Design Implementation of Offshore Skid in Compliance with DNV Regulations

Atul B. Bokané1, Micah Stewart2, Nitinkumar P. Katke1, and Siddharth Jain3

1Halliburton Technology India Pvt. Ltd. 
Pune Maharshtra, India

2Halliburton Energy Services, 
Duncan, Oklahoma, USA

3Halliburton Technology Center, 
Singapore

ABSTRACT

Offshore skids play a vital role in transportation of heavy pumps, engines, and blende units used during fracturing treatments at the well-site. For universal acceptance and usage of these skids worldwide, the offshore design should meet various applicable codes and regulations, such as Bureau Veritas, Lloyds, ABS, or Det Norske Veritas (DNV) design standards. This paper presents a review of the design, development, and implementation of an offshore skid per DNV regulations. A finite element approach of design was adopted to meet DNV requirements. Design implementation efforts, such as manufacturing, inspection, and prototype testing under different loading and lifting conditions are discussed. The output should help obtain DNV certification and guide global field operators during operation.

KEY WORDS: Offshore skid; DNV regulations; loading and lifting conditions; design development and test results; DNV certification; finite element modeling.

INTRODUCTION

DNV is an autonomous and independent foundation created in 1864 in Norway. Its main objective is to safeguard life, property, and the environment both on and offshore. This involves the establishment of rules and guidelines regarding classification, quality assurance, and certification of sea-going vessels, structures, and other installations. Like other standards, DNV certification implies that a structure or an item of equipment has been reviewed against a certain set of requirements and furthermore that a document has been issued stating that the item is in compliance with the requirement. DNV certified skids are designed as structural frames that provide good continuity under different loading and lifting conditions. All primary structural members of a skid should qualify the criteria of allowable stresses and member deflection as per DNV design guidelines.

The need for certification has evolved from events, such as disasters at sea and pressure vessel explosions. In recent years, there has been a growing clamor for improved protection of life, equipment, and resources, which have been reflected in ever tighter surveillance and inspections by certifying societies, such as DNV (Oystein, 2004). Evaluation of the ultimate strength and history of collapse of structures in both their intact and damaged conditions is a key issue of advanced design techniques based on explicit safety evaluation and collective optimization (Ueda, 1991). However, significant work has contributed to the development and implementation of regulation for offshore structures, such as equipment providing power management and dynamic positioning to heavy vessels (Eri, 1975).

In this context, DNV Standard for Certification No. 2.7-1 is discussed extensively. This standard for certification applies to transport related requirements for offshore containers with respect to design, manufacture, testing, certification, and periodic inspection. An offshore container is a unit with a maximum gross mass not exceeding 25 000 kg, designed and intended for repeated use in the transport of goods or equipment, handled in open seas to, from, or between fixed and/or floating installations and ships. The intention is that offshore containers meet the requirements such that containers should be safe with regard to personnel, the environment, and are not a hazard to the vessel/ installation. These containers are suitable for repeated use through choice of material, protection, and to be simple in terms of repair and maintenance. The relationship of DNV standards with other standards (e.g., IMO, ISO containers, and European Standard EN 12079), codes, and regulation is discussed in Standard for Certification No. 2.7-1, April 2006 Edition.

IMO has issued both the International Convention for Safe Containers, CSC, and the International Maritime Dangerous Goods code, IMDG. Both of these are mandatory international regulations. IMO has recognized that the CSC convention is not directly applicable for offshore containers that are handled in open seas, and has issued a circular (MSC/Circ.860) with guidelines on certification of offshore containers. The IMDG code also requires that containers and portable tanks that are handled in open seas should be certified for this purpose.

Containers that are intended for sea transport on container ships are normally designed according to an applicable part of ISO 1496. Containers that are certified to CSC are, in general, also designed as ISO containers. Offshore containers designed and certified according to this Standard for Certification can also be designed and certified according to CSC and ISO 1496.

The European Standard EN 12079 “Offshore Containers and Associated Lifting Sets” consists of three parts: (A) offshore