Failure analysis of $\varnothing 127$mm IEU G105 drill pipe wash out

Li Fangpo *, Liu Yonggang, Wang Xinhu, Lu Caihong

CNPC Tubular Goods Research Institute, Xi’an, Shaanxi 710065, China

ABSTRACT

One $\varnothing 127$ mm IEU G105 drill pipe body washed out infrequently just after 126 h of pure drilling time. This paper gives a systematic analysis in consideration of material quality and loading condition on drill strings. Measurement and inspection were performed on configuration, chemical composition, mechanical performance, metallography and micro-fractography. It’s thought that the drill pipe washed out accident was premature fatigue failure accident. Failure reason is the 0.35 mm decarburization layer caused by improper heat treatment and mechanical damage because of improper operating on the out surface. Under the effect of fluctuating stress, cracks originated from decarburization layer and grew rapidly. When cracks propagated through the wall thickness, drill pipe washed out.

1. Introduction

Drill pipe is one kind of important tools for drilling in oil and gas field. Drill pipe bears various tension load, torsion load, bending load, etc., so fatigue failure accidents take place frequently. Drill pipe wash out (hole occur and leak) is one kind of failure, which results in great loss. In order to prevent or decrease the same accident, failure analysis is very necessary.

A $\varnothing 127$ mm IEU G105 drill pipe used in the southwest oil field washed out in 2009. Well’s vertical depth is 2335 m, and it is directional well. Drilling composite structure is $\varnothing 214$ mm STB + $\varnothing 165$ mm DC + $\varnothing 159$ mm DC + $\varnothing 159$ mm STB + $\varnothing 159$ mm DC + $\varnothing 127$ mm DP. During drilling course, pump pressure dropped from 8 MPa to 2 MPa. After that, drilling team members decided to raise drill string and found a drill pipe washed out, whose piercing location was about 450 m far away from the wellhead.

2. Experiment methods

The chemical composition of drill pipe body was determined by spectroscopic chemical analysis. The microstructure in various regions was observed by optical metallography. The mechanical properties were conducted. Micro-hardness profiles from surface to interior in various regions were made using a Vickers system with a load of 100 g to determine the depth of decarburization layer. The crack surface was observed by visual examination and scanning electronic microscopy (SEM). The criterion for drill pipe is Oil and Gas Standard of China SY/T5561-2008 [1].

3. Results

3.1. Visual inspection

Failed pipe is shown in Fig. 1, washout is 850 mm far away from tool joint make-up shoulder. Drill pipe’s out and inner surface character is shown in Fig. 2, which is far away from the beginning of internal upset tape and its inner surface’s

* Corresponding author. Tel.: +86 29 88726101.
E-mail address: lifangpo@163.com (L. Fangpo).

1350-6307/$ - see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.engfailanal.2011.06.018