



**SPE 143137**

## **Ultrasonic Peening, a Solution for Fatigue Cracking on Offshore Installations**

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This paper was prepared for presentation at the Brasil Offshore Conference and Exhibition held in Macaé, Brazil, 14–17 June 2011.

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### **Abstract**

By using Ultrasonic Peening the service-life of an offshore installation can be extended.

Every floating installation will have weak spots in its structure, this is almost inevitable. We call these weak areas “fatigue hot-spots”. In practice the fatigue hot-spots are the locations where the first cracks start to initiate in the structure; in effect these cracks will threaten the structural integrity of the structure. Ultrasonic peening is a pro-active solution to prevent fatigue cracks to initiate at these locations. The method is a practical and efficient solution for structural integrity challenges related to fatigue cracking. It can extend the service life of high stressed weld joints in an offshore platform by four times<sup>1</sup> if the weld quality is adequate. Even though Ultrasonic Peening is a very efficient way to strengthen the integrity of offshore installation, the method will always be dependant on the existing weld-quality. As ultrasonic peening is a post weld treatment it can not magically transform a bad weld into a good weld, it can only enhance a good weld to an even better weld. Occasionally Ultrasonic Peening Technicians come across fatigue hot-spots with bad weld quality. In order to be able to estimate the benefit of Ultrasonic Peening even if the weld quality is inadequate, a couple of fatigue trails were designed to investigate this further.

Two separate batches of F Specimens were manufactured.

-As- welded; used for reference purpose

-As welded + UP treated; Specimens were first put under fatigue cycles until ½ of the predicted fatigue life had been consumed, the specimens were then treated with the LETS Global Ultrasonic Peening Procedure, after these two steps the specimens were put back on the fatigue trail until failure.

It was made sure that all the specimens had a relatively bad weld quality. For example the weld toe angle was too high and the weld toe was filled with irregularities.

The results show that Ultrasonic peening doubles the fatigue life of a welded attachment even though; the weld quality is poor and even if the welded attachments have already consumed half of its fatigue life. This corresponds with American Bureau of Shipping’s official guidelines<sup>2</sup>.

This document focuses on the benefit of Ultrasonic peening on offshore installations which have already consumed a big part of their service life and have locations with bad weld quality. Since operators tend to focus on life extension of offshore installations beyond the original designed service life at a relatively late stage, ultrasonic peening is often used when the welded attachments have used half or more of their intended service life.