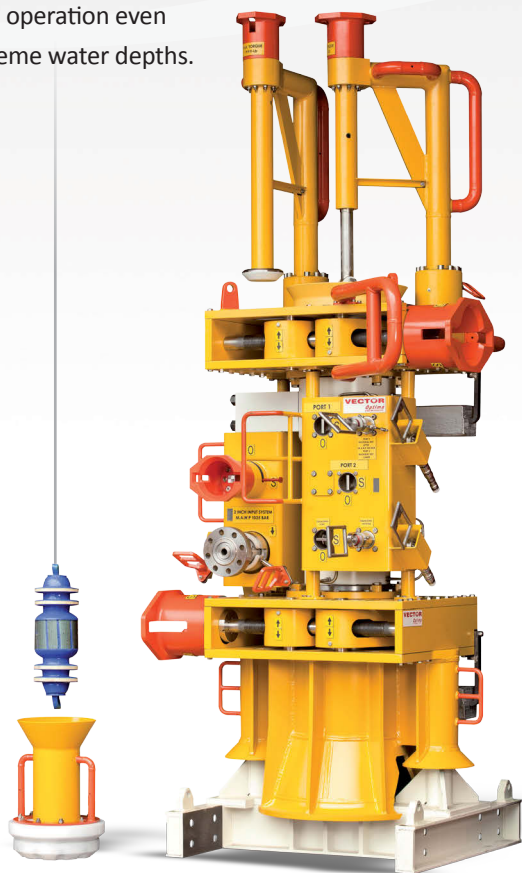


Full Assemblies

Complete subsea PLR solutions

Freudenberg Oil & Gas Technologies (FO>) has the full design and manufacture capabilities for producing both vertical and horizontal Pig Launcher Receivers, Pig Launcher connectors and Pig Launcher End Closures.

Freudenberg Oil & Gas Technologies' PLR design can cater for all sizes of bore and pressure ratings. They can be fitted with all the ROV interfaces to allow reliable subsea operation even at extreme water depths.



*Vertical PLR Launcher - Production use
Pressure : 15,000psig (1,034Barg) Water Depth : 8,200 ft (2,500m)*

The Multi-Pig PLR offers a compact and lightweight design with the benefit of being able to contain several pigs at a time. The length of the pig storage can be detailed to suit the type of pigs that are being used on the system. The Vector Optima® connector is used to connect the PLR to the pipeline / PLEM / PLET and also to offer a fully ROV loadable / unloadable feature via the end closure mounted cartridge and single lift point. This PLR can be tailored to suit vertical and horizontal orientations.

The Vector Optima® subsea connector is at the heart of our PLR systems, below is a summary of the current status:

- Field proven Vector Optima® connector offering simple, reliable and quick operation.
- Seal Sealing with double metal to metal seals and full integrity testing as part of connection.
- MAWP as standard at 5,000psig, 10,000psig and 15,000psig. Other pressures available upon request.
- Qualification tested to 13,123ft (4,000m) water depth.
- ROV operable connector via API-17D (typical) drive buckets.
- Suitable for permanent or temporary installation.

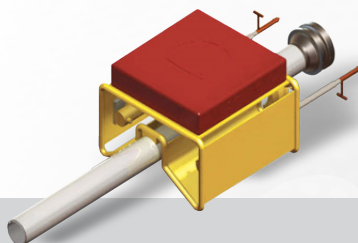
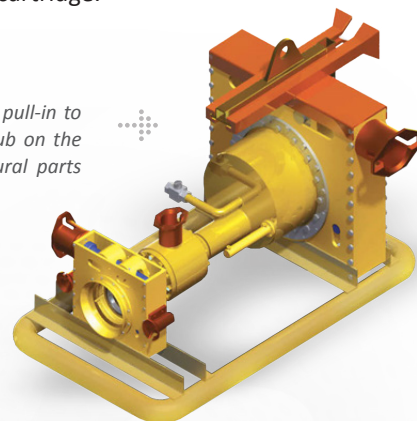


VECTOR
Optima® subsea connector

The picture to the left is of a full production activity Pig Launcher for use in deep water. This Pig Launcher is a high pressure full bore unit with an internal diameter of 6.785" for the main PLEM connection. The internal profile for the body was tapered to allow the pig to be freely inserted in the top and then seal as it progressed down the bore. The PLR is equipped with two head lift davits, one was used to remove the pressure retaining head via a torque tool lift and then rotated out of the way by an ROV. The second head lift is used for pushing the pig down the PLR barrel to beyond where it sealed in the bore. This was also done via torque tool. The pig was then launched into the pipeline using the 2" hot stab receptacle by the ROV. The pig in this case is used as a barrier between the produced oil and the fluid pumped in behind the pig, the pig was then used to displace the produced oil in the pipeline. This PLR is also fitted with Freudenberg Oil & Gas Technologies' field proven Passive Soft Land.

FO> also has a Multi-Pig PLR design that offers a single pig launch (no risk of launching more than one pig) as the other pigs are kept out of the flow path on an internal revolving cartridge.

Horizontal Multi-Pig PLR with a horizontal pull-in to bring the PLR onto the Vector Optima® hub on the end of the pipeline (for simplicity, structural parts have been omitted).



Statoil VIGDIS PLR Receiver connector

The connector shown in the picture to the right is a No.12 Vector Optima® connector for a 12" ID Super Duplex Water Injection Line in the North Sea, where it is operating at 5,000psig (345Barg) in a water depth of 750ft (230m). FO> supplied the new structure, running tool and Vector Optima® connector with the guide structure located and locked onto a mock-up of the existing PLET.

The Vector Optima® connector was lowered into position on the new structure using the Running Tool (shown with the white guide funnels). Once in place the Running Tool was removed and returned to the surface and the connector was then used to connect the Pig Receiver.



Statoil Tampen Link PLR connector

This is Freudenberg Oil & Gas Technologies' largest Optima® in service to date. It is a 32" Vector Optima® connector with a design pressure of 2,560psig (177 Barg) in 660ft (200m) water depth. The connector was used to connect the PLR to the pipeline behind the large valve on the skid. The connector can be retrieved with the PLR or left on the skid. Also, there are two No.16 Optima® connectors that are on the 16" side branch, but these can-not be seen as they are behind the large valves. These have been in service for several years now.



connector fitted to the PLR on its transport skid.

BP Norge SKARV PLR connector

This is a 28" connector with a 26" bore operating at 4,567psig (315Barg) in 984ft (300m) water depth.

In the picture to the left, it can be seen that the connectors were fitted with two drive buckets. The larger one at the bottom was the drive for the leadscrew, which opened and closed the connector. The smaller / upper drive bucket was provided as the blind end was deemed too heavy for an ROV to operate, therefore a torque tool driven hinge assembly was designed and supplied to allow the ROV to operate the door correctly.