

Self-Rotation to Run Casing and Vibration Cementing Technology

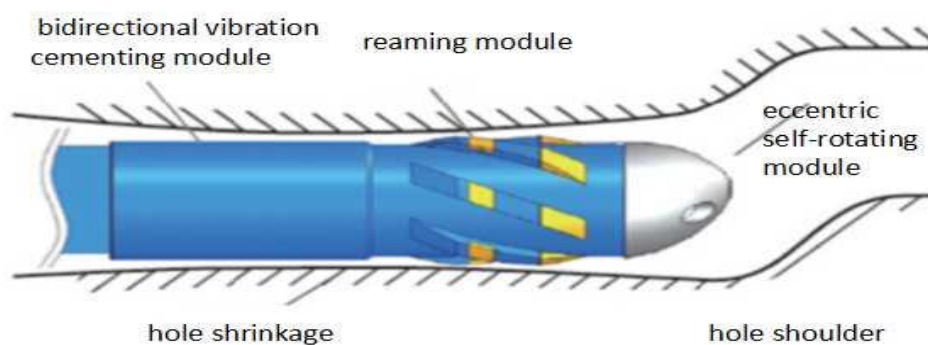
1 Research Background

The formation pressure system of the old oil field is seriously damaged in the process of continuous waterflood recovery, resulting in the existence of multiple pressure systems in the same well, which will have a serious impact on the cementing quality of the adjustment well. Take Liaohe oilfield as an example, it entered the stable phase after 40 years of development. In order to fully exploit reserves, a number of adjustment wells will be drilled in the old oilwell block every year. After waterflooding development, formation pressure system of the old block disorder, easy to produce water invasion, lost circulation and so on all sorts of problems, lead to narrow density window and high difficulty for cementing operation and also higher requirements for the cementing quality.

Anton vibration cementing technology, as a matching technology to improve cementing bonding quality, in combination with the cementing quality problems, technical difficulties, influencing factors, cement slurry performance and cementing method, has been widely applied and improved in China and has achieved good results. The self-rotation running casing tool is designed to supply support to run casing to bottom in a variety of well conditions and all kinds of casings.

2 Technology Introduction

Self-rotation to run casing and vibration cementing technology is mainly composed of eccentric spin module, reaming module, vibration cementing modules. Eccentric self-rotating and reaming module is used to solve the problem of running casing difficultly before cementing, and vibration cementing module is used to solve the problem of low displacement efficiency and poor cementing quality in the special section such as horizontal section and high deviation section.



Tool structure diagram

Tool Structure



Self-rotation to run casing tool structure diagram

Tool Parameter

Casing Size	Max. OD (mm)	Drift inside (mm)	Diameter casing	Total Length (mm)	Weight(kg)
9 5/8"	270	220		1350	128
7"	195	156		1200	98
5 1/2"	154	120		1000	65
5"	142	108		960	55
4"	116	83		960	43

working principle

The eccentric self-rotating module is mainly composed of eccentric rotating head and fixed sleeve, which the eccentric rotating head can rotate freely. Due to its special eccentric angle design, it can realize the force imbalance when it encounters resistance, and then rotate under the reaction of resistance, and guide the casing string to cross the

obstacle at the most appropriate angle.

The reaming module can reduce friction through circulating drilling fluid to drive the reaming sub to rotate during running the casing string. The surface of the module is embedded with tungsten carbide for reaming to reduce the running resistance of the casing string when running the casing.

The bidirectional vibration cementing tool is mainly composed of radial vibration wave generator and axial vibration wave generator. The radial vibration wave generator adopts the turbine principle, producing radial vibration wave by centrifugal force. The axial vibration generator adopts the principle of water shock, producing high amplitude axial vibration wave by the effect of water shock. Vibration wave can act energy into the medium, destroy the interparticle and intermolecular structure of the medium, change its original physical and chemical properties, and intervene in some reaction processes. Then, the drilling fluid at the narrow edge of the annulus will be completely displaced. Especially combined with the use of cyclone generator or cyclone rigid centralizer, the cementing displacement efficiency can be significantly improved.

➤ **Operation Procedure**

- (1) Wiper trip according to drilling design before running casing to ensure that well diameter is regular. ;
- (2) Pump lubricant last wiper trip to minimize string friction.
- (3) Connect the quick circulation head and circulate more than 30 minutes before running casing to point A.
- (4) The friction will increase obviously after the casing string run into the horizontal section. In case of resistance, move casing up and down to drive the self-rotating casing tool to rotate freely through the resistance point.
- (5) If two consecutive casings need to be moved up and down for 1-2 times to pass during run casing, connect the quick circulation head for circulation.
- (6) If there is no resistance in two consecutive casings, remove the quick circulation head and continue running the casing normally.
- (7) If the move casing for 3-4 times and still cannot pass through the resistance point, pull out the top casing, put it in the rat hole and connect the quick circulation head for

circulation. When the two casings are continuously run without resistance, remove the quick circulation head and continue to run the casing normally.

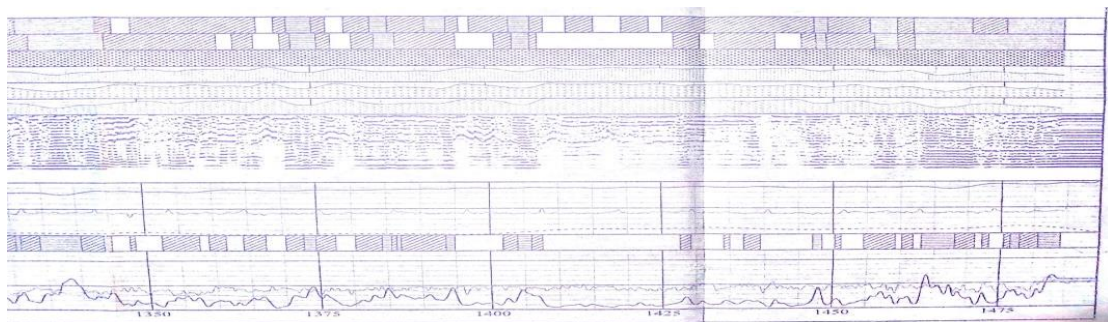
- (8) The vibration cementing module are self-initiated to generate radial and axial vibration waves during cementing to improve annulus displacement efficiency.

➤ Technical Features

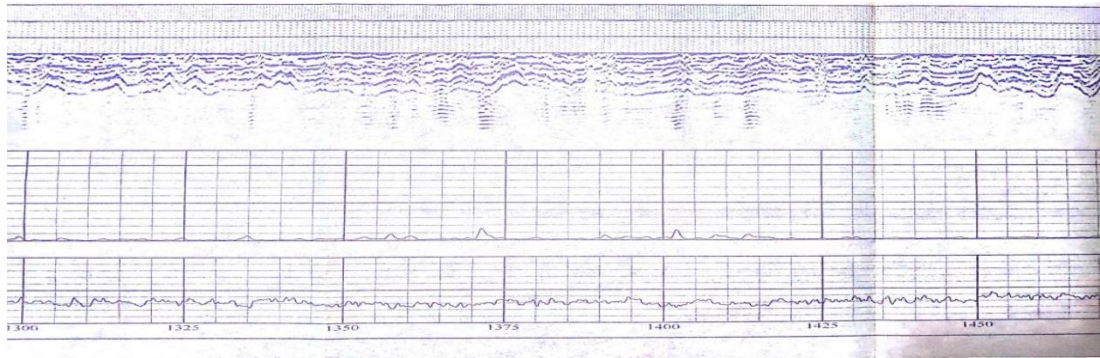
- (1) During running casing, the rotation module rotates freely to avoid obstacles.
- (2) Circulate drilling fluid to drive hole drilling and reaming module by hydraulic pressure, dressing hole and break the obstruction points.
- (3) The vibration module generates radial and axial vibration waves during cementing to improve displacement efficiency.
- (4) High reliability, easy installation, simple operation, widely used in the vertical well, directional well, horizontal well cementing.
- (5) Good temperature resistance, up to 160°C
- (6) The tool is drillable.

3 The Application Case

Since the application of vibration cementing module in Liaohe oilfield, more than 100 wells have been applied, and no accident has occurred. The cementing quality has been recognized by oil production plant of client, and the technology is still being promoted and applied. The following is a effect comparison of the vibration cementing technology used in Wa** block of Jinhai oil production plant in Liaohe oilfield. It is obvious that the cementing quality of the reservoir section is mainly medium or poor without the technology, and the cementing quality is not ideal. In the following picture, the cementing quality of the reservoir section is good with the technology, which provides a strong guarantee for later oil and gas development.



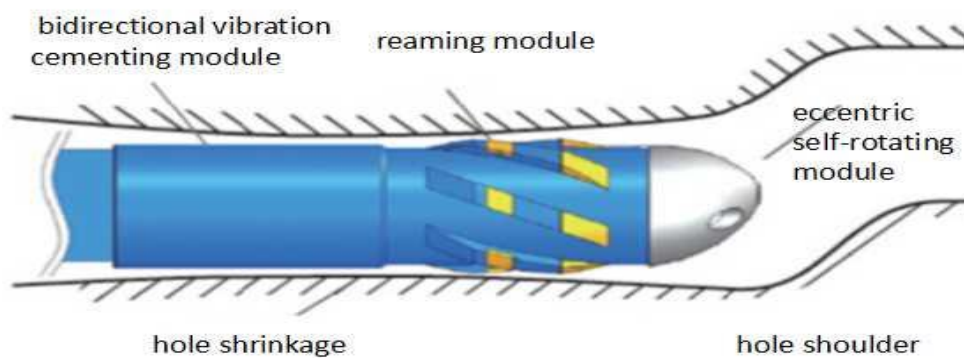
cementing quality without vibration cementing technology



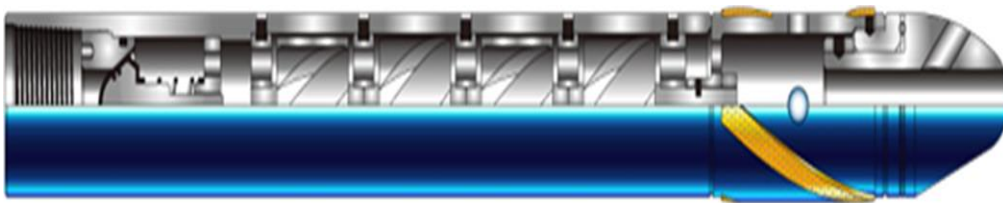
cementing quality with vibration cementing technology

Since 2021, the current application in Sinopec Northwest Bureau (Xinjiang) work area: including TKC1-1, TKC1-3, TKC1-4, TK7250H, TK160H, TKC1-7, TK159, TKC1-6H, TK158H, TKC2-1, TKC1-8H, TP278CH (adjustment well), AT1-23H, TKC1-5, TKC5-1, and TP12-Q8H Wells, has been applied and achieved good application results, which has been recognized by client.

Tool picture



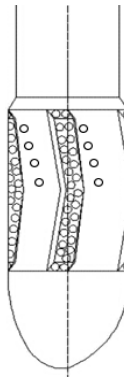
Tool structure diagram



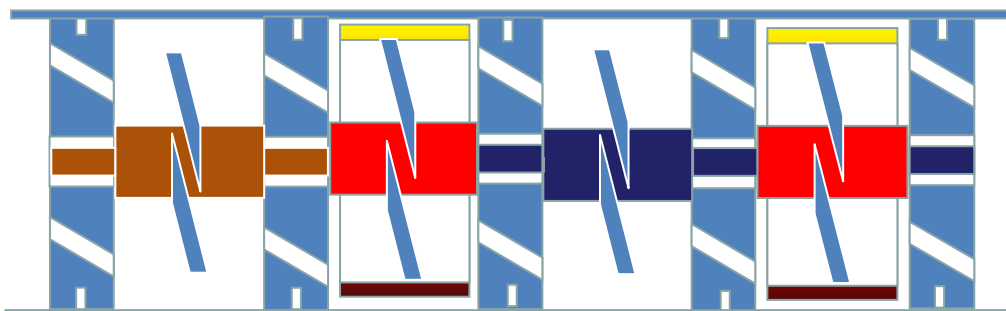
Self-rotation to run casing tool structure diagram



eccentric self-rotating module



Multi-function casing guide reaming module



Eccentric turbine vibration cementing module schematic