

THE RE-WINDER DRIVE SYSTEM DESIGN BASED ON COMMON DC BUS

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ABSTRACT

According to the analysis of the common DC BUS control system about the re-winder, and based on the common DC BUS system structure analysis foundation, which has realized a set of complete re-winder drive system through the hardware disposition and the functional design, the paper describes that the system changes the model of the former drive system from the construction, and uses the selenium rectifier and inverter to realize module control, which restrains the harmonic interference, simplifies the construction, economizes energy and lessens money. The control system can meet the winder's requirements of stability and precision.

Keywords: *Common DC BUS, Re-winder, System Design, Performance Analysis*

1. INTRODUCTION

For the most re-winder machine drive control system, most have adopted higher automation dc speed control unit as dc motor's control unit, the PLC function as the master unit completed before and bottom rollers after, and withdrew paper roll speed regulation and tension control^[10]. This kind of dc transmission control mode now is perfect, completely replaced the 1990s analog signal control mode, and gradually meets the ac inverter control mode change^[12].

The traditional AC bus structure, Re-winder work in the power generation status difficult to energy feedback to the grid^{[1][2]}, Can only take the braking means to consume the energy generated, The common DC bus Control structure can achieve the feedback electrical energy reuse, Improve the energy utilization efficiency of the drive system. therefore, the way of common DC bus drive system is very necessary.

As people make a research on power electronic technology to rectify and inverter device a more in-depth understanding, this paper proposes a new control concept: DC BUS type structure. This structure makes the re-winder transmission control method simpler and less investment is needed, and more effective energy is saved.

2. BASED ON DC BUS OF RE-WINDER MACHINE DRIVE CONTROL SYSTEM SCHEME OVERVIEW

Based on DC BUS of re-winder machine drive control structure, it uses the public rectifier unit, DC BUS advance charging device, the public braking unit, and then hang a certain number of inverter unit that drive the ac motor, Meanwhile, match large-scale programmable controller with it such as Siemens S7-400 PLC as central control unit, make scene operation by touch screen, and adopts profibus-dp fieldbus to realize control system data communication, in order to improve the system anti-interference ability and reduce the wiring. This control structure can not only reduce the harmonic, improve the system of power factor and accelerate the system dynamic process, and also can realize quickly stopping of the system and special transmission division normal power feedback electricity needs. The system structure is shown in figure 1:

The control system with a single dc speed control device or inverter comparison, it has less installation dimensions, fuses, contactor and switches etc which can focus on using a reactor. In order to reduce power grid harmonics interference, total rectifier unit adopts 6 pulse or 12 pulse system rectifier feedback unit.

Based on the DC BUS rectifier feedback + inverter's motor drive scheme can save investment.^{[3][5]}This system uses into line reactor and self

coupling system of transformer for grid harmonic pollution greatly reduced, and ensure motor can achieve the maximum torque even in generating state. Its unique DC BUS power-supply modes, within the system motor or electric generator can respectively realize positive electric, braking and reverse electric, braking quadrant operation in

power, and to make the motor energy state directly supplied by bus in motor, greatly improve the utilization of renewable energy, has obvious effect in energy saving and so on. A series of advantage is currently the re-winder machine driving variable frequency speed regulation system of a kind of ideal choice schemes.

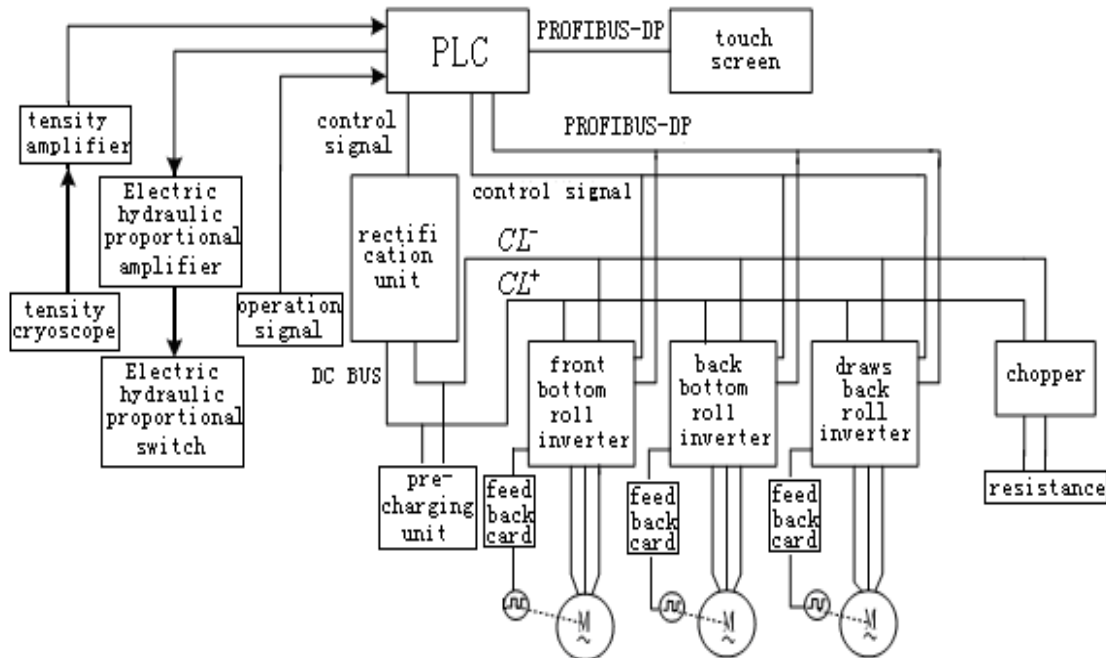


Figure1 Re-Winder Machine Drive Control System Structure Based On DC BUS

3. DC BUS SYSTEM ANALYSIS

3.1 DC BUS System Structure Analysis

It uses a set of high-power public rectifier power unit, each load motor respectively go through the inverter unit that hanging in DC BUS. Adopts DC BUS power supply characteristics are:

(i) as a result of the ac drive technology, so in power efficiency greatly superior technology, DC BUS with concentrated rectifier technology, it will be in traditional communication system based on energy saving of 8-15 % again^[4];

(ii) concentrated rectifier technology enables all inverter is the same with DC BUS voltage, and because the bus capacity is big, dc voltage inverter voltage is more stable, make inverter system improve anti-jamming performance, and make the system harmonic control effectively.

(iii) improve the system of power factor, can reach above 95%, reduce the power grid harmonic current, and improve the system power efficiency^[6].

(iv) DC BUS is using frequency inverter, partly by the original rectifier unit into each of the frequency converter rectifier public rectification unit compact structure, thus enhance the overall equipment reliability,

(v) DC BUS technology used in paper machine production line, can make the motor feed energy first DC BUS back to offer other motor use, only when feedback energy is more than other operation motor required energy, redundant energy to feedback to grid or consumption in braking unit, can avoid because a division of bus voltage high frequency inverter, and produce trip, stop the phenomena, this during the commissioning, production will greatly reduce the commissioning and downtime,

(vi) DC BUS system equipment compact structure, stable work, in many motor drive system is omitted in large amounts of brake units, braking resistance peripherals, and save the area and equipment maintenance quantity, reduce the equipment fault point, improved facilities of overall control level^{[7][9]}.



3.2 DC BUS System Hardware Configuration

(i) public rectifier unit

According to the paper machine equipment level and mill finances, and the related selection, reference may be ABB or SIEMENS company product to determine. What we use is the perfect harmonic control ability and high efficiency of six or twelve phase pulsation phase pulsation rectifier feedback unit system, can realize the energy two-way flow, but relatively greater investment is needed. When more driving points is achieved, we can choose multiple sets of rectifier unit, reduce single-user rectifier unit work risk, as well as reduce control cabinet, large voltage loss caused by the distance.

(ii) inverter module unit

The drive unit inverter choice may have two kinds of products available, one kind is SIEMENS company 6SE70 series, another kind is the ABB ACS800 series, which is 6SE70 series inverter modern vector control (VC) representative. In the closed-loop control mode, its steady performance and dynamic properties can meet the winders drive control system requirements.

(iii) pre charging device

Control system of DC BUS voltage is installed beforehand charging link namely among bus voltage capacitor to slow build process. DC BUS capacity of choice among capacitor principle is: the capacity is at least among capacitor inverter of capacitance 30%. If the startup inverter but not possess enough capacitive loads, dc voltage will be over controller voltage amplitude limit value, thus immediately set energy regeneration feedback. Therefore the capacity of choice among capacitor must cause the high value^[11].

(iv) public braking unit

This is to prevent transmission point in part in the system dynamic process, some high-power

inverter work in regenerative braking condition, if proximate inverter with the capacity of the inverter, the capacity of the large difference is easy to cause the energy reduced to small capacity inverter inrush current, and cause small capacity inverter over-current trip. This re-winder machine control system due to retreat paper roller and around the roller inverter capacity, so must set large difference public braking unit. General public braking unit capacity choice for inverter one-third of the total capacity for appropriate.

(v) system other devices

A central control unit can choose Siemens PLC300 or 400 series to complete re-winder machine pressure paper roller pressure control, front bottom rollers torque differential control and retreat paper roller tension control and operation of screen can choose a function optimization of Siemens OP27 series touch screen, these Siemens product support PROFIBUS protocol, therefore can realize real-time data between the accurate device communications. At the same time, using MPI agreement cable complete industrial PC remote monitoring of PLC. if else choose high-precision OMRON company E6B2 - CWZ6C 1024P/R type photoelectric encoder realize the transmission point of closed-loop speed control regulation.

4. BASED ON DC BUS OF RE-WINDER MACHINE DRIVE CONTROL OF ELECTRICAL CONTROL DESIGN

4.1 Re-Winder Machine For Rectifier Feedback Unit Electric Control

This system is mainly for 3800/3,000 from insufficient paper re-winder machine provides drive control, before and after the bottom rollers motor respectively, 160kW refund paper roll motor 250 kW. In supplying rectifier units, according to users requirements, we adopt Siemens company 6SE7041-3EK85-1AA0 series rectifier feedback

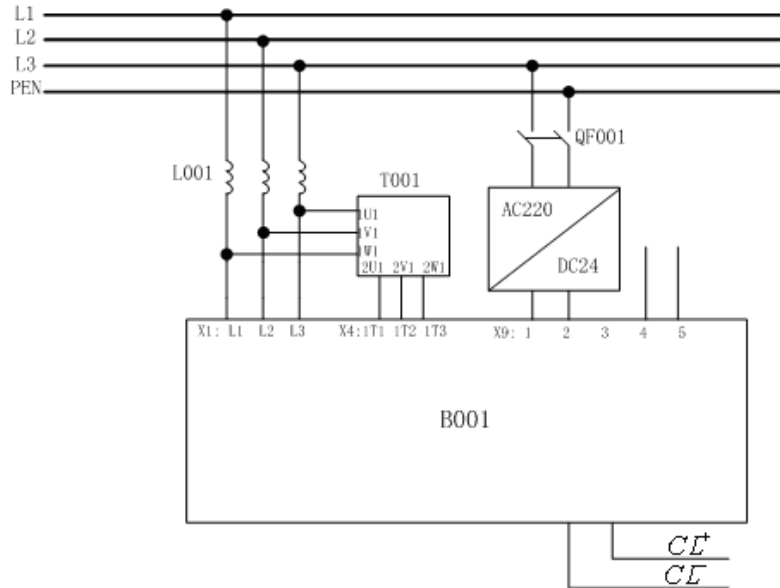


Figure2 Re-Winder Rectifier / Feedback Unit Electrical Design

device, rectifier feedback device consists of two anti parallel six pulsation center composition, can in both directions are electric energy flow, namely its generating work state of the bridge by one self coupling transformer T001 and grid connected to electric work state of the bridge through the dc power supply, the lateral inverter unit electric control chart rectifier feedback as figure2 shows. Therefore it is not only by the three-phase ac power obtained electronic state of energy, and can be on the DC BUS generating state energy back to the grid.

4.2 Re-Winder Machine Drive Inverter Unit Electric Control

For front bottom rollers, back bottom rollers, and withdrew paper roll three transmission points respectively by three inverter driving, before and after bottom roller adopts 6SE7033-2TG60 series, retreat paper roller adopts 6SE7035-1TJ60 series and attached to SPW 420 axial winding machine T400 standard package craft board [3] and overall realize three ac motor speed adjustment, torque control and tension control, fig.3 shows.

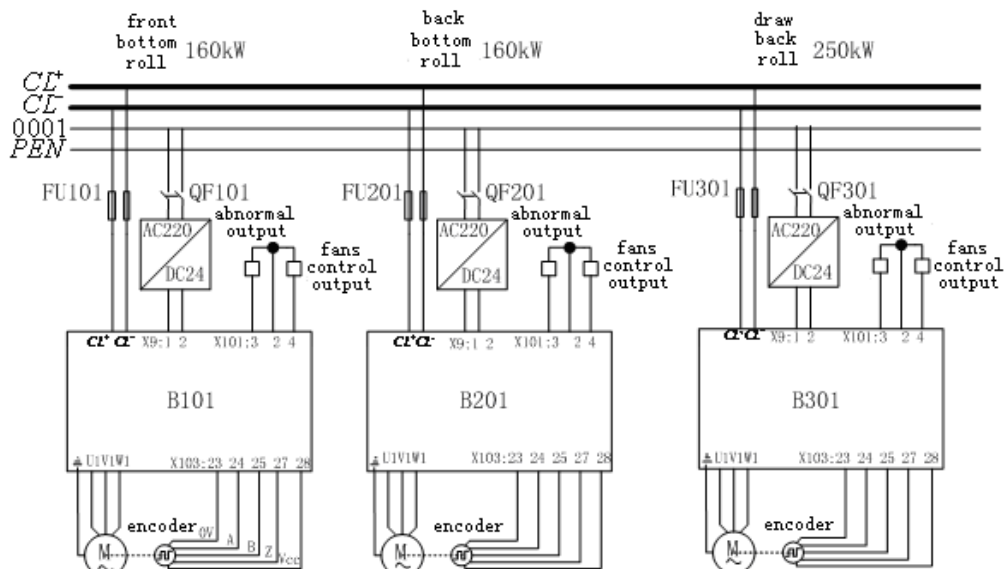


Figure3 Re-Winder Inverter Unit Electrical Design



(i) before and after bottom rollers torque differential control

Using 6SE7033-2TG60, the real-ti control to achieve the required torque differential control function. Master-slave control is designed for motor drive applications^[9], main transmission is typical speed control, and other inverters follow the main transmission torque or speed given. In this paper the main drive after bottom rollers, for from the driving for the former bottom rollers. Master/from control parameters on the default setting can satisfy re-winder machine main transmission needs, we'll set the driving parameter adjustment, makes the winders in lead paper state around bottom rollers which are set for speed control, running state when automatic convert the former bottom rollers for speed control, after bottom rollers for torque control.

(ii) retreat paper roller tension control

SPW 420 axial winding machine standard software is designed for re-winder machine equipment and design special inverter software, it can achieve precise tension control in economic way. When retreat paper roller diameter variates, in order to make paper of surface tension remained unchanged, it can guarantee the rotational speed of change and inversely proportional to coil diameter and torque changes and coil diameter is priced. Speed adjustment patterns are tension given value and feedback value, adjust the drive motor torque to stay on for a given newspeak tension value; Torque adjusting model can be used to open loop tension control mode, do not need tension sensor feedback, application software and curly according to the given value of tension, coil diameter, the rotation inertia parameters can be calculated by required tension torque values.

4.3 DC BUS System And Traditional Inverter Drive System Comparison

The analysis of DC BUS has the characteristics of the system are described, and no doubt this system, with its technical performance and energy saving effects of superiority obtains the widespread application, of course, inverter drive control system in today's that for a time also will occupy more motor's dominance of ac speed adjustment.

First, technically, DC BUS system overcomes over-voltage protection movement. In the re-winder running processes, retreat paper roll motor due to drag large inertia retreat paper roll in the braking power state, cause a dc side over-voltage, if choose the inverter control dc side voltage which exceeds a

certain set of over-voltage protection value system fault alarm, cause downtime further. The energy can flow in DC BUS by other transmission point absorption; also can use fast melting or braking unit electrical protection.

Second, when using reversible DC BUS rectifying power supply, feedback unit DC BUS system is formed with a regenerative braking system, namely the quadrant any transmission point is can work at state can also work in generating state. Especially in the re-winder machine is more important, because the re-winder machine in inertial may require a long time to stop after the quit, so a brake function can quickly stop work.

Again, the device, simplify, structure and more compact system input decrease. DC BUS system is only a common rectifying power supply unit in bus sub-accounts multiple inverter unit, but step speed regulation system, then each transmission point all need a frequency converter realize motor speed. So actually, DC BUS system costs should be lower than variable frequency drive control system [4].

5 CONCLUSION

Using DC BUS system of re-winder machine control mode to apply in many applications, system on site operation is good, can well satisfy re-winder control requirements. As a new type of re-winder machine control mode and actual application still slant less, but it is consummation further, the technology will be more mature, the price will be more reasonable, meanwhile, we are dedicated to developing integrated control device based on DC BUS of re-winder machine transmission, which will make the whole control system products. Therefore, DC BUS control systems will also do because of its superior performance by our customers.

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