PIANC French Section

PIANC Mediterranean Days

and Conference «Port of the future» by Cerema

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Introduction to the up coming WG211 report

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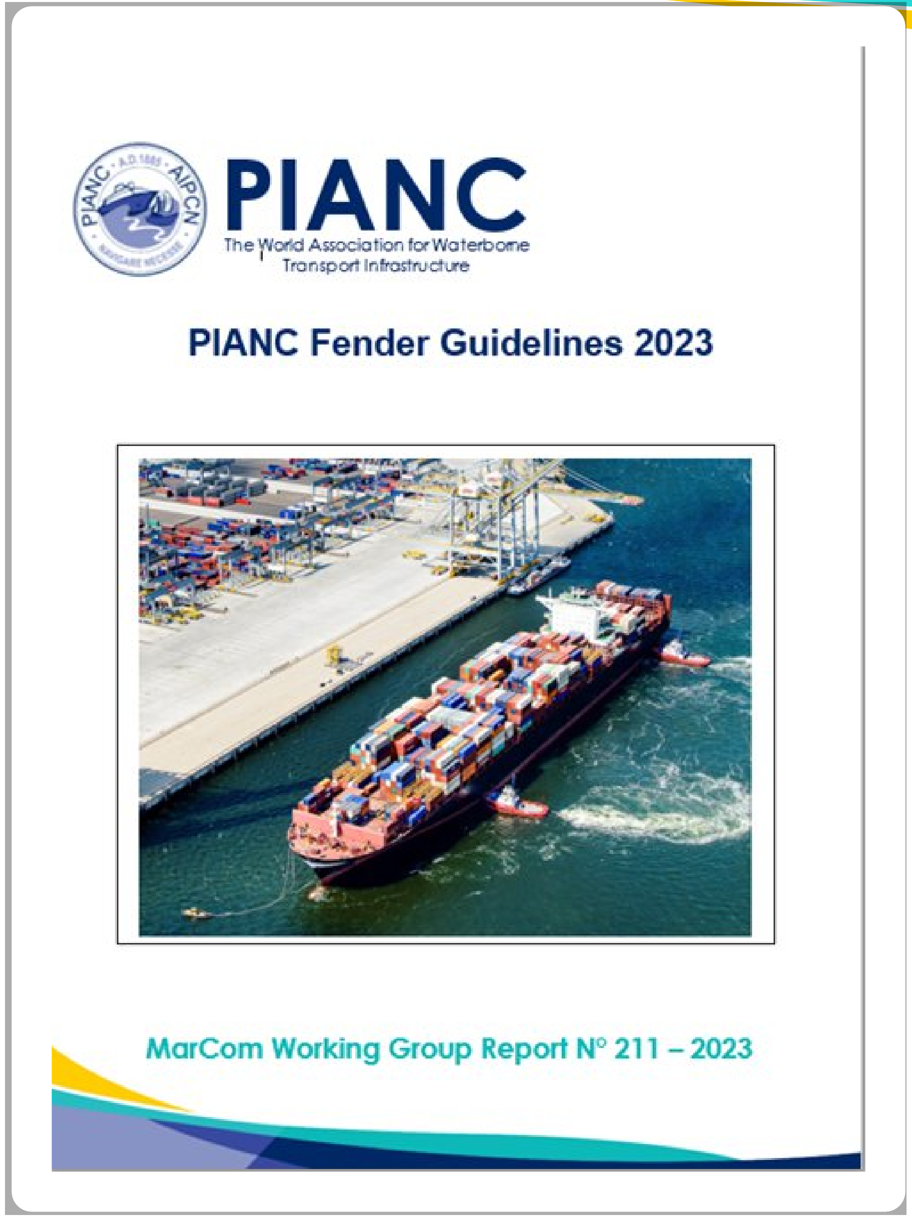
Why WG211?

Current report WG33 dates from 2002 and needs to be updated:

- New reports on vessel sizes (WG235)and berthing velocities (WG145) were published.
- New insights in fender testing and materials that need to be covered.
- The need for the industry to raise the bar.
- Clearer and yet more accurate design approach in line with international design codes.
- Various general improvements.

Clear & Logical chapters

1. Introduction & General Aspects
2. Introduction to the Principles of Fendering
3. Particular Aspects Regarding Design Vessels
4. Basis of Design
5. Berthing Energy
6. Fender System Selection
7. Fender Response under Moored Conditions
8. Fender System Elements Design
9. Manufacturing of Fender Systems
10. Test Procedures for Marine Fenders
11. Installation, Inspection and Maintenance
12. Sustainability of Fenders
13. Specification Writing



Chapter 1 – Introduction & General Aspects

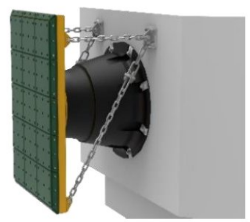
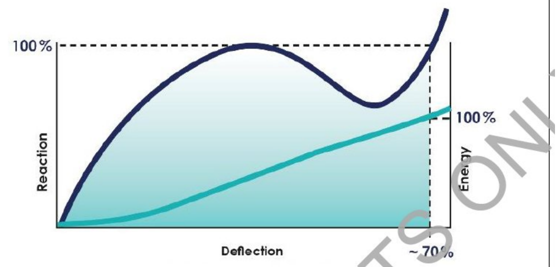
- Function & Scope
- Seagoing vessels & berthing
- PIANC type approval explained

Impact:
- 2 years to be in line with the WG211 guidelines
- Abuse of "PIANC certified" made clear
- Complete guidelines covering all aspects (where W33 was very limited)

Chapter 2 – Introduction to the Principals of Fendering

- Overview of the typical characteristics of the various types of fenders and fender systems.
- Typical fenders explained
- Fender efficiency (buckling and non-buckling)
- Typical fender characteristics

Table 2-2: Typical Cone Fender system (A) and Performance Curves (B)

A)	B)	
		
Size (H): 250 – 2500 mm	Energy: ~ 10 – 9500 kNm	Reaction: ~ 55 – 7200 kN

Chapter 3 – Particular Aspects Regarding Design Vessels

- PIANC WG235 section 2.3.5: Providing basic vessel considerations
- PIANC WG235 Appendix A: providing up to date vessel design parameters
- WG211 chapter 3: Better ways to assess the vessels hull geometry and optimize berthing energy calculations

PIANC Report WG 235 Appendix A: Vessel Data Spreadsheet Tables

Nominal DWT (GT where noted)	Class Name	Key Dimensions (Upper Values)				Key Dimensions (Typical Ships)						
		LOA (m)	L_{bp} (m)	B (m)	T Fully Laden (m)	LOA (m)	L_{bp} (m)	B (m)	T_{max} Fully Laden (m)	T_b Ballast Midship UON (m)	Moulded Depth (m)	Air Draft (m) Ballast
LNG Carriers (All types)												
155,000	LNG-QMax	345	333	55.0	13.7	345	333	55.0	13.7	Usually in the order of 0.80 to 0.85 T_{max}	27.0	58
130,000	LNG-QMax	345	332	53.8	12.2	345	332	53.8	12.2		27.0	58
120,000	LNG-Qflex	315	304	50.0	13.6	315	304	50.0	13.6		27.0	58
107,000	LNG-Qflex	315	303	50.0	12.0	315	303	50.0	12.5		27.0	58
98,000	LNG New Panamax	300	294	50.0	13.0	296	284	46.4	12.8		26.5	68
90,000	LNG New Panamax	300	292	48.9	13.0	289	275	45.6	12.5		26.0	68
80,000	LNG Conventional	300	285	49.0	12.5	289	274	48.0	12.3		26.5	68
70,000	LNG Conventional	298	283	47.2	12.0	274	260	47.2	11.8		26.5	68
40,000	LNG Conventional	220	211	35.0	10.0	220	211	35.0	10.0		22.5	59
11,000	LNG Small	156	146	28.0	8.2	151	140	28.0	7.7		16.0	45
20,000	Combination Gas/LPG	180	171	26.6	9.4	180	171	26.6	9.4		17.8	43
10,000	Combination Gas/LPG	137	127	19.8	8.3	137	127	19.8	8.3		11.5	38

Impact:

- More accurate vessel data resulting in more accurate design of fenders.
- Better ways considering vessel geometry improving assessment of compressing angles, Ce factor (Energy) and multiple fender contact.

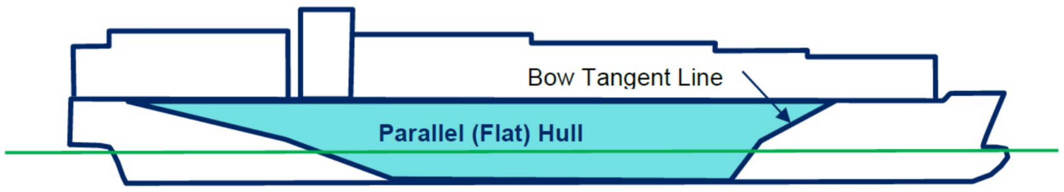


Figure 3-1: parallel hull of a typical container vessel

Chapter 4 – Basis of Design

The chapter can be used as a roadmap for the design process or as a template to develop a Basis of Design document to document the various parameters that will affect the design.

What is new and most relevant:

- 4.7: Reliability requirements in line with national codes. "Probability of failure and the associated reliability target for different consequence classes". Providing fender specific consequence class in table 4.1

Impact:

- The consequence class impacts the Partial Energy Factor (chapter 5.8).
- And with that it can have an impact on the berthing energy and fender size.

Table 4-1: Consequence classes and description of failure consequences

Class	Description of failure consequences	Explanation	Example of fender systems
A	Negligible/ low consequences for risk of loss of human life AND, environmental damage AND, economic damage.	Failure of a single fender predominantly results in insignificant structural damages.	Fenders installed on a marine structure that is part of a terminal or port with functional redundancy [a] and limited number of people at risk; Exceeding the rated deflection of a single fender is not likely to result in widespread damage to the marine structure or unavailability of the berth. An example can be a continuous earth retaining quay wall or a dolphin berth with more than two breasting dolphins

Chapter 5 – Berthing Energy

I. A probabilistic approach
II. Terminology "Characteristic" ($E_{k,c}$) and "design" ($E_{k,d}$) values – in line with common design code language
III. Site specific information (berthing speeds)
IV. Characteristic berthing angles
V. Partial Energy factor
    I. Depend on berthing frequency, navigation conditions and consequence class
VI. Multiple fender contact

Impact:

- More "refined" method to calculate the berthing energy considering the like hood of occurrence
- Without data the berthing speeds could be higher potentially resulting in higher berthing energies
- Local data can help reduce fender & structure costs

$$E_{k,d} = \gamma_E E_{k,c}$$

Where,

$E_{k,d}$ Design energy to be absorbed by fenders in contact during the impact [kNm]

γ_E Partial energy factor; see Section 5.9

The characteristic berthing energy is therefore calculated as;

$$E_{k,c} = \left(\frac{1}{2} M V_{B,c}^2\right) C_e C_m$$

Chapter 6 – Fender System Selection

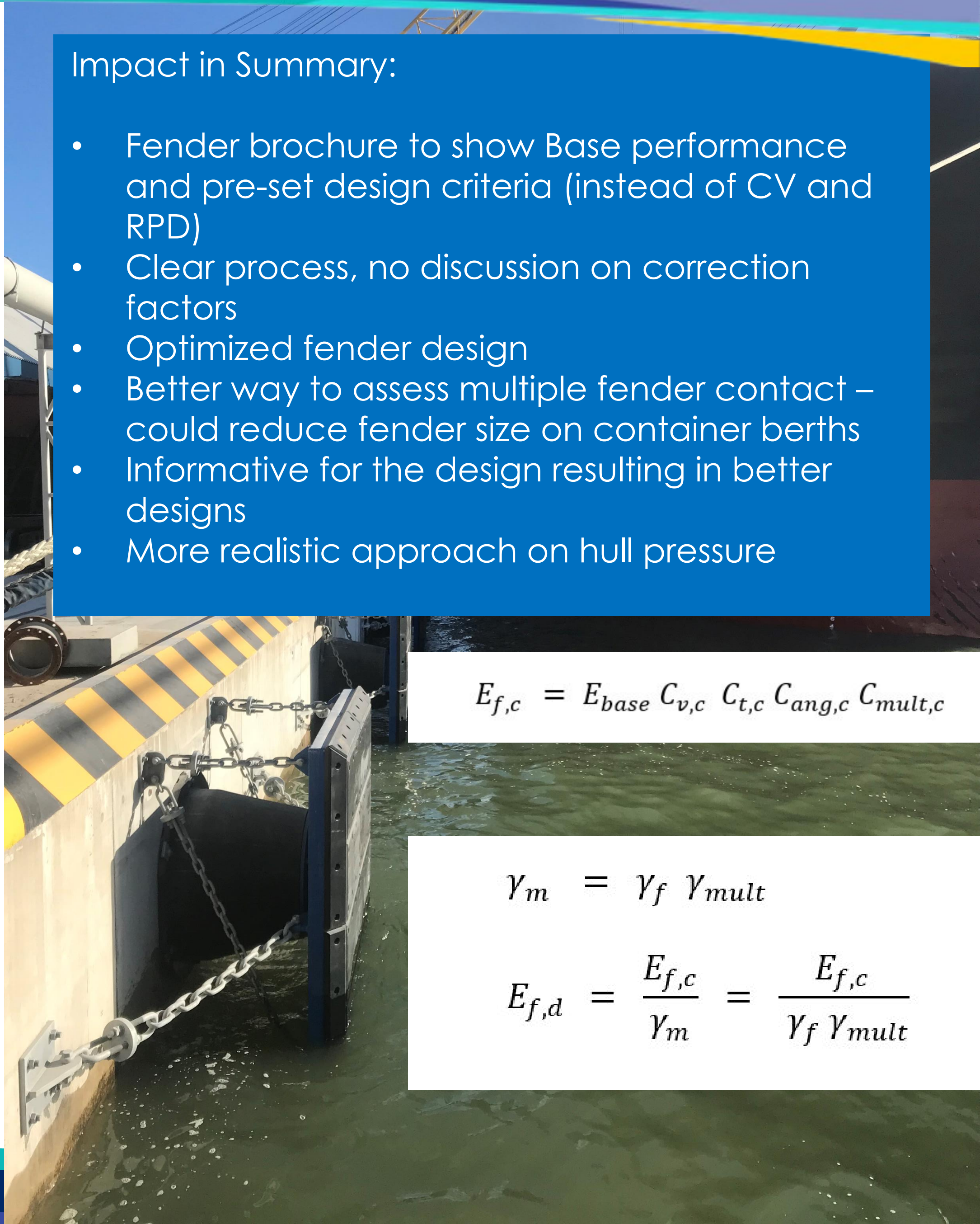
This chapter outlines the fender selection process, providing background information on the issues that should be considered when selecting a fender system.

New terminology:

- Base Performance
- Characteristic Performance
- Design performance (Characteristic performance x Partial Resistance Factors)
- Pre-Set design criteria

Other Design considerations, i.e.:

- Hull Pressure, Aging effects, submerged fenders, vessel geometry (multiple fender contact), etc.



Impact in Summary:

- Fender brochure to show Base performance and pre-set design criteria (instead of CV and RPD)
- Clear process, no discussion on correction factors
- Optimized fender design
- Better way to assess multiple fender contact – could reduce fender size on container berths
- Informative for the design resulting in better designs
- More realistic approach on hull pressure

$$E_{f,c} = E_{base}\, C_{v,c}\, C_{t,c}\, C_{ang,c}\, C_{mult,c}$$

$$\gamma_m = \gamma_f\, \gamma_{mult}$$

$$E_{f,d} = \frac{E_{f,c}}{\gamma_m} = \frac{E_{f,c}}{\gamma_f\, \gamma_{mult}}$$

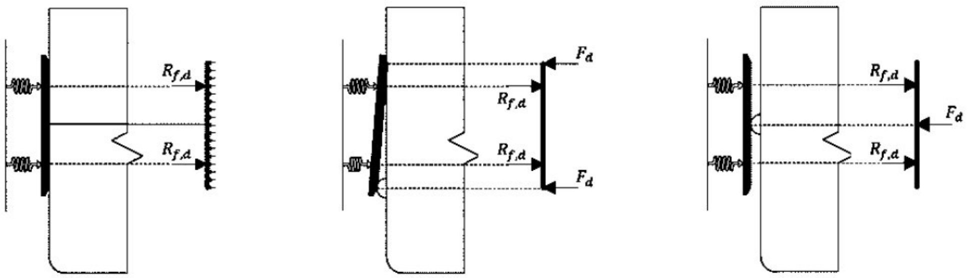
Chapter 7 – Fender Selection under Moored Conditions

Key elements

- Conditions to be considered
- Fatigue and creep of fenders
- Guidance on limiting fender deflection in moored conditions

Chapter 8 – Fender System Components Design

Careful consideration should be given to the design of the fender panel, chains, UHMW-PE pads and fixing details to ensure an efficient, yet robust design of the fender systems



Flat Hull Contact   Low Belting Contact   Middle Belting Contact

Chapter 9 – Manufacturing of Fender Systems

Impact:
- Mostly an informative chapter helping the knowledge of designers
- It can help a designer and authority to distinguish bad practices and write a better specification

Chapter 10 – Test Procedure of Marine Fenders

The main purpose of this chapter is to present the various recommended testing procedures for establishing performance, verifying material quality and performance reporting

Type of testing

- **Fundamental Testing (catalogue Data)**
- **Type Approval Testing (3rd party verified catalogue data) including protocols for VF, TF and AF**
- **Verification Testing (project specific testing)**

Impact:

- TGA as a traceability test between Type fundamental testing, approval testing and verification testing
- Much better-defined processes – clear and with less room for creativity
- Clearer for 3rd parties and requirements for 3rd parties
- Significant amount of testing required

Chapter 11 – Installation, Inspection and Maintenance

- Installation (incl. handling and accessibility)
- Spares and storage
- Inspections & Maintenance

Impact:
- Importance of maintenance and asset management is made clear

Chapter 12 – Sustainability of Fenders

Informative chapter – challenging the industry (but not setting guidelines yet)

- Carbon Footprint
- Sustainable Rubber sourcing
- Fabrication, Fender design and material selection
- Recycling
- Recommendations for the industry

Impact:

- Challenging the industry to raise the bar

Chapter 13 – Specification writing

The minimum recommended specification guidance for fender systems are given in this chapter.

Point by point guidance what to be considered in a specification

- References to the various chapters

Impact:
- Clear guide for designers and authorities that can help them to write better specifications
- TGA as tractability test should race the bar for suppliers and provides reliability for the end-user

WG211 – Estimated release

- 2023 October – Document completed by the WG211
- 2023 October – Final editing and review by PIANC HQ
- 2023 October / November release of WG211 Report

Trelleborg Webinars
PIANC WG211

90 minutes Introduction webinar

5 x 90 minutes Detailed training webinar series

Dates: To be announced

Sign in: Open already

Presented by Mishra Kumar and Marco Gaal

Q&A

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The World Association for Waterborne Transport Infrastructure

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