TH Series
Industrial Robot

INSTRUCTION MANUAL

CLEAN BELLOWS 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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TOSHIBA MACHINE CO., LTD.

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 series clean bellows type industrial robot (–CRB). This robot can be used under an environment where high cleanness level is required. It's basic structure and performance other than the clean bellows are the same as those of the standard robot. Like the standard robot, this robot has high-speed and high-accuracy performance characteristics.
Before using this manual, you are strongly requested to fully understand and familiarize yourself with the names, functions and handling methods of respective parts of the clean bellows type robot, referring to the Transportation and Installation Manual, Maintenance Manual and Safety Manual of the standard robot.
Before unpacking the shipment containing this robot, be sure to read through this manual. After reading through the manual, keep it nearby for future reference.

This manual is comprised of the following sections.

Section 1 Basic Specifications
This section describes the basic specifications, outer dimensions, operating range and dust-preventive measures of the clean bellows type industrial robot.

Section 2 Transportation and Installation
This section describes how to remove the clean bellows type robot from its box, how to transport it to the installation site and how to install it there. It also explains the precautions when the robot is to be stored temporarily after unpacking.
Before reading this section, be sure to read through the Transportation and Installation Manual of the standard robot, as shown below.

Section 3 Maintenance
This section describes the structure and maintenance schedule of the clean bellows type robot, and all items required for the maintenance and inspection of the same robot.
Before reading this section, be sure to read through the Maintenance Manual of the standard robot, as shown below.

Section 4 Safety

This section explains the locations where the caution and warning labels are pasted, and the safety measures.

Before reading this section, be sure to read through the Safety Manual of the standard robot, as shown below.

The types of the clean bellows type robot, and the types and instruction manuals of the standard robot are tabled below.

Clean bellows type	Standard type	Transportation and Installation Manual	Maintenance Manual	Safety Manual
TH250A–CRB	TH250A	STE 73995	STE 73966	STE 73997
TH350A–CRB	TH350A			

Precautions on Safety

Important information on the robot is noted in the instruction manual to prevent injury to the user and persons nearby, prevent damage to assets and 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 damage 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.

! CAUTION

- To perform the work covering from the robot installation to operation with safety, be sure to read through and well understand the Safety Manual provided separately before starting the work.

[Handling the robot]

Be sure to observe the following items to use this robot safely.

! CAUTION	
 Prohibited	• The user must NEVER replace or modify parts other than those described in the instruction manual. Otherwise, the robot 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.

Table of Contents

1. Basic Specifications

1.1 Basic Specifications

The specifications of the main robot are shown in Tables 1.1 and 1.2 below.

Table 1.1 TH250A–CRB specifications

No.	Item		Specifications	Remarks
1	Structure		Horizontal multi-joint type robot	
2	No. of controlled axes		Four (4)	
3	Arm length	Full length	250 mm	
		Arm 1	125 mm	
		Arm 2	125 mm	
4	Operating range	Axis 1	±115 deg	
		Axis 2	±125 deg	
		Axis 3	100 mm	
		Axis 4	±360 deg	
5	Maximum speed (Note 1)	Axis 1	540 deg/s	
		Axis 2	540 deg/s	
		Axis 3	1,120 mm/s	
		Axis 4	1,143 deg/s	
		Composite speed	3.53 m/s	
6	Load (Note 1)	Maximum payload mass	3 kg (Gravity center offset of load: 70 mm or less)	
		Permissible inertia moment	0.017 kg·m^2	
7	Repeatability	X–Y	±0.01 mm	
		Z	±0.01 mm	
		C	±0.005 deg	

No.	Item	Specifications	Remarks
8	Cleanness level	Cleanness level of ISO standard: Class 3 (Dust particle diameter: 0.1 µm) (Note 2)	Cleanness level of FED standard: Equivalent to Class 10 (dust particle diameter of 0.1µm).
9	Drive system	All axes are driven by AC servo motors.	
10	Mass of robot body	14.5 kg	

Table 1.2 TH350A–CRB specifications

No.	Item		Specifications	Remarks
1	Structure		Horizontal multi-joint type robot	
2	No. of controlled axes		Four (4)	
3	Arm length	Full length	350 mm	
		Arm 1	225 mm	
		Arm 2	125 mm	
4	Operating range	Axis 1	±115 deg	
		Axis 2	±130 deg	
		Axis 3	100 mm	
		Axis 4	±360 deg	
5	Maximum speed (Note 1)	Axis 1	337.5 deg/s	
		Axis 2	540 deg/s	
		Axis 3	1,120 mm/s	
		Axis 4	1,143 deg/s	
		Composite speed	3.24 m/s	
6	Load (Note 1)	Maximum payload mass	3 kg (Gravity center offset of load: 70 mm or less)	
		Permissible inertia moment	0.017 kg·m^2	

No.	Item		Specifications	Remarks
7	Repeatability	X–Y	±0.01 mm	
		Z	±0.01 mm	
		C	±0.005 deg	
8	Cleanness level		Cleanness level of ISO standard: Class 3 (Dust particle diameter: 0.1 µm) (Note 2)	Cleanness level of FED standard: Equivalent to Class 10 (dust particle diameter of 0.1µm).
9	Drive system		All axes are driven by AC servo motors.	
10	Mass of robot body		14.5 kg	

Note 1: The acceleration and deceleration are limited by the motion pattern, mass of a load and offset value.

Note 2: Cleanness level of Class 3 of the ISO standard signifies that 1,000 or less dust particles of 0.1 µm or over in diameter exist in the air of 1 m^3 sample area.

To maintain the specified cleanness level of this robot, strictly observe the following operating conditions.

- Install the robot just below the down air flow in the clean room or clean booth.
- The down air flowrate should be 0.3 to 0.5 m/s.
- Scavenge the robot interior by connecting the clean vacuum air joint (for 6 mm-diameter air tube) with the scavenging vacuum pump.
- The target scavenging air volume should be 50 L/min.

1.2 Outer Dimensions and Operating Range

The outer dimensions and operating range are shown in Fig. 1.1 and Fig. 1.2 below.

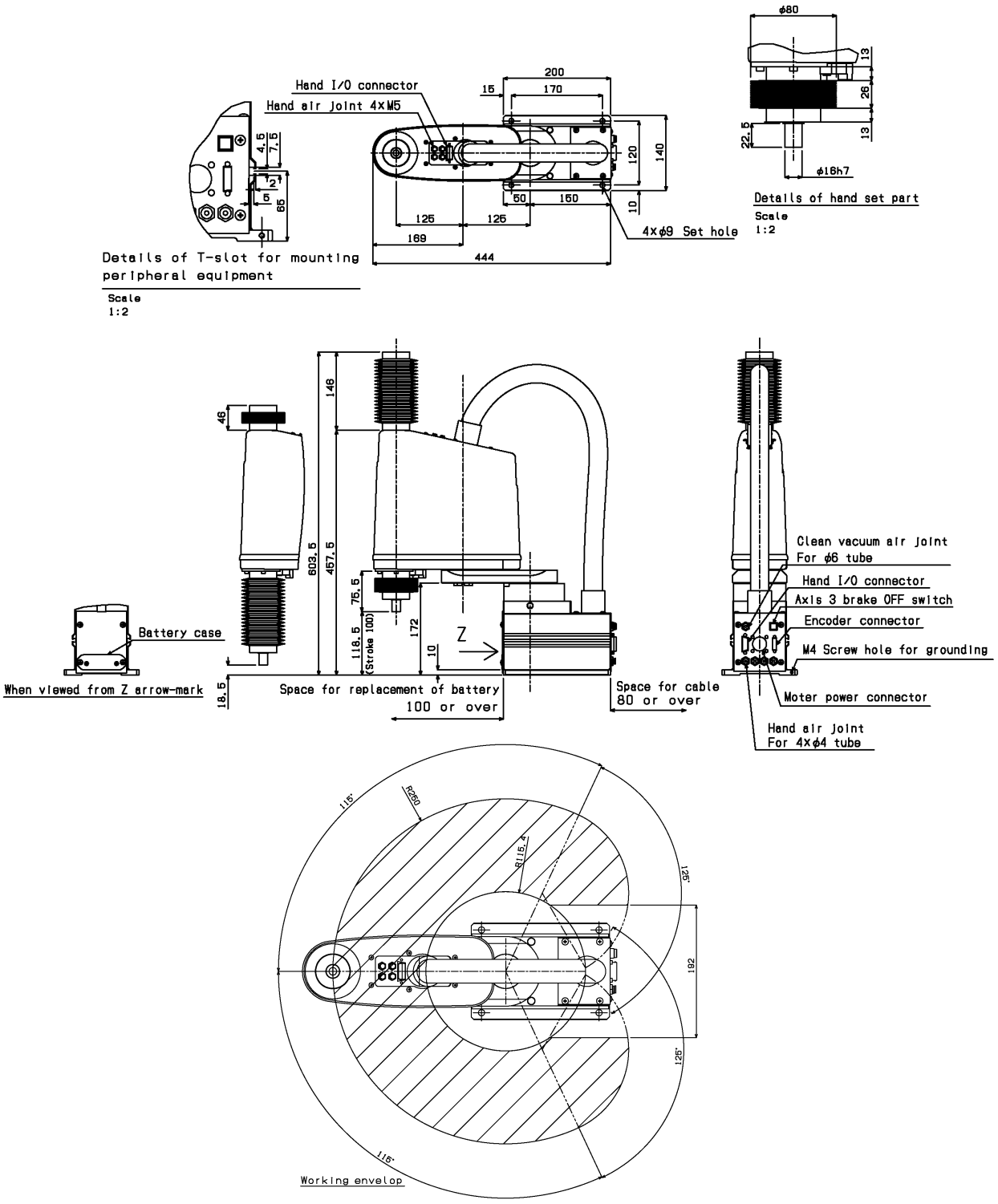


Fig. 1.1 External view of TH250A–CRB

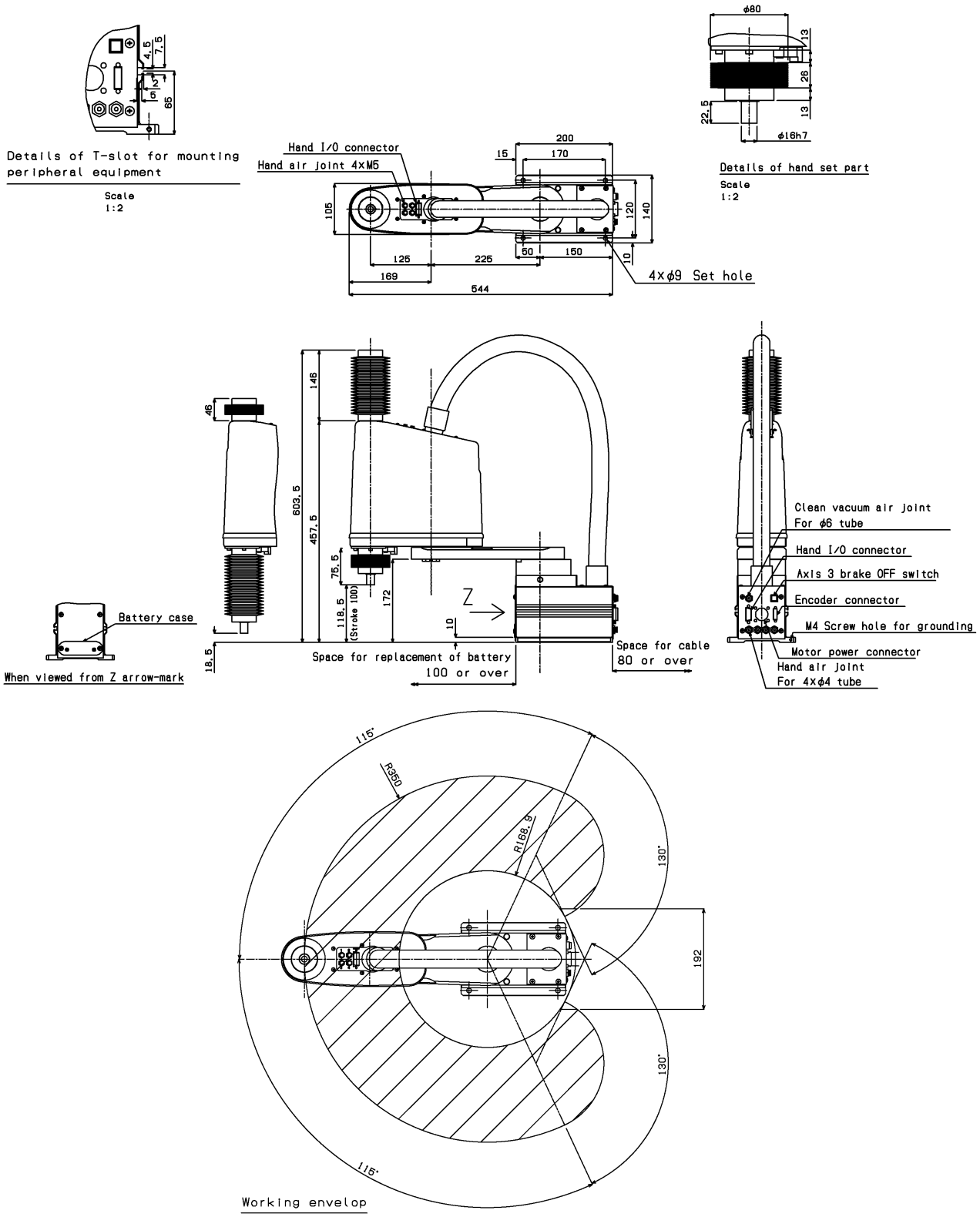


Fig. 1.2 External view of TH350A–CRB

1.3 Dust-Preventive Measures

(1) Axis 3/axis 4 drives

The ball screw spline shaft is covered with the clean bellows. Thus, splash of grease of the ball screw spline shaft, and scatter of dust generated in the clean bellows or axis 3 and axis 4 drives can be prevented.

(2) Clean bellows

The clean bellows is of a round type of antistatic specifications, without an air vent hole. Thus, the clean bellows is fully closed and dust existent inside the bellows will not scatter outside. If the clean bellows has broken, however, dust will scatter outside. To prevent this, perform maintenance and inspection of the clean bellows on a regular basis.

(3) Arm 2

A packing is attached to between the bottom of the arm 2 cover and the arm 2 to make the arm 2 fully closed and to prevent scatter of any dust inside. Especially, at other than the inspection and adjustment of the arm 2 interior, DO NOT remove the cover.

(4) Scavenging in the robot

Scavenging is performed through the air tube in the arm 2 cover by connecting the scavenging vacuum pump with the clean vacuum air joint (for 6 mm-diameter air tube). As a yardstick, the scavenging air volume is 50 L/min. The scavenging vacuum pump and air tube (between the robot and scavenging vacuum pump) other than the robot body are not standardly provided, which should be prepared by the customer.

It should be noted that when an operation is executed without scavenging, the specified cleanness level cannot be maintained.

2. Transportation and Installation

2.1 Transport

2.1.1 Unpacking and Transport

Though the robot is shipped in a clean bag, the bag should be opened in the same manner as in the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to Para. 1.1 of the Transportation and Installation Manual (STE 73995) provided separately.

The robot is covered with a vinyl bag for vacuum package. To remove the vinyl bag, take careful precautions not to damage the robot. Especially, utmost care should be taken to the clean bellows as they are soft and easy to break.

Additionally, the vinyl bag containing the robot is contaminated with dust or dirt, and when opening the bag, the robot may be stained with such dust or dirt. Eliminate the dust or dirt left on the robot body. Especially, before moving the robot to the clean room at job site, completely clean it with alcohol or pure water. When packaging each robot in our plant, careful precautions are taken not to allow entry of any contaminants into the robot body.

The robot should be carried in the same manner as in the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to Para. 1.2 of the Transportation and Installation Manual (STE 73995) provided separately.

2.1.2 Storage

The robot should be stored in the same manner as in the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to Para. 1.3 of the Transportation and Installation Manual (STE 73995) provided separately.

Store the clean bellows at an ambient temperature and in a dark room. Otherwise, they may tarnish from the milky-white to yellow. The quality remains unaffected by the discoloration.

2.2 Installation

The robot should be installed in the same manner as in the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to Section 2 of the Transportation and Installation Manual (STE 73995) provided separately.
Especially, utmost care should be taken to the clean bellows at the time of installation because they are soft and easy to break.
In addition to the installation environment of the standard robot, this robot should be installed just under the down air flow in the clean room or clean booth. The down air flowrate should be 0.3 to 0.5 m/s.

3. Maintenance

3.1 Maintenance Items

This section refers to the maintenance items of the clean bellows type industrial robot. The check intervals and procedures are shown in Table 3.1 below.
For the parts used in common with the standard robot, see the maintenance items for the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to Sections 1 and 2 of the Maintenance Manual (STE 73996) provided separately.

Table 3.1 Maintenance items of TH250A–CRB and TH350A–CRB

Item	Procedures	Refer to	Check intervals
Check for clean bellows	Visually make sure that each clean bellows is not damaged and in a good shape.	Para. 3.1.1	Every six (6) months
Replacement of clean bellows	Replace the clean bellows if it has broken, or according to the predetermined schedule.	Para. 3.1.2	After the axis 3 has shuttled 30 million times, or every year.
Greasing of ball screw spline	Remove the clean bellows. Fill the grease to the ball screw spline and shaft, then mount the clean bellows as it was set before.	Para. 3.1.3	Every six (6) months

3.1.1 Check for Clean Bellows

While the robot is operating or while it is stopped, visually make sure that abnormalities such as peel-off, cut or scratch, wear, twist and wrinkle are not found in the clean bellows.

! DANGER

- When approaching the robot for the maintenance or inspection, be sure to turn off the main power switch of the controller beforehand.

If the clean bellows is broken, it will result in drop in the cleanness level. When this happens, replace the bellows immediately. Abnormalities such as twist and wrinkle will cause the bellows to break. To avoid this, mount it again correctly.
The customer should take all necessary measures to prevent adverse effects on the entire system by drop in the cleanness level which is caused by breakage of the clean bellows.
For the replacement procedures of the clean bellows, see Para. 3.1.2.

3.1.2 Replacement of Clean Bellows

The clean bellows should be replaced with a new one after it has broken or according to the schedule (i.e., the axis 3 has reciprocated 30 million times or one (1) year has passed, whichever comes first).
The clean bellows should be handled with utmost care because it is soft and easy to break.
As the clean bellows is dismantled, the cleanness level may drop temporarily. Take appropriate measures to prevent adverse affects on the entire system by drop in the cleanness level.

! DANGER

- When approaching the robot for the maintenance or replacement, be sure to turn off the main power switch of the controller beforehand.

Described below are the clean bellows and clean bellows mounting sections.
Each clean bellows is attached with clamp bands, as shown in Fig. 3.1 below.
Use only the clamp bands which are provided as accessories.
The clean bellows mounting sections are illustrated in Fig. 3.2.

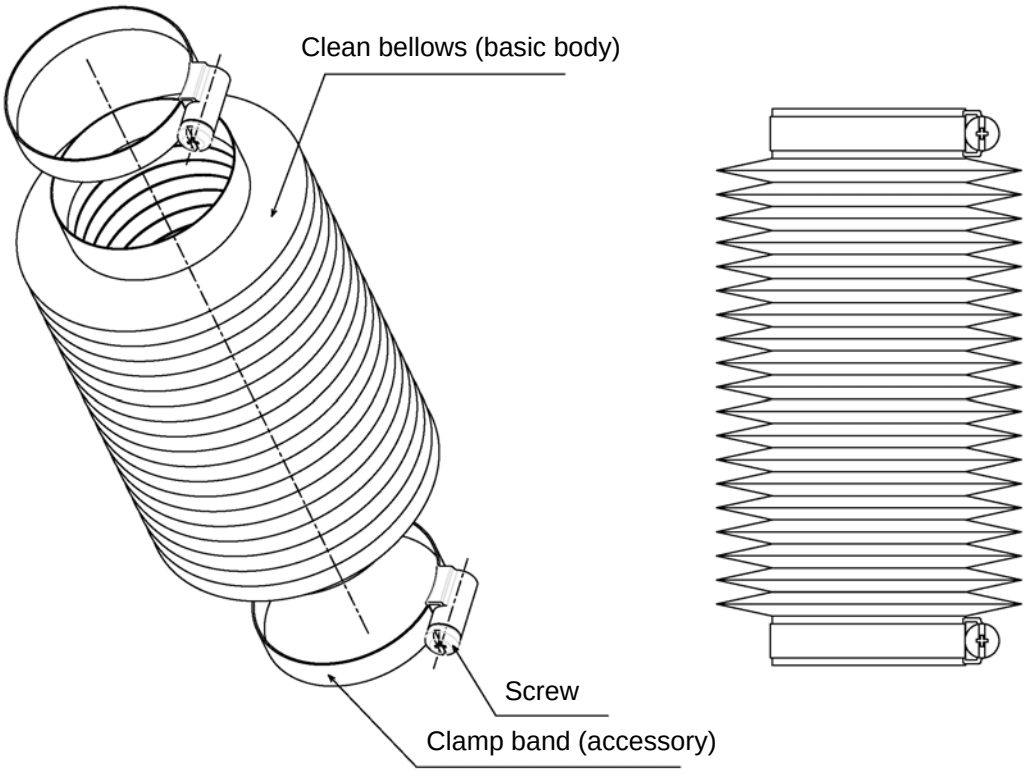


Fig. 3.1 Clean bellows

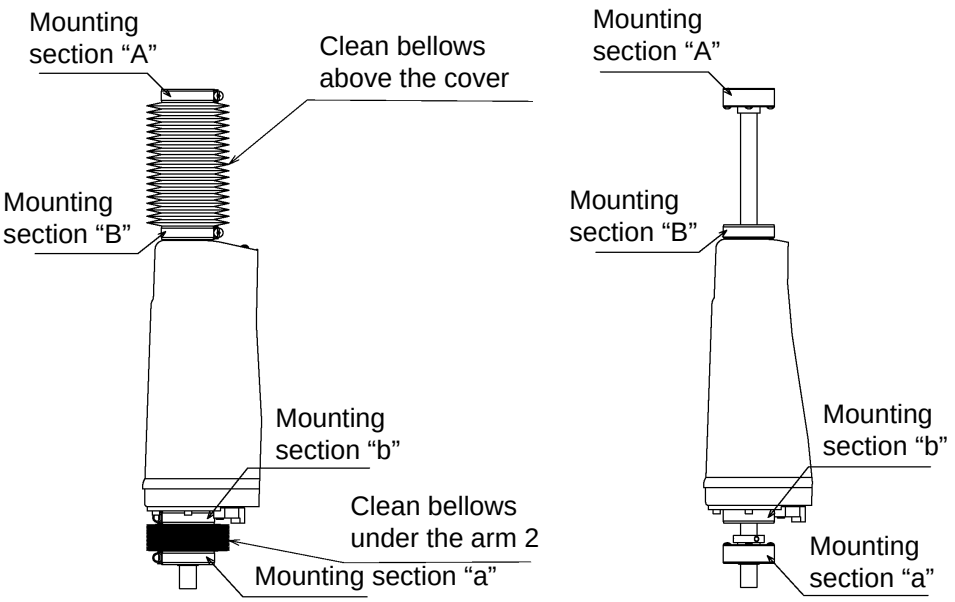


Fig. 3.2 Clean bellows mounting sections
(Left side: with clean bellows; Right side: without clean bellows)

To replace the clean bellows, follow the procedures given below.
The axis 3 should be located within the operating range.
There is no difference between the clean bellows above the cover and clean bellows under the arm 2, and the replacement procedures are the same for the both bellows.
For the name of each part of the clean bellows and clean bellows mounting sections, see Fig. 3.1 and Fig. 3.2 above.

[1] Dismount the tool flange, hand, etc.
[2] Dismount the clean bellows in the manner shown in Fig. 3.3.

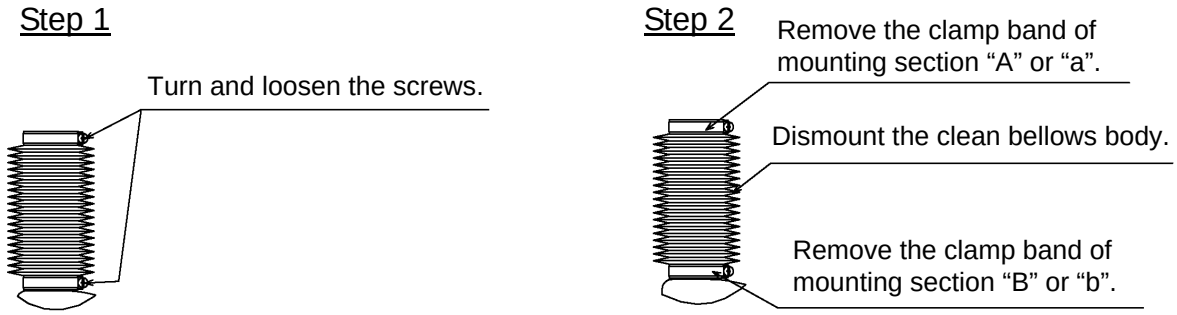
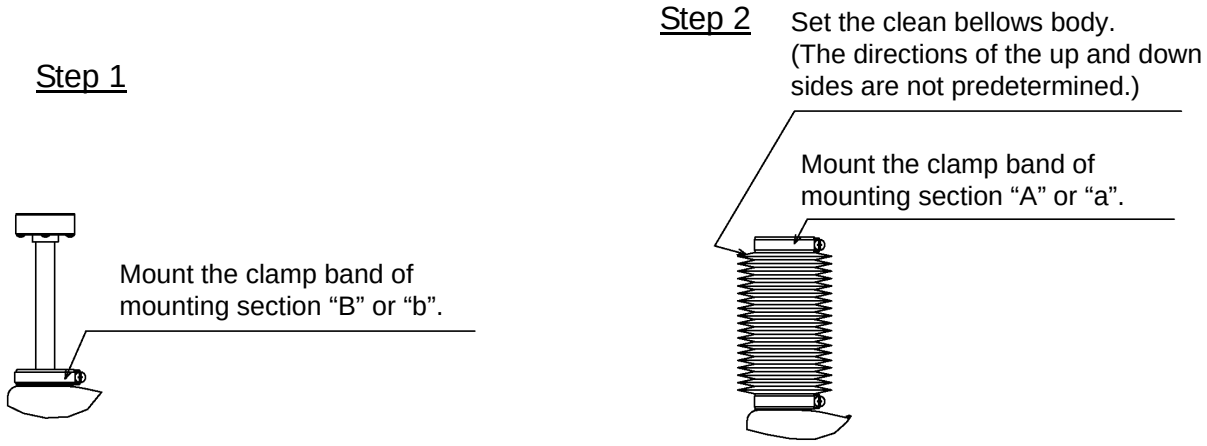


Fig. 3.3 Procedures for dismounting clean bellows

[3] Mount the clean bellows as shown in Fig. 3.4 below. Take careful precautions not to damage the clean bellows. Abnormalities such as twist and wrinkle will result in breakage of the bellows. Make sure that no such abnormalities are found in the clean bellows and that the clean bellows is in a good condition. Take utmost care that the screw will not interfere with the bellows. The clamping torque of the screw is 1.2 N·m.



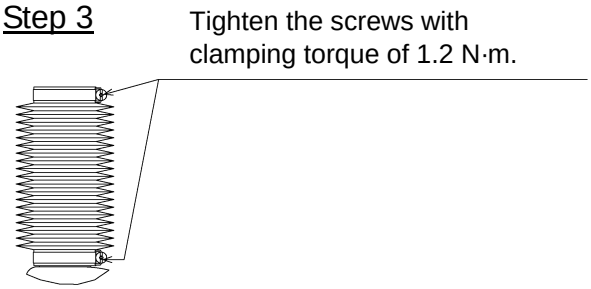


Fig. 3.4 Procedures for mounting clean bellows

[4] Move the robot within the operating range and make sure that the robot can be operated normally. During the operation, make sure that the clamp bands, etc. will not damage the clean bellows.

3.1.3 Greasing of Ball Screw Spline

Dismount the clean bellows and fill the grease to the ball screw spline.
As the clean bellows is dismantled, the cleanness level may drop temporarily. Take appropriate measures to prevent adverse affects on the entire system by drop in the cleanness level.
For dismounting and mounting the clean bellows, see Para. 3.1.2.
For the TH250A–CRB and TH350A–CRB robots, see Para. 2.3.4 of the Maintenance Manual (STE 73996) provided separately.

3.2 Replacement Parts List for Maintenance

Table 3.2 shows the replacement parts list for maintenance.
For the parts used in common with the standard robot, see the replacement parts list for the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to Appendix Table 1 of the Maintenance Manual (STE 73996) provided separately.

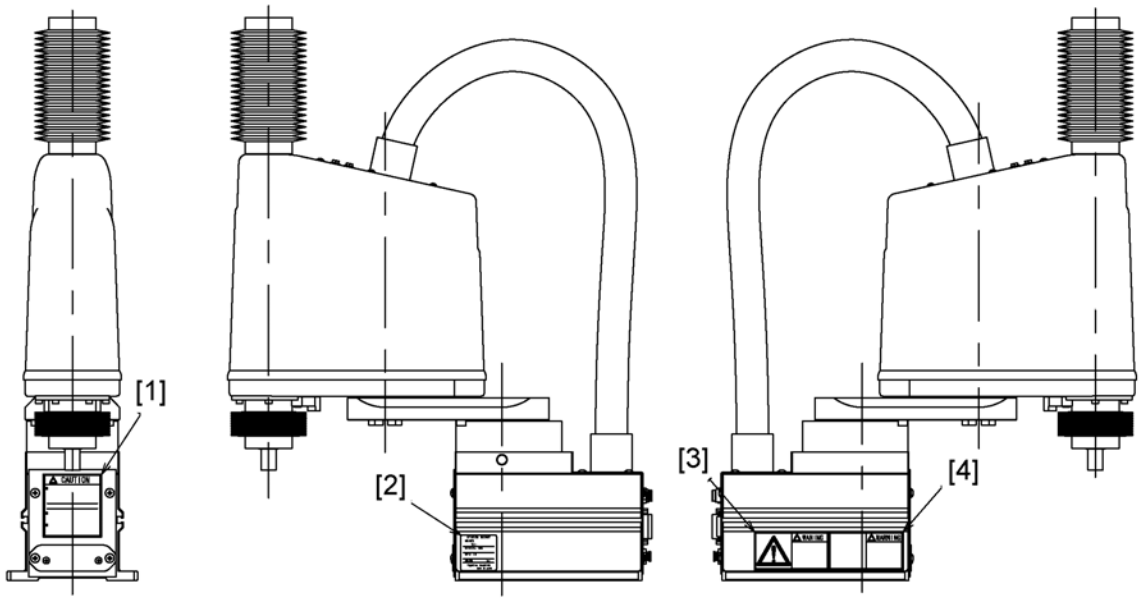
Table 3.2 Replacement parts list for maintenance

Part name	Type	Maker	Description
Clean bellows for TH250A–CRB and TH350A–CRB	M215344	Toshiba Machine	Q'ty: One (1) Accessory: Two (2) clamp bands

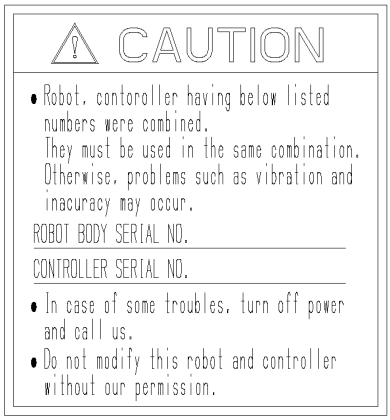
4. Safety

4.1 Locations of Caution/Warning Labels

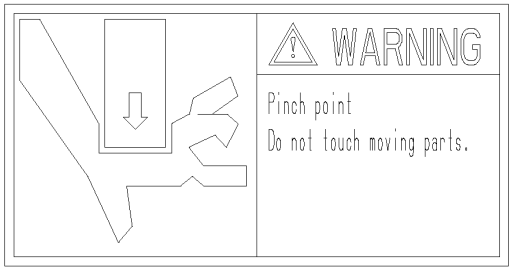
The locations of the caution and warning labels are shown in Fig. 4.1 below.



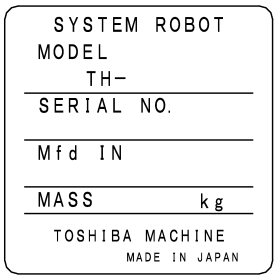
[1]



[3]



[2]



[4]

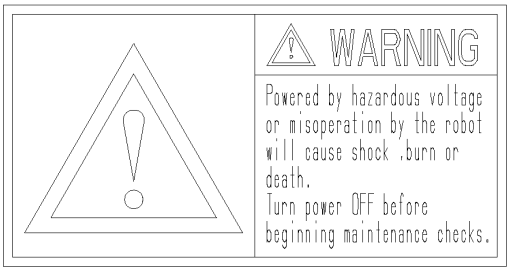


Fig. 4.1 Locations and contents of caution/warning labels ([1] ~ [4]) for TH250A–CRB/TH350A–CRB

4.2 Safety Measures

The safety measures for the clean bellows type robot are the same as those for the standard robot. For the TH250A–CRB and TH350A–CRB robots, refer to the Safety Manual (STE 73997) provided separately.
Note that the operating range of the clean bellows type robot differs from that of the standard robot. The operating range is given in Tables 4.1 and 4.2.

Table 4.1 Operating range of TH250A–CRB

	Clean bellows type	Standard type
Axis 1	±115 deg	±115 deg
Axis 2	±125 deg	±140 deg
Axis 3	100 mm	120 mm
Axis 4	±360 deg	±360 deg
Dimension “A” of Fig. 4.2	192 mm	141 mm

Table 4.2 Operating range of TH350A–CRB

	Clean bellows type	Standard type
Axis 1	±115 deg	±115 deg
Axis 2	±130 deg	±145 deg
Axis 3	100 mm	120 mm
Axis 4	±360 deg	±360 deg
Dimension “A” of Fig. 4.2	192 mm	–

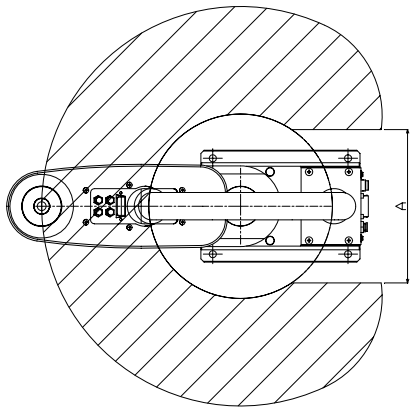


Fig. 4.2 Example of Dimension "A"

APPROVED BY: Y. Yamaguchi

CHECKED BY: K. Takeuchi

PREPARED BY: R. Amemiya