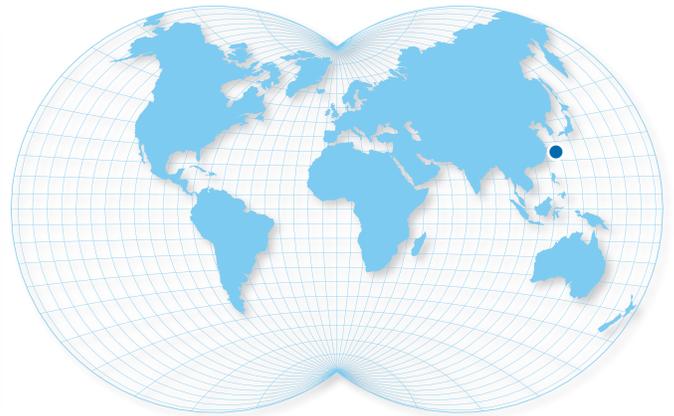


LIUHUA 11-1 FIELD, PEOPLE'S REPUBLIC OF CHINA:

FPSO Nan Hai Sheng Li Internal Permanent Turret



Scope of Work

SOFEC designed, constructed, and installed an internal permanent turret mooring system for the MODEC-converted 140,000 dwt Nan Hai Sheng Li FPSO.

The permanent turret mooring system installed in the FPSO enables the tanker to remain on station during 100-year typhoon conditions characterized by wave heights up to 13.2m, currents more than 3 knots, and 87 knot winds. The Liuhua 11-1 field is located in Typhoon Alley offshore, southeast Hong Kong, PRC. The Nan Hai Sheng Li FPSO survived a direct hit by Super Typhoon Sally in 1996. The FPSO has a design life of 15 years.

The dual toroidal swivel system on this FPSO, as well as the piping and riser systems, was designed for H₂S service.

General Description

Client Name:	Amoco Orient Petroleum Co.
Contract Award:	July 1993
Installation Date:	March 1996
First Oil:	April 1996

Vessel Size:	140,000 dwt
Storage Capacity:	650,000 bbls
Water Depth:	305m (1,000ft)
Fabrication:	Turret - Japan Vessel - Singapore

Design Environmental Criteria (100-year storm)

Significant Wave Height:	13.2m (43.2ft)
Wind Velocity:	45m/s (87 knots)
Current:	2.26m/s (4.39 knots)

Mooring System

- 10x1 chain-wire-chain with subsea buoys (inverted catenary mooring):
- 4.5-in. ORQ +20% chain
- 4.5-in. Spiral strand wire rope
- Syntactic foam support buoys
- 40mt High holding power anchors



FPSO Nan Hai Sheng Li

(Continued)

Turret

Internal Permanent Bow

Turret

The 6.5m internal turret houses a four-pass swivel, with toroidal passages for two production lines, one test line and one spare line. A hydraulic swivel for control lines is also included. Hydraulically activated emergency shut down valves were placed below the swivel as part of the FPSO safety.

Fluid Swivel Assembly

2 x 12-in. 300# ANSI flange connection (740 psi design)

Riser System

2 x 13.5-in. Flexible riser
1 x 6-in. Flexible riser

Comments

In September 1996, the eye of Typhoon Sally passed within one kilometer of the FPSO. Typhoon Sally was classed as a "Super Typhoon" in the South China Sea. Although the environmental conditions reached the 200-year design environment criteria, the MODEC converted FPSO, and its turret and mooring system received no reportable damage.

This SOFEC permanent internal turret mooring system is ABS classed.