TRELLEBORG

Marine Fender Systems

Foam Fenders

SeaGuard

SeaGuard fenders work equally well in harbours or between vessels. Low hull pressures protect soft-skinned ships. Seaguard combines a durable, non-marking finish with low maintenance.

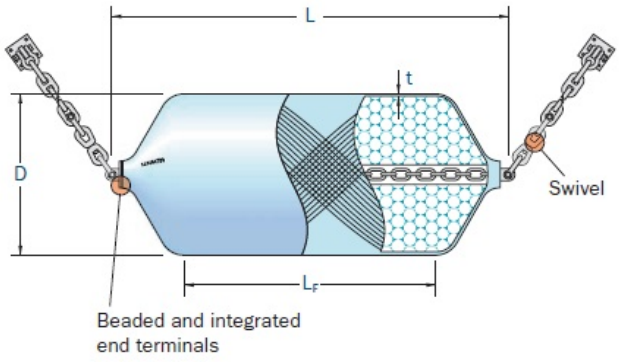
SeaGuard fenders can be deployed floated or suspended, against a quay wall or for ship-to-ship operations. SeaGuard fenders suit all sites with small or large tidal changes. They also work just as well on new or old structures.

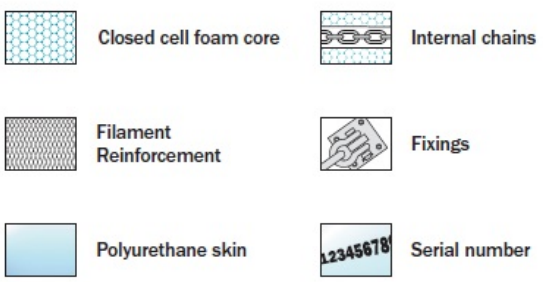
Hull pressures are very low, making SeaGuard fenders gentle on soft-skinned ships. The skin is very tough but also non-marking, even against white-hulled yachts and cruise liners.

Low maintenance comes as standard because the polyurethane elastomer is highly resistant to the effects of ozone and ultra violet light. SeaGuard fenders will never sink or deflate. Even at the end of their first service life they can be returned to the factory for refurbishment before going back to work.

Features

- Fully compliant with US Navy specifications
- Wide range of standard and custom sizes
- Low reaction and high energy options
- Operate floating or suspended
- Virtually indestructible
- No chain/tyre net required
- Non-marking even against white hulls
- Unsinkable design





Applications

- Cruise ships
- Container vessels
- Bulk cargo
- RoRo and ferries
- Oil and gas tankers
- General cargo
- Navy berths
- Ship-to-ship transfers

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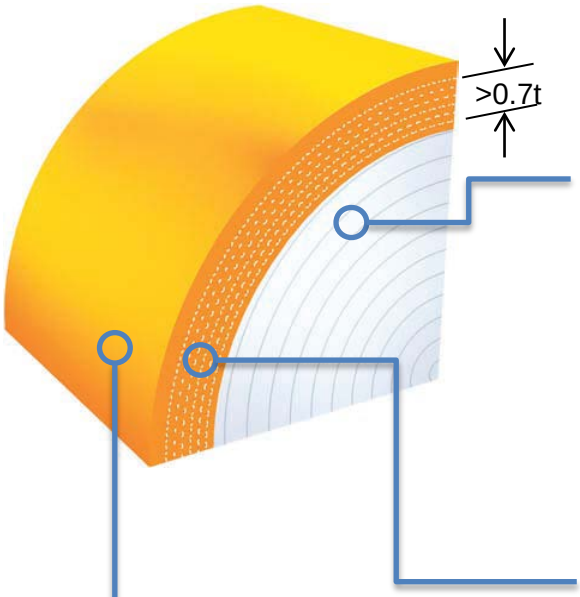

Polyethylene foam core

Property [1]	Unit	Typical result
Density [1]	kg/m^3	64 ± 6
Tensile strength [1]	kN/m2	>414
Elongation at break [1]	%	>120
Compressive strength (50%) [1]	kN/m2	>140
Water absorption [1]	kg/m^2	<1
Working temperature [2]	ºC	–30 to +70

Reinforcement fi lament

Property	Unit	Typical result
Material	-	2520 denier nylon
Tensile strength (single fi lament)	N	230
Elongation at break	%	16
Helix angle	degrees	40 - 60
Filament spacing	mm	< 4

All physical properties are typical values which can be adjusted to suit specifi c applications. Foam density can be increased for higher energy absorption or reduced for lower reaction force and hull pressure. Additional reinforcement layers can be added for extreme duty applications. The polyurethane elastomer skin can be increased or reduced in hardness to adjust friction and wear resistance properties. The standard fender skin colour is black. Orange, red and yellow skins are widely specifi ed for maximum visibility, grey is common for navy applications and almost any other colour is available on special request. Please ask for further details.

Polyurethane elastomer

Property	Unit	Typical result
Hardness [3]	Shore A	75 - 95
Tensile strength (PU only) [4]	MPa	> 13.8
Elongation at break (PU only) [4]	%	> 300
Tear strength [4]	kN/m	> 32
Flexural life (Ross) [5]	cycles	> 10000
Abrasion resistance [6]	NBS	> 100

Standards

1 ASTM D-3575
2 PPC-C-1752B
3 ASTM D-2240
4 ASTM D-412
5 ASTM D-1052
6 ASTM D-1630

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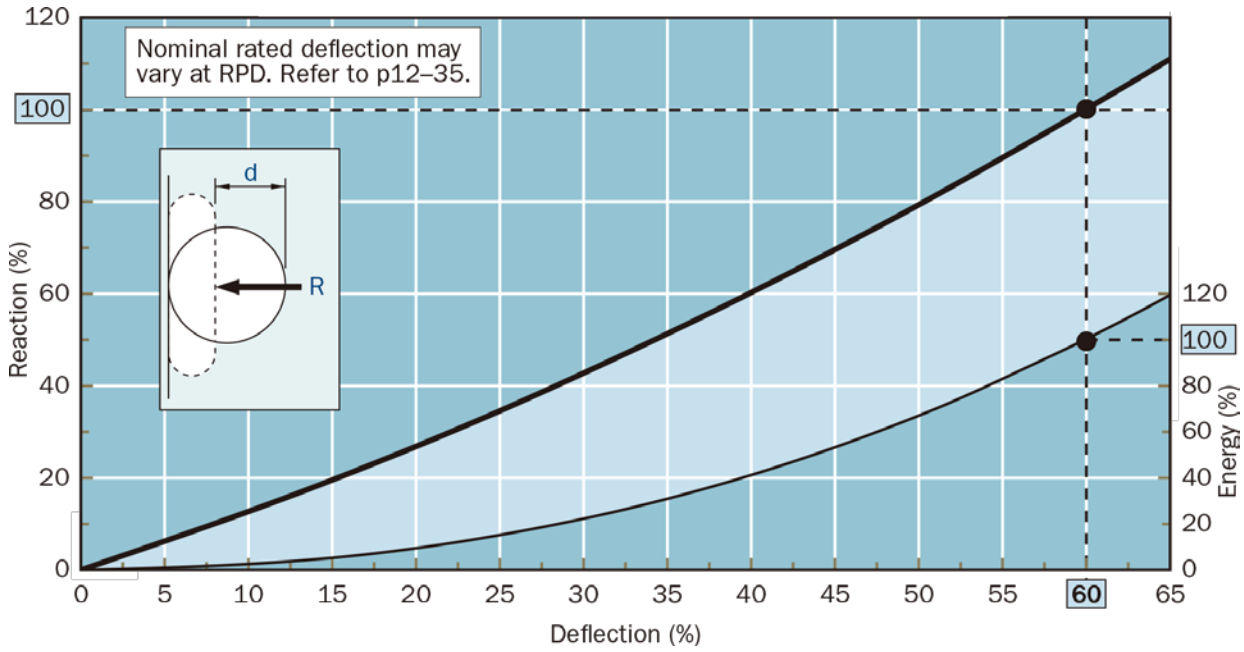
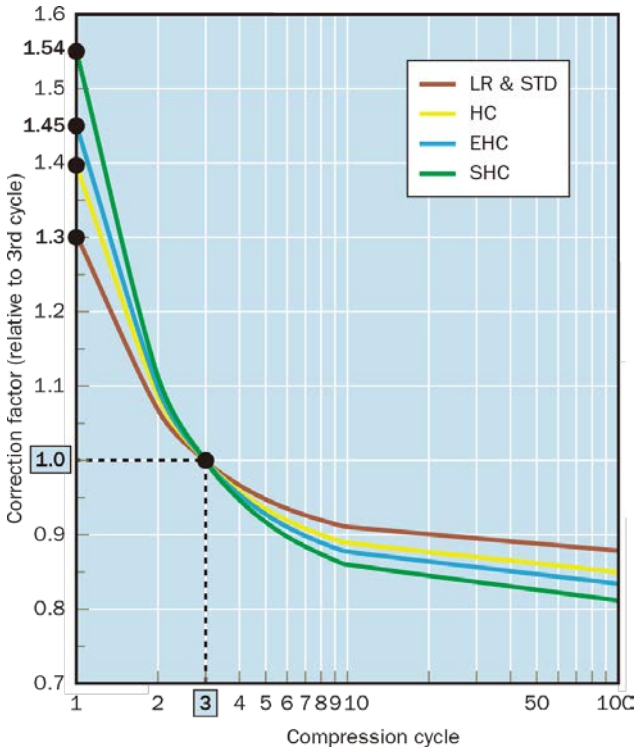


For increased energy use High, Extra High or Super High capacity foam grades. For reduced hull pressure use Low Reaction foam grade.

Foam grades	E	Ratio
Low Reaction	LR	0.6
Standard	**STD**	**1.0**
High Capacity	HC	1.4
Extra High Capacity	EHC	1.9
Super High Capacity	SHC	2.6



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Calculation example

Determine the 1st cycle performance for SeaGuard 2000 × 4000 (LR)

$E_{3\text{-}STD}$ = 3rd cycle energy for STD grade = 540kNm

$R_{3\text{-}STD}$ = 3rd cycle reaction for STD grade = 1005kN

$P_{3\text{-}STD}$ = 3rd cycle hull pressure for STD grade = 172kN/m^2

F_R = Foam Ratio for LR grade = 0.6

N_1 = 1st cycle compression ratio = 1.3

$E_{1\text{-}LR}$ = 1st cycle energy for L_R grade = $E_{3\text{-}STD} \times F_R \times N_1$
= 540 × 0.6 × 1.3 = 421kNm

$R_{1\text{-}LR}$ = 1st cycle reaction for L_R grade = $R_{3\text{-}STD} \times F_R \times N_1$
= 1005 × 0.6 × 1.3 = 784kN

$P_{1\text{-}LR}$ = 1st cycle pressure for L_R grade = $P_{3\text{-}STD} \times F_R \times N_1$
= 172 × 0.6 × 1.3 = 134kN/m^2

Caution

Fender selection should not be based on 1st cycle performance. Always use ≥3rd cycle performance depending on application, required safety factors and other parameters.

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Performance at 60% defl ection, STD Grade, 3rd cycle

Diameter × Length		Energy	Reaction	Pressure	Energy	Reaction	Pressure	Weight	
(mm)	(ft)	(kNm)	(kN)	(kN/m^2)	(ft-kip)	(kip)	(ksf)	(kg)	(lb)
700×1500	2.3×4.9	26	133	172	19	30	3.6	109	240
1000×1500	3.3×4.9	47	173	172	35	39	3.6	147	325
1000×2000	3.3×6.5	68	254	172	50	57	3.6	200	440
1200×2000	3.9×6.5	91	280	172	67	63	3.6	299	660
1350×2500	4.4×8.2	152	418	172	112	94	3.6	426	940
1500×3000	4.9×9.8	232	578	172	171	130	3.6	653	1440
1700×3000	5.6×9.8	282	618	172	208	139	3.6	748	1650
2000×3500	6.5×11.5	454	845	172	335	190	3.6	1161	2560
2000×4000	6.5×13.1	540	1005	172	398	226	3.6	1397	3080
2000×4500	6.5×14.7	624	1161	172	460	261	3.6	1571	3465
2500×4000	8.2×13.1	801	1197	172	591	269	3.6	1925	4245
2500×5500	8.2×18.0	1200	1788	172	885	402	3.6	3059	6745
3000×4900	9.8×16.0	1430	1775	172	1055	399	3.6	3295	7265
3000×6000	9.8×19.7	1851	2295	172	1365	516	3.6	4370	9635
3300×4500	10.8×14.7	1498	1690	172	1105	380	3.6	3531	7785
3300×6500	10.8×21.3	2421	2731	172	1786	614	3.6	5485	12095

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Diameter × Length		Energy	Reaction	Pressure	Energy	Reaction	Pressure	Weight	
(ft)	(mm)	(kNm)	(kN)	(kN/m^2)	(ft-kip)	(kip)	(ksf)	(kg)	(lb)
2×4	610×1220	15	89	172	11	20	3.6	86	190
2×6	610×1830	24	147	172	18	33	3.6	118	260
2×8	610×2440	34	209	172	25	47	3.6	150	330
3×6	910×1830	53	214	172	39	48	3.6	168	370
3×8	910×2440	75	302	172	55	68	3.6	254	560
3×10	910×3050	96	391	172	71	88	3.6	331	730
4×6	1220×1830	81	249	172	60	56	3.6	283	625
4×8	1220×2440	121	369	172	89	83	3.6	374	825
4×10	1220×3050	160	494	172	118	111	3.6	476	1050
4×12	1220×3660	198	605	172	146	136	3.6	658	1450
5×8	1520×2440	183	445	172	135	100	3.6	476	1050
5×10	1520×3050	244	596	172	180	134	3.6	680	1500
5×12	1520×3660	305	743	172	225	167	3.6	816	1800
5×14	1520×4270	365	890	172	269	200	3.6	1134	2500
6×12	1830×3660	407	827	172	300	186	3.6	1122	2475
6×16	1830×4880	579	1179	172	427	265	3.6	1701	3750
6×20	1830×6100	751	1530	172	554	344	3.6	2426	5350
7×14	2130×4270	660	1152	172	487	259	3.6	1678	3700
7×16	2130×4880	778	1357	172	574	305	3.6	1995	4400
7×20	2130×6100	1013	1766	172	747	397	3.6	2857	6300
8×14	2440×4270	839	1281	172	619	288	3.6	2132	4700
8×16	2440×4880	994	1517	172	733	341	3.6	2449	5400
8×20	2440×6100	1303	1988	172	961	447	3.6	3447	7600
9×18	2740×5490	1399	1899	172	1032	427	3.6	3288	7250
9×22	2740×6710	1787	2424	172	1318	545	3.6	4762	10500
10×16	3050×4880	1466	1788	172	1081	402	3.6	3370	7430
10×18	3050×5490	1706	2082	172	1258	468	3.6	3839	8465
10×20	3050×6100	1946	2375	172	1435	534	3.6	4535	10000
10×22	3050×6710	2186	2669	172	1612	600	3.6	5351	11800
11×18	3350×5490	2009	2229	172	1482	501	3.6	4512	9950
11×22	3350×6710	2590	2874	172	1910	646	3.6	5805	12800
12×24	3660×7320	3518	3781	172	2595	850	3.6	7324	16150
13×26	3960×7920	4393	4381	172	3240	985	3.6	9116	20100
14×28	4270×8530	5423	5026	172	4000	1130	3.6	10884	24000

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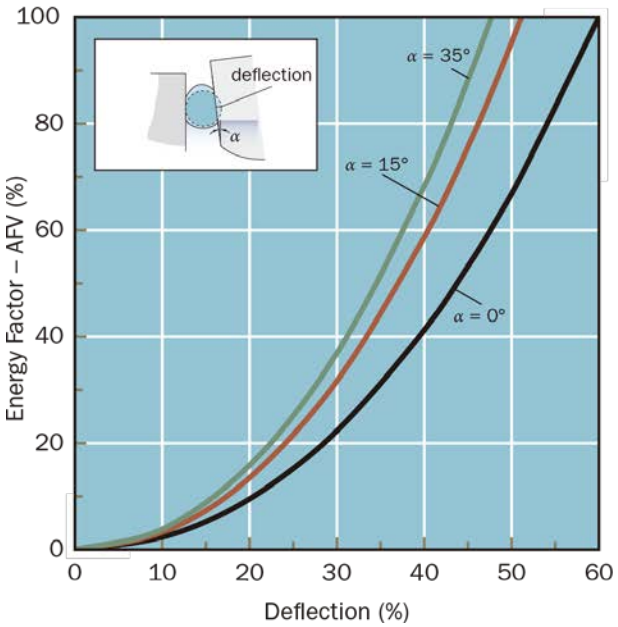
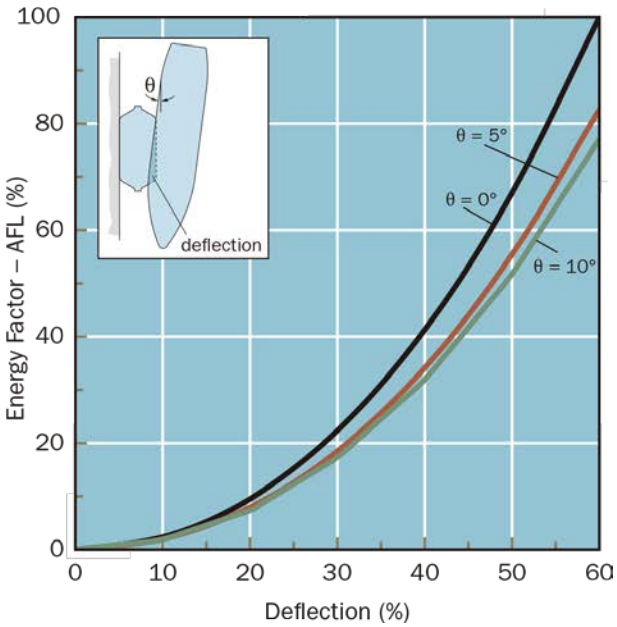
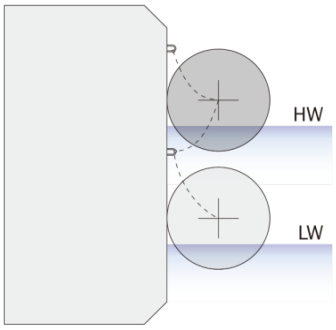
Angular compression factors

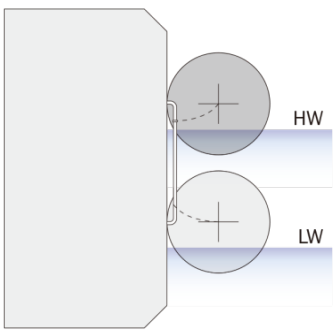




Mooring applications

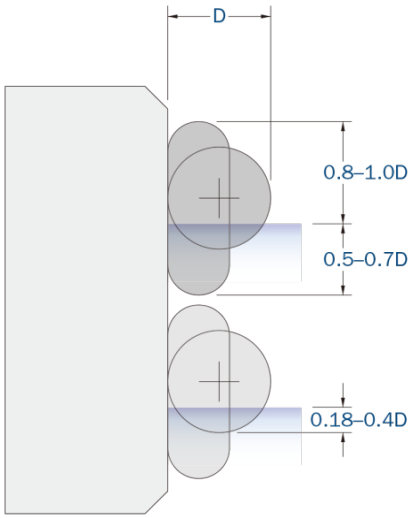


Floating or suspended



Guide rail

Mounting area



Supporting structures must be large enough to cope with tides and the fender footprint when compressed.

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