

Deepwater Well Design and Construction

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Foreword

Life cycle well integrity is an important objective in the design and execution of a deepwater (DW) well program. Technical, operational, and organizational solutions are to be employed such that the risk of an unintended release of formation fluids is minimized during drilling, completion, operational, and abandonment phases of the well. This document describes established well design practices and operational procedures that engineers, well planners, and operators consider when planning and executing a DW well project. It is not intended to prohibit the development and application of new technology.

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Introduction

The safe construction and operation of a deepwater (DW) well requires proper well design and operational procedures. The complexity of DW operations demands an in-depth understanding of the DW environment (e.g., metocean, marine, and subsurface) as well as DW procedures and equipment. This combined understanding is used to provide the basis of design for DW subsea wells.

This recommended practice provides well design and operational considerations to assist an experienced well (drilling or completion) engineer to safely design and construct any DW well drilled with subsea blowout preventers (BOPs). This document also addresses riserless drilling considerations prior to the installation of the subsea BOPs.

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Deepwater Well Design and Construction

1 Scope

The complexity of deepwater (DW) operations requires a thorough understanding of well design criteria and associated equipment. This recommended practice (RP) provides engineers a reference for DW well design as well as drilling and completion operations. This RP will also be useful to support internal reviews, internal approvals, contractor engagements, and regulatory approvals.

The scope of this RP is to discuss DW drilling and completion activities performed on wells that are constructed using subsea blowout preventers (BOPs) with a subsea wellhead. This document addresses the following.

- Identifies the appropriate barrier and load case considerations to maintain well control during DW well operations (drilling, suspension, completion, production, and abandonment).
- Supplements barrier documentation in API 65-2 with a more detailed description of barriers and discussion of the philosophy, number, type, testing, and management required to maintain well control. This document also supplements the barrier documentation in API 90 in regard to annular pressure buildup (APB). Abandonment barrier requirements are described for use when designing the well.
- Discusses load assumptions, resistance assumptions, and methodologies commonly used to achieve well designs with high reliability. The load case discussion includes less obvious events that can arise when unexpected circumstances are combined.
- Describes the risk assessment and mitigation practices commonly implemented during DW casing and equipment installation operations.

The purpose of this document is to enhance safety and minimize the likelihood of loss of well control or damage to the environment. These practices are generally intended to apply to subsea wells drilled with subsea BOPs in any water depth. Some of the descriptions of rig hardware and operations, such as remotely operated vehicles (ROVs), are less relevant in shallower water depths [e.g. less than 500 ft (152 m)]. In these shallower water depths the operator may substitute alternative hardware or operations that maintain safety and system reliability.

The following aspects of DW well design and construction are outside the scope of this document.

- Detailed casing design load case definitions (does not include specific casing designs or design factors). Individual companies combine differing severities of loads and resistances or differing calculation methods to achieve designs with similar high levels of reliability.
- Wells drilled and/or completed with a surface BOP and high pressure riser from a floating production system; however, considerations for wells predrilled with floating rigs to be completed to a floating production system are included.
- Well control procedures (refer to API 59 for well control information).
- Managed pressure drilling operations (including dual gradient drilling).
- Production operations and fluids handling downstream of the tree (subsea facilities/subsea architecture, and surface facilities/offloading hydrocarbons).
- Intervention operations.
- Quality assurance (QA) programs.