Development and Application of Intelligent Environmental Protection Testing Sealer

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Abstract: Intelligent environmental protection testing sealer is a new type of cable sealer. It is designed for the serious leakage of original testing sealer of injection wells, difficulty to operate of the down-hole equipment and other issues. Air-core motor resistance self-styled technology, sealed packing anti-partial wear technology, auxiliary salvaging technology and intelligent controlling motor technology are used to not only solve the original types of injection wells test sealer's serious leakage, but also the operating difficulty of high efficiency measurement equipment. The problem that free climbing lubricator technology can't adjust the plug manually and be applied to a large area is solved as well. Field application so far, the instrument successfully carried outrunning-pulling operation, the closed test and intelligent controlling. After 10 minutes of power, the main body temperature of the sealer can reach about 30℃. In the winter test, the freezing situation of the test plug will not appear and the test team's measurement efficiency is improving. The device extends the service life of the cable and enables significant economic benefits.

Introduction

The testing sealer is mainly composed of four parts, as illustrated in Figure 1: First, the spray prevention part, consisting of the main sealed shell, two pressure relief baffle, three pressure relief ring, self-sealing column and shell pressure relief valve.Second, anti-partial wear part, consisting of the gland, two support ring and a self-sealing top column. And all of these are equipped with precious metal linear bearings Third, the resistance part, consisting of the self-sealing column, electromagnetic motor, control module, wireless transceiver module, external power supply composition. Last, auxiliary salvage part. See Fig.1.

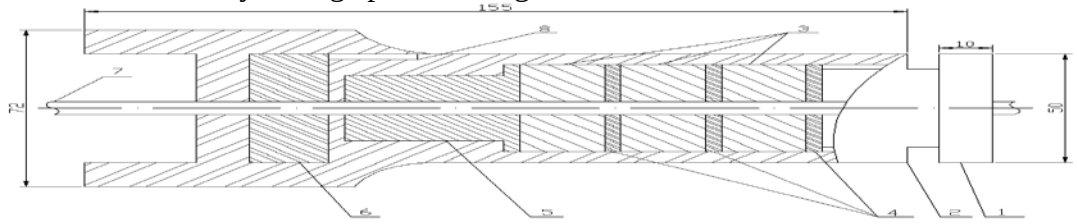

Fig.1 Schematic diagram of the intelligent environmental protection testing sealer

Illustrated description:1, screw gland 2, shell 3, seal gasket 4, block ring 5, self-sealing top column 6, motor 7, test cable 8, motor terminal

Performance and Characteristics of Intelligent Environmental protection Testing Sealers

The testing sealer is a versatile blowout testing air core motor cable sealer with the following features:

(1) The gasket, motor, thread gland are middle hollow structure and testing wire or cable can pass them. The sealer is suitable for not only steel wire, but also cable, with a high compatibility.

(2) Compared with the one-piece gasket structure, the sealing of the three-gasket structure is more uniform. The design of the conical mating structure makes the gasket easier to gather inwardly,

thus improving the sealing effect of the device, improving the pressure capacity of the sealer and realizing the closed test.

(3) The sealer is designed with tubing threads. When used, it can be directly connected to the nozzle through the tubing thread, no need to transfer with the connector.

(4) Using the motor as a power source, electronic control of the setting and unsetting process achieve. Control personnel effectively control motor to start and stop through the wired or wireless switch on the ground. Whenever the wire or cable does not go well, the motor can be stopped by the switch. So that the packing re-seal, the inner diameter of the wire channel in the testing sealer increase and the wire or cable can be successfully ran. And then the packing is settee through the switch to control motor to achieve closed test. This avoids the security risks brought by climbing high-level platform and improve the work efficiency.

(5) 10 minutes after the power, the main body temperature of the sealer can reach about 30℃.So the case of frozen plug will not appear in winter test and the measurement efficiency is improved greatly.

Analysis of Field Application Effect

The new type of sealer was put into field test in March 2015 and has applied 10 sets of equipment to test 236 wells which included 76 wells to verify the anti-spray seal and anti-seal seal and 160 wells to verify the anti-wear and sealing life. Field application so far, the new environmental protection testing sealers all is ran and pulled smoothly. Closed test achieve in the armor cable testing process and the pressure rise only 0.2-0.3MPa. 10 minutes after the power, the temperature of sealers' main body reached about 30℃. The case of frozen plug never appear. In addition, the use of the sealers can eliminate the impact from replacing the packing or tightening plug due to the large amount of plug leakage in the past on testing efficiency. And each team can test 1.5 times more per month. The relief valve leakage slightly when the instruments are ran and pulled, but the loss is less than 1m^3/d. Sealing packing is used in more than 30 wells to be replaced and the operating life of armored cable is extended from the average of 6 months to 24 months or more. Around 22 accident wells caused by armored cable drop or card are reduced per year. Specific tests are as follows.

Anti - spray sealing technology to reduce sealer leakage. The testing sealer is mainly consist of the two-step decompression retainer and the same three wear-resistant packing components and self-sealing top column. In the test, the self-sealing column uses the fluid pressure in the wellhead to push the packing to achieve decompression seal from top to bottom and step by step. The average single well overflow of the 76 wells that used the sealer was only 0.93 m^3/d, which was lower than that of the conventional sealer by 0.67 m^3/d. This is environmentally friendly and can be recycled in plastic drums. (As shown in table 1).

Anti-wear sealing technology to extend the service life of seals. We know that the armored cable has a helical linear motion when it pass the inside of the testing sealer during the running and pulling of the instrument. In order to verify the wear and tear of the packing and cable, verify the reliability of the retainer and the linear bearing., the four sealers were tested for winter and summer wearing test In 2015 (see Table 2 for the testing data). Tests show that each sealer can test an average of 48 wells per summer, and each tank can be used to test an average of 32 wells per winter. While the original sealer only test 8 wells sealing packing before must being replaced. Thus, the new sealing packing's operation life is much longer than the original sealer.

Table 1 Comparison of Leakage of New Sealers

injection flow rate	Wellhead pressure			Average leakage of single well（m^3/d)	
	≤8.0MPa	8.1MPa～11.9MPa	≥12.0MPa	Original sealer	New sealer
≤80m^3	10	6	2	1.6	0.7
81m^3～119m^3	7	10	11	3.6	0.9
≥120m^3	3	12	15	5.0	1.1
total	20	28	28		
average				3.6	0.93

Table 2 Comparison of anti-wear tests for new sealers

classification	Number of sealers	Number of wells	Aperture changes caused by retainer wearing(mm)		Degree of Packing wearing	Loss of overflow
			before	after		
Summer	2	96	2.50 mm	2.65 mm	serious	Loss is greater than 2m^3/d
winter	2	64	2.50 mm	2.71 mm	serious	Loss is greater than 2m3/d

Resistive sealing technology to shorten the running time of the instrument, improve the success rate of running down.Whether the test equipment can be decentralized quickly is the main indicator to check whether the testing sealer is developed successfully. And the most critical parts is the distance from the wellhead to 200 meters depth. When the test equipment is decentralized, the frictional resistance of the sealing packing increase due to the self-sealing pressure inside the testing sealing plug, resulting in difficulties in the testing instrument entry. Sometimes it is needed to manually run the wire by more than 200m, bringing great difficulty to the field test. The success rate of the original sealer was only 71.4%. As can be seen from the table below, the success rate of the new testing sealer being sent on one trip to 96.3% and the success rate is greatly improved.

Through the 76 wells track testing records, we found that the time used by the instrument to be sent to 200m from wellhead and the success rate of the instrument being sent on one trip have an important relationship with wellhead water injection pressure. The higher the water injection pressure, the harder to run, the longer the time, the lower the success rate. The amount of overflow caused by the instrument is also related to the injection pressure, and the amount of overflow caused by the increase of the water injection pressure also increases (see Table 3).

Table 3 Comparison of the average time of the new sealer to be sent to 200m depth

Wellhead pressure	Number of wells	time of the new sealer to be sent to 200m depth(min)	Once down to succeed		twice down to succeed		Amount of Overflow (m^3/d)
			well	Success rate （%）	well	Success rate（%）	
≤8.0MPa	20	5.0	20	100.0			0.7
8.1MPa～11.9MPa	28	5.8	27	96.4	1	100.0	0.8
≥12.0MPa	28	7.6	26	92.9	2	100.0	1.2
Total	76		73	96.1	3	100.0	
Average		6.2		96.3		100.0	0.93

Conclusion

(1) Intelligent environmental testing sealers adopt three-gasket structure and the design of conical mating structure makes the gasket easier to gather inwardly. These features improve the sealing effect of the device, realize the closed test, improve the quality of the test data, and lay the foundation for improving the oilfield development effect.

(2) The intelligent environmental protection sealer uses the motor as the power source to achieve the electronic control of setting and unsetting process , to ensure the wire or cable running smoothly, avoid the security risks of climbing high-platform to tighten testing plug , improve work efficiency.

Reference

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