



## VANTAGENS, CONSIDERAÇÕES DE DESENHO E FALHAS EM DEFESAS DE ESPUMA

Alvaro Rodero, Matheus Palacios  
ShibataFenderTeam  
[a.rodero@sft.group](mailto:a.rodero@sft.group), [m.palacios@sft.group](mailto:m.palacios@sft.group)

### Objective

The aim of the presentation is not only to introduce the foam filled fenders, but also to know and understand their design, advantages over other types of fenders and possible failures due to a bad design and manufacture.

### Introduction

Foam Filled Fenders are fenders designed for dedicated berths. Our FFF (Foam Filled Fenders) are made in Germany and the US from high quality raw materials based on highly engineered design.

Made from heat laminated 100% closed cell foam core and a tough and tick nylon filament reinforced polyurethane skin.



Figure 1. Ocean Guard Foam Filled Fenders.

### Different types

There are different type of FFF:

- Ocean Guard:



Figure 2. Ocean Guard.

Ocean Cushion:



Figure 3. Ocean Curshion



- Small Standard Duty (SSD):



Figure 4. Small Standard Duty (SSD).

- Donut Fender:



Figure 5. Donut Fender.

- Submarine Fender:



Figure 6. Submarine Fender

- Ocean Guard Buoys:



Figure 7. Ocean Guard Buoys.

### Advantages and applications

The advantages of these fenders are the following:

- Linear increase of energy and reaction
- Extremely robust and durable
- No performance loss and unsinkable even if damaged
- Small skin damages can easily be repaired on site
- Hull conforming capabilities
- Non-marking skin
- Low maintenance
- Low friction

The main applications of these fenders are the following:

- Navy vessel berths
- Cruise terminals
- Ship to ship operations

Due to the low hull pressure, non-marking Polyurethane skin and hull adjustment capabilities.



## Foam Fender Design

Foam Filled Fenders are composed by a foam core, an elastomeric skin and steel end fittings.

In the presentation we will see photo of the different elements and failures due to a bad design or low quality product.

### *Foam core*

The energy absorbing foam core shall be closed-cell cross-linked polyethylene foam. The foam core construction shall utilize only a heat-laminated process, and yield a single solid foam core.

The foam core shall not contain scraps, strips, or sheets of foam either rolled or stuffed into the required shape unless pieces are bonded together in layers of uniform patterns to form a homogeneous, one piece core. Homogeneous foam rings of adequate thickness to insure performance of the fender is acceptable provided the Contractor could show a minimum 5-year performance of similar fenders.

### *Elastomeric skin*

The elastomer skin of the fender shall be free from cracks, burrs, warpage, checks, chipped or blistered surfaces, and shall have a smooth surface.

Reinforcing is mandatory. A minimum of ten separate filament-reinforcing wraps shall be applied as specified under Filament Wrap. The filament wraps shall be evenly distributed in the inner 75 percent to 90 percent of the coating thickness. The outer 10 percent to 25 percent of elastomer shall have no filament reinforcing. The elastomer and filaments shall be applied in a continuous manner to assure adhesion between the various layers. The connection of the skin to the end fittings shall be designed and sized to transmit twice the safe tensile capacity of the chain into the fender skin. The fender skin shall be a singular material, homogeneous of the same formula and batch throughout the skin and in strict conformance below. Multiple skin material or layers are forbidden.

### *End fittings*

The steel used in fabrication shall be free from kinks, sharp bends, and other conditions, which would be detrimental to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. Make bends by controlled means to insure uniformity of size and shape.

## Conclusion

FFF should be used when:

- High energy absorption is requested with low hull pressures
- Marks on the hull of the vessels are not desired (cruise vessels, navy vessels,...)
- Large tides and vessels with beltings
- Ship-to-ship operations
- Proportional E/R increase required

Specifications should required:

- Heat-lamination process for foam with wide sheets
- Reinforced urethane skin with nylon filament tire cords (min. thickness)
- Internal swivel end fittings connected with heavy duty stud-link chain and pull thru stopper
- Required skin thickness test and performance test