

Development and Experiment of the Automatic Emergency Well Shut-in Control System

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Outline

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Introduction

2

Scheme and Structure

3

Experiment

4

Conclusions



1. Introduction



Well kick in Changqing oilfield, 31 Oct 2016



1. Introduction



Well blowout in Qionglai No.1 well , 22 Dec 2011



1. Introduction

Why did it happen?

In the process of well drilling, because of the formation pressure inaccuracy and wellhead leakage, which easily lead to overflow and explosion.

What can we do?

When overflow and wellhead leakage happened, carry out well shut-in control as soon as possible is an important guarantee to prevent blowout accident.



1. Introduction

The current drilling team generally use the **“four seven” action** to implement well shut-in control, which needs **many workers** operate **many devices** and pass gesture **in different positions**.

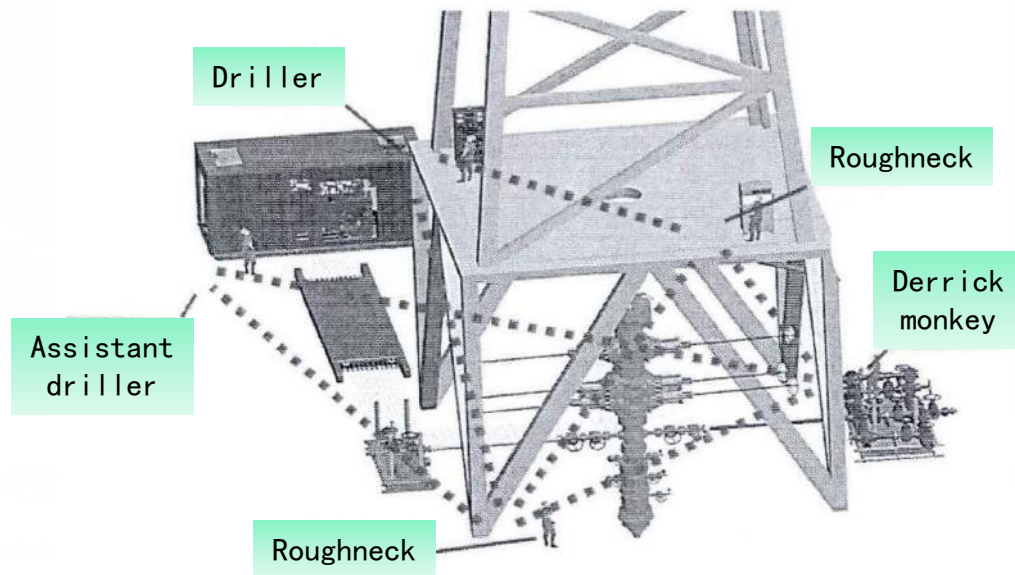


The pit drill figure



1. Introduction

This operation mode was a complicated process with tedious cooperation, errors in any operation link could cause the **delay** of the **best well shut-in time** and brought **potential risks** for well control safety.



The whole stance and the visual relationship



1. Introduction

Therefore, to **improve the automation** of well control equipment and **convert the control mode** from the current distributed to centralized, we developed the automatic emergency well shut-in control system, which was a research achievement.



The PLC cabinet and the remote control console



The control panel



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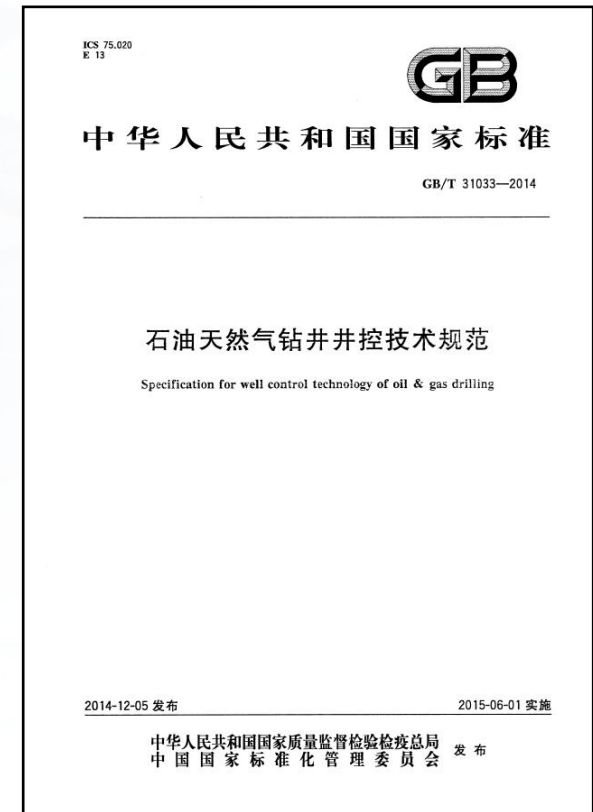
Conclusions



2. Scheme and Structure

According to "GBT 31033-2014 Oil and Gas drilling Well Control technical specifications," The well shut-in control procedure for the overflow in the drilling process is as follows:

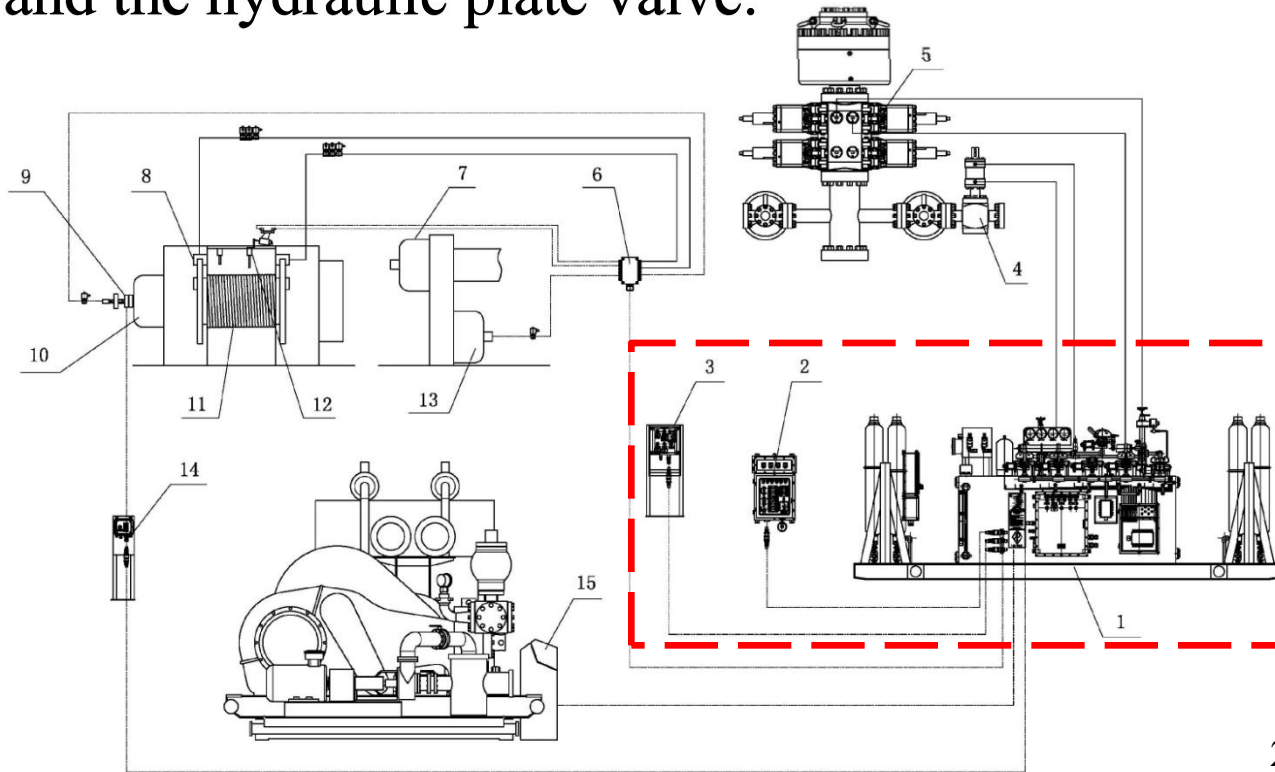
- Send:** send out a signal;
- Stop:** stop the rotary table, stop the pump, pick up the kelly;
- Open:** open the hydraulic (manual) plate valve;
- Off:** close the BOP;
- Off:** switch off the choke valve;
- Observe:** the standpipe and casing pressure and the changes in pit volume and report promptly





2. Scheme and Structure

The well shut-in control system should **manage** the related devices, such as the rotary table, the mud pump, the drawworks, the BOP and the hydraulic plate valve.



1-The remote control console



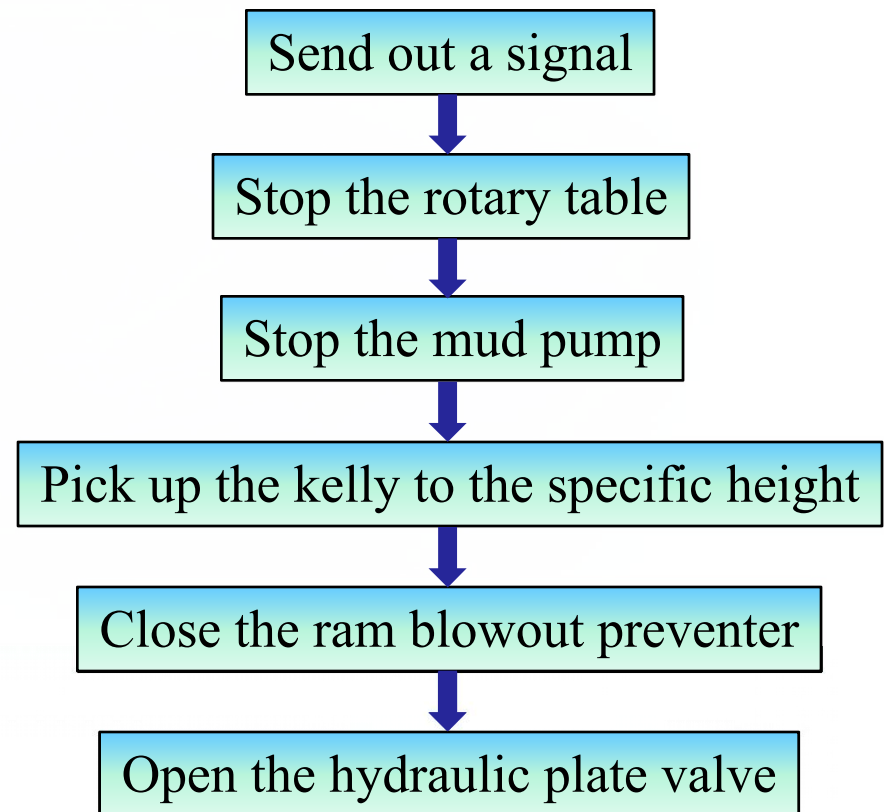
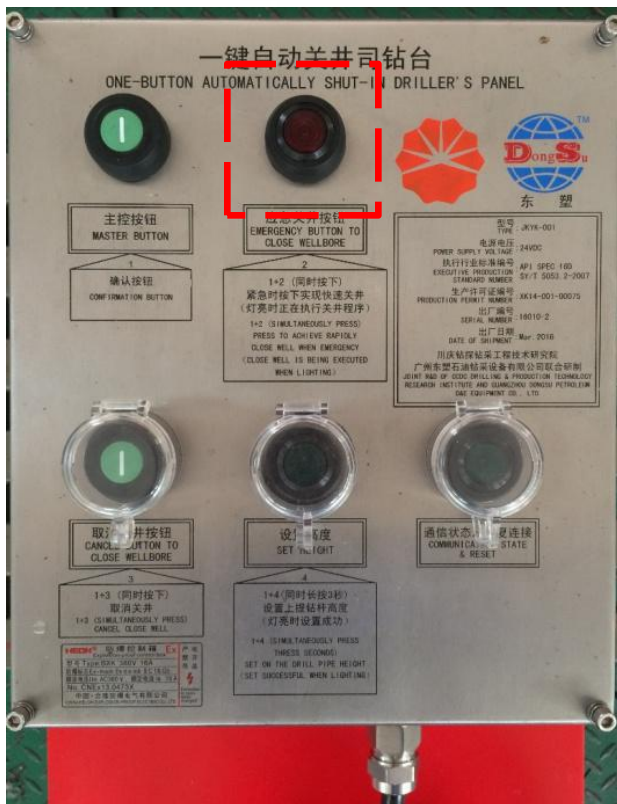
2-The driller panel 3-The control panel

The well shut-in control system devices connection diagram



2. Scheme and Structure

The well shut-in control system can realize the following function **automatically** and **orderly** by **pushing only one button**.

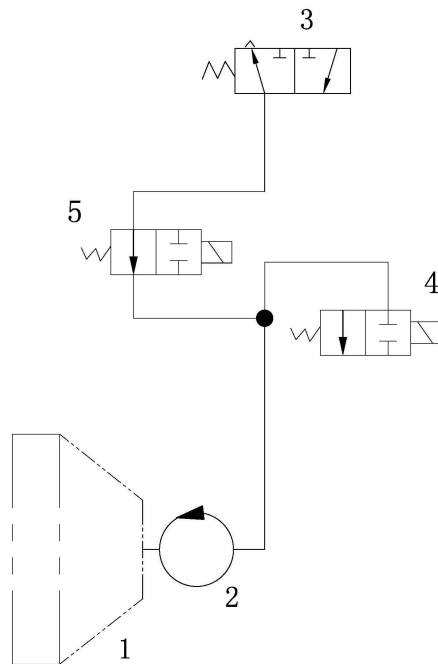




2. Scheme and Structure

The scheme of stopping the rotary table

It mainly **used the solenoid valve to disconnect the gas source** of the rotary table clutch, which can easily achieve this function.



The principle diagram of
Stopping the rotary table



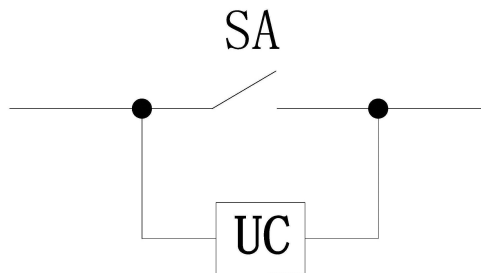
The figure of the connection



2. Scheme and Structure

The scheme of stopping the mud pump

It **paralleled a relay on the switch** of the mud pump, which can control the running conditions of the pump.



The principle diagram of
Stopping the mud pump



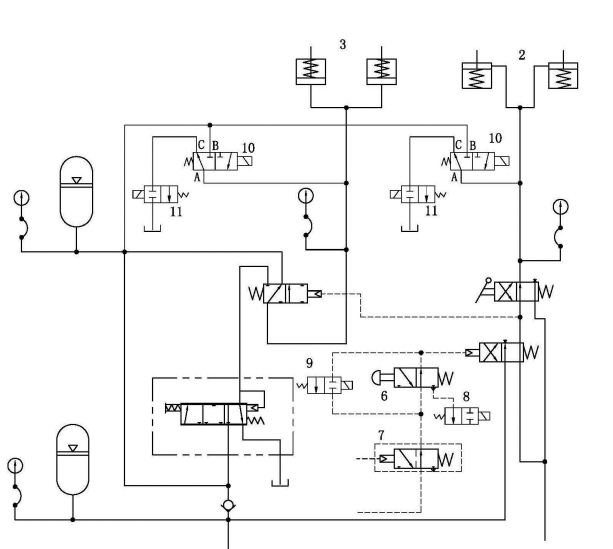
The control panel of the mud pump



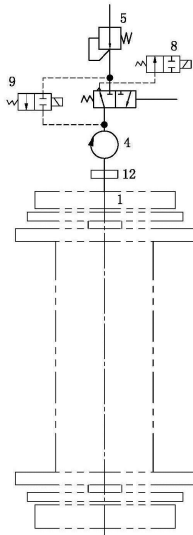
2. Scheme and Structure

The scheme of pick up the kelly

It's the most important node of the control system, which includes **release** the winch brake, **pick up** the kelly to the specific height and the winch **brake**



The principle diagram of the drawwoks control



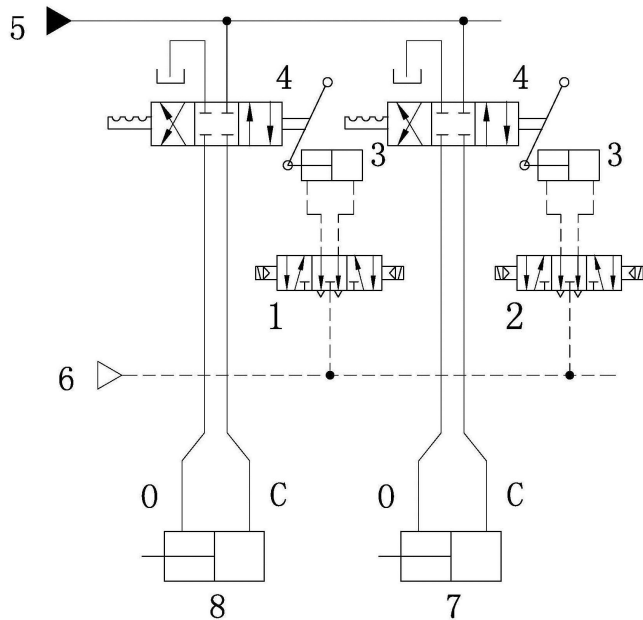
The figure of the connection



2. Scheme and Structure

The scheme of closing the BOP and opening the valve

It mainly **controlled the reversal valve** to realize the opening and closing conditions of the BOP and the hydraulic plate valve.



The schematic diagram of closing the BOP and opening the valve



The PLC cabinet and the remote control console



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Experiment

Time: In August 2016.

Place: At the simulation test well of the DPRI in Guanghan.

Test projects: The unit test 25 times, the system test 11 times.

Test result: The control system is **reliable**. The total well shut-in time is less than 45s, which can reach the design requirements.





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Conclusions

- 1.The automatic emergency well shut-in control system can **realize the well shut-in control** in the in the drilling process. The total time **less than 45s**, which can reach the design requirements.
- 2.This system is **easy to operate and easy to control** by pushing only one button, which is a great significance for improving the **timeliness, safety and reliability** of current well shut-in control.
- 3.According to different types of the drilling rig and the other three kinds of drilling conditions from the “four seven” action, we should **do more in-depth study and exploration** in the future.

Thank You !



Q&A

