DRILLING CONTROL SYSTEM

CNPC can provide drilling control systems for onshore, offshore, domestic and overseas, references are outstanding. For DC rigs, from 4000 meters to 9000 meters; for AC(VFD) rigs, from 1000 meters to 12000 meters; for compound-drive rigs, from 1000 meters to 7000 meters. The systems keep a technical step ahead in domestic.

A DC rig control system mainly consists of 5 sections, such as diesel generator control system, DC drive system, driller operation control system, eddy current brake control system and AC motor control center (MCC). The system has features of efficient and stable working, good dynamic performance, easy operation, and perfect protection functions.

An AC (VFD) rig control system, supplied with the advanced full digital variable frequency speed control and dynamic brake device to make the control of AC drilling motors become more simple and efficient. Meanwhile, a high power factor within the range of speed control, effectively improved diesel generator with evident energy-saving.

1. Main Functions and features of Drilling Control System

- Accurately control the speed of diesel engine and the voltage of generator sets
- Synchronizing the on-line generator sets
- Power limitation for generator sets
- Multiple protection for generator sets (under-voltage,over-voltage,over-current,short-circuit, under-frequency, over-frequency and reverse power)
- Wide range and accurate speed control can be fully satisfied with the drilling requirements
- PLC technology to carry out controlling, monitoring and communication
- Dynamic brake of drawworks and rotary table(VFD rig)
- Anti-slip protection of belt pulley(DC rig)
- Zero-position interlock
- Eddy current brake control(DC rig)
- Automatic driller(VFD rig)
- Traveling block saver
- Integrated drilling instruments

2. Composition of Drilling Control System

2.1 Generator Control System

· Analogue generator control system includes breaker, synchronizer, AC control units, power limitation circuit and testing circuit for ground fault, etc.

· Full digital generator control system includes WOODWARD EGCP-2 generator control module,2301D engine speed controller, BASLER DECS-100 voltage adjuster, etc.

2.2 Drive System

◇ DC drive system

SCR is used to change AC power to the continuously adjustable DC power. The assignment contactors are used to supply power to DC motor, to control drawworks, mud pump, rotary table or top drive system.

◇ AC drive system (VFD)

· AC drive systems(VFD) are developed on the base of SIEMENS, ABB, VACON or other top brand frequency converters.

· Mainly controlled objects: Drilling motors of drawworks, mud pump, rotary table and automatic driller.

· Protection functions:

◎ Converter fault alarm.

◎ Safe speed for anti-collision.

◎ Over-current, short-circuit and AC loss protection.

◎ Drilling motor air loss, low pressure of lub oil.

◎ I2t monitoring.

◎ Drilling motor lockout.

◇ Dynamic Brake Unit:

· In DC control system, it can decelerate the motor with high-speed to reach the speed of cathead controlled by hand wheel. As long as the driller releases the foot-controller, through time lag, the dynamic braking will start automatically.

· In AC variable frequency control system, it could automatically put itself into operation through the chop unit and the brake resistor when the motor is running in regenerative mode.

◇ Auto-driller Unit

· Automatic driller is used to fulfill WOB/ROB functions. This can improve the drilling quality, increase of the drilling efficiency, decrease the labor intensity and prolong the life of bit.

◇ Composite Control System

· Driller Operation Control System:

It transfers data through PLC,PROFIBUS-DP bus to control drawworks, rotary table, mud pump and automatic driller, and monitor them by industrial control computer. It has the following control functions: tripping in and out, controlling traveling block position, automatic/manual driller, disc brake and dynamic brake, rotary table speed and torque, mud pump stroke, as well as mechanical, electrical, hydraulic and pneumatic PLC program.

· Traveling block saver control system:

Automatically control the position of traveling block and prevent it from any accidents.

· Eddy current brake control system (for DC rigs).

· Integrated Instrument control system:

Transfer various of drilling data into PLC through the sensors, encoders, transducers and other units, after calculation and processing, the following drilling parameters could be displayed on the touch screens, the industrial control computers: hook load, drilling pressure, well depth, drilling speed, rotary table speed, ,rotary table torque, pump stroke, pump pressure, mud conditions, etc.

◇ Medium & Low Voltage Switchboard(MCC)

· Medium & low voltage switchboard (MCC)(400V ~ 10kV) conform to NEMA and IEC Standard.

· MCC is to control the AC motors of drillfloor, mud pump room, mud circulation area, air compressor room, oil tank area, water tank area and other areas within the well site, and supplies power for lighting and living.

· According to different motor size, DOL (direct on line) and soft starter can be chosen.