

TEKMARINE



Marine Fenders



About TekMarine

From its base in the United States, TekMarine Systems LLC designs and supplies advanced marine fendering and mooring systems to ports, harbors and waterways across the world.

We bring a wealth of engineering and market experience to each project. Our fender solutions range from simple modules to the most sophisticated engineered systems. We supply every type of berth, including passenger terminals, bulk and RoRo ports, Oil and Gas installations and naval facilities.

We offer full support at each step from early concept discussions through to design and detailing, material selection, construction, testing, shipping, and installation. A full after-care service helps keep your investment working safely and reliably for many years after commission.

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TJCO Cone Fender

The TJCO Cone Fender is one of the most advanced molded units available. The conical shape is self-centering, which keeps it stable at large compression angles. The TJCO resists high shear forces and can handle large panel weights. Chain systems, where required, are simple and reliable.

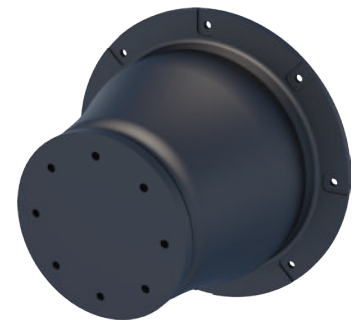
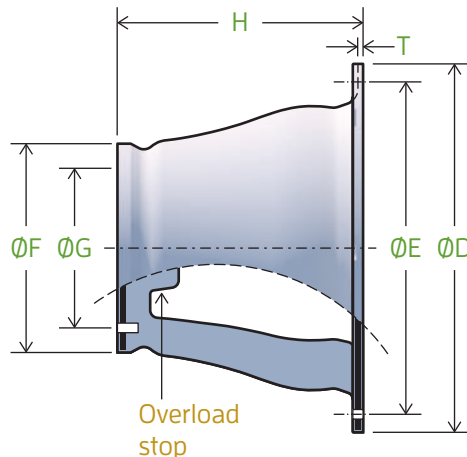
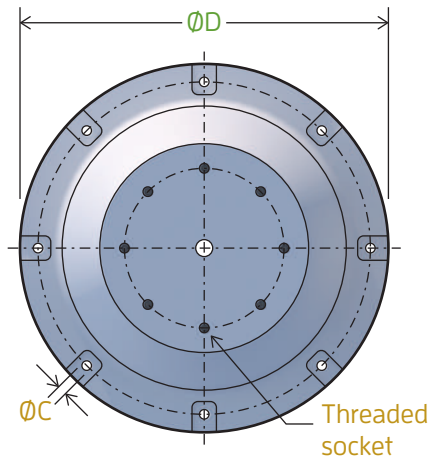
The TJCO fender works just as well mounted in reverse (with its smaller face against the quay wall) so designers can make use of the TJCO on narrow harbor structures where the footprint area is limited.

Please ask TekMarine about optional overload stops and how TJCO systems can be designed to prevent hydraulic locking.

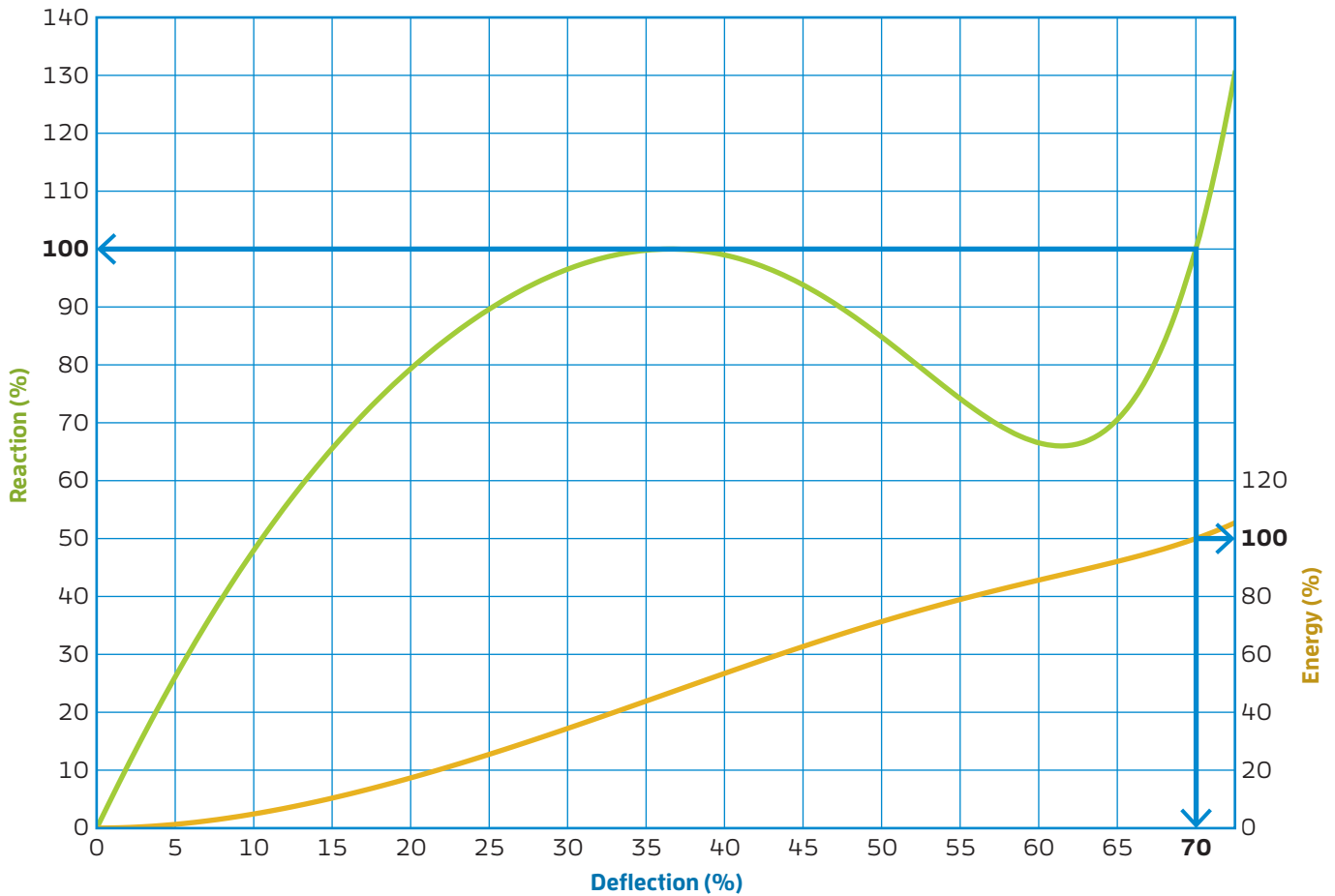


Dimensions

Model	Height		ØD		ØE		ØF		ØG		T	n × ØC		Bolt	Weight		
	mm	in	mm	in	mm	in	mm	in	mm	in		mm	in		mm	kg	lb
TJCO 300	300	11.8	450	17.7	405	15.9	255	10.0	195	7.7	14	0.50	4 × 20	4 × 0.80	M16	30	66
TJCO 500	500	19.7	750	29.5	675	26.6	425	16.7	325	12.8	21	0.83	4 × 30	4 × 1.20	M24	140	309
TJCO 600	600	23.6	900	35.4	810	31.9	510	20.1	390	15.4	22	0.87	6 × 30	6 × 1.20	M24	230	507
TJCO 700	700	27.6	1050	41.3	945	37.2	595	23.4	455	17.9	26	1.02	6 × 38	6 × 1.50	M30	390	860
TJCO 800	800	31.5	1200	47.2	1080	42.5	680	26.8	520	20.5	30	1.18	6 × 44	6 × 1.70	M36	540	1190
TJCO 900	900	35.4	1350	53.1	1215	47.8	765	30.1	585	23.0	30	1.18	6 × 44	6 × 1.73	M36	755	1664
TJCO 1000	1000	39.4	1500	59.1	1350	53.1	850	33.5	650	25.6	40	1.57	6 × 50	6 × 1.97	M42	1020	2249
TJCO 1100	1100	43.3	1650	65.0	1485	58.5	935	36.8	715	28.1	42	1.65	6 × 50	6 × 1.97	M42	1500	3308
TJCO 1150	1150	45.3	1725	67.9	1550	61.0	998	39.3	750	29.5	42	1.65	6 × 50	6 × 1.97	M42	1600	3527
TJCO 1200	1200	47.2	1800	70.9	1620	63.8	1020	40.2	780	30.7	45	1.77	8 × 50	8 × 1.97	M42	1960	4321
TJCO 1300	1300	51.2	1950	76.8	1755	69.1	1105	43.5	845	33.3	47	1.85	8 × 60	8 × 2.36	M48	2400	5291
TJCO 1400	1400	55.1	2100	82.7	1890	74.4	1190	46.9	930	36.6	54	2.13	8 × 60	8 × 2.36	M52	3000	6615
TJCO 1600	1600	63.0	2400	94.5	2160	85.0	1360	53.5	1060	41.7	58	2.28	8 × 66	8 × 2.60	M56	4600	10141
TJCO 1800	1800	70.9	2880	113	2625	103	1530	60.2	1190	46.9	75	2.95	10 × 66	10 × 2.6	M56	6600	14553
TJCO 2000	2000	78.7	3200	126	2920	115	1900	74.8	1540	60.6	80	3.15	10 × 66	10 × 2.6	M56	9200	20286



TJCO Performance



Intermediate values

Deflection (%)	Reaction (%)	Energy (%)
5	26	1
10	48	5
15	66	10
20	79	17
25	90	25
30	97	34
35	100	44
40	99	53
45	94	63
50	85	71
55	74	79
60	67	86
65	71	92
70	100	100
72.5	130	105

Angle factor

Angle (°)	γ_A	
	Energy	Reaction
0	1.00	1.00
3	1.00	1.00
5	1.00	1.00
8	0.99	1.00
10	0.98	1.00
15	0.93	1.00
20	0.87	1.00

Velocity factors

Time (s)	γ_V
1	1.31
2	1.13
3	1.08
4	1.05
5	1.03
6	1.02
7	1.02
8	1.01
9	1.01
≥10	1.00

Temperature factor

Temperature		γ_T
(°C)	(°F)	
50	122	0.90
40	104	0.94
30	86	0.98
23	73	1.00
10	50	1.06
0	32	1.10
-10	14	1.14
-20	-4	1.19
-30	-22	1.24

Values are for single units. Standard tolerance ±10%. Please ask TekMarine if $t < 4$ seconds or for any other performance data.

TJCO Performance (metric units)

Model		E = kNm, R=kN												
		T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
TJCO 300	E	8.7	9.9	11.2	12.4	12.6	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.2
	R	52.3	59.8	67.2	74.7	76.0	77.3	78.5	79.8	81.1	82.4	83.7	84.9	86.2
TJCO 500	E	40.7	46.5	52.3	58.1	58.9	59.7	60.5	61.2	62.0	62.8	63.6	64.3	65.1
	R	145	166	186	207	211	214	218	222	225	229	232	236	240
TJCO 600	E	70.6	80.7	90.8	101	102	103	105	106	107	109	110	111	113
	R	209	239	269	299	304	309	314	319	324	329	334	340	345
TJCO 700	E	111	127	143	159	161	163	165	167	170	172	174	176	178
	R	285	326	366	407	414	421	428	435	442	449	456	463	470
TJCO 800	E	166	190	213	237	240	244	247	250	254	257	260	263	267
	R	372	425	478	531	541	550	559	568	577	586	595	604	613
TJCO 900	E	236	270	303	337	342	347	351	356	361	365	370	375	379
	R	470	537	604	671	683	695	706	718	729	741	752	764	776
TJCO 1000	E	324	370	417	463	469	476	482	488	495	501	508	514	520
	R	581	664	747	830	844	858	873	887	901	915	930	944	958
TJCO 1100	E	431	493	554	616	624	633	641	650	658	667	675	684	693
	R	703	803	904	1004	1021	1039	1056	1073	1090	1107	1125	1142	1159
TJCO 1150	E	492	562	633	703	713	722	732	742	752	762	772	781	791
	R	768	878	987	1097	1116	1135	1154	1172	1191	1210	1229	1248	1267
TJCO 1200	E	560	640	720	800	811	822	833	844	855	867	878	889	900
	R	836	955	1075	1194	1215	1235	1256	1276	1297	1317	1338	1358	1379
TJCO 1300	E	711	813	914	1016	1030	1044	1058	1072	1086	1100	1115	1129	1143
	R	982	1122	1263	1403	1427	1451	1475	1499	1523	1547	1571	1595	1619
TJCO 1400	E	889	1016	1143	1270	1288	1305	1323	1340	1358	1376	1393	1411	1428
	R	1138	1301	1463	1626	1654	1682	1710	1737	1765	1793	1821	1849	1877
TJCO 1600	E	1327	1517	1706	1896	1922	1948	1974	2001	2027	2053	2080	2106	2132
	R	1486	1698	1911	2123	2159	2196	2232	2269	2306	2342	2379	2415	2452
TJCO 1800	E	1889	2159	2429	2699	2736	2773	2811	2848	2886	2923	2960	2998	3035
	R	1882	2151	2420	2689	2735	2781	2827	2873	2919	2965	3011	3058	3104
TJCO 2000	E	2591	2961	3331	3701	3753	3804	3855	3907	3958	4009	4060	4112	4163
	R	2324	2656	2988	3320	3377	3434	3491	3548	3605	3661	3718	3775	3832

Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

TJCO Performance (metric units)

Model		E = kNm, R=kN												
		T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32
TJCO 300	E	14.4	14.6	14.8	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	17.2	18.0
	R	87.5	88.8	90.0	91.3	92.6	93.9	95.2	96.4	97.7	99.0	100	105	110
TJCO 500	E	65.9	66.7	67.4	68.2	69.0	69.8	70.5	71.3	72.1	72.9	73.6	77.3	81.0
	R	243	247	250	254	258	261	265	268	272	275	279	293	307
TJCO 600	E	114	115	117	118	119	121	122	123	125	126	127	134	140
	R	350	355	360	365	370	375	380	386	391	396	401	421	441
TJCO 700	E	181	183	185	187	189	192	194	196	198	201	203	213	223
	R	477	484	491	498	505	512	519	525	532	539	546	574	601
TJCO 800	E	270	273	276	280	283	286	290	293	296	299	303	318	333
	R	623	632	641	650	659	668	677	686	695	705	714	749	785
TJCO 900	E	384	389	393	398	403	407	412	417	422	426	431	452	474
	R	787	799	810	822	833	845	856	868	880	891	903	948	993
TJCO 1000	E	527	533	540	546	552	559	565	572	578	585	591	620	650
	R	972	987	1001	1015	1029	1043	1058	1072	1086	1100	1115	1170	1226
TJCO 1100	E	701	710	718	727	735	744	752	761	769	778	786	826	865
	R	1176	1193	1211	1228	1245	1262	1279	1297	1314	1331	1348	1416	1483
TJCO 1150	E	801	811	821	830	840	850	860	870	879	889	899	944	989
	R	1285	1304	1323	1342	1361	1380	1398	1417	1436	1455	1474	1547	1621
TJCO 1200	E	911	922	933	944	955	966	977	989	1000	1011	1022	1073	1124
	R	1399	1420	1440	1461	1481	1502	1522	1543	1564	1584	1605	1685	1765
TJCO 1300	E	1157	1171	1185	1199	1213	1228	1242	1256	1270	1284	1298	1363	1428
	R	1643	1667	1691	1715	1739	1763	1787	1812	1836	1860	1884	1978	2072
TJCO 1400	E	1446	1464	1481	1499	1516	1534	1551	1569	1587	1604	1622	1703	1784
	R	1905	1933	1961	1989	2017	2045	2073	2101	2129	2157	2185	2294	2403
TJCO 1600	E	2158	2185	2211	2237	2263	2290	2316	2342	2368	2395	2421	2542	2663
	R	2488	2525	2561	2598	2634	2671	2707	2744	2781	2817	2854	2996	3139
TJCO 1800	E	3072	3110	3147	3185	3222	3259	3297	3334	3372	3409	3446	3619	3791
	R	3150	3196	3242	3288	3334	3380	3426	3473	3519	3565	3611	3791	3972
TJCO 2000	E	4214	4266	4317	4368	4420	4471	4522	4573	4625	4676	4727	4964	5200
	R	3889	3946	4003	4060	4117	4174	4231	4287	4344	4401	4458	4681	4904

Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

TJCO Performance (US units)

Model		E = ft.kip, R=kips												
		T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
TJCO 300	E	6.4	7.3	8.3	9.2	9.3	9.5	9.6	9.7	9.9	10.0	10.2	10.3	10.5
	R	11.8	13.4	15.1	16.8	17.1	17.4	17.7	17.9	18.2	18.5	18.8	19.1	19.4
TJCO 500	E	30.0	34.3	38.6	42.9	43.5	44.0	44.6	45.2	45.7	46.3	46.9	47.5	48.0
	R	32.6	37.3	41.9	46.6	47.4	48.2	49.0	49.8	50.6	51.4	52.2	53.0	53.8
TJCO 600	E	52.1	59.5	66.9	74.4	75.4	76.3	77.3	78.3	79.3	80.2	81.2	82.2	83.2
	R	47.0	53.7	60.4	67.1	68.3	69.4	70.6	71.7	72.9	74.0	75.2	76.3	77.5
TJCO 700	E	81.9	93.6	105	117	119	120	122	123	125	127	128	130	132
	R	64.1	73.2	82.4	91.5	93.1	94.7	96.2	97.8	99.4	101	102	104	106
TJCO 800	E	122	140	157	175	177	180	182	185	187	189	192	194	197
	R	83.6	95.6	108	119	122	124	126	128	130	132	134	136	138
TJCO 900	E	174	199	224	249	252	256	259	262	266	269	273	276	280
	R	106	121	136	151	154	156	159	161	164	167	169	172	174
TJCO 1000	E	239	273	307	341	346	351	356	360	365	370	374	379	384
	R	131	149	168	187	190	193	196	199	203	206	209	212	215
TJCO 1100	E	318	363	409	454	460	467	473	479	486	492	498	504	511
	R	158	181	203	226	230	234	237	241	245	249	253	257	261
TJCO 1150	E	363	415	467	518	526	533	540	547	555	562	569	576	584
	R	173	197	222	247	251	255	259	264	268	272	276	281	285
TJCO 1200	E	413	472	531	590	598	606	615	623	631	639	647	655	664
	R	188	215	242	268	273	278	282	287	292	296	301	305	310
TJCO 1300	E	524	599	674	749	760	770	780	791	801	812	822	832	843
	R	221	252	284	315	321	326	332	337	342	348	353	359	364
TJCO 1400	E	656	749	843	937	950	963	976	989	1002	1015	1028	1040	1053
	R	256	292	329	365	372	378	384	391	397	403	409	416	422
TJCO 1600	E	979	1119	1258	1398	1418	1437	1456	1476	1495	1514	1534	1553	1573
	R	334	382	430	477	485	494	502	510	518	527	535	543	551
TJCO 1800	E	1393	1592	1791	1990	2018	2046	2073	2101	2128	2156	2183	2211	2239
	R	423	484	544	604	615	625	636	646	656	667	677	687	698
TJCO 2000	E	1911	2184	2457	2730	2768	2806	2844	2881	2919	2957	2995	3033	3071
	R	522	597	672	746	759	772	785	798	810	823	836	849	862

Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

TJCO Performance (US units)

Model		E = ft.kip, R=kips												
		T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32
TJCO 300	E	10.6	10.8	10.9	11.1	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.7	13.3
	R	19.7	20.0	20.2	20.5	20.8	21.1	21.4	21.7	22.0	22.3	22.5	23.7	24.8
TJCO 500	E	48.6	49.2	49.7	50.3	50.9	51.5	52.0	52.6	53.2	53.7	54.3	57.0	59.7
	R	54.7	55.5	56.3	57.1	57.9	58.7	59.5	60.3	61.1	61.9	62.7	65.9	69.0
TJCO 600	E	84.1	85.1	86.1	87.1	88.0	89.0	90.0	90.9	91.9	92.9	93.9	98.6	103
	R	78.6	79.8	80.9	82.1	83.2	84.4	85.5	86.7	87.8	89.0	90.1	94.6	99.1
TJCO 700	E	133	135	136	138	140	141	143	145	146	148	150	157	164
	R	107	109	110	112	113	115	117	118	120	121	123	129	135
TJCO 800	E	199	202	204	206	209	211	214	216	218	221	223	234	246
	R	140	142	144	146	148	150	152	154	156	158	160	168	176
TJCO 900	E	283	287	290	294	297	301	304	307	311	314	318	334	350
	R	177	180	182	185	187	190	193	195	198	200	203	213	223
TJCO 1000	E	389	393	398	403	407	412	417	422	426	431	436	458	479
	R	219	222	225	228	231	235	238	241	244	247	251	263	276
TJCO 1100	E	517	523	530	536	542	549	555	561	567	574	580	609	638
	R	264	268	272	276	280	284	288	291	295	299	303	318	333
TJCO 1150	E	591	598	605	612	620	627	634	641	649	656	663	696	729
	R	289	293	297	302	306	310	314	319	323	327	331	348	364
TJCO 1200	E	672	680	688	696	705	713	721	729	737	745	754	791	829
	R	315	319	324	328	333	338	342	347	351	356	361	379	397
TJCO 1300	E	853	864	874	885	895	905	916	926	937	947	957	1005	1053
	R	369	375	380	386	391	396	402	407	413	418	423	445	466
TJCO 1400	E	1066	1079	1092	1105	1118	1131	1144	1157	1170	1183	1196	1256	1316
	R	428	435	441	447	453	460	466	472	479	485	491	516	540
TJCO 1600	E	1592	1611	1631	1650	1669	1689	1708	1727	1747	1766	1786	1875	1964
	R	559	568	576	584	592	600	609	617	625	633	642	674	706
TJCO 1800	E	2266	2294	2321	2349	2376	2404	2432	2459	2487	2514	2542	2669	2796
	R	708	718	729	739	750	760	770	781	791	801	812	852	893
TJCO 2000	E	3108	3146	3184	3222	3260	3297	3335	3373	3411	3449	3487	3661	3835
	R	874	887	900	913	925	938	951	964	977	989	1002	1052	1102

Other sizes and intermediate performances are available on request. Please ask TekMarine for details.



UHMW-PE Facings

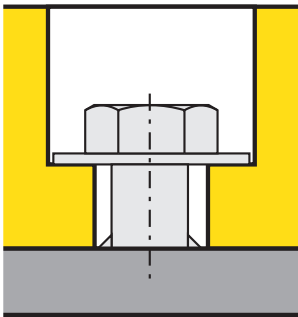
TekMarine protects every fender panel with top quality UHMW-PE (Ultra High Molecular Weight Polyethylene) facings. Impact resistant and very low in friction, UHMW-PE allows vessels to move smoothly past a fender system without snagging or abrasion. It is also popular for heavy duty impact protection where fenders are not required.

Easy to machine and install, UHMW-PE comes in many colors and several quality grades.

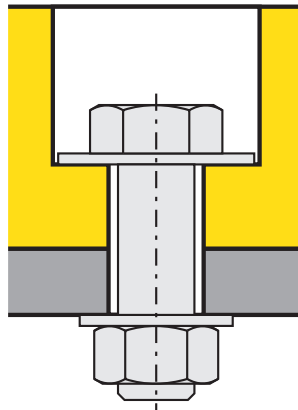
UHMW-PE does not rot, split or decay and does not suffer from UV or ozone damage. It is fully recyclable.



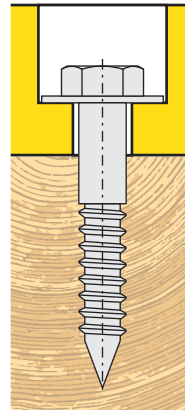
Steel panel with welded stud



Open steel structure



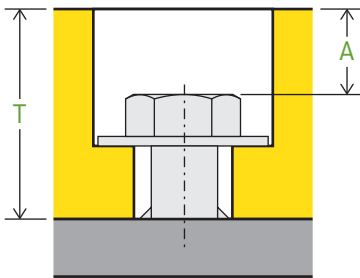
Timber structure



The fixing type depends on the underlying structure. Welded studs or stronger 'blind boss' fixings are used for steel panels. Oversize washers are recommended when bolting through open steel structures.

Fixings are available in various steel grades and finishes: please ask TekMarine for more details.

Wear Allowances



T	A
30	5
40	10
50	15
70	25
100	40

A small increase in the thickness of UHMW-PE can dramatically improve the working life of the facing, protecting the fender and structure for longer.

Physical Properties

Property	Test method	Metric			US Units		
		Unit	Virgin	Recycled	Unit	Virgin	Recycled
Density	ASTM D-792	kg/m ³	930	945	lb/ft ³	58.01	58.9
Molecular Weight	Viscosimetric	g/mol	4.2 × 10 ⁶	4.2 × 10 ⁶	g/mol	4.2 × 10 ⁶	4.2 × 10 ⁶
Yield Strength	ASTM D-638	MPa	21	20	psi	3050	2900
Ultimate Strength	ASTM D-638	MPa	40	34.3	psi	5800	4974
Elongation at Break	ASTM D-638	%	250	218	%	250	218
Impact Strength	ASTM D-4020	kJ/m ²	70	50	ft-lb/in ²	34	24
Tensile Impact	DIN 53448	kJ/m ²	2200	1600	ft-lb/in ²	1050	762
Abrasion Index (Sand Slurry)	ASTM 965	AR-01 Steel=100	90	116	AR-01 Steel=100	90	116
Hardness	ASTM D-2240	Type D	68	70	Type D	68	70
Static Friction	ASTM D-1894	-	0.15	0.15-0.20	-	0.15	0.15-0.20
Dynamic Friction	ASTM D-1894	-	0.12	0.14-0.16	-	0.12	0.14-0.16
Operating Temperature		°C	-80 to +80	-80 to +80	°F	-112 to 176	-112 to 176
Thermal Expansion	ASTM D-696	K ⁻¹	2.0 × 10 ⁻⁴	1.8 × 10 ⁻⁴	°F ⁻¹	1.1 × 10 ⁻⁴	1.1 × 10 ⁻⁴
Melting Point	ASTM D-3417	°C	137-143	137-143	°F	278-289	278
Water Absorption	ASTM D-570	%	0	0	%	0	0

Friction comparisons

Material	Coefficient of friction against steel (μ)
UHMW-PE	0.15-0.2
HD-PE	0.3
Nylon	0.2
Rubber	0.6-0.7
Timber	0.4
Steel	0.5

The coefficient of friction of UHMW-PE varies according to the material grade and the pressure applied to the panel's surface.

These coefficients of friction only apply to smooth contact surfaces.

Source: BS 6349-4:2014

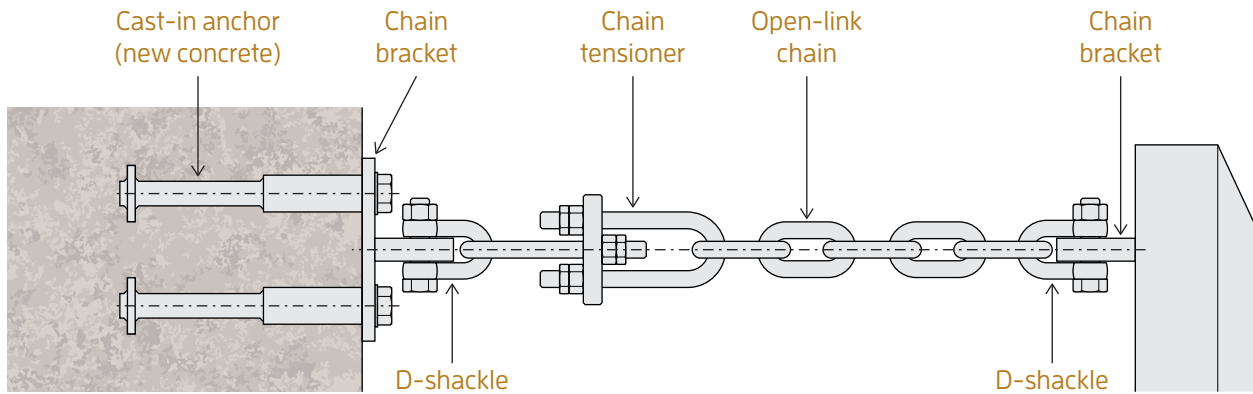
For more information please consult TekMarine.



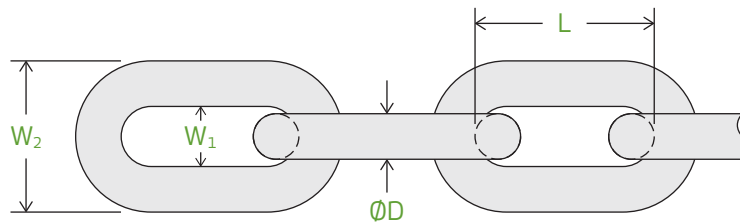
Anchors and Fixings

A fender system relies on the best quality fixings and accessories to perform properly. Large or heavy-duty fenders need chain systems to manage shear, tension and weight. These comprise open or stud-link chain, tensioners and shackles. Cast-in or resin anchors connect the chain systems and brackets to the quay structure. Various material grades and finishes are available: please ask TekMarine for details.

Typical chain system

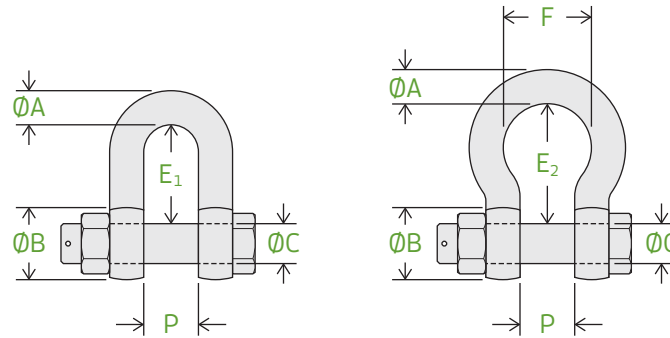


Chains



ØD	W ₁	W ₂	L = 4D	Weight	W ₁	W ₂	L = 5D	Weight	MBL	
									SL2	SL3
mm	mm	mm	mm	kg/m	mm	mm	mm	kg/m	kN	kN
14	20	48	56	3.8	21	49	70	3.7	124	154
16	22	54	64	5.0	24	56	80	4.8	160	202
18	25	61	72	6.3	27	63	90	6.0	209	262
20	28	68	80	7.8	30	70	100	7.5	264	330
22	31	75	88	9.4	33	77	110	9.0	304	380
25	35	85	100	12.1	38	88	125	11.6	393	491
28	39	95	112	15.2	42	98	140	14.6	492	616
30	42	102	120	17.4	45	105	150	16.7	566	706
32	45	109	128	19.8	48	112	160	19.0	644	804
35	49	119	140	23.8	53	123	175	22.8	770	964
38	53	129	152	28.0	57	133	190	26.9	900	1130
40	56	136	160	31.0	60	140	200	29.8	1010	1260
45	63	153	180	39.3	68	158	225	37.7	1275	1590
50	70	170	200	48.5	75	175	250	46.5	1570	1960
55	77	187	220	58.6	83	193	275	56.4	1900	2380
60	84	204	240	70.0	90	210	300	67.0	2260	2770

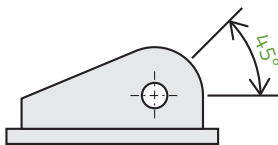
Shackles



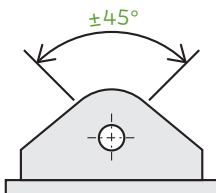
ØA	ØB	ØC	P	D-shackle		Bow shackle			NBL
				E ₁	Weight	E ₂	F	Weight	
mm	mm	mm	mm	mm	kg	mm	mm	kg	kN
13	26	16	22	43	0.4	51	32	0.4	120
16	32	19	27	51	0.7	64	43	0.8	195
19	38	22	31	59	1.1	76	51	1.3	285
22	44	25	36	73	1.5	83	58	1.9	390
25	50	28	43	85	2.6	95	68	2.8	510
28	56	32	47	90	3.3	108	75	3.8	570
32	64	35	51	94	4.7	115	83	5.3	720
35	70	38	57	115	6.2	133	95	7.0	810
38	76	42	60	127	7.6	146	99	8.8	1020
45	90	50	74	149	12.8	178	126	15.0	1500
50	100	57	83	171	18.2	197	138	20.7	2100
57	114	65	95	190	27.8	222	160	29.3	2550
65	130	70	105	203	35.1	254	180	64.5	3330

Brackets

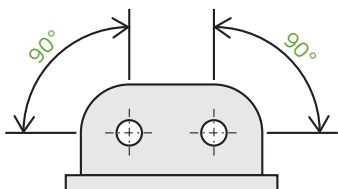
BSO



BSC

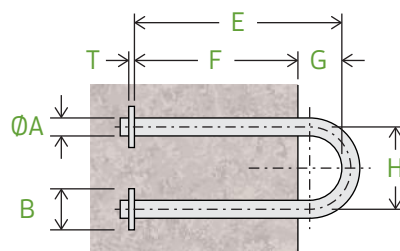


BDB



Brackets are purpose designed for every project. Please ask TekMarine for details.

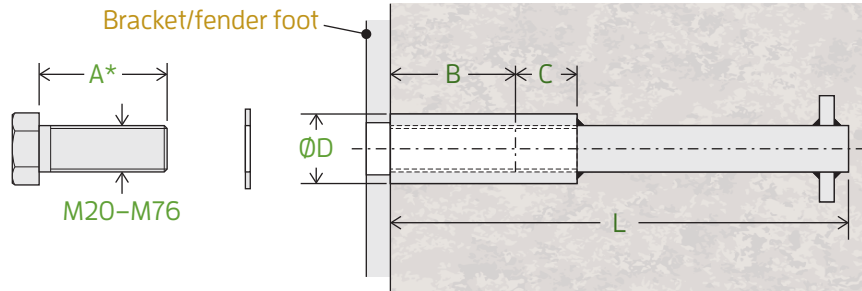
U-anchors



ØA	E	F	G	H	B	T	Weight	NBL
mm	mm	mm	mm	mm	mm	mm	kg	kN
26	320	260	60	104	50	12	3.4	209
30	370	300	70	120	50	15	5.1	264
34	410	340	70	136	60	15	7.3	304
36	430	360	70	144	60	20	8.6	393
42	510	420	90	168	70	20	13.7	492
44	540	440	100	176	80	20	16.1	566
48	580	480	100	192	80	25	20.5	644
50	610	500	110	200	90	25	23.7	770
56	680	560	120	224	100	30	33.4	900
60	730	600	130	240	110	30	41.1	1010
66	800	660	140	264	120	35	54.8	1275
74	900	740	160	296	130	40	76.9	1570

Anchors

Anchors are available in galvanized or stainless steel finishes, in various strength grades and in metric or inch sizes. Ask TekMarine for details if the required specification is not listed.



Cast-in type

Cast-in anchors are preferred for new concrete structures. The threaded anchor links via a long tail to an anchor plate, for even load distribution.

* Dimension A varies according to the thickness of the bracket or fender foot and should always be calculated.

Anchor	B	C	ØD	L	Weight
mm	mm	mm	mm	mm	kg
M20	50	20	30	214	0.9
M24	60	25	35	258	1.5
M30	70	30	45	318	2.7
M36	80	40	55	328	4.2
M42	85	45	65	416	6.9
M48	100	50	75	431	10.2
M56	105	60	85	436	14.0
M64	128	80	100	600	29.8
M76	152	90	114	700	46.1

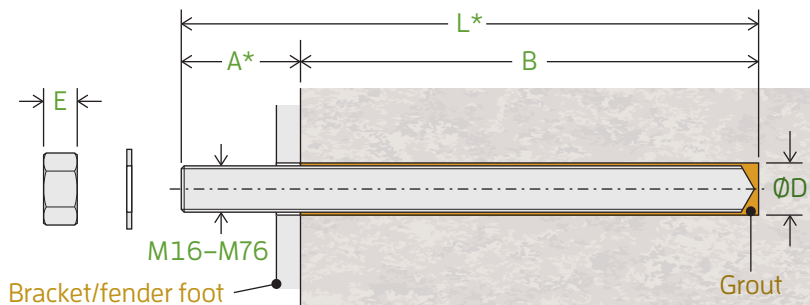
Chemical type

Chemical anchors are used for existing concrete structures.

Please ask about glass grout capsules and other grouting systems.

For an accurately drilled hole, allow for grout wastage of 10%–30%, depending on grout type.

* Dimensions A and L depend on the bracket/fender foot thickness and the concrete grade, and should always be calculated.

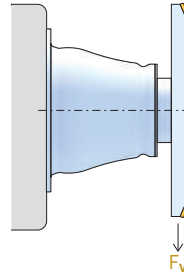


Anchor	B	ØD	E	Grout
mm	mm	mm	mm	ml
M16	140	20	13	16
M20	170	24	16	23
M24	210	28	19	34
M30	280	35	24	71
M36	360	42	29	132
M42	420	50	34	243
M48	460	54	38	221
M56	500	64	45	377
M64	560	72	51	479
M76	670	84	61	674



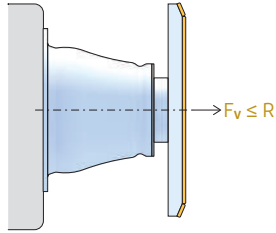
Design Considerations

Chains can assist in controlling the compression geometry of fenders in some applications. Please ask TekMarine for more details.



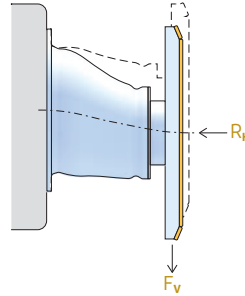
Weight support

Fenders can support large static weights. We recommend weight support chains for panels heavier than the rubber fender.



Tension

When the tension will exceed the fender's rated reaction force, then tension chains are strongly recommended.

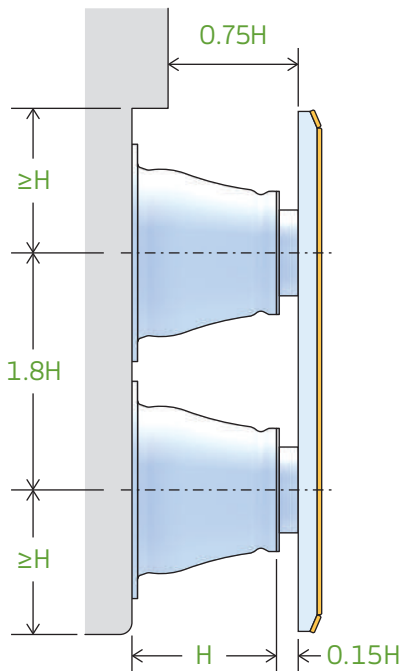


Shear

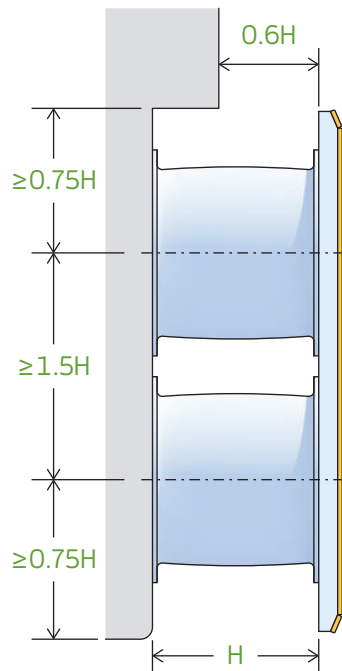
Fenders remain stable with vertical or horizontal shear forces. Shear chains may be needed for some applications and fender layouts.

Clearances

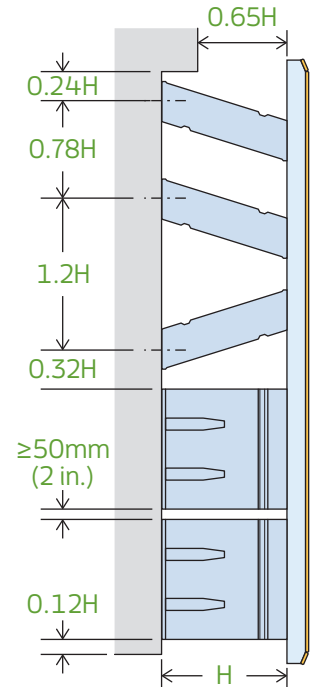
TJCO Cone



TJSC Cell



TJUE Element



Fenders should not contact each other when compressed. Neither fenders nor panel should touch the quay face during compression. Adequate space should be allowed for chains and other fender features. Overhanging hull features such as bow flares and beltings (strakes) should also be considered.

The values given in the diagrams indicate minimum clearances between fenders, with respect to fender height. Values are for guidance only and should be calculated and checked in each case.



Rubber Properties

Every TekMarine rubber fender unit uses the highest quality Natural Rubber (NR) and/or Styrene-butadiene (SBR) based compounds. These meet or exceed the performance requirements of the main international fender specifications such as PIANC and EAU-E 62 "Acceptance Requirements for Fender Elastomers". The table below shows typical specifications for laboratory prepared and tested specimens.

Please consult TekMarine about other fender compounds such as EPDM, Butyl, Neoprene and Polyurethane.

Material samples for laboratory test purposes are prepared differently to rubber fender units. Please ask TekMarine for details.

Property	Test method	Conditions	Requirements	Unit
Tensile Strength	ASTM D412 Die C; AS 1180.2; BS 903.A2; ISO 37; JIS K6251 Item 3, Dumbell 3	Original	≥ 16.0	MPa
		Aged for 96 hours at 70°C	≥ 12.8	
Elongation at Break	ASTM D 412 Die C; AS 1180.2; BS 903.A2; ISO 37; JIS K 6251 Item 3, Dumbell 3	Original	≥ 400	%
		Aged for 96 hours at 70°C	≥ 320	
Hardness	ASTM D 2240; AS1683.15.2; BS 903.A6; ISO 815; JIS K 6301 Item 5A Tester	Original	≤ 78°	Shore A
		Aged for 96 hours at 70°C	original value +6°	
Compression Set	ASTM D 395; AS1683.13B; BS903.A6; ISO 815; JIS K6262 Item 10	Aged for 22 hours at 70°C	≤ 30	%
	DIN 53517	Aged for 24 hours at 70°C	≤ 40	
Tear Resistance	ASTM D624; AS1683.12; BS903.A3; ISO 34.1; JIS K6301 Item 9; Test Piece A	Die B	≥ 70	kN/m
Ozone Resistance	ASTM D1149; AS1683.24; BS903.43; DIN 53509; ISO 143/1	1ppm at 20% strain at 40°C for 100 hours	no visible cracking	n/a
Seawater Resistance (Hardness)	ASTM D 471; BS ISO 1817	28 days in artificial seawater at 95°C ±2°C	≤ ±10°	Shore A
Seawater Resistance (Volume)			≤ +10/-5	%
Abrasion Resistance	BS 903.A9	Method B	≤ 0.5	cc
Bond Strength (Steel to Rubber)	BS 903.A21	Method B	≥ 7	N/mm



Tolerances

Standard manufacturing and performance tolerances apply to all TekMarine fenders. TekMarine may agree to smaller tolerances in special cases. Please ask TekMarine for tolerances of types not listed below.

Fender Type	Property	Tolerance	
TJCO, TJSC, TJUE, TJDA-A and TJDA-B	All dimensions	±3% or ±2mm (whichever greater)	
	Bolt hole spacing	±2mm	
TJCY	Outside diameter	±4%	
	Inside diameter	±4%	
	Length	±40mm	
TJDD, TJSD, TJDO and TJSO	Cross-section	±4%	
	Length	±2% or ±10mm (whichever greater)	
	Drilled hole centers	±4mm (non-cumulative)	
	Counterbore depth	±4mm (under-head depth)	
TJCA, TJCB	Cross-section	±3% or ±2mm (whichever greater)	
	Length	±2% or ±25mm (whichever greater)	
	Drilled hole centers	±4mm (non-cumulative)	
	Counterbore depth	±4mm (under-head depth)	
HD-PE fenders	Cross-section	±4%	
	Length	±2% or ±20mm (whichever greater)	
	Drilled hole centers	±4mm (non-cumulative)	
	Counterbore depth	±4mm (under-head depth)	
UHMW-PE panels	Length and width	(cut panels)	±5mm (cut pads)
		(uncut sheets)	±20mm (uncut sheets)
	Planed thickness	≤ 30mm	±0.2mm
		31–100mm	±0.3mm
		≥ 100mm	±0.5mm
	Unplaned thickness	≤ 30mm	±2.5mm
		31–100mm	±4.0mm
≥ 100mm		±6.0mm	
Drilled hole centers		±2mm (non-cumulative)	
Counterbore depth		±2mm (under-head depth)	
M, W and Block fenders	Cross-section	±3% or ±2mm (whichever greater)	
	Length	±3% or ±20mm (whichever greater)	
	Fixing hole centers	±3mm	
	Fixing hole diameter	±3mm	

Performance

Fender Type	Property	Tolerance
TJCO, TJSC, TJUE, TJDA-A and TJDA-B	Reaction, energy and deflection	±10%
Cylindricals (wrapped)	Reaction, energy and deflection	±10%
Cylindricals (extruded)	Reaction, energy and deflection	±10%
Profile fenders	Reaction, energy and deflection	±10%
Pneumatic fenders	Reaction and energy	±10%
Foam fenders	Reaction and energy	±15%

Unless otherwise listed or agreed with TekMarine, tolerances are ±20%.

Testing

Testing of molded¹ and wrapped cylindrical² fenders is conducted in-house, with an option for third party witnessing, using full size fenders in accordance with the PIANC 2002³ guidelines below.

- 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 using the Constant Velocity (CV) method.
- The test specimen shall be broken-in by deflected three or more times to at least its rated deflection. After break-in cycles the fender specimen is allowed to recover for at least one hour.
- Axial compression test speed is 2 cm/min ± 8cm/min.
- The test specimen is temperature stabilized to 23°C ± 5°C.⁴
- Reaction force⁵ is recorded at intervals to at least a deflection at which the permitted⁶ minimum energy absorption is achieved.
- Energy absorption⁵ is determined as the integral of reaction and deflection, calculated using Simpson's Rule. The results of a pre-compression cycle⁶ and subsequent break-in compression cycle(s) are not recorded.
- The fender performance shall be determined from a single measured compression cycle and pass if the reaction force is less than the maximum permitted⁷ reaction force and more than the minimum permitted⁷ energy absorption.⁸
- Sampling is 10% of fenders (rounded up to a unit).⁹
- 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 Molded fenders include TJCO, TJSC, TJUE, TJDA-A and TJDA-B fenders. TJCO, TJSC, TJDA-A and TJDA-B fenders are tested singly. TJUE fenders are tested in pairs.
- 2 Excluding TJTB tug cylindrical fenders.
- 3 Permanent International Association of Navigation Congress Report of the International Commission for Improving the Design of Fender Systems (Guidelines for the design of Fender systems: 2002, Appendix A).
- 4 Where the ambient temperature is outside this range, fenders shall be normalized to this temperature range in a conditioning room for a suitable period (according to fender size), or performance values may be adjusted according to the temperature correction factor tables.
- 5 Reaction forces (and the corresponding, calculated energy absorption) shall be the exact recorded value and not corrected or otherwise adjusted for speed, unless the project specifications require otherwise.
- 6 Pre-compression testing involves a single 'run in' cycle up to the catalogue rated deflection. The reaction force is not recorded.
- 7 Maximum permitted reaction force is the catalogue value plus the applicable manufacturing tolerance. Minimum permitted energy absorption is the catalogue value minus the applicable manufacturing tolerance.
- 8 The deflection at which the minimum permitted energy absorption is achieved may differ from the nominal 'rated' deflection indicated in the catalogue for the corresponding fender type. Actual deflection is not considered as a pass/fail criterion.
- 9 Testing to PIANC protocols is included within the fender price. Higher testing frequencies, third party witnessing and temperature stabilization costs shall be paid by the purchaser.



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