



25 YEARS
WARRANTY
RUBBER FENDER PRODUCTS

10 YEARS
WARRANTY
FENDER ACCESSORIES

5 YEARS
WARRANTY
BOLLARD PRODUCTS

LIAONING QINGYUAN NO.1 BUFFER MANUFACTURE CO., LTD

FENDERSYS CATALOG VERSION 1.0 (INTERNATIONAL/ENGLISH VERSION)
FOR CHINESE VERSION AND OTHERS, PLEASE DO CONTACT US



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LARGE CORPORATE MEMBER OF PIANC

HONOURABLE CLIENT AND COOPERATIVE TECHNICAL PARTNERSHIP



INTERNATIONAL LARGE CORPORATE MEMBERSHIP



LOCAL MEMBERSHIP



CERTIFICATION



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FENDERSYS

- WORLD CLASS MARINE FENDERS



I WISH WE COULD FENDER THE ENTIRE BERTH FACE OF PORT AND JETTY INSTALLATION IN THE WORLD!

I HOPE YOU ARE HAPPY WITH THE MARINE FENDER SYSTEM YOU ARE INSTALLING AND THAT THEY'RE BRANDED FENDERSYS!

I BELIEVE WE CAN PROVIDE ALL THE SOLUTIONS FOR BERTH AND VESSEL FENDER PROTECTION SYSTEM NEARLY NO MATTER WHAT IS YOUR MODE OF OPERATION AND YOUR PORT CHALLENGES.



FENDER INSTALLATION AND MAINTENANCE FOR JETTIES ARE ONE OF THE MOST COSTLY EXPENDITURE COMPONENTS IN PORT AND MARINE INFRASTRUCTURE. WE CAN HELP REDUCE THE COST FOR THE EMPLOYER, BUT MOST OF ALL THE MISHAP AND DANGERS TO THE BERTHING VESSEL AS WELL AS THE INTEGRITY OF THE JETTY STRUCTURES. A SMALL MISTAKES DUE TO FLAWS IN SELECTING THE RIGHT FENDERS OR INFERIOR QUALITY OF THE INSTALLED FENDER MAY CAUSE SERIOUS PROBLEMS TO PORT OPERATION.

I'LL GIVE YOU 10 REASONS FOR CHOOSING OUR MARINE FENDER:

- WE ARE INTENSELY PASSIONATE ABOUT MARINE FENDER.
- WE TRY OUR VERY BEST TO ENSURE BEST FENDER SYSTEM SOLUTION FOR ANY GIVEN JETTY, MODE OF PORT OPERATION, TYPE OF TARGET VESSEL, SAFETY OF VESSEL'S BERTHING AND INTEGRITY OF THE JETTY STRUCTURE
- WE WILL NEVER STOP TO LISTEN TO OUR CUSTOMERS' NEEDS AND REQUIREMENTS.
- WE WILL NEVER STOP TO IMPROVE OURSELVES.
- WE DARE TO BE DIFFERENT FROM OUR COMPETITORS AND WALK IN A DIFFERENT DIRECTION.
- WE LOVE TO EXCITE OUR CUSTOMERS, AND EXCEED THEIR EXPECTATIONS.
- WE BELIEVE INTEGRITY GOES BEFORE ANYTHING, AND WE ALWAYS FOCUS ON BUILDING CONFIDENCE.
- WE LOVE TO CHALLENGE THE LEADING BRANDS BY GIVING OUR CUSTOMERS BETTER PRODUCTS.
- WE TRY OUR BEST TO TAKE GOOD CARE OF OUR OWN EMPLOYEES AS WELL AS OUR SUBCONTRACTORS, AND ENSURING THEIR SAFETY AND WELL-BEING.
- WE WILL NEVER FORGET OUR PAST. WE WERE SMALL AND INSIGNIFICANT 30 YEARS AGO, BUT IT IS THIS HERITAGE THAT BROUGHT US WHERE WE ARE TODAY.

PLEASE LET US HEAR FROM YOU. WE PREFER PRAISE, BUT WE ALSO NEED CRITICISM TO BE ABLE TO ALWAYS IMPROVE.

ENJOY THIS PRODUCT CATALOG, AND ALWAYS REQUEST AND TRUST FENDERSYS MARINE FENDER SYSTEM FOR YOUR ULTIMATE VESSEL BERTHING EXPERIENCE.

SINCERELY YOURS



MANAGING DIRECTOR OF

LIAONING QINGYUAN NO 1 BUFFER MANUFACTURE CO. LTD

(FENDERSYS MARINE FENDER SYSTEM INC)



COMPANY OVERVIEW

LIAONING QINGYUAN NO.1 BUFFER MANUFACTURE CO.,LTD



Who we are?

LIAONING QINGYUAN NO 1 BUFFER MANUFACTURE CO. LTD (LQBM) is a family business established by Yang Wanchun in 1986 as a small manufacturing company to cater to the burgeoning demand for specialized industrial marine equipment and product in PR China, an Asia country with strong maritime traditions.

Since then, the company has succeeded in becoming one of the biggest PR China manufacture for a number of specialize marine equipment & products especially in the area of Buffer System Technology for cranes, Marine Fender System Technology for vessel's launching & berthing, and Bollard for vessel's mooring.

With over 30years of company history prior to kickstart of Cultural Revolution in the late 1960s, LQBM has witnessed the growth of PR China, and played an active part in providing its services & solutions in marine system & technologies for a number of government authorities and private entities in port & maritime industry. From there on, with confidence gaining throughout the learning curves, the company has spread their wings beyond China for greater opportunity & adventure at large in the global landscape.

At present, the company has proudly established 12 nos. of agent/branches/partner located in Dalian, Shanghai, Qingdao, Nanjing, Guangzhou, locally and in Malaysia,France,North America,India,Latvia,Singapore and Taiwan etc. internationally.

What we do?

The company provides in-house professional consultation & collaborations, technical analysis & detail design and material & performance testings, prior to product manufacturing at own plant with modern & state-of-the-art production machines for various system for Buffer, Marine Fender and Mooring Bollard. Besides in-situ supervision monitoring & technical advisory, all of our supplied products will undergo series of after-sales follow-up inspection in order to monitor the product performance throughout its service live.

Today, LQBM is standing tall as one of the premier & major player in Buffer, Marine Fenders and Marine Bollards specialist and producer in PR China as well as in global scene, thanks to the company combining strategic planning, ingenuity, creativity and highly qualified dedicated personnel in maintaining the company's reputation, efficiency, reliability, and professionalism.

LQBM will continue to explore and enhance for new technologies & products and to develop the opportunities, improve customer services and further expand as a company, never resting on its success.

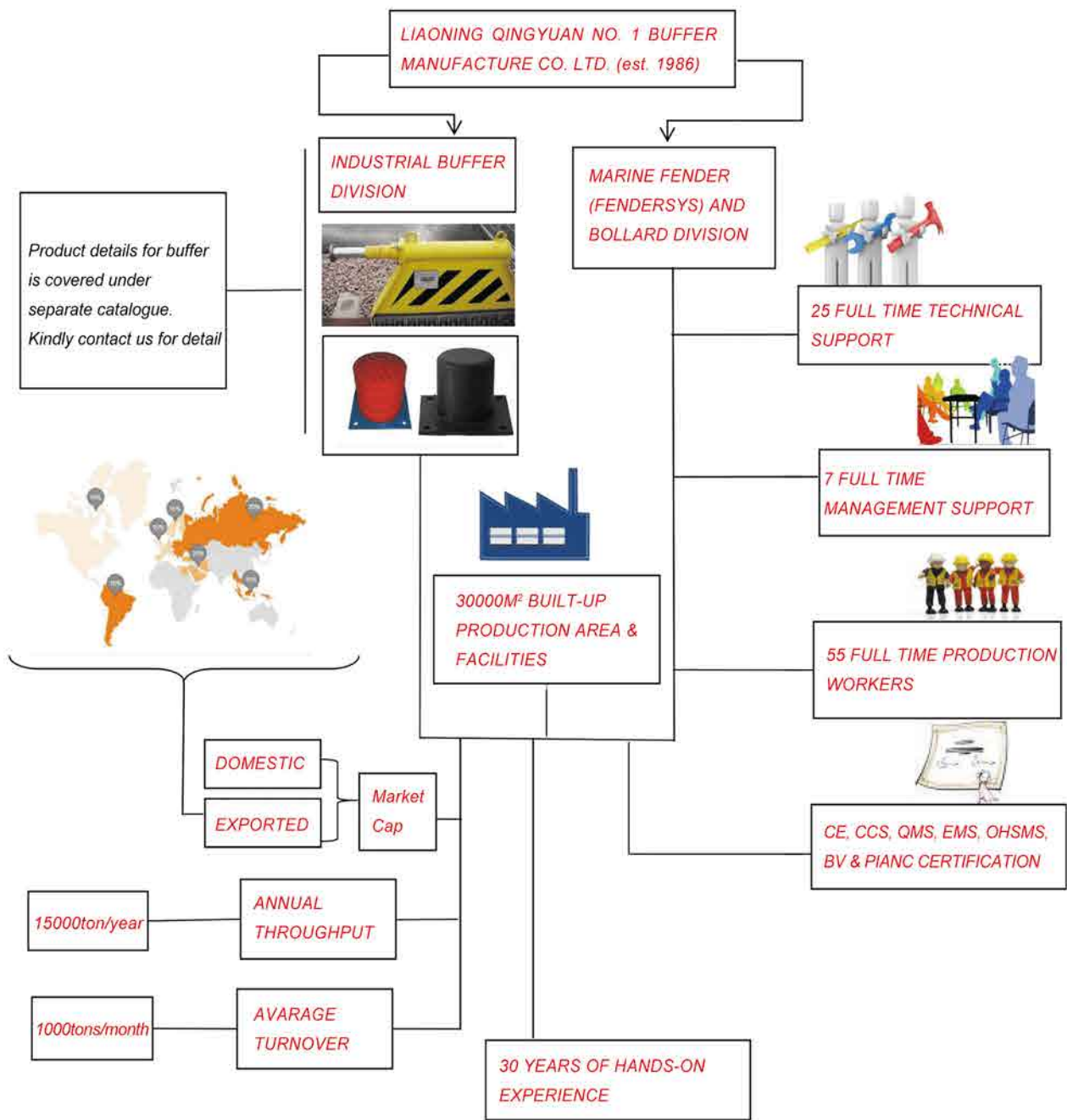
Why we are different?

In the era of mass production and product globalization nowadays where dollar and cent counts, many suppliers even the world top-recognize suppliers had started to outsource to other to manufacture & produce their brand even through their own competitors via white-label marketing strategies. These products have loosen its originality in the expense to achieve target sale and became less passionate on the engineering value of the products itself. Furthermore, they will never learned on how to improve the manufacturing process or new technology/R&D themselves in order to reduce the production cost at aims to compete in global markets as well as direct relationship with clients.

In LQBM, we had never and will never ever associated with this white-label scheme that may turn down our reputation to the drain by matter of simple mistakes that prone to happen when the products is produced beyond our own quality control. Until to date, we had successfully maintained our professionalism and honesty to strive for pure excellence in quality and service in what we do and moreover, we pride ourselves in our ability to design, develop and protect our signature products ever-since the existence of the company.



Our huge 5720 m² of covered workshop and warehouse space are dedicated for fender stacking and storage before delivery to customer. With this facility, we are able to cope with unlimited order but at the same time maintaining the quality, tidiness & cleanliness of our customer assets prior to final delivery.



Our huge 20000 m² of covered production warehouses are fully-equipped with modern & state-of-the-art machine & equipment for complete processing from raw material until final ready-to-deliver products. Most of the machines were customly designed and developed by our own R&D team based on pure understanding of the chemical and structural requirement in rubber engineering.



Super Cell fender mold



Three roll calender



Universal electronic testing machine



Open Mill



Cooling roll

PRODUCTION EQUIPMENT



PCL Controller



Connection



Super Arch fender mold



600t Press machine



Mixed rubber sheet



Vulcanizing boiler



Vulcanizing machine

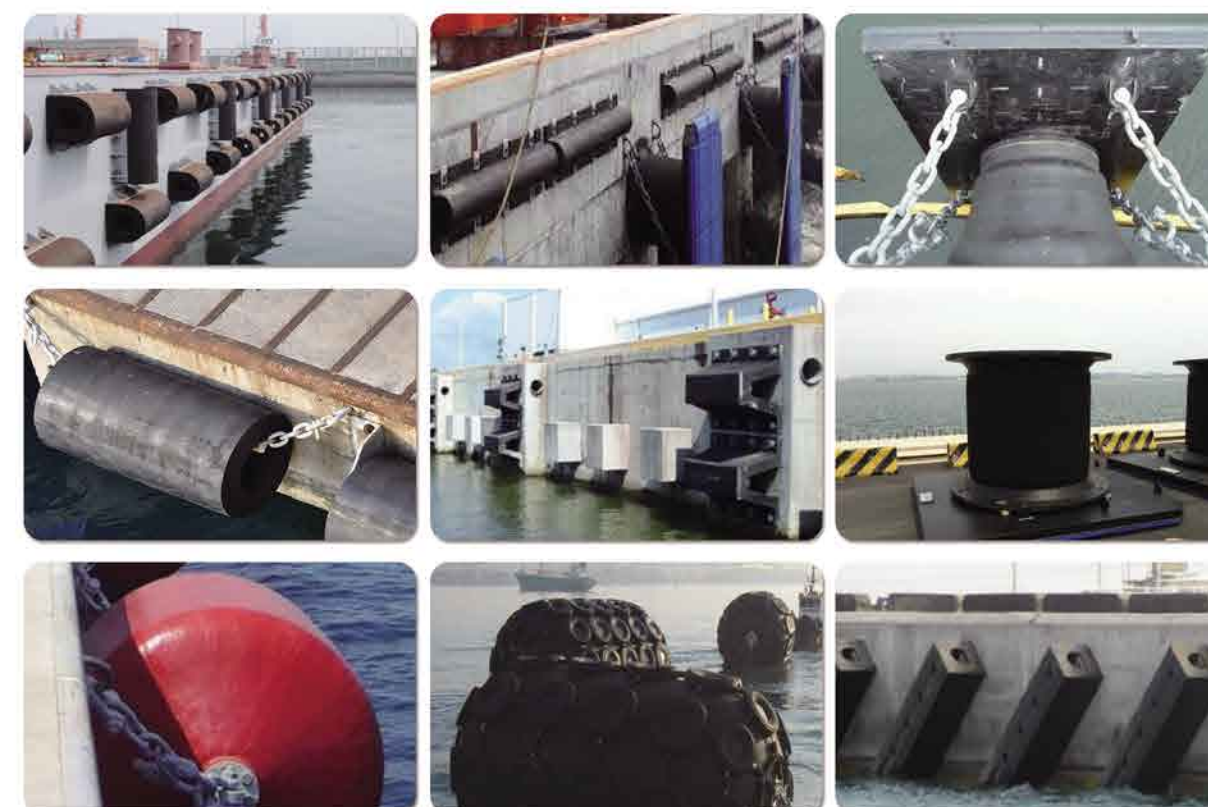


600t Press machine



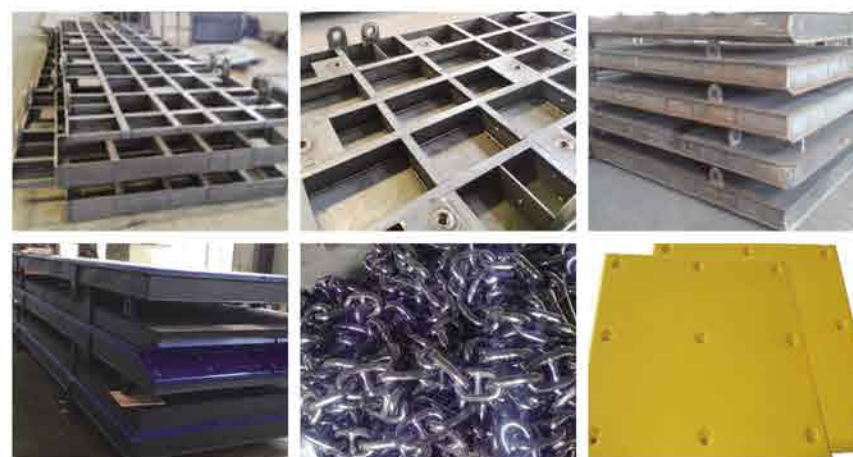
Extruding machine

MARINE FENDER PRODUCTS



We have confidence in our products and in their reliability. That is why we have decided to extend our warranty period for all type of rubber fender up to 20 years. Yes you are not dreaming. It is 20 unbeatable years!

If our fender is proven failed under normal designed berthing conditions and was not due to accident or coalition, we will compensate with the new one straight to you doorsteps with no further question asked.

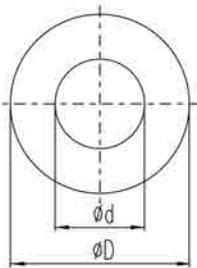
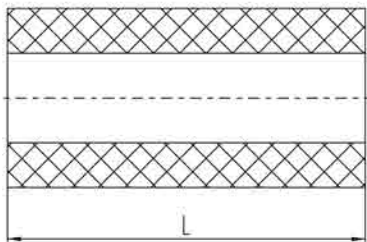


FENDER TYPE	Square	Polyurethane	Pneumatic	GD	Cone	Super Cell	Super Arch	D Type	Cylindrical	VESSLS TYPE
Tankers	×	✓	✓	×	✓	✓	*	×	*	Tankers
Gas Carriers	×	✓	✓	×	✓	✓	*	×	*	Gas Carriers
Bulk Cargo	×	✓	✓	×	✓	✓	✓	×	✓	Bulk Cargo
General Cargo	×	✓	✓	×	✓	✓	✓	×	✓	General Cargo
Container	×	*	*	×	✓	✓	*	×	*	Container
RoRo	×	✓	✓	×	✓	✓	✓	×	✓	RoRo
Passenger Ferry	×	✓	✓	×	✓	✓	✓	×	✓	Passenger Ferry
Cruise Ship	×	✓	✓	×	✓	✓	*	×	*	Cruise Ship
High Speed Ferries	*	*	*	×	✓	✓	*	×	*	High Speed Ferries
Naval Vessels	✓	*	*	×	✓	✓	✓	×	*	Naval Vessels
Submarines	*	×	×	×	*	*	×	×	*	Submarines
Fishing Boats	✓	*	*	×	*	*	✓	✓	×	Fishing Boats
Pleasure Crafts	✓	*	*	×	✓	✓	✓	✓	×	Pleasure Crafts
Pontoons	✓	*	*	×	*	*	✓	✓	✓	Pontoons
Pile Guides	×	×	×	×	*	*	*	×	×	Pile Guides
Lock Entrances	×	×	×	×	*	*	✓	×	*	Lock Entrances
Dry Docks	*	×	×	×	*	*	✓	*	*	Dry Docks
Jetty Corners	*	×	×	×	*	*	*	*	*	Jetty Corners
Linspans	✓	×	×	×	✓	✓	✓	✓	*	Linspans
Bridge Protection	*	*	*	×	✓	✓	✓	*	*	Bridge Protection
Tugs for Berthing	✓	*	*	×	*	*	✓	✓	✓	Tugs for Berthing
Tugs for Ship Mounted	✓	×	×	✓	×	×	*	✓	×	Tugs for Ship Mounted

✓ Generally suitable
 * Possibly suitable
 × Not suitable

CYLINDRICAL RUBBER FENDER

MARINE FENDER PRODUCTS



FEATURES

- 1.Low reaction, reasonable energy absorption,low hull pressure;
- 2.Suit to rolling and pitching of berthing vessels;
- 3.Wide-range use;
- 4.Easy to install and maintain, versatile installation, vertical, horizontal, diagonal;

SPECIFICATION

Fender (mm)	Dimensions			
	D(mm)	d(mm)	Max. Length (mm)	Approx. Weight (kg/m)
CY150xL	150	75	10000	15
CY200xL	200	100	10000	28
CY250xL	250	125	10000	45
CY300xL	300	150	10000	64
CY400xL	400	200	8000	110
CY500xL	500	250	8000	175
CY600xL	600	300	3000	250
CY700xL	700	350	3000	345
CY800xL	800	400	3000	450
CY900xL	900	450	3000	570
CY1000xL	1000	500	3000	710
CY1200xL	1200	600	3000	1020
CY1400xL	1400	700	3000	1400
CY1600xL	1600	800	3000	1800

Other specifications out of the series can be produced upon request.

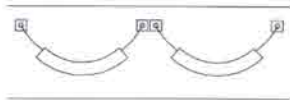
PERFORMANCE

Fender (mm)	Rate Compression Deflection50%				Rate Compression Deflection40%			
	Performance				Performance			
	RO		RH		RO		RH	
	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)
CY150×1000	45	1.5	73	73	30	0.9	50	1.4
CY200×1000	61	2.7	97	97	41	1.7	65	2.6
CY250×1000	76	4.2	122	122	52	2.6	82	4.0
CY300×1000	91	6.0	146	146	62	3.6	98	5.9
CY400×1000	121	10.6	195	195	83	6.5	131	10.4
CY500×1000	151	16.4	244	244	103	10.1	164	16.5
CY600×1000	182	24	292	292	124	15	196	23
CY700×1000	212	32	341	341	145	20	229	31
CY800×1000	242	42	390	390	165	26	262	41
CY900×1000	273	53	439	439	186	32	295	53
CY1000×1000	303	65	488	488	206	40	328	64
CY1200×1000	370	95	588	588	252	61	393	92
CY1400×1000	430	130	683	683	292	80	459	126
CY1600×1000	490	173	781	781	334	107	525	164

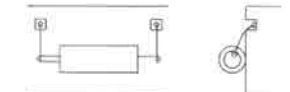
Note: Performance tolerance ±10%



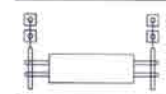
Chain Bearing



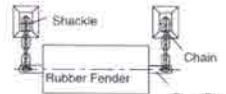
Chain and Steel Bar Bearing



Trapsna Bearing



Fixing Parts

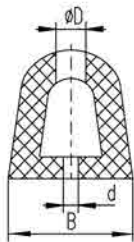
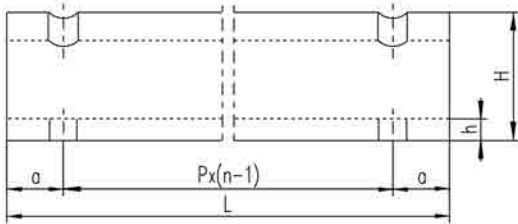


Steel Bar



D TYPE RUBBER FENDER

MARINE FENDER PRODUCTS



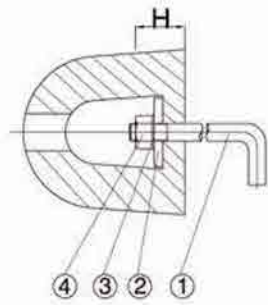
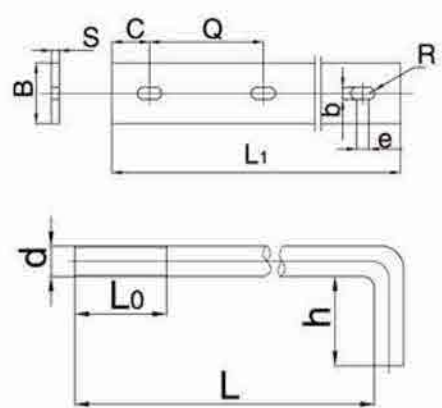
FEATURES

- 1.Suitable reaction force, with higher energy absorption than Cylindrical rubber fender;
2. Easy to install and maintain;
- 3.Applicable for frame dock and ship due to the smaller bottom width;

SPECIFICATION

Type	Dimension(mm)										Dimension (mm)	
	H	B	L	n	P	a	h	D	d		Rate Compression Deformation 50%	
D300×300×850-3z	300	300	850	3	325	100	40	65	32	255	10	
D300×300×900-2z	300	300	900	2	600	150	40	65	32	270	10.6	
D300×300×1500-3z	300	300	1500	3	600	150	40	65	32	450	17	
D300×300×1500-4z	300	300	1500	4	400	150	40	65	32	450	17	
D300×300×1500-5z	300	300	1500	5	325	100	40	65	32	450	17	
D300×300×2000-4z	300	300	2000	4	500	250	50	65	32	600	22	
D300×360×850-3z	300	360	850	3	325	100	45	65	32	276	11	
D300×360×1500-5z	300	360	1500	5	325	100	45	65	32	490	20	
D400×360×1500-4z	400	360	1500	4	400	150	65	65	42	490	20	
D500×500×850-3z	500	500	850	3	325	100	90	97	45	395	27	
D500×500×1500-5z	500	500	1500	5	325	100	90	97	45	700	48	

Other specifications out of the series can be produced upon request.
Note: Performance tolerance ±10%

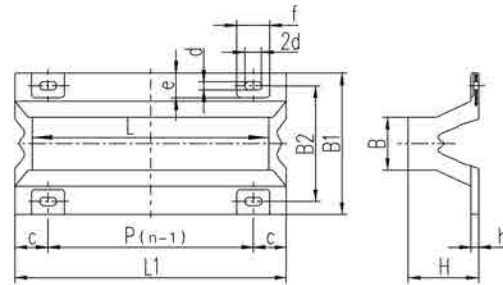


- ① Bolt
- ② Press Plate
- ③ Washer
- ④ Nut



SUPER ARCH RUBBER FENDER

MARINE FENDER PRODUCTS



FEATURES

1. With high energy absorption, low reaction force;
2. Reasonable structure, with long life span;
3. Easy installation;

SPECIFICATION

Dimensions	Size(mm)												
	H	L	B	L1	B1	B2	c	p	d	e	f	h	n
SA-A300*225*1000	300	1000	225	1150	600	490	140	870	35	105	140	33	2
SA-A300*225*1500	300	1500	225	1650	600	490	140	685	35	105	140	33	3
SA-A300*225*2000	300	2000	225	2150	600	490	137.5	625	35	105	140	33	4
SA-A300*225*2500	300	2500	225	2650	600	490	140	790	35	105	140	33	4
SA-A300*225*3000	300	3000	225	3150	600	490	145	715	35	105	140	33	5
SA-A300*225*3500	300	3500	225	3650	600	490	140	674	35	105	140	33	6
SA-A400*300*1000	400	1000	300	1200	800	670	150	900	41	120	165	40	2
SA-A400*300*1500	400	1500	300	1700	800	670	150	700	41	120	165	40	3
SA-A400*300*2000	400	2000	300	2200	800	670	147.5	635	41	120	165	40	4
SA-A400*300*2500	400	2500	300	2700	800	670	150	800	41	120	165	40	4
SA-A400*300*3000	400	3000	300	3200	800	670	150	725	41	120	165	40	5
SA-A400*300*3500	400	3500	300	3700	800	670	150	680	41	120	165	40	6
SA-A500*375*1000	500	1000	375	1250	1000	840	160	930	47	140	180	45	2
SA-A500*375*1500	500	1500	375	1750	1000	840	160	715	47	140	180	45	3
SA-A500*375*2000	500	2000	375	2250	1000	840	157.5	645	47	140	180	45	4
SA-A500*375*3000	500	3000	375	3250	1000	840	165	730	47	140	180	45	5
SA-A500*375*3500	500	3500	375	3750	1000	840	160	686	47	140	180	45	6
SA-A600*450*1000	600	1000	450	1300	1200	1010	170	960	50	160	195	54	2
SA-A600*450*1500	600	1500	450	1800	1200	1010	170	730	50	160	195	54	3
SA-A600*450*2000	600	2000	450	2300	1200	1010	167.5	655	50	160	195	54	4
SA-A600*450*2500	600	2500	450	2800	1200	1010	170	820	50	160	195	54	4
SA-A600*450*3000	600	3000	450	3300	1200	1010	170	740	50	160	195	54	5
SA-A600*450*3500	600	3500	450	3800	1200	1010	170	692	50	160	195	54	6
SA-A800*600*1000	800	1000	600	1400	1600	1340	180	1040	68	260	270	72	2
SA-A800*600*1500	800	1500	600	1900	1600	1340	180	770	68	260	270	72	3
SA-A800*600*2000	800	2000	600	2400	1600	1340	182.5	680	68	260	270	72	4
SA-A800*600*2500	800	2500	600	2900	1600	1340	180	845	68	260	270	72	4
SA-A800*600*3000	800	3000	600	3400	1600	1340	180	760	68	260	270	72	5
SA-A1000*750*1000	1000	1000	750	1500	2000	1680	200	1100	68	300	290	90	2
SA-A1000*750*1500	1000	1500	750	2000	2000	1680	200	800	68	300	290	90	3
SA-A1000*750*2000	1000	2000	750	2500	2000	1680	200	700	68	300	290	90	4

PERFORMANCE

SA-A300H Rubber fender

	RS				RH				RO				RI			
	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
Rate Compression Deformation	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
Performance	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
SA-A300Hx1000L	324	41	450	44	249	31	346	33	206	26	286	28	177	22	246	24
1.5M	486	62	675	66	374	47	519	50	309	39	429	42	266	33	369	36
2.0M	648	82	900	88	498	62	692	66	412	52	572	56	354	44	492	48
2.5M	810	103	1125	110	623	78	865	83	515	65	715	70	443	55	615	60
3.0M	972	123	1350	132	747	93	1038	99	618	78	855	84	531	66	738	72
3.5M	1134	144	1575	154	872	109	1211	116	721	91	1001	98	620	77	861	84

SA-A400H Rubber fender

	RS				RH				RO				RI			
	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
Rate Compression Deformation	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
Performance	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
SA-A400x1000L	432	73	600	78	332	56	461	60	275	46	382	49	236	40	328	43
1.5M	648	110	900	117	498	84	692	90	413	69	573	74	354	60	492	65
2.0M	864	146	1200	156	664	112	922	120	550	92	764	98	472	80	656	86
2.5M	1080	183	1500	195	830	140	1153	150	688	115	955	123	590	100	820	108
3.0M	1296	219	1800	234	996	168	1383	180	825	138	855	147	708	120	984	129
3.5M	1512	256	2100	273	1162	196	1614	210	963	161	1001	172	826	140	1148	151

SA-A800H Rubber fender

	RS				RH				RO				RI			
	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
Rate Compression Deformation	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
Performance	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
SA-A800X1000L	864	290	1200	311	664	223	922	239	550	185	764	198	472	159	656	170
1.5M	1296	435	1800	467	996	335	1383	359	825	278	1146	297	708	239	984	255
2.0M	1728	580	2400	622	1328	446	1844	478	1100	370	1528	396	944	318	1312	340
2.5M	2160	725	3000	778	1660	558	2305	598	1375	463	1910	495	1180	398	1640	425
3.0M	2592	870	3000	933	1992	669	2766	717	1650	555	2292	594	1416	477	1968	510

SA-A1000H Rubber fender

	RS				RH				RO				RI			
	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
Rate Compression Deformation	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
Performance	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
SA-A400x1000L	1080	454	1500	486	830	349	1153	374	688	289	956	310	590	248	820	266
1.5M	1620	681	2250	729	1245	524	1730	561	1032	434	1434	465	885	372	1260	399
2.0M	2160	908	3000	972	1660	698	2306	748	1376	578	1912	620	1180	496	1640	532

SA-A500H Rubber fender

	RS				RH				RO				RI			
Rate Compression Deformation	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
Performance	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
SA-A500x1000L	540	113	750	121	415	87	576	93	344	72	478	77	295	62	410	66
1.5M	810	170	1125	182	623	131	864	140	516	108	717	116	443	93	615	99
2.0M	1080	226	1500	242	830	174	1152	186	688	144	956	154	590	124	820	132
2.5M	1350	283	1875	303	1038	218	1440	233	860	180	1195	193	738	155	1025	165
3.0M	1620	339	2250	363	1245	261	1728	279	1032	216	1434	231	885	186	1230	198
3.5M	1890	396	2625	424	1453	305	2016	326	1204	252	1673	270	1033	217	1435	231

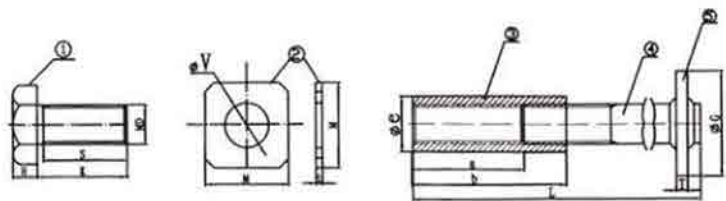
SA-A600H Rubber fender

	RS				RH				RO				RI			
Rate Compression Deformation	52.5%		55%		52.5%		55%		52.5%		55%		52.5%		55%	
Performance	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M	KN	KN.M
SA-A600x1000L	647	163	899	175	498	126	692	135	412	104	572	111	354	89	492	95
1.5M	971	245	1349	263	747	189	1038	203	318	156	858	167	531	134	738	143
2.0M	1294	326	1798	350	996	252	1384	270	824	208	1144	222	708	178	984	190
2.5M	1618	408	2248	438	1245	315	1730	338	1030	260	1430	278	885	223	1230	238
3.0M	1941	489	2697	525	1949	378	2076	405	1236	312	1716	333	1062	167	1476	285
3.5M	2265	571	3147	613	1734	441	2422	473	1442	364	2002	389	1239	312	1722	333

Accessories Features

NO.	Name	Material
1	Bolt	SS400,SM490,JIS G3101/JIS G3106, ASTM A36, Q235, Q235 HDG
2	Washer	SS400,SUS304, JIS G 3101, JIS G4303, Q235, Q235HDG,ASTM A36, AISI304
3	Anchor Bolt	SS400,SUS304,JIS G3101, JIS G4303, ASTM A36, AISI 304
4	Foot rod	SS400,SM490,JIS G3101/G3106, ASTM A36, Q235;
5	Foot board	SS400,SM490, JIS G 3101/G3106, ASTM A36, Q235

Installation



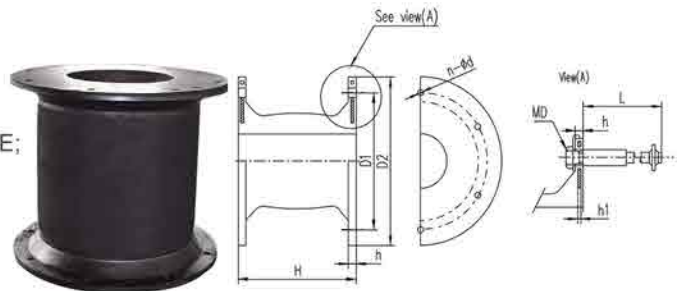
SUPER CELL RUBBER FENDER

MARINE FENDER PRODUCTS



FEATURES

- 1.HIGH PERFORMANCE, REASONABLE STRUCTURE;
- 2.CAN SUPPORT LARGE PANELS;
- 3.EASY INSTALLATION , WITH LONG LIFE SPAN;



SPECIFICATION

Fender	Dimensions(mm)									
	H	D1	D2	h	n	φd	MD	h1	L	
SC800	800	900	1050	30	6	40	32	14	360	
SC1000	1000	1100	1300	35	6	47	39	18	430	
SC1150	1150	1300	1500	37	6	50	42	18	500	
SC1250	1250	1450	1650	40	6	53	45	22	500	
SC1450	1450	1650	1850	42	6	61	52	22	570	
SC1600	1600	1800	2000	45	8	61	52	26	570	
SC1700	1700	1900	2100	50	8	66	56	28	620	
SC2000	2000	2000	2200	50	8	74	64	28	700	
SC2250	2250	2300	2550	57	10	74	64	32	700	
SC2500	2500	2700	2950	70	10	74	64	38	700	
SC3000	3000	3150	3350	75	12	90	76	40	800	

Other specifications out of the series can be produced upon request.

PERFORMANCE

Max Compression Deflection 55%

Rated Compression Deflection 52.5%

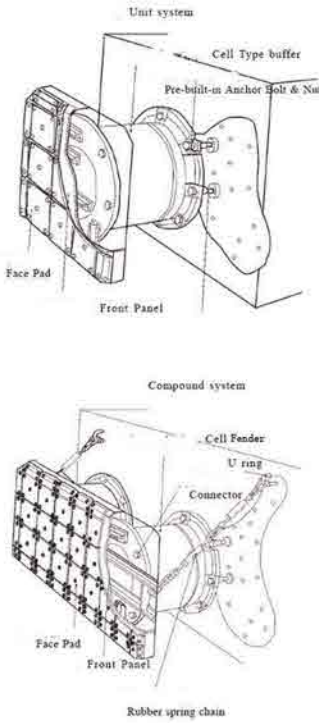
Fender	Max Compression Deflection 55%										Fender	Rate Compression Deflection 52.5%									
	Performance											Performance									
	RE		RS		RH		RO		RL			RE		RS		RH		RO		RL	
	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)		R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)	R(KN)	E(KNM)
SC800	493	173	437	153	378	132	292	102	225	78	SC800	464	163	412	145	355	125	275	96	211	75
SC1000	880	350	710	310	615	269	473	207	379	116	SC1000	752	330	668	293	579	254	445	195	356	156
SC1150	1058	532	939	472	814	409	626	315	501	252	SC1150	995	502	883	446	765	387	589	297	471	238
SC1250	1250	683	1109	606	961	526	739	404	592	323	SC1250	1176	654	1043	573	904	496	696	382	556	305
SC1450	1682	1066	1493	947	1294	820	995	631	796	505	SC1450	1582	1007	1404	894	1217	775	936	596	749	477
SC1600	2007	1405	1781	1247	1544	1080	1189	832	950	665	SC1600	1888	1326	1676	1177	1453	1020	1117	786	894	628
SC1700	2311	1719	2052	1525	1778	1322	1368	1017	1094	814	SC1700	2174	1623	1930	1441	1673	1249	1287	960	1027	768
SC2000	3199	2798	2839	2484	2561	2153	1893	1656	1514	1325	SC2000	3000	2643	2671	2346	2315	2033	1781	1564	1425	1251
SC2250	4494	4423	3989	3925	3457	3402	2659	2617	2260	2224	SC2250	4228	4178	3752	3702	3252	3214	2502	2473	2126	2105
SC2500	5549	6067	4925	5385	4268	4667	3283	3590	2791	3051	SC2500	5220	5730	4633	5086	4015	4408	3088	3391	2625	2882
SC3000	6750	7200	N/A	N/A	NA	N/A	5200	5450	4400	4650	SC3000	5800	6700	N/A	N/A	NA	N/A	4400	5100	3750	4300

Note: Performance tolerance ±10%

Note: Performance tolerance ±10%

INSTALLATION

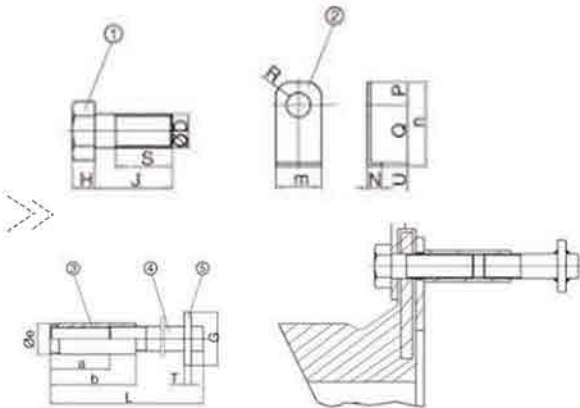
Main accessories and Applications



NO.	Name	Applications	Material
1	U-Anchor	To hang the rubber springs chain	SS400,SUS304,SUS316, JIS G3101, JIS G4303, ASTM A36, Q235, Q235 HDG
2	Anchor Bolt	Mounting the fender on a wharf or a dolphin	SUS400,SUS304, JIS G3101, JIS G4303, ASTM A36, AISI 304,Q235, Q235 HDG
3	Frontal frame	Reducing surface pressure and protecting the hull of vessel	SS400,SM490,JIS G3101, JISG3106,ASTM A36, Q235, Q235HDG
4	Frontal Pad	Reducing the friction coefficient and protecting the ship's hull	UHMW-PE
5	Weight Chain	Support of frontal frame	SBC50, JIS G3105, Q235, Q235HDG;
6	Shear Chain	Retraining stretching of the fender at partial compredion	SBC50, JIS G3105, Q235, Q235HDG;
7	Tension Chain	Resisting stretching of the fender at partial compredion	SBC50, JIS G3105, Q235, Q235HDG;
8	Fender	Absorb ship impact energy to protect dock and vessels	Natural Rubber

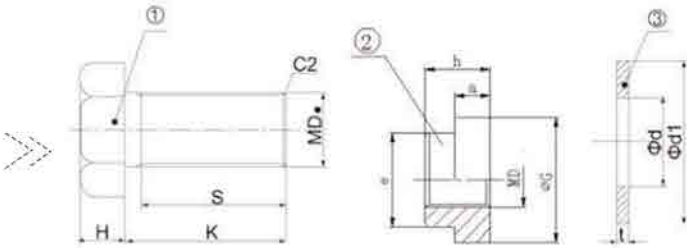
ANCHOR AND CONNECTOR

NO.	Name	Material
1	Bolt	SS400, SUS304, JISG 3101, JISG4303, ASTM A36, Q235, Q235HDG
2	Washer	SS400, SUS304, JISG 3101, JISG4303, ASTM A36, Q235, Q235HDG
3	Anchor Bolt	SS400, SUS304, JISG 3101, JISG4303, ASTM A36, Q235, Q235HDG
4	Foot rod	SS400, SM490, JISG 3101, JIS G3106, ASTM A36, Q235, Q235 HDG
5	Foot board	SS400, SM490, JISG 3101, JIS G3106, ASTM A36, Q235, Q235 HDG



FASTENING BOLT FOR FRONTAL FRAME

NO.	Name	Material
1	Bolt	SS400,SUS304, JIS G3101, JISG 4303, ASTM A36, Q235, Q235 HDG
2	Nuts	SS400,SUS304, JIS G3101, JISG 4303, ASTM A36, Q235, Q235 HDG
3	Washer	SS400,SUS304, JIS G3101, JISG 4303, ASTM A36, Q235, Q235 HDG

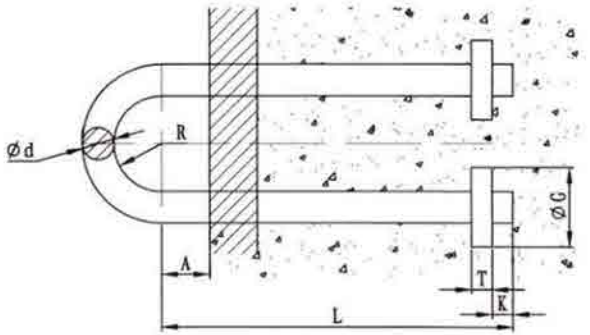


FASTENING BOLT FOR FRONTAL PAD

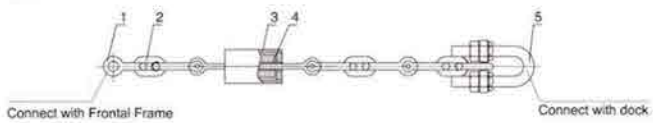
NO.	Name	Material
1	Bolt	SS400,SUS304, JIS G3101, JISG 4303, ASTM A36, Q235, Q235 HDG
2	Nuts	SS400,SUS304, JIS G3101, JISG 4303, ASTM A36, Q235, Q235 HDG
3	Washer	SS400,SUS304, JIS G3101, JISG 4303, ASTM A36, Q235, Q235 HDG

U-ANCHOR

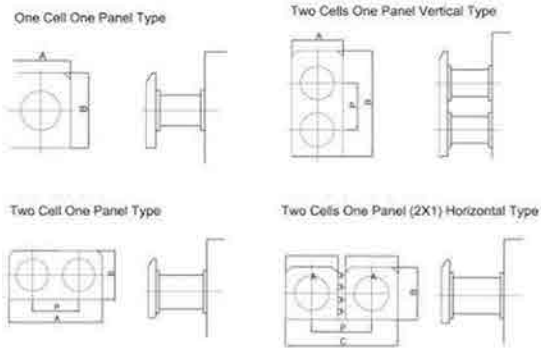
Specifications	d	R	A	B	L	T	K	G
SC800	50	75	70	250	650	30	30	120
SC1000	60	75	70	250	750	30	30	120
SC1150	60	75	70	250	750	30	30	120
SC1250	60	90	70	250	790	30	30	120
SC1450	60	90	70	250	850	30	30	120
SC1600	60	90	70	250	900	30	30	120
SC1700	70	90	70	250	1100	30	30	120
SC2000	70	90	70	250	1220	30	30	130
SC2250	80	120	70	300	1300	30	30	160
SC2500	80	120	70	300	1400	30	30	160
SC3000	90	130	80	320	1500	30	30	180



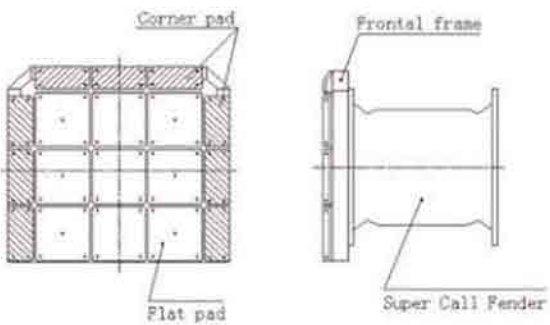
CHAIN

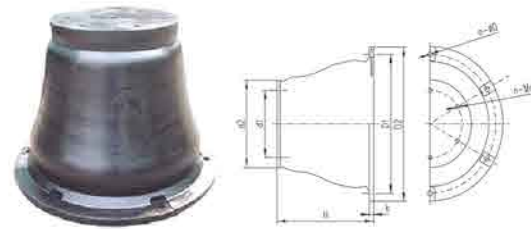


FRONTAL FRAME



FRONTAL PAD





FEATURES

1. Suitable structure, with high energy absorption;
2. With good compression specification;
3. With long life span;

SPECIFICATION

Fender (mm)	Dimensions							
	D1	D2	H	h	d1	d2	φD	Md
CT500H	675	750	500	25	325	425	4-φ30	4-M24
CT600H	810	900	600	27	390	510	6-φ30	6-M24
CT700H	945	1050	700	32	455	595	6-φ38	6-M30
CT800H	1080	1200	800	36	520	680	6-φ44	6-M36
CT900H	1215	1350	900	41	585	765	6-φ44	6-M36
CT1000H	1350	1500	1000	45	650	850	6-φ50	6-M42
CT1100H	1485	1650	1100	49.5	715	935	6-φ50	6-M42
CT1200H	1620	1800	1200	54	780	1020	8-φ50	8-M42
CT1300H	1755	1950	1300	58.5	845	1105	8-φ56	8-M48

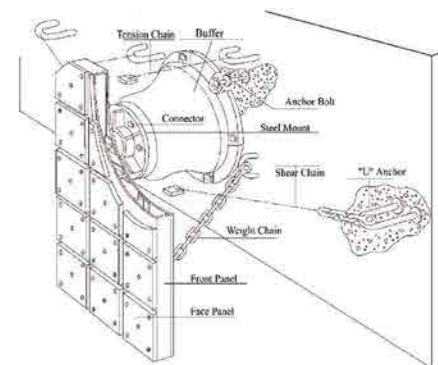
Other specifications out of the series can be produced upon request.

PERFORMANCE

Fender (mm)	Rate Compression Deformation 70%					
	Performance					
	RS		RH		RO	
	R(KN)	E(KN.M)	R(KN)	E(KN.M)	R(KN)	E(KN.M)
CT500H	270	92	200	66	150	46
CT600H	410	139	320	105	250	78
CT700H	560	218	450	166	360	129
CT800H	720	324	570	245	450	189
CT900H	930	465	740	355	590	271
CT1000H	1160	626	920	478	730	365
CT1100H	1400	826	1120	638	890	489
CT1200H	1650	1056	1300	806	1040	624
CT1300H	1950	1346	1560	1029	1240	793

Fender (mm)	Max Compression Deformation 72%					
	Performance					
	RS		RH		RO	
	R(KN)	E(KN.M)	R(KN)	E(KN.M)	R(KN)	E(KN.M)
CT500H	302	95	220	66	180	51
CT600H	459	144	362	109	285	81
CT700H	627	226	508	172	410	134
CT800H	806	336	644	255	513	196
CT900H	1041	482	836	369	672	282
CT1000H	1300	650	1040	490	832	380
CT1100H	1568	858	1265	664	1014	509
CT1200H	1848	1097	1469	839	1185	650
CT1300H	2184	1399	1762	1072	1413	827

INSTALLATION

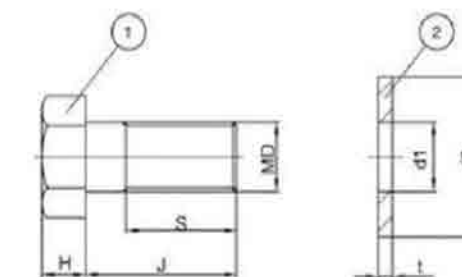
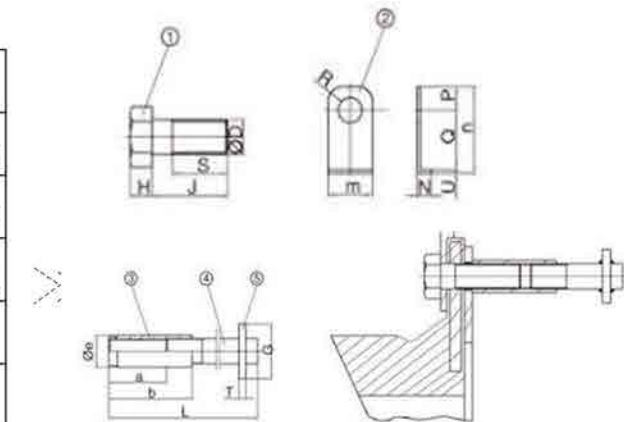


NO.	Name	Applications	Material
1	U-Anchor	To hang the rubber springs chain	SUS400, SUS304, SUS316, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
2	Anchor Bolt	Mounting the fender on a wharf or a dolphin	SUS400, SUS304, JIS G3101, JIS G4303, ASTM A36, AISI 304, Q235, Q235HDG
3	Frontal frame	Reducing surface pressure and protecting the hull of vessel	SS400, SM490, JIS G3101, JIS G3106, ASTM A36, Q235, Q235HDG
4	Frontal Pad	Reducing the friction coefficient and protecting the ship's hull	UHMW-PE
5	Weight Chain	Support of frontal frame	SBC50, JIS G3105, Q235, Q235HDG
6	Shear Chain	Retraining stretching of the fender at partial compression	SBC50, JIS G3105, Q235, Q235HDG
7	Tension Chain	Resisting stretching of the fender at partial compression	SBC50, JIS G3105, Q235, Q235HDG
8	Fender	Absorb ship impact energy to protect dock and vessels	Natural Rubber
9	Steel mount	Increase fender performance	ASTM A36, Q235



ANCHOR AND CONNECTOR

NO.	Name	Material
1	Bolt	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
2	Washer	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
3	Anchor Bolt	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
4	Foot rod	SS400, SM490, JIS G3101, JIS G3106, ASTM A36, Q235, Q235 HDG
5	Foot board	SS400, SM490, JIS G3101, JIS G3106, ASTM A36, Q235, Q235 HDG

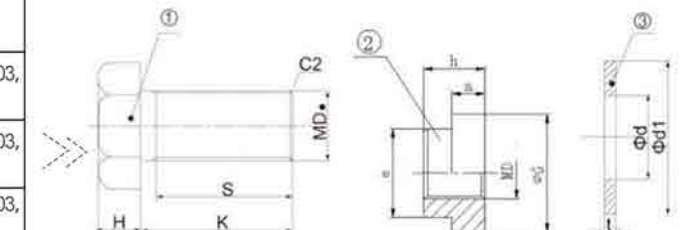


FASTENING BOLT FOR FRONTAL FRAME

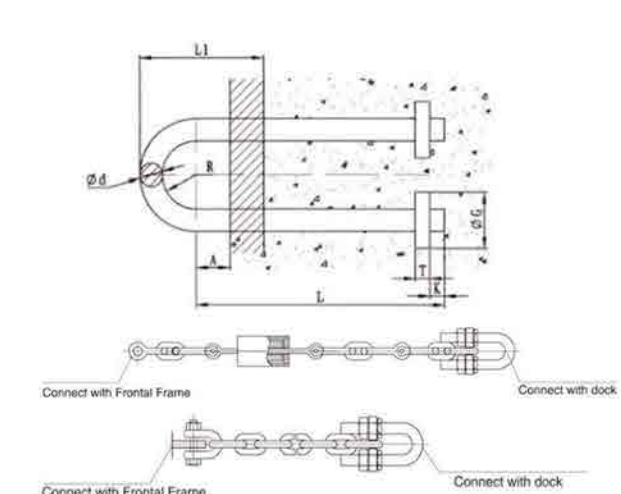
NO.	Name	Material
1	Bolt	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235 HDG
2	Washer	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235 HDG

FASTENING BOLT FOR FRONTAL PAD

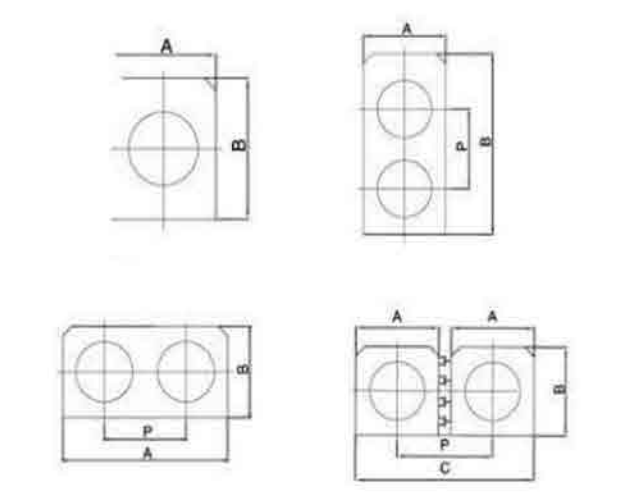
NO.	Name	Material
1	Bolt	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235 HDG
2	Nuts	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235 HDG
3	Washer	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235 HDG



U ANCHOR AND RUBBER SPRING CHAINS

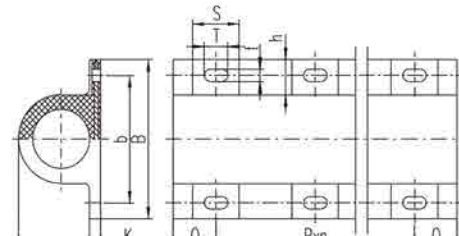


FRONTAL FRAME



GD TYPE RUBBER FENDER

MARINE FENDER PRODUCTS



FEATURES

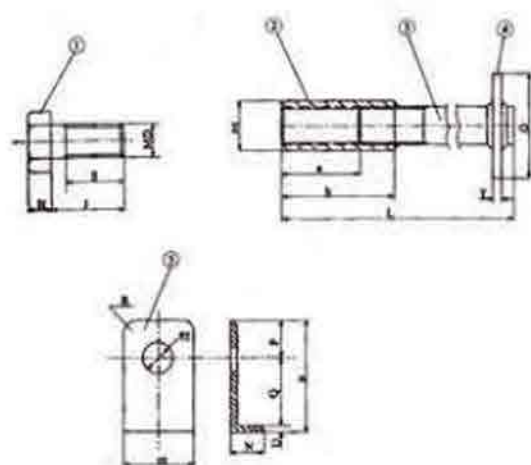
1. SUITABLE REACTION FORCE, WITH HIGH ENERGY ABSORPTION;
2. STRONG AND HARD WEARING, WITH LONG LIFE SPAN;
3. EASY INSTALLATION;

SPECIFICATION

Fender (mm)	Dimensions											Fender (mm)	Performance		Approx Weight (kg)
	H	B	b	L	Q	P	S	h	T	t	K	n	R(KN)	E(KN.M)	
GD280H*1000L	280	540	430	1000	150	700	165	120	82	41	40	1	375	14	140
GD280H*1500L	280	540	430	1500	150	600	165	120	82	41	40	2	565	21	210
GD280H*2000L	280	540	430	2000	145	570	165	120	82	41	40	3	750	28	280
GD280H*2500L	280	540	430	2500	150	550	165	120	82	41	40	4	940	35	350
GD280H*3000L	280	540	430	3000	150	540	165	120	82	41	40	5	1130	42	420

Other Specifications out of the series can be produced upon request.

INSTALLATION

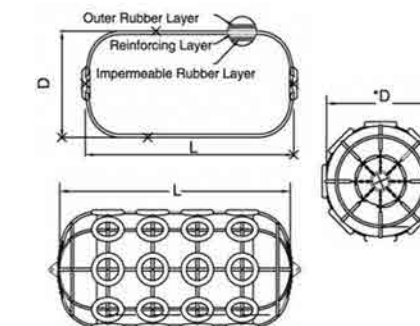


NO.	Name	Material
1	Bolt	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
2	Washer	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
3	Anchor Bolt	SS400, SUS304, JIS G3101, JIS G4303, ASTM A36, Q235, Q235HDG
4	Foot rod	SS400, SM490, JIS G310, JIS G3106, ASTM A36, Q235, Q235 HDG
5	Foot board	SS400, SM490, JIS G310, JIS G3106, ASTM A36, Q235, Q235 HDG



PNEUMATIC RUBBER FENDER

MARINE FENDER PRODUCTS



FEATURES

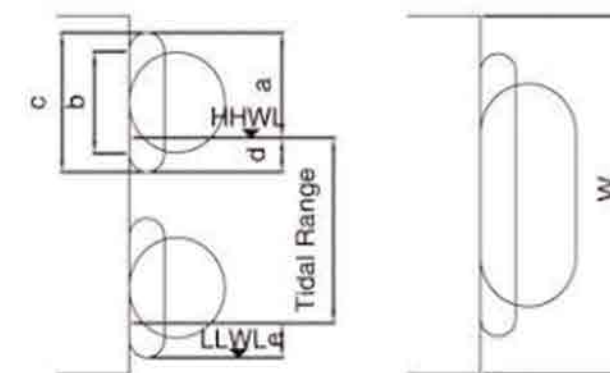
1. With low reaction force, high energy absorption;
2. Suitable for large scale ships in docks and lightering;
3. Easy to install and maintain;

SPECIFICATION

size	Fender body	Chain weight	Total weight	Chian
300*500	8	-	8	10
400*800	20	-	20	12.5
500*1000	25	20	45	12.5
600*1000	28	22	50	14
700*1500	64	150	214	16
1000*1500	125	190	315	16
1000*2000	175	230	405	16
1200*2000	208	300	508	19
1200*2400	248	320	568	19
1350*2400	270	330	600	22
1500*3000	225	490	715	22
1700*3000	365	580	945	26
2000*3500	585	980	1565	28
2200*4500	1080	1090	2170	30
2500*4000	1560	1260	2820	32
3300*6500	2585	2680	5265	44
4500*9000	4575	4810	9385	50

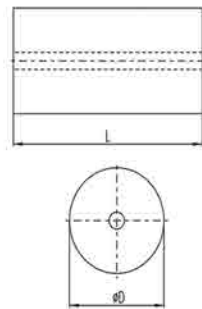
Other Specifications out of the series can be produced upon request.

INSTALLATION





POLYURETHANE FENDER



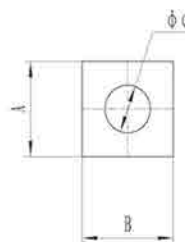
FEATURES

1. With low reaction force;
2. Easy installation;
3. Good elasticity, resistance to deformation;
4. Widely used;

Specifications		Rate Compressive Deformation 60%	
D(mm)	L(mm)	Reaction Force(ton)	Energy Absorption
300	500	1.5	0.18
400	800	4	0.38
500	1000	5	0.68
1000	1500	15	3.8
1000	2000	24	5.2
1200	2000	28	7
1500	3000	50	17
2000	3500	78	36
2000	4000	98	39
2500	4000	132	68
3000	5000	150	98
3000	6000	160	114

Other Specifications out of the series can be produced upon request.

SQUARE RUBBER FENDER



FEATURES

1. Suitable reaction force, with high energy absorption;
2. Easy to install and maintain;
3. Applicable for all kinds ports, boats;

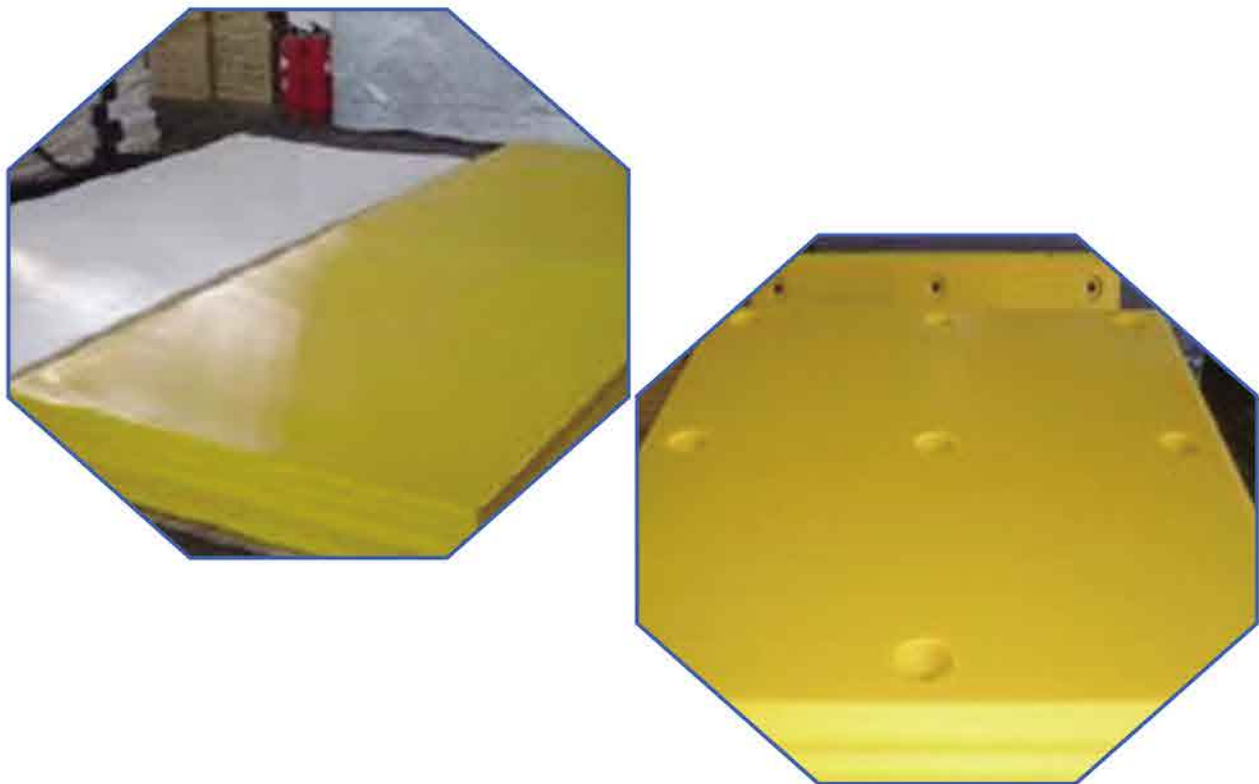
Fender(mm)	Dimensions			
	A(mm)	B(mm)	L(mm)	Ød
300*300*1000	300	300	1000	150
300*300*1500	300	300	1500	150
300*300*2000	300	300	2000	150
300*300*2500	300	300	2500	150
300*300*3000	300	300	3000	150
300*300*3500	300	300	3500	150
300*300*4000	300	300	4000	150
300*300*4500	300	300	4500	150

Other Specifications out of the series can be produced upon request.



FRONTAL FRAME & UHMW-PE PAD





RUBBER FENDER MATERIAL SPECIFICATION

Rubber Material Properties			Testing Standard	Requirements
1	Tensile Strength(MPa)		ASTM D412 DIE C	≥16
2	Elongation at Break(%)		ASTM D412 DIE C	≥350
3	Compression Set(70℃,22h,30%)		ASTM D395	≤30
4	Hardness(Shore A)		ASTM D2240	≤78
5	Tear Resistance DIE B		ASTM D624	≥80
6	Ozone Resistance (50pphm at 40℃ and 20% Strain for 100 hours)		ASTM D1149	No Visible Cracking
7	Abrasion Resistance(mm³)		ASTM D5963-04DIN 53516	≤100
8	Hot air Aging(70℃, 96h)	Tensile Strength(MPa)	ASTM D412DIE C	≥12.8
		Elongation at Break(%)	ASTM D412DIE C	≥280
		Hardness(Shore A)	ASTM D2240	Original Value+8°(Max.)



UHMW-PE PAD MATERIAL SPECIFICATION

UHMW-PE Pads Properties		Testing Standard	Requirements
1	Molecular Weight(g/mol)	Viscosimetric/ASTM D 4020 81	≥4x10 ⁶
2	Tensile Strength Break(MPa)	ASTM D 638	≥38
3	Tensile Strength(MPa)	ASTM D 638	≥20
4	Elongation at Break(%)	ASTM D 638	≥300
5	Tensile Modulus(MPa)	ISO 527/ASTM D 790 B	≥650
6	Hardness(Shore D)	ASTM D 2240	≥66
7	IZOD Impact, Notched(ft-ibs/inch)	ASTM D 256A	No Break
8	Friction Coefficient	ASTM D 1894	0.1-0.3

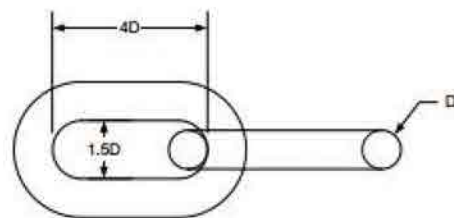
DOCK CHAIN

MARINE FENDER PRODUCTS



Our dock fender chain is a versatile open link high strength chain suitable for all fender applications. It can be supplied in any practical length and normally with a hot dip galvanized finish. All sizes are proof tested at the factory and a certificate of testing can be supplied.

Chain will be supplied hot dip galvanized according to equivalent local & international standard. Other sizes and grades are available upon special request.



NO.	Diameter (mm)	Grade 2		Grade 3		Inside Length (mm)	Inside Width (mm)
		Proof Load (metric tons)	Breaking Strength (metric tons)	Proof Load (metric tons)	Breaking Strength (metric tons)		
1	16	6.67	13.3	9.5	18.9	64	24
2	20	10.4	20.8	14.8	29.6	80	30
3	22	12.6	25.2	17.9	35.8	88	33
4	24	15.1	30.0	21.3	42.6	96	36
5	26	17.6	35.2	25.0	50.0	104	39
6	28	20.5	40.8	29.0	58.0	112	42
7	30	23.5	46.9	33.1	66.8	120	45
8	32	26.7	53.3	38.0	76.0	128	48
9	34	30.1	60.2	42.8	85.6	136	51
10	36	33.7	67.5	48.0	96.0	144	54
11	38	37.6	75.2	53.4	107	152	57
12	40	41.6	83.2	59.0	118	160	60
13	42	46	91.9	65.3	131	168	63
14	44	50.5	100	71.8	144	176	66
15	46	55.1	110	78.4	157	184	69
16	48	60	120	85.0	171	192	72
17	50	65.1	130	93.0	185	200	75
18	52	70	140	98.4	197	208	78
19	54	75.5	151	106	212	216	81
20	56	82	164	113	226	224	84
21	58	87.5	175	120	239	232	87

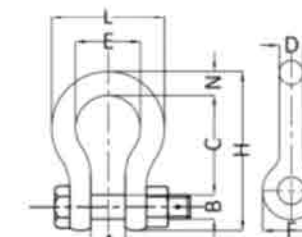
SHACKLE

MARINE FENDER PRODUCTS



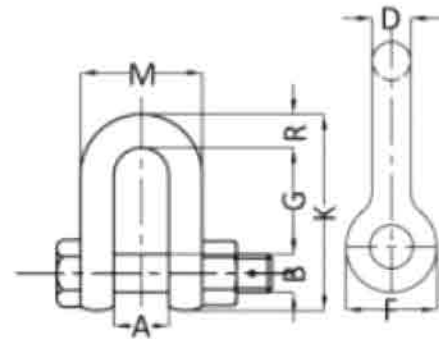
Our shackles is suitable for all fendering applications. All sizes are proof tested at the factory and a certificate of testing can be supplied.

Shackles will be supplied hot dip galvanized according to equivalent local & international standard. Other sizes and grades are available upon special request.



G2130

Size(in)	Dimensions(mm)									Wll(T)	Weight (KG)
	A	B	C	D	E	F	H	L	N		
3/16	9.65	6.35	22.4	4.85	15.2	14.2	37.3	24.9	4.85	1/3	0.03
1/4	11.9	7.85	28.7	6.35	19.8	15.5	46.7	32.5	6.35	1/2	0.05
5/16	13.5	9.65	31	7.85	21.3	19.1	53	37.3	7.85	3/4	0.1
3/8	16.8	11.2	36.6	9.65	26.2	23.1	63	45.2	9.65	1	0.15
7/16	19.1	12.7	42.9	11.2	29.5	26.9	74	51.5	11.2	1-1/2	0.22
1/2	20.6	16	47.8	12.7	33.3	30.2	83.5	58.5	12.7	2	0.36
5/8	26.9	19.1	60.5	16	42.9	38.1	106	74.5	17.5	3-1/4	0.62
3/4	31.8	22.4	71.5	19.1	51	46	126	89	20.6	4-3/4	1.23
7/8	36.6	25.4	84	22.4	58	53	148	102	24.6	6-1/2	1.79
1	42.9	28.7	95.5	25.4	68.5	60.5	167	119	26.9	8-1/2	2.28
1-1/8	46	31.8	108	28.7	74	68.5	190	131	31.8	9-1/2	3.75
1-1/4	51.5	35.1	119	31.8	82.5	76	210	146	35.1	12	5.31
1-3/8	57	38.1	133	35.1	92	84	233	162	38.1	13-1/2	7.18
1-1/2	60.5	41.4	146	38.1	98.5	92	254	175	41.1	17	8.62
1-3/4	73	51	178	44.5	127	106	313	225	57	25	15.4
2	82.5	57	197	51	146	122	348	253	61	35	23.7
2-1/2	105	70	267	66.5	184	145	453	327	79.5	55	44.6
3	127	82.5	330	76	200	165	546	365	92	85	70
3-1/2	133	95.5	372	92	229	203	626	419	105	120	120
4	140	108	368	104	254	229	653	468	116	150	153



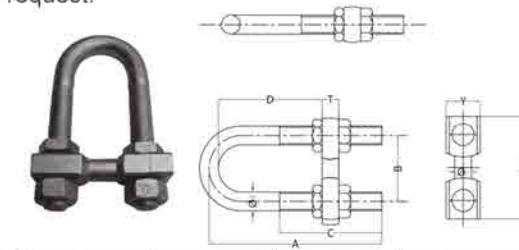
G2150

Size (In.)	Dimensions(mm)								Well (T)	Weight (KG)
	A	B	D	F	G	K	M	R		
1/4	11.9	7.85	6.35	15.5	19.1	40.4	24.6	6.35	1/2	0.06
5/16	13.5	9.65	7.85	19.1	25.4	48.5	29.5	7.85	3/4	0.1
3/8	16.8	11.2	9.65	23.1	31	58.5	35.8	9.65	1	0.15
7/16	19.1	12.7	11.2	26.9	36.1	67.5	41.1	11.2	1-1/2	0.22
1/2	20.6	16	12.7	30.2	41.4	77	46	12.7	2	0.34
5/8	26.9	19.1	16	38.1	51	95.5	58.5	16	3-1/4	0.67
3/4	31.8	22.4	19.1	46	60.5	115	70	20.6	4-3/4	1.14
7/8	36.6	25.4	22.4	53	71.5	135	81	24.6	6-1/2	1.74
1	42.9	28.7	25.4	60.5	81	151	93.5	25.4	8-1/2	2.52
1-1/8	46	31.8	28.7	68.5	91	172	103	31.8	9-1/2	3.45
1-1/4	51.5	35.1	31.8	76	100	191	115	35.1	12	4.9
1-3/8	57	38.1	35.1	84	111	210	127	38.1	13-1/2	6.24
1-1/2	60.5	41.4	38.1	92	122	230	137	41.1	17	8.39
1-3/4	73	51	44.5	106	146	279	162	54	25	14.2
2	82.5	57	51	122	172	312	184	60	35	21.2
2-1/2	105	70	66.5	145	203	377	238	66.5	55	38.6
3	127	82.5	76	165	216	429	279	89	85	56

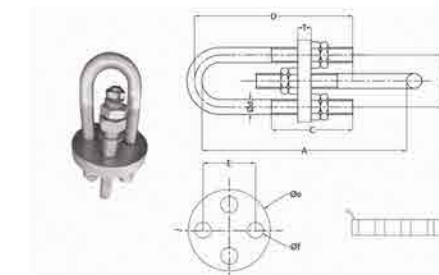


Our tensioner is suitable for all fendering applications. All sizes are proof tested at the factory and a certificate of testing can be supplied.

Tensioners will be supplied hot dip galvanized according to equivalent local & international standard. Other sizes and grades are available upon special request.



Size	A	B	C	D	T	X	Y	d	e
M30	290	110	170-220	172	28	165	55	32	28
M36	330	125	195-260	198	32	195	65	36	32
M39	365	140	215-280	220	36	215	73	40	36
M42	400	150	240-310	237	40	230	80	42	40
M45	430	160	255-335	257	40	250	90	46	40
M48	455	170	275-355	271	45	265	95	48	45
M52	485	185	290-375	292	45	285	100	52	45
M56	520	195	310-410	312	50	300	105	56	50
M60	560	210	335-440	335	55	325	115	60	55
M64	600	225	360-470	358	60	345	120	64	60
M68	640	245	380-500	385	60	365	120	70	60



Size	A	B	C	D	T	d	e	t
M20	230-305	70	140	200	25	20	120	23
M22	250-340	78	140	220	25	22	125	28
M24	270-350	84	160	240	30	24	150	28
M27	310-420	95	180	270	30	27	180	31
M30	345-465	106	200	300	35	30	200	34
M36	420-560	126	220	360	40	36	210	40
M42	460-650	148	315	420	50	42	250	46
M48	530-755	168	315	480	55	48	280	52
M56	450-550	196	230	390	60	56	330	60
M60	680-950	210	400	600	65	60	360	65
M64	730-1010	224	420	640	70	64	380	70



1.0 INTRODUCTION

Marine fenders provide the necessary interface between berthing ships and berth structures. Therefore the principle function of fenders is as an energy absorption device that transformed ship berthing energies into reactions which both the ships and berth structures can safely sustain.

Fender system can be categorized according to the mode by which they absorb or dissipate the kinetic energy of the berthing ship. Common types used are buckling type fender system, pneumatic fender system and side loaded fender system.

Buckling type fender system also known as elastomeric fender units are the most commonly used to accommodate large ships.

Unit formed of an energy-absorbing rubber elements that absorbed berthing energy by virtue of work required to deform them elastically by compression, bending or shear or a combination of such effects. These rubber fender systems are assembled in various shape i.e. circular or longitudinal shape with panel contact or direct contact.

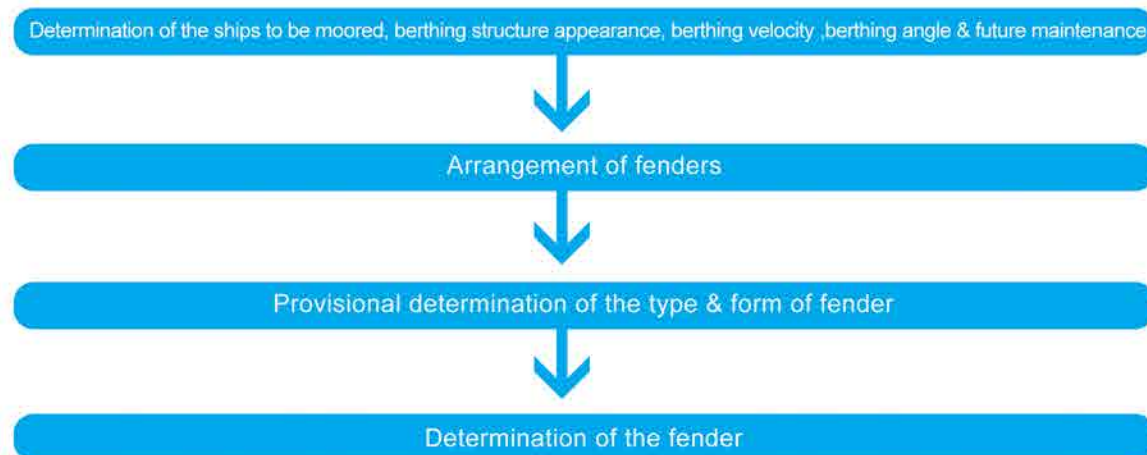
In such a fender system, the selection of the type of rubber fenders and their installation is influenced by factors such as the strength of the vessel's hull, the berthing method, the configuration of the berth itself etc.

This technical data sheet details the selection procedure for the fender system to be fabricated and installed accordingly to the reliable guidelines established for design, manufacturing and testing of the rubber fender:

- Code of Practice for Maritime Structures, BS 6349 : Part 1 : 1984 : General Criteria
- Code of Practice for Maritime Structures, BS 6349 : Part 4 : 1997 : Design of Fendering and Mooring System
- PIANC - Marcom WG33, recommended by The World Port Development.
- Japanese Inspection Standard for Solid Rubber Dock Fenders.
- EM 1110-2-1613 - US Army Corps of Engineers - Hydraulic Design of Deep Draft Navigation Projects (As a reference)
- EM 1110-2-2611 - US Army Corps of Engineers - Engineering for Prefabricated Construction of Navigation Projects (As a reference)

2.0 DETERMINATION OF THE FENDER

The design of the fender systems shall be made generally according to the following sequence:



3.0 BERTHING ENERGY CALCULATION (DESIGN NOTES)

To determine the kinetic energy that must be absorbed by the fender system, the kinetic energy of the berthing vessel is defined as:

$$E_{\text{ship}} = \frac{1}{2} M \cdot V^2$$

where,

E_{ship} = berthing energy of the ship (kJm) ,

M = mass of design vessel (displacement in tonnes) = W/g

W = the weight of the ship (tonnes) ,

g = acceleration due to gravity (m/s^2), and

V = speed of approaching vessel perpendicular to the berth (m/s)

The energy that the fender system must absorb is obtained by multiplying the kinetic energy of the berthing ship by coefficients that account for the position, C_e , and type, C_s , of vessel, the location of the docking structure, C_c , and the hydrodynamic mass, C_m .

Ultimate berthing energy under normal operational condition:

$$E_n = \frac{1}{2} M \cdot v^2 \cdot C_e \cdot C_m \cdot C_s \cdot C_c$$

Ultimate berthing energy under abnormal operational condition:

$$E_a = \frac{1}{2} M \cdot v^2 \cdot C_e \cdot C_m \cdot C_s \cdot C_c \cdot C_{ab}$$

where,

E_n = kinetic energy (under normal conditions) to be absorbed by fender system (kJm)

M = mass of design vessel (displacement in tonnes) = W/g

v = speed of approaching vessel perpendicular to the berth (m/s)

C_e = eccentricity factor

C_m = virtual mass factor

C_s = softness factor

C_c = berth configuration factor/cushion factor

C_{ab} = abnormal impact factor

3.1 Mass of the Design Vessel (M)

The displacement tonnage (M) of a vessel is the total mass of the vessel and calculated from the water displaced multiplied by the water density.

Dimensions and tonnage, etc. relating to types of vessels can be estimated from the tables given as given by PIANC :

General Cargo	GRT=0.712 DWT
Bulk Carrier	GRT=0.538 DWT
Container	GRT=0.880 DWT
Oil Tanker	GRT=0.553 DWT
Ro/Ro	GRT=1.217 DWT
Passenger Liner	GRT=7.657 DWT
Ferry	GRT=4.490 DWT
Gas Carrier	GRT=1.185DWT

Note:

DWT	dead weight tonnage
GRT	gross registered tonnage
M	mass of vessel
$\underline{M}$	displacement tonnage of vessel

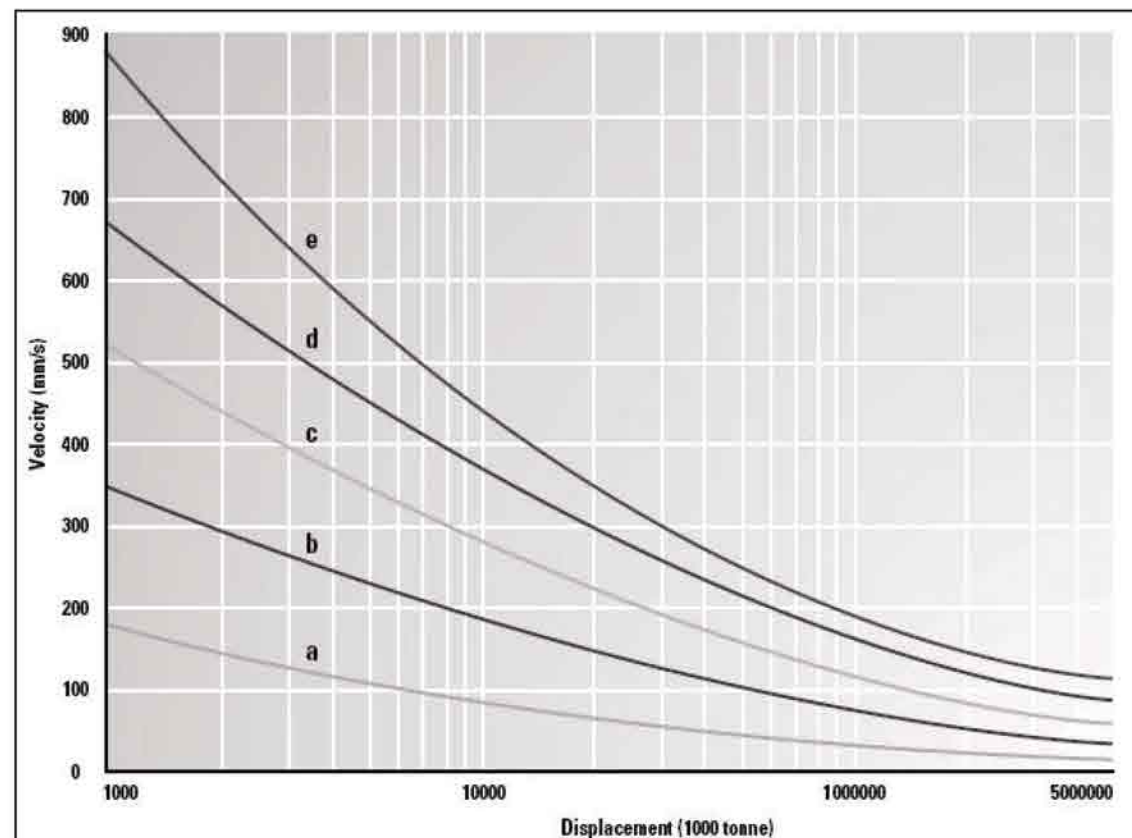


3.2 Approach Velocity (V)

The approach velocity (v) is defined as the vessel speed at initial berthing contact, measured perpendicular to the berth.

Below are the recommended design approach velocities with refers to the 5 navigational conditions:

- a – good berthing conditions, sheltered
- b – difficult berthing conditions, sheltered
- c – easy berthing condition, sheltered
- d – good berthing condition, exposed
- e – navigation conditions difficult, expose



For preliminary design, the suggested berthing velocity can be adopted as follows:

Displacement (M) (ton)	Suggested Velocity (m/s)
Up to 2000	0.30
2000 < M < 10,000	0.18
10,000 < M < 125,000	0.16
Over 125,000	0.14

However, for more accurate design velocity data, it should preferably be obtained from velocity of approach record at similar jetties elsewhere, provided that the exposure, tidal conditions and difficulty of approach are also similar.



3.3 Eccentricity Factor (Ce)

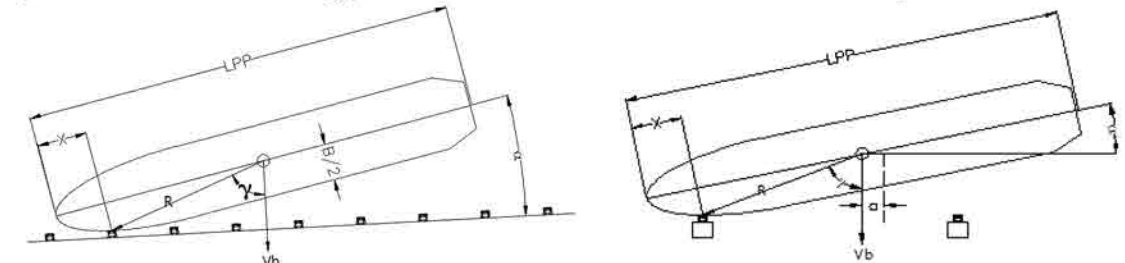
Factor depends on the configuration of the berth either a continuous berth or a berthing dolphin. It is an allowance for the energy dissipated in rotation of the ship when the point of impact is not opposite the centre of mass of the vessel.

For continuous berth which is quarter point type of berthing, the berthing point of the vessel is some 25% of the vessels length from the bow: $C_e \sim 0.4-0.6$

For continuous berth which is third point type of berthing, the berthing point of the vessel is some 33% of the vessels length from the bow: $C_e \sim 0.6-0.8$

For continuous berth which is mid-point type of berthing, the berthing point of the vessel is some 50% of the vessels length from the bow: $C_e \sim 1.0$

For a dolphin berth where the berthing point of the vessel is some 35% of the vessels length from the bow: $C_e \sim 0.7$



The Eccentricity Coefficient can be calculated based on the radius of gyration (K), the distance from the vessels centre of mass to point of impact (R) and the velocity vector angle using the following formula:

$$C_e = \frac{K^2 + (R^2 \cdot \cos^2(\gamma))}{K^2 + R^2}$$

where,

$$K = [(0.19 \cdot C_B) + 0.11] \cdot L_{BP}$$

$$R = \sqrt{\left[\frac{L_{BP} - x}{2}\right]^2 + \left[\frac{B}{2}\right]^2}$$

$$\gamma = 90^\circ - \alpha - \sin^{-1}\left[\frac{B}{2R}\right]$$

$$C_B = \frac{M_D}{L_{BP} \cdot B \cdot D_{PSW}}$$

C_B = Block coefficient

L_{BP} = Length between perpendiculars (m)

x = Distance from bow to point of impact

B = Beam (m)

α = Berthing angle

M_D = Displacement of vessel (t)

L_{BP} = Length between perpendiculars (m)

B = Beam (m)

P_{SW} = Seawater density = 1.025 t/m³

$x = L_{BP}/4$ (quarter point berthing type);

$x = L_{BP}/3$ (one third point berthing type);

$x = L_{BP}/2$ (mid-point berthing type)

3.4 Virtual Mass Factor (Cm)

The virtual mass factor can be defined as a coefficient to allow for the movement of water around the vessel to be taken into account when calculating the total energy of the vessel by increasing the mass of the system.

For virtual mass Factor or added mass factor or hydrodynamic mass factor generally formulated as:

$$C_M = 1 + \frac{2 \cdot D}{B}$$

for Ship-to-Shore type of berthing (Vasco-Costa Method), and

$$C_M = 1 + \frac{\pi \cdot D}{2 \cdot c_a \cdot B}$$

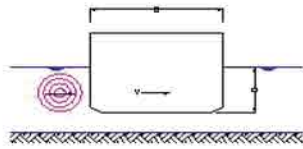


for Ship-to-Shore & Ship-to-Ship type of berthing (Shigure-Ueda Method)
where,

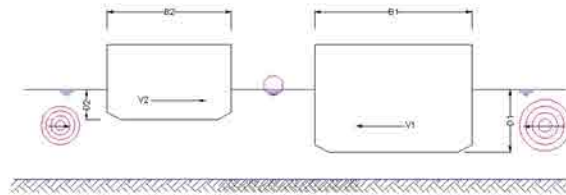
D=Draft(m)

C_B =Block Coefficient

B=Beam(m)



Ship-to-Shore type of berthing



Ship-to-Ship type of berthing

3.5 Berth configuration Factor (C_c)

Berth configuration Factor or Cushion Factor indicates the difference between an open structure (e.g. a piled jetty) and a closed structure (quay wall).

For open berths and corners of quay walls, $C_c = 1.0$

For solid quay walls under parallel approach, $C_c = 0.9$

3.6 Softness Factor (C_s)

Softness Factor expresses the kinetic energy portion on the berthing vessel onto the fender.

The following values are often used:

For soft fenders & smaller vessels, $C_s = 1.0$

For hard fenders & large vessels, $C_s = 0.9 - 1.0$

3.7 Abnormal Impact Factor (C_{ab})

The above formula is based on normal operation and may be exceeded due to operational berthing failure i.e engine failure of the vessel or tug, breaking of mooring or towing rope, environmental and human error.

As such, the ultimate energy capacity of the fenders shall consider a factor of 1.5 - 2.0 safety factor against the normal condition so as to provide a margin of safety against above unquantifiable risks.



4.0 FENDER BERTHING ENERGY AND SELECTION OF FENDER (CALCULATION EXAMPLE)

(A) BS 6349 : PART 1 : 1985 : MARITIME STRUCTURE - GENERAL CRITERIA

(B) BS 6349 : PART 4 : 1985 : MARITIME STRUCTURE - DESIGN OF FENDERING & MOORING SYSTEM

(C) PIANC : GUIDELINES FOR THE DESIGN OF FENDER SYSTEM : 2002

Company ABC

Project

Date

Design by

Approved by

Rev.

4.1 DESIGN PARAMETERS

4.1.1 Environmental

Specific Gravity (g)

9.81

m/s²

Sea Water Density (ρ)

1.025

ton/m³

4.1.2 Vessel's Charectaristic

Target Vessel

Gross Tonnage (GT)

Ton

Full Load Displacement (FLD)

120000

Ton

Length Overall (LOA)

362

m

Draft / Drough (D)

10

m

Beam (B)

66

m

Berthing Angle (θ)

6

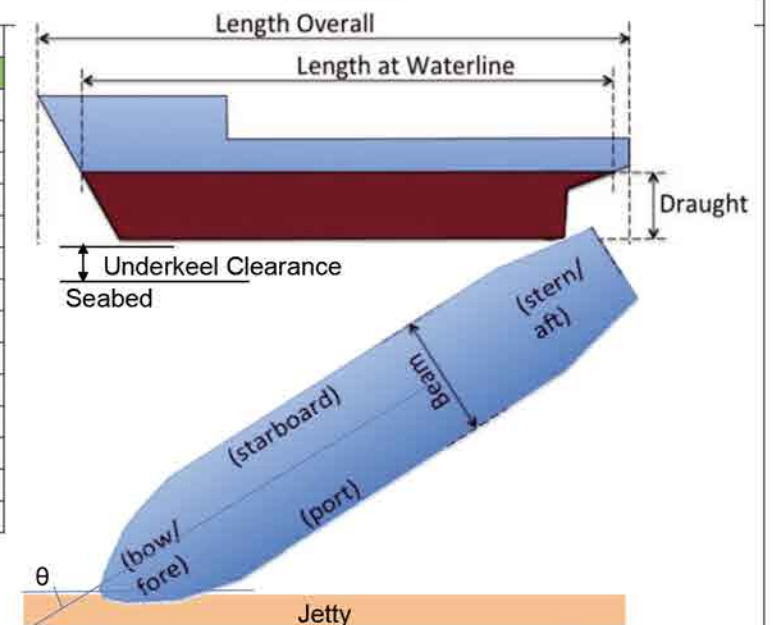
°

Underkeel Clearance (K_C)

1

m

Input Required



4.2 BERTHING CALCULATION

4.2.1 Normal Berthing Energy (EN)

Ref.

Most berthings will have energy less than or equal to the normal berthing energy (EN). The calculation should take into account worst combinations of vessel displacement, velocity, angle as well as the various coefficients

The normal energy to be absorbed by the fender can be calculated as:

$$E_N = 0.5 \times M \times V_B^2 \times C_M \times C_E \times C_C \times C_S$$

Where,

E_N = Normal berthing energy to be absorbed by the fender (kNm)

M = Mass of the vessel (displacement in tonne)

V_B = Approach velocity component perpendicular to the berthing line (m/s)

C_M = Added mass coefficient

C_E = Eccentricity coefficient

C_C = Berth configuration coefficient

C_S = Softness coefficient

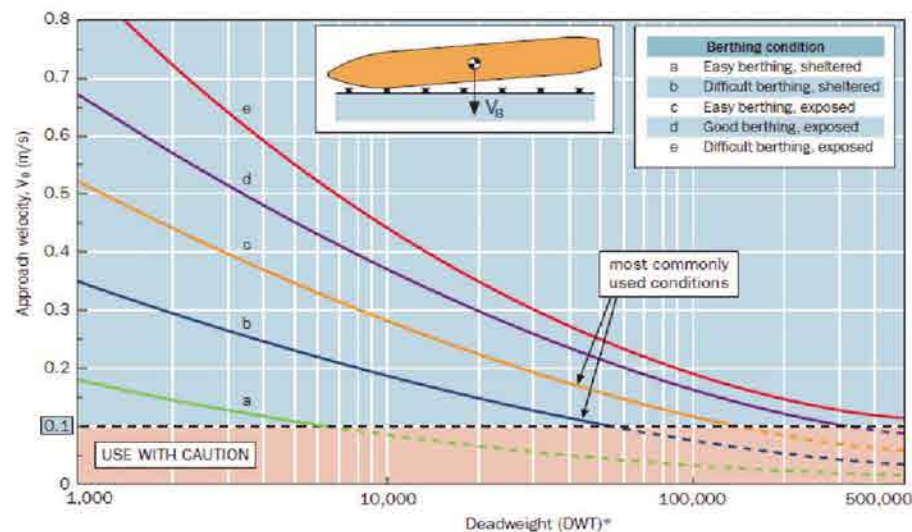
(B) : 4.7.1
(C) : 4.2.1



4.2.2 Approach Velocity (V_B)

Berthing speeds depend on the ease or difficulty of the approach, the exposure of the berth and the vessel's size.

Conditions are normally divided into five categories as shown in the chart's key table



(A) : Table 6
(C) : Fig. 4.2.1

Use $V_B =$ 0.15 m/s

Input Required

4.2.3 Block Coefficient (C_B)

The block coefficient (C_B) is a function of the hull shape and is expressed as follows:

where,

$$C_B = \frac{M_D}{L_{BP} \times B \times D \times \rho_{SW}}$$

M_D = displacement of vessel (t)
 L_{BP} = length between perpendiculars (m)
 B = beam (m)
 D = draft (m)
 ρ_{SW} = seawater density $\approx 1.025 \text{ t/m}^3$

Diagram of a ship hull with dimensions L_{BP} , B , and D .

$$CB = \frac{120000}{362 \times 66 \times 10 \times 1.025} = 0.49$$

(C) : 4.2.4

Use $C_B =$ 0.49

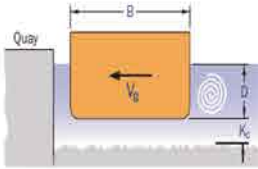
Input Required



4.2.4 Added Mass Coefficient (C_M)

The added mass coefficient allows for the body of water carried along with the ship as it moves sideways through the water. As the ship is stopped by the fender, the entrained water continues to push against the ship, effectively increasing its overall mass.

Condition 1	OK	Condition 2	OK
$K_C = 1.00 \geq 0.1$	$D = 1.00$	$V_B = 0.15 \geq 0.08 \text{ m/s}$	

$K_C / D = 0.1000$	PIANC 2002		Shigera Ueda (1981)		Vasco Costa (1964) & BS	
Side Approach	Condition	C_M	Formula	C_M	Formula	C_M
	$\frac{K_C}{D} \leq 0.1$	1.80	$1 + \frac{\pi \cdot D}{2 C_B \cdot B}$	1.49	$C_M = 1 + \frac{2D}{B}$	1.3
	$0.1 \leq \frac{K_C}{D} \leq 0.5$	1.80				
	$\frac{K_C}{D} \geq 0.5$	1.50				

Longitudinal Approach C_M

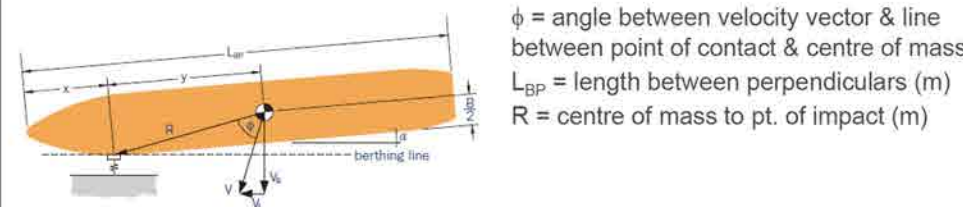


Average $C_M =$ 1.53

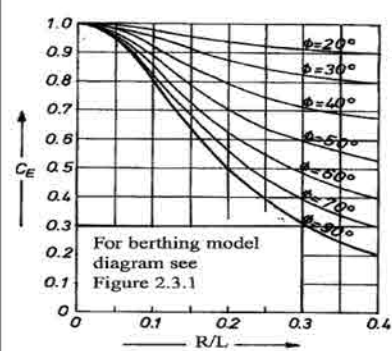
Input Required

4.2.5 Eccentricity coefficient (C_E)

The Eccentricity Coefficient allows for the energy dissipated by rotation of the ship about its point of impact with the fenders



Berthing Cases	X (m)	y (m)	R (m)	ϕ (°)	R/ L_{BP}
1/4 pt. berthing	$L_{BP}/4$	90.5	90.5	96	0.27
1/3 pt. berthing	$L_{BP}/3$	121	$(L_{BP}/2) - X$	69	0.19
1/2 pt. berthing	$L_{BP}/2$	181	0	33	0.09



Design as

1/4 pt. Berthing

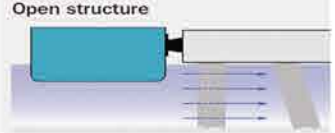
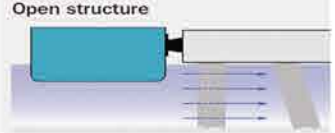
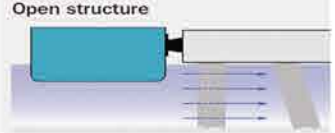
From graph, $C_E =$ 0.40

(B) : 4.7.2
(C) : 4.2.5

Ref.

(B) : 4.7.3
(C) : 4.2.4



4.2.6	Berth Configuration Coefficient (C_C)	Ref.														
When ships berth at small angles against solid structures, the water between hull and quay acts as a cushion and dissipates a small part of the berthing energy																
<table> <tr> <td>Condition 1</td> <td>C_C</td> <td>Condition 2</td> <td>C_C</td> </tr> <tr> <td>  </td> <td rowspan="4">1.0</td> <td>  </td> <td rowspan="4">0.9</td> </tr> <tr> <td>Open structures including berth corners</td> <td rowspan="3">Solid quay walls under parallel approach. (berthing angles $< 5^\circ$)</td> </tr> <tr> <td>Berthing angles $> 5^\circ$</td> </tr> <tr> <td>Very low berthing velocities</td> </tr> <tr> <td>Large under keel clearance</td> <td>Under keel clearance less than 15% of the vessel draught</td> </tr> </table>			Condition 1	C_C	Condition 2	C_C		1.0		0.9	Open structures including berth corners	Solid quay walls under parallel approach. (berthing angles $< 5^\circ$)	Berthing angles $> 5^\circ$	Very low berthing velocities	Large under keel clearance	Under keel clearance less than 15% of the vessel draught
Condition 1	C_C	Condition 2	C_C													
	1.0		0.9													
Open structures including berth corners		Solid quay walls under parallel approach. (berthing angles $< 5^\circ$)														
Berthing angles $> 5^\circ$																
Very low berthing velocities																
Large under keel clearance	Under keel clearance less than 15% of the vessel draught															
<table> <tr> <td>Use $C_C =$</td> <td>1.00</td> <td>-</td> </tr> <tr> <td colspan="3">Input Required</td> </tr> </table>			Use $C_C =$	1.00	-	Input Required										
Use $C_C =$	1.00	-														
Input Required																
4.2.7	Softness Coefficient (C_S)	Ref.														
Where fenders are hard relative to the flexibility of the ship hull, some of the berthing energy is absorbed by elastic deformation of the hull.																
<table> <tr> <td>Condition 1</td> <td>C_S</td> <td>Condition 2</td> <td>C_S</td> </tr> <tr> <td>Soft fenders ($\delta f > 150\text{mm}$)</td> <td>1.0</td> <td>Soft fenders ($\delta f < 150\text{mm}$)</td> <td>0.9</td> </tr> </table>			Condition 1	C_S	Condition 2	C_S	Soft fenders ($\delta f > 150\text{mm}$)	1.0	Soft fenders ($\delta f < 150\text{mm}$)	0.9						
Condition 1	C_S	Condition 2	C_S													
Soft fenders ($\delta f > 150\text{mm}$)	1.0	Soft fenders ($\delta f < 150\text{mm}$)	0.9													
<table> <tr> <td>Use $C_S =$</td> <td>1.00</td> <td>-</td> </tr> <tr> <td colspan="3">Input Required</td> </tr> </table>			Use $C_S =$	1.00	-	Input Required										
Use $C_S =$	1.00	-														
Input Required																
4.2.8	Normal Berthing Energy (E_N)	Ref.														
$E_N = 0.5 \times M \times V_B^2 \times C_M \times C_E \times C_C \times C_S$ $= 0.5 \times 120000 \times 0.0225 \times 1.53 \times 0.40 \times 1.00 \times 1.00$ $= 825.97 \text{ kN-m}$																
4.2.9	Abnormal Berthing Energy (E_A)															
Abnormal impacts arise when the normal energy is exceeded. Causes may include human error, malfunctions, exceptional weather conditions or a combination of these factors.																
<table> <tr> <td> $E_A = F_S \times E_N$ </td> <td>where</td> <td> E_A = Abnormal berthing energy to be absorbed by the fender (kNm) F_S = Safety factor for abnormal berthings E_N = Normal berthing energy to be absorbed by the fender (kNm) </td> </tr> <tr> <td colspan="3"> PIANC recommends that 'the factor of abnormal impact when derived should be not be less than 1.1 nor more than 2.0 unless exception circumstances prevail'. Source: PIANC 2002: Section 4.2.8.5. </td> </tr> <tr> <td>Take $F_S =$</td> <td>1.1</td> <td>$E_A = 1.1 \times 825.97 = 908.57 \text{ kN-m}$</td> </tr> </table>			$E_A = F_S \times E_N$	where	E_A = Abnormal berthing energy to be absorbed by the fender (kNm) F_S = Safety factor for abnormal berthings E_N = Normal berthing energy to be absorbed by the fender (kNm)	PIANC recommends that 'the factor of abnormal impact when derived should be not be less than 1.1 nor more than 2.0 unless exception circumstances prevail'. Source: PIANC 2002: Section 4.2.8.5.			Take $F_S =$	1.1	$E_A = 1.1 \times 825.97 = 908.57 \text{ kN-m}$					
$E_A = F_S \times E_N$	where	E_A = Abnormal berthing energy to be absorbed by the fender (kNm) F_S = Safety factor for abnormal berthings E_N = Normal berthing energy to be absorbed by the fender (kNm)														
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Take $F_S =$	1.1	$E_A = 1.1 \times 825.97 = 908.57 \text{ kN-m}$														
(B) : 4.9 (C) : 4.2.8																



4.3 FENDER SELECTION				Ref.
				FENDERSYS Fender Catalogue
Fender Brand		FENDERSYS		
Fender Model		SC1450-RE		
Performance at	Energy Absorption (E) kN-M		Reaction Force (R) kN	
52.5% Rated Deflection	1007		1582	
55% Maximum Deflection	1066		1682	
Design Condition to be fulfilled :				
Energy Absorption (E) capacity of the Fender provided > Abnormal Berthing Energy produced by Vessel (EA)				
1007 kN-M > 908.57 kN-MOk				
1066 kN-M > 908.57 kN-MOk				
4.4 CHECKING ON BERTH LATERAL CAPACITY				Ref.
				Manufacturer Pile Catalogue and Jetty Designer/As- Built Data
Pile Type				
Pile Size (mm)				
Pile per pier, n (nos.)				
Ultimate Resistance of Installed Pile Capacity, F _U (kN)		1700		
Design Pile Depth, H (m)				
Favourable condition : (Pass) Resistance Force of the single weakest pile, F _U > R max				
Unfavourable condition : (Fail) Resistance Force of the single weakest pile, F _U < R max				
Since F _U > R max i.e. 1700 kN > 1682 kNPassed. Fender selected is Ok!				



5.0 FENDER FRAME CALCULATION (DESIGN NOTES)

5.1 Fender Panel Design

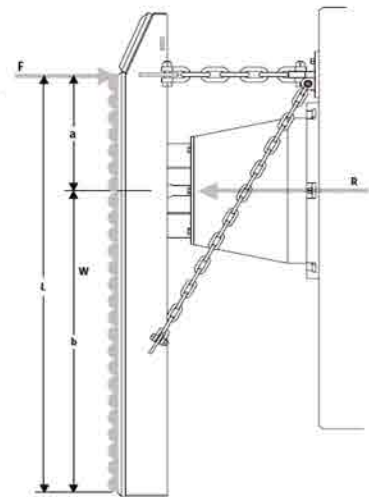
Fender panel are designed as either a Mild Steel / High Tension Steel Close-type Box Girder which consist of frontal, back and horizontal stiffening members, or as an Open-Type Girder.

Regardless of type of panel system, all shall be designed to structurally withstand-able to resist the maximum load from vessel's berthing as explained in Section 1-4 of this design notes.

The panel shall be structurally designed to cater for direct vessel impact on the panel surface and tension load of the chains. The panel at normal berthing circumstances will fall under 2 load transferred conditions as below :

5.1.1 Load Case 1 - Frame at Full Face Load Contact

This case often arises during berthing at high free-board vessel condition.



$$R = W + F$$

$$F = \frac{2R}{L} \left[\frac{L}{2} - a \right]$$

$$W = \frac{2R \cdot a}{L}$$

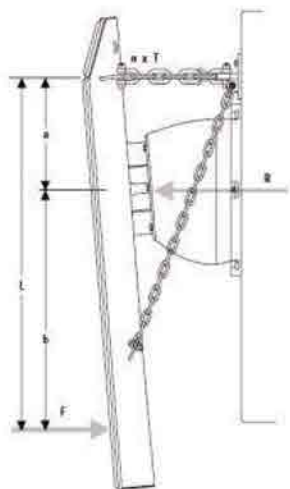
$$M_{max} = M_R = \frac{W \cdot b^2}{2L} = \frac{W \cdot a^2}{2L} + F \cdot a$$

$$\text{for } a = b = \frac{L}{2} \Rightarrow F = 0$$

where,
 R = Reaction of rubber unit (kN)
 W = Uniform load across panel face (kN)
 F = Equilibrium load (kN)
 L = Contact length of panel face (m)
 M_{max} = Maximum bending moment (kNm)
 M_R = Moment at R (kNm)

5.1.2 Load Case 2 - Frame at Lower Face Load Contact

This case often arises during berthing of low free-board vessel during low tide.



$$R = F + n \cdot T$$

$$F = \frac{R \cdot a}{L}$$

$$T = \frac{R \cdot b}{n \cdot L}$$

$$M_{max} = M_R = n \cdot T \cdot a = F \cdot b$$

where,
 R = Reaction of rubber unit (kN)
 W = Uniform load across panel face (kN)
 F = Equilibrium load (kN)
 L = Contact length of panel face (m)
 M_{max} = Maximum bending moment (kNm)
 M_R = Moment at R (kNm)



5.2 Chain Design

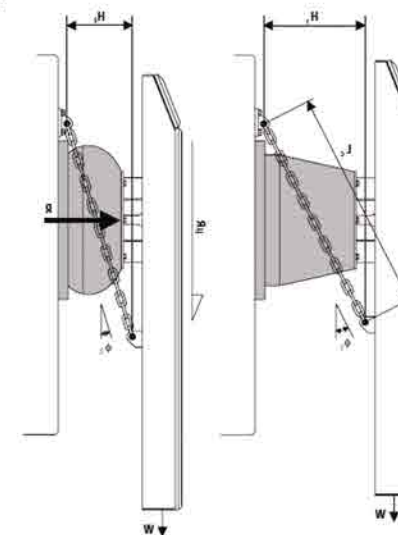
Chains are used to resist high load impact from berthing of vessels.

5.2.1 To enable the chains to perform well, basic configuration and design factor as below shall be taken into considerations :

- Right length of chain in a correct oriented plane of brackets is necessary to avoid excessive slack. Chain adjuster shall also be considered to control the excessive slack.
- Open link chain type is preferred rather than stud link chains which might loosen after series of repeated loading that significantly loosen its original strength.
- Weight chain shall be initially set at 15-25° to the vertical and shear chain at 20-30° to the horizontal.
- Safety factor of 2-3 times the chain breaking load shall be included during design to minimize the risk of chain breakage.
- Weaker link i.e. the shackles shall be installed as first breaking point before the chains.

5.2.2 Chain Calculation

Basic formulae



$$\phi_1 = \arcsin \left[\frac{H_1}{L_c} \right] \text{ or } H_1 = L_c \cdot \sin \phi_1$$

$$H_2 = H_1 - \delta_f$$

$$\phi_2 = \arcsin \left[\frac{H_2}{L_c} \right] \text{ or } \phi_2 = \arcsin \left[\frac{H_1 - \delta_f}{L_c} \right]$$

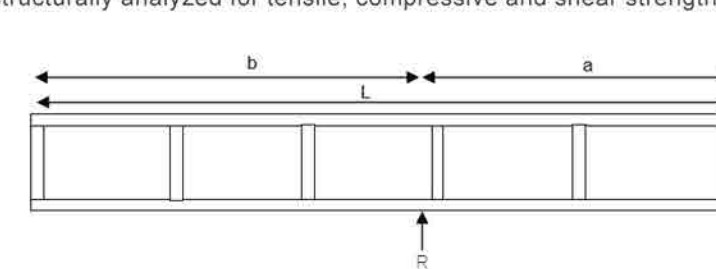
$$SWL = \frac{(\mu \cdot \Sigma R) + W}{9.81 \cdot n \cdot \cos \phi_2}$$

$$MBL = F_s \cdot SWL$$

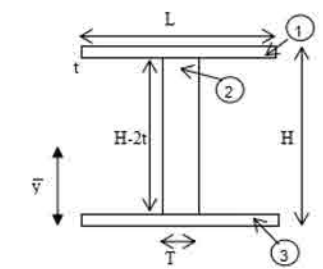
where,
 ϕ_1 = Static angle of chain (degrees)
 H_1 = Static offset between brackets (m)
 L_c = Bearing length of chain (m)
 H_2 = Dynamic offset between brackets at δ_f (m)
 δ_f = Fender compression (m)
 ϕ_2 = Dynamic angle of chain (degrees)
 SWL = Safe Working Load of chain (tonne)
 μ = Friction coefficient of face pad material
 = 0.15 for UHMW-PE facings, typically
 ΣR = Combined reaction of all rubber fenders (kN)
 n = Number of chains acting together
 MBL = Minimum Breaking Load of chain (tonne)
 F_s = Factor of safety = 2-3 (typically)

5.3 Flexural Strength Calculation

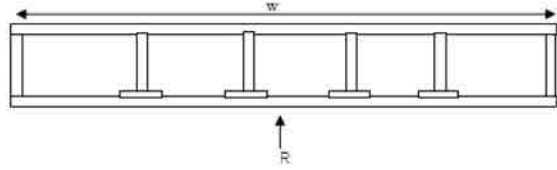
By taking into consideration on the worst loading condition, the panel in both long & short span section shall be structurally analyzed for tensile, compressive and shear strength.



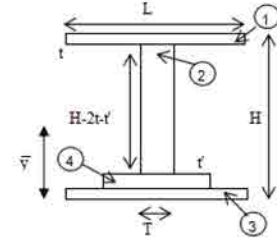
Long Spanned Panel Section



Imaginary combined section



Short Spanned Panel Section



Imaginary combined section

Tensile & Compressive Stress for Bottom and Top Section of Fender Panel

$$f_{bx} < f_{bx}' \text{ and } f_{by} < f_{by}'$$

$$f_{bx} = \frac{M_{\max} \bar{y}}{I_x} \text{ (N/mm}^2\text{)} ; \text{ and } f_{by} = \frac{M_{\max} \bar{x}}{I_y} \text{ (N/mm}^2\text{)}$$

Shear Stress for Bottom and Top Section of Fender Panel

$$f_{vx} < f_{vx}' ; \text{ and } f_{vy} = f_{vy}'$$

$$f_{vx} = \frac{V_{\max} \Delta A \bar{y}}{I_{xx} L} ; \text{ and } f_{vy} = \frac{V_{\max} \Delta A \bar{x}}{I_{yy} H}$$

where,

$$\bar{x} = \frac{\sum x \Delta A}{\sum \Delta A} \text{ (mm)} = \frac{x_1 \Delta A_1}{\Delta A_1} + \frac{x_2 \Delta A_2}{\Delta A_2} + \frac{x_3 \Delta A_3}{\Delta A_3} + \dots + \frac{x_{n-1} \Delta A_{n-1}}{\Delta A_{n-1}} + \frac{x_n \Delta A_n}{\Delta A_n}$$

$$\bar{y} = \frac{\sum y \Delta A}{\sum \Delta A} \text{ (mm)} = \frac{y_1 \Delta A_1}{\Delta A_1} + \frac{y_2 \Delta A_2}{\Delta A_2} + \frac{y_3 \Delta A_3}{\Delta A_3} + \dots + \frac{y_{n-1} \Delta A_{n-1}}{\Delta A_{n-1}} + \frac{y_n \Delta A_n}{\Delta A_n}$$

and,

$$I_x = \sum I_{xx} + \sum \Delta A d_y^2$$

$$= (I_{xx1} + I_{xx2} + I_{xx3} + \dots + I_{xx(n-1)} + I_{xxn}) + (\Delta A d_{y1}^2 + \Delta A d_{y2}^2 + \Delta A d_{y3}^2 + \dots + \Delta A d_{y(n-1)}^2 + \Delta A d_{yn}^2)$$

$$I_y = \sum I_{yy} + \sum \Delta A d_x^2$$

$$= (I_{yy1} + I_{yy2} + I_{yy3} + \dots + I_{yy(n-1)} + I_{yy n}) + (\Delta A d_{x1}^2 + \Delta A d_{x2}^2 + \Delta A d_{x3}^2 + \dots + \Delta A d_{x(n-1)}^2 + \Delta A d_{xn}^2)$$

where

- f_{bx} = max tensile/compressive strength in x-axis (N/mm²)
- f_{bx}' = max allowable tensile/compressive strength in x-axis (N/mm²)
- f_{by} = max tensile/compressive strength in y-axis (N/mm²)
- f_{by}' = max allowable tensile/compressive strength in y-axis (N/mm²)
- f_{vx} = max shear stress in x-axis (N/mm²)
- f_{vx}' = max allowable shear stress in x-axis (N/mm²)
- f_{vy} = max tensile strength in y-axis (N/mm²)
- f_{vy}' = max allowable tensile strength in y-axis (N/mm²)
- $M_{\max}$ = max sagging/hogging moment (Nmm)
- $V_{\max}$ = max force (N)



- $\bar{x}$ = centroid of the system in x-axis (mm)
- $\bar{y}$ = centroid of the system in y-axis (mm)
- x = centre of elements to reference plane in x-axis (mm)
- y = centre of elements to reference plane in y-axis (mm)
- ΔA = sectional area of elements (mm²)
- I_x = moment of inertia of the system in x-axis (mm⁴)
- I_y = moment of inertia of the system in y-axis (mm⁴)
- I_{xx} = moment of inertia of elements in x-axis (mm⁴)
- I_{yy} = moment of inertia of elements in y-axis (mm⁴)
- d_x = centre of elements to centroid plane in x-axis (mm)
- d_y = centre of elements to centroid plane in y-axis (mm)
- L = width of system (mm)
- H = height of system (mm)

5.4 UHMW PE-Pads Design

UHMW PE pads are low friction pads bolted to the frontal frame of fender. The PE pad of 0.1-0.2 coefficient of friction shall be installed to prevent the vessel hull from being damaged by the steel panel and also protects the elastomer in fender assembly.

Required area for panel at where the UHMW PE-Pads is going to be installed, shall be calculated by taking into consideration on the permissible ship hull pressure as follow :

ULCC & VLCC	150-250kN/m ²
Tankers	250-350kN/m ²
Product & Chemical Tankers	300~400kN/m ²
Bulk Carriers	150-250kN/m ²
Post-Panamax Container Ships	200-300kN/m ²
Panamax Container Ships	300-400kN/m ²
Sub-Panamax Container Ships	400-500kN/m ²
General Cargo(un-belted)	300-600kN/m ²
Gas Carriers	100-200kN/m ²

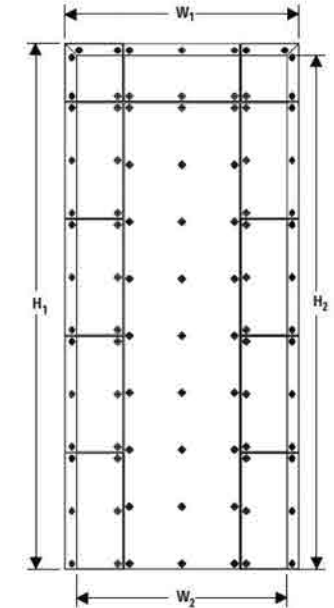
$$P = \frac{\sum R}{W_2 \cdot H_2} \leq P_p$$

where,

P=Hull pressure(kN/m²) $\sum R$ =Combined reaction of all rubber fenders(kN)

W2=Panel width excluding lead-in chamfers(m)

H2=Panel height excluding lead-in chamfers (m)

Pp =Permissible hull pressure(kN/m²)



6.0 SAMPLING & TESTING OF FENDER

6.1 The specimen for testing and inspection of the materials, dimensions, and performance will be sampled as specified below. All testing is conducted in-house or accredited 3rd party laboratory, with the option of third party witnessing.

Test Item	No. of Sample For Testing	Testing Procedure & Forms
Material testing for Rubber	1 set	Refer Annex 1
Rubber fender performance test	10% of total ordered for each Fender Type/Size	Refer Annex 2
Dimension	All fender pars	Refer Annex 3
Chain breaking load	1 set for each combination	Refer Annex 4
Material Testing for UHMW PE-Pad	1 set	Refer Annex 5

6.2 The specimen to be used for the material test will be taken directly from the product or from the rubber prepared in the quality check and under the condition of the same vulcanization as the products.

Only units which satisfy the specifications will be passed for shipment.

Items to be provided upon delivery of the fender systems will include the following items:

- Test certificates for the rubber material properties
- Test certificates for fender performance
- Dimensions check on fender systems

6.3 Performance Verification to test the capabilities of the rubber fender units will be demonstrated by testing in accordance to Chinese Standard or PIANC 2002 through In-House or Third-Party Testing Body based on client's requirement.

In general, the performance verification will undergo some preparations, testing and data recordings as follow:

- All fender units will be given a unique serial number which can be traced back to manufacturing and testing records.
- Fenders will be tested under direct (vertical) compression.
- Compression speed will be 2~8 cm/min.
- Test temperature is at 23°C ±5°C.
- Reaction force will be recorded at intervals to at least a deflection at which the permitted minimum energy absorption is achieved.
- Energy absorption will be determined as the integral of reaction and deflection i.e. area below the graph.
- The result of the first compression cycle will not be recorded.
- The average performance from the second and third compression cycles will be less than the permitted maximum reaction and more than the permitted minimum energy absorption. Sampling will be 1 in 10 fenders (rounded up to a unit).
- If any sample does not satisfy the specifications, sampling of the remainder will be increased to 1 in 5 fenders (rounded up to a unit), excluding non-compliant units.
- If any further sample does not satisfy the specifications, all remaining samples will be tested. Only units which satisfy the specifications shall be passed for shipment.
- Non-compliant units shall be clearly marked and isolated.



6.4 Packaging & Delivery

The rubber fenders will be packaged including all chains and hardware while being delivered to the site so as to prevent damage to the fenders.

Prior to shipment to site, the panel's UHMW-PE Pads will be firstly attached.

The fenders are supplied/shipped in components. Upon receipt of the shipment, confirmation on the size, quantity and attachment of all required testing certificates of the components will be made.

6.5 Installation Procedure

Each and every fender requires unique assembly and installation procedure. Kindly get in touch with our technical guys to assist on detail assembly and installation procedures to fully maximized the work-ability of the installed fender system.





Annex. 1 - Rubber Fender Material Testing Form

Test Certificates : Rubber Material Properties

Project : _____
Product I.D. : _____
Fender Size : _____
Product Date : _____
Delivery Date : _____ Time _____ am/pm
Arrival Date : _____ Time _____ am/pm
P.O. No. : _____
D.O. No. : _____

Test Result Summary :

Rubber Material Properties		Testing Standard	Requirement	Testing Result	Remarks
1	Tensile Strength (MPa)	ASTM D412 DIE C	≥16		
2	Elongation at Break (%)	ASTM D412 DIE C	≥350		
3	Compression Set(70°C, 22h, 30%)	ASTM D395	≤30		
4	Hardness (SHORE A)	ASTM D2240	≤78		
5	Tear Resistance DIE B	ASTM D624	≥80		
6	Ozone Resistance(50pphm at 40°C and 20% Strain for 100 hours)	ASTM D1149	No Visible Cracking		
7	Abrasion Resistance (mm ³)	ASTM D5963-04DIN 53516	≤100		
8	Hot air Aging (70°C, 96h)	Tensile Strength (MPa)	ASTM D412 DIE C	≥12.8	
		Elongation at Break (%)	ASTM D412 DIE C	≥280	
		Hardness (SHORE A)	ASTM D2240	Original Value + 8° (Max.)	

Notes: _____

Tested By: _____ Verified By: _____
Name : _____ Name : _____
Designation : _____ Designation : _____
Date : _____ Date : _____
Initial : _____ Initial : _____

Annex. 2 - Fender Performance Testing Form

Test Certificates : Fender Performance Test

Project : _____
Test Description : Compression Test
Product I.D. : _____
Fender Size : _____
Product Date : _____
Delivery Date : _____ Time _____ am/pm
Arrival Date : _____ Time _____ am/pm
P.O. No. : _____
D.O. No. : _____

Tabulated Results:

i) Deflection (% of Fender Height)

ii) Reaction (Tons)

iii) Energy absorption (Tons-m)

Date Tested : _____ Start: _____ End: _____



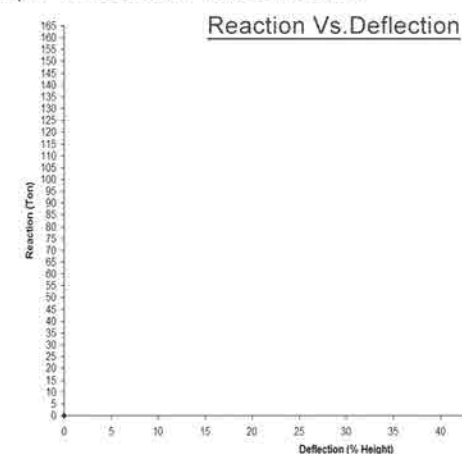
Deflection (% of Height)	Reaction (kN / Tons) Dial Gauge Readings					Energy absorption (KN-M / Tons-M) Area below Graph
	1	2	3	4	Ave.	
0						
5						
10						
15						
20						
25						
30						
35						
40						
45						
50						
55						
55						

Graph to be plotted:

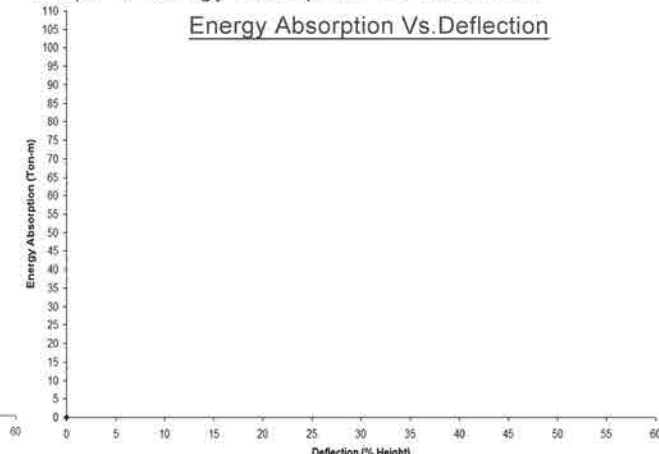
i) Reaction Vs. Deflection

ii) Energy Absorption Vs. Deflection

Graph 1: Reaction Vs. Deflection



Graph 2: Energy Absorption Vs. Deflection



Notes: _____

Tested By: _____ Verified By: _____
Name : _____ Name : _____
Designation : _____ Designation : _____
Date : _____ Date : _____
Initial : _____ Initial : _____

Test Result Summary

Description	Deflection(% Height)	Required	Tested	Tolerance(%)	Remarks
Energy Absorption (KN-M)	Rated			±10%	
	Max.			±10%	
Reaction Force (KN)	Rated			±10%	
	Max.			±10%	



Annex. 3 - Fender System Dimension Tolerance Inspection Form

Test Certificates : Fender Dimension Tolerances

Project : _____

Test Description : Manual Checking

Product I.D. : _____

Fender Size : _____

Product Date : _____

Delivery Date : _____ Time _____ am/pm

Arrival Date : _____ Time _____ am/pm

P.O. No. : _____

D.O. No. : _____

1. Rubber Fender

Description	Required Dimension-mm	Required Dimension-mm	Tolerances	Remarks
Length			±40mm	
Width - Long			±40mm	
Width - Short			±40mm	
Height			±40mm	
OD			± 4%	
ID			± 4%	

2. Fender Panel

Description	Required Dimension (Long x Width x Thick) - mm	Measured Dimension-mm	Tolerances	Remarks
Front Panel			±40mm	
Back Panel			±40mm	
Top Panel			±40mm	
Bottom Panel			±40mm	
Left Side Panel			±40mm	
Right Side Panel			±40mm	
Stiffeners Spacing			±40mm	
Drilled Holes			± 2mm	



3. Chains & Accessories

Description	Required Dimension-mm	Required Dimension-mm	Tolerances	Remarks
Chain Length			± 4%	
Chain OD			± 2mm	
Shackle Length			± 4%	
Shackle OD			± 2mm	
Tensioner Length			± 4%	
Tensioner OD			± 2mm	

Notes: _____

Tested By:

Verified By:

Name : _____

Name : _____

Designation : _____

Designation : _____

Date : _____

Date : _____

Initial : _____

Initial : _____

4. UHMW-PE Pad

Description	Required Dimension (Long x Width x Thick x Holes) - mm	Measured Dimension-mm	Tolerances	Remarks
Type 1				
Type 2				
Type 3				
Type 4				
Type 5				
Type				

Notes: _____

Tested By:

Verified By:

Name : _____

Name : _____

Designation : _____

Designation : _____

Date : _____

Date : _____

Initial : _____

Initial : _____



Annex. 4 - Chain Breaking Load (BL) Test

Test Certificates : Chain Breaking Load Test
Project : _____
Test Description : Breaking Load Test
Product I.D. : _____
Fender Size : _____
Product Date : _____
Delivery Date : _____ Time _____ am/pm
Arrival Date : _____ Time _____ am/pm
P.O. No. : _____
D.O. No. : _____

Chain Assembly		Requirement	Testing Result	Remarks
Weight Chain (a)Shackle (b)Chain (c)Tensioner	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
Tension Chain (d)Shackle (e)Chain (f)Tensioner	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
Shear Chain (g)Shackle (h)Chain Tensioner	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
Other Chain (j)Shackle (k)Chain Tensioner	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	
	Φ ____ mm, Grade ____	> ____ kN (BL) x ____ SF	_____ kN	

Note : SF - Safety Factor lies between 2 to 3

Notes: _____

Tested By: _____ Verified By: _____
Name : _____ Name : _____
Designation : _____ Designation : _____
Date : _____ Date : _____
Initial : _____ Initial : _____



Annex. 5 - UHMW-PE Pad Material Testing

Test Certificates : UHMW-PE Pad Material Testing
Project : _____
Test Description : _____
Product I.D. : _____
Fender Size : _____
Product Date : _____
Delivery Date : _____ Time _____ am/pm
Arrival Date : _____ Time _____ am/pm
P.O. No. : _____
D.O. No. : _____

UHMW-PE Pads Properties		Testing Standard	Requirement	Testing Result	Remarks
1	Molecular Weight (g/mol)	Viscosimetric / ASTM D 4020 81	≥4 x 10 ⁶		
2	Tensile Strength Break (MPa)	ASTM D 638	≥38		
3	Tensile Strength(MPa)	ASTM D 638	≥20		
4	Elongation at Break(%)	ASTM D 638	≥300		
5	Tensile Modulus(MPa)	ISO 527 / ASTM D 790 B	≥650		
6	Hardness(Shore D)	ASTM D 2240	≥66		
7	IZOD Impact, Notched (ft-lbs/inch)	ASTM D 256 A	No break		
8	Friction Coefficient	ASTM D 1894	≤0.15		

Notes: _____

Tested By: _____ Verified By: _____
Name : _____ Name : _____
Designation : _____ Designation : _____
Date : _____ Date : _____
Initial : _____ Initial : _____

FENDNR PROJECT REFERENCE

LIAONING QINGYUAN NO.1 BUFFER
MANUFACTURE CO.,LTD

Super Arch Rubber Fender System
---North Sea Fleet



Super Arch Rubber Fender System
----Navy Base



Super Cell Rubber Fender System
---Sharjah,U.A.E



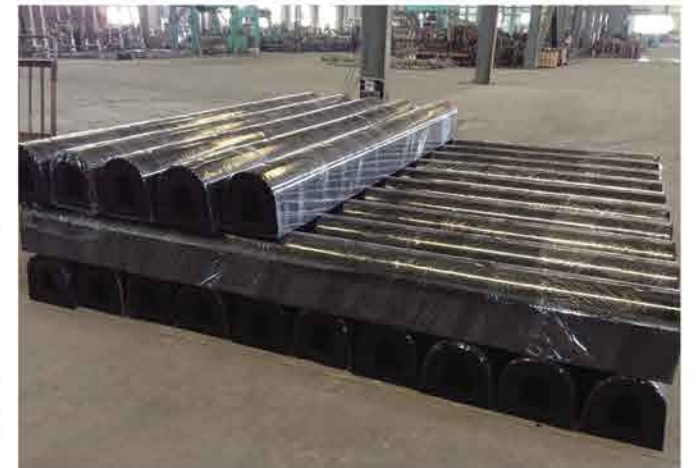
Cylindrical Rubber Fender System
----Dalian Port, China



D type Rubber Fender
----The Three Gorges power Station



D type Rubber Fender System
-----Norway



Super Cell Ruber Fender
---Shanghai Port, China



Cylindrical Rubber fender System
----Riga Port



V type Rubber Fender System
-----Philippines



OTHER MAJOR PROJECTS REFERENCE

MARINE FENDER PRODUCTS



OTHER MAJOR PROJECTS REFERENCE

NO.	PROJECTS	CUSTOMER	PRODUCTS	YEAR
Yea	Sanya Oil Terminal	EMBA	D type rubber fender&A type rubber fender	2013.1
2	Dayao Wan port, Berth 16#	Dalian Port Company Limited	Super Cell Rubber Fender SC1700H	2013.5
3	Huanghua Port	CCCC	Super Cell Rubber Fender SC1450H	2013.6
4	Dalian Port	Dalian Harbour Construction Group	Super Cell Rubber Fender SC1000H	2013.7
5	Huarun Haifeng Power Plant	CCCC	1.Super Cell Rubber Fender SC1250H 2. Super Cell Rubber Fender SC800H 3.D Type Rubber Fender 4.AType Rubber Fender	2013.10
6	Dalian Port	Dalian Harbour Construction Group	1.Super Cell Rubber FenderSC1250 2.D Type Rubber Fender	2013.11
7	Angola	TME Company	Super Cell Rubber Fender SC1250	2014.1
8	Libya	TME Company	Super Cone Rubber Fender CT500	2014.2
9	Huludao Liutiaogou Port, Berth 6#, Berth 7#,Berth 8#, Berth 9#	Port of Huludao Group Corporation	1.Super Cell Rubber Fender SC1450H 2.D Type Rubber Fender	2014.3
10	Huludao Liutiaogou Port, Berth 1#, Berth 2#	Port of Huludao Group Corporation	Super Cell Rubber Fender SC1450H	2014.5
11	Tianjin Port	Tianjin Port Navigation Lock	Square Rubber Fender 300×4000	2014.7
12	Dalian Pikou Terminal	Dalian Harbour Construction Group	A Type Rubber Fender A300 D Type rubber fender D300	2014.8
13	United Oil Port of Southern China	Southern China Zhuhai Allied Oil Company Limited	A Type rubber fender;D Type rubber fender	2014.9
14	Dalianwan Port	Liaoning Dalian Ocean Fishery Group	Cylindrical Rubber Fender CY1000*500*2500	2014.9
15	Dalianwan Port	Liaoning Dalian Ocean Fishery Group	Cylindrical Rubber Fender CY1000*500*1000	2015.2
16	Huludao Liutiaogou Port Zhuanghe Port	Port of Huludao Group Corporation	A type rubber fender A800 D Type rubber fender D300	2015.3
17	Huludao Liutiaogou Port	China Shipping Construction Group	DA400 D300	2015.5
18	Dalian Lushun Port	Port of Huludao Group Corporation	Cylindrical Rubber Fender CY1800*900*2000	2015.7
19	China Shipbuilding Heavy Industry 760	Bureau CRPCE	1.A Type rubber fender 500*375*1000 2.DType rubber fender D300	2015.8
20	Dalian Shipyard	760 projects in the construction of the Ministry of construction	A Type rubber fender A500	2015.11

OTHER MAJOR PROJECTS REFERENCE

MARINE FENDER PRODUCTS



21	Dalian Shipyard	Dalian Cihang Marine Equipment Co.,Ltd	Marine rubber fender	2015.11
22	Dalian Port	Port of Dalian Group Corporation	Super Cell Rubber Fender SC1700H	2015.12
23	Sharjah	UAE	Super Cell Rubber Fender SC1250H	2015.12
24	Riga	Latvia	Cylindrical Rubber fender 1000*500*1500	2016.3
25	Riga	Latvia	Cylindrical Rubber Fender 1000*500*1500	2016.5
26	Batagnas	Philippines	1.A Type rubber fenders A600*420*1500A800*600*1500 2.Cylindrical rubber fenders 450*225*1500	2016.7
27	Singapore	Singapore	Cylindrical rubber fenders 530*265*1000mm	2016.9
28	Riga	Latvia	Cylindrical Rubber Fender CY1000*500*1500	2016.10
29	Trondheim	Norway	D Type rubber fender D300*300*3000mm	2016.11
30	Guangzhou Salvage Bureau	Guangzhou Gangcheng Electrical Equipment Co.,Ltd	D300*2000 DA500*1500	2016.11





MARINE BOLLARD PRODUCTS



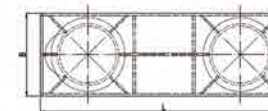
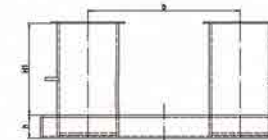
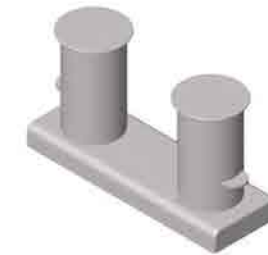
FENDERSYS BOLLARD WARRANTY PROGRAMME

We have confidence in our products and in their reliability. That is why we have decided to offer our bollard with up to 5 years warranty.

If our bollard is proven failed under normal designed mooring conditions and was not due to accident or operational flaws, we will compensate with the new one straight to u doorsteps with no future question asked.

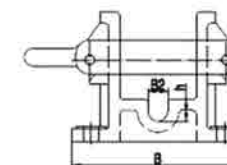
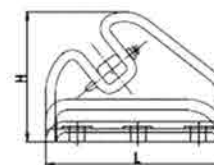


● DOUBLE BOLLARD



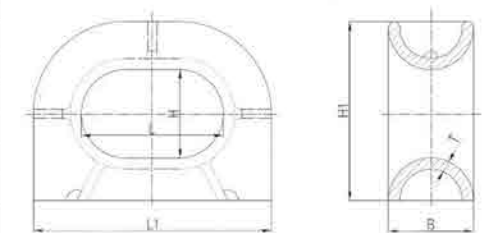
Nominal diameter	D	H1	b	B	L	h	Reference calculated mass(kg)	Max breaking load of applicable rope				Manila and sisal fibre rope	Synthetic fibre rope	
								P _(kN)	Wire rope					
									NO.2	NO.4	NO.5			NO.6
100	114	150	250	165	445	50	18.9	29	10	8	8	6.3	20	14
125	139	190	315	195	540	60	29.4	39	11.2	10	9	8	24	18
160	165	250	400	225	670	70	44.7	49	14	12.5	10	10	28	20
200	216	300	500	290	860	85	79.5	78	18	16	12.5	12.5	36	26
250	267	380	630	360	1065	100	139	118	22.4	20	16	14		30
315	318	480	800	430	1300	125	261	196	25	22.4	20	20	55	39
355	355	530	890	480	1475	145	361	255	30	25	22.4	22.4	65	45
400	406	600	1000	550	1630	160	502	314	33.5	28	25	25	75	53
450	457	680	1130	620	1840	170	685	382	33.5	31.5	30	28	80	56
500	508	750	1250	690	2040	190	911	451	40	33.5	31.5	30	90	64
560	558	830	1380	750	2240	210	1208	549		37.5	35.5	33.5	100	70
630	609	940	1570	820	2510	225	1601	686		37.5	40	35.5	110	77
710	711	1050	1750	960	2840	260	2252	804		40	42.5	40	120	84
800	812	1200	2000	1100	3240	295	3071	981		45	47.5	42.5		

● CAST IRON BAR TYPE CHAIN CABLE STOPPER(BOLT MOUTING)

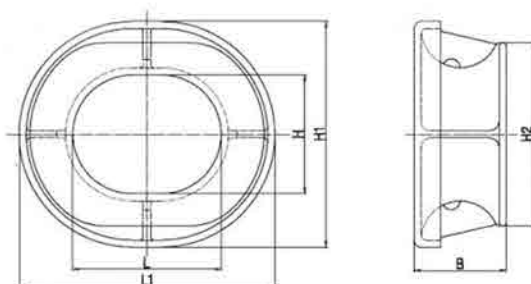


Nominal NO.	Cable Dia.	B	H	L	h	B2	Reference calculated mass(kg)
19	17-19	195	190	270	32	32	22
22	20-22	215	216	310	37	38	31
25	23-25	240	241	345	43	43	44
28	26-28	265	270	385	48	49	58
32	30-32	305	305	435	54	55	89
36	34-36	340	342	490	61	61	122
40	38-40	370	378	540	68	65	160
44	42-44	405	412	590	75	72	208
48	46-48	440	450	640	82	78	272
52	50-52	470	491	695	88	85	338
56	54-56	495	522	745	95	92	414
60	58-60	530	564	795	102	98	505
64	62-64	565	600	850	109	104	618
68	66-68	590	635	900	116	110	737

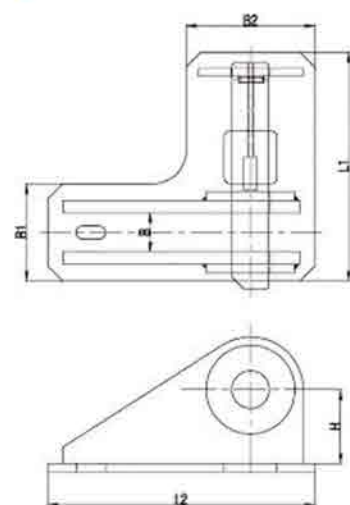
Nominal size(mm)	L	L1	H	H1	B	T	Mass (kg)	Nominal dia of applicable chain cable and rope(reference)	
								Wire rope	Hemp rope
100	100	170	76	141	60	12	3.7	14	18
150	150	250	110	205	110	16	10.5	16	22
200	200	340	150	280	150	20	24	18	28
250	250	434	200	372	160	24	48	20(6×12)	50
300	300	528	250	464	200	28	83	22.4(6×12)	60
350	350	600	250	485	220	30	103	24(6×24)	70
400	400	672	250	506	240	32	136	26(6×24)	80
450	450	746	250	528	260	36	184	30(6×24)	85
500	500	820	250	550	280	40	232	35.5(6×24)	90



Nominal size(mm)	L	L1	H	H1	H2	B	Mass (kg)	Nominal dia of applicable chain cable and rope(reference)	
								Wire rope	Hemp rope
150	150	300	110	260	202	129	15	16	40
200	200	368	150	318	250	143	21	18	45
250	250	430	200	380	308	155	27	20(6×12)	50
300	300	500	250	450	372	169	43	22.4 (6×12)	60
350	350	560	250	460	378	179	51	24(6×24)	70
400	400	632	250	482	394	185	77	26(6×24)	80
450	450	700	250	500	406	209	102	30(6×24)	85
500	500	760	250	510	412	219	115	35.5(6×24)	90

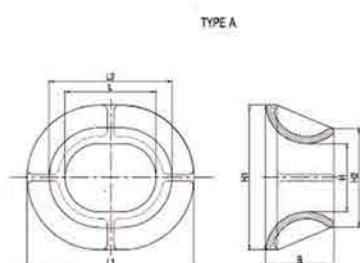


DOUBLE BOLLARD



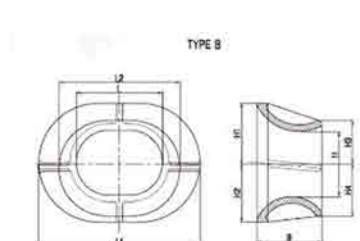
Nominal Diameter (mm)	Dimension(mm)						Mass(kg)
	L1	L2	B	B1	B2	H	
50-52	425	470	70	165	230	130	55
54-56	450	500	75	180	250	140	70
58-60	475	540	80	195	260	150	83
62-64	500	580	85	205	270	160	99
66-68	530	610	90	220	300	170	121
70-73	560	660	100	235	310	180	144
76-78	600	700	105	260	340	195	180
81-84	620	760	110	270	360	210	219
87-90	695	810	120	295	390	225	280
92-95	725	860	130	305	410	235	321
97-102	765	920	135	330	440	255	386
105-111	805	1000	145	350	470	275	465
114-120	850	1080	160	370	510	300	586
124-132	910	1200	175	395	560	330	723

Type A

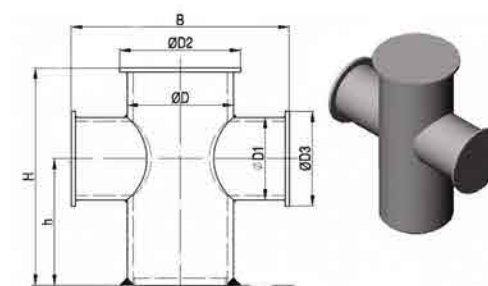


Nominal size(mm)	L	L1	L2	H	H1	H2	B	Mass (kg)	Nominal dia of applicable chain cable and rope(reference)		
									Chain cable	Wire rope	Synthetic fibre rope
400	400	780	570	300	680	460	350	210	50-60	30	80
500	500	940	690	400	840	580	400	340	62-73	40	90
600	600	1100	810	450	950	655	450	490	76-92	50	100
700	700	1260	930	500	1060	730	500	600	95-114	60	110
800	800	1420	1050	600	1220	850	550	880	117-132	70	120

Type B

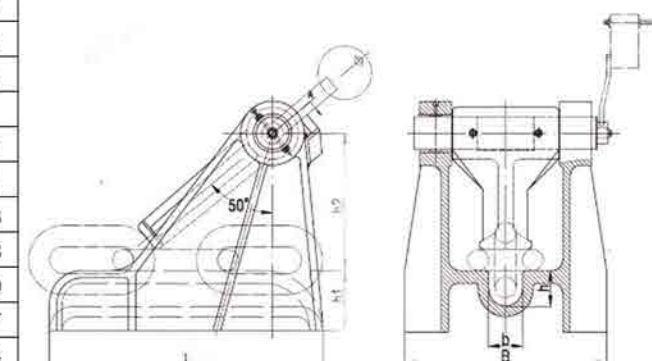


Nominal size(mm)	L	L1	L2	H	H1	H2	H3	H4	B	Mass (kg)	Nominal dia of applicable chain cable and rope(reference)		
											Chain cable	Wire rope	Synthetic fibre rope
400	400	800	600	300	320	300	200	260	350	190	50-60	30	80
500	500	960	720	400	370	350	250	310	400	310	62-73	40	90
600	600	1120	840	450	420	400	300	360	450	460	76-92	50	100
700	700	1280	960	500	470	450	350	410	500	660	95-114	60	110
800	800	1440	1080	600	520	500	400	460	550	830	117-132	70	120

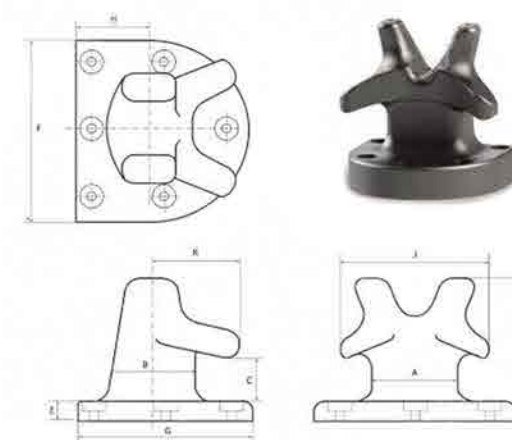


Nominal size (mm)	Sybol for material	H	b	B	D	D1	D2	D3	Chill strip	Calculated mass (kg)	Dia of applicable rope (reference)	
											Chain cable	Wire rope
150	P	480	280	460	165.2	114.3	206	158	25x4.5	33.0	16	45
	S				170	120	210	164		32.0		
200	P	560	320	520	216.3	165.2	256	206	25x4.5	60.4	22.4	-
	S				220	170	260	210		58.6		
250	P	640	360	610	267.4	216.3	308	256	25x4.5	102.9	28	-
	S				270	220	310	260		94.1		
300	P	680	380	660	318.5	267.4	360	308	25x4.5	154.0	33.5	-
	S				320	270	310	310		138.0		
350	P	720	420	720	355.6	267.4	400	312	25x4.5	186.3	37.6	-
	S				360	270	404	314		171.7		

Nominal size(mm)	B	b	L	h	H1	H2	Mass (kg)
58-60	600	95	780	102	182	394	495
62-64	630	101	835	109	191	421	582
66-68	660	107	885	116	200	446	701
70-73	700	115	950	125	212	478	846
76-78	750	123	1015	133	222	511	964
81-84	800	134	1095	143	235	550	1268
87-90	850	143	1170	153	248	588	1498
92-95	900	151	1235	162	260	620	1769
97-102	950	161	1350	175	276	665	2277
105-107	1000	170	1400	185	289	703	2664
111-114	1050	180	1480	195	302	742	3054
117-122	1120	191	1585	207	318	790	3660



TWIN HORN BOLLARD(STAG HORN BOLLARD)



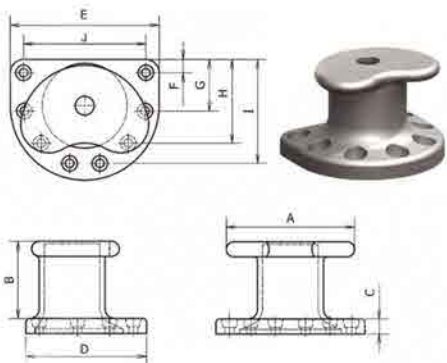
size	Dimension (mm)										Bolts	
	A	B	C	D	E	F	G	H	J	K	NO.	Dia
5	127	57	48	152	19	305	152	76	222	76	4	20
10	178	127	108	362	57	349	305	102	382	115	5	24
15	178	152	118	401	64	400	349	133	420	127	5	24
20	203	203	140	476	70	483	406	165	407	165	5	24
30	254	254	152	533	76	610	572	267	508	184	5	24
40	305	305	152	617	127	610	610	305	610	210	6	36
50	317	317	178	597	83	762	660	279	559	229	4	30
60	317	317	178	597	83	762	660	279	559	229	7	30
75	355	355	191	743	95	851	724	305	761	241	7	36
100	356	356	202	774	114	965	838	356	762	242	7	48
150	432	432	254	851	114	1016	914	381	838	278	7	48
200	432	432	254	857	120	1016	914	381	838	278	7	56

Dimension may vary according to different mold.

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers

Material: Cast Iron, cast steel and ductile iron(Spheroidal Graphite) Surface and Paint: Fully painted or with rust preventative primer;

● KIDNEY BOLLARD

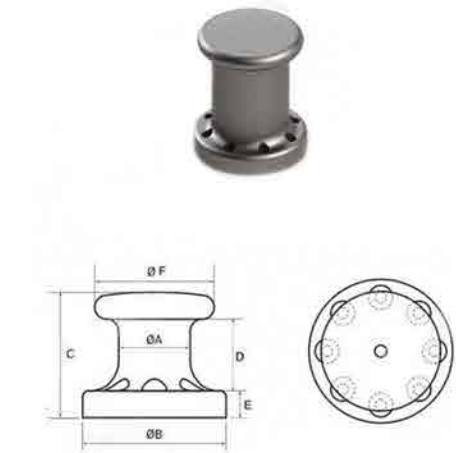


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)											Bolts	
	A	B	C	D	E	F	G	H	J	K		NO.	Dia
15	275	194	41	288	325	50	-	-	213	250		4	24
20	330	216	51	345	390	60	-	213	300	300		5	24
30	385	257	54	402	455	70	-	258	350	350		5	30
50	413	264	60	431	488	75	-	226	353	375		6	36
75	481	298	70	503	569	88	238	381	438	438		7	36
100	550	340	79	575	650	100	272	436	500	500		7	42
125	605	375	89	632	715	110	299	479	550	550		7	48
150	660	410	95	690	780	120	326	523	600	600		7	56
200	759	457	111	793	897	138	345	543	671	690		8	56

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● PILLAR BOLLARD

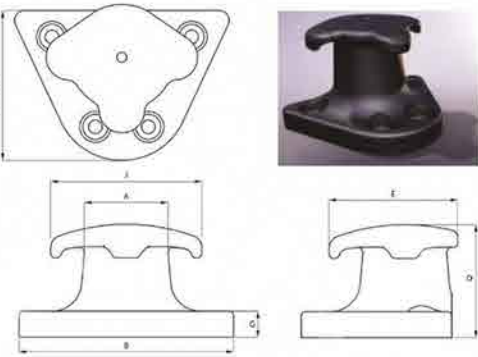


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)						Bolts	
	A	B	C	D	E	F	NO.	Dia
10	204	300	350	248	57	280	4	24
15	229	381	368	254	51	356	4	24
30	254	559	426	254	83	432	5	30
50	305	610	533	305	114	508	8	30
75	457	914	864	648	102	610	8	36
100	559	1067	762	510	102	813	8	45
150	559	1067	762	510	102	813	8	48

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● TRITON HEAD BOLLARD

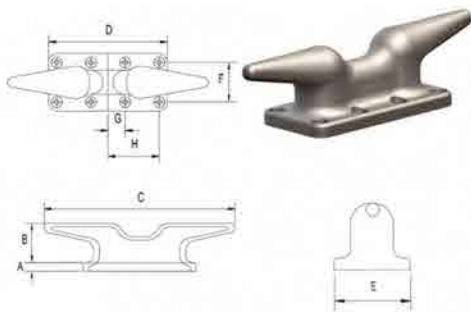


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)							Bolts	
	A	B	C	D	E	F	G	NO.	Dia
10	168	333	240	218	206	240	45	4	24
30	210	417	300	272	257	300	55	4	30
50	250	555	400	363	340	400	75	4	36
75	311	690	500	465	425	500	102	4	42
100	394	880	625	485	535	630	120	4	48
150	467	1020	720	545	613	720	125	4	56
200	482	1070	750	565	642	750	130	4	64

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● CLEAT

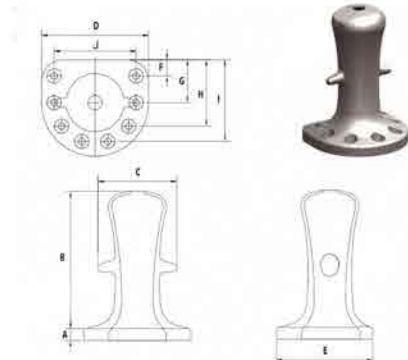


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)								Bolts	
	A	B	C	D	E	F	G	H	NO.	Dia
24	44	159	610	406	216	140	-	165	6	20
30	51	178	762	508	267	178	-	203	6	24
36	51	203	914	610	305	209	-	254	6	24
42	51	229	1067	660	305	216	95	285	8	24
54	64	292	1371	838	406	279	121	362	8	30

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● SINGLE BITT BOLLARD

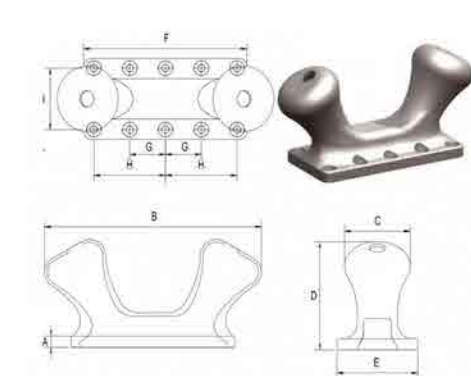


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)										Bolts	
	A	B	C	D	E	F	G	H	I	J	NO.	Dia
10	44	390	224	325	284	46	-	-	205	234	4	24
15	44	429	246	358	313	50	-	-	225	257	4	24
20	54	454	263	358	322	54	-	201	281	275	5	24
30	60	540	307	419	377	63	-	236	328	321	5	30
50	70	686	391	533	480	80	-	256	394	409	6	36
75	82	829	475	648	583	97	-	311	478	497	6	42
100	89	925	559	762	686	114	330	522	597	584	7	48
125	92	2057	604	823	741	123	357	564	645	631	7	48
150	98	1153	659	899	809	135	390	616	704	689	7	56
200	111	1270	726	991	892	149	396	614	755	759	8	56

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● INCLINED DOUBLE BITTS BOLLARD

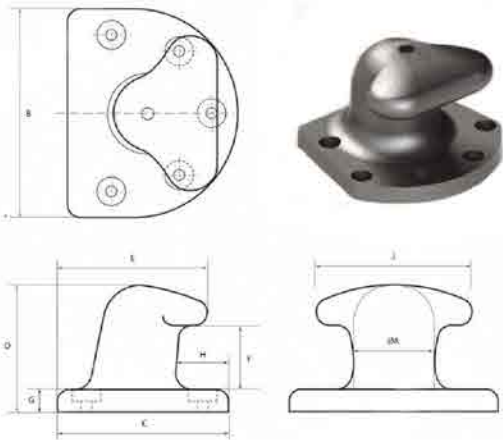


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)									Bolts	
	A	B	C	D	E	F	G	H	I	NO.	Dia
20	38	673	204	335	267	533	70	222	191	8	20
30	46	781	236	389	302	604	81	258	221	8	22
50	56	942	285	469	356	711	98	311	267	8	30
75	62	1144	346	570	432	864	489	378	324	10	36
100	73	1346	407	670	508	1016	222	444	381	10	42
125	80	1548	468	771	584	1168	256	512	438	10	42
150	97	1683	509	838	635	1270	278	556	476	10	48
200	98	1885	570	938	702	1422	311	622	533	10	56

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● KIDNEY BOLLARD

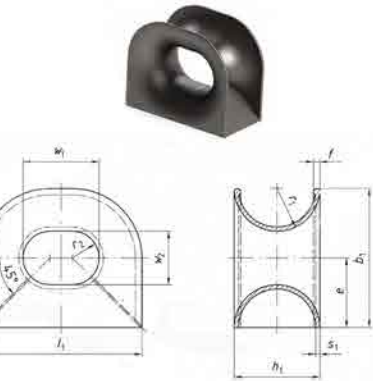


Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

size	Dimension (mm)									Bolts	
	A	B	C	D	E	F	G	H	I	NO.	Dia
10	157	350	305	241	286	127	45	91	248	5	24
15	172	400	350	275	300	135	51	105	300	5	24
20	190	483	410	290	360	145	50	125	360	5	24
30	250	600	540	380	476	190	65	155	460	5	30
50	300	800	650	480	470	245	80	206	600	5	36
60	300	800	650	490	570	245	90	206	600	5	36
75	343	800	720	510	620	260	90	222	650	6	48
100	374	1000	813	600	710	306	100	265	750	7	45
125	376	1000	813	600	710	306	100	265	750	7	48
150	430	1080	900	670	830	350	110	283	800	7	48
200	460	1080	930	685	848	320	125	287	830	7	56

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;

● KIDNEY BOLLARD



Dimension may vary according to different mold.
Material: Cast Iron, cast steel and ductile iron
(Spheroidal Graphite)

Type	Wire W.L (KN)	Dimension (mm)										Mass (kg)
		e	B1	h1	l1	r1	r2	S1	S2	W1	W2	
C2	20	157.5	315	200	360	100	57.5	12	6	160	115	29
C3	30	195	390	250	450	125	70	14	7	200	140	48
C5	50	240	480	300	550	150	90	16	8	250	180	84.5
C8	80	292.5	585	360	680	180	112.5	18	9	320	225	135.8
C12	125	355	710	440	840	220	135	20	10	400	270	211.1
C20	200	420	840	520	1020	260	160	22	11	500	320	325.4
C32	300	550	110	700	1300	350	200	35	20	600	400	840

Mounting Hardware: Galvanized Grade 8.8 bolts, nuts and washers
Surface and Paint: Fully painted or with rust preventative primer;



BOLLARD DESIGN NOTE

MARINE BOLLARD
PRODUCTS



1.0 INTRODUCTION

Marine Bollards are a the most simplest and cost-effective structural elements to be installed on decks in in order to secure vessels alongside at jetties, berths, wharves & dolphins in ports and harbors .

In the event of selecting new bollard for new jetty construction or modifications/upgrading works due to new operational needs, a new mooring assessment shall be rightly performed in order to select the most technically and operationally suitable for the intended mooring objectives.

This technical data sheet details the selection procedure for the bollard system to be fabricated and installed accordingly to the reliable guidelines established for design, manufacturing and testing of the bollards:

- Code of Practice for Maritime Structures, BS 6349 : Part 1 : 1984 : General Criteria
- Code of Practice for Maritime Structures, BS 6349 : Part 4 : 1997 : Design of Fendering and Mooring Systems

2.0 DETERMINATION OF THE BOLLARDS

In structural loading analysis of bollard, the following environmental & operational parameters shall be taken into account during the assessment:

- 2 current directions (maximum ebb and flood)
- 2 tide levels (highest high and lowest low)
- 2 vessel loading conditions (ballast and maximum draft at the terminal)
- 8 wind directions (45 degree increments)

and with the load combination as follow :

- Load is taken by mooring lines entirely
- Load is taken by breasting structures entirely
- Load is taken by combination of mooring lines and breasting structures
- Longitudinal load is taken only by spring lines

In the event of no basic data to perform the above analysis, bollard can be choose by using this approximate value suggested by BS6349-4:1994 for general cargo vessels & bulk carrier as follow:

Ship displacement	Mooring point loadt
20000 up to and incluidng 50 000	80
Above 50000 up to and including 100000	100
Above 100000 up to and including 200000	150
Above 200000	200

For location of exceptional wind, current or other adverse effects, these mooring point loads should be increased by 25%.

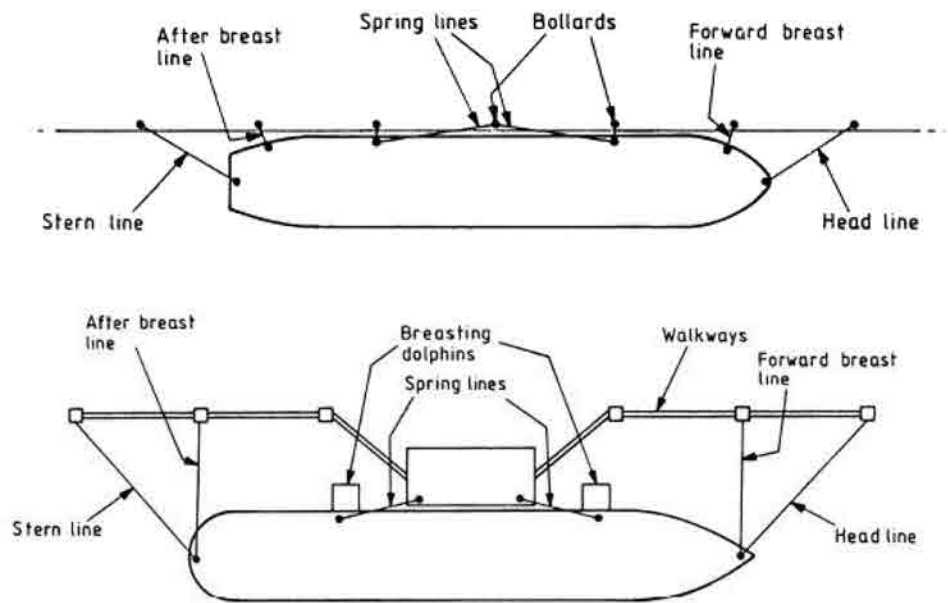




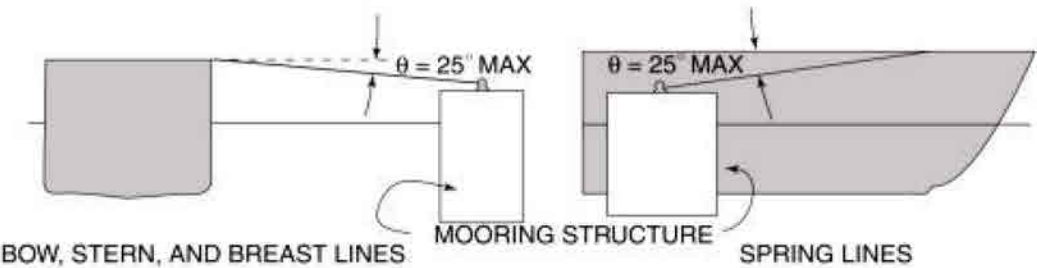
3.0 POSITIONING OF THE BOLLARDS

The second most critical parameter to be looked into is the positioning of the bollard on the deck.

According to BS6349-4:1994, the bollards is normally installed at 30m spacing, however it is suggested that for a good mooring condition, bollards positioning shall be analyzed to having a horizontal mooring pattern of 45°, -90° & -45° including 10° of springline as shown below :



As for the vertical mooring pattern, the height of the mooring point shall practically produce a mooring angle of no more than 25° as below :



4.0 BOLLARDS DETAILINGS

Our Bollards are produced to the highest material specifications in accordance to the following standards and grades.

Material	Standards	Grade(s)
Ductile Cast Iron (Spheroidal Graphite Iron)	BS EN 1563 ASTM A 536	EN-GJS-450 or 500 65-45-12 or 80-55-6
Anchor bolts(Galvanized)	ISO898 BS3692 ASTM	Gr 8.8(Galvanized) Gr 8.8(Galvanized) A325(Galvanized)
Blasting(Standard) Blasting(High performance)	N/A ISO12944	Sweep blast Sa2.5
Paint(Standard) Paint(High performance)	BS3416 ISO12944	Black bitumen(1 coat) Class C5M

BS5950:2000	Structural Use of Steelwork
BS6349 part 2:1988	Marine Structures
AS3990:1993	Mechanical Equipment Design

As for structural design of bollard itself including the holding down bolt, they are designed with a minimum Factor of Safety against failure of 3.0.





5.0 BOLLARDS TESTING

Depending on the requirement by client, normal testing procedure is as follow:

- Testing to the sample to determine the Yield Strength of the material used.
- Bollard pull out testing at which normally be carried out by independent tester by using a tugboat to pull it up to 3 times working load.

BOLLARD PROJECTS REFERENCE



Teel head---Norway



Twin Horn Bollard-----Norway



Tee head bollard----Norway



SWL 150ton Bollard double bitts---Poland



PIANC
The World Association for
Waterborne Transport Infrastructure

It is hereby certified that

LIAONING QINGYUAN N° 1 BUFFER MANUFACTURE CO. LTD

is a Large Corporate Member of

PIANC
The World Association for
Waterborne Transport Infrastructure

For the period July 13, 2017 – July 12, 2018

Geert Van Cappellen,
Secretary-General of PIANC
Brussels July 14, 2017

Boulevard du Roi Albert II 20, B 3 • B-1000 Brussels • Belgium
T + 32 2 553 71 61 • F + 32 2 553 71 55 • e-mail: info@pianc.org • www.pianc.org



华信技术检验有限公司

VOUCHING TECHNICAL INSPECTION LTD

质量管理体系认证证书

QMS CERTIFICATE OF REGISTRATION

我公司认定下列组织的质量管理体系
VTI Certifies herewith that

辽宁清原第一缓冲器制造有限公司 (含大连万春护舷科技发展有限公司)
Qingyuan Liaoning No.1 Buffer Plant Lnc (including: Dalian Wanchun Technology Inc)

组织机构代码 (912104111196350031)

辽宁省抚顺市第146号信箱

Fushun P.O. Box 146, Liaoning, P.R. China

邮政编码 (ZIP): 113103

符合以下标准的要求, 特发此证
demonstrated a Quality Management Systems
that complies with the requirements of

GB/T19001-2008 idt ISO9001:2008

管理体系认证范围:

Scope:

各类缓冲器、护舷、港机起重机配件、系船柱、防冲板、锚链、码头设施的设计、制造、销售和服务

Design, manufacture and sale and service of all type of buffer, fender, port crane accessories, bollard, steel constructed frame, anchor chains and terminal facilities

注册号:	0416Q10238R5M	颁发日期:	2016-7-8	有效终止日期:	2019-7-7
Registration No.		Issue Date		Expiration Date	



[Signature]
总经理 President



本证书信息可在国家认证认可监督管理委员会官方网站 (www.cnca.gov.cn) 上查询。
The certificate information can be inquired in the CNCA official website (www.cnca.gov.cn).

通讯地址: 北京市海淀区北三环西路48号2号楼2层2B
2B, Building 2, Floor 2, No.48 Beisanhuan Xilu, Haidian District, Beijing, China

邮编 (Zip Code): 100086
www.vti-china.org

本证书有效性须由每年例行监督审核维持
The effectiveness of this certificate is maintained by annual regular surveillance audit.



华信技术检验有限公司

VOUCHING TECHNICAL INSPECTION LTD

环境管理体系认证证书

EMS CERTIFICATE OF REGISTRATION

我公司认定下列组织的环境管理体系
VTI Certifies herewith that

辽宁清原第一缓冲器制造有限公司 (含大连万春护舷科技发展有限公司)
Liaoning Qingyuan First Stock Absorber Manufacturing Co., Ltd. (Including: Dalian Wanchun Fender Technology Development Co., Ltd.)

组织机构代码 (912104111196350031)

辽宁省抚顺市第146号信箱

No. 146 Mailbox, Fushun, Liaoning, P.R. China

邮政编码 (ZIP): 113103

符合以下标准的要求, 特发此证
has demonstrated an Environmental Management System
that complies with the requirements of

GB/T24001-2004 idt ISO14001:2004

环境管理体系覆盖范围:

Scope:

各类缓冲器、护舷、港机起重机配件、系船柱、防冲板、锚链、码头设施的设计、制造、销售和服务。

Design, manufacture, sale and service of all kinds of bumper, fender, port crane accessories, dolphin, impingement plate, chain, port facilities

注册号:	0416E10139R0S	颁发日期:	2016-3-17	有效终止日期:	2019-3-16
Registration No.		Issue Date		Expiration Date	



中国认可
国际互认
管理体系
MANAGEMENT SYSTEM
CNAS C004-M

[Signature]
总经理 President



本证书信息可在国家认证认可监督管理委员会官方网站 (www.cnca.gov.cn) 上查询。
The certificate information can be inquired in the CNCA official website (www.cnca.gov.cn).

通讯地址: 北京市海淀区北三环西路48号2号楼2层2B
2B, Building 2, Floor 2, No.48 Beisanhuan Xilu, Haidian District, Beijing, China

邮编 (Zip Code): 100086
www.vti-china.org

本证书有效性须由每年例行监督审核维持
The effectiveness of this certificate is maintained by annual regular surveillance audit.



华信技术检验有限公司

VOUCHING TECHNICAL INSPECTION LTD

职业健康安全管理体系认证证书

OHSMS CERTIFICATE OF REGISTRATION

我公司认定下列组织的职业健康安全管理体系
VTI Certifies herewith that

辽宁清原第一缓冲器制造有限公司 (含大连万春护舷科技发展有限公司)
Liaoning Qingyuan first stock absorber manufacturing Co., Ltd. (including: Dalian
Wanchun Fender Technology Development Co., Ltd.)

组织机构代码 (912104111196350031)
辽宁省抚顺市第146号信箱
No. 146 Mailbox, Fushun, Liaoning, P.R. China
邮政编码 (ZIP): 113103

符合以下标准的要求, 特发此证
has demonstrated an Occupational Health and Safety Management System
that complies with the requirements of

GB/T28001-2011 idt OHSAS18001:2007

职业健康安全管理体系覆盖范围:

Scope:

各类缓冲器、护舷、港机起重机配件、系船柱、防冲板、锚链、码头设施的设计、制造、销售和服务。

Design, manufacture, sale and service of all kinds of bumper, fender, port crane accessories, dolphin, impingement plate, chain, port facilities

注册号: 0416S10140R0S 颁发日期: 2016-3-17 有效终止日期: 2019-3-16
Registration No. Issue Date Expiration Date



中国认可
管理体系
MANAGEMENT SYSTEM
CNAS C004-M

总经理 President



本证书信息可在国家认证认可监督管理委员会官方网站 (www.cnca.gov.cn) 上查询。
The certificate information can be inquired in the CNCA official website (www.cnca.gov.cn).

通讯地址: 北京市海淀区北三环西路48号2号楼2层2B
2B, Building 2, Floor 2, No. 48 Beisanhuan Xilu, Haidian District, Beijing, China

邮编 (Zip Code): 100086
www.vti-china.org

本证书有效性须由每年例行监督审核维持
The effectiveness of this certificate is maintained by annual regular surveillance audit.



ISET S.r.l.

Sede Legale e Uffici
Via Donatori di sangue, 9 - 46024 Moglia (MN)
Tel. e fax +39 (0)376 598963
iset@iset-italia.com www.iset-italia.eu

Cap. soc. i.v. € 10.200,00
Cod. Fisc. e P.IVA 02 332 750 369
Reg. Imprese 02 332 750 369
REA MN 0221098

CERTIFICATE OF COMPLIANCE

Certificado de Conformidade - Сертификат соответствия - Konformitätserklärung

1) **APPLICANT:**
Liaoning Qingyuan NO.1 Buffer Manufacture Co., Ltd
146 Mailbox, Fushun City, Liaoning Province, China

2) **CERTIFICATE NO.:**
IT091441QY160531

3) **WITH REFERENCE TO EC DIRECTIVE APPLIED:**
General Product Safety Directive 2001/95/EC

4) **CERTIFICATION ISET MARK:**

HARMONIZED STANDARDS APPLIED:

5) **PRODUCT CHARACTERISTICS:** Rubber Fender

MODEL(S): D, CY, SC, A, CT, GD, S, F, SCN

REMARK: CE marking and EC declaration are duties of the manufacturer before the putting into service of its product on market. The verification has been carried out on voluntary application of the manufacturer based only on the documents prepared and provided by the manufacturer itself. The manufacturer is responsible to maintain the internal production control to ensure the compliance of the product. ISET declines any liability with reference to any other document, product or test report that hasn't been submitted to evaluation.

6) **DATE OF ISSUE:** 31/05/2016**DATE OF EXPIRE:** 30/05/2021

CERTIFICATION MANAGER:





证书格式号/Form: S01.02-
HQ000046

中国船级社
CHINA CLASSIFICATION SOCIETY
船用产品检验证书
INSPECTION CERTIFICATE OF MARINE PRODUCT

证书编号/Certificate No. DL16P00075

兹证明应 辽宁清原第一缓冲器制造有限公司 的申请,

下列产品经本社注册验船师检验,符合本证书注明标准的要求。

This is to certify that, upon request of
Liaoning Qingyuan No.1 Buffer Manufacture Co., Ltd.

the following products have been inspected by the undersigned the surveyor of the Society and are found to comply
with the requirements of the specified standards.

制造厂名 辽宁清原第一缓冲器制造有限公司
Manufacturer Liaoning Qingyuan No.1 Buffer Manufacture Co., Ltd.

订货方 大连万春船科技发展有限公司
Purchaser Nil

产品名称 橡胶护舷
Product Rubber Fender

产品编号
Serial No. 见附页

申请方确定的产品标准/ Product Standard Specified by the Applicant

1. 《护舷实验大纲ITP2016001》

产品检验标志/ Marking

位置/ Position : 在产品上/ On the product

标志样式/ Type of Marking : CCS 防伪标志/ CCS anti-forgery label

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验船师
Surveyor 赵琦 Zhao Qi

本证书按照中国船级社《钢质海船入级规范》及有关规定签发,关于证书的有效期及本证书背面说明,由本证书背面说明。本证书在有效期内,所有证书为一个整体,必须同时使用。每一页证书均须由本社盖章方为有效,证书复印件无效。任何单位和个人不得擅自复制或篡改本证书的部分内容,有关各方对持证书的真实性负责。如有任何单位和个人擅自复制或篡改本证书的部分内容,本社将依法追究其法律责任。

This Certificate is issued pursuant to the Rules for Classification of Seagoing Steel Ships and related procedures of the Society. Refer to the back of the certificate for detailed requirements of the certificate. When the certificate consists of more than one page, all pages of the certificate are taken as a whole and are used simultaneously. No certificate page is valid without bearing the stamp of the Society and no copied form of the certificate is regarded as valid. Any part of the certificate is not to be extracted or abridged by any unit or individual in any form. Related parties who are entrusted about the authenticity of the certificate may inquire of the Society or its office.



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No. 15730231

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1. 证书适用范围
1.1. 经本社设计认可、型式认可或工厂认可的产品及其生产厂,本社将颁发产品证书。当 CCS 规范要求产品证书的情况下,认可证书不能替代产品证书。
1.1.1. 设计认可系指 CCS 准予设计在特定条件下适用于规定用途的认定过程,一般包括图纸审查和型式试验(如适用时)。
1.1.2. 型式认可系指 CCS 通过产品的设计认可和制造管理体系审核,以确认申请认可的制造厂具备持续生产符合 CCS 规范要求的产品的能力的认定过程。根据产品制造管理体系的证实程度,为型式认可 A 和 B 两级,其中申请型式认可 B 的制造厂应具有申请认可产品的生产和测试能力;并具有有效的质量控制制度;申请型式认可 A 的制造厂除具备型式认可 B 的条件外,还应建立并保持一个至少符合 ISO9000 标准的质量保证体系,使其产品的质量保持持续稳定。
1.1.3. 工厂认可系指 CCS 通过制造厂的资料审查、认可试验和产品制造过程的审核,对产品制造厂的产品生产条件和能力予以确认的认定过程。
1.2. 入级和法定产品经本社注册验船师检验完成后,本社将颁发产品证书或签署等效证明文件。
1.2.1. 产品证书是由 CCS 验船师签发的文件以证明 a) 产品符合规范要求; b) 产品已进行规定的检验和试验; c) 检验样品取自检验产品本身; d) 产品的试验在验船师参加或根据特别规定下进行。
1.2.2. 等效证明文件是由制造厂出具并经 CCS 盖章和验船师签署的文件以证明 a) 产品符合规范要求; b) 产品已进行规定的检验和试验; c) 检验样品取自检验产品本身; d) 产品的试验在验船师参加或根据特别规定下进行。
1.3. 对于要求型式认可和/或工厂认可而不要求持有产品证书的入级和法定产品,可由制造厂证明形式予以证明。
1.3.1. 制造厂证明由制造厂签发,以证明: a) 该产品经 CCS 型式认可或工厂认可; b) 产品符合规范要求; c) 产品已进行规定的检验和试验; d) 检验样品取自检验产品本身; e) 产品的试验在制造厂授权的部门在场的情况下进行。
1.4. 规范和法定要求以外的产品经本社注册验船师检验完成后,由检验证书或试验证书予以记录和证明。
1.4.1. 检验证书是由 CCS 验船师签署的文件,以证明 a) 符合申请方确定的产品标准; b) 检验和试验经验船师见证和/或试验报告经验船师审查; c) 试验样品取自现有产品生产中。
1.4.2. 试验证书是由 CCS 验船师签署的文件,以证明 a) 产品的试验在验船师在场下进行; b) 试验样品取自现有产品生产中。
2. 证书的自动失效
本社通过认可、检验工作所签发的证书或相关的证明文件,在发生下列情况时即自动失效:
2.1. 证书或证明文件严重破损,内容无法辨认,或证书页缺失;
2.2. 证书或证明文件的内容被涂改;
2.3. 申请方、制造厂、提供服务方或其他相关各方,在取得本社签发的证书或证明文件的过程中使用欺诈、作假、故意隐瞒事实等不道德手段或存在违法行为,致使本社在认证工作中无法客观、全面了解必要的认可信息;
2.4. 由于发证依据变化,经本社或国家主管机关认定并公布予以废止的。(例如:相关证书或证明文件的发证依据发生重大改变,且原使用的发证依据被证实为对产品或服务的使用安全性存在重大影响);
2.5. 由于其他原因,经本社认定并通知相关方予以废止的;
2.6. 有关认可证书的保持和失效见本社规范;
3. 责任
3.1 本社承担的认可和检验服务是在所涉及的产品设计方、制造方、拥有方、销售方、供应方、修理方、使用方以及其他方履行各自职责的基础上进行的。无论本社及所属验船师采用何种认可/检验方式,也不论在本社名义下颁发、签署的任何报告、文件和证书在内容上如何,均不意味着可减轻或解除上述任何方应承担的任何责任。
3.2 本社签发的与认可/检验有关的任何文件,只反映检验当时的技术状况,并不表明被认可的工厂和产品的所有权和知识产权归属,与被认可的工厂和产品的所有权和知识产权有关的任何争议,与本社无关。
3.3 本社的认可/检验不影响,替代与本社授权或检验无关的各方对上述工厂的认可/发证,并且不对本社授权或检验无关的各方负责,不承担其未经应允而承认、接受本社认可/检验所导致的法律和经济责任。
3.4 本社仅对由于自身疏忽行为而直接造成的合同关系方的损失或损害承担责任。在任何情况下,本社均不对合同关系方的间接损失或随后引发的附加损失或损害承担责任,也不对非合同关系方的任何损失承担责任。
3.5 尽管有上述规定,如依法判定合同关系方所遭受的损失或损害,仅仅是由于本社或其雇员、代理人或本社其他代表方的疏忽行为造成的,本社将承担责任,并将支付赔偿。但此赔偿的数额不超过该项服务收费的 5 倍,且最大不超过人民币 200 万元。但如该损失或损害系由如下行为造成,本社将不承担任何责任:
1) 本社雇员超越其受权权限的行为;
2) 本社代理人或其他代表方,超越本社对其书面授权范围的行为。
3.6 对本社承担责任的损失或损害的索赔,应以书面形式,在损害最初发现或损失形成的 6 个月内提出,否则将被视为彻底放弃索赔权。
4. 适用法律和仲裁
4.1 本证书条款的生效、解释、执行、争议的解决均适用中华人民共和国法律。
4.2 除与本社另有约定外,凡因与本社提供的服务有关的任何争议,均应提交中国海事仲裁委员会,按照申请仲裁时该会现行有效的仲裁规则进行仲裁。仲裁裁决是最终的,对争议双方均有约束力。
5. THE APPLICATION OF CERTIFICATES
5.1. After Approval, Certificate of Design Approval, Certificate of Type Approval or Certificate of Works Approval will be issued by the Society for the products and manufacturers. Where a products certificate is required by CCS' rules, the Approval Certificate cannot replace it.
5.1.1. Design approval means the process whereby permission is granted by CCS for the design to be used for a stated purpose under specific conditions, generally comprising drawing approval and evaluation/type test (if applicable).
5.1.2. Type approval means the evaluation process whereby the requesting manufacturer's ability to produce consistent products in compliance with CCS' rules is confirmed by CCS through Design Approval of products and audit of manufacturing management system. Depending on the validation of the manufacturing management system, the type approval is to be classified as A or B.
6. A manufacturer requesting type approval B is to be capable of producing and testing the products to be approved and have an effective quality control system. A manufacturer requesting type approval A is to be qualified for type approval B and in addition, to establish and maintain a quality assurance system complying at least with ISO 9000 so as to meet the specified level of product quality consistently.
7. Works approval means the evaluation process whereby the manufacturer's production conditions and ability is confirmed by CCS through document review, approval testing and verification of manufacturing process.
8. A unit/batch inspection of classed or statutory products is to be documented as Certificate of Product or Equivalent document:
8.1. Certificate of Product issued by the Surveyor to show that: i) the product complies with rules; ii) required inspection and test have been carried out; iii) the sample is taken from the product to be inspected; iv) the product has been tested in the presence of the Surveyor or in a specially agreed condition.
8.2. Equivalent document issued by the manufacturer and endorsed by the Surveyor to show that: i) the product complies with rules; ii) required inspection and test have been carried out; iii) the sample is taken from the product to be inspected; iv) the product has been tested in the presence of the Surveyor or in a specially agreed condition.
9. The classed and statutory products of which the type approval and/or works approval is required but the products certificate is not required, may be certified as Manufacturer's document.
9.1. The manufacturer's document is issued by the manufacturer to show that: i) the product is type approved or works approved by CCS; ii) the product complies with rules; iii) required inspection and test have been carried out; iv) the sample is taken from the product to be inspected; v) the product has been tested in the presence of the department authorized by the manufacturer.
9.2. A unit/batch inspection Products other than those specified in rules or statutory requirements is to be documented as Inspection Certificate or Test Certificate:
9.3. Inspection Certificate issued by the Surveyor to show that: i) the product standards as determined by the applicant has been complied with; ii) the inspection and test has been witnessed by the Surveyor and/or the test report has been reviewed by him; iii) the test sample has been taken from the existing products.
9.4. Test Certificate issued by the Surveyor to show that: i) the product has been tested in the presence of the Surveyor; ii) the test sample has been taken from the existing products.
10. AUTOMATIC INVALIDATION OF CERTIFICATE
The certificates or equivalent documents issued by the Society by means of approval or certification will be invalidated automatically under the following circumstances:
10.1. The certificate or equivalent document is severely damaged and illegible or with missing page(s).
10.2. The certificate or equivalent document is altered.
10.3. The applicant, manufacturer, service supplier or other interested parties deceive, swindle and hide facts or even dare to violate the laws in the process of obtaining the certificate or equivalent document issued by the Society, so that the Society can not get hold of the certification information fully and objectively.
10.4. Due to the change of the certification basis, the certificate or equivalent document is revoked as advised by the Society or the national administrations. (e.g. The certification basis for relevant certificate or equivalent document are significantly changed and the original certification basis are substantiated to badly affect the safety of the product or service used).
10.5. Due to other reasons, the certificate or equivalent document is revoked as confirmed and advised by the Society to relevant parties.
10.6. Please refer to CCS' Rules for the maintenance and invalidation of Approval Certificate
11. LIABILITY
11.1. The service of approval / inspection undertaken by the Society is carried out on the basis that the designers, manufacturers, owners, sellers, suppliers, repairers, operators and other parties fulfill their respective responsibilities. The contents of any reports, documents and certificates issued by the Society do not mean to diminish any liability of any party mentioned above or absolve it therefrom, whatever the module of approval/inspection adopted by this Society and its surveyors.
11.2. Any approval/inspection-related documents issued by the Society only reflect the status at the time when the approval/inspection is carried out. They do not constitute the description for ownership and intellectual property rights of the approved/inspected factory and product. This Society should not be affected by any dispute over ownership and intellectual property rights of the approved/inspected factory and product.
11.3. The approval/inspection of the Society does not affect and replace any approval and certification of the manufacturer by any parties that bear no relation with this Society's authorization or survey and therefore takes no responsibility for these parties. The Society does not undertake any legal and economic liabilities arising from accepting this Society's certificate without prior permission from this Society.
11.4. The Society will be liable only for the loss or damage of contract parties resulting directly from its negligent act. In no event shall the Society be liable for any indirect or consequential losses or damage, and any loss of non-contract parties.
11.5. Notwithstanding the previous paragraph, the Society will be liable for the loss or damage due to negligent act judicially attributed exclusively to the Society and its employees, agents or other parties acting on behalf of the Society. And in no case shall the amount of this liability exceed five times the fee(s) charged by the Society in respect of the service(s) in question or 2,000,000 RMB in maximum. The Society liability for the loss or damage is specially excluded when such loss or damage arises out of an act:
(1) by an employee of the Society acting outside the terms or scope of his/her employment; or
(2) by any agent or other parties acting on behalf of the Society, when such act exceeds the authority granted in writing by the Society to such agent or parties.
11.6. Any claim for any loss or damage set forth above is to be made in writing within six months of the date the damage first discovered or the loss occurred, failure of doing so will be deemed as an absolute waiver of this right.
12. APPLICABLE LAWS AND ARBITRATION
12.1. The laws of the People's Republic of China shall apply to the coming into force, explanation, implementing, and resolution of dispute of the clause of the certificate.
12.2. Unless otherwise agreed with the Society, any dispute of whatsoever nature in respect to the service(s) provided shall be referred to China Maritime Arbitration Commission and arbitrated in accordance with its arbitration rules effective at the time of request for arbitration. The arbitration award shall be final and binding upon both interested parties.



证书编号/Certificate No. DL16P00075

产品明细/ Product Description

橡胶护舷/Rubber fender
产品名称/Name of product : 见附页
型式/Type : 见附页
图号/Drawing No. : 见附页
数量/Quantity : 见附页

试验项目及结果/ Scope of Testing and the Result

- 1、外观与尺寸测量: 现场见证, 结果合格;
2、产品压缩试验: 现场见证, 结果合格。

责任声明/ Statement of Responsibility

本社的检验不影响、替代与本社授权或检验无关的各方对上述工厂的认可和发证, 并且不对与本社授权或检验无关的各方负责, 不承担其未经应允而承认、接受本社检验所导致的法律和经济责任。
The inspection of the Society does not affect and replace any approval and certification of the manufacturer by any parties that bear no relation with this Society's authorization or survey and therefore takes no responsibility for these parties. The Society does not undertake any legal and economic liabilities arising from accepting this Society's certificate without prior permission from this Society.

中国船级社大连分社
CCS Dalian Branch

*****本证书正文完/ End of Text*****

注: 本证书含有附页, 共1页

Note:The certificate is attached with 1 additional page(s)

Nº 15963061

证书编号/Certificate No. DL16P00075

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附页

证书编号/Certificate No. DL16P00075

产品明细

产品名称	型式	图号	编号	数量
D 型橡胶护舷	D300x300x1500	D300x300x1500-3z-2015-001	D300x300x1500	1
拱型橡胶护舷	SA500x2000	SA500x2000-2015-002	SA500x2000	1
筒型橡胶护舷	CY500x1000	CY500x1000-2015-003	CY500x1000	1
鼓型橡胶护舷	SC1250H	SC1250H-2015-004	SC1250H	1
锥型橡胶护舷	CT500H	CT500H-2015-005	CT500H	1

Nº 15963062

证书编号/Certificate No. DL16P00075

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