TRELLEBORG MARINE AND INFRASTRUCTURE

Fender Systems

HANDLING, STORAGE, INSTALLATION AND MAINTENANCE MANUAL

The Smarter Approach

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Better connected systems mean faster turnaround and increased throughput, improved safety and lower operating costs.

Connecting decades of experience with a new, smarter approach to port and terminal equipment optimization, Trelleborg's marine systems operation helps ports and terminals deploy smart, engineered solutions for port approach, berthing, docking and mooring. This enables better informed real-time and strategic decision making, both onshore and on board the vessel.

From port owners and operators to consulting engineers, Trelleborg works with customers to determine best fit solutions for specific applications, and supply a fully integrated solution. End-to-end service and a comprehensive product portfolio meet and exceed customer needs, enhancing safety and improving efficiency in all marine environments, from conception to completion and beyond.

Fender Systems Handling, Storage, Installation and Maintenance Manual

Trelleborg Marine Systems is a world leader in the design and manufacture of advanced marine fender systems.

We provide bespoke solutions for large and complex projects all over the world. Best practice design and quality materials ensure a long, low maintenance service life, no matter how demanding the working and environmental conditions.

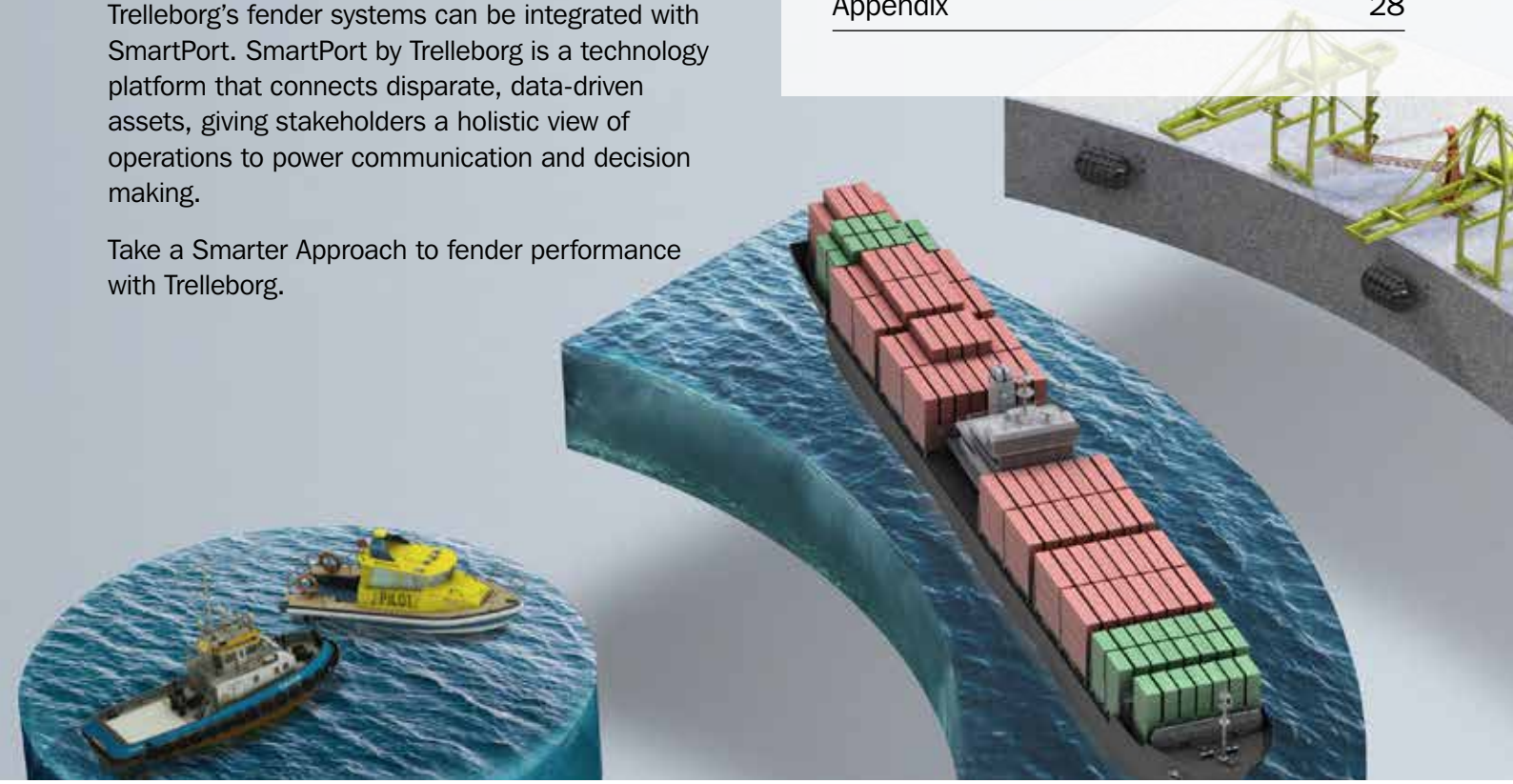
All fenders are supplied fully tested and meet PIANC 2002 guidelines. Our pneumatic fenders are also completely ISO17357-1:2014 compliant. Our high performance solutions combine low reaction force and hull pressure with good angular performance and rugged construction.

Trelleborg's fender systems can be integrated with SmartPort. SmartPort by Trelleborg is a technology platform that connects disparate, data-driven assets, giving stakeholders a holistic view of operations to power communication and decision making.

Take a Smarter Approach to fender performance with Trelleborg.

Contents

FENDER SYSTEMS HANDLING, STORAGE, INSTALLATION AND MAINTENANCE MANUAL



A Smarter Approach at every stage

A smarter approach to…

CONSULTATION

Consultation from the earliest project phase to ensure the optimum fender, mooring, navigation and transfer solutions are specified, with full technical support from our global offices.

CONCEPTS

Conceptual design in your local office – with full knowledge of local standards and regulations, delivered in your language – for optimized port and vessel solutions.

DESIGN

Concepts are taken to our Engineering Centers of Excellence where our team generates 3D CAD designs, application-engineering drawings, a bill of materials, finite engineering analyses and calculations for both our fender systems and marine technology solutions.

MANUFACTURE

Our entire product range is manufactured in-house, meaning we have full control over the design and quality of everything we produce. Our strategically located, state-of-the-art facilities ensure our global, industry leading manufacturing capability.

TESTING

Across our entire product range, stringent testing comes as standard at every step in our in-house manufacturing process. We ensure that life-cycle and performance of our entire product range meets your specifications, and more.

INSTALLATION

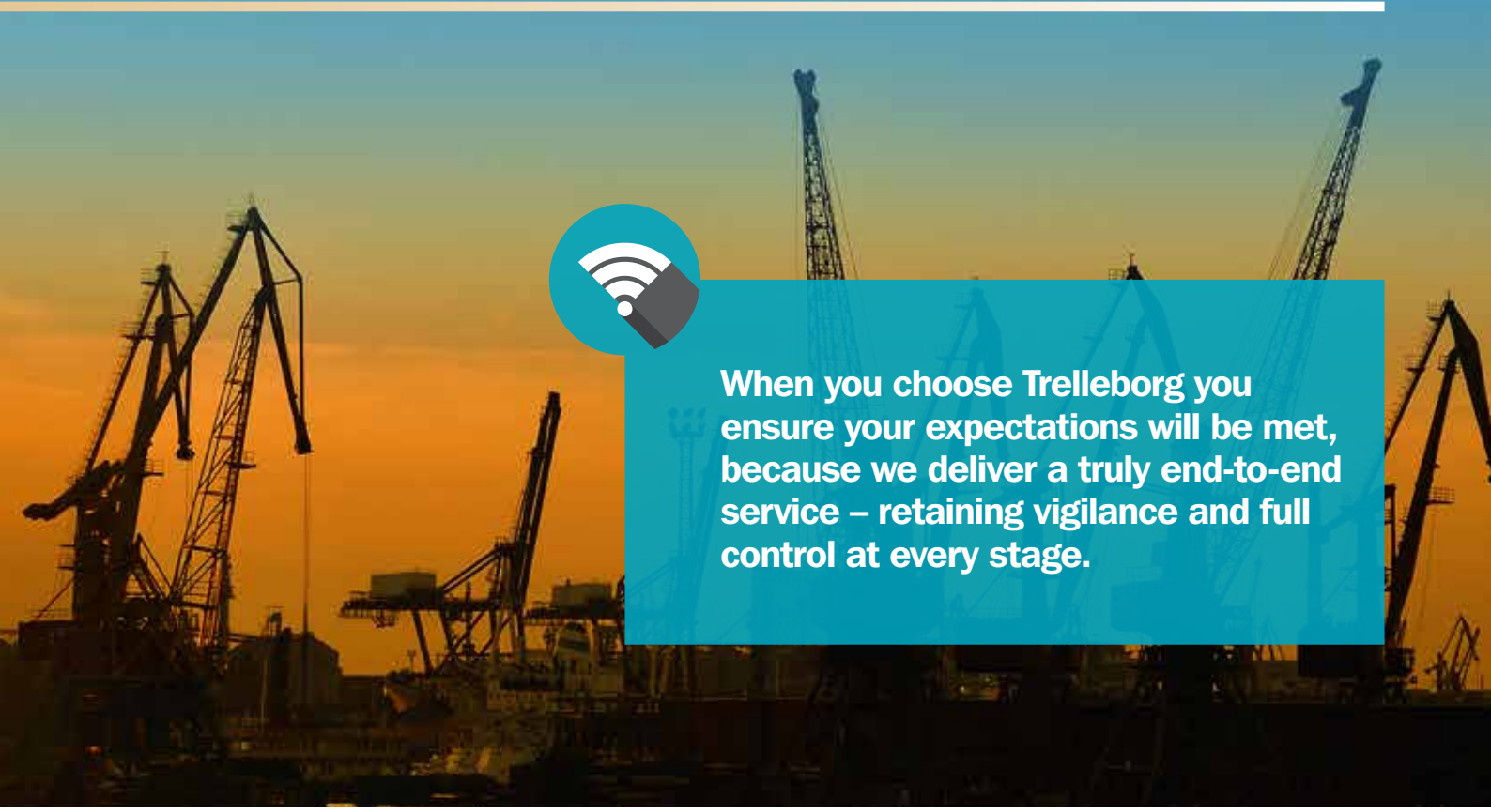
Dedicated project management, from solution design right the way through to on-site installation support. We design products and solutions that always consider ease of installation and future maintenance requirements.

SUPPORT

Local support on a truly global scale, with customer support teams all over the world. And this service doesn't stop after a product is installed. You have our full support throughout the entire lifetime of your project, including customized training programs, maintenance and on-site service and support.

THE FUTURE

Deploying the latest in smart technologies to enable fully automated, data-driven decision making that optimizes port and terminal efficiency. At Trelleborg, we're constantly evolving to provide the digital infrastructure our industry increasingly needs.

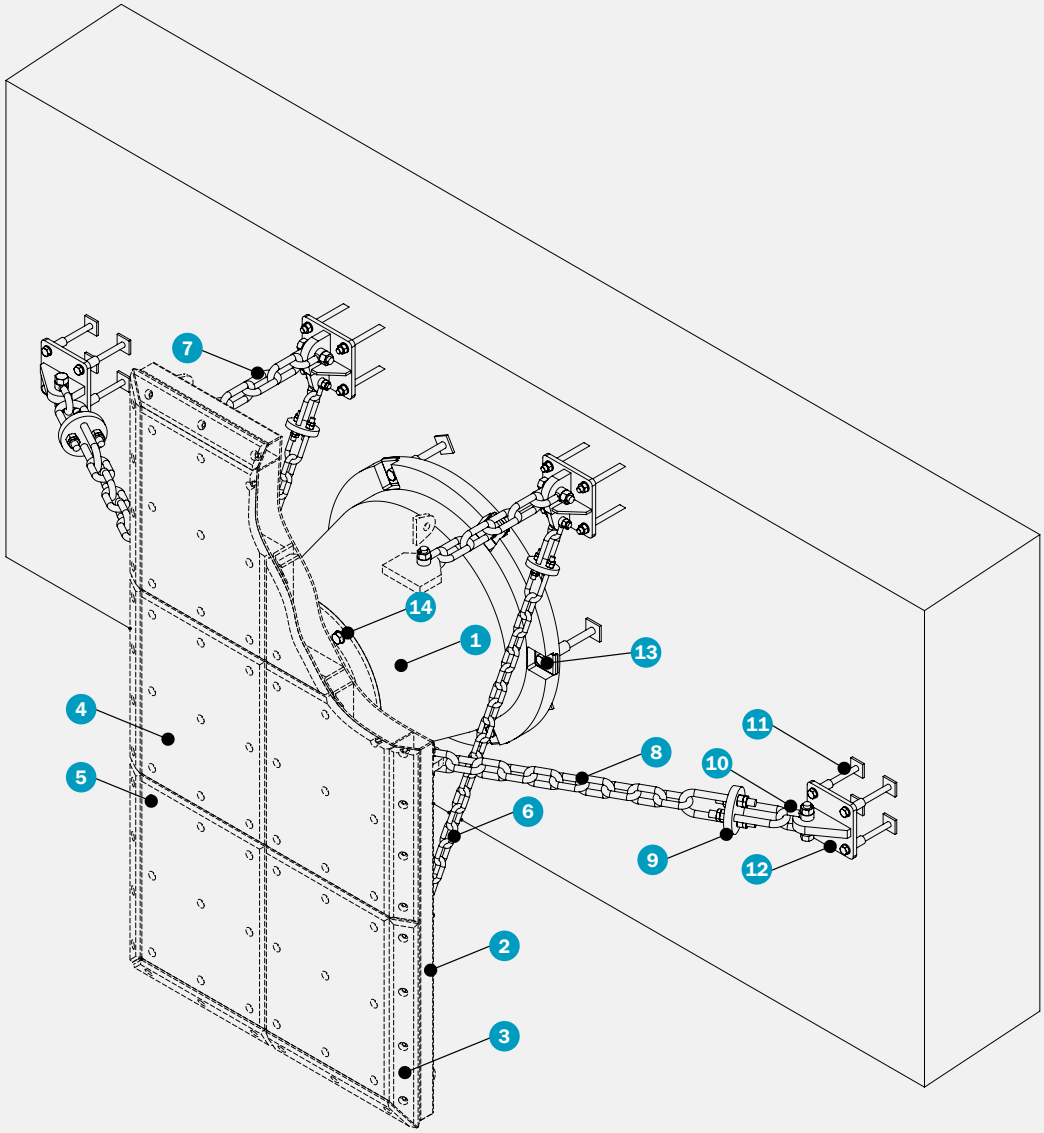


When you choose Trelleborg you ensure your expectations will be met, because we deliver a truly end-to-end service – retaining vigilance and full control at every stage.

Introduction

This section includes handling, storage, installation, inspection and maintenance of various components of a fender system.

TYPICAL SYSTEM INSTALLATION



1. Rubber fender
2. Steel frontal frame
3. Chamfered edge on frontal frame
4. UHMW-PE facing pads
5. Fixing bolts for UHMW-PE pads
6. Weight chain
7. Tension chain
8. Shear chain
9. Chain tensioner
10. Chain shackle
11. Cast-in Anchors / Epoxy (Adhesive) Anchors
12. Chain bracket / U-Anchor
13. Foot bolt
14. Head bolt

TYPICAL FENDER SYSTEM INSTALLATION

Phase 1 :

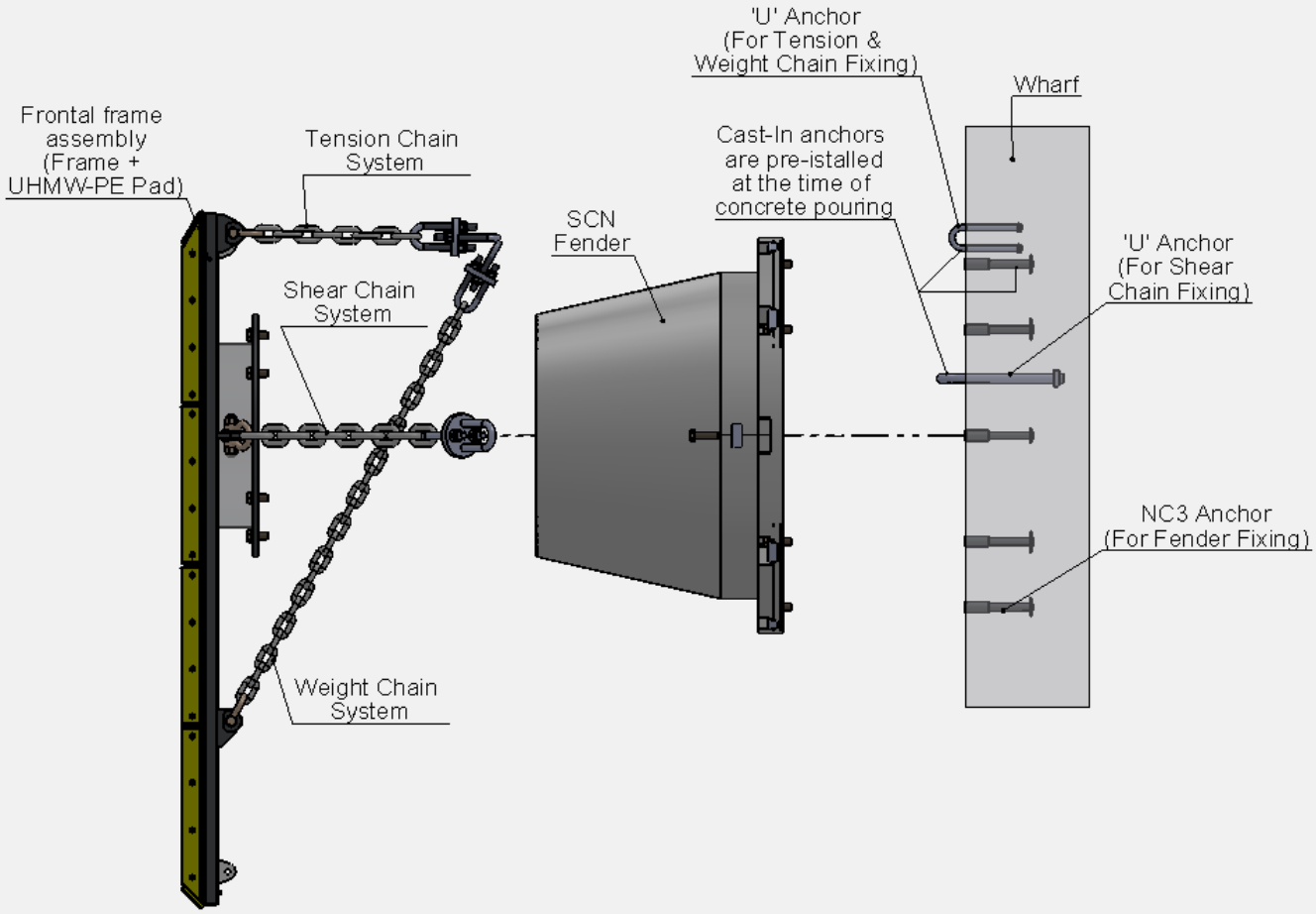
Assembling of rubber fender and frontal frame

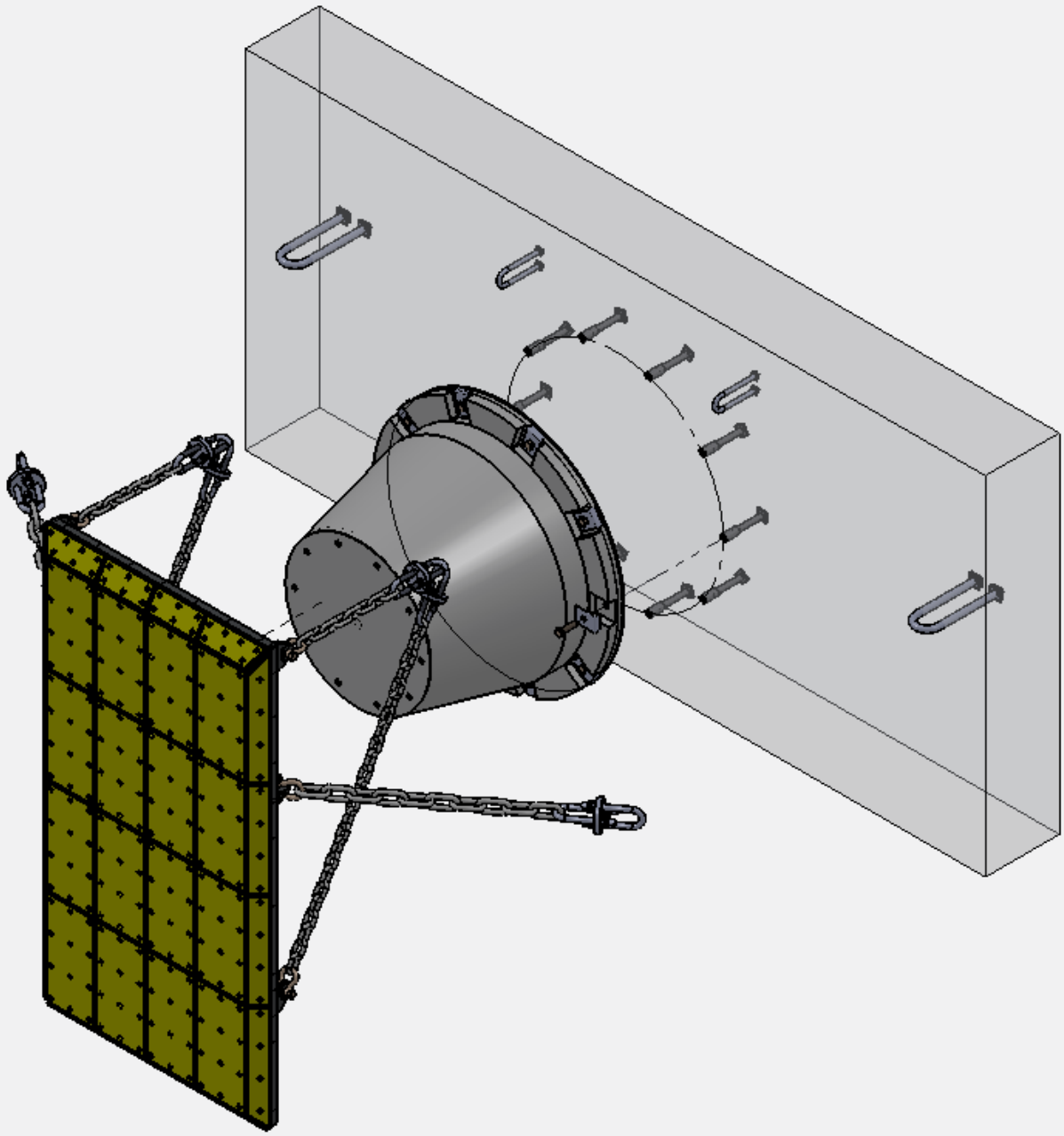
Phase 2 :

Installing fender + frame assembly on wharf structure

Phase 3 :

Installation of chain systems





⚠ CAUTION

- All relevant local health, safety, environmental standards and local compliance regulations are to be adhered to when installing the fender system.
- The installer is responsible for ensuring all works are carried out in a safe manner and in accordance with local occupational, health and safety requirements.
- This manual serves as a guide and is not intended to be used as a basis of risk assessment.
- In the event that the paintwork (coating) is damaged during installation, the client / installation agency is responsible for the repair after installation.
- Cover the fender system fully if hotwork or fabrication work is required in the immediate vicinity. Failure to do so may result in the warranty being void.

Handling

For unloading and handling of rubber fender units and anchors, refer to MN-I&M-RUB-SCN&SCKv1.0-EN and MN-I&M-ANCHOR-v1.0-EN respectively.

UNLOADING AND HANDLING OF FENDER SYSTEM UNIT

MATERIALS/CONSUMABLES REQUIRED	INFORMATION
Timber slats / rubber blocks	After unloading, place all equipment on timber / rubber blocks to avoid damage to plastic (engineering) or painted steel surfaces.
Forklift or crane (the tower crane, a mobile crane or a barge crane)	Refer to general arrangement drawing (issued by Trelleborg) for the total equipment weight.
Rigging equipment with spreader beam	Refer to the general arrangement drawing (issued by Trelleborg) for the total weight of the equipment.

- Use a crane or forklift with suitable capacity for unloading of frontal frame assembly and other system accessories.
- The fender system components will be delivered in completely plastic wrapped or in pallet boxes.

  Fully wrap the components of the fender system in plastic or pallet boxes, secured with paddings at the base when delivered.
- Unwrap the plastic packaging of the frontal frame, facing pad and accessories unit with suitable tools.
- Locate all lifting points before unloading.

  Details of lifting point locations can be found in the drawings of the project's specific fender system construction (Frontal frame drawings issued by Trelleborg).
- Unload the panels and pallets using designated lifting location.

Handling (unloading) frontal frame using crane

Handling

UNLOADING AND HANDLING OF FENDER SYSTEM UNIT

- It is advice to use a spreader beam of suitable length and load rating to lift the frontal frame assembly from the truck trailer.
- If the spreader beam is not available, two separate lifting hooks can be used.

RECOMMENDATIONS

- Frontal frame assembly of up to 2,100mm height are usually transported in closed box container. Panel above 2100mm height are transported either in open top container or flat racks.
- Lift frontal frame using designated lifting cleats / eyes only.
- Frontal frame assembly should be covered with a waterproof plastic tarpaulin to protect from dust, direct sunlight and ambient moisture, untill it is installed.

CAUTION

- Lifting rope angles should be set in a way that they do not scrape off any painted surfaces.
- Any paint damage during handling is not covered under warranty. The damages should be repaired prior installation to avoid corrosion.
- Do not walk under suspended loads.
- Do not move goods without proper protection.
- Unprotected forklift or hooks may potentially damage the goods.
- Do not put any equipment, tools or furniture over the frontal panel and accessories.

Unloading frontal frame using forklift

Handling of fender system using rigging equipment with spreader beam

Packaged frontal frame + PE pad assembly unit on truck trailer

Unloaded chain fixing bracket laying on wooden pellets

Storage

All components such as frontal frame, UHMW-PE pad assembly, chains and spool (fender spacer) should be stored properly at all times to avoid any damages (environmental damages or damages occurring from nearby moving equipment).

For storage of rubber fender and anchors, refer to document no. MN-I&M-RUB-SCN&SCK-v1.0-EN and MN-I&M-ANCHOR-v1.0-EN respectively.

Storage

MATERIALS/CONSUMABLES REQUIRED	INFORMATION
Timber / rubber blocks	All equipment should be well placed on timber / rubber blocks to avoid damage to plastic or painted surfaces.
Tarpaulin	Heavy-duty waterproof plastic

EQUIPMENT REQUIRED	INFORMATION
Forklift or crane	Forklift or crane should be of adequate capacity to lift the package. Please refer to the packing list or shipping marks for weight details.

- Place timber / rubber blocks on dry surface before placing frontal frame on it.
- Pack all other accessories properly using tarpaulin and keep them in a dry place.

RECOMMENDATIONS

- Store all components in a dry area and away from moving equipment.
- After installing the frontal frame, cover it with waterproof tarpaulin to protect it from dust, direct sunlight and ambient moisture.
- Use medium-duty tarp with an approximate thickness of 0.007 – 0.008 in (0.18 – 0.20 mm).
- For long term storage (>6 months), use heavy-duty tarp with an approximate thickness of 0.011 – 0.012 in (0.28 – 0.30 mm)
- Secure tarpaulin with nylon straps making sure there is no exposed area.
- All stored fender system component such as chain systems, frame + UHMW-PE pad assembly and spool (fender spacer) if any, should be packed and labeled properly.
- Visual inspection should be conducted every 3 months to verify the condition of fender system's components for any changes.

CAUTION

- Inspection can be done either by clients or by Trelleborg representatives. In case of any damages observed by the clients, inform local Trelleborg office for further assistance.
- Do not put any equipment, tools or furniture over the covered steel panel.

Packaging of stored frontal frame + PE pad assembly

Installation

Installation

ASSEMBLING FENDER TO FRONTAL FRAME

This section showcases the various steps involved for assembling the fender to the frontal frame.

MATERIALS/CONSUMABLES REQUIRED	INFORMATION
Timber slats / rubber blocks	Fender should be well placed on timber / rubber blocks to avoid any damages to the rubber body.

EQUIPMENT REQUIRED	INFORMATION
Fasteners	Supplied by Trelleborg.
Spanner / torque wrench	Suitable to the fasteners supplied.

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT	INFORMATION
General PPE	As per site / plant requirements.

Standard mounting configuration

- Lay frontal panel on hard and flat surface at a location with clear access to cranes and personnel.
- Place the frontal frame with the UHMWPE facing down while supported on timber bearers.
- With the assistance of a suitable crane, lift and align the fender fixing holes (head side) with the holes on the frontal frame / steel panel spool.
- Lift fender by attaching two eye bolts to the foot side holes and subsequently lifting the 2-legged slings.

  Please refer to the drawings of the project's specific fender system construction (provided by Trelleborg) for the total weight of the lifting assembly.

Installation

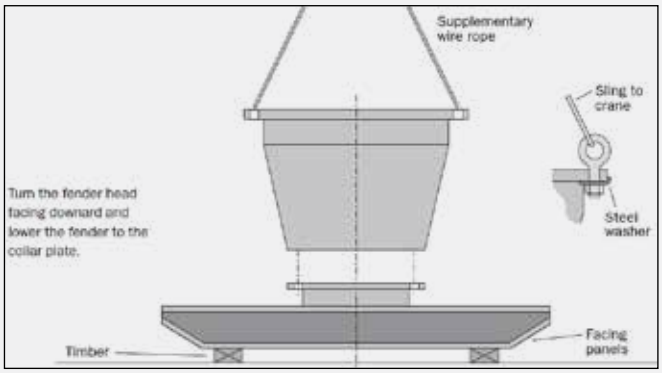
ASSEMBLING FENDER TO FRONTAL FRAME

Standard mounting configuration

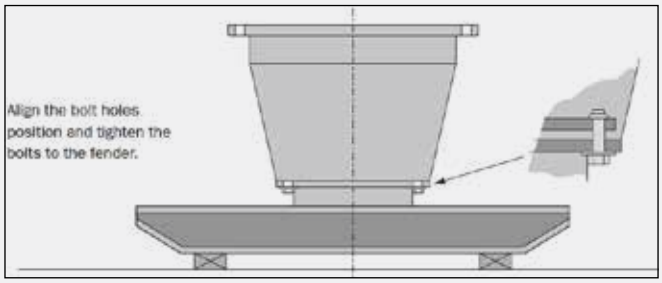
- Once all bolts are loosely inserted and aligned with the holes, proceed to tighten the bolt. (refer to Appendix for recommended torque value)
- Insert bolts one at a time and tighten adequately, ensuring the threads are engaged in line.
- Torque down after fastening all bolts, making sure the adjacent bolts are not tightened in sequence.
- The first operation prior to lifting the fender system, is to upend the panel from top side and tilt it around the soft fabric type material.
- Once the fender panel is upright, the fender + frontal frame assembly is ready to be positioned at concrete wharf.

RECOMMENDATION

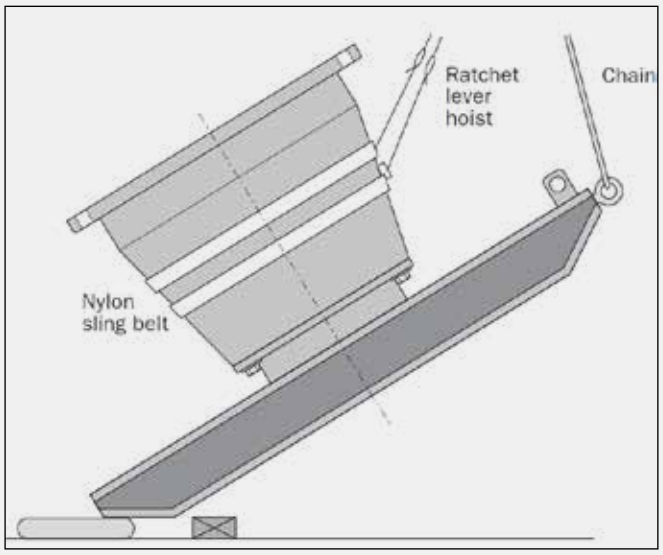
- Bolts must be tightened correctly.



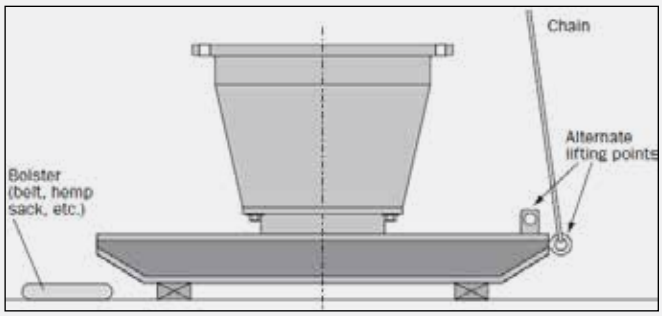
Alignment of fender holes with the frontal frame / steel panel spool holes.



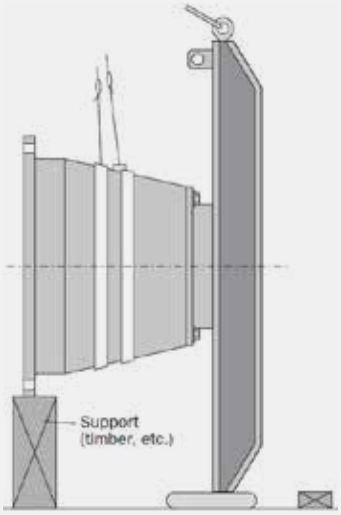
Fastening fender to frontal frame.



Tilting of sub-assembly by lifting from frame top lugs and slings fitted around the fender body.



Lifting the assembly from top lifting lugs.



Upright orientation of fender + frame assembly

Installation

ASSEMBLING FENDER TO FRONTAL FRAME

Reverse mounting SCN or SCK fender system configuration

- Lay frontal panel on hard and flat surface at a location with clear access to cranes and personnel.
- Place the frontal frame with the UMWPE facing down while supported on timber bearers.
- With the assistance of a crane lift, align the fender mounting holes with the steel panel ferrules.
- Lift fender by attaching two eye bolts to the foot side holes and subsequently lifting the 2-legged slings.
- Please refer to the drawings of the project's specific fender system construction (provided by Trelleborg) for the total weight of the lifting assembly.

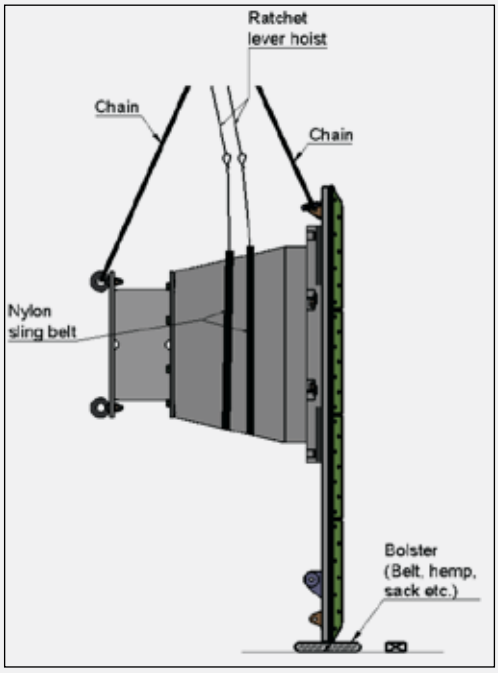
Bolt Tightening sequence

1. Insert bolts one at a time and tighten adequately, ensuring the threads are engaged in line.
2. Once all bolts are loosely inserted and aligned with the holes, proceed to tighten the bolt.
3. Torque down after fastening all bolts, making sure the adjacent bolts are not tightened in sequence.
4. Tighten the bolt until the washer is embedded 2-3mm into the rubber. Re-tighten the bolt by a quarter to half a turn after seven days to allow the rubber to relax.
5. In case of reverse mount configuration, fasten the fender head to the spool by following the above mentioned bolt tightening sequence.

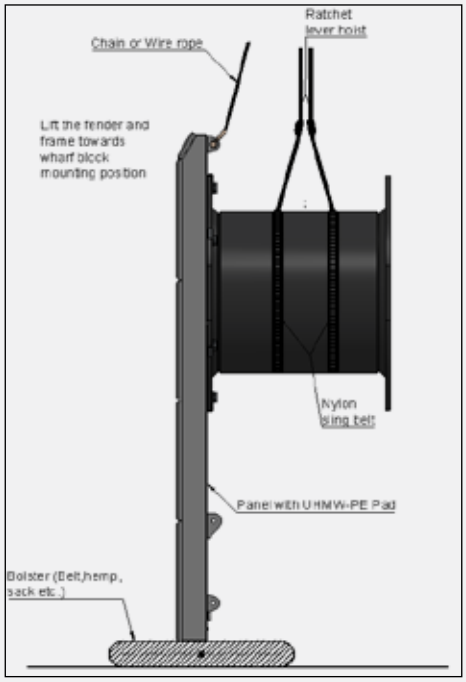
- The first operation prior to lifting is to lift the top end of the panel and tilt it around the soft fabric type material.
- Once the fender panel is upright, the fender + frontal frame assembly is ready to be positioned at concrete wharf.

RECOMMENDATIONS

- Standard bolt torque values to be used while fastening to steel frame.
- For fastening to rubber, torque values from Appendix should be used.



SCK fender system configuration

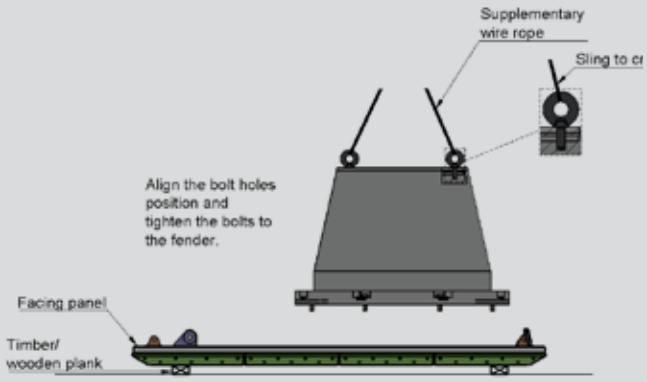


Reverse mounting configuration SCN fender system

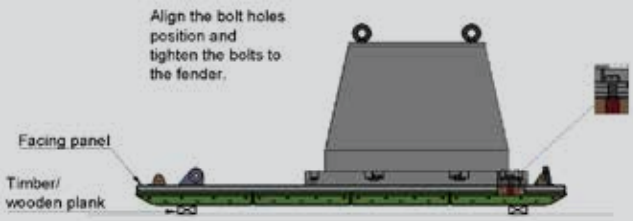
Installation

ASSEMBLING FENDER TO FRONTAL FRAME

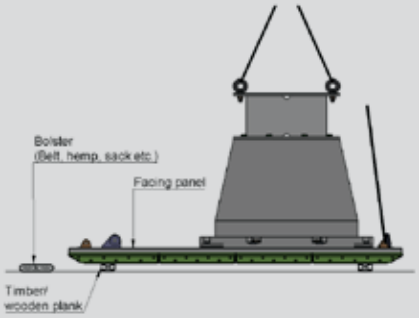
ASSEMBLING OF SCN FENDER TO FRONTAL FRAME (REVERSE MOUNTING SCN FENDER SYSTEM CONFIGURATION)



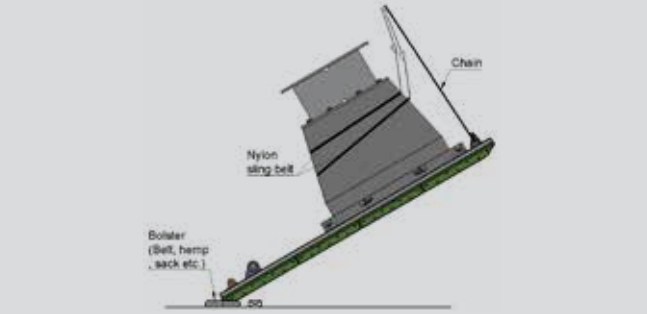
Alignment of SCN fender holes with the frontal frame/steel panel spool holes



Fastening of SCN fender (frame side)

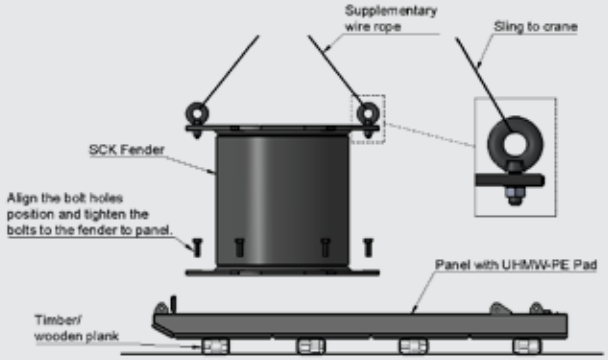


Fastening of spool to fender head

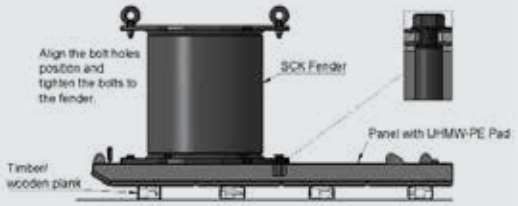


Tilting of sub-assembly by lifting from frame top lugs and slings fitted around the SCN fender body

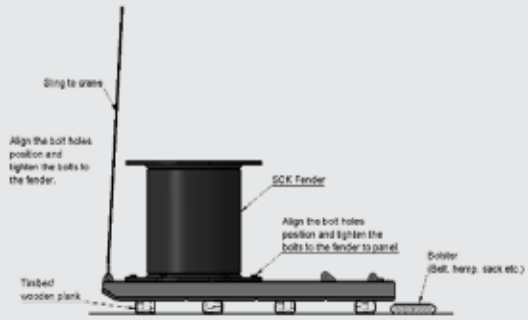
ASSEMBLING OF SCK FENDER TO FRONTAL FRAME



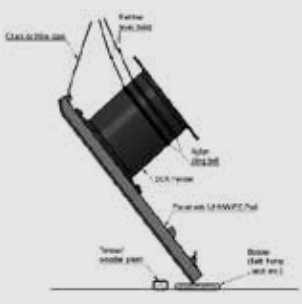
Alignment of SCK fender holes with the frontal frame/steel panel ferrule locations



Fastening of SCK fender (frame side)



Fastening of SCK Fender to frame



Tilting of sub-assembly by lifting from frame top lugs and slings fitted around the SCK fender body

Installation

ASSEMBLING FENDER TO FRONTAL FRAME

RECOMMENDATIONS

- Always lay components carefully on dry, firm and level ground supported by dunnage.
- The assembled weight of the complete fender system should be checked on-site before the final lift is attempted.
- Lifting assembly of the frontal frame can either be purpose-made lifting lugs or tension chain lugs.
- Always use undamaged and certified lifting equipment.
- Only use soft slings with lifting eyes for handling rubber and painted (coated) items.
- Use spreader beams to avoid excessive angles on slings or chains.
- Ensure components are stable and secured before removing slings.

Fender assembly ready for installation on wharf

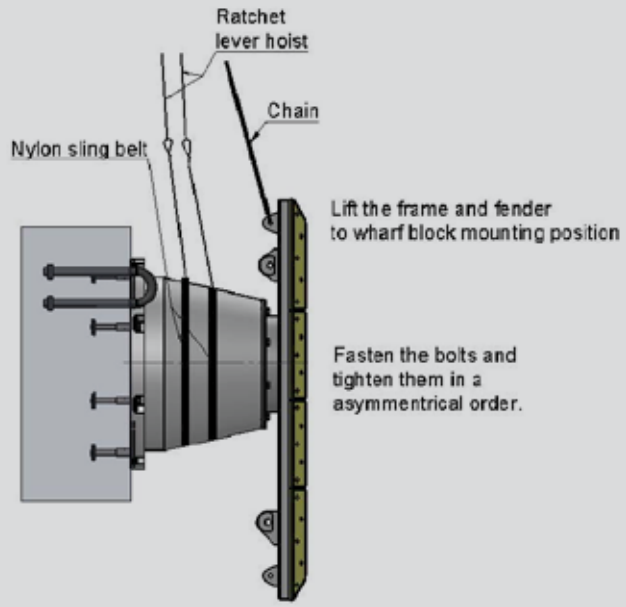
Installation

ASSEMBLING FRONTAL FRAME & FENDER UNIT TO WHARF STRUCTURE

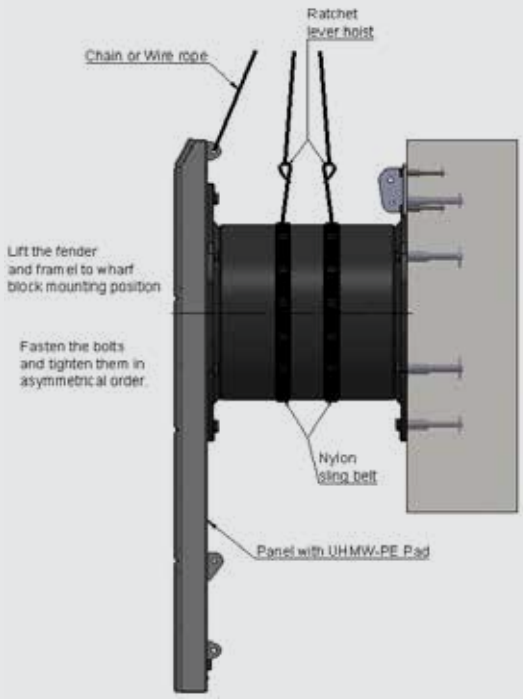
MATERIALS/CONSUMABLES REQUIRED	INFORMATION
Timber / rubber blocks	Unit should be well placed on timber / rubber blocks to avoid any damages to the painted steel surface and rubber body.

EQUIPMENT REQUIRED	INFORMATION
Fasteners	Supplied by Trelleborg.
Spanner	Suitable for the bolt size supplied.

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT	INFORMATION
General PPE	As per site / plant requirements.



Assembling SCN fender & frontal frame unit to wharf structure (standard mounting)

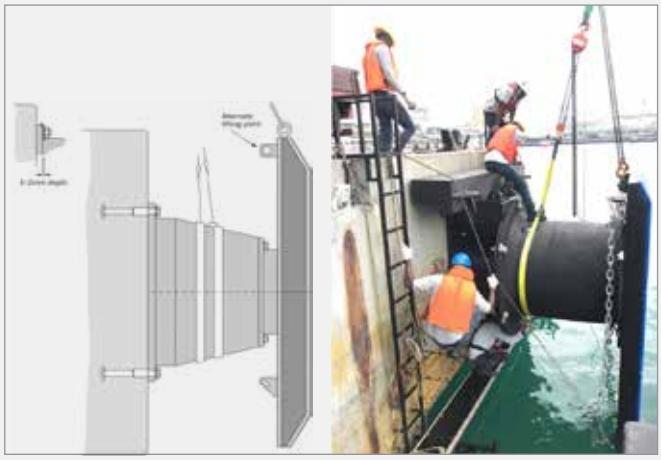


Assembling SCK fender & frontal frame unit to wharf structure

Installation

ASSEMBLING FRONTAL FRAME & FENDER UNIT TO WHARF STRUCTURE

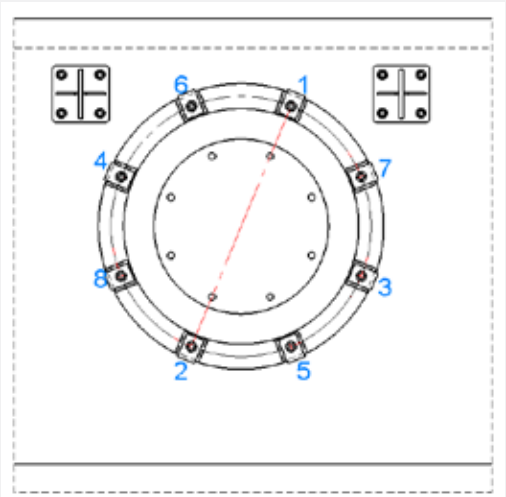
- Bracket for chains should be installed prior to placing fender systems.
- Identify the top side and frame orientation of the frontal frame from the drawings of the fender system's construction (as per Trelleborg submittal).
- Attach the lifting chain or wire rope to the lifting point on the frontal frame and another to the nylon slings fitted around the SCN / SCK fender body or around spool in case of reverse mount SCN fender system configuration.
- The length of the lifting chain should be adjusted to ensure the fender base or panel back face is parallel to the face of structure.
- Once the fixing holes at the side of the fender assembly wharf are aligned with the anchor locations, insert one of the top bolt (in case of cast-in anchors) or nut (in case of epoxy anchors). Ensure that the washer is fitted before inserting the bolt. Loosely tighten the bolt into the cast-in anchor ensuring the bolt / nut is straight and the threads aligned.



Lifting a Unit from top side

RECOMMENDATIONS

- Cleanout sockets (cast-in anchors) and check threads before fixing the fender system.
- Loosely fit all fender fixing bolts/nuts and washers into the pre-installed anchors.
- Tighten all bolts in asymmetrical order manually in first pass, until the washer touches the fender. Use torque wrench to tighten the fasteners up to recommended torque if torque wrench is not available tighten the anchors until the rubber is compressed by 2–3mm.



Tighten bolts in an asymmetrical order
(Image need to recreate in solid works)

CAUTION

- Support the fender systems with crane until everything has been properly installed.

Fastening of fender to wharf

Installation

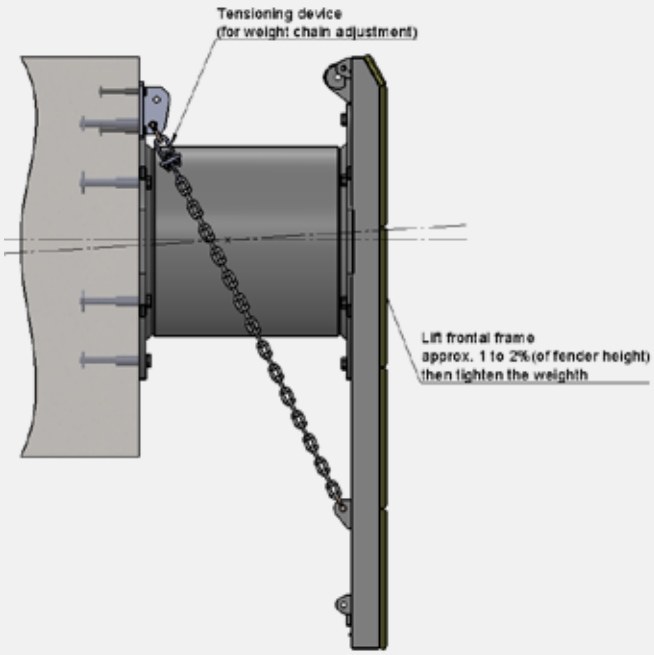
ASSEMBLING CHAIN SYSTEMS TO WHARF STRUCTURE

- Layout the chain system on the wharf beside the fender system and ensure all components are available and assembled in the correct order.
- Connect chains either to the frame or structure, whichever is more convenient.

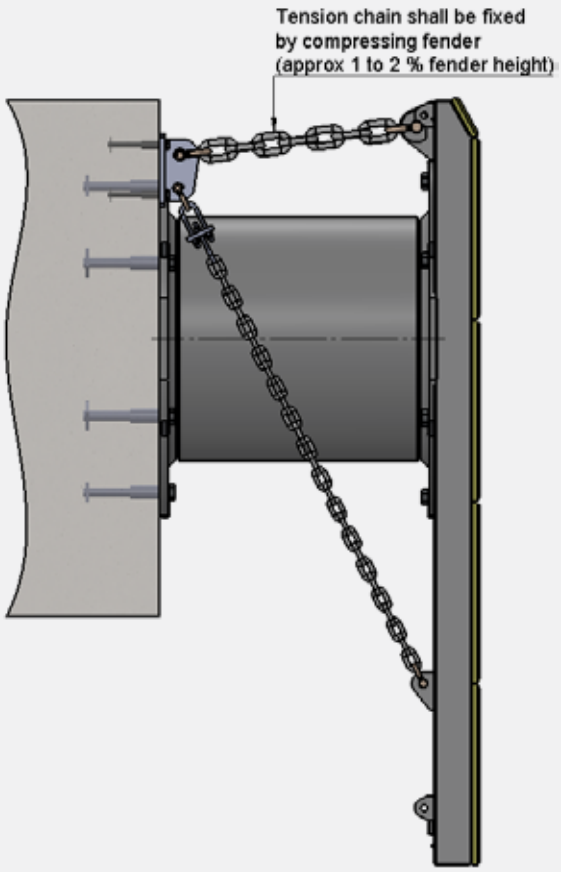
⚠ CAUTION

1. Other chain arrangements may be applicable. (Refer to project drawings for details provided by Trelleborg).
2. Measure the distance between the frontal frame cleat and wharfside cleat / anchor for respective chain type and ensure correct chain assembly (with tensioners if any) of the same measurement is connected to respective cleats.
3. In some installations, chains are supplied with excess links which may be required to be removed.

- Lift the frontal frame 1 - 2% of the fender height (size) and then tighten the weight chain.
- Lower the panel to a stable position, but do not remove the frontal frame support from the crane.
- Tighten the tension and shear chains as much as possible without rotating the frontal frame. A sag in the tension and shear chains that would allow the frontal frame to rotate 50mm is acceptable as long as the frontal frame is sitting vertically.
- Adjust the tension / shear and weight chain to ensure the frontal frame and fender are aligned with no sag of the fender under the frontal frame weight.
- Touch up any damaged paint work once all bolts (shackle or 'U' bolt) are tightened and chains installed.



Weight chain fixing



Tension chain fixing

Installation

ASSEMBLING CHAIN SYSTEMS TO WHARF STRUCTURE

RECOMMENDATIONS

- The crane should always support the weight of the fender system until all the components are fixed and secured at their respective positions.
- Comply to the standard torque values while fastening to the steel.
- Refer Appenedix for fender fixing fastener torque value.
- Any damage to the paint work should be repaired in accordance with the recommended procedures by the paint supplier (manufacturer).

Maintenance and Inspection

An inspection and maintenance guideline is essential to identify the maintenance scope of the installed fender system. This section covers inspection schedule and procedure as specified in the below tables for the following critical parts:

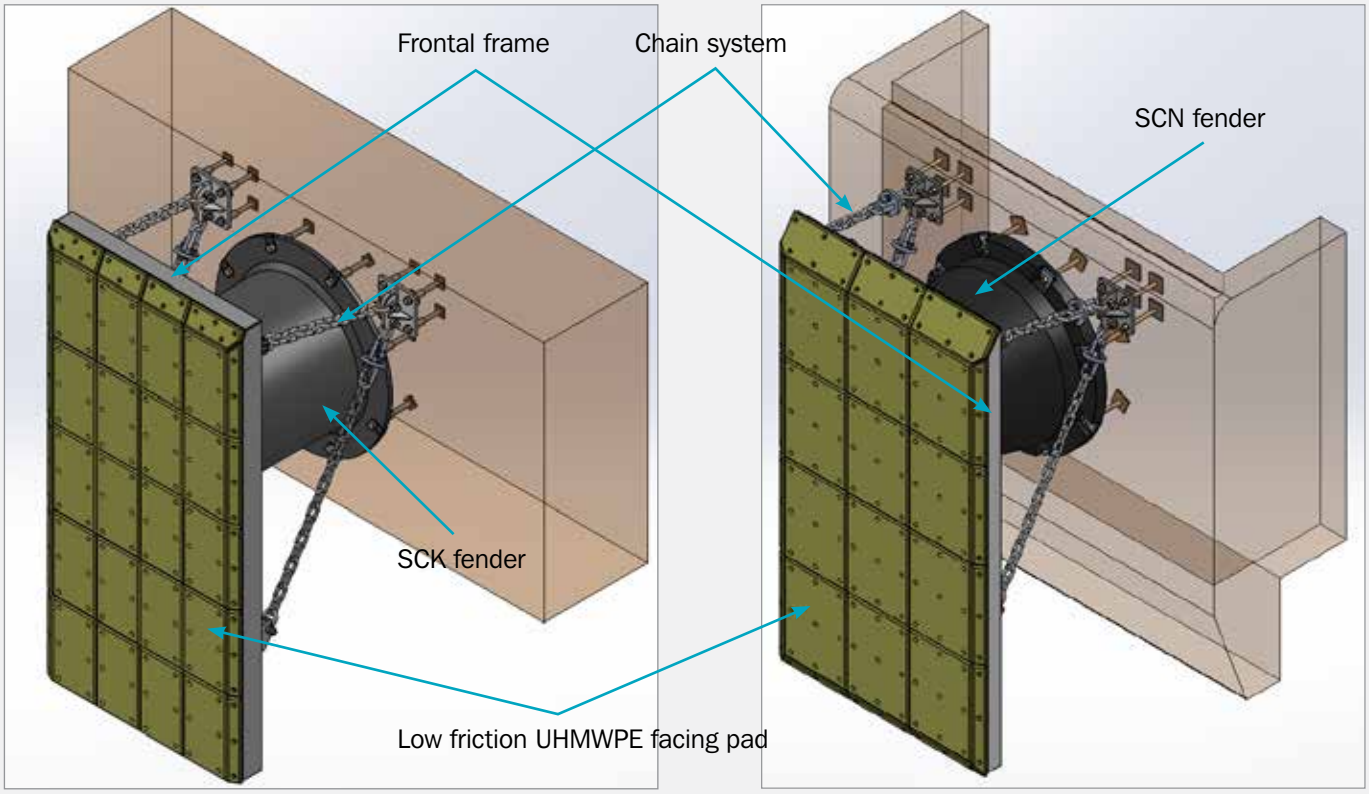
A. Low friction UHMW-PE facing pad

B. Frontal frame (paint and steel work)

C. Chain system components

Three levels of inspection and maintenance are recommended. The table gives an average period for temperate climates. These should more often be in harsh environments such as the tropics (hot and humid).

If you are uncertain about any aspect of inspection or maintenance, please consult Trelleborg Marine Systems. Inspection Intervals should be adjusted to suit local conditions and feedback from maintenance personnel.



Typical SCN & SCK fender system

Inspection and Maintenance

LOW FRICTION UHMW-PE FACING PAD INSPECTION SCHEDULE & PROCEDURE

Table – 1A : Inspection schedule for Low friction UHMW-PE facing pad

INSPECTION POINTS	INTERVALS		
	3 MONTHS	6 MONTHS	12 MONTHS
1	✔		
2	✔		
3	✔		
4		✔	
5			✔

Table – 1B : Inspection procedure for Low friction UHMW-PE facing pad

INSPECTION POINTS	INSPECTION	ACTION	CHECK
1	Visually inspect if there is any missing fixing fasteners on the facing pad.	Replace missing fasteners (half nut, oversize washer or any hex bolt etc.).	
2	Check if any facing pad is missing.	Replace pad after checking thread condition of the fastener (stud, nut or ferrule etc.).	
3	Check facing pad for physical damage.	If facing pad is partially broken, ripped off and observed wide cuts exposing fixing studs, than facing pad should be replaced.	
4	Inspect the areas surrounding the bolt head for any wear and tear.	If the remaining wear allowance is 2mm above the head of the fastener, replace the facing pad.	
5	Check the tightness of minimum ten facing pad fasteners (randomly) at different locations (on top / bottom / side bevels and front pad.	Tighten all loose fasteners.	

Notes:

- In general, UHMW-PE pads cannot be repaired. Damaged or missing pads must be replaced immediately.
- Missing pads may lead to accelerated wear or damage to adjacent facing pads. Enquire local Trelleborg office for replacement parts.
- UHMW-PE pads normally last for 10 years or more but may have a shorter lifespan due to different berthing conditions and local environment.

Inspection and Maintenance

PAINT AND STEEL WORK INSPECTION SCHEDULE & PROCEDURE

TABLE – 2A : Inspection schedule for paint and steel work of frontal frame

ITEM	INTERVALS		
	3 MONTHS	6 MONTHS	12 MONTHS
6	✔		
7		✔	
8			✔
9		✔	
10			✔
11			✔

TABLE – 2B : Inspection procedure for paint and steel work of frontal frame

ITEM	INSPECTION	ACTION	CHECK
6	Inspect for rust bleed marks.	Trace the source of bleed and mark rust point and re-paint local area. Follow paint manufacturer's repair procedure.	
7	Inspect for rust blisters (apply an anti-rust primer and repaint it).	Mark on the frame clearly.	
8	Inspect for damage on paint work.	Mark the damaged area clearly.	
9	Inspect for physical damage on steelwork.	Determine whether the damage will affect the frontal frame performance and if repair work is required.	
10	Remove one facing pad and inspect paintwork underneath.	If paint is deteriorating, remove panels completely to inspect the area under the facing panels.	
11	Anode protection block (if fitted).	The protection block should be replaced when ; ▌The anode is coming loose from the mounting frame. ▌less than 30 cc of metal remains	

Notes:

- Damaged paintwork should be treated in accordance with the Approved Paint Repair Procedure.
- Do not alter the original supplied components.
- Pneumatic testing of the installed frontal frame is recommended once a year to check any leakages which may require repair works.

Inspection and Maintenance

CHAIN SYSTEM COMPONENT INSPECTION SCHEDULE & PROCEDURE

TABLE – 3A : Inspection schedule for chain system & components

ITEM	INTERVALS		
	3 MONTHS	6 MONTHS	12 MONTHS
12		✔	
13		✔	
14		✔	
15			✔
16		✔	

TABLE – 3B : Inspection procedure for coating system chain system & components

ITEM	INSPECTION	ACTION	CHECK
12	Inspect chain system for rusting.	If mild rust (type of corrosion) is found, it may be ignored. For heavily rusted chain, remove rust on a section of the chain (treat with rust inhibiting paint or using rust dissolver) and measure the diameter of the remaining metal. Replace the chain if diameter measured is less than the indicated value in Table A.	
13	Check for missing shackle locking nuts or split pins.	Replace if missing.	
14	Check threads on all shackles pins for rust or physical damage.	Wire brush threads and treat with rust inhibiting paint if pin is rusted. Replace pin if heavy rusting or damage is found.	
15	Check all shackles for wear or corrosion.	Replace shackle if the remaining usable metal is less than indicated in Table A.	
16	Check to ensure all chains are firmly tensioned.	Tighten all chains so there will be no slack. Weight chains should always be tightened and adjusted so that the fender system and rubber element does not loosen over time. This may also require the adjusting of the tension chains in sequence with the weight chains.	

Inspection and Maintenance

CHAIN SYSTEM COMPONENT INSPECTION SCHEDULE & PROCEDURE

Table A

Original chain diameter	22	24	26	28	30	32	34	36	38	40	42	46	48	50
Minimum chain diameter	16	17	19	20	22	23	24	25	26	28	30	32	34	35

This table is only applicable to chain systems which are designed with factor of safety of 3.0 or more.

Notes:

- Chains and other components, if galvanized, are expected to have discoloration due to the act of zinc sacrificing.
- Some hot-dip galvanized steel may turn a reddish-brown color after a period of exposure (sometimes as fast as a few months)
- The source of discoloration is the corrosion of Zn-Fe alloy forming rust together with humid air or rain water. Rust has a great ability to stain and even small amounts can cause considerable discoloration.
- Sometimes when discoloration is severe it is easy to conclude that rust protection has been greatly reduced, or completely destroyed. However, this is seldom the case. The iron-zinc alloys give better protection to the underlying steel than pure zinc.

Appendix

Appendix 1
Torque table based on anchor loading

SCN FENDERS (F1.9 TO F3.1)

FENDER	AXIAL FORCE (kN) (F)	BOLT SIZE	CO-EFFICIENT (k)	TORQUE (T) N.m T =KFD
SCN 2250	401	M64	0.18	4614
SCN 2250	374	M56		3765
SCN 2000	317	M56		3190
SCN 1800	279	M56		2812
SCN 1600	264	M48		2281
SCN 1400	203	M42		1531
SCN 1300	177	M42		1338
SCN 1200	167	M42		1259
SCN 1100	128	M36		826
SCN 1050	143	M36		923
SCN 1000	131	M36		846
SCN 950	117	M30		632
SCN 900	107	M30		575
SCN 860	98	M30		527
SCN 800	84	M30		454
SCN 700	84	M30		454
SCN 600	63	M30		340
SCN 550	54	M24		233
SCN 500	41	M24		175
SCN 400	29	M20		103
SCN 350	21	M16		60
SCN 300	17	M16		48

Appendix 1
Torque table based on anchor loading

SCN FENDERS (F0.7 TO F1.8)

FENDER	AXIAL FORCE (kN) (F)	BOLT SIZE	CO-EFFICIENT (k)	TORQUE (T) N.m T =KFD
SCN 2250	254	M48	0.18	2190
SCN 2250	236	M48		2035
SCN 2000	200	M42		1508
SCN 1800	177	M42		1338
SCN 1600	167	M42		1259
SCN 1400	128	M36		826
SCN 1300	111	M36		719
SCN 1200	96	M30		518
SCN 1100	81	M30		437
SCN 1050	90	M30		486
SCN 1000	83	M30		446
SCN 950	75	M30		405
SCN 900	68	M30		365
SCN 860	62	M24		266
SCN 800	54	M24		233
SCN 700	54	M24		233
SCN 600	38	M20		135
SCN 550	35	M20		124
SCN 500	26	M20		92
SCN 400	18	M16		52
SCN 350	14	M16		39
SCN 300	11	M16		30

k=0.18 for hot-dip galvanized screw threads with normal metric thread, clean and dry (ungreased).

k=0.15 for bolts with normal metric thread, clean and light oiled, in the manner the manufacturer usually delivers.

k=0.12 for bolts with normal metric thread of which the screw thread and the nut face are lightly greased with a Molyslip screw thread paste (or similar).

- Torque value calculated considering k = 0.18.
- Above ‘k’ values are for reference only. Appropriate ‘k’ values shall be considered as per lubricant manufacturer datasheet.
- If a digital torque wrench is not available, measure the initial clamping thickness and allow the rubber to compress not more than 2-3 mm.

Appendix 2
Paint repair procedure

TYPE OF DEFECTS : Scratches during handling and transportation

PAINTING DETAIL

Surface preparation	: With emery paper
Primer coat	: As per approved drawing or project specification.
Intermediate and top coat	: As per approved drawing or project specification.
Total DFT	: As per approved drawing or project specification.
Colour	: As per approved drawing or project specification.

REPAIRS PROCEDURE

The repair material consists of the ready mix and the original paint used for painting. The repair steps are as following:

Step 1 : Drying and cleaning of the affected area.
– Remove all residual dust and dirt before coating.
– Abrasives or other foreign particles are not permitted within the coating.

Step 2 : Remove the damaged lining / rust by grinding or using a wire brush and/or emery paper (tool damaging the surface must not be used).

Step 3 : Mark the area with masking tape.

Step 4 : Cover the steel surface with a thin film of ready mixed paint using a paintbrush / roller within the masking tape area. Fill the cavity (damaged portion) with ready mixed paint up to the specified minimum film thickness by using a paint brush or roller, following coating intervals as specified by the paint manufacturer.

Step 5 : Allow the paint to dry, as specified.

Step 6 : Remove the masking tape.

Step 7 : After curing, inspect the repaired area for the following:
a) Measuring the total dry film thickness as per approved drawing or project specification.
b) Pinhole and foreign particles (visually).
c) Coating appearance (visually).

Step 8 : Remove the masking tape.

ACCEPATANCE CRETARIA

Defective damaged coating shall be repaired by the skilled (professional) applicator.

Notes:

- Trelleborg recommends that paint repair procedure for any minor paint damage work to be done in accordance with ISO12944 (latest revision / edition).
- Periodical minor repair work should be done as as per standards specified by port operators / owners. Alternatively, contact Trelleborg local office for further assistance (or as per Approved Paint Repair Procedure).

References

This section contains references to other associated installation and maintenance manuals as mentioned below.

DOCUMENT NO.	DESCRIPTION
MN-I&M-RUB-SCN&SCK-v1.0-EN, 2017	Handling, Storage, Installation, Inspection & Maintenance Manual for SCN/SCK Rubber Fender System
MN-I&M-ANCHOR-v1.0-EN, 2017	Handling, Storage, Installation, Inspection & Maintenance Manual for Anchors
MN-I&M-PMF-SYS-v1.0-EN, 2017	Handling, Storage, Installation, Inspection & Maintenance Manual for PMF System

DISCLAIMER

Trelleborg AB has made every effort to ensure that the technical specifications and product descriptions in this brochure are correct.

The responsibility or liability for errors and omissions cannot be accepted for any reason whatsoever. Customers are advised to request a detailed specification and certified drawing prior to construction and manufacture. In the interests of improving the quality and performance of our products and systems, we reserve the right to make specification changes without prior notice. All dimensions, material properties and performance values quoted are subject to normal production and testing tolerances.

This brochure supersedes the information provided in all previous editions. If in doubt, please check with Trelleborg Marine Systems.

MN-I&M-FEN-SYS-v1.0-EN, 2017

TRELLEBORG

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Thesmartapproachblog.trelleborg.com

Trelleborg Marine and Infrastructure
Email: marine_infra@trelleborg.com