2025

Coupling Threading Machine

Hotstone Zhou

Hotstone Group Co.,Ltd

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High-End CNC Coupling Threading Machine| DSMC-13

一、Production Introduction: High Performance Coupling Threading Machine

The high-end CNC coupling threading machine is an advanced precision machining solution for the metallurgical steel pipe industry. Designed based on leading international principles, it ensures superior automation, accuracy, and production efficiency.

It is specifically engineered for machining short round, long round, buttress, and special connection threads in compliance with **API 5CT & 5B standards**. Supported steel grades include **J55, N80, L80, C90, P110, and Q125**, with optional **FANUC or Siemens CNC systems** for optimized control.

1.1 Key Features of the Coupling Threading Machine

1.1.1 Innovative Design

Incorporates advanced threading machine concepts from globally recognized manufacturers. Balances high precision with high-efficiency machining.

1.1.2 High-Rigidity Structure

Integrated **45° slant bed** for enhanced structural stability. Equipped with a **large-diameter spindle** and **high-load tapered roller bearings**, ensuring superior rigidity.

1.1.3 Exceptional Machining Accuracy

Spindle assembly utilizes **high precision world-famous brand tapered roller bearings** for enhanced stability. The feed system integrates **INA feed bearings, Excellent ball screws, hardened guide rails**, and **injection-molded carriage slides**, delivering excellent static geometric accuracy, positioning precision, transmission stability, and machining consistency. Precision levels surpass domestic counterparts and approach global industry standards.

1.1.4 High Efficiency & Dynamic Performance

Optimized for rigidity, strength, wear resistance, vibration absorption, and precision retention. Utilizes **multi-tooth comb tool technology** for high-strength, efficient internal thread machining. Supports high torque at low speeds, high metal removal rates, and rapid cycle times.

1.1.5 Advanced Structural Configuration

Equipped with a **flipping hydraulic chuck** for secure and reliable workpiece clamping. Features a **four-station vertical hydraulic (or servo) turret**, enabling simultaneous machining of both coupling ends.

1.2 Technical Specifications

1.2.1 Transmission System

- **Main drive**: Servo spindle motor + belt transmission.
- **Feed drive**: High-precision servo motor + synchronous belt + ball screw assembly + steel-insert guide rail + injection-molded carriage slide.

1.2.2 Reliability & Maintenance

Key components—**spindle, ball screw bearings, hydraulic system, cooling system, electrical elements, steel-insert guide rails**—are sourced from **top-tier domestic and international brands**, ensuring long-term stability and easy maintenance.

1.2.3 Intelligent Control & User-Friendly Interface

Equipped with **SIEMENS 840Dsl or FANUC CNC system**, offering advanced control functions and an intuitive human-machine interface.

1.2.4 Automated & Intelligent Production

Supports **six-axis robotic arms, gantry loaders, and AGV material transport systems**, enabling fully automated threading, inspection, unloading, and packaging. Significantly reduces manual intervention while maximizing efficiency

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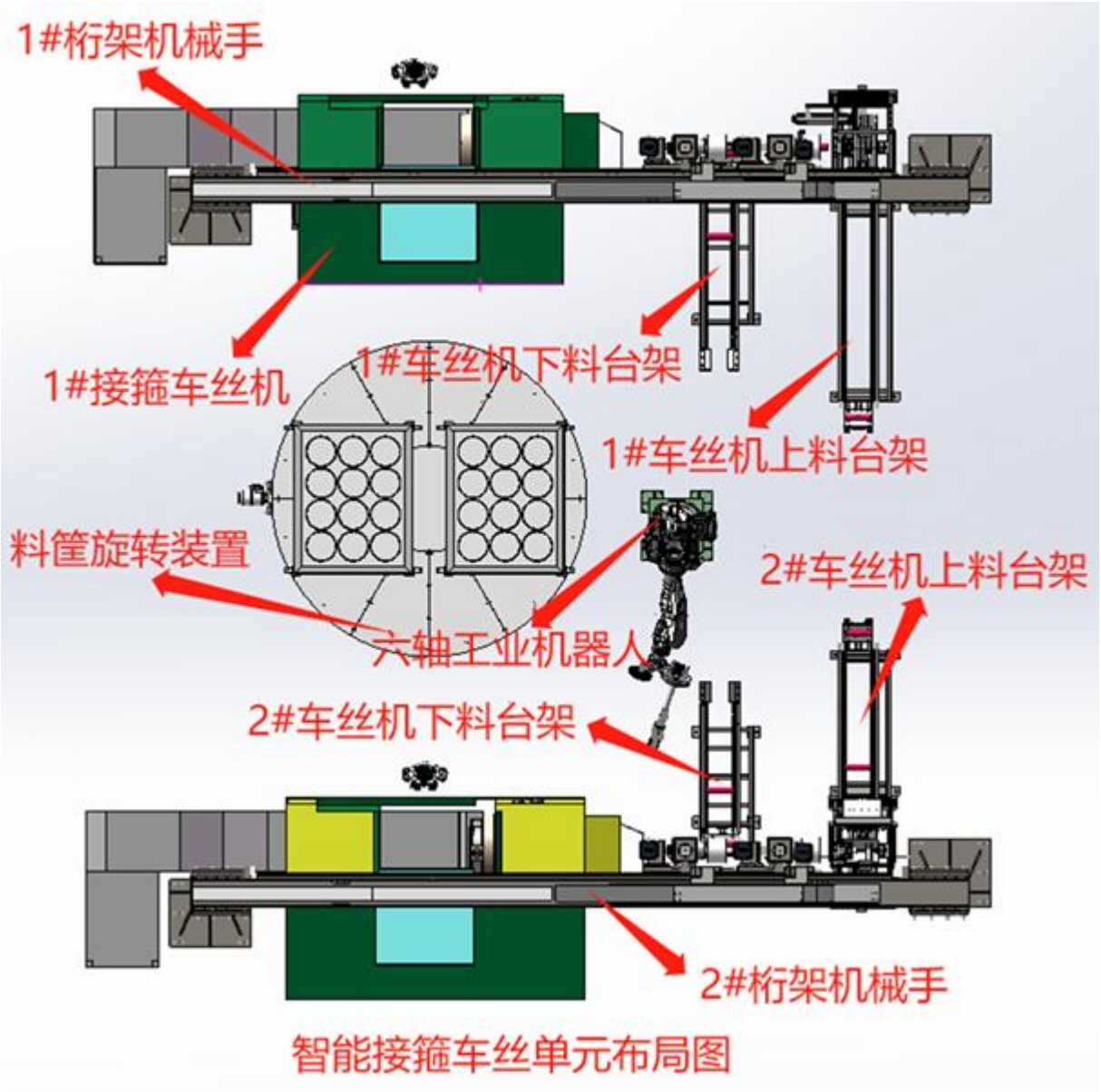
二、Coupling Threading Unite Composition

Each threading unit consists of **two CNC main machines**, **two gantry-type robotic arms** for material handling, **auxiliary loading and unloading equipment**, and **a six-axis industrial robot with integrated intelligent control system**, ensuring efficient and precise automated threading operations.



No	Item	Qty	Remarks
1	6-Axis Robotic Automatic System	1 Set	Optional
2	Rotary Bin System	1 Set	Optional
3	Gantry Manipulator System	2 Set	
4	Gantry Loading Bench	2 Set	
5	Gantry Unloading Bench	2 Set	

6	Coupling Threading Machine	2 Set	
7	Hydraulic System	2 Set	
8	Lubrication System	2 Set	
9	Emulsion Cooling System	2 Set	
10	Chip Conveyor Device	2 Set	
11	Control System	2 Set	

三、Pipe Threading Process Flow Description

3.1 Raw Material Loading

- The coupling blank tray is positioned, and **the robot picks up the coupling blank**, placing it onto **the loading platform**.
- The blank is transferred to **the positioning and clamping station**.

3.2 Feeding Preparation

- The gantry slide moves the feeding arm horizontally to the machine front.
- The feeding arm lowers and moves horizontally, delivering the blank to the machine’s feeding point.
- The machine's top door opens, preparing for machining.

3.3 Machining Stage

- The spindle clamps the coupling blank, and the feeding arm releases, returning to its initial position.
- The machine spindle begins rotation, and the tool turret advances to the machining position, reaching the predefined speed.
- Thread machining for Side A is completed, after which the tool turret retracts, and the flipping chuck rotates the workpiece.
- Thread machining for Side B is performed, and the tool turret returns to its original position.

3.4 Finished Product Output

- The machine door opens, and the unloading arm moves horizontally to the unloading station.
- The unloading arm lowers, clamps the finished coupling, and moves it to the unloading platform.
- The unloading platform transfers the finished coupling to the bottom end, ready for robotic handling.

3.5 Continuous Production

- The robot picks up the finished coupling and transfers it to the horizontal thread inspection station.
- After material transfer, the robot returns to the coupling tray and picks up a new blank.
- The next machining cycle begins, ensuring continuous production.

3.6 Features & Advantages

- Highly automated operation, reducing manual intervention and improving production efficiency.
- Precision control, ensuring process stability and machining consistency.
- Optimized workflow, balancing machining and material handling for enhanced production reliability.

四、Equipment Specification

No	Items	Unit	Specification
Processing Performance			
1	Coupling Size		4 1/2"-13 3/8”
2	Max Coupling Length	Mm	400
Spindle System			
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
Swivel Chuck System			
1	Outside Dia	Mm	865
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
Turret System			
1	Turret Pattern		Vertical hydraulic
2	Position	Position	4
3	Center Height	Mm	200
4	Max Torqure	Nm	250
5	Repeat Position Accuracy	Mm	≤0.005
X-Axis Feeding System			
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

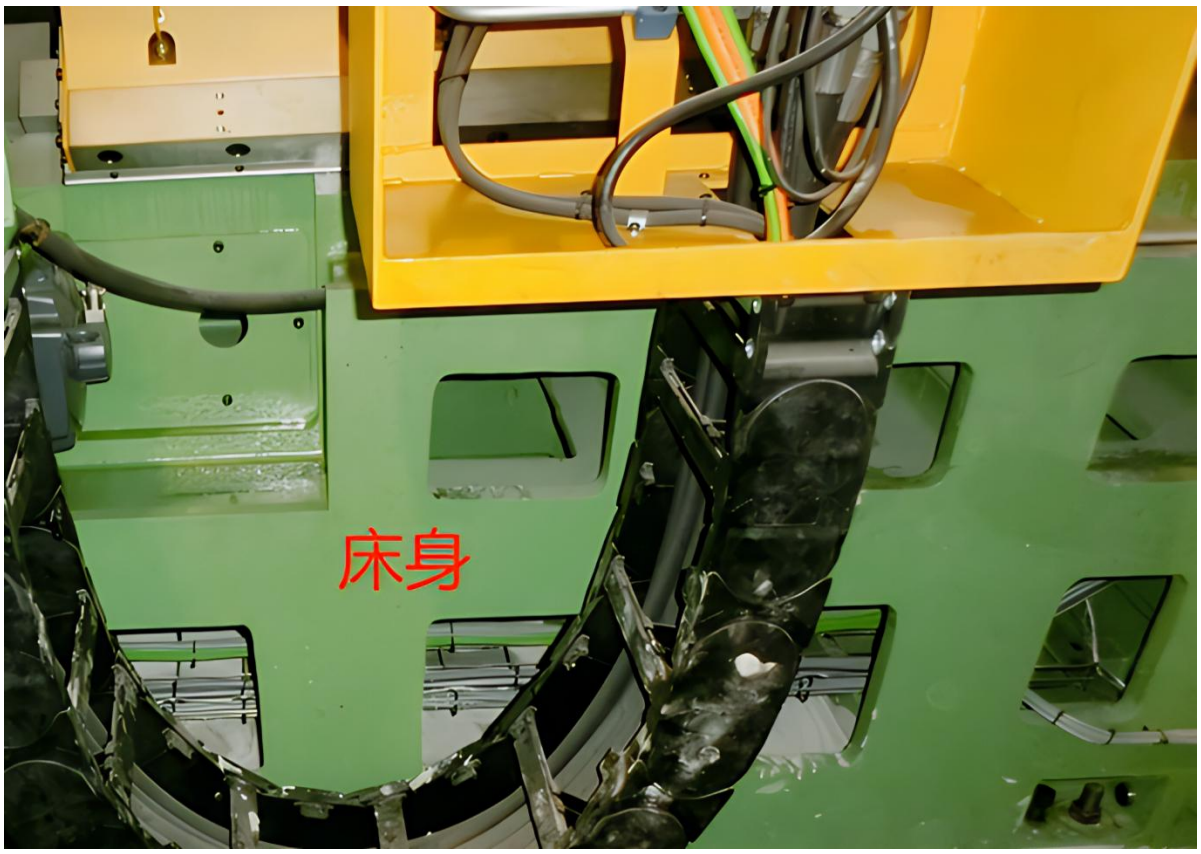
No	Items	Unit	Specification
5	Balance cylinder balance pressure	Bar	30 (Adjustment range: 0 ~ 50)
Z-Axis Feeding System			
1	Z-axis trave	Mm	600
2	Z-pulley reduction ratio		1/2
3	Z axis ball screw		Ø 50 x10
4	Z-axis motor with no brakes		SIEMENS/4.87KW 27NM
5	Fast Moving Speed (X/Z)	m/min	15/15
Hydraulic System			
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)
Spindle Lubrication System			
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
Centralized lubrication system			
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
Cooling System			
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
5	Cooling tank capacity	L	1000
6	Filtration accuracy	μm	50

No	Items	Unit	Specification
Chip Conveyor System			
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
Control System			
	Numerical Control System		SIEMENS 840D

五、Main Description of The Mechanical Components

The main structural components are manufactured using resin sand casting and high-strength, stress-free cast iron, fully utilizing the **vibration damping characteristics** of castings to maximize precision retention. The design incorporates finite element analysis and employs a frame-type internal ribbed structure, significantly enhancing vibration resistance, bending rigidity, and torsional stiffness.

5.1 Machine Bed



The machine bed features a 45° inclined design and is cast from high-performance iron. It undergoes dual annealing treatments to eliminate internal stress. The internal rib structure adopts a globally

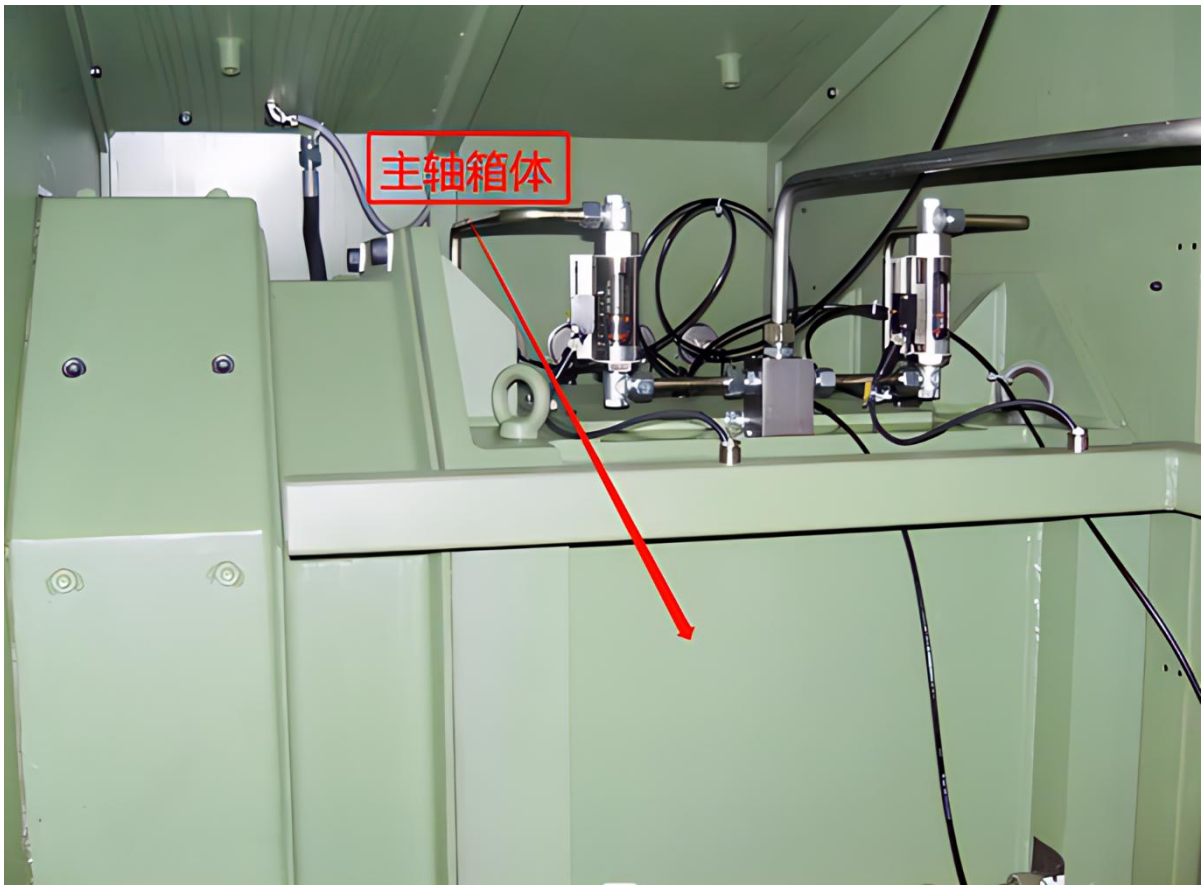
recognized closed-frame design, offering superior bending and torsion resistance, significantly enhancing cutting rigidity, precision, and stability.

The bed guideway is a steel-inlaid type, subjected to induction hardening and precision grinding, ensuring a hardened layer depth of no less than 2.5mm with a Shore hardness of 70°. The bed base is an integrated, box-type, densely ribbed cast structure, with the spindle lubrication box cast as part of the base. This guarantees exceptional overall rigidity while eliminating oil leakage during operation.

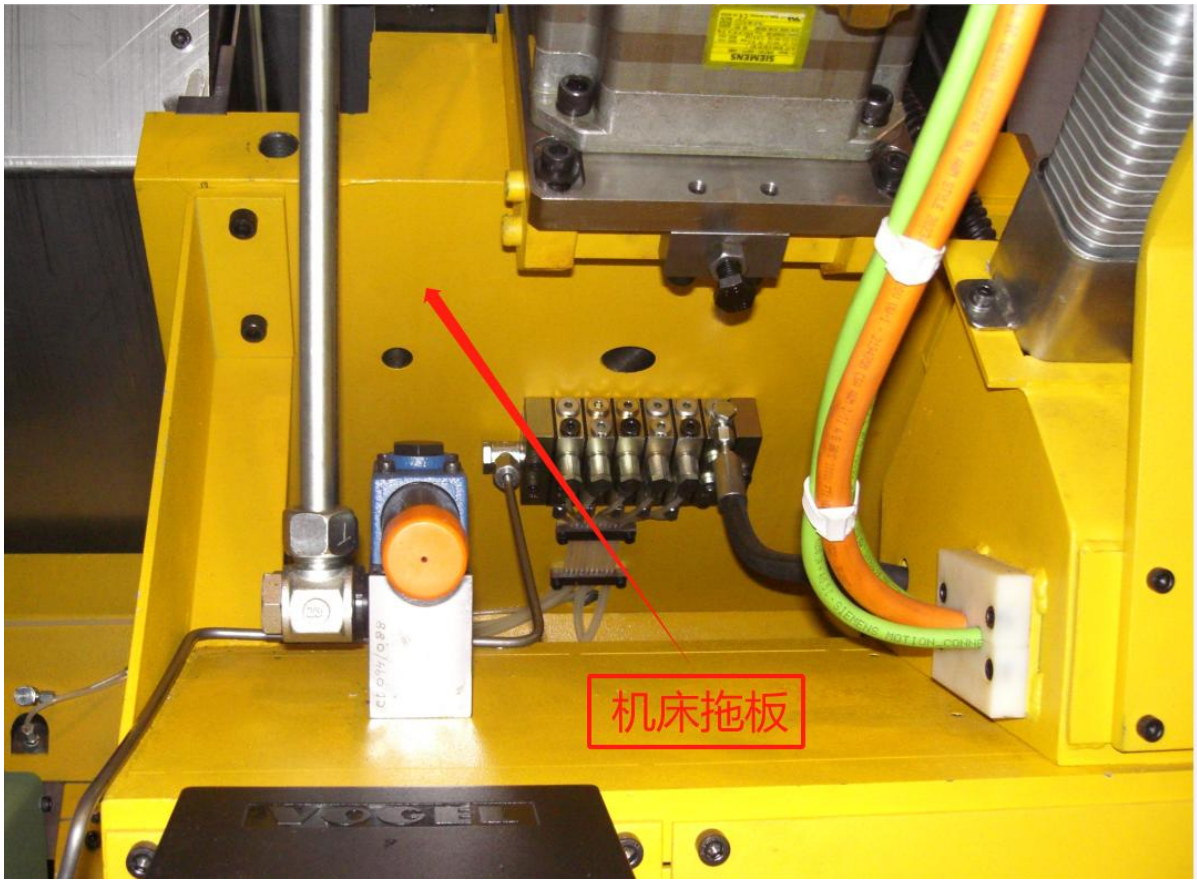
5.2 Spindle Box

The spindle box is welded using **Q345-A steel plates**. Through advanced **pre-weld treatment**, mature **large-component welding techniques**, **heat treatment**, and **precision machining**, welding stress is effectively eliminated. The steel material's **elastic modulus** is significantly higher than that of cast steel and cast iron, providing the spindle box with superior **rigidity and strength**.

The spindle features a **large through-hole design**, equipped with **imported high-precision tapered roller bearings**, and utilizes **hydraulic oil cooling and lubrication**. This ensures **excellent rigidity, low temperature rise, and high precision** throughout the spindle system.



5.3 Carriage Guideway

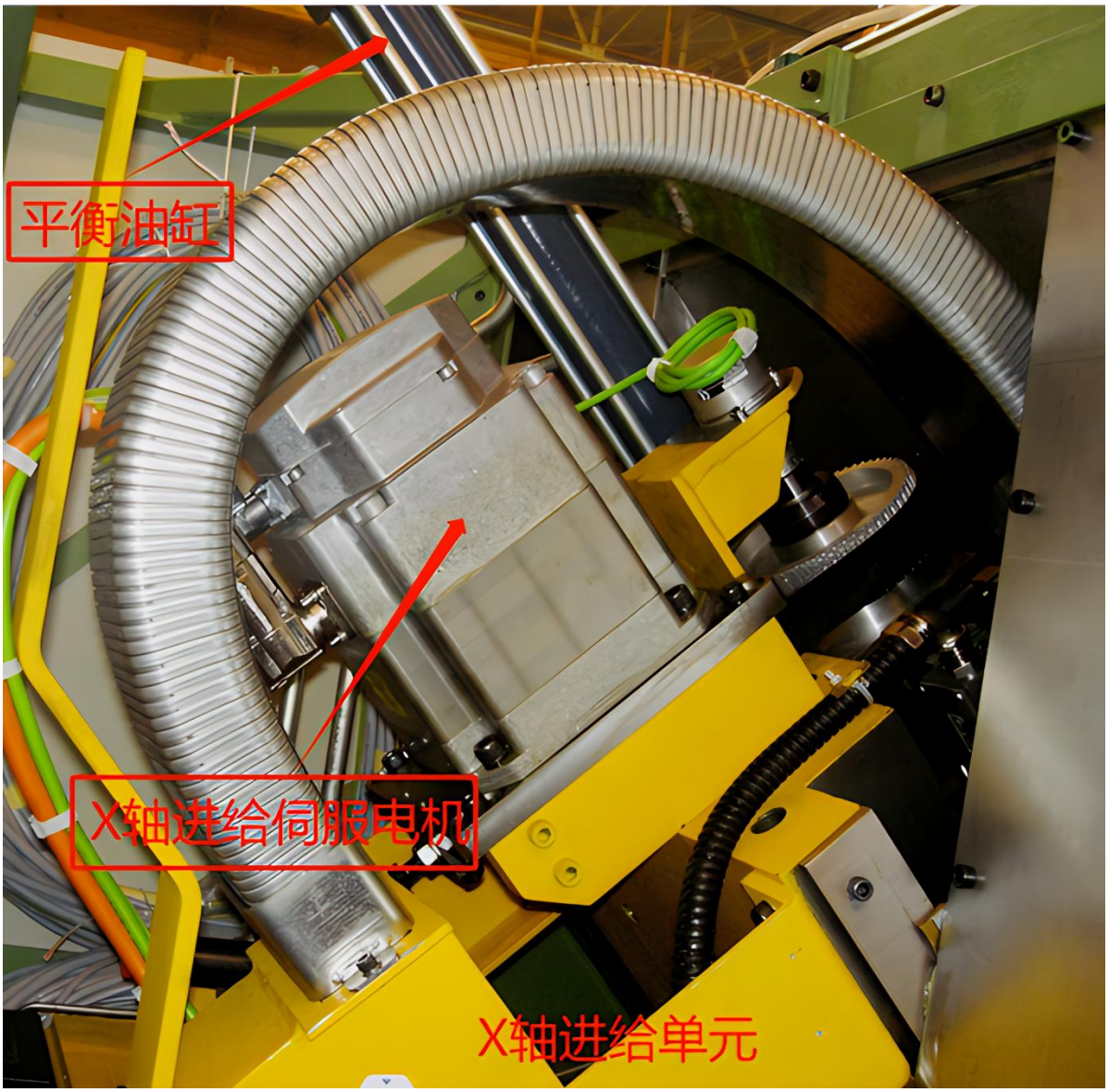


The carriage guideway adopts hardened steel guide rails, which are heat-treated and precision-ground to achieve a hardness exceeding 60HRC. The sliding friction surface of the carriage utilizes a polymer injection coating, providing low frictional resistance, high rigidity, excellent shock absorption, and long service life.

During low-speed feed operations, this structure significantly outperforms conventional bonded plastic processes in terms of dynamic and static friction resistance, while the contact stiffness of the guideway pairs approaches that of steel-to-steel contact, making it particularly suitable for heavy-duty cutting environments.

Additionally, the carriage is equipped with a hydraulic counterbalance cylinder to compensate for the weight of both the carriage and the tool post

5.4 X/Z Axis Feeding System

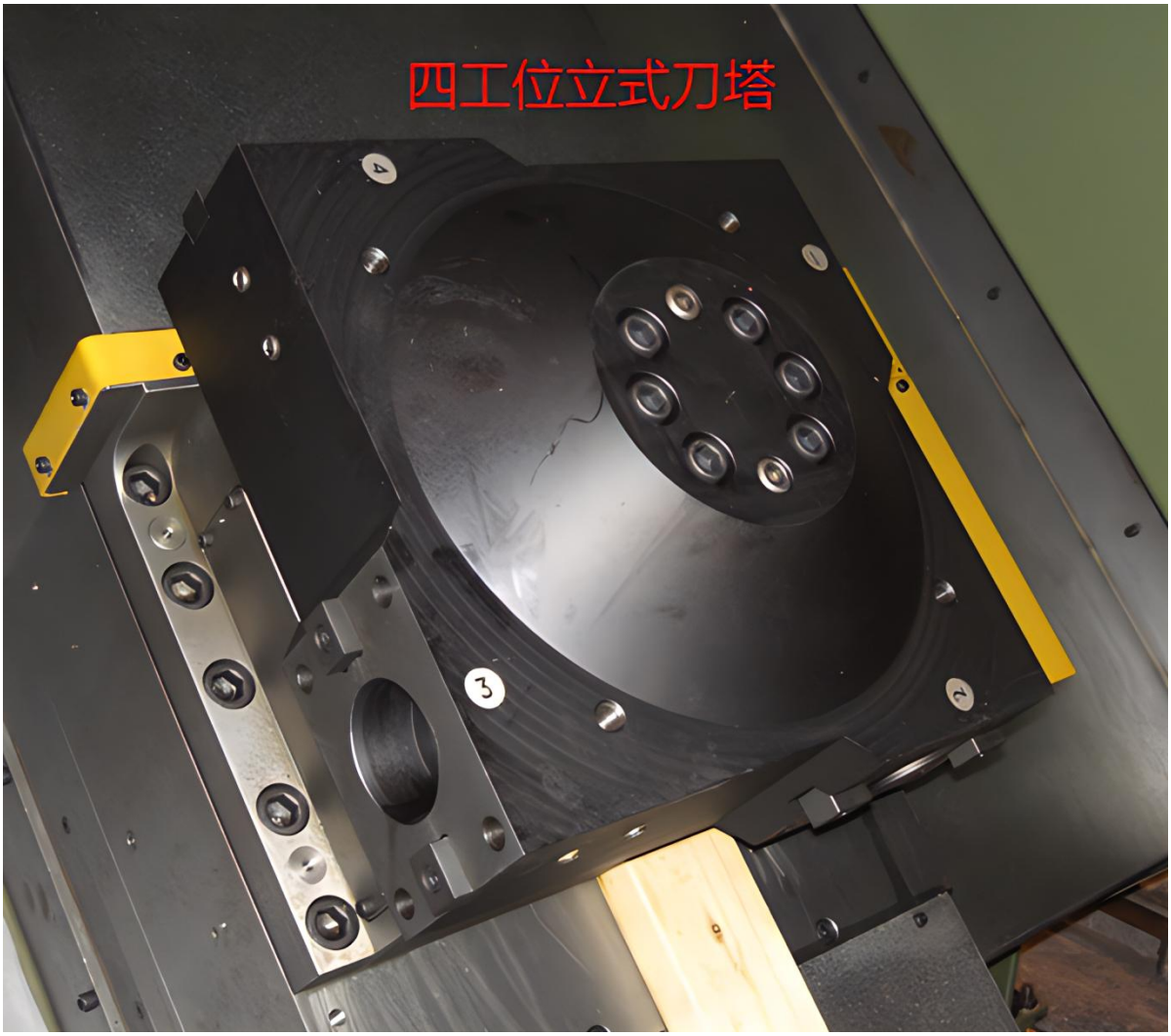


Both feed-axis ball screws are supported by imported INA ZARN heavy-duty needle-thrust cylindrical roller bearings with grease lubrication, ensuring superior precision, rigidity, and load-bearing capacity. The ball screw is linked to the feed motor via a synchronous belt reduction drive, delivering greater feed thrust than a direct coupling. A high-precision absolute encoder, mounted directly at the ball screw's tail end, continuously feeds back position data to the CNC system, enabling closed-loop control and further improving machine tool accuracy.

5.5 Turret System

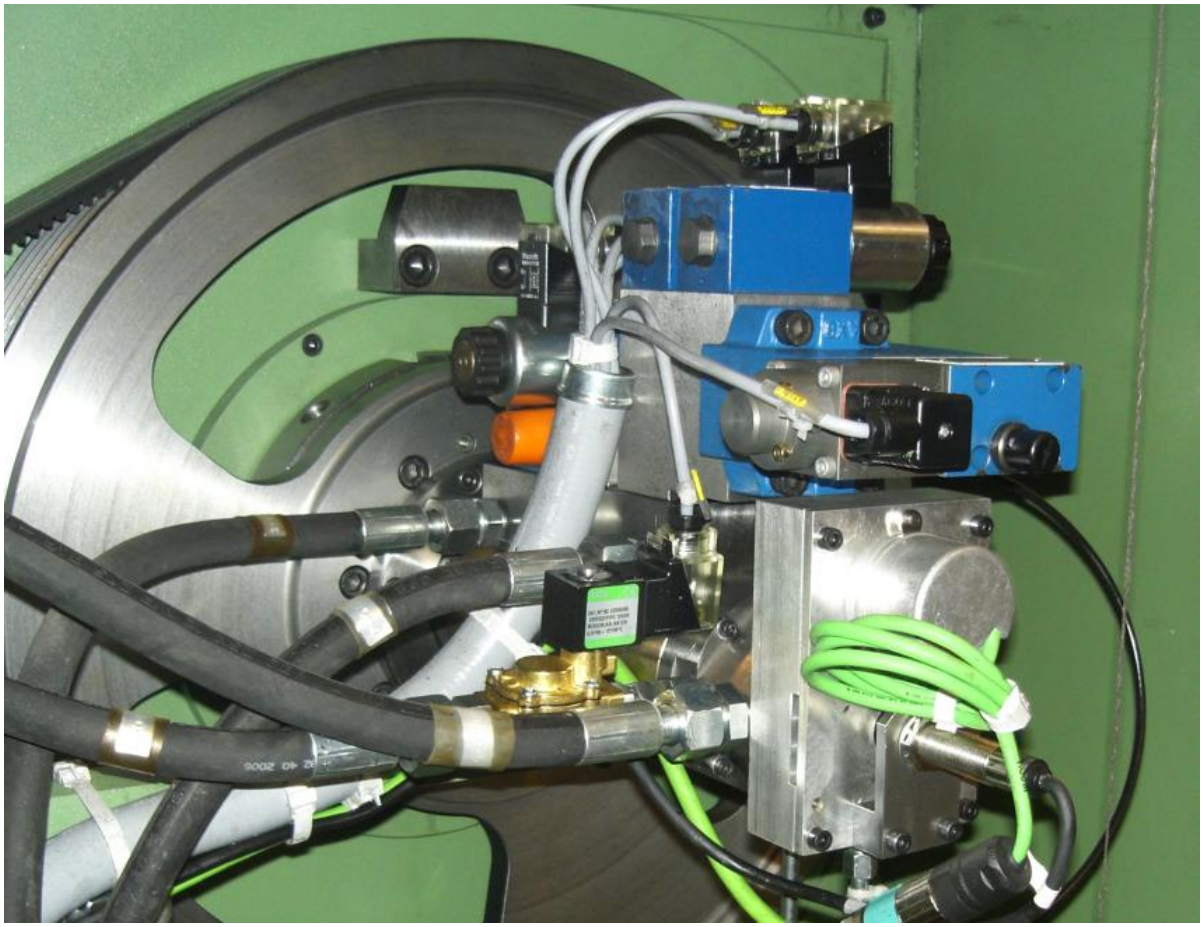
This high-end vertical four-position hydraulic tool turret is independently developed by our company to meet the demanding requirements of heavy-duty cutting and high-precision machining. Its key features are as follows:

- **Compact structure with high rigidity**: Optimized design ensures stability and reliability, making it suitable for high-load environments.
- **High-precision positioning**: A hardened large-diameter face gear is used as the indexing and positioning element, achieving accurate positioning and enhancing machining precision.
- **Fast and stable indexing**: The turret rotates smoothly and quickly, reducing tool change downtime and improving operational efficiency.
- **PLC-compatible encoding system**: Signals are transmitted via proximity switches, enabling direct communication with the PLC for precise control and enhanced automation.
- **Hydraulic locking with strong load-bearing capacity**: A high-performance hydraulic cylinder ensures powerful locking, significantly enhancing the machine's stability and adaptability for heavy-duty cutting.
- **Easy maintenance**: Modular design allows for efficient maintenance, reducing overall operating costs.



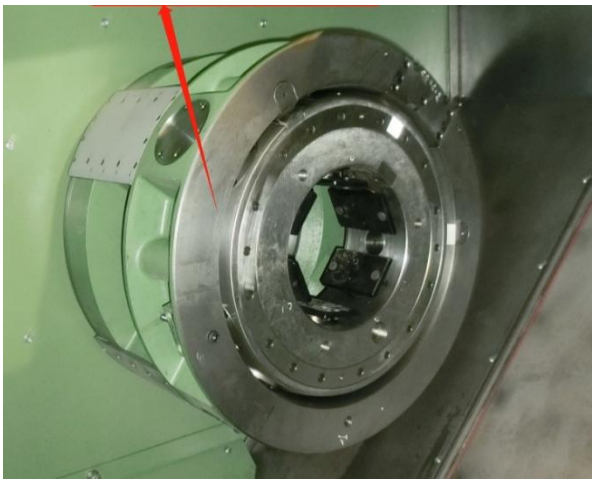
5.6 Rotary Valve Assembly:

Mounted at the end of the main spindle, the rotary valve assembly integrates all solenoid valves, pressure-reducing valves, and other hydraulic actuators required to control the operations of the flipping chuck. This assembly enables functions such as chuck rotation, locking, jaw centering, and clamping, ensuring efficient and reliable system performance.



5.7 Hydraulic Flip Chuck System

The hydraulic flip chuck is a specialized accessory designed for use with coupling threading machines. It enables complete machining of both internal surfaces and end faces of a coupling blank in a single clamping operation. Once the coupling blank is secured, the first end is machined. Upon completion, the chuck rotates 180 degrees around its flipping axis, allowing seamless machining of the second end.



Key Features of the Chuck System

- **High Flipping Accuracy**
  Ensures precise coaxial alignment and accurate thread engagement between both ends of the coupling.
- **Exceptional Reliability**
  Engineered for consistent performance under high-load, continuous machining conditions.
- **Adjustable Clamping Force**
  The hydraulic system allows for dynamic adjustment of clamping pressure to meet varying process requirements:

  Rough Boring: Higher clamping force is applied to counteract large cutting forces and maintain workpiece stability.

  Finish Boring & Threading: Lower clamping force minimizes the risk of deformation, particularly beneficial for large-diameter or high-strength couplings.

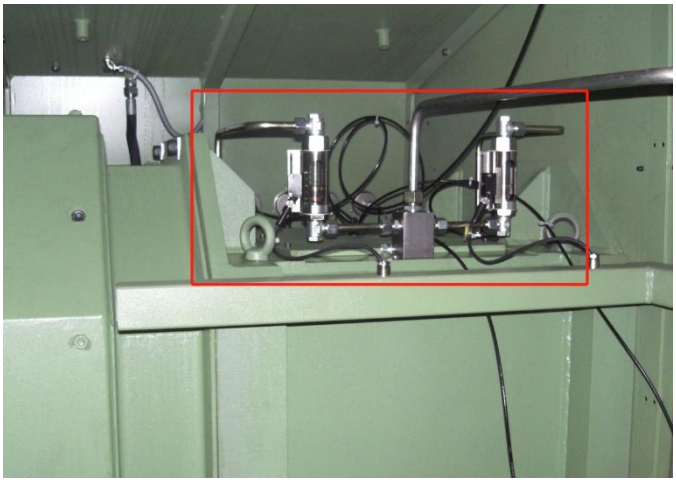
This system significantly enhances machining efficiency and precision, ensuring optimal thread integrity and meeting stringent performance standards for coupling connections.

5.8 Lubricating System

5.8.1 Feed Axis Lubrication System

The feed axis unit adopts a centralized lubrication system to supply oil quantitatively to key lubrication points such as guideway contact surfaces, wedge blocks, and ball screw assemblies. This is an open-type, total-loss lubrication system, where the lubricating oil is eventually mixed with the coolant and discharged. The lubrication cycle and oil quantity for each lubrication point can be adjusted via the electrical control system to achieve optimal lubrication performance. The system is equipped with flow monitoring devices connected to the PLC, enabling real-time monitoring and alerting operators to any abnormalities in system operation.

5.8.2 Spindle Lubrication System



The spindle unit uses pressure oil-spray circulation lubrication method. An electric oil pump draws lubricating oil from the bed reservoir to forcibly lubricate and cool critical components such as the bearings inside the spindle housing. The system is equipped with precision filters and electronic flow switches to monitor the oil flow at key lubrication points in real time, ensuring effective lubrication and providing timely alerts to the operator in case of any malfunction.

5.8.3 Gantry Robot Lubrication System

The gantry-type robotic arm is equipped with a centralized automatic grease lubrication system, which periodically supplies grease to all lubrication points, ensuring reliable lubrication and extended service life under high-frequency operation.

5.8.4 Lubrication System Safety Monitoring

All lubrication systems are equipped with oil level monitoring and alarm devices to ensure sufficient lubricant supply and prevent equipment failure due to lubricant shortage.

5.9 Emulsion Cooling System

To ensure effective cooling of the cutting edge during turning operations and facilitate efficient chip removal, thereby guaranteeing machining quality and process stability, the system is configured as follows:

Emulsion Cooling System

5.9.1 High-Pressure, High-Flow Emulsion Cooling System

Equipped with a high-pressure, high-flow emulsion cooling unit, the system delivers powerful and targeted cooling to the cutting zone. This effectively reduces tool temperature, extends tool life, and minimizes thermal deformation, ensuring consistent machining accuracy.

5.9.2 Chip Conveyor System

A high-efficiency chip conveyor is integrated to promptly

remove metal chips generated during machining, preventing accumulation that could affect operational efficiency and equipment safety.

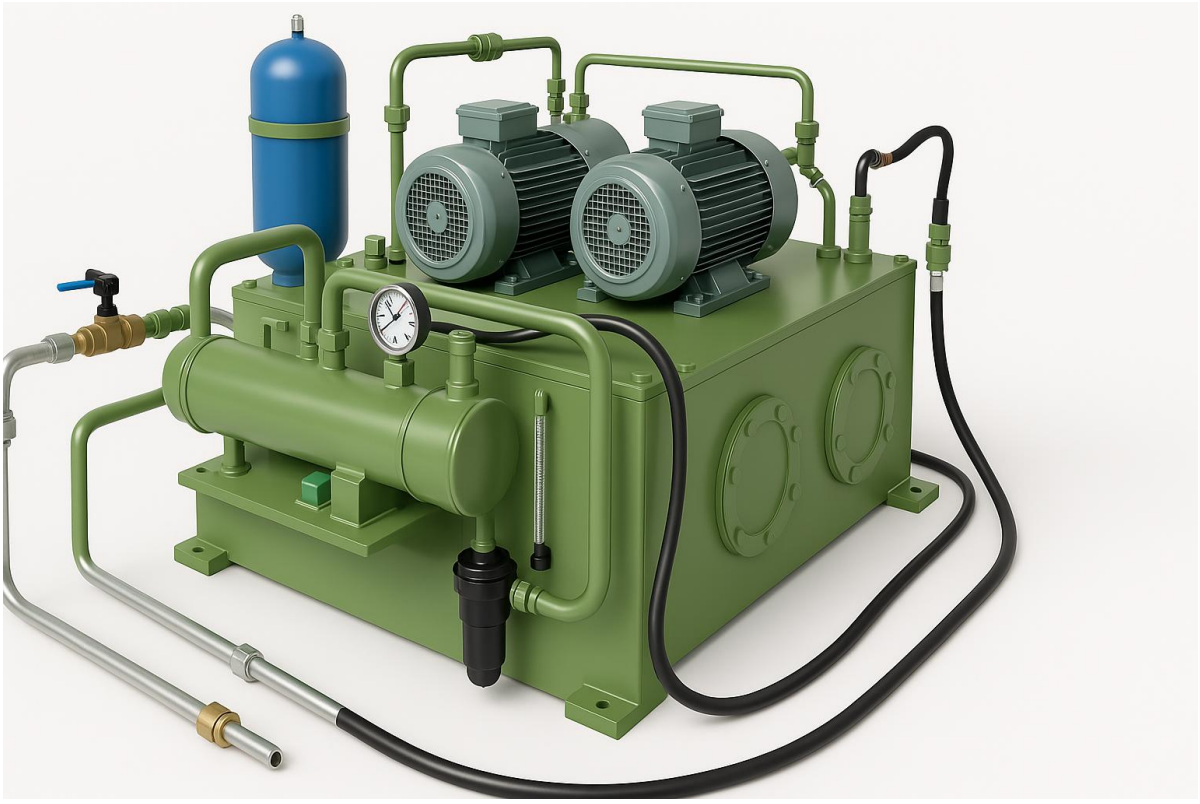
5.9.3 Emulsion Recovery and Filtration System

The chip conveyor is fitted with a return pump that recycles emulsion collected in the conveyor tank. After preliminary filtration, the emulsion is returned to the main cooling tank, enabling closed-loop circulation and reducing operational costs while enhancing environmental sustainability.

5.9.4 Liquid Level Monitoring System

The system includes a liquid level detection sensor that continuously monitors the coolant level. It ensures stable system operation and can trigger alarms to prompt timely refilling or maintenance.

5.10 Hydraulic System



The integrated and independent hydraulic pump station is highly modular and flexible, allowing for customized placement and layout optimization based on the end user's installation requirements. The system provides all hydraulic drive functions for the machine tool, covering the following key motion controls:

- **Spindle Flip Chuck Control**: Enables hydraulic actuation for chuck opening and closing, ensuring stable and secure workpiece clamping.
- **Tool Post Indexing and Locking Control**: Uses hydraulic actuators to achieve precise tool post

positioning and locking, enhancing tool change efficiency and machining accuracy.

- **Balance Cylinder Control**: Provides balancing support for the spindle or other heavy components, ensuring stable operation and structural safety.

System Configuration and Monitoring Functions

To ensure stable operation and intelligent management of the hydraulic system, the pump station is equipped with the following professional monitoring and protection devices:

- **Liquid Level Detection**: Monitors tank fluid levels in real time, preventing hydraulic oil shortage that could cause system idling or damage.
- **Pressure Detection**: Dynamically monitors system working pressure to ensure all actuators operate within the designated pressure range.
- **Oil Temperature Detection**: Tracks hydraulic oil temperature, preventing overheating that could lead to oil degradation or system failure.

5.11 Machine Safety and Protection Features

5.11.1 Multi-Level Limit Protection System

The X and Z axis drive systems are equipped with electrical, software, and mechanical limit protections, ensuring safe machine operation and absolute safety for the operator.

5.11.2 Guideway Protection System

The bed and carriage guideways are fully enclosed with stainless steel telescopic covers, effectively protecting the guideways and lead screws from chips and coolant corrosion.

5.11.3 Fully Enclosed Sheet Metal Guarding

The machine features a fully enclosed sheet metal exterior with a sleek design, effectively preventing the splashing of chips, oil, and coolant, and maintaining a clean working environment.

5.11.4 Automated Safety Door Control

The protective cabin doors can only be opened via the control panel in JOG mode or automatically through machining programs (M codes). The upper movable door operates pneumatically in coordination with the gantry robot.

5.11.5 CE-Compliant Safety Design

The overall safety protection system complies with European CE safety standards, ensuring regulatory compliance and operational safety in international markets.

六、Contact Us

Hotstone Zhou

Email: Hotbiz88@outlook.com
Email: Hotstone@dsrobots.com
Whatsapp: +8618006414500
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