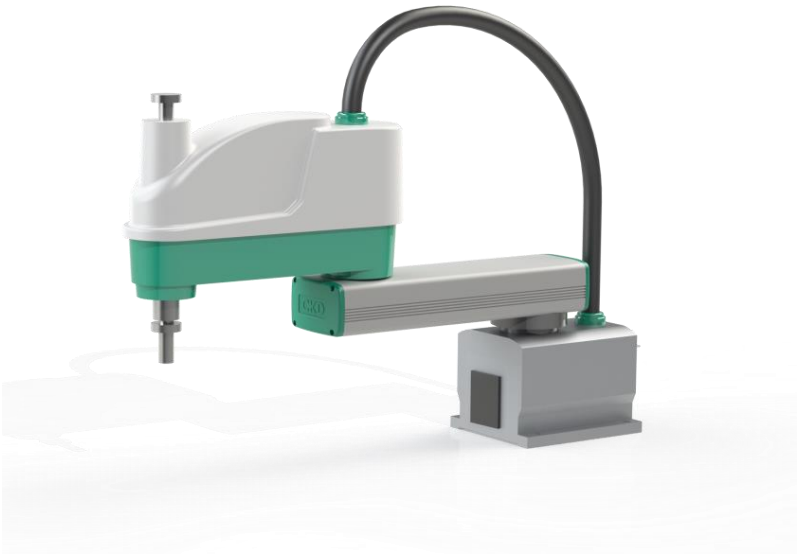
CKD

SCARA Robot

Model with Dust-proof Specifications

INSTRUCTION MANUAL

SM-A20065A



- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

Introduction

This manual describes the KHL series industrial robot with dust-proof specifications.
This manual provides essential information for maintaining robot performance over a long period, preventing breakdowns, and improving safety. Before actually starting operation, be sure to read through this manual and to establish a maintenance plan.

Cautions on Safety

This manual contains the important information on the robot and controller to prevent injury to the operators and persons nearby, to prevent damage to assets and to ensure correct use.
Make sure that the following details (indications and symbols) are well understood before reading this manual. Always observe the information that is noted.

[Explanation of indications]

Indication	Meaning of indication
DANGER	This means that "incorrect handling will lead to fatalities or serious injuries."
WARNING	This means that "incorrect handling will lead to fatalities or serious injuries."
CAUTION	This means that "incorrect handling may lead to personal injuries*1) or physical damage*2)."

1) Injuries refer to injuries, burns and electric shocks, etc., which do not require hospitalization or long-term medical treatment.
2) Physical damage refers to damages due to destruction of assets or resources.

[Explanation of symbols]

Symbol	Meaning of symbol
	This means that the action is prohibited (must not be done). The details of the actions actually prohibited are indicated with pictures or words in or near the symbol.
	This means that the action is mandatory (must be done). The details of the actions that must be done are indicated with pictures or words in or near the symbol.
	This means danger and caution. The details of the actual caution are indicated with pictures or words in or near the symbol.

Maintenance and Inspection

Be sure to carefully follow the safety information below to ensure the safe use of this product.

⚠ DANGER	
 PROHIBITED	• DO NOT incinerate, disassemble or charge the battery. Otherwise, it will rupture.
 MANDATORY	• Be sure to turn off the main power of the controller before starting inspection or maintenance. • When disposing of the battery, follow the user's provided regulations.

⚠ CAUTION	
 DISASSEMBLY PROHIBITED	• NEVER replace or modify parts other than those described in the instruction manual. Otherwise, the robot performance will deteriorate, or faults or accidents will be caused.
 MANDATORY	• Always use the CKD designated spare parts when replacing the parts. • Perform maintenance and inspection regularly. Otherwise, the equipment will go wrong or you will be involved in an accident.

This manual consists of the following sections.

Chapter 1: Specifications

This describes the basic specifications and names of parts for the robot with dust-proof specifications.

Chapter 2: Shipping

This describes the procedures from unpacking of the robot with dust-proof specifications and how to transport it to the installation location.

This also contains important information on temporary storage after unpacking.

Chapter 3: Installation

This describes the environment where the robot with dust-proof specifications is installed, surrounding space, and the installation procedures.

Chapter 4: Tool Interface

This describes the tool wire and tube routing work for the robot with dust-proof specifications.

Chapter 5: Maintenance

This describes the configuration of the robot with dust-proof specifications and the information required for maintenance and inspection.

Chapter 6: Cleaning of Robot body

This contains important information on the cleaning and washing of the robot body.

Chapter 7: Maintenance Replacement Parts

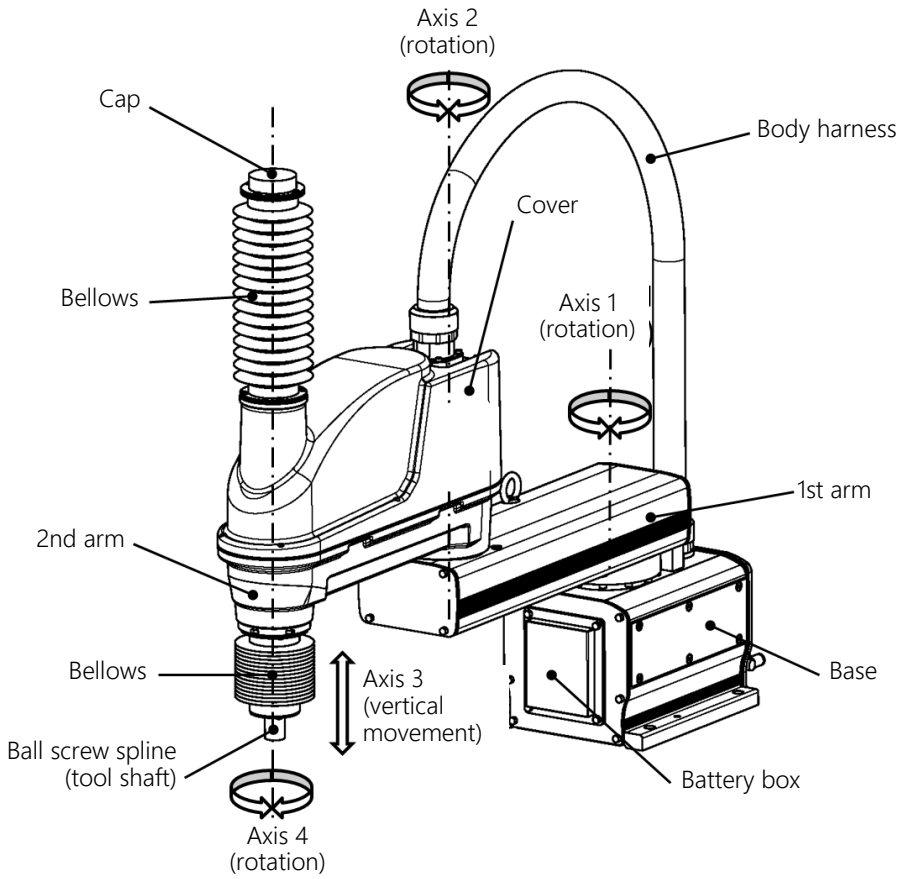
This describes the maintenance replacement parts.

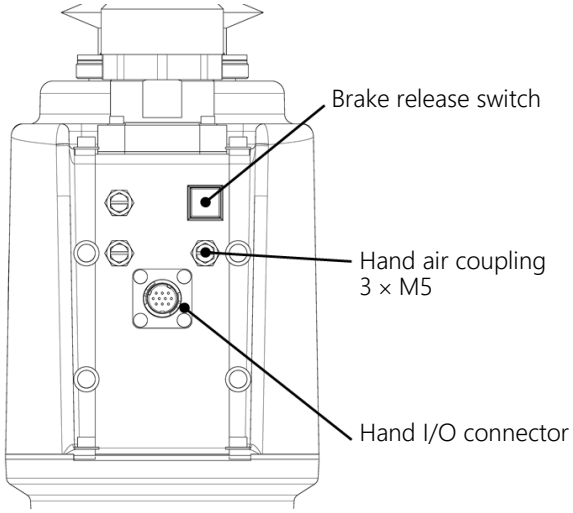
Table of Contents

1. Specifications

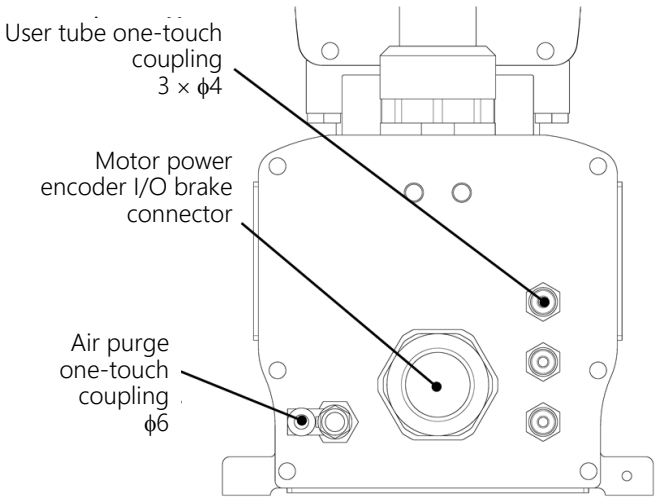
1.1 Names of Parts

The names of the robot parts are shown in Figure 1.1.
(The figure shows the KHL-600 Model with Dust-proof Specifications.)





Rear Panel of 2nd Arm



Rear Panel of Base

Figure 1.1 Names of Parts

1.2 Dimensions

The robot dimensions are shown in Figures 1.2 to 1.4, and the work envelopes are shown in Figures 1.5 to 1.7.

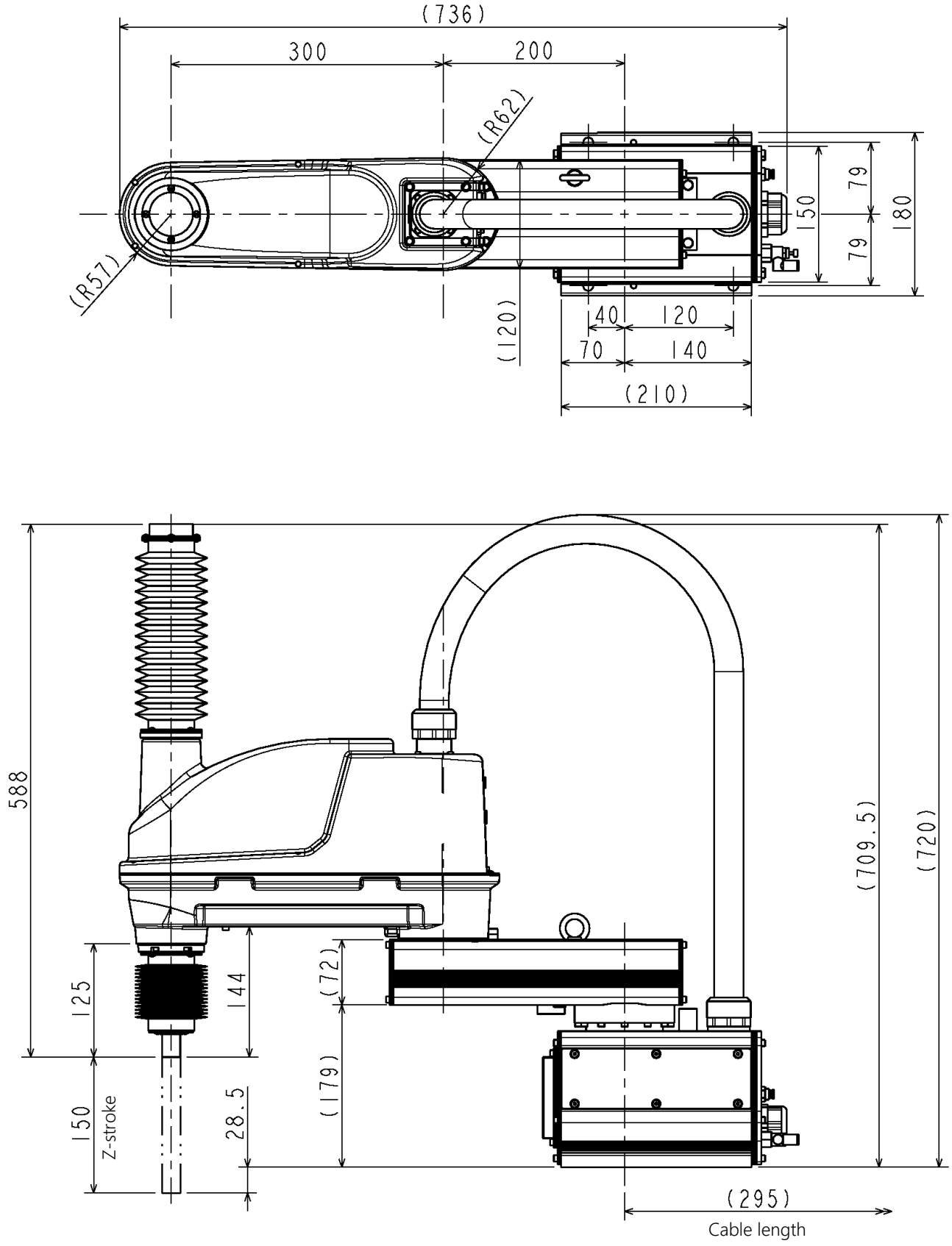


Figure 1.2 Robot Dimensions (KHL-500 Model with Dust-proof Specifications)

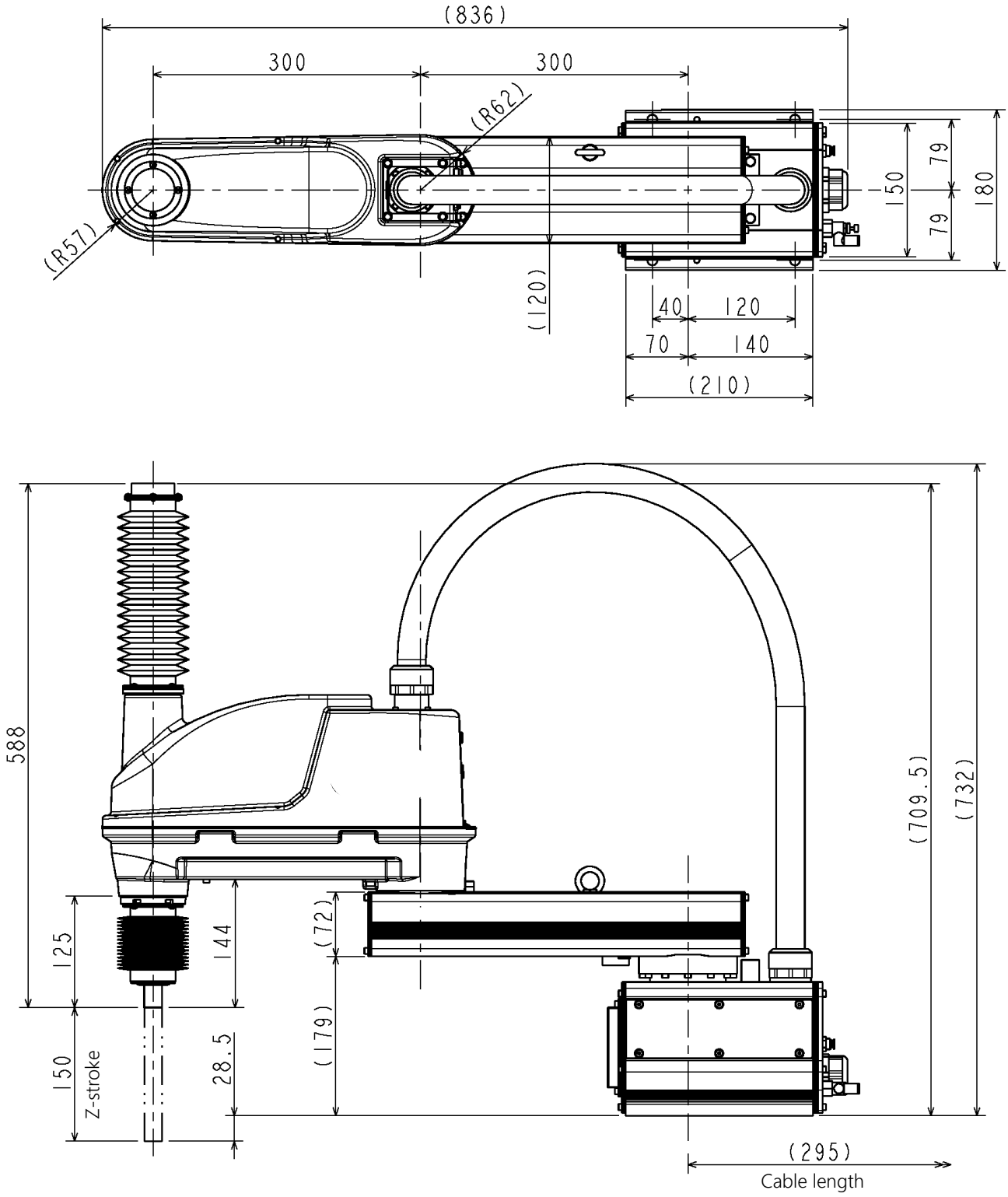


Figure 1.3 Robot Dimensions (KHL-600 Model with Dust-proof Specifications)

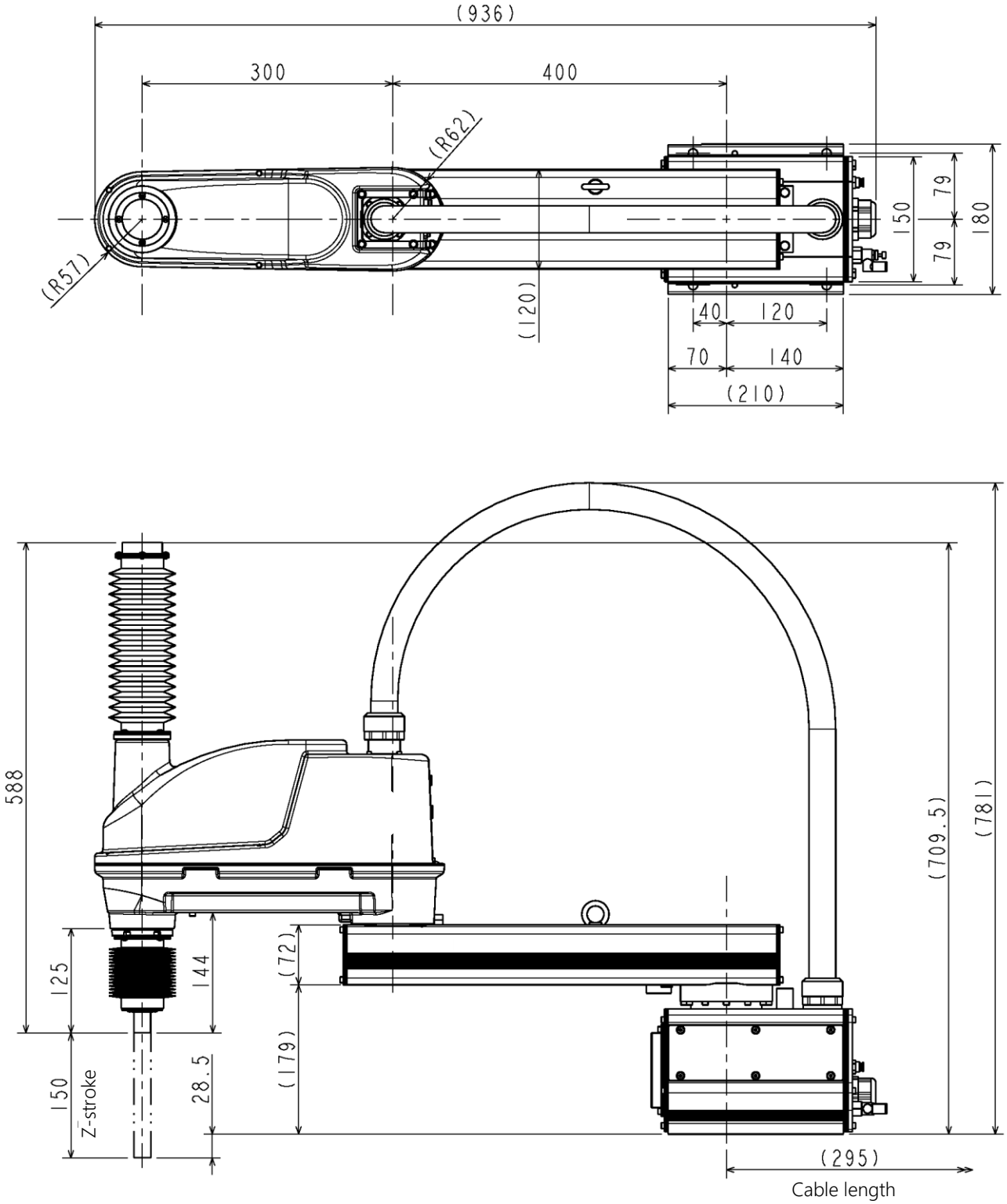


Figure 1.4 Robot Dimensions (KHL-700 Model with Dust-proof Specifications)

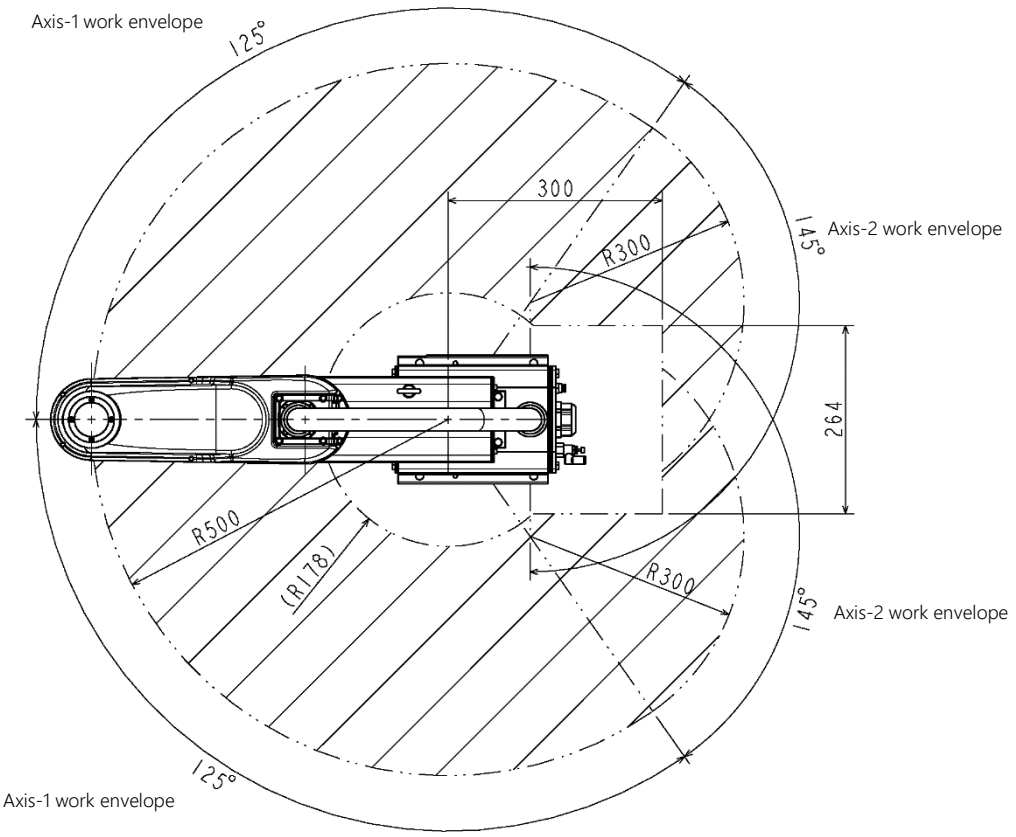


Figure 1.5 Robot Work Envelope (KHL-500 Model with Dust-proof Specifications)

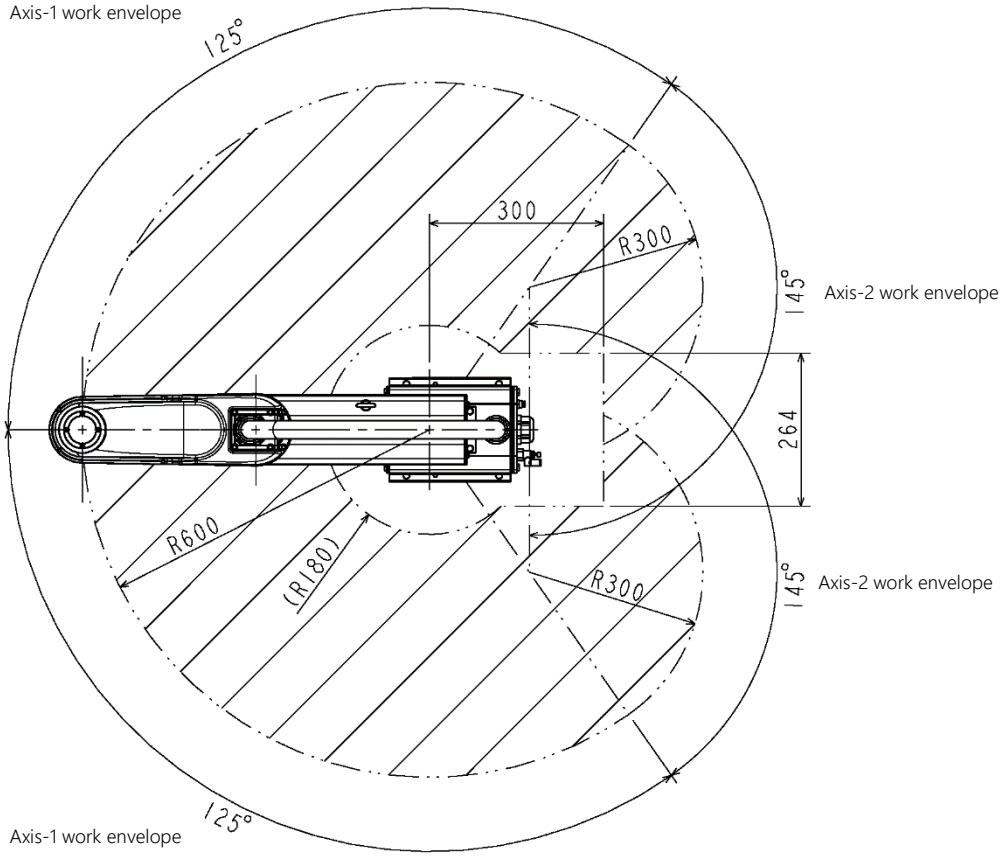


Figure 1.6 Robot Work Envelope (KHL-600 Model with Dust-proof Specifications)

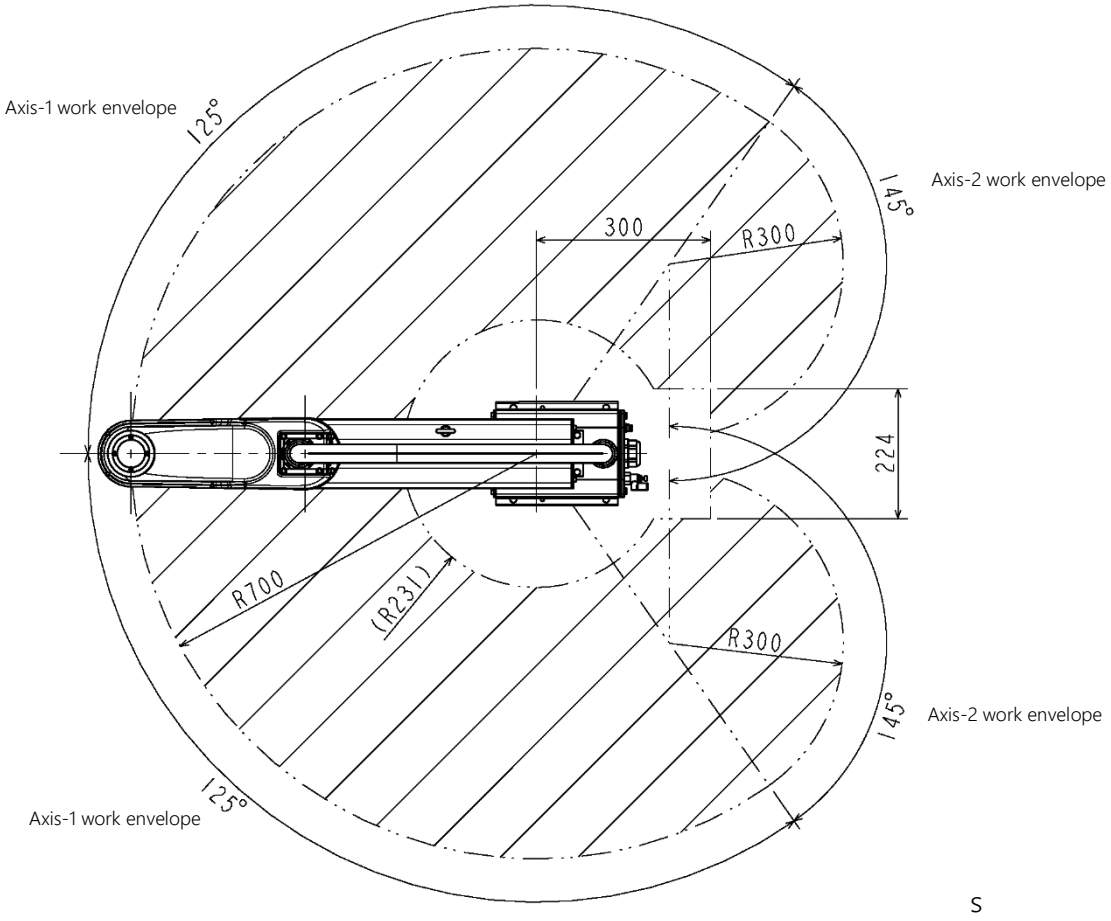


Figure 1.7　Robot Work Envelope (KHL-700 Model with Dust-proof Specifications)

1.3. Specifications Table

Item		Specifications		
Structure		Horizontally-articulated SCARA robot		
Model		KHL-500	KHL-600	KHL-700
Dust-proof and drip-proof protection rating		IP6X *1		
Compatible controller		KSL3000 *2		
Mass of robot body		24 kg	25 kg	26 kg
Number of control axes		4		
Arm length		500 mm (200 mm + 300 mm)	600 mm (300 mm + 300 mm)	700 mm (400 mm + 300 mm)
Motor capacity	Axis 1	400 (W)		
	Axis 2	200 (W)		
	Axis 3	200 (W)		
	Axis 4	200 (W)		
Work envelope	Axis 1	±125 (deg)		
	Axis 2	±145 (deg)		
	Axis 3	150 (mm)		
	Axis 4	±360 (deg)		
Maximum speed *3	Axis 1	450 (deg/s)		
	Axis 2	450 (deg/s)		
	Axis 3	2000 (mm/s)		
	Axis 4	1700 (deg/s)		
	Composite speed of axes 1 and 2	6.3 (m/s)	7.1 (m/s)	7.9 (m/s)
Rated payload		2 (kg)		
Maximum payload		10 (kg)		
Allowable load inertia *3		0.2 (kg•m^2)		
Position repeat accuracy *4	X,Y	±0.01 (mm)		
	Z	±0.015 (mm)		
	C	±0.007 (deg)		
Cycle time *5 (for payloads up to 2 kg)		0.45 (sec)	0.45 (sec)	0.50 (sec)
Drive system		AC servomotor		
Position detection system		Absolute type		
Power supply capacity		1.4 (kVA)		

*1: For details on the protection rating, see "3.2 Protection Ratings for Models with Dust-proof Specifications".

*2: The robot controller does not have a dust-proof structure.

*3: If the payload exceeds 2 kg or if the center of gravity of the load deviates from the center of gravity of axis 4, the speed and acceleration must be reduced using the PAYLOAD command.

*4: This is the unidirectional position repeat accuracy at a fixed ambient temperature of 20°C. This is not the absolute positioning accuracy. X, Y, and C are the values at the Z upper limit. Path accuracy is not guaranteed.

*5: Time for back and forth movement of rough positioning operation at 300 mm in the horizontal direction and 25 mm in the vertical direction. Continuous operation cannot be performed if the execution load factor for the standard cycle operation pattern is exceeded.

2. Shipping

2.1 Unpacking

The robot and controller are shipped by storing in wooden crates or cardboard boxes. Unpack at a location suitable for later transportation and installation while being careful not to damage the robot or controller. After unpacking, first, check for any damage that may have occurred during shipping and then check the quantities of the accessories.

The packing orientation and packing contents are identical to those for the standard model. For details, see the separate instruction manual "Installation and Shipping".

For robots with dust-proof specifications, be sure to follow the safety information below.

⚠ CAUTION

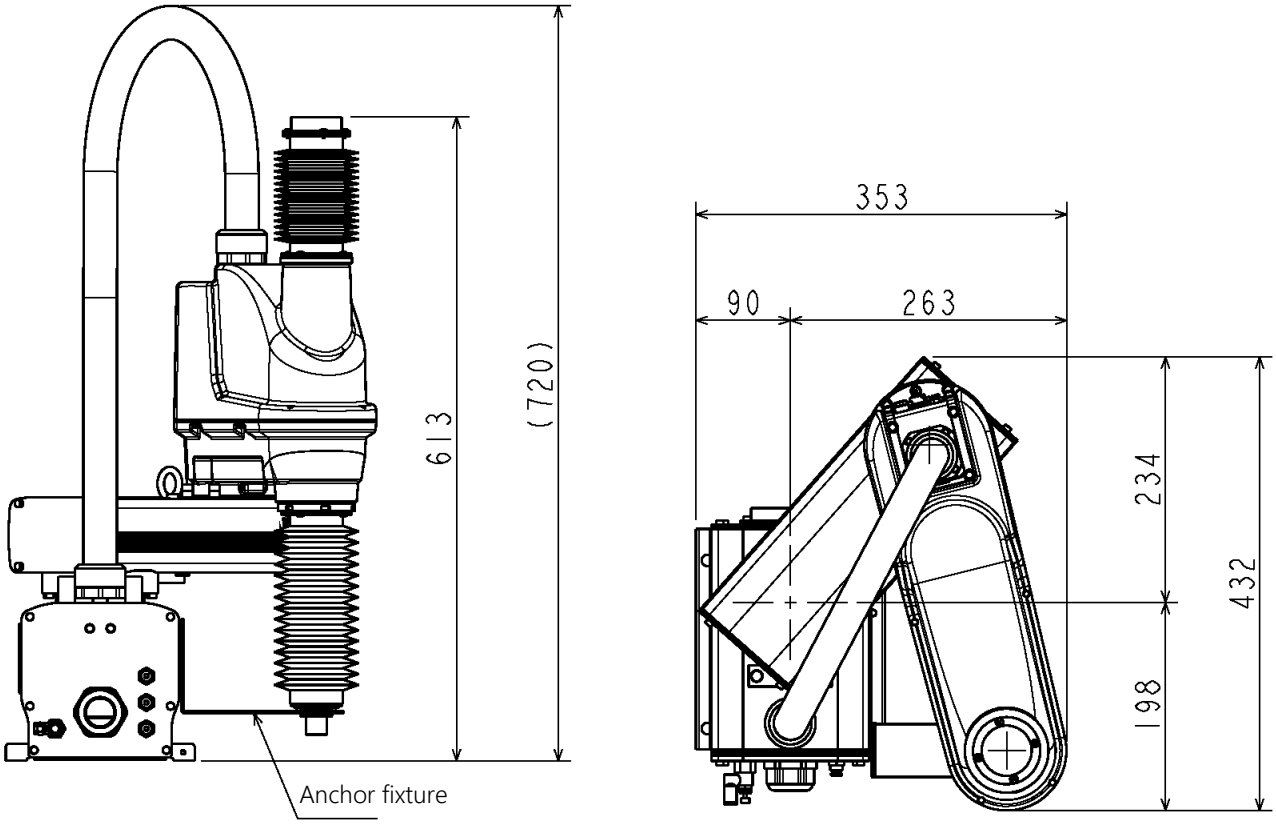
- The robot body is packed in a plastic bag. Take out the plastic bag carefully. If the plastic bag is pulled with excessive force, the bellows or covers could be damaged.

2.2 Transportation

Be careful that the robot and controller are not subjected to impact or vibrations during transportation. If the robot or controller will be exposed to vibrations for an extended period of time, further tighten the bolts for the anchor fixtures and base anchor, and insert into wooden crates or cardboard boxes for transportation.

2.2.1 Weight and Dimensions

The robot weight and dimensions during transportation are shown in Figures 2.1 to 2.3.



Robot unit weight: 24 kg

Figure 2.1 Dimensions During Transportation (KHL-500 Model with Dust-proof Specifications)

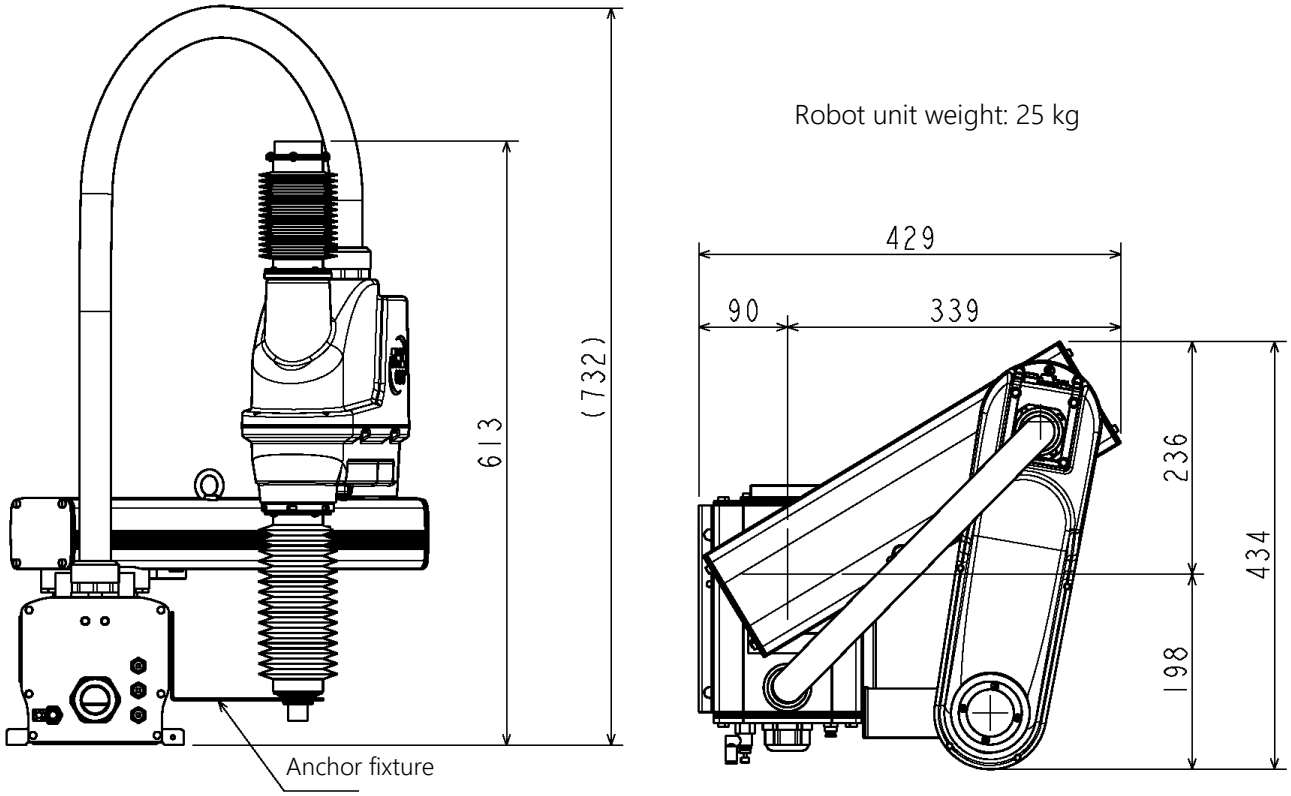


Figure 2.2 Dimensions During Transportation (KHL-600 Model with Dust-proof Specifications)

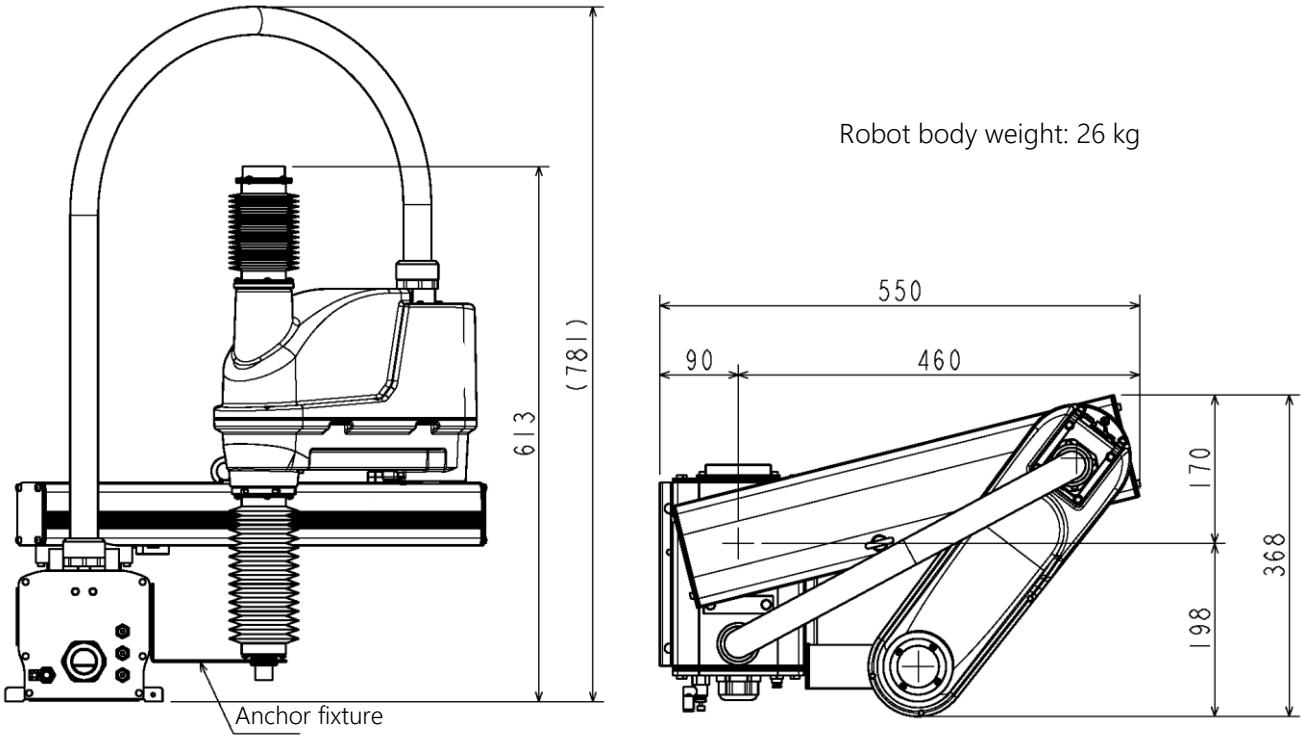


Figure 2.3 Dimensions During Transportation (KHL-700 Model with Dust-proof Specifications)

2.2.2 Robot Transportation

Compared to the standard robot, the robot with dust-proof specifications has bellows and other dust-proof parts.
The safety information during transportation is shown below. The other safety information is identical to that for the standard model. For details, see the separate instruction manual "Installation and Shipping". (The figure shows the KHL-600 Model with Dust-proof Specifications.)

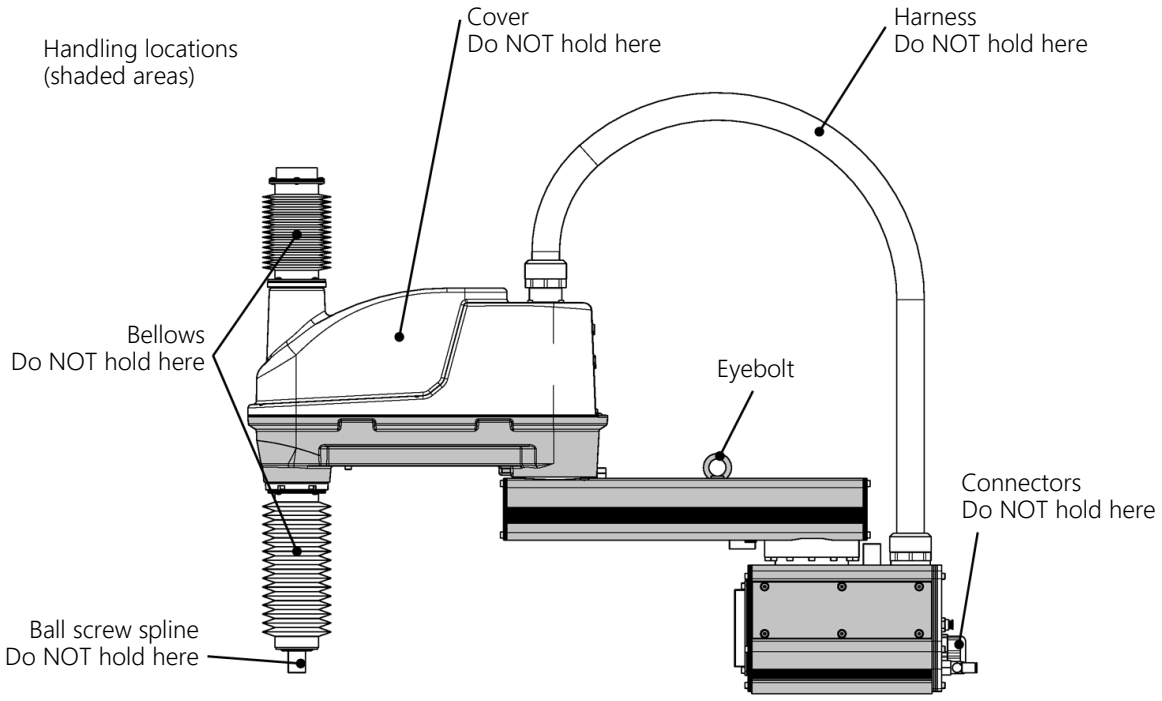


Figure 2.4 Handling Prohibited Locations on Robot

After installation, remove the anchor fixtures and eyebolt. After removing, return the anchor bolts for the shipping jigs to their original locations by applying Loctite, and mount the supplied hex socket-head cap screw in the location where the eyebolt was mounted by applying Loctite.

⚠ CAUTION

- When lifting the robot by hand, place your hands on the shaded locations shown in Figure 2.4. Grasping the ball screw spline shaft could apply excessive force, resulting in damage.
- If the bellows are grasped when holding, friction with the internal parts could cause the bellows to tear.
- When carrying the robot by hand, be careful that you do not get your hands or feet pinched in between parts.
- Be sure to always carry robot using two or more people.
- After the anchor fixtures are removed, the bolts used for mounting the anchor fixtures should be mounted in their original locations by applying Loctite. Dust-proof performance will be reduced if the bolts are left removed.
- After removing the eyebolt, apply Loctite to the hex socket-head cap screw used as a plug, and mount it. Dust-proof performance will be reduced if you leave the part where the screw has been removed without plugging it.

3. Installation

3.1 Installation Environment

The robot and controller environment specifications are shown in Table 3.1.

Table 3.1 Robot and Controller Environment Specifications

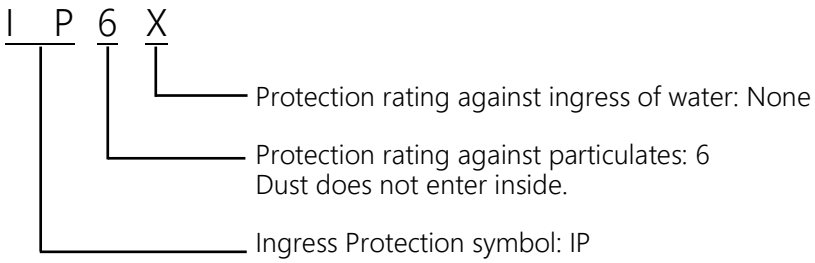
Item	Specifications
Temperature	Operation: 0°C to 40°C Storage: -10°C to 50°C
Humidity	20% to 80% RH (no condensation)
Altitude	1000 m or less
Vibrations	During operation: 0.98 m/s^2 max.
Dust	No conductive dust.
Gas	No corrosive or flammable gas.
Sunlight	Not exposed to direct sunlight.
Power-supply noise	No devices that generate large amounts of noise are in the vicinity.
Magnetic fields	No devices that generate strong magnetic fields are in the vicinity.
Other	Location where the robot will not be submerged in liquids. Atmosphere that does not generate small chips such as those from turning and cutting processes. Atmosphere that does not have mist from coolants, grinding fluids, and similar substances.

⚠ CAUTION

- Do not place flammable objects near the robot or controller.
  A fire could occur if sparks fly off due to a breakdown or other cause.

3.2 Protection Ratings for Models with Dust-proof Specifications

The protection rating for dust and water of the KHL-500/KHL-600/KHL-700 Model with Dust-proof Specifications is equivalent to IP6X. Drip-proof performance is not guaranteed. Do not use these robots in locations exposed to liquids. Be sure to always apply an air purge when using the robots. Otherwise, dust could enter them in certain operating environments.



⚠ WARNING

- Drip-proof performance is not guaranteed. Do not use the robot in locations exposed to liquids.
- Do not use the robot in environments where the protection rating for dust of the robot is exceeded. Otherwise, dust could enter into the robot, resulting in shorter lifespan, reduced operation accuracy, or a malfunction.
- The robot controller does not have dust-proof or drip-proof specifications.
- In some operating environments, the bellows could become discolored, but this does not affect dust-proof performance.
- Be sure to always apply an air purge. If an air purge is not applied, dust-proof performance will be reduced.
- Models with dust-proof specifications do not have an explosion-proof structure.

3.3 Air Purge

Robots with dust-proof specifications have an air supply port for air purges in the base connector section.

See "Figure 1.1. Names of Parts". (One-touch coupling with speed controller)

Connecting air here prevents dust from entering inside the robot.

The air supply source (pressure reducing valve, air filter, etc.) and air tubes (6 mm diameter) must be supplied by the customer.

- Air specifications
  - Maximum operating pressure: 0.58 MPa (6 kgf/cm^2)
  - Tube size: Outer diameter 6 mm × Inner diameter 4 mm
  - Working fluid: Clean, dry air that does not contain compressor oil or other contaminants

    Air filter: A filterability of 10 μm or less
- Flow rate adjustment procedure

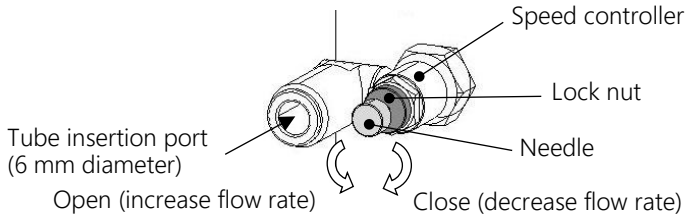
  Fully close the speed controller mounted to the robot body's base connector.

  Set the pressure reducing valve (supplied by customer) to a pressure in the range from 0.3 MPa to a maximum pressure of 0.58 MPa, and connect the air tube.

  Turn the needle of the speed controller from the fully-closed state in the counter-clockwise direction to increase the flow rate.

  Adjust the flow rate while watching the state of the bellows, and tighten the lock nut of the speed controller.

  If too much air is inserted, the bellows will swell, and so adjust until just before the bellows swell.



⚠ CAUTION

- Be sure to always use clean, dry air. Failure to use dry air will cause condensation inside the robot, resulting in collection of water, which can lead to a fault current and malfunction.
- Do not apply pressure above the maximum specified pressure. Doing so could damage the seals and other parts of the joints, resulting in reduced dust-proof performance.

3.4 Coordinate System

At factory shipping, the robot's origin (0° or 0 mm position) of the joint angle is calibrated to the reference plane of the base. The base coordinate system (X_B, Y_B, Z_B) and origin position of each axis joint angle are shown in Figure 3.1. (The figure shows the KHL-600 Model with Dust-proof Specifications.)

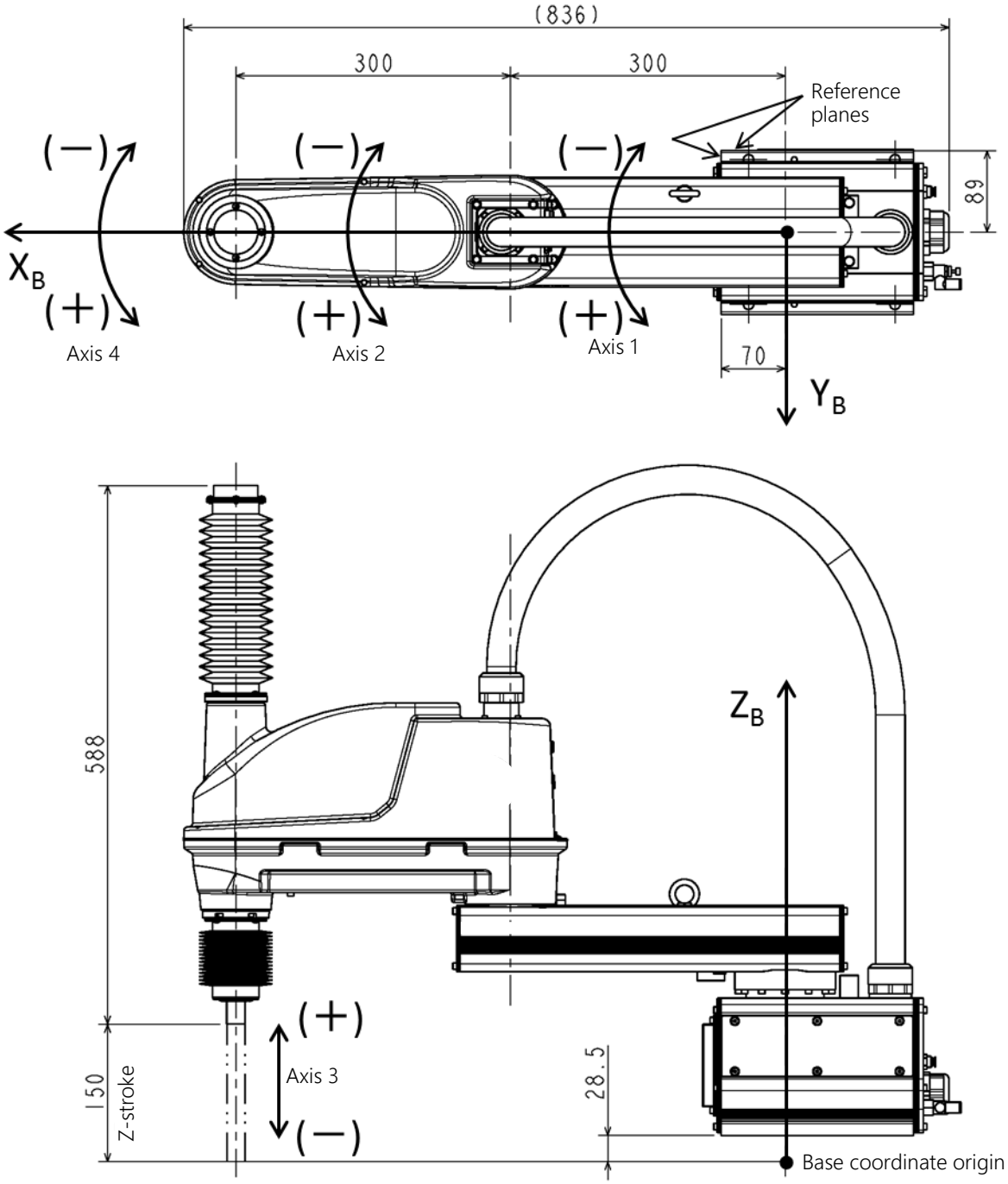


Figure 3.1 Base Coordinate System and Joint Angle Origin

3.5 Installation Procedure

The installation procedure is identical to that for the standard model. For details, see the instruction manual "Installation and Shipping".

4. Tool Interface

4.1 Tool Mounting

The dimensions of the ball screw spline tip where the tool is mounted are shown in Figure 3.2. The optional tool flange can also be used in the same way as the standard model. For details on the tool flange, see the instruction manual "Installation and Shipping". The hollow hole in the ball screw spline is covered to protect against dust, and so it cannot be used for wiring or other purposes.

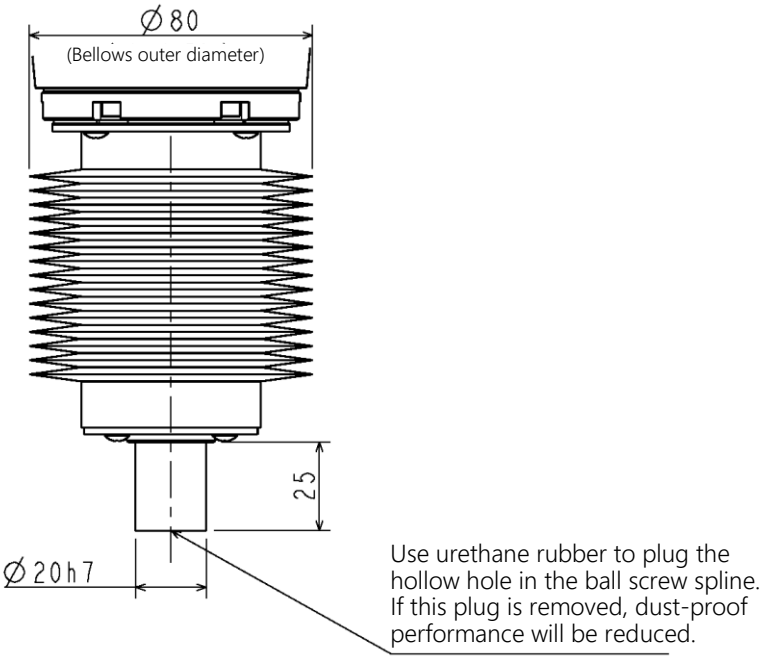


Figure 4.1 Tool Mounting Section Dimensions

4.2 Tool Cable Connections

The tool cabling has four input ports for sensors and other signals, and has 24 V DC (total 2 A max.) and four output ports for solenoid valves and other control signals, and these are connected to the controller. The cables are connected to the connectors on the rear panel of the 2nd arm. The customer must provide the following connectors and connect the cables.

Cannon connector (standard) Model: Angle plug JN2FS10SL2-R
(Manufacturer: Japan Aviation Electronics (JAE))

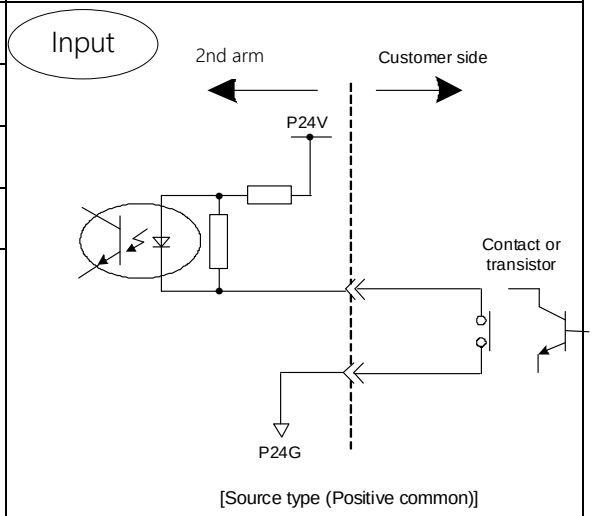
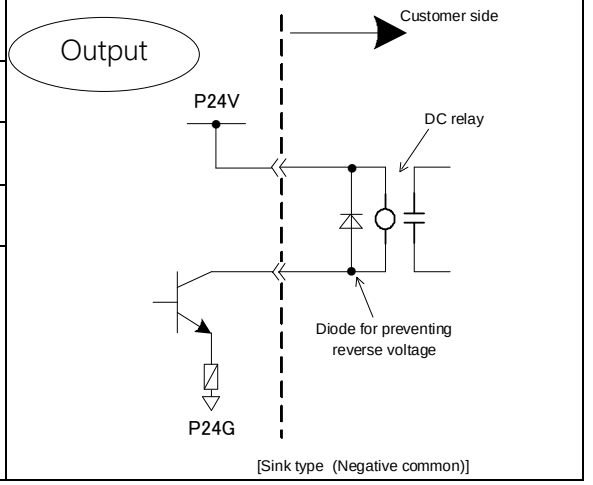
Contact model:	JN1-22-26S-PKG100	Compatible wires: AWG26 to AWG28
	JN1-22-22S-PKG100	AWG21 to AWG25
	JN1-22-20S-PKG100	AWG20

If it is difficult to obtain the parts and materials above, cables are available from CKD.
The HAND cable (option) list is shown in Table 4.1.

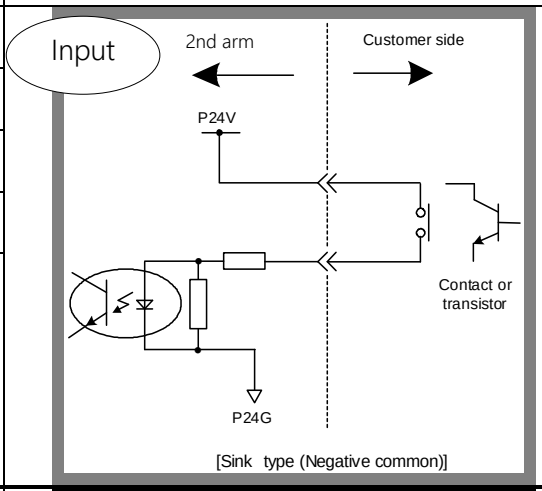
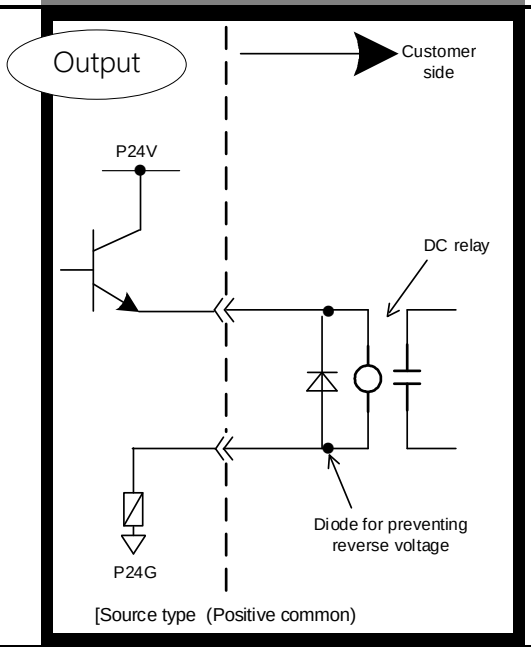
⚠ DANGER

- Be sure to always use the specified wires. Otherwise, a fire or accident could result.
- When connecting a connector and wire, be careful not to mistake the pin arrangement.
- After connection, use a tester or similar device to confirm that the connection is correct.

Input/Output Signal: Connector HAND (KSL3000 Type-N)

Pin	Signal name		Signal No.	Input/output circuit and connection example
1	D_IN1	Input signal 1	201	
2	D_IN2	Input signal 2	202	
3	D_IN3	Input signal 3	203	
4	D_IN4	Input signal 4	204	
5	DC 24V GND (P24G)			
6	D_OUT1	Output signal 1	201	
7	D_OUT2	Output signal 2	202	
8	D_OUT3	Output signal 3	203	
9	D_OUT4	Output signal 4	204	
10	DC 24V (P24V)			

Input/Output Signal: Connector HAND (KSL3000 Type-P)

Pin	Signal name		Signal No.	Input/output circuit and connection example
1	D_IN1	Input signal 1	201	
2	D_IN2	Input signal 2	202	
3	D_IN3	Input signal 3	203	
4	D_IN4	Input signal 4	204	
5	DC 24V (P24V)			
6	D_OUT1	Output signal 1	201	
7	D_OUT2	Output signal 2	202	
8	D_OUT3	Output signal 3	203	
9	D_OUT4	Output signal 4	204	
10	DC 24V GND (P24G)			

The input signals use either non-voltage contacts or transistor open collector input.

Non-voltage contact specifications	Contact rating	24 V DC - 10 mA or more (circuit current approx. 7 mA)
	Contact minimum current	24 V DC - 11 mA
	Contact impedance	100 Ω max.
Transistor specifications	Collector-emitter breakdown voltage	30 V min.
	Collector-emitter current	10 mA min. (circuit current approx. 7 mA)
	Collector-emitter leakage current	100 μA max.

The 24 V DC power supply of the controller can be used to drive the relays and solenoid valves.
If using an external power supply, the ground of the external power supply must be shared with the robot controller ground (PG).

Output specifications	Rated voltage	24 V DC (30 V max.)
	Rated current	1 A
	Leakage current	100 μA max.

- The 24 V DC supplied from the robot controller must not exceed a total of 2 A.
- Also, when using an external power supply, it must not exceed a total current of 2 A.
- When connecting relays or solenoid valves, use surge killers or diodes to absorb any surge voltage.

Table 4.1 HAND Cable (Option) List

	Item name	Drawing No.	Unit code	Manufacturer	Plug shape	Cable length
1	I/O cable	392N1201	Y610A3VP0	Shibaura Machine Co., Ltd.	Angle	1 m
2		392N1202	Y610A3VQ0			2 m

4.3 Air Piping for Tool

Three lines are provided for air piping for the tool. The outer diameter of the air piping is 4 mm. The piping is shown in Figure 4.2. The solenoid valves and other pneumatic equipment must be supplied by the user.

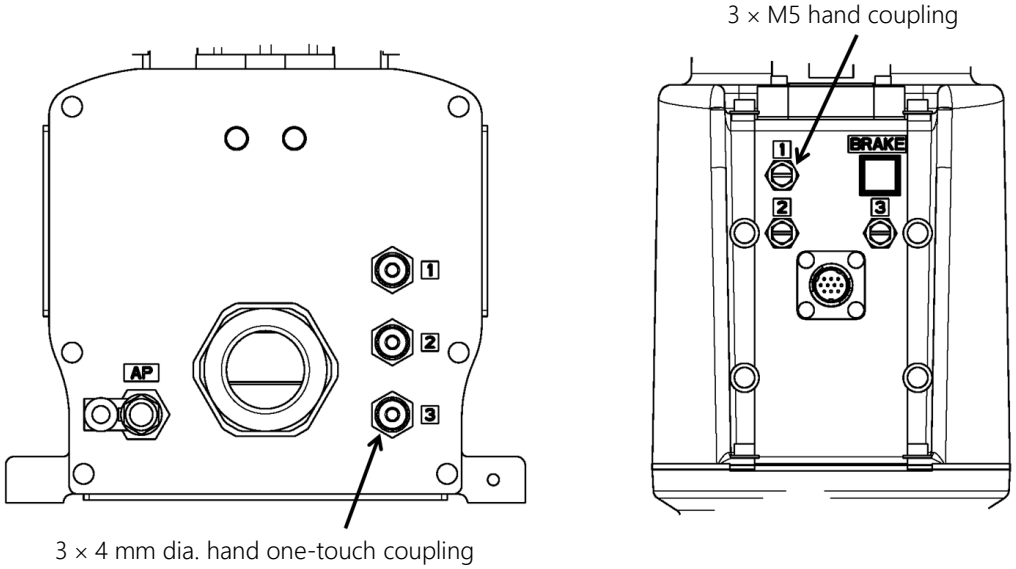


Figure 4.2 Air Piping for Tool

The air tubes are identified by number and color. When connecting the tubes, refer to the information below to ensure that they are connected correctly.

1: Red, 2: White, 3: Blue

5. Maintenance

This describes the maintenance and inspection items for the robot with dust-proof specifications. For details on other maintenance and inspection items, see the instruction manual "Maintenance".

5.1 Maintenance Items

The maintenance schedule and maintenance procedures for the robot with dust-proof specifications are shown in Table 5.1. The other maintenance items are identical to the standard model. For details, see the instruction manual "Maintenance".

Table 5.1 Maintenance Items for Robot with Dust-proof Specifications

Inspection item	Inspection procedure	Daily inspection	Inspection every 3 months	Inspection every 6 months	Inspection every year	Refer to
Inspection of bellows	Visually check that there are no tears, cracks, or other damage on the bellows (upper and lower).	○	○	○	○	5.1.1
Replacement of bellows	Replace the bellows if any damage or other defects are found on it or if it is due for scheduled replacement.				○	5.1.2
Greasing of the ball screw spline unit	Remove the bellows, apply grease to the ball screw spline, and mount the bellows.		○	○	○	5.1.3

DANGER

- If you will come near the robot for maintenance or inspection, be sure to turn off the power before starting the work.

CAUTION

- If dust gets inside the robot, a breakdown could result. Perform removal of the bellows and other maintenance work in a dust-free environment.

5.1.1 Inspection of Bellows

During robot operation or when the robot is stopped, visually check that there is no peeling, wear or other damage, twisting, wrinkles, or other abnormalities on the bellows.
If any damage is found, dust-proof performance will be reduced, and this could cause a breakdown of the robot, and so replace the bellows immediately. Twisting, wrinkles, and other abnormalities could result in damage, and so fix by remounting the bellows.

5.1.2 Replacement of Bellows

Replace the bellows if any damage is found on it or if it is due for scheduled replacement.
The scheduled replacement of the bellows is 30 million back-and-forth movements of axis 3 or one year, whichever comes first.

5.1.3 Greasing of Ball Screw Spline Unit

Remove the bellows by referring to "5.4 Bellows Replacement Procedure", and grease the ball screw spline unit by referring to the instruction manual "Maintenance".

5.2 Locations of Mechanical Parts

The basic structure of the robot with dust-proof specifications is identical to the standard model. The locations of the mechanical parts are shown in Figure 5.1. (The figure shows the KHL-600 Model with Dust-proof Specifications.)

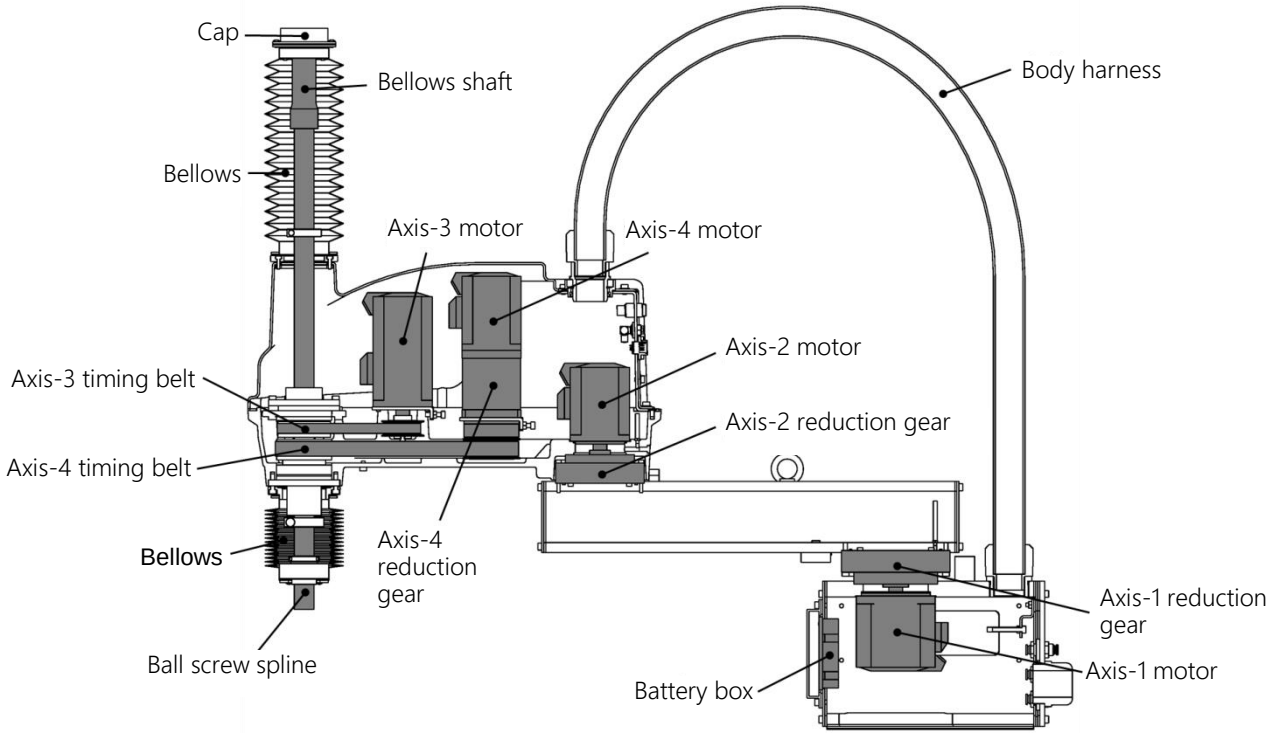


Figure 5.1 Locations of Mechanical Parts

5.3 Maintenance Tools and Required Items

The following maintenance tools and items are recommended.
For details on tools and required items other than those shown below, see the instruction manual "Maintenance".

- Screwdriver (Phillips-head screwdriver)
- Allen wrench (hex key) set M2 to M10
- Loctite (221, Low-strength)

5.4 Bellows Replacement Procedure

The work for replacing the bellows must be performed by a CKD service technician. CKD will not be liable for any breakdowns or accidents that occur as a result of bellows replacement performed by the customer.

⚠ DANGER

- Before starting the replacement work, be sure to turn off the controller power, and unplug it from the outlet.

5.4.1 Lower Bellows Replacement Procedure

1) Remove the holding plate under the bellows.
2) Remove the holding plate above the bellows, and pull out the bellows in the downward direction.
3) To mount the lower bellows, perform the removal procedure in reverse.

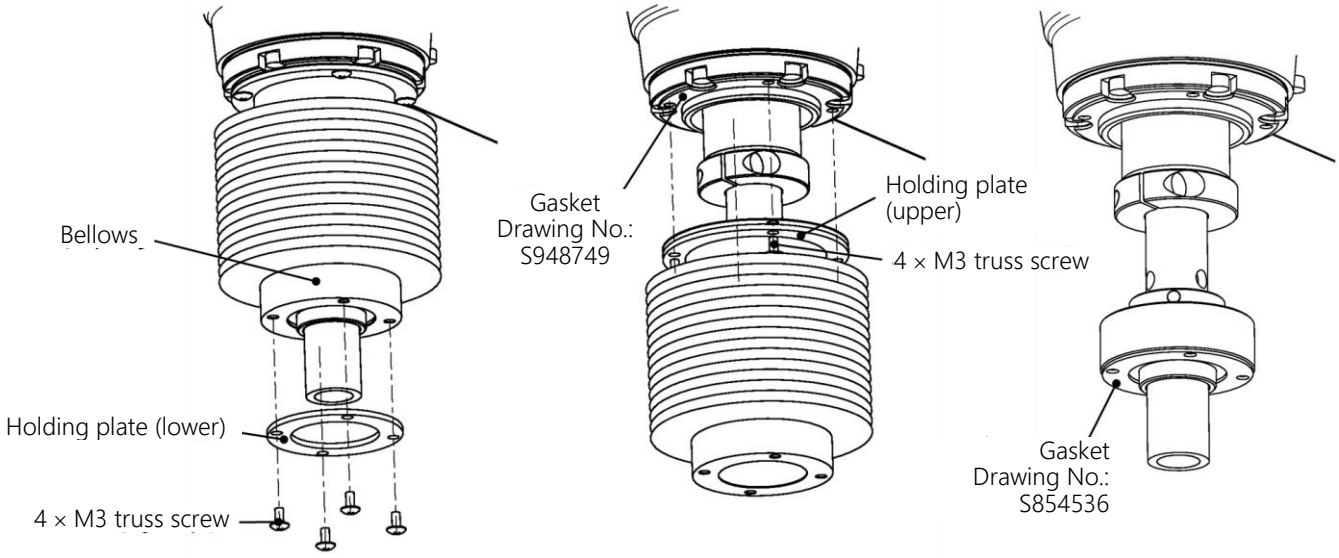


Figure 5.2 Lower Bellows

⚠ CAUTION

- When removing the bellows, do not use excessive force to pull on it.
  This could cause the bellows to tear.
- Be sure to always apply Loctite to the mounting screws. If Loctite is not applied, this could result in reduced dust-proof performance, and dust could enter inside the robot.
- Be careful not to damage the gaskets. If the gaskets are damaged, dust-proof performance will be reduced, and dust could enter inside the robot.
- The gaskets are fragile, and they may be damaged during part replacement. When performing replacement work, obtaining of new gaskets is also recommended. For more information about gaskets, see "7.1 Maintenance Replacement Parts List".

5.4.2 Upper Bellows Replacement Procedure

1) After removing the cap and upper holding plate, remove the three locking screws, and remove the wiring guide.
2) Remove the lower holding plate, and pull out the bellows in the upward direction.
3) When removing the 2nd arm cover, pull off the bearing case in the upward direction.
   For details on removing the 2nd arm cover, see "5.6.2 2nd Arm Cover".
4) Also, when replacing the ball screw spline, remove the three locking screws that secure the bellows shaft, and remove the bellows shaft by pulling it in the upward direction.
   For details on replacement of the ball screw spline, see the instruction manual "Maintenance".
5) To mount the upper bellows, perform the removal procedure in reverse.

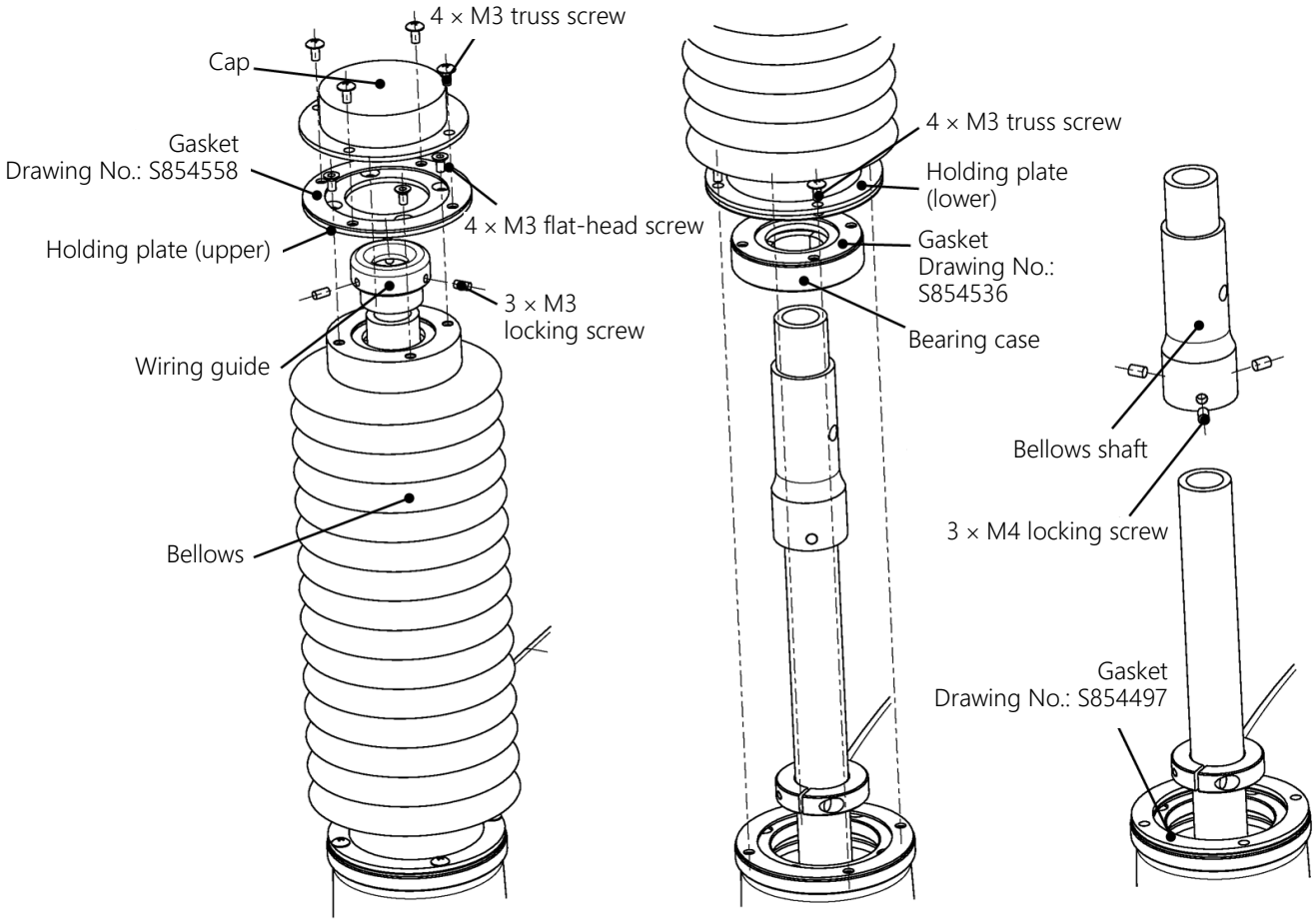


Figure 5.3 Upper Bellows

⚠ CAUTION

- When removing the bellows, do not use excessive force to pull on it. Pulling on it forcedly could cause the bellows to tear.
- Be sure to always apply Loctite to the mounting screws. If Loctite is not applied, this could result in reduced dust-proof performance, and dust could enter inside the robot.
- Be careful not to damage the gaskets. If the gaskets are damaged, dust-proof performance will be reduced, and dust could enter inside the robot.
- The gaskets are fragile, and they may be damaged during part replacement. When performing replacement work, obtaining of new gaskets is also recommended. For more information about gaskets, see "7.1 Maintenance Replacement Parts List".

5.5 Battery Replacement Procedure

5.5.1 Battery Case Cover Mounting and Removal Procedures

In contrast to the standard model, the battery case in the robot with dust-proof specifications is protected by a cover. Before replacing the battery, be sure to remove the cover as shown in Figure 5.4. For details on the battery replacement procedure, see the instruction manual "Maintenance".

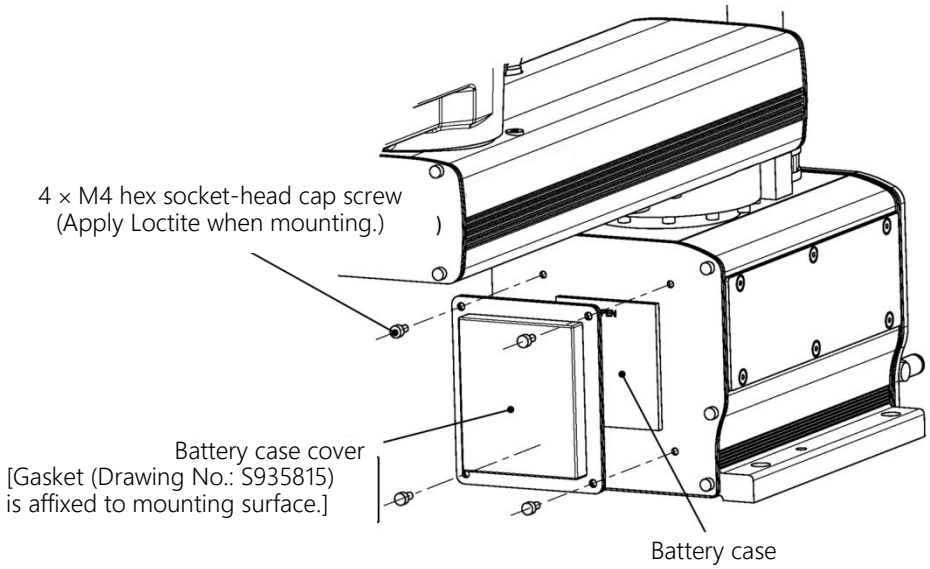


Figure 5.4 Battery Case Cover

⚠ CAUTION

- Be sure to always apply Loctite to the mounting bolts. If Loctite is not applied, this could result in reduced dust-proof performance, and dust could enter inside the robot.
- Be careful not to damage the gaskets. If the gaskets are damaged, dust-proof performance will be reduced, and dust could enter inside the robot.
- The gaskets are fragile, and they may be damaged during part replacement. When performing replacement work, obtaining of new gaskets is also recommended. For more information about gaskets, see "7.1 Maintenance Replacement Parts List".

5.5.2 Origin Orientation When Clearing Multi-Rotation Data

In the robot with dust-proof specifications, the height of axis 3 when clearing the multi-rotation data is different from that of the standard model. Set the position of the ball screw spline by referring to Figure 5.5. (The figure shows that for the KHL-600 Model with Dust-proof Specifications, but the height setting for axis 3 is identical for each model.) Also, the origin mark for axis 4 is found on the inner side of the bellows. Remove the bellows by referring to "5.4.1 Lower Bellows Replacement Procedure", and align the position as shown in Figure 5.6.

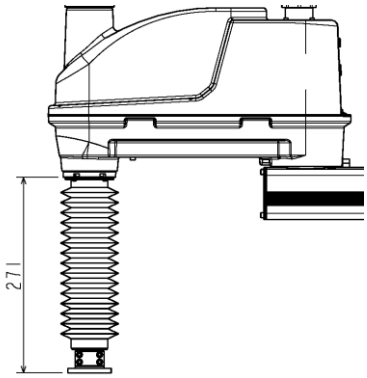


Figure 5.5 Axis-3 Height Setting

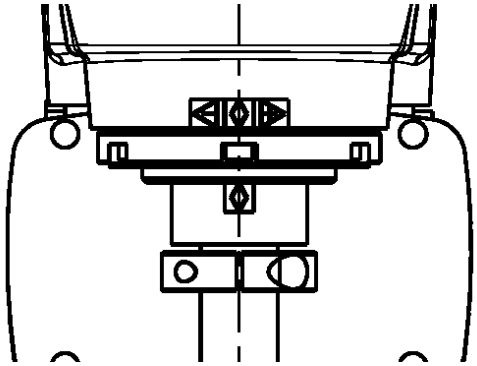


Figure 5.6 Axis-4 Position Setting

5.6 Cover Mounting and Removal

Gaskets are mounted to the cover mounting surfaces of the robot with dust-proof specifications, and so the procedure is different than that for the standard model. Be sure to carefully follow the work procedure in this section.

⚠ DANGER

- Before mounting and removing the covers, be sure to always turn off the main power (POWER) switch.
- When opening the covers, be careful that no moisture or foreign objects get inside the robot. Turning on the power while there is moisture or foreign objects inside is extremely hazardous and can result in an electrical shock or breakdown.

5.6.1 Base Covers

1) The base covers, which consist of base rear covers 1 and 2, are mounted with six hex socket-head cap screws (M4×16) securing base rear covers 1 and 2 tightened together. A cable is secured in base rear cover 1, and so be careful not to pull with excessive force on it. Gaskets are mounted on each cover. When mounting and removing the base covers, be careful not to damage the gaskets.

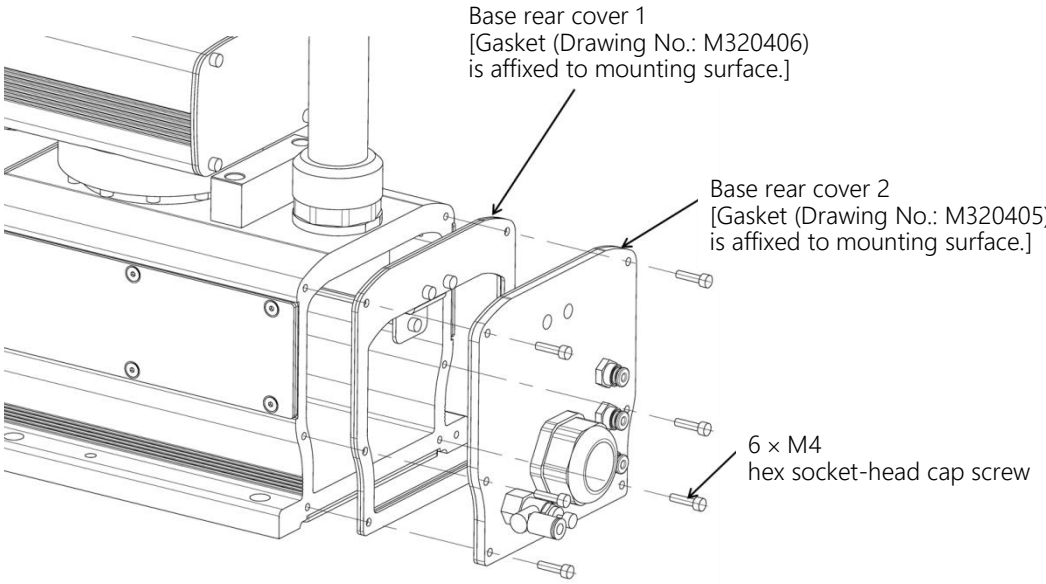


Figure 5.7 Base Covers

⚠ CAUTION

- Be careful not to damage the gaskets. If the gaskets are damaged, dust-proof performance will be reduced, and dust could enter inside the robot.
- The gaskets are fragile, and they may be damaged during part replacement. When performing replacement work, obtaining of new gaskets is also recommended. For more information about gaskets, see "7.1 Maintenance Replacement Parts List".

5.6.2 2nd Arm Cover

1) Be sure to remove the upper bellows before removing the 2nd arm cover. For details on removing the upper bellows, see "5.4.2 Upper Bellows Replacement Procedure". The 2nd arm cover is secured in place using M3 and M4 hex socket-head cap screws. First, remove the 14 hex socket-head cap screws securing the cover.
2) Gaskets are affixed to 2nd arm and the cover bracket. Be careful that you do not damage them or use excessive force to remove them. There are some gasket locations that partially adhere to the cover using Liquid Gasket. If they do not come off easily, use a slotted screwdriver or similar tool to carefully peel off the gasket without damaging it.

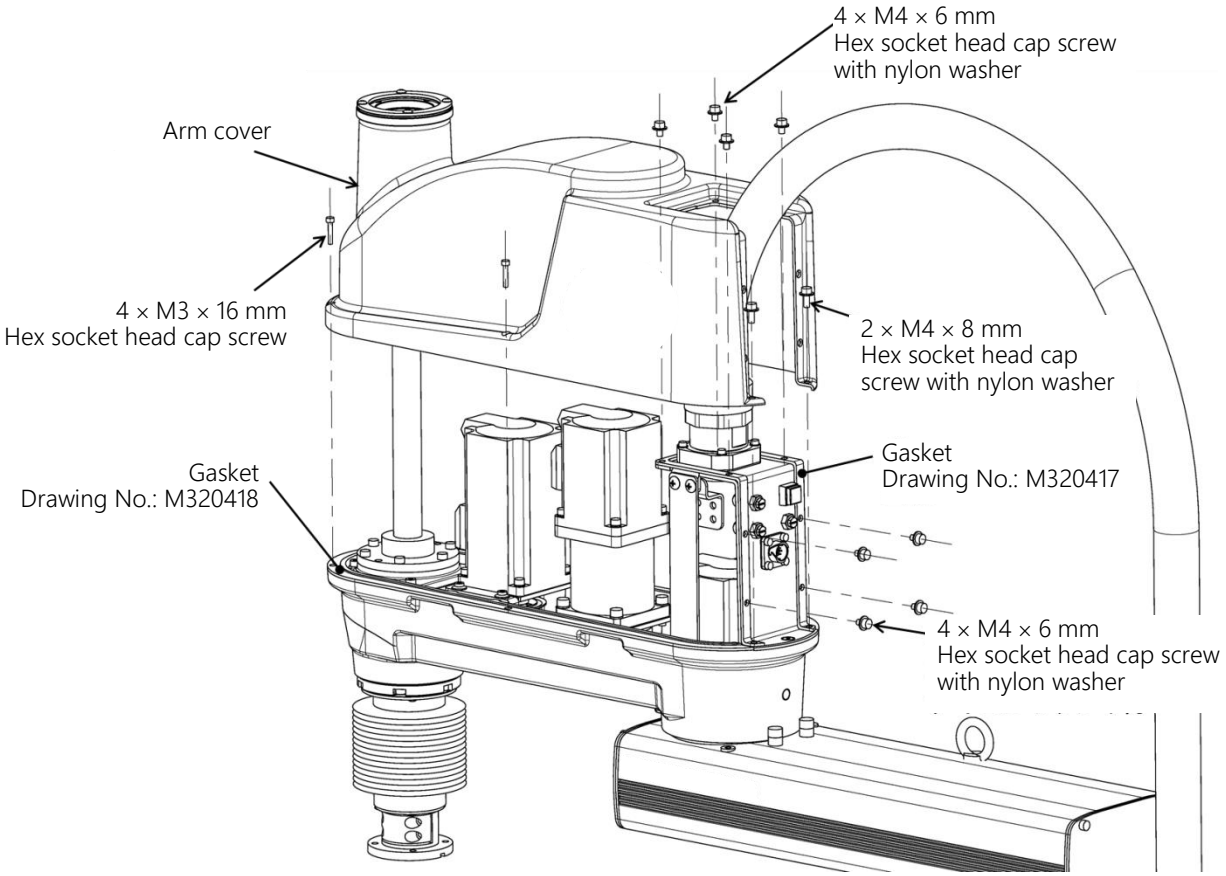


Figure 5.8 2nd Arm Cover

Apply Loctite to the mounting bolts.

CAUTION

- Be sure to always apply Loctite to the mounting bolts. If Loctite is not applied, this could result in reduced dust-proof performance, and dust could enter inside the robot.
- Be careful not to damage the gaskets. If the gaskets are damaged, dust-proof performance will be reduced, and dust could enter inside the robot.
- The gaskets are fragile, and they may be damaged during part replacement. When performing replacement work, obtaining of new gaskets is also recommended. For more information about gaskets, see "7.1 Maintenance Replacement Parts List".

6. Cleaning of Robot Body

To clean the robot body, use a soft cloth dipped in cleaning alcohol, and wipe off any dirt while being careful not to damage the robot body.

DANGER

- Before starting the cleaning work, be sure to turn off the controller power, and unplug it from the outlet. Leaving the power on during the work is extremely hazardous and can result in an electrical shock or breakdown.

CAUTION

- Apply an air purge when removing dust using a blower or similar tool. If an air purge is not applied, dust-proof performance will be reduced, and dust could enter inside the robot.
- Do not splash water or other liquids on the robot. Liquid could get inside the robot, resulting in a breakdown.

7. Maintenance Replacement Parts

7.1 Maintenance Replacement Parts List

	Item name	Drawing No.	Unit code	Manufacturer	Qt'y	Notes
1	Bellows	S854575	Y610A3GH0	Shibaura Machine Co., Ltd.	2	Z-stroke: 150 mm
2	Body harness	F113105	Y610A3TN0	Shibaura Machine Co., Ltd.	1	For KHL-500
3	Body harness	F113106	Y610A3TP0	Shibaura Machine Co., Ltd.	1	For KHL-600
4	Body harness	F113094	Y610A3TQ0	Shibaura Machine Co., Ltd.	1	For KHL-700-IP6X
5	Gasket	S854536		Shibaura Machine Co., Ltd.	2	See 5.3.1 and 5.3.2
6	Gasket	S948749		Shibaura Machine Co., Ltd.	1	See 5.3.1
7	Gasket	S854497		Shibaura Machine Co., Ltd.	1	See 5.3.2
8	Gasket	S854558		Shibaura Machine Co., Ltd.	1	See 5.3.2
9	Gasket	S935815		Shibaura Machine Co., Ltd.	1	See 5.4.1
10	Gasket	M320405		Shibaura Machine Co., Ltd.	1	See 5.5.1
11	Gasket	M320406		Shibaura Machine Co., Ltd.	1	See 5.5.1
12	Gasket	M320417		Shibaura Machine Co., Ltd.	1	See 5.5.2
13	Gasket	M320418		Shibaura Machine Co., Ltd.	1	See 5.5.2

Maintenance replacement parts other than those in the table above are identical to the standard KHL-500, KHL-600, and KHL-700 models.
For details, see the instruction manual "Maintenance".

- When purchasing maintenance replacement parts, please send an inquiry to CKD after confirming the robot body serial number.