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

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TJDA-A Arch Fender

TJDA-A Arch Fenders are single piece rubber units. The simplest version has a plain rubber face and can be installed almost anywhere. An optional embedded steel plate allows mounting behind pilings, or for UHMW-PE facings (p28) or steel plates to be attached.

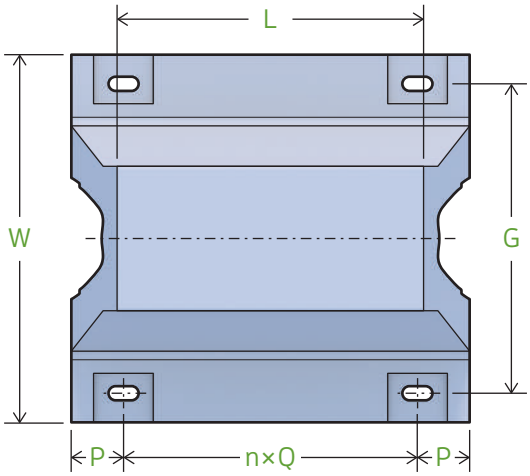
Arch fenders are used wherever simplicity and toughness are essential, such as general-purpose berths and exposed sites. They are easy to install horizontally or vertically and need little maintenance.

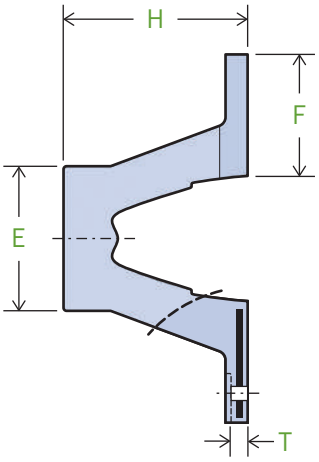
Dimensions

Model	Height		W		E		F		G		T		Slot size		Bolt	Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	kg	lb
TJDA-A250	250	9.8	500	19.7	164	6.5	160	6.3	410	16.1	21	0.8	32 × 64	1.3 × 2.5	M24	85	187
TJDA-A300	300	11.8	600	23.6	225	8.9	195	7.7	490	19.3	24	0.9	35 × 70	1.4 × 2.8	M30	125	276
TJDA-A400	400	15.7	800	31.5	300	11.8	260	10.2	670	26.4	30	1.2	41 × 82	1.6 × 3.2	M36	205	452
TJDA-A500	500	19.7	1000	39.4	375	14.8	325	12.8	840	33.1	33	1.3	47 × 94	1.9 × 3.7	M42	325	717
TJDA-A600	600	23.6	1200	47.2	450	17.7	390	15.4	1010	39.8	36	1.4	50 × 100	2.0 × 3.9	M48	480	1058
TJDA-A800	800	31.5	1600	63.0	600	23.6	520	20.5	1340	52.8	45	1.8	68 × 136	2.7 × 5.4	M56	875	1929
TJDA-A1000	1000	39.4	2000	78.7	750	29.5	650	25.6	1680	66.1	60	2.4	68 × 136	2.7 × 5.4	M56	1400	3086

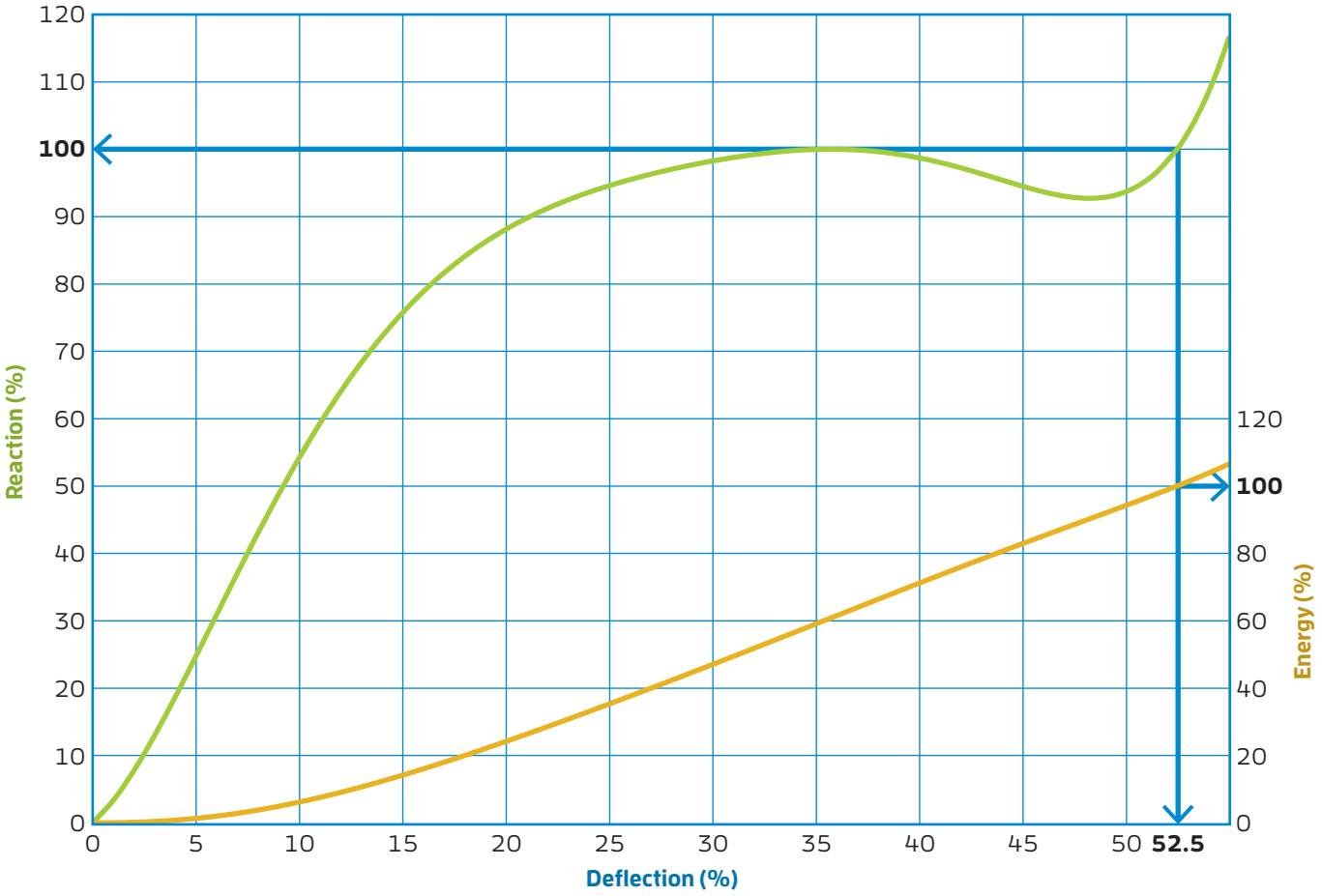
Values are for single units, L = 1m.

Model	1m (3.28ft), n=1				1.5m (4.92ft), n=2				2m (6.56ft), n=3				2.5m (8.2ft), n=3				3m (9.84ft), n=4				3.5m (11.48ft), n=5			
	P		Q		P		Q		P		Q		P		Q		P		Q		P		Q	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
TJDA-A250	130	5.1	865	34.1	135	5.3	680	26.8	135	5.3	620	24.4	130	5.1	790	31.1	135	5.3	715	28.1	120	4.7	673	26.5
TJDA-A300	140	5.5	870	34.3	140	5.5	685	27.0	140	5.5	625	24.6	140	5.5	790	31.1	145	5.7	715	28.1	140	5.5	674	26.5
TJDA-A400	150	5.9	900	35.4	150	5.9	700	27.6	150	5.9	635	25.0	150	5.9	800	31.5	150	5.9	725	28.5	150	5.9	680	26.8
TJDA-A500	160	6.3	930	36.6	160	6.3	715	28.1	160	6.3	645	25.4	160	6.3	810	31.9	165	6.5	730	28.7	160	6.3	686	27.0
TJDA-A600	170	6.7	960	37.8	170	6.7	730	28.7	170	6.7	655	25.8	170	6.7	820	32.3	170	6.7	740	29.1	170	6.7	692	27.2
TJDA-A800	180	7.1	1040	40.9	180	7.1	770	30.3	180	7.1	680	26.8	185	7.3	845	33.3	180	7.1	760	29.9				
TJDA-A1000	200	7.9	1100	43.3	200	7.9	800	31.5	200	7.9	700	27.6												





TJDA-A Performance



Intermediate values

Deflection	Reaction	Energy
%	%	%
5	25	1
10	54	6
15	76	14
20	88	25
25	95	35
30	98	47
35	100	59
40	99	71
45	95	83
50	94	94
52.5	**100**	**100**
55	116	106

Angle factor

Angle (°)	γ_A	
	Energy	Reaction
0	**1.00**	**1.00**
3	0.97	1.00
5	0.95	1.00
8	0.91	1.00
10	0.88	1.00
15	0.80	1.00
20	0.73	1.00

Velocity factors

Time (s)	γ_V
1	1.19
2	1.08
3	1.04
4	1.03
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.

TJDA-A Performance (metric units)

Model		E = kNm, R=kN												
		T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
TJDA-A250	E	10.6	12.2	13.7	15.2	15.8	16.5	17.1	17.7	18.4	19.0	19.6	20.3	20.9
	R	102	117	132	146	152	158	164	170	176	182	188	194	200
TJDA-A300	E	15.3	17.5	19.7	21.9	22.8	23.7	24.6	25.5	26.4	27.4	28.3	29.2	30.1
	R	123	140	158	175	183	190	197	204	211	218	225	232	240
TJDA-A400	E	27.2	31.1	35.0	38.9	40.5	42.2	43.8	45.4	47.0	48.6	50.2	51.9	53.5
	R	164	187	210	234	243	253	262	272	281	291	300	310	319
TJDA-A500	E	42.6	48.7	54.7	60.8	63.3	65.9	68.4	70.9	73.5	76.0	78.5	81.0	83.6
	R	205	234	263	292	304	316	328	340	352	364	375	387	399
TJDA-A600	E	61.3	70.1	78.8	87.6	91.2	94.9	98.5	102	106	109	113	117	120
	R	246	281	316	351	365	379	394	408	422	436	451	465	479
TJDA-A800	E	109	125	140	156	162	169	175	182	188	195	201	207	214
	R	327	374	421	468	487	506	525	544	563	582	601	620	639
TJDA-A1000	E	170	195	219	243	253	263	274	284	294	304	314	324	334
	R	409	468	526	585	608	632	656	680	703	727	751	775	798

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

TJDA-A Performance (US units)

Model		E = ft.kip, R=kips												
		T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
TJDA-A250	E	7.9	9.0	10.1	11.2	11.7	12.1	12.6	13.1	13.5	14.0	14.5	14.9	15.4
	R	23.0	26.3	29.6	32.9	34.2	35.5	36.9	38.2	39.5	40.9	42.2	43.5	44.9
TJDA-A300	E	11.3	12.9	14.5	16.2	16.8	17.5	18.2	18.8	19.5	20.2	20.8	21.5	22.2
	R	27.6	31.5	35.5	39.4	41.0	42.6	44.2	45.8	47.4	49.0	50.6	52.2	53.8
TJDA-A400	E	20.1	23.0	25.8	28.7	29.9	31.1	32.3	33.5	34.7	35.9	37.1	38.3	39.4
	R	36.8	42.1	47.3	52.6	54.7	56.8	59.0	61.1	63.3	65.4	67.5	69.7	71.8
TJDA-A500	E	31.4	35.9	40.4	44.9	46.7	48.6	50.5	52.3	54.2	56.0	57.9	59.8	61.6
	R	46.0	52.6	59.1	65.7	68.4	71.1	73.7	76.4	79.1	81.7	84.4	87.1	89.7
TJDA-A600	E	45.2	51.7	58.1	64.6	67.3	70.0	72.7	75.3	78.0	80.7	83.4	86.1	88.7
	R	55.2	63.1	71.0	78.9	82.1	85.3	88.5	91.7	94.9	98.1	101	104	108
TJDA-A800	E	80.4	91.9	103	115	120	124	129	134	139	143	148	153	158
	R	73.6	84.1	94.6	105	109	114	118	122	127	131	135	139	144
TJDA-A1000	E	126	144	162	179	187	194	202	209	217	224	232	239	247
	R	92.0	105	118	131	137	142	147	153	158	163	169	174	179

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

TJDA-A Performance (metric units)

Model		E = kNm, R=kN												
		T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32
TJDA-A250	E	21.5	22.2	22.8	23.4	24.0	24.7	25.3	25.9	26.6	27.2	27.8	29.2	30.6
	R	206	211	217	223	229	235	241	247	253	259	265	278	291
TJDA-A300	E	31.0	31.9	32.8	33.7	34.6	35.5	36.4	37.4	38.3	39.2	40.1	42.1	44.1
	R	247	254	261	268	275	282	289	296	304	311	318	334	350
TJDA-A400	E	55.1	56.7	58.3	59.9	61.6	63.2	64.8	66.4	68.0	69.6	71.3	74.8	78.4
	R	329	338	348	357	367	376	386	395	405	414	424	445	466
TJDA-A500	E	86.1	88.6	91.1	93.7	96.2	98.7	101	104	106	109	111	117	122
	R	411	423	435	447	459	470	482	494	506	518	530	556	583
TJDA-A600	E	124	128	131	135	139	142	146	149	153	157	160	168	176
	R	493	507	522	536	550	564	579	593	607	621	636	667	699
TJDA-A800	E	220	227	233	240	246	253	259	266	272	279	285	299	314
	R	658	677	696	715	734	753	772	791	810	829	848	890	932
TJDA-A1000	E	344	354	365	375	385	395	405	415	425	435	445	468	490
	R	822	846	870	893	917	941	965	988	1012	1036	1059	1112	1165

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

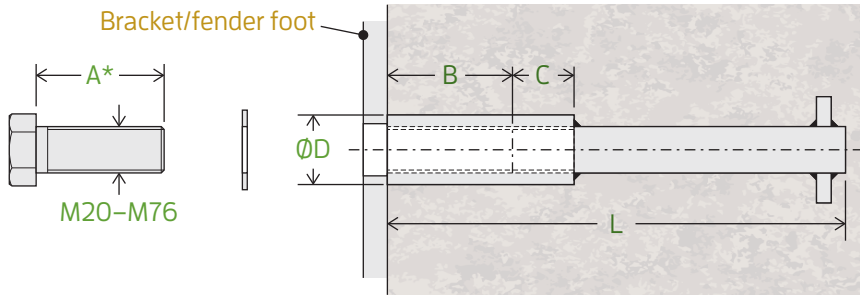
TJDA-A Performance (US units)

Model		E = ft.kip, R=kips												
		T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32
TJDA-A250	E	15.9	16.3	16.8	17.3	17.7	18.2	18.7	19.1	19.6	20.1	20.5	21.6	22.6
	R	46.2	47.5	48.9	50.2	51.5	52.9	54.2	55.5	56.9	58.2	59.5	62.5	65.5
TJDA-A300	E	22.9	23.5	24.2	24.9	25.5	26.2	26.9	27.6	28.2	28.9	29.6	31.0	32.5
	R	55.4	57.0	58.6	60.2	61.8	63.4	65.0	66.7	68.3	69.9	71.5	75.0	78.6
TJDA-A400	E	40.6	41.8	43.0	44.2	45.4	46.6	47.8	49.0	50.2	51.4	52.6	55.2	57.8
	R	73.9	76.1	78.2	80.3	82.5	84.6	86.7	88.9	91.0	93.1	95.3	100	105
TJDA-A500	E	63.5	65.4	67.2	69.1	70.9	72.8	74.7	76.5	78.4	80.3	82.1	86.2	90.3
	R	92.4	95.1	97.7	100	103	106	108	111	114	116	119	125	131
TJDA-A600	E	91.4	94.1	96.8	99.5	102	105	108	110	113	116	118	124	130
	R	111	114	117	120	124	127	130	133	137	140	143	150	157
TJDA-A800	E	163	167	172	177	182	186	191	196	201	205	210	221	231
	R	148	152	156	161	165	169	173	178	182	186	191	200	210
TJDA-A1000	E	254	261	269	276	284	291	299	306	314	321	329	345	361
	R	185	190	195	201	206	211	217	222	228	233	238	250	262

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

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.

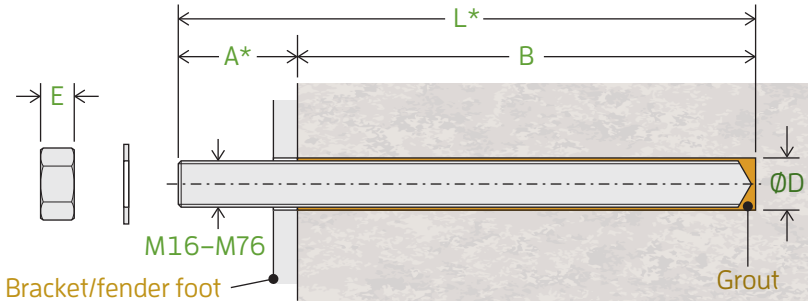


Cast-in type

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

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.

Unit Conversions

Length

	m	ft	in
1 m =	1	3.281	39.37
1 ft =	0.3048	1	12
1 in =	0.0245	0.0833	1

Force

	kN	tonne-f	ton-f
1 kN =	1	0.102	0.225
1 tonne-f =	9.81	1	2.2046
1 ton-f =	4.45	0.454	1

Area

	m^2	ft^2	in^2
1 m^2 =	1	10.764	1550
1 ft^2 =	0.0929	1	144
1 in^2 =	645.2×10^{-6}	6.944×10^{-3}	1

Energy

	kNm	tf-m	ft.kip
1 kNm =	1	0.102	0.7376
1 tf-m =	9.81	1	7.233
1 ft.kip =	1.36	0.138	1

Volume

	m^3	ft^3	in^3
1 m^3 =	1	35.315	61024
1 ft^3 =	0.0283	1	1728
1 in^3 =	16.387×10^{-6}	578.7×10^{-6}	1

Pressure

	kPa	t/m^2	kip/ft^2
1 kPa =	1	0.102	0.0209
1 t/m^2 =	9.81	1	0.205
1 kip/ft^2 =	47.9	4.88	1

Velocity

	m/s	ft/s	km/h	mph	knot
1 m/s =	1	3.2808	3.6	2.2369	1.9438
1 ft/s =	0.3048	1	1.0973	0.6818	0.5925
1 km/h =	0.2778	0.9113	1	0.6214	0.54
1 mph =	0.447	1.4667	1.6093	1	0.869
1 knot =	0.5144	1.6878	1.852	1.1508	1

Acceleration

	g	m/s^2	ft/s^2
1 g =	1	9.807	32.17
1 m/s^2 =	0.102	1	3.281
1 ft/s^2 =	0.031	0.3048	1

Important note

US customary units are listed for your convenience in this catalog, however figures in metric prevail throughout.

Useful software

At the time of publication, third-party unit conversion tools include:

Convert for Windows: https://joshmadison.com/convert-for-windows/

NumericalChameleon: http://sourceforge.net/projects/numchameleon/

TekMarine offers no warranty for nor makes any claims as to accuracy or fitness for purpose of these programs.

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