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.

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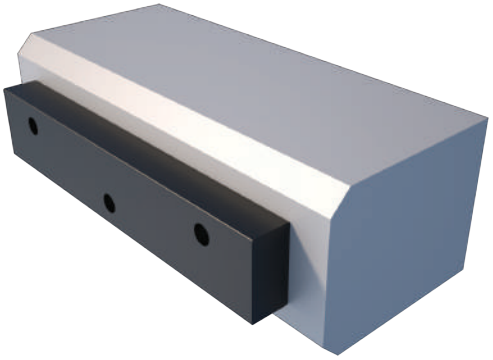
HD-PE Sliding Fenders

TekMarine HD-PE Fenders are durable, low friction strips that wear better and last longer than traditional timbers. HD-PE does not rot, split or suffer from marine borer infestation.

HD-PE Fenders are ideal for workboat berths, waterways and lock entrances and as components in larger fender installations.

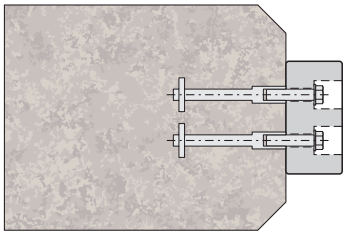
HD-PE is easy to machine and install onto concrete, steel or timber substrates. Better still, HD-PE is fully recyclable after its working life, and is a cost-effective alternative to tropical hardwoods.



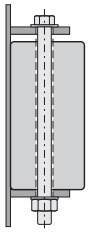
Fixing

HD-PE Fenders are equally at home mounted on concrete, steel plate or beam structures, or as a timber facing. Please ask TekMarine about the most suitable drilling diameters and fixings for your project.

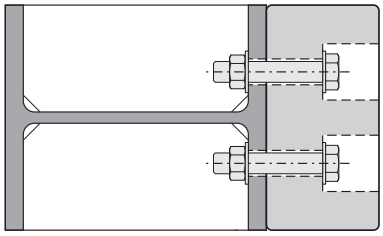
Concrete



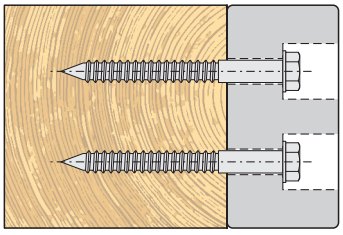
Plate



Beam



Timber



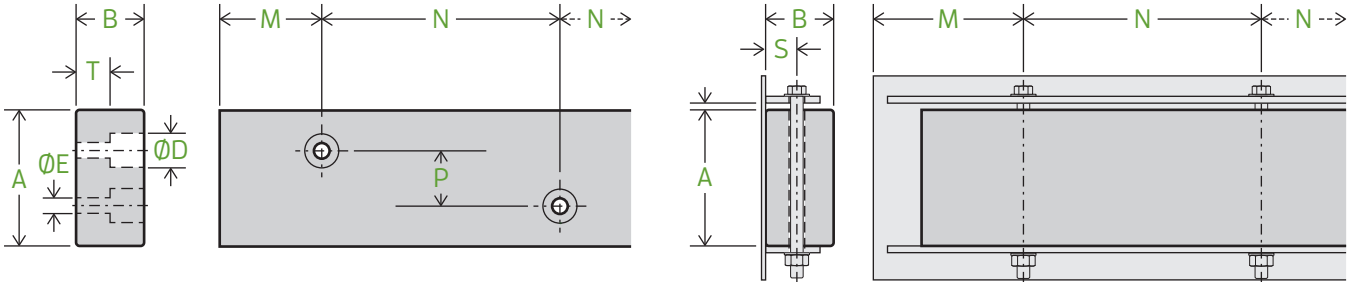
Physical Properties

Property	Test method	Typical results	Unit
Abrasion index (sand slurry)	ISO DIS 15527	~400	–
Density	ISO 1183-1	0.91–0.94	g/cm³
Dynamic friction (wet plastic)	ISO 8295	0.20–0.25	–
Molecular weight	Light diffusion method ASTM D6474	~200,000 $>4 \times 10^{-6}$	g/mol
Operating temperature	Not applicable	–20 to +70	°C
Shore hardness	DIN 53505/ISO 868	48–50	Shore D
Thermal expansion	DIN 53752/ ISO 3146	2×10^{-4}	K^{-1}
Yield strength	DIN 53504/ISO 527	10–15	MPa

Typical results are for virgin HD-PE. Actual values for Sliding Fenders can differ due to the proportion of recycled materials used in their manufacture.

For a comparison of the friction properties of various materials, please refer to p51.

HD-PE Dimensions



A		B		ØD		ØE		L		M		N		P		S		T		Flat Bar		Bolt	Weight	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in		kg	lb
50	2.0	50	2.0	32	1.3	16	0.6	5500	217	75–125	3–5	250–300	10–12	0	0	25	1.0	-	-	-	-	M12	2.3	5.1
60	2.4	60	2.4	32	1.3	16	0.6	5500	217	75–125	3–5	250–300	10–12	0	0	30	1.2	-	-	-	-	M12	3.3	7.3
70	2.8	50	2.0	32	1.3	16	0.6	2500	98	75–125	3–5	250–300	10–12	0	0	25	1.0	-	-	-	-	M12	3.3	7.3
70	2.8	70	2.8	32	1.3	16	0.6	6500	256	75–125	3–5	250–300	10–12	0	0	35	1.4	-	-	-	-	M12	4.5	9.9
80	3.1	60	2.4	32	1.3	16	0.6	5000	197	75–125	3–5	250–300	10–12	0	0	30	1.2	-	-	-	-	M12	4.5	9.9
100	3.9	50	2.0	32	1.3	16	0.6	5500	217	75–125	3–5	250–300	10–12	0	0	25	1.0	-	-	-	-	M12	4.7	10.4
100	3.9	65	2.6	32	1.3	16	0.6	5500	217	75–125	3–5	250–300	10–12	0	0	30	1.2	-	-	-	-	M12	6.1	13.4
100	3.9	100	3.9	32	1.3	16	0.6	6000	236	75–125	3–5	250–300	10–12	0	0	50	2.0	32	1.3	50×6	2×0.25	M12	9.3	20.5
120	4.7	80	3.1	40	1.6	20	0.8	5000	197	100–150	4–6	300–350	12–14	0	0	40	1.6	-	-	-	-	M16	8.9	19.6
120	4.7	120	4.7	40	1.6	20	0.8	6000	236	100–150	4–6	300–350	12–14	0	0	60	2.4	40	1.6	65×10	2.5×0.4	M16	13.4	29.5
140	5.5	70	2.8	40	1.6	20	0.8	5500	217	100–150	4–6	300–350	12–14	0–50	0–2.0	35	1.4	-	-	-	-	M16	9.1	20.1
160	6.3	70	2.8	40	1.6	20	0.8	5000	197	100–150	4–6	300–350	12–14	0–70	0–2.8	35	1.4	-	-	-	-	M16	10.4	22.9
160	6.3	160	6.3	40	1.6	20	0.8	6000	236	100–150	4–6	300–350	12–14	0–80	0–3.1	80	3.1	40	1.6	80×10	3.1×0.4	M16	24.1	53.1
170	6.7	120	4.7	40	1.6	20	0.8	5500	217	100–150	4–6	300–350	12–14	0–80	0–3.1	60	2.4	40	1.6	65×10	2.5×0.4	M16	19.0	41.9
175	6.9	150	5.9	50	2.0	23	0.9	4000	157	125–175	5–7	350–450	14–18	0–80	0–3.1	75	3.0	40	1.6	80×10	3.1×0.4	M20	24.2	53.4
180	7.1	70	2.8	50	2.0	23	0.9	5000	197	125–175	5–7	350–450	14–18	0–80	0–3.1	35	1.4	-	-	-	-	M20	11.7	25.8
180	7.1	180	7.1	50	2.0	23	0.9	6000	236	125–175	5–7	350–450	14–18	0–80	0–3.1	90	3.5	46	1.8	80×10	3.1×0.4	M20	30.2	66.6
190	7.5	110	4.3	50	2.0	23	0.9	5000	197	125–175	5–7	350–450	14–18	0–90	0–3.5	55	2.2	46	1.8	80×10	3.1×0.4	M20	19.4	42.8
200	7.9	75	3.0	50	2.0	23	0.9	5000	197	125–175	5–7	350–450	14–18	0–100	0–3.9	35	1.4	46	1.8	-	-	M20	14.0	30.9
200	7.9	100	3.9	50	2.0	23	0.9	6000	236	125–175	5–7	350–450	14–18	0–100	0–3.9	50	2.0	46	1.8	80×10	3.1×0.4	M20	18.6	41.0
200	7.9	150	5.9	50	2.0	23	0.9	5500	217	125–175	5–7	350–450	14–18	0–100	0–3.9	75	3.0	46	1.8	80×10	3.1×0.4	M20	27.9	61.5
200	7.9	200	7.9	50	2.0	23	0.9	6000	236	125–175	5–7	350–450	14–18	0–100	0–3.9	100	3.9	46	1.8	80×10	3.1×0.4	M20	37.6	82.9
210	8.3	165	6.5	50	2.0	23	0.9	2000	79	150–200	6–8	450–550	18–22	0–130	0–5.1	80	3.1	46	1.8	80×10	3.1×0.4	M20	31.9	70.3
250	9.8	150	5.9	65	2.6	28	1.1	6500	256	150–200	6–8	450–550	18–22	0–130	0–5.1	75	3.0	46	1.8	80×10	3.1×0.4	M24	34.8	76.7
250	9.8	160	6.3	65	2.6	28	1.1	5000	197	150–200	6–8	450–550	18–22	0–130	0–5.1	80	3.1	46	1.8	80×10	3.1×0.4	M24	37.2	82.0
250	9.8	250	9.8	65	2.6	28	1.1	5000	197	150–200	6–8	450–550	18–22	0–130	0–5.1	125	4.9	56	2.2	100×10	3.9×0.4	M24	58.1	128
300	11.8	100	3.9	65	2.6	28	1.1	5500	217	150–200	6–8	450–550	18–22	0–160	0–6.3	50	2.0	-	-	-	-	M24	27.9	61.5
300	11.8	210	8.3	70	2.8	36	1.4	5000	197	175–225	7–9	500–600	20–24	0–160	0–6.3	105	4.1	56	2.2	100×12	3.9×0.5	M30	58.6	129
300	11.8	300	11.8	70	2.8	36	1.4	5000	197	175–225	7–9	500–600	20–24	0–160	0–6.3	105	4.1	72	2.8	100×12	3.9×0.5	M30	84.6	187
440	17.3	160	6.3	70	2.8	36	1.4	2000	79	175–225	7–9	500–600	20–24	0–160	0–6.3	80	3.1	-	-	-	-	M30	66.8	147

Values are for single units, L = 1m.

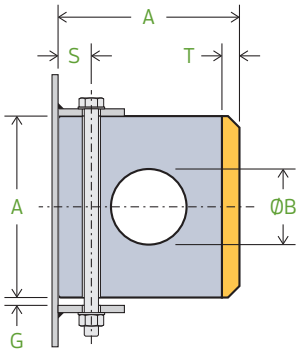
Composite Fenders

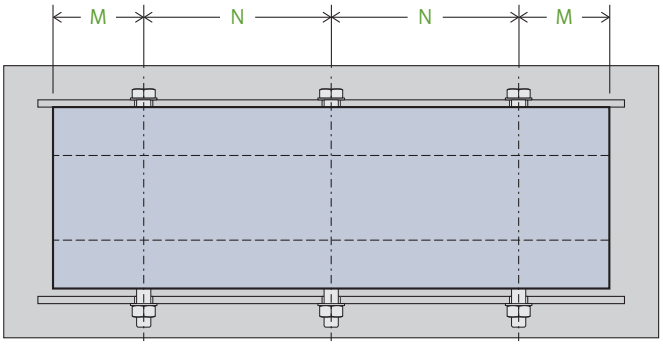
Composite Fenders combine a rubber body permanently bonded to a low-friction UHMW-PE face pad. The rubber body absorbs berthing energy while the facing reduces shear forces.

TJCA

Hollow ◘

Solid ■





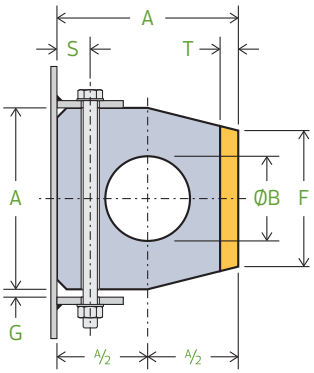
A		ØB*		G		S		T		M		N		Standard length		Flat bar		Bolt	Weight			
																			Hollow ◘		Solid ■	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in		kg	lb	kg	lb
100	3.9	30	1.2	10	0.4	25	1.0	20	0.8	90–130	3.5–5.1	200–300	7.9–11.8	3000	118	50 × 6	2.0 × 0.2	M12	10.3	22.7	11.1	24.5
150	5.9	65	2.6	12	0.5	30	1.2	20	0.8	110–150	4.3–5.9	250–350	9.8–13.8	3000	118	60 × 8	2.4 × 0.3	M16	21.5	47.4	27.0	59.5
200	7.9	75	3.0	20	0.8	45	1.8	25	1.0	130–180	5.1–7.1	300–400	11.8–15.7	3000	118	80 × 10	3.1 × 0.4	M20	40.2	88.6	48.0	106
250	9.8	100	3.9	25	1.0	50	2.0	30	1.2	140–200	5.5–7.9	350–450	13.8–17.7	2000	79	100 × 6	3.9 × 0.2	M24	60.2	133	75.0	165
300	11.8	125	4.9	30	1.2	60	2.4	30	1.2	140–200	5.5–7.9	350–450	13.8–17.7	3700	146	110 × 12	4.3 × 0.5	M24	92.1	203	108	238

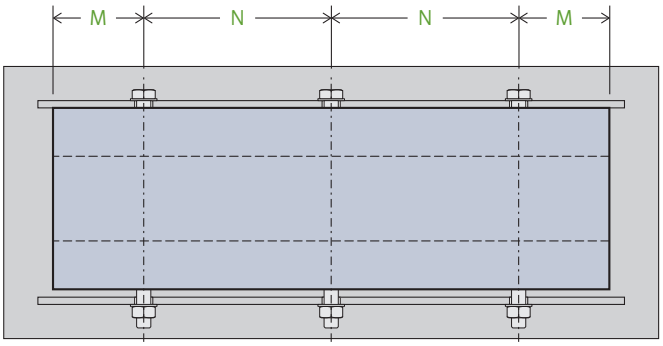
Values are for single units, L = 1m. *Dimension applies to hollow fenders only.

TJCB

Hollow ◘

Solid ■





A		ØB*		F		G		S		T		M		N		Standard length		Flat bar		Bolt	Weight			
																					Hollow ◘		Solid ■	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in		kg	lb	kg	lb
80	3.1	42	1.7	60	2.4	6	0.2	25	1.0	10	0.4	90–130	3.5–5.1	200–300	7.9–11.8	2000	79	45 × 6	1.8 × 0.2	M12	5.4	11.9	7.0	15.4
100	3.9	45	1.8	74	2.9	8	0.3	25	1.0	10	0.4	90–130	3.5–5.1	200–300	7.9–11.8	2000	79	45 × 6	1.8 × 0.2	M12	8.4	18.5	11.0	24.3
120	4.7	65	2.6	88	3.5	10	0.4	30	1.2	12	0.5	110–150	4.3–5.9	250–350	9.8–13.8	2000	79	60 × 8	2.4 × 0.3	M16	12.2	26.9	15.8	34.8
150	5.9	73	2.9	110	4.3	12	0.5	30	1.2	15	0.6	110–150	4.3–5.9	250–350	9.8–13.8	3000	118	60 × 8	2.4 × 0.3	M16	19.7	43.4	24.8	54.7

Values are for single units, L = 1m. *Dimension applies to hollow fenders only.

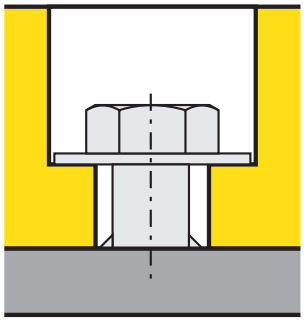
UHMW-PE Facings

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.

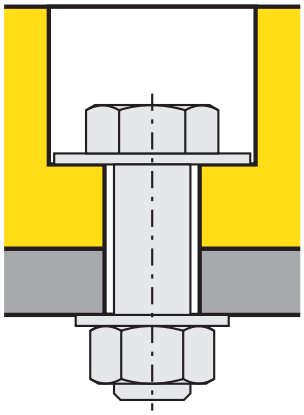
Easy to machine and install, UHMW-PE comes in many colors and several quality grades.

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

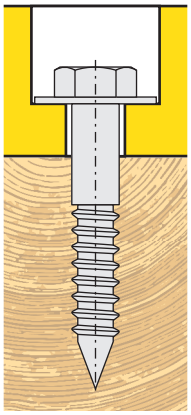
Steel panel with welded stud



Open steel structure



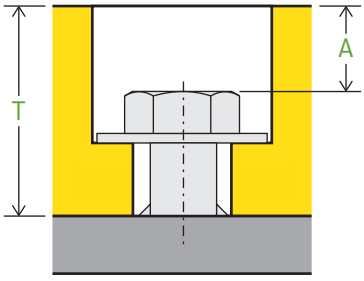
Timber structure



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.

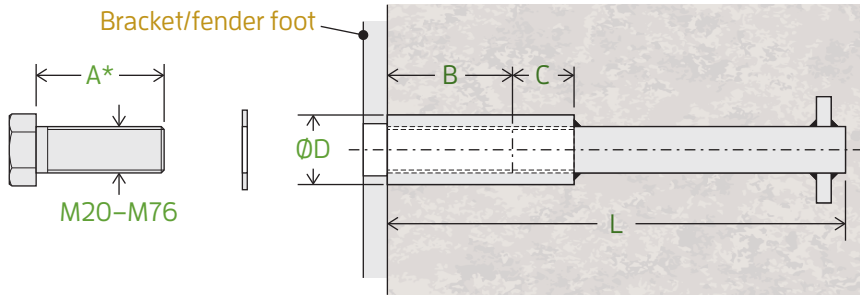
These coefficients of friction only apply to smooth contact surfaces.

Source: BS 6349-4:2014

For more information please consult TekMarine.

Anchors

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.

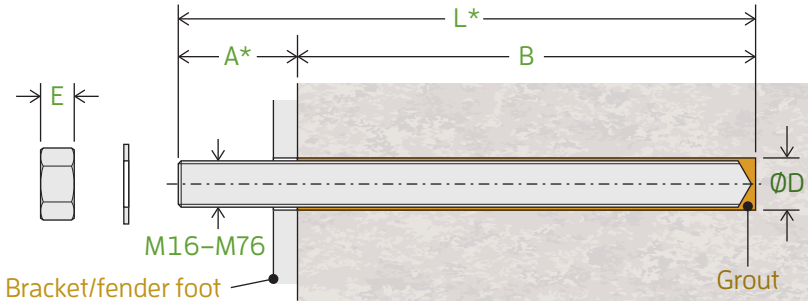


Cast-in type

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.

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

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