



OPERATION INSTRUCTIONS



ESTUN General Medium Payloads Series Robot Body Operation Instructions

**ALL
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ESTUN
AUTOMATION

ESTUN Medium Payloads Robot

Mechanical Unit Operator's Manual

EBM03101-EN-11

PREFACE

This manual describes the following manipulators.

Robot type	Load capacity
ER20-2300-HI	20kg
ER30B-2700-LI	30kg
ER50B-2100	50kg
ER50B-2700	50kg
ER70B-2100-LI	70kg

Related manuals

ESTUN Robot Mechanical Unit Operator's Manual
ESTUN ER Series Cabinet Operator's Manual
ESTUN ERC Series Cabinet Operator's Manual
ESTUN ER Series Industrial Robot Operation Manual

Thank you for purchasing ESTUN robots.

Before using the robot, be sure to read the SAFETY PRECAUTION and understand the content.

ESTUN endeavor to improve the products. All specifications and designs are subject to change without notice.

In this manual, all specifications and information are checked on a regular basis. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. ESTUN assumes no responsibility for any direct or indirect losses arising from use of this manual and products described herein.

Keep this manual handy for easy access at all times.

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SAFETY

This chapter describes the precautions which must be followed to ensure the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly.

ESTUN robots must be transported, mounted and operated in accordance with national laws, regulations and standards. Appropriate safeguards must be correctly performed to protect the users. Before using (mounting, operating, maintaining, repairing) the robot, be sure to read and understand this manual and its relevant manuals. Be sure to have familiarization with the knowledge of robot system and the safety precaution. Even if all instructions are followed, this is not a guarantee that the robot will not cause injuries or damage.

DEFINITION OF USERS

The personnel can be defined as follows.

- Operator
 - Turns the robot power ON/OFF.
 - Starts the robot program from the panel.
- Programmer
 - Operates the robot.
 - Teaches the robot inside the safety area.
- Maintenance engineer
 - Operates the robot.
 - Teaches the robot inside the safety area.
 - Maintenance (repair, adjustment, replacement).

Operator must not work in the safety area.

Programmer and maintenance engineer can work in the safety area.

During operation, programming, and maintenance of the robot, the operator, programmer, and maintenance engineer should take precautions to ensure the safety by wearing the following safety items.

- Clothes for operation
- Safety shoes
- A helmet

SPECIAL TRAINING

Tasks in the safety area including transportation, setting, teaching, adjustment, maintenance, etc.

Training course must be performed before operating the robot.

For more information about training course, contact ESTUN.

DEFINITION OF SAFETY NOTATIONS

Precautions and information are defined as follows.



Symbol	Definitions
 DANGER	Danger notation Death or serious injury will be expected to occur if the user fails to follow the approved procedure.
 CAUTION	Caution notation Minor or moderate injury of the user or equipment damage will be expected to occur if the user fails to follow the approved procedure.
 INFO	Information A supplementary explanation helps users operating the robot more efficiently.

SAFETY OF USERS

- (1) The robot should be transported and installed as procedures recommended by ESTUN. Wrong procedures may cause severe injuries or damage due to the robot fall.
- (2) Draw an area clearly indicates the safety area. Install a fence or hang a warning board to ensure the safety operation of the robot, and keep unauthorized personnel outside the safety area.
- (3) Never hang any tools above the robot. Falling of these tools may cause damage to equipment.
- (4) Never lean on the cabinet. Never touch any buttons without permission. Unexpected movement of the robot may cause personnel injuries and equipment damage.
- (5) Take precautions for falling parts to avoid injuries when disassemble the robot.
- (6) Turn off the power when adjusting peripheral equipment.
- (7) Peripheral equipment must be grounded.
- (8) The robot should be operated in a low speed in the first operation. The speed should be added gradually to check if there is any abnormal situation.
- (9) Do not wear gloves when using the teach pendant. Operate with gloves may cause an operation error.
- (10) Programs, system variables, and other information can be saved on the memory card or USB memories. Be sure to save the data periodically in case that the data is lost.
- (11) Never forcibly move any axis of the robot. Move the axes forcibly may cause injuries or damage.
- (12) Take precautions when wiring and piping between the robot, the cabinet, and peripheral equipment. Put the pipes, wires or cables through a pit or covered with a protective lid, to avoid stepped by personnel or run over by a forklift.
- (13) Unexpected movement may occur on any operating robot, which will cause severe injuries or damages in the working area. Test (safe door, brake, safe indicators, etc.) must be performed on each safety measures before using the robot. Before turn on the system, make sure that no one is in the working space.
- (14) Never set motion range or load condition exceeds the rated range. Incorrect setting may cause personnel injury and equipment damage.
- (15) Observe the following precautions when teaching inside the working space of the robot
 - Do not enable the system unless the mode is switched to manual, and make sure that all auto-control is cut off.
 - Speed must be limited under 250mm/s at manual mode. Only authorized person with fully understand of the risks can adjust the robot to rated speed manually.
 - Be careful about rotating joints to prevent hair and clothes involved. Take precautions of injury or damage caused by the manipulator or other auxiliary devices.
 - Check the motor brake to avoid personnel injuries caused by unexpected situation.
 - Always have an escape plan in mind in case the robot comes towards you unexpectedly.



- Ensure that there is a place to retreat to in case of emergency.

**DANGER**

Never stand beneath the robot in case of unexpected movement or the system be turned on inadvertently.

**CAUTION**

Make sure there is a CO₂ fire extinguisher at hand.

SAFETY OF OPERATORS

- (1) Before operating the robot, check that the SERVO ON indicator goes out when the EMERGENCY STOP button on the right of the front door of the controller and the pendant are pressed. And confirm that the power is turned off.
- (2) Never allow unauthorized personnel to touch the controller during operation. This may result in unexpected movement of the robot, severe injuries and material damage.
- (3) When attaching tools to the robot, be sure to turn off the power of the controller and the peripheral equipment, and display a warning sign. Turning the power on during equipment installation may cause electric shock or injury due to unexpected movement of the robot.
- (4) Emergency stop is an external button of the controller that can stop the robot operation. When emergency button is pressed, the power of the robot (except the power of the servo) is cut off. The system will not run unless the pressed emergency button being released and the system being turned on.



There are several emergency stop buttons in a robot system to stop the robot in case of emergencies. The red button, as shown in the left figure, can be mounted on the teach pendant and the controller. Certainly, the emergency buttons can be mounted by special requirement.

Emergency stop button should be mounted where is easy to reach, so that the buttons can be pressed down immediately in case of emergencies.

**DANGER**

Operators must take precautions to avoid high voltage from cables of servo motors, grippers and other devices.

**CAUTION**

Emergency button is used in case of emergency only. Do not use it to stop the robot for normal operation.

SAFETY OF PROGRAMMERS

While teaching the robot, the programmer must enter the robot operation area. The programmer must ensure the safety especially.

**CAUTION**

Turn on or off the system by press or release Mot button on the teach pendant.

To use the teach pendant safely, the following precautions should be taken.

- Be sure that the enable switch is effective at any time.





- Turn off the enable switch when pausing, programming or testing the system.
- Teach pendant must be taken with the programmer when teaching in the work space, to avoid inadvertent operation by unauthorized person.
- Teach pendant must not be left within the work space of the robot, as injury or damage can occur if the robot comes in contact with the teach pendant.

SAFETY OF MAINTENANCE ENGINEERS

(1) Heated parts

Some parts of the robot are heated when the robot is operating, especially the servo motor and reducer. If a maintenance engineer needs to touch such a part, the user should wear heat-resistant gloves or use other protective tools.



**Try to feel the temperature of heated parts before touching them, to avoid burn injuries.
After turning off the power supply, wait until the heated parts cool down before performing any maintenance.**

(2) Disassembly parts

Open the cover or shell only after interior parts such as gears are not moving any more. Never open the cover or shell when the gear or bearing is moving. Use auxiliary device to keep interior part to its position.

Observe the following precaution when performing the first test after installation, inspection or maintenance:

- a) Clear tools to proper locations outside of the working space of the robot.
- b) Make sure that all precaution measures are available.
- c) Make sure that there is no one in the working space of the robot.
- d) Pay special attention to working condition of the maintenance parts when performing test.

Never use the manipulator as a ladder when performing maintenance. Never climb on the manipulator to avoid falling down.

(3) Pneumatic / hydraulic pressure

There may be air/liquid residue in the system when the air pump or hydraulic pump is turned off. Before checking the pneumatic or hydraulic parts, release remaining pressure from the system to avoid personnel injury or equipment damage.



Install a safety valve in case of accident.

- (4) Although the power supply need to be turned on during fault diagnosis, it must be turned off when perform maintenance.

(5) Brake inspection

Brake may be wearing in daily operation. So brake inspection should be performed by the following procedure:

- a) Move each joint to the position where the joint bears maximum load.
- b) Turn off the robot. The brake works.
- c) Mark each joint.
- d) Check if the joint moves over a period of time.

(6) Greasing

Personnel injury or equipment damage may occur during greasing. Observe the following precautions before greasing.





- Take additional care of safety by wearing safety items (such as gloves) to avoid injury from heated oil or reducer.
- Open the oil chamber with caution and keep away from the opening. Oil may spray due to oil pressure.
- Feed the oil according to required quantity and never fill up the oil chamber. Check the oil indicator when finished.
- Never mix different types of oil into one reducer. Clean the oil chamber thoroughly before changing oil type.
- Oil draining must be performed thoroughly. Check the oil indicator when finished.

INFO

Operate the robot for a short period of time before oil draining to heat the oil.

SAFETY OF THE TOOLS AND PERIPHERAL EQUIPMENT

Peripheral device may still be running even after the system has been turned off. Personnel injury may occur due to damaged power lines.

SAFETY OF THE ROBOT MECHANICAL UNIT

For abnormal or emergency situations, e.g. persons trapped in or pinched by the robot, the robot axes should be moved. (Contact ESTUN for more details about dismantling).

Small arms can be moved by hand. Lager arms should be moved by crane or other handling equipment.

Fasten the robot firmly before releasing the brake to avoid secondary injury caused by falling arms.

STOP TYPE OF ROBOT

There are three types of robot stop.

Power-off stop

Servo power is turned off and the robots stops immediately. Servo power is turned off when the robot is moving, the path of the deceleration is uncontrolled.

The following processing is performed at Power-off stop:

- An alarm is generated and servo power is turned off immediately.
- Execution of the program is paused.

Frequent Power-off stop of the robot during operation can cause failures of the robot. Avoid system designs that require routine or frequent Power-off stop conditions.

Alarm stop

The robot system sends alarm (not include power-off alarm), and the robot is decelerated until it stops by control instructions.

The following processing is performed at Alarm stop:

- An alarm (not include power-off alarm) is generated due to overload, system faulty, etc.
- Control instruction is send from servo system. The robot operation is decelerated until it stops. Execution of the program is paused.
- Servo power is off.

Hold

The robot is decelerated until it stops, and servo power remains on.



The following processing is performed at Hold:

- The robot operation is decelerated until it stops. Execution of the program is paused.

LABELS

(1) Electric Shock Warning

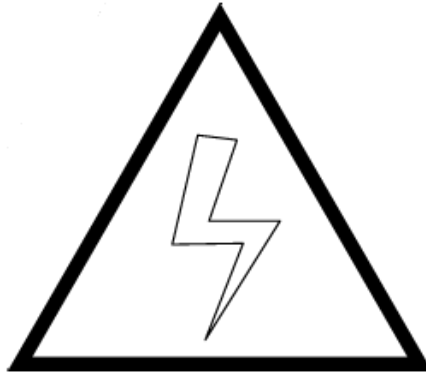


Fig 0.1 Electric Shock Warning

This label indicates hazardous voltage or electric shock.

(2) High-temperature Warning

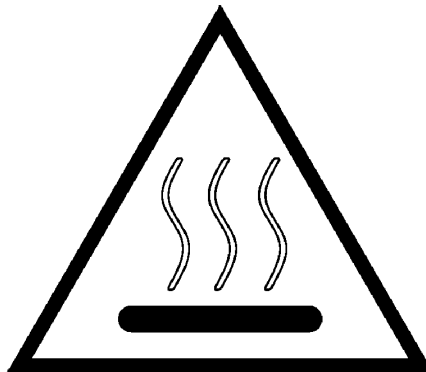


Fig 0.2 High-temperature Warning

Be cautious about a section where this label is affixed, as the section generates heat. If you have to inevitably touch such a section when it is hot, use a protection provision such as heat-resistant gloves.

(3) No Step-on Warning





Fig 0.3 Step-on prohibitive Warning

Never step on or climb the robot or controller as it may adversely affect the robot or controller and may get hurt if you lose your footing as well.

(4) Personal Injury Warning

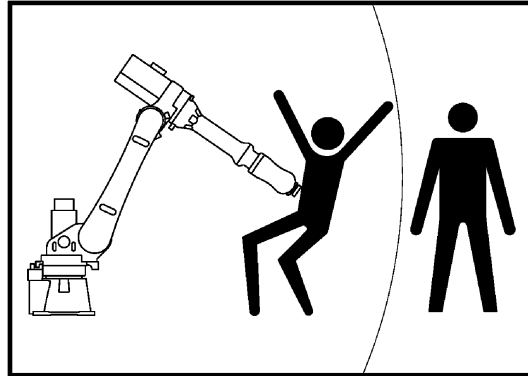


Fig 0.4 Personal Injury Warning

Never enter the operation area while the Manipulator is moving. This is extremely hazardous and may result in serious safety problems.

(5) No Disassembly Warning



Fig 0.5 No Disassembly Warning

Never perform disassembly arbitrarily where the warning is affixed. Contact ESTUN for disassembly.

(6) Handling



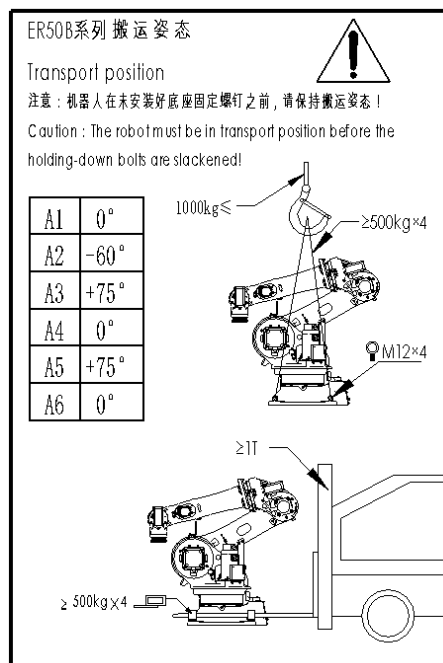


Fig 0.6 Handling sign



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1. TRANSPORTATION AND INSTALLATION

1.1. TRANSPORTATION



DANGER

When transport the robot, be sure the robot is in safe condition, or it may result in serious personnel injury and/or equipment damage.

Turn each axis to transportation gesture before move the robot and be sure to keep the gesture during transportation until it be properly installed and mounted. Transportation gesture of each axis is shown below. Perform the transportation properly, or it may result in personnel injury or equipment damage.

Position	J1-axis	J2-axis	J3-axis	J4-axis	J5-axis	J6-axis
ER20-2300-HI	0°	-60°	+75°	0°	+75°	0°
ER30B-2700-LI	0°	-60°	+75°	0°	+75°	0°
ER50B-2100	0°	-60°	+75°	0°	+75°	0°
ER50B-2700	0°	-60°	+75°	0°	+75°	0°
ER70B-2100-LI	0°	-60°	+75°	0°	+75°	0°

Refer to theoretical weight of main parts shown below to install, disassemble and transport the robot.

Parts	Weight (kg)				
	ER20-2300-HI	ER30B-2700-LI	ER50B-2100	ER50B-2700	ER70B-2100-LI
Robot	502	520	522	550	522
Big arm casting	62	78	62	78	62
Base assembly (Including rotation base)	328	328	335	335	335
Small arm assembly (Including motor casting)	75	77	64	71	64
Wrist	14	14	38	38	38

INFO

Some parts with less weight are not listed. Contact ESTUN if you need the details.

When transporting the robot, a fixed bracket needs to be installed. The fixing bracket needs to be removed before installing the robot. The figure below lists the fixing bracket screw holes for easy user removal.



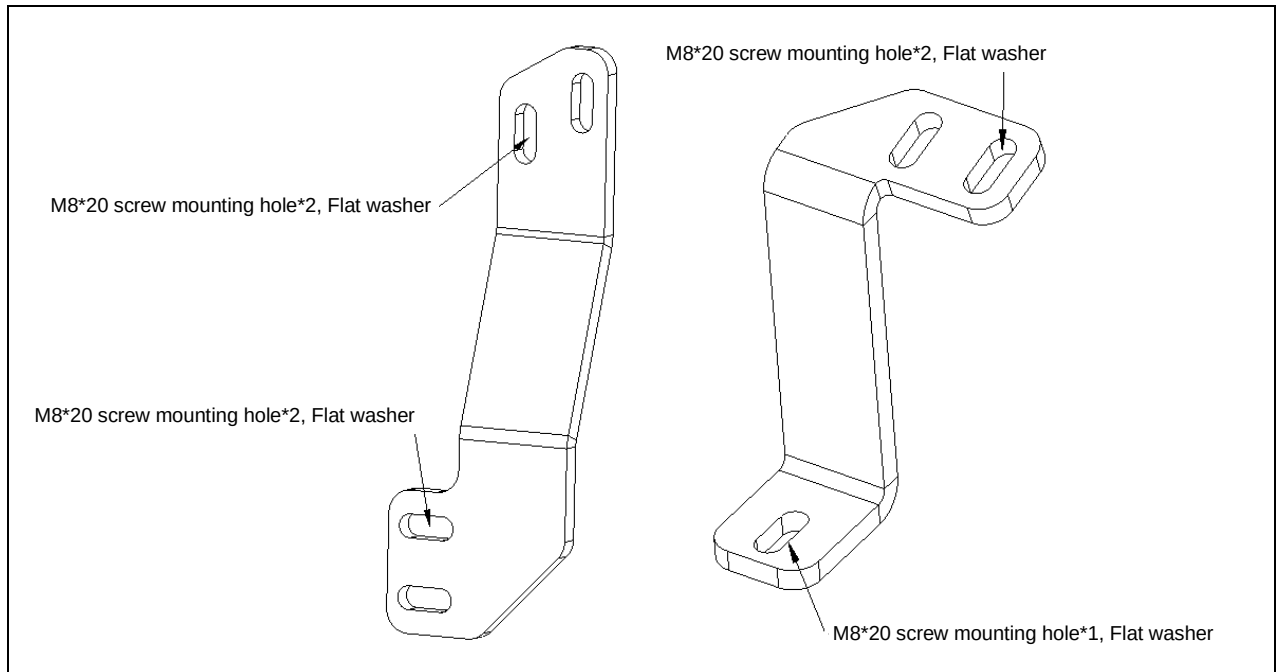


Fig 1.1 Robot fixed bracket (ER20-2300-HI, ER50B-2100, ER70B-2100-LI)

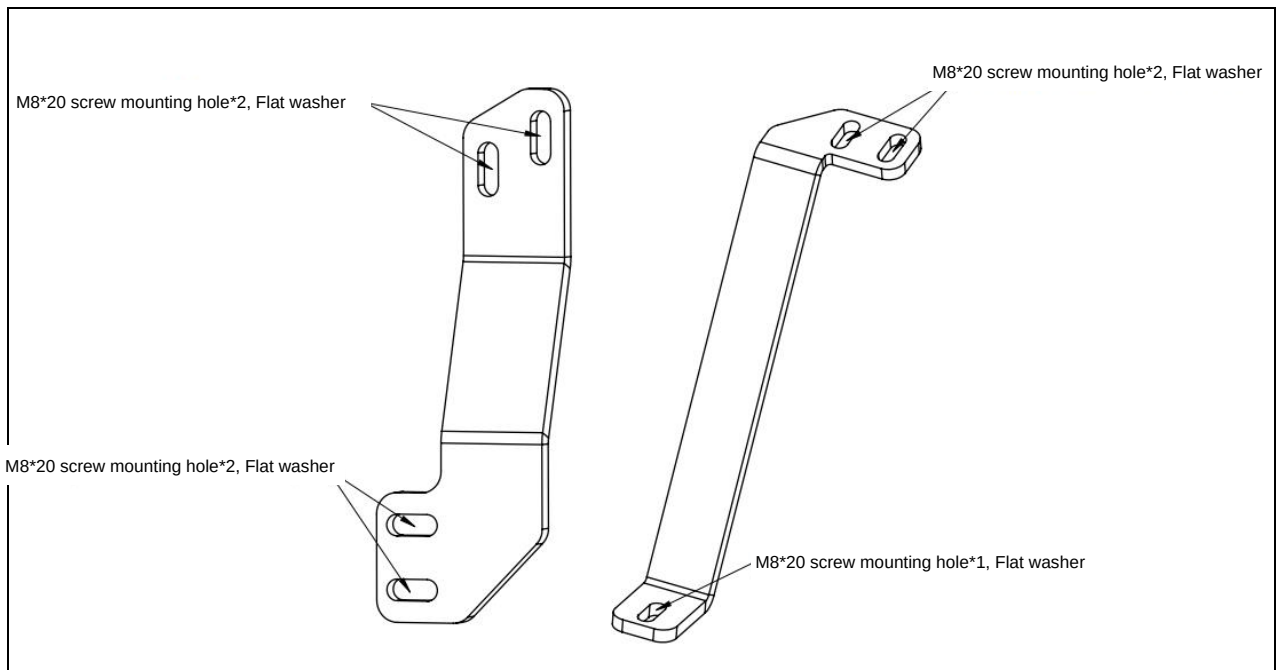


Fig 1.2 Robot fixed bracket (ER30B-2700-LI)



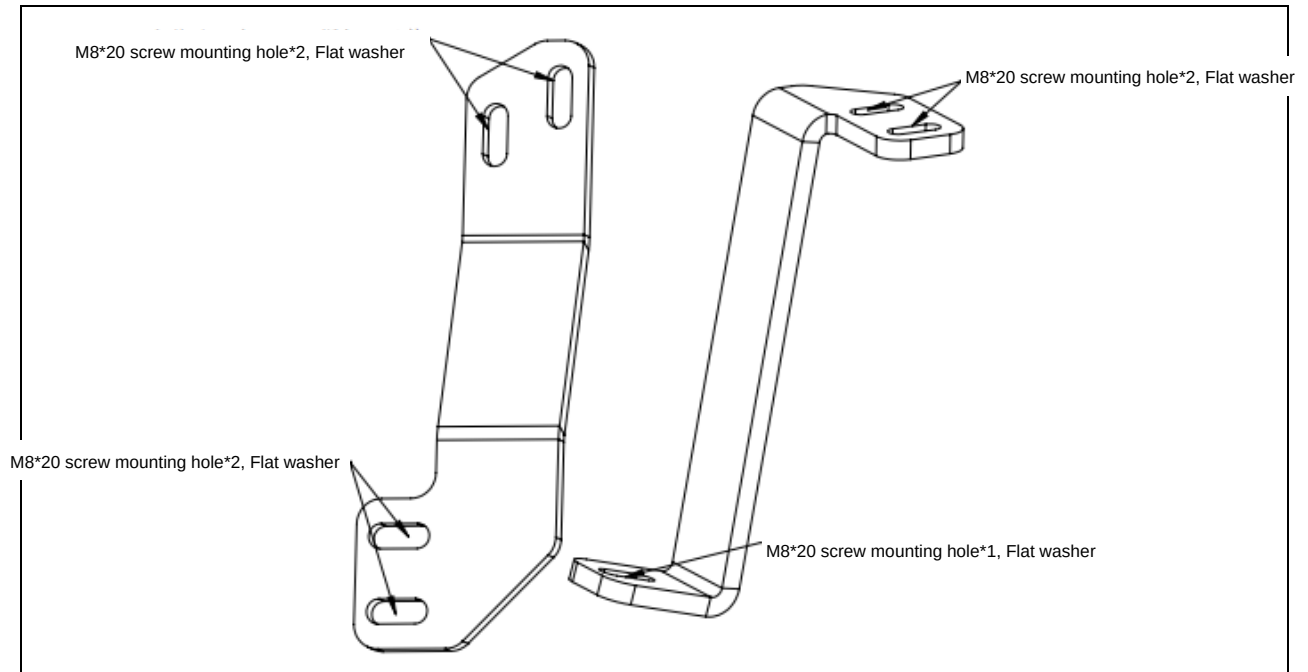


Fig 1.3 Robot fixed bracket (ER50B-2700))

1.1.1. Transport by a forklift

The robot described in this manual can be transported by a forklift. Use eight M12X35 bolts to fix the 4 fixed plates on the forklift to the robot base, use a forklift to heave the robot. Make sure that the fixed bolts of the robot are removed before transportation.



CAUTION

Forklift fixing plates and screws are optional by the customer.



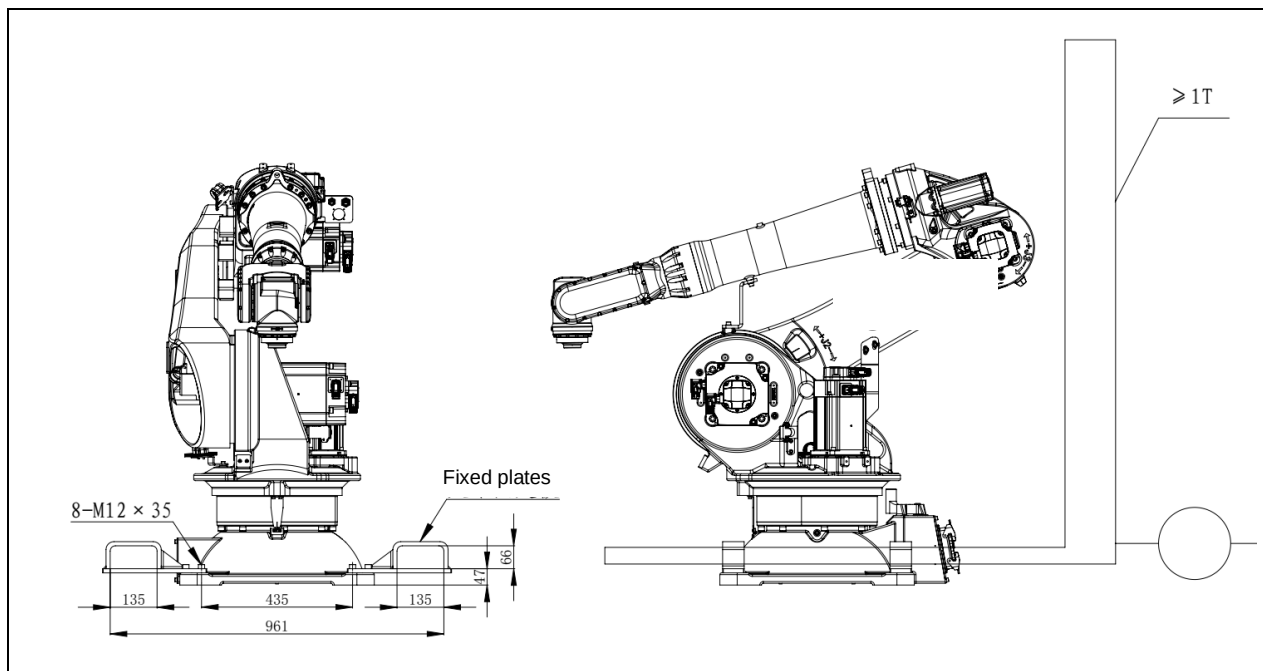


Fig 1.4 Use a forklift to transport the robot (ER20-2300-HI)

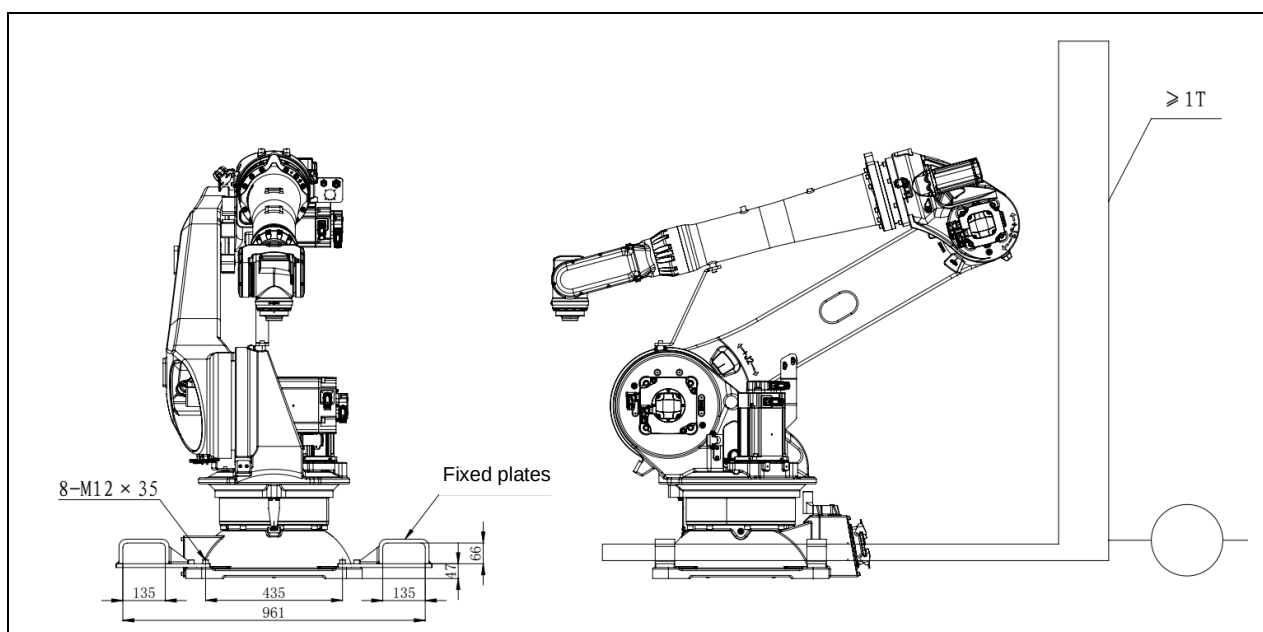


Fig 1.5 Use a forklift to transport the robot (ER30B-2700-LI)

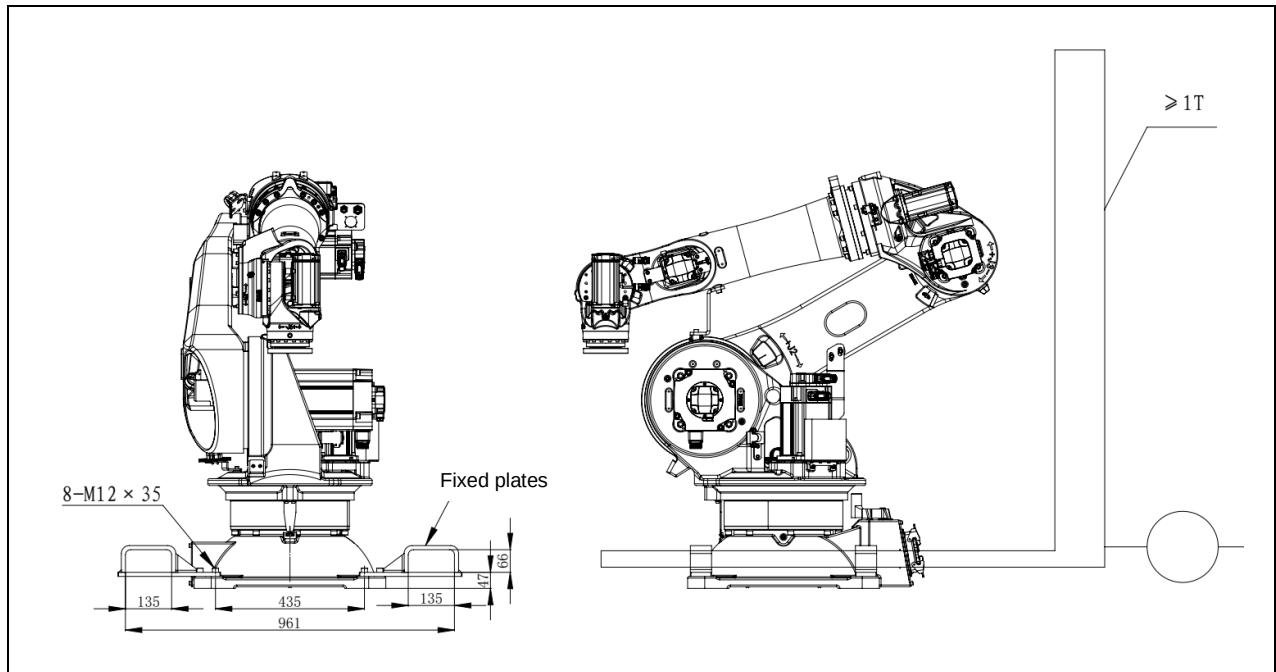


Fig 1.6 Use a forklift to transport the robot (ER50B-2100, ER70B-2100-LI)

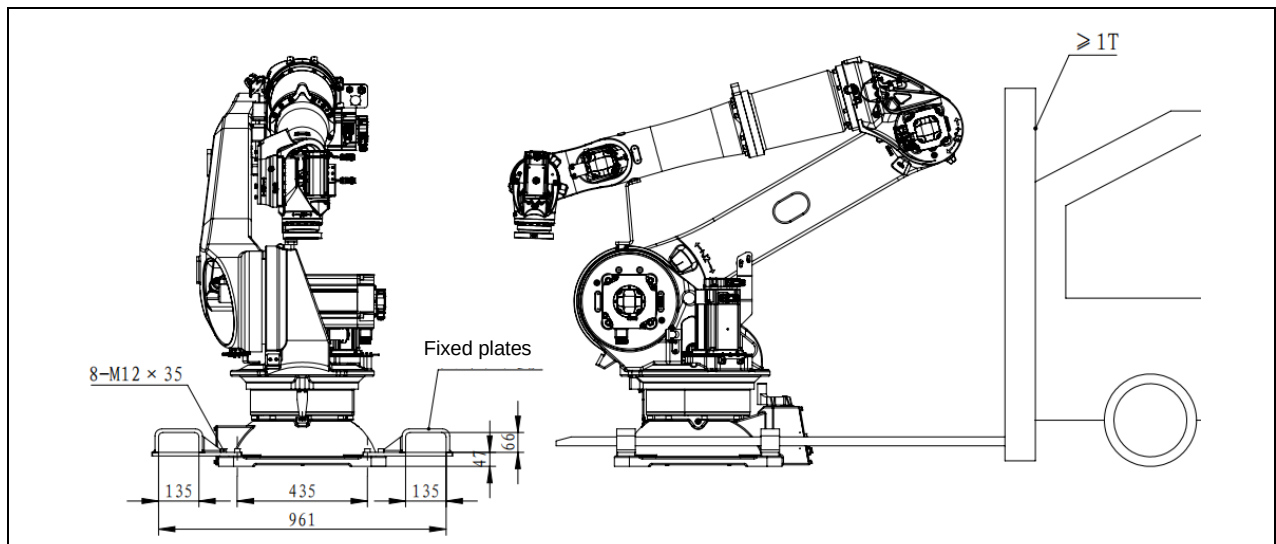


Fig 1.7 Use a forklift to transport the robot (ER50B-2700)

1.1.2. Transport by a crane

The robot described in this manual can be transported by a crane. Fix the M12 rings on the robot rotation base, use a crane and strings to heave the robot. Make sure that the strings are fixed as shown in the figure below. Take necessary measures to avoid paint peeling due to collision between the strings and the robot.



CAUTION

Eyebolt and sling should be prepared by customers.

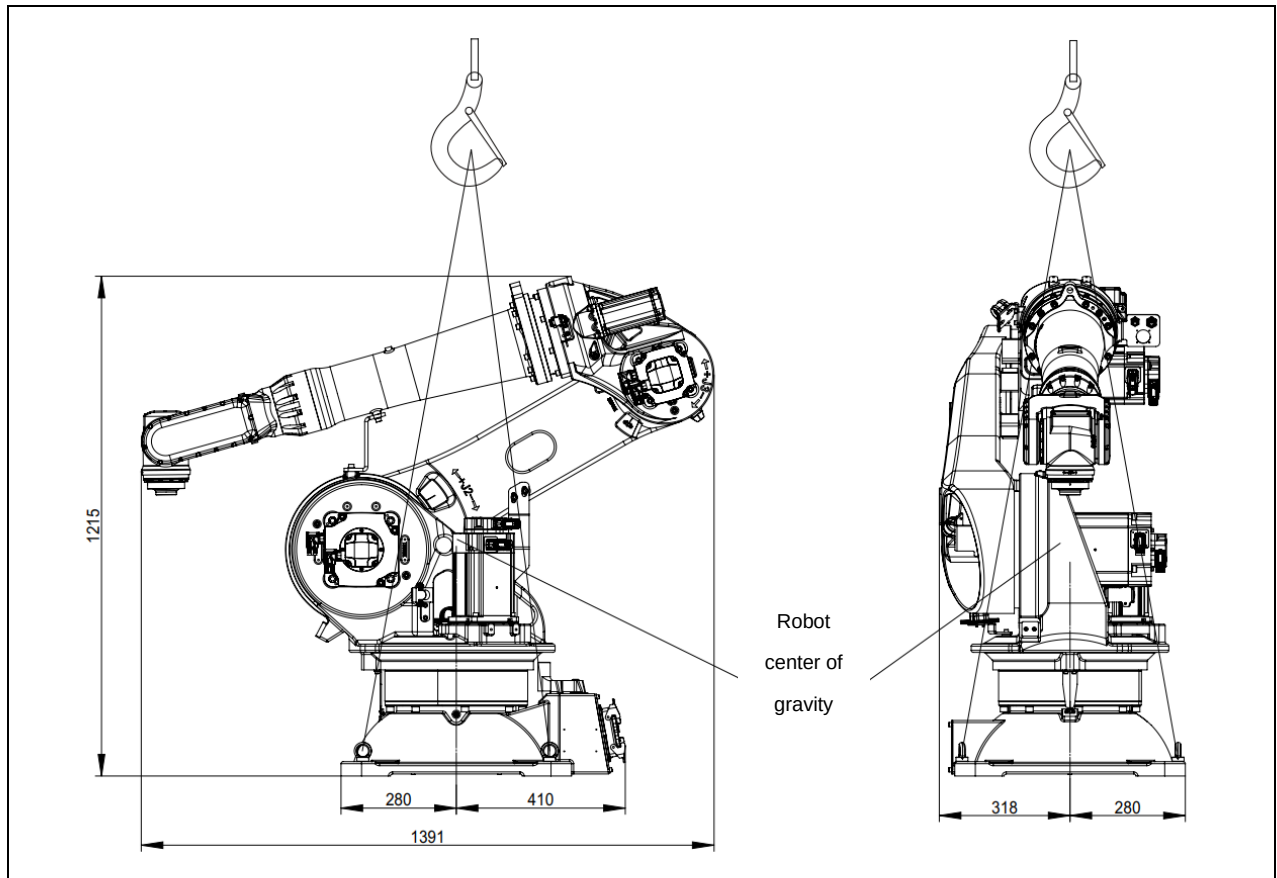


Fig 1.8 Use a crane to transport the robot (ER20-2300-HI)

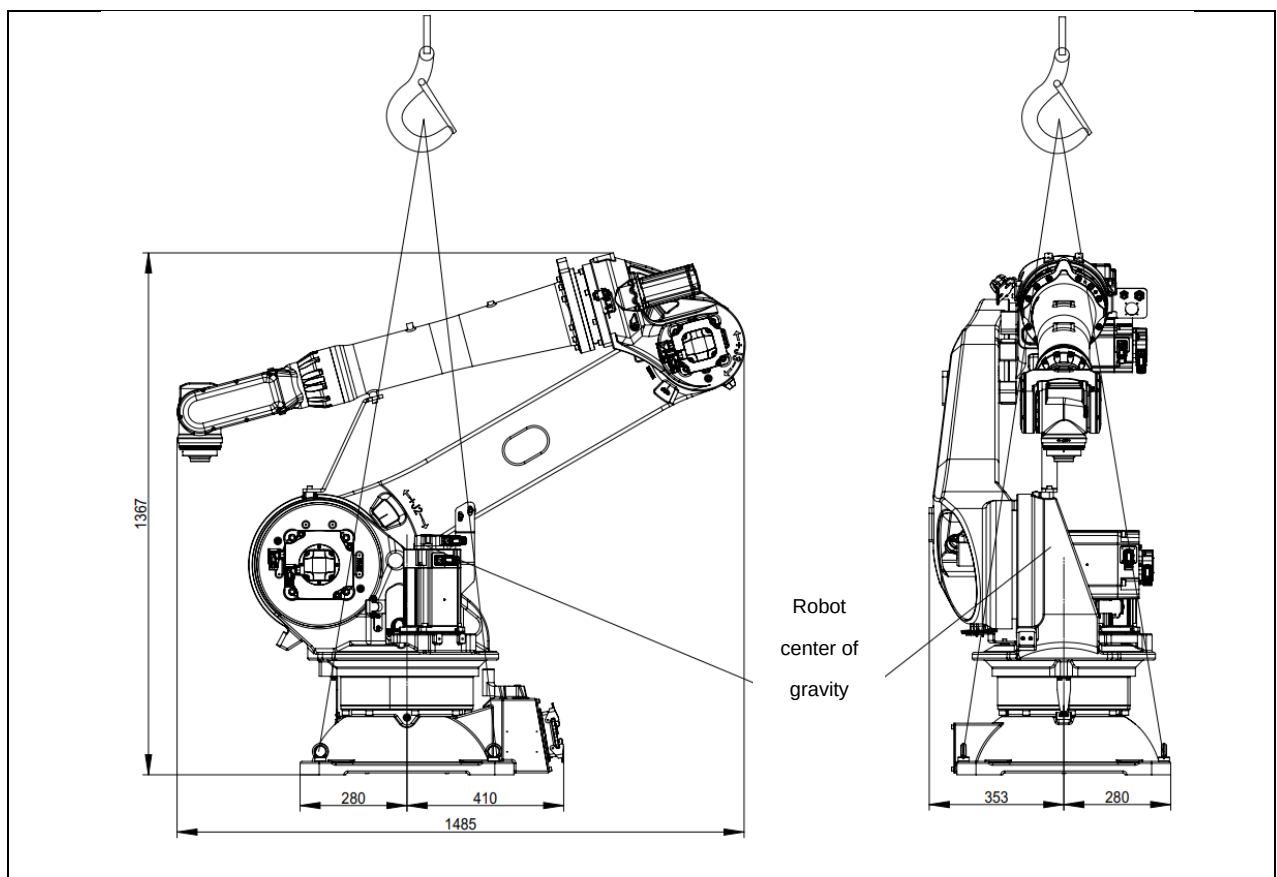


Fig 1.9 Use a crane to transport the robot (ER30B-2700-LI)

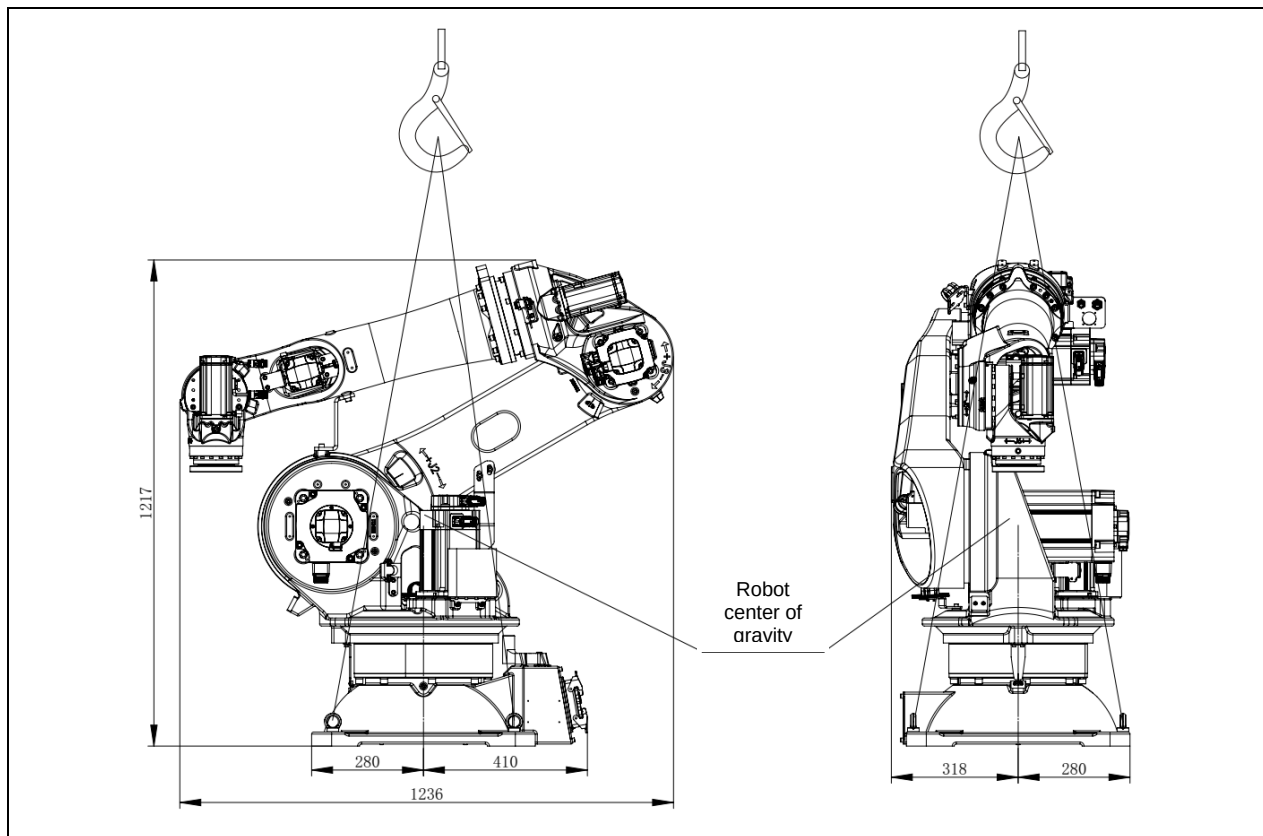


Fig 1.10 Use a crane to transport the robot (ER50B-2100, ER70B-2100-LI)

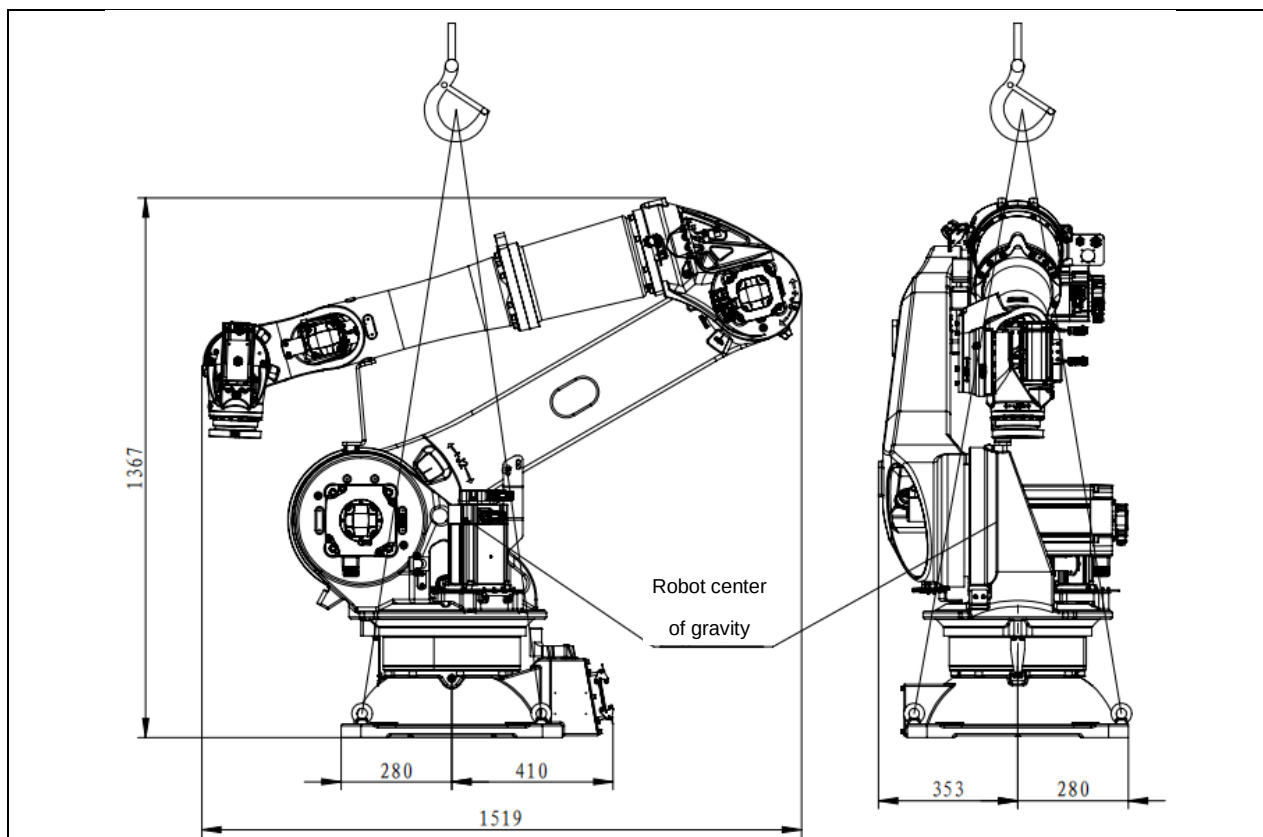


Fig 1.11 Use a crane to transport the robot (ER50B-2700)



1.2.INSTALLATION



CAUTION

Make sure the system is properly grounded before installation.

The following precautions must be fully understood and observed before installing the robot.

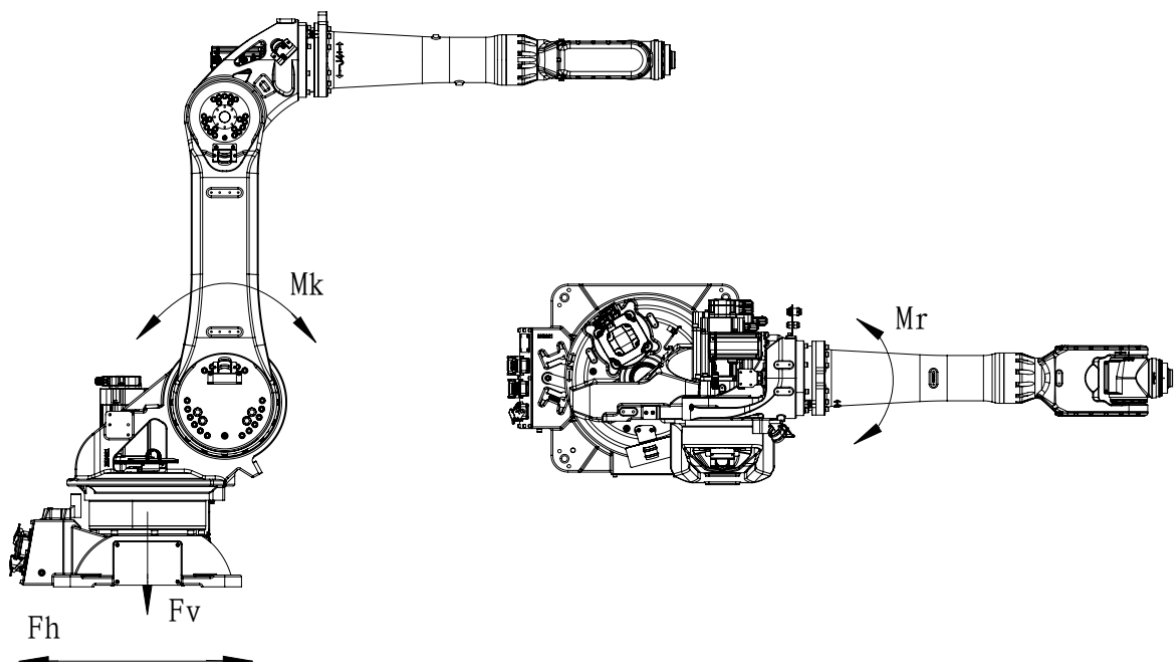
- Be sure to read and understand SAFETY chapter thoroughly.
- ESTUN robots must be transported, mounted and operated by authorized person, and in accordance with the applicable national laws, regulations and standards.
- Check the external damage of the robot package. Open the package and check the external damage of the robot.
- Make sure the weight of the robot is within the forklift or crane load capacity. Details see Section 1.1 TRANSPORTATION.
- Storage and mounting condition should be complied with Section 1.3 INSTALLATION CONDITION.



CAUTION

When mounting the robot base, consider its structure and the force upon it. Concrete on the base may not have any crack and conform to the specified codes. The bearing capacity and compaction of the concrete foundation should be in accordance with the design guideline. Concrete strength level C20/C25 should be in accordance with the following codes:

- GB50010-2010 *Code for design of concrete structures*
- ISO 1920:2007 *Standard for test method of mechanical properties on ordinary concrete*



Item	Definition	Max. value				
		ER20-2300	ER30B-2700-LI	ER50B-2100	ER50B-2700	ER70B-2100-LI
Mk	Max. overturning torque	19600 (N•m)	19600 (N•m)	19600 (N•m)	19600 (N•m)	19600 (N•m)
Mr	Max. torsional	14700 (N•m)	14700 (N•m)	14700 (N•m)	14700 (N•m)	14700 (N•m)



	torque					
Fv	Max. vertical force	28500 (N)	21250 (N)	22250 (N)	22250 (N)	22250 (N)
Fh	Max. horizontal force	15000 (N)	12000 (N)	11400 (N)	11400 (N)	11400 (N)

Fig 1.12 Robot base force

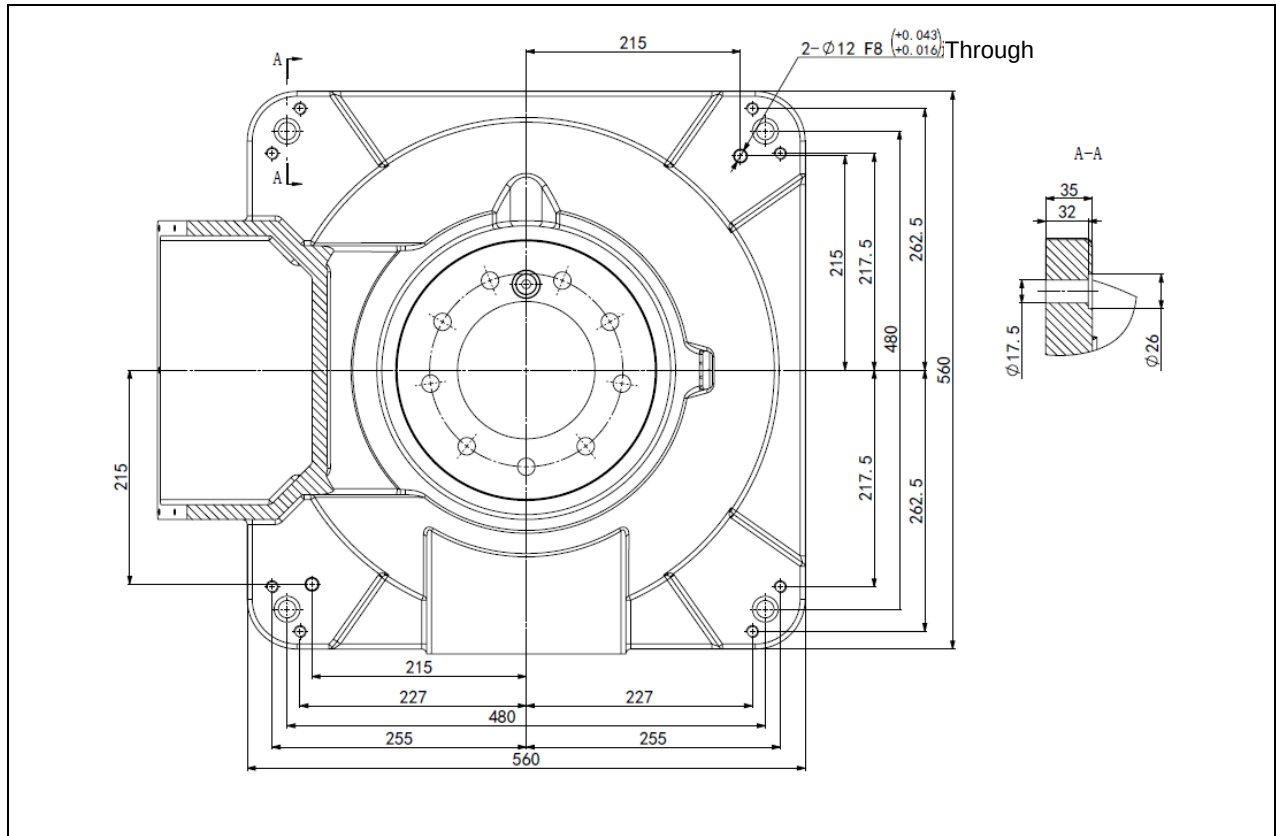


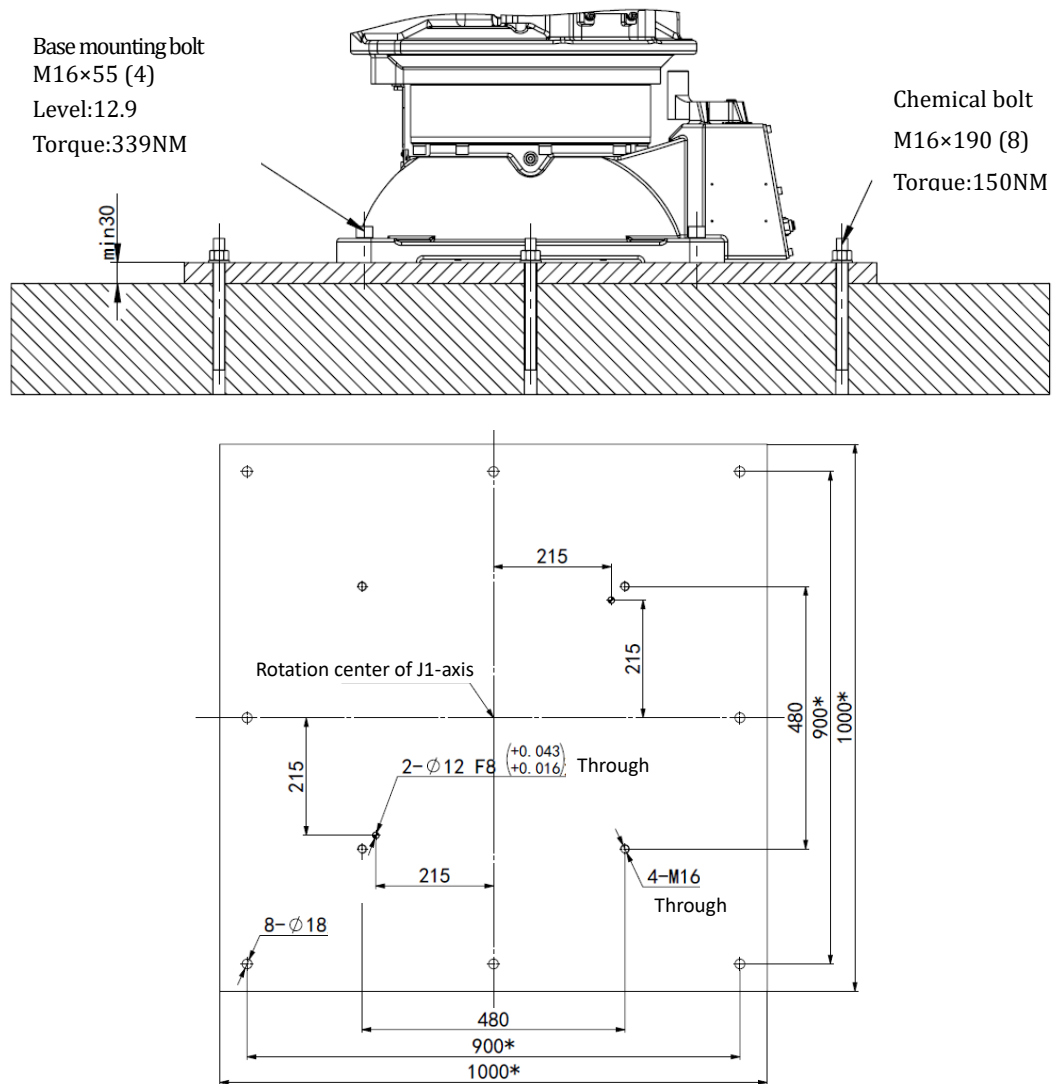
Fig 1.13 Robot base mounting dimension

Tab 1.1 Robot fixing components

Item and mode	Amount
Fixed screw: M16X55 (ISO4762 12.9 level)	4
Spring washer: spring washer 16 (DIN 7880-1987)	4
Positioning pin: cylindrical pin 12X50 (ISO 8735)	2

INFO

Positioning pin can reduce the influence on current program caused by re-installation or replacement of the robot. If the recovery of programmed path is needed, perform adjustment. If not, positioning pin can be eliminated.



Note: When installing the iron plate on the ground, secure the robot mounting plate to the concrete floor using eight M16X190 chemical bolts. The concrete thickness should be at least 160mm, with an effective area of 1000mmx1000mm. The base is fixed to the iron plate using the parts listed in the table.

The dimensions marked with * in the figure are recommended dimensions. If the user wishes to make changes, they should consider the forces exerted by the robot on the base and the structure of the base.

Fig 1.14 Robot mounting plate dimension and mounting method



1.3.INSTALLATION CONDITIONS



Damage of the cable jacket can cause water intrusion. Take care when installing the cable and exchange if it is damaged.

See the table below about installation conditions. Robot storage conditions are also listed in case that the robot needs to be stored for a period of time.

Foundation	
Max. surface roughness	0.5mm
Max. inclination angle	5°
Storage condition	
Min. ambient temperature	-25℃
Max. ambient temperature	+55℃
Max. ambient humidity	95%RH
Protection level	
ER20-2300-HI	Wrist IP65 Manipulator IP54
ER30B-2700-LI	
ER50B-2100	
ER50B-2700	
ER70B-2100-LI	

Performance of resistant chemicals and resistant solvents.

- (1) The robot cannot be used with the following liquids. Potentially these liquids will cause irreversible damage to the rubber parts (such as gaskets, oil seal, O-rings, etc.) (As exception to this only liquids approved by ESTUN can be used with the robot).
 - (a)organic solvents
 - (b)cutting oil including chlorine/gasoline
 - (c)amine type detergent
 - (d)acid, alkali and liquid causing rust
 - (e)other liquids or solutions that will harm NBR or CR rubber
- (2) When the robot works in the environment using water or liquid, complete draining of J1 base must be done. Incomplete draining of J1 base will make the robot break down.
- (3) Do not use unconfirmed liquid.
- (4) Do not use the robot immersed in water, neither temporary nor permanent. Robot must not be wet permanently. Example, in case motor surface is exposed to water for a long time, liquid may invade inside the motor and cause failure.





2. CONNECTION WITH THE CONTROLLER

The figure below shows the cables connect the robot with the controller. Connect these cables on the back of the base.

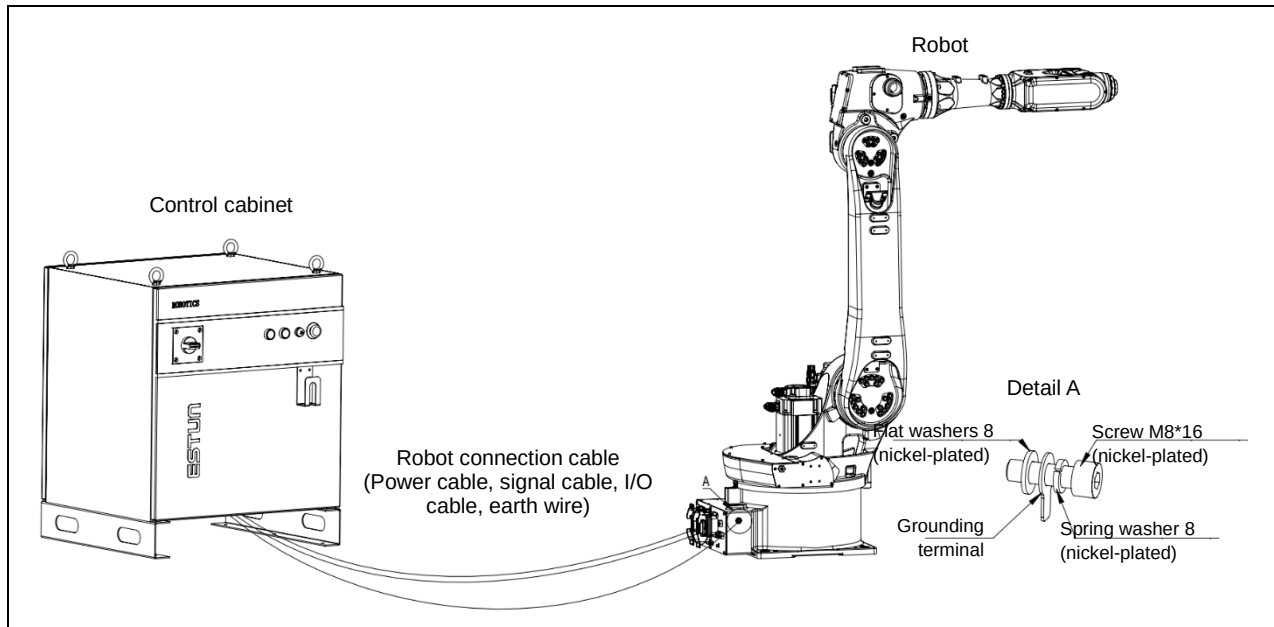


Fig 2.1 Cable connection



CAUTION

- The serial number of the robot body must match the serial number of the control cabinet, and the wrong serial number matching will lead to the accuracy deviation of the robot.
- Before connecting the power of the control device, connect the robot and the control device through the ground wire. If the ground wire has not been connected, there is a risk of electric shock.
- The grounding wire should be installed between the flat washer and the spring washer, the grounding position of the robot has a small amount of anti-rust oil, please clean it before grounding.



3. SPECIFICATIONS

3.1. ROBOT CONFIGURATION

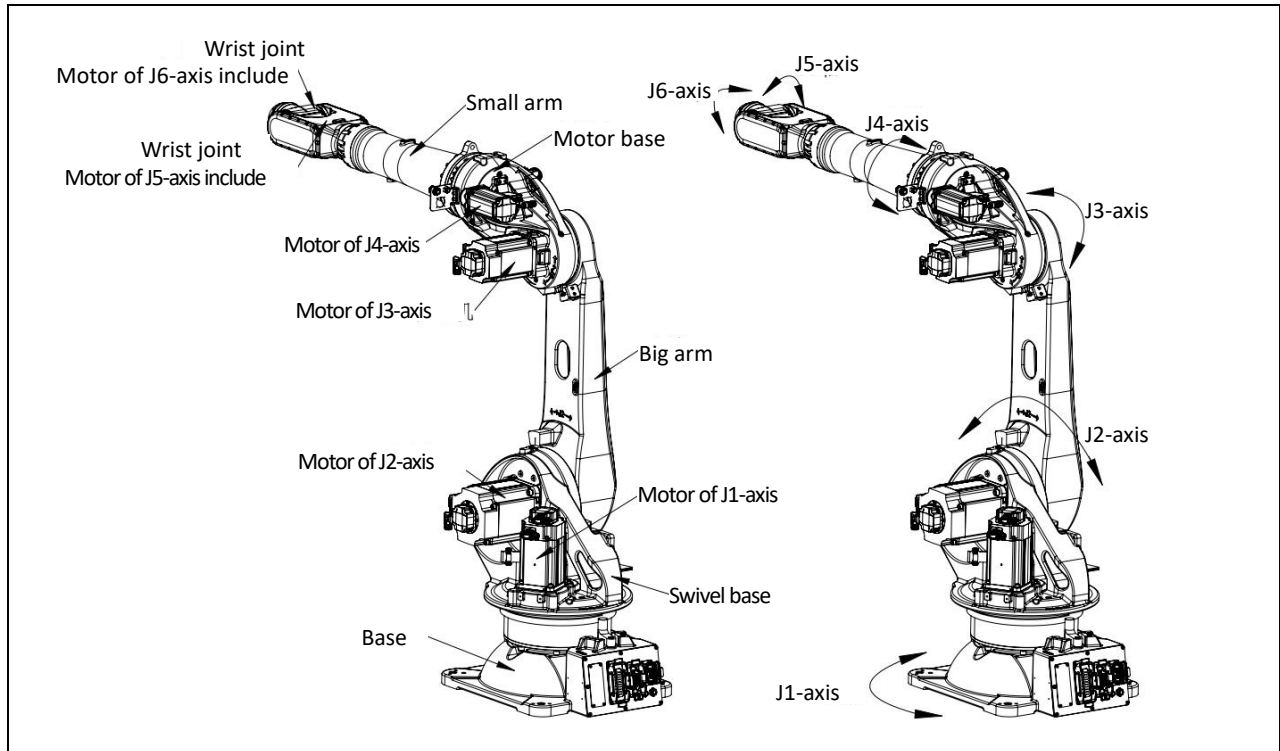


Fig 3.1 Robot Configuration (ER20-2300-HI, ER30B-2700-LI)

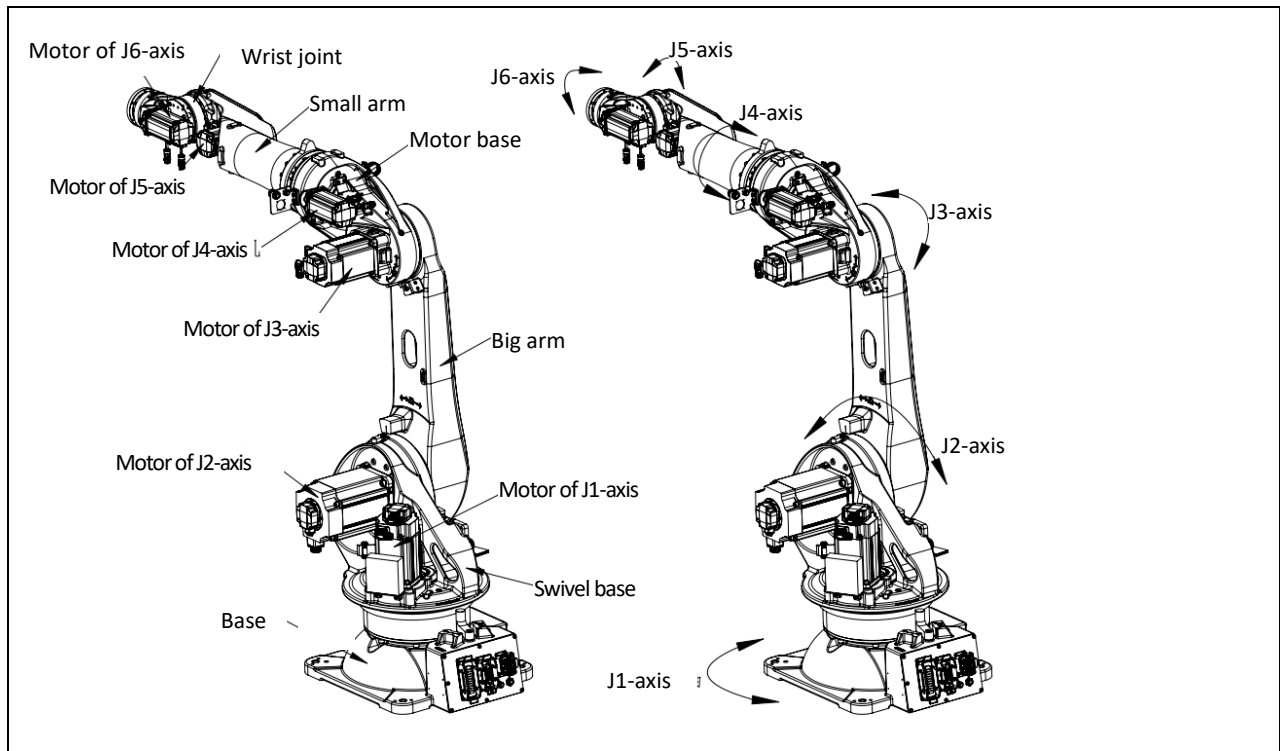


Fig 3.2 Robot Configuration (ER50B-2100, ER70B-2100-LI)

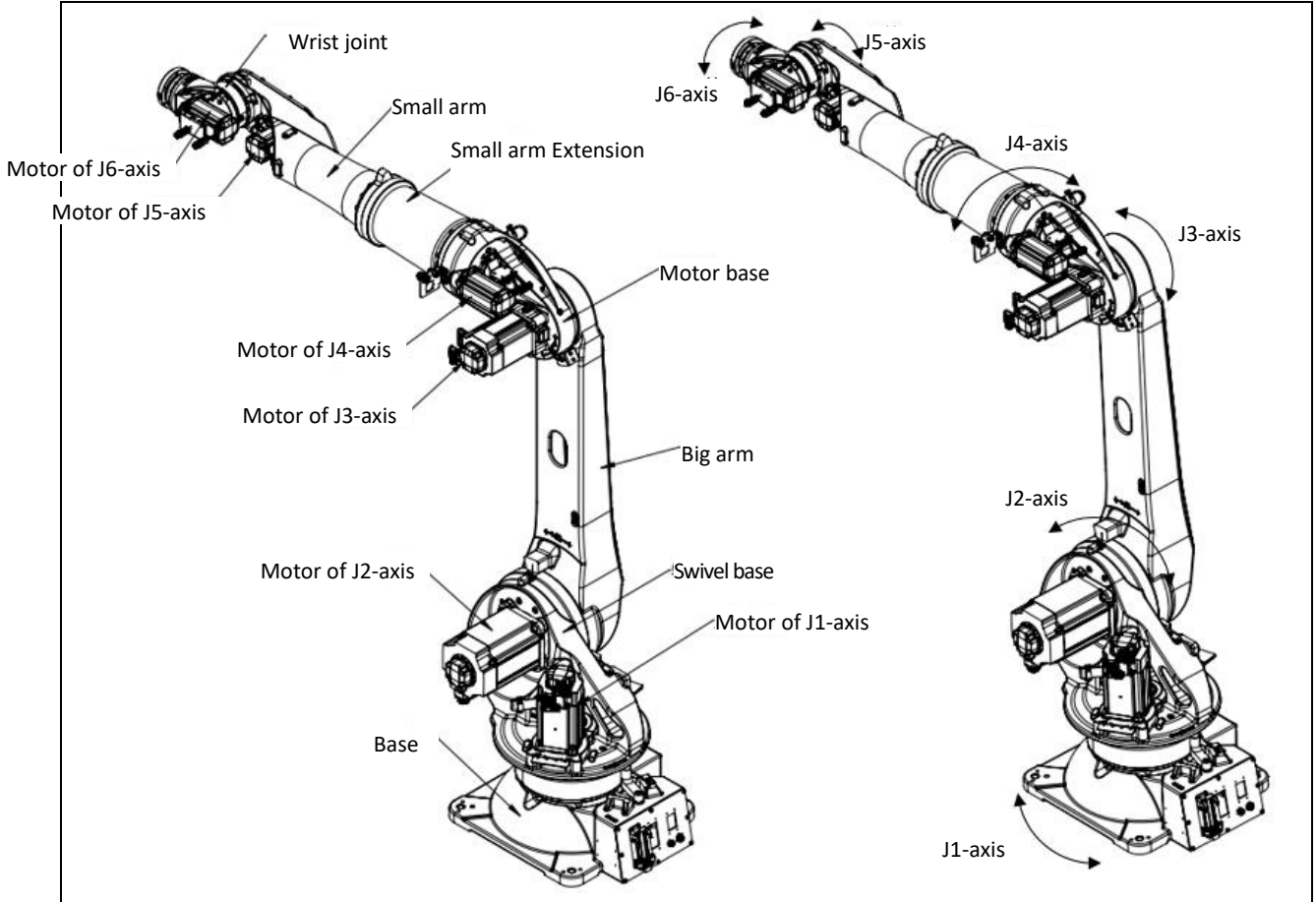


Fig 3.3 Robot Configuration (ER50B-2700)

Tab 3.1 Specifications

Model		ER20-2300-HI	ER30B-2700-LI	ER50B-2100	ER50B-2700	ER70B-2100-LI
Type		Articulated robot				
Controlled axes		6 axes				
Installation		Floor/Top				
Motion range	J1-axis	$\pm 180^\circ$	$\pm 180^\circ$	$\pm 180^\circ$	$\pm 180^\circ$	$\pm 180^\circ$
	J2-axis	$-90^\circ \sim +135^\circ$	$-90^\circ \sim +135^\circ$	$-90^\circ \sim +135^\circ$	$-90^\circ \sim +135^\circ$	$-90^\circ \sim +135^\circ$
	J3-axis	$-185^\circ \sim +80^\circ$	$-185^\circ \sim +80^\circ$	$-185^\circ \sim +80^\circ$	$-185^\circ \sim +80^\circ$	$-185^\circ \sim +80^\circ$
	J4-axis	$\pm 200^\circ$	$\pm 200^\circ$	$\pm 200^\circ$	$\pm 200^\circ$	$\pm 200^\circ$
	J5-axis	$\pm 130^\circ$	$\pm 130^\circ$	$\pm 130^\circ$	$\pm 130^\circ$	$\pm 130^\circ$
	J6-axis	$\pm 360^\circ$	$\pm 360^\circ$	$\pm 360^\circ$	$\pm 360^\circ$	$\pm 360^\circ$
Max. speed (Note 1)	J1-axis	172°/s	172°/s	172°/s	172°/s	172°/s
	J2-axis	119°/s	134°/s	119°/s	134°/s	134°/s
	J3-axis	206°/s	186°/s	186°/s	186°/s	186°/s
	J4-axis	255°/s	255°/s	255°/s	255°/s	245°/s
	J5-axis	330°/s	330°/s	254°/s	253°/s	245°/s
	J6-axis	407°/s	407°/s	366°/s	367°/s	355°/s
Max	At	20kg	30kg	50kg	50kg	70kg



payload	wrist					
Allowable load inertia at wrist	J4-axis	7.7 kg·m ²	3.95 kg·m ²	30 kg·m ²	30 kg·m ²	30 kg·m ²
	J5-axis	7.7 kg·m ²	3.95 kg·m ²	30 kg·m ²	30 kg·m ²	30 kg·m ²
	J6-axis	5.82 kg·m ²	1.57 kg·m ²	12 kg·m ²	22 kg·m ²	12 kg·m ²
Allowable load torque at wrist	J4-axis	62.1N·m	101.4N·m	216N·m	216N·m	308N·m
	J5-axis	62.1N·m	101.4N·m	216N·m	216N·m	308N·m
	J6-axis	19.6N·m	58.8N·m	130N·m	130N·m	150N·m
Drive method		Electric servo drive by AC servo motor				
Repeatability		±0.03mm	±0.05mm	±0.05mm	±0.05mm	±0.05mm
Reach		2303mm	2700mm	2110mm	2700mm	2110mm
Weight		502kg	520kg	522kg	550kg	522kg
Installation environment		Ambient temperature: 0~45°C (Note 2) Ambient humidity: 20~80%RH Height: up to 1000 meters above the sea level required Vibration acceleration: 4.9m/s ² (0.5G) or less Free of corrosive gases (Note 3)				

(Note 1) During short distance motions, the axis speed may not reach the maximum value stated. The maximum speed is measured at zero position of the robot, and will be limited by the position of other axes.

(Note 2) When the robot is used in low temperature environment that is near 0°C or not operated for a long time in the environment that is less than 0°C in a holiday or the night, collision detection alarm may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

(Note 3) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other foreign substances.

3.2.EXTERNAL DIMENSIONS AND OPERATING SPACE

The following figures show the robot operating space, for the reference of robot installation. When install peripheral devices, be careful not to interfere with the robot and its motion range.



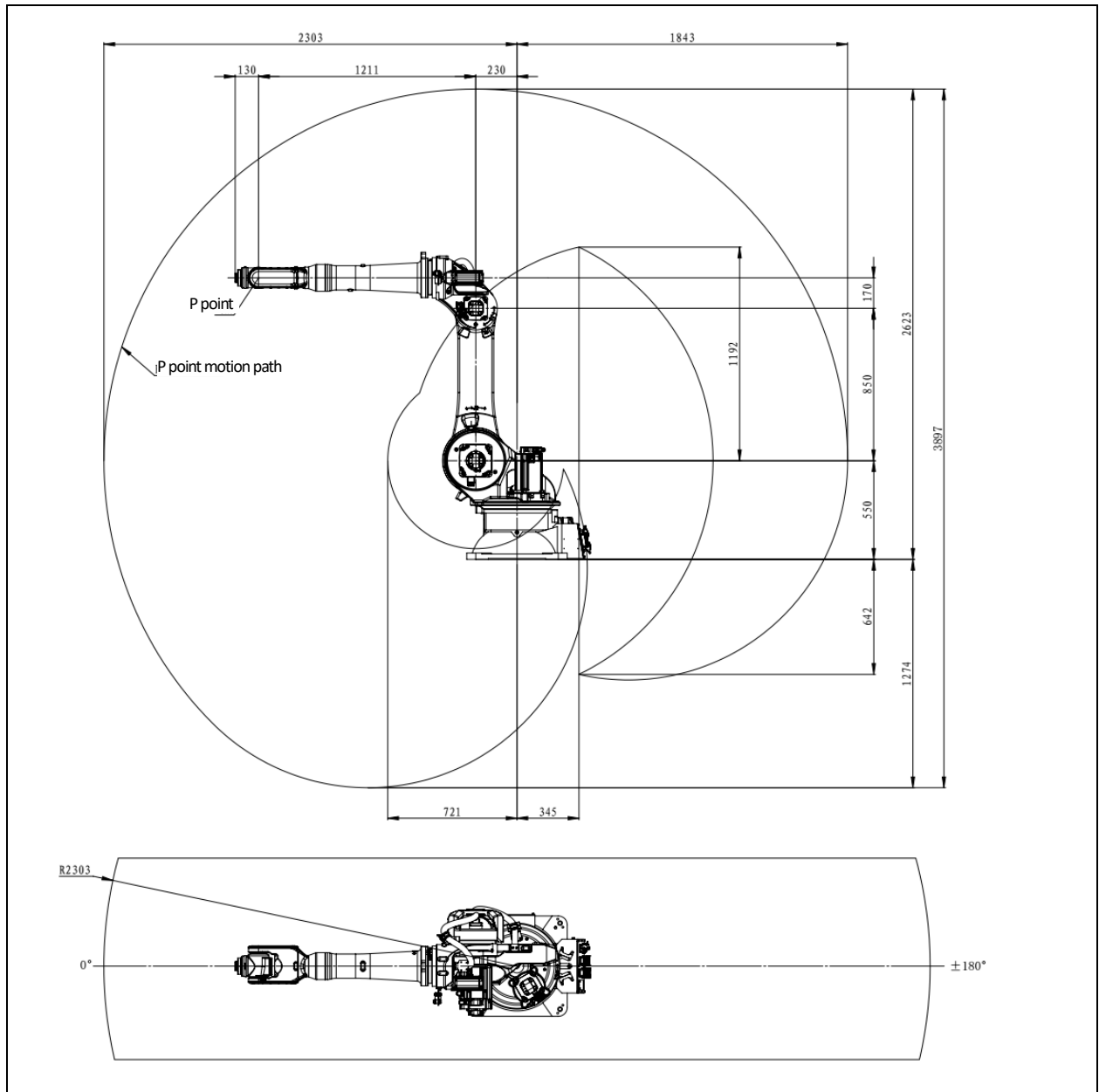


Fig 3.4 Motion range (ER20-2300-HI)

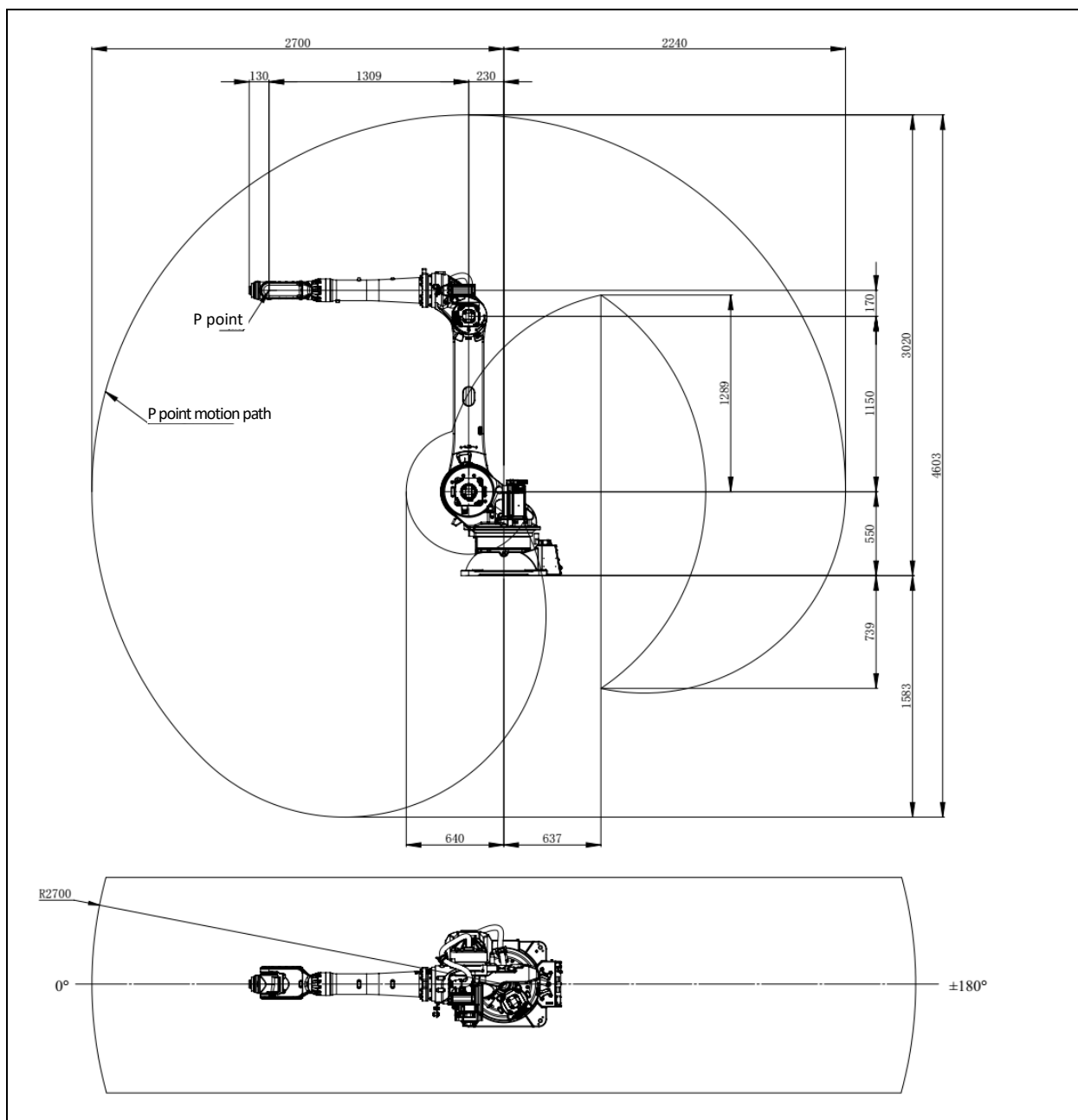


Fig 3.5 Motion range (ER30B-2700-LI)

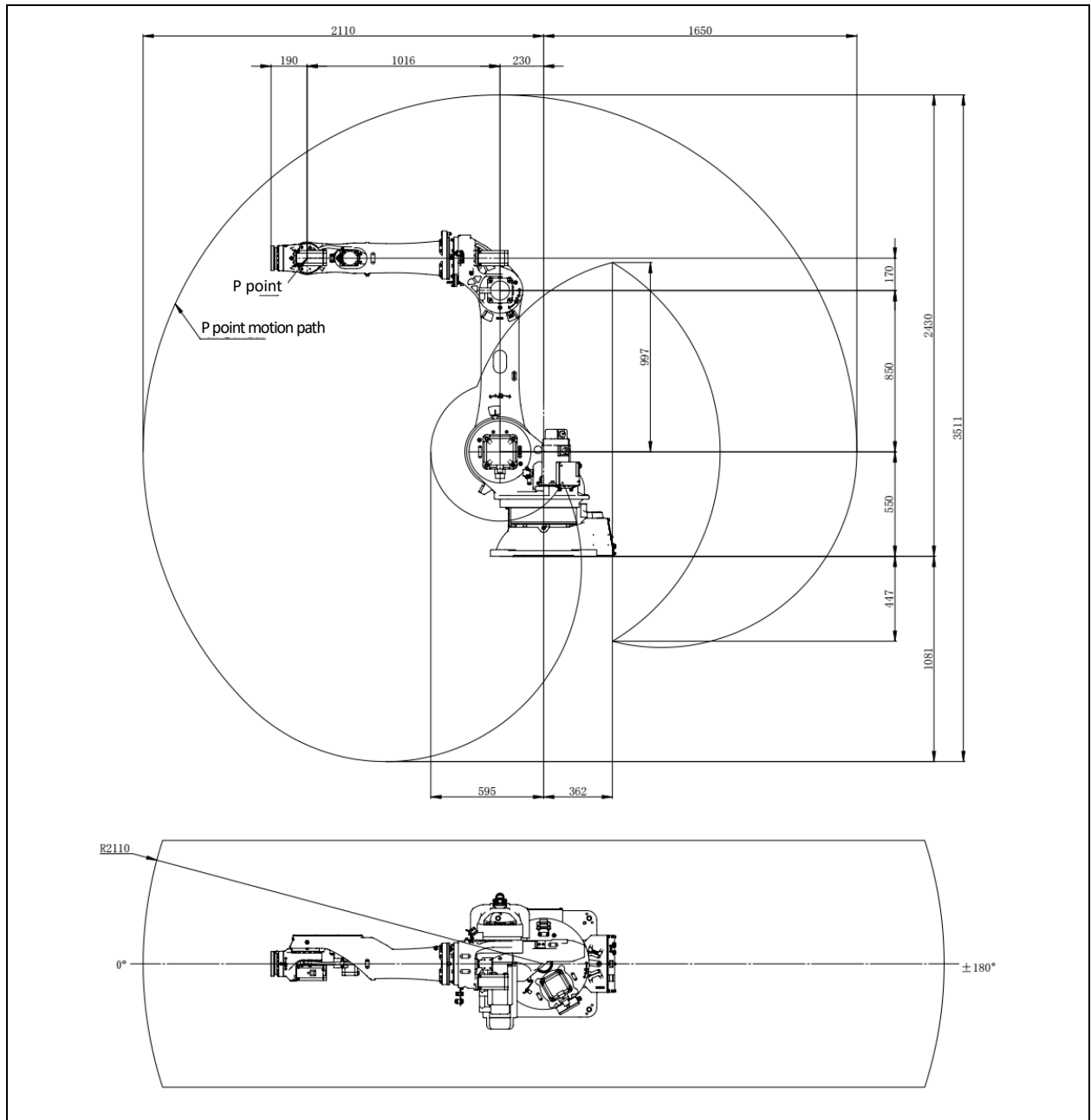


Fig 3.6 Motion range (ER50B-2100, ER70B-2100-LI)

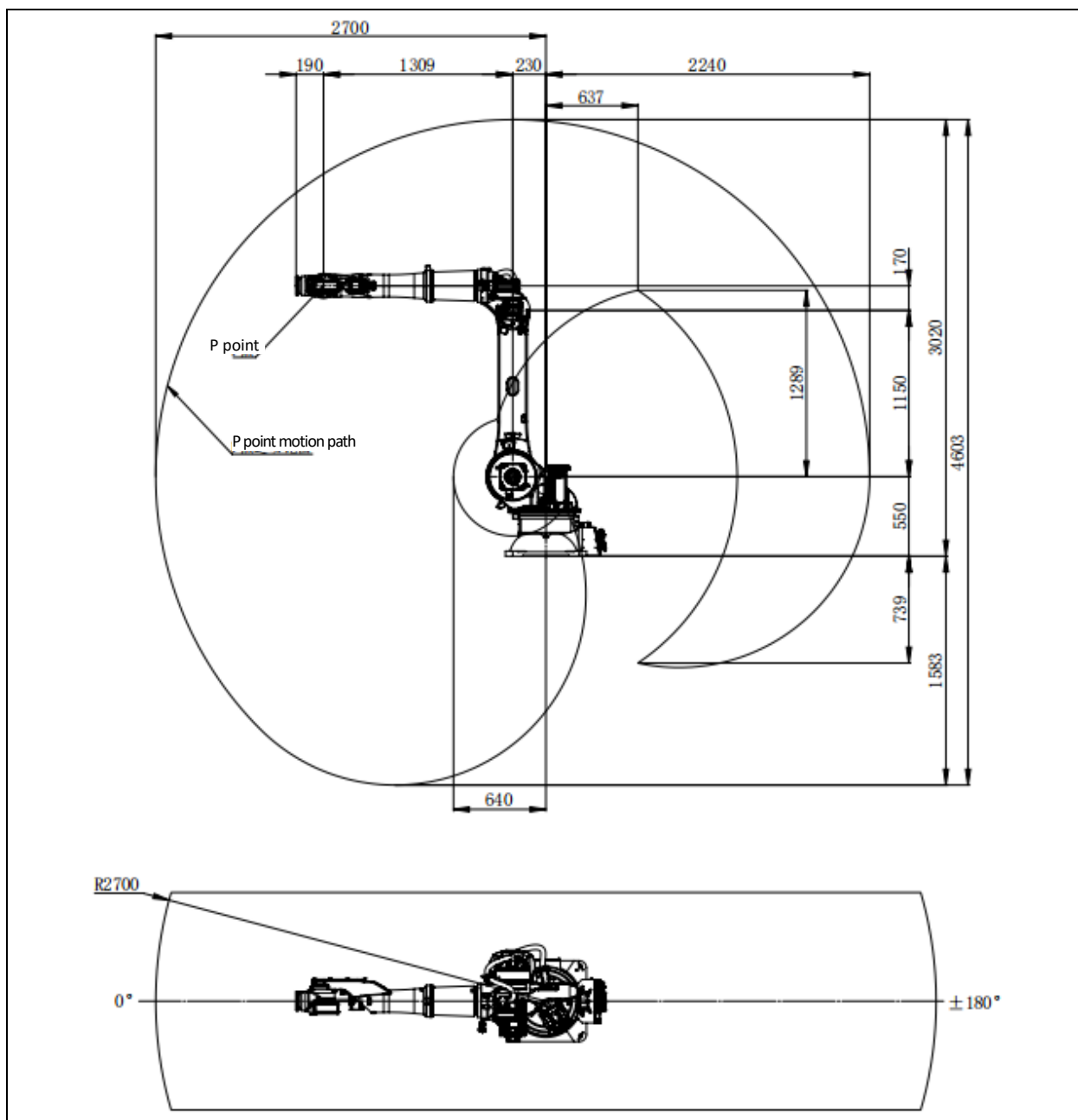


Fig 3.7 Motion range (ER50B-2700)



3.3.ZERO POINT POSITION AND MOTION LIMIT

Zero point and motion range are provided for each controlled axis. Exceeding the software motion limit of a controlled axis is called overtravel (OT). Overtravel is detected at both ends of the motion limit for each axis. The robot cannot exceed the motion range unless there is a loss of zero point position due to abnormalities in servo system or system error. In addition, the motion range limit by a fixed mechanical stopper is also prepared to improve safety.

**CAUTION**

Do not reconstruct the fixed mechanical stopper. There is a possibility that the robot doesn't stop normally.

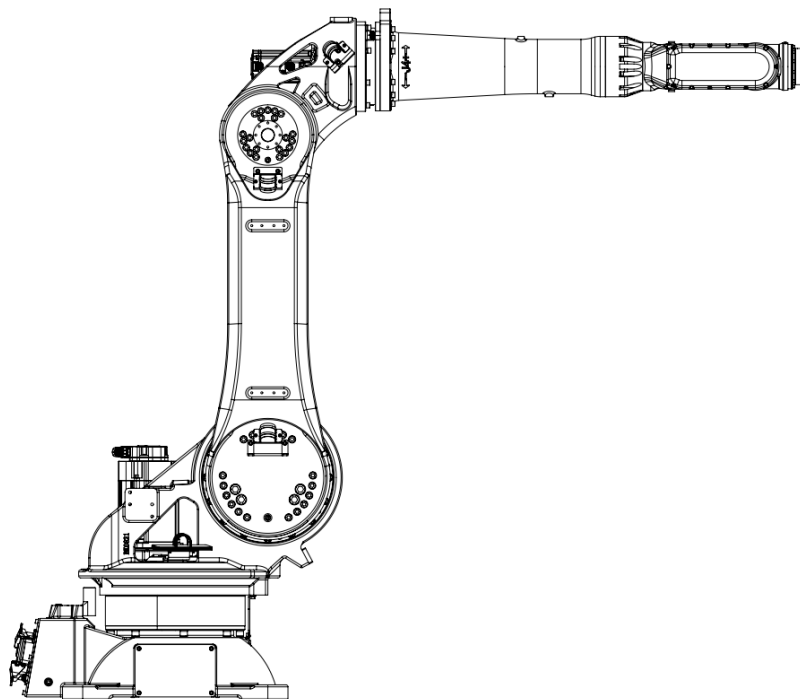


Fig 3.8 Zero point position (ER20-2300-HI, ER30B-2700-LI)



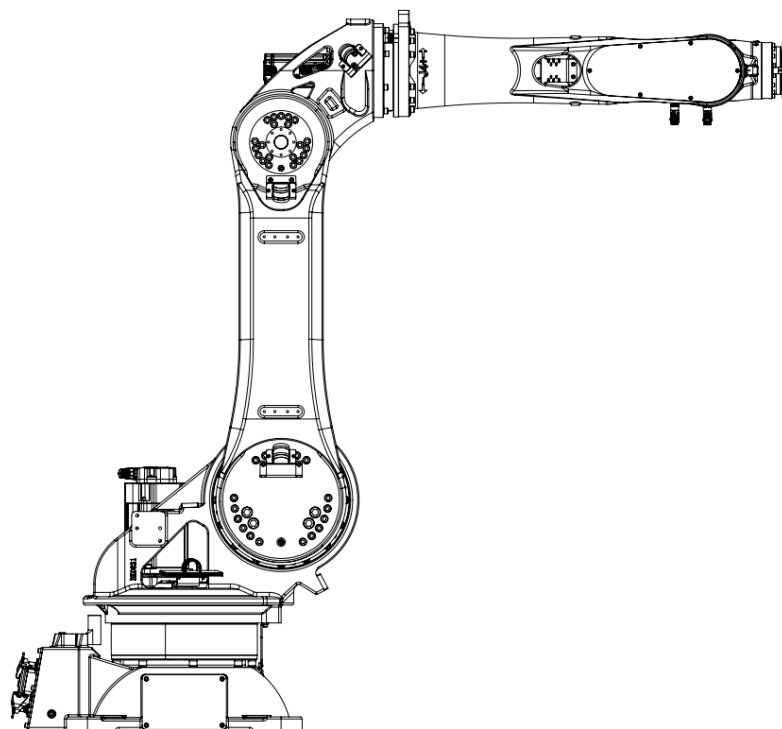


Fig 3.9 Zero point position (ER50B-2100, ER70B-2100-LI)

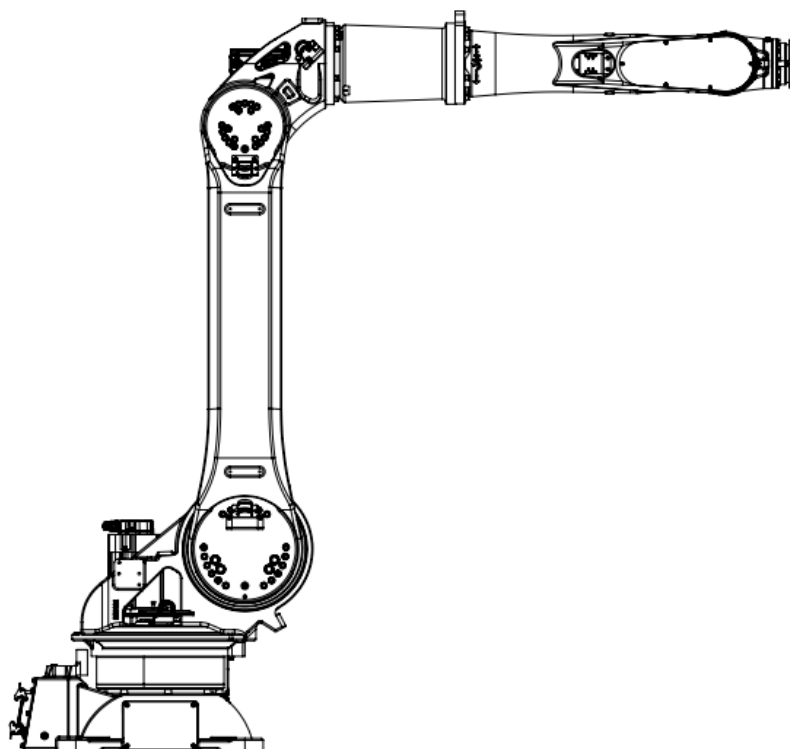


Fig 3.10 Zero point position (ER50B-2700)

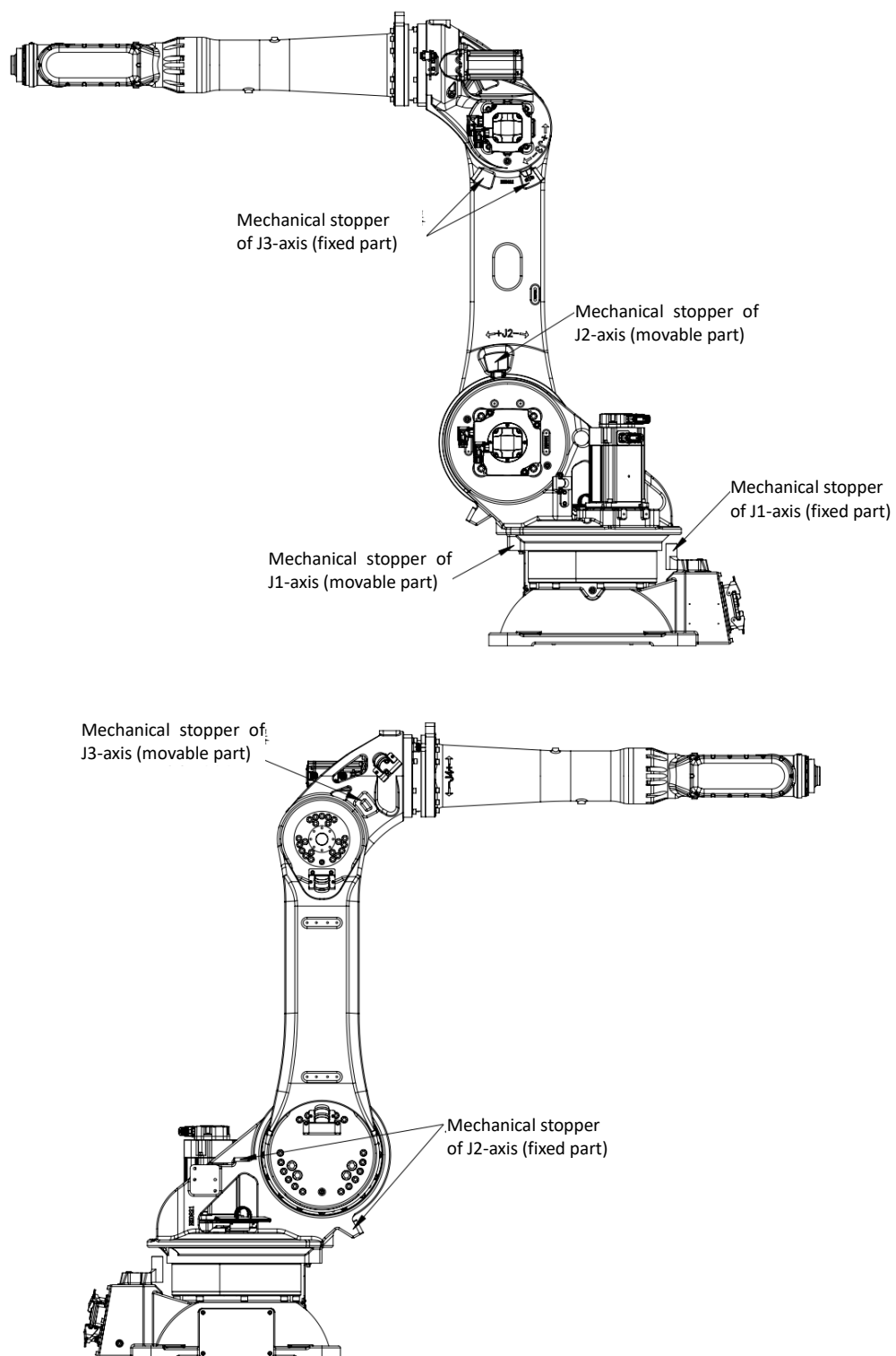


Fig 3.11 J1-axis mechanical stoppers (ER20-2300-HI, ER30B-2700-LI)

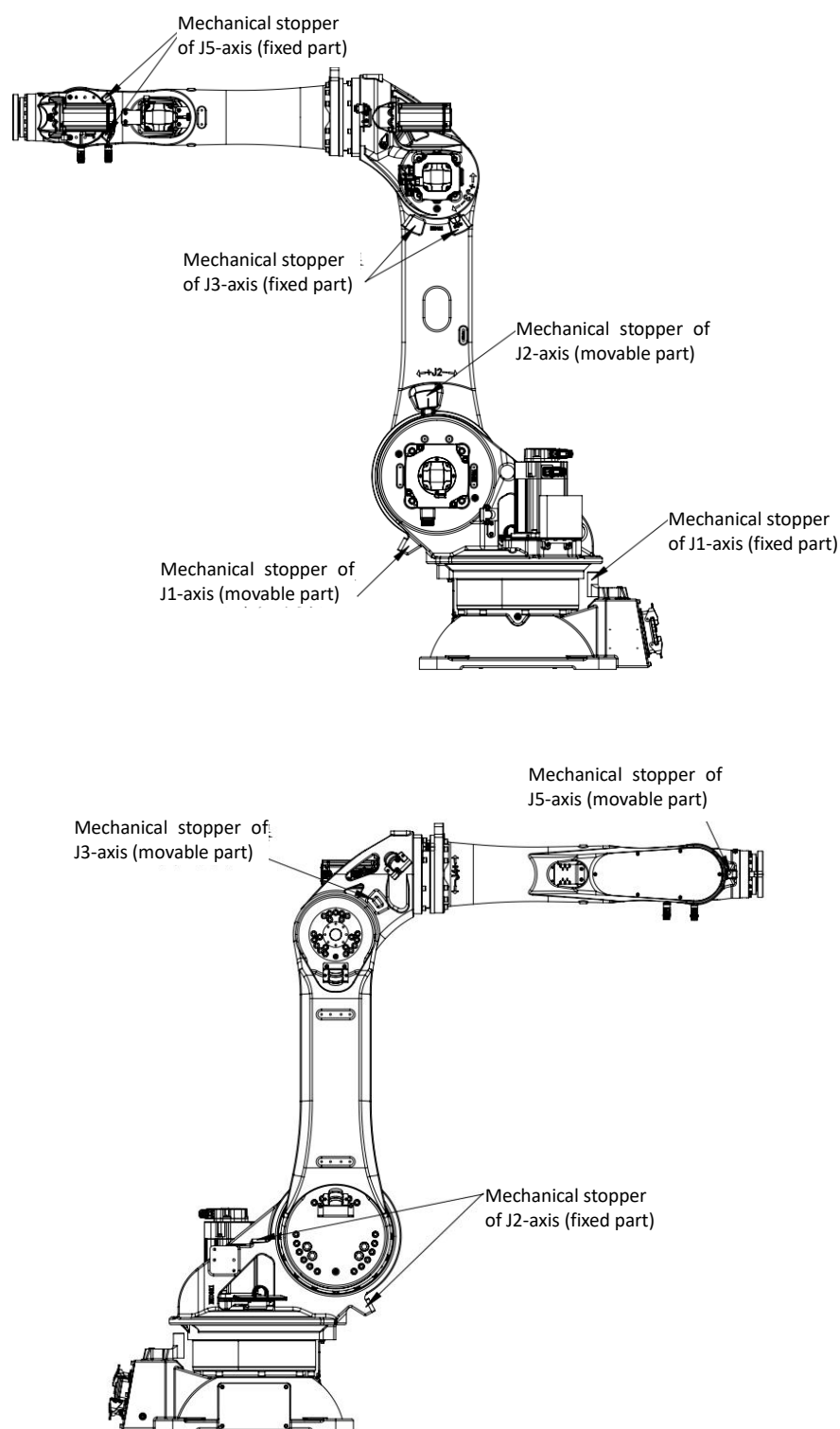


Fig 3.12 J1-axis mechanical stoppers (ER50B-2100, ER70B-2100-LI)

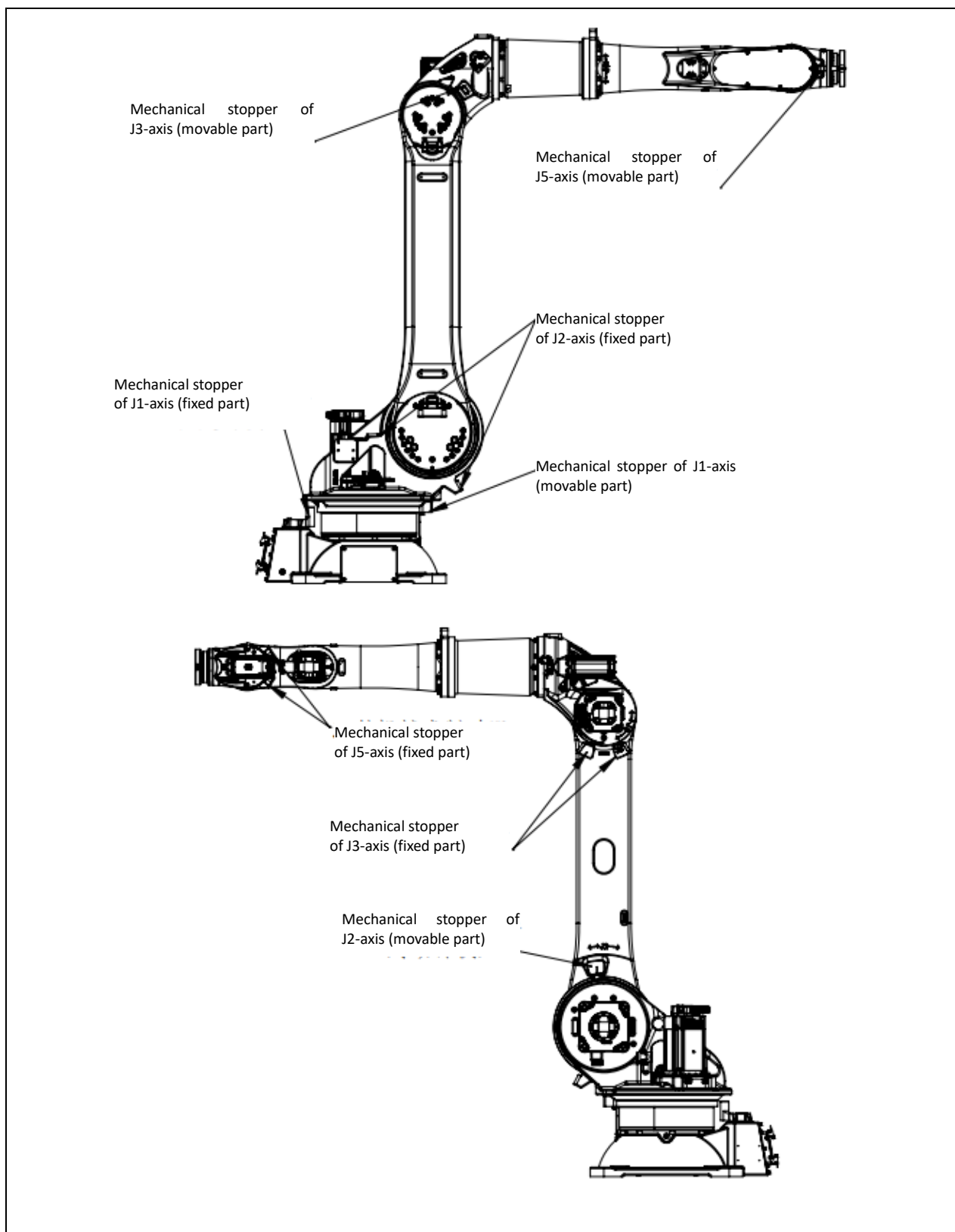


Fig 3.13 J1-axis mechanical stoppers (ER50B-2700)

Refer to system operation manual for more information about setting motion range.



3.4. WRIST LOAD CONDITION

Robot load capacity (including weight of gripper or welding gun) coincides with robot model. Observe restrict of load torque and load inertia strictly.



CAUTION

Overload the robot may result in a worse movement performance on the robot or a reduction of service time on the reducer.

Payloads include total weight of tools such as grippers, welding guns, tool convertors, dampers, etc. If payload exceeds allowable value, it is necessary to consult ESTUN representatives.

Refer to *ESTUN robot bearing capacity calculation table* when calculate load torque and load inertia. Contact ESTUN sales representatives for more detail.

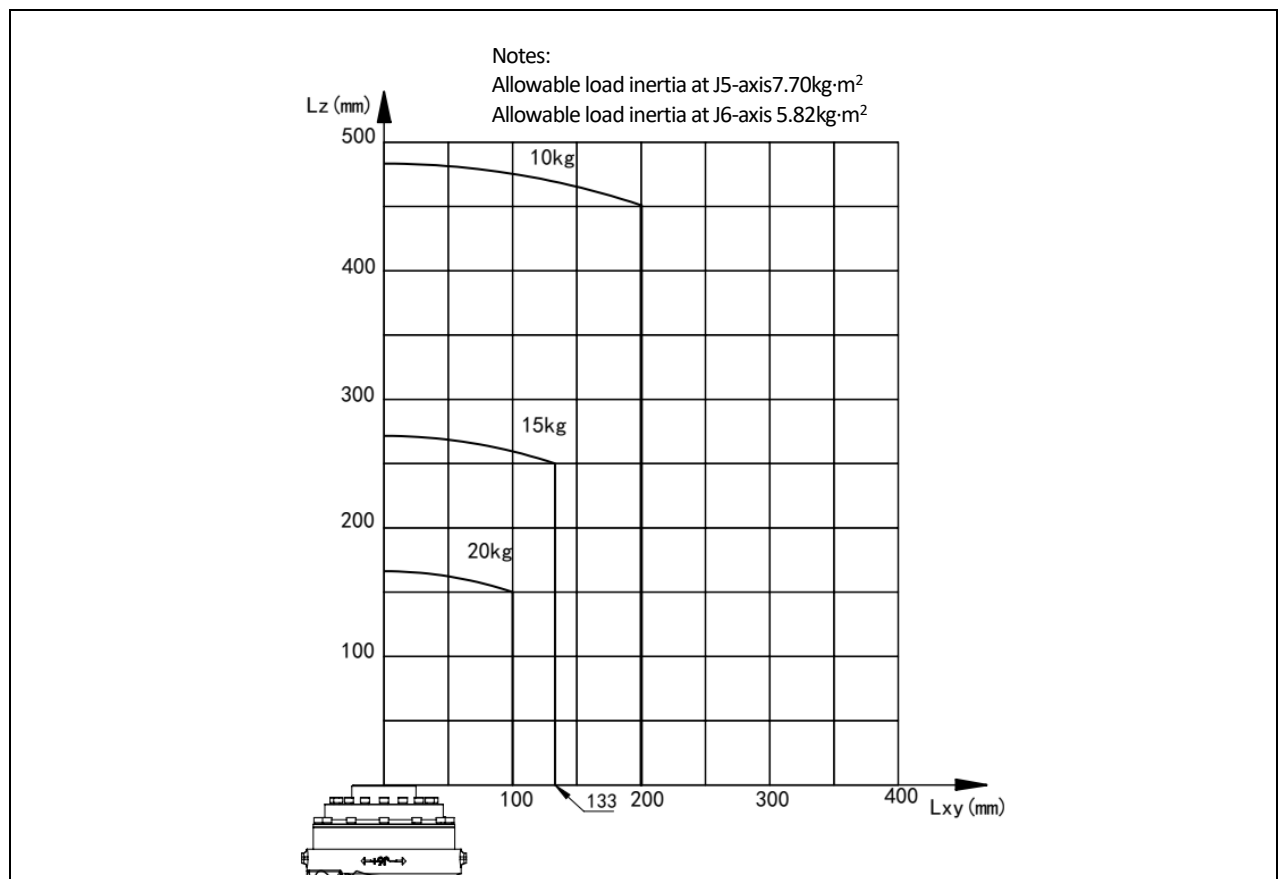


Fig 3.14 Load capacity at wrist (ER20-2300-HI)



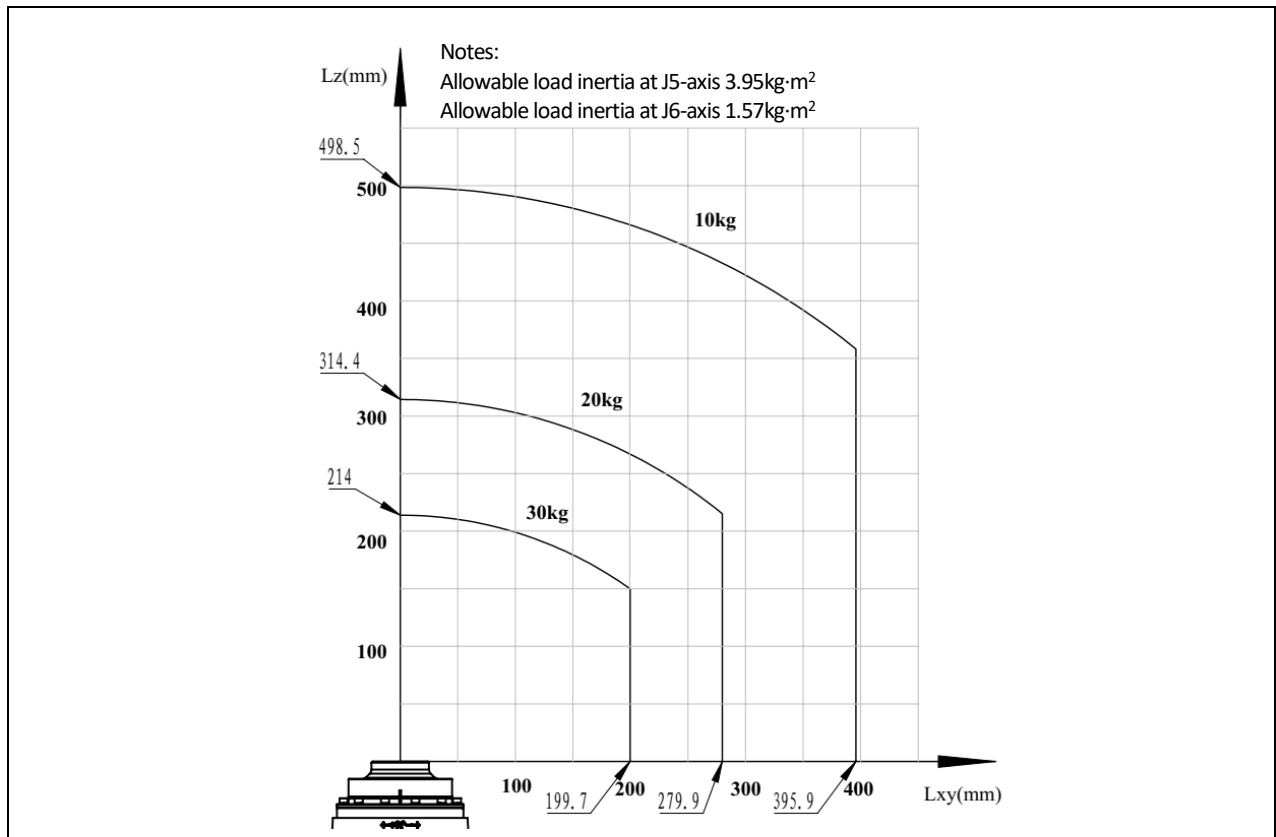


Fig 3.15 Load capacity at wrist (ER30B-2700-LI)

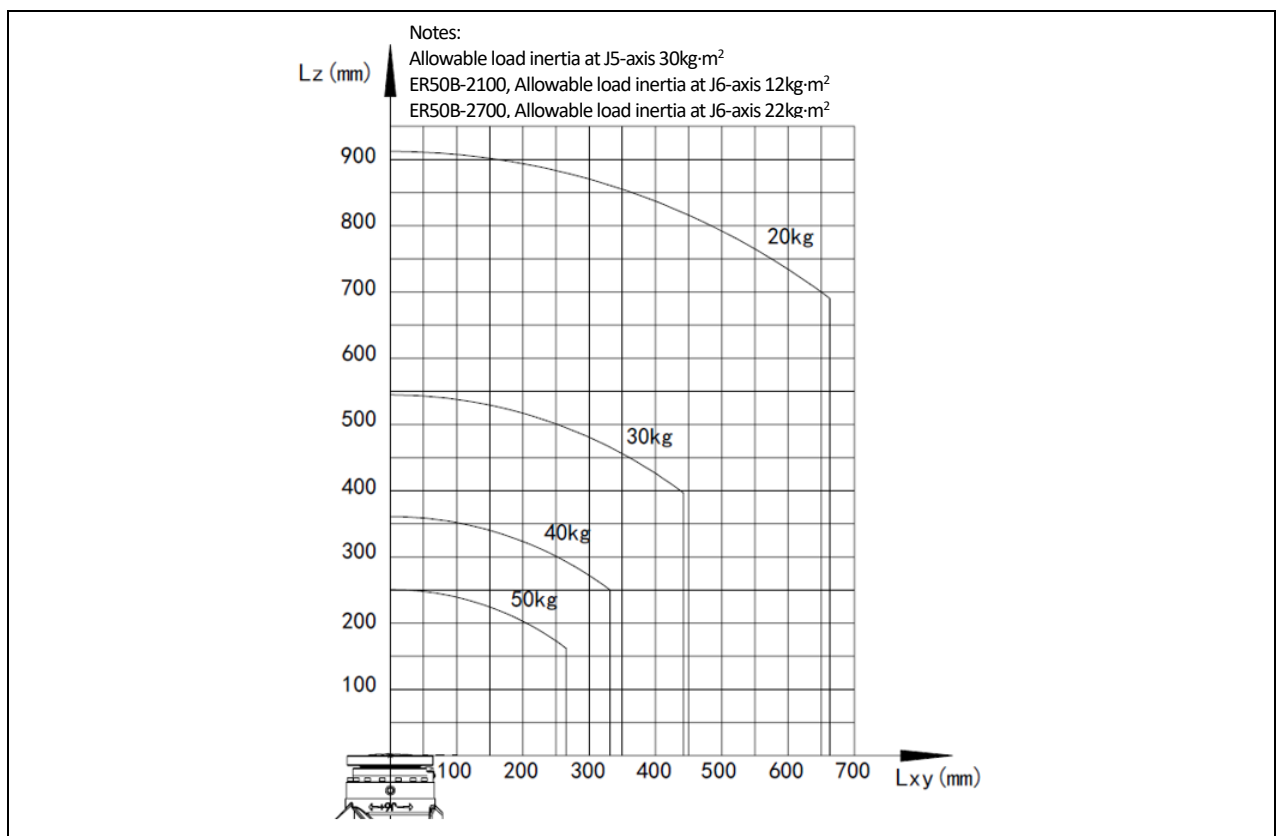


Fig 3.16 Load capacity at wrist (ER50B-2100, ER50B-2700)



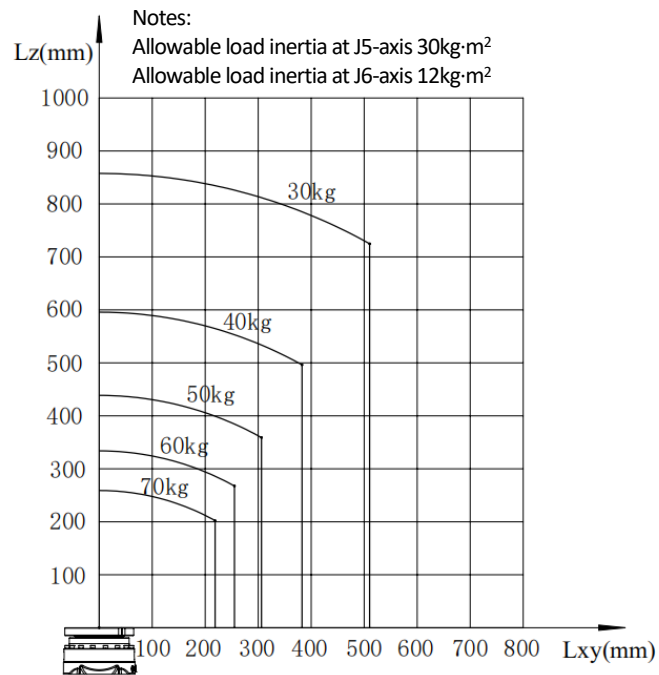


Fig 3.17 Load capacity at wrist (ER70B-2100-LI)



4. EQUIPMENT INSTALLATION TO THE ROBOT

4.1.FLANGE DIMENSION

This section describes the mounting face dimension of the end effector. Consider the depth of the screw holes and pin holes sufficiently before choose the length of the bolts and pins. Antirust measures of screws, grippers, etc., should be considered as well.

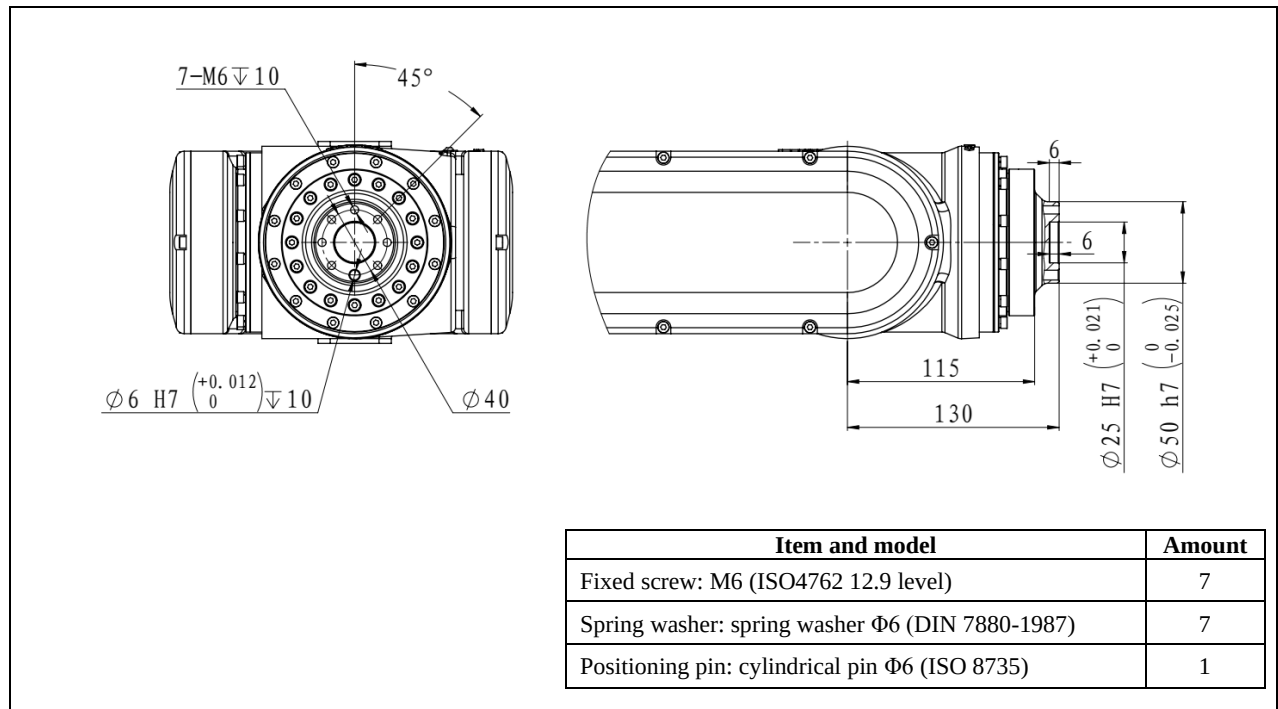
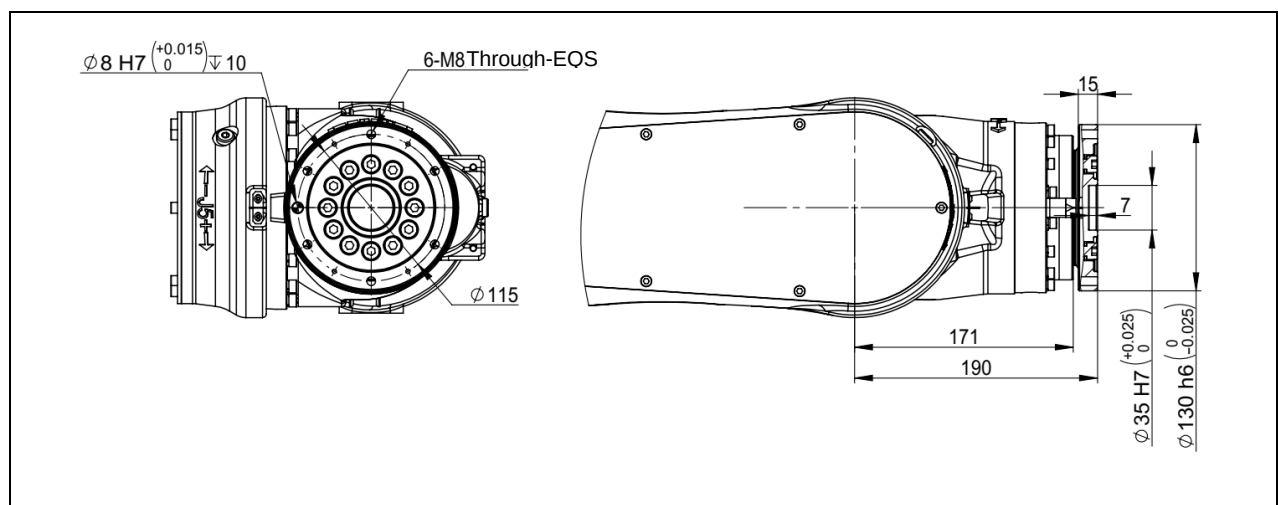


Fig 4.1 End flange mounting dimension (ER20-2300-HI, ER30B-2700-LI)





	Item and model	Amount
	Fixed screw: M8 (ISO4762 12.9 level)	6
	Spring washer: spring washer $\Phi 8$ (DIN 7880-1987)	6
	Positioning pin: cylindrical pin $\Phi 8$ (ISO 8735)	1

Fig 4.2 End flange mounting dimension (ER50B-2100, ER50B-2700, ER70B-2100-LI)

4.2.EQUIPMENT MOUNTING FACE

As shown in the figures below, tapped holes are provided to install equipment to the robot.



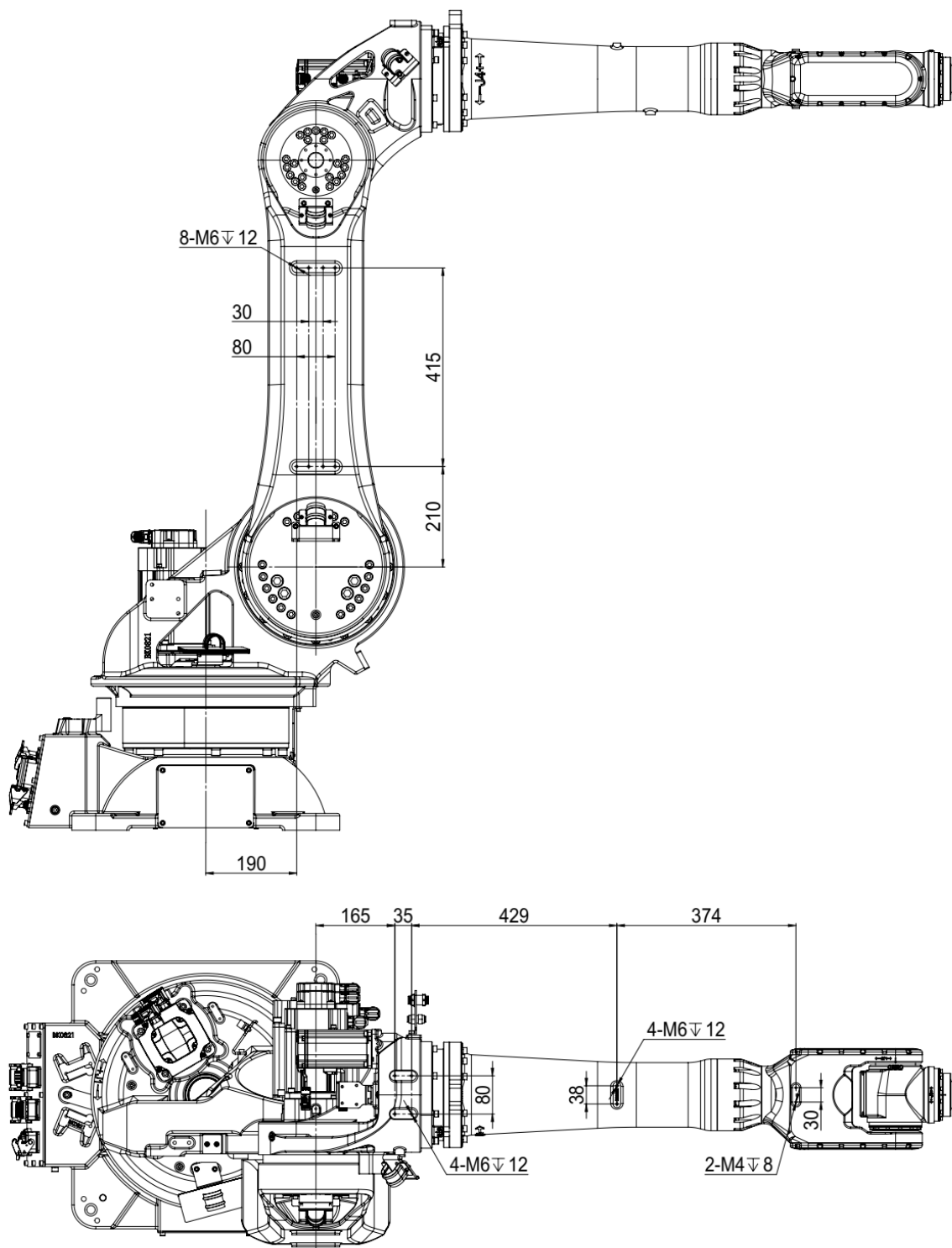


Fig 4.3 Equipment mounting face (ER20-2300-HI)

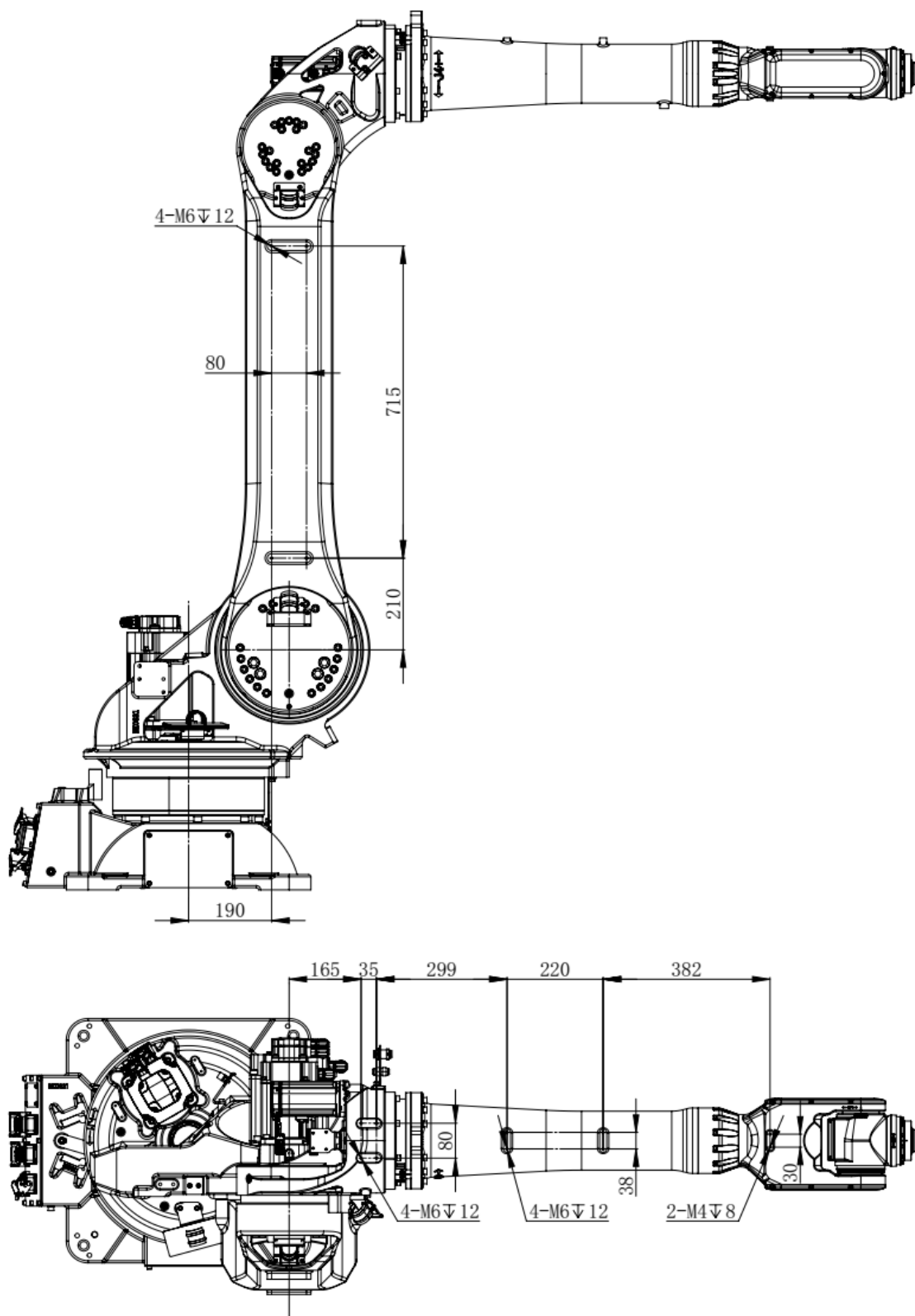


Fig 4.4 Equipment mounting face (ER30B-2700-LI)

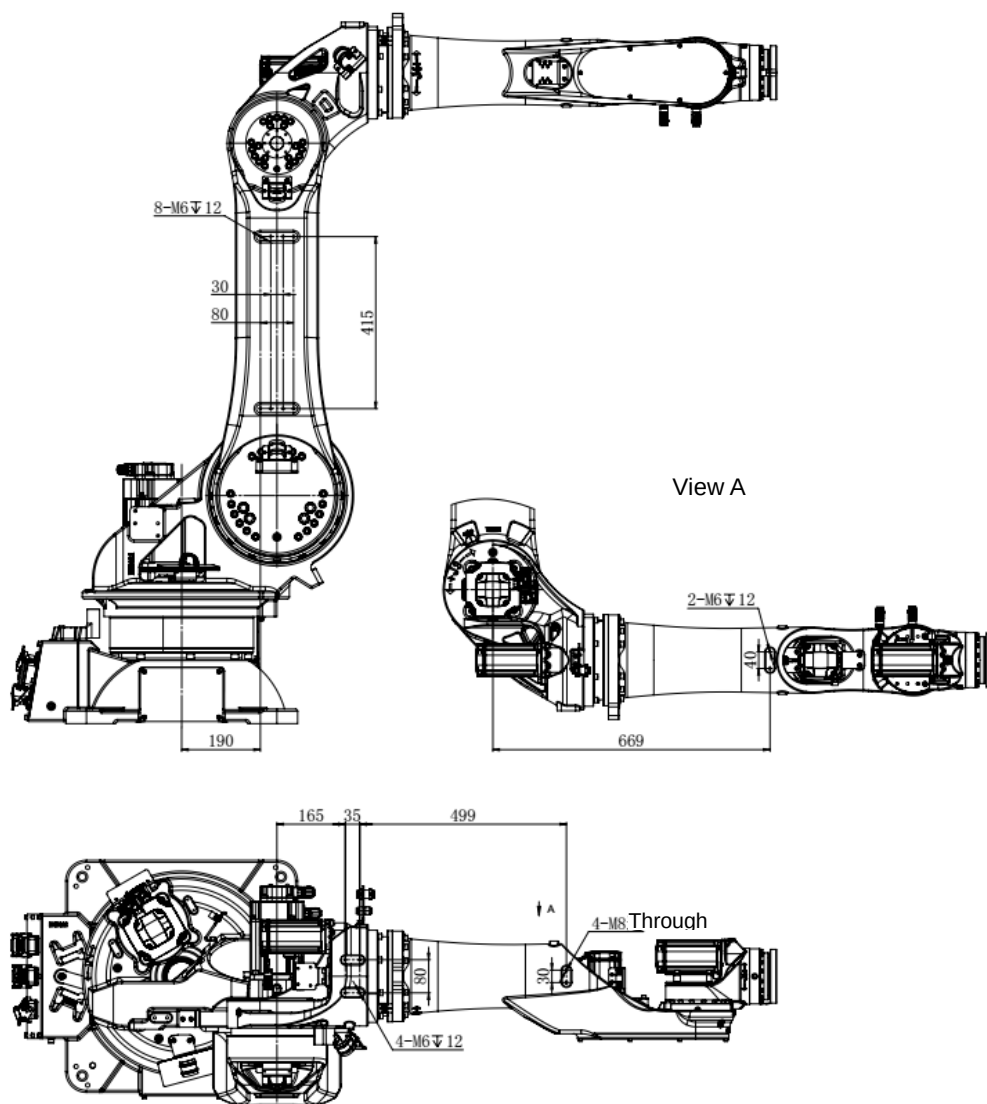


Fig 4.5 Equipment mounting face (ER50B-2100, ER70B-2100-LI)

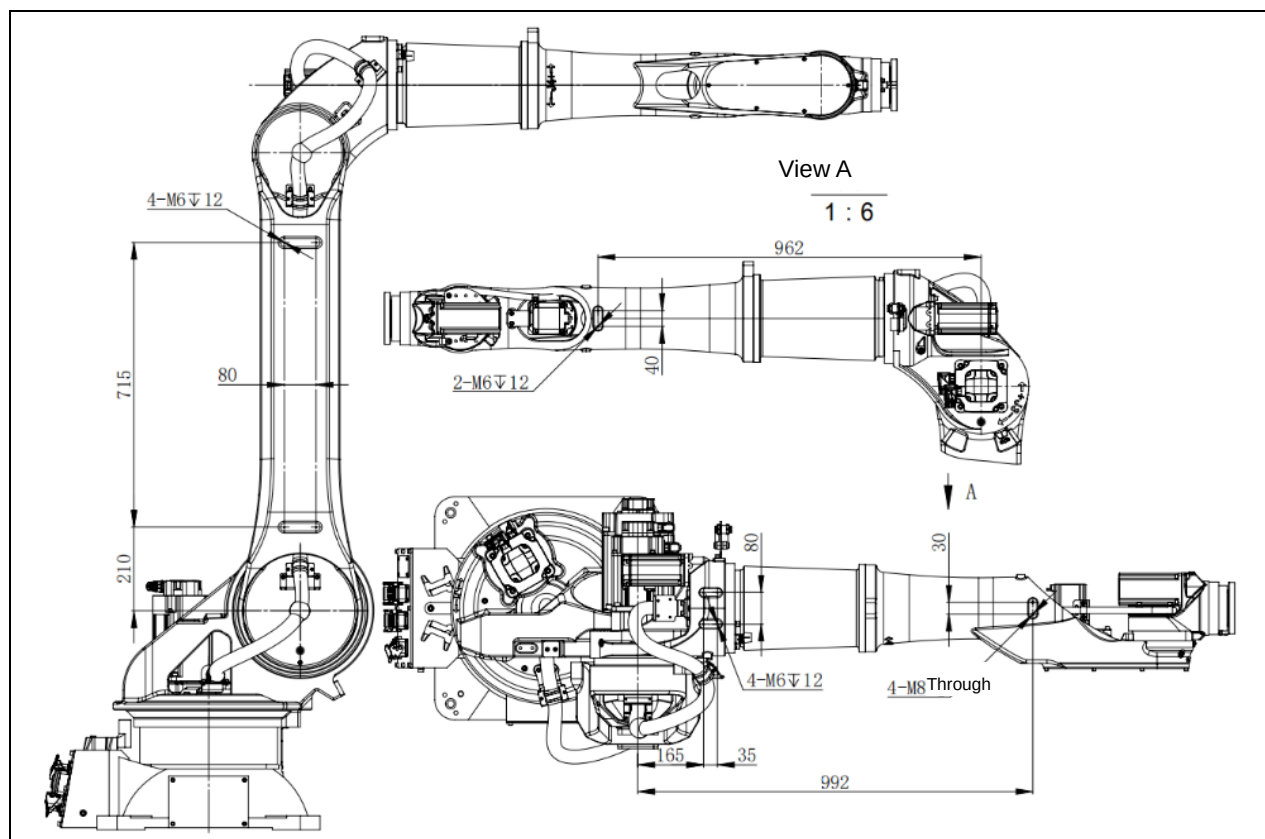


Fig 4.6 Equipment mounting face (ER50B-2700)



Take precautions to avoid interference between peripheral device and the robot.



4.3.PIPES AND TUBES

The robot has inlets and outlets openings to supply air or hydraulic pressure to the end effector.

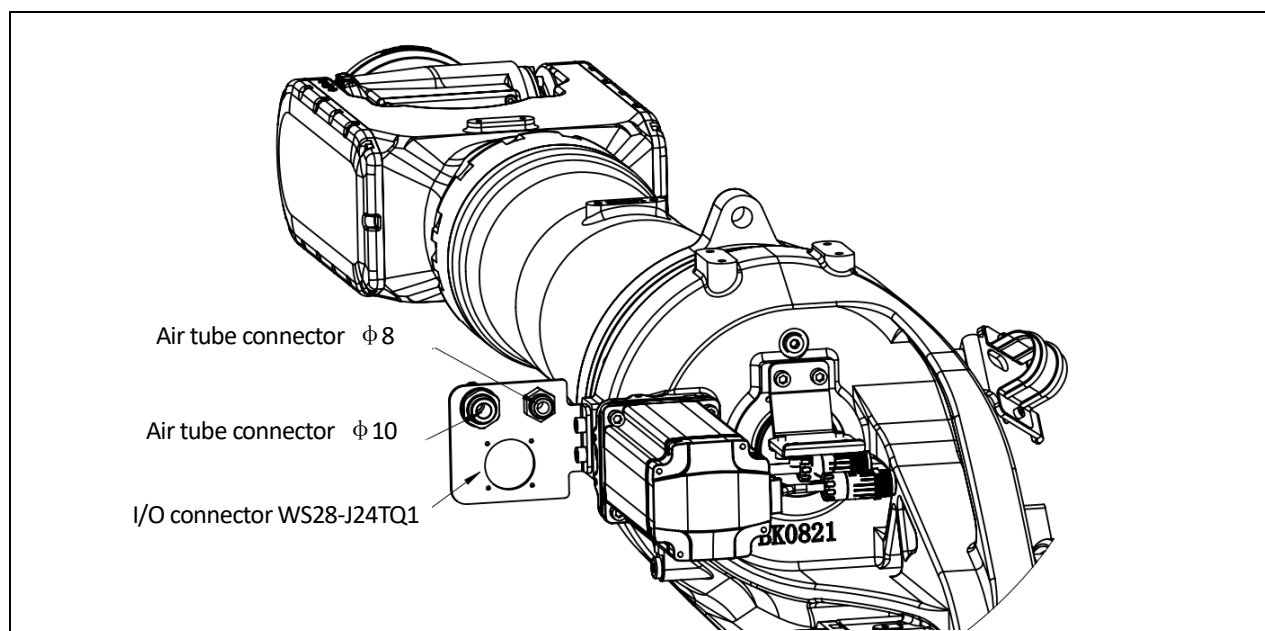


Fig 4.7 Pipes and tubes





5. CHECK AND MAINTENANCE

Before performing any maintenance, be sure to read SAFETY PRECAUTIONS and understand the content.



Never implement any maintenance unless the power of the robot is cut off.

5.1. DAILY CHECKS

Check the items below before daily operation as occasion demands.

Item	Check item	Check points
1	Oil seepage	Check if there is oil on the sealed part. If there is an oil seepage, clean it.
2	Vibration, abnormal noises	Check if there is vibration or abnormal noises in each transmission mechanism. If there is vibration or abnormal noises, perform measures referring to section 7.2.
3	Positioning accuracy	Check if there is a deviation between the current stop position and the previous taught position.
4	Cooling fan in the cabinet	Check whether poor ventilation or abnormal noise occur in the cooling fan on the backside.
5	Peripheral cable set part	Check if there is missing parts, fray or rust.
6	Peripheral electrical equipment	Check whether the connection of peripheral electrical equipment or the button is normal. Check if there is any fray on the surface.
7	Warnings	Check whether unexpected warnings occur in the alarm screen on the teach pendant. If unexpected warnings occur, perform measures as described in the ALARM DISPLAY in cabinet operator's manual.

5.2. PERIODIC CHECKS AND MAINTENANCE

Check the items at the intervals recommended below based on the total time or the accumulated operating time, whichever comes first. Periodic checks keep the performance of the robot. The items below can be performed by yourself, or you can contact ESTUN for maintenance service.

Check and maintenance intervals (Operating time, Accumulated operating time)						Check and maintenance item	Check points, management and maintenance method
1 month 320h	3 months 960h	1 year 3840h	1.5 years 5760h	3 years 11520h	4 years 15360h		
○ Only 1st check	○					Cleaning the controller ventilation system	Confirm the ventilation system is not dusty. If dust has accumulated, remove it.
	○					Check the external damage or peeling	Check whether the robot has external damage or peeling due to the interference with the peripheral equipment. If an interference occurs, eliminate the cause. Also, if the external damage is serious, and causes a problem in which the robot will not operate, replace the damaged parts.
○ Only 1st check	○					Check the damages of the cable protection sheaths.	Check whether the cable protection sheaths of the mechanical unit cable have holes or tears. If damage is found, replace the cable protection sheath.



	○				Check for water	Check if there is water or cut oil on the robot. If there is water or cut oil, eliminate the cause and clean it.
	○ Only 1st check	○			Check for damages to the teach pendant cable, cabinet connection cable and robot connection cable.	Check whether the teach pendant cable, cabinet connection cable or the robot connection cable are unevenly twisted or damaged. If damage occurs, replace the damaged cables.
○ Only 1st check		○			Check for damage to the robot cable (movable part).	Observe the movable part of the robot cable, and check for damage to the sheath. Also, check whether the cables are excessively bent or twisted.
	○ Only 1st check	○			Check for damage to the end effector (hand) connection cable	Check whether the end effector connection cables are unevenly twisted or damaged. If damage occurs, replace the damaged cables.
	○ Only 1st check	○			Check the connection of each axis motor and other exposed connectors.	Check the connection of each axis motor and other exposed connectors.
	○ Only 1st check	○			Retightening the end effector mounting bolts	Retightening the end effector mounting bolts.
	○ Only 1st check	○			Retightening the external main bolts	Retightening the robot installation bolts, bolts to be removed for inspection, and bolts exposed to the outside. Refer to APPENDIX A for recommended tightening torque. An adhesive is applied to some bolts. If the bolts are retightened with a torque greater than the recommended value, the adhesive might be removed. Therefore, follow the recommended torque when retightening the bolts.
	○ Only 1st check	○			Check for mechanical stoppers	Check whether the mechanical stoppers have evidence of collision such as external damage or deformation. Also, check the looseness of the stopper mounting bolts.
	○ Only 1st check	○			Clean spatters, sawdust and dust	Check that spatters, sawdust and dust does not exist on the robot main body. If dust has accumulated, remove it. Especially, clean the robot movable parts well (each joint, the balancer rod, the support part of in front and behind the balancer, and the cable protection sheaths).
	○ Only 1st check	○			Check the operation of the cooling fan	(When cooling fans are installed on the each axis motor) Check whether the cooling fans are operating correctly. If the cooling fans do not operate, replace them.
		○			Replacing the mechanical unit battery	Replace the mechanical unit battery.
				○	Replacing the grease of each axis reducer	Replace the grease of each axis reducer.
				○	Replacing the mechanical unit cable	Replace the mechanical unit cable. Contact ESTUN representative for information regarding replacing the cable.



5.3.ADJUST THE BELT

J5-axis of the robot (ER20-2300,ER50B-2100 and ER70B-2100) are drove by timing belt. The belt tense tends to reduce after a period of operation. This section describes how to strain the belt.



DANGER

A loose timing belt may cause a reduction of robot repeatability and a shortness of belt lifetime. Use a proper force when straining the timing belt. Excessive tense may shorten the belt lifetime.

ER20-2300-HI, ER30B-2700-LI J5 shaft tensioning timing belt steps:

1. Disassemble the hexagonal cylindrical head screw M4×8 inside the left and right cover plates of the forearm, remove the left and right covers of the forearm and place them in the storage area;
2. Loosen the hex nut M5 that fixes the J5 shaft motor;
3. Adjust the adjustment device on the left side of the motor, mainly adjust the bolt M4×30, so that the bolt head is tight J5 shaft motor flange;
4. Test the timing belt tension on the side of the timing belt to make the timing belt tension appropriate (see the table below for the specific range);
5. Tighten the hexagonal nut M5 that fixes the J5 shaft motor, and tighten the hexagonal nut M4 that fixes the bolt at the same time;
6. Install the left and right covers of the forearm to the wrist connector through the hexagonal cylindrical head screw M4×8, and the left and right covers of the forearm are evenly coated with Loctite 5910 silicone, and the screws are tightened symmetrically.



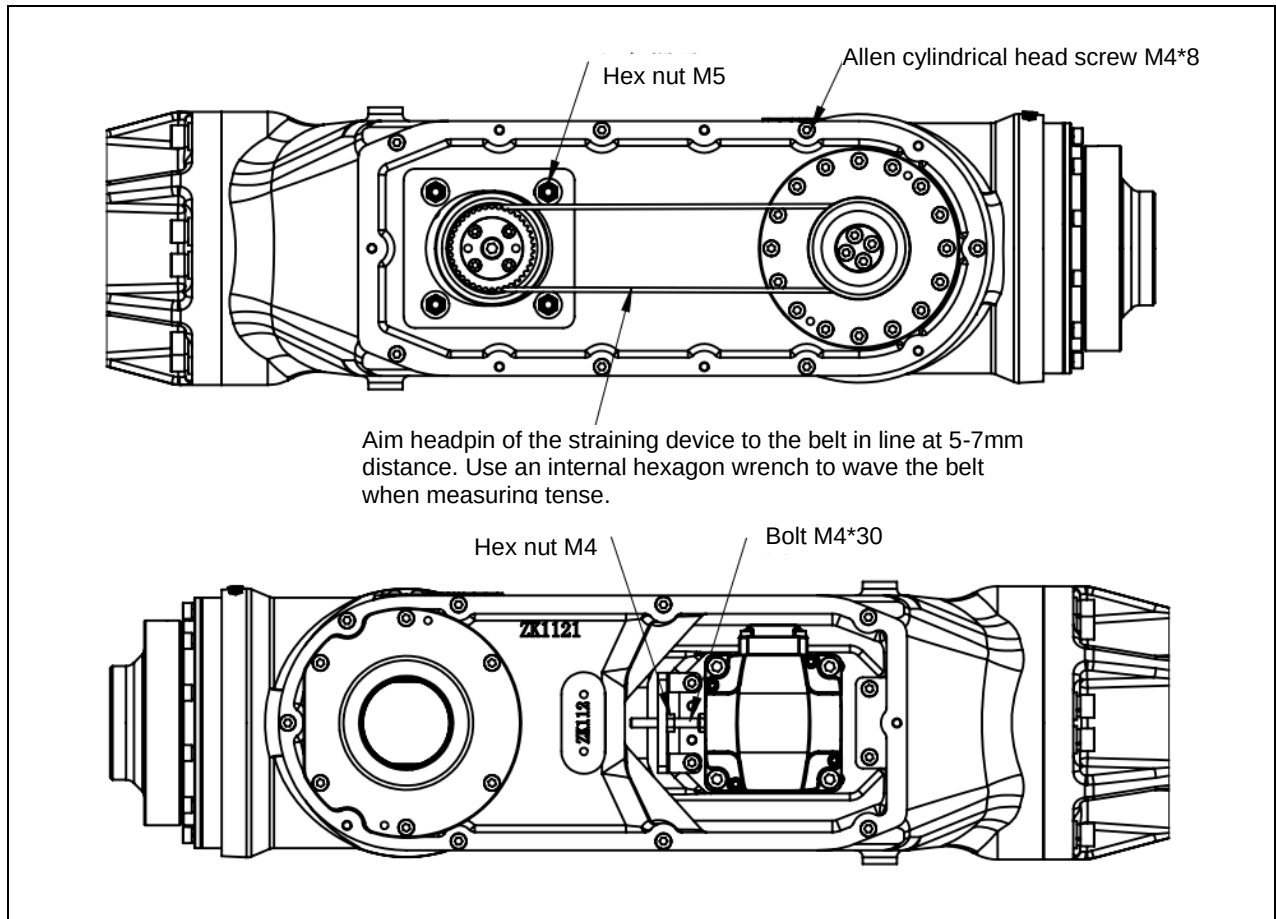


Fig 5.1 Strain the timing belt (ER20-2300-HI, ER30B-2700-LI)

Tab 5.1 Timing belt tense/frequency value reference (ER20-2300-HI, ER30B-2700-LI)

Model		Range of belt tense	Range of frequency
Belt	new belt	76~90N	162.7~177.1Hz
	used belt	76~85N	162.7~172.1Hz

ER50B-2100, ER50B-2700, ER70B-2100-LI J5 Axis Tensioning Timing Belt Steps:

1. Disassemble the hexagonal cylindrical head screw M5×10 inside the J5 shaft cover plate, remove the J5 shaft cover plate and place it in the storage area;
2. Loosen the hexagonal cylindrical head screw M6×25 on the J5 axis motor adapter plate;
3. Adjust the adjustment device on the left side of the adapter plate, mainly adjust the bolt M6×25, so that the tail of the bolt is pressed against the J5 axis motor adapter plate;
4. Test the timing belt tension on the side of the timing belt to make the timing belt tension appropriate (see the table below for the specific range);
5. Tighten the hexagonal cylindrical head screw M6×25 that fixes the motor adapter plate, and tighten the hexagonal nut M6 that fixes the bolt at the same time;
6. Install the J5 axis cover plate to the small arm rod through the Allen cylindrical head screw M5×10, the J5 axis cover plate is evenly coated with Loctite 5910 silicone, and the screws are tightened symmetrically.

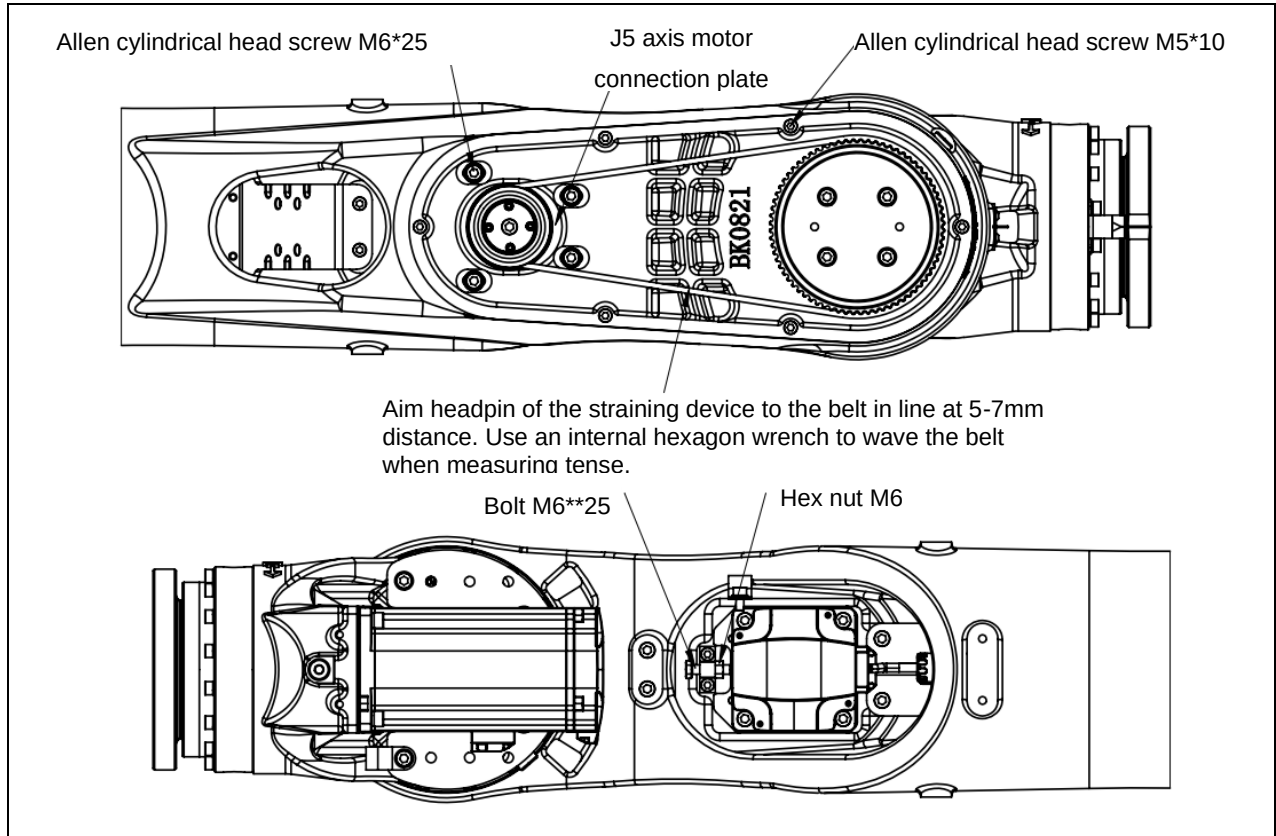


Fig 5.2 Strain the timing belt (ER50B-2100, ER50B-2700, ER70B-2100-LI)

Tab 5.2 Timing belt tense/frequency value reference (ER50B-2100, ER50B-2700, ER70B-2100-LI)

Model		Range of belt tense	Range of frequency
Belt	new belt	90.7~99.8N	111~116Hz
	used belt	63.5~72.6N	93.2~99.7Hz

Measure the belt tense according to frequency, as internal parameter set is not required.

5.4.REPLACING THE BATTERY

The position data of each axis is preserved by the backup batteries. The batteries need to be replaced every one year. Also use the following steps to replace the batteries when voltage drop alarm occurs.

Procedures of replacing the battery:

1. Press the emergency stop button to avoid any dangerous situation.
2. Remove the cover of the battery box.
3. Take out the old battery from the box.
4. Fix the new battery into the battery box. Make sure the direction is correct.
5. Fix the cover of the battery box.

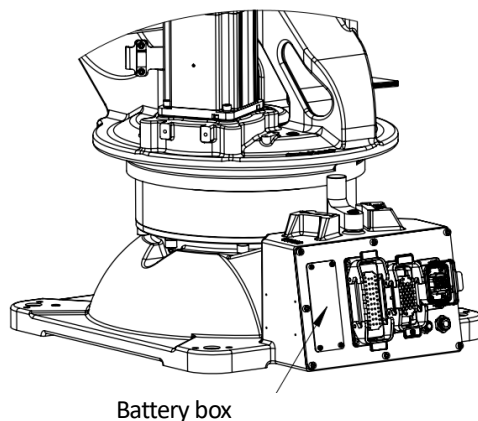


Fig 5.3 Battery replacing (ER20-2300-HI, ER30B-2700-LI)

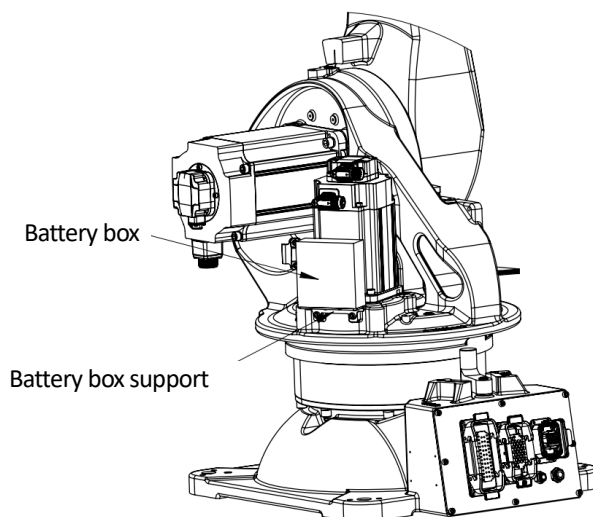


Fig 5.4 Battery replacing (ER50B-2100, ER50B-2700, ER70B-2100-LI)



Be sure to keep the power on. If the power is cut off during battery replacing, the position data will be lost. Therefore, calibration will be required again.



5.5. GREASING

Greasing is required to each part every 3 years, or for a cumulative operation time of 11520 hours, whichever occurs first, according to the following steps. Refer to the table below for the brand and quantities of the grease applied to each joint.



When the robot operates in a harsh environment, is frequently used at a small angle, or runs at a high frequency for a long time, please shorten the grease replacement cycle of the corresponding joint to 3,000 hours.

Tab 5.3 Replacing the grease periodically

Model	Location	Amount
ER20-2300-HI ER30B-2700-LI ER50B-2100 ER50B-2700 ER70B-2100-LI	J1-axis reducer	3200g
	J2-axis reducer	1400g
	J3-axis reducer	1250g
	J4-axis reducer	620g
ER50B-2100 ER50B-2700 ER70B-2100-LI	J5-axis reducer	120g
	J6-axis reducer	200g

Recommend greasing gesture is list below.

Tab 5.3 Robot joint greasing angle (ER20-2300-HI, ER30B-2700-LI)

Location	Orientation					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	any	any	any	any	any	any
J2-axis reducer		0°				
J3-axis reducer			0°			
J4-axis reducer				0°		

Tab 5.4 Robot joint greasing angle (ER50B-2100, ER50B-2700, ER70B-2100-LI)

Location	Orientation					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	any	any	any	any	any	any
J2-axis reducer		0°				
J3-axis reducer			0°			
J4-axis reducer				0°		
J5-axis reducer			-90°			
J6-axis reducer						



5.5.1. Inlet/outlet of each axis



CAUTION

Follow the instructions in the safety chapter when greasing the reducer.

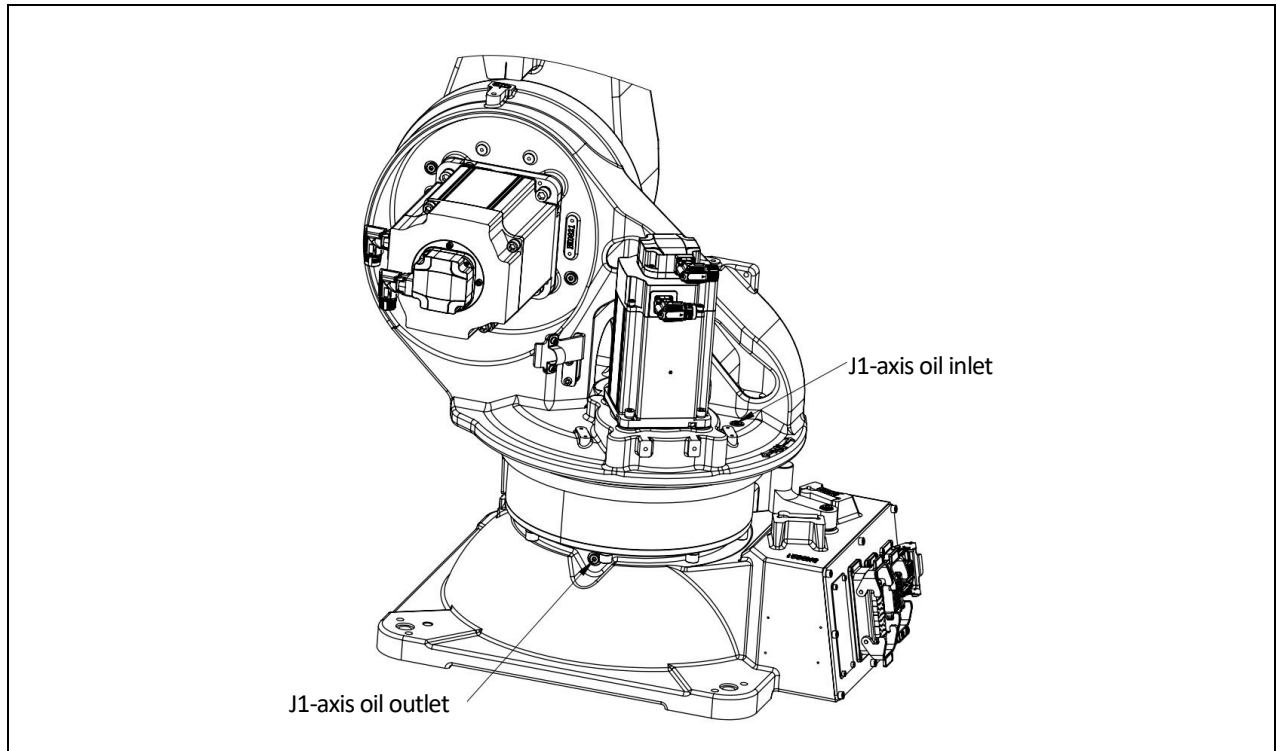


Fig 5.5 J1-axis oil inlet/outlet

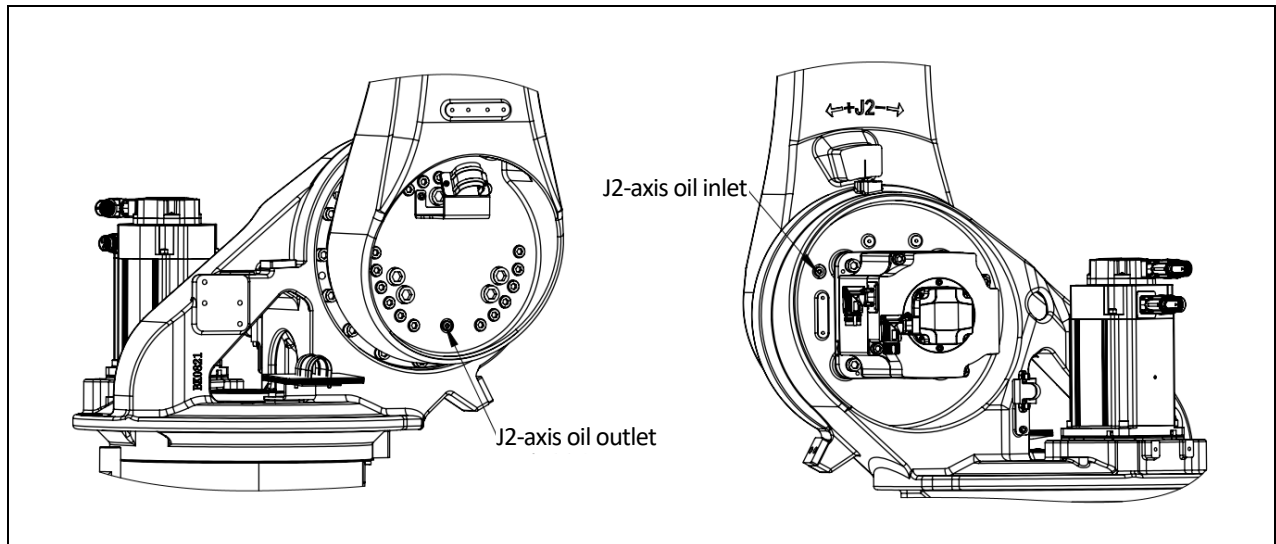


Fig 5.6 J2-axis oil inlet/outlet

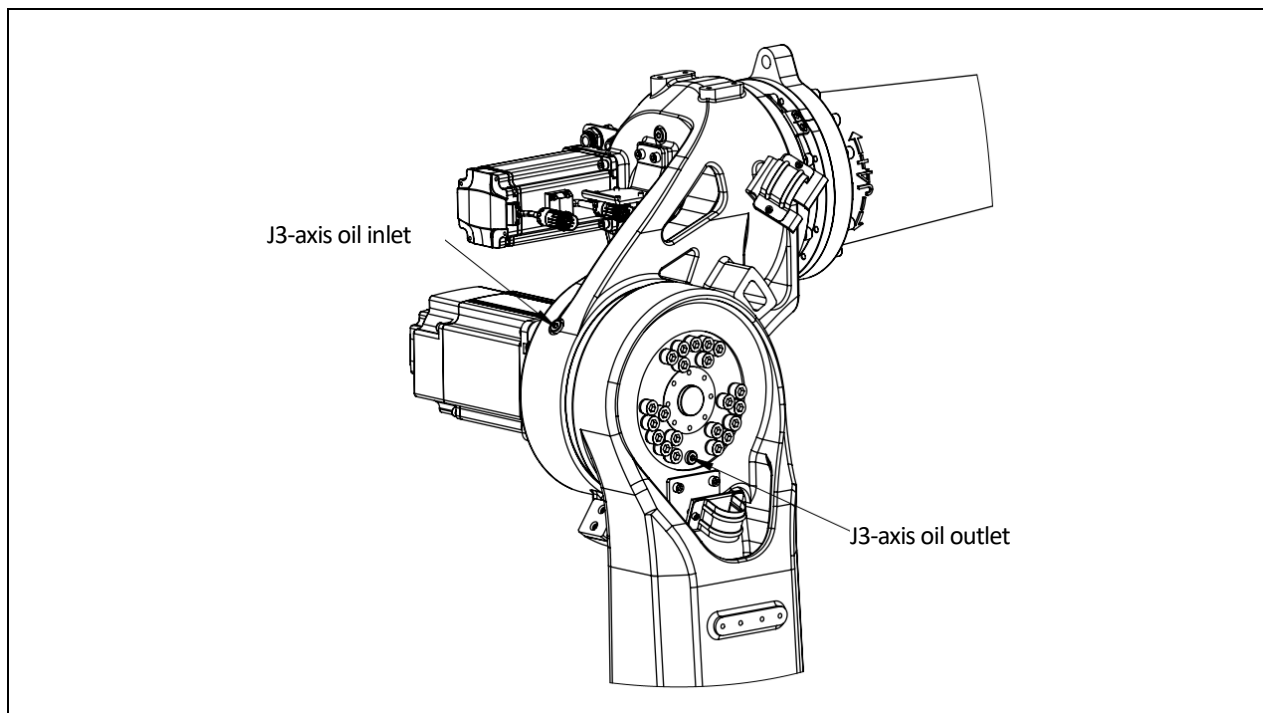


Fig 5.7 J3-axis oil inlet/outlet

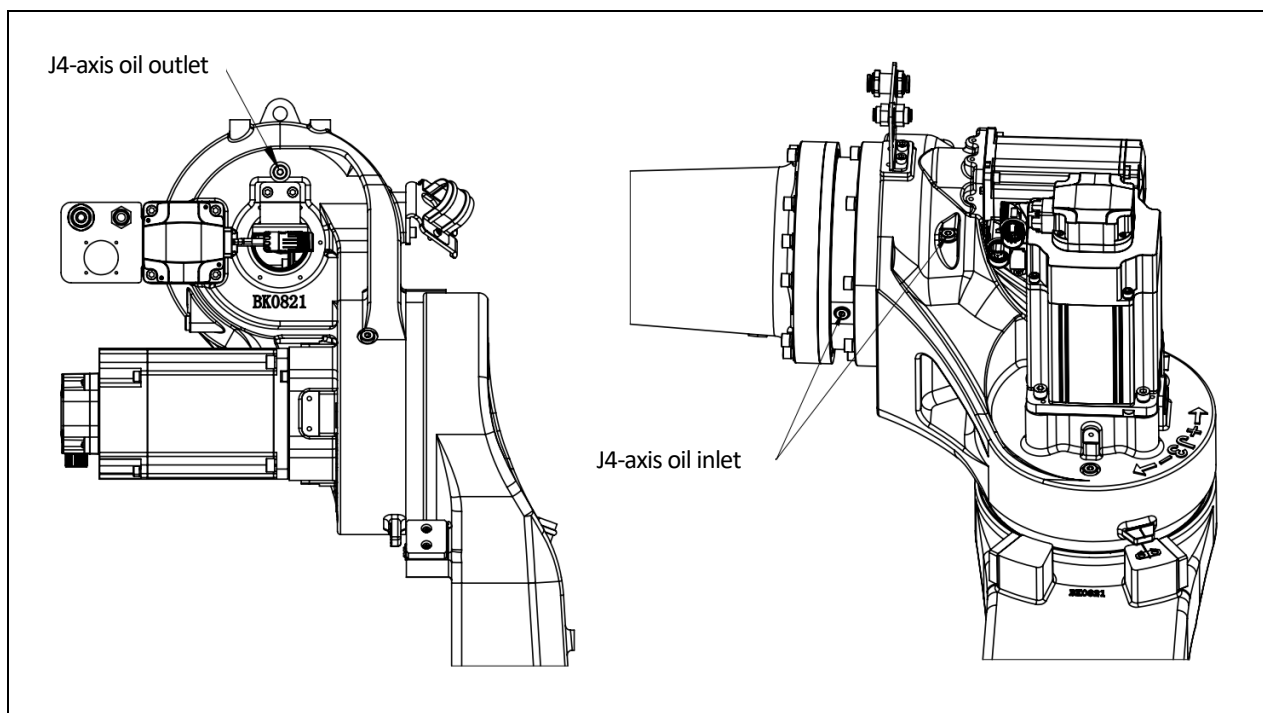


Fig 5.8 J4-axis oil inlet/outlet

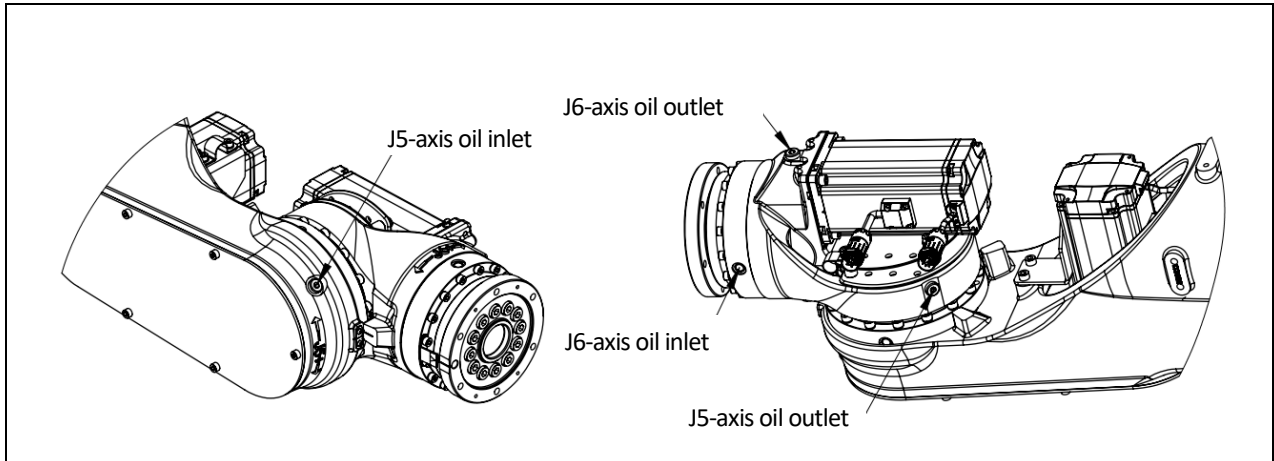


Fig 5.9 J5, J6 axis oil inlet/outlet (ER50B-2100, ER50B-2700, ER70B-2100-LI)

5.5.2. Procedure of greasing

The grease replacement procedure of each shaft reducer is as follows:

- All joints of the teaching robot run at 100% speed for 10-20min, so that the internal grease becomes a lower viscosity oil;
- Run the robot to the angle of the robot to lubricate the joints and cut off the power supply;
- Place grease recovery containers under the oil drain;
- Remove the screw plug corresponding to the joint oil outlet and oil injection port;
- Inject new grease from the oil injection port until the grease discharged from the oil outlet becomes a newly added grease, adjust the injection amount, and use the measuring instrument to ensure that the amount of oil filled is consistent with the amount of oil flowing out (including the amount released after the heat engine);
- release the residual pressure in the grease bath according to the steps in 5.5.3;
- Install the screw plug to the oil injection port and oil outlet with a tightening torque of 13.7 Nm.

If the operation is not properly lubricated, the internal pressure of the lubrication chamber may suddenly increase, which can damage the sealing part, resulting in grease leakage and abnormal operation. Therefore, when performing lubrication operations, observe the following precautions:

- Before performing the lubricating oil filling operation, open the lubricating oil vent (remove the screw plug at the lubricating oil outlet).
- Inject the lubricating oil/grease slowly, without too hard.
- Whenever feasible, the use of compressed gas pumps (driven by the plant gas source) should be avoided.
- Only use lubricating oil/grease with the specified type, if other lubricating oil other than the specified type is used, it may damage the reducer or cause other problems.
- After the lubrication is completed, confirm that there is no lubricating oil/grease leakage at the lubricating oil outlet and that the lubricating chamber is not pressurized, and then close the lubricating oil/grease outlet.
- In order to avoid accidents such as slipping or fire, excess lubricating oil/grease should be completely removed from the ground and robot.



5.5.3. Procedure for releasing remaining pressure within the grease bath

Release remaining pressure with the following procedures. Attach bags under the oil outlet to prevent spilled oil/grease from splattering.

- a) Power the robot, and operate at a 100% speed with full load for 4 hours continuously.
- b) Stop the running program of the robot at zero position, turn off the servo power with the teach pendant.
- c) Disassemble the screw at oil inlet of each axis after safety confirmation. Do not face the screw when removing it, in case that oil with high pressure and high temperature ejects, resulting personnel injury.
- d) Retighten the screw 3% seconds later after removing it, and clean up the oil around the screw with a clean cloth.
- e) Be sure to complete pressure releasing of a robot (step c and step d) in 15 minutes. Otherwise, it should be repeated from step 1.





5.6. Oil leakage inspection

Maintenance Area

Insert a cloth or similar material into the gaps of each joint to check for any oil leakage from the oil seals. If oil leakage is observed, please wipe it clean.

- Depending on the operating conditions and surrounding environment, oil may leak from the outer lip of the oil seals. When accumulated oil forms droplets, it may drip during certain movements. Prior to operating the robot, please wipe off any oil accumulation on the underside of the oil seals.
- Additionally, if the temperature during operation is excessively high, the internal pressure in the joint chambers may increase. In such cases, after the operation, please open the oil filling port once to restore the internal pressure. (Do not open or close the oil filling port while the machine is in a cooled state)
- If oil leakage persists even after frequent wiping, please refer to 7.2 Troubleshooting.



When opening the oil filling port, there is a possibility of high-temperature grease spraying out. Please prepare a plastic bag or similar item in advance to catch the grease.

6. CALIBRATING

6.1. INTRODUCTION

Calibration associates the angle of each robot axis with the pulse count value supplied from the absolute Pulsecoder connected to the corresponding axis motor. To be specific, calibration is an operation for obtaining the pulse count value, corresponding to the zero position.

Calibration is factory-performed. It is unnecessary to perform calibration in daily operation. However, calibration becomes necessary after:

- Motor replacement
- Pulsecoder replacement
- Reducer replacement
- Cable replacement
- Backup batteries for pulse count in the mechanical unit has run out



Robot data (including calibration data) and pulsecoder data are backed up by their respective backup batteries. Data will be lost if the batteries die. Replace the batteries in the controller and mechanical units periodically. An alarm will occur when battery voltage is low.

6.2. QUICK ZERO POSITION CALIBRATION

Quick zero calibration is performed at factory with all loads uninstalled using special apparatus. Based on the robot parameter, this method provides the most precise zero position calibration.

Quick zero position calibration can reload zero position data that stored in the controller, when zero position



data lost due to electrical or software faults. If the zero position data lost due to disassembly or maintenance, this method cannot be used.

ESTUN robot uses encoder data as an auxiliary of calibration. Procedures are shown below.

- Jog the robot manually to the place where the calibration marks are align.
- Display the encoder information screen. Jog the axis at a low speed to make the real single loop value close to the reference value.
- Calibrate the zero position of the axis. Create a new program, then create a new instruction “RefRobotAxis”, and run it.

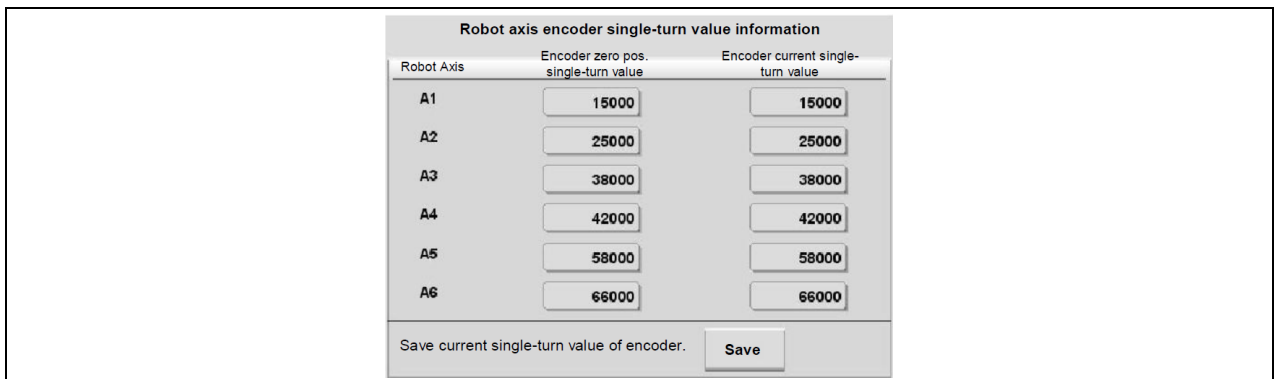


Fig 6.1 Single loop value of quick zero position calibration (CP controller)

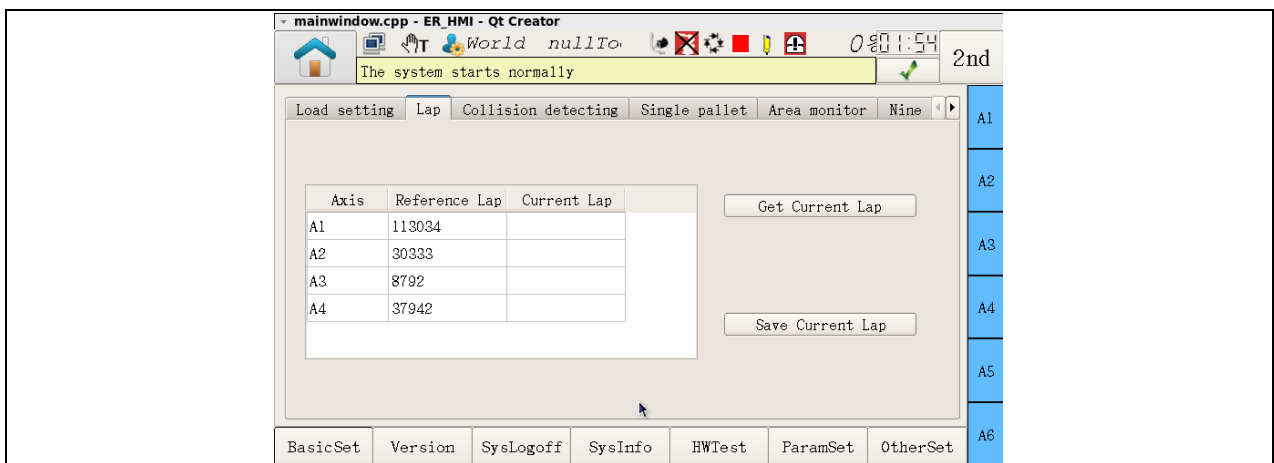


Fig 6.2 Single loop value of quick zero position calibration (ERC controller)

6.3.MECHANICAL ZERO POSITION CALIBRATION

Mechanical disassembly or maintenance may cause zero position data lost. Mechanical zero position calibration is performed with all six axes jogged to zero-position by using their respective witness marks.

Take J1-axis for example of zero position calibration. As shown in the figure below, there are witness marks on the base and rotation base. Move the axis to align the marks as the procedures below.

- Move J1-axis with teach pendant to align two witness marks.
- Set this position as the zero position of J1-axis with the teach pendant.

Perform calibration for each axis with procedures recommended above. If calibration for all axes has been performed and recorded, zero position for each axis can be set with teach pendant. Figures in this section are reference for calibration of other axes.

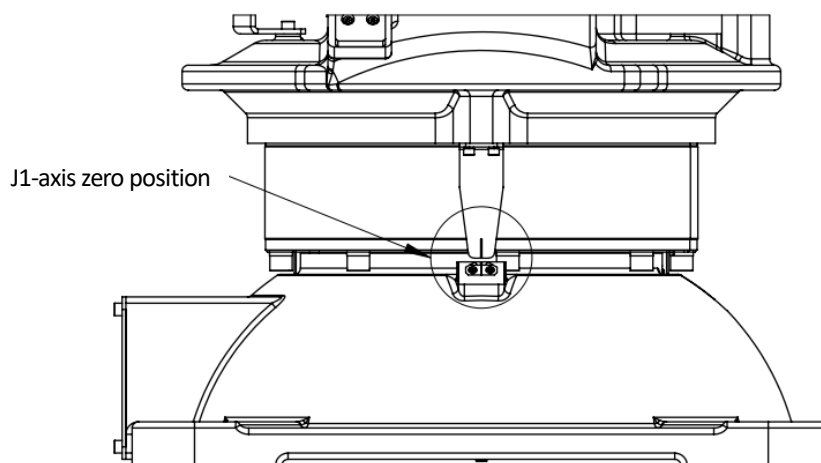


Fig 6.3 Calibration for J1-axis

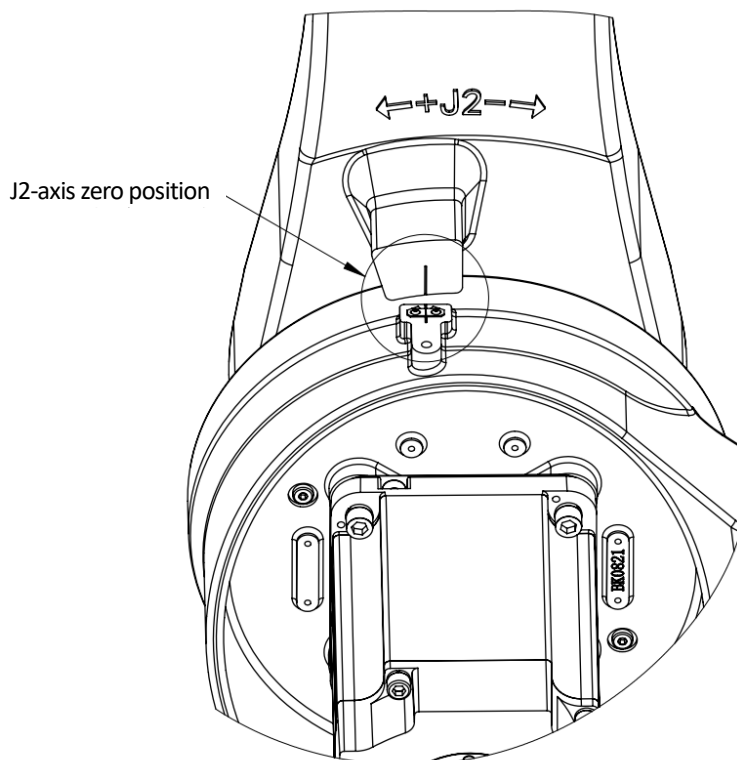


Fig 6.4 Calibration for J2-axis



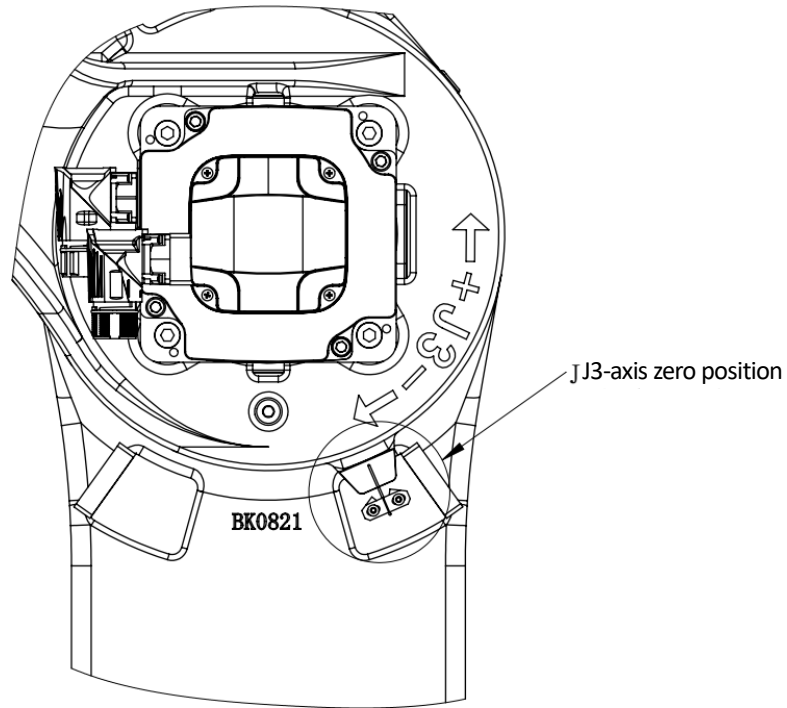


Fig 6.5 Calibration for J3-axis

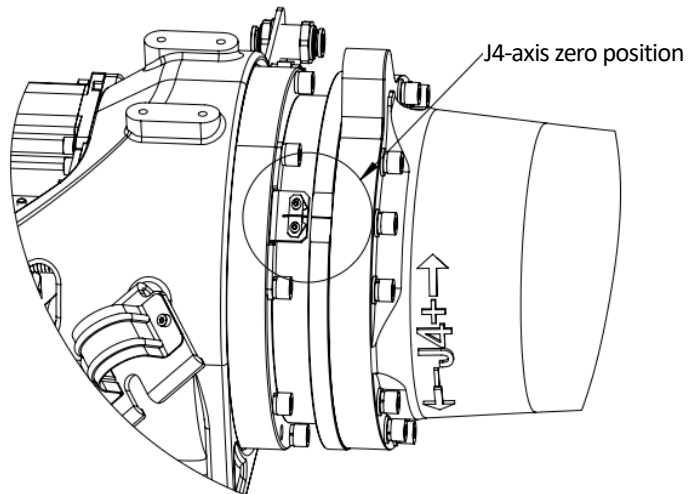


Fig 6.6 Calibration for J4 -axis (ER20-2300-HI, ER30B-2700-LI, ER50B-2100, ER70B-2100-LI)



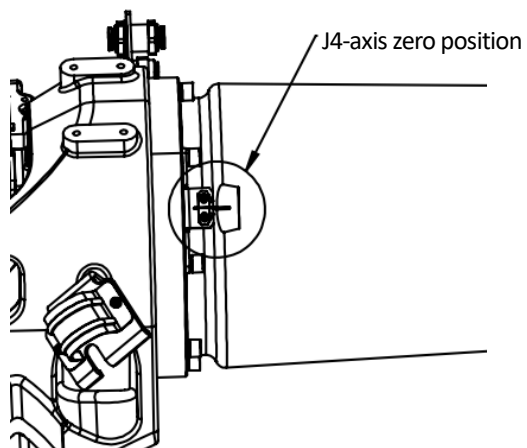


Fig 6.7 Calibration for J4 -axis (ER50B-2700)

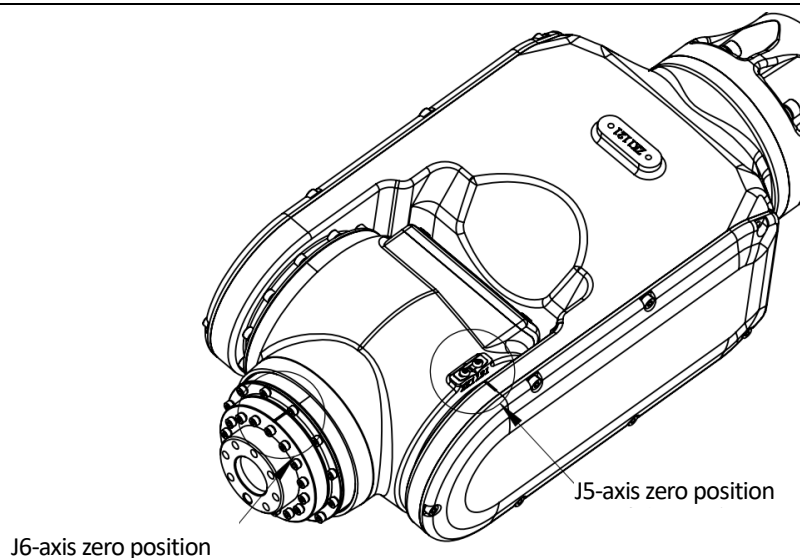


Fig 6.8 Calibration for J5, J6 -axis (ER20-2300-HI, ER30B-2700-LI)

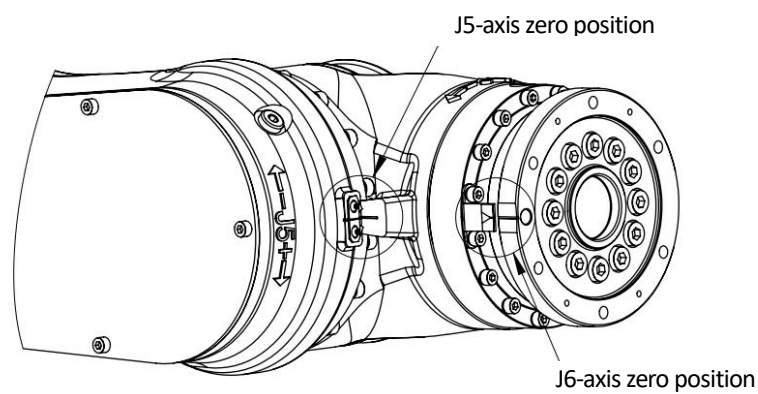


Fig 6.9 Calibration for J5, J6 -axis (ER50B-2100, ER70B-2100-LI)





7. TROUBLESHOOTING

Be sure to read SAFETY PRECAUTIONS and understand its contents before any maintenance.



Never perform any maintenance unless the power of the robot system is cut off.

7.1. TOOLS

Troubleshooting tools includes travelling crane, forklift, internal hexagonal wrench, monkey wrench and special tools for removing the bearings.

7.2. TROUBLESHOOTING

Symptom	Description	Cause	Measure
Vibration and noise	Unfirm connection between base and floor.	Frequent vibration due to robot operation causes unfirm connection.	Reinforce the connection between robot base and floor.
	Joint connection is loose.	It is likely caused by a loose bolt, or lack of bolt fastening measures (such as screw fastening agent, spring washer) on the joint.	Re-mount and re-fasten the bolts.
	Vibration becomes serious when the robot is at a certain speed.	The robot control program is too demanding for the robot hardware.	Modify the control program.
	Vibration becomes serious when the robot adopts a specific posture.	It is likely the robot is overloaded.	Reduce the robot load.
	Damaged reducer.	Prolonged usage of the reducer.	Replace the reducer.
	Vibration occurs after the robot collided with an object or was overloaded for a long period.	The reducer or the joint structure was damaged due to collision or overload.	Replace the reducer or structure where the vibration occurs.
	Some relationship may occur between the robot and the machine near it.	The robot resonates with the machine near it.	Change the distance between the robot and the other machines.
Click	The robot wobbles due to push by hand when turn off it.	Bolts in the robot joint loosen due to overload or collision.	Check tightness of motor retaining bolt, reducer retaining bolt, reducer retaining bolt and mounting bolt of each joint. If any bolt is loose, re-tight it.
Motor overheat	The ambient temperature rose or a cover was attached to the motor.	Ambient temperature roses or the motor is overheated, and could not release the heat.	Reduce the ambient temperature, make ventilation well and remove the cover of the motor.
	Changing the robot control program or the load.	Program or load is too demanding for the robot.	Modify the program and reduce the load.
	Parameters imported to the controller are changed, the motor overheated.	Parameters imported are not correct with the robot.	Import correct parameters.





Symptom	Description	Cause	Measure
Gear case grease leakage	Grease leakage from the joint.	Prolonged usage of the robot leads to a damage of the oil seal.	Replace the oil seal and O-ring.
		There is a gap on the surface of the seal.	Re-mount and tighten the oil seal.
		There is a problem with the oil inlet or outlet.	Replace the oil inlet or the bolt.
Dropping joint	The robot axis cannot stop at a certain position, or drops in standstill due to gravity.	There is a problem with the servo motor brake.	Replace the servo motor.

7.3.REPLACING THE SERVO MOTOR

Contact ESTUN representative if servo motor replacement is needed.



DANGER

**When removing some parts of the robot, other parts may lose support, thus leads to unexpected movement, and cause personnel injury and equipment damage.
Disassembling of the robot must be performed by authorized person.**



CAUTION

When replacing servo motors, the disassembled parts should be kept properly and cleaned thoroughly before remounting. Replace it when damage occurs.





APPENDIX

APPENDIX A BOTL TORQE LIST

Bolt Models (ISO4762)	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18
Tightening Torque/N.m (Level 12.9)	2	4	9.01 ±0.49	15.6 ±0.78	37.2 ±1.86	73.5 ±3.43	129 ±6.37	205 ±10.2	319 ±15.9	441 ±22

APPENDIX B SPECIFICATION OF BOLT

Nominal diameter	Screw dimension	Drill diameter	Anchor depth(mm)	Max. anchor thickness(mm)	Designed pulling force (KN)	Designed shearing force (KN)	Anti-pull force (KN)
M8	φ8×110	φ10	80	13	10.3	12.3	≥20KN
M10	φ10×130	φ12	90	20	12.3	14.2	≥30KN
M12	φ12×160	φ14	110	25	16.8	17.5	≥40KN
M16	φ16×190	φ18	125	35	28.9	35	≥60KN
M20	φ20×260	φ25	170	65	50.1	51.5	≥90KN
M24	φ24×300	φ28	210	65	75.5	80	≥140KN
M30	φ30×380	φ35	280	70	121.3	163.7	≥200KN
M33	φ33×420	φ38	300	90	135	182	≥260KN





APPENDIX C Part list for ER20-2300-HI

No.	SAP	Name	Amount	Note
1	12700000506	Servo motor (J1-axis)	1	
2	12800000080	Servo motor (J2-axis)	1	
3	12700000505	Servo motor (J3-axis)	1	
4	12700000500	Servo motor (J4-axis)	1	
5	12700000039	Servo motor (J5-axis)	1	
6	12700000059	Servo motor (J6-axis)	1	
7	26100001698	Wrist unit	1	
8	51200000073	Lithium battery ER34615M (Wire with XT30U-M) with socket	3	
9	G5400000523	Timing Belt	1	

APPENDIX D Part list for ER30B-2700-LI

No.	SAP	Name	Amount	Note
1	12700000506	Servo motor (J1-axis)	1	
2	12800000087	Servo motor (J2-axis)	1	
3	12700000505	Servo motor (J3-axis)	1	
4	12700000500	Servo motor (J4-axis)	1	
5	12J00000085	Servo motor (J5-axis)	1	
6	12J00000150	Servo motor (J6-axis)	1	
7	26100001696	Wrist unit	1	
8	51200000073	Lithium battery ER34615M (Wire with XT30U-M) with socket	3	
9	G5400000523	Timing Belt	1	





APPENDIX E Part list for ER50B-2100

No.	SAP	Name	Amount	Note
1	12700000506	Servo motor (J1-axis)	1	
2	12800000080	Servo motor (J2-axis)	1	
3	12700000505	Servo motor (J3-axis)	1	
4	12700000500	Servo motors (J4, J6 axis)	2	
5	12700000501	Servo motors (J5-axis)	1	
6	31521100006	Lithium battery ER34615M/2	3	
7	G5400000472	Wrist unit	1	

APPENDIX F Part list for ER70B-2100-LI

No.	SAP	Name	Amount	Note
1	12700000506	Servo motor (J1-axis)	1	
2	12800000087	Servo motor (J2-axis)	1	
3	12700000505	Servo motor (J3-axis)	1	
4	12700000500	Servo motors (J4, J6 axis)	2	
5	12700000501	Servo motors (J5-axis)	1	
6	31521100006	Lithium battery ER34615M/2	3	
7	G5400000472	Wrist unit	1	

APPENDIX G Part list for ER50B-2700

No.	SAP	Name	Amount	Note
1	12700000506	Servo motor (J1-axis)	1	
2	12800000087	Servo motor (J2-axis)	1	
3	12700000505	Servo motor (J3-axis)	1	
4	12700000500	Servo motors (J4, J6 axis)	2	
5	12700000501	Servo motors (J5-axis)	1	
6	112A1100021	Battery Box Bat-Unit-C1	1	
7	G5400000472	Wrist unit	1	

REVISION RECORD

Revision	Date	Contents
01	2016.11	New edition.
02	2018.06	Deletion of ER50-2100-5. Update of motion range. Correction of errors.
03	2018.11	Add crane hand method, Modify the error description.
04	2019.05	Delete ER50-2100-5, Modify the error description





05	2020.08	Add ER50B-2100.
06	2020.12	Add ER20-2300-HI.
07	2022.01	Modify the 5.5 robot lubrication precautions, and periodically replace the amount of grease used.
08	2022.07	Add ER70B-2100-LI.
09	2022.09	Update 1.2 Installation Note the connection between Update 2 and the appliance.
10	2023.12	Updated ER20-2300-HI model related materials; The ER30B-2700-LI model was added. Add Oil Leakage Inspection.
11	2024.07	Add ER50B-2700.



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