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Using BOPs at Pressures in Excess of the Rated Working Pressure—A Solution for High-Pressure Wells?

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Abstract

As a result of the offshore oil and gas industry's ongoing expansion of technology frontiers, ever more challenging conditions are being explored. This paper is based on the research completed for the MMS (Minerals Management Service) titled, Assess the Acceptability and Safety of Using Equipment, Particularly BOP and Wellhead Components, at Pressures in Excess of Rated Working Pressure. Due to space limitations, limited content was selected from this project. The full text of the project will be available when published on the MMS website.

With the exception of pressure testing, it is most unusual and almost universally considered a poor practice in the industry to use BOP (Blow Out Preventer) and wellhead components in excess of MWP (Maximum Working Pressure). In most cases, API (American Petroleum Institute) Specifications and Recommended Practices are acceptable relative to defining MWP. These and other industry standards use defined safety factors that are reasonable and not subject to inadvertent escalation or compounding.

In contrast to operating equipment in excess of MWP is the ongoing concern about operating above equipment capability in its current condition. BOP equipment pressure de-rating is used in the industry, particularly when equipment fails to pressure test at its rated working pressure. This paper identifies factors that may compromise equipment pressure ratings so that the risks of exceeding current capabilities can be assessed.

It is clear to the authors that the most successful and highest reliability systems are those that are systematically and consistently operated and maintained with clearly defined,

quality controlled procedures by trained technicians, and tested as closely as possible to the expected operating conditions. This is consistent with reliability engineering principles. The highest value program of this sort will be performance based.

Introduction

The MMS is aware of exploration drilling prospects where reservoir conditions are as high as 28,000 psi. As current drilling and production standards frequently seek to utilize large bore drill through equipment, a limitation is encountered as there are no 18^{3/4}" BOPs with a working pressure in excess of 15,000 psi. With the current high commodity prices, the industry is exploring possibilities for using or modifying existing equipment to be fit for exploiting these opportunities more quickly. Additionally, to address the nameplate rating limitation and expand industry capabilities, an API work group has been formed to create a recommended practice for equipment rated above 15,000 psi. However, the expansion of this technical envelope will take time.

Historically, occasions of use (outside of subsea testing) in excess of MWP were almost exclusively limited to accidental or emergency use. MASP (Maximum Allowable Surface Pressure) is a separate area where there are no industry standard safety factors; such should be developed and integrated with equipment safety factors for a single, composite factor. Although reviewed in the MMS research, MASP will not be covered in this paper.

This paper, as with the research project, focused on two areas:

1. Design, manufacture, and initial use, and
2. Capabilities over time, including remanufacture and modification.

The ultimate and definitive limit of equipment capability is known when failure occurs, if comprehensive failure analysis is subsequently conducted. In this way, assumptions, calculations, and safety factors are better understood and can be modified so as to reduce failures. However, failure of critical pressure containing equipment is highly undesirable. Accordingly, as systematic review of both failures as well as operation above MWP will provide a method to reduce failures and improve reliability.