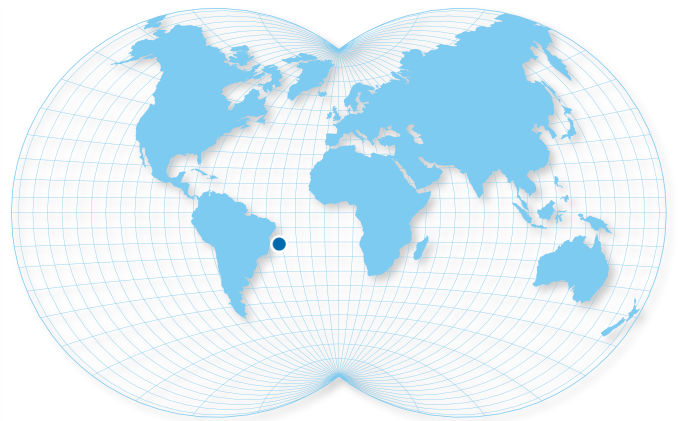


BARRACUDA AND CARATINGA FIELDS, BRAZIL:

FPSO Petrobras P34 Internal Permanent Turret



Scope of Work

SOFEC designed and constructed an internal permanent turret for a deepwater FPSO installed on the Barracuda and Caratinga fields offshore Brazil. The FPSO is located in 835m water depth becoming, at the time of installation, the world's deepest FPSO system. The turret system is designed to accommodate 34 flexible risers and umbilicals, at that time, the largest number of risers ever handled by a tanker-based FPSO and the largest number of flowpaths ever to be manifolded in an internal turret system. The turret design is based upon a turret shaft supported by a large diameter roller bearing at the FPSO's main deck allowing ready access to inspection and maintenance. Catenary risers are routed to periphery of turret shaft to reduce congestion. The six-path fluid swivel includes production, test, gas lift, gas export, and hydraulic control. The turret uses a six-leg symmetric catenary polyester/chain mooring system. The P34 is the first FPSO to utilize polyester.

This SOFEC internal permanent turret mooring system is Lloyd's classed.

General Description

Client Name:	Petroleo Brasileiro S.A. - Petrobras
Contract Award:	February 1995
Installation Date:	July 1997
First Oil:	September 1997
Vessel Size:	50,000 dwt
Storage Capacity:	340,000 bbls
Water Depth:	835m (2,739ft)
Fabrication:	Lower Turret Modules - Texas, USA Manifold Deck - Louisiana, USA Upper Turret Structure - Brazil

Design Environmental Criteria (50-year storm)

Significant Wave Height:	7.2m (23.6ft)
Wind Velocity:	34.8m/s (67.6 knots)
Current:	2.1m/s (4 knots)

FPSO Petrobras P34

(Continued)

Mooring System

- 6-leg Symmetric catenary:
- 4.375-in. ORQ chain
- 3.0875-in. ORQ + 10% top chain
- 160mm Synthetic polyester rope
- 16mt High holding capacity anchors

Turret

Internal Permanent Bow

The number of risers and their geometry dictates a large diameter turret shaft and the loads imposed by these risers control the design requirements for the main bearing.

The large size of turret shaft permits the chain support assemblies to mount internally thus eliminating a below keel chain table.

The turret is approximately 19m high, extending from the lower module to the pull-in deck. During construction, the turret was divided into five sections, ranging in height from approximately 2 to 5m. The turret was divided into sections because the shipyard doing the conversion work could not accept the turret as a one-piece lift.

Mounted above the pull-in deck is the swivel support base on which the entire swivel stack is mounted. The manifold deck is supported from the pull-in deck and the swivel base and remains stationary with the rest of the turret, as the FPSO weathervanes around the turret.

The risers from the 11 wells are manifolded together at the manifold deck. The manifold for the FPSO is essentially circular in nature and contains four production headers; a 12-in. production header, a 6-in. production test header, a 4-in. gas lift header, and a 3-in. gas lift test header.

In order to provide access to all parts of the swivel stack for inspection and maintenance, a swivel access structure is provided which is connected to the vessel surrounding the swivel stack and the manifold deck.

Fluid Swivel Assembly

Production:	2 x 10-in. toroid (740 psi design, ANSI 300)
Production Test:	1 x 6-in. toroid (740 psi design, ANSI 300)
Gas Export:	1 x 4-in. toroid (740 psi design, ANSI 300)
Gas Lift:	1 x 4-in. in-line (2,500 psi design, ANSI 900)
Temporary Gas Lift/ Gas Export Relief:	1 x 4-in. toroid (740 psi design, ANSI 300)
Hydraulic Control Swivel:	6 pass (5,000 psi design)
Pneumatic Supply Swivel:	2 pass (5,000 psi design)
Electrical (control, power & Inst.) Swivel:	12 pass (7 control, 2 - 120 volt, 3 - 440 volt)

Riser System

- 11 Production risers 4-in. ID @ 3000 psi
- 1 Gas lift risers 2.5-in. ID @ 3000 psi / 4-in. ID @ 3000 psi
- 11 Control umbilicals 4.5-in. OD
- 1 Gas export riser 11-in. ID @ 2000 psi