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Structural Integrity and Life Extension of Offshore Installations by Ultrasonic Peening

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Abstract

Extensive life extension studies for a FPSO installation have been carried out. High stressed welds showed too short fatigue lives in as-welded condition. Ultrasonic peening has been selected to extend the fatigue lives of the concerned weld details. The aim with the ultrasonic peening treatment was to avoid any further weld repair and by that contribute to the structural integrity of the installation during its remaining service life.

Fatigue life extension has been achieved by the application of ultrasonic peening to high stressed areas on the pallet stool- and on longitudinal-weld details on the ballast tanks on a FPSO installation.

The fatigue lives for the treated welds were extended to twenty years which is the targeted service life for the installation.

Quality Assurance and Quality Control were covered by Ultrasonic Peening Procedure Specification, applied for every treated weld. It ensures that the treatment is exactly reproduced to achieve the expected life extension.

Despite the variable weld quality encountered on the pallet stool welds the treatment was carried out at perfection and it showed to be relatively easy and straight forward application even in locations of difficult access.

The economical benefits due to reduced maintenance as a result of the ultrasonic peening treatment include:

- Avoidance of long term plan for extensive hot work
- Avoidance of long an unscheduled operational disruptions
- Increased structural safety for the installation during remaining service life
- Ultrasonic peening treatment can be applied while the installation is in operation

1. Introduction

It is the desire of every operator of an offshore installation to ensure the structural integrity during the targeted service life. In many cases the targeted service life is difficult to achieve alternatively the maintenance costs increase to unacceptable levels. Therefore an earlier life extension study of the offshore structure suspected to have structural integrity deficiencies increases the chances to keep the installation working safe for the original alt. extended design life as well as to keep the maintenance costs under acceptable level. An extensive life extension project is being carried out on FPSO Triton [1]. One of the remedies used to achieve the targeted service life on this installation is the ultrasonic peening treatment of weld connections subjected to high stresses.

To ensure the structural integrity of an operating offshore structure there are a number of interacting variables which needs to be taken into account. First of all it would be necessary to achieve the general awareness of the necessity of a life extension study for the installation. This is itself a major challenge. It is of a big concern to integrate, at an early stage into the process of life extension, a number of parties which for one reason or other there are not really convinced that something must be done now to avoid any failure of the structure in a near future. For example some of the damaging mechanisms as fatigue cracking,