FACT SHEET

BSEE's Subsea Bolts Performance and Critical Drill-Through Equipment Fastener Study

1. INTRODUCTION AND BACKGROUND

As the oil and gas industry moves into deeper water and more hostile environments in the Gulf of Mexico, Alaska and other offshore domestic or global areas, it becomes more challenging to manage safety, risk and environmental concerns. Barrier and control failures account for nearly two-thirds of all offshore loss-of-well-control events to date (Andersen et al. SINTEF 2011). In particular, there have been a number of cases associated with fastener/bolt failures. Assessment and verification of the integrity of design, manufacture, installation, maintenance and inspection processes for the fasteners that are currently being used or being developed is essential for controlling losses of well control, worker safety, and protection of environment.

Currently, there is a lack of reliable industry standards to adequately address bolt/connector performance in subsea marine applications. Connectors that are designed for other industries such as aerospace, automobile, nuclear energy, or medicine may not contain material property requirements for subsea applications. In addition, the existing information about materials performance that is publically available has not been compiled or integrated into an easily accessible, consumable resource. Therefore, development of disciplined design guidelines and standardized fabrication and installation practices for subsea environments are critical for reducing risk for offshore operations.

2. OBJECTIVE

The overall objectives of this research are to advance the current understanding of subsea fastener performance and to determine the optimal material properties requirements for subsea fastener applications for harmonization across industry standards.

This research encompasses four main components:

- Review of industry codes and identification of any existing standards or regulations with underlying failure mechanisms for subsea bolt technology;
- Initiation of a failure analysis roundtable for identifying the failure mechanisms for subsea bolt technology;
- Assessment of the critical drill-through equipment fastener systems used subsea for offshore oil and gas operations; and
- Final recommendation of identified gaps and identification of alternative fastener designs capable of improving offshore drilling safety.

BSEE will provide this information to the industry and other stakeholders for discussion and action.

3. BSEE Study Objectives

The study will accomplish the following;

3.1 Subsea Bolts Performance

3.1.1 Review industry codes and identify any existing standards or regulations with underlying failure mechanisms for subsea bolt technology.

The proposed industry code review and literature survey include:

- Design processes and procedures
- Material specifications
- Procurement (forging, manufacturing, coating, heat treatment)
- Quality Analysis/ Quality Control
- Assembly and Make-up
- Best practices from other industries (aerospace, nuclear, military)

3.1.2 Root Cause Failure Analysis (RCA) Workshop

BSEE will assist in the hosting of a RCA-style workshop with the stakeholders/ Subject Matter Experts. The goal is to investigate the failure modes for subsea bolted connections. The RCA will not be limited to the technical components, but will also encompass the entire system and bolt lifecycle (design, procurement, manufacturing, installation, commissioning, and operation), including the human components.

3.1.3 Recommendation Report on Subsea Bolt Technology

(1) The research will result in recommendations on the methodology for the selection for material properties (such as hardness, yield, UTS), and other critical parameters identified by the code review, in accordance with the subsea bolt application and operating environment; and

(2) The study will evaluate how the existing industry standards should be modified to address these findings, or how BSEE should structure a 30 CFR 250 regulation to require these conditions be met.

3.2 Subsea Critical Drill-Through Equipment Fastener Study Goals

3.2.1 Evaluation of the performance of fastener systems currently in use, including the process of manufacturing (e.g. smelting, casting, drawing, heat treatment, coatings, mechanical/material properties, performance properties-shear stress, fatigue life etc.), corrosion protection (cathodic protection) installation (e.g., torqueing), maintenance and inspection processes associated with fastener systems.

3.2.2 Identification of the similarities and differences in industry standards and regulations as related to fastener systems worldwide.

3.2.3 Evaluation of alternative fastener designs used globally by the oil and gas industry (OCS, other offshore areas, onshore), nuclear, aviation, automotive and/or other industries.

3.2.4 Recommendation for reducing or eliminating the identified gaps and identification of alternative fastener designs capable of improving offshore drilling safety.

(1) Recommendations on the methodology for the selection for material properties such as hardness, yield strength, ultimate tensile strength, and other critical parameters identified by the code review, in accordance with the subsea bolt application and operating environment; and

(2) Recommendation how the existing industry standards should be modified to address these findings, and/or how BSEE should structure a 30 CFR 250 regulation to require these conditions be met.

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Prepared March 2016