ESTUN
ROBOTICS

OPERATION INSTRUCTIONS

ESTUN General Small Payloads Series Robot Body Operation Instructions

ALL MADE BY ESTUN

ESTUN AUTOMATION

ESTUN General Small Payloads Series Robots

Robot Body Operation Instructions

M-0106EN-02

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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Instructions for Safe Use

This Chapter describes the content to be observed for the safe use of the robot. Before using, be sure to read and understand the content in this Chapter.

Companies and individuals using ESTUN Robotics should be familiar with the local and national standards and laws. Appropriate safety facilities shall be provided to protect users. Before use (installation, operation, maintenance and repair), please be sure to read and understand this Manual as well as other ancillary materials thoroughly, and use it after being familiar with all knowledge on equipment, safety and precautions. However, ESTUN would not guarantee that the user will absolutely not be injured even if he follows completely all the safety information given in the Manual.

DEFINITION OF USER

The personnel can be defined as follows.

- Operator
  To turn the robot power ON/OFF.
  To start the robot program from the panel.
- Programmer
  To operate the robot.
  To teach the robot in a safe area.
- Maintenance engineer
  To operate the robot.
  To teach the robot in a safe area.
  To carry out the robot maintenance (repair, adjustment, replacement).

Operator must not work in a safe area.

Programmer and maintenance engineer can work in a safe 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.

SPECIAL TRAINING

Tasks in the safe 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.

Safety Symbols

If the manual contains instructions marked as follows, users must read them carefully and follow strictly.

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

Safety precautions for users

(1) The robot should be transported and installed as procedures recommended by ESTUN. Wrong procedures may cause severe injuries or damage due to the robot fall.

(2) Draw an area clearly indicates the safety area. Install a fence or hang a warning board to ensure the safety operation of the robot, and keep unauthorized personnel outside the safety area.

(3) Never hang any tools above the robot. Falling of these tools may cause damage to equipment.

(4) Never lean on the cabinet. Never touch any buttons without permission. Unexpected movement of the robot may cause personnel injuries and equipment damage.

(5) Take precautions for falling parts to avoid injuries when disassemble the robot.

(6) Turn off the power when adjusting peripheral equipment.

(7) Peripheral equipment must be grounded.

(8) The robot should be operated in a low speed in the first operation. The speed should be added gradually to check if there is any abnormal situation.

(9) Do not wear gloves when using the teach pendant. Operate with gloves may cause an operation error.

(10) Programs, system variables, and other information can be saved on the memory card or USB memories. Be sure to save the data periodically in case that the data is lost.

(11) Never forcibly move any axis of the robot. Move the axes forcibly may cause injuries or damage.

(12) Take precautions when wiring and piping between the robot, the cabinet, and peripheral equipment. Put the pipes, wires or cables through a pit or covered with a protective lid, to avoid stepped by personnel or run over by a forklift.

(13) Unexpected movement may occur on any operating robot, which will cause severe injuries or damages in the working area. Test (safe door, brake, safe indicators, etc.) must be performed on each safety measures before using the robot. Before turn on the system, make sure that no one is in the working space.

(14) Never set motion range or load condition exceeds the rated range. Incorrect setting may cause personnel injury and equipment damage.

(15) Observe the following precautions when teaching inside the working space of the robot

- Do not enable the system unless the mode is switched to manual, and make sure that all auto-control is cut off.
- Speed must be limited under 250mm/s at manual mode. Only authorized person with fully understand of the risks can adjust the robot to rated speed manually.
- Be careful about rotating joints to prevent hair and clothes involved. Take precautions of injury or damage caused by the manipulator or other auxiliary devices.

- Check the motor brake to avoid personnel injuries caused by unexpected situation.
- Always have an escape plan in mind in case the robot comes towards you unexpectedly.
- Ensure that there is a place to retreat to in case of emergency.

WARNING	**Under any circumstances, do not stand under any robot arm to prevent abnormal motion of the robot or connection with other people.**

CAUTION	**A carbon dioxide fire extinguisher needs to be placed on site to prevent the robot system from catching fire.**

Operators:

(1) Before operate the robot, you should press E-stop button, which is on the teach pendant or the upper right of electric cabinet, in order to check whether the indicator of Servo Ready is not light, and make sure the power of the indicator is turnoff.

(2) In course of operation, never allow the non-work personnel to touch the control cabinet. Otherwise, the robot might bring some unexpected movements, which can cause personal injury or equipment damage.

(3) When you install a device on the robot, the power supplies of the control cabinet and the device must be cut off (OFF), and then hang a caution sign. If you power on in your installation, it might cause the danger of electric shock, or the robot might bring some unexpected movements, which can cause personal injury.

(4) E-stop

The E-stop is independent of the electrical control of all robots, and it can stop all robot motions;

E-stop means that all power supplies to the robot are disconnected, but the power to the brake on the servomotor is not disconnected. The robot can work again after releasing E-stop button and re-starting the robot.

	**There're several buttons for emergency stopping the robot. On the teach pendant and at the upper right of control cabinet, each of these places has one red button, as shown in the left side. Certainly, users can also set the E-stop button as required.** **The E-stop button must be installed in an accessible position so that the robot can be stopped in an emergency.**

危险	**Operators shall pay attention to the high-voltage danger of the power line of the servomotor, as well as the power line connecting the fixture and other devices.**

注意	**E-stop is just used for stopping the robot in the case of an emergency. That is to say, it cannot be used in the normal stop.**

Programmers:

While teaching the robot, and in some cases, the programmer needs to enter the range of the

robots movement, so be sure to keep himself safe.

CAUTION	**ON/OFF enabling is done by operating a Mot button on the teach pendant. When pressing this button, the servomotor is enabled, and disabled when releasing it.**

To ensure the safe use of the teach pendant, the following rules must be observed:

- Ensure that the enable button works at all times.
- Disconnect the enabling timely when temporarily stopping the robot, programming or testing.
- When entering the robot working space, the demonstrator shall bring the teach pendant to avoid other people operating the robot without the programmer is informed.
- The teach pendant must not be placed within the working space of the robot to prevent abnormal actions in case of collision between the robot and the teach pendant.

Maintenance personnel:

(1) Pay attention to the parts in the robot that are prone to become hot

Some parts of the robot in normal operation will become hot, especially the servomotor and reducer, which may cause burns when being approached or touched. When it is inevitable, protective equipment such as heat-resistant gloves should be worn.

CAUTION	**Before touching these parts with your hands, try to feel the temperature of these parts by approaching with your hand, in case you are scalded.** **Wait for enough time after machine halt, so that the hot parts can be cooled down, and then you can carry out the maintenance work.**

(2) Safety precautions on removing parts

Ensure that the internal parts such as the gears are no longer rotating, and then you can open the lid or the protection device. You shall not open the protection device when the gears and bearings are rotating. If necessary, use the auxiliary device to make the internal unfixed parts remains its original position.

The initial test upon repair, installation and maintenance shall be carried out by following the steps below:

a) Clean up the robot and all maintenance and installation tools in the working space of the robot.
b) Install all the protective measures.
c) Ensure that people are standing outside the safe range of the robot.
d) Pay special attention to the working conditions of the parts repaired during testing.

In case of robot repair, do not use the robot as a ladder, and do not climb on the robot to avoid falling.

(3) Safety precautions on pneumatic/hydraulic components

After turning off the air source or hydraulic pump, a few residual gas or liquid exists in the pneumatic system or hydraulic system. Beware these gases or liquid, which have a certain energy; we must take some measures to prevent the residual energy from damaging to the human body and equipment. Therefore, it is necessary to release the residual energy in the system before maintaining the pneumatic or hydraulic components.

CAUTION	**Mount a safety valve to avoid accidents.**

(4) The power supply need be opened in many cases of fault diagnosis, but it must be shut when the

maintenance or repair is carried, moreover, you should cut off other power supply connections.

(5) Brake detection

In general, the brake can be worn in the normal operation. Therefore, the brake detection is necessary by following the steps below.

a) Move each joint to a position, where the joint can bear the maximum load.
b) Shut down the robot and brake.
c) Mark every joint of the robot.
d) Examine whether any joint moves after waiting for a moment.

(6) Safety precautions for adding lubricating oil

When add lubricating oil to the reducer, it might do harm to the person and the equipment. Therefore, you must obey the below safety information before adding lubricating oil.

- Wear the protective measures (e.g. gloves, etc.) when refueling or draining oil to prevent damage to maintenance personnel caused by high-temperature oil or reducer.
- Be cautious when opening the oil chamber cover. Keep away from the opening as there may be pressure in the oil chamber to cause splashing.
- Oil filling shall be made according to the fuel gauge, which shall be not too full. Check the oil indicator port after oil filling.
- Oil of different designations cannot be added to the same reducer, and the remaining oil must be cleaned up before using the oil of different designation.
- Drain the oil completely or check the oil indicator port after oil filling.

INFO	**Before emptying the oil in the reducer, you can run the robot for a period of time to heat the oil, to allow easier draining.**

Safety precautions for tools and peripheral equipment

The external equipment of the robot may still be running after the robot is turned off, so damage to the power cord or power cable of the external equipment may also cause bodily injury.

Safety precautions for robot

In an emergency, any arm of the robot that clips the operator shall be removed. Please ask our technicians for details to ensure the safe removal.

Small robot arms can be removed manually, but for large robots, cranes or other small equipment may be required.

Before releasing the joint brake, the mechanical arm needs to be fixed first to ensure that the mechanical arm will not cause damage again to the person trapped under the action of gravity.

Ways to stop robot

The stopping of robots has the following three ways.

Power-Off Stop

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

The following processing is performed at Power-Off stop:

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

For the robot in motion, frequent power-off operations through E-stop buttons will cause robot failure. The system configuration for daily power-off stop should be avoided.

Alarm Stop

The motion of the robot is decelerated and stopped through a control command after the robot system issues an alarm (except for the power failure alarm).

The following processing is performed at Controlled stop:

- The robot system issues an alarm due to overload, failure, etc. (except for power failure alarms).
- The servo system sends a command “Control Stop” along with a decelerated stop. Execution of the program is paused.
- The servo power is turned 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.

Warning and Caution Signs

(1) Electric shock

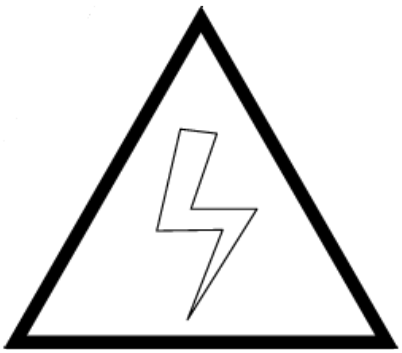


Figure 0.1 Electric shock warning sign

Attention should be paid to the danger of high voltage and electric shock at the place where this sign is affixed.

(2) High temperature

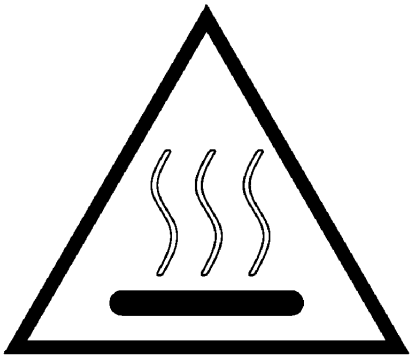


Figure 0.1 High temperature warning sign

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 protective provision such as heat-resistant gloves.

(3) No stepping

Figure 0.2 No stepping warning sign

Do not step on or climb the robot as it may adversely affect the equipment, and cause the bodily injury to operators.

(4) Wounding by robot

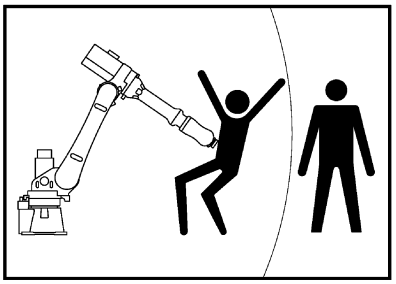


Figure 0.4 Wounding by robot warning sign

There is a danger of wounding by robot when working within the motion range of robot.

(5) No disassembly

Figure 0.3 No disassembly warning sign

Users are prohibited from disassembling the part affixed with this sign. Disassembly shall be carried out by professionals using professional tools.

(6) Handling

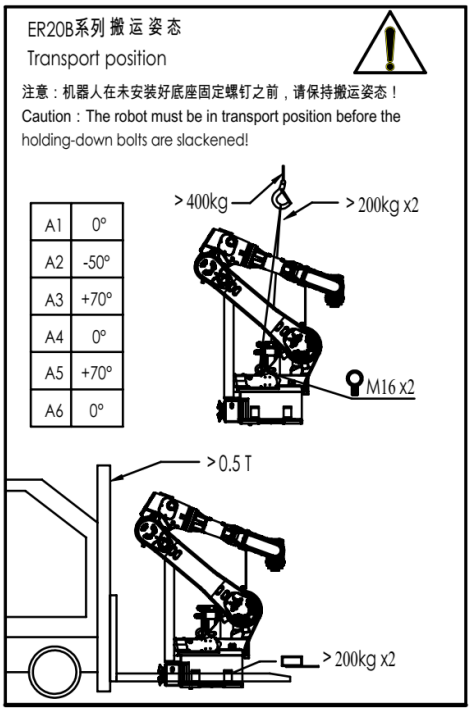


Figure 0.4 Handling sign (ER20B/10-2010-HI, ER20B-1760, ER35B-1810-LI, ER35B-1810)

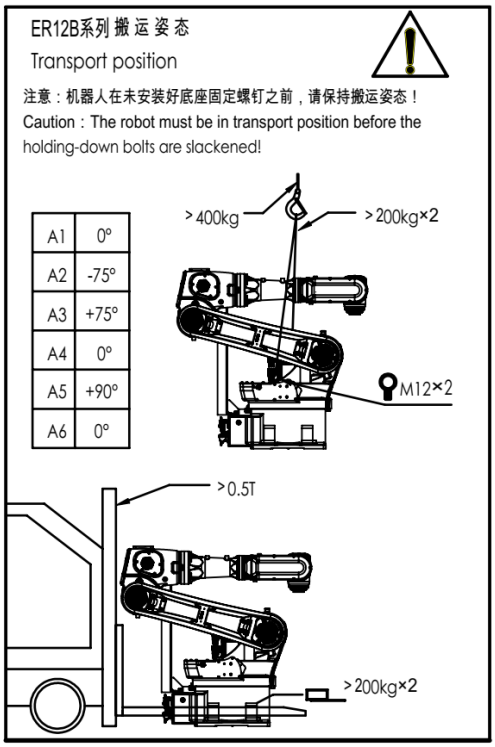


Figure 0.5 Handling sign (ER12B-1510-LI, ER12B-1510)

Preface

This manual is applicable to the following robot type.

Robot type	Load capacity
ER20B/10-2010-HI	10kg
ER12B-1510-LI, ER12B-1510	12kg
ER20B-1760	20kg
ER35B-1810-LI, ER35B-1810	35kg

List of relevant instructions

ESTUN Robot Body Operation Instructions
ESTUN Robot C3E Series Control Panel Operation Manual
ESTUN Robot S1E Series Control Panel Operation Manual
ESTUN Robot ER Series Industrial Robot Operation Manual

CONTENTS

1.Transportation & Installation

1.1. Transportation

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

Before moving the robot, position each joint of the robot into the handling position to ensure that the robot remains in the handling position without any movement or displacement during transportation. The robot should maintain the handling position until it is fully installed and secured. The angular rotation of each axis in the handling position is as follows, and it is crucial to handle the robot according to the specified angles in the table. Failure to do so may result in safety accidents or equipment malfunctions.

Angle	J1 axis	J2 axis	J3 axis	J4 axis	J5 axis	J6 axis
ER20B/10-2010-HI	0°	-50°	+70°	0°	+70°	0°
ER12B-1510-LI ER12B-1510	0°	-75°	+75°	0°	+90°	0°
ER20B -1760	0°	-50°	+70°	0°	+70°	0°
ER35B-1810-LI ER35B-1810	0°	-50°	+70°	0°	+70°	0°

During the installation, disassembly, and transportation of the robot, the weight of the robot is a critical parameter. The table below lists the theoretical weight of the main components of the robot.

Component	Weight (kg)			
	ER20B/10-2010-HI	ER12B-1510-LI ER12B-1510	ER20B-1760	ER35B-1810-LI ER35B-1810
Complete robot	275	164	273	277
Base assembly (Including rotation base)	184	103	184	184
Big arm casting	38	19	38	38
Small arm assembly (Including motor casing and motors of J4-axis)	37	26	35	36
Wrist (including J5-axis and J6-axis)	11	11	11	14

> **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.

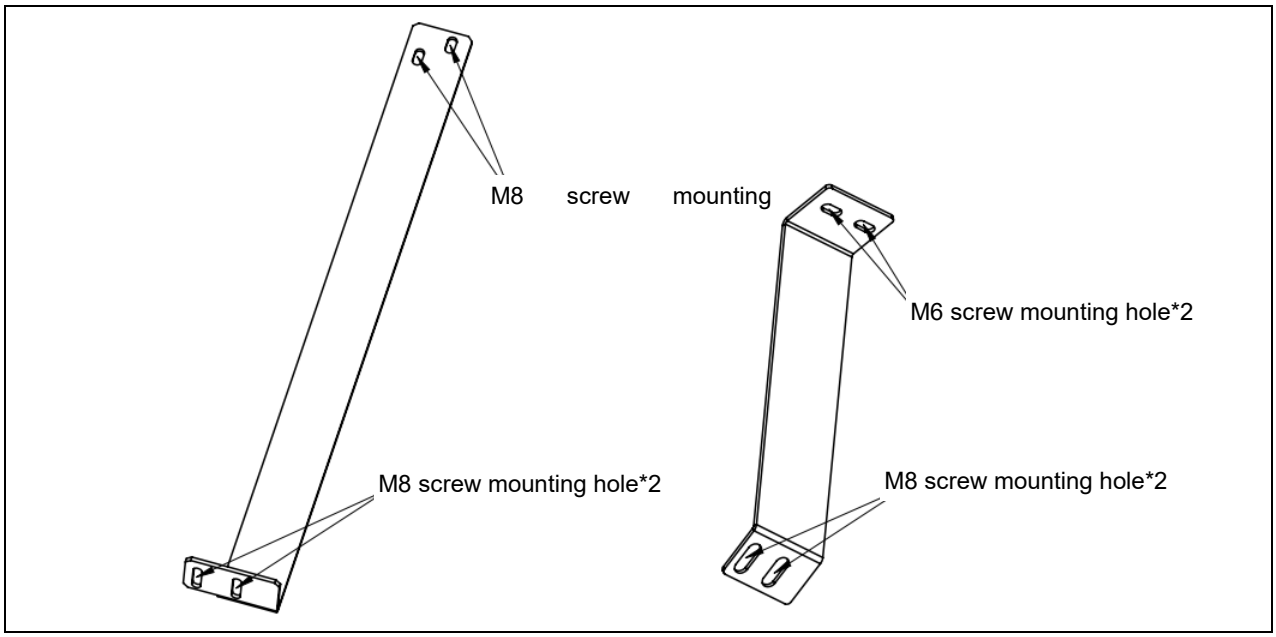


Figure 1.1 Robot fixed bracket (ER20B/10-2010-HI)

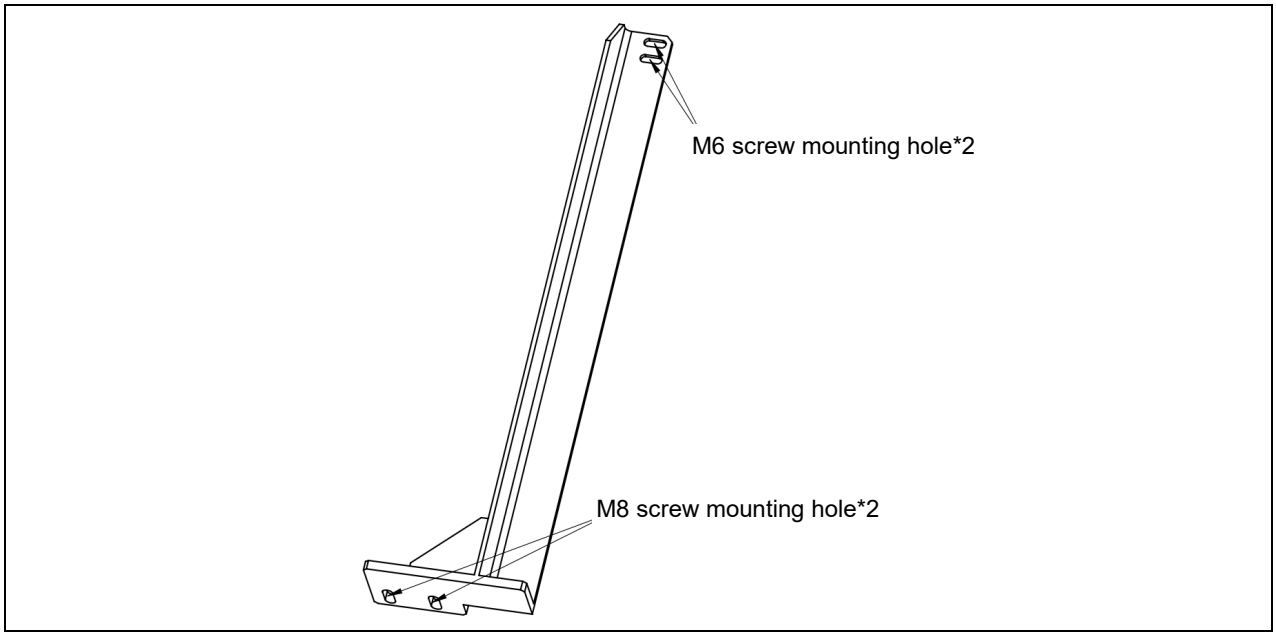


Figure 1.2 Robot fixed bracket (ER12B-1510-LI, ER12B-1510)

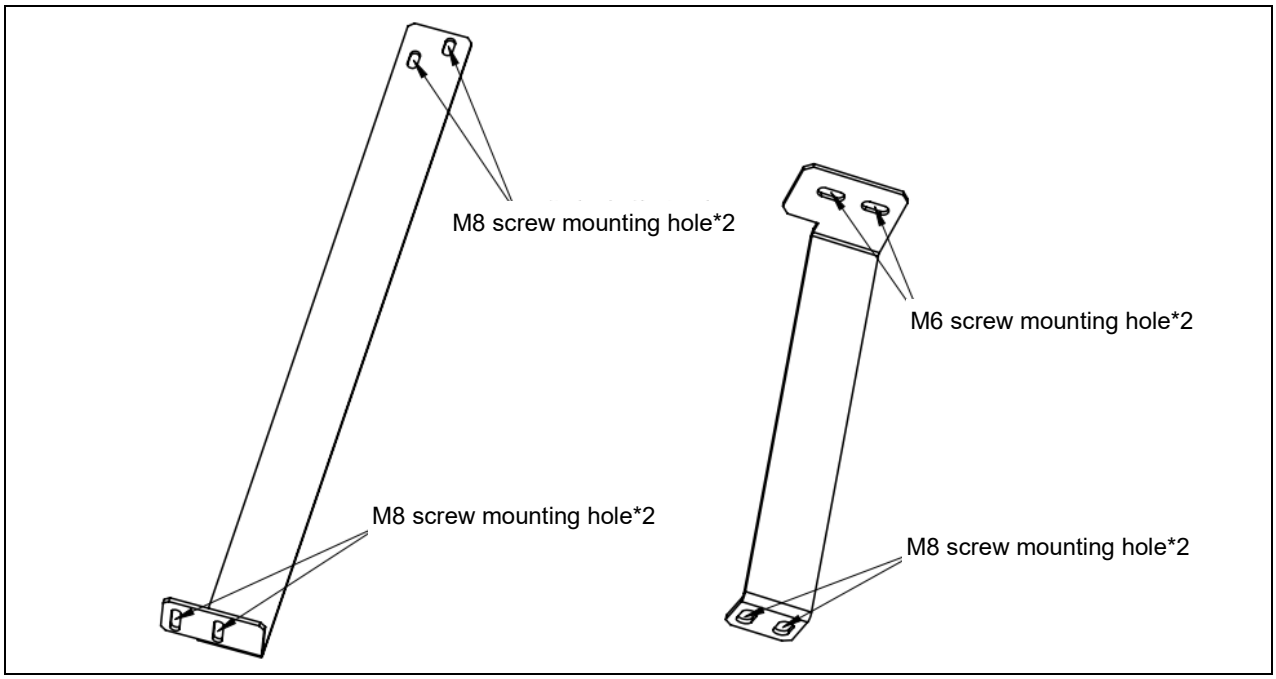


Figure 1.3 Robot fixed bracket (ER20B-1760)

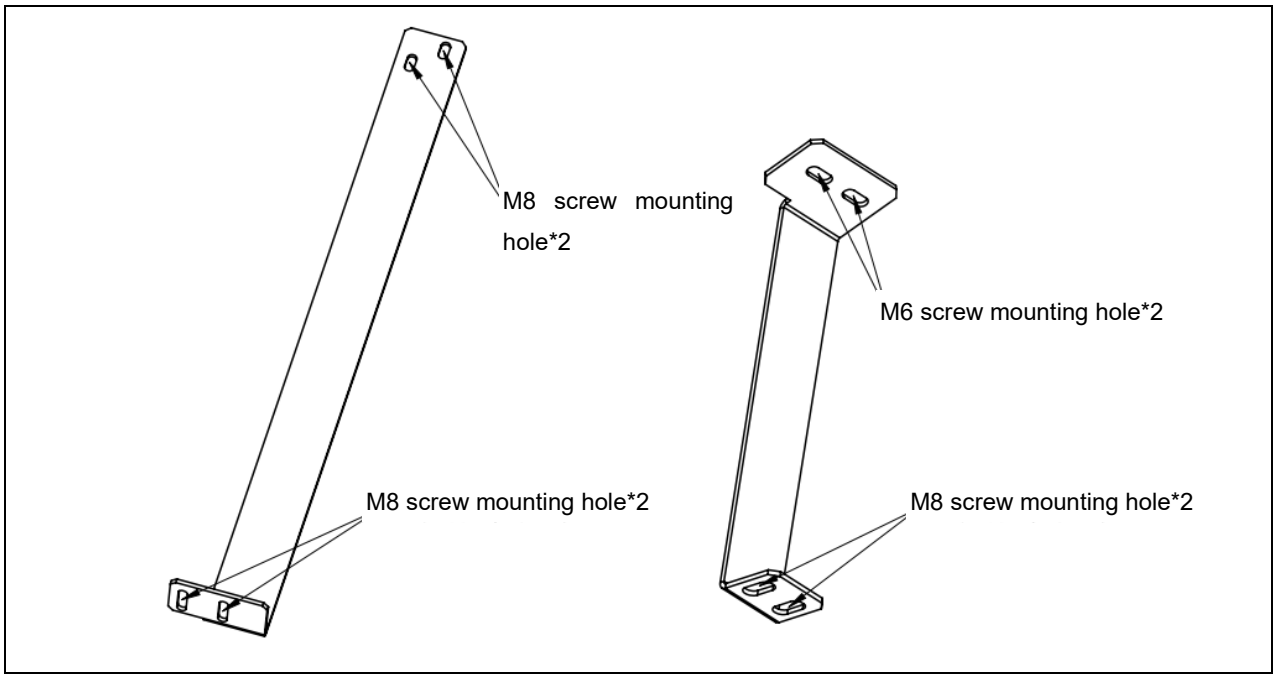


Figure 1.4 Robot fixed bracket (ER35B-1810-LI, ER35B-1810)

1.1.1.Transport by a forklift

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

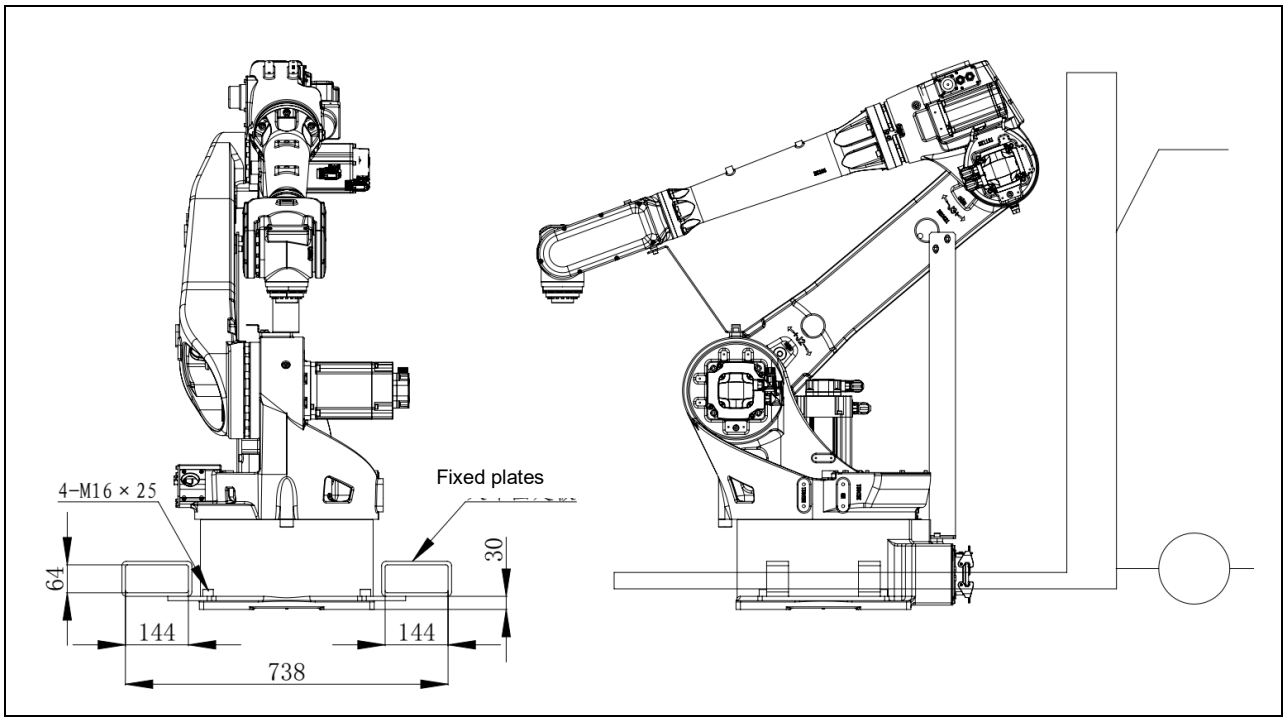


Figure 1.5 Use a forklift to transport the robot (ER20B/10-2010-HI)

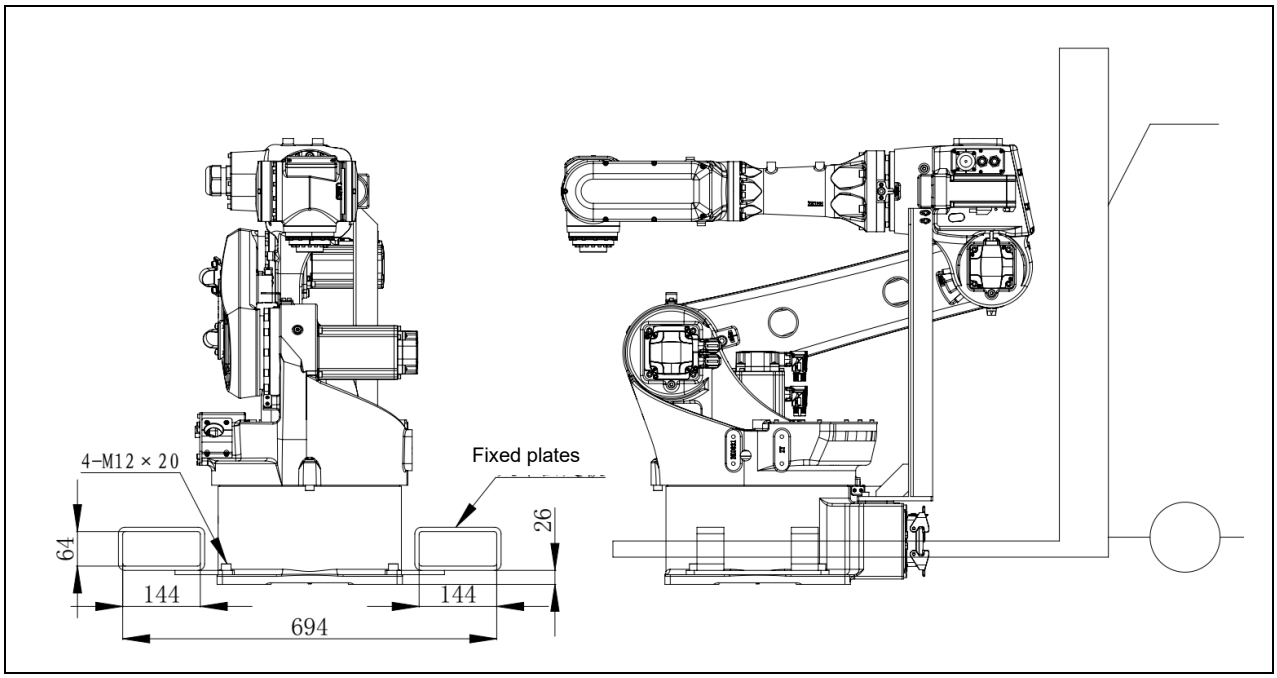


Figure 1.6 Use a forklift to transport the robot (ER12B-1510-LI, ER12B-1510)

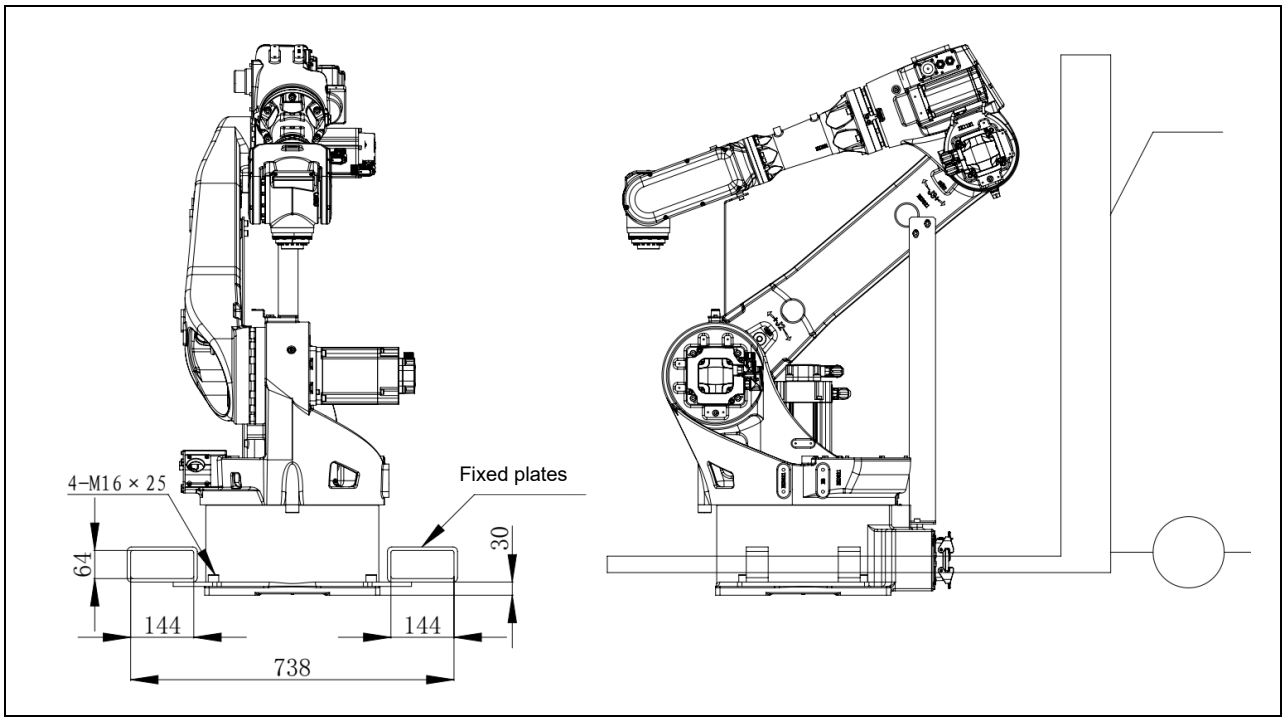


Figure 1.7 Use a forklift to transport the robot (ER20B-1760)

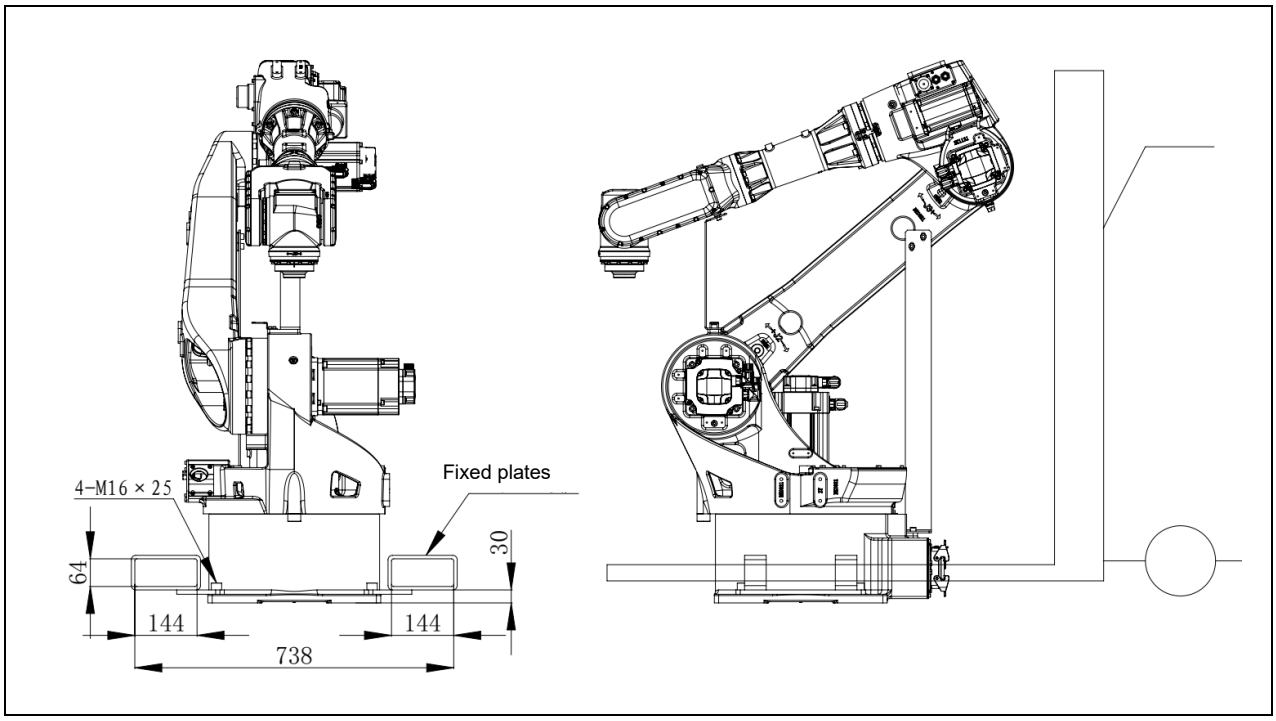


Figure 1.8 Use a forklift to transport the robot (ER35B-1810-LI, ER35B-1810)

CAUTION

The forklift mounting plate and screws are optional and can be selected by the customer.

Transportation conditions: Forklift load capacity above one ton. Four forklift fixed plates. Socket head screws M12X30 with specifications conforming to GB/T70.1-2000.

1.1.2.Transport by a crane

This series of robots can also be transported using a crane. Install lifting eye bolts on the robots base and use slings to lift it. Please refer to the provided diagram to ensure that the slings are crossed during lifting. Take necessary precautions to protect the robots surface where the slings come in contact to prevent any paint damage.

CAUTION

Eyebolt and sling should be prepared by customers.

Transportation conditions: Crane load capacity above 1000kg. String load capacity above 500kg. Rings with specifications conforming GB/T 825-1988.

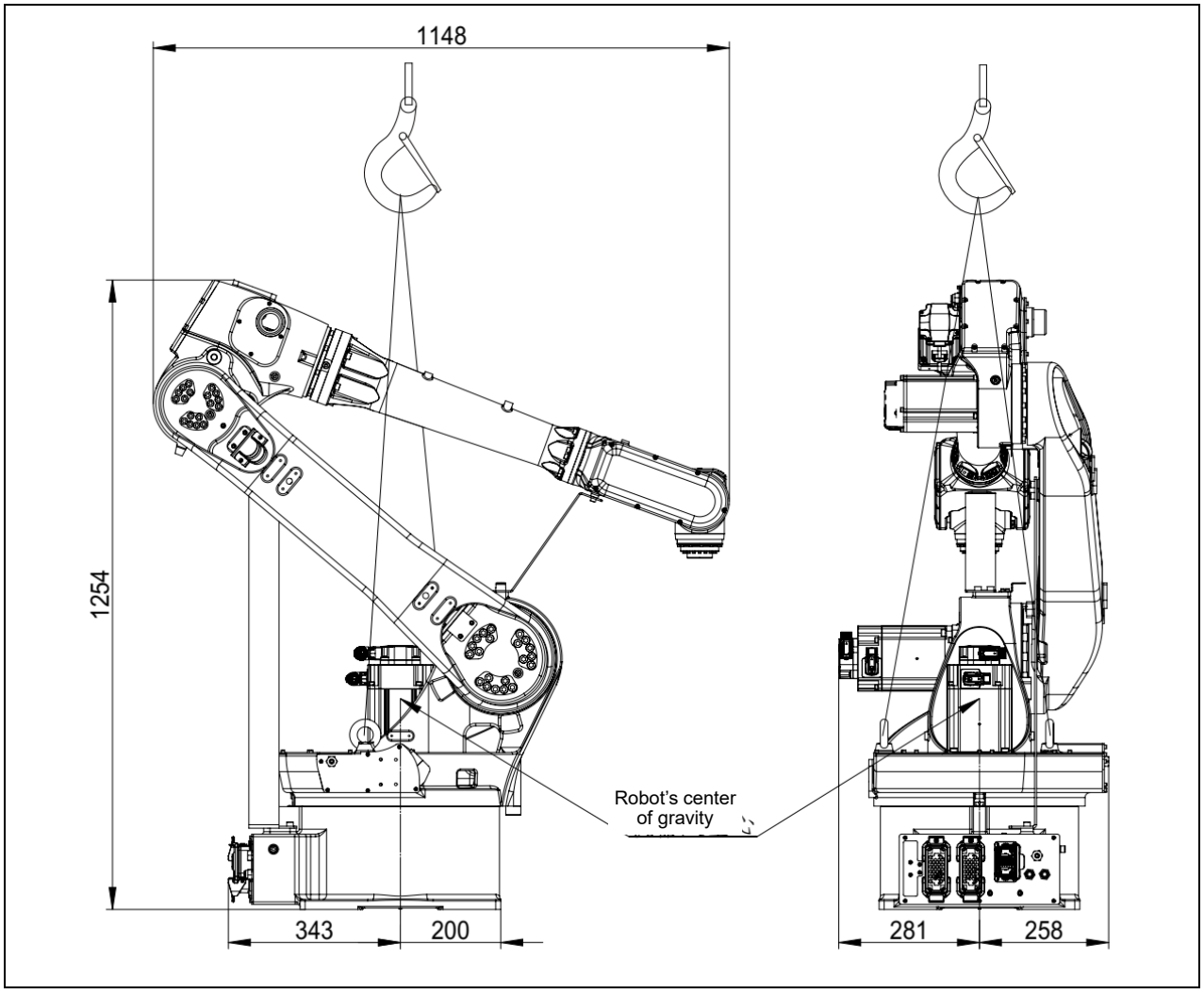


Figure 1.9 Use a crane to transport the robot (ER20B/10-2010-HI)

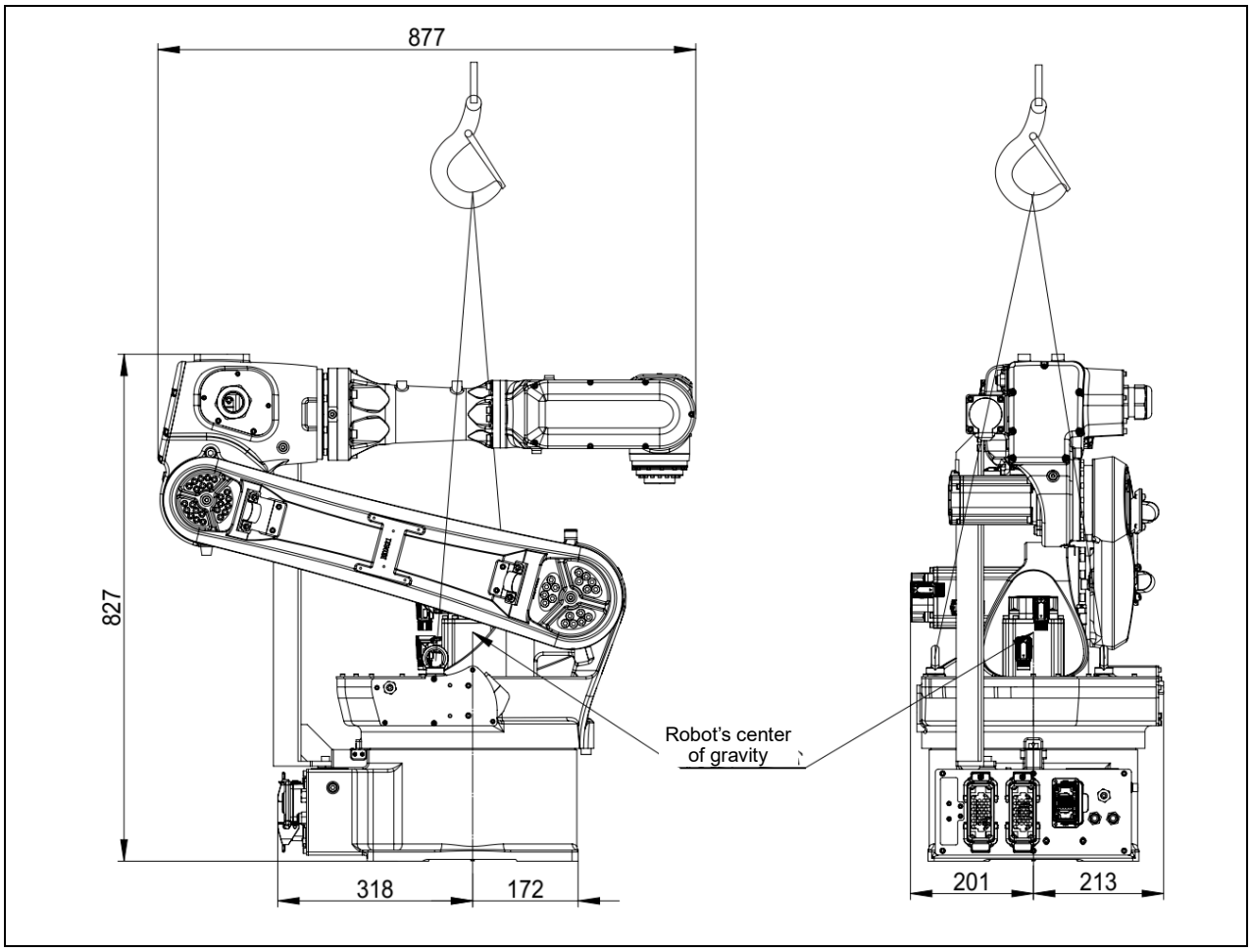


Figure 1.10 Use a crane to transport the robot (ER12B-1510-LI, ER12B-1510)

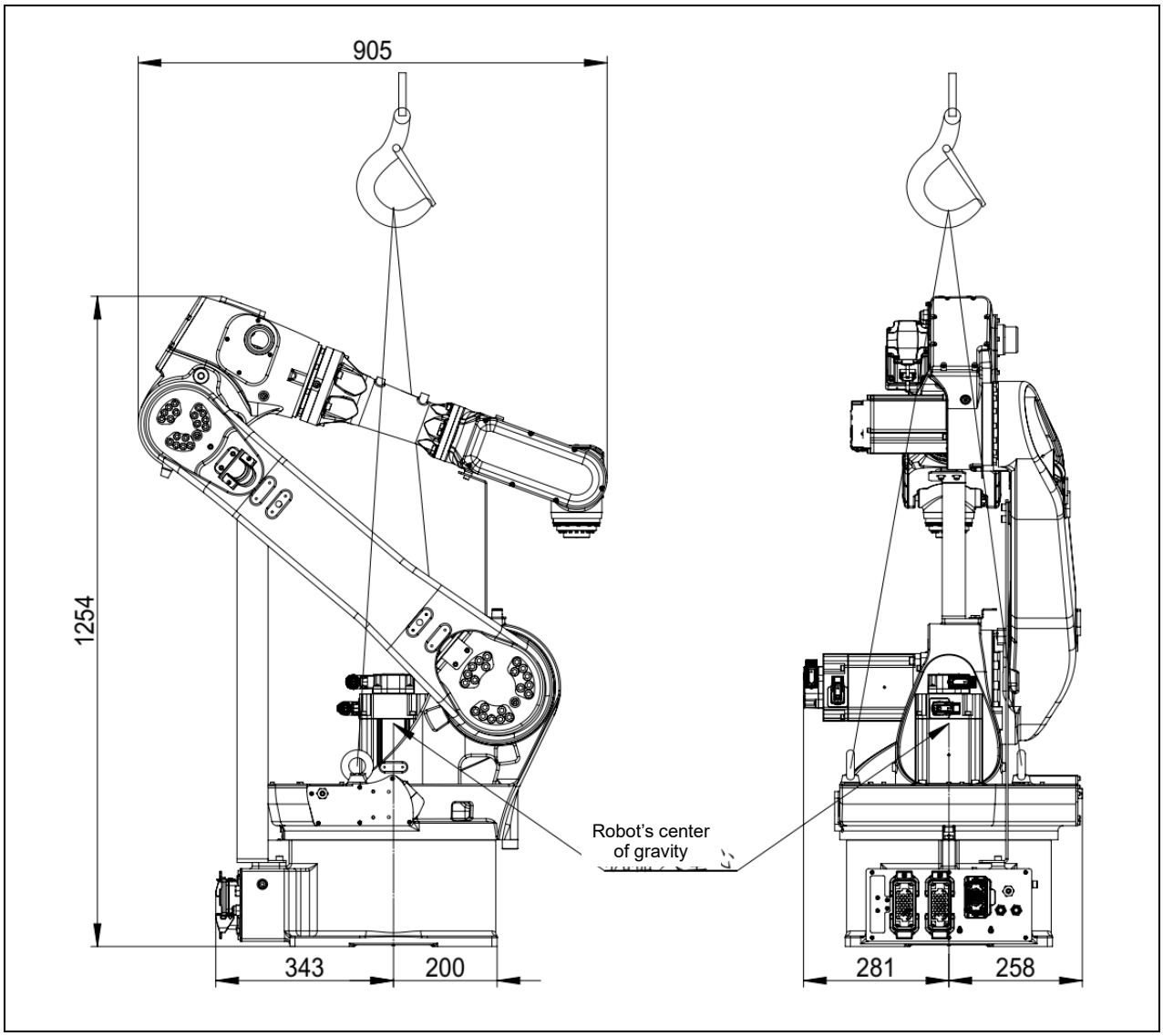


Figure 1.11 Use a crane to transport the robot (ER20B-1760)

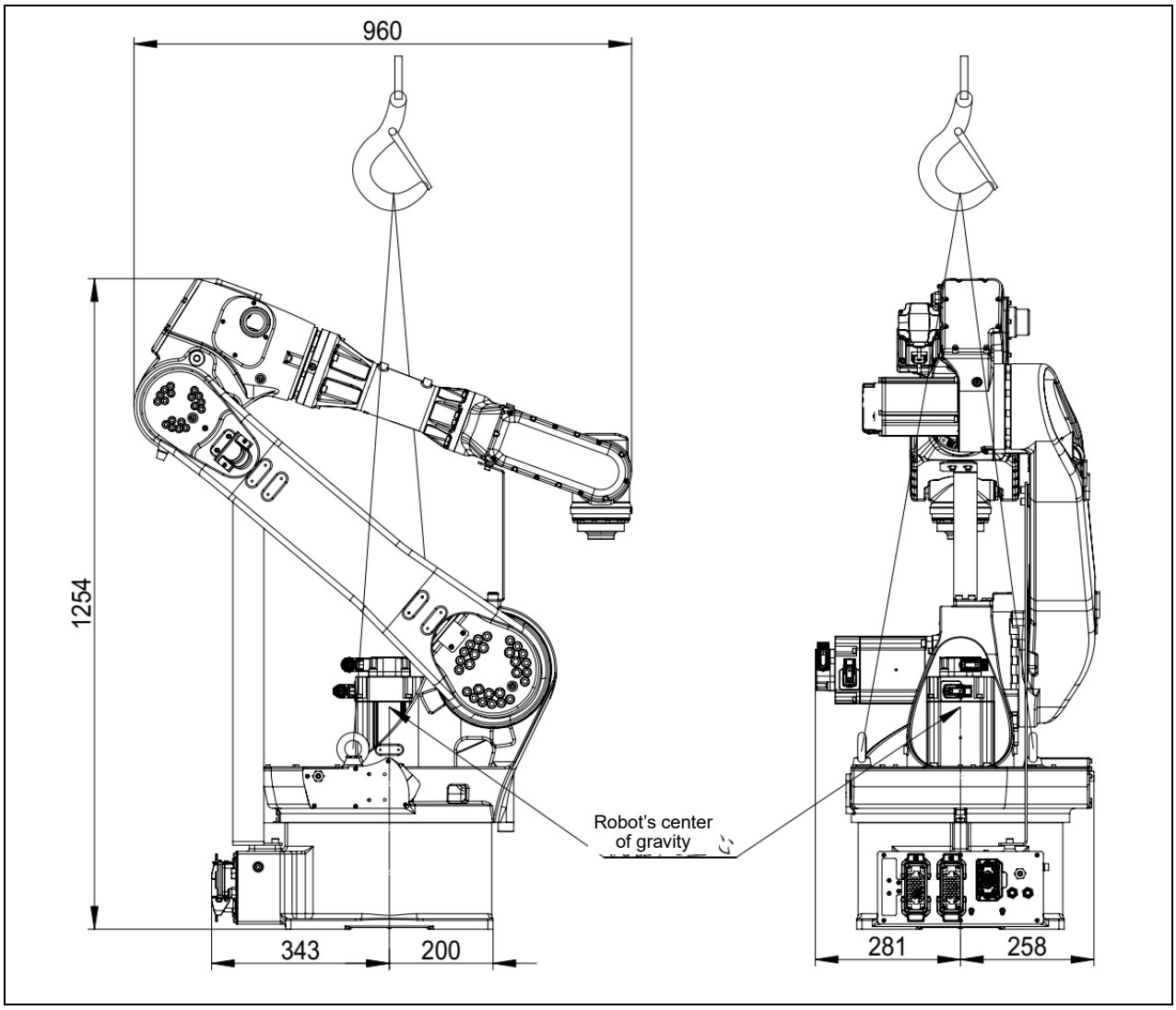


Figure 1.12 Use a crane to transport the robot (ER35B-1810-LI, ER35B-1810)

1.2. Installation

CAUTION

Before starting any installation work with the robot connected to the power supply, ensure that the robot's grounding wire is properly grounded. There is a risk of electric shock if the grounding wire is not connected.

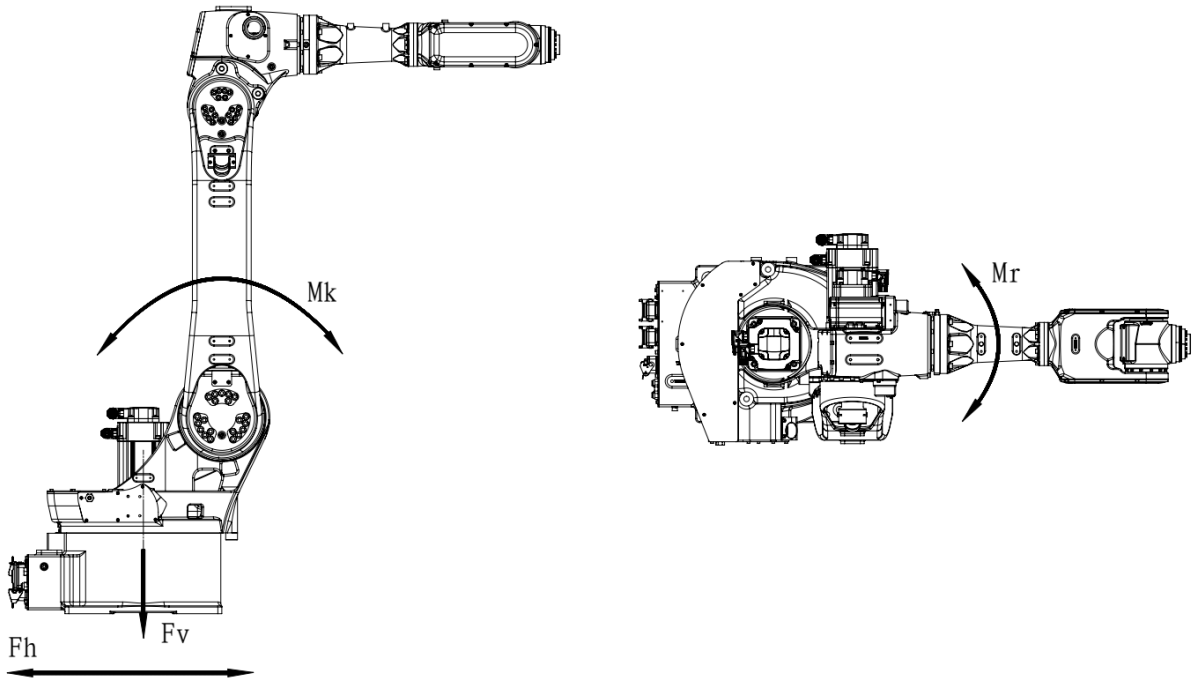
The following precautions must be fully understood and observed before installing the robot:

- 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***



Name	Definition	Max. value			
		ER20B/10-2010-HI	ER12B-1510-LI ER12B-1510	ER20B-1760	ER35B-1810-LI ER35B-1810
Mk	Max. overturning torque	8575 (N·m)	4165 (N·m)	8575 (N·m)	8575 (N·m)
Mr	Max. torsional torque	9900 (N·m)	3750 (N·m)	9900 (N·m)	9900 (N·m)
Fv	Max. vertical force	13750 (N)	6250 (N)	13750 (N)	11500 (N)
Fh	Max. horizontal force	11100 (N)	4500 (N)	11400 (N)	9000 (N)

Figure 1.13 Robot base force

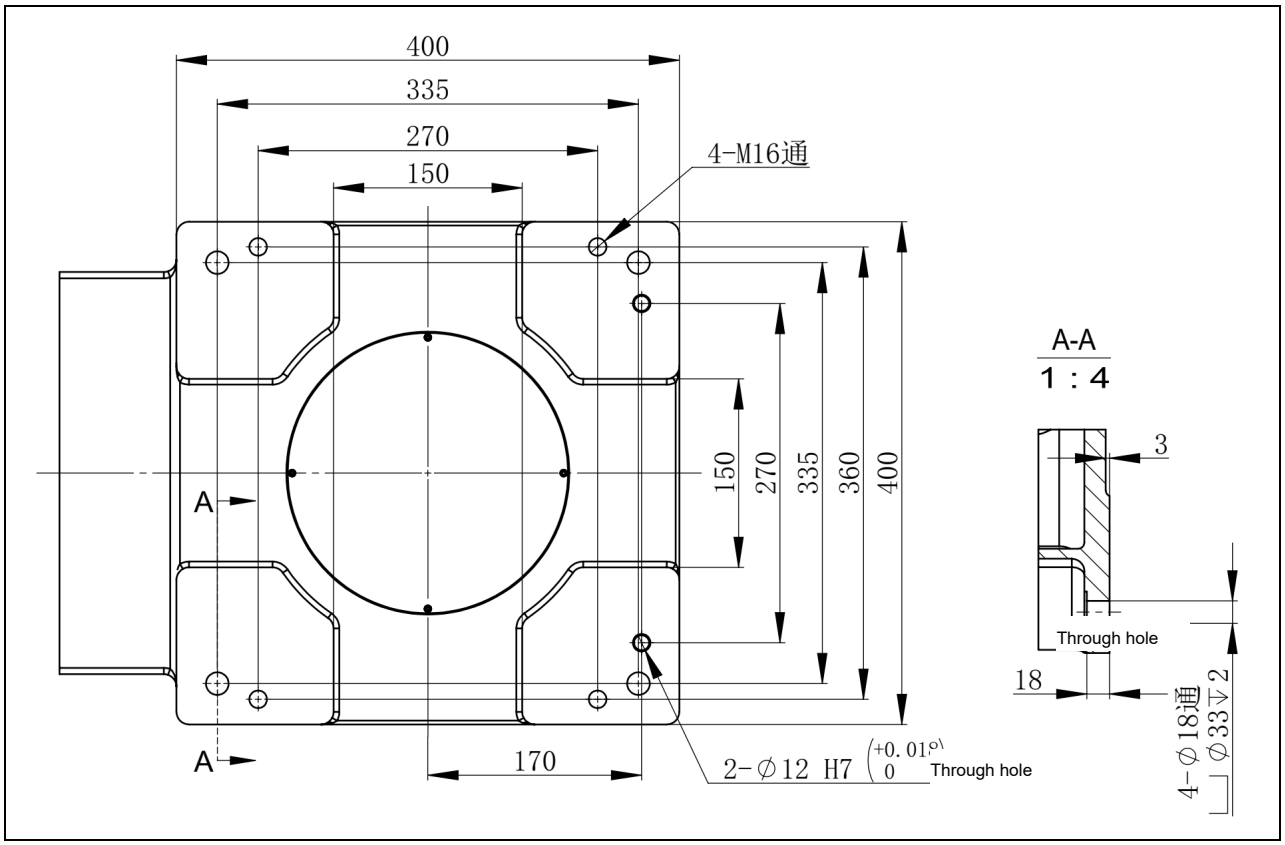


Figure 1.14 Robot base mounting dimension (ER20B/10-2010-HI, ER20B-1760, ER35B-1810-LI, ER35B-1810)

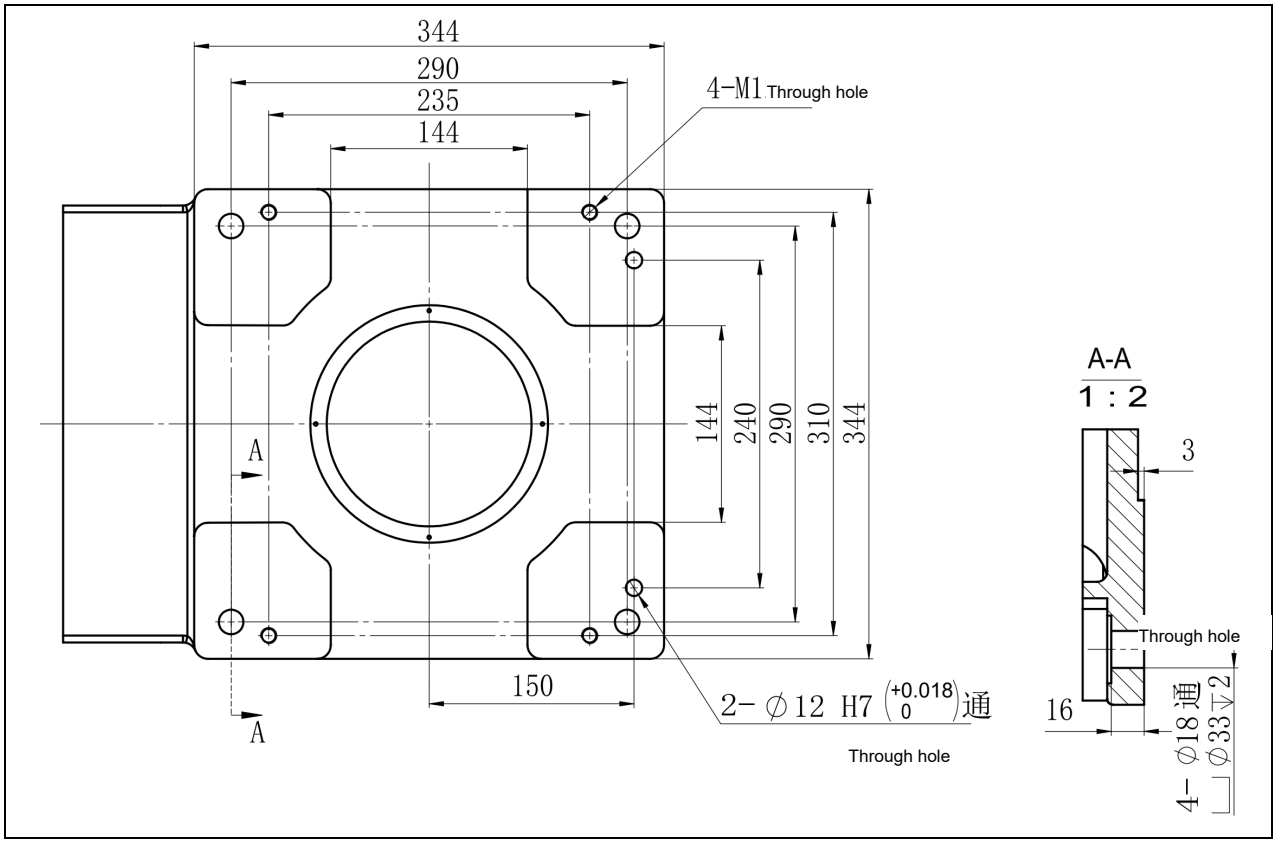


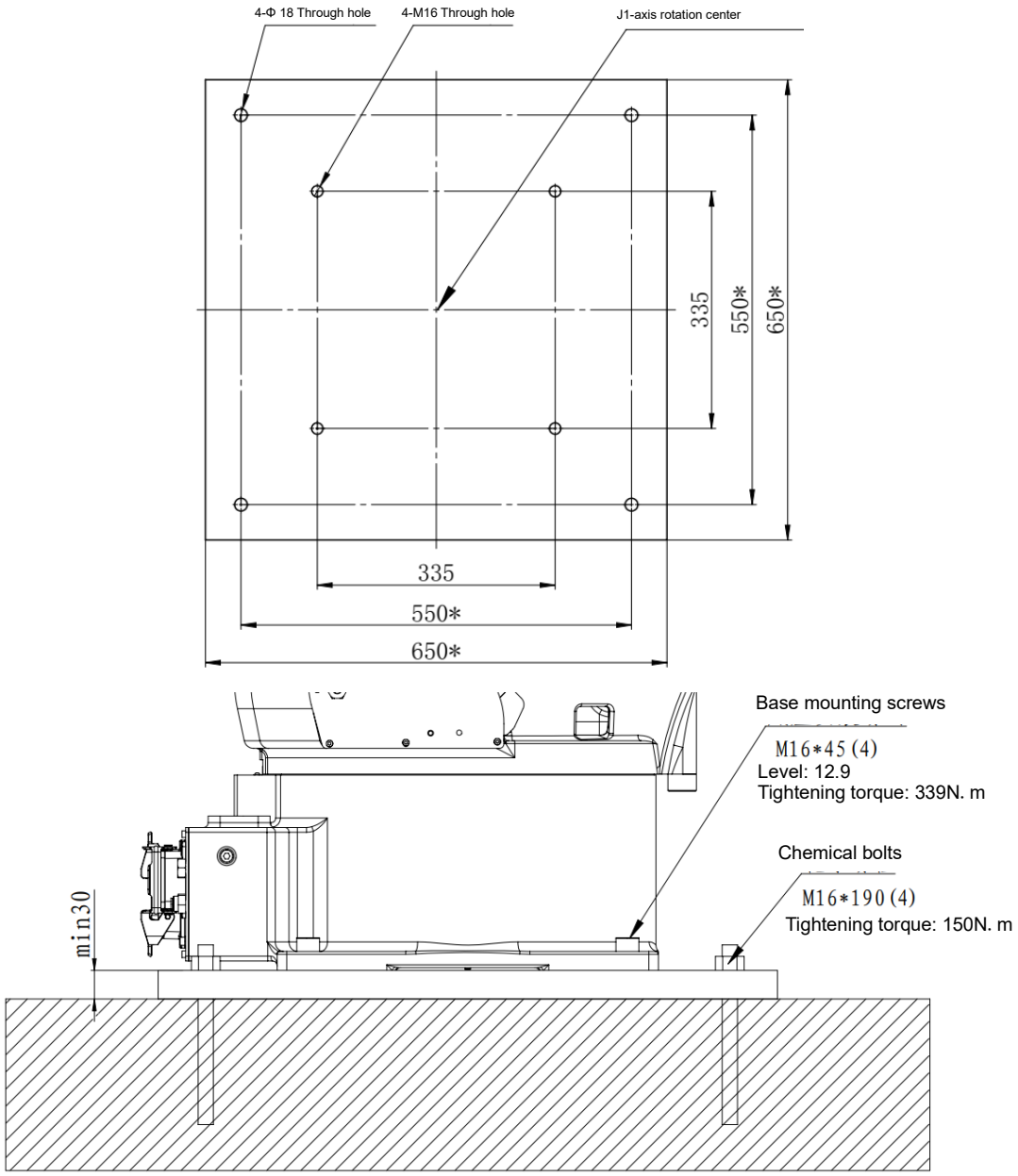
Figure 1.15 Robot base mounting dimension (ER12B-1510-LI, ER12B-1510)

Table 1.1 Robot fixing components

Name & model	Qty.
Fixed screw: M16X40 (GB/T 70.1 12.9 level)	4
Spring washer: Spring washer 16 (GB/T 93)	4
Positioning pin: Cylindrical pin 12X45 (GB/T120.2)	2

INFO

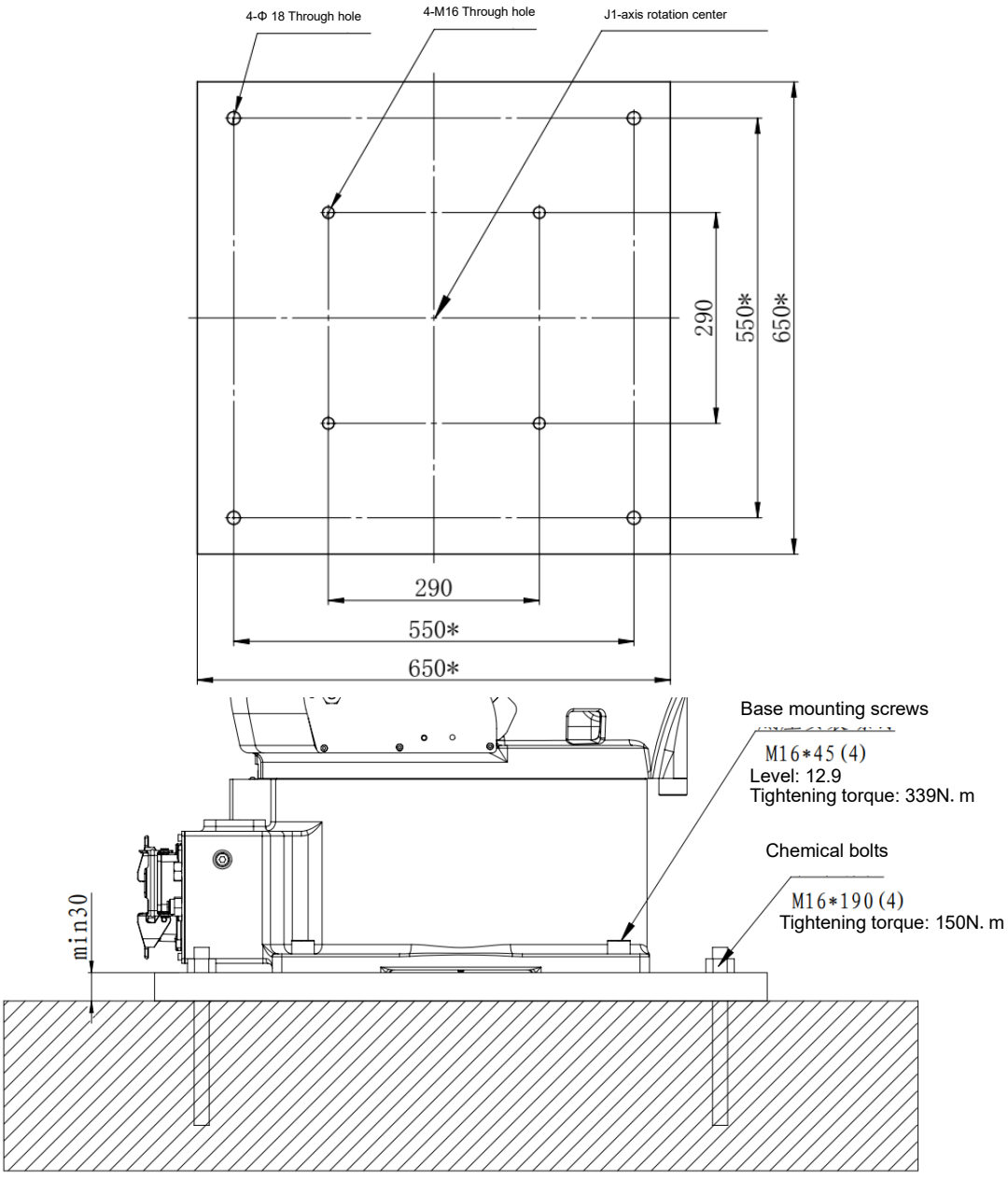
Installing positioning pins can greatly minimize the impact on the existing robot's program trajectory caused by reinstalling or replacing the robot. It only requires slight adjustments to the running program to restore the robot's normal operating path. If you do not need to consider this aspect, you may choose to omit the installation of positioning pins.



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

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

Figure 1.16 Robot mounting plate dimension (ER20B/10-2010-HI, ER20B-1760, ER35B-1810-LI, ER35B-1810)



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

The dimensions marked with an asterisk (*) in the figure are recommended dimensions. If the user wishes to make changes, they should consider the forces exerted by the robot on the base and the structure of the base. Any changes should be made only after rigorous calculations.

Figure 1.17 Robot mounting plate dimension (ER12B-1510-LI, ER12B-1510)

1.3. Installation conditions

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

Foundation	
Max. surface roughness	0.5mm
Max. inclination angle	5°
Storage condition	
Min. ambient temperature	-25℃
Max. ambient temperature	+55℃
Max. humidity	95%RH
Protection level	
ER20B/10-2010-HI	Wrist IP65 Main part IP54
ER20B-1760	
ER35B-1810-LI ER35B-1810	
ER12B-1510-LI ER12B-1510	Wrist IP67 Main part IP54

The robot body exhibits excellent resistance to chemicals and solvents, as described below:

(1) The following liquids may cause aging or corrosion of rubber components (seals, gaskets, O-rings, etc.) on the robot. Please refrain from using them, except for products approved by ESTUN.
   (a)Organic solvents
   (b)Cutting fluid including chlorine/gasoline
   (c)Amine type detergent
   (d)Acid, alkali and liquid causing rust
   (e) Other liquids or aqueous solutions, such as nitrile rubber (NBR), lack resistance to them

(2) When using the robot in environments where liquids such as water may splash onto it, special attention should be given to the drainage of the base. Inadequate drainage that results in frequent water immersion of the base can cause robot malfunctions.

(3) Do not use cutting fluids or cleaning solutions with unclear properties.

(4) The robot should not be immersed in water for prolonged periods or used in environments prone to getting wet. For example, if the motor surface is exposed and remains wet for an extended period, liquid can infiltrate the motor and cause malfunctions.

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.

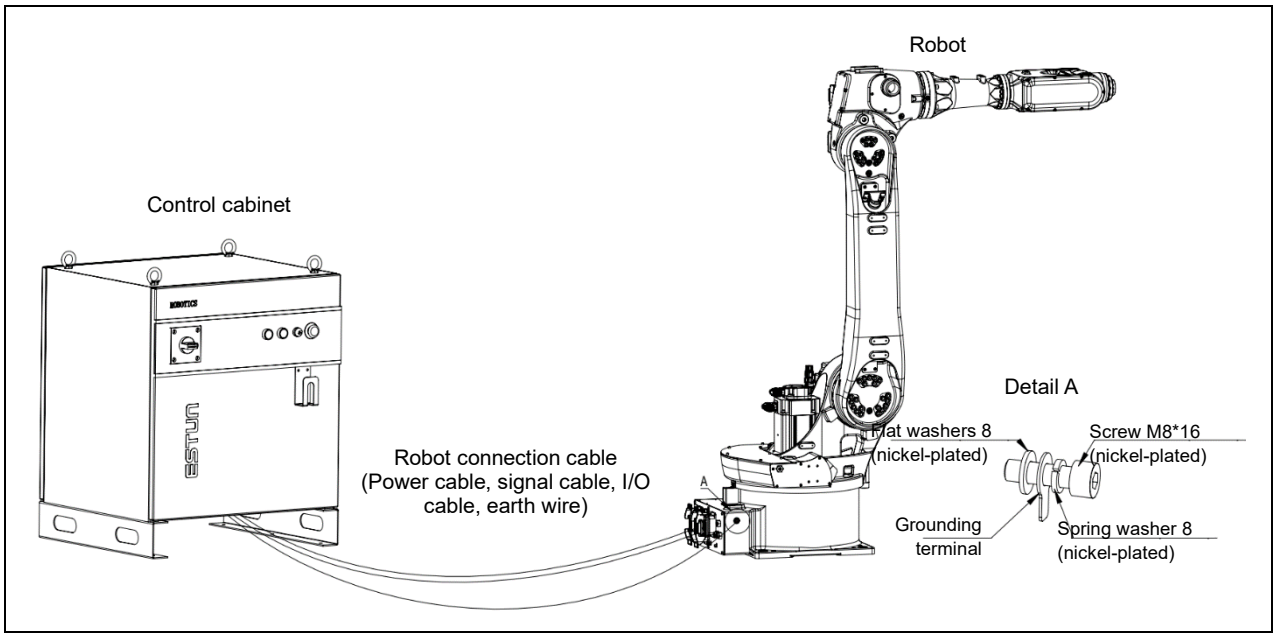


Figure 2.1 Cable connection

CAUTION

1. It is essential to ensure that the serial number of the robot body matches the serial number of the control cabinet. Mismatched serial numbers can result in deviation in robot accuracy.

2. Before turning on the power supply to the control device, please connect the robot and the control device with a grounding wire. There is a risk of electric shock if the grounding wire is not connected.

3. Install the grounding terminal between the flat washer and the spring washer. The grounding position of the robot may have a small amount of anti-rust oil, so please clean it properly before grounding.

3. Specification

3.1. Robot configuration

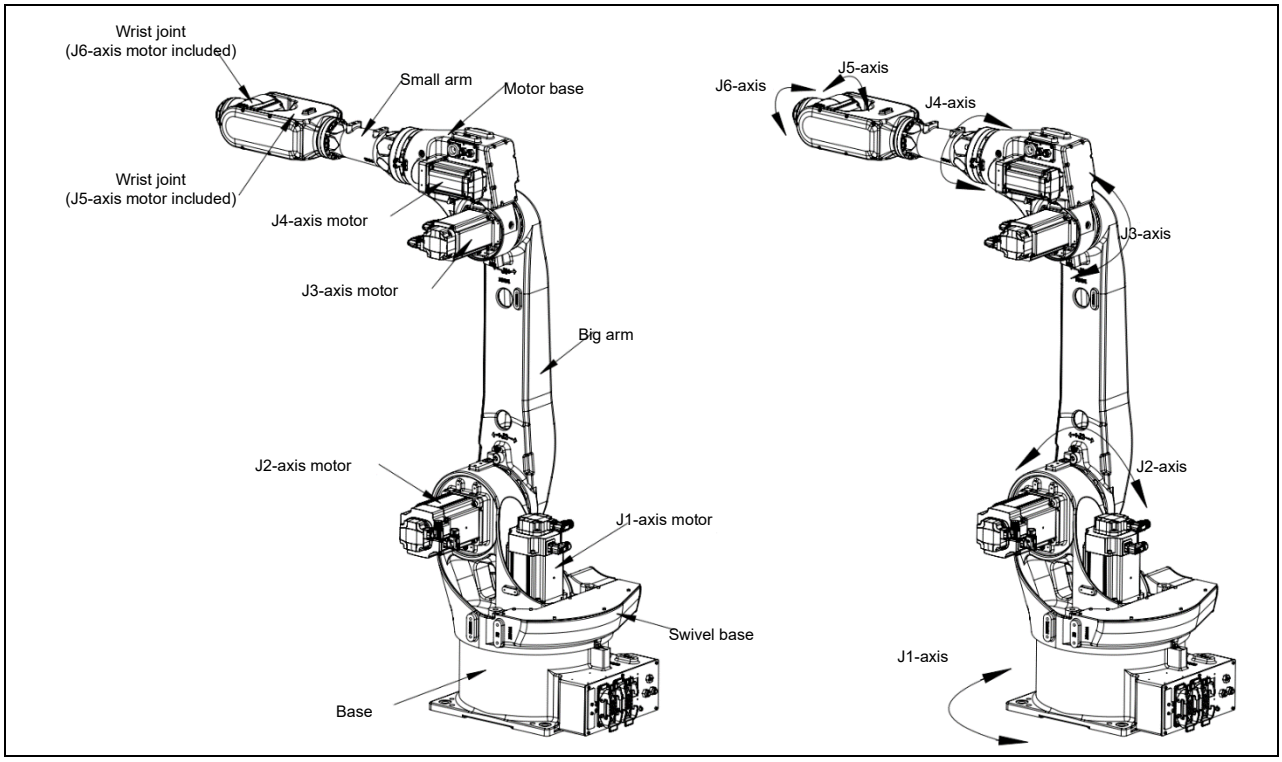


Figure 3.1 Robot configuration (ER20B/10-2010-HI, ER20B-1760, ER35B-1810-LI, ER35B-1810)

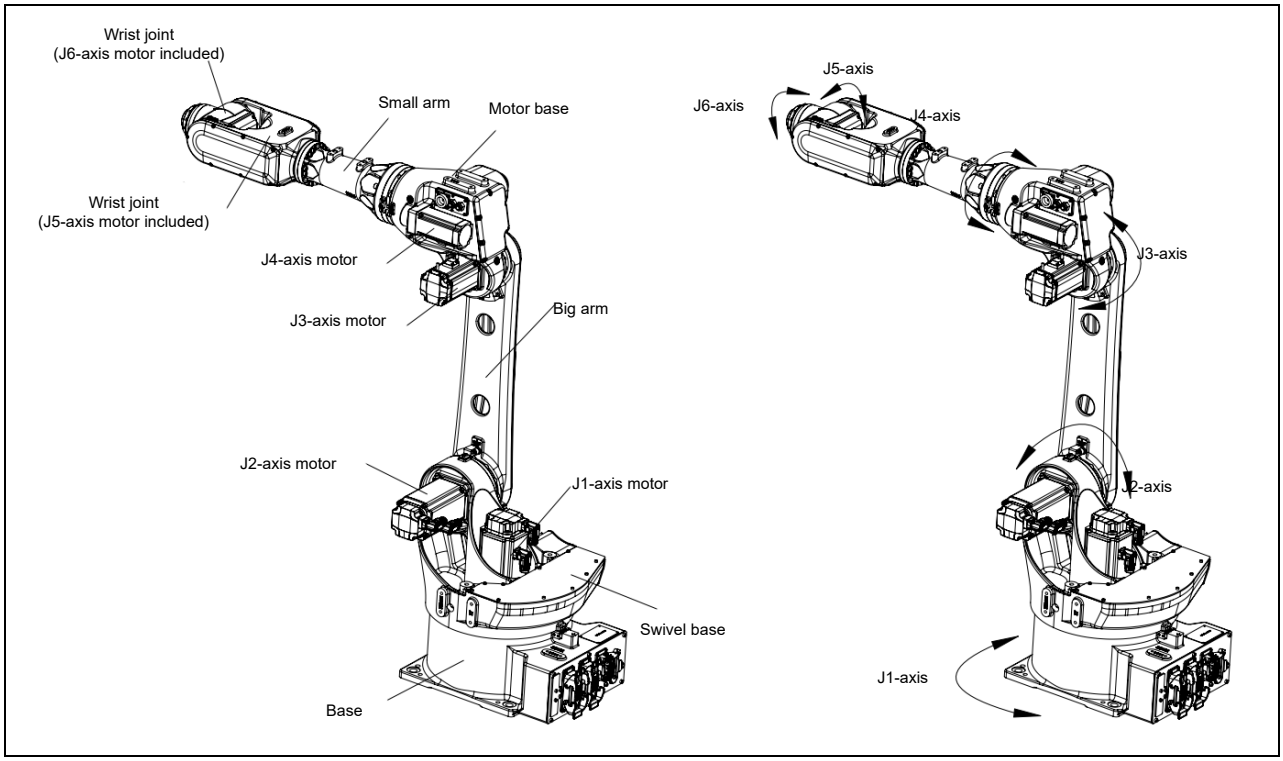


Figure 3.2 Robot configuration (ER12B-1510-LI, ER12B-1510)

Table 3.1 Robot specifications

Model		ER20B/10-2010-HI	ER12B-1510-LI	ER12B-1510	ER20B-1760	ER35B-1810-LI	ER35B-1810
Type		Articulated robot					
Controlled axis		6 axes (J1，J2，J3，J4，J5，J6)					
Installation		Floor					
Motion range	J1-axis	±170°	±170°		±170°	±170°	
	J2-axis	-100°~+155°	-90°~+155°		-100°~+155°	-100°~+155°	
	J3-axis	-160°~+86°	-145°~+85°		-160°~+86°	-160°~+86°	
	J4-axis	±200°	±200°		±200°	±200°	
	J5-axis	±135°	±135°		±135°	±130°	
	J6-axis	±360°	±360°		±360°	±360°	
Max. speed (Note 1)	J1-axis	206°/s	242°/s	238°/s	206°/s	180°/s	206°/s
	J2-axis	206°/s	242°/s	238°/s	206°/s	180°/s	206°/s
	J3-axis	238°/s	283°/s	285°/s	238°/s	242°/s	238°/s
	J4-axis	480°/s	480°/s		480°/s	480°/s	
	J5-axis	412°/s	412°/s		412°/s	330°/s	
	J6-axis	356°/s	705°/s		705°/s	407°/s	
Allowable handling weight	At wrist	10kg	12kg		20kg	35kg	
	Additional load	2kg	2kg		10kg	2kg	
Allowable load inertia at wrist	J4-axis	2.91 kg·m²	0.70 kg·m²		1.30 kg·m²	4.03 kg·m²	
	J5-axis	2.91 kg·m²	0.70 kg·m²		1.30 kg·m²	4.03 kg·m²	
	J6-axis	2.70 kg·m²	0.175 kg·m²		0.35 kg·m²	1.51 kg·m²	
Allowable torque at wrist	J4-axis	16.8 N·m	26.9 N·m		47.6 N·m	110.9 N·m	
	J5-axis	16.8 N·m	26.9 N·m		47.6 N·m	110.9 N·m	
	J6-axis	10.0 N·m	11.7 N·m		21.4 N·m	62.0 N·m	
Drive method		Electric servo drive by AC servo motor					
Repeatability		±0.03mm	±0.03mm		±0.03mm	±0.04mm	
Max. reach		2010mm	1527mm		1756mm	1813mm	
Weight		275kg	164kg		273kg	277kg	
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.
(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.

(Note 1) Short-distance movements may not reach the maximum speed of each axis. The maximum range of motion for each axis is measured when the robot is in the zero position, but the actual motion may be limited by the position of other axes.

(Note 2) When using the robot in low-temperature environment that is near 0°C, or when leaving the robot stopped in environments below 0°C during rest days or overnight, collision detection alarms may occur due to high resistance in the movable parts during the initial startup. In such cases, it is recommended to perform several minutes of warm-up operation.

(Note 3) For usage in high-temperature, low-temperature, vibrating, dusty, or environments with high concentrations of cutting oil, please consult ESTUN for guidance.

3.2. External dimensions and operating space

The following figures illustrate the range of motion of the robot and serves as a reference for selecting and setting up the robots installation position. When installing peripheral devices, it is important to ensure they do not interfere with the main body of the robot and its range of motion.

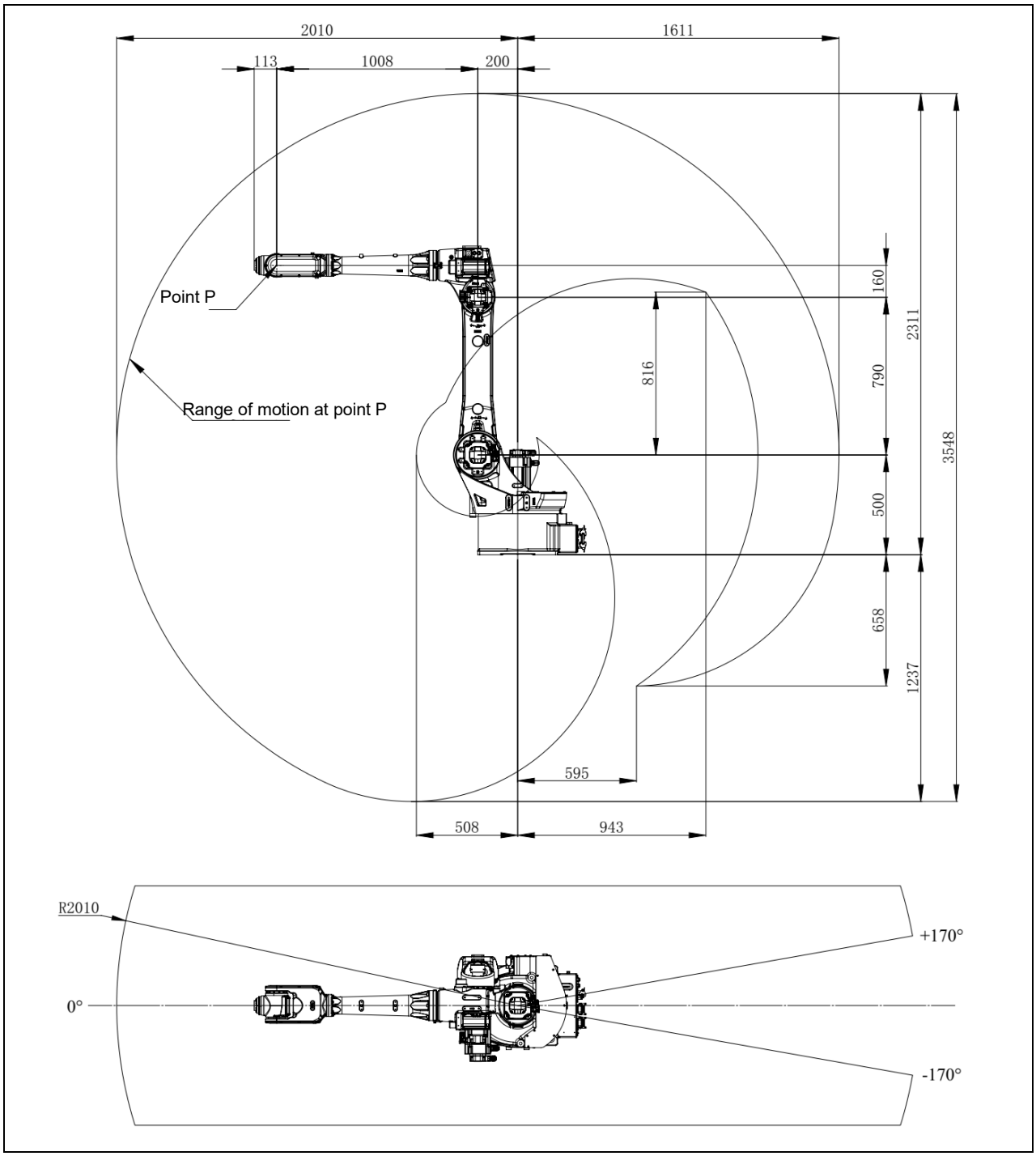


Figure 3.3 Motion range (ER20B/10-2010-HI)

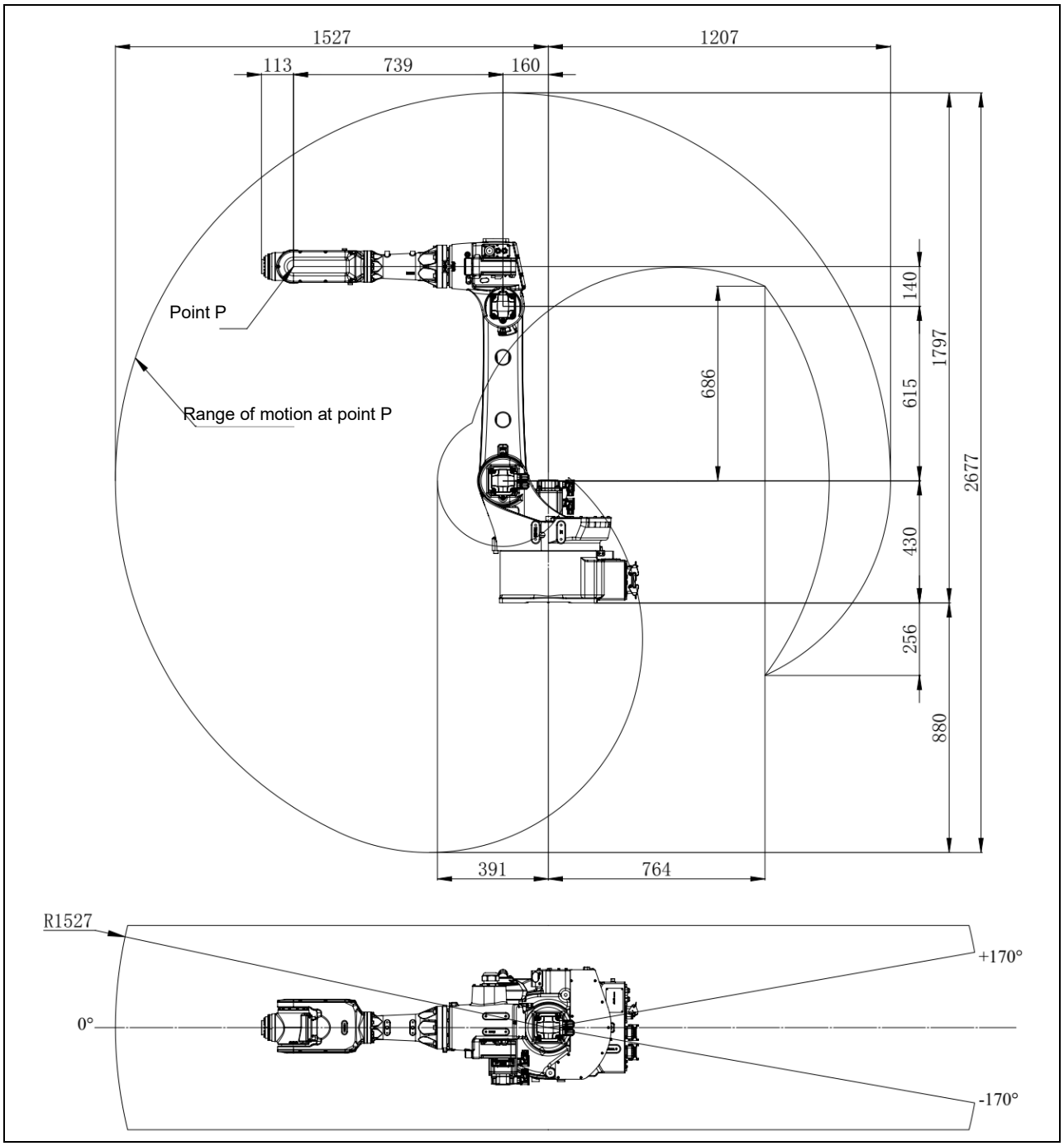


Figure 3.4 Motion range (ER12B-1510-LI, ER12B-1510)

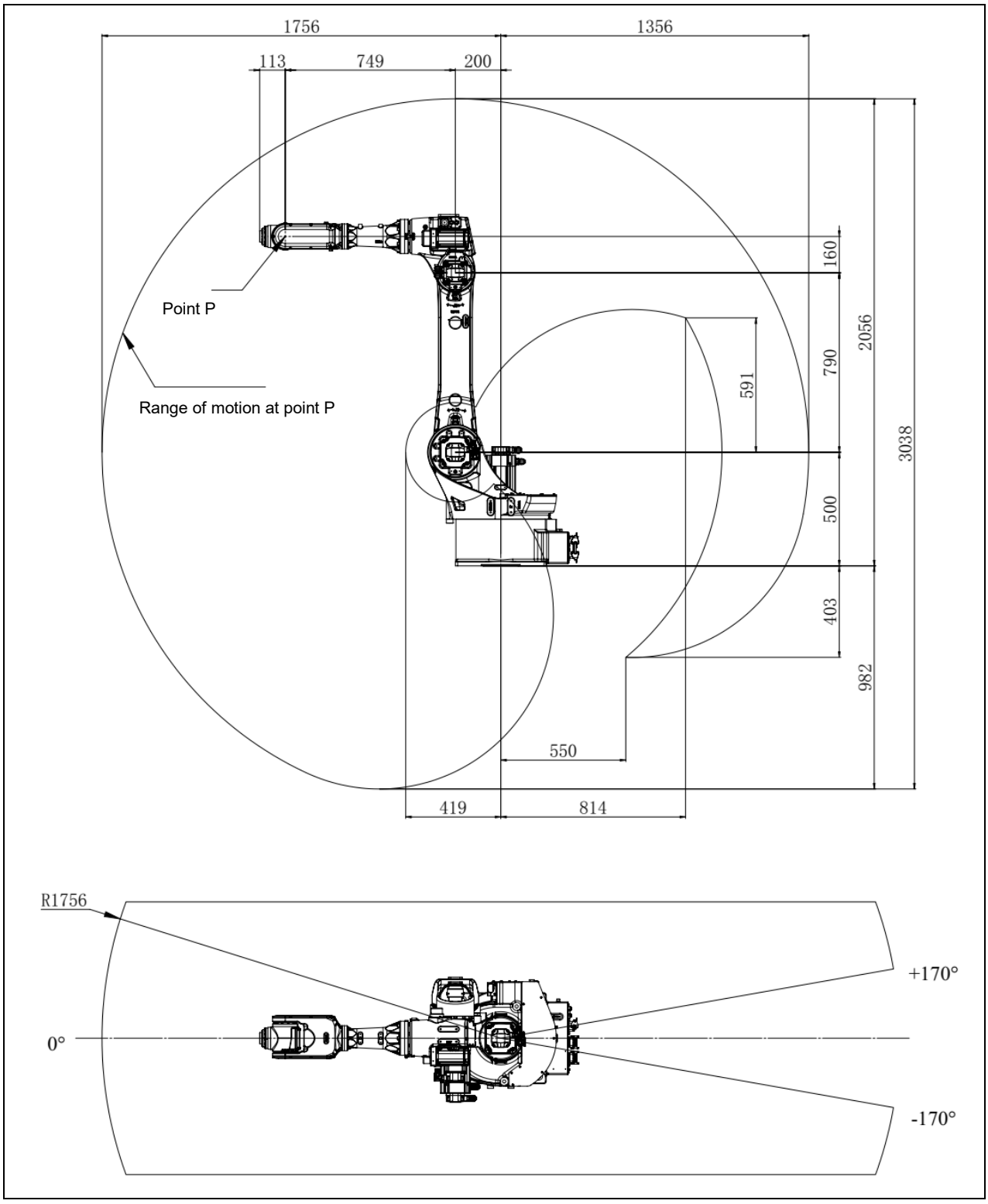


Figure 3.5 Motion range (ER20B-1760)

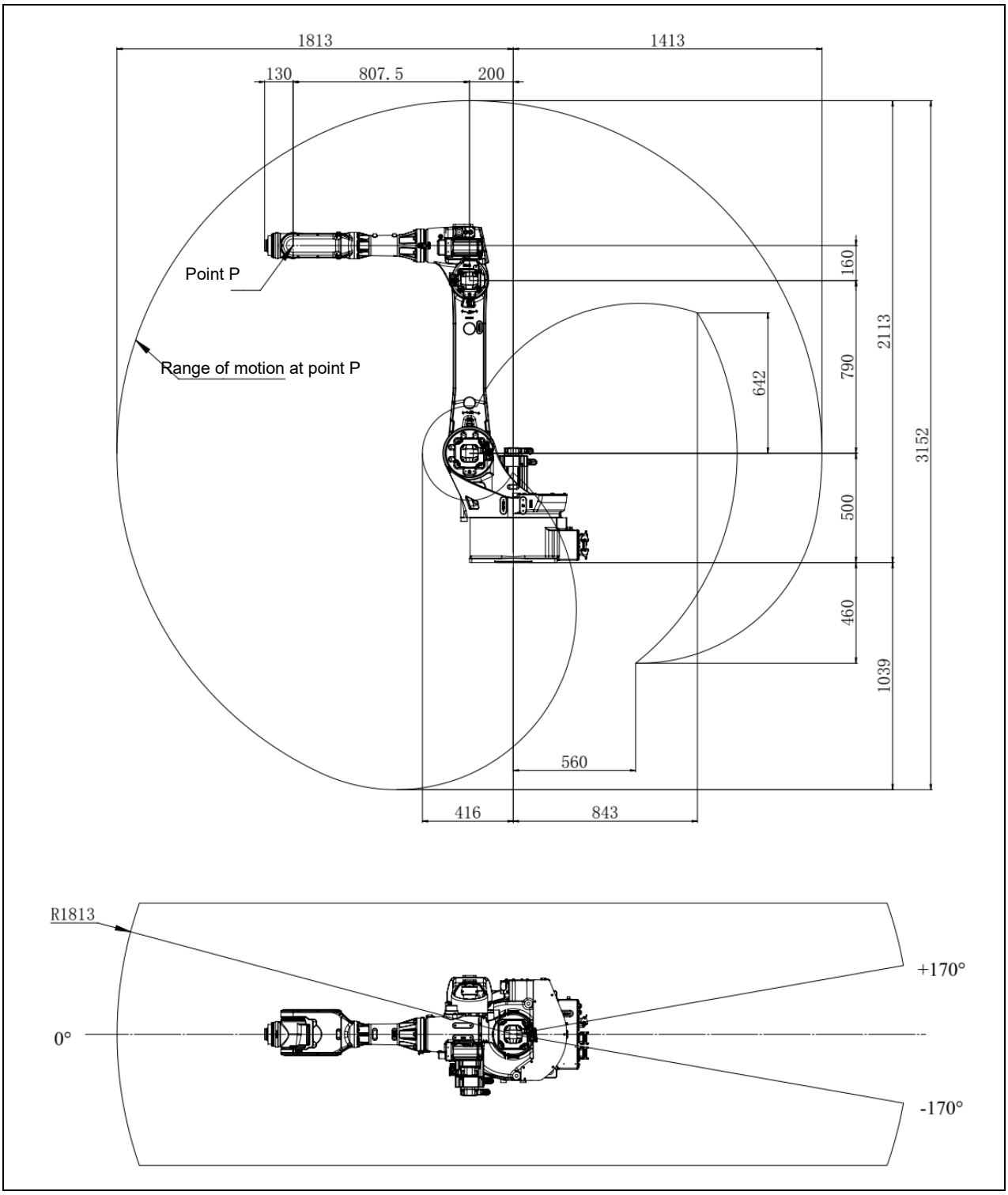


Figure 3.6 Motion range (ER35B-1810-LI, ER35B-1810)

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.

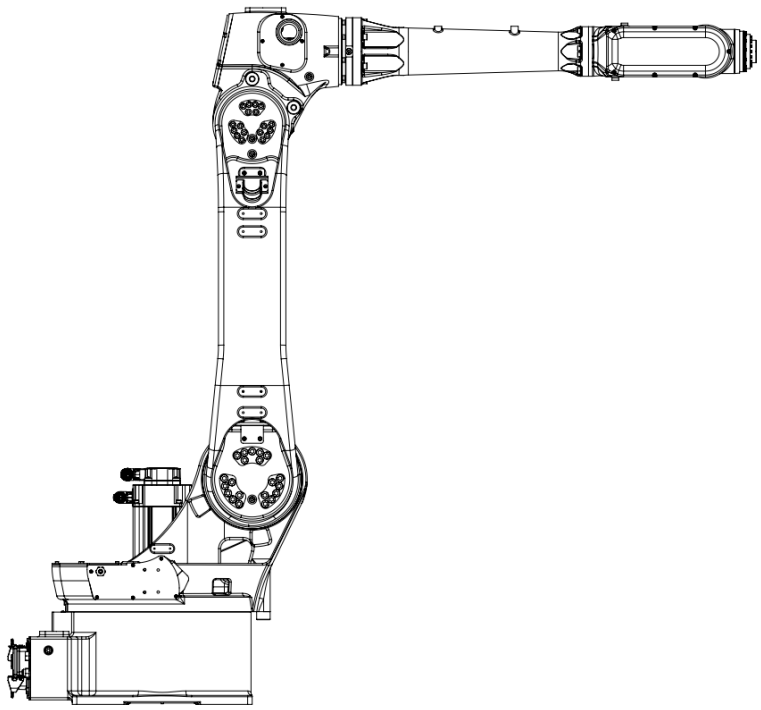


Figure 3.7 Zero point position of robot (ER20B/10-2010-HI)

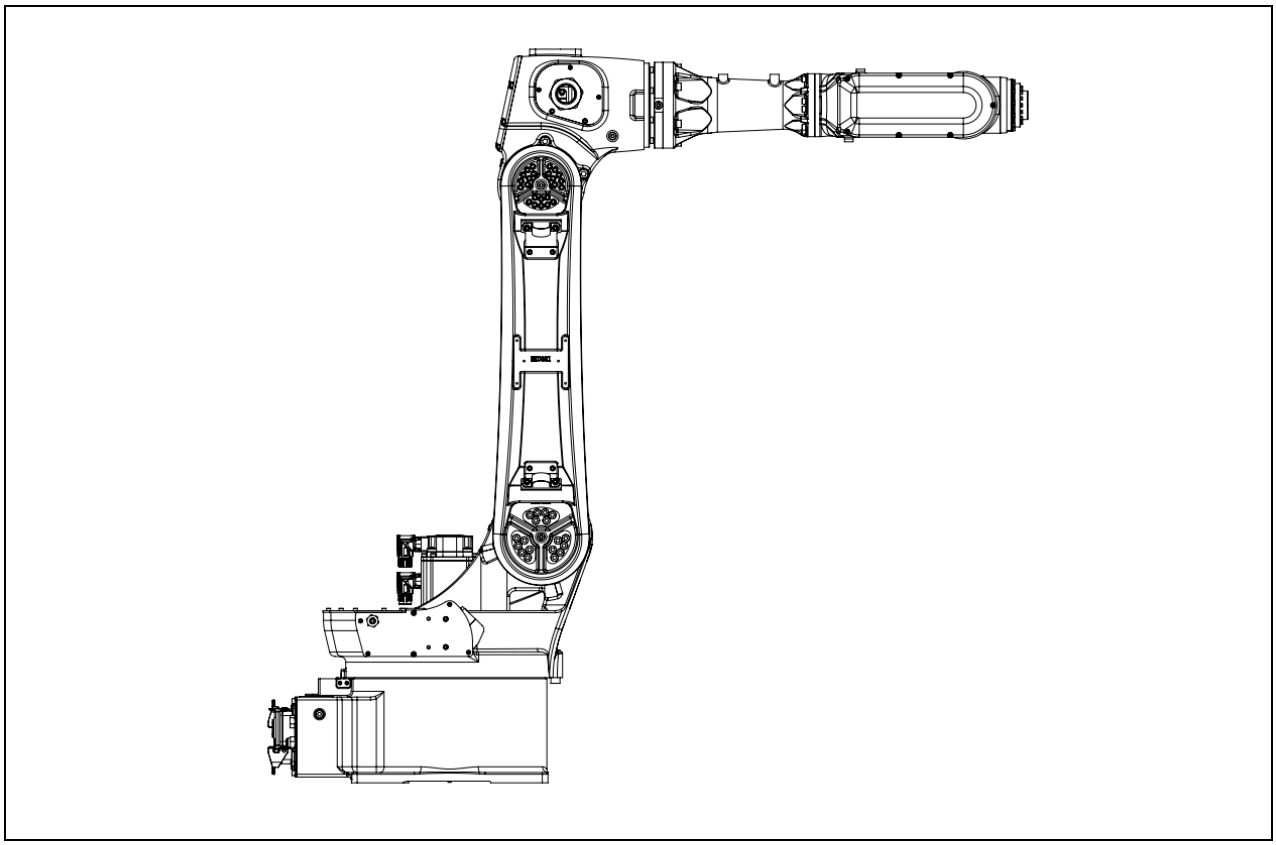


Figure 3.8 Zero point position of robot (ER12B-1510-LI, ER12B-1510)

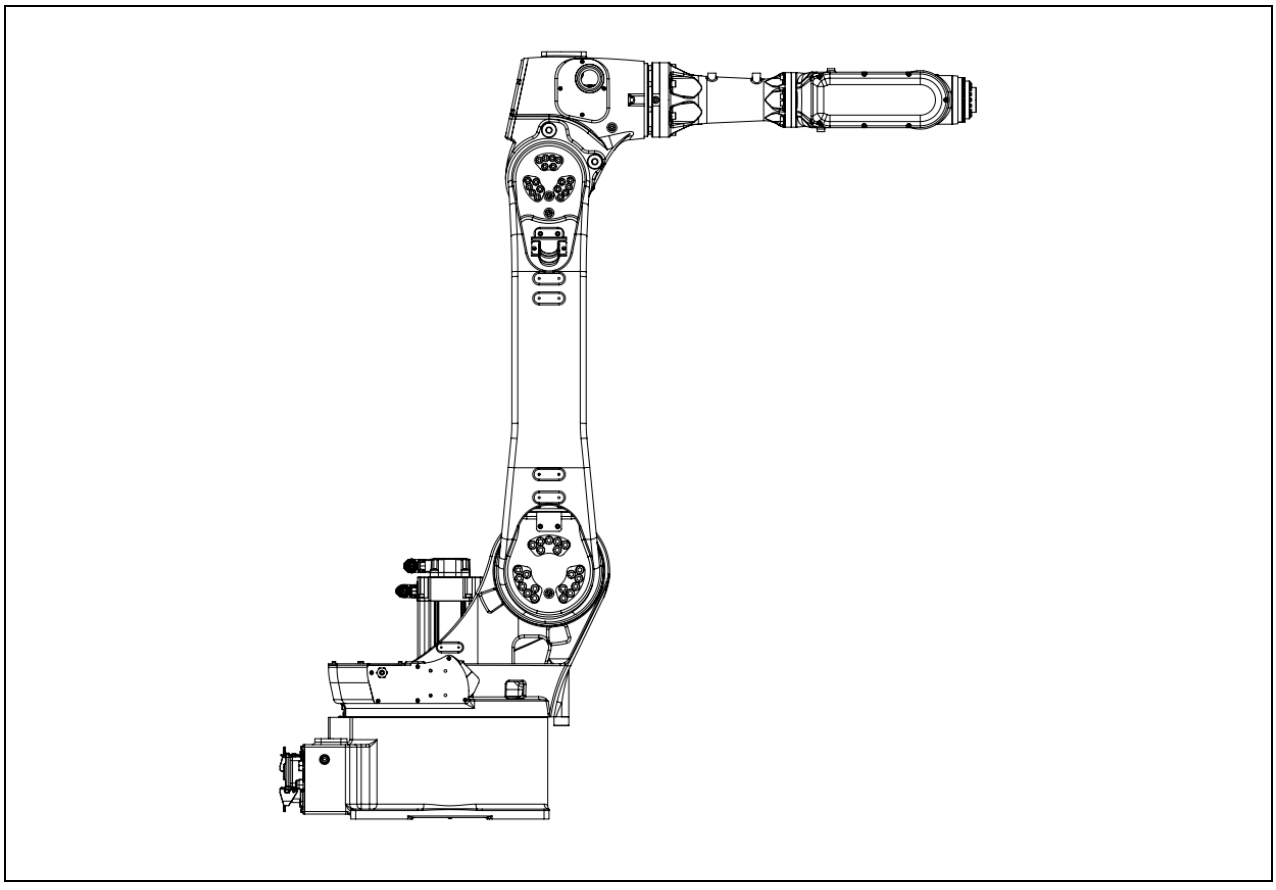


Figure 3.9 Zero point position of robot (ER20B-1760)

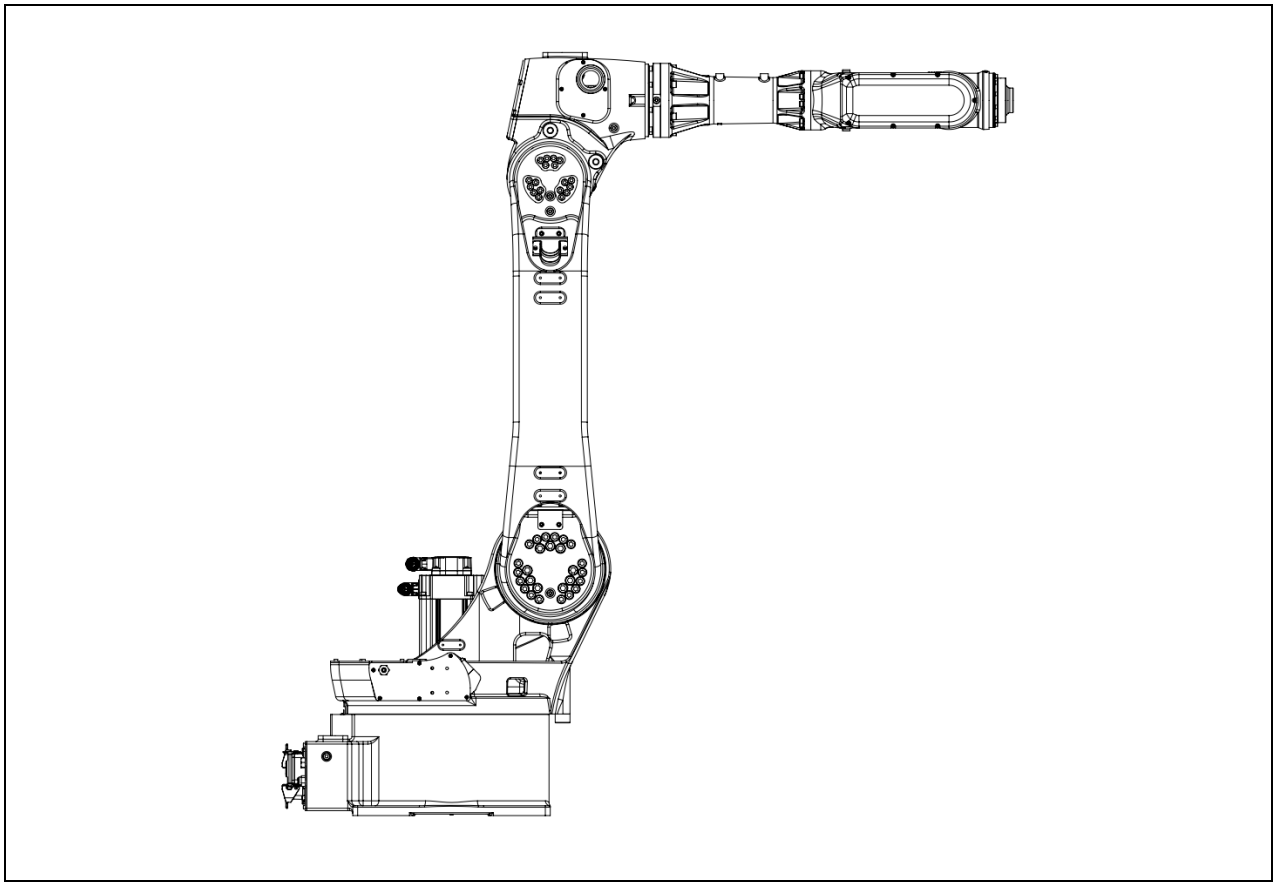


Figure 3.10 Zero point position of robot (ER35B-1810-LI, ER35B-1810)

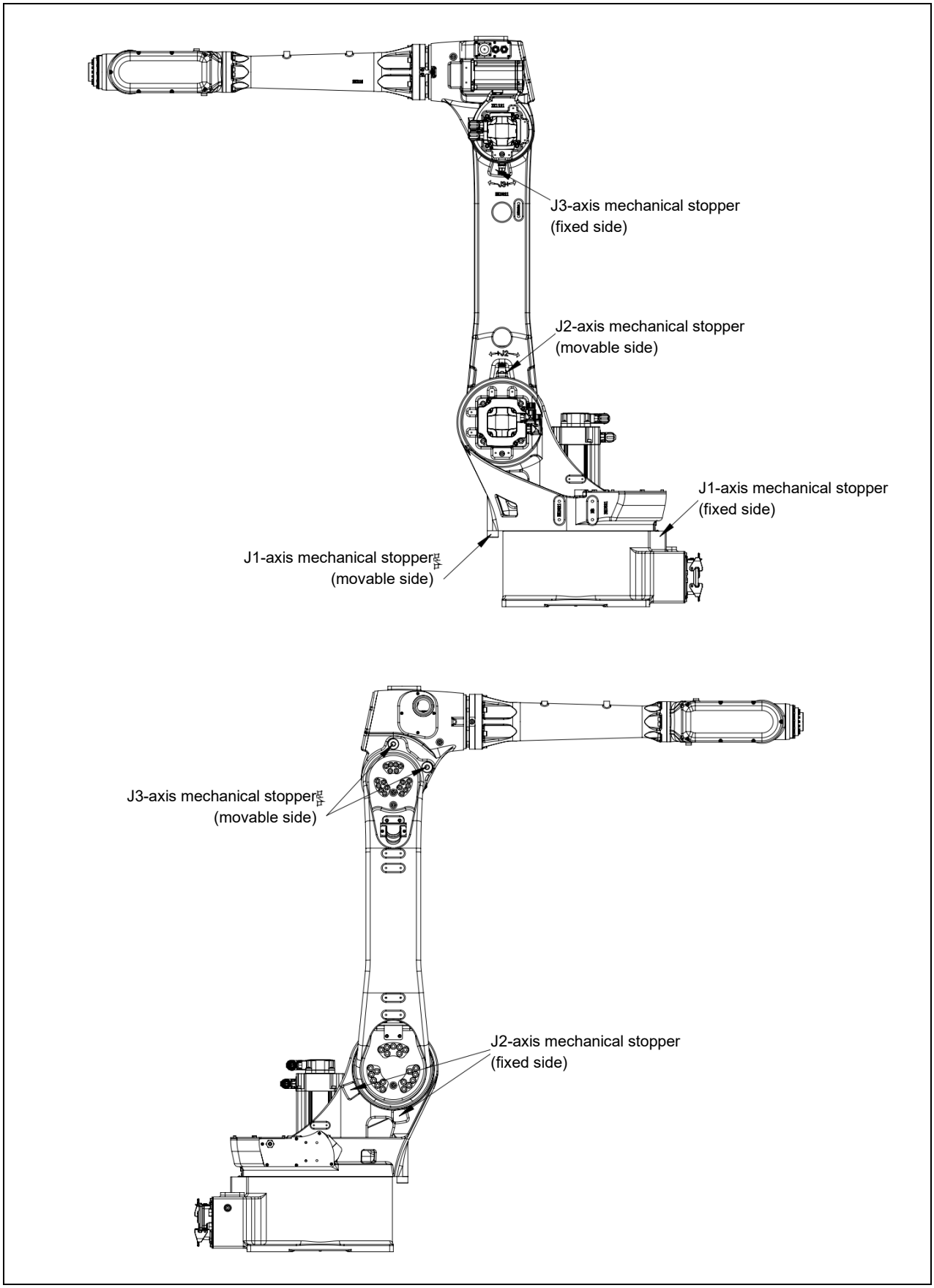


Figure 3.11 Mechanical stopper position (ER20B/10-2010-HI)

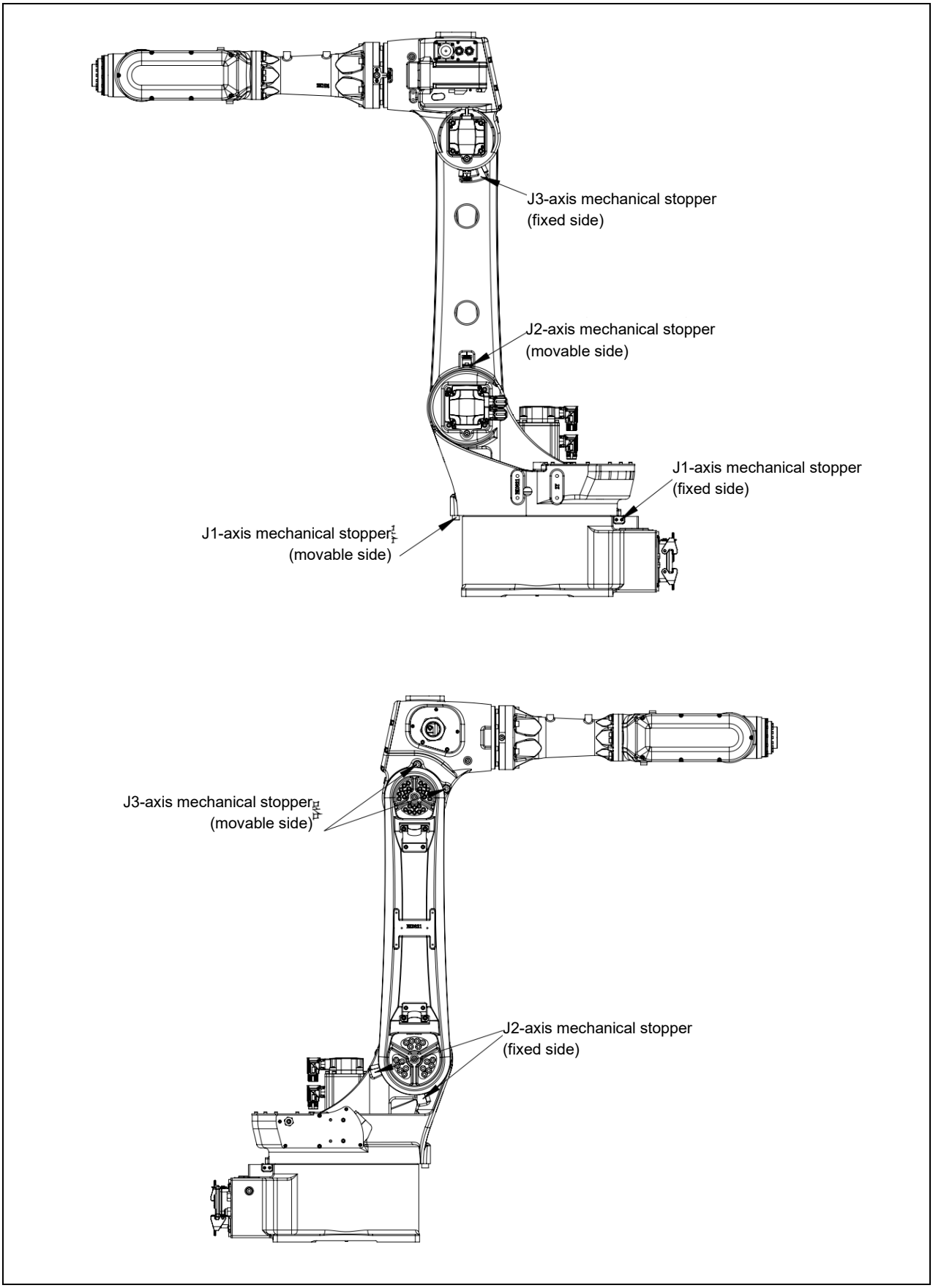


Figure 3.12 Mechanical stopper position (ER12B-1510-LI, ER12B-1510)

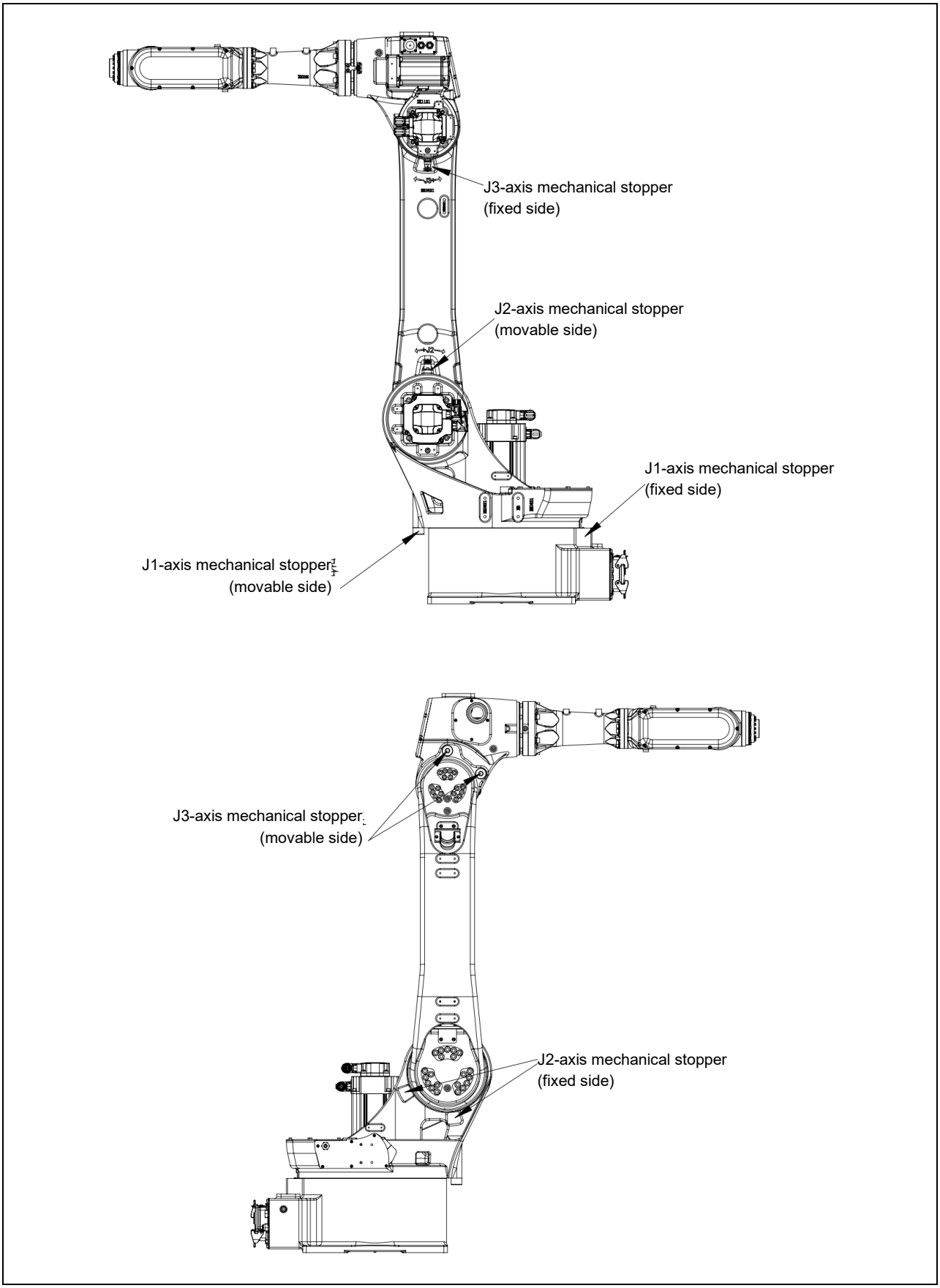


Figure 3.13 Mechanical stopper position (ER20B-1760)

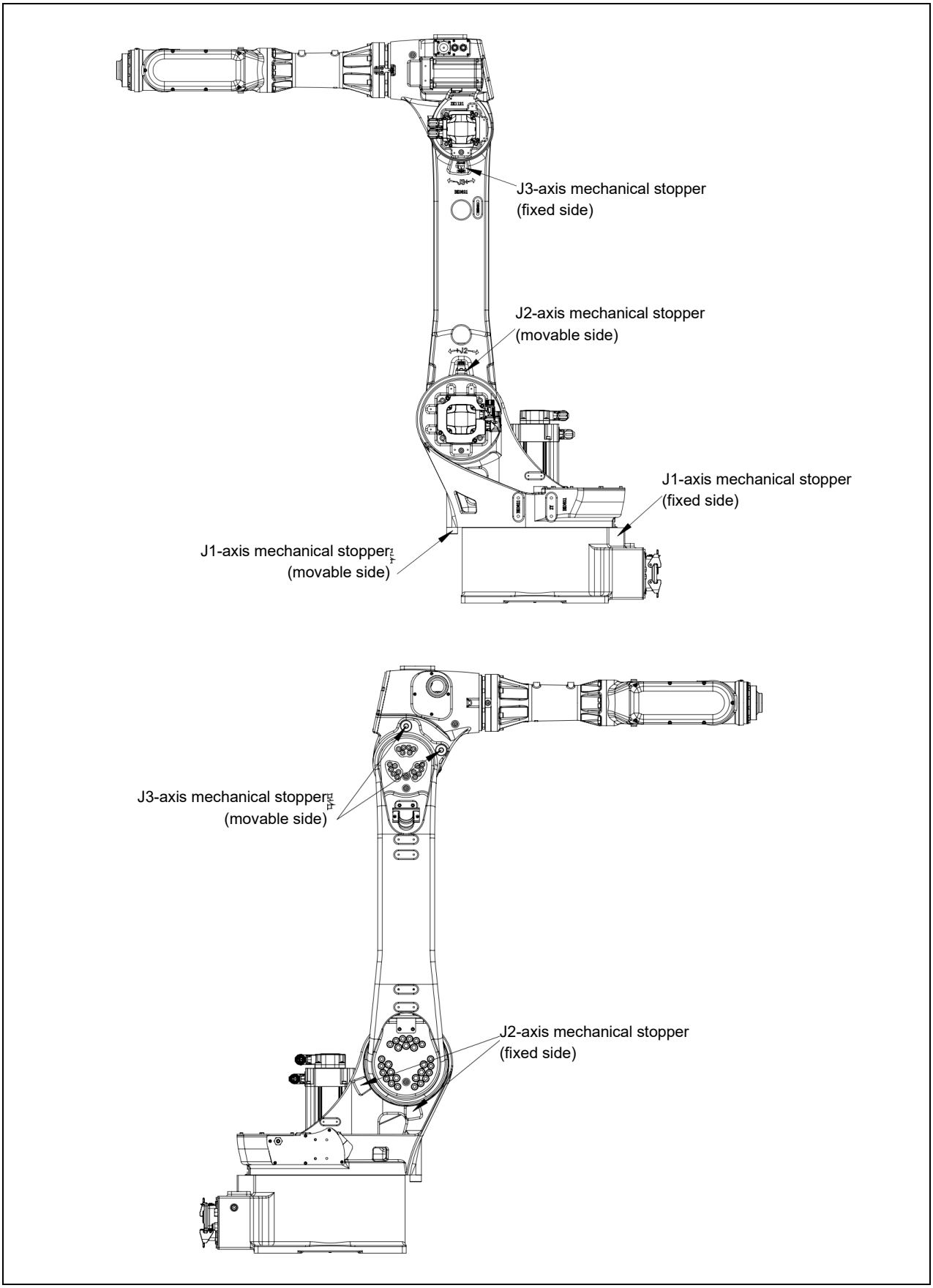


Figure 3.14 Mechanical stopper position (ER35B-1810-LI, ER35B-1810)

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.

> **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.

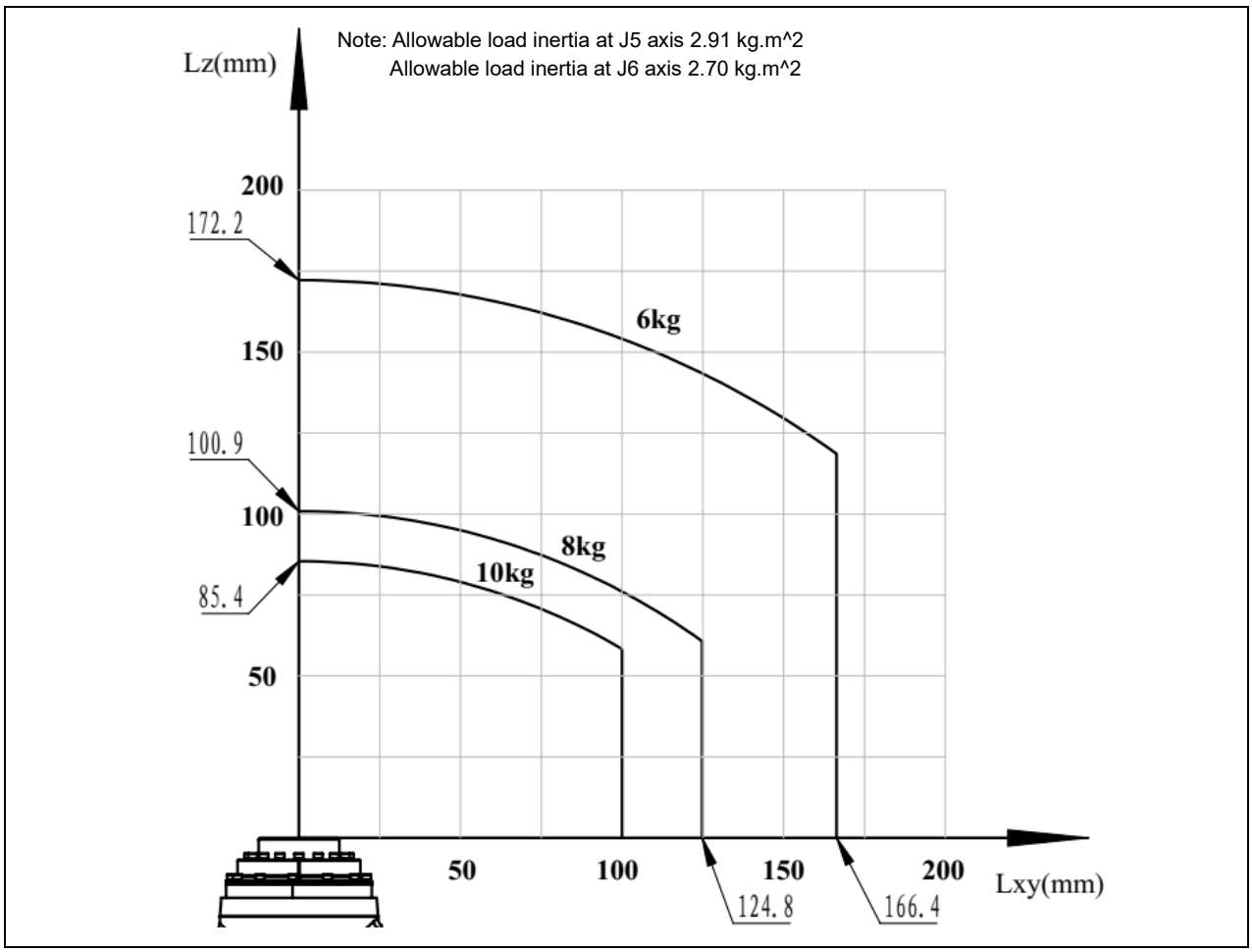


Figure 3.15 Load capacity at wrist (ER20B/10-2010-HI)

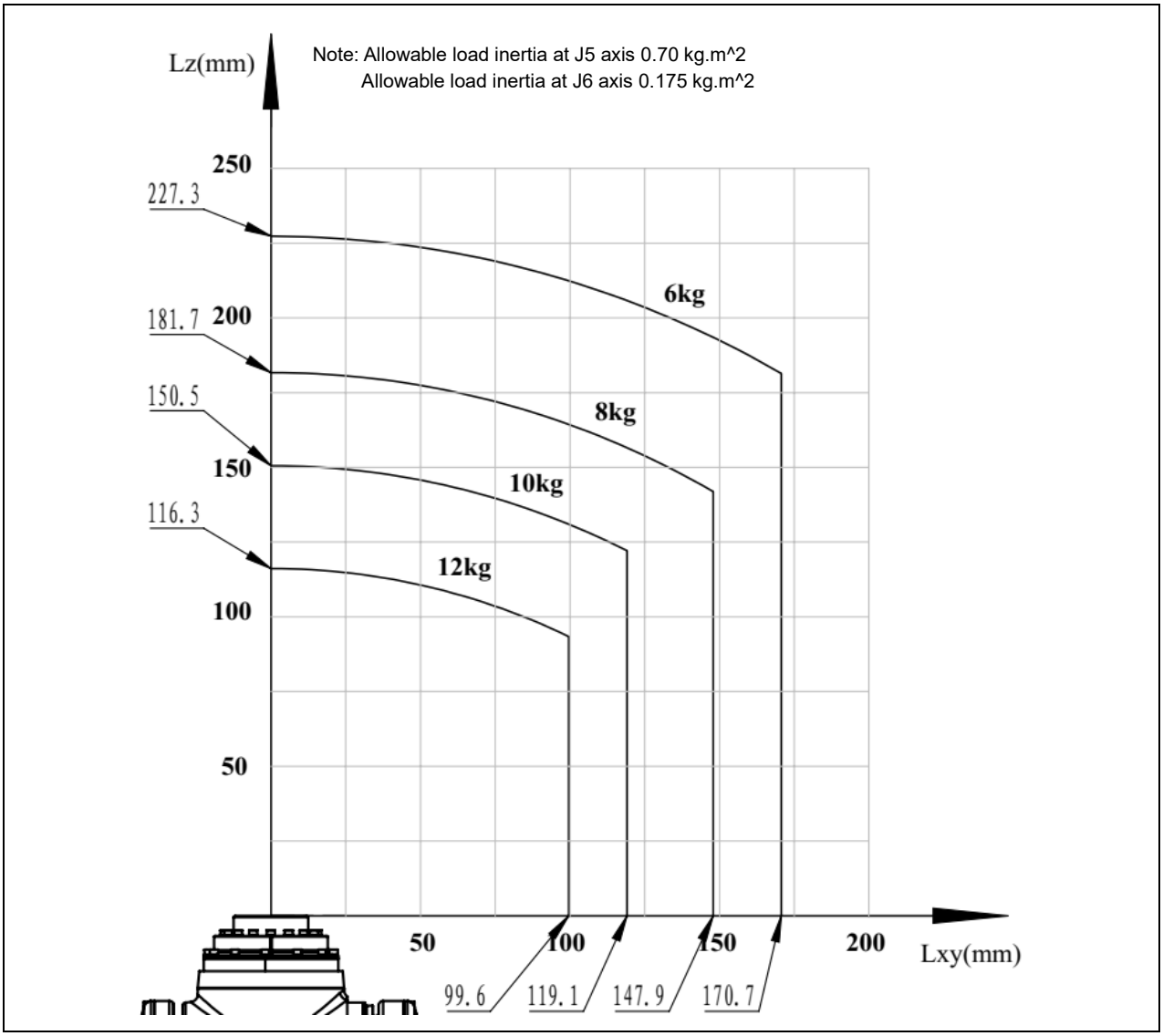


Figure 3.16 Load capacity at wrist (ER12B-1510-LI, ER12B-1510)

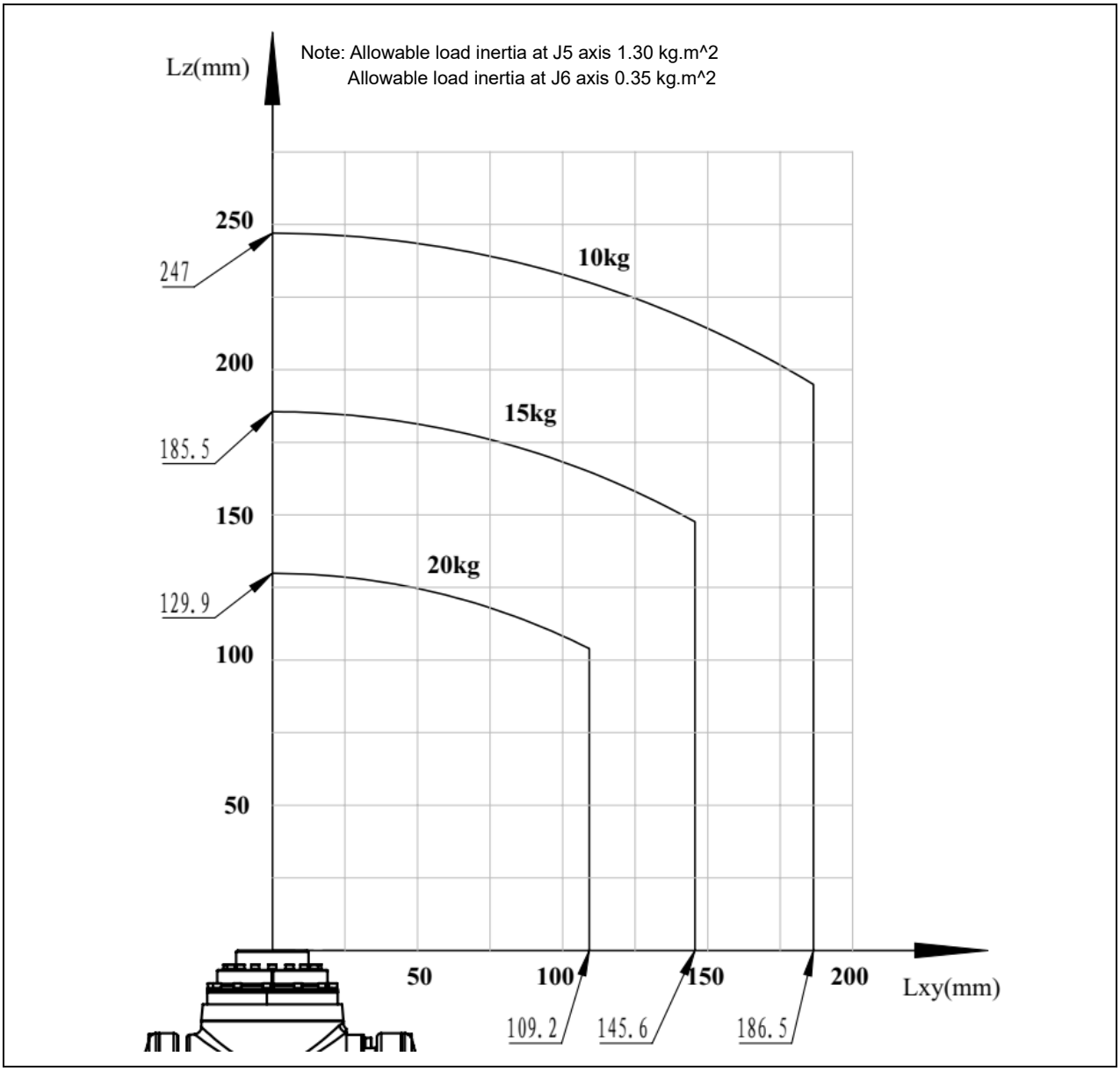


Figure 3.17 Load capacity at wrist (ER20B-1760)

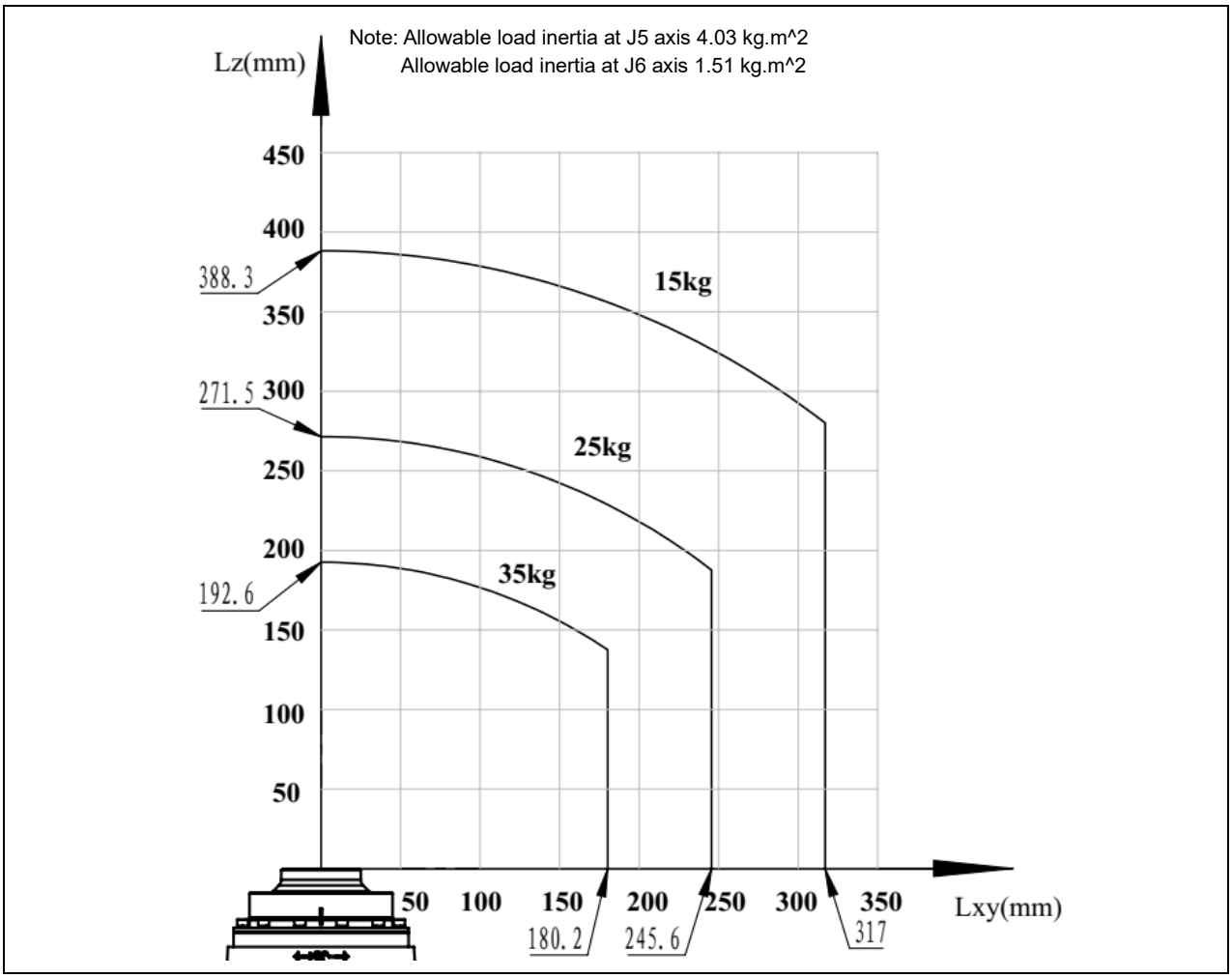


Figure 3.18 Load capacity at wrist (ER35B-1810-LI, ER35B-1810)

3.5. Additional load conditions

The robot may have additional loads. Additional load condition is shown as below.

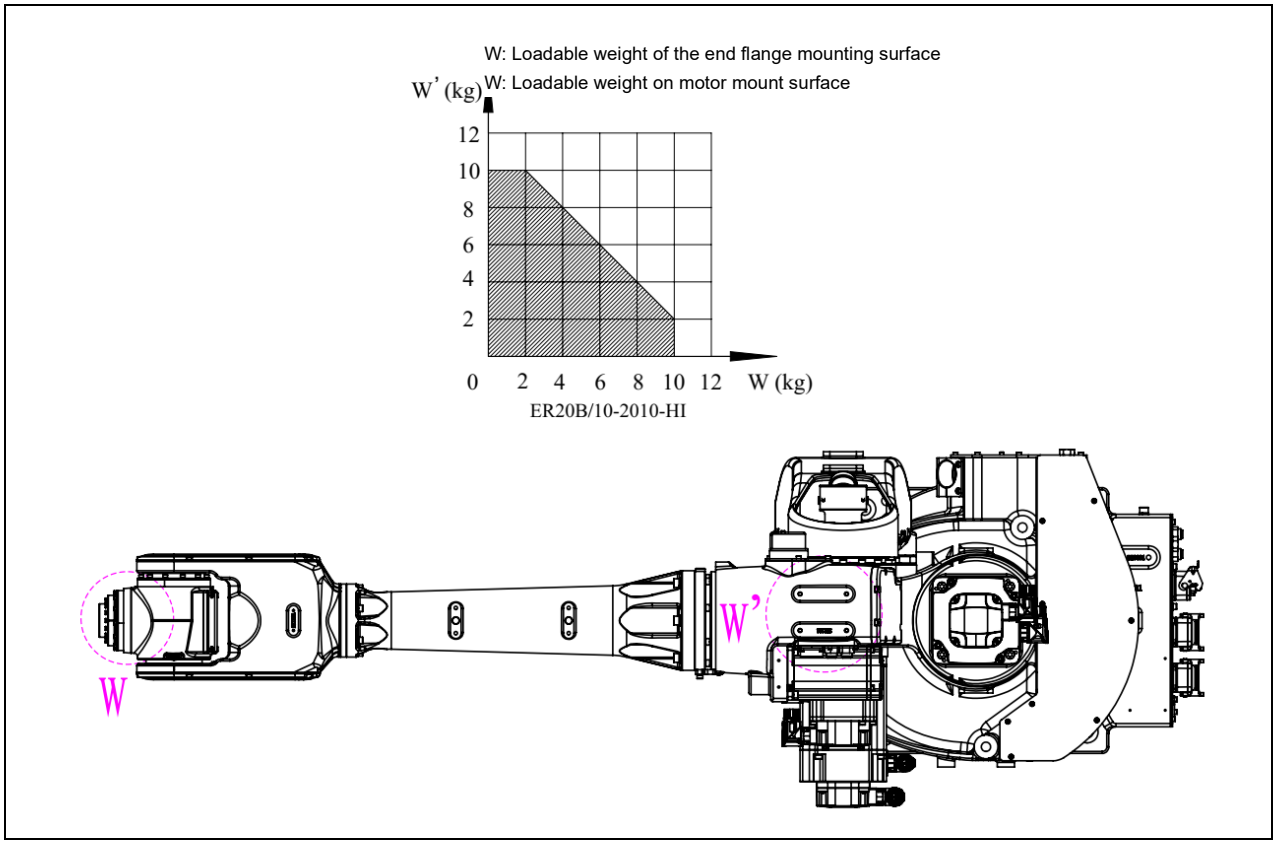


Figure 3.19 Additional load condition (ER20B/10-2010-HI)

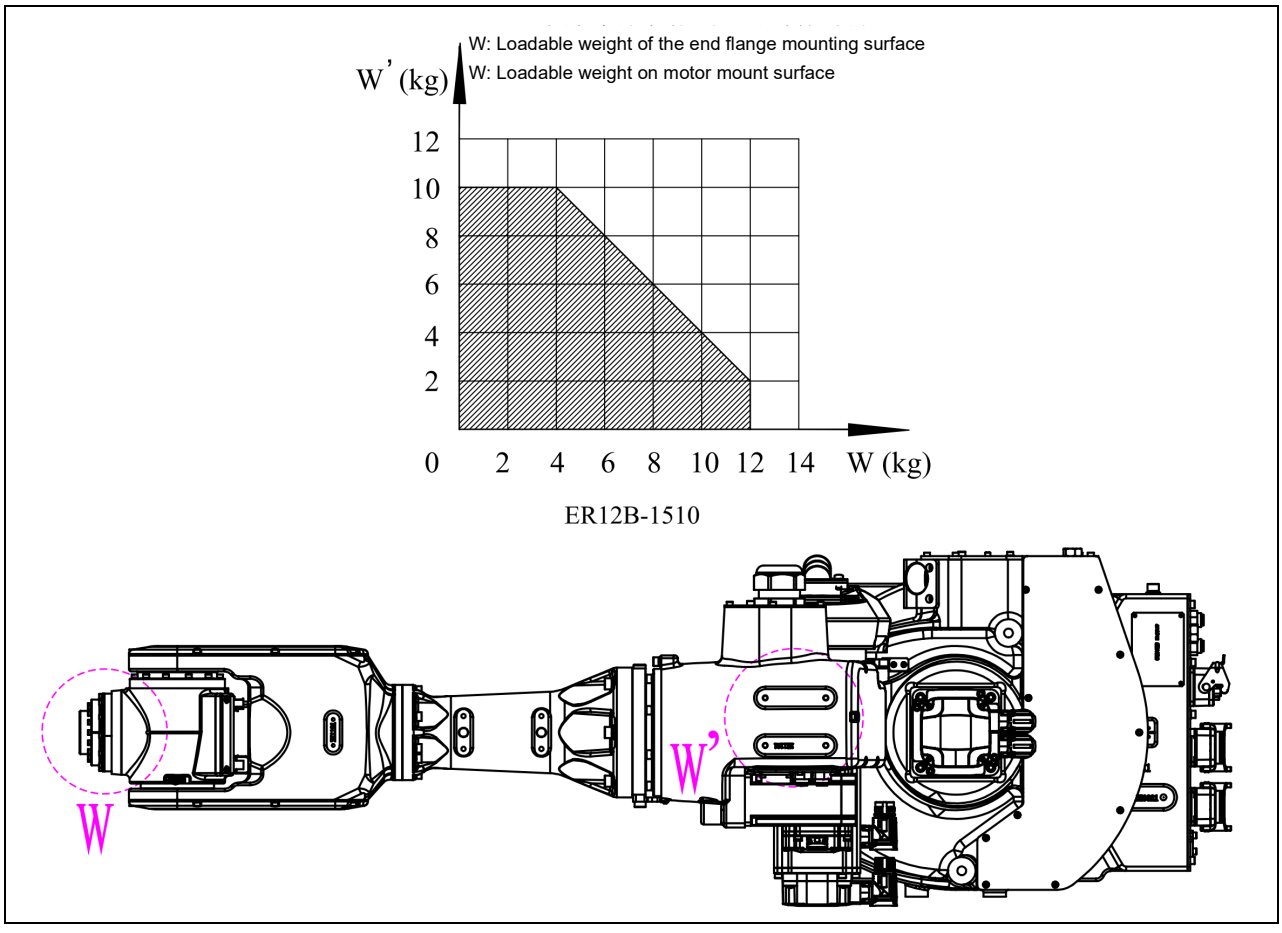
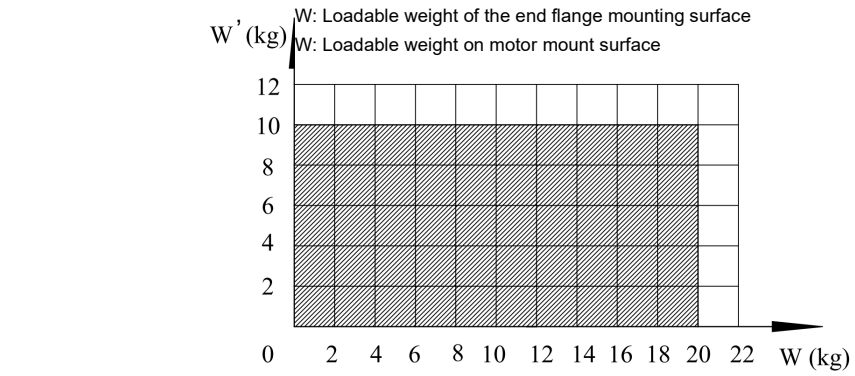


Figure 3.20 Additional load condition (ER12B-1510-LI, ER12B-1510)



ER20B-1760

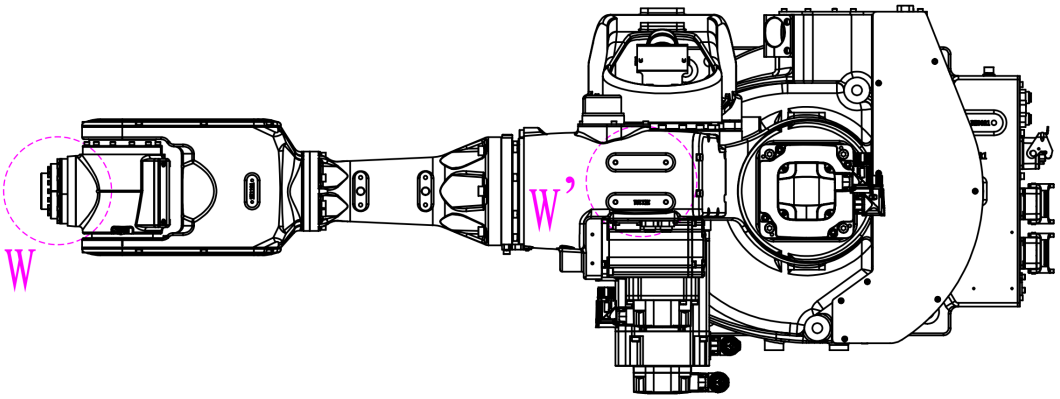
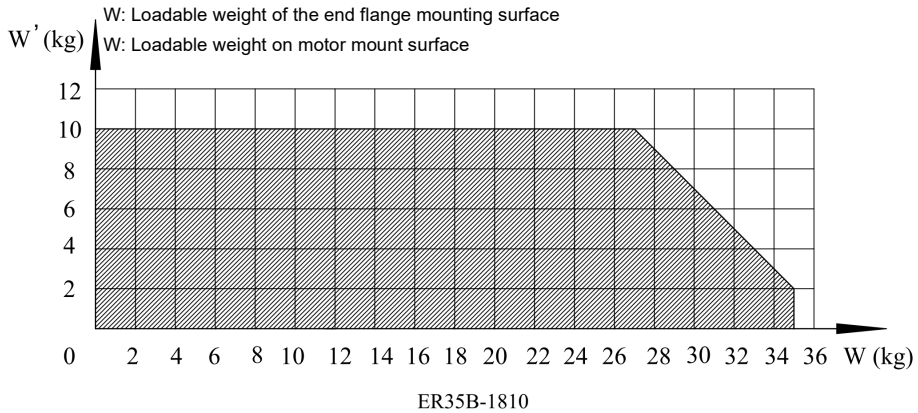


Figure 3.21 Additional load condition (ER20B-1760)



ER35B-1810

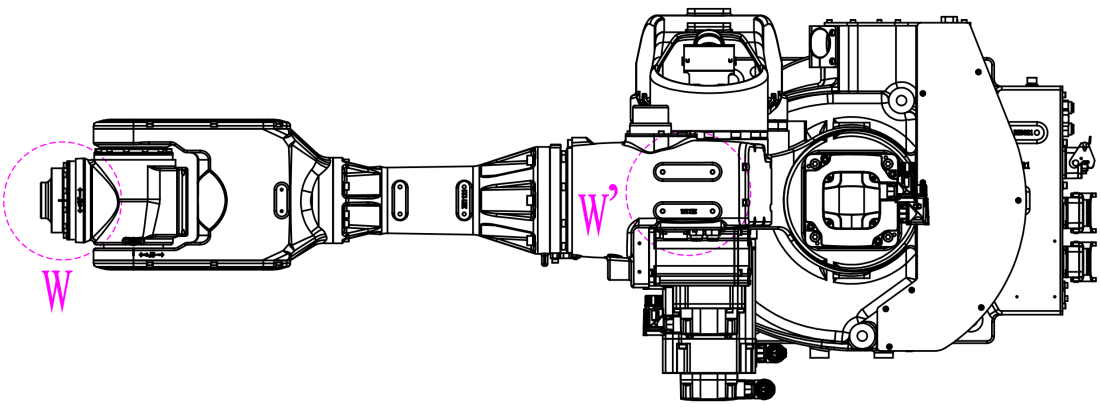
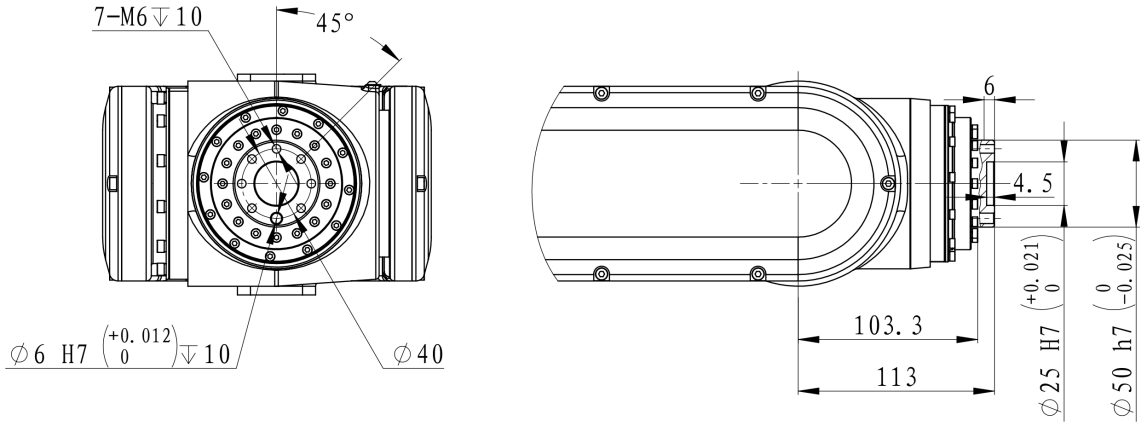


Figure 3.22 Additional load condition (ER35B-1810-LI, ER35B-1810)

4.Equipment Installation

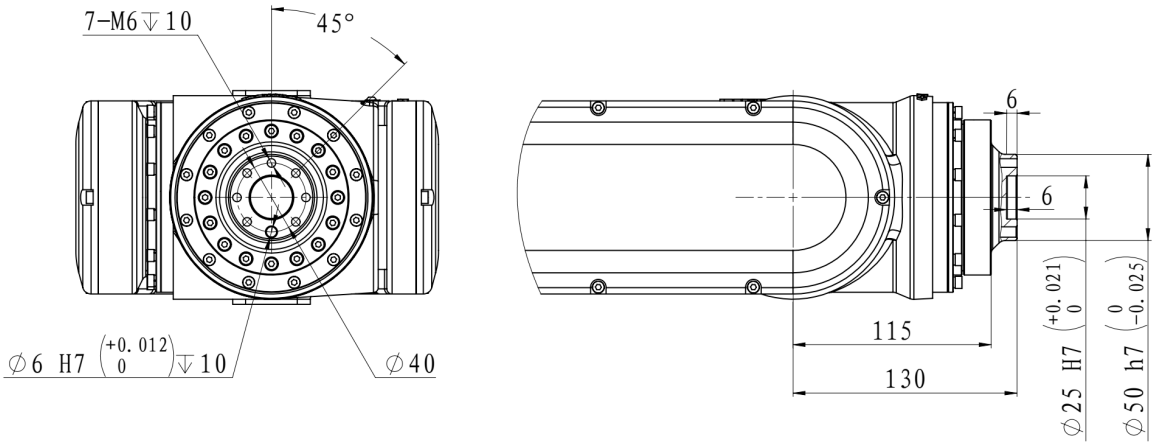
4.1. End flange mounting interface

This section describes the mounting face dimension of the end flange. 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: M6 (GB/T 70.1 12.9 level)	7
Spring washer: spring washer Φ6 (GB/T 93)	7
Positioning pin: cylindrical pin Φ6 (GB/T120.2)	1

Figure 4.1 End flange mounting interface (ER20B/10-2010-HI, ER12B-1510-LI, ER12B-1510, ER20B-1760)



Item and model	Amount
Fixed screw: M6 (GB/T 70.1 12.9 level)	7
Spring washer: spring washer Φ6 (GB/T 93)	7
Positioning pin: cylindrical pin Φ6 (GB/T120.2)	1

Figure 4.2 End flange mounting interface (ER35B-1810-LI, ER35B-1810)

4.2. Equipment mounting face

The figure indicates the locations of the screw holes for equipment installation. The robot has external device mounting threaded holes located on the top of the small arm component.

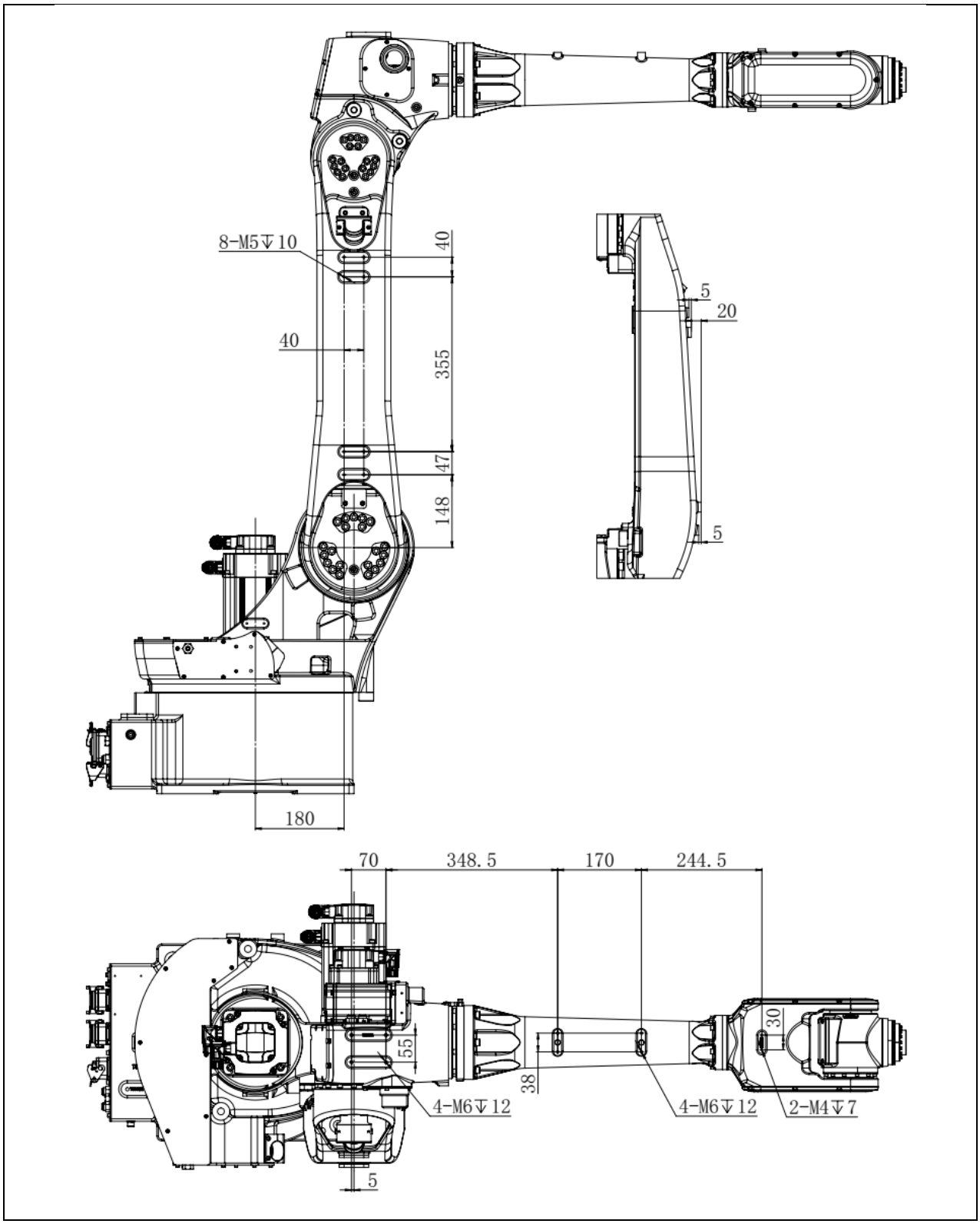


Figure 4.3 Equipment mounting face (ER20B/10-2010-HI)

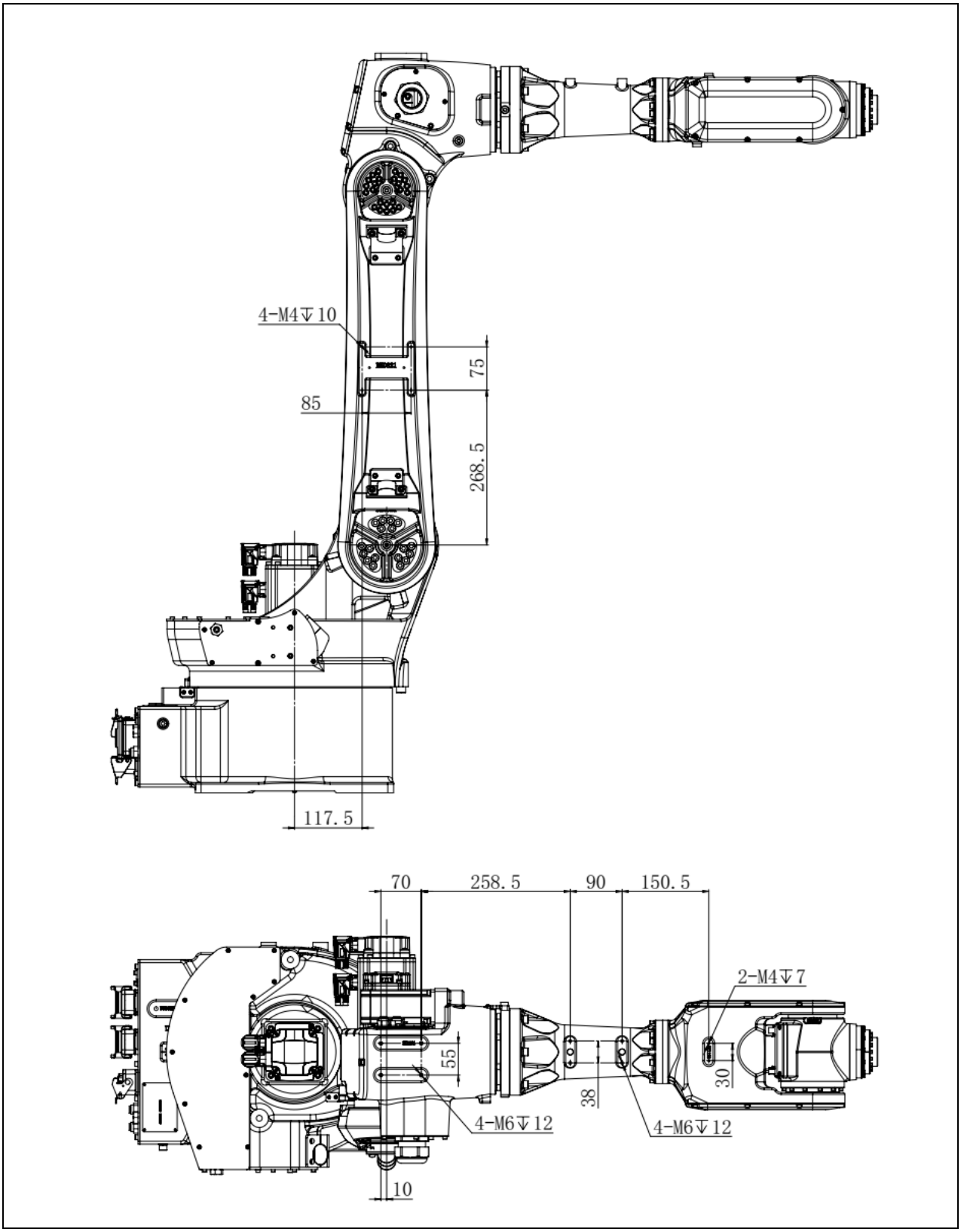


Figure 4.4 Equipment mounting face (ER12B-1510-LI, ER12B-1510)

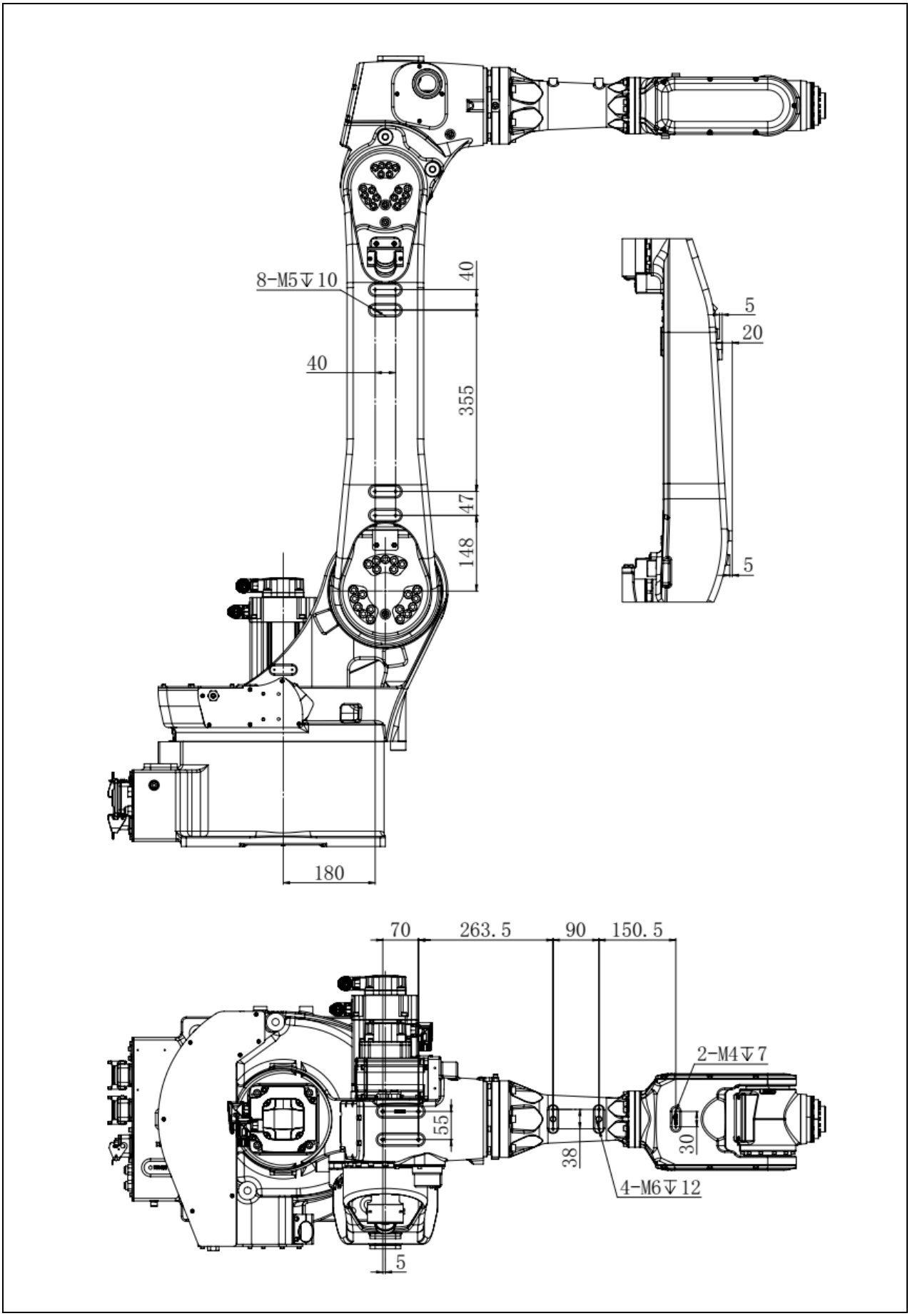


Figure 4.5 Equipment mounting face (ER20B-1760)

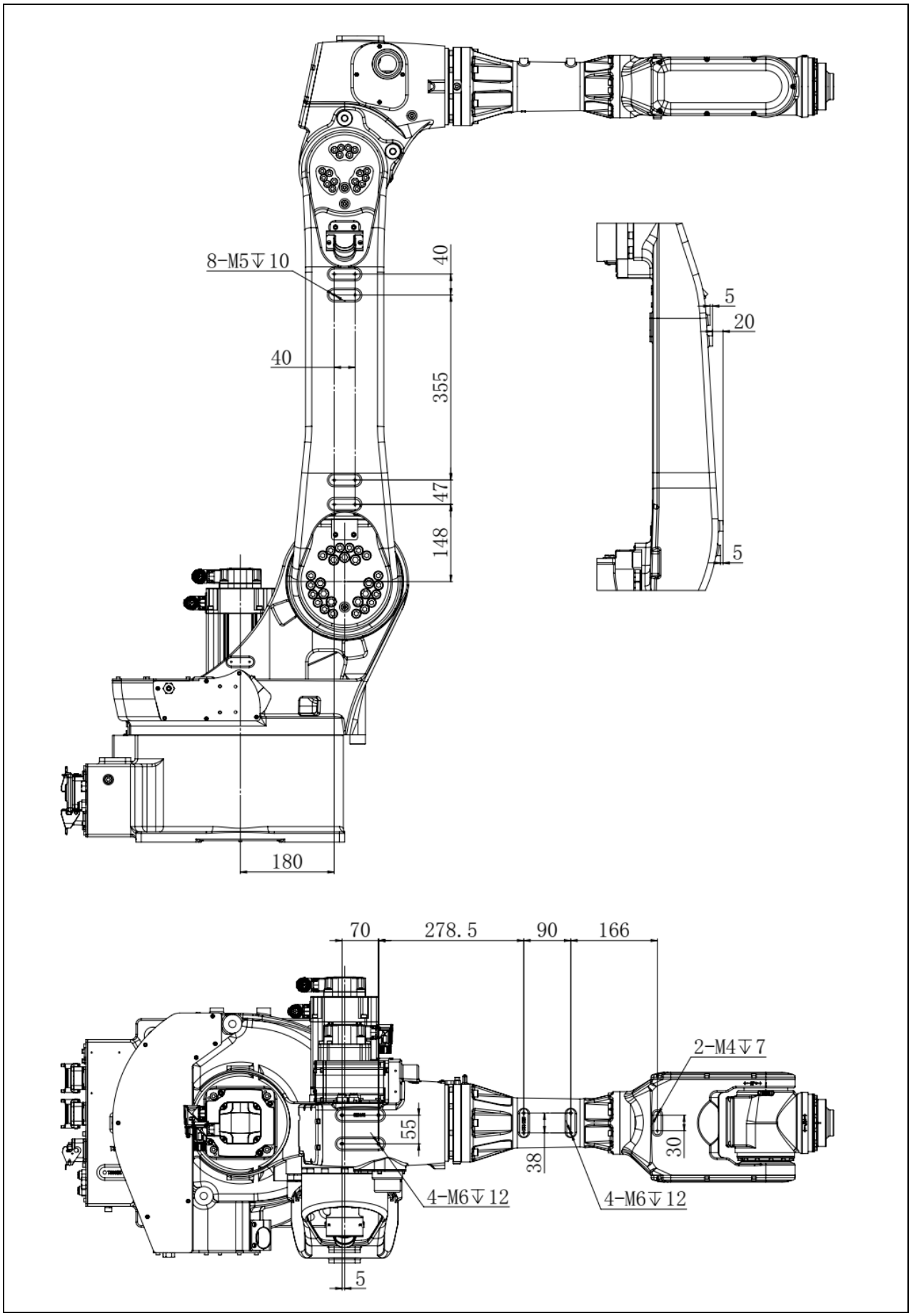


Figure 4.6 Equipment mounting face (ER35B-1810-LI, ER35B-1810)

CAUTION

When installing external equipment, it is important to ensure that there is no interference with the robot body to prevent any accidents.

4.3. External pipelines

This series of robots provides pathways for supplying pneumatic or hydraulic pressure to the end effector mechanism.

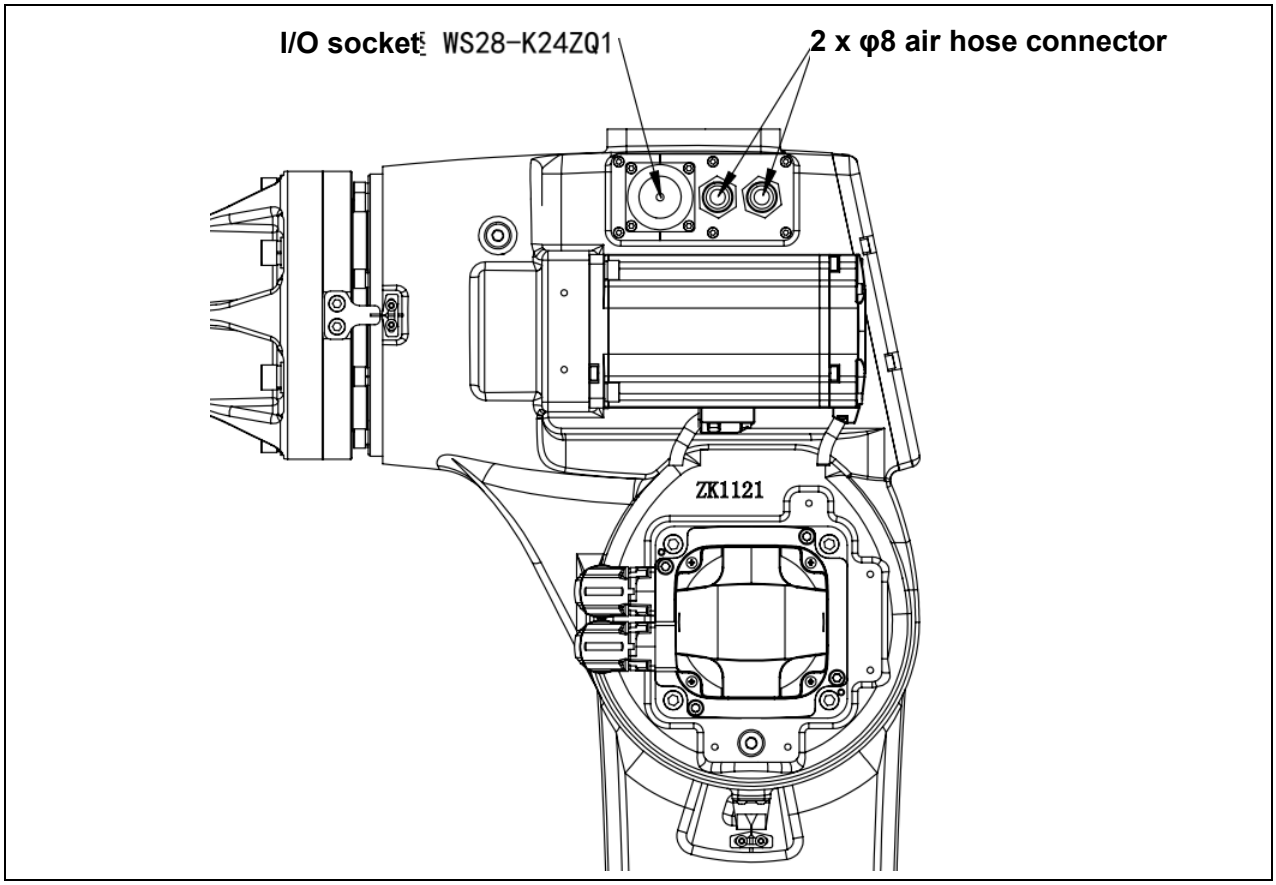


Figure 4.7 External pipelines

5. Check and Maintenance

Before performing any maintenance, be sure to read SAFETY PRECAUTIONS in Chapter 1 and understand the content.

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

5.1. Daily checks

Check the items below before daily operation as occasion demands.

S/N	Check item	Requirements
1	Oil seepage	Please check for any oil leakage from the robot product. If present, please wipe it clean.
2	Vibration, abnormal noises	Inspect each transmission mechanism for vibrations and abnormal noises. If detected, refer to section 7.2 for troubleshooting methods.
3	Positioning accuracy	Check if the current position deviates from the last taught position and if there are any deviations in the stop positions.
4	Cooling fan in the cabinet	Inspect the ventilation of the rear fan in the control cabinet for smooth airflow and any abnormal sounds.
5	Peripheral cable set part	Check for completeness, integrity, wear, and rust.
6	Peripheral electrical equipment	Verify the proper functioning of external circuit connections, check for any damages, and ensure the buttons are working correctly.
7	Warnings	Check if any warnings appear on the teaching pendant screen. If there are any, refer to the alarm code list for appropriate actions.

5.2. Periodic checks and maintenance

Perform maintenance and repairs at approximate intervals based on the specified operating cycle or cumulative operating time. By following the regular maintenance steps, the robots optimal performance can be maintained. Users can carry out scheduled inspections and maintenance according to the table below, or they can contact ESTUNs professionals for 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	3years 11520h	4years 15360h		
○ 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.
	○					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.
	○					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 first check	○				Check for damages to the teach pendant cable, the operation box connection cable or the robot connection cable	Check whether the cable connected to the teach pendant, operation box and robot are unevenly twisted or damaged. If damage is found, replace the damaged cables.
	○ Only first 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 first 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 first check	○				Check the connection of each axis motor and other exposed connectors	Check the connection of each axis motor and other exposed connectors.
	○ Only first check	○				Retightening the end effector mounting bolts	Retightening the end effector mounting bolts.
	○ Only first 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 the end of the manual. 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 first 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 first 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 first 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.
		○				Replace the mechanical unit battery	Replace the controller battery.
		○				Replace the grease of each axis reducer	Replace the grease of each axis reducer.
					○	Replace the mechanical unit cable	Replace the mechanical unit cable. Contact ESTUN representative for information regarding replacing the cable.

5.3. Adjustment of drive belts

J5-axis of this series of robots is drove by timing belt. The belt tense tends to reduce after a period of operation. This section describes how to strain the belt.

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 are shown below:

1. Remove the hexagon socket head cap screws M4×8 from the left and right cover plates of the forearm, and place the cover plates in the designated storage area.

2. Loosen the hexagon nut M5 that secures the J5 axis motor.

3. Adjust the adjustment device on the left side of the motor, primarily adjusting the M4×30 bolt to ensure that the bolt head is tightly against the J5 axis motor flange.

4. Test the tension of the timing belt on the side of the belt and adjust it to an appropriate tension (refer to the specific range in the table below).

5. Tighten the hexagon nut M5 to secure the J5 axis motor, and also tighten the hexagon nut M4 that secures the bolt.

6. Attach the left and right cover plates to the wrist connection body using hexagon socket head cap screws M4×8. Apply a uniform layer of Loctite 5910 silicone adhesive to the cover plates, and tighten the screws symmetrically.

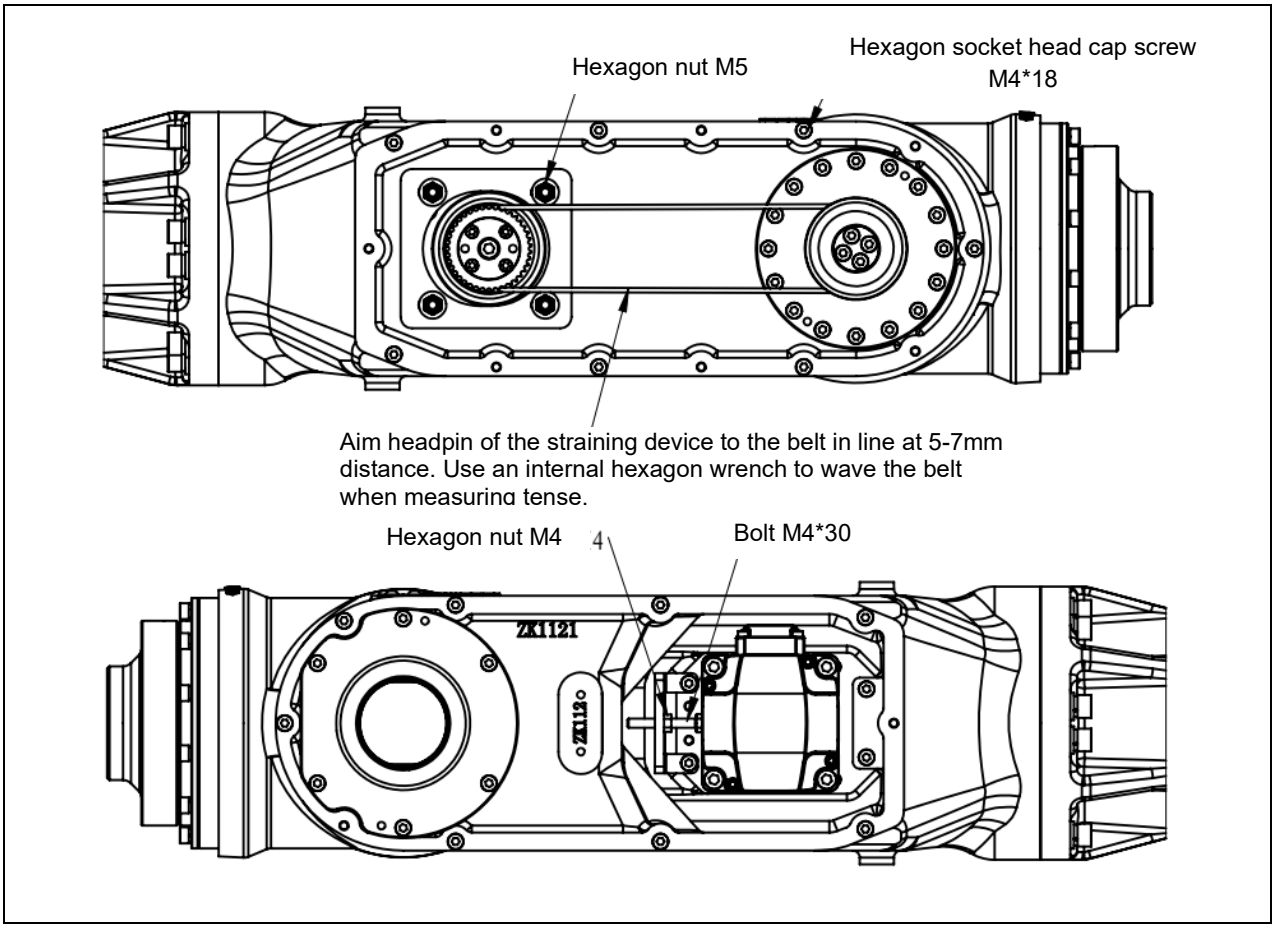


Figure 5.1 Strain the timing belt

Table 5.1 Timing belt tense/frequency value reference (ER20B/10-2010-HI, ER12B-1510-LI, ER12B-1510, ER20B-1760)

Model		Range of belt tense	Range of frequency
Timing belt	new belt (new)	44.2~48.6N	129~136Hz
	used belt (old)	31.0~35.4N	108~116Hz

Table 5.2 Timing belt tense/frequency value reference (ER35B-1810-LI, ER35B-1810)

Model		Range of belt tense	Range of frequency
Timing belt	new belt (new)	76~90N	162.7~177.1Hz
	used belt (old)	76~85N	162.7~172.1Hz

It is preferable to measure the frequency (Hz) to determine the tension of the timing belt. When measuring using a frequency meter, there is no need to adjust the internal parameters of the tension meter. Before reinstalling an old belt, inspect each pulley for any deformations and check the timing belt for any abnormalities. If any issues are found, promptly replace the pulley and timing belt.

5.4. Replacement of batteries

The position data of each axis is preserved by the backup batteries. The batteries need to be replaced every 1 year. Also use the following procedure to replace when the backup battery voltage drop alarm occurs.

Procedure of replacing the battery is shown below.

1. Press the emergency stop button to stop the robot motion.

2. Remove the plug cover on the robot base.
3. Take out the old batteries from the battery case.
4. Insert new batteries into the battery case while observing the correct direction.
5. Re-mount the cover after replacing the battery.

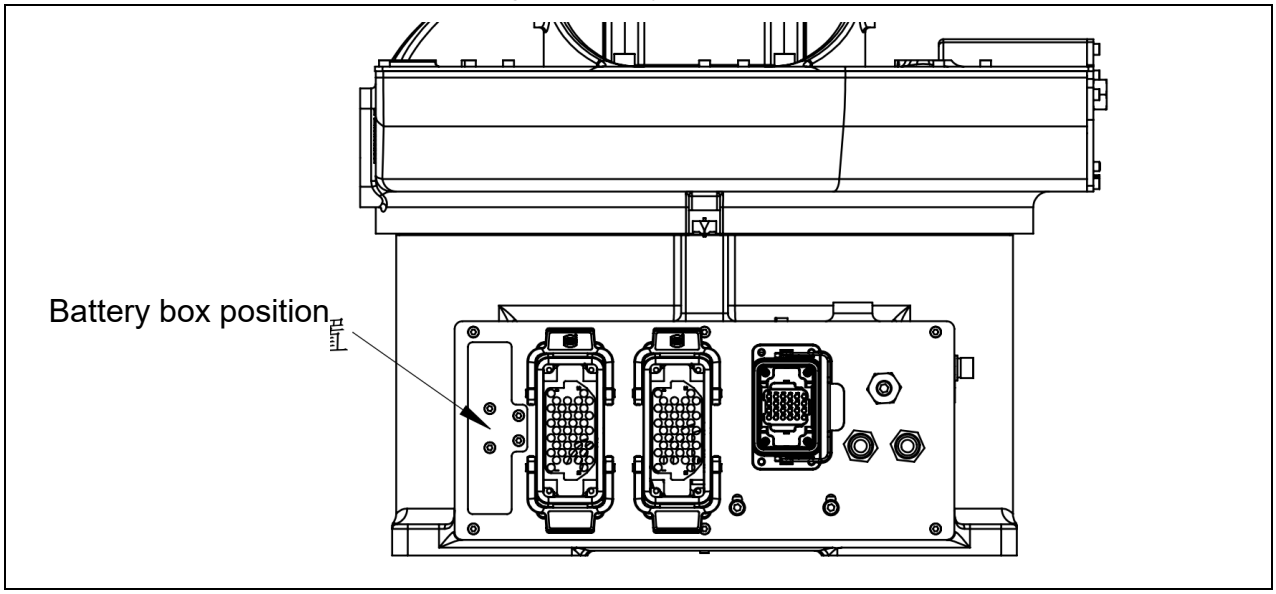


Figure 5.2 Battery position

CAUTION

During the battery replacement process, it is important to keep the control cabinet powered on. If the control cabinet loses power, the robot's position information will be lost, and after replacing the battery, a zero-point calibration will be required.

5.5. Robot greasing

For the J1~J4 axes oil chambers in this series of r obots, the grease and oil should be replaced at intervals of every 1 year or when the cumulative operating time reaches 5,000 hours, whichever is shorter. The lubricant types and grease quantities for each joint are listed in the table below.

CAUTION

When the robot operates in harsh environments, experiences frequent small-angle movements, or runs continuously at high frequencies for extended periods, it is recommended to shorten the lubricant replacement interval for the corresponding joints to 3000 hours.

Table 5.2 Replacing the grease periodically

Model	Position	Quantity
ER20B/10-2010-HI ER20B-1760 ER35B-1810	J1-axis reducer	1200g
	J2-axis reducer	1460g
	J3-axis reducer	370g
	J4-axis reducer	280g
ER12B-1510-LI	J1-axis reducer	330g
	J2-axis reducer	310g
	J3-axis reducer	230g
	J4-axis reducer	245g
ER12B-1510	J1-axis reducer	390g
	J2-axis reducer	310g
	J3-axis reducer	230g
	J4-axis reducer	245g
ER35B-1810-LI	J1-axis reducer	1050g
	J2-axis reducer	1410g
	J3-axis reducer	340g
	J4-axis reducer	280g

The following table provides the recommended azimuth angles for lubricant replacement or replenishment operations. Please note that users should not attempt to replace the lubricant at the robot wrist themselves.

Table 5.3 Robot joint greasing angle

Position	Azimuth			
	J1	J2	J3	J4
J1-axis reducer	Any	0°	Any	Any
J2-axis reducer				
J3-axis reducer			0°	
J4-axis reducer				0°

5.5.1. Position of oil inlet/outlet on each axis

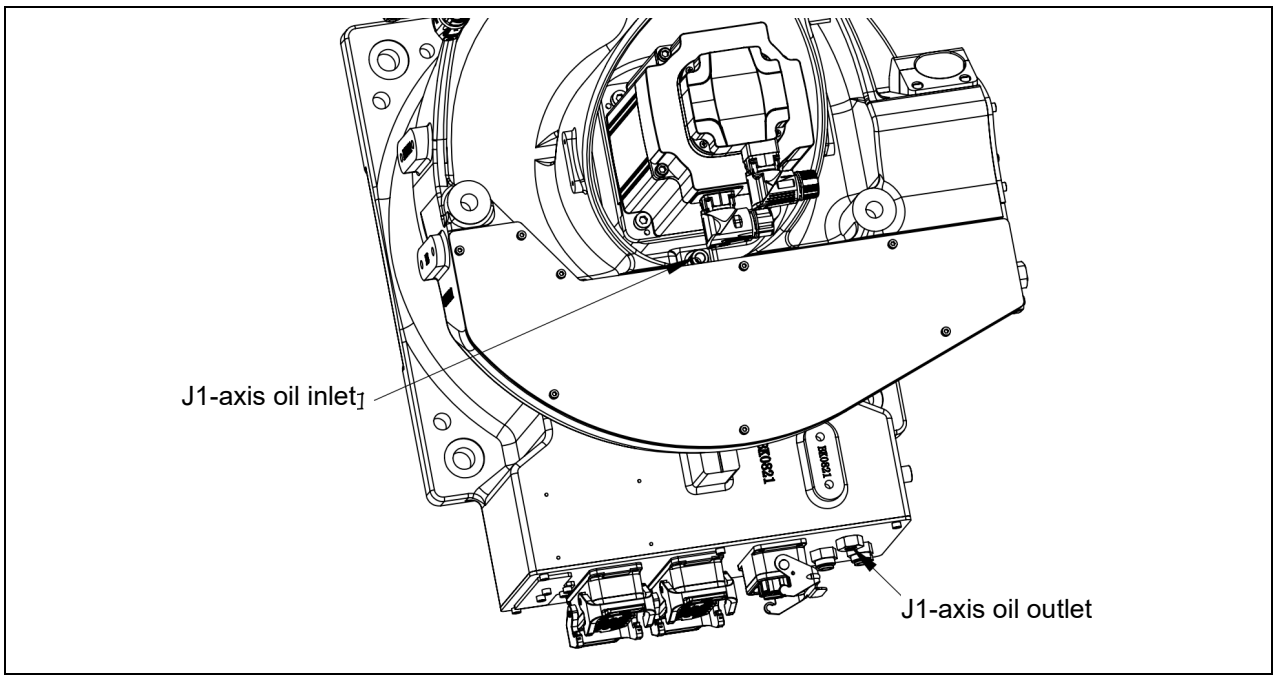


Figure 5.3 J1-axis oil inlet/outlet

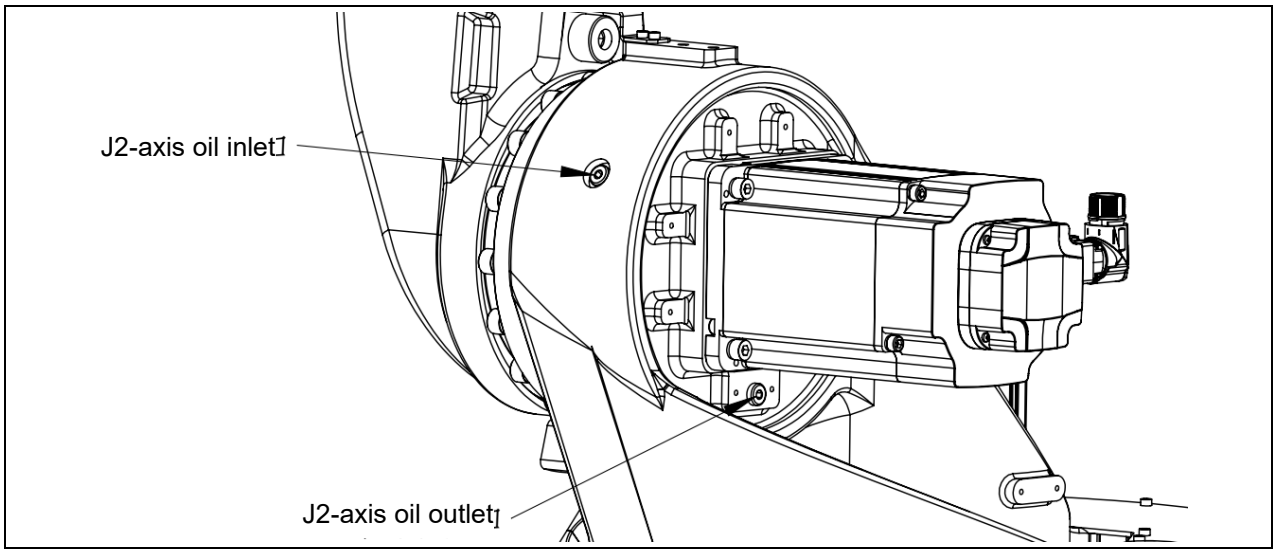


Figure 5.4 J2-axis oil inlet/outlet

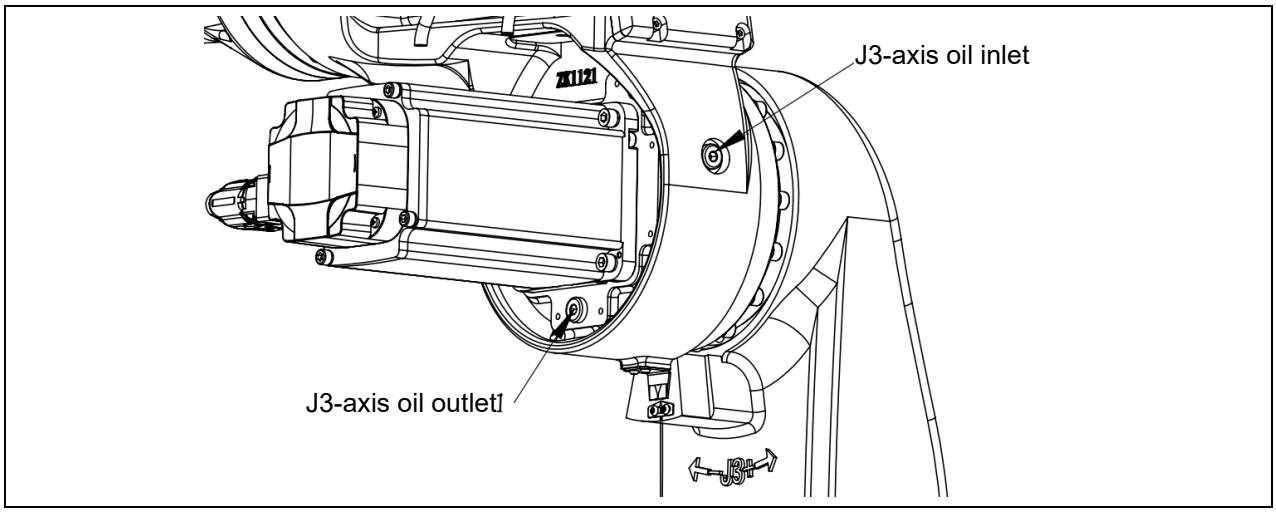


Figure 5.5 J3-axis oil inlet/outlet

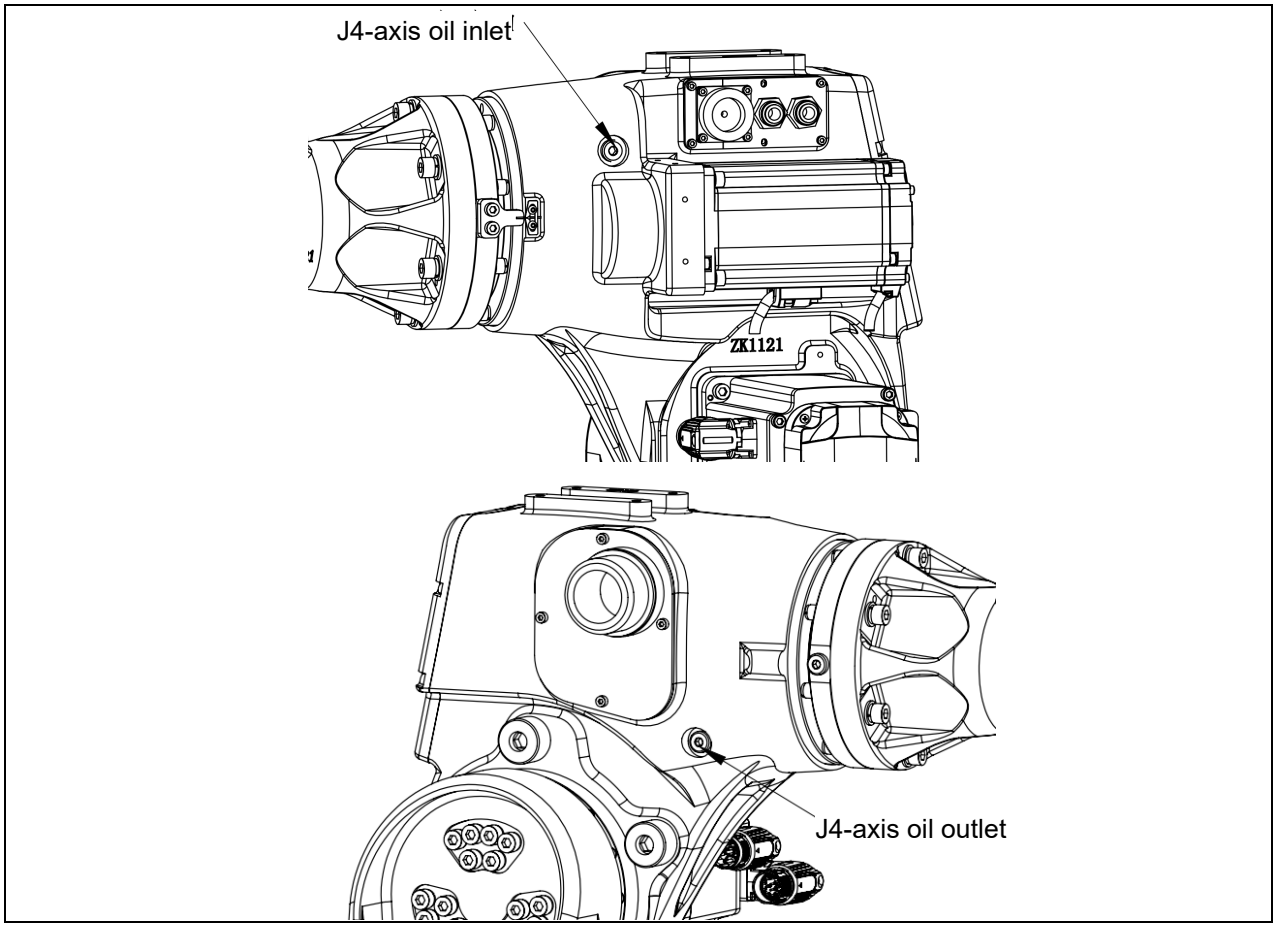


Figure 5.6 J4-axis oil inlet/outlet

In this series of robots, under normal operating conditions, the J5 and J6 axes reducers do not require lubricant replenishment (except for cases involving reducer replacement). However, under severe conditions such as high duty cycle, high-speed movements, and heavy loads, regular lubricant replacement is necessary. For inquiries regarding lubricant replacement, please contact ESTUN.

5.6. Oil leakage inspection

Maintenance Area

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

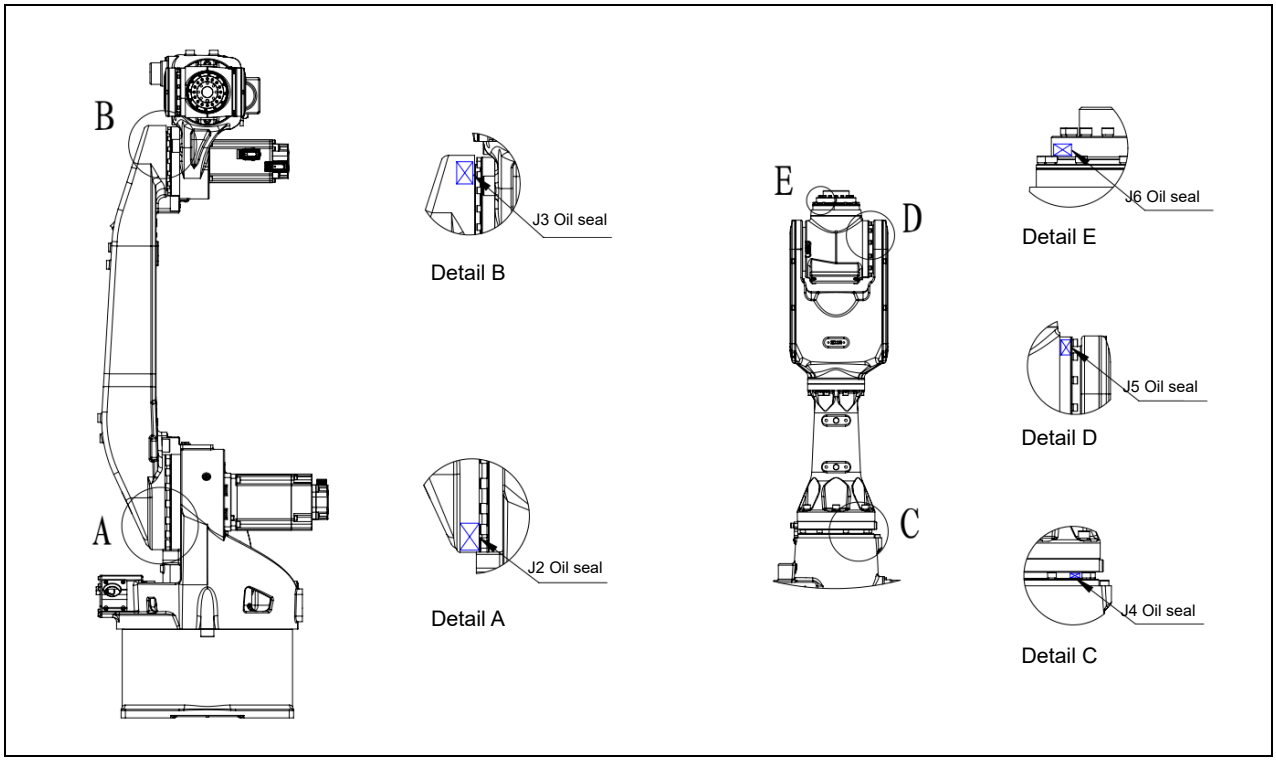


Figure 5.7 Inspection area of oil seals

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

CAUTION

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

6. Zero Calibration

6.1. Introduction

Zero 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, zero alibration is an operation for obtaining the pulse count value, corresponding to the zero position.

“Zero 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
- Batteries for pulse count backup in the mechanical unit have gone dead

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. Calibration with instrumentation

During the factory setup, all loads on the robot need to be removed, and instrumentation is used for calibration. This calibration method is based on the complete set of robot parameters and utilizes instrumentation and software to achieve the most precise zero-point calibration.

In case of electrical or software issues resulting in the loss of zero-point data, restoring the previously stored zero-point data serves as a quick teaching and debugging reference. However, if mechanical disassembly or repairs lead to the loss of robot zero-point data, this method cannot be applied.

ESTUN employs robot encoder information to assist in zero-point calibration, following these steps:

a) Manually operate the robot and align the axis with two zero reference marks.

b) Open the encoder information display interface and compare the current actual single-turn data with the previously calibrated reference single-turn data. Adjust the axis at a lower speed to make the current single-turn data closely match the reference single-turn data.

c) Calibrate the zero point of the axis. Create a new program in the teach pendant, add the "RefRobotAxis" instruction, select the axis to be calibrated, and execute the command.

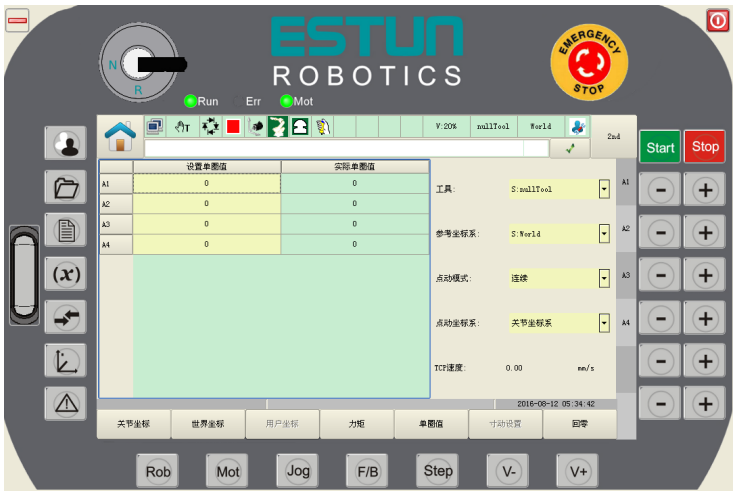


Figure 6.1 Quick zero calibration single-turn value

6.3. Mechanical zero calibration

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

6.3.1.Zero calibration for J1-axis

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) Use teach pendant to move J1-axis to the position where two marks are aligned.

b) Set this position as zero position of J1-axis with the teach pendant.

Perform zero position 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.

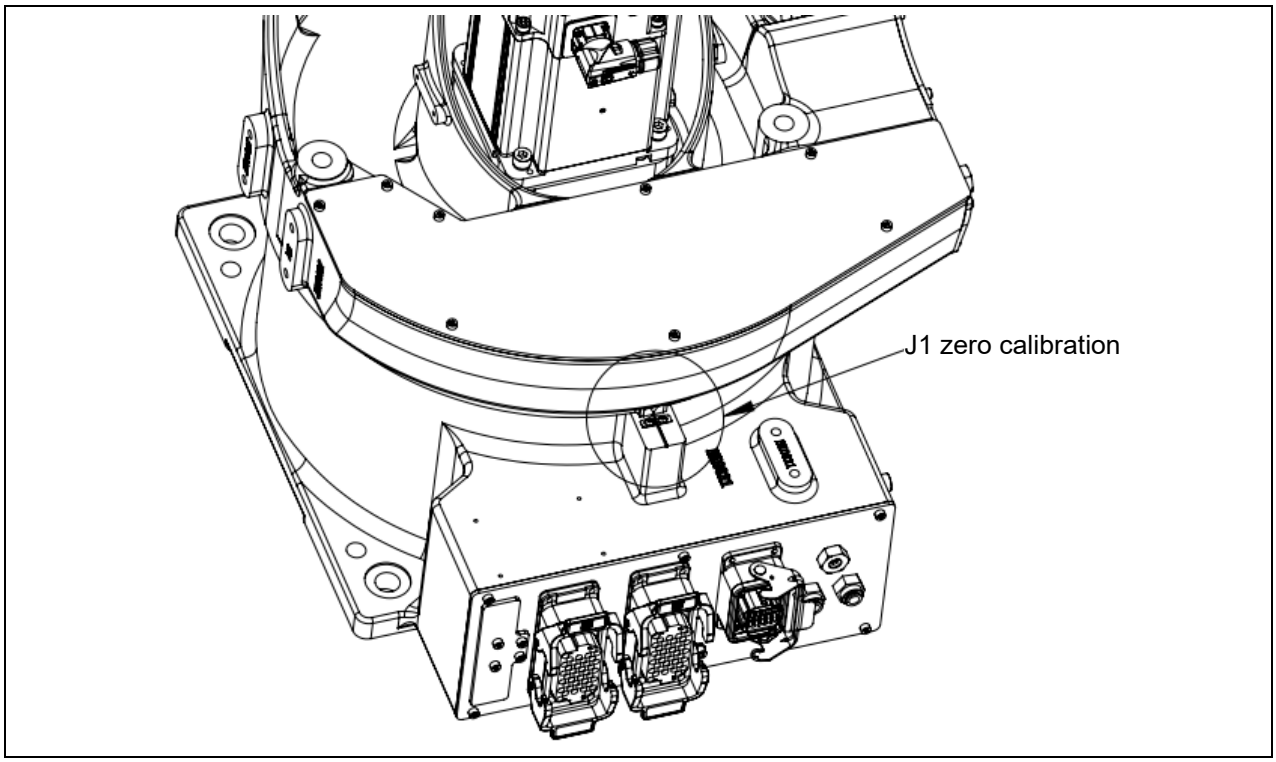


Figure 6.2 Calibration for J1-axis

6.3.2. Zero calibration for J2-axis

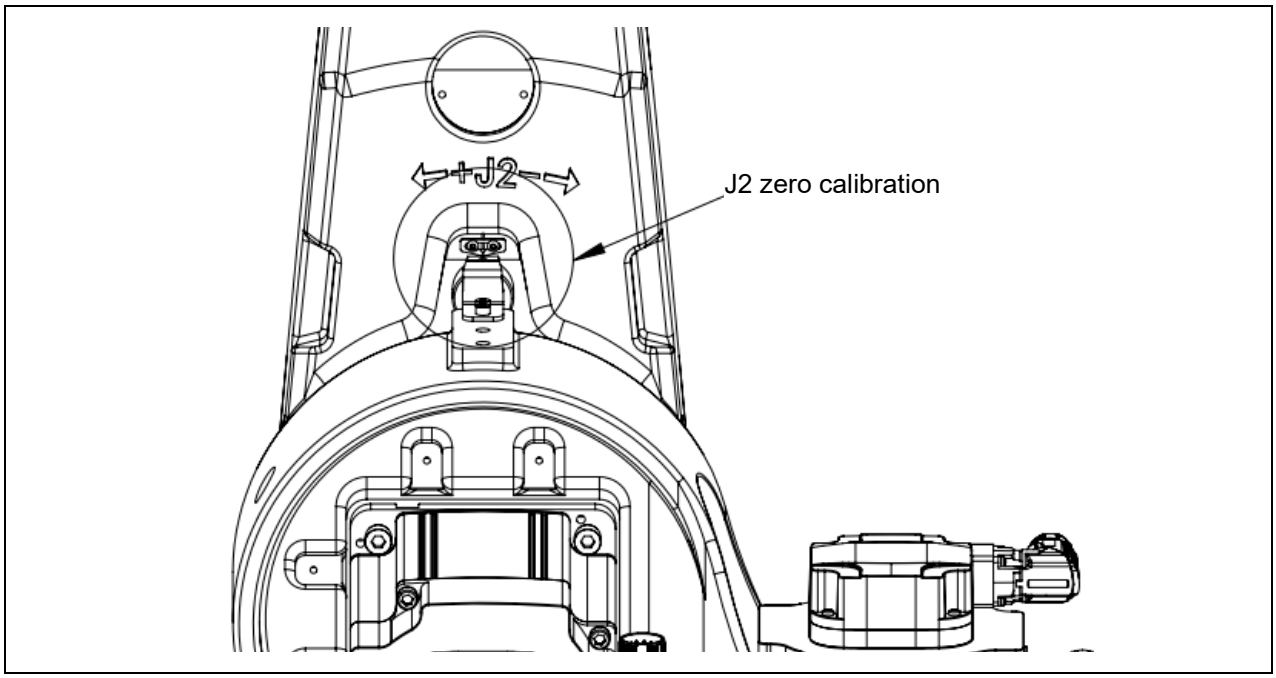


Figure 6.3 Calibration for J2-axis

6.3.3. Zero calibration for J3-axis

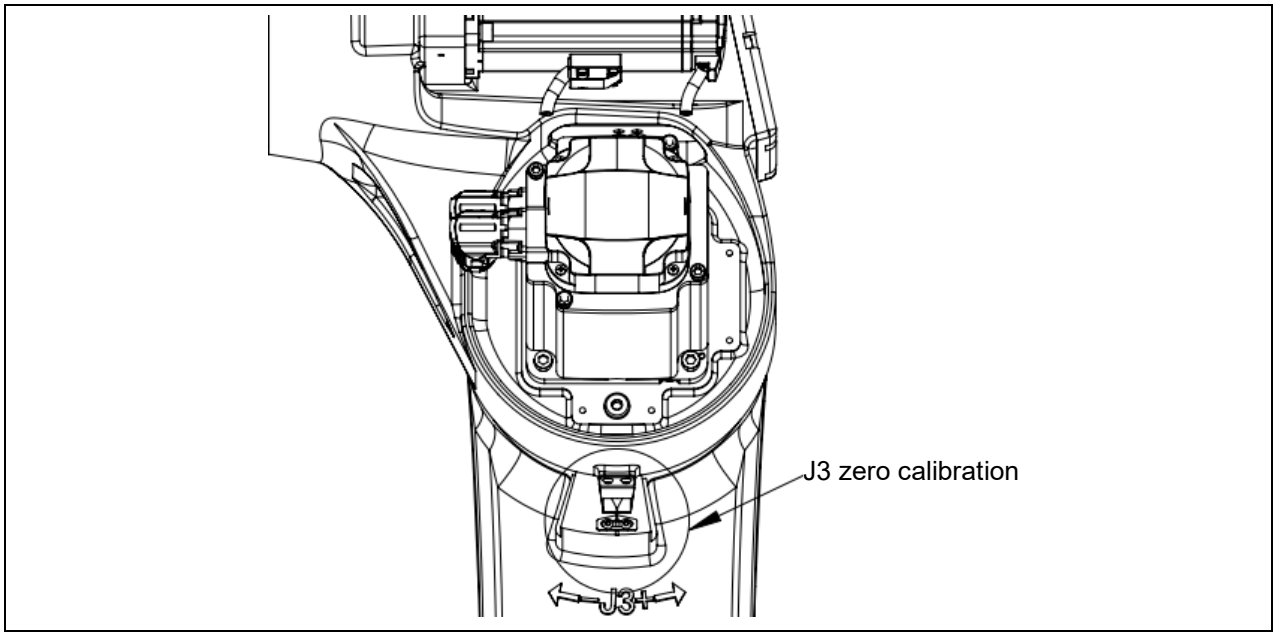


Figure 6.4 Calibration for J3-axis

6.3.4. Zero calibration for J4-axis

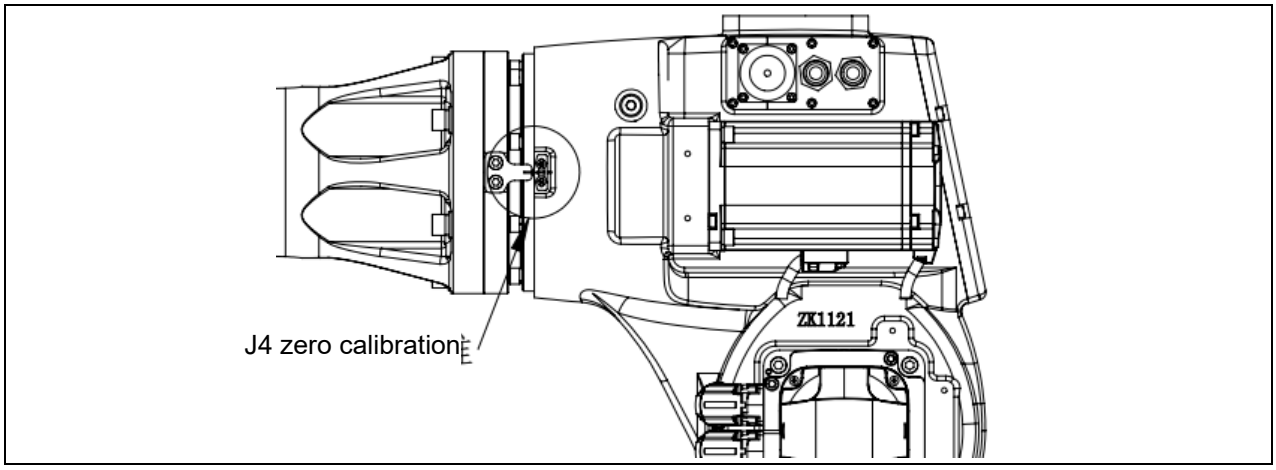


Figure 6.5 Calibration for J4-axis

6.3.5. Zero calibration for J5-axis and J6-axis

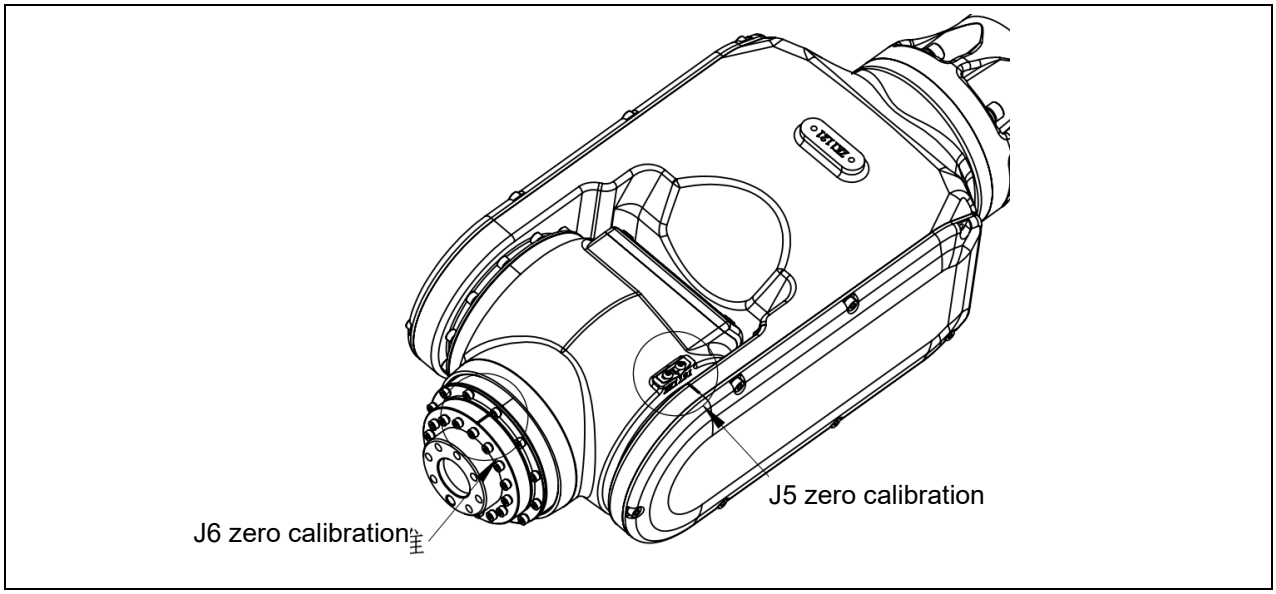


Figure 6.6 Calibration for J5-axis and J6-axis

7.Troubleshooting

Be sure to read SAFETY PRECAUTIONS in Chapter 1 and understand its contents before any maintenance.

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 damaged sealing oil seal or O-ring.
		The damage to the sealing ring may occur due to mishandling during disassembly and reassembly.	Replace the damaged sealing oil seal or O-ring.
		The rupture of the oil seal can be attributed to scratches on the lip caused by the intrusion of foreign particles such as dust.	Depending on the location of the oil leakage, replace the gearbox if the oil seal is damaged at the gearbox position; replace the oil seal at the motor end with a new one.
		There are gaps present on the sealing surface.	Tighten the installation screws to ensure a tight fit between the mating surfaces.
		The sealant on the motor or gearbox mounting surface has failed.	Apply a fresh coat of sealant.
		There are issues with the oil nozzle or plug.	Replace the faulty oil nozzle or plug with a new one.

Symptom	Description	Cause	Solution
		Cracks or damage to the oil chamber can occur as a result of collisions or other incidents in the casting.	Replace the worn-out components.
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. Replacement of servo motor components

Contact ESTUN technical representative if servo motor replacement is needed.

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.

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

Appendix

Appendix A Screw tightening torque list

Bolt Models (GB/T 70.1)	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18
Tightening Torque /N.m (Level 12.9)	2	4	9	15.6	37.2	73.5	129	205	319	441

Appendix B Specifications and technical parameters of chemical bolts

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 List of recommended spare parts for ER20B/10-2010-HI (required for one unit/set)

S/N	Material code	Name	Qty.	Remark
1	12700000298	Robot servo motor (J1/J2-axis)	2	
2	12700000767	Robot servo motor (J3-axis)	1	
3	12700000487	Robot servo motor (J4-axis)	1	
4	12J00000068	Robot servo motor (J5-axis)	1	
5	12700000055	Robot servo motor (J6-axis)	1	
6	26100001056	Wrist unit	1	
7	G5401000049	Timing belt	1	
8	51200000103	Lithium battery ER14505	6	

Appendix D List of recommended spare parts for ER12B-1510-LI and ER12B-1510 (required for one unit/set)

S/N	Material code	Name	Qty.	Remark
1	12700000526	Robot servo motor (J1/J2-axis)	2	
2	12700000517	Robot servo motor (J3-axis)	1	
3	12700000059	Robot servo motor (J4-axis)	1	
4	12700000673	Robot servo motor (J5-axis)	1	
5	12700000055	Robot servo motor (J6-axis)	1	
6	26100001058	Wrist unit	1	
7	G5401000049	Timing belt	1	
8	51200000103	Lithium battery ER14505	6	

Appendix E List of recommended spare parts for ER20B-1760 (required for one unit/set)

S/N	Material code	Name	Qty.	Remark
1	12700000298	Robot servo motor (J1/J2-axis)	2	
2	12700000767	Robot servo motor (J3-axis)	1	
3	12700000487	Robot servo motor (J4-axis)	1	
4	12700000160	Robot servo motor (J5-axis)	1	
5	12700000055	Robot servo motor (J6-axis)	1	
6	26100000899	Wrist unit	1	
7	G5401000049	Timing belt	1	
8	51200000103	Lithium battery ER14505	6	

Appendix F List of recommended spare parts for ER35B-1810-LI and ER35B-1810 (required for one unit/set)

S/N	Material code	Name	Qty.	Remark
1	12700000298	Robot servo motor (J1/J2-axis)	2	
2	12700000767	Robot servo motor (J3-axis)	1	
3	12700000487	Robot servo motor (J4-axis)	1	
4	12700000160	Robot servo motor (J5-axis)	1	
5	12700000059	Robot servo motor (J6-axis)	1	
6	26100000875	Wrist unit	1	
7	G5400000523	Timing belt	1	
8	51200000103	Lithium battery ER14505	6	

Revision Record

Revision	Date	Contents
01	2022.10	New edition.
02	2023.03	Update the contents of transport signs, mechanical stopper position, adjustment of the drive belt, etc.

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