TH650A-T
TH1050A-T/TS2100

Industrial Robot

INSTRUCTION MANUAL

CEILING TYPE (OVERHEAD TRAVELING 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.

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NUMAZU, JAPAN

The information contained in this manual is subject to change without prior notice to effect improvements.

Preface

This manual describes the specifications of the TH–A series ceiling type (or overhead traveling 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
! **DANGER**	This means that "incorrect handling will imminently lead to fatalities or major injuries".
! **WARNING**	This means that "incorrect handling may 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 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. Details of the actual danger are indicated with pictures or words in or near the symbol.
	This means 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.

 **DANGER**	
 Prohibited	• DO NOT incinerate, disassemble or charge the batteries. Otherwise, they may rupture.
 Mandatory	• Be sure to turn off the main power switch of the controller before starting inspection or maintenance. • Batteries should be disposed of according to the user's in-house regulations.

! CAUTION	
 Disassembly prohibited	• 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.
 Mandatory	• Always use the Toshiba Machine's designated spare parts when replacing the parts. • Maintenance and inspection should be performed regularly. Otherwise, the system may malfunction or accidents will be caused.

This manual is comprised of the following five (5) sections:

Section 1 Specifications
This section describes the basic specifications and names of respective parts for the ceiling type (or overhead traveling type) industrial robot.

Section 2 Transportation
This section describes how to remove the ceiling 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 ceiling type robot installation environment, space requirements, and how to install the robot.

Section 4 Maintenance
This section describes the structure of the ceiling type robot and all items required for the maintenance and inspection of the same robot.

Section 5 Replacement Parts for Maintenance
This section explains the replacement parts for the maintenance.

Table of Contents

1. Specifications

1.1 Name of Each Part

The names of respective parts of the ceiling type (or overhead traveling type) robot are shown in Figs. 1.1 and 1.2 below.

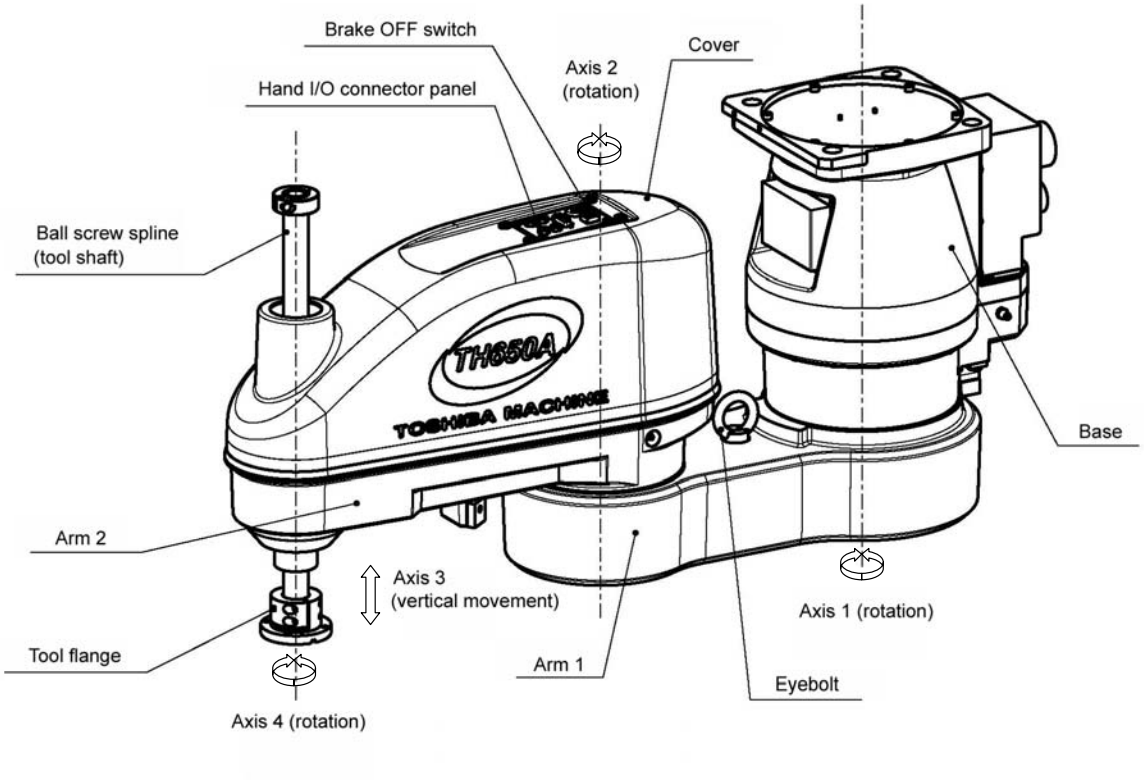


Fig. 1.1 Name of each part (TH650A-T)

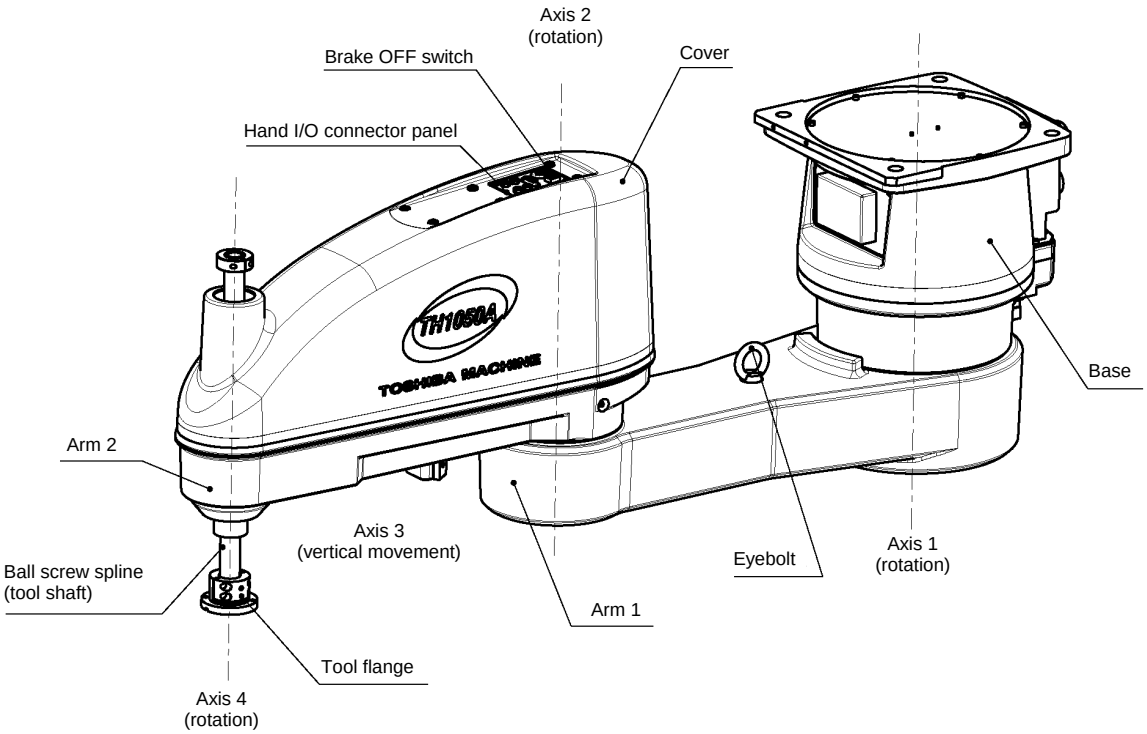


Fig. 1.2 Name of each part (TH1050A-T)

1.2 Outer Dimensions

Figs. 1.3 to 1.6 show the outer dimensions of the ceiling type robot.

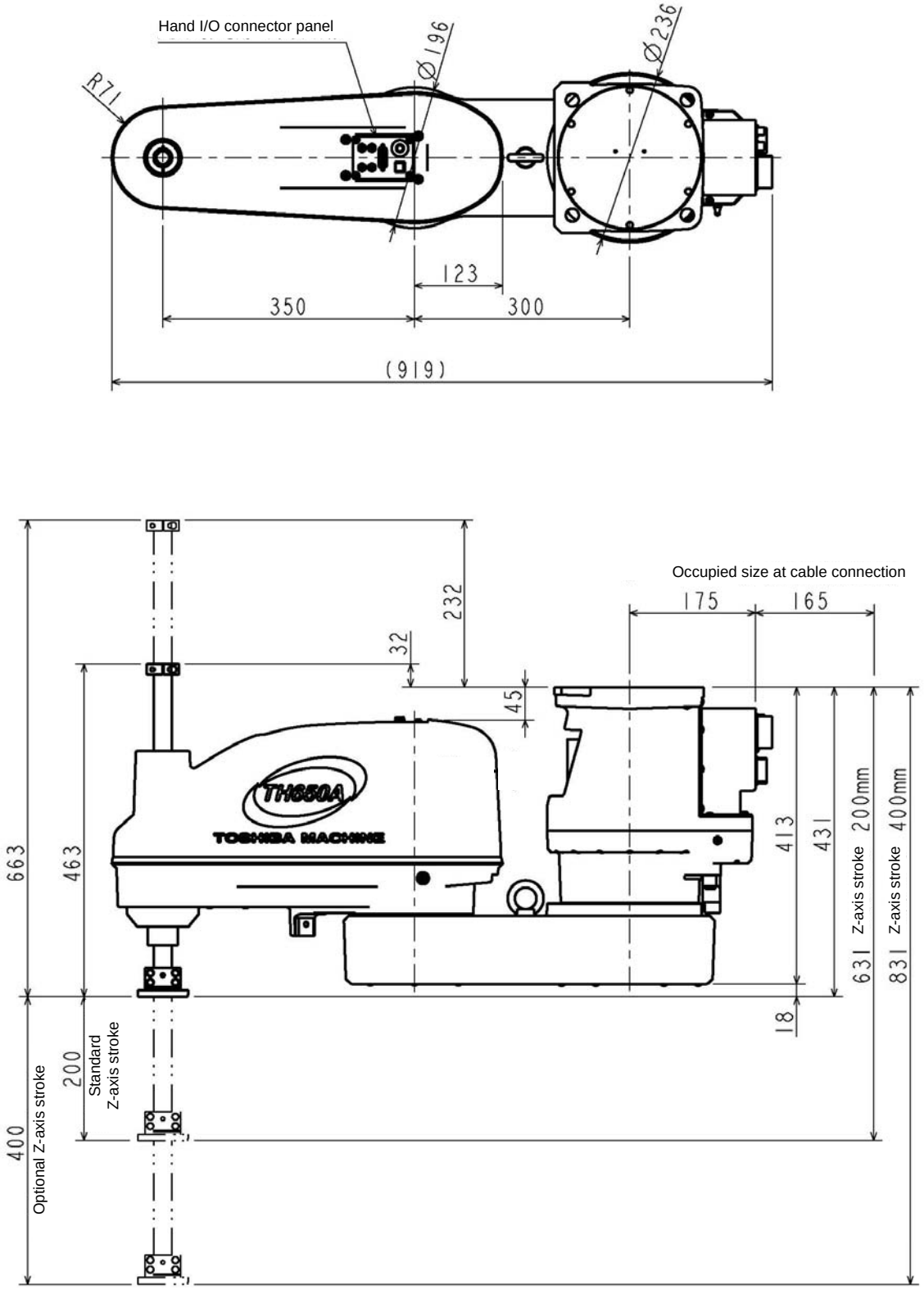


Fig. 1.3 Outer dimensions of the robot (TH650A-T)

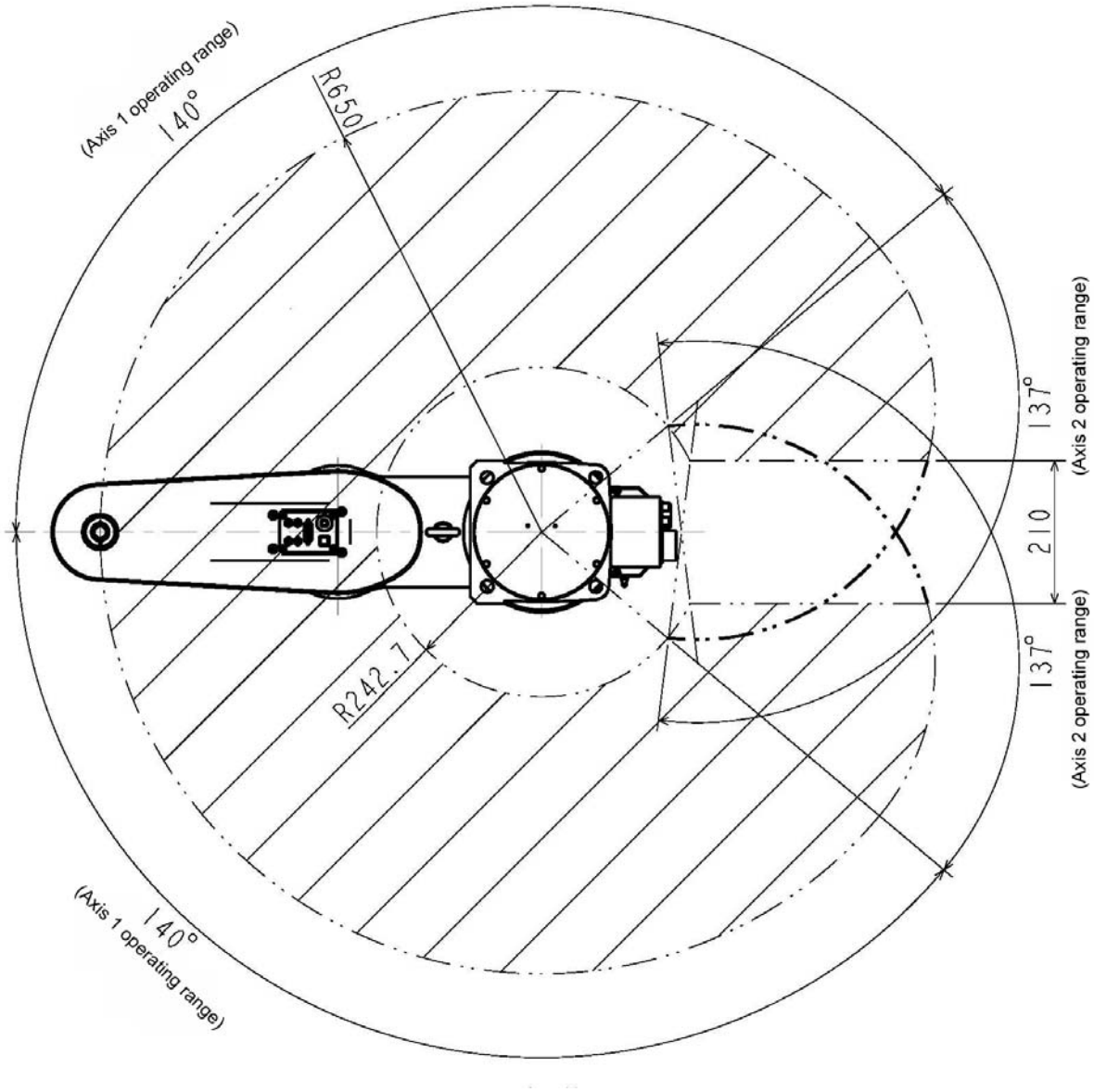


Fig. 1.4 Operating range of the robot (TH650A-T)

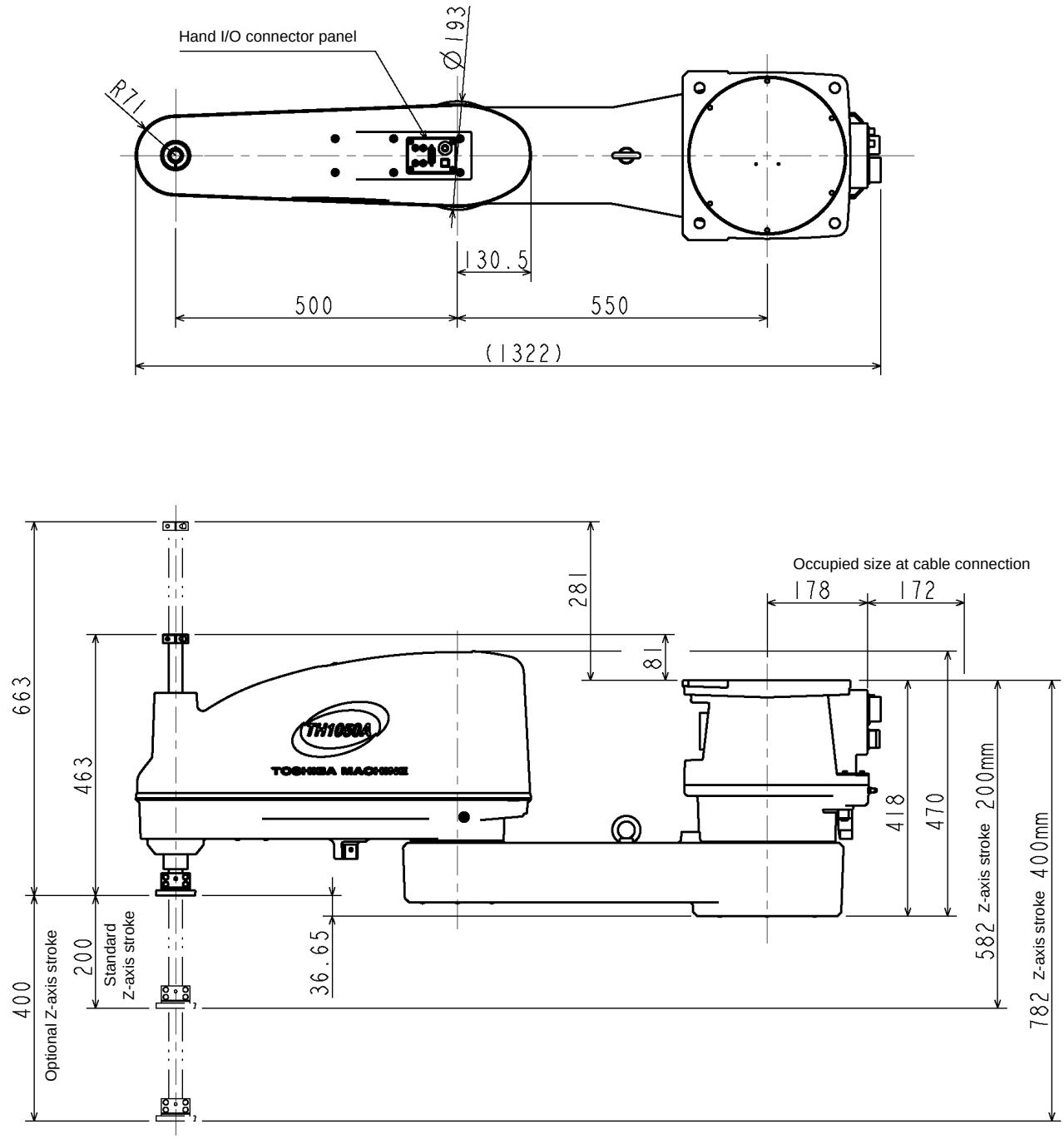


Fig. 1.5 Outer dimensions of the robot (TH1050A-T)

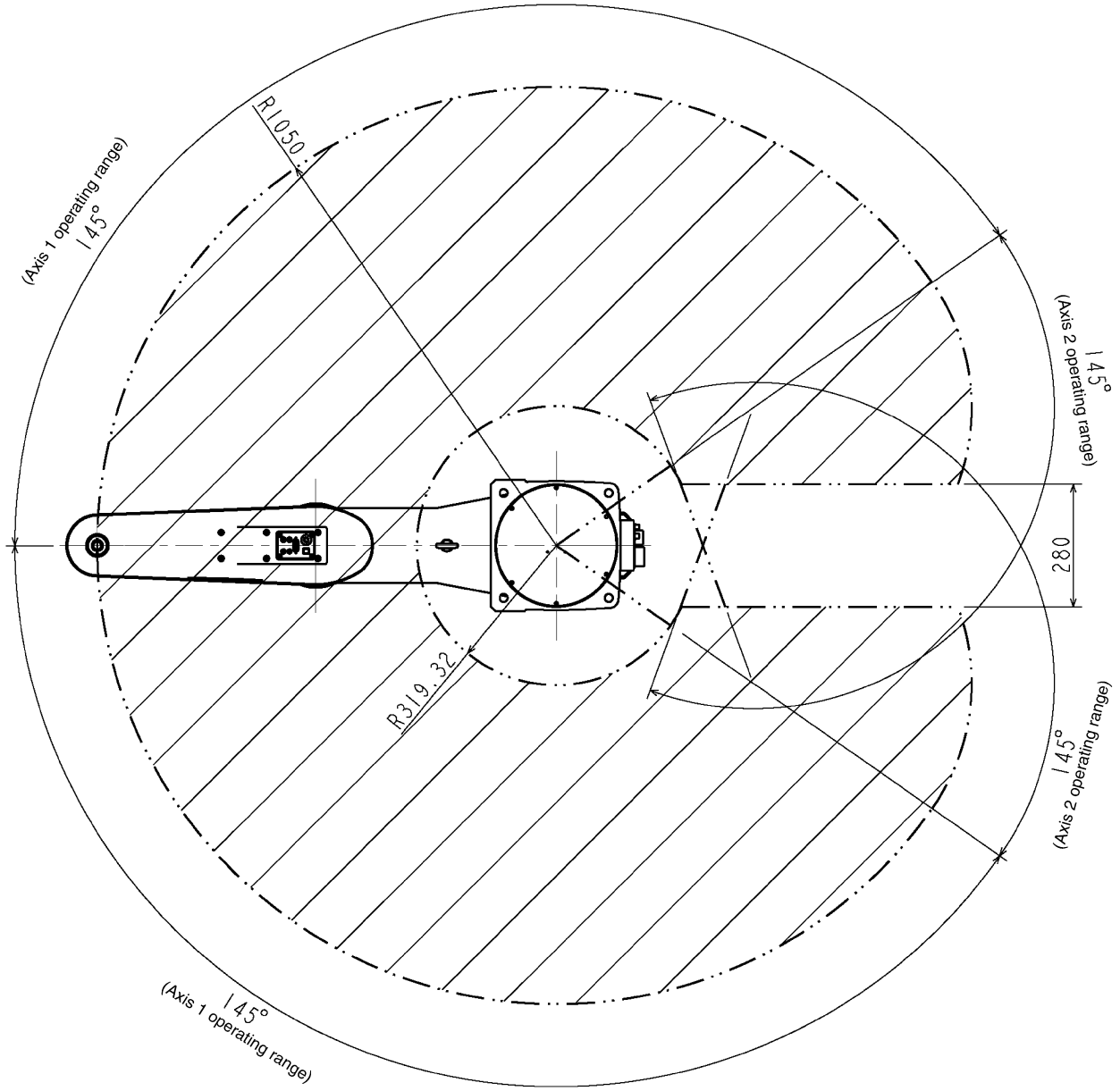


Fig. 1.6 Operating range of the robot (TH1050A-T)

1.3 Specifications Table

[TH650A-T]

Item		Specifications
Structure		Horizontal multi-joint type SCARA robot
Model		TH650A–T
Applicable controller		TS2100
Mass of robot body		52 kg
No. of controlled axes		Four (4)
Arm length		650 mm (300+350)
Motor capacity	Axis 1	1,000 (W)
	Axis 2	600 (W)
	Axis 3	400 (W)
	Axis 4	400 (W)
Operating range	Axis 1	±140 (deg)
	Axis 2	±137 (deg)
	Axis 3	200 (mm) [Option: 400 (mm)]
	Axis 4	±360 (deg)
Maximum speed (*1)	Axis 1	340 (deg/s)
	Axis 2	600 (deg/s)
	Axis 3	2,050 (mm/s)
	Axis 4	1,700 (deg/s)
	Composite speed of axes 1 and 2	7.52 (m/s)
Rated payload mass		2 (kg)
Maximum payload mass		10 (kg)
Permissible load inertia (*1)		0.1 (kg·m^2)
Repeatability (*2)	X, Y	±0.01 (mm)
	Z	±0.01 (mm)
	C	±0.004 (deg)
Cycle time (*3) (When payload mass is 2 kg)		0.31 (sec)
Drive system		By means of AC servo motors
Position detection method		Absolute

*1: 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.

*2: This is the value for the single-direction repeatability at a fixed ambient temperature.

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

[TH1050A-T]

Item		Specifications
Structure		Horizontal multi-joint type SCARA robot
Model		TH1050A-T
Applicable controller		TS2100
Mass of robot body		82 kg
No. of controlled axes		Four (4)
Arm length		1,050 mm (500+550)
Motor capacity	Axis 1	1,000 (W)
	Axis 2	1,000 (W)
	Axis 3	600 (W)
	Axis 4	750 (W)
Operating range	Axis 1	±145 (deg)
	Axis 2	±145 (deg)
	Axis 3	200 (mm) [Option: 400 (mm)]
	Axis 4	±360 (deg)
Maximum speed (*1)	Axis 1	300 (deg/s)
	Axis 2	420 (deg/s)
	Axis 3	2,050 (mm/s)
	Axis 4	1,200 (deg/s)
	Composite speed of axes 1 and 2	9.15 (m/s)
Rated payload mass		5 (kg)
Maximum payload mass		20 (kg)
Permissible load inertia (*1)		0.2 (kg·m^2)
Repeatability (*2)	X, Y	±0.01 (mm)
	Z	±0.01 (mm)
	C	±0.004 (deg)
Cycle time (*3) (When payload mass is 2 kg)		0.42 (sec)
Drive system		By means of AC servo motors
Position detection method		Absolute

*1: When the mass of load exceeds 5 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.

*2: This is the value for the single-direction repeatability at a fixed ambient temperature.

*3: 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.

Accessories included in the instruction manuals

System floppy disk: 1 pc.
CD-ROM for TCPRGOS (option): 1 pc.
CD-ROM for TSPC (option): 1 pc.

Accessories included in the controller package

CN5 dummy connector: 1 pc.
CN6 dummy connector: 1 pc.
TP dummy connector: 1 pc.
Power connector: 1 pc.

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 Figs. 2.1 and 2.2.

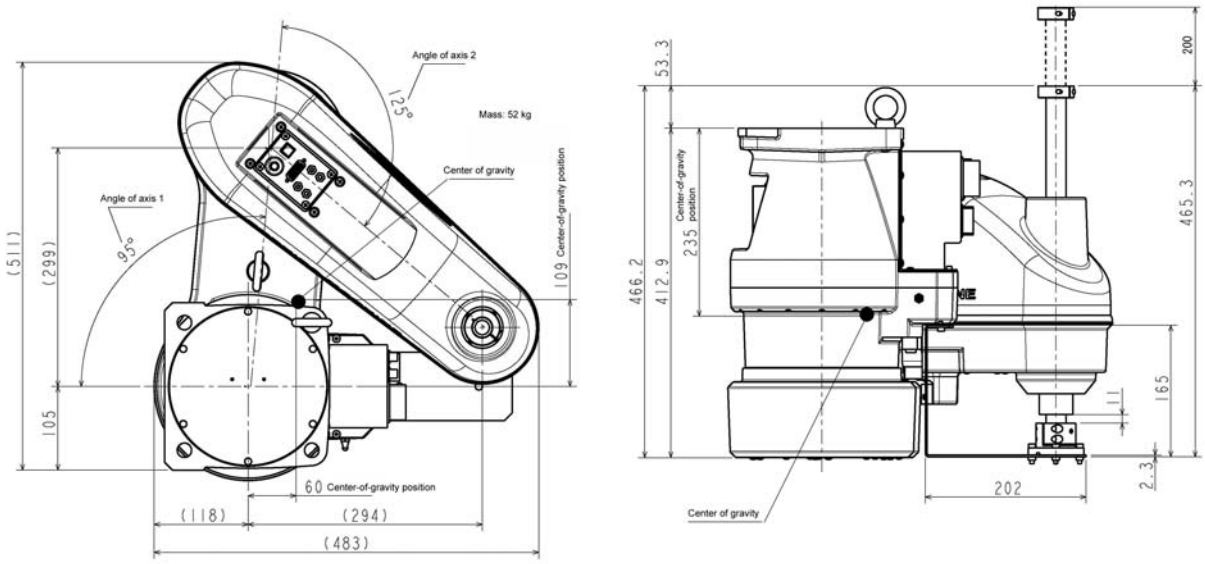


Fig. 2.1 Outer dimensions at transport (TH650A-T)

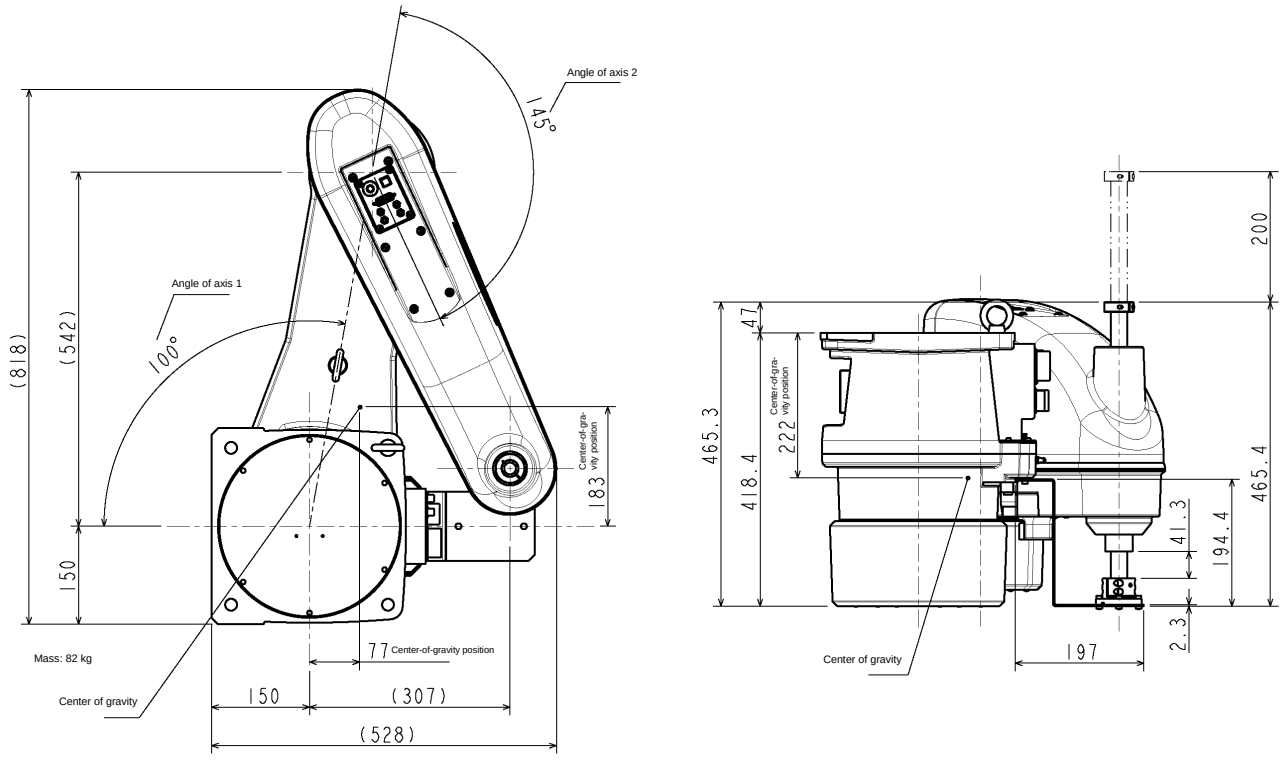


Fig. 2.2 Outer dimensions at transport (TH1050A-T)

2.2.2 Transporting the Robot

In principle, the robot should be transported in the state shown in Figs. 2.1 and 2.2 above. Fold back and secure the arm with the attached clamp. (The robot is shipped in this posture. After you have unpacked the shipment, you should move it as it is.) At this time, take careful precautions not to impose a large force on the tool shaft.

! DANGER

- Be sure to secure the arm with the attached clamp before transporting the robot. Failure to do so could cause a hazardous situation as the arm will move when the robot is lifted.

It is possible to lift up and transport the robot. Pass the wire through the attached eyebolt, then lift up the robot carefully, as shown in Fig. 2.3.
Use a chain block on the base side or arm 1 side.

* If a chain block cannot be provided and wires are used on both sides, the wire on one side should be longer than the step between the base and arm (see the table below).

TH650A-T	Use a wire with a length of 320 mm on one side.
TH1050A-T	Use a wire with a length of 288 mm on one side.

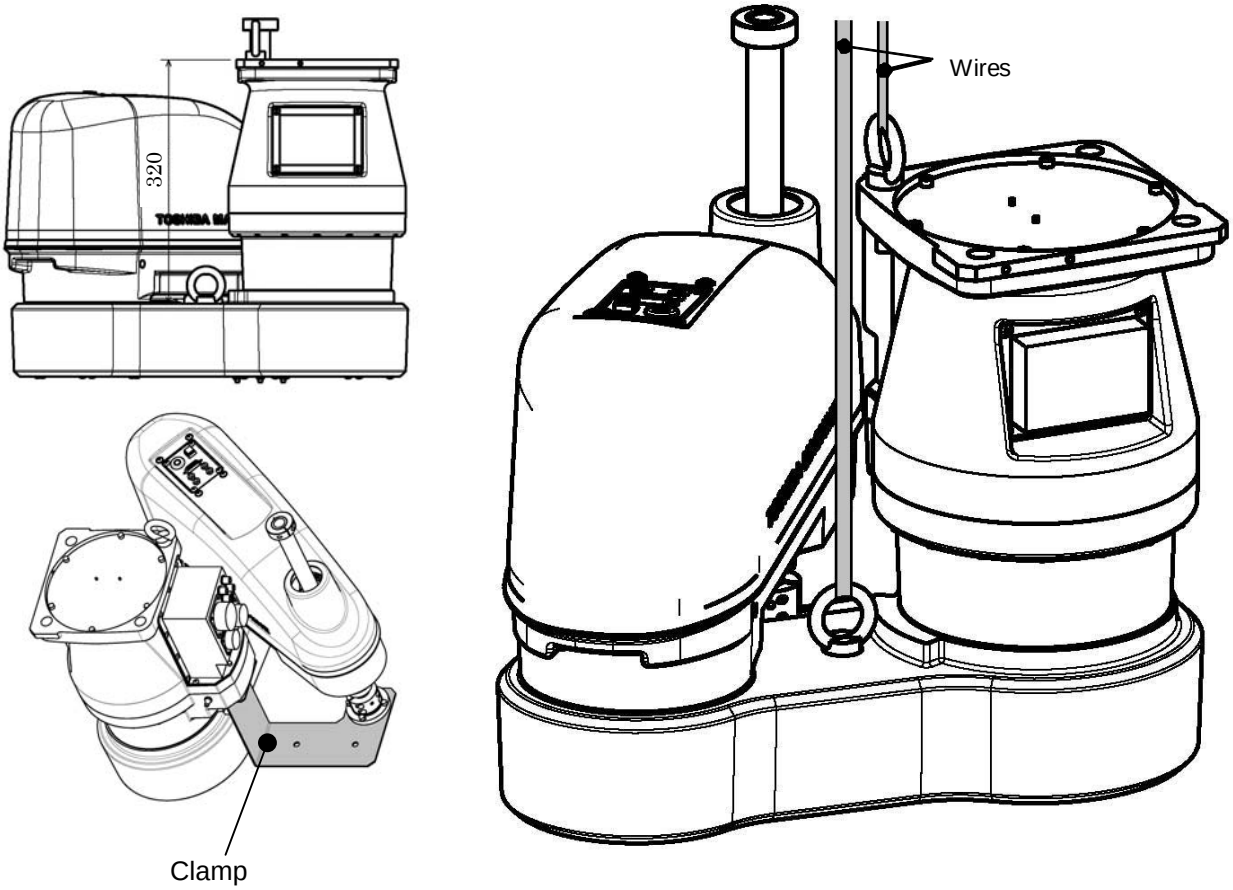


Fig. 2.3 Lifting up the robot

! CAUTION

- The wire to be used should be such that can well withstand the mass of the robot.
- When lifting up the robot, it may tilt a little. Lift it up slowly.
- Lifting up and down should be performed carefully so that any impact cannot be exerted on the robot.
- When carrying the robot by workers, take careful precautions to prevent their hand or leg from being caught in the robot.

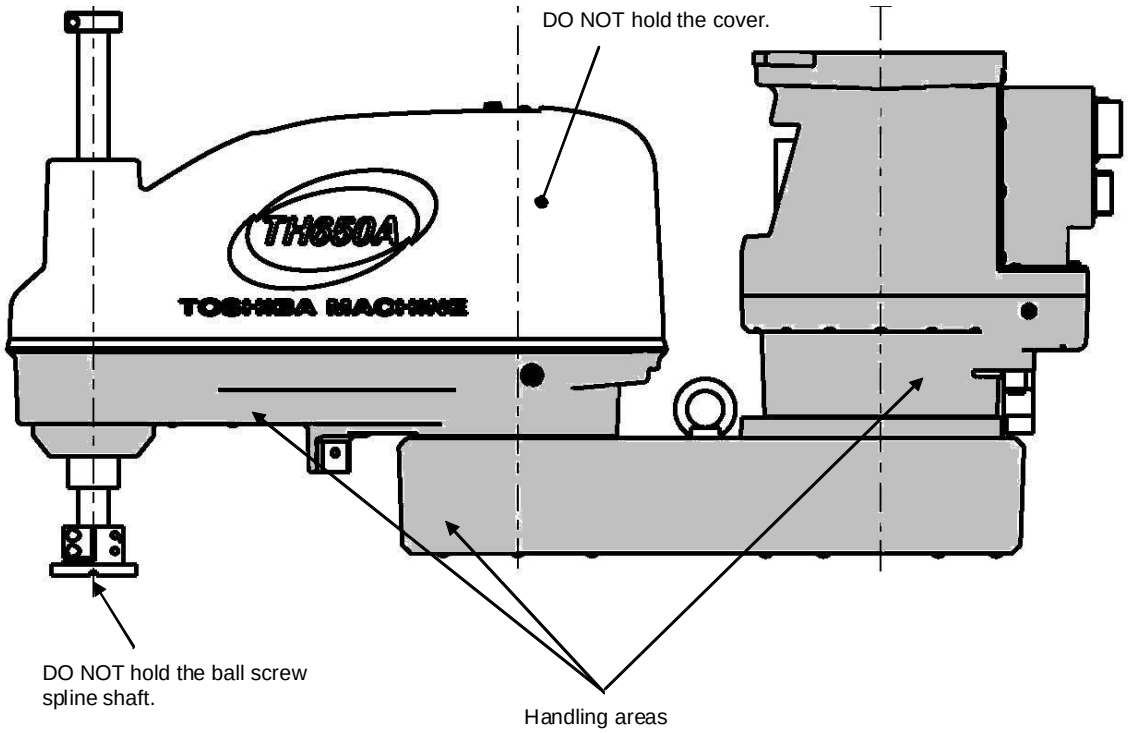


Fig. 2.4 Robot handling areas

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

! CAUTION

- When lifting up the robot by workers, hold the specified locations by hand, as shown in Fig. 2.4. If the arm 2, cover, or ball screw spline shaft is held by hand, an unusually large force is exerted, resulting in a malfunction.
- When carrying the robot by workers, take careful precautions to prevent their hand or leg from being caught in the robot.
- The work should be performed by two (2) or more workers.

2.3 Storage

Avoid storing the robot and controller for long periods of time after unpacking them. If this is unavoidable, however, strictly observe the following precautions for storage.

2.3.1 Storage Precautions for the Robot

! CAUTION

- Secure the base or arm 1 bottom surface completely to prevent the robot from falling over. When placed directly on the floor, the robot is unstable and will fall over.
- Keep the robot out of direct sunlight. The timing belts and resin covers may deteriorate.
- Seal the robot in a vinyl bag to prevent rust development and contamination. Put a desiccant in the bag to absorb moisture. As the ball screw spline shaft is susceptible to rust development, coat it with rust-preventive agent or grease the entire spline shaft beforehand.
- Before the use, apply the grease to the ball screw spline shaft.
- Before starting an operation, perform running completely.
- During storage, the life of the backup batteries will shorten. It is recommended to replace the batteries at the time of operation.

2.3.2 Storage Precautions for the Controller

! CAUTION

- Keep the controller out of direct sunlight. Otherwise, the controller interior will be excessively heated up, causing a trouble.
- Seal the controller in a vinyl bag to prevent rust development and contamination. Put a desiccant in the bag to absorb moisture.

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) DO NOT install the robot where it may be subject to fluids such as water.
Altitude	1,000 m or less
Vibration	In operation: 0.98 m/s^2 or less
Dust	No inductive dust should exist. Consult with Toshiba Machine first if you wish to use the robot and controller in a dusty environment.
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.

! DANGER

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

3.2 Installation Posture of the Robot

This robot can be used only in the posture shown below.

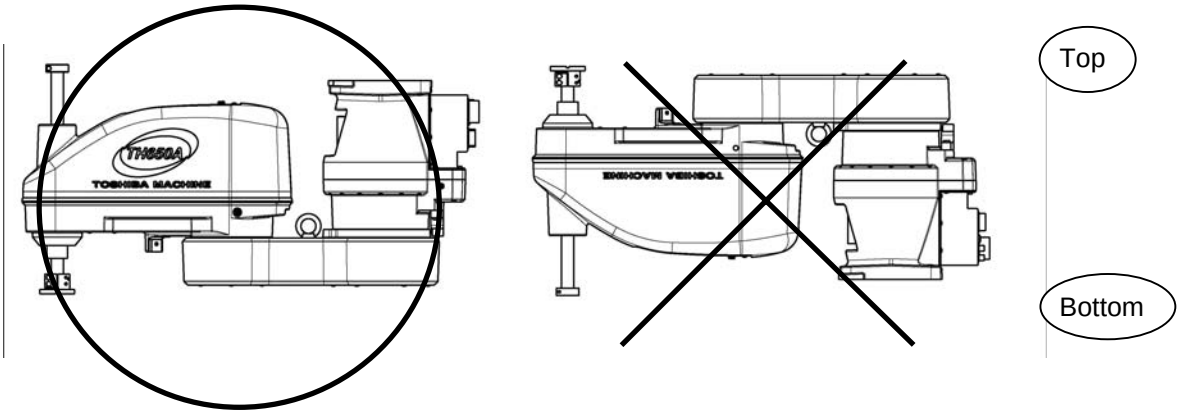


Fig. 3.1 Installation posture of the robot

Before installing the robot, you should plan a layout, fully considering the working envelope (or operating range), coordinate system and space for maintenance.

! CAUTION

- When the TH650A-T takes a posture factory-set before shipment, it will exceed the axis 3 soft limit. If the power of the robot controller is turned on in this condition, an axis 3 soft limit error will occur.
  This error can be reset by moving the axis 3 down while pressing the brake OFF switch, as shown in Fig. 1.1.
- When the TH1050A-T takes a posture factory-set before shipment, it will be outside the operating range. If the power of the robot controller is turned on in this condition, an interference range error will occur, but this is not a malfunction.
  This error can be reset by moving axes 1 and 2 within the operating range.

3.2.1 Coordinate System

The robot's joint angle origin (0° or 0 mm position) is factory-calibrated according to the base reference planes. Figs. 3.2 and 3.3 show the base coordinate system (XB, YB, ZB) and the origin of each axis joint angle.

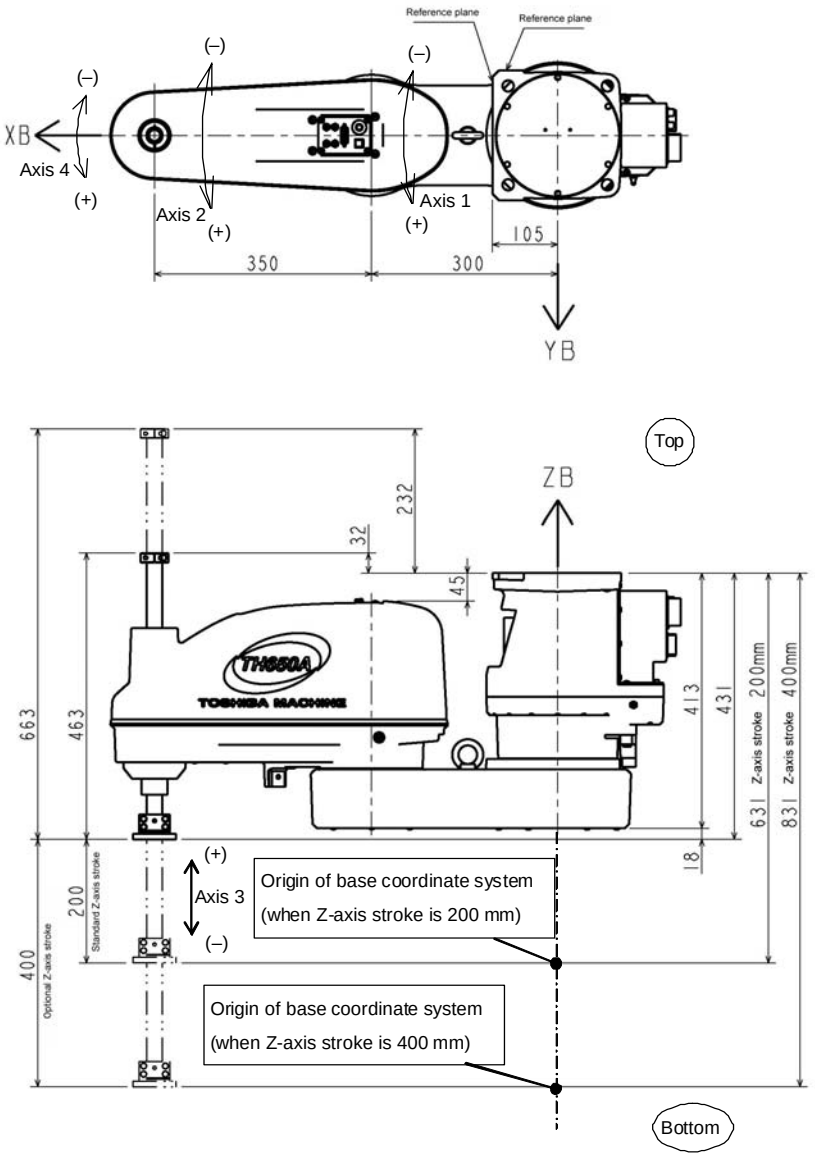


Fig. 3.2 Base coordinate system and joint angle origin (TH650A-T)

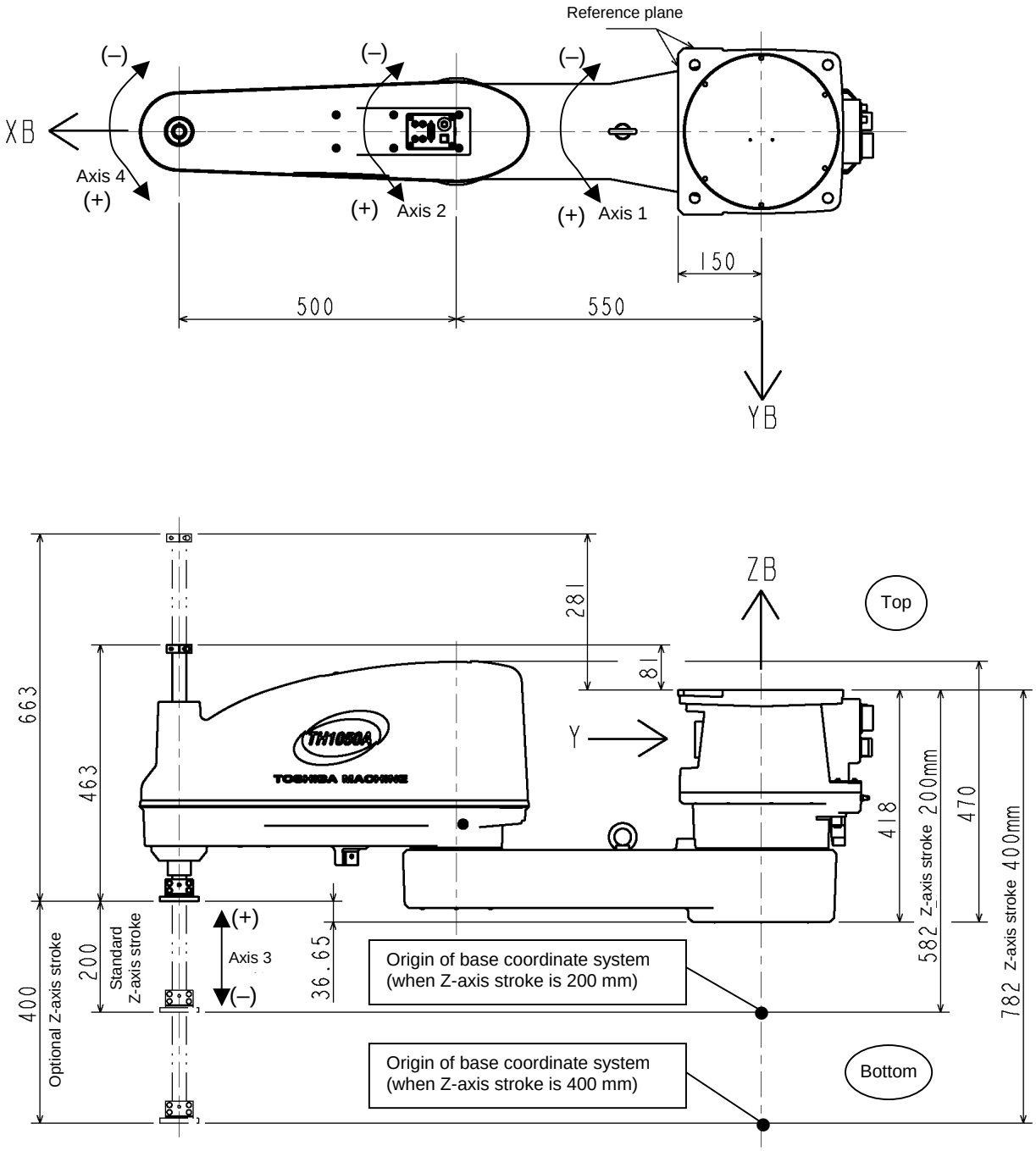


Fig. 3.3 Base coordinate system and joint angle origin (TH1050A-T)

3.2.2 Installing the Robot

The robot is secured, using the set holes on the base (four (4) places). Use M16 hexagon socket head cap screws.
The robot installation method is shown in Figs. 3.4 and 3.5.
Place the robot on a pallet, etc., then carry it to a frame where the robot is to be installed, using a forklift truck, etc.

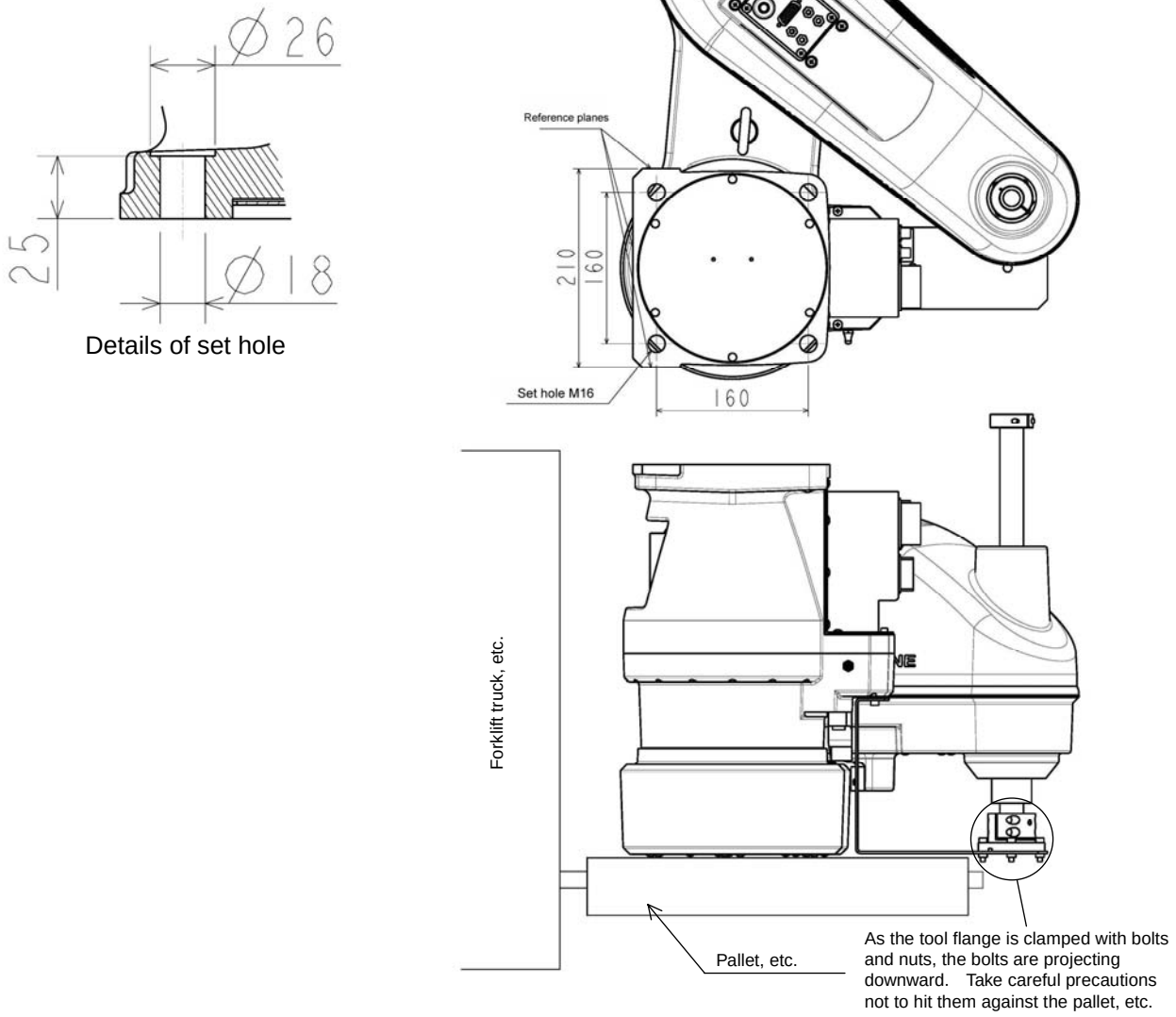
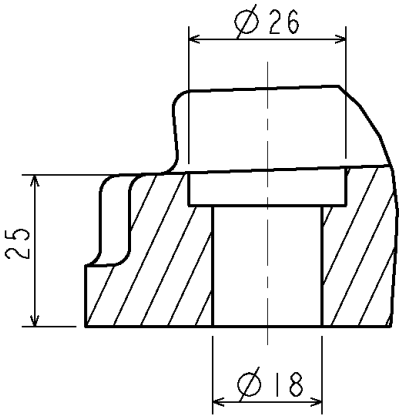
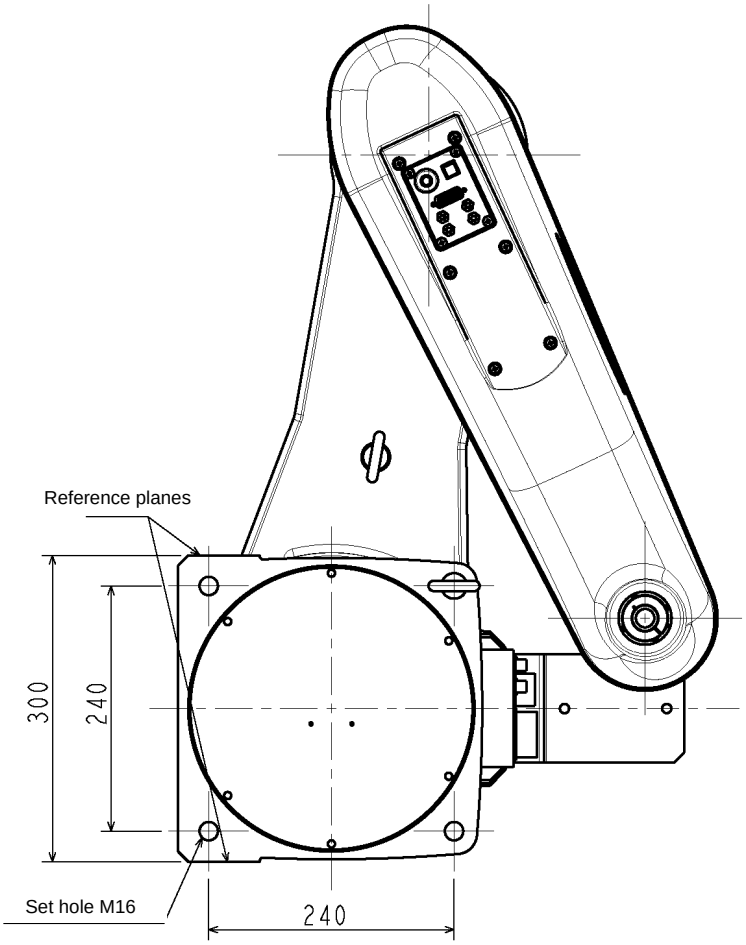


Fig. 3.4 Installation method (TH650A-T)



Details of set hole



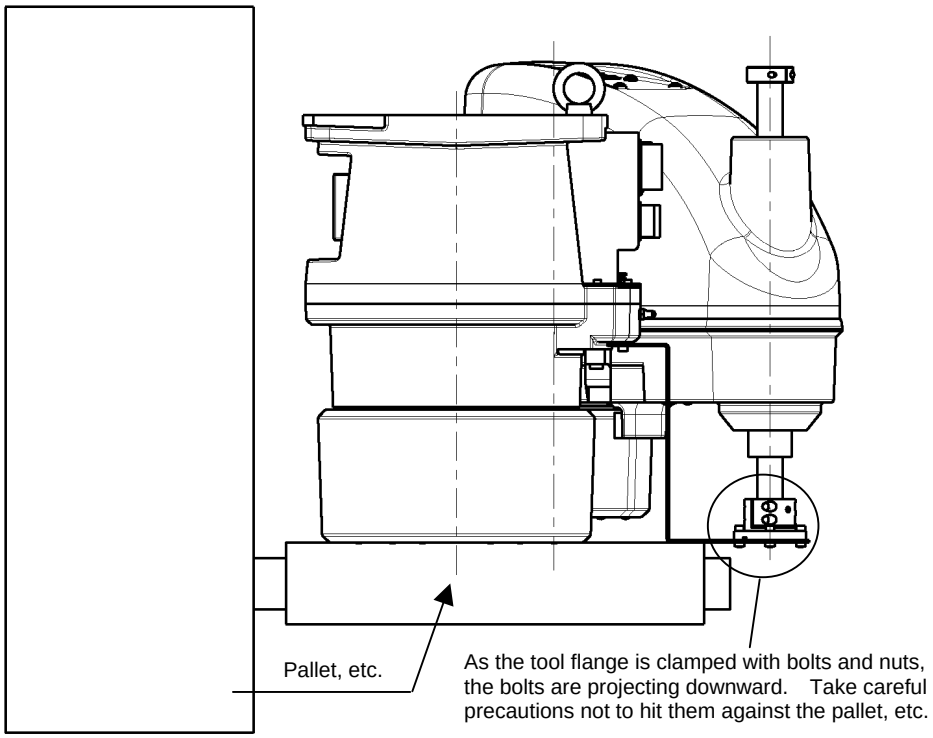


Fig. 3.5 Installation method (TH1050A-T)

3.2.3 Frame Rigidity

The loads that occur during TH650A-T/TH850A-T operation are shown in Table 3.2. A reaction force due to the loads shown in Table 3.2 occur on the frame, and so be sure to design the frame by incorporating a large number of beams and using other methods to provide a sufficient factor of safety.

Table 3.2 Frame rigidity

Model	Load by horizontal axis (axes 1, 2, and 4) operation	Load by vertical axis (axis 3) operation
TH650A-T	760[Nm]	860[N]
TH1050A-T	932[Nm]	1180[N]

! 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.
- Install the robot on a level place. Failure to do so could lead to a drop in performance or faults.
- When carrying the robot to a frame by means of a forklift truck, etc., move down the robot and perform the work with utmost care.
- When moving up the robot to the set surface by means of a forklift truck, etc., perform the work with utmost care.

4. Maintenance

The basic structure of the lifting type (or overhead traveling type) robot is the same as that of the standard robot though the arm set direction differs.
For the other inspection items, see the TH–A Series Maintenance Manual provided separately.
TH650A Maintenance Manual: ST79088 (Japanese), STE79088 (English)
TH1050A Maintenance Manual: ST79096 (Japanese), STE79096 (English)
This section describes only the items different from those of the standard robot.

4.1 Details of Inspection

4.1.1 Check of Each Cable and Air Tube for Abrasion

Disassemble the arm 2 cover and arm 1 covers (two (2) different covers are provided) and make sure that each cable and air tube are not worn out, broken or cracked. Especially, take careful precautions to inspect the vicinity of the cable outlets of the axis 1 joint and axis 2 joint.
For how to disconnect the covers, see Para. 2.4 in the TH–A Series Maintenance Manual provided separately. For details about removing the die 1 arm cover, see section 4.3.

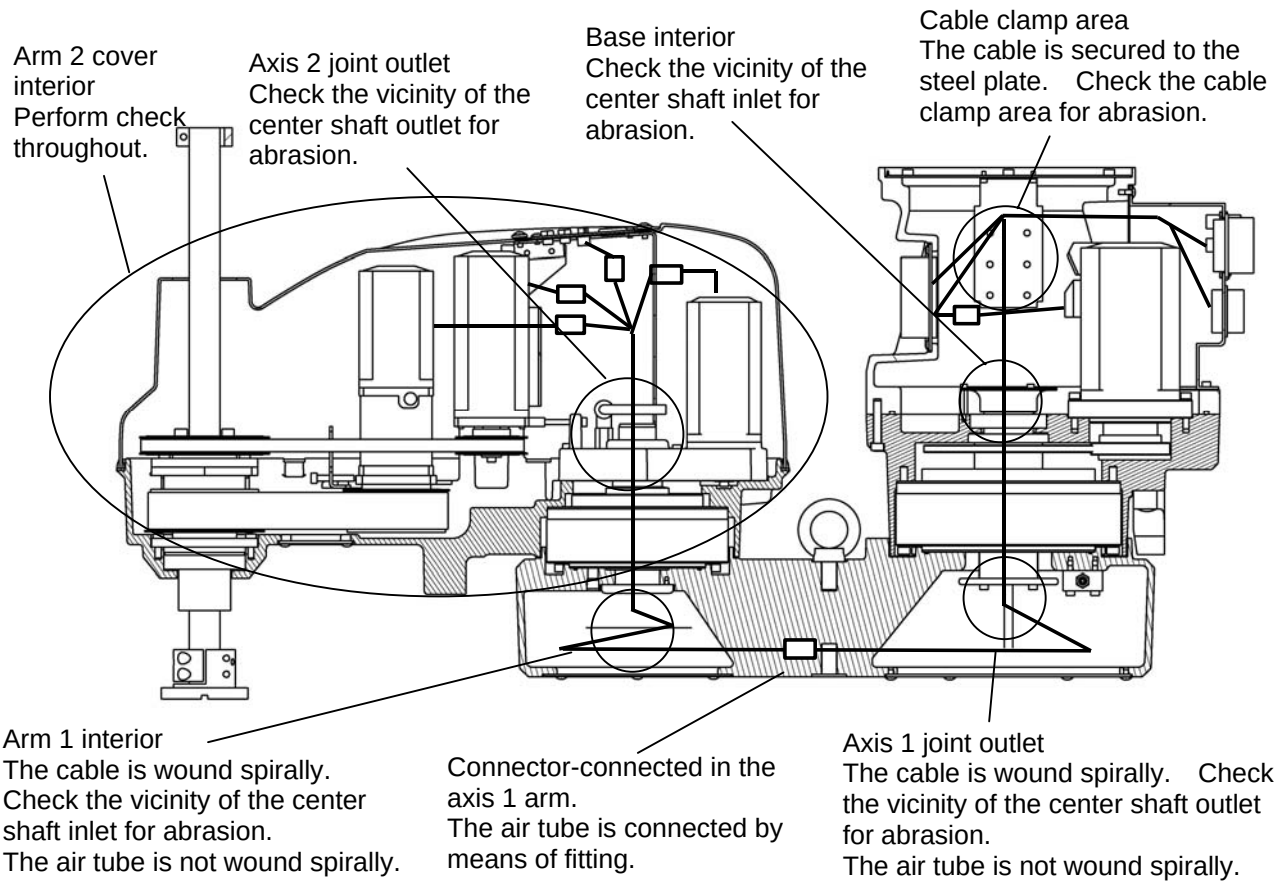


Fig. 4.1 Cable and air tube check points

4.2 Layout of Robot Components

The layout of the robot mechanical components is shown in Figs. 4.2 and 4.3.

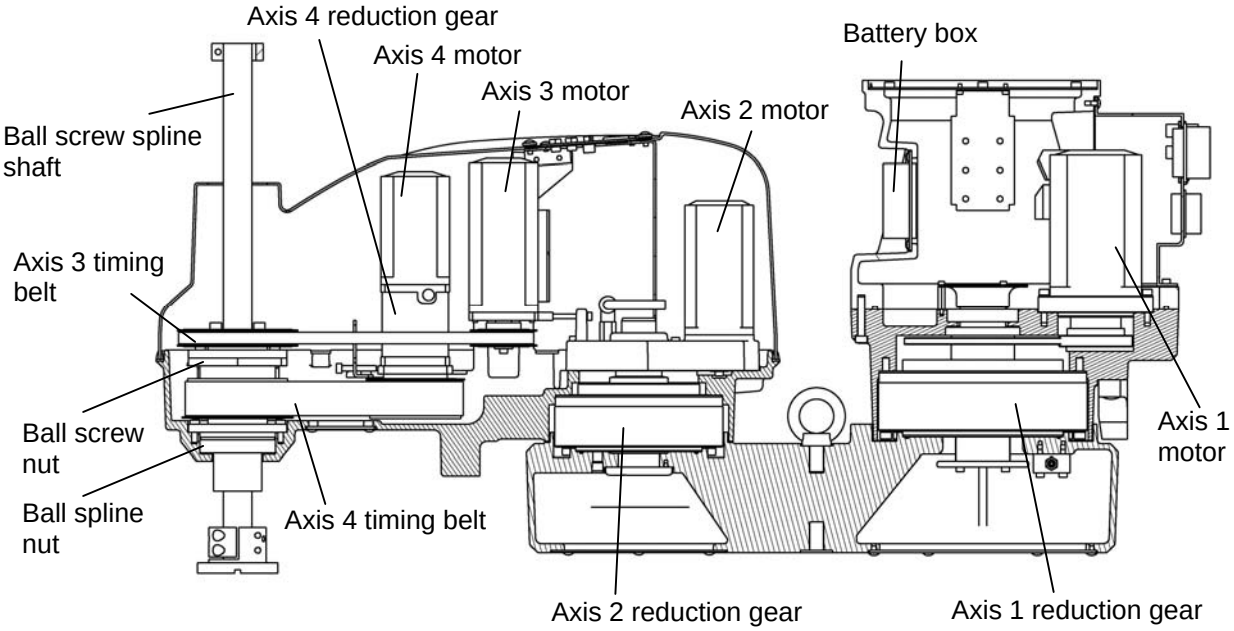


Fig. 4.2 Layout of robot mechanical components (TH650A-T)

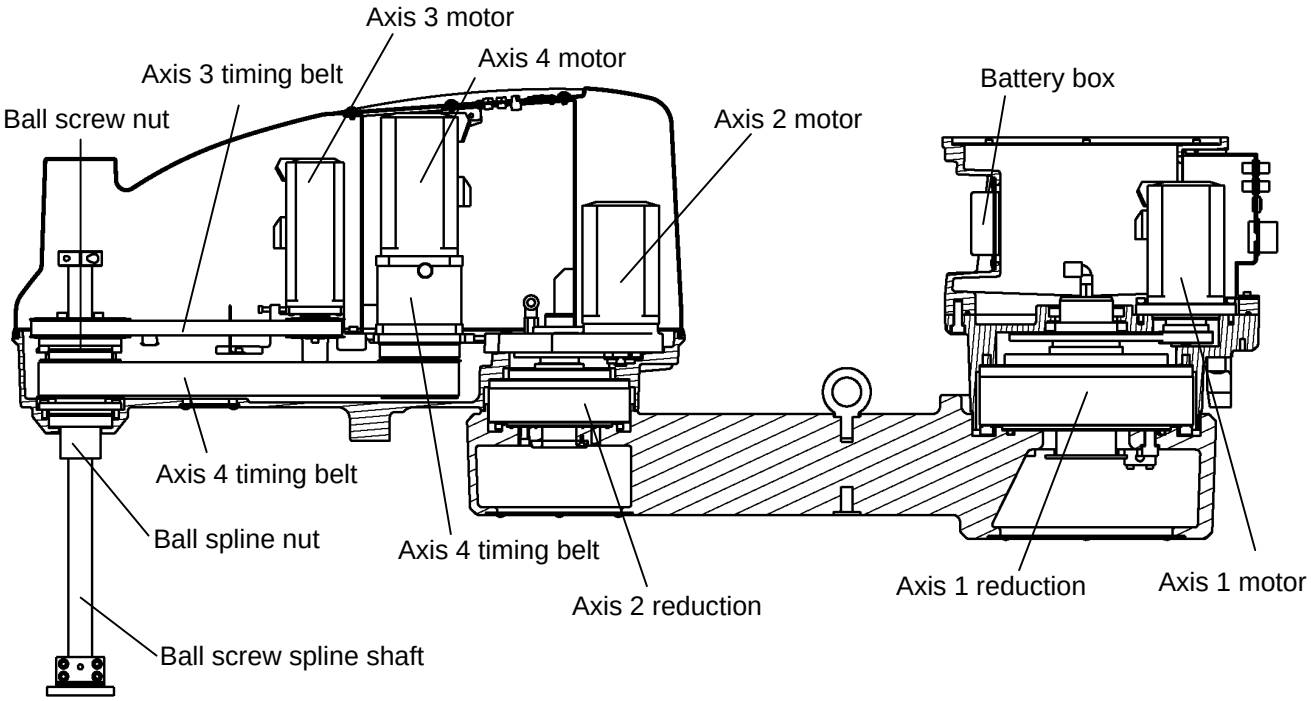


Fig. 4.3 Layout of robot mechanical components (TH1050A-T)

4.3 Dismounting and Mounting Each Cover

4.3.1 Arm 1 Covers

The axis 1 covers are provided under the axis 1 (arm cover 1) and under axis 2 (arm cover 2).
Each cover is secured to the axis 1 with six (6) cross-recessed truss head screws (M4 × 6).

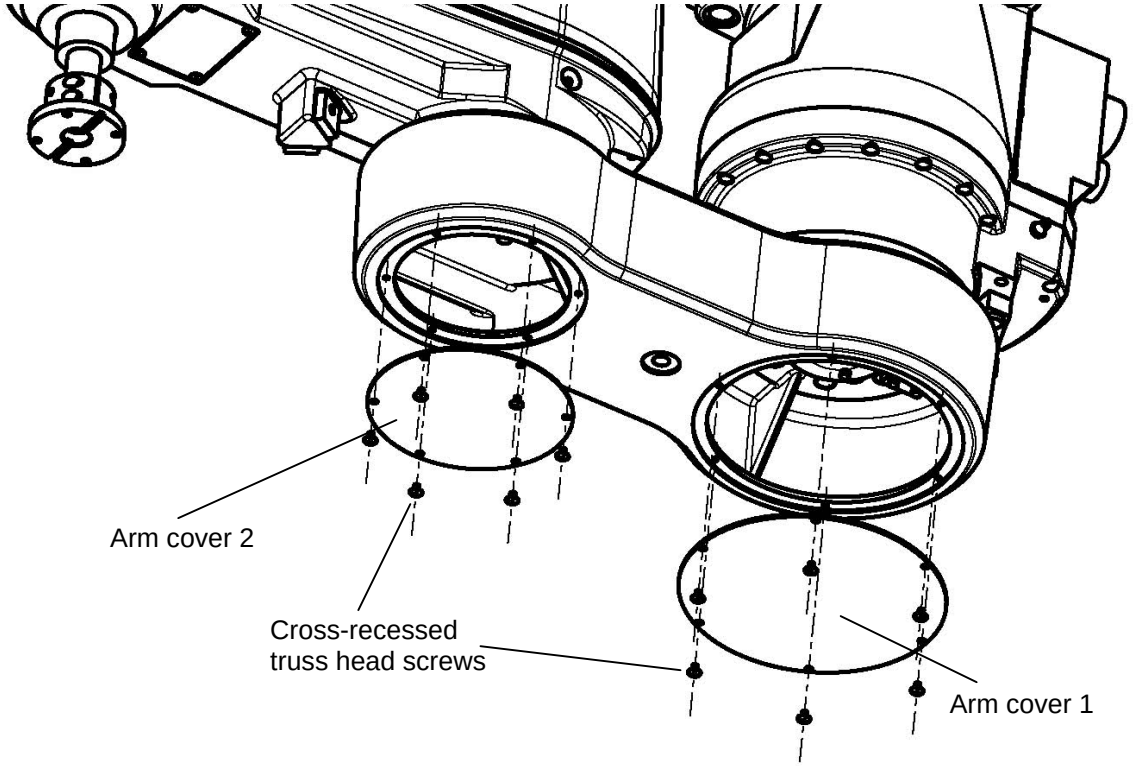


Fig. 4.4 Arm 1 covers

4.4 Filling Grease to Reduction Gear

The reduction gear is to be replaced by our service engineer.

DANGER

- The reduction gear should be replaced with a new one only after the controller power is turned off with the power supply plug removed. If the work is done while the power is turned on, you may get an electric shock or the robot may malfunction, which is very dangerous.

CAUTION

- Because the reduction gear is disconnected, the mechanical home point shifts and proper control cannot be done. To avoid this, home return operation is necessary after replacement of the reduction gear. For the home return procedures, see Section 4 in the TH–A Series Maintenance Manual provided separately.

4.4.1 Reduction Gear Locations

The locations of respective reduction gears are shown in Figs. 4.5 and 4.6 below.

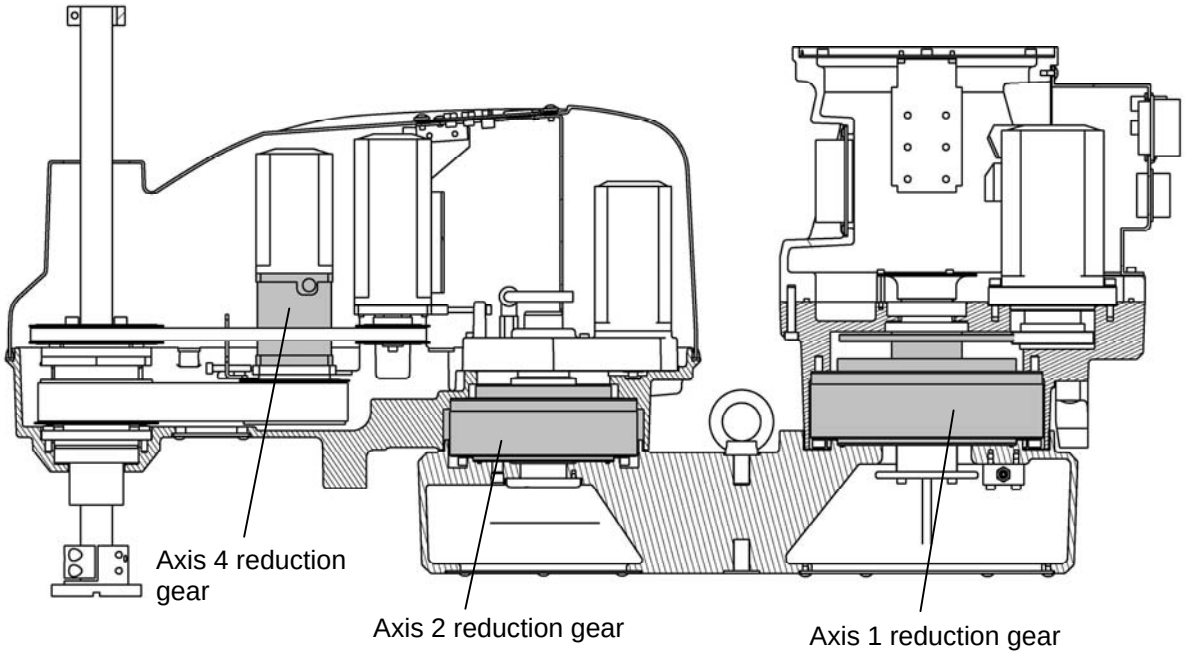


Fig. 4.5 Reduction gear locations (TH650A-T)

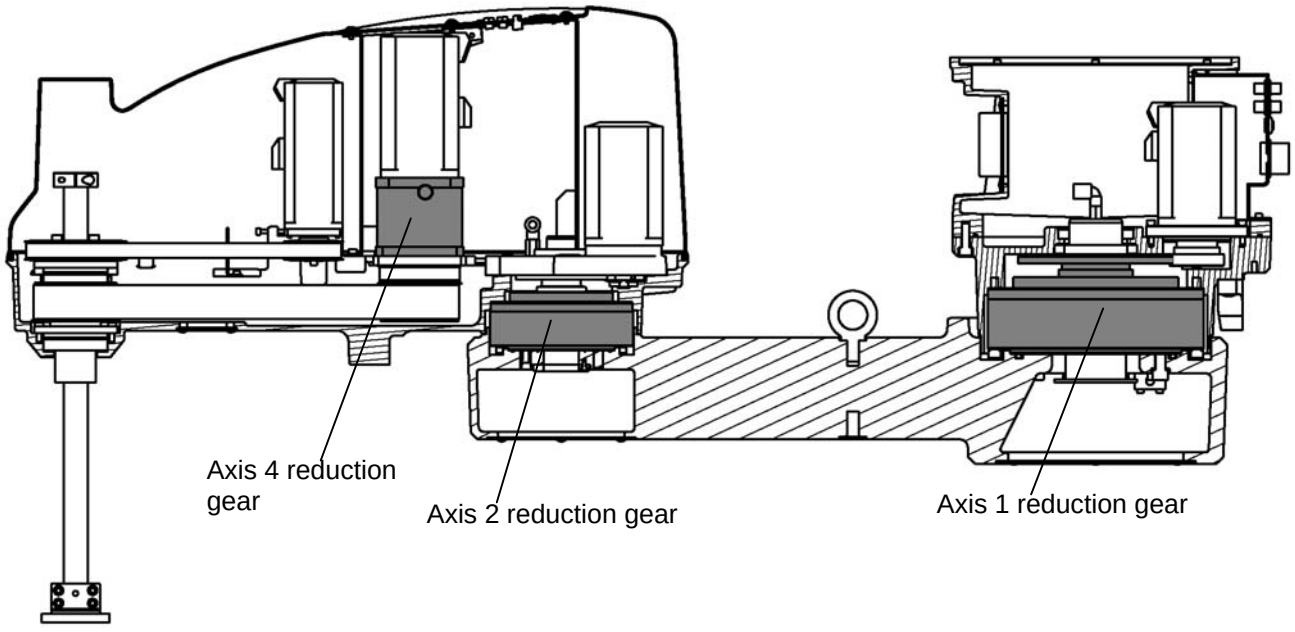


Fig. 4.6 Reduction gear locations (TH1050A-T)

4.4.2 Filling Grease to Axis 1 Reduction Gear

When the reduction gear is used under the normal operating conditions, regular greasing is unnecessary. Replace the reduction gear with a new one at the time of overhauling. If the reduction gear is used under the conditions of high operation duty and heavy load, fill the grease to the same gear every 10,000 hours (i.e., approximately two (2) years).

! CAUTION

- When the grease has run short, cut or scratch will be caused on the reduction gear interior or gear, resulting in drop of the performance. To avoid this, take careful precautions to prevent shortage of the grease.
- Be sure to use the grease designated by Toshiba Machine.
- Increase in internal pressure will adversely affect the starting torque and damage the internal seal. To avoid this, be sure to observe the grease filling volume.

Grease filling volume for axis 1 reduction gear: 330 g

When you wish to place an order for the grease, contact us at the Service Department.

1) Filling grease to axis 1 reduction gear

- Remove the battery box cover, then the long type union in the base.
- Remove the hexagon socket plug attached to the lateral side of the base, then set it in the place where the long type union was mounted.

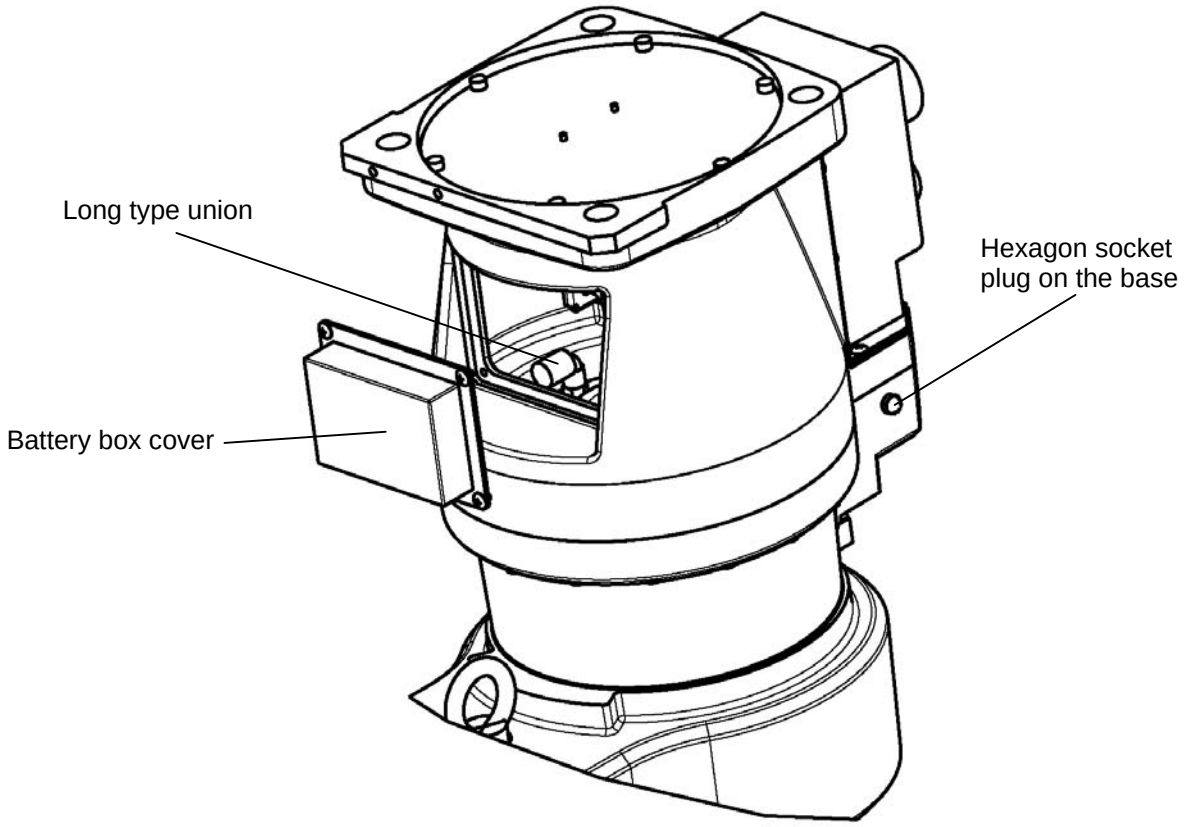


Fig. 4.7 Removing long type union

- Remove the cover under the arm 1. Remove the grease nipple attached to the block and attach it to the lateral side of the base instead to feed grease.
- Disconnect the hexagon socket plug (Rc1/8) in the arm 1 and remove the old grease. Provide an oil pan, etc. to receive the old grease.

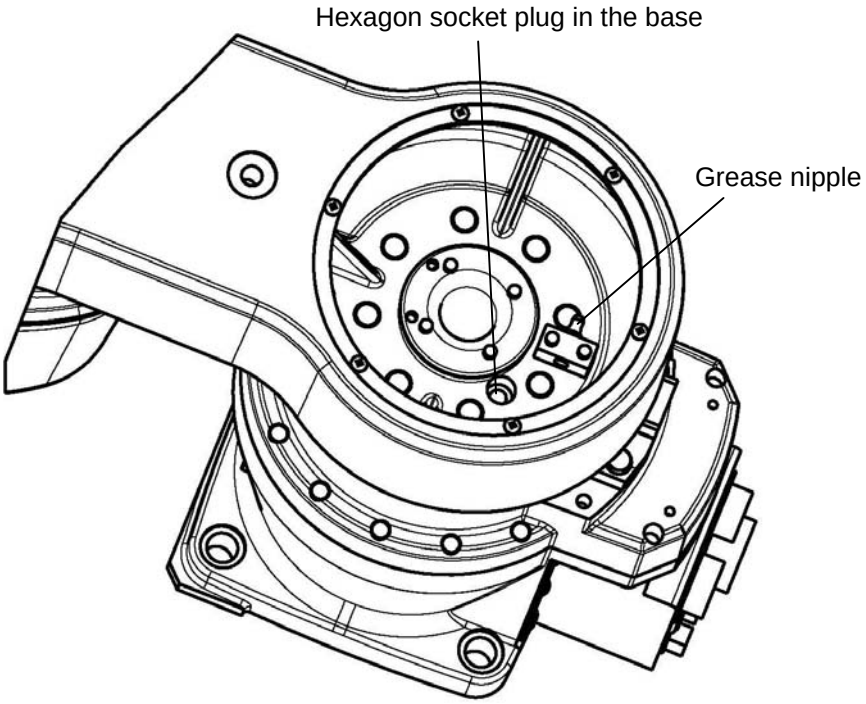


Fig. 4.8 Removing grease nipple

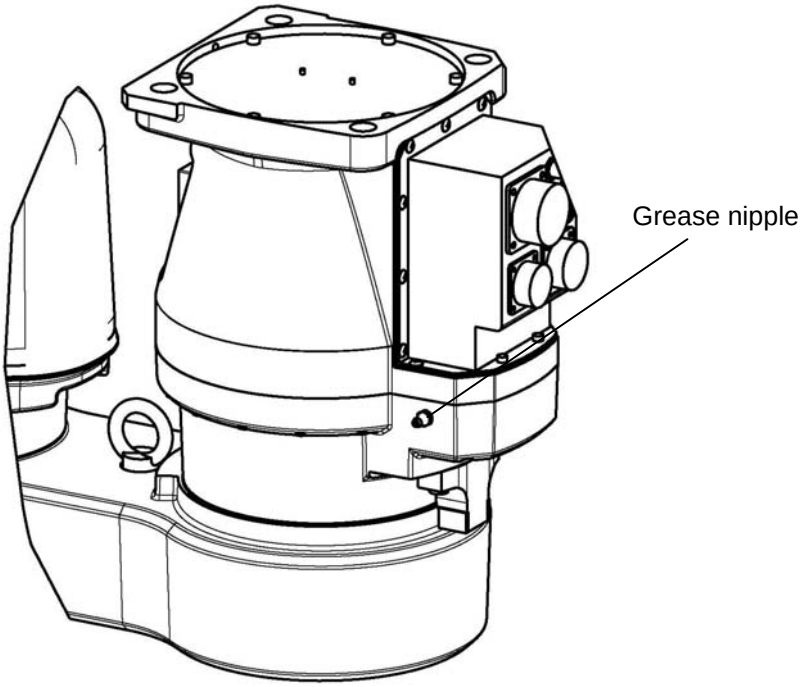


Fig. 4.9 Mounting grease nipple

- After the specified volume of grease has been filled, attach the hexagon socket plug in the arm 1, remove the hexagon socket plug attached in the base, then mount the long type union again. Also, remove the grease nipple set on the lateral side of the base and mount the hexagon socket plug.

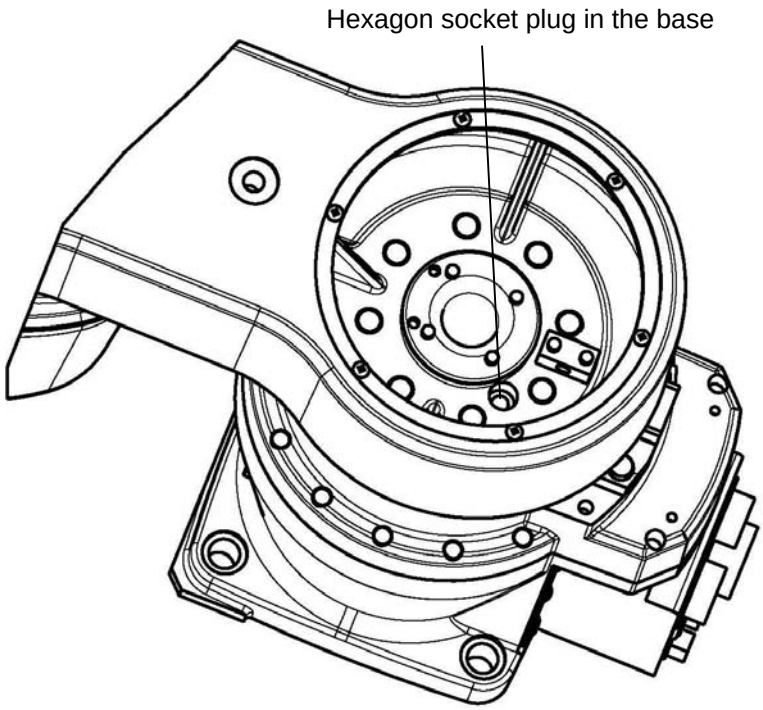


Fig. 4.10 Mounting hexagon socket plug

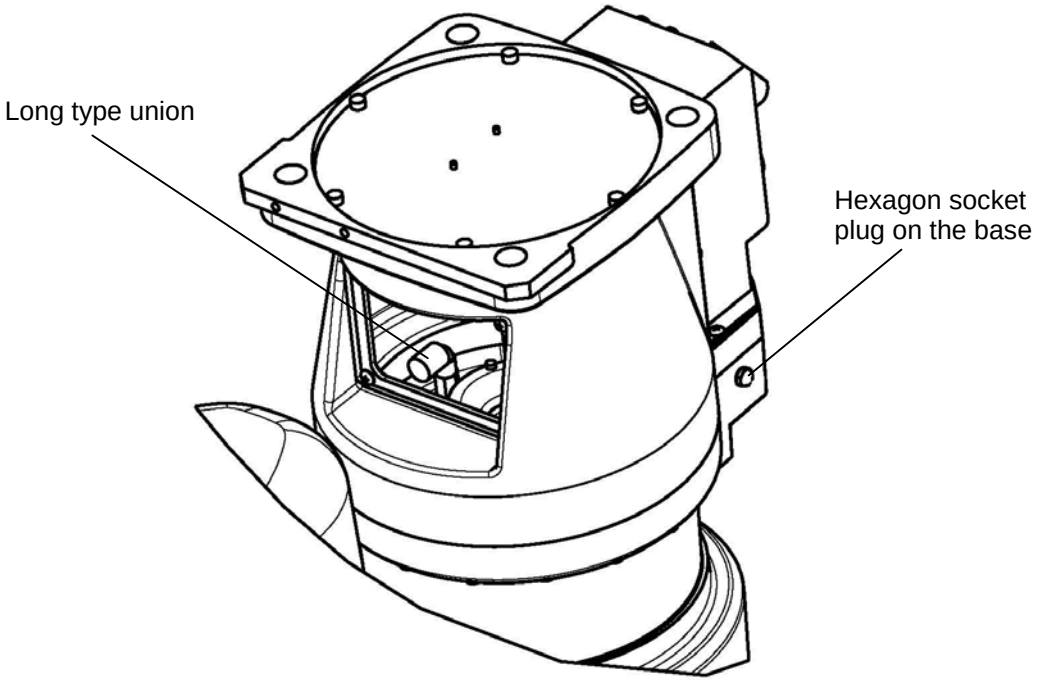


Fig. 4.11 Mounting long type union

- Attach the disconnected grease nipple to the block, then set them in the arm 1. Cover the arm 1 and mount the battery box cover as originally set. Now greasing is complete.
  When attaching the hexagon socket plug, be sure to use a seal tape.
  To circulate the grease throughout the reduction gear interior, it is recommended to perform running at a low speed for about five (5) minutes.

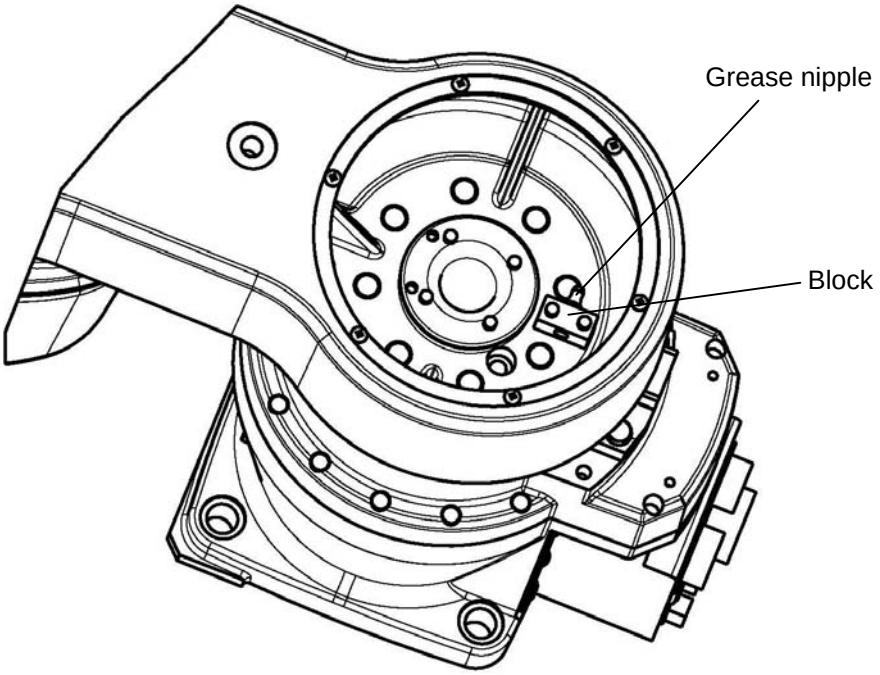


Fig. 4.12 Mounting grease nipple

! CAUTION

- DO NOT leave the grease nipple and hexagon socket plug which were used for greasing as they are. Otherwise, internal pressure in the reduction gear will increase, resulting in malfunction of the same gear at an early date. To avoid this, be sure to return them to their original positions.

4.4.3 Filling Grease to Axis 2 Reduction Gear

Greasing of the axis 2 reduction gear is identical to that for the standard machine. For details, see Section 2.8 in the TH-A Series Maintenance Manual.

5. Replacement Parts for Maintenance

5.1 Replacement Parts List for Maintenance

The replacement parts lists for maintenance are the same as those of the TH650A/TH1050A robot. For details, see Section 5 of the TH–A Series 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.

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