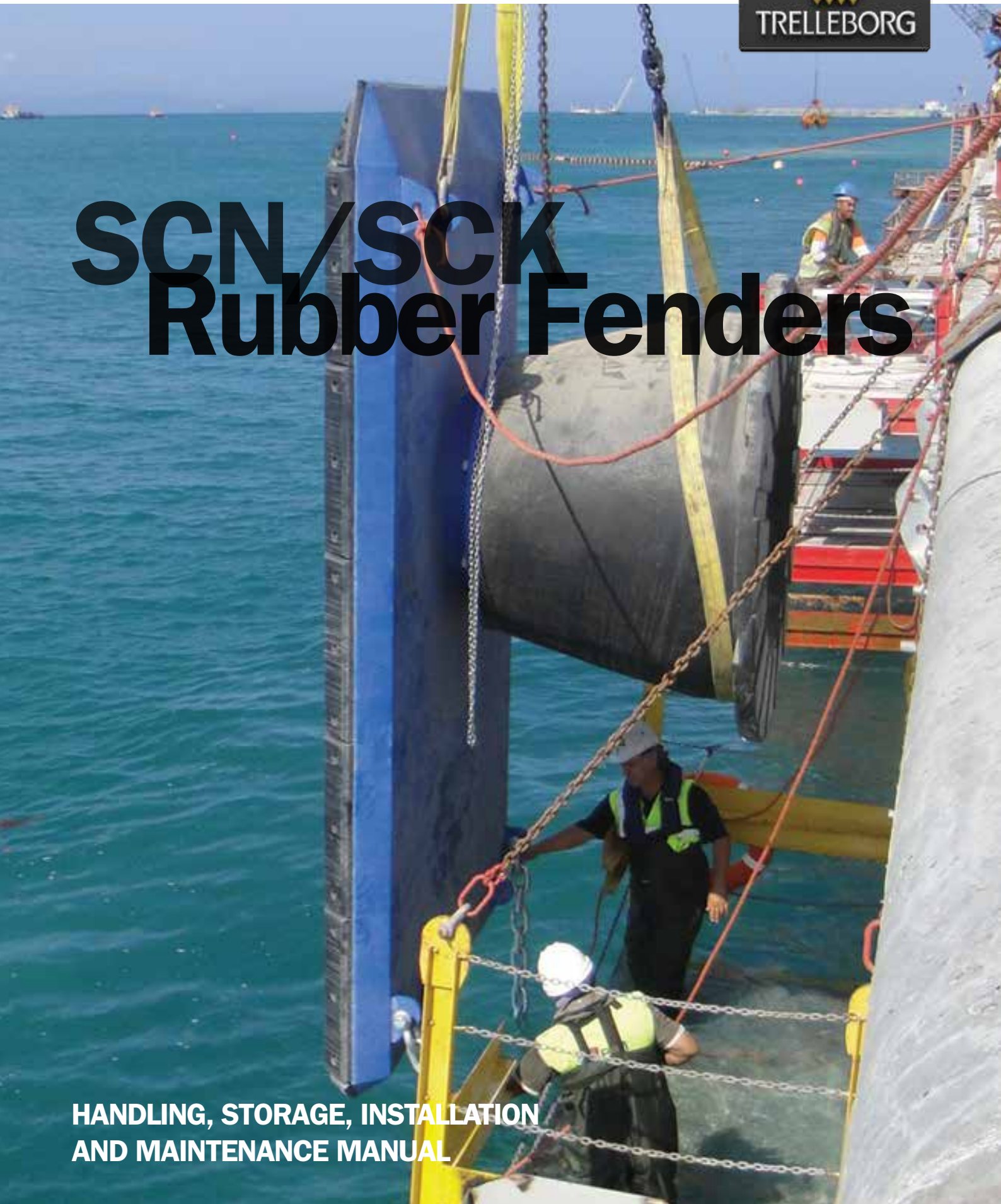


SCN/SCK Rubber Fenders

**HANDLING, STORAGE, INSTALLATION
AND MAINTENANCE MANUAL**



The Smarter Approach



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SCN/SCK Rubber Fenders 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.

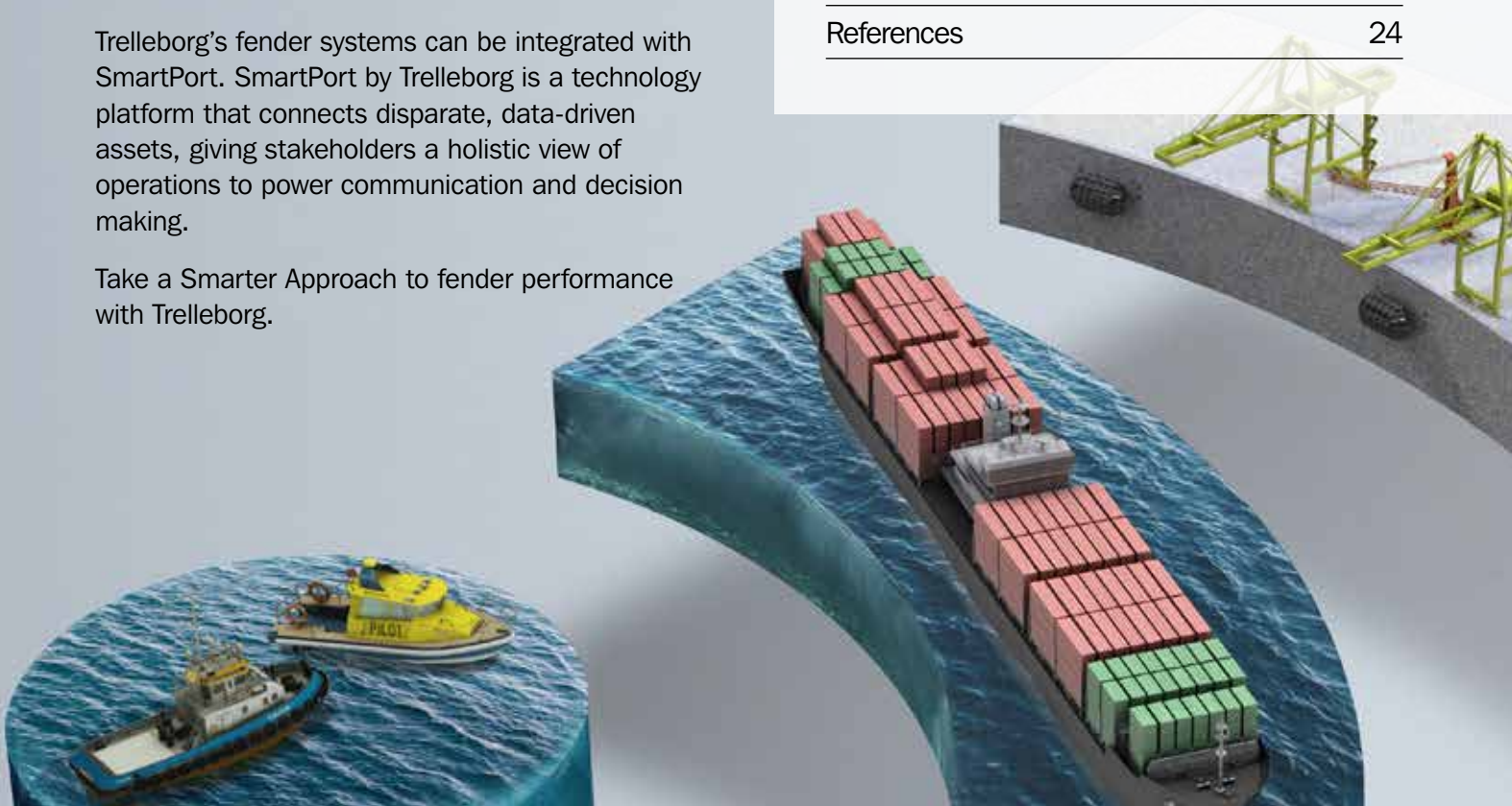
Trelleborg's fender systems can be integrated with SmartPort. SmartPort by Trelleborg is a technology platform that connects disparate, data-driven assets, giving stakeholders a holistic view of operations to power communication and decision making.

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SCN/SCK RUBBER FENDERS HANDLING, STORAGE, INSTALLATION AND MAINTENANCE MANUAL

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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 Center of Excellence where our team generates 3D CAD designs, application-engineering drawings, a bill of materials, finite engineering analysis 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 meet your specifications, and more.



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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.



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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.

Handling



Handling

MATERIALS/CONSUMABLES REQUIRED	INFORMATION
Timber / rubber blocks / steel or wooden pallets	Fenders should be well placed on bolster (soft material) / dunnage to avoid damage to rubber body and rolling / sliding of fender.
Tarpaulin	Should be heavy-duty waterproof plastic (Refer to storage guideline section - 2).
Use forklift or crane with adequate load and the required rigging equipment with spreader beam (if needed)	Refer to table 1 & 2 for weight and C.G (center of gravity) details.

Unloading of rubber fenders shall be done either using forklift or cranes.

- Check weight and overall dimensions of the fender, prior to selecting the suitable certified equipment for lifting and rigging. Refer to table 1 & 2 for fender weight and product catalog for fender dimensions.
- Locate all lifting points before beginning to move items, refer to table 1 & 2 for fender C.G (center of gravity) details.
- Forklift shall be used for unloading of fender sizes (height) up to SCN1400 and SCK2000 as these are generally transported in close box containers.
- Crane shall be used for unloading of fenders above SCN1400 and SCK2000 as these are generally transported in top rack containers or flat racks.



Figure 2 – Fender lifting using forklift

RECOMMENDATION

- Before unloading the shipment from container, it must be visually inspected for any visible damages on surface during transportation. If significant damage is found, capture image and send to Trelleborg Marine Systems.
- Rubber fenders should be handled with nylon slings or by other methods. The method and size of the slings should be agreed upon by the engineer on site.
- Always lay components on ground level with dry and firm surface. The components should be supported by dunnage.
- Never drop the components or lay them directly onto rocky or waterlogged ground.
- Keep rubber fenders and fittings in their original packing until installation.

CAUTION

Never lift the fender using flange holes (bolt holes) directly by tying wire rope / sling etc. As it might damage the rubber and expose the steel part which leads to corrosion.



Figure 1 – Fender lifting using crane hook

Handling

TABLE – 1 (Fender weight index: SCN - Super Cone Fenders)

FENDER	HEIGHT "H" (mm)	F0.9-1.8 ANCHORS / BOLTS	F1.9-3.1 ANCHORS / BOLTS	WEIGHT/UNIT (kg)	FLANGE FOOT "ØW" (mm)	FLANGE HEAD "ØU" (mm)
SCN 300	300	4 x M16	4 x M16	40	500	295
SCN 350	350	4 x M16	4 x M16	50	570	330
SCN 400	400	4 x M16	4 x M20	76	650	390
SCN 500	500	4 x M20	4 x M24	160	800	490
SCN 550	550	4 x M20	4 x M24	210	880	540
SCN 600	600	4 x M20	4 x M30	270	960	590
SCN 700	700	4 x M24	4 x M30	411	1120	685
SCN 800	800	6 x M24	6 x M30	606	1280	785
SCN 860	860	6 x M24	6 x M30	750	1376	845
SCN 900	900	6 x M30	6 x M30	841	1440	885
SCN 950	950	6 x M30	6 x M30	980	1520	930
SCN 1000	1000	6 x M30	6 x M36	1125	1600	980
SCN 1050	1050	6 x M30	6 x M36	1360	1680	1030
SCN 1100	1100	8 x M30	8 x M36	1567	1760	1080
SCN 1150	1150	8 x M30	8 x M36	1779	1840	1125
SCN 1200	1200	8 x M30	8 x M42	2028	1920	1175
SCN 1300	1300	8 x M36	8 x M42	2455	2080	1275
SCN 1400	1400	8 x M36	8 x M42	3105	2240	1370
SCN 1600	1600	8 x M42	8 x M48	4645	2560	1570
SCN 1800	1800	10 x M42	10 x M56	6618	2880	1765
SCN 2000	2000	10 x M42	10 x M56	9560	3200	1955
SCN 2250	2250	12 x M48	12 x M56	13500	3600	2205
SCN 2500	2500	12 x M48	12 x M64	18500	4000	2450



Figure 3 – C.G detail of SCN Fender

Handling

TABLE – 2 (Fender weight index: SCK - Cell fenders)

FENDER	HEIGHT "H" (mm)	ANCHORS / BOLTS	WEIGHT/UNIT (kg)	FLANGE DIMENSION "ØW" (mm)
SCK 400	400	4 x M20	75	650
SCK 500	500	4 x M24	95	650
SCK 630	630	4 x M27	220	840
SCK 800	800	6 x M30	400	1050
SCK 1000	1000	6 x M36	790	1300
SCK 1150	1150	6 x M42	1200	1500
SCK 1250	1250	6 x M42	1500	1650
SCK 1450	1450	6 x M48	2300	1850
SCK 1600	1600	8 x M48	3000	2000
SCK 1700	1700	8 x M56	3700	2100
SCK 2000	2000	8 x M64	5000	2200
SCK 2250	2250	10 x M64	7400	2550
SCK 2500	2500	10 x M64	10700	2950
SCK 3000	3000	12 x M76	18500	3350

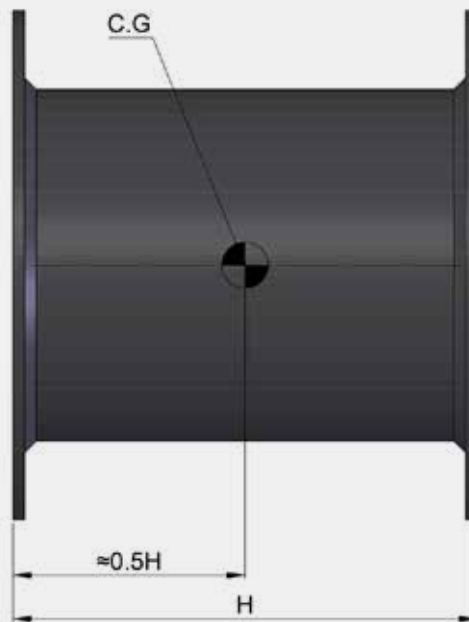


Figure 4 – C.G detail of SCK Fender

Handling

Precautions must be taken whilst handling cone / cell rubber fenders. Prevention of damage and correct installation will maximize the system's performance and life cycle.

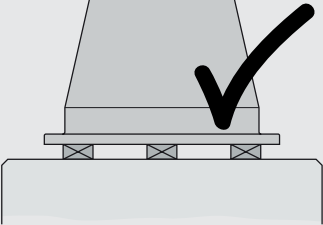
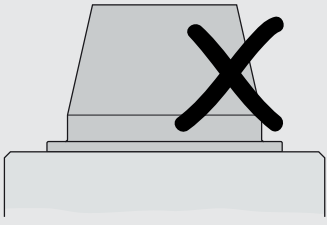
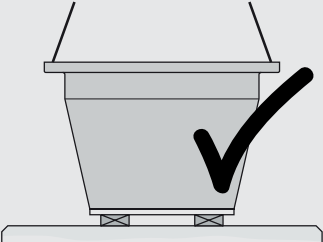
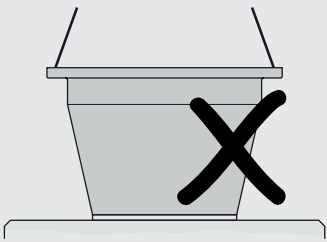
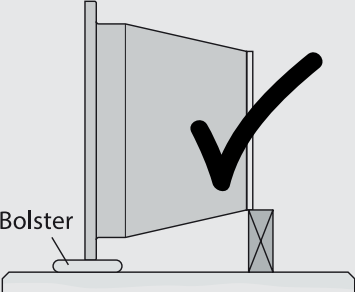
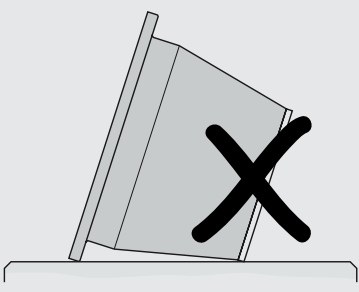
RECOMMENDATION

- | Always use certified lifting and rigging equipment.
- | Only use soft slings with lifting eyes for handling rubber fenders.
- | Check weights and C.G (centre of gravity) before lifting.
- | Check if the ground conditions are firm enough for crane operations.

CAUTION

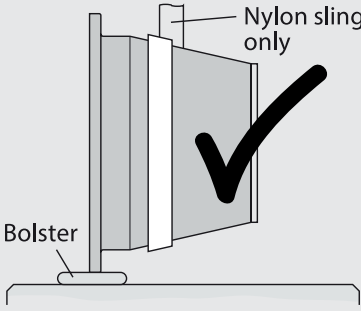
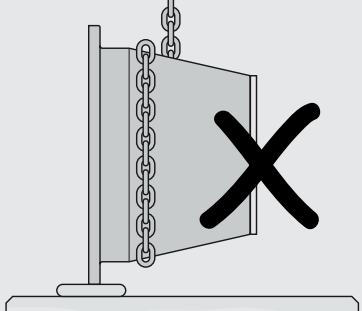
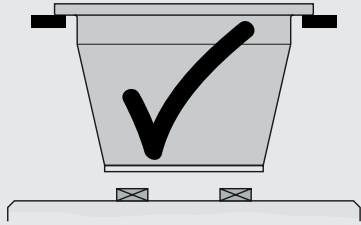
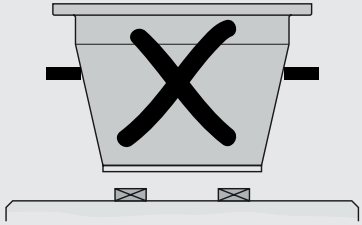
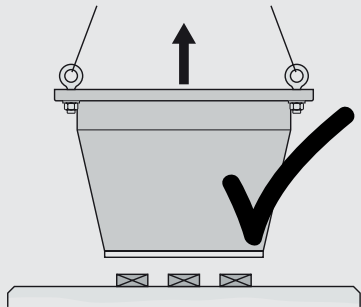
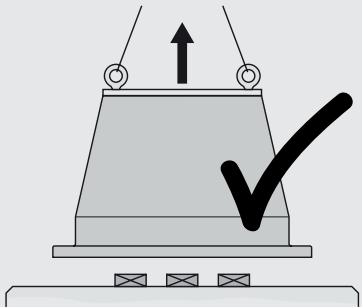
- | Do not drag components over the ground.
- | Do not use makeshift tools that are not designed for the job.

Refer table 3 for basic guideline of SCN & SCK rubber fender handling after unloading it at site;

TABLE 3A (SCN FENDER HANDLING)		
Never rest the rubber on a rough surface		
		
Never rest or drop a rubber fender on its side		

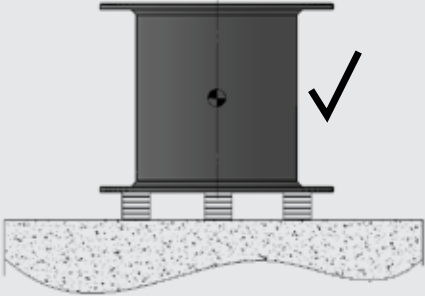
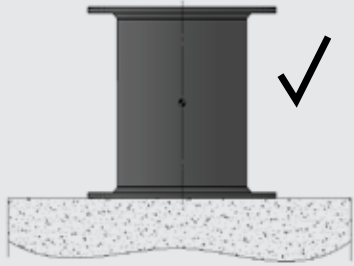
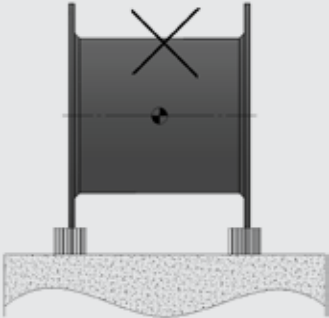
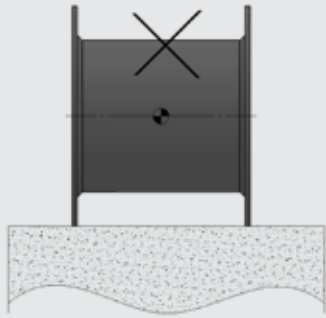
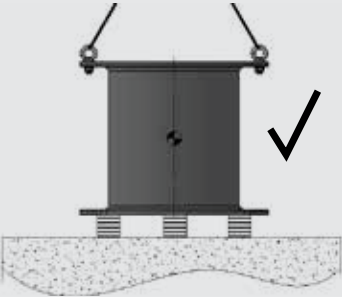
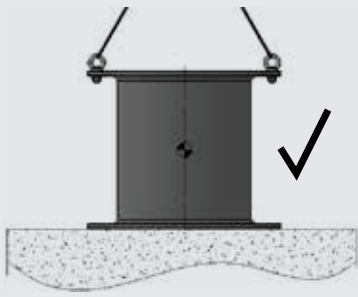
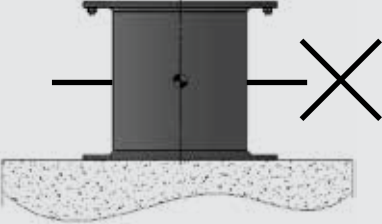
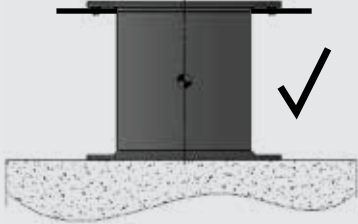
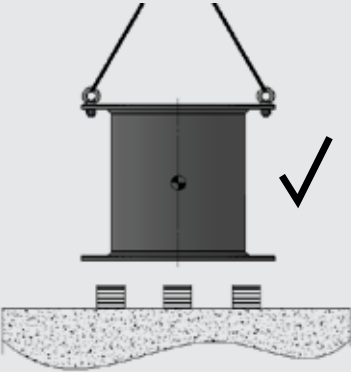
Handling

TABLE 3A (SCN FENDER HANDLING)

<p>Never wrap rope, chains or wire ropes around a fender for lifting. Always use a nylon sling</p>		
<p>Never lift a fender with forklift tines against the fender body</p>		
<p>Fenders can be lifted by properly attaching temporary slings to the bolt mounting points</p>		

Handling

TABLE 3B (SCK FENDER HANDLING)

<p>Never rest or drop a rubber fender on its side</p>		
		
<p>Never lift fender by it's body</p>		
<p>Never lift a fender with forklift tines against the fender body</p>		
<p>Fenders can be lifted by properly attaching temporary slings to the bolt mounting points</p>		



Storage



Trelleborg's fenders are designed to be used in outdoor applications. In general, special packaging and storage are not required if the fenders are used immediately after unloading at the site.

However, if the client requires spare fenders to be stored, proper packaging and inspections are required. The guidelines are given in the following section based on ISO2230:2002(E).

Table 4 provides guidelines for storage duration of unassembled rubber fenders with respect to their material property.

Storage

2.1 STORAGE TIME GUIDELINE FOR UNASSEMBLED FENDERS

TABLE 4 : INITIAL AND EXTENSION STORAGE PERIODS FOR UNASSEMBLED COMPONENTS

Material group	Initial storage period (Applicable if proper packaging & storage conditions are followed)	Extension storage period (*Confirmation can be given once initial storage reports have been verified and approved by Trelleborg and subsequent testings are done)
Natural Rubber, SBR & Blend	5 Years	2 Years
EPDM Rubber	5 Years	5 Years

Note:

- Classification of above rubber type is according to their relative susceptibility to deterioration.
- If the storage temperature is over or under 25°C, this will influence the storage duration. Storage at a temperature higher than 10°C will reduce storage duration by about 50% and storage at a temperature lower than 10°C will increase storage time by about 100%.

RECOMMENDATION

- Stored fenders shall be periodically inspected and tested for changes in rubber properties due to degradation or any physical deformation, contamination or mechanical changes in it.
- Every package or container should be labelled in a way that is visible from the outside of the package, without tearing the fender packaging (please refer to 2.2 for guidelines on packaging and labelling).



Figure 5 – Ideal fender storage

Storage

Some rubbers are more prone to deterioration as they are more susceptible to environmental factors such as heat, light, ozone, oxygen and humidity.

Exposure to these factors should be minimized to extend storage life. As system of storage control, proper packaging and periodic inspection is therefore necessary. Refer to table 5 for various factors affecting the aging process of fenders.

TABLE 5 : THE AGING PROCESS IS PREDOMINANTLY DEPENDENT ON THE FOLLOWING FACTORS

FACTORS	REMARKS
Temperature	<p>The storage temperature should be < 25°C</p> <ul style="list-style-type: none"> ■ Material shouldn't be exposed to direct sources of heat such as boilers, radiators and direct sunlight. ■ At very lower temperature, rubber may stiffened and become susceptible to distortion if not handled carefully.
Humidity	Relative humidity should be < 65%
Ozone	<p>The rubber seal must be protected from the effects of ozone and ionizing radiation.</p> <ul style="list-style-type: none"> ■ Storage rooms should not contain any equipment that generates ozone i.e. mercury vapor lamps or high-voltage electrical equipment giving rise to electric sparks or silent electrical discharges. ■ When an equipment such as a forklift truck is used to handle large rubber products, care should be taken to ensure this equipment is not a source of pollution that may affect the rubber.
Stacking	Fenders must not be stored on top of the other. If needed, due to space constraint, use appropriate racks.
Contact with liquid and semi-liquid materials	The rubber seal should never be in contact with liquid or semi-liquid materials. For example - petrol, greases, acids, disinfectants, cleaning fluids or any chemicals.
Contact with metals	Fenders should never be in contact with metals or sharp edges as some metals and their alloys (in particular, copper and manganese) are known to have deleterious effects on some rubbers.

Storage

2.2 PACKAGING & LABELLING OF STORED RUBBER FENDERS

2.2.1 Packaging

Packaging can be done by sealed wrapping of fenders with polyethylene (PE film) to prevent exposure of external factors e.g. humidity.

- The relative humidity in the atmosphere should not be greater than 65% during packaging.
- Fender packaging should be carried out using polyethylene (single wrapping) with minimum 75microns thickness (in accordance with ISO 4591).

⚠ CAUTION

If the fenders are removed from storage for inspection, testing or any other purposes and subsequently returned to storage for a further period of time, they should be repackaged and labelled in accordance with section 2.2. The date of repackaging must be recorded and label on the container.

2.2.2 Labelling

- Every package or container should be labelled with the below requisite information (Labelling of Fenders Table) and should be visible from the outside of the package without breaking the seal.
- Label should include, basic fender details like rubber type (Natural rubber, SBR & Blend or EPDM compound), quarter and year of vulcanization, fender size and grade.

LABELLING OF FENDERS (DATA CAN BE OBTAINED FROM PRODUCT OR MANUFACTURER)	
Fender size	SCN xxxx/SCK xxxx
Fender grade	F1.1 / E1.1
Year of manufacturing	xxxx (year)
Rubber type	Blend/NR/SBR



Figure 6 – Ideal packaging & labelling of fender



Figure 7 – Example of label

Storage

2.3 INSPECTION AND DATA RECORDING DURING FENDER STORAGE

Minimum visual inspection on all fenders should be carried out once a year.

Visual inspection shall be done for following:

- Permanent distortions, such as creases or flats on rubber body.
- Mechanical damage on fenders, such as cuts, tears, abraded areas or delaminated plies and condition of the fenders.
- Surface cracking when viewed under a magnification of X 10.
- Changes in surface condition of the rubber fenders, such as hardening, softening or tackiness.



RECOMMENDATION

If extension is required after the initial storage duration, breaking test should be carried out on all fenders for the following reasons:

- To ensure fender performance
- To provide a break-in cycle (after a long period of storage, the reaction force generated by the first cycle may exceed design specifications).

CAUTION

Inspection can be carried out either by clients or by Trelleborg representatives. In the event that any of the above-mentioned changes are detected, clients should inform Trelleborg for further assistance.

Installation

In general, fender is a significant part of any fender system and the installation of SCN/SCK fender is interconnected with other sub-parts of the system i.e. fontal frame, chain systems and anchor installation. Proper installation and interconnection of all components ensures better performance of the system.

Please refer to document MN-I&M-FEN-SYS-v1.0-EN, 2017 for SCN/SCK fender system installation guideline.

Maintenance and Inspection



An inspection and maintenance guideline is significant to identify maintenance scope of installed rubber fenders.

Three levels of inspection and maintenance are recommended (as per table – 6, applicable for temperate climates).

Inspection and Maintenance

INSPECTION PROCEDURE AND SCHEDULE – TABLE 6

ITEM NO.	SCOPE OF MAINTENANCE	ACTION	CHECK	INTERVALS
1	Inspect for foreign matter on the top of the fender.	Remove foreign matter with water and a biodegradable organic based cleaner (Amway LOC or similar) or request cleaner from your Trelleborg representative.		3 months
2	Inspect for sea growth on the fender.	Remove with a bristle or nylon brush. (refer to point above)		3 months
3	Inspect the rubber body of the fender element for physical damage, tears or cracks.	Note inspection results and contact Trelleborg representative for further information.		6 months
4	Remove one fender foot bolt and inspect for corrosion.	If corrosion is apparent remove corrosion from bolt and thread with rust inhibitor or replace bolt. Ensure that a non-soluble vegetable grease is applied to the bolt and the ferrule before refitting. If unacceptable deterioration is apparent on one bolt sequentially remove, inspect and treat remaining bolts.		12 months
5	Remove one fender head bolt and inspect for corrosion.	See above.		12 months
6	Ensure that the fender is sitting symmetrically on the face of the wharf.	If not symmetrical the weight and tension chains will require adjustment.		12 months

 **CAUTION**

Major repair of rubber fenders by the client is not recommended.

Appendix

Rubber fender repair procedure

Small cracks and splits can be repaired using a suitable repair compound.

Trelleborg recommends the following methods:

1. Cold bonding: using Rema Tip Top (Vulc compound A + B) or Trelleborg approved alternatives.
2. Hot bonding: Using bonding cement provided by Trelleborg or equivalent.

METHOD: 1 COLD BONDING

Repairs using Rema Tip Top(Vulc compound A + B) should be carried out as follows:

Step 1: Pare off damaged area.



Step 2: Buff the pared off surface.



CAUTION

- If minor cracks, delamination or cuts on the fender are observed, consult Trelleborg with as much details as possible (the nature of the damage, size, depth and location).
- A crack right through the body of the rubber will probably require a complete replacement of the rubber fender.

METHOD: 1 COLD BONDING

Step 3: Remove buffing dust using Toluene or MEK and allow to dry.



Step 4: Apply one coat of special cement BL and allow to dry (10 to 45 minutes).



Step 5: Thoroughly mix equal part of the compound A & B ensuring no more white strips are visible (10 to 15 minutes).



Step 6: Apply mixed compound to prepared area. Build up approximately 2 to 3 mm above the surface level.



Step 7: Set aside for 48 hours to vulcanize at ambient temperature.



Step 8: Grind the repaired area to make it cosmetically acceptable.



Step 9: Paint the repaired area to improve appearance.



Rubber fender repair procedure

METHOD: 2 HOT BONDING

Repairs using suitable bonding cement provided by Trelleborg or equivalent (compound dissolved in 120# gasoline, 5%-6% compound content) should be carried out as follows:

- Cut the full surface of where the crack is.
- Grind to roughen the surface of the cured compound where repair is required.
- Remove the dust of the grinded compound using 120# gasoline.
- Apply a layer of suitable bonding cement (compound dissolved in 120# gasoline, 5%-6% compound content, when the surface is totally dry (Estimated time needed to be 30-45mins).
- Ensure there is no rust on the embedded plate if it is exposed. Apply a layer of Chemlok 205 + Chemlok 220 on it and brush over it with a layer of bonding cement.
- Apply a 2mm thick compound on the surface once it is fully dry. The compound should be NR or NR_SBR without PR. Cut the compound with a hot knife to ensure the surface remains smooth (press tight on every layer and ensure air is not entrapped during the process. Puncture any air entrapment if found), ensure that every layer of compound should apply bonding cement and let it fully dry. Layer by layer until the repaired surface is higher than the internal face of the fender by 2-3mm.
- After the surface to be repaired is pressed with rubber, clamp the pressed surface of the fender needed for repair fully.
- Heat up to vulcanize if the thickness is less than 30mm, recommended to use 140°C x 8h. (Actual curing time depends on the temperature of the heating tools).
- Remove the clamp after the heat up operation is completed.



Surface grinding



Brush using gasoline



Apply bonding cement



Apply compound layer



Curing in autoclave



Cutting with hotknife

References

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

DOCUMENT NO.	DESCRIPTION
MN-I&M-ANCHOR-v1.0-EN, 2017	Handling, Storage, Installation & Maintenance Manual for Anchors
MN-I&M-FEN-SYS-v1.0-EN, 2017	Handling, Storage, Installation & Maintenance Manual for Fender System

DISCLAIMER


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