SPS
TECHNOLOGY

Structural Composites
Engineered for
the 21st Century

SPS Impact Protection

Proven standard for impact protection

SPS TECHNOLOGY

Technology of choice for leading ship owners

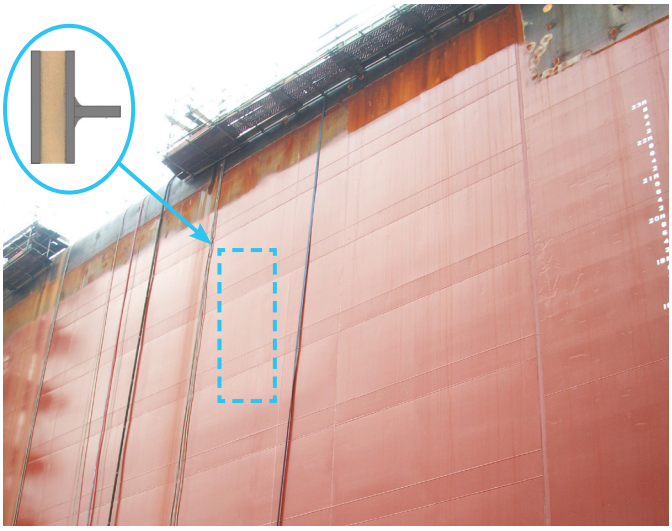
- SPS is a lightweight alternative to conventional stiffened steel that provides exceptional energy absorption characteristics, resisting impacts and minimising damage in key areas where extra protection is required to maintain safe and reliable operations.
- Since 1999, SPS has been installed on a wide range of ships and offshore structures for repairs, strengthening and enhance impact protection. With approvals from all major classification societies, SPS has now become a standard specification item for leading operators.

SPS side impact protection

Applying SPS during ship construction is an efficient and cost-effective solution to maintaining structural integrity, reducing operational downtime and minimising risks to safety and the environment.

Reducing future repair costs

- SPS side impact protection outperforms conventional steel solutions for typical damage cases, e.g. fender, wave and collision impacts, reducing future repairs and steel renewals



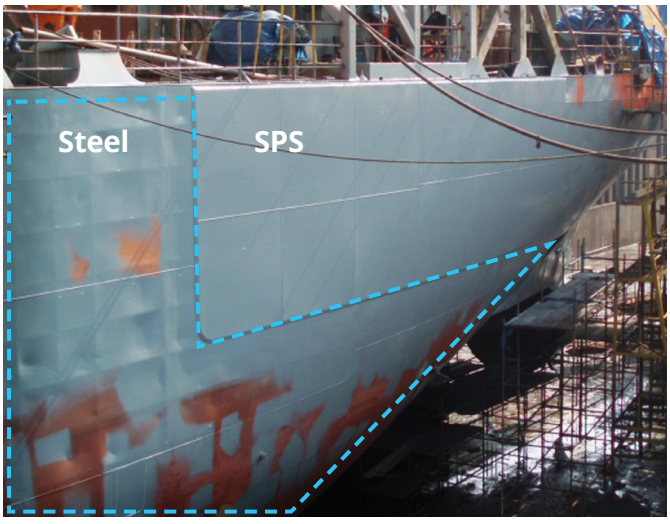
Increasing safety

- A study was commissioned by Single Buoy Moorings to investigate the performance of SPS for protecting sideshell structures of FPSOs in accordance with IMO MEPCGuidelines
- The study confirmed that the SPS 'Compact Double Hull' provides at least equivalent side impact protection compared to a conventional all-steel double hull, sponson or cofferdam

Reducing risk

- Using SPS on FPSOs eliminates the need for void spaces found on traditional double hulls. This removes the need for access, inspection, venting, gas freeing and other maintenance activities; so reducing risk and minimising through-life costs

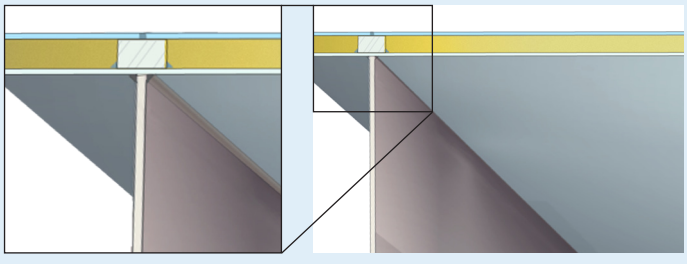
Typical damage cases on side shell areas



What is SPS?

SPS is a structural composite comprising two metal plates bonded with a polyurethane elastomer core.

In maritime structures, load-bearing plates are usually made from steel, which is heavily stiffened to prevent buckling. SPS eliminates the stiffening elements, making ship structures much less complicated and much less prone to fatigue and corrosion



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SPS general impact protection

Tug contact and anchor impact areas

- Enhanced puncture resistance
- Safer handling for ships in port and lower maintenance costs
- Improved safety and reliability for offshore operations
- Effective and proven operational risk reduction

Strengthening of pipe deck and lay-down areas

- High impact and wear resistance
- Reduced maintenance costs and extended service life
- Added protection to high risk spaces below decks

Dropped object protection

- Added protection for structures vulnerable to dropped objects such as drill collars and shackles etc
- Enhanced safety to high risk areas below decks, such as thruster rooms and other working spaces
- Analytical studies confirm that SPS exceeds the puncture resistance criteria applied to dropped object protection

Anchor handling pads

- SPS anchor pads stay flat, eliminating pooling, reducing wear and corrosion
- Providing a safer working environment for crew, extending service lifetime and reducing maintenance costs

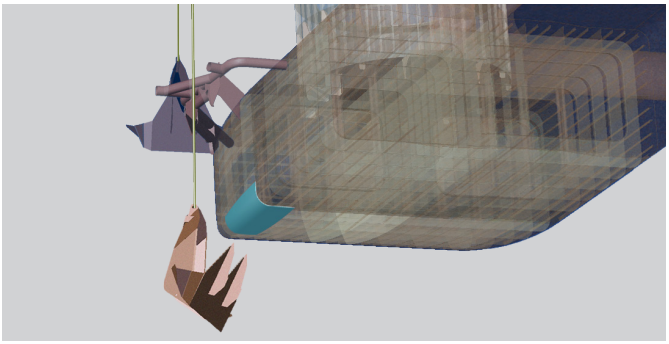
What the owners say...

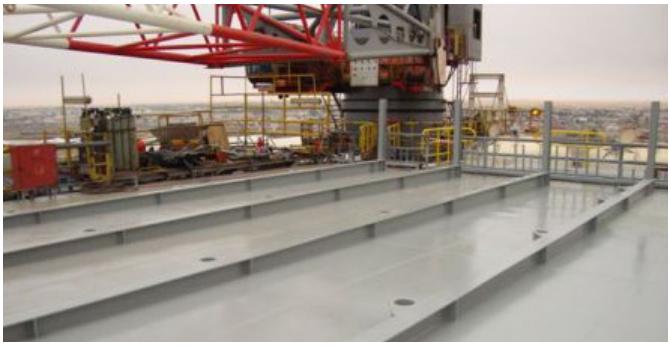
"The impact resistant qualities of SPS made it an ideal material to use on this, the first FDPSO"

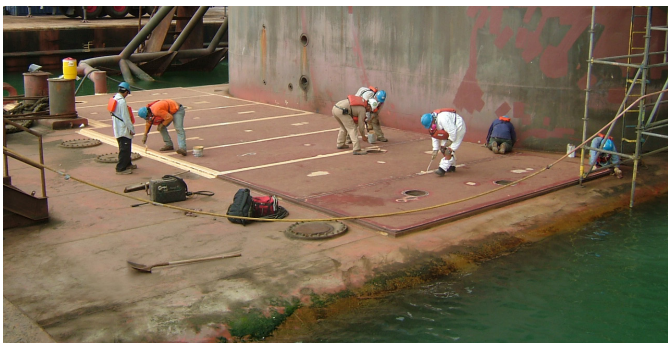
David Trimble, Prosafe Production Pte Ltd

SPS provides the ideal side shell protection for our FPSOs. It is applied quickly, delivers improved impact resistance and reduces our operational costs"

Lloyd's Register







From top: Anchor impact areas, pipe deck protection, dropped object protection, and anchor handling pads

SPS side impact protection and reinstatement installed on:

FPSO Petroleo Nautipa
FPSO Kwame Nkrumah MV21
FPSO Brasil
FPSO Conkouati
FPSO Benchamas Explorer
FPSO Serpentina
Semi-sub Sedco 702
Yetagun FSO
FPF 003

FPSO Espoir Ivoirien
FSO Dampier Spirit
FPSO Baobab Ivorien - MV10
FPSO Sendje Ceiba
FPSO Petroleo Nautipa
FPSO Kwame Nkrumah MV21
FPSO Brasil
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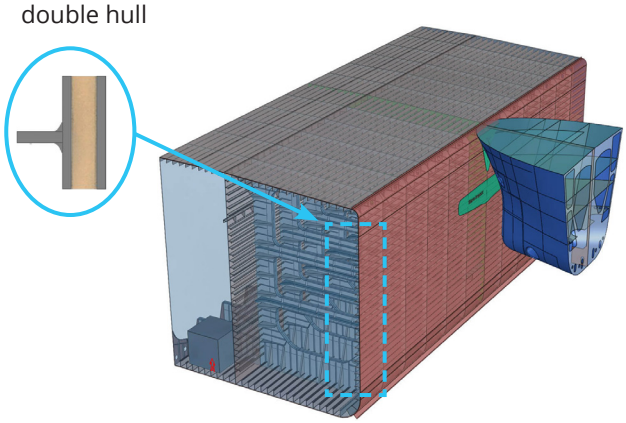
How does SPS impact resistance outperform conventional steel structures?

- The steel faceplates bonded directly to the polyurethane elastomer core form a high performance, impact resistant, structuralcomposite plate. The steel is placed where it is most effective and the elastomer core provides through thickness flexibility to absorb energy, distribute loads and reduce hard spots and stress concentrations. The performance has been verified by detailed analysis using industry-standard engineering software and proven by a range of full-scale tests.
- The result is a highly efficient structural plate system that has excellent puncture and impact resistance and is able to withstand both regular in-service and extreme impact load events that occur through the lifetime of a structure.

IMO MEPC guideline testing

- FPSO collision protection using SPS 'Compact Double Hull'
- 5,000 DWT supply vessel impacting at 5 knots
- Proven to have 'at least' equivalent protection to double hull



Rock drop tests

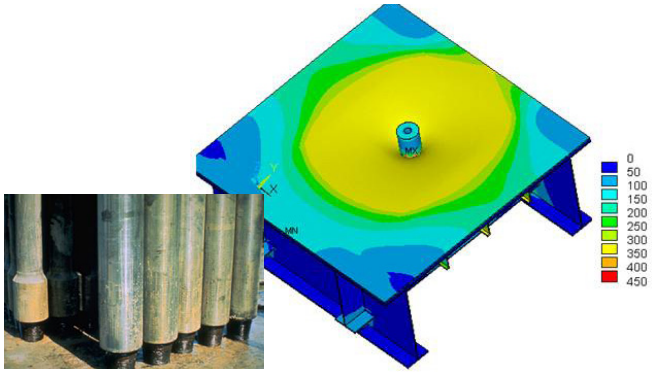
- Multiple rocks (500 kg to 2,100 kg) dropped from 3 m in full-scale tests
- Minor indents, no punctures or weld failures

Heavy drop tests for SPS hatch cover

- DSME test using 4.7 tonnes weight with impactor, simulating a dropped container with twist lock
- Steel hatch cover penetrated but no penetration on SPS hatch cover

Dropped drill collar simulation

- Simulated accidental impact cases for drill collars weighing 3 tonnes dropped 9 m from drill floor
- Demonstrated no penetration of SPS protected structure



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