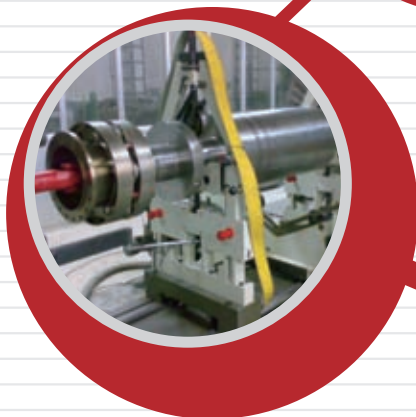


Coking Tower Bottom Valve

Science & Technology Management Department

■ 2013



CHINA NATIONAL PETROLEUM CORPORATION

*Coking Tower Bottom Valve, the Guardian
of Delayed Coking Unit!*





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China National Petroleum Corporation (CNPC) is a state-authorized investment agency and a state holding company. On July 1998, with the implementation of the Institutional reform of the State Council, CNPC was reorganized to become an integrated oil company of cross-regions, cross-industries and cross-countries, it adopts modern enterprise system to realize the integrations of upstream and downstream operations, internal and external trade, production and marketing. CNPC's business covers six main sectors: oil and gas operations, petroleum engineering service, petroleum engineering construction, petroleum equipment manufacturing, financial services and new energy development. In 2012 CNPC produced 110 million tons of crude oil and 79.82 billion cubic meters of natural gas, while crude processing volume reached 191 million tons. The total revenue of RMB 2,690 billion with a profit of RMB139.1 billion had been achieved the same year.

CNPC was ranked 4th among the world's largest 50 oil companies and 6th in Fortune Global 500 in 2012.

CNPC strictly follows by the combined strategies of increasing resource capacity, expanding market shares and consolidating the international role, and persists in regarding technical innovation as a key framework to advance technological progress. To develop its core businesses, focuses will be placed on the solutions of key bottleneck technologies and key proprietary technologies. Thanks to continuously improving of the technical innovation system, optimizing the configuration of technological resources and strengthening the construction of strong talent teams, CNPC's technological creativity has been considerably upgraded. Consequently, a large number of technologies have been developed independently, with its own intellectual property.

Coking Tower Bottom Valve is one of representatives for major innovations of CNPC.

CLEAN ENERGY SUPPLY FOR BETTER ENVIRONMENT

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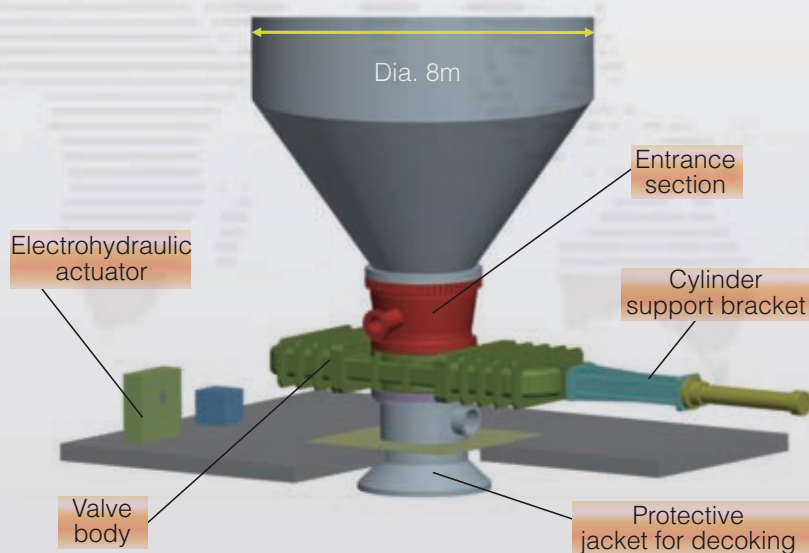
INTRODUCTION

- ◆ Following that the world's first coking tower bottom valve was put into use in 2001, new standards came into being for the design and application of coking unit, and the coking industry therefore made a revolutionary breakthrough.
- ◆ In line with the technical features of delayed coking unit, CNPC developed JHF1500 Coking Tower Bottom Valve based on its proprietary flat gate valve technology.
- ◆ After being applied in the delayed coking unit, the JHF 1500 Coking Tower Bottom Valve shortens decoking time, lessens environmental pollution and eliminates potential hazards for human safety, thus standing out as a typically safe, energy-saving and

eco-friendly product, and representing the new-generation standard for the design and application of delayed coking unit.

Overall Technology

- ◆ JHF1500 Coking Tower Bottom Valve adopts the Metal Floating Hard Seal and Auxiliary Steam Seal Technology, which ensure excellent sealing effect.
- ◆ High-power Electrohydraulic Actuator is employed to realize omni-bearing safety interlock control, which ensures precise and reliable control.
- ◆ Its total weight is more than one third lighter than its foreign counterparts, easy to be installed and maintained.



Outline dimension: 10854cm×2250cm×896cm

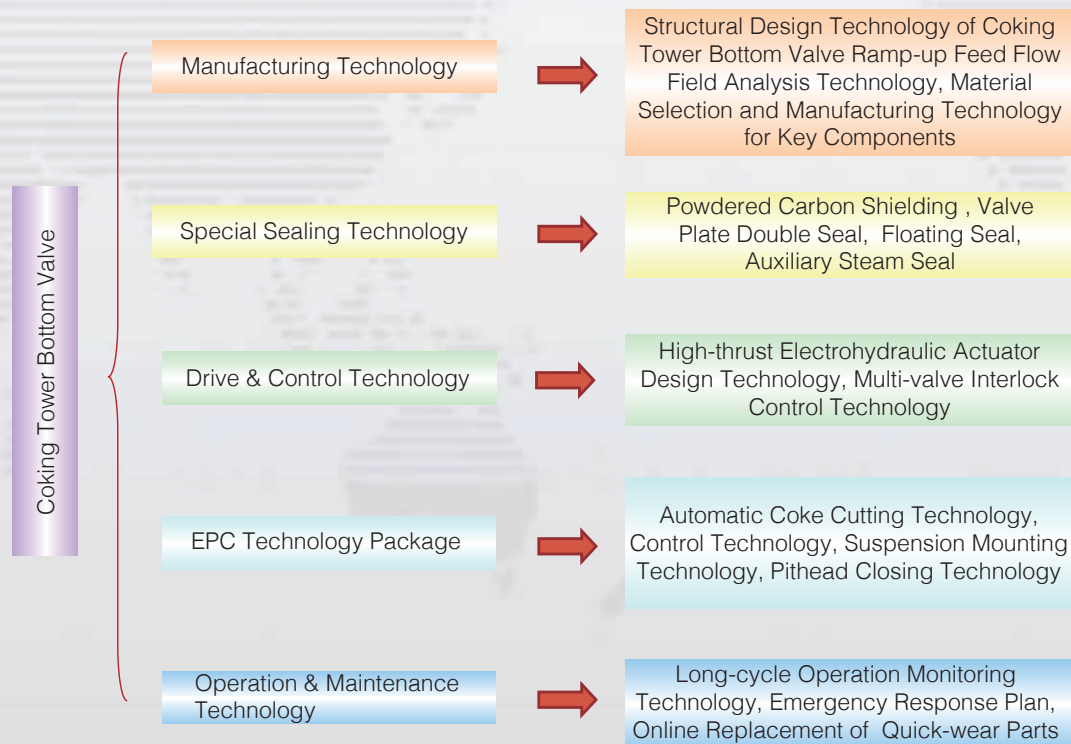
Total weight: approx. 35t



Technical Process of Delayed Coking

- ◆ The production process of delayed coking is semi-continuous: when coke coalescence in tower A reaches a certain height, a four-way valve switches raw materials into tower B; the coke in tower A is cooled below 70°C by steam and water, and decoking then starts; residual water in tower A is first discharged, workers then remove the bottom blank cap (incl. feed pipe flange) and use high-pressure water (approx. 30MPa) from the nozzle of hydraulic coke cutter to cut off coke; after decoking, workers mount the bottom blank cap.
- ◆ This process generally takes 24~48h each time, with cumbersome operation, long auxiliary time and poor safety.

Technology Framework



Current Technology Situation in China



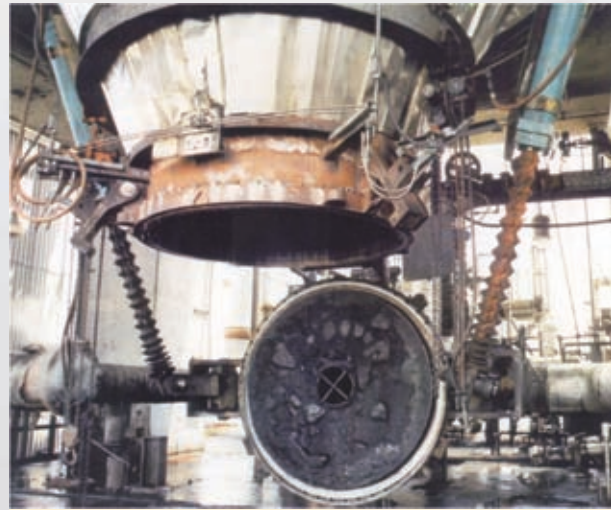
- ◆ Open system: discharging toxic and harmful matters directly and counting against environmental protection



- ◆ High risk for workers: more vulnerable to steam scalding, collapsed coke and intoxication.



- ◆ High labor intensity for workers, complicated operation and more potential hazards on the site.

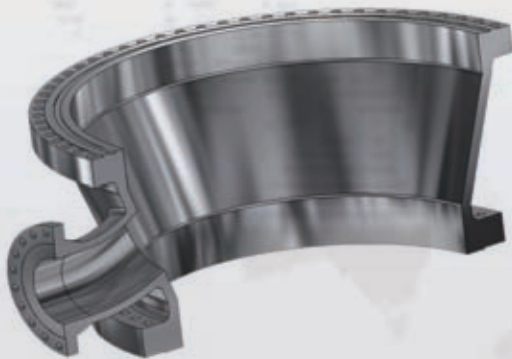


- ◆ High difficulty in equipment maintenance and high maintenance/overhauling cost.

2.1 Customized Product Design Technology

◆ Customized design based on technical parameters and on-site conditions

Item	Parameter	Item	Parameter
Design temperature (℃)	520	Operating temperature (℃)	500
Nominal diameter (mm)	φ1500	Diameter (mm)	φ1500
Design pressure (MPa)	0.8	Travel speed (mm/min)	0.45
Effective travel (mm)	1600	Travel speed (mm/min)	533 ~ 400
Explosion-proof grade	Exd II BT4	Leakage	Zero medium leakage



◆ Design feeding method and flow field feature via simulation according to the nature of feed supply, so as to minimize the impact on coking tower.



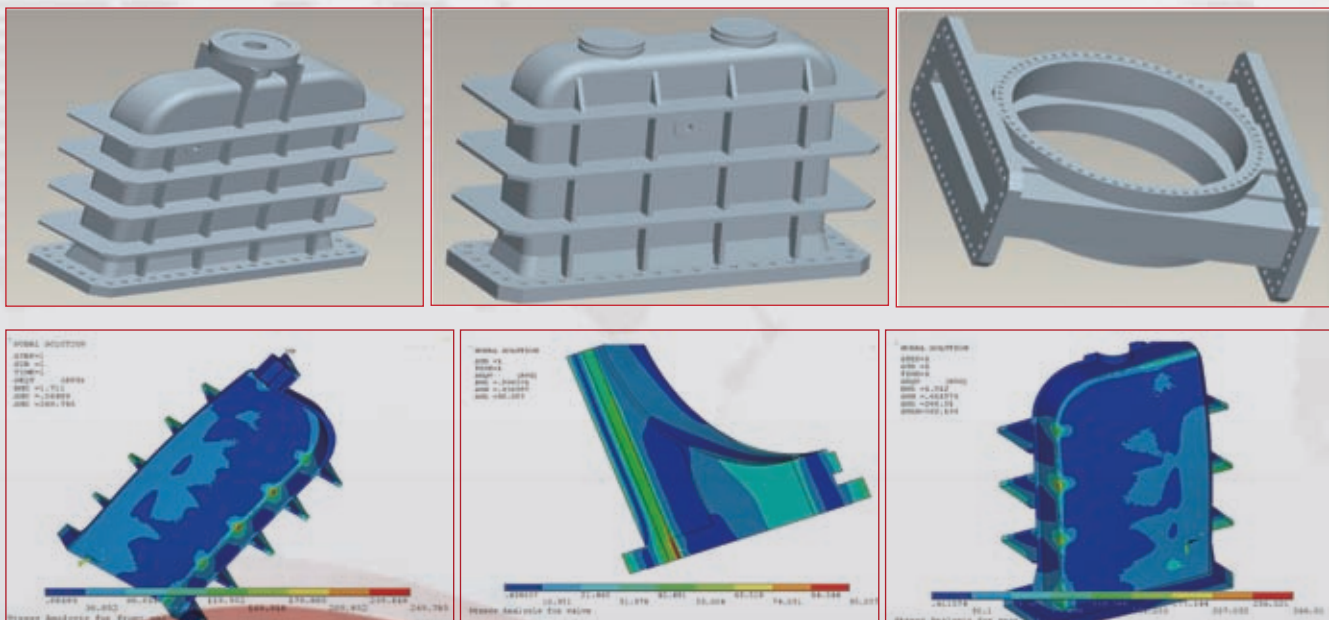
2.2 Valve Plate Manufacture & Surface Treatment Technology

The Valve Plate is made of a whole piece of customized steel plate, with dimension of 3700mm×1700mm×128mm, surface flatness of 0.05mm, glow ion hardness up to HV600 after nitriding, all of which effectively enhance the Valve Plate's overall performance.



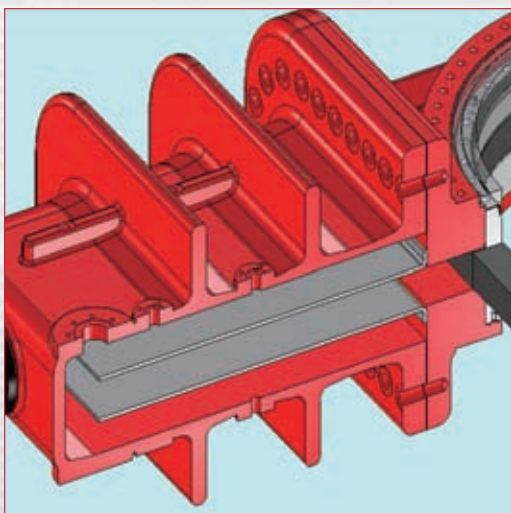
2.3 ANSYS Finite Element Stress Analysis Technology

The ANSYS Finite Element Stress Analysis Technology is applied to make stress analyses totally and visually, thus avoiding stress concentration.



2.4 Self-developed Floating Seal Technology

CNPC developed “Metal Floating Hard Seal and Auxiliary Steam Seal Technology” that is suitable for processing occasions with solid-containing liquid and high-low temperature alternation, ensuring zero medium leakage and avoiding fire hazards.



2.5 Coke Shielding Technology

JHF1500 Coking Tower Bottom Valve is embedded with a coke shielding case, which prevents sharp decline in steam pressure during valve opening and thus blocks the coke powder from the central cavity of valve cover.

2.6 High-power Electrohydraulic Actuator

High-power Electrohydraulic Actuator features high oil pump delivery pressure, hydraulic cylinder ID 320mm, push-pull effort max. 150t. It also adopts the technology of emergent jammed valve opening of supercharger.

2.7 Electric Interlock Control Technology

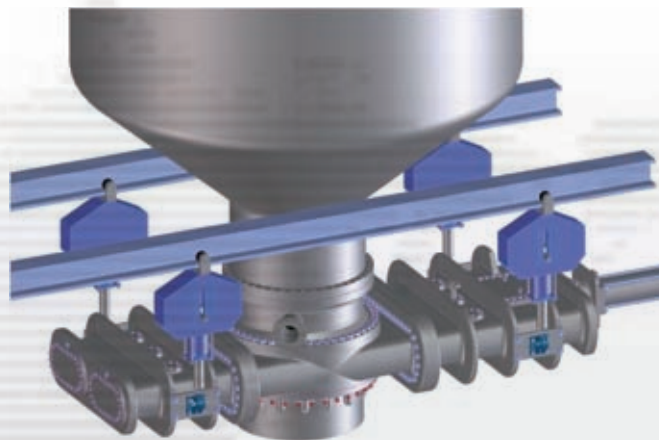
The Electric Interlock Control Technology ensures safe and controllable switching and effectively prevents misoperation by on-site workers.

2.8 Variable Steam Consumption Design Technology

The steam flow can be adjusted automatically in line with different working conditions, thus ensuring safety and reliability of pipeline system, stability and accuracy of sealing steam pressure and smooth condensate drain, and preventing medium leakage.

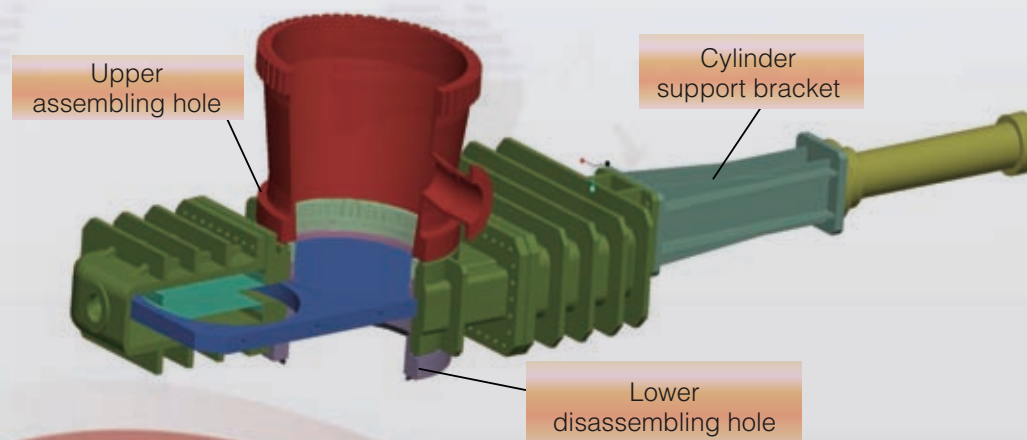
2.9 Automatic Coke Cutting System Technology

The Automatic Coke Cutting System Technology for Coking Unit includes Equipment Design Technology, DCS Control System Technology, Suspension Mounting Technology, Pithead Closing Technology, etc.



2.10 Online Overhauling & Parts Replacement Design

- ◆ The cylinder support bracket is equipped so that the cylinder rod cannot enter the valve body, ensuring easy re-feeding and cylinder overhauling.
- ◆ Upper and lower assembling/disassembling holes can be taken as the entry for overhauling, which allows more flexible overhauling and replacement of sealing parts.



3

TYPICAL CASES

In July 2008, the first JHF1500 Coking Tower Bottom Valve was put into operation on the delayed coking unit with capacity of 1.2 million tons/year at the oil refinery of Lanzhou Petrochemical Company, which runs well till now.



Effect Contrast



Case of Outdated Bottom Cap Machine

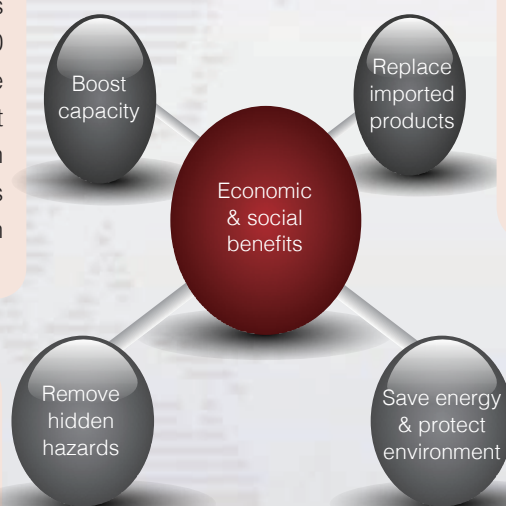


Case of JHF1500 Coking Tower Bottom Valve

JHF1500 Coking Tower Bottom Valve enhances the safety of delayed coking unit, realizes seal the opening and decoking under sealing condition, improves the unit's decoking environment and operating efficiency, and increases the yield by over 20% and annual output value by nearly 200 million Yuan.

Analysis Economic & Social Benefits

The capacity of delayed coking unit of 1.2 million tons per year, after using JHF1500 Coking Tower Bottom Valve raises 20% and annual output value added by 200 million Yuan and economic benefits added by about 24.1 million Yuan.



With high level of design and manufacture, the valve can substitute imported counterparts and represents the new standard for design and application of delayed coking unit.

The valve avoids workers from steam scalding and removes the hidden hazards for human safety due to coke collapse.

The valve features excellent sealing effect that prevents leakage of toxic and harmful matters, and reduces energy consumption and coke cooling water discharge.

4

R&D EQUIPMENT

Equipped with plentiful research and manufacturing equipment of advanced international standards, CNPC boasts a specialized research and production base for refining equipment.

Research Equipment

CNPC has 79 units or sets of major research equipment, including imported data processing projector, coordinate measuring machine, mechanical performance test facilities, metallographic test facilities, spectral analysis facilities and metering facilities. It has also equipped with flue gas turbine and special valve test beds.



Germany-made Data Processing Projector ST1000



America-made Coordinate Measuring Machine HERA-20-10-10

Manufacturing Equipment

CNPC has over 800 units or sets of major manufacturing equipment, including large NC lathe, large horizontal boring machine, large double housing planer, large plano-milling machine, kinds of drilling machines, NC equipment, large dedicated facilities, common facilities, etc.



Imported 100t Large Broacher



Turn-milling Composite Machine Tool



CNPC boasts the horizontal machining center FH6800 and E-800v/5, turn-milling composite center Integrex 200- II and Integrex 200- III, vertical machining center VF-5/50, etc.



NC Machining Workplace



Large Parts Machining Workplace



Assembling & Testing Workplace



Assembling & Testing Workplace

5

QUALIFICATIONS & STANDARDS

International QMS Certificates

The quality management system of JHF1500 Coking Tower Bottom Valve strictly follows GB/T 19001-2000, idtISO 9001-2000 and U.S. API Q1.



Product Standard & Environmental Assessment Certificate

JHF1500 Coking Tower Bottom Valve strictly follows CNPC's enterprise standard and has passed the HSEMS certification.



Patents

Name of patent	Type of patent	Country	No.
A Coking Tower Bottom Valve	Patent for utility model	China	ZL 200620079742.9
A Large-diameter Parallel Single-disc Gate Valve	Patent for utility model	China	ZL 201020143613.8



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EXPERT TEAM

The R&D team of JHF1500 Coking Tower Bottom Valve takes in both experienced experts and aggressive young ones proficient in advanced design technologies.



Zhang Yufeng Senior engineer, senior technical expert. He has achieved multiple influential research results in refining equipment development, obtained more than 20 national patents and over 30 papers published.
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Qi Daqiang Senior engineer and special valve expert. He has achieved multiple influential research results in the special valve field for oil refineries, obtained 2 national patents and 5 papers published.
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Liang Zonghui Senior engineer He has achieved multiple influential research, obtained 5 national patents for utility model and published over 20 papers.
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Liu Xiaodong Senior engineer. He has been engaged in the development of special valves and pipeline valves for years, especially excelled in designing large-diameter high-temperature valves. He has obtained 3 national patents for utility model and over 10 papers published.
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