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Offshore - Deep Water Swivels

Deep Water Swivels

Introduction

In the early 1990s Mobile Offshore Drilling Units (MODU) started to venture into water depths in excess of 3000 Ft. At this depth, due to the considerable weight of mooring equipment and limited available reserve buoyancy of vessels, a combination chain & wire rope mooring line was necessary. However, it became evident during the first 'rig moves' that torque build up in the mooring lines was so significant as to render their safe operation impossible. Problems experienced include -

- Failure of mooring lines in use
- Serious entanglement of mooring lines during deployment and recovery
- Failure of mooring lines during recovery
- Wire rope damage due to 'unwinding'
- Loss of equipment through failures
- High replacement costs for lost equipment
- Significant delays in rig moves caused by entanglement of mooring lines
- Serious loss of earnings due to delayed rig moves
- Significant risks posed to Health & Safety (H&S) due to torque induced uncontrollable 'whipping' of mooring lines during deployment and recovery

Initially simple bow & eye swivels used on ships anchor chains were introduced to the mooring lines however, these failed to swivel under load and, due to the high bending moments experienced over stern rollers of Anchor Handling Vessels (AHV) and MODU fairleads, failed during deployment and recovery.

Solution Definition

In order to resolve all issues highlighted above Griffin-Woodhouse considered a product to meet the following design criteria -

1. Swivel at operational loads experienced by mooring lines in service, during deployment and recovery
2. Rated as a minimum to the same grade requirements of the chain, wire rope and/ or other suitable equipment within the mooring line
3. Capable of being connected into the mooring line at interface of chain, wire rope and/ or other suitable equipment within the mooring line
4. Capable of withstanding a high bending moment
5. Capable of running AHV stern roller and MODU fairlead



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Design Refinement

In order to further satisfy the main design criteria the following refinements were identified -

1. The body of the swivel should be streamlined so as to run a stern roller or fairlead without 'snagging'
2. Due to the high load rating of the mooring lines, the swivel bearing needs to be 'crush proof' with a low coefficient of friction and corrosion resistant
3. The eye of the swivel needs to suit the available range of connecting links including a Kenter Shackle (KS), Detachable Chain Connecting Link (DCCL) and Detachable Anchor Connecting Link (DAKL)
4. The fatigue capability of the swivel should be as a minimum equivalent to that of the chain, wire rope and/ or other equipment in the mooring line
5. Robust enough to withstand the likely heavy handling experienced on-board AHV during deployment and recovery

Final Product Design

In order to address a variety of mooring line configurations two separate designs of swivel, both based around the original design concept and utilizing standard product dimensions and specifications, were finalized -

1. A conventional Eye and Eye Swivel designated GPS. Primarily designed for deployment in chain-to-chain configurations, or otherwise chain to CR Socket/ other suitable equipment located in mooring line
2. A Swivelling Spelter Socket designated SSS. Specifically designed for deployment in chain-to-wire rope configurations, whereby the wire is socketed directly into the main body of the swivel, thus eliminating the need for excessive 'jewellery'

Based on prevailing MODU classification world-wide, swivels are standardized on Offshore Mooring Chain grade R4.

