



OTC 20202

## Castings and Forgings for Offshore Structures and Moorings

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This paper was prepared for presentation at the 2009 Offshore Technology Conference held in Houston, Texas, USA, 4–7 May 2009.

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### Abstract

Following recent difficulties with the jewelry in deepwater moorings, a number of attendant issues have identified, which were reviewed in a “white paper” prepared in the spring of 2008. The author’s background is in practical fracture control standards for fixed platforms and hull structures, offering a fresh (naïve?) insight into the following topics:

- system reliability,
- geometric design,
- Manufacture & QC
- incorporation into the overall construction,
- operation, inspection and maintenance, and
- the way forward

### Introduction

There are many offshore applications of castings and forgings. Although the primary focus of the author’s work is specification of materials and welding for fixed platforms, it is mooring jewelry in projects such as Kikeh and Tahiti that has become a cause for concern in recent months.

Yield before fracture is the prevailing philosophy in designing critical components of permanent fixed offshore platforms and marine hull structure. Observable deformation gives a warning of impending failure. If there is less ductility, the component “fails ugly”. In structures, this is considered undesirable, even if the load capacity is almost the same. In mooring lines, with no redundancy and no warning, both modes of failure have the same consequences.

The cast mooring socket in Figure 1 is an example of “failing ugly”, from the MMS post mortem of hurricane Ivan [2]. Mooring jewelry is typically designed not to fail before the wire or chain. The first of 8 mooring lines on the semi-submersible MODU failed at the expected location (rig wire at the fairlead). However, as the system unzipped, there was one failure at an in-line connector, and a padeye failed after being loaded out-of-plane. The rig’s drift path hooked around and came within five miles of hitting the Nakika hub. Had it hit the LOOP facility, the estimated \$30 billion economic disaster for the nation (not just oil companies) would be on the same order as losing 300 ICAF lives.

MMS Order No. 0105PO39221

Post Mortem Failure Assessment of MODU's During Hurricane Ivan

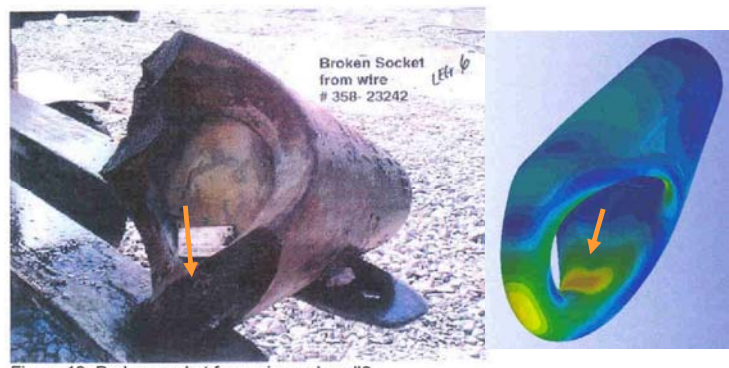


Figure 1. Broken mooring socket