

Well Control Equipment Reliability Modeling

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Introduction

This technical report documents the results of an industry led well control equipment systems reliability model. This technical report is under the jurisdiction of the API Committee on Standardization of Oilfield Equipment and Materials.

The objective of this technical report is to assist the oil and gas industry in promoting personnel safety, public safety, integrity of the drilling equipment, and preservation of the environment for land and marine drilling operations. In the context of well control equipment systems, this objective is best attained through a combination of equipment reliability and management of risk. This technical report is published to provide direction and guidance to analyze reliability in design, installation, and operation of well control equipment. Analysis of model through reliability engineering will also provide insight for redundancy, testing and maintenance frequency that could be used by other API working groups to improve our industry standards, making a positive impact on equipment reliability to reduce risk. This report models typical system designs and does not account for all system designs that can be employed to successfully install and operate well control equipment systems in drilling, completions, and well testing operations.

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Well Control Equipment Reliability Modeling

1 Scope

The purpose of this technical report is to document methods of reliability analysis for well control equipment systems installed for drilling wells.

Well control equipment systems are designed with components that provide wellbore pressure control in support of well operations. As an example, the following typical systems were modeled and analyzed:

- Surface On-Shore BOP Systems.
- Surface Off-Shore BOP Systems.
- Subsea BOP System with Discrete Hydraulic Control System.
- Offshore DP MODU with a Subsea BOP System with Electro-hydraulic/Multiplex Control System.

Fault trees were developed based on generic (non-original equipment manufacturer specific), and limited to, well control equipment components with a top event of “failing to seal and secure the well” (see [Annex B](#), [Annex C](#), and [Annex D](#)). This technical report did not include consequence analysis. The intent of the models is to identify the system’s ability to perform its intended function and document the individual components importance and percentage failure contribution to the top event.

The fault trees only analyze the probability of sealing a well, and do not address non-productive time.

2 Normative References

There are no normative references for this document.

3 Terms, Definitions, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

availability

Ability to be in a state to perform as required.

3.1.2

autoshear

System designed to automatically shut in the wellbore in the event of a disconnect of the lower marine riser package.

3.1.3

cascade failures

Failure(s) that are precipitated by failure of another component(s) in the system.

3.1.4

common cause failures

CCF

Failures of multiple items, which would otherwise be considered independent of one another, resulting from a single cause.