QJRH4-1 Industrial robot

Mechanical Use and Maintenance Manual

Please make sure that the relevant instruction book reaches the end user of the product.

Preface

	■ Before operating the robot, please read the instruction book carefully and follow all the safety related issues and instructions provided in the text. ■ The installation, operation and maintenance of the robot shall be undertaken by the personnel who have attended the training courses of our company.
	■ Please be sure to deliver the instruction book to the personnel who actually operate the robot.
	■ If there is any ambiguity in the instruction book or if you have any questions about the after-sales service of the robot, please contact the service center directly. See the back cover for the contact way.

Notes

1 The contents described in the instruction book are subject to change without notice.

2 The display of the screen of the suspended teaching operation control key board is just an example. If there is any difference from the actual display, please understand.

3 The contents described in the operating instruction have been given full attention to prevent mistakes, but the company is not responsible for any direct or indirect damages in case of errors.

4 The operating instruction is a part of the robot product. When moving, transferring, or selling the robot, please make sure to attach the operating instruction.

5 All or part of the contents of the operating instruction is prohibited from being reproduced without the consent of our company.

6 About prohibiting modifications

- It is strictly forbidden to make any modifications to our products.
- Fires, faults and malfunctions due to modifications may cause injury and damage to the machine.
- The modifications of the product made by the customer are outside the warranty scope of our company, therefore no responsibility is granted.

Revision history record of instruction book		
Version	Year/Moth	Change contents
V2.0	June, 2018	1. Re-typesetting; 2. LOGO change

Contents

Chapter I Safety specification

1.1 Safety introduction

Requirements of robots are often different from other those of mechanical equipments, such as its large range of motion, quick operation and fast movement of the arms, all of which will have safety hazard.

Read and understand the instruction and related documents, and follow the various procedures to avoid personal injury or equipment accidents. It is the user's responsibility to ensure that the safe operating environment complies with and observes local and national safety laws, regulations and rules.

MANDATORY!

•The teaching and maintenance of the robot must observe the following regulations:

- Industrial safety and health Laws.
- Mandatory orders on industrial safety and health laws.
- Corresponding regulations on industrial safety and health laws.

•Prepare:

-Safety technical rules

Production safety management is carried out according to specific policies in accordance with relevant laws and regulations.

•Observe:

-Safe operation of industrial robots

The work of teaching and repairing robots is included into the "dangerous operation" of industrial safety and health laws. The operators must attend special training, master the basic knowledge of the robot and understand the welding process.

1.2 Pre-employment training

MANDATORY!

The personnel for teaching and maintaining the robot must be subject to prior training. The repair and maintenance of the robot must be carried out by professionals. The adverse consequences caused by the disassembly of the robot without permission are not the responsibility of our company. The relevant personnel shall not maintain, repair or use the teaching after being affected by drinking, taking drugs and stimulant medications.

1.3 Safety precautions for operators

There is potential danger within the entire maximum range of motion of the robot. All personnel working for the robot (security administrators, installers, operators and service personnel, etc.) must always set up “safety first” thinking to ensure the personal safety of all personnel.

- Make sure to operate outside the range of motion of the robot when there is no need to enter into the working area of the robot.

- Make sure that there is not anything abnormal of the robot or peripheral equipments before teaching.

- The programmer must be careful not to allow others to enter into the working range of the robot. If someone enters by mistake, must stop!

CAUTION!

Any dangerous work is prohibited within the installation area of the robot:

If the robot and its peripheral equipments are touched arbitrarily, there is a danger of injury.

Take strict safety precautions:

- The relative obvious warning signs such as “stop” or “No Entrance” shall be placed in the relevant working area of the robot, and the isolation fences shall be arranged in the placement area of the robot and subsidiary tools to prevent accidental injury during production.

-It is recommended to lay washer switches or photoelectric switches on the floor so that when the operator enters into the range of motion of the machine, an alarm is sounded through buzzer and light to stop the robot to ensure staff safety.

Ignoring these safety details may result in electric shock or personal injury caused by arbitrary touching of the robot and other equipments.

Strictly observe the following provisions:

- Wear work clothes (do not wear loose clothes).
- Do not wear gloves when operating the robot.
- Shirts and ties shall not be exposed from the work clothes.
- The female workers shall wear work caps with hair inside the cap.
-Do not wear big jewelry such as earrings, rings or pendants. Wear appropriate personal protective equipments such as safety helmets, safety shoes (with anti-skidding soles), masks, safety goggles and gloves if necessary.

Unsuitable clothes may cause personal injury, for example, loose clothes hang on the robot or accessory equipments, causing the robot to suddenly stop or start.

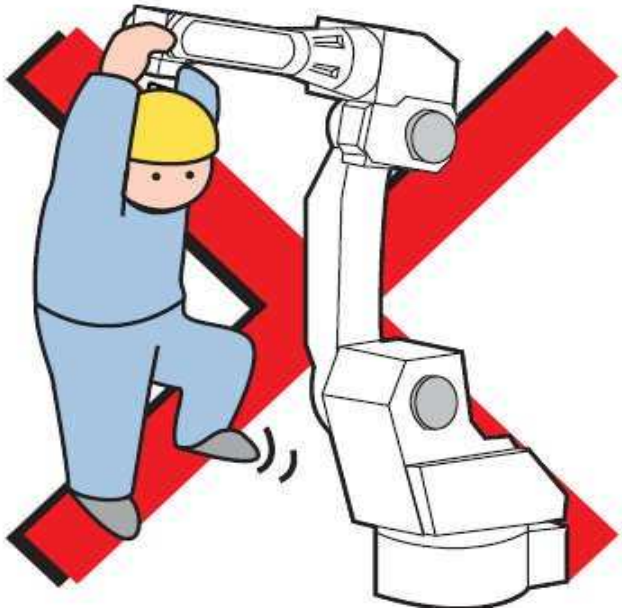
注意

CAUTION!

Unauthorized personnel shall not access the robot and its peripheral auxiliary equipments. Failure to observe the instruction may cause injury due to touching the control cabinet, workpieces and positioning device, etc.

It is strictly forbidden to pull the axes of the robot compulsively. It is not allowed to use tools to hit and impact the robot.

Otherwise, it may cause personal injury and equipment damage, for example, sudden release of the servo motor will cause accidental injury to the worker, and damage to confidential parts such as servo motors and reducers.



Do not lean on the control cabinet or other control cabinets. Do not press the operation keys arbitrarily.

Otherwise, it may cause unexpected movements of the robot, thus resulting in personal injury and equipment damage.

Non-staff are strictly prohibited to touch the control cabinet during operation.

Otherwise, it may cause unexpected movements of the robot, thus resulting in personal injury and equipment damage.

1.4 Safety precautions for robots

1.4.1 Installation and wiring safety

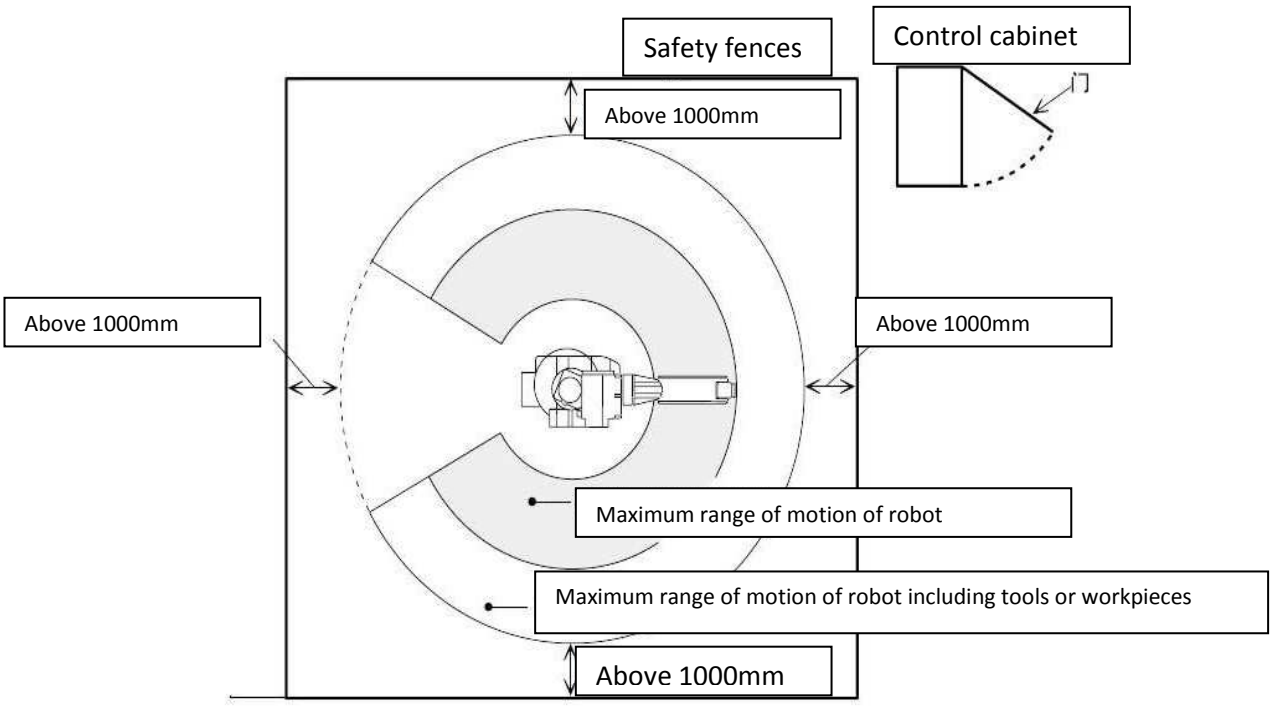
Look up the requirements of robot installation and wiring in the instruction book and the specific installation requirements are described subsequently in the instruction book. In a planned installation, develop simple measures to ensure safety. When planning the installation area, take full account of safety issues.

When installing the robot, observe the following items:

危险

DANGER!

Select an area to install the robot and verify that the area is large enough to ensure that the robot equipped with tools does not touch the wall when rotating, safety fences or control cabinet when it rotates. Otherwise it may cause personal injury or equipment damage due to unintended actions of the robot.



The grounding engineering must comply with electrical equipment standards and interior wiring rules and regulations. Robot wiring must be performed by professional electrical personnel. Wiring without permission is absolutely forbidden.

Otherwise it may result in very serious consequences such as electric shock and fire.

The robot or fixture is controlled by the control cabinet.

In order to ensure safety, it is necessary to operate at a position where the robot can be seen. Operation by unauthorized personnel may cause personal injury or equipment damage.

The control cabinet shall be installed outside the safety fence of the range of motion of the robot.

Otherwise it may cause personal injury and equipment damage due to contact with the robot.

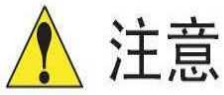
After setting, fix the position of the control cabinet.

Fix the control cabinet to the ground or rack and other objects with screws through the bolt holes on the bottom of the control cabinet.

Otherwise it may cause the control cabinet to shift or dump, thus resulting in personal injury and equipment damage.

Be familiar with the wiring diagram before wiring the control cabinet, and wring must be done according to the wiring diagram.

Incorrect wiring or incorrect displacement of parts can cause equipment damage or personal injury.



CAUTION!

Cranes, spreaders or forklifts shall be operated by authorized personnel.
Otherwise it may cause personal injury and equipment damage.

The robot is kept vertical using the wire rope passing through the lifting ring and the positioning device, and the overhead crane is used to lift and transport according to the requirements specified in the robot instruction book. Otherwise, it may cause the robot to tip over, thus resulting in personal injury or equipment damage.

When lifting the robot and control cabinet, please check the following items.

- Generally, when lifting the control cabinet or robot, it is necessary to use the wire rope to pass through the eyebolt bolt fixed to the robot, lifting with overhead crane. Make sure the wire rope is strong enough to withstand the weight of the robot. The weight of the control cabinet is about 100Kg and the weight of the robot is about 150Kg.

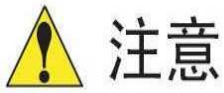
- Check the wire rope before lifting. Do not use damaged, broken or rusted wire ropes. Select the well-maintained wire ropes for work.

Otherwise it may cause the equipment to suddenly fall off and cause serious damage to persons and equipments.

Make sure the eyebolts are fixed firmly. Otherwise it may result in personal injury and equipment damage.

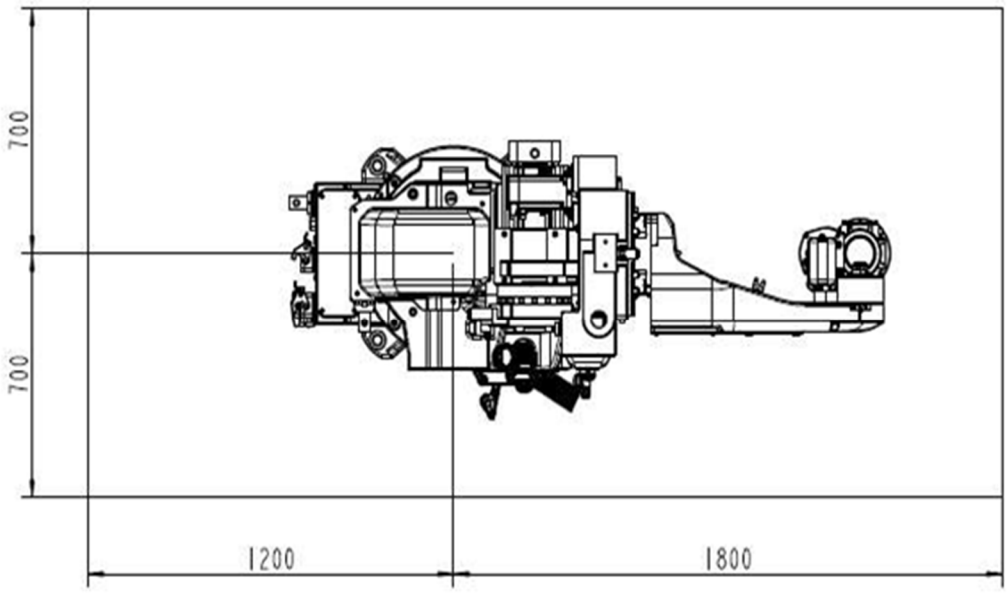
If the robot needs to be temporarily stored before installation, it shall be placed on a stable level and an obvious warning sign shall be set up to prevent non-staff from touching.

Otherwise it may result in personal injury and equipment damage.



CAUTION!

Make sure there is enough space to repair the robot, control cabinet and other peripheral equipments, which shall be performed by professionals. It is strictly forbidden for non-professionals to disassemble the robot system.



1-

Otherwise it may cause injury accidents during maintenance. The maximum size shown in the figure is the robot maintenance space, to ensure that the staff has enough space to install and maintain the robot and accessory equipments.

- Enter into the maintenance space when the power is off. Lock the circuit breaker, and prevent other people from switching on the power supply.

- The operation personnel shall hang the warning sign "Maintenance work" to remind others not to operate the robot freely.

- When performing pneumatic system separation, make sure that the supply pressure is released.

- Avoid repair tools and equipments from blocking the escape way.

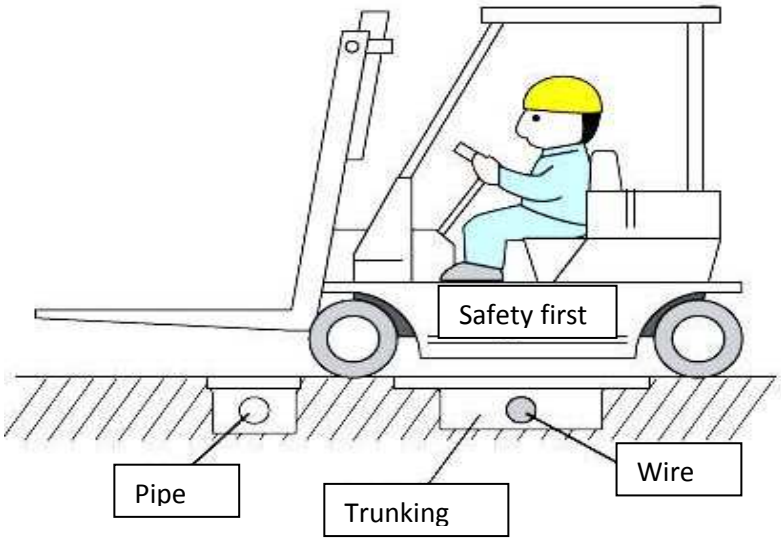
- When the operation personnel start the operation, make sure that there is no one in the maintenance space, and the maintenance tools and equipments are ready. The robot can be operated to move only after ensure that the robot and the peripheral equipments are not abnormal.

For different positions of the robot, the assembly tasks shall be carried out according to the bolt size and type specified in the instruction book. Otherwise it may cause personal injury and equipment damage.

CAUTION!

Take protective measures when performing the wiring and piping between the control cabinet and the robot and peripheral equipments. For example, run the pipe, wire or cable through pit or covered with a protective cap to prevent from being trampled by individuals or crushed by the forklifts.

The operators and other personnel may be caught by the open wires, cables or pipelines, causing damage, thus causing the abnormal movements of the robot, thus resulting in personal injury or equipment damage.



Note the following items about the cable:

- Do not add cables and hoses other than those recommended by our company to the

robot system.

- When installing cables outside the mechanism, avoid blocking the mechanism operation, and the installation of the peripheral equipments shall avoid cable interference.

- For the cables exposed outside the mechanism, do not modify the cable harness freely for convenience (such as adding cover and external cable, etc.).

- Always comb the knotted cable to avoid excessive winding, but it must be done in accordance with the relevant safety instructions.

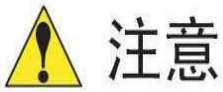
1.4.2 Safety at work area

Careless during work in the work area will cause serious accidents, therefore it is strongly recommended to implement the following precautions:

DANGER!

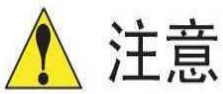
Set the safety fences around the robot to prevent accidental contact with the powered robot. Post the warning sign “Keep away from work area” at the entrance of the safety fence. The door of the safety fence must be installed with a reliable safety interlock devive.

Ignoring the warning will cause serious accidents due to contact with the robot.



CAUTION!

Spare tools and similar equipments shall be placed in the suitable areas outside the safety fences. Tools and scattered equipments shall not be left around the robot, control cabinet or application (such as welding fixtures). Personal injury or equipment accidents can occur if the robot hits the items left in the work area.



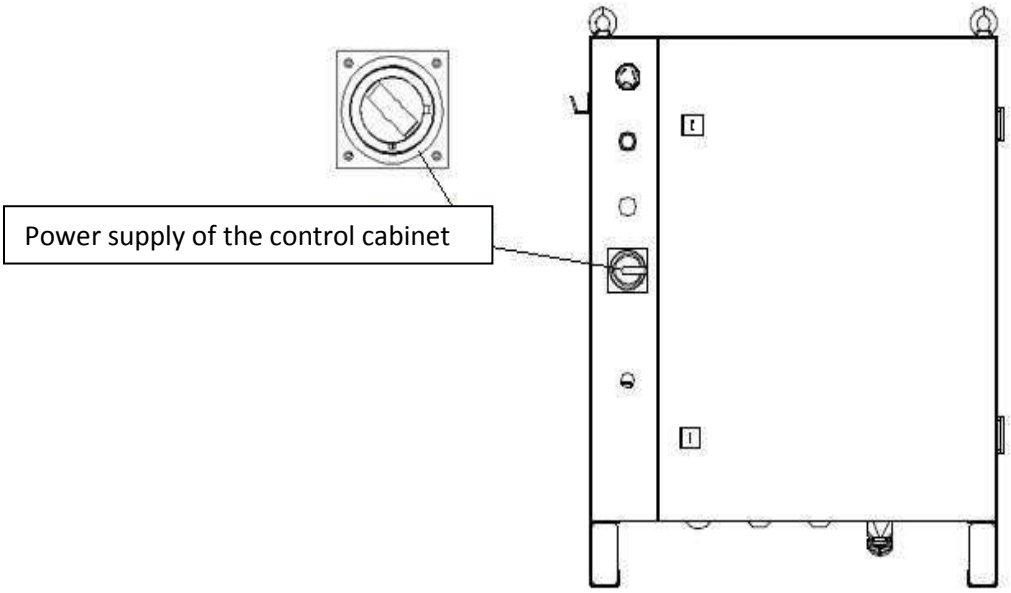
CAUTION!

The fire-fighting equipments must be placed in strict accordance with national standards, regularly inspected and replaced.

1.4.3 Operational Safety

DANGER!

When installing the tools on the robot, cut off (OFF) the power supply of the control cabinet and the installed tools firstly and lock the robot power switch (position of power supply as shown below), and hang the obvious warning sign.



During the installation process (such as swithing on the power supply), it may cause electric shock, or abnormal movement of the robot, thus resulting in damage.

Do not exceed the maximum allowable range of the robot.

Otherwise it may cause personal injury and equipment damage.

The following warnings shall be observed when the teaching must be carried out within the range of motion of the robot:

- Always observe from the front of the robot.
- Always operate in accordance with pre-determined operating procedures.
- Always have an idea of avoiding a robot in case of an unexpected motion.
- Make sure there is a route of retreat in case of emergency.

Otherwise, the robot may be wrong operated, causing injury accidents.

DANGER!

Before operating the robot, press the emergency stop keys on the front door of the control cabinet and on the upper right of the teaching pendant to check whether the indicator of “Servo ready” is off and confirm the power supply is off.

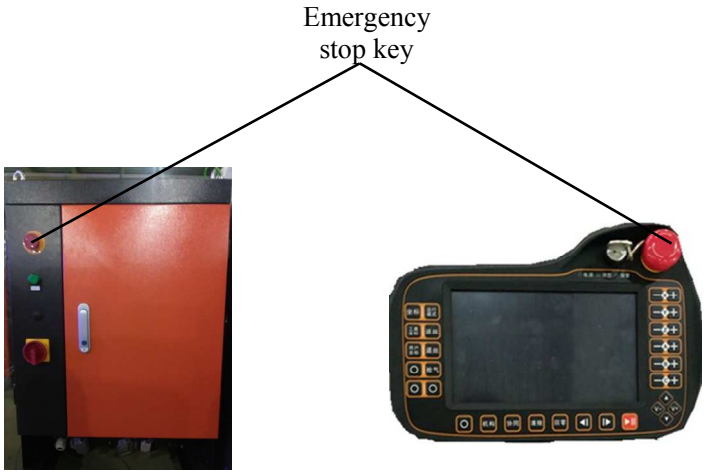
If the robot cannot be stopped in case of emergency, it will cause damage to the mechanical body.

Before performing the following operations, make sure that there is no one in the range of

motion of the robot.

- Switch on the power supply of the control cabinet;
- Use the teaching pendant to make the robot move;
- Reproduce to operate the robot;

If an individual accidentally enters into the range of motion of the robot that he/she may be injured due to contact with the robot, press the emergency stop keys immediately. The emergency stop keys are located at the front door of the control cabinet and on the upper right of the teaching pendant (as shown in the figure below)



Perform the following inspection steps before teaching the robot. If problems are found, correct them immediately and confirm that all preparations have been completed.

- Check for problems of robot movement.
- Check the insulation and cover of the external cable for damage.

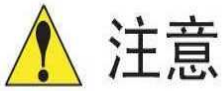
After using the teaching pendant, make sure to put back on the hook of the control cabinet.

If the teaching pendant is left on the robot, on the system fixture or on the ground, the robot or the tool installed on the robot may hit it, causing personal injury or equipment damage.

MANDATORY!

The operators or maintenance personnel for robot must be subject to the training of relevant regulations and company strategies.

1.5 Precautions for moving and transferring robots



CAUTION!

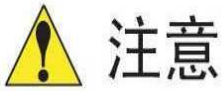
When moving or transferring the robot, the relevant instruction books for the robot shall be attached so that all users have the right to use these necessary instruction books.
If the warning sign on the robot or control cabinet is blurred, please clear the warning sign so that they can be recognized correctly. Please also pay attention to some local regulations, for example, if the safety warning sign is not in the right place, the equipment may be prohibited to use.
When moving or transferring the robot, it is recommended to ask our company to send personnel for inspection.
Incorrect installation and wiring will cause significant personal injury and equipment accidents.

PROHIBITION!

Never make any modification to the robot or control cabinet.

Failure to comply with the warning may result in fire, power fault or operational error. Our company is not responsible for the equipment damage and personal injury caused.

1.6 Precautions for abandoning Robots



CAUTION!

The robots must be abandoned in accordance with the national and local laws and regulations.

Before abandoned, even for temporary storage, the robot shall be fixed firmly to prevent dumping.

Otherwise, personal injury may occur due to the robot dumping.

If disassembly is required when abandoning the robot, please remember the following items before starting disassembly to avoid personal injury.

Make sure to remove all the batteries inside the robot which will explode if heated (such as from a blowtorch).

Make sure to drain the oil in the gearbox which will catch fire if heated (such as from a blowtorch).

When removing the motor from the robot, if the robot is not properly supported before removing the motor, it will suddenly fall down.

Chapter II Composition of robot

2.1 Confirmation of packing contents

Please check the shipping list after arrival of the products. The standard shipping list includes the following items (information on the contents of the goods will be provided separately):

1） Robot

2） Control cabinet

3） Teaching programmer

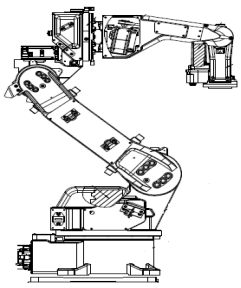
4） Full set of instruction book (electronic edition)

5） Power supply cable (communication cable and optional power cable between the robot and the control cabinet)

6） Connection fastener & accessories, etc.

7） Shipping list

8） Welding system or handling system (optional).



Full set of instruction book

Power supply cable

2.2 Robot system installation site and environment

Before installing the robot, confirm whether the order numbers on the robot and control cabinet are consistent; confirm that the detailed list in the box is consistent with the number of equipments in the packing list.

The installation location must meet the following basic conditions:

1) The ambient temperature during operation shall be between 0°C and 45 °C (32°F to 113°F); during handling and maintenance, it shall be between -10°C to 60°C (14°F to 140°F));

2）The humidity must be lower than the dew point (below 10% of relative humidity);

3）Sites with less ash, dust, oil smoke and water;

4）Flammable materials and corrosive liquids and gases are not allowed in the work area;

5）Sites with small vibration or impact energy to the control cabinet

(vibration below 0.5G);

6）There shall be no major electrical noise sources (such as gas shielded welding (TIG) equipments, etc.) nearby;

7）There is no potential risk of collision with mobile devices (such as forklifts).

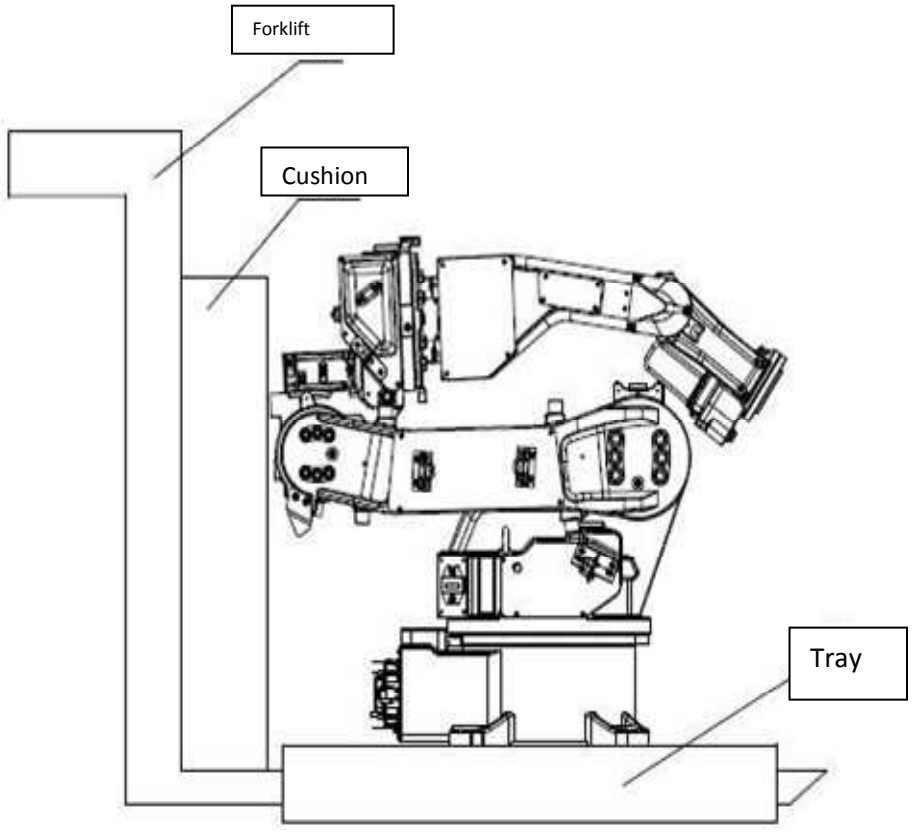
2.3 Handling and installation method of robot system

注意

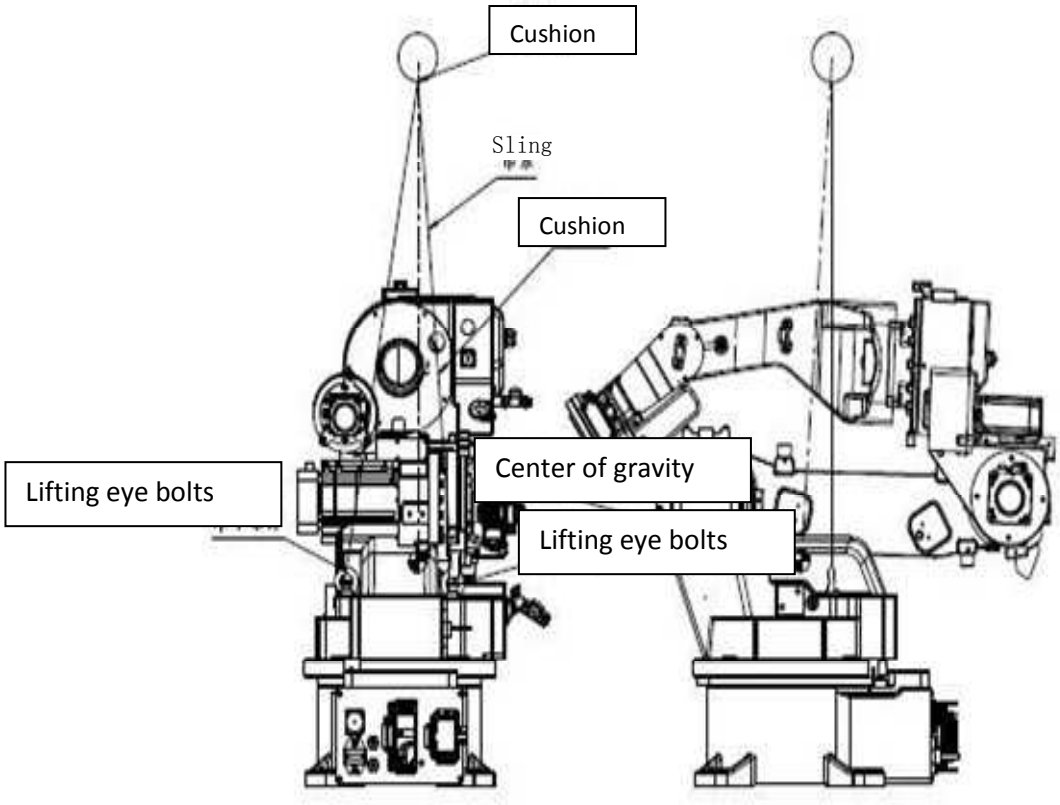
CAUTION!

The operation of the cranes, lifting appliances and forklifts must be carried out by the relevant qualified personnel. Please carry out the handling and lifting work by the personnel who hold the operation permit for special equipments such as lifting, cranes and forklifts.

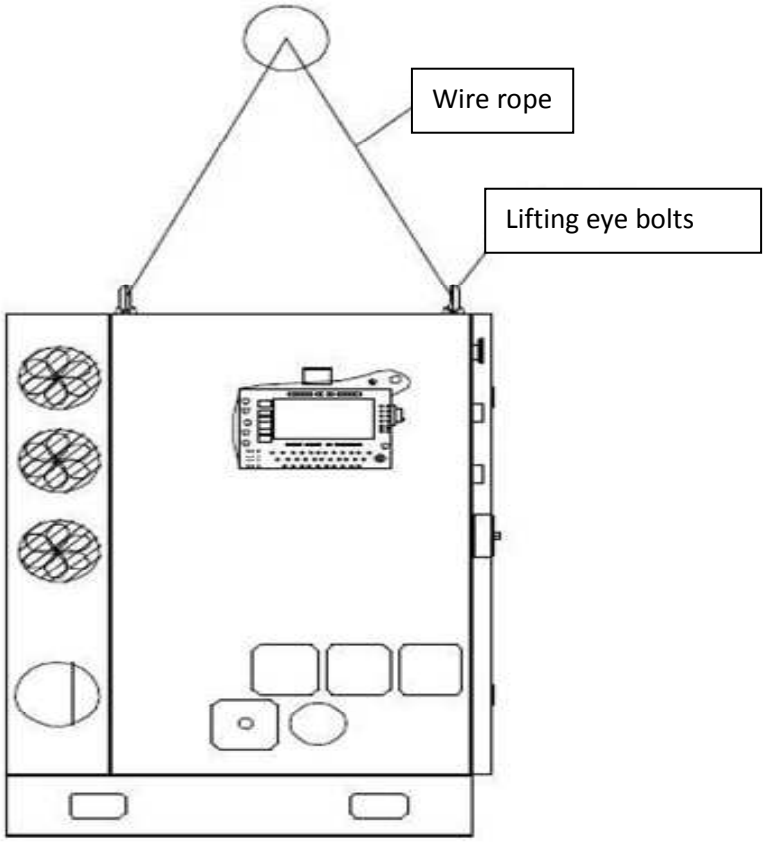
Otherwise, it may result in personal injury and equipment damage.



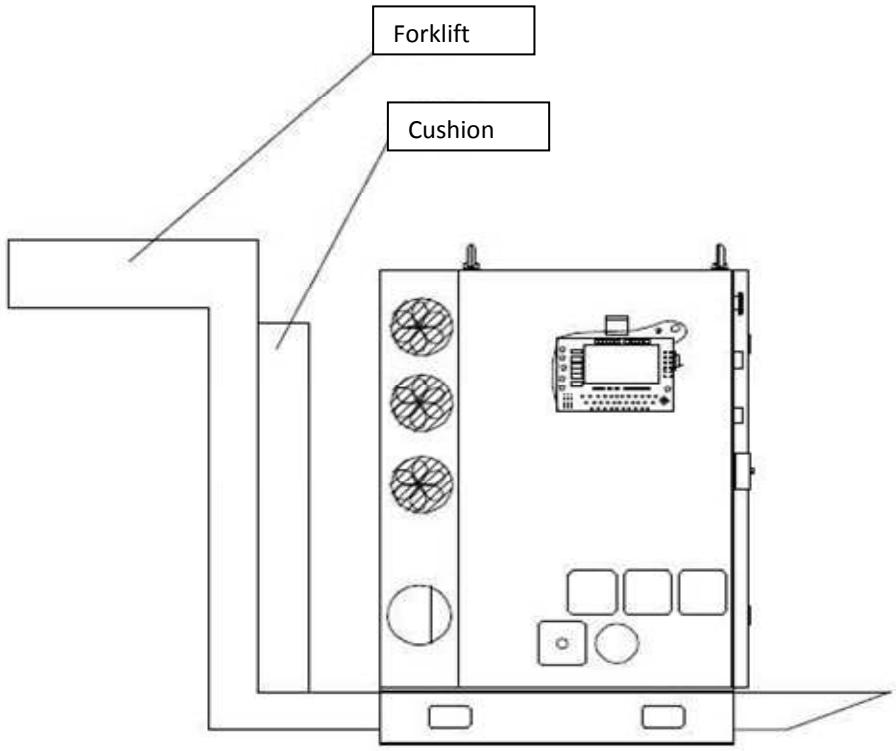
Schematic diagram of robot handling



Schematic diagram of robot lifting



Schematic diagram of control cabinet lifting



Schematic diagram of control cabinet handling

The following items shall be checked before handling (refer to the handling precautions in section 2.3 for specific requirements):
- Confirm the weight of the robot and the control cabinet (the weight of the robot is 150kg, and the weight of the control cabinet is 100kg).
Use a wire rope with bearing capacity greater than the weight of the robot to lift. It is recommended to use forklifts and lifting equipments with tonnage above as showing in the figure.

- The quality of the wire rope and whether the forklift and the crane system operate normally must be checked before handling. Install the eyebolts and tighten before lifting, and confirm that they are firmly fixed.

- If there is any ambiguity, please consult our staff in detail.

Avoid vibration, drop or impact to the control cabinet during handling.

Excessive vibration or impact to the control cabinet will have a detrimental effect on its performance and Protection must be strengthened.

注意

CAUTION!

When using the forklift to handle and lift, the robot must be protected from collisions, especially impact to the servo motor. Otherwise, it may cause failure of the motor encoder and affect the overall performance of the robot. When using the forklift for

transport, use buffering facilities such as lining cloth and foam board whenever possible to protect the handling safety of the robot or control cabinet. Collisions with the forklift shall be avoided, which will cause damage to the critical components of the robot.

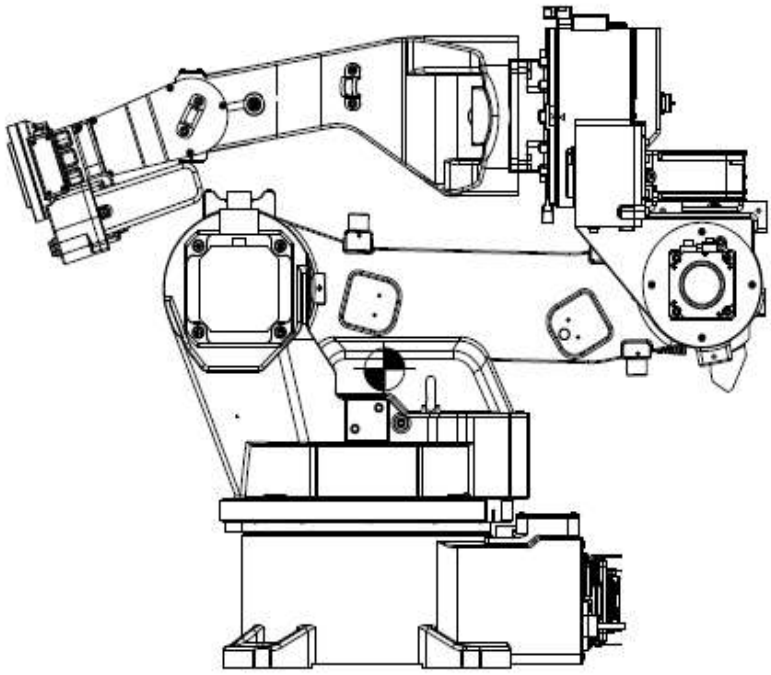
When using the forklift to handle the robot system, the following precautions shall be followed:

- Confirm that there is a safe working environment that allows the safe handling of the robot system to the installation site.
- Inform the personnel working in the area that the forklift is passing and ask them to note that the system is being transported.
- Avoid shifting or dumping when handling.
- Lower the height position as much as possible when handling.
- Avoid vibration, dropping or impact during handling, and place carefully before landing to avoid severe impact.

注意

CAUTION!

When the robot is lifted, it is to lift the hoisting bolts on the base of the robot that the base lifts the entire robot instead of lifting the robot. Ensure that the bolts are tightened to prevent sudden fall, resulting in personal injury and equipment damage.



Posture figure when the robot is handled.

注意

CAUTION!

When handling, the robot shall be kept in this state as much as possible to avoid the excessive shifting of the center of gravity, resulting in dumping of the robot during handling.

2.4 Installation method of robot system

Before installation, the relative installation location and layout of the relevant equipments shall be confirmed.

-The control cabinet shall be installed outside the range of robot movement (please see section 1.4.1 for detailed layout).

- The control cabinet shall be installed in a location where the movement of the robot can be seen clearly.

- The control cabinet shall be installed in a location to facilitate to open the door of the control cabinet for inspection.

- The control cabinet shall be installed at least 500mm away from the wall to keep smooth flow of maintenance channel.

注意

CAUTION!

There are several ways to install and fix the robot, including mechanical connection fixation and welding fixation. It is depending on customer's selection, our company hereby only takes the mechanical connection as an example to illustrate the robot fixing way (the same below).

Robot installation location	Range of application	Remarks
Installation above ground	Applicable	The inclination of the robot shall not exceed ±5°.
Slanting installation	Applicable, but maximum inclination ±5°	If the inclination of the robot exceeds ±5°, It must be lowered down and fixed on the ground.

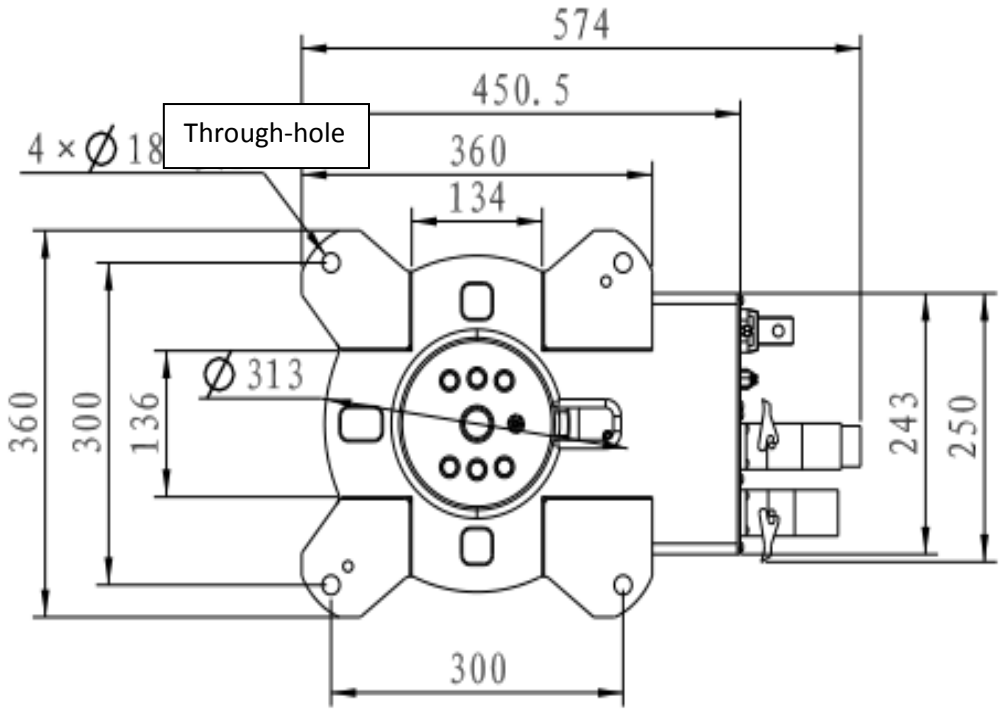
Wall-mounting	Not applicable, the robot must be lowered down and fixed on the ground.	The robot must be lowered down and fixed on the ground.
Hitch mounting	Applicable	

注意

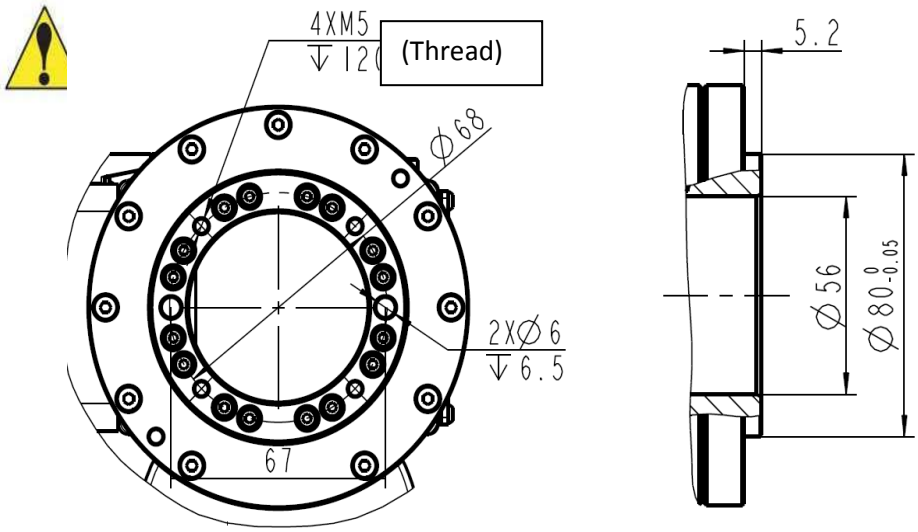
CAUTION!

When the robot is hitch mounted, the connection strength of the base must be ensured to prevent the robot from falling suddenly, resulting in personal injury and equipment damage.

The user can fix the robot on the ground with the self-prepared mounting bracket as shown in the figure below (recommended installation way)



Robot base mounting and location hole size



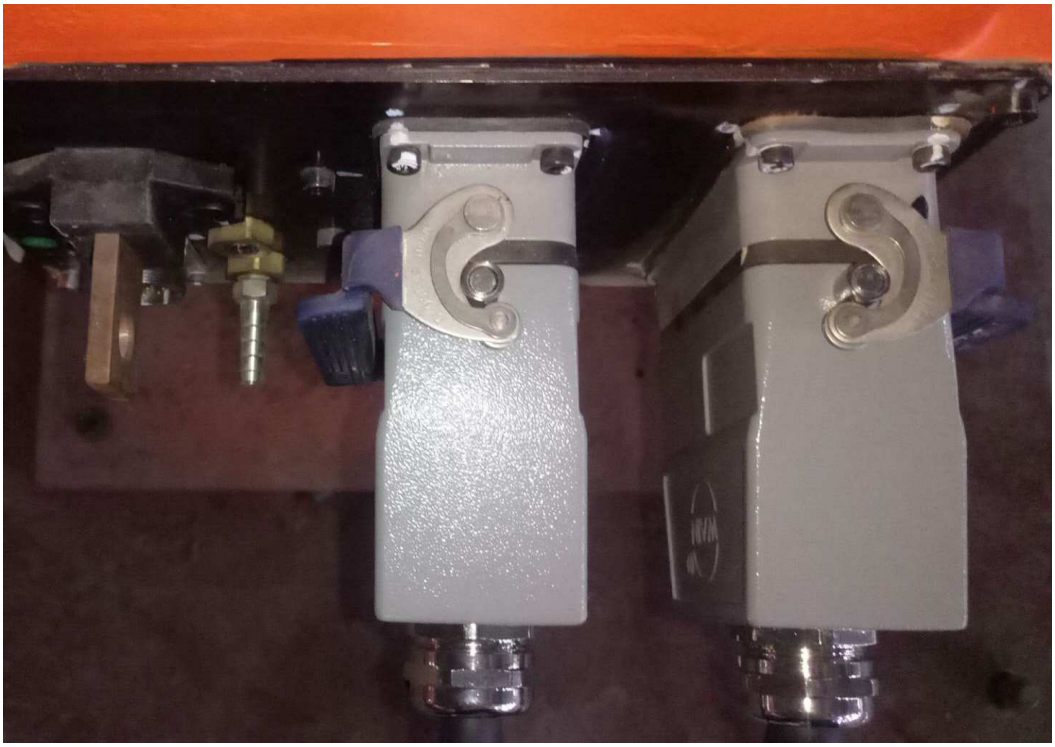
Robot end mounting dimension drawing

CAUTION!

When the robot is running, it produces an enormous inertia force. Therefore, the mounted base must be very firm. It needs to use four M16 socket head cap screws with spring washers to firmly fix the robot base. If necessary, use the location pin to ensure the positioning accuracy of the robot. The correct torque must be used to secure the bolts are tightened. The tighten torque table of socket head cap screw for robots is as follows:

Thread	Square size	N.m
M5	4	7
M6	5	12
M8	6	30
M10	8	58
M12	10	100
M14	12	160
M16″	14	240
M18	17	340
M20	17	440

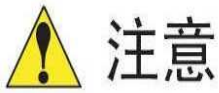
2.5 Connection of robot electrical system



Schematic diagram of electrical mounting plate (top view)

Schematic diagram of electrical mounting plate (front view)

Except above installation locations, it is not allowed to add additional machining holes to the robot, which may have adverse effects on the performance of the robot. When installing with the tools, refer to the thread torque table in the text to tighten the bolts to prevent the bolts from falling off.



CAUTION!

Notes for cable connection:

1) Pay attention to the direction during plug-in installation. Do not install it violently to avoid hurting the internal contact pins of the connector and damaging the device.

2) The cable connecting the control cabinet with the peripheral equipments is low voltage cable. The signal cable of the control cabinet shall be away from the mains power circuit. The high voltage power circuit is parallel to the signal cable of the control cabinet, and if unavoidable, metal tubes or metal slots shall be used to prevent interference of electrical signals. If the cables must be arranged crosswise, the power cable shall be perpendicular to the signal cable.

3) Confirm the socket and cable number (to prevent equipment damage due to incorrect connection), in which one is connected to the robot and control cabinet, and the other to the control cabinet and peripheral equipments. Incorrect connection will cause damage to the electronic equipments.

4) All non-staff shall be evacuated from the site during cable connection. All the cables shall be placed in the underground cable trenches with covers.

5）Do not use the excess part of the robot cable (above 10m) in a loop; if it is used in such a state, the cable temperature may rise according to the movement of the robot, which may damage the cable cladding layer.

DANGER!

The system must be electrically grounded. Before switching on the control device, the grounding wire connection system and control equipment must be passed through. If it is not grounded, a fire alarm or electric shock will occur, resulting in personal injury.

Before the system is grounded, turn off the power and lock the mains power switch. Otherwise, it may cause electric shock and personal injury. The power of the control device must be turned off during cable connection operation

Do not touch any substrate inside the control cabinet within 5 minutes after the power is cut off. The capacitor will store electrical energy after power-off, so care shall be taken whenever the substrate is operated. Fail to observe this

warning may result in electric

shock.

If the door of the control cabinet is not closed, the power supply cannot be switched on, that is, the safety interlock device prevents switching on the power. Otherwise, it may cause a fire alarm and electric shock. During wiring, when the control cabinet is in emergency stop mode, anything happened is the user’s responsibility; once the wiring is completed, an operation inspection shall be performed.

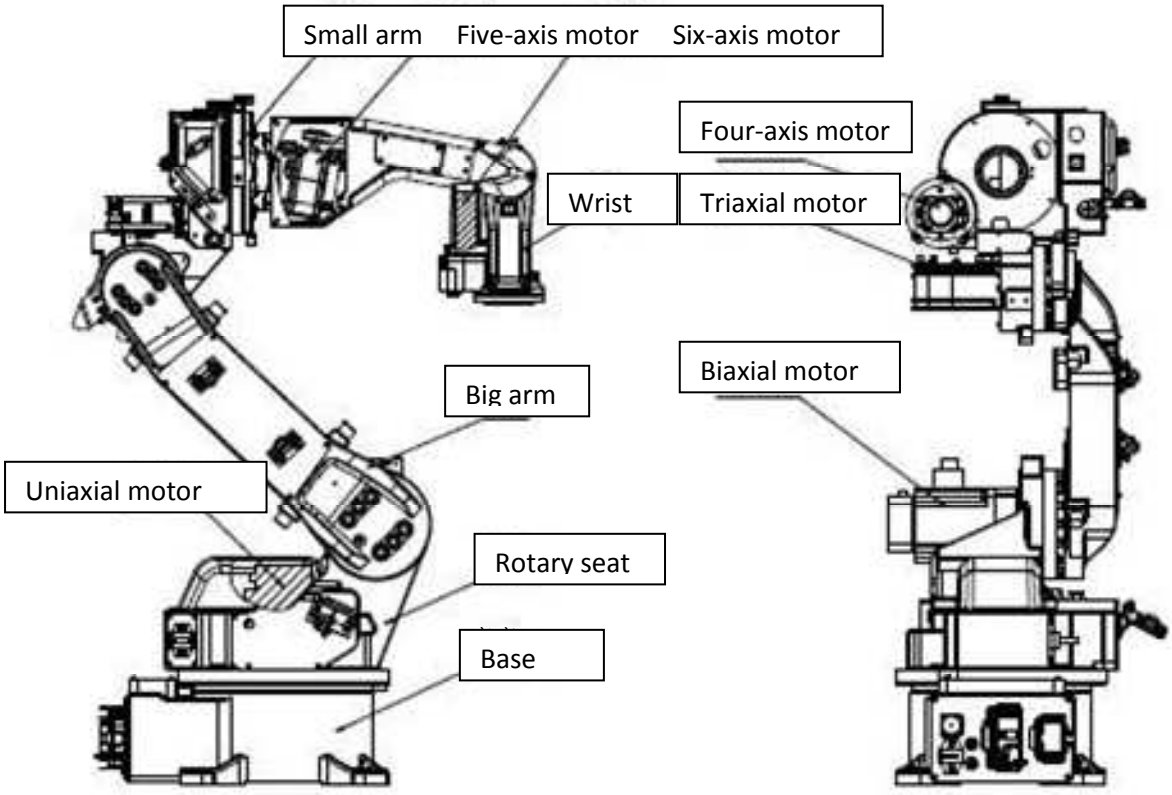
Otherwise, it may result in personal injury or mechanical faults.

注意

CAUTION!

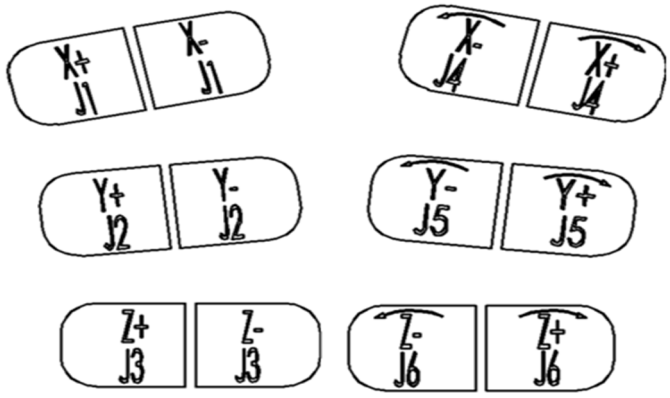
Wiring must be performed by an authorized staff.
Incorrect wiring may cause a fire alarm and electric shock.
Wiring is performed according to the rated capacity specified in the instruction book.
Incorrect wiring may cause a fire alarm and mechanical damages.
Make sure that the wiring of all circuits is safe and firm.
Loose wiring of the circuit may cause a fire alarm and electric shock.
Do not touch the substrate directly with your hands.
An integrated circuit (IC) substrate may malfunction due to static electricity.

2.6 Fundamental performance parameters of robots

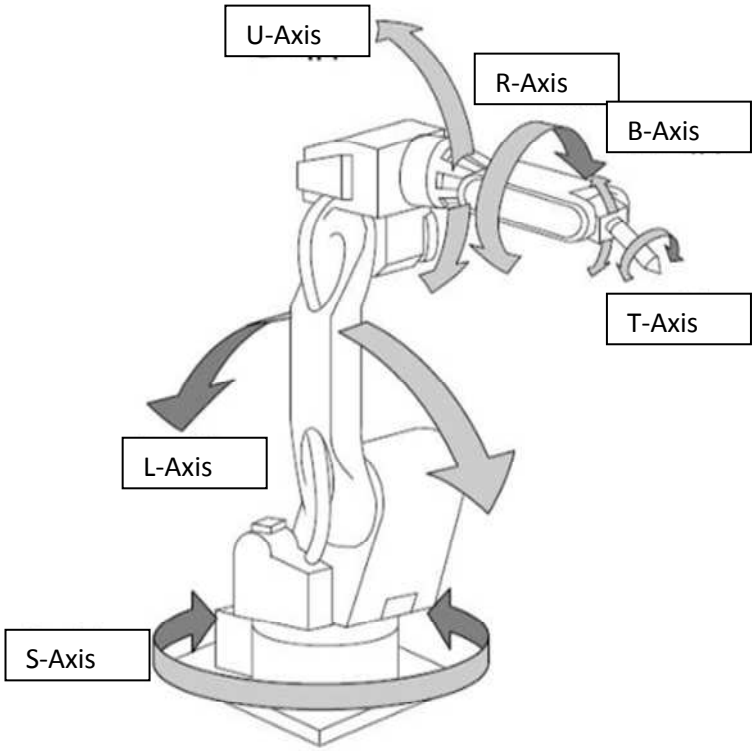


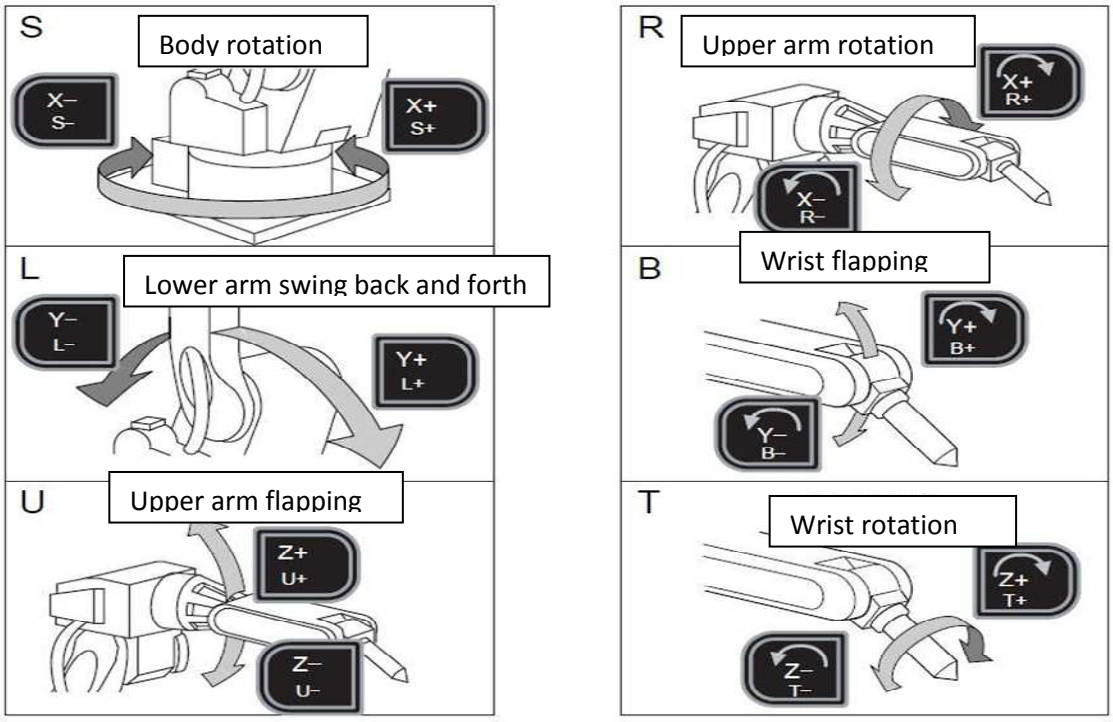
Schematic diagram of robot structure

Make each axis of the robot do the desired action by pressing the operational key of each axis on the teaching programmer. The figure below shows the motion diagram of each axis in the space of joint coordinate system.



Operational key of axis





Saxis: Axis1;

Laxis: Axis2;

U axis: Axis3;

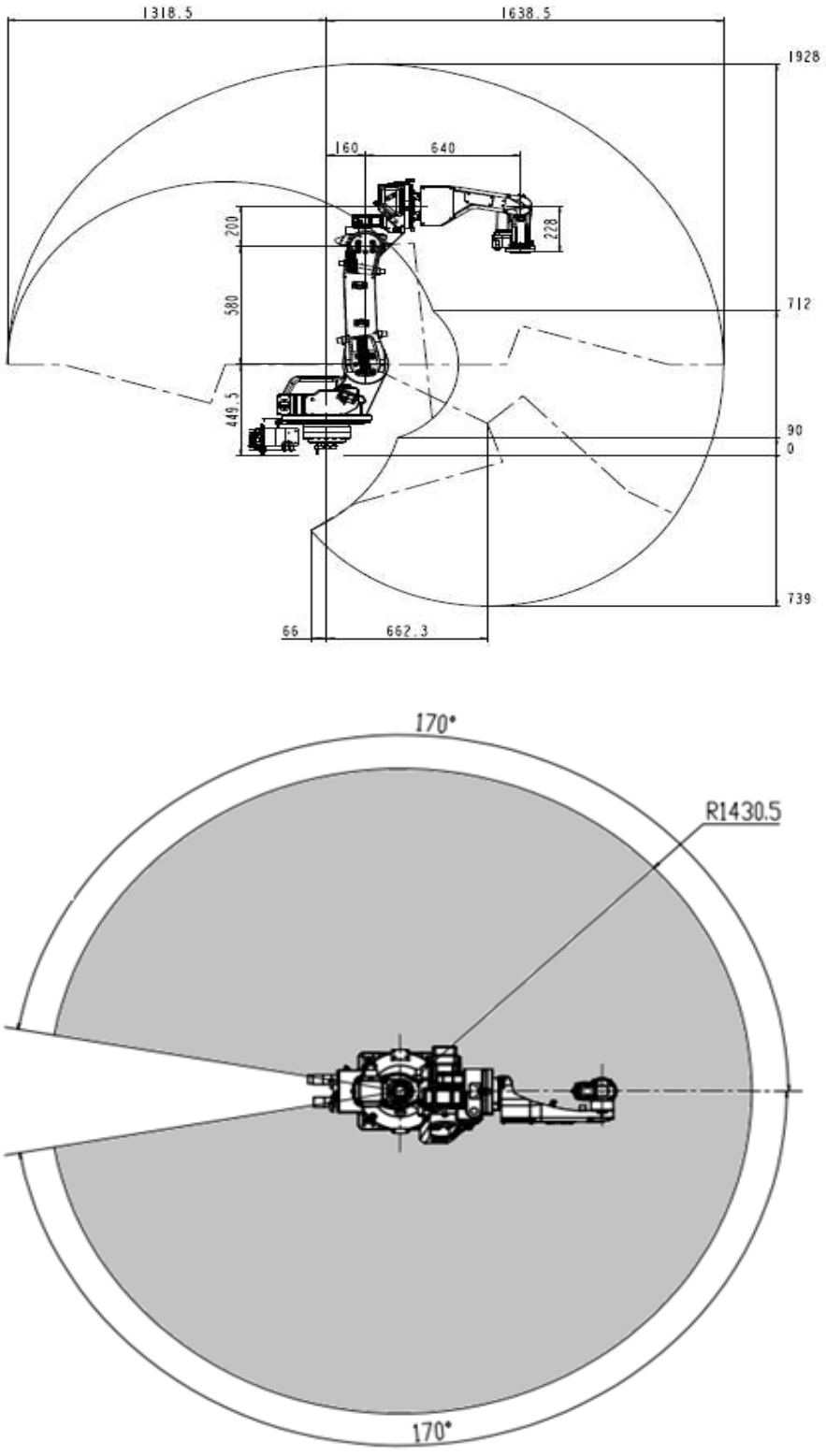
Raxis: Axis4;

B axis: Axis 5;

T axis: Axis 6

The state of motion of each axis is determined according to the actual motion direction of the system.

The motion space of the robot is as follows, and the end point takes the center of the wrist of Axis 5 as the reference point.

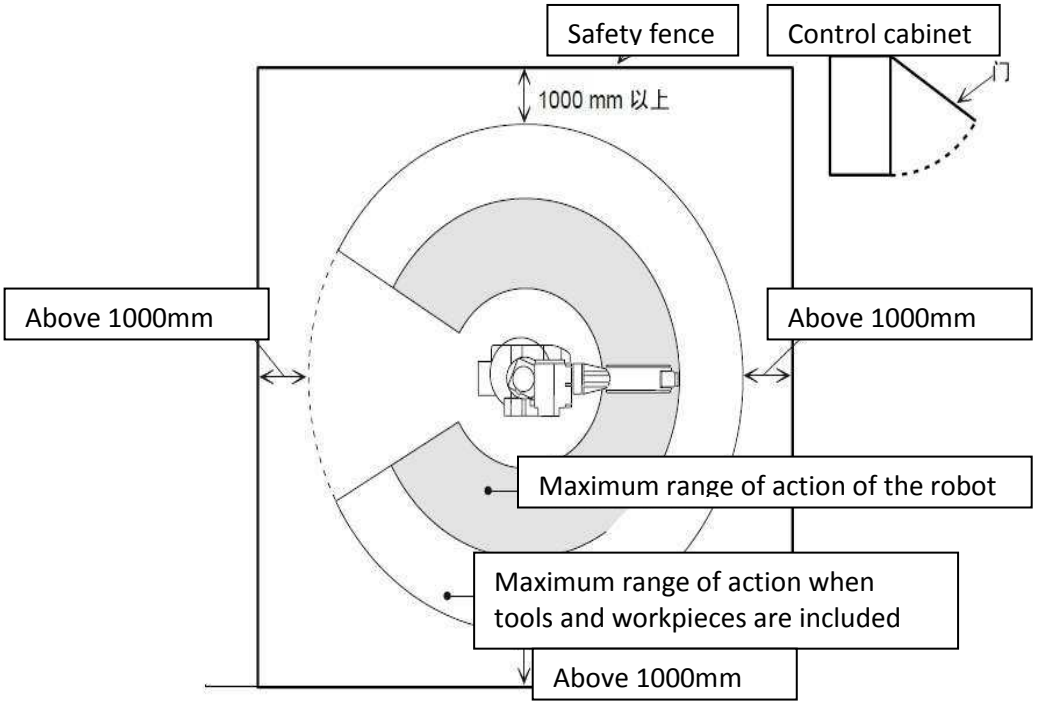


The maximum range of motion space of QJRH4-1 type robot

注意

CAUTION!

When the robot is equipped with tools or installed with cables, the motion position shown in the figure may not be reached. The range of motion shown in the figure is the ideal range of motion that can be reached by the robot which is not equipped with tools (see section I for safety precautions).



Work space layout of robot system

危险

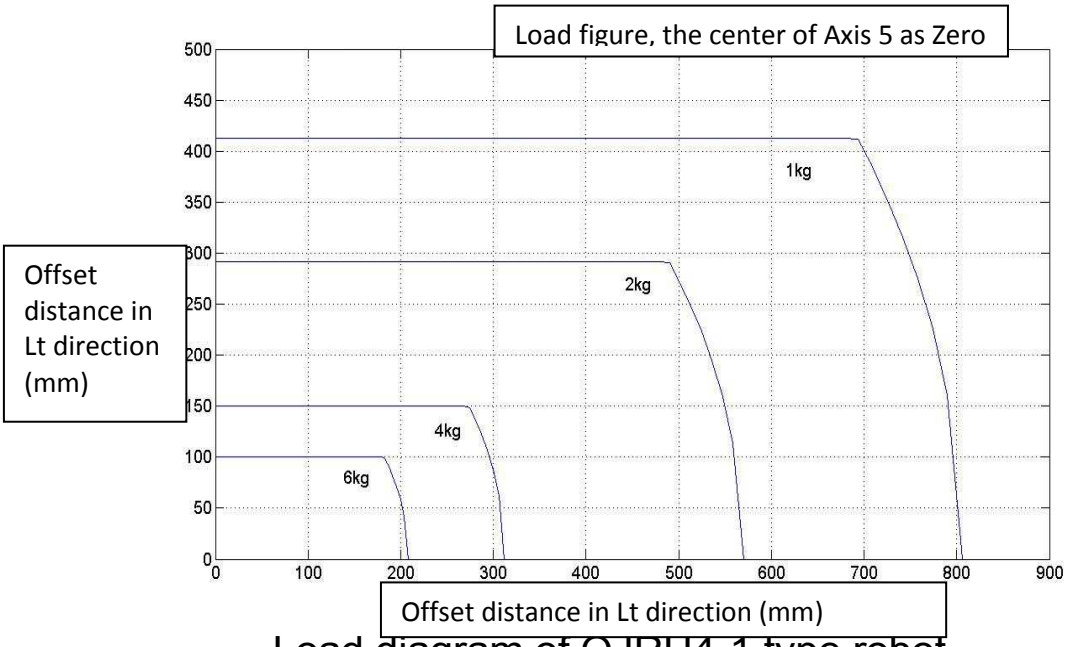
DANGER!

When the robot is started, no person is allowed to enter into the range of work space of the robot, otherwise it will cause serious personal injury and mechanical damage.

Fundamental performance parameters of robots

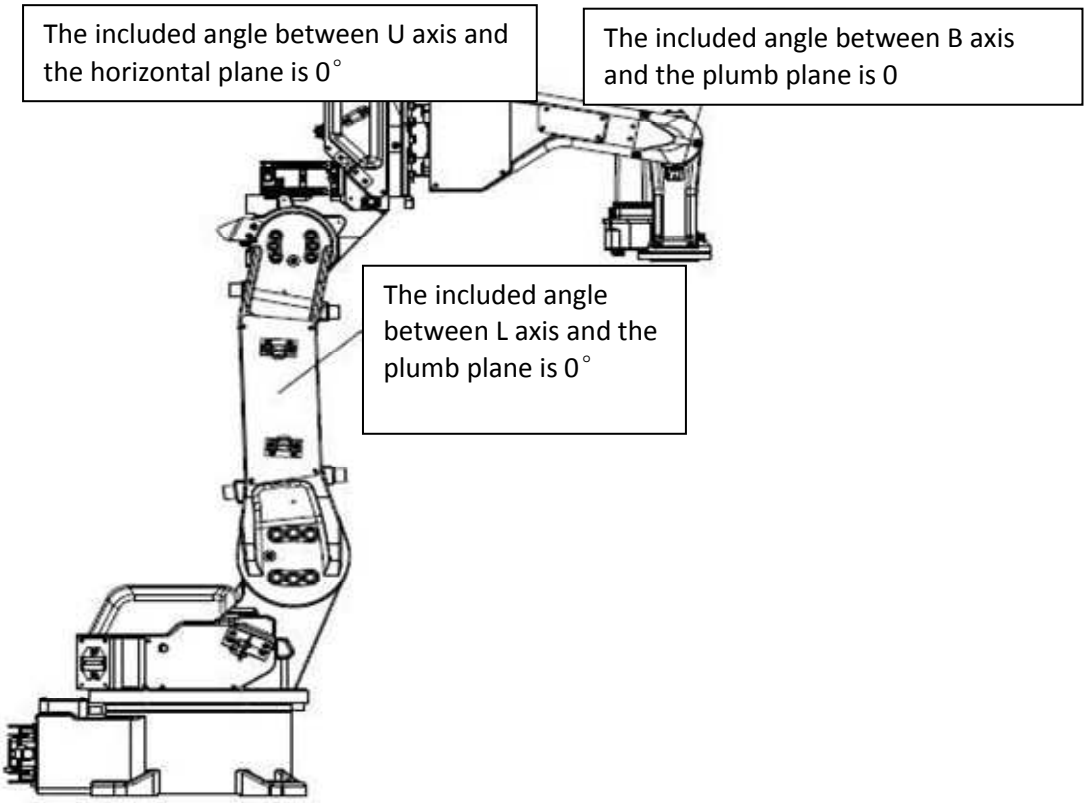
Basic specification sheet of QJRH4-1		
Mechanism and type		Vertical multiple articulated type
Degree of freedom		6
Effective load		4kg
Repeated positioning accuracy^2		±0.03mm
Range of mechanical position limit	Axis 1	±168°
	Axis 2	+150°，-89°
	Axis 3	+89°，-111°
	Axis 4	±167°
	Axis 5	+58°，-217°
	Axis 6	±360°
Maximum speed	Axis 1	3.5rad/s
	Axis 2	3.5rad/s
	Axis 3	3.8rad/s
	Axis 4	7rad/s
	Axis 5	7rad/s
	Axis 6	9.5rad/s
Allowable torque	Direction X (mechanical interface coordinate)	12.18N.m
	Direction Y (mechanical	12.18N.m
	Direction Z (mechanical interface coordinate)	3.34N.m
Inertia moment	Axis 4	0.38kg.㎡
	Axis 5	0.38kg.㎡
	Axis 6	0.03kg.㎡
Robot weight		150kg
Installation environment	Temperature	0~45℃
	Humidity	20%~80%RH (Non-condensate)
	Vibration	<4.9m/s2(0.5G)

	Others	Avoid flammable and corrosive gases and liquids; avoid contact with water, oil and dust, etc.; do not get close to electrical noise sources.
Power capacity		2.8KVA



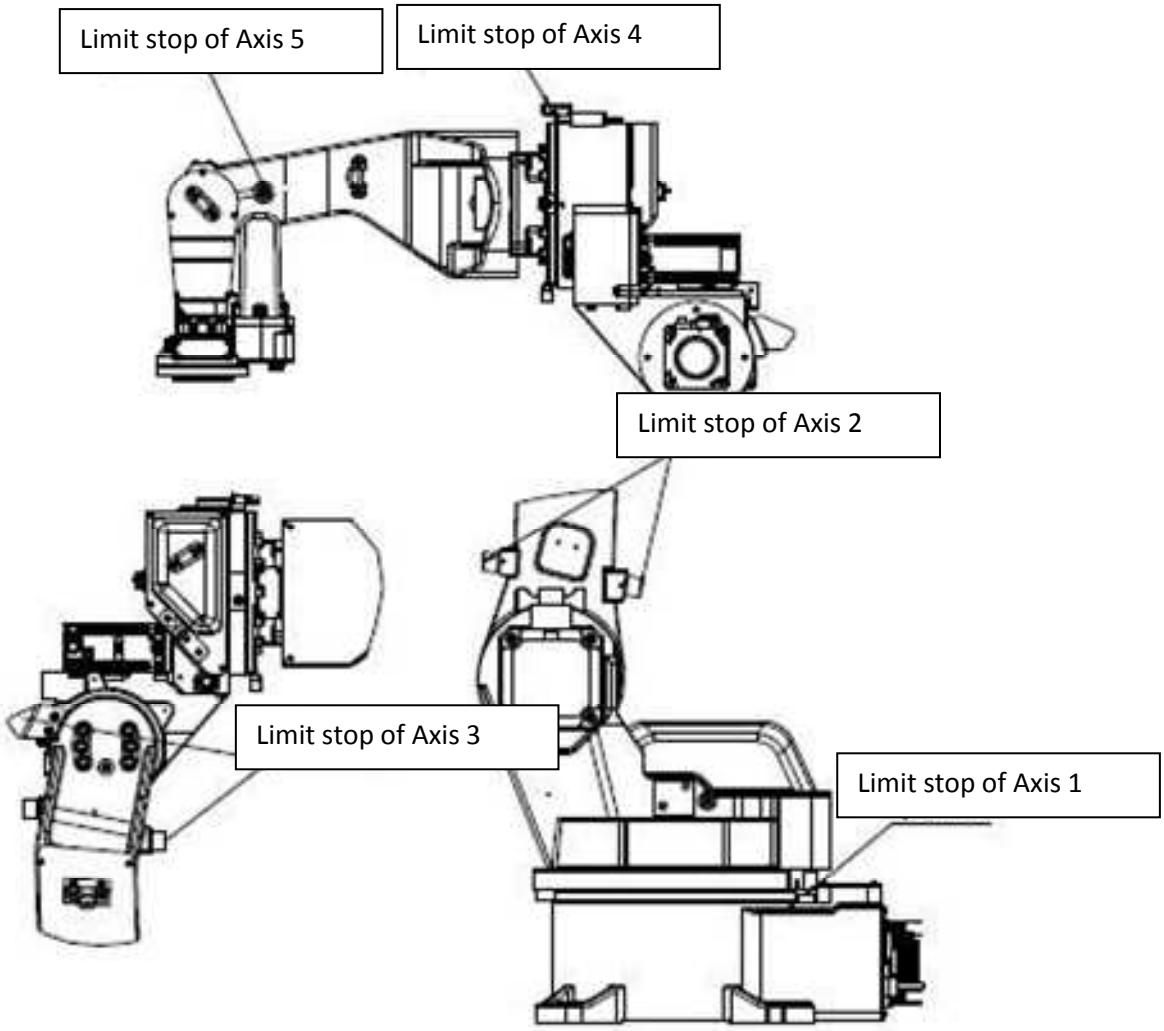
Load diagram of QJRH4-1 type robot

Original position setting of the robot: The original position posture of the robot is as shown in the figure below, so that the initial position of the robot is consistent with the zero mark in the robot.



QJRH4-1 type robot figure

Mechanical limit stop position: The hard limit ensures that the robot works within the space in the figure above. Ensure the range of motion of each axis of the robot.



Limit stop positions of Axes J1, J2, J3, J4 and J5

CAUTION!

The figure above shows the mechanical hard limit position, using mechanical restraints to ensure the range of motion of the robot. There is also a soft limit in addition to the mechanical hard limit. When there is still a certain distance from the hard limit, set the position of this soft limit in the software which can further protect the robot with less impact. See the subsequent manual of the robot system for specific soft limit setting method.

In case of the following circumstances, the movable range of the robot can be changed from the standard value by setting the range of motion of the robot.

1) The range of motion of the robot is limited during operation

2）There are interference areas of the tools and peripheral equipments

3）When the length of the cable installed on the robot interferes, the above several circumstances can change the range of motion of the robot, which can be adjusted through the following two ways:

1）Software-based movable range setting (all axes)

2）Adjustment of movable range based on limit stop (J1, J2, J3, J4 and J5)

CAUTION!

The above limit adjustment will have a large impact on the range of motion of the robot. Before determining to change the range of motion, it is necessary to reconsider the possible impacts; the limit principle of the limit stop is to brake the robot through deformation, which may not continue to be used after deformation. After collision, a new limit stop shall be replaced.

2.7 Precautions in Production

CAUTION!

Precautions during production and operation:

When teaching and manually operating the robot:
1) Please do not operate the teaching pendant and operation panel with gloves.

2）Use a lower rate of speed when jogging the robot to increase the chance of controlling the robot.

3）The movement trend of the robot shall be considered before pressing the jog key on the teach pendant.

4）Pre-consider the movement trend to avoid the robot and confirm that the line is free from disturbing.

During production runtime:

1) Before the robot is started, It is necessary to know all the tasks that the robot will perform according to the programmed procedure.

2）It is necessary to know the positions and states of all switches, sensors and control signals that can control the movement of the robot.

3）It is necessary to know the position of the emergency stop button on the robot controller and peripheral control devices, preparing to press these buttons in emergency.

4）Do not ever think that the procedure is completed after the robot does not move, because the robot is likely to be waiting for the input signal to continue moving.

Chapter III Maintenance and service

Robot maintenance and service

Regular maintenance and inspection are essential for the normal operation of the robot, as well as ensuring the safety of personnel and equipments during operation. The inspection time is the time when the control cabinet is under closed state.

The following are the precautions for robot maintenance and service:

3.1 Daily inspection

1) Items to check before the power is closed.

Part	Item	Repair	Remark
Grounding cable/other cables	Loose, broken or damaged	Retighten or replace	
Robot	Whether it is stained with splash and dust	Remove splash and dust	Do not remove dust or splash with compressed air, which may introduce foreign matters and cause damage the robot.
	Loose accessories and fasteners	Retighten	
Safety fence	Damaged	Repair	
Working site	Whether clean	Clear site	

2）Items to check after the power is closed.

Part	Item	Repair	Remark
Emergency stop switch	Disconnect the servo power supply immediately.	Repair, if there is any unknown situation, please contact our technicians.	Please do not use the robot before the switch is repaired.

Centering mark of original point	After the original point is reset, check whether the centering marks of all original points align.	In case of misalignment, please contact our technicians.	It is allowed to access the robot for inspection after pressing the emergency stop switch and disconnecting the servo power.
Fan	Check rotation of fan, whether it is stained with dust.	Clean the fan	Please disconnect all the power supply before fan cleaning.
Robot	See whether the operation of each axis is smooth and stable during automatic operation and manual operation.	If the cause is unknown, please contact our technicians.	Please do not use the robot before repaired.

DANGER!

The power can be closed after confirm that no other person is within the working range of the robot to prevent the brake sudden release after the power is closed, resulting in accidental injury to the person.

3.2 Regular inspection for robots

Interval						Item	Method/tools	Inspection and repair
3 months	1 year	2 year	3 year	4 year	5 year			
●						Fixed bolts for robot	Wrench	Check for looseness and tighten if necessary.
●						Screws on the cover	Screwdriver and wrench	Check for looseness and tighten if necessary.
●						Connecting cable and connector	Visual inspection and tools	Check for looseness and tighten if necessary.
○	●					Fixed bolts for motor	Wrench	Check for looseness and tighten if necessary.
○	●					Rotating/driving part	Torque wrench, feeling and visual inspection	Check the tightening torque to see if any looseness.
○	●					Reduction gear	Torque wrench and visual inspection	Check the tightening torque and visually inspect the appearance.
○	●					Wiring and connectors inside the robot	Multimeter and visual inspection	Conduction check Visual inspection Add lubricating oil
	○	●				Battery (inside the robot)	Replace	Replace with new parts
	○		●			Reduction gear	Lubricating oil	Apply lubricating oil
	○		●			Cog-type belt	Tensiometer	Check the tension force and adjust if necessary

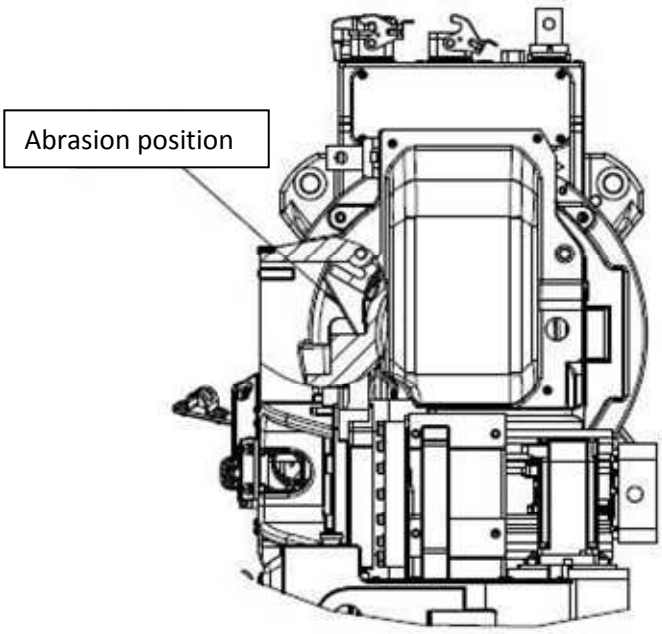
	○			●		Wiring inside the robot	Replace	Replace with new parts Apply lubricating oil
	○				●	Cog-type belt	Replace	Replace with new parts Adjust tension force
	○				●	Battery (inside the control cabinet)	Replace	Replace with new parts

Note: ● in the table indicates that it must be inspected; ○ indicates that it is recommended to inspect, but it must be disposed timely when the problem is found.

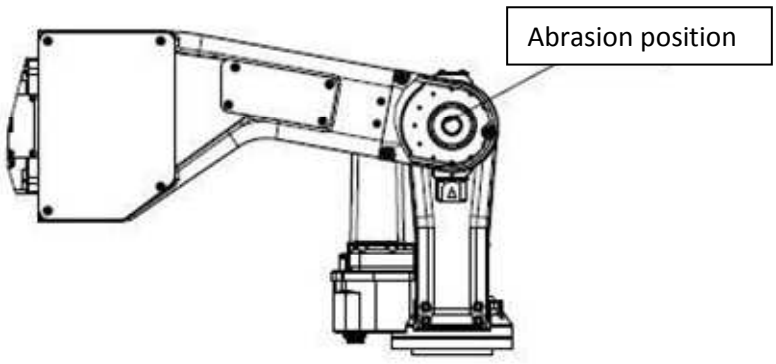
注意

CAUTION!

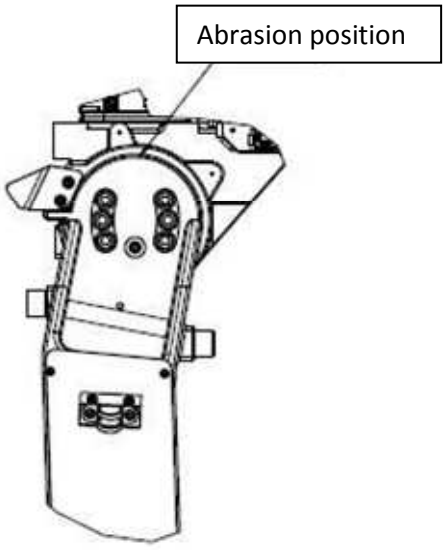
In addition to checking and maintaining the robot according to the time recommended in the above table, often pay attention to whether the robot cable is knotted or entangled, and whether it has serious abrasion with the robot. In the figure below, the threading hole in the rotary seat is the most common wearable position in the robot. Although the orifice chamfering is blunt when machining, the plastic cable is easy to rub at the position of threading hole and causes damage when working on the robot which shall be paid more attention.



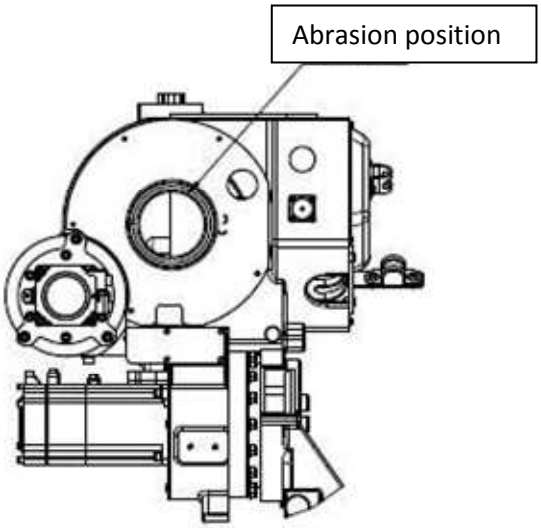
(a) Threading hole in the rotary seat



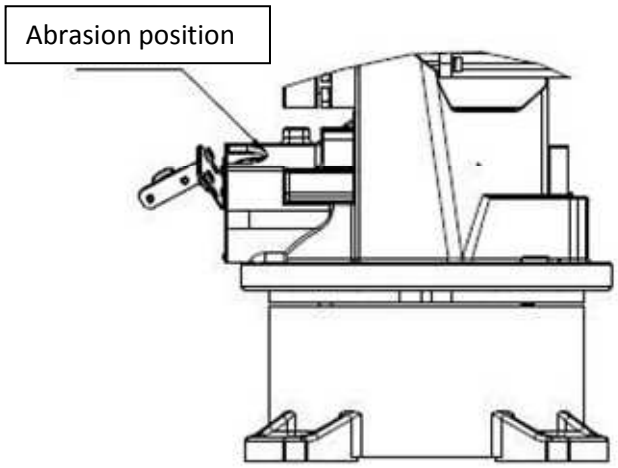
(b) Threading hole in the wrist



(c) Upper position of big arm



(d) Threading hole in small arm



（e) Threading hole outside the rotary seat

Most wearable position of cable

3.3 Replacement of encoder battery

The robot has batteries installed inside which are used for data backup of the absolute encoder and recording the position data of each axis. The service life of the battery varies with the working environment. It is recommended to replace the battery once a year or two years. Otherwise, the absolute encoder data will be lost and it is required to readjust the original point. Please back up the teaching data before replacement operation to prevent the teaching program or setting parameters from being lost. Please cut off the power of the robot before replacement. Replace the battery in sequence:

1) Check the service time of battery and make sure to replace with new batteries when it has been used for more than 2 years.

2) When replacing the battery, to prevent danger, and please press the emergency stop button.

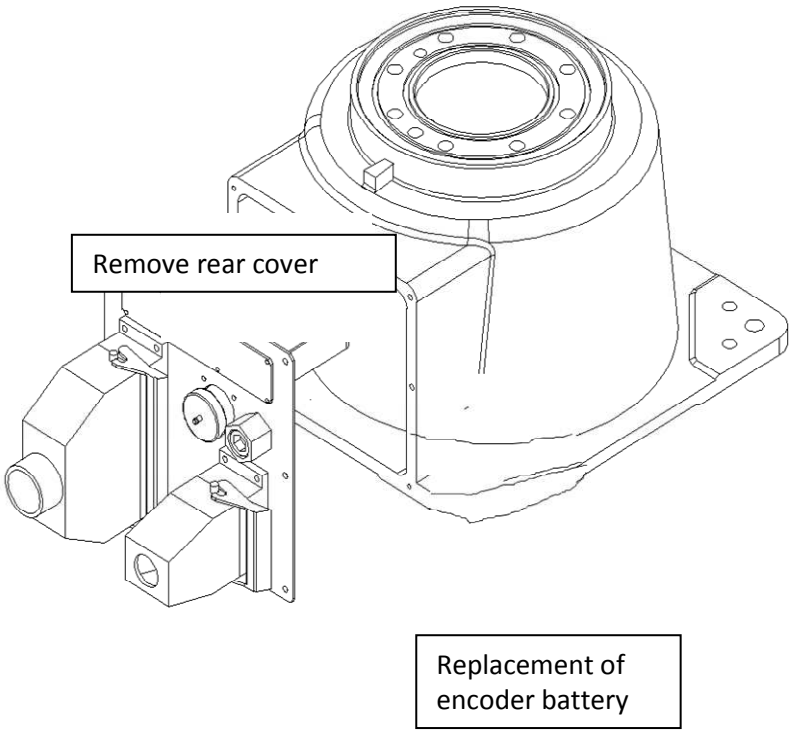
3) Remove the battery box, take out the old battery, and install the new battery (fix the battery in advance and remove the battery with nylon clip). Or replace when the robot displays “Check Lithium Battery” message.

4) After replacing or checking the battery, insert the cable, fix the nylon clip, and finally place the protecting cover at location A.

注意

CAUTION!

Please open the rear cover of the base to replace the battery. Do not mistake the positive and negative directions of the battery. Please contact our technician for details. The actual battery service life may be less than theoretical time, and continuous use (closed power supply of control cabinet for a long time) may also reduce the battery service life.

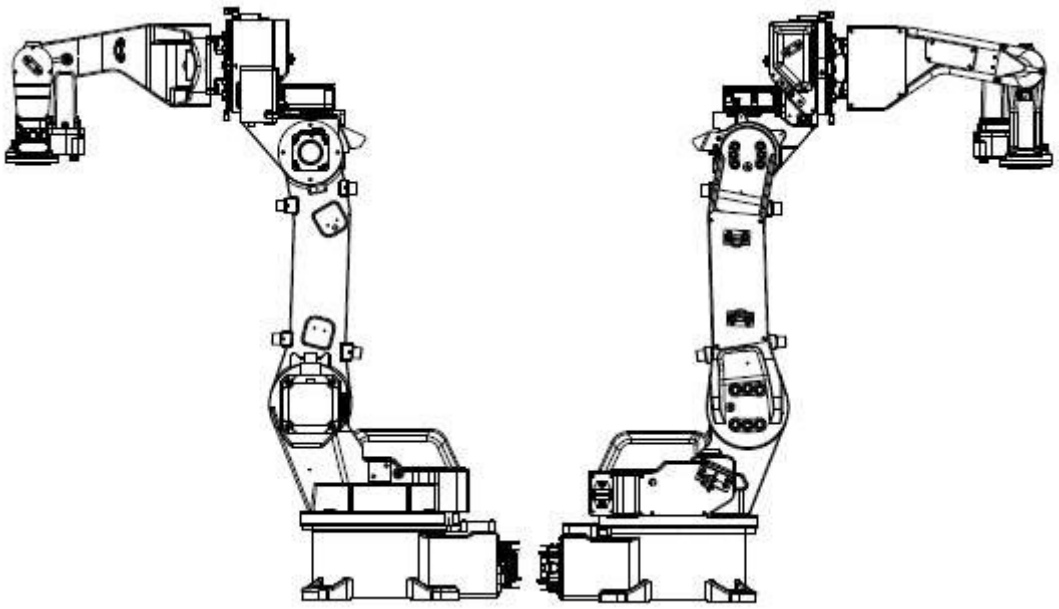


3.4 Replacement of transmission mechanism grease

CAUTION!

The lubricating grease of the reducer and gear mechanism (J1, J2, J3, J4, gearbox and J6) at each joint of the robot must be replaced every 3 years or after 11520 hours of continuous operation. The grease replenishment cycle is about 1000h of operation for the gearbox, 6000h of operation for the harmonic reducer, and 6000h of operation for the RV reducer. The lubricating grease used must be selected from the reducer grease and gear grease designated by our company. The non-designated grease may decrease the accuracy of the robot and even damage the transmission mechanism.

Moreover, in daily use, be careful not to contaminate the lubricating grease or exceed the specified temperature (0-40°) of the grease. If this happens, please check the degree of grease contamination and deterioration to determine the grease replacement time.



The posture of robot when filling grease and discharging grease

CAUTION!

When pressing the pump by hand to fill grease, press the pump 2 times every 3 seconds as standard and the front end pressure of the grease gun is kept below 0.15MPa. During lubricating grease replacement, the posture of robot shall be as shown above, to ensure that the grease used for a long time can be removed completely.

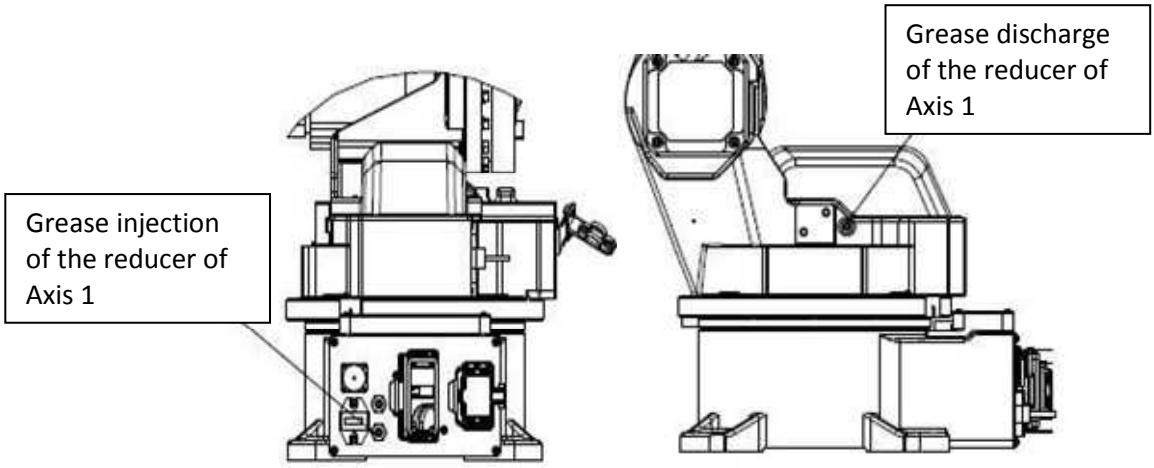
- Operating steps of grease fill and grease discharge:

1）Move the robot to keep the posture shown on the figure above;

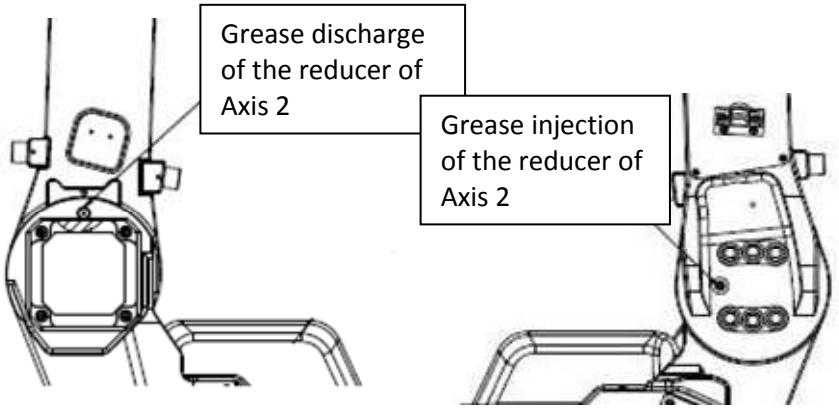
2）Cut off the power supply of the control device;

3）Remove the sealing plug screw of the grease fill port and grease discharge port;

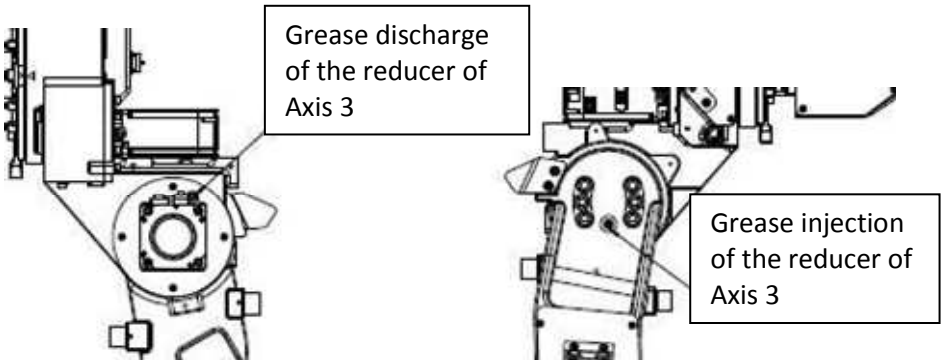
4）When the grease replacement cycle is reached, the grease is supplied from the grease fill port until the new supplied grease is discharged from the grease discharge port. After the old grease is drained, retighten the screw plug.



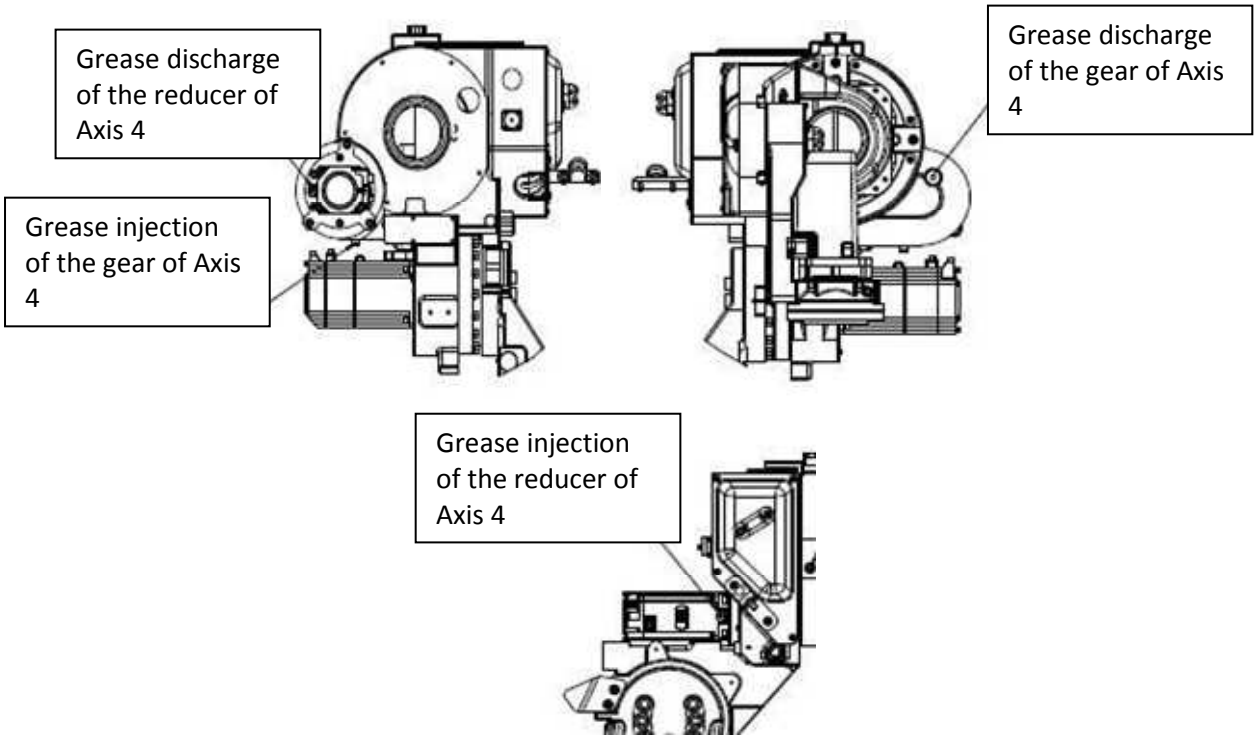
The positions of the grease filling and discharging of the reducer of Axis 1



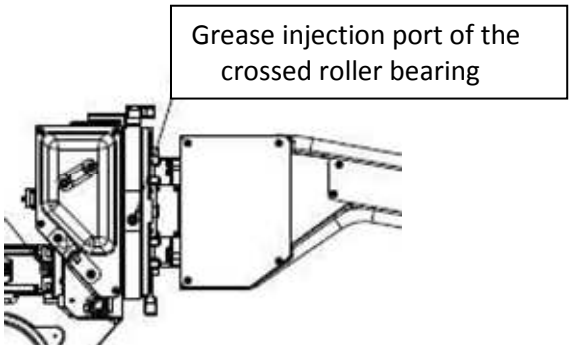
The positions of the grease filling and discharging of the reducer of Axis 2



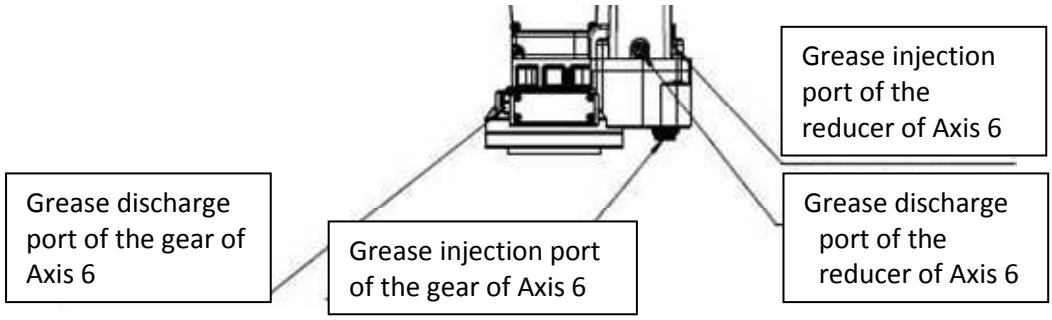
The positions of the grease filling and discharging of the reducer of Axis 3



The positions of the grease filling and discharging of the reducer of Axis 4



The position of the grease filling of the crossed roller bearing



The positions of the grease filling and discharging of the reducer and gear of Axis 6

CAUTION!

Incorrect grease filling and discharging methods may cause damage to the seal ring due to increased internal pressure inside the oil chamber, thus resulting in oil leakage and poor operation due to poor sealing. Therefore, be sure to observe the following precautions during grease filling operation:

1）When filling grease, be sure to remove the seal plug screw of grease discharging port;

2）Do not fill the oil chamber full with the grease, leaving about 10% of the remaining space;

3）Using a manual pump, slowly fill grease according to the standard;

4）Try not to use factory air pump. In some cases, the pressure of the air pump shall be adjusted to avoid damage to the seal ring due to over pressure;

5）The designated lubricating grease must be used;

6）After grease filled, tighten the seal plug screw;

7）Clean the lubricating grease remaining on the ground to prevent individuals from slipping and falling.

Note: Please consult our technicians for the specific values of the type of selected technician grease and injection volume of the oil chamber.

CAUTION!

Frequently sweep the welder and its relevant accessories to remove ash, residual splash particles and other contaminants which will greatly increase the service life of the equipment and prevent the contaminants from entering into the equipment and causing damage to the equipment.
Frequent inspection of the cable harnesses and wire feeding tubes can greatly increase the production efficiency and reduce the probability of problems to avoid minor problems from affecting production.

3.5 Special precautions

危险

DANGER!

Part	Precaution	Consequence
Robot	The oil filling hole of the robot is not allowed to be filled with ordinary butter.	Inflexible rotation, noise and wear of each axis
	Compressed air is not allowed to clean dust or splash	Impurities entering into the robot, causing damage
Control chamber	All cables are not allowed to be stepped on, pressed or bumped.	Cable broken
	Do not connect with large-capacity electrical equipments	Crash
Teaching pendant	Avoid throw and impact.	Blank screen
	Avoid cable winding.	Cable broken
	Avoid scratching of the display panel.	Damage of liquid crystal display panel

Thank you very much for selecting our products! Please keep the relevant manual of the system properly for review in case of need! If the equipment needs to be switched, please forward the relevant information to the other party! Buttons, functions, and options not described in the relevant manual of the system are considered to be unavailable. Please do not use!