SBM Offshore is a global leader in the supply of systems and services to the offshore Oil and Gas industry. In the early 1980s, SBM Offshore pioneered the turret concept to moor vessel-based Floating (Production) Storage and Offloading systems (FSOs/ FPSOs). SBM Offshore has since supplied over 50 turret mooring systems to the industry and continues to develop specific technology to meet project requirements.

In essence, a turret mooring system is composed of a geostationary turret cylinder connected to the vessel structure via a bearing arrangement. The vessel-bound components can therefore freely rotate around the turret, which is fixed to the seabed via a number of anchor legs. This arrangement allows the FSO/FPSO to adopt the direction of least resistance against waves, wind, and currents. The risers and umbilicals are connected to the turret and a structure at the top of the turret cylinder supports piping manifold and equipment. The swivel stack allows for the transfer of fluids, electrical power and signals between fixed and rotating parts while the FSO/FPSO is weathervaning.
• The turret design is configured to suit the environmental conditions and client’s requirements:

• External turrets for mild to medium environments and moderate number of risers;

• Internal turrets for harsher environments and larger number of risers;

• Disconnectable turrets for extreme environments (typhoons, hurricanes or ice conditions).
The turret mooring concept became a reality in 1985 when the stern of the 140,000 DWT Floating Storage and Offloading (FSO) vessel, the “Alba Marina”, was fitted with an external turret.

The external turret (ET) comprises a steel box-type mooring arm cantilevered from the bow or stern of the vessel, which supports the turret cylinder via a 3 race roller bearing. The mooring chains, risers and umbilicals are connected to the chaintable at the bottom of the turret cylinder. The overall geometry is such that the chaintable remains above water in normal conditions.

An alternative design is the clamped turret (CT) where the chaintable is below the sea surface near the vessel keel. In this solution an additional bearing transfers the mooring load from the chaintable directly to the vessel hull.

The external turret design is used for mild to medium sea states, which are generally located in West Africa and South East Asia.
An important milestone in the history of offshore Oil and Gas production was reached when SBM Offshore supplied its first internal turret for the Alba Floating Storage Unit in the North Sea in 1991. This new technology was the result of the evolving requirements of the industry to use FSOs/FPSOs in deeper waters and harsher environments.

This first internal turret was a Bottom Mounted Internal Turret (IT1). This type of turret is integrated into the forward end of the vessel. It consists of a chaintable structure fixed to the vessel moonpool via a 3-race roller bearing, located near the keel of the vessel and below the sea surface. Above the bearing the turret cylinder houses the risers “I-tubes” and supports manifold deck(s) and swivel stack, both above vessel deck.

The Bottom Mounted Internal Turret is well suited for harsh conditions and moderate number of risers. It has been successfully applied to several units in North Sea and Australia.

For a larger number of risers SBM Offshore has developed other concepts of Internal Turrets with different bearing systems.

In the mid 1990s SBM Offshore was awarded contracts to moor 2 large deepwater FPSOs for Petrobras where the challenge was to accommodate 35 and 47 risers. In the selected concept, the turret is fixed to the vessel via 2 bearings. The lower bearing consists of discrete frictionless pads whereas the upper roller bearing is mounted on a spherical elastomeric foundation for an optimum load distribution. The Spherical Bearing Internal Turret (IT2) has then been used on several FPSOs, all located in Brazil.
The Bogie Bearing Internal Turret (IT3) came about in 1996, when SBM Offshore was contracted to design and supply a turret mooring system for an FPSO in the very harsh environment of the West of the Shetlands and for up to 24 risers. In this design an axial bogie and radial wheel system replaces the conventional roller bearing system. Bogies and wheels run on bolted rail sectors in such a way that all components can be replaced in situ, should it ever be required. Turret diameter and number of axial bogies and radial wheels can easily be adapted to meet project specific load requirements and number of risers. SBM Offshore has supplied several Bogie Bearing Internal Turrets with a record size in 2005 for an FPU offshore Brazil carrying 75 risers.

Then in the late 2000s another variant was created by adding a set of radial stoppers mounted near vessel keel in order to cope with higher mooring loads. To date the Bogie Bearing Internal Turret with Lower Stoppers (IT4) has been used on 4 different projects in Northern Europe and Australia.
The concept of disconnectable turret mooring systems was developed to allow the exploitation of reserves in locations where severe weather conditions such as typhoons, hurricanes, icebergs or ice packs might threaten the safe operation of the facility.

SBM Offshore supplied the first external disconnectable turret mooring system in 1985, a Riser Turret Mooring (RTM) system, for the “Jabiru Venture” FPSO, located in the cyclone-prone region off the northwest coast of Australia.

An internal disconnectable Buoyant Turret Mooring (BTM) system was then developed a few years later for the “Nan Hai Fa Xian” FPSO, installed offshore Hong Kong in the typhoon affected environment of the South China Seas.

SBM Offshore has supplied several BTMs and RTMs and continues today to develop this technology in response to industry demands for innovative disconnectable turret mooring systems capable of handling ever larger vessels with significant numbers of risers, in various water depths and environments worldwide.
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