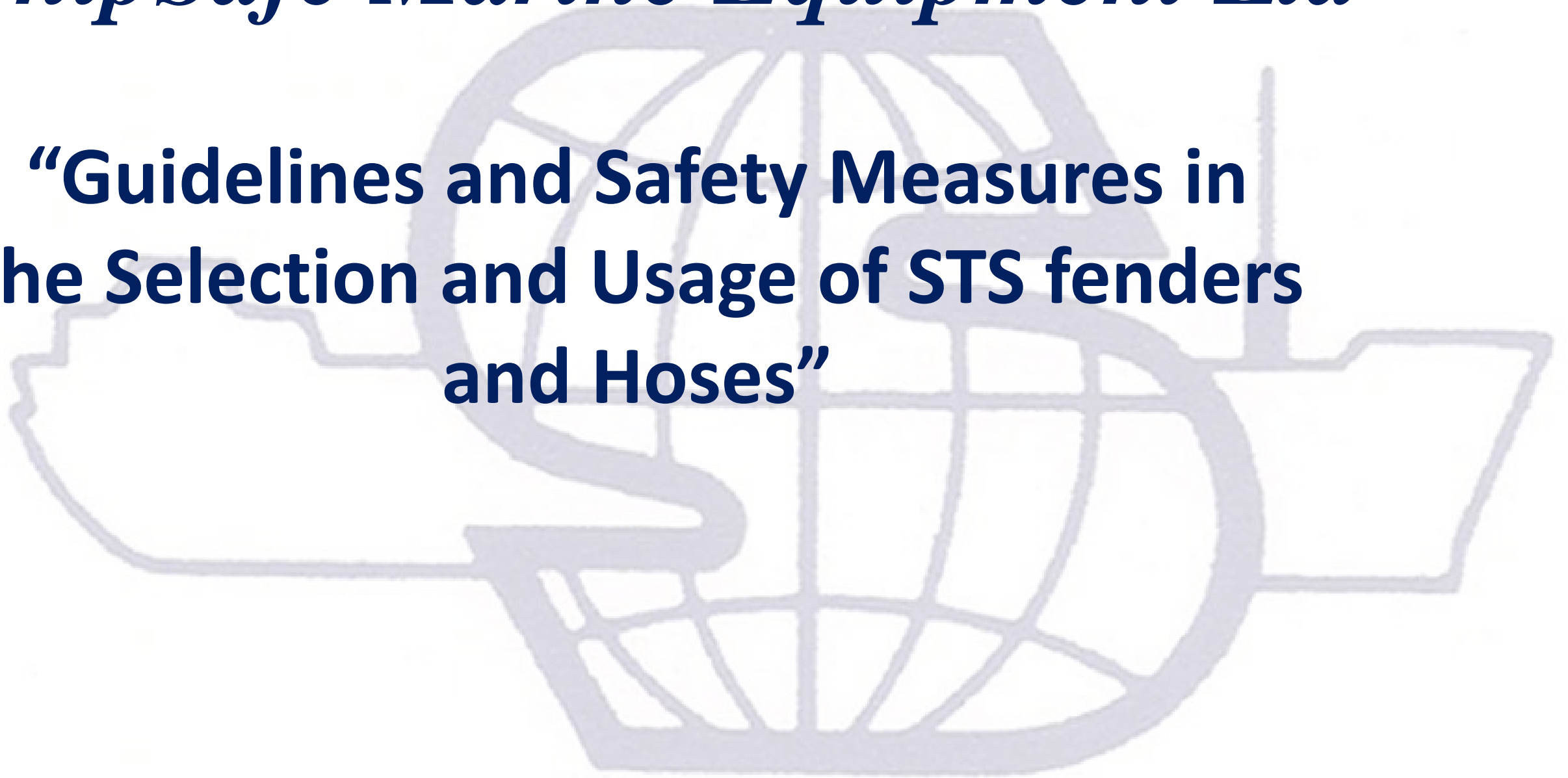


ShipSafe Marine Equipment Ltd

“Guidelines and Safety Measures in the Selection and Usage of STS fenders and Hoses”



❑ Oil & Gas Industry

- Future Looks Strong
- 2040: 80-130 Mb/day (Global Consumption)
- Trillions of US \$ Needed



❑ Transfer it to the Metropolis

- Pipelines: Political Turmoil
- Maritime Transportation:
Oil, Gas, 3.000 Chemicals
(Cheap, Safe and Reliable)

❑ STS Operations

- Vital Part in the Supply Chain
- Increasing in Frequency
- Provide Flexibility
- Save Time and Money



- ❑ Good Safety Record but...
- Perceived as Relatively High Risk (difficult cargo)
- Unstable, Flammable, Toxic
- A single incident is enough
- STS Equipment is Crucial



MARINE FENDERS

☐ Marine Fender

- Protection Element (Mooring, STS)
- Resistance to Berthing Momentum
- Absorbs the Ship's Kinetic Energy

☐ Pneumatic Fender

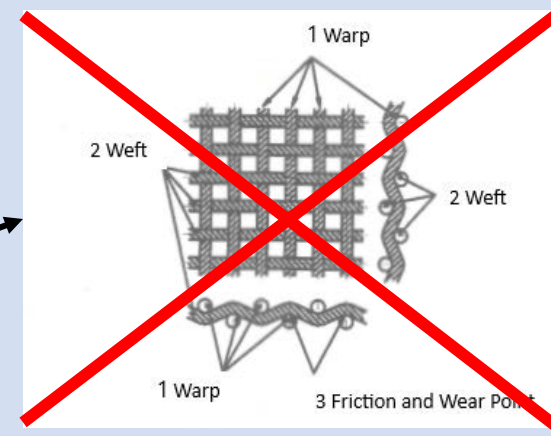
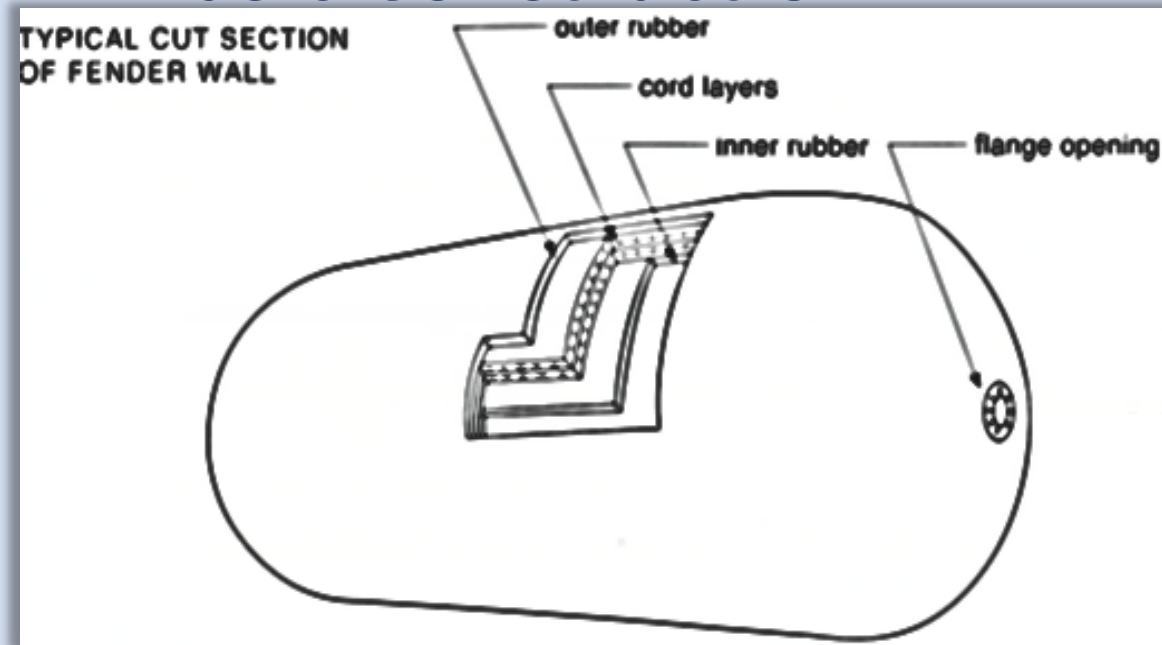


- Guaranteed Performance (sequential compression, shearing forces, angle berthing, equal distribution of load, stability vs temperature variations, ISO 17357-1:2014)

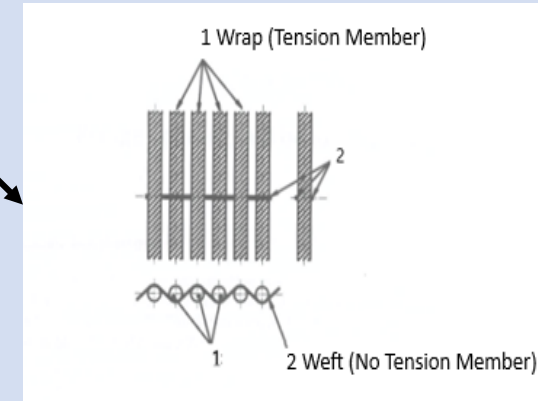
☐ Other Fenders: Foam Fenders etc

- No Standards setting manufacturing conditions
- No Guaranteed Performance (Weak to Shear Forces, Cannot Restore Immediately, Heavy & Difficult to Handle)

Basic Construction



Canvas Fabric



Tyre Cord

- Synthetic Tyre Cord for Maintaining the Internal Air Pressure
- Net Type (Always in STS)
- Hot Dip Galvanized Chains
- Strong Aircraft Tires (in adverse to cheaper truck tires)

- Canvas Fabric Should Not be Used in HP Floating Fenders as We Vastly See

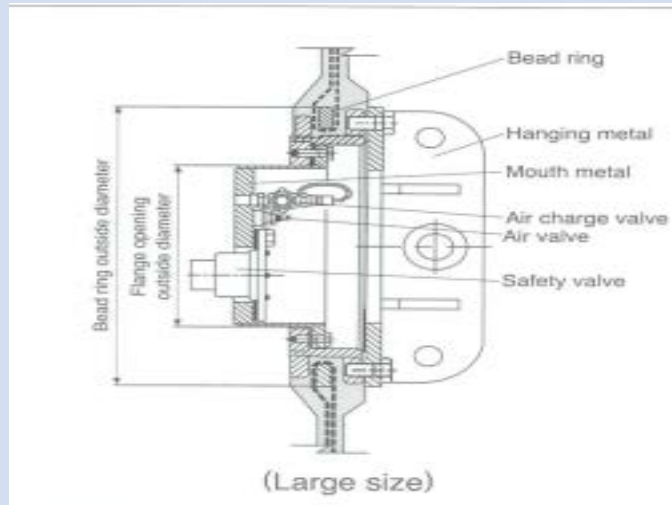
❑ How to Select Your Fender (from suppliers point of view)

- Must Comply With ISO 17357-1:2014 (Material, Performance & Dimensions) and PIANC 2002 (Manufacturing & Testing)
- Manufacturer Should Provide Prototype Testing (<10 years By Classification Society)



- Markings
- Handling & Storage Recommendations

- Bead Ring $D_{out}=0.2 \times D_{fender}$
- Synthetic Tyre Cord
- Air Valve for Inflation
- Safety Valve $D_{fender}>2500\text{mm}$



❑ How to Select Your Fender (from a technical point of view)

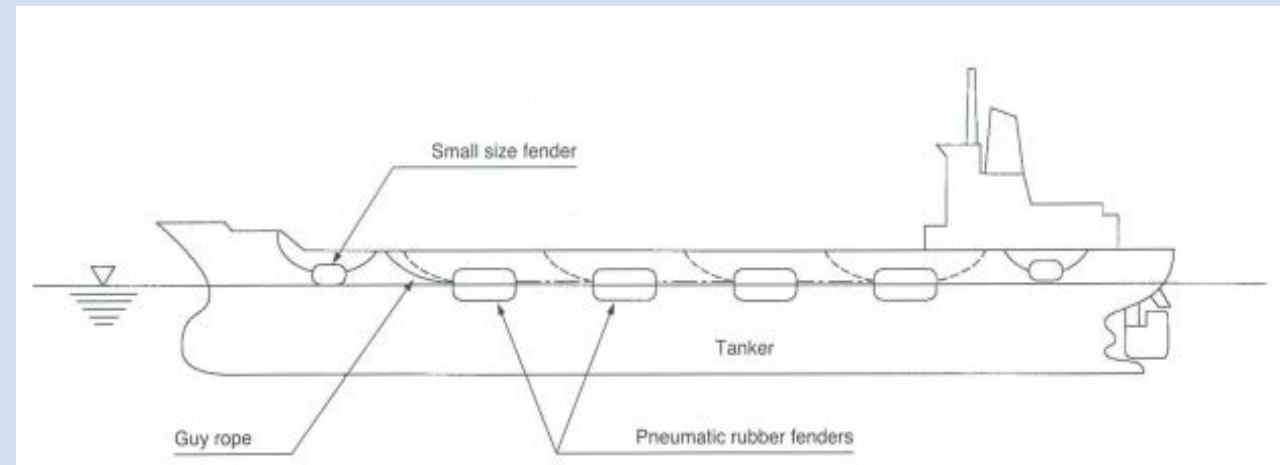
- Calculate the Berthing Energy $E = \frac{1}{2} \times W_{VAB} \times V^2 \times C_e \times SF$
- If $E_f < E$ choose a bigger one (E_f energy absorption of the tentative selected fender)
- Fender Diameter (Sufficient stand-off distance less than the half of the freeboard to prevent boarding during inclement weather)
- Quick Reference Guides (tricky points, approach velocity)

Berthing Coefficient-C (Tonnes)	Approach Velocity (m/sec)	Berthing Energy (Tonnes.m)	Suggested Fenders (Quantity)	Typical HP Pneumatic Fender (50kPa)
1 000	0.30	002.4	3 or more	1.0x2.0
3 000	0.30	007.0	"	1.5x3.0
6 000	0.30	014.0	"	2.5x5.5
10 000	0.25	017.0	"	2.5x5.5
30 000	0.25	040.0	4 or more	3.3x6.5
50 000	0.20	048.0	"	3.3x6.5
100 000	0.15	054.0	"	3.3x6.5
150 000	0.15	071.0	5 or more	3.3x6.5
200 000	0.15	093.0	"	3.3x6.5
330 000	0.15	155.0	4 or more	4.5x9.0
500 000	0.15	231.0	"	4.5x9.0

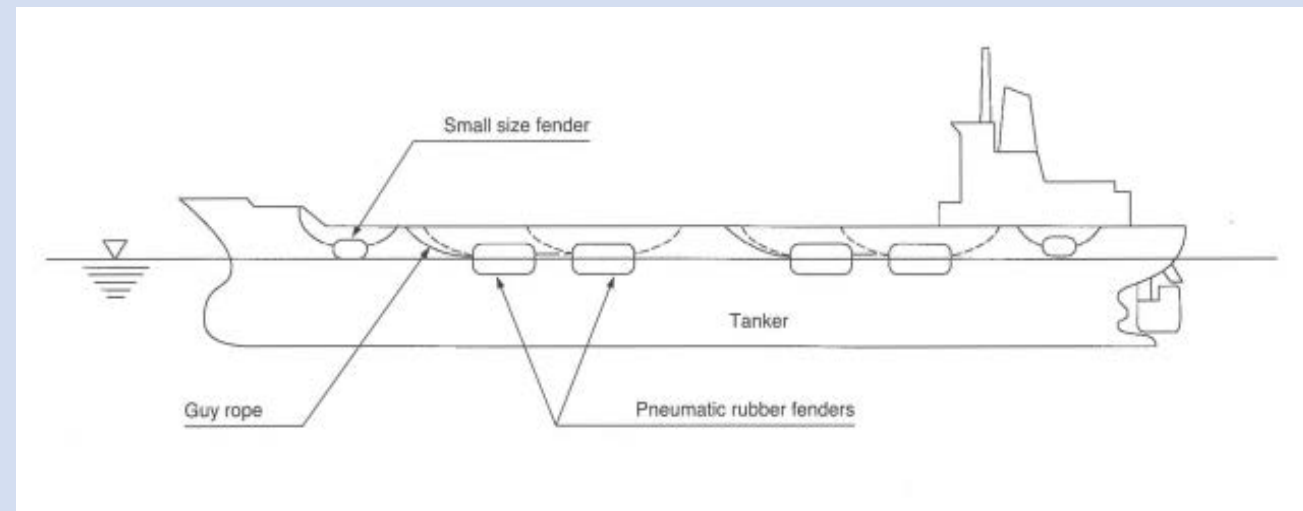
Berthing Coefficient-C (Tonnes)	Approach Velocity (m/sec)	Berthing Energy (Tonnes.m)	Suggested Fenders (Quantity)	Typical HP Pneumatic Fender (50kPa)
1 000	0.30	004.0	3	1.0x2.0
3 000	0.30	012.0	3	1.5x3.0
5 000	0.30	024.0	3	2.0x3.5
8 000	0.25	025.0	3	2.0x3.5
20 000	0.25	061.0	3	3.3x4.5
40 000	0.20	074.0	4	3.3x4.5
80 000	0.15	078.0	4	3.3x4.5

❑ Fender Installation

A) Rigged in a Continuous String



B) Rigged in Pairs



- Preferably to the Manouvring Ship (being the smaller one)
- Speed Limits (overstressing)
- Guy ropes (long enough to avoid sudden stress)
- Attached to a secure point-bollard-avoid handrails
- Guy Lines long enough for tidal variations
- Protect the fenders from sharp edges/protrusions

☐ Usage Guidelines:

- Delivered Packed or Containerized (Deflated)**
- Inflation on a Clear Surface (Air Pressure 50kPa/80kPa)**
- Inflation stops at 20-30kPa (Storage-Away from Heat, Oil Grease, Sunlight, Protrusions, Select a Cool & Dark Place)**
- Ensure Uniform Lifting Force while Lifting it**
- Check & Adjust Pressure (Before any STS Operation)**
- Do not Use them During Extreme Weather Conditions**
- Suppliers & Stockists must follow also Guidelines of the Manufacturer (Transportation)-Do they? Trust a Well Established Distributor**

☐ Inspection & Maintenance:

- We follow ISO 17357-1:2014 & OCIMF STS guide**
- Follow Manufacturers Guidelines**
- Inspect Regularly & Keep Records (Net, Safety Valve, I.P.)**
- Fender Condition and Air Pressure to be checked at least once a year and especially before any STS operation**
- The Safety Valve to be inspected every Second Year (New Safety Valves) and the set pressure to be checked every net is replaced but never later than 3 years. Safety Valves >10 years to be inspected every year**
- Authorized Personnel-Testing Equipment Calibrated, Certified, Good Condition**
- Remove Rust (Net, Shackles) & Sea Moss**
- Periodical Rotation is Recommended to Extend Fenders Life**

☐ Retirement or Replacement:

- **Determined by Manufacturers (Lifespan of YOKOHAMA Pneumatic Fender is Recommended at 10 years)**
- **Longevity of your Fender Depends On Various Factors(Storage, Frequency Of Use, Maintenance)**
- **Metal Fittings Not Functional**
- **Reinforcement Cord-Layers Exposed- Damage Beyond Repair**
- **CUT or Peeled Surfaces can be Fixed-Too Deep and Large Damages?-Ask the Manufacturer or authorized persons**
- **If Does Not Comply with Standards especially if Safety Valve is Absent-Buy a New One**



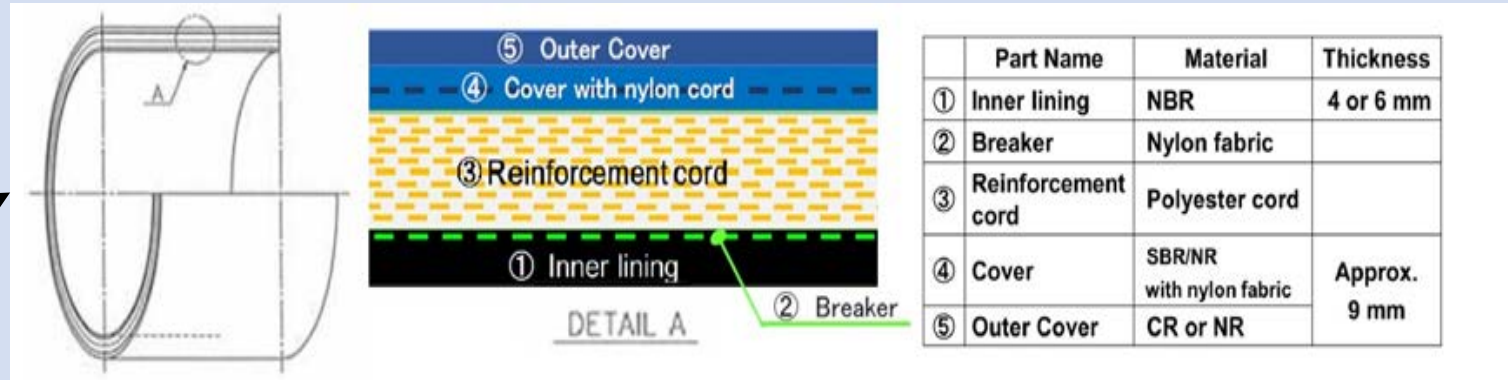
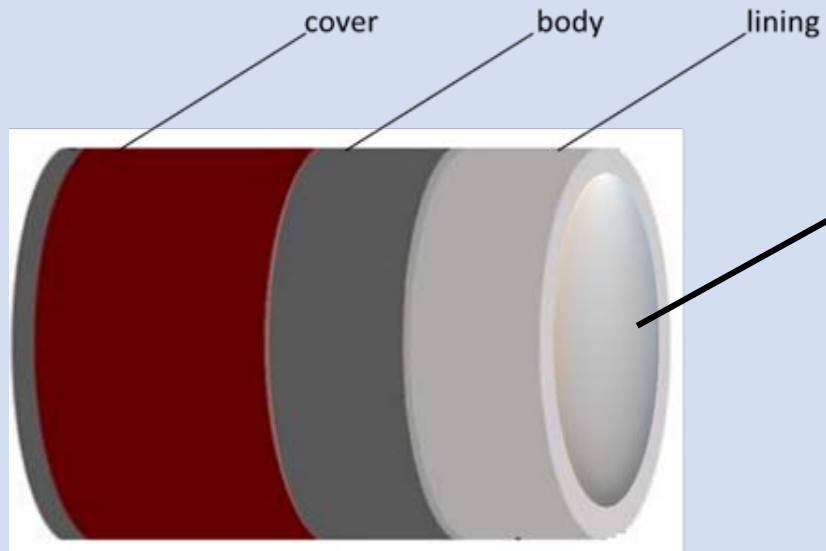
STS HOSES

❑ STS HOSES:

- Connect the two ships
- Provide a conduit to transfer cargo from one ship to another
- (1960 first STS operation)
- No International Standard-Dock Hose Standards
- Oil & Chemicals (EN 1765, EN13765), LPG (ISO 10380, ISO 2928, ISO 13766), LNG (EN1474)
- Rubber & Plastic Hose Assemblies (EN ISO 8330, EN ISO 8031, GMPHOM 2009)
- Almost Incident Free Service Over the Years
- Generally Easy to Handle, Present Kink Tolerance



□ Basic Construction



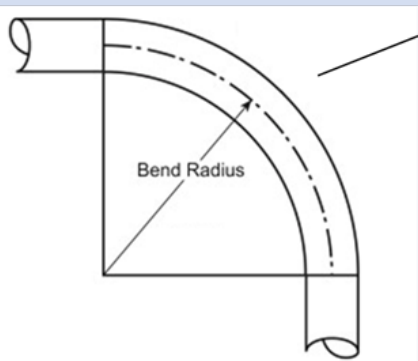
- **Lining:** Elastomer Suitable For Handling Specific Mixtures
- **Body-Carcass:** Reinforced Elastomer-Multiple Plies-Strength (External Forces, Internal P, Helical Wire Free-Deformation)
- **Cover:** Smooth Elastomer Reinforced with Fibers-Protects from External Forces & Elements. Extends Over the Full Length-Ends at the Flanges

- ❑ **Selection Criteria: The Hose Selection Should be Considered on a Case by Case Basis Taking Into Account Several Factors**
- **Hose Length & Ship Characteristics (Distance Between the Manifold and the Ship's Side-Vessels Manifold System Relative Heights-Hose Handling Requirements)**
- **Minimum Allowable Bending Radius (MBR)**
(How Much Can We Bent the Hose without Permanent Damage or Deformation)

$$\text{MBR ratio} = \frac{\text{MBR}}{\text{Hose Nominal Diameter}}$$



$$\text{MBR} = \text{Nominal Bore of Hose} \times 6$$



Always Measure the Radius to the Innermost Surface of the Bent Section

❑ Selection Criteria :

- Allowable ΔP : Hose shall be Treated As if the System Was a Pipeline-Offshore Hoses Have Smooth Lining

Manufacturer for ΔP calculations.

Typical Pressure Drop: Perfect Rubber Lined 16" Hose/11m is Equal to 5.7 psi (6.6 psi for a steel pipe of equal length)

Operating Pressure: Pressure Experienced by the Hose During Cargo Transfer

Related Working Pressure: Maximum Cargo System Pressure Capabilities

Maximum Working Pressure: Used as A Ref. in EN Standards

❑ Selection Criteria :

- Allowable Flow Velocity & Hose Diameter:

Limitations by the Hose Construction. Manufacturers Provide Recommendations About Q and u.

$$u = Q/A \quad (\text{m/s})$$

$$A = \pi D^2/4$$

$$Q = u \times A = u \times \pi D^2/4 = u \times \pi \times r^2 \quad (\text{m}^3/\text{s})$$

Wear & Deterioration

Failure of Hose Liners -Nasty Situations

(Leakages, Hose Burst Failure, Separation of the Inner Liner)

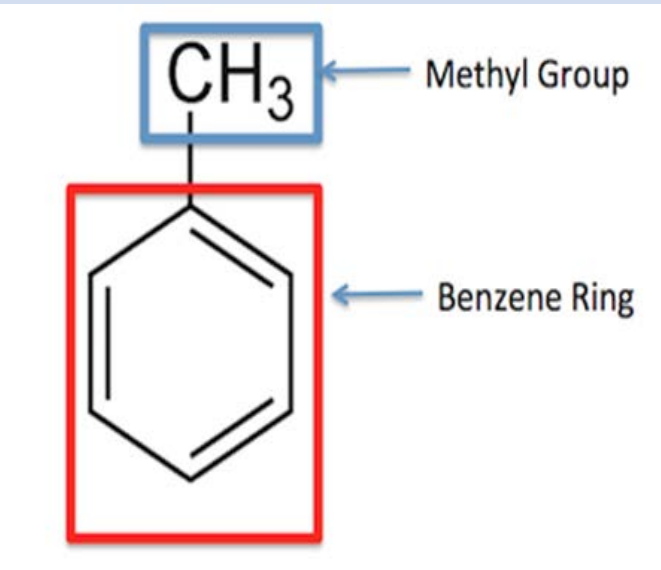
Rule of Thumb for Cargo Transfer Flow Rates: (!Empty Tanks!)

Crude Oil: 15m/s LPG: 12m/s Based On Experience

Throughput at 12 metres / second Velocity			
Hose Nominal Inside Diameter		Throughput	
Inches	Millimetres	m ³ /hour	Barrels/hour
2"	50	87	550
4"	101	349	2199
6"	152	783	4930
8"	203	1398	8794
10"	254	2188	13768
12"	305	3156	19852

❑ Selection Criteria :

- Aromatic Content and Chemical Compatibility:



Aggressive Nature & T, t, Rubber Compound
Affect Hose Longevity
Destroy Physical Properties of the Hose
ASTM D471-06 (Rubber Properties vs Liquids)
~Aromatic Content up to 50%

Always Check the Chemical Compatibility Charts Provided by the Supplier or the Manufacturer

- A - Excellent (minimal or no effect)
- B - Good (possible swelling and/or loss of physical properties)
- C - Doubtful (moderate or severe effect and/or loss of physical properties)
- D - Not recommended (severe effect and should not be considered)

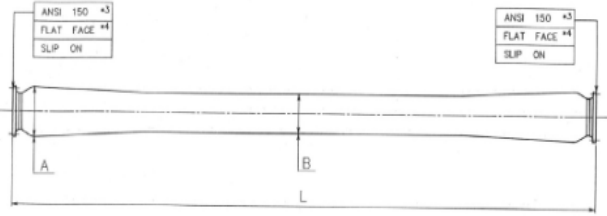


CHLOROPRENE	B
CHLOROTOLUENE	D
CRESOL	C
CRUDE OIL	A

ASPHALT	B
BENZENE	D
BENZONITRILE	C
BENZOTRICHLORIDE	D
BENZOTRIFLUORIDE	D
BRAKE FLUID, DOT3	C
BROMOBENZENE	D
BUNKER OIL	B

❑ Usage Guidelines:

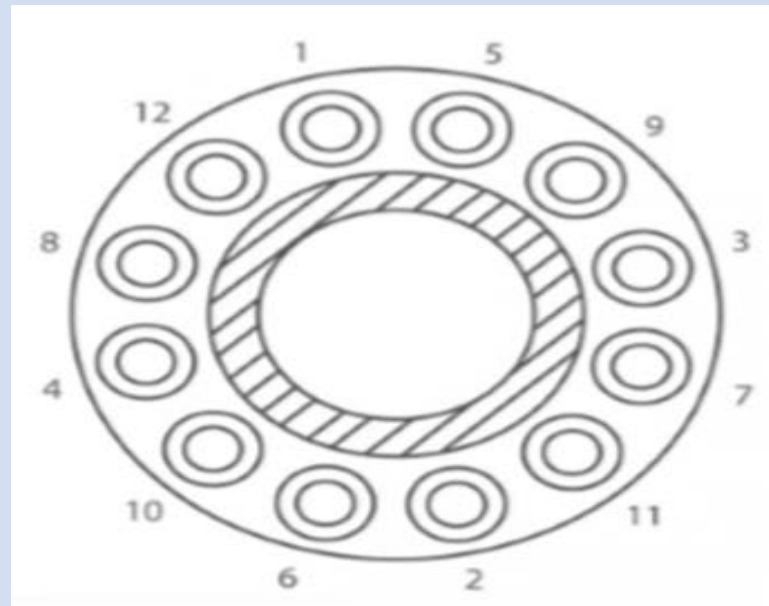
- Hoses Delivered in Individual Lengths to One of the Vessels
- ## Assemble the Hose String-Gaskets-Tight The Flanges Properly



Technical drawing of a hose assembly showing flange details and dimensions. The drawing includes labels for 'ANSI 150', 'FLAT FACE', 'SLIP ON', and dimensions 'A', 'B', and 'L'.

Nominal Diameter	Actual Diameter	Diameter		Weight in Air			
		a	b	L = 30'	L = 10m	L = 35'	L = 12m
12"	300 mm	360 mm	360 mm	583 kg	620 kg	649 kg	702 kg
10"	250 mm	375 mm	300 mm	412 kg	438 kg	458 kg	494 kg
8"	200 mm	320 mm	245 mm	276 kg	295 kg	310 kg	335 kg
6"	152 mm	250 mm	190 mm	177 kg	190 kg	200 kg	220 kg

⁺² Flange rating: ANSI 300 is also available on request.
⁺³ Flange face: Raised face is also available on request.
The Yokohama Rubber Co., Ltd. reserves the right to modify data and designs without notice.



- Avoid Kinking
- MBR/Dragging/Rolling
- Support Properly-Avoid Stresses
- Ensure Electrical Isolation (Follow OCIMF Insulating Directions)
- Avoid Contact with Hot Surfaces (Steam Pipes)
- Never Lift the Hose by Using Steel Wires in Direct Contact

☐ Inspection & Maintenance:

- Follow Standards, Local Regulations, Contact Manufacturer
- Before Usage & Periodically External Visual Inspection
- Internal Visual Inspection Once Every 6 Months
- Hydrostatic Test (Run it Properly by authorized persons)
- Electrical Continuity: Every 2 Years/10Mb
- Outer Cover: Check for Cuts, Abraded Spots & Tears
- Inner Lining: Check for Blisters, Cracks etc., Shall Be Smooth
- Check the Flanges, the Nipples



- Damage on the Outer Cover Can be Repaired
- Always Keep Records

❑ When to Replace it: (Ask the opinion of authorized persons)

- Cracks on the Inner Lining
- Extensive Corrosion on Welded Portions
- Reduced Nipple Thickness
- Flange Face Deformation
- Leakages during Hydrostatic Test/Elongation $+2\% >$ than Recorded by Manufacturer
- Failure of Adhesion Between Layers
- No Manufacturer Trademark/S.N./Date/Continuity



Seaflex
YOKOHAMA



THANK YOU FOR YOUR ATTENTION



SHIP SAFE Marine Equipment Ltd.

Marine Rubber Fenders, Bollards, Buoys, Quick Release Hooks

Since 1992