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.

Disclaimer

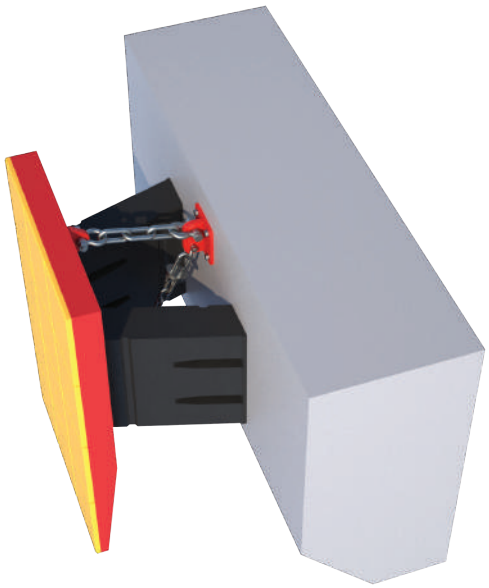
TekMarine Systems LLC ("TekMarine") has made every effort to ensure that the product descriptions and technical specifications in this catalog are correct. TekMarine can not accept liability or responsibility for errors and omissions for any reason. Customers and catalog users are kindly requested to ask TekMarine for a detailed specification and approved drawings before manufacturing and construction. TekMarine reserves the right to make changes to specifications and drawings without prior notice. All dimensions, performance values, material properties and other product specifications are subject to standard tolerances. This catalog and the information herein replaces all earlier editions. If in any doubt, please contact TekMarine.

Copyright

TJUE Element Fender

TJUE Element Fenders are molded buckling column legs with embedded mounting plates. Ideal for restricted spaces, they are easy to install and need little maintenance.

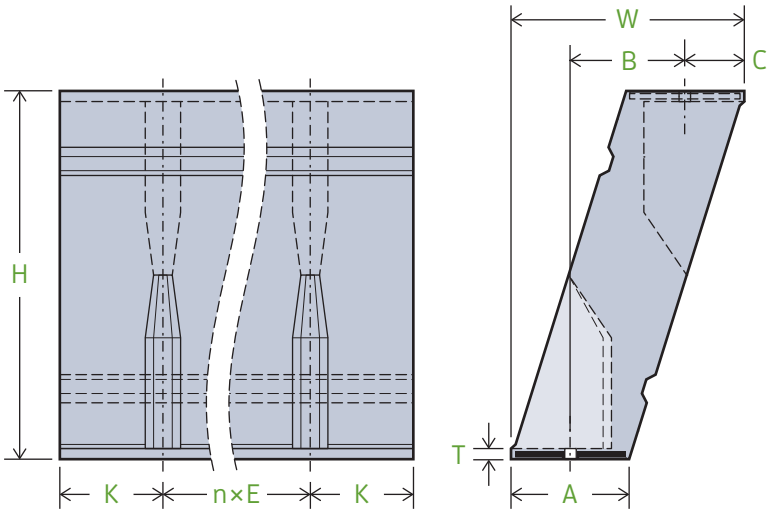
TJUE systems combine one or more pairs of elements mounted horizontally and/or vertically behind a UHMW-PE facing or a steel panel. TJUE Elements can be used in many more configurations than traditional V-fenders, or even within specialist engineered fender systems.



Dimensions

Model	Height		W		A		B		C		T		E		K		Bolt	Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	kg	lb
TJUE 300	300	11.8	188	7.40	94	3.70	94	3.70	47	1.85	15	0.59	300	11.8	200	7.87	M20	39	86
TJUE 400	400	15.7	250	9.84	125	4.92	124	4.88	63	2.48	17	0.67	500	19.7	250	9.84	M24	70	155
TJUE 500	500	19.7	316	12.4	158	6.22	142	5.59	87	3.43	20	0.79	500	19.7	250	9.84	M30	110	243
TJUE 550	550	21.7	344	13.5	172	6.77	170	6.69	87	3.43	20	0.79	500	19.7	250	9.84	M30	132	291
TJUE 600	600	23.6	373	14.7	188	7.40	199	7.83	87	3.43	20	0.79	500	19.7	250	9.84	M30	156	344
TJUE 750	750	29.5	466	18.3	235	9.25	230	9.06	118	4.65	26	1.02	500	19.7	250	9.84	M36	230	507
TJUE 800	800	31.5	498	19.6	250	9.84	240	9.45	129	5.08	26	1.02	500	19.7	250	9.84	M36	283	624
TJUE 1000	1000	39.4	634	25.0	322	12.7	310	12.2	162	6.38	31	1.22	500	19.7	250	9.84	M42	430	948
TJUE 1250	1250	49.2	792	31.2	401	15.8	388	15.3	202	7.95	36	1.42	500	19.7	250	9.84	M48	655	1444
TJUE 1450	1450	57.1	910	35.8	454	17.9	445	17.5	228	8.98	41	1.61	500	19.7	250	9.84	M48	835	1841
TJUE 1600	1600	63.0	994	39.1	500	19.7	480	18.9	257	10.1	50	1.97	500	19.7	250	9.84	M56	1005	2216

Values are for single units, L=1m. Other sizes and fender lengths are available on request. Please ask TekMarine for details.

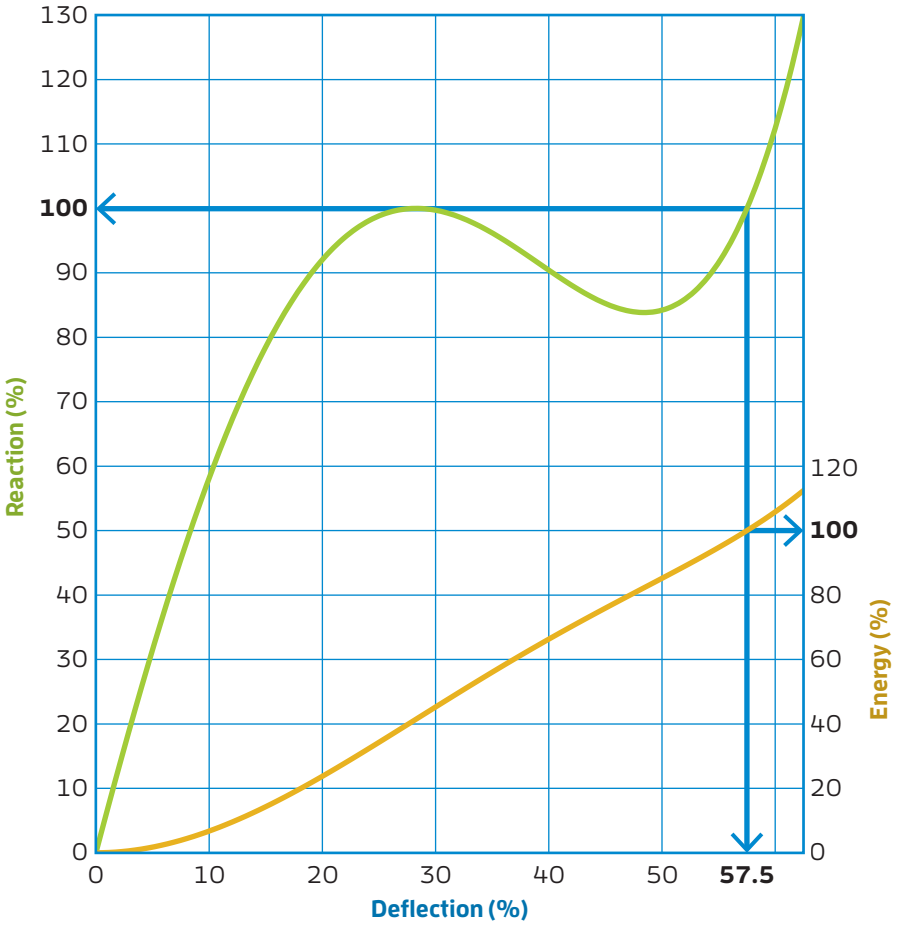


Available sizes

Model	ⓝ standard length / ⓝ available on request				
	L=900	L=1000	L=1200	L=1500	L=2000
TJUE 300	❸	–	❹	❺	–
TJUE 400	❸	–	❹	❸	❹
TJUE 500	③	❷	–	❸	❹
TJUE 550	③	❷	–	❸	❹
TJUE 600	③	❷	–	❸	❹
TJUE 750	③	❷	–	❸	❹
TJUE 800	③	❷	–	❸	❹
TJUE 1000	❸	❷	–	❸	❹
TJUE 1250	❸	❷	–	❸	❹
TJUE 1450	–	❷	–	❸	❹
TJUE 1600	–	❷	–	❸	❹

Please ask TekMarine about other lengths.

TJUE Performance

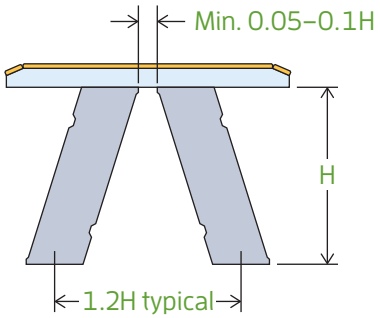


Element spacing

Always ensure there is a gap between the elements, on the panel side, of at least 5% to 10% of the element fender height.

The angular factors given are based on a typical separation of 1.2 times the fender height (see diagram). For other spacings consult TekMarine.

For more details on fender spacing within systems, please see 'Design Considerations' on p59.



Intermediate values

Deflection	Reaction	Energy
%	%	%
5	31	2
10	58	7
15	79	14
20	92	24
25	99	34
30	100	45
35	96	56
40	90	66
45	85	76
50	84	85
55	92	95
57.5	**100**	**100**
60	112	106
62.5	130	112

Angle factor

Angle (°)	γ_A	
	Energy	Reaction
0	**1.00**	**1.00**
3	0.99	1.00
5	0.99	1.00
8	0.96	1.00
10	0.93	1.00
15	0.81	1.00
20	0.71	1.00

Velocity factors

Time (s)	γ_V
1	1.24
2	1.10
3	1.06
4	1.04
5	1.02
6	1.01
7	1.01
8	1.00
9	1.00
≥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, L = 1m. Standard tolerance ±10%. Please ask TekMarine if t < 4 seconds or for any other performance data.

TJUE Performance (metric units)

Model		E = kNm, R=kN												
		T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
TJUE 300	E	12.5	12.8	13.1	13.5	13.8	14.1	14.5	14.8	15.1	15.5	15.9	16.4	16.9
	R	90.6	93.0	95.4	97.8	100	103	105	107	110	112	116	119	123
TJUE 400	E	22.2	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.9	27.5	28.3	29.2	30.0
	R	121	124	127	130	134	137	140	143	146	150	154	159	163
TJUE 500	E	34.7	35.6	36.5	37.4	38.3	39.3	40.2	41.1	42.0	42.9	44.2	45.6	46.9
	R	151	155	159	163	167	171	175	179	183	187	193	199	204
TJUE 550	E	41.9	43.0	44.2	45.3	46.4	47.5	48.6	49.7	50.8	51.9	53.5	55.1	56.7
	R	166	170	175	179	184	188	193	197	201	206	212	218	225
TJUE 600	E	49.9	51.2	52.5	53.9	55.2	56.5	57.8	59.2	60.5	61.8	63.7	65.6	67.5
	R	181	186	191	196	200	205	210	215	220	224	231	238	245
TJUE 750	E	78.0	80.0	82.1	84.2	86.2	88.3	90.4	92.5	94.5	96.6	99.5	103	105
	R	226	232	238	244	250	257	263	269	275	281	289	298	306
TJUE 800	E	88.7	91.1	93.4	95.8	98.1	100	103	105	108	110	113	117	120
	R	242	248	254	261	267	274	280	286	293	299	308	318	327
TJUE 1000	E	139	142	146	150	153	157	161	164	168	172	177	182	187
	R	302	310	318	326	334	342	350	358	366	374	386	397	408
TJUE 1250	E	217	222	228	234	240	245	251	257	263	268	277	285	293
	R	377	387	397	407	417	428	438	448	458	468	482	496	511
TJUE 1450	E	291	299	307	315	322	330	338	346	353	361	372	383	394
	R	438	449	461	473	484	496	508	519	531	542	559	576	592
TJUE 1600	E	355	364	374	383	393	402	411	421	430	440	453	467	480
	R	483	496	509	522	534	547	560	573	586	599	617	635	653

Values are for single units, L= 1m (3.28ft) . Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

TJUE Performance (metric units)

Model		E = kNm, R=kN												
		T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32
TJUE 300	E	17.3	17.8	18.3	18.8	19.2	19.7	20.2	20.7	21.1	21.6	22.1	22.6	23.0
	R	126	129	133	136	140	143	147	150	153	157	160	164	167
TJUE 400	E	30.8	31.7	32.5	33.4	34.2	35.0	35.9	36.7	37.6	38.4	39.3	40.1	40.9
	R	168	173	177	182	186	191	195	200	205	209	214	218	223
TJUE 500	E	48.2	49.5	50.8	52.1	53.4	54.8	56.1	57.4	58.7	60.0	61.3	62.6	64.0
	R	210	216	221	227	233	239	244	250	256	261	267	273	279
TJUE 550	E	58.3	59.9	61.5	63.1	64.7	66.3	67.8	69.4	71.0	72.6	74.2	75.8	77.4
	R	231	237	244	250	256	262	269	275	281	288	294	300	307
TJUE 600	E	69.4	71.3	73.2	75.1	77.0	78.9	80.7	82.6	84.5	86.4	88.3	90.2	92.1
	R	252	259	266	273	279	286	293	300	307	314	321	327	334
TJUE 750	E	108	111	114	117	120	123	126	129	132	135	138	141	144
	R	315	323	332	341	349	358	366	375	384	392	401	409	418
TJUE 800	E	123	127	130	133	137	140	144	147	150	154	157	160	164
	R	336	345	354	363	373	382	391	400	409	418	428	437	446
TJUE 1000	E	193	198	203	209	214	219	224	230	235	240	245	251	256
	R	420	431	443	454	466	477	489	500	511	523	534	546	557
TJUE 1250	E	301	309	318	326	334	342	350	359	367	375	383	392	400
	R	525	539	553	568	582	596	611	625	639	654	668	682	697
TJUE 1450	E	405	416	427	438	449	461	472	483	494	505	516	527	538
	R	609	625	642	659	675	692	708	725	742	758	775	791	808
TJUE 1600	E	493	507	520	534	547	561	574	588	601	615	628	641	655
	R	672	690	708	727	745	763	782	800	818	837	855	873	892

Values are for single units, L= 1m (3.28ft) . Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

TJUE Performance (US units)

Model		E = ft.kip, R=kips												
		T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
TJUE 300	E	9.2	9.4	9.7	9.9	10.2	10.4	10.7	10.9	11.2	11.4	11.7	12.1	12.4
	R	20.4	20.9	21.4	22.0	22.5	23.1	23.6	24.1	24.7	25.2	26.0	26.8	27.5
TJUE 400	E	16.4	16.8	17.2	17.7	18.1	18.5	19.0	19.4	19.8	20.3	20.9	21.5	22.1
	R	27.1	27.9	28.6	29.3	30.0	30.8	31.5	32.2	32.9	33.6	34.7	35.7	36.7
TJUE 500	E	25.6	26.2	26.9	27.6	28.3	28.9	29.6	30.3	31.0	31.7	32.6	33.6	34.6
	R	33.9	34.8	35.7	36.6	37.5	38.4	39.3	40.2	41.1	42.0	43.3	44.6	45.9
TJUE 550	E	30.9	31.7	32.6	33.4	34.2	35.0	35.8	36.7	37.5	38.3	39.5	40.7	41.8
	R	37.3	38.3	39.3	40.3	41.3	42.3	43.3	44.3	45.3	46.3	47.7	49.1	50.5
TJUE 600	E	36.8	37.8	38.8	39.7	40.7	41.7	42.7	43.6	44.6	45.6	47.0	48.4	49.8
	R	40.7	41.8	42.9	44.0	45.0	46.1	47.2	48.3	49.4	50.5	52.0	53.5	55.1
TJUE 750	E	57.5	59.0	60.6	62.1	63.6	65.1	66.7	68.2	69.7	71.2	73.4	75.6	77.8
	R	50.9	52.3	53.6	55.0	56.3	57.7	59.0	60.4	61.7	63.1	65.0	66.9	68.9
TJUE 800	E	65.4	67.2	68.9	70.6	72.4	74.1	75.8	77.6	79.3	81.1	83.5	86.0	88.5
	R	54.3	55.7	57.2	58.6	60.1	61.5	62.9	64.4	65.8	67.3	69.3	71.4	73.5
TJUE 1000	E	102	105	108	110	113	116	119	121	124	127	131	134	138
	R	67.9	69.7	71.5	73.3	75.1	76.9	78.7	80.5	82.3	84.1	86.7	89.2	91.8
TJUE 1250	E	160	164	168	172	177	181	185	189	194	198	204	210	216
	R	84.8	87.1	89.3	91.6	93.9	96.1	98.4	101	103	105	108	112	115
TJUE 1450	E	215	221	226	232	238	243	249	255	261	266	274	283	291
	R	98.4	101	104	106	109	111	114	117	119	122	126	129	133
TJUE 1600	E	262	269	276	283	289	296	303	310	317	324	334	344	354
	R	109	111	114	117	120	123	126	129	132	135	139	143	147

Values are for single units, L= 1m (3.28ft) . Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

TJUE Performance (US units)

Model		E = ft.kip, R=kips												
		T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32
TJUE 300	E	12.8	13.1	13.5	13.8	14.2	14.5	14.9	15.2	15.6	15.9	16.3	16.6	17.0
	R	28.3	29.1	29.9	30.6	31.4	32.2	33.0	33.7	34.5	35.3	36.0	36.8	37.6
TJUE 400	E	22.7	23.4	24.0	24.6	25.2	25.8	26.5	27.1	27.7	28.3	28.9	29.6	30.2
	R	37.8	38.8	39.8	40.8	41.9	42.9	43.9	45.0	46.0	47.0	48.1	49.1	50.1
TJUE 500	E	35.5	36.5	37.5	38.4	39.4	40.4	41.4	42.3	43.3	44.3	45.2	46.2	47.2
	R	47.2	48.5	49.8	51.1	52.3	53.6	54.9	56.2	57.5	58.8	60.1	61.4	62.6
TJUE 550	E	43.0	44.2	45.3	46.5	47.7	48.9	50.0	51.2	52.4	53.6	54.7	55.9	57.1
	R	51.9	53.3	54.7	56.2	57.6	59.0	60.4	61.8	63.2	64.7	66.1	67.5	68.9
TJUE 600	E	51.2	52.6	54.0	55.4	56.8	58.2	59.6	60.9	62.3	63.7	65.1	66.5	67.9
	R	56.6	58.2	59.7	61.3	62.8	64.4	65.9	67.4	69.0	70.5	72.1	73.6	75.2
TJUE 750	E	80.0	82.1	84.3	86.5	88.7	90.9	93.1	95.2	97.4	100	102	104	106
	R	70.8	72.7	74.7	76.6	78.5	80.4	82.4	84.3	86.2	88.2	90.1	92.0	94.0
TJUE 800	E	91.0	93.5	95.9	98.4	101	103	106	108	111	113	116	118	121
	R	75.5	77.6	79.6	81.7	83.7	85.8	87.9	89.9	92.0	94.0	96.1	98.2	100
TJUE 1000	E	142	146	150	154	158	162	165	169	173	177	181	185	189
	R	94.4	97.0	100	102	105	107	110	112	115	118	120	123	125
TJUE 1250	E	222	228	234	240	246	252	258	265	271	277	283	289	295
	R	118	121	124	128	131	134	137	141	144	147	150	153	157
TJUE 1450	E	299	307	315	323	332	340	348	356	364	372	380	389	397
	R	137	141	144	148	152	156	159	163	167	170	174	178	182
TJUE 1600	E	364	374	384	394	404	414	423	433	443	453	463	473	483
	R	151	155	159	163	167	172	176	180	184	188	192	196	200

Values are for single units, L= 1m (3.28ft) . Other sizes and intermediate performances are available on request. Please ask TekMarine for details.

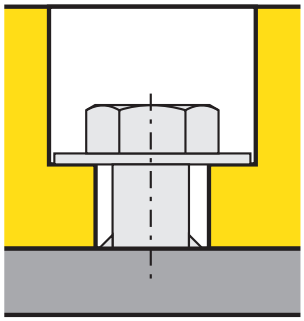
UHMW-PE Facings

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.

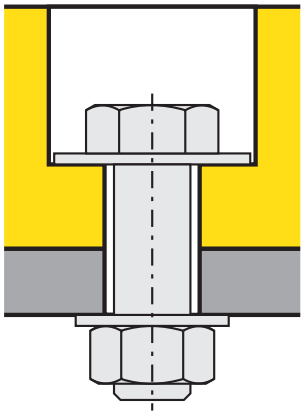
Easy to machine and install, UHMW-PE comes in many colors and several quality grades.

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

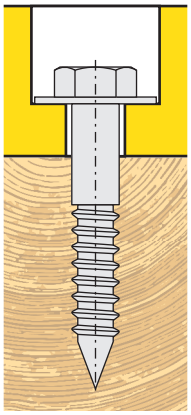
Steel panel with welded stud



Open steel structure



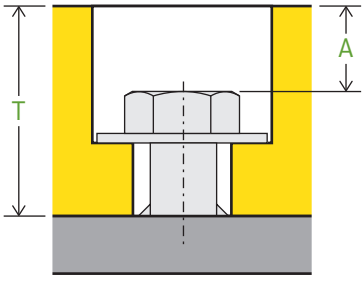
Timber structure



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/m³	930	945	lb/ft³	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/m²	70	50	ft-lb/in²	34	24
Tensile Impact	DIN 53448	kJ/m²	2200	1600	ft-lb/in²	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.

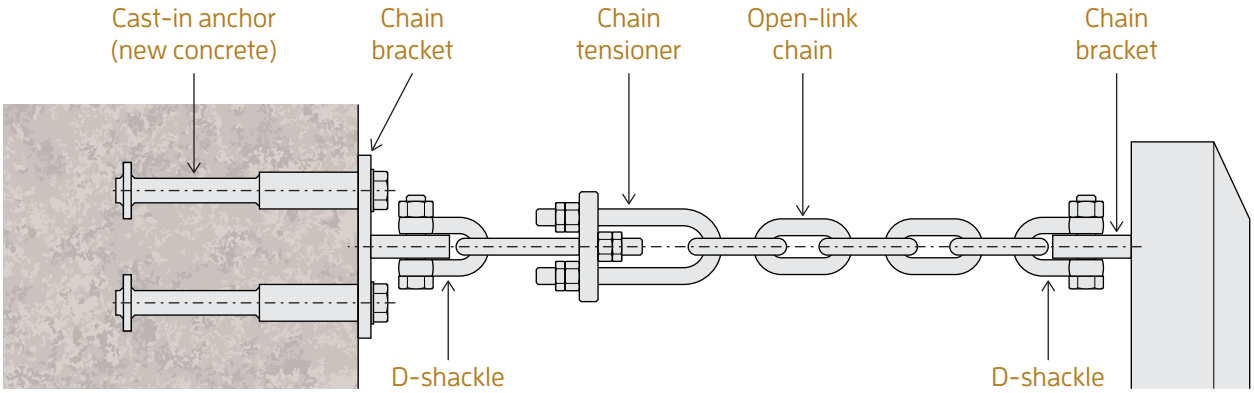
Source: BS 6349-4:2014

For more information please consult TekMarine.

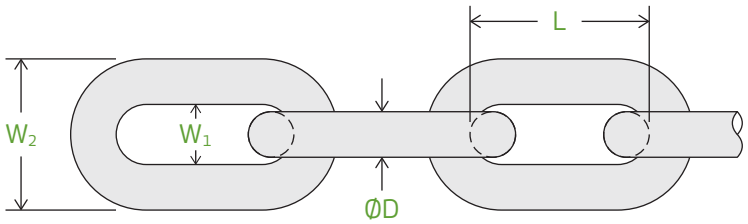
Anchors and Fixings

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

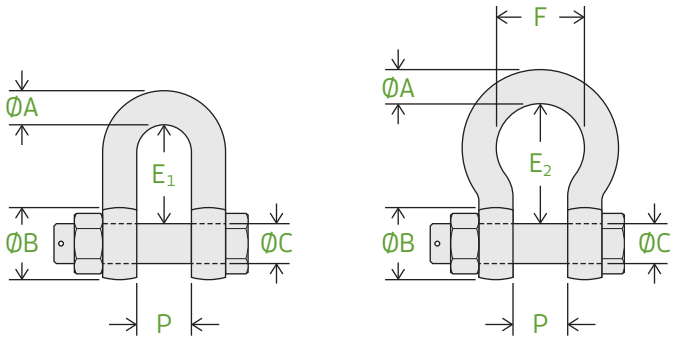


Chains



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

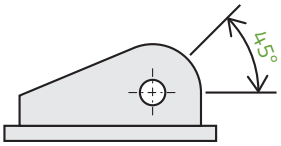
Shackles



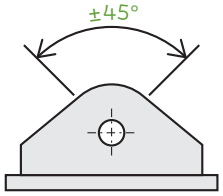
ØA	ØB	ØC	P	D-shackle		Bow shackle			NBL
				E_1	Weight	E_2	F	Weight	
mm	mm	mm	mm	mm	kg	mm	mm	kg	kN
13	26	16	22	43	0.4	51	32	0.4	120
16	32	19	27	51	0.7	64	43	0.8	195
19	38	22	31	59	1.1	76	51	1.3	285
22	44	25	36	73	1.5	83	58	1.9	390
25	50	28	43	85	2.6	95	68	2.8	510
28	56	32	47	90	3.3	108	75	3.8	570
32	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

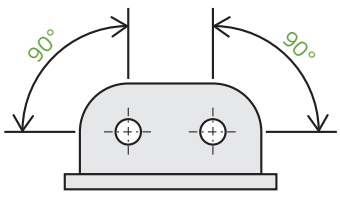
BSO



BSC

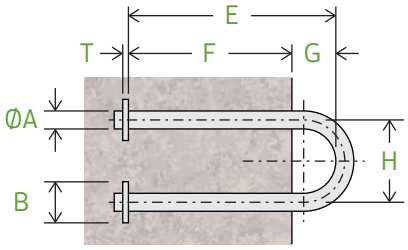


BDB



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

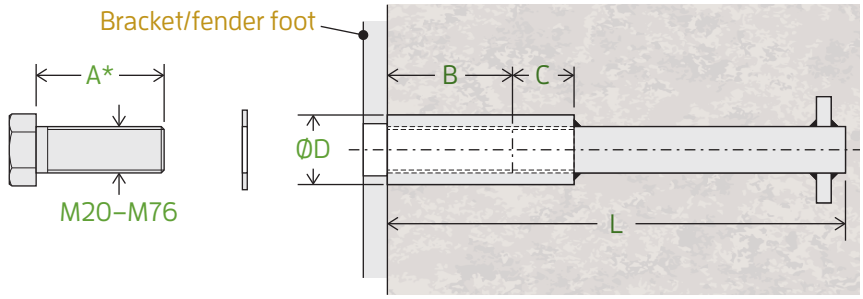
U-anchors



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.

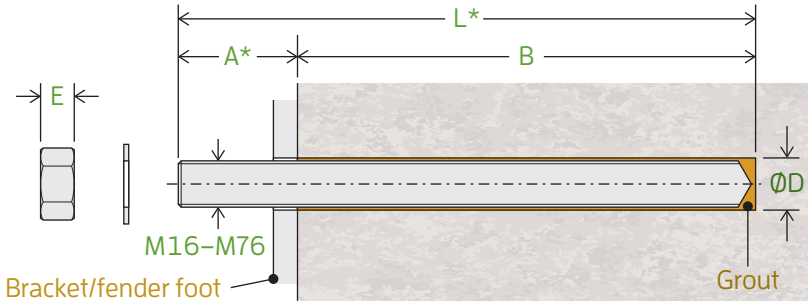


Cast-in type

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.

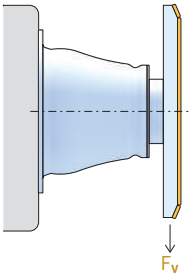
For an accurately drilled hole, allow for grout wastage of 10%–30%, depending on grout type.

* 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

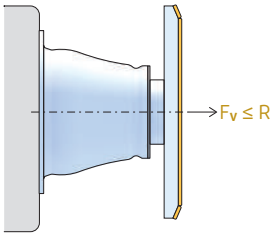
Design Considerations

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



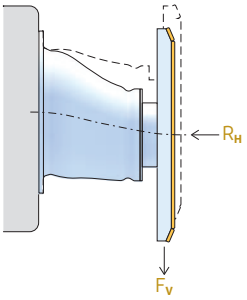
Weight support

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.

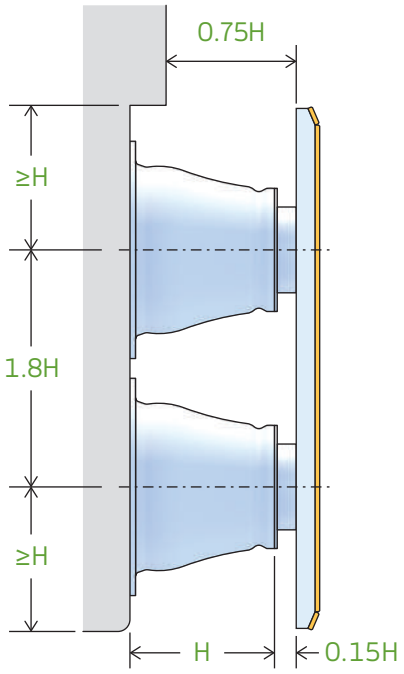


Shear

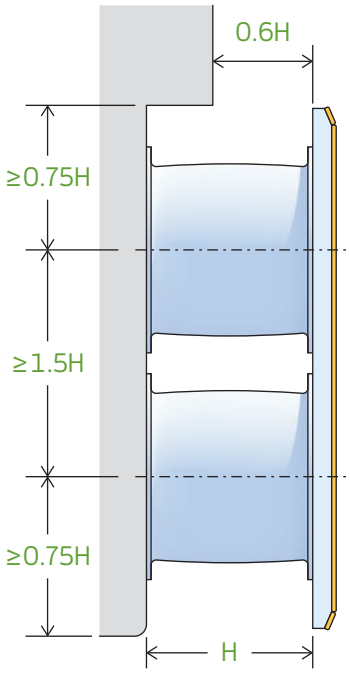
Fenders remain stable with vertical or horizontal shear forces. Shear chains may be needed for some applications and fender layouts.

Clearances

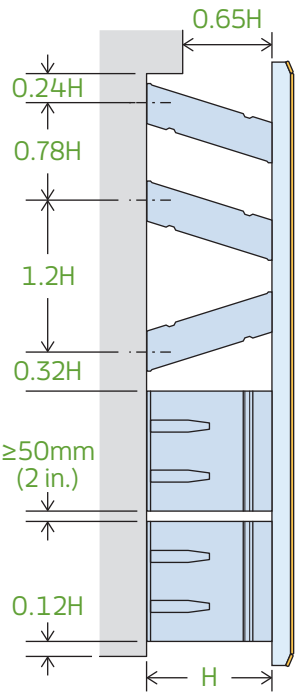
TJCO Cone



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 molded[1] and wrapped cylindrical[2] fenders is conducted in-house, with an option for third party witnessing, using full size fenders in accordance with the PIANC 2002[3] 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 force[5] is recorded at intervals to at least a deflection at which the permitted[6] minimum energy absorption is achieved.
- Energy absorption[5] is determined as the integral of reaction and deflection, calculated using Simpson's Rule. The results of a pre-compression cycle[6] and subsequence 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 permitted[7] reaction force and more than the minimum permitted[7] 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.

TEKMARINE SYSTEMS LLC
9595 Six Pines Drive, Suite 8210
The Woodlands
Houston, TX 77380, USA

phone +1 832 631-6104
email sales@tekmarine.com
web www.tekmarine.com

Presented by

Catalogue version 001d