of fixing accessories (chain / nylon strap)
*** end plug factory fitted or supplied separately for site installation

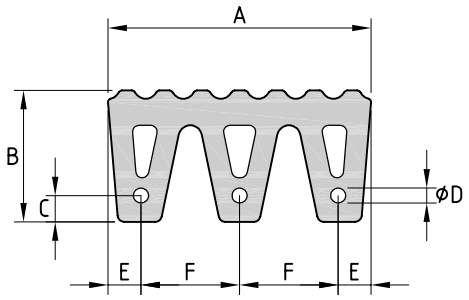
GENERIC PERFORMANCE CURVE CYLINDRICAL TUG BOAT FENDERS



M FENDER DIMENSIONS AND FIXING

Fender Type	A [mm]	B [mm]	C [mm]	Ø D [mm]	E [mm]	F [mm]	L_{MAX} [mm]	Weight [kg/m]	Ø Pin [mm]	Flat bar [mm]	R_{min} [mm]
M 40	400	200	40	23	50	150	2,000	56	20	100 x 15	450
M 50	500	250	50	27	60	190	2,000	89	24	125 x 20	550
M 60	600	300	60	33	70	230	2,000	132	30	150 x 20	650
M 80	800	400	80	44	95	305	2,000	233	36	180 x 25	850

M FENDER DRAWING



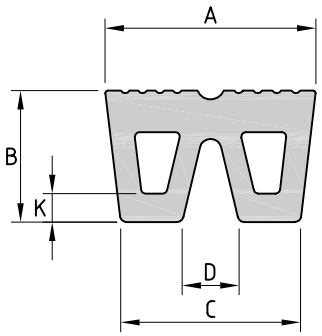
Available with profiled or smooth surface

Tug Boat Terminal | Hamburg | Germany

W FENDER DIMENSIONS AND FIXING

Fender Type	A [mm]	B [mm]	K [mm]	C [mm]	D [mm]	L_{MAX} [mm]	Weight [kg/m]	Ø Pin [mm]	Flat bar [mm]	R_{min} [mm]
W 32	320	200	50	280	100	2,000	51	25	100 x 20	600
W 40	400	250	55	350	110	2,000	81	30	120 x 20	800
W 48	480	300	65	426	135	2,000	120	40	140 x 20	900
W 50-35	500	350	60	413	250	2,000	135	40	150 x 20	1,000
W 50-45	500	450	75	420	90	2,000	180	40	150 x 20	1,000

W FENDER DRAWING



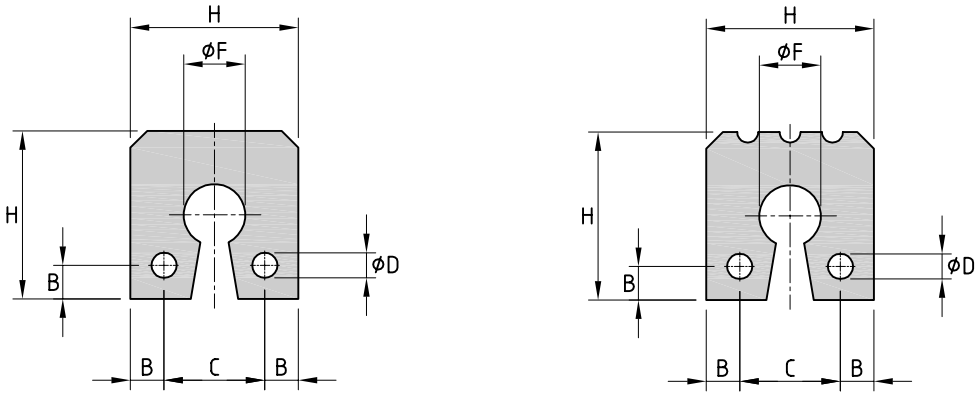
Available with profiled or smooth surface

TNPA Tugs | Durban | South Africa

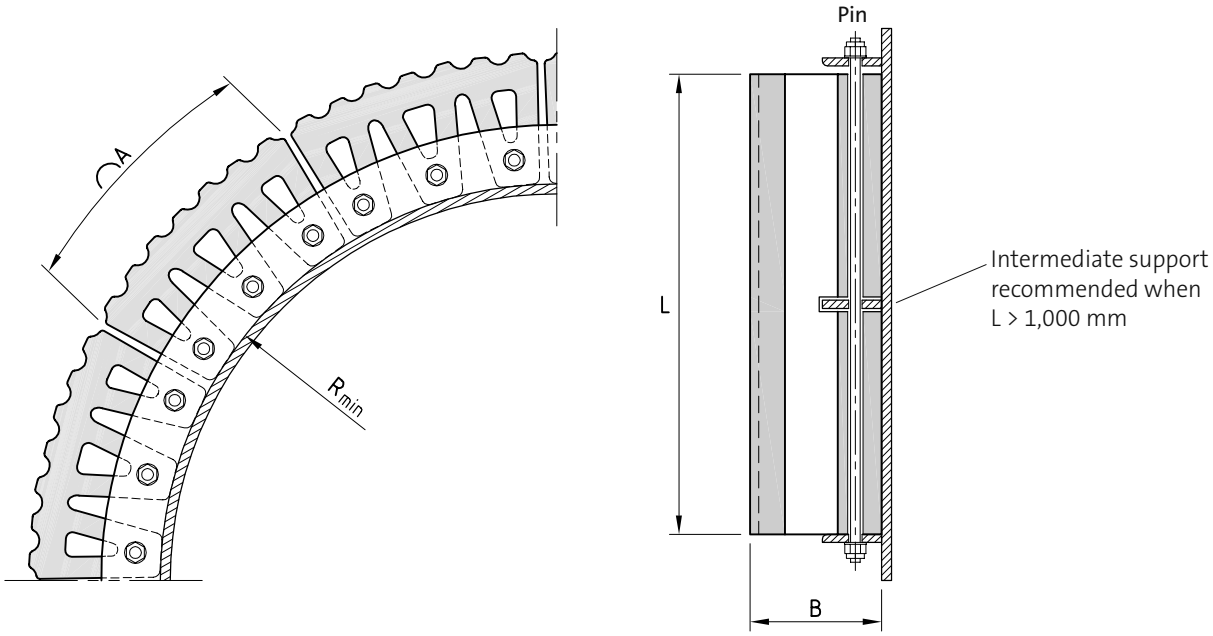
KEYHOLE FENDER DIMENSIONS AND FIXING

Fender Type	H [mm]	B [mm]	C [mm]	Ø D [mm]	Ø F [mm]	L_{MAX} [mm]	Weight [kg/m]	Ø Pin [mm]	Flat bar [mm]	R_{min} [mm]
KH 20	200	35	130	28	90	2,000	33	25	100 x 15	450
KH 25	250	50	150	33	100	2,000	54	30	120 x 20	600
KH 30	300	60	180	33	115	2,000	80	30	150 x 20	800
KH 35	350	70	210	33	125	2,000	114	30	175 x 25	1,000

KEYHOLE FENDER DRAWING



TYPICAL FIXING DRAWING

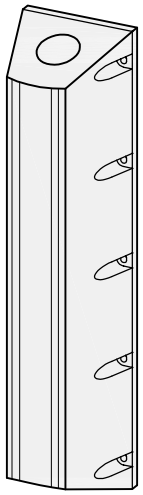


Suitable for M Fenders, W Fenders and Keyhole Fenders

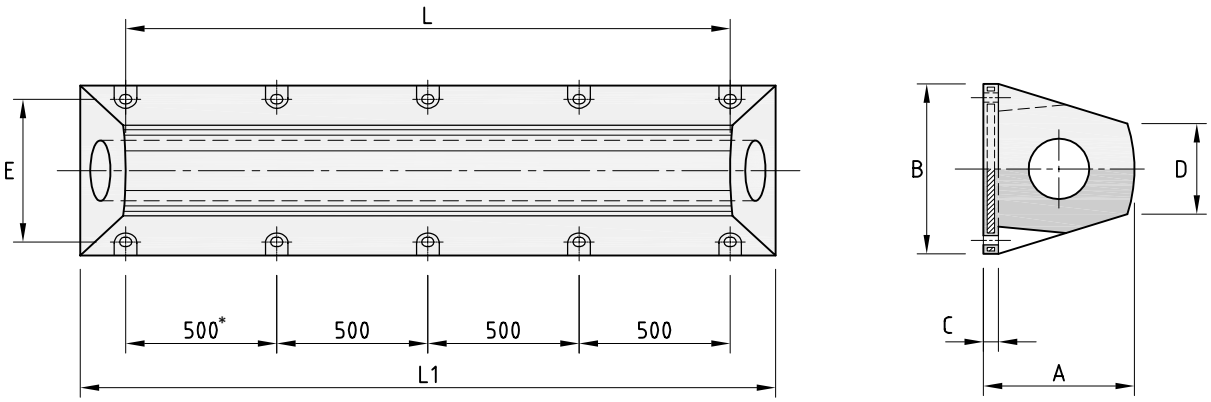
SIDE FENDERS.

MC FENDER DIMENSIONS

Fender Type	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]
MC 30	300	360	40	200	280
MC 40	400	500	50	300	410
MC 50	500	562	50	300	472
MC 60	600	700	125	420	550



MC FENDER DRAWING



*Bolt spacing for MC 60 is 580 mm

AVAILABLE STANDARD LENGTHS

	L = 1,000 mm			L = 1,500 mm			L = 2,000 mm		
Fender Type	L1 [mm]	Anchors	Weight [kg]	L1 [mm]	Anchors	Weight [kg]	L1 [mm]	Anchors	Weight [kg]
MC 30	1,350	6 x M22	141	1,850	8 x M22	198	2,350	10 x M22	255
MC 40	1,300	6 x M24	256	1,800	8 x M24	362	2,300	10 x M24	469
MC 50	1,300	6 x M24	356	1,800	8 x M24	507	2,300	10 x M24	658
MC 60	1,300	4 x M48	531	1,800	6 x M48	748	2,300	8 x M48	966

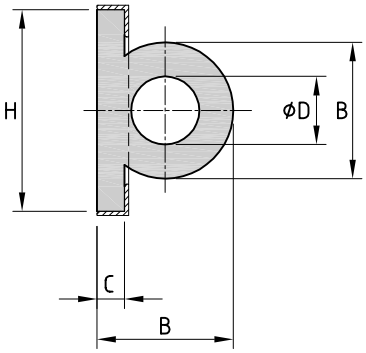
	L = 2,500 mm			L = 3,000 mm		
Fender Type	L1 [mm]	Anchors	Weight [kg]	L1 [mm]	Anchors	Weight [kg]
MC 30	2,850	12 x M22	312	3,350	14 x M22	369
MC 40	2,800	12 x M24	575	3,300	14 x M24	682
MC 50	2,800	12 x M24	809	-	-	-
MC 60	2,800	10 x M48	1,183	3,300	12 x M48	1,401

WING-TYPE FENDER DIMENSIONS

Fender Type	H [mm]	B [mm]	C [mm]	Ø D [mm]	Weight [kg/m]
WD 18	180	100	25	50	10.5
WD 21	215	150	30	75	20.3
WD 24	245	150	30	75	21.3
WD 28	280	200	40	100	35.8
WD 32	320	200	40	100	37.6
WD 37	370	250	50	125	57.0
WD 41	410	250	50	125	59.0

Wing-Type Fenders

WING-TYPE FENDER DRAWING



For other Tug Boat Side Fenders, see Extruded Fenders p. 82 and Komposite Fenders p. 86

TNPA Tugs | Durban | South Africa

UHMW-PE Sliding Plates.

Characteristics

- Low friction coefficient
- Very high abrasion resistance
- UV and ozone resistant
- Reduced conductivity optional
- 100 % recyclable & non-rotting
- Available in different colors and bendable

Applications

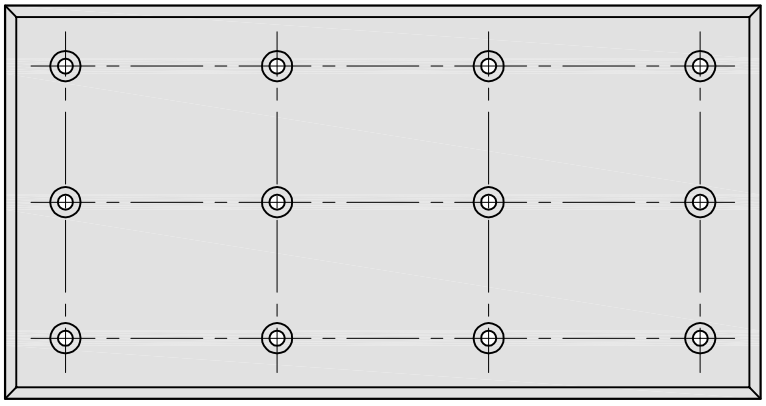
- Fender panel facing
- Sliding boards
- V Fender front shields
- Lock doors & entrances
- Quay wall protection
- Pile protection

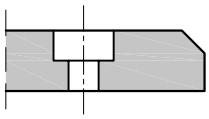
PHYSICAL AND MECHANICAL PROPERTIES

Property	Norms	Virgin Material	Reclaimed Material
Density [g / cm³]	ISO 1183-1	0.93 – 0.94	0.94 – 0.96
Molecular Weight [g / mol]	Viscosimetric Method	≥ 4,000,000	≥ 3,000,000
Friction Coefficient	DIN / EN / ISO 8295	0.15 – 0.20	0.15 – 0.20
Yield Strength [N / mm²]	ISO 527	≥ 17	≥ 17
Breaking Strength [N / mm²]	ISO 527	≥ 30	≥ 25
Break Elongation [%]	ISO 527	≥ 50	≥ 50
Ball Indentation Hardness [N / mm²]	ISO 2039-1	≥ 32	≥ 38
Shore Hardness [Shore D]	ISO 868 / (DIN 53505)	≥ 61	≥ 63
Impact Strength (with V-notch) [mJ / mm²]	ISO 11542-2	≥ 130 colored	≥ 70
Abrasion Sand Slurry Test	ISO 15527	~ 100	≥ 130
Temperature Range [°C]	–	- 200 up to + 80	- 100 up to + 80
Crystalline Melting Point [°C]	ISO 11357-3	132 – 136	132 – 136
Coefficient of Linear Expansion [K^{-1}]	DIN 53752	~ 2 x 10^{-4}	~ 2 x 10^{-4}

This product information and specification is generic and based on our present know-how and randomly performed material tests | Results are therefore not applicable for any specific order and may vary | Machining is done at 18°C | Thermal expansion should be taken into consideration if installation is done at different temperatures

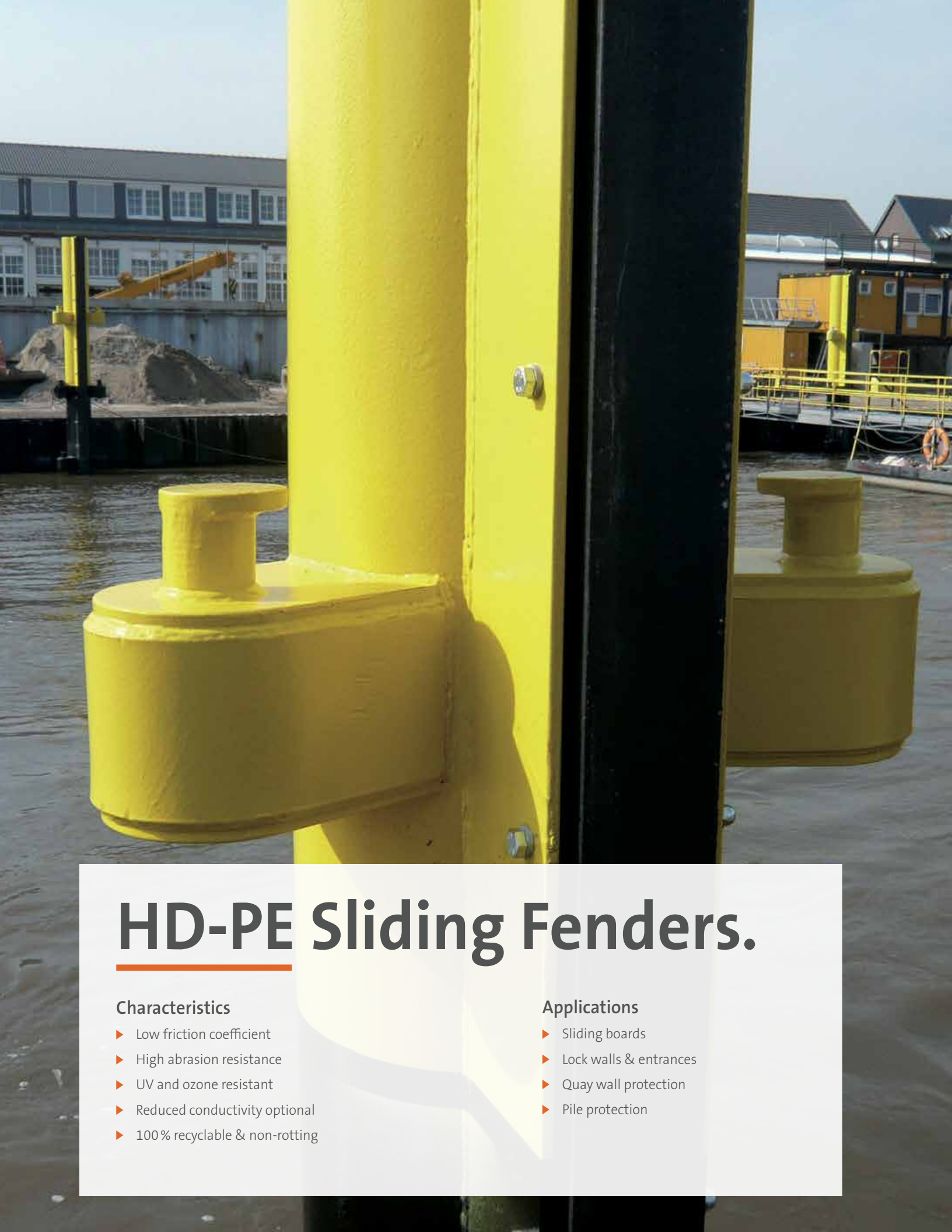
GENERIC UHMW-PE SLIDING PLATE DRAWING





COUNTERSUNK DETAIL

UHMW-PE Sliding Plates are supplied fully machined or alternatively in raw press format. Available thicknesses from 2 mm to 200 mm for regenerated material and 2 mm to 400 mm for virgin material. Plate sizes range from 1,000 mm x 1,000 mm up to 6,000 mm x 2,500 mm.



HD-PE Sliding Fenders.

Characteristics

- Low friction coefficient
- High abrasion resistance
- UV and ozone resistant
- Reduced conductivity optional
- 100 % recyclable & non-rotting

Applications

- Sliding boards
- Lock walls & entrances
- Quay wall protection
- Pile protection

PHYSICAL AND MECHANICAL PROPERTIES

Properties	Standards	Results
Density [g / cm³]	ISO 1183-1	0.90 – 0.95
Molecular Weight [g / mol]	Light diffusion method	~ 200,000
Dynamic Friction	–	0.20 – 0.25
Yield Strength [Mpa]	ISO 527	10 – 15
Shore Hardness [Shore D]	DIN 53505	48 – 52
Abrasion Index	ISO / DIS 15527 (Draft) FQ1000 - V = 100	~ 400
Operating Temperature [°C]	–	- 20 to + 80
Coefficient of Linear Expansion [K^{-1}]	DIN 53752	~ 2 x 10^{-4}

Owing their glass fibre reinforcement and material characteristics, HD-PE Sliding Fenders are able to bridge small gaps in the supporting structure | For applications with a curved substructures our factory is offering to produce precurved sliding fenders | For limitations and details, please contact your local SFT office

Potoon Schellebelle | Wintam | Belgium

HD-PE SLIDING FENDERS

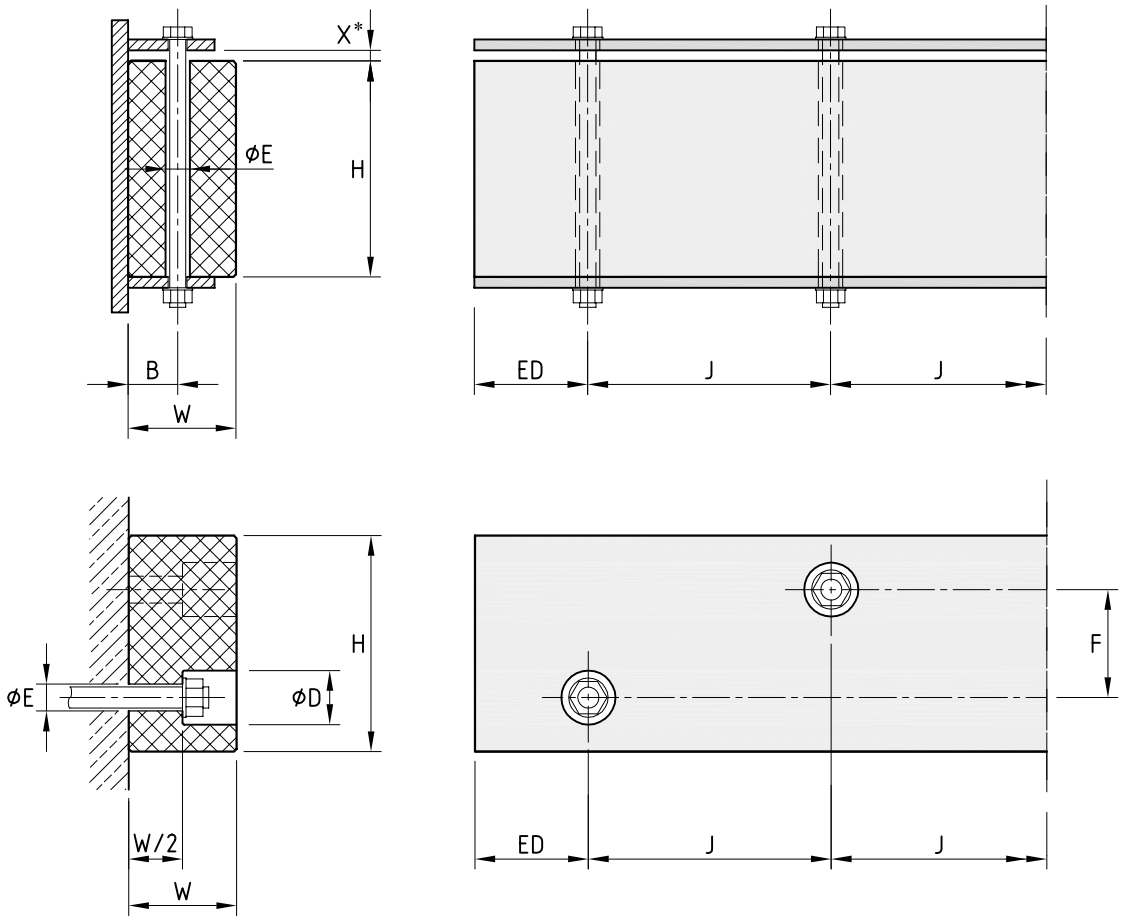
DIMENSIONS

H [mm]	W [mm]	L [mm]	Weight [kg/m]
50	50	5,500	2.3
60	60	5,500	3.3
70	50	2,500	3.3
70	70	6,500	4.5
80	60	5,000	4.5
100	50	5,500	4.7
100	65	5,500	6.1
100	100	6,000	9.3
120	80	5,000	8.9
120	120	6,000	13.4
140	70	5,500	9.1
160	70	5,000	10.4
160	160	6,000	24.1
170	120	5,500	19.0
180	70	5,000	11.7
180	180	6,000	30.2
190	110	5,000	19.4
200	75	5,000	14.0
200	100	6,000	18.6
200	150	5,500	27.9
200	200	6,000	37.6
210	165	2,000	31.9
240	180	5,000	40.6
250	150	6,500	34.8
250	160	5,000	37.2
250	250	5,000	58.1
300	100	5,500	27.9
300	210	5,000	58.6
300	250	5,000	70.5
300	300	5,000	83.7
440	160	2,000	64.8

RECOMMENDED FIXING DETAILS

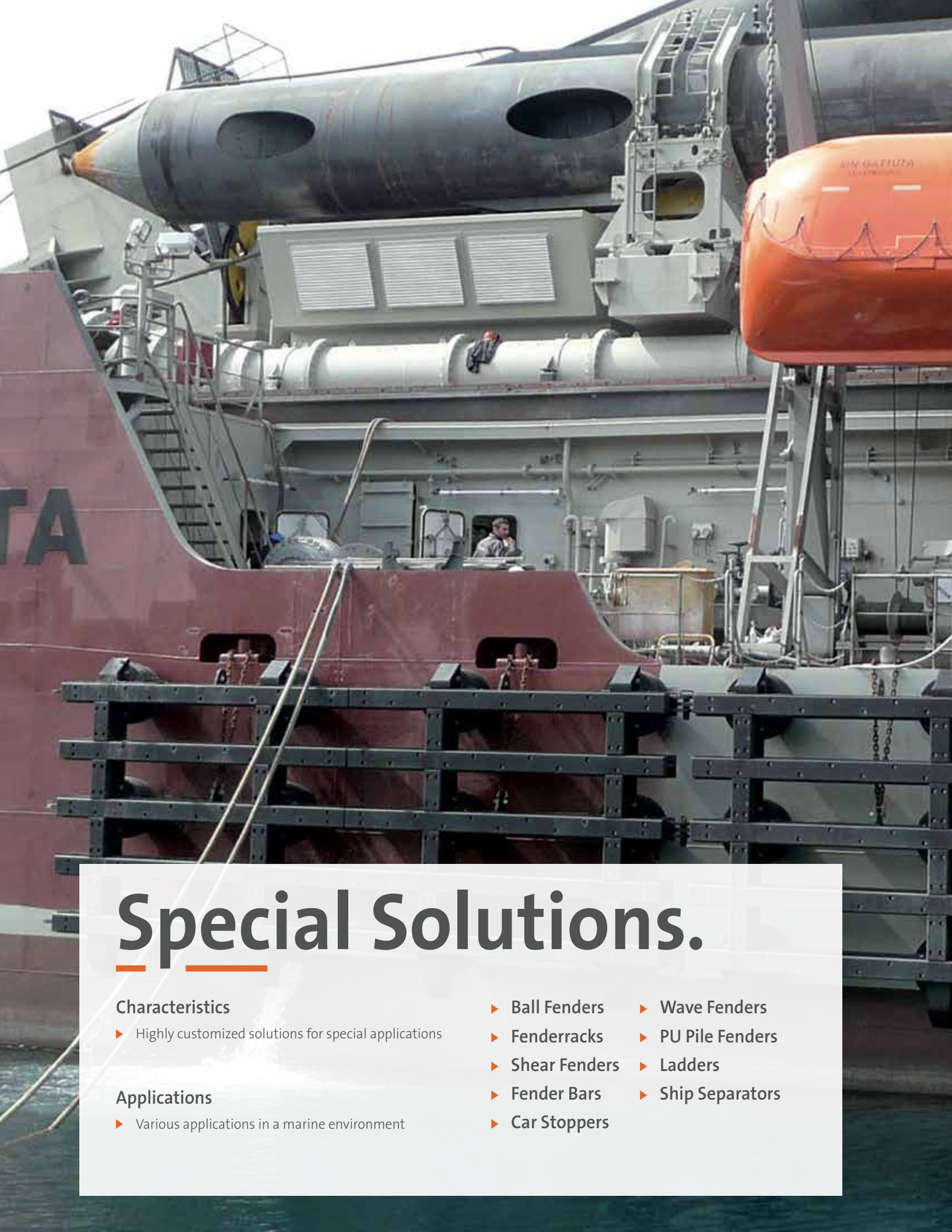
W/2 [mm]	B [mm]	Ø D [mm]	Ø E [mm]	F [mm]	ED [mm]	J [mm]	Flat Bar [mm]	Fixing
25	-	32	16	0	75–125	250–300	-	M12
30	-	32	16	0	75–125	250–300	-	M12
25	-	32	16	0	75–125	250–300	-	M12
35	-	32	16	0	75–125	250–300	-	M12
30	-	32	16	0	75–125	250–300	-	M12
25	-	32	16	0	75–125	250–300	-	M12
30	-	32	16	0	75–125	250–300	-	M12
50	32	32	16	0	75–125	250–300	50 x 6	M12
40	-	40	20	0	100–150	300–350	-	M16
60	40	40	20	0	100–150	300–350	65 x 10	M16
35	-	40	20	0–50	100–150	300–350	-	M16
35	-	40	20	0–70	100–150	300–350	-	M16
80	40	40	20	0–80	100–150	300–350	80 x 10	M16
60	40	40	20	0–80	100–150	300–350	65 x 10	M16
35	-	50	23	0–80	125–175	350–450	-	M20
90	46	50	23	0–80	125–175	350–450	80 x 10	M20
55	46	50	23	0–90	125–175	350–450	80 x 10	M20
35	46	50	23	0–100	125–175	350–450	-	M20
50	46	50	23	0–100	125–175	350–450	80 x 10	M20
75	46	50	23	0–100	125–175	350–450	80 x 10	M20
100	46	50	23	0–100	125–175	350–450	80 x 10	M20
80	46	50	23	0–130	150–200	450–550	80 x 10	M20
90	46	50	28	0–130	150–200	450–550	80 x 10	M24
75	46	65	28	0–130	150–200	450–550	80 x 10	M24
80	46	65	28	0–130	150–200	450–550	80 x 10	M24
125	56	65	28	0–130	150–200	450–550	100 x 10	M24
50	-	65	28	0–160	150–200	450–550	-	M24
105	56	70	36	0–160	175–225	500–600	100 x 12	M30
105	-	70	36	0–160	175–225	500–600	100 x 12	M30
105	72	70	36	0–160	175–225	500–600	100 x 12	M30
80	-	70	36	0–160	175–225	500–600	-	M30

HD-PE SLIDING FENDER DRAWING



* Allowance for cross-sectional tolerances of ± 4 % | Planing optional to reduce plus tolerances

Scheepsdalebrug Kanaal | Gent | Belgium



Special Solutions.

Characteristics

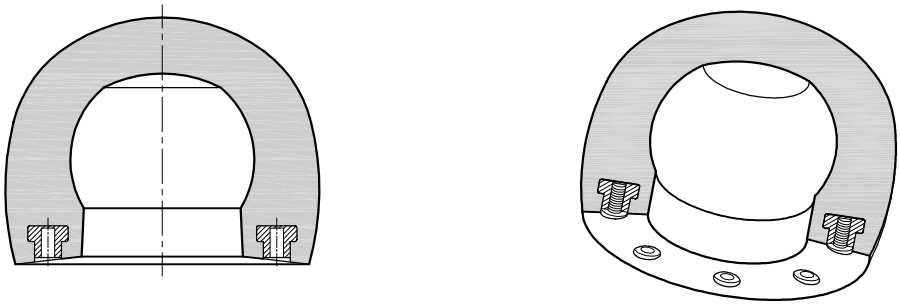
- Highly customized solutions for special applications

Applications

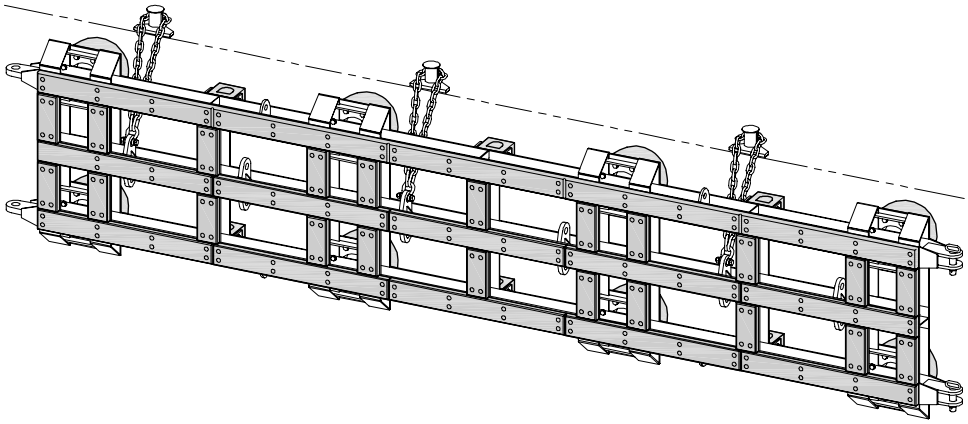
- Various applications in a marine environment

- Ball Fenders
- Fenderracks
- Shear Fenders
- Fender Bars
- Car Stoppers
- Wave Fenders
- PU Pile Fenders
- Ladders
- Ship Separators

BALL FENDER DRAWING



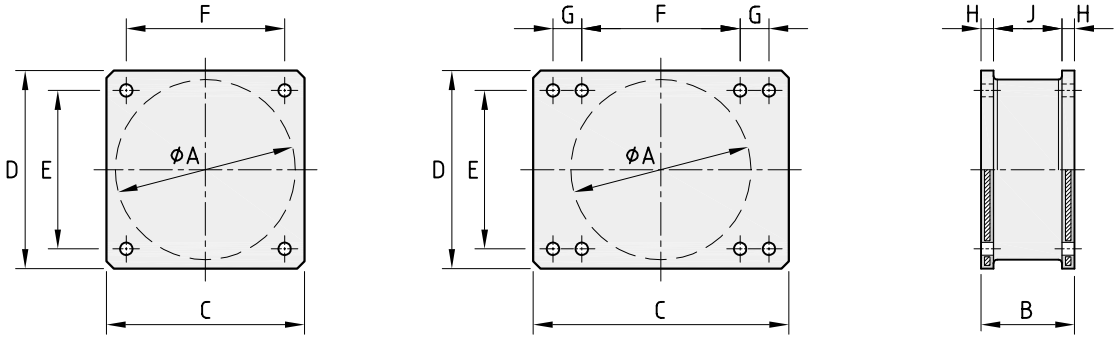
FENDERRACK DRAWING



SHEAR FENDER DIMENSIONS AND PERFORMANCE VALUES

Fender Type	Ø A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	J [mm]	H [mm]	Bolts	Energy [kNm]	Reaction [kN]
SF 500-260	500	260	710	550	440	440	80	190	35	8 x M30	25.5	250
SF 500-285	500	285	610	610	510	510	–	221	32	4 x M24	24.9	216

SHEAR FENDER DRAWING

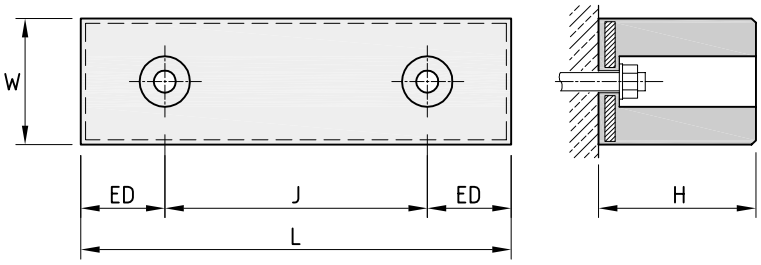


FENDER BAR DIMENSIONS

Fender Type	W [mm]	H [mm]	ED [mm]	J [mm]	Anchors	Weight [kg/m]
FB 15-15	150	150	250	500	M24	38
FB 15-20	150	200	250	500	M24	43
FB 20-20	200	200	250	500	M30	65
FB 20-25	200	250	250	500	M30	77
FB 20-30	200	300	250	500	M30	88

Made from Rubber

FENDER BAR DRAWING



Ferry Terminal | Landskrona | Sweden

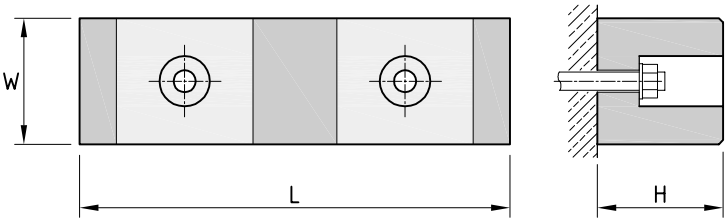
CAR STOPPER DIMENSIONS

Size	W [mm]	H [mm]	L [mm]	Weight [kg/m]
ST 90	90	90	6,000	7.5
ST 110	110	110	6,000	11.3
ST 150	150	150	6,000	20.9
ST 170	170	170	6,000	27.0
ST 190	190	190	6,000	33.6

Size	W [mm]	H [mm]	L [mm]	Weight [kg/m]
ST 200	200	200	4,000	40.0
ST 240	240	240	5,000	53.6
ST 250	200	250	4,000	50.0
ST 290	290	290	5,000	78.2
ST 300	200	300	4,000	60.0

Made from HD-PE

CAR STOPPER DRAWING

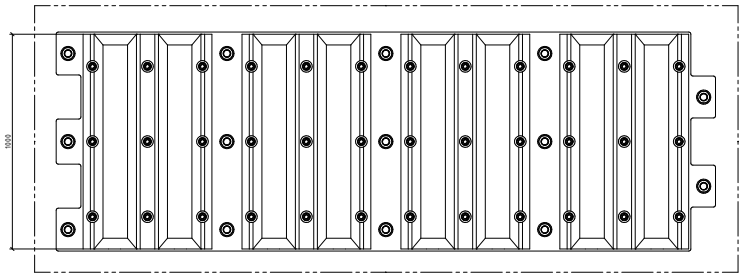


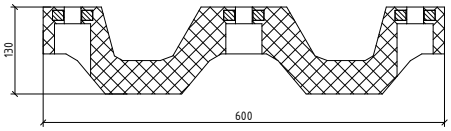
Southern Quay Wall | Simaisma | Qatar

WAVE FENDERS

Wave fenders are modular systems consisting of individual fenders pre-mounted to a solid steel backing plate. The pre-fitted modules feature significantly less anchors to be cast or drilled and the make installation safer, quicker and more economic. A random number of pre-fitted wave fender modules can be placed next to each other as they all fit into each other by overlapping and inter-connecting links. In the unusual case of the need for a replacement, all waver fenders can be easily removed from the modules and individually replaced.

WAVE FENDER DRAWING





Ropsten | Stockholm | Sweden

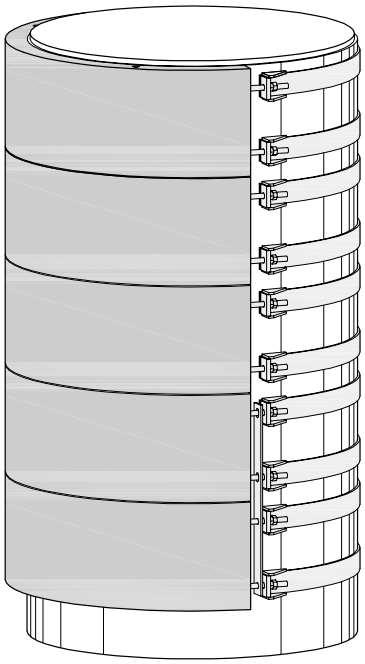
Logårdstrappan | Stockholm | Sweden

PU PILE FENDER DIMENSIONS

Fender Size	Pile Diameter [mm]	Height [mm]	Thickness [mm]
PF 914	914	500	100
PF 1016	1,016	500	100
PF 1520	1,520	500	100

Fenders for other pile sizes available upon request

PU PILE FENDER DRAWING



Standby pile | Kiel | Germany

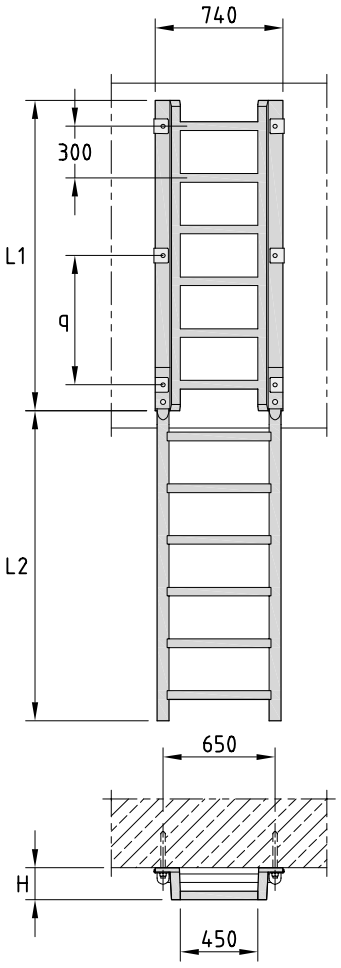
Kiel Canal | Germany

PU LADDER DIMENSIONS

Ladder Type	Height [mm]	L1 [mm]	Rungs	q [mm]
PU 185	185	600	2	1 x 300
PU 185	185	900	3	1 x 600
PU 185	185	1,200	4	2 x 450
PU 185	185	1,500	5	2 x 600
PU 185	185	1,800	6	2 x 750
PU 185	185	2,100	7	3 x 600
PU 185	185	2,400	8	3 x 700
PU 185	185	2,700	9	3 x 800
PU 185	185	3,000	10	4 x 675

Ladder Type	Height [mm]	L1 [mm]	Rungs	Bolt Pitch (q) [mm]
PU 250	250	800	3	500
PU 250	250	1,100	4	400 + 400
PU 250	250	1,400	5	550 + 550
PU 250	250	1,700	6	700 + 700
PU 250	250	2,000	7	550 + 600 + 550
PU 250	250	2,300	8	650 + 700 +650
PU 250	250	2,600	9	750 + 800 + 750
PU 250	250	2,900	10	650 + 650 + 650 + 650

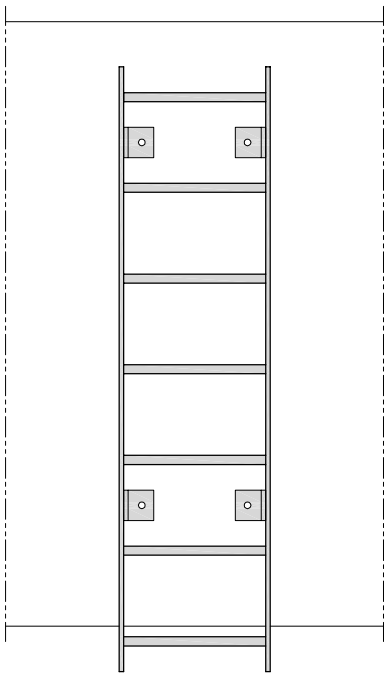
PU LADDER DRAWING



Joint Ladders for both types available in various lengths, typically max. 3,000 mm length of use (L2)

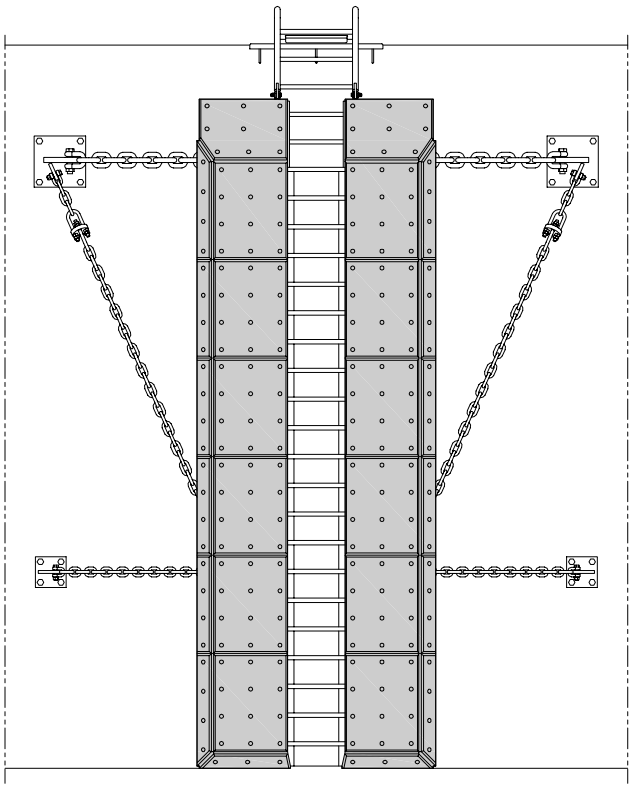
Passenger Terminal | Sochi | Russia

STEEL LADDERS.



Naval Base | Doha | Qatar

INTEGRATED LADDERS.

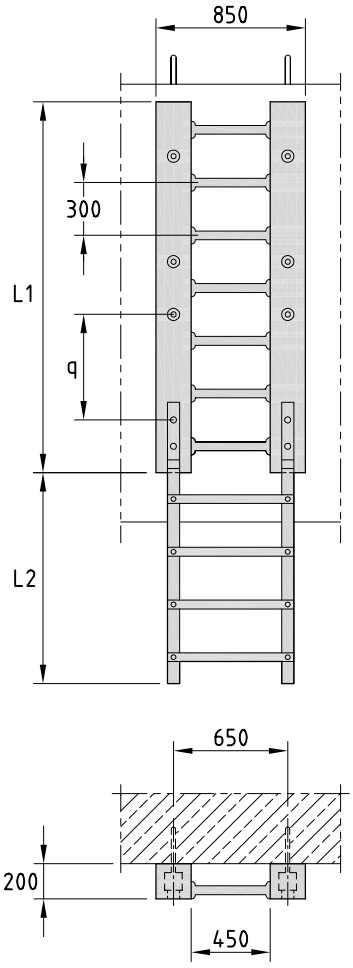


Maasvlakte II | Rotterdam | The Netherlands

RL RUBBER LADDER DIMENSIONS

Ladder Type	Length [mm]	Weight [kg]	Rungs	Bolts	Bolt Pitch (q) [mm]
RL 200	900	93	3	2x2	300 + 300 + 300
RL 200	1,200	125	4	3x2	300 + 300 + 300 + 300
RL 200	1,500	157	5	3x2	300 + 600 + 300 + 300
RL 200	1,800	188	6	4x2	300 + 300 + 600 + 300 + 300
RL 200	2,100	221	7	4x2	300 + 600 + 300+ 600 + 300
RL 200	2,400	252	8	5x2	300 + 600 + 300 + 300 + 600 + 300
RL 200	2,700	284	9	5x2	300 + 600 + 600 + 300 + 600 + 300
RL 200	3,000	316	10	6x2	300 + 600 + 300 + 600 + 300 + 600 + 300

RL RUBBER LADDER DRAWING



Joint Ladders available in various lengths, typically max. 1,800 mm length of use (L2)

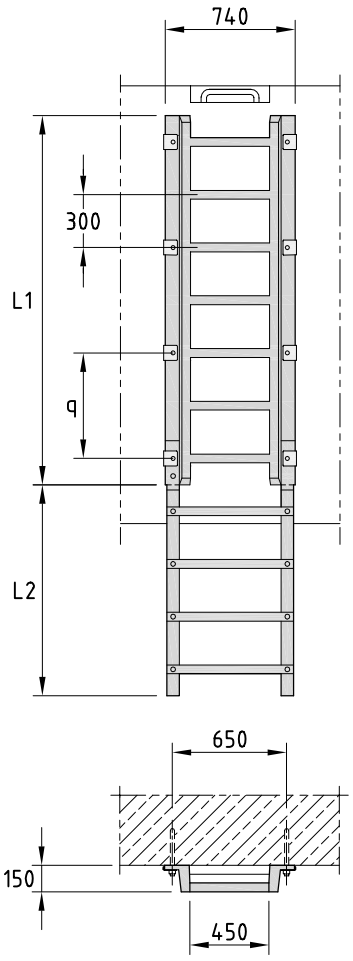
International Cruise Terminal | Singapore

IDPT Jetty 1 | Johor | Malaysia

RV RUBBER LADDER DIMENSIONS

Ladder Type	Length [mm]	Weight [kg]	Rungs	Bolts	Bolt Pitch (q) [mm]
RV 150	600	32	2	2x2	150+300+150
RV 150	900	48	3	2x2	150+600+150
RV 150	1,200	64	4	3x2	150+450+450+150
RV 150	1,500	80	5	3x2	150+600+600+150
RV 150	1,800	96	6	3x2	150+750+750+150
RV 150	2,100	112	7	4x2	150+600+600+600+150
RV 150	2,400	128	8	4x2	150+750+600+750+150
RV 150	2,700	144	9	5x2	150+600+600+600+600+150
RV 150	3,000	160	10	5x2	150+600+750+750+600+150

RV RUBBER LADDER DRAWING



Joint Ladders available in various lengths, typically max. 1,800 mm length of use (L2)

Feed Solid Product Jetty | Johor | Malysia

Kashima Port | Kashima | Japan

SHIP SEPARATORS

Ship Separators are designed customized to the berthing requirements. They are used for ship-to-ship operation and can increase clearance between berth and vessel. Usually Ship Separators consist of two Foam Fender and a steel construction.

Ship Separator Installation | Guatemala

Ship Separator Installation | Guatemala

Ship Separator Study for US project

Accessories and Fixings.

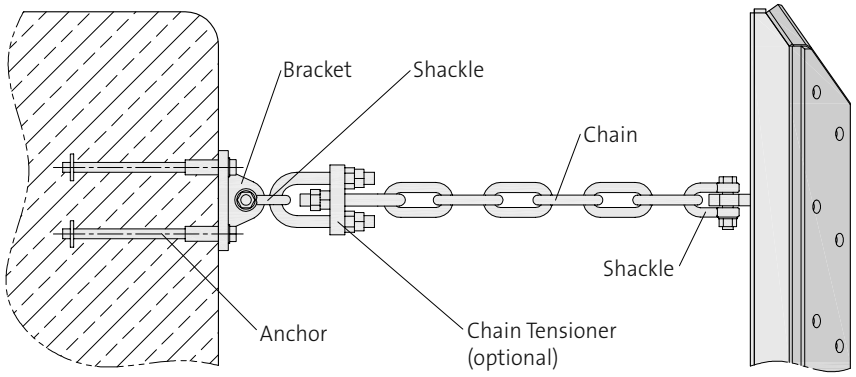
Characteristics

- High quality chains, accessories and compatible fixings
- Customized
- Wide range of materials
- Tested and certified

Chains
Chain Tensioners
Shackles & Brackets
Cast-in Anchors & Cast-in U Anchors
Chemical Anchors & Chemical U Anchors
Washers
Bolts & Nuts

CHAIN SYSTEMS.

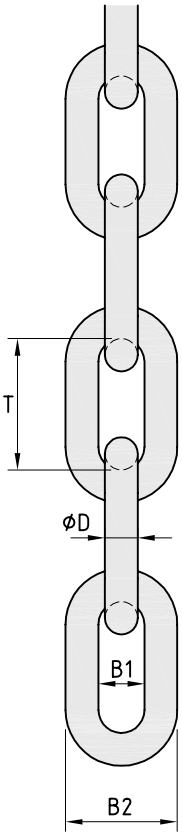
TYPICAL CHAIN SYSTEM DRAWING



CHAIN DIMENSIONS

	Chain 4 x D				Chain 5 x D				K2	K3
Ø D [mm]	T [mm]	B1 [mm]	B2 [mm]	Weight [kg/m]	T [mm]	B1 [mm]	B2 [mm]	Weight [kg/m]	MBL [kN]	MBL [kN]
14	56	20	48	3.8	70	21	49	3.7	124	154
16	64	22	54	5.0	80	24	56	4.8	160	202
18	72	25	61	6.3	90	27	63	6.0	209	262
20	80	28	68	7.8	100	30	70	7.5	264	330
22	88	31	75	9.4	110	33	77	9.0	304	380
25	100	35	85	12.1	125	38	88	11.6	393	491
28	112	39	95	15.2	140	42	98	14.6	492	616
30	120	42	102	17.4	150	45	105	16.7	566	706
32	128	45	109	19.8	160	48	112	19.0	644	804
35	140	49	119	23.8	175	53	123	22.8	770	964
38	152	53	129	28.0	190	57	133	26.9	900	1,130
40	160	56	136	31.0	200	60	140	29.8	1,010	1,260
45	180	63	153	39.3	225	68	158	27.7	1,275	1,590
50	200	70	170	48.5	250	75	175	46.5	1,570	1,960
55	220	77	187	58.7	275	83	193	56.3	1,900	2,380
60	240	84	204	70.0	300	90	210	67.0	2,260	2,770

Intermediate or larger sizes available upon request



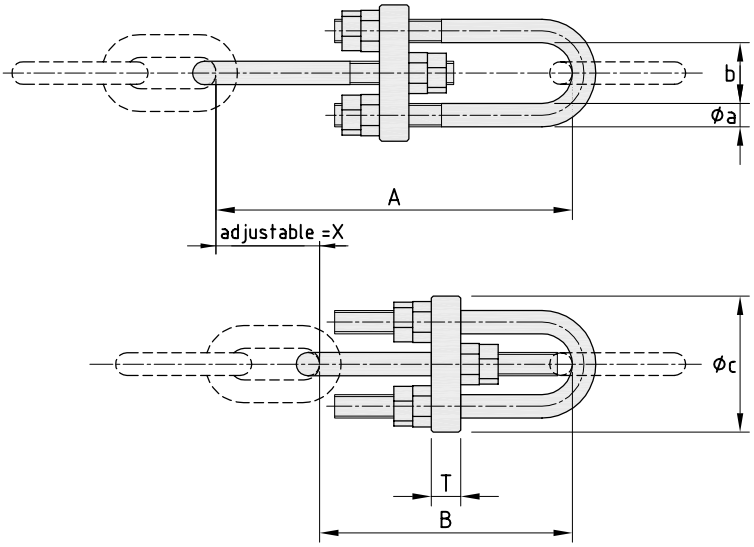
CHAIN TENSIONER DIMENSIONS

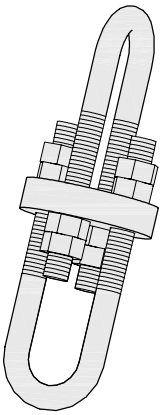
Type	A [mm]	B [mm]	X [mm]	T [mm]	Ø c [mm]	Ø a [mm]	b [mm]	Weight* [kg]
Ø 20	375	260	115	30	120	20	50	5.8
Ø 24	370	270	100	30	130	24	56	8.0
Ø 30	430	325	105	40	170	30	80	15.0
Ø 36	545	390	155	45	210	36	94	27.0
Ø 42	670	470	200	55	250	42	108	45.0
Ø 48	855	595	260	60	280	48	122	68.0
Ø 56	890	610	280	70	330	56	144	103.0
Ø 64	925	660	265	80	350	64	160	150.0

Different adjustments (X) available upon request | The table above indicates dimensions of standard Chain Tensioners | Chain Tensioners need to be customized for every project, based on geometry and capacity of the chain system
* Typical weights

Chain Tensioner

CHAIN TENSIONER DRAWING





Chain Tensioner and rubber sleaves

Chain Tensioner

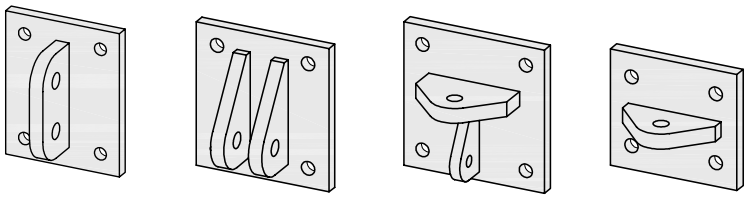
SHACKLE DIMENSIONS

					D Type		Bow Type		
WLL [t]	Ø A [mm]	Ø B [mm]	Ø C [mm]	E [mm]	D1 [mm]	Weight [kg]	D2 [mm]	F [mm]	Weight [kg]
2.0	13	16	34	22	43	0.4	51	32	0.4
3.25	16	19	40	27	51	0.7	64	43	0.8
4.75	19	22	47	31	59	1.1	76	51	1.3
6.5	22	25	53	36	73	1.5	83	58	1.9
8.5	25	28	60	43	85	2.6	95	68	2.8
9.5	28	32	67	47	90	3.3	108	75	3.8
12.0	32	35	74	51	94	4.7	115	83	5.3
13.5	35	38	80	57	115	6.2	133	95	7.0
17.0	38	42	89	60	127	7.6	146	99	8.8
25.0	45	50	104	74	149	12.8	178	126	15.0
35.0	50	57	119	83	171	17.0	197	138	20.7
42.5	57	65	134	95	190	25.9	222	160	29.0
55.0	65	70	145	105	203	35.3	267	180	41.1

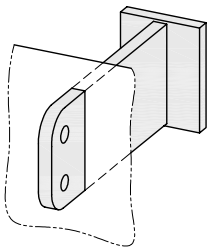
Other types and sizes available upon request

D Type Shackle

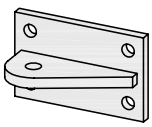
GENERIC BRACKET DRAWINGS



Various Bolt-on Brackets

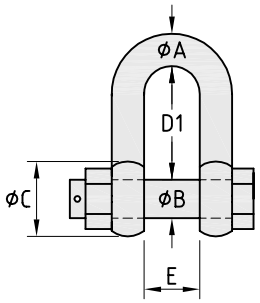


Cast-in Bracket

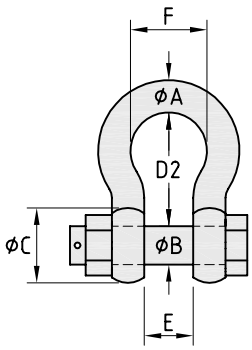


Shear Bracket

SHACKLE DRAWINGS



D Type



Bow Type

Shear Bracket

FIXINGS.

CAST-IN ANCHOR DIMENSIONS

Anchor Size	L [mm]	B [mm]	C [mm]	Ø D [mm]	Weight [kg]
M16	175	29	16	25	0.4
M20	214	50	20	30	0.8
M24	258	60	25	35	1.5
M30	318	70	30	45	2.4
M36	328	80	40	55	3.7
M42	416	85	45	65	6.0
M48	431	100	50	75	9.0
M56	436	105	60	85	14.0
M64	600	128	80	100	23.0
M76	700	152	90	114	42.0

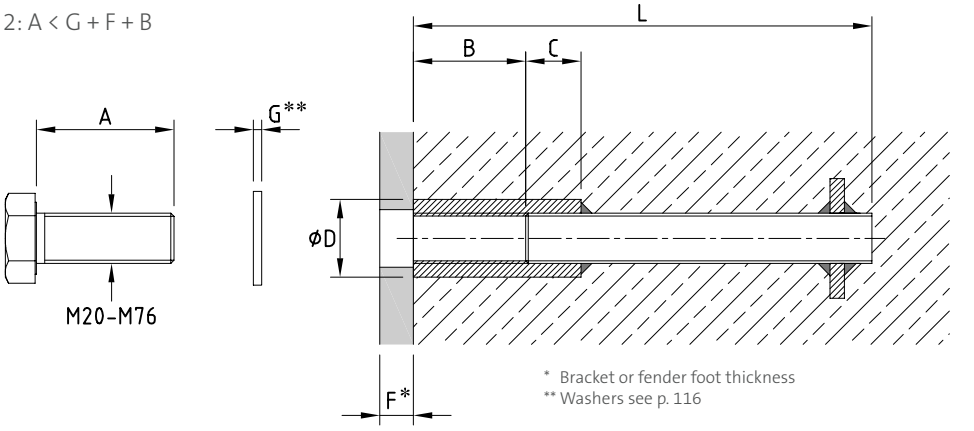
Other sizes available upon request

Cast-in Anchor

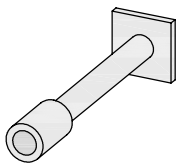
Formula to determine bolt length:

1: A > G + F + 1.2 x M

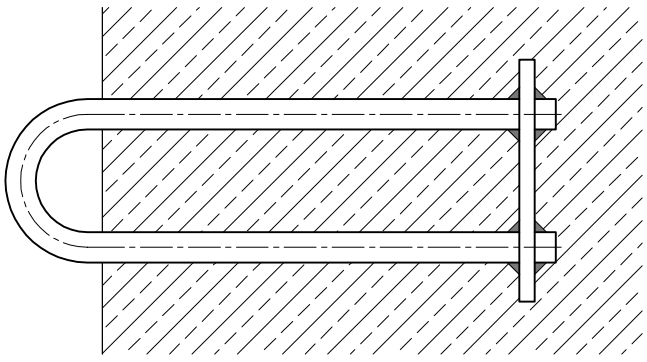
2: A < G + F + B

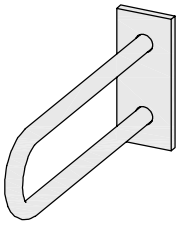


* Bracket or fender foot thickness
** Washers see p. 116



GENERIC CAST-IN U ANCHOR DRAWING





CHEMICAL ANCHOR DIMENSIONS

Anchor Size	A [mm]	Ø D [mm]	E [mm]	Grout Volume [ml]
M12	110	14	11	11
M16	140	18	15	18
M20	170	22	18	30
M24	210	28	22	66
M30	280	35	26	130
M36	360	42	31	232
M42	420	48	34	325
M48	460	55	38	460
M56	500	62	45	550
M64	560	70	51	725
M76	670	84	58	1,200

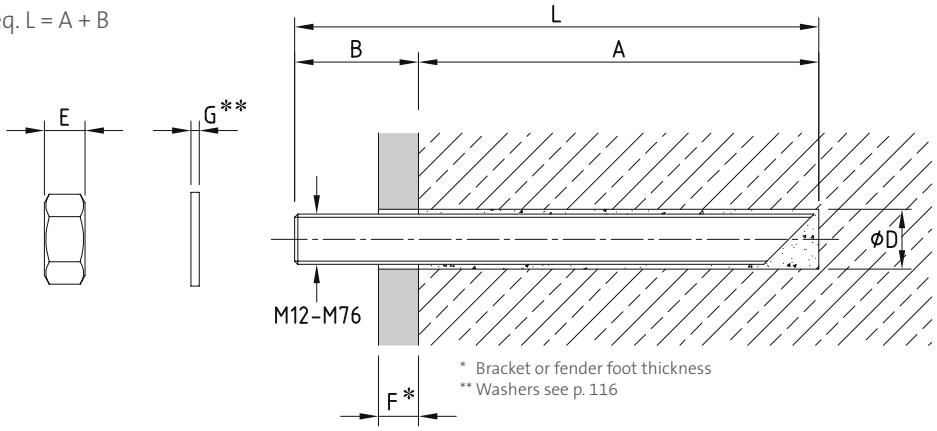
For all cases, the required embedded depth should be checked by calculations | Other sizes available upon request

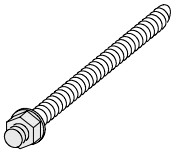
Chemical Anchor

Formula to determine bolt length:

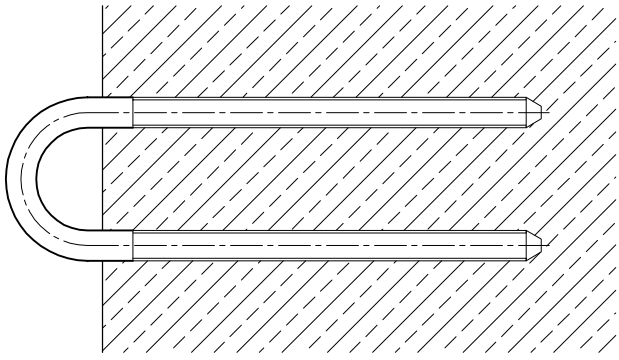
1: req. B = E + F + G + ca. 0.4 x M

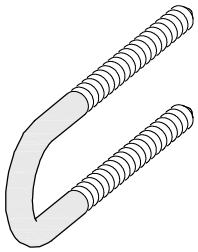
2: req. L = A + B





GENERIC CHEMICAL U ANCHOR DRAWING



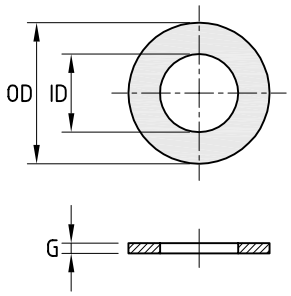


WASHER DIMENSIONS

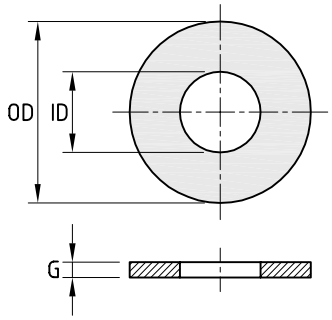
Anchor Size	ISO 7089		Special Washer Plate (FE Element Fenders)		Washer Plate (CSS and V Fenders)				L-Washer (SPC Fenders*)		
	OD x ID [mm]	G [mm]	OD x ID [mm]	G [mm]	L x B [mm]	D [mm]	G [mm]	Weight [kg]	L x B [mm]	D [mm]	G [mm]
M16	30 x 17	3	-	-	-	-	-	-	-	-	-
M20	37 x 21	3	44 x 21	4	50 x 45	22	5	0.08	55 x 45	22	6
M24	44 x 25	4	56 x 25	5	75 x 55	26	6	0.15	80 x 70	26	6
M30	56 x 31	4	72 x 32	6	85 x 65	32	6	0.30	150 x 90	34	8
M36	66 x 37	5	80 x 38	8	100 x 75	38	6	0.36	165 x 130	40	8
M42	78 x 45	8	92 x 45	8	150 x 90	45	10	0.97	205 x 170	46	10
M48	92 x 52	8	105 x 52	8	175 x 100	52	10	1.26	180 x 140	52	10
M56	105 x 62	10	115 x 60	8	185 x 125	62	10	1.85	245 x 170	60	12
M64	115 x 70	10	-	-	200 x 130	70	10	2.08	-	-	10
M76	135 x 82	10	-	-	230 x 150	80	12	3.30	-	-	12

* Typical sizes | For details, refer to the project specific fender drawing

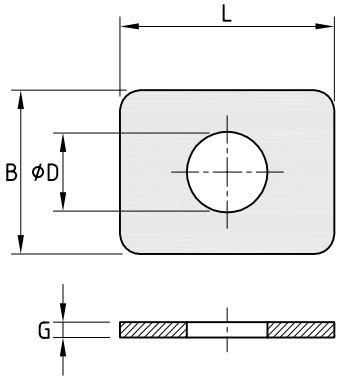
WASHER DRAWING



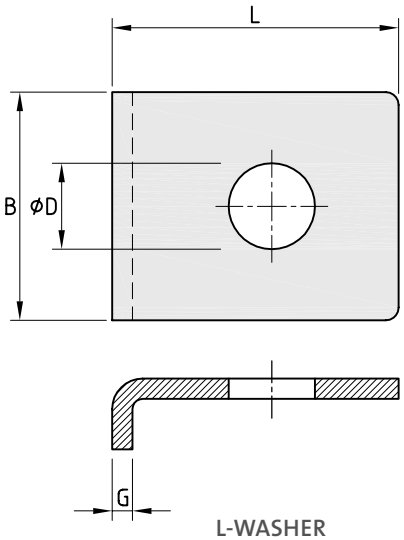
ISO 7089



SPECIAL WASHER PLATE
(FE ELEMENT FENDERS)



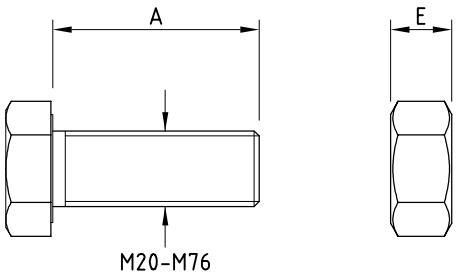
WASHER PLATE
(CSS CELL AND V FENDERS)



L-WASHER
(SPC CONE FENDERS)

Maasvlakte II | Rotterdam | The Netherlands

BOLTS & NUTS DRAWING



Formula to determine bolt length:

1: A > G + F + 1.2 x M

2: A < G + F + B

For details, see p. 114

Bolts & Nuts

Restraint chain assemblies and brackets

Bollards.

Characteristics

- Wide range of standard shapes, load ratings, materials, and anchor systems
- Strong & long lasting designs
- Standard epoxy coating (NDFT 450 µ)
- Large line angles possible
- Special designs available upon request

Applications

- Container & Bulk Terminals
- Oil & Gas Terminals
- General Cargo Terminals
- Cruise Terminals, Ferry & RoRo Terminals
- Navy
- Leisure craft (customized)

T HEAD

Type	Capacity [t]	Anchors	Weight [kg]
FT 10	10	4 x M24	50
FT 15	15	4 x M24	55
FT 20	20	5 x M24	66
FT 30	30	5 x M30	80
FT 50	50	5 x M36	165
FT 75	75	6 x M42	215
FT 100	100	7 x M42	345
FT 125	125	7 x M48	485
FT 150	150	7 x M48	565
FT 200	200	8 x M56	650
FT 250	250	8 x M56	925
FT 300	300	8 x M64	1.175

Also available as Double T Head

STAGHORN

Type	Capacity [t]	Anchors	Weight [kg]
FSH 10	10	4 x M24	55
FSH 15	15	4 x M24	65
FSH 20	20	5 x M24	85
FSH 30	30	5 x M30	135
FSH 50	50	5 x M36	165
FSH 75	75	6 x M42	285
FSH 100	100	7 x M42	395
FSH 125	125	7 x M48	525
FSH 150	150	7 x M48	665
FSH 200	200	8 x M56	785

Higher capacity available upon request

T Head Bollard

Staghorn Bollard

For detailed information on design, load angles, anchor types, materials as well as good practice installation and application, please contact your local SFT office

SINGLE BITT

Type	Capacity [t]	Anchors	Weight [kg]
FSB 10	10	4 x M24	45
FSB 15	15	4 x M24	55
FSB 20	20	5 x M24	65
FSB 30	30	5 x M30	100
FSB 50	50	6 x M36	210
FSB 75	75	6 x M42	350
FSB 100	100	7 x M48	585
FSB 125	125	7 x M48	615
FSB 150	150	7 x M56	845
FSB 200	200	8 x M56	1.150
FSB 250	250	8 x M64	1.425

Higher capacity available upon request

Single Bitt Bollard

DOUBLE BITT

Type	Capacity* [t]	Anchors	Weight [kg]
FDB 20	10	8 x M20	70
FDB 35	15	8 x M20	105
FDB 50	20	8 x M30	180
FDB 75	30	10 x M36	305
FDB 100	50	10 x M42	465
FDB 125	75	10 x M42	705
FDB 150	100	10 x M48	885
FDB 200	125	10 x M56	1.165

Higher capacity available upon request
* Capacity per bitt

Double Bitt Bollard

SINGLE BITT 360°

Capacity available from 10 t - 200 t

KIDNEY

Capacity available from 15 t – 200 t

FABRICATED / WELDED

Custom design

TRICORN

Capacity available from 50 t – 150 t

CLEATS

Sizes available from 610 mm – 1,372 mm

Hole for concrete infill omitted

Physical Properties.

ShibataFenderTeam's rubber fender components are manufactured from the highest quality Natural Rubber (NR) and Styrene Butadiens (SBR) based compounds which meet or exceed the performance requirements of European Union specification EAU-E 62 “Acceptance Requirements for Fender Elastomers” and ASTM D2000 “Standard Classification System for Rubber Products”. Typical specifications are listed in the table on the following page.

In addition to NR and SBR, other rubber compounds like EPDM and Polyurethane are available on request for specialized applications and certain products. Please consult ShibataFenderTeam for further details.

RUBBER PROPERTIES

Property	Testing Standard	Condition	Requirement
Tensile Strength	JIS K6251 – Dumbbell No. 5; ASTM D412 – Die C; ISO 37 – S1; BS 903, Part A2 – S1	Original	16 MPa (min)
		Aged for 96 hours at 70°C	12.8 MPa (min)
	DIN 53504	Original	15 MPa (min)
		Aged for 168 hours at 70°C	12.75 MPa (min)
Elongation at Break	JIS K6251 – Dumbbell No. 5	Original	350 % (min)
		Aged for 96 hours at 70°C	280 % (min)
	ASTM D412 – Die C; ISO 37 – S1; BS 903, Part A2 – S1	Original	400 % (min)
		Aged for 96 hours at 70°C	320 % (min)
	DIN 53504	Original	300 % (min)
		Aged for 168 hours at 70°C	280 % (min)
Hardness	JIS K6253 – Shore A	Original	72° (max)
		Aged for 96 hours at 70°C	Original Value + 8° points increase (max)
	ASTM D2240 – Shore A; ISO 7619 – Shore A; BS 903, Part A57 – Shore A	Original	78° (max)
		Aged for 96 hours at 70°C	Original Value + 6° points increase (max)
	DIN 53505 – Shore A	Original	75° (max)
		Aged for 168 hours at 70°C	Original Value + 5° points increase (max)
Compression Set	JIS K6262; ASTM D395 – Method B; BS 903, Part A6; ISO 815	Aged for 22 hours at 70°C	30 % (max)
	DIN 53517	Aged for 24 hours at 70°C	40 % (max)
Tear Resistance	JIS K6252 – Crescent Type; ASTM D624 – Die B; BS 903, Part A3 – Method C; ISO 34-1 – Method C	Crescent Type	70 kN/m (min)
	DIN 53507		80 N/cm (min)
Ozone Resistance	JIS K6259; ASTM D1149; ISO 1431-1; BS 903.A43; DIN53509	50 pphm at 20 % strain at 40°C for 100 hours	No cracking visible by eye
Seawater Resistance	ASTM D471; ISO 1817	28 days in artificial seawater at 95°C at ± 2°C	Hardness ± 10° (max) Volume + 10 / - 5 % (max)
Abrasion Resistance	BS 903, Part A9 – Method A;	1,000 revolutions	Volume Loss 0.5 cc (max)
	DIN 53516; ISO 4649 – Method A; ASTM D5963 – Method A	–	100 mm³ (max)
Bond Strength Steel to Rubber	BS 903, Part A21; ASTM D429 – Method B; ISO 813	–	7 N/mm (min)
Dynamic Fatigue*	ASTM D430-95 – Method B	15,000 cycles	Grade 0 - 1

* Dynamic fatigue testing is optional at extra cost.

The values above are based on tests, carried out under strict laboratory conditions using specimens taken from batches of unvulcanized rubber compound. All tests will be done on specially prepared samples as per applicable standard. The results of samples taken from finished product may differ.

TOLERANCES

All ShibataFenderTeam fenders are subject to standard manufacturing and performance tolerances. Smaller tolerances may be agreed if required for special applications.

Fender Type	Dimensional Tolerances	
Molded Fenders		
SPC, CSS, FE, V and others	Outside dimensions Bolt hole spacing	± 3 % or ± 2 mm* ± 2 mm
Komposite Fenders	Cross-section Length	± 3 % or ± 2 mm* ± 2 % or ± 25 mm*
	Drilled hole centers Counterbore depth	± 4 mm (non-cumulative) ± 4 mm (under-head depth)
M & W Fenders	Cross-section Length	± 3 % or ± 2 mm* ± 3 % or ± 20 mm*
	Fixing hole centers Fixing hole diameter	± 3 mm ± 3 mm
Cylindrical Fenders		
Cylindrical Fenders (wrapped)	Outside diameter Inside diameter Length	± 4 % ± 4 % - 0 / + 40 mm
Extruded Fenders		
Extruded Fenders	Cross-section Length	± 5 % ± 2 % or ± 10 mm*
	Drilled hole centers Counterbore depth	± 4 mm (non-cumulative) ± 4 mm (under-head depth)
PE Sliding Plates and Fenders		
HD-PE Sliding Fenders **	Cross-section Length	± 4 % ± 2 % or ±20 mm*
	Drilled hole centers Counterbore depth	± 4 mm (non-cumulative) ± 4 mm (under-head depth)
UHMW-PE Plates **	Length and width Thickness planed	± 5 mm ± 0.3 mm
	Thickness unplaned Drilled hole centers	± 3 mm ± 2 mm (non-cumulative)

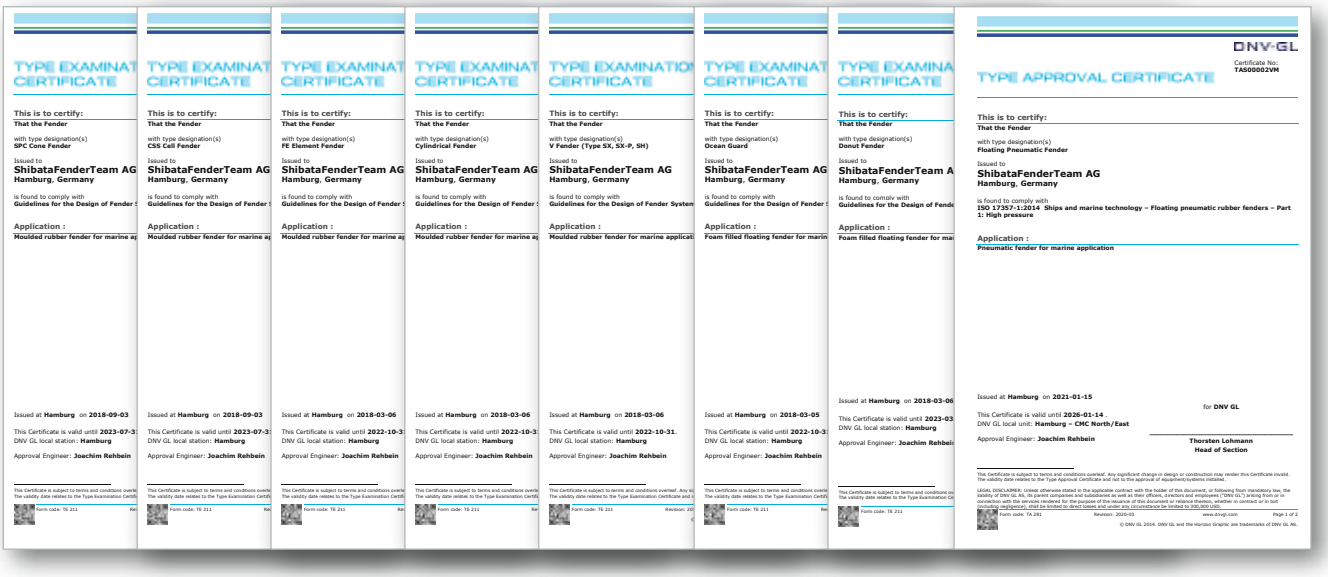
Fender Type	Performance Tolerances	
SPC, CSS, SX, SX-P, SH	Reaction, Energy	± 10 % ***
Cylindricals (wrapped)	Reaction, Energy	± 10 %
Cylindricals (extruded)	Reaction, Energy	± 20 %
Extruded, Komposite & Shear Fenders	Reaction, Energy	± 20 %
Pneumatic Fenders	Reaction, Energy	see p. 69 and p. 73
Foam Fenders	Reaction, Energy	± 15 % ***
Wheel & Roller Fenders	Reaction, Energy	± 20 %

* Whichever is the greater dimension
** Any HD-PE and UHMW-PE tolerances (length, cross-section and machining) are strictly applicable to a material temperature of 18°C
*** For special tolerances, please contact your local SFT office

Performance Tolerances apply to Rated Performance Data (RPD) only and not to energy and/or reaction at intermediate deflections | The nominal rated deflection when the RPD is achieved may vary and is provided as a guidance only | RPD data do not necessarily apply to constant-load and cyclic-load conditions | For detailed advice on fender types that are not listed above, please contact your local SFT office | Values might partially be rounded | In rare cases, small deviations to drawing may occur | Weight may vary, depending on hardness grades and compound

QUALITY CERTIFICATES

- ISO 14001:2015 – Certified production facility (Shibata Industrial Co. Ltd.)
- ISO 9001:2015 – Certified quality management system (Shibata Industrial Co. Ltd.)
- ISO 9001:2008 – Certified quality management system (ShibataFenderTeam AG)
- EN 1090-2:2008+A1:2011 – EXC3 Certified workshops (ShibataFenderTeam AG)



Type approval certificates according to PIANC 2002. For verification, please check: https://approvalfinder.dnvgl.com

- SPC Cone Fenders
- CSS Cell Fenders
- FE Element Fenders
- Cylindrical Fenders
- V Fenders
- Ocean Guard Fenders
- Donut Fenders
- Pneumatic Fenders

Fender Testing.

- Testing to latest PIANC protocols
- Full size test equipment for quality assurance and development testing
- Full size combined shear compression test equipment
- Fully equipped and independently certified in-house laboratory
- Fatigue / durability testing equipment
- Temperature stabilization chamber
- Type Approval for standard range of fenders

TESTING PROCEDURE

ShibataFenderTeam's standard testing procedure for 'engineered'[1] solid rubber fenders complies with PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)': Appendix A: Section 6: Verification/Quality Assurance Testing'.

TEST EQUIPMENT AND MEASURING DEVICES

The test equipment is fully fitted with calibrated load cells or pressure transducer and linear transducer(s) for measuring displacement to allow continuous monitoring of fender performance. All test equipment is calibrated and the calibration certificates are revalidated frequently to be within their validity period of one year at any time.

TEST PROCEDURE – METHOD CV

Testing of molded[2] fenders and wrapped cylindrical[3] fenders is carried out in-house, with the option of third-party witnessing using full size fenders in accordance with the following test setup which follows the PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)' (Appendix A:4.1):

- All fender units have a unique serial number which can be traced back to manufacturing and testing records.
- Fenders are tested under direct (vertical) compression.
- The fender shall be compressed 3 times up to its rated deflection following a recovery period of at least one hour.
- Test temperature is 23°C ± 5°C[4].
- Actual performance values are recorded from 4th compression.
- Compression speed is 2 – 8 cm / min.
- During the test the load shall be recorded to a precision of ± 1.0 kN (± 0.1 t) and the deflection to ± 0.5 mm, unless otherwise specified.
- Energy absorption[5] is determined as the integral of reaction and deflection, calculated using Simpson's Rule.
- Compression shall be stopped once 110 % of rated reaction force, maximum specified reaction force or, nominal / max. fender deflection has been reached.
- If any sample does not satisfy the specifications, sampling of the remainder is increased to 20 % of fenders (rounded up to a unit), excluding non-compliant units.
- If any further sample does not satisfy the specifications, 100 % of remaining samples will be tested. Only units which satisfy the specifications shall be passed for shipment. The non-compliant fenders will be rejected.

[1] As defined in PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)' in Appendix A: Section 1.2, small fendering bumpers are excluded.
[2] Molded Fenders include SPC, CSS, FE, SX, SX-P and SH Fenders. SPC, CSS, SX, SX-P and SH Fenders are tested singly, FE Fenders are tested in pairs.
[3] Excluding Tug Cylindrical Fenders.
[4] Where ambient temperature is outside of this range, fenders shall be normalized to this temperature range in a conditioning room for an appropriate period (dependent upon fender size) or performance values may be corrected according to temperature correction factor tables at the sole discretion of the supplier. Stabilization time shall be not less than $20x^{1.5}$ days, rounded to the next whole day (x = dimension of greatest rubber thickness, in meters).
[5] Reaction force (and corresponding calculated energy absorption) is corrected for initial berthing speed and temperature where applicable.

Rubber Fender Testing

PASS CRITERIA

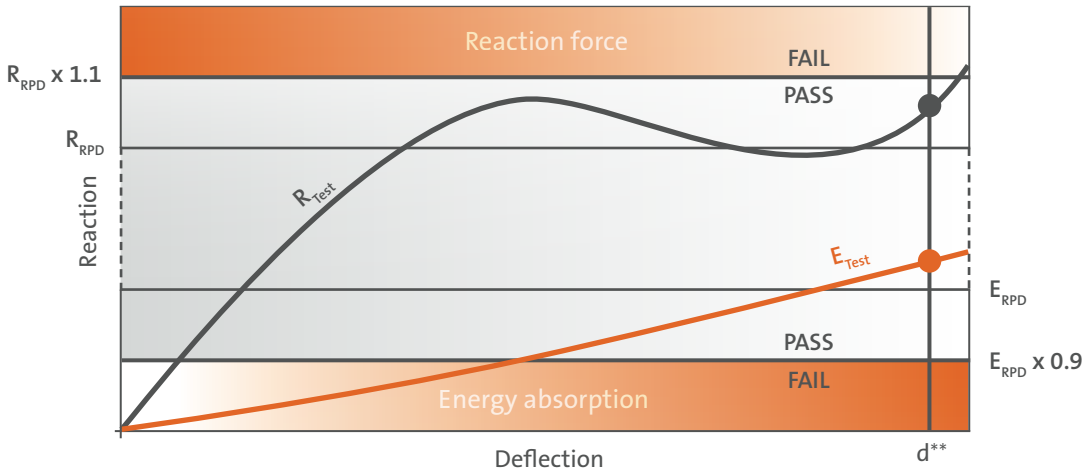
Verification testing (or quality control testing) is carried out to prove the performance of fenders in accordance with catalogue RPD or other customer-specified values. Samples from the actual fenders for the project are tested. Results obtained are adjusted if necessary, using the correction factor tables for initial impact speed and temperature. The fender passes verification testing if it meets the following conditions:

1. Visual

There is no visual evidence of defects, such as bonding failures or splits on the surface of the fender.

2. Performance

The fender provides Required Performance (Required Energy and Reaction) within production tolerances, if it meets the following requirements simultaneously at any point during the test.*



REACTION FORCE PASS CRITERIA

R_{Test} Velocity-and-temperature-adjusted reaction is less than or equal to required reaction multiplied by the nominal reaction tolerance* (high end) specified in the catalogue.

$$R_{Test} \leq R_{RPD} \times 1.1$$

ENERGY ABSORPTION PASS CRITERIA

E_{Test} Velocity-and-temperature-adjusted energy absorbed is greater than or equal to required energy multiplied by the nominal energy tolerance* (low end) specified in the catalogue.

$$E_{Test} \geq E_{RPD} \times 0.9$$

The rated performance data in this catalogue may not necessarily apply to constant load and cyclic-load conditions. In such cases, please contact ShibataFenderTeam for design assistance.

R_{Test} = Velocity-and-temperature-adjusted reaction force from verification testing
R_{RPD} = RPD Performance Data, Reaction
E_{Test} = Velocity-and-temperature-adjusted energy absorption from verification testing
E_{RPD} = RPD Performance Data, Energy

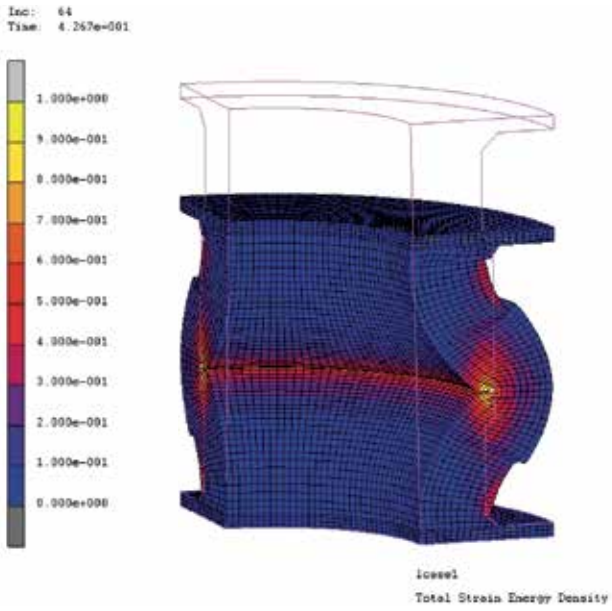
* Standard manufacturing tolerances, see ShibataFenderTeam product catalogue p. 124

** Deflection is not a pass/fail criteria, please refer to PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)' page 49 point 6.1.2

NOTES

- Standard Verification Testing with reference to PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)' is considered.
- A single break-in deflection is mandatory for fenders with a reaction force of 100 tons or more, which are to be installed on load sensitive structures (refer to PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)' 6.2.1).
- All measuring equipment shall be calibrated and certified, to be accurate within ± 1% according to ISO, equivalent JIS or ASTM requirements. Calibration shall be traceable to national / international standards and shall be performed annually by an accredited third-party organization.
- Standard Testing with reference to PIANC WG Report 33 'Guidelines for the Design of Fenders (2002)' is included in the fender price. Other testing frequency, third-party witnessing and temperature conditioning costs are to be borne by the purchaser.

FE ANALYSIS



SPC Fender angular compression testing with restrain chains

Climate Chamber

CSS Fender shear testing with panel and UHMW-PE face pads

PROJECT REQUIREMENTS

Port: .....

Berth: .....

Client: .....

Designer: .....

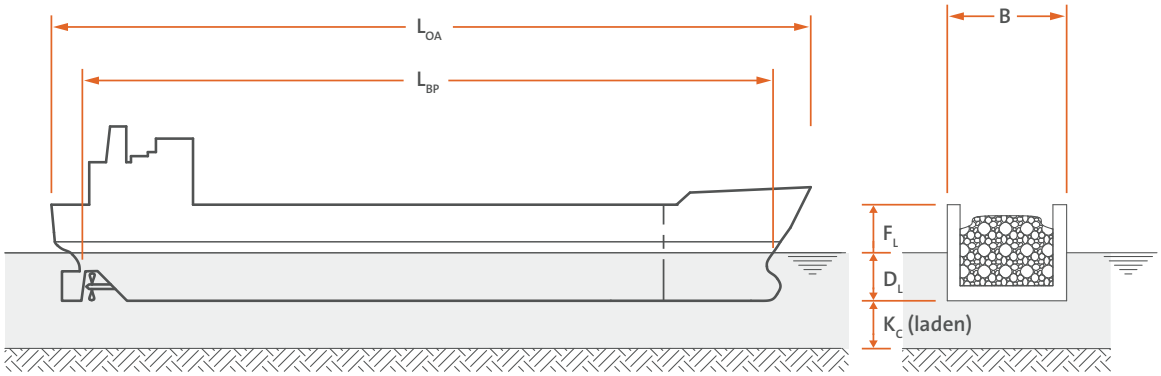
Contractor: .....

Accurate project information is needed to propose the most suitable fenders.

Please use the table below to describe the operating requirements with as much detail as possible.

Project: ☐ New Construction ☐ Upgrade **Status:** ☐ Preliminary ☐ Detail ☐ Tender

SHIP INFORMATION



LARGEST SHIPS

Type/Class .....

Deadweight ..... DWT

Displacement .....t

Length Overall ..... m

Beam ..... m

Draft ..... m

Hull Pressure ..... kN/m² (kPa)

Belting ☐ Yes ☐ No ..... Size

Bow Flare ..... deg.

Bow Radius ..... m

SMALLEST SHIPS

Type/Class .....

Deadweight ..... DWT

Displacement ..... t

Length Overall ..... m

Beam ..... m

Draft ..... m

Hull Pressure ..... kN/m² (kPa)

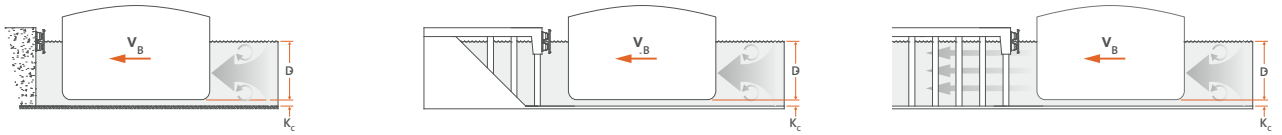
Belting ☐ Yes ☐ No ..... Size

Bow Flare ..... deg.

Bow Radius ..... m

BERTH INFORMATION

☐ CLOSED BERTH FACE ☐ PART-CLOSED BERTH FACE ☐ OPEN STRUCTURE



Berth Type ☐ Continuous Wharf ☐ Dolphins ☐ Pontoon ☐ Lock or Drydock ☐ Other

Length of Berth ..... m

Fender Spacing ..... m

Deck Level ..... m (above datum)

Highest Tide (HHW) ..... m (above datum)

Under Keel .....m (min) ..... m (max)

Import/Export ☐ Import ☐ Export ☐ Both

Maximum Reaction .....kN

Soffit Level .....m (above datum)

Lowest Tide (LLW) .....m (above datum)

Wind Speed ..... m/s

Current Speed ..... m/s

LOCATION

Climate ☐ Moderate ☐ Tropical ☐ Desert ☐ Mediterranean ☐ Polar

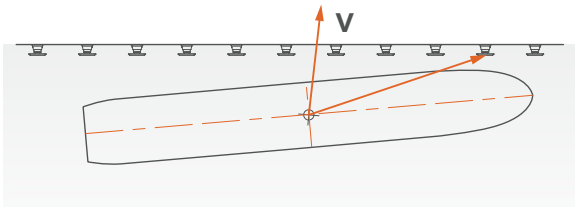
Temperature .....°C (min) .....°C (max) **Corrosivity** ☐ High ☐ Medium ☐ Low

Water type ☐ Sea ☐ Fresh SG = ... t/m³ **Winter Ice** ☐ Never ☐ Sometimes ☐ Every Year

BERTHING INFORMATION

Point of contact ☐ Midships ☐ Thirdpoint ☐ Quarterpoint ☐ Fifthpoint ☐ Sixthpoint

Side Berthing

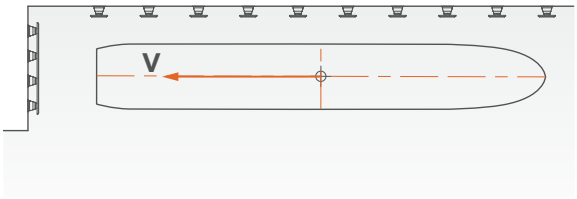


Approach Speed.....m/s

Berthing Angle.....deg.

Factor of Safety.....

End Berthing

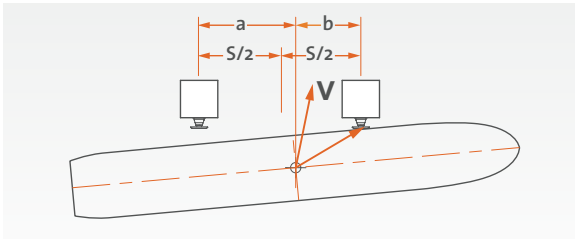


Approach Speed.....m/s

Berthing Angle.....deg.

Factor of Safety.....

Dolphin Berthing

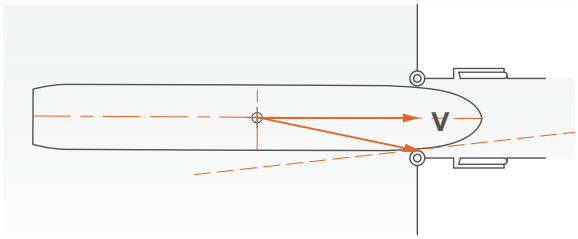


Approach Speed.....m/s

Berthing Angle.....deg.

Factor of Safety.....

Lock Entrance

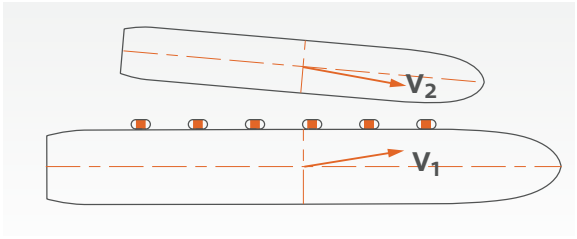


Approach Speed.....m/s

Berthing Angle.....deg.

Factor of Safety.....

Lithering (Ship-to-Ship)



Approach Speed.....m/s

Berthing Angle.....deg.

Factor of Safety.....

OTHER INFORMATION

Design Code:
- ☐ PIANC 2002
- ☐ BS6349
- ☐ EAU-2004
- ☐ ROM 0.2-90
- ☐ ROSA 2000
- ☐ ASNZ 4997
- ☐ UFC 4-152-01
- ☐ Other

NOTES

Disclaimer:

This product catalogue has been prepared with the greatest possible care and to the best of our knowledge and belief. All technical specifications, product descriptions and planning principles used are correct at the time of going to press. ShibataFenderTeam AG, its subsidiaries, agents and associates do not accept the responsibility or liability for any errors and omissions for whatsoever reason. When using this product catalogue to develop a design, customers are strongly recommended to request a detailed specification, calculations and certified drawings from our specialists prior to construction and/or manufacture. ShibataFenderTeam constantly strives to improve the quality and performance of products and systems. We reserve the right to change specification without prior notice. All dimensions, material properties and performance values quoted are subject to normal production tolerances. This product catalogue supersedes the information provided in all previous editions. If in doubt, please consult ShibataFenderTeam.

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Drawings: Ingenieurbüro Roßburger
Date: 08 / 2021, Layout: wn8.de

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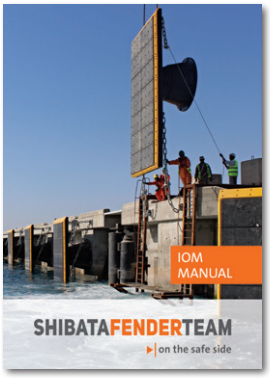
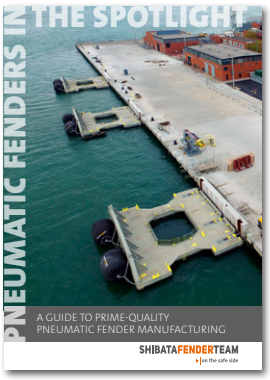
COMPANY PROFILE
Introduction of the full services range of SFT: Consulting, Engineering, Manufacturing, After Sales Service and Testing / Quality Control, including an overview of the SFT product range.



INSTALLATION, OPERATION AND MAINTENANCE MANUAL
Gives advise for the installation and operation of different fender types and provides guidance for the maintenance process of fender systems.

DESIGN MANUAL
Concise resource to assist designers and specifiers to identify the key input criteria, to calculate berthing energies and to select the optimal fender type.



PNEUMATIC FENDER MANUAL
Focus on the design and quality requirements of Pneumatic Fenders to present unbiased information about the two conventional manufacturing methods wrapping and moulding.

WHITE PAPER SERIES
Four-part SFT White Paper Series to explore the production steps of rubber compounding, mixing, manufacturing & curing, and testing in order to provide an unbiased view of “what exactly makes a high-quality fender”.

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