

## Glen Lyon FPSO Blast and Fire Proof Escape Tunnel

<b>Area</b>	3150m <sup>2</sup>
<b>Design</b>	4.5-25-4.5 SPS Double Protection System
<b>Location</b>	NW of Shetlands
<b>Owner</b>	BP
<b>Protection</b>	2 bar Blast Overpressure H60, J30

Glen Lyon FPSO. The design specification required that the escape tunnel should withstand an explosion overpressure of 2 bar and a subsequent jet or hydrocarbon fire. The tunnel is required to provide both a safe refuge and a protected means of escape in the event of an emergency. It also has positive internal air pressure to prevent the ingress of smoke and dangerous gases, with airlocks spaced at intervals along the length to allow safe and easy access.

### Details

The tunnel is divided into four sections, each of which is suspended from one of the four topside modules. Between each section is an airlock giving access to the processing modules and main deck area. The combined length of the SPS escape tunnel and airlocks is approximately 152m, extending from the aft accommodation area to the forward end of the process deck.

To meet the specification of this demanding project a unique "double protection" system using two concentric SPS tunnels separated by an air gap was designed. The specification of the SPS panels is 4.5-25-4.5, meaning two 4.5mm face plates separated by an elastomer core of 25mm. In the areas of high risk from jet fire, the outer skin of the SPS panels is fabricated from stainless steel, giving additional protection due to the higher melting point compared to carbon steel.



### Summary

The SPS Escape Tunnel delivers:

- Protection from explosions and subsequent fire events
- Safe refuge and protected means of escape
- Confirmed performance verified by full-scale tests for fire and blast resistance

### Background

The offshore working environment has many hazards and the risk of life-threatening events involving explosions and fire is ever present. The concept of an escape tunnel extending over the length of the vessel was originated by BP to meet their stringent safety requirements for the





## Features

The outer tunnel of the double protection system consists of SPS panels forming a primary barrier to resist the initial blast event. The air gap allows the outer tunnel to absorb the blast energy and the SPS inner tunnel provides additional blast and fire protection.

The section profile of the escape tunnel is a rectangular shaped tube, with rounded corners to reduce the drag loads imposed by high velocity gases passing over the structure during a blast event.

The composite SPS panels have no secondary stiffeners, thus avoiding stress concentrations that could potentially lead to structural failure in high energy blast events.

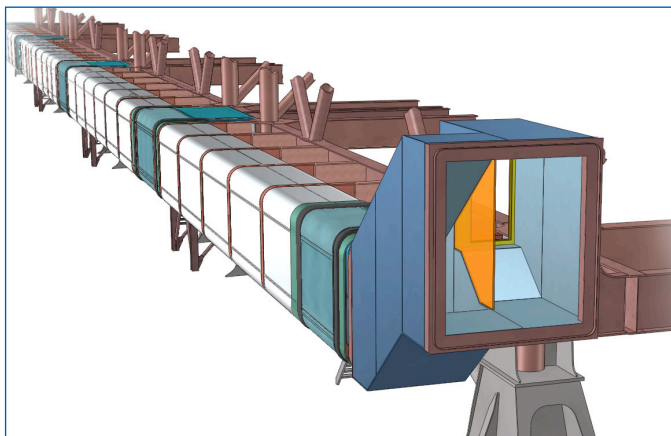
Conventional steel structures require a separate insulation layer such as rockwool blanket to meet the required fire protection standards. But this can become damaged or dislodged in the initial blast, compromising resistance to a subsequent fire event. However SPS panels have built-in fire protection which cannot be dislodged; so the fire protection remains fully effective after the initial explosion.

## Verification and testing

Every aspect of the SPS escape tunnel design was subjected to extensive verification. All of the technical work was subjected to independent assessment by Lloyds Register. To verify the blast resistance, full scale tests were conducted at a specialist facility operated by GL-Noble Denton.

Tests for hydrocarbon and jet fires are among the most onerous used in the industry. To demonstrate compliance IE built a number of full-scale samples which were subjected to the specified tests at GL-Noble Denton and at the UK Building Research Establishment, witnessed by Lloyds Register.

In addition to blast and fire performance, a programme of extensive engineering design and analysis was conducted to demonstrate compliance with the specified strength requirements. This included blast loads, live loads, stresses induced by hull bending, green water impact, wind loads and vessel motions. The analytical verification was completed for the specified survivability requirements and included pre- and post-emergency event scenarios.



***SPS is a structural composite material comprising two metal plates bonded with a polyurethane core to form a light, stiff sandwich material with excellent strength and energy absorption characteristics. In using SPS, structures can be tailored to take advantage of the enhanced impact protection, greater resistance to blast and ballistics, built-in fire protection and improved performance against fatigue and corrosion compared to traditional steel structures.***