

SHIBATAFENDERTEAM GROUP

GERMANY | FRANCE | AMERICAS | ASIA

The importance of Proper Fender Design and Procedure

- 15th ASEAN Ports&Shipping 2017

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CONTENT

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2. TYPICAL FENDER DESIGN STEPS
3. REFERENCE PROJECTS





SHIBATAFENDERTEAM GROUP

HEADQUARTERS

Hamburg, Germany

OFFICES

Lansdowne, USA

Paris, France

Kuala Lumpur, Malaysia (from 01st of June 2016)

PRODUCTION

Rubber fender production in Japan and Malaysia

Foam Filled Fender production in Germany and the USA

Own steel fabrication facilities in Germany

TURNOVER

~ 40 Million USD

DELIVERED PROJECTS

> 2.800 worldwide since 2006

PROJECT SIZES

> 5 Million USD / project

> 200 fender systems / project

ACHIEVEMENTS

ISO 9001

ISO 14001

PIANC Type Approval for std. range



CASE STUDY

Typical steps for the design of a high performance, reliable and high quality fender system



FIRST STEP – BASICS

➤ DETERMINATION OF APPLICABLE STANDARDS

- PIANC 2002: Guidelines for the Design of Fender-Systems
- British Standard 6349: Maritime Structures
- BS5950: Structural Use of Steel in Buildings
- EUROCODE 3: Design and Construction of Structural Steelwork





FIRST STEP – BASICS

➤ COLLECTION OF DATA

Most important data:

- Site condition
- Vessel type, Size
- Approach velocity of vessels
- Quay wall structure type
- Tidal level
- Temperature

PROJECT REQUIREMENTS

Name: _____
 Title: _____
 Client: _____
 Designer: _____
 Contractor: _____

Accurate project information is needed to produce the most suitable letters.
 Please use the table below to describe the operating requirements with as much detail as possible.

Project: New Construction Upgrade Status: Preliminary Design Trade

SHIP INFORMATION

SHIP TYPE		SHIP SIZE	
Species	_____	Length	_____
Model No.	_____	Beam	_____
Displacement	_____	Depth	_____
Length Overall	_____	Draft	_____
Beam	_____	Max. Depth	_____
Deck	_____	Max. Draft	_____
Height	_____	Max. Depth	_____
Max. Depth	_____	Max. Draft	_____
Max. Draft	_____	Max. Depth	_____
Max. Draft	_____	Max. Depth	_____

DEPTH INFORMATION

Quay Wall Type Quay Wall Type Quay Wall Type

QUAY WALL TYPE		QUAY WALL TYPE		QUAY WALL TYPE	
Species	_____	Length	_____	Species	_____
Model No.	_____	Beam	_____	Model No.	_____
Displacement	_____	Depth	_____	Displacement	_____
Length Overall	_____	Draft	_____	Length Overall	_____
Beam	_____	Max. Depth	_____	Beam	_____
Deck	_____	Max. Draft	_____	Deck	_____
Height	_____	Max. Depth	_____	Height	_____
Max. Depth	_____	Max. Draft	_____	Max. Depth	_____
Max. Draft	_____	Max. Depth	_____	Max. Draft	_____



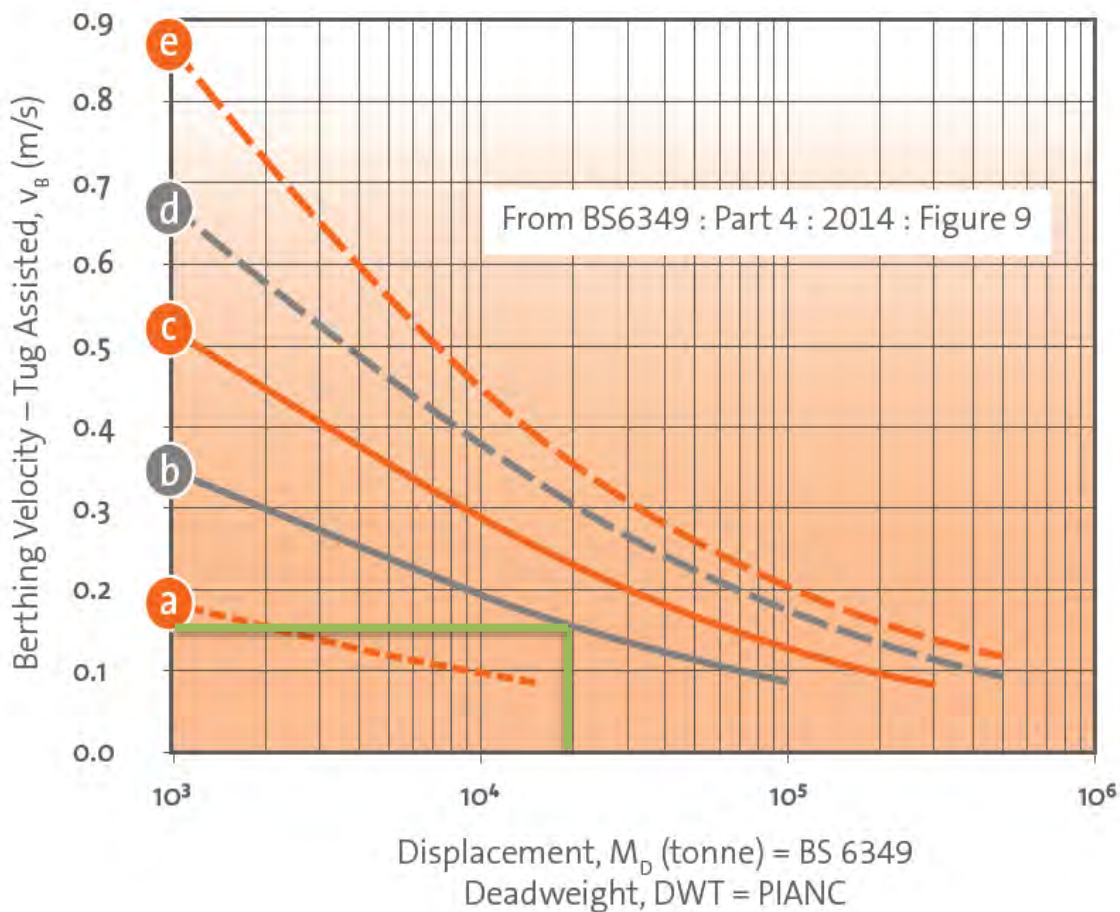
SECOND STEP – DESIGN

➤ PREPARE ENERGY CALCULATIONS

ENERGY ABSORPTION CAPACITY > BERTHING ENERGY

$$E = \frac{1}{2} M * v^2 * C_e * C_m * C_s * C_c$$

V - Berthing Velocity



Brolsma

- a) Easy, Sheltered
- b) Difficult, Sheltered
- c) Easy, Exposed
- d) Good, Exposed
- e) Difficult, Exposed

SECOND STEP – DESIGN

➤ PREPARE ENERGY CALCULATIONS

$$E_N = \frac{1}{2} M * v^2 * C_e * C_m * C_s * C_c$$

$$E_A = S_f * E_N$$

$$E_{catalog\ value} \geq E_A$$

VESSEL CLASS	LARGEST	SMALLEST
Tankers	1.25 ^A	1.75 ^B
Bulk carriers	1.25 ^A	1.75 ^B
Gas carriers	1.50~2.00	
Container ships	1.50 ^A	2.00 ^B
General cargo, freighters	1.75	
RoRo & Ferries	≥2.00	
Car carriers	2.00	
Cruise ships	2.00	
Fast ferries	≥2.00	
Tugs, workboats	2.00	

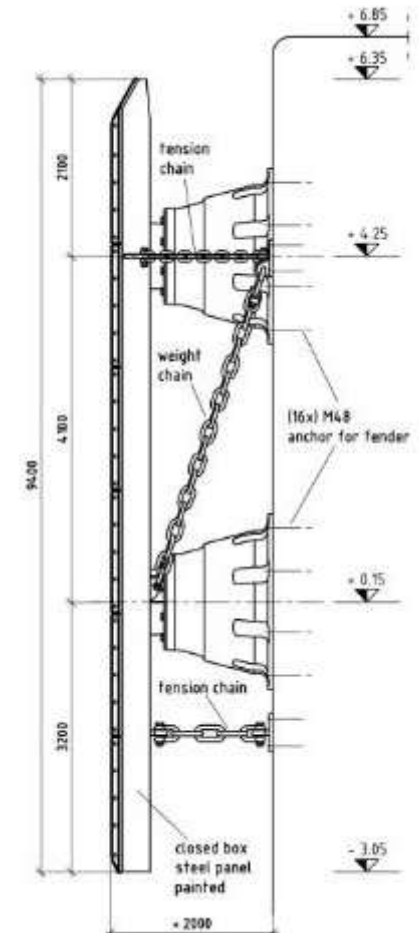


SECOND STEP – DESIGN

➤ SELECTION OF THE RUBBER FENDER UNIT

Consideration of the following issues:

- Quay wall designs
 - Sheet pile wall
 - Combi wall (sheet pile section with piles, or beams)
 - Open / Semi-Open Pile Structure
 - Gravity structures (caissons, concrete blocks)

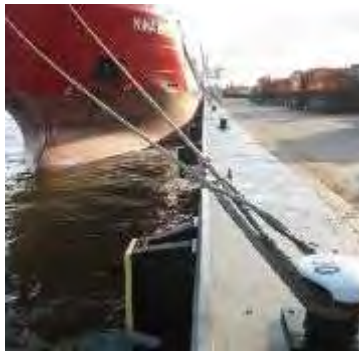




SECOND STEP – DESIGN

➤ SELECTION OF THE FENDER UNIT

Standard types of fender units





SECOND STEP – DESIGN

➤ SELECTION OF THE FENDER UNIT

SPC Cone Fender



CSS Cell Fender

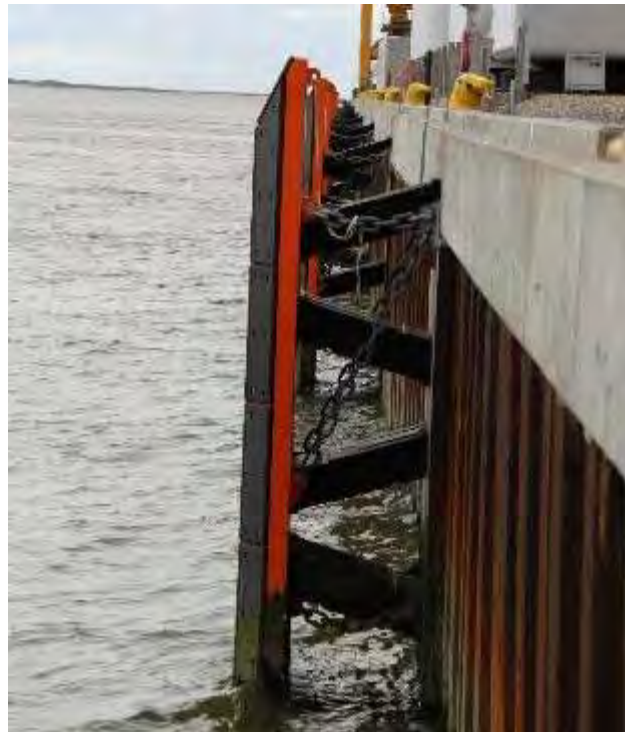




SECOND STEP – DESIGN

➤ SELECTION OF THE FENDER UNIT

FE Element Fender



V Fender (SX / SX-P)





SECOND STEP – DESIGN

➤ SELECTION OF THE FENDER UNIT

Cylindrical Fender



Pneumatic Fender





SECOND STEP – DESIGN

➤ SELECTION OF THE FENDER UNIT

Ocean Guard



Ocean Cushion





SECOND STEP – DESIGN

➤ SELECTION OF THE RUBBER FENDER SYSTEM

Design Criteria

Type of vessel = Container vessel 180,000ton

Quay wall type = Block type

Abnormal Energy = 2200 kNm

Max Reaction = < 3500 kN

Maximum fender height = < 2000m

=> Tolerance and correction factor to be discussed

SHIBATA FENDER TEAM		on the safe side	
Project:	Shibata Fender Team	Ref No.:	11005
Client:	Shibata Fender Team	Project:	Shibata Fender Team
Country:	Japan	Date:	06/01/2015
Drawn:		Revised:	00

SHIP CHARACTERISTICS	
Vessel Name:	SHIBATA FENDER TEAM
Ship Type:	CONTAINER SHIP 180,000ton
Vessel Length:	225.00 m
Vessel Width:	32.00 m
Vessel Depth:	12.00 m
Vessel Draft:	12.00 m
Vessel Displacement:	180,000 t
Vessel Capacity:	180,000 t
Vessel Tonnage:	180,000 t
Vessel Speed:	24.00 kn
Vessel Power:	3,800 kW
Vessel Fuel:	3,800 kW

BERTH & APPROACH	
Berth Type:	Block Type
Berth Length:	225.00 m
Berth Width:	32.00 m
Berth Depth:	12.00 m
Berth Draft:	12.00 m
Berth Displacement:	180,000 t
Berth Capacity:	180,000 t
Berth Tonnage:	180,000 t
Berth Speed:	24.00 kn
Berth Power:	3,800 kW
Berth Fuel:	3,800 kW

BERTHING FACTORS	
Berthing Angle:	0.00 deg
Impact Force (Control Mass):	30,000 kN
Impact Force (Control Mass):	30,000 kN
Velocity Vector Angle:	0.00 deg
Added Mass Factor:	1.00
Frequency Factor:	0.50
Shock Correction Factor:	0.50
Hull Softness Factor:	0.50

BERTHING VELOCITY	
Velocity Type:	SHIBATA FENDER TEAM
Velocity Condition:	SHIBATA FENDER TEAM
Berthing Velocity:	24.00 kn
Berthing Energy:	1,000 kNm
Berthing Force:	3,800 kN
Abnormal Energy	E_A 2,675.9 kNm



SECOND STEP – DESIGN

➤ SELECTION OF THE FENDER SYSTEM

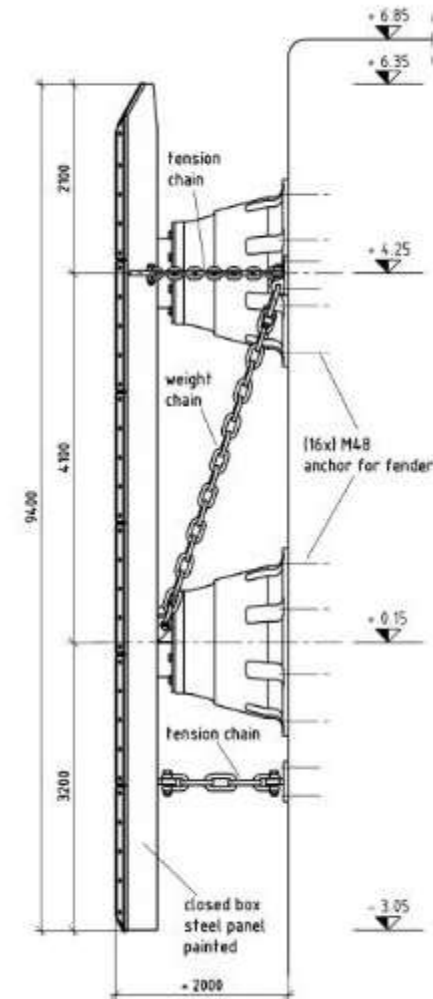
Selected Fender

2 nos. SPC-1300H G2.3

$$E = 1168 \text{ kNm} * 2 = \underline{2336 \text{ kNm} (> 2200)}$$

$$R = 1705 \text{ kN} * 2 = \underline{3410 \text{ kN} (< 3500)}$$

$$\text{Fender system height} = 1800\text{mm} (< 2000\text{mm})$$

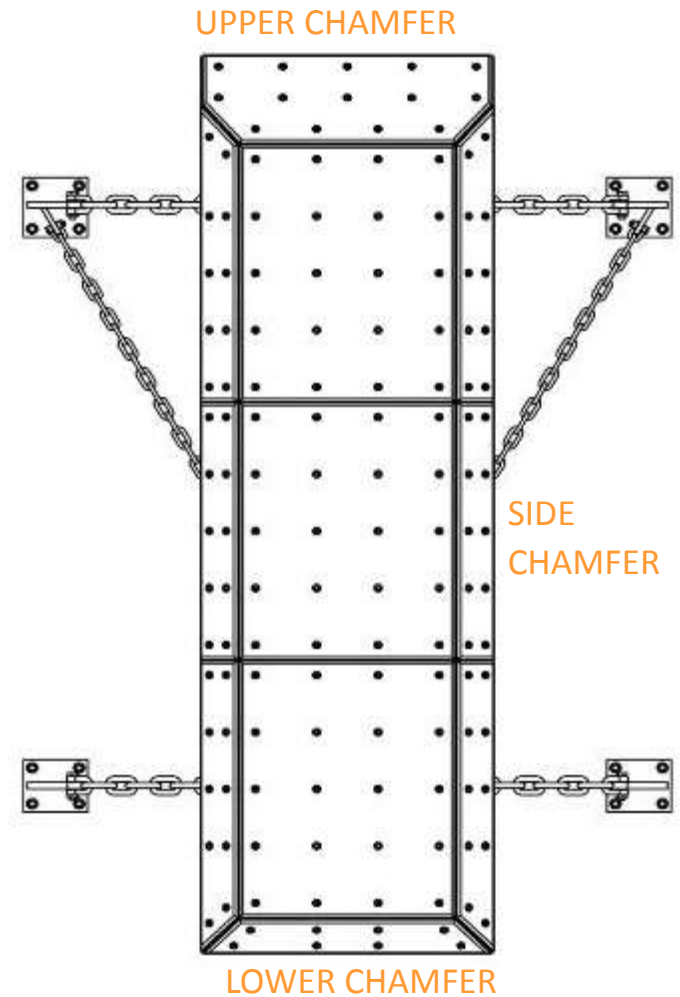




SECOND STEP – DESIGN

➤ PRELIMINARY DESIGN OF THE STEEL FENDER PANEL

Why chamfers?

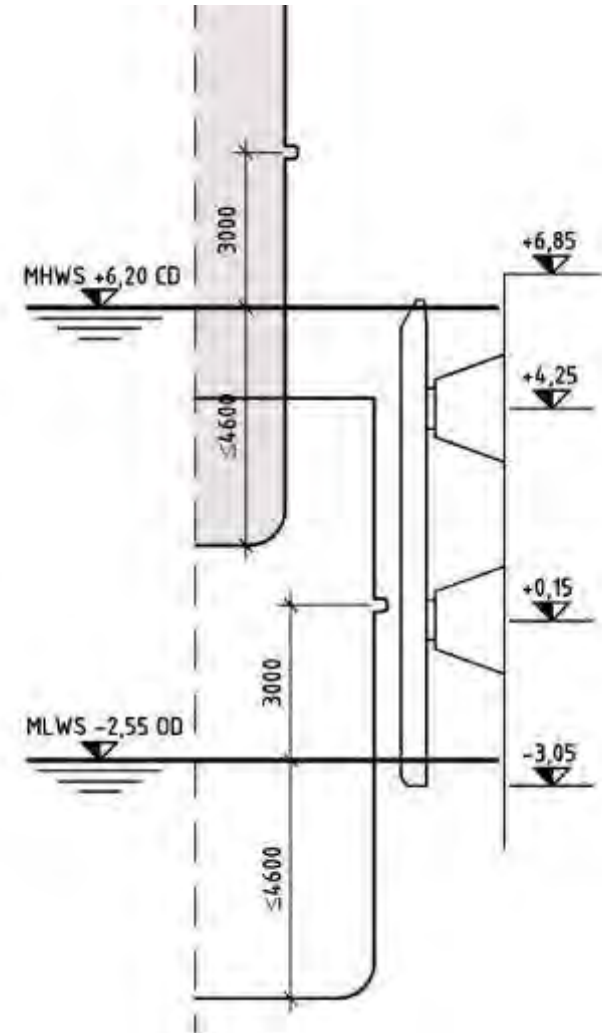




SECOND STEP – DESIGN

➤ PRELIMINARY DESIGN OF THE STEEL FENDER PANEL

Why chamfers?





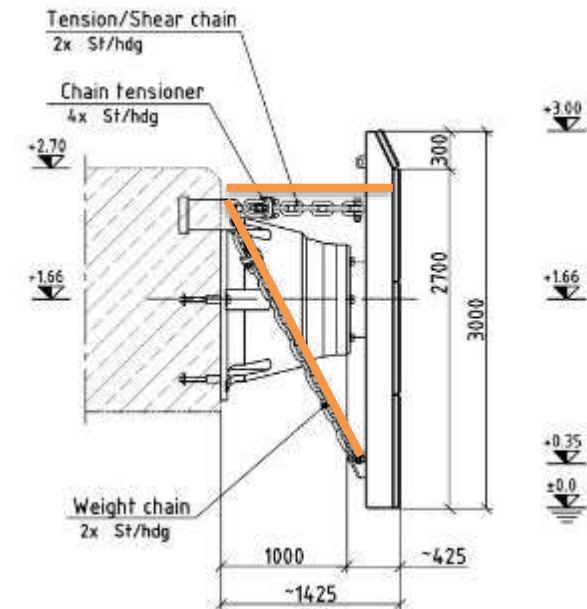
SECOND STEP – DESIGN

➤ SELECTION OF ACCESSORIES

Chain and shackle assembly

- Weight chains
- Tension chains
- Shear chains
- Chain tensioner & shackles

=> Make sure you consider angles



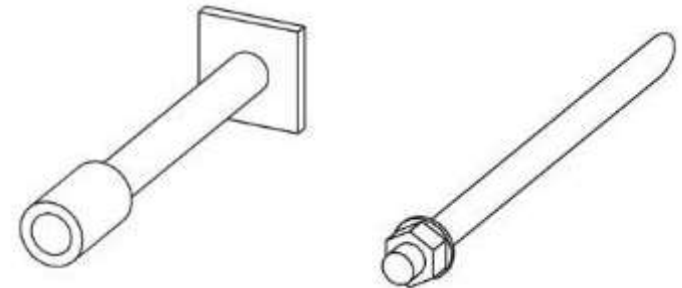


SECOND STEP – DESIGN

➤ SELECTION OF ACCESSORIES

Anchors

- Cast-in anchors (New concrete)
- Resin anchors (Existing concrete)



Chain fixation

- U-anchors
- Brackets





SECOND STEP – DESIGN

➤ SELECTION OF ACCESSORIES

UHMW-PE Low Friction Plates

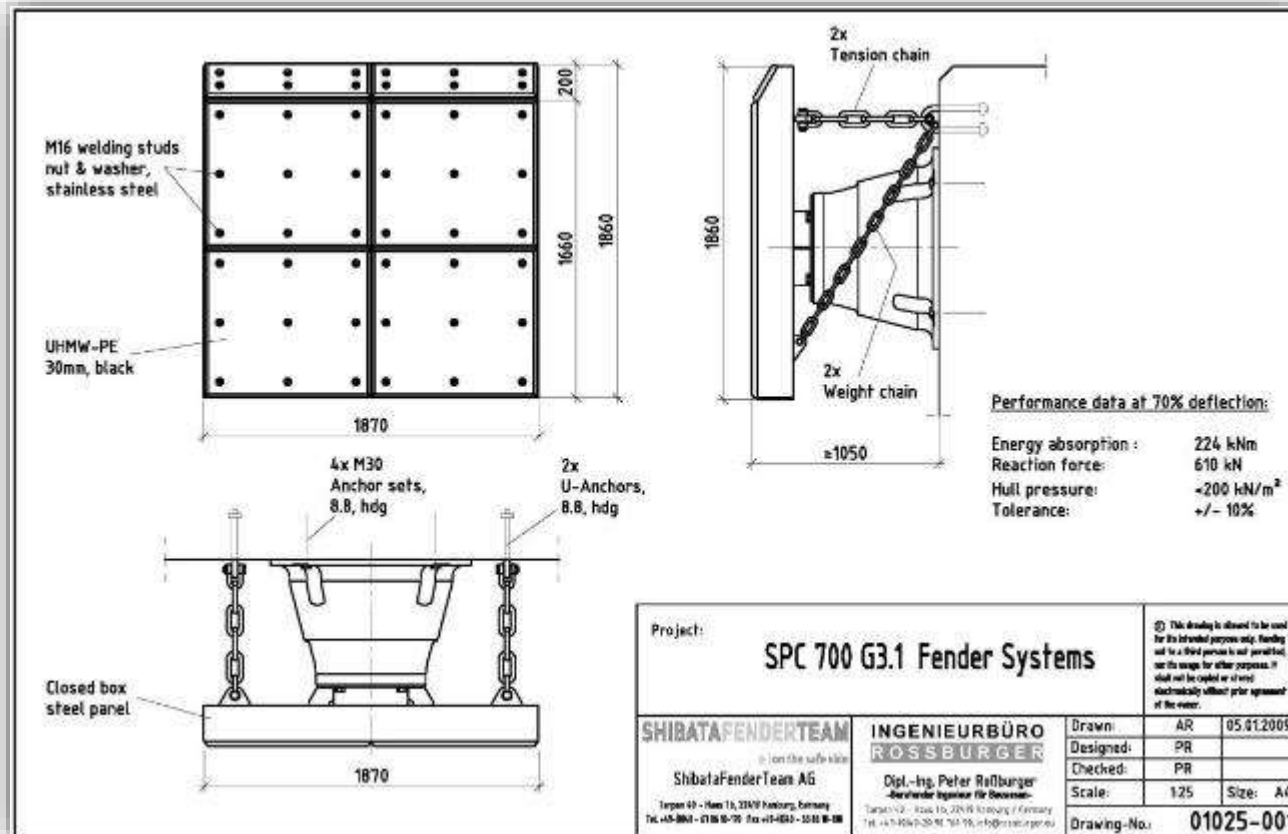
- Reclaimed (FQ Material, multicolour)
- Virgin material





SECOND STEP – DESIGN

➤ PREPARATION AND SUBMISSION OF DRAWINGS





SHIBATA**FENDER****TEAM**

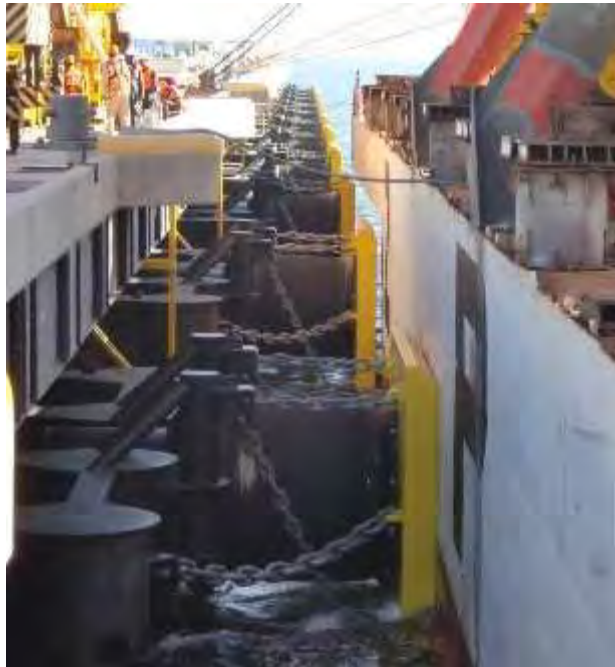
▶ | on the safe side

REFERENCE PROJECTS

GERMANY | FRANCE | AMERICAS | ASIA



➤ SPC/CSS Fender systems for Bulk Jetty - Sohar, Oman



CSS 3000H
E/A = 7906 kNm



SPC 2000H
E/A = 4242 kNm



- > 200 nos. SPC Fender systems for Maasvlakte II, Rotterdam, The Netherlands





➤ Double SPC Fender systems for Container Terminal – Port of Beirut, Lebanon





➤ 24 nos. SPC Fender systems for CMIT – Cai Mep, Vietnam





- **128 nos. SPC Fender systems for Tema Bulk Terminal – Tema, Ghana**

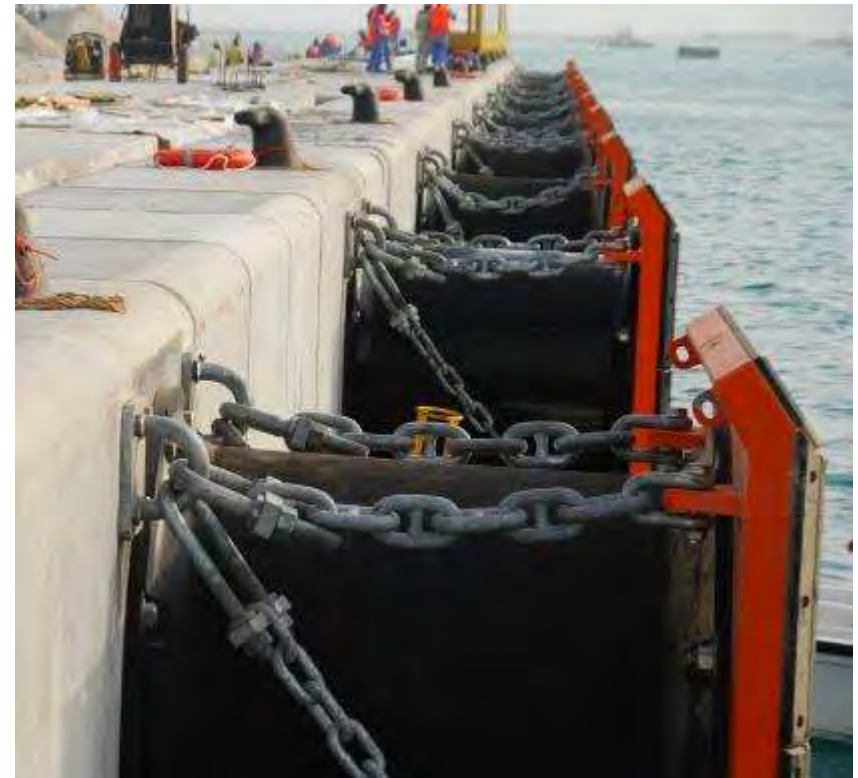




SHIBATA FENDER TEAM

▶ on the safe side

➤ CSS Fender systems for Khalifa Port – Abu Dhabi, U.A.E





➤ FE Element Fender systems with Belt Deflectors – Port of Sochi, Russia





➤ PM Fender systems for Oil Terminal - Labuan, Malaysia





➤ PM Fender systems for Ferry Terminal – Hirtshals, Denmark






- **60 pcs. 10' x 16' Ocean Guard Fenders for Container Terminal – Port of Miami, FL - USA**





➤ Cylindrical Fenders for Burchardkai LP2 – Hamburg, Germany





Thank you for your attention!

For more information visit us at www.shibata-fender.team