



# 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

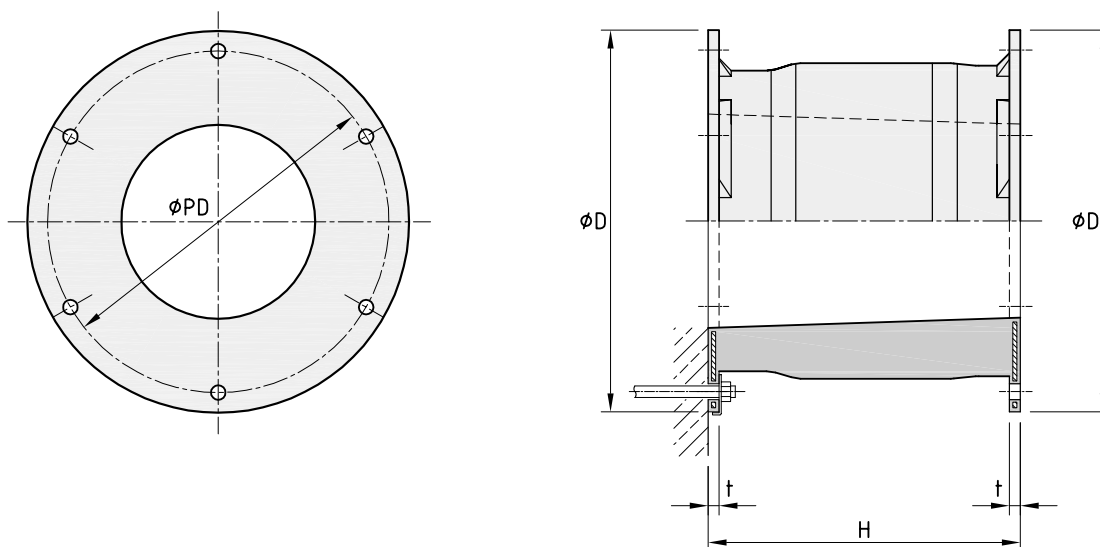
SAFIM AS AGENT

### CSS FENDER DIMENSIONS

Fender Size	H [mm]	Ø D [mm]	t [mm]	Ø PD [mm]	Anchors / Bolts	Weight [kg]
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	30	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

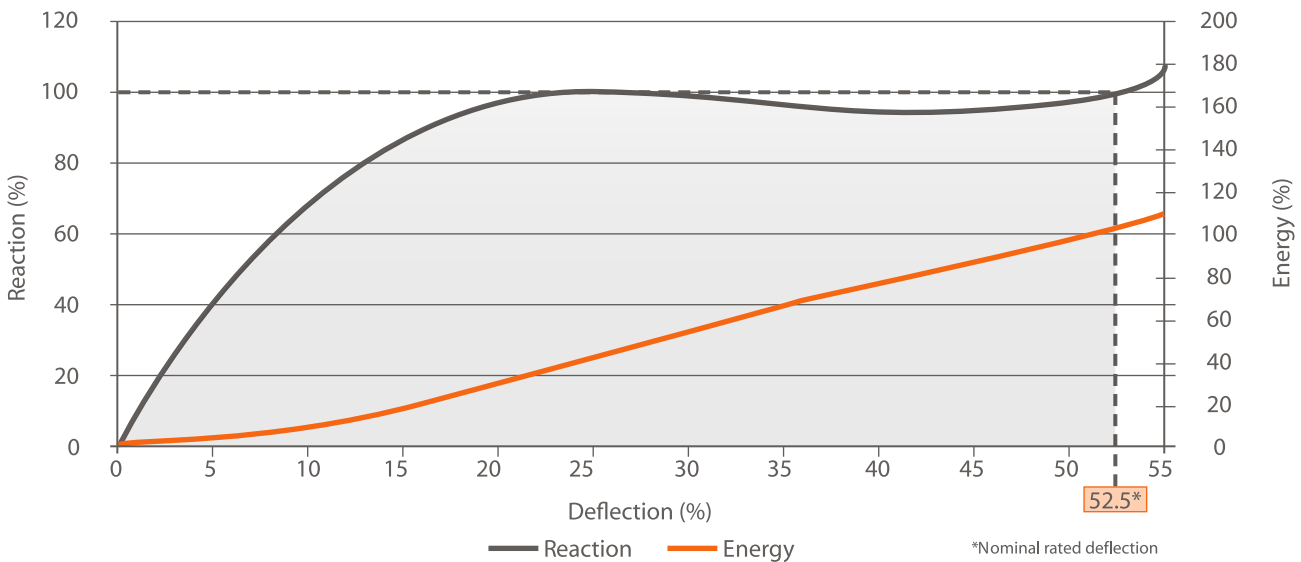


PERFORMANCE TABLE CSS FENDERS (RPD = RATED PERFORMANCE DATA IN ACC. WITH PIANC)

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 400	$\frac{E_A}{R_F}$ 0.17	9 50	10 56	10 59	11 63	12 67	12 70	13 74	13 77	14 81	15 84	
CSS 500	$\frac{E_A}{R_F}$ 0.22	18 83	19 87	20 91	21 96	22 100	23 105	24 109	25 115	27 122	28 128	
CSS 600	$\frac{E_A}{R_F}$ 0.30	31 119	33 126	35 132	36 138	38 144	40 151	41 157	44 166	46 176	49 185	
CSS 800	$\frac{E_A}{R_F}$ 0.35	75 211	79 223	82 234	86 245	90 256	94 267	98 279	104 295	110 312	116 329	
CSS 1000	$\frac{E_A}{R_F}$ 0.44	145 331	153 348	161 366	168 383	176 401	184 418	191 435	203 462	214 488	226 514	
CSS 1150	$\frac{E_A}{R_F}$ 0.51	222 438	233 461	245 484	257 507	268 530	280 553	291 576	309 610	326 645	344 679	
CSS 1250	$\frac{E_A}{R_F}$ 0.55	284 517	299 544	314 571	329 598	343 626	359 653	374 680	396 720	419 761	441 802	
CSS 1450	$\frac{E_A}{R_F}$ 0.64	444 694	467 732	490 768	514 805	537 842	560 878	584 915	619 969	654 1,024	689 1,078	
CSS 1600	$\frac{E_A}{R_F}$ 0.70	596 846	628 891	659 937	690 982	721 1,027	753 1,073	785 1,118	832 1,185	879 1,251	926 1,318	
CSS 1700	$\frac{E_A}{R_F}$ 0.75	714 961	751 1,010	789 1,059	827 1,108	864 1,157	902 1,206	940 1,255	997 1,332	1,054 1,404	1,110 1,484	
CSS 2000	$\frac{E_A}{R_F}$ 0.88	1,165 1,322	1,226 1,393	1,287 1,463	1,348 1,534	1,408 1,604	1,469 1,675	1,530 1,746	1,622 1,860	1,714 1,953	1,806 2,057	
CSS 2250	$\frac{E_A}{R_F}$ 0.99	1,659 1,676	1,746 1,765	1,832 1,854	1,918 1,942	2,005 2,030	2,091 2,118	2,177 2,207	2,309 2,338	2,440 2,469	2,571 2,601	
CSS 2500	$\frac{E_A}{R_F}$ 1.10	2,544 2,317	2,826 2,574	2,976 2,711	3,026 2,847	3,275 2,983	3,425 3,120	3,575 3,256	3,724 3,392	3,874 3,528	4,024 3,665	
CSS 3000	$\frac{E_A}{R_F}$ 1.15	3,795 3,310	4,217 3,678	4,452 3,879	4,688 4,080	4,923 4,281	5,158 4,482	5,394 4,683	5,629 4,884	5,865 5,085	6,100 5,286	

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	
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
6,335 5,487	6,571 5,688	6,761 5,856	6,952 6,023	7,143 6,191	7,334 6,358	7,525 6,526	7,716 6,693	7,906 6,860	8,097 7,028	8,288 7,195	8,479 7,363	9,327 8,099	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

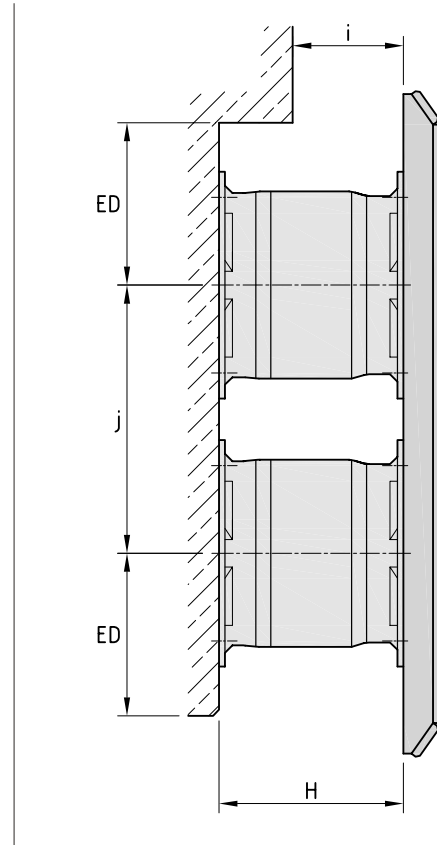
Compression Angle [°]	0	3	5	8	10	15	20
Energy Absorption of original value [%]	100	98.7	97.8	96.8	95.0	87.6	85.5
Reaction Force of original value [%]	100	100	100	100	100	100	100

## INSTALLATION CLEARANCES

Fender Size	H [mm]	i [mm]	j [mm]	ED [mm]
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

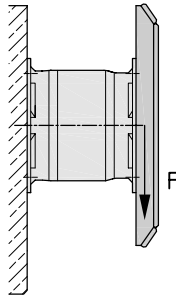
The fender system design should allow for:

- ▶ 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



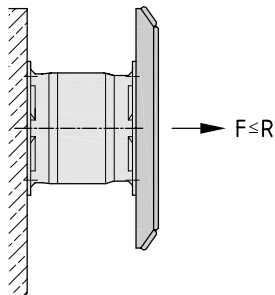
WEIGHT SUPPORT CAPACITY

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.\*



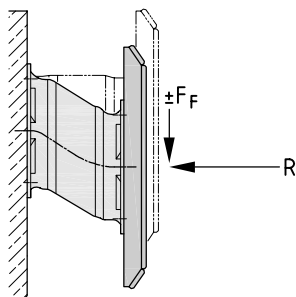
TENSION

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



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.\*



Barbours Cut Container Terminal | Houston, TX | USA



Khalifa Port | Abu Dhabi | U.A. E.



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.