

2025

# Coupling Line Solution



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# Coupling Technical Solutions

## 一、 Project Detailed Requirements

### 1.1 Project Description:

In accordance with the specified requirements, customer is planning to establish two OCTG Coupling threading production lines. These lines will be capable of producing both API and Premium threads, accommodating pipe sizes ranging from 4-1/2 inches to 13-5/8 inches. The project will match the pipe threading production line production capacity 00,000 tons/year .

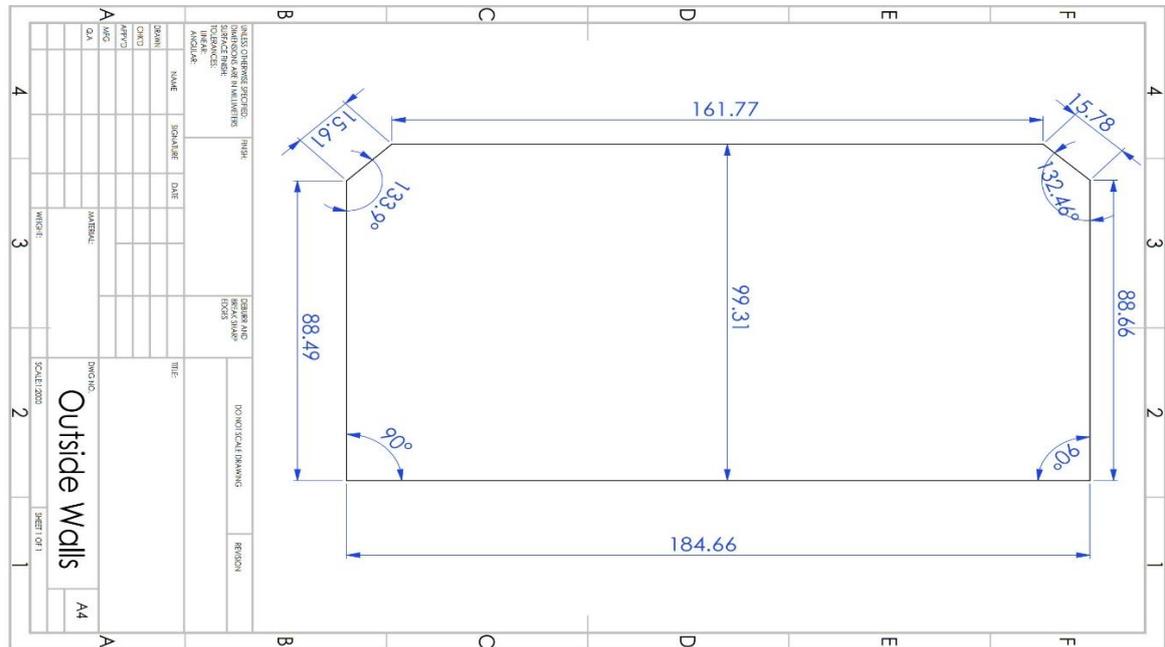
### 1.2 Annual Production Allocation

NO	SIZE (INCH)	QUANTITY (LE)	Weight %	PREMIUM %	API %	CONNECTION TYPE	CONNECTION TYPE
1	4-1/2	62,220	15%	100%	0	VAM TOP , NEW VAM	-
2	5	10,285	3%	100%	0	VAM TOP , NEW VAM, 20% VAM FJL	-
3	5-1/2	10,605	4%	100%	0	VAM TOP , NEW VAM, 20% VAM FJL	-
4	7	25,158	14%	100%	0	VAM TOP , NEW VAM	-
5	9-5/8	39,875	33%	90%	10%	VAM TOP & NEW VAM	BTC
6	10- 3/4	2,200	2%	80%	20%	NEW VAM	BTC
7	13- 3/8	20,680	25%	30%	70%	NEW VAM	BTC
8	13- 5/8	1,625	2%	30%	70%	NEW VAM	BTC

### 1.3 Materials Property

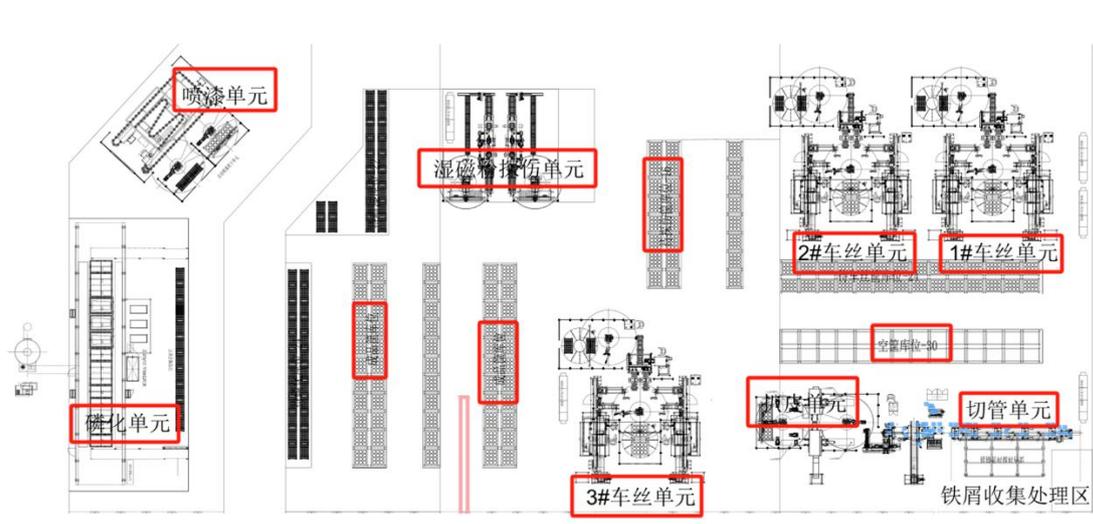
No	Items	Value
1	Pipe Diameter	4-1/2" -13-5/8"
2	Wall Thickness	6mm-21mm
3	Pipe Length	6000mm-14500mm
4	Material Grade	OCTG Group – N80/L80/P110/Q125/T95/C90/C110

### 1.4 Workshop Land Scope



## 二、 Coupling Line Technical Solution

### 2.1 Coupling Production Line Plane Layout



### 2.2 Production Processing Procedure Description

**2.2.1** The loose bales are fed into the coupling cutter unit, where the coupling blanks are cut and finished. After being discharged by the six-axis industrial robot, then enter the pipe surface turning (outer diameter machining) unit.

**2.2.2** After turning , the six-axis industrial robot discharges the coupling blanks and loads them into a crate, which is then transported by an AGV vehicle to the semi-finished goods warehouse or transferred to the coupling threading unit.

**2.2.3** The AGV vehicle transports the coupling blanks that have been turned or do not need turned to the coupling threading unit for threading processing. After threading is completed, a thread inspection is performed. The coupling with a qualified thread is discharged by the six-axis industrial robot and loaded into a crate, which is then transported by an AGV vehicle to the semi-finished goods warehouse or transferred to the magnetic particle inspection unit.

**2.2.4** The couplings are inspected one by one using wet magnetic particle inspection. After inspection, the six-axis industrial robot discharges them and loads them into a crate, which is then transported by an AGV vehicle to the semi-finished goods warehouse or transferred to the phosphating unit.

**2.2.5** The couplings are subjected to phosphating treatment, and after phosphating, they are transported by an AGV vehicle to the semi-finished goods warehouse or the spray painting unit.

**2.2.6** The couplings are subjected to spray painting treatment, and after spray painting, they are transported by an AGV vehicle to the finished goods warehouse.

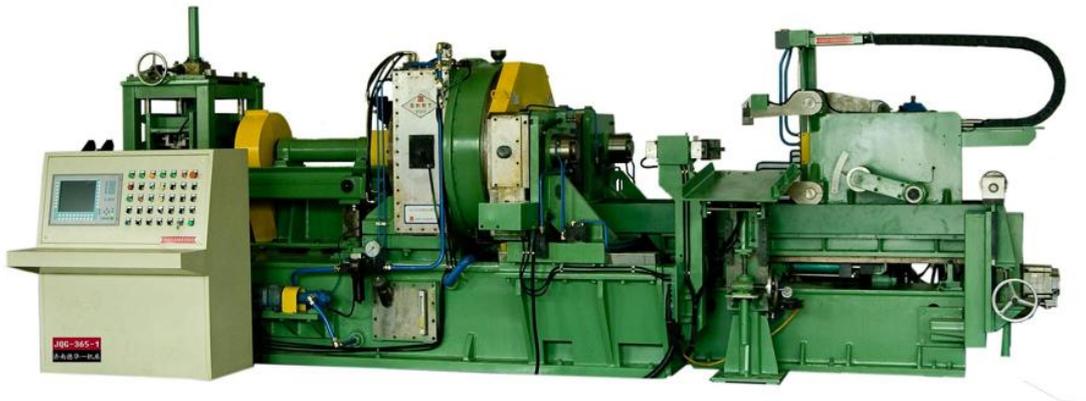
### 2.3 The Coupling Production Line Equipment List

<b>Coupling Production Line 4-1/2" to 13-5/8 Main Equipment List</b>			
<b>No</b>	<b>Items</b>	<b>Unit</b>	<b>Qty</b>
<b>DSJQG-13 Pipe Cutting Unit</b>			
1	DSQG-13 Pipe Cutting Machine	Set	1
2.	Coupling rust-removal Device	Set	1
3	Coupling Conveyor Manipulator system	Set	1
4	Coupling Unloading System	Set	1
5	Chips crushing device	Set	1
6	Band Sawing	Set	1
<b>JWM-13 OD Turning Unit</b>			
1	DSWM-13 OD Turning Unit	Set	2
2	Stamping Position Table	Set	2
3	Pneumatic Stamping Marking Device	Set	2
4	Laser Marking Machine with Swivel Chuck	Set	2
5	Robotic Loading and Unloading System	Set	1
<b>Coupling Threading Unite -13 inch</b>			
1.	DSMC-13 Coupling threading machine with Swivel Chuck	Set	4
2	DSCH-13 Gantry Manipulator and loading and unloading Rack	Set	4
3	Bin Rotation Device	Set	4
4	Coupling Cleaning and Blower System	Set	4
5	Coupling Gantry Manipulator Handling System	Set	4
6	Coupling Flipping Device	Set	4
7	Human Inspection Table	Set	4
8	Defective Coupling Conveyor System	Set	4
9	Robotic Coupling Loading and Unloading System	Set	4
10	Chips Crushing Device	Set	4

<b>Magnetic Powder Inspecting Unit</b>			
1	Magnetic Powder Inspector Machine	Set	2
2	Robotic Loading and unloading System	Set	2
<b>Coupling Painting and Drying Unit</b>			
1	Conveyer Chain and Drive system	Set	1
2	Coupling Painting Device	Set	1
3	Drying Chamber	Set	1
4	Coupling Color ring painting System	Set	1
5	Spraying and Printing System	Set	1
6	VOC Waste Gas Treatment Device	Set	1
7	Robotic Coupling loading and unloading System	Set	1
<b>Coupling Phosphating Unit</b>			
1	Lifting Device	Set	2
2	Track and Pick System	Set	1
3	Tank System	Set	1
4	Tank-Top suction hood System	Set	5
5	Operating Table	Set	1
6	Pipeline System	Set	1
7	Upper and lower Rack Roller	Set	2
8	Electrical Control System	Set	1
9	Phosphating filtration system	Set	1
10	Waste Liquid Colleting System	Set	1
11	Operation, monitoring room	Set	1
12	Heat transfer fluid	Set	2
<b>Control and Other Independent Equipment</b>			
1	AGV Intelligent warehousing and logistics system	Set	5
2	Itemized tracking system	Set	1
3	Coupling line central Control system	Set	1
4	Coupling MES System	Set	1
5	Coupling Workshop Production Quality Monitoring System	Set	1
6	Access control security system	Set	1

## 三、 Production Main Equipment Description

### 3.1 DSJQG 13 Pipe Cutting Machine



The JQG series of CNC pipe cutters fills the domestic gap and has been granted a national patent for invention. It has been listed as a 2008 Shandong Technological Innovation Project. This machine tool utilizes the gear differential feed principle to achieve longitudinal feed of the cutting tool on a high-speed rotating cutting head, thus realizing the new concept of holding the pipe firmly in place while the cutting head rotates for cutting.

It effectively solves the problems of high energy consumption, machine vibration, low cutting efficiency, short tool life, low production efficiency, poor end-face quality of the pipe, and inability to set the cutting length in the high-speed rotating processing method of pipes.

The Siemens CNC system controls this machine tool and can automatically perform functions such as pipe feeding, setting the cutting length, clamping, tool feeding, loosening, conveying finished products, printing batch numbers, and outputting scrap material, and can automatically cycle to achieve continuous automated processing, thereby greatly improving production efficiency and providing a solution for continuous mass production for enterprises.

This machine tool is particularly suitable for high-efficiency and precise cutting of oil pipe casings, welded pipes, high-pressure boiler pipes, pipeline pipes, and clear pipe casings. It can meet the mass production requirements of the petroleum, metallurgy, and bearing industries. At the same time, it can reduce electric energy consumption and save steel.



### 3.1.1 Equipment Composition

Each Coupling cutting line is composed of a main engine and a set of auxiliary equipment

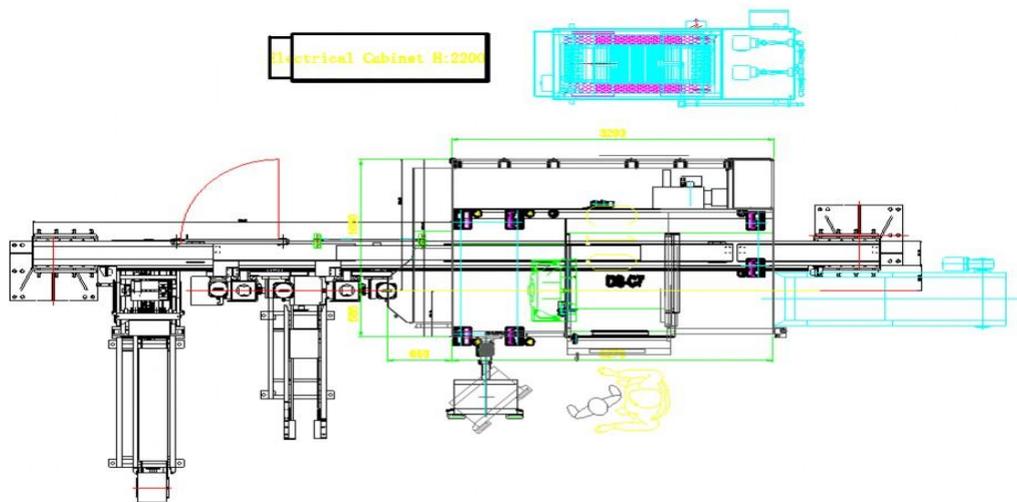
No	Item	Qty (Unit)	Remarks
1	Loading Convey Bench	1	Auxiliary
2	Clamping and Convey Roller	1	Auxiliary
3	Pipe Cutting Machine	1	
4	Feeding Trolley	1	
5	Position Stopper	1	
6	Hydraulic System	1	
7	Lubrication System	1	
8	Emulsion Cooling System	1	
9	Chips Conveyor	1	
10	Control System	1	

### 3.1.4 Pipe Cutting Machine Specification

No	Item	Unit	Specification
1	Max Cutting Pipe Dia	Inch	4 1/2 ”- 13 5/8 ”
2	Max Cutting Wall Thickness	Mm	32
3	Max Cutting pipe Length	Mm	6000-15000
4	Max Spindle Speed	Rpm	50-400
5	Feeding Travel	Mm	50
6	Main Motor Power	Kw	37
7	Max Cutting Accuracy	Mm	0.2
8	Machining perpendicularity	Mm	0.15/100
9	Cutting Roughness	Um	Ra6.3

### 3.2 Coupling Threading Machine with Swivel Chuck

CNC Coupling threading machine is responsible for boring and threading of the Coupling. The main equipment includes a CNC threading machine host, truss manipulator and loading and unloading rack, threads inspection table (customer's own), a hydraulic system, a control system, and so on.



车丝机

### 3.2.1. Technical Description Of DSMC-13 CNC Coupling Threading Machine



#### 3.2.1.1 Overview of the threading machine

The “DSMC series (including DSMC-7, DSMC-13, DSMC-20) CNC Coupling threading machine is a kind of Coupling thread special processing machine with flipping chuck independently developed by our company for reference to the mature structure of foreign threading machine tools. The Coupling can be completed at both ends of the Coupling thread processing at one time.



#### The Main Advantage:

**Good rigidity:** the adoption of integral 45° inclined bed, large through hole spindle and high rigidity spindle bearing configuration.

**High precision:** TIMKEN spindle bearing, automatic turning chuck, imported ball screw, to ensure high machining accuracy and precision stability.

**High reliability, good accuracy retention, easy maintenance:** The bearings used in the lead screw and hydraulic pressure, lubrication, lighting, cooling system, transmission belt, electrical components, ball screw, etc. are selected from famous brand products at home and abroad.

**Strong control function, Excellent man-machine interface pleasant:** The control system adopts Siemens 840Dsl, and the software design and interface design are user-friendly and friendly.

### 3.2.1.2. Main Specifications of Threading Machine DSMC-13

No	Items	Unit	Specification
<b>Processing Performance</b>			
1	Coupling Size		4 1/2"-13 5/8"
2	Max Coupling Length	Mm	400
<b>Spindle System</b>			
1	Spindle Speed	Rpm	700 Stepless
2	Spindle Motor Power	Kw	75
3	Spindle End Type and Code		A2-15
4	Spindle Through Hole Dia	Mm	195
<b>Swivel Chuck System</b>			
1	Outside Dia	Mm	265
2	Height	Mm	509
3	Clamping Stroke	Mm	10 (7+3)
4	No of Claws	pc	6 (3 centering claws, 3 floating claws)
5	Clamp Pressure	Bar	15~40
6	Clamping Force (35 Bar)	T	16.2
<b>Turret System</b>			
1	Turret Pattern		Vertical hydraulic
2	Position	Position	4
3	Center Height	Mm	200
4	Max Torque	Nm	250
5	Repeat Position Accuracy	Mm	≤0.005
<b>X-Axis Feeding System</b>			
1	X-axis travel	Mm	600
2	X-axis pulley reduction ratio		1/2
3	X axis ball screw		Ø 50 x10
4	X axis motor with brake		SIEMENS /4.87KW 27NM
5	Balance cylinder balance pressure	Bar	30 (Adjustment range: 0 ~ 50)

No	Items	Unit	Specification
<b>Z-Axis Feeding System</b>			
1	Z-axis travel	Mm	600
2	Z-pulley reduction ratio		1/2
3	Z axis ball screw		Ø 50 x10
4	Z-axis motor with no brakes		SIEMENS/4.87KW 27NM
5	Fast Moving Speed (X/Z)	m/min	15/15
<b>Hydraulic System</b>			
1	Motor Power	Kw	4
2	Hydraulic pump flow	L/Min	28
3	Working pressure	Bar	60
4	Tank Capacity	L	200
5	Filtration accuracy	µm	10
6	Heater	Kw	0.5
7	Energy accumulator	L	20L (35 bar)
<b>Spindle Lubrication System</b>			
1	Motor Power	Kw	1.5
2	Lubrication Pump Flow	L/Min	24
3	Working Pressure	Bar	3-5 Bar
4	Filtration accuracy	µm	10
<b>Centralized lubrication system</b>			
1	Model		AMO-II-150S/3-II-P
2	Electric Motor	Kw	0.02
3	Lubrication pump flow	L/Min	0.15
4	Working Pressure	Bar	20
5	Tank Capacity	L	4
<b>Cooling System</b>			
1	Motor	Kw	4KW-2P-50HZ
2	Cooling pump model		CDLK4-220/19
3	Cooling pump flow	L/Min	100
4	Working pressure	Bar	20-25

No	Items	Unit	Specification
5	Cooling tank capacity	L	1000
6	Filtration accuracy	μm	50
<b>Chip Conveyor System</b>			
1	Heigh of outlet from Ground	Mm	1600
2	Speed	m/Min	1.4
3	Motor Power	Kw	0.55Kw 380V 50HZ
4	Return Water Pump	L/Min	100L/min
<b>Control System</b>			
	Numerical Control System		SIEMENS 840D

### 3.2.1.3. Coupling Threading Machine Equipment Composition

Each threading machine consists of a main machine and the following auxiliary equipment

NO	Items	Qty
1	Coupling Threading Machine	1 Set
2	Loading and unloading Manipulator	1 Set
3	Emulsion Cooling System	1 Set
4	Hydraulic System	1 Set
5	Control System	1 Set
6	Lubrication System	2 Set
7	Pneumatic System	1 Set
8	Chip Conveyor System	1 Set

### 3.2.1.4. Technical description of Threading Machine

Items	Name	Technical description	Technical data	Remarks
1	<b>General specification</b>			

	No Axis	2 axis slide +1 manipulator shaft +1 spindle	See parameter sheet for details	
	Travel	2-axle skateboard		
	Diameter			
	Length range	Maximum length of coupling material		
	Spindle speed			
	Spindle power	Servo spindle motor		
	temperature	Max temperature	+ 40 °C	
		Minimum temperature	0 °C	
	Humidity	Maximum humidity	85%	
	Compressed air	The user should provide compressed air up to the following qualities	The compressed air provided by 0.4~ 0.6Mpa should be clean and dry	
	Processed Products	API standard: long round, short round, side ladder buckle. Special buckle.		
	Power supply	The transformer supplied by Buyer shall conform to the following power	Each machine has an electrical capacity of 150 kVA and a voltage of 380 V	
	CNC System	SIEMENS 840D SL		
<b>2</b>	<b>Bed and bed base</b>			
	The machine base is divided into two parts: the Spindle +2 axis skateboard. The two parts are connected by screws.			
		Machine base, bed material	QT500-7	
		Level the number of bolts	6 + 4	
		<b>Number of fixing bolts</b>	<b>6 + 4</b>	

		Optimal chip removal tilt	45 degrees	
		Angle for the bed		
<b>3</b>	<b>Headstock and reduction box gearing</b>			
	<p>1. The headstock houses a standard spindle equipped with two high precision tapered roller bearings. The clearance of the spindle is adjusted by a nut located at the rear.</p> <p>2. The main shaft is connected with the reducer by the belt. There is no gear in the headstock, which simplifies the structure of the headstock.</p> <p>3. Power transmission according to the following: spindle motor → reducer → motor pulley → belt conveyor → receiving pulley → spindle</p>			
		Headstock material	QT500-7	
		Belt pulley ratio	See parameter sheet for details	
		Number of drive pulley		
		Spindle motor power		
		Spindle motor type		
		Spindle aperture		
<b>4</b>	<b>Swivel chuck</b>			
	<p>1. The flip chuck is mounted on the front of the spindle. It is allowed to process the coupling in this way: the first side of the coupling is processed first, and the second side of the coupling can be processed after the indexing chuck spinner is rotated once after the first side is processed.</p> <p>2. Make the chuck rotate through the gear and rack.</p> <p>3. The locking pin is protected with compressed air so that it is not easily blocked (due to metal shavings between the locking pin and the bed).</p> <p>4. Chuck lubrication is automatic.</p> <p>5. The rotary distributor at the rear of the spindle is used to transfer hydraulic power from the fixed valve stand to the tilting chuck.</p>			
		Number of jaws	6	
		Number of centering claws	3 (synchronous ring)	

		Number of floating clamp	3	
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		<b>Gripper travel</b>	<b>10mm</b>	
		Adjustable clamp pressure (proportional valve for double pressure)	15-40 bar	
		Theoretical maximum clamping force	6×27KN @35 bar	
		Number of accumulators	2	

<b>5</b>	<b>2--axis main skateboard</b>			
	<ol style="list-style-type: none"> <li>1. The main skateboard is equipped with 1 longitudinal skateboard (z-axis) and 1 transverse skateboard (X-axis)</li> <li>2. The steel insert guide is carburized and quenched with a minimum hardness of 60HRC. The guide rail can be replaced to reduce maintenance costs.</li> <li>3. The sliding surface of the slide board is made of injection molding. The advantages of this resin coating are low maintenance and long service life.</li> <li>4. Adjust the slip clearance by adjusting the inclined iron.</li> <li>5. The servo motor drives the high-precision ball screw to move the skateboard through the transmission belt. The position information of the slide is fed back to the CNC by a high precision encoder installed directly on the end of the ball screw.</li> <li>6. The transverse slide (X-axis) is hydraulically balanced to compensate for the weight of the slide and tool holder. (Since the skateboard is located on the tilting bed at a 45° Angle).</li> <li>7. uses a retractable guard to protect the main components of the skateboard (mainly ball screws) from iron filings and coolant damage.</li> <li>8. The guide rail and ball screw of the machine tool are made of the same specifications as JMT-13.</li> </ol>			
		Number of longitudinal slide boards	1	

		Number of longitudinal skateboards	1	
		Longitudinal stroke (Zaxis)	Meeting parameters sheet	
		Nominal diameter of		

		<b>longitudinal ball screw</b>		
		Lateral travel (X-axis)		
		Nominal diameter of transverse ball screw		
		Balanced pressure (usually)		
		Balance pressure (adjustable)		
		Belt ratio		
		Ball screw pitch		
		Main servo motor power		
		Rated torque of main servo motor		
<b>6</b>	<b>4 station Turret</b>			
	Hydraulic vertical 4-station turret			
		Number of tool stand	1	
		Number of stations	4	
		Turret handle	3 sets	
<b>7</b>	<b>Claws</b>			
	Seller provides 3 of these specifications, the rest of the specifications of the jig itemized quotation.			
<b>8</b>	<b>Safety Guard</b>			

	<p>1. A fully enclosed guard is used to protect the safety of the operator (under normal circumstances, the operator should avoid contact with the moving parts of the machine) and to prevent oil and emulsion leakage.</p> <p>2. The opening of the pneumatic protective door is automatic and can be operated either in the JOG mode of the operating panel or in full automatic mode via the machining procedure (M code).</p>	
<b>9</b>	<b>Emulsion unit and chip extractor</b>	
	1. The emulsion system is characterized by high pressure and large flow.	

	<p>2. The main functions of the emulsion system are: 1) to cool the cutting edge during machining, 2) to help remove iron filings.</p> <p>3. The iron filings conveyor is equipped with a return pump for returning the dirty emulsion to the tank through the filter unit on the emulsion tank.</p> <p>4. The emulsion system is a completely self-contained unit.</p>	
	Emulsion tank capacity	1000L
	Emulsion pump flow rate	100L/MIN 20bar
	Spare pump	have
	Emulsion pump power	4kw
	Filter grade	50um
emulsion	Emulsion grease concentration	5% - 8%
	Clear water hardness	6-16
	Clean water PH	7-8
	PH of the emulsion	8.4-9.4
	Suspended solids	10mg/L
	Total alkali content	80 mg/L
	Chlorine content	400 ppm
	Sulfur tetroxide	50 mg/L
	Total iron content	1 mg/L
	Soluble silica	6 mg/L
	Electrical conductivity	420us/cm
	Soluble) volatile residues	+/-300 mg/L

		Microbial count		
		Emulsion return pump flow rate	70-100 L/min 1bar	
		Return pump power	0.25 Kw	
	Chips conveyor	Conveyor belt motor power	0.37kw	
		Conveyor belt speed	1.4 m/min	
10	Loading and unloading device (full automatic manipulator)			

Loading and unloading device is a set of automatic transmission device, consisting of the following parts;

1. The feeding device sends the semi-finished Coupling material one by one to the centering device, and checks whether the feeding chute of the semifinished Coupling material is empty through a photoelectric switch.

2. centering device positions the semi-finished Coupling material correctly, which is convenient for the manipulator to take out material. The centering device adopts a double-threaded screw mechanism, one side has right-handed screw thread, the other side has left-handed screw thread, and the hydraulic motor drives the screw to rotate. The V-frame loaded with the semi-finished Coupling material below rises, and the upper part falls relative to the installed V-frame. When the two V-frames contact the Coupling material, the pressure of the hydraulic motor increases, and the hydraulic motor stops rotating when the set pressure is reached. The Coupling material is positioned for the manipulator to pick up the material.

3. The manipulator is a linear guide rail device, consisting of two moving axes. The longitudinal shaft is parallel to the main shaft and controlled by a servo motor. The vertical shaft is hydraulically controlled for loading and unloading Coupling materials. The transverse shaft is also hydraulically controlled to align the loading and unloading manipulator with the center of the main shaft.

4. The discharge device consists of a V-bracket driven by a hydraulic cylinder. When the discharge arm manipulator moves with the finished coupling, the Vbracket rises to the position of the discharge clamp and accepts the finished coupling. The V-bracket then descends to place the finished coupling on the discharge chute.

5. The Seller shall be solely responsible for the safety and protective facilities surrounding the equipment. The loading and unloading area of the manipulator is a dangerous area, which is closed by a metal mesh. There is a door that can be opened and closed for personnel to enter and exit during

debugging and maintenance. The door should be locked during work, and the machine can be started only when the electronic door lock sends out a locking signal.

		Diameter of coupling (outside diameter)	See parameter sheet for details	
		Coupling length  Note: In order to ensure the yield, it is recommended that the length of the coupling material should not exceed $N L+2\times 2\text{mm}$ . NL: The rated length of the finished coupling material as determined by API 5B and 5CT standards.	Max 400 mm	
		Max weight of coupling material	90 kg	
		Servo motor torque	6 Nm	
		Servo motor power	1.5 kW	
		Vertical stroke of hydraulic cylinder	1100 mm	
		Maximum weight of coupling material	90 kg	
		Servo motor torque	6 Nm	
		Gripper specifications	3 types. Same specifications as the claws supplied to the host.	
11	Hydraulic station and hydraulic line			
	<p>1 The hydraulic station controls all hydraulic actions of the machine tool and the loading and unloading device.</p> <p>2 The hydraulic valve stand installed at the spindle rotary distributor contains all the solenoid valves, pressure reducing valves and other hydraulic actuators</p>			

	<p>on the flip chuck to complete the hydraulic and mechanical actions in the machine tool.</p> <p>3.The two hydraulic valve stands of the loading and unloading device (one at the loading device and the other at the manipulator) contain all the solenoid valves, reducing valves and other hydraulic actuators for the hydraulic and mechanical actions of the manipulator.</p> <p>3. The actuation mechanism of the tool table is mounted directly in the tool table housing to reduce reaction time.</p> <p>4. The hydraulic station is equipped with temperature controller and high and low level alarm.</p>	
	Filtration level	10 µm
	Tank capacity	200L
	Hydraulic pump flow	35 L/min
	Spare pump	have
	Hydraulic pump motor power	5,5 kW
	Hydraulic system pressure	60 bar
	Host accumulator	20 L @ 35 bar
	Manipulator accumulator	1L @ 35 bar
	Hydraulic oil cooling method	Water cooling device. The seller provides the heat exchanger, which the buyer connects to the water pipe.
12	Lubrication device and lubrication line	
	The main engine is equipped with two sets of lubrication pipes:	
	The first casing line is the line that lubricates the main shaft: This line is a closed loop line, using the fuel tank in the bed under the headstock. This line is fully equipped including a filter device. Electronic flow switches are installed on the two main lubrication lines (main shaft bearings) to monitor the lubrication flow of these bearings.	
	Tank (main tank) capacity	220 L

		Lubrication pump flow	40 L/min	
		Lubricating pump motor power	1.5kW	
		Filter grade	20 to 25 microns	
		Pressure	3-5 bar	
	<p>1.The second casing road is the lubrication line for the slide. The lubrication line is designed as an open loop. The oil is supplied according to the lubrication cycle time set by PLC program.</p> <p>2. Each slide board is equipped with a quantitative oil distributor, which is used to deliver lubricating oil to different lubrication points of the slide board (mainly used for ball screw nuts, slide guide surface, etc.).</p>			
		Lubrication pump power	20W	
		Tank capacity	3 L	
<b>13</b>	<b>Pneumatic unit</b>			
	The main engine is equipped with a set of pneumatic units:			
	It is mainly used for the switch of the pneumatic door and the blowing of the flipping chuck.			
<b>14</b>	<b>Electrical device and performance</b>			

	<p>3. The electrical components required for the automation of all equipment are supplied with the main engine and manipulator.</p> <p>4. The complete unit (main machine + manipulator) is fully automatic and completely independent of the end-user facility.</p> <p>5. A photocell is installed at the feeding port to check whether the coupling material is in place. The photocell at the discharge port determines whether the discharge bench is full of finished coupling materials awaiting inspection.</p> <p>This information can be used to carry out the blanking process.</p> <p>6. The equipment is equipped with the latest generation Siemens CNC system.</p> <p>According to the selected CNC system, the equipment is also equipped with a High-efficiency PLC(SIEMENS) system. The PLC system ensures that the equipment operates in a logical manner.</p>	
	<p>7. The entire electrical apparatus is supplied in a decentralized manner to minimize maintenance costs. The cables used are kept as simple as possible to reduce the risk of working errors and breakdowns. Each major equipment is equipped with its own distribution box, equipped with circuit breakers, relays, output and input modules, such as loading and unloading manipulators, main engines, hydraulic stations and emulsion units. In addition, the main electrical control cabinet is equipped with all the electrical components, such as the main circuit breaker, CNC module, shaft drive module and spindle drive module. An operator control panel is mounted on the main engine through a movable arm. This control panel enables the operator to manually or automatically control the main engine and auxiliary equipment by means of buttons and other potentiometers. The control panel is equipped with a display screen for easy operation by the operator.</p> <p>8. All cables and wires for connecting the electrical control cabinet with the equipment components and the auxiliary equipment will be provided with the product. Connections between major auxiliaries will be made at the installation site in a plug-and-pull manner that facilitates on-site work. The entire circuit will be logically labeled to facilitate maintenance of the equipment.</p>	
	Numerical control system	SIEMENS 840D SL

		The machine will be configured with an Ethernet card		
		Use the Profibus DP interface		
		Configure PCU50		
		I/O module protected by relay	(I/O module for controlling solenoid valves)	
		Separate power supply for the I/O module	Each group of 3 modules is equipped with a parallel switch.	
		Electrical control cabinet/main engine	Separate from main engine	
		The electrical cabinet is		

		<b>equipped with air conditioning</b>		
		Number of servo motors	2 + 1	
		PLC system	SIEMENS S1500	
		Spindle motor and spindle drive	Meet parameters table	
		Reserved output/input interface	Leave 15% more than the actual number	
		The main power supply is provided by the end user	380 VAC 10%	
		Frequency	50 HZ 1 HZ	
		Power supply	AC 220V This voltage is obtained directly through the electrical cabinet	
		Solenoid valve power supply	DC 24V This voltage is obtained directly from the power supply of the electrical cabinet	

		Use two separate DC 24V power supply units. The first is dedicated to providing power for CNC systems, and the second is for other units that require DC 24V. The circuit breaker that protects the DC 24V power unit should be correctly selected.	
		Maximum permissible distance between main electrical cabinet and auxiliary unit	Max 20 m
		Max allowed length of cable	Max 35 m
		Operating console	The console is directly connected to the main engine by a movable arm. The manmachine design structure is suitable for perennial use.
<b>15</b>	<b>Equipment weight</b>		
		Host	19000KG
		Electrical cabinet	1000KG
		Loading manipulator (loading part) One mechanical arm ten beam frame	7000KG
		Feeding device (select ten pairs of central device	1000KG
		Blanking device	800KG
		Emulsion unit	1000KG
<b>16</b>	<b>Media consumption per unit</b>		

		Main transformer	250 kVA @ 380V per machine	
		Tap water to replenish the emulsion	100L/ shift	
		Shaft oil	1,5-2,5 L/ shift	
		Headstock oil	250 L/6 months	
		Hydraulic oil	300 L/6 months	
		Compressed air	Not more than 500 L/h@ 6 bar	
		Semi-mineral water for hydraulic cooling units	1,5 m <sup>3</sup> /h	

### 3.2.2. Coupling Threading truss manipulator device

The equipment includes a gantry frame, lifting device, feeding and V-shaped centering mechanism, blanking device, clamping chuck, hydraulic system, control system, etc. Each threading machine is equipped with a set of truss manipulators.

#### 3.2.2.1 Gantry Truss

Gantry truss adopts square tube welding structure, the beam of the truss is installed on the linear rolling guide rail and rack, the skateboard is driven by servo motor, reducer and gear rack on the beam to do longitudinal (parallel to the main shaft) movement, the lifting device is hydraulically driven on the skateboard to do up and down movement, the skateboard is installed with two sets of lifting devices, each set of lifting device end is installed with a set of manipulator, A set of manipulator is used to feed the machine tool, the other set of manipulator is used to feed the machine tool, the manipulator uses the hydraulic chuck configuration of special clamping claw.

#### 3.2.2.2 Feeding Bench

The robot sends the Coupling billet to the top rack, and the Coupling billet is sent to the centering V-type device by the loading rack, and the Coupling billet feeding chute is checked by an photoelectric switch, and the material is fetched by the manipulator.

#### 3.2.2.3 Blanking Rack

The blanking rack consists of a bracket, a centering V-shaped mechanism, a lifting mechanism, and a raceway.

After the Coupling is completed Threading, it is grabbed by the truss manipulator and placed on the unloading rack. The material pulling mechanism moves the Coupling to the raceway, and the Coupling along the raceway to the robot take-up point. The robot takes the material from the cutting rack and sends it to the conveying rack, which sends the Coupling to the cleaning station.

#### **3.2.2.4 Manipulator**

The manipulator is equipped with special clamping jaws using hydraulic chucks.

#### **3.2.2.5 Hydraulic System**

The hydraulic station is composed of three-phase asynchronous motor, hydraulic variable vane pump, oil filter, air filter and oil level indicating device and oil tank, valve station, etc. The temperature of hydraulic oil can be controlled, and the cooling method of hydraulic oil is air cooling system. The temperature of the hydraulic oil can be controlled between 10°C and 45°C.

#### **3.2.2.6 Control system**

Siemens CNC system control (integrated into the host system), configuration 10.4" display, plus S120 drive and executive unit servo motor together. The control system has the characteristics of high stability, strong anti-interference, etc. It is a relatively mature and complete servo control system. The control system communicates with the DRIVE through PROFINET, and the drive and motor are connected through DRIVE-CLIQ.

#### **3.2.2.7 Truss system function realization and main operation**

The working status of the truss manipulator, such as Coupling clamping release, servo slide movement, steel pipe inlet and outlet conveying system, hydraulic system, lubrication system, ordinary motor, valve and indicator light signals, are collected in the control module of the CNC system.

Man-machine interface production: input and output interface, hydraulic station interface, parameter input interface, specification selection interface, input, output point status value. When these signals are 1, the green color is displayed; Otherwise, red is displayed.

Scram switch: When there is an emergency, take a picture of the Scram switch and keep the action of the truss manipulator in the current state. The scram can not be lifted until it is safe.

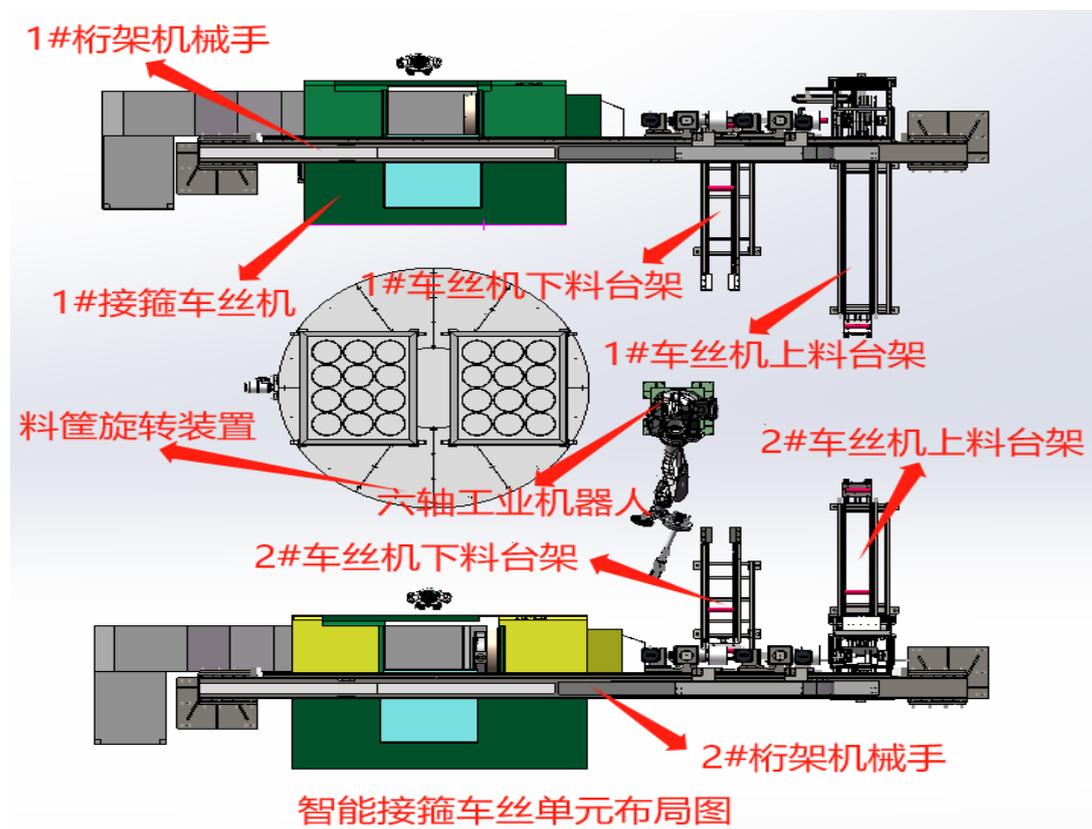
The host numerical control system must be open, so that the truss manipulator and the host can realize the communication of handover signals, and the exchange signals between the two are isolated relays, which is convenient for the rapid diagnosis of faults on site.

The main operation mode: There are three main operation modes of the CNC system, manual (DSOG), semi-automatic (MDI) and automatic (AUTO), which fully meet the normal use of the equipment.

Operation screen: numerical control system operation interface including the main interface, program interface, parameter interface, diagnostic interface and alarm screen. These interfaces can be switched back and forth according to the actual production needs of the site, and the operation is very convenient.

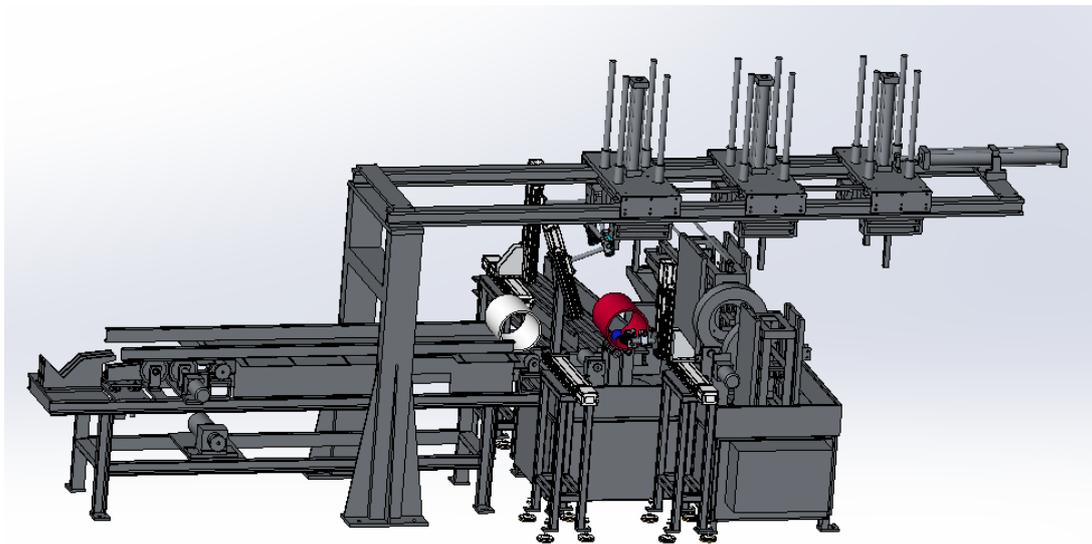
Alarm screen: alarm information is divided into system alarm and PLC alarm. The system alarm is mainly for the servo motor, CNC communication network, servo drive, MCP483 and screen information alarm inside the CNC system. PLC alarm is the alarm information sent for the peripheral abnormal signal of the equipment.

### 3.2.3 Coupling Threading Working Unit



No	Item	QTY (Unit)	Remarks
1	6-Axis Robot System	1	
2	Rotary Basket Device	1	
3	Gantry Manipulator System	2	
4	Gantry Loading Bench	2	
5	Gantry Unloading Bench	2	
6	Coupling Threading Machine	2	
7	Hydraulic System	2	
8	Lubrication System	2	
9	Emulsion Cooling System	2	
10	Steel Chips Conveyor	2	
11	Control System	2	

### 3.3. Automatic wet magnetic powder flaw detection machine (MPI)



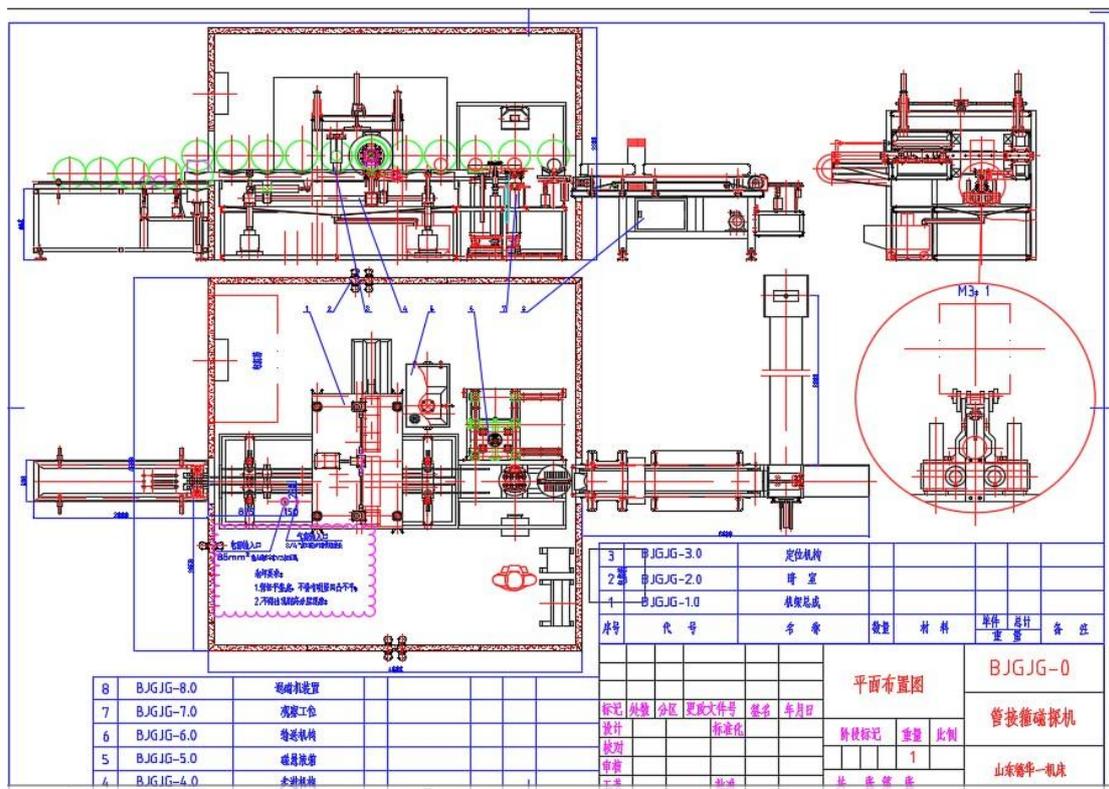
#### 3.3.1 Product Scheme, General Description and Technical Data

##### 3.3.1.1 Equipment Functions

CJW4000GZD type wet magnetic powder coupling detection machine, is suitable for the coupling wet magnetic detection of the pipeline. The whole set of equipment is composed of magnetizing power supply (separate cabinet), control system (separate cabinet), clamping

magnetizing device (electric lifting), gantry truss-type lifting transverse stepping device, workpiece rotation bracket, magnetic suspension spray and recovery system, rotation observation device, ultraviolet light source, dark shed, feeding path and demagnetization coil, bad material sorting device and unqualified material path; It can fully meet the production demand of Party A.

The whole set of equipment is a special online flaw detection equipment using wet magnetic powder detection method to detect the scars and cracks of the coupling. It can detect the transverse defects and longitudinal defects in the inner and outer surfaces of the coupling. It can realize automatic and manual operation according to the needs respectively, and meet the different needs of online detection and equipment adjustment.



### 3.3.2. Specifications Of Raw Materials

- ✧ Coupling outer diameter: 4 1/2-13 5/8 inch
- ✧ Coupling length: 105 ~ 320mm;
- ✧ Coupling wall thickness: API and premium standard all coupling wall thickness.
- ✧ Production capacity: 40~72 hours/hour, annual working time: 6500h.

### 3.3.3 Site Construction Conditions

A, the minimum indoor temperature in winter: above 0 ° C to ensure that the magnetic suspension does not freeze

### **B, power supply conditions**

- ✧ Supply voltage: 380V ±10% Frequency: 50 Hz ±2 C, circulating water
- ✧ Water inlet temperature: ≤35°C
- ✧ Pressure: 0.35MPa
- ✧ D, compressed air Pressure: 0.4 ~ 0.6MPa
- ✧ Dew point: Max.+2°C
- ✧ Oil content: Max.25mg/m

### **3.3.4 Equipment process flow**

The workpiece is sensed at the end of the feed passage → the stepper mechanism starts, and the workpiece is moved into the rotating bracket of the magnetization position → the workpiece rotates around the circle, while the inside and outside spray → the tail frame chuck conductance magnetic rod extends and tightens the head of the head frame clamp → the conductive rod and the coil are energized to the magnetic conductive rod, and the composite magnetization → the tail frame chuck conductance magnetic rod retreats → the stepper mechanism starts. The workpiece is moved into the rotating observation device → under the irradiation of the ultraviolet light source, the plane rotation and the circle rotation are automatically detected and judged (can also be manually detected and judged) → the good material is automatically transported by the stepping mechanism to the feeding path, and the passing demagnetization is completed on the feeding path → the bad material is turned over by the sorting and turning device to the bad material path and rolled to the waste basket.

### **3.3.5 Cycle schedule**

The single cycle timing table of the coupling in the wet magnetic flaw detection machine is as follows; Different specifications of the coupling cycle timing is basically the same.

Step 16 seconds → conductance magnetic rod into 4 seconds → coupling rotation 8 seconds → spray magnetization 5 seconds → Conductance magnetic rod back 4 seconds → detection 28 seconds

**Total: about 45 seconds/piece.**

### 3.3.6 Electrical Installation Capacity and Energy Medium Consumption/Connection Amount

#### 3.3.6.1 Electrical Load (Single set)

Equipment name	Quantity	Power (KW)	
		Single meter	Total
Magnetized power supply	2	20 (instantaneous Max.) 20% load factor	40 (instantaneous Max.) 20 percent load rate
Rotary motor	3	0.15	0.45
Regulating motor	1	0.55	0.55
Magnetic suspension mixing pump	1	1	0.25
Demagnetized feed track motor	1	0.75	0.75
Ot her			0.5
<b>T</b>	<b>total</b>		<b>42.5</b>

#### 3.3.6.2 Air Pressure and consumption

A, pressure: 0.4 ~ 0.6MPa;

B, consumption: 3m<sup>3</sup>/h.

#### 3.3.6.3 Water consumption

For magnetic suspension, average consumption: 100 ml/min.

### 3.4 Pneumatic Marking Machine

It is suitable for fixed installation on the production line, or special desktop tooling, which can meet the requirements of high beat and mass production on the production line

### **3.4.1 Marking Headers**

- 3.4.1.1 High speed: can achieve 6 characters per second (word height: 4mm, word width: 2.5mm) high speed marking.
- 3.4.1.2 High strength: using dialuminium-alloy structure, beautiful, high strength.
- 3.4.1.3 Beautiful: standard with high frequency pneumatic needle, dot matrix continuous uniform, beautiful printing effect.
- 3.4.1.4 Smooth: precision screw drive, smooth operation, high precision.
- 3.4.1.5 Power: imported servo motor drive, strong power, closed loop controls more reliable.
- 3.4.1.6 External protection: upgrade the stainless-steel protection, the protection level is further improved.
- 3.4.1.7 According to the needs of printing depth, printing speed and printing two-dimensional code, different specifications of printing needles can be selected
- 3.4.1.8 IPC control system can be conveniently connected with the factory management network to meet the requirements of the factory MES system.
- 3.4.1.9 It can be equipped with GF440/450 controller and can easily integrate the marking machine into the production line system.

### **3.4.2 Making Head Technical Parameters**

- ✧ Marking range: 90mm x 110mm
- ✧ Mark depth :0-0.8mm(depending on material)
- ✧ Marking speed :can print 120 # 5 words per minute.
- ✧ Weight: 12kg
- ✧ Operating temperature: -10 to 40 degrees
- ✧ Maximum mark hardness: Rc60 for steel

### **3.4.3 Pneumatic Marking Machine Control Part:**

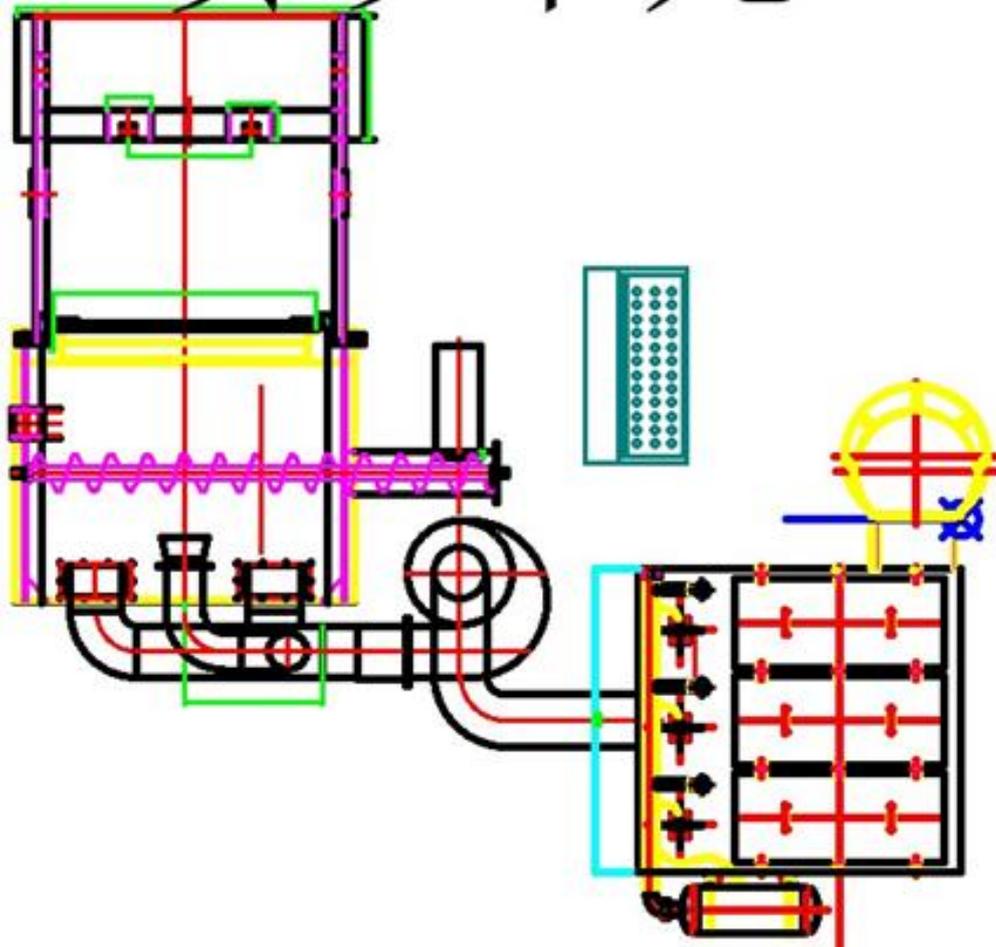
Marking platform is powerful, with system administrator, operator password authority management; The workpiece quickly establish, copy, delete, automatic memory, storage management; Boot automatically into the set workpiece; Keyboard, scanning gun quickly modify the marking content; The serial number automatically increases; Automatic date and time; Multi-variety unified automatic serial number; Shift setting; VIN calculation (validation); Mark speed selection, a variety of character selection, support PLT format graphic printing; Support two-dimensional code printing and other functions. It can easily set the size, position, direction, font, printing speed, etc. of the marked content; For the workpiece setting system

automatically save, can automatically call the workpiece, according to the format set last time to print.

### 3.5 Coupling Sand Blasting Equipment

Q3212 automatic loading and unloading caterpillar shot blasting machine

# 喷砂单元



#### 3.5.1 Function Overview

The rubber track shot blasting machine is used to mechanically fit the workpiece of this size. Through shot blasting cleaning, not only can remove the sand on the surface of the workpiece, but also can eliminate the stress of the workpiece, improve the fatigue strength of the workpiece,

increase the paint film adhesion when the workpiece is painted, and finally achieve the purpose of improving the surface and internal quality of the whole workpiece. The shot blasting machine has the following characteristics:

The arrangement of the shot blasting chamber and the shot blasting device is determined by computer 3D dynamic projectile simulation.

Using the centrifugal shot blasting device with large blasting quantity and high blasting speed can significantly improve the cleaning efficiency and obtain satisfactory cleaning quality.

All the drawings of the simulated projectile drawing (including the determination of the type number, number and spatial arrangement of the shot blasting machine, etc.) and the shot blasting machine are completely drawn by computer aided design (CAD), and the selection and arrangement of the shot blasting machine are more reasonable. The utilization rate and labor productivity of the projectile are improved, the cleaning effect is ensured, and the wear of the chamber body protection board is reduced.

After the workpiece is cleaned, the track can be reversed to realize vibration discharge. The pneumatic gate and chain hoist feeding device are added to further reduce the labor intensity of workers.

Cleaning room with tied MN13 plate protection, compared with the previous rubber plate protection, its service life is greatly improved, and beautiful appearance, easy to replace, is today's most economical and practical cleaning machine room body protection. Our company has a full set of protective board accessories of the machine, which can provide services for users at any time.

### **3.5.2 Process And Working Principle**

Add no more than the specified number of workpieces with the charging mechanism in the cleaning room. After the machine starts, the workpiece is driven by the drum to turn over, while the high-speed projectile thrown by the shot blasting machine forms a projectile bundle, evenly hitting the surface of the workpiece, so that it is cleaned. After the shot blasting is finished, the workpiece can be unloaded from the drum by reversing the track, so the machine is especially suitable for integration into the automatic production line.

The thrown projectile and sand particles flow into the steel mesh at the bottom through the small hole on the JA3212 rubber track, and are fed into the elevator by the screw conveyor, and

then separated into the separator. The dust is sucked into the dust collector by the fan and filtered, and the clean air is discharged into the atmosphere. The dust on the cloth bag is blown back into the dust collecting box at the bottom of the dust collector by the pulse valve, and the user can remove it regularly. The waste sand is discharged from the waste pipe for reuse. The shot sand mixture is collected into the chamber by the recycling pipe and then reused after separation by the separator. The clean shot enters the shot blasting machine again through the electromagnetic shot feeding gate of the shot feeding system. Repeat the above process until the work is completed and stop the machine in order. The following are its operating instructions.

### 3.5.3 Operate The Shot Blasting Machine in the Following Order

- ① Close the main power switch
- ② Turn on the control power button
- ③ Press the lift on button
- ④ Press the screw conveyor open button
- ⑤ Press the lift button for the lift door
- ⑥ Press the track forward button
- ⑦ Lift the hanger into place and press the hopper lift button
- ⑧ After unloading, press the hopper drop button
- ⑨ When the hopper is in place, press the lift door drop button
- ⑩ Drop the hanging door into place and press the shot blast open button ⑪ Press the shot supply gate open button

### 3.5.4 Technical Specifications

No	Contents	unit	Data
1	Maximum single weight of the workpiece	Kg	40
2	Maximum load of drum (easy rollover piece)	Kg	800-1000
3	Productivity (ash castings)	kg/h	3000-4500
4	Track - end disc diameter	mm	Phi 1200
5	Track - end disc RPM	r/min	3.5
6	Shot blast device - Model number		Q034
7	Shot blasting machine - Quantity		2
8	Shot blast - Impeller diameter	mm	Phi 400
9	Shot blast machine - RPM	r/min	3000
10	Shot blast device - amount of shot blast	kg/min	2 * 180
11	Shot blast - Power	Kw	2 * 11

12	Shot blast - motor model		Y160M-4
13	Track drive mechanism - drive speed	m/s	0.1
14	Track drive mechanism - motor power	Kw	3
15	Hoist - Lift quantity	t/h	25
16	Hoist - Power	Kw	4
17	Separator - separation amount		16
18	Separator - amount of air required	m <sup>3</sup>	2000
19	Screw conveyor - screw diameter	mm	Phi 400
20	Screw conveyor - throughput	t/h	> 25
21	Conveyor reducer power	Kw	1.5
22	2 t chain hoist	Kw	0.3
23	Dust collector air volume	m <sup>3</sup> /h	10500
24	Fan power	Kw	7.5 LT-9
25	Maximum overall dimensions	mm	5050 * 3085 * 6200
26	Total power of equipment	Kw	45.2

### 3.6 Coupling Phosphating Complete Equipment



#### 3.6.1 Process Plan, Production Capacity, Overall Description and Technical Data

The complete set of equipment of Coupling Phosphating production line, including tank body, rail frame, gantry car, hanging basket, wire frame, working platform, pipeline system, auxiliary tank circulation system, wastewater collection system, exhaust gas extraction system and

electrical control system, etc., as well as all the necessary supporting equipment, random spare parts and wearing parts manufacturing, supply, etc.

### 3.6.2 Specification Description

The main products are oil (sleeve) pipe, special buckle Coupling

Steel pipe grade: H40 J55, K55, N80-1, N80-Q, R95, L80-1, C90, T95, C110, P110, Q125, etc

Coupling Outer diameter: 73.02 ~ 380mm

Coupling length: 107.95 ~ 360 mm

Coupling single weight: 1.28 ~ 27.45kg

### 3.6.3 Equipment Overview

This project is an automatic phosphating process production line equipment which adopts the production process of high rail gantry crane, vertical lifting Coupling basket and horizontal moving operation. The equipment mainly consists of a tank body, rail frame, gantry crane, hanging basket, wire frame, working platform, pipeline system, auxiliary tank circulation system, wastewater collection system, exhaust gas extraction system and electrical control system.

The control of process equipment adopts PLC programmable controller, through the touch screen computer to realize the dynamic display of the production line, various process parameters such as time, temperature, failure, etc., to create a friendly human-machine interface, with a high intelligent automatic control. Realize intelligent production, intelligent temperature real-time detection, intelligent automatic temperature control, intelligent automatic scheduling, intelligent dynamic display, etc.



### **3.6.4 Equipment Production Capacity**

Production capacity requirement: no less than 80 pieces per phosphating piece, taking the diameter of 160mm and the height of 300mm as an example

The production beat time is 5-40min/ basket, adjustable. According to different phosphating products to develop different phosphating rhythm requirements. Taking P110 steel grade, diameter 160mm Coupling as an example, in the normal production process, the phosphating rhythm is less than 20min/ basket (no less than 7 baskets within two hours), and the product phosphating technical indicators meet the production standard requirements.

### **3.6.5 Technical Performance (Specification) Description**

#### **3.6.5.1 Main Technical Specifications:**

The control room and power cabinet are arranged in the auxiliary room of the production line, and the water treatment should be arranged independently. The phosphating production line tank body adopts the ascending ground arrangement mechanism to ensure the production line "clean production" and "energy saving and emission reduction".

the operator is located in the production line operation platform observation or manual operation, the production line tank is placed on the ground frame or cement foundation. The gas supply and water supply main pipes on the production line are placed on both sides of the production line, and the wastewater flow discharge port on the production line is centralized to facilitate waste water treatment.

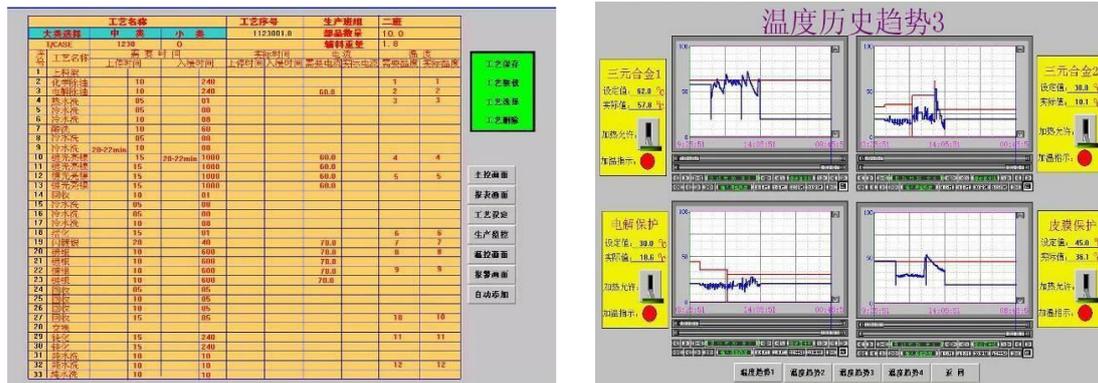
According to the layout, the phosphating production line equipment is unified with the overall logistics layout of the plant. Exhaust gas suction system is placed outside the workshop. The suction system is isolated from the production line to reduce the noise in the workshop, reduce the corrosion of the equipment, and extend the service life of the equipment.

According to the requirements of national environmental protection standards, the top suction system is set up in the process tank that distributes harmful and corrosive gases, and the exhaust branch pipe is set on the top of the rack to improve the workshop and the production line in a clean environment.

According to the requirements of national environmental protection standards, the waste liquid collection system should be set up to connect with the existing water treatment.

The production line adopts high rack column gantry driving automatic production line, using PLC control, touch screen man-machine interface operation, the production line has automatic and semi-automatic operation.

The equipment has a certain degree of flexibility and adjustability, such as: time parameters, temperature parameters can be adjusted.



The equipment has a high operating efficiency, with a more stable treatment means to complete the process requirements, to meet the requirements of 24-hour continuous production.

The equipment has perfect safety measures to protect, with transmission parts cover and guardrail, with a multi-point emergency button.

The production line adopts the leading, mature, stable and reliable technology, equipment and materials at home and abroad, and the overall technical level has reached the domestic advanced level.

### 3.6.6 Equipment Composition:

The equipment is mainly composed of: tank body, rail frame, gantry crane, hanging basket, wire frame, working platform, pipeline system, auxiliary trough circulation system, exhaust gas extraction system, waste liquid collection system and electrical control system.

### **3.6.7 Process flow:**

**3.6.7.1** Feeding → ultrasonic degreasing → ultrasonic degreasing → water washing → water washing → pickling → water washing → Water washing → table adjustment → phosphating → phosphating → phosphating → water washing → water washing → saponification → discharging

**3.6.7.2** the production line is composed of 15 main tanks: 2 ultrasonic degreasing tanks, 6 washing tanks, 1 pickling tank, 1 surface conditioning tank, 3 phosphating tanks, 1 saponification tank and 1 high sludge auxiliary tank.

**3.6.7.3** equipment production line layout: phosphating production line layout

**3.6.7.4** equipment production line process technical parameters: see the phosphating production line process parameter configuration table.

**3.6.7.5** phosphating tank heating using heat conduction oil circulation system, with an independent heat conduction oil heating system.

## **3.7 Coupling Spray Drying Complete Equipment**

### **3.7.1 Equipment description:**

The Coupling painting complete equipment project consists of a Coupling painting machine including a conveyor chain, a Coupling dryer, a Coupling printing machine, a Coupling printing machine, a VOC processing system and an electrical control system.

### **3.7.2 Function description:**

#### **3.7.2.1 Coupling Conveying Process**

Material to be prepared → feeding → chain movement → Coupling painting & dust removal equipment → electric heating air drying → color ring → spray label → blanking

#### **3.7.2.2 Detailed Description**

The Coupling is lifted from the other place to the loading station, and the Coupling is installed on the Coupling carrier of the conveyor wheel by the robot, and the cap is covered. After the conveyor chain starts, it does not stop at the loading and unloading station, and the loading speed depends on the start and stop time of other automatic stations on the conveyor chain. Coupling movement to the surface after spray paint station stops, the coupling tray cha rotating grinding begins to spray paint spray gun last, wait for a coupling to the spray gun in the next.

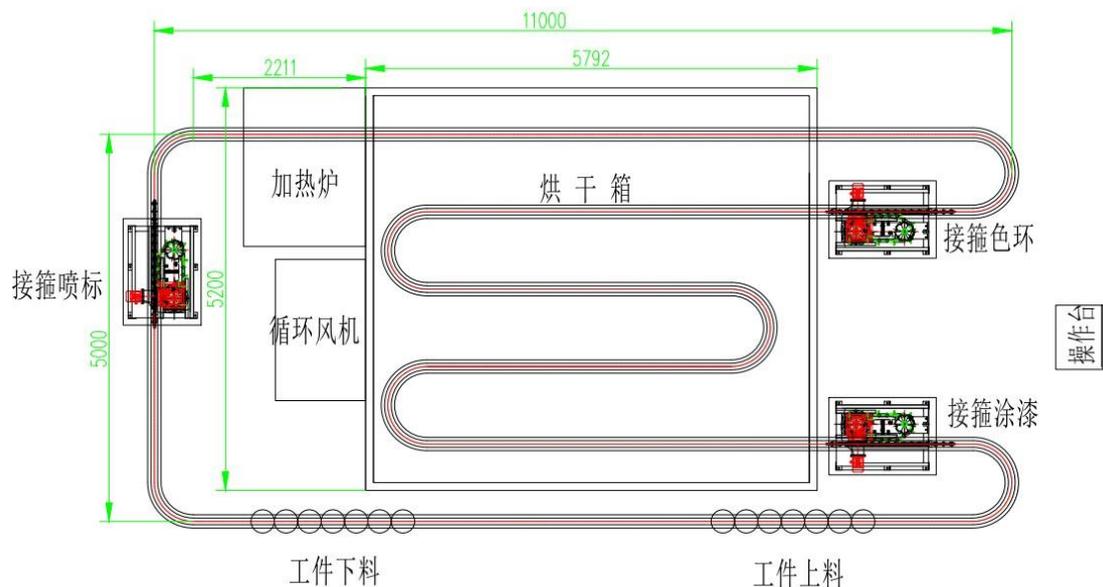
After the spray gun is sprayed once, the conveying wheel will start once. In turn, the conveying wheel will go once and stop once and enter the drying room. When the Coupling reaches the color ring position after drying, start the color ring when the conveyor chain is stopped, and the color ring spray gun needs to be adjusted manually in advance. The spray gun is fixed, and the height distance and flow rate need to be adjusted at any time to change the specification. Color ring drying using quick drying paint, with the Coupling just out of the drying room temperature, so that Coupling can dry color ring paint in a short distance. After the color ring paint is dried, the surface is sprayed once. The length of the spray print, the height of the word, and the string number arrangement need to be provided to facilitate the selection of the machine. The end of the final conveyor chain cycle is the unloading Coupling.

The equipment is automatic operation equipment, remote control, the site does not set the operation table, the field operation box is only used for equipment repair and maintenance, the necessary electric control cabinet is placed in the field instrument room.

### 3.7.3 Equipment Contents

No	Item	Qty
1	Coupling coating machine with conveyor chain	1 Set
2	Coupling dryer	1 Set
3	Coupling color ring machine	1 Set
4	Coupling printing machine	1 Set
5	VOC dust removal treatment system	1 Set

### 3.7.4 Technical Description of the Equipment



### 3.7.4.1 Technical Specifications:

#### 3.7.1.1 Coupling automatic spray-painting machine

X axis: paint machine translation axis, manually adjusted, used to control the distance from the spray gun to the product

The effective stroke of X axis is 400mm,

Z-axis: linear guide rail and slider are used for automatic control of the spray gun up and down

reciprocating spray painting

The effective stroke of Z axis is 600mm,

The maximum speed of Z axis is 0.5M /Sec,

Z-axis power: 400W servo motor drive;

Control system: PLC+7" full color man-machine interface, programmable control.

Linkage

control with conveyor line,

#### 3.7.1.2 Spraying Machine Paint Supply System

Spraying method: high-tech centrifugal technology

Metering flow: SCC

Operation mode: full numerical control

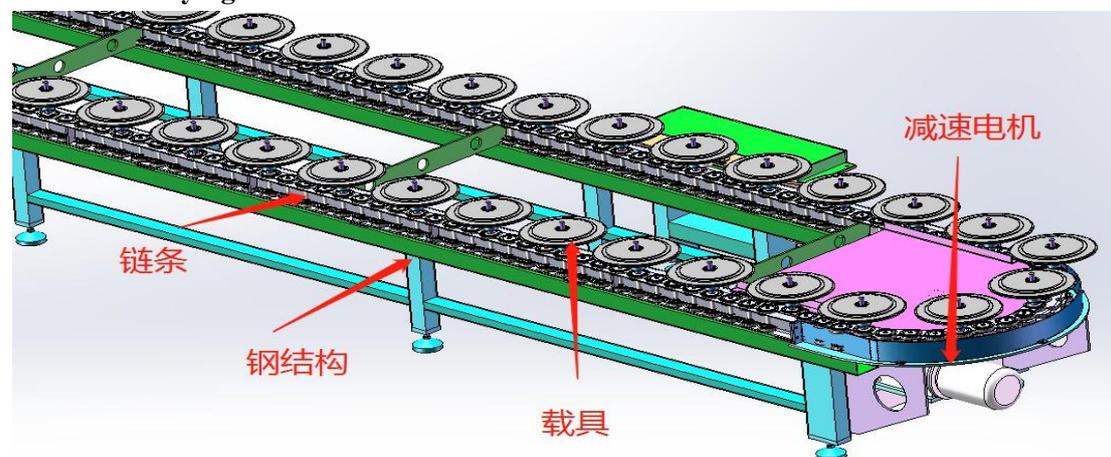
Production speed: >1m/min

Paint medium: oily (water-based) liquid

Paint film thickness (dry film) : minimum thickness 25-35 $\mu$ m Maximum thickness 50-60 $\mu$ m

On the same Coupling , the difference between the measured minimum and maximum thickness is 20 $\mu$ m

#### 3.7.1.3 Conveying Line



Conveying line length: 30 meters  
Conveying speed: maximum 6 m/min (continuous operation),  
Conveyor chain: large roller ground rail conveyor chain, with horizontal bearing wheel, breaking strength 5000KN  
Reducer: RV150-14-1.1  
Fixture spacing: 304.8mm  
Number of fixtures: 95 sets  
Fixture form: double bearing rotary fixture  
Single point maximum load bearing: 30kgs (244) + 50kgs (508)  
Control system: Share the central control system with the spray painting machine and run in tandem

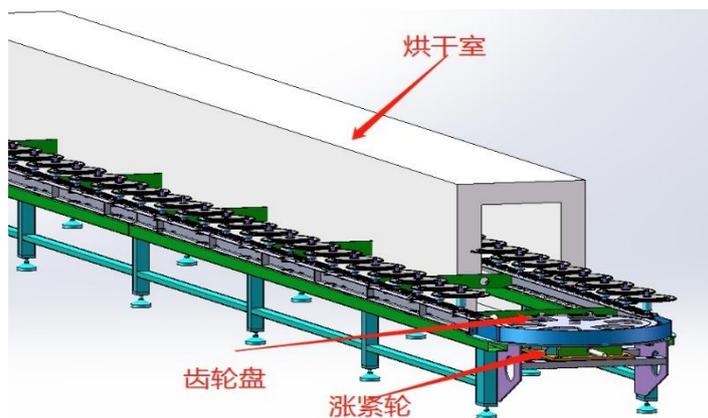
### 3.7.5 Scope of Supply and Function Description:

#### 3.7.5.1 1 set of conveying chains

Function: The Coupling is placed on the pallet carrier of the chain track, and the cycle moves, so that the Coupling is transmitted on each station in turn.

Scope of supply: conveying wheel  $\approx$ 50 meters, 80-90 sets of vehicles, 1 set of driving reducer, 1 set of tightening wheels, 1 set of driving wheel, 3 sets of passive wheels, 1 set of steel structure.

Detailed description of process function: The Coupling moves on the delivery chain and locates the position of each station according to the actual final design distance. The Coupling needs



to be placed at the station before the Coupling spray painting at the initial loading. The chain starts once after the automatic mode. The chain way carries a coupling again move down a beat (according to the actual touch screen set up mobile number)

### 3.7.5.2 1 set of drying chambers

**Function:** The Coupling is placed on the pallet carrier of the chain path, and enters the drying room. The circulating air duct is arranged in the room, and the temperature control automatically adjusts the indoor temperature.

**Scope of supply:** drying room  $\approx$ 10 meters, 1 set of circulating air duct, 1 set of electric heating furnace, 1 set of circulating fans, 2 sets of air curtain machine, 1 set of temperature control electrical operation. (Outsourced equipment, made in Nanjing)

Detailed description of **process functions:** the Coupling moves on the transport chain and enters the constant temperature cycle in the drying room. The inlet and outlet are equipped with air curtain machines to keep the temperature from leaking out.

### 3.7.5.3 Spray booth 2 sets (color ring + 277 Coupling surface)

**Function:** Coupling on the spray booth tray carrier, self-service rotation, spray paint up and down spray Coupling surface.

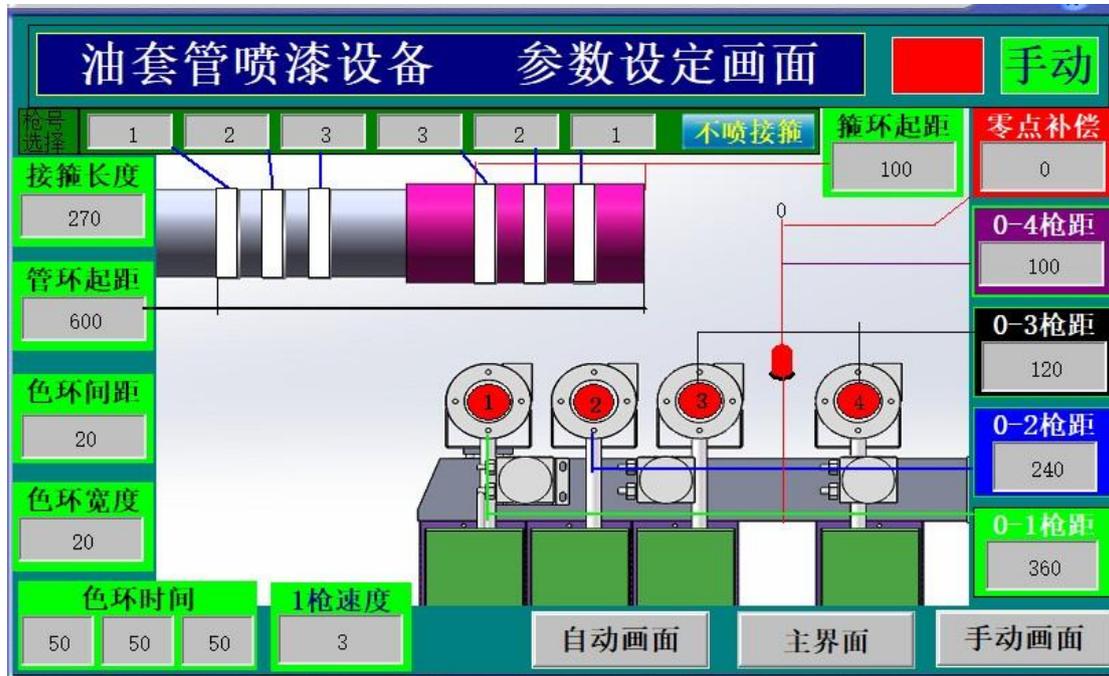
**Scope of supply:** 2 sets of self-help rotating mechanism, 2 sets of rotary drive motor, 2 sets of spray-painting feeding mechanism, 2 sets of up and down moving slide mechanism, 2 sets of servo motor, 2 sets of steel structure.

**Detailed description of process functions:** the Coupling moves on the delivery chain, stops after the painting station, the self-service rotation drives the carrier of the tray, and the carrier drives the Coupling to rotate. Start the servo, the servo moves up and down once according to the set length, start the spray gun when the servo electric starts, set the servo moving speed according to the Coupling outer diameter. The servo stops after the given length ends once and gives the completion signal to the conveying wheel.

Adjust the position of the color ring spray gun, after the Coupling reaches the station, the self-rotation, the spray gun starts once according to the set time as the spray gun stop time (set according to the actual experience value, the outside diameter will change).

**Features of this machine:** intelligent environmental protection, no air and no fog, centrifugal coating technology, energy saving and environmental protection, paint is not wasted (so there is no need for spray gun dripping containers). This machine does not need to be equipped with dust removal devices.

This machine position 3 colors, 3 colors in the coating, can be arbitrarily switched, man-machine screen Settings. If the 3 colors cannot meet or want to change with other colors, you need to take out the paint bucket, use the cleaning function to clean the paint in the nozzle pipe, the longest paint pipe 500mm



### 3.7.5.4 Printing mechanism 1 set (according to the requirements of selection) black ink machine

Function: After the Coupling surface color ring paint is dried, the surface of the butt coupling is sprayed with characters.

Scope of supply: 1 set of spray mark machine, 1 set of rotary mechanisms, 1 set of servo control, 1 set of moving slide table.

Working principle: According to the Coupling size, the spray label machine can choose a single spray printing and a single multiple spray printing. Large Coupling to achieve a printing, time can print multiple information content. Small Coupling is printed with a single piece of information.

After spraying one Coupling, rotate at a set Angle and then spray the second and third.

Note: The Coupling size of its arc surface is different, the printing nozzle of the inkjet printer is a plane, the arc changes in the middle and the corresponding plane on both sides of the inkjet printer has a significant distance difference, beyond the printing distance of the inkjet code, you can only spray one information at a time.

### **3.7.5.5 Dust removal mechanism (VOC) 1 set**

Function: In the spray-painting station on the paint fog collection

Scope of supply: 3 sets of dust removal water curtain room, 3 sets of dust removal pipe, 1 set of water mist filter room

Working principle: The spray gun spray is connected to the coupling, the mist is blown forward by the wind of the spray gun, the front is placed in a water curtain, the water flows down from the top direction, and a filter is arranged behind the water curtain. The part behind the filter cotton is the suction inlet of the fan, and the fan is starting.

The paint mist of the spray gun floats in front of the water curtain, the attraction drains the paint mist through the water curtain, and then the water is isolated by the filter cotton and flows to the bottom tank, effectively controlling the diffusion of paint mist.

### **3.7.5.6 1 set of spray printing mechanisms**

Function: After the Coupling surface color ring paint is dried, the surface of the butt coupling is sprayed with characters.

Scope of supply: 1 set of spray mark machines, 1 set of rotary mechanisms, 1 set of servo control, 1 set of moving slide table.

Working principle: According to the Coupling size, the spray label machine can choose a single spray printing and a single multiple spray printing. Large Coupling to achieve printing, time can print multiple information content. Small Coupling is printed with a single piece of information.

After spraying one Coupling, rotate at a set Angle and then spray the second and third.