The CALM is the most popular and widely-used type of offshore loading terminal with more than 500 systems installed to date. CALMs have been deployed worldwide for a variety of applications, water depths and vessel sizes ranging from small product carriers to Very Large Crude Carriers (VLCC). Because of safe and easy berthing and un-berthing operations, the CALM is equally the preferred offshore terminal of Mooring Masters and Tanker Captains.

Back in the 1950’s, SBM Offshore pioneered the development of the CALM. Since then, we have delivered over 400 CALM offshore terminals, remaining the principle innovator and market leader. For more specific information about our projects, please refer to our Loading & Offloading Terminals Performance Record Brochure.
What is a CALM?

A CALM consists of a floating buoy anchored to the seabed by catenary chain legs which are secured to anchors or piles. One or more elastic mooring hawsers hold the tanker captive to a turntable which is mounted on top of the buoy by means of a slewing bearing.

This bearing allows the turntable to freely weathervane so that the tanker can take up the position of least resistance to the prevailing weather at all times. Fluid product is transferred via the CALM to or from the tanker by floating and subsea hose systems.

When the tanker moves off station, due to the effects of wind, wave and current, certain anchor legs are lifted. This generates a restoring force which tends to return the system to the equilibrium position, thus limiting the tanker’s excursion.

CALMs are usually located in water depths between 20 to 100 meters and are connected to a shore storage facility (tank farm) or to offshore production platforms by means of a submarine pipeline. Since early 2000, the CALM design has been used and adapted to deepwater conditions, greater than 1,000 meters. For this application, the CALM is used as an offloading system for a deepwater Floating Production Storage and Offloading unit (FPSO). SBM is currently the market leader of deepwater CALMs having supplied eight out of ten deepwater CALM systems to date.
When SBM Offshore invented the turret concept, its application to CALM buoys was considered. This idea was rejected, however in favour of continued use of the turntable configuration for the following reasons that still hold true today, even for deep water.

The most prominent advantages of the turntable-type buoy are as follows:

- A naturally ventilated turntable and centre well offer safe and easy access to maintenance personnel. The entire piping path is open to air and there is no enclosed area which could contain an explosive mixture.

- The working area for maintenance operations is unobstructed.

- The safe and easy re-tensioning of moorings is accomplished through the use of automatic ratchet type chain stoppers positioned at the periphery of the buoy.

- The main bearing is mounted above the upper deck and supports an above-water turntable. This dry turntable arrangement offers free and easy rotation with minimum break-out and running torque requirement.

- The main bearing is only loaded when a tanker is attached and is not directly affected by wave loading, impact from workboats or from tankers riding up.

- The main bearing is easily accessible in a dry and open environment and can be fully maintained or even replaced offshore in case of damage by collision.
Recently, the life span of SBM CALMs was increased to 30 years. Based on offshore platform standards, the paint system and corrosion allowance of the CALM were updated permitting the buoy to remain in the water for such a significant period of time. Additionally, the SBM CALM Buoy does not need to be brought to shore for overhaul and repair during this period. Special tooling and procedures are now available for the removal of the main bearing on site in the event of a failure due to a vessel collision with the turntable.

All mechanical components, Central Pipe Unit bearing, seals and valves, can be overhauled in-situ by using either the lifting equipment available on the CALM buoy or replaced using much smaller lifting means such as the “A” frame of a workboat. This feature represents a significant advantage over other designs, which require regular in-shore overhauls, resulting in associated costs for the removal of the buoy body, overhaul and re-installation.

These associated costs include the following:

- **Direct Costs -** Mobilisation and work costs of the barge which disconnects the buoy from the chains and the hoses, the shipyard bill and the barge cost of reconnecting the buoy to the chains and the hoses, plus the barge demobilisation cost.

- **Indirect or Additional Direct Costs -** The indirect costs associated with the unavailability of the terminal, or the direct cost of hiring a replacement buoy, plus its own installation and uninstalling.

The Turntable design and outfitting are adapted to the specific requirements of the project and client. Product flow dictates buoy piping requirements and on-deck equipment can either be simple and manually operated, or more complex with remote control from shore station or ship by the use of telemetry.
CALM terminals are typically designed for the transfer of one product, e.g. for delivery of crude oil to a refinery, however, they can be used for the transfer of multiple products. CALMs have been designed to handle as many as five products simultaneously and discretely without co-mingling.

These products include:

- Crude oil or condensates
- Refined Petroleum products (e.g. fuel oil, diesel, aviation spirits, etc.)
- Chemicals and fertilizers in liquid form
- LPG
- Fresh water
- Minerals in slurry form (e.g. iron, sand, or coal)
CALM terminals do not usually require tugs for berthing or un-berthing, only a small rope handling boat. The tanker turn-around times are generally less than 24 hours (i.e. no demurrage charges).

Other advantages to clients include:

• Capital cost and lead time to system commissioning are significantly less than for a fixed-jetty facility

• Operating costs are lower due to the “no tug” requirement

• CALM systems are designed to comply with the rules and regulations of all of the leading Classification Societies such as: the American Bureau of Shipping, Lloyd’s Register, Det Norske Veritas, and Bureau Veritas, among others.
While the original concept remains the same, a number of safety features and special equipment have been developed, which can be made available for all multi-purpose buoys, including the following:

- **Telemetry and Berthing Aids** - to provide the Master and Operators with information on process and ancillary equipment, together with berthing data
- **Load Monitoring Systems** - to provide a constant display of the tension in the hawser
- **Breakaway Couplings** - to provide the means to prevent overstretching of the floating hoses in the event of overload (broken hawser), thus avoiding any risk of significant pollution
- **Electric Swivels** - to enable power and instrument signals to be transferred between the fixed and rotating parts of the buoy
- **Hydraulic Power Units and Hydraulic Swivels** - to provide hydraulic power supplies for sub-sea applications, i.e. PLEM control valve(s)
- **Solar and Wind Power Systems** - to power the navigation aids, telemetry and berthing aids
- **Outboard Product Swivels** - to limit the stress on the offloading hoses and thereby increase hose life
- **Surge Relief Systems** - to provide a means to contain any fluids that may be relieved due to pressure surges during loading/offloading operations
- **Subsea Wave, Tide, and Current Sensors** - to monitor the long term tide height, significant wave height and wave period.
Providing the most complete package to clients is key for SBM Offshore. Specialised service needs such as after sales services, management of CALM and other terminals or mooring systems, as well as spare parts are essential compliments to the sale or lease of facilities, offering comprehensive and integrated assistance. This is achieved through a dedicated division, staffed and equipped to handle a large variety of offshore works.

Highly experienced installation project managers, engineers and marine supervisors, who control and manage accurately all aspects of offshore installation work, are supported by a group of skilled installation engineers who perform feasibility and analytical studies, and prepare calculations, specifications and procedures for the projects. Through a close collaboration throughout the company, SBM ensures that installation aspects are integrated early into the design of its systems.

SBM executes offshore installation and subsea construction projects on a turnkey basis, for SBM units as well as for external clients. To be successful in these projects, SBM operates two offshore installation vessels: one dynamically positioned Diving Support Vessel, the Dynamic Installer, and one state-of-the-art deep water Subsea Construction Vessel, the Normand Installer. And with their team of qualified and experienced engineers, the division resolves operations and maintenance problems including:

- Site troubleshooting
- Training of operation and maintenance teams

SBM can also assist clients through Services Agreements, allowing a swift and efficient response to their needs.