



U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

Safety Alert

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Contact: Lance Labiche
(504) 736-2433

Catastrophic Failures in Mooring Systems Possibly Put Floating Structures at Risk

The U. S. Coast Guard, 8th District and the MMS have agreed to issue this joint Safety Alert

In two separate incidents, a catastrophic failure occurred in a portion of an anchoring system. One component failed on a system in the Gulf of Mexico. The other was found during installation to be defective after a similar component failed overseas.

Incident No. 1: A one-ton, 8+ inch-diameter shackle connecting a mooring system to anchoring pilings failed on an overseas floating production facility. Subsequently, an identical shackle scheduled to be used in a deepwater GOM production facility also failed catastrophically under test loads below specifications. Operator reviews of the manufacturing and testing procedure and additional material testing indicated that all of the shackles were possibly defective.



Failed Mooring Socket



Example: Mooring Shackle

Because anchor pilings with shackles attached had already been driven, the GOM test failure required new shackles to be manufactured, new pilings installed, and the replacement of portions of the mooring systems that could not be recovered. Production start-up of the facility has been delayed by at least one year.

Incident No. 2: Two sockets in a mooring system for a MODU failed under moderate loading. Testing of the remaining sockets found that others were also defective and a number of them failed catastrophically at less than specification loading.

The MMS and the U.S.C.G., 8th District, concluded the following:

- In both cases the manufacturing procedures are thought to have been defective. Heat treating after casting apparently resulted in a metal unable to meet “Charpy” standards for material “toughness.”
- In both cases, the operator’s and/or manufacturer’s specifications for the items were either out of date or inadequate.
- In both cases the Operator’s material testing requirements were either not followed, or were not adequate to insure specifications were met.
- Material handling during installation may have exposed the equipment to potential critical damage.

The MMS recommends the following:

- **Operators** should review their specifications requirements to insure testing and manufacturing produces a product that will meet the usage demands.
- **Operators** should include sufficient *Charpy testing requirements* in the specifications to insure the materials and manufacturing process will produce a product of sufficient toughness.
- **Operators** should review their requirements for both destructive and non-destructive testing of critical elements. Operators should insure their test coupons are properly representative.
- **Operators** should review their requirements for equipment inspection and handling to insure no damaging techniques are employed in transportation or installation.