

Trelleborg Marine Fenders



TES-IMF01



Trelleborg Hercules Pte Ltd
4 Jalan Pesawat, Singapore 619362
Phone: +65 6265 0955 Fax: +65 6265 9853
Email: hercules@trelleborg.com
www.trelleborg.com/hercules
www.trelleborg.com



FENDERS

Fentek Cone Fender

Fentek Cone Fender is a major advance in the field of fender technology. Superior in both design and operation this type of fender offers both technical and financial advantages.

The fender geometry and integrated method of construction incorporating steel plates vulcanised into the base and head of the fender during production provides a stable, self-contained fender element that is easily installed. This unit is supplied with a frontal frame system faced with low friction material to protect the ship's hull.

Sizes range from 300mm to 2000mm high.



Fentek Arch Fender

Fentek Arch Fenders are versatile, well proven fenders used in a wide variety of installations. Arch fenders excel in applications where fender height must be minimised. Steel plates are vulcanised into the base of the fender providing a simple and effective method of attachment.

The ANP type arch fender has a steel plate incorporated into the head region of the fender. This enables the mounting of a steel fender frontal panel or UHMW-PE protector pad direct to the fender head.

Sizes range from 150mm to 1000mm high with lengths ranging from 500mm to 3000mm.



Fentek Unit Element Fender

Fentek Unit Element Fender with its modular design concept facilitates multiple configurations. The system is always used in combination with either a UHMW-PE protector pad or a steel or timber frontal panel.

This approach assists in meeting specific design requirements that may relate to overall fender outstand, enhancing stability under shear forces and support of frontal panels without chain systems.

UE Fender heights range from 250mm to 1600mm in length increments of 500mm to 2000mm.



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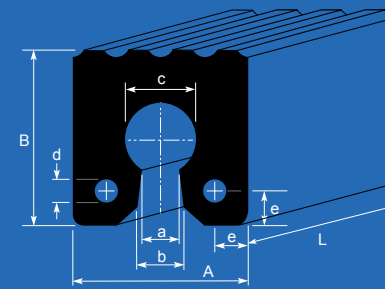




Cylindrical Fender

Cylindrical Fenders have been used for many years for ship and wharf protection. The inherent simplicity of installation and operation makes these units an economical solution for remote locations and for wharves that have to cope with a wide diversity of unknown vessel sizes.

Cylindrical Fenders are available in diameters from 90mm to 2000mm.



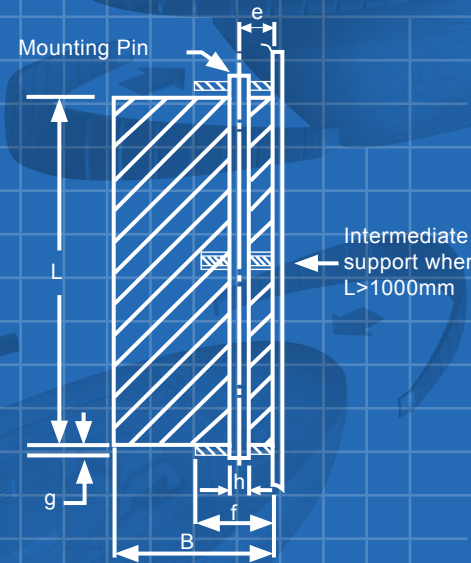
Cross Sectional View

Foam Filled Fender

The Foam Filled Fenders are suitable for locations where fixed fendering systems are not appropriate and for ship-to-ship operations. These fenders can be supplied with a tyre net for additional protection for the fender itself. The foam filled fender does not deflate and remains operational even when subjected to overdesign berthing loads or physical damage. The construction is internal cellular foam encased within a very tough and wear resistant polyurethane outer skin. This construction allows for very easy on site repair and maintenance.

The fender has a low reaction force on initial contact and a large bearing area and is ideal for vessels of light hull construction.

Sizes range from 300mm to 3000mm in diameter.



Sectional View

Tug Fender

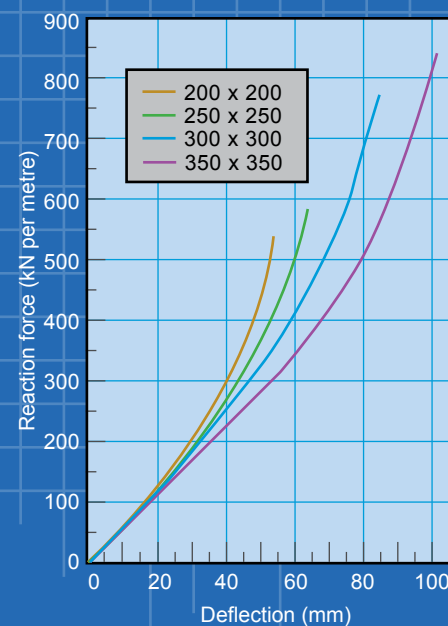
Tug Fendering is supplied in a variety of styles and profiles to suit the large range of operational tugs, pusher barges and work boats. The most used profiles being:

- Cylindrical profile with chain recesses for bow and stern protection.
- "W" & "M" style fender for applications that require a large curved hull area to be protected.
- Block fender for hard wearing applications where replacement may be more frequent.
- Square and "D" shaped profiles for side protection of vessels.

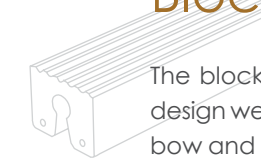
The fendering is able to be supplied cut to length and drilled as required so that minimum onsite work is required. A wide variety of sizes are available in all the profiles shown.



Deflection - Reaction Force Diagram Applicable to 1 metre long block fender



Block Fender (keyhole)



The block fender with the "Keyhole profile" is a versatile design well suited for protecting the curved surfaces on the bow and stern of tugs, supply vessels and workboats. Twin attachment holes are provided to allow simple installation and removal.

The block fender may be cut and bevelled to suit individual design requirements. This work may be carried out during production or by the customer during installation. Block fenders can be precisely tailored to fit bow and stern profiles and therefore maximise surface coverage and provide excellent aesthetic appearance.

Block fenders are available with either a smooth or ribbed contact face. The ribbed face is generally chosen where friction between the tug and the other vessel is required to be maximised.

A	B	Steel Support (f x g)	Mounting Pin Diameter (h)	e	Min. Bending Radius (R)
mm	mm	mm	mm	mm	mm
200	200	100 x 15	25	35	450
250	250	125 x 20	30	50	600
300	300	150 x 20	30	60	800
350	350	175 x 25	30	70	1000

Refer to sectional view

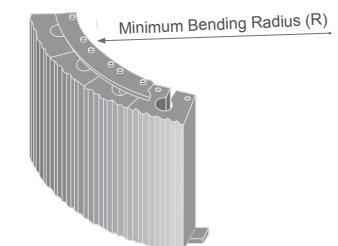
Block Fender Dimensions

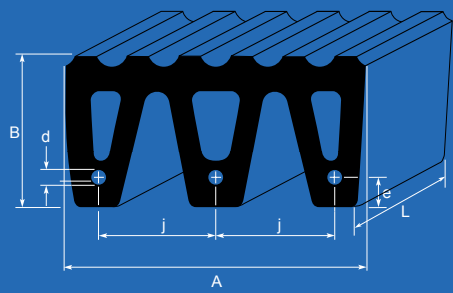
A	B	L Max Length	Slot Width a/b	Hole Diameter c	Fixing Hole Diameter d	e	Weight
mm	mm	mm	mm	mm	mm	mm	kg/m
200	200	2000	50/70	90	28	35	33
250	250	2000	50/70	100	33	50	54
300	300	1750	60/90	115	33	60	80
350	350	2000	60/100	125	33	70	114

Refer to cross sectional view

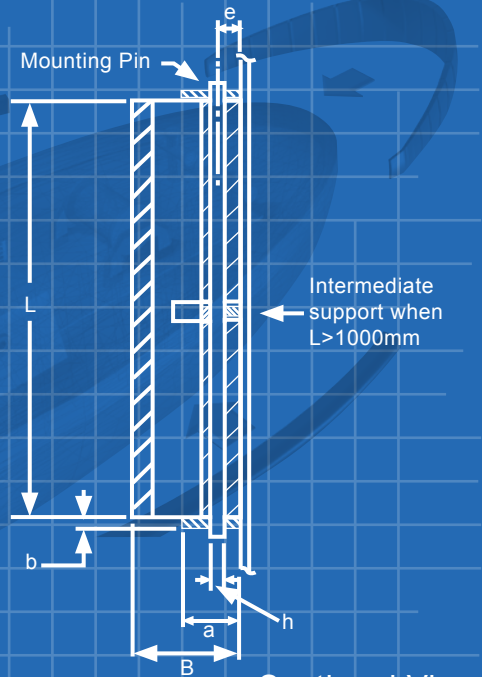
Dimensional Tolerance

Cross Section : > 100mm : ± 4%, or < 100mm : ISO3302-1, Class E3
 Length : ± 20mm



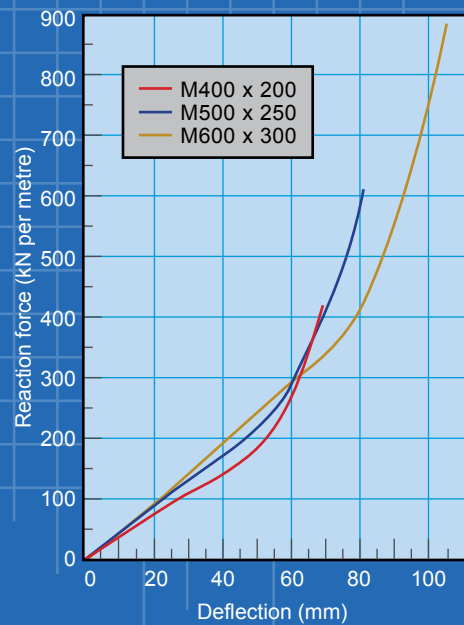


Cross Sectional View



Sectional View

Deflection - Reaction Force Diagram Applicable to 1 metre long M Fender



M Fender

M-Fenders are supported by three "feet" and are primarily designed as large thrust fenders for the bow and stern of tugs. However, the M-Fender is also suitable for protecting quay corners, bridge buttresses and other heavy duty applications.

Mounted side by side, M-Fenders closely follow the ships' contours and provide a protective, elastic surface which uniformly distributes the contact force over the contact area.

The special geometric shape of the M-Fender offers savings in weight and installation advantages – reducing both the initial purchase price, fitting costs and day to day operational expenses of the vessel.

A	B	Steel Support (a x b)	Mounting Pin Diameter (h)	e	Min. Bending Radius (R)
mm	mm	mm	mm	mm	mm
400	200	100 x 15	20	40	450
500	250	125 x 20	24	50	550
600	300	150 x 20	30	60	650

Refer to sectional view

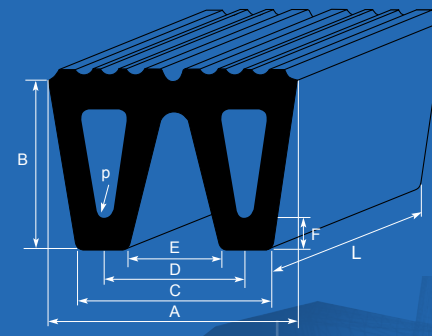
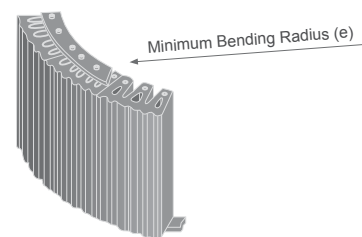
M Fender Dimensions

Fender Type	A	B	L Max Length	j	Fixing Hole Diameter d	e	Weight
	mm	mm	mm	mm	mm	mm	Kg/m
400 x 200	400	200	2000	150	23	40	56
500 x 250	500	250	2000	190	27	50	89
600 x 300	600	300	2000	230	33	60	132

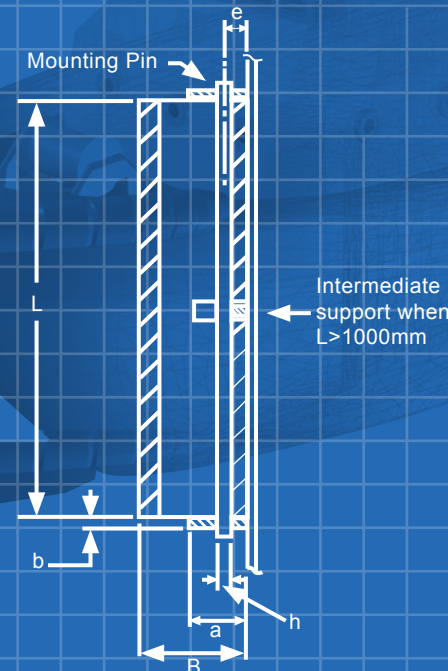
Refer to cross sectional view

Dimensional Tolerance

Cross Section : > 100mm : ± 4%, or < 100mm : ISO3302-1, Class E3
 Length : ± 20mm

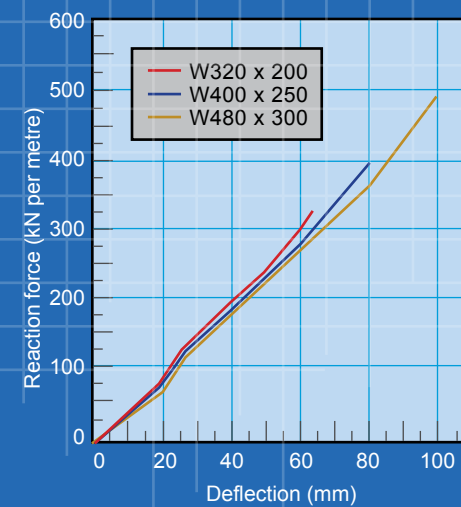


Cross Sectional View



Sectional View

Deflection - Reaction Force Diagram Applicable to 1 metre long W Fender



W Fender

W-Fenders are specially designed as vertical fenders for the bow and stern of tugs. It's unique profile is able to accommodate the tight radius and closely follow the ship's contours.

The wider external face present a continue and uniform surfaces thus providing an unbroken protective surfaces at the bow and stern of tugboats.

The special shape of the W-Fenders offer savings in weight and installation advantages - reduce both the initial purchase and installation cost.

A	B	Steel Support (a x b)	Mounting Pin Diameter (h)	e	Min. Bending Radius (R)
mm	mm	mm	mm	mm	mm
320	200	100 x 20	25	67	600
400	250	120 x 20	30	75	800
480	300	140 x 20	40	90	900
500	450	150 x 20	40	100	1000

Refer to sectional view

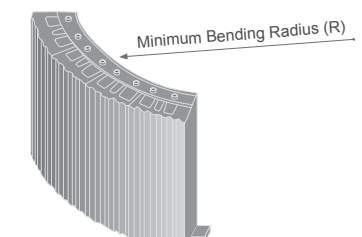
W Fender Dimensions

Fender Type	A	B	L Max Length	C	D	E	F	P	Weight
	mm	mm	mm	mm	mm	mm	mm	mm	Kg/m
320 x 200	320	200	2000	280	180	100	67	17	51
400 x 250	400	250	2000	350	220	110	75	20	81
480 x 300	480	300	2000	420	265	135	90	25	116
500 x 450	500	450	2000	420	250	90	100	25	178

Refer to cross sectional view

Dimensional Tolerance

Cross Section : > 100mm : ± 4%, or < 100mm : ISO3302-1, Class E3
 Length : ± 20mm





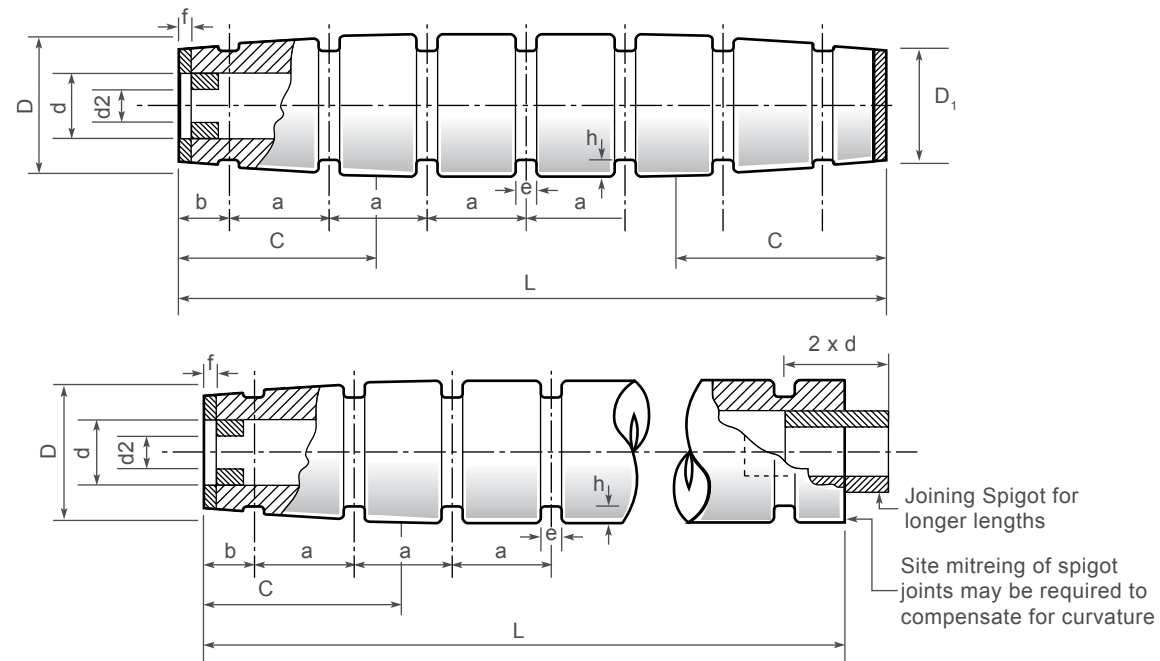
Cylindrical Bow & Stern Fender

Cylindrical Bow & Stern Fenders are commonly used on ocean going tugs and where significant movement occurs between the tug and ship. This fender is commonly used in conjunction with Block or M-Fender to accommodate vessels with large bow flare such as container vessels.

Special features of the Cylindrical Bow and Stern Fender include tapered ends, protective end plates and groove to accommodate circumferential securing chains or straps. Single fender can be manufactured up to 800mm diameter and 13 metres in length (subject to transport limitations.) Longer fender sections can be made by joining shorter sections with joining plugs.

Curve Radius

Cylindrical Fenders are produce in straight lengths but can be pulled around radiused hull provided that the inside radius is at least four times the outside diameter of the fender.

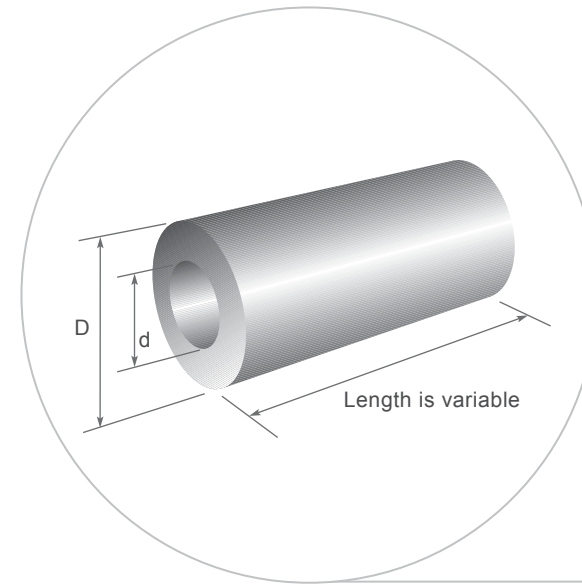


D ø	200	250	300	350	400	500	600	700	800	900	1000
L	Length including taper sections (2-13 meters in one piece or joined for longer length)										
a	Varies according to fender length										
D ₁ ø	150	190	225	260	300	375	450	525	600	675	750
d ø	100	125	150	175	200	250	300	350	400	450	500
d ₂ ø	75	75	75	100	100	100	125	125	125	150	150
b	150	200	225	250	300	300	350	350	350	350	350
c	500	500	700	800	800	900	900	1000	1000	1100	1200
e/h	Groove width and depth to suit chain or web type fixings as specified by client										
f	10	10	20	20	20	20	40	40	40	40	40

Dimensional Tolerance

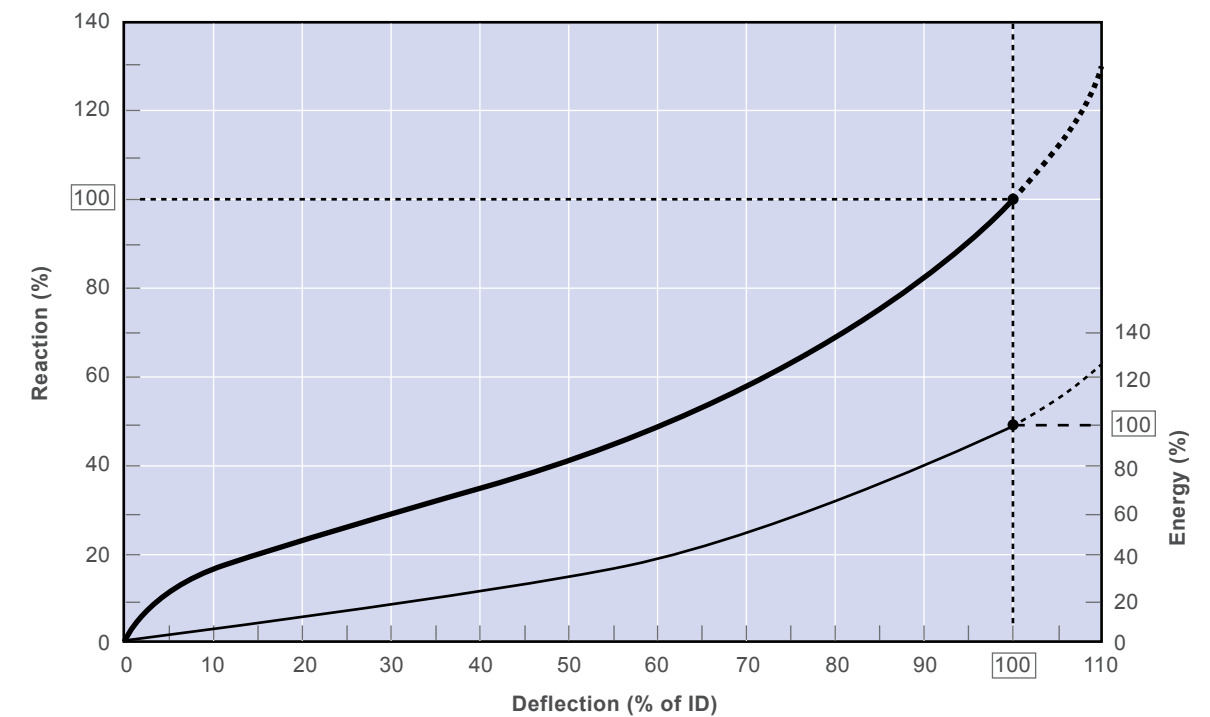
Cross Section : ± 4%
Length : ± 40mm

Standard dimensions are shown in the table. Fenders can be manufactured to client's supplied dimensions. All dimensions in mm.



Cylindrical Fender

Cylindrical Fenders provide a simple and cost effective protection for ships, they are used as bow and stern fenders on smaller vessels as well as complimentary fenders by being mounted in conjunction with Block or M-Fenders on tug boats. Cylindrical fenders can also be hung vertically over the side of a vessel. For bow and stern usage on tugs, an exact fit to the ship's curvature may be achieved. Complete circumferential is possible by joining adjacent lengths with plugs.



Cylindrical Fender Dimensions & Performance

Outside Diameter D	Inside Diameter d	* Rated Energy Absorption	* Rated Reaction Force	Weight
mm	mm	kNm	kN	kg/m
100	50	0.8	43	7.2
125	65	1.3	51	11
150	75	1.8	65	16.3
200	100	3.3	86	29
250	125	5.1	108	45.3
380	190	11.8	164	105
400	200	13.1	172	116
450	225	16.6	194	147
500	250	28.0	275	181
600	300	40.0	330	255
800	400	72.0	440	453
1000	500	112.0	550	707

(* at 50% deflection)

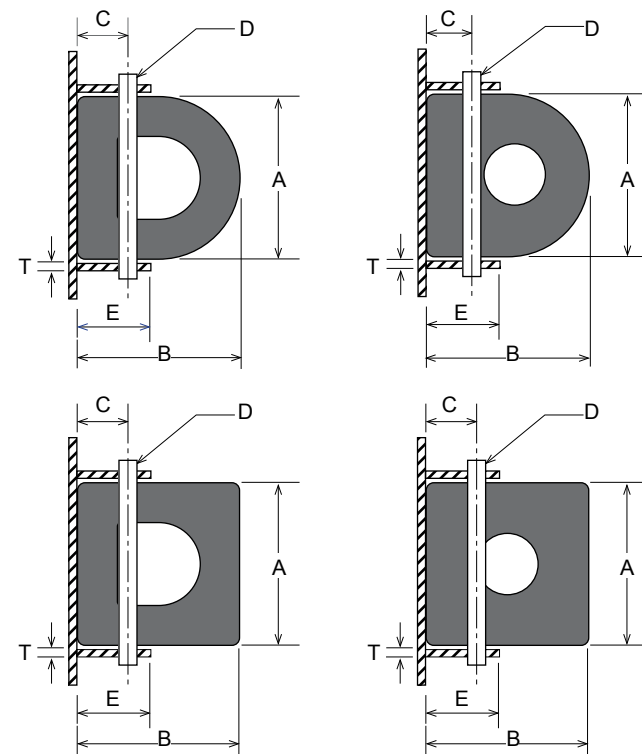


Extruded Fender

Extruded Fender is able to be delivered with fixing points, i.e. holes drilled into the fender, sloping ends, fixing plates, bolts and accessories. Extruded lengths vary dependant on handling and transport criteria.

Extruded fenders are normally used as side fendering on tugs, supply vessels and pilot boats.

Typical Mounting Details For Ships



A & B	C	E	Steel Thickness T	Bolt Size	Bolt Spacing
mm	mm	mm	mm	D	mm
80	30	40	6	M12	250
100	35	50	8	M12	250
125	45	60	12	M16	300
150	50	70	15	M16	300
200	50	80	15	M20	350
250	75	100	20	M24	400
300	90	120	20	M24	400
350	105	140	25	M30	400
400	115	160	25	M30	400
500	145	200	25	M36	450

Dimensional Tolerance

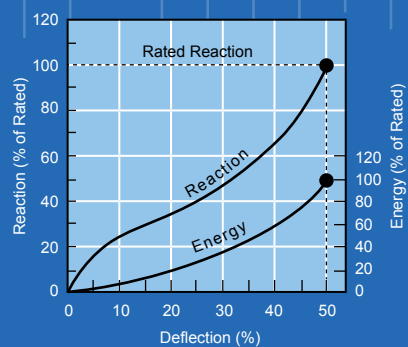
Cross Section : >100mm; ±4% or <100mm
ISO3302-1, Class E3
Length : ±20mm

Fender Size				
	E (kNm)	R (kN)	E (kNm)	R (kN)
100	1.4	77	2.7	136
150	3.2	115	6.4	206
200	5.7	153	11.3	275
250	8.9	191	17.6	343
300	12.9	230	25.5	412
350	17.6	268	34.3	471
400	23.0	306	45.2	589
500	35.9	383	70.7	736

Values are per metre.

Fender Size				
	E (kNm)	R (kN)	E (kNm)	R (kN)
100	1.9	157	2.7	157
150	4.2	235	6.4	235
200	7.5	314	11.3	314
250	11.7	392	17.7	392
300	16.9	471	25.5	471
350	22.9	549	34.3	589
400	29.4	628	45.1	628
500	46.0	785	70.5	785

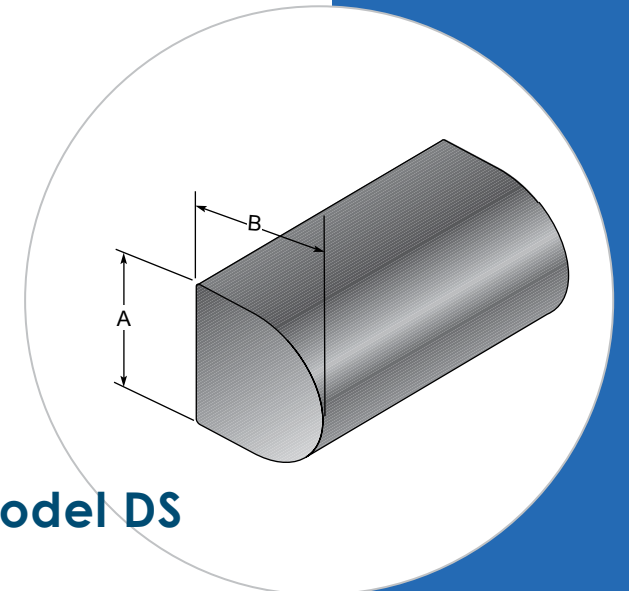
Values are per metre.



SPECIFICATIONS

Solid-D Fender

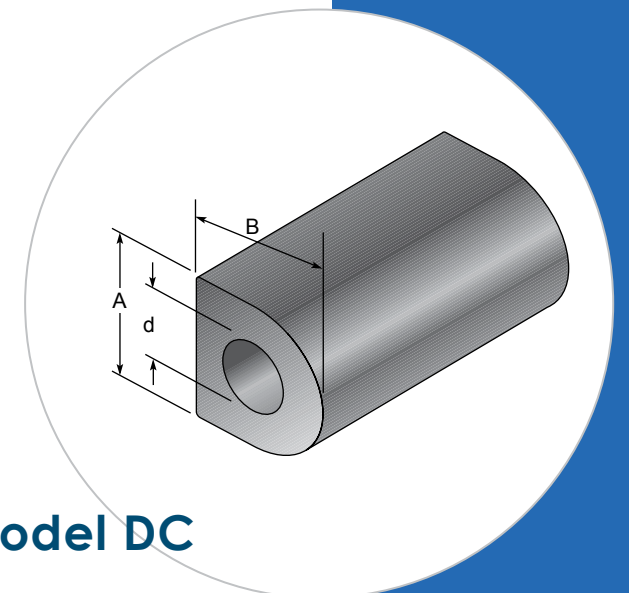
Width A (mm)	Height B (mm)	Weight (kg/m)
100	100	11.0
150	150	24.8
200	200	44.2
200	250	55.2
250	250	69.0
300	300	99.4
350	350	135.2
400	400	176.6



Model DS

D-Circle Fender

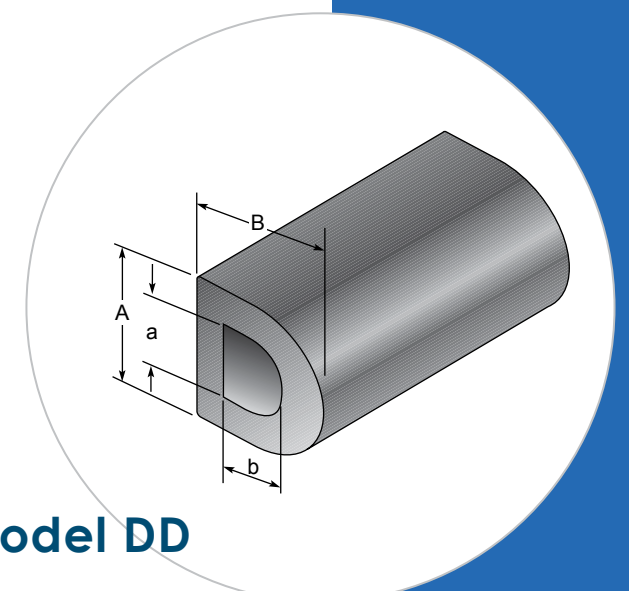
Width A (mm)	Height B (mm)	Hole Diameter d (mm)	Weight (kg/m)
100	100	30	10.1
150	150	65	20.6
200	200	75	38.5
250	250	100	59.0
300	300	125	83.7
350	350	150	113.0
400	400	175	146.0
500	500	250	214.0



Model DC

D-D Fender

Width A (mm)	Height B (mm)	Width a (mm)	Height b (mm)	Weight (kg/m)
80	70	45	30	4.8
100	100	50	45	8.5
125	125	60	60	13.2
150	150	75	75	18.5
200	150	100	80	23.1
200	200	100	100	32.9
250	200	125	100	39.9
250	250	125	125	51.5
300	300	150	150	74.1
350	350	175	175	101.0
400	400	200	200	133.0
500	500	250	250	206.0

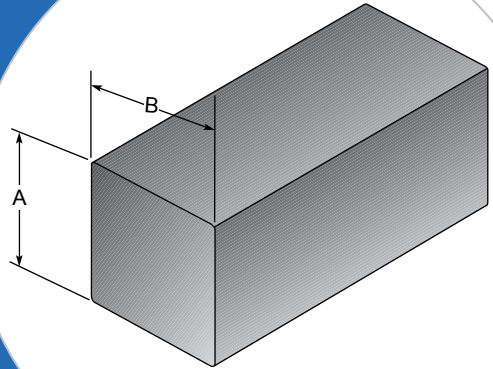


Model DD

EXTRUDED FENDER

SPECIFICATIONS

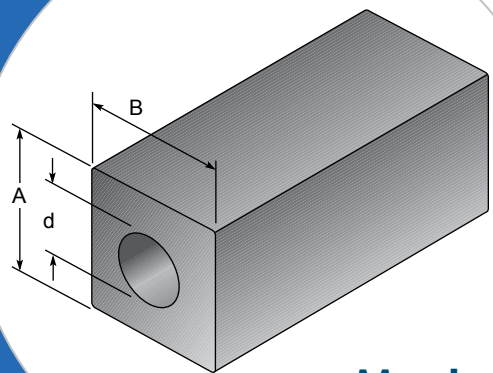
Solid-Square Fender



Model SS

Width A (mm)	Height B (mm)	Weight (kg/m)
100	100	12.0
150	150	27.0
200	200	48.0
250	250	75.0
300	300	108.0
350	350	147.0
400	400	192.0

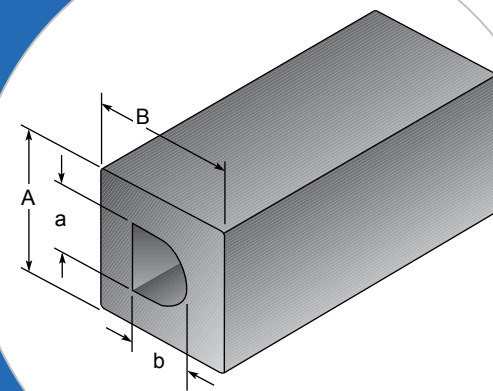
Square-Circle Fender



Model SC

Width A (mm)	Height B (mm)	Hole Diameter d (mm)	Weight (kg/m)
100	100	30	11.4
150	150	65	23.6
165	125	65	21.3
200	200	75	43.8
200	200	100	39.5
250	200	80	55.3
250	250	100	67.2
300	250	100	82.6
300	300	125	95.6
400	400	200	158.0
500	500	250	247.0

Square-D Fender



Model SD

Width A (mm)	Height B (mm)	Width a (mm)	Height b (mm)	Weight (kg/m)
100	100	50	45	9.9
150	150	70	65	22.7
165	125	80	60	20.3
200	150	90	65	30.8
200	200	90	95	39.8
250	200	120	95	49.4
250	250	120	120	61.1
300	250	140	115	75.0
300	300	125	135	92.0
400	400	200	200	153.0
500	500	250	250	239.0

MATERIAL SPECIFICATIONS

Rubber Specifications

- Physical properties of rubber for Marine Fenders

Property	Testing Standard	Condition	Requirement
Tensile Strength	DIN 53504; ASTM D-412 Die C; AS 1180.2 BS ISO 37; JIS K 6251	Original	13 MPa (minimum)
		Aged for 96 hours at 70°C	10.4 MPa (minimum)
Elongation at Break	DIN 53504; ASTM D-412 Die C; AS 1180.2 BS ISO 37; JIS K 6251	Original	280% (minimum)
		Aged for 96 hours at 70°C	224% (minimum)
Hardness	DIN 53505; ASTM D-2240; AS 1683.15.2; JIS K 6253	Original	78° Shore A (maximum)
		Aged for 96 hours at 70°C	Original + 8° Shore A (maximum)
Compression Set	ASTM D-395 Method B; AS 1683.13 Method B; BS 903 A6; ISO 815; JIS K 6262	22 hours at 70°C	30% (maximum)
		DIN 53517	
Tear Resistance	ASTM D-624 Die B; AS 1683.12; BS ISO 34-1; JIS K 6252	Original	60 kN/m (minimum)
			DIN 53507
Ozone Resistance	DIN 53509; ASTM D-1149; AS 1683.24; BS ISO 1431-1; JIS K 6259	50pphm at 20% stain, 40°C, 100 hours	No Cracks
Seawater Resistance (1) Hardness change (2) Volume change	DIN 86076	28 days at 95 ± 2°C	± 10° (Shore A) (maximum) + 10 / -5 (%) (maximum)
Abrasion Resistance	DIN 53516	Original	180 mm ³ (maximum)

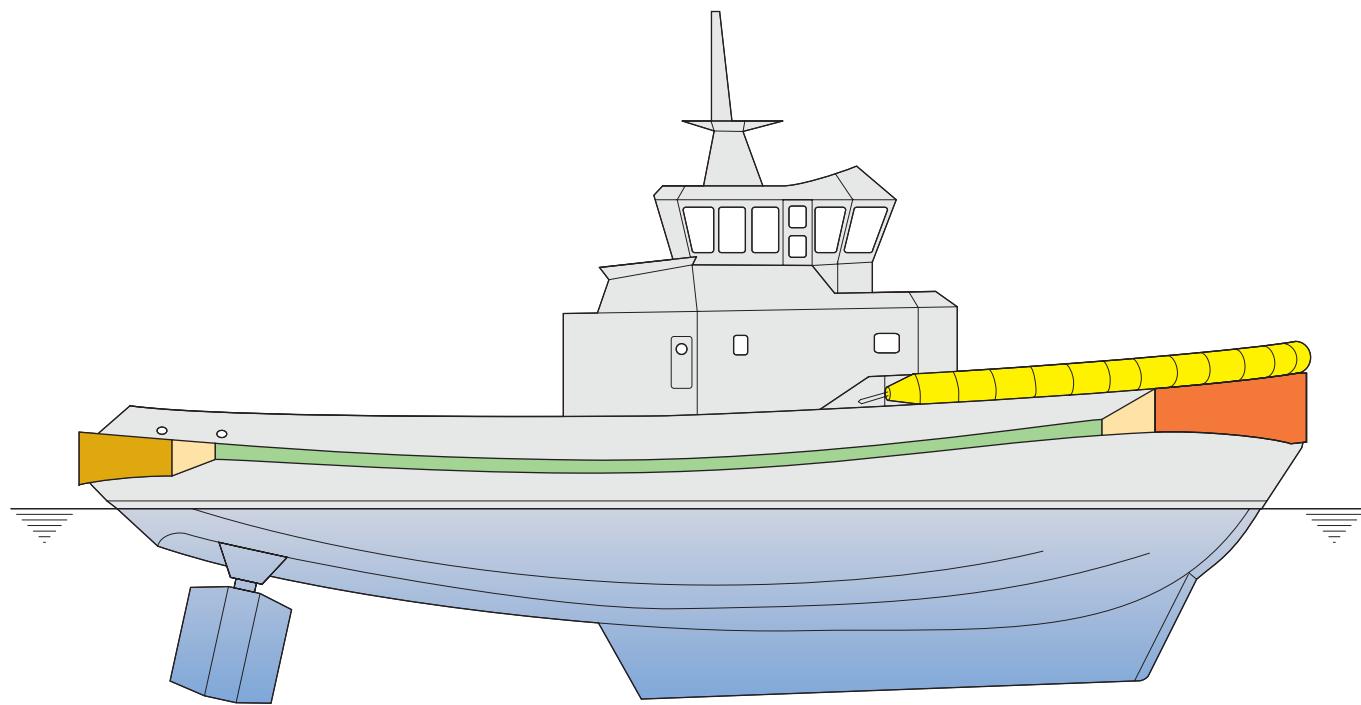
EXTRUDED FENDER


MATERIAL SPECIFICATIONS

PROJECT REQUIREMENTS

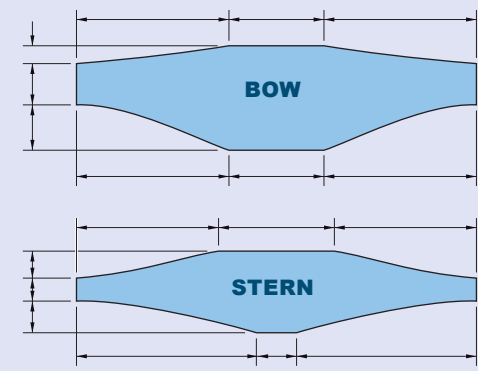



For assistance with design or pricing of tug fenders, please complete this form and fax or email it to Trelleborg Hercules office, together with legible GA drawings of the vessel with Fender arrangement.



VESSEL		
Name or Yard Number: _____		
Overall length _____ m	Length at waterline _____ m	Beam (moulded) _____ m
Depth (moulded) _____ m	Draft (max) _____ m	Displacement _____ t
Bollard Pull :	Ahead _____ t	Astern _____ t



CYLINDRICAL FENDER		
	Bow <input type="checkbox"/> Stern <input type="checkbox"/>	
Inside diameter _____ mm	Outside diameter _____ mm	
Length _____ m	Joints allowed: yes <input type="checkbox"/> no <input type="checkbox"/>	Tapered ends: yes <input type="checkbox"/> no <input type="checkbox"/>
Longitudinal chain: yes <input type="checkbox"/> no <input type="checkbox"/>	Size _____ mm	End plugs: yes <input type="checkbox"/> no <input type="checkbox"/>
Circumferential fixings: chain <input type="checkbox"/> web <input type="checkbox"/> not required <input type="checkbox"/> Size of chain / web / Groove's dimension: _____ mm		

PROJECT REQUIREMENTS

PUSHING FENDERS				
		Bow	Stern	
M-Type		<input type="checkbox"/>	<input type="checkbox"/>	
W-Type		<input type="checkbox"/>	<input type="checkbox"/>	
Keyhole		<input type="checkbox"/>	<input type="checkbox"/>	
Section Size (mm)				

SIDE BELTINGS	
	(tick required section)
Section size _____ mm	Approx. length _____ m (total port and starboard)
Joints allowed: yes <input type="checkbox"/> no <input type="checkbox"/>	Plugged joints: yes <input type="checkbox"/> no <input type="checkbox"/>
Transition Blocks: 	Bow: yes <input type="checkbox"/> no <input type="checkbox"/> Stern: yes <input type="checkbox"/> no <input type="checkbox"/>

DRAWINGS	Full drawings available: yes <input type="checkbox"/> no <input type="checkbox"/>
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NOTES	
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FURTHER DETAILS	
Name:	Telephone:
Company:	Fax:
Address:	Mobile:
	Email:
	Web: