

**ESC**  
MARINE SYSTEMS

An affiliate of:



# MARINE FENDER CATALOGUE 2023 EDITION



Get In Touch  
[www.escmarinesystems.com](http://www.escmarinesystems.com)

Delivering complete  
MARINE FENDER SYSTEMS  
to the projects WORLDWIDE

# About ESC

**ESC has been serving various global industries over the last 30 years, providing high quality complete foundation and structural solutions to ports, bridges, buildings and more. With strategically located manufacturing and engineering offices around the world, ESC is well positioned to provide an unparalleled combination of services and products.**

Now located in twenty (20) countries and counting, ESC has so far established manufacturing and engineering offices in different regions primarily in Asia, the Middle East and North America. This growth through project awards and market footprint spearheaded its recognition and popularity in the global market helping it become one of the foremost trusted products and service providers with delivery of significant projects all over the world.

ESC, over the years, has evolved into an internationally certified organization with full capacity in Engineering and Design, Project Management, Research and Development, Manufacturing, Supply, and Construction.

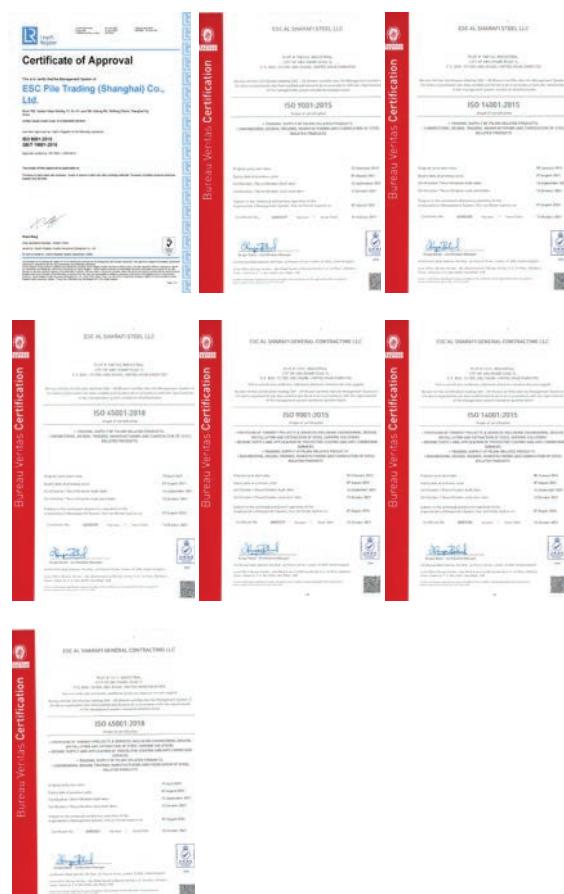
Heading up operations in the USA is ESC Steel LLC which is an integral part of the Group and now has locations in both North Carolina and Texas. The activities for the entire of North and South America are coordinated from these offices along with those in Mexico and Brazil.

ESC Group is also an affiliate company of Marubeni-Itochu Steel Inc. (MISI), one of the largest steel trading companies in Japan and in fact the world. This joining of ESC and MISI firms up a 10+ year successful relationship of two like-minded and driven corporations.

ESC continues to follow its path of engineering value-added products and projects for the world, with MISI's worldwide network, logistics, finance, and human resources, allowing larger project volumes and values to be carried out.

## COMPANY CERTIFICATIONS

ESC products are produced & designed in accordance with the ISO 9001:2015 Quality Management System



An affiliate of:



# Table of Contents

<b>ESC Marine Fender System</b>	<b>04</b>	<b>Square Fender Series</b>	<b>23</b>
Introduction	04	ESC-SQF Series	23
Components & Types of Fenders	04	<b>D Fender Series</b>	<b>23</b>
Design Process	05	ESC-TDF Series	24
Design Standards	05	ESC-TDC Series	25
Design, Manufacturing & Testing	06	Improved D-Fenders	25
Quality Assurance & Testing	07	<b>Pneumatic Fender Series</b>	<b>26</b>
<b>Cone Fender Series</b>	<b>08</b>	<b>Foam Filled Fender Series</b>	<b>27</b>
ESC-TCF Series	08	<b>Fender Photos</b>	<b>28</b>
<b>Cell Fender Series</b>	<b>11</b>	<b>Accessories</b>	<b>29</b>
ESC-TCL Series	11	UMHW PE Pads	29
<b>Arch Fender Series</b>	<b>14</b>	Chain System	30
ESC-TAR Series	14	Anchors & Fixings	32
ESC-TDA Series	17	<b>Rubber Properties</b>	<b>33</b>
<b>Element Fender Series</b>	<b>19</b>	<b>Testing</b>	<b>34</b>
ESC-TEV Series	19	<b>Design Considerations</b>	<b>35</b>
<b>Cylindrical Fender Series</b>	<b>21</b>	<b>Tolerances</b>	<b>36</b>
ESC-TCY Series	21	<b>ESC Product Catalogues</b>	<b>37</b>

## Disclaimer

The information provided within this catalogue is for general information purposes only, without any warranty. ESC Group shall not be held responsible for any errors, omissions or misuse of any of the information provided. ESC Group disclaims any and all liability resulting from the ability or inability to use the information within this document. Anyone using the information contained does so at their own risk. ESC Group shall not be held liable for any damages which includes any financial losses or incidental or consequential damages arising from the use of this information. The product range contained is liable to change without notice.





## ESC MARINE FENDER SYSTEM

### INTRODUCTION

Marine Rubber Fenders are critical for the energy absorption of a berthing vessel into the berth structure. A single tanker can be over 500,000 tons so safe energy absorption in worst case scenarios is paramount. The marine fenders primary job is to protect the berthing structure without damaging the vessel hull for all potential vessel types, sizes and approach scenarios. ESC offers a full range of fender options to compliment its marine steel piling products.

ESC has strategic partnerships with manufacturers with over 20 years of experience delivering marine fender system solutions to Asia, North America, Central & South America, Europe and Middle East. ESC's global network provides an end-to-end solution that is customized to project requirements providing detailed support in close proximity to its valuable clients.

### ESC offers complete Marine Rubber Fender Systems

- ✓ Full range of fender types, sizes and rubber grades
- ✓ Manufacturers certified to ISO 9001
- ✓ Experienced design engineers for berthing energy calculations & fender selection and detailed design of fender and frontal panels to PIANC 2002, BS 6349:4 & EAU 2004
- ✓ Intimate understanding for integration into berthing structure
- ✓ Highly skilled and experienced front panel fabricators
- ✓ High quality mixture of natural, synthetic rubbers from reputable and prequalified suppliers with strict quality control
- ✓ Global supply network in Asia and Europe
- ✓ Full suite of in-house testing equipment all the way up to 4410 kips (2,000 tonnes) compression

### FENDER COMPONENTS & TYPES AVAILABLE

- ✓ Cone & Cell Fenders up to 22 short tons (20 tonnes) unit weight
- ✓ Arch Fenders (option for frontal PE pads) up to 13'-1 1/2" (4m) length
- ✓ Element Fenders
- ✓ Other extruded/moulded fenders—cylinder, roller, D fender

- ✓ Pneumatic & Foam Fenders
- ✓ Full Frontal Panels Fabrication—low friction UHMW PE Pads, Open and Closed Steel Frames
- ✓ Anchoring Bolts & Brackets
- ✓ Shear, Weight & Tension Chains

## DESIGN PROCESS



## DESIGN STANDARDS

- Code of Practice for Design of Fendering and Mooring Systems: BS 6349: Part 4 (2014)
- PIANC WG33 Guidelines for the Design of Fenders (2002)
- Recommendations of the Committee for Waterfront Structures, Harbours and Waterways (EAU 2012)
- Dock Fenders – Rosa 2000 Edition No.1
- Design of Piers And Wharves: Unified Facilities Criteria UFC 4-152-01 (2005)
- Guidelines for the Design of Maritime Structures – Australia: AS4997 (2005)
- Engineering Standards for Port & Harbour Structures Design Manual —Philippine Ports Authority (2009)
- Determining and Reporting the Berthing Energy and Reaction of Marine Fenders: ASTM F2192-05 (2005)
- Recommendations for the design and construction of berthing and mooring structures ROM 2.0.11
- Ships and marine technology—high pressure floating pneumatic fenders: ISO 17357-2002



## MARINE FENDERS

### DESIGN, MANUFACTURE & TESTING

#### PRELIMINARY DESIGN & BUDGETING

ESC can complete a preliminary assessment and design of the most appropriate fender system to allow budgeting and estimation for projects. ESC can complete this even with a limited information set.

#### DETAILED DESIGN

ESC has developed software that assist in calculating berthing energies for the project's complete vessel range which are then used to specify the optimal fender configuration which includes rubber fender selection, frontal panel sizing and location, chain and anchor design and if appropriate cathodic protection design. These calculation is conforming to BS 6349: Part 4, PIANC guidelines and other standards. Full manufacturing and layout drawings are produced to enable high quality production and comprehensive detailing for installation on site.

#### MANUFACTURING

ESC's fender product line is comprehensive, with over 50 profiles and various rubber grades (low reaction to super high reaction force) to select from. The frontal pad fabrication facility (complete with blasting and painting) is in close proximity to the fender facility which makes factory visits and ex-mill logistics more convenient and efficient. Components such as chains and anchors are produced by pre-qualified manufacturers also in close proximity to the facilities.

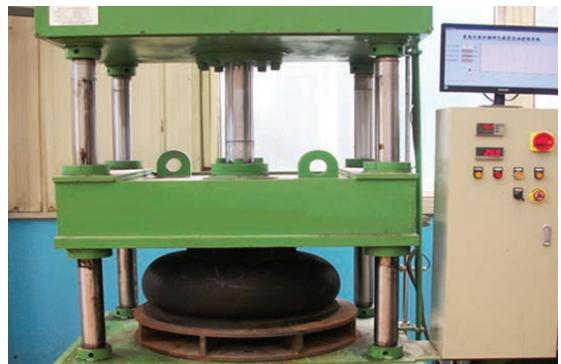
BERTHING ENERGY CALCULATOR			
by John Luis Yeates, Calculator Version A3			
Project Number	ESC-ME-10923		
Date	09-07-17		
Calculation by	JLY		
Vessel Information			
Ship Type	Container Ship		
DWT	DWT	67000	DWT
Deadweight	DWT	67000	DWT
Vessel Dimensions (from PIANC graphs)			
Mass	Md	100893	T
Length overall	LOA	300	m
Length between perpendiculars	LBP	286	m
Beam (or breadth)	B	40	m
Moulded Depth	Hm	21.7	m
Laden draft	DL	13	m
Ballast draft	DB	7.7	m
Scantling draft	DS		m
Block Coefficient	Cb	0.662	
Safety Factor	SF	1.5	



## MARINE FENDERS

### QUALITY ASSURANCE & TESTING

Marine Fender Rubber is an engineered material that exhibits optimal properties in terms of cost, energy absorption, wear resistance, UV resistance and more. An engineered mixture of additives is used to improve the overall mechanical and wear properties of the material. The rubber utilised comes from the highest quality sources and is inspected and tested in accordance with the ISO 9001 Quality Management System. Some parameters tested are: tensile strength, elongation at break, compression set, hardness, density, seawater resistance, tear resistance, ozone resistance, abrasion resistant, bond strength and ageing.





## ESC-TCF SERIES

### CONE FENDER SYSTEM

## MODERN FENDER GEOMETRY WITH HIGH ENERGY ABSORPTION AND LOW REACTION FORCES

### FENDER FEATURES

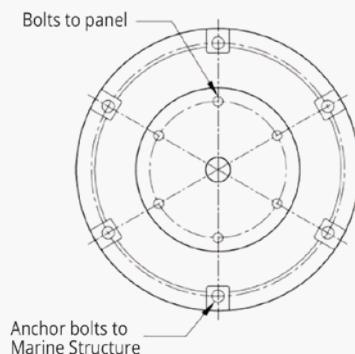
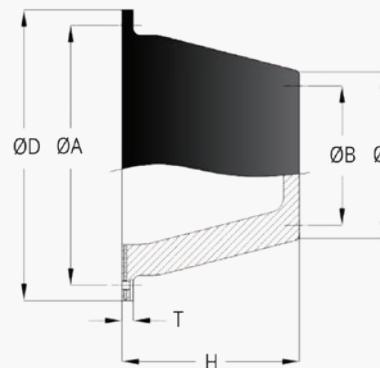
- Excellent Geometrical Efficiency
- Excellent performance at a wide range of berthing angles
- Good Shear Resistance
- Wide range of rubber grades and compounds for various applications

### APPLICATIONS

- General Cargo Berths
- Bulk Terminals
- Oil / LNG Facilities
- Container Terminal Berths
- RoRo and Cruise Terminals
- Monopiles & Dolphins



TCF SERIES



### DIMENSIONS

Section	H mm	ØD mm	ØF mm	T mm	ØA mm	ØB mm	Anchors* / Head Bolts	Weight kg
ESC-TCF350	350	570	330	22	510	275	4 x M20	50
ESC-TCF400	400	600	340	22	540	260	4 x M24	75
ESC-TCF500	500	750	425	22	675	325	4 x M24	135
ESC-TCF600	600	900	510	27	810	390	6 x M30	230
ESC-TCF700	700	1,050	595	27	945	455	6 x M30	350
ESC-TCF800	800	1,200	680	27	1,080	520	6 x M36	540
ESC-TCF900	900	1,350	765	33	1,215	585	6 x M36	760
ESC-TCF1000	1,000	1,500	850	35	1,350	650	6 x M42	1,050
ESC-TCF1100	1,100	1,650	935	40	1,485	715	6 x M42	1,400
ESC-TCF1150	1,150	1,725	980	40	1,550	750	6 x M42	1,600
ESC-TCF1200	1,200	1,800	1,020	42	1,620	780	8 x M42	1,950
ESC-TCF1300	1,300	1,950	1,105	46	1,755	845	8 x M48	2,400
ESC-TCF1400	1,400	2,100	1,190	49	1,890	980	8 x M48	2,880
ESC-TCF1600	1,600	2,400	1,360	58	2,160	1,200	8 x M48	4,510
ESC-TCF1800	1,800	2,700	1,530	62	2,430	1,350	10 x M56	6,400
ESC-TCF2000	2,000	3,000	1,700	62	2,700	1,500	10 x M56	9,050

\* For anchor types, refer to Anchors and Fixings on page 32.

## PERFORMANCE

			RUBBER GRADE									
			G1.0	G1.2	G1.4	G1.6	G1.8	G2.0	G2.2	G2.4	G2.6	G2.8
ESC-TCF350	E	kN-m				14	15	17	19	20	21	22
	R	kN				84	95	106	116	123	129	136
ESC-TCF400	E	kN-m				22	25	28	31	32	34	36
	R	kN				118	124	138	148	160	171	183
ESC-TCF500	E	kN-m				43	48	50	54	58	63	65
	R	kN				185	200	215	230	247	264	280
ESC-TCF600	E	kN-m	61	67	73	78	86	93	101	111	122	132
	R	kN	192	211	231	250	273	296	320	352	385	416
ESC-TCF700	E	kN-m	103	112	122	131	144	154	166	180	194	208
	R	kN	285	310	335	360	390	420	450	488	527	565
ESC-TCF800	E	kN-m	151	164	176	189	208	226	245	268	291	314
	R	kN	355	387	418	450	490	530	570	625	679	734
ESC-TCF900	E	kN-m	215	236	257	278	302	327	351	381	411	442
	R	kN	469	510	552	593	645	698	751	813	876	939
ESC-TCF1000	E	kN-m	296	323	350	377	411	444	478	520	562	604
	R	kN	578	629	679	730	793	857	920	1,003	1,085	1,168
ESC-TCF1100	E	kN-m	375	416	457	498	545	591	638	692	746	801
	R	kN	707	767	827	886	964	1,042	1,120	1,213	1,307	1,400
ESC-TCF1150	E	kN-m	460	496	533	569	620	670	721	781	841	902
	R	kN	788	849	911	971	1,056	1,142	1,227	1,331	1,436	1,539
ESC-TCF1200	E	kN-m	508	553	597	642	697	752	806	881	958	1,033
	R	kN	821	894	967	1,040	1,127	1,213	1,300	1,417	1,534	1,650
ESC-TCF1300	E	kN-m	665	723	782	840	910	980	1,050	1,138	1,226	1,313
	R	kN	992	1,075	1,157	1,240	1,346	1,453	1,560	1,688	1,817	1,945
ESC-TCF1400	E	kN-m	824	890	956	1,022	1,117	1,212	1,308	1,413	1,518	1,623
	R	kN	1,154	1,246	1,338	1,431	1,561	1,690	1,819	1,966	2,113	2,260
ESC-TCF1600	E	kN-m	1,288	1,370	1,452	1,533	1,675	1,818	1,959	2,135	2,312	2,488
	R	kN	1,516	1,616	1,717	1,818	1,990	2,162	2,334	2,537	2,739	2,942
ESC-TCF1800	E	kN-m	1,695	1,854	2,014	2,172	2,371	2,568	2,767	3,025	3,282	3,540
	R	kN	1,817	1,987	2,157	2,328	2,543	2,759	2,974	3,241	3,501	3,763
ESC-TCF2000	E	kN-m	2,444	2,637	2,829	3,022	3,285	3,549	3,813	4,142	4,471	4,800
	R	kN	2,356	2,541	2,726	2,912	3,165	3,417	3,670	3,991	4,313	4,634

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force

## PERFORMANCE FACTORS

TEMPERATURE FACTOR (TF)		ANGULAR FACTOR (AF)		
Temp °C	TF	Angle (°)	Energy	Reaction
50	0.92	0	1.00	1.00
40	0.94	3	1.02	1.00
30	0.98	5	1.05	1.00
23	1.00	8	1.03	1.00
10	1.05	10	1.00	1.00
0	1.09	15	0.88	0.96
-10		20	0.78	0.85
-20	Consult ESC			
-30				

VELOCITY FACTOR (VF)		PERFORMANCE AT INTERMEDIATE DEFLECTION		
Compression Time (s)	VF	Angle (°)	Energy	Reaction
1	1.30	0	0	0
2	1.10	5	6	24
3	1.09	10	14	45
4	1.05	15	22	63
5	1.03	20	28	77
6	1.02	25	36	88
7	1.02	30	44	95
8	1.01	35	50	99
9	1.01	40	56	100
≥ 10	1.00	45	62	98
		50	68	95
		55	76	91
		60	84	88
		65	92	90
		70	100	100

## TEMPERATURE FACTOR

Performance data is at standard temperature of 23°C. Temperature factor is considered at extreme temperatures because reaction force decreases as temperature increases and gets softer. Conversely, rubber becomes stiffer when temperature decreases.

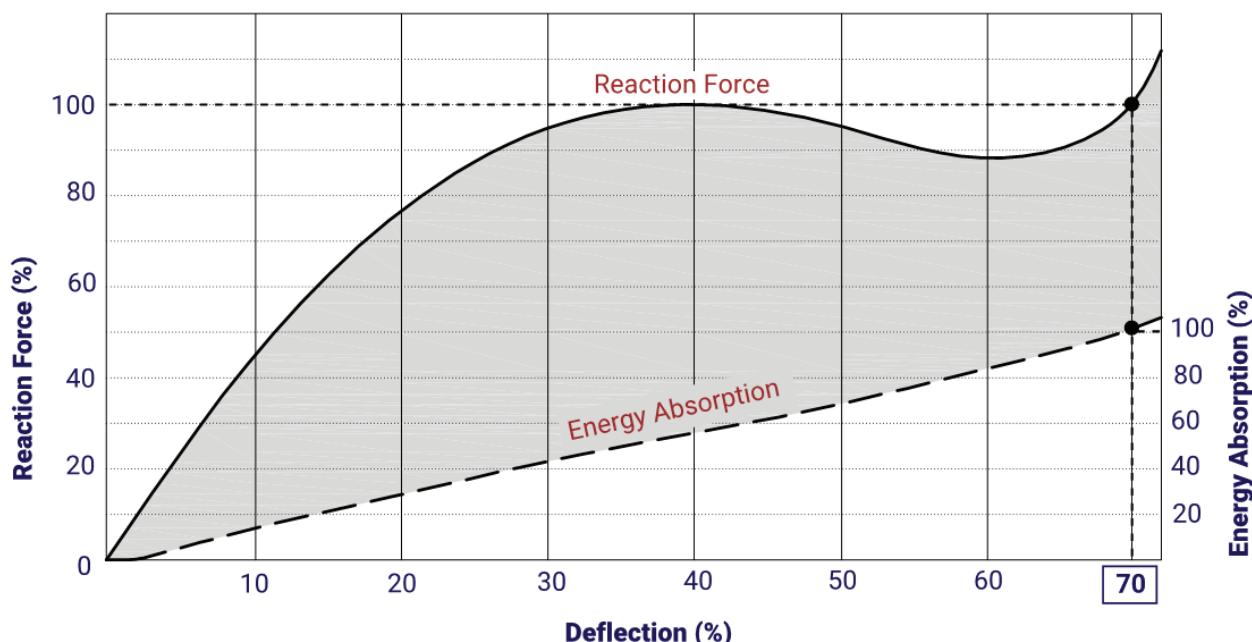
## ANGULAR FACTOR

Performance data is at standard angle of 0°. Angular factor varies according to angle of compression.

## VELOCITY FACTOR

Since rubber is viscoelastic, the reaction force changes depending on the compression speed.

## PERFORMANCE CURVE





## ESC-TCL SERIES

### CELL FENDER SYSTEM

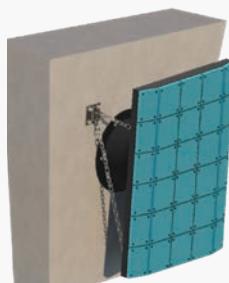
### VERSATILE FENDER GEOMETRY WITH HIGH EFFICIENCY

#### FENDER FEATURES

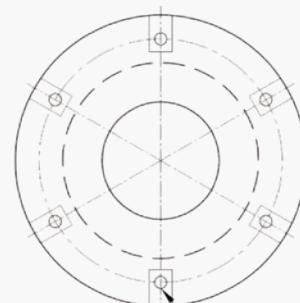
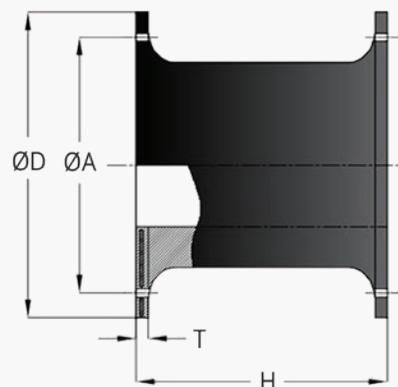
- Long record history
- Good energy absorption to reaction force ratio
- Excellent for vessels with low hull pressure allowance

#### APPLICATIONS

- General Cargo Berths
- Bulk Terminals
- Oil / LNG Facilities
- Container Terminal Berths
- RoRo and Cruise Terminals
- Monopiles & Dolphins



TCL SERIES



#### DIMENSIONS

Section	H mm	ØD mm	ØA mm	T mm	Anchors* / Head Bolts	Weight kg
ESC-TCL630	630	840	700	25	4 x M30	220
ESC-TCL800	800	1050	900	30	6 x M33	400
ESC-TCL1000	1,000	1,300	1,100	35	6 x M39	790
ESC-TCL1150	1,150	1,500	1,300	37	6 x M42	1,200
ESC-TCL1250	1,250	1,650	1,450	40	6 x M42	1,500
ESC-TCL1450	1,450	1,850	1,650	42	6 x M52	2,300
ESC-TCL1600	1,600	2,000	1,800	45	8 x M52	3,000
ESC-TCL1700	1,700	2,100	1,900	50	8 x M56	3,600
ESC-TCL2000	2,000	2,200	2,000	50	8 x M64	4,200
ESC-TCL2250	2,250	2,550	2,300	57	10 x M64	7,400
ESC-TCL2500	2,500	2,950	2,700	70	10 x M64	10,500
ESC-TCL3000	3,000	3,350	3,150	75	10 x M76	18,500

\*For anchor types, refer to Anchors and Fixings page 32.

## PERFORMANCE

		RUBBER GRADE												
			G1.0	G1.2	G1.4	G1.6	G1.8	G2.0	G2.2	G2.4	G2.6	G2.8	G3.0	
		E	kN-m	39	55	71	48	53	58	63	68	73	78	82
ESC-TCL630		R	kN	140	198	257	175	193	210	228	246	263	280	296
		E	kN-m	75	108	140	98	105	111	118	128	138	147	154
ESC-TCL800		R	kN	211	304	398	280	297	313	330	366	383	407	431
		E	kN-m	158	223	288	195	214	233	252	270	289	307	325
ESC-TCL1000		R	kN	355	503	652	445	487	530	572	616	660	704	747
		E	kN-m	240	259	278	297	327	358	388	417	445	475	505
ESC-TCL1150		R	kN	470	510	549	589	646	703	760	822	885	937	990
		E	kN-m	306	331	357	382	420	459	497	536	574	615	655
ESC-TCL1250		R	kN	552	600	648	696	765	833	902	972	1,042	1,109	1,175
		E	kN-m	478	517	557	596	656	716	776	836	895	952	1,008
ESC-TCL1450		R	kN	750	812	874	936	1,029	1,122	1,215	1,308	1,402	1,491	1,580
		E	kN-m	640	694	747	801	857	914	970	1,045	1,120	1,190	1,260
ESC-TCL1600		R	kN	894	976	1,058	1,140	1,210	1,281	1,351	1,455	1,558	1,657	1,756
		E	kN-m	769	833	897	960	1,057	1,154	1,250	1,346	1,442	1,133	1,624
ESC-TCL1700		R	kN	1,027	1,114	1,200	1,287	1,415	1,544	1,672	1,800	1,928	2,050	2,171
		E	kN-m	1,252	1,355	1,459	1,562	1,722	1,881	2,040	2,194	2,348	2,497	2,645
ESC-TCL2000		R	kN	1,425	1,544	1,662	1,781	1,957	2,134	2,310	2,489	2,668	2,832	2,995
		E	kN-m	2,104	2,227	2,350	2,472	2,720	2,967	3,215	3,459	3,703	3,941	4,179
ESC-TCL2250		R	kN	2,125	2,251	2,376	2,502	2,751	3,000	3,249	3,499	3,748	3,987	4,226
		E	kN-m	2,885	3,054	3,222	3,391	3,731	4,070	4,410	4,749	5,088	5,410	5,732
ESC-TCL2500		R	kN	2,624	2,779	2,933	3,088	3,396	3,704	4,012	4,321	4,630	4,923	5,217
		E	kN-m	4,894	5,181	5,467	5,754	6,327	6,899	7,472				
ESC-TCL3000		R	kN	3,730	3,947	4,163	4,380	4,812	5,244	5,676				

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force



## PERFORMANCE FACTORS

TEMPERATURE FACTOR (TF)		ANGULAR FACTOR (AF)		
Temp °C	TF	Angle (°)	Energy	Reaction
50	0.90	0	1.00	1.00
40	0.93	3	0.94	0.96
30	0.98	5	0.87	0.93
23	1.00	8	0.84	0.92
10	1.05	10	0.80	0.92
0	1.10	15	0.72	0.90
-10				
-20	Consult ESC			
-30				

VELOCITY FACTOR (VF)		PERFORMANCE AT INTERMEDIATE DEFLECTION		
Compression Time (s)	VF	Angle (°)	Energy	Reaction
1	1.05	0	0	0
2	1.03	5	2	40
3	1.02	10	10	70
4	1.01	15	19	88
5	1.00	20	29	97
6	1.00	25	40	100
7	1.00	30	50	99
8	1.00	35	61	97
9	1.00	40	72	96
10	1.00	45	83	95
11	1.00	50	95	97
12	1.00	52.5	100	100
13	1.00			
14	1.00			
≥15	0.99			

## TEMPERATURE FACTOR

Performance data is at standard temperature of 23°C. Temperature factor is considered at extreme temperatures because reaction force decreases as temperature increases and gets softer. Conversely, rubber becomes stiffer when temperature decreases.

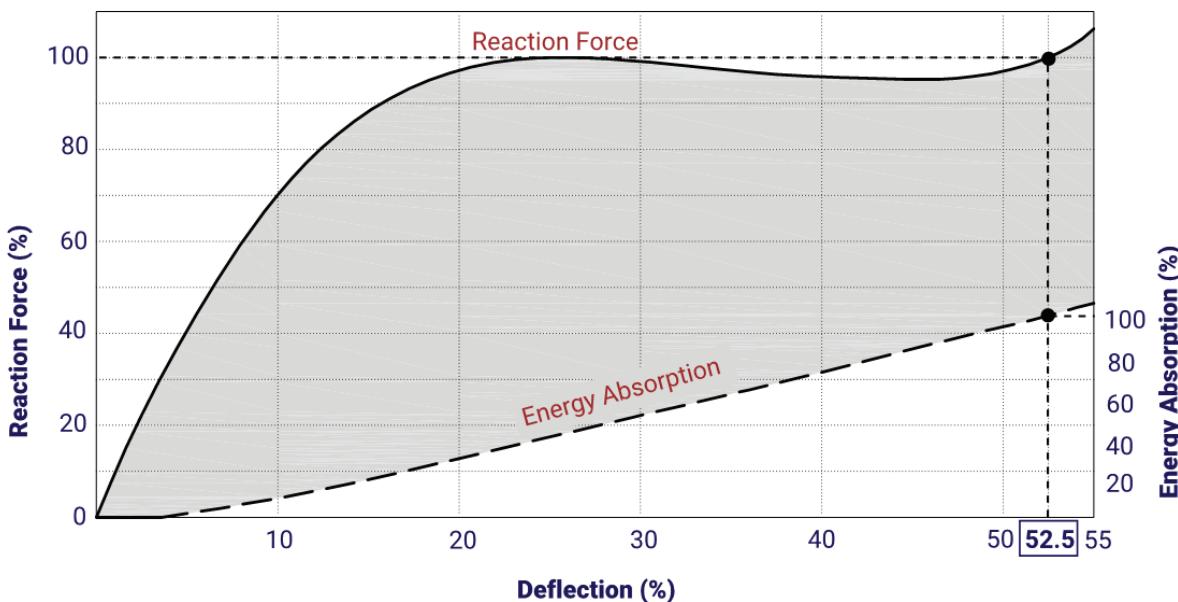
## ANGULAR FACTOR

Performance data is at standard angle of 0°. Angular factor varies according to angle of compression.

## VELOCITY FACTOR

Since rubber is viscoelastic, the reaction force changes depending on the compression speed.

## PERFORMANCE CURVE



# ESC-TAR SERIES

## ARCH FENDER SYSTEM

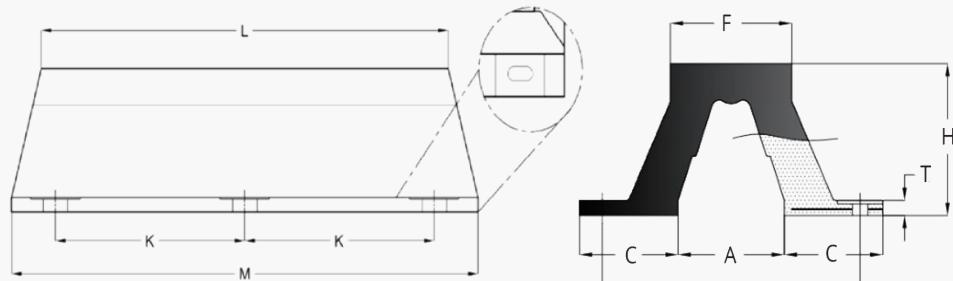
MODERN FENDER GEOMETRY WITH HIGH ENERGY ABSORPTION AND LOW REACTION FORCES

### FENDER FEATURES

- Excellent Geometrical Efficiency
- Excellent performance at a wide range of berthing angles
- Good Shear Resistance
- Wide range of rubber grades and compounds for various applications

### APPLICATIONS

- General Cargo Berths
- Bulk Terminals
- Oil / LNG Facilities
- Container Terminal Berths
- RoRo and Cruise Terminals
- Monopiles & Dolphins



### DIMENSIONS

Section	H mm	A mm	B mm	C mm	F mm	T mm	Width(2C+A) mm	Hole size mm	Bolt*	Weight kg/m
ESC-TAR200	200	144	320	128	130	30	400	58X29	M24	60
ESC-TAR250	250	180	410	160	165	33	500	64X32	M30	90
ESC-TAR300	300	210	490	195	245	33	600	70X35	M30	120
ESC-TAR400	400	280	670	260	320	40	800	82X41	M36	210
ESC-TAR500	500	350	840	325	395	45	1,000	94X47	M42	330
ESC-TAR600	600	420	1,010	390	470	54	1,200	100X50	M48	480
ESC-TAR800	800	560	1,340	520	600	72	1,600	136X68	M64	880
ESC-TAR1000	1,000	700	1,680	650	750	90	2,000	136X68	M64	1,395

\*For anchor types, refer to Anchors and Fixings page 32.

Section	L = 1,000mm n=4		L=1,500mm n=6		L=2,000mm n=8		L=2,500mm n=8		L=3,000mm n=10		L=3,500mm n=12	
	K mm	M mm	K mm	M mm	K mm	M mm	K mm	M mm	K mm	M mm	K mm	M mm
ESC-TAR200	860	1,100	680	1,600	620	2,100	785	2,600	715	3,100	672	3,600
ESC-TAR250	862	1,125	680	1,625	620	2,125	790	2,625	715	3,125	673	3,625
ESC-TAR300	870	1,150	685	1,650	625	2,150	790	2,650	715	3,150	674	3,650
ESC-TAR400	900	1,200	700	1,700	635	2,200	800	2,700	725	3,200	680	3,700
ESC-TAR500	930	1,250	715	1,750	645	2,250	810	2,750	730	3,250	686	3,750
ESC-TAR600	960	1,300	730	1,800	655	2,300	820	2,800	740	3,300	692	3,800
ESC-TAR800	1,040	1,400	770	1,900	680	2,400	845	2,900	775	3,500		
ESC-TAR1000	1,100	1,500	800	2,000	700	2,500	865	3,000				

n = number of bolts

## PERFORMANCE

		RUBBER GRADE											
			G1.0	G1.2	G1.4	G1.6	G1.8	G2.0	G2.2	G2.4	G2.6	G2.8	
		E	kN-m	5	6	7	8	9	10	11	12	13	14
ESC-TAR200		R	kN	75	87	93	110	123	137	150	157	163	170
ESC-TAR250		E	kN-m	16	17	18	19	20	21	22	24	26	28
		R	kN	148	156	164	172	184	196	208	229	250	270
ESC-TAR300		E	kN-m	22	23	25	26	28	29	31	34	38	41
		R	kN	175	185	194	204	219	233	248	273	297	322
ESC-TAR400		E	kN-m	41	43	44	46	50	53	57	63	68	74
		R	kN	234	248	261	275	293	312	330	363	397	430
ESC-TAR500		E	kN-m	63	66	69	72	77	83	88	97	105	114
		R	kN	294	311	327	344	367	391	414	455	497	538
ESC-TAR600		E	kN-m	89	94	99	104	111	119	126	139	151	164
		R	kN	351	371	392	412	440	468	496	545	595	644
ESC-TAR800		E	kN-m	159	168	176	185	198	210	223	245	268	290
		R	kN	470	497	523	550	587	624	661	728	795	862
ESC-TAR1000		E	kN-m	246	261	275	290	309	329	348	383	417	452
		R	kN	588	621	655	688	735	782	829	912	995	1,078

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force  
Performances are per meter length.



## PERFORMANCE FACTORS

TEMPERATURE FACTOR (TF)		ANGULAR FACTOR (AF)		
Temp °C	TF	Angle (°)	Energy	Reaction
50	0.92	0	1.00	1.00
40	0.94	3	0.98	1.00
30	0.98	5	0.95	1.00
23	1.00	8	0.92	1.00
10	1.05	10	0.88	1.00
0	1.09	15	0.80	1.00
-10	1.15	20	0.74	1.00
-20	1.19			
-30	1.25			

VELOCITY FACTOR (VF)		PERFORMANCE AT INTERMEDIATE DEFLECTION		
Compression Time (s)	VF	Angle (°)	Energy	Reaction
1	1.16	0	0	0
2	1.07	5	6	32
3	1.04	10	10	59
4	1.03	15	18	79
5	1.02	20	28	93
6	1.01	25	40	98
7	1.01	30	50	100
8	1.00	35	64	98
9	1.00	40	76	96
≥ 10	1.00	45	86	95
		50	98	96
		52.5	100	100

## TEMPERATURE FACTOR

Performance data is at standard temperature of 23°C. Temperature factor is considered at extreme temperatures because reaction force decreases as temperature increases and gets softer. Conversely, rubber becomes stiffer when temperature decreases.

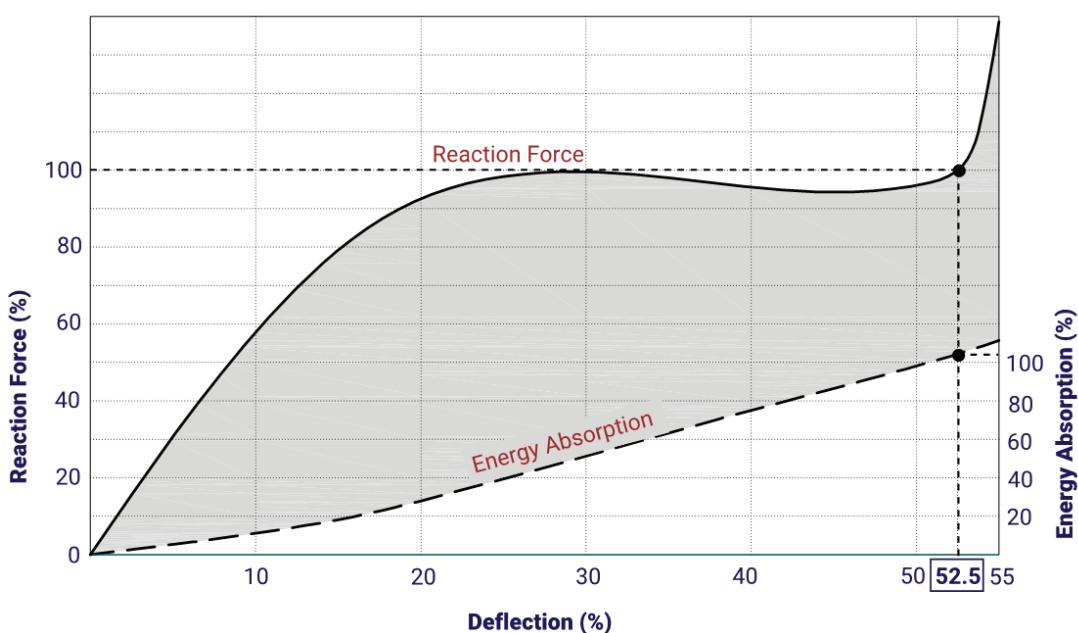
## ANGULAR FACTOR

Performance data is at standard angle of 0°. Angular factor varies according to angle of compression.

## VELOCITY FACTOR

Since rubber is viscoelastic, the reaction force changes depending on the compression speed.

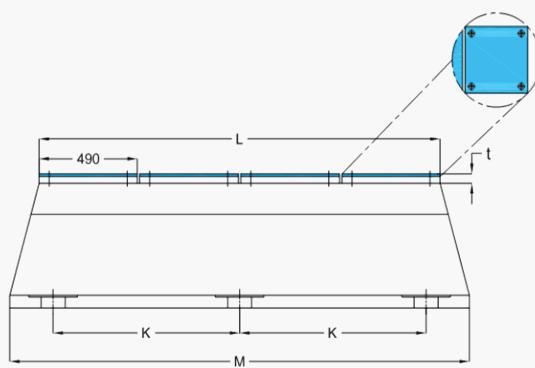
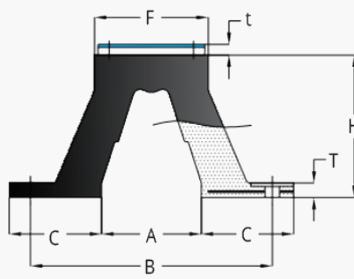
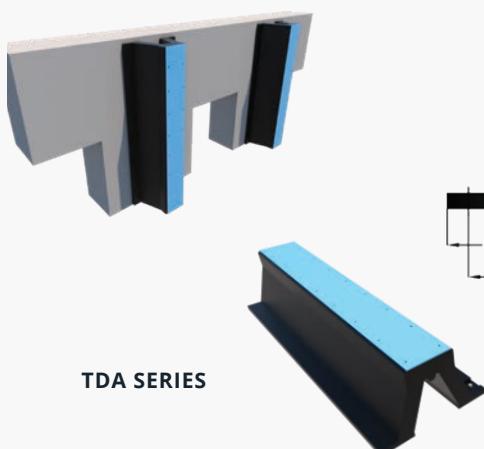
## PERFORMANCE CURVE



## ESC-TDA SERIES

SUPER ARCH FENDER SYSTEM

### MODERN FENDER GEOMETRY WITH HIGH ENERGY ABSORPTION AND LOW REACTION FORCES



#### DIMENSIONS

Section	H mm	A mm	B mm	C mm	F mm	T mm	Width(2C+A) mm	Hole size mm	Bolt*	Weight kg/m
ESC-TDA300	300	210	490	195	245	33	600	70X35	M30	126
ESC-TDA400	400	280	670	260	320	40	800	82X41	M30	218
ESC-TDA500	500	350	840	325	395	45	1,000	94X47	M36	340
ESC-TDA600	600	420	1,010	390	470	54	1,200	100X50	M42	492
ESC-TDA800	800	560	1,340	520	600	72	1,600	136X68	M48	895
ESC-TDA1000	1,000	700	1,680	650	750	90	2,000	136X68	M64	1,420

\*For anchor types, refer to Anchors and Fixings page 32.

Section	L = 1,000mm n=4		L= 1,500mm n=6		L= 2,000mm n=8		L= 2,500mm n=8		L= 3,000mm n=10		L= 3,500mm n=12	
	K mm	M mm	K mm	M mm	K mm	M mm	K mm	M mm	K mm	M mm	K mm	M mm
ESC-TDA300	870	1,150	685	1,650	625	2,150	790	2,650	715	3,150	674	3,650
ESC-TDA400	900	1,200	700	1,700	635	2,200	800	2,700	725	3,200	680	3,700
ESC-TDA500	930	1,250	715	1,750	645	2,250	810	2,750	730	3,250	686	3,750
ESC-TDA600	960	1,300	730	1,800	655	2,300	820	2,800	740	3,300	692	3,800
ESC-TDA800	1,040	1,400	770	1,900	680	2,400	845	2,900	775	3,500	-	-
ESC-TDA1000	1,100	1,500	800	2,000	700	2,500	865	3,000	-	-	-	-

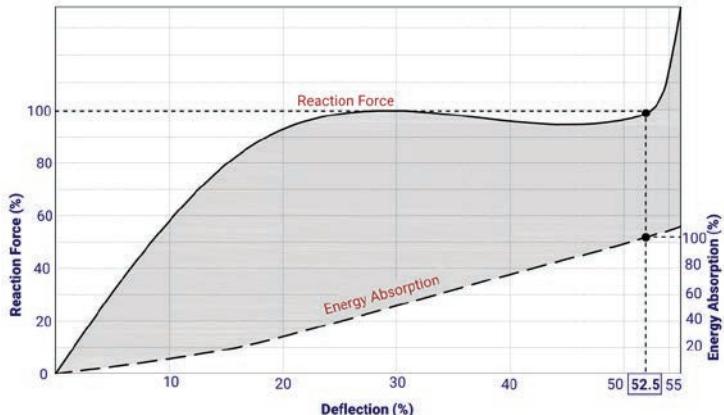
n = number of bolts; Other sizes available, please contact us for further information.

## PERFORMANCE

			RUBBER GRADE									
			G1.0	G1.2	G1.4	G1.6	G1.8	G2.0	G2.2	G2.4	G2.6	G2.8
ESC-TDA300	E	kN-m	22	23	25	26	28	29	31	34	38	41
	R	kN	175	185	194	204	219	233	248	273	297	322
ESC-TDA400	E	kN-m	41	43	44	46	50	53	57	63	68	74
	R	kN	234	248	261	275	293	312	330	363	397	430
ESC-TDA500	E	kN-m	63	66	69	72	77	83	88	97	105	114
	R	kN	294	311	327	344	367	391	414	455	497	538
ESC-TDA600	E	kN-m	89	94	99	104	111	119	126	139	151	164
	R	kN	351	371	392	412	440	468	496	545	595	644
ESC-TDA800	E	kN-m	159	168	176	185	198	210	223	245	268	290
	R	kN	470	497	523	550	587	624	661	728	795	862
ESC-TDA1000	E	kN-m	248	262	276	290	309	329	348	383	417	452
	R	kN	588	595	601	608	682	755	829	912	995	1,078

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force  
Performances are per meter length.

## PERFORMANCE CURVE & FACTORS



### TEMPERATURE FACTOR

Performance data is at standard temperature of 23°C. Temperature factor is considered at extreme temperatures because reaction force decreases as temperature increases and gets softer. Conversely, rubber becomes stiffer when temperature decreases.

### ANGULAR FACTOR

Performance data is at standard angle of 0°. Angular factor varies according to angle of compression.

### VELOCITY FACTOR

Since rubber is viscoelastic, the reaction force changes depending on the compression speed.

TEMPERATURE FACTOR (TF)		ANGULAR FACTOR (AF)			VELOCITY FACTOR (VF)		PERFORMANCE AT INTERMEDIATE DEFLECTION		
Temp °C	TF	Angle (°)	Energy	Reaction	Compression Time (s)	VF	Angle (°)	Energy	Reaction
50	0.92	0	1.00	1.00	1	1.16	0	0	0
40	0.94	3	0.98	1.00	2	1.07	5	5	31
30	0.98	5	0.95	1.00	3	1.04	10	10	58
23	1.00	8	0.92	1.00	4	1.03	15	18	79
10	1.05	10	0.88	1.00	5	1.02	20	27	93
0	1.10	15	0.80	1.00	6	1.01	25	38	99
-10	1.15	20	0.74	1.00	7	1.01	30	49	100
-20	1.19				8	1.00	35	60	98
-30	1.25				9	1.00	40	73	96
					≥ 10	1.00	45	83	95
							50	94	97
							52.5	100	100

# ESC-TEV SERIES

## ELEMENT FENDER SYSTEM

### ADVANCED FENDER GEOMETRY WITH HIGH PERFORMANCE AND ADAPTABLE DESIGN

#### FENDER FEATURES

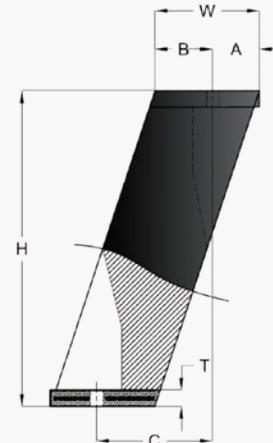
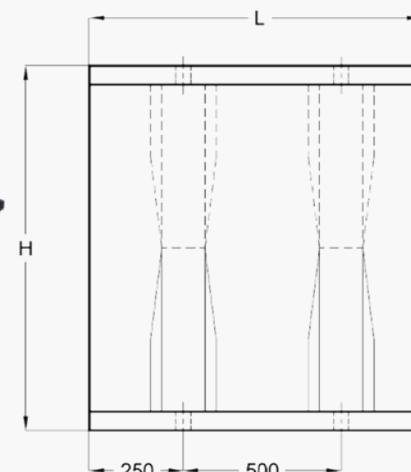
- High efficiency
- Modular design
- Good angular performance
- Wide range of sizes

#### APPLICATIONS

- Bulk Terminals
- Oil / LNG Facilities
- Container Terminal Berths
- RoRo and Cruise Terminals
- Monopiles & Dolphins



TEV SERIES



Length, L = 900mm, 1000mm, 1500mm, 2000mm

#### DIMENSIONS

Section	H mm	W mm	C mm	A mm	B mm	T mm	Bolt*	Weight kg/m
ESC-TEV400	400	125	124	63	62	17	M24	66
ESC-TEV500	500	158	142	87	71	20	M30	111
ESC-TEV600	600	188	200	87	101	20	M30	153
ESC-TEV750	750	235	230	118	117	26	M36	239
ESC-TEV800	800	250	240	129	121	26	M36	268
ESC-TEV1000	1,000	322	310	162	160	31	M42	432
ESC-TEV1250	1,250	400	390	196	204	36	M48	640
ESC-TEV1400	1,400	440	445	215	225	41	M48	820
ESC-TEV1450	1,450	454	454	228	226	41	M48	873
ESC-TEV1600	1,600	500	480	257	243	50	M56	1,115

\*For anchor types, refer to Anchors and Fixings page 32.

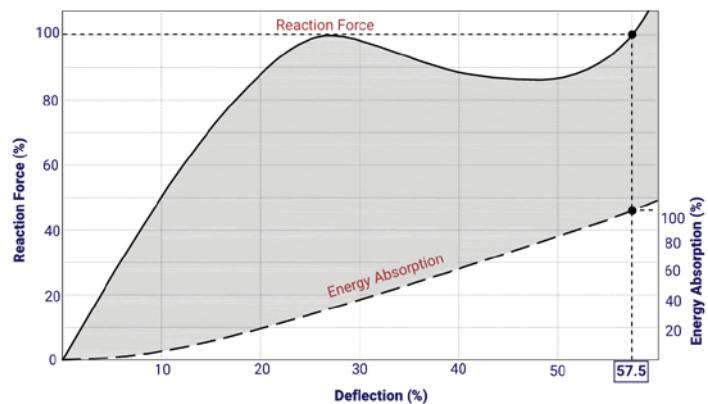
## PERFORMANCE

## PERFORMANCE CURVE

		RUBBER GRADE			
		G1.0	G1.5	G2.0	G2.5
ESC-TEV400	E	kN-m	27	31	35
	R	kN	149	171	192
ESC-TEV500	E	kN-m	43	49	55
	R	kN	186	212	239
ESC-TAR600	E	kN-m	62	71	79
	R	kN	224	256	288
ESC-TEV750	E	kN-m	96	110	123
	R	kN	281	321	361
ESC-TEV800	E	kN-m	110	126	141
	R	kN	299	342	385
ESC-TEV1000	E	kN-m	172	196	221
	R	kN	374	427	481
ESC-TEV1250	E	kN-m	268	306	345
	R	kN	467	534	600
ESC-TEV1400	E	kN-m	336	385	434
	R	kN	521	597	672
ESC-TEV1450	E	kN-m	361	415	468
	R	kN	543	623	702
ESC-TEV1600	E	kN-m	440	503	565
	R	kN	598	683	769
ESC-TEV2000	E	kN-m	733	810	888
	R	kN	889	983	1,076

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force

Performances are per meter length.



## PERFORMANCE FACTORS

Temp °C	TEMPERATURE FACTOR (TF)		ANGULAR FACTOR (AF)		
	Temp °C	TF	Angle (°)	Energy	Reaction
1.00	1.00	0	1.00	1.00	1.00
0.99	1.00	3	0.98	1.00	1.00
0.98	1.00	5	0.95	1.00	1.00
0.96	1.00	8	0.92	1.00	1.00
0.92	1.00	10	0.88	1.00	1.00
0.81	1.00	15	0.80	1.00	1.00
0.73	1.00	20	0.74	1.00	1.00

Compression Time (s)	VELOCITY FACTOR (VF)		PERFORMANCE AT INTERMEDIATE DEFLECTION		
	Compression Time (s)	VF	Angle (°)	Energy	Reaction
1		1.22	0	0	0
2		1.09	5	2	26
3		1.06	10	6	50
4		1.04	15	15	71
5		1.02	20	22	88
6		1.01	25	31	99
7		1.01	30	40	100
8		1.00	35	50	94
9		1.00	40	63	89
≥10		1.00	45	73	87
			50	85	86
			55	95	93
			57.5	100	100

## TEMPERATURE FACTOR

Performance data is at standard temperature of 23°C. Temperature factor is considered at extreme temperatures because reaction force decreases as temperature increases and gets softer. Conversely, rubber becomes stiffer when temperature decreases.

## ANGULAR FACTOR

Performance data is at standard angle of 0°. Angular factor varies according to angle of compression.

## VELOCITY FACTOR

Since rubber is viscoelastic, the reaction force changes depending on the compression speed.

# ESC-TCY SERIES

## CYLINDRICAL FENDER SYSTEM

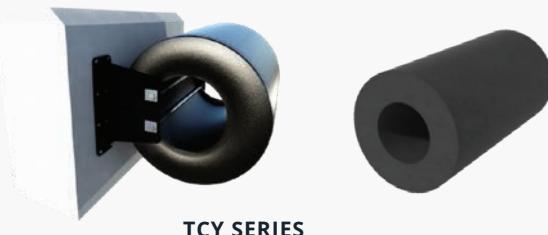
### USER-FRIENDLY, ECONOMICAL FENDER WITH HIGH EFFICIENCY

#### FENDER FEATURES

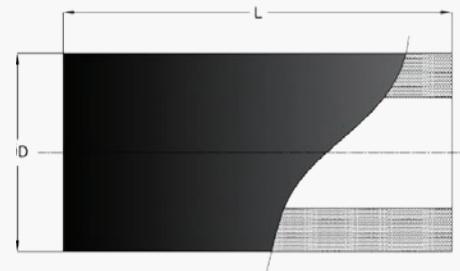
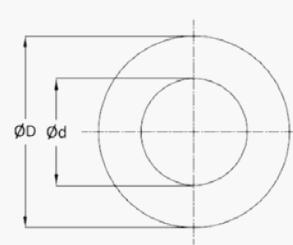
- Very simple and practical design, easy to install
- Wide range of sizes available in almost any length
- Will last for years with low maintenance

#### APPLICATIONS

- Tug havens
- General Cargo Quays
- Pontoons & Floating Structures
- Pier Terminals
- Bulk Cargo Berths
- Fishing and Workboat Berths



TCY SERIES

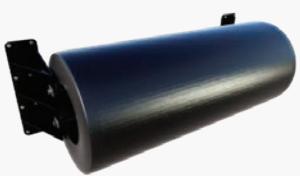


#### DIMENSIONS & PERFORMANCE

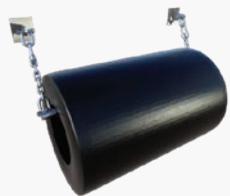
Section	DIMENSIONS				RUBBER GRADE G1.0		RUBBER GRADE G2.0	
	ØD mm	Ød mm	Lmax mm	Weight kg/m	E kN-m	R kN	E kN-m	R kN
ESC-TCY150	150	75	10,000	17	2	46	2	74
ESC-TCY200	200	100	10,000	30	3	62	4	97
ESC-TCY250	250	125	10,000	47	4	76	7	123
ESC-TCY300	300	150	10,000	67	6	92	10	146
ESC-TCY400	400	200	8,000	118	11	122	17	195
ESC-TCY500	500	250	8,000	184	16	152	27	245
ESC-TCY600	600	300	3,000	265	24	182	38	293
ESC-TCY700	700	400	3,000	360	32	212	53	342
ESC-TCY800	800	400	3,000	469	42	244	69	390
ESC-TCY900	900	450	3,000	594	53	275	87	440
ESC-TCY1000	1,000	500	3,000	733	65	305	108	490
ESC-TCY1200	1,200	600	3,000	1,055	97	375	155	588
ESC-TCY1400	1,400	700	3,000	1,434	130	434	216	685
ESC-TCY1600	1,600	800	3,000	1,872	174	495	276	785
ESC-TCY1800	1,800	900	3,000	2,370	226	556	359	883
ESC-TCY2000	2,000	1,000	3,000	2,925	271	640	431	1,015

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force. Performances are per meter length.

## FIXING METHODS



LADDER BRACKET (>1200mm dia.)



BAR & CHAIN (500-1600mm dia.)



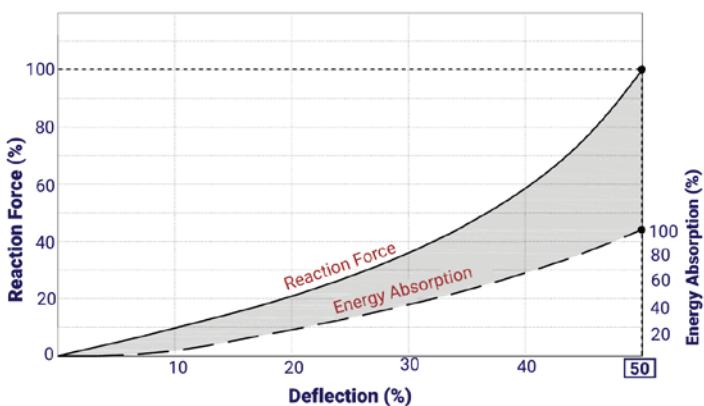
NECKLESS CHAIN (<600mm dia.)

## FIXINGS\*

$\text{ØD} = 150\text{--}700\text{mm}$		
$\text{ØD}$ mm	$\text{Ød}$ mm	Chain mm
150	75	16
200	100	18
250	125	20
300	150	20
400	200	26
500	250	32
600	300	32
700	350	36

$\text{ØD} = 800\text{--}1600\text{mm}$				
$\text{ØD}$ mm	$\text{Ød}$ mm	L mm	Bar mm	Chain mm
800	400	2,000	55	32
		2,500	65	34
		3,000	70	38
900	450	2,000	60	32
		2,500	70	34
		3,000	80	38
		1,000	45	28
		1,500	55	32
1,000	500	2,000	65	38
		2,500	75	40
		3,000	85	44
1,200	600	2,000	75	40
		2,500	85	44
		3,000	100	50
1,400	700	1,000	65	32
1,500	750	1,500	70	38
		2,000	80	44
		2,500	90	48
		3,000	100	52
1,600	800	2,000	90	44
		2,500	110	48
		3,000	120	54

## PERFORMANCE CURVE



PERFORMANCE AT INTERMEDIATE DEFLECTION		
Angle (°)	Energy	Reaction
0	0	0
5	1	5
10	5	10
15	13	15
20	20	21
25	30	28
30	40	36
35	52	46
40	66	58
45	82	76
50	100	100

1,000	700	1,000	65	32
1,500	750	1,500	70	38
		2,000	80	44
		2,500	90	48
1,600	800	2,000	90	44
		2,500	110	48
		3,000	120	54

\*For anchor types and chains, refer to pages 30-32.

## ESC-SQF SERIES

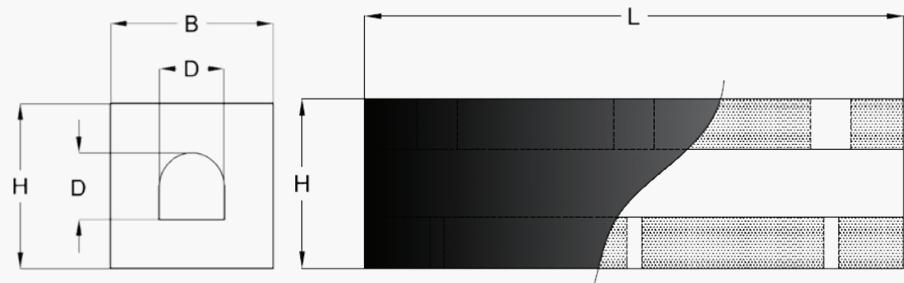
### SQUARE FENDER SYSTEM



UTILISED IN APPLICATIONS WHICH REQUIRE STIFFER FENDERS THAN D FENDERS

#### FENDER FEATURES

- Optimal for more harsh service environments
- Mounted easily onto quay via anchor belts
- Can be supplied to a wide range of lengths, with options for angle cutting for corners



Also Available Option: with UHMW-PE Pad and C-Bore SQF fenders

#### DIMENSIONS & PERFORMANCE

Section	DIMENSIONS				Performance (40% Rated Deflection)		
	H mm	B mm	D mm	Bolt Size*	Bolt Spacing mm	E kN-m	R kN
ESC-SQF150HB	150	150	75	M22	260-330	3.8	117
ESC-SQF200HB	200	200	100	M26	260-330	6.9	156
ESC-SQF250HB	250	250	125	M30	250-320	10.6	195
ESC-SQF300HB	300	250	150	M32	275-330	15.4	234
ESC-SQF350HB	350	250	175	M36	275-350	20.9	273
ESC-SQF400HB	400	250	200	M38	300-370	27.4	312
ESC-SQF500HB	500	250	250	M45	300-400	42.8	390
ESC-SQF600HB	600	250	300	M52	300-450	61.6	468

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force. Performances are per meter length.

\*For anchor types, refer to Anchors and Fixings page 32



## ESC-TDF & TDC SERIES

D-BORE & C-BORE FENDER SYSTEM

HIGHLY VERSATILE FENDER THAT PROVIDES EXCELLENT PROTECTION

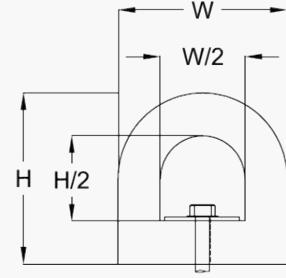
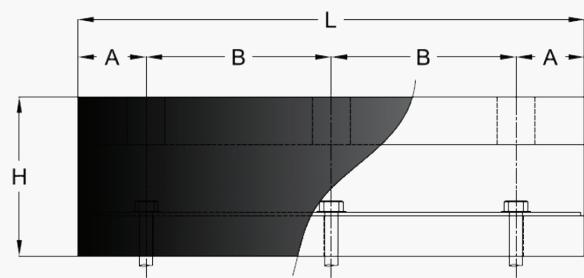
### FENDER FEATURES

- Easy to install
- Heavy-duty rubber fenders
- Ideal for smaller quays and wharves

### FENDER FEATURES

- Tug Boats
- Workboats Berths
- Pontoons & Floating Structures
- Pier Terminals
- Inland Waterways
- Loading Bays
- Fishing Boats

### ESC-TDF SERIES



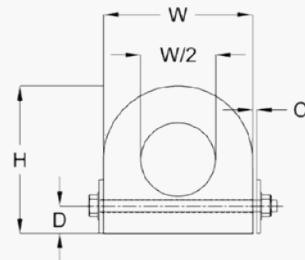
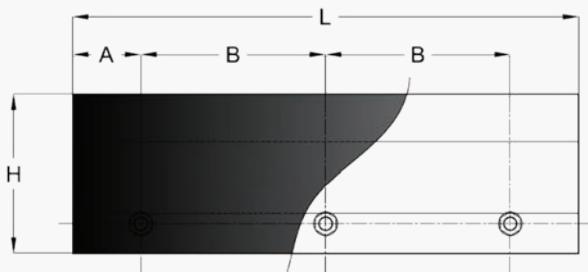
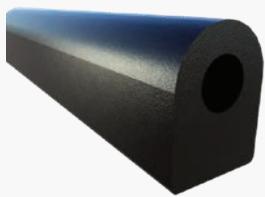
### DIMENSIONS & PERFORMANCE

Section	H mm	W mm	A mm	B mm	Weight kg/m	Flat Bar mm	Bolt* mm	E kN-m	R kN
ESC-TDF150	150	150	110-150	250-350	18.1	60 x 8	M16	3.2	115
ESC-TDF200	200	200	130-180	300-400	32.1	80 x 10	M20	8.6	211
ESC-TDF250	250	250	140-200	350-450	50.2	90 x 12	M24	8	195
ESC-TDF300	300	300	140-200	350-450	72.3	110 x 12	M24	12	300
ESC-TDF400	400	400	140-200	350-450	129	150 x 15	M30	20	390
ESC-TDF500	500	500	140-200	350-450	201	180 x 20	M36	47.1	460

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force. Performances are per meter length.

\*For anchor types, refer to Anchors and Fixings page 32

## ESC-TDC SERIES



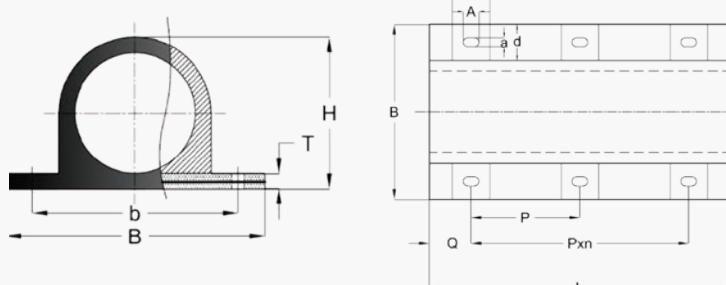
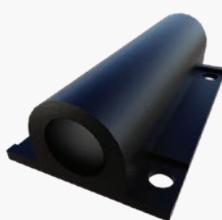
## DIMENSIONS & PERFORMANCE

Section	DIMENSIONS							Performance (40% Rated Deflection)			
	H mm	W mm	A mm	B mm	A mm	B mm	Weight kg/m	Flat Bar mm	Bolt* mm	E kN-m	R kN
ESC-TDC150	150	150	110-150	250-350	12	30	18.8	60 x 8	M16	4	236
ESC-TDC200	200	200	130-180	300-400	15	45	33.4	80 x 10	M20	7	314
ESC-TDC250	250	250	140-200	350-450	20	50	52.2	90 x 12	M24	12	393
ESC-TDC300	300	300	140-200	350-450	25	60	75.2	110 x 12	M24	17	471
ESC-TDC350	350	350	140-200	350-450	25	70	102	130 x 15	M30	23	550
ESC-TDC375	375	375	140-200	350-450	30	80	118	140 x 15	M30	26	589
ESC-TDC400	400	400	140-200	350-450	30	80	134	150 x 15	M30	29	628
ESC-TDC500	500	400	140-200	350-450	40	90	209	180 x 20	M36	46	785

Constant Velocity (CV) E : Energy Absorption; R : Reaction Force  
Performances are per meter length.

\*For anchor types, refer to Anchors and Fixings page 32.

## IMPROVED D-TYPE SERIES



- Also called Wing fenders
- Anchoring grip is bigger than D-fenders.
- Can be fixed with double line anchors.
- Higher installation stability.

## DIMENSIONS & PERFORMANCE

Section	DIMENSIONS												
	H mm	B mm	b mm	T mm	L mm	Q mm	P kg/m	D mm	d mm	A mm	a mm	E kN-m	R kN
ESC-TDO280x540x1000L	280	540	430	40	1000	150	700	165	120	82	41	33	150
ESC-TDO300x600x1000L	300	600	490	40	1000	150	700	165	120	82	41	61	220

\* Other dimensions available, please contact [info@escmarinesystems.com](mailto:info@escmarinesystems.com) for further details required.



## ESC-PNF SERIES

### PNEUMATIC FENDER SYSTEM

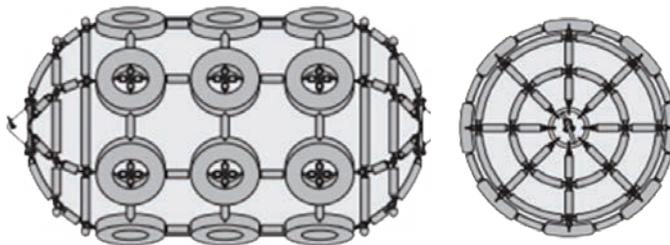
**ROBUST, ITS WELL PROVEN DESIGN MAKES IT A FAVORITE FOR NAVAL USE**

#### FENDER FEATURES

- Vast energy absorption with low unit surface pressure
- Easy to install and low maintenance requirement
- Good performance on inclined berthing
- Low hull pressures

#### TYPES

##### CHAIN AND TIRES



##### SLING

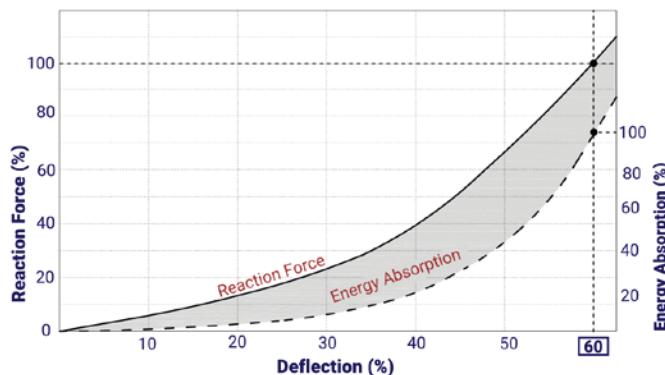


#### DIMENSIONS\* & PERFORMANCE

Performance at 60% deflection, Internal pressure = 50kPa

Section	Energy Absorption	Reaction Force	Hull Pressure
	E kN-m	R kN	kN/m <sup>2</sup>
ESC-PNFØ500x1000	6	64	132
ESC-PNFØ1000x1500	32	182	122
ESC-PNFØ1000x2000	45	257	132
ESC-PNFØ1200x2000	63	297	126
ESC-PNFØ1350x2500	102	427	130
ESC-PNFØ1500x3000	153	579	153
ESC-PNFØ1700x3000	191	639	128
ESC-PNFØ2000x3500	308	875	128
ESC-PNFØ2500x4000	663	1,381	137
ESC-PNFØ2500x5500	943	2,019	148
ESC-PNFØ3300x4500	1,175	1,884	130
ESC-PNFØ3300x6000	1,814	3,015	146
ESC-PNFØ3300x10600	3,067	5,257	158
ESC-PNFØ4500x9000	4,752	5,747	146

#### PERFORMANCE CURVE



\* A wide range of pneumatic fender dimensions and performance are available, please contact [info@escmarinesystems.com](mailto:info@escmarinesystems.com) for further details required.

## ESC-TFF SERIES

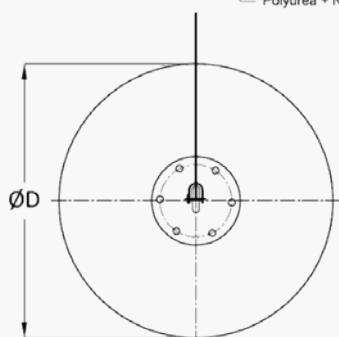
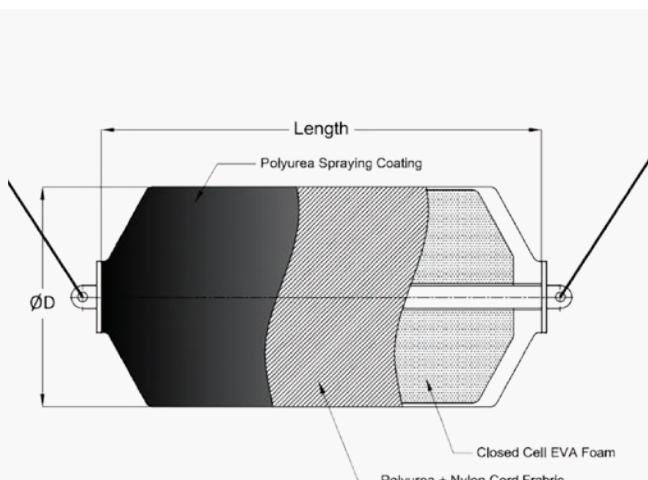
### FOAM FILLED FENDER SYSTEM

#### FENDER FEATURES

- Foam grades from Standard to Ultra High Capacity options
- Distributes stresses across the fender during impact.
- Economical, works reliably for years.
- Performance adjustable by varying initial pressure.

#### PARTS

- Foam Core - the closed cell EVA foam core used inside offers unsink ability during operation
- Outer Rubber + Nylon Cord Fabrics —specifically designed to seal EVA foam inside and to prevent any leakage.
- Polyurea Spraying Coating—permanent spray on coatings that protect the surface of fender body. It is more durable than rubber and flexible in all weather conditions; no softening in heat or becoming brittle in cold.



#### DIMENSIONS & PERFORMANCE

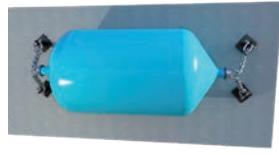
Section	Performance (60% Rated Deflection)	
	E kN-m	R kN
ESC-TFFØ300x500	2	38
ESC-TFFØ1000x1600	17	54
ESC-TFFØ1000x2000	68	218
ESC-TFFØ1200x2000	335	460
ESC-TFFØ1600x3000	270	860
ESC-TFFØ2200x3000	540	1,720
ESC-TFFØ2400x6000	1,340	4,300
ESC-TFFØ2700x6000	1,680	5,360
ESC-TFFØ3100x6000	2,107	6,742
ESC-TFFØ3400x6000	2,636	8,428
ESC-TFFØ4300x6000	4,214	13,485
ESC-TFFØ4500x9000	6,742	21,570

\* A wide range of pneumatic fender dimensions and performance are available, please contact [info@escmarinesystems.com](mailto:info@escmarinesystems.com) for further details required.

#### FIXING METHODS

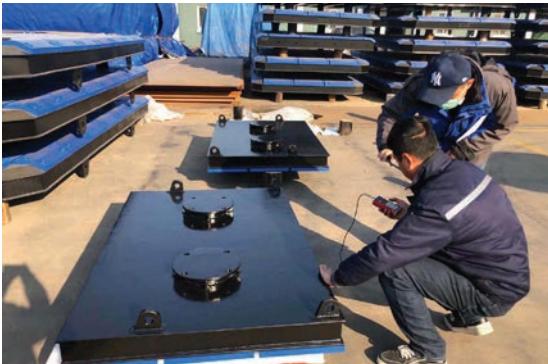


SINGLE PAIR OF CHAINS



PAIRED CHAINS

## Fender Photos



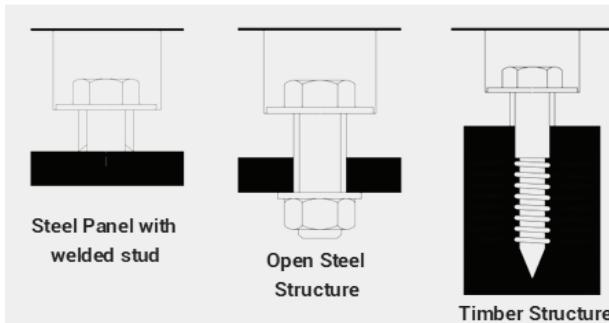


## ACCESSORIES

### UHMW PE PADS

Fender panels distributes reaction forces to provide low hull pressures and cope with large tidal variations. ESC recommends high quality UHMW-PE Pads as the best material for heavy duty impact protection. Impact resistant and very low in friction. The UHMW Pads allows vessels to move smoothly past a fender system.

### FIXING METHODS



Fixing types depends on the underlying structure. Fixings are available in different steel grades and finishes. Contact ESC for details.

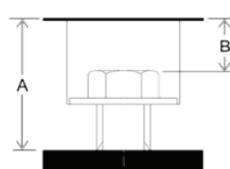
### PHYSICAL PROPERTIES

Property	Test method	Requirement	Unit
Hardness	ASTM D2240, ISO 868, GB/T 2411-2008	≥ 60	Shore D
Density	ASTM D792, ISO 1183, GB/T 1033-2010	58.7-60.6 0.94-0.97	lb/ft <sup>3</sup> g/cm <sup>3</sup>
Yield strength	ASTM D638, ISO 527, GB/T 1040-2006	2.5 ≥ 17	ksi MPa
Tension strength	ASTM D638, ISO 527, GB/T 1040-2006	4.4 ≥ 30	ksi MPa
Elongation at break	ASTM D638, ISO 527, GB/T 1040-2006	≥ 150	%
Friction coefficient	ASTM D1894, GB/T 10006-1998	≤ 0.15	-
Notch impact strength	ASTM D256A, GB/T 1843-2008	61.9 ≥ 130	ft-lb/in <sup>2</sup> KJ/m <sup>2</sup>
Melting point	ISO 3146, GB/T 16582-2008	≥ 266 ≥ 130	°F °C

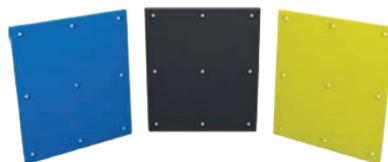
### FEATURES

- Easy to install
- Available in different color and several quality grades
- Does not rot, split or decay
- Fully recyclable.

### WEAR ALLOWANCES



A mm	B mm
30	5
40	10
50	15
70	25



UHMW PE PADS COLORS: BLUE, BLACK, YELLOW

### FRICITION COMPARISONS

MATERIAL	Coefficient of friction against ( $\mu$ )
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 surface. These coefficients of friction only apply to smooth contact surfaces.

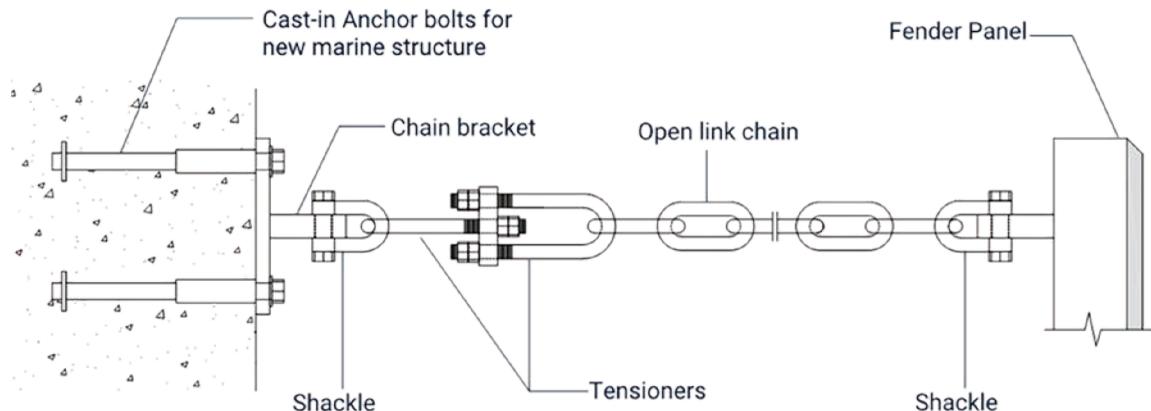
# ACCESSORIES

## CHAIN SYSTEM

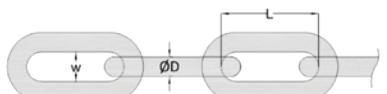
On the stage of fender design, chains systems should be considered as one of the configuration. Accurate design and detailed chain system are necessary for effective fender performance and load paths of a system as a whole.

ESC Chain system includes the following components:

- Chains
- Shackles
- Tensioner
- Brackets



## CHAINS

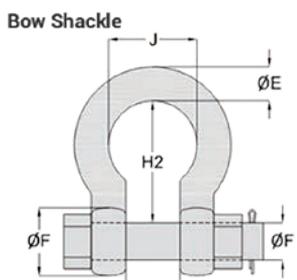
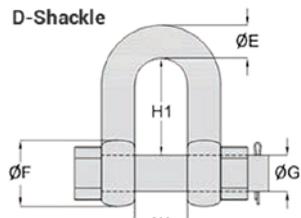


Coating: hot-dipped galvanized, painted or as specified

ØD mm	W mm	OPEN LINK CHAINS		Weight kg/m	W mm	Chain 5 x ØD L = 5 x ØD		Weight kg/m	U2 kN	U3 kN
		Chain 4 x ØD L = 4 x ØD	Weight kg/m			Chain 5 x ØD L = 5 x ØD	Weight kg/m			
14	20	56	3.8	21	70	3.7	124	154		
16	22	64	5	24	80	4.8	160	202		
18	25	72	6.4	27	90	6	209	262		
20	28	80	7.7	30	100	7.5	264	330		
22	31	88	9.3	33	110	9	304	380		
25	35	100	12.1	38	125	11.6	393	491		
28	39	112	15.1	42	140	14.6	492	616		
30	42	120	17.4	45	150	16.7	566	706		
32	45	128	19.7	48	160	19	644	804		
35	49	140	23.7	53	175	22.8	770	964		
38	53	152	28	57	190	26.9	900	1,130		
40	56	160	31	60	200	29.8	1,010	1,260		
45	63	180	39.2	68	225	37.7	1,275	1,590		
50	70	200	48.4	75	250	46.5	1,570	1,960		

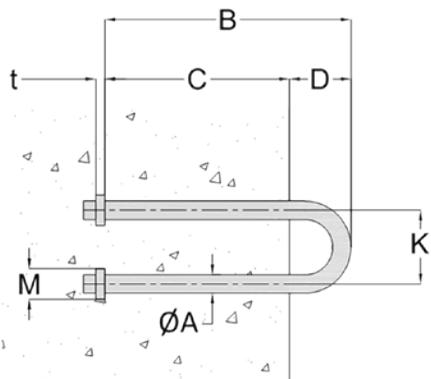
MBL: Minimum Breaking Load

## SHACKLES



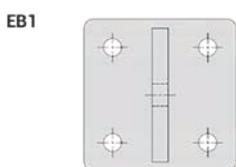
ØE mm	ØF mm	ØG mm	W mm	D-Shackle		Bow Shackle			MBL kN
				H <sub>1</sub> mm	Weight kg	H <sub>2</sub> mm	J mm	Weight kg	
13	26	16	22	43	0.4	51	32	0.4	120
16	32	19	27	51	0.7	64	43	0.8	195
19	38	22	31	59	1.1	76	51	1.3	284
22	44	25	36	73	1.5	83	58	1.9	388
25	50	28	43	85	2.6	95	68	2.8	510
28	56	32	47	90	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	810
38	76	42	60	127	7.6	146	99	8.8	1020
45	90	50	74	149	12.8	178	126	15	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

## U-ANCHORS

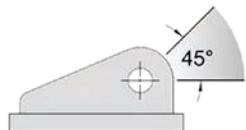
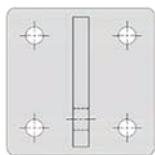


ØA mm	B mm	C mm	D mm	K mm	M kg	t mm	Weight kg/m	MBL kN
26	320	260	60	104	50	12	3	209
30	370	300	70	120	50	15	5	264
34	410	340	70	136	60	15	7	304
36	430	360	70	144	60	20	9	393
42	510	420	90	168	70	20	14	492
44	540	440	100	176	80	20	16	566
48	580	480	100	192	80	25	21	644
50	610	500	110	200	90	25	24	770
56	680	560	120	224	100	30	33	900
60	730	600	130	240	110	30	41	1,010
66	800	660	140	264	120	35	55	1,275
74	900	740	160	296	130	40	77	1,570

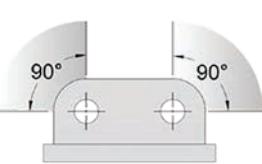
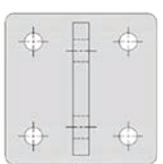
## BRACKETS\*



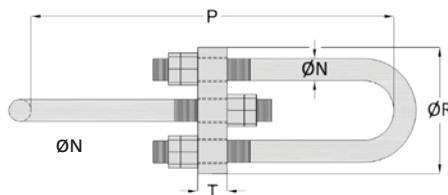
EB2



EB3



## TENSIONERS



ØN mm	ØR mm	P mm	Weight kg
24	160	270~350	8.4
30	200	345~465	16.5
36	230	420~560	27.0
42	270	480~600	45.0
48	300	540~655	64.0

\*Chain Brackets are designed for different applications, please contact ESC for further details.

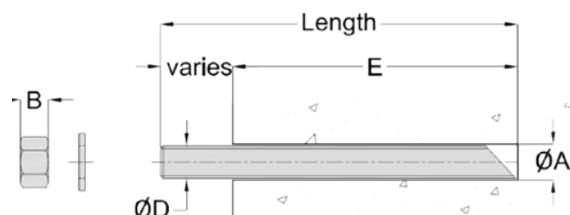
# ACCESSORIES

## ANCHORS & FIXINGS



### CHEMICAL TYPE ANCHORS

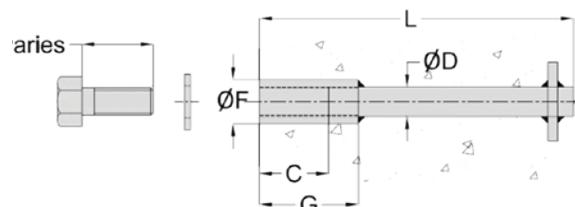
Chemical type anchors (EC2 Anchors) are used for installing fenders on existing concrete structures. These type of anchors are installed using special grout capsules.



ØD mm	E mm	ØA mm	B mm
16	140	20	13
20	170	24	16
24	210	28	19
30	280	35	24
36	360	42	29
42	420	50	34
48	460	54	38
56	500	64	45
64	560	72	51
76	670	84	61

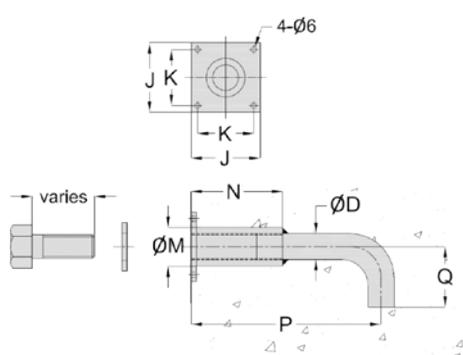
### CAST-IN TYPE ANCHORS

Cast-in anchors are standard type of anchors used for installing fenders to new concrete structures. Cast-in anchors have a threaded socket with long tail, easily customized for special applications.



ØD mm	ØF mm	C mm	G mm	L mm
20	30	50	20	214
24	36	60	25	258
30	44	70	30	318
36	50	80	40	328
42	60	85	45	416
48	65	100	50	431
56	75	105	60	436
64	85	128	80	600
76	95	152	90	700

### CAST-IN TYPE ANCHORS (L- TYPE)



ØD mm	ØM mm	N mm	P mm	Q mm	J mm	K mm
22	28	85	164	50	55	40
24	32	90	173	60	65	50
30	40	110	205	70	80	65
36	48	125	232	90	85	70
42	55	145	319	100	110	85
48	65	175	366	110	115	90
64	85	215	388	150	130	105

Material: Q235, JIS G3101, ASTM A325/A36, Stainless steel or as specified.

Coating: hot-dipped galvanized, uncoated or as specified

\* Bolt dimensions may vary per type and size of fender, please contact [info@escmarinesystems.com](mailto:info@escmarinesystems.com) for further details required.

# RUBBER PROPERTIES

## MARINE FENDER SYSTEM

ESC Fenders uses high quality rubbers that are designed for long life performance in marine environments. All fenders are made using natural or synthetic rubber compounds to meet the performance requirement and its reliability.

ESC Fenders complies with 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.

## FEATURES

- Marine Grade Compounds
- Natural and/or synthetic
- Resists ozone and UV light
- Fully recyclable
- Excellent bond strengths
- Fully homogenous

## PHYSICAL PROPERTIES

Property	Test method	Requirement	Unit
Hardness	GT/T 531, ISO 868, ASTM D2240, DIN53505	≤ 78	Shore A, Degree
Tensile Strength	GB/T 528, ISO 37, ASTM D412, DIN53504	≥ 2.3	ksi
		≥ 16	MPa
Elongation at Break	GT/T 531, ISO 868, ASTM D2240, DIN53505	≥ 350	%
Tear Strength	GB/T 529, ISO 34-1, ASTM D624, DIN53507	≥ 4.8	kips/ft
		≥ 70	kN/m
Abrasion Resistance	GB/T 9867, ISO 4649, ASTM D5963, DIN53516	≤ 0.16	in <sup>2</sup>
		≤ 100	mm <sup>2</sup>
Ozone Resistance 38°Cx48h 20% 50 ppm	GB/T 7762, ISO 1431, ASTM D1149, DIN53509	No visible cracking	-
Abrasion Resistance	GB/T 9867, ISO 4649, ASTM D5963, DIN53516	No visible cracking	-
After aging (70°Cx160h)	Change in tensile strength Change in elongation at break Hardness	≤ 20	%
		≤ 20	%
		≤ 8	Shore A, Degree
Aging in seawater, Change in volume	ISO 1817, ASTM D471	-5	%
		+10	%
Resistance to heavy oil (25°Cx24h)	GB/T 1690, ISO1817, ASTM D471 Method B, DIN86076	≤ 20	%
Resistance to heavy oil (25°Cx24h)		≤ 60	%



# TESTING

## MARINE FENDER SYSTEM

ESC tests fenders to verify their consistent performance and quality. Additional testing properties can be tested and/or third party witnessed upon request.

### CONSTANT VELOCITY (CV) METHOD

- Axial compression test speed is 2 cm/min  $\pm$  8cm/min, at angle 0°
- Fender unit shall be stabilized to 23°C  $\pm$  5°C.

### TESTING\*

1. All fender units are marked with unique serial number for tracing of records.
2. Fender unit will undergo break-in by deflecting three (3) times or more to its rated deflection.
3. Fender will be allowed to recover for one (1) hour or more at stabilized temperature 23°C  $\pm$  5°C.
4. Reaction force is recorded at intervals to at least a deflection at which the permitted minimum energy absorption is achieved.
5. Energy absorption is determined as the integral of reaction and deflection, calculated using Simpson's Rule. The results of a pre-compression cycle and subsequent break-in compression cycle/s are not recorded
6. The fender performance shall be determined from a single measured compression cycle and pass if the reaction force is less than the maximum permitted reaction force and more than the minimum permitted energy absorption
7. Sampling is 10% of fenders (rounded up to a unit).
8. 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.
9. 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.

#### NOTES:

\*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.

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).

AST, F 2192-05 Standard Method for Determining and Reporting the Berthing Energy and Reaction of Marine Fenders.

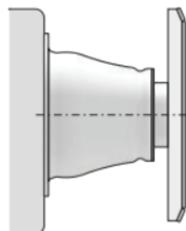


# DESIGN CONSIDERATIONS

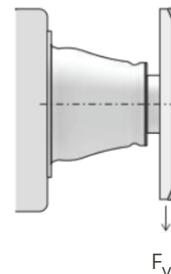
## MARINE FENDER SYSTEM

Chains can assist in controlling the compression geometry of fenders in some applications. Please contact ESC for further details.

### TENSION

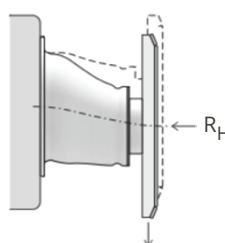


Chains can assist in controlling the compression geometry of fenders in some applications. Please contact ESC for further details.



### WEIGHT SUPPORT

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

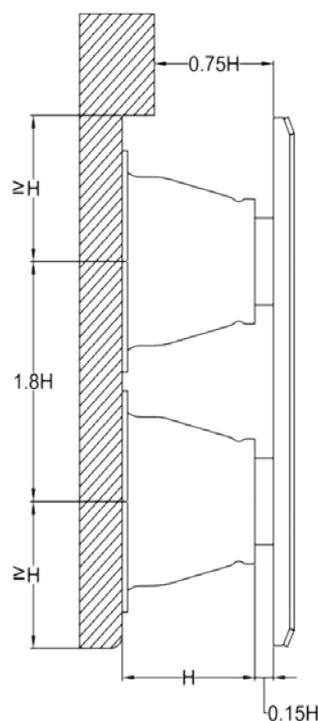


### SHEAR

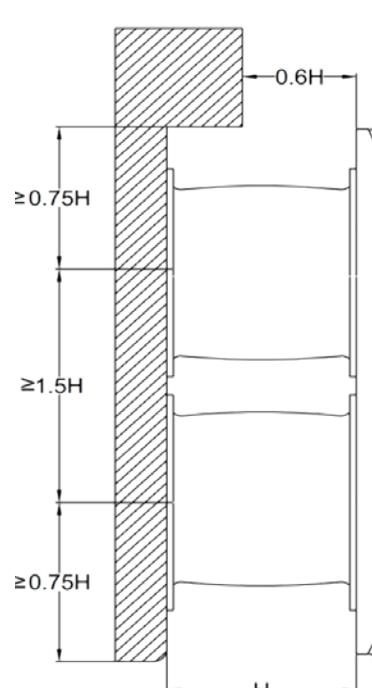
Fenders remain stable with vertical or horizontal shear forces. Shear chains may be needed for some applications and fender layouts.

## CLEARANCES

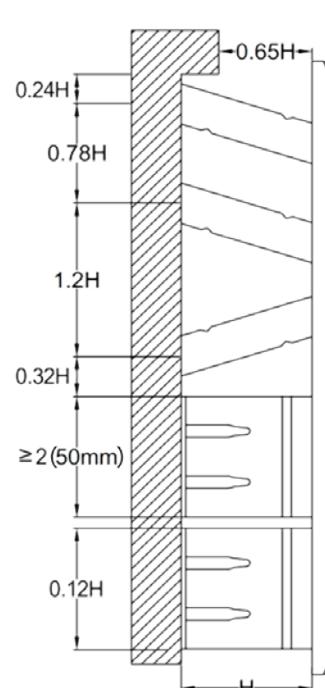
### CONE FENDERS



### CELL FENDERS



### ELEMENT FENDERS



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.

# TOLERANCES

## MARINE FENDER SYSTEM



ESC Fenders are manufactured to precise quality standards. ESC can accommodate other tolerances and inspection levels on special cases.

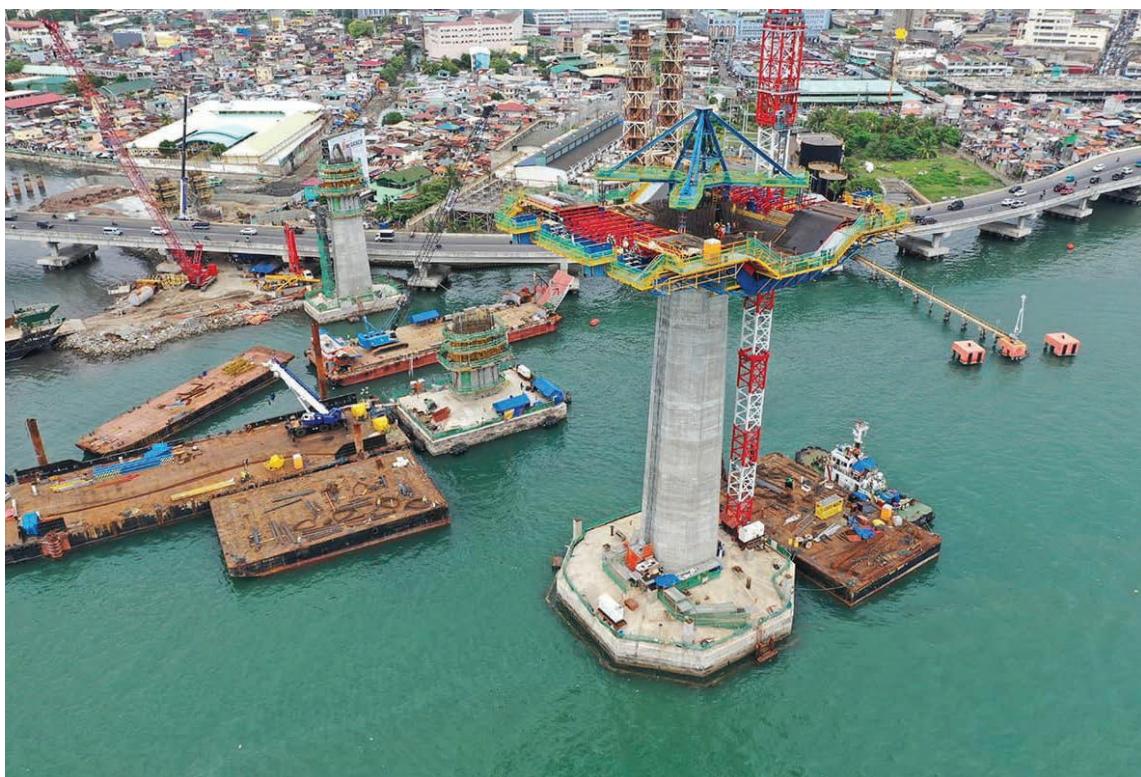
FENDER TYPE	PROPERTY	TOLERANCE
Cone, Cell, Element, Arch	All dimensions	±3% or ± 1/16" (2mm), whichever greater
	Cone, Cell, Element, Arch	±1/16" (2mm)
Cylindrical	Outside diameter	±4%
	Cylindrical	±4%
	Cylindrical	±1 9/16" (40mm)
D, Square	Cross-section	±4%
	D, Square	±2% or ± 3/8" (10mm), whichever greater
	D, Square	±3/16" (4mm), non-cumulative
	D, Square	±3/16" (4mm), under-head depth
Wing	Cross-section	±3% or ± 1/16" (2mm), whichever greater
	Wing	±3% or ± 13/16" (20mm), whichever greater
	Wing	±1/8" (3mm)
	Wing	±1/8" (3mm)
UHMW-PE Pads	Length and width (cut panels) (uncut sheets)	±3/16" (5mm), cut pads ±13/16" (20mm), uncut sheets
	UHMW-PE Pads	±0.2mm ±0.3mm ±0.5mm
	UHMW-PE Pads	±1/8" (2.5mm) ±3/16" (4mm) ±1/4" (6mm)
	UHMW-PE Pads	±1/16" (2mm), non-cumulative
	UHMW-PE Pads	±1/16" (2mm), under-head depth
Pneumatic Fenders	Performance	±3/8" (10mm), on reaction at guaranteed energy absorption

## PERFORMANCE TOLERANCE

Fender Type	Property	Tolerance
Cone, Cell, Element, Arch	Reaction, energy and deflection	±10%
Cylindrical (wrapped)	Reaction, energy and deflection	±10%
Cylindrical (extruded)	Reaction, energy and deflection	±10%
Pneumatic Fenders	Reaction and energy	±10%
Foam Fenders	Reaction and energy	±10%

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

## PROJECT PHOTOS



## ESC GLOBAL CONTACT LIST

<b>Australia, New Zealand &amp; PNG</b>	<b>Argentina, Paraguay &amp; Uruguay</b>	<b>Brazil</b>	<b>China</b>
<b>ESC Asia Limited</b> <b>A</b> Acclime Offices 17/F 95 Queensway Admiralty Hong Kong <b>E</b> escglobal@escpile.com <b>T</b> +852 8198 0239 <b>W</b> www.escpile.com	<b>Cimtronic Design &amp; Engineering</b> <b>A</b> Vedia 144, 5th Floor, Office 2 (C1429EIB) Nuñez CABA, Argentina <b>E</b> informes@cimtronic.com.ar <b>E</b> fgallo@cimtronic.com.ar <b>T</b> +55 (31) 99976 4714 <b>W</b> www.escpile.com.br	<b>ESC Brazil</b> <b>A</b> Sao Paulo, SP, Brazil <b>E</b> info@escpile.com.br <b>T</b> +55-11-3170-8598 <b>W</b> www.escpile.com.br	<b>ESC Trading (Shanghai) Co., Ltd.</b> <b>A</b> Rm 02, 5/F, No.16, Gopher Qibao T2 Building, Lane 399, Xinlong Rd., Minhang District, Shanghai, China <b>E</b> vincenthuang@escpilechina.com <b>E</b> brucecolson@escpilechina.com <b>T</b> +86 21 3126 3501 <b>T</b> +86 21 3126 3502
<b>Indonesia</b>	<b>Malaysia, South East Asia &amp; South Asia</b>	<b>Mexico, Central &amp; South America</b>	<b>Middle East &amp; Africa</b>
<b>PT ESC Steel Indonesia</b> <b>A</b> Graha Mustika Ratu, 5th Floor #505, Jln. Jend Gatot Subroto Kav. 74-75, Jakarta 12870 <b>E</b> zulfan@escpile.com <b>E</b> chanhonkit@escpile.com <b>T</b> +62 811 980 376 <b>T</b> +62 821 247 99 468 <b>W</b> www.escsteel.co.id	<b>ESC Steel Engineering Sdn Bhd</b> <b>A</b> F-1-2 Second Floor, Block F Suite 5 Setia Walk, Persiaran Wawasan, Pusat Bandar Puchong 47160 Puchong, Selangor, Malaysia <b>E</b> chanhonkit@escpile.com <b>T (Malaysia)</b> +6012 428 5759 <b>W</b> www.escsteel.com.my	<b>Acerlum ESC SAPI de CV</b> <b>A</b> Loma de la Cañada No. 4, Loma, Querétaro, México CP 76060 <b>E</b> info@acerlum-esc.com <b>T</b> +52 442 4711 500 <b>W</b> www.acerlum-esc.com	<b>ESC Middle East</b> <b>A</b> P.O. Box 131355, Industrial Area City of Abu Dhabi, Mussafah, Abu Dhabi, UAE <b>E</b> escuae@escpileuae.com <b>E</b> kevinashdown@escpileuae.com <b>T</b> +971 2550 6188 <b>F</b> +971 2550 6112 <b>W</b> www.escpileuae.com
<b>Netherlands</b>	<b>Nigeria</b>	<b>Philippines</b>	<b>Russia</b>
<b>Europile B.V.</b> <b>A</b> Dam Bustersstraat 7 NL 4651 Sj Steenbergen Netherlands <b>E</b> info@europile.nl <b>E</b> esceuro@escpile.com <b>T</b> +31 167 534 747 <b>F</b> +31 167 534 850 <b>W</b> www.europile.com	<b>Europile B.V.</b> <b>A</b> Dam Bustersstraat 7 NL 4651 Sj Steenbergen Netherlands <b>E</b> info@europile.nl <b>E</b> esceuro@escpile.com <b>T</b> +31 167 534 747 <b>F</b> +31 167 534 850 <b>W</b> www.europile.com	<b>ESC Steel Philippines, Inc.</b> <b>A</b> 12V 12/F Cyber One Building, 11 Eastwood Avenue, Eastwood City Cyberpark, Bagumbayan, Quezon City, Philippines <b>E</b> manila@escsteelphil.com <b>E</b> cebu@escsteelphil.com <b>T</b> +632 8526 8839 <b>M</b> +63 917 202 7798 /+63 920 504 3801 <b>W</b> www.escsteelphil.com	<b>ESC-Beregstat Jsc</b> <b>A</b> 20 Ulitsa Lotsmanskaya St Petersburg 190121 Russian Federation <b>E</b> escrussia@escpile.com <b>E</b> vovauliev@gmail.com <b>T</b> +7812 495 0806 <b>F</b> +7812 325 9357
<b>Ukraine</b>	<b>United States &amp; Canada</b>	<b>United States &amp; Canada</b>	<b>United Kingdom &amp; Ireland</b>
<b>Mageba Ukraine LLC</b> <b>A</b> Gagarina Str.55, off 466 Cherkasy, 18000, Ukraine <b>E</b> escukraine@escpile.com <b>E</b> oleg@escpile.com <b>T</b> +38 472 503661 <b>F</b> +38 472 503662	<b>ESC Steel LLC</b> <b>Contact: Bruce Colson</b> <b>A (North Carolina)</b> 18805 W Catawba Ave, Suite #207, Cornelius, 28031, North Carolina, USA <b>E</b> bruce@escsteel.com <b>T</b> +1 (704) 654 0321 <b>T</b> +1 (980) 689 4388 <b>T (Canada)</b> +1 (604) 235 1911 <b>F (Canada)</b> +1 (415) 500 9825 <b>W</b> www.escsteel.com	<b>ESC Steel LLC</b> <b>A (Texas)</b> 9595 Six Pines Dr. Suite 8210, The Woodlands Texas, 77380 USA <b>E</b> info@escsteel.com <b>E</b> kevin@escsteel.com <b>T</b> +1 (281) 205 7261  <b>Sales &amp; Distribution Yard</b> <b>A</b> 5268 Davidson Highway Concord, North Carolina 28027, USA	<b>ESC Steel LLC</b> <b>Contact: Bruce Colson</b> <b>A</b> 18805 W Catawba Ave, Suite #207, Cornelius, 28031, North Carolina, USA <b>E</b> bruce@escsteel.com <b>T</b> +1 (704) 654 0321 <b>T</b> +1 (980) 689 4388 <b>T</b> +1 (604) 235 1911 <b>F</b> +1 (415) 500 9825 <b>W</b> www.escsteel.com

# ESC Product Catalogs

You may download all our product catalogs on this <https://www.esctglobalgroup.com/esc-group-product-catalogues> or request via email: [escglobal@escpile.com](mailto:escglobal@escpile.com). If you are viewing online, you may click on the image below to download.

The grid displays 15 ESC product catalog covers:

- ESC CAPABILITY STATEMENT**: Global Capability Statement 2022 Edition
- GENERAL CATALOGUE**: General Catalogue 2022 Edition
- SHEET PILE INSTALLATION MANUAL**: Sheet Pile Installation Procedures
- STEEL STRUCTURES CAPABILITIES**: ESC Steel Structures 2022 Edition
- TRENCH SHORING CATALOGUE**: Trench Safety Catalogue 2022 Edition
- VINYL SHEET PILE CATALOGUE**: ESC VINYL SHEET PILES 2022 Edition
- VINYL SHEET PILE INSTALLATION GUIDE**: ESC VINYL SHEET PILES Installation Guide
- PORT & OFFSHORE STRUCTURES**: Port & Offshore Structures Capability Statement
- MOORING BOLLARDS CATALOGUE**: Delivering High Strength Mooring Bollards to the Global Market
- ESC PROJECT CASE STUDIES**: ESC Project Case Studies Book I (2014 - 2016)
- COMBINATION WALL PROJECTS**: ESC Project Case Studies Book II (2017 - 2019)
- STEEL PIPE PILING PROJECTS**: ESC Project Case Studies Book III (2020 - 2022)
- Combination Walls Project Case Study**: ESC Project Case Studies Book IV (2023)
- Steel Pipes Projects Case Study**: ESC Project Case Studies Book V (2023)



**ESC**  
MARINE SYSTEMS

An affiliate of:



## ESC Global Headquarters

### ESC 1997 Limited

A Acclime Offices, 17/F United Centre,  
95 Queensway Admiralty,  
Hong Kong  
E [info@escmarinesystems.com](mailto:info@escmarinesystems.com)  
T +852 8198 0239

### ESC China Office

A Rm 02, 5/F, No. 16, Gopher Qibao T2 Building,  
Lane 399, Xinlong Rd., Minhang District,  
Shanghai, China  
E [escchina@escpile.com](mailto:escchina@escpile.com)  
T +86 21 3126 3501  
F +86 21 3126 3502



[/escmarinesystems](#)



[/escmarinesystem](#)



[/esc-marine-systems](#)



ESC Group



[www.escmarinesystems.com](http://www.escmarinesystems.com)



Download  
"ESC GROUP" APP