SHIBATAFENDERTEAM

on the safe side

SHIBATAFENDERTEAM GROUP

GERMANY | FRANCE | AMERICAS | ASIA

The importance of Proper Fender Design and Procedure

- 15th ASEAN Ports&Shipping 2017

Presented by: Y. OSAKI

SHIBATAFENDERTEAM

on the safe side

CONTENT

1. SHIBATAFENDERTEAM GROUP

2. TYPICAL FENDER DESIGN STEPS

3. REFERENCE PROJECTS

SHIBATAFENDERTEAM

on the safe side

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

SHIBATAFENDERTEAM

on the safe side

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

SHIBATAFENDERTEAM

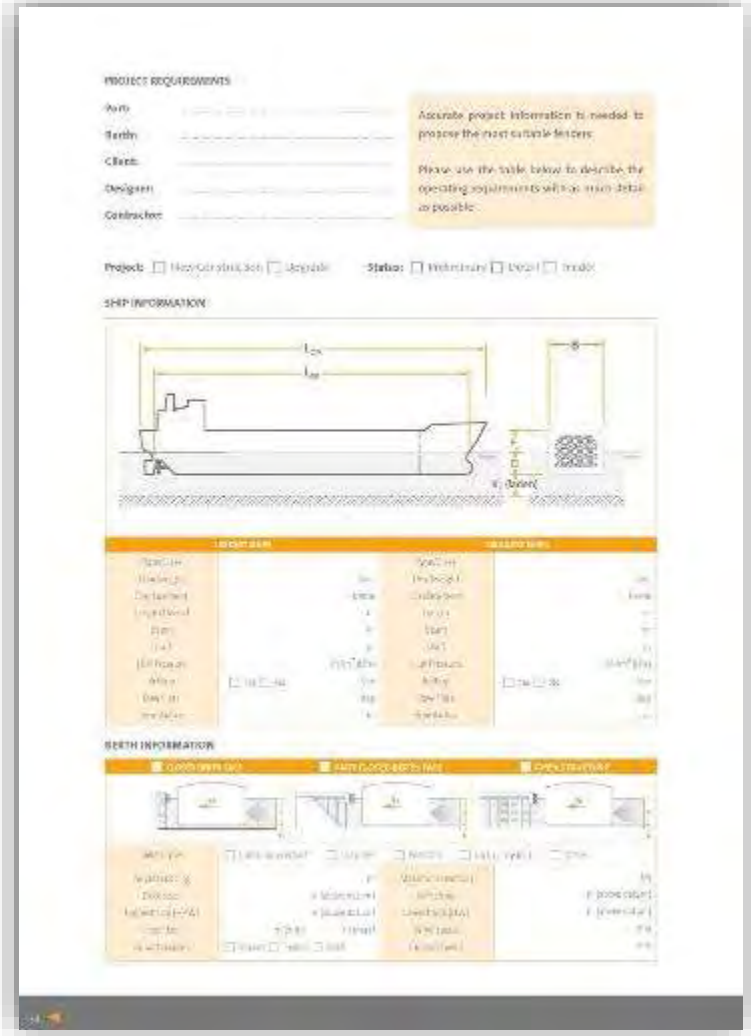
on the safe side

FIRST STEP – BASICS

➢ COLLECTION OF DATA

<u>Most important data:</u>

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



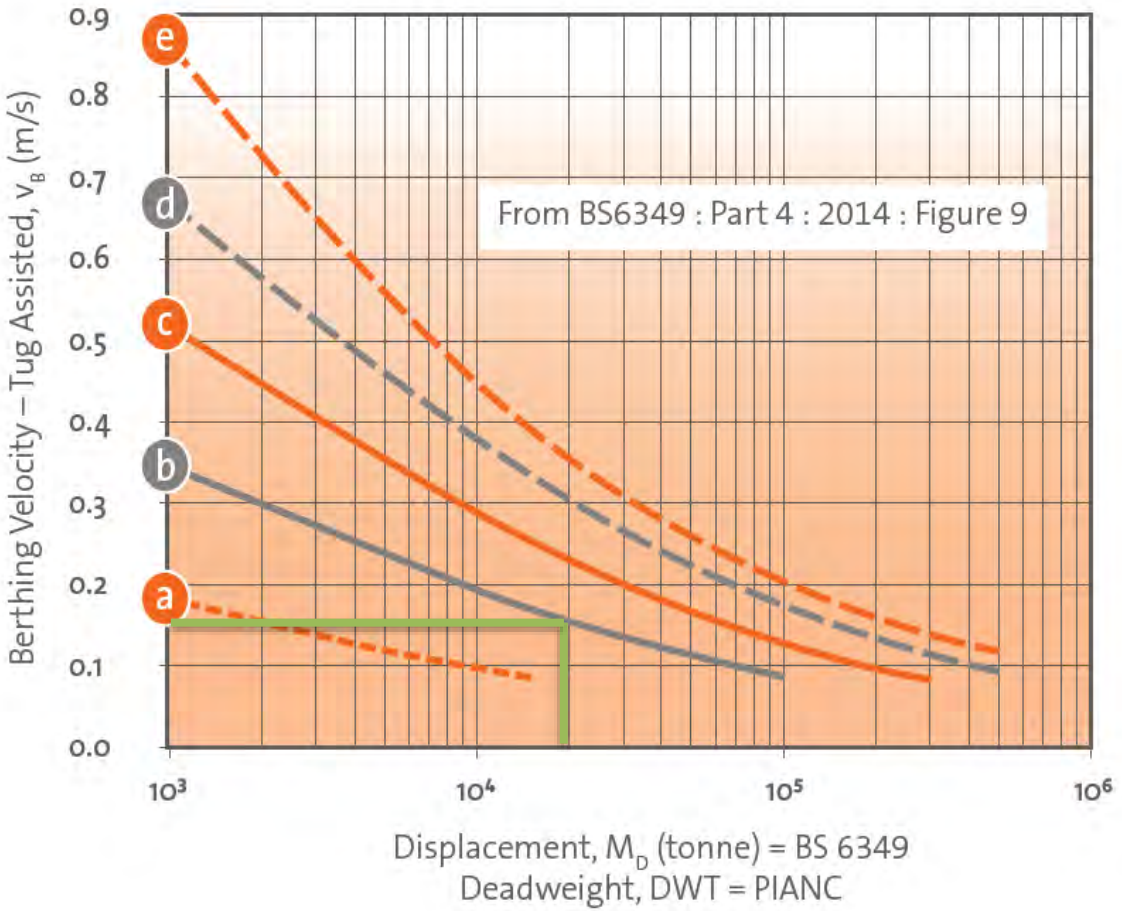
SECOND STEP – DESIGN

- **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

BERTHING ENERGY

SHIBATAFENDERTEAM

on the safe side

SECOND STEP – DESIGN

- **PREPARE ENERGY CALCULATIONS**

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

$$E_A = S_f * E_N$$

$$E_{catalogvelue} \geq E_A$$

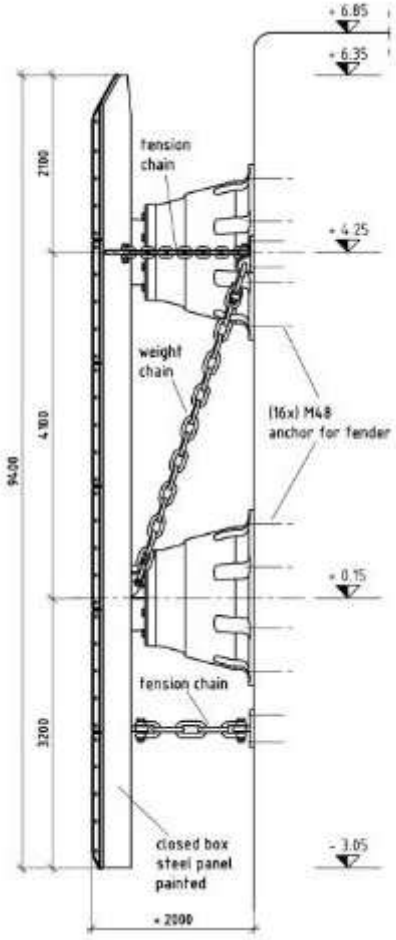
VESSEL CLASS	LARGEST	SMALLEST
Tankers	1.25[A]	1.75[B]
Bulk carriers	1.25[A]	1.75[B]
Gas carriers	1.50~2.00	
Container ships	1.50[A]	2.00[B]
General cargo, freighters	1.75	
RoRo & Ferries	≥2.00	
Car carriers	2.00	
Cruise ships	2.00	
Fast ferries	≥2.00	
Tugs, workboats	2.00	

SECOND STEP – DESIGN

➢ SELECTION OF THE RUBBER FENDER UNIT

<u>Consideration of the following issues:</u>

- 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)



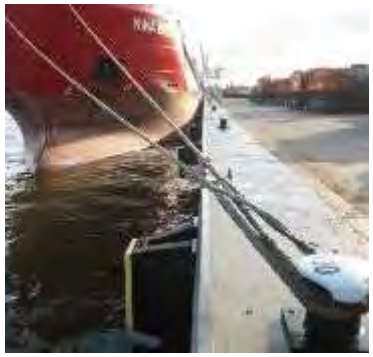
SECOND STEP – DESIGN

➢ SELECTION OF THE FENDER UNIT

Standard types of fender units





SECOND STEP – DESIGN

➢ SELECTION OF THE FENDER UNIT

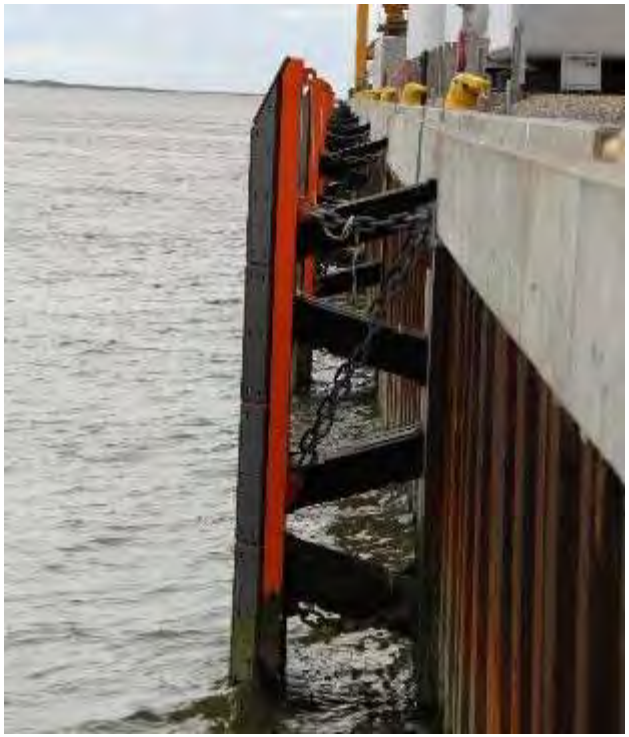
SPC Cone Fender

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

SHIBATAFENDERTEAM

on the safe side

SECOND STEP – DESIGN

- **SELECTION OF THE RUBBER FENDER SYSTEM**

<u>Design Criteria</u>

Type of vessel = Container vessel 180,000ton

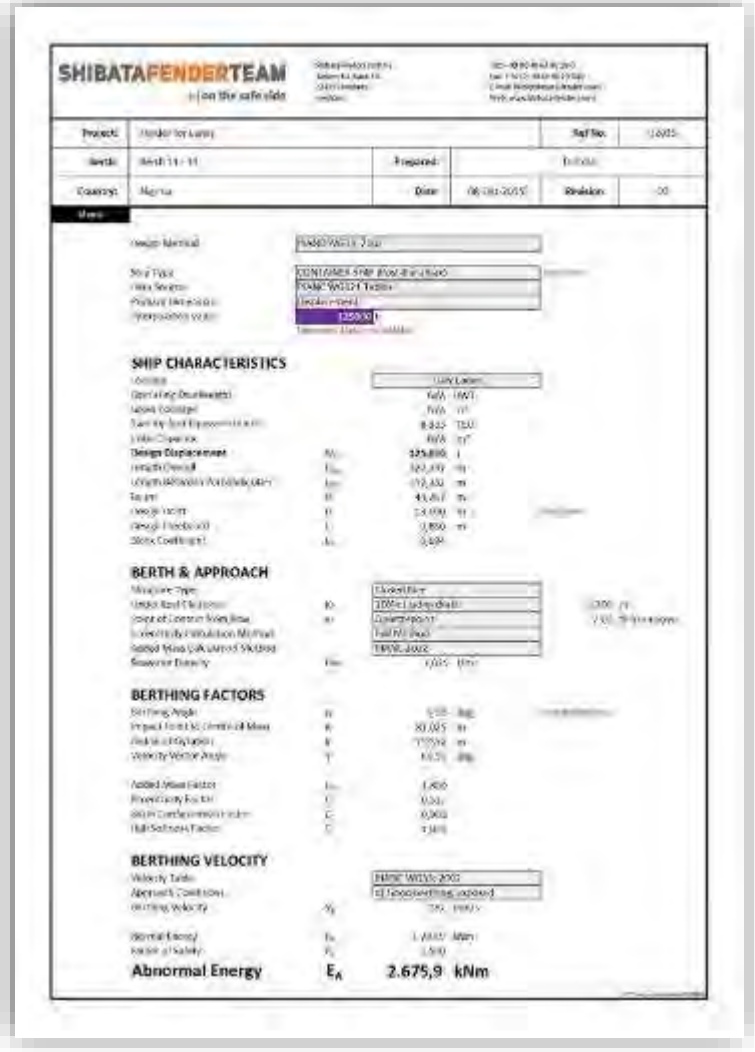
Quay wall type = Block type

Abnormal Energy = 2200 kNm

Max Reaction = < 3500 kN

Maximum fender height = < 2000m

=> Tolerance and correction factor to be discussed


SHIBATAFENDERTEAM

on the safe side

SHIP CHARACTERISTICS

BERTH & APPROACH

BERTHING FACTORS

BERTHING VELOCITY

Abnormal Energy E_A 2.675,9 kNm

SECOND STEP – DESIGN

➢ SELECTION OF THE FENDER SYSTEM

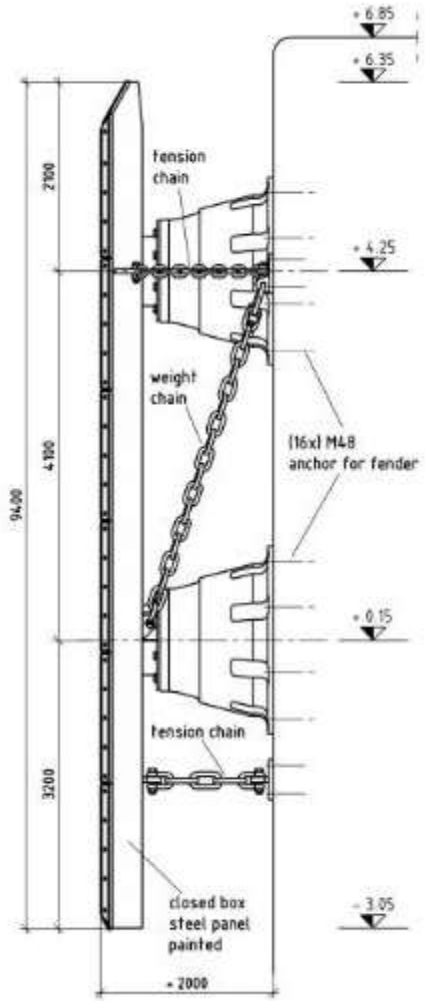
Selected Fender

2 nos. SPC-1300H G2.3

E = 1168 kNm * 2 = 2336 kNm (> 2200)

R = 1705 kN * 2 = 3410 kN (< 3500)

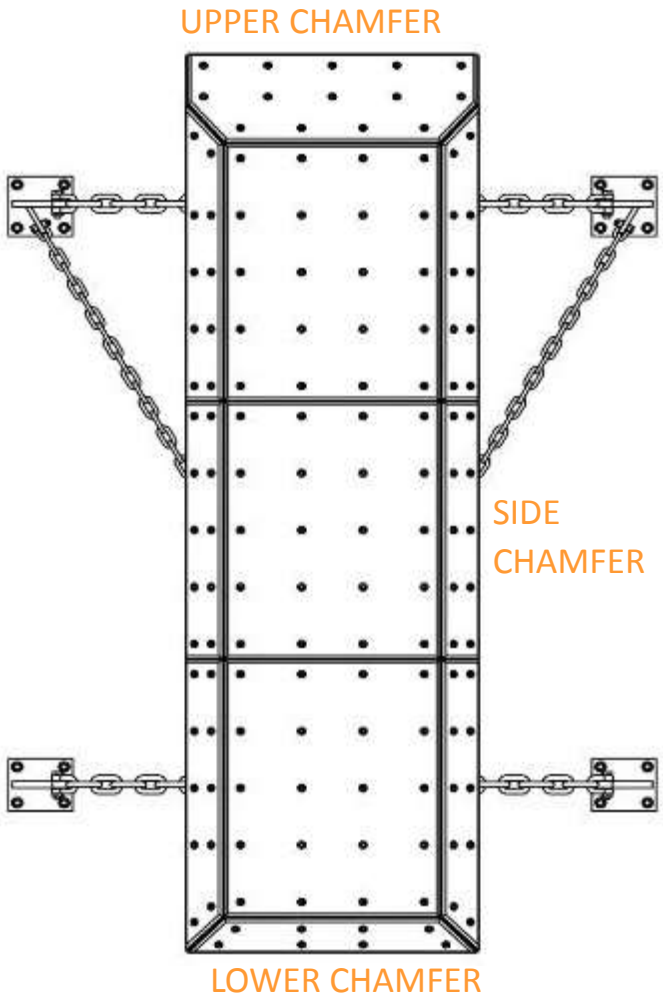
Fender system height = 1800mm (<2000mm)



SECOND STEP – DESIGN

- **PRELIMINARY DESIGN OF THE STEEL FENDER PANEL**

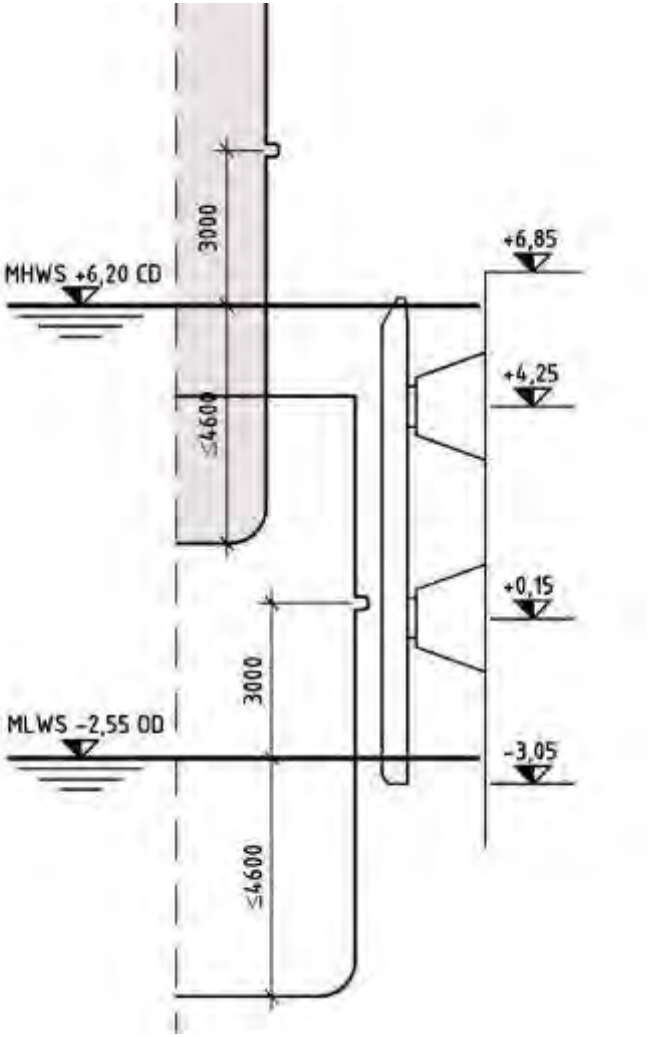
Why chamfers?



SECOND STEP – DESIGN

- **PRELIMINARY DESIGN OF THE STEEL FENDER PANEL**

Why chamfers?



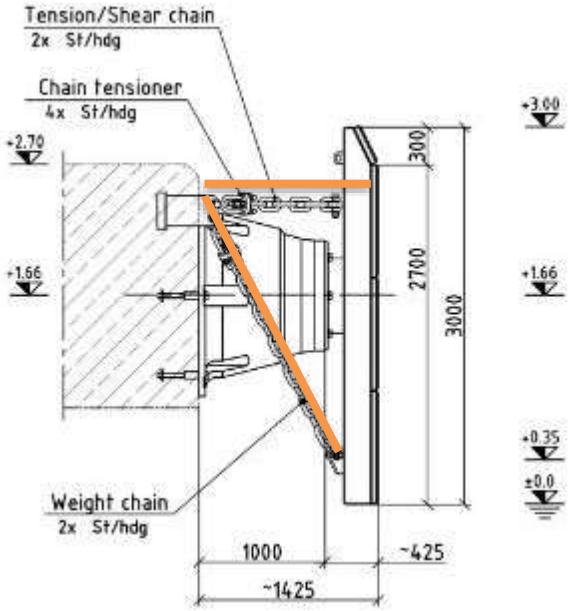
SECOND STEP – DESIGN

➢ SELECTION OF ACCESSORIES

Chain and shackle assembly

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

=> Make sure you consider angles

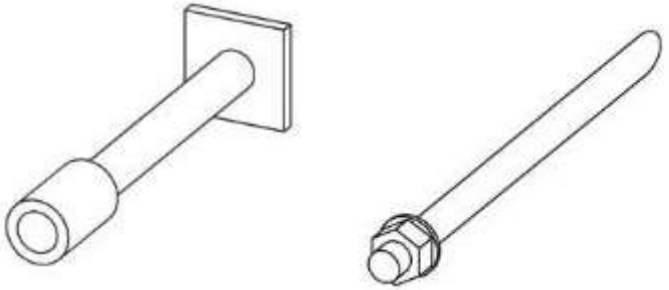


SECOND STEP – DESIGN

➢ 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

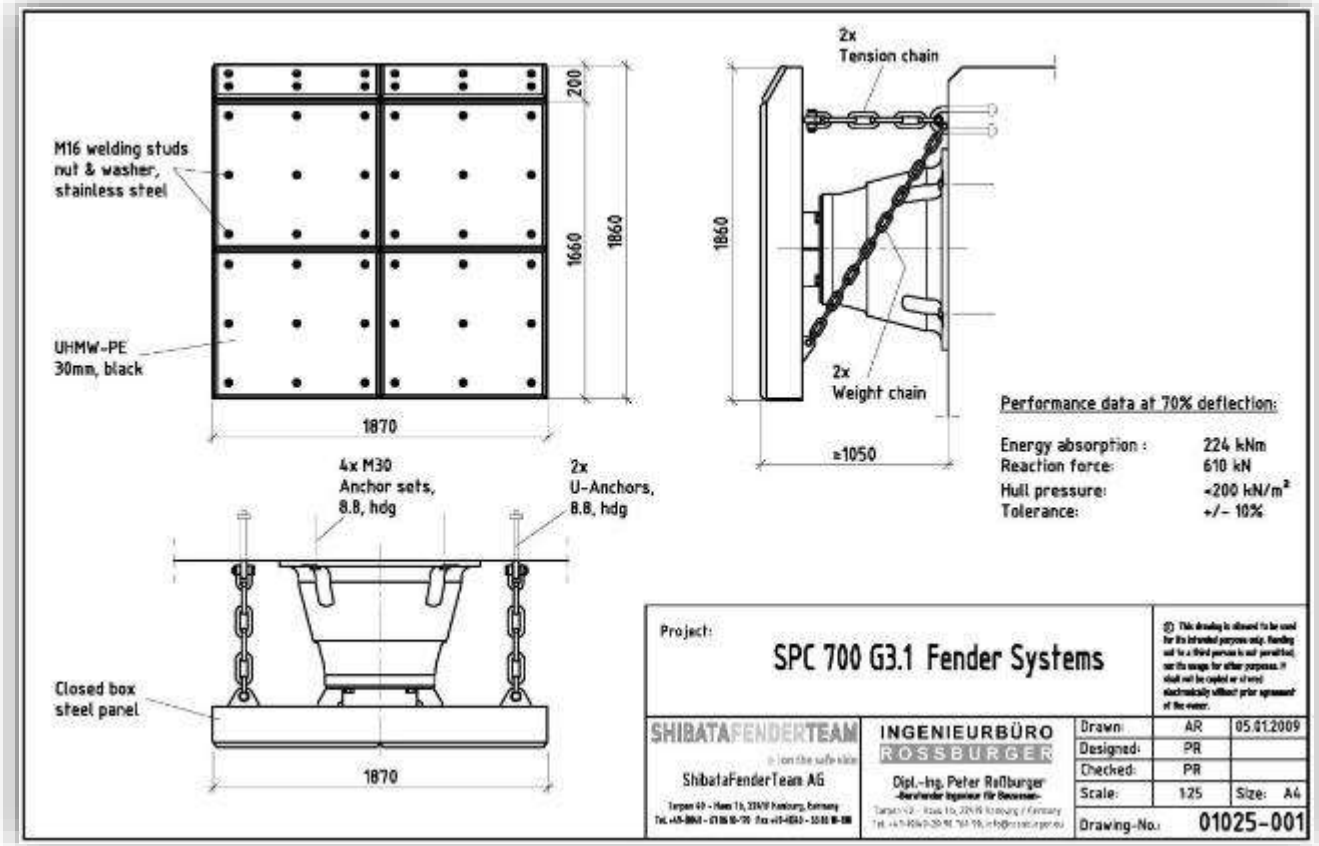
- Reclaimed (FQ Material, multicolour)
- Virgin material

SHIBATAFENDERTEAM

on the safe side

SECOND STEP – DESIGN

➢ PREPARATION AND SUBMISSION OF DRAWINGS



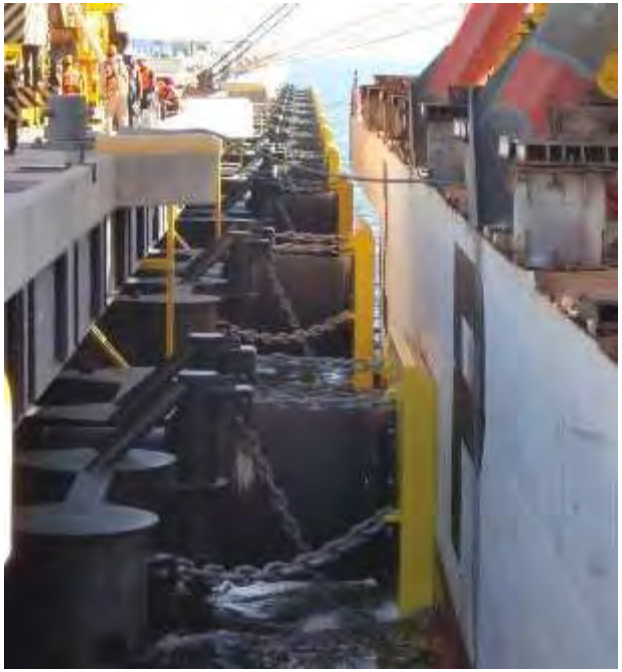
SHIBATAFENDERTEAM

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

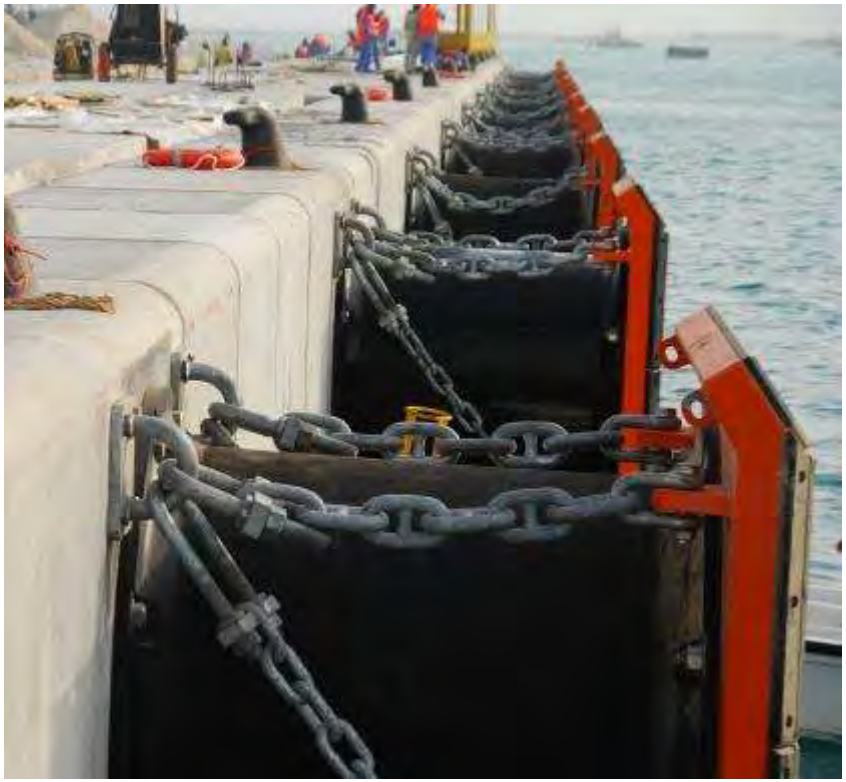
- **> 200 nos. SPC Fender systems for Maasvlakte II, Rotterdam, The Netherlands**

- **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**

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