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RELIABILITY OF SUBSEA PIPELINES

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ABSTRACT
The subsea industry is having to face increasingly more challenges to develop hydrocarbon reserves in the marginal and more in accessible fields around the world. These challenges include those associated with deep water, high pressure/ high temperature, aggressive environments and economic restrictions. All of these put increasing demand on the achievement and improvement of reliability at every stage of the system life cycle. The reliability depends strictly on the design rules and the associated parameters that have been used in system design. So the evaluation of reliability requires an understanding of design methodologies and what design parameters can cause and increase unreliability in a designed system. This study provides a comparison of DNV and API Design Methodologies for Subsea Pipelines and discusses the rules and parameters for designing subsea pipeline by each method. Reliability of both DNV and API designed subsea system is evaluated using corresponding Limit State Equations. The results that have been achieved are applied to a realistic model and suggestions are made for a more reliable method.

KEYWORDS: Subsea Pipeline – System Reliability – Failure Modes

INTRODUCTION
This paper is concerned with the application of design standards for subsea pipelines. The subsea pipelines have been constructed for different purposes such as transformation of crude oil and gas transmission. Some countries use their own standards as guideline for design of subsea pipeline. In our country, Iran, the most popular used standards are API rule and DNV design standards which will be compared in this paper.

There are many discussions which standard is the best one. The main differences in subsea pipeline standards are in the classification of safe zone, the differences in safety factor definition which depends on the material, wall thickness, diameter, environment, loads, and pipe manufacturing procedures.

On the other hand, in structural analysis and safety calculation, the designer is solely concentrated on the behavior of individual elements and the safety factors (in Working Stress Method) or Load factor (in Limit State Method) are controlled. In structural system reliability, the structure involves a variety of structural elements and the elements are used to form a "system" concept and not the individual elements alone.

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