


# THP550-IP TH450A-IP TH550A-IP/TS3000

Industrial Robot 

## INSTRUCTION MANUAL

### DUST- & DRIP-PROOF TYPE INDUSTRIAL ROBOT SPECIFICATIONS

#### Notice

1. Make sure that this instruction manual is delivered to the final user of Toshiba Machine's industrial robot.
2. Before operating the industrial robot, read through and completely understand this manual.
3. After reading through this manual, keep it nearby for future reference.

March, 2010

**TOSHIBA MACHINE CO., LTD.**

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## Preface

This manual describes the specifications of the THP550/TH450A/TH550A dust- and drip-proof type industrial robot.




This manual is essential to keep the robot performance for a long time, to prevent failures and to assure safety. Be sure to look through this manual and set up a maintenance program before actually starting the robot.

## Precautions on Safety

Important information on the robot and controller is noted in the instruction manual to prevent injury to the user and persons nearby, 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
 <b>DANGER</b>	This means that "incorrect handling will imminently lead to fatalities or major injuries".
 <b>WARNING</b>	This means that "incorrect handling may lead to fatalities or serious injuries."
 <b>CAUTION</b>	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 treatment.




\*2) Physical damage refers to major fires 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). 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). 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 observe the following items to use this product safely.

 <b>DANGER</b>	
 Prohibited	<ul style="list-style-type: none"> <li>• DO NOT incinerate, disassemble or charge the batteries. Otherwise, they may rupture.</li> </ul>
 Mandatory	<ul style="list-style-type: none"> <li>• Be sure to turn off the main power switch of the controller before starting inspection or maintenance.</li> <li>• Batteries should be disposed of according to the user's in-house regulations.</li> </ul>

 <b>CAUTION</b>	
 Disassembly prohibited	<ul style="list-style-type: none"> <li>• The user must NEVER replace or modify parts other than those described in the instruction manual. Otherwise, the performance may deteriorate or faults or accidents will be caused.</li> </ul>
 Mandatory	<ul style="list-style-type: none"> <li>• Always use the Toshiba Machine's designated spare parts when replacing the parts.</li> <li>• Maintenance and inspection should be performed regularly. Otherwise, the system may malfunction or accidents will be caused.</li> </ul>

This manual is comprised of the following seven (7) sections:

**Section 1 Specifications**

This section describes the basic specifications and names of respective parts for the dust- and drip-proof type industrial robot.

**Section 2 Transportation**

This section describes how to remove the dust- and drip-proof type robot from its box and how to transport it to the installation site. This section also deals with the precautions to be taken when the robot is to be stored temporarily after unpacked.

**Section 3 Installation**

This section discusses the dust- and drip-proof type robot installation environment, space requirements, and how to install the robot.

**Section 4 Tool Interface**

This section discusses how to connect the cables and pipelines for the tool of the dust- and drip-proof type robot.

**Section 5 Maintenance**

This section describes the structure of the dust- and drip-proof type robot and all items required for the maintenance and inspection of the same robot.

**Section 6 Cleaning of Robot Body**

This section describes the precautions to be taken when the robot body is to be cleaned and washed.

**Section 7 Replacement Parts for Maintenance**

This section explains the replacement parts for the maintenance.

**Section 8 Optional Parts**

This section explains the optional parts.

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1. Specifications

1.1 Name of Each Part

The names of respective parts of the dust- and drip-proof type robot are shown in Fig. 1.1 below. The figure shows the THP550-IP.

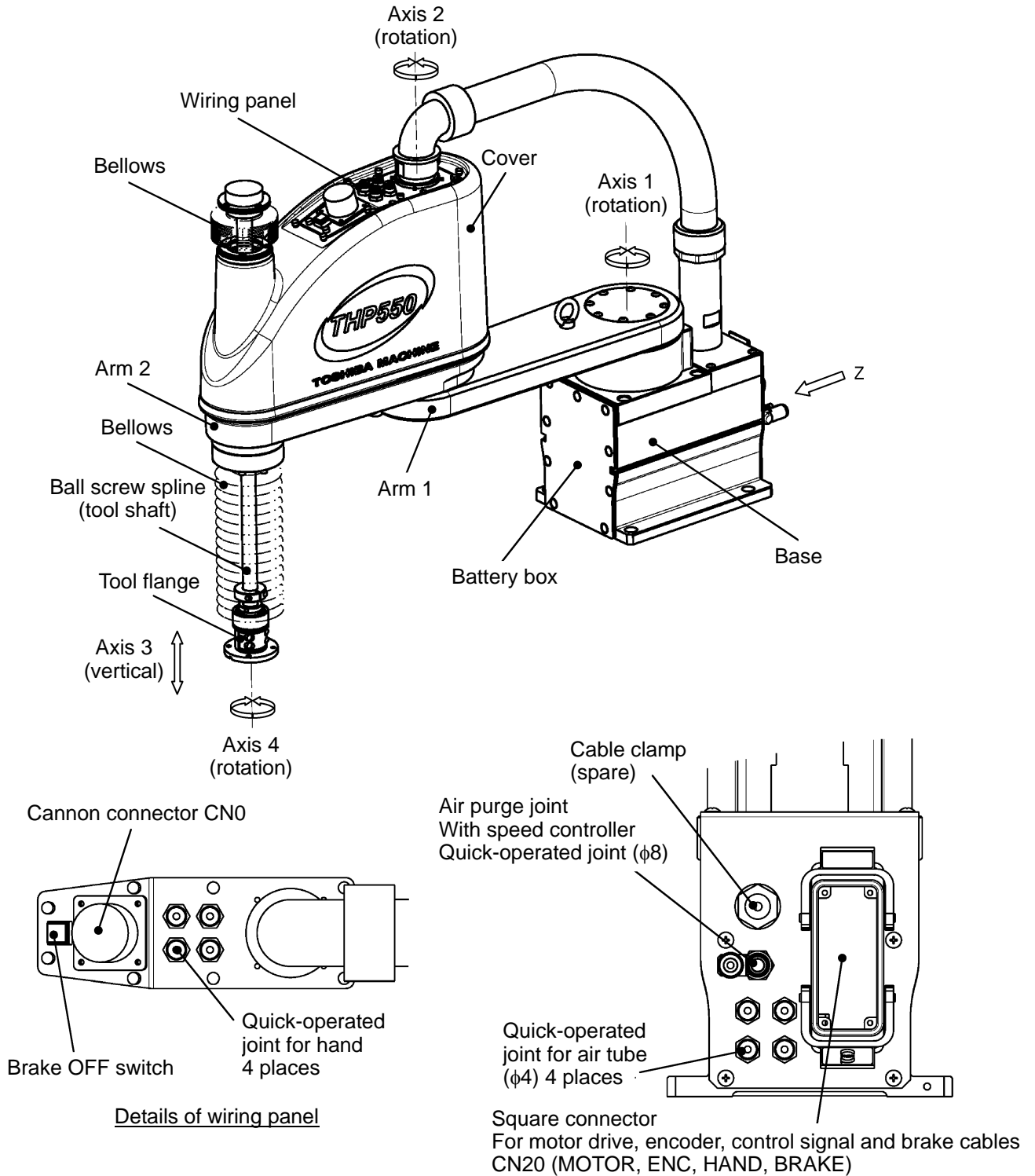


Fig. 1.1 Name of each part When viewed from arrow-mark Z



1.2 Outer Dimensions

Fig. 1.2 to Fig. 1.4 show the outer dimensions and Fig. 1.5 to Fig. 1.7 show operating range of the robot.

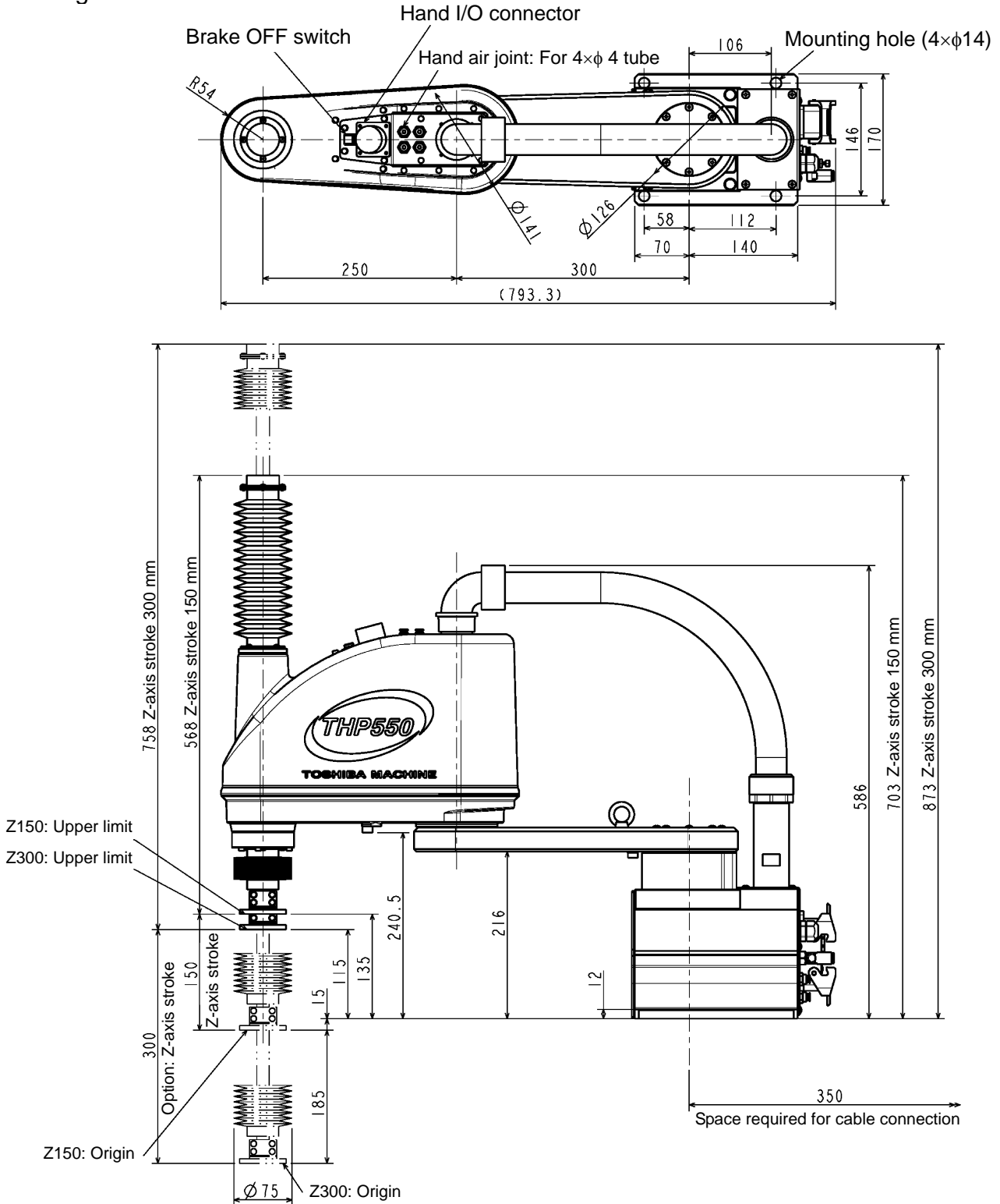


Fig. 1.2 Outer dimensions of the robot (THP550-IP)

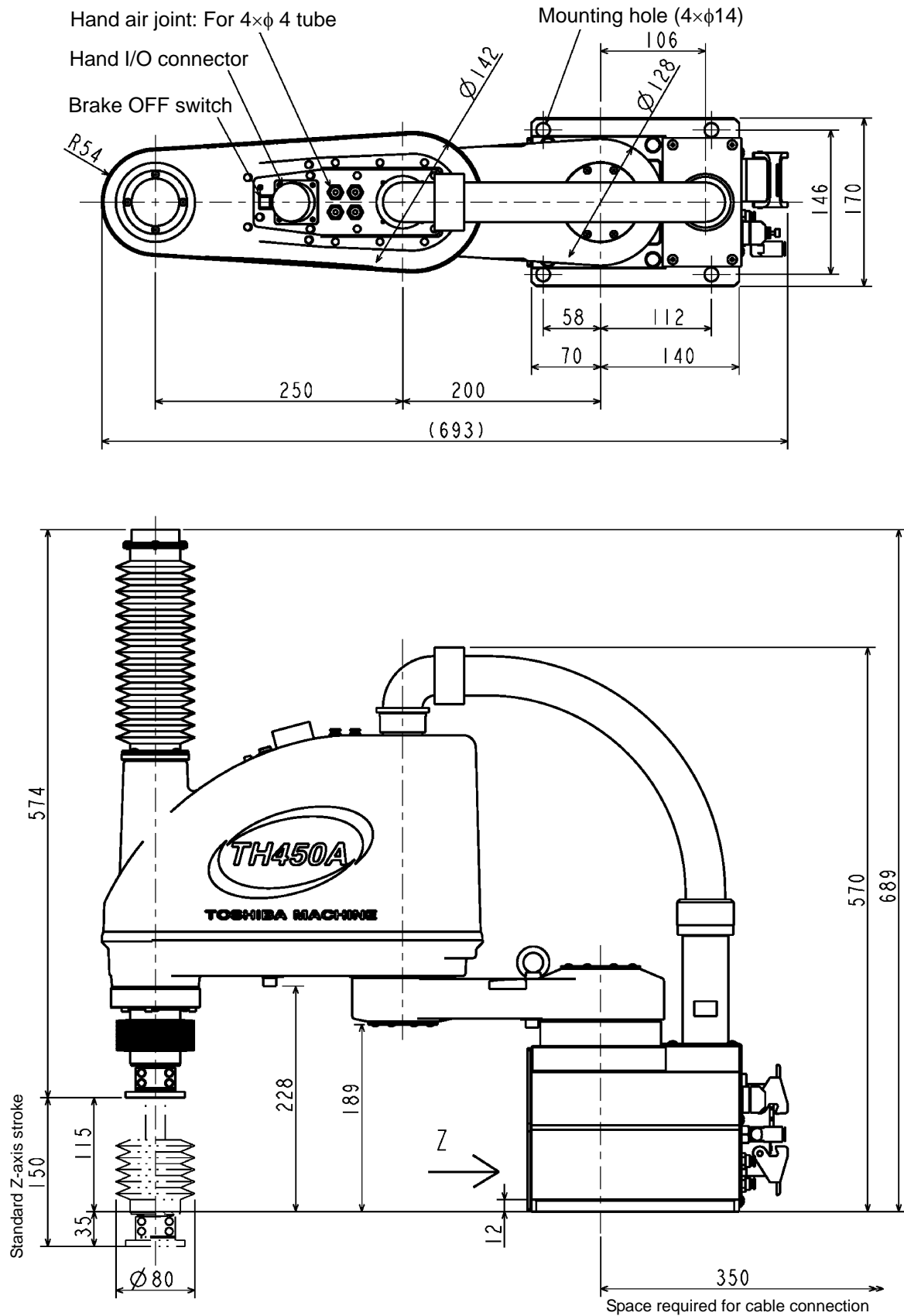


Fig. 1.3 Operating range of the robot (TH450A-IP)

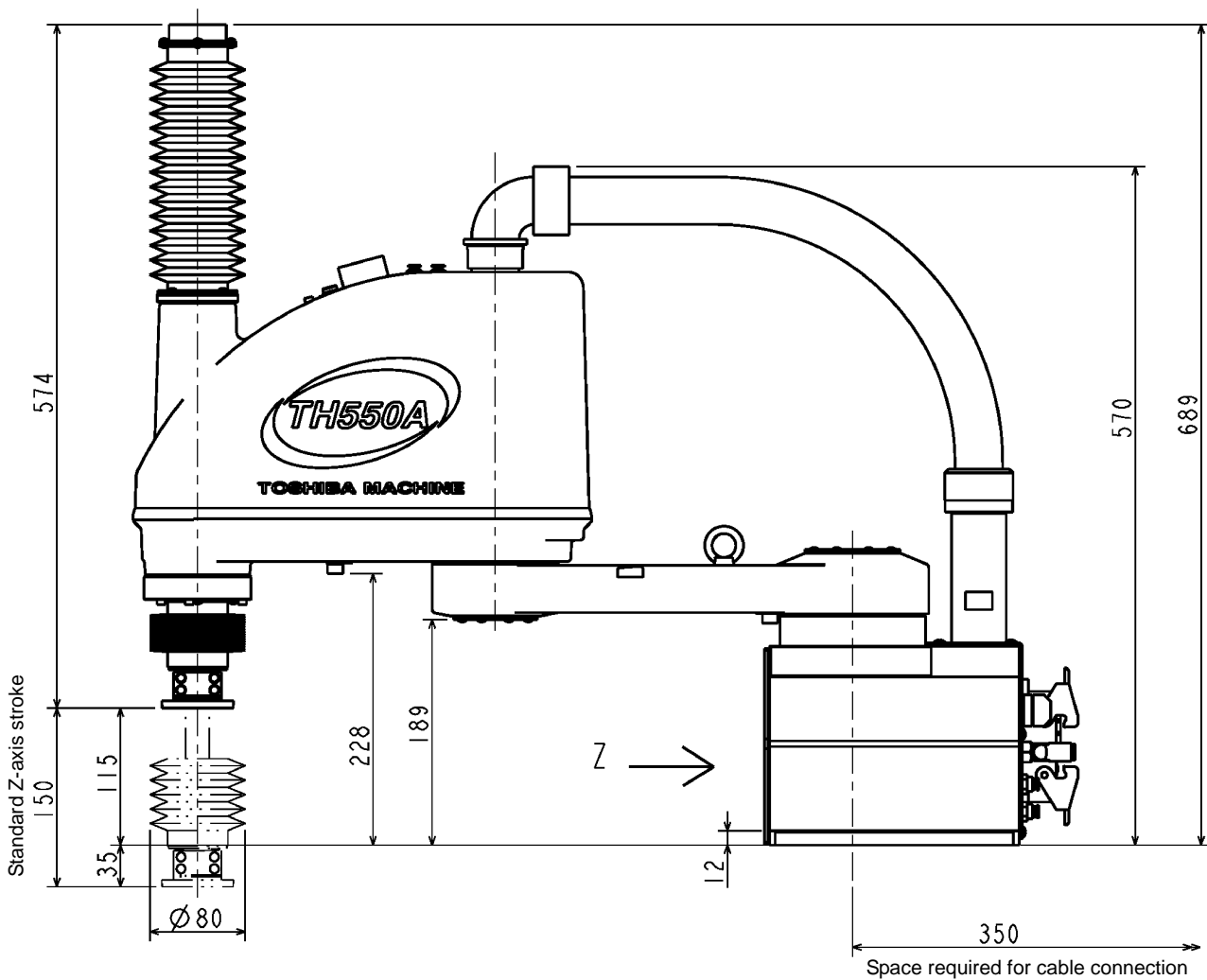
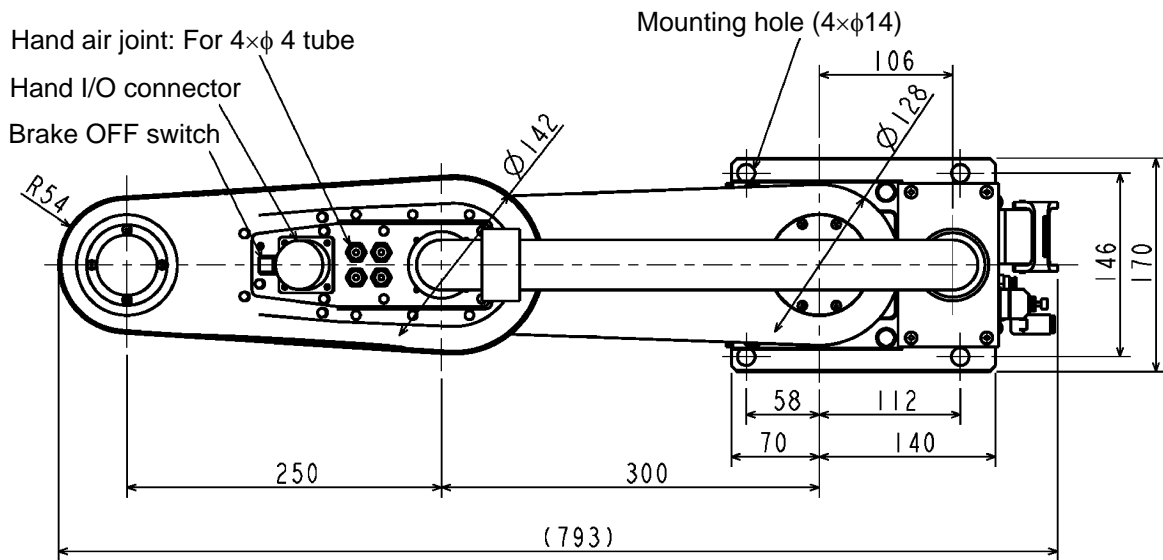


Fig. 1.4 Operating range of the robot (TH550A-IP)

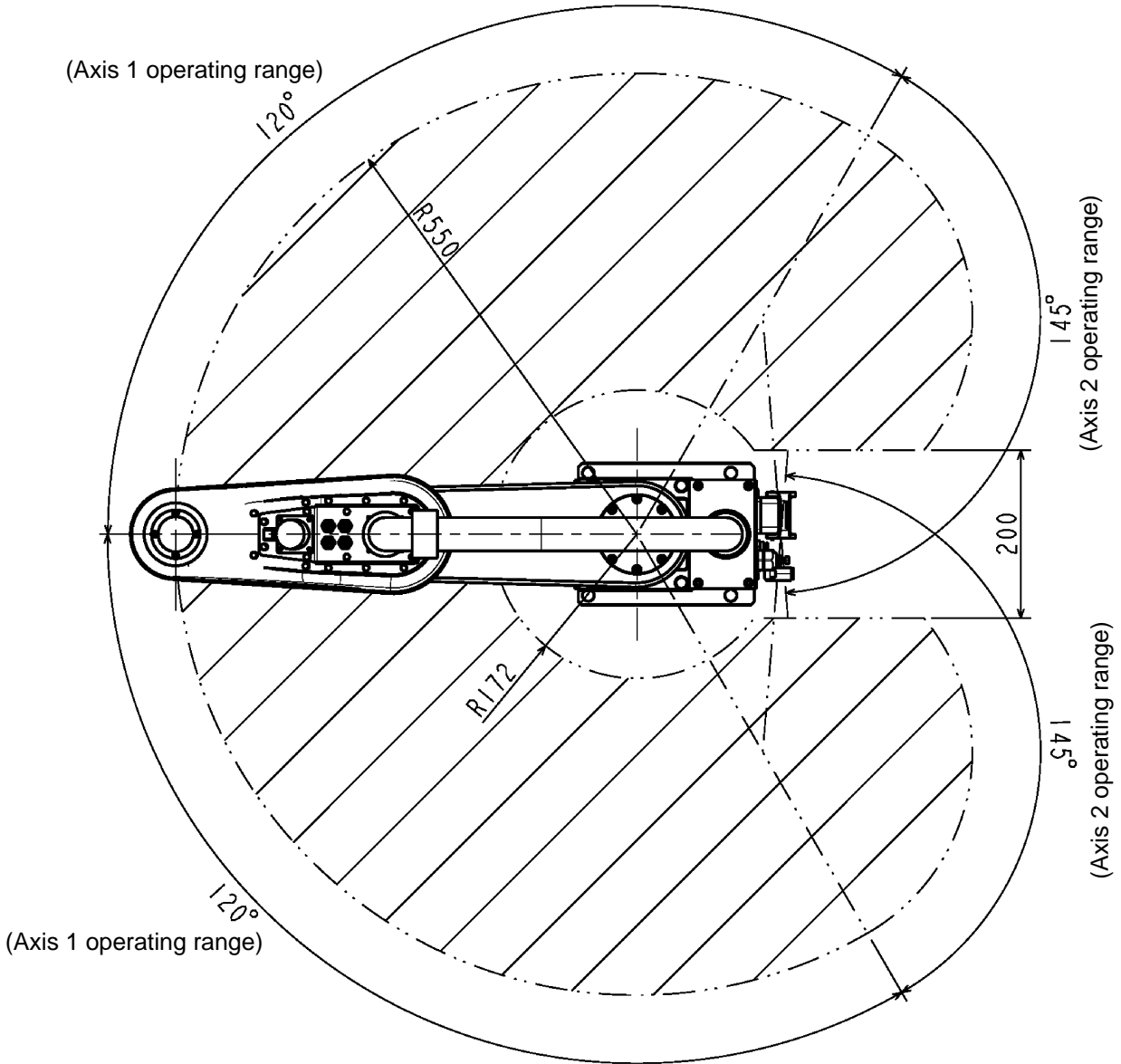


Fig. 1.5 Operating range of the robot (THP550-IP)

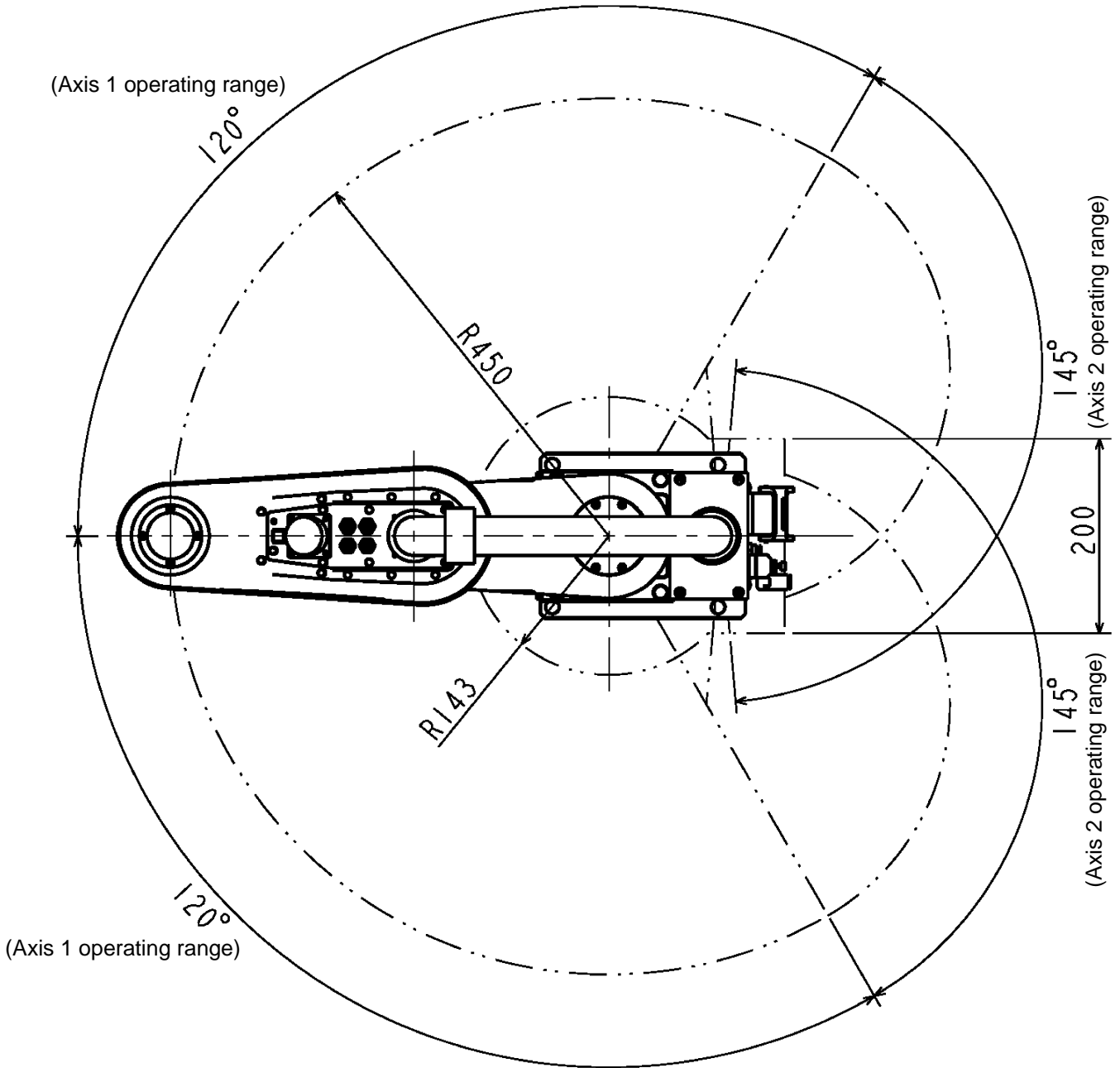


Fig. 1.6 Operating range of the robot (TH450A-IP)

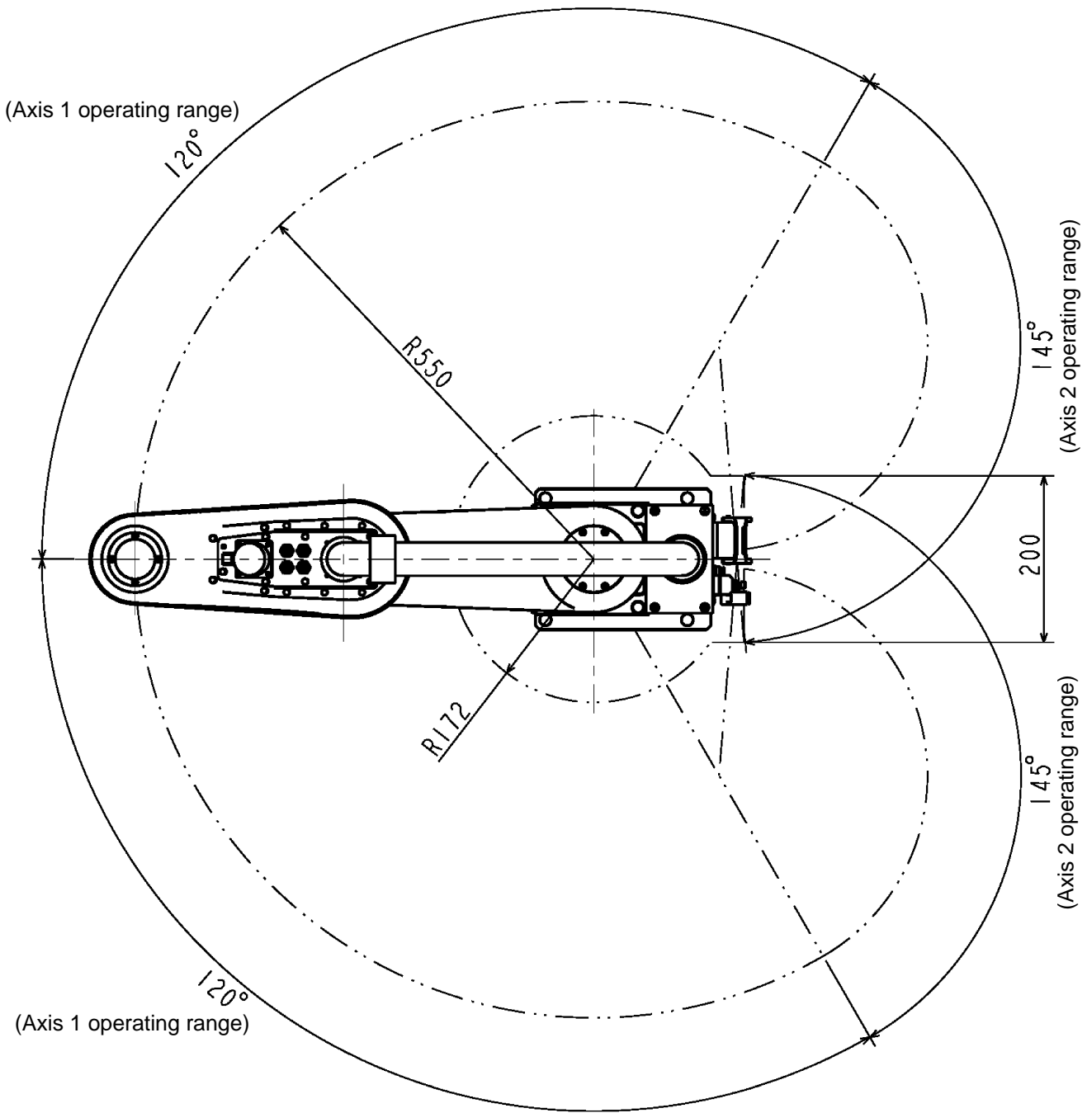


Fig. 1.7 Operating range of the robot (TH550A-IP)

### 1.3 Specifications Table

Item		Specifications
Structure		Horizontal multi-joint type SCARA robot
Model		THP550-IP
Ingress protection (IP) class of dust- and drip-proof structure		IP65 (*1)
Applicable controller		TS3000 (*2)
Mass of robot body		27 kg
No. of controlled axes		4
Arm length		550 mm (300+250)
Motor capacity	Axis 1	1000 (W)
	Axis 2	400 (W)
	Axis 3	200 (W)
	Axis 4	100 (W)
Operating range	Axis 1	±120 (deg)
	Axis 2	±145 (deg)
	Axis 3	150 (mm) [Option: 300 (mm)]
	Axis 4	±360 (deg)
Maximum speed (*3)	Axis 1	375 (deg/s)
	Axis 2	600 (deg/s)
	Axis 3	2000 (mm/s)
	Axis 4	2000 (deg/s)
	Composite speed of axes 1 and 2	6.21 (m/s)
Rated payload mass		1 (kg)
Maximum payload mass		2 (kg)
Permissible load inertia (*3)		0.01 (kg·m <sup>2</sup> )
Repeatability (*4)	X, Y	±0.015 (mm)
	Z	±0.01 (mm)
	C	±0.02 (deg)
Cycle time (*5) (When payload mass is 1 kg)		0.29 (sec)
Drive system		By means of AC servo motors
Position detection method		Absolute

\*1: For details of the IP class, see Para. 3.2.

\*2: The structure of the robot controller is not dust- and drip-proof.

\*3: When the mass of load exceeds 2 kg, or when the gravity center position of load is away from the axis 4 center position, both the speed and acceleration should be reduced, using the PAYLOAD command.

\*4: The ambient temperature is predetermined at 20°C.

\*5: Shuttle time for rough positioning in horizontal direction of 300 mm and vertical direction of 25 mm.

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Item		Specifications	
Structure		Horizontal multi-joint type SCARA robot	
Model		TH450A-IP	TH550A-IP
Ingress protection (IP) class of dust- and drip-proof structure		IP65 (*1)	
Applicable controller		TS3000 (*2)	
Mass of robot body		28 kg	29 kg
No. of controlled axes		4	
Arm length		450 mm (200+250)	550 mm (300+250)
Motor capacity	Axis 1	1000 (W)	
	Axis 2	400 (W)	
	Axis 3	200 (W)	
	Axis 4	200 (W)	
Operating range	Axis 1	±120 (deg)	
	Axis 2	±145 (deg)	
	Axis 3	150 (mm) [Option: 300 (mm)]	
	Axis 4	±360 (deg)	
Maximum speed (*3)	Axis 1	600 (deg/s)	375 (deg/s)
	Axis 2	600 (deg/s)	
	Axis 3	2000 (mm/s)	
	Axis 4	2000 (deg/s)	
	Composite speed of axes 1 and 2	7.3 (m/s)	6.21 (m/s)
Rated payload mass		2 (kg)	
Maximum payload mass		5 (kg)	
Permissible load inertia (*3)		0.06 (kg·m <sup>2</sup> )	
Repeatability (*4)	X, Y	±0.01 (mm)	
	Z	±0.01 (mm)	
	C	±0.005 (deg)	
Cycle time (*5) (When payload mass is 2 kg)		0.3 (sec)	
Drive system		By means of AC servo motors	
Position detection method		Absolute	

\*1: For details of the IP class, see Para. 3.2.

\*2: The structure of the robot controller is not dust- and drip-proof.

\*3: When the mass of load exceeds 2 kg, or when the gravity center position of load is away from the axis 4 center position, both the speed and acceleration should be reduced, using the PAYLOAD command.

\*4: The ambient temperature is predetermined at 20°C.

\*5: Shuttle time for rough positioning in horizontal direction of 300 mm and vertical direction of 25 mm.



## **2. Transportation**

### **2.1 Unpacking**

The robot and controller are shipped separately in wooden crates or corrugated cardboards.

Open the packages in a location easily accessible, where the equipment is to be installed. Take careful precautions not to damage the robot and controller.

After opening the packages, make sure that all the accessories are present and that no part has been damaged during transport.

The package posture and contents are the same as in the standard robot. See the THP550A Installation and Transportation Manual and TH450A/TH550A Installation and Transportation Manual provided separately.

For the dust- and drip-proof type robot, strictly observe the following cautions.



#### **CAUTION**

- The main robot is factory-packed in a vinyl bag for shipment. Carefully remove the bag after the shipment has reached your office. If the vinyl bag is pulled by force, the bellows or cover may be damaged.

### **2.2 Transportation**

Move the robot and controller very carefully. Make sure that no excessive impact or vibration is exerted on the equipment. If the equipment is to be subject to vibration over a long period, be sure to tighten all of the clamp and base set bolts completely and put the equipment back into the wooden crates or corrugated cardboards.

2.2.1 Mass and Outer Dimensions

The mass and outer dimensions of the robot are shown in Fig. 2.1 to Fig. 2.3.

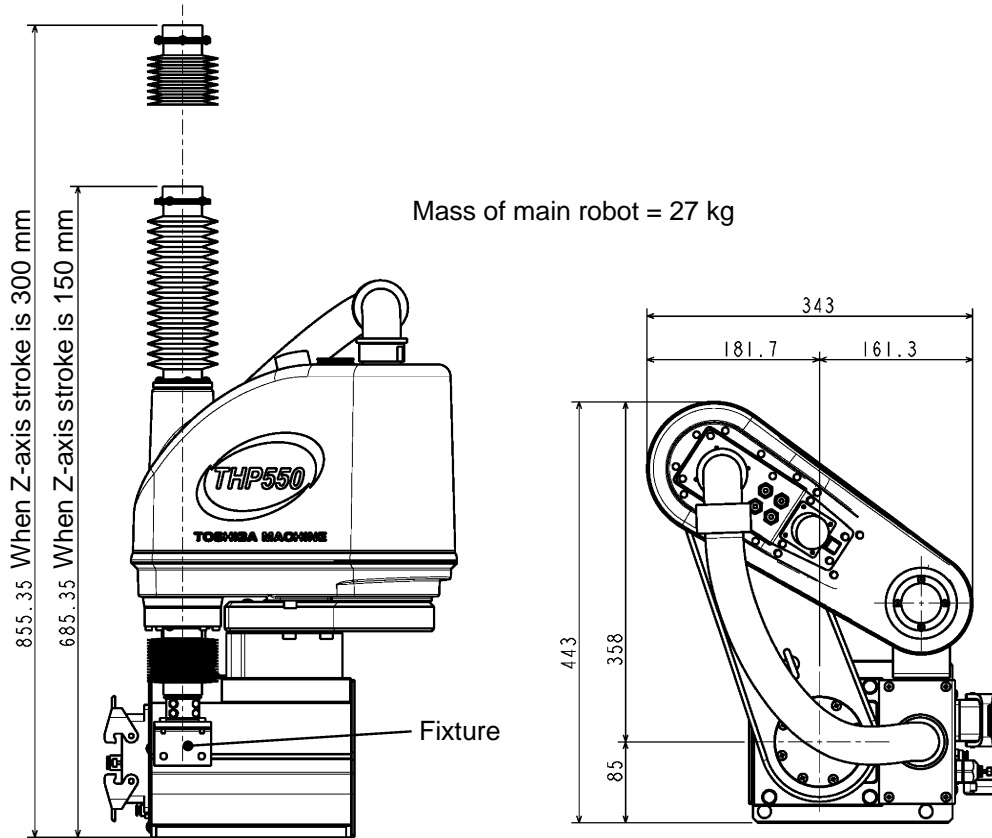


Fig. 2.1 Outer dimensions at transport (THP550-IP)

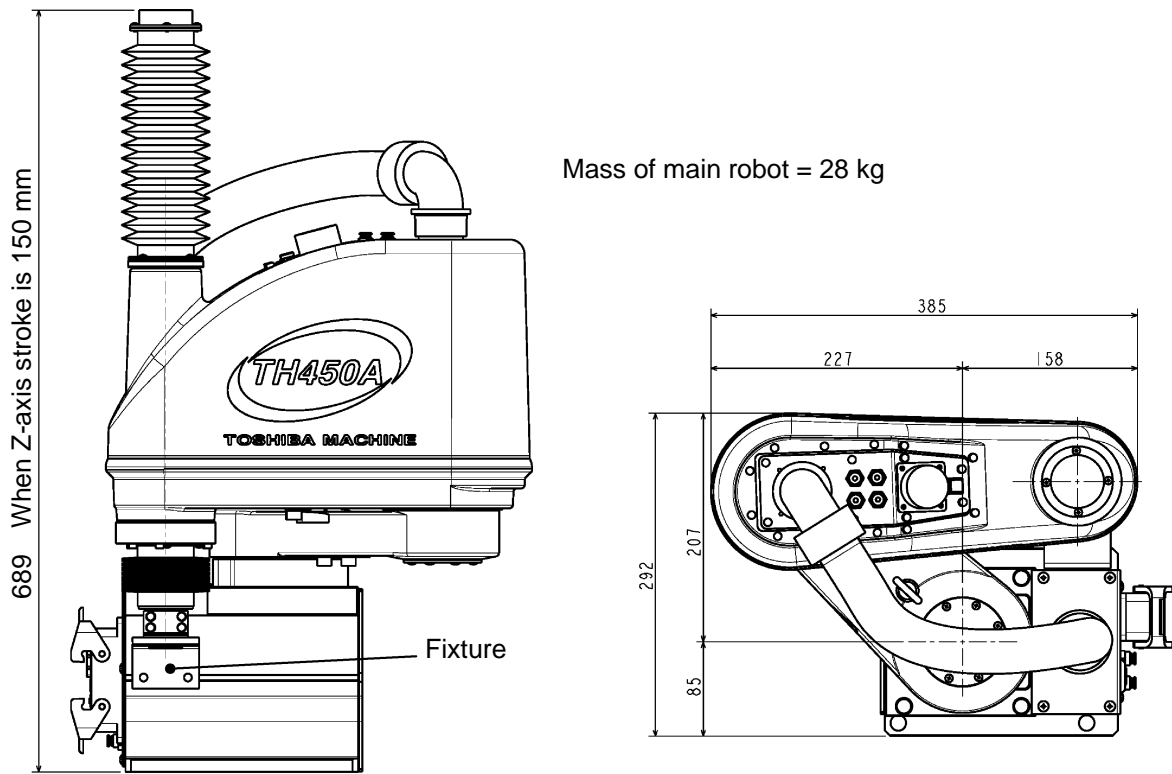


Fig. 2.2 Outer dimensions at transport (TH450A-IP)

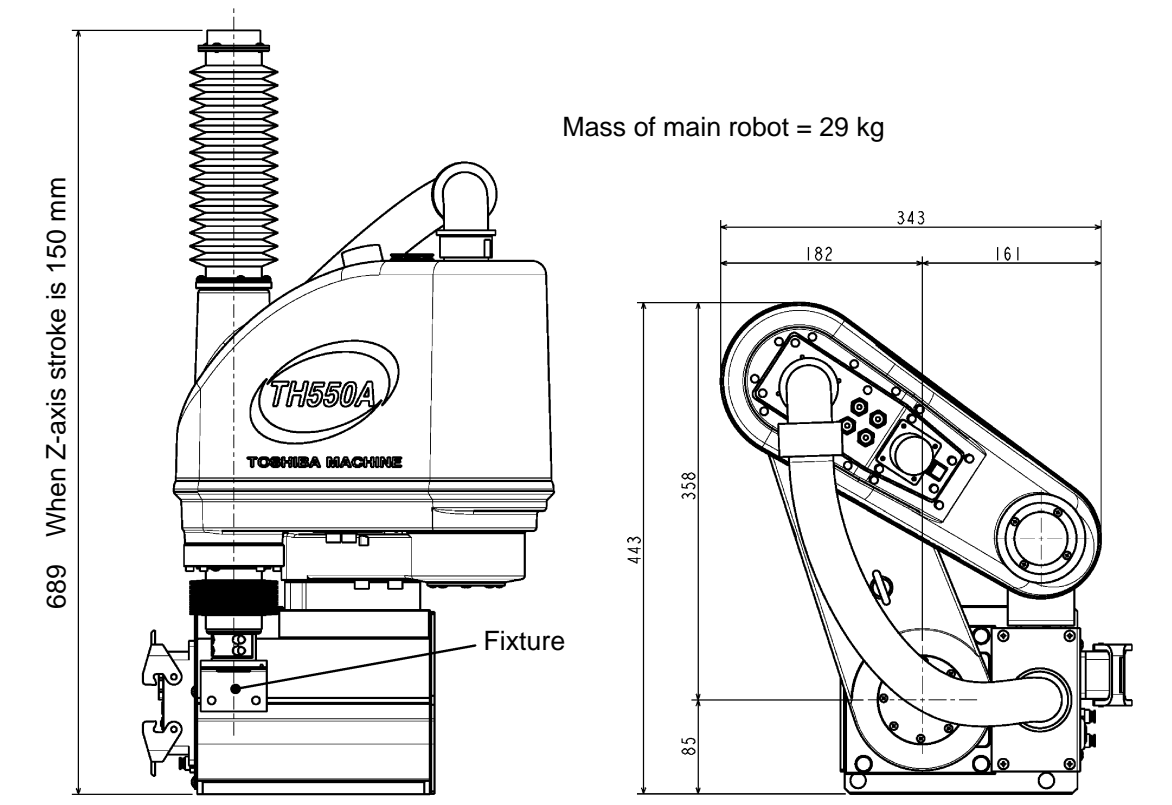


Fig. 2.3 Outer dimensions at transport (TH550A-IP)

### 2.2.2 Transporting the Robot

The dust- and drip-proof type robot equals the standard robot added with a cap and bellows. The precautions to be taken at transport are stated below. The precautions other than the below are the same as in the standard robot. See the TH650A Installation and Transportation Manual provided separately.

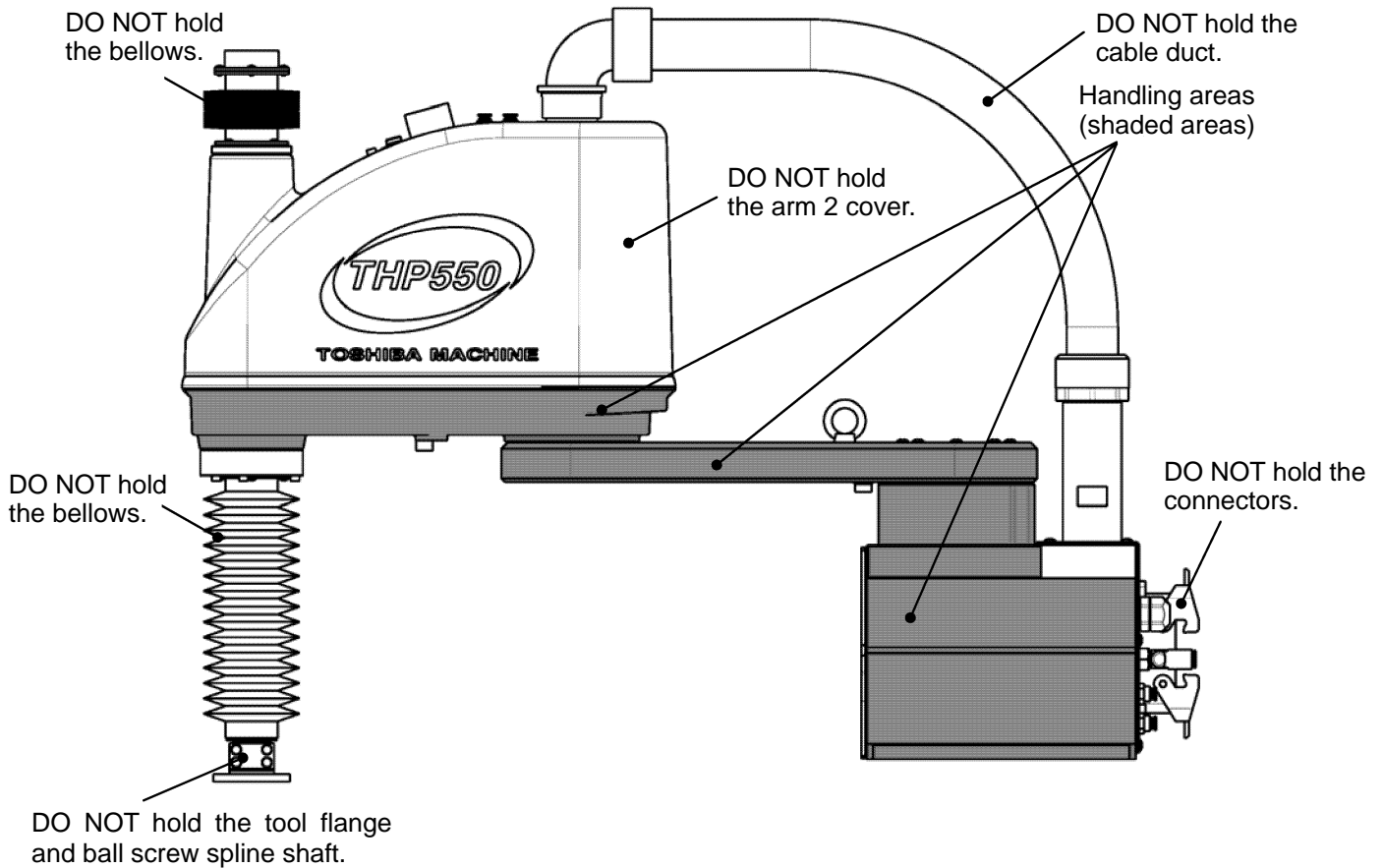


Fig. 2.4 Robot handling prohibited areas

After the installation, remove the clamp and eyebolt used for transport.

**CAUTION**

- When lifting up the robot by workers, hold the shaded locations by hands, as shown in Fig. 2.4. If the ball screw spline shaft is held by hands, an unusually large force is exerted, resulting in a malfunction.
- If the cap is held by hands, the cap and cover may be damaged.
- If the bellows is held or gripped by hands, it may be broken due to friction with the parts inside.
- When carrying the robot by workers, take careful precautions to prevent their hand or leg from being caught in the robot.
- The work should always be performed by two (2) or more workers.

**3. Installation**

**3.1 Installation Environment**

Table 3.1 shows the environmental conditions for the location in which the robot and controller are to be installed.

Table 3.1 Environmental conditions for robot and controller

Item	Specifications
Temperature	In operation : 0 to 40°C In storage : -10 to 50°C
Humidity	20 to 90 % (Non-condensing)
Altitude	1000 m or less
Vibration	In operation : 0.98 m/s <sup>2</sup> or less
Dust	No inductive dust should exist.
Gas	No corrosive or combustible gas should exist.
Sunlight	The robot and controller should not be exposed to direct sunlight.
Power noise	A heavy noise source should not exist nearby.
Magnetic field	A heavy magnetic field source should not exist nearby.
Dust-proof and drip-proof	Any place where the equipment sinks in liquid shall not exist. Small chips involved in turning or cutting operation shall not be contained. Mist of cutting fluid or coolant oil shall not be contained.



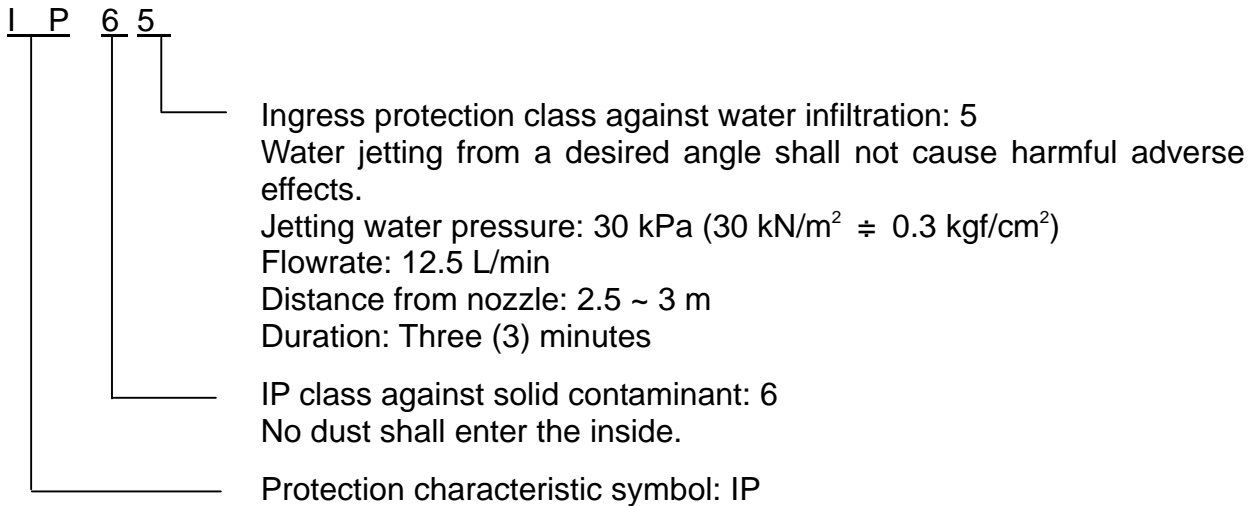
**DANGER**

- Do not place the robot or controller near combustible. Doing so could lead to fires if it ignites due to a fault, etc.

### 3.2 Ingress Protection (IP) Class of Dust- and Drip-Proof Specification

For the dust- and drip-proof specification of THP550, the ingress protection (IP) class against dust and water is IP65 or equivalent.

Be sure to perform air purge. Under some operating environment, water or dust may enter.



#### **WARNING**

- DO NOT use the entire robot or part of the robot sinking in water. Otherwise, the water will enter the robot interior.
- DO NOT use the robot in an environment exceeding the specified IP class against water and dust. Otherwise, the water or dust may enter the robot interior, resulting in shortening of the robot life, deterioration of operating accuracy or mis-operation of the robot.
- The robot controller does not have dust- and drip-proof specification.
- For the drip-proof ability against other than water, consult us.
- The bellows may discolor under some operating environment, which poses no problem, however, to the dust- and drip-proof performance.
- Be sure to perform air purge. Otherwise, the dust- and drip-proof performance will drop.
- The dust- and drip-proof specification does not mean the explosion-proof structure.

## 3.3 Air Purge

The dust- and drip-proof type robot is provided with an air supply port for air purge in its base connector unit. See Para. 1.1. (Quick-operated joint with speed controller)  
By feeding air into the air supply port, entry of dust into the robot can be prevented.  
The air supply unit (reducer or pressure reducing valve, air filter, etc.) and air tube (8 mm-dia.) should be provided by the customer.

- Air specifications

Maximum operating pressure: 0.58 MPa (6 kgf/cm<sup>2</sup>)

Tube size: Outer dia. 8 mm × Inner dia. 5 mm

Fluid used: Fresh dry air not containing compressor oil, etc.

Filtration accuracy of air filter 10 μm or less

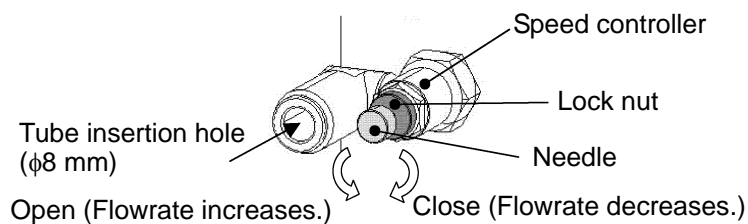
- How to regulate flowrate

Fully close the speed controller attached to the robot base connector unit.

Set the pressure to 0.3 MPa ~ 0.58 MPa (maximum pressure), using a regulator (or pressure reducing valve: to be provided by the customer), then connect the air tube.

Turn the needle of the speed controller counterclockwise from the fully closed state to increase the flowrate. Regulate the flowrate while observing the bellows condition and tighten the lock nut of the speed controller.

If the air volume fed is too much, the bellows will swell out. Regulate the air to just before the bellows starts expanding.



### CAUTION

- Be sure to use fresh dry air. Otherwise, the robot interior will condense and water stays there, resulting in an electric leak or malfunction.
- DO NOT increase the pressure exceeding the specified maximum pressure. Otherwise, the seal, etc. of each joint will be broken to damage the dust- and drip-proof performance.



### 3.4 Coordinate System

The robot's joint angle origin ( $0^\circ$  or 0 mm position) is factory-calibrated according to the base reference planes. Fig. 3.1 and Fig. 3.2 show the base coordinate system ( $X_B$ ,  $Y_B$ ,  $Z_B$ ) and origin of each axis joint angle.

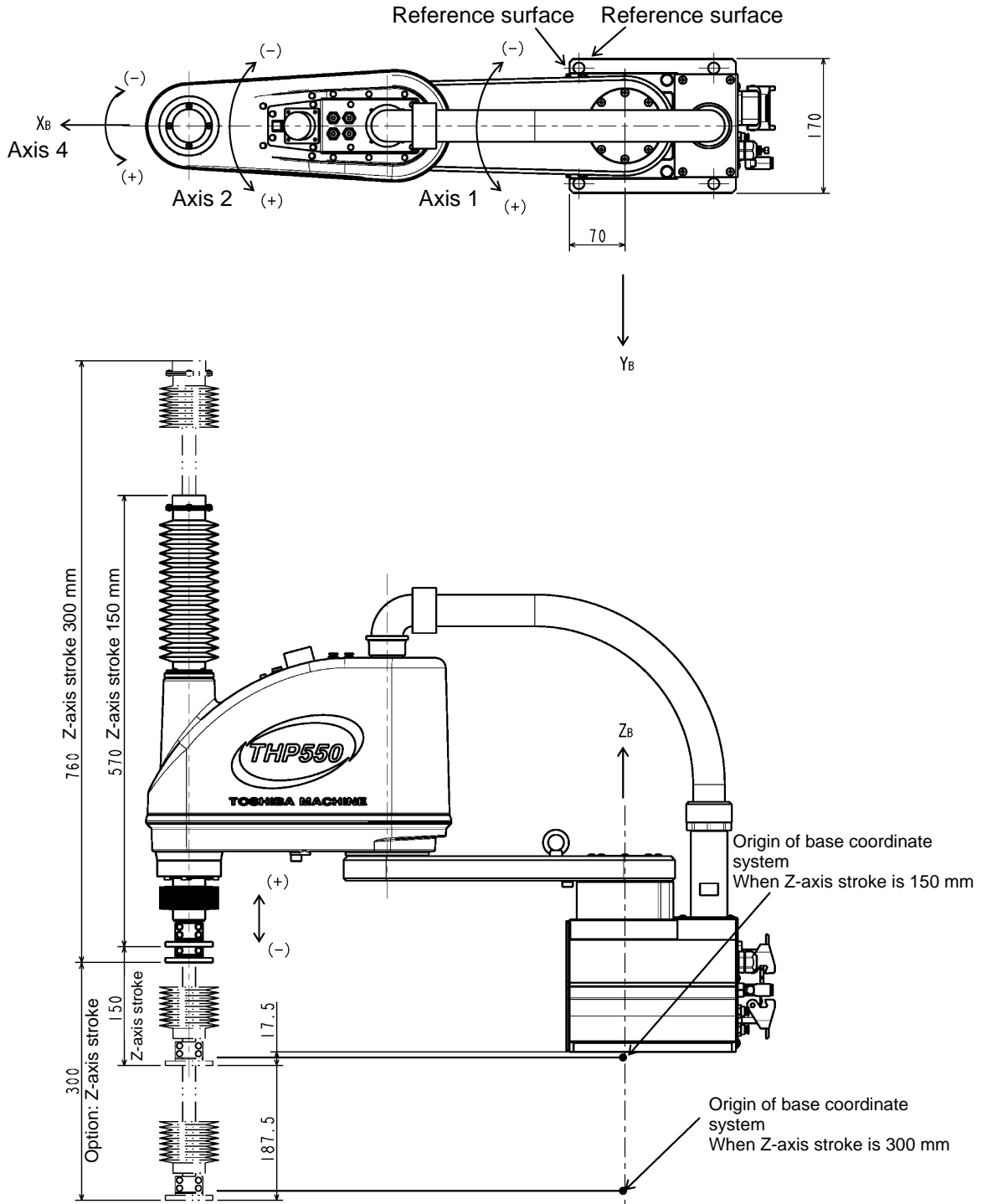


Fig. 3.1 Base coordinate system and joint angle origin (THP550-IP)

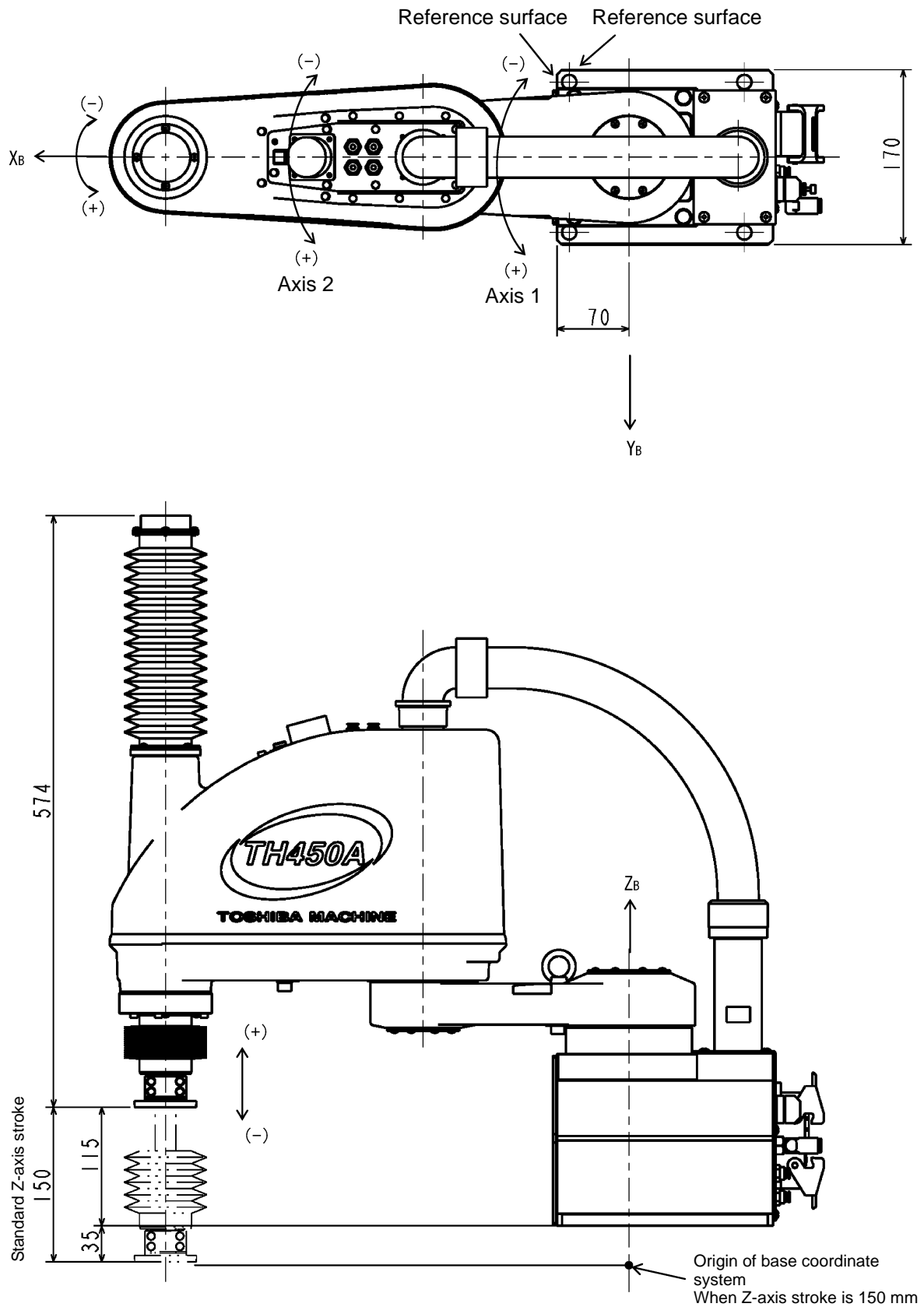


Fig. 3.2 Base coordinate system and joint angle origin (TH450A-IP/TH550A-IP)


### 3.5 Installing the Robot

The robot is secured, using the set holes on the base (four (4) places).

Use M12 hexagon socket head cap screws.

The robot installation method is shown in Fig. 3.3. The reference surfaces are provided on the base.

When you wish to adjust the robot position in the base coordinate system, or replace the robot with another one, provide appropriate reference surfaces and secure the robot by applying them to the reference surfaces of the base.



**CAUTION**

- The robot will suddenly accelerate and decelerate during operation. When installing it on a frame, make sure that the frame has sufficient strength and rigidity.  
If the robot is installed on a frame that does not have sufficient rigidity, vibration will occur while the robot is operating, and could lead to faults.  
When the robot is installed on the floor, secure it completely with anchor bolts, etc.
- Install the robot on a level place. Failure to do so could lead to a drop in performance or faults.

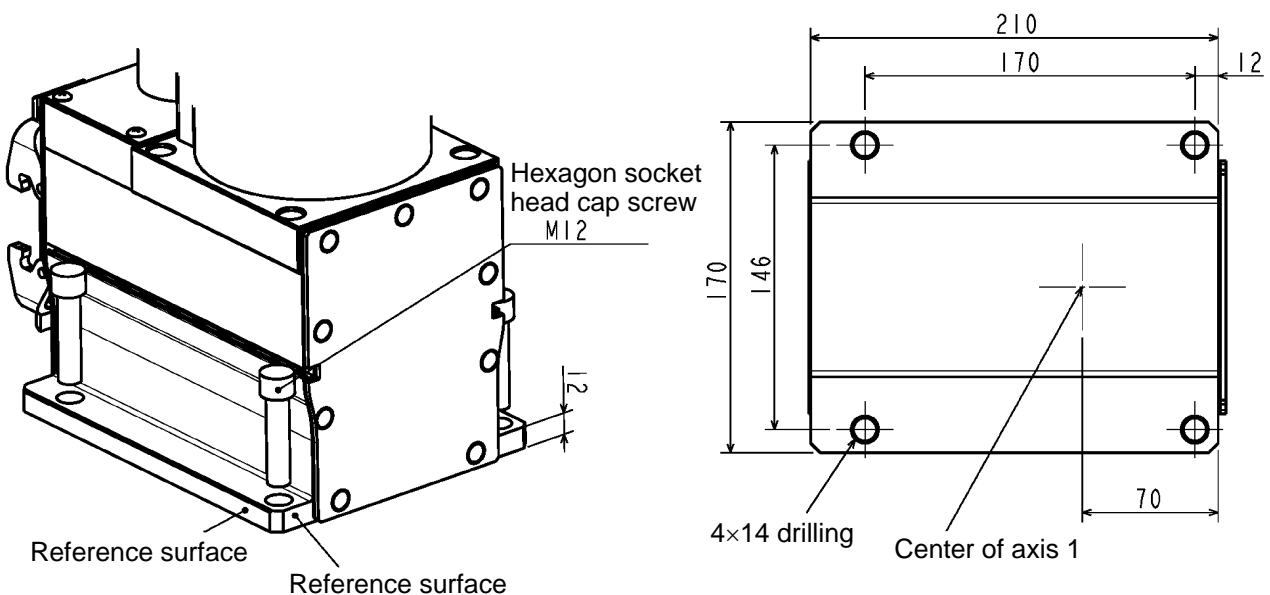


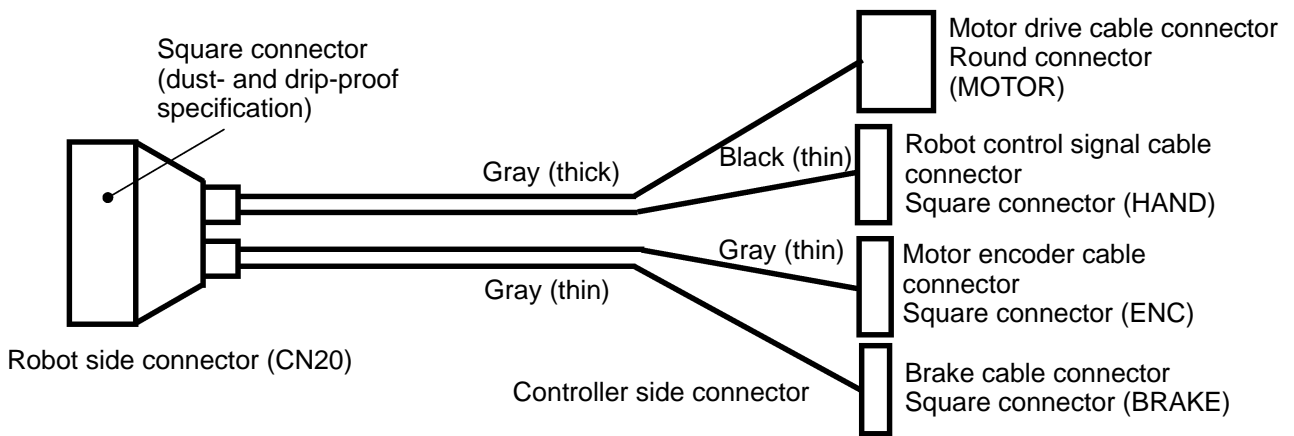
Fig. 3.3 Installation method

### 3.6 Cable Connection

The connector layout and connection method on the controller side are the same as in the standard robot. See the THP550 Installation and Transportation Manual and TH450A/TH550A Installation and Transportation Manual provided separately. For the dust- and drip-proof type robot, the connector on the robot side differs from that of the standard robot.

This paragraph describes the cable connection on the robot side.

#### 3.6.1 Cables between Robot and Controller



#### CAUTION

- Neither the robot controller nor the connectors on the robot controller side are dust- and drip-proof.

#### 3.6.2 Connecting and Disconnecting Connectors



#### CAUTION

- Before connecting or disconnecting any controller cable, be sure to turn off the main power ("POWER") switch.
- When disconnecting a cable, be sure to hold the connector body by hand to pull it out. If you pull out the cable, the cable may be broken.

To connect the connector, make sure of the top and bottom sides of the connector, completely insert the cable side connector into the robot side connector, then lock the lever of the robot side connector completely. An incomplete lock can cause a contact failure or other accident. To avoid this, make sure that the lever is locked completely.

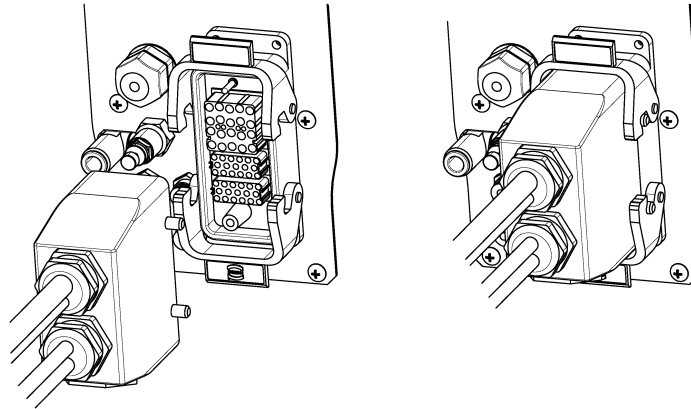
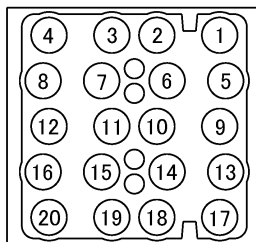
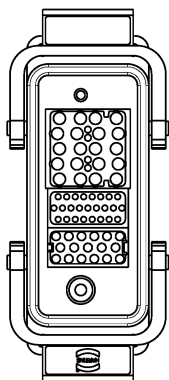


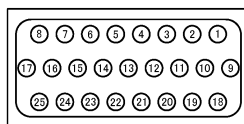
Fig. 3.4 Connecting and disconnecting connectors

### 3.6.3 Connector Terminal Layout

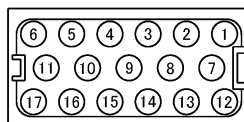
Square connector on the robot side: CN20  
 Type: 09300160301 (Body) 09140160313 (Frame)  
 Maker: Harting



Motor drive cable connector  
 (MOTOR)  
 Type: 09140203101  
 Maker: Harting



Robot control and brake signal  
 cable connector (ENC/BRAKE)  
 Type: 09140253101  
 Maker: Harting



Motor encoder cable connector  
 (HAND)  
 Type: 09140173101  
 Maker: Harting

## 4. Tool Interface

Mounting of a tool and tool signals are the same as in the standard robot.

For details, see the THP550 Installation and Transportation Manual and TH450A/TH550A Installation and Transportation Manual provided separately.

### 4.1 Tool Wiring

Five (5) input signals are provided for sensors, etc. and four (4) control signals for solenoid valves, etc. A power supply signal of DC24 V is also provided. They are connected to the controller. The cables are connected to the connectors on the upper side of the arm 2. The user should provide the following connector to connect the cables.

Cannon connector (dust- and drip-proof type):

Type: JA06A-24-28S-J1-R (Maker: JAE)

Clamp (dust- and drip-proof type):

Type: E2KD1224 (Maker: SANKEI Manufacturing)

Adaptive cable: Conductive cross section area: 0.2 mm<sup>2</sup> ~ 0.5 mm<sup>2</sup>

Outside diameter of final cable: 8-12 mm

Each connector and cable are connected by soldering.

Cannon connector and clamp can be purchased in sets separately as options. For details, see "List of Optional Parts."



### **DANGER**

- Be sure to use the designated cables. Otherwise, fires or faults may be caused.
- When connecting the connector and cables, make sure not to mistake the terminal arrangement.
- After making the connection, use a tester, etc., to confirm the connection.

When controlling the robot from the sequencer (i.e., programmable ladder controller: PLC), etc. installed separately, remove the motor cover from the base section, remove connectors JOES and JOFS on the rear side, then connect the cables running from the PLC, etc. through the cable clamp provided on the motor cover. (See Fig. 4.1.) For ahead of the JOES and JOFS connectors, the user should prepare the following plug connectors and connect the cables. The current is 1 A or less per cable.

Type of connector: **JOES** SMP-10V-BC (Maker: J.S.T. Mfg.)  
**JOFS** SMP-11V-BC (Maker: J.S.T. Mfg.)  
 Type of contact: BHF-001T-0.8SS (Maker: J.S.T. Mfg.)  
 Adaptive cable: Conductive cross section area: 0.2 mm<sup>2</sup> ~ 0.3 mm<sup>2</sup>

Opposite connector type

Type of connector: **JOEP** SMR-10V-B (Maker: J.S.T. Mfg.)  
**JOFP** SMR-11V-B (Maker: J.S.T. Mfg.)  
 Type of contact: BYM-001T-0.6 (Maker: J.S.T. Mfg.)  
 Adaptive cable: Conductive cross section area: 0.2 mm<sup>2</sup> ~ 0.3 mm<sup>2</sup>

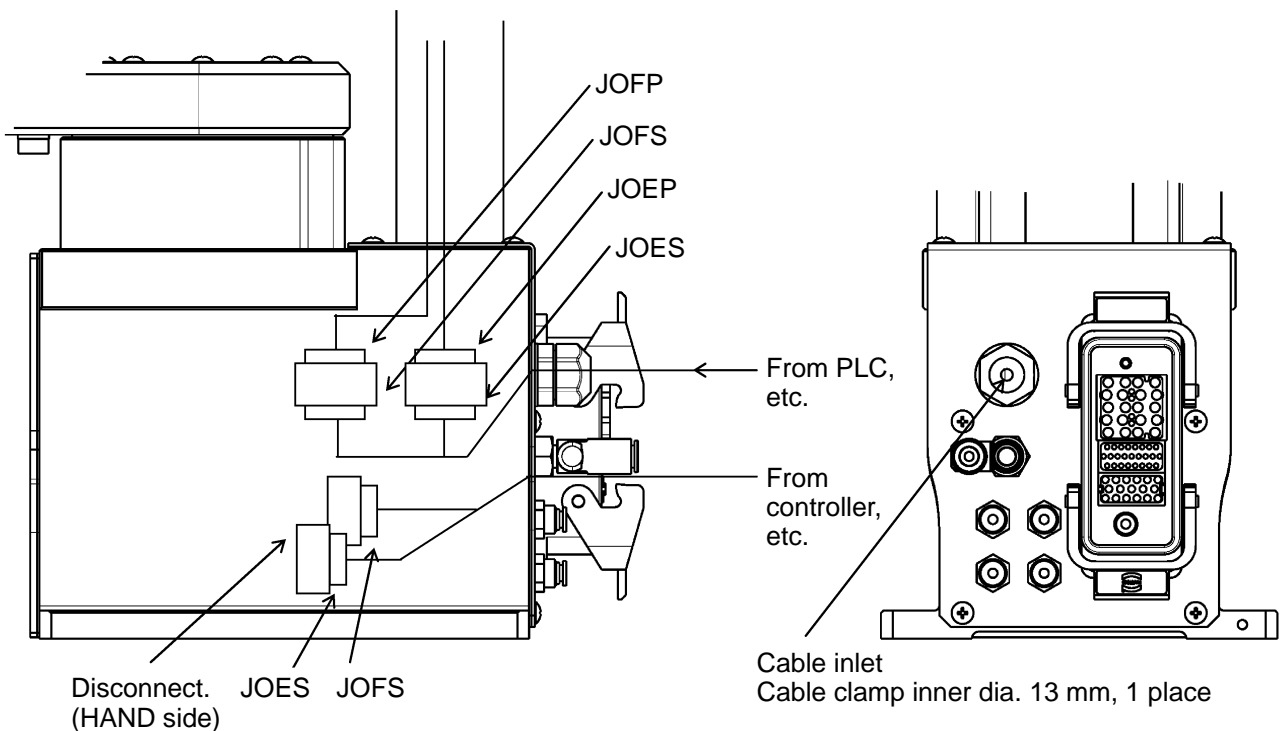


Fig. 4.1 Wiring to PLC, etc.

4.1.1 How to Connect Connectors

The motor cover of the dust- and drip-proof type robot is equipped with a cable clamp (dust- and drip-proof construction). To connect the cables from the separate PLC, etc., use this cable clamp to connect them with the connectors in the robot.

For the cable clamp, use a cable with shield, whose outer diameter is 7.0 to 13.0 mm.

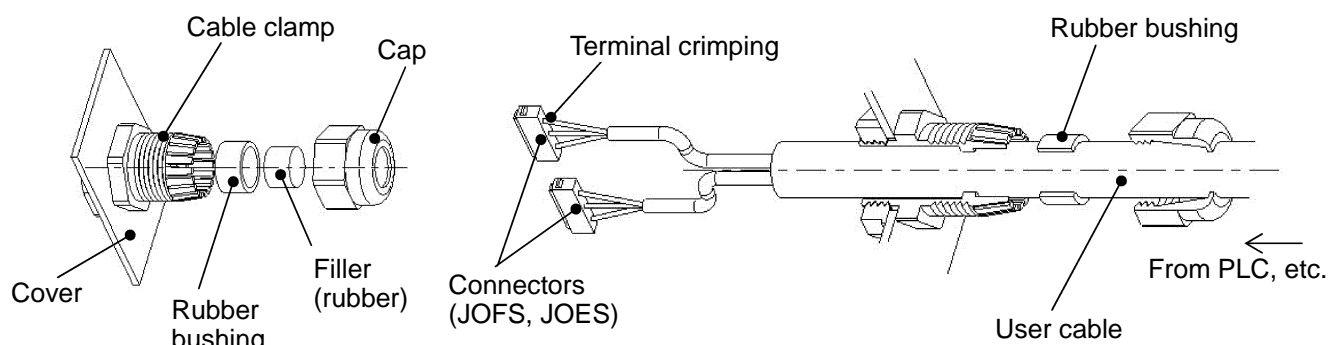


Fig. 4.2 How to connect connectors

- [1] Remove the motor cover of the base unit. For the dust- and drip-proof specification, liquid gasket is coated on the motor cover set surface. For the dismantling procedures, see Section 5.
- [2] Remove the cap of the cable clamp, then the rubber bushing and filler. This filler is unnecessary and is not used any more.
- [3] Pass the cables running from the PLC, etc. through the cap, rubber bushing and cable clamp in this order, then carry out terminal crimping.
- [4] Make sure, using a tester, etc., that the power is supplied to the specified poles and cables.
- [5] Push the rubber bushing into the cable clamp, and completely tighten the cap.
- [6] Connect the cables with connectors JOFP and JOEP on the robot side.
- [7] Mount the motor cover in the manner described in Section 5.



### DANGER

- Before connecting or disconnecting the cables, be sure to turn off the main power (“POWER”) switch. Otherwise, the robot may malfunction.
- Be sure to use the cable of the designated specification. Otherwise, the cable may be heated to cause a fire or electric leak.
- At the time of connection, be sure to attach the rubber bushing. Unless the rubber bushing is present, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Unless wiring is performed by the user, DO NOT remove the filler. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.



Input/output signal connector CN0

Pin (Cannon)	Signal name		Signal No.	Input/output circuit and example of connections
A	D-IN0	Input signal 0	201	
B	D-IN1	Input signal 1	202	
C	D-IN2	Input signal 2	203	
D	D-IN3	Input signal 3	204	
E	D-IN4	Input signal 4	205	
F	D-IN5	Input signal 5	206	
G	D-IN6	Input signal 6	207	
H	D-IN7	Input signal 7	208	
J	PGND	0V		
K	FG	0V		
L	Not used			
N	Not used			
M	Not used			
P	Not used			
Q	D-OUT0	Output signal 0	201	
R	D-OUT1	Output signal 1	202	
S	D-OUT2	Output signal 2	203	
T	D-OUT3	Output signal 3	204	
U	D-OUT4	Output signal 4	205	
V	D-OUT5	Output signal 5	206	
W	D-OUT6	Output signal 6	207	
X	D-OUT7	Output signal 7	208	
Y	P24	24V		
Z	P24	24V		

As input signals, no-voltage contacts or transistor open collector inputs are used.

No-voltage contact specification:

Contact rating: DC24 V, 10 mA or over (circuit current: approx. 7 mA)

Minimum contact current: DC24 V, 1 mA

Contact impedance: 100 Ω or less

Transistor specification:

Withhold voltage between collector and emitter: 30 V or over

Current between collector and emitter: 10 mA or over (circuit current: approx. 7 mA)

Leak current between collector and emitter: 100 μA or less

By using the DC24 V power of the controller, a relay, solenoid valve, etc., can be driven. When the external power is used, GND of the external power should be common to GND (PG) of the robot controller.

Output specification:

Rated voltage : DC24 V (max. DC30 V)

Rated current : 100 mA

- If the DC24 V power is supplied from the robot controller, the total current should be 2 A or less.
- When the external power is used, the total current should also be 2 A or less.
- When a relay, solenoid valve, etc., are connected, it is necessary to use a surge killer or diode to absorb the surge voltage.

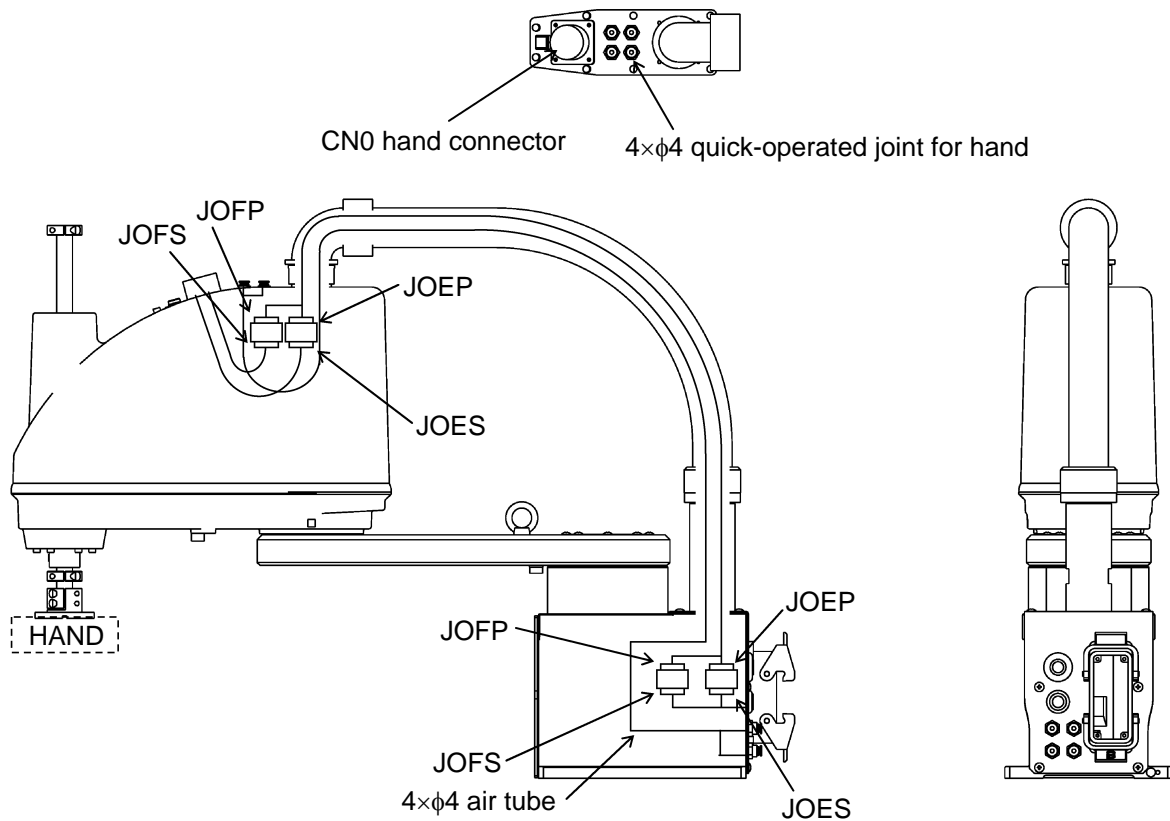


Fig. 4.3 Tool wiring



### CAUTION

- Firmly connect the connectors. Failure to do so may cause the robot to malfunction.

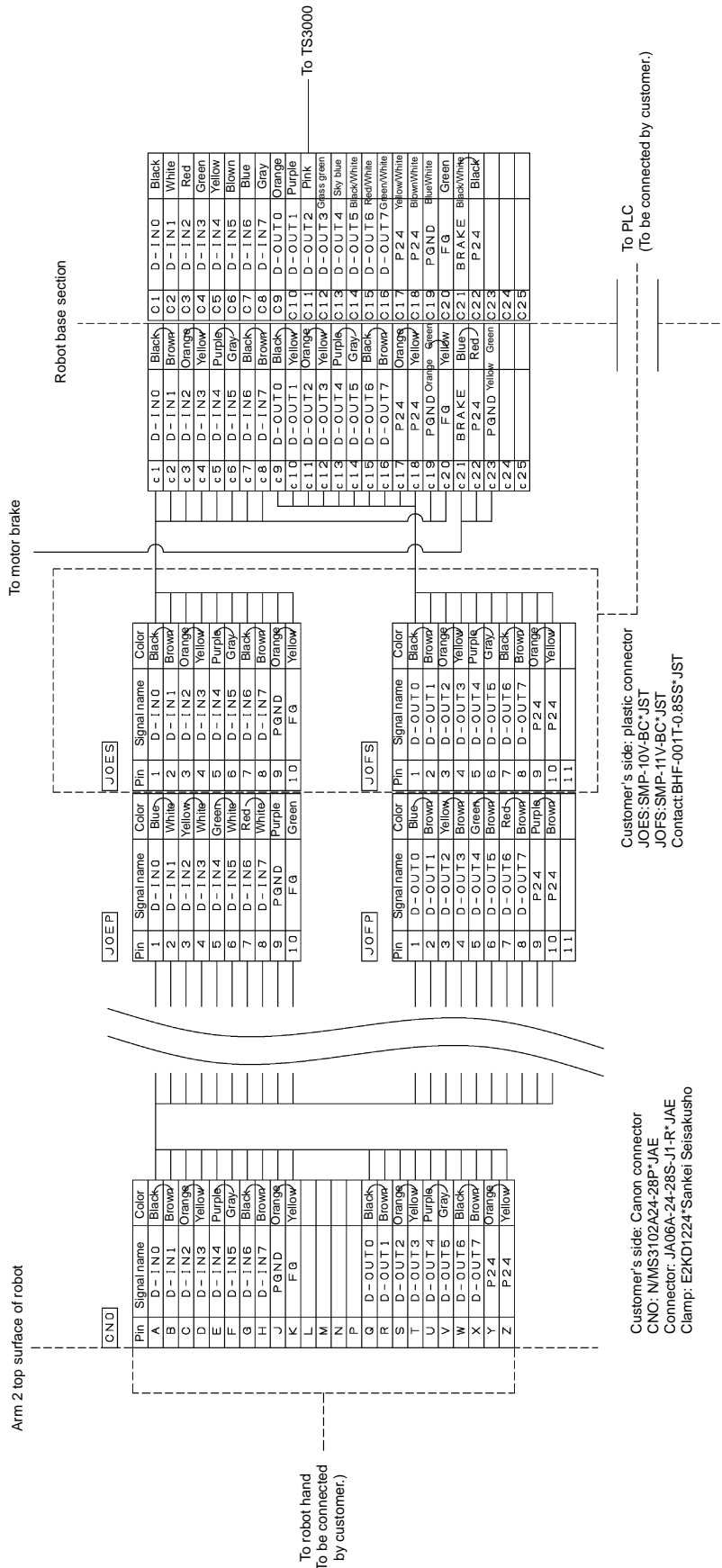


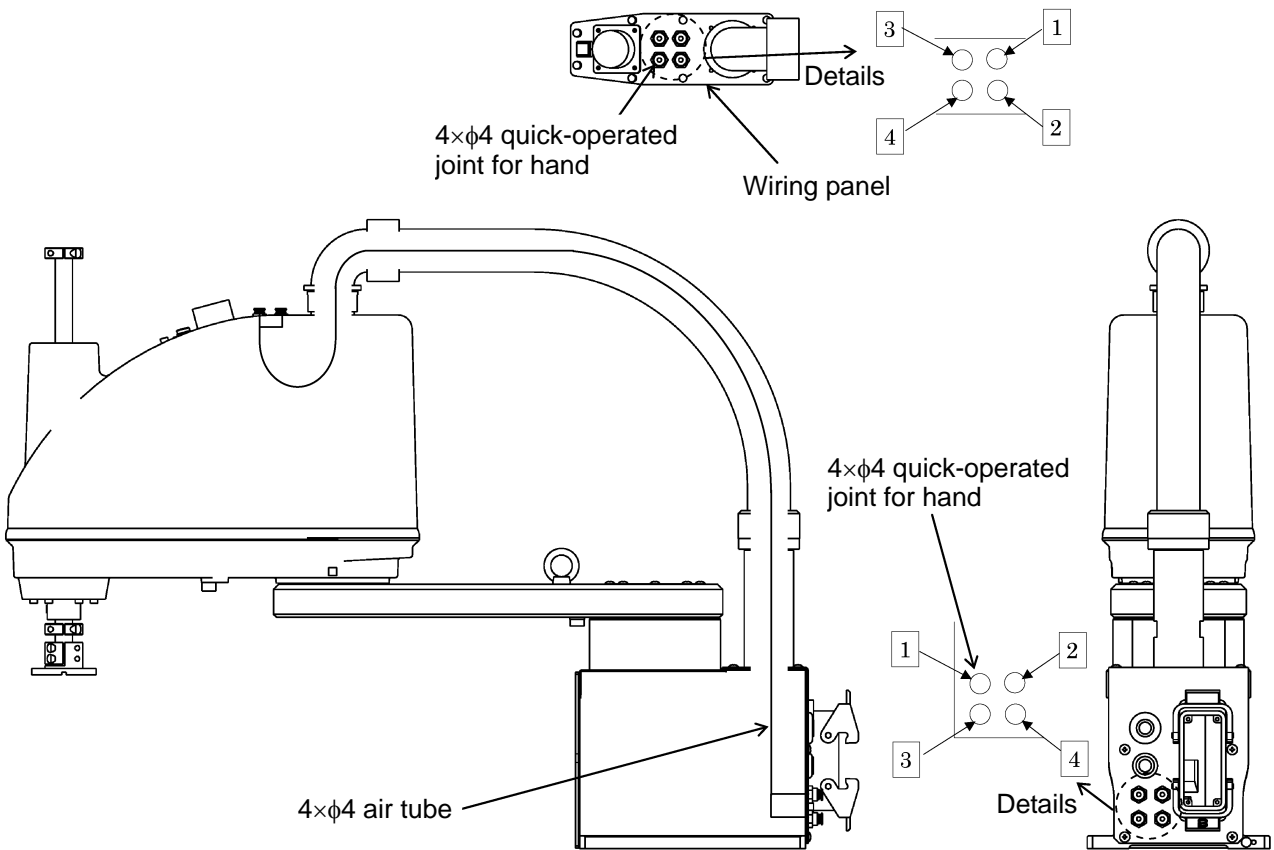
Fig. 4.4 Tool wiring diagram ②

### 4.2 Tool Air Piping

The robot is provided four (4) air lines for the tool.

The outer diameter of the air pipelines is 4 mm. Fig. 4.5 shows the tool air piping.

The air control unit (oiler, regulator with gage and filter) and solenoid valves should be provided by the user.



The air tube is identified by the number and color. At piping, make sure that each tube is connected properly, referring to the below-mentioned.

1: Red 2: White 3: Blue 4: Yellow

Air joint pitches of the panel

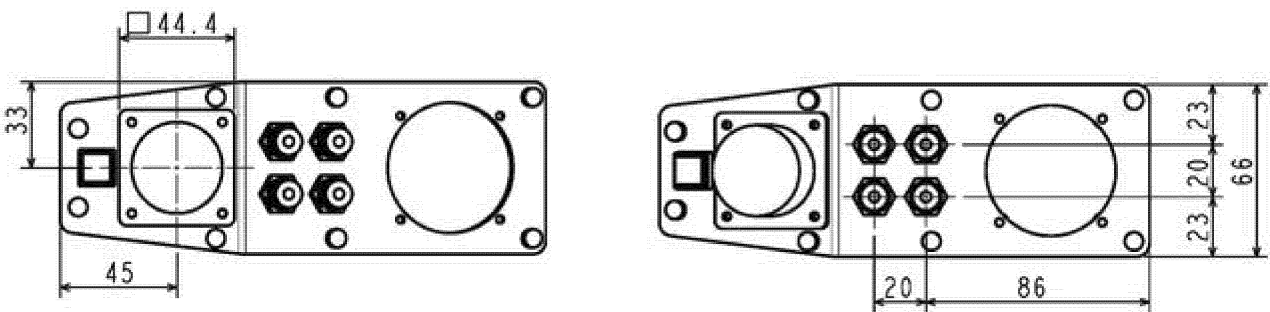


Fig. 4.5 Tool air piping

**5. Maintenance**

The basic structure of the dust- and drip proof type robot is the same as that of the standard robot. For the contents of inspection, etc., see the THP550 Maintenance Manual and TH450A/TH550A Maintenance Manual provided separately.

This section deals with the layout of the robot mechanical components and the procedures for mounting and dismounting the covers and for replacing the bellows.

**5.1 Maintenance and Inspection Items**

Maintenance is classified into the following categories: daily routine inspection, and maintenance/inspection carried out at regular intervals.

This section shows maintenance/inspection items. For details on maintenance and replacement, see the corresponding reference section.

**5.1.1 Inspection in Power-Off State (Non-operating State)**

Inspection item	Component inspected	Daily inspection	Quarterly inspection	Semi-annual inspection	Annual inspection	Reference section
Check for an air leak.	Arm-2 cover	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/
Check the bellows for a break.	Upper and lower bellows	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/

## 5.2 Layout of Robot Components

The layout of the robot mechanical components is shown in Fig. 5.1.

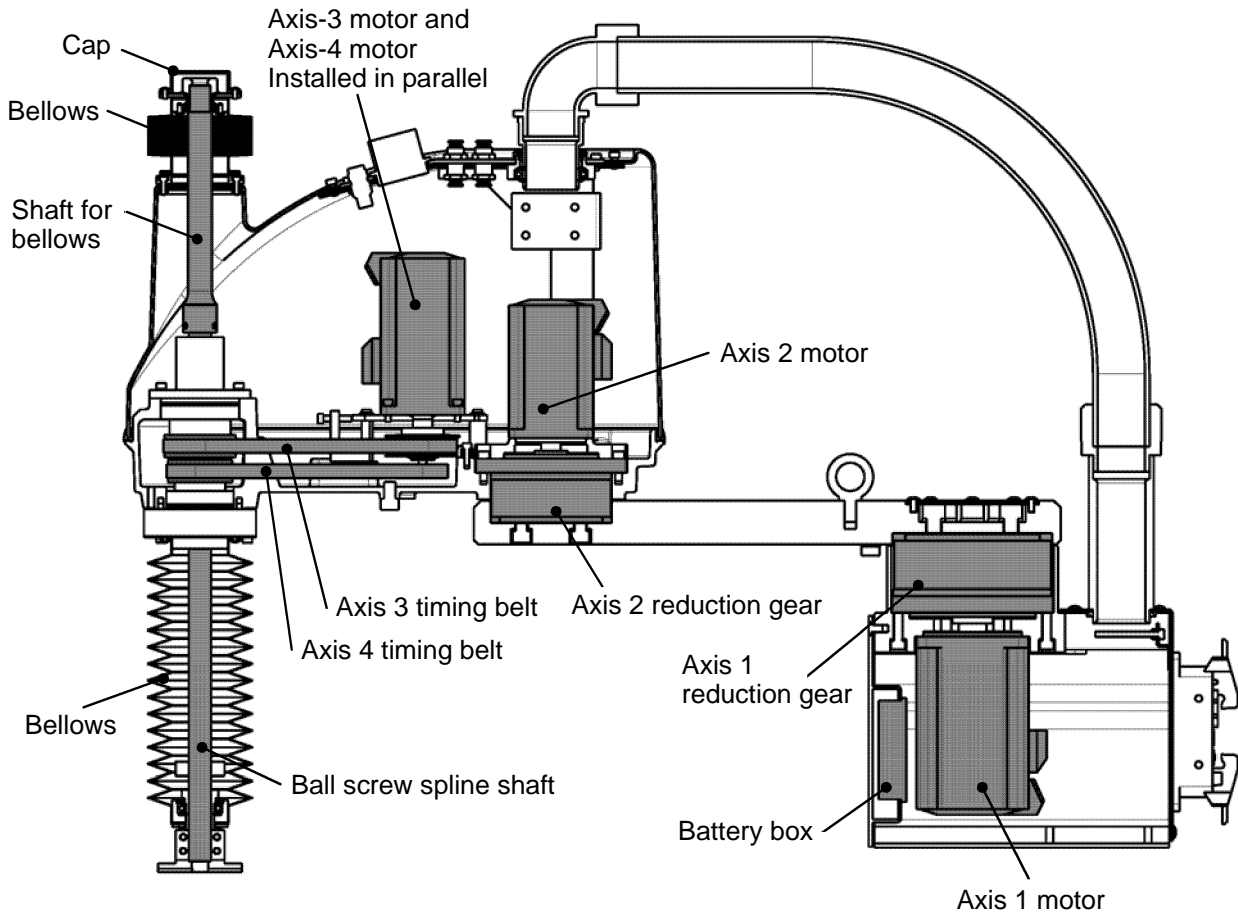


Fig. 5.1 Layout of robot mechanical components (THP550-IP)

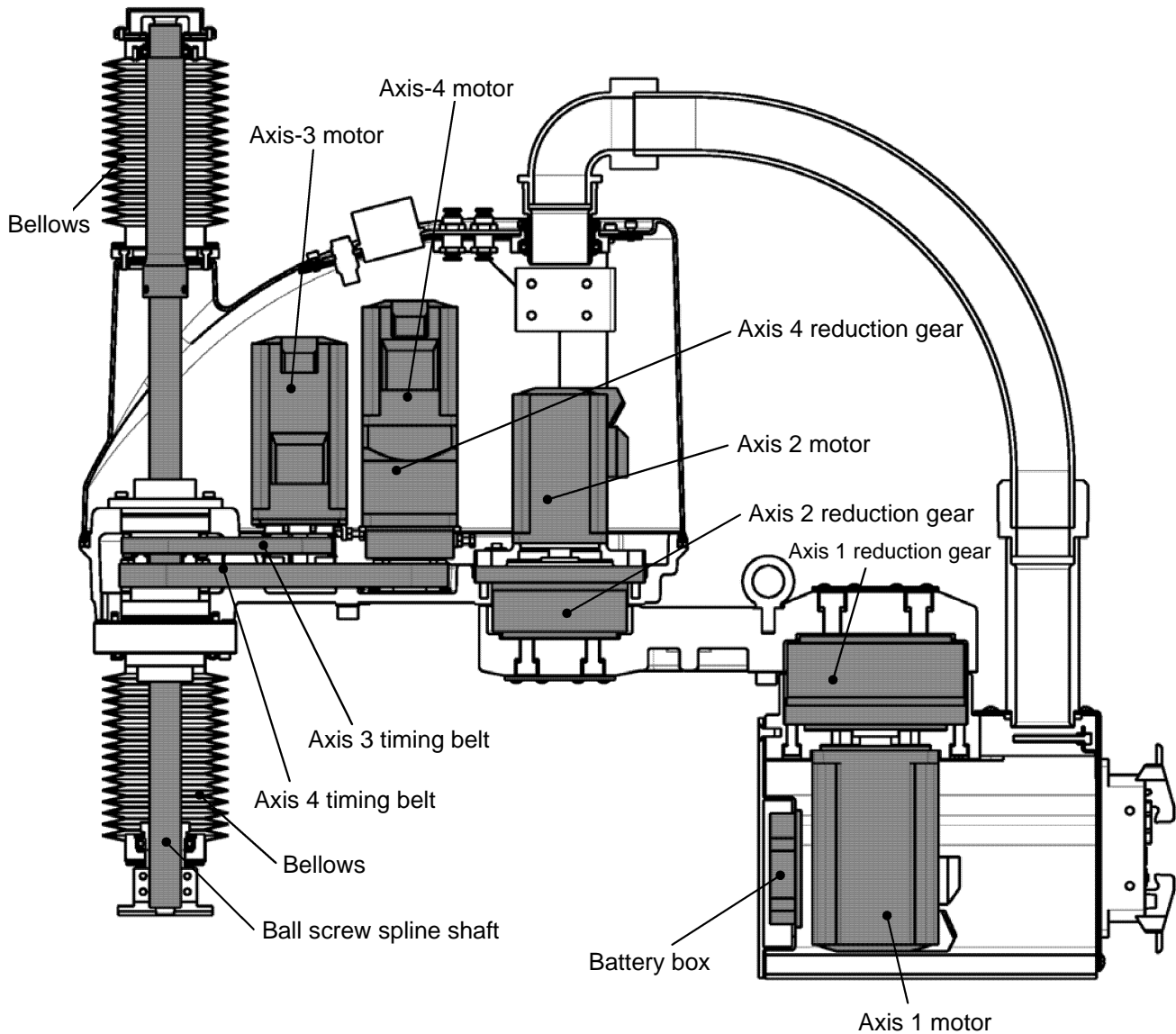


Fig. 5.2 Layout of robot mechanical components (TH450A-IP/TH550A-IP)

### 5.3 Tools and Supplies for Maintenance

The following should be provided as tools and supplies for maintenance. For other tools and supplies, see the THP550 Maintenance Manual or the TH450A/TH550A Maintenance Manual provided separately.

- Phillips and slotted screwdrivers
- Set of hexagon wrenches M3-M16
- Cutter knife
- Liquid gasket (Recommendation: 1221H made by ThreeBond)
- Loctite (242 modest strength)

## 5.4 Replacing Bellows

Replacement of the bellows is performed by our after-sale service engineer. If bellows is replaced by the customer, we will not guarantee any consequential troubles or accidents.



### DANGER

- Before replacing the bellows with a new one, be sure to turn off the controller power and remove the power plug.

### 5.4.1 Replacing Lower Bellows

- 1) Remove the tool flange, followed by the keep plate under the bellows.
- 2) Remove the keep plate above the bellows, then pull the bellows downward.

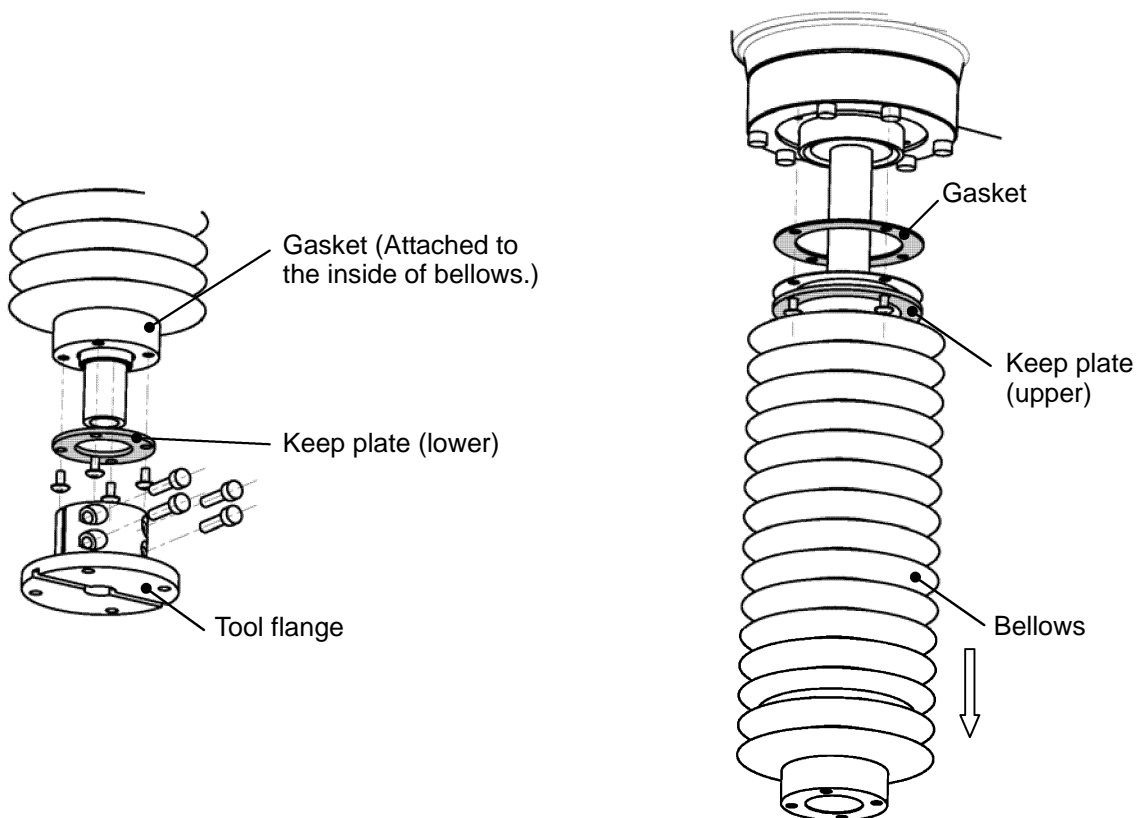


Fig. 5.3 Lower Bellows



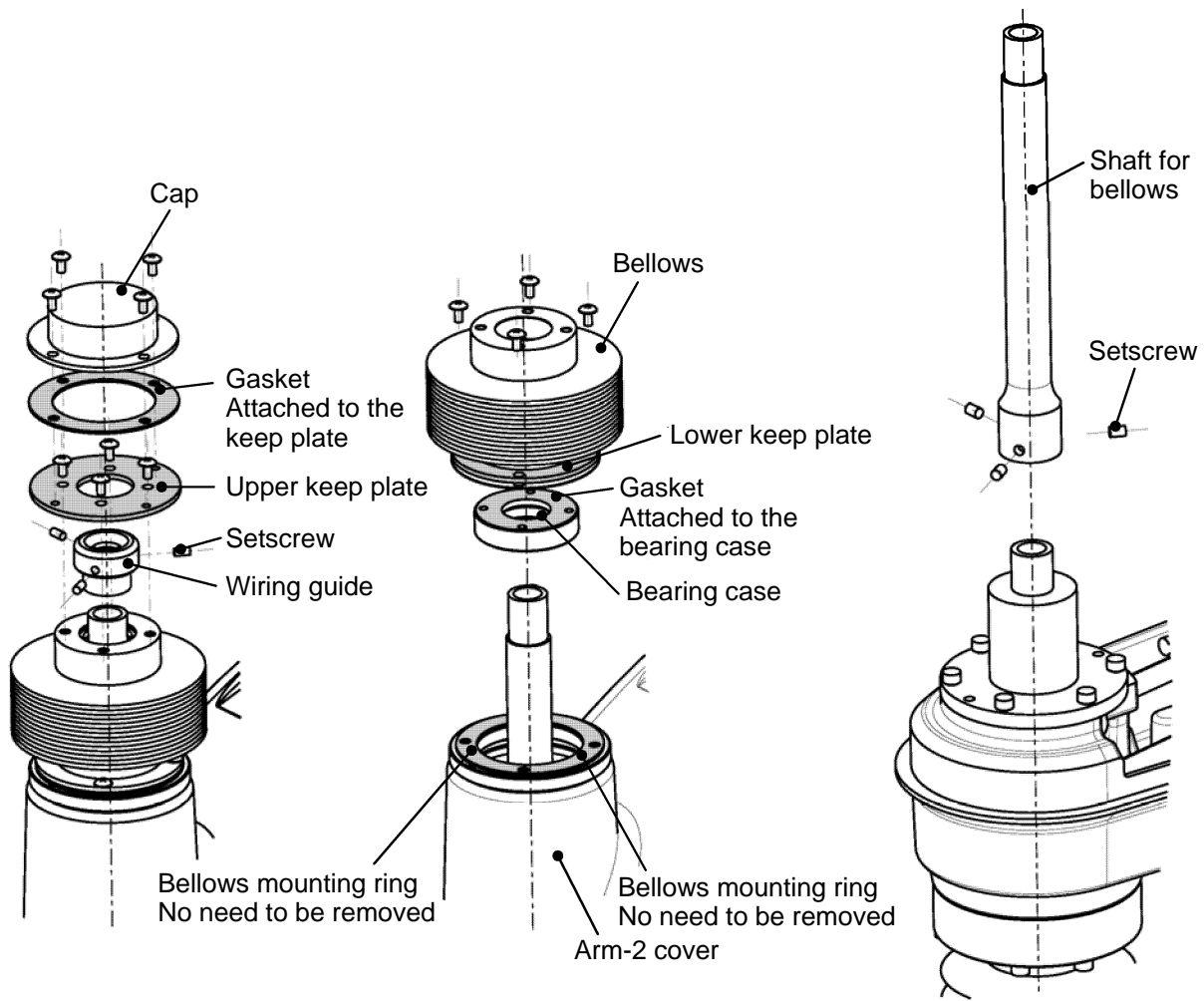
- 3) To mount the bellows, observe the above steps in the reversed order.  
Be sure to attach the gasket, and apply the Loctite adhesives to all set bolts.

**CAUTION**

- When dismantling the bellows, DO NOT pull it out by force. Otherwise, the bellows may rupture.
- Be sure to apply the Loctite adhesives to all set bolts. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Be sure to attach the gasket. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.

#### 5.4.2 Replacing Upper Bellows

- 1) Remove the cap and the keep plate above the bellows, and remove the three setscrews to remove the wiring guide.
- 2) Remove the keep plate under the bellows, and pull the bellows upward to remove it.
- 3) To remove the arm-2 cover, pull the bearing case upward to remove it.  
For the procedure to remove the arm-2 cover, see Para. 5.3.3.
- 4) If the ball screw needs replacement at the same time, remove the three setscrews securing the shaft for the bellows, and pull the shaft upward to remove it.  
For the procedure to replace the ball screw, see the THP550 Maintenance Manual or the TH450A/TH550A Maintenance Manual provided separately.



To mount the bellows, install parts and components in reverse order of removal. Apply Loctite to all the bolts and setscrews.

Fig. 5.4 Upper bellows



**CAUTION**

- Do not pull the bellows when removing it. Otherwise, the bellows may rupture.
- Be sure to apply Loctite to all the bolts and setscrews. Otherwise, the dust- and drip-proof performance is deteriorated, causing the entry of water or dust.
- Do not forget to install the gasket. Otherwise, the dust- and drip-proof performance is deteriorated, causing the entry of water or dust.

## 5.5 Mounting and Dismounting Covers

A gasket (i.e., rubber packing) is attached to each cover set surface of the dust- and drip-proof type robot. Also, as the liquid gasket is coated to some areas, the mounting and dismounting procedures of each cover differ from those of the standard robot. Strictly observe the following procedures to mount and dismount each cover.



### **DANGER**

- Before mounting and dismounting each cover, be sure to turn off the main power (“POWER”) switch.
- When opening each cover, make sure that water or contaminant will not enter the robot. If the power is supplied while water or contaminant is left in the robot, you may get an electric shock or the robot may be damaged, which is very dangerous.

### 5.5.1 Base Cover

In all, two (2) base covers are provided; the cover concurrently used for connector panel and the cover concurrently used for battery box.

The cover that also serves as the connector panel is secured together with the gasket to the base by tightening eight cross-recessed truss head screws (M4×6). As the cover is connected with the connectors inside, **DO NOT** pull out the cover by force.

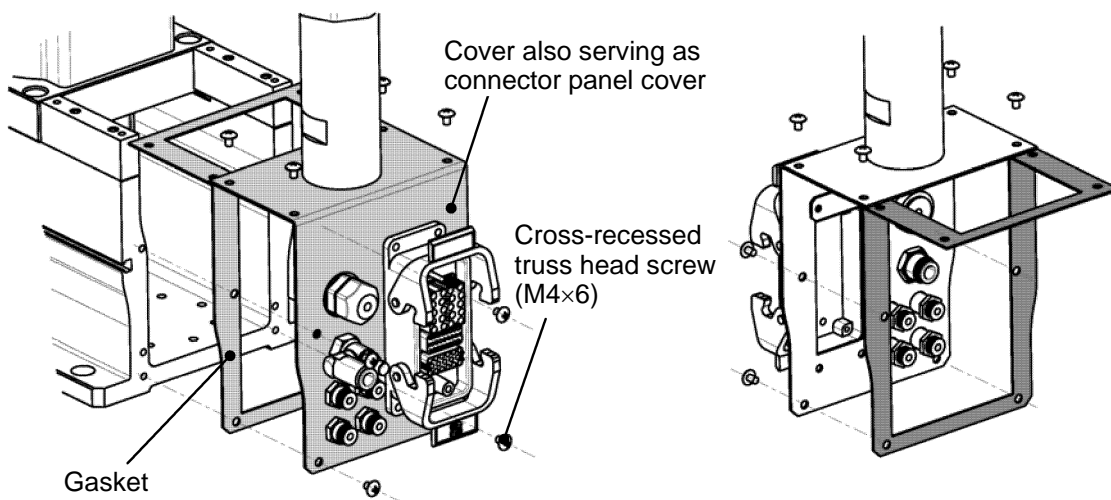



Fig. 5.5 Cover concurrently used for connector panel

Also, apply the Loctite adhesives to all set bolts.

**CAUTION**

- Do not forget to install the gasket.  
Also, be sure to coat the Loctite adhesives to all set bolts. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Be sure to replace the gasket before it is damaged. Damaged gasket causes the deterioration of the dust- and drip-proof performance.

- 1) The cover that also serves as the battery box is secured together with the gasket to the base by tightening nine hexagon flat head screws (M5×10). As the cover is connected with the connectors inside, DO NOT pull out the cover by force.

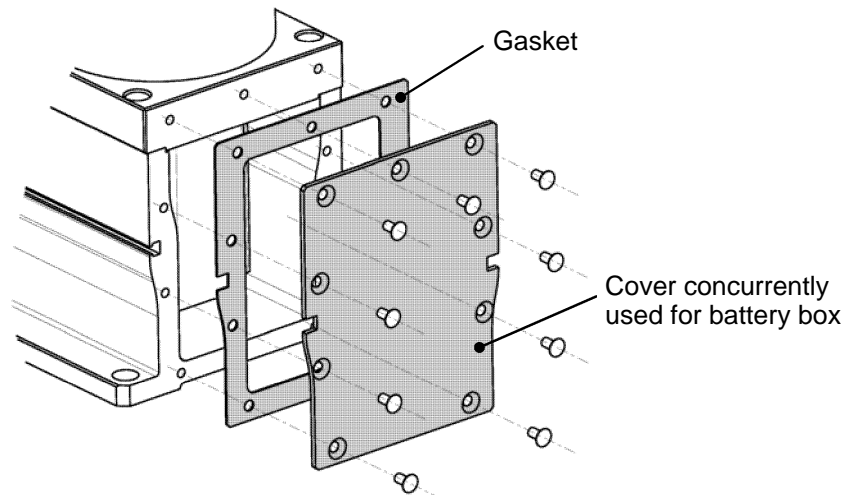



Fig. 5.6 Cover concurrently used for battery box

Also, apply the Loctite adhesives to all set bolts.

**CAUTION**

- Do not forget to install the gasket.  
Also, be sure to coat the Loctite adhesives to all set bolts. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Be sure to replace the gasket before it is damaged. Damaged gasket causes the deterioration of the dust- and drip-proof performance.

5.5.2 Arm 1 Covers

The arm 1 covers are provided above the axis 1 (arm cover 1). Each cover is secured to the arm 1 with eight (8) cross-recessed truss head screws (M4×6) by inserting the gasket.

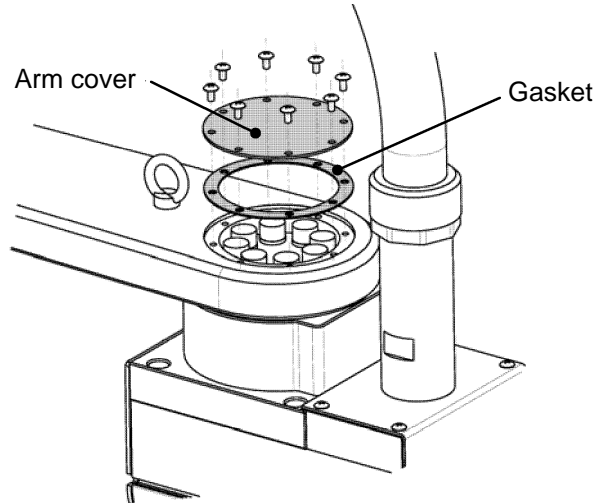


Fig. 5.7 Arm 1 covers (THP550-IP)

Apply the Loctite adhesives to all set bolts.

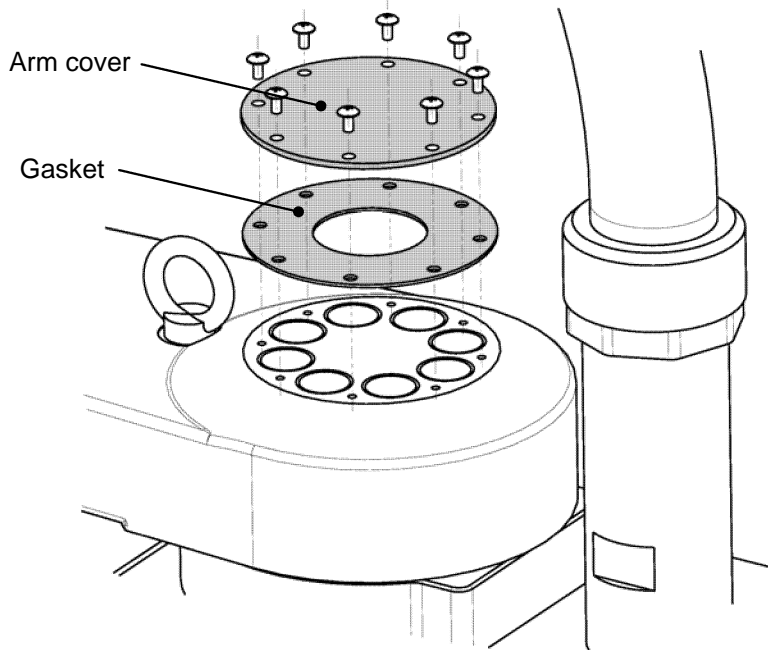


Fig. 5.7 Arm 1 covers (TH450A-IP/TH550A-IP)



**CAUTION**

- Do not forget to install the gasket. Also, be sure to coat the Loctite adhesives to all set bolts. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Be sure to replace the gasket before it is damaged. Damaged gasket causes the deterioration of the dust- and drip-proof performance.

5.5.3 Arm 2 Cover

- 1) Before the arm-2 cover can be removed, the upper bellows must be removed. For the procedure to remove the upper bellows, see Para. 5.2.2. The arm-2 cover is secured together with the packing to the cover bracket by tightening 12 hexagon socket head cap screws (M4×8).
- 2) Though the cover is embedded to the arm 2, the liquid gasket is applied to the full circumference of the packing under the cover to maintain the dust- and drip-proof feature. When disconnecting the cover, peel off the liquid gasket between the arm 2 and gasket, using a full circumferential cutter, etc. Then carefully peel off the liquid gasket to remove the cover, using a slotted screwdriver, etc. **DO NOT** peel off the liquid gasket between the cover and gasket. Disconnect the cover together with the gasket. The figure shows the THP550.

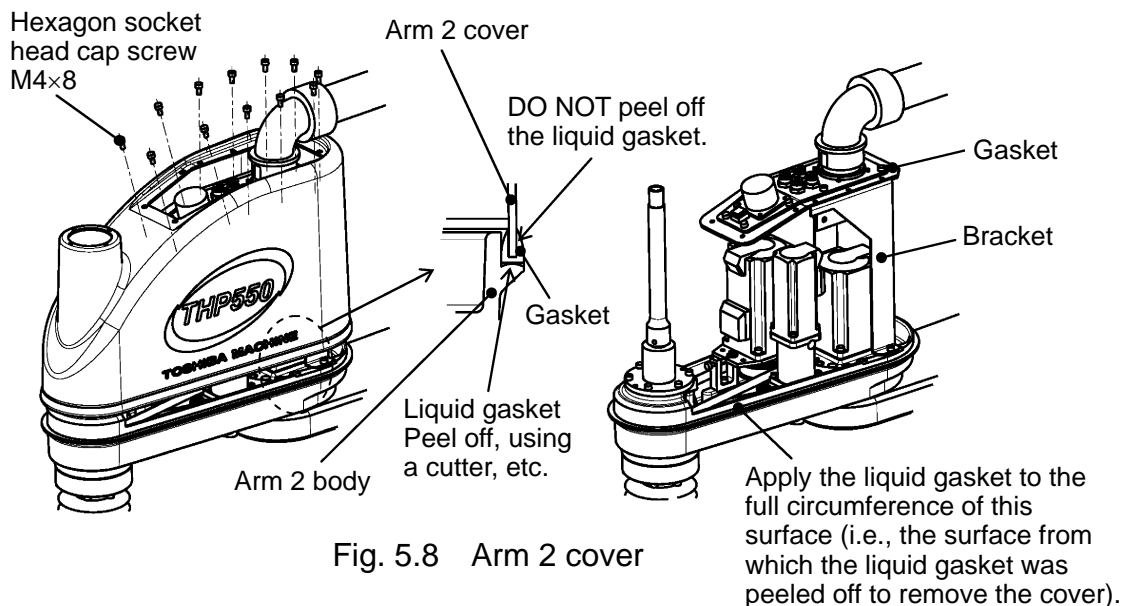


Fig. 5.8 Arm 2 cover

When mounting the cover, apply the liquid gasket to the area shown in Fig. 5.8 above. Also, apply the Loctite adhesives to all set bolts.

**CAUTION**

- When using the cutter, take careful precautions not to cut the gasket body.
- DO NOT peel off the liquid gasket between the cover and gasket. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Under some circumstances, the gasket may be separated from the cover. When this happens, apply the liquid gasket to between the cover and gasket at the time of cover mounting.
- Be sure to attach the gasket and apply the liquid gasket. Also, be sure to coat the Loctite adhesives to all set bolts. Otherwise, the dust- and drip-proof performance is damaged to cause entry of water or dust.
- Be sure to replace the gasket before it is damaged. Damaged gasket causes the deterioration of the dust- and drip-proof performance.

## 6. Cleaning Robot Body

To clean and wash the robot body, be sure to use a neutral detergent. Use a soft sponge and waste cloth, and take careful precautions not to cut or scratch the robot body.

To wash the robot body with water, strictly observe the IP class in terms of water. Be sure to water the robot body while conducting air purge.



### **DANGER**

- Before cleaning the robot body, be sure to turn off the controller power and remove the power plug. Otherwise, you will get an electric shock or the robot will malfunction, which is very dangerous.
- After the cleaning, completely wipe out the water.



### **CAUTION**

- Be sure to use a neutral detergent to clean and wash the robot body. If a detergent (such as chlorine detergent and acid detergent) other than the neutral detergent is used, the paint may deteriorate, or the cover or bellows may be damaged.
- Be sure to water the robot body during air purging. Unless air purge is executed, the dust- and drip-proof performance is damaged to cause entry of water or dust.



## 7. Replacement Parts for Maintenance

### 7.1 Replacement Parts List for Maintenance

No.	Part name	Type	Our dwg. No.	Unit code	Maker	Q'ty	Remarks
1	Bellows		S849728	Y610A3F90	Toshiba Machine	2	When Z-axis stroke is 150 mm THP550-IP
2	Bellows		S854887	Y610A3FT0	Toshiba Machine	2	When Z-axis stroke is 300 mm THP550-IP
3	Bellows		S854575	Y610A3GH0	Toshiba Machine	2	When Z-axis stroke is 150 mm TH450A-IP/TH550A-IP
4	Ball screws		H846422	Y610A3GF0	Toshiba Machine	1	When Z-axis stroke is 150 mm TH450A-IP/TH550A-IP
5	Cushion rubber	RBCXA-D11-L15		Y610A3F80	Toshiba Machine	1	THP550-IP
6	Cushion rubber	RBCXA-D14-L15		Y610A3GJ0	Toshiba Machine	1	TH450A-IP/TH550A-IP

The replacement parts for maintenance other than the above are the same as those of the THP550/TH450A/TH550A robots. For details, see the THP550 Maintenance Manual and TH450A/TH550A Maintenance Manual provided separately.

- When you wish to purchase the replacement parts for maintenance, make sure of the serial number of the main robot and contact us.

**8. Optional Parts****8.1 List of Optional Parts**

No.	Part name	Type	Our dwg. No.	Unit code	Maker	Q'ty	Remarks
1	CNO assembly		S854768	Y610A3F40	Toshiba Machine	1	Set of connectors and clamps

- Contact us for the purchase of optional parts.

APPROVED BY: *R. Galen*

CHECKED BY: *K. Kido*

PREPARED BY: *Y. Nakai*