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PROMISING SCREW JOINTS ON PREMIUM-CLASS CASING PIPES FOR OFFSHORE RUSSIAN FIELDS

B. Yu. Shcherbakov,[1] E. S. Zyryanov,[2] and A. I. Stepanov[2]

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The article describes casing pipes with premium screw joints for use in fields on the continental shelf, the properties of TMK products, and new drilling technologies – horizontal drilling, drilling on a casing column, and the lubricant-free Green Well technology.

Keywords: *oil and gas recovery, casing pipe, coupling-equipped and coupling-free screw joints of the Premium class, drilling on a casing column, lubricant-free technology.*

World reserves of petroleum – including those that have already been prospected – are continually being depleted. Some experts predict that they will be completely exhausted in 40–50 years. The quest for alternative energy resources has not yet produced significant results. The intensive scientific research being done in the area of oil and gas recovery is the most promising development in the search for new deposits. Here, undersea deposits of energy resources are the main source of hope. Preliminary studies have shown that the quantities of oil and gas in located in the deposits in the seabed are many times greater than the oil and gas reserves on dry land.

Despite the fact that today's oil and gas companies are prospecting for and extracting oil and gas by using technologies that were unthinkable twenty years ago, finding and recovering these two energy resources – especially on continental shelves – is becoming increasingly complicated due to the growing risks and rising costs. All this increases the need for high-tech products with special properties and further growth of the service market.

The Metallurgical Pipe Company (TMK) is the undisputed leader in the Russian market for premium pipe joints. The company has invented and patented more than 15 premium screw-type joints for casing and pump-compressor tubing (PCT), making it possible to fully equip columns of pipes for any well and any type of operating conditions.

TMK is developing two lines of joints: coupling-equipped joints of the Premium class, which have been designed by specialists in the company's Russian division; coupling-free ULTRA joints, developed at TMK IPSCO by the firm's American division.

All of the screw joints in the TMK – Premium and ULTRA series are unique with respect to their hermetic and strength properties; high strength is assured by the design of the joint and the very stringent standards observed on the accuracy with which the threads are made. In addition, the joints can withstand very high levels of tension.

As validation of the quality of the pipes made by TMK factories, the company's products are in the course of being certified at the highest (fourth) CALIV level under the standard ISO 13679. This will allow the pipes to be used in offshore and onshore projects that involve complicated drilling operations and hydrocarbon-recovery conditions. TMK has already

[1] TMK-Premium Service, Moscow, Russia.
[2] Severskii Pipe Plant (STZ), Polevskoi, Sverdlovskaya Oblast, Russia; e-mail: stw@stw.ru.

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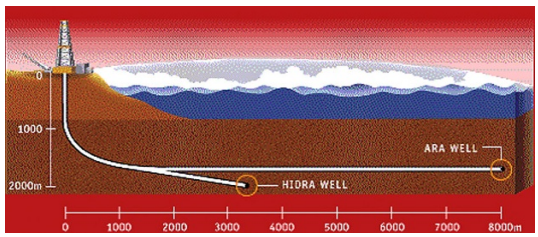

Fig. 1.

Casing-pipe joint for horizontal, vertical, and inclined wells in oil and gas fields

TMK GF

Casing-pipe joint for vertical and inclined wells in oil, gas, and gas-condensate fields

TMK FMC

Casing-pipe joint for horizontal, vertical, and inclined wells in oil and gas fields. This model of joint is used for well construction in the presence of large flexural and compressive loads and excessive amounts of torque

TMK PF, TMK PF ET

High-strength coupling-free screw joint for the operation of wells in oil, gas, and gas-condensate fields. It is distinguished by its high tensile strength. Its compressive strength is greater than its tensile strength

ULTRA-SF

High-strength coupling-free screw joint for wells in oil, gas, and gas-condensate fields. It is distinguished by its 100% strength rating in the presence of tensile stresses. The dimensions of the gap in the joint are optimal. The joint's compressive strength is equal to its tensile strength

ULTRA-FX

ULTRA-FJ

Fig. 2.

gained certification under the same standard for its TMK PF and TMK PF ET joints for casing and TMK PF joints for PCT, as well as for the TMK IPSCO – ULTRA-OQ™ joint. TMK now seeks certification for its products in accordance with international standards, including ISO 13679 CALIV, by working with the Oil States certification center in Aberdeen (Great Britain). However, the company has also opened its own R&D center in Houston (U.S.). This center designs and tests new products, and after it has been accredited it will also have the ability to certify new products. That will significantly shorten the amount of time that elapses from the creation of products to their appearance on the market.

In 2012–2013, TMK products successfully underwent testing at several oil and gas fields that are operating under complex conditions. Casing pipes with the TMK PF joint have been tested in the Belaya Koshka undersea field off Vietnam, while casing that contains the ULTRA-FJ™ joint have undergone trial use at another undersea deposit – Belyi Tigr. Pipes with TMK GF joints have passed tests at the Yu. K Korchagin undersea field (in the Caspian Sea), which is owned by LUKOIL-Nizhnevolzhskneft. The same model of joint has been put to successful use at the Bovanenkovskoye gas-condensate field owned by the company Gazprom Dobycha Nadym. Pump-compressor tubing with TMK FMT joints made of chromium-bearing steel have been certified as satisfying strength requirements for use at the Chkalovskoye field Tomskneft (owned by the

Fig. 3. The Deepsea Delta platform at the Shtokmanovskoye oil field in the Barents Sea. The platform is owned by Gazprom.

company Rosneft). At the Yurkharovskoye oil and gas-condensate field of the company NOVATEK, the TMK company simultaneously installed two unique columns of casing pipes with TMK PF joints – one column in the onshore part of the field and a second column in the offshore part (at the bottom of the Karsk Sea).

Well-drilling operations today encounter an increasing number of problems related to pressure fluctuations in the beds, borehole instability, and depletion of the beds. Having to deal with these complications usually increases total well-drilling time by 20–30%. For wells being drilled by the traditional technology, the problems just mentioned are being solved by the introduction of new techniques that make the drilling operation as a whole more efficient, shorten its duration, and thus reduce operating costs for the companies operating the well. Thus, there is a strong need for the continued development of new drilling technologies,

There are two methods of drilling: the traditional vertical method and horizontal drilling. Horizontal drilling has become the more popular technology over the last few decades. Preference was given to vertical drilling for over a hundred years despite the fact that most oil and gas fields typically cover a broad area but are not very deep. A horizontal well is more expensive but envelops a significant greater surface area. The efficiency of horizontal wells is usually two to three times greater than the productivity of vertical wells.

Vertical drilling can now be done by using a new technology – drilling with a column of casing pipes. The highly efficient screw joints of the TMK CWB series are designed for the drilling of casing columns and the construction of wells at oil and gas fields.

Using a drilling system that employs casing pipes offers the following advantages over the conventional drilling technology:

1) the well is drilled and the casing column is completed in a single lowering-and-hoisting operation (LHO);

2) drilling is performed with the casing column through intervals of difficult sections, such as those containing zones characterized by pressure gradients and unstable rocks;

3) the time required to construct the well in those sections is shortened by avoiding complications in the drilling operation and decreasing the number of LHOs needed for reinforcing the borehole and lowering the casing column;

4) the column can be cemented as soon as the prescribed well depth is reached.

Yet another TMK innovation is the lubricant-free Green Well technology, which offers significant advantages over its counterparts. The use of Green Well technology ensures that the screw joints of casing columns are hermetic without the use of a thread-sealing lubricant. A big plus of the lubricant-free coating used in the new technology is that it makes it possible to screw pipes together faster during the assembly of columns. Since it eliminates the need to clean the threads during the assembly operation (the threads are always cleaned before a “liquid” lubricant is applied), the coating significantly shortens the process of preparing pipes to be lowered into the well. The time saved during column assembly in turn reduces the

operating costs of oil and gas companies in recovering energy resources, which is the strongest argument in favor of the lubricant-free technology's use. In addition, the Green Well coating conforms to existing standards on environmental safety and makes working conditions safer during production operations.

Casing pipes with a premium TMK PF screw joint and the innovative Green Well coating were used to form casing columns that were lowered into well at the Vankorskoye field of the company Rosneft.

The development of deposits on the continental shelf is a science-intensive process that requires the use of complex technologies and the operation of equipment under extreme environmental conditions. The prospects for the successful recovery of energy resources on continental shelves are based on the economic expediency of this undertaking and have been substantiated by the results obtained from studies. Those results show that the seabed contains half of the world's total reserves of hydrocarbons. The Metallurgical Pipe Company is ready to provide the Russian oil and gas industry with its high-quality pipes in order to solve any and all problems, regardless of their complexity.