

Application of Standards in Design of Drilling Equipment



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Abstract

Following the rapid development of petroleum industry and “Go abroad” strategy, China’s petroleum drilling equipment manufacturing industry has made rapid progress. Based on the R &D and production of drilling equipment in the last few years in China, this article talks about some basic standards which need to be emphasized in the design of domestic land rigs, oversea land rigs and offshore platforms in order to meet the needs of different environment, region and clients through standard adoption. Further more, in accordance with China’s present situation, the article puts forwards some suggestions on the current standards, which can enable the drilling equipment manufacturers to adopt better standards so that their products can better satisfy the needs of the world market.





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Foreword

Standard is the foundation for development of technology, economy and society. In different industries, regions and countries, there would be standards which are thought to be the main supporting elements promoting social development. Petroleum industry, a pillar industry of economy, is of great importance to economic development and national strategic security. Following a surge in oil price in recent years, the Chinese drilling rig manufacturing sector has made rapid progress.



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Foreword

BOMCO is thought to be one of the rig manufacturers which first use international renowned standards strictly following API specs in rig design, so BOMCO products could enter the international market at an early stage compared to other rig manufacturers in China. The process of global integration deepens and we are faced with a market in which requirements of customer are much more comprehensive. Despite of API SPECS, we are requested to make rigs which meet requirements of ISO, DNV,ABS, SSME,IEC, and ASTM etc. Design ideas vary based on different Standard System.





Foreword

Standardization aims to solve such problems and bridge the gap between possibilities and customer requirements, quantities and varieties, and promote professional manufacturing of spare parts. It is the only way to grow big and maximize profit by providing customer performance-reliable and quality-assured products.

As strategic resources, petroleum & natural gas has become more and more important to all the nations over the world. It has become a common aim of every oil drilling company to make sure the economic, safe and environmental benefit can be achieved with the most effective drilling equipment.





Foreword

This article analyzes the various needs of different environments, regions and customers according to recent years' petroleum drilling study and production, AT the same time it puts forward the relative standards to be considered in the design of onshore rigs and offshore rigs and some suggestions according to the real condition of China, so that the rig manufactures can find proper and clear direction for bidding and study as a result their products can be competitive in the world drilling market.





| Domestic land drilling rig

Basically, the design and production of onshore rigs in our country conforms to the national petroleum & natural gas industry standards and API standards.

1 Overall design

China has its own systematic standards of rig design. Almost all rig manufacturers are designing and producing rigs according to petroleum & natural gas industry standard SY/T5609: Basic Specification and Type of Petroleum Oil Drilling Rig.





| Domestic land drilling rig

In the practical design, the overall layout of the drilling rig on site is reasonably and completely considered according to China's petroleum & natural gas industry standard SY/T 5466: Well Site Preparation and Layout Requirements and API RP 54: Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations.



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I Domestic land drilling rig

2 The design and manufacture of the main equipment of the rig

The main equipments of the rig are designed following the principle of standardization and generalization. That means the main equipments such as crown block, traveling block, hook, swivel, rotary table, mast, substructure, drawworks, mud pump, top drive and well control system are designed according to national and petroleum industry standards or API specification.

Many other rig manufacturer also exploit series and modular design to better improve standardization and modular of rig parts, and also cut costs and so that better quality and reliable products can be reached.





I Domestic land drilling rig

3 Electrical equipment

Electrical equipment explosion-proof performance: 1)

GB 3836: Electrical Apparatus for Explosive Gas Atmospheres and

2) GB4208: Degrees of Protection Provided by Enclosure (IP code) 。



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I Domestic land drilling rig

4 Rig auxiliary equipments

All the auxiliary equipments (such as drillers' cabin, disc brake, air clutch, casing stabbing board, hydraulic cat head, elevator etc.), as the important parts of rig, are mainly designed according to the specification of the manufacture. As all these equipments used widely in practice and improved constantly in technique, some of them can be used as standard parts (for example: disc brake and air clutch), providing the guarantee of rig auxiliary equipments standardization.





I Domestic land drilling rig

5 FAT of the rig.

The development of drilling rig is a very complicated project covering wide range of knowledge; all the rigs must be assembled and tested before leaving the factory. Temporally, the FAT is conform to SY/T 6680 Acceptance Specification for Petroleum Drilling and Servicing Rigs which includes all the contents, methods, procedures and requirements of test and inspection and clarifies the responsibilities of the manufacturer, the user, and third party in order to promote trade, protect the interest of all parties involved, push the development of technology ,reduce and prevent quality and safety problems, increase the quality and function and decrease the risk cost of rig.





II Overseas land drilling rig

China adopted international standard and advanced standard of other countries rather early, so most of the rig equipment in our country conforms to international products. In general, all our rigs conform to industry standard of CNPC and API standard. If customer raises special requirement, we will design the rig according to new standard.

1 Middle East drilling rig

Rig in Middle East area requires high quality structure components for safety reasons, for example, higher standard of mast safety height and max hook load more than domestic rig. So the standard of mast and crown block max hook load is a grade higher than oil field industry standard in China.





II Overseas land drilling rig

The quality and standard of electric control system, well site lighting system is stricter than other components of rig. They are manufactured according to international standards of IEC, IEE, API and some relative electric standard of GB as well as the requirements of the customers.

Environmental requirement is stricter in Middle East: centralized treatment of garbage, reducing pollutants discharge, zero discharge of the liquids from all the oil tank, water tank and mud tank.





II Overseas land drilling rig

2 Polar Rig

The working temperature of polar is in between $-40^{\circ}\text{C}\sim +45^{\circ}\text{C}$ and all the current criterion can't satisfy the requirements in such condition. Hence except for some special material, heat preservation and heating up of rig are the first issues should be considered.

When heat preserving wall or shed is used, there will be enclosed space in some areas of rig. Necessary ventilation should be designed for these areas to lower the flammable and explosive air to safe level according to ST/T 10041 or API RP 500 .





II Overseas land drilling rig

3 FAT of rig

The international customer has strict rules for FAT. Besides general standards, they also raise some special specification. As there is no uniform international standard, the contents, style and norm of FAT must be agreed on to meet the requirements of customers.





III Off shore rig

Most equipment and drilling system of off shore rig are similar to that of land rig.

Most products of off shore rig adopt modular design to adapt to fast assembly and disassembly. These includes main parts of rig (drawworks, rotary table, mast, hoisting system)modules, substructure module with x-y shifting unit, mud pump module, mud treating module, power supply module and motor control center module. The design must fully comply with technical agreement or relative specification of off shore rig platform.

Compared to land rig, off shore rig require higher quality of equipment in fire resistance, anti explosion, security and environment given the working condition and frequently moving.





III Off shore rig

Off shore rig requires stricter specification in fire resistance and anti explosion including requirements of platform, ventilation, equipments in dangerous areas.

In aspect of reliability, mast adopts Hot-dip galvanized treatment for corrosion prevention; all pipes, connectors and valves of equipments adopt different material and thickness according to different pressure, different temperature and different mediums .

All the equipment of rig must be innocuous, harmless and radiation-free. Efforts should be made to make sure there is no contaminants released or contaminants can be recycled after treatment.





IV Suggestions

1 With the improvement of drilling workmanship, application of new technology and development of new technology, the existing technical requirements and parameters in standard are not suitable. For example, the power of drawworks have been reached 4412 kW (6000 hp, the power of single mud pump can come to 1618 kW (2200 hp) , the highest pressure can reach MPa, but these are not included in SY/T 5609 industry standard. Simultaneously some parameters in the standard contradict the parameters in practice which need to be revised and added in new technical requirements for guiding and promoting the application of new technology.





IV Suggestions

2 Along with perfection and popularity of computer technology and modern communication technology, digitization and intelligence of rig have been developed, but the criterions lag behind. Till now there is no uniform criterion, so research work should be done on this.



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IV Suggestions

3 The auxiliary equipments of rig are important parts of rig, the quality and technology of which influence the whole rig directly. But currently we have no uniform criterion; most manufacturers implement their own standards which create many problems about the design and production of rig, lowering the interchangeability and quality. So lots of work should be accelerated on research and revision.



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IV Suggestions

4 Because of translation and communication problems, the rig manufacturers can hardly know main stream of overseas rig market in detail, causing many work on technology preparation and modification. Work on introducing, translating and publicizing other international industry standards should be enhanced in addition to publicizing API standards.

5 As for oilfield drilling rig, the basic requirement on rigs, safety rules and environmental requirements must be listed and added to ISO Standards.





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Thanks !



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