

MARINE FENDERS

Cell or Cone Type – HCF SERIES

1. GENERAL INTRODUCTION

With successful service record dating back to 1972, **HERCULES Elastomeric Energy Absorbing Devices (eg HVB)** have been widely used worldwide in today's construction industry although used extensively in bridge structures, **HERCULES Energy Absorbing Devices** are also specified in marine structures and other applications where Hercules Fenders (HF) and vibration isolation (HVB) are required.

Hercules Cell Fenders (HCF) are typically installed against the face of marine facility for the purpose of attenuating the forces inherent in arresting the motion of berthing vessels safety

2. DESIGN CONCEPT

Hercules Cell Fender (HCF) is specially modeled as a 3-dimensional elastomeric device with Excellent Energy Absorption (E_a) at minimum Rated Reaction Force (R_a). The elastomeric section is vulcanized onto mild steel mounting plates on both ends. It is designed such that the solid elastomeric element deflects radically to allow multi-directional dispersion of energy while elastomeric element maintains its geometrical stability. The HCF design incorporates other features for durable performance and design advantage:

- a) Higher Energy Absorption E_a at minimum Rate Reaction Force R_a
- b) Uniform performance at multi-direction contact
- c) Reduced Frictional Force by attachment of PE ng pads on Frontal Frame
- d) Hull is not stained by the carbon content of rubber since no direct contact
- e) Superior performance at larger berthing angles
- f) Uniform deflection under Shear Force
- g) Compact Geometry shape allows economic design of support structures
- h) Excellent corrosion Protection on exposed steel components
- i) Simplified connection detail allows easy site installation
- j) Requires lesser maintenance compared with conventional type fenders

3. MANUFACTURE, TOLERANCES AND QUALITY

HERCULES Rubber Fenders can be designed and manufactured to the dimensional tolerances using natural rubber or neoprene to the requirements of Quality Management System MS ISO 9001 : 2000 and the following standards: -

- BS 5400 : PART 9
- AASHTO
- Australian Standards
- JIS, etc

4. MATERIAL SPECIFICATION

Generally all proposed materials are equivalent to **BS, JIS ASTM & etc.** All material will be new and unused, with no reclaimed material incorporated in the finished fenders

ELASTOMER

The marine fenders have no moving parts to perform their required functions. Instead, they achieve this energy absorption through deformation of the elastomer. Therefore, the properties of the elastomer largely determine the behavior of the fenders.

Although a wide variety of elastomers are available, only two types are allowed for use on marine fenders:

- a) Nr, natural rubber (100% virgin natural polyisoprene)
- b) Cr, neoprene (100% virgin synthetic polychloroprene)

Each of these materials has its advantages. Polyisoprene (Natural Rubber) does not stiffen as drastically at low temperatures. Polychloroprene (Neoprene) will exhibit more creep but has a greater resistance to ozone and chemical deterioration.

The mechanical properties of Hercules Fenders after tested according to the specified standards/methods, will comply with project relevant requirements

Table 1

Physical Properties of Rubber

Property		Unit	Requirement	Relevant Testing Standard And Conditions	Similar Standards
Before Aging	Tensile Strength	Kg/cm	min. 160	JIS K 6301 item 3 Dumbell No. 3	ISO37 ASTM S412 BS903 A2
	Elongation	%	min. 350		
	Hardness	Deg.	max. 77	JIS K 6301 item 5 A type tester	ISO2783 ASTM D2240 BS903 A26
After Aging	Change in Tensile Strength	%	not less than 80% of original value	JIS K 6301 item 6 Dumbell No. 3 70°C x 96 hrs aging through Air Heating	ISO188 ASTM D573 BS903 A19
	Change in Elongation	%	not less than 80% of original value		
	Hardness	Deg.	Original value +8 deg. max.	JIS K 6301 item 5 A type tester durometer	Alt. ASTM D2240 shore A
		Kg/cm	min. 30		
Tear resistance		%	min. 30	JIS K 6301 item 10	ASTM D395 70°C x 22 hrs heat treatment
Compression set		cc	Max. 1.5 No visible cracks	Method-C 3000 revolutions JIS K 6301 cracking	BS903 A9 ASTM D1149 Elongation 20%, 40° x 100 hrs
Abrasion					
Resistance Ozone Resistance					

MILD STEEL PRODUCTIONS

All mild steel products used for frontal panel & mounting of the rubber fenders are structural mild steel plate and flats [weldable] of Grade 43A to BS4360 / SS400 /ASTM A709 / ASTM A36 A570 or equivalent.

UHMW PE PADS

UHMW PE pads are low friction pads bolted to the frontal frame of fender. The PE pad has no more than 0.2 coefficient of friction. It prevents the ship hull from being damaged by the steel panel and also protects the elastomer in fender assembly.

PE has shore D Durometer hardness of 65±5. In the event of damage, these pads can easily be replaced by removing the attachment bolts.

ATTACHMENT BOLTS & ANCHORAGE

For the case of anchorage & attachment bolts, stainless steel & Gr 8.8 or Gr 12.9 are available. The following details show the proposed accessories of Hercules Cell Fenders:

Table 1 ATTACHMENT BOLTS & CAST IN ANCHORS

Hercules Part No.	Qty	ØQ1	Attachment bolts			Wachters				Socket flange			Cast In Anchors			Est'd Wt (kg)
			Lt	Lb	tb	Wx	Wy	ØQ2	tw	ts	A	aa	Lf	Ls	Lj	
HCF/500N	6	M24Gr8.8	60	70	15	75	75	26	6	10	65	50	50	90	185	2.00
HCF / 600N	6	M28Gr8.8	65	80	17	85	85	30	6	10	75	60	75	95	210	2.50
HCF/800N	6	M30Gr8.8	70	90	19	85	85	32	6	10	80	65	85	110	230	3.00
HCF/1000N	6	M32Gr8.8	80	105	23	100	100	34	6	10	85	70	100	125	255	4.50
HCF/1150N	6	M36Gr8.8	80	105	23	100	100	38	6	10	85	70	100	125	255	4.50
HCF/1250N	8	M36Gr8.8	80	105	23	100	100	38	6	10	85	70	100	125	255	5.50
HCF/1450N	8	M36Gr8.8	80	105	23	100	100	38	6	10	85	70	100	125	255	5.50
HCF/1650N	8	M36Gr8.8	80	105	23	100	100	38	6	10	85	70	100	125	255	5.50

Table 2 SUPPORT CHAIN

Design Load	Chain Dia, Øs	Shackle Dia, Øs	Dogbone Shackle		U-Anchor Dia, Øu
kN	(mm)	(mm)	ØQs	Length	(mm)
Material	SBC490	S45, SCM435	SBC490(S45C), SS400		SS400
80	22	20	M30	130-220	32
100	25	22	M36	150-250	36
130	28	25	M39	160-270	40
180	32	29	M42	170-300	42
200	34	32	M45	190-320	46
220	36	35	M48	190-340	48
250	38	38	M52	210-360	55
280	40	38	M56	230-390	55

TYPICAL SITE INSTALLATION METHOD FOR HERCULES CELL FENDER [HCF]

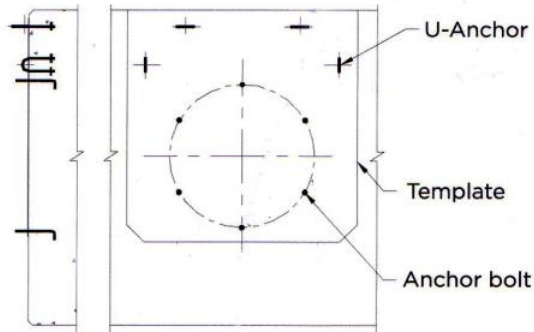


Fig 1 Cast-In anchors using a Template

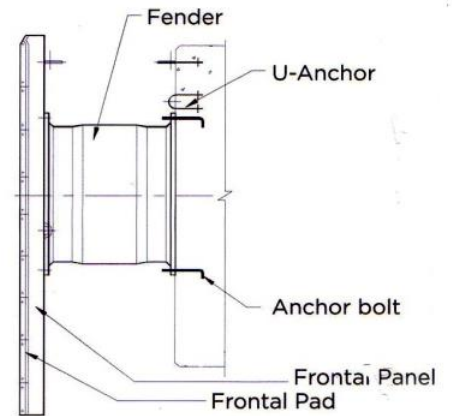


Fig 4 Install all Other Accessories

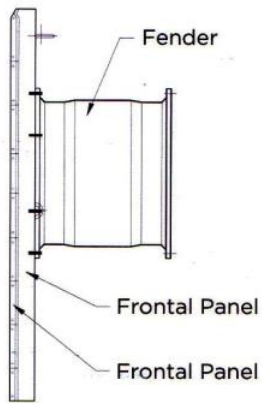


Fig 2 Mount Frontal Panel to Fender c/w Vulcanized with Mounting Plates

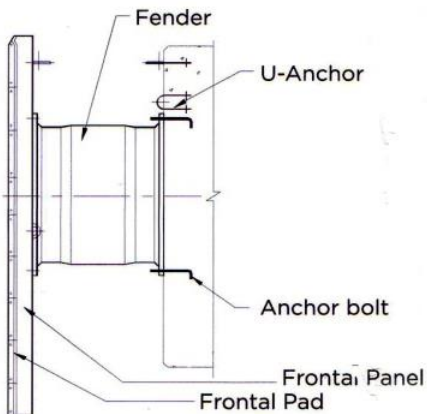


Fig 3 Install the Fender & Frontal Panel onto berthing face by fastening the fixing Bolts to Cast in Anchors

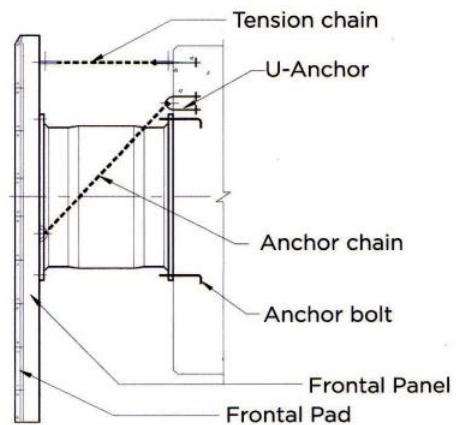
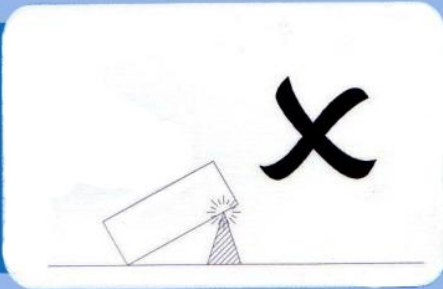
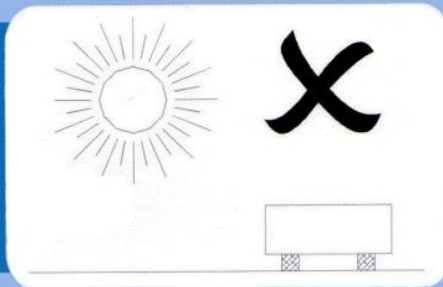


Fig 5 Inspect To Tighten All other fixing Bolts

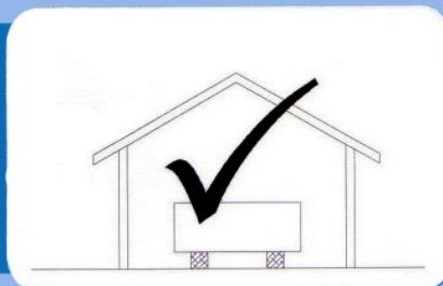
Handling and Storage



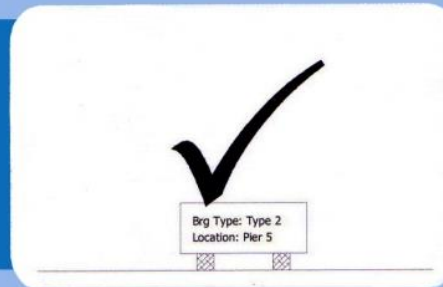
Avoid fenders in contact with sharp objects. This can damage the surface of fenders



Avoid exposure to direct sun light.



Store under cover, away from sun light, oils, chemicals, etc..



All fenders should be clearly identified by a type, reference number and location.