STUDY OF TUBING REPAIRING TECHNOLOGY IN DAQING OILFIELD

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Abstract

Tubing always works in the complicated environment which contains different mediums such as oil, gas,water, wax, and sand, etc. The abrasion and corrosion phenomena of the operating condition are also very serious and popular. This paper studys the failure analysis of tubing and summarizes the tubing repairing techniques currently applied in Daqing Oilfield. Based on the above study, the economic benefit of the tubing repairing in Daqing Oilfield was also presented. There was a significant strategy sense and economic sense that induced advanced surperficial engineering technique to the field of tubing remanufacturing.

Keywords:tubing;rapair;antisepticize;remanufacturing

1 Introduction

The failure problem of tubing is a big problem which is widely existed and has been puzzled the oilfield production for a long time. Especially in recent years when Daqing Oilfield goes into the high water exploration stage, the failure of tubing happened more frequently, it brought an important influence in normal production, it does not only increase a great deal of operation cost, make the crude oil's cost increase, make the benefit descend, but also influence the production of crude oil, it bring a lot of difficulties to production management.

At present，Daqing Oilfield has more than 60,000 oil-water wells,from these 60 thousands more wells Daqing Oilfield replace 5,000,000m wasted tubing every year, each year it will not only increase production investment,but also need larger stock site and more management staff. By now, there is totally 6,440,000m wasted tubing in the entire oilfield, meanwhile, there are 6,000 wells increasing every year, the wasted tubing and production investment is also increasing every year. Therefore, with the research results and successful experience of green remanufacturing technology received in military territory and automobile territory, refering to the concrete situation and present repairing technology, to develop and consummate the own remanufacturing innovation technology, decreasing the consumption of the resource, decreasing the environment pollution, saving the repairing cost, realizing the cyclic reutilizing of the mechanical production equipment.

2 Problems of a great quantity of wasted tubing

2.1 The wasted amount of the tubing is amazing

With the Oilfield steping into the high water exploration stage，the wasted amount of the tubing is increasing, it doesn't result the waste of the resource and environment pollution, but also influence the supply of the crude oil, bring lots of difficulties of the production management.

Until 10,12th,2006, the total amount of the present using tubing is 60,200,000m, the amount of the tubing which is serviced over 8 years is 269,430,000m, is 44.8% of the total amount. The total amount of the wasted tubing in stock is 6,440,000m, among them there is 3,147,000m waiting for wasting, there is 3,293,000m waiting for repairing. The amount of repairing and application in 2006 is 2,633,000m, there is 1,096,000m modifying the wasted tubing into other use.

2.2 The endanger of unsuitably handle of the wasted tubing

(1)threaten mankind health: compared with common solid garbage ,wasted tubing probably has the harmful chemicals, if handle it unsuitably ,the harmful substance may enter into the humanbody through breathing, food link even skin , seriously threaten the health of mankind.

(2)pollute the nature environment: because lack of effective management and scientific treatment method, some of the tubing directly expose the environment by the wind and the sun, or landfill with the common life garbage ,make the air, earth and water to be seriously polluted, make the negative effect to the ecologic environment.

(3) occupy lots of earth: stacking the wasted tubing as their pleases, it is not only destroy the beautiful sight of the environment,but also occupy lots of earth.

(4) constitute the safety incipient fault: for lack of effective control of the tubing, that makes some of the tubing that ought to abandon continue using unscientifically, it doesn't only overage wasting the energy, noise interference, environment pollution etc., moreover, it is easy to generate the accident which is directly harming mankind safety.

3 Reason and analysis of the tubing failure

Tubing always works in the complicated environment which contains oil, gas, water, polymer, and stands the fluid column force, friction, alternate load, it causes the connection screw dropout, wearing , corrosion, , scaling, fatiguing broken, the analysis of the main reason like the following:

3.1 Connection screw dropout

The connection of the downhole tubing is completed with the screw , the quality of the screw connection, directly influence the using effect of the downhole tubing, the main reason of dropout is that:

(1)as the wear of the present screw using in the downhole is serious, it makes the interspace between the male thread and the female thread increasing, although using the sealant , with the affect of the thousands of the alternate load every day, it will generate the interspace and makes the screw infiltrating water, and finally result the screw dropout.

(2)The effect of the dynamic load to the dropout is significant. The faster the frequency of stroke is, the more the indicator diagram loads fluctuation is, and the fluctuation scope is increasing, thus it make the tubing dropout. Moreover, with the depth of the fluid level increasing, the larger the fluid column pressure difference which the tubing screw stand , the higher the proportion that the tubing screw with default dropout.

3.2 Dropout result by rod and tubing eccentric wear

As between the plunger and pump-barrel exist the friction, and it is large, the wear of the pump is increasing; the dropout amount of the pump is increasing, the service life is shorten; the effective stroke of the pump is shorten; the pump efficiency decreasing, that influence the production ; the forced situation become worse; the energy consumption is increasing ,the system efficiency is decreasing. On the down stroke ,the sucker rod bend to friction with tubing, that result the rod and tubing eccentric wear .

3.3 Tubing corrosion

During the exploit and production process of the oil well, as the formation liquid has the corrosion medium such as hydrogen sulfide, carbon dioxide, water and microbe, it result most of the tubing generate the corrosion, afterwards to take a sample and analysis with the corrosion environment, the principal factor that influence the tubing corrosion is H_2S, CO_2, Cl^- and the three factors result coordination .

3.4 Scaling of the tubing

The scaling of the tubing could result the formation production decline , shaft pump jamming, broken off frequently , pump detection period shorten and gathering jamming, so that it increase the difficulty of the field management, the cost of stop production , clean the pipeline is also increasing. There are many factors influence the scaling, including CO_2, temperature, pressure, Cl^-, SO_4^{2-}, dissolve oxygen, production liquid fluid condition etc., but the main factor is that the production liquid has abundant Ca^{2+}, HCO_3^-, Cl^- and the CO_2 in the associated gas of the crude oil is a lot.

Until April 2005, the proportion of the pump detection wells that due to the tubing problems is 1/3 of the total numbers, the pump detection period is shorten ,it directly result every cost including materials cost, workover operation cost and working cost with large scope increasing, that make a huge economic loss.

4 Present repairing technology of the tubing

Technological process of repairing tubing is shown in the following figure:

Repairing process's feature:

(1)Adopting high pressure water jet to clean the tubing, after cleaning the surface of the tubing doesn't has oil contamination, the water could be circulately use, saving the energy , protect the environment.

(2)Each tubing adopting pneumatic going devil, the incompetence one resolutely doesn't draft into the next circuit, to ensure the repaired tubing has no jamming.

(3)After going devil, the competence tubing will be detected a flaw, and marking it to classify utilize, the one overtake the standard requirement will be decided wasted, doesn't draft into the next circuit.

(4)The screw process of the tubing adopts the digital control pipe thread lathe to process, and every tubing will be sliced and thread once more, in order to ensure the tubing screw meet the requirement of GB/T 9253.2-1999,the process, measurement and testing standard of oil natural gas industry casing , tubing and pipescrew .

(5)To mark the repaired tubing, in order to retrieve it later.

(6)Adopting multi-tubing pressure test machine to test according to the standard requirement the tubing entering this circuit , the competence one could draft into the next circuit.

Repairing technology has two preponderance: ①Adopting assembly leakage tubing harmless detecting equipment, the default of the tubing reflects clearly; ②Apply the digital control lathe to repair the screw, the stability of the repaired screw is better.

5 Present antiseptic technology of the tubing

At present ,the antiseptic technology which is applied in home and abroad is the following :

(1)Nickel phosphorus dipping method:

The cost of this method is high, the index of the preceding treatment requirement is high. When the thickness of the coating is 60 μm , and the preceding treatment is acceptable, the binding force and the antiseptic performance is better. On the situation that controlling the cost, the thickness of the coating is thin, (more than 60 μm in petrify system, and more than 25 μm in oilfield system)it consequently has pinhole when the coating is thin and doesn't achieve the technology index, for the coating belong to negative pole, it will react big positive electrode and small negative electrode, accelerating the corrosion of the tubing.

（2）organic coating method:

the thickness of the coating is thick, and it is fine and close, the material of the coating itself has the strong capability of antiseptic.at present it has a certain market, but it expose some problems during the using, the organic coating become ageing after a long time ,and the coating is differ with tubing on the physics and chemistry parameters, it is bad to the shape resistance, delamination capability , the fragments of the delamination may jam the flooding opening or jam the reservoir, so the organic coating tubing is applicable to the earth surface gathering environment which is high antiseptic, the steady pipeline, the small deformation. However ,the tubing is always in downhole operation, handling and transporting condition, always stand by the tensile stress and extend stress, but the antiseptic of the screw joint is hard to resolve, so the organic coating method is not applicable to tubing antiseptic.

(1) three layers composite coating method and pipe-in-pipe method(stainless steel neck bush or glassteel neck bush):

After the Nickel phosphorus dipping, and then make the tubing generate "down"in the strong corrosion liquid, then dipping paint, mainly used to antiscale, the cost of the method is high, and the expansion factor and tensile-extend deformation parameters of the surface paint is different, it is not applicable to the motion condition ,it is easy to make the paint membrane full of cracks or delamination,pip-in-pipe method could not meet the requirement of the tubing antiseptic in screw antiseptic, technology process, the binding area with the base, repairing capability, self protect capability after wearing, cost, oil/water well operation etc.

From the above we know, to the oilfield tubing ,the main antiseptic method is nickel phosphorus dipping method, organic coating method, three layers composite coating method and pipe-in-pipe method， but in the practice application there is some of default, for that all these method belong to surface isolation, with the outside force ,the antiseptic layer would be broken and stripping, therefore,in order to resolve the high dependability, low cost problem with the antiseptic of the tubing, Daqing Beiyou foundation company create a set of three in one "material protect +isolate protect+ electrochemistry protect" alloyed nanometer proofing plating tubing, it has the good performance of the antiseptic and attack resistance , the most excellent merit is that its coating and tubing base mix together perfectly, so that it could make good to the corrosion pit and mini crack etc. default. Through this technology , the tubing which could not use in downhole ,with the treatment could apply on the earth surface pipeline, the feature may significantly improve the repairing utilizing rate of the wasted tubing, and it could save a lot of purchase capital
of the surface pipeline, it has the very good application foreground.

(4)The technology of alloyed nanometer proofing plating

Since it is serious that the superficial corruption of some wasted tubing, the coarseness is also great . in order to decrease the deposit rate of the filth, rate of paraffin deposition, rate of scaling and coarseness, based on the alloy layer, then coating epoxy nanometer dope inside the tubing, to create the chemical bond between coating layer and alloy layer. Moreover,by using homogen handling installation which is well-developed domestic to rotate the coated tubing, to provent berm appearance when it is motionless, to avoid sag appearance, allow the coating of the entire tubing inside incline ideal plane, thereby fills the corruption pit, declines the superficial coarseness, declines the friction coefficient, make the coating finer and closer, so as to improve the film forming quality, achieving the face smoothly like the mirror. After composite dipping, the operating performance of alloying composite dipping antiseptic tubing come to the optimum condition, it doesn't only significantly improve the antiseptic property, mechanical strength, but also significantly improve paraffin control property, scale control property, improve the glossy quality of hydraulic power, to exploit the reuse property of wasted tubing better, thereby.

Alloyed composite coating tubing has the following significant feature：

(1)Adhesion is powerful. Alloy coating combine with iron base is in the interest of metallurgy., in the corrosion environment, it won't happen blistering and denudation.

(2) The outward of alloy coating is unmixed Zn coating, so it is pliable, it could buffer the collision to the tubing during transportation and building process, decreasing the deformation rate of tubing; however, the inward hardness of Zn-Fe alloy layer is high, the crashworthy and wear resistance are both powerful.

(3) Not only the alloy coating may act as segregation and protection, but also it has the electrochemistry protection.

(4) The superficial fault of alloyed tubing is restored by the growth of phase, it offers some of decided wasted tubing with utilize value once more.

(5) Composite coating has the more outstanding chemistry stability than the common coating ,the paraffin control property, scale control property is better.

6 The economic benefit analysis of the tubing repairing

At present, Daqing oilfield has more than 60,000 wells on production , the total utilizing amount of the tubing is 60,200,000m, and now it has wasted tubing 6,440,000m in stock, the worthless tubing is 2,540,000m, moreover, there is 6000 new wells
increasing, according to the average depth of the well is 1200m to calculate , it will need 6,000,000m tubing ,now the repairing factories could repair wasted tubing 2,600,000m, according to 500yuan per meter to calculate, adopting the advanced repairing technology, it could save nearly 1.3billion yuan for oilfield.

The consummate repairing technology process production line has the huge affect to improve the quality of the tubing, to decrease the operation number caused by the quality of the tubing, to save the detect operation cost, to decrease the tubing accident rate and prolong pump inspection cycle, therefore ,repairing technology of the tubing is the key factor to realize the oilfield sustainable development , to cost cutting of the oilfield exploit.

7 Conclusion

(1) The tubing has the specific gravity in raw material of the downhole operation, the repairing utilizing rate is high, to improve the quality of the repaired tubing has the significant function to decrease the cost of the downhole operation.
(2)With the difficulty of the cost control increasing, especially the recent two years, the price of the steel is increasing widely, however there are lots of tubing in stock, the potension potential capacity is large.
(3) Daqing Oilfield has many tubing repairing and the antiseptic tubing factory ,the production level is different. Especially lack of relative quality standard and testing method about tubing in the recent years, the quality problem is always discovered during the operation, it seriously affect the operation quality.
(4)With the successful application of remanufacturing technology in military territory and automobile territory, through the way of production, learning and study join together , display the independent innovation, make definite of the competent department, sort out the policy mechanism, strengthen the study dynamics, bring the advanced superficial engeering technology into the tubing remanufacturing territory, it has the significant sense to drive outcome transforming and to drive the industrialization development of remanufacturing.

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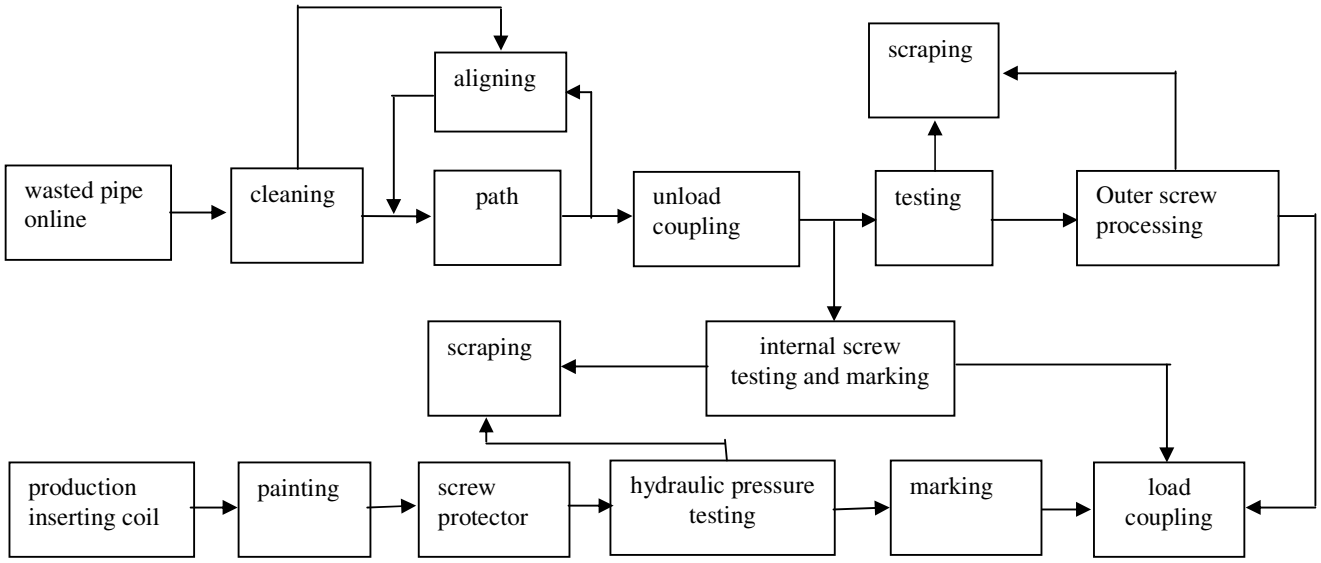

Figure 1 repairing technology processing of tubing