ESTUN
ROBOTICS

OPERATION INSTRUCTIONS

ESTUN General Large Payloads Series Robot Body Operation Instructions

ALL MADE BY ESTUN

ESTUN AUTOMATION

ESTUN Large Payloads Robot

Mechanical Unit Operator's Manual

M-0104EN-12

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.

All statements, information, and advice provided in this manual have been carefully processed, but no guarantee is given for their complete accuracy. We shall not be held liable for any direct or indirect losses arising from the use of this manual.

Users are solely responsible for the application of any products and should exercise caution when using this manual and the associated products.

The interpretation of all content in this manual belongs to ESTUN Robotics Engineering Co., Ltd.

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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 USER

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
WARNING	**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.
IN FO	**Information** A supplementary explanation helps users operating the robot more efficiently.

SAFETY OF THE USER

(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.

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

CAUTION	**Make sure there is a CO_2 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.**

WARNING	**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.

CAUTION

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.

CAUTION

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 in 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

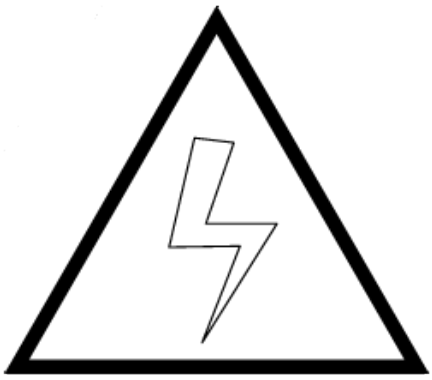


Fig 0.1 Electric Shock Warning

This label indicates hazardous voltage or electric shock.

(2) High-temperature Warning

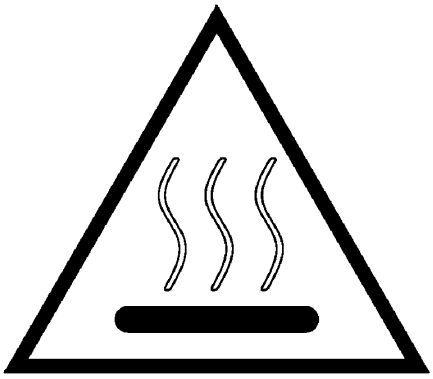


Fig 0.2 High-temperature Warning

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

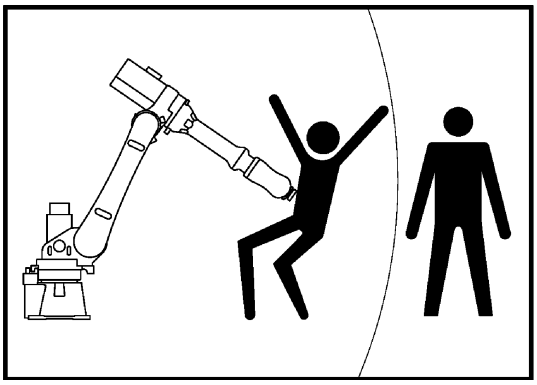


Fig 0.4 Personal Injury Warning

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

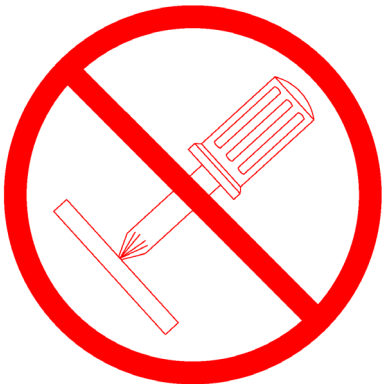


Fig 0.5 No Disassembly Warning

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

(6) Energy Storage Warning

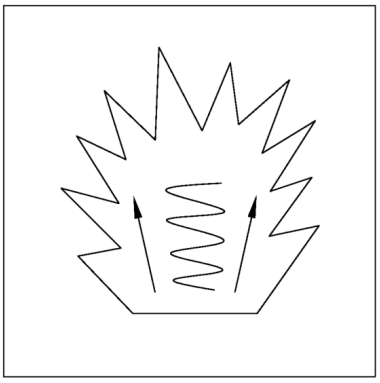


Fig 0.6 Energy Storage Warning

The balance cylinder is equipped with springs, high-pressure gas or high-pressure liquid. Never disassemble the balance cylinder without permission.

(7) Transport symbol

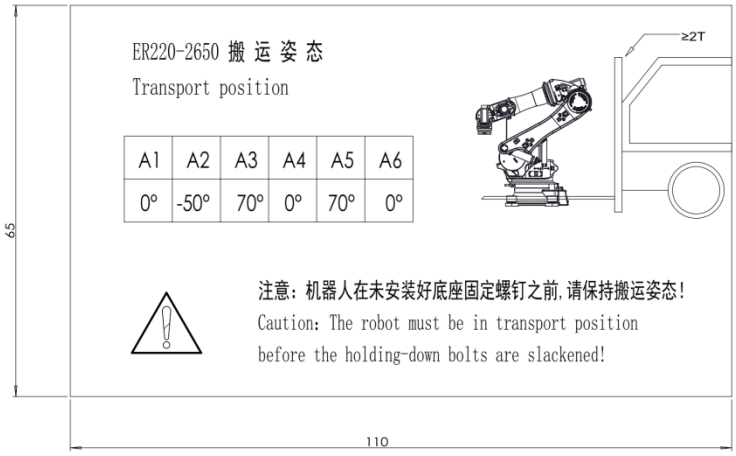


Fig. 0.1 Transport symbol (ER100B-3000,ER170B-2650,ER220B-2650)

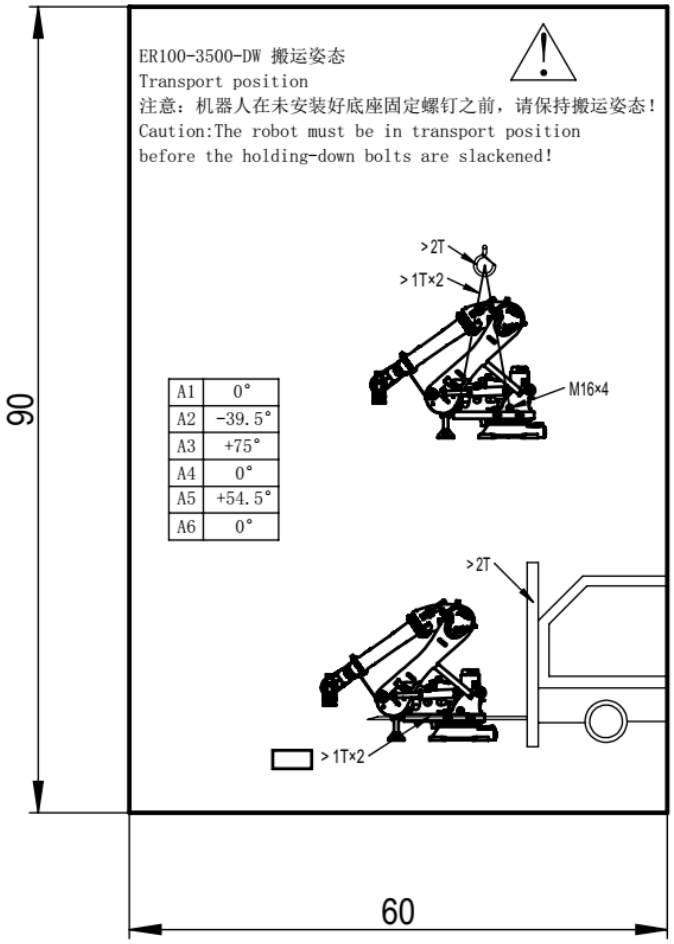


Fig. 0.8 Transport symbol (ER100B-3550-DW)

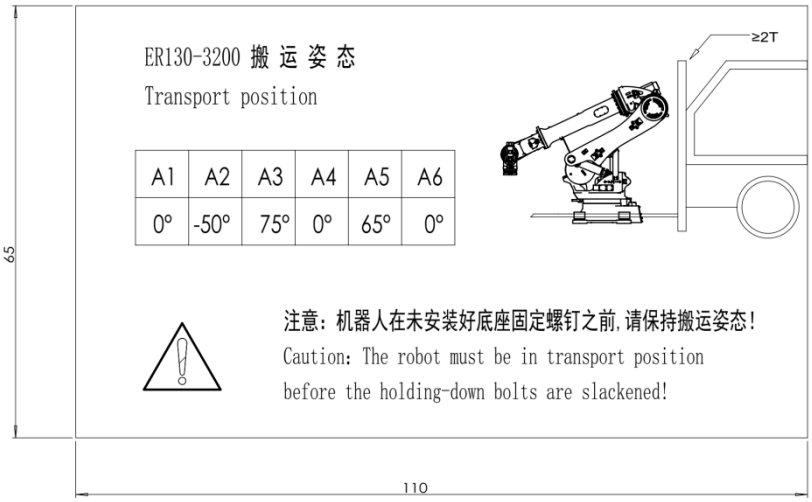


Fig. 0.9 Transport symbol (ER130B-3200)

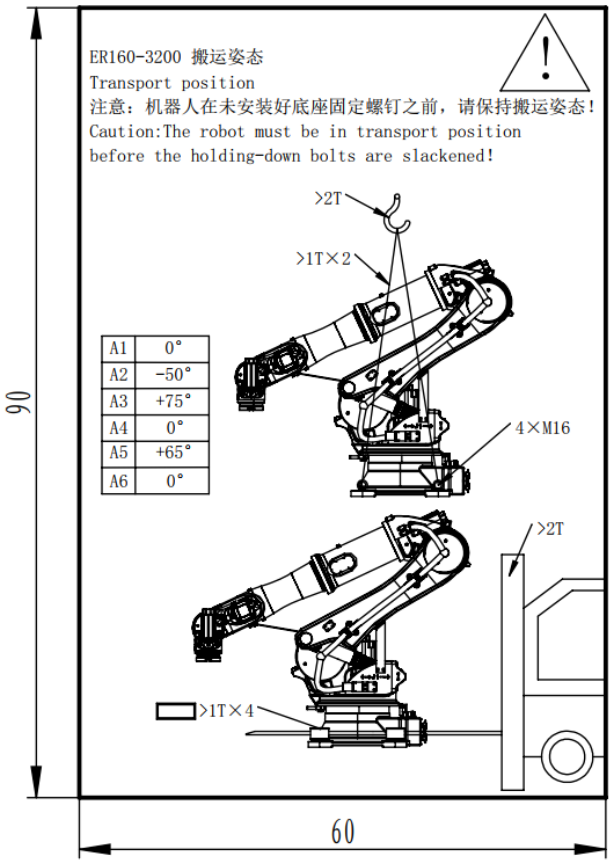


Fig. 0.10 Transport symbol (ER160B-3200)

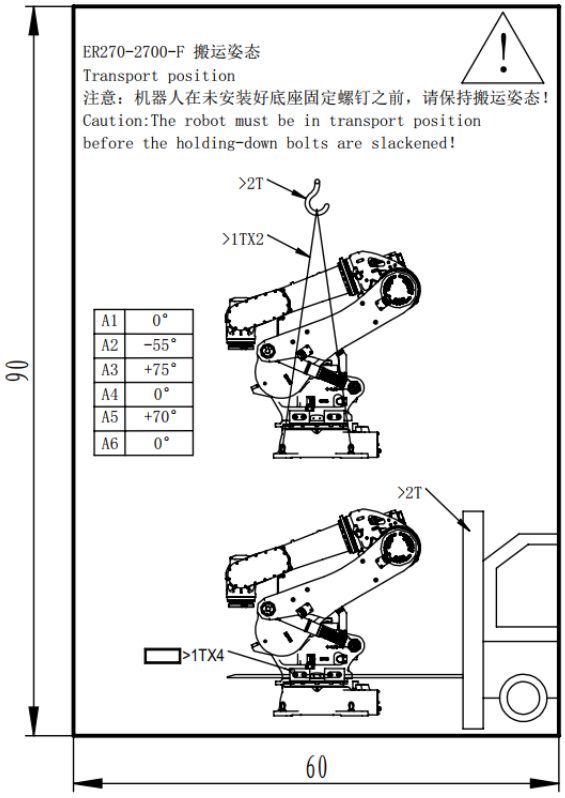


Fig. 0.11 Transport symbol (ER270-2700)

PREFACE

This manual describes the following manipulators.

Robot type	Load capacity
ER100B-3000	100kg
ER100B-3500-DW	100kg
ER130B-3200	130kg
ER160B-3200	160kg
ER170B-2650	170kg
ER220B-2650	220kg
ER270-2700	270kg

Related manuals

ESTUN Robot Mechanical Unit Operator’s Manual
ESTUN Robot S1P Series Cabinet Operator’s Manual
ESTUN Robot S2F Series Cabinet Operator’s Manual
ESTUN Robot S2E Series Cabinet Operator’s Manual
ESTUN RCS2 System Operator’s Manual
ESTUN CP System Operator’s Manual

CONTENTS

1. TRANSPORTATION AND INSTALLATION

1.1. TRANSPORTATION

> **WARNING** **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
ER100B-3500-DW	0°	-39.5°	+75°	0°	+54.5°	0°
ER130B-3200 **ER160B-3200**	0°	-50°	+75°	0°	+65°	0°
ER100B-3000 **ER170B-2650** **ER220B-2650**	0°	-50°	+70°	0°	+70°	0°
ER270-2700	0°	-55°	+75°	0°	+70°	0°

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

Parts	Weight (kg)						
	ER100-3000	**ER100B-3500-DW**	**ER130B-3200**	**ER160B-3200**	**ER170B-2650**	**ER220B-2650**	**ER270-2700**
Robot	1053	1050	1120	1150	1092	1120	1360
Big arm casting	154	150	154	154	154	154	222
Base assembly (Including rotation base)	449	449	449	449	449	449	697
Wrist assembly (including wrist joint and motors of J5-axis and J6-axis)	41	41	60	110	96	110	161

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

Fixed bracket should be mounted before transport the robot and be removed before install the robot. Refer to the following figures when remove the bolts on fixed bracket.

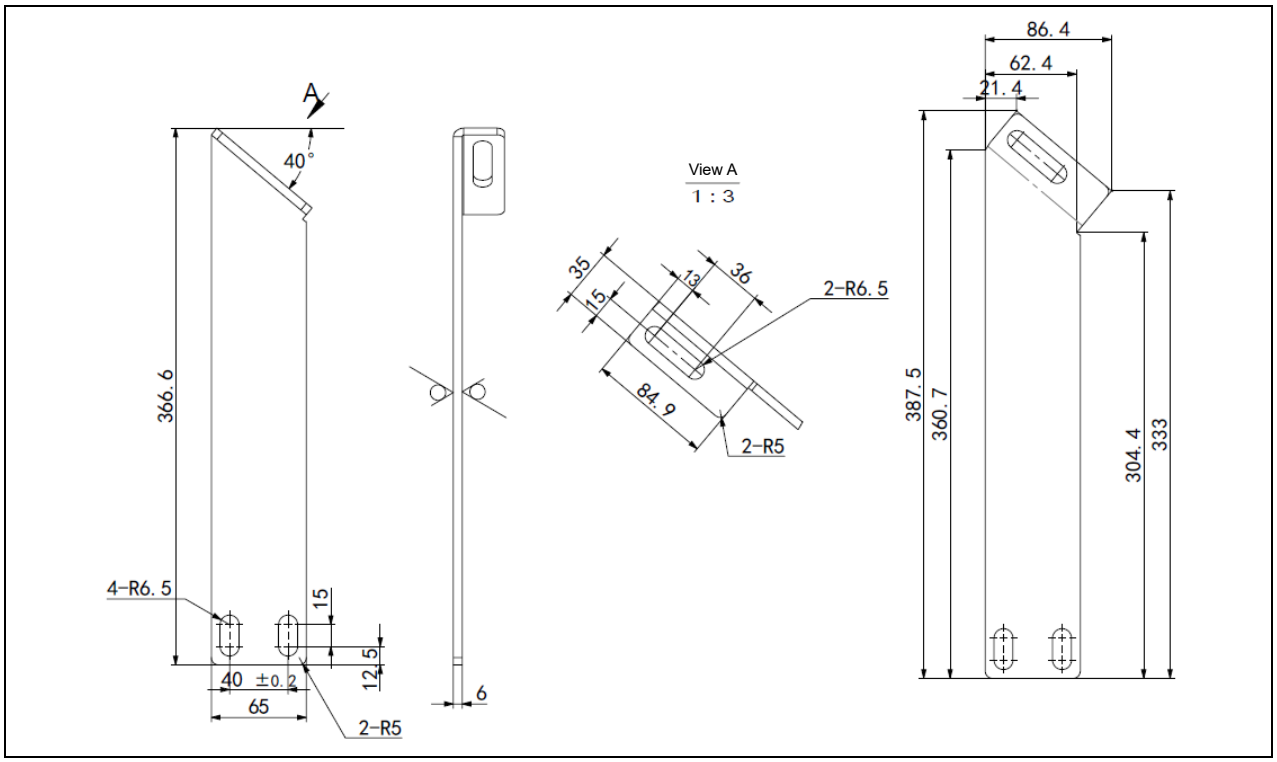


Fig. 1.1 Robot fixed bracket 1 (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

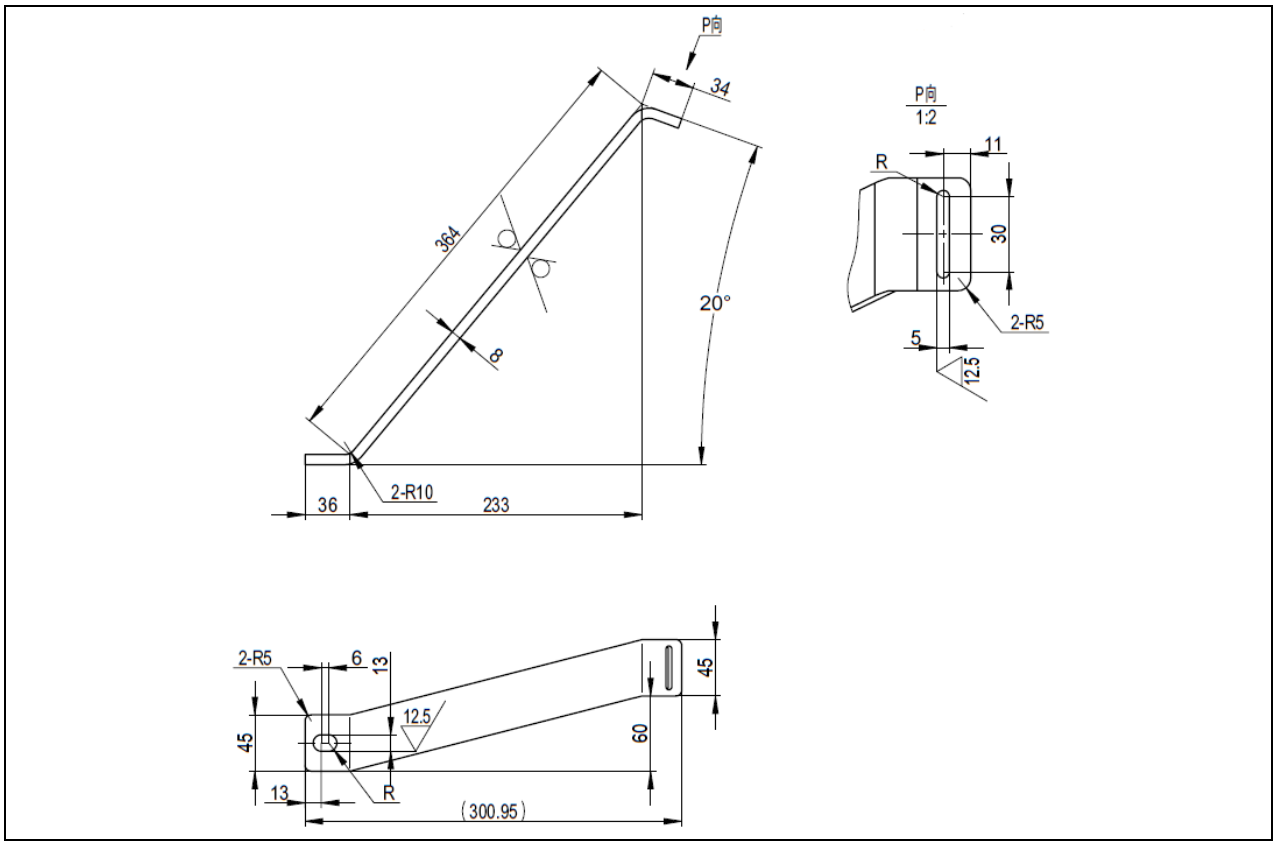


Fig. 1.2 Robot fixed bracket 2 (ER100B-3000)

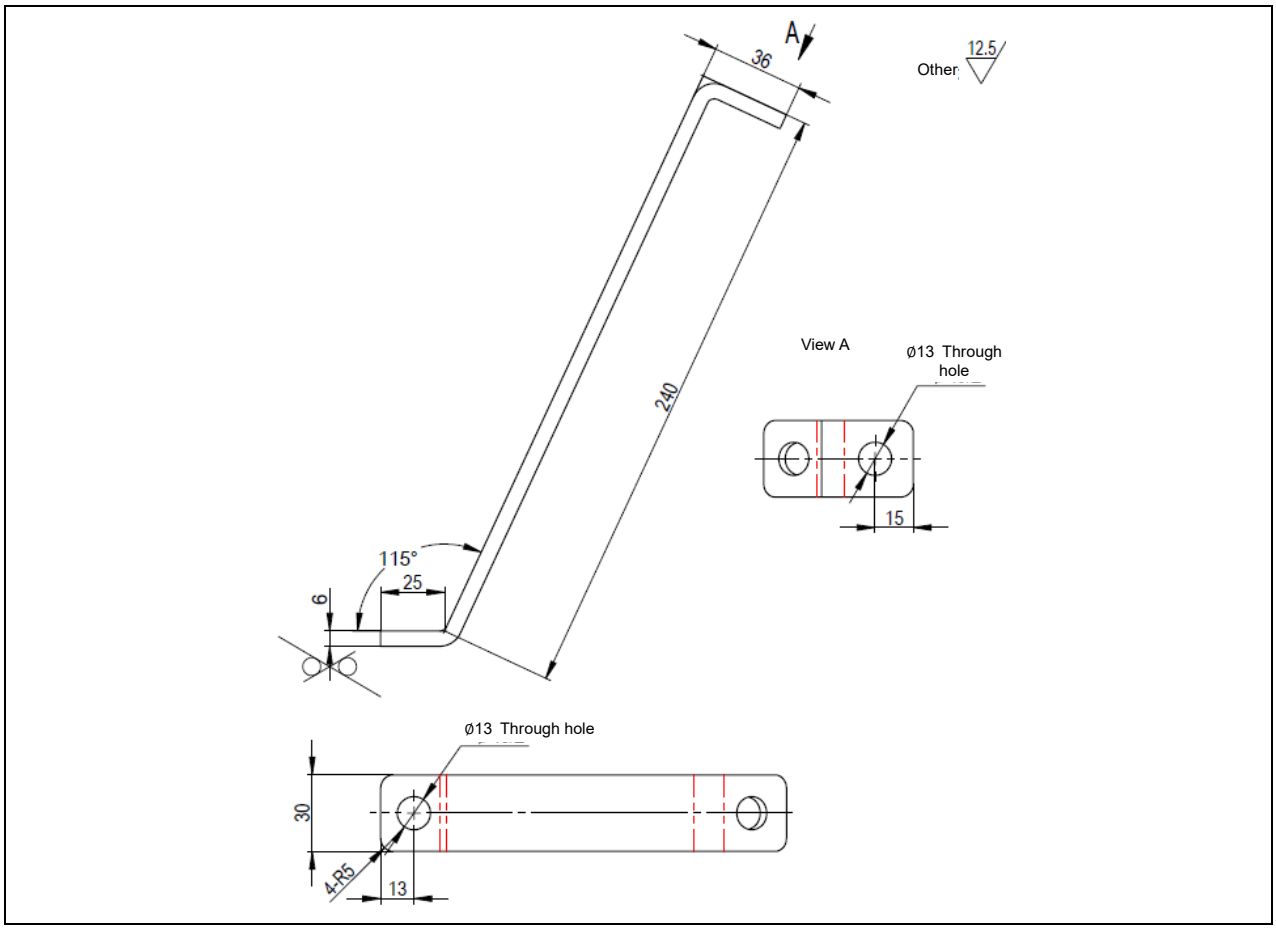


Fig. 1.3 Robot fixed bracket 3 (ER130B-3200)

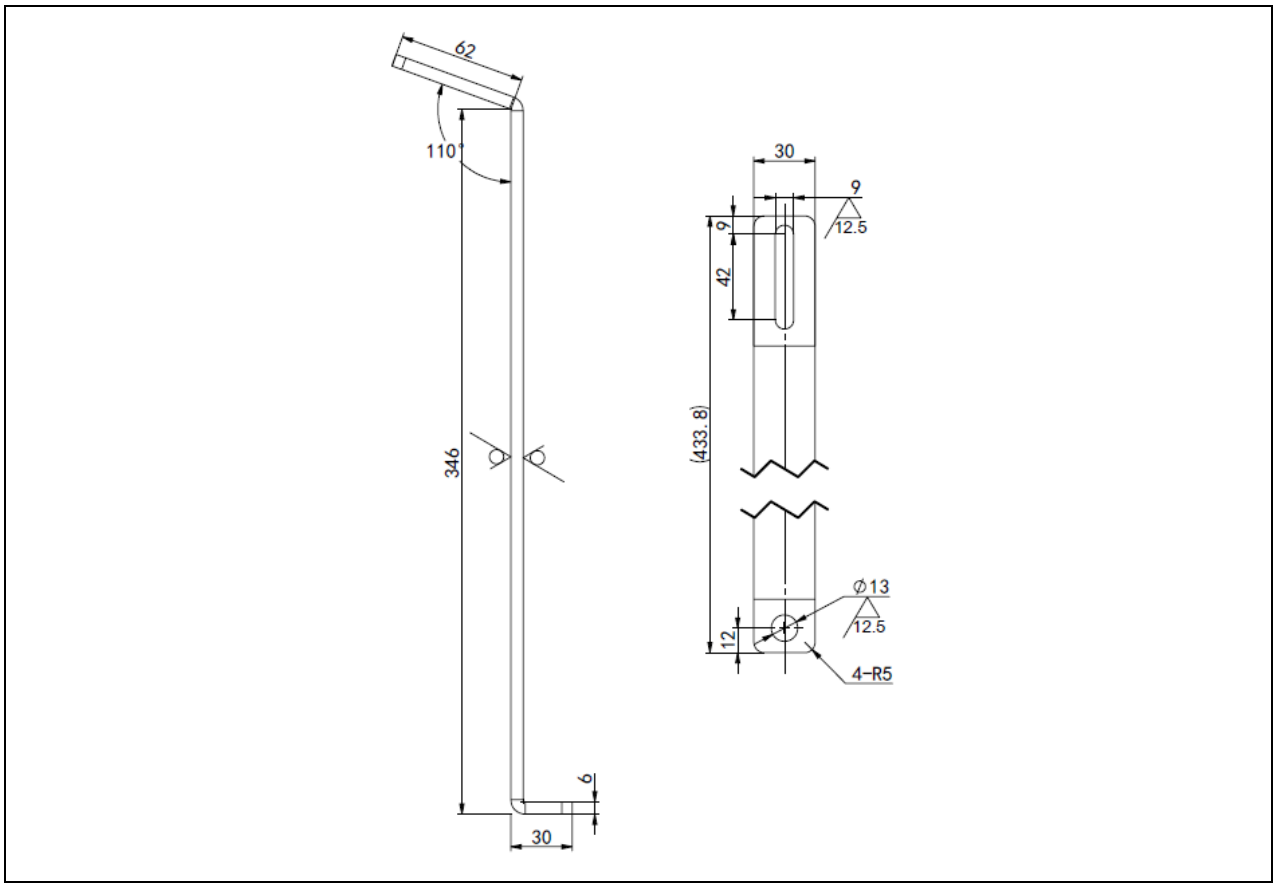


Fig. 1.4 Robot fixed bracket 4 (ER170B-2650,ER220B-2650)

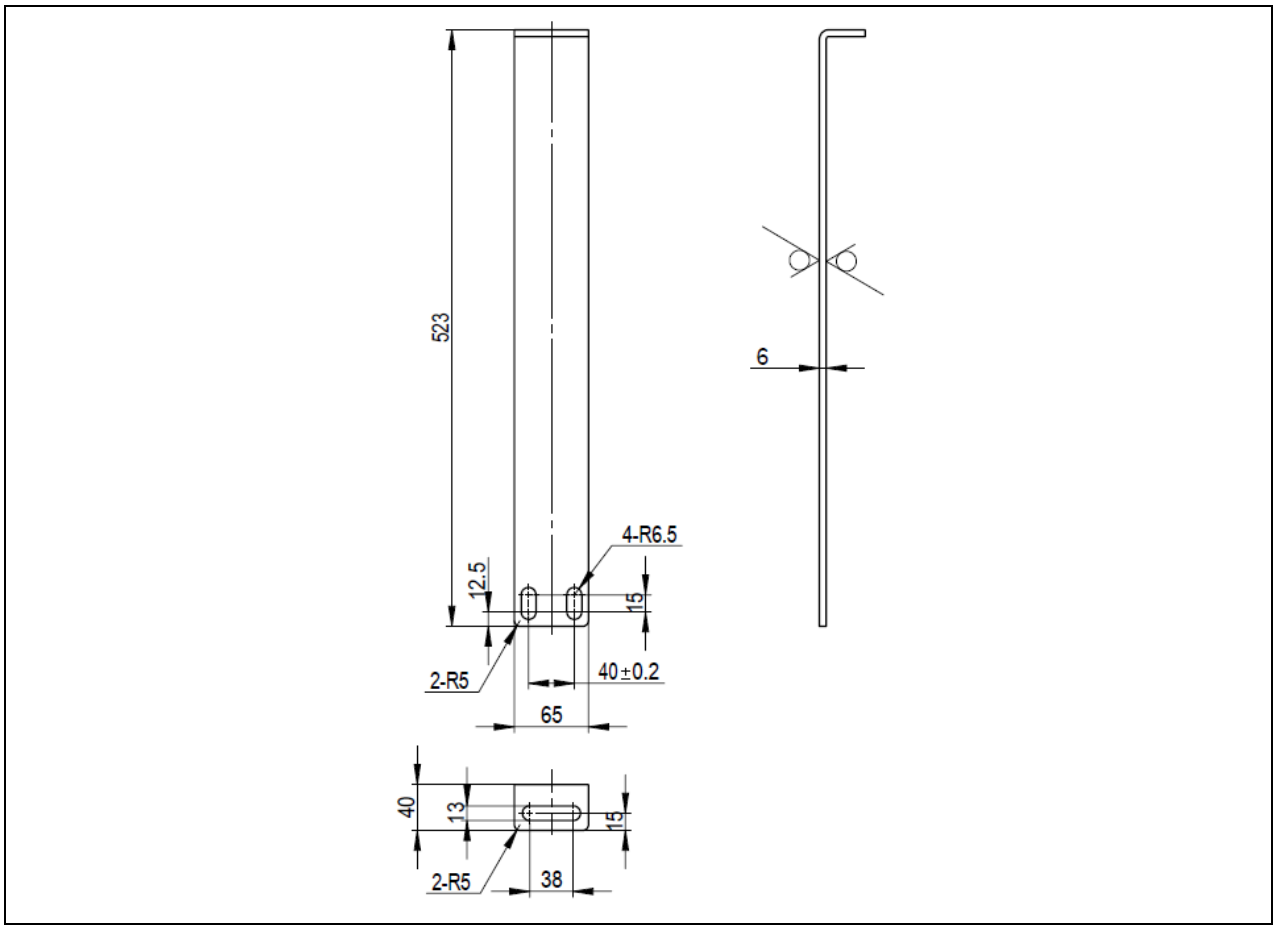


Fig. 1.5 Robot fixed bracket (ER100B-3500-DW)

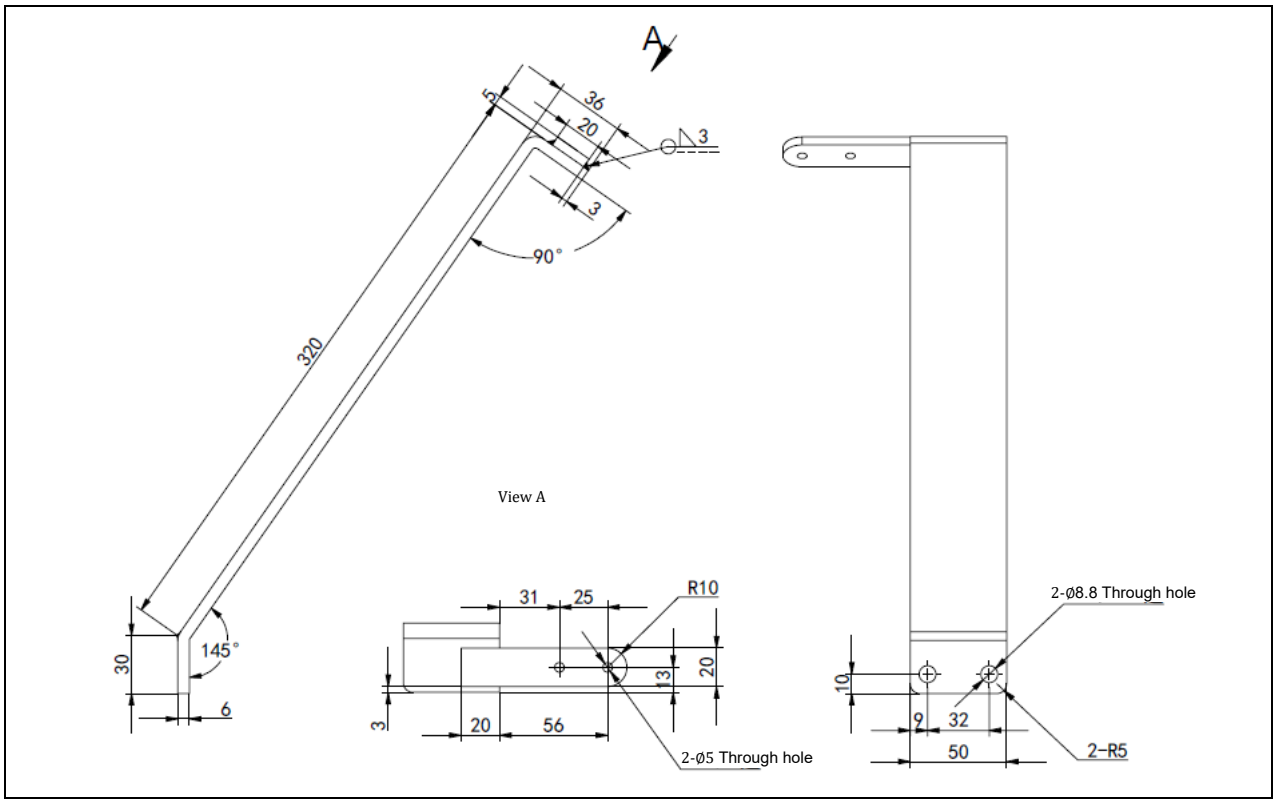


Fig. 1.6 Robot fixed bracket 6 (ER100B-3500-DW)

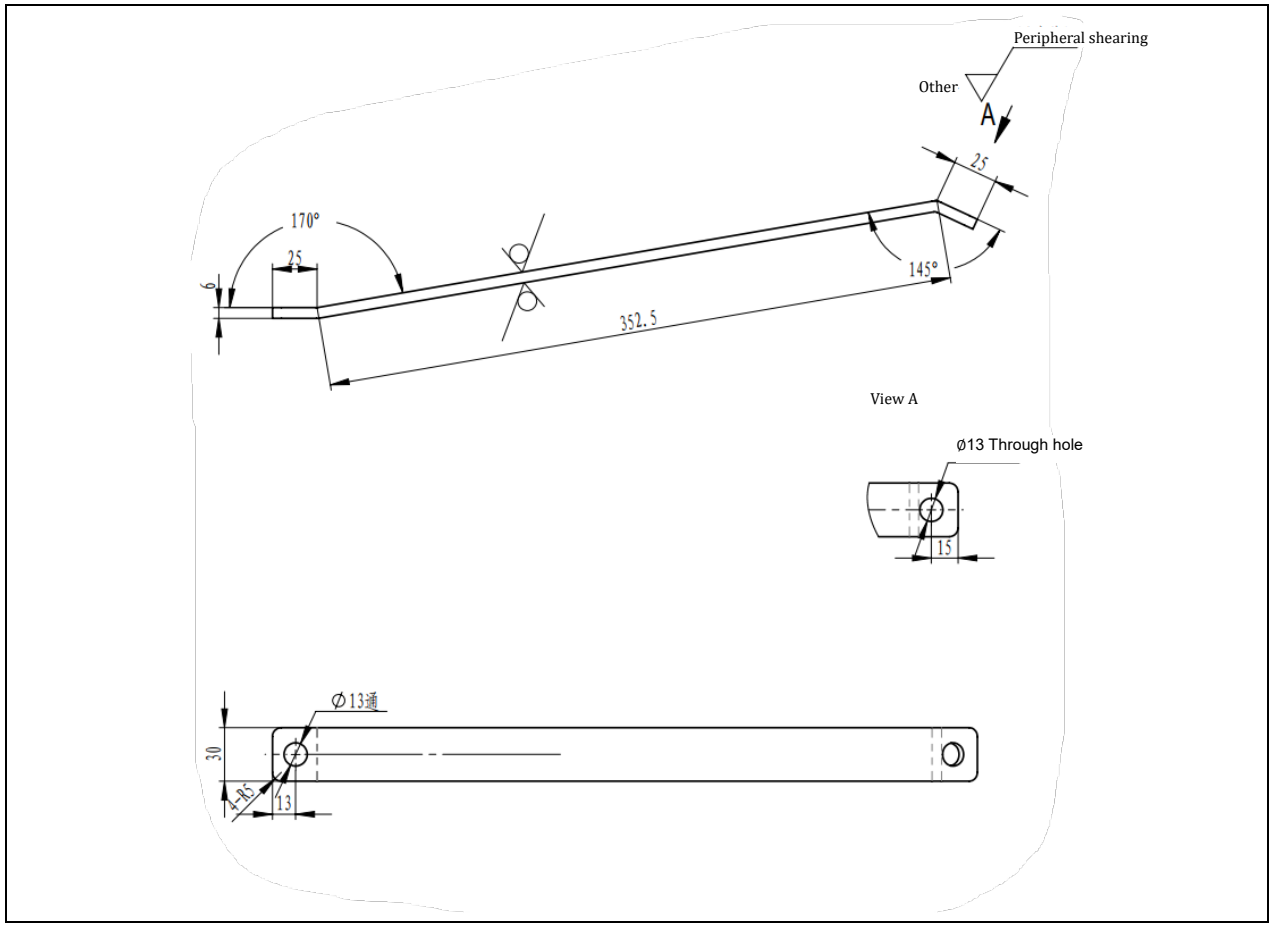


Fig. 1.7 Robot fixed bracket 7 (ER160B-3200)

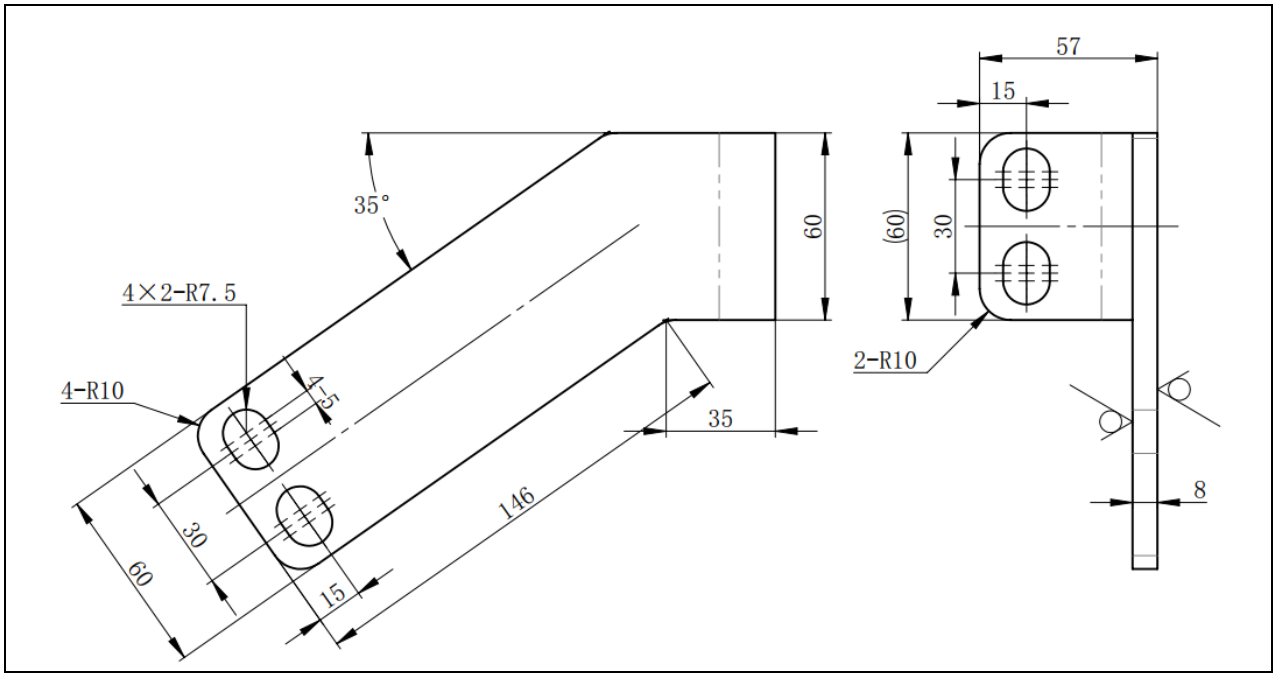


Fig. 1.8 Robot fixed bracket 7 (ER160B-3200)

1.1.1.Transport by a forklift

Use a forklift to transport the robot. As ER100B-3000、ER100B-3500-DW、ER130B-3200、ER160B-3200，ER170B-2650 和 ER220B-2650,Use 12 M16X50 bolts to fix the 4 fixed plates on the forklift to the robot base. As ER270-2700 ,Use 8 M16X45 bolts to fix the 4 fixed plates on the forklift to the robot base a forklift to heave the robot. Make sure that the fixed bolts of the robot are removed before transportation.

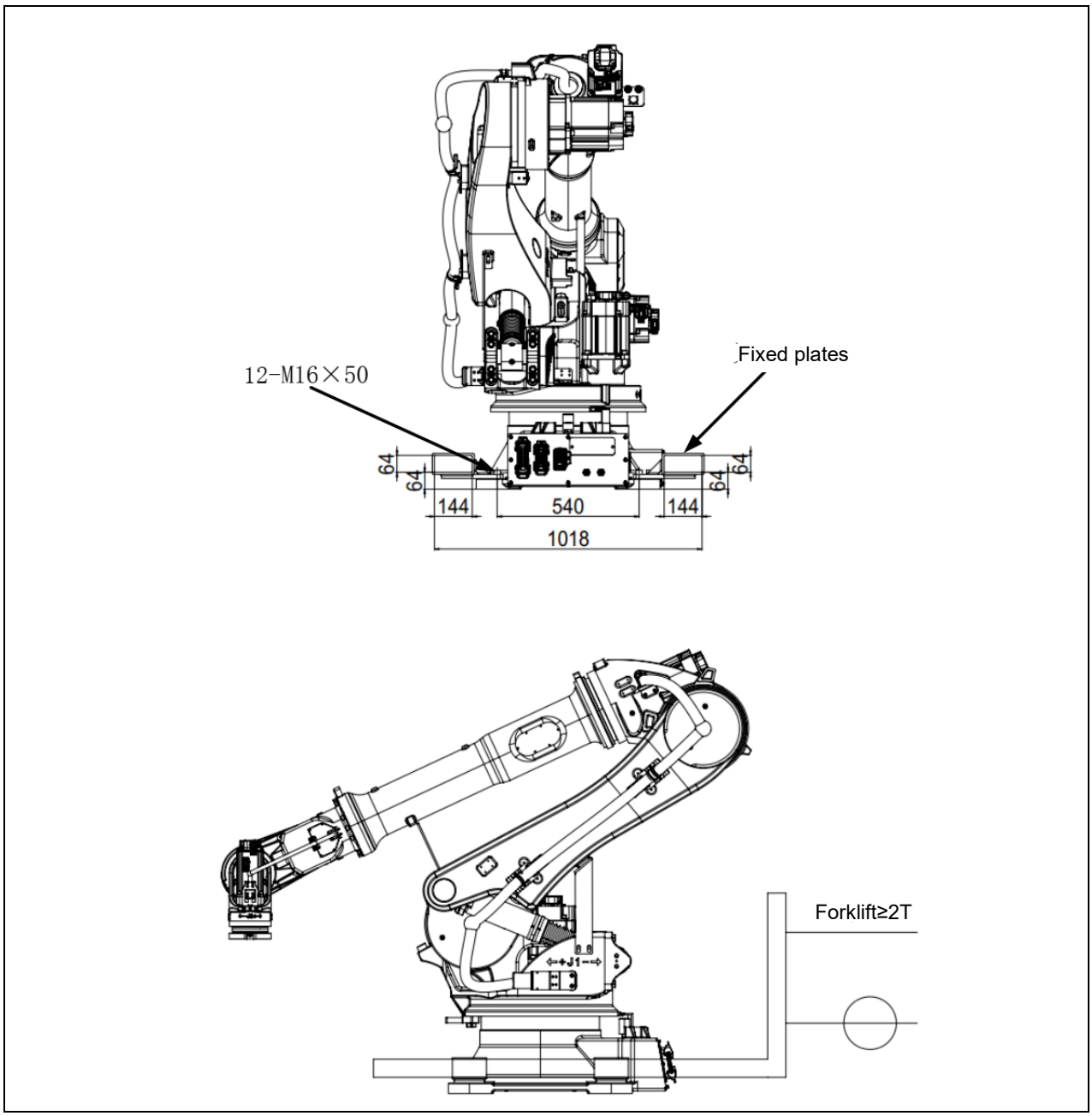


Fig. 1.9 Use a forklift to transport the robot
(ER100B-3000,ER130B-3200,ER160B-3200,ER170B-2650,ER220B-2650)

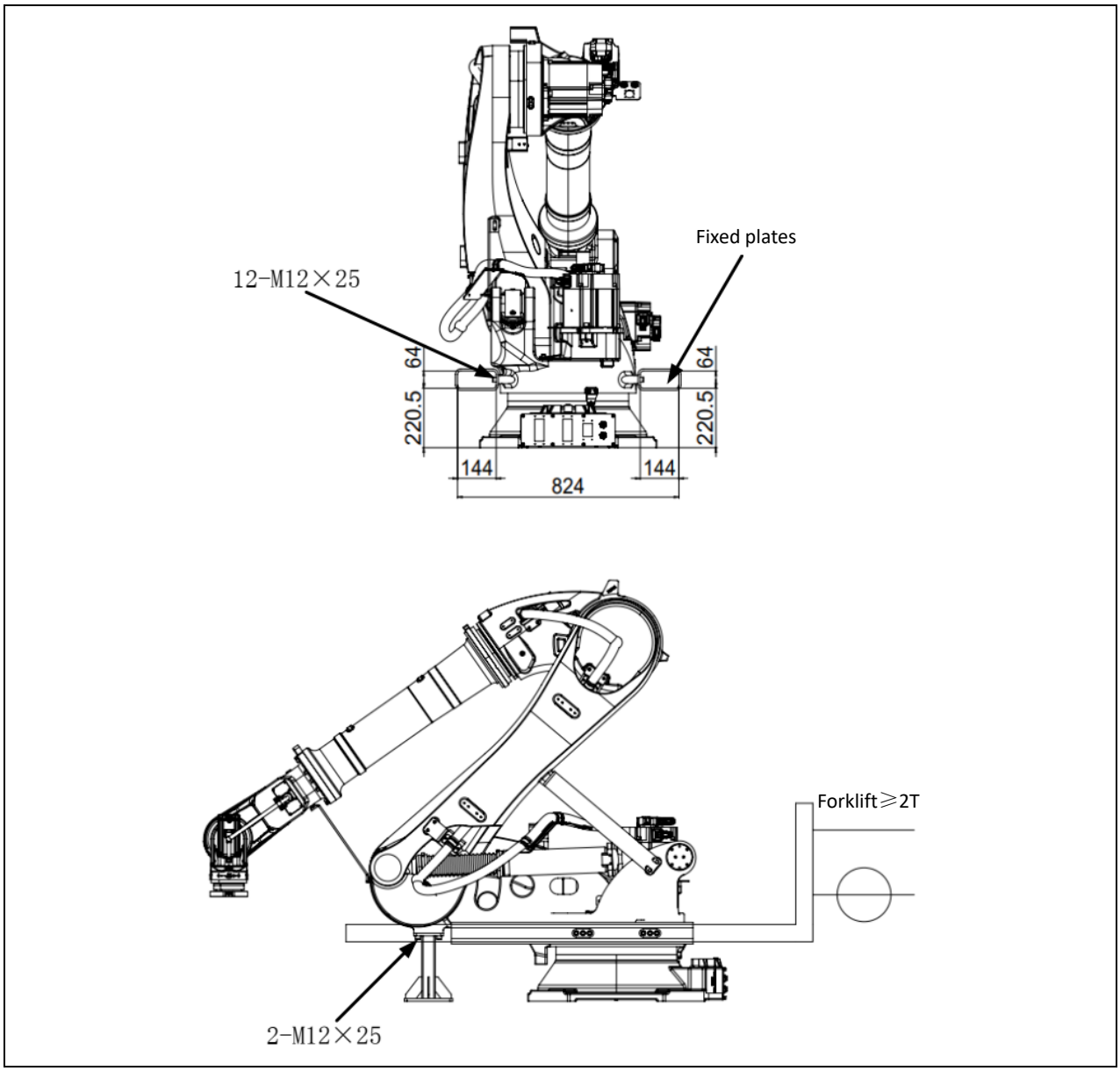


Fig. 1.10 Use a forklift to transport the robot (ER100B-3500-DW)

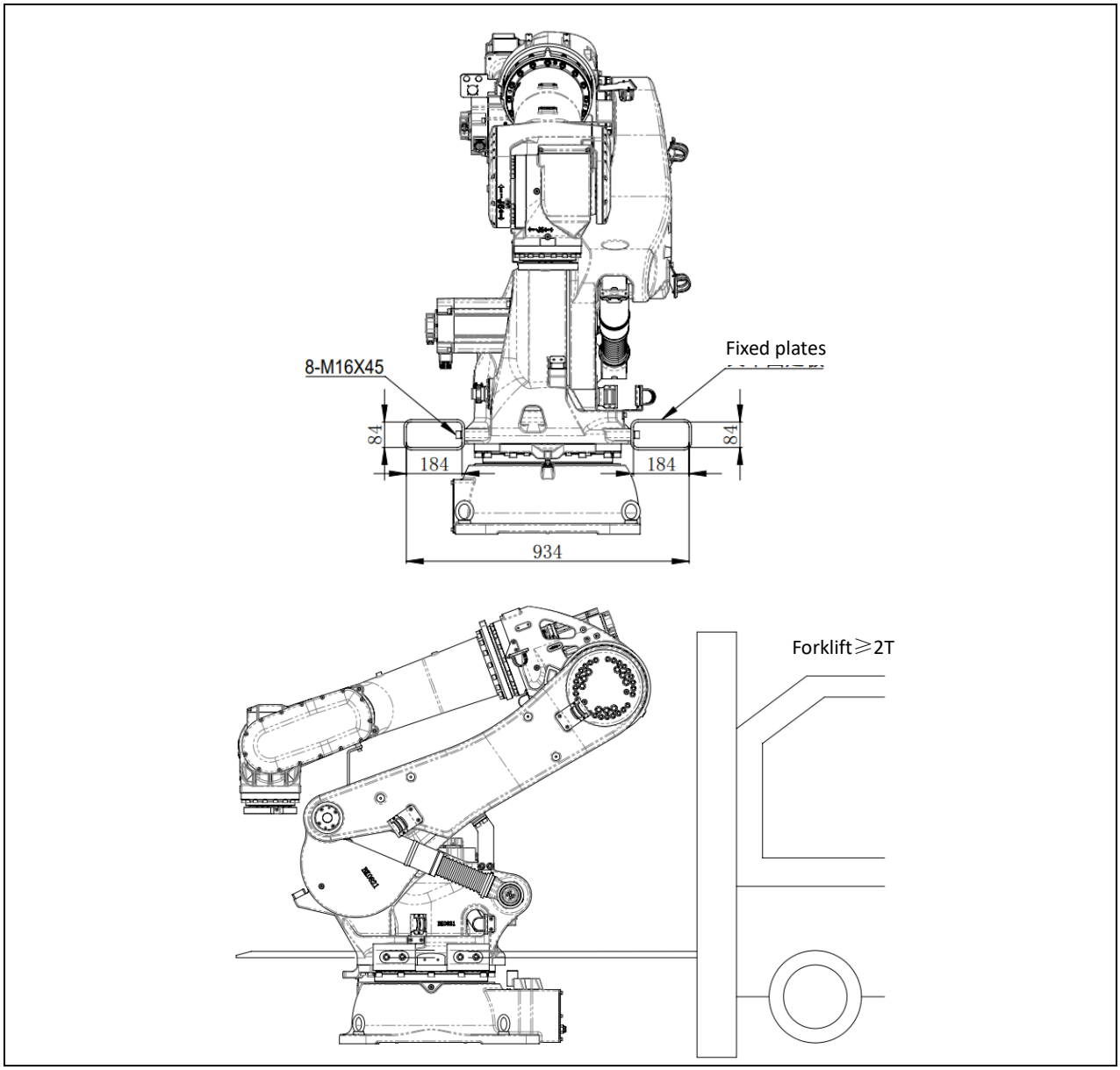


Fig. 1.11 Use a forklift to transport the robot (ER270-2700)

CAUTION

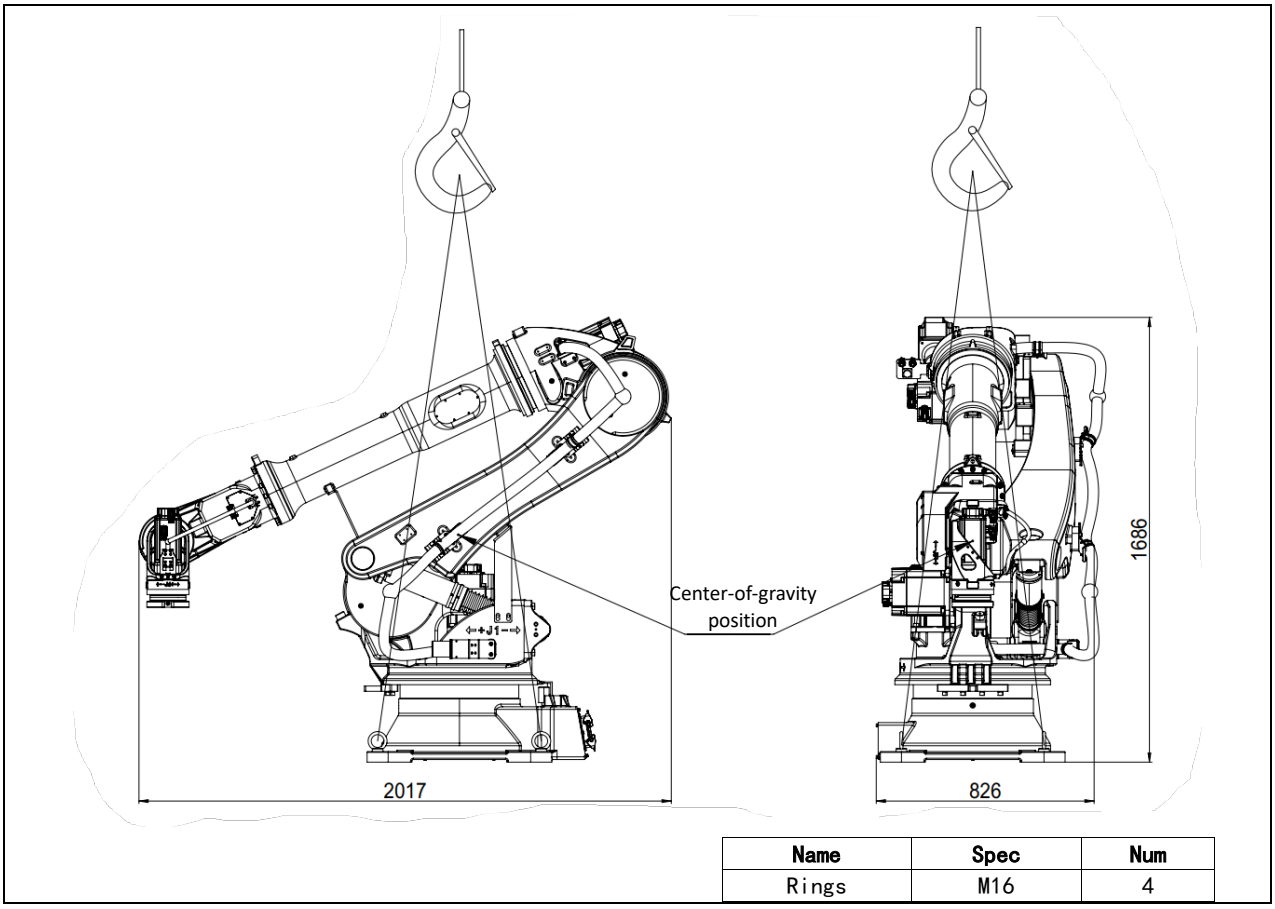
The forklift mounting plate and screws are to be provided by the customer or can be optionally purchased when placing the order.

1.1.1.1. Transport by a crane

The robot described in this manual can be transported by a crane. Fix the M16 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.

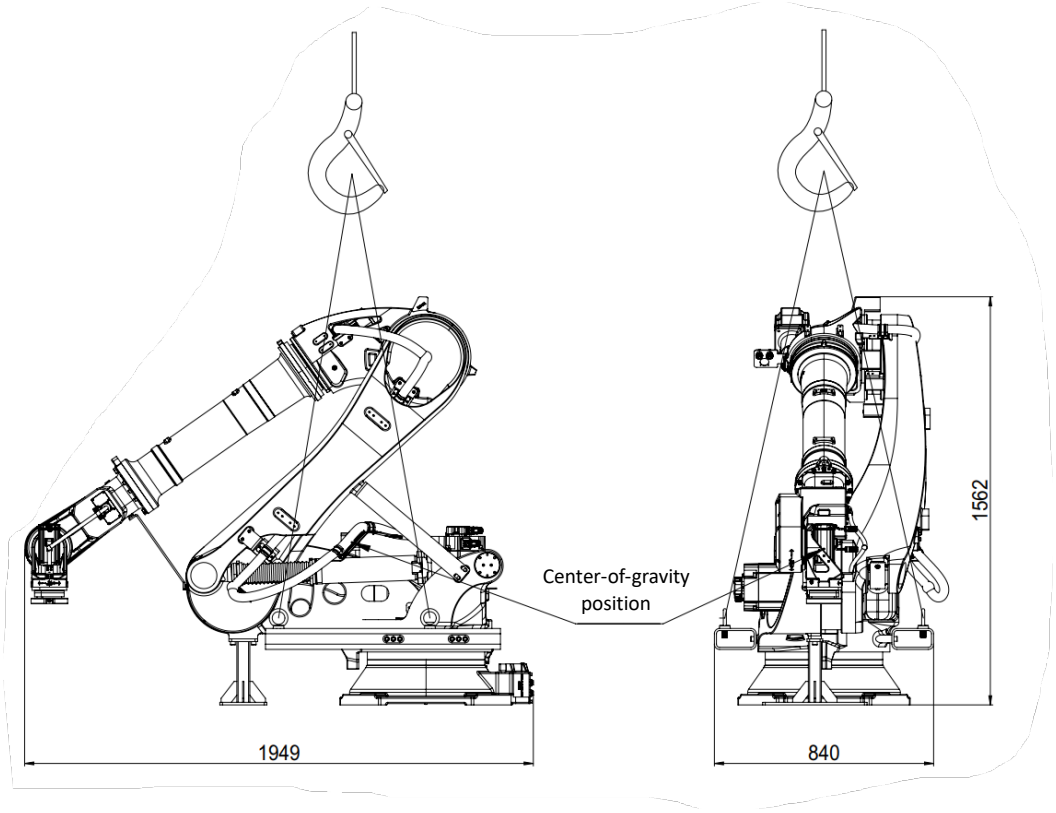
CAUTION

Eyebolt and sling should be prepared by customers.
Transportation conditions are listed below: Crane load capacity above 2000kg, String load capacity above 2000kg, Rings with specifications conforming GB/T 825-1988.



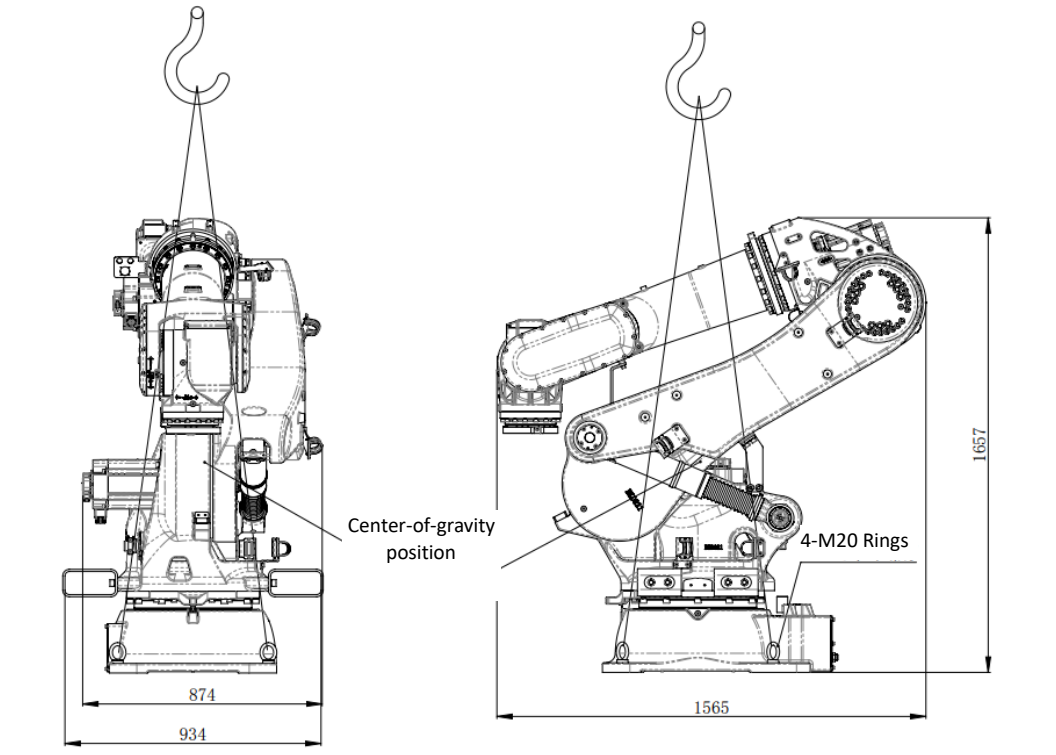
Name	Spec	Num
Rings	M16	4

Fig. 1.12 Use a crane to transport the robot (ER100B-3000, ER130B-3200,ER160B-3200,ER170B-2650, ER220B-2650)



Name	Spec	Num
Rings	M16	4

Fig. 1.13 Use a crane to transport the robot (ER100B-3500-DW)

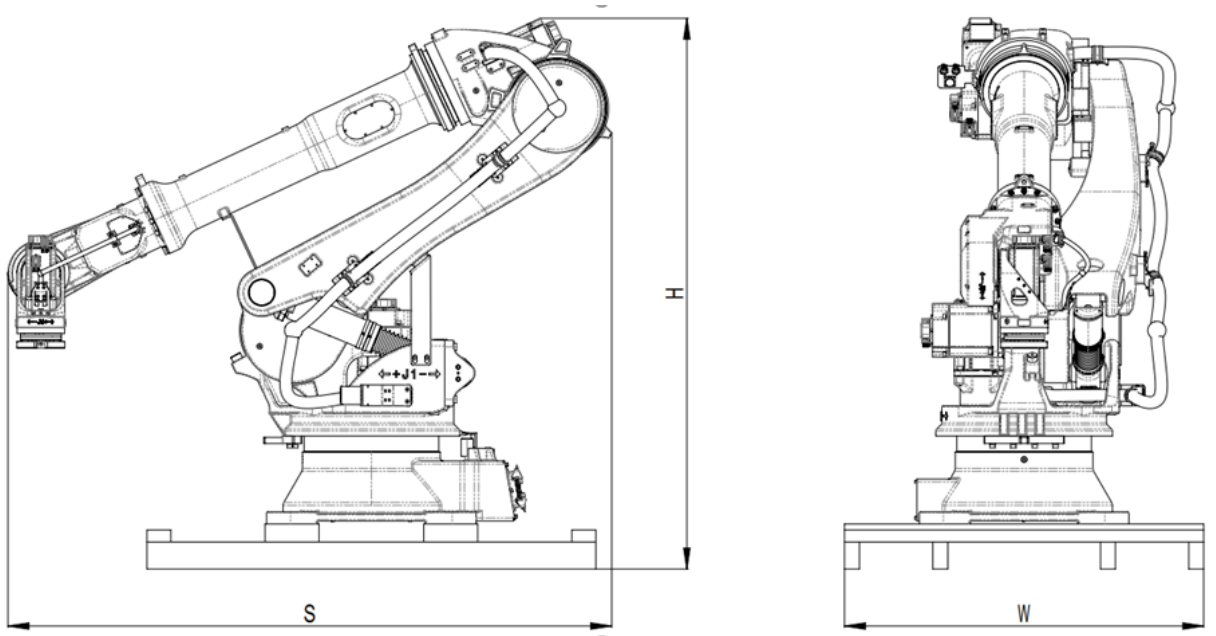


Name	Spec	Num
Rings	M16	4

Fig. 1.14 Use a crane to transport the robot (ER270-2700)

1.2. Storage

The storage requirements for this model of robot when transported on a wooden pallet are as follows:



Model	H(mm)	S(mm)	W(mm)
ER100B-3000	1850	1900	1250
ER100B-3500-DW	1750	2150	1250
ER130B-3200	1900	2050	1250
ER160B-3200	1900	2050	1250
ER170B-2650	1850	1600	1250
ER220B-2650	1900	1600	1250
ER270-2700	1807	1580	1250

Fig. 1.15 Dimensions of robot storage space

1.3. INSTALLATION

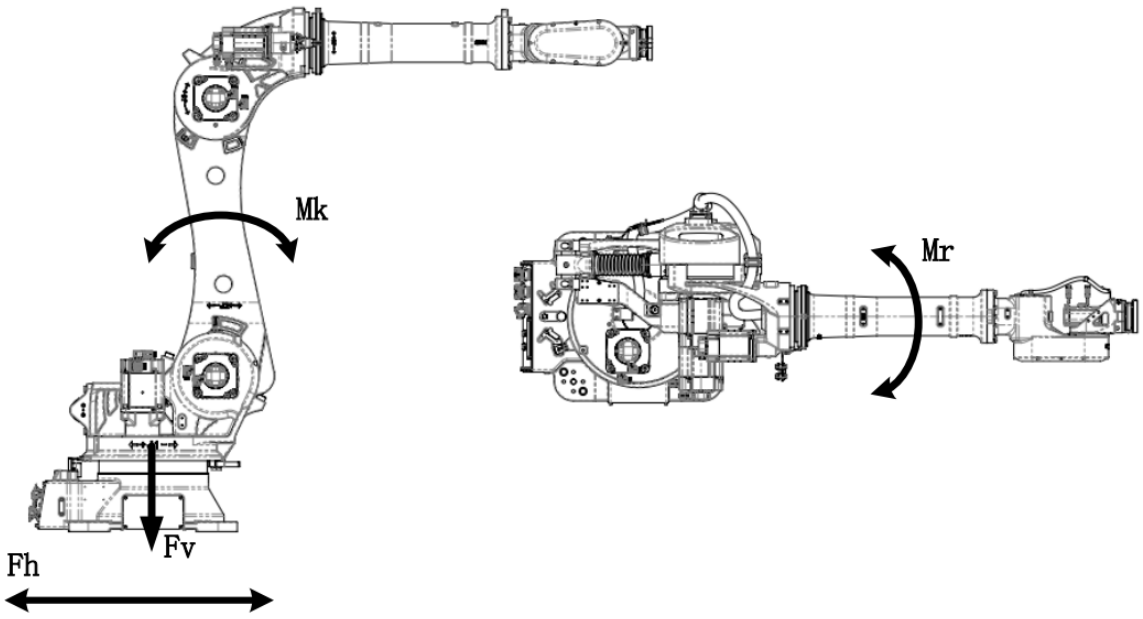
CAUTION	**Make sure the system is properly grounded before installation. There is a risk of electric shock when the ground wire is not connected.**

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.

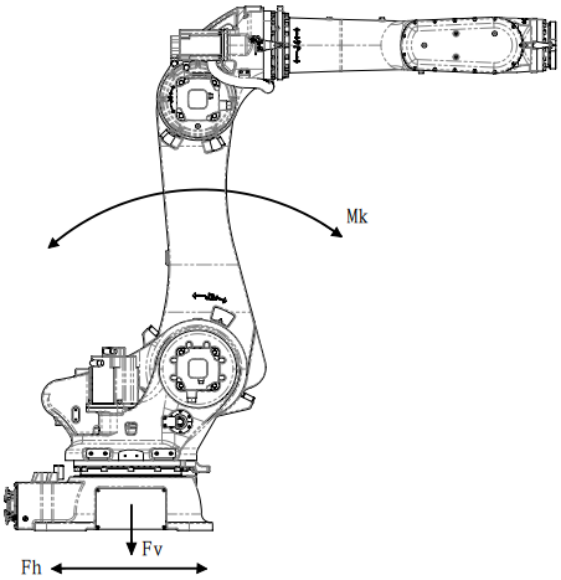
- Make sure the weight of the robot is within the forklift or crane load capacity. Details see Section 1.1 TRANSPORTATION.
- Storage and mounting condition should be complied with Section 1.3 INSTALLATION CONDITION.

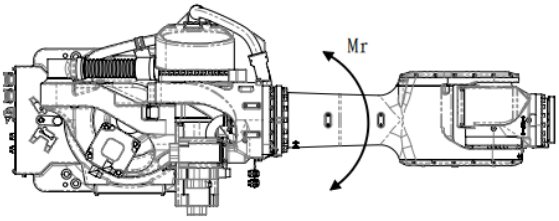
> **CAUTION**
>
> **When mounting the robot base, consider its structure and the force upon it. Concrete on the base may not have any crack and conform to the specified codes. The bearing capacity and compaction of the concrete foundation should be in accordance with the design guideline. Concrete strength level C20/C25 should be in accordance with the following codes:**
>
> - **GB50010-2010 *Code for design of concrete structures***
> - **GB/T50081-2002 *Standard for test method of mechanical properties on ordinary concrete***



Item	Definition	Max. value					
		ER100B-3000	ER100B-3500-DW	ER130B-3200	ER160B-3200	ER170B-2650	ER220B-2650
Mk	Max. overturning torque	28600 (N·m)	27500 (N·m)	39200 (N·m)	39200 (N·m)	36000 (N·m)	39200 (N·m)
Mr	Max. torsional torque	23520 (N·m)	23520 (N·m)	23520 (N·m)	23520 (N·m)	23520 (N·m)	23520 (N·m)
Fv	Max. vertical force	34050 (N)	30750 (N)	39000 (N)	40000 (N)	37800 (N)	39000 (N)
Fh	Max. horizontal force	5450 (N)	14700 (N)	8500 (N)	9110 (N)	7200 (N)	8500 (N)

Fig 1.16 Robot base force





Item	Definition	Max. value ER270-2700
Mk	Max. overturning torque	43750（N·m）
Mr	Max. torsional torque	29400（N·m）
Fv	Max. vertical force	50250（N）
Fh	Max. horizontal force	15900（N）

Fig 1.17 Robot base force

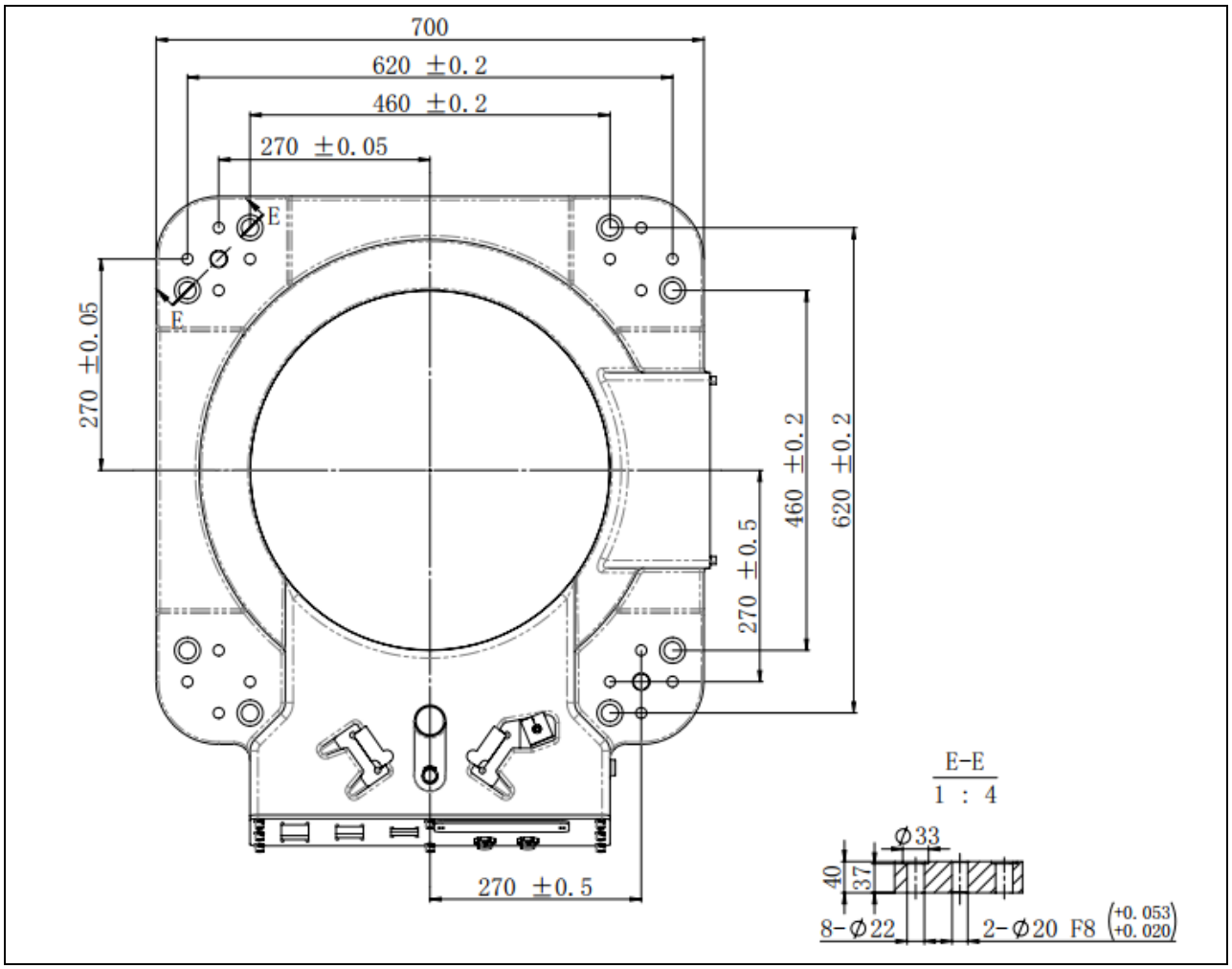


Fig. 1.18 Robot base mounting dimension (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

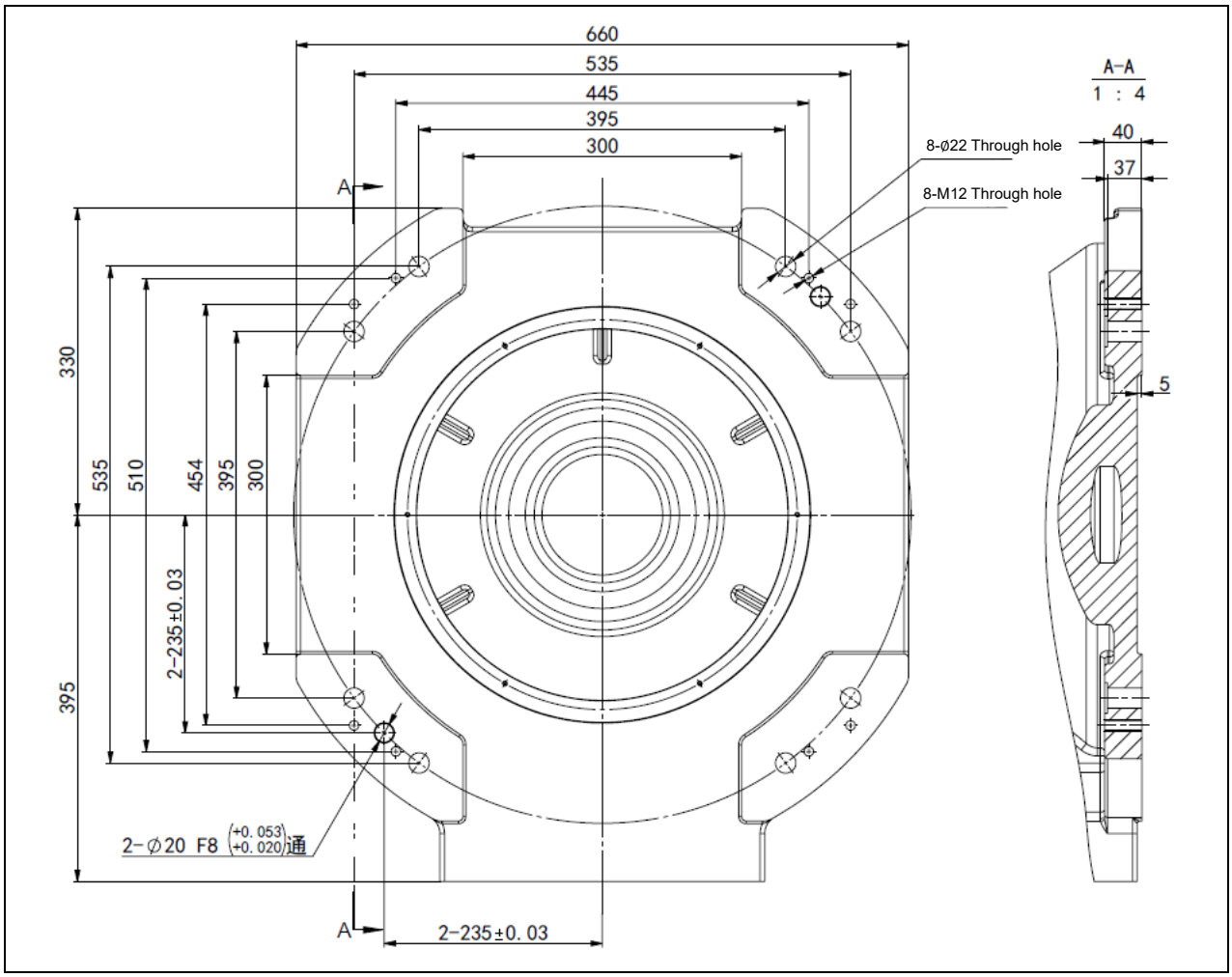


Fig. 1.19 Robot base mounting dimension (ER100B-3500-DW)

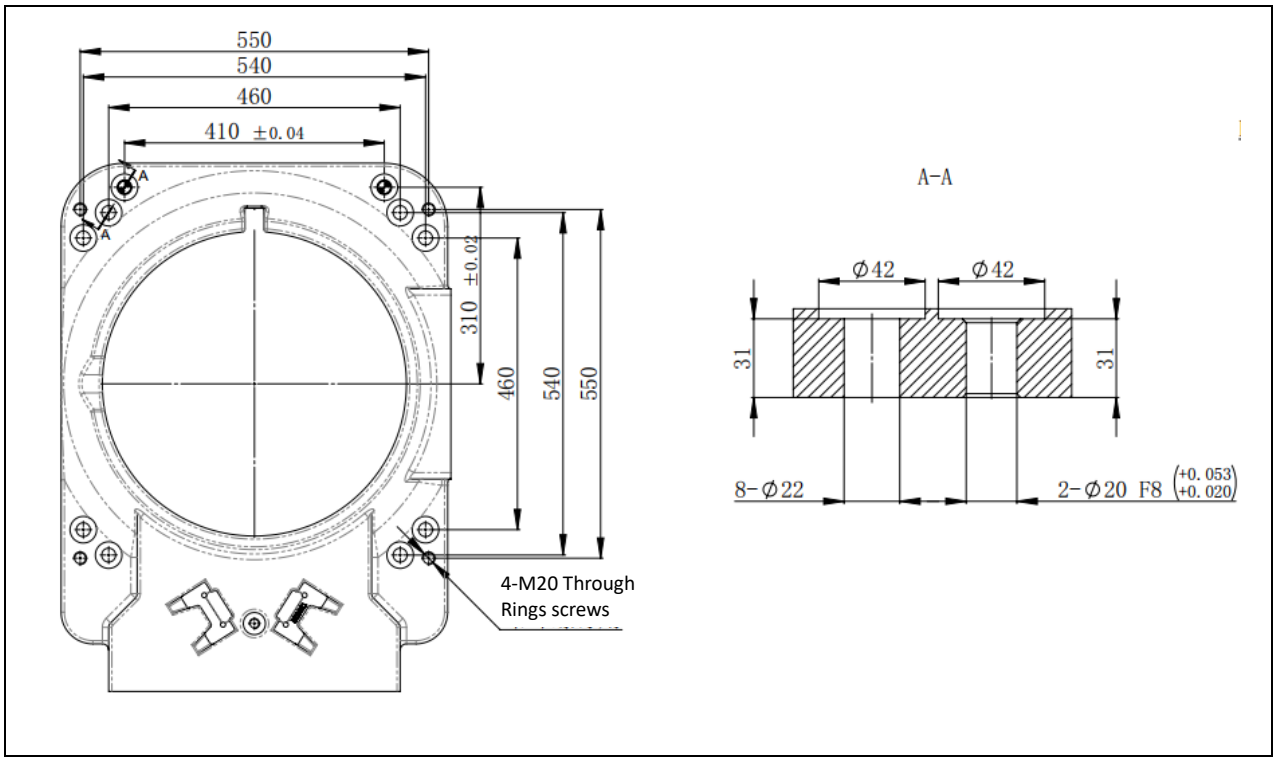
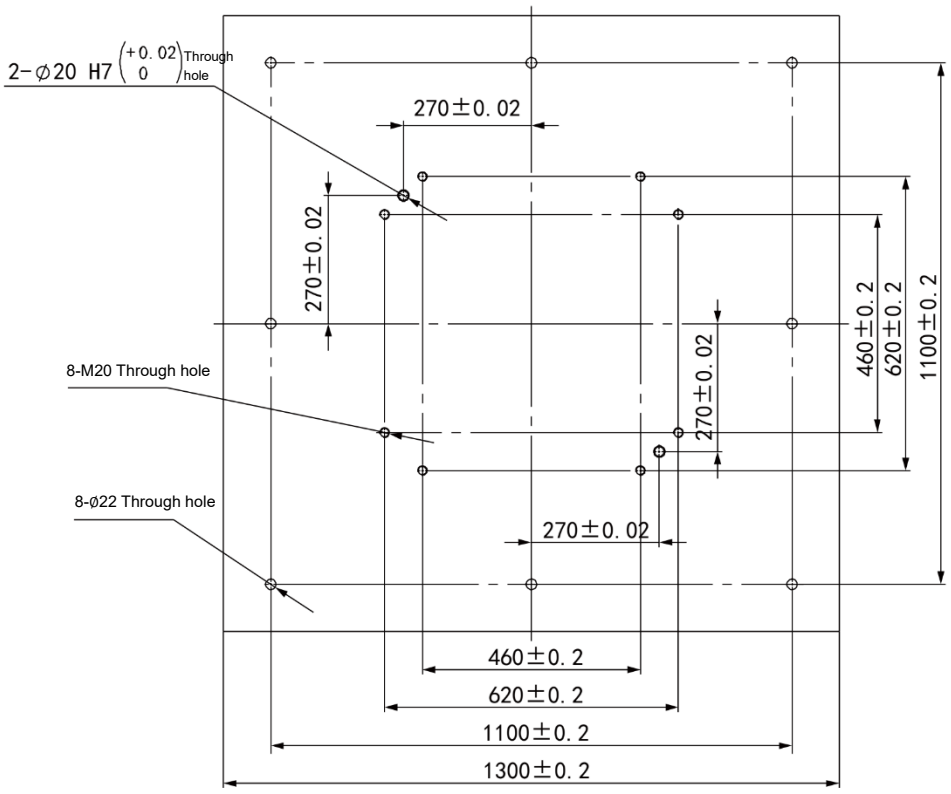


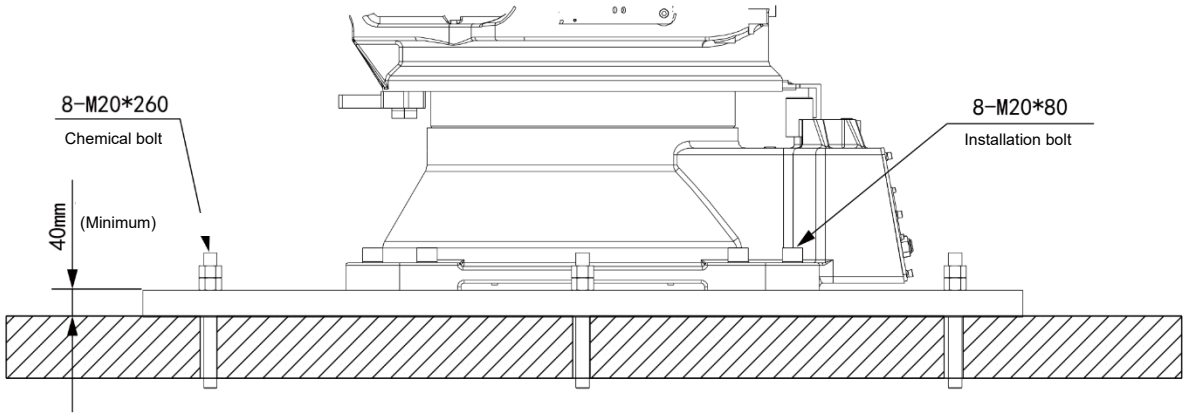
Fig. 1.20 Robot base mounting dimension (ER270-2700)

Tab. 1.1 Robot fixing components

Item and model	Number
Fixed screw: M20X70 (GB/T 70.1 12.9 级)	8
Spring washer: Spring washer 20 (GB/T 93)	8
Positioning pin: Cylindrical pin 20X60 (GB/T120.2)	2

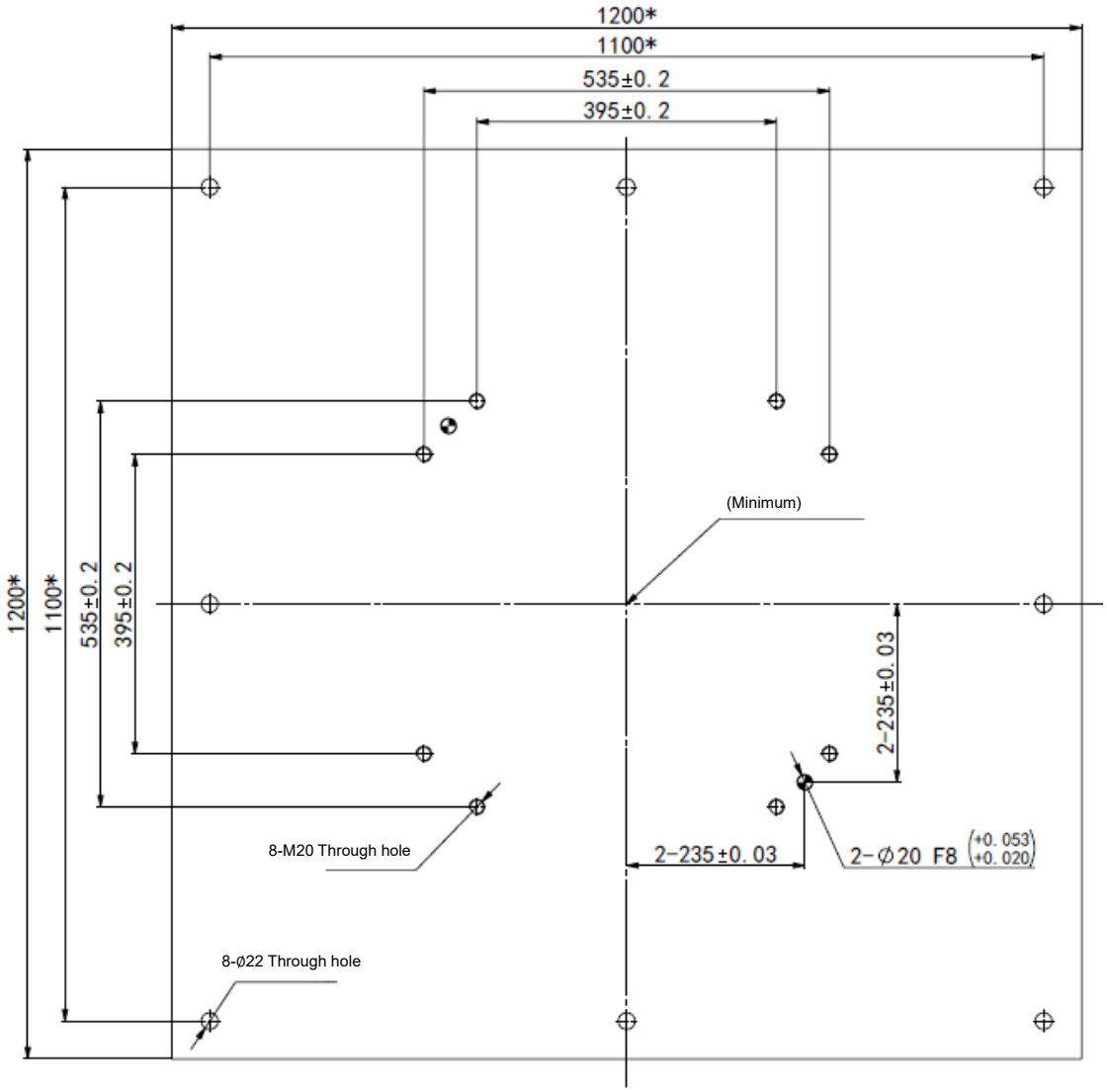
INFO **Positioning pin can reduce the influence on current program caused by re-installation or replacement of the robot. If the recovery of programmed path is needed, perform adjustment. If not, positioning pin can be eliminated.**

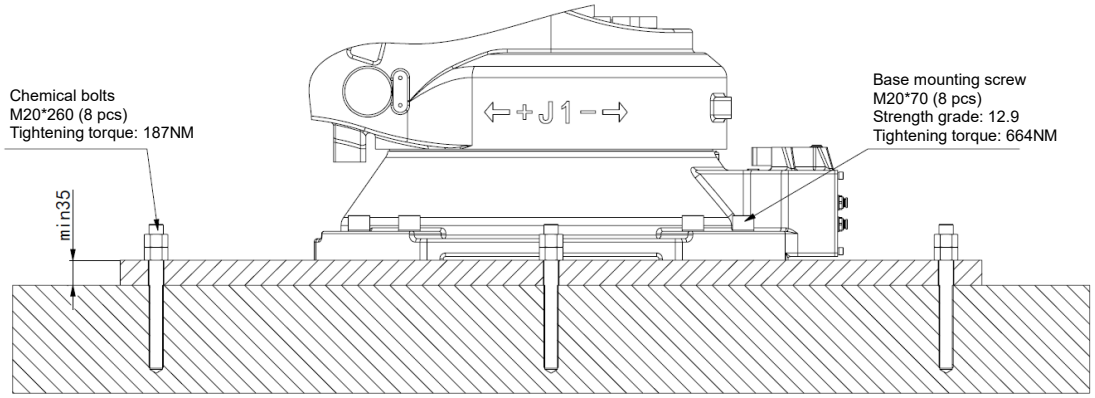




Note: use eight M20x260 chemical bolts to fix the mounting plate on the concrete floor. The thickness of the concrete should be no less than 190mm, effective area no less than 1300mmx1300mm. Fix the robot base with parts shown in the table above.

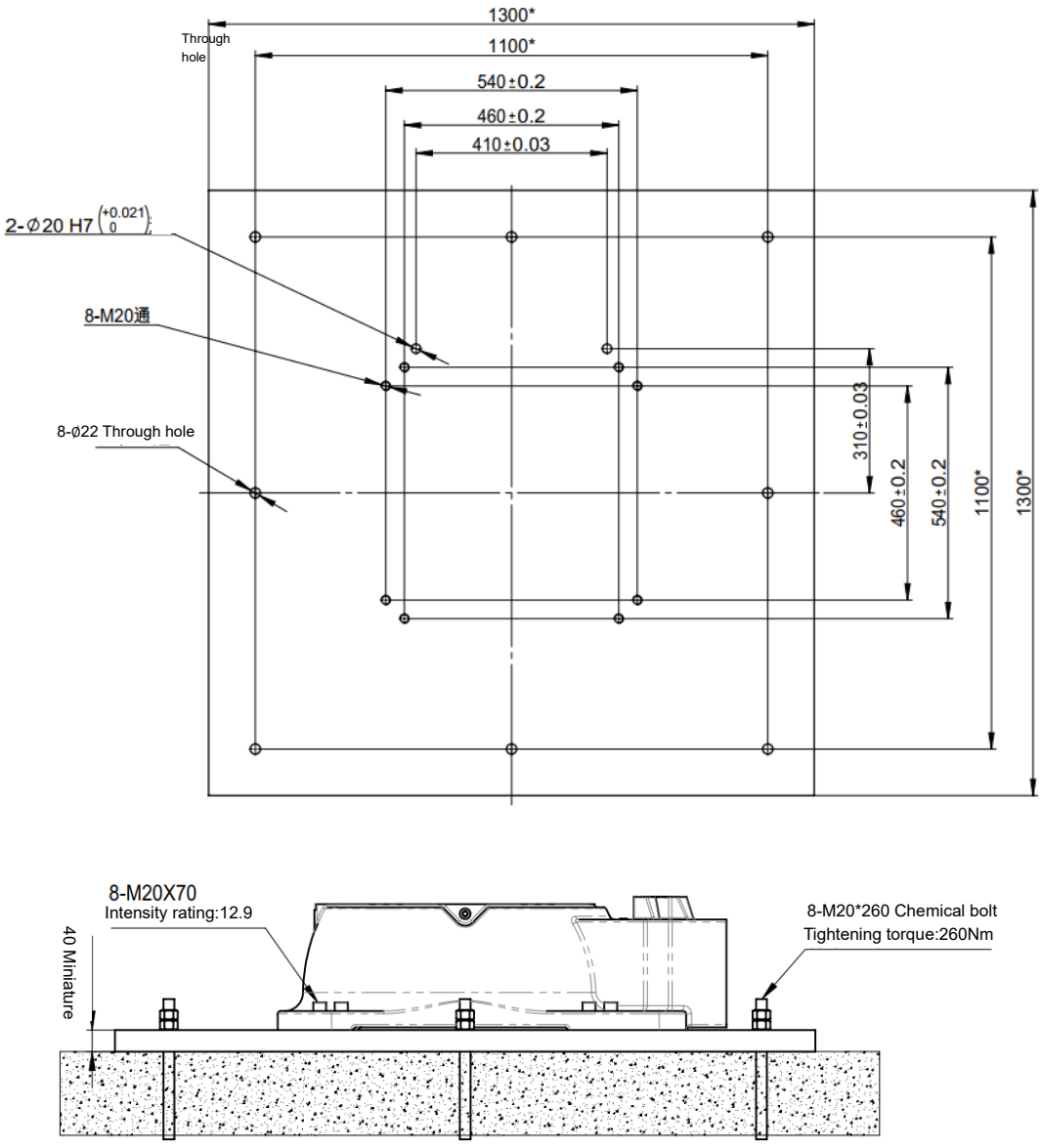
Fig. 1.21 Robot mounting plate dimension and mounting method (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)





Note: use eight M20x260 chemical bolts to fix the mounting plate on the concrete floor. The thickness of the concrete should be no less than 190mm, effective area no less than 1300mmx1300mm. Fix the robot base with parts shown in the table above.

Fig. 1.22 Robot mounting plate dimension and mounting method (ER100B-3500-DW)



Note: use eight M20x260 chemical bolts to fix the mounting plate on the concrete floor. The thickness of the concrete should be no less than 190mm, effective area no less than 1300mmx1300mm. Fix the robot base with parts shown in the table above.

Fig. 1.23 Robot mounting plate dimension and mounting method (ER270-2700)

1.4. INSTALLATION CONDITIONS

CAUTION

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

Foundation	
Max. surface roughness	0.5mm
Max. inclination angle	5°

Storage condition	
Min. ambient temperature	-25℃
Max. ambient temperature	+55℃
Min. ambient temperature	95%RH
Protection level	
ER100B-3000	Wrist: IP65 Body: IP54
ER100B-3500-DW	
ER130B-3200	
ER160B-3200	
ER170B-2650	
ER220B-2650	
ER270-2700	Wrist: IP67 Body: IP54

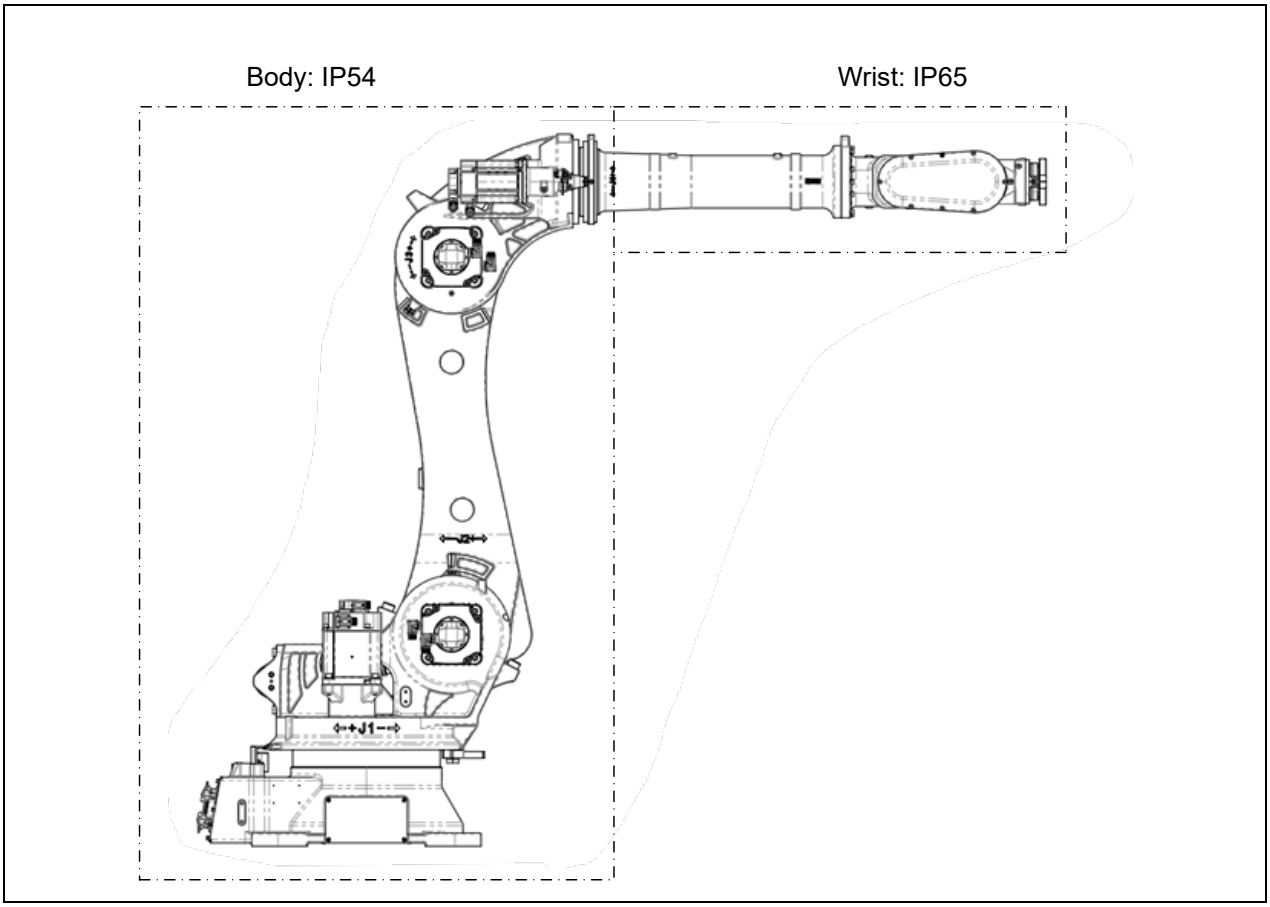


Fig. 1.24 IP grade of robot

Performance of resistant chemicals and resistant solvents.

(1) The robot (including severe dust/liquid protection model) cannot be used with the following liquids. Potentially these liquids will cause irreversible damage to the rubber parts (such as gaskets, oil seals, O-rings etc.). (As exception to this only liquids tested and approved by ESTUN can be used with the robot).

(a) Organic solvents

(b) Cutting fluid 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 robots work in the environment, using water or liquid, complete draining of J1 base must be done. Incomplete draining of J1base 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.

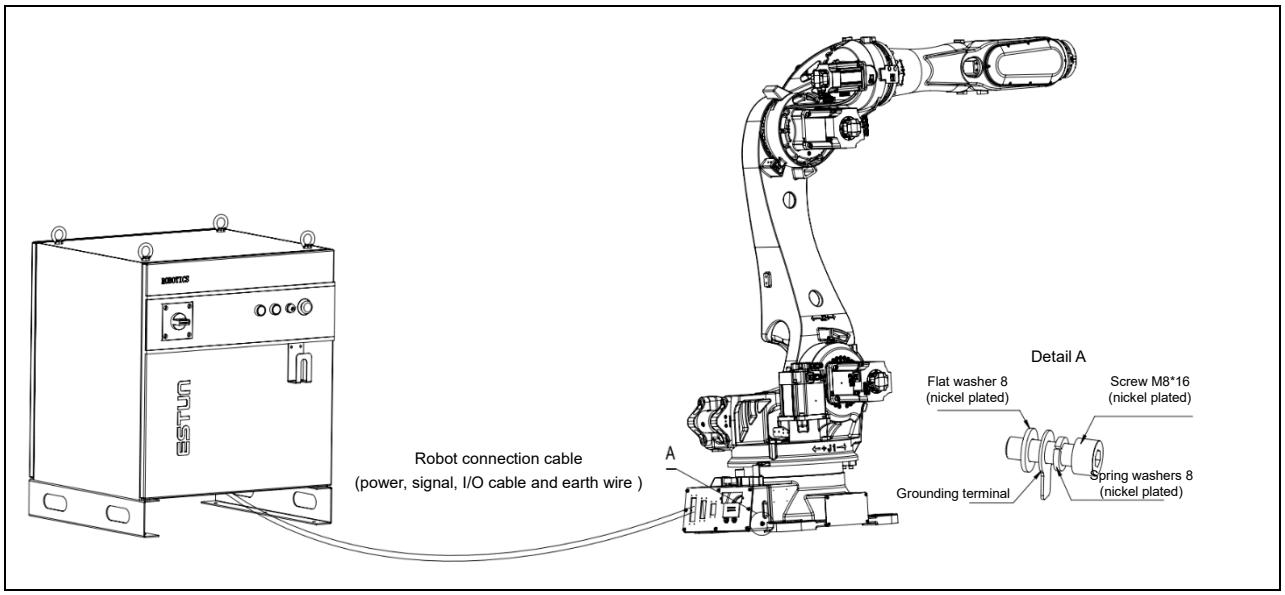


Fig. 2.1 Cable connection

CAUTION

- **The serial number of the robot should be accordance with the serial number of the cabinet. Precision deviation may occur due to unmatched serial numbers.**
- **Before connecting the power supply to the control device, please ensure that the robot and the control device are grounded through the use of a grounding wire. There is a risk of electric shock if the grounding wire is not connected.**
- **When installing the grounding wire, please place it between the flat washer and the spring washer. The grounding position on the robot may have a small amount of rust preventive oil, so please ensure proper cleaning before grounding.**

3.SPECIFICATIONS

3.1. ROBOT CONFIGURATION

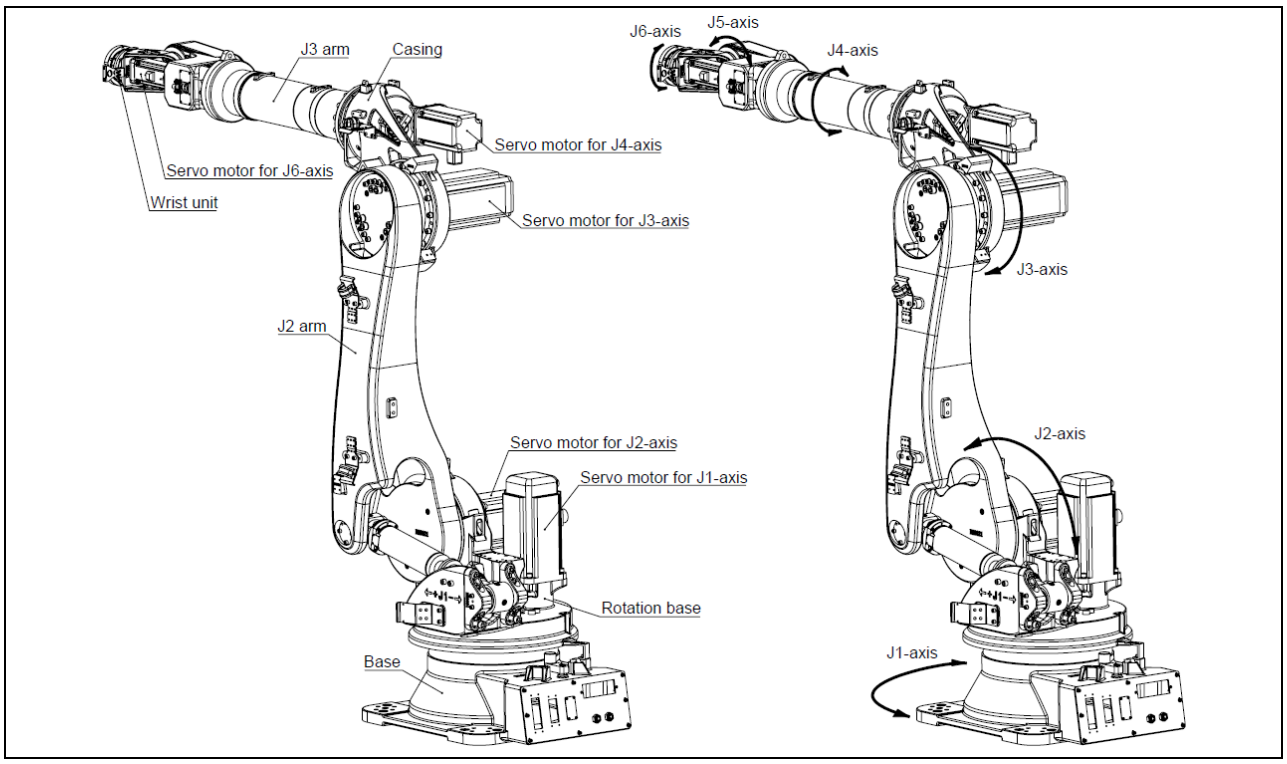


Fig 3.1 Robot Configuration (ER100B-3000)

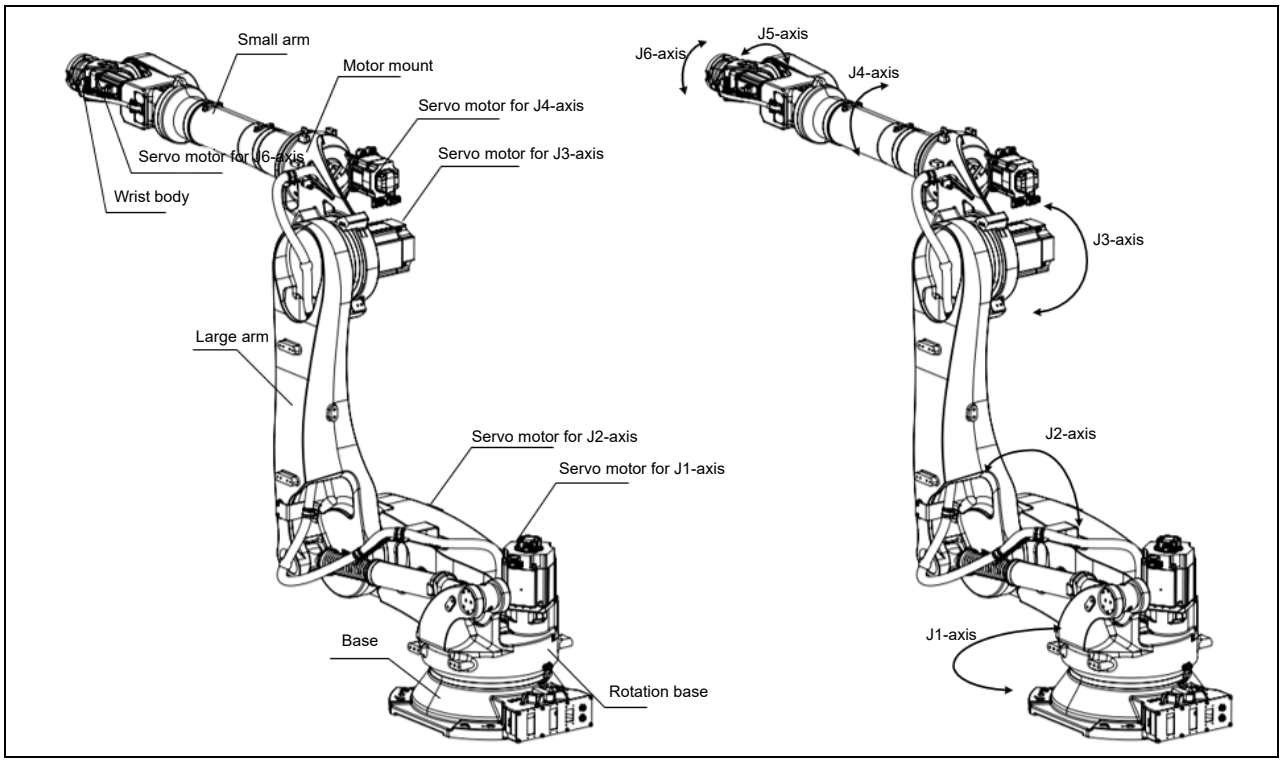


Fig 3.2 Robot Configuration (ER100B-3500-DW)

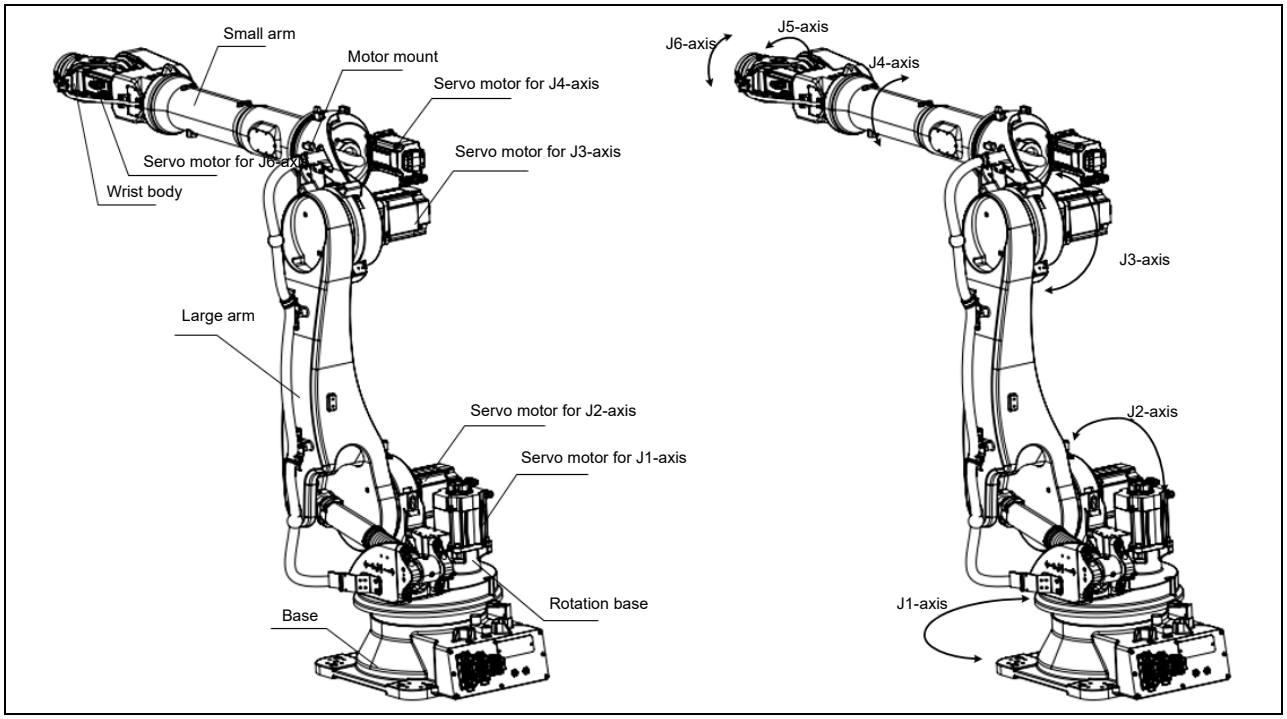


Fig. 3.3 Robot Configuration (ER130B-3200)

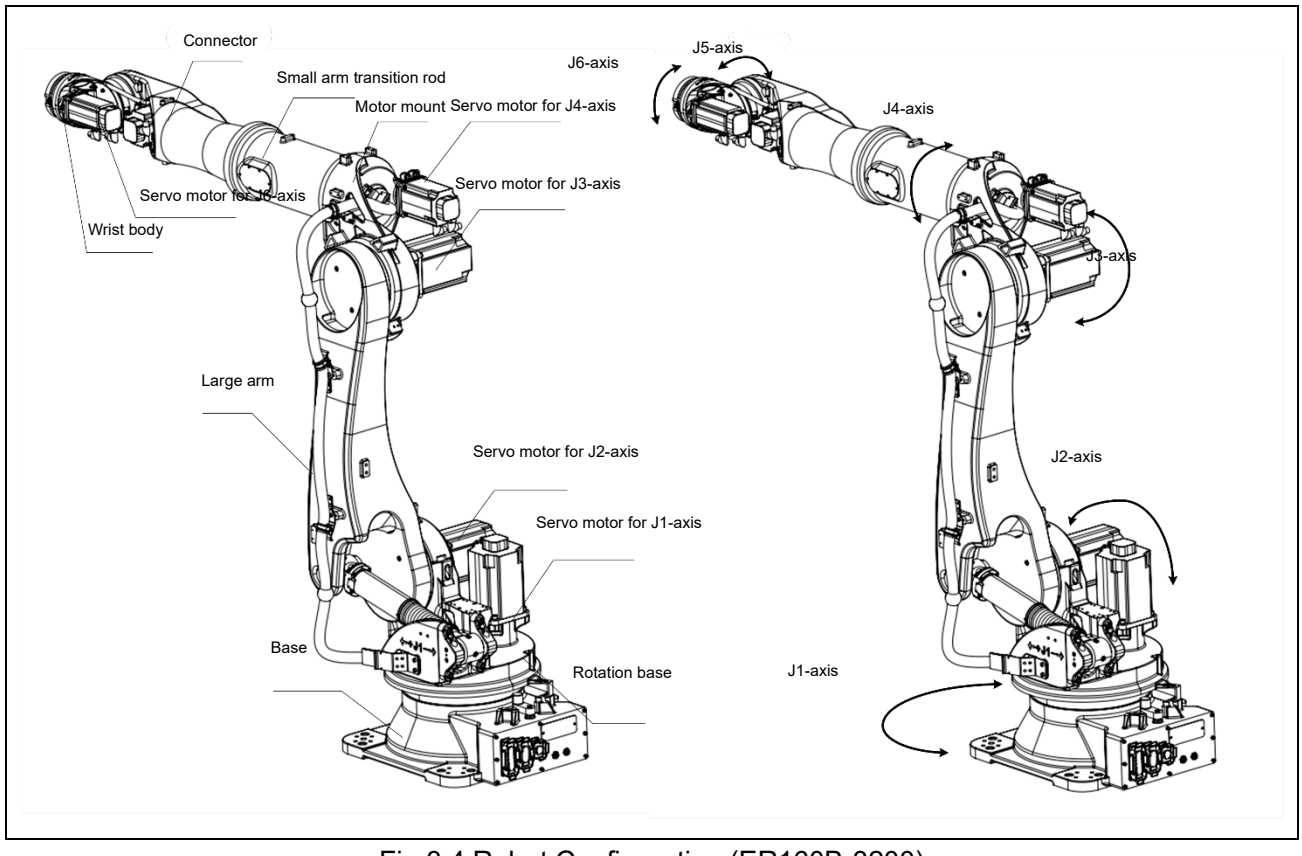


Fig 3.4 Robot Configuration (ER160B-3200)

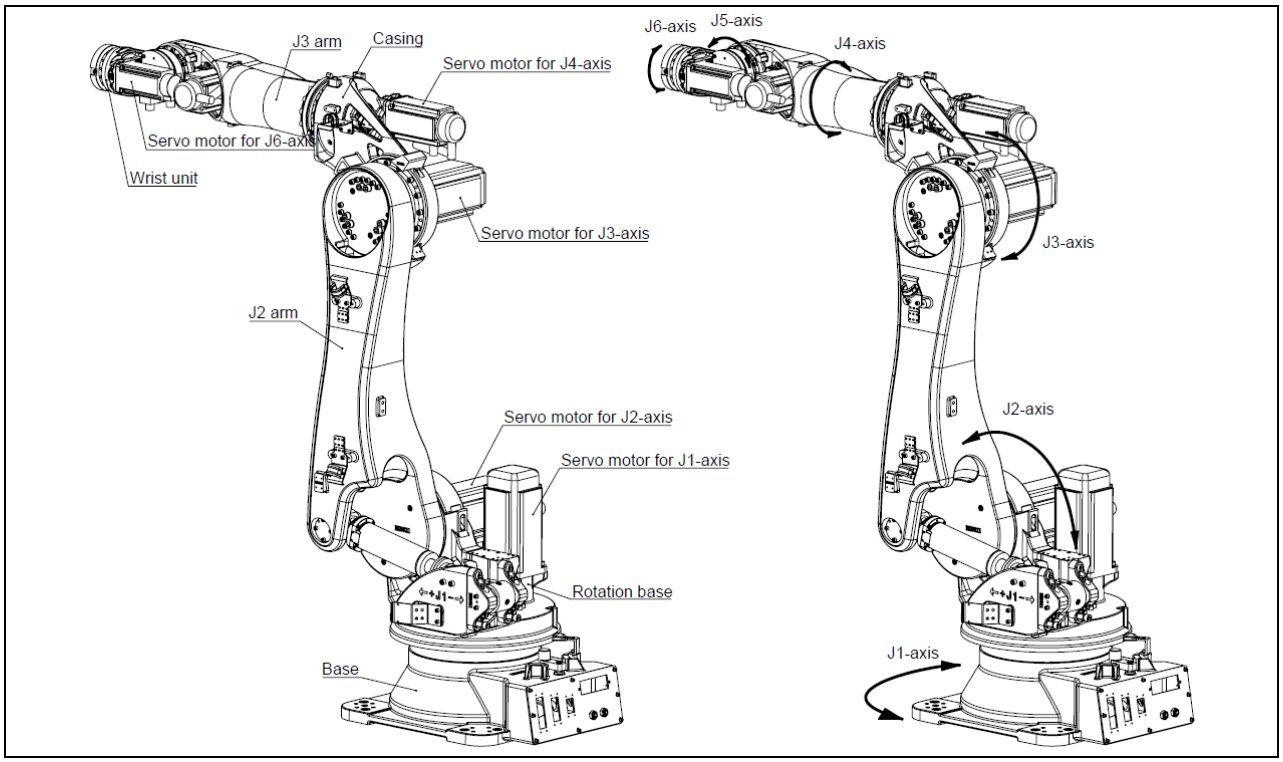


Fig 3.5 Robot Configuration (ER170B-2650, ER220B-2650)

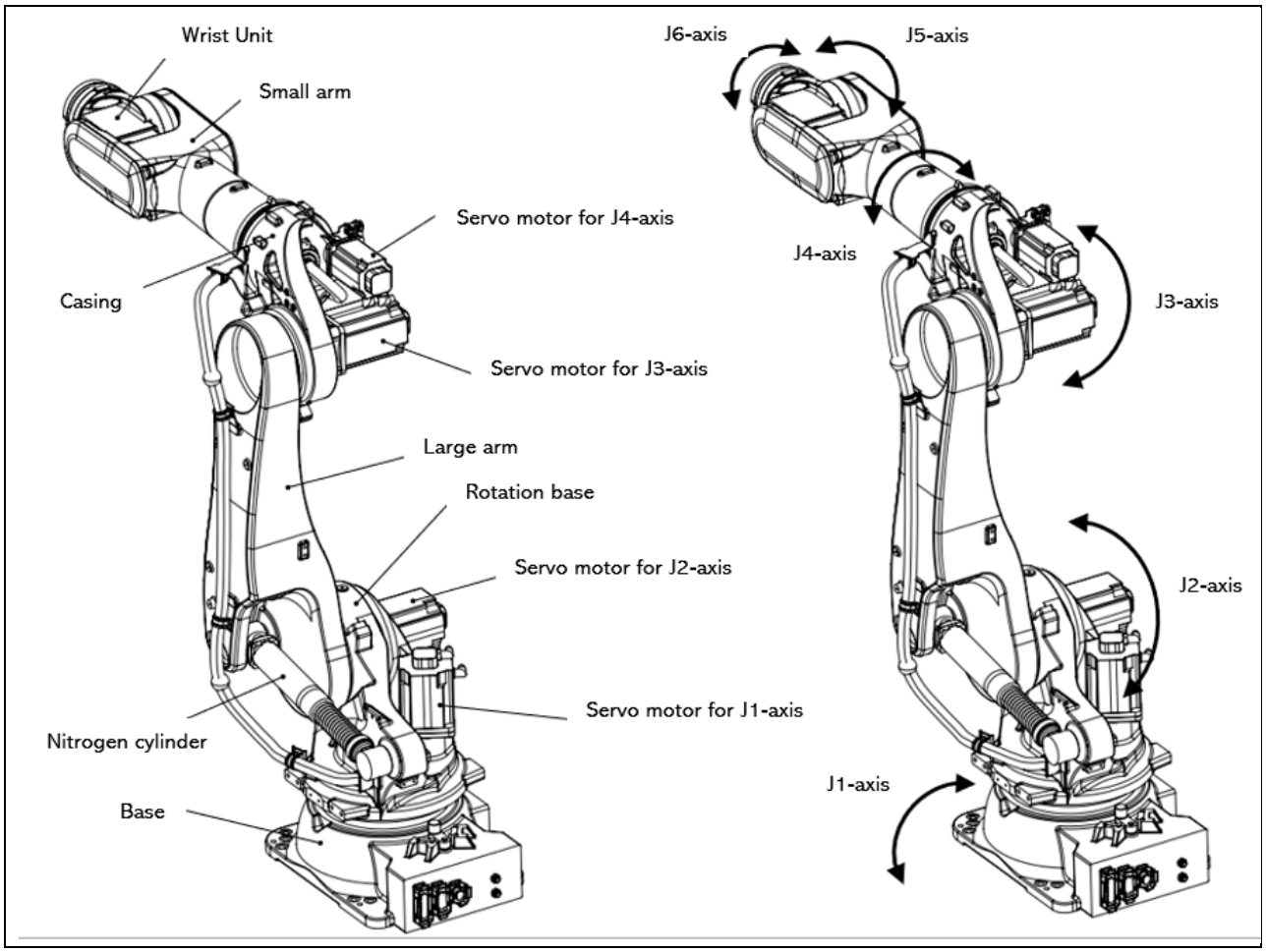


Fig 3.6 Robot Configuration (ER170B-2650, ER220B-2650)

Tab. 3.1 Specifications

Model		ER100B-3000	ER100B-3500-DW	ER130B-3200	ER160B-3200
Type		Articulated robot			
Controlled axis		6 axes			
Installation		Floor			
Motion range	J1-axis	±180°	±180°	±180°	±180°
	J2-axis	-60°~ +80°	-40°~ +170°	-60°~ +80°	-60°~ +80°
	J3-axis	-95°~ +80°	-95°~ +80°	-95°~ +80°	-95°~ +80°
	J4-axis	±200°	±200°	±250°	±250°
	J5-axis	±130°	±130°	±125°	±125°
	J6-axis	±360°	±360°	±360°	±360°
Max. speed (Note 1)	J1-axis	120°/s	120°/s	128°/s	128°/s
	J2-axis	110°/s	110°/s	110°/s	98°/s
	J3-axis	120°/s	120°/s	120°/s	107°/s
	J4-axis	140°/s	120°/s	165°/s	166°/s
	J5-axis	200°/s	200°/s	200°/s	146°/s
	J6-axis	285°/s	285°/s	220°/s	198°/s
Max. payload	At wrist	100kg	100kg	130kg	160kg
Allowable load inertia at wrist	J4-axis	72kg·m²	72kg·m²	111.1kg·m²	150kg·m²
	J5-axis	72kg·m²	72kg·m²	111.1kg·m²	150kg·m²
	J6-axis	40kg·m²	40kg·m²	89.4kg·m²	90kg·m²
Allowable load torque at wrist	J4-axis	513N·m	513N·m	776N·m	1365N·m
	J5-axis	513N·m	513N·m	776N·m	1365N·m
	J6-axis	196N·m	196N·m	369N·m	740N·m
Drive method		Electric servo drive by AC servo motor			
Repeatability		±0.06mm			
Reach		3000mm	3500mm	3200mm	3158mm
Weight		1053kg	1050kg	1120kg	1150kg
Installation environment		Ambient temperature: 0~45℃ (Note 2)	Ambient humidity: 20~80%RH	Height: Up to 1000 meters above the sea level required	Vibration acceleration: 4.9m/s² (0.5G)or less
		Ambient temperature: 0～45℃(Note 2) Ambient humidity: 20~80%RH Height: Up to 1000 meters above the sea level required Vibration acceleration: 4.9m/s² (0.5G)or less Free of corrosive gases (Note 3)			

Tab. 3.2 Robot specification (cont'd)

Model	ER170B-2650	ER220B-2650	ER270-2700
Type	Articulated robot		
Controlled axis	6 axes		
Installation	Floor		

Motion range	J1-axis	±180°	±180°	±180°
	J2-axis	-60°~ +80°	-60°~ +80°	-60°~ +80°
	J3-axis	-95°~ +80°	-95°~ +80°	-180°~ +80°
	J4-axis	±200°	±200°	±250°
	J5-axis	±125°	±125°	±125°
	J6-axis	±360°	±360°	±360°
Max. speed (Note 1)	J1-axis	120°/s	120°/s	118°/s
	J2-axis	110°/s	95°/s	100°/s
	J3-axis	120°/s	95°/s	99°/s
	J4-axis	205°/s	165°/s	166°/s
	J5-axis	215°/s	150°/s	141°/s
	J6-axis	305°/s	200°/s	208°/s
Max. payload	At wrist	170kg	220kg	270kg
Allowable load inertia at wrist	J4-axis	81kg·m²	146.8kg·m²	340kg·m²
	J5-axis	81kg·m²	146.8kg·m²	340kg·m²
	J6-axis	40.1kg·m²	81kg·m²	260kg·m²
Allowable load torque at wrist	J4-axis	943N·m	1245N·m	1785N·m
	J5-axis	943N·m	1245N·m	1785N·m
	J6-axis	485N·m	582N·m	950N·m
Drive method		Electric servo drive by AC servo motor		
Repeatability		±0.06mm		
Reach		2650mm	2650mm	2700mm
Weight		1092kg	1120kg	1360kg
Installation environment		Ambient temperature: 0～45℃(Note 2) Ambient humidity: 20~80%RH Height: Up to 1000 meters above the sea level required Vibration acceleration: 4.9m/s2 (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℃ or not operated for a long time in the environment that is less than 0℃ 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.

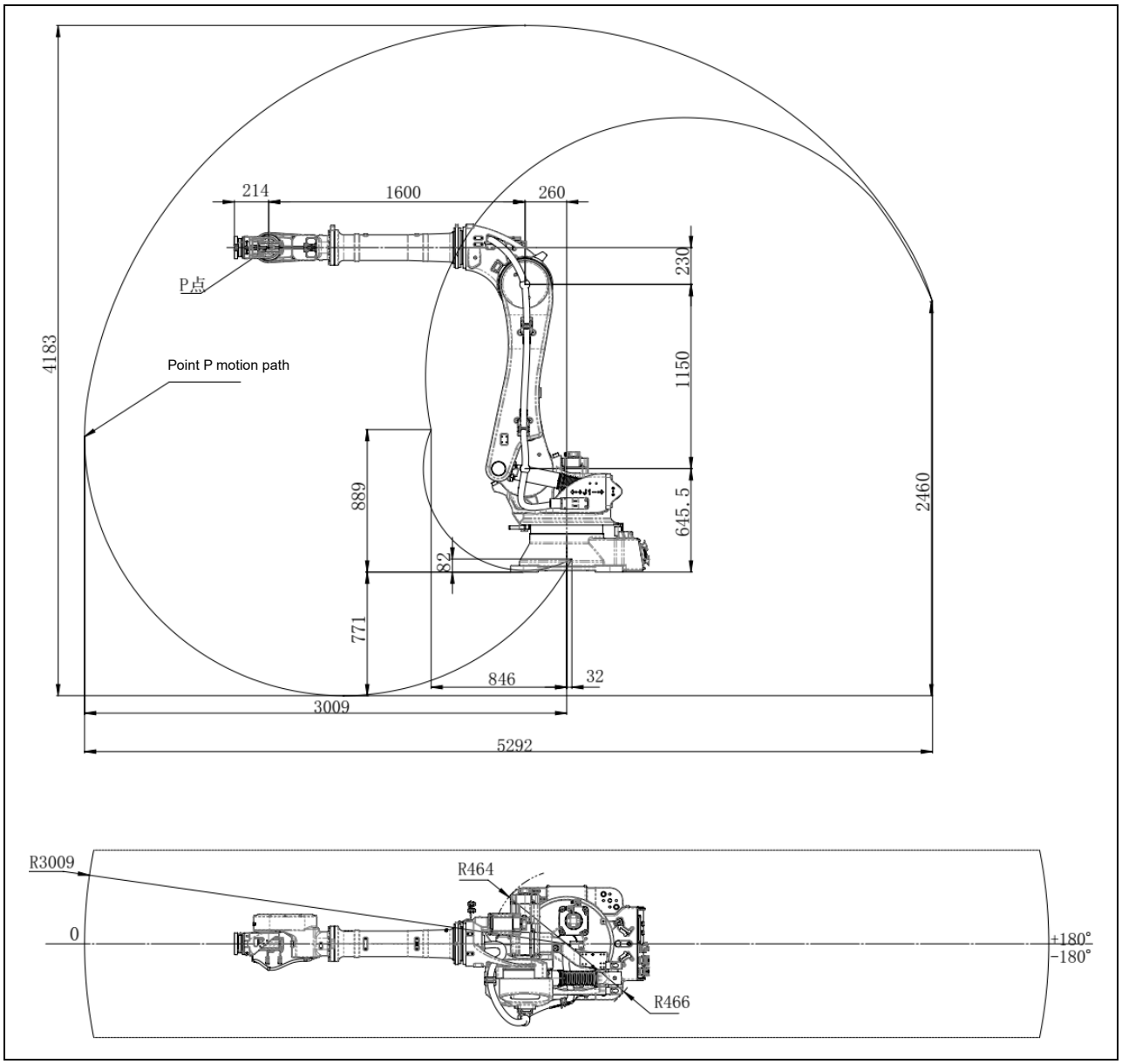


Fig. 3.7 Motion range (ER100B-3000)

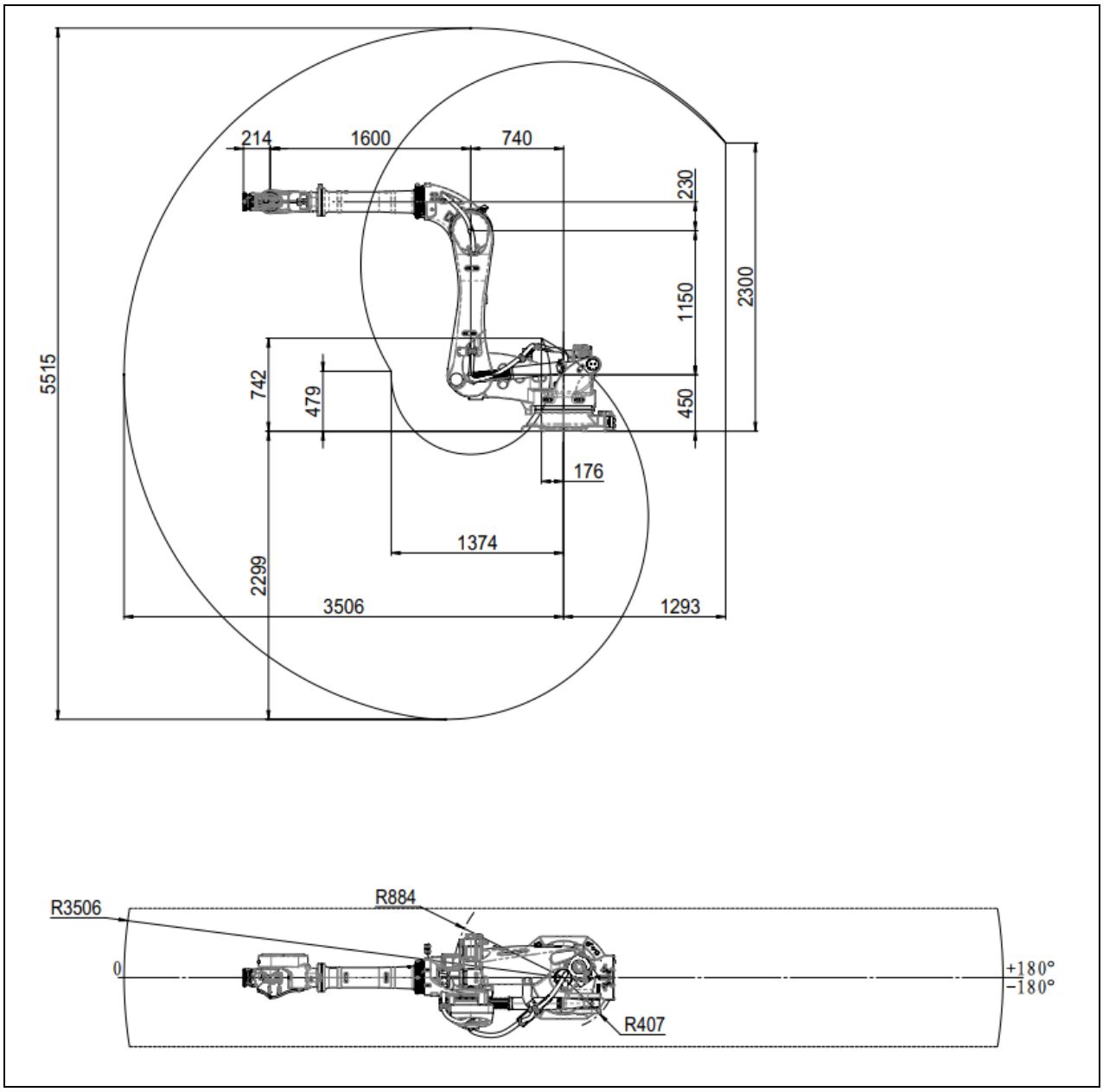


Fig. 3.8 Motion range (ER100B-3500-DW)

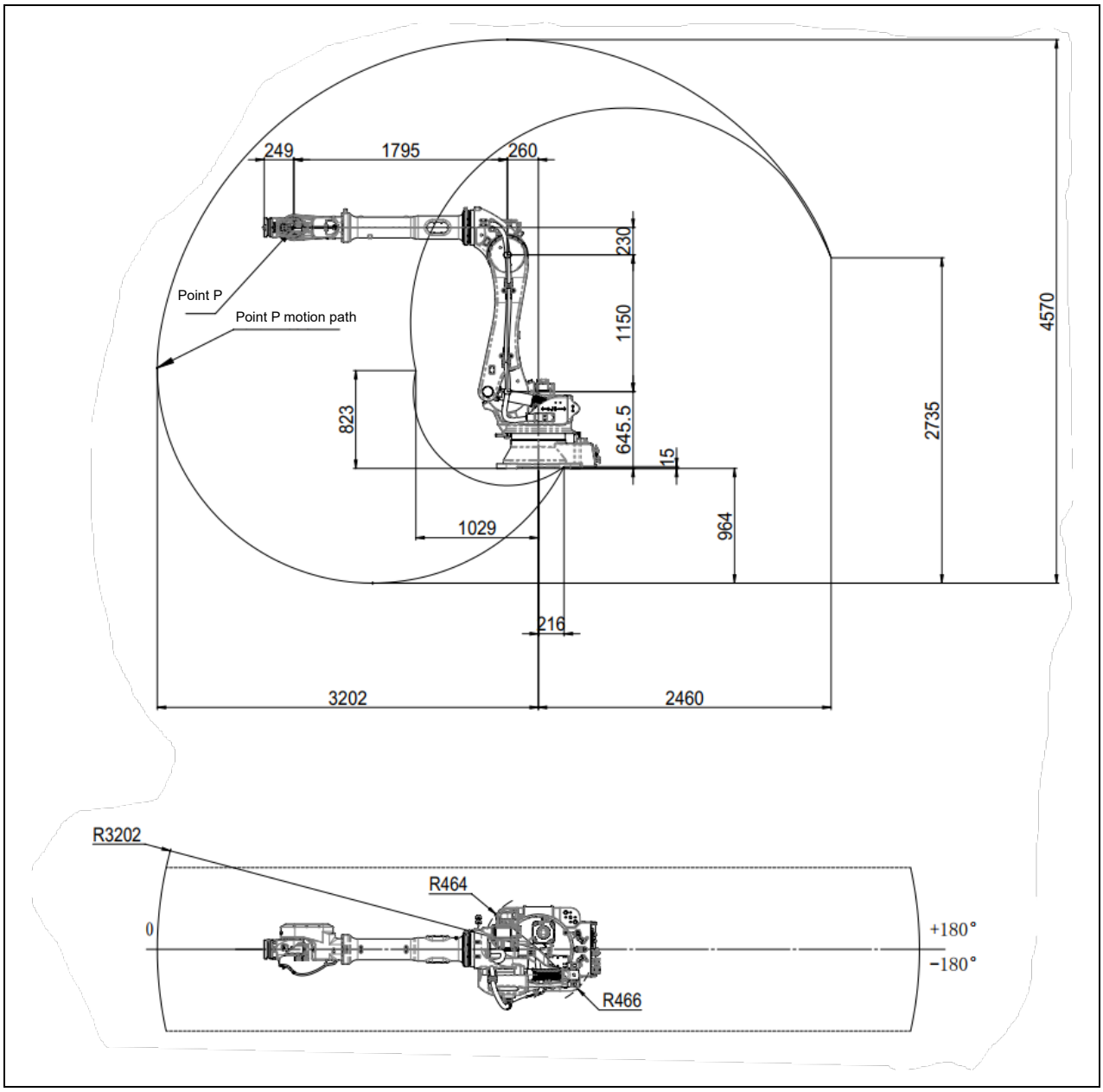


Fig. 3.9 Motion range (ER130B-3200)

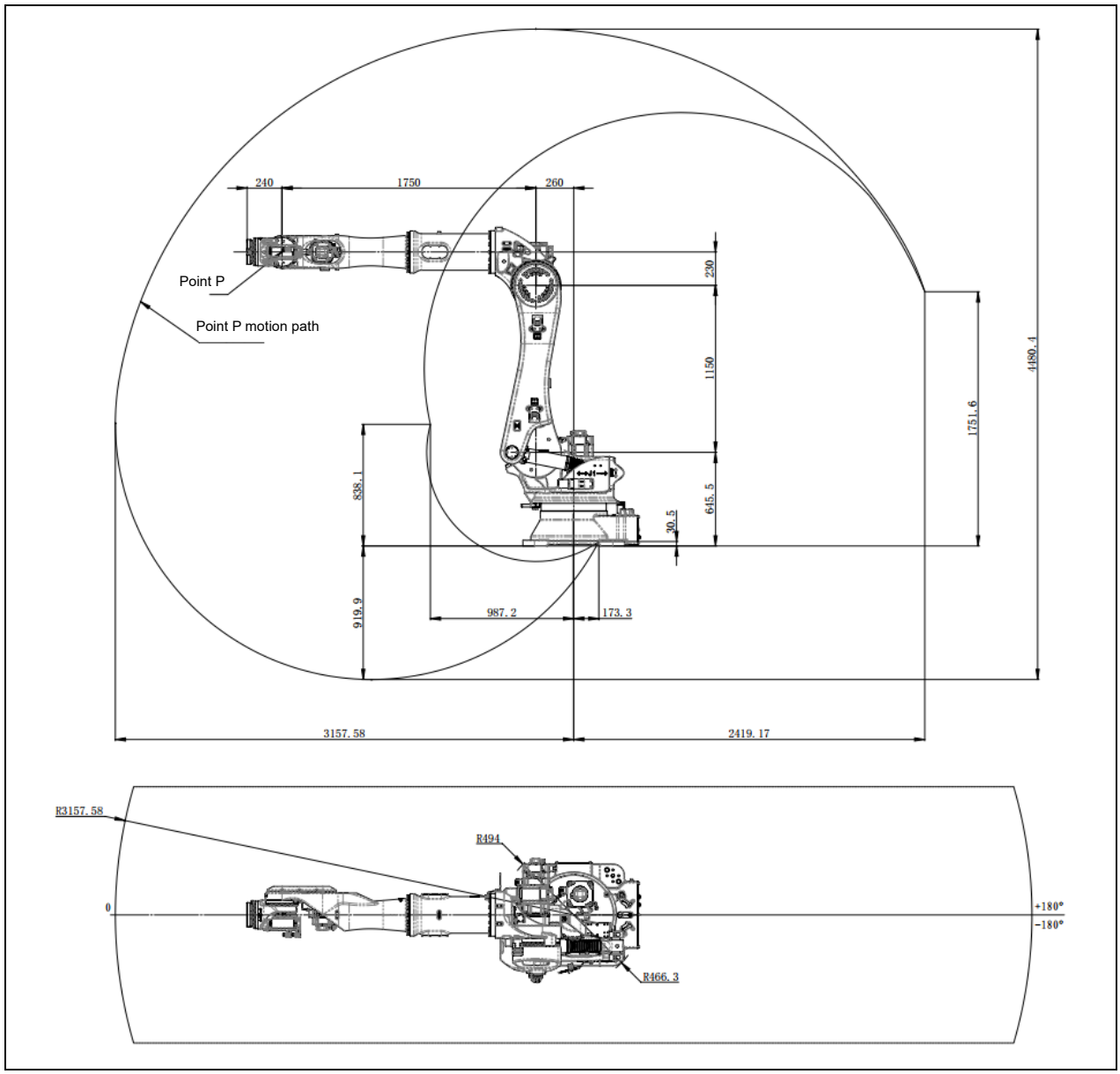


Fig 3.10 Motion range (ER160B-3200)

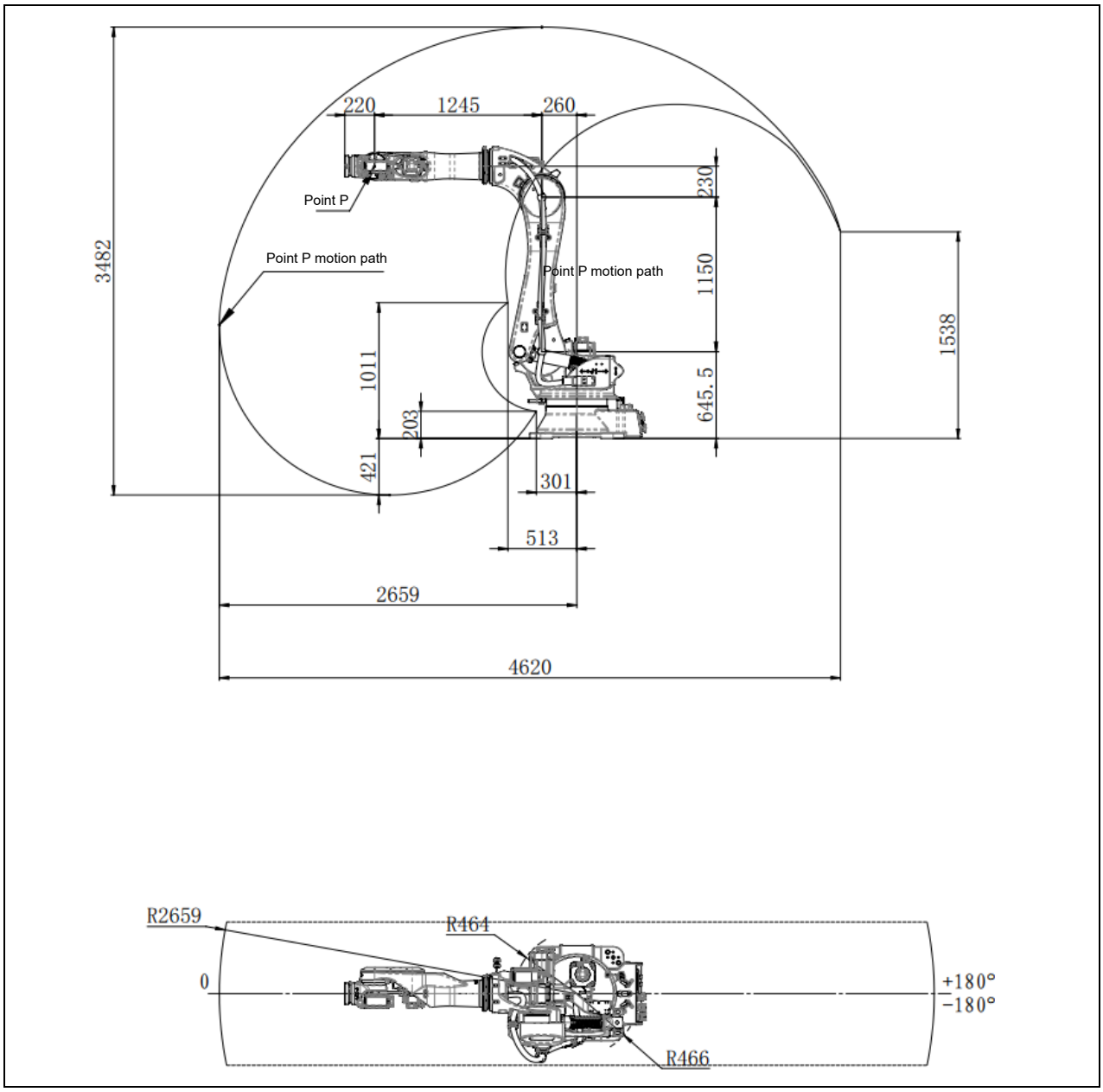


Fig 3.11 Motion range (ER170B-2650)

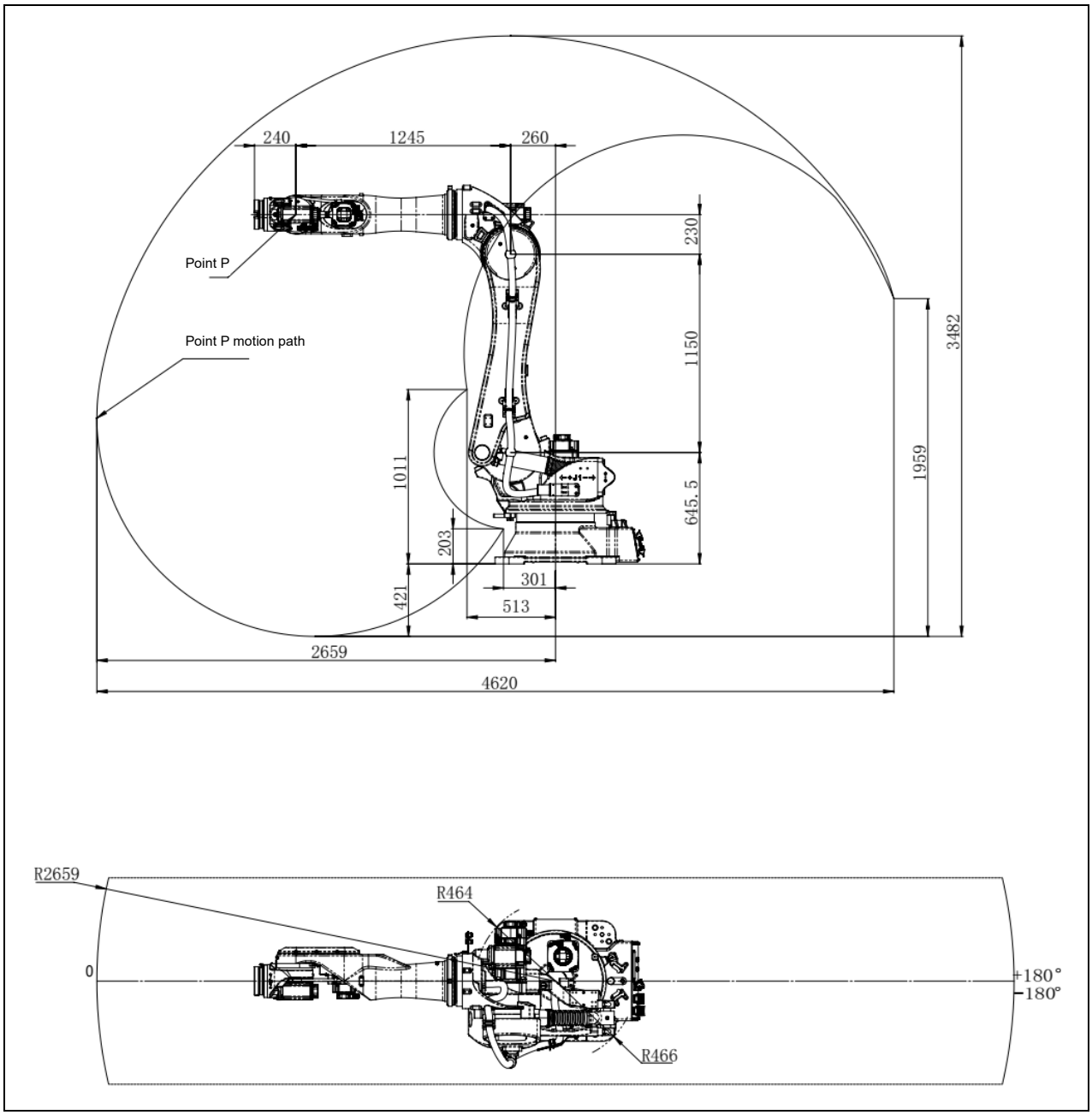


Fig 3.12 Motion range (ER220B-2650)

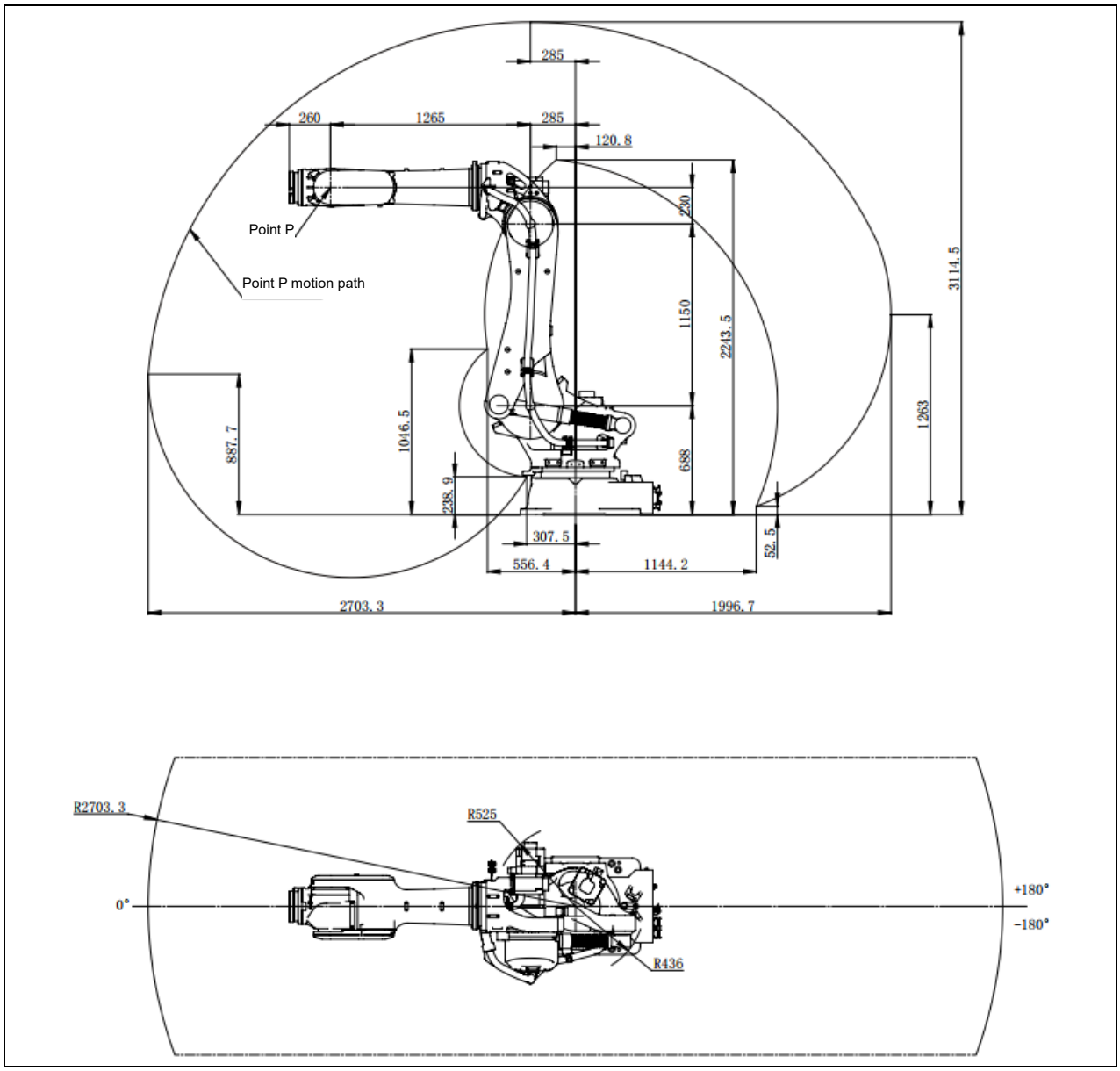


Fig 3.13 Motion range (ER270-2700)

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.**

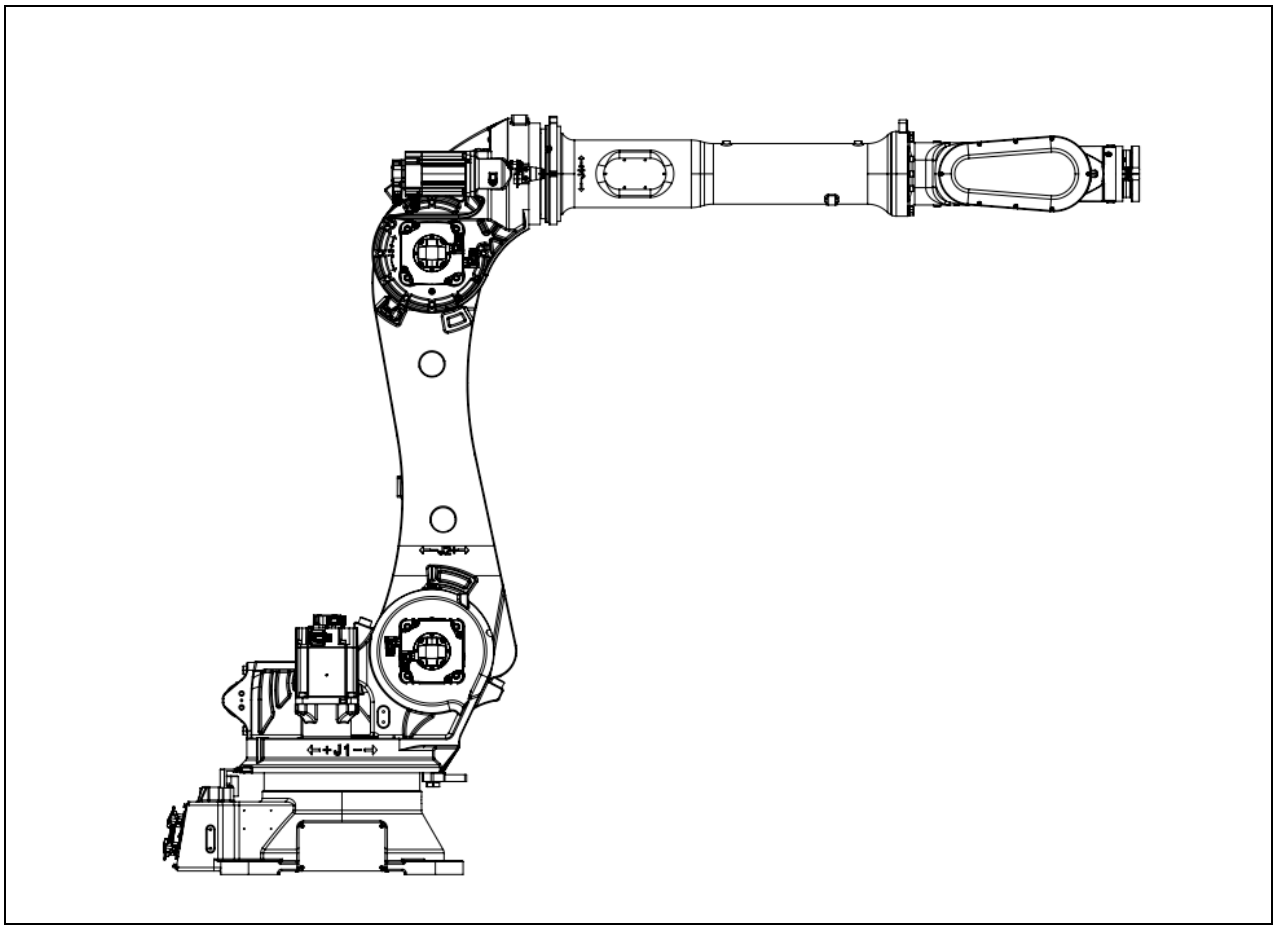


Fig. 3.14 Zero point position

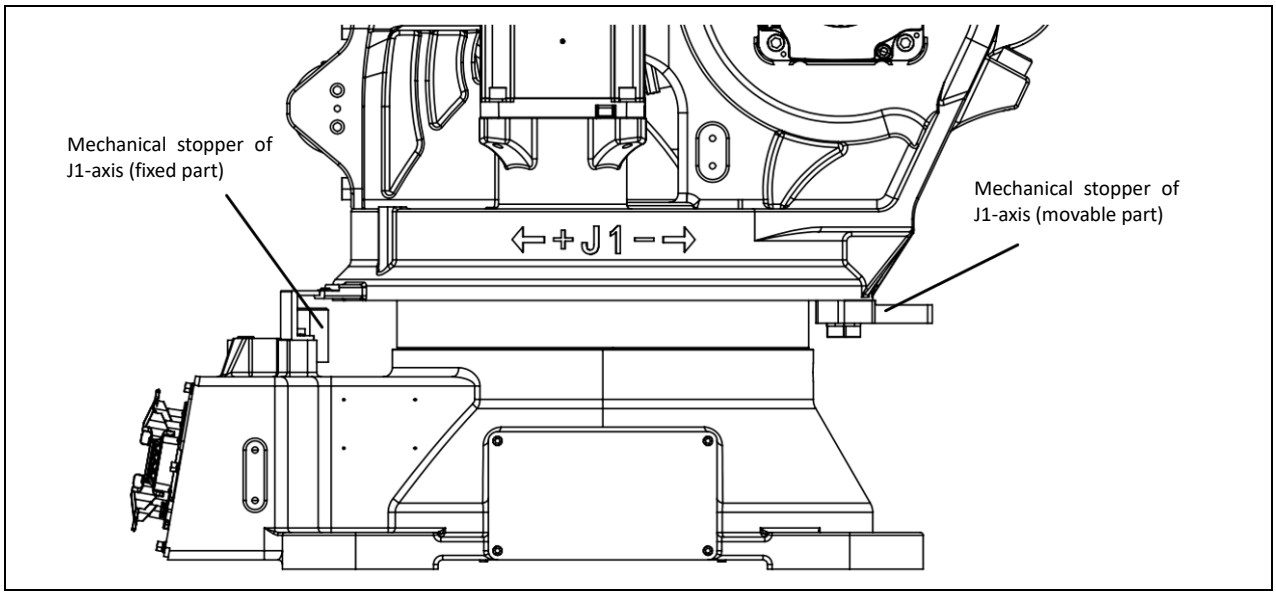


Fig. 3.15 J1-axis mechanical stoppers (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

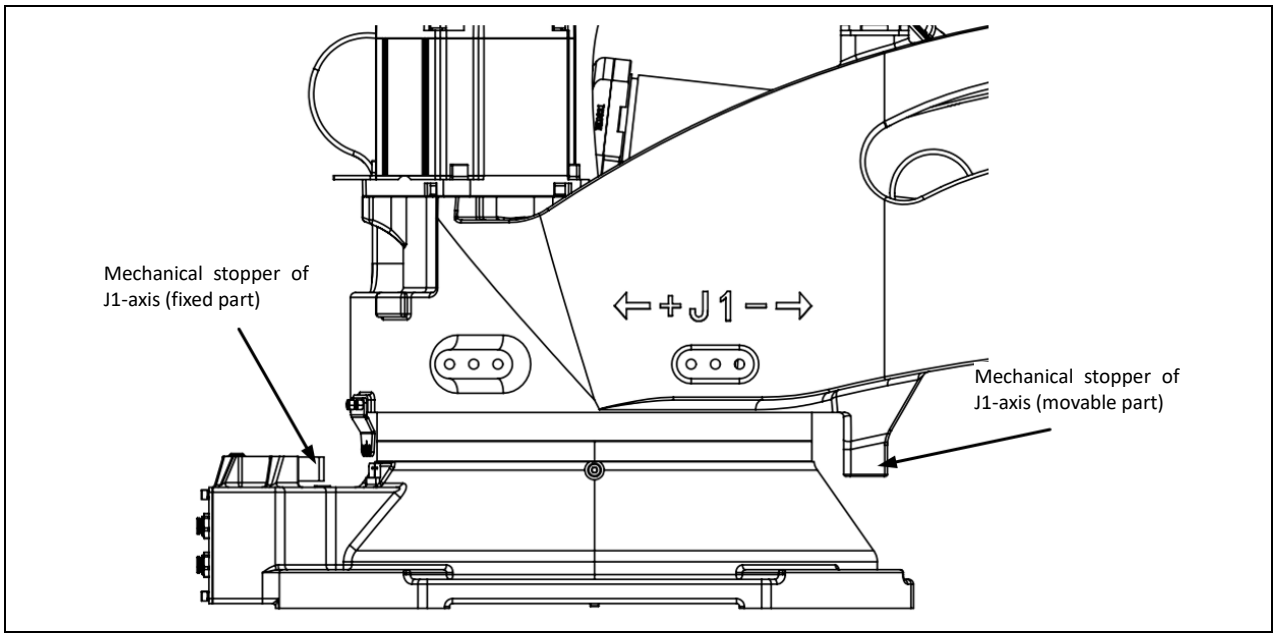


Fig. 3.16 J1-axis mechanical stoppers (ER100B-3500-DW)

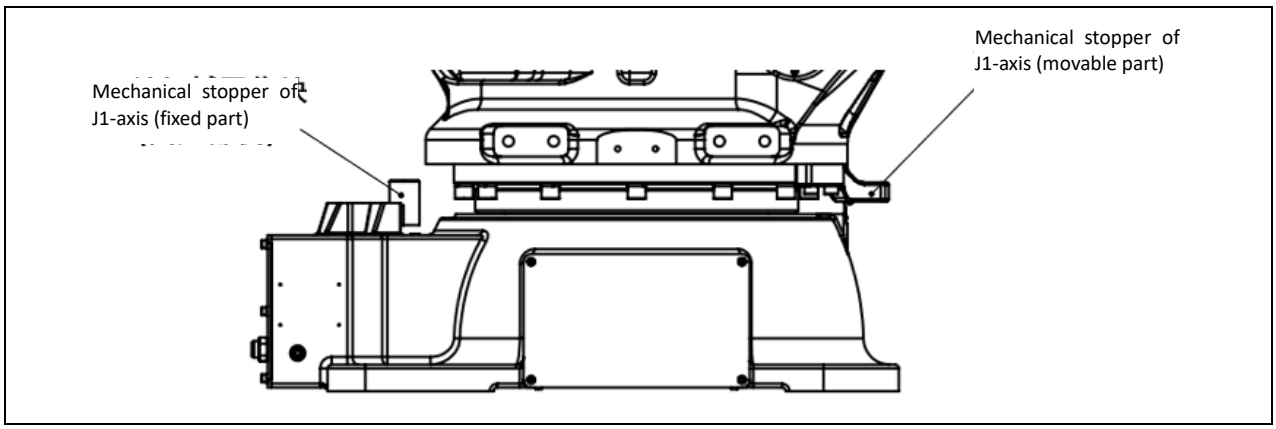


Fig. 3.17 J1-axis mechanical stoppers (ER270-2700)

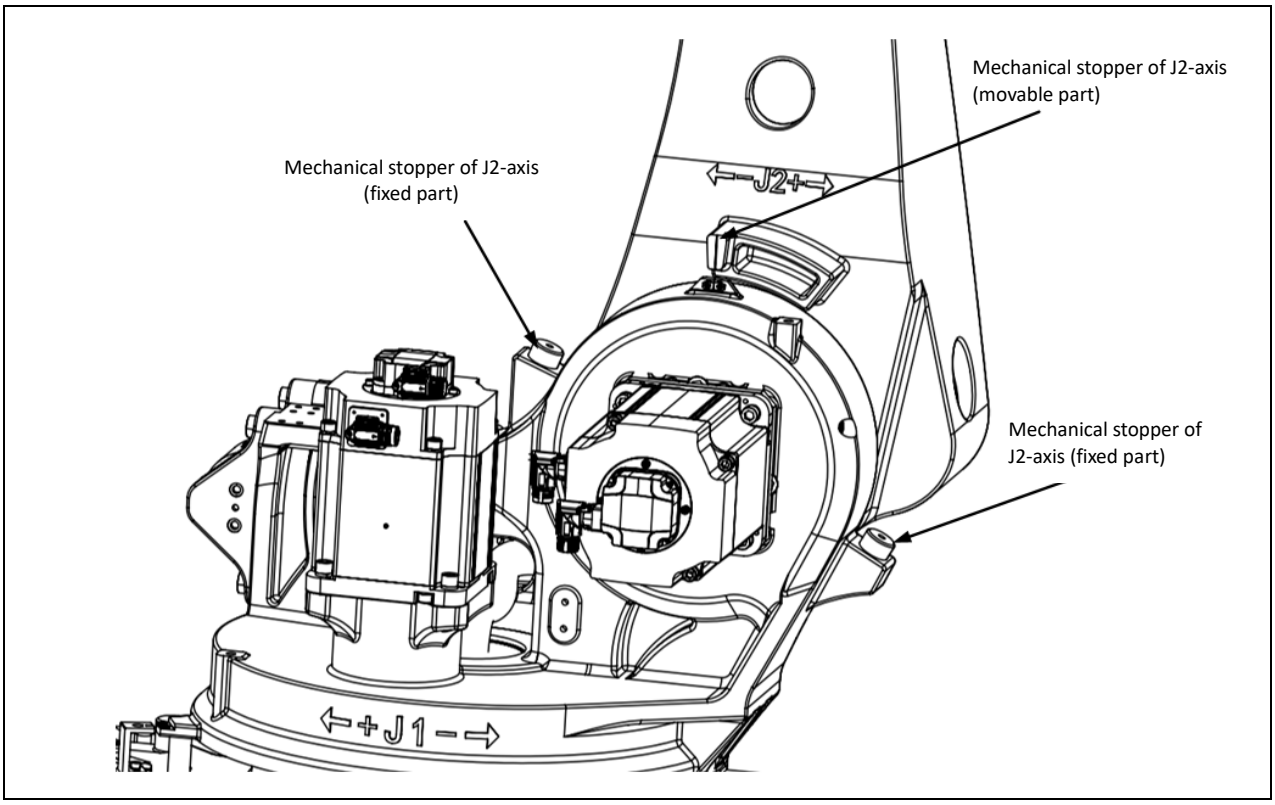


Fig. 3.18 J2-axis mechanical stoppers (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

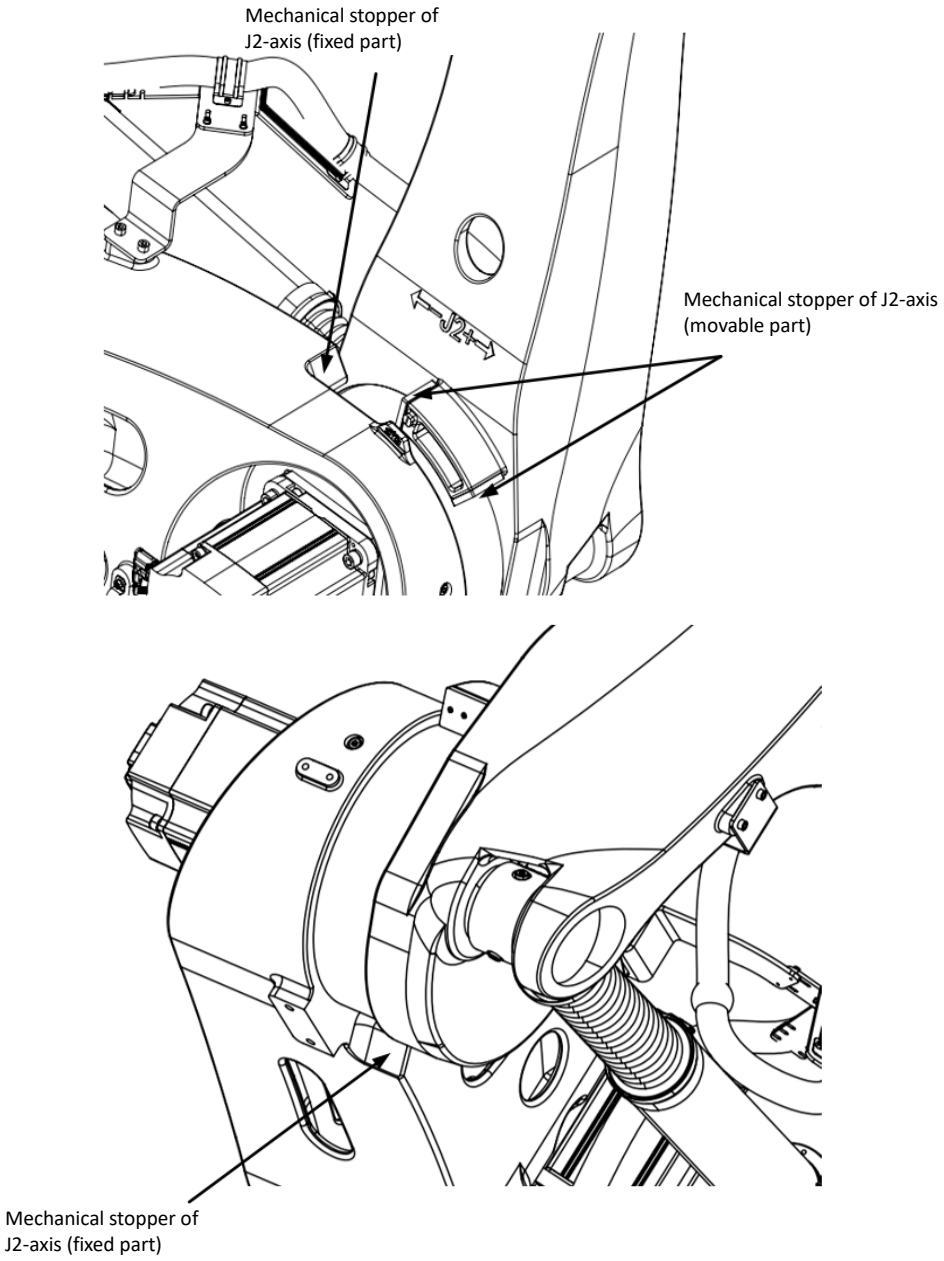


Fig. 3.19 J2-axis mechanical stoppers (ER100B-3500-DW)

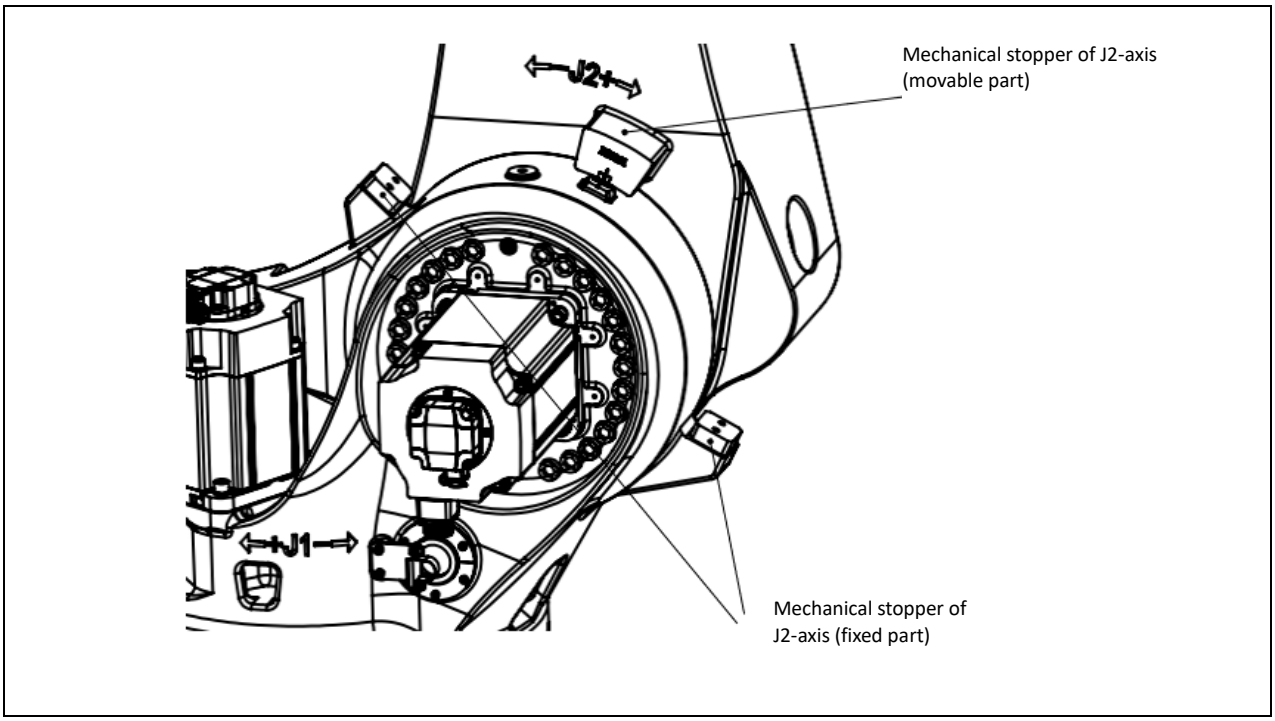


Fig. 3.20 J2-axis mechanical stoppers (ER270-2700)

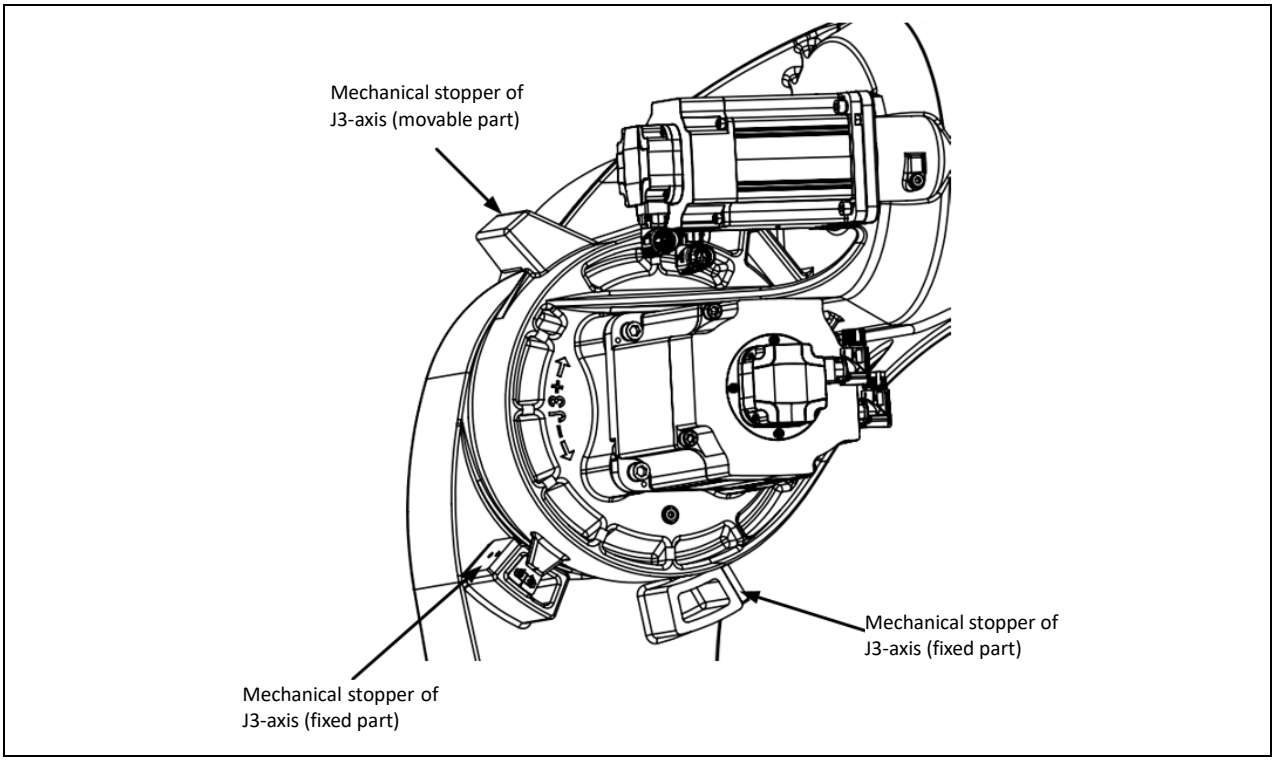


Fig. 3.21 J3-axis mechanical stoppers(ER100B-3000, ER100B-3500-DW, ER130B-3200,ER160B-3200 ER170B-2650, ER220B-2650)

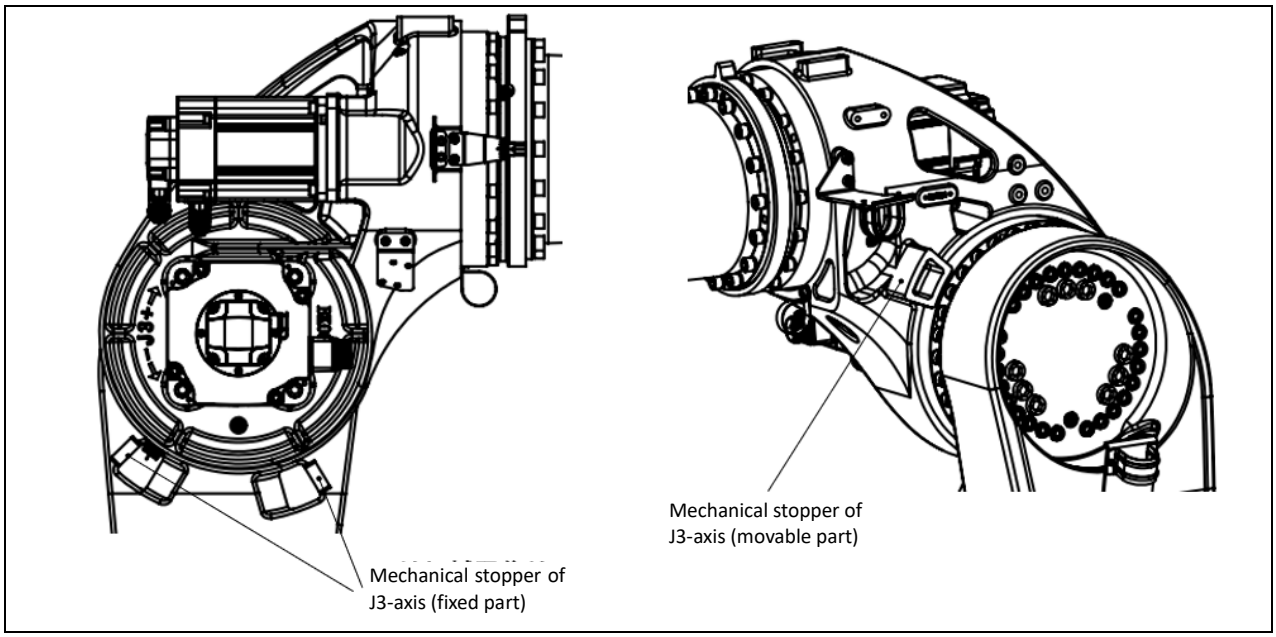


Fig. 3.22 J3-axis mechanical stoppers（ER270-2700）

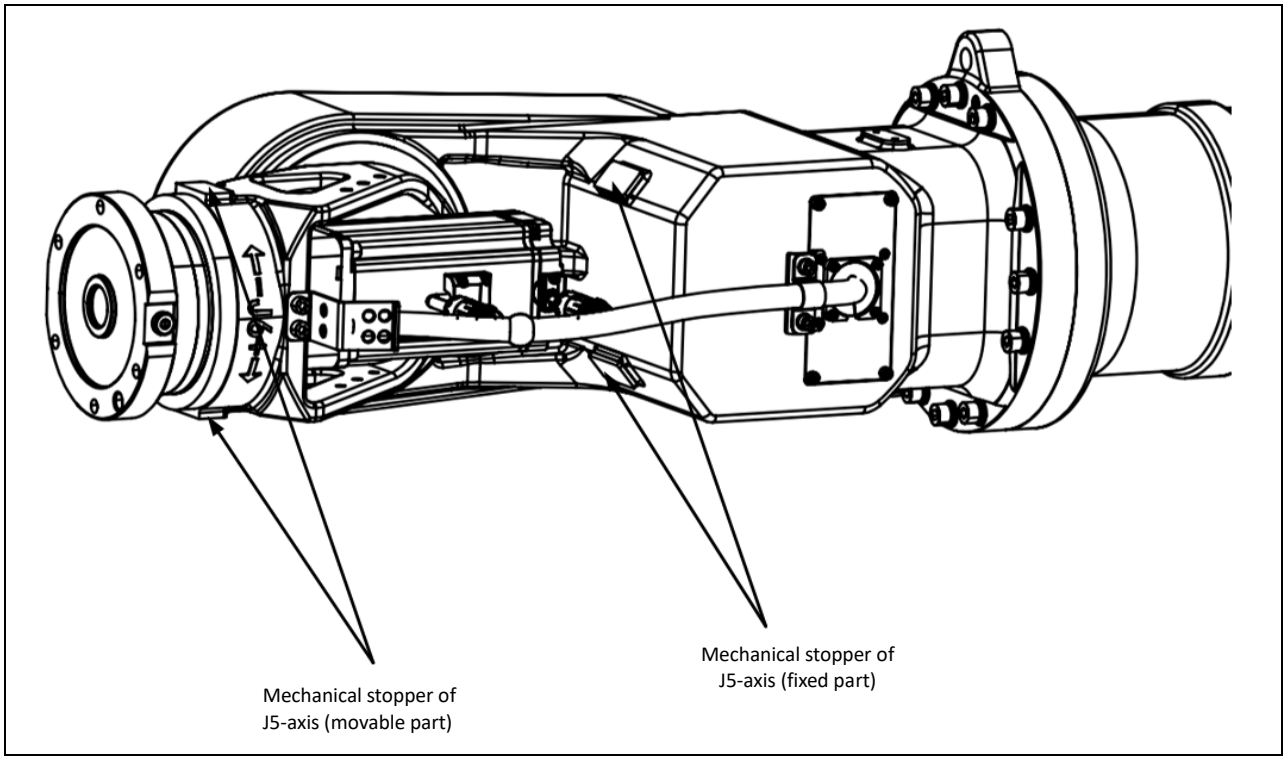


Fig. 3.23 J5-axis mechanical stoppers (ER100B-3000, ER100B-3500-DW, ER130B-3200)

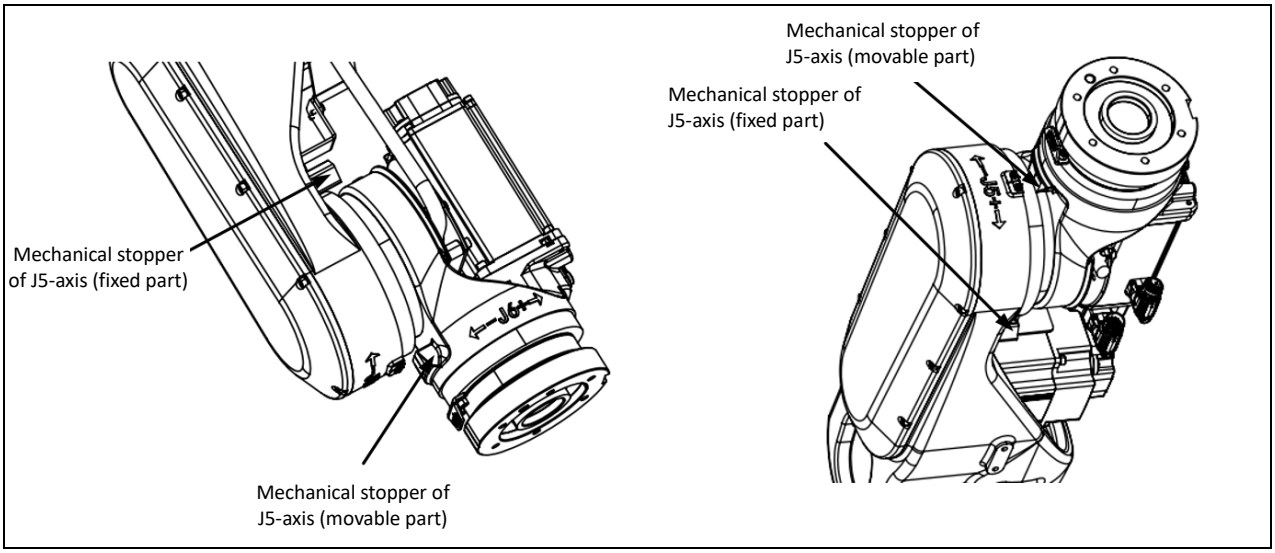


Fig. 3.24 J5-axis mechanical stoppers (ER160B-3200, ER170B-2650, ER220B-2650)

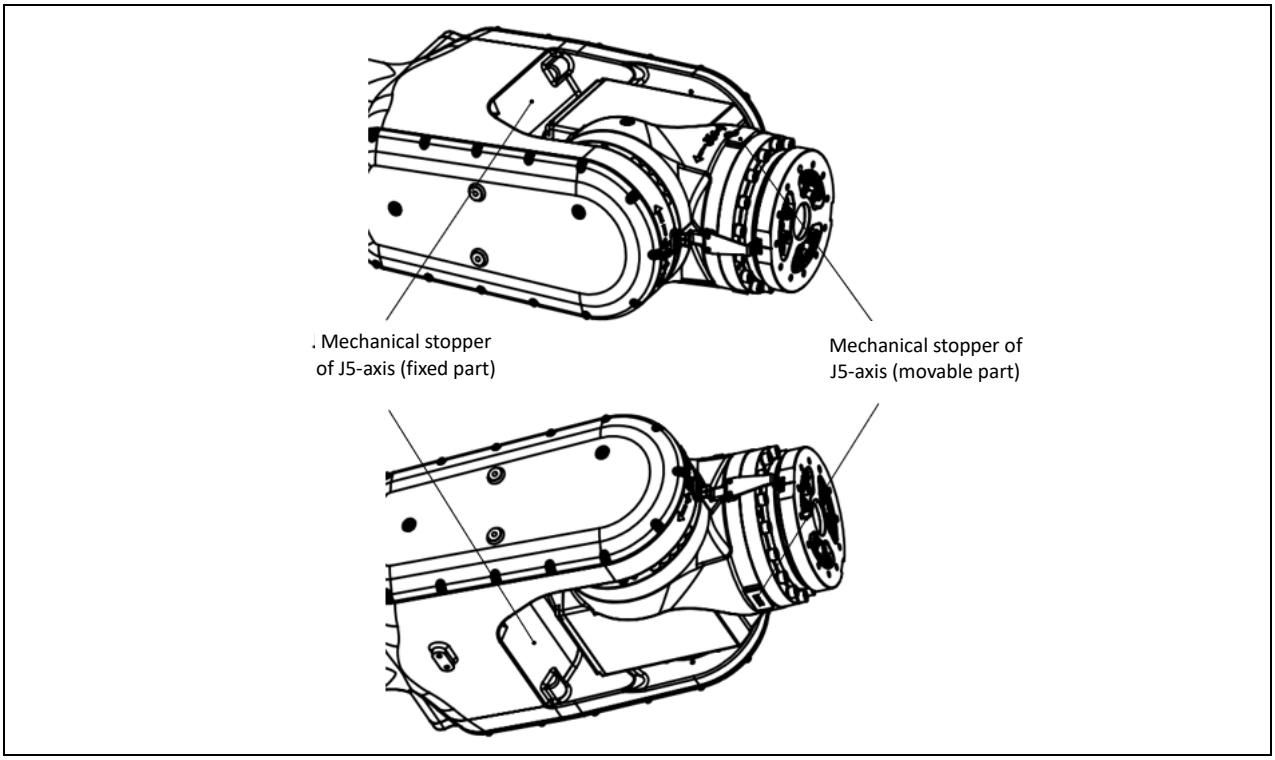


Fig. 3.25 J5-axis mechanical stoppers (ER270-2700)

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.

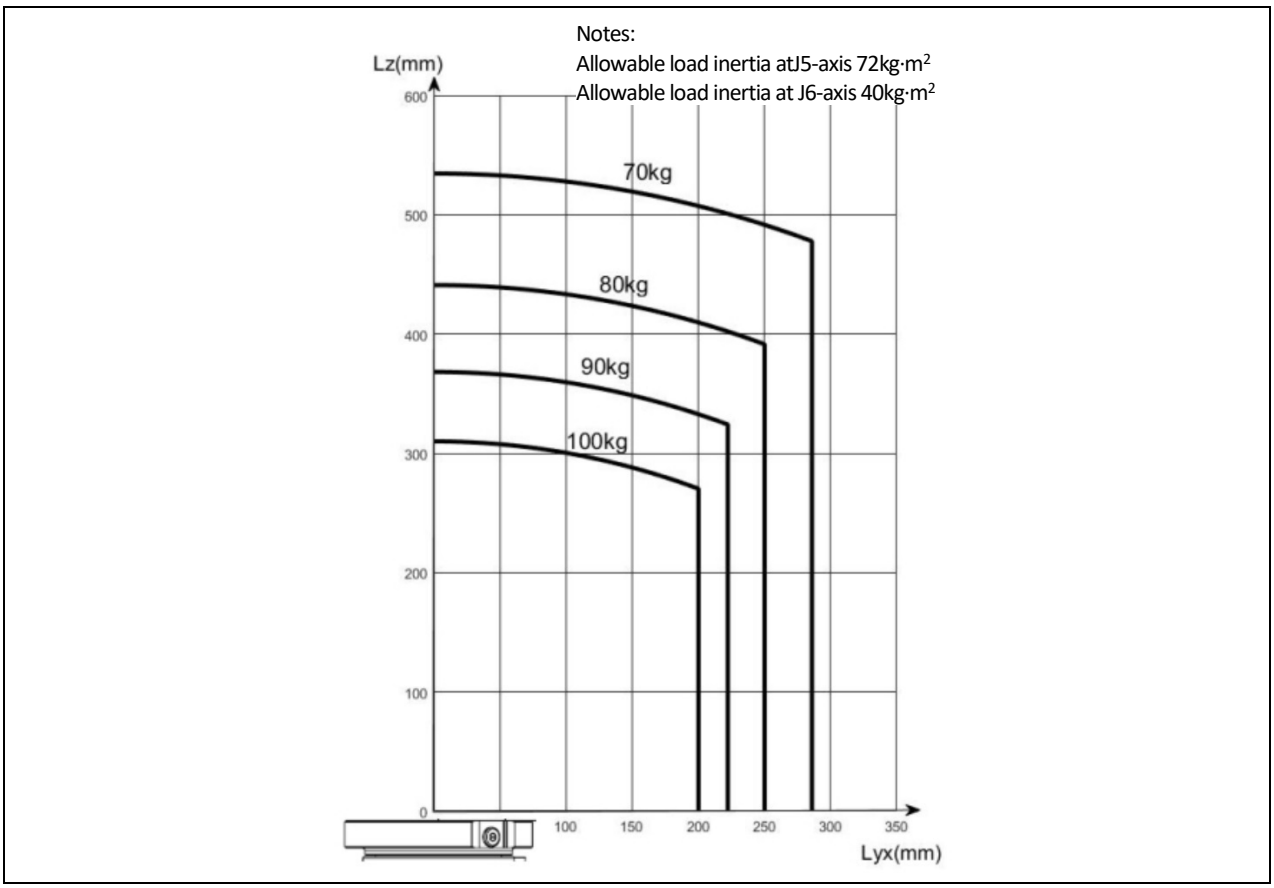


Fig. 3.26 Load capacity at wrist (ER100B-3000, ER100B-3500-DW)

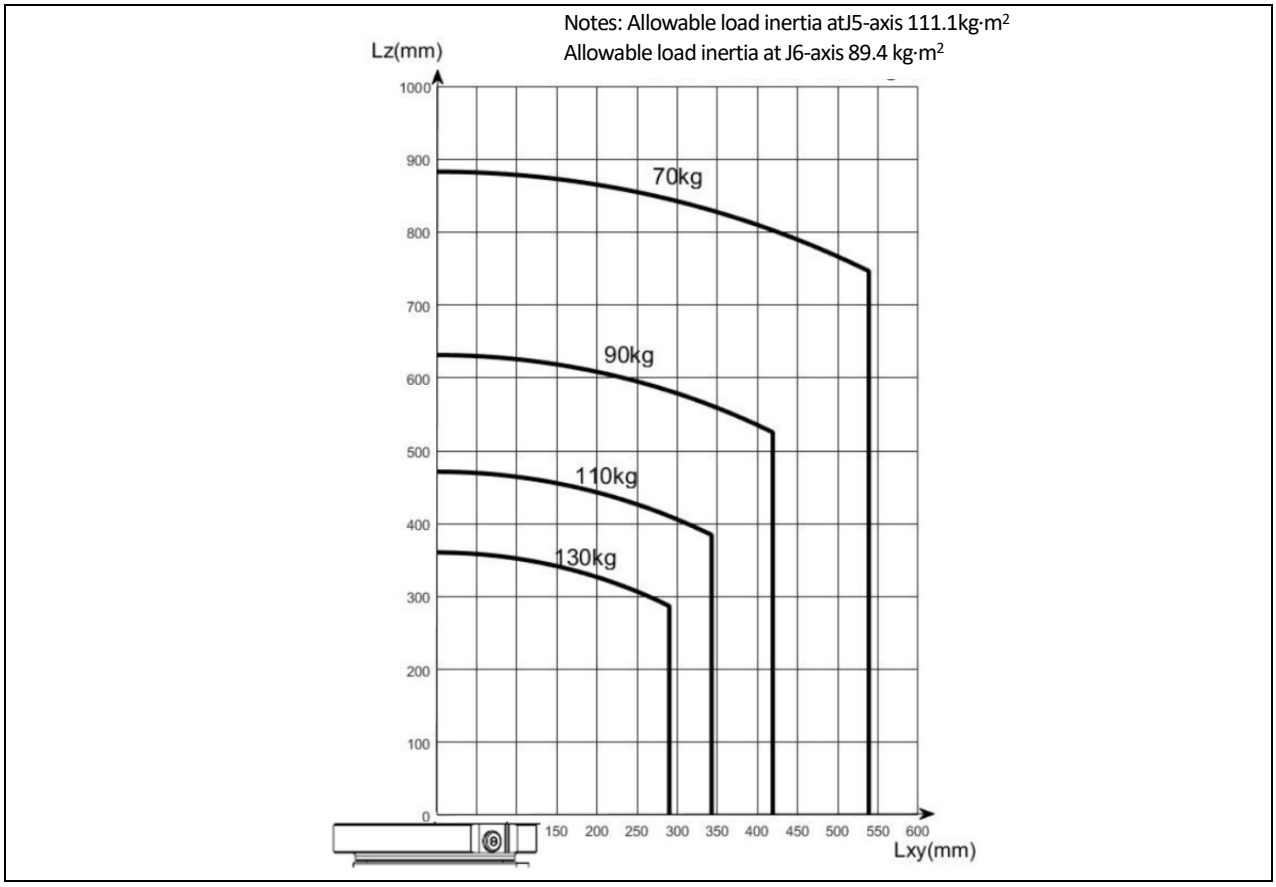


Fig. 3.27 Load capacity at wrist (ER130B-3200)

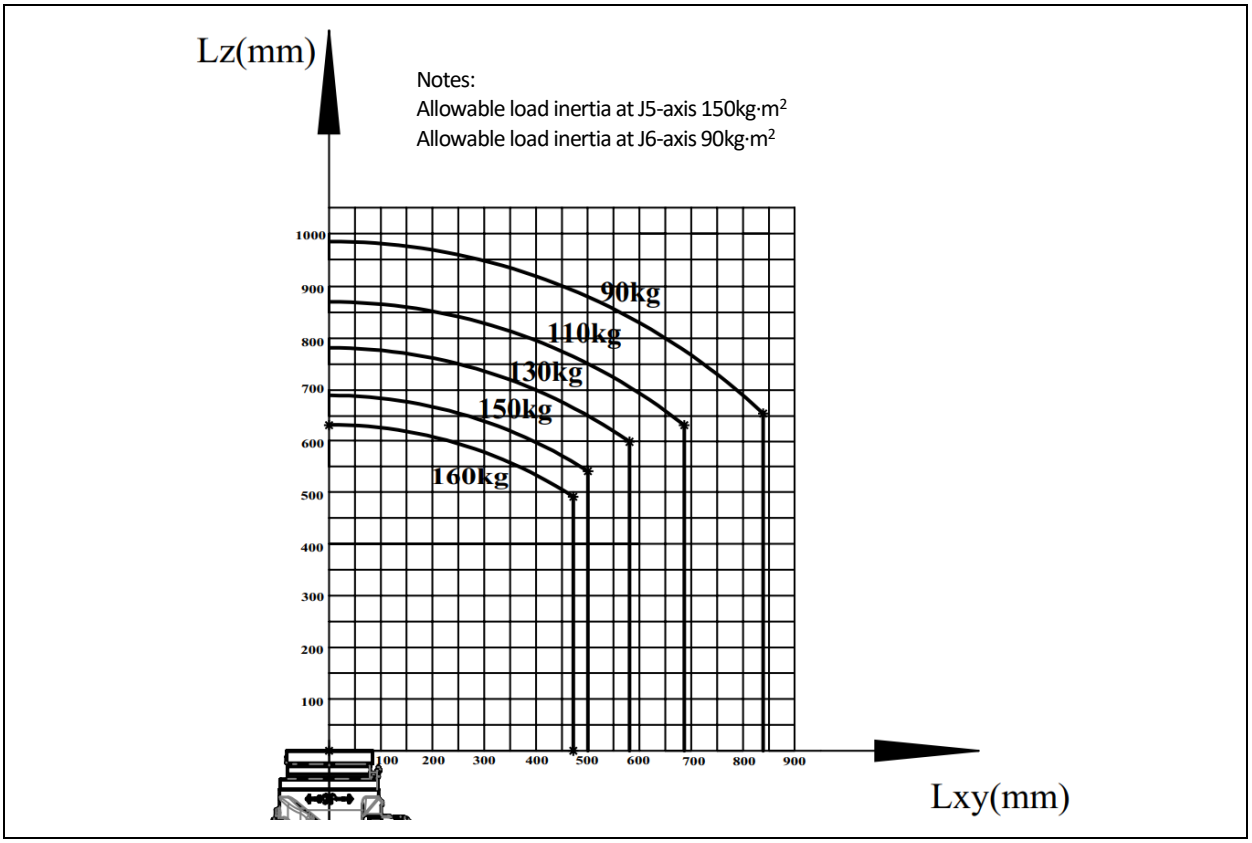


Fig 3.28 Load capacity at wrist (ER160B-3200)

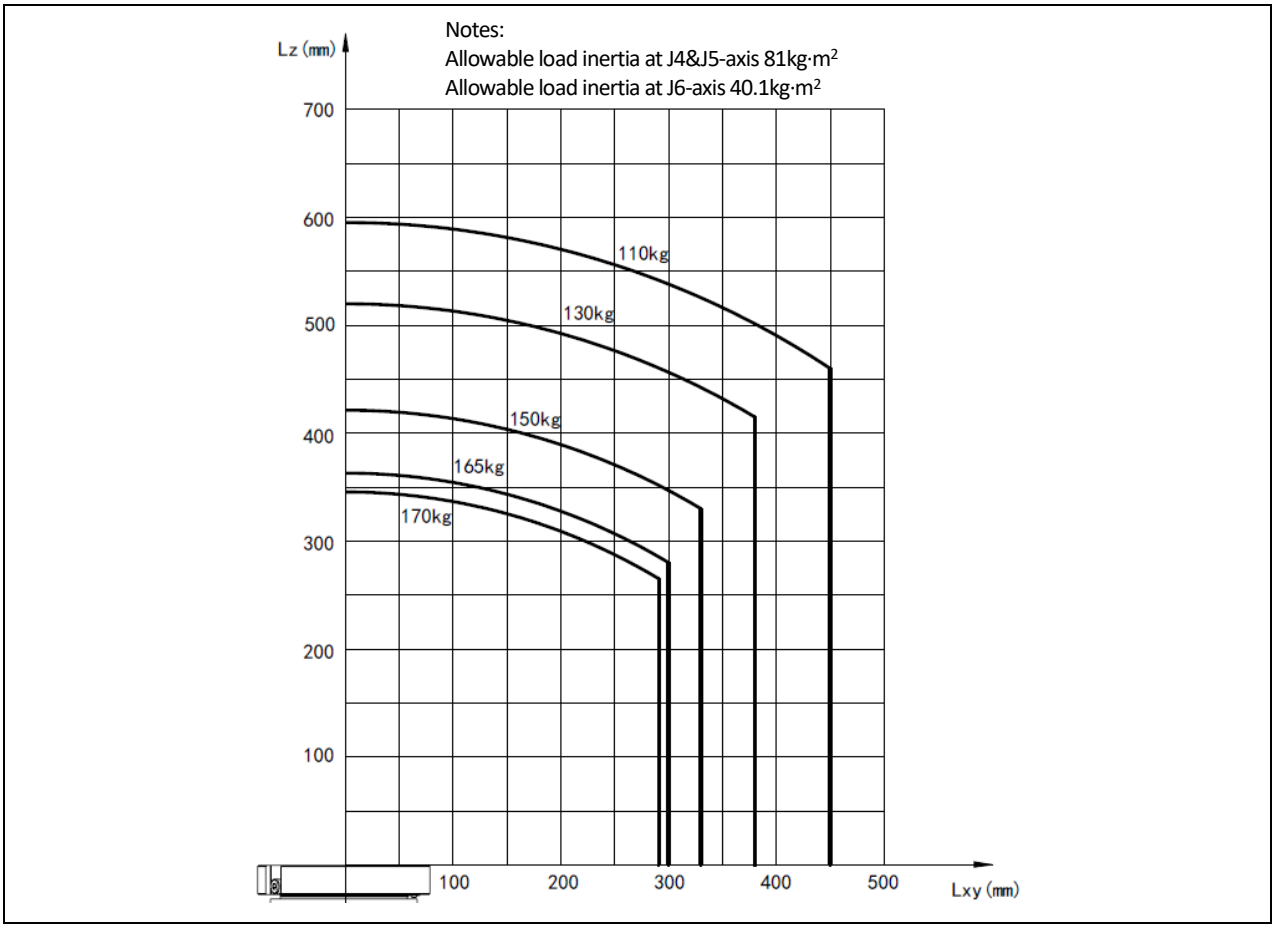


Fig. 3.29 Load capacity at wrist (ER170B-2650)

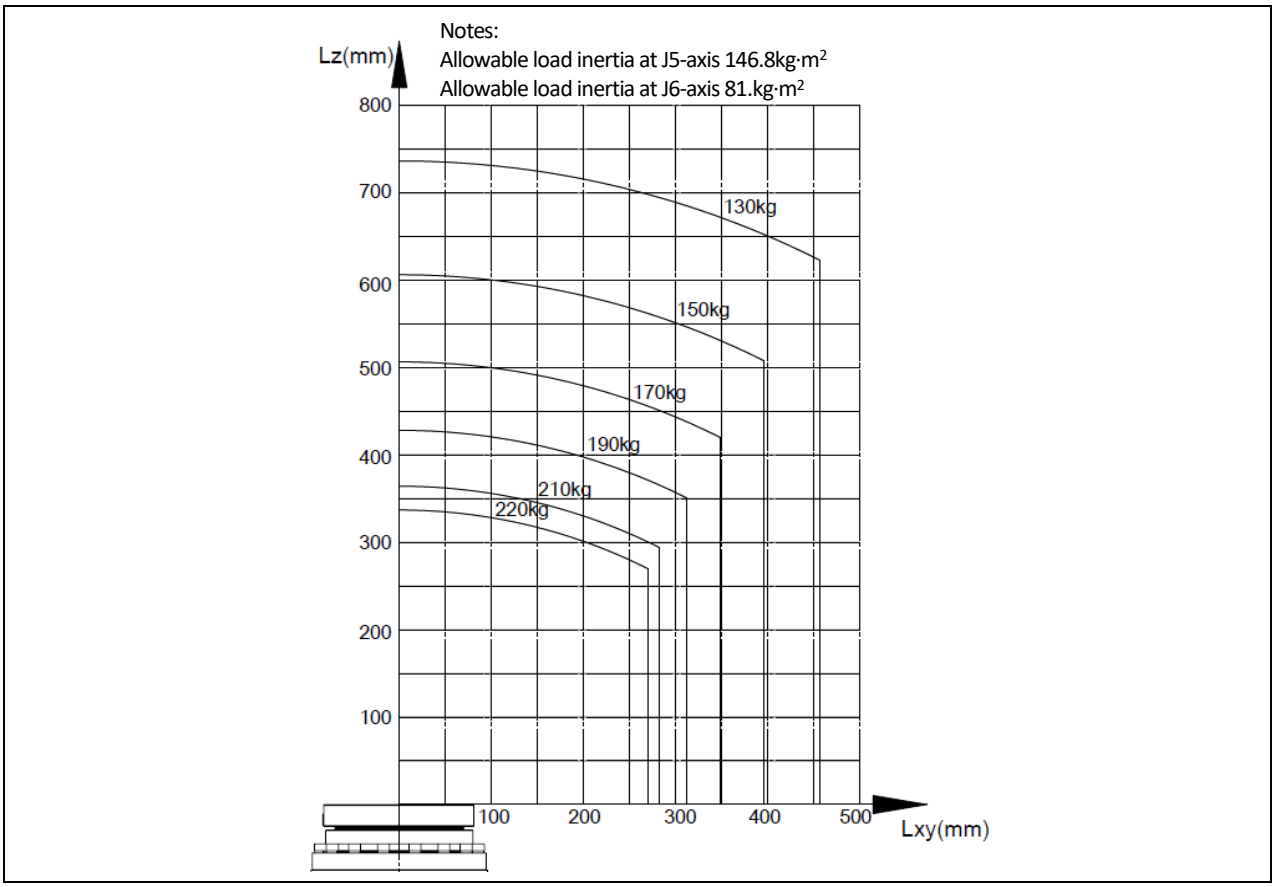


Fig. 3.30 Load capacity at wrist (ER220B-2650)

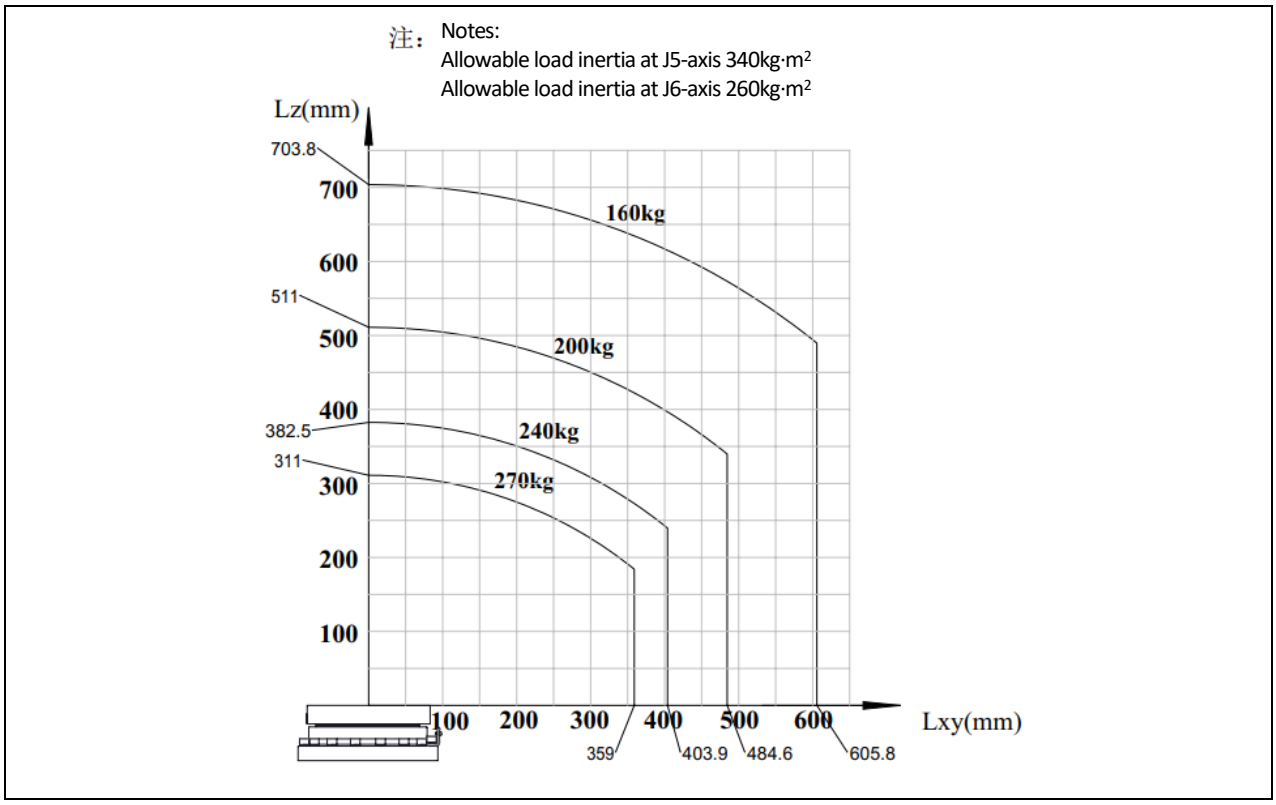
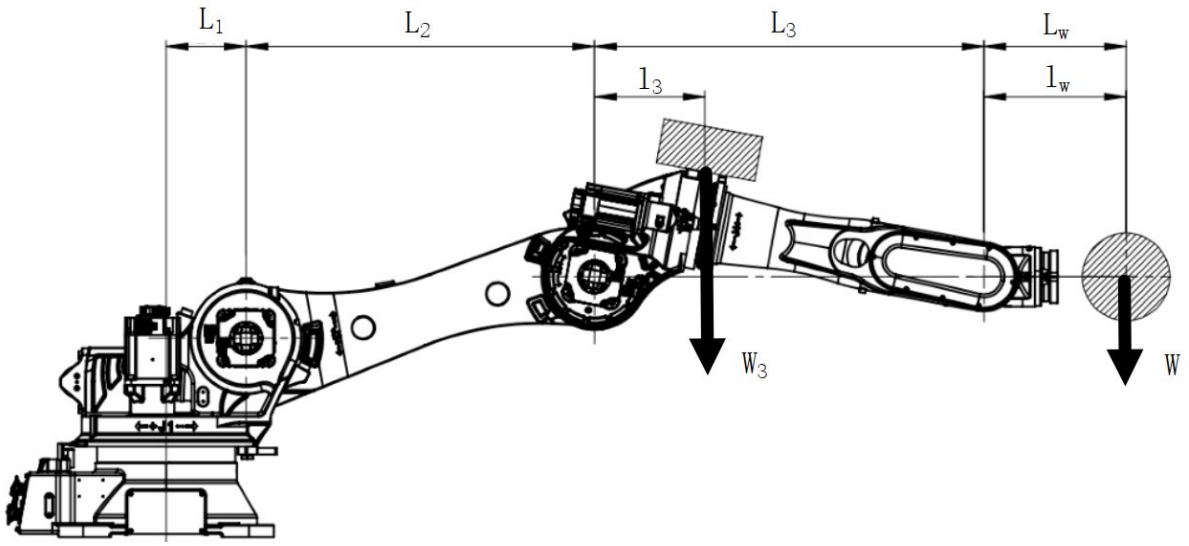


Fig. 3.31 Load capacity at wrist (ER270-2700)

3.5 Additional payload conditions

Additional loads can be added to each robot of this series. The payload conditions are detailed as follows.



J3: $W(L_3+l_w)+W_3 \cdot l_3 \leqq W_{max}(L_3+L_w)$;

J2: $W(L_2+L_3+l_w)+W_3(L_2+l_3) \leqq W_{max}(L_2+L_3+L_w)$;

W_{max}: Maximum payload capacity (kg);

W: Wrist end load (kg);

W_3: Total load on J3 axis (kg);

l_w: Wrist payload center of mass position (mm);

l_3: Position of payload center of mass on J3 axis (mm).

Model	L_1 (mm)	L_2 (mm)	L_3 (mm)	L_w (mm)	W_{max} (kg)
ER100B-3000	260	1132	1616	523	100
ER100B-3000-DW	740	1150	1616	523	100
ER130B-3200	260	1132	1809	609	130
ER160B-3200	260	1132	1765	731	160
ER170B-2650	260	1132	1266	566	170
ER220B-2650	260	1132	1266	577	220
ER270-2700	285	1132	1286	571	270

However, W3 should not exceed the following value:

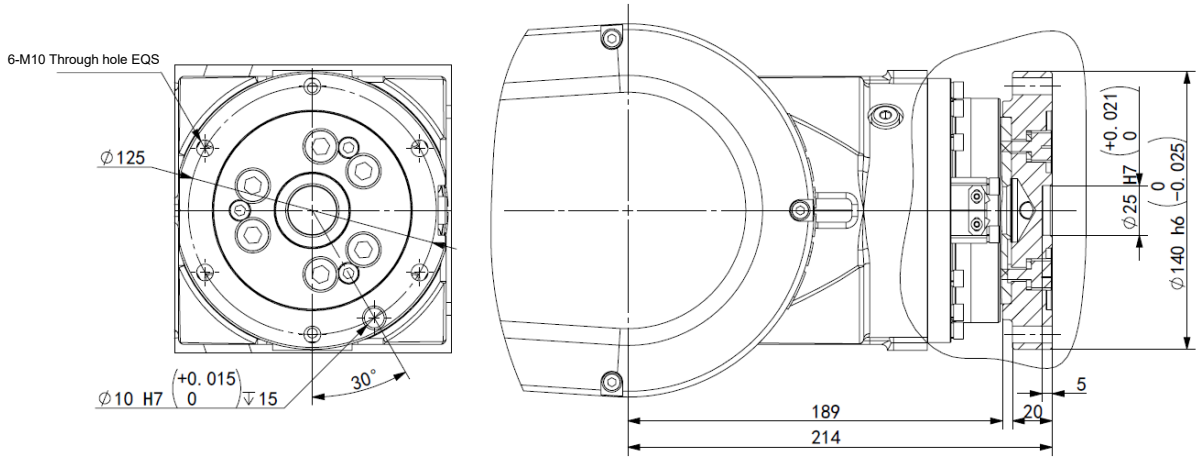
$W(L_1+L_2+L_3+l_w)+W_3(L_1+L_2+l_3) \leqq W_{max}(L_1+L_2+L_3+L_w)$

Fig. 3.32 Additional payload conditions

4. EQUIPMENT INSTALLATION TO THE ROBOT

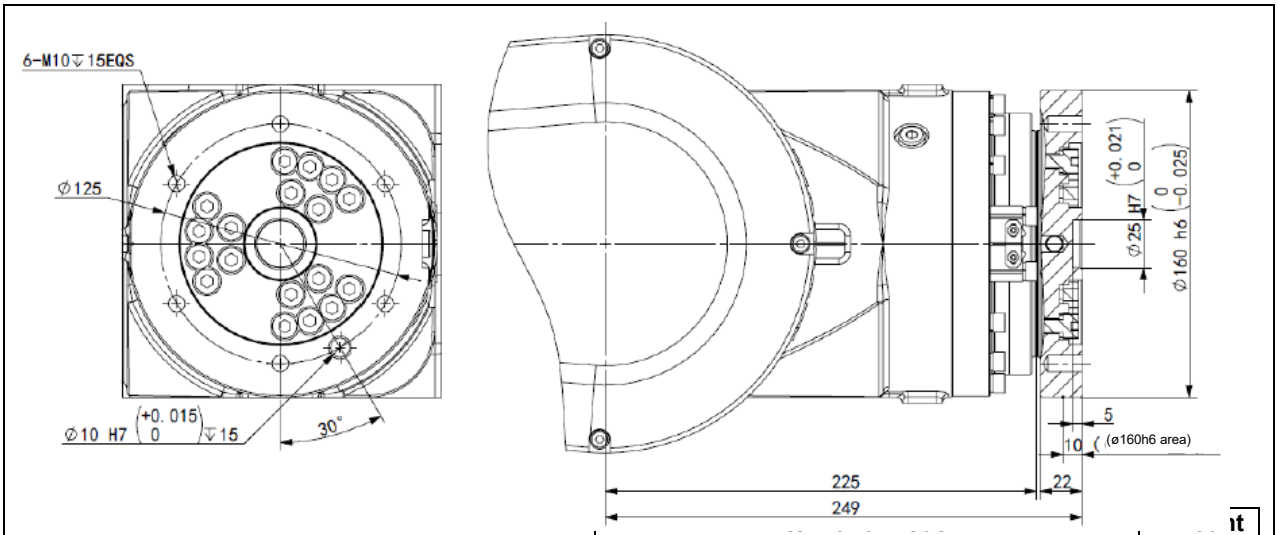
4.1. FLANGE DIMENSION

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.



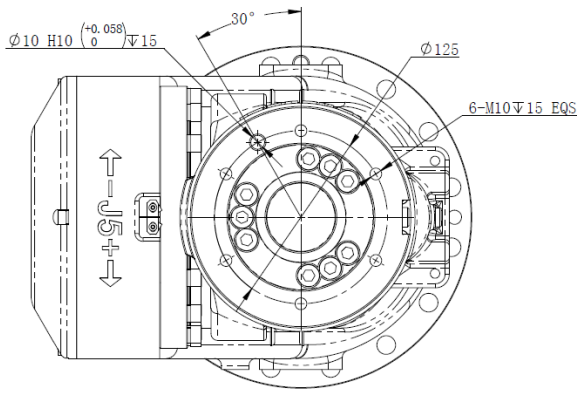
Item and model	Amount
Fixed screw: M10 (GB/T 70.1 12.9 级)	6
Spring washer: spring washerΦ10 (GB/T 93)	6
Positioning pin: cylindrical pinΦ10 (GB/T120.2)	1

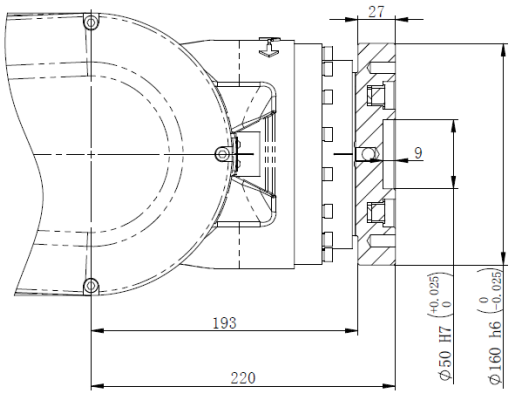
Fig. 4.1 End flange mounting dimension (ER100B-3000, ER100B-3500-DW)



Fixed screw: M10 (GB/T 70.1 12.9 级)	6
Spring washer: spring washerΦ10 (GB/T 93)	6
Positioning pin: cylindrical pinΦ10 (GB/T120.2)	1

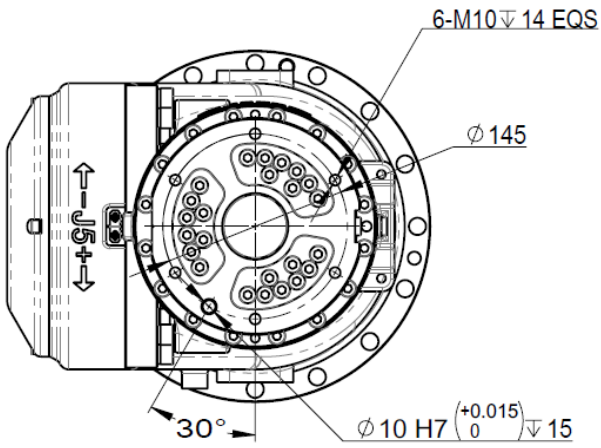
Fig. 4.2 End flange mounting dimension (ER130B-3200)

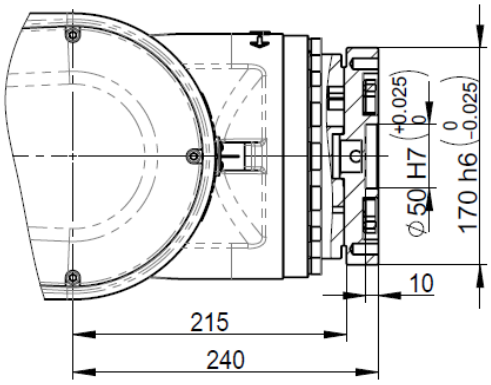




Item and model	Amount
Fixed screw: M10 (GB/T 70.1 12.9 级)	6
Spring washer: spring washerΦ10 (GB/T 93)	6
Positioning pin: cylindrical pinΦ10 (GB/T120.2)	1

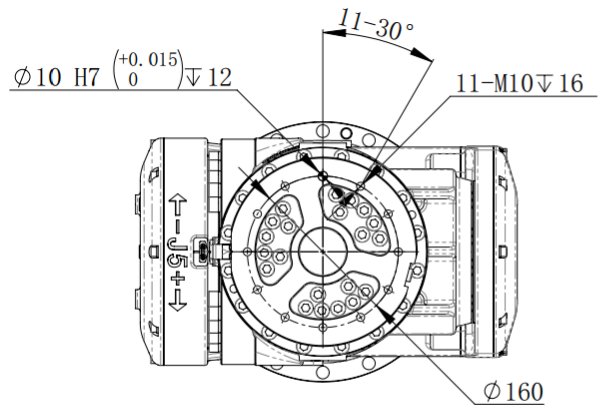
Fig. 4.3 End flange mounting dimension (ER170B-2650)

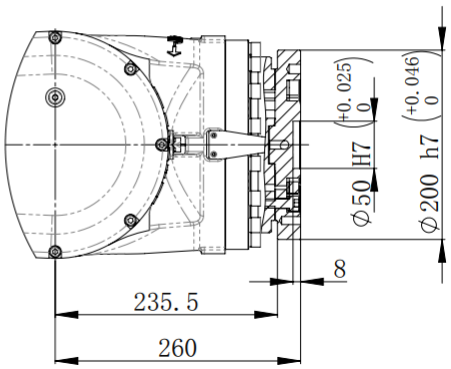




Item and model	Amount
Fixed screw: M10 (GB/T 70.1, grade 12.9)	6
Spring washer: spring washerΦ10 (GB/T 93)	6
Positioning pin: cylindrical pinΦ10 (GB/T120.2)	1

Fig. 4.4 End flange mounting dimension (ER160B-3200, ER220B-2650)





Item and model	Amount
Fixed screw: M10 (GB/T 70.1, grade 12.9)	11
Spring washer: spring washerΦ10 (GB/T 93)	11
Positioning pin: cylindrical pinΦ10 (GB/T120.2)	1

Fig. 4.5 End flange mounting dimension (ER270-2700)

4.2. EQUIPMENT MOUNTING FACE

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

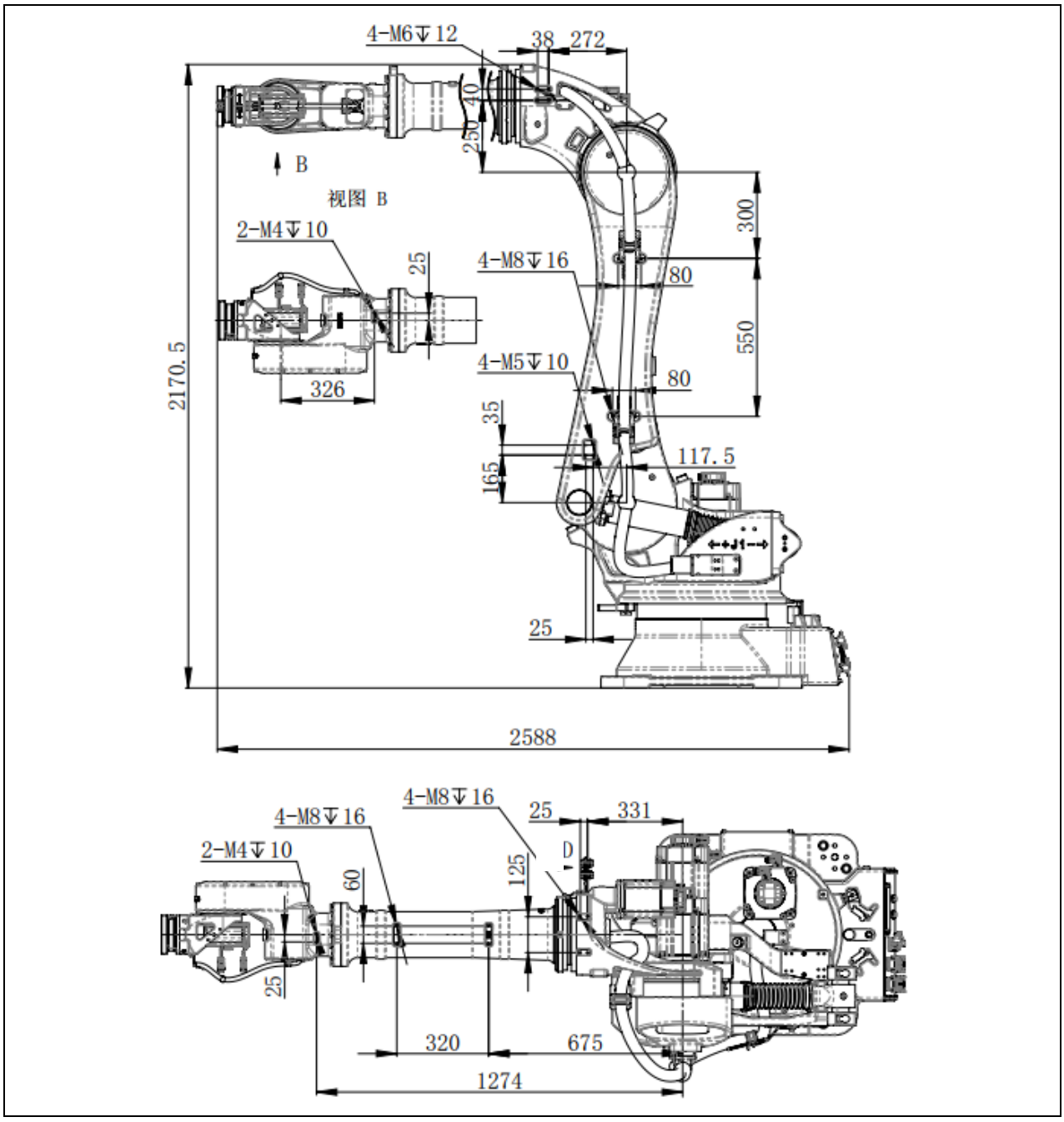


Fig. 4.6 Equipment mounting face (ER100B-3000)

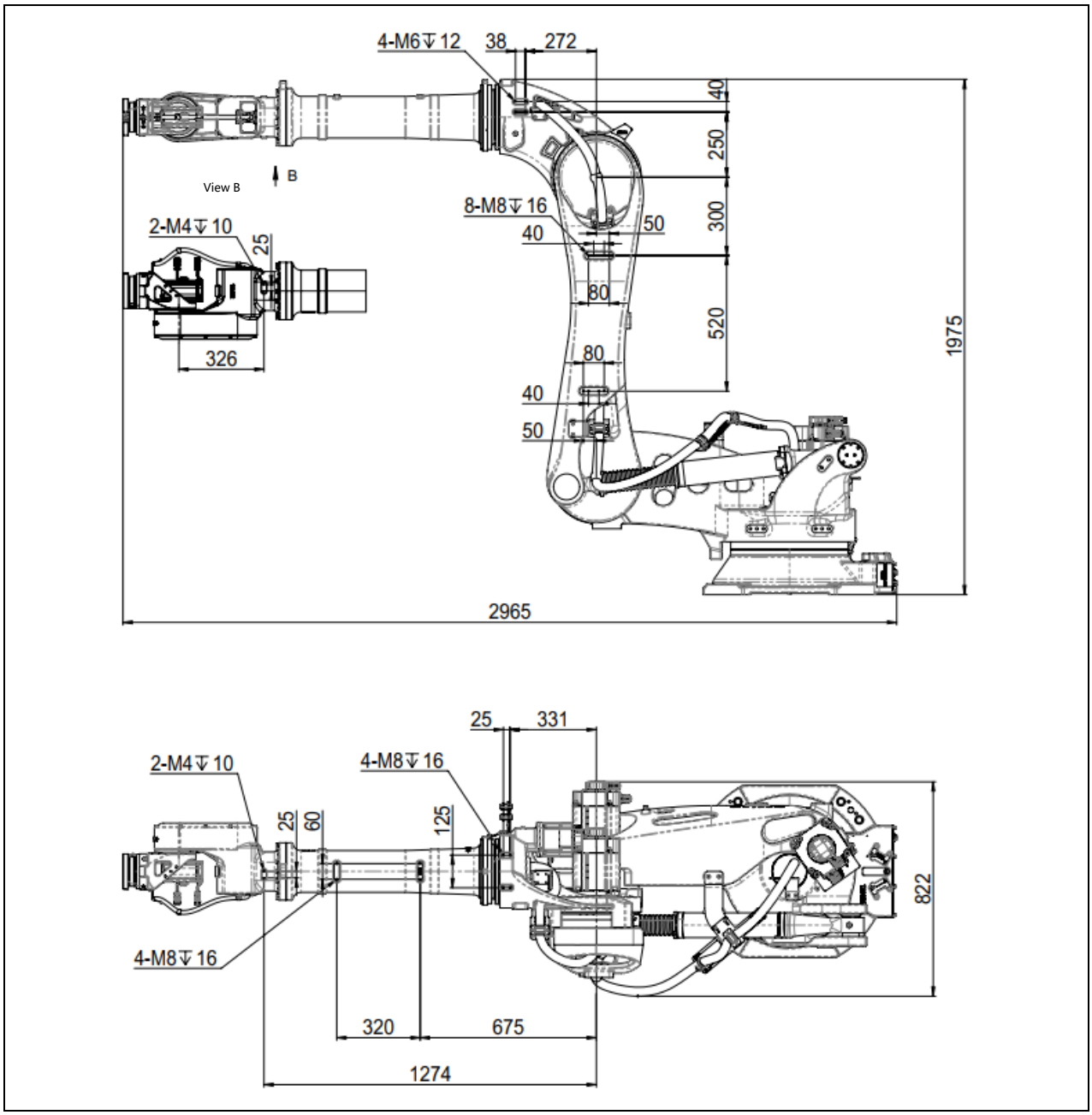


Fig. 4.7 Equipment mounting face (ER100B-3500-DW)

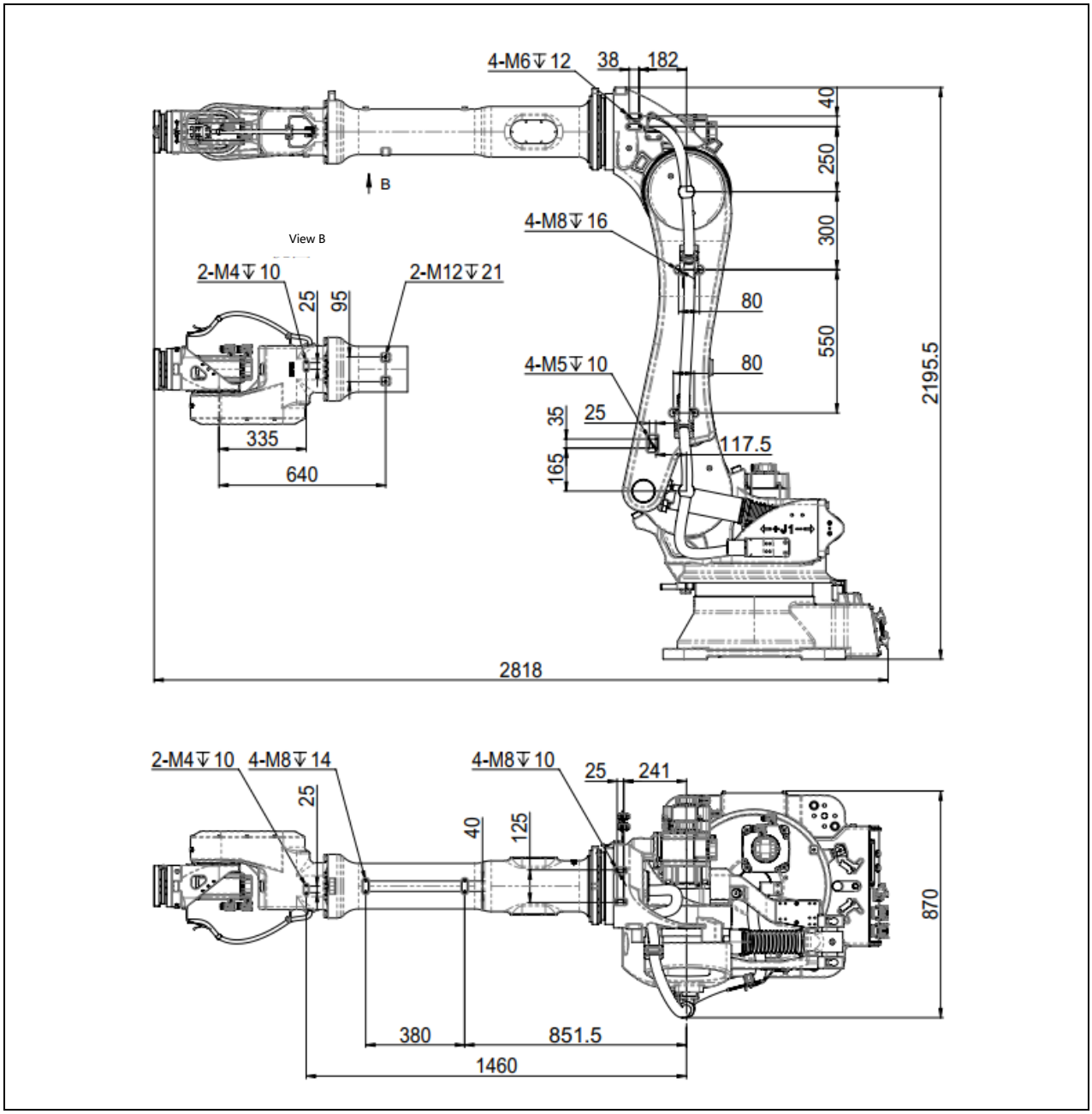


Fig. 4.8 Equipment mounting face (ER130B-3200)

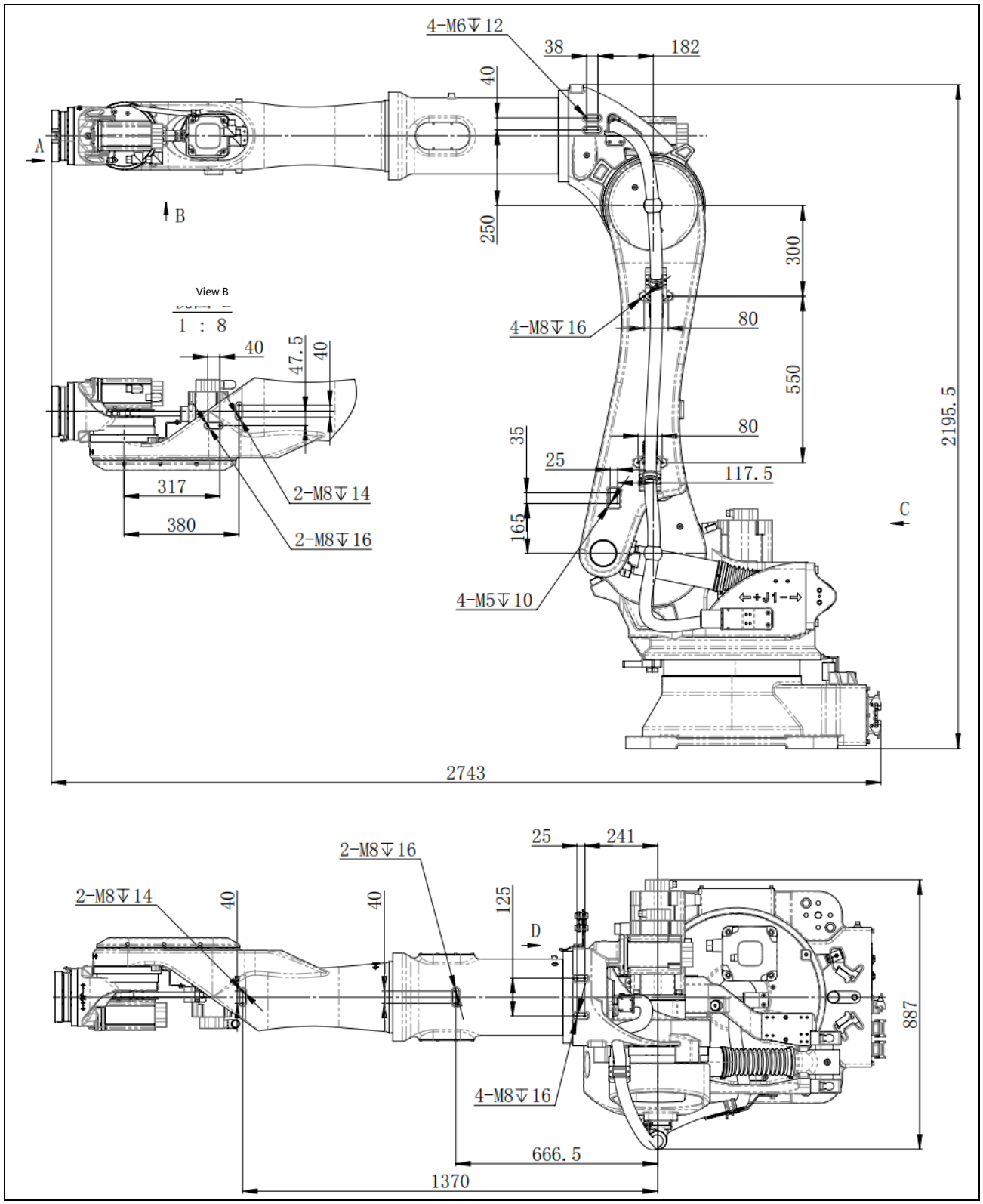


Fig. 4.9 Equipment mounting face (ER160B-3200)

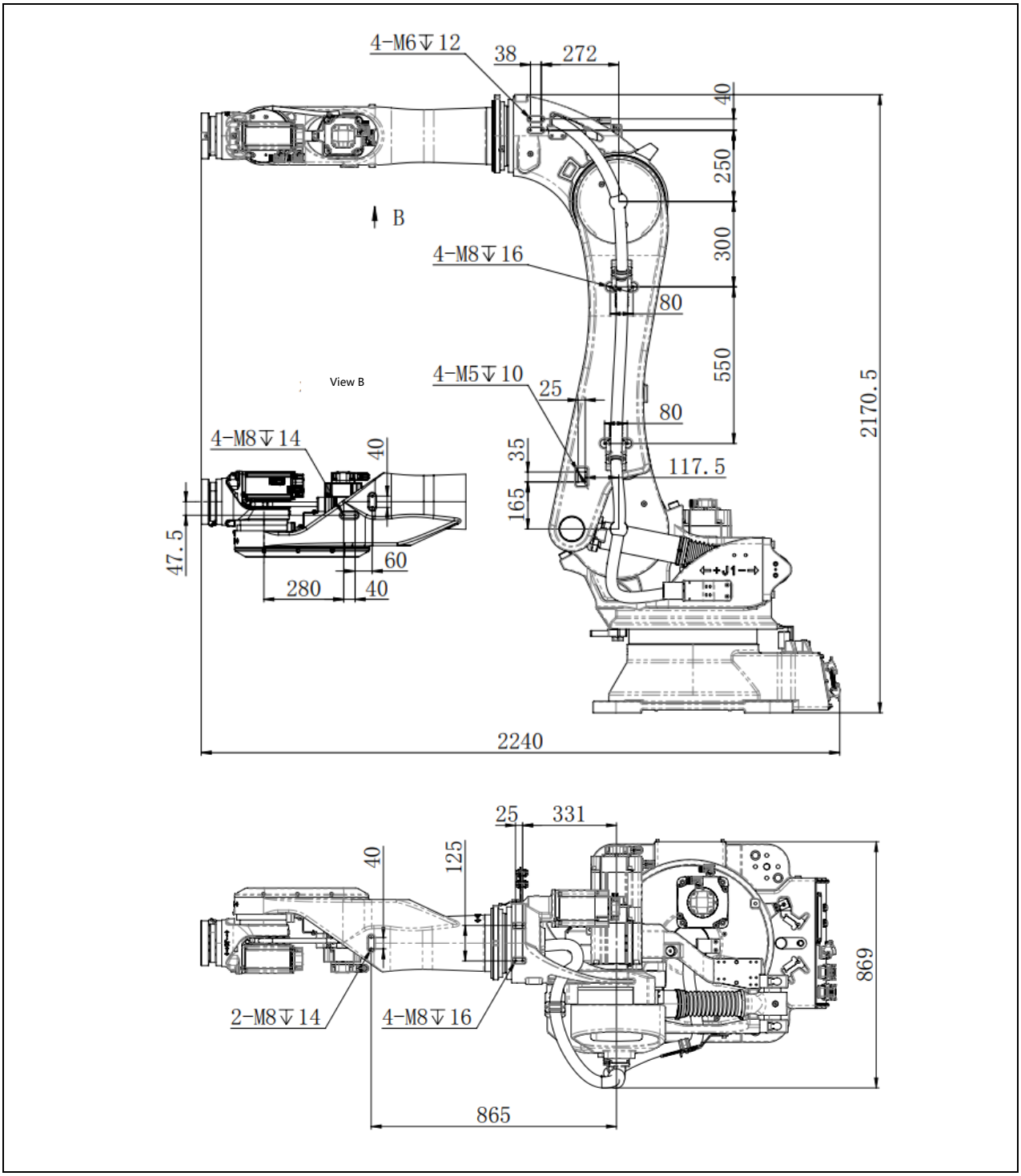


Fig. 4.10 Equipment mounting face (ER170B-2650)

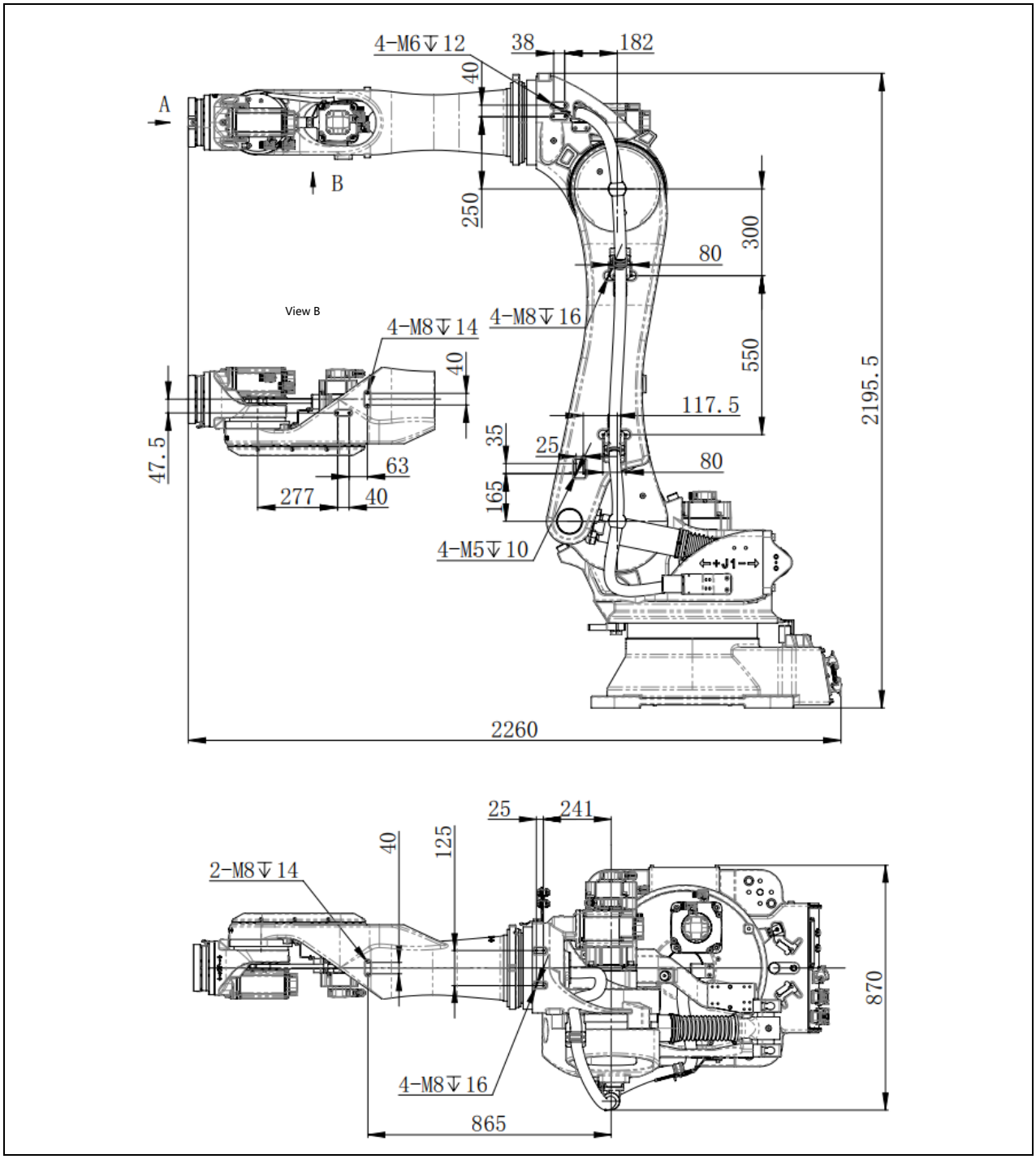


Fig. 4.11 Equipment mounting face (ER220B-2650)

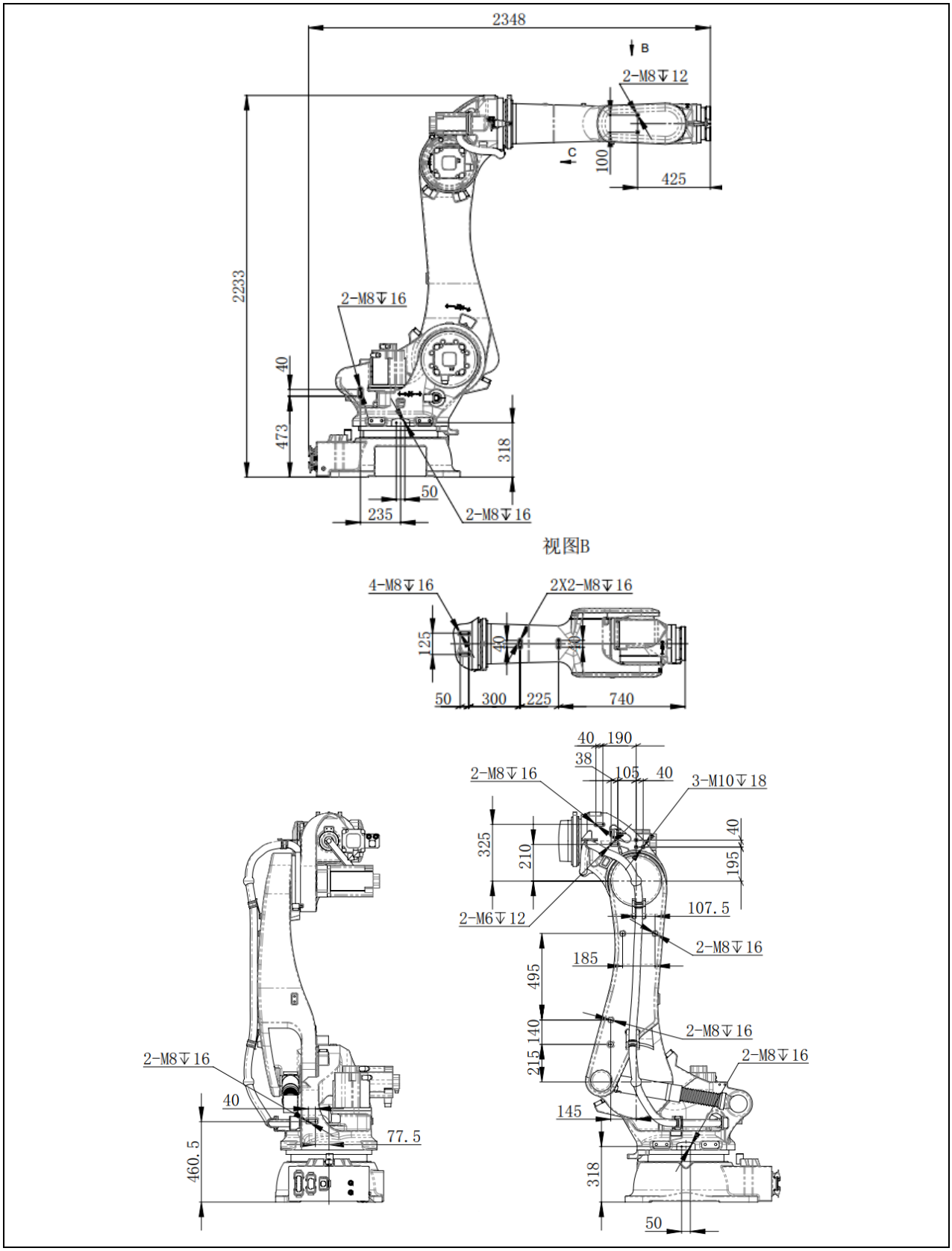


Fig. 4.12 Equipment mounting face (ER220-2700)

CAUTION **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.

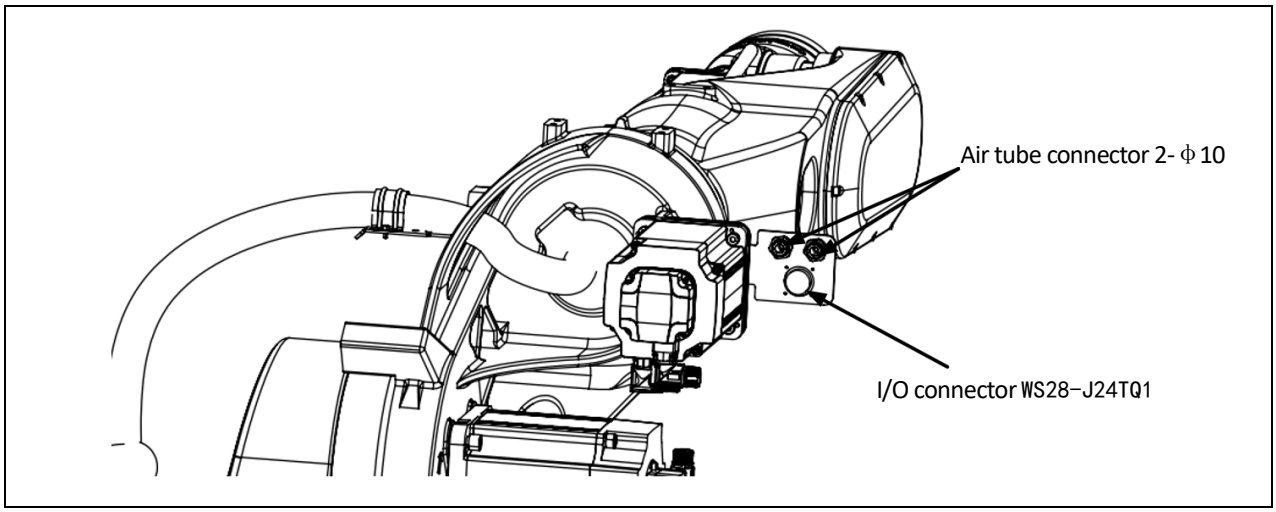


Fig. 4.13 Pipes and tubes (ER100B-3000, ER100B-3500-DW, ER170B-2650, ER220B-2650)

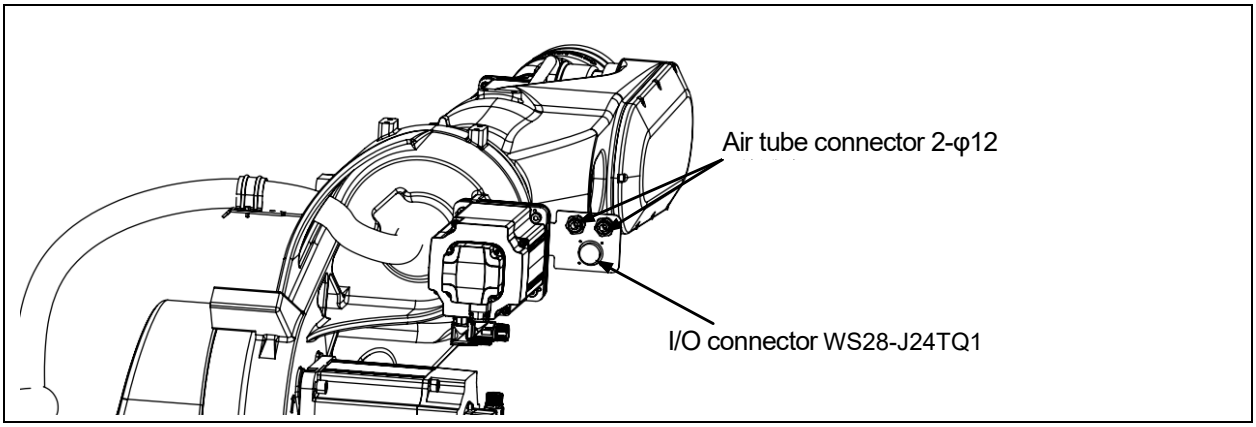


Fig. 4.14 Pipes and tubes (ER130B-3200, ER160B-3200)

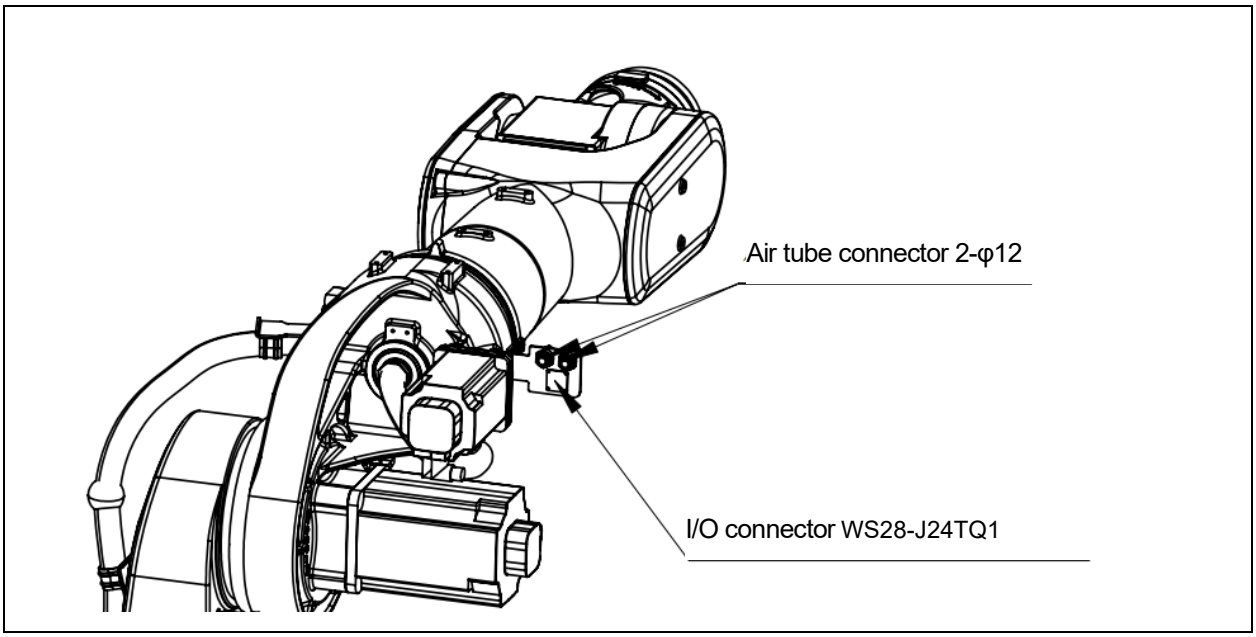


Fig. 4.15 Pipes and tubes (ER270-2700)

5.CHECK AND MAINTENANCE

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

CAUTION	**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 whether the taught positions of the robot have not deviated from the previous taught positions. Check whether the stop position have not deviated from the previous stop positions.
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	1 month 320h		
○ Only 1st check	○						Cleaning the controller ventilation system	Confirm the controller ventilation system is not dusty. If dust has accumulated, remove it.
	○						Check the external damage or peeling paint	Check whether the robot has external damage or peeling paint 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 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. If the cable protection sheath is damaged due to the interference with peripheral equipment, eliminate the cause.
		○					Inspection of gas spring	Check if the gas spring cylinder contains normal pressure and if the piston rob shows any sign of wear.
	○						Check for water	Check whether the robot is subjected to water or cutting oils. If water is found, remove the cause and wipe off the liquid.
	○ Only 1st check		○				Check for damages to the teach pendant cable, the cabinet connection cable or the robot connection cable	Check whether the cable connected to the teach pendant, cabinet and robot are unevenly twisted or damaged. If damage is found, replace the damaged cables.
○ Only 1st check			○				Check for damage to the mechanical unit cable (movable part)	Observe the movable part of the mechanical unit cable, and check for damage. Also, check whether the cables are excessively bent or unevenly 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 is found, 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	Retighten the robot installation bolts, bolts to be removed for inspection, and bolts exposed to the outside. Refer to the recommended bolt tightening torque guidelines at Appendix A. An adhesive to prevent bolts from loosening is applied to some bolts. If the bolts are tightened with greater than the recommended torque, the adhesive might be removed. Therefore, follow the recommended bolt tightening torque guidelines when retightening the bolts.
	○ Only 1st check		○				Check the mechanical stopper	Check that there is no evidence of a collision on the mechanical stopper, and check the looseness of the stopper mounting bolts.
	○ Only 1st check		○				Clean spatters, sawdust and dust	Check that spatters, sawdust, or 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 of 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

5.2.1.Inspection of gas spring

CAUTION	**Before checking the gas spring, be sure to disconnect the controller and external power source. Set up an eye-catching sign to prevent any personnel turn on the power unintentionally, or avoid unpredictable shock accident.** **Replace the gas spring when the pressure is not maintained or when wear occurs on the piston pin. Contact ESTUN for more details about replacing the gas spring.**

There are two methods to check the gas spring.

Method I: check the gas pressure of the spring by measure the static load rate of J2-axismotor.

Tab. 5.1 Static load rate of J2-axis

Model	Orientation	Load rate (zero load)	Load rate (full load)
ER100B-3000	J2: 47°, J3: -38.82°, J4: 0°, J5: -30.56°, J6: the load is in the vertical direction	2.3±5%	52.8±5%
ER100B-3500-DW	J2:82°, J3: -73.82°, J4:0°, J5: -30.08°, J6: the load is in the vertical direction	15.3%±5%	76.8±5%
ER130B-3200	J2: 50°, J3: -42.7°, J5: -33.36°	17.4%±5%	87.7%±5%
ER160B-3200	J2: 48°, J3: -38°, J5: -42°	16%±5%	84.4%±5%
ER170B-2650	J2: 47°, J3: -36.53°, J4: 0°, J5:-39.57°, J6: the load is in the vertical direction	4.1±5%	89.6±5%
ER220B-2650	J2: 0°, J3: 0, J4: 0°, J5:0°, J6: the load is in the vertical direction	7.4±5%	67.2±5%

Method II: check with a gas-pressure meter.

This robot needs a gas-pressure meter (model GA3500) to check the gas spring.

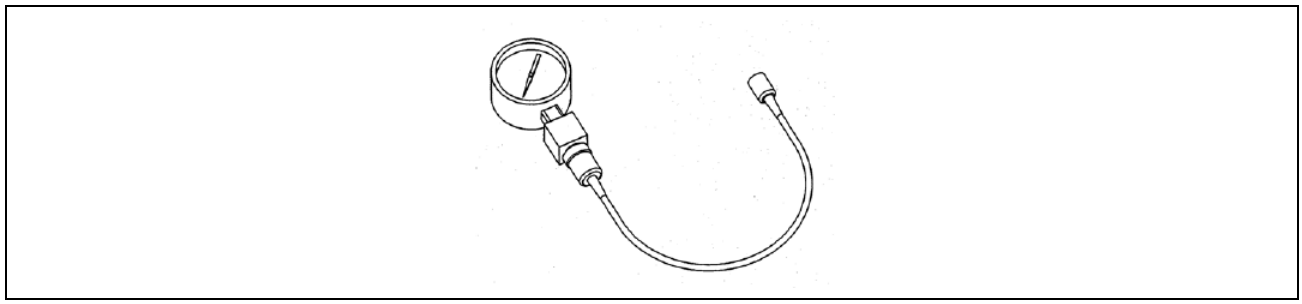


Fig 5.1 Gas-pressure meter

Procedures of checking the gas spring pressure.

a) Adjust J2-axis to 0° and then turn off the power supply.

b) Remove the cover and screw of the gas spring inlet.

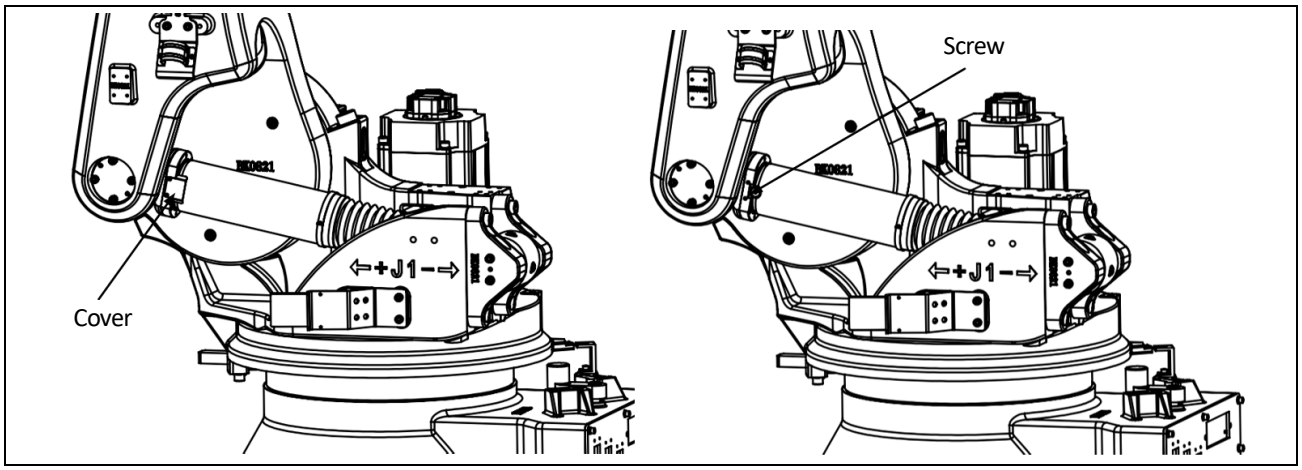


Fig. 5.2 Inspection of gas spring (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

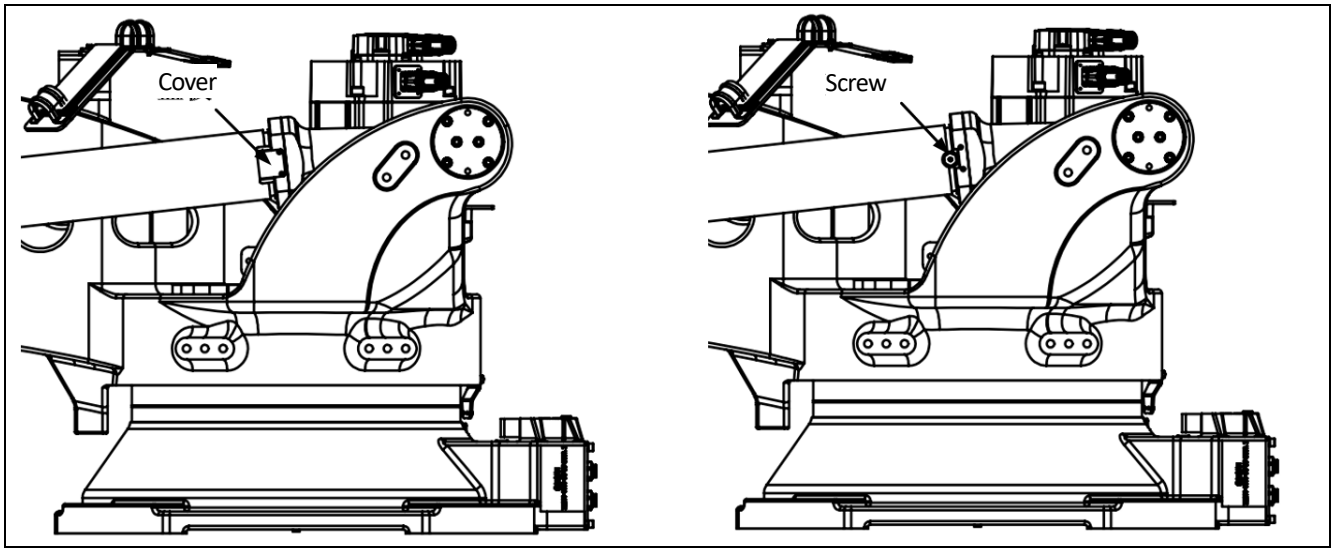


Fig. 5.3 Inspection of gas spring (ER100B-3500-DW)

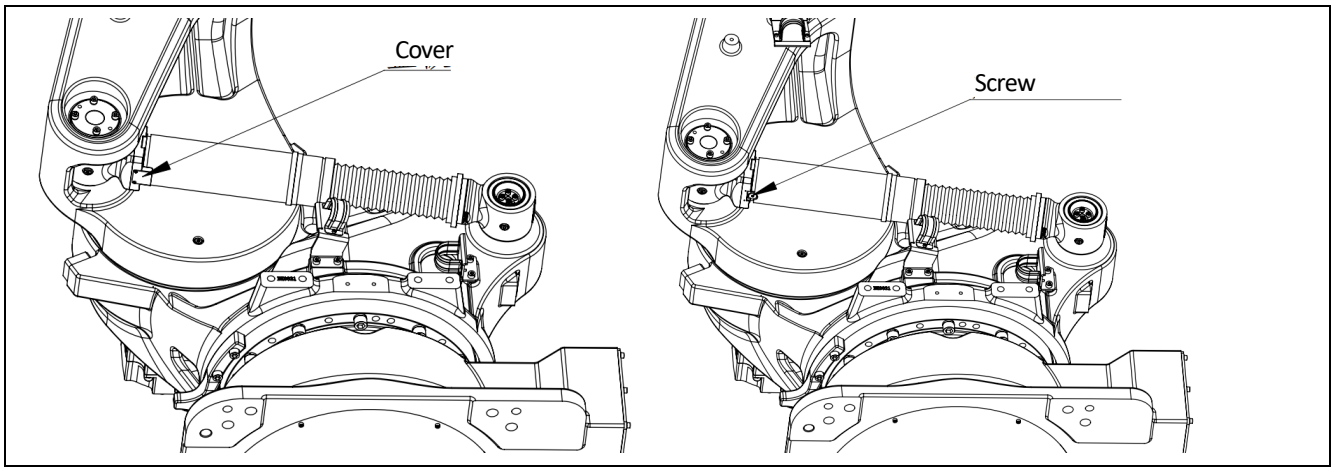


Fig. 5.4 Inspection of gas spring (ER270-2700)

c) A gas pressure detection device is mounted at the air inlet and specified pressure is listed in the table below;

d) After confirming the air pressure, remove the detection device and reinstall the screw and cover.

Method III: Using the software reminder function on the teach pendant.

Fig. 5.5 Reminder of gas spring inspection software

Tab. 5.2 Gas-pressure corresponding to the surface temperature of the gas spring (ER100B-3000、ER130B-3200、ER170B-2650)

Surface temp / J2-axis angle	0℃	5℃	10℃	15℃	20℃	25℃	30℃	35℃	40℃
0°	12.80MPa	13.04MPa	13.27MPa	13.51MPa	13.74MPa	13.97MPa	14.21MPa	14.44MPa	14.68MPa

Tab. 5.3 Gas-pressure corresponding to the surface temperature of the gas spring (ER160B-3200, ER220B-2650)

Surface temp / J2-axis angle	0℃	5℃	10℃	15℃	20℃	25℃	30℃	35℃	40℃
0°	13.74MPa	14.00MPa	14.25MPa	14.5MPa	14.75MPa	15.00MPa	15.25MPa	15.50MPa	15.76MPa

Tab. 5.4 Gas-pressure corresponding to the surface temperature of the gas spring (ER100B-3500-DW)

Surface temp / J2-axis angle	0℃	5℃	10℃	15℃	20℃	25℃	30℃	35℃	40℃
0°	12.36MPa	12.59MPa	12.82MPa	13.04MPa	13.27MPa	13.50MPa	13.72MPa	13.95MPa	14.18MPa

CAUTION

Fill the gas tank if the air pressure is more than 0.5MPa below the specified value.

5.3. ADJUSTING THE BELT

J5-axis of this series of robot is drove by timing belt. After a period of operation, the belt tense will reduce. This section describes how to strain the J5-axis timing belt.

WARNING

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.

Procedures of straining J5-axis timing belt is shown as below.

1. Disassemble the hexagon flat round head screw M6X16 under the cover on the right side of the small arm, and keep it in a proper place.
2. Unscrew the hexagon screw M8X30 on the mounting plate of J5-axis.
3. Adjust the device underneath the mounting plate, mainly adjust the M6 nut, to make the screw firmly against to the mounting plate of J5-axis motor.
4. Test the tense on the side of the timing belt. Refer to the table below for a proper tense value.
5. Tighten the hexagon screw M6X16 on the mounting plate to fix the plate.
6. Use hexagon flat round head screw to fix the cover to the right side of the small arm. Tighten the screw.

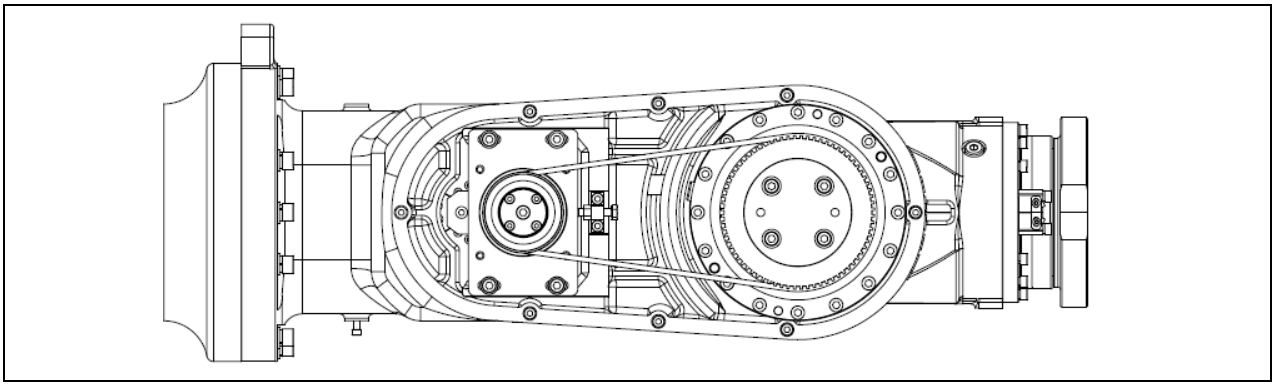


Fig. 5.6 Strain the timing belt (ER100B-3000, ER100B-3500-DW)

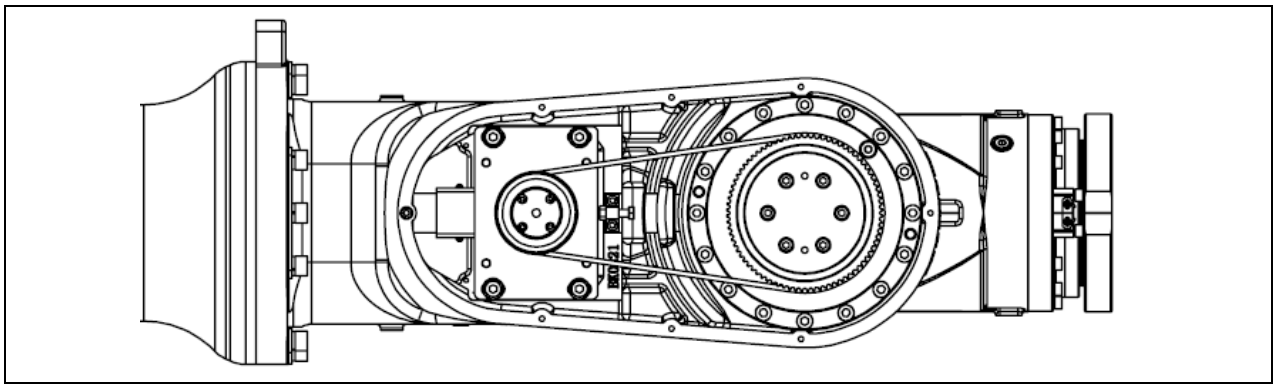


Fig. 5.7 Strain the timing belt (ER130B-3200)

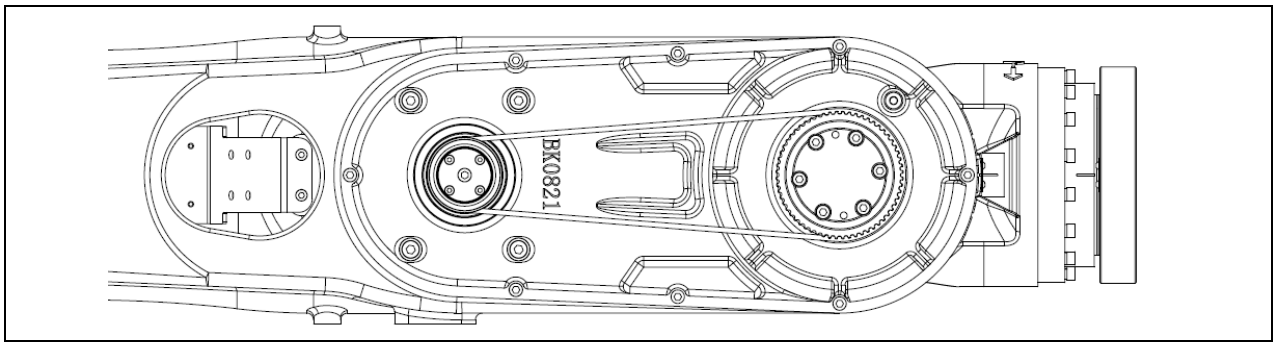


Fig 5.8 Strain the timing belt (ER160B-3200, ER170B-2650, ER220B-2650)

Tab. 5.5 Timing belt tense/frequency value (ER100B-3000, ER100B-3500-DW)

Model		Range of belt tense	Range of frequency
Belt	new belt (new)	86.9～95.6N	96.4～101Hz
	used belt (old)	60.8～69.5N	80.6～86.2Hz

Tab. 5.6 Timing belt tense/frequency value (ER130B-3200)

Model		Range of belt tense	Range of frequency
Belt	new belt (new)	142～156N	88.6～93Hz
	used belt (old)	99.4～113N	74.2～79.3Hz

Tab. 5.7 Timing belt tense/frequency value (ER160B-3200, ER170B-2650, ER220B-2650)

Model		Range of belt tense	Range of frequency
Belt	new belt (new)	187～206N	79.2～83.1Hz
	used belt (old)	131～150N	66.3～70.9Hz

When measuring, it is best to measure the frequency (Hz) to determine the timing belt tension. 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.

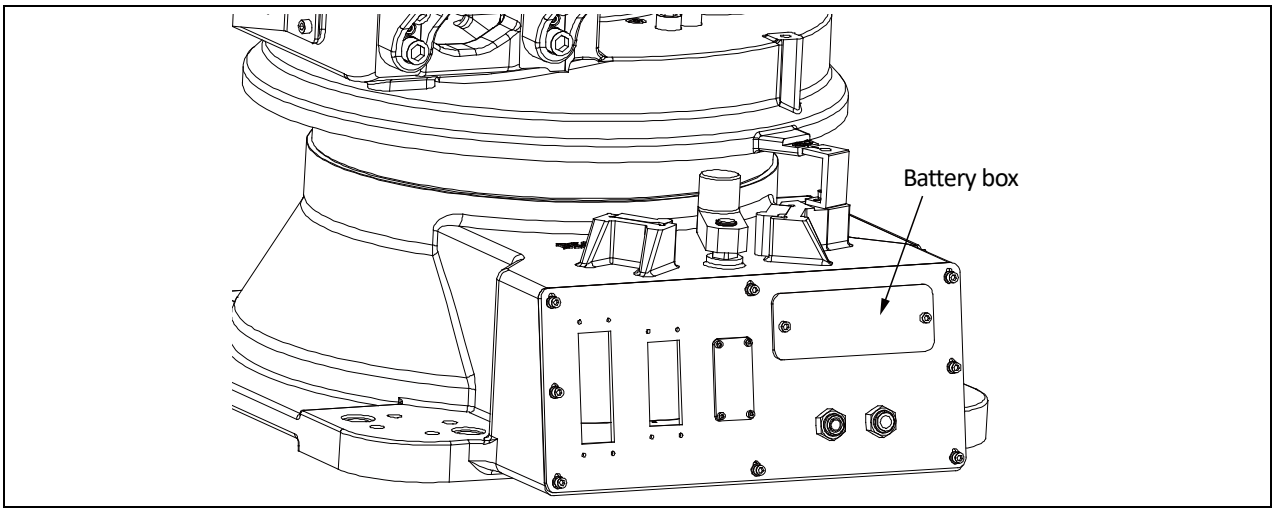


Fig. 5.9 Battery replacing

> **CAUTION**
>
> **Be sure to keep the power on. If the power is cut off during replacing, the position data will 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.

> **CAUTION**
>
> **When the operating environment of the robot is harsh, or when small angles are frequently used, or when it runs continuously at high frequencies for extended periods, the lubricating grease replacement cycle for the corresponding joints should be shortened to 3000 hours.**

Tab. 5.8 Replacing the grease periodically

Model	Position	Quantity
ER100B-3000 ER100B-3500-DW	J1-axis reducer	4450ml
	J2-axis reducer	2450ml
	J3-axis reducer	1370ml
	J4-axis reducer	1130ml
	J5-axis reducer	170ml
	J6-axis reducer	220ml
ER130B-3200	J1-axis reducer	4450ml
	J2-axis reducer	2450ml
	J3-axis reducer	3150ml
	J4-axis reducer	1850ml

Model	Position	Quantity
	J5-axis reducer	330ml
	J6-axis reducer	410ml
ER170B-2650	J1-axis reducer	4450ml
	J2-axis reducer	2450ml
	J3-axis reducer	1370ml
	J4-axis reducer	1130ml
	J5-axis reducer	440ml
	J6-axis reducer	330ml
ER220B-2650 ER160B-3200	J1-axis reducer	4450ml
	J2-axis reducer	2450ml
	J3-axis reducer	3150ml
	J4-axis reducer	1850ml
	J5-axis reducer	450ml
	J6-axis reducer	550ml
ER270-2700	J1-axis reducer	6600ml
	J2-axis reducer	3620ml
	J3-axis reducer	3800ml
	J4-axis reducer	2070ml
	J5-axis reducer	3050ml
	J6-axis reducer	1150ml

The table below lists the recommended azimuth for grease replacement or replenishment operations.

Tab. 5.9 Robot joint greasing angle

<table>
<tr><th rowspan="2">Location</th><th colspan="6">Orientation</th></tr>
<tr><th>J1</th><th>J2</th><th>J3</th><th>J4</th><th>J5</th><th>J6</th></tr>
<tr><td>J1-axis reducer</td><td rowspan="6">Any</td><td>Any</td><td rowspan="2">Any</td><td rowspan="2">Any</td><td rowspan="3">Any</td><td rowspan="6">Any</td></tr>
<tr><td>J2-axis reducer</td><td rowspan="5">0°</td></tr>
<tr><td>J3-axis reducer</td><td>0°</td></tr>
<tr><td>J4-axis reducer</td><td>10°</td><td>0°</td></tr>
<tr><td>J5-axis reducer</td><td>0°</td><td>90°</td><td>90°</td></tr>
<tr><td>J6-axis reducer</td><td>0°</td><td>0°</td><td>90°</td></tr>
</table>

5.5.1.Position of oil inlet/outlet on each axis

CAUTION

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

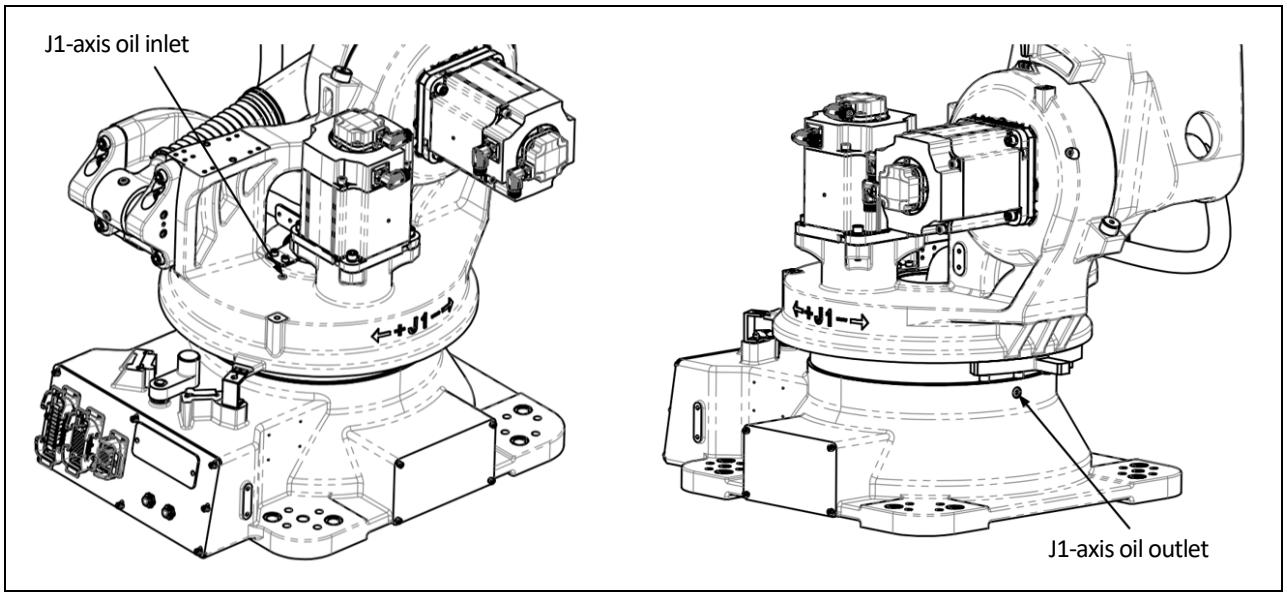


Fig. 5.10 J1-axis oil inlet/outlet (ER100B-3000, ER130B-3200,ER160B-3200, ER170B-2650, ER220B-2650)

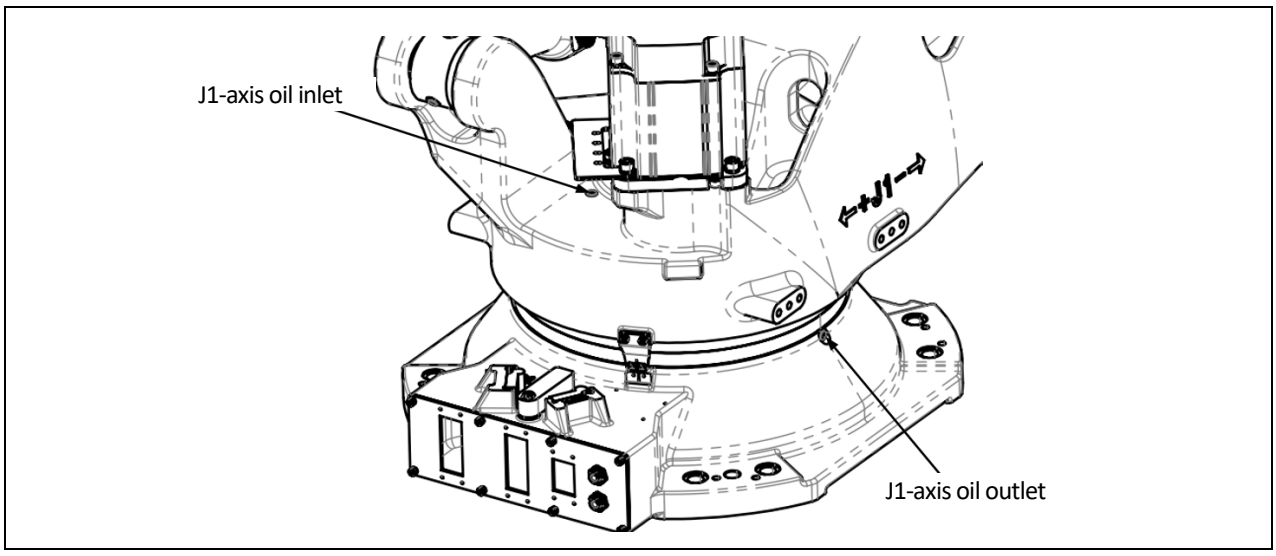


Fig. 5.11 J1-axis oil inlet/outlet (ER100B-3500-DW)

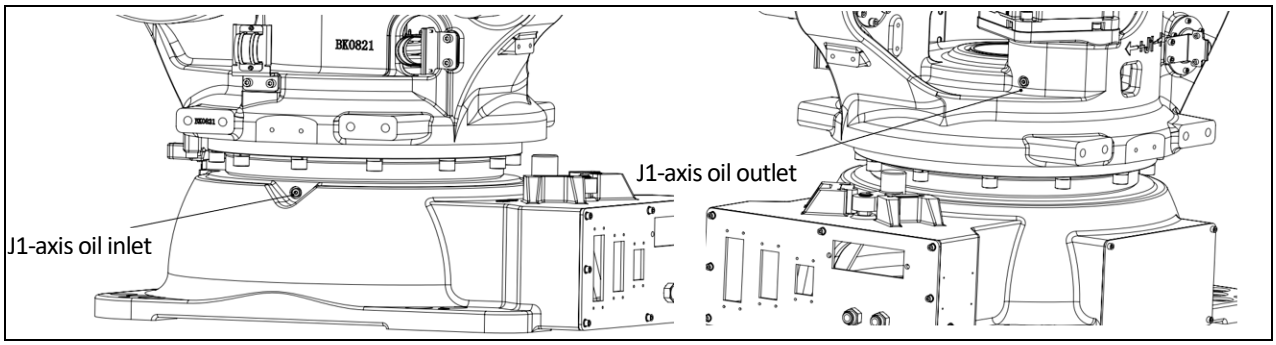


Fig. 5.12 J1-axis oil inlet/outlet (ER270-2700)

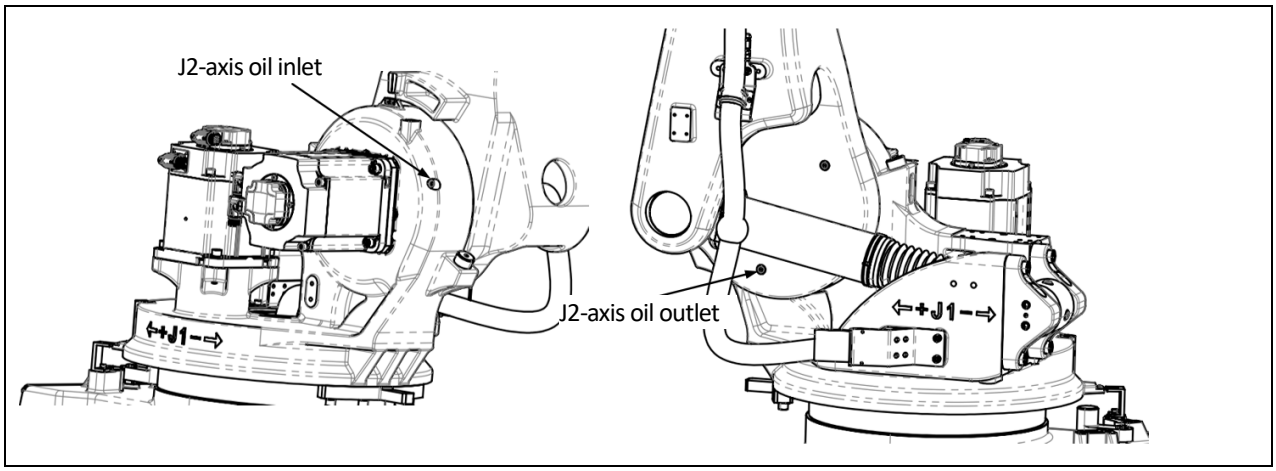


Fig 5.13 J2-axis oil inlet/outlet (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

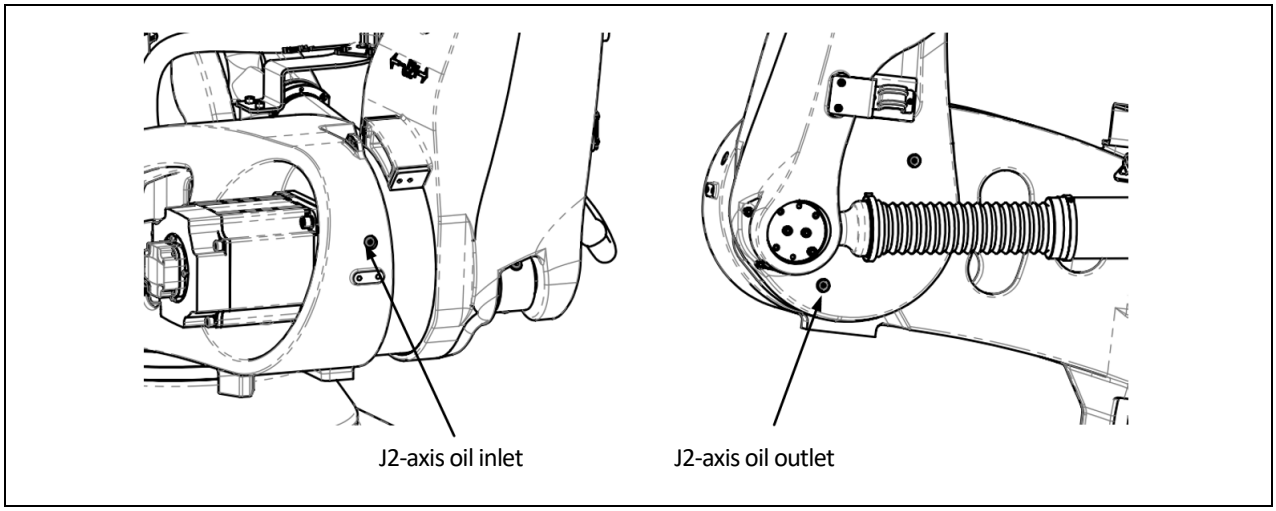


Fig 5.14 J2-axis oil inlet/outlet (ER100B-3500-DW)

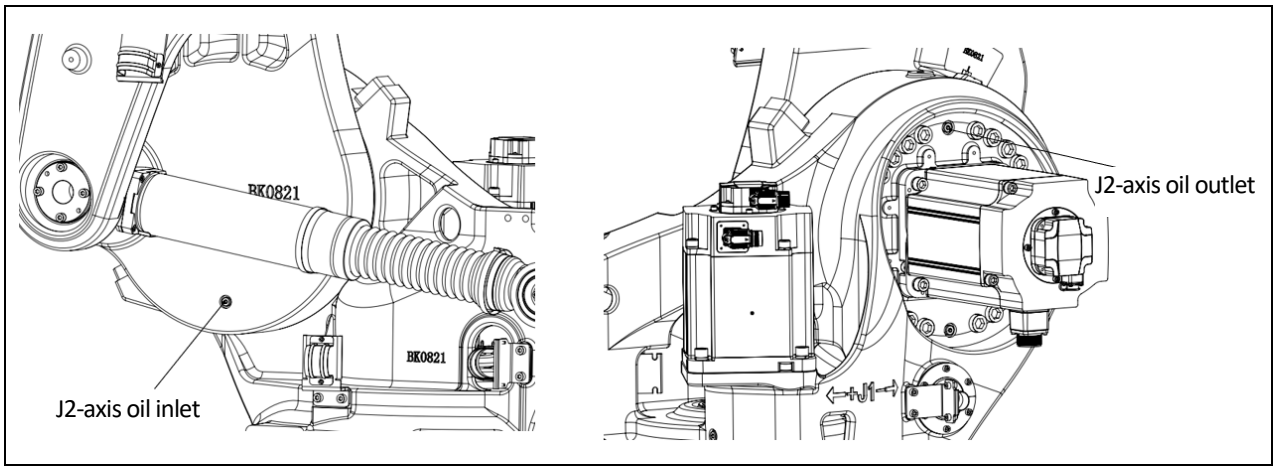


Fig 5.15 J2-axis oil inlet/outlet (ER270-2700)

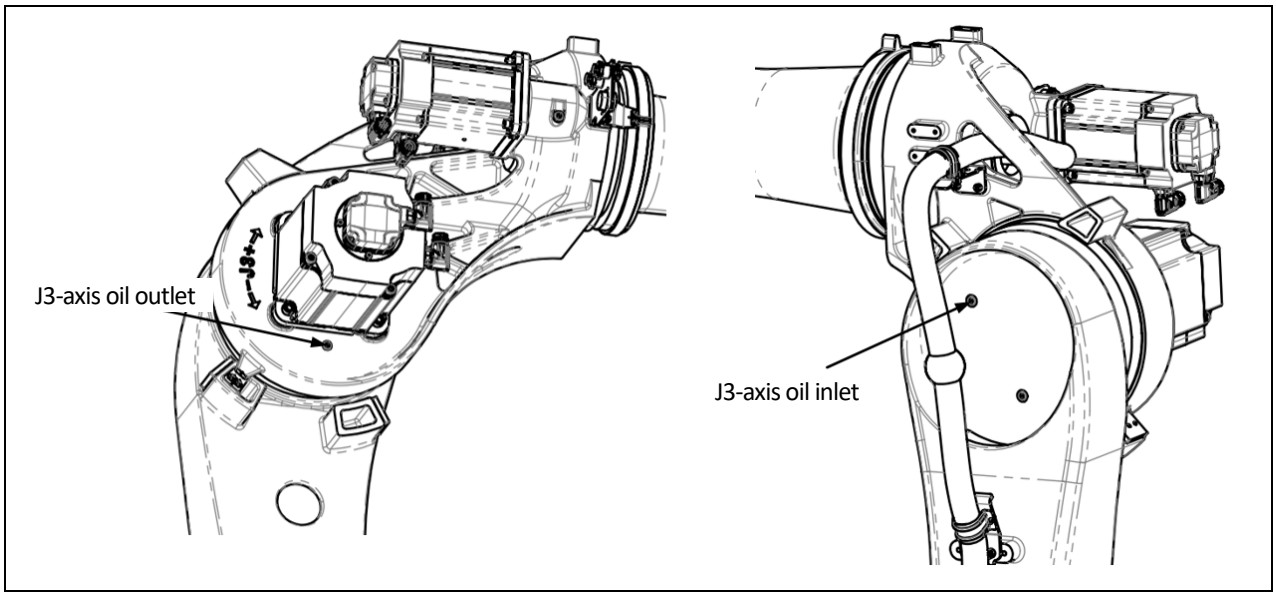


Fig. 5.16 J3-axis oil inlet/outlet

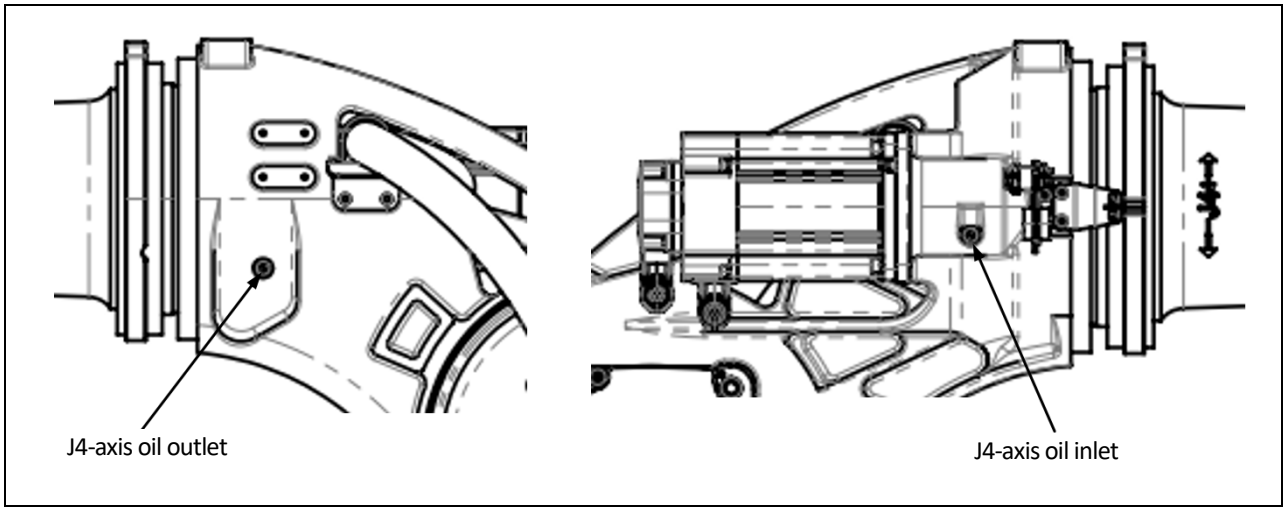


Fig. 5.17 J4-axis oil inlet/outlet

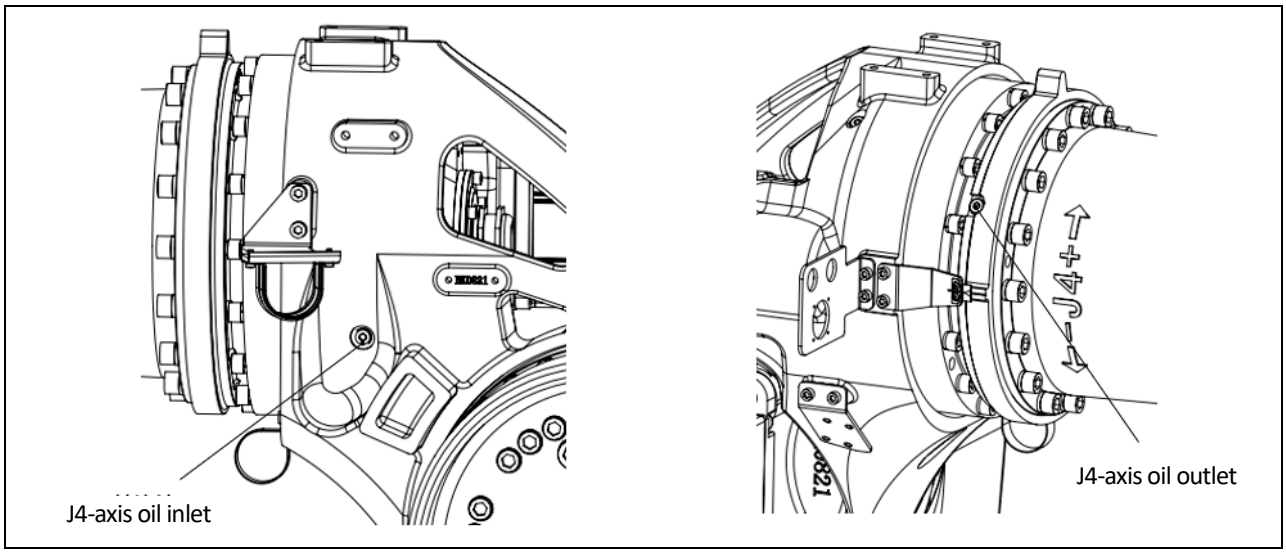


Fig. 5.18 J4-axis oil inlet/outlet(ER270-2700)

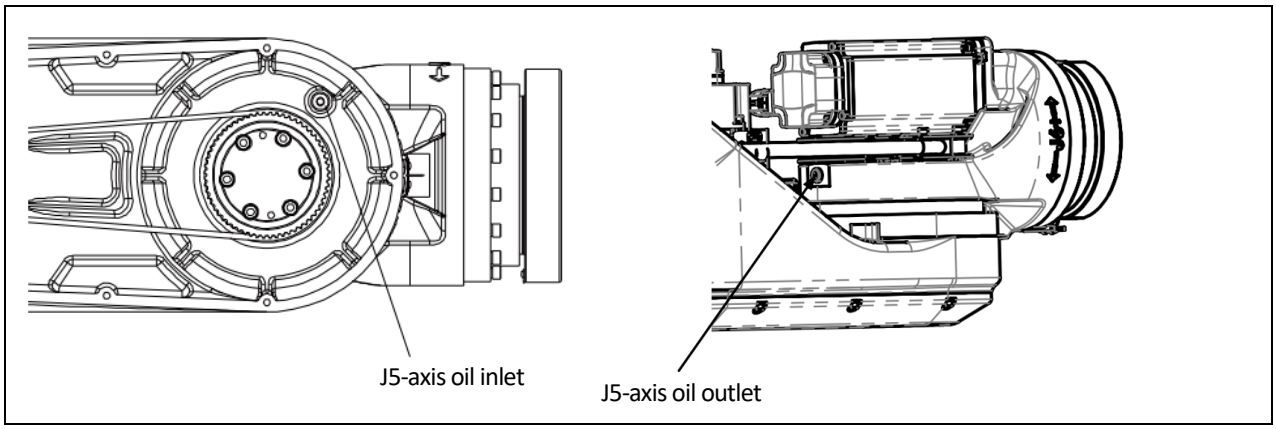


Fig. 5.19 J5-axis oil inlet/outlet (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

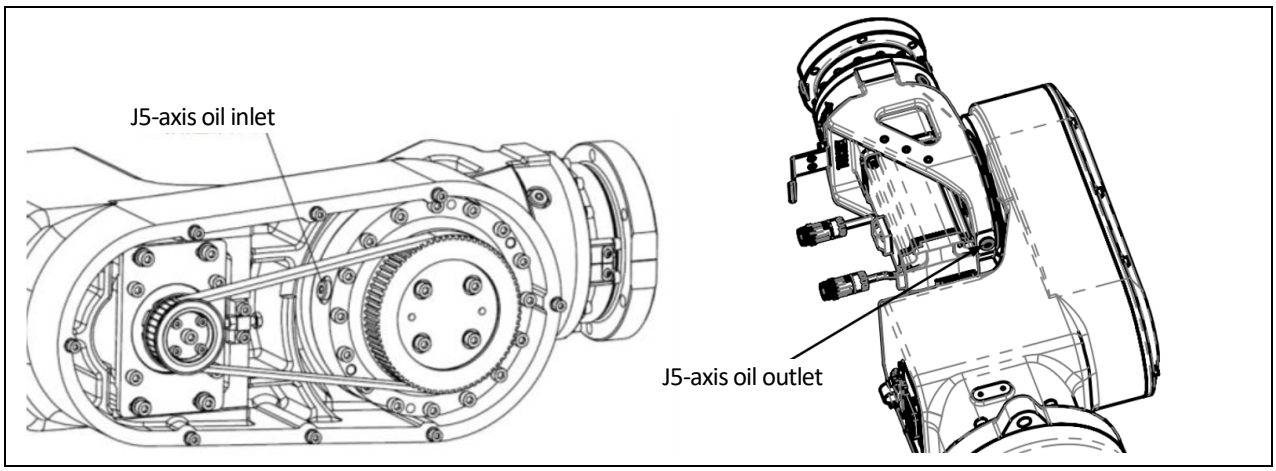


Fig. 5.20 J5-axis oil inlet/outlet (ER100B-3500-DW)

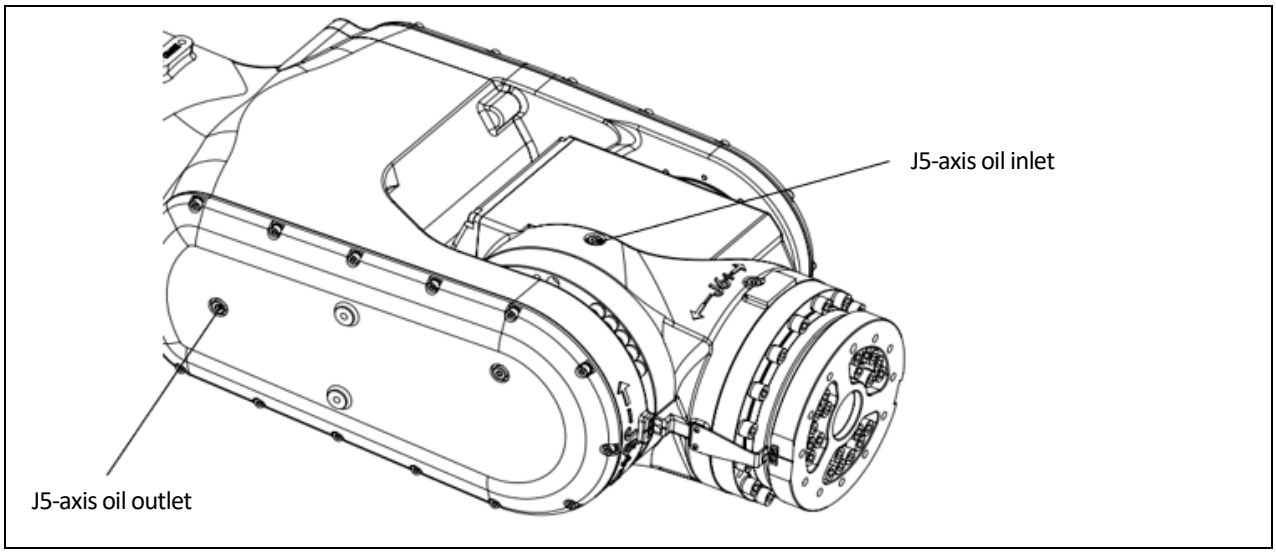


Fig. 5.21 J5-axis oil inlet/outlet (ER270-2700)

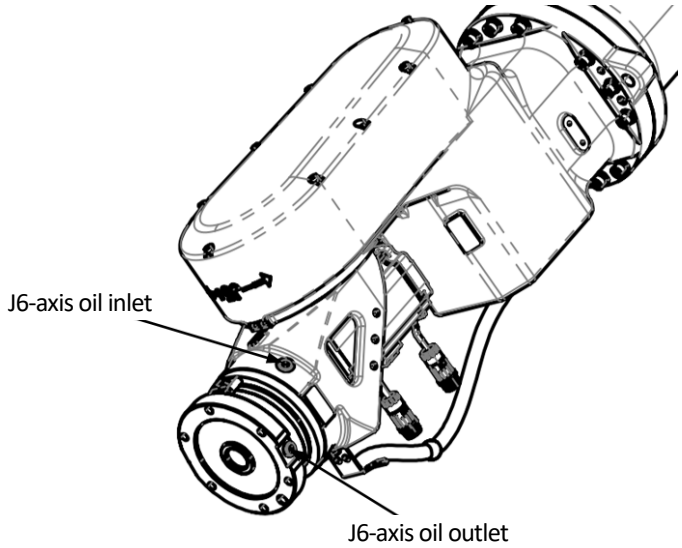


Fig. 5.22 J6-axis oil inlet/outlet (ER100B-3000, ER100B-3500-DW, ER130B-3200)

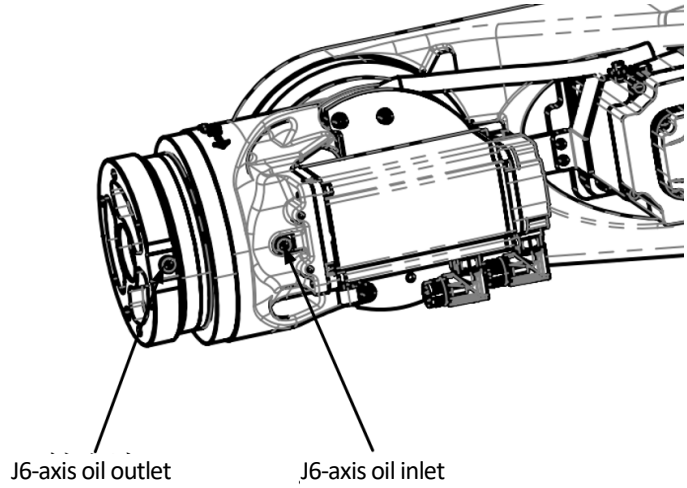


Fig. 5.23 J6-axis oil inlet/outlet (ER160B-3200, ER170B-2650, ER220B-2650)

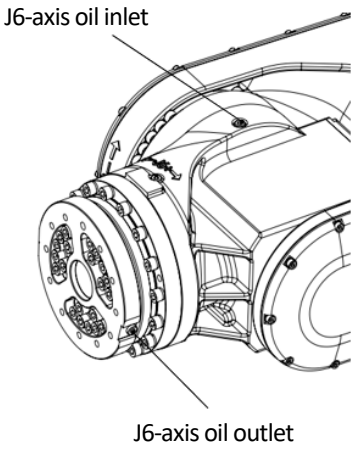


Fig. 5.24 J6-axis oil inlet/outlet (ER270-2700)

5.5.2.Procedures of greasing

The following steps only applied to operation of reducers of J1, J2, J3, and J4 axes.

a) Teach each joint to run at a speed of 100% for 10-20min, to make the grease into oil with low viscosity.
b) Move the robot to the gesture of greasing, then turn off the power supply.
c) Put an oil recycle container beneath the grease outlet.
d) Remove the screw on the inlet and outlet of each joint.
e) Inject new grease via the oil inlet until new grease goes out of the outlet. The amount of oil injected should be equal to the amount that is discharged (including those discharged after warming up the machine).
f) Release the residual pressure in the grease groove according to section 5.5.3.
g) Install the screw to oil inlet and outlet with a torque of 13.7N·m.

If greasing is not performed properly, the internal pressure inside the grease bath may increase suddenly, which will damage the seal part, resulting in oil leakage and abnormal operation. Therefore, when performing greasing, observe the following precautions.

- Open the grease bath vent (remove the screw on the oil outlet) before greasing.
- Inject the grease/oil slowly without excessive force.
- Avoid compressed gas pump (powered by factory gas source) whenever possible.
- Use specified model of grease/oil. Unauthorized model of grease may cause damage to the reducer or other problems.
- When greasing is completed, make sure that there is no oil/grease leakage outside the outlet. and the grease bath is not pressurized. Then close the outlet.
- Clean the excess oil/grease on the floor to avoid accidents such as slipping or fire.

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.

6.ZERO 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

CAUTION	**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.

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

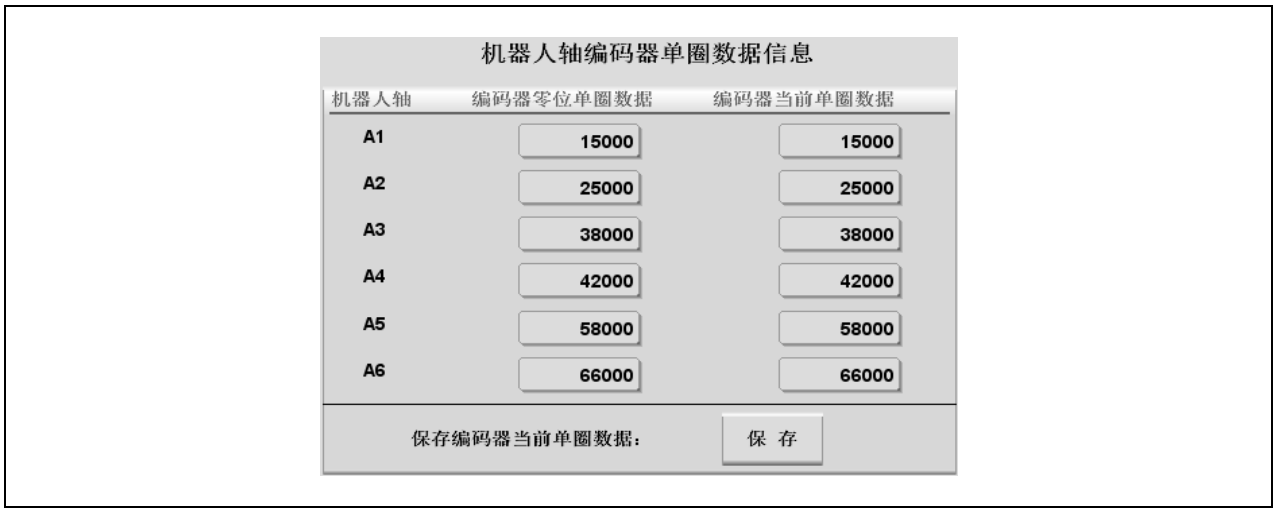


Fig. 6.1 Single loop value of quick zero position calibration (CP controller)

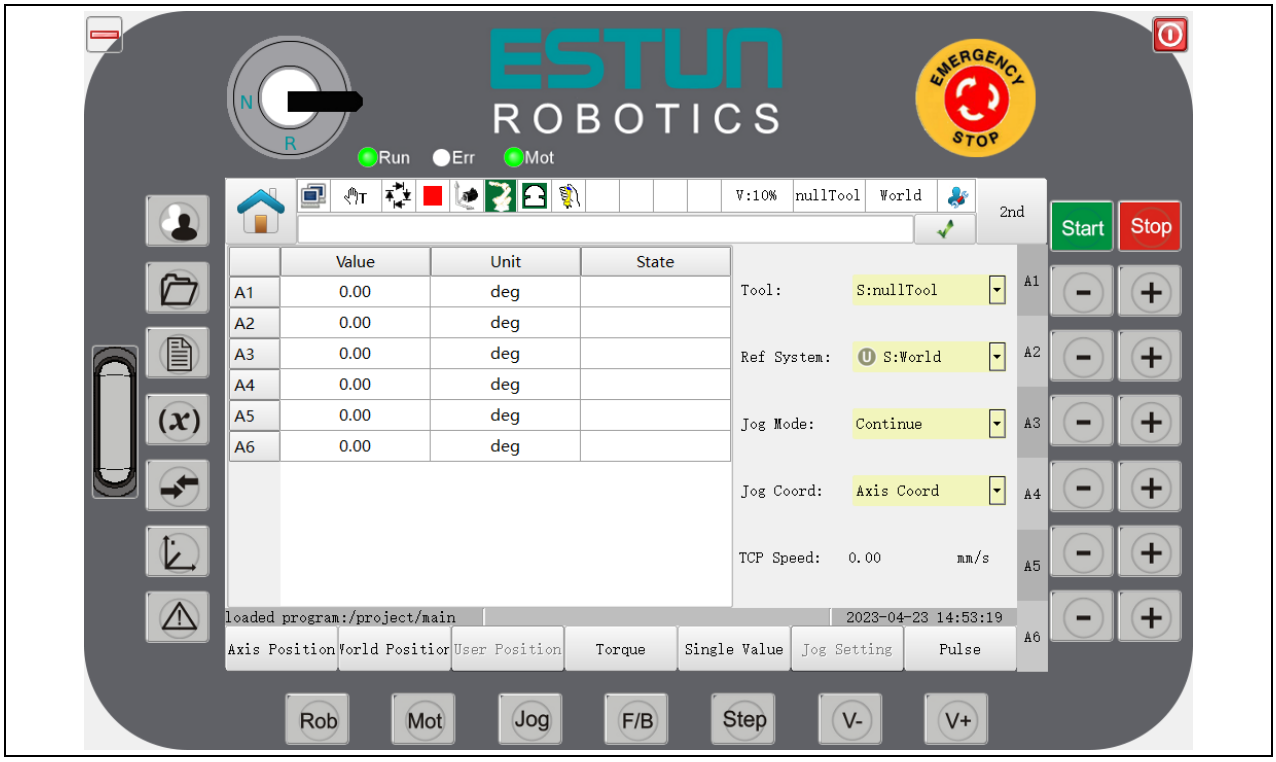


Fig. 6.2 Single loop value of quick zero position calibration (ERC controller)

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.

a) Move J1-axis with teach pendant to align two witness marks.

b) 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.

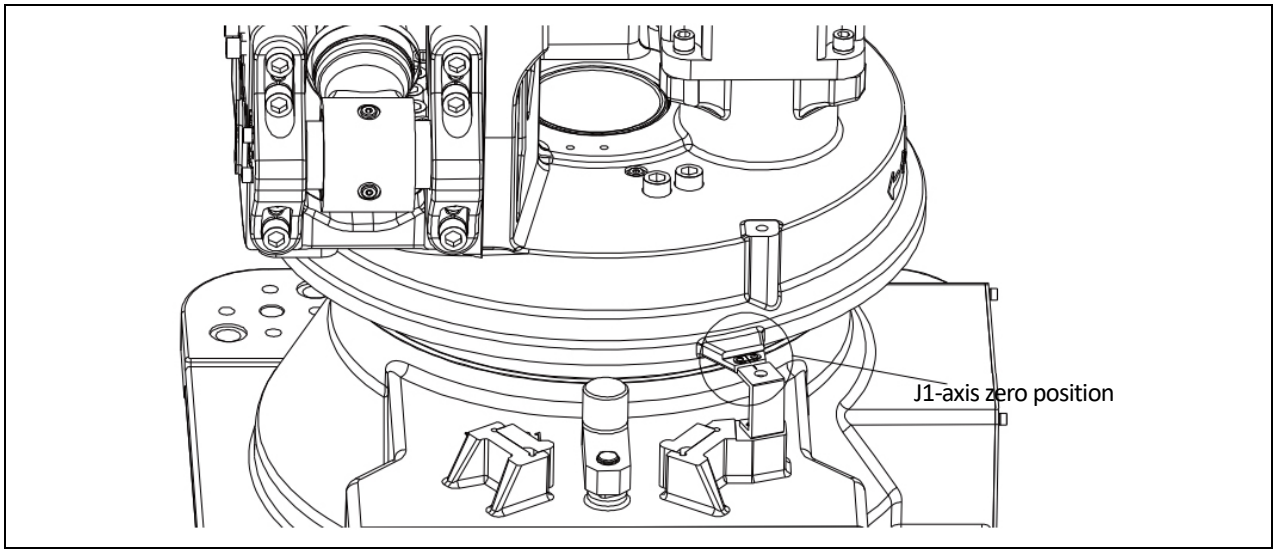


Fig. 6.3 Calibration for J1-axis (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

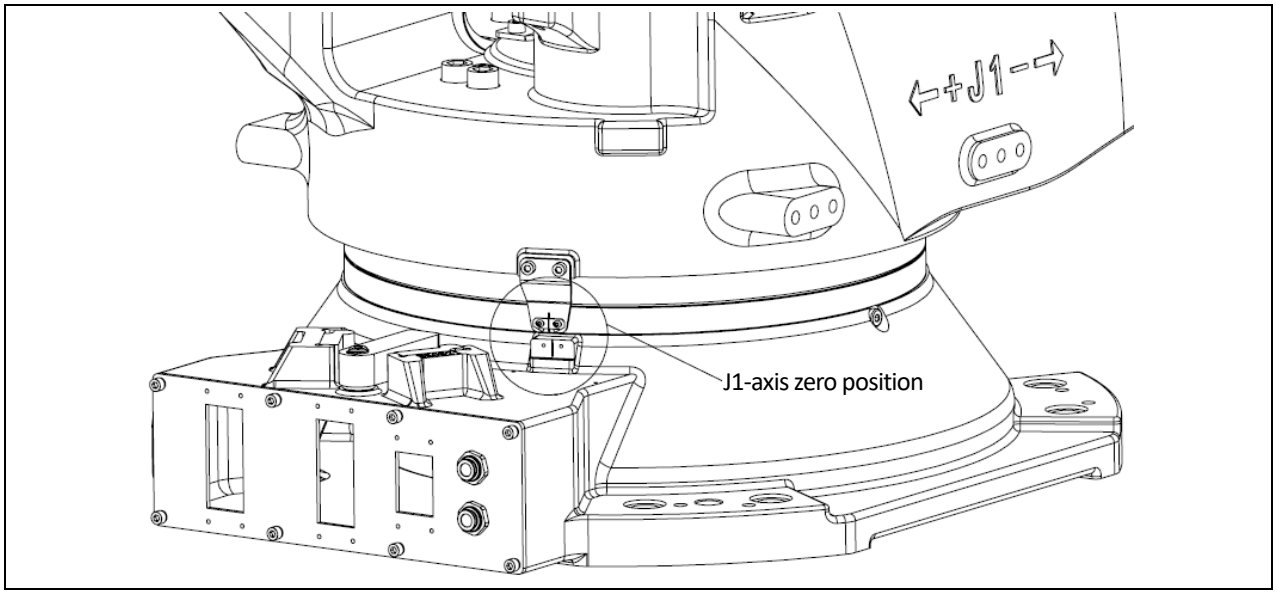


Fig. 6.4 Calibration for J1-axis (ER100B-3500-DW)

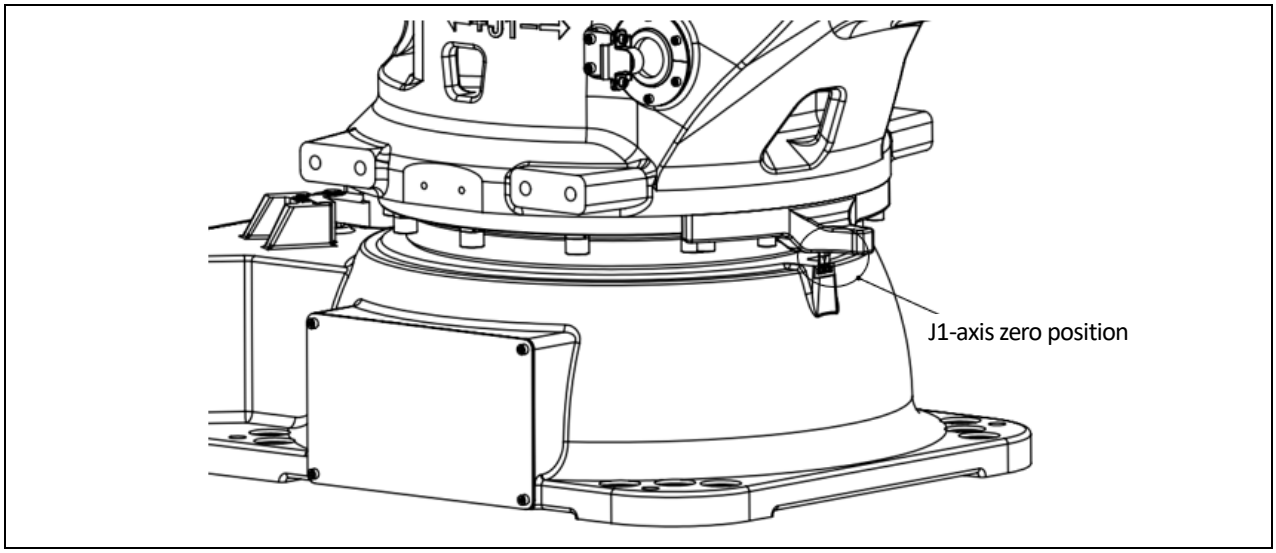


Fig. 6.5 Calibration for J1-axis (ER270-2700)

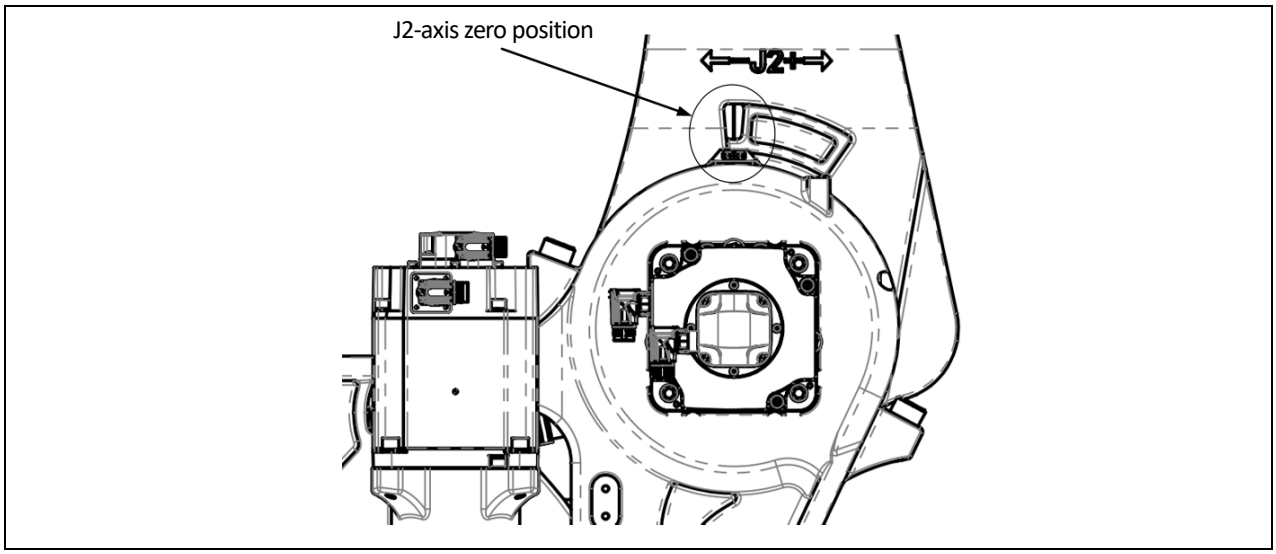


Fig. 6.6 Calibration for J2-axis (ER100B-3000, ER130B-3200, ER160B-3200, ER170B-2650, ER220B-2650)

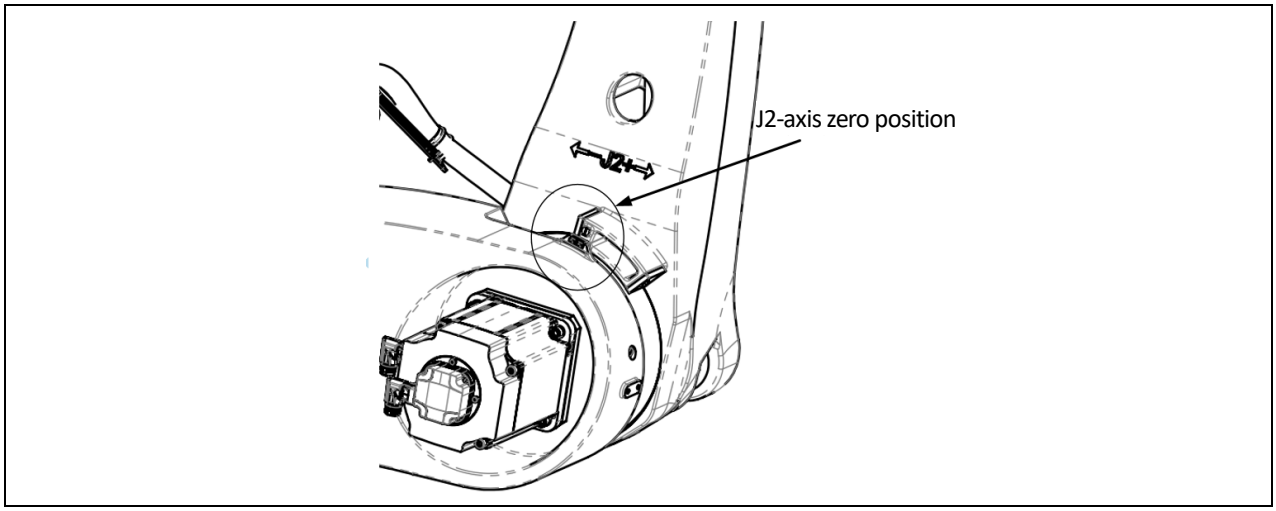


Fig. 6.7 Calibration for J2-axis (ER100B-3500-DW)

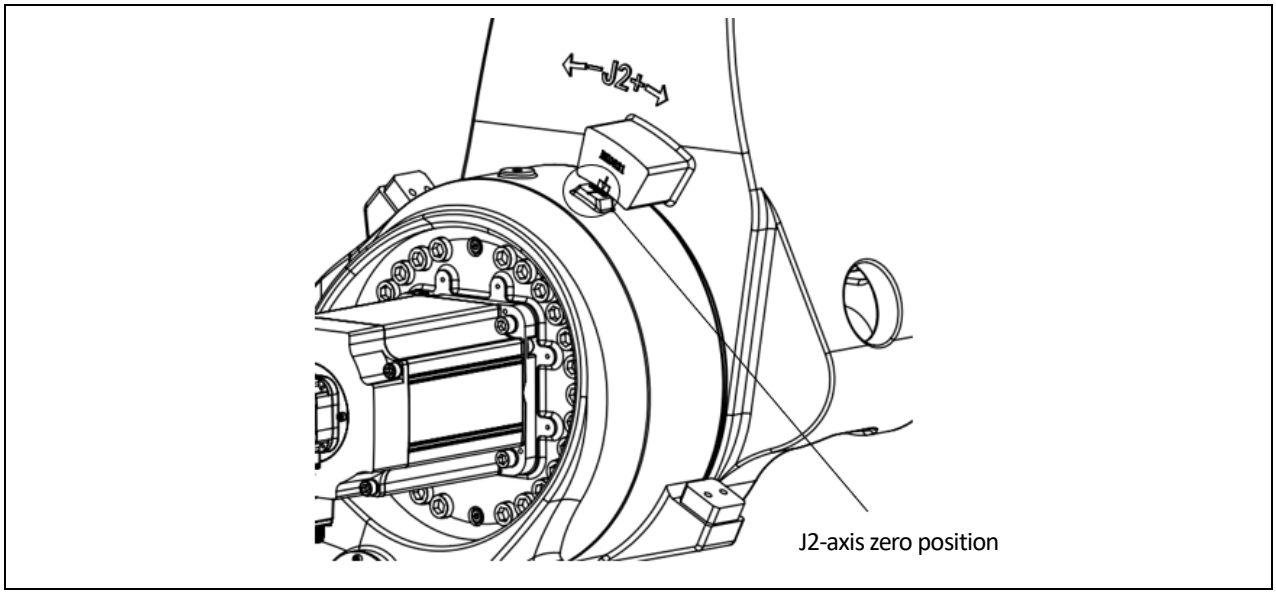


Fig. 6.8 Calibration for J2-axis (ER270-2700)

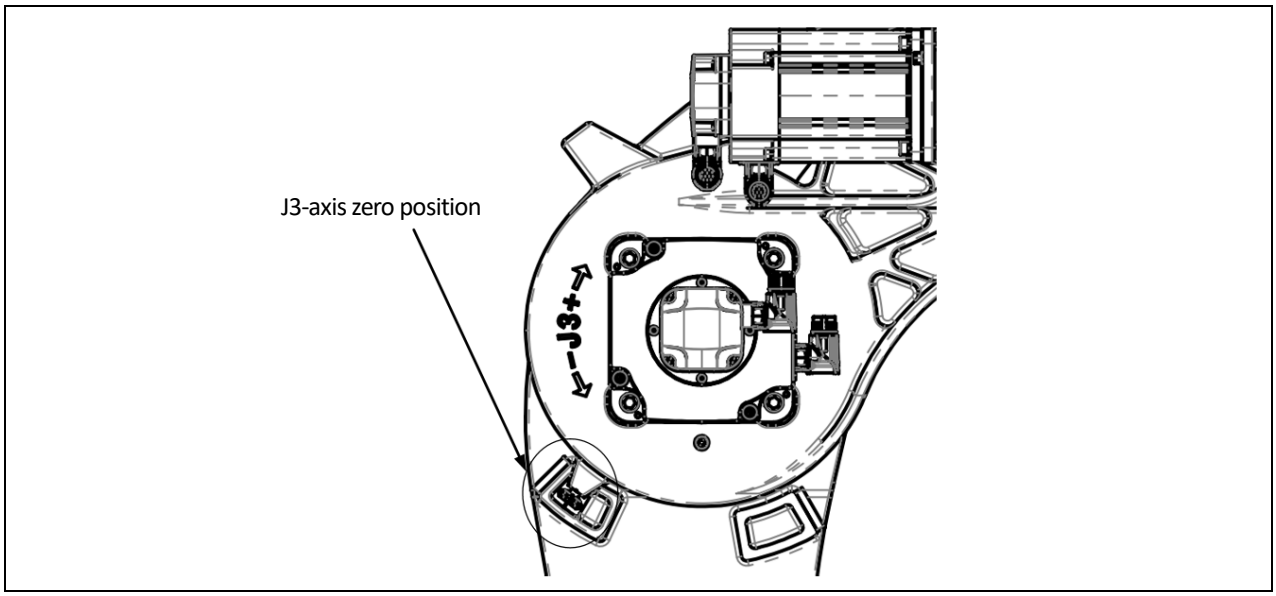


Fig. 6.9 Calibration for J3-axis

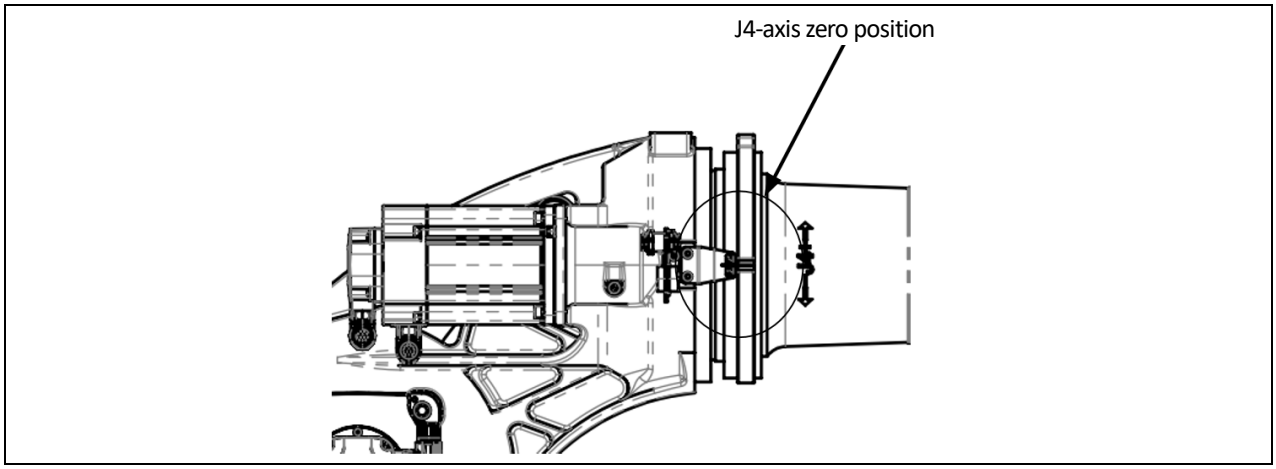


Fig. 6.10 Calibration for J4-axis

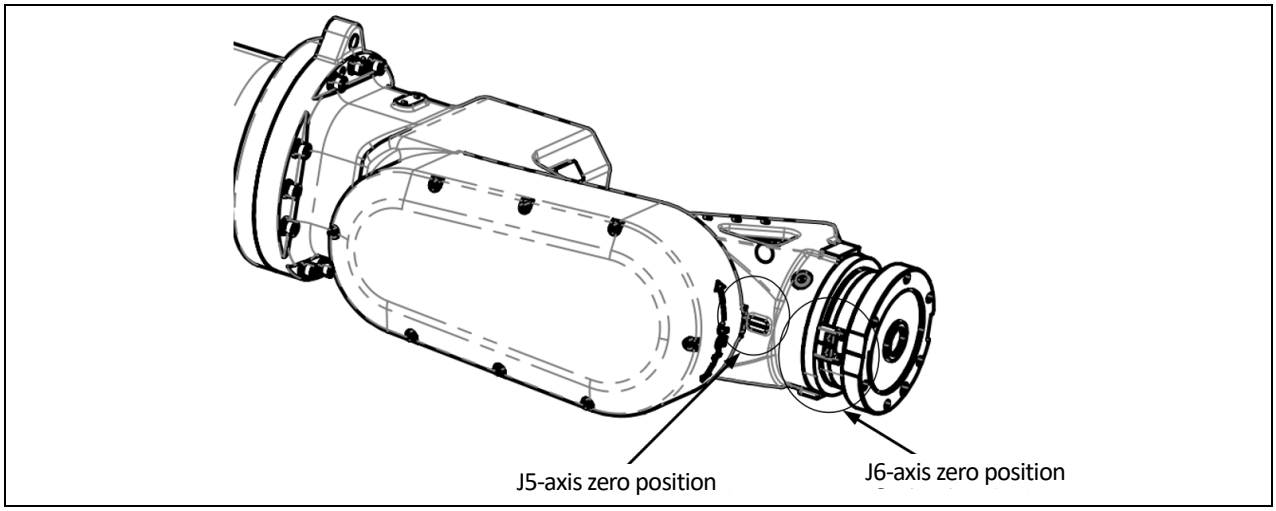


Fig. 6.11 Calibration for J5&J6-axis (ER100B-3000, ER100B-3500-DW, ER130B-3200)

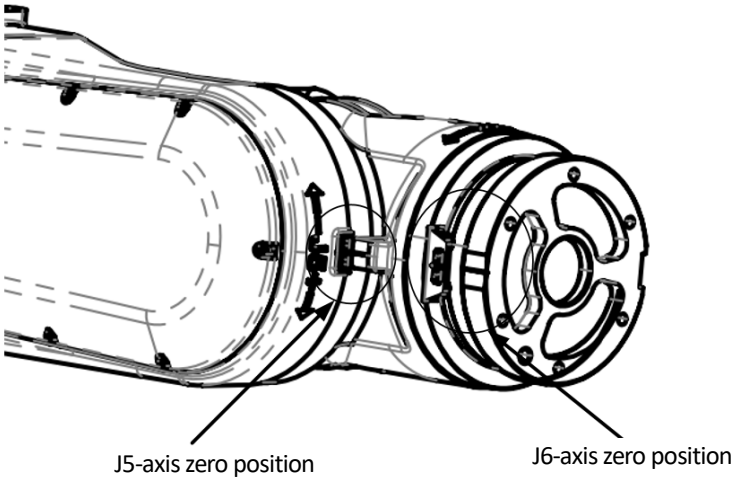


Fig. 6.12 Calibration for J5&J6-axis (ER160B-3200, ER170B-2650, ER220B-2650)

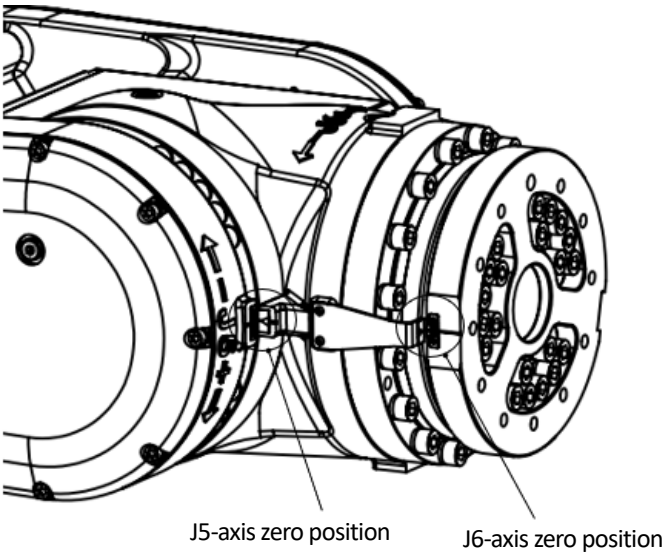


Fig. 6.13 Calibration for J5&J6-axis (ER270-2700)

7.TROUBLESHOOTING

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

> **CAUTION**
>
> **Never perform any maintenance unless the power of the robot system is turned 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	Solution
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.

Symptom	Description	Cause	Solution
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 motor overheated due to 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.
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.

WARNING	**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 been 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 (GB/T 70.1)	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18
Tightening Torque/N.m (12.9 级)	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 ER100B-3000

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	
2	48300000974	Nitrogen spring	1	
3	12800000076	Servo motors (J1 axes)	1	
4	12800000014	Servo motors (J2、J3 axes)	2	
5	12800000050	Servo motors (J4 axes)	1	
6	12J00000073	Servo motors (J5 axes)	1	
7	12J00000074	Servo motors (J6 axes)	1	
8	G5401000035	Timing belt	1	

APPENDIX D Part list for ER100B-3500-DW

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	
2	48300000141	Nitrogen spring	1	
3	12800000076	Servo motors (J1 axes)	1	
4	12800000014	Servo motors (J2、J3 axes)	2	
5	12800000050	Servo motors (J4 axes)	1	
6	12J00000073	Servo motors (J5 axes)	1	
7	12J00000074	Servo motors (J6 axes)	1	
8	G5401000035	Timing belt	1	

APPENDIX E Part list for ER130B-3200

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	
2	48300000974	Nitrogen spring	1	
3	12800000079	Servo motors (J1 axes)	1	
4	12800000014	Servo motors (J2 axes)	1	
5	12800000016	Servo motors (J3 axes)	1	
6	12700000298	Servo motors (J4 axes)	1	
7	12700000325	Servo motors (J5 axes)	1	
8	12700000326	Servo motors (J6 axes)	1	
9	G5401000076	Timing belt	1	

APPENDIX F Part list for ER160B-3200

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	
2	48300001112	Nitrogen spring	1	
3	12800000079	Servo motors (J1、J2 axes)	2	
4	12800000119	Servo motors (J3 axes)	1	
5	12700000298	Servo motors (J4 axes)	1	
6	12700000362	Servo motors (J5 axes)	1	
7	12700000326	Servo motors (J6 axes)	1	
8	G5400000096	Arc tooth timing belt	1	

APPENDIX G Part list for ER170B-2650

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	

2	48300000974	Nitrogen spring	1	
3	12800000076	Servo motors (J1 axes)	1	
4	12800000014	Servo motors (J2、J3 axes)	2	
5	12700000298	Servo motors (J4 axes)	1	
6	12700000326	Servo motors (J5 axes)	1	
7	12700000685	Servo motors (J6 axes)	1	
8	G5400000096	Arc tooth timing belt	1	

APPENDIX H Part list for ER220B-2650

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	
2	48300001112	Nitrogen spring	1	
3	12800000076	Servo motors (J1 axes)	1	
4	12800000014	Servo motors (J2 axes)	1	
5	12800000016	Servo motors (J3 axes)	1	
6	12700000298	Servo motors (J4 axes)	1	
7	12700000362	Servo motors (J5 axes)	1	
8	12700000326	Servo motors (J6 axes)	1	
9	G5400000096	Arc tooth timing belt	1	

APPENDIX I Part list for ER270-2700

No.	SAP	Name	Amount	Note
1	31521100006	Lithium battery ER34615M/2	3	
2	48300001645	Nitrogen spring	1	
3	12800000076	Servo motors (J1 axes)	1	
4	12800000073	Servo motors (J2 axes)	1	
5	12800000119	Servo motors (J3 axes)	1	
6	12700000298	Servo motors (J4 axes)	1	
7	12700000298	Servo motors (J5 axes)	1	
8	12700000771	Servo motors (J6 axes)	1	

REVISION RECORD

Revision	Date	Contents
01	2018.12	New edition.
02	2019.05	Add ER220-2650. Modify part lists. Modify BOTL TORQE LIST. Modify calibration of J5 and J6 axes for ER170-2650 and ER220-2650.
03	2019.06	Modify the screw tightening torque table, and the spare parts list.
04	2019.07	Update the zero-point calibration for J5 and J6 axes of the ER170B-2650 and ER220B-2650 robots.
05	2019.10	Modify the relevant components of the integrated control cabinet in the spare parts list.
06	2019.11	Change the parameter list.
07	2020.04	Add ER130B-3200 model.
08	2020.11	Add ER100B-3500-DW model. Modify the spare parts list for the ER220B-2650 model.
09	2022.01	Modify the precautions in 5.5 "Greasing"
10	2022.04	Add the handling symbol chart, update the maximum movement speed and repeated positioning accuracy for all models.
11	2022.11	Delete description under installation conditions, column of grease names, grease row in spare parts list; modify the description of installation precautions and the ambient temperature; update diagram and spare parts list for all models.
12	2023.04	Add the ER160B-3200、ER270-2700 model.

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