



# Welcome to the World of Trelleborg

**NordPIANC 2024**

WG211 – Fender Testing Passport

04 Sep 2024

## Presenters

---

ALEX KONDRATIEV

Regional Sales Manager | Europe  
Marine Fenders



MARCO GAAL

Technical Director  
Marine Fenders  
Member PIANC WG211



# PIANC WG211

## A Whole System Approach

01

**Application engineering**

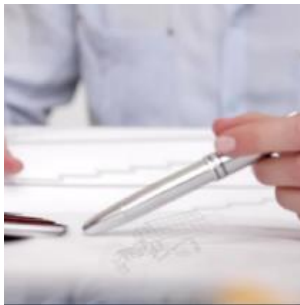
Chapters 1 - 7



02

**Detailed fender system design**

Chapter 8



03

**Fender production & quality control**

Chapter 9 & 10



04

**Installation, operations and maintenance**

Chapter 11



05

**Sustainability and recycling**

Chapter 12



**Fender Life Cycle**

# PIANC WG211

Fender testing & Fender Passport (Chapter 10)

---

03

**Fender production &  
quality control**

Chapter 9 & 10

Chapter 10 Introduction

Rubber Passport (Q&A Documentation)

# CHAPTER 10

## TEST PROCEDURE OF MARINE FENDERS

---



- Much better-defined processes – clear and with less room for ambiguity
- Clearer for 3<sup>rd</sup> parties and requirements for 3<sup>rd</sup> parties
- Significant amount of testing required
- Traceability requirements (TGA)
- Covering solid fenders & foam fenders and accessories
- Special testing

## Classification of testing : Rubber and Foam

---

Fundamental  
testing



Type approval  
testing



Verification  
testing



# Fundamental testing



- Base performance
- Creation of performance correction factors
- Durability test
- Chemical composition
- Physical properties

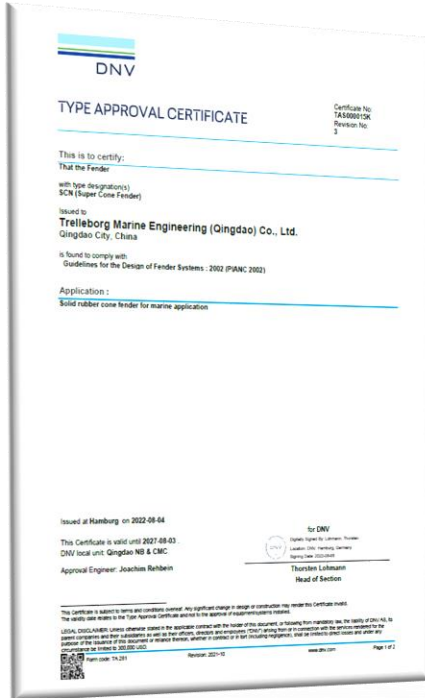


**Super Cone Fenders**  
**BASE PERFORMANCE DATA\***

	F 0.9'	F 1.0	F 1.1	F 1.2	F 1.3	F 1.4	F 1.5	F 1.6	F 1.7	F 1.8	F 1.9	F 2.0
1000 E	338	375	385	395	405	415	425	435	445	455	465	475
R	587	630	647	663	680	696	713	737	761	786	810	834
1050 E	392	435	446	458	469	481	493	504	515	527	538	550
R	626	695	713	731	750	768	787	813	839	866	892	919
1100 E	450	500	513	527	540	554	568	581	594	608	621	635
R	685	761	781	802	822	843	864	893	922	952	981	1011
1150 E	514	570	585	600	616	631	646	661	676	692	707	722
R	750	833	855	877	899	921	942	974	1007	1039	1071	1103
1200 E	585	650	667	685	702	720	738	755	772	790	807	825
R	818	909	933	957	982	1006	1031	1066	1101	1136	1171	1206
1300 E	742	825	847	869	891	913	935	957	979	1001	1023	1045
R	957	1064	1092	1120	1149	1177	1206	1246	1287	1327	1368	1409
1400 E	927	1030	1057	1085	1112	1140	1168	1195	1222	1250	1277	1305
R	1111	1235	1268	1301	1334	1367	1400	1447	1494	1541	1588	1636
1600 E	1381	1535	1576	1618	1659	1701	1743	1784	1825	1867	1908	1950
R	1447	1608	1651	1695	1738	1782	1826	1888	1950	2012	2074	2136
1800 E	1956	2185	2244	2303	2362	2421	2480	2539	2598	2657	2716	2775
R	1835	2039	2094	2149	2204	2259	2314	2369	2471	2549	2628	2707
2000 E	2700	3000	3080	3160	3240	3320	3400	3480	3560	3640	3720	3800
R	2259	2511	2578	2645	2712	2779	2846	2941	3037	3133	3229	3325

Testing of fenders and material to create data for publication in their catalogue

# Type approval testing



1. Base performance (CV slow speed test data- **NO RPD data**)
2. Clear tables of Cv, Ct, and Cang (Performance correction factors)
3. Durability test (Min. 3000 cycles)
4. Chemical composition by TGA (Thermogravimetric analysis) results of compounds
5. Physical properties table



Type approval testing

Fundamental testing witnessed and verified by a 3<sup>rd</sup> party

# Verification testing

PIANC WG211 suggests 3 types of testing

---



Mandatory testing

Highly recommended testing

Optional testing



Verification testing

The testing of commercial fenders to ascertain their adherence to the requirements

# Verification testing – Mandatory tests

The absolute minimum for every project

---

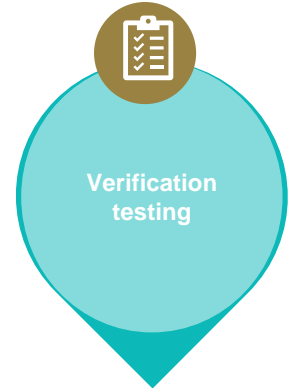
Mandatory tests cover:

- Verification of base performance
- Physical properties of rubber compound



Challenges:

- Reliability of the performance data
- No link between the physical properties of the rubber compound tested and the actual fenders
- No link between the compound used for the project and the compound used for the type approval testing (correction factors, durability, etc.)



# Verification testing – Highly recommended testing

## Assurance of test results

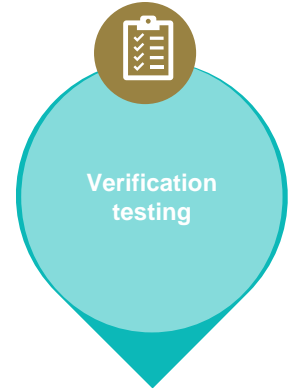


Highly recommended tests cover:

- Performance and physical properties testing witnessed by third party, using a third-party testing jig, or in a third-party testing facility
- Chemical composition or ThermoGravimetric Analysis (TGA) of rubber compound used for production
- TGA Analysis of samples from rubber fenders

Challenges:

- Still no guarantee on durability of the actual fender and the performance corrections factors
- No coverage of specific project requirements (cyclic conditions, resistance to shear)



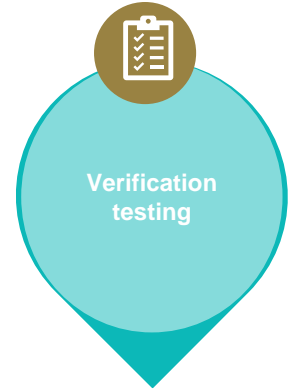
# Verification testing – Optional testing

## Next level testing

---

### Optional Tests:

- Verification of factors
- Verification of durability tests
- Shear compression tests
- Fatigue test



# TGA testing

Two functions:

## Traceability

- WG211 requirement (optional)
- Link between performance test result and physical properties
- Link between verification testing and type approval testing
- Basis of the fender passport

## Quality

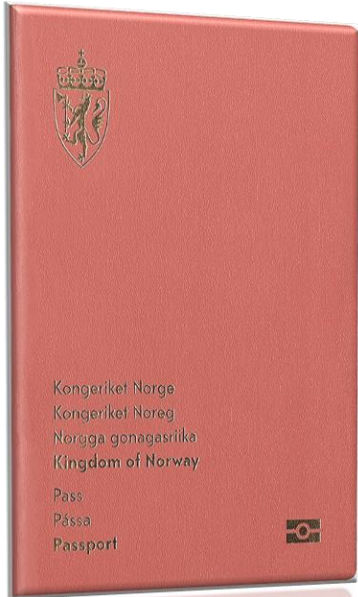
- As per BS6394-1-4, Statens Vegvesen Veiledning V431 e.a.
- Restriction for non-reinforcement fillers such as ash, CaCo<sub>3</sub>, etc.
- Research by K. Shimizy et.al (2015) show a direct correlation between durability and CaCo<sub>3</sub>

“TGA is really the foundation of the rubber passport”



# Fender Passport

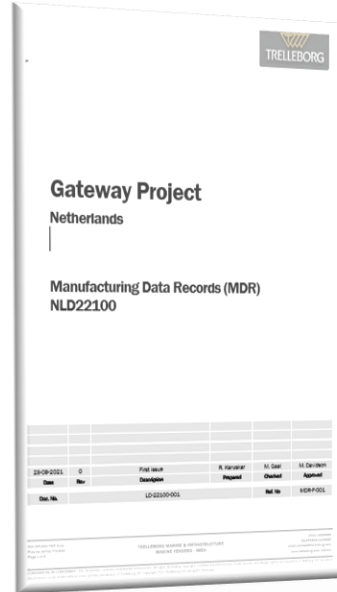
## MDR (Manufacturing Data Records)



Data on:

- Name
- Date of birth
- Etc.

Security via Biometric data



Data on:

- Test results
- Physical properties
- Welding inspection
- Coating inspection
- Etc.

Security via TGA and 3<sup>rd</sup> party testing

# Rubber Passport based on WG211

## I. Tender submission

To ensure the suppliers capabilities to manufacture and supply fenders that are in accordance with WG211 and the project specific requirements

### WG211 Requirement (see WG211 Section 13.2.4)

- Experience
- Design capability
- Manufacturing methodologies
- Manufacturing facility
- Program and testing regime
- Source of rubber
- Type approval testing - manufacturers catalogue

### Additional requirements

- General Assembly drawing
- Relevant ITP's (Inspection & test plan) for all components – for qualification
- Compliance declaration to the technical specifications / WG211 or list of deviations
- Fender selection (if relevant)
- Type Approval certificates



# Rubber Passport based on WG211

## II. Prior to fabrication

To ensure the supplier has met the project design requirements and has all relevant QA/QC procedures in place

### WG211 Requirement (see WG211 Section 13.2.4)

- Calculations showing the requirements and designs of the fender panel.
- Calculations and drawings showing the requirements and designs of accessories such as chains, anchors, panels, etc.
- Design computations that indicate the fender system meets the project specified criteria.
- Installation, maintenance, and removal manuals.
- Any other relevant information agreed upon between the purchaser and supplier.



### Additional requirements

- Relevant ITP's (Inspection & test plan) for all components – for review & approval
- Welding documents PQR/WPS/WPQ & EN1090 qualification

# Rubber Passport based on WG211

## III. Post-fabrication

To ensure the supplier has produced all components in accordance with the project requirements and provide traceable records.

### WG211 Requirement (see WG211 Section 13.2.4)

- See WG211 Section 13.2.4 for details
- Verification test results rubber fender as agreed (Mandatory, High recommended, optional)
- Break-in confirmation
- Foam density and thickness if applicable
- Confirmation and results of the fender panel pressure test.
- Coating materials and application methods, dry film thickness (DFT) certifications.
- Internal and/or third-party records of low friction UHMW-PE facing properties including the friction coefficient.
- Internal and/or third-party records of coatings DFT for all painted elements or galvanization certificates.



### Additional requirements

- Fabrication records steel panel as per approved ITP's
- Warranty certificate
- Declaration of compliance

# PIANC Fender Guidelines 2024

2-year transition period

- WG211 introduces significant changes in testing, energy calculation, fender selection etc.
- For more information or for arranging trainings and seminars, please contact:  
Alex Kondratiev at [alex.kondratiev@trelleborg.com](mailto:alex.kondratiev@trelleborg.com)



**WATCH THE WEBINARS  
ON-DEMAND NOW**



**CHANGES AND KEY  
INSIGHTS BY TRELLEBORG**



**TRELLEBORG**

[www.trelleborg.com](http://www.trelleborg.com)