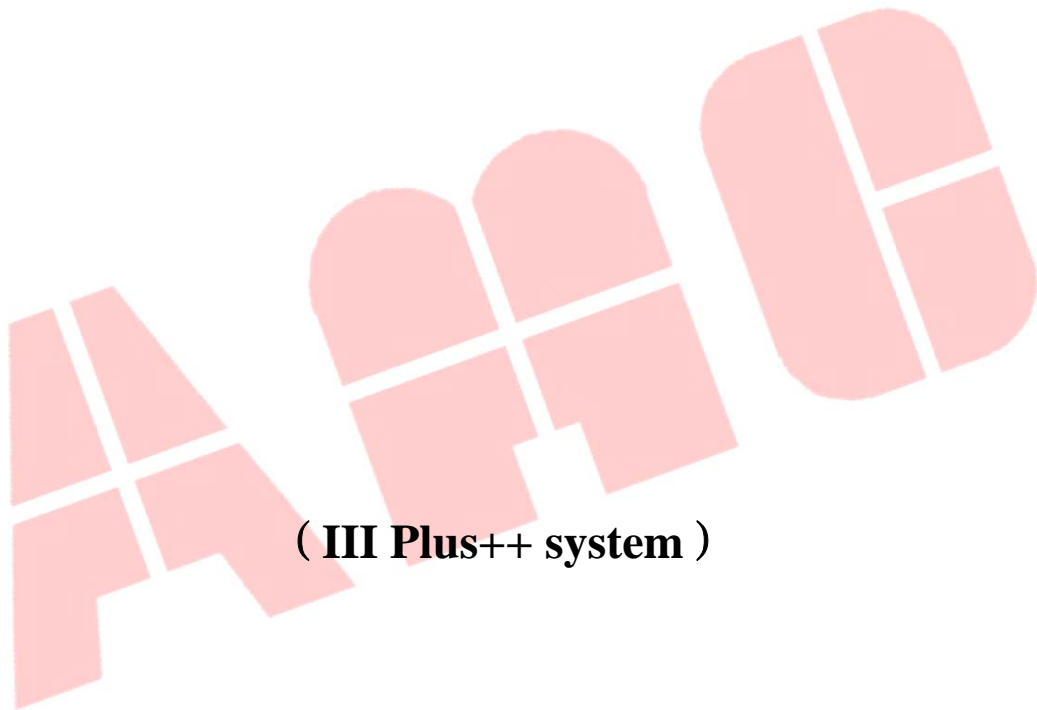


20 Roll Hydraulic Mill Crown Control And AGC Control System

Operating Instructions



XI'AN AMCTECH CO.,LTD

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1450mm 20 Rolling Mill Crown Control & AGC Control System

Operating instructions

(III Plus++ System) System Composition

This system is used for multi rolling mill. III Plus++ System includes: roll contour control system, first intermediate roll shifting control system, pass line adjustment control system, wiper control system compared with III System.

Chapter One Crown Control System

1 System Constitute

Crown control system consists of control cabinet, crown control console, button switches on main operation console (pass line elevation up/down, crown zero, crown unloading/work, crown single/linkage motion, crown adjustment left/right), left operation cabinet (intermediate roll forward/backward), right operation cabinet (intermediate roll forward/backward) . The crown control cabinet is composed of a DC power supply system, a Simens 300 PLC controller, a display, a number of AMC201 (signal amplification boards), and an AMC300 (servo valve drive board). The crown console consists of an industrial control computer, a keyboard, and a display.

2 System Operation

System functions include: crown control function, intermediate roll traverse function and roll line adjustment function.

2.1 Crown Control:

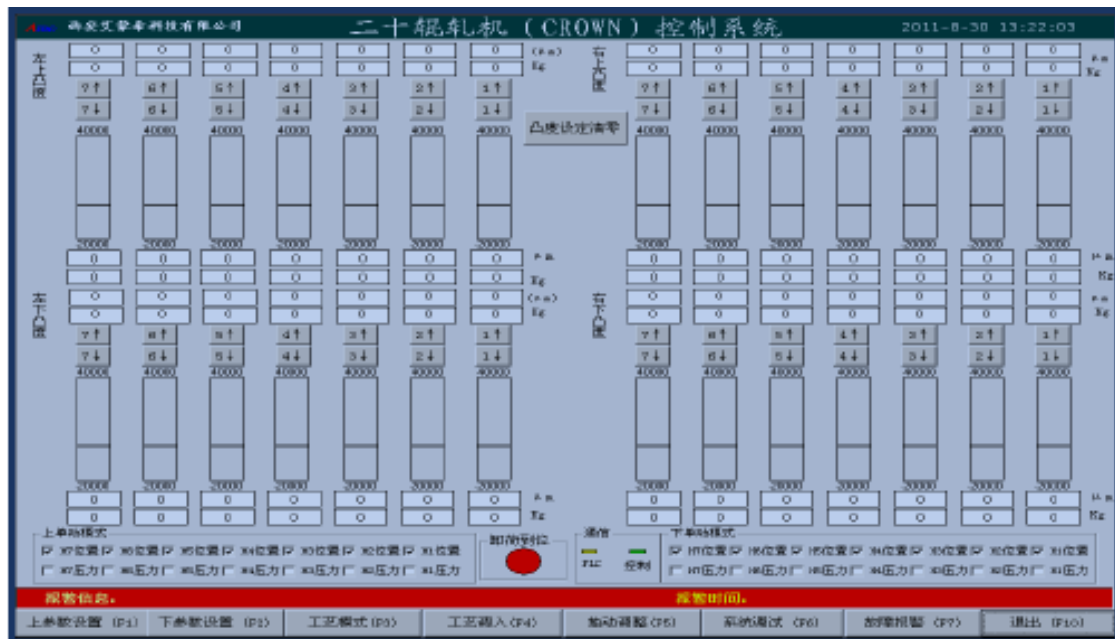


Figure1. Crown Control Interface

The crown control is the core of the twenty-roll mill. In order to obtain a better strip shape, the system adopts a seven-stage adjustment control method to indirectly change the shape of the plate by dynamically adjusting the roll shape. The shape of the sheet is satisfied by adjusting the four roll shapes of A, D, a, and d.

operating procedures:

1. Start the computer->double click Crown Control software “amcCrown” -> enter the main interface(see figure 1)

2. left mouse click “system tuning” or press F6 to enter tuning interface (see figure 2), then click “PLC status” to check the PLC working status (see figure 3). Click “Initialize” and “Connect” to connect PC and PLC. If the PLC indicator light on main interface turns green and blinks, the connection is successful. Click “Exit” to close PLC working status window.

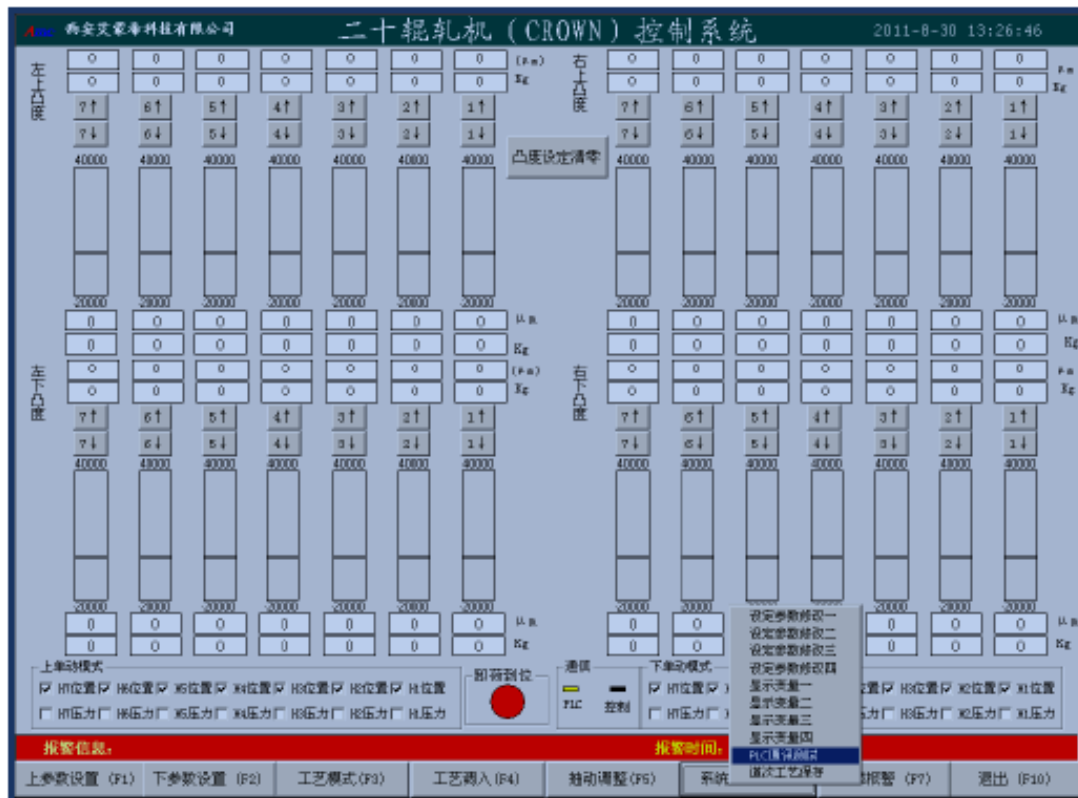


Figure2. System Debug Screen

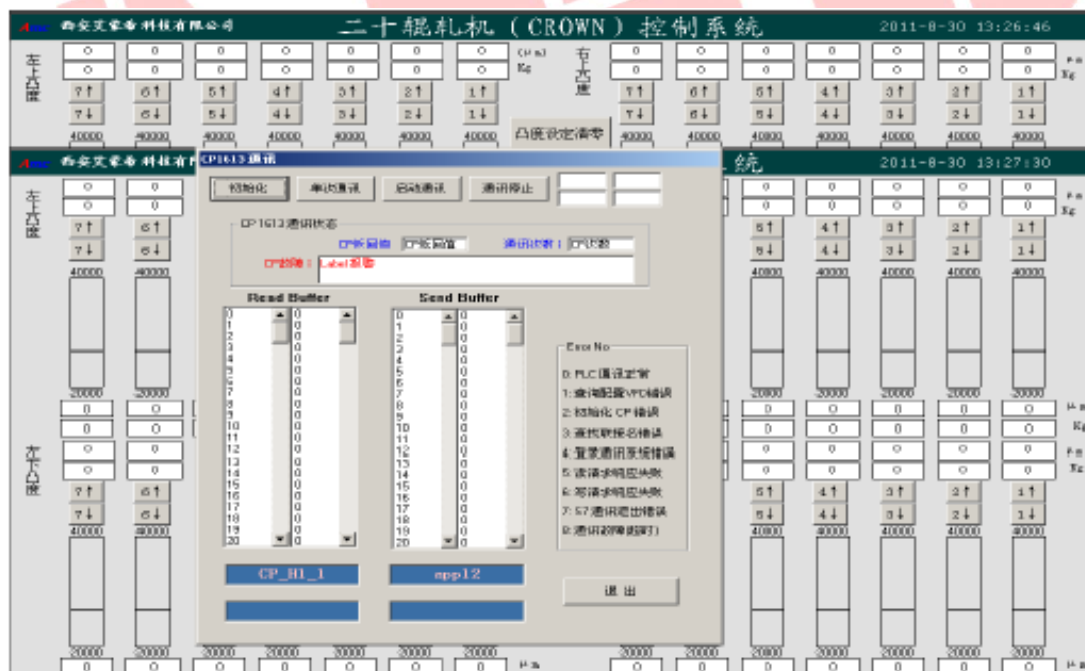


Figure3. Communication Test Screen

3. Select "position" on main interface as control mode. Click "Upper Parameters Input" or press F1 to input parameters for upper part. Similarly, click "Lower Parameters Input" or press F2 to input parameters for lower part. Confirm the

previously input parameters by pressing “upper crown adjustment left/right” and “upper crown adjustment left/right” switches. Select “work” in “crown unloading/work” switch, and the oil cylinder will move to the designated position. If the parameters need to be modified later, redo the parameters input procedures or mouse click the oil cylinder position button on the main interface, then confirm and start as stated before.

4. For a convenient use, you can save a set of crown parameters in advance by clicking operating mode or pressing F3.

5. To import the “operating mode” set and saved in the previous step, click “mode import” or press F4, and click “Add” to add the predefined operating mode into the operating sequence. The mode can still be modified during work, if click “system tuning” or press F6, and select “save operating mode” .

6. After thickness gauge scans the thickness of plate and strip, crown system will generate the predefined values to control the oil cylinder motion. When thickness gauge finishes scanning, click the left/right thickness gauge scan buttons to get the thickness curve and the predefined values of crown. The convexity system can automatically generate a set of preset values by scanning the thickness of the strip material by the thickness gauge to control the convex cylinder action and then trim the strip material quality during the rolling process. After the end, just click the left (right) thickness gauge scan button in the animation surface to get the thickness curve and obtain the convexity preset value.

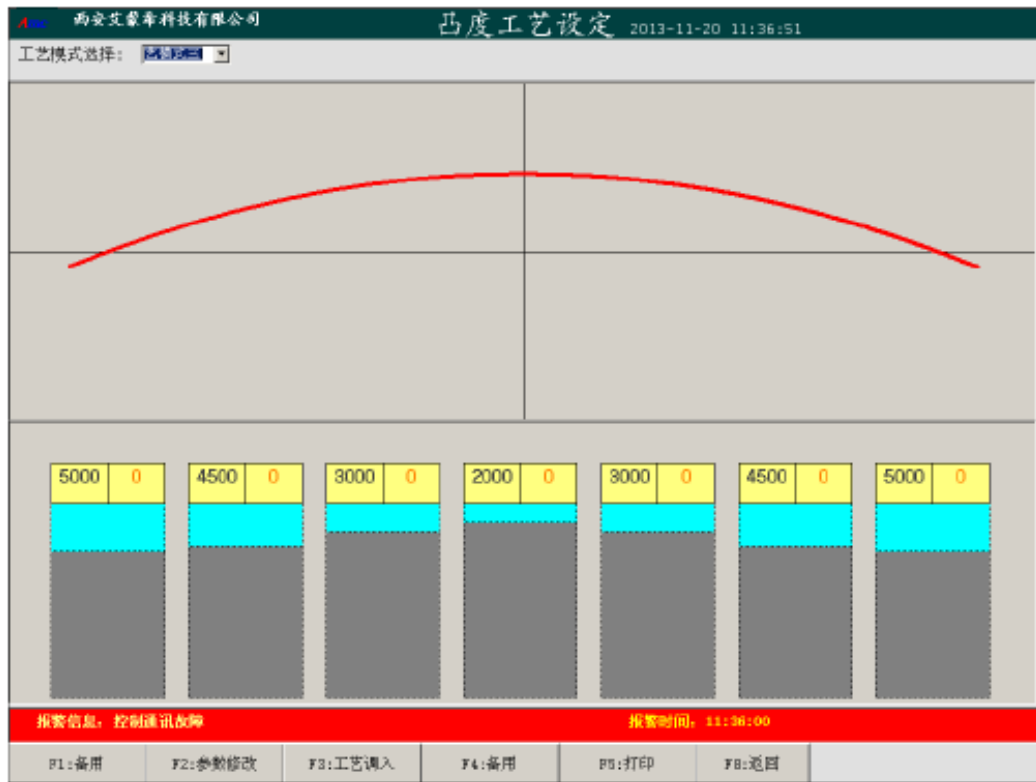


Figure4. Process Transfer Screen

2.2 First Intermediate Roll Shifting Control System



Figure5. Twitch Adjustment

First intermediate roll shifting control is an important way to ensure the flatness on the edge of plate and strip. The movement of hydraulic cylinder would adjust the position and cause the movement of first intermediate roll. PLC acquires the signals on displacement sensors, and compares the signals with the default. When error occurs, position controller generates the signal and changes the state of oil cylinder servo valve, and thus drive the oil cylinder to the required position. To control the flatness on the edge of plate and strip, the position of the first intermediate roll needs to be adjusted dynamically. Before rolling, the operator sets the position parameters of intermediate rolls according to the width of the strip, and the control system will drive the intermediate roll to the target position. The position of intermediate roll can also be adjusted by manually on position adjustment interface (see figure 5). To improve the rolling efficiency, when rolling speed exceeds 120m/min, the position of intermediate roll can be adjusted in real-time on position adjustment interface.

2.3 Pass Line Adjustment:

Pass line adjustment is required whenever a roll is changed (except for the work roll). The operator needs to enter the diameter of each roll into the PC after changing the roll. The system will automatically calculate the pass line elevation. Click ("pass line confirmed ")button or press the pass line up/down switch on the main operation console to adjust the pass line position. When the pass line needs to be retreated to zero position, set the pass line position to "0" on pass line up/down switch and "position adjustment " interface. Click ("pass line confirmed ")button to finish.

2.4 error alarming

Error alarming information and alarming time are displayed in real-time on main interface. To view the alarming records, click "error alarming" or press F7 key see figure 7.

3 Special Instructions

There are 28 ammeters for servo valve drive current display and 4 ammeters for shifting servo valve drive current display in a crown control cabinet. When the system is charged with electricity, the ammeter points to positive current; when the servo valve is taking in oil, the ammeter points to negative current; otherwise, it should point to zero.

Champer Two wiper control system

Wiper control system includes 2-roll wiping system, 4 roll wiping system and purging systems. The operator switches the left / right wiper or cancels wiping, according to the rolling direction.

1 2 Roll Wiping System

The 2-roll wiper is of box structure with upper and lower roll, driven by hydraulic cylinder.

Synchronized machinery with rack and pinion is to ensure the synchronization of the opening and closing of the upper roller box. The closing pressure of the wiper is adjustable according to the strip speed. If a rolling accident happens, the wiper will open automatically at its maximum speed.

The opening and closing of the 2-roll wiper is realized by the switches on the operation cabinet. The pressure of the wiper is adjustable according to the speed of the strip. The higher the speed, the higher the pressure of the wiper. The rolling mill starts at the speed of 200m / min with constant pressure. When the speed exceeds 200m / min, the pressure increases along with the speed.

To adjust the pressure of 2-roll wiper, click "system tuning" in the main interface, and select "parameter reset 4", then the parameter setting window will pop up, and enter the parameter (percentage) at "Two_Roll_Paramater".

2 4 Roll Wiping System

4-roll wiper consists of 2 upper rolls and 2 lower rolls. The wiping roll is supported by the backing bearing. The supporting bearing is connected to the air cylinder. The speed, width, and thickness of the air cylinder can be individually controlled.

The hydraulic cylinder is to perform the opening and closing operation. The use of rack and pinion ensures the synchronization of the opening and closing of the upper roller box.

The system will set the cylinder pressure, based on rolling speed.

The air pressure is the maximum when the rolling speed is maximum.

Pressure is controlled by a proportional valve. The rolling speed and air pressure

reaches the maximum value at the same time. The number of air cylinders (4, 6, or 8) is determined by the width of the strip. The air purge system is used to remove the oil from the strip edges. Rolling stops as air purging stops.

The 4-roller wiper can be open or close in both manual and automatic ways. Manual operation is realized by switches on the machine. To automatically operate the machine, turn the switch in the neutral position, the system will open or close the 4-roller wiper itself. For safety concern, manual operation has priority over automatic control.

The number of air cylinders is determined by the width of the strip. If the strip width is in between 600mm ~ 800mm, 4 cylinders are required; if the strip width is in between 800mm ~ 1200mm, 6 cylinders are required; if the strip width is greater than 1200mm, 8 cylinders are required. The rolling mill starts at the speed of 200m / min with constant pressure. When the speed exceeds 200m / min, the pressure increases along with the speed.

To adjust the pressure of 4-roll wiper, click "system tuning" in the main interface, and select "parameter reset 4", then the parameter setting window will pop up, and enter the parameter (percentage) at "Four_Roll_Paramater".

Champer Three AGC Control System

AGC control system includes:

(+ P111) AGC control cabinet (including power processing system, DC power supply, real-time controller, display, keyboard, signal adapter box, several AMC37、AMC20) AGC console (+ T) (including: industrial personal computer, keyboard, display .etc) management computer (including: network Huber, SiemensCP1613, industrial personal computer .etc)

main console (including buttons for: unloading, unloading reset, open roll gap, close roll gap, united lift, united press, transmission side pressure, operation side pressure)

left/right operation cabinet (including buttons for: transmission side pressure, operation side pressure; meters for: transmission side pressure, operation side pressure, 2-roll wiper pressure, 4-roll wiper pressure, intermediate roll shifting)

1. System Principle

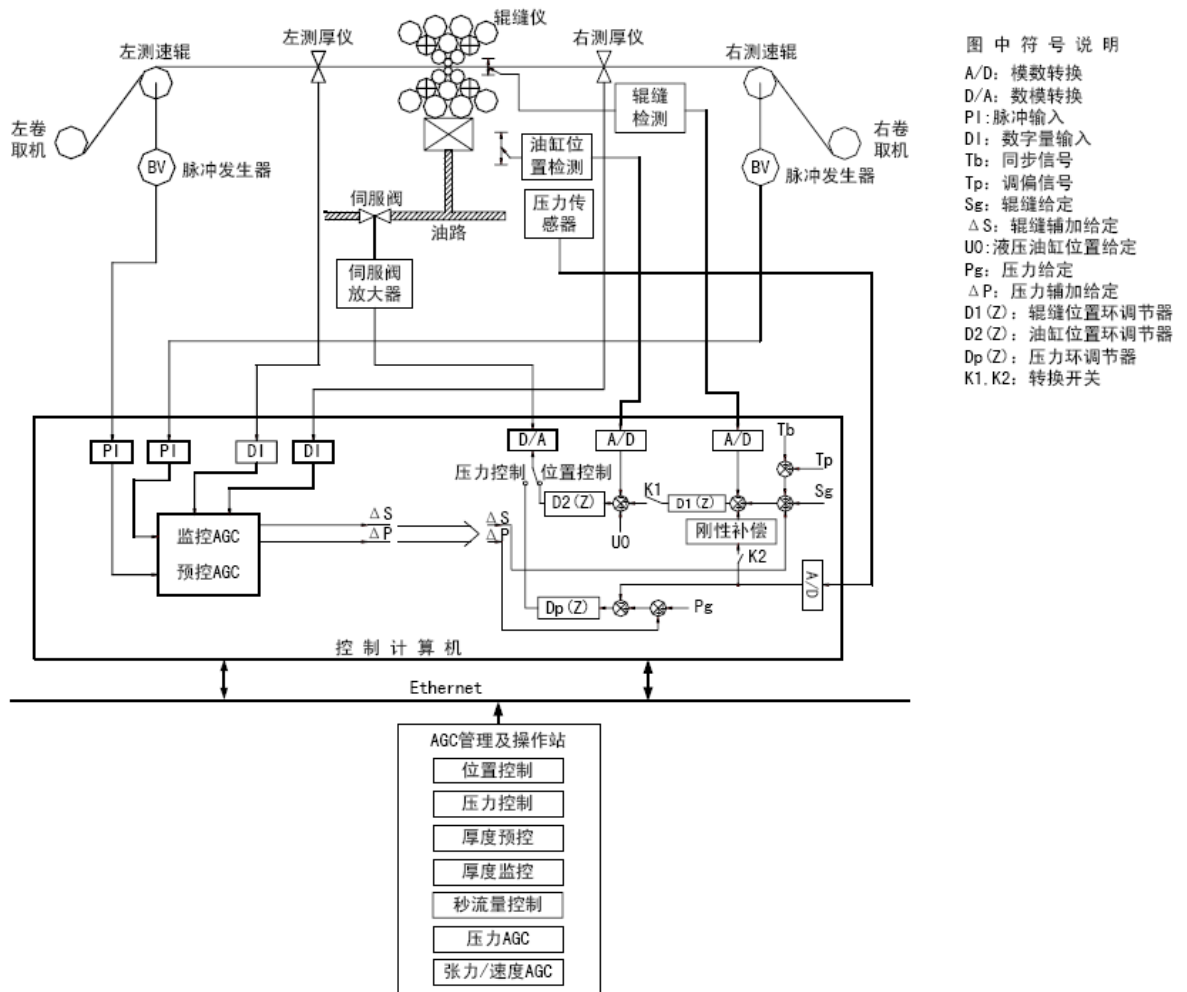


Figure 6. AGC Computer Control System Block Diagram

2 System Structure

operation instructions

notes:

The AGC control system must be started before starting the screw down pumping station. During interrupts and accidents, or before the system starts up, the system should be in unloading status. That is to say, the operator must press down the unloading button on main console, and confirm the system is in unloading status.

After change the roll, pre-pressing is required; if the roll is changed during rolling with strip in the arch, pre-pressing is not necessary, but instead, do remember to switch to pressure control, set the pressure to 1000KN, and take down the roll gap as initial roll gap. After change the roll, since the diameter of the new roll is larger

than the former roll, if the roll gap is not set properly, the oil cylinder will cause too much pressure and damage the machine.

(1) Charge the system with electricity. Turn on the air switches Q1, Q2 on + P111 AGC control cabinet, and the power supply +24 V, $\pm 15V$, +5 V. Start control computer, operation computer, management computer in order.

(2) To start AGC system management software on management computer, double-click AMCSERVER on desktop.

(3) To start AGC system operation software on operation computer, double-click AMCOP on desktop.

(4) Click "F9 System Tuning" on the main interface of the management software, and enter "Network Connection Test". Start GAP and AGC computer network connection. If the connection is successful, the connection indicator light on main interface turns green and blinks. If the connection fails, the connection indicator light on main interface turns red (see figure 8).

(5) Click "F9 System Tuning" on the main interface of the management software, and enter "PLC Connection Test". Click "Initialize" and "Connect". If the PLC connection is successful, the connection indicator light on main interface turns green and blinks. If the connection fails, the connection indicator light on main interface turns red (see figure 9).

(6) After the rolling mill is changed, pre-pressing is an important operation. Pre-pressing is proceed when the roll gap is open.

Lift "Unloading" button

Press "Unloading Reset" button

Press "Open Roll Gap", and the corresponding indicator light blinks.

Press "Automatic Pre-pressing F2", and enter the "Automatic Pre-pressing" window (see figure 10)

Note: It is recommended to use dynamic pressing instead of static pressing.

The dynamic pressing means rotating rolls, and spraying on coolant. Usually we choose 1/3-1/2 of the maximum rolling force as pressing pressure or force.

(7) On pre-pressing interface, click "F1 Pre-press Start" and follow the following steps. Set pre-press force and roll gap. When the system enters the pressure loop and

the pre-press reaches P0, press "F2 pre-press reset". Then press "F3 pre-press finish", "F8 return", and press the "Unloading" button. In setting pre-pressing force, please note:

- ①. Choose 1/3-1/2 of the maximum rolling force as pressing force
- ②. When pre-press for the first time, use small force to avoid damage due to pressure sensors, servo valves and other equipment failure
- ③ In pressing, to observe the pressure changes and roll gap changes on transmission side/ operating side. If the pressure and roll gap does not change, stop and find out the error.
- ④. During pre-pressing, only when the drive side / operating side pressure is almost equal, and the transmission side / operating side roller gap is less than 100 μ m, you can press "F2 clear pre-press", Forced by the force to take 1 / 3-1 / 2 maximum rolling force.

(8)Operation setting: Operators can get save or modify the operation setting via "F1 Operation Setting" on main interface in the management computer (see figure).

(9) Rolling queue:The operator can use "F4 rolling queue" to set previously saved operation parameters in sequence. When a rolling pass finishes the work, input the next rolling pass number to set the operation mode (see figure 5).

(10)Curve Display: To see rolling force curve, rolling speed curve, roll gap curve, and left/right thickness gauge curve in real-time, click "F6 曲线显示" ("F6 curve display") on management computer. These curves can also be zoomed in, zoomed out or printed (see figure 5).

(11)Parameter Setup:During rolling, the following parameters can be modified in real-time by F1 Parameter Setup entry thickness, exit thickness, entry tension, exit tension, rolling force, roll gap setting, rolling speed, rolling pass, roll offset, force offset.

(12)System Tuning:The "F9 system tuning" is used for rolling parameter setup, rolling test, start or stop the AGC-computer and PLC connection.

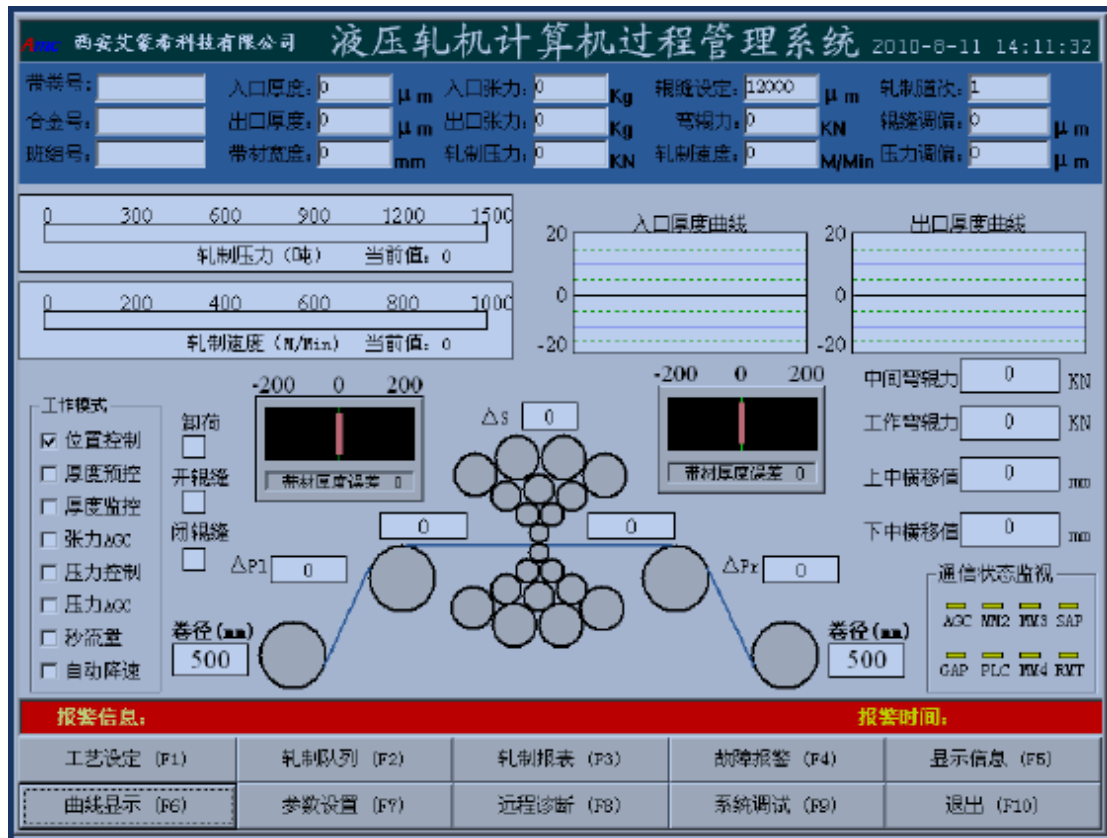


Figure 7 Operation Main Screen

(13)Rolling Report: “F3” ” Rolling Report” can generate reports for each tape, each rolling pass, each rolling group, and each day. Customers can choose to print the reports about rolling speed, rolling force, exit thickness or other parameters. See figure 6.

(14)Error alarming:Click "F4 Error Alarming" for error records, such as error name and error time. See figure 7.

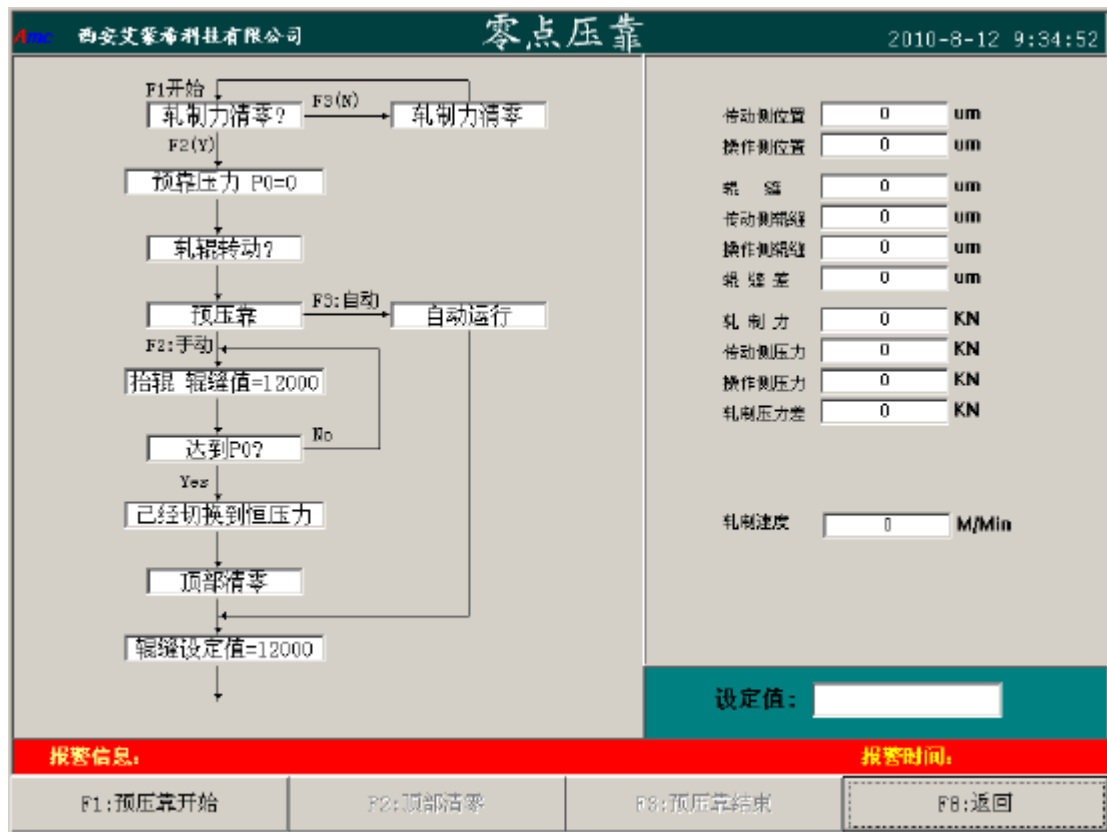


Figure 8 Pre-pressing Screen



Figure 9 Rolling Queue Setting

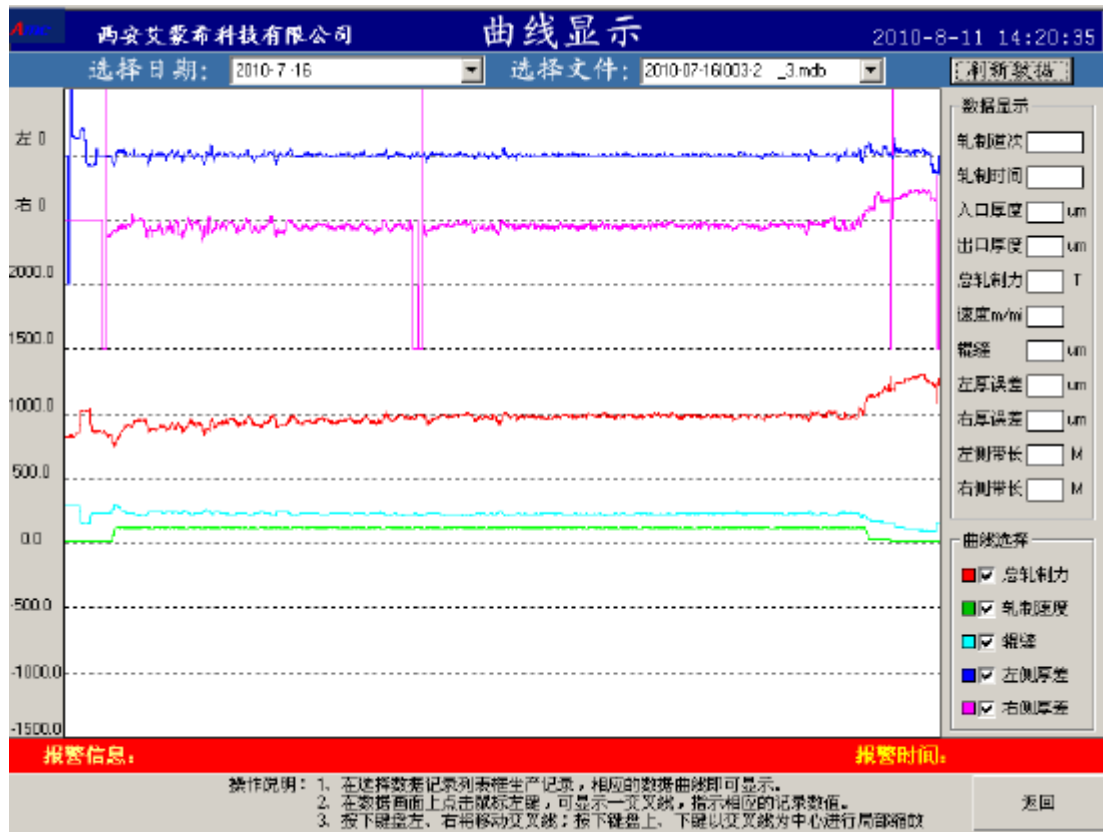


Figure 10 Curve Display



Figure 11 PLC Communication

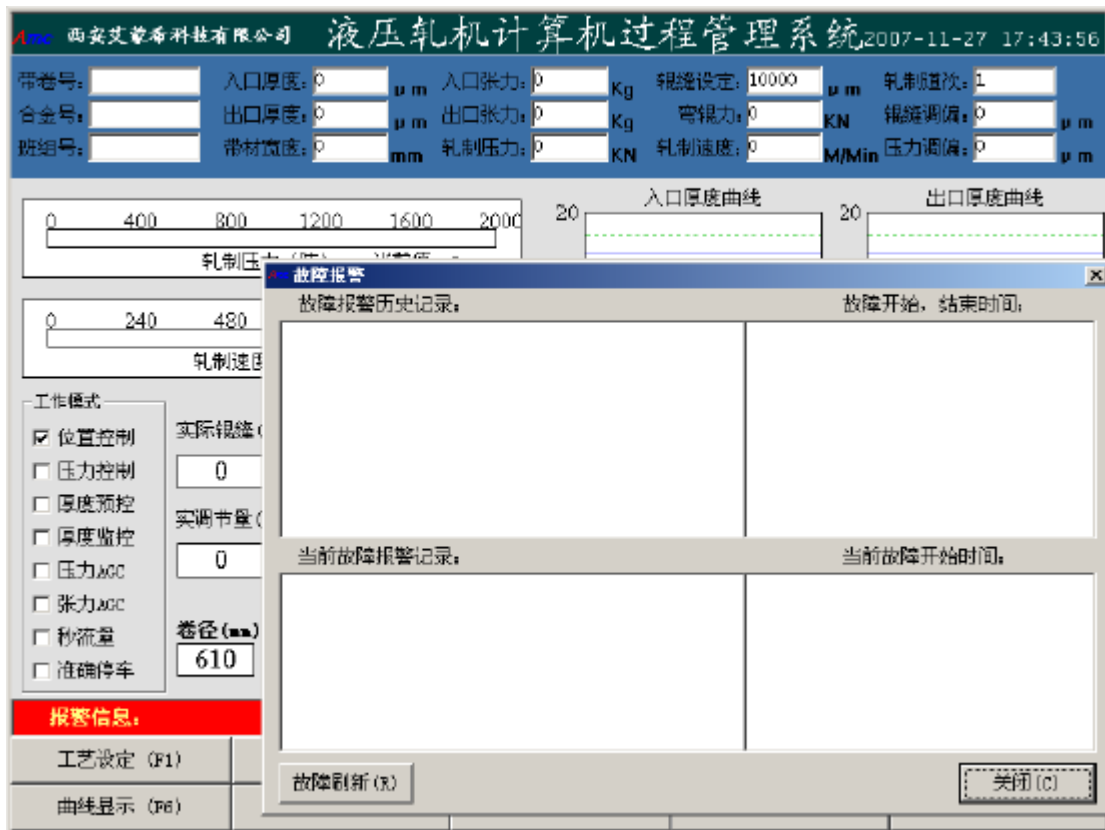


Figure 12 Error Alarm

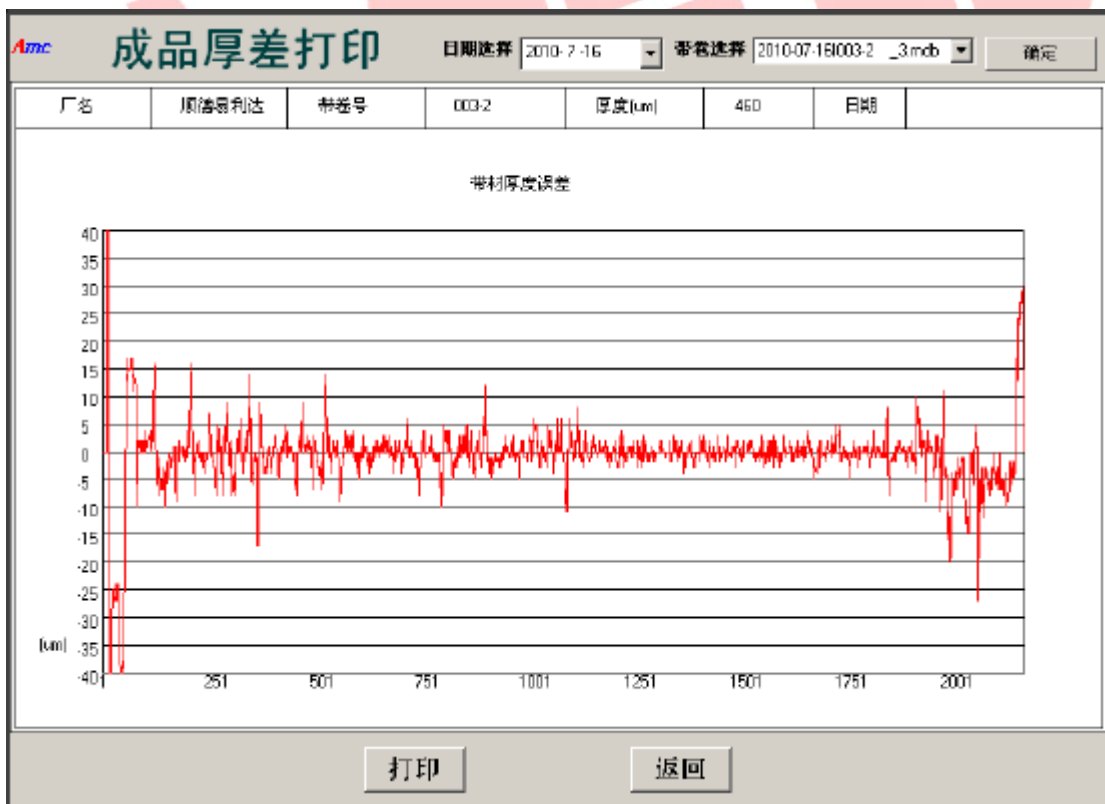


Figure 13 Report Printing

3 Working mode selection

There are 2 working mode to choose from on the upper left corner of the main interface: 1.position control, 2.pressure control. Position control is usually recommended here. The inner loop control of the system are position control and pressure control. The outer loop control are thickness pre-control, thickness monitoring, flow control, AGC for pressure, and AGC for speed. Only when the thickness gauge is in normal state, thickness pre-control, thickness monitoring, and flow control can be started.

Our working mode recommendations for each rolling pass are listed below:

First rolling pass: position control, thickness pre-control, and flow control

Second rolling pass: position control, thickness pre-control, flow control, flow monitoring

Third rolling pass: position control, thickness monitoring, flow control

Forth and subsequent rolling pass: position control, thickness monitoring, flow control

4 Parameter Modification

When the system is in normal state, these parameters can still be modified by operators:

西安艾蒙希科技有限公司 系统调试参数修改 2010-8-12 9:50:22

操作侧位置增益系数	200		AGC预控系数	50	
传动侧位置增益系数	200		AGC监控系数	60	
操作侧位置积分系数	2		辊缝调偏量	6	
传动侧位置增益系数	2		压力调偏量	3	
操作侧压力增益系数	50		操作侧压力基本零点修正值	400	
传动侧压力增益系数	50		传动侧压力基本零点修正值	400	
操作侧压力积分系数	2		操作侧弯辊基本零点修正值	400	
传动侧压力积分系数	2		传动侧弯辊基本零点修正值	400	
弯辊增益系数	20		压力传感器最大量程	35	
弯辊积分系数	5		主油缸面积 (Cm2)	1000	
系统控制死区	0		弯辊缸面积 (Cm2)	100	
右侧测厚仪距离	1800		最大压力保护值	12000	
左侧测厚仪距离	1800		两侧压力差保护值	1400	
码盘脉冲数	1000		弯辊压力传感器最大量程	35	
偏道辊周长	900		操作侧预置零点	90000	
MTS波特率(Kbs)	500		传动侧预置零点	88888	

报警信息: 报警内容..... 报警时间:

控制0	控制2	控制4	控制6	控制8	控制10	参数保存	退出
F1帮助	控制3	控制5	控制7	控制9	控制11	控制13	

Figure 14 Parameter Modification One

西安艾蒙希科技有限公司 系统调试参数修改 2013-11-20 12:02:57

左卷初始卷径	0		中间弯辊积分	2	
右卷初始卷径	0		中间弯辊基本零点修正值	400	
张力最大值	3000		中间弯辊压力传感器量程	35	
速度设定最大值	300		辊缝差报警值	2000	
张力调节步长	1		轧机穿带速度	15	
速度调节步长	1		轧机加速度	20	
压力调节步长	10		带材宽度	0	
辊缝调节步长	1		工作辊直径	0	
弯辊调节步长	1		支撑辊直径	0	
中间弯辊调节步长	5		轧机位置刚性	300	
轧机减速位置	20000		轧机辊缝刚性	400	
轧机停车位置	1800		轧机位置刚性系数	50	
弯辊最大值 (KN)	300		轧机辊缝刚性系数	50	
中间弯辊最大值 (KN)	300		2系流量系数	2	
中间弯辊缸面积 (Cm2)	300		3系流量系数	3	
中间弯辊增益	5		4系流量系数	3	

报警信息: 报警内容..... 报警时间:

控制0	控制2	控制4	控制6	控制8	控制10	参数保存	退出
F1帮助	控制3	控制5	控制7	控制9	控制11	控制13	

Figure 15 Parameter Modification Two



Figure 16 Parameter Modification Three

- Control parameters Kr: ranges from 10 to 150 (please refer to "F9 system settings" - "parameter modification one")
- Monitoring parameter (H): ranges from 2 to 50 (please refer to "F9 system settings" - "parameter modification one")
- Flow coefficient (V): stainless steel series 2, series 3 and series 4 have different characteristics. For stainless steel series 2, flow coefficient V should be 2 to 4; For stainless steel series 3 or 4, flow coefficient V should be 3 to 6.
- Maximum rolling force (please refer to "F9 system settings" - "parameter modification one")
- Pressure difference (please refer to "F9 system settings" - "parameter modification one")
- Acceleration and deceleration compensation of rolling pass (please refer to "F9 system settings" - "parameter modification three") depending on equipment rolling conditions and process conditions, the pressure difference can be increased or decreased. Note: The larger the value, the smaller the compensation effect.
- AGC enable, (please refer to "F9 system settings" - "parameter

modification three”). AGC can be enabled or disabled, according to the rolling speed.

8, Flow enable, (please refer to "F9 system settings" - “parameter modification three”). Flow can be enabled or disabled, according to the rolling speed.

5 button specification

1. Unloading: If pressed, the oil cylinder will be forced to retract, the servo valve will be in negative, the oil return port will be open, and the oil will return to the depressing station.

2. Unloading Reset: Before pressed, the Unloading button must be lifted. If pressed, the system will be reset, the oil cylinder will be negative open and ready to be operated.

3. Roll Gap Open: Before pressed, “Unloading Reset” must be pressed first. If pressed, the system will be in position loop, and the roll gap will remain the given position. (Rolling mill roll gap is generally set between 12 and 20mm)

4. Roll Gap Close: Before pressed, “Roll Gap Close” must be pressed first. Press the button to open the roll seam, you must press the unloading reset. If the system is in position control, the roll gap will remain the given position. If the system is in pressure control, the pressure will remain the given value.

5. Joint Lift: This button is to slightly increase the roll gap manually.

6. Joint Press: This button is to slightly decrease the roll gap manually.

7 Left thickness gauge start: Press the button to start the left thickness gauge.

8 Right thickness gauge start: Press the button to start the right thickness gauge.

9 Operation side lift: This button is for roll gap error correction. Press “operation side lift” to increase the operation side gap, and decrease the transmission side gap.

10 transmission side lift: This button is for roll gap error correction. Press “transmission side lift” to increase the transmission side gap, and decrease the operation side gap.

6 Rolling Mill Maintenance Instruction

The maintenance introduced here can only be operated by electrical engineers

when the rolling mill is stopped.

We have “F4 input test” ,” F9 pulse test” on main console to do system testing.

“F4 input test” checks whether the signals from main console and left/right operation cabinet are received by the computer. If so, the state shown on main interface will change from 1 to 0. If the machine is not working, the output current and voltage should be a constant value.

“F9 pulse test” checks whether measuring rolls and counting boards are normal. When the measuring roll are rolling, the corresponding rolling pass will change, otherwise, please look into the problem.

"F2 parameters upload" is to pass the parameters to the control computer. Press "PageDown", you can see “Port1_V_OP” and “Port2_V_DR” for actual values of the operation side displacement sensor and transmission side displacement sensor. If there is no 1-2 μ m fluctuation range at the end, please check the displacement sensor of the oil cylinder.

Pressure Sensor Error Detection: In unloading state, the voltage output of the pressure sensor is 2V. Transmission side pressure and operation side pressure should be close to 0. If not, diagnose the error.

Servo Valve Error Detection:

The 4 typical errors of servo valve are:

1. Servo valve plugging: when given a positive current, the oil cylinder does not take in the oil; when given a negative current, the oil cylinder does not drain the oil.
2. Coil burned out: When coil burns out, the resistance becomes infinite.
3. Large zero offset: The zero offset of the ammeter on operating cabinet should not be too large. If the offset is larger than 2mA, the servo valve should be changed.
4. Servo valve not activated: The servo valve may not be responsive, if the machine has not been used for long. Do the “close roll gap-unloading” in pressure control for several times to activate the servo valve.

7 Special Instructions

There are 2 milliammeters on system control cabinet. When the Q1, Q2, +24 V, \pm 15V, +5 V air switches are turned on, and the system is charged with electricity, the

2 milliammeters should point to negative current. When the servo valve is taking in oil, the ammeter points to negative current; otherwise, it should point to zero. If the lower control computer is in working, please do not change anything about the system. Only when the machine is stopped for maintenance, can we operate the lower control computer.

8 Consulting Method

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