



SPE 116221

Extended-Stroke Downhole Power Unit Successfully Pulls Subsea Wellhead Plugs in the Gulf of Mexico

Dennis McDaniel, SPE, and John Cromb, SPE, Anadarko Petroleum Corporation; Jim Walton, HTK Consultants, Inc.; and Jack Clemens, Darrell Moore, and Jeff Huggins, Halliburton

Copyright 2008, Society of Petroleum Engineers

This paper was prepared for presentation at the 2008 SPE Annual Technical Conference and Exhibition held in Denver, Colorado, USA, 21–24 September 2008.

This paper was selected for presentation by an SPE program committee following review of information contained in an abstract submitted by the author(s). Contents of the paper have not been reviewed by the Society of Petroleum Engineers and are subject to correction by the author(s). The material does not necessarily reflect any position of the Society of Petroleum Engineers, its officers, or members. Electronic reproduction, distribution, or storage of any part of this paper without the written consent of the Society of Petroleum Engineers is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of SPE copyright.

Abstract

Today's need to provide deepwater subsea well servicing has created many new challenges for the industry. For example, pulling a deepwater subsea wellhead or crown plug can require an extreme pulling force. The difficulties experienced can be compounded by conditions when the plug has been in place for extended periods of time as well as the more demanding deepwater conditions, such as high differential forces and settlement on top of the plug that contribute to the need for the higher pulling forces. These conditions often exceed the capabilities of conventional slickline services. As exploration continues to venture into more challenging environments, service companies have had to increase the scope of capabilities of their equipment to meet the challenges brought about by the new environments that require capability for tools to pull high tensile loads. The deepwater subsea arena has been particularly challenging, and this paper will focus on a slickline innovation — an extended-stroke electro mechanical device — that can provide deepwater subsea well interventions more cost-effectively than other service alternatives.

The tool is a slickline-deployed electro-mechanical device that is operated by batteries rather than explosives or hydrostatic pressurized tools and can produce a high linear pulling force. Since first being introduced, the electro-mechanical device has undergone several changes that have increased its capabilities and functionality. For example, it has recently been configured for pulling subsea wellhead plugs.

This paper will present three case histories that discuss the first use of the 'extended stroke' electro mechanical device in the Gulf of Mexico in which it was capable of pulling plugs at a water depth of 5,339 feet as well as several subsequent case histories.

Using the slickline electro-mechanical device rather than coiled-tubing resulted in substantial savings in both the cost of deployment and rig time.

Introduction

Subsea well intervention can be costly when one considers that the first task often required is to pull the subsea crown plugs in the wellhead. The hydrostatic pressure associated with the fluid in the riser creates the large pressure differential across the wellhead plugs that seal the cross sectional area. Conventional slickline services have limited constant pulling force due to the finite strength limits of the wire. Deepwater and debris above wellhead plugs often compound the required pulling force because of the additional hydrostatic pressure across the plugs. These forces are well above the tensile-strength limit of slickline wire.

A subsea wellhead plug requires a steady pull along the entire length of the seal bore as it is withdrawn. Conventional slickline is limited to creating extremely high but short-duration impact loads; however, brief impact loads are not suitable for unseating subsea wellhead plugs, because they have a tendency to reseat after each impact load and are forced back on seat by hydrostatic pressure from above. Therefore, using mechanical or hydraulic jars to simplify the delivered force does not effectively retrieve the plug from the wellhead.

When conventional slickline service is not capable of pulling a subsea wellhead plug, coiled tubing service methods may be used. However, the cost of the service can be compromised significantly because of the additional deployment time, rig-up time, and additional tripping time required.

Since slickline is usually considered to be the most economical method for well intervention, the need for a system that could pull subsea wellhead plugs using slickline became more apparent.