THE PREVENT OF THE LOSS OF WASHING FLUID IN THE DRILLING PROCESS THANKS TO REDUCING THE GAP OF THE TOOL JOINT TAPERED THREAD TO EFFECTIVELY

[1]Onysko Oleh, [1]Borushchak Lubomyr, [2]Tkachuk Valentyna, [3]Cristian Barz
[1]*Ivano-Frankivsk National Technical University of oil and gas*
[2]*Lutsk National Technical University*
[3]*Technical University of Cluj-Napoca - North University Centre of Baia Mare*

The elements of a drill string are connected by special devices called tool joint. One of the functions of the tool joint is to prevent the loss of the washing fluid, which is fed to the bottom of the drill string at a pressure of 2–26 MPa. During operation, up to 30% of the drilling pump energy losses are appear due to the thread gaps [1]. The design of the tool joint tapered thread provides a significant structural gap between the root of the pin and the crest of the box and vice versa [2].

The gap is shown in figure 7. It is denoted by the number 3 and occurs in a screwed form between the thread surfaces of the box 1 and the pin 2. If the end face of the 4 box and the end face of the 5 nipple are nontightly adjacent to each other, then the specified coupling connection will skip the drilling solution from the inside of the drill string into the outside of the tube space, that is, into the drilled well.

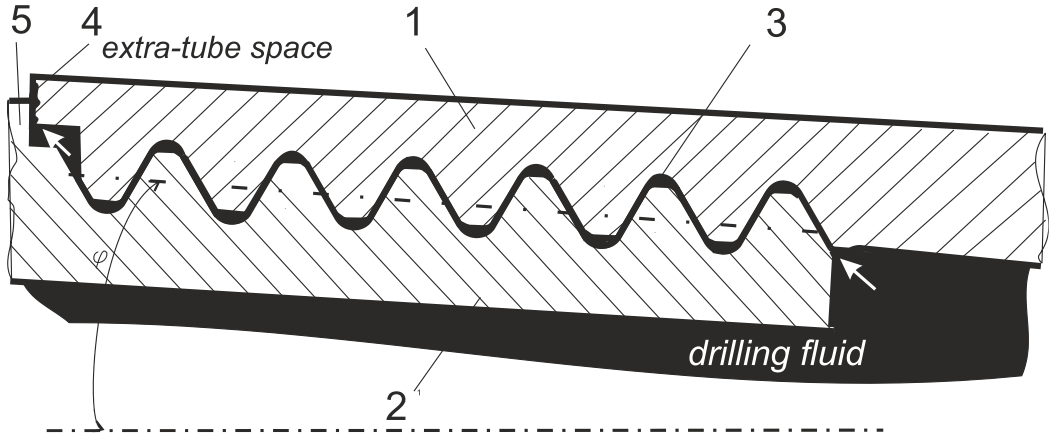

Fig. 1. Existence of the technological gap between the nipple and the box in the drill string connection

This gap has the form of a screw, and in cross section its height reaches according to standard API7 - 0,43 mm. Computer studies based on the application of the Float Simulation application show a rather small pressure drop along the helical line of this gap. If the cross section of the screw channel is reduced so that the height does not exceed 0.15 mm, it will lead to significant changes in the pressure distribution in the screw gap [2] in the case of the initial stage of loss of tightness in the drill string tool joint. If at the beginning of it (look at fig 2, cross section III), that is, inside the drill pipe, the pressure is 20 MPa, then at the level of the first turn of the

box thread (look at fig 2, cross section II) it may be less than 1 MPa [2].

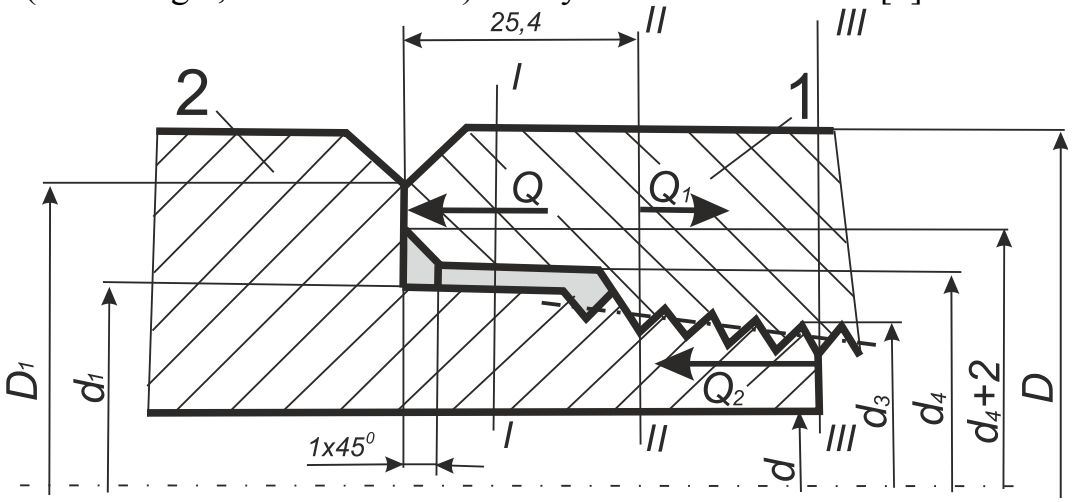

Fig 2. Scheme of the distribution of the clamping force components in the screwed state of the drill tool joint

As a rule, when the signs of initial depressurization appear for drill pipes connecting the more torque is used. This leads to a further effect on the end surfaces of the tool joint and plastic deformation on ones. This deformation causes the transition to a further stage of depressurization and the corresponding need to apply even more tightening torque. This may occur as long as the yield strength of the drill pipe material allow. In the case of applying a screw gap height of 0.15 mm, force Q_1 (cross section II) opposing the clamping force Q of the box and the pin in (cross section I) is minimal due to the reduction of pressure from 20 to 1 Mpa. this eliminates the need for additional pressure between the end surfaces of the of the pin and the box, and thus eliminates the problem of increasing the plastic deformation of the contact surfaces and further depressurization.

References:

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