Impression block with orientator

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Abstract. Tool review, namely the impression block, applied to check the shape and size of the top of fish as well as to determine the appropriate tool for fishing operation was realized. For multiple application and obtaining of the impress depth of 3 cm and more, the standard volumetric impression blocks with fix rods are used. However, the registered impress of fish is not oriented in space and the rods during fishing are in the extended position. This leads to rods deformation and sinking due to accidental impacts of impression block over the borehole irregularity and finally results in faulty detection of the top end of fishing object in hole. The impression blocks with copy rods and fixed magnetic needle allow estimating the object configuration and fix the position of magnetic needle determining the position of the top end of object in hole. However, the magnetic needle fixation is realized in staged and the rods are in extended position during fishing operations as well as it is in standard design. The most efficient tool is the impression block with copy rods which directs the examined object in the borehole during readings of magnetic needles data from azimuth plate and averaging of readings. This significantly increases the accuracy of fishing toll direction. The rods during fishing are located in the body and extended only when they reach the top of fishing object.

1. Introduction
A wide range of different impression blocks are used to determine dimension, configuration, condition (of drilling bit, cutter, etc) and location of the top end of fishing object in the borehole.

The lead impression blocks or alloy impression blocks (the materials consist of aluminium 90 – 98.5\% and antimony 1.5 -2\% and others) are applied to get impress of the frontal surface of the objects which are inside the borehole. Good-quality impresses are taken by the impression blocks made of material with high plastic properties of the following content: 45-50\% of aluminium powder, 18-27\% of ethoxyline resin, 15-20\% of castor oil and 10-12\% of stearin [1].

To get a frontal impress it is necessary to design reinforcing wires which will be 2-3 mm lower than the height of the impression block or mastic foundation before filling it up with lead or other binding materials over the working surface. After that the impression block is filled with the material which allows getting the impress. The flat impression block should not have borders outstanding the body otherwise it could run out of operation causing more serious accidents. The applied impression blocks of this type are usually of single use and allow getting only shallow non-orientable impress. At that if a broken tool has sharp edges, some parts of the impression blocks could be left in a well.

2. Methods
The standard volumetric impression blocks (SVB) with the diameter from 112 to 370 mm are applied for multiple use and taking the impress of 3 cm in depth and more [1]. SVB particularities lie in the
possibilities of multiple applications and getting the impress with the help of the extended rods (figure 1). Before running into the well, the impression block is joined to a drill string, at that it is necessary to check the absence of rod displacement.

It is necessary to run the impression block accurately into the well especially after running the casing shoe. Upon reaching the place of impress taking, the load of 20-50 kN is created on a drill string. After reaching the fishing object which is inside the well, the rods begin to run up, then fix and copy the shape of the upper part of fishing object. The disadvantage of the impression block application is that the rods are in extended position during run. This could lead to deformation and loosing of rod due to accidental impacts of impression block over the borehole irregularity, which could result in faulty detection of the top end of a fish object. Besides, the impress is not oriented inside the well.

There is an impression block which has a body with watercourse and a connection thread for the drill string (figure 2) [2]. The lower part of the body has a flange which is connected with a fixed plate having a hollow rod. The plate has an elastic packing and a disk with equally located and matched holes in which copy rods are installed capable to run up. Extended copy rods are retained by elastic packing (with the diameter of holes less than that of the copy rod) before running into a well.

The hollow rod has a magnetic needle, with the holders, floating in liquid, placed in a leakproof annular camera limited by: disk 5, flange 4 and a transparent body side part.
During failure investigation the impression blocks with preliminarily extended copy rods run down the borehole and fluid is started to be pumped through a drill string to wash the cutting away cleaning the fishing object. Then the impression block is lowered to the fishing object and copy rods run up copying the object configuration by their ends, at that the upper ends with heads fix the position of magnetic needle. After that, the impression block is lifted from the well and the magnetic needle is matched with the direction of magnetic meridian in order to fix the position and shape of fishing object.

The disadvantages of the equipment lies in inaccuracy of fishing objects azimuthal location assessment, as during running up of copy rod, displacement of the magnetic needle (fixed by the rod) could occur due to the fact that rods fix the magnetic needle not gradually, but in stages according to the rare placement of rods.

Besides, the rods during well run are in the expended position which leads to deformation or loosing of rod in the well.

3. Results
The offered impression block (figure 3) is intended to increase reliability and efficiency of fishing operations by obtaining of volumetric impress and azimuthal location detection of fishing object inside a well, at that protecting copy rods from deformation during well run [3].

The impression block consists of upper 1 and lower 2 parts of a split body which has a spring hollow bushing 3 inside to forming together with pusher-disk 4 a mechanism to run in/out of operation the copy rods 5.

The main parts of copy tool – copy rods 5 installed in the holes of backing disk 6 and run through elastic packing 7 and guide disk 8, which together with packing 7 and base disk 6 is attached to the upper part of body 1 by tightening screws 9 and bushing 10. Disks 4, 6, 8 and packing 7 are made with a central hole through which runs a washing tube 11, connected with pusher disk 4 and rod 3.

The lower part of body 2 has a row of cameras 12 (not less than 3) filled with liquid where cylindrical fitting elements 13 with limb (outer ring) 14 in their upper ends are installed. Upper 15 and lower 16 axes for magnetic needles 17 fixation are installed in the central part of the fitting elements. Relatively to magnetic needles 17, in the lower part of body 2 with an exit to the lower part of cameras 12, holes 18 are located under needles 17 and thus attached by spring connecting rods 19 above pusher disk 4. To the upper end of connecting rods 19, elastic retainers 20 are fixed, which have the central hole intended for lower axis 16 of the magnetic needle. The upper part of cameras 12 has a reamer 21 with plug 22 and is covered with cap 23 made from the transparent material.

Control sphere 24 is essential for impression block operating. Hole 25 is intended for liquid release from the tool during its run to the surface after the investigation.

Before running into a well, rods 5 are installed in initial position along the lower border of guide disk 8, at that disk 4 blocks the magnetic needles by retainers 20 through spring connecting rods 19. Cameras 12 and reamer 21 are filled with transparent liquid. The impression block is attached to a drill string and is lowered to the place of impress taking. When the impression block runs into the well, well washing is started to remove the cutting in order to clean the fishing object. Then the control sphere 24 is placed into the tool. It delivers the impression block under its own weight and flow of liquid. Then under the liquid pressure, the rod 3 runs down compressing the spring and moving pusher disk 4 into the lower position. Disk 4 moves rods 5 to lower operating position and simultaneously spreads the magnetic needles during rods 19 moving to the lower position under the strings influence. The tool is left steady (for some period of time) without pressure of liquid in order to still magnetic needles. Then fluid injection is stopped and the system (connecting rod 3 and disk 4) returns to initial position under the string influence. Disk 4 moves connecting rods 19 up fixing
the magnetic needle position. After that the impression block covers the fishing object and is loaded with the drill string weight.

**Figure 3.** The impression block with orientator

- a – layout of the impression block (profile plan), b – the impression block (cross sectional drawing with cameras and magnetic needle), c – camera with magnetic needle (cross-section)
- 1 – upper part of the split body, 2 – lower part of the split body, 3 – spring hollow bushing, 4 – pusher, 5 – copy rods, 6 – holes of backing disk, 7 – elastic packing, 8 – guide disk, 9 – tightening screws, 10 – bushing, 11 – washing tube, 12 – camera, 13 – fitting element, 14 – limb (outer ring), 15 – upper semiaxis, 16 – lower semiaxis, 17 – magnetic needle, 18 – hole, 19 – rod, 20 – retainer, 21 – reamer, 22 – plug, 23 – cap, 24 – control sphere, 25 – hole.
Rods 5 during interaction with the fishing object move copying its configuration. When rods 5 run up to the surface, they keep their new configuration due to flexible elastic packing 7 in the holes of which they are fixed. The guiding of the fishing object inside the well is realizes after matching of the magnetic needles with magnetic meridian direction during readings of magnetic needles data from azimuth plate and averaging of readings to increase the guide accuracy. For further tool application it is necessary to press the tool over the horizontal surface for putting rods 5 to the lower part of guide disk 8.

**Conclusion**

The present impression block allows:
- defining precisely the azimuthal projection of fishing object inside the well;
- avoiding copy rods deformation in the process of running inside the well as well as deformation and displacement of the magnetic needles during their fixation in definite position.

All the above mentioned provides the reliable impression block operation and high efficiency of well investigation.

**References**

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