

SCARA Robots  
XE series

**R6Y – XE series**

# **MAINTENANCE MANUAL**

**OMRON**



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# Warranty

The OMRON robot and/or related product you have purchased are warranted against the defects or malfunctions as described below.

## ■ Warranty description

If a failure or breakdown occurs due to defects in materials or workmanship in the genuine parts constituting this OMRON robot and/or related product within the warranty period, then OMRON shall supply free of charge the necessary replacement/repair parts.

## ■ Warranty period

The warranty period ends 24 months after the date of manufacturing as shown on the products.

## ■ Exceptions to the warranty

This warranty will not apply in the following cases:

1. Fatigue arising due to the passage of time, natural wear and tear occurring during operation (natural fading of painted or plated surfaces, deterioration of parts subject to wear, etc.)
2. minor natural phenomena that do not affect the capabilities of the robot and/or related product (noise from computers, motors, etc.)
3. Programs, point data and other internal data were changed or created by the user. Failures resulting from the following causes are not covered by warranty.
  1. Damage due to earthquakes, storms, floods, thunderbolt, fire or any other natural or man-made disaster.
  2. Troubles caused by procedures prohibited in this manual.
  3. Modifications to the robot and/or related product not approved by OMRON or OMRON sales representative.
  4. Use of any other than genuine parts and specified grease and lubricant.
  5. Incorrect or inadequate maintenance and inspection.
  6. Repairs by other than authorized dealers.

## ■ WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NONINFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

## ■ LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE OR INAPPROPRIATE MODIFICATION OR REPAIR.



# Chapter 1 Introduction

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# 1. Introduction

The OMRON XE series robots are SCARA type industrial robots developed based on years of OMRON experience and achievements in the automation field as well as efforts to streamline our in-house manufacturing systems.

The XE series robots have a two-joint manipulator consisting of an X-axis arm and a Y-axis arm, and are further equipped with a vertical axis (Z-axis) and a rotating axis (R-axis) at the tip of the manipulator. The XE series robots can be used for a wide range of assembly applications such as installation and insertion of various parts, application of sealant, and packing operations.

## 1.1 Available manuals

The following manuals can be download from the OMRON website:



### **Safety instructions**

Describes safe and correct operating method for controller and robot.



### **Installation manual**

Describes how to install and connect the robot.



### **Maintenance manual (this manual)**

Describes the maintenance procedures for the robot.

This user's manual describes the safety measures, handling, adjustment and maintenance of XE series robots for correct, safe and effective use. Be sure to read this manual carefully before installing the robot.

For details about actual robot operation and programming, refer to the "OMRON Robot Controller User's Manual".



### **WARNING**

The adjustment and maintenance work with the cover removed needs the special knowledge and skill. If unskilled work person performs such work, this may involve risk. Read "2. Qualification of operators/workers" in section 4.1 of the Safety Instructions and allow only qualified engineers to perform this work while referring to the separate Maintenance Manual.

- Place a conspicuous sign indicating the robot is being adjusted, to prevent others from touching the controller switch, programming box (PBEX) or operation panel.
- If a safety enclosure has not yet been provided right after installation of the robot, rope off or chain off the movement range around the manipulator in place of a safety enclosure, and observe the following points.
  1. Use stable posts which will not fall over easily.
  2. The rope or chain should be easily visible by everyone around the robot.
  3. Place a conspicuous sign prohibiting the operator or other personnel from entering the movement range of the manipulator.
- To check the operation after setting, refer to "4.6.1 Trial run" in the chapter "Safety precautions" in the separate Safety Manual.



### **CAUTION**

Use only the lubricants specified by your distributor.

"Harmonic" and "Harmonic drive" are the registered trademarks of Harmonic Drive Systems Inc.

## 1.2 Signal symbols

The following safety alert symbols and signal words are used to provide safety instructions that must be observed and to describe handling precautions, prohibited actions, and compulsory actions. Make sure to understand the meaning of each symbol and signal word and then read this manual.

**DANGER**

This indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

This indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or damage to the equipment.

**NOTE**

This indicates a supplementary explanation in the operation.



## 2. Before using the robot (Be sure to read the following notes.)

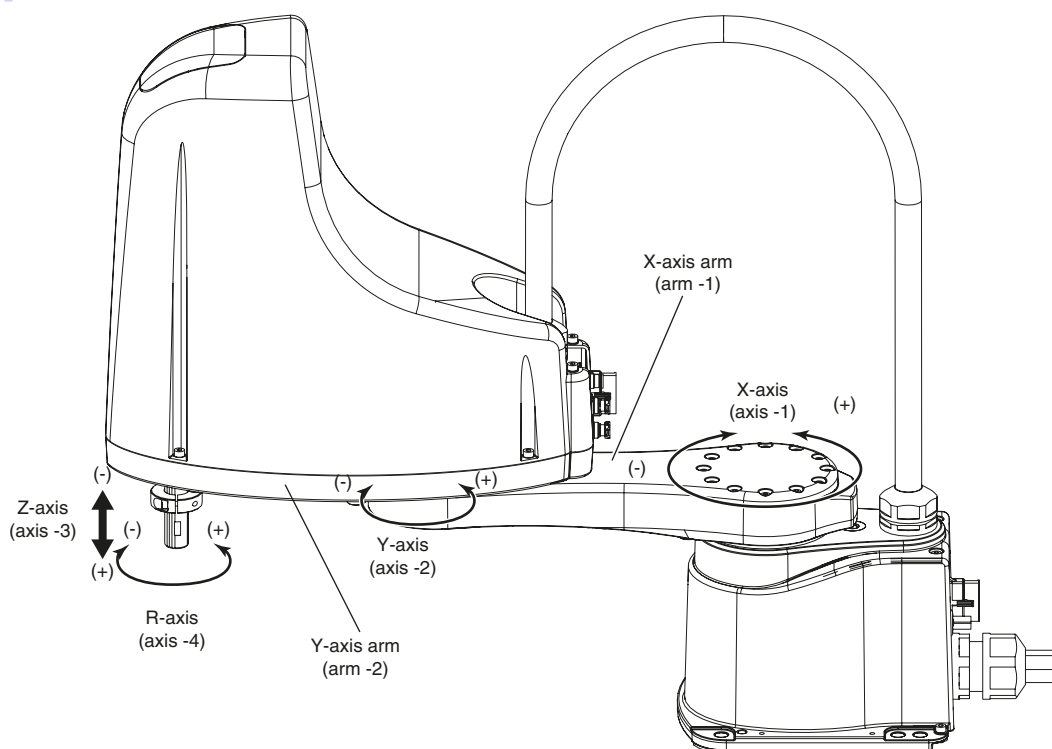
At this time, our thanks for your purchase of this OMRON XE series SCARA robot.



### NOTE

In the YRCX controller, axis names are called using numeric values, like axis-1, axis-2, axis-3, and so on. In this manual, axis names are called using alphabetic characters, like X-axis, Y-axis, Z-axis, and so on. So, read this manual while referring to the robot external view and axis name correspondence table shown below.

### External view of robot and axis name correspondence table



23002-FV-00

YRCX controller axis name	Axis name in this manual
Axis 1	X-axis
Axis 2	Y-axis
Axis 3	Z-axis
Axis 4	R-axis



## Chapter 2

# Attaching, detaching, and replacing the cover

## Contents

Attaching, detaching, and replacing the cover

2-1



# 1. Attaching, detaching, and replacing the cover

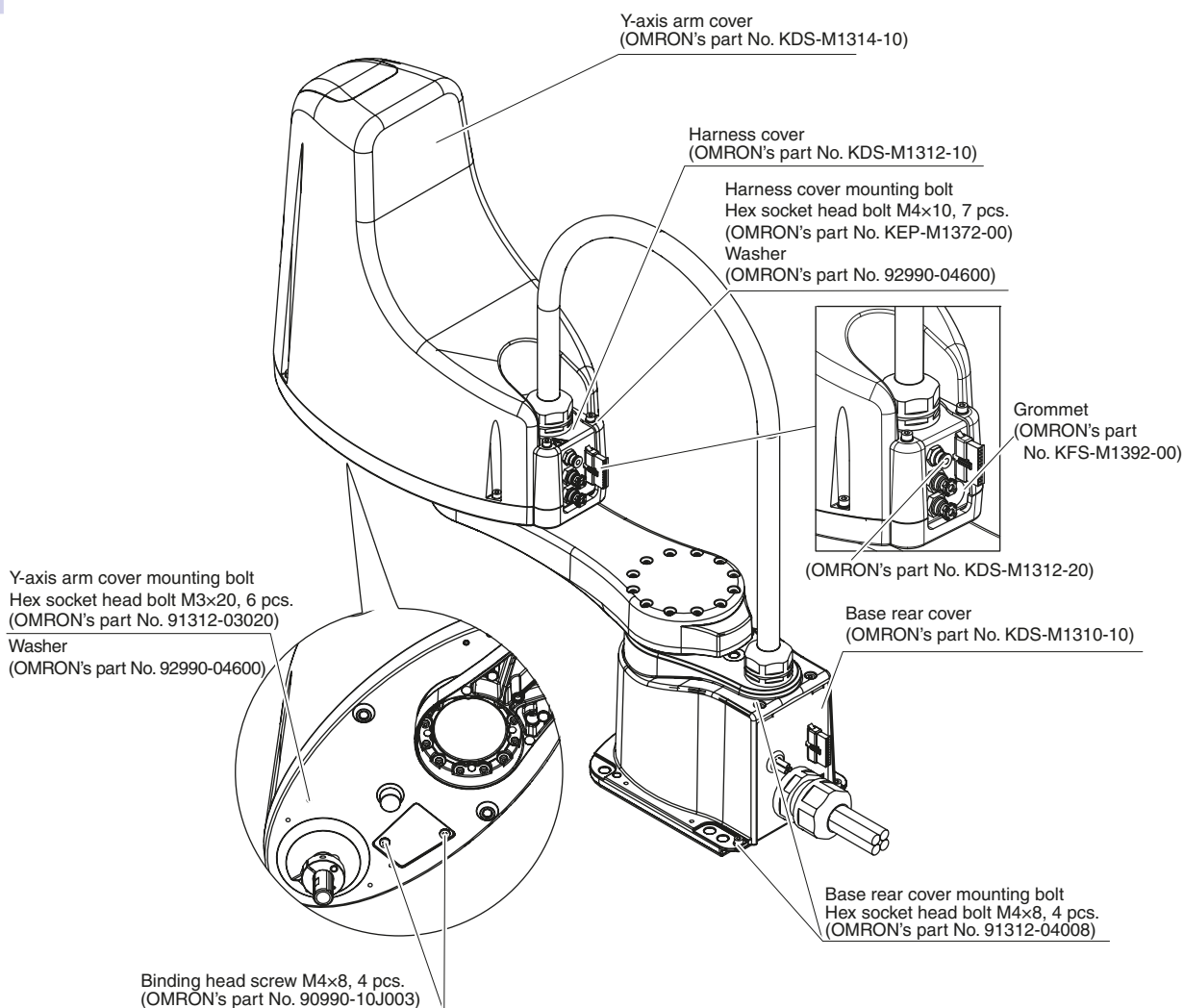
To attach, detach, or replace the covers, remove the bolts and screws shown in the Fig. below.



## WARNING

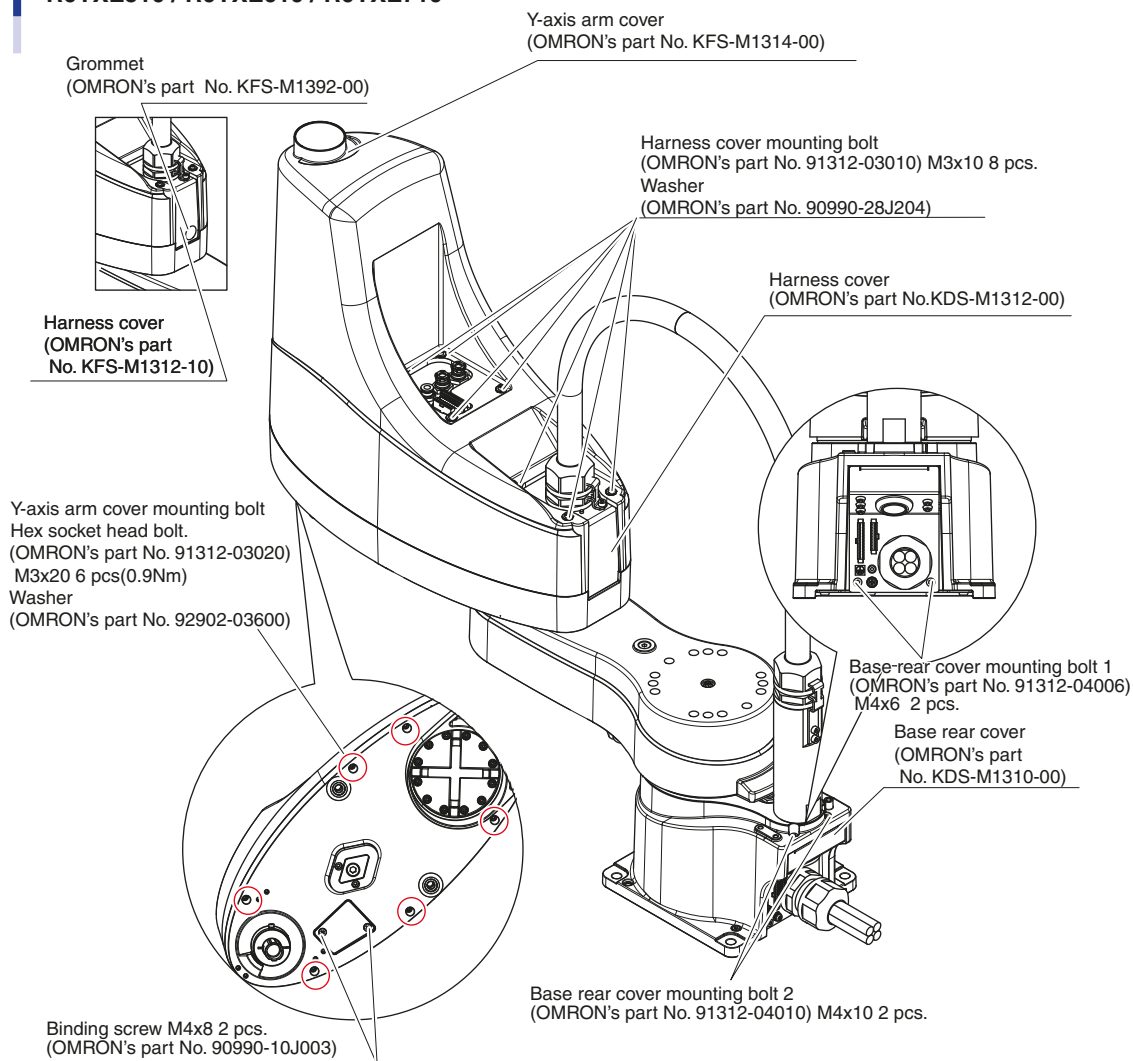
- When the covers have been removed for the maintenance work, be sure to return the covers to their original positions using the screws and bolts that have secured them.
- If any screw or bolt is lost, be sure to secure the covers with the specified number of specified screws and bolts while referring to the Fig. below.
- If the covers are not secured firmly, noise may occur, the cover may drop and fly out, your hand may be entangled in the drive unit during teaching, or your hand may be in contact the hot drive unit, causing burn. To prevent such troubles, strictly observe this caution.

## R6YXE400



23217-FV-00

## R6YXE510 / R6YXE610 / R6YXE710



23218-FV-00

## Chapter 3 Periodic inspection

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# 1. Overview

Daily and periodic inspection of the OMRON robot is essential in order to ensure safe and efficient operation. This chapter describes the periodic inspection items and procedures for the OMRON XE series robots.

Periodic inspection includes:

- Daily inspection
- 6-month inspection

Make sure that you thoroughly understand details of the inspection and follow the procedures and precautions explained in this chapter.



## WARNING

The adjustment and maintenance with the cover removed require special skill and technique. If an unskilled person performs such work, this may cause a hazard. Read "2. Qualification of operators/workers" in section 4.1 of the Safety Instructions and allow only qualified engineers to perform the adjustment and maintenance work while referring to this instruction manual.



## WARNING

- When you need to touch the terminals or connectors on the outside of the controller during inspection, always first turn off the controller power switch and also the power source in order to prevent possible electrical shock.
- Never touch any internal parts of the controller.



## WARNING

- When inspection is required inside the safety enclosure, always turn off the controller and also the external switch board.
- If the inspection or maintenance procedure calls for operation of the robot, stay outside the safety enclosure.
- Place a sign indicating the robot is being inspected, to keep others from operating the controller switch, programming box or operation panel.
- For details regarding the operation check which is performed after the inspection, refer to section "4.6.1 Test Operation" of these Safety Instructions.



## CAUTION

Use only the lubricants specified by your distributors.



## NOTE

For precautions on handling the controller, refer to the "OMRON Robot Controller User's Manual".

## 2. Daily inspection

The following is an inspection list that must be performed every day before and after operating the robot.

### ■ Inspection to be performed with the controller turned off

#### **Step1** Turn off the controller.

#### **Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being inspected, to keep others from operating the controller switch.

#### **Step3** Perform the daily inspection.

Enter the safety enclosure and check the following points.

Checkpoint	Procedure
Robot cable User cable and wiring	Check for scratches, dents and excessive bend and kinks. (If the machine harness or robot cable is damaged, contact your distributor.)
Regulator, joints, air tube, solenoid valve, air cylinder	Check air pressure. Check for air leaks. Check drain. Check air filter for clogging or damage.
Robot exterior	Check for damage. (If a damage is found, contact your distributor.)
Wires and tubes (Optional user wiring/ tubing through spline type)	Check for damage to the wiring that runs through the robot.
Wires, tubes and cap (Optional user wiring/tubing through cap type)	Check for wear on cap. Check for sufficient silicon grease Check that the through-hole wiring moves smoothly.

### ■ Inspection to be performed with the controller turned on

#### **Step1** Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

#### **Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being inspected, to keep others from operating the controller, programming box or operation panel.

#### **Step3** Perform the daily inspection.

Check the following points from outside the safety enclosure.

Checkpoint	Procedure
Safety enclosure	Check if the safety enclosure is in place. Check if emergency stop is triggered when the door is opened. Check if warning labels are affixed at the entrance and clearly visible.
Emergency stop device	Press the emergency stop button to check if it works.
Robot movement	Check for abnormal movement and excessive vibration and noise. (If any abnormal symptom is found, contact your distributor.)
Z-axis brake operation (*1)	Check if the brake works to stop the Z-axis from dropping more than 3mm from the stationary point. (If any abnormal operation is found, contact your distributor.)
Functional check of Brake release switch (optional to XE) and Brake release switch of programming box (*2)	Check that the Z-axis moves when pressing the switch and does not move when releasing the switch.

\*1 Visually check the Z-axis movement when you press the emergency stop button from outside the safety enclosure and also when you turn off the controller.

\*2 To perform the functional check, make an emergency stop beforehand and follow the WARNING for brake release.

## ■ Adjustment and parts replacement



### CAUTION

- After inspection, if you notice any adjustment or parts replacement is needed, first turn off the controller and then enter the safety enclosure to perform the necessary work. To perform the inspection after the adjustment and parts replacement work, follow the steps stated in ■ Inspection to be performed with the controller turned off and ■ Inspection to be performed with the controller turned on described above.
- If repair or parts replacement is required for the robot or controller, please contact your distributor. This work requires specialized technical knowledge and skill, so do not attempt it by yourself.

## 3. Six-month inspection

Take the following precautions when performing 6-month inspection.



### WARNING

The Z-axis will slide down when the Z-axis brake is released, causing a hazardous situation. Do not release the brake when lubricating the Z-axis parts.

When lubricating the ball screw and spline shaft, observe the following precautions.



### WARNING

Precautions when handling grease:

- Inflammation may occur if this gets in the eyes.  
Before handling the grease, wear your safety goggles to ensure the grease will not come in contact with the eyes.
- Inflammation may occur if the grease comes into contact with skin. Be sure to wear protective gloves to prevent contact with skin.
- Do not take orally or eat. (Eating will cause diarrhea and vomiting.)
- Hands and fingers might be cut when opening the container, so use protective gloves.
- Keep out of the reach of children.
- Do not heat the grease or place near an open flame since this could lead to sparks and fires.

Emergency Treatment:

- If this grease gets in the eyes, wash liberally with pure water for about 15 minutes and consult a physician for treatment.
- If this grease comes in contact with the skin, wash away completely with soap and water.
- If taken internally, do not induce vomiting but promptly consult a physician for treatment.

Disposing of grease and the container:

- Proper disposal is compulsory under federal, state and local regulations. Take appropriate measures in compliance with legal regulations.
- Do not pressurize the empty container. Pressurizing may cause the container to rupture.
- Do not attempt to weld, heat up, drill holes or cut this container. This might cause the container to explode and the remaining materials inside it to ignite.



### CAUTION

Unless grease specified by OMRON is used, the service life of the ball screw and ball spline will shorten.

■ Inspection to be performed with the controller turned off

**Step1** *Turn off the controller.*

**Step2** *Place a sign indicating the robot is being adjusted.*

*Place a sign showing that the robot is being inspected, to keep others from operating the controller switch.*

**Step3** *Perform the daily inspection.*

*Enter the safety enclosure and check the following points.*

Checkpoint	Procedure
Manipulator bolts and screws (Only for major bolts and screws exposed externally)	Check for looseness and tighten if necessary. (See the Table below.)
Detection areas of the origin sensors of the X-axis, Y-axis, and R-axis	Clean if it is dirty.
Controller	Check for looseness at each terminal and connector on the panel. (See "4. Robot cable connection" in Chapter 2 of the Installation Manual.)
Application of grease to Z-axis ball screw and spline	See "4. Applying the grease" in this Chapter.
Z-axis ball spline, ball screw	Check for backlash. (If any abnormality is found, contact your distributor.)
Z-axis, R-axis timing belt	Check the timing belt tension. (See "1.1 Replacing the Z-axis motor" and "1.2 Replacing the Z-axis belt" in Chapter 8 and "1.1 Replacing the R-axis motor" and "1.2 Replacing the R-axis belt" in Chapter 9.)

**Bolt tightening torque**

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 set screw	7	0.69
M4 set screw	17	1.7
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37.0
M10	459	45.0

## ■ Inspection to be performed with the controller turned on



### WARNING

- The robot controller must be installed outside the safety enclosure, to prevent a hazardous situation in which you or anyone enter the safety enclosure to inspect the controller while it is turned on.
- Bodily injury may occur from coming into contact with the fan while it is rotating.
- When removing the fan cover for inspection, first turn off the controller and make sure the fan has stopped.

### Step1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being inspected, to keep others from operating the controller, programming box or operation panel.

### Step3 Perform the daily inspection.

Check the following points from outside the safety enclosure.

Checkpoint	Procedure
Cooling fan of controller	<ul style="list-style-type: none"> <li>• Check if the fan rotates normally.</li> <li>• Check if objects blocking the fan are located and remove if any are found.</li> <li>• Check for abnormal noise from the rotating fan. If abnormal noise is heard, visually check and remove the cause. If no cause is found, contact your distributor.</li> <li>• Check the fan cover for contamination. If contaminated, replace the fan filter. (Refer to the User's Manual for OMRON Robot Controller.)</li> </ul>

## ■ Adjustment and parts replacement



### CAUTION

- After inspection, if you notice any adjustment or parts replacement is needed, first turn off the controller and then enter the safety enclosure to perform the necessary work. o perform the inspection after the adjustment and parts replacement work, follow the steps stated in “■ Inspection to be performed with the controller turned off” and “■ Inspection to be performed with the controller turned on” described above.
- If repair or parts replacement is required for the robot or controller, please contact your distributor. This work requires specialized technical knowledge and skill, so do not attempt it by yourself.

## 4. Applying the grease

### ■ Applying the grease

Name	Manufacturer	Part No.	Remarks
L100	THK. Co., Ltd.	KDS-M7122-00	

### 4.1 Applying the grease to the spline shaft

Follow the steps below to apply the grease to the spline shaft.

**Step1** *Turn off the controller power.*

**Step2** *Place a sign indicating the robot is being adjusted.*

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

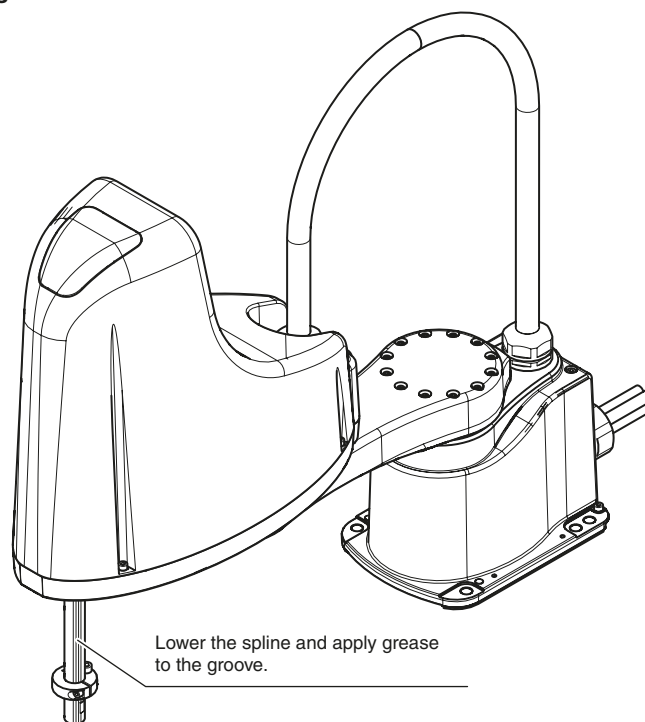
**Step3** *Enter the safety enclosure.*

**Step4** *Remove the old grease with a cloth rag.*

**Step5** *Apply the grease.*

Apply the grease to the spline shaft of the Z-axis. (See also the Fig. below.)

#### Applying the grease



53301-FV-00

## 4.2 Applying the grease to the ball screw

Follow the steps below to apply the grease to the ball screw.



### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

**Step1** Turn off the controller power.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

**Step4** Remove the Y-axis arm cover.

Remove the cover while referring to "1. Detaching or attaching the covers" in Chapter 2.

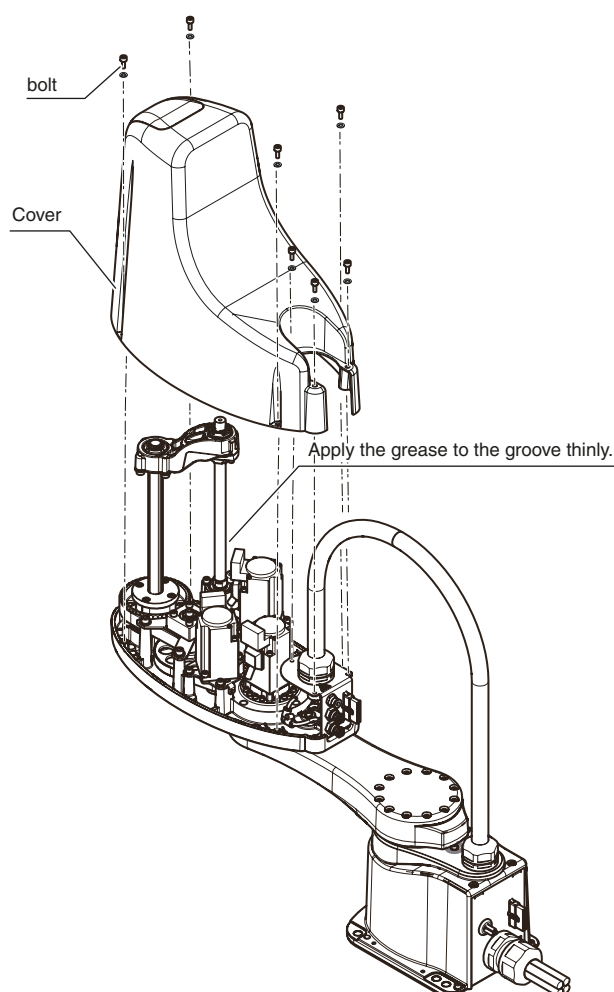
**Step5** Remove the old grease with a cloth rag.

**Step6** Apply the grease.

Apply the grease to the ball screw. (See the Fig. below.)

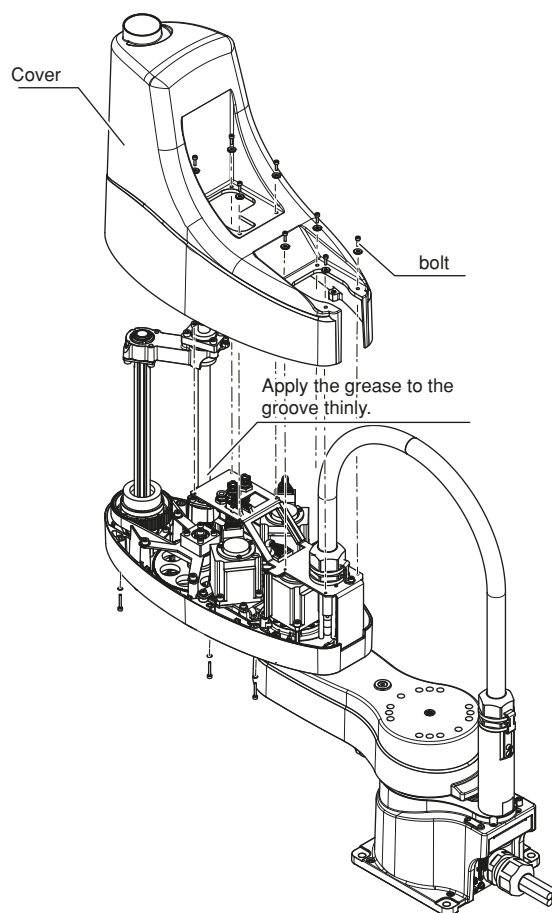
**R6YXE400**

Applying the grease



53302-FV-00

## Applying the grease



53312-FV-00



## Chapter 4

# Adjusting the origin

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# 1. Adjusting the machine reference value

The X- and Y-axis origin positions of the XE series are fixed and cannot be changed. Additionally, the machine reference value was correctly adjusted at shipment. The readjustment is not needed during normal operation. However, if the machine reference value exceeds the return-to-origin tolerance range for some reason, follow the steps below to readjust the machine reference value.



## WARNING

Before starting the work, thoroughly read "1. Detaching or attaching the covers" in Chapter 2.



## CAUTION

If any machine reference is adjusted, the origin position may change. Before the adjustment, mark off the reference mark at the current origin position on the main body of the robot. After the machine reference is adjusted, be sure to check that the origin position has not deviated. If the origin position changes after the machine reference has been adjusted, then the standard coordinate and point data must be reset.

## 1.1 Stroke end method

The machine reference value was adjusted correctly at shipment. So, the readjustment is not needed during normal operation. However, if the machine reference value exceeds the return-to-origin tolerance range (25 to 75%) for some reason, follow the steps below to readjust the machine reference value.



## CAUTION

The origin position may change due to machine reference adjustment. If it occurs, you must set point data again.

### Step1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

### Step3 Perform the return-to-origin.



## NOTE

For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in Chapter 3 of the Installation Manual.

### Step4 Record the machine reference value.

### Step5 Turn off the controller.

The motor brake is now working at the origin position.

### Step6 Enter the safety enclosure.

## 1.1.1 Changing the X-axis reference value **R6YXE400**

### **Step7** Loosen the bolts that secure the speed reduction gear.

At this time, it is enough to loosen the bolts. Do not pull out the bolts.

A rattle is produced. Utilize this rattle to turn the arm.

To increase the reference value, turn the X-axis arm clockwise when viewed from the top of the robot. Conversely, to decrease the reference value, turn the X-axis arm counterclockwise when viewed from the top of the robot.

### **Step8** Secure the speed reduction gear temporarily.

Tighten the bolts while applying an appropriate torque so that the speed reduction gear and arm do not deviate.

### **Step9** Remove the temporarily secured bolts, and then secure the speed reduction gear temporarily with new bolts.

Replace the bolts one-by-one and take great care so that the speed reduction gear and arm do not deviate.

Bolt M3 x 35, (OMRON's part No.: 91312-03035) 12 pcs.

### **Step10** Secure the speed reduction gear.

Secure the speed reduction gear while referring to "2.1 Replacing the X-axis harmonic drive" in Chapter 5.

## 1.1.2 Changing the Y-axis reference value **R6YXE400**

### **Step7** Loosen the bolts that secure the speed reduction gear.

At this time, it is enough to loosen the bolts. Do not pull out the bolts.

A rattle is produced. Utilize this rattle to turn the arm.

To increase the reference value, turn the Y-axis arm counterclockwise when viewed from the top of the robot. Conversely, to decrease the reference value, turn the Y-axis arm clockwise when viewed from the top of the robot.

### **Step8** Secure the speed reduction gear temporarily.

Tighten the bolts while applying an appropriate torque so that the speed reduction gear and arm do not deviate.

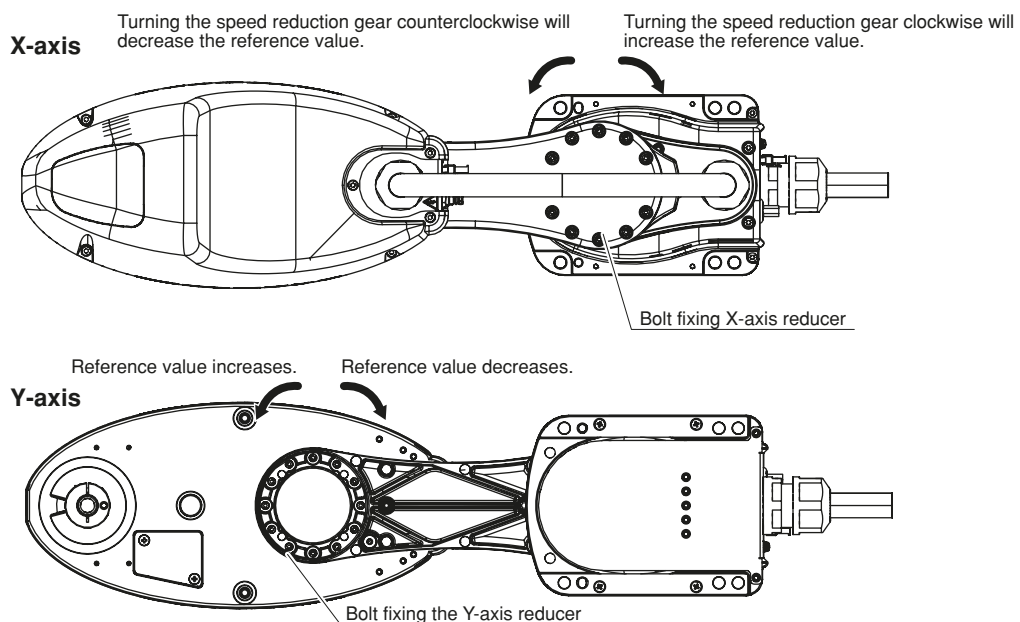
### **Step9** Remove the temporarily secured bolts, and then secure the speed reduction gear temporarily with new bolts.

Replace the bolts one-by-one and take great care so that the speed reduction gear and arm do not deviate.

### **Step10** Secure the speed reduction gear.

Secure the speed reduction gear while referring to "2.2 Replacing the Y-axis harmonic drive" in Chapter 5.

#### **Step 7** Changing the reference value



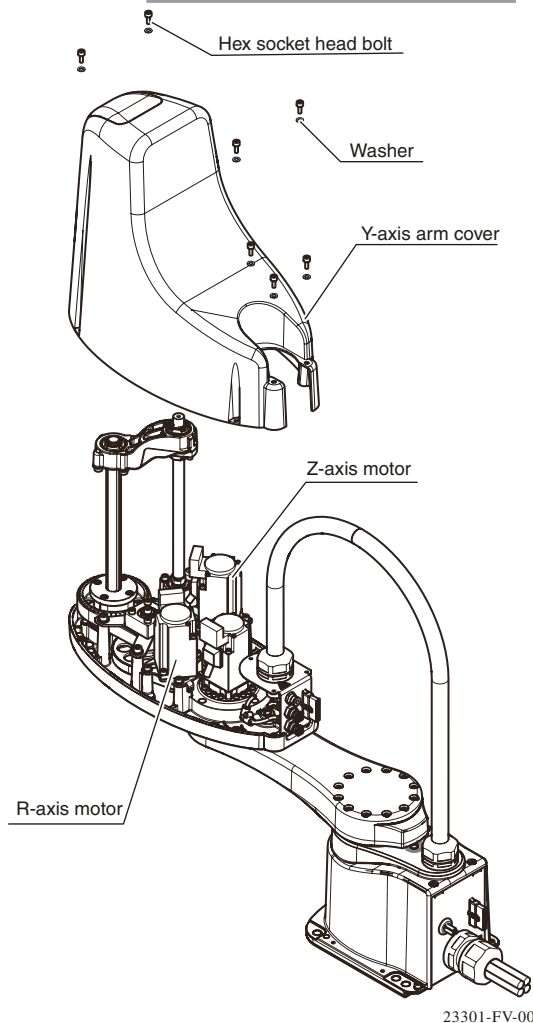
## 1.1.3 Changing the Z-axis and R-axis reference values

### Step7 Remove the cover.

Remove the cover while referring to "12. Detaching or attaching the covers" in Chapter 2.

R6YXE400

#### ► Step 7 Removing the cover

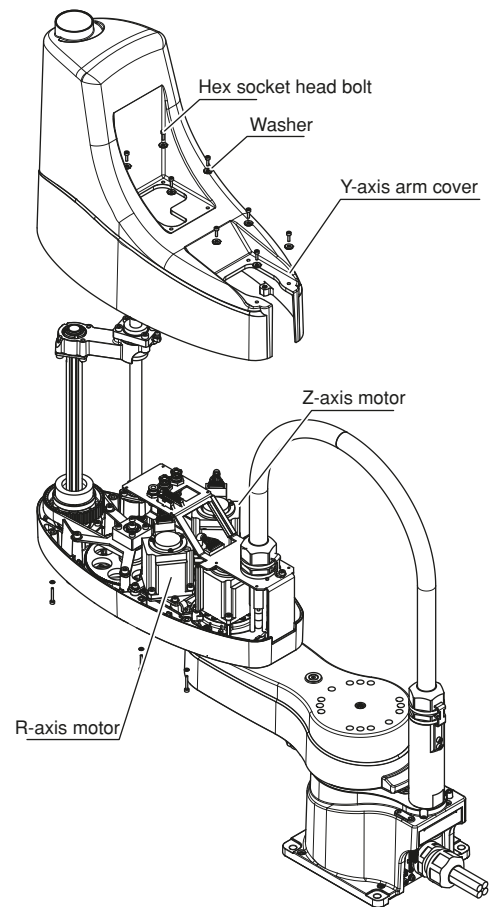


R6YXE510

R6YXE610

R6YXE710

#### ► Step 7 Removing the cover



#### WARNING

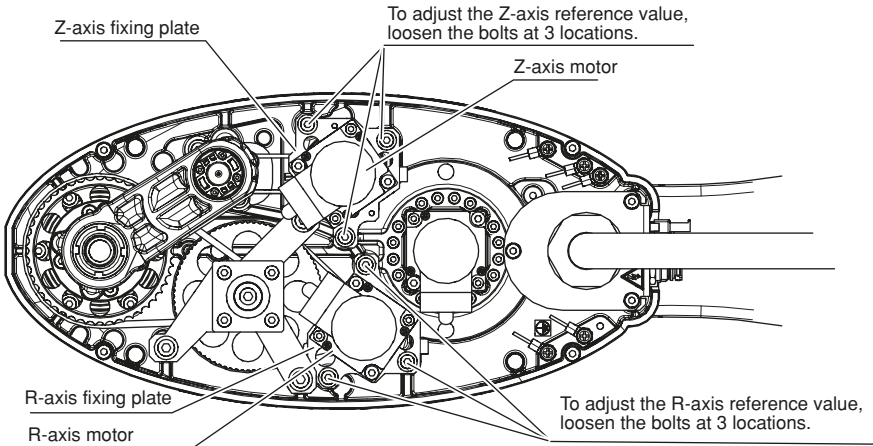
If the pulley comes off from the belt, the Z-axis may drop. Be sure to prop the Z-axis with a support stand. Be careful not to drop the Z-axis and entangle the belt during adjustment.

### Step8 Prop the spline or end effector with a support stand to prevent from dropping.

**Step9** Loosen the bolts that secure the motor installation plate.

R6YXE400

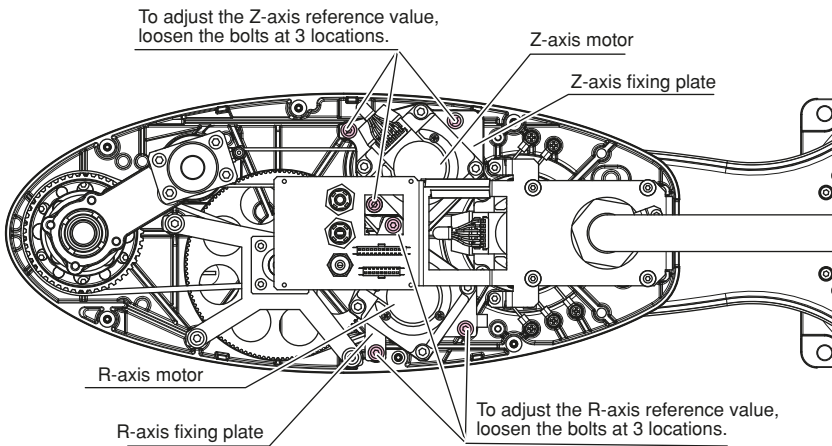
**Step 9** Removing the plate



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R6YXE510 R6YXE610 R6YXE710

**Step 9** Removing the plate



53401-FV-00

**Step10** Shift the engagement between the motor pulley and belt tooth.

Shifting the belt engagement one tooth will change the machine reference value approximately 25%. When shifting the pulley clockwise with the belt teeth left as they are, the reference value will increase. Conversely, when shifting the pulley counterclockwise, the reference value will decrease. Shift the engagement between the pulley and belt so that the Z-axis machine reference value enters a range of 25 to 75% when compared to that confirmed in Step 4.

**Step11** Tighten the plate mounting bolts.

At this time, tighten the bolts while applying an appropriate tension to the belt. The appropriate tension can be checked as the vibration frequency is measured when the belt is stretched. (Appropriate frequency: 50 to 53 Hz)

	R6YXE400	R6YXE510, R6YXE610, R6YXE710
Z-axis belt tension (Appropriate frequency)	259 to 333Hz	150 to 173Hz
R-axis belt tension (Appropriate frequency)	308 to 398Hz	286 to 366Hz

**Step12** *Go out of the safety enclosure.*

**Step13** *Turn on the controller.*

*Check that no one is inside the safety enclosure, and then turn on the controller.*

**Step14** *Perform the return-to-origin of the Z-axis.*



NOTE

For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.

**Step15** *Check the Z-axis machine reference value.*

*After the return-to-origin has been completed, check that the machine reference value is within the return-to-origin tolerance range (25 to 75%).*

*If the adjustment machine reference value is outside the tolerance range (25 to 75%), then repeat the procedure from step 9 again to readjust it.*

**Step16** *Turn off the controller.*

**Step17** *Enter the safety enclosure.*

**Step18** *Reattach the cover.*

## 1.2 Sensor method (X-axis, Y-axis)

### 1.2.1 Adjusting the X-axis machine reference



#### CAUTION

- The origin position may change due to machine reference adjustment. If it occurs, you must set point data again.
- When the return-to-origin direction is reversed, the origin position may not be the base front. When using the standard soft limit, the axis may collide with the mechanical stopper. At this time, set the soft limit 2° or more inward from the mechanical stopper while referring to "3. Setting the soft limits".

Follow the steps below to adjust the X-axis machine reference value.  
Prepare a wrench for a width across flat of 13 mm.

#### **Step1** Turn on the controller.

*Check that no one is inside the safety enclosure, and then turn on the controller.*

#### **Step2** Perform the return-to-origin.

*Perform the return-to-origin from outside the safety enclosure.*

*For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.*

#### **Step3** Check the machine reference value.

*If the machine reference value displayed on the PBEX is not in the range between 25 and 75 (recommended range) after the return-to-origin has been completed, follow the steps below to adjust the machine reference value.*

#### **Step4** Place a sign indicating the robot is being adjusted.

*Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.*

#### **Step5** Turn off the controller.

#### **Step6** Enter the safety enclosure.

#### **Step7** Put a mark at the origin position.

*Scribe a mark at the current origin position on the X-axis joint area of the robot.*

*At this time, be careful to prevent the origin position from deviating since the X-axis arm is touched.*



**Step8 Loosen the hex nut.**

Using the wrench, loosen the hex nut that secures the X-axis origin sensor.

23307-FV-00

**CAUTION**

It is enough to loosen the nut. Do not remove the nut completely.

**Step9 Move the X-axis origin sensor.**

Move the X-axis origin sensor as follows. Determine the distance between the sensor and dog to 0.2 to 0.8 mm so that the sensor does not collide with the dog.

To decrease the X-axis machine reference value, move the sensor away from the dog.

To increase the X-axis machine reference value, put the sensor close the dog.

**Step10 Secure the X-axis origin sensor with the hex nut.**

Secure the X-axis origin sensor with the hex nut.

<b>Tightening torque</b>	5Nm (50kgfcm)
<b>Tool</b>	KANON (Nakamura Mfg. Co., Ltd.)
<b>Torque wrench</b>	N190SPK 13

**Step11 Turn on the controller.**

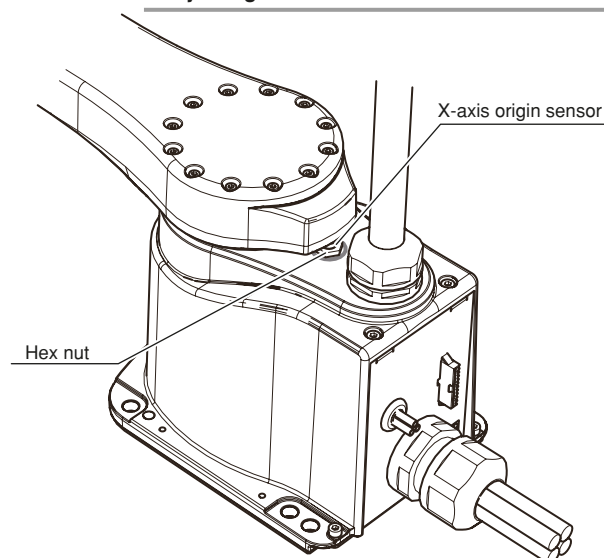
Check that no one is inside the safety enclosure, and then turn on the controller.

**Step12 Perform the return-to-origin.**

Perform the return-to-origin from outside the safety enclosure.

**Step13 Check the machine reference value.**

1. After the return-to-origin has been completed, read the machine reference value displayed on the PBEX.
2. If the machine reference value is in the range between 25 and 75 (recommended range), the adjustment of the machine reference value is then completed.
3. If it is outside the recommended range, then repeat the procedure from step 9 again to readjust it.

**Step14 Turn off the controller.****Step15 Enter the safety enclosure.****Step 8-10 Adjusting the X-axis machine reference value**

## 1.2.2 Adjusting the Y-axis machine reference



### CAUTION

The origin position may change due to machine reference adjustment. If it occurs, you must set point data again.

Follow the steps below to adjust the Y-axis machine reference value.  
Prepare a wrench for a width across flat of 13 mm.

#### **Step1** *Turn on the controller.*

*Check that no one is inside the safety enclosure, and then turn on the controller.*

#### **Step2** *Perform the return-to-origin.*

*Perform the return-to-origin from outside the safety enclosure.*

*For details about how to perform the return-to-origin, refer to "2.3 Return-to-origin procedures" in this Chapter.*

#### **Step3** *Check the machine reference value.*

*If the machine reference value displayed on the PBEX is not in the range between 25 and 75 (recommended range) after the return-to-origin has been completed, follow the steps below to adjust the machine reference value.*

#### **Step4** *Place a sign indicating the robot is being adjusted.*

*Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.*

#### **Step5** *Turn off the controller.*

#### **Step6** *Enter the safety enclosure.*

#### **Step7** *Put a mark at the origin position.*

*Scribe a mark at the current origin position on the Y-axis joint area of the robot.*

*At this time, be careful to prevent the origin position from deviating since the Y-axis arm is touched.*

**Step8 Loosen the hex nut.**

Using the wrench, loosen the hex nut that secures the Y-axis origin sensor.

23308-FV-00

**CAUTION**

It is enough to loosen the nut. Do not remove the nut completely.

**Step9 Move the Y-axis origin sensor as follows.**

Move the Y-axis origin sensor as follows. Determine the distance between the sensor and dog to 0.2 to 0.8mm.

To decrease the Y-axis machine reference value, move the sensor away from the dog.

To increase the Y-axis machine reference value, put the sensor close the dog.

**CAUTION**

Pay special attention so that the sensor does not collide with the dog.

**Step10 Secure the Y-axis origin sensor with the hex nut.**

Secure the Y-axis origin sensor with the hex nut.

Tightening torque	5Nm (50kgfcm)
Tool	KANON (Nakamura Mfg. Co., Ltd.)
Torque wrench	N190SPK 13

**Step11 Turn on the controller.**

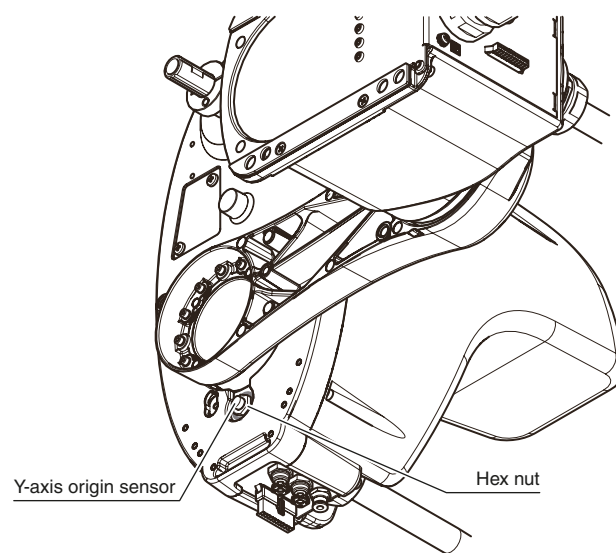
Check that no one is inside the safety enclosure, and then turn on the controller.

**Step12 Perform the return-to-origin.**

Perform the return-to-origin from outside the safety enclosure.

**Step13 Check the machine reference value.**

1. After the return-to-origin has been completed, read the machine reference value displayed on the PBEX.
2. If the machine reference value is in the range between 25 and 75 (recommended range), the adjustment of the machine reference value is then completed.
3. If it is outside the recommended range, then repeat the procedure from step 9 again to readjust it.

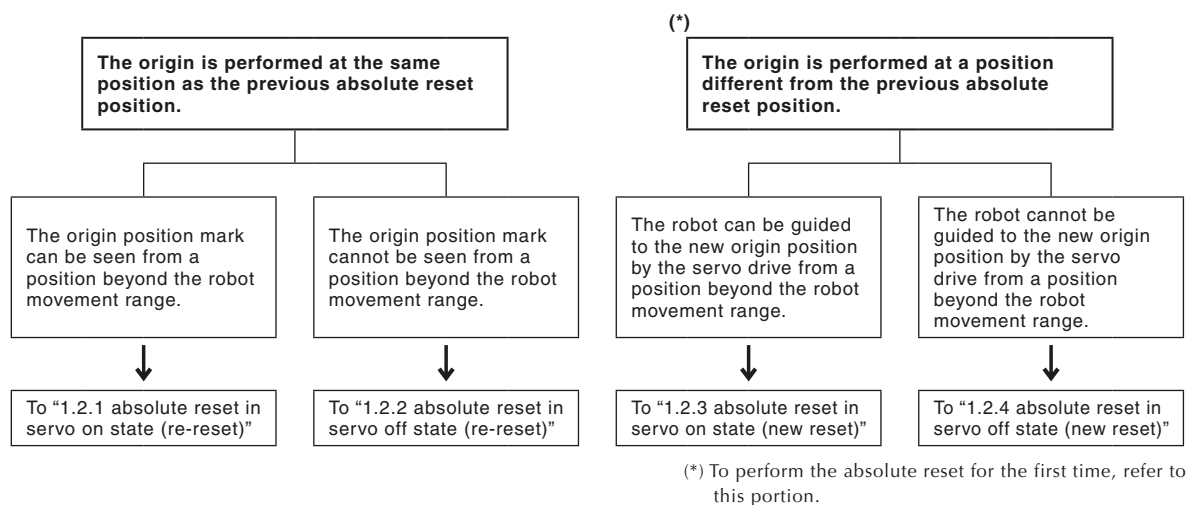
**Step14 Turn off the controller.****Step15 Enter the safety enclosure.****Step 8-10 Adjusting the Y-axis machine reference value**

## 1.3 Mark method R6YXE400

The absolute reset in the mark method is classified into four groups according to the conditions as shown in the flowchart below.

Since each operating procedure varies, refer to relevant portion.

### ■ Absolute reset flowchart



### 1.3.1 Absolute reset in servo on state (re-reset)



#### WARNING

Serious injury might occur from physical contact with the robot during operation. Never enter within the robot movement range during absolute reset.

The operation procedure using the PBEX is described below.



#### NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "OMRON Robot Controller User's Manual".

#### Step1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

#### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

#### Step3 Move to a position where the origin position sticker can be seen.




Move to a position where the origin position sticker can be seen while holding the PBEX. At this time, never enter the robot movement range.

#### Step4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBEX (operation → return-to-origin).

#### Step5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

**Step6** *Select an axis whose absolute reset is performed.*

Use the cursor keys (  /  ) to select an axis number whose absolute reset is performed, and then press .

The execution confirmation screen will pop up.

**Step7** *Perform the step movement.*

Press the jog key to perform the step movement of the robot until the origin position marks are matched with each other.

**CAUTION**

Multiple absolute resettable positions exist discretely.

When moving the robot by pressing the jog key, all robot stop positions become absolute resettable positions.

Before performing the absolute reset, press the jog key again to move the axis left or right to check that the origin position marks are matched with each other correctly.

(See the figure below.)

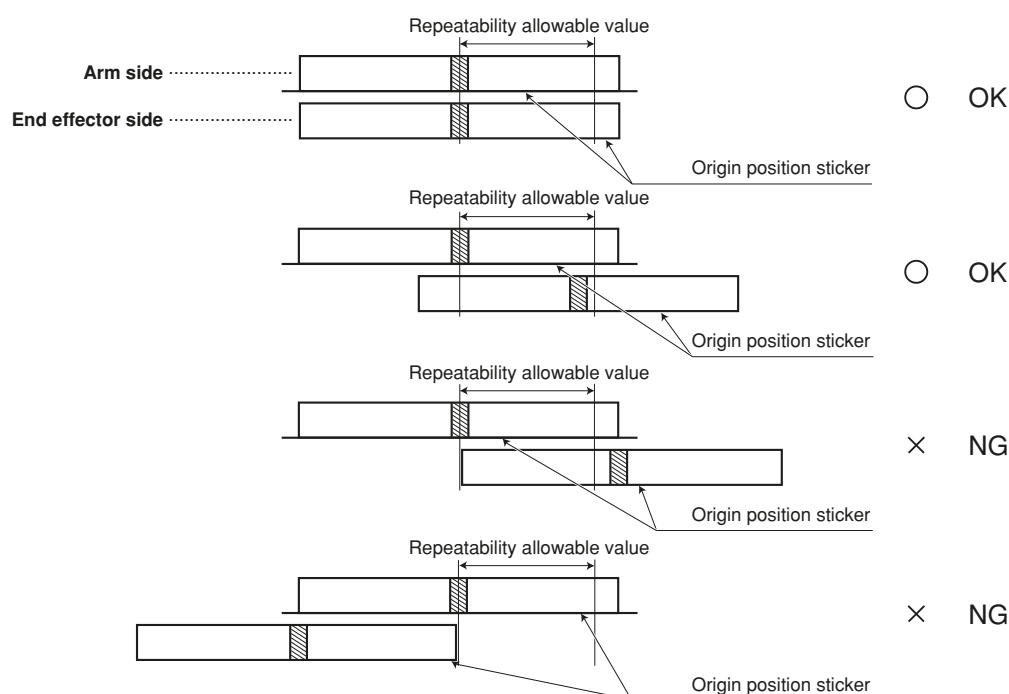
When performing the absolute reset again at the previous absolute reset position, the deviation between the origin position marks needs to be put in a certain range (repeatability allowable value). (See the figure below.)

If the absolute reset is performed at a position exceeding the repeatability allowable value or at a position different from the previous absolute reset position, the position deviation may occur. When performing the absolute reset, take appropriate measures so that the deviation between the origin position marks is put in the repeatability allowable value range correctly.

The origin position repeatability allowable value of each axis is shown below.

**Origin position repeatability allowable value.**

axis	Origin position repeatability allowable value(°)
X	±0.72
Y	±0.72
R	±3.00

**Positional relationship between origin position stickers**

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**Step8** *Perform the absolute reset.*

Press  on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset. After the absolute reset has been completed, the axis moves to the "0" pulse position.

## 1.3.2 Absolute reset in servo off state (re-reset)



### WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.

The operation procedure using the PBEX is described below.



### NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "OMRON Robot Controller User's Manual".

#### **Step1** Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

#### **Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

#### **Step3** Enter the safety enclosure.

Enter the safety enclosure while holding the PBEX.

#### **Step4** Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBEX (operation → return-to-origin).

#### **Step5** Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

## Step6 Move the arm to the position where the origin position marks are matched with each other.

Press the emergency stop button on the PBEX to put the robot in the emergency stop state.



### WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.

Manually move the robot to a position where the origin position marks are aligned with each other.



### CAUTION

To perform the absolute reset again at the same position as the previous absolute reset position, it is necessary to put the deviation between the origin position marks within a certain range (repeatability allowable value). (See the Fig. below.)

If the absolute reset is performed at a position exceeding the repeatability allowable value or a position different from the previous absolute reset position, the positional deviation may occur.

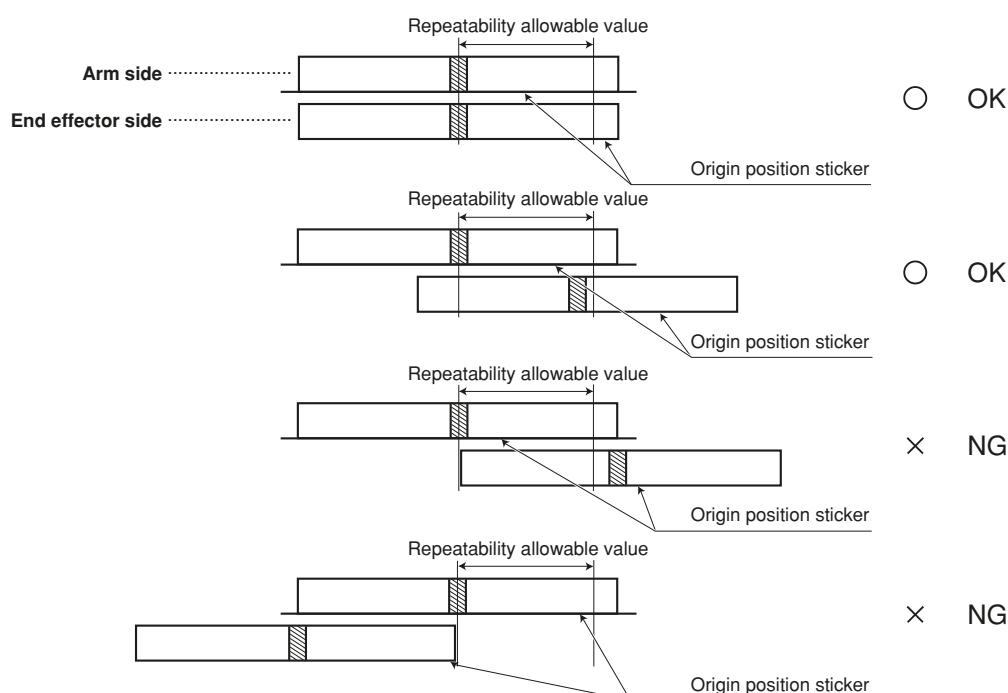
When performing the absolute reset, take appropriate measures so that the deviation between the origin position marks is put in the repeatability allowable value range correctly.

The origin position repeatability allowable value of each axis is shown below.

### Origin position repeatability allowable value.

axis	Origin position repeatability allowable value(°)
X	±0.72
Y	±0.72
R	±3.00

### Positional relationship between origin position stickers






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## Step7 Check the machine reference value.


When the robot is moved to a position where the absolute reset is performed, check that the value of the selected axis is in the range between 26 and 74 on the PBEX screen. (Normally, this value is 50.)

**Step8** *Select an axis whose absolute reset is performed.*

Use the cursor keys (  /  ) to select an axis number whose absolute reset is performed, and then press .

The execution confirmation screen will pop up.

**CAUTION**

- There are multiple discrete positions where the absolute reset can be performed. Move the robot step-by-step while referring to the PBEX screen. When the robot comes to a position near the return-to-origin position where the value of the selected axis on the PBEX screen enters the range between 26 and 74, press the  key.
- If the value of the selected axis is not in the range between 26 and 74, the message, "Position reset malposition", appears in the next operation and the absolute reset cannot be completed.

**Step9** *Perform the absolute reset.*

Press  on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset.

**Step10** *Go out of the safety enclosure.***Step11** *Release the emergency stop of the controller.*

After checking that no one is inside the safety enclosure, release the emergency stop of the controller.



### 1.3.3 Absolute reset in servo on state (new reset)



#### WARNING

Serious injury might occur from physical contact with the robot during operation. Never enter within the robot movement range during absolute reset.

The operation procedure using the PBEX is described below.



#### NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "OMRON Robot Controller User's Manual".

#### Step1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

#### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

#### Step3 Move to a position where the joint can be seen.




Move the robot to an arm position where the absolute reset is performed newly, and then move to a position where the joint can be seen while holding the PBEX. At this time, never enter the robot movement range.

#### Step4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBEX (operation → return-to-origin).

#### Step5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

#### Step6 Select an axis whose absolute reset is performed.

Use the cursor keys (  /  ) to select an axis number whose absolute reset is performed, and then press .

#### Step7 Perform the step movement.

Press the jog key to perform the step movement of the robot until the absolute reset position are matched with each other.



#### CAUTION

There are multiple discrete positions where the absolute reset can be performed.  
After the absolute reset has been completed, the axis moves to the "0" pulse position.

#### Step8 Perform the absolute reset.

Press  on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset.  
After the absolute reset has been completed, the axis moves to the "0" pulse position.

#### Step9 Move to the all-axis 0 pulse position.

When the absolute reset has been completed, move the robot to the all-axis 0 pulse position. For details about how to move to the 0 pulse position, refer to the "OMRON Robot Controller User's Manual".



#### CAUTION

Before affixing the origin position stickers, be sure to move the robot to the all axes "0" pulse position. If the robot is not moved to this position, the next absolute reset may not be performed correctly.

## Step10 Affix the origin position stickers.

After the robot has been moved to the all axes "0" pulse position, press the emergency stop button and affix the origin position stickers to legible positions. After that, these origin position stickers are used to perform the absolute reset again at the same position.

Degrease the origin position sticker affixing surface with alcohol, etc. After the surface has been dried, affix the sticker.



### CAUTION

When the next absolute reset is performed at the same position, it is necessary to put the deviation between the origin position stickers in a certain range (repeatability allowable value). (See the Fig. below.)

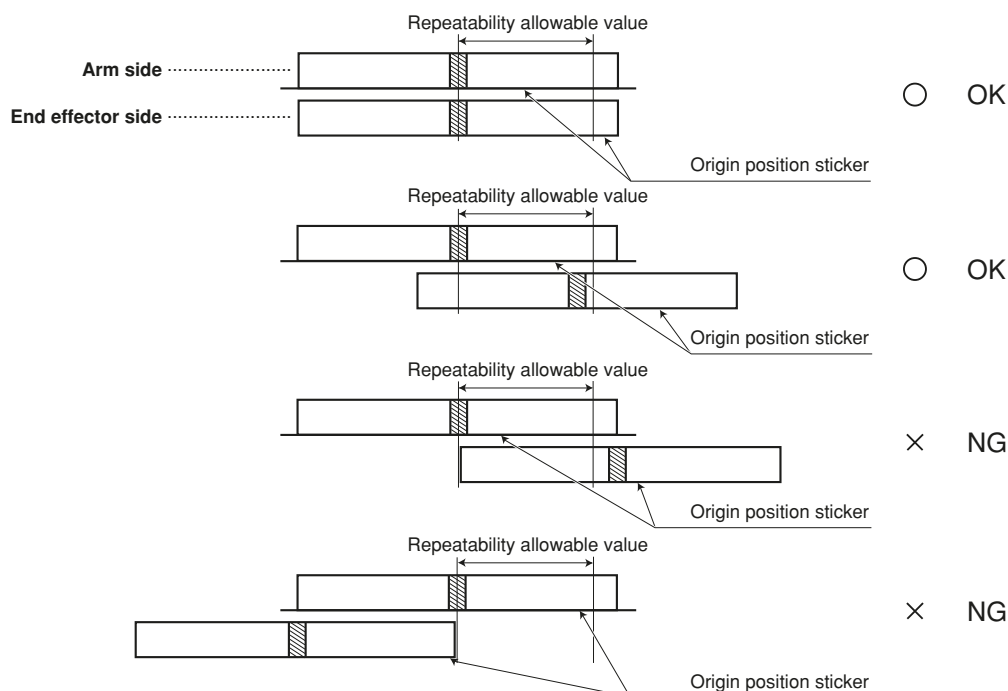
When affixing the origin position stickers, eliminate the deviation between the upper and lower stickers as much as possible so that the reset position can be understood securely during next absolute reset.

The origin position repeatability allowable value of each axis is shown below.

Origin position repeatability allowable value.

axis	Origin position repeatability allowable value(° )
X	±0.72
Y	±0.72
R	±3.00

### Positional relationship between origin position stickers



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### CAUTION

When affixing the origin position stickers, be careful not to move the joint of the robot. When the servo is turned off, the joint may move due to the harness reaction force depending on the arm position. If this symptom is predicted, determine other position where the joint does not move to the origin position.

## Step11 Go out of the safety enclosure.

## Step12 Release the emergency stop of the controller.

After checking that no one is inside the safety enclosure, release the emergency stop of the controller.

### 1.3.4 Absolute reset in servo off state (new reset)



#### WARNING

Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.



#### NOTE

- When pressing the **ESC** key on the execution confirmation screen, the execution of the absolute reset is canceled.
- For details about how to operate the robot controller, see the "OMRON Robot Controller User's Manual".

#### Step1 Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.

#### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

#### Step3 Enter the safety enclosure.

Enter the safety enclosure while holding the PBEX.

#### Step4 Display the "ORIGIN RTN (TRQ/SENS)" screen on the PBEX (operation → return-to-origin).

#### Step5 Display the "ORIGIN RTN (MARK)" screen.

Press **F1** (MARK) on the "ORIGIN RTN (TRQ/SENS)" screen.

#### Step6 Move the arm to the position where the origin position marks are matched with each other.

Press the emergency stop button on the PBEX to put the robot in the emergency stop state.



#### WARNING




Be sure to press the emergency stop button and move the robot in the state where the servo on cannot be operated from the outside.

Manually move the robot to a position where the return-to-origin is performed.

#### Step7 Check the machine reference value.

When the robot is moved to a position where the absolute reset is performed, check that the value of the selected axis is in the range between 26 and 74 on the PBEX screen. (Normally, this value is 50.)


#### Step8 Select an axis whose absolute reset is performed.

Use the cursor keys (  /  ) to select an axis number whose absolute reset is performed, and then press .


The execution confirmation screen will pop up.



#### CAUTION

- There are multiple discrete positions where the absolute reset can be performed. Move the robot step-by-step while referring to the PBEX screen. When the robot comes to a position near the absolute reset position where the value of the selected axis on the PBEX screen enters the range between 26 and 74, press the  key.
- If the value of the selected axis is not in the range between 26 and 74, the message, "Position reset malposition", appears in the next operation and the return-to-origin cannot be completed.

#### Step9 Perform the absolute reset.

Press  on the "ORIGIN RTN (MARK)" pop-up screen to complete the absolute reset. After the absolute reset has been completed, the axis moves to the "0" pulse position.

#### Step10 Move the robot to the all-axis 0 pulse position.

When the absolute reset has been completed, move the robot to the all-axis 0 pulse position. For details about how to move to the 0 pulse position, refer to the "OMRON Robot Controller User's Manual".



#### CAUTION

Before affixing the origin position stickers, be sure to move the robot to the all axes "0" pulse position. If the robot is not moved to this position, the next absolute reset may not be performed correctly.

## Step 11 Affix the origin position stickers.

After the robot has been moved to the all-axis 0 pulse position, press the emergency stop switch and affix the origin position stickers supplied with the robot to easy-to-identify positions near the R-axis rotation part so that they can be used when the absolute reset is performed again at the same position.

Degrease the origin position sticker affixing surfaces with alcohol. After the surfaces have been dried, affix the origin position stickers.



### CAUTION

When the next absolute reset is performed at the same position, it is necessary to put the deviation between the origin position stickers in a certain range (repeatability allowable value). (See the Fig. below.)

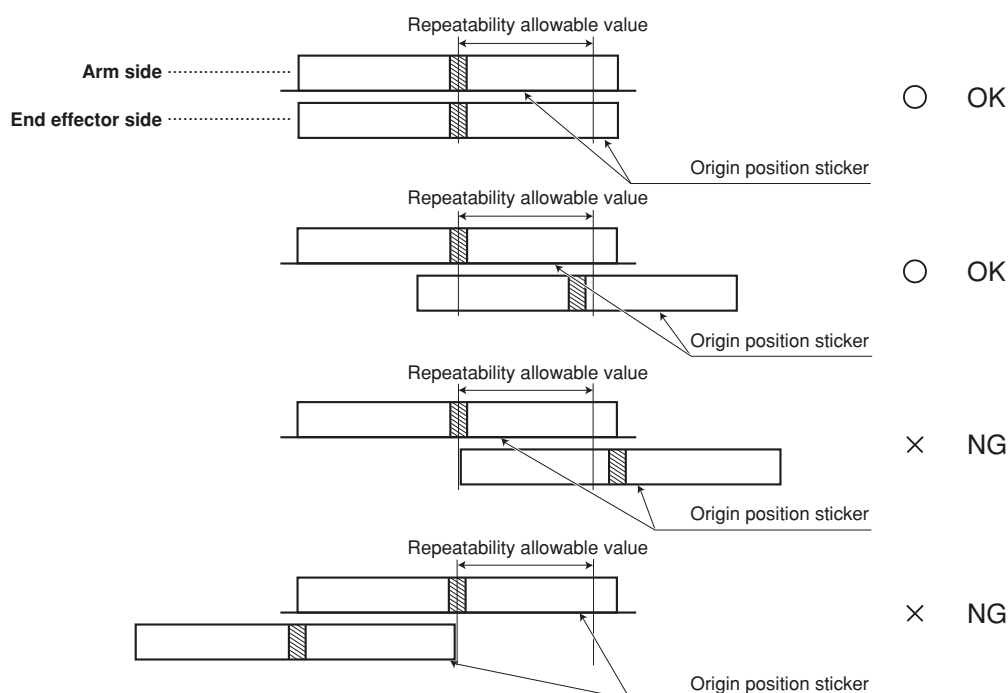
When affixing the origin position stickers, eliminate the deviation between the upper and lower stickers as much as possible so that the reset position can be understood securely during next absolute reset.

The origin position repeatability allowable value of each axis is shown below.

Origin position repeatability allowable value.

axis	Origin position repeatability allowable value(° )
X	±0.72
Y	±0.72
R	±3.00

### Positional relationship between origin position stickers



23311-FH-00



### CAUTION

When affixing the origin position stickers, be careful not to move the joint of the robot. When the servo is turned off, the joint may move due to the harness reaction force depending on the arm position. If this symptom is predicted, determine other position where the joint does not move to the origin position.

## Step 12 Go out of the safety enclosure.

## Step 13 Release the emergency stop of the controller.

After checking that no one is inside the safety enclosure, release the emergency stop of the controller.

## Chapter 5

# Replacing the harmonic drive

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# 1. Cautions on replacement of the harmonic drive

The following describes the cautions on replacement of the harmonic drive. Before beginning the replacement work, always be sure to read these replacement procedures and caution.

## Cautions on replacement of the harmonic drive



### WARNING

- The motor and speed reduction gear casing are extremely hot after automatic operation, so burns may occur if these are touched. Before touching these parts, turn off the controller, wait for a while and check that the temperature has cooled.
- When removing the wave generator from the motor shaft or reinstalling it back onto the motor shaft, use caution to avoid as much as possible, applying a thrust load to the motor shaft. If a load is applied, the resolver may be damaged resulting in a hazardous situation of the robot trouble.

Precautions when handling harmonic grease, cleaning oil:

- Inflammation may occur if they get in the eyes.  
Before handling them, wear your safety goggles to ensure they will not come in contact with the eyes.
- Inflammation may occur if they come into contact with skin. Be sure to wear protective gloves to prevent contact with skin.
- Do not take orally or eat. (Eating will cause diarrhea and vomiting.)
- Hands and fingers might be cut when opening the container, so use protective gloves.
- Keep out of the reach of children.
- Do not heat them or place near an open flame since this could lead to sparks and fires.

Emergency Treatment:

- If they get in the eyes, wash liberally with pure water for about 15 minutes and consult a physician for treatment.
- If they come in contact with the skin, wash away completely with soap and water.
- If taken internally, do not induce vomiting but promptly consult a physician for treatment.

Disposing of harmonic grease, cleaning oil and the container:

- Proper disposal is compulsory under federal, state and local regulations. Take appropriate measures in compliance with legal regulations.
- Do not pressurize the empty container. Pressurizing may cause the container to rupture.
- Do not attempt to weld, heat up, drill holes or cut this container. This might cause the container to explode and the remaining materials inside it to ignite.



### CAUTION

The harmonic drive service life may shorten if the grease recommended by OMRON is not used.

## Recommended grease

Use the following harmonic drive grease.

4B No.2 (made by Harmonic Drive Systems Inc.)



### CAUTION

Harmonic drive

- Do not apply strong shocks or impacts to these parts such as with a hammer. Also, do not scratch, scar or dent these parts by dropping, etc. Such actions will damage the harmonic drive.
- The specified performance cannot be maintained if any part of the harmonic drive is used in a damaged state. This damage or wear may also lead to trouble with the harmonic drive.
- Since a positional shift occurs after replacing the harmonic drive, it is necessary to make return-to-origin and set the standard coordinate setting and point data setting again.

## 2. Replacement procedure for harmonic drive

### R6YXE400

The following describes the procedures and precautions for replacing the harmonic drive. For the bolt tightening torque in the harmonic drive replacement work, see the Table below. However, when tightening the mounting bolts for the harmonic drive, observe the tightening torque specified in each replacement procedure. Use only OMRON genuine bolts.

#### Bolt tightening torque

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 set screw	7	0.69
M4 set screw	17	1.7
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37.0
M10	720	71.0

Recommended "Screw thread locking agent": LOCTITE 262 (made by Henkel Corporation)

### 2.1 Replacing the X-axis harmonic drive



#### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

The following shows the parts and tools necessary for the X-axis harmonic drive replacement work.

#### 2.1.1 Preparation

##### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Harmonic drive	KDS-M2110-00		1	
2	O-ring (Supplied with the harmonic drive.)	KN3-M2144-00	Cross section diameter: 0.99mm Inside diameter: 53.28mm	1	May deteriorate and must be replaced
3	O-ring	KN3-M2143-00	Cross section diameter: 1.5mm Inside diameter: 49.0mm	1	May deteriorate and must be replaced
4	O-ring	KN4-M257K-00	Cross section diameter: 1.78mm Inside diameter: 72.75mm	1	May deteriorate and must be replaced
5	Harmonic drive mounting bolt	91312-03020	M3 × 20	16	Must be replaced
6	Harmonic drive mounting bolt	91312-03035	M3 × 35	12	Must be replaced
7	Washer	92903-03600		28	Must be replaced
8	Harmonic drive mounting bolt	91312-03008	M3 × 8	4	

##### 2. Tools(Torque wrench, etc.)



#### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 7.4Nm (76kgfcm)
	Changeable head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Wrench (without ball end) for M5 hex socket head bolt; insert 110mm
B	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 1.8Nm (18kgfcm)
	Drive bit	B35, opposite side 2.5×75	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm



	Name	Part No.	Manufacturer	Remarks
C	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 set screw Tightening torque: 0.7Nm (7kgfcm)
	Drive bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 70mm Hexagonal width across flat at tip: 1.5mm

\* Use a commercially available torque wrench to tighten bolts other than those shown above.

### 3. Other tools

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
Screw thread locking agent	Loctite 262	Henkel	High strength type (red)

\*1: 27g

## 2.1.2 Removal

Follow the steps below to remove the X-axis parts.

**Step1** Turn off the controller.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.



#### CAUTION

In the following steps, when removing the robot body, perform the work with great care since it is very heavy.

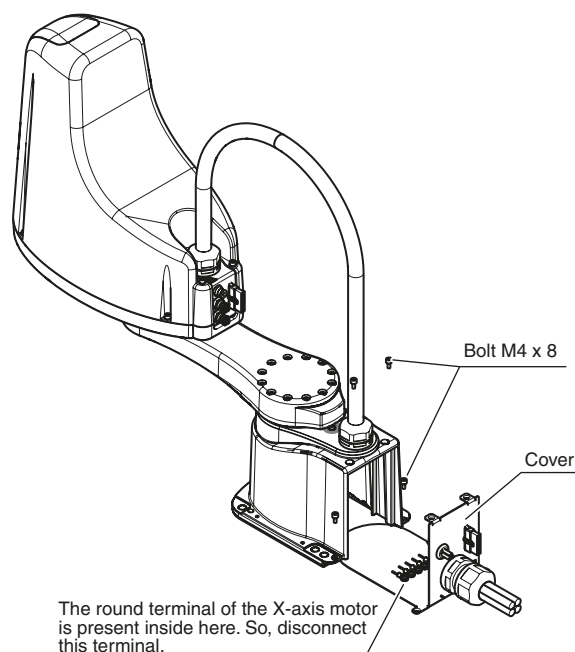
**Step4** Remove the base cover.

53504-FV-00

► **Step 4-5** Remove the base cover

**Step5** Disconnect the connectors of the X-axis motor power wire XM and resolver wire XP in the base, and the round terminal of the X-axis motor.

Refer to Chapter 6 "Replacing the machine harness".



## Step6 Remove the X-axis motor.

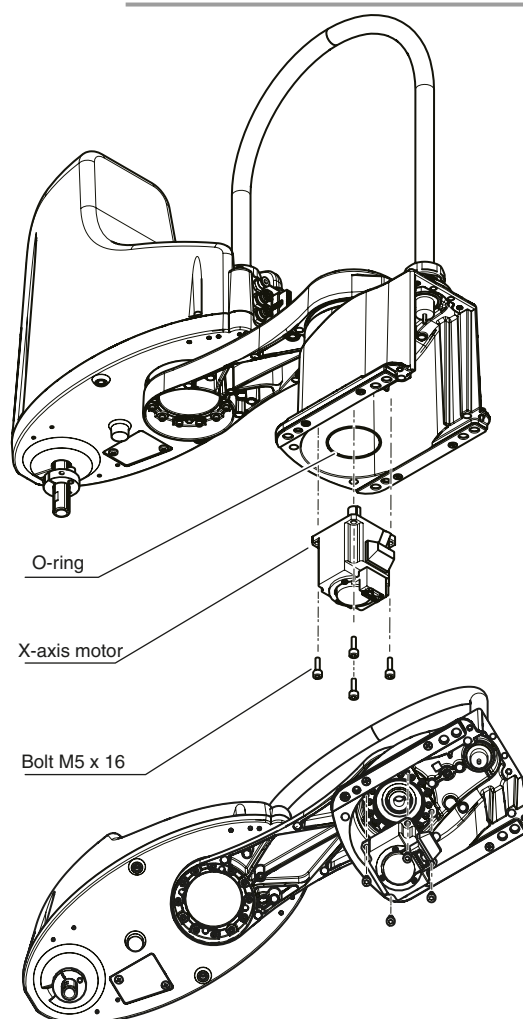
53501-FV-00

## Step7 Remove the wave generator.

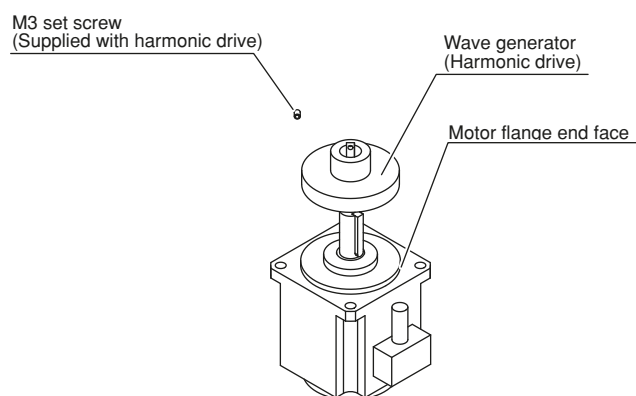
1. Remove the set screw (1 pc.) that secures the wave generator.
2. Remove the wave generator from the motor.

53502-FK-00

## ▶ Step 6 Removing the X-axis motor



## ▶ Step 7 Removing the wave generator



## Step8 Remove the X-axis arm.

53503-FV-01

## Step9 Remove the X-axis harmonic drive from the X-axis arm.

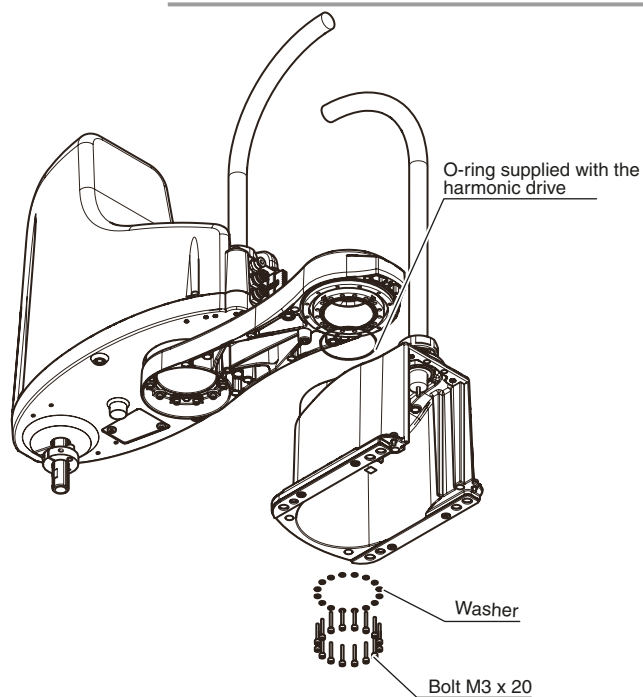
53505-FV-00



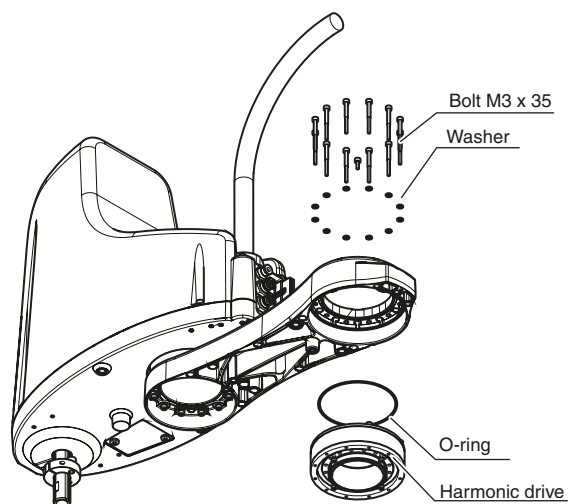
### NOTE

An O-ring is fitted to the X-axis arm. Replace this O-ring with a new one.

## ▶ Step 8 Removing the X-axis arm



## ▶ Step 9 Removing the harmonic drive



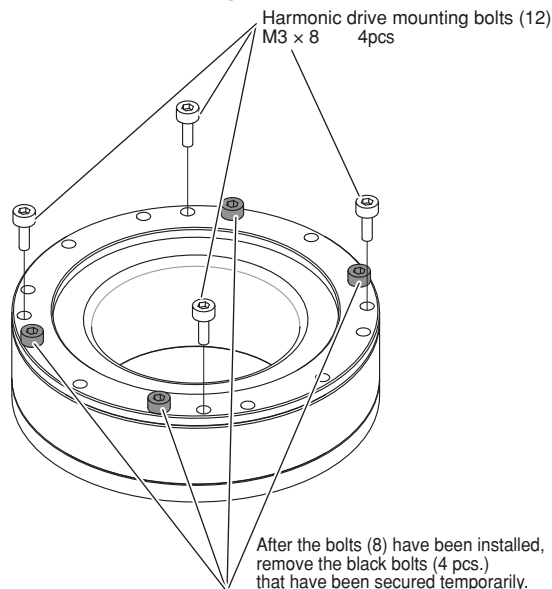
## 2.1.3 Replacement and reassembly

Follow the steps below to replace the harmonic drive with a new one and reassemble it.

### Step 1 Perform the work shown below before reassembling the harmonic drive.

1. Install the bolts on the harmonic drive.
2. Remove the bolts that have been assembled and secured temporarily.

#### Step 1 Preparations before assembling the harmonic drive



53512-FK-00



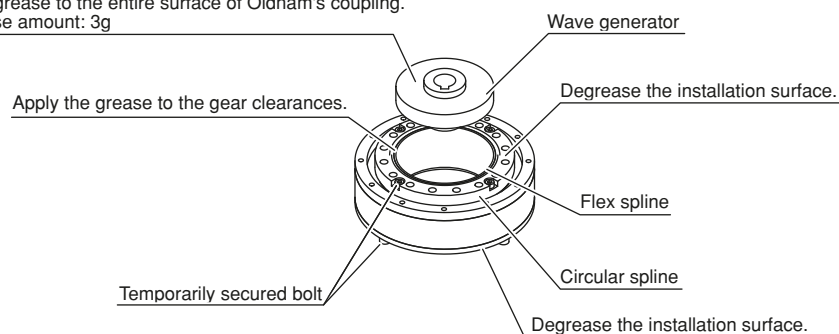
#### CAUTION

Do not remove the bolts that have been secured temporarily before installing new bolts. Doing so may cause a misalignment.

3. Apply the harmonic grease to a new wave generator. For details about how to apply the grease, see the Fig. below.  
Degrease the top and bottom installation surfaces of the harmonic drive.

#### Step 1 Applying the harmonic grease

Fill ball spaces with the grease sufficiently.  
Apply the grease to the entire surface of Oldham's coupling.  
Total grease amount: 3g



53506-FK-00

4. Remove the old grease and worn-out particles from the installation surfaces of the harmonic drive completely.



#### CAUTION

- If foreign matter is caught in during reassembly work, this may cause the noise from the harmonic drive or the harmonic drive to break.
- Never remove the temporarily secured bolts. Doing so may cause a misalignment.

**Step2** *Secure a new harmonic drive to the X-axis arm.*

1. Degrease the harmonic drive installation surface of the X-axis arm.  
Do not apply the grease to the seating part.
2. Fit the O-ring coated with the new harmonic grease into the O-ring groove of the X-axis arm. Since the grease application to the O-ring is intended to prevent the O-ring from coming off, it is accepted to apply a small amount of the grease.

**CAUTION**

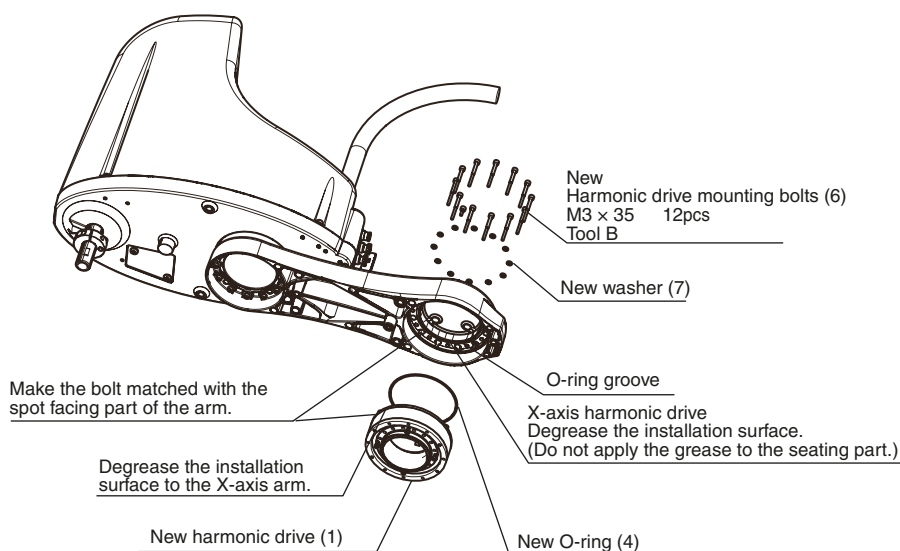
Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.

3. Secure the new harmonic drive to the X-axis arm with new bolts.  
Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first four threads are filled with grease.

**NOTE**

When performing the return-to-origin by means of the stroke end method, make the positioning of the harmonic drive and secure it with the old bolts. After that, replace the old bolts with new ones to secure the harmonic drive firmly.

For details, see "1. Adjusting the machine reference value" in Chapter 4.

**Step 2 Mounting the harmonic drive**

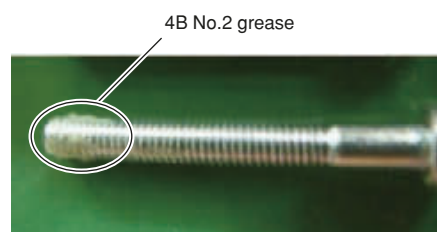
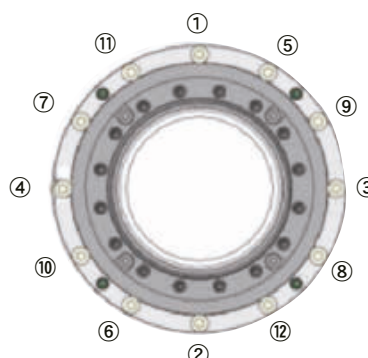
53507-FV-00

53508-FH-00

**Step 2, 5 Applying the grease to the mounting bolt****Step3** *Tighten the bolts in the order shown below.*

1. Using the wrench, tighten the bolts and pan head bolts manually in the order indicated by circled numbers.
2. Using the torque screwdriver, tighten the bolts and pan head bolts to approximately 50% of the specified torque in the order indicated by circled numbers.
3. Tighten the bolts and pan head bolts to the specified torque in the order indicated by circled numbers.
4. Finally, check that the bolts and pan head bolts are tightened to the specified torque.

53509-FH-00

**Step 3 Bolt and pan head bolt tightening order**

#### Step4 *Fit the new O-ring coated with the harmonic grease into the O-ring groove of the harmonic drive.*

1. Degrease the top surface of the plate where the harmonic drive is to be installed.



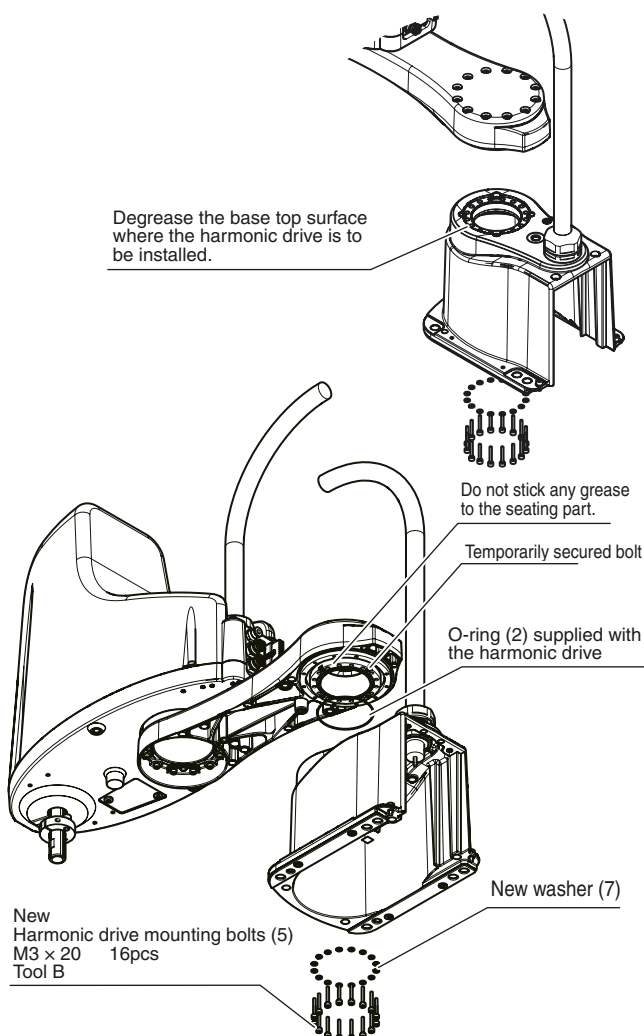
#### CAUTION

**Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.**

2. Fit the new O-ring coated with the harmonic grease into the O-ring groove of the harmonic drive.  
Since the grease application to the O-ring is intended to prevent the O-ring from coming off, it is accepted to apply a small amount of the harmonic grease.

53510-FV-01

#### Step 4 Installing the harmonic drive



#### Step5 *Secure the harmonic drive to the base.*

*Secure the harmonic drive to the base with the new bolts.*

*The harmonic drive's phase with respect to the plate should be as shown in the Fig. on the right.*

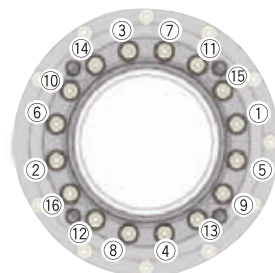
*Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first four threads are filled with grease.*

#### Step6 *Tighten the bolts in the order shown below.*

1. Using the wrench, tighten the bolts manually in the order indicated by circled numbers.
2. Using the torque screwdriver, tighten the bolts to approximately 50% of the specified torque in the order indicated by circled numbers.
3. Tighten the bolts to the specified torque in the order indicated by circled numbers.
4. Finally, check that the bolts are tightened to the specified torque.

53511-FH-00

#### Step 5-6 Bolt tightening order



## Step7 Fit a new O-ring (3) into the motor flange end face.

53613-FK-00



### CAUTION

Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.

## Step8 Secure the wave generator.

1. Pass the wave generator through the motor shaft.  
For details about the positional relationship between the wave generator and motor, see the figure at right.

53513-FK-00

2. Secure the wave generator with the set screw (1 pc.).  
At this time, apply a small amount of the screw lock to the set screw.
3. Apply the harmonic grease to the portion between the wave generator and motor, and the top surface of the wave generator as shown in the Fig. on the right.

53513-FV-00



### CAUTION

- If it is difficult to fit the wave generator onto the motor shaft by pushing by hand, do not forcefully push in. Grind the key or motor shaft with sandpaper or similar tool to make it easier to fit the wave generator onto the motor shaft.
- Apply the specified amount of harmonic grease (total specified amount, 24g) to each part of the harmonic drive. An insufficient amount of grease may shorten the service life of the drive parts, and an excessive amount may cause the grease to leak.

## Step9 Install the X-axis motor.

1. Push the X-axis motor into the base while moving the X-axis arm manually.  
At this time, pay special attention so that any grease does not stick to the base.
2. Using the tool A, uniformly tighten the four bolts while moving the X-axis arm by hand slowly left and right at intervals of 45°. At this time, if any jamming or catching is felt, reassemble from the beginning.

53615-FV-00

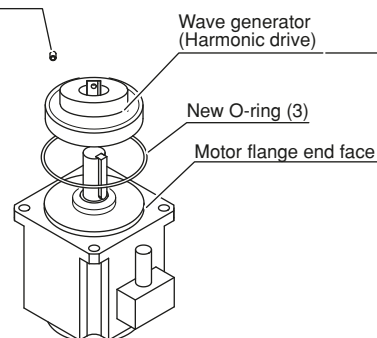
## Step10 Attach the connectors of the X-axis motor power wire XM and resolver wire XP in the base, and the round terminal of the X-axis motor.

Refer to Chapter 6 "Replacing the machine harness".

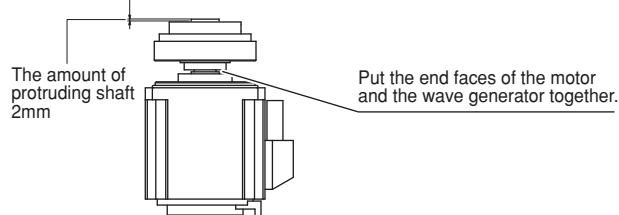
## Step11 Reattach the base cover.

## Step 7-8 Securing the wave generator

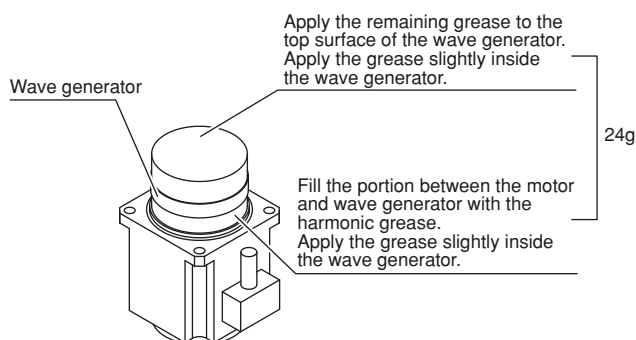
M3 set screw  
(Supplied with the harmonic drive.)  
Apply a small amount of the screw lock.  
Use the tool C.



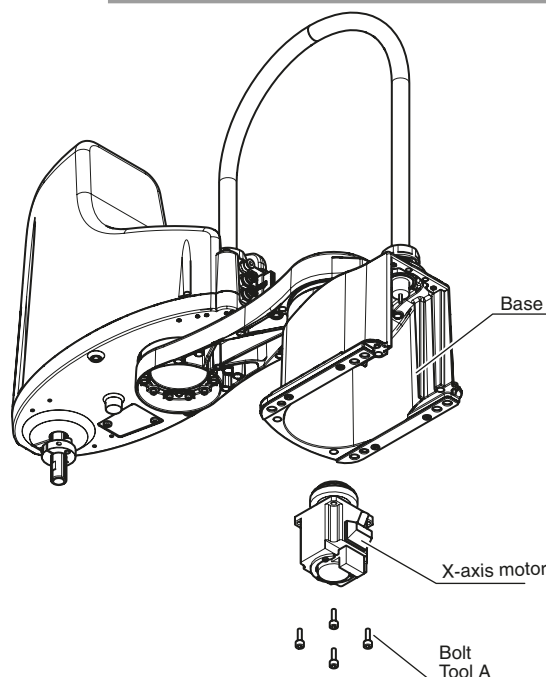
## Step 8 X-axis motor position



## Step 8 Applying the harmonic grease



## Step 9 Installing the X-axis motor



## 2.1.4 Aging

---

**Step1** *Go out of the safety enclosure.*

**Step2** *Turn on the controller.*

*Check that no one is inside the safety enclosure, and then turn on the controller.*



**CAUTION**

After the harmonic drive has been replaced, it is necessary to perform the return-to-origin and set the standard coordinates and point data again. Make the adjustments while referring to Chapter 3 “Adjusting the robot” in the Installation Manual.

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**Step3** *Perform the aging.*

*Perform the aging for 30 minutes at 5% speed and for another 30 minutes at 20% speed by rotating the X-axis arm as much as possible (at least 10°).*



## 2.2 Replacing the Y-axis harmonic drive



### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

The following shows the parts and tools necessary for the Y-axis harmonic drive replacement work.

### 2.2.1 Preparation

#### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Harmonic drive	KDS-M2510-00		1	
2	O-ring (Supplied with the harmonic drive.)	90990-17J016	Cross section diameter: 0.8mm Inside diameter: 45.40mm	1	May deteriorate and must be replaced.
3	O-ring	KN4-M1896-00	Cross section diameter: 1.78mm Inside diameter: 63.22mm	1	May deteriorate and must be replaced.
4	Washer	92903-03600	M3	28	Must be replaced
5	Harmonic drive mounting bolt	91312-03030	M3 × 30	12	Must be replaced
6	Harmonic drive mounting bolt	91312-03018	M3 × 18	16	Must be replaced
7	Harmonic drive mounting bolt	91312-03008	M3 × 8	4	

#### 2. Tools(Torque wrench, etc.)



### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 1.8Nm (18kgfcm)
	Drive bit	B35, opposite side 2.5×75	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm
B	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 set screw Tightening torque: 0.7Nm (7kgfcm)
	Drive bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 70mm Hexagonal width across flat at tip: 1.5mm

\* Use a commercially available torque wrench to tighten bolts other than those shown above.

#### 3. Other tools

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
Screw thread locking agent	Loctite 262	Henkel	High strength type (red)

\*1: 27g

## 2.2.2 Removal

Follow the steps below to remove the Y-axis parts.

**Step1** Turn off the controller.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

**Step4** Remove the cover.

53618-FV-00

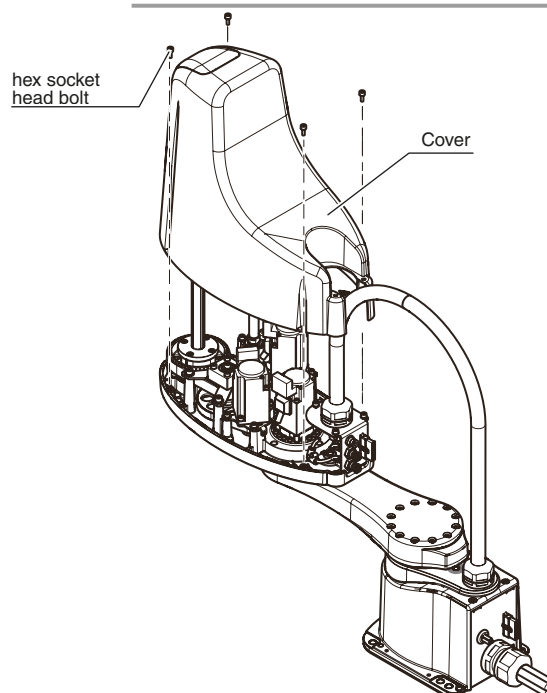


### WARNING

If the Y-axis arm mounting bolts are removed in step 5, the Y-axis arm comes off, causing hazardous situation.

If a heavy tool is attached to the arm tip, the arm may drop. Take great care when removing the Y-axis arm mounting bolts.

### Step 4 Removing the cover



### Step 5 Removing the Y-axis arm

**Step5** Remove the Y-axis arm.

1. Remove the Y-axis arm mounting bolts.
2. Remove the Y-axis arm.  
Place the Y-axis arm that has been removed in a place where it is not in contact with the harness. This does not hinder the work.
3. Remove the O-ring.

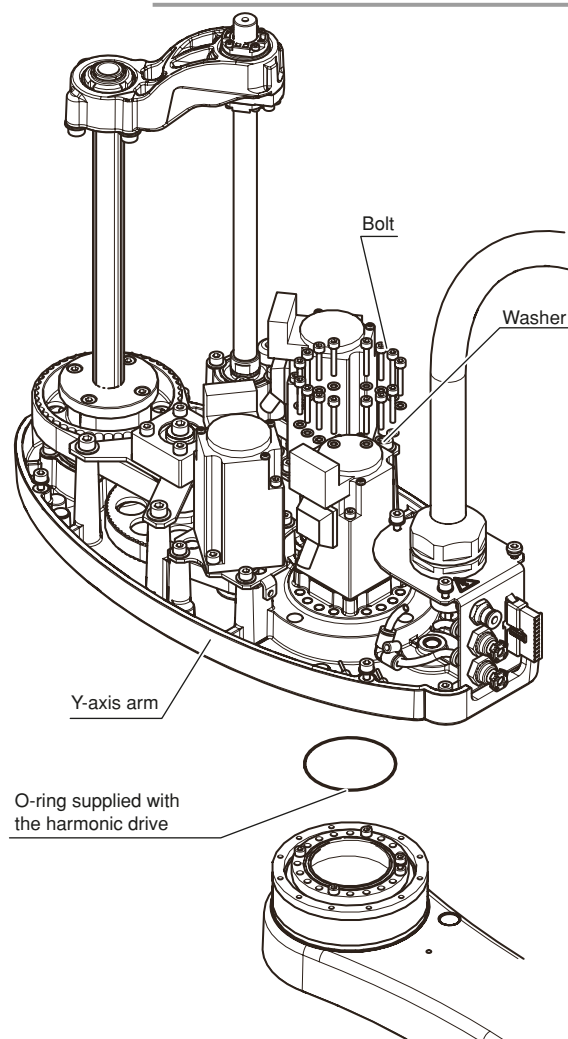
53619-FV-00



### NOTE

The O-ring in the harmonic drive must be replaced with a new one later on.

The O-ring may adhere to the bottom surface of the Y-axis arm, so be sure to remove it.



- Step 6** *Remove the wave generator from the motor shaft.*  
Remove the set screws (2 pcs.) that secure the wave generator.

53620-FV-00

- Step 7** *Remove the Y-axis harmonic drive from the top surface of the X-axis arm.*

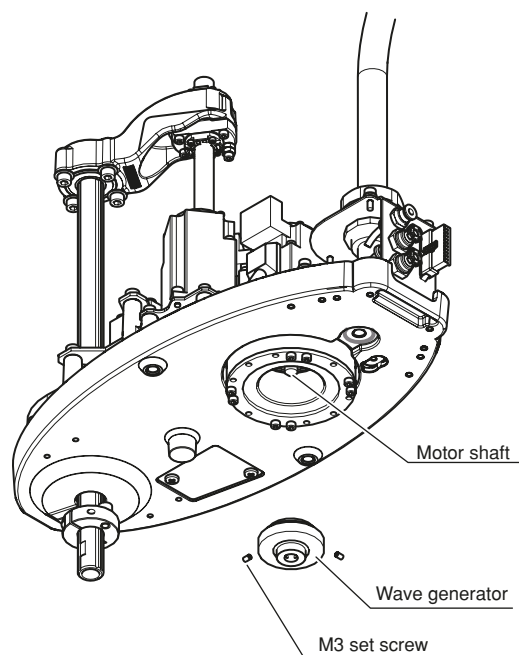
1. Remove the Y-axis harmonic drive mounting bolts.
2. Remove the O-ring.

53621-FV-00

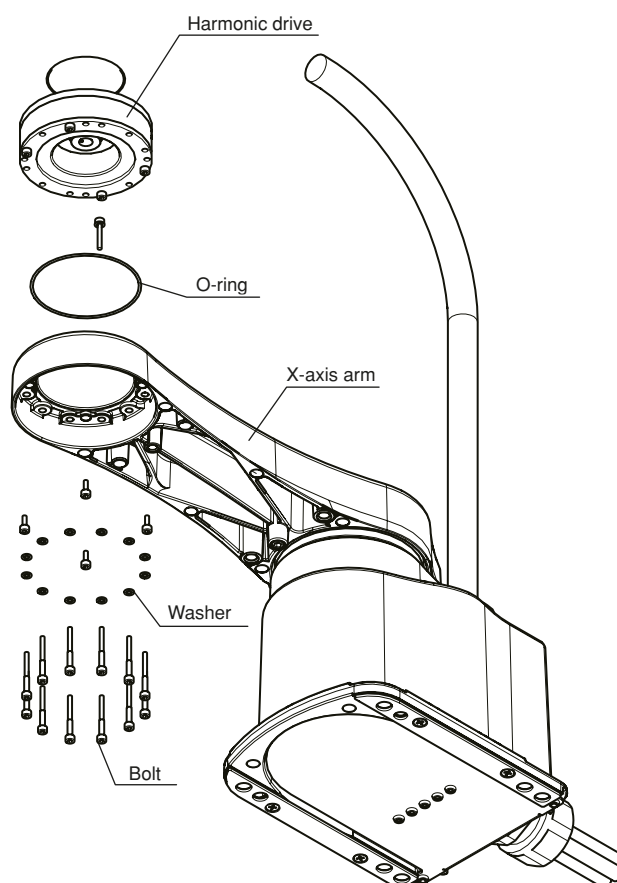


**NOTE**  
The O-ring in the Y-axis harmonic drive must be replaced with a new one later on.

► **Step 6** Removing the wave generator



► **Step 7** Removing the Y-axis harmonic drive



## 2.2.3 Replacement and reassembly

Follow the steps below to replace the harmonic drive with a new one and reassemble it.

### Step 1 *Perform the work shown below before reassembling the harmonic drive.*

1. Install the bolts on the harmonic drive.
2. Remove the bolts that have been assembled and secured temporarily.

53514-FK-00



#### CAUTION

Do not remove the bolts that have been secured temporarily before installing new bolts. Doing so may cause a misalignment.

3. Apply the harmonic grease 4B No.2 to a new wave generator.
4. Remove the old grease and worn-out particles from the motor, X-axis arm, and Y-axis arm completely.

53622-F6-00



#### CAUTION

If foreign matter is caught in during reassembly work, this may cause the noise from the harmonic drive or the harmonic drive to break.

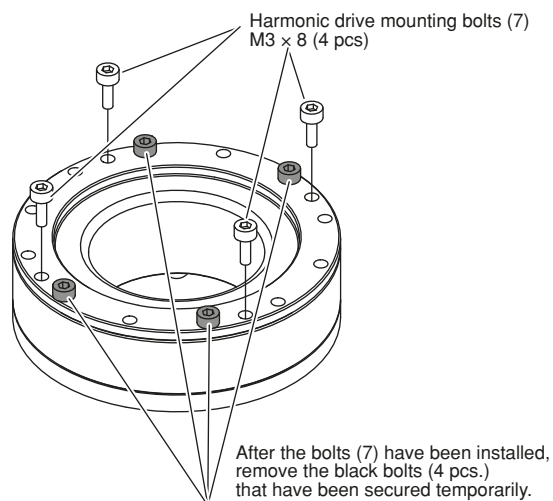
5. Apply the grease to the harmonic drive gear clearances.



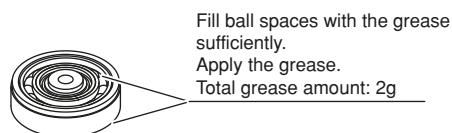
#### CAUTION

An insufficient amount of grease may shorten the service life of the drive parts, and an excessive amount may cause the grease to leak.

### Step 1 Preparations before assembling the harmonic drive



### Step 1 Applying the harmonic grease (wave generator)



## Step2 Secure a new harmonic drive to the X-axis arm.

1. Degrease the harmonic drive installation surface of the X-axis arm. Do not apply the grease to the seating part.
2. Fit a new O-ring (3) into the O-ring groove of the X-axis arm.

53623-FV-00



### CAUTION

- Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.
- Never remove the temporarily secured bolt. Doing so may cause a misalignment.

3. Place a new harmonic drive on the X-axis arm and secure it with the new bolts.  
Apply the harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first four threads are filled with grease.  
Grease applied to the bolt tip is intended to stabilize the bolt axial force.



### NOTE

When performing the return-to-origin by means of the stroke end method, make the positioning of the harmonic drive and secure it with the old bolts. After that, replace the old bolts with new ones to secure the harmonic drive firmly. For details, see "1. Adjusting the machine reference value" in Chapter 4.

## Step3 Tighten the bolts and pan head bolts in the order shown below.

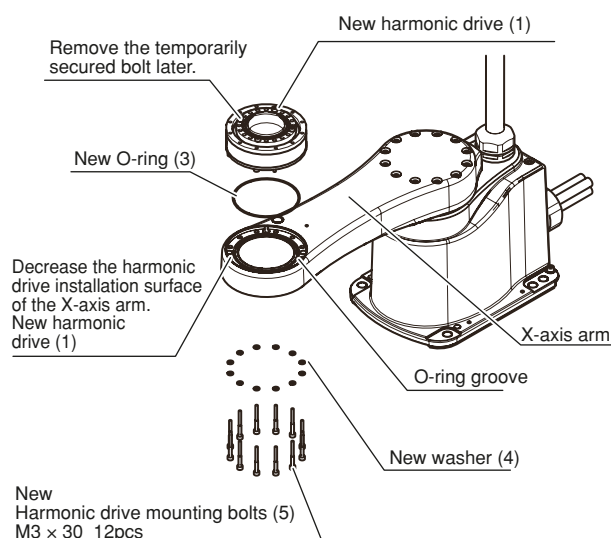
1. Using the wrench, tighten the bolts and pan head bolts manually in the order indicated by circled numbers.
2. Using the torque driver, tighten the bolts and pan head bolts to approximately 50% of the specified torque in the order indicated by circled numbers..

## Step3

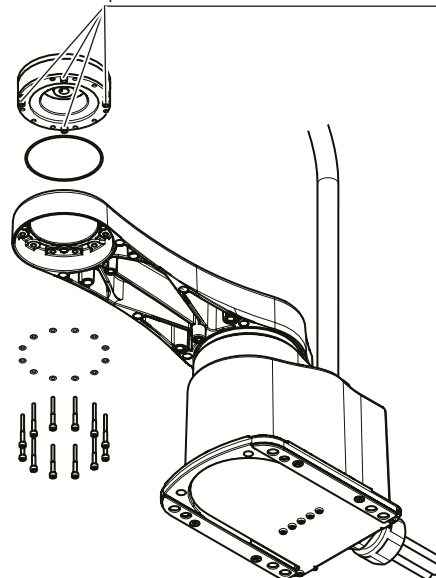
3. Tighten the bolts and pan head bolts to the specified torque in the order indicated by circled numbers.
4. Finally, check that the bolts and pan head bolts are tightened to the specified torque.

53625-FV-00

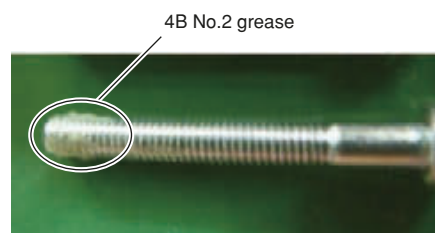
## Step 2 Installing the harmonic drive



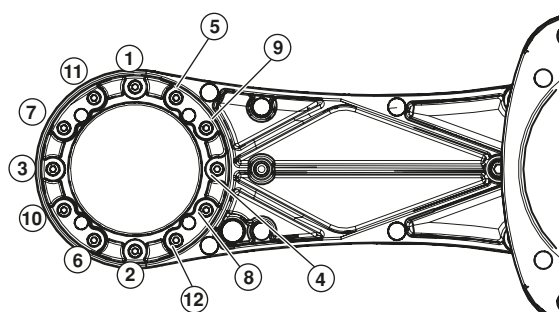
Never remove this temporarily secured bolt. Make the bolt matched with the spot facing position of the arm.



## Step 2, 7 Applying the grease to the mounting bolt



## Step 3 Bolt tightening order



#### Step4 Apply the grease to the inside of the harmonic drive main body.

For the Y-axis, apply the grease so that it becomes flat.

53626-FV-00

#### Step5 Remove four temporarily secured bolts.

#### Step6 Install the new O-ring (2) supplied with a new harmonic drive.

1. Degrease the installation surface on the top surface of the harmonic drive.
2. Fit the O-ring supplied with the new harmonic drive into the O-ring groove of the harmonic drive.  
If it is difficult to fit the O-ring into the groove, slightly stretch the O-ring.  
It is accepted to apply a small amount of the harmonic drive grease to the O-ring in order to prevent the O-ring from coming off from the groove.



#### CAUTION

Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.

#### Step7 Secure the wave generator.

1. Pass the wave generator through the motor shaft while carefully checking its orientation.  
For details about the positional relationship between the wave generator and motor, see the figure at right.
2. Secure the wave generator with the set screws (2 pcs.).  
At this time, apply a small amount of the screw lock to the set screws.

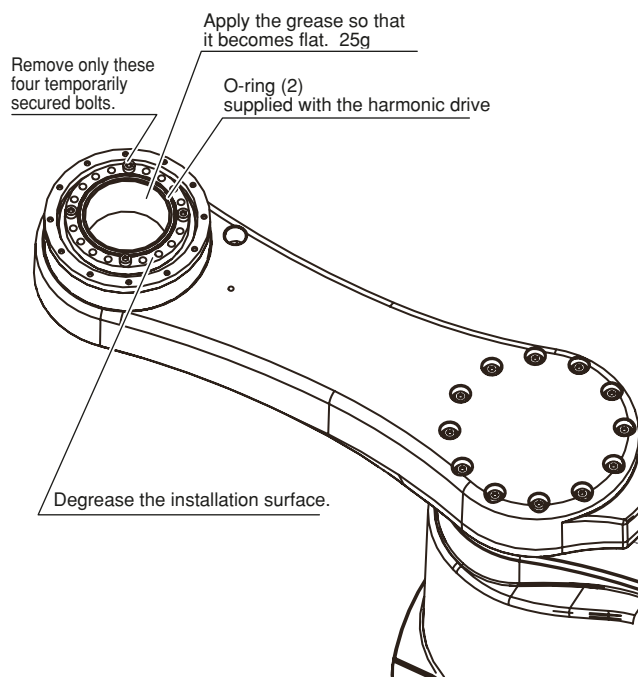
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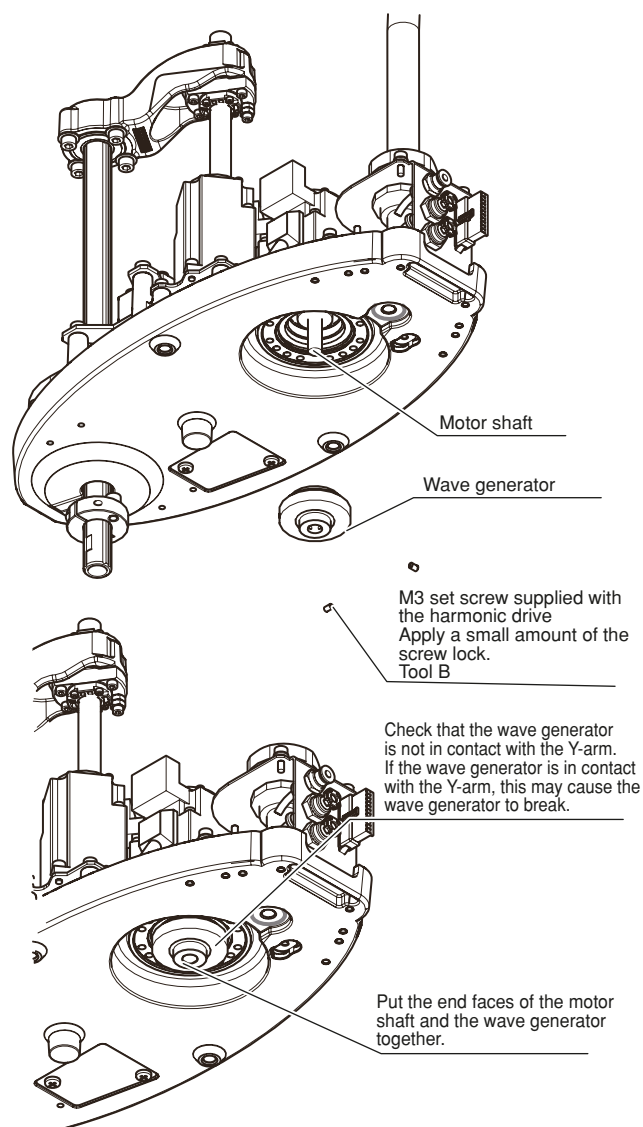
#### CAUTION

- If it is difficult to fit the wave generator onto the motor shaft by pushing by hand, do not forcefully push in. Grind the key or motor shaft with sandpaper or similar tool to make it easier to fit the wave generator onto the motor shaft.
- Apply the specified amount of the harmonic grease to each part of the harmonic drive. An insufficient amount of grease may shorten the service life of the drive parts, and an excessive amount may cause the grease to leak.

#### Step 4-6 Applying the grease to the inside of the harmonic drive main body



#### Step 7 Securing the wave generator



## Step8 *Secure the Y-axis arm to the harmonic drive.*

1. Degrease the Y-axis arm side where the harmonic drive is to be installed.
2. Apply the harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first four threads of the new bolt are filled with grease.



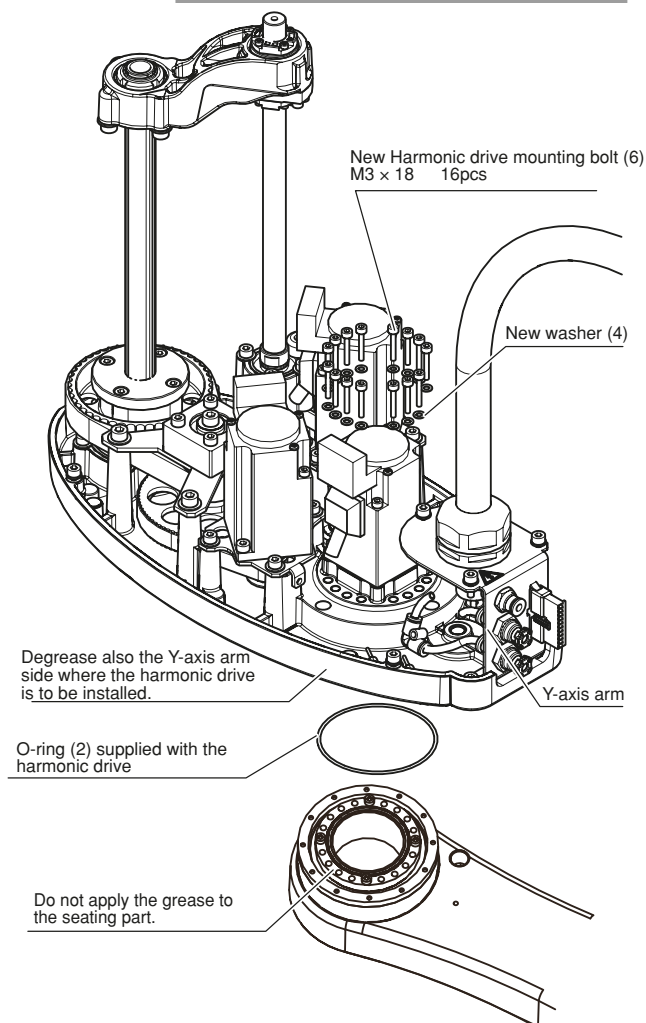
### CAUTION

When tightening the bolts with the moment load applied to the harmonic drive, this may cause breakage. Perform the work not to apply the moment load to the harmonic drive.

3. Secure the Y-axis arm to the harmonic drive with new mounting bolts (6). In order to prevent abnormal sounds from the harmonic drive, only four bolts <13>, <14>, <15> and <16> shown in the Step 9 illustration should be seated first, and tightened only to the point where a torque is not yet applied. The remaining bolts should then be seated. At this time, two work personnel perform the work with the Y-axis arm kept horizontally so that no moment load is applied to the Y-axis harmonic drive. One person supports the end of the Y-axis arm and the other person secures the Y-axis arm in place.

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## Step 8 Securing the Y-axis arm



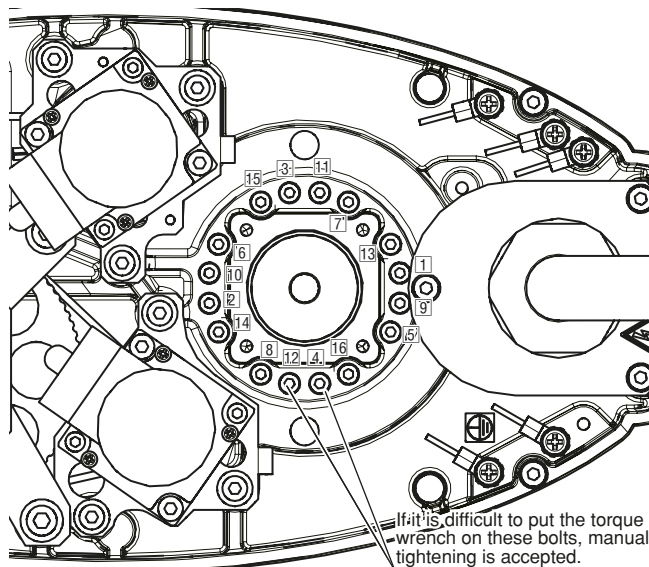


## Step9 Tighten the bolts in the bolt tightening order shown below.

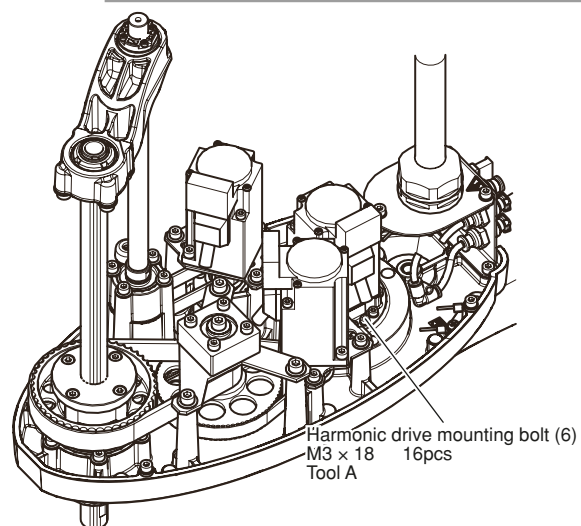
1. While rotating the Y-axis arm, gradually tighten the bolts <13> <14> <15>, and <16> in an alternating manner, and in the order indicated below (rotate the arm in ultra-low-speed mode (1/10 of turn per second)).  
At this time, tighten the bolts in the following alternating sequence three times <13> → <14> → <15> → <16> → <13> → <14> etc. until they can no longer be turned by hand.
2. Tighten four bolts <13> → <14> → <15> → <16> while rotating the Y-axis arm using the tool A.
3. Use tool B to also tighten 12 remaining bolts in diagonal pattern sequence.
4. Finally, check that the bolts are tightened to the specified torque.

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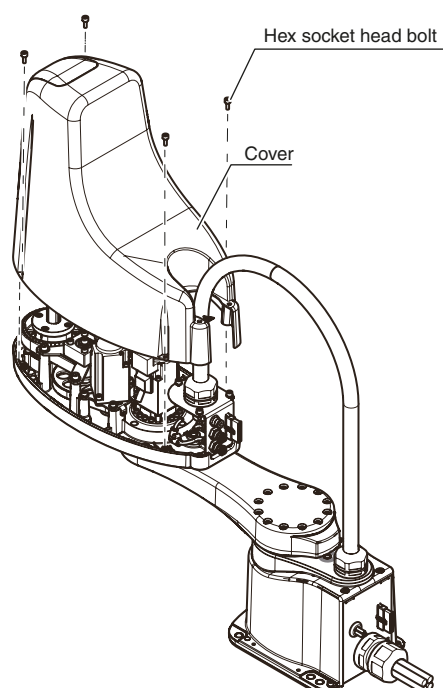
## Step 9 Tightening the bolts



## Step 9 Retightening the bolts



## Step 10 Reattaching the cover



## Step10 Reattach the cover.

53631-FV-00



## 2.2.4 Aging

---

**Step1** *Go out of the safety enclosure.*

**Step2** *Turn on the controller.*

*Check that no one is inside the safety enclosure, and then turn on the controller.*



---

**CAUTION**

After the harmonic drive has been replaced, it is necessary to perform the return-to-origin and set the standard coordinates and point data again.

---

**Step3** *Perform the aging.*

*Perform the aging for 30 minutes at 5% speed and for another 30 minutes at 20% speed by rotating the Y-axis arm as much as possible (at least 10°).*

### 3. Replacement procedure for harmonic drive

#### R6YXE510 R6YXE610 R6YXE710

The following describes the procedures and precautions for replacing the harmonic drive. For the bolt tightening torque in the harmonic drive replacement work, see the Table below. However, when tightening the mounting bolts for the harmonic drive, observe the tightening torque specified in each replacement procedure. Use only OMRON genuine bolts.

#### Bolt tightening torque

Bolt size	Tightening torque (kgfcm)	Tightening torque (Nm)
M3 set screw	7	0.69
M4 set screw	17	1.7
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37.0
M10	720	71.0

Recommended "Screw thread locking agent": LOCTITE 262 (made by Henkel Corporation)

### 3.1 Replacing the X-axis harmonic drive



#### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

The following shows the parts and tools necessary for the X-axis harmonic drive replacement work.

#### 3.1.1 Preparation

##### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Harmonic drive	KBP-M2510-00		1	
2	O-ring	KN4-M2143-00	S90(JIS)	1	May deteriorate and must be replaced
3	O-ring	90990-17J030	Cross section diameter: 1.78mm Inside diameter: 66.4mm	1	May deteriorate and must be replaced
4	O-ring	KN5-M257L-00	Cross section diameter: 1.30mm Inside diameter: 66.5mm	1	Attached to harmonic drive
5	Harmonic drive mounting bolt	91312-04040	M4 × 40	10	Must be replaced
6	Harmonic drive mounting bolt	91312-04030	M4 × 30	2	Must be replaced
7	Harmonic drive mounting bolt	91312-04020	M4 × 20	16	Must be replaced
8	Harmonic drive mounting bolt	91312-03022	M4 × 22	4	Must be replaced
9	Motor holder fixing bolt	91312-05025	M5 × 25	8	Must be replaced
10	Washer	92902-03200	M3	4	Must be replaced
11	Washer	92902-04600	M4	26	Must be replaced
12	Harmonic drive mounting bolt	91312-03008	M3 × 8	4	

## 2. Tools(Torque wrench, etc.)



### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N230QLK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 15.2Nm (156kgfcm)
	Changeable head	3KH5L	KANON (Nakamura Mfg. Co., Ltd.)	Mounting 9.53mm, total length 100mm, Hexagonal width across flat at tip: 5mm
B	Torque screwdriver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	Tightening torque for M4 hexagon socket head bolt, 4.0Nm (41kgfcm)
	Drive bit	3C3007	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 70mm Hexagonal width across flat at tip: 3mm
C	Torque screwdriver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 set screw Tightening torque: 1.7Nm (17kgfcm)
	Drive bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 100mm Hexagonal width across flat at tip: 2mm
D	Torque wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 9.0Nm (9.2kgfcm)
	Replacement head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Insert M5 hexagon socket wrench (without ball tip) 110mm
E	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 1.8Nm (18kgfcm)
	Drive bit	B35 2.5 × 75	Vessel Co., Inc.	Mounting hexagon width across flats 6.35mm, total length 75mm, hexagon width across flats 2.5mm

\* Use a commercially available torque wrench to tighten bolts other than those shown above.

## 3. Other tools

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
Screw thread locking agent	Loctite 262	Henkel	High strength type (red)

\*1: 27g

### 3.1.2 Removal

Follow the steps below to remove the X-axis parts.

#### Step1 Turn off the controller.

#### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

#### Step3 Enter the safety enclosure.

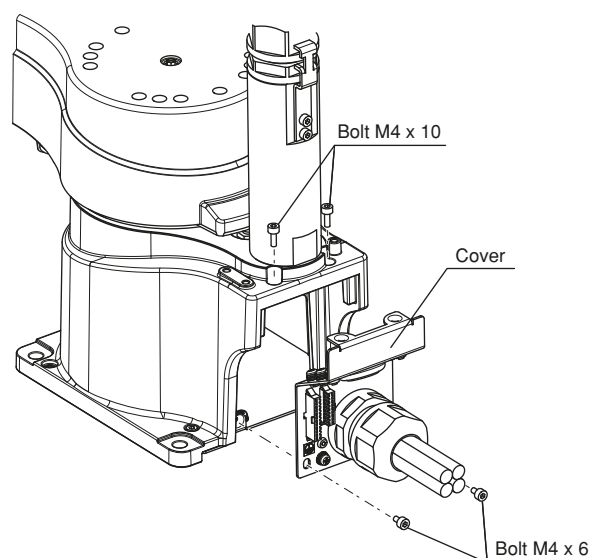


### CAUTION

In the following steps, when removing the robot body, perform the work with great care since it is very heavy.

#### Step4 Remove the base cover.

#### Step 4-5 Remove the base cover



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**Step5** *Disconnect the connectors of the X-axis motor power wire XM and resolver wire XP in the base, and the round terminal of the X-axis motor.*

*Refer to Chapter 6 "Replacing the machine harness".*

**Step6** *Remove the X-axis motor.*

*Place the X-axis arm where it does not apply any force to the harness and does not interfere with the work.*

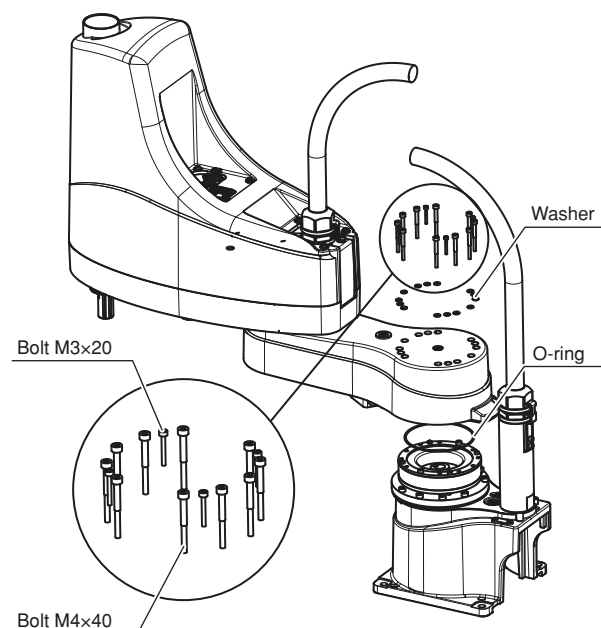


**WARNING**

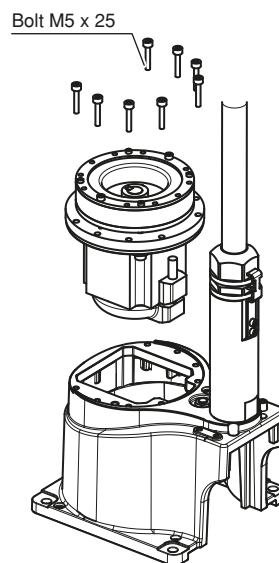
- If the X-axis arm mounting bolts are removed, the X-axis arm may come off. Use caution as the arm may fall.
- Removing the X-axis arm is dangerous for one person. Do it with two or more people, Remove the Y-axis arm in advance.
- To remove the Y-axis arm, see "3.2 Replacing the Y-axis harmonic drive" in this chapter.

53530-FV-00

► **Step 6** Removing the X-axis motor



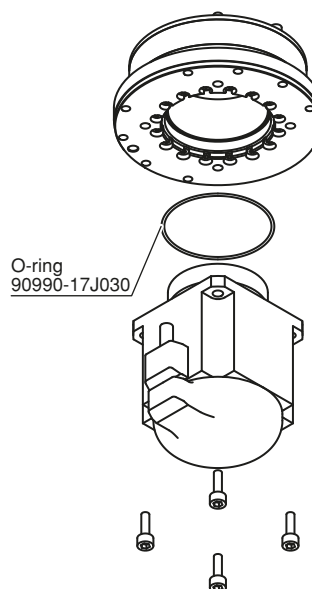
► **Step 7** Motor assembly removal



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**Step8** *Motor removal.*

► **Step 8** Motor removal

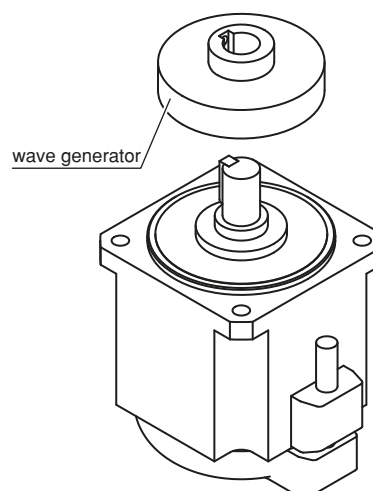


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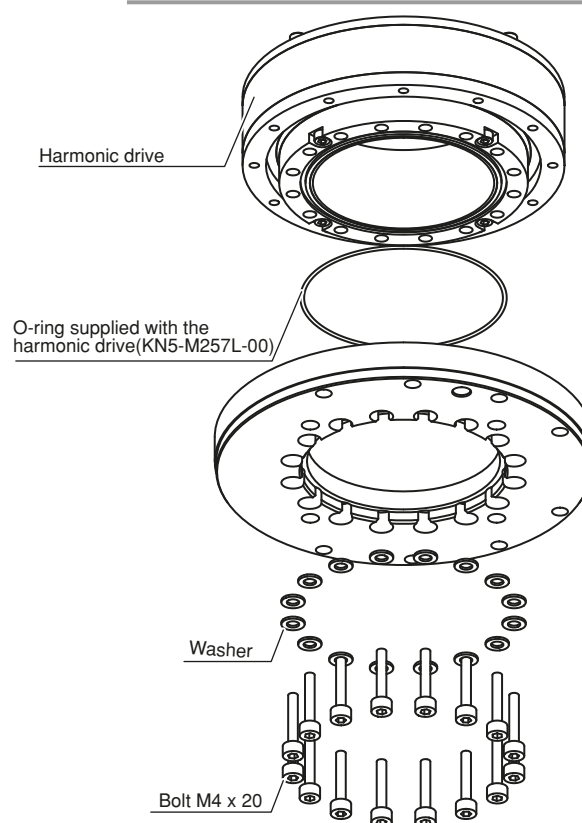
**Step9** *Remove the wave generator.*

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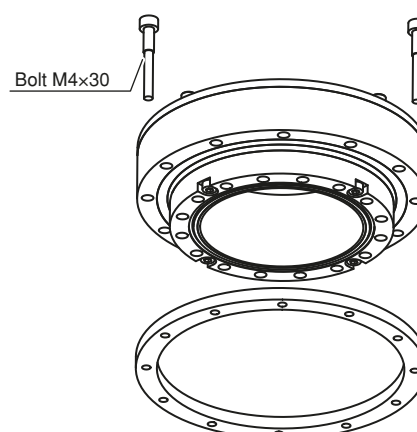
Remove the set screw (1 pc.) that secures the wave generator.

► **Step 9** *Remove the wave generator.***Step10** *Removing the harmonic drive*

53534-FV-00

► **Step 10** *Removing the harmonic drive***Step11** *Removing the ring.*

53535-FV-00

► **Step 11** *Removing the ring*

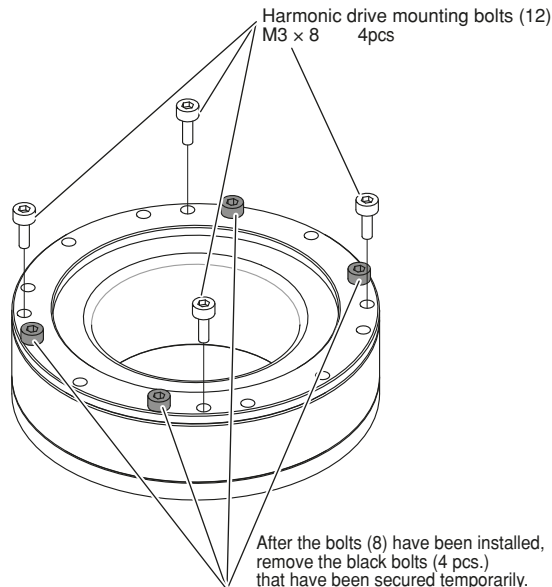
### 3.1.3 Replacement and reassembly

Follow the steps below to replace the harmonic drive with a new one and reassemble it.

#### Step 1 Perform the work shown below before reassembling the harmonic drive.

1. Install the bolts on the harmonic drive.
2. Remove the bolts that have been assembled and secured temporarily.

##### Step 1 Preparations before assembling the harmonic drive



53512-FK-00



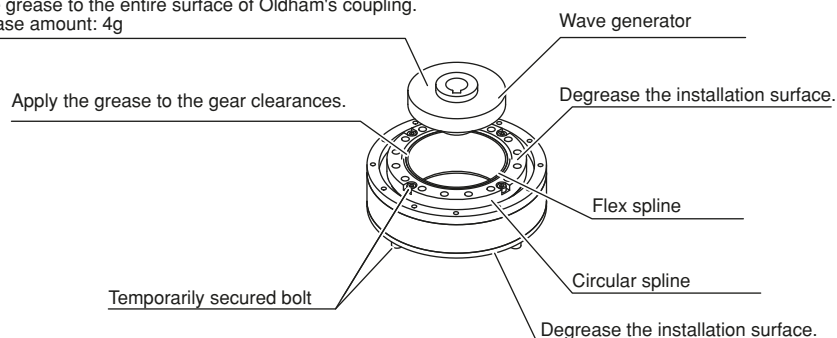
#### CAUTION

Do not remove the bolts that have been secured temporarily before installing new bolts. Doing so may cause a misalignment.

3. Apply the harmonic grease to a new wave generator. For details about how to apply the grease, see the Fig. below.  
Degrease the top and bottom installation surfaces of the harmonic drive.

##### Step 1 Applying the harmonic grease

Fill ball spaces with the grease sufficiently.  
Apply the grease to the entire surface of Oldham's coupling.  
Total grease amount: 4g



53536-FK-00

4. Remove the old grease and worn-out particles from the installation surfaces of the harmonic drive completely.



#### CAUTION

- If foreign matter is caught in during reassembly work, this may cause the noise from the harmonic drive or the harmonic drive to break.
- Never remove the temporarily secured bolts. Doing so may cause a misalignment.

**Step2** *Secure a new harmonic drive to the X-axis arm.*

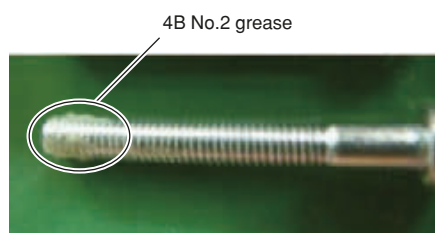
1. Degrease the harmonic drive installation surface of the X-axis arm.  
Do not apply the grease to the seating part.
2. Fit the O-ring coated with the new harmonic grease into the O-ring groove of the X-axis arm. Since the grease application to the O-ring is intended to prevent the O-ring from coming off, it is accepted to apply a small amount of the grease.

**CAUTION**

Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.

3. Secure the new harmonic drive to the X-axis arm with new bolts.  
Apply harmonic grease 4B No.2 to the tip of each bolt so that the roots of at least the first four threads are filled with grease.

53508-FH-00

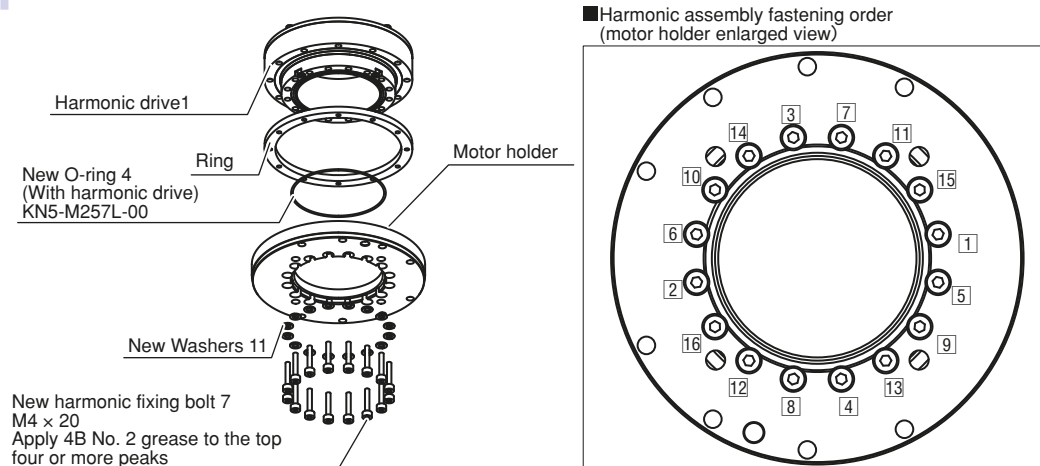
► **Step 2, 5** Applying the grease to the mounting bolt**NOTE**

When performing the return-to-origin by means of the stroke end method, make the positioning of the harmonic drive and secure it with the old bolts. After that, replace the old bolts with new ones to secure the harmonic drive firmly.

For details, see "1. Adjusting the machine reference value" in Chapter 4.

**Step3** *Tighten the bolts in the order shown below.*

1. Using the wrench, tighten the bolts and pan head bolts manually in the order indicated by circled numbers.
2. Using the torque screwdriver, tighten the bolts and pan head bolts to approximately 50% of the specified torque in the order indicated by circled numbers.
3. Tighten the bolts and pan head bolts to the specified torque in the order indicated by circled numbers.
4. Finally, check that the bolts and pan head bolts are tightened to the specified torque.

**Step 2, 3** Installing the harmonic drive

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## Step4 Install the wave generator.

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### CAUTION

Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.

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## Step5 Secure the wave generator.

1. Push the wave generator through the motor shaft until it hits the step.
2. Fix with one set screw.  
At this time, apply a small amount of screw lock to the set screw.

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3. Apply harmonic grease between the wave generator and the motor as shown in the figure on the right (application of harmonic grease).



### CAUTION

- If the wave generator is too tight to press into the motor shaft when pressed with your finger, do not force the key or motor shaft into place, but rub the key or motor shaft with sandpaper so that it can be inserted without difficulty.
- Apply a specified amount of harmonic grease (total specified amount: 24g) to each part of the harmonic drive. Be aware that if it is too small, the life of the drive section may decrease, and if it is too large, grease may leak.

## Step6 X Install the shaft motor.

1. Be careful not to attach grease to the motor holder.
2. Use tool A to evenly tighten the four bolts. At this time, re-assemble the product if there is "prying" or abnormal feeling.

53541-FV-00

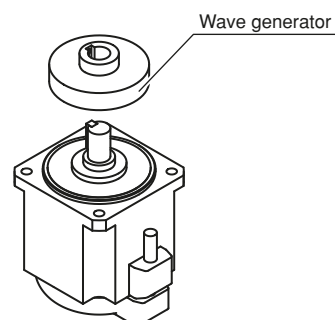
## Step7 Apply grease to the motor unit.

Flatly apply harmonic grease to the flex spline.

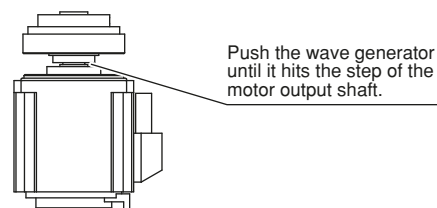
Make sure that the grease is below the flex spline surface.

53542-FV-00

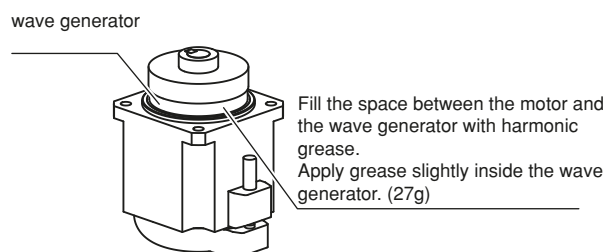
## Step 4 Install the wave generator



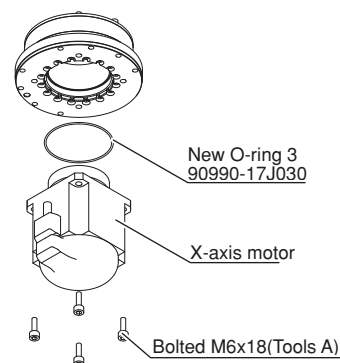
## Step 5 X motor position



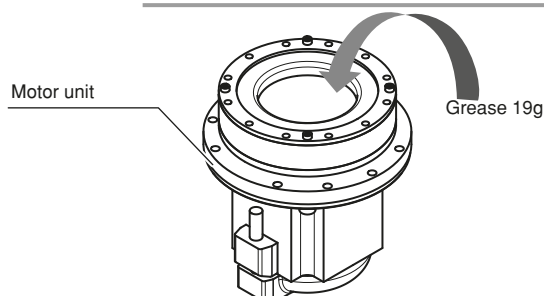
## Step 5 Applying motor grease



## Step 6 Installing the X-axis Motor



## Step 7 Applying grease



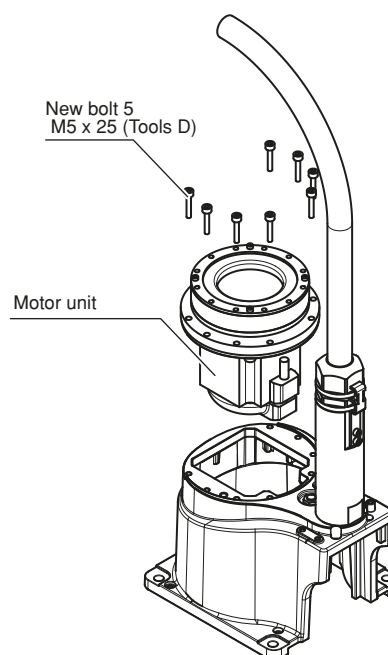


**Step8** *Fix the motor unit to the base.*

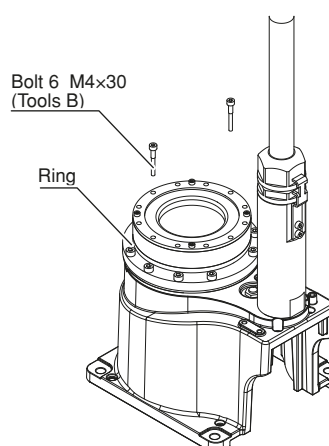
Use new fixing bolts. Apply 4BNo. 2 grease to at least 4 threads at the end.

Degrease the mating surfaces of the motor holder and base.

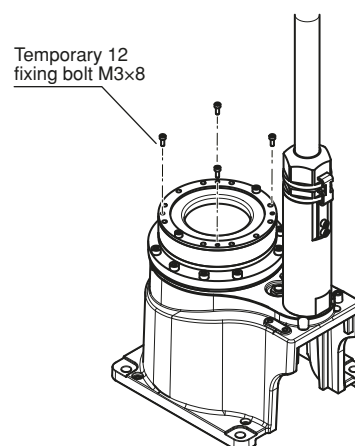
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**Step 8** Motor Unit Mounting**Step9** *Secure the ring.*

53544-FV-00

**Step 9** Fixing the ring**Step10** *Removal of temporary fixing bolt*

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**Step 10** Removal of temporary fixing bolt

## Step 11 Secure q X shaft arm and harmonic drive.

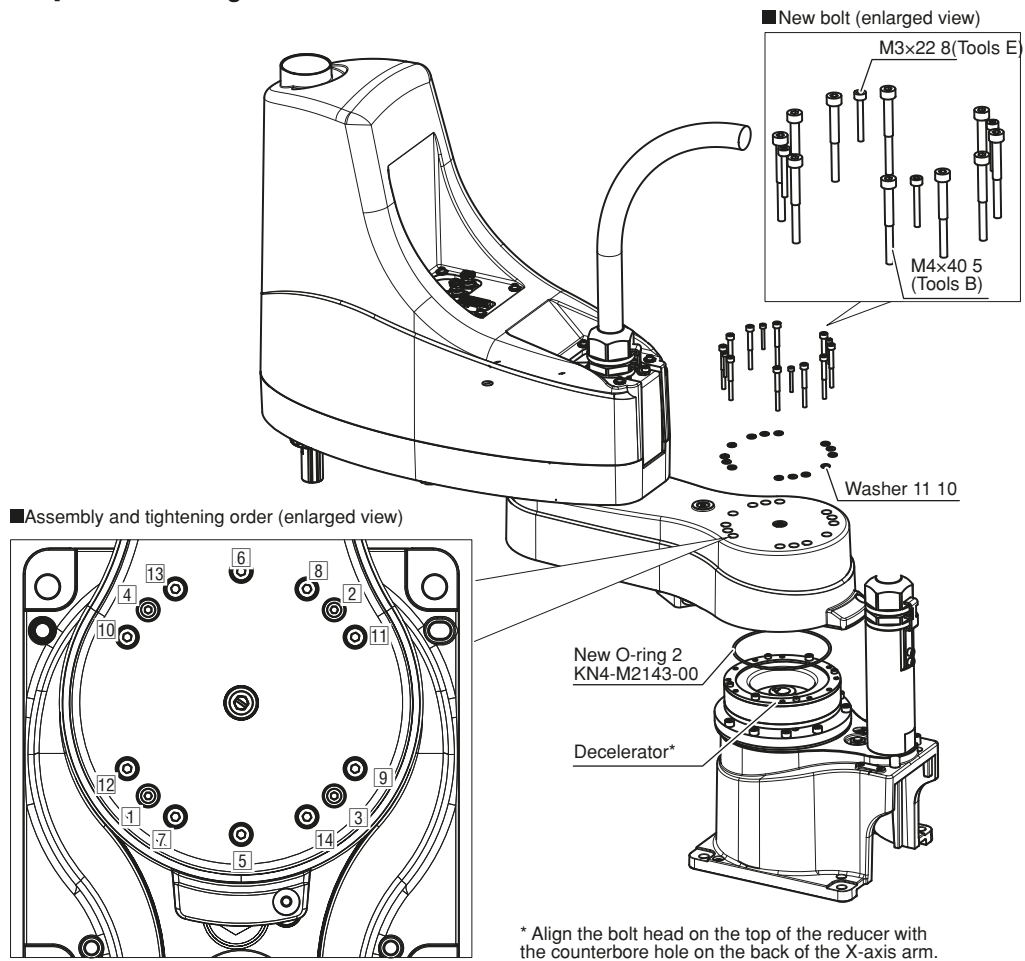
X Secure the axis arm and harmonic drive.

Use new fixing bolts. Apply 4BNo. 2 grease to at least 4 threads at the end.

### ***Tighten the bolts in the following tightening order.***

1. Tighten all parts by hand using a wrench in the order of assembly tightening shown in the figure below.
2. Tighten them all at about 50% of the specified torque by the torque driver in the order shown below.
3. The torque is increased in the order shown in the figure below in order with the specified torque.
4. Finally, check the torque for one full rotation.

## Step 11 Attaching

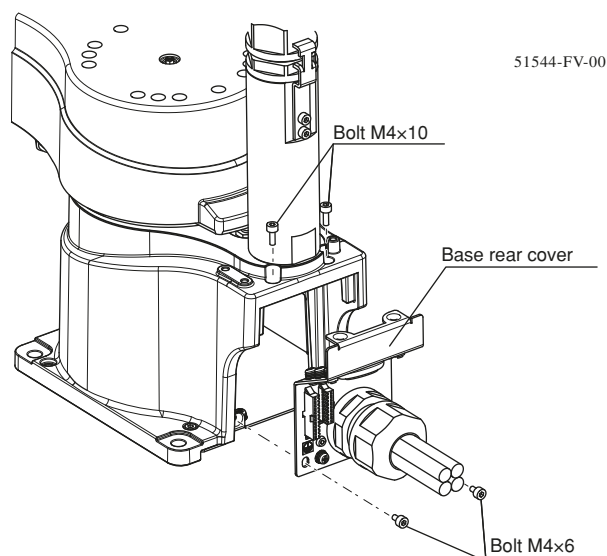


### CAUTION

- To prevent moment load from being applied to the harmonic drive, work with the X-axis and Y-axis arms horizontal by two people. One person is an X-axis arm, Y Hold the shaft arm and attach the X-axis arm by another person.
- Tightening the bolts while a moment load is applied to the harmonic drive may cause damage. Make sure that the moment load is not applied.

## Step 12 Replace the base cover.

## Step 12 Replacing Base Back Covers



### 3.1.4 Aging

**Step 1** Go out of the safety enclosure.

**Step 2** Turn on the controller.

Check that no one is inside the safety enclosure, and then turn on the controller.



#### CAUTION

After the harmonic drive has been replaced, it is necessary to perform the return-to-origin and set the standard coordinates and point data again. Make the adjustments while referring to Chapter 3 "Adjusting the robot" in the Installation Manual.

**Step 3** Perform the aging.

Perform the aging for 30 minutes at 5% speed and for another 30 minutes at 20% speed by rotating the X-axis arm as much as possible (at least 10°).

## 3.2 Replacing the Y-axis harmonic drive



### WARNING

Before starting the work, thoroughly read “1. Attaching, detaching, and replacing the cover” in Chapter 2.

The following shows the parts and tools necessary for the Y-axis harmonic drive replacement work.

### 3.2.1 Preparation

#### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Harmonic drive	KDS-M2110-00		1	
2	O-ring(Supplied with the harmonic drive.)	KN3-M2144-00	Cross section diameter: 0.99mm Inside diameter: 53.28mm	1	May deteriorate and must be replaced.
3	O-ring	KN3-M2143-00	Cross section diameter: 1.5mm Inside diameter:49.0mm	1	May deteriorate and must be replaced.
4	O-ring	KN4-M257K-00	Cross section diameter: 1.78mm Inside diameter:72.75mm	1	May deteriorate and must be replaced.
5	Washer	92902-03600	M3	16	
6	Washer	92902-32000	M3	12	
7	Harmonic drive mounting bolt	91312-03020	M3 × 20	16	
8	Harmonic drive mounting bolt	91312-03030	M3 × 30	12	
9	Harmonic drive mounting bolt	91312-03008	M3 × 8	8	

#### 2. Tools(Torque wrench, etc.)



### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque Wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M5 hex socket head bolt Tightening torque: 7.4Nm (76kgfcm)
	Replacement head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Insert M5 hexagon socket wrench (without end ball) 110mm
B	Torque screwdriver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 hex socket head bolt Tightening torque: 1.8Nm (18kgfcm)
	Drive bit	B35, opposite side 2.5×75	Vessel Co., Inc.	Attachment hexagonal width across flat: 6.35mm Overall length: 75mm Hexagonal width across flat at tip: 2.5mm
C	Torque screwdriver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	For M3 set screw Tightening torque: 0.7Nm (7kgfcm)
	Drive bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Attachment hexagonal width across flat: 6.35mm Overall length: 70mm Hexagonal width across flat at tip: 1.5mm

\* Use a commercially available torque wrench to tighten bolts other than those shown above.

#### 3. Other tools

Name	Part No.	Manufacturer	Remarks
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.
Cleaning wipe			
Phillips screwdriver			
Hex wrench set			
Screw thread locking agent	Loctite 262	Henkel	High strength type (red)

\*1: 27g

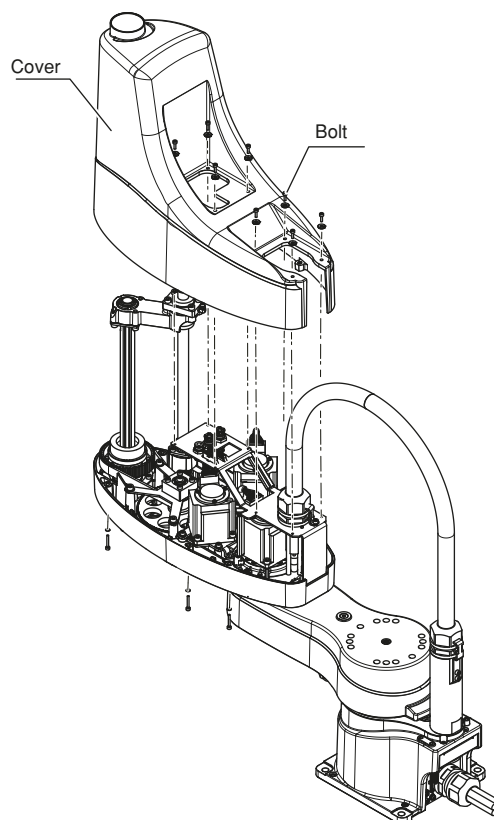
### 3.2.2 Removal

Follow the steps below to remove the Y-axis parts.

- Step1** *Turn off the controller.*
- Step2** *Place a sign indicating the robot is being adjusted.*  
Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.
- Step3** *Enter the safety enclosure.*
- Step4** *Remove the cover.*

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#### ► Step 4 Removing the cover



#### Step5 Remove the harness cover.

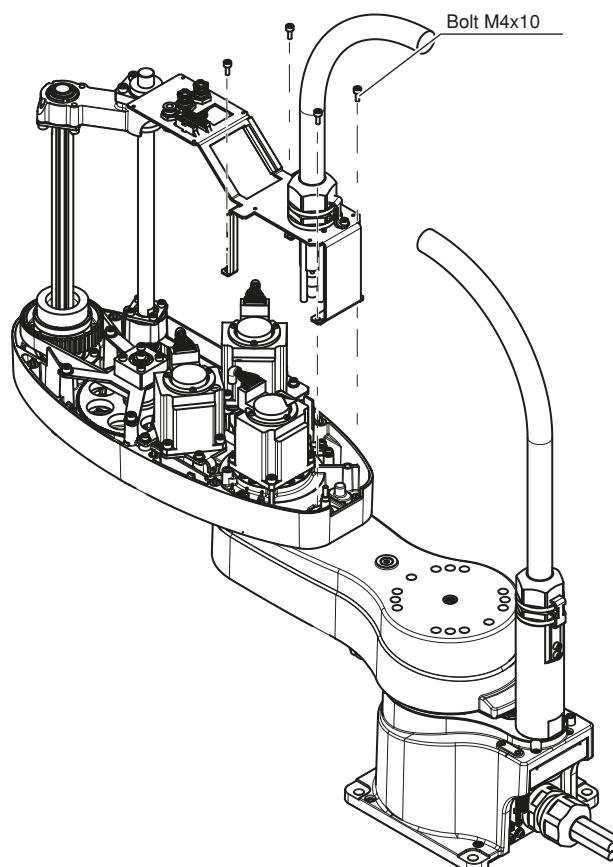
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#### NOTE

- Place the removed harness in a place where the harness will not be stressed and will not interfere with work.
- Since the harness is connected to the wiring inside the base, if it interferes with the work, remove the Y-axis, Z-axis, R-axis motor power wires, resolver wires YP, ZP, RP connectors, brake wires, and grounding round terminals, please.

#### ► Step 5 Remove the harness cover



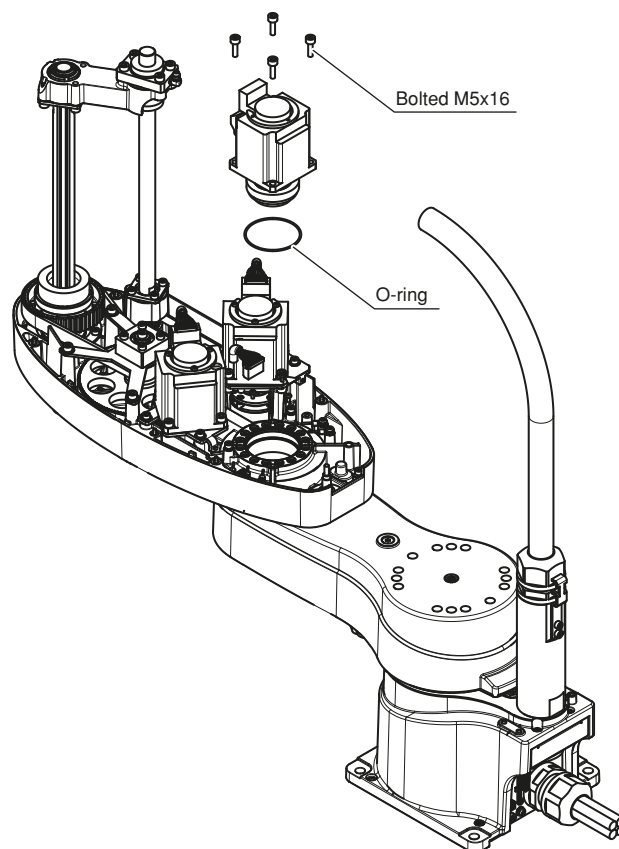
## Step6 Y Remove the shaft motor wiring.

Y Remove the shaft motor wiring.

53620-FV-00

## Step7 Remove the motor.

## Step 6 Y motor removal



## Step8 Y Remove the shaft arm.

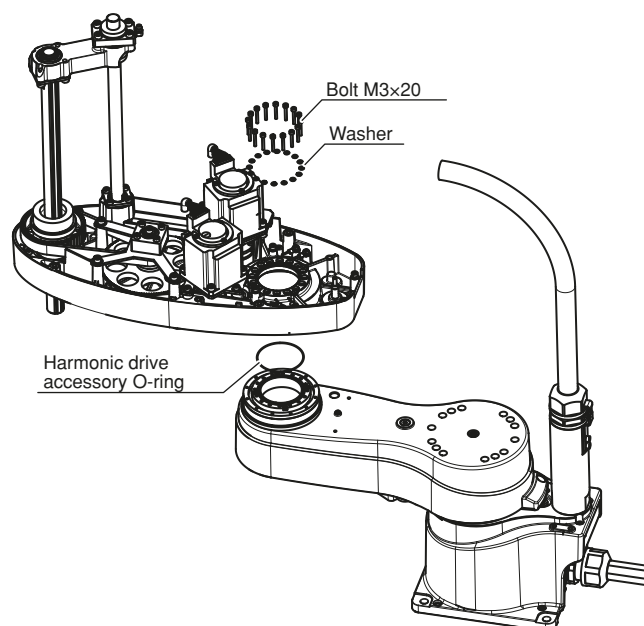
53549-FV-00



### CAUTION

Y Removing the shaft arm mounting bolts may cause the Y-axis arm to come off. Be careful not to drop the arm.

## Step 8 Y motor removal

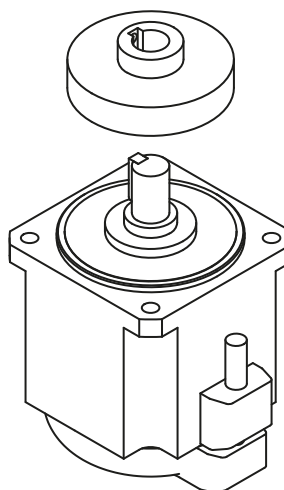


### Step9 Remove the wave generator from the motor shaft.

Remove the set screw that secures the wave generator.

53559-FV-00

### ▶ Step 9 Removing the Wave Generator



### Step10 Remove the Y-axis harmonic drive from the top surface of the X-axis arm.

1. Y Remove the shaft harmonic drive mounting bolts.
2. O Remove the ring.

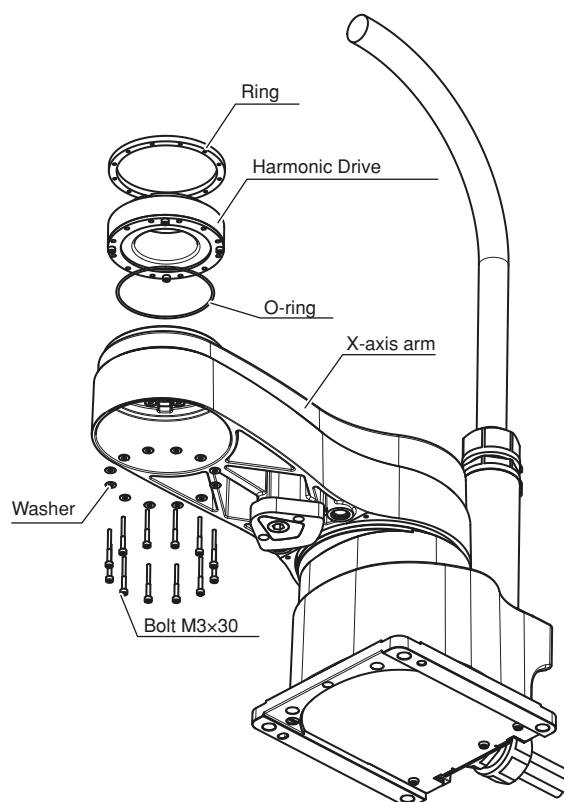
53550-FV-00



#### NOTE

Y Replace the O-ring of the shaft harmonic drive with a new one later.

### ▶ Step 10 Removing the Wave Generator



### 3.2.3 Replacement and reassembly

Prepare 40g of harmonic grease 4BNo. 2 and replace it with a new harmonic drive by following the procedures below.

#### Step1 *Perform the work shown below before reassembling the harmonic drive.*

1. Install the bolts on the harmonic drive.

53551-FV-01

2. Remove the pre assembled temporary fixing bolts.



#### CAUTION

**Do not remove the temporary fixing bolt before installing the new bolt. Misalignment occurs.**

3. Apply harmonic grease 4BNo. 2 to the wave generator of the new harmonic drive.
4. Remove old grease, wear dust, etc. from the motor, X-axis arm, and Y-axis arm.



#### CAUTION

**In Harmonic Drive, foreign objects may be caught during assembly, which may cause abnormal noise and damage.**

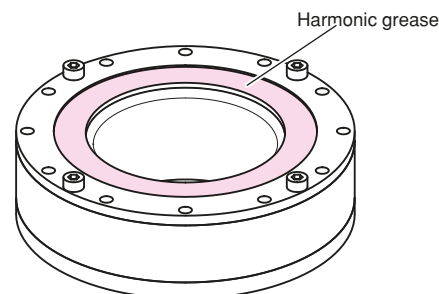
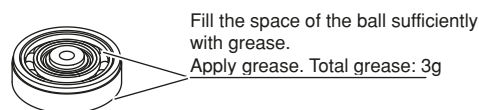
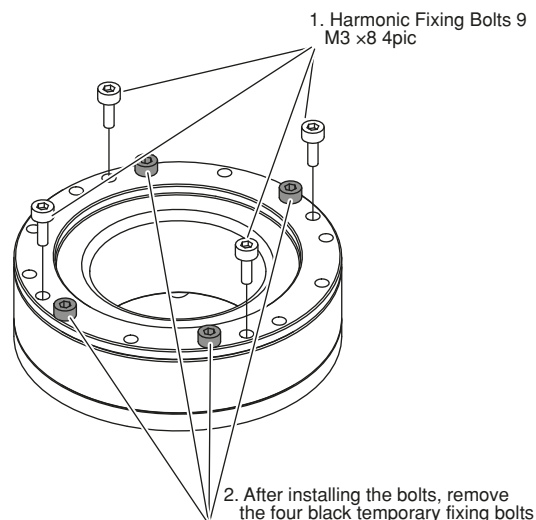
5. Apply grease to the gaps in the gears of the Harmonic Drive.



#### CAUTION

**Be aware that if it is too small, the life of the drive section may be shortened, and if it is too large, grease may leak.**

#### Step 1 Preparing to Install Harmonic Drives



Apply grease to the flexible spline steps.  
Apply grease slightly below the bolt fastening surface.



## Step2 Secure the new harmonic drive to the X-axis arm.

1. X Degrease the mounting surface of the harmonic drive on the shaft arm.  
Do not apply grease to the seating surface.
2. X Attach a new O-ring 3 to the O-ring groove on the shaft arm.

53623-FV-00



### CAUTION

- Be careful not to bite the O-ring through the groove. If the product is used while it is caught, failure may result.
- Never remove the temporary fixing bolts. Misalignment occurs.

3. Place the new harmonic drive on the X-axis arm and secure it with the new bolts. For the fixing bolts, apply 4B No. 2 grease to the troughs with four or more crests at the end and fill the entire circumference.  
Grease is applied to stabilize bolt axial force.



### NOTE

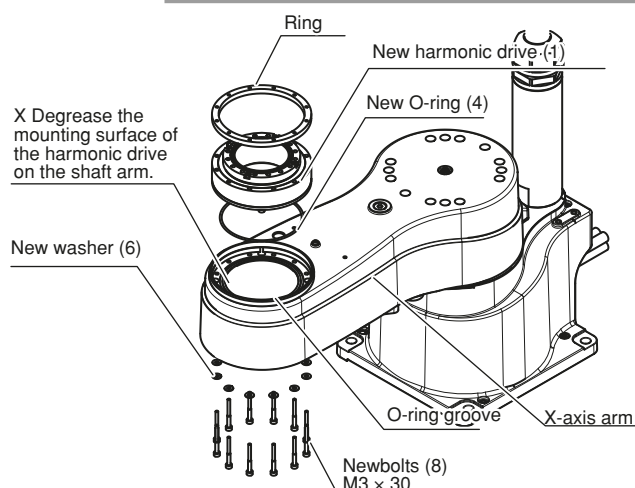
If the origin return is the abutting method, use the old bolt to perform positioning, and then use the new bolt.  
For details, see "1. Adjusting the machine reference value" in Chapter 4.

## Step3 Assemble the bolts using the following tightening procedures.

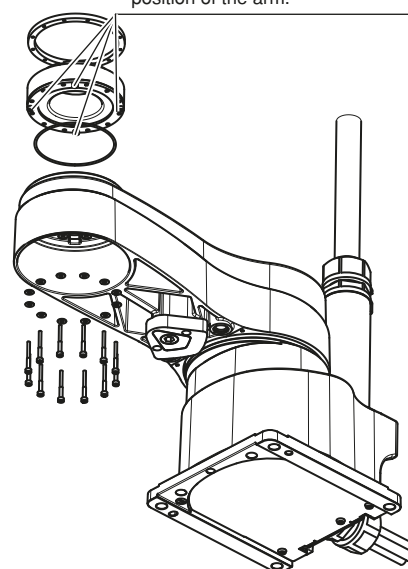
1. In the order shown in the figure on the right, tighten all parts by hand using a wrench.
2. In the order shown in the figure on the right, tighten them all at about 50% of the specified torque by the torque driver.
3. Torque up with the specified torque sequentially in the order shown in the figure on the right.
4. Finally, check the torque for one full rotation.

53625-FV-00

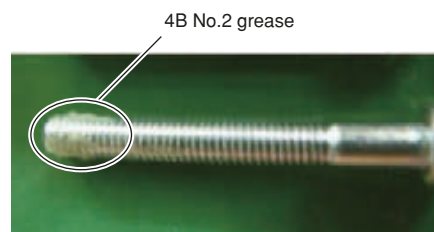
## Step 2 Installing the harmonic drive



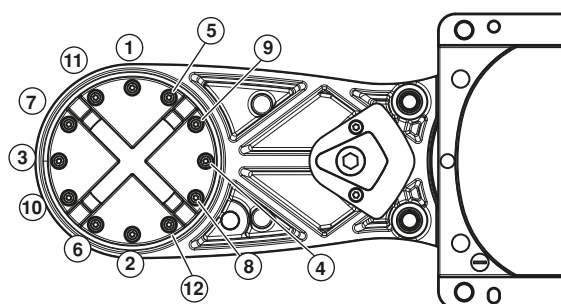
Never remove this temporarily secured bolt. Make the bolt matched with the spot facing position of the arm.



## Step 2, 7 Applying the grease to the mounting bolt



## Step 3 Tightening instructions for bolts



## Step4 Apply the remaining grease to the inside of the harmonic unit.

Y On the shaft, apply grease so that it is flat.

53626-FV-00

## Step5 Install the new harmonic drive attached O-ring.

1. Degrease the installation surface on the top surface of the harmonic drive.
2. Fit the O-ring supplied with the new harmonic drive into the O-ring groove of the harmonic drive.  
If it is difficult to fit the O-ring into the groove, slightly stretch the O-ring. It is accepted to apply a small amount of the harmonic drive grease to the O-ring in order to prevent the O-ring from coming off from the groove.



### CAUTION

Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.

## Step6 Secure the Y-axis arm to the harmonic drive.

1. Degrease the Y-axis arm side where the harmonic drive is attached.
2. Apply 4BNo. 2 grease to a trough of 4 or more tips of new fixing bolts and fill the entire circumference.

53627-FV-01

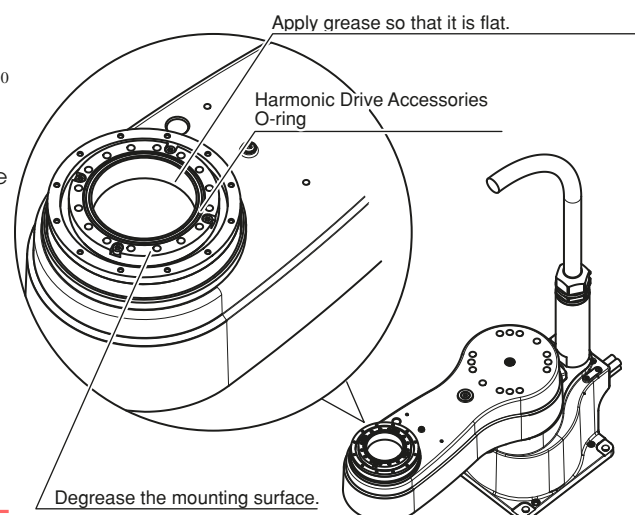


### CAUTION

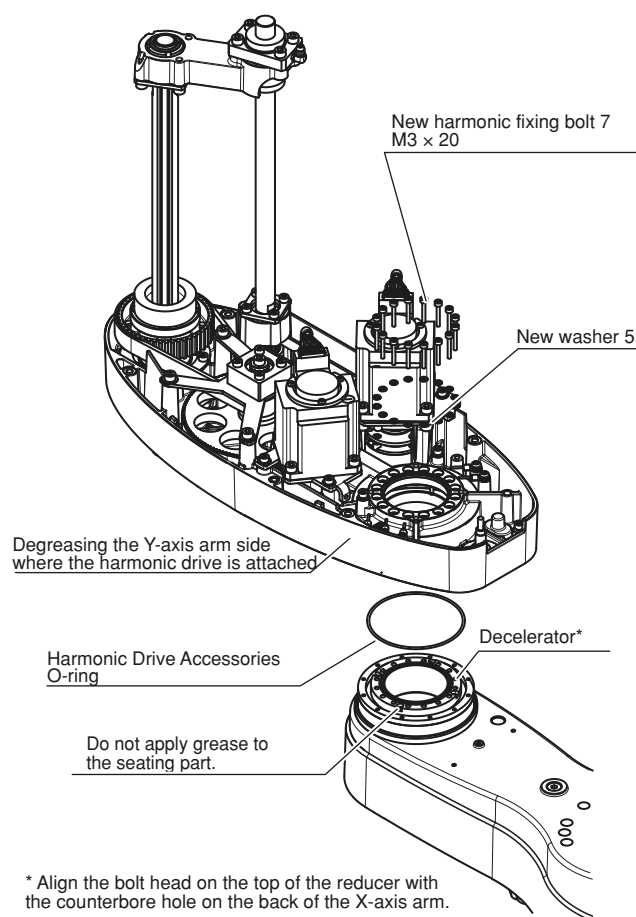
Tightening the bolts while a moment load is applied to the harmonic drive may cause damage. Perform the work so that the moment load is not applied.

3. Y Attach the shaft arm to the harmonic drive with a new bolt (harmonic fixing bolt (No.6)) for fixing. At this time, make sure that the Y-axis arm is horizontal with two people so that no moment load is applied to the Y-axis harmonic drive. One person should support the tip of the Y-axis arm and the other should attach the Y-axis arm.

## Step 4-5 Applying grease inside the harmonic body



## Step 6 Fixing the Y-axis arm

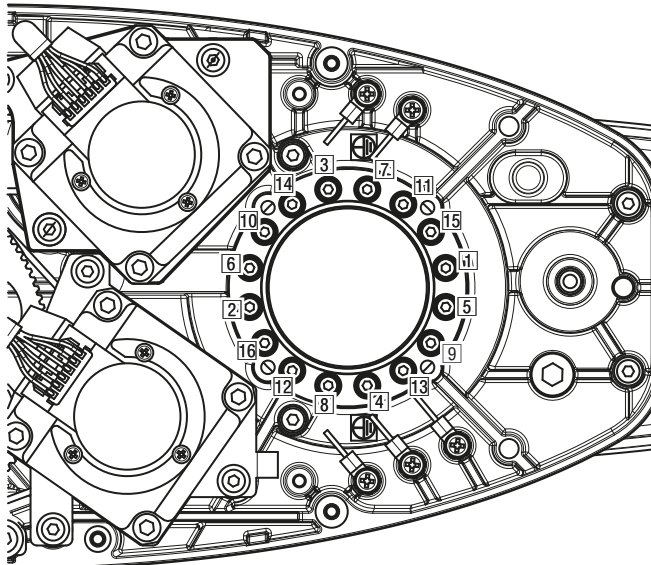


### Step7 Tighten the bolts using the following tightening procedures.

1. Tighten all parts by hand using a wrench in the order of assembling and tightening shown in the figure on the right.
2. In the order shown in the figure on the right, tighten them all at about 50% of the specified torque by the torque driver.
3. In the order shown in the figure on the right, torque up with the specified torque, loosen once, and return 1 to 2 turns (bolts are not removed), and then torque up again.
4. Finally, check the torque for one full rotation.

53556-FV-00

### Step 7 Tightening instructions for bolts

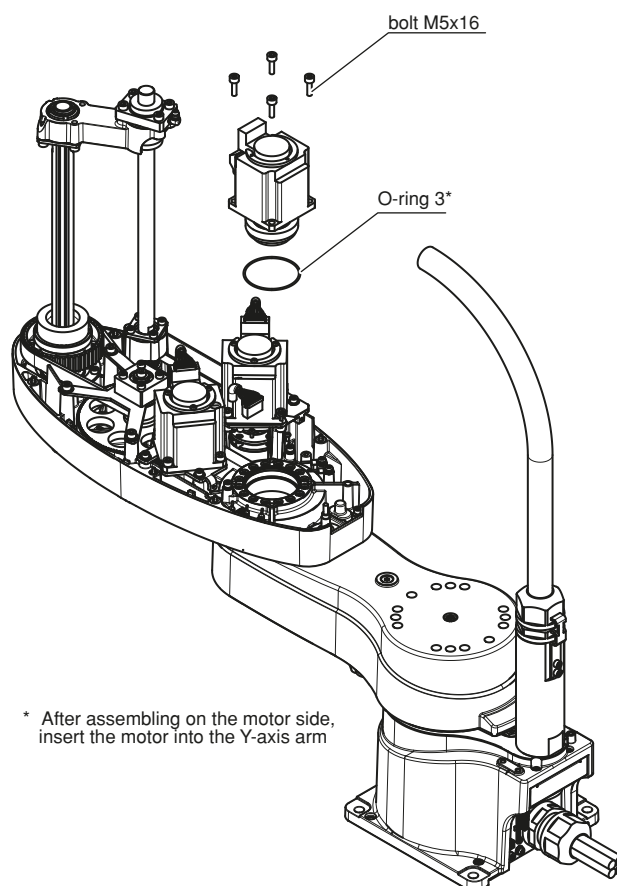


### Step8 Y Install the shaft motor.

1. Y While moving the axis arm manually, push the Y-axis motor into the base. Be careful not to let the grease attach to the arm.
2. Using tool A, tighten the four bolts evenly while moving the Y-axis arm in 45° increments from side to side by hand. At this time, re-assemble the product if there is "prying" or abnormal feeling.

53557-FV-00

### Step 8 Y Install the shaft motor.

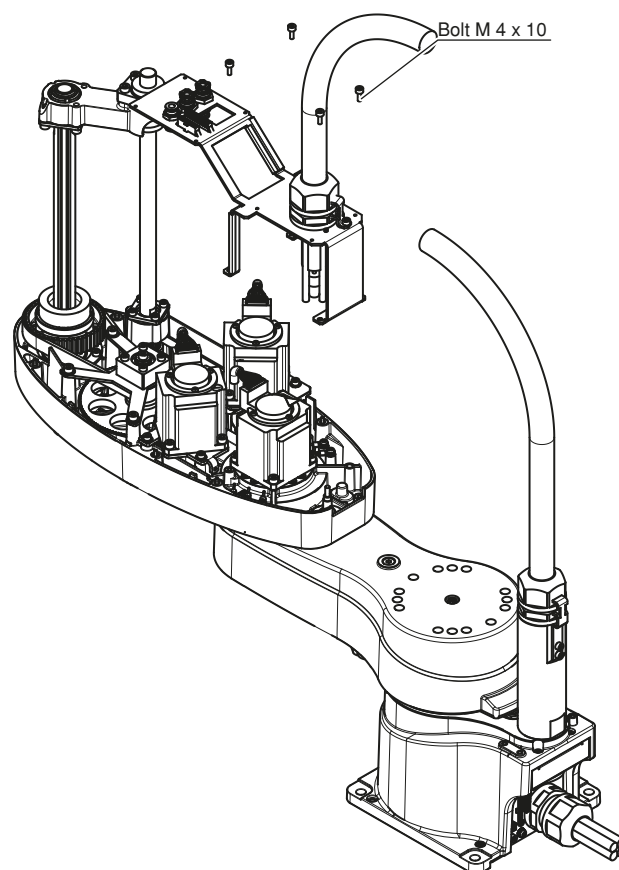


\* After assembling on the motor side, insert the motor into the Y-axis arm

**Step9** *Install the harness cover.*

► **Step 9** **Installing the Harness Cover**

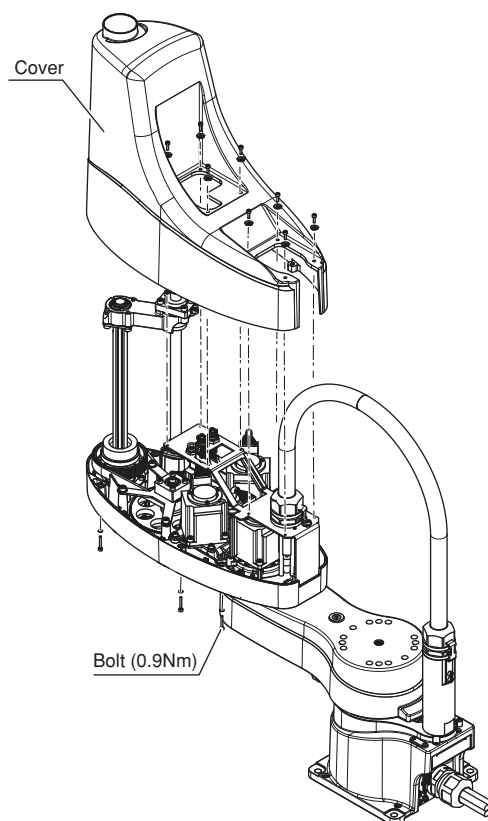
53558-FV-00



**Step10** *Replacing the Cover*

► **Step 10** **Reattaching the cover**

53631-FV-00



### 3.2.4 Aging

---

**Step1** *Go out of the safety enclosure.*

**Step2** *Turn on the controller.*

*Check that no one is inside the safety enclosure, and then turn on the controller.*



**CAUTION**

---

After the harmonic drive has been replaced, it is necessary to perform the return-to-origin and set the standard coordinates and point data again.

---

**Step3** *Perform the aging.*

*Perform the aging for 30 minutes at 5% speed and for another 30 minutes at 20% speed by rotating the Y-axis arm as much as possible (at least 10°).*



## Chapter 6

# Replacing the machine harness

## Contents

1. Replacing the machine harness	R6YXE400	6-1
1.1	Removal	6-2
1.2	Assembly	6-5
2. Replacing the machine harness	R6YXE510 R6YXE610 R6YXE710	6-6
2.1	Removal	6-7
2.2	Assembly	6-13





# 1. Replacing the machine harness **R6YXE400**



## WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.



## CAUTION

- If the bolt tightening torque is not instructed, see the tightening torque stated in "2. Replacement procedure for harmonic drive" "2. Replacement procedure for harmonic drive R6YXE400" in Chapter 5.
- The return-to-origin needs to be performed after replacing the machine harness.

## 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Machine harness	KDS-M4843-01		1	R6YXE400

## 2. Other tools

Name	Part No.	Manufacturer	Remarks
Hex wrench set			
Phillips screwdriver			
Pliers			
Torque wrench			

## 1.1 Removal

Follow the steps below to disconnect the machine harness.

**Step1** Turn off the controller power and air supply.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

**Step4** Remove the connector hood.

53601-FV-00

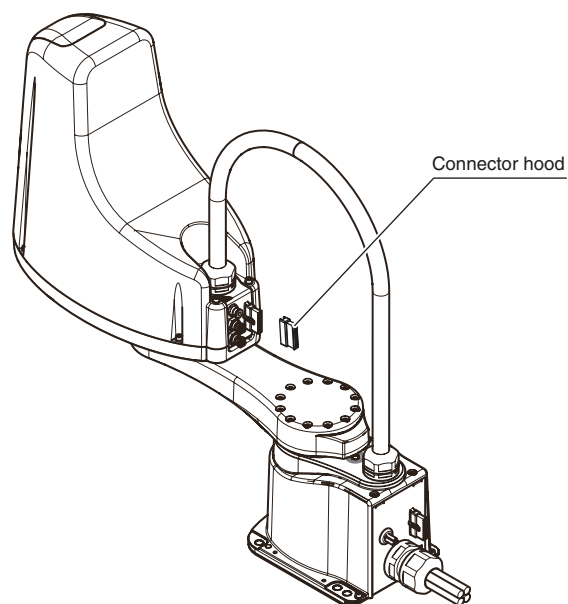
**Step5** Remove the cover.

Remove the bolts, and then remove the cover.

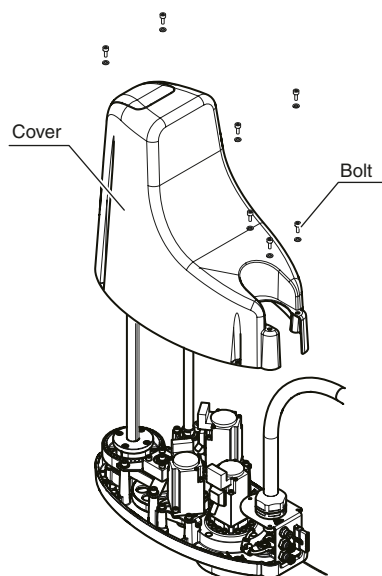
53602-FV-01

**Step6** Disconnect the connector.

### ► Step 4 Removing the connector hood

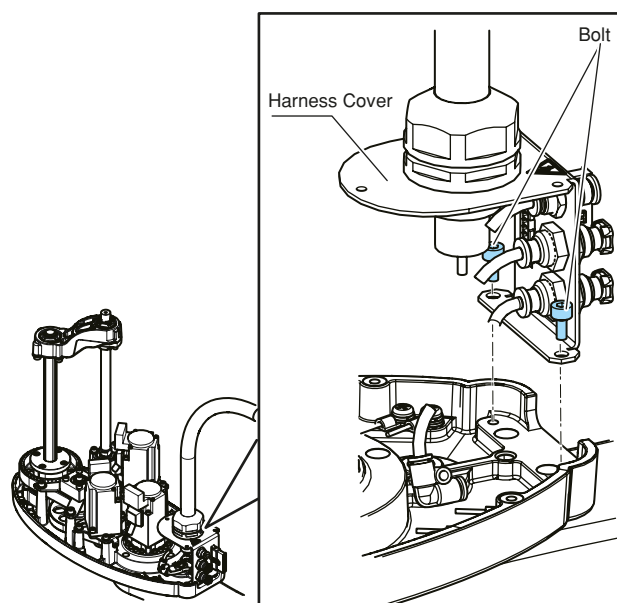


### ► Step 5 Remove the cover



51632-FV-00

### ► Step 6 Remove the harness cover



**Step7** *Disconnect the connector.*

**Step8** *Disconnect the air tube and round terminal.*

*Disconnect the air tube and round terminal (round terminal for the White and yellow/green wire).*

*Be careful not to drop any lock washer or screw.*

**Step9** *Disconnect the wiring connector.*

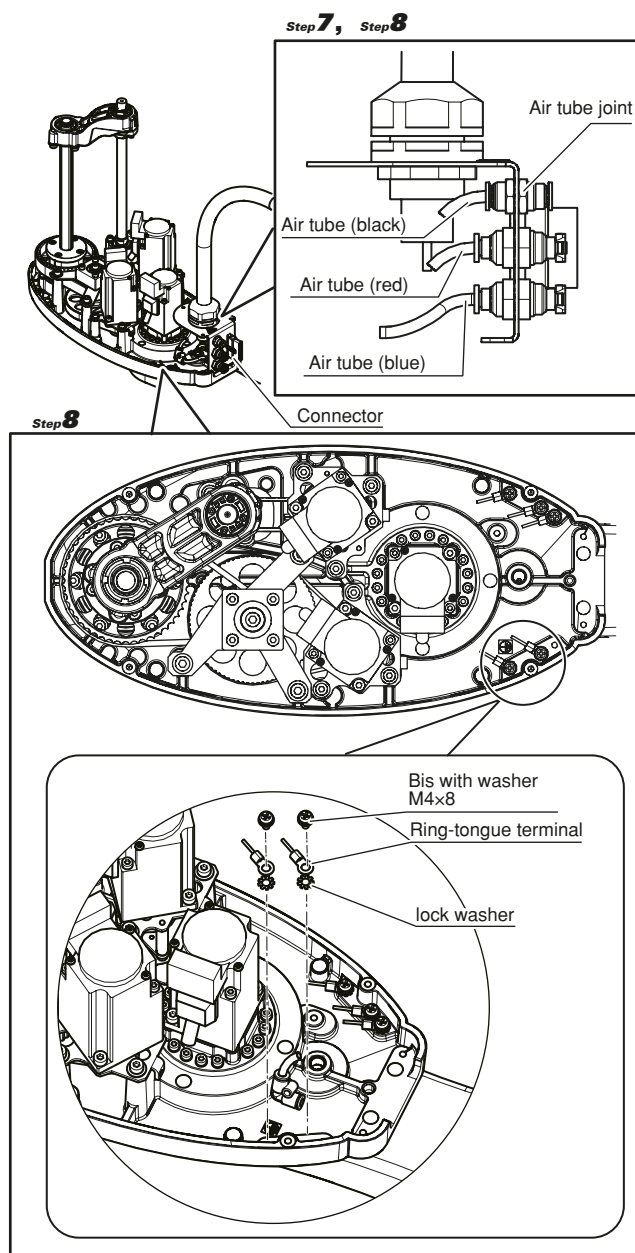
53603-FV-01

**Step10** *Disconnect the machine harness.*

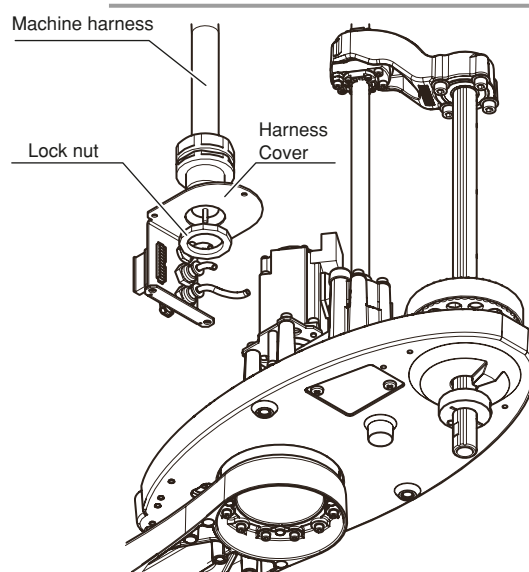
*Remove the lock nut and plate to disconnect the machine harness.*

53604-FV-00

► **Step 7-9 Removal**



► **Step 10 Disconnecting the machine harness**



### Step11 Remove the cover.

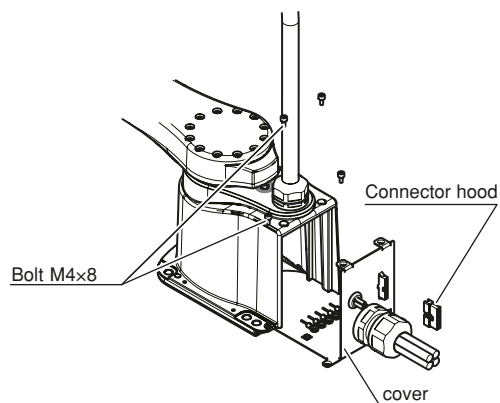
Remove the cover while referring to "1. Attaching, detaching, and replacing the cover" in Chapter 2.

53605-FV-00

### Step12 Remove the connector hood.

53606-FV-00

### ► Step11-12 Removing cover, connector hood



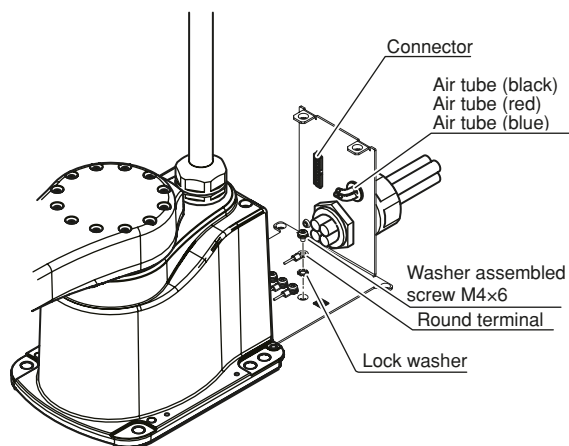
### Step13 Remove the air tubes, connector, and round terminal.

53610-FV-00

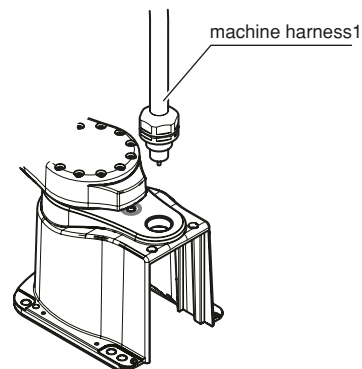
### Step14 Disconnect the machine harness.

53607-FV-00

### ► Step 13 Removal



### ► Step 14 Disconnect the machine harness



## 1.2 Assembly

Assemble a new machine harness in the reverse order of removal.

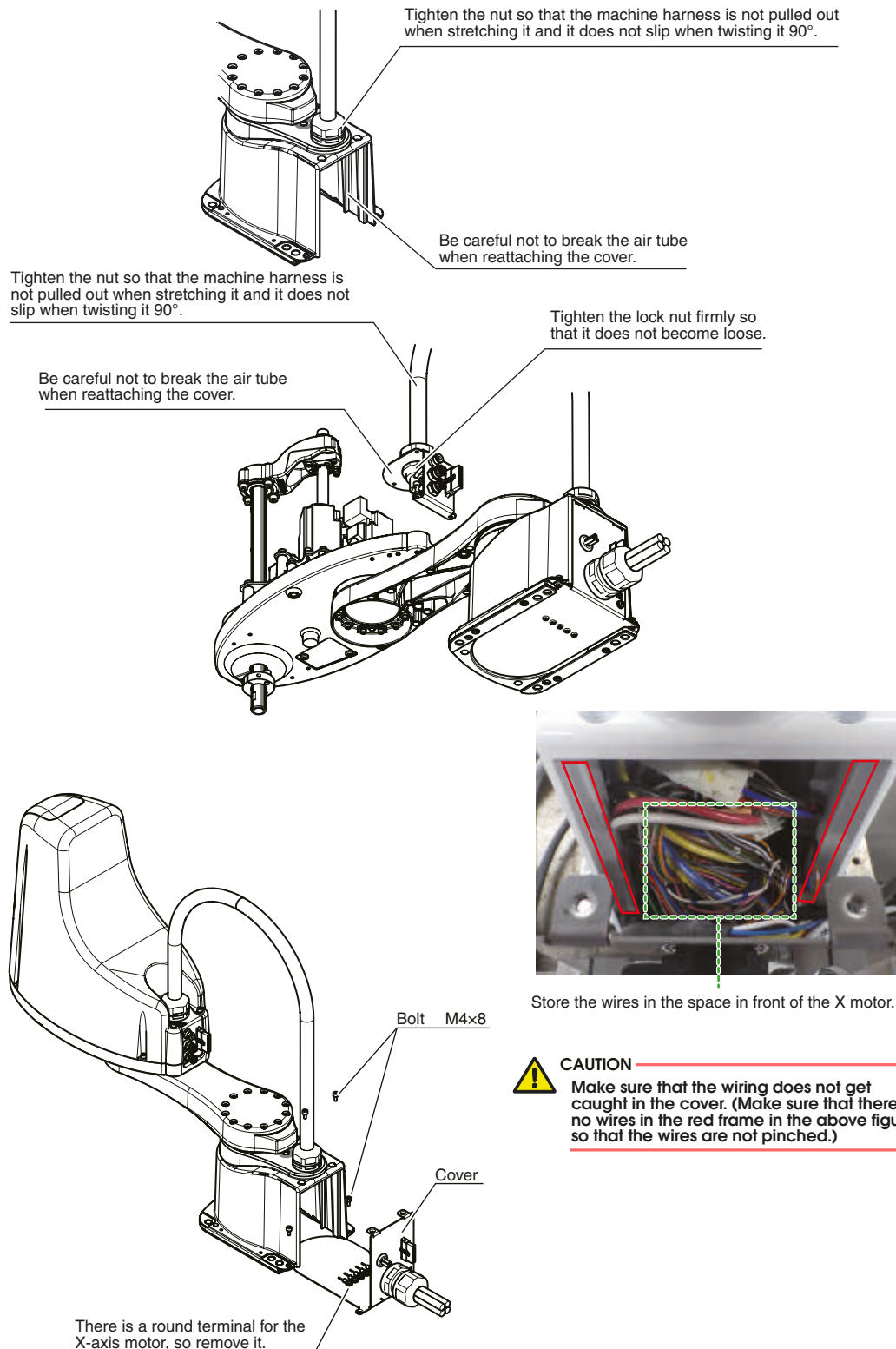
### Step 1 Reconnect the connector, round terminal, and air tubes.



#### NOTE

Refer to the separate document "XE Series Installation Manual" for wiring diagrams.

#### Step 1 Assembly



53608-FV-00

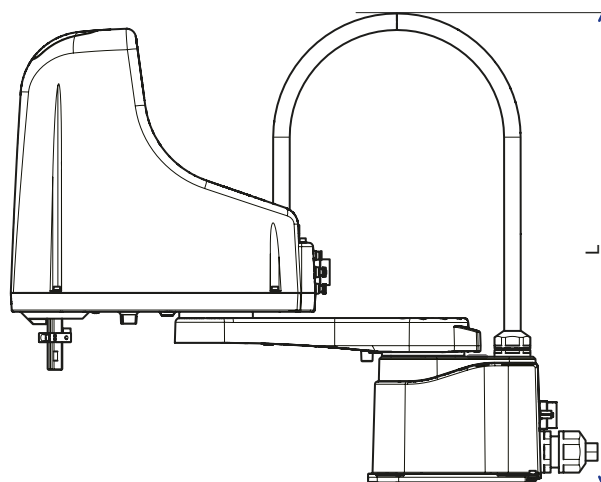
## Step2 Clamp the machine harness on the Y-axis side.

For the machine harness clamp position on the Y-axis side, clamp the machine harness at a specified position while referring to the Fig.

L (mm)
508

53609-FV-00

## Step 2 Clamping



## 2. Replacing the machine harness

**R6YXE510 R6YXE610 R6YXE710**



### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.



### CAUTION

- If the bolt tightening torque is not instructed, see the tightening torque stated in "3. Replacement procedure for harmonic drive R6YXE510 R6YXE610 R6YXE710" in Chapter 5.
- The return-to-origin needs to be performed after replacing the machine harness.

### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Machine harness	KFS-M4844-00		1	R6YXE510
2	Machine harness	KFS-M4843-10		1	R6YXE610
3	Machine harness	KFS-M4843-20		1	R6YXE710

## 2. Other tools

Name	Part No.	Manufacturer	Remarks
Hex wrench set			
Phillips screwdriver			
Pliers			
Torque wrench			

## 2.1 Removal

Follow the steps below to disconnect the machine harness.

### ► Step 4 Remove the cover

**Step1** *Turn off the controller power and air supply.*

**Step2** *Place a sign indicating the robot is being adjusted.*

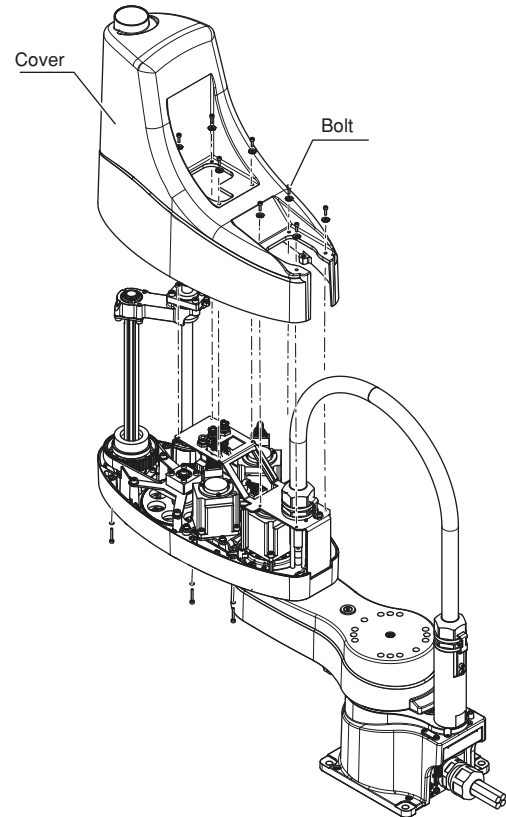
*Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.*

**Step3** *Enter the safety enclosure.*

**Step4** *Remove the cover.*

*Remove the bolts, and then remove the cover.*

53649-FV-00



**Step5** *Disconnect the connector.*

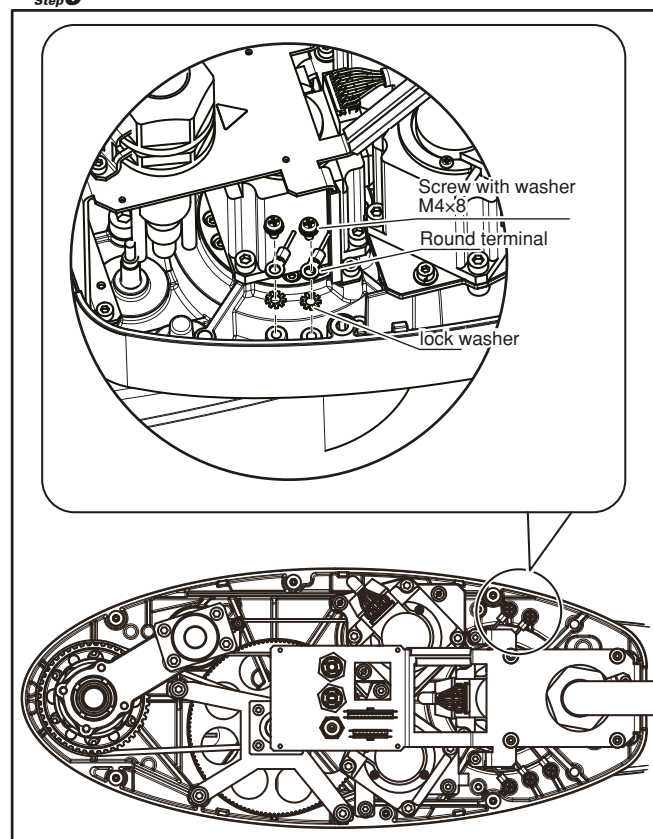
**Step6** *Remove the air tube and round terminal.*

*Remove the air tube and round terminals (white and yellow / green wiring round terminals).*

*Be careful not to drop lock washer, screws, etc.*

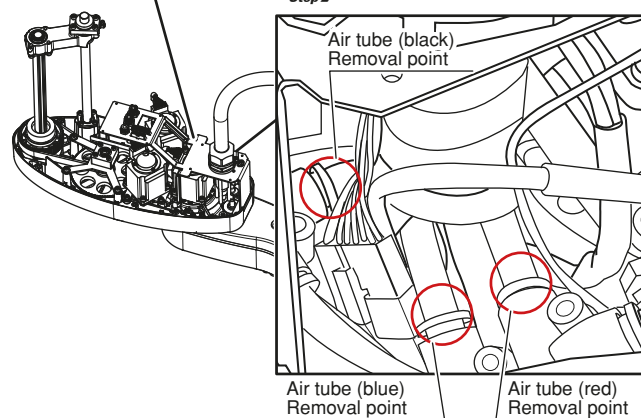
► **Step 6-7** Removal

**Step 6**



53640-FV-01

**Step 7**



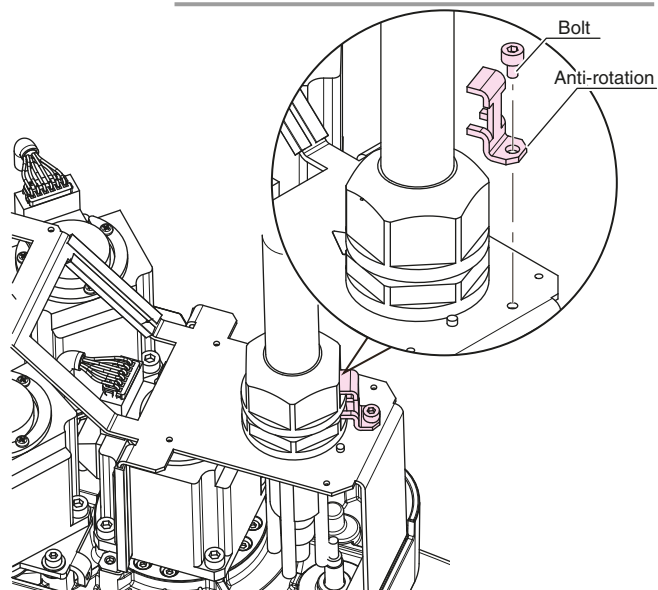


### Step7 Remove the harness detent (anti-rotation).

Remove the bolts and the anti-rotation.

53643-FV-00

#### ► Step 7 Harness detent removal

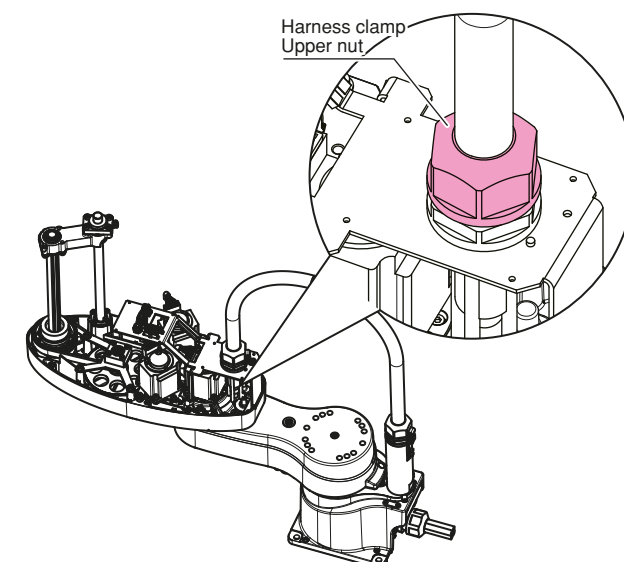


### Step8 Remove the harness detent (anti-rotation).

Remove the bolt and the detent.

53652-FV-00

#### ► Step 8 Removal

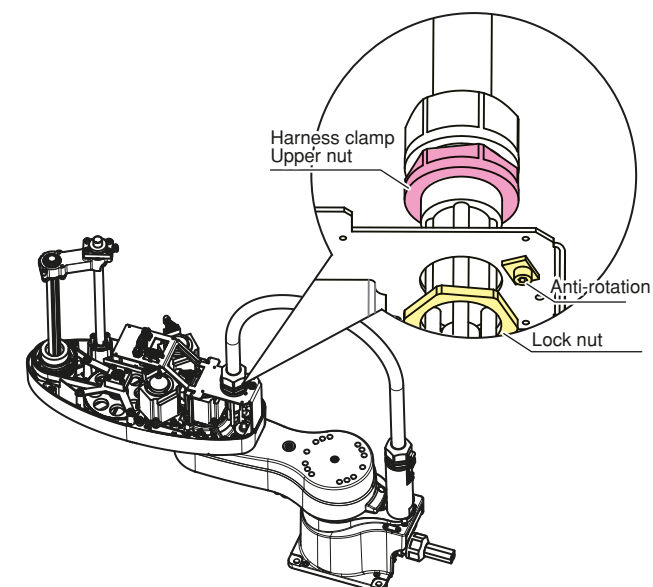


### Step9 Remove the machine harness.

Remove the lock nut and harness cover to remove the machine harness.

53641-FV-00

#### ► Step 9 Removal



#### NOTE

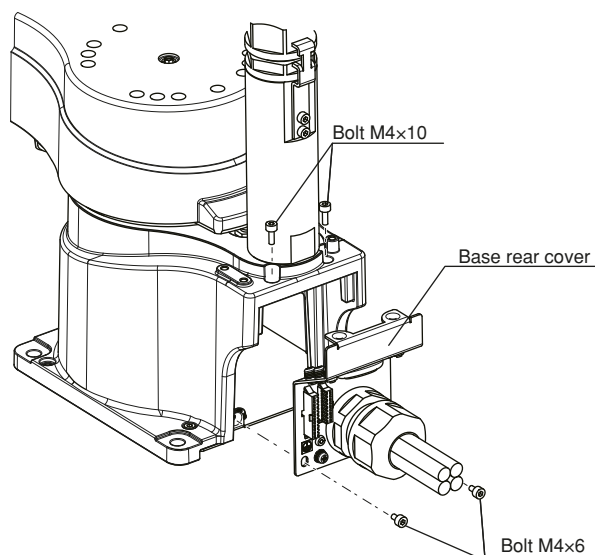
Turn the harness clamp lower nut with the lock nut rotation stopper attached.

## Step10 Remove the base rear cover.

Refer to Chapter 2 "1. Attaching, detaching, and replacing the cover" and remove the cover.

53604-FV-00

## ▶ Step10 Removing the Base Back Cover



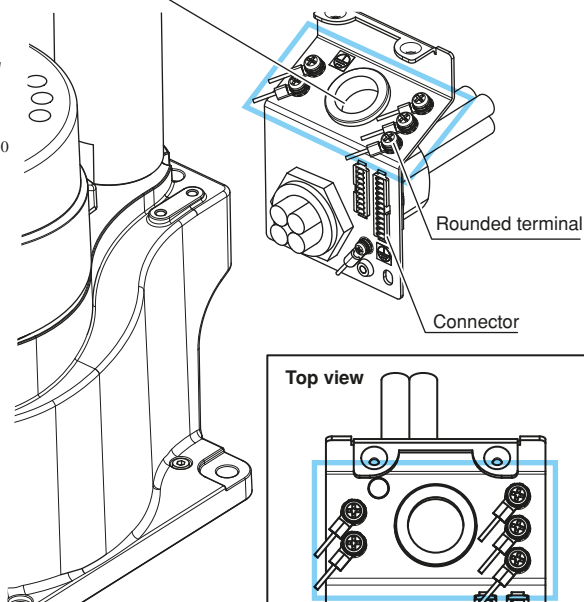
## ▶ Step11 Disconnecting the wires on the base rear cover

## Step11 Disconnect the wires on the base rear cover.

Remove the air tube connector and round terminal.

51610-FV-00

Pass this grommet through the air tubes (three shown below).  
Air tube (black) / Air tube (red) / Air tube (blue)

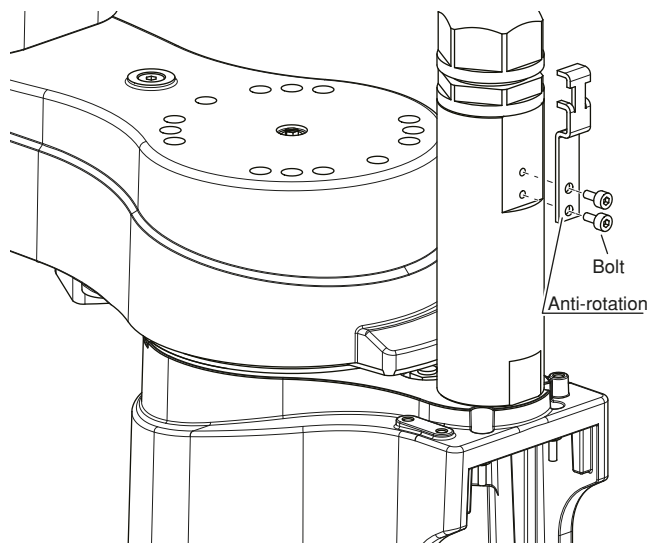


There are five round terminals on the top surface of the cover. Remove the two round terminals (black and green/yellow wires) connected to the machine harness.

**Step12** *Remove the base side detent.  
(anti-rotation)*

► **Step12** Removing the base side detent

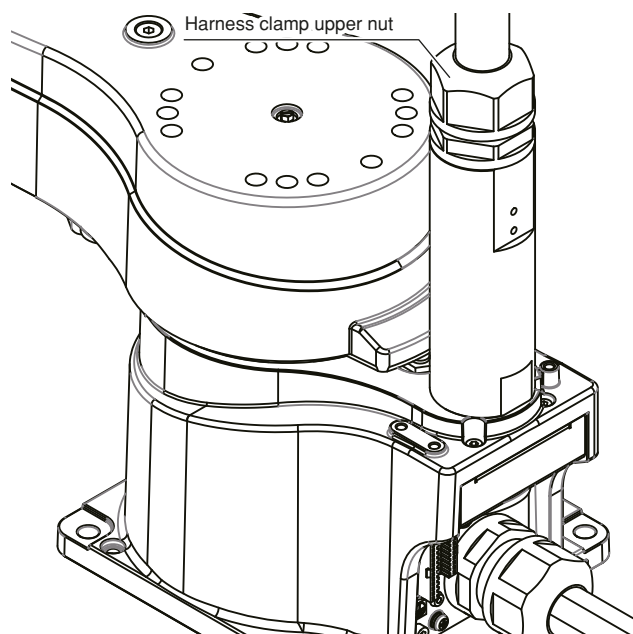
53645-FV-00



**Step13** *Remove harness clamp.*

► **Step13** Base side clamp removal

53655-FV-00

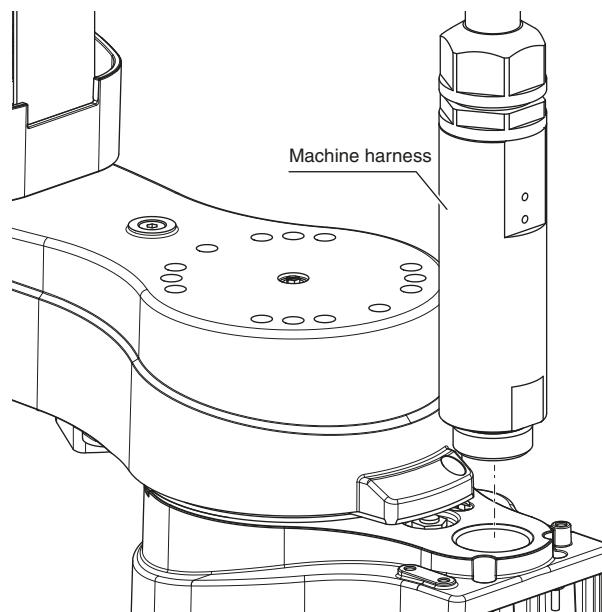


**Step14** Remove the machine harness on the base side.

► **Step14**

**Removing the machine harness**

53610-FV-00



## 2.2 Assembly

Assemble a new machine harness in the reverse order of removal.

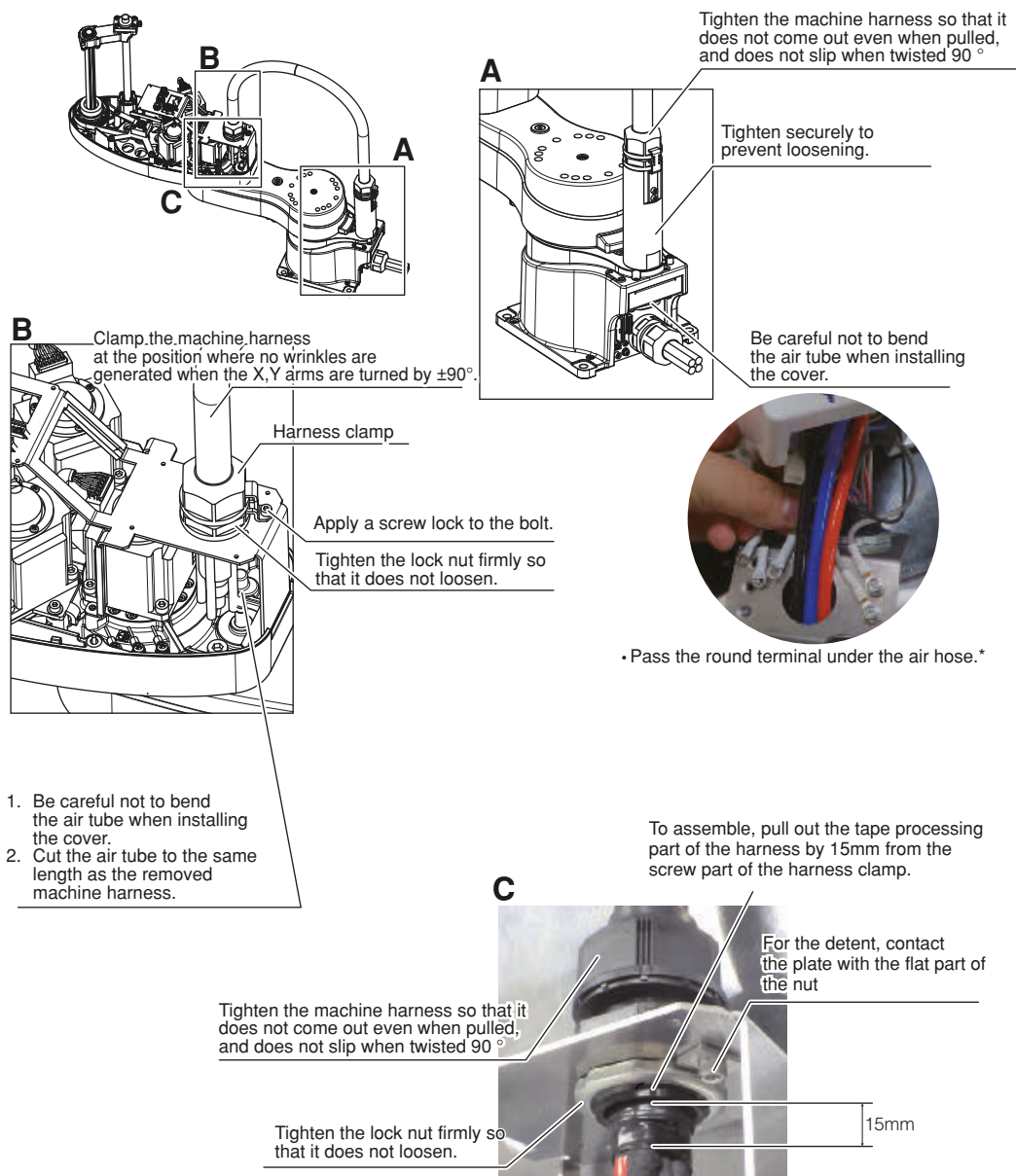
### Step 1 Reconnect the connector, round terminal, and air tubes.



NOTE

Refer to the separate document "XE Series Installation Manual" for wiring diagrams.

#### Step 1 Assemble



53647-FV-02

## Step2 Clamp the machine harness on the Y-axis side.

For the machine harness clamp position on the Y-axis side, clamp the machine harness at a specified position while referring to the figure.

53609-FV-00

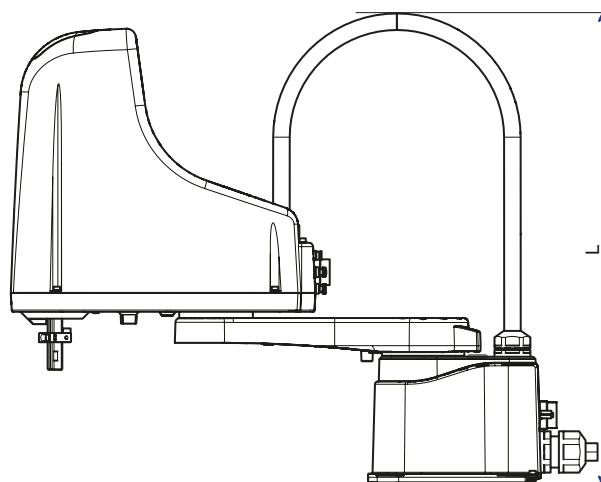
	L (mm)
R6YXE510	610
R6YXE610	620
R6YXE710	645



### NOTE

- The harness must not be tilted or twisted when extending the arm straight.
- When measuring the height of the harness, lift the harness gently and release it before measurement.

## Step 2 Clamping



## Chapter 7

# Motor replacement

### Contents

<b>1. Motor replacement</b>	<b>7-1</b>
1.1 X-axis motor replacement	7-1
1.2 Y-axis motor replacement	7-2





# 1. Motor replacement



## CAUTION

- Replacing the motor causes a positional deviation. Therefore, following the motor replacement, return-to-origin must be performed, and the point data must be re-specified. After an X, Y, R axis motor replacement, the reference coordinates must also be re-specified.
- If the bolt tightening torque is not instructed, see the tightening torque stated in "2. Replacement procedure for harmonic drive" in Chapter 5.

## 1.1 X-axis motor replacement



## WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

For details about how to replace the motor, refer to the harmonic replacement procedure for each axis. To replace the X-axis motor, disassemble to the point where the X-axis motor is removed, remove the old grease from the harmonic, and then apply new grease while referring to the harmonic replacement procedure.

### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	X-axis motor	KDS-M4880-01		1	R6YXE400
		KBF-M4881-00		1	R6YXE510 R6YXE610 R6YXE710
2	Motor O-ring	KN3-M2143-00	Cross section diameter: 1.5mm Inside diameter: 49.0mm	1	May deteriorate and must be replaced. R6YXE400

### 2. Other tools

Name	Part No.	Manufacturer	Remarks
Cleaning wipe			
Hex wrench set			
Phillips screwdriver			
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.

\*1: X-axis 27g

## 1.2 Y-axis motor replacement



### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Y-axis motor	KDS-M4882-00		1	R6YXE400
		KDS-M488A-00		1	R6YXE510 R6YXE610 R6YXE710
2	Motor O-ring	KN3-M2143-00	Cross section diameter: 1.0mm Inside diameter: 29.5mm	1	May deteriorate and must be replaced. R6YXE400

### 2. Tools(Torque wrench, etc.)



### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque wrench	N60CPCK	KANON (Nakamura Mfg. Co., Ltd.)	For M4 hex socket head bolt Tightening torque: 3.8Nm (38kgfcm)
	Changeable head	230HCK3	KANON (Nakamura Mfg. Co., Ltd.)	Wrench (without ball end) for M4 hex socket head bolt; insert 93mm

### 3. Other tools

Name	Part No.	Manufacturer	Remarks
Cleaning wipe			
Hex wrench set			
Harmonic grease	4B No.2 (*1)	Harmonic Drive Systems	Do not use grease if it was purchased 4 or more years ago. The grease has probably deteriorated.

\*1: R6YXE400: 27g, R6YXE510 / R6YXE610 / R6YXE710: 40g

Follow the steps below to perform the replacement work.

#### ■ Removal

**Step1** Turn off the controller.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

**Step4** Remove the wave generator.

Remove the wave generator as described in Chapter 5 "2.1.2 Replacing the Y-axis harmonic drive".

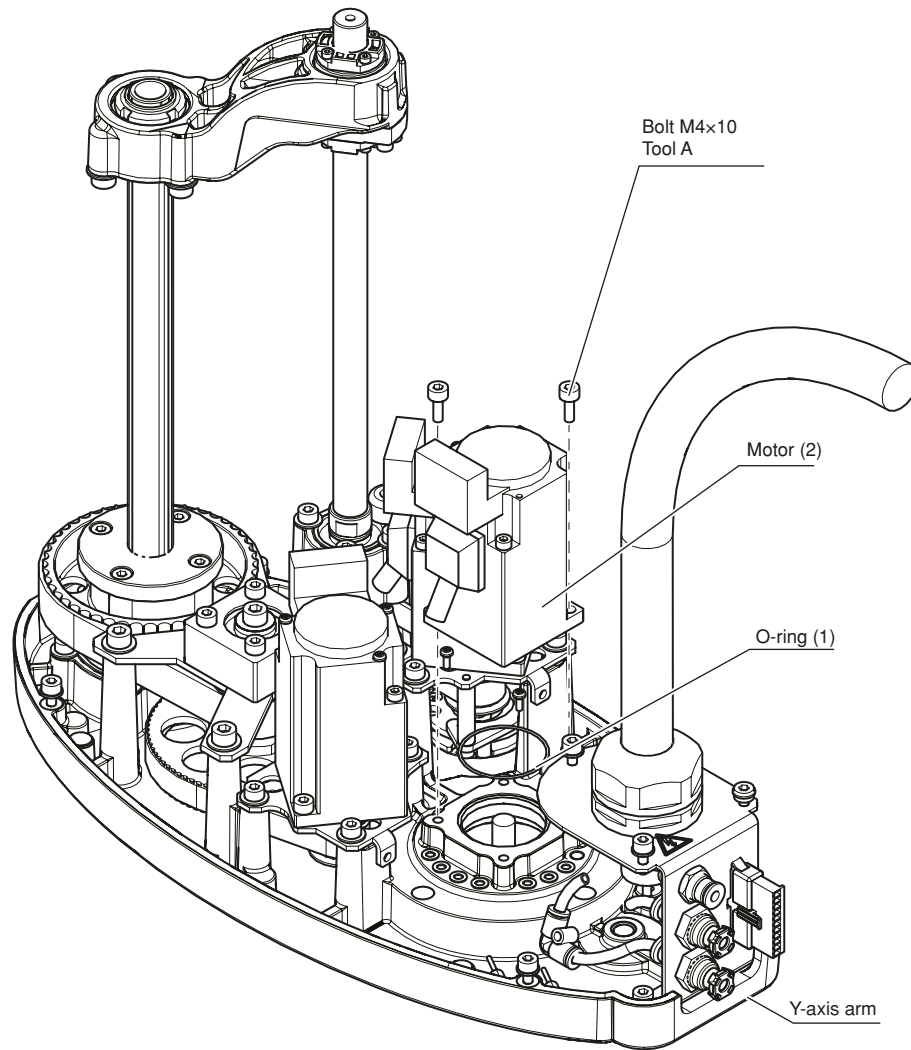
**Step5** Remove the motor and O-ring.

Remove the motor's round terminal and the connector. Remove the bolt, then remove the motor and O-ring.



### NOTE

Replace the O-ring with a new one.



53701-FV-00

### ■ Replacement and reassembly

Use the following procedure to replace the motor and reassemble the removed parts.

#### **Step1** Apply new grease to the harmonic.

Wipe off the old grease from the harmonic, then apply new grease as described in Chapter 5 "2.2 Replacing the Y-axis harmonic drive".

#### **Step2** Install the motor and O-ring.



##### CAUTION

- Do not allow the O-ring to get caught out of the groove during reassembly. If the robot is operated with the O-ring left caught out of the groove, this may cause a malfunction.
- If foreign matter is caught in during reassembly work, this may cause the noise from the harmonic drive or the harmonic drive to break.

#### **Step3** Secure the round terminal.

#### **Step4** Connect the motor's connector.

Connect the connector as described in Chapter 6 "Replacing the machine harness".

#### **Step5** Install the wave generator and the remaining parts.

Perform the work steps from the reassembly of the wave generator while referring to "Replacing the Y-axis harmonic drive" of each models in Chapter 5.



## Chapter 8

# Replacing the Z-axis drive unit

## Contents

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1.2	Replacing the Z-axis belt		8-3	
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2.	Replacing the Z-axis drive unit			
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# 1. Replacing the Z-axis drive unit **R6YXE400**



## WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

## 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Z axis motor	KDS-M4881-01		1	
2	Z axis belt	KDS-MI754-00		1	
3	Z-axis ball screw ASSY	KDS-MI756-00		1	
4	Brake unit	KDS-M4890-00		1	

## 2. Tools(Torque wrench, etc.)



## CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque driver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	0.7Nm tightening torque for M3 set screw
	Tip bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 70mm, Hexagonal width across flat at tip 1.5mm
B	Torque driver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	1.7Nm tightening torque for M4 set screw
	Tip bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 100mm, Hexagonal width across flat at tip 2mm
C	Torque driver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	M3 hexagon socket head bolt tightening torque 1.8 Nm
	Tip bit	B35 opposite side 2.5x75	Vessel Co., Inc.	Mounting hexagonal width across flats 6.35mm, overall length 75mm, hexagonal width across flats 2.5mm
D	Torque driver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	4.0 Nm tightening torque for M4 hexagon socket head bolts
	Tip bit	3C3007	NAC (Nagahori Industry Co., Ltd.)	Mounting hexagonal width across flats 6.35mm, total length 70mm, hexagonal width across flats 3mm
E	Torque Wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	Tightening torque 9.0Nm for M5 hexagon socket head bolt
	Replacement head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Insert a 110mm M5 hexagon socket wrench (no tip pole)

## 1.1 Replacing the Z-axis motor

Follow the steps below to replace the Z-axis motor.

**Step1** Turn off the controller.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

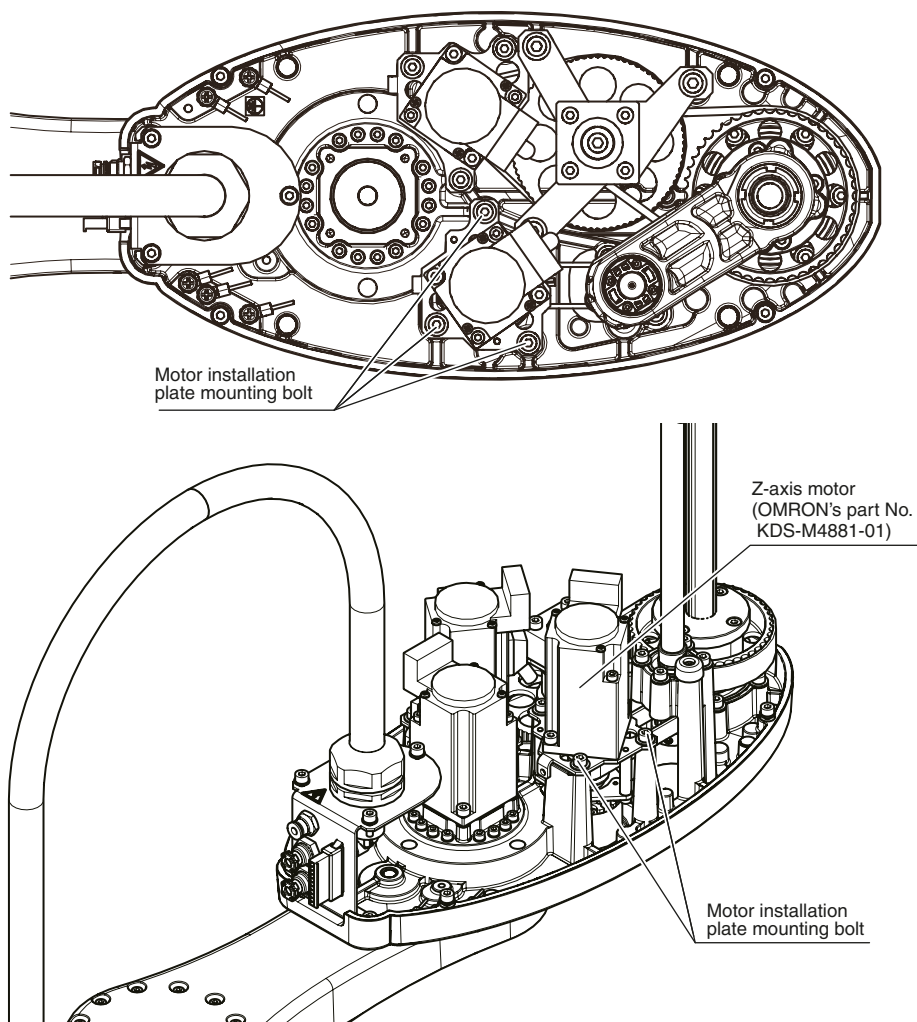
**Step4** Remove the Y-axis arm cover and machine harness fixing cover.

**Step5** Disconnect the Z-axis power cable connector, signal cable connector, and brake cable connector of the Z-axis motor.

Cut the tie bands to disconnect the wiring connectors.

**Step6** Remove the ground terminal mounting bolts and loosen the Z-axis motor installation plate mounting bolts.

**Step 5-6** Removing the ground terminal and loosening the motor installation plate mounting bolts



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### WARNING

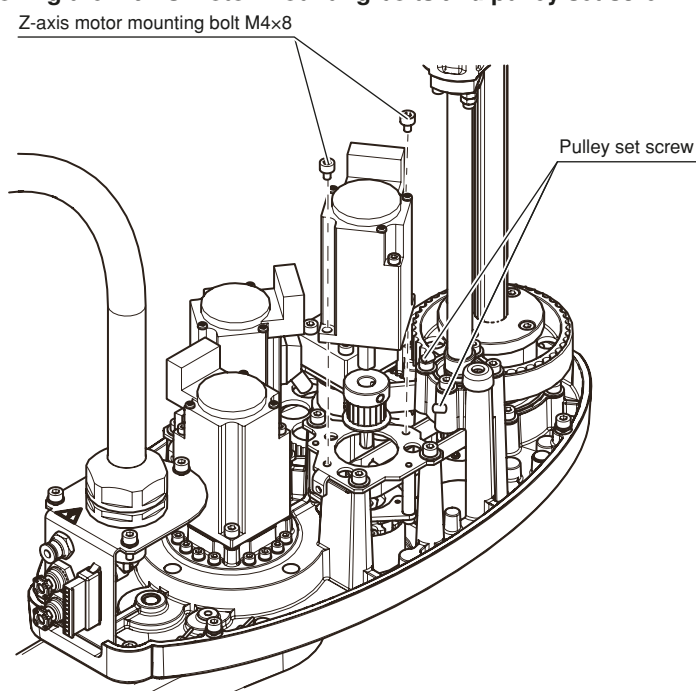
When loosening the Z-axis motor installation plate, the belt comes off from the pulley and the Z-axis drops. Before removing the motor, prop the Z-axis with a support stand.



**Step7** Remove the Z-axis motor mounting bolts.

**Step8** Remove the pulley set screw, and then remove the pulley.

**Step 7-8** Removing the Z-axis motor mounting bolts and pulley set screw.



53802-FV-00

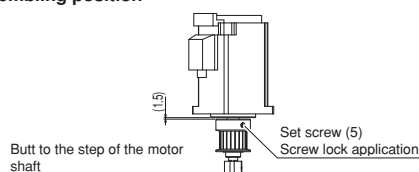
**Step9** Replace the motor with a new one and reassemble it in the reverse order of removal.

When assembling the belt onto the motor, it is necessary to adjust the belt tension and machine reference.

Adjust the belt mounting tension by changing the Z-axis motor installation plate mounting position.

- Z-axis belt tension (Appropriate frequency) : 259 to 333 Hz

**Z-axis motor assembling position**



53807-FK-00

**Step10** Reattach the covers.

**Step11** Go out of the safety enclosure.

## 1.2 Replacing the Z-axis belt

Follow the steps below to replace the Z-axis belt.

**Step1** Perform the work from Step 1 to Step 7 stated in “1.1 Replacing the Z-axis motor” of this Chapter to remove the Z-axis motor.

**Step2** Remove the Z-axis belt (OMRON's part No. KDS-M1754-00) from the Y-axis arm and replace it with a new one.

**Step3** Perform the work after Step 9 stated in “1.1 Replacing the Z-axis motor” to make the adjustments.

## 1.3 Replacing the Z-axis ball screw

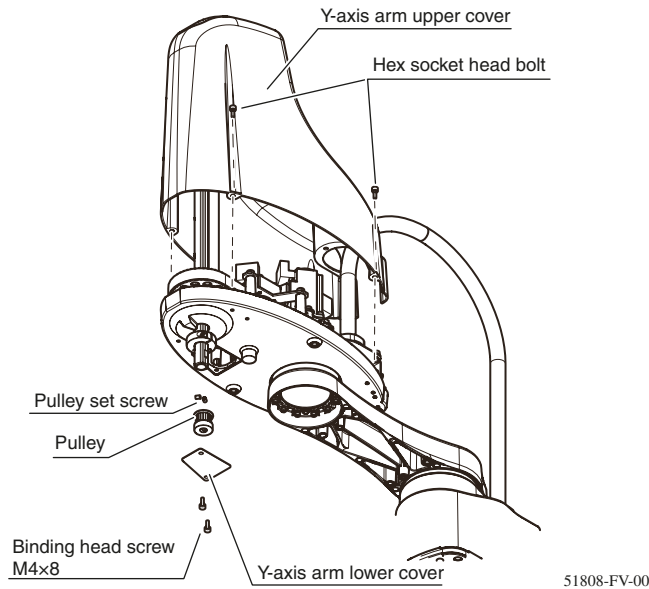
Follow the steps below to replace the Z-axis ball screw.

**Step1** Remove the Y-axis arm cover.

**Step2** Loosen the Z-axis motor fixing plate mounting bolts.

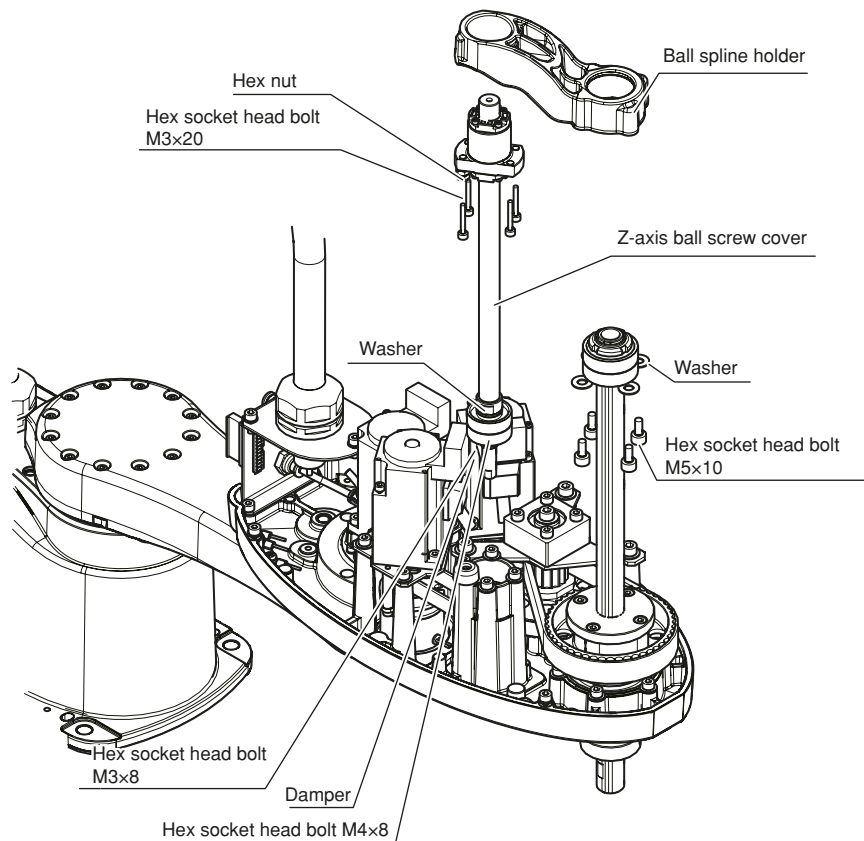
**Step3** Remove the pulley.

### Step 1-3 Removing the Y-axis arm cover



**Step4** Remove the hex socket head bolts, and remove the ball screw and ball spline holder.

### Step 4 Replacing the ball screw



**Step5** Remove the U nut, and then remove the bearing.

Assemble the new bearing and U nut to the new ball screw.

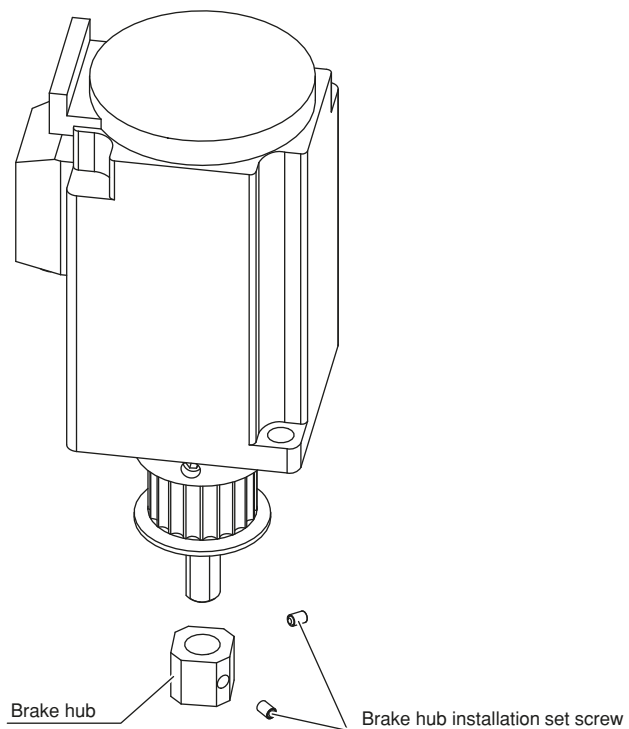
## 1.4 Replacing the Z-axis brake

Follow the steps below to replace the Z-axis brake.

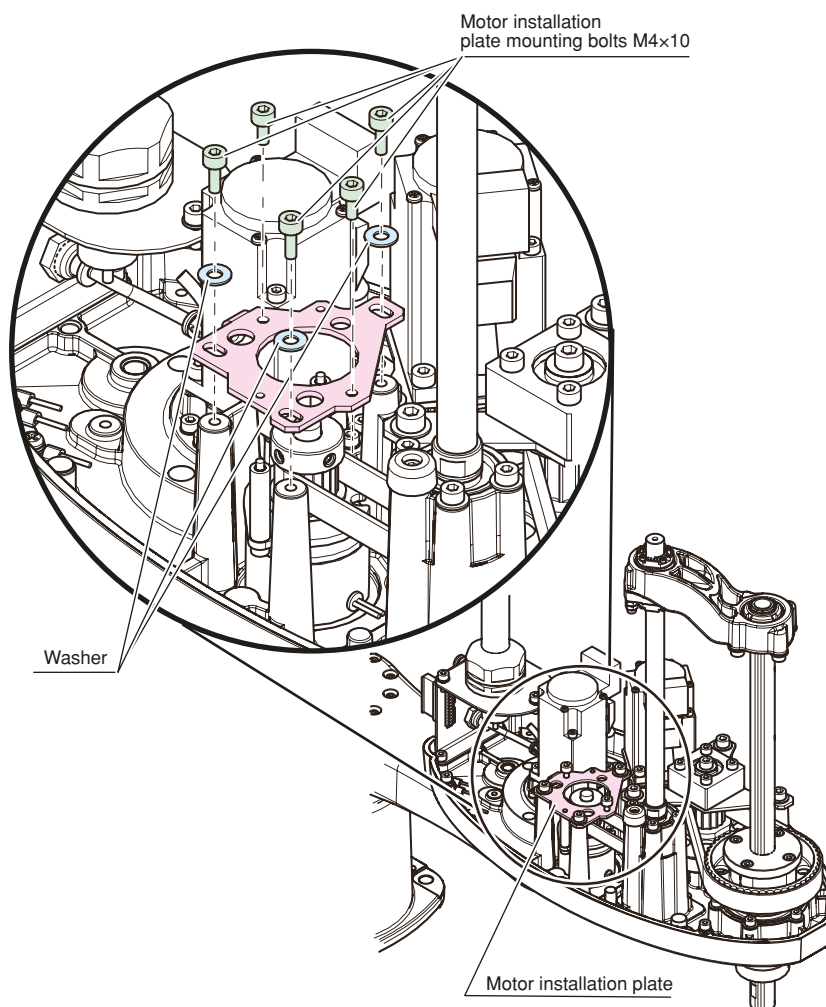
**Step1** *Perform the work from Step1 to Step7 stated in “1.1 Replacing the Z-axis motor” of this Chapter to remove the Z-axis motor.*

**Step2** *Remove the brake hub from the pulley.*

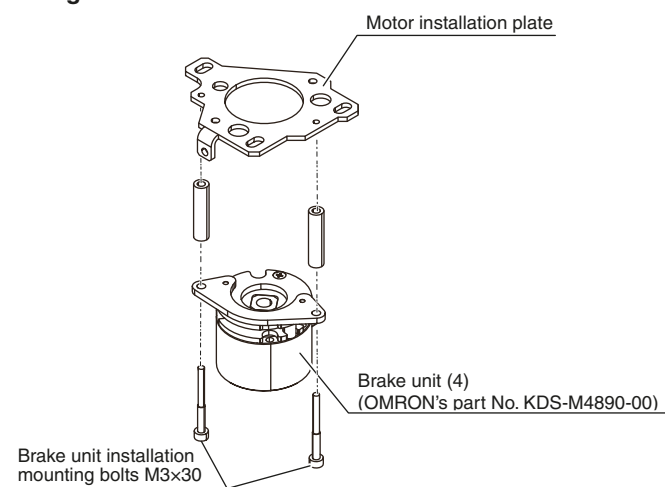
### Step 2 Removing the brake hub



53811-FK-00

**Step3** Remove the motor installation plate mounting bolts.**Step 3** Removing the motor installation plate mounting bolts

53805-FV-00

**Step4** Remove the brake unit installation mounting bolts and then the brake.**Step 4** Removing the brake

53806-FK-01

**Step5** Assemble a new brake in the reverse order of removal.

When assembling the new brake, it is necessary to adjust the belt tension and machine reference.

## 2. Replacing the Z-axis drive unit

R6YXE510

R6YXE610

R6YXE710



### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Z axis motor	KFS-M488E-00		1	
2	Z axis belt	KFS-M1754-00		1	
3	Ball screw	KFS-M1750-00		1	
4	Brake unit	KFS-M4892-00		1	
5	Set screw	92A08-04308		2	

### 2. Tools(Torque wrench, etc.)



### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque driver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	0.7Nm tightening torque for M3 set screw
	Tip bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 70mm, Hexagonal width across flat at tip 1.5mm
B	Torque driver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	1.7Nm tightening torque for M4 set screw
	Tip bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 100mm, Hexagonal width across flat at tip 2mm
C	Torque driver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	M3 hexagon socket head bolt tightening torque 1.8 Nm
	Tip bit	B35 opposite side 2.5x75	Vessel Co., Inc.	Mounting hexagonal width across flats 6.35mm, overall length 75mm, hexagonal width across flats 2.5mm
D	Torque driver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	4.0 Nm tightening torque for M4 hexagon socket head bolts
	Tip bit	3C3007	NAC (Nagahori Industry Co., Ltd.)	Mounting hexagonal width across flats 6.35mm, total length 70mm, hexagonal width across flats 3mm
E	Torque Wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	Tightening torque 9.0Nm for M5 hexagon socket head bolt
	Replacement head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Insert a 110mm M5 hexagon socket wrench (no tip pole)

## 2.1 Replacing the Z-axis motor

Follow the steps below to replace the Z-axis motor.

**Step1** Turn off the controller.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

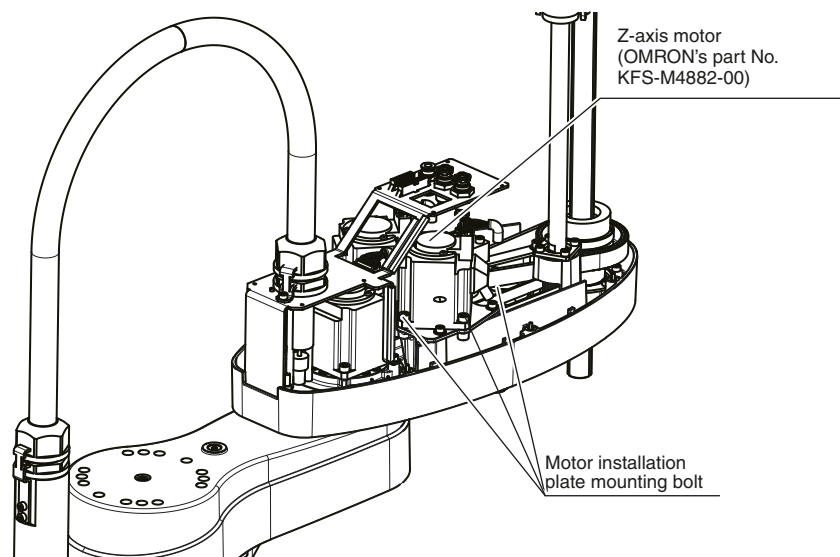
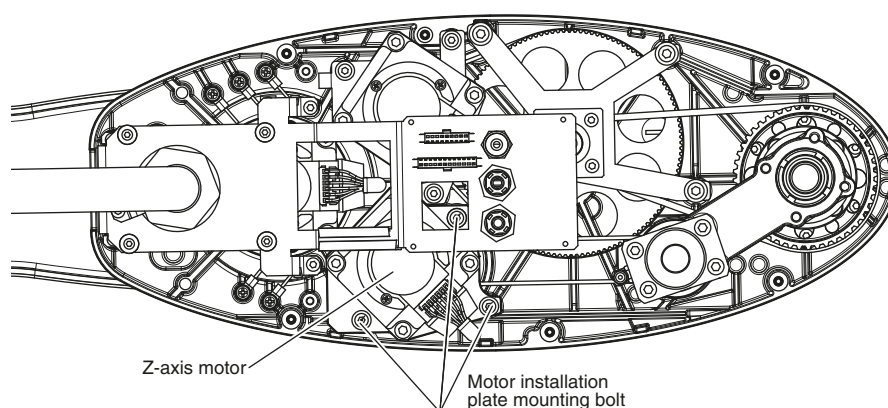
**Step4** Remove the Y-axis arm cover and machine harness fixing cover.

**Step5** Disconnect the Z-axis power cable connector, signal cable connector, and brake cable connector of the Z-axis motor.

Cut the tie bands to disconnect the wiring connectors.

**Step6** Remove the ground terminal mounting bolts and loosen the Z-axis motor installation plate mounting bolts.

**Step 5-6** Removing the ground terminal and loosening the motor installation plate mounting bolts



53820-FV-00



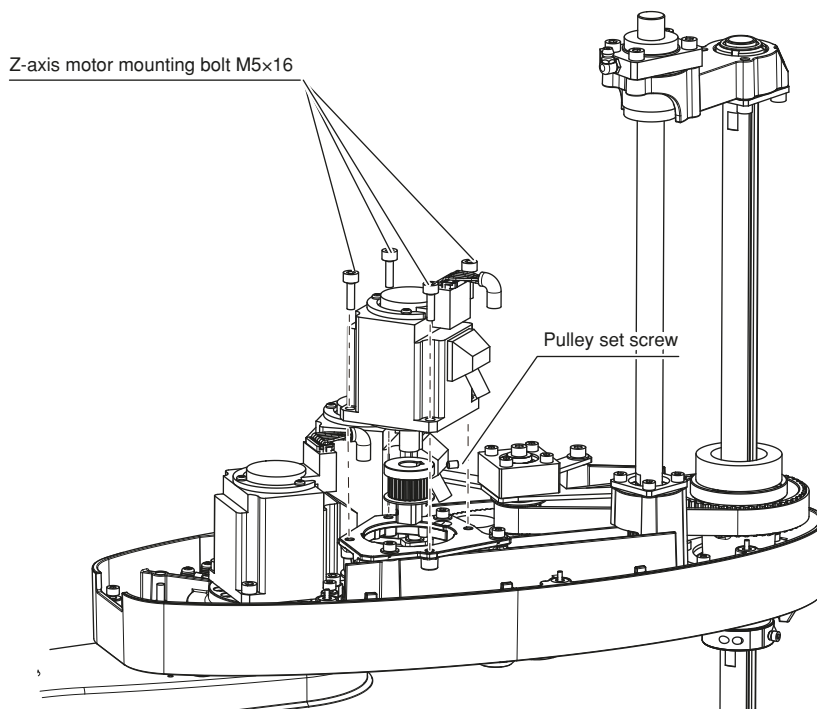
### WARNING

When loosening the Z-axis motor installation plate, the belt comes off from the pulley and the Z-axis drops. Before removing the motor, prop the Z-axis with a support stand.

**Step7** Remove the Z-axis motor mounting bolts.

**Step8** Remove the pulley set screw, and then remove the pulley.

**Step 7-8** Removing the Z-axis motor mounting bolts and pulley set screw.



53802-FV-00

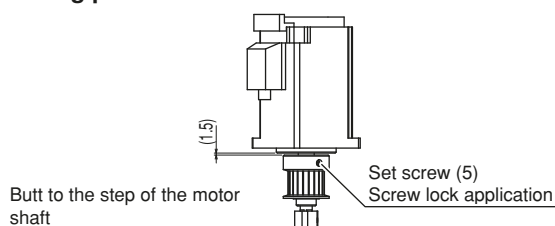
**Step9** Replace the motor with a new one and reassemble it in the reverse order of removal.

When assembling the belt onto the motor, it is necessary to adjust the belt tension and machine reference.

Adjust the belt mounting tension by changing the Z-axis motor installation plate mounting position.

- Z-axis belt tension (Appropriate frequency) : 150 to 173 Hz

**Z-axis motor assembling position**



53807-FK-00

**Step10** Reattach the covers.

**Step11** Go out of the safety enclosure.

## 2.2 Replacing the Z-axis belt

Follow the steps below to replace the Z-axis belt.

**Step1** Perform the work from Step 1 to Step 7 stated in "2.1 Replacing the Z-axis motor" of this Chapter to remove the Z-axis motor.

**Step2** Remove the Z-axis belt (OMRON's part No. KDS-M1754-00) from the Y-axis arm and replace it with a new one.

**Step3** Perform the work after Step 9 stated in "2.1 Replacing the Z-axis motor" to make the adjustments.



## 2.3 Replacing the Z-axis ball screw

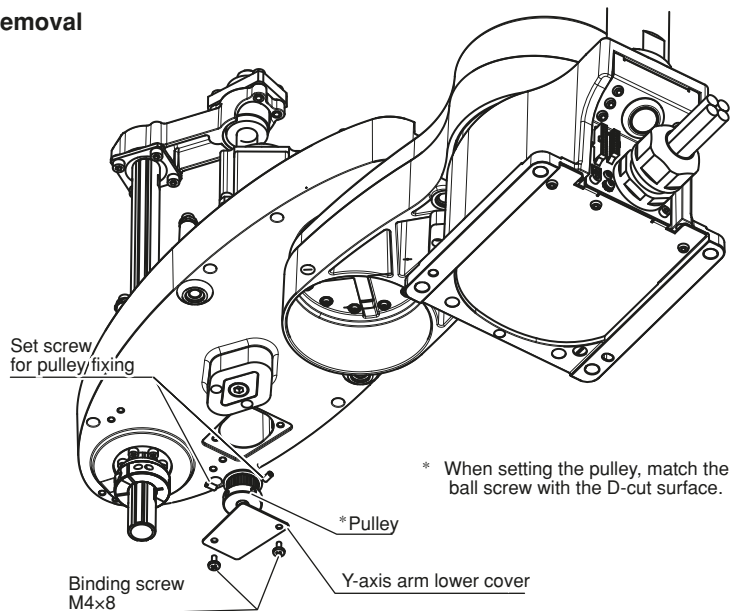
Follow the steps below to replace the Z-axis ball screw.

**Step1** Remove the Y-axis arm cover.

**Step2** Loosen the Z-axis motor fixing plate mounting bolts.

**Step3** Remove the pulley.

### Step 3 Pulley removal



51822-FV-01



### CAUTION

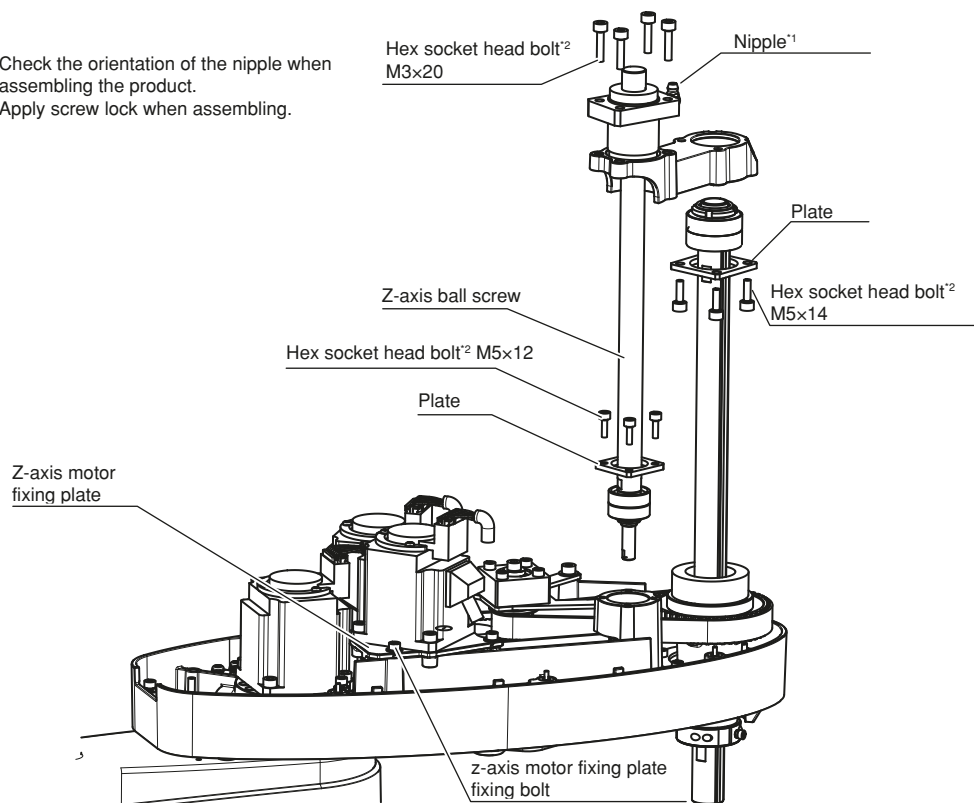
- Align the ball screw with the D-cut surface when assembling.
- Pay attention to the direction of the pulley and attach it to the end of the ball screw.

**Step4** Remove the hex socket head bolts, and remove the ball screw and ball spline holder.

### Step 4 Replacing the ball screw

<sup>\*1</sup> Check the orientation of the nipple when assembling the product.

<sup>\*2</sup> Apply screw lock when assembling.



51823-FV-02

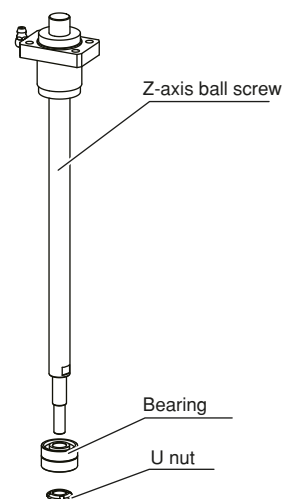


- Step5** *Remove the U nut, and then remove the bearing.*  
*Assemble the new bearing and U nut to the new ball screw.*

53823-FV-00

- Step6** *Assemble in the reverse order of removal.*  
*When assembling, it is necessary to adjust the belt tension and machine reference.*

► **Step 5** Removing the bearing

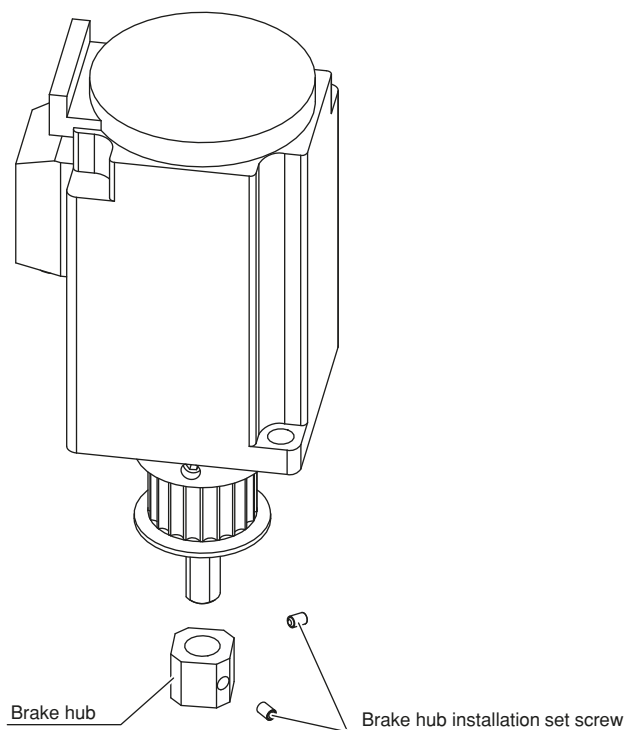


## 2.4 Replacing the Z-axis brake

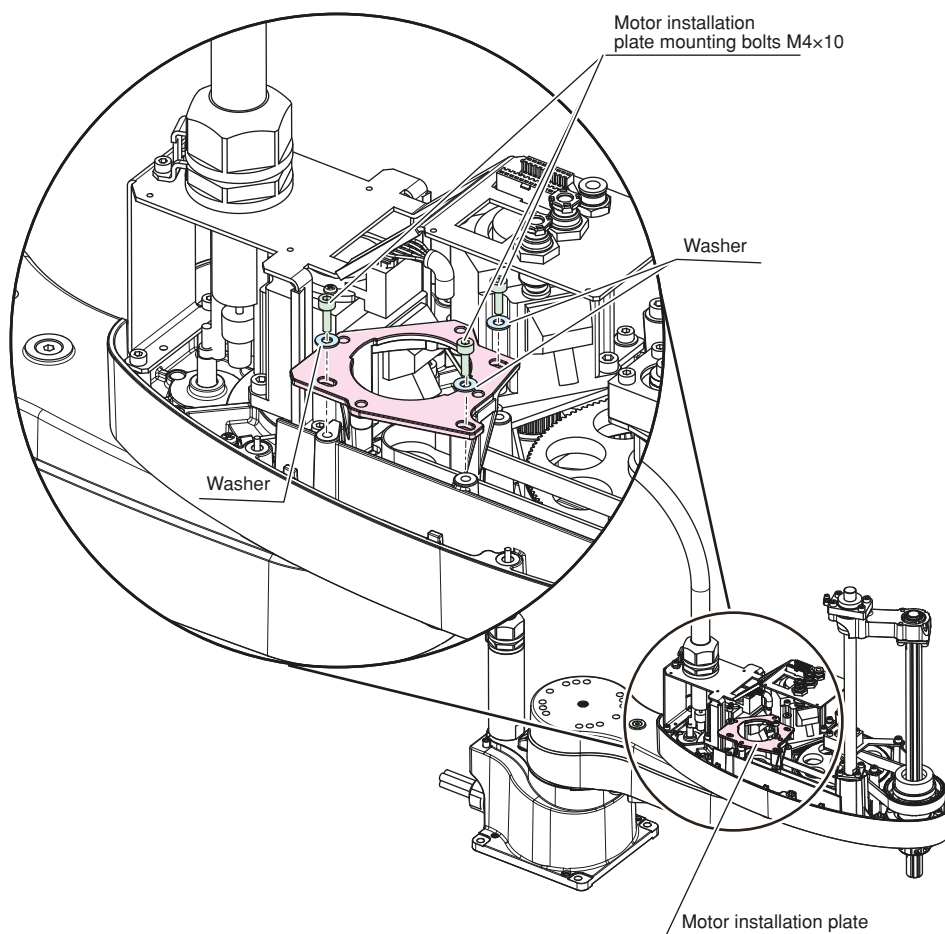
Follow the steps below to replace the Z-axis brake.

- Step1** *Perform the work from Step1 to Step7 stated in “2.1 Replacing the Z-axis motor” of this Chapter to remove the Z-axis motor.*
- Step2** *Remove the brake hub from the pulley.*

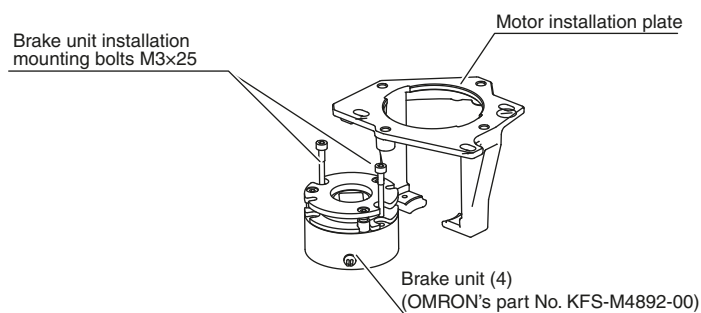
**Step 2** Removing the brake hub



53811-FK-00

**Step3** Remove the motor installation plate mounting bolts.**Step 3** Removing the motor installation plate mounting bolts

53825-FV-00

**Step4** Remove the brake unit installation mounting bolts and then the brake.**Step 4** Removing the brake

53826-FK-01

**CAUTION**

When assembling, align with the stepped section (spigot) in the motor plate.

**Step5** Assemble a new brake in the reverse order of removal.

When assembling the new brake, it is necessary to adjust the belt tension and machine reference.

## Chapter 9

# Replacing the R-axis drive unit

### Contents

<b>1. Replacing the R-axis drive unit</b>	<b>R6YXE400</b>	<b>9-1</b>
1.1	Replacing the R-axis motor	9-2
1.2	Replacing the R-axis belt	9-3
1.3	Replacing the R-axis ball spline	9-4
<b>2. Replacing the R-axis drive unit</b>	<b>R6YXE510 R6YXE610 R6YXE710</b>	<b>9-5</b>
2.1	Replacing the R-axis motor	9-6
2.2	Replacing the R-axis belt	9-8
2.3	Replacing the R-axis ball spline	9-9



# 1. Replacing the R-axis drive unit **R6YXE400**



## WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

## 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	R axis motor	KDS-M4881-01		1	
2	R axis pulley	KDS-M1751-00		1	
3	R axis belt	KDS-M1856-00		1	1st stage
4	R axis belt	KDS-M1857-00		1	2st stage
5	Ball spline	KDS-M1840-01		2	



## CAUTION

For robots with the following serial numbers, replace the ball spline with KDS-M1840-00. KLA6D001 to KLA6D110, KL9F6171 to KL9F6200, KLA9A001 to KLA9A003, KLA82001 to KLA82002, KLA4A001, KLA84001, KLA8F001, KLA96001, KLA9B001

## 2. Tools(Torque wrench, etc.)



## CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque driver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	1.7Nm tightening torque for M4 set screw
	Tip bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 100mm, tip Hexagonal width across flat at tip 2mm
B	Torque driver	N30LTDK	KANON (Nakamura Mfg. Co., Ltd.)	1.8Nm tightening torque for M3 set screw
	Tip bit	B35 opposite side 2.5x75	Vessel Co., Inc.	Mounting Hexagonal width across flat 6.35mm, total length 75mm, tip Hexagonal width across flat at tip 2.5mm
C	Torque driver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	4.0 Nm tightening torque for M4 hexagon socket head bolts
	Tip bit	3C3007	Vessel Co., Inc.	Mounting hexagonal width across flats 6.35mm, total length 70mm, hexagonal width across flats 3mm
D	Torque Wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	Tightening torque 9.0Nm for M5 hexagon socket head bolt
	Replacement head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Insert a 110mm M5 hexagon socket wrench (no tip pole)
E	Belt tension adjustment jig	KDS-M1836-00		Use this when adjusting the tension of the 2nd stage belt of the R-axis.

## 1.1 Replacing the R-axis motor

Follow the steps below to replace the R-axis motor.

**Step1** Turn off the controller.

**Step2** Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

**Step3** Enter the safety enclosure.

**Step4** Remove the Y-axis arm.

**Step5** Disconnect the R-motor power cable connector and signal cable connector.

**Step6** Remove the ground terminal mounting bolt and loosen the R-axis motor installation plate mounting bolts.

53902-FV-01

**Step7** Remove the R-axis motor mounting bolts.

53903-FV-00

**Step8** Remove the pulley set screws.

Remove the pulley and replace it with a new one.

53904-FK-00

**Step9** Replace the motor with a new one and assemble this new pulley in the reverse order of removal.

When assembling the belt onto the motor, it is necessary to adjust the belt tension. Adjust the belt mounting tension by changing the R-axis motor installation plate mounting position.

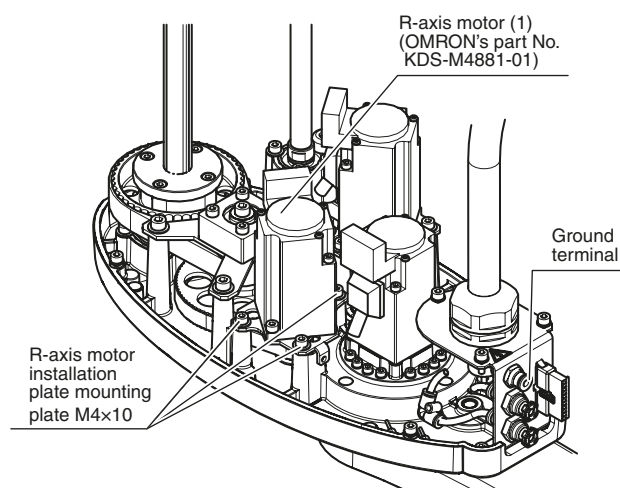
- R-axis belt tension  
(Appropriate frequency): 308 to 398 Hz

53911-FK-00

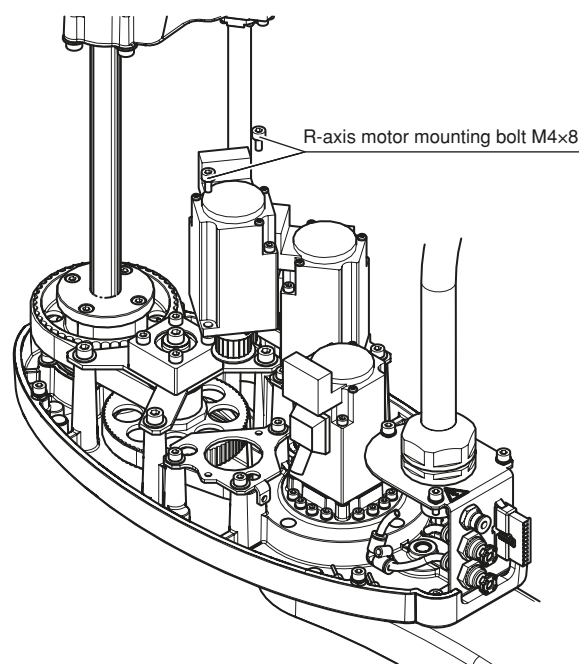
**Step10** Reattach the covers.

**Step11** Go out of the safety enclosure.

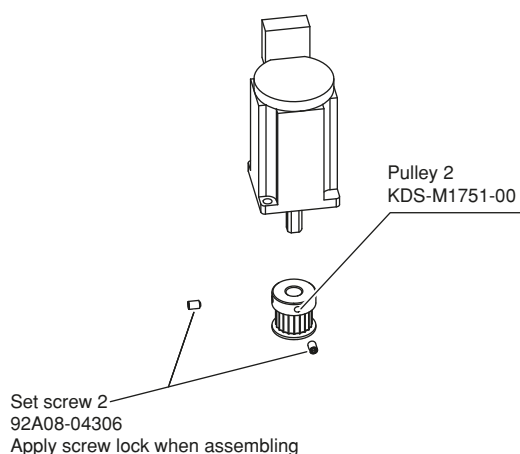
### Step 6 Removing the R-axis motor



### Step 7 Removing the R-axis motor mounting bolts



### Step 8 Removing the pulley set screws



## 1.2 Replacing the R-axis belt

Follow the steps below to replace the R-axis belt.

### Step1 Remove the R-axis motor.

Perform the work from Step1 to Step7 stated in "1.1 Replacing the R-axis motor" of this Chapter to remove the R-axis motor.

### Step2 Remove the hex socket head bolts, and then remove the Y-axis arm from the pulley assembly. Remove the first stage belt.

53908-FV-00

### Step3 Remove the hex socket head bolts to disassemble the ball spline holder and ball spline.

53910-FV-00

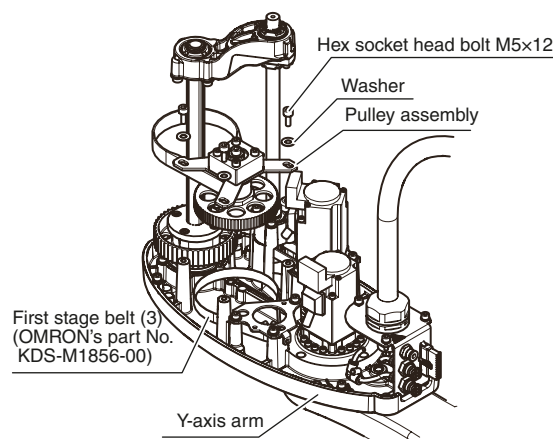
### Step4 Remove the second stage belt.

### Step5 Make the adjustment.

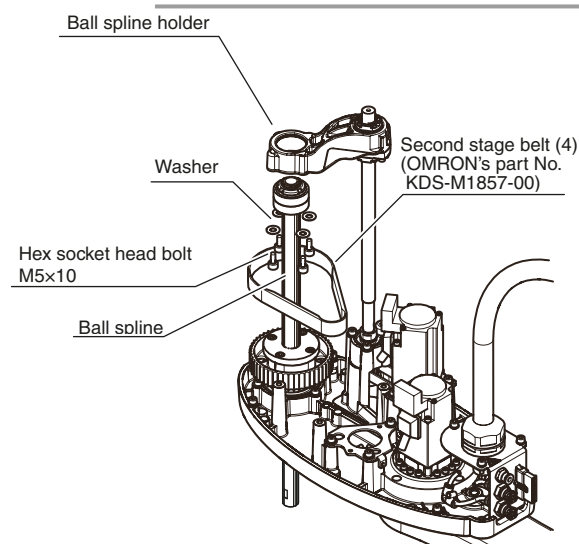
Follow the work from Step9 stated in "1.1 Replacing the R-axis motor" of this Chapter to make the adjustment.

- R-axis first stage belt tension (Appropriate frequency): 308 to 398Hz
- R-axis second stage belt tension (Appropriate frequency): 284 to 374Hz

### Step 2 Removing the pulley assembly and first stage belt



### Step 3-4 Removing the second stage belt



## 1.3 Replacing the R-axis ball spline

Follow the steps below to replace the R-axis ball spline.

### Step1 Remove the Z-axis stopper.

53905-FV-00

### Step2 Remove the bolt that secures the R-axis ball spline.

### Step3 Remove the R-axis ball spline unit.

53906-FV-00

### Step4 Remove the ball spline and replace it with a new one.

Replace the ball spline (OMRON's part No. KDS-M1840-00) in assembly state with two bearings (90933-01J002) and U nut (90990-16J012).

53907-FV-00



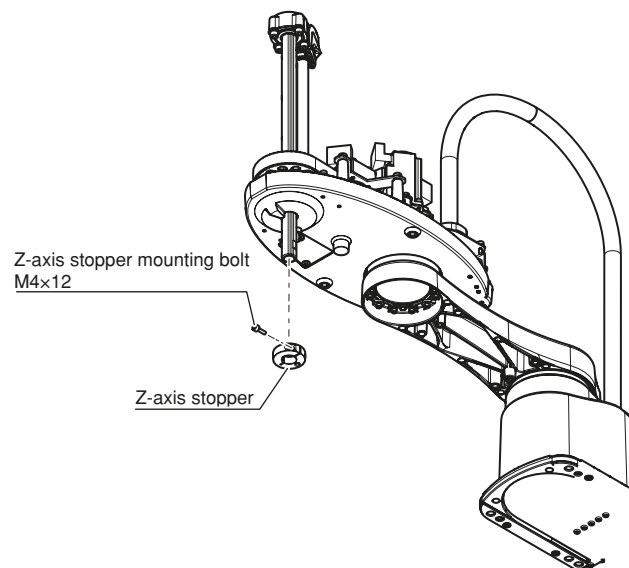
#### NOTE

Robots with some serial numbers have different ball spline model numbers. See "1.Replacing the R-axis drive unit R6YXE400" in this Chapter.

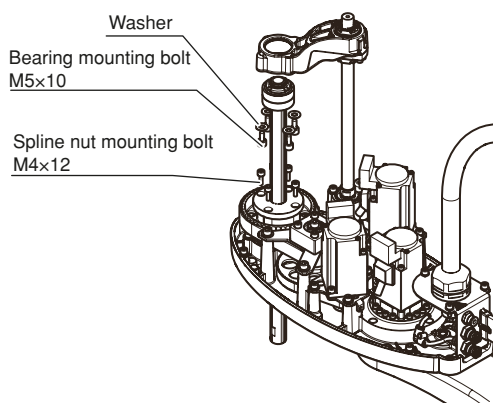
### Step5 Assemble a new ball spline in the reverse order of removal.

When assembling the new ball spline, it is necessary to adjust the belt tension and machine reference.

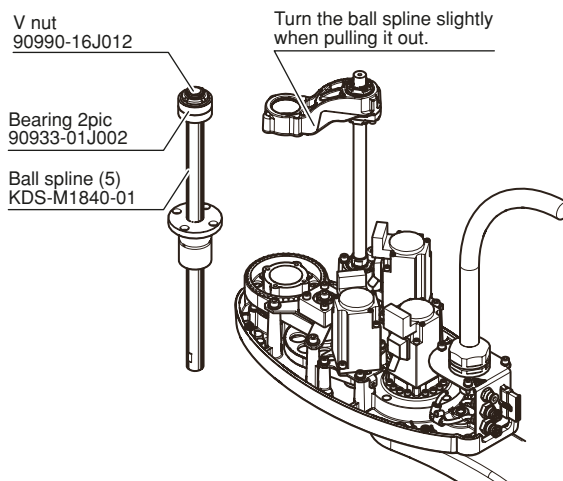
#### Step 1 Removing the Z-axis stopper



#### Step 3 Removing the R-axis ball spline unit



#### Step 4 Replacing the ball spline





## 2. Replacing the R-axis drive unit

**R6YXE510 R6YXE610 R6YXE710**



### WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	R axis motor	KFS-M488F-00		1	
2	R axis pulley	KFS-M1853-00		1	
3	R axis belt	KFS-M1856-00		1	1st stage
4	R axis belt	KFS-M1857-00		1	2st stage
5	Ball spline	KFS-M1840-00		2	

### 2. Tools(Torque wrench, etc.)



### CAUTION

Use accurately calibrated torque screwdrivers and torque wrenches.

	Name	Part No.	Manufacturer	Remarks
A	Torque driver	N12LTDK	KANON (Nakamura Mfg. Co., Ltd.)	0.7Nm tightening torque for M3 set screw
	Tip bit	3C1507	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 70mm, Hexagonal width across flat at tip 1.5mm
B	Torque driver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	1.7Nm tightening torque for M4 set screw
	Tip bit	3C2010	NAC (Nagahori Industry Co., Ltd.)	Mounting Hexagonal width across flat 6.35mm, total length 100mm, Hexagonal width across flat at tip 2mm
C	Torque driver	N20LTDK	KANON (Nakamura Mfg. Co., Ltd.)	1.8Nm tightening torque for M3 hexagon socket head bolts
	Tip bit	B35 opposite side 2.5x75	Vessel Co., Inc.	Mounting Hexagonal width across flat 6.35mm, total length 75mm, Hexagonal width across flat at tip 2.5mm
D	Torque driver	N50LTDK	KANON (Nakamura Mfg. Co., Ltd.)	4.0 Nm tightening torque for M4 hexagon socket head bolts
	Tip bit	3C3007	NAC (Nagahori Industry Co., Ltd.)	Mounting hexagonal width across flats 6.35mm, total length 70mm, hexagonal width across flat at tip 3mm
E	Torque Wrench	N120SPCK	KANON (Nakamura Mfg. Co., Ltd.)	9.0Nm tightening torque for M5 hexagon socket head bolt
	Replacement head	230HCK4	KANON (Nakamura Mfg. Co., Ltd.)	Insert a 110mm M5 hexagon socket wrench (no tip pole)
F	Belt tension adjustment jig	KFS-M1836-00		Use this when adjusting the tension of the 2nd stage belt of the R-axis.

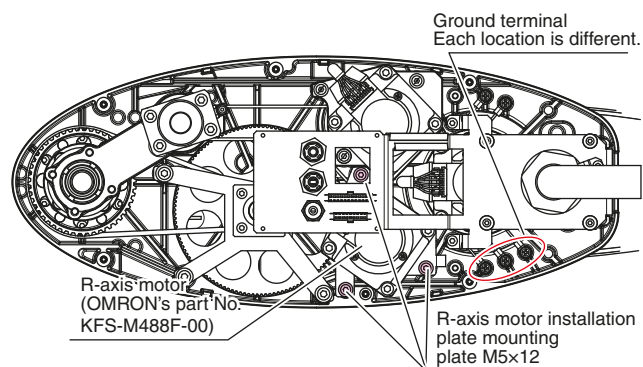
## 2.1 Replacing the R-axis motor

Follow the steps below to replace the R-axis motor.

- Step1** *Turn off the controller.*
- Step2** *Place a sign indicating the robot is being adjusted.*  
*Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.*
- Step3** *Enter the safety enclosure.*
- Step4** *Remove the Y-axis arm.*
- Step5** *Disconnect the R-motor power cable connector and signal cable connector.*
- Step6** *Remove the ground terminal mounting bolt and loosen the R-axis motor installation plate mounting bolts.*

### Step 6 Removing the R-axis motor

53921-FV-01



**Step7** Remove the R-axis motor mounting bolts.

53922-FV-00

**Step8** Remove the pulley set screws.  
Remove the pulley and replace it with a new one.

53904-FK-00

**Step9** Replace the motor with a new one and assemble this new pulley in the reverse order of removal.

When assembling the belt onto the motor, it is necessary to adjust the belt tension. Adjust the belt mounting tension by changing the R-axis motor installation plate mounting position.

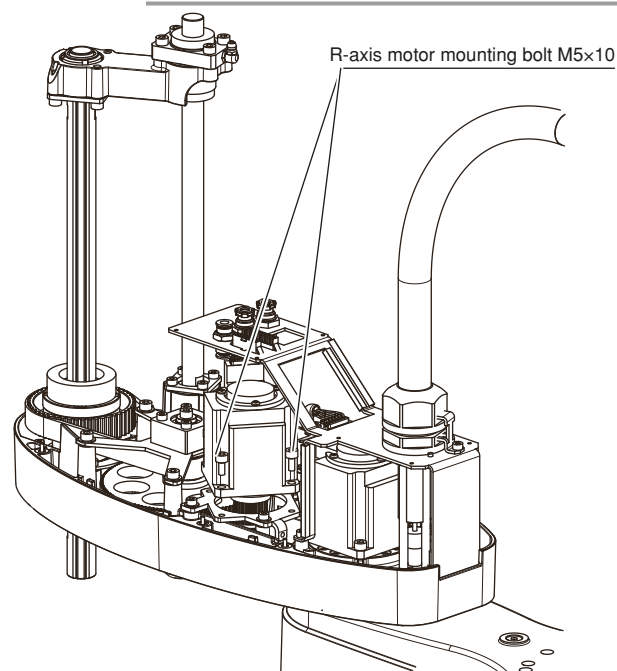
- R-axis belt tension  
(Appropriate frequency): 286 to 398 Hz

53911-FK-00

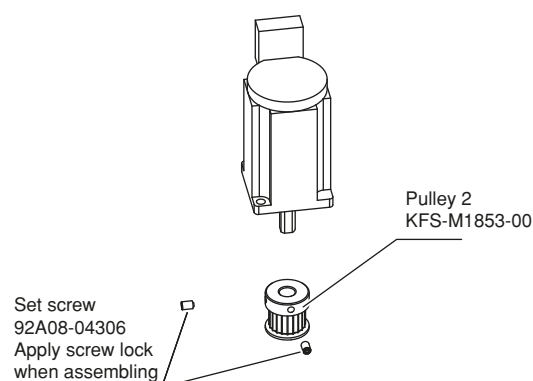
**Step10** Reattach the covers.

**Step11** Go out of the safety enclosure.

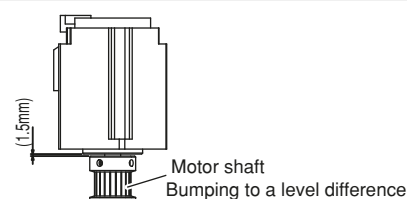
► **Step 7** Removing the R-axis motor mounting bolts



► **Step 8** Removing the pulley set screws



► **Step 9** R-axis motor assembling position



## 2.2 Replacing the R-axis belt

Follow the steps below to replace the R-axis belt.

### Step1 Remove the R-axis motor.

Perform the work from Step1 to Step7 stated in "2.1 Replacing the R-axis motor" of this Chapter to remove the R-axis motor.

### Step2 Remove the hex socket head bolts, and then remove the Y-axis arm from the pulley assembly. Remove the first stage belt.

53908-FV-00

### Step3 Remove the hex socket head bolts to disassemble the ball spline holder and ball spline.

53923-FV-00

### Step4 Remove the second stage belt.

### Step5 Make the adjustment.

Follow the work from Step9 stated in "2.1 Replacing the R-axis motor" of this Chapter to make the adjustment.

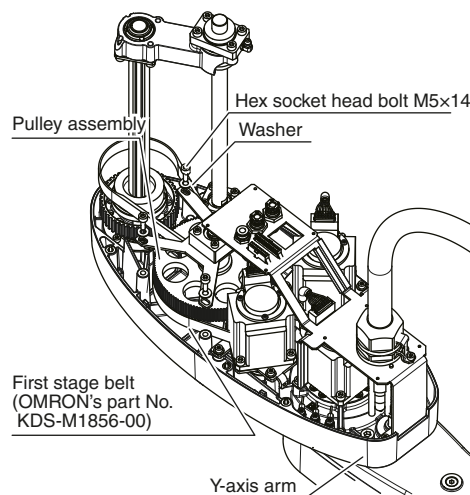
- R-axis first stage belt tension (Appropriate frequency): 286 to 366Hz
- R-axis second stage belt tension (Appropriate frequency): 174 to 229Hz



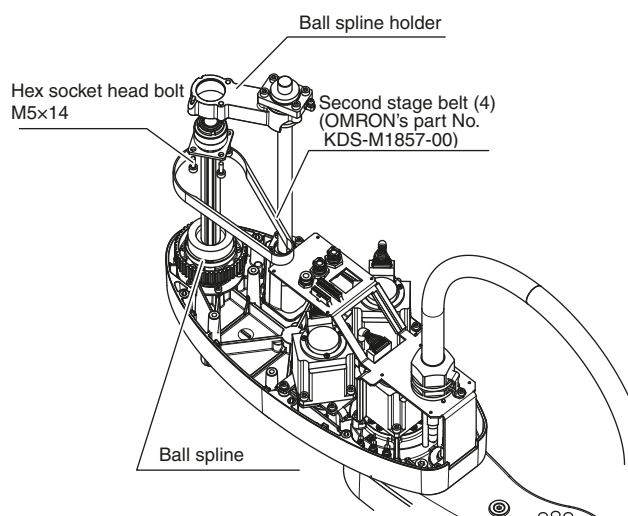
#### NOTE

When tightening the plate fixing bolt, make the backlash between the bolt and the plate as small as possible and tighten from the bolt on the spline side. In some cases, the plate may be deformed.

### Step 2 Removing the pulley assembly and first stage belt



### Step 3-4 Removing the second stage belt



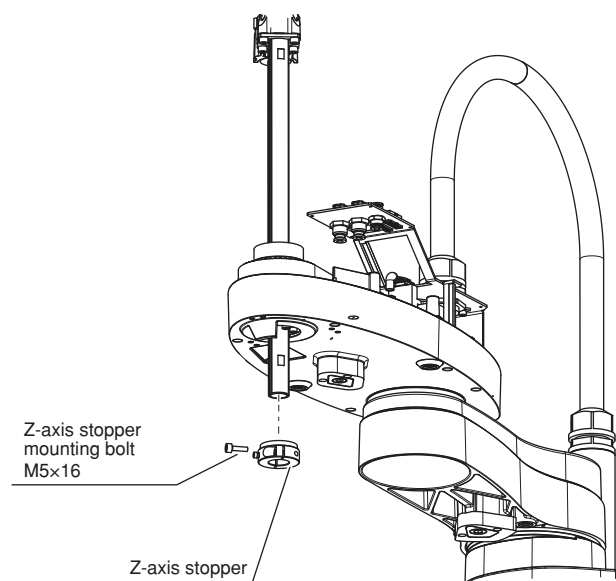
## 2.3 Replacing the R-axis ball spline

Follow the steps below to replace the R-axis ball spline.

### Step1 Remove the Z-axis stopper.

53925-FV-00

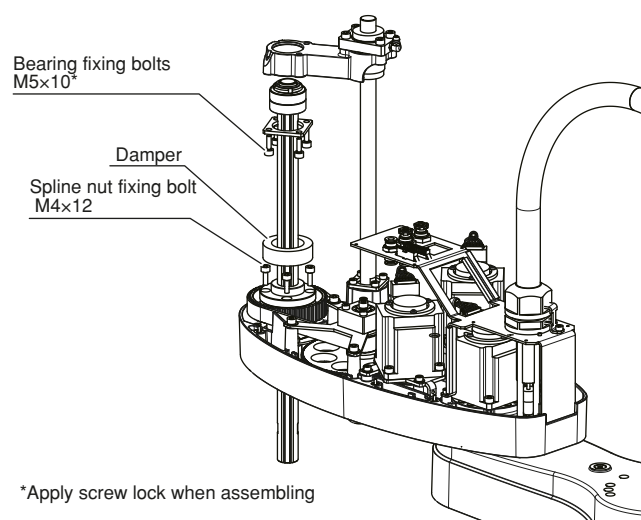
#### Step 1 Removing the Z-axis stopper



### Step2 Remove the bolt that secures the R-axis ball spline.

53926-FV-00

#### Step 2 Removing the R-axis ball spline unit



NOTE  
Remove the damper from the spline nut because it is bonded.

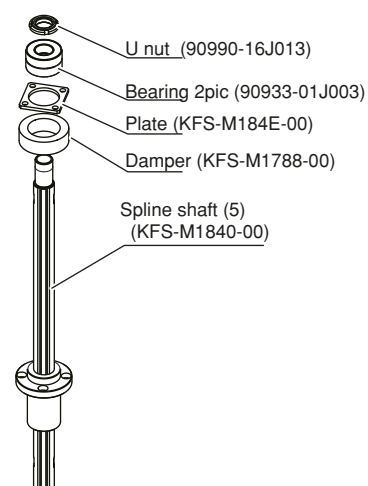
### Step3 Remove the R-axis ball spline unit.

53927-FV-00

#### Step 3-4 Disassembly of R axis ball spline unit

### Step4 Remove the U nut and remove the bearing, plate and damper from the spline shaft.

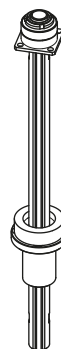
### Step5 Remove the ball spline and replace it with a new one.



**Step6** Assemble the U nut, bearing, plate and damper to the spline shaft.

53928-FV-00

► **Step 6** Assembly of R axis ball spline unit



**Step7** Install the R-axis ball spline.

53929-FV-00

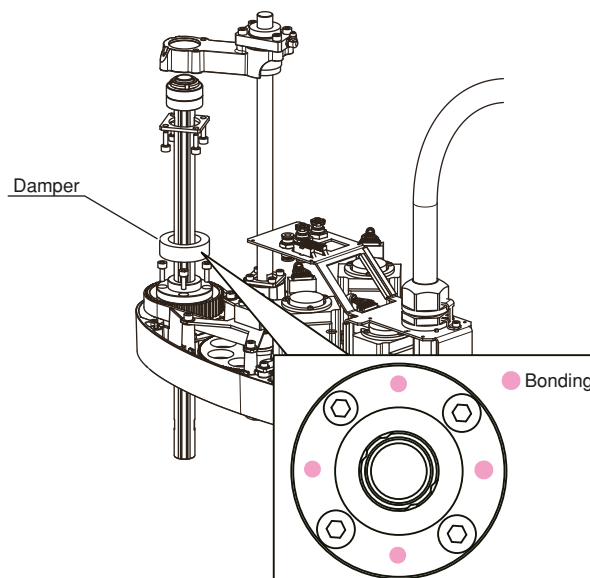
► **Step 7** Installation of R axis ball spline



**NOTE**

Attach the damper to the spline nut as shown on the right.

Use three-bond instant adhesive 1739.



**Step8** Assemble in the reverse order of removal.

When assembling, belt tension adjustment and machine reference adjustment are required.

## Chapter 10

# Robot cable replacement

### Contents

Robot cable replacement

10-1





# 1. Robot cable replacement



## CAUTION

- An return-to-origin is required after a robot cable replacement.
- If the bolt tightening torque is not instructed, see the tightening torque stated in "2. Replacement procedure for harmonic drive" in Chapter 5.



## WARNING

Before starting the work, thoroughly read "1. Attaching, detaching, and replacing the cover" in Chapter 2.

### 1. Replacement parts

	Part Name	OMRON Part No.	Part No. / Specs	Q'ty	Remarks
1	Screw for round terminal	97602-04306	M4 × 6	2	Spare parts
2	Lock washer for round terminal	90172-00J040	For M4	2	Spare parts
3	Robot cable	KBF-M6211-00		1	3.5m
		KBF-M6211-10		1	5m
		KBF-M6211-20		1	10m

### 2. Other tools

Name	Part No.	Manufacturer	Remarks
Phillips screwdriver			
41mm spanner			

## ■ Removal

Disassemble using the following procedure.

### Step1 Turn off the controller.

### Step2 Place a sign indicating the robot is being adjusted.

Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.

### Step3 Enter the safety enclosure.

### Step4 Remove the base cover.

Remove the cover while referring to "1. Attaching, detaching, and replacing the cover" in Chapter 2.

### Step5 Disconnect the connector.

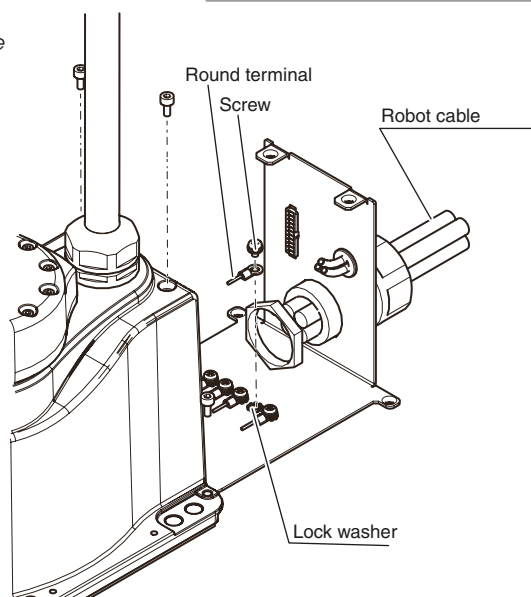
Remove the robot cable's round terminal and the connector.

### Step6 Disconnect the robot cable.

Use a spanner to loosen the lock nut, then disconnect the robot cable.

**R6YXE400**

#### ▶ Step 5-6 Disconnecting the robot cable



53A01-FV-00

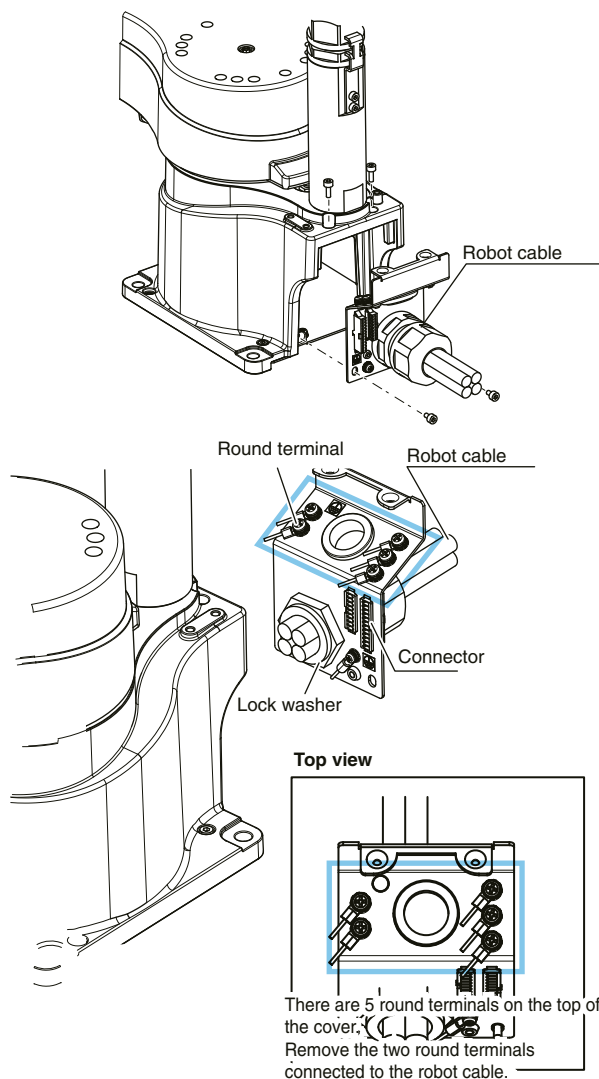
**R6YXE510**

**R6YXE610**

**R6YXE710**

#### ▶ Step 5-6 Disconnecting the robot cable

53019-X0-00



## ■ Reassembly

Reassemble by reversing the disassembly procedure.

### Step1 Tighten the lock nut and clamp.

### Step2 Secure the round terminal and connect the connector.



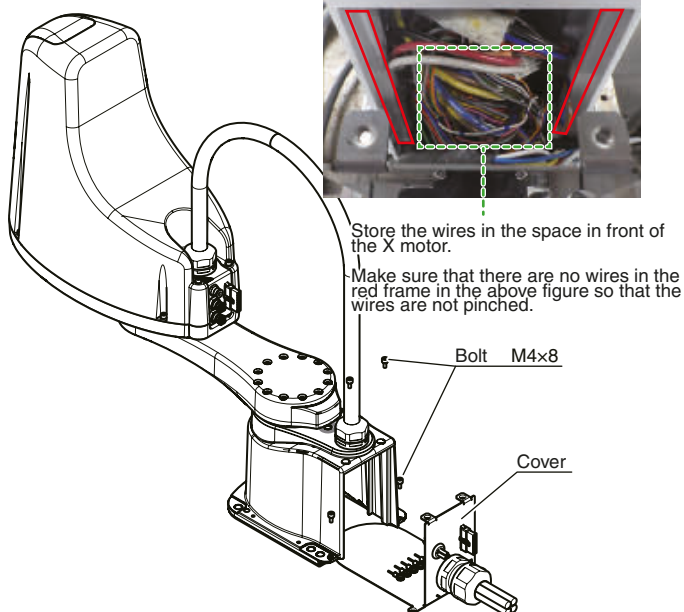
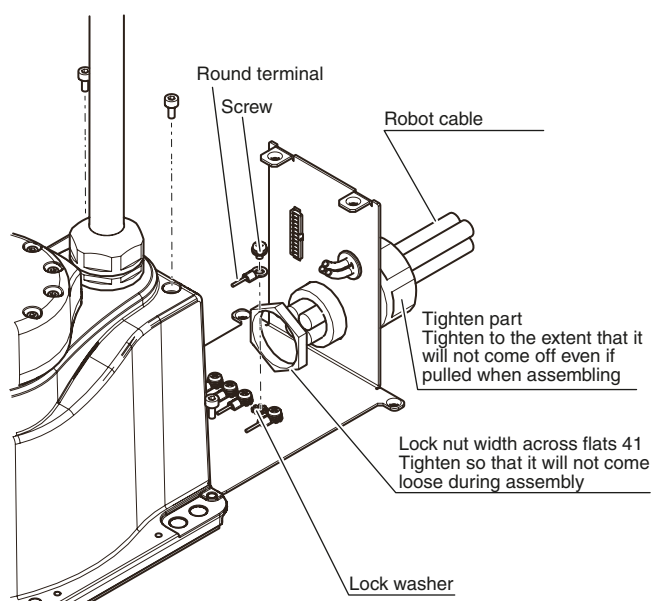
#### NOTE

Refer to the installation manual, Chapter 8 "1.3 Robot inner wiring diagram".

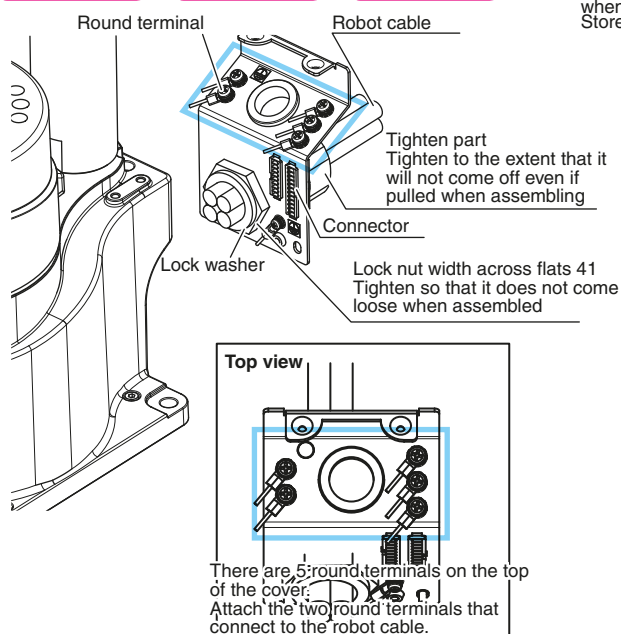
### Step3 Attach the cover.

#### Step 3 Attaching the base rear cover

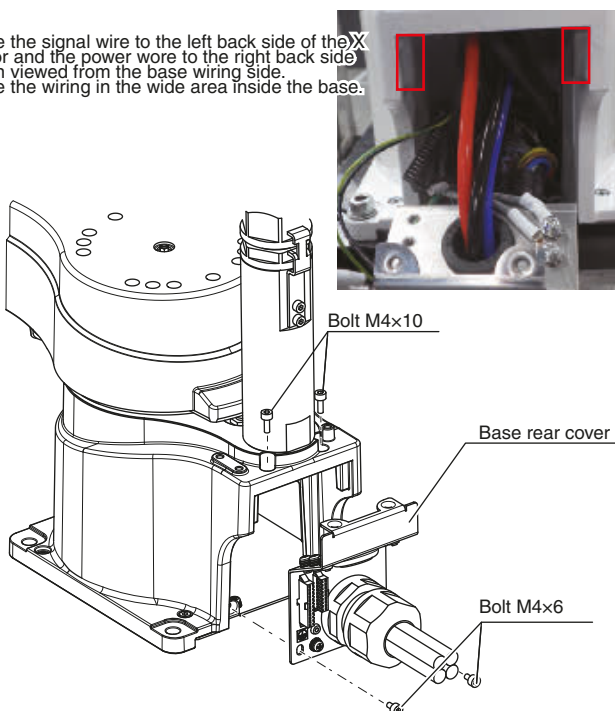
##### R6YXE400



##### R6YXE510 R6YXE610 R6YXE710



Store the signal wire to the left back side of the X motor and the power wire to the right back side when viewed from the base wiring side. Store the wiring in the wide area inside the base.





# Chapter 11

## Maintenance parts

### Contents

1. Consumable parts	11-1
2. Basic specification	11-2



# 1. Consumable parts

Consumable part	Q'ty	Remarks
KDS-M4843-01	1	Machine harness <b>R6YXE400</b>
KDS-M4844-00	1	Machine harness <b>R6YXE510</b>
KDS-M4843-10	1	Machine harness <b>R6YXE610</b>
KDS-M4843-20	1	Machine harness <b>R6YXE710</b>

## 2. Basic specification

			R6YXE400	R6YXE510	R6YXE610	R6YXE710	
Axis specifications	X-axis	Arm length	225mm	235mm	335mm	435mm	
		Rotation angle	±132°	±134°			
	Y-axis	Arm length	175mm	275mm			
		Rotation angle	±150°	±152°			
	Z-axis	Stroke	150mm	200mm			
	R-axis	Rotation angle	±360°				
Motor		X-axis	200W	400W			
		Y-axis	100W	200W			
		Z-axis					
		R-axis					
Maximum speed		XY resultant	6m/s	7.8m/s	8.6m/s	9.5m/s	
		Z-axis	1.1m/s	2m/s			
		R-axis	2600°/s				
Repeatability (*1)		XY-axes	±0.01mm			±0.02mm	
		Z-axis	±0.01mm				
		R-axis	±0.01°				
Payload			4kg (*2)	10kg (*5)			
Standard cycle time (*3)			0.41s	0.38s	0.39s	0.42s	
R-axis tolerable moment of inertia (*4)			0.05kgm <sup>2</sup>	0.3kgm <sup>2</sup>			
User wiring			0.2sq×10	0.2sq×20			
User tubing			φ4×3	φ6×3			
Travel limit			1. Soft limit   2. Mechanical stopper (X, Y, Z-axis)				
Robot cable			Standard: 3.5m Option: 5m, 10m				
Weight			17kg	25kg		26kg	

\*1: This is the value at a constant ambient temperature.

\*2: User wiring/tubing through spline type (option) are 3kg.

\*3: When moving a 2 kg load back and forth 300mm horizontally and 25mm vertically (rough positioning arch motion).

\*4: The acceleration coefficient is automatically set by setting the tip weight and R-axis inertia moment offset.

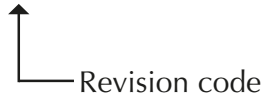
\*5: 9 kg for tool flange mounting or user wiring and piping spline through specification (option).



## Revision history

A manual revision code appears as a suffix to the catalog number on the front cover manual.

Cat. No. I240E-EN-02



The following table outlines the changes made to the manual during each revision.

Revision code	Date	Description
01	June 2020	Original production
02	March 2021	New R6YXE510 model has been included. Addition of optional types: Brake release switch type and User wiring/tubing through cap type.



**Authorized Distributor:**