**SCARA Robots
XC Series**

R6Y - XC series

USER´S MANUAL

OMRON

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

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

1. Please be sure to perform the following tasks before using the robot.
Failing to perform the tasks below will require re-teaching of the robot since the origin position cannot be set to the same previous position. Robot malfunctions (vibration, noise) may also occur.

The origin position of the XC series robots is adjusted to the robot arm extended position at the factory prior to shipment, so the reference or standard coordinates are temporarily set.
The customer should set the origin position before any other job. There are 2 types of origin position settings as shown below.

[1] Setting the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position
(When setting the origin position with the robot arm extended, you must check that there will not be any interference from any peripheral equipment during the next absolute reset.)

[2] Setting a position **OTHER** than the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position

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[1] To set the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position.

Absolute Reset

The XC series robots only require the absolute reset to be performed once when the robot is introduced.
Once the absolute reset is performed, you do not need to reperform it when the power is turned on next time.
Set the origin position while referring to absolute reset methods in "3. Adjusting the origin" in Chapter 4 of this manual and in "Absolute Reset" of the "OMRON Robot Controller User's Manual". Setting of reference coordinates is not required in the above case.

⚠ **CAUTION**
NEVER ENTER THE ROBOT MOVEMENT RANGE ONCE THE ROBOT SERVO IS TURNED ON AS THIS IS EXTREMELY HAZARDOUS.

[2] To set a position **OTHER** than the robot arm extended position (the origin position adjusted at the factory prior to shipment) as the origin position.

1. Absolute reset

The XC series robots only require the absolute reset to be performed once when the robot is introduced.
Once the absolute reset is performed, you do not need to reperform it when the power is turned on next time.
Set the origin position while referring to absolute reset methods in "3. Adjusting the origin" in Chapter 4 of this manual and in "Absolute Reset" of the "OMRON Robot Controller User's Manual".
Set the origin position with the absolute reset.

⚠ **CAUTION**

NEVER ENTER THE ROBOT MOVEMENT RANGE ONCE THE ROBOT SERVO IS TURNED ON AS THIS IS EXTREMELY HAZARDOUS.

2. Affixing the origin position sticker

Set in emergency stop when absolute reset is complete, and immediately affix the origin point sticker according to instructions in "6. Affixing Stickers for Origin Positions, Movement Directions and Axis Names" in Chapter 4 of this manual.

3. Setting the reference coordinates

Set the reference coordinates while referring to instructions in "5. Setting the Reference Coordinates" in Chapter 4 of this manual and also to "Setting the Reference Coordinates" in the "OMRON Robot Controller User's Manual".
Robot malfunctions (vibration, noise) may occur if the reference coordinates are not set correctly.

Even though there is no problem with the robot, the following error messages are issued when the robot and controller are connected and power first turned on.
(Actual error messages may differ according to how the robot and controller are connected.)

Error messages issued when robot & controller are connected (YRC)
17.81 : D?.ABS.battery wire breakage
17.83 : D?.Backup position data error 1
17.85 : D?.Backup position data error 2
17.92 : D?.Resolver disconnected during power off
17.93 : D?.Position backup counter overflow
                                    etc.

2. If the X, Y or R axis rotation angle is small.

If the X, Y or R axis rotation angle is smaller than 5° so that it always moves in the same position, an oil film is difficult to be formed on the joint support bearing, possibly leading to damage to the bearing. In this type of operation, add a movement so that the joint moves through 90° or more, about 5 times a day.

Copyright

The following shall be described in the Copyright section and the description shall not be changed without permission.

Introduction

This user's manual was prepared for XC series ceiling-mount models (R6YXCH250 to R6YXC1000) of the OMRON industrial robots.

This user's manual describes the safety measures, handling, adjustment and maintenance of XC series robots for correct, safe and effective use. Be sure to read this manual carefully before installing the robot. Even after you have read this manual, keep it in a safe and convenient place for future reference.

This user's manual should be used with the robot and considered an integral part of it. When the robot is moved, transferred or sold, send this manual to the new user along with the robot. Be sure to explain to the new user the need to read through this manual.

For the operating or maintenance procedures not described in this manual, please refer to the description of standard models listed in the "OMRON SCARA Robot User's Manual". Also refer to that manual for precautions and warranty. If there are any obscure points in handling the robot, be sure to contact OMRON sales office or dealer.

For details on specific operation and programming of the robot, refer to the separate "OMRON Robot Controller User's Manual".

Disclaimers

CHANGE IN SPECIFICATIONS
Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS
Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA
Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS
The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

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CHAPTER 4 Adjustment

CHAPTER 5 Periodic Inspecition

CHAPTER 6 Specifications

CHAPTER 1

Using the Robot Safely

1 Safety Information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To ensure correct and safe use of OMRON industrial robots, carefully read this manual and make yourself well acquainted with the contents. FOLLOW THE WARNINGS, CAUTIONS AND INSTRUCTIONS INCLUDED IN THIS MANUAL. Failure to take necessary safety measures or mishandling due to not following the instructions in this manual may result in trouble or damage to the robot and injury to personnel (robot operator or service personnel) including fatal accidents. Warning information in this manual is shown classified into the following items.

⚠ **DANGER**

FAILURE TO FOLLOW DANGER INSTRUCTIONS WILL RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, A BYSTANDER OR A PERSON INSPECTING OR REPAIRING THE ROBOT. ADDITIONALLY, THERE MAY BE SEVERE PROPERTY DAMAGE.

⚠ **WARNING**

FAILURE TO FOLLOW WARNING INSTRUCTIONS COULD RESULT IN SEVERE INJURY OR DEATH TO THE ROBOT OPERATOR, A BYSTANDER OR A PERSON INSPECTING OR REPAIRING THE ROBOT. ADDITIONALLY, THERE MAY BE SEVERE PROPERTY DAMAGE..

⚠ **CAUTION**

FAILURE TO FOLLOW CAUTION INSTRUCTIONS MAY RESULT IN INJURY TO THE ROBOT OPERATOR, A BYSTANDER OR A PERSON INSPECTING OR REPAIRING THE ROBOT, OR DAMAGE TO THE ROBOT AND/OR ROBOT CONTROLLER.

📋 NOTE

Explains the key point in the operation in a simple and clear manner.

Refer to the instruction manual by any of the following methods to operate or adjust the robot safely and correctly.

1. Operate or adjust the robot while referring to the printed version of the instruction manual (available for an additional fee).
2. Operate or adjust the robot while viewing the CD-ROM version of the instruction manual on your computer screen.
3. Operate or adjust the robot while referring to a printout of the necessary pages from the CD-ROM version of the instruction manual.

It is not possible to detail all safety items within the limited space of this manual. So it is essential that the user have a full knowledge of basic safety rules and also that the operator makes correct judgments on safety procedures during operation. This manual and warning labels supplied with or affixed to the robot are written in English.

2   Essential Caution Items

Particularly important cautions for handling or operating the robot are described below. In addition, safety information about installation, operation, inspection and maintenance is provided in each chapter. Be sure to comply with these instructions to ensure safe use of the robot.

(1) Observe the following cautions during automatic operation.

Warning labels 1 (Fig. 1-1) are affixed to the robot. See Fig. 2-2 to Fig. 2-4 for the locations of warning labels.

- Install a safeguard enclosure (protective enclosure) to keep any person from entering within the movement range of the robot and suffering injury due to being struck by moving parts.
- Install a safety interlock that triggers emergency stop when the door or panel is opened.
- Install safeguards so that no one can enter inside except from doors or panels equipped with safety interlocks.
- The warning labels shown in Fig. 1-1 are supplied with the robot and should be affixed to a conspicuous spot on doors or panels equipped with safety interlocks.

⚠ **DANGER**

SERIOUS INJURY OR DEATH WILL RESULT FROM IMPACT WITH MOVING ROBOT.
• KEEP OUTSIDE OF GUARD DURING OPERATION.
• LOCK OUT POWER BEFORE APPROACHING ROBOT.

(2) Use caution to prevent hands or fingers from being pinched or crushed.

Warning labels 2 (Fig. 1-2) are affixed to the robot. See Fig. 2-2 to Fig. 2-4 for the locations of warning labels.

Be careful not to let hands or fingers be pinched or crushed by the moving parts of the robot during transportation or teaching.

⚠ **WARNING**

MOVING PARTS CAN PINCH OR CRUSH.
KEEP HANDS AWAY FROM ROBOT ARMS.

■**Fig. 1-1 Warning label 1**
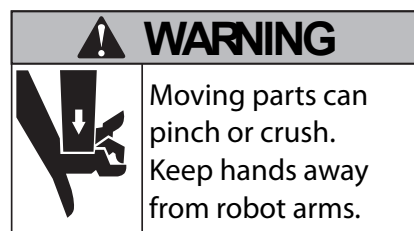
■**Fig. 1-2 Warning label 2**

(3) Follow the instructions on warning labels and in this manual.

Warning label 3 (Fig. 1-3) is affixed to the robot. See Fig. 2-2 to Fig. 2-4 for the locations of warning labels.

- Be sure to read the warning label and this manual carefully and make you thoroughly understand the contents before attempting installation and operation of the robot.

- Before starting the robot operation, even after you have read through this manual, read again the corresponding procedures and cautions in this manual as well as descriptions in this chapter (Chapter 1, "Using the Robot Safely").

- Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.

⚠ **WARNING** ────────────────────

IMPROPER INSTALLATION OR OPERATION CAN RESULT IN SERIOUS INJURY OR DEATH.
READ USER'S MANUAL AND ALL WARNING LABELS BEFORE OPERATION.

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> ⚠ **WARNING**
>
> Improper Installation or operation can result in serious injury or death.
> Read user's (owner's) manual and all warning labels before operation.
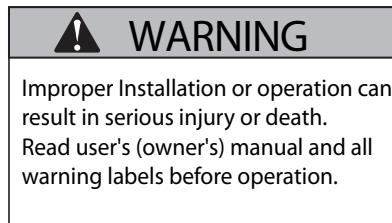
■Fig. 1-3 Warning label 3

(4) Do not use the robot in environments containing inflammable gas, etc.

⚠ **WARNING** ────────────────────

•THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.
•DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE COULD OTHERWISE RESULT.

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(5) Do not use the robot in locations possibly subject to electromagnetic interference, etc.

⚠ **WARNING** ────────────────────

AVOID USING THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. MALFUNCTION MAY OTHERWISE OCCUR.

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(6) Use caution when releasing the Z-axis (vertical axis) brake.

⚠ **WARNING** ━━━━━━━━━━━━━━━━━━━━━━━━━━

THE Z-AXIS WILL SLIDE DOWN WHEN THE Z-AXIS BRAKE IS
RELEASED, CAUSING A HAZARDOUS SITUATION.

•PRESS THE EMERGENCY STOP BUTTON AND PROP UP THE Z-AXIS
WITH A SUPPORT STAND BEFORE RELEASING THE BRAKE.

•USE CAUTION NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE
Z-AXIS AND INSTALLATION BASE WHEN RELEASING THE BRAKE TO
PERFORM DIRECT TEACH.

(7) Provide safety measures for end effector (gripper, etc.).

⚠ **WARNING** ━━━━━━━━━━━━━━━━━━━━━━━━━━

•END EFFECTORS MUST BE DESIGNED AND MANUFACTURED SO
THAT THEY CAUSE NO HAZARDS (FOR EXAMPLE, LOOSENING OF
WORKPIECE) EVEN IF POWER (ELECTRICITY, AIR PRESSURE, ETC.) IS
SHUT OFF OR POWER FLUCTUATIONS OCCUR.

•IF THERE IS A POSSIBLE DANGER THAT THE OBJECT GRIPPED BY
THE END EFFECTOR MAY FLY OFF OR DROP, THEN PROVIDE
APPROPRIATE SAFETY PROTECTION TAKING INTO ACCOUNT THE
OBJECT SIZE, WEIGHT, TEMPERATURE AND CHEMICAL PROPERTIES.

(8) Be cautious of possible Z-axis movement when the controller is turned off or emergency stop is triggered. (2-axis robots with air-driven Z-axis)

⚠ **WARNING** ━━━━━━━━━━━━━━━━━━━━━━━━━━

THE Z-AXIS MOVES UP WHEN THE POWER TO THE CONTROLLER OR
PLC IS TURNED OFF, THE   PROGRAM IS RESET, EMERGENCY STOP IS
TRIGGERED, OR AIR IS SUPPLIED TO THE SOLENOID VALVE FOR THE
Z-AXIS AIR CYLINDER.

•DO NOT LET HANDS OR FINGERS GET CAUGHT AND SQUEEZED BY
MOVING PARTS OF THE Z-AXIS.

•KEEP THE USUAL ROBOT POSITION IN MIND SO THAT THE Z-AXIS
WILL NOT INTERFERE WITH   OBSTACLES DURING RAISING OF THE
Z-AXIS, EXCEPT IN CASE OF EMERGENCY STOP.

(9) Use the following caution items when the Z-axis is interfering with peripheral equipment. (2-axis robots with air driven Z-axis)

⚠ **WARNING** ━━━━━━━━━━━━━━━━━━━━━━━━━━

WHEN THE Z-AXIS COMES TO A STOP DUE TO OBSTRUCTIONS FROM
PERIPHERAL EQUIPMENT, THE Z-AXIS MAY MOVE SUDDENLY WHEN
THE OBSTRUCTION IS REMOVED, CAUSING INJURY SUCH AS
PINCHED OR CRUSHED HANDS.

•TURN OFF THE CONTROLLER AND REDUCE THE AIR PRESSURE
BEFORE ATTEMPTING TO REMOVE THE OBSTRUCTION.

•BEFORE REDUCING THE AIR PRESSURE, PLACE A SUPPORT STAND
UNDER THE Z-AXIS BECAUSE IT WILL DROP UNDER ITS OWN
WEIGHT.

(10) Use caution on Z-axis movement when air supply is stopped. (2-axis robots with air-driven Z-axis)

⚠ **WARNING**

THE Z-AXIS MAY SUDDENLY DROP WHEN THE AIR PRESSURE TO THE Z-AXIS AIR CYLINDER SOLENOID VALVE IS REDUCED, CREATING A HAZARDOUS SITUATION.
TURN OFF THE CONTROLLER AND PLACE A PROP OR SUPPORT UNDER THE Z-AXIS BEFORE CUTTING OFF THE AIR SUPPLY.

(11) Use the following caution items when disassembling or replacing the pneumatic equipment.

⚠ **WARNING**

AIR OR PARTS MAY FLY OUTWARDS IF PNEUMATIC EQUIPMENT IS DISASSEMBLED OR PARTS REPLACED WHILE AIR IS STILL SUPPLIED.
•DO SERVICE WORK AFTER FIRST TURNING OFF THE CONTROLLER AND REDUCING THE AIR PRESSURE.
•BEFORE REDUCING THE AIR PRESSURE, PLACE A SUPPORT STAND UNDER THE Z-AXIS (2-AXIS   ROBOTS WITH AIR DRIVEN Z-AXIS) SINCE IT WILL DROP UNDER ITS OWN WEIGHT.

(12) Use the following caution items when removing the Z-axis motor.

⚠ **WARNING**

THE Z-AXIS WILL DROP WHEN THE Z-AXIS MOTOR IS REMOVED, POSSIBLY RESULTING IN INJURY.
•TURN OFF THE CONTROLLER AND SET A SUPPORT STAND UNDER THE Z-AXIS BEFORE REMOVING THE MOTOR.
•USE CAUTION NOT TO ALLOW HANDS OR BODY TO BE SQUEEZED OR CRUSHED BY MOVING PARTS ON THE Z-AXIS OR BETWEEN THE Z-AXIS AND THE INSTALLATION BASE.

(13) Use the following caution during inspection of controller.

⚠ **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.

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

(14) Consult us for corrective action when the robot is damaged or malfunction occurs.

⚠ WARNING

IF ANY PART OF THE ROBOT IS DAMAGED OR ANY MALFUNCTION OCCURS, CONTINUOUS OPERATION MAY BE VERY DANGEROUS. PLEASE CONSULT OMRON DEALER FOR CORRECTIVE ACTION.

Damage or Trouble	Possible Danger
Damage to machine harness or robot cable	Electrical shock, malfunction of robot
Damage to exterior of robot	Flying outwards of damaged parts during robot operation
Abnormal operation of robot (positioning error, excessive vibration, etc.)	Malfunction of robot
Z-axis brake trouble	Dropping of load

(15) Use caution not to touch the controller rear panel cooling fan.

⚠ WARNING

•BODILY INJURY MAY OCCUR FROM COMING INTO CONTACT WITH THE COOLING FAN WHILE IT IS ROTATING.
 •WHEN REMOVING THE FAN COVER FOR INSPECTION, FIRST TURN OFF THE CONTROLLER AND MAKE SURE THE FAN HAS STOPPED.

(16) Use caution not to touch the high temperature motor or speed reduction gear casing.

⚠ 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 DURING INSPECTIONS OR SERVICING, TURN OFF THE CONTROLLER, WAIT FOR A WHILE AND CHECK THAT THE TEMPERATURE HAS COOLED.

(17) Do not remove, alter or stain the warning labels.

⚠ WARNING

IF WARNING LABELS ARE REMOVED OR DIFFICULT TO SEE, NECESSARY CAUTIONS MAY NOT BE TAKEN, RESULTING IN AN ACCIDENT.
 •DO NOT REMOVE, ALTER OR STAIN THE WARNING LABELS ON THE ROBOT.
•DO NOT ALLOW THE WARNING LABELS TO BE HIDDEN BY THE DEVICE INSTALLED TO THE ROBOT BY THE USER.
•PROVIDE PROPER LIGHTING SO THAT THE SYMBOLS AND INSTRUCTIONS ON THE WARNING LABELS CAN BE CLEARLY SEEN EVEN FROM THE OUTSIDE OF SAFEGUARDS.

(18) Protective bonding

⚠ WARNING ───────────────────────

BE SURE TO GROUND THE ROBOT AND CONTROLLER TO PREVENT
ELECTRICAL SHOCK.

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(19) Be sure to make correct parameter settings.

⚠ CAUTION ───────────────────────

THE ROBOT MUST BE OPERATED WITH CORRECT TOLERABLE
MOMENT OF INERTIA AND ACCELERATION COEFFICIENTS
ACCORDING TO THE MANIPULATOR TIP MASS AND MOMENT OF
INERTIA. IF THIS IS NOT OBSERVED, PREMATURE END TO THE LIFE
OF THE DRIVE UNITS, DAMAGE TO THE ROBOT PARTS OR RESIDUAL
VIBRATION DURING POSITIONING MAY RESULT.

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(20) Do not use the robot for tasks requiring motor thrust.

⚠ CAUTION ───────────────────────

AVOID USING THE XC SERIES ROBOTS FOR TASKS WHICH MAKE USE
OF MOTOR THRUST (PRESS-FITTING, BURR REMOVAL, ETC.). THESE
TASKS MAY CAUSE MALFUNCTIONS OF THE ROBOT.

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(21) If the X, Y or R axis rotation angle is small

⚠ CAUTION ───────────────────────

IF THE X, Y OR R AXIS ROTATION ANGLE IS SMALLER THAN 5° SO
THAT IT ALWAYS MOVES IN THE SAME POSITION, AN OIL FILM IS
DIFFICULT TO BE FORMED ON THE JOINT SUPPORT BEARING,
POSSIBLY LEADING TO DAMAGE TO THE BEARING. IN THIS TYPE OF
OPERATION, ADD A MOVEMENT SO THAT THE JOINT MOVES
THROUGH 90° OR MORE, ABOUT 5 TIMES A DAY.

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3   Special Training for Industrial Robot Operation

Companies or factories using industrial robots must make sure that every person, who handles the robot such as for teaching, programming, movement check, inspection, adjustment and repair, has received appropriate training and also has the skills needed to perform the job correctly and safely.

Since the XC series robots fall under the industrial robot category, the user must observe local regulations and safety standards for industrial robots, and provide special training for every person involved in robot-related tasks (teaching, programming, movement check, inspection, adjustment, repair, etc.).

4   Robot Safety Functions

(1) Overload detection

This function detects an overload applied to the motor and shuts off the servo power. If an overload error occurs, take the following measures.
1. Insert a timer in the program.
2. Reduce the acceleration coefficient.

(2) Overheat detection

This function detects an abnormal temperature rise in the driver inside the controller and shuts off the servo power. If an overheat error occurs, take the following measures.
1. Insert a timer in the program.
2. Reduce the acceleration coefficient.

(3) Soft limits

Soft limits can be set on each axis to limit the working envelope in manual operation after return-to-origin and during automatic operation.
Note: The working envelope is the area limited by soft limits.

(4) Mechanical stoppers

If the servo power is suddenly shut off during high-speed operation by emergency stop or safety functions, these mechanical stoppers prevent the axis from exceeding the movement range.The movement ranges of the X-axis arm can be limited as needed by use of mechanical stoppers. (Excluding the R6YXCH250, R6YXCH350 and R6YXCH400)
On the Y-axis arm, mechanical stoppers are fixed at both ends of the maximum movement range.
The Z-axis has a mechanical stopper at the upper end and lower end.
No mechanical stopper is provided on the R-axis.
Note: The movement range is the area limited by mechanical stoppers.

⚠ **WARNING**

AXIS MOVEMENT WILL NOT STOP IMMEDIATELY AFTER THE SERVO

POWER SUPPLY IS SHUT OFF BY EMERGENCY STOP OR OTHER

SAFETY FUNCTIONS.

(5) Z-axis (vertical axis) brake

An electromagnetic brake is installed on the Z-axis to prevent the Z-axis from sliding down when servo power is turned off. This brake is working when the controller is off or the Z-axis servo power is off even when the controller is on.The Z-axis brake can be released by means of the programming box or by a command in the program when the controller is on.

⚠ **WARNING**

THE Z-AXIS WILL SLIDE DOWN WHEN THE Z-AXIS BRAKE IS

RELEASED, CREATING A HAZARDOUS SITUATION.

• PRESS THE EMERGENCY STOP BUTTON AND PROP THE Z-AXIS WITH

A SUPPORT STAND BEFORE RELEASING THE BRAKE.

 • USE CAUTION NOT TO LET YOUR BODY GET CAUGHT BETWEEN

THE Z-AXIS AND INSTALLATION BASE WHEN RELEASING THE BRAKE

TO PERFORM DIRECT TEACH.

5   Safety Measures for the System

Since the robot is commonly used in conjunction with an automated system, dangerous situations are more likely to occur from the automated system than from the robot itself. Accordingly, appropriate safety measures must be taken on the part of the system manufacturer according to the individual system. The system manufacturer should provide a proper instruction manual for safe, correct operation and servicing of the system.

6 Trial Operation

After making installations, adjustments, inspections, maintenance or repairs to the robot, make a trial run using the following procedures.

(1) If a safeguard enclosure has not yet been provided right after installation of the robot, rope off or chain off around the movement area of the manipulator in place of the safeguard enclosure, and observe the following points.
   1. Use sturdy, 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 sign to keep the operator or other personnel from entering the movement range of the manipulator.

(2) Check the following points before turning on the controller.
   1. Is the robot securely and correctly installed?
   2. Are the electrical connections to the robot correct?
   3. Are items such as air pressure correctly supplied?
   4. Is the robot correctly connected to peripheral equipment?
   5. Have safety measures (safeguard enclosure, etc.) been taken?
   6. Does the installation environment meet the specified standards?

(3) After the controller is turned on, check the following points from outside the safeguard enclosure.
   1. Does the robot start and stop as intended? Can the operation mode be selected correctly?
   2. Does each axis move as intended within the soft limits?
   3. Does the end effector move as intended?
   4. Are the signal transmissions to the end effector and peripheral equipment correct?
   5. Does emergency stop work?
   6. Are the teaching and playback functions normal?
   7. Are the safeguard enclosure and interlock working as intended?
   8. Does the robot move correctly during automatic operation?

7   Work Within the Safeguard Enclosure

(1) When work is required inside the safeguard enclosure, always turn off the controller and place a sign indicating that the robot is being adjusted or serviced in order to keep any other person from touching the controller switch or operation panel, except for the following cases.
1) Origin position setting (See Section 3 in Chapter 4.)
2) Soft limit settings (See Section 4 in Chapter 4.)
3) Standard coordinate settings (See Section 5 in Chapter 4.)
4) Teaching

For items 1) to 3), follow the precautions and procedure for each section. To perform item 4), refer to the description in (2) below.

(2) Teaching
When performing teaching within the safeguard enclosure, comply with the instructions listed below.
1) Check or perform the following points from outside the safeguard enclosure.
    1. Make sure that no hazards are present within the safeguard enclosure by a visual check.
    2. Check that the programming box (PB) operates correctly.
    3. Check that no failures are found in the robot.
    4. Check that emergency stop works correctly.
    5. Select teaching mode and prohibit automatic operation.
2) Never enter the movement range of the manipulator while within the safeguard enclosure.

8 Automatic Operation

Automatic operation described here includes all operations in AUTO mode.

(1) Check the following before starting automatic operation.
1. No one is within the safeguard enclosure.
2. The programming box and tools are in their specified locations.
3. The alarm or error lamps on the robot and peripheral equipment do not flash.
4. The safeguard enclosure is securely installed with safety interlocks actuated.

(2) Observe the following during automatic operation or in cases where an error occurs.
1) After automatic operation has started, check the operation status and warning lamp to ensure that the robot is in automatic operation.
2) Never enter the safeguard enclosure during automatic operation.
3) If an error occurs in the robot or peripheral equipment, observe the following procedure before entering the safeguard enclosure.
1. Press the emergency stop button to set the robot to emergency stop.
2. Place a sign on the start switch, indicating that the robot is being inspected in order to keep any other person from touching the start switch and restarting the robot.

9 Adjustment and Inspection

Do not attempt any installation, adjustment, inspection or maintenance unless it is described in this manual.

10 Repair and Modification

Do not attempt any repair, parts replacement and modification unless described in this manual. These works require technical knowledge and skill, and may also involve work hazards.

11   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 that 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 disasters.

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 representatives.

4) Use of any other than genuine parts and specified grease and lubricants.

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.

12   CE Marking

When the OMRON robots are exported to or used in EU (European Union) countries, refer to the separate "OMRON Robot Controller User's Manual" or "CE marking Supplement Manual" for related information about CE marking.

CHAPTER 2

Functions

1   Robot Manipulator

The XC series robots are available in 4-axis models having an X/Y-axis arm (equivalent to human arm) and a Z/R-axis (equivalent to human wrist).

With these 4 axes, the XC series robots can move as shown in Fig. 2-1. By attaching different types of end effector (gripper) to the end of the arm, a wide range of tasks can be performed with high precision at high speeds.

The (+) and (-) signs show the direction of axis movement when the jog keys on the programming box are pressed (standard setting at the factory). Fig. 2-2 to Fig. 2-4 on the subsequent pages show part names and functions of each robot model.
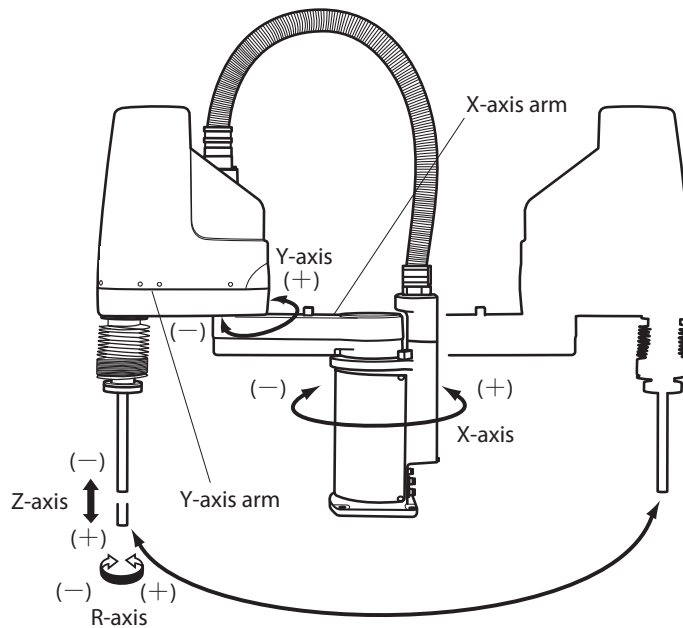
Fig. 2-1 Manipulator movement

Fig. 2-2 R6YXCH250, R6YXCH350, R6YXCH400

User tubing 2 (ø6 red)

User tubing 3 (ø6 blue)

Eyebolt installation position

X-axis movable mechanical stopper

D-sub connector for user wiring (No.1 to 20)

User tubing 1 (ø6 black)

Y-axis mechanical stopper

Machine harness

Ball screw

Warning label 1 (Same on opposite side)

Warning label 2 (Same on opposite side)

2×2-M4×0.7 Depth10

(Same on opposite side)

Bellows top clamp plate

Y-axis motor

Z-axis motor

R-axis motor

Y-axis speed reduction gear

Y-axis arm

Z-axis,R-axis pulley, belt

R-axis speed reduction gear

Z-axis spline

End effector attachment

X-axis arm

X-axis speed reduction gear

X-axis motor

Bellows

Bellows bottom clamp plate

Warning label 3

Serial label

D-sub connector for user wiring (No.1 to 20)

M4 ground terminal

User tubing 1 (ø6 black)

User tubing 2 (ø6 red)

User tubing 3 (ø6 blue)

Suction air joint (ø12×3)

Robot cable

Fig. 2-3 R6YXC500, R6YXC600

User tubing 1 (ø6 black)

User tubing 2 (ø6 red)

User tubing 3 (ø6 blue)

Eyebolt installation position

X-axis movable mechanical stopper

D-sub connector for user wiring (No.1 to 20)

Y-axis mechanical stopper

Machine harness

Ball screw

Warning label 2 (Same on opposite side)

R-axis motor

Z-axis motor

Y-axis motor

Warning label 1 (Same on opposite side)

2×2-M4×0.7 Depth10 (Same on opposite side)

Y-axis speed reduction gear

X-axis arm

Bellows top clamp plate

Y-axis arm

Z-axis,R-axis pulley, belt

Bellows

X-axis speed reduction gear

X-axis motor

R-axis speed reduction gear

Z-axis spline

Bellows bottom clamp plate

End effector attachment

Warning label 3

Serial label

Suction air joint (ø12×2)

User tubing 1 (ø6 black)

User tubing 2 (ø6 red)

User tubing 3 (ø6 blue)

M4 ground terminal

D-sub connector for user wiring (No.1 to 20)

For air exhaust (ø12)

Robot cable

Fig. 2-4 R6YXC700, R6YXC800, R6YXC1000

2   Robot Controller

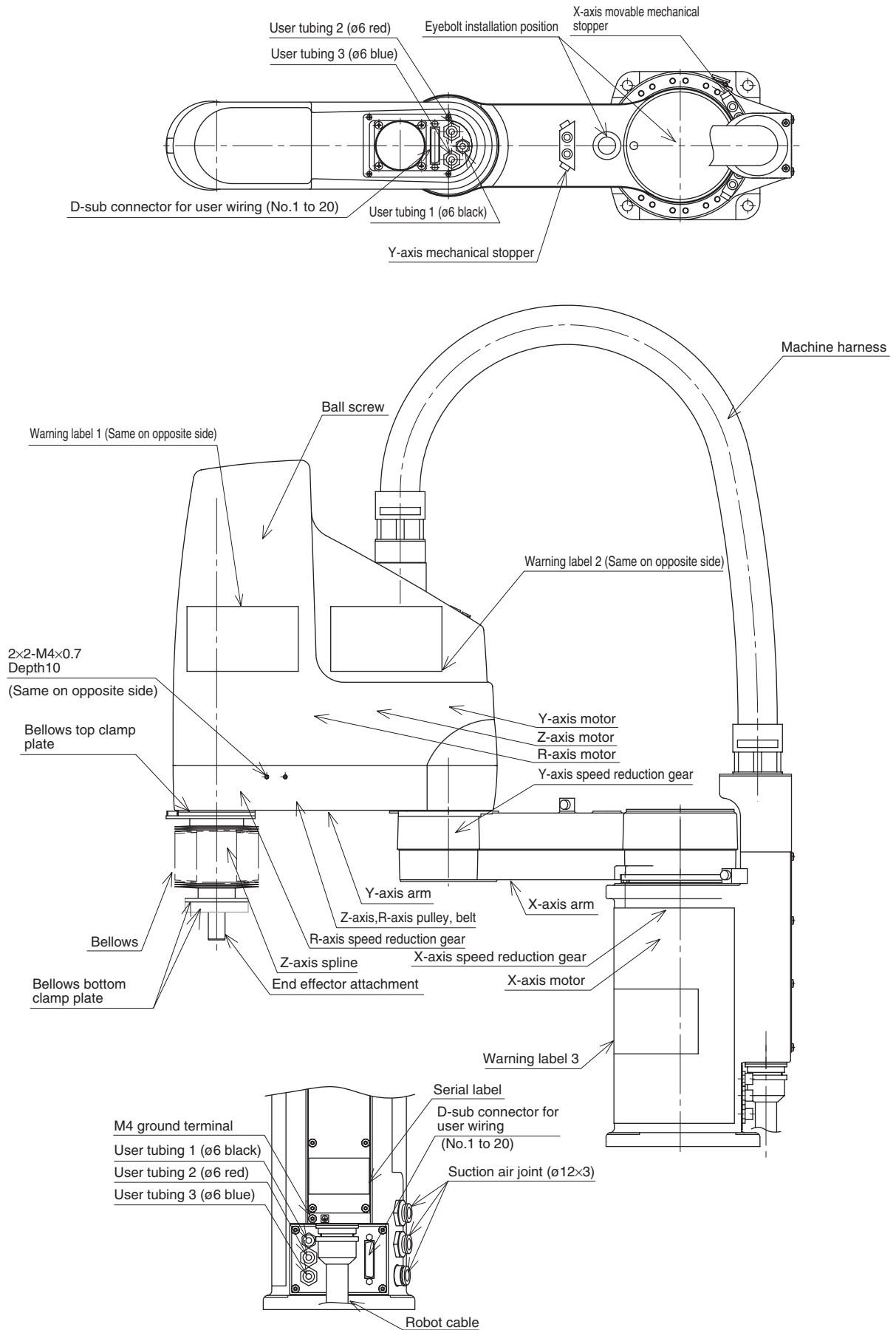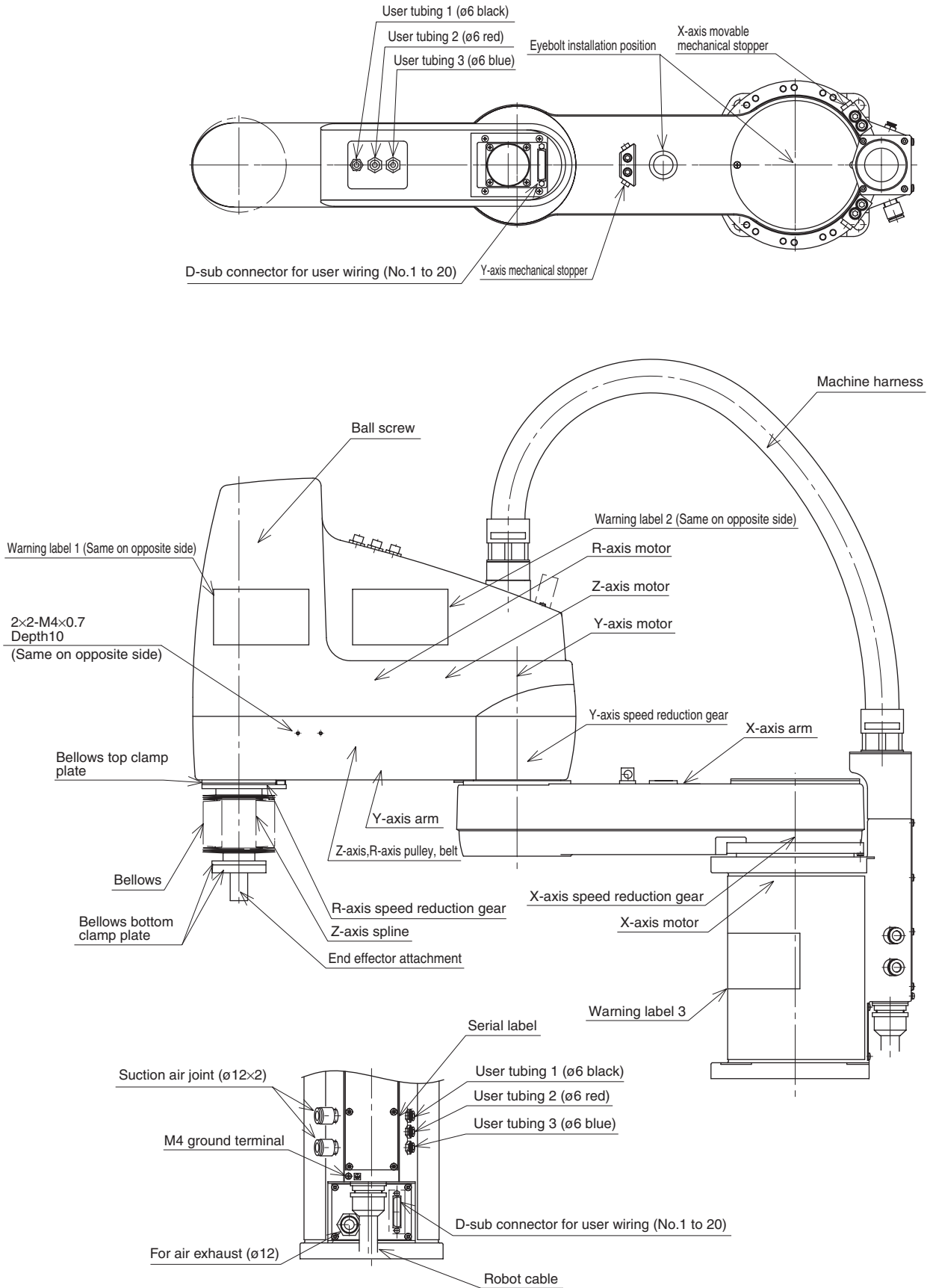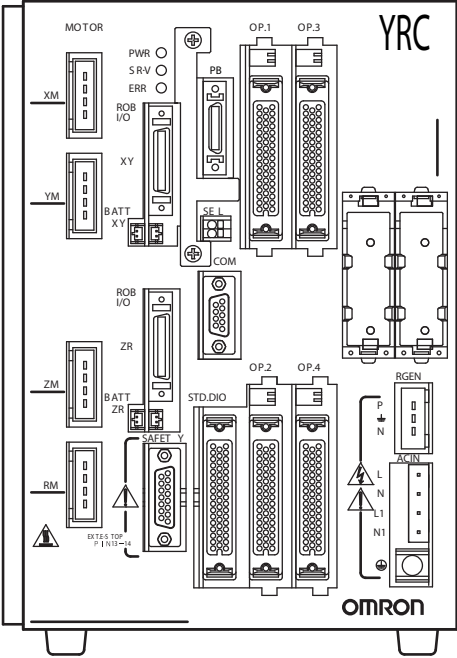The XC series robot comes supplied with a robot controller YRC. For more details, refer to the separate "OMRON Robot Controller User's Manual".

YRC robot controller

Fig. 2-5 Robot controller

CHAPTER 3

Installation

1   Robot Installation Conditions

1-1   Installation environments

Be sure to install the robot in the following environments.

Items	Specifications
Allowable ambient temperature	0 to 40°C
Allowable ambient humidity	35 to 85% RH (non condensation)
Altitude	0 to 1000 meters above sea level
Ambient environments	Avoid installing near water, cutting water, oil, dust, metallic chips and organic solvent.
	Avoid installation near corrosive gas and corrosive materials.
	Avoid installation in atmosphere containing inflammable gas, dust or liquid.
	Avoid installation near objects causing electromagnetic interference, electrostatic discharge or radio frequency interference.
Vibration	Do not subject to impacts or vibrations.
Air supply pressure, etc.	Below 0.58MPa (6.0kgf/cm2); clean dry air not containing deteriorated compressor oil; filtration 40μm or less
Working space	Allow sufficient space margin to perform jobs (teaching, inspection, repair, etc.)

For detailed information on how to install the robot controller, refer to the separate "OMRON Robot Controller User's Manual".

⚠ **WARNING** ─────────────────────────────────

AVOID INSTALLING THE ROBOT IN LOCATIONS WHERE THE AMBIENT CONDITIONS MAY EXCEED THE ALLOWABLE TEMPERATURE OR HUMIDITY, OR IN ENVIRONMENTS WHERE WATER, CORROSIVE GASES, METALLIC POWDER OR DUST ARE GENERATED. MALFUNCTION, FAILURE OR SHORT CIRCUITS MAY OTHERWISE RESULT.

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⚠ **WARNING** ─────────────────────────────────

• THIS ROBOT WAS NOT DESIGNED FOR OPERATION IN ENVIRONMENTS WHERE INFLAMMABLE OR EXPLOSIVE SUBSTANCES ARE PRESENT.
 • DO NOT USE THE ROBOT IN ENVIRONMENTS CONTAINING INFLAMMABLE GAS, DUST OR LIQUIDS. EXPLOSIONS OR FIRE COULD OTHERWISE RESULT.

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⚠ **WARNING** ─────────────────────────────────

AVOID USING THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. MALFUNCTION MAY OTHERWISE OCCUR.

─────────────────────────────────

⚠ **WARNING**

DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO EXCESSIVE VIBRATION. ROBOT INSTALLATION BOLTS MAY OTHERWISE BECOME LOOSE CAUSING THE MANIPULATOR TO FALL OVER.

1-2 Installation base

1) Prepare a sufficiently rigid and stable installation base, taking account of the robot weight including the end effector (gripper), workpiece and reaction force while the robot is operating. The maximum reaction force (see Fig. 3-1) applied to the X-axis and Z-axis of each robot during operation is shown in the table below. These values are an instantaneous force applied to the robot during operation and do not indicate the maximum load capacity.

The maximum reaction force

Robot Model	F_xmax		M_xmax		F_zmax	
	N	kgf	Nm	kgfm	N	kgf
R6YXCH250	305	31	56	6	40	4
R6YXCH350	330	34	56	6	40	4
R6YXCH400	391	40	56	6	40	4
R6YXC500	708	72	137	14	89	9
R6YXC600	735	75	137	14	89	9
R6YXC700	1653	169	304	31	159	16
R6YXC800	1707	174	304	31	159	16
R6YXC1000	1618	165	333	34	127	13
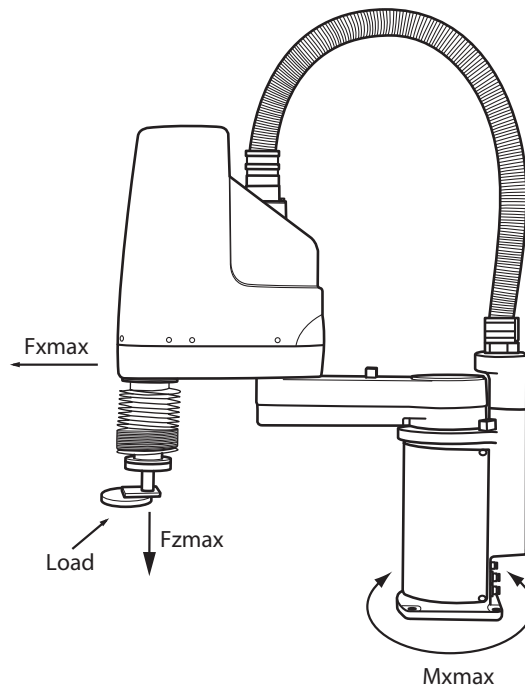
Fig. 3.1 Maximum reaction force applied during operation

2) The parallelism of the installation base surface must be machined within a precision of ±0.05mm/500mm. The robot base mount must be installed facing down and in a level position (except ceiling-mount models which should be installed with the base mount facing up).

3) Tap holes into the surface of the installation base. For machining dimensions and positions, refer to the dimensional outlines listed in our robot catalog.

4) Securely fix the installation base on the floor with anchor bolts.

⚠ **WARNING**

DO NOT PLACE THE ROBOT ON A MOVING INSTALLATION BASE.
EXCESSIVE LOADS WILL BE APPLIED TO THE ROBOT ARM BY
MOVEMENT OF THE INSTALLATION BASE, RESULTING IN DAMAGE
TO THE   ROBOT.

⚠ **CAUTION**

THE MANIPULATOR POSITIONING MIGHT DECREASE IF THE
INSTALLATION SURFACE PRECISION IS   INSUFFICIENT.

⚠ **CAUTION**

IF THE INSTALLATION BASE IS NOT SUFFICIENTLY RIGID AND
STABLE OR A THIN METALLIC PLATE IS ATTACHED TO THE
INSTALLATION BASE, VIBRATION (RESONANCE) MAY OCCUR DURING
OPERATION, CAUSING DETRIMENTAL EFFECTS ON THE
MANIPULATOR WORK.

2 Installation

2-1 Unpacking

⚠ **WARNING**

THE ROBOT AND CONTROLLER ARE HEAVY. TAKE SUFFICIENT CARE NOT TO DROP THEM DURING   MOVING OR UNPACKING AS THIS MAY DAMAGE THE EQUIPMENT OR CAUSE BODILY INJURY.

⚠ **CAUTION**

WHEN MOVING THE ROBOT OR CONTROLLER BY EQUIPMENT SUCH AS A FOLKLIFT THAT REQUIRE A LICENSE, ONLY PROPERLY QUALIFIED PERSONNEL MAY OPERATE IT. THE EQUIPMENT AND TOOLS USED FOR MOVING THE ROBOT SHOULD BE SERVICED DAILY.

The XC series robot comes packed with a robot controller and accessories, according to the order specifications. Using a carrying cart (dolly) or forklift, move the package to near the installation base. Take sufficient care not to apply shocks to the equipment when unpacking it.

R6YXCH250, R6YXCH350, R6YXCH400

* Illustrations show examples of standard specifications.

Robot manipulator

Case

R6YXC500, R6YXC600, R6YXC700, R6YXC800, R6YXC1000

Robot manipulator

Robot controller and accessories

Arm clamping stay
(Used only for transportation. Remove after installation.)
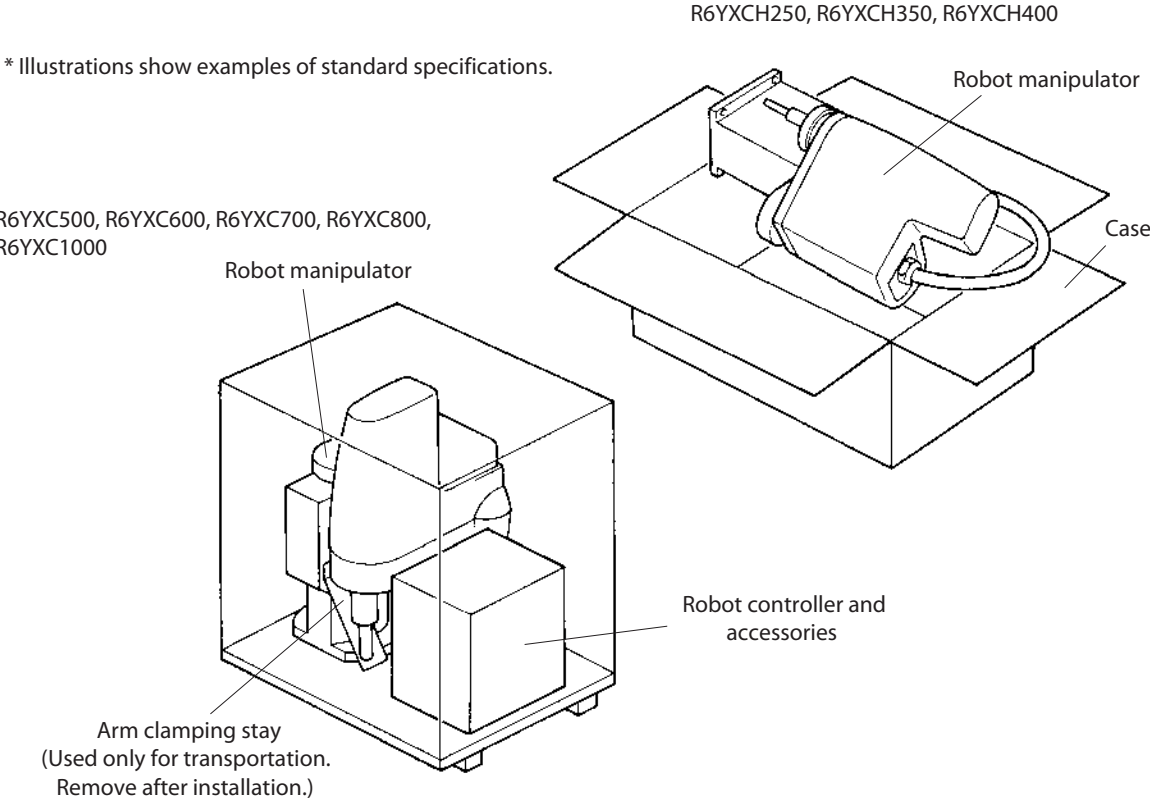
Fig. 3-2 Packed state

2-2　　Checking the product

After unpacking, check the product configuration and conditions.

The following configurations are typical examples, so please check that the product is as specified in your order.

⚠ **CAUTION**

IF THERE IS ANY DAMAGE DUE TO TRANSPORTATION OR INSUFFICIENT PARTS, PLEASE NOTIFY YOUR OMRON SALES OFFICE OR DEALER IMMEDIATELY.

[Example]　Controller　:　YRC
　　　　　　Robot　　　:　R6YXCH250, R6YXCH350, R6YXCH400,
　　　　　　　　　　　　　 R6YXC500, R6YXC600, R6YXC700, R6YXC800,
　　　　　　　　　　　　　 R6YXC1000
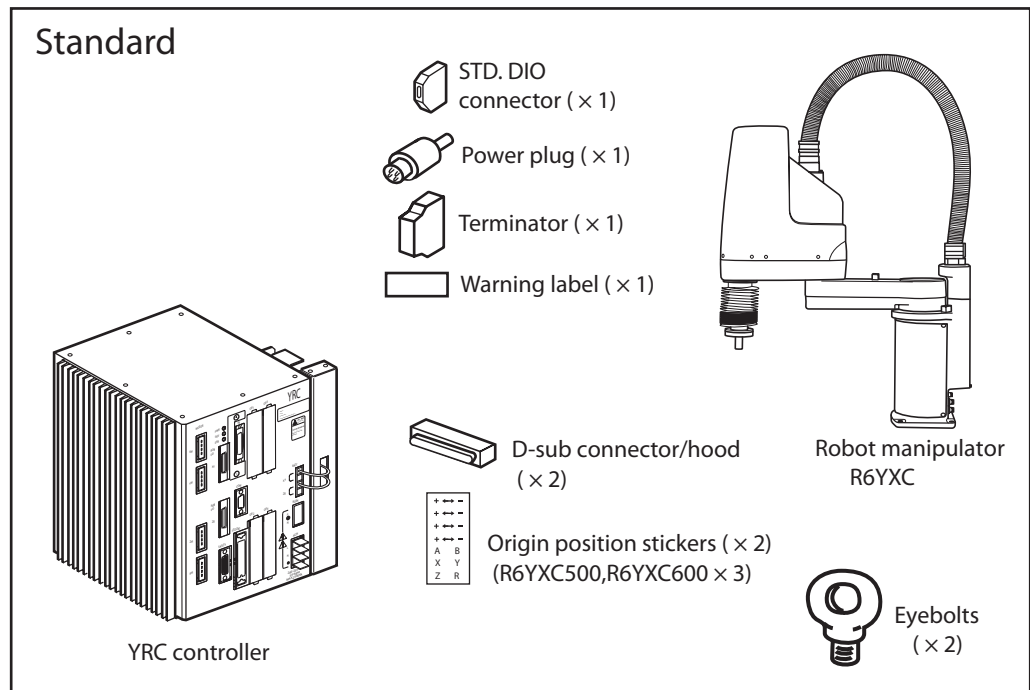
Eyebolts are not supplied with R6YXCH250, R6YXCH350 and R6YXCH400
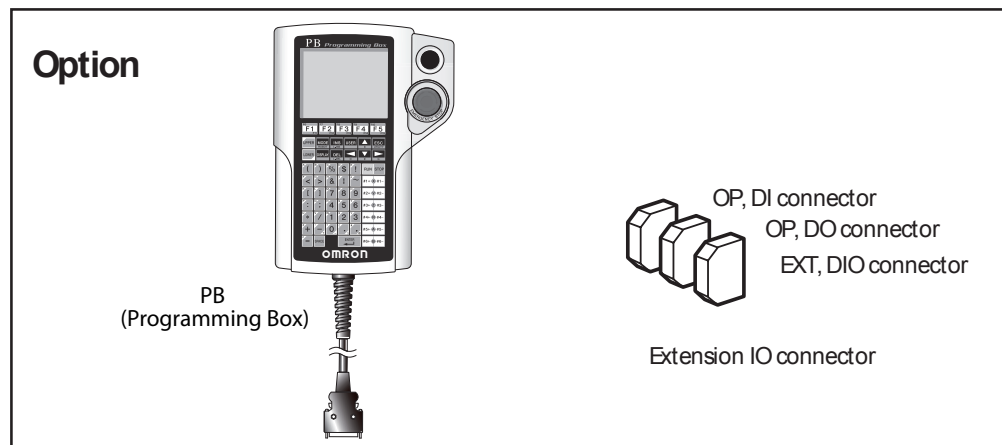
Fig. 3-3 Product configurations

2-3   Moving the robot

⚠ **WARNING**

SERIOUS INJURY MAY OCCUR IF THE ROBOT FALLS AND PINS
SOMEONE UNDER IT.
•DO NOT ALLOW ANY PART OF YOUR BODY TO ENTER THE AREA
BENEATH THE ROBOT DURING WORK.
•ALWAYS WEAR A HELMET, SAFETY SHOES AND GLOVES DURING
WORK.

To check the mass of each robot, refer to "1-1 Basic specifications" in Chapter 6.

2-3-1   Moving the R6YXCH250, R6YXCH350, R6YXCH400

1) Fold the X and Y axis arms as shown in Fig. 3-4, and wind the robot cable
    around the upper part of the pedestal, then fasten the robot cable with
    adhesive tape so as not to cover the bolt installation holes.

2) Holding the support parts as shown in the figure with both hands, place the
    robot on the installation base and secure it temporarily by tightening the
    bolts.
    (For tightening torque to secure the robot firmly, see the next section,
    "2-4 Installing the robot".)

Fig. 3-4

2-3-2   Moving the R6YXC500, R6YXC600, R6YXC700, R6YXC800, R6YXC1000

⚠ **WARNING** _____

SERIOUS INJURY MAY OCCUR IF THE ROBOT FALLS AND PINS SOMEONE UNDER IT.
 • CHECK THAT THERE ARE NO CRACKS AND CORROSION ON THE EYEBOLT INSTALLATION. IF FOUND, DO NOT USE EYEBOLTS TO MOVE THE ROBOT.
• SCREW THE EYEBOLTS SECURELY INTO THE TAPPED HOLES UNTIL THE BEARING SURFACE OF EYEBOLT MAKES TIGHT CONTACT WITH THE BEARING SURFACE ON THE ARM.
 • USE A HOIST AND ROPE WITH CARRYING CAPACITY STRONG ENOUGH TO SUPPORT THE ROBOT WEIGHT.
• MAKE SURE THE ROPE STAYS SECURELY ON THE HOIST HOOK.
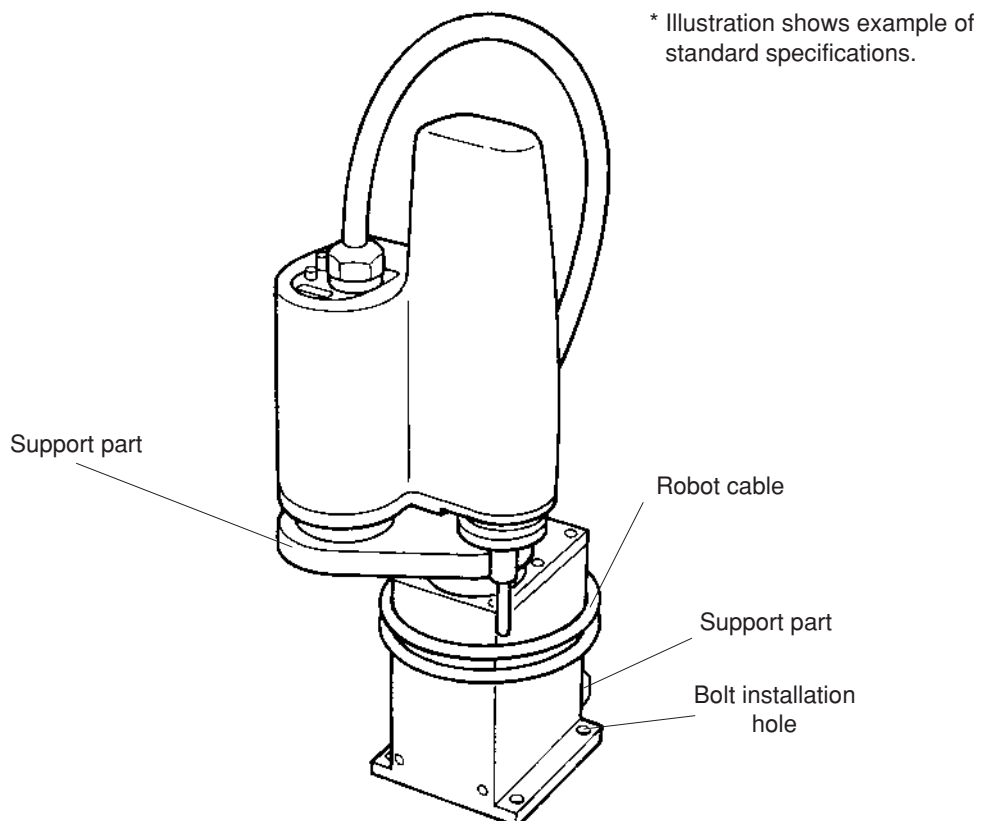• REMOVE ALL LOADS ATTACHED TO THE ROBOT MANIPULATOR END. IF ANY LOAD IS STILL ATTACHED, THE ROBOT MAY LOSE BALANCE WHILE BEING CARRIED, AND TOPPLE OVER CAUSING ACCIDENTS.
_____

⚠ **CAUTION** _____

• WHEN MOVING THE ROBOT BY EQUIPMENT SUCH AS CRANES THAT REQUIRE A LICENSE, ONLY PROPERLY QUALIFIED PERSONNEL MAY OPERATE IT.
• THE EQUIPMENT AND TOOLS USED FOR MOVING THE ROBOT SHOULD BE SERVICED DAILY.
_____

To move a robot (for example, the R6YXC500) correctly and safely, follow the procedure below. (See Fig. 3-5.) Use the same procedure to move other robots.

1) If the Z-axis is not at the origin position, perform return-to-origin from outside the safeguard enclosure. Then, turn off the controller and unplug the robot cable from the controller. (The Z-axis is fixed at the origin position prior to shipping.)

2) Remove the X-axis arm cover and set screws.

3) Fold the X and Y-axis arms as shown in the drawing, and clamp the Y axis arm to the robot pedestal by using the stay and bolts that come with the robot. If the arms cannot be folded in the carrying position due to the X-axis mechanical stoppers, then remove them. (When the robot is shipped, the mechanical stoppers are installed to provide the maximum movement range.)

4) Screw the two eyebolts securely into the tapped hole on the machined bearing surface of the X-axis arm.

5) Wind the robot cable around the upper part of the robot pedestal so that it does not hang up on the base mount, then fasten the cable end with adhesive tape.

6) Prepare two looped ropes with the same length to allow a good lifting balance, then pass each rope through each eyebolt and catch it on the hoist hook.

7) Slightly lift the hoist so that each rope has light tension to hold the robot. In this state, remove the bolts securing the robot base to the pallet supplied or installation base (if robot is to be moved to another installation base).

8) Using caution to keep the balance of the robot and avoid subjecting it to any strong vibrations and shocks, operate the hoist carefully to move to the installation base. The angle between each rope and the arm surface should be kept at 45 degrees or more.

9) Slightly lower the robot on the installation base and temporarily secure it by tightening the bolts.
(For tightening torque to secure the robot firmly, see the next section, "2-4 Installing the robot".)

10) Remove the ropes, eyebolts and arm clamping stay, then reattach the cover and the set screws on the X-axis arm. (Be sure to fit the set screws and the cover in position to protect the tapped holes for eyebolts.) Keep the eyebolts, arm clamping stay, bolts and pallet for future use in case the robot needs to be moved or transported.

⊖ Set screw

Eyebolt (2 pieces supplied with the robot)

Bearing surface for eyebolt

X-axis arm cover

Arm clamping stay (supplied with the robot)

Bolt (2 pieces supplied with the robot)
Tightening toeque 4.5N•m (46kgf•cm)

R6YXC500, R6YXC600

Hoist hook

Rope

Bearing surface for eyebolt

45 or more

R6YXC700 - R6YXC1000

Robot cable

M12 x 20mm-length bolt
Tightening toeque 71N•m (720kgf•cm)

Bolt and nut (4 pieces each supplied with the robot)

Pallet (supplied with the robot)

Fig. 3-5

2-4   Installing the robot

Install the robot securely with the four hex socket head bolts as shown in Fig. 3-6.

⚠ **WARNING** _____

WHEN INSTALLING THE ROBOT, BE SURE TO USE THE SPECIFIED SIZE AND QUANTITY OF BOLTS THAT MATCH THE DEPTH OF TAPPED HOLES IN THE INSTALLATION BASE, AND SECURELY TIGHTEN THE BOLTS TO THE CORRECT TORQUE. IF THE BOLTS ARE NOT TIGHTENED CORRECTLY, THE ROBOT MIGHT FALL OVER DURING OPERATION CAUSING A SERIOUS ACCIDENT.

Tightening torque

Robot Model	Bolts Used	Tightening torque
R6YXCH250, R6YXCH350, R6YXCH400	M8	37N·m (380kgf · cm)
R6YXC500, R6YXC600	M10	71N·m (720kgf · cm)
R6YXC700, R6YXC800, R6YXC1000	M12	128N·m (1310kgf · cm)

Depth of tapped holes in installation base:

Iron installation base   Bolt diameter × 1.5 or more

Aluminum installation base   Bolt diameter × 3 or more

Fig. 3-6 Installing the robot

3   Protective Bonding

⚠ **WARNING** ────────────────────────────────

    BE SURE TO GROUND THE ROBOT AND CONTROLLER TO PREVENT
    ELECTRICAL SHOCK.

──

⚠ **WARNING** ────────────────────────────────

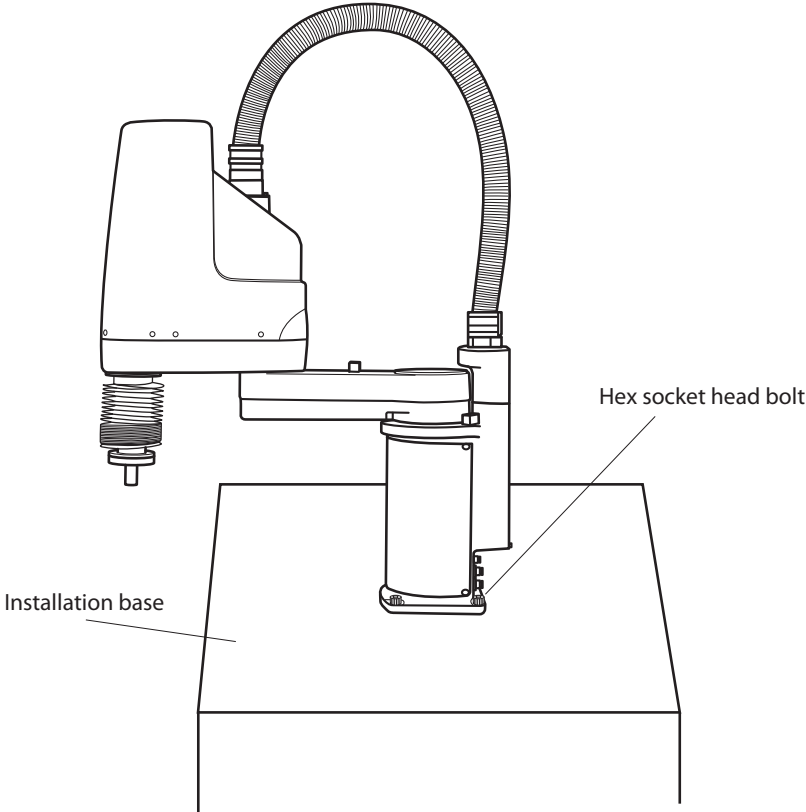   TURN OFF THE CONTROLLER BEFORE GROUNDING THE ROBOT.

──

The robot must be grounded as follows:

1) Provide a terminal marked "PE" for the protective conductor of the entire system and connect it to an external protective conductor. In addition, securely connect the ground terminal on the robot pedestal to the same protective conductor. (See Fig. 3-7 for example of the R6YXC500.)
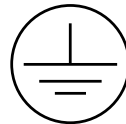
(Symbol 417-IEC-5019)

2) When the end effector uses an electrical device which, if it malfunctions, might make contact with the power supply, the user must provide proper grounding on his own responsibility. The XC series robots do not have a ground terminal for this purpose.

3) For details on protective bonding on the robot body to comply with CE markings, follow the instructions on protective bonding explained in the "OMRON Robot Controller User's Manual".

4) Use a ground cable with a conductor wire cross section of at least 2.0mm^2 and a length within 1 meter.

Fig. 3-7 Ground terminal

4 Robot Cable Connection

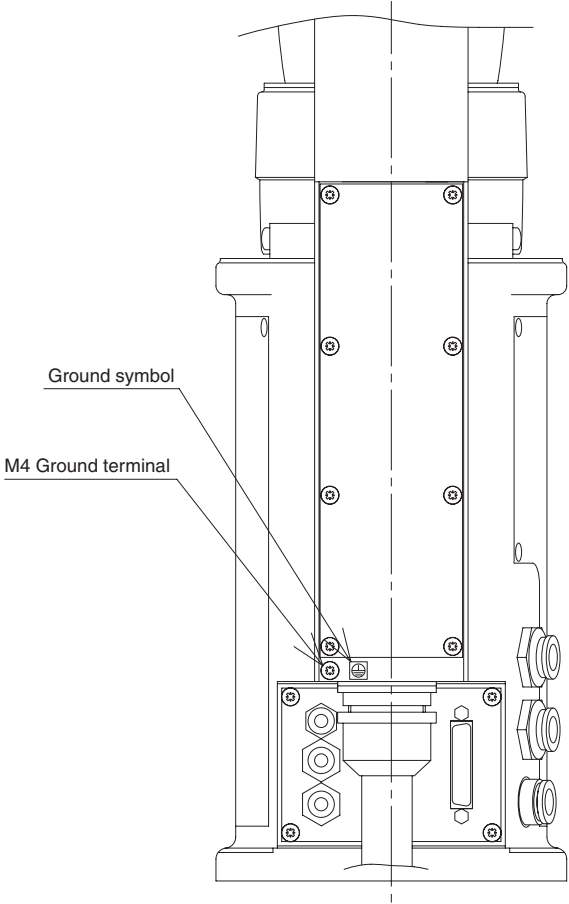The robot cable is pre-connected to the XC series robot. For details on connections to the robot controller, refer to Fig. 3-8 and the "OMRON Robot Controller User's Manual". After making connections, check the operation while referring to "6 Trial operation" in Chapter 1.

⚠ **WARNING** _____

•BEFORE CONNECTING THE CABLES, CHECK THAT THERE ARE NO BENDS OR BREAKS IN THE   CONNECTOR PINS OF THE ROBOT CABLE AND THAT THE CABLES ARE NOT DAMAGED. BENT OR BROKEN PINS OR CABLE DAMAGE MAY CAUSE MALFUNCTION OF THE ROBOT.
•ENSURE THAT THE CONTROLLER IS OFF BEFORE CONNECTING THE ROBOT CABLE TO THE CONTROLLER.

⚠ **WARNING** _____

IN THE YRC CONTROLLER, THE MOTOR CONNECTORS XM AND ZM, AND YM AND RM EACH HAVE IDENTICAL SHAPES. IN ADDITION, THE PI CONNECTORS XY AND ZR HAVE IDENTICAL SHAPES. DO NOT CONFUSE THESE CONNECTORS WHEN MAKING CONNECTIONS. WRONG CONNECTIONS MAY RESULT IN MALFUNCTION AND HAZARDOUS SITUATIONS.

⚠ **WARNING** _____

•IF THE CONNECTOR INSTALLATION IS INADEQUATE OR IF THERE ARE CONTACT FAILURES IN THE PINS, THE ROBOT MAY MALFUNCTION CAUSING A HAZARDOUS SITUATION. RECONFIRM THAT EACH CONNECTOR IS SECURELY INSTALLED BEFORE TURNING ON THE CONTROLLER.
•TO ATTACH THE PI CONNECTOR SECURELY, TIGHTEN THE SCREWS SUPPLIED WITH THE ROBOT.
•TAKE CAUTION NOT TO APPLY AN EXCESSIVE LOAD TO THE CONNECTORS DUE TO STRESS OR TENSION ON THE CABLES.

⚠ **WARNING** _____

LAY OUT THE CABLES SO THAT THEY DO NOT OBSTRUCT THE MOVEMENT OF THE MANIPULATOR. DETERMINE THE ROBOT WORK AREA IN WHICH THE ROBOT CABLES WILL NOT INTERFERE WITH THE LOAD OR WORKPIECE PICKED UP BY THE MANIPULATOR. IF THE ROBOT CABLES INTERFERE WITH THE MOVABLE PARTS OF THE ROBOT, THE CABLES MAY BE DAMAGED CAUSING MALFUNCTION AND HAZARDOUS SITUATIONS. FOR THE EXTERNAL VIEW AND DIMENSIONS OF EACH ROBOT, REFER TO THE DIMENSIONAL OUTLINES LISTED IN OUR ROBOT CATALOG.

⚠ **WARNING**

LAY OUT THE ROBOT CABLES SO AS TO KEEP THE OPERATOR OR ANY OTHER PERSON FROM TRIPPING ON THEM. BODILY INJURY MAY RESULT IF SOMEONE TRIPS ON THE CABLES.
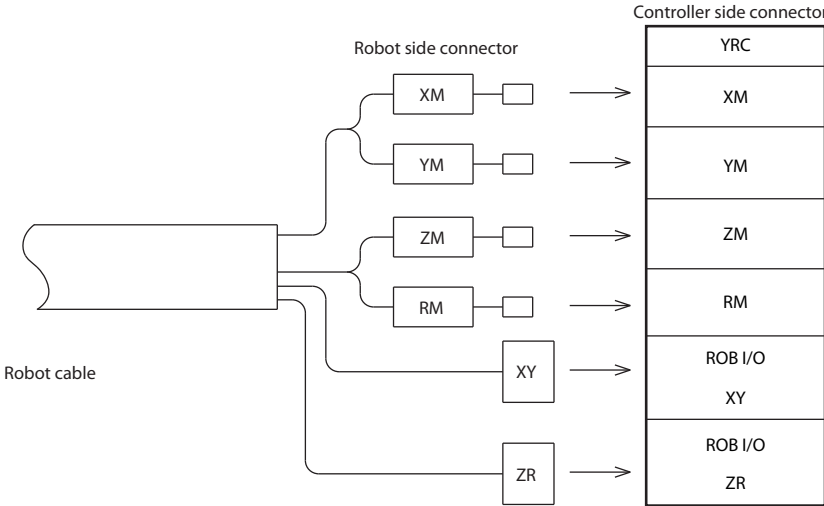

Fig. 3-8 Robot cable connections

5   User Wiring and User Tubing

⚠ **WARNING**

ALWAYS TURN OFF THE CONTROLLER AND SHUT OFF AIR SUPPLY
BEFORE ATTEMPTING WIRING AND PIPING WORK. IF AIR OR POWER
IS SUPPLIED DURING THIS WORK, THE MANIPULATOR MAY MOVE
ERRONEOUSLY CAUSING A HAZARDOUS SITUATION.

1) The XC series robots are equipped with user wires and air tubes in the
    machine harness. The table below shows the number of wires and air tubes
    available for each robot model.

Robot model	User wiring	User tubing (Diameter)
R6YXCH250, R6YXCH350, R6YXCH400	14wires	4, 3tubes
R6YXC500, R6YXC600, R6YXC700, R6YXC800, R6YXC1000	24wires	6, 3tubes

(Robot models for custom specifications may have different wiring or
tubing.)

The specifications of the user wires and air tubes are shown below. Always
observe the specifications.

User Wiring

Rated voltage	30V
Allowable current	1.5A
Nominal cross-section area of conductor	0.2mm^2
Shield	Yes

User Tubing

Maximum pressure	0.58MPa (6Kgf/cm^2)
Outer diameter × inner diameter	$\phi4\text{mm} \times \phi2.5\text{mm}$
	$\phi6\text{mm} \times \phi4\text{mm}$
Fluid	Dry clean air not containing deteriorated compressor oil; filtration 40μm or less

2) A D-sub connector for user wiring and a bulkhead union for user tubing are
    provided one each on the arm side and pedestal side. For their positions,
    refer to the dimensional outlines listed in our robot catalog.

3) Signal wiring connections in the machine harness

1. R6YXCH250, R6YXCH350, R6YXCH400

Connector pins 1 to 14 can be used. Pin 15 is connected to a shield wire and cannot be used as a signal wire.

Signal	Connector	NO	Connection	NO	Connector	Color
User signal line	I O (Arm side)	1		1	I O (Base side)	Brown
		2		2		Red
		3		3		Orange
		4		4		Blue
		5		5		Violet
		6		6		Grey
		7		7		White
		8		8		Black
		9		9		Brown
		10		10		Red
		11		11		Orange
		12		12		Blue
		13		13		Violet
		14		14		Grey
Shield		15		15		Green
Flame ground				1	FG	Green

(Robots models with non-standard specifications may have different wiring colors.)

2. R6YXC500, R6YXC600, R6YXC700, R6YXC800, R6YXC1000

Connector pins 1 to 24 can be used. Pin 25 is connected to a shield wire and cannot be used as a signal wire.

Signal	Connector	NO	Connection	NO	Connector	Color
User signal line	I O (Arm side)	1		1	I O (Base side)	Brown
		2		2		Red
		3		3		Orange
		4		4		Blue
		5		5		Violet
		6		6		Grey
		7		7		White
		8		8		Black
		9		9		Brown
		10		10		Red
		11		11		Orange
		12		12		Blue
		13		13		Violet
		14		14		Grey
		15		15		White
		16		16		Black
		17		17		Brown
		18		18		Red
		19		19		Orange
		20		20		Blue
		21		21		
		22		22		
		23		23		
		24		24		
Shield		25		25		Green
Flame Ground				1	FG	Green

(Robots models with non-standard specifications may have different wiring colors.)

4) As shown in Fig. 3-9, solder the user cable wires to the D-sub connector (supplied with the robot). Reattach the hood to the D-sub connector after soldering, then plug it into the user wiring connector.

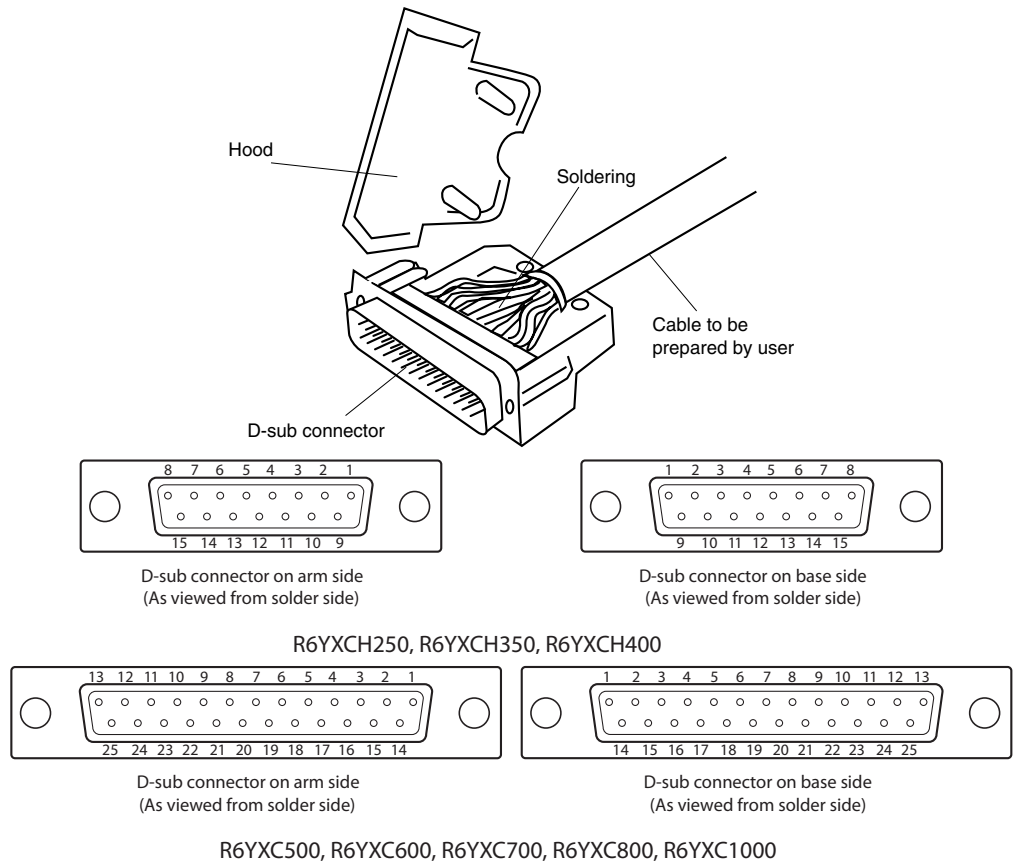The connector pinouts as viewed from the solder side are shown below.

R6YXCH250, R6YXCH350, R6YXCH400

R6YXC500, R6YXC600, R6YXC700, R6YXC800, R6YXC1000

Fig. 3-9

⚠ **WARNING**

THE USER CABLE WIRES SHOULD HAVE A SHIELD WIRE. CONNECT IT TO THE SAME NO. PIN IN THE D-SUB CONNECTOR ON THE ROBOT SIDE, WHICH ALSO CONNECTS TO THE SHIELD WIRE. IF THIS TASK IS OMITTED, NOISE MAY CAUSE MALFUNCTION OF THE ROBOT.

⚠ **WARNING**

SECURELY ATTACH THE D-SUB CONNECTOR (SUPPLIED WITH THE ROBOT) INTO THE D-SUB CONNECTOR ON THE ROBOT SIDE, BY TIGHTENING THE SCREWS ON THE CONNECTOR HOOD. IF THIS CONNECTOR COMES LOOSE OR COMES OFF, MALFUNCTION MAY RESULT.

⚠ **WARNING**

AVOID FASTENING THE USER CABLE OR TUBE WITH THE MACHINE HARNESS, AS THIS MAY LEAD TO HARNESS BREAKAGE AND MALFUNCTION.

⚠ **WARNING** ―――――――――――――――――

MAKE SURE THAT THE USER CABLE ATTACHED TO THE D-SUB
CONNECTOR FOR USER WIRING AND THE TUBE ATTACHED TO THE
BULKHEAD UNION FOR USER TUBING WILL NOT INTERFERE WITH
THE ROBOT MOVEMENT, ENTANGLE AROUND THE ROBOT OR FLAP
AROUND DURING OPERATION. WIRING AND TUBING MIGHT THEN BE
DAMAGED CAUSING MALFUNCTION OF THE ROBOT.

⚠ **WARNING** ―――――――――――――――――

LAY OUT THE USER CABLE ATTACHED TO THE D-SUB CONNECTOR
FOR USER WIRING AND THE TUBE ATTACHED TO THE BULKHEAD
UNION FOR USER TUBING SO THAT THEY DO NOT OBSTRUCT THE
MOVEMENT OF THE OPERATOR OR ANY OTHER PERSONS. BODILY
INJURY MAY RESULT IF ANYONE TRIPS ON THE CABLE OR AIR TUBE.

⚠ **CAUTION** ―――――――――――――――――

THE D-SUB CONNECTOR SUPPLIED WITH THE ROBOT SHOULD BE
CONNECTED TO THE ARM SIDE BY PIN CONTACT, AND TO THE
PEDESTAL SIDE BY SOCKET CONTACT. USE CAUTION AT THESE
POINTS WHEN SOLDERING.

⚠ **CAUTION** ―――――――――――――――――

BE SURE TO USE THE D-SUB CONNECTOR AND HOOD WHICH ARE
SUPPLIED WITH THE ROBOT. USING OTHER TYPES MAY RESULT IN
CONTACT FAILURE.

D-sub connectors (supplied with robot)

Robot model	D-sub connector on arm side	D-sub connector on base side	Hood
R6YXCH250, R6YXCH350, R6YXCH400	DA-15P-NR	DA-15S-NR	DA-C1-J10R
R6YXC500, R6YXC600, R6YXC700, R6YXC800, R6YXC1000	DB-25P-NR	DB-25S-NR	DB-C2-J9R

Manufacturer : Japan Aviation Electronics Industry, Limited.

5) To check the operation and signal transmission between the end effector
and the controller or peripheral equipment after making connections, refer
to "6. Trial operation" in Chapter 1.

6   Attaching The End Effector

6-1   R-axis tolerable moment of inertia and acceleration coefficient

1) The moment of inertia of a load (end effector and workpiece) that can be attached to the R-axis is limited by the strength of the robot drive unit and residual vibration during positioning. It is therefore necessary to reduce the acceleration coefficient in accordance with the moment of inertia.

2) The R-axis tolerable moment of inertia and the acceleration coefficient versus R-axis moment of inertia for each robot model are shown in Fig. 3-10 to Fig. 3-61 on the subsequent pages. The symbols A^X, A^Y, and A^R in each figure respectively indicate the acceleration coefficients of the X-axis, Y-axis and R-axis. The symbol I^R (J^R) is the moment of inertia of the load around the R-axis and m is the tip mass.

   Example: R6YXCH250
   Assume that the mass of the load installed to the R-axis is 1.5kg and the moment of inertia around the R-axis is $0.02kgm^2$ ($0.2kgf \cdot cm \cdot sec^2$). When the tip mass parameter is set to 2kg, the robot can be operated by reducing the X, Y and R-axis acceleration coefficients to 60%, as can be seen from Fig. 3-11.
   Be sure to select an optimum tip mass and acceleration coefficient parameters that meet the mass of the load and moment of inertia before using the robot.
   To make settings for the tip mass and acceleration coefficient, refer to the separate "OMRON Robot Controller User's Manual".

3) For information on how to calculate the moment of inertia of the load, refer to "6-2 Equation for moment of inertia calculation" in Chapter 3 of the standard model X user's manual. Note that it is not easy to precisely calculate the moment of inertia.
   If a calculated value smaller than the actual moment of inertia is set, residual vibrations may occur. If this happens, reduce the acceleration coefficient parameter even further.

⚠ **CAUTION** ─────────────────────────────

THE ROBOT MUST BE OPERATED WITH CORRECT TOLERABLE MOMENT OF INERTIA AND ACCELERATION COEFFICIENTS ACCORDING TO THE MANIPULATOR TIP MASS AND MOMENT OF INERTIA. IF THIS IS NOT OBSERVED, PREMATURE END TO THE LIFE OF THE DRIVE UNITS, DAMAGE TO THE ROBOT PARTS OR RESIDUAL VIBRATION DURING POSITIONING MAY RESULT.

⚠ **CAUTION**

DEPENDING ON THE Z-AXIS POSITION, VIBRATION MAY OCCUR
WHEN THE X, Y OR R-AXIS MOVES. IF THIS HAPPENS, REDUCE THE X,
Y OR R-AXIS ACCELERATION TO AN APPROPRIATE LEVEL.

⚠ **CAUTION**

IF THE MOMENT OF INERTIA IS TOO LARGE, VIBRATION MAY OCCUR
ON THE Z-AXIS DEPENDING ON ITS OPERATION POSITION. IF THIS
HAPPENS, REDUCE THE Z-AXIS ACCELERATION TO AN APPRORIATE
LEVEL.

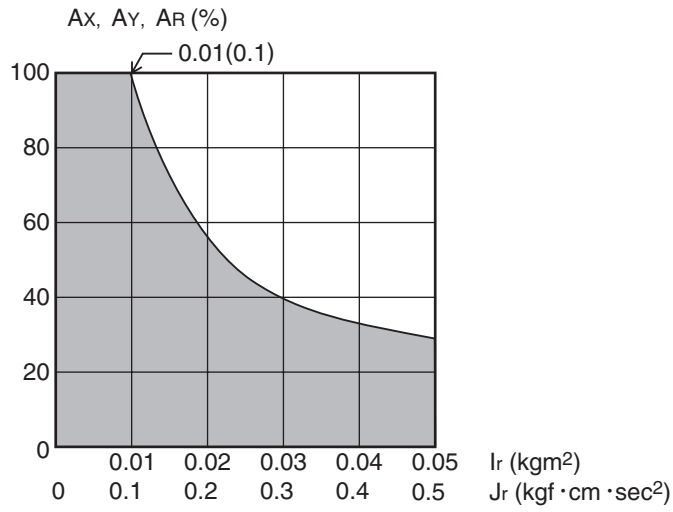## 6-1-1   Acceleration coefficient vs. moment of inertia (R6YXCH250)
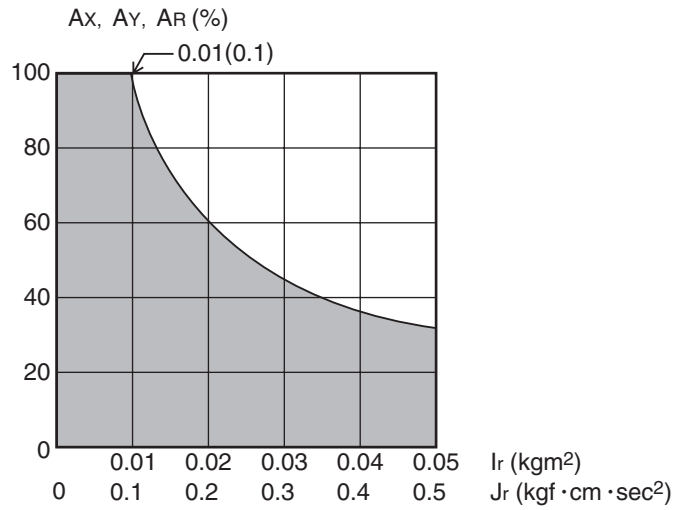

Fig. 3-10 m=1kg
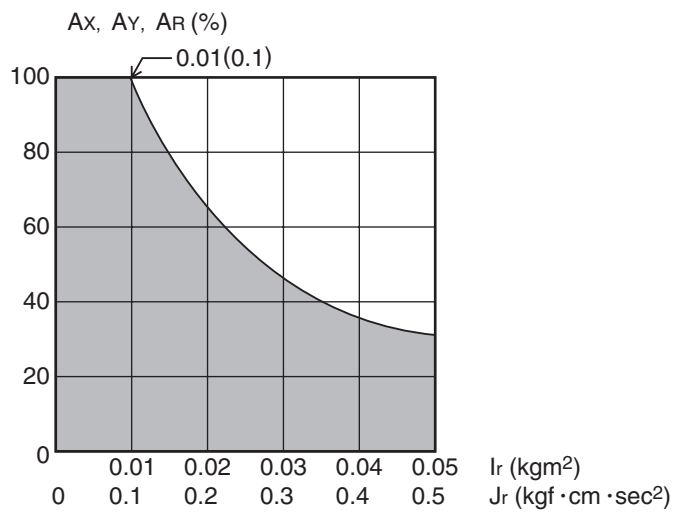

Fig. 3-11 m=2kg

Fig. 3-12 m=3kg

6-1-2   Acceleration coefficient vs. moment of inertia (R6YXCH350)

Fig. 3-13 m=1kg
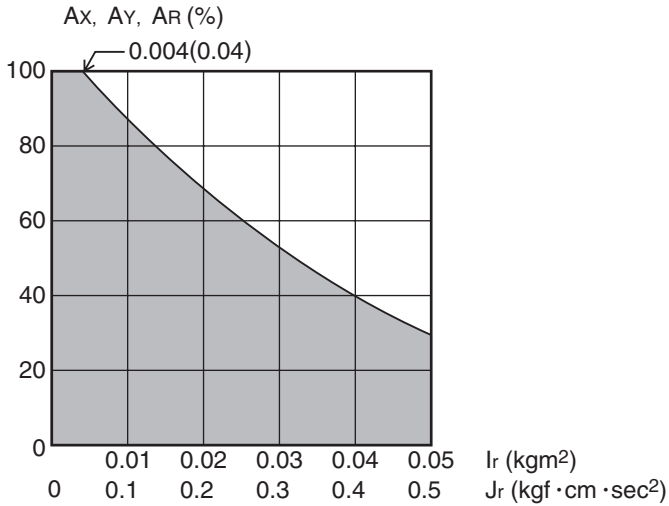
Fig. 3-14 m=2kg
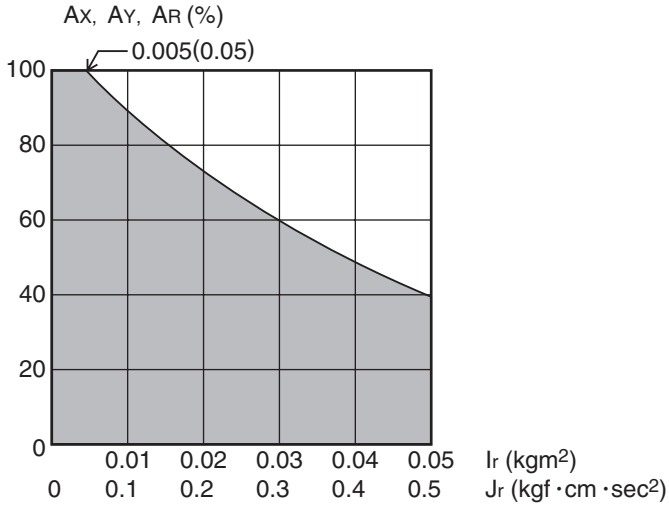
Fig. 3-15 m=3kg

6-1-3   Acceleration coefficient vs. moment of inertia (R6YXCH400)
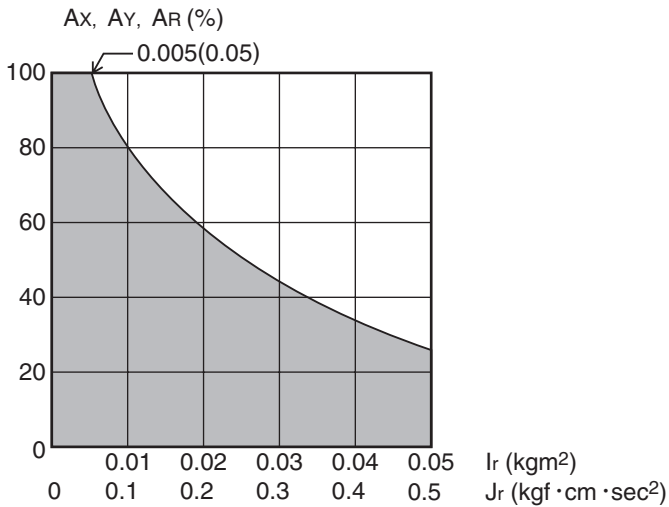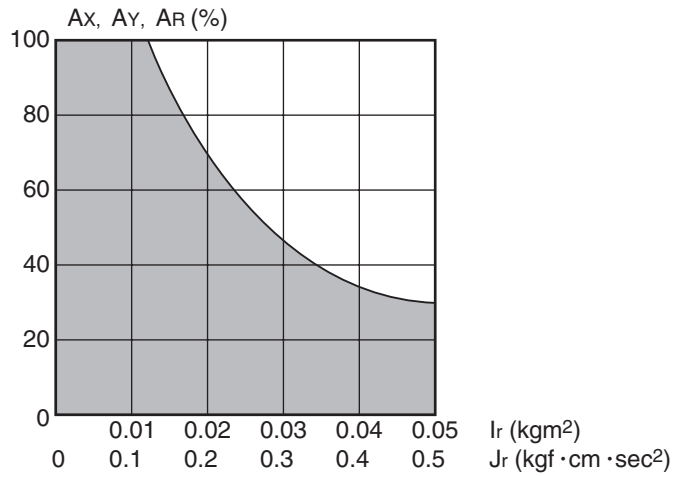

Fig. 3-16 m=1kg
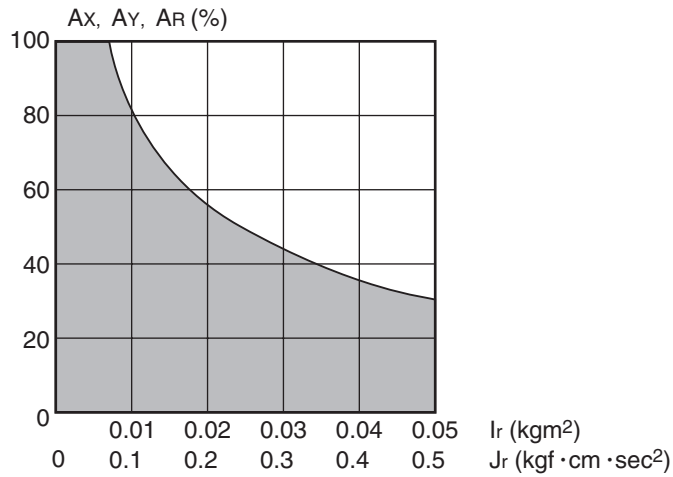
Fig. 3-17 m=2kg
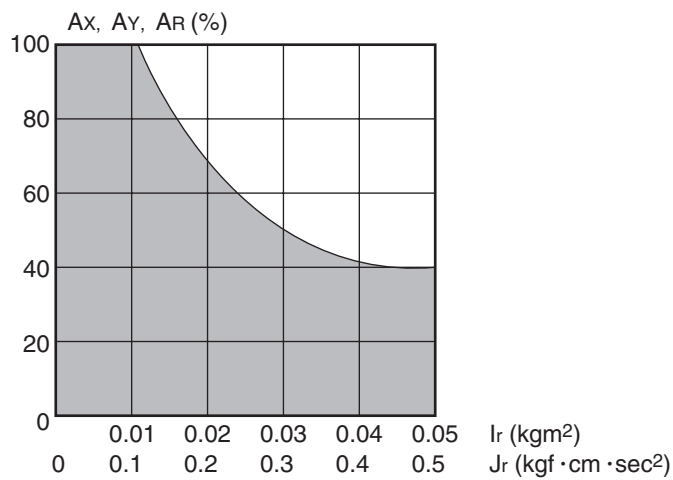
Fig. 3-18 m=3kg

6-1-4   Acceleration coefficient vs. moment of inertia (R6YXC500)
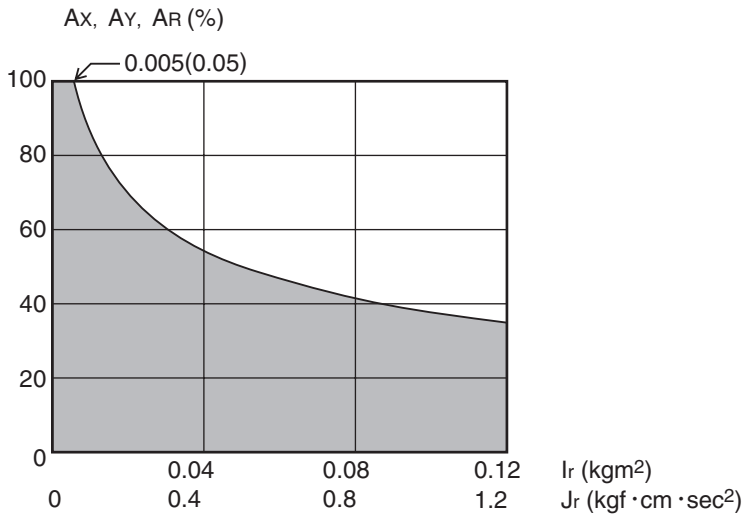
Fig. 3-19 m=1kg
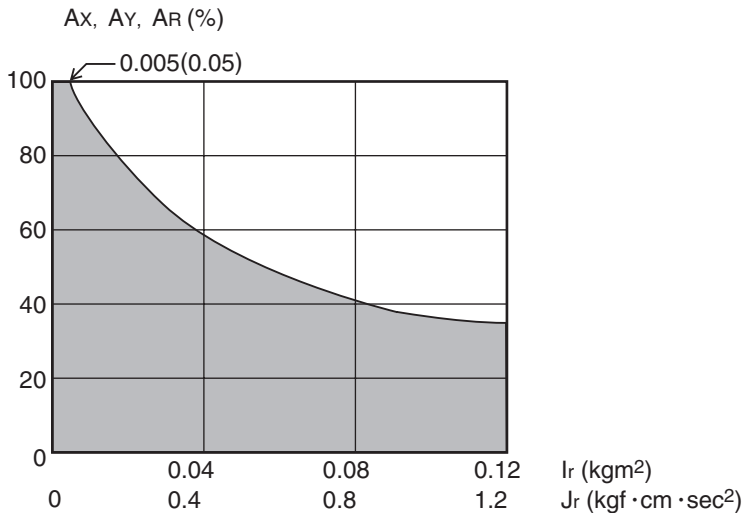
Fig. 3-20 m=2kg
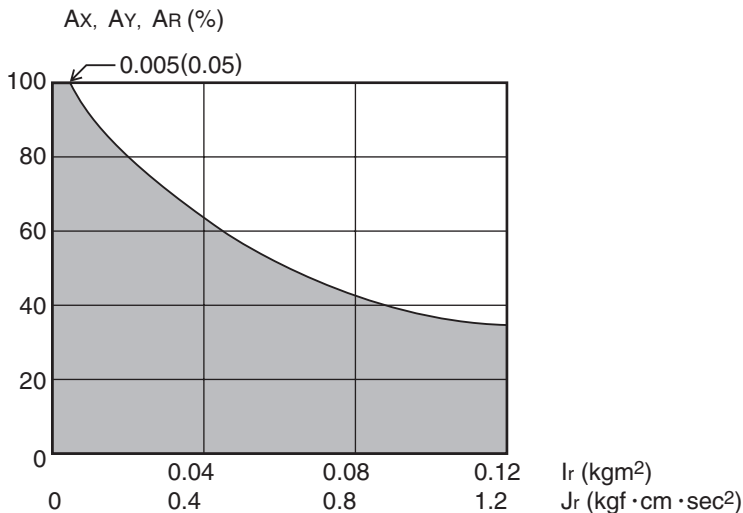
Fig. 3-21 m=3kg
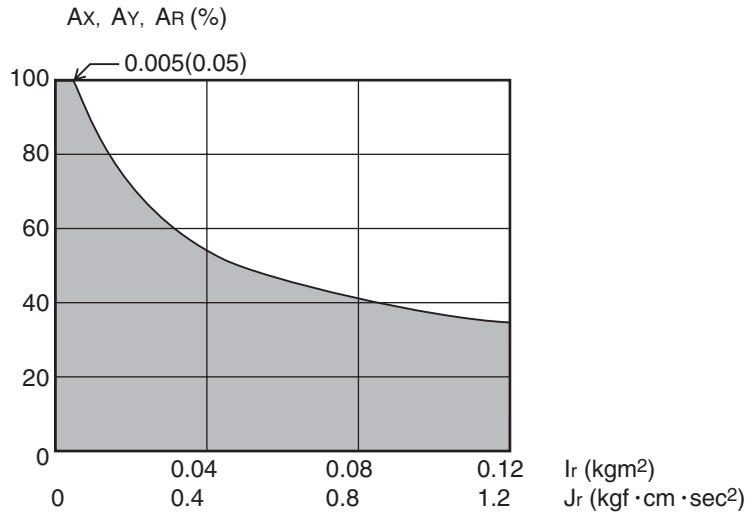
Fig. 3-22 m=4kg
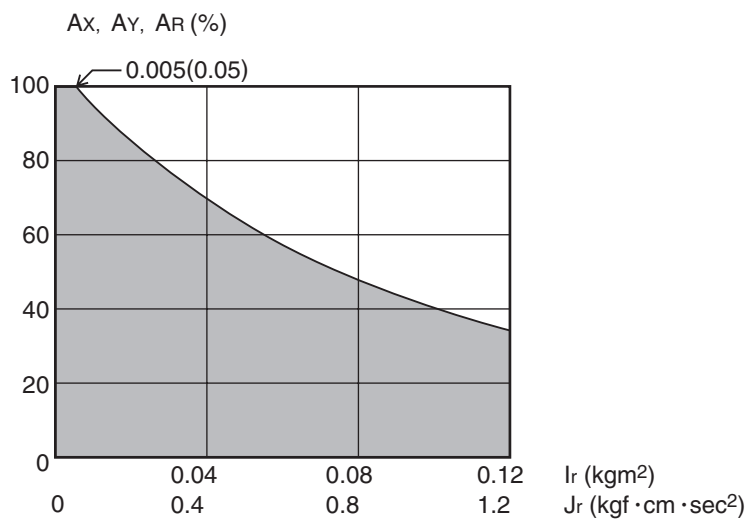
Fig. 3-23 m=5kg

Fig. 3-24 m=6, 7kg

Ax, Ay, Ar (%)

Fig. 3-25 m=8, 9kg

Ax, Ay, Ar (%)
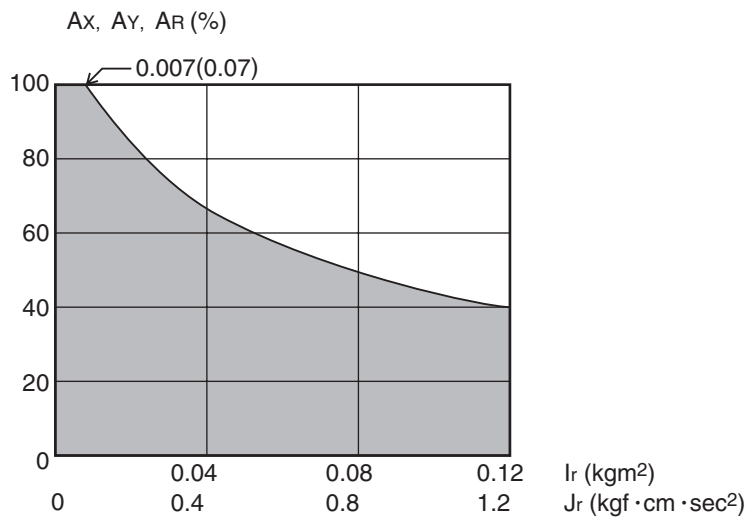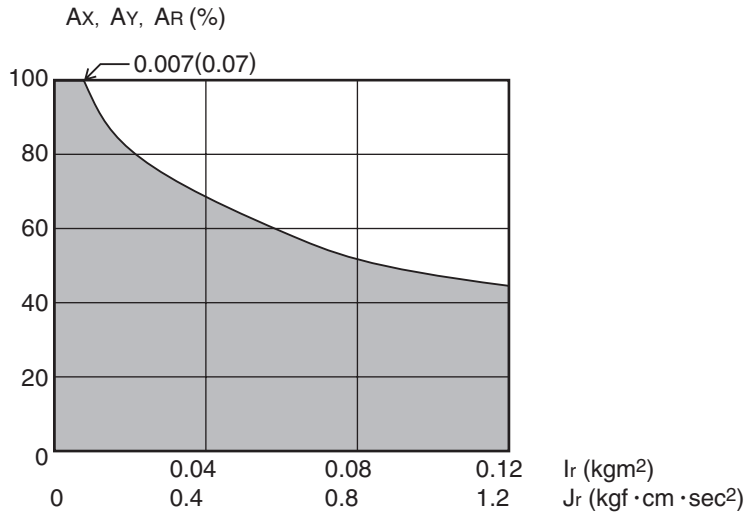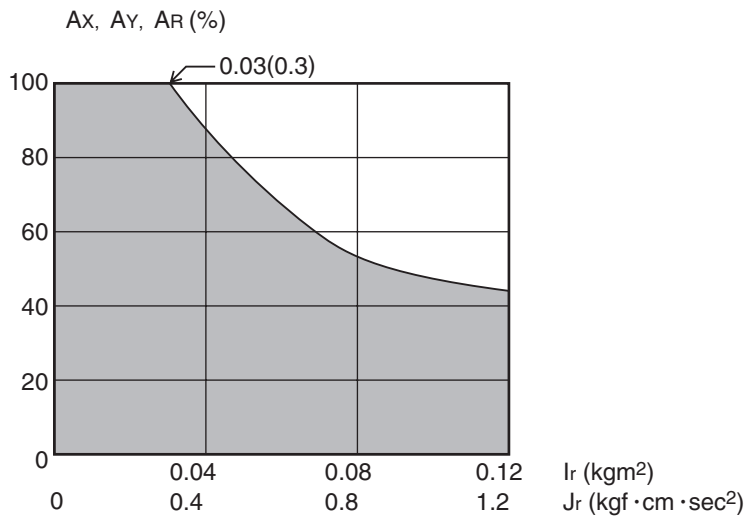
Fig. 3-26 m=10kg

6-1-5 Acceleration coefficient vs. moment of inertia (R6YXC600)
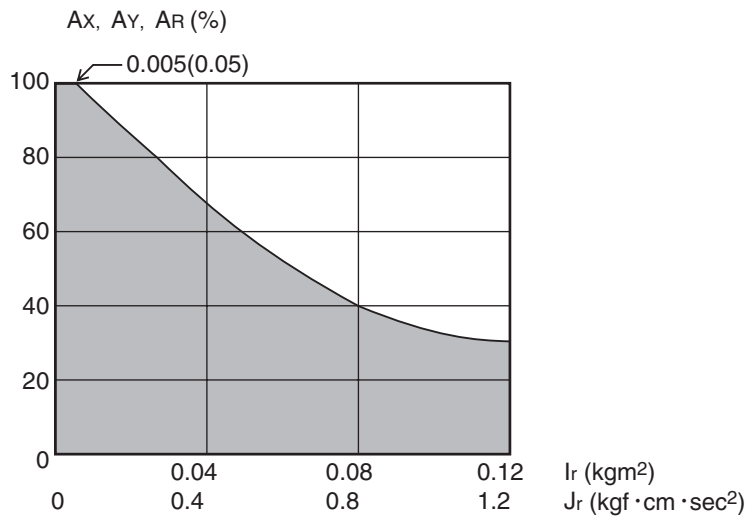
Fig. 3-27 m=1kg
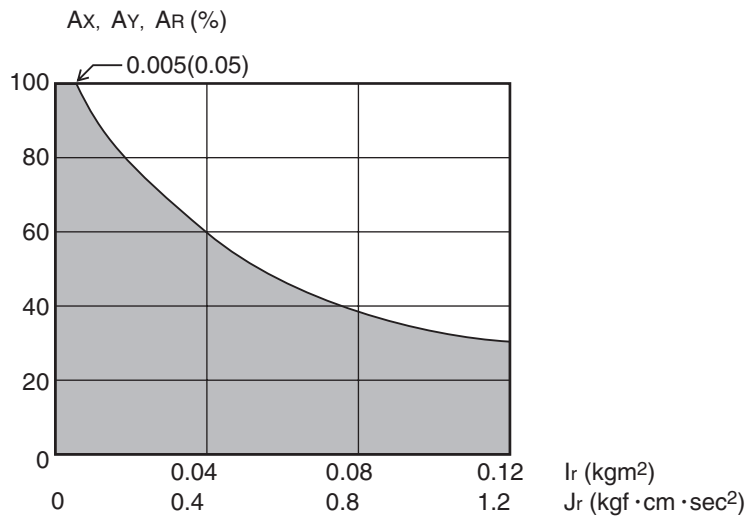
Fig. 3-28 m=2kg

Fig. 3-29 m=3kg

Ax, Ay, Ar (%)

0.005(0.05)

Fig. 3-30 m=4kg

Ir (kgm²)

Jr (kgf·cm·sec²)

Ax, Ay, Ar (%)

0.01(0.1)

Fig. 3-31 m=5kg

Ir (kgm²)

Jr (kgf·cm·sec²)

Ax, Ay, Ar (%)

0.005(0.05)

Fig. 3-32 m=6, 7kg

Ir (kgm²)

Jr (kgf·cm·sec²)

AX, AY, AR (%)

0.005(0.05)

Fig. 3-33 m=8, 9kg

AX, AY, AR (%)

0.015(0.15)
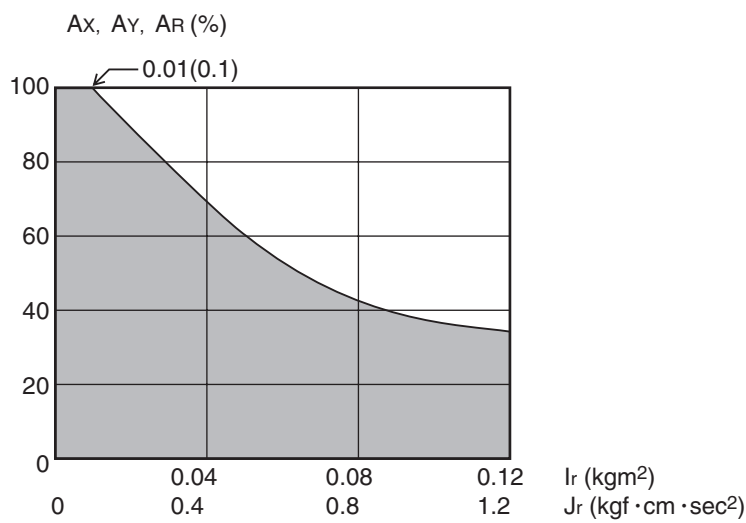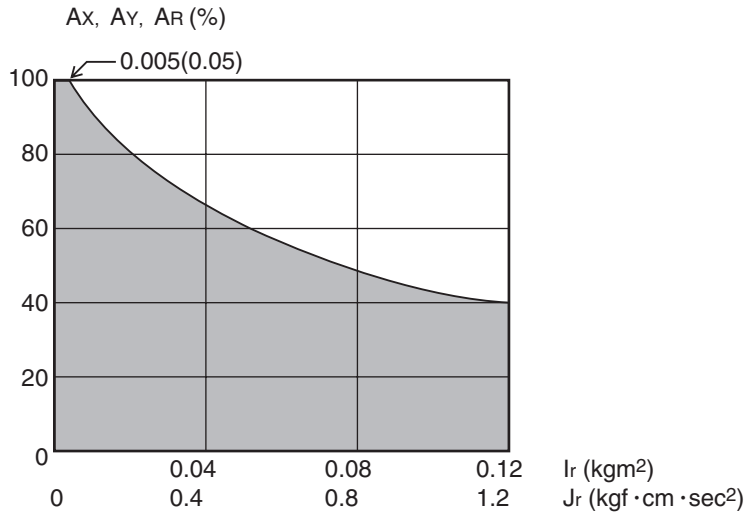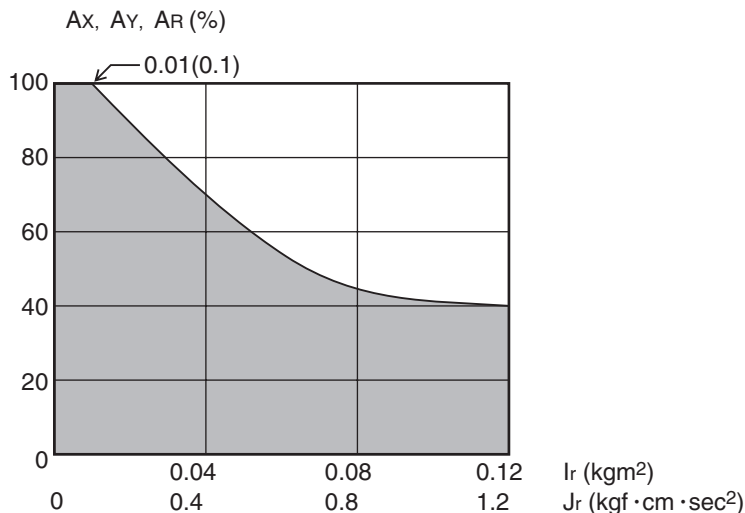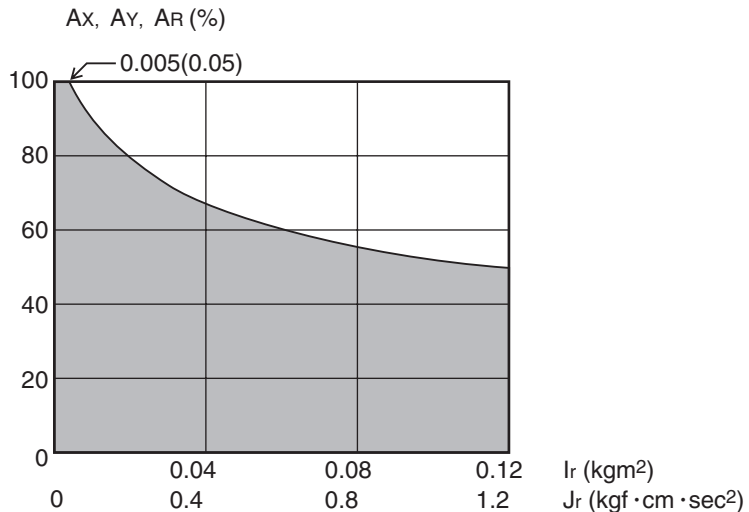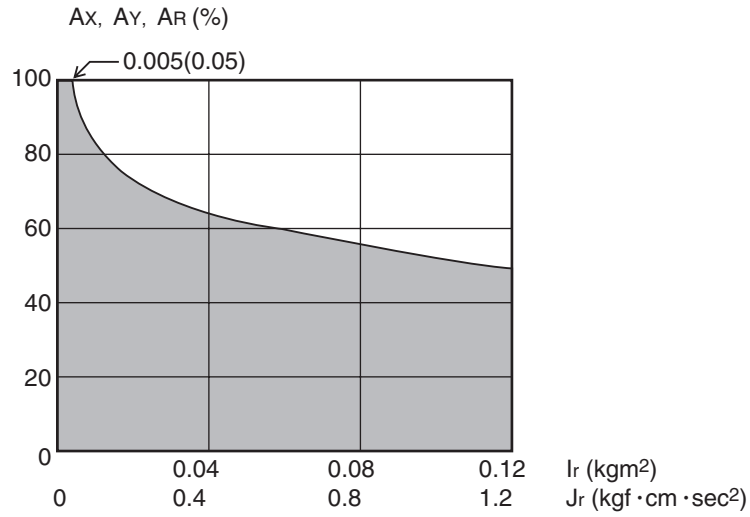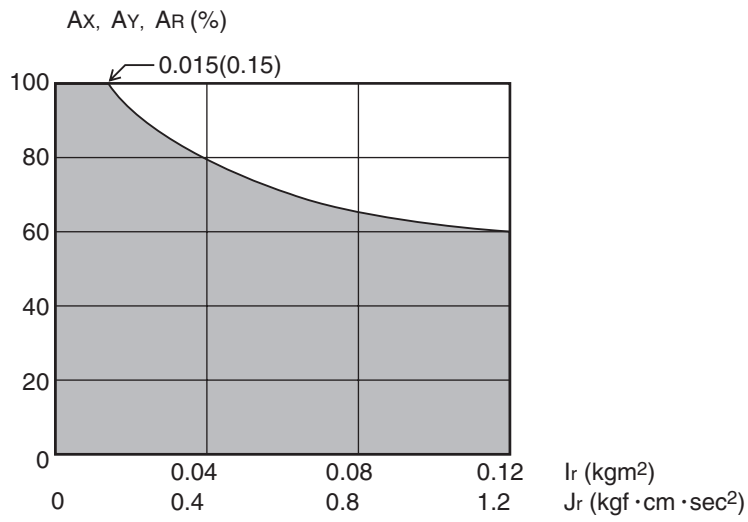
Fig. 3-34 m=10kg

6-1-6　　　Acceleration coefficient vs. moment of inertia (R6YXC700)

A_X, A_Y, A_R (%)

Fig. 3-35 m=1kg

A_X, A_Y, A_R (%)
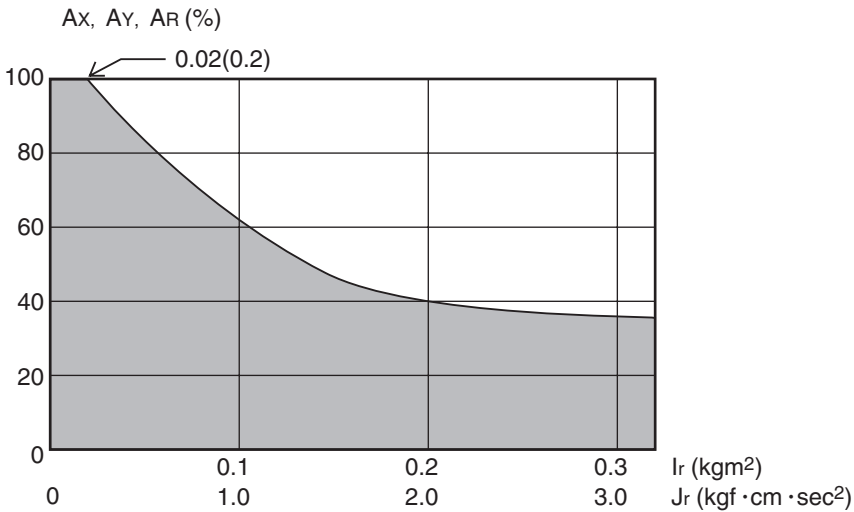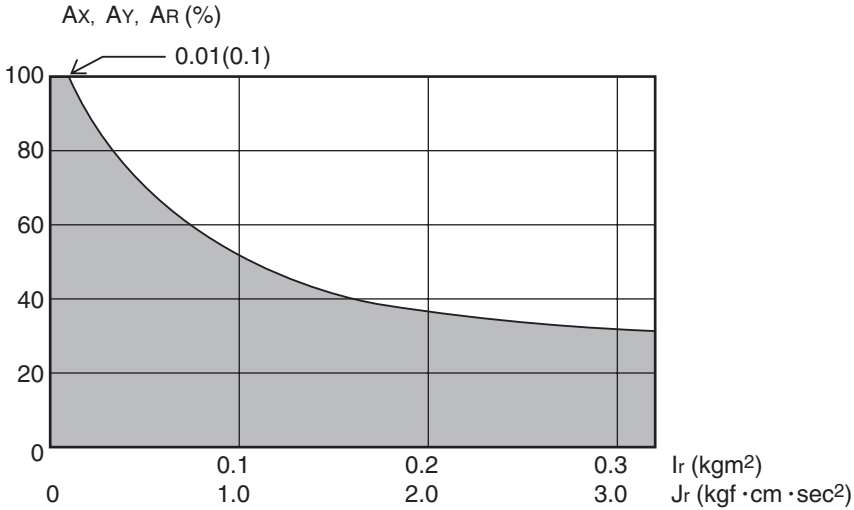
Fig. 3-36 m=2kg
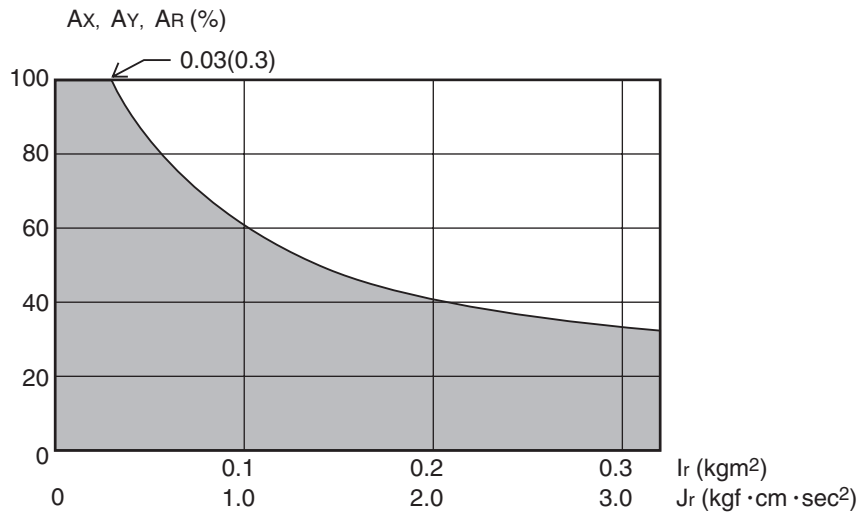
Fig. 3-37 m=3, 4kg

Fig. 3-38 m=5, 6kg

Ax, Ay, Ar (%)

Fig. 3-39 m=7, 8kg

Ax, Ay, Ar (%)

Fig. 3-40 m=9, 10kg

Ax, Ay, Ar (%)

Fig. 3-41 m=11 to 13kg

Ax, Ay, Ar (%)
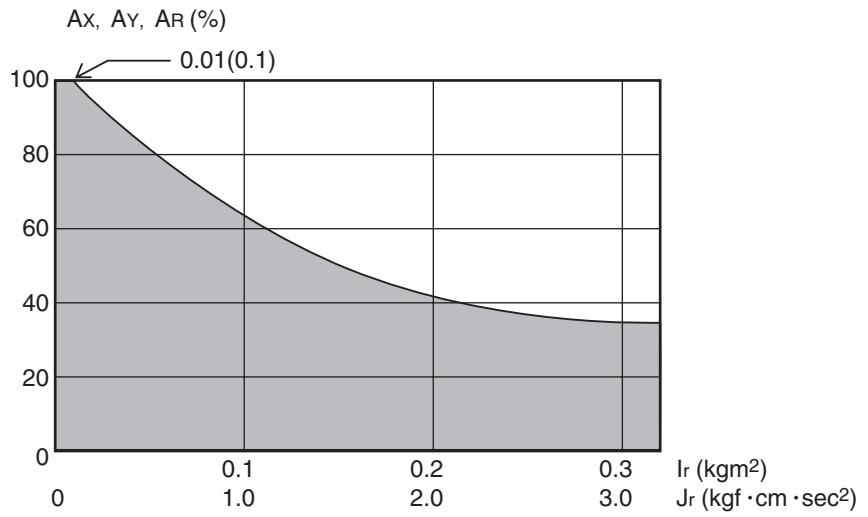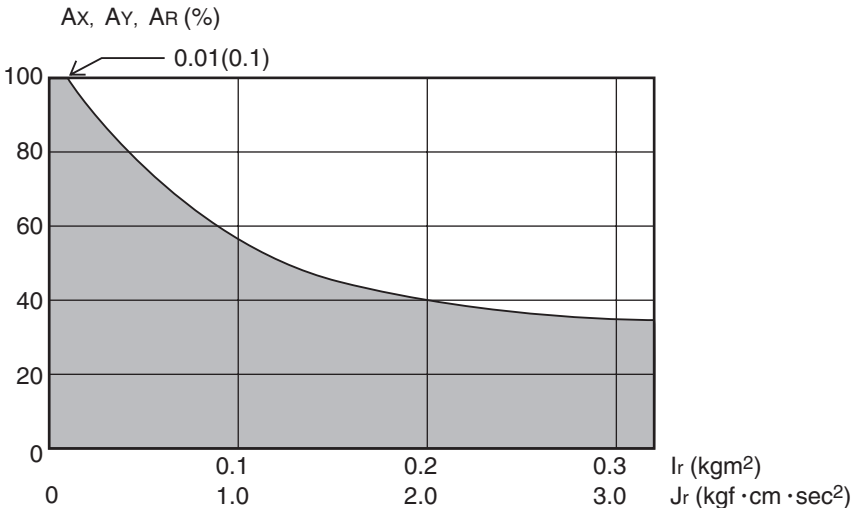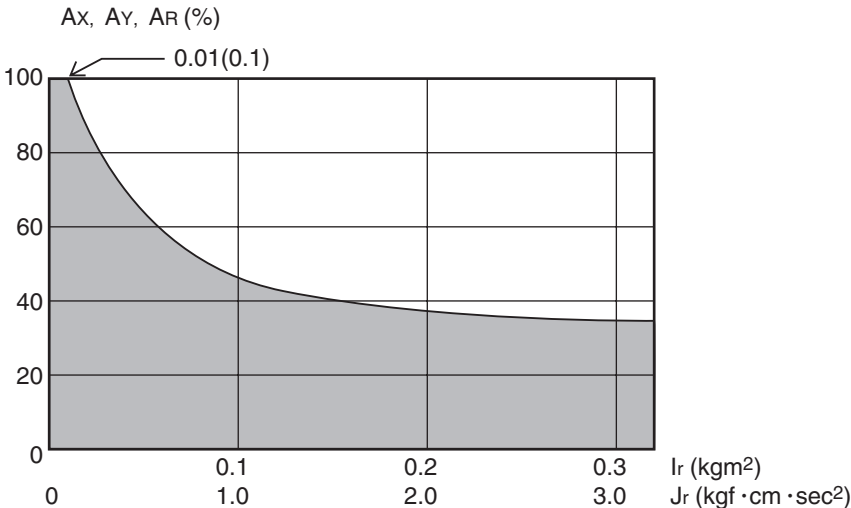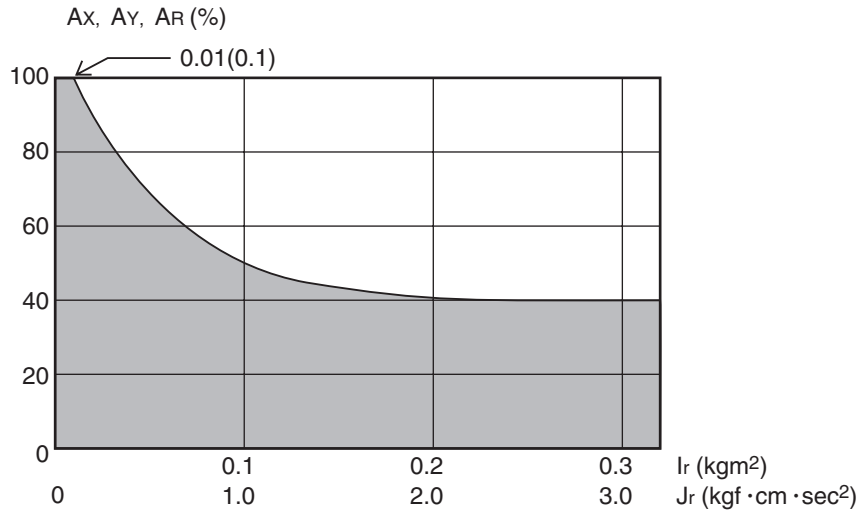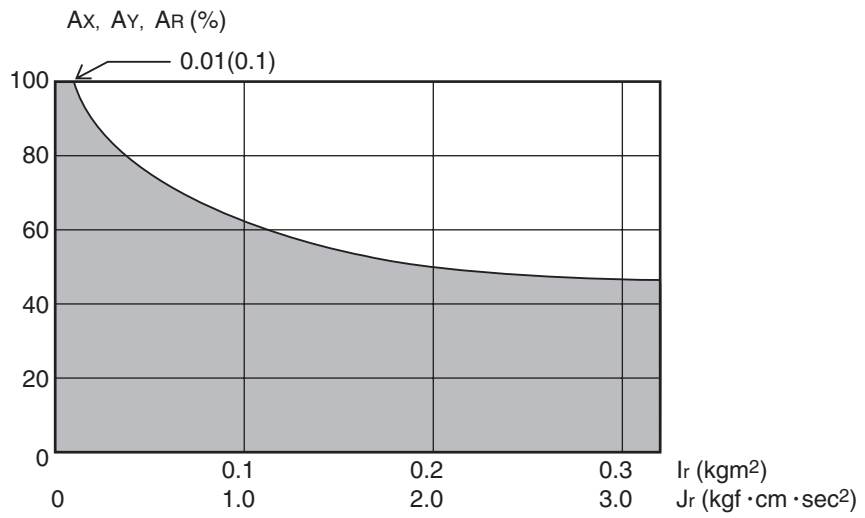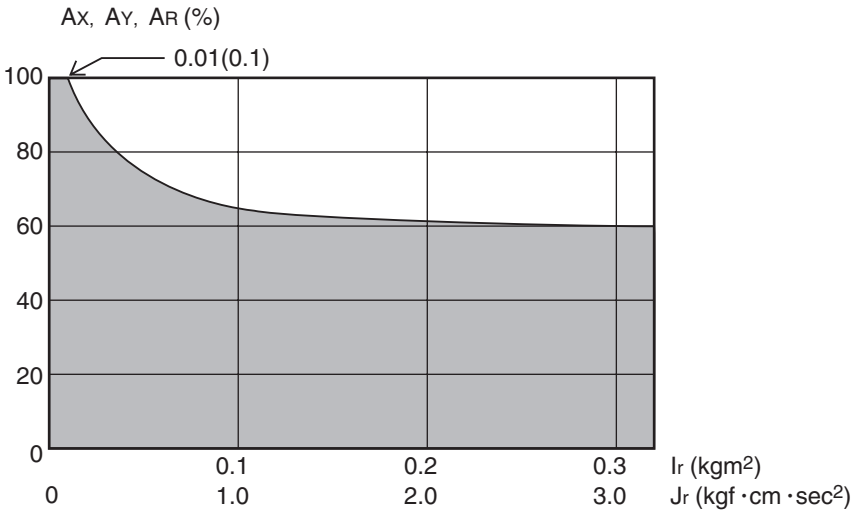
Fig. 3-42 m=14 to 16kg

Fig. 3-43 m=17 to 20kg

6-1-7   Acceleration coefficient vs. moment of inertia (R6YXC800)
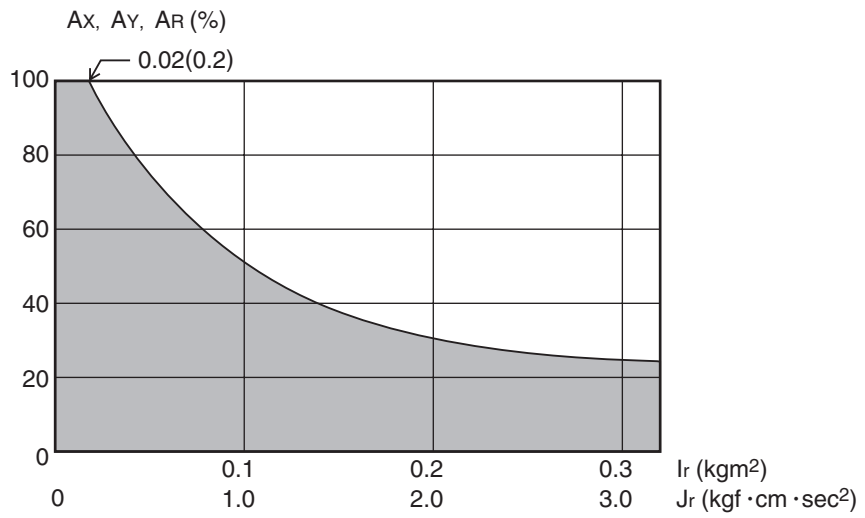
Fig. 3-44   m=1kg

Fig. 3-45   m=2kg

AX, AY, AR (%)

Fig. 3-46 m=3, 4kg

AX, AY, AR (%)
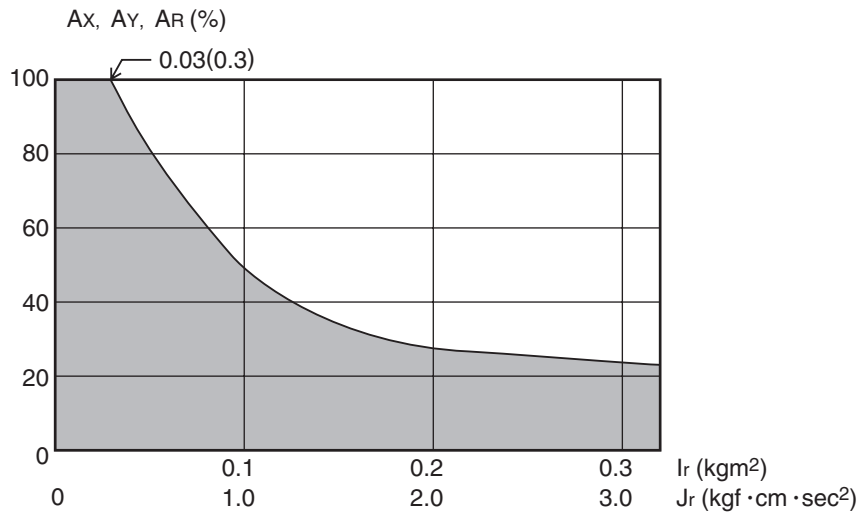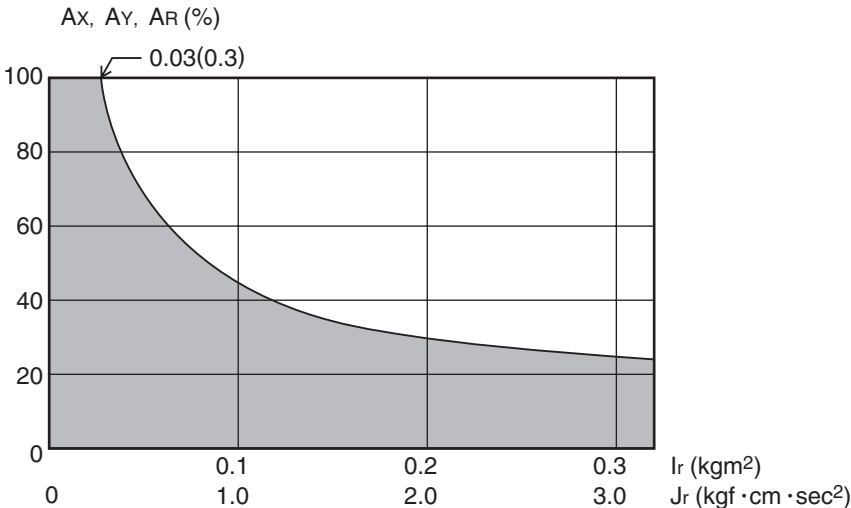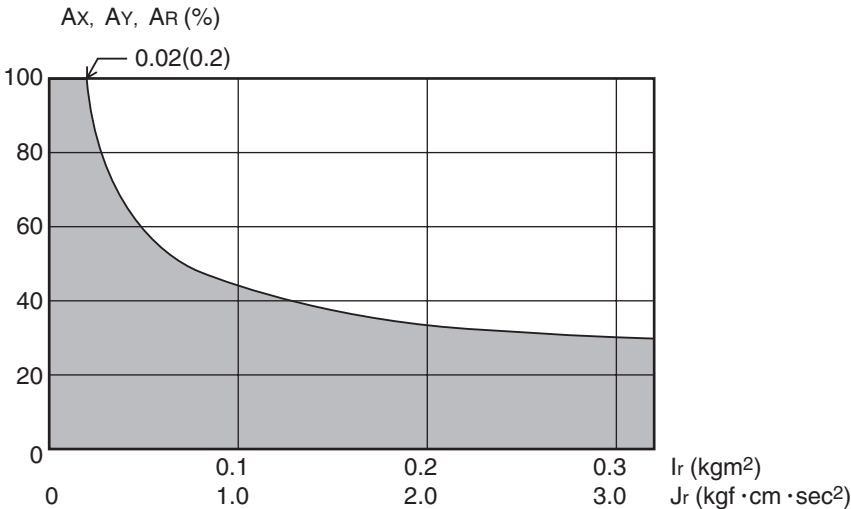
Fig. 3-47 m=5, 6kg
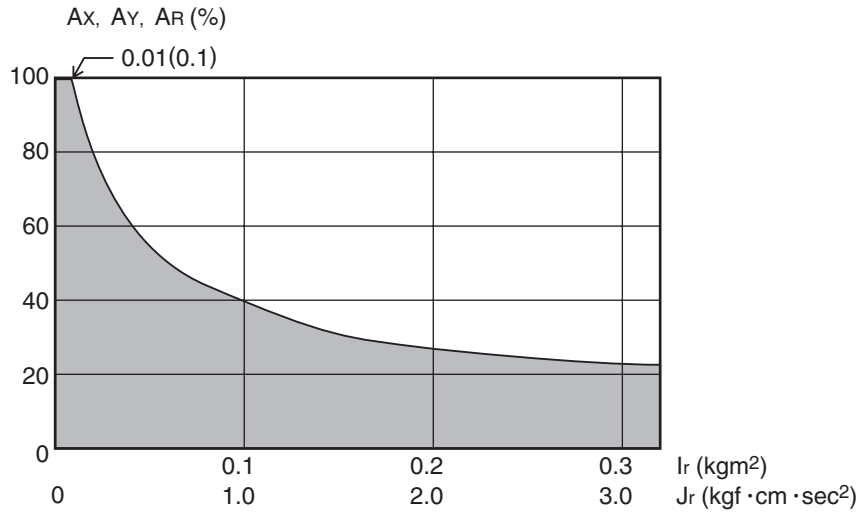
Fig. 3-48 m=7, 8kg
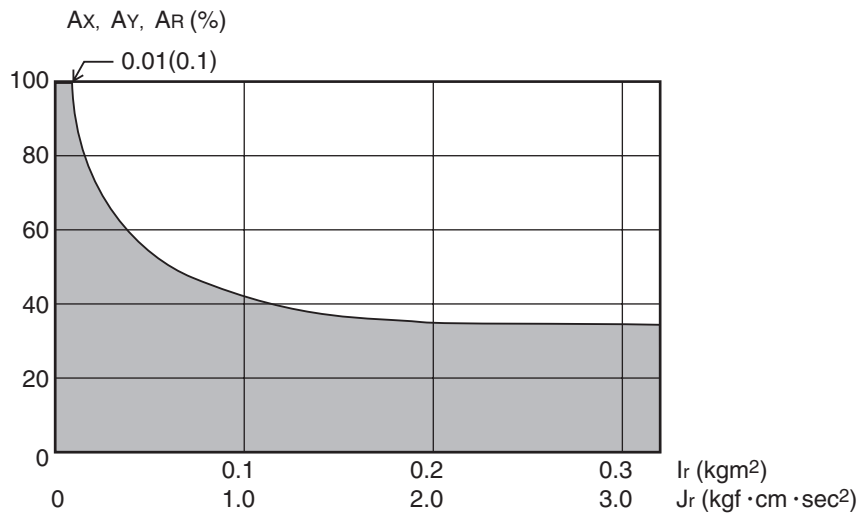
Fig. 3-49 m=9, 10kg
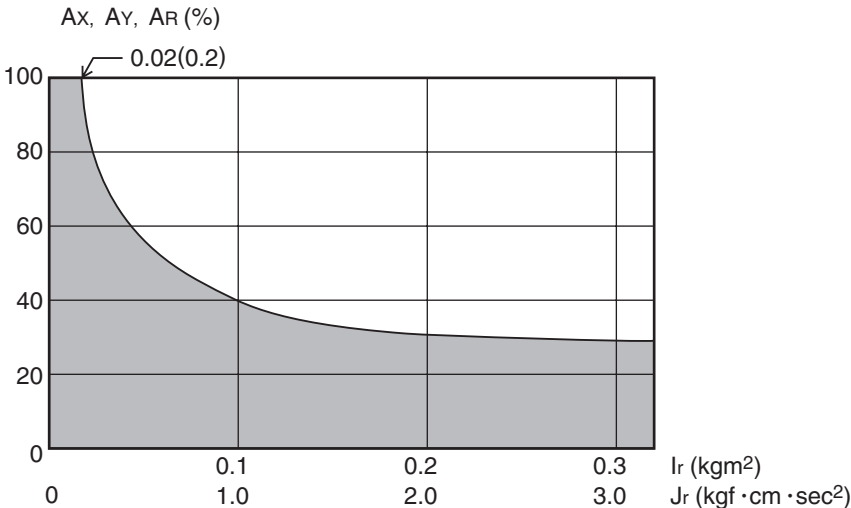
Fig. 3-50 m=11 to 13kg
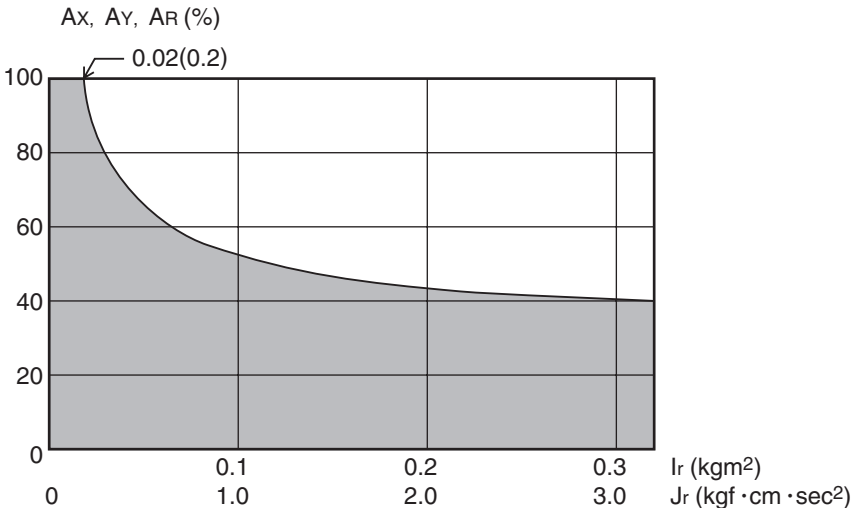
Fig. 3-51 m=14 to 16kg
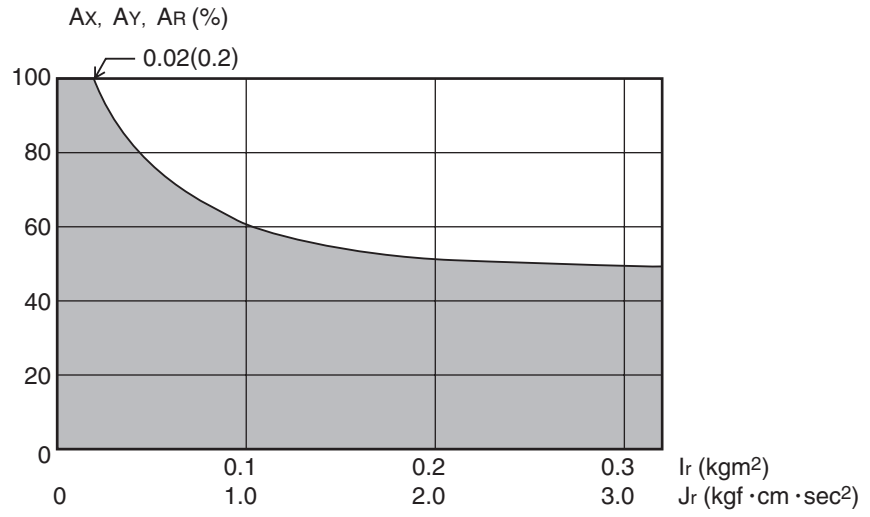
Fig. 3-52　m=17 to 20kg

6-1-8   Acceleration coefficient vs. moment of inertia (R6YXC1000)
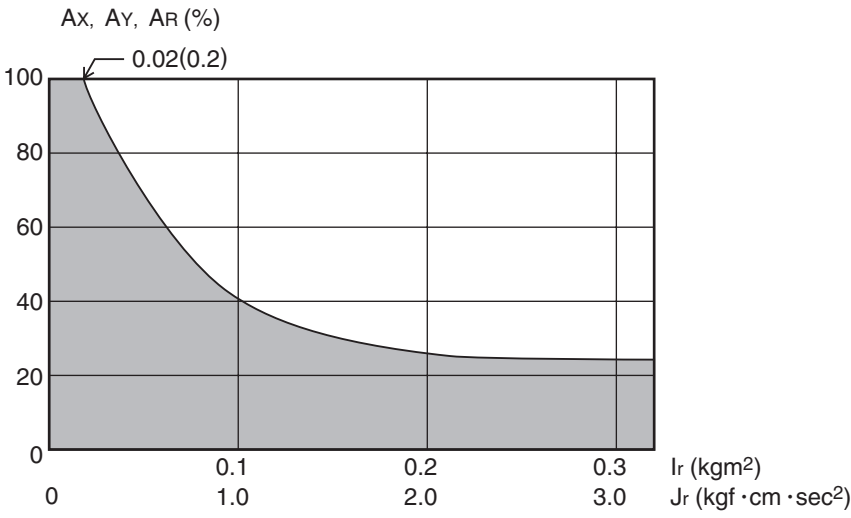
Fig. 3-53   m=1kg
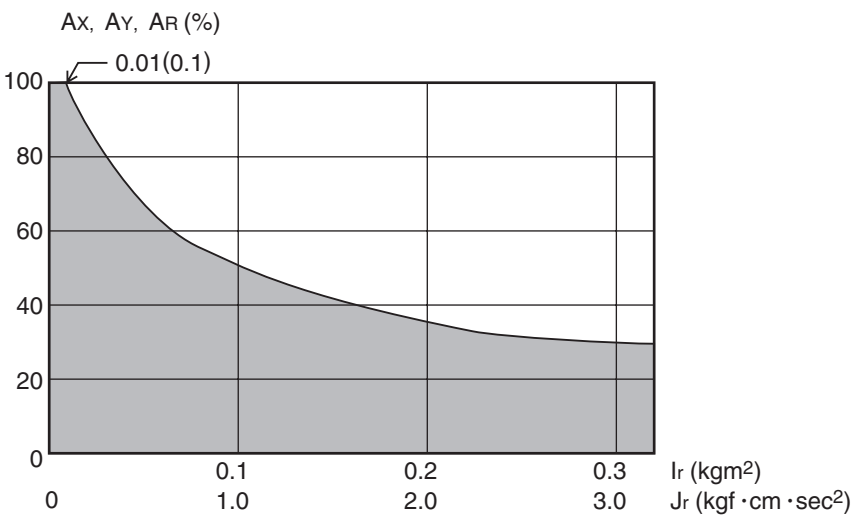
Fig. 3-54   m=2kg

AX, AY, AR (%)

0.01(0.1)

100

80

60

40

20

0

| 0.1   0.2   0.3 | Ir (kgm²)
| 1.0   2.0   3.0 | Jr (kgf·cm·sec²)

0

Fig. 3-55 m=3, 4kg

AX, AY, AR (%)

0.01(0.1)

100

80

60

40

20

0

| 0.1   0.2   0.3 | Ir (kgm²)
| 1.0   2.0   3.0 | Jr (kgf·cm·sec²)

0

Fig. 3-56 m=5, 6kg

AX, AY, AR (%)

Fig. 3-57 m=7, 8kg

AX, AY, AR (%)

Fig. 3-58 m=9, 10kg

A$_X$, A$_Y$, A$_R$ (%)

Fig. 3-59 m=11 to 13kg

A$_X$, A$_Y$, A$_R$ (%)
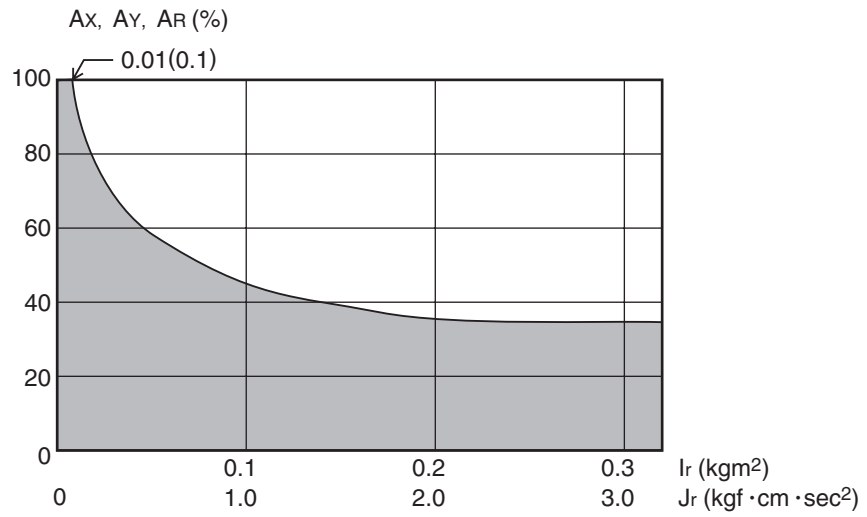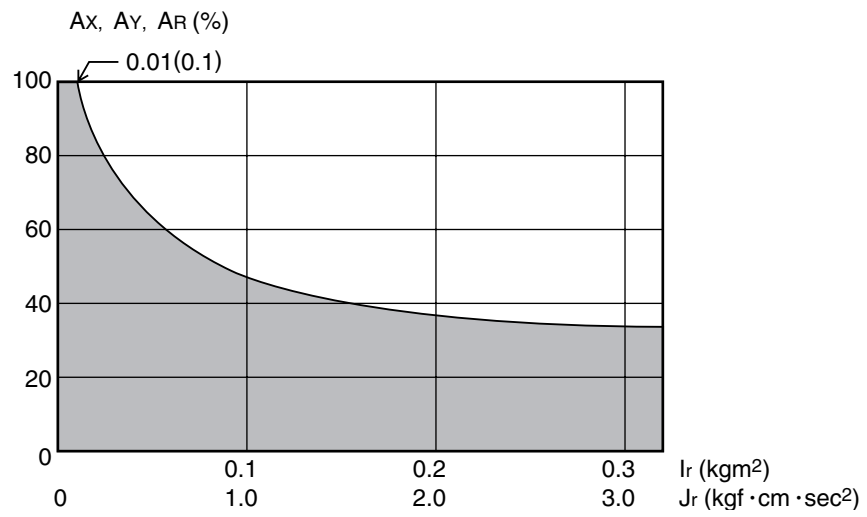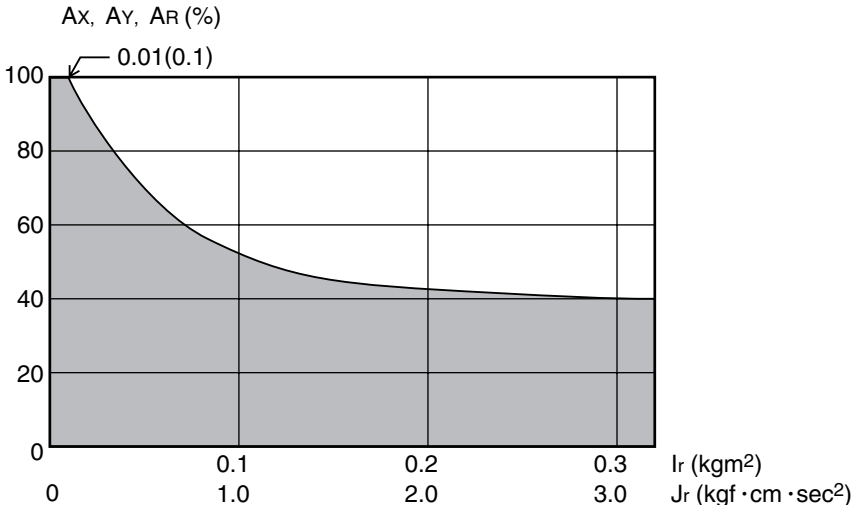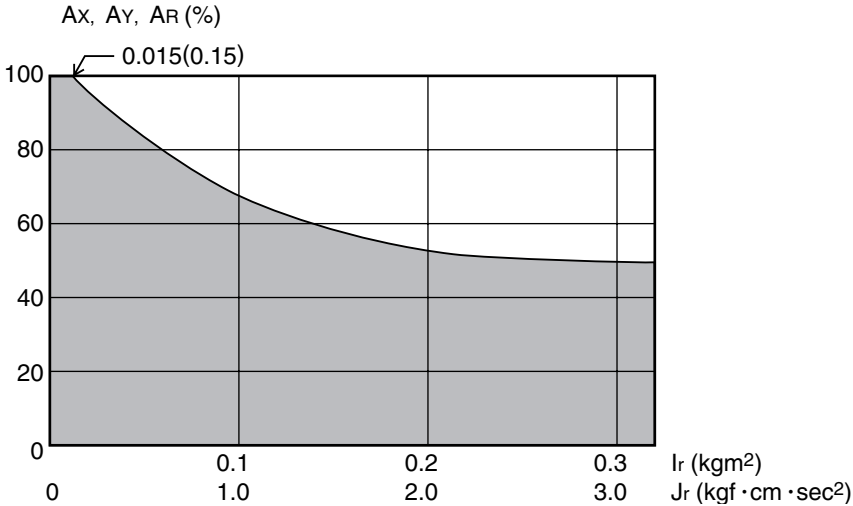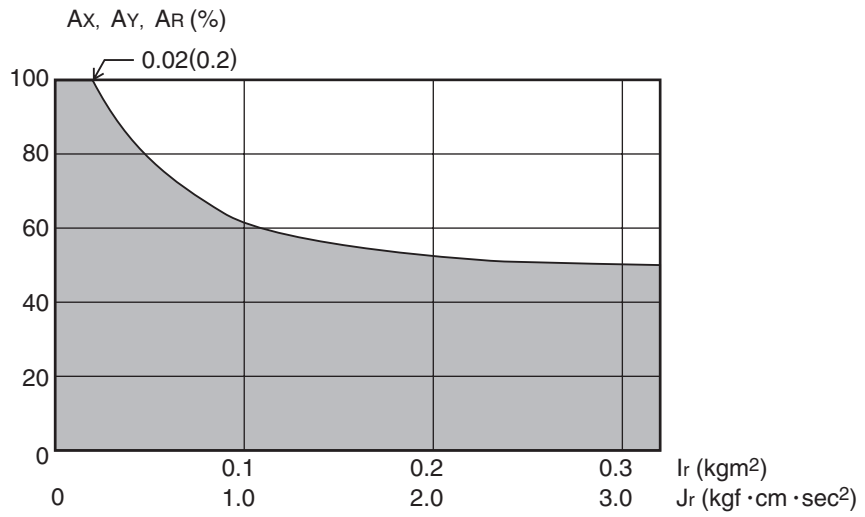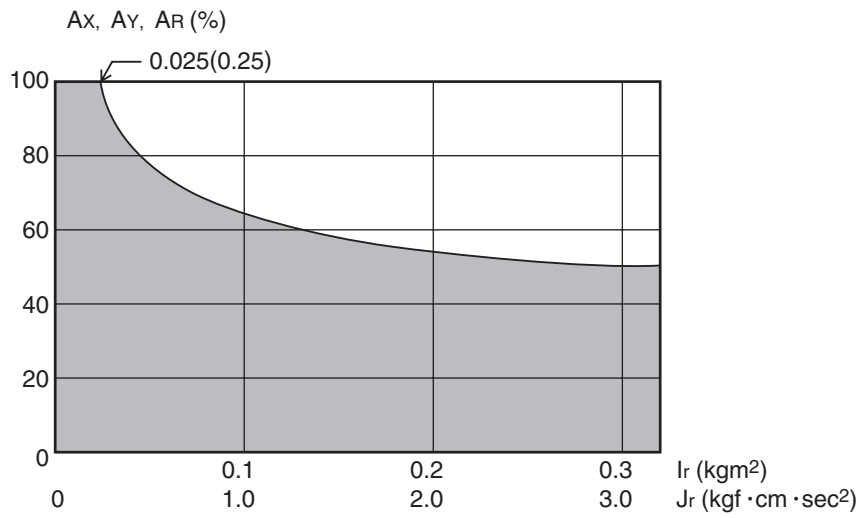
Fig. 3-60 m=14 to 16kg
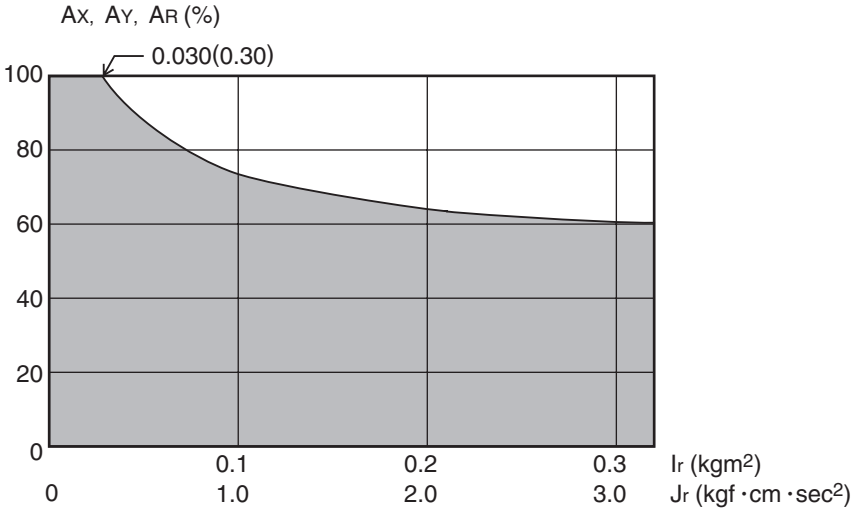
Fig. 3-61 m=17 to 20kg

6-2   Equation for moment of inertia calculation

For equation for moment of inertia calculation, refer to "6-2 Equation for moment of inertia calculation" in Chapter 3 of the standard model X user's manual.

6-3   Example of moment of inertia calculation

For example of moment of inertia calculation, refer to "6-3 Example of moment of inertia calculation" in Chapter 3 of the standard model X user's manual.

6-4   Attaching the end effector

⚠ **WARNING**

BEFORE ATTACHING THE END EFFECTOR, BE SURE TO TURN OFF THE
CONTROLLER.

The manipulator part to which an end effector is attached must have adequate
strength and rigidity, as well as gripping force to prevent positioning errors. Ta-
ble 3-1 shows the maximum load that can be applied to the end effector attach-
ment of each robot during operation. Recommended methods for attaching end
effectors are shown in Table 3-2 and Fig. 3-65. Refer to Fig. 3-62 and Fig. 3-63
for details on the end effector attachment of each robot.

When checking end effector operation, refer to "6 Trial Operation" in Chapter 1.

R6YXCH250, R6YXCH350, R6YXCH400
: Z-axis tip shape

R6YXC500, R6YXC600 : Z-axis tip shape
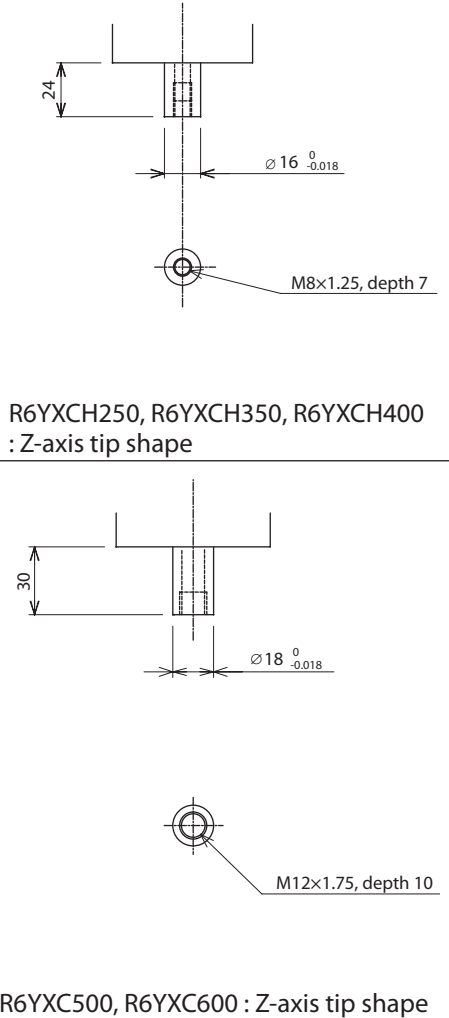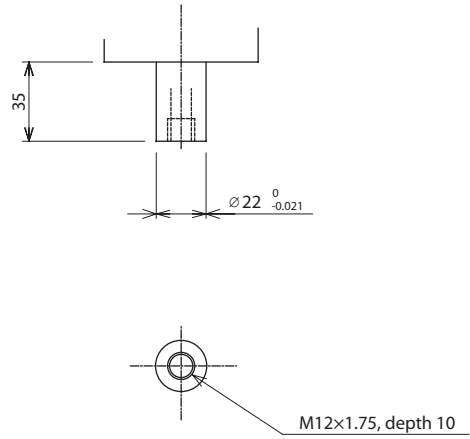
Fig. 3-62

R6YXC700, R6YXC800, R6YXC1000 : Z-axis tip shape

Fig. 3-63

Table 3-1

Robot Model	F$_{XY}$max		F$_Z$max		F$_R$max		M$_R$max		Mmax	
	N	kgf	N	kgf	N	kgf	Nm	kgfm	Nm	kgfm
R6YXCH250	46	5	40	4	121	12	6	0.6	5	0.5
R6YXCH350	46	5	40	4	121	12	6	0.6	5	0.5
R6YXCH400	46	5	40	4	121	12	6	0.6	5	0.5
R6YXC500	115	12	89	9	253	26	12	1.3	10	1.0
R6YXC600	115	12	89	9	253	26	12	1.3	10	1.0
R6YXC700	376	38	178	18	464	47	47	4.8	22	2.3
R6YXC800	376	38	159	16	464	47	47	4.8	20	2.0
R6YXC1000	341	35	159	16	464	47	43	4.4	20	2.0
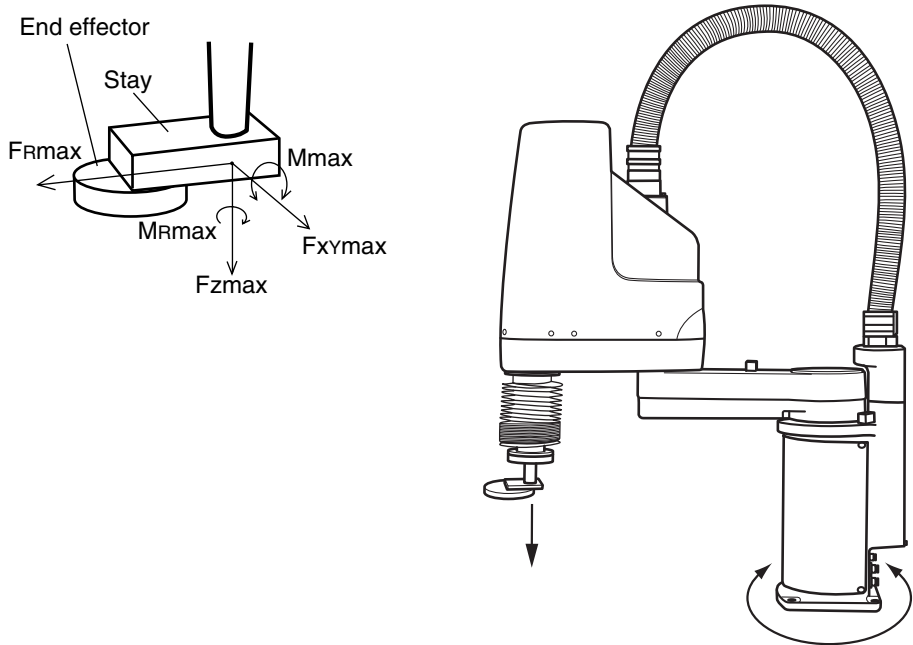
Fig. 3-64 Maximum load applied to end effector attachment

Table 3-2

Robot Model	Bolts Used	Number of bolts	Tightening torque		Hole diameter(mm)	
			Nm	kgf · cm		
R6YXCH250	M4 or lager	2 or more	4.5	46	12	+0.018 / 0
R6YXCH350	M4 or lager	2 or more	4.5	46	12	+0.018 / 0
R6YXCH400	M4 or lager	2 or more	4.5	46	12	+0.018 / 0
R6YXC500	M6 or lager	2 or more	15.3	156	18	+0.018 / 0
R6YXC600	M6 or lager	2 or more	15.3	156	18	+0.018 / 0
R6YXC700	M8 or lager	2 or more	37.0	380	22	+0.021 / 0
R6YXC800	M8 or lager	2 or more	37.0	380	22	+0.021 / 0
R6YXC1000	M8 or lager	2 or more	37.0	380	22	+0.021 / 0
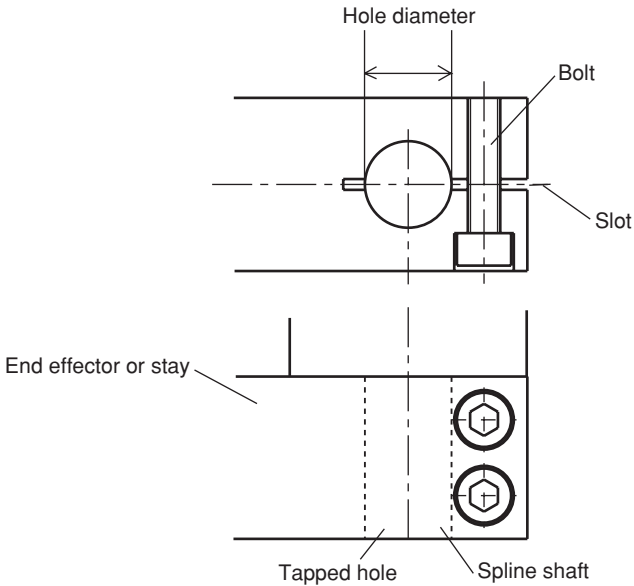
Fig. 3-65

⚠ **WARNING** _____

THE END EFFECTOR ATTACHMENT MUST HAVE ADEQUATE
STRENGTH TO WITHSTAND THE LOADS LISTED IN TABLE 3-1. IF TOO
WEAK, THE ATTACHMENT MAY BREAK DURING ROBOT OPERATION
AND FRAGMENTS FLY OFF CAUSING ACCIDENTS OR INJURIES.

⚠ **WARNING** _____

THE END EFFECTOR ATTACHMENT MUST HAVE SUFFICIENT RIGIDITY
VERSUS THE LOADS LISTED IN TABLE 3-1. IF THIS RIGIDITY IS
INADEQUATE, THE END EFFECTOR MAY VIBRATE DURING ROBOT
OPERATION CAUSING BAD EFFECTS ON THE MANIPULATOR
OPERATION.

⚠ **WARNING** _____

•WHEN THE END EFFECTOR IS ATTACHED BY SLOT CLAMPING,
ALWAYS OBSERVE THE CONDITIONS LISTED IN TABLE 3-2. IF THESE
ARE IGNORED, THE END EFFECTOR MAY COME LOOSE AND FLY OFF
DURING ROBOT OPERATION, RESULTING IN AN ACCIDENT OR INJURY.
•IN CASES WHERE OTHER ATTACHMENT METHODS ARE USED, BE
SURE THAT THE END EFFECTOR WILL NOT COME OFF WHEN THE
LOADS LISTED IN TABLE 3-1 ARE APPLIED.

⚠ **WARNING** _____

•THE TAPPED HOLE (SEE FIGS. 3-62, 3-63 AND 3-65) PROVIDED ON THE
LOWER PART OF THE END EFFECTOR ATTACHMENT SHOULD BE
USED ONLY FOR PREVENTING THE END EFFECTOR FROM COMING
LOOSE.
•DO NOT FASTEN THE END EFFECTOR JUST BY USING THIS TAPPED
HOLE. IF THE END EFFECTOR IS FASTENED ONLY WITH THIS TAPPED
HOLE, IT MAY COME LOOSE FROM THE ATTACHMENT DURING
ROBOT OPERATION AND FLY OFF RESULTING IN ACCIDENTS OR
INJURIES.

6-5 Gripping force of end effector

The gripping force of the end effector must have a sufficient extra margin of strength versus the workpiece weight and reaction force applied to the workpiece during robot operation.

The reaction force applied to the workpiece during operation can be calculated from the acceleration applied to the end effector attachment. The maximum acceleration on the end effector attachment of each robot model is listed in the table below. When the workpiece position is offset to the end effector attachment, the accelerations Amax and A^{XY}max become larger by an amount equal to the offset versus the arm length. When the R-axis rotates during operation, this acceleration $A_R$max must be taken into account.

Table 3-3 Maximum acceleration during robot operation

Robot Model	Amax(m/sec^2)	A$_{XY}$max(m/sec^2)	Azmax(m/sec^2)	A$_R$max(rad/sec^2)
R6YXCH250	62	45	23	140
R6YXCH350	71	48	23	120
R6YXCH400	91	46	23	120
R6YXC500	48	32	38	140
R6YXC600	52	27	38	140
R6YXC700	64	46	32	160
R6YXC800	67	39	32	160
R6YXC1000	63	39	32	136
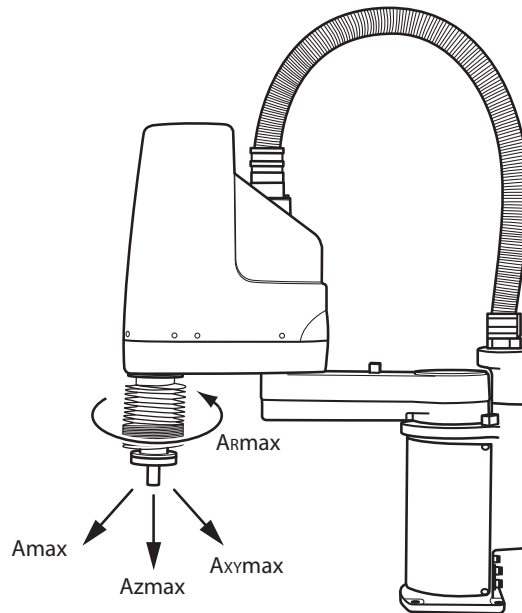
Fig. 3-66 Maximum acceleration on end effector attachment

⚠ **WARNING**

THE GRIPPING FORCE OF THE END EFFECTOR MUST HAVE A SUFFICIENT EXTRA MARGIN OF STRENGTH TO PREVENT THE WORKPIECE FROM COMING LOOSE AND FLYING OFF DURING ROBOT OPERATION.

IF THE GRIPPING FORCE IS TOO WEAK, THE WORKPIECE MAY COME LOOSE AND FLY OFF CAUSING ACCIDENTS OR INJURIES.

7 Limiting the Movement Range with X-Axis Mechanical Stoppers (Excluding R6YXCH250, R6YXCH350, R6YXCH400)

In the XC series (excluding R6YXCH250, R6YXCH350, R6YXCH400), the movement range can be limited by changing the X-axis mechanical stopper positions. (The Y-axis mechanical stopper positions are fixed and cannot be changed.) When the robot is shipped from the factory, the movement range is set to the maximum. If the maximum movement range is too large compared to the actual work range, or the manipulator might interfere with peripheral units, then the movement range can be limited as outlined below.
The X-axis mechanical stopper positions may slightly differ depending on machining precision.

⚠ **WARNING** ─────────────────────────────

ALWAYS TURN OFF THE CONTROLLER BEFORE CHANGING THE MOVEMENT RANGE WITH MECHANICAL STOPPERS.

⚠ **CAUTION** ─────────────────────────────

WHEN THE MECHANICAL STOPPERS ARE INSTALLED, THE SOFT LIMITS MUST BE SET TO A POINT INSIDE THE MECHANICAL STOPPER POSITIONS. (REFER TO "4 SETTING THE SOFT LIMITS" IN CHAPTER 4.)

To change the X-axis mechanical stopper positions, use the procedure below.

1) Prepare the following tools.
   Hex wrench set

2) Turn off the robot controller.

3) Place a sign indicating the robot is being adjusted, to keep others from touching the controller switch.

4) Enter the safeguard enclosure.

5) Remove the X-axis mechanical stoppers installed as shown in Fig. 3-67 and Fig. 3-68. Then reinstall the mechanical stoppers at the positions that determine the desired movement range by tightening them to the torque specified in Table 3-4.

6) Check that the movement range is limited by the mechanical stoppers as desired.

7) Go outside the safeguard enclosure.

8) Check that no one is inside the safeguard enclosure when turning on the controller.

Table 3-4

Robot Model	Bolt size	Tightening torque(kgf·cm)	Tightening torque(N·m)
R6YXC500, R6YXC600	M6	156	15.3
R6YXC700, R6YXC800, R6YXC1000	M8	380	37.2
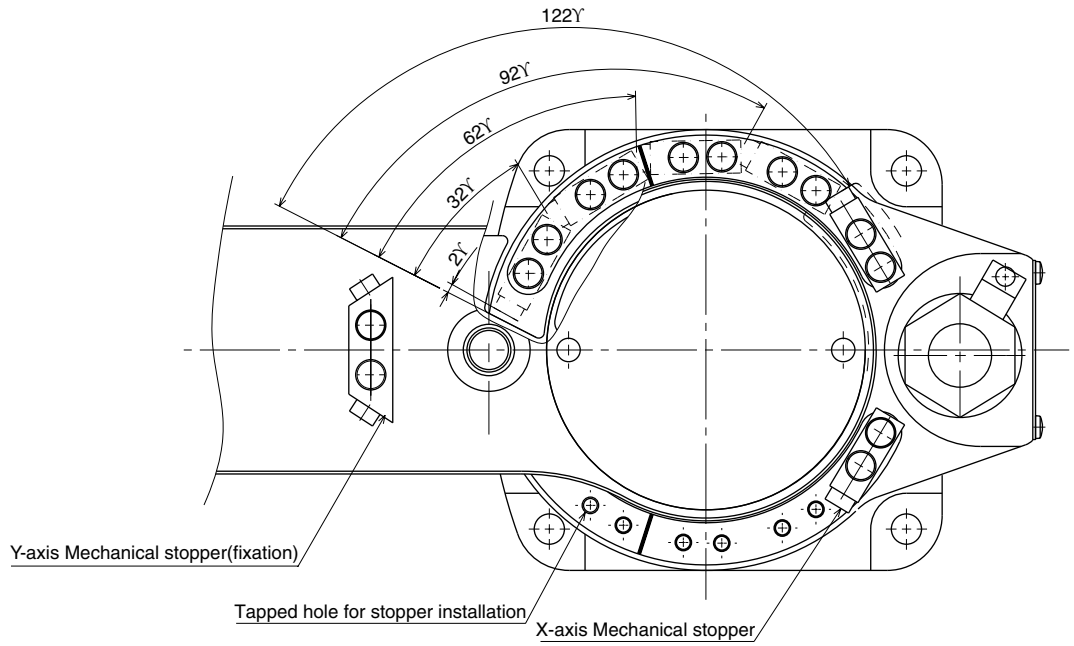
**Fig. 3-67 Mechanical stopper positions and movement range
(R6YXC500, R6YXC600)**
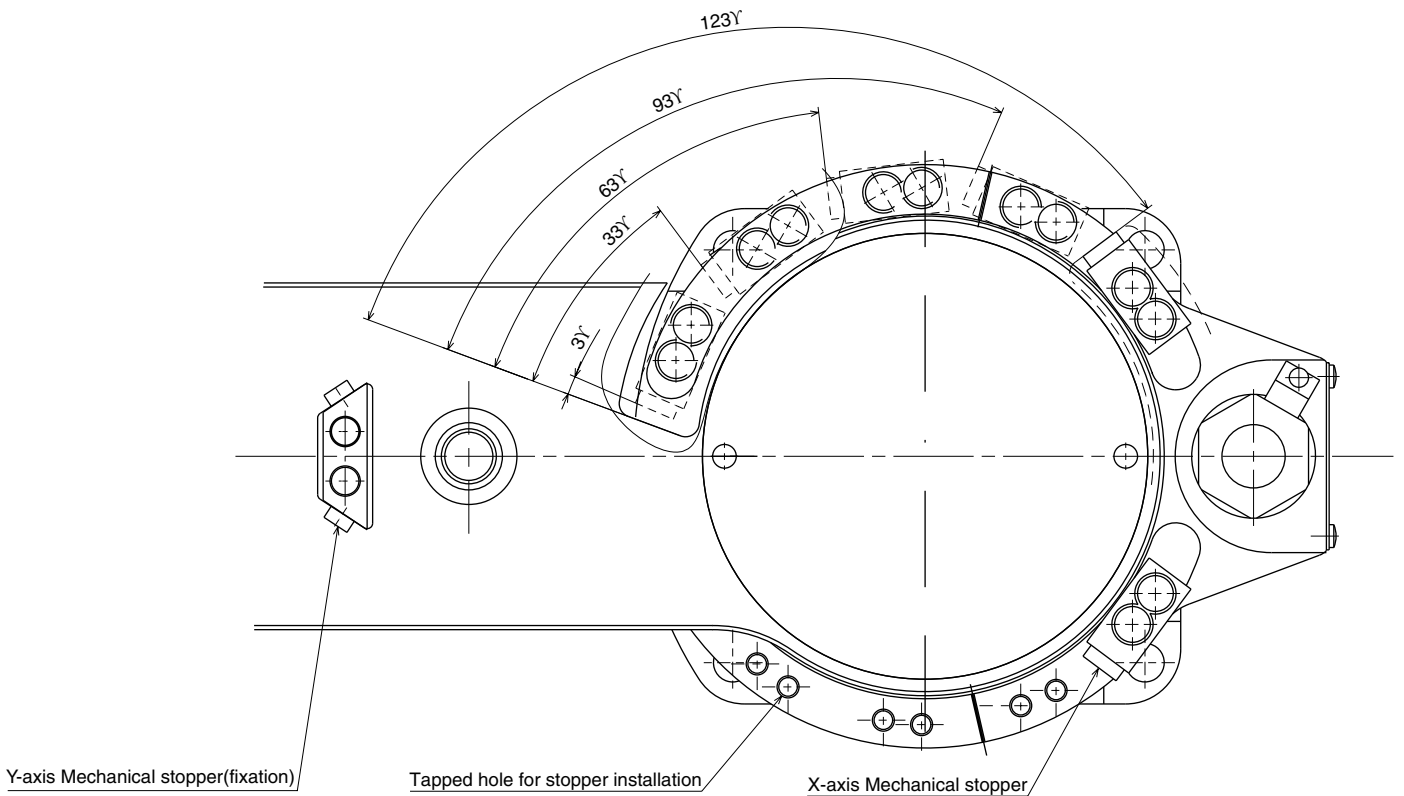
**Fig. 3-68 Mechanical stopper positions and movement range
(R6YXC700, R6YXC800, R6YXC1000)**

8 Working Envelope and Mechanical Stopper Positions for Maximum Working Envelope

Working envelope of each robot and mechanical stopper positions for the maximum working envelope are shown in Fig. 3-69 to Fig. 3-76.
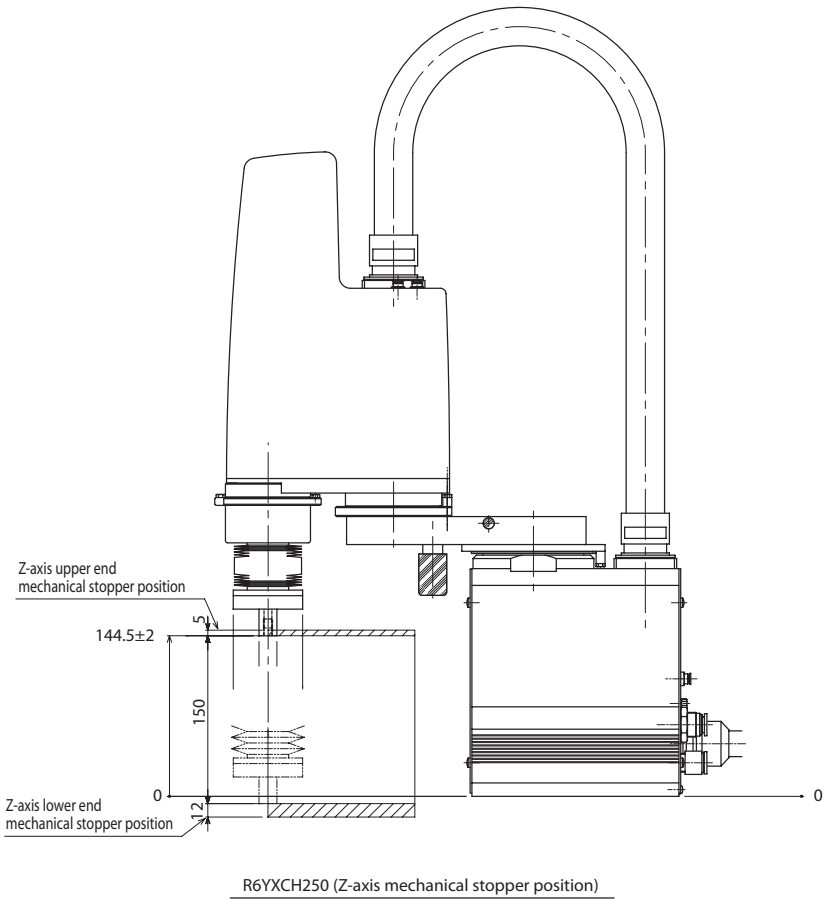
R6YXCH250 (Z-axis mechanical stopper position)
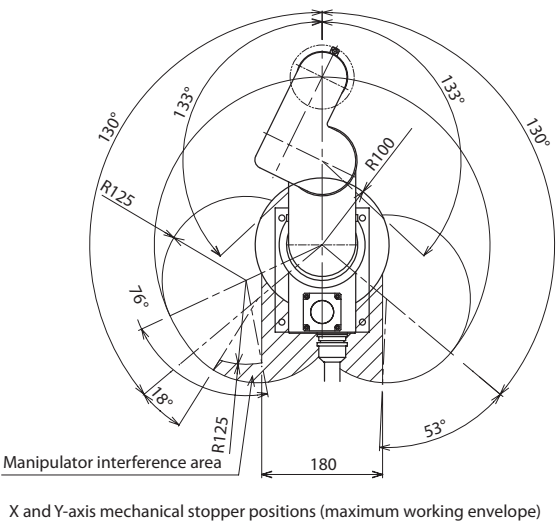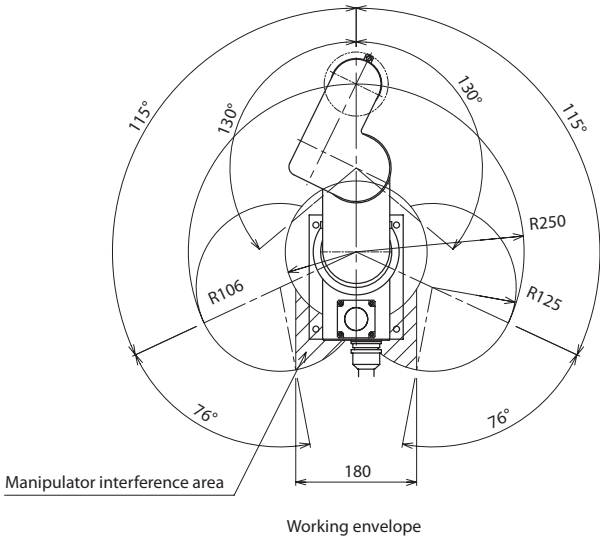
Working envelope

X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-69 R6YXCH250

Z-axis upper end
mechanical stopper position

144.5±2

Z-axis lower end
mechanical stopper position

R6YXCH350 (Z-axis mechanical stopper position)

Interference position
(a) Base flange
(b) Base rear side

Working envelope

X and Y-axis mechanical stopper positions (maximum working envelope)

Manipulator interference area

Fig.3-70 R6YXCH350

Z-axis upper end
mechanical stopper position

144.5±2

5

150

0

12

Z-axis lower end
mechanical stopper position

0
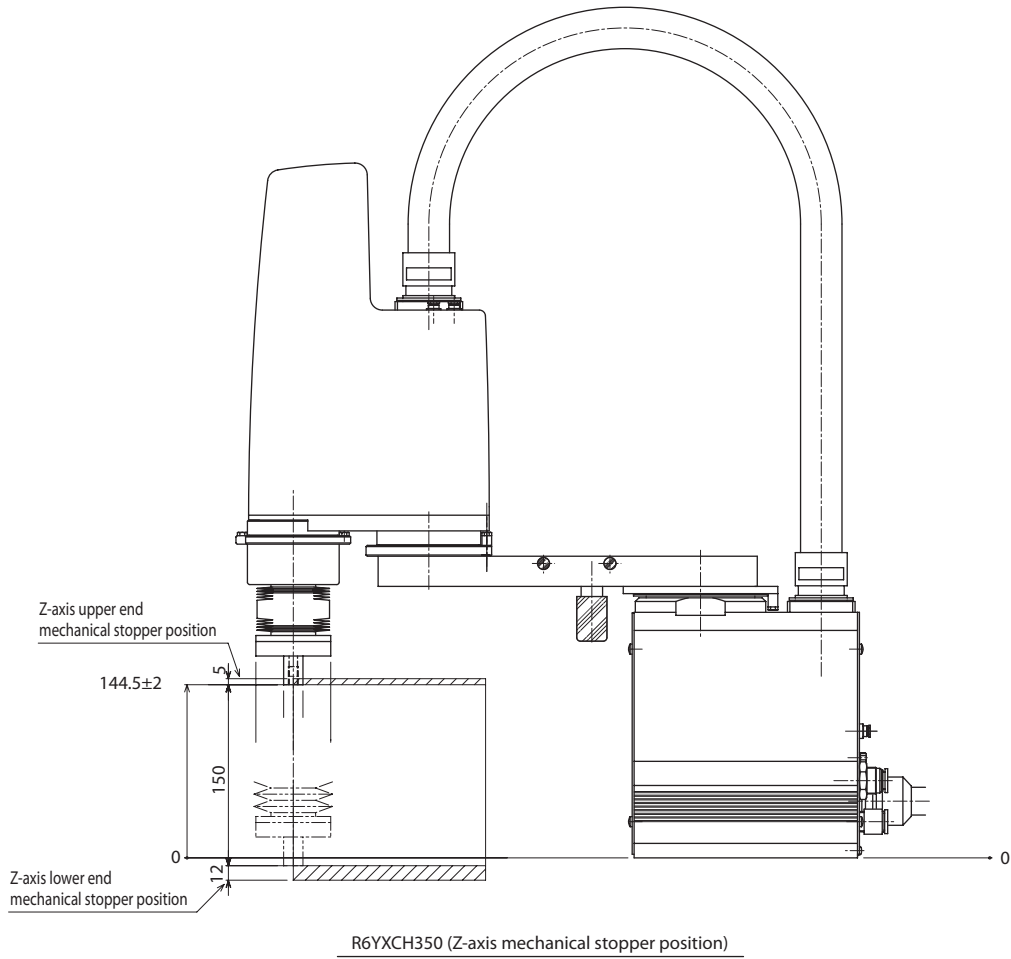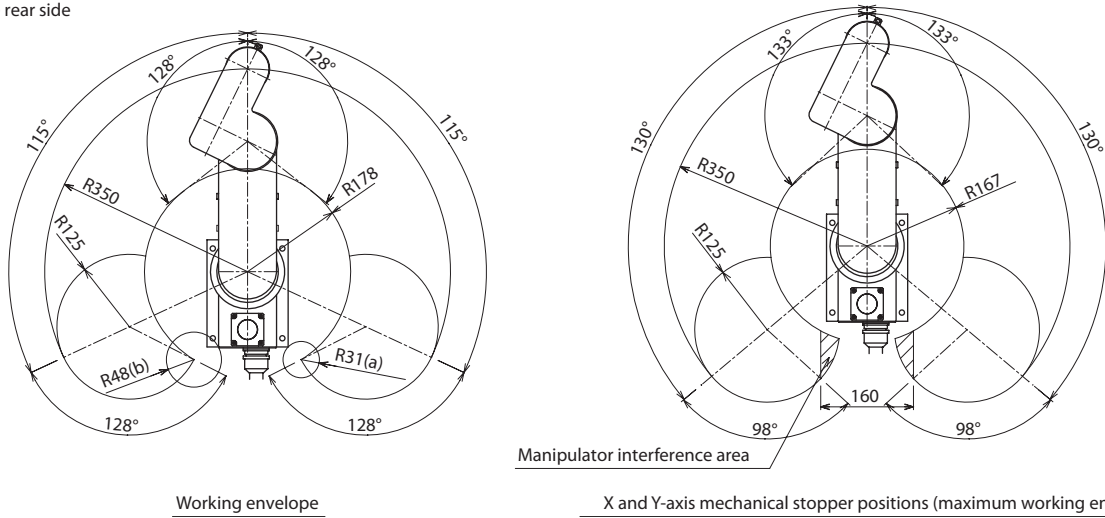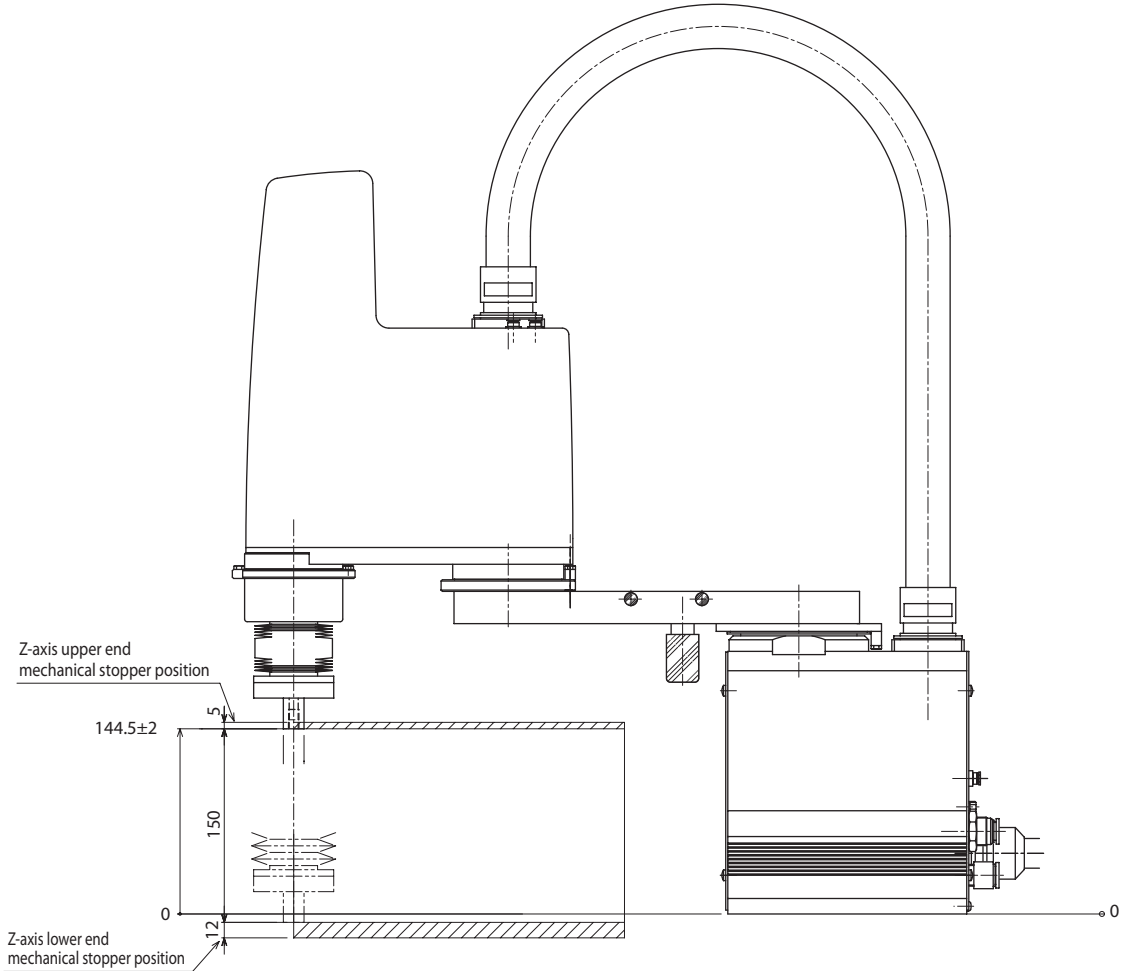
R6YXCH400 (Z-axis mechanical stopper position)
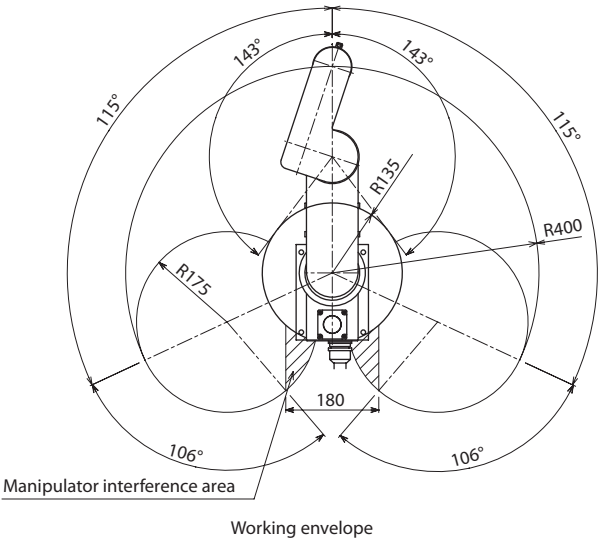
143°   143°

115°   115°

R135

R400

R175

180

106°   106°

Manipulator interference area

Working envelope

145°   145°

123°   123°

R129

R175

180

91°   91°

Manipulator interference area

X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-71 R6YXCH400
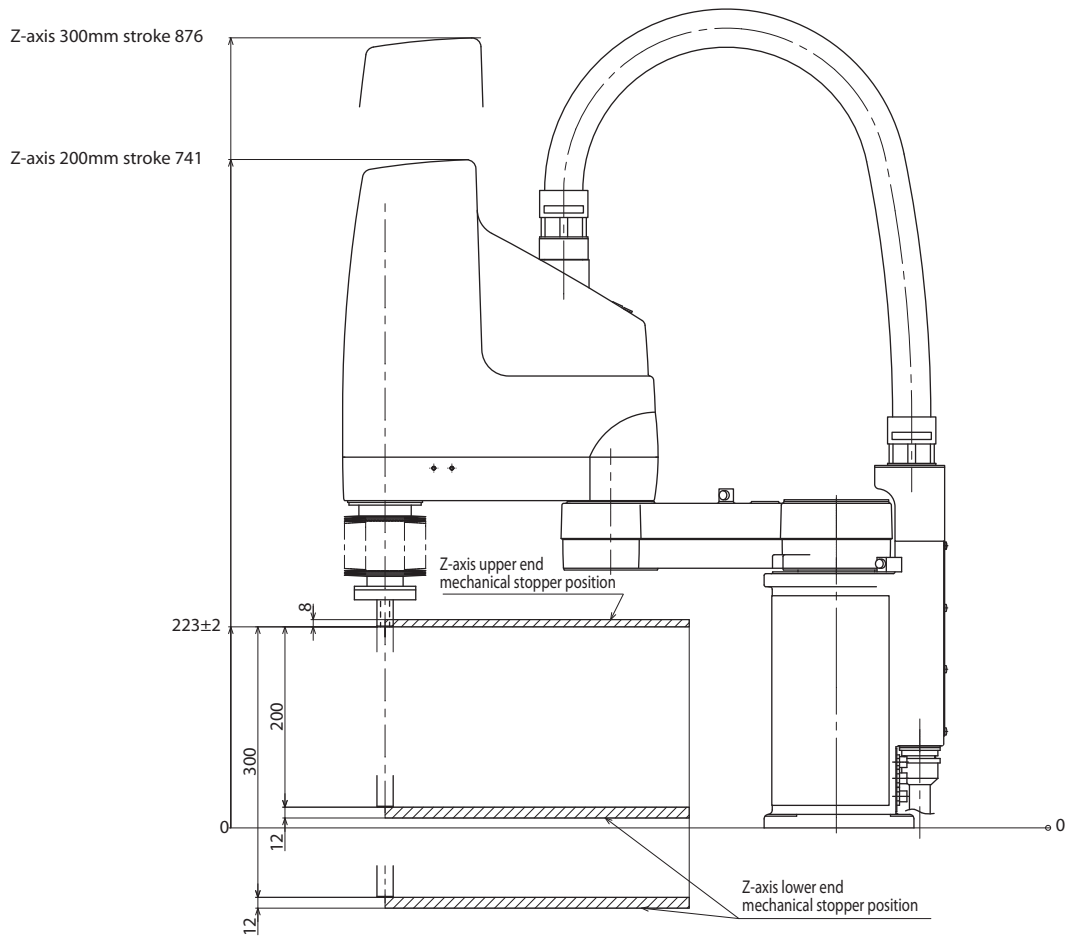
R6YXC500 (Z-axis mechanical stopper position)

Interference position
(a) Base flange
(b) Base rear side
(c) Base

Working envelope

X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-72 R6YXC500

Z-axis 300mm stroke 876

Z-axis 200mm stroke 741

Z-axis upper end
mechanical stopper position

223±2

8

300   200

0

12

12

Z-axis lower end
mechanical stopper position
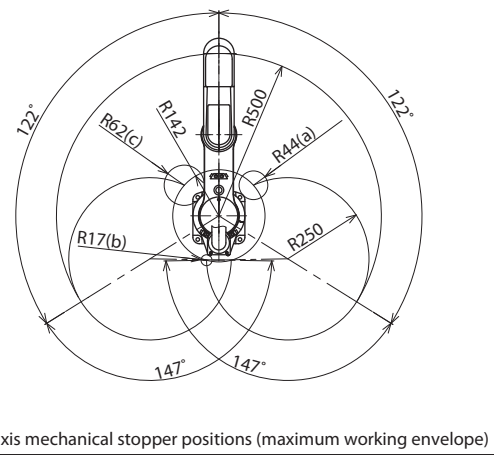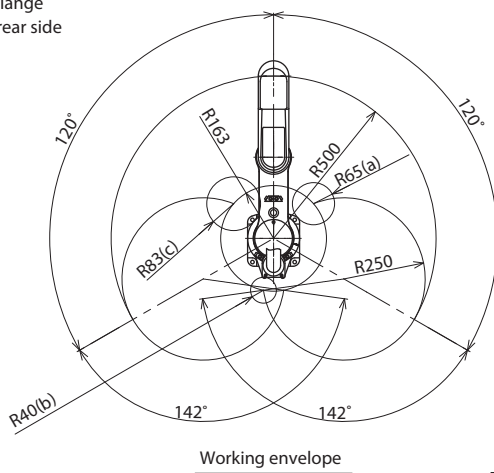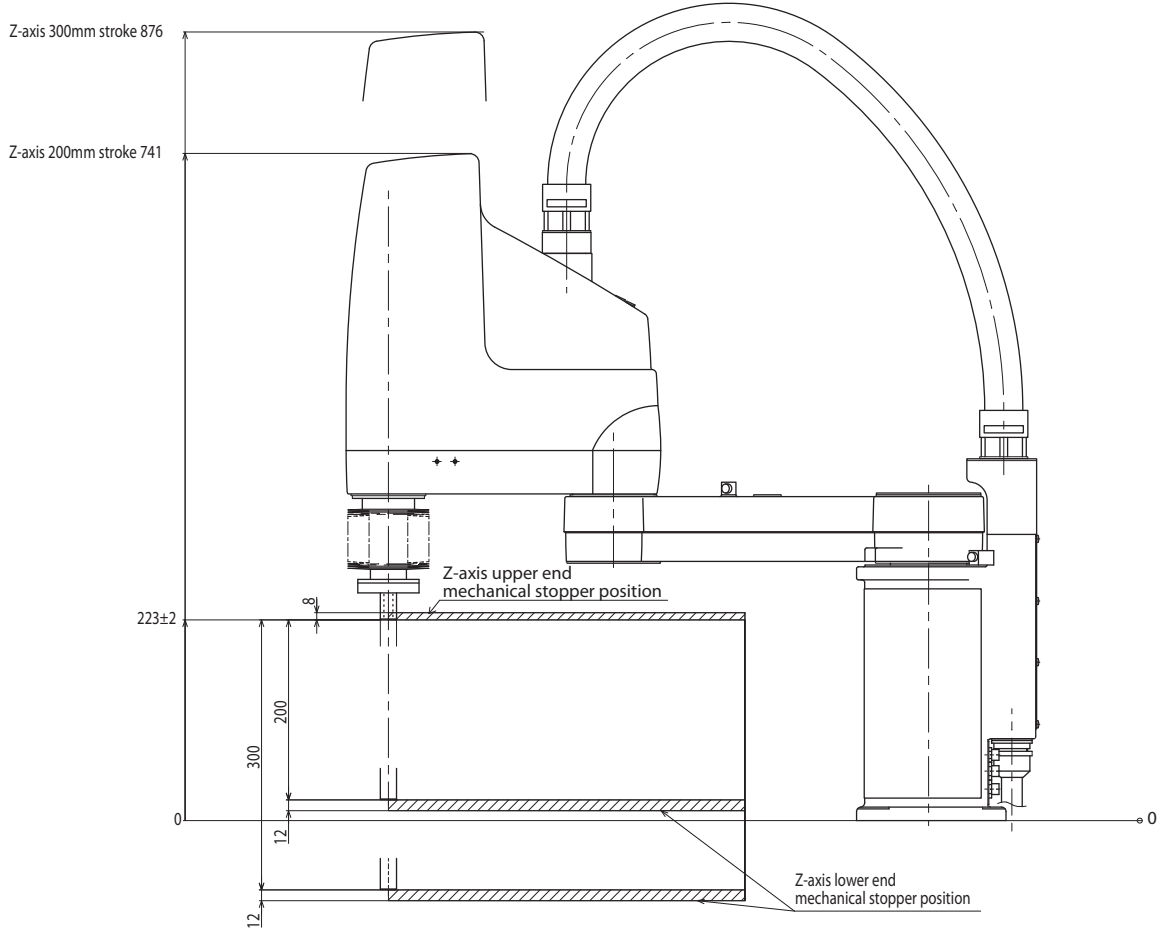
R6YXC600 (Z-axis mechanical stopper position)

Interference position
(a) Base flange
(b) Base rear side
(c) Base

120°   120°

R124(c)   R204   R600   R117(a)

R77(b)   R250

145°   145°

Working envelope

122°   122°

R116(c)   R196   R600   R111(a)

R70(b)   R250

147°   147°
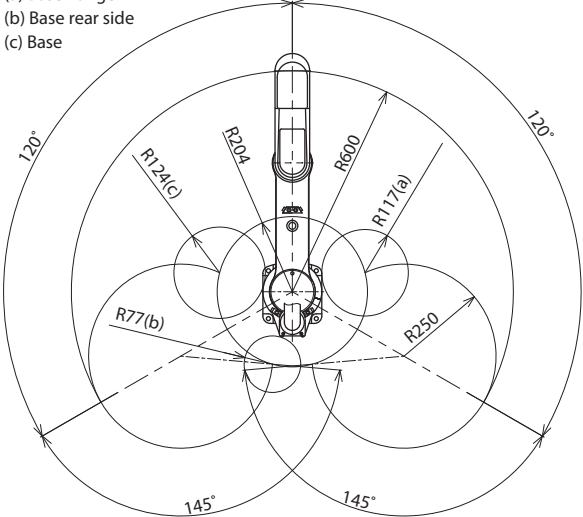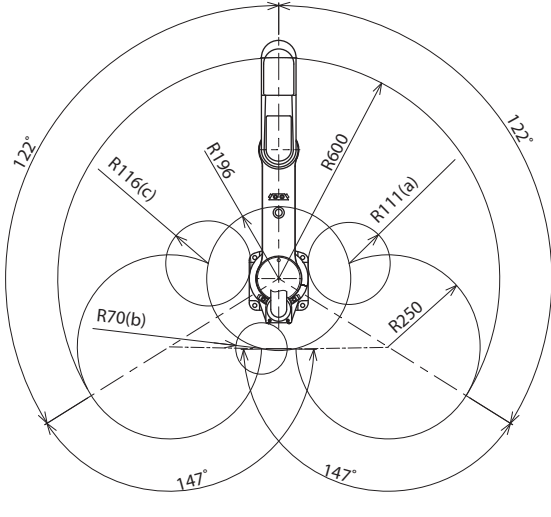
X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-73 R6YXC600

Z-axis 400mm stroke 956

Z-axis 200mm stroke 756

Z-axis upper end
mechanical stopper position

224±2

8

200

400

0

12

Z-axis lower end
mechanical stopper position

176

12
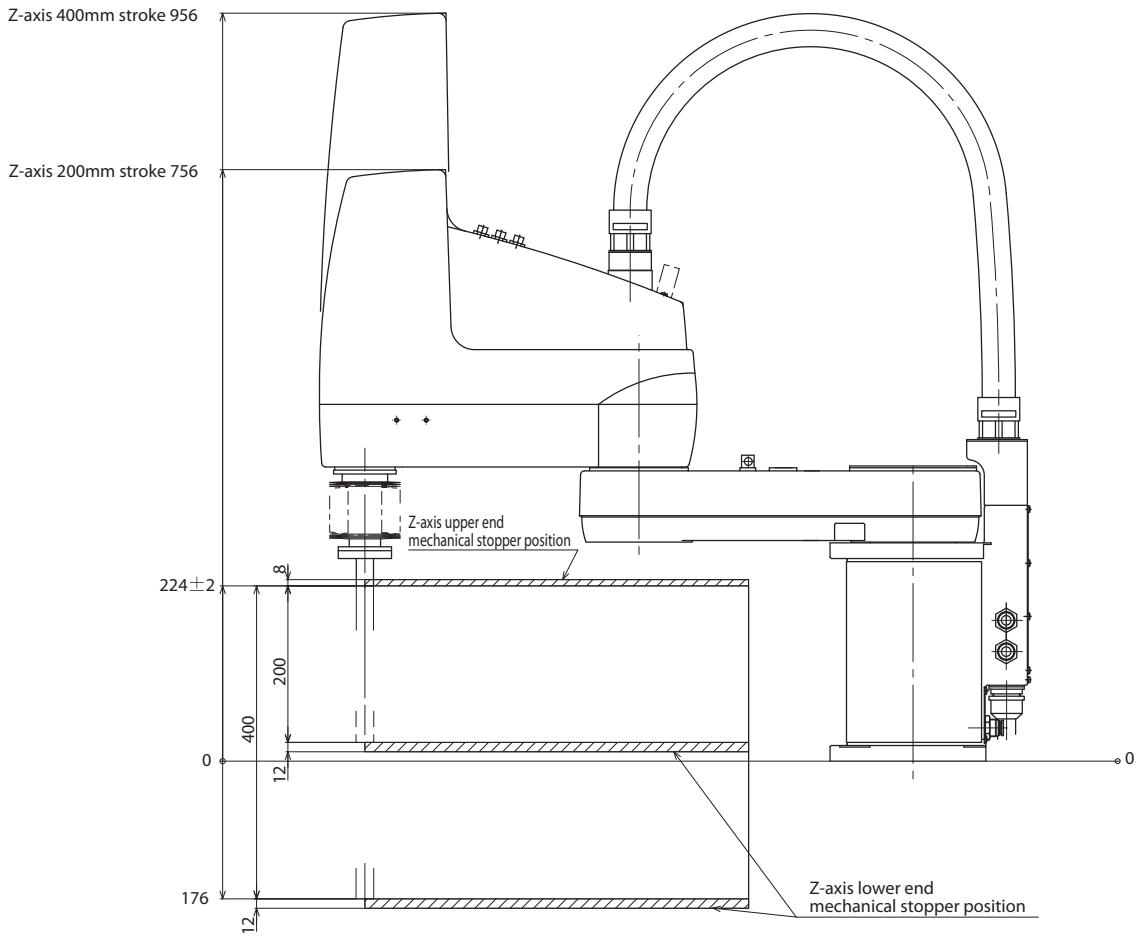
R6YXC700 (Z-axis mechanical stopper position)

Interference position
(a) Base flange
(b) Base rear side
(c) Base

120°   120°

R104(c)   R95(a)

R210   R700

R350

R60(b)

145°   145°

Working envelope

123°   123°

R93(c)   R83(a)

R199   R700

R350

R49(b)

147°   147°
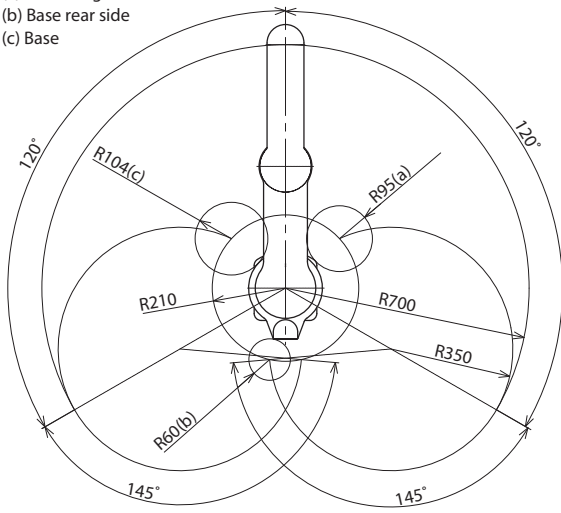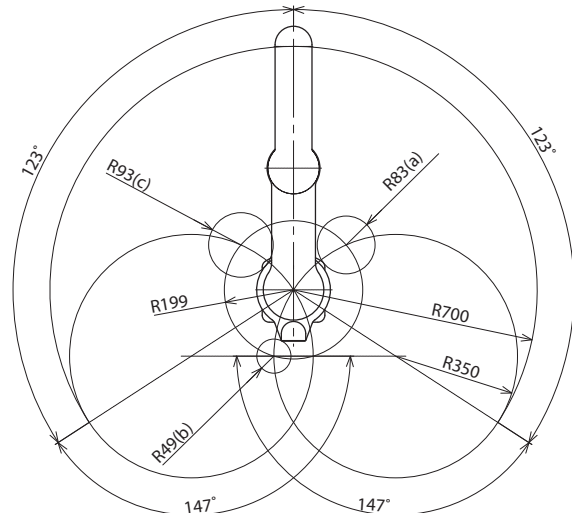
X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-74 R6YXC700
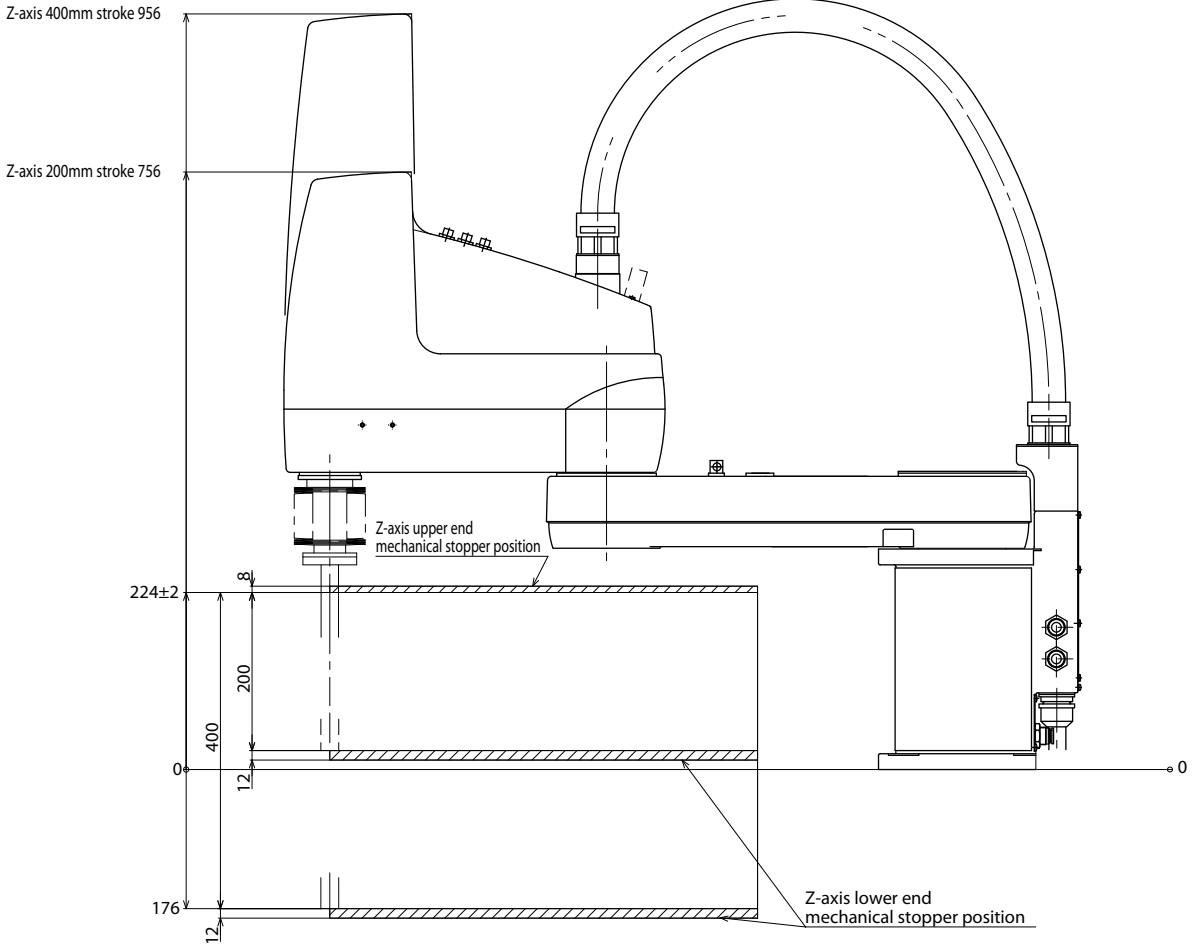
R6YXC800 (Z-axis mechanical stopper position)

Interference position
(a) Base flange
(b) Base rear side
(c) Base
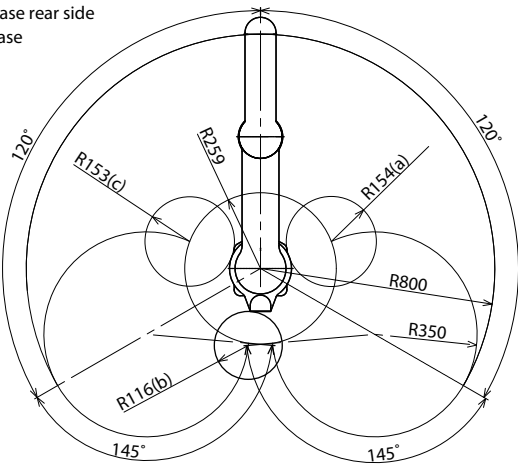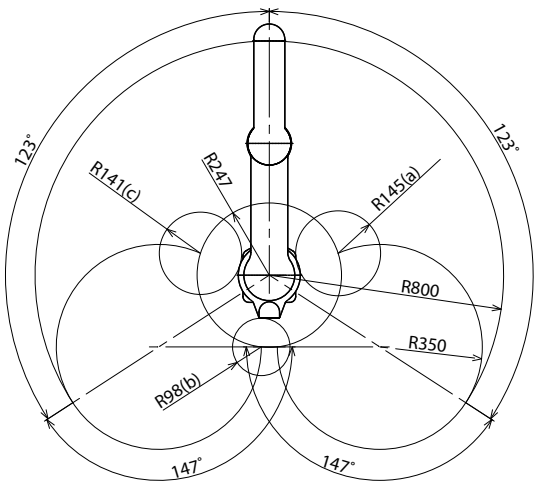
Working envelope

X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-75 R6YXC800
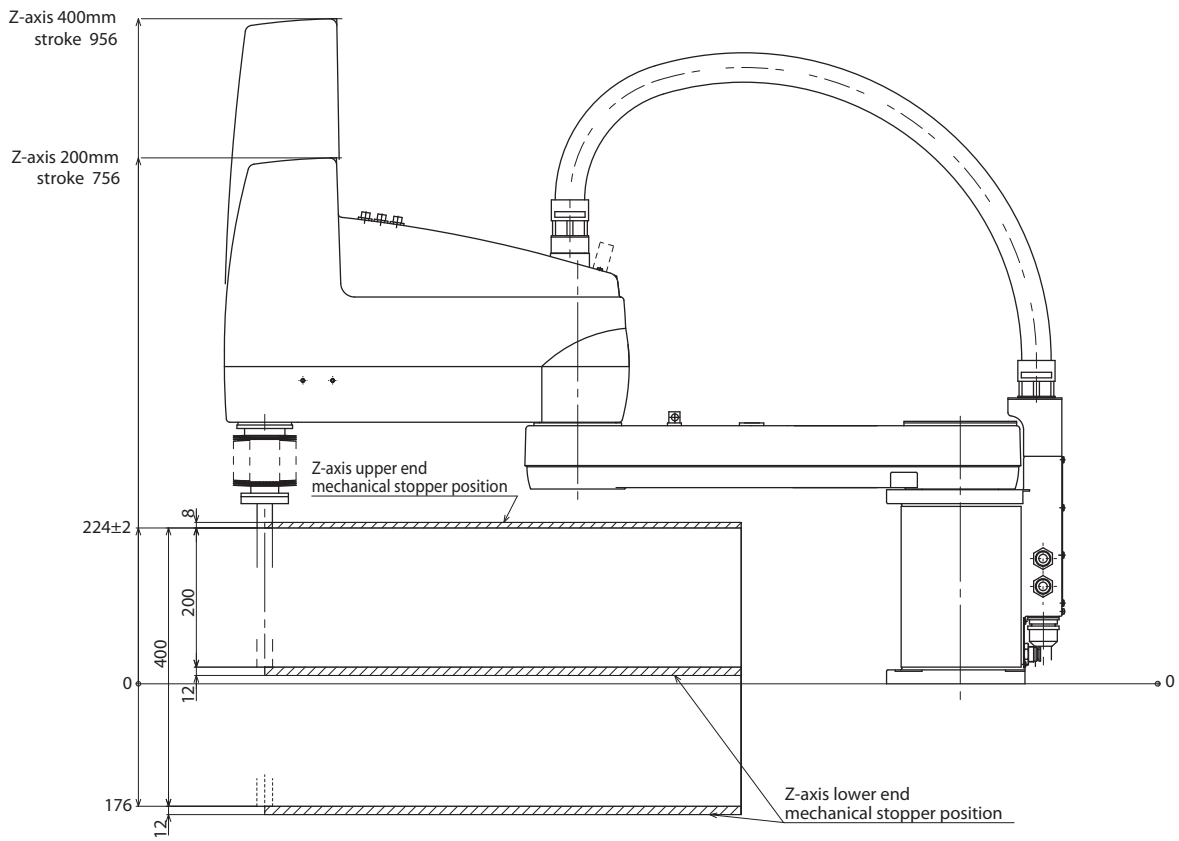
R6YXC1000 (Z-axis mechanical stopper position)

Interference position
(a) Base flange
(b) Base rear side
(c) Base
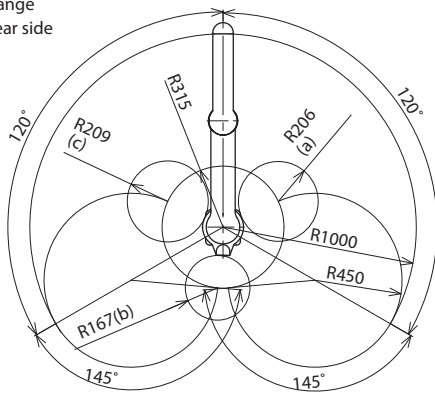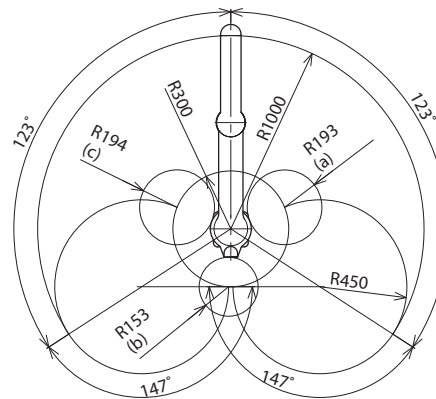
Working envelope

X and Y-axis mechanical stopper positions (maximum working envelope)

Fig.3-76 R6YXC1000

Here, robot working envelope and mechanical stopper positions for the maximum working envelope are described using the R6YXC500 as an example. Refer to Fig. 3-72 for the R6YXC500. Other robot models are the same.

1) X and Y axes

   1. Do not attempt operation outside the working envelope. On the XC series, the origin can be set at any position. The working envelope described in this manual is an area with the robot frontal reference.

   2. Interference positions where a load may touch the robot within the working envelope and their radii are shown in the figure. Here, "a", "b" and "c" are the respective interference positions with the base flange, base rear panel, and base. Use caution not to allow the robot load to interfere with any part of the robot.

   3. Interference positions where a load might touch the robot when the robot strikes the X-axis or Y-axis mechanical stoppers set for the maximum working envelope and their radii are shown at the mechanical stopper positions. Here, "b" and "c" are the respective interference positions with the base rear panel and the base.

2) Z-axis

Do not attempt work outside the working envelope. In particular, do not attempt work in the area between the working envelope and mechanical stopper position. Mechanical stoppers are installed at both the upper and lower ends of the movement range.

⚠ WARNING

THE ROBOT CABLE, USER WIRING OR TUBING MAY BE DAMAGED IF THE ROBOT LOAD INTERFERES WITH THEM RESULTING IN HAZARDOUS ROBOT MALFUNCTIONS. DO NOT OPERATE AT POINTS WHERE THE LOAD MAY INTERFERE WITH THE ROBOT CABLE, USER WIRING OR TUBING.

3) R-axis

The R-axis has no mechanical stoppers.

⚠ CAUTION

SINCE THE R-AXIS HAS NO MECHANICAL STOPPERS, MAKE CERTAIN THAT THE END EFFECTOR WIRING AND TUBING DO NOT BECOME ENTANGLED DURING OPERATION.

4) Robot overrun during impacts with mechanical stopper
   A urethane damper is installed to absorb the shock when an impact occurs with the mechanical stopper, so a certain amount of overrun occurs when the robot strikes the mechanical stopper. Use caution and take overrun into account since the end effector may interfere with the robot body and peripheral equipment or the robot body may interfere with the peripheral equipment. Maximum overrun amounts are listed below (for normal operation, maximum load mass, maximum speed).

Robot model	X-axis	Y-axis	Z-axis	
			Upper end	Lower end
R6YXCH250, R6YXCH350, R6YXCH400	10˚	2˚	2mm	2mm
R6YXC500, R6YXC600	6˚	2˚	5mm	2mm
R6YXC700, R6YXC800, R6YXC1000	6˚	2˚	5mm	2mm

Note: Here, ° (deg.) is the overrun angle at the X-axis and Y-axis joints.

1. When the robot strikes the X-axis or Y-axis mechanical stopper or another object, or when the R-axis collides with an object, speed reduction gears are locked while being meshed if the collision impact is large. If this happens, please contact our sales office or dealer.

2. When the robot strikes the Z-axis upper mechanical stopper excessively, the urethane damper may be splayed beyond the retaining ring. In this case, return the urethane damper to its original state.

CHAPTER 4

Adjustment

1   Overview

OMRON robots have been completely adjusted at the factory or sales representative before shipment, including the Z-axis origin position adjustment. However, when the operating conditions are changed and adjustment of the robot becomes necessary, follow the procedure described in this chapter.

2   Safety Precautions

(1) Read and understand the contents of this chapter completely before attempting to adjust the robot.

(2) Place a conspicuous sign indicating the robot is being adjusted, to prevent others from touching the controller switch, programming box or operation panel.

(3) If a safeguard enclosure has not yet been provided right after installation of the robot, rope off or chain off the movement area around the manipulator in place of a safeguard 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 area of the manipulator.

(4) To check operation after adjustment, refer to "6. Trial Operation" in Chapter 1.

3   Adjusting the origin

3-1   Absolute reset method

For information on absolute reset method, refer to "3 Adjusting the origin" in Chapter 4 of the standard model X user's manual.

3-2   Machine reference

For information on machine reference, refer to "3 Adjusting the origin" in Chapter 4 of the standard model X user's manual.

3-3   Absolute reset procedures

For information on absolute reset procedures, refer to "3 Adjusting the origin" in Chapter 4 of the standard model X user's manual.

3-4   Changing the origin position and adjusting the machine reference

For information on changing the origin position and adjusting the machine reference, refer to "3 Adjusting the origin" in Chapter 4 of the standard model X user's manual.

3-4-1   Sensor method

For information on sensor method, refer to "3 Adjusting the origin" in Chapter 4 of the standard model X user's manual.

3-4-2   Mark method

For information on mark method, refer to "3 Adjusting the origin" in Chapter 4 of the standard model X user's manual.

3-4-3   Stroke end method

The stroke end method is employed on the XC series robots for the absolute reset of the Z-axis.

The origin position of the Z-axis is fixed at the upper end of the Z-axis stroke, and it cannot be changed.

The machine reference is factory-adjusted at shipment, and readjustment is not necessary for normal use.

The readjustment in the following procedure is required, however, if the machine reference exceeds the tolerance range (26 to 74) of the absolute reset for any reason.

⚠ **WARNING** ─────────────────────────────────

INJURY CAN OCCUR IF HANDS OR FINGERS ARE SQUEEZED BETWEEN THE DRIVE PULLEY AND BELT. ALWAYS TURN OFF THE CONTROLLER AND USE CAUTION WHEN HANDLING THESE PARTS.

─────────────────────────────────

⚠ **CAUTION** ─────────────────────────────────

THE POSITIONAL SHIFT WILL OCCUR AFTER ADJUSTING THE MACHINE REFERENCE VALUE, SO POINT DATA SETTINGS ARE REQUIRED AGAIN.

─────────────────────────────────

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Place a sign indicating the robot is being adjusted, to keep others from operating the controller or operation panel.
3) Perform the Z-axis absolute reset.
   To perform the Z-axis absolute reset, see "3-3 Absolute reset procedures" in Chapter 4.
4) Turn off the controller.
5) Enter the safeguard enclosure.
6) Remove the Y-axis upper cover and under cover (R6YXC500 to R6YC1000).
   To remove the covers, see "7 Removing the Robot Covers" in Chapter 4.
   Place the upper cover on the robot base (pedestal) side with the machine harness still connected.
7) Prop the spline or end effector with a support stand to prevent the Z-axis from dropping.
8) Remove the bolts securing the Z-axis motor (See Figs. 4-1 to 4-3) and then remove the Z-axis motor.

⚠ **WARNING** ─────────────────────────────────

IF THE Z-AXIS MOTOR COMES OFF THE Z-AXIS BELT, THE Z-AXIS DROPS CAUSING A HAZARDOUS SITUATION. BE SURE TO PROP THE Z-AXIS WITH A SUPPORT STAND.

─────────────────────────────────

9) Adjust the distance (L) between the Z-axis mechanical stopper and the axis end so it is set to the value shown in Table 4-1. Then tighten the four bolts to reassemble the Z-axis motor. (See Fig. 4-4.) At this point, do not allow the spline shaft position to shift from the correct height.

10) After reassembling the Z-axis motor, adjust the timing belt tension.
To adjust the timing belt tension, see "8 Adjusting the Timing Belt Tension" in Chapter 4.

11) Reattach the Y-axis upper cover and under cover (R6YXC500 to R6YXC1000).
To attach the covers, see "7 Removing the Robot Covers" in Chapter 4.

12) Go outside the safeguard enclosure.

13) Check that no one is inside the safeguard enclosure, and then turn on the controller.

14) Perform the Z-axis absolute reset.
To perform the Z-axis absolute reset, see "3-3 Absolute reset procedures" in Chapter 4.
After absolute reset is complete, use the following procedure to check if the **adjustment machine reference value** is within the tolerance range (26 and 74).

⚠ **CAUTION** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

THE ADJUSTMENT MACHINE REFERENCE VALUE IS DISPLAYED WITH THE PROCEDURE BELOW.
ALWAYS CHECK THE ADJUSTMENT MACHINE REFERENCE VALUE WHEN THE MACHINE REFERENCE IS ADJUSTED.

━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

1- Press the MODE key.
2- Press the F3 key to set MANUAL mode.
3- Press the F13 (LOWER+F3) key to select "RST. ABS ".
4- After the Z-axis absolute reset is complete, press the F10 (UPPER+F5) to display the **adjustment machine reference value (%)**.

If **adjustment machine reference value** is outside the absolute reset tolerance range (26 to 74), remove the Z-axis motor again and make fine-adjustment to the spline shaft height, so that the **adjustment machine reference value** is within the absolute reset tolerance range.

Table 4-1

Robot Model	L
R6YXCH250, R6YXCH350, R6YXCH400	4mm
R6YXC500, R6YXC600	8mm
R6YXC700, R6YXC800, R6YXC1000	8mm
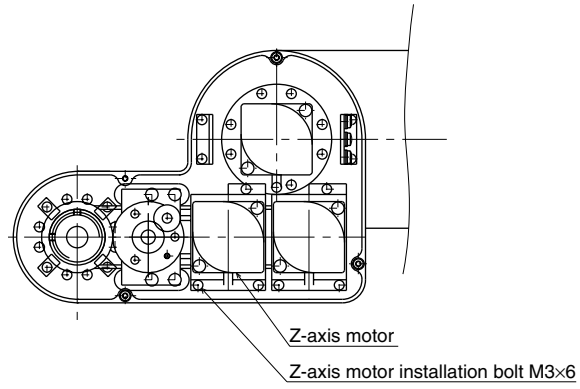
Z-axis motor

Z-axis motor installation bolt M3×6

Fig. 4-1 R6YXCH250, R6YXCH350, R6YXCH400

Z-axis motor

Z-axis motor installation bolt M5×14

Fig. 4-2 R6YXC500, R6YXC600

Y-axis motor

Z-axis motor installation bolt M5×12

Fig. 4-3 R6YXC700, R6YXC800, R6YXC1000

Z-axis mechanical stopper

L
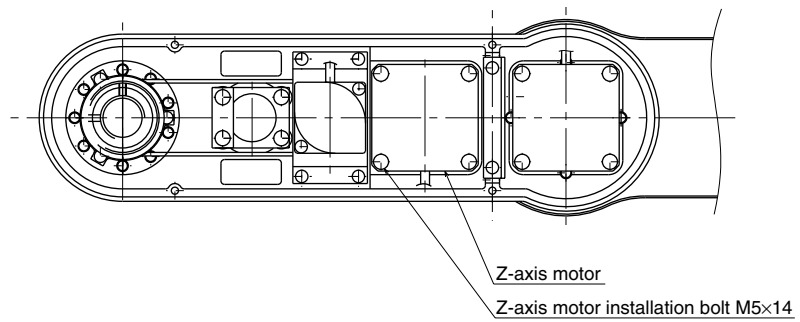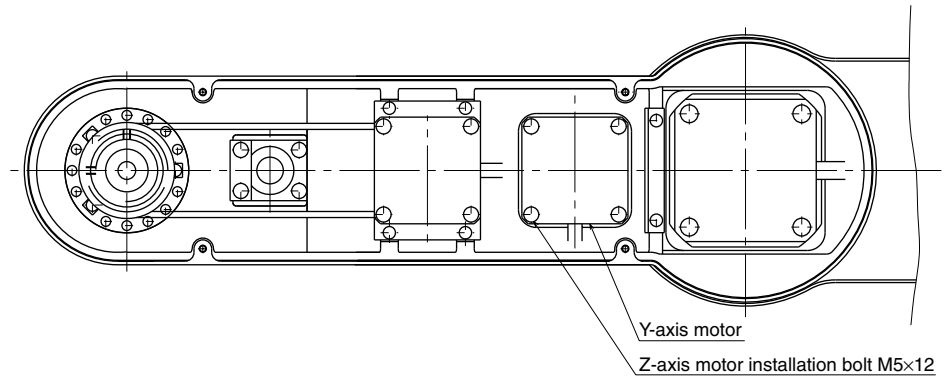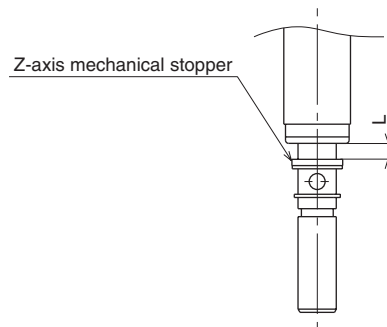
Fig. 4-4

4   Setting the Soft Limits

In the XC series, the working envelope during manual and automatic operation can be limited by setting the plus soft limit [pulse] and minus soft limit [pulse] on each axis.

The origin point 0 [pulse] is used as the reference to set the soft limits. The working envelope can be limited by specifying the number of pulses from the 0 pulse position. For the working envelope of each robot, refer to the dimensional outlines listed in our robot catalog.

When performing actual checks of the soft limit settings, operate the robot manually from outside the safeguard enclosure.

(1) Setting the X-axis and Y-axis soft limits

The soft limits must be set within the movement range limited by the mechanical stoppers as explained in Section 7 in Chapter 3 or within the range where the manipulator does not interfere with the peripheral equipment (but within maximum working envelope). Set the soft limits with the following procedure. Also use this procedure when the origin position has been changed. Likewise, in models where the mechanical stopper position cannot be changed, reduce the soft limits to narrow the working envelope when the actual working range of the robot is small or the manipulator interferes with the peripheral equipment.

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.

2) Press the emergency stop button on the PB to set emergency stop.

Refer to the "OMRON Robot Controller User's Manual" for further details on emergency stop and canceling emergency stop.

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

4) Enter the safeguard enclosure while holding the PB.

5) Move the X-axis and Y-axis arms by hand to the mechanical stopper positions or to the point where interference with the peripheral equipment occurs, and note the X-axis and Y-axis plus (+) and minus (-) direction pulses displayed on the PB.

6) Check that no one is inside the safeguard enclosure, then cancel emergency stop from outside the safeguard enclosure.

7) Set the soft limits to within the figure for the X-axis and Y-axis encoder pulses that you noted above in step 5). This software limit setting must be made from outside the safeguard enclosure.

Refer to the "OMRON Robot Controller User's Manual" for further details on soft limit settings.

(2) Setting the Z-axis soft limits

Make this setting from outside the safeguard enclosure.

The Z-axis has mechanical stoppers fixed at the upper and lower ends of the Z-axis movement range. When the actual working range of the robot is smaller than the maximum working envelope or the manipulator interferes with the peripheral equipment, reduce the Z-axis plus (+) soft limit [pulses] to narrow the working envelope.

(3) Setting the R-axis soft limit

To make this setting, set emergency stop just as for the X-axis and Y-axis, or be sure to do this from outside the safeguard enclosure. The R-axis has no mechanical stoppers. When the actual working range of the R-axis is small or it interferes with the peripheral equipment, reduce the R axis plus (+) soft limit [pulse] and minus (-) soft limit [pulses] to narrow the working envelope.

⚠ **CAUTION**
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OVERLOADS MAY OCCUR IF THE SOFT LIMIT IS ALMOST NEAR THE ENCODER PULSE AT THE MECHANICAL STOPPER AND THE OPERATING POINT IS USED AT THE EDGE OF THE MOVEMENT RANGE. SET THE SOFT LIMIT TO THE INNER SIDE OF THE MECHANICAL STOPPER WITH AN AMPLE SAFETY MARGIN.

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(4) Relation between the X, Y and R-axis movement angle, the Z-axis movement distance and the number of pulses

The tables below are for calculating resolver pulses with respect to the X, Y and R-axis movement angles and to the Z-axis movement distance for each robot. Use these figures as a guide to set the soft limits.

X, Y and R-axis speed reduction ratio and Z-axis ball screw lead for each robot

Robot model	X-axis	Y-axis	Z-axis	R-axis
R6YXCH250, R6YXCH350, R6YXCH400	50	50	12mm	50
R6YXC500, R6YXC600	80	80	20mm	50
R6YXC700, R6YXC800	80	80	20mm	50
R6YXC1000	100	80	20mm	50

Operation angle/distance vs. number of resolver pulses

X, Y and R-axis speed reduction ratio

Speed ratio	Number of resolver pulses per turn (360 degrees)
50	819200
80	1310720
100	1638400

Z-axis

Lead	Number of resolver pulses per lead movement
12mm	16384
20mm	16384

5   Setting the Standard Coordinates

⚠ **CAUTION** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

IF THE STANDARD COORDINATE SETTINGS ARE INCORRECT, THE
ACCELERATION CANNOT BE OPTIMIZED TO MATCH THE ARM
POSITION. THIS RESULTS IN TOO SHORT A SERVICE LIFE, DAMAGE TO
THE DRIVE UNIT, OR RESIDUAL VIBRATION DURING POSITIONING. IN
ADDITION, THE CARTESIAN COORDINATE ACCURACY WILL BE
IMPAIRED.

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Setting the standard coordinates enables the following operations and functions.

1. Optimizes acceleration according to arm position during automatic operation.
2. Allows moving robot arm tip at right angles.
3. Allows using shift coordinates.
4. Enables commands such as linear interpolation and arm switching.

The procedure for setting standard coordinates and cautions are shown below.

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.

2) Check that the soft limits are correctly set.
   If not correctly set, adjust the soft limits while referring to the description of "4 Setting the Soft Limits" in Chapter 4.

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

4) Enter the safeguard enclosure while holding the PB. Stay outside the robot movement range at this time.

5) Make the standard coordinate settings while referring to methods for "Setting the Standard Coordinates" as explained in the "OMRON Robot Controller User's Manual". Never enter within the robot movement range.

6) When the standard coordinate settings are complete, check the following points from outside the safeguard enclosure.
   1. Check that the robot arm tip can move at right angles in MANUAL operation (cartesian coordinates).
   2. Check that the values nearly equal to the X-axis arm and Y-axis arm lengths are entered in "Arm length" of the axis parameter 10.
   If the above points are not satisfied, the standard coordinate settings are incorrect, so make the standard coordinate settings again.

6   Affixing Stickers for Origin Positions, Movement Directions and Axis Names

The robot comes packed with stickers showing origin positions, movement directions and axis names as shown in Fig. 4-5. Using the following procedure, attach these stickers in conspicuous points on the robot after changing the origin position and installing peripheral equipment.

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Move the robot to the 0 pulse position.
   To move the axes to their "0" pulse positions, see "Chapter 4 Point trace function" in the "OMRON Robot Controller User's Manual".
3) Turn off the controller.
4) Place a sign indicating the robot is being adjusted, to keep others from operating the controller switch.
5) Enter the safeguard enclosure.
6) Being careful not to move the origin positions, attach stickers at conspicuous points on matching sides of components such as the robot arm of each axis, base (robot pedestal) and end effector. Affix stickers nearby showing the axis name and direction of movement. Use a cloth moistened with alcohol to remove grease from the surface where you will affix the stickers. After the surface is dry, affix the stickers securely. (See Fig. 4-6)

⚠ **CAUTION** ────────────────────

AFFIX THE ORIGIN POSITION STICKERS PRECISELY ON THE ORIGIN POSITIONS. ALIGN THE DIRECTION OF MOVEMENT STICKERS WITH THE JOG DIRECTION AND AFFIX THEM CORRECTLY. AFFIX EACH AXIS NAME STICKER ON THE CORRECT AXIS. AFFIXING THE STICKER AT A WRONG LOCATION MAY CAUSE FAULTY OPERATION AND HAZARDOUS SITUATIONS.

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R6YXC500, R6YXC600

Fig. 4-5

(a) Origin position stickers

(b) Direction of movement and axis name stickers
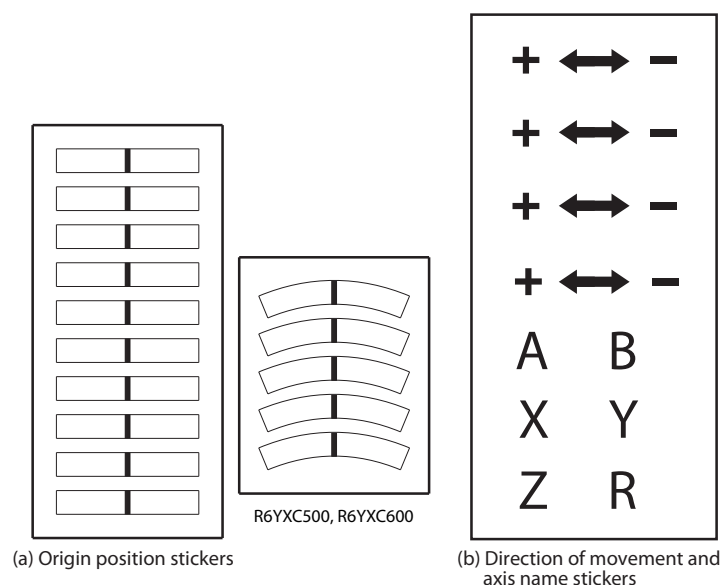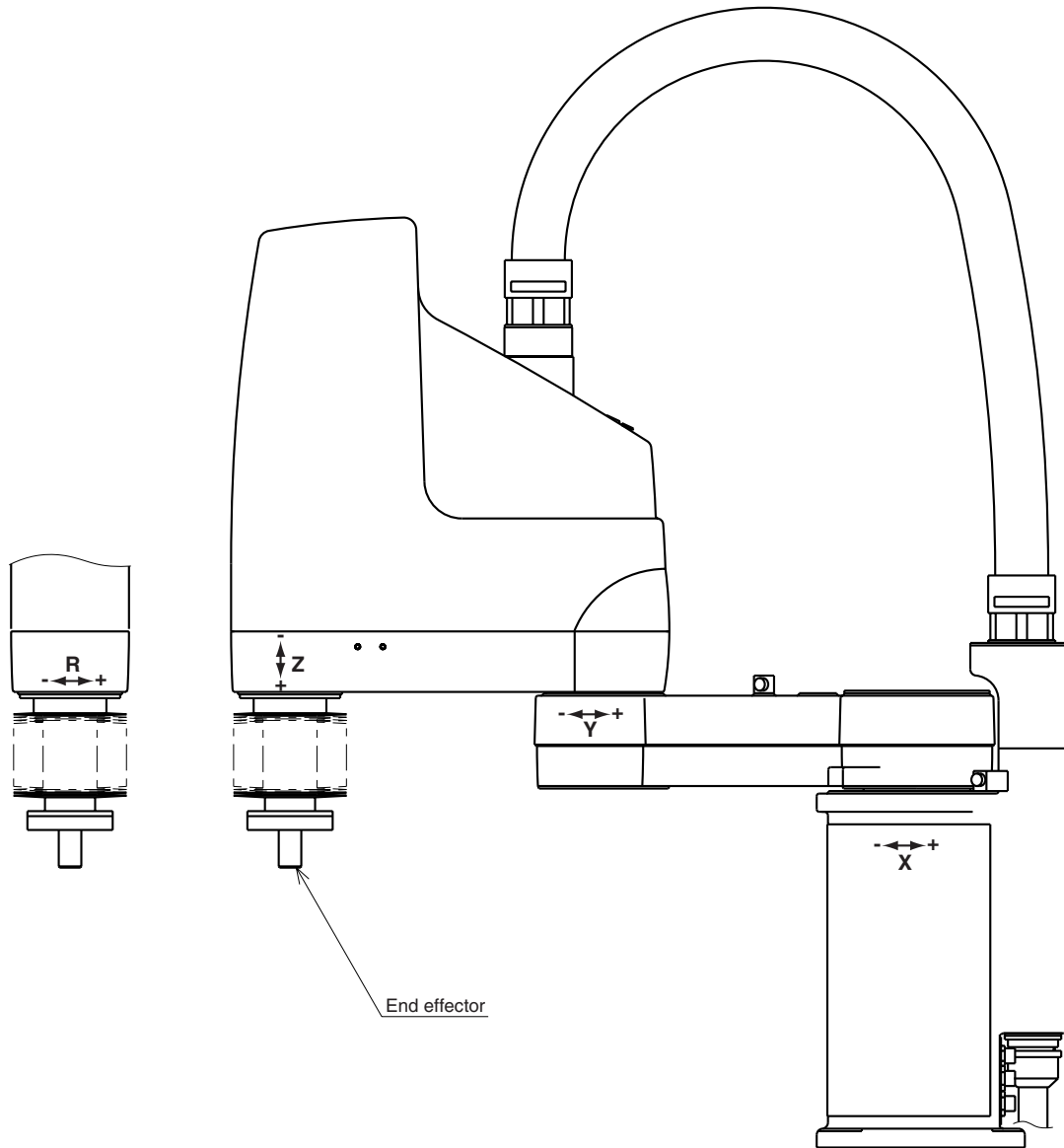
Fig. 4-6 Positions for affixing the stickers (R6YXC500)

7   Removing the Robot Covers

To remove the robot cover, follow the procedure below.

1)   Prepare the necessary tools.
   • Hex wrench set
   • Phillips-head screwdriver

2)   Turn off the controller.

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

4)   Enter the safeguard enclosure.

5)   Remove the covers while referring to Fig. 4-7 to Fig. 4-9.
     Screws used to fasten each cover are listed in Tables 4-2 to 4-4.

Table 4-2 R6YXCH250, R6YXCH350, R6YXCH400 (See Fig. 4-7)

Cover name	Screw No.	Screw size	Qty
Base (robot pedestal) rear cover	1	M4x6	4
Base (robot pedestal) front cover	2	M4x6	4
Y-axis arm upper cover	3 4 5	M3x6 M3x10 M3x16	4 2 2

Table 4-3 R6YXC500, R6YXC600 (See Fig. 4-8)

Cover name	Screw No.	Screw size	Qty
Base (robot pedestal) rear cover 1	1	M4x6	8
Base (robot pedestal) rear cover 2	2	M4x6	4
Base (robot pedestal) front cover	3	M4x6	8
X-axis arm upper cover	4	M4x6	2
Y-axis arm upper cover	5	M3x6	4
	6	M3x50	4
X-axis arm under cover	7	M4x6	4
Y-axis arm under cover	8	M4x6	4

Table 4-4 R6YXC700, R6YXC800, R6YXC1000 (See Fig. 4-9)

Cover name	Screw No.	Screw size	Qty
Base (robot pedestal) rear cover 1	1	M4x6	8
Base (robot pedestal) rear cover 2	2	M4x6	4
Base (robot pedestal) front cover	3	M4x6	8
X-axis arm upper cover	4	M4x8	2
Y-axis arm upper cover	5	M4x6	4
	6	M4x50	4
Y-axis arm under cover	7	M4x6	4 (6 for R6YXC1000)

③ M3×6 (with washer)

Y-axis upper cover

Base rear cover

M4×6 ②

Base front cover

M4×6 ①

④ M3×10

⑤ M3×16

Fig. 4-7

⑤ M3×6 (with washer)   ④ M4×6

Y-axis upper cover

X-axis upper cover

③ M4×6

Base rear cover 1   ① M4×6

Base rear cover 2   ② M4×6

Y-axis under cover

X-axis under cover

Base front cover

⑥ M3×50

⑧ M4×6   ⑦ M4×6

Fig. 4-8

⑤ M3×6 (with washer)

④ M4×6

Y-axis upper cover

X-axis upper cover

③ M4×6

Base rear cover 1

① M4×6

Base rear cover 2

② M4×6

Y-axis under cover

X-axis under cover

Base front cover

⑥ M3×50

⑦ M4×6

Fig. 4-9

8   Adjusting the Timing Belt Tension

The XC series robots use a timing belt for controlling the movement of the Z and R axes. If the belt becomes slack, use the following procedure to give proper tension to the belt.

⚠ **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.

⚠ **WARNING** ────────────────────────────

INJURY CAN OCCUR IF HANDS OR FINGERS ARE SQUEEZED BETWEEN THE DRIVE PULLEY AND BELT. ALWAYS TURN OFF THE CONTROLLER AND USE CAUTION WHEN HANDLING THESE PARTS.

⚠ **CAUTION** ────────────────────────────

SINCE A POSITIONAL SHIFT OCCURS AFTER ADJUSTING THE BELT TENSION, IT IS NECESSARY TO MAKE ABSOLUTE RESET, STANDARD COORDINATE SETTING AND POINT DATA SETTING AGAIN.
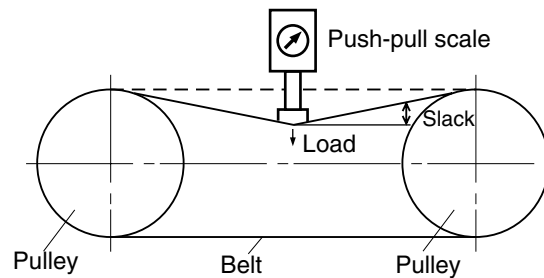
Fig. 4-10 Belt tension adjustment
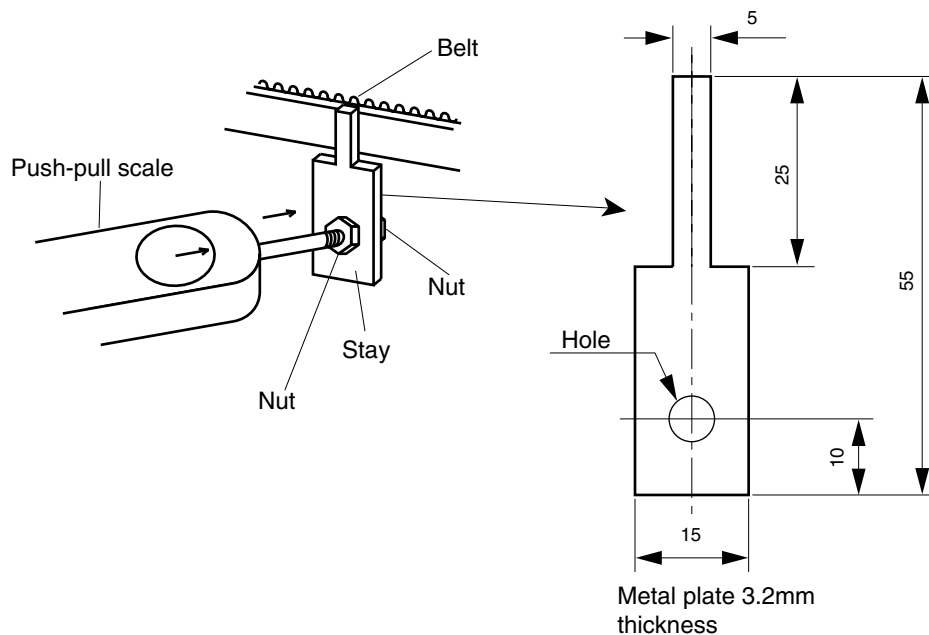
Fig. 4-11 Stay (example)

8-1   Adjusting the belt tension R6YXCH250, R6YXCH350, R6YXCH400

⚠ **WARNING**

IF THE Z-AXIS PULLEY COMES OFF THE Z-AXIS BELT, THE Z-AXIS DROPS CAUSING A HAZARDOUS SITUATION. TURN OFF THE CONTROLLER AND BE SURE TO PROP THE Z-AXIS WITH A SUPPORT STAND BEFORE BEGINNING ADJUSTMENT.

Adjust the Z-axis and R-axis timing belts of the R6YXCH250, R6YXCH350 and R6YXCH400 with the procedure below.

1) Prepare the necessary tools.
    • Push-pull scale
    • Stay (See Fig. 4-11. This stay should be prepared by the user.)
    • Hex wrench set
    • Phillips-head screwdriver
    • Scale

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis upper cover.

    Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the cover.

    Place the upper cover on the robot base (pedestal) side with the machine harness still connected.

6) Prop the spline or end effector with a support stand to prevent the Z-axis from dropping (when adjusting the Z-axis belt tension).

7) Adjust the belt tension by two people as follows.

    Using the push-pull scale, one person applies a load perpendicular to the middle of the belt. The other person checks the slack of the belt. (See Fig. 4-10 and Fig. 4-11.)

8) The correct load to be applied to the belt of each robot model and the resulting slack are shown in Tables 4-5 and 4-6. When the load producing the specified slack is within this range, no adjustment is required. If not, adjust the tension with the following procedure.

(1) Z-axis belt adjustment
    1. Loosen the bolt 1 shown in Fig. 4-12.
    2. If the load producing the slack specified in Table 4-5 (step 7) above) is smaller than the specified range, move the Z-axis motor in the direction increasing the tension. If the load is greater than this, move it in the direction reducing the tension. Then, retighten the bolt.
    3. Recheck the belt tension using the same procedure in step 7). When the load applied to produce the specified slack is within the specified range of Table 4-5, the adjustment is okay. If not, repeat the above procedure from steps 1 to 3.

(2) R-axis belt adjustment
    1. Loosen the bolt 2 shown in Fig. 4-12.
    2. If the load producing the slack specified in Table 4-6 (step 7) above) is
       smaller than the specified range, move the R-axis motor in the direction
       increasing the tension. If the load is greater than this, move it in the
       direction reducing the tension. Then, retighten the bolt.
    3. Recheck the belt tension using the same procedure in step 7). When the
       load applied to produce the specified slack is within the specified range
       of Table 4-6, the adjustment is okay. If not, repeat the above procedure
       from steps 1 to 3.

9) After adjustment is complete, tighten the bolt 1 or 2 to the torque specified
    in Table 4-7.

10) Reattach the upper cover to the Y-axis arm.
    Refer to ''7 Removing the Robot Covers'' in Chapter 4 for attaching the
    cover.

11) Go outside the safeguard enclosure.

12) Check that no one is inside the safeguard enclosure, and then turn on the
    controller.
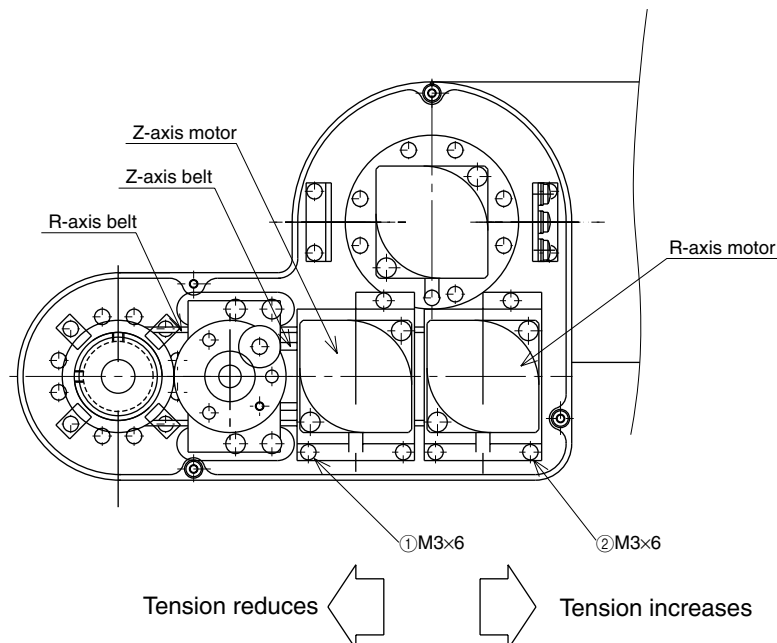
Fig. 4-12 R6YXCH250, R6YXCH350, R6YXCH400

8-2   Adjusting the belt tension (R6YXC500, R6YXC600)

⚠ **WARNING** ─────────────────────────────

IF THE Z-AXIS PULLEY COMES OFF THE Z-AXIS BELT, THE Z-AXIS
DROPS CAUSING A HAZARDOUS SITUATION. TURN OFF THE
CONTROLLER AND BE SURE TO PROP THE Z-AXIS WITH A SUPPORT
STAND BEFORE BEGINNING ADJUSTMENT.
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Adjust the Z-axis and R-axis timing belts of the R6YXC500 and R6YXC600
with the procedure below.

1) Prepare the necessary tools.
   • Push-pull scale
   • Stay (See Fig. 4-11. This stay should be prepared by the user.)
   • Hex wrench set
   • Phillips-head screwdriver
   • Scale

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis upper and under covers.

   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

   Place the upper cover on the robot base (pedestal) side with the machine
   harness still connected.

6) Prop the spline or end effector with a support stand to prevent the Z-axis
   from dropping (when adjusting the Z-axis belt tension).

7) Adjust the belt tension by two people as follows.

   Using the push-pull scale, one person applies a load perpendicular to the
   middle of the belt. The other person checks the slack of the belt. (See
   Figs. 4-10 and 4-11.)

8) The correct load to be applied to the belt of each robot model and the
   resulting slack are shown in Tables 4-5 and 4-6. When the load producing
   the specified slack is within this range, no adjustment is required. If not,
   adjust the tension with the following procedure.

(1) Z-axis belt adjustment
   1. Loosen the bolt 1 shown in Fig. 4-13.
   2. If the load producing the slack specified in Table 4-5 (step 7) above) is
      smaller than the specified range, move the Z-axis motor in the direction
      increasing the tension. If the load is greater than this, move it in the
      direction reducing the tension. Then, retighten the bolt.
   3. Recheck the belt tension using the same procedure in step 7). When the
      load applied to produce the specified slack is within the specified range
      of Table 4-5, the adjustment is okay. If not, repeat the above procedure
      from steps 1 to 3.

(2) R-axis belt adjustment
1. Loosen the bolt 2 shown in Fig. 4-13.
2. If the load producing the slack specified in Table 4-6 (step 7) above) is smaller than the specified range, move the R-axis motor in the direction increasing the tension. If the load is greater than this, move it in the direction reducing the tension. Then, retighten the bolt.
3. Recheck the belt tension using the same procedure in step 7). When the load applied to produce the specified slack is within the specified range of Table 4-6, the adjustment is okay. If not, repeat the above procedure from steps 1 to 3.

9) After adjustment is complete, tighten the bolt 1 or 2 to the torque specified in Table 4-7.

10) Reattach the upper and under covers to the Y-axis arm.
Refer to "7 Removing the Robot Covers" in Chapter 4 for attaching the covers.

11) Go outside the safeguard enclosure.

12) Check that no one is inside the safeguard enclosure, and then turn on the controller.

Fig. 4-13 R6YXC500, R6YXC600

8-3   **Adjusting the belt tension (R6YXC700,R6YXC800,R6YXC1000)**

⚠ WARNING ─────────────────────────────

IF THE Z-AXIS PULLEY COMES OFF THE Z-AXIS BELT, THE Z-AXIS
DROPS CAUSING A HAZARDOUS SITUATION. TURN OFF THE
CONTROLLER AND BE SURE TO PROP THE Z-AXIS WITH A SUPPORT
STAND BEFORE BEGINNING ADJUSTMENT.

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Adjust the Z-axis and R-axis timing belts of the R6YXC700, R6YXC800 and
R6YXC1000 with the procedure below.

1) Prepare the necessary tools.
    • Push-pull scale
    • Stay (See Fig. 4-11. This stay should be prepared by the user.)
    • Hex wrench set
    • Phillips-head screwdriver
    • Scale

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis upper and under covers.
    Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.
    Place the upper cover on the robot base (pedestal) side with the machine
    harness still connected.

6) Prop the spline or end effector with a support stand to prevent the Z-axis
    from dropping (when adjusting the Z-axis belt tension).

7) Adjust the belt tension by two people as follows.
    Using the push-pull scale, one person applies a load perpendicular to the
    middle of the belt. The other person checks the slack of the belt. (See
    Figs. 4-10 and 4-11.)

8) The correct load to be applied to the belt of each robot model and the
    resulting slack are shown in Tables 4-5 and 4-6. When the load producing
    the specified slack is within this range, no adjustment is required. If not,
    adjust the tension with the following procedure.

(1) Z-axis belt adjustment

    1. Loosen the bolt 1 shown in Fig. 4-14.

    2. If the load producing the slack specified in Table 4-5 (step 7) above) is
       smaller than the specified range, move the Z-axis motor in the direction
       increasing the tension. If the load is greater than this, move it in the
       direction reducing the tension. Then, retighten the bolt.

    3. Recheck the belt tension using the same procedure in step 7). When the
       load applied to produce the specified slack is within the specified range
       of Table 4-5, the adjustment is okay. If not, repeat the above procedure
       from steps 1 to 3.

(2) R-axis belt adjustment
1. Loosen the bolt 2 shown in Fig. 4-14.
2. If the load producing the slack specified in Table 4-6 (step 7) above) is smaller than the specified range, move the R-axis motor in the direction increasing the tension. If the load is greater than this, move it in the direction reducing the tension. Then, retighten the bolt.
3. Recheck the belt tension using the same procedure in step 7). When the load applied to produce the specified slack is within the specified range of Table 4-6, the adjustment is okay. If not, repeat the above procedure from steps 1 to 3.

9)   After adjustment is complete, tighten the bolt 1 or 2 to the torque specified in Table 4-7.

10)   Reattach the upper and under covers to the Y-axis arm.
Refer to "7 Removing the Robot Covers" in Chapter 4 for attaching the covers.

11)   Go outside the safeguard enclosure.

12)   Check that no one is inside the safeguard enclosure, and then turn on the controller.

Fig. 4-14 R6YXC700, R6YXC800, R6YXC1000

Table 4-5 Z-axis belt specifications

Robot model	Load (N)	Load (kgf)	Slack (mm)
R6YXCH250, R6YXCH350	2.3 to 2.5	0.23 to 0.26	0.7
R6YXCH400	2.3 to 2.5	0.23 to 0.26	1.4
R6YXC500, R6YXC600	5.7 to 6.3	0.58 to 0.64	1.6
R6YXC700, R6YXC800	5.7 to 6.3	0.58 to 0.64	2.8
R6YXC1000	5.7 to 6.3	0.58 to 0.64	4.4

Table 4-6 R-axis belt specifications

Robot model	Load (N)	Load (kgf)	Slack (mm)
R6YXCH250, R6YXCH350	1.3 to 1.7	0.13 to 0.17	2.1
R6YXCH400	1.3 to 1.7	0.13 to 0.17	2.8
R6YXC500, R6YXC600	2.1 to 2.9	0.22 to 0.30	1.9
R6YXC700, R6YXC800	3.6 to 5.0	0.37 to 0.51	2.7
R6YXC1000	3.6 to 5.0	0.37 to 0.51	4.3

Table 4-7 Tightening torque

Robot model	Axis	Bolt size	Tightening torque (kgf·cm)	Tightening torque (N·m)
R6YXCH250, R6YXCH350, R6YXCH400	Z	M3	20	2.0
	R	M3	20	2.0
R6YXC500, R6YXC600	Z	M5	92	9.0
	R	M4	46	4.5
R6YXC700, R6YXC800, R6YXC1000	Z	M5	92	9.0
	R	M4	46	4.5

CHAPTER 5

Periodic Inspecition

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 XC series robots.

Periodic inspection includes:
  • Daily inspection
  • 6-month inspection
  • Replacement of speed reduction gear (harmonic drive)

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

If the robot or controller requires a repair or parts replacement, please contact OMRON EUROPE, B.V. Company or local sales office.

2   Precautions

(1) Periodic inspection must be performed by or in the presence of personnel who have received the Robot Training given by OMRON or OMRON dealers.

(2) Do not attempt any inspection, adjustment, repair and parts replacement not described in this manual. This work requires specialized technical knowledge and skill, and may also involve work hazards.

(3) When inspection is required inside the safeguard enclosure, always turn off the controller and also the external switch board.

(4) If the inspection or maintenance procedure calls for operation of the robot, stay outside the safeguard enclosure.

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

(6) Use only the lubricants specified by OMRON or OMRON dealers.

(7) To check the operation after inspection, refer to "6 Trial operation" in Chapter 1.

⚠ **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.

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

CHAPTER 5 Periodic Inspection

3   Daily Inspection

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

(1) Inspection to be performed with the controller turned off

1) Turn off the controller.
2) Place a sign indicating the robot is being inspected, to keep others from operating the controller switch.
3) Enter the safeguard enclosure and check the following points.

Checkpoint	Procedure
Machine harness 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 OMRON dealer.)
Regulator, joints, air tube, solenoid valve, air cylinder	Check air pressure. Check for air leaks. Check drain. Check air filter for clogging or damage.
Exterior of robot, bellows at manipulator tip*	Check for damage. (If damage is found, contact OMRON dealer)

* Grease may adhere to the inside of the bellows depending on robot operation time or robot work. But this does not have adverse effects on robot performance including the cleanliness degree.

(2) Inspection to be performed with the controller turned on

1) Check that no one is inside the safeguard enclosure, and then turn on the controller.
2) Place a sign indicating the robot is being inspected, to keep others from operating the controller, programming box or operation panel.
3) Check the following points from outside the safeguard enclosure.

Checkpoint	Procedure
Safeguard enclosure	Check if the safeguard 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 OMRON dealer.)
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 OMRON dealer.)

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

5-3

(3) Adjustment and parts replacement

1) After inspection, if you notice any adjustment or parts replacement is needed, first turn off the controller and then enter the safeguard enclosure to perform the necessary work. After adjustment or replacement is finished, again review the checkpoints outlined in (1) and (2) above.

2) If repair or parts replacement is required for the robot or controller, please contact your OMRON dealer. This work requires specialized technical knowledge and skill, so do not attempt it by yourself.

4   Six-Month Inspection

Take the following precautions when performing 6-month inspection.

⚠ **WARNING** ───────────────────────────────

INJURY CAN OCCUR IF HANDS OR FINGERS ARE SQUEEZED BETWEEN THE DRIVE PULLEY AND BELT. ALWAYS TURN OFF THE CONTROLLER AND USE CAUTION WHEN HANDLING THESE PARTS.

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⚠ **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.

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When lubricating the ball screw, spline shaft and linear busing 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.

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⚠ **WARNING** ────────────────────────────

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.

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⚠ **CAUTION** ────────────────────────────

UNLESS GREASE SPECIFIED BY OMRON IS USED, THE SERVICE LIFE OF THE BALL SCREW, BALL SPLINE AND LINEAR BUSHING SHAFT WILL SHORTEN.

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⚠ **CAUTION** ────────────────────────────

HOW TO KEEP GREASE:
• TIGHTLY CAP THE GREASE TUBE OR CONTAINER TO PREVENT DUST OR MOISTURE FROM ENTERING IT.
• KEEP THE GREASE IN DARK LOCATIONS NOT EXPOSED TO DIRECT SUNLIGHT.

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(1) Inspection to be performed with the controller turned off

1) Turn off the controller.

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

3) Enter the safeguard 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.*1
Z-axis and R-axis timing belts	Check belt tension. (See 8 in Chapter 4.)
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 in Chapter 3.)
Grease lubrication of Z-axis ball screw, spline, linear shaft	Every 6 month, lubricate the Z-axis ball screw nut with grease gun, and the linear shaft, spline shaft and ball screw shaft by hand after removing the old grease. The specified grease is LG2 (Nihon Seiko).
Z-axis ball spline, ball screw	Check for backlash. (If any abnormality is found, contact OMRON dealer.)

*1 Bolt tightening torque

Bolt size	Tightening torque (kgf·cm)	Tightening torque (N·m)
M3 button head bolt	14	1.4
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37
M10	720	71
M12	1310	128

(2) Inspection to be performed with the controller turned on

⚠ **WARNING**

THE ROBOT CONTROLLER MUST BE INSTALLED OUTSIDE THE SAFEGUARD ENCLOSURE, TO PREVENT A HAZARDOUS SITUATION IN WHICH YOU OR ANYONE ENTER THE SAFEGUARD ENCLOSURE TO INSPECT THE CONTROLLER WHILE IT IS TURNED ON.

⚠ **WARNING**

•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.

After turning on the controller, check the following points.

Checkpoint	Procedure
• Cooling fan at rear of controller	• Check if the fan rotates normally. • Check if objects blocking the fan are located and remove if any are found. • 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 OMRON dealer. • Check for dust on the fan cover. Remove and clean if necessary.

(3) Adjustment and parts replacement

1) If adjustment or parts replacement is required after inspection, turn off the robot controller before entering the safeguard enclosure and beginning the work. Follow the instructions explained in items (1) and (2) for six-month inspection.

2) If repair or parts replacement is required for the robot or controller, please contact your OMRON dealer. This work requires specialized technical knowledge and skill, so do not attempt it by yourself.

5   Replacing the Harmonic Drive

The XC series robots use a harmonic drive as the speed reduction gear for the X, Y and R axes. Harmonic drives need to be replaced after a specified operation time. Use the guideline explained below to determine the replacement period and replace the harmonic drive periodically.

Since the XC series robots use long-life harmonic grease, it is not necessary to replace the harmonic grease.

5-1   Replacement period

The harmonic drive replacement period is determined by the total number of turns of the wave generator used in the harmonic drive. It is recommended to replace the harmonic drive when the total number of turns has reached 8.4×10^8 (at ambient operating temperatures of 0°C to +40°C). This means that the replacement period will differ depending on the following operating conditions. If the robot operation duty ratio is high or the robot is operated in environments at higher temperatures, the harmonic drive should be replaced earlier.

Replacement period = $8.4 \times 10^8/(n \times 60 \times h \times D \times N \times \theta)$ years

where
     n   :   Number of axis movements per minute
     θ   :   Average turn per axis movement
     N   :   Speed reduction ratio
     h   :   Operation time per day
     D   :   Operation days per year

For example, when the robot is used under the following conditions, the replacement period for the X-axis harmonic drive of the R6YXC500 can be calculated as follows.

     n   :   10
     θ   :   0.25
     N   :   80
     h   :   24 hours per day
     D   :   240 days per year

Replacement period = $8.4 \times 10^8/(n \times 60 \times h \times D \times N \times \theta)$
                = $8.4 \times 10^8/(10 \times 60 \times 24 \times 240 \times 80 \times 0.25)$
                = 12.2 years

Table 5-1 Harmonic drive speed reduction ratio

Robot model	X-axis	Y-axis	R-axis
R6YXCH250, R6YXCH350, R6YXCH400	50	50	50
R6YXC500, R6YXC600	80	80	50
R6YXC700, R6YXC800	80	80	50
R6YXC1000	100	80	50

Table 5-2 Bolt tightening torque

Bolt size	Tightening torque (kgf·cm)	Tightening torque (N·m)
M3 button head bolt	14	1.4
M3	20	2.0
M4	46	4.5
M5	92	9.0
M6	156	15.3
M8	380	37
M10	720	71

5-2   Basic replacement procedure for harmonic drive and precautions

Basic procedures and precautions for replacing the harmonic drive are described below. Before beginning the replacement work, always be sure to read these replacement procedures and caution.

⚠ **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.

⚠ **WARNING** ──────────────────────────

PRECAUTIONS WHEN HANDLING GREASE, CLEANNING OIL:
 •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.

⚠ **WARNING** ──────────────────────────

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.

⚠️**WARNING** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

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.

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⚠️**CAUTION** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

THE HARMONIC DRIVE SERVICE LIFE MAY SHORTEN IF THE GREASE RECOMMENDED BY OMRON IS NOT USED.

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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.

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⚠️**CAUTION** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

SINCE A POSITIONAL SHIFT OCCURS AFTER REPLACING THE HARMONIC DRIVE, IT IS NECESSARY TO MAKE ABSOLUTE RESET, STANDARD COORDINATE SETTING AND POINT DATA SETTING AGAIN.

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5-2-1   R6YXCH250, R6YXCH350, R6YXCH400

The following steps describe procedures and precautions when replacing the harmonic drives of the R6YXCH250, R6YXCH350 and R6YXCH400.
For the bolt tightening torques in this work, refer to Table 5-2.

1. X-axis

1) Prepare the following tools and items.
   • Harmonic grease 4B No.2
   • Waste cloth (rag)
   • Phillips-head screwdriver
   • Hex wrench set
   • Screw Lock (thread sealant)
   • Ratchet handle
   • Hexagonal socket set
   • Extension bar
   • Torque-limiting wrench
   • Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic	SHF-20-50	KN3-M2110-001	
O-ring	S71(JIS)	KN3-M2159-000	Top of harmonic drive
	Rubber wire diameter 1.50mm x Ring inner diameter 49.00mm	KN3-M2143-000	For motor
	Rubber wire diameter 0.99mm x Ring inner diameter 53.28mm	KN3-M2144-000	Supplied with harmonic drive

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the base (robot pedestal) front and rear covers.
   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

⚠ **WARNING** ━━━━━━━━━━━━━━━━━

WHEN YOU REMOVE THE X-AXIS ARM INSTALLATION BOLTS (M3×40L, 8 PIECES) IN THE NEXT STEP, THE X-AXIS ARM MAY COME OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED TO THE ARM TIP.

6) Remove the X-axis arm installation bolts (M3×40L, 8 pieces). (See Fig. 5-1.)

M3×40
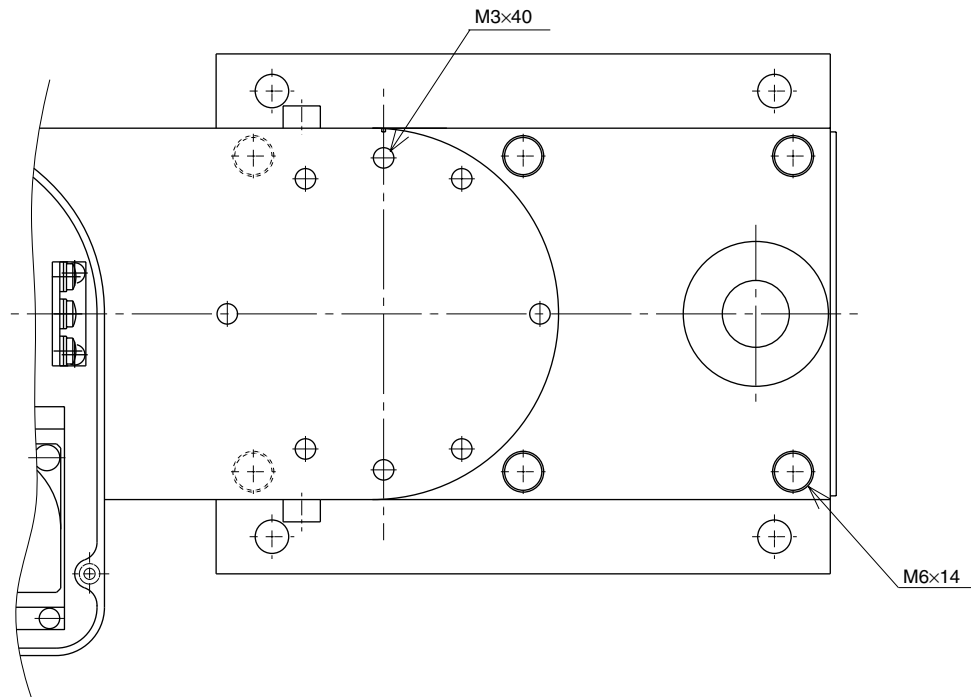
M6×14

Fig. 5-1

⚠ **CAUTION**

AN O-RING IS FITTED TO THE X-AXIS ARM, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-2.)

O-ring
(S71 : KN3-M2159-000)
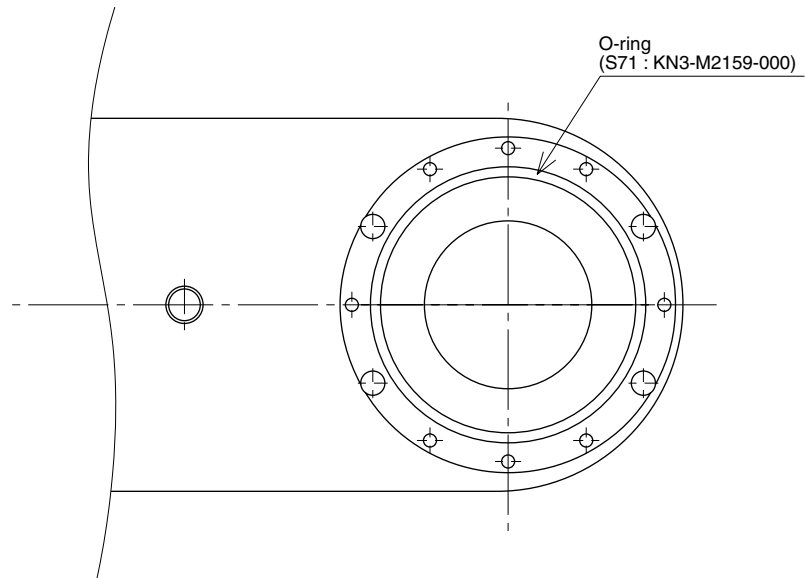
Fig. 5-2

7) Disconnect the connectors on the X-axis motor power cable XM and resolver cable XP.

8) Remove the base assembly bolts (M6×14L, 6 pieces) to separate base 1 and base 2. (See Fig. 5-1 and Fig. 5-3.)
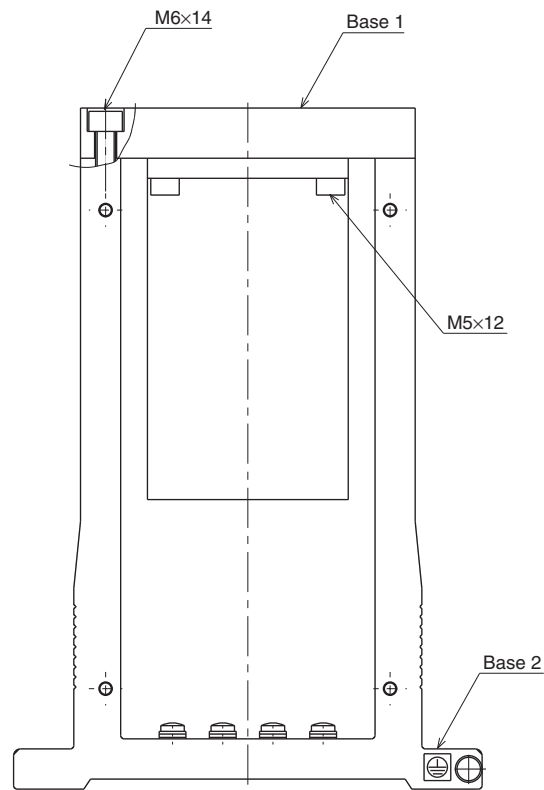
Fig. 5-3

9) Remove the bolts (M5×12L, 4 pieces) securing the motor and remove the motor from base 1. (See Fig. 5-4.)
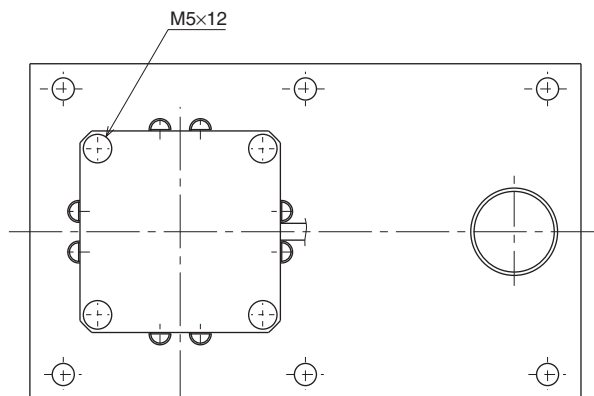
Fig. 5-4

⚠ **CAUTION**

AN O-RING IS FITTED TO THE MOTOR, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

10) Remove the wave generator from the motor shaft. The wave generator is secured with an M3 set screw. (See Fig. 5-6.)

11) Remove the X-axis harmonic drive installation bolts (M3×20L, 16 pieces). (See Fig. 5-5.)

M3×20
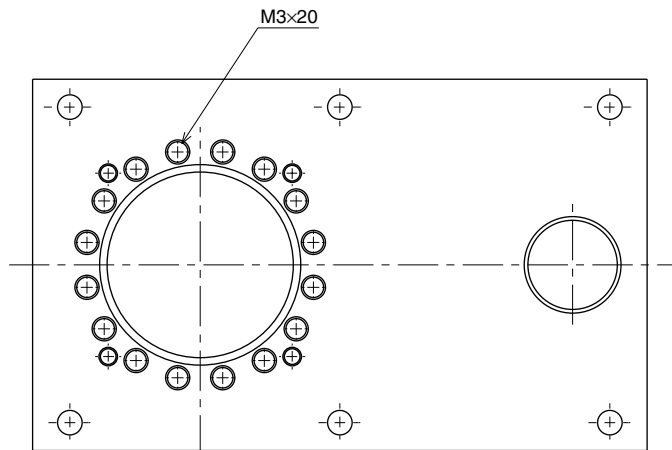
Fig. 5-5

12) Remove the X-axis harmonic drive from the top of base 1.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE X-AXIS HARMONIC DRIVE, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

13) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive.
Apply small amounts of "Screw Lock" to the bolts (M3×20L, 16 pieces) and tighten them to secure the harmonic drive from the backside of the base. (See Fig. 5-5.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

14) Apply harmonic grease to the new wave generator and flexible spline. See Fig. 5-6 for applying grease properly.

Fit O-ring (supplied) into this groove
Harmonic drive willl be damaged if O-ring is caught out of groove.
O-ring : KN3-M2144-000

M3 set screw
Apply grease to entire oldham coupling.

O-ring : KN3-M2143-000
Wave generator
Apply grease to sufficiently fill in the ball space.
Apply grease to the thickness equal to the ball diameter.
Circular spline
Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

Fig. 5-6

15) Fit the wave generator onto the motor shaft and fully insert it against the motor. Then, apply small amounts of "Screw Lock" to the M3 set screw (1 piece) you removed earlier and tighten it to secure the wave generator. (See Fig. 5-6.)

16) Fit a new O-ring to the motor and secure the motor to base 1 with the bolts (M5×12L, 4 pieces) you removed earlier. (See Fig. 5-4.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Fasten base 1 to base 2 with the bolts (M6×14L, 6 pieces) you removed earlier. (See Fig. 5-3.)

18) Reattach the connectors on the X-axis motor power cable XM and resolver cable XP.

19) Fit a new O-ring into the O-ring groove on the X-axis arm and place the arm on the harmonic drive. Then, apply small amounts of "Screw Lock" to the bolts (M3×40L, 8 pieces) you removed earlier and tighten them uniformly to secure the X-axis arm to the base. (See Fig. 5-1 and Fig. 5-2.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

20) Reattach the base (robot pedestal) front and rear covers.

21) Go outside the safeguard enclosure.

22) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION**

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

2. Y-axis

1) Prepare the following tools and items.
   - Harmonic grease 4B No.2
   - Waste cloth (rag)
   - Phillips-head screwdriver
   - Hex wrench set
   - Screw Lock (thread sealant)
   - Torque-limiting wrench
   - Replacement parts (See table below.)

Replacement parts			
Parts name	Type No.	OMRON Parts No.	Note
Harmonic drive	SHF-17-50	KN3-M2510-001	
O-ring	S63(JIS)	KN3-M2519-000	Lower part of harmonic drive
	Rubber wire diameter 1.00mm x Ring inner diameter 29.50mm	KN3-M257K-000	For motor
	Rubber wire diameter 0.80mm x Ring inner diameter 45.40mm	KN3-M257L-000	Supplied with harmonic drive

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis arm upper cover. Place the cover on the robot base (pedestal) side with the machine harness still connected.
   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

⚠ **WARNING** ────────────────────────

WHEN YOU REMOVE THE Y-AXIS ARM INSTALLATION BOLTS (M3×20L, 8 PIECES) IN THE NEXT STEP, THE Y-AXIS ARM MAY COME OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED TO THE ARM TIP..

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6) Remove the Y-axis arm installation bolts (M3×20L, 8 pieces). (See Fig. 5-7.)
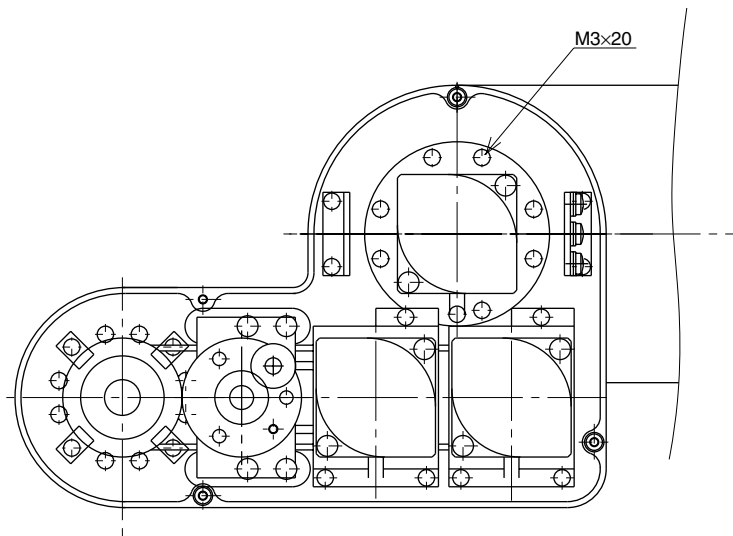
Fig. 5-7

7) Remove the Y-axis arm and place it where it will not obstruct the work.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE UPPER SURFACE OF THE HARMONIC DRIVE, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

8) Remove the wave generator from the motor shaft. The wave generator is secured with an M3 set screws (2 pieces). (See Fig. 5-10.)

9) Remove the flange installation bolts (M5×20, 6 pcs) and then detach the flange from the X-axis arm. Next, remove the bolts (M3×20, 6 pcs) securing the Y-axis harmonic drive. (See Fig. 5-8.)
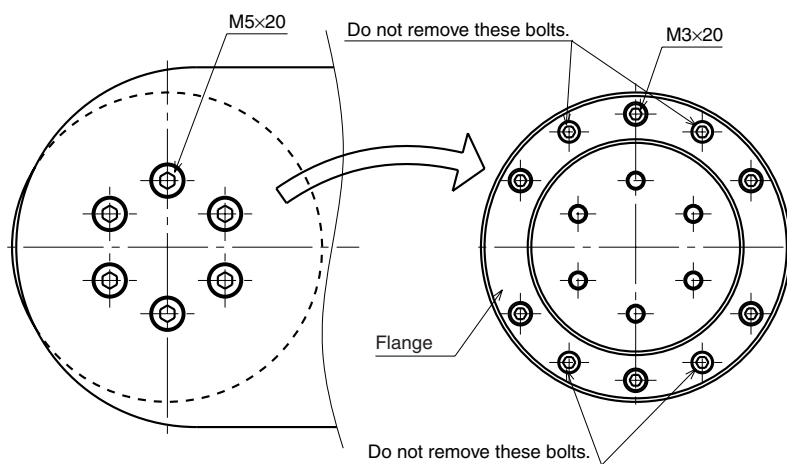
Fig. 5-8

10) Remove the Y-axis harmonic drive from the flange.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE FLANGE, SO BE CAREFUL NOT TO DROP IT INTO PERIPHERAL UNITS. (SEE FIG. 5-9.)

O-ring (S63: KN3-M2519-000)
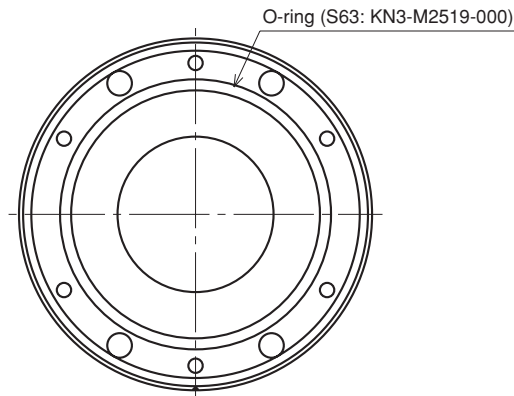
Fig. 5-9

11) Remove the four bolts temporarily tightened to the new harmonic drive.

⚠ **CAUTION**

REMOVE ONLY THE FOUR BOLTS SHOWN IN FIG. 5-10 AT THIS POINT. NEVER REMOVE THE BOLTS ON THE OPPOSITE SIDE. IF THEY ARE REMOVED, THE HARMONIC DRIVE AXIS MAY DEVIATE FROM THE CENTER CAUSING A TROUBLE.

12) Fit a new O-ring coated with harmonic grease into the O-ring groove on the Flange. (See Fig. 5-9.)

13) Place the new harmonic drive on the flange. Apply small amounts of "Screw Lock" (thread sealer) to the bolts (M3×20, 6 pcs) and tighten them equally from the backside of the flange to secure the harmonic drive. Next, place the flange on the X-axis arm and tighten the bolts (M5×20) from the back-side to secure the flange. (See Fig. 5-8.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

14) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive

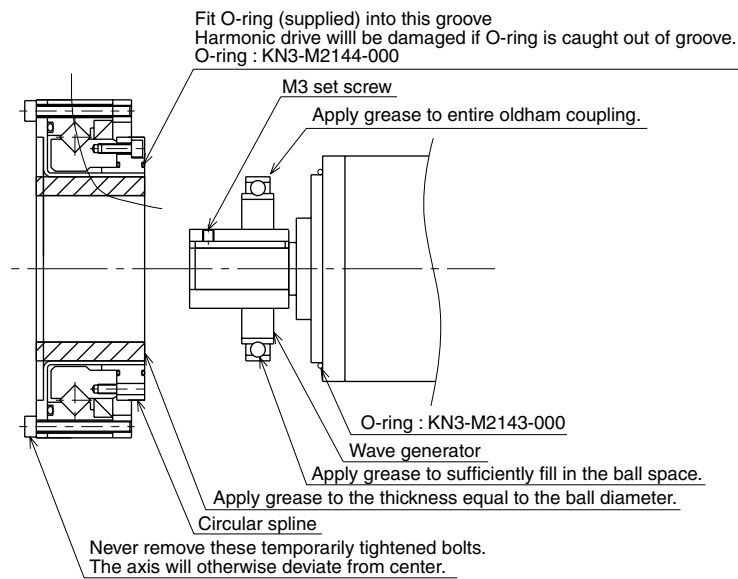15) Apply harmonic grease to the new wave generator and flexible spline. See Fig. 5-10 for applying grease properly.

16) Fit the wave generator onto the motor shaft and fully insert it against the motor. Then, apply small amounts of "Screw Lock" to the M3 set screw (2 piece) you removed earlier and tighten it to secure the wave generator. (See Fig. 5-10.)

Circular spline

Remove the temporarily tightened bolts when assembling
Keep the circular spline from coming off when assembling

Fit O-ring (supplied) into this groove
Harmonic drive will be damaged if O-ring is caught out of groove.
O-ring : KN3-M257L-000

Apply grease to entire oldham coupling.

Wave generator

O-ring : KN3-M257K-000

Y-axis arm

Apply grease to sufficiently fill in the ball space.

Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

M3 set screw

Apply grease to the thickness equal to the ball diameter.

Fig. 5-10

17) Secure the Y-axis arm to the harmonic drive with the bolts (M3×20L, 8 pieces) you removed earlier. Apply small amounts of "Screw Lock" to the bolts and tighten them uniformly to secure the Y-axis arm. (See Fig. 5-7.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE. WHEN REASSEMBLING THE HARMONIC DRIVE, BE CAREFUL TO KEEP THE CIRCULAR SPLINE FROM COMING OFF. IF IT COMES OFF, THE HARMONIC DRIVE AXIS WILL DEVIATE FROM THE CENTER CAUSING A TROUBLE.

18) Reattach the Y-axis arm upper cover.

19) Go outside the safeguard enclosure.

20) Check that no one is inside the safeguard enclosure, and then turn on the controller.

3. R-axis

1) Prepare the following tools and items.
   - Harmonic grease 4B No.2
   - Waste cloth (rag)
   - Phillips-head screwdriver
   - Hex wrench set
   - Screw Lock (thread sealant)
   - Torque-limiting wrench
   - Adjustable wrench
   - Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic drive	SHF-14-50	KN3-M1821-001	
O-ring	S53(JIS)	KN3-M1895-000	Lower part of harmonic drive Upper part of bellows. (2 pieces)
	Rubber wire diameter 0.80mm x Ring inner diameter 23.70mm	KN3-M181H-000	For wave generator
	Rubber wire diameter 0.60mm x Ring inner diameter 37.10mm	KN5-M181G-000	Supplied with harmonic drive
Edge seal	VR18A	KN3-M1886-000	

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis upper cover and bellows. Place the cover on the robot base (pedestal) side with the machine harness still connected.
   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing and reattaching the covers. Refer to "6 Replacing the bellows" in Chapter 5 for removing and reattaching the bellows.

6) Remove the bolts (M4×8L, 4 pieces) securing the bearing to the upper end of the spline and remove the spline mount plate, spline and bearing from the holder. (See Fig. 5-11.)
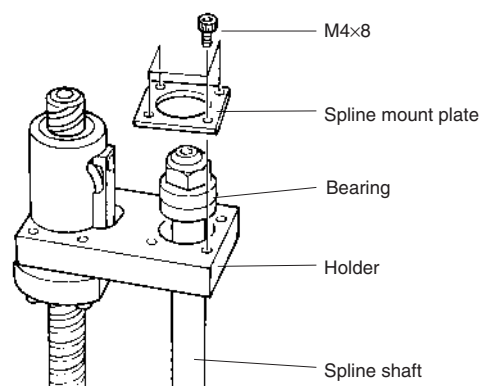
Fig. 5-11

⚠️**WARNING**

THE Z-AXIS WILL SLIDE DOWN WHEN THE U-NUT IS REMOVED IN
THE NEXT STEP, CAUSING A HAZARDOUS SITUATION. PROP THE
Z-AXIS WITH A SUPPORT STAND BEFORE LOOSENING THE U-NUT.

7) While placing a steel rod or similar tool through the 5mm diameter hole at
the lower part of the spline, loosen the U-nut at the top of the spline with
the wrench, and remove the bearing. (See Fig. 5-12.)
Use a round steel rod with a diameter slightly smaller than 5mm. Avoid
using a square rod because the spline might be damaged by the edge of the
rod.
After removing the bearing, refit the U-nut to the top of the spline shaft to
keep the spline shaft from falling out.
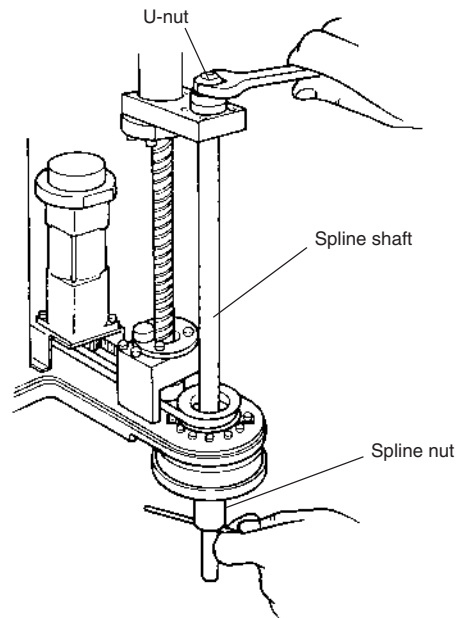
Fig. 5-12

8) Remove the button bolts (M3×20L, 6 pieces) on the underside of the Y-axis
arm and remove the plate fastening the spline and the harmonic drive. (See
Fig. 5-13.)
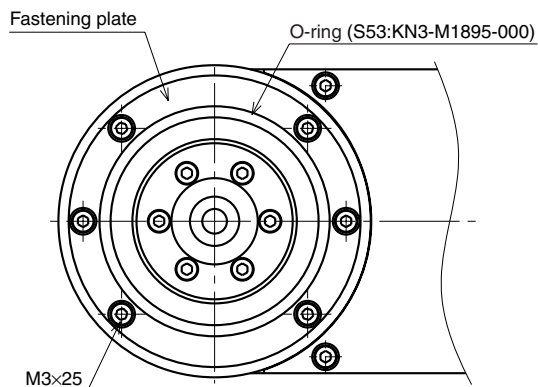
Fig. 5-13

⚠ **CAUTION**

AN O-RING IS FITTED TO THE FASTENING PLATE, SO BE CAREFUL
NOT TO LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-14.)

O-ring (S53 : KN3-M1895-000)
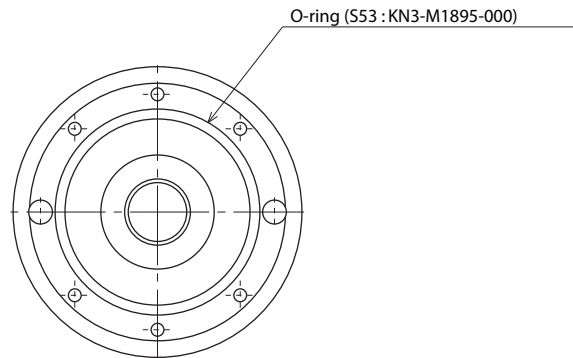
Fig. 5-14

9) Remove the bolts (M3×6L, 3 pieces) securing the R-axis motor plate at the top of the Y-axis arm. (See Fig. 5-15.)

M3×18

M4 set screw

M3×6

Pulley

R-axis motor plate
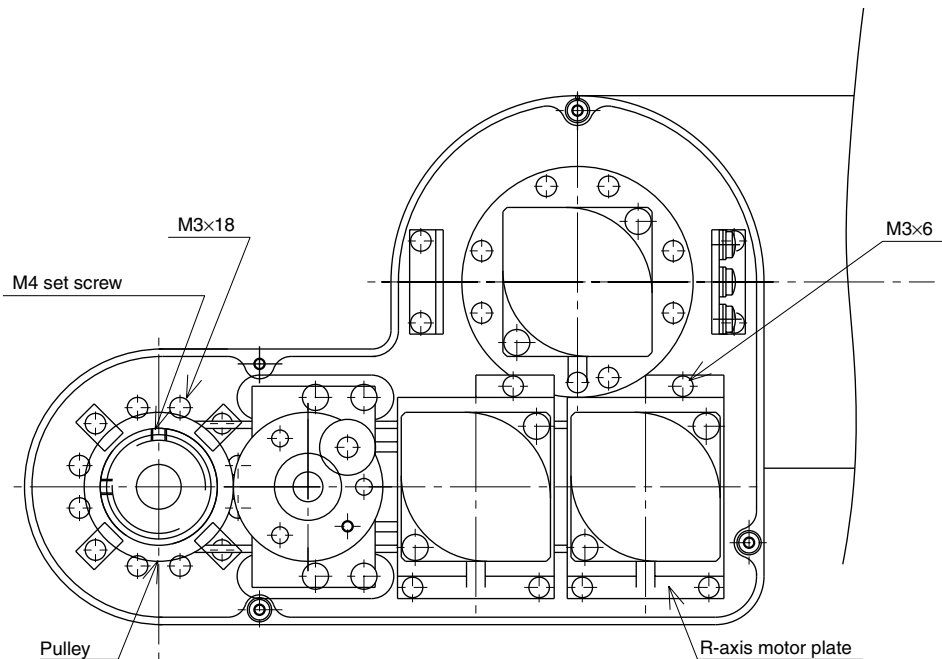
Fig. 5-15

10) Loosen the pulley set screw (M4, 2 pieces) and remove the pulley from the wave generator. (See Fig. 5-15.)

11) Remove the harmonic drive installation bolts (M3×18L, 8 pieces) and pull out the harmonic drive from the bottom of the Y-axis arm. (See Fig. 5-15.)

⚠ **CAUTION**

AN O-RING IS FITTED TO THE HARMONIC DRIVE, SO BE CAREFUL
NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

12) Remove the retaining ring for the wave generator and pull out the wave generator from the bottom of the Y-axis arm. (See Fig. 5-16.)

13) Apply harmonic grease to the new wave generator. See Fig. 5-16 for applying grease properly.

14) Fit a new O-ring into the O-ring groove on the wave generator. (See Fig. 5-16.)
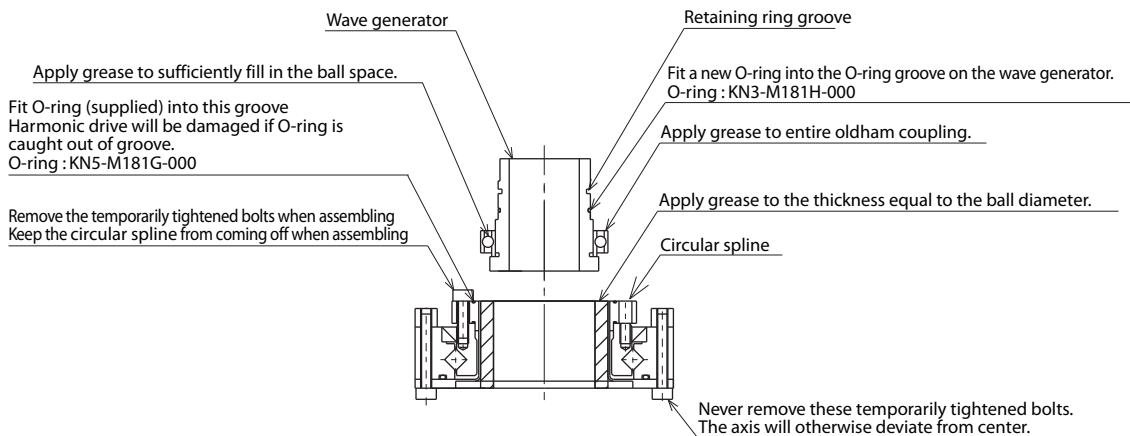
Fig. 5-16

15) Insert the new wave generator into the Y-axis arm from the bottom, and secure it with the retaining ring. The chamfered side of the retaining ring should face downwards.

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

16) Apply harmonic grease to the circular spline.
See Fig. 5-16 for applying grease properly.

17) Remove the four bolts temporarily tightened to the new harmonic drive.

⚠ **CAUTION**

REMOVE ONLY THE FOUR BOLTS SHOWN IN FIG. 5-16 AT THIS POINT. NEVER REMOVE THE BOLTS ON THE OPPOSITE SIDE. IF THEY ARE REMOVED, THE HARMONIC DRIVE AXIS MAY DEVIATE FROM THE CENTER CAUSING A TROUBLE.

18) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive.
Apply small amounts of "Screw Lock" to the bolts (M3×18L, 8 pieces) and tighten them to secure the harmonic drive to the Y-axis arm from the top of the Y-axis arm.

⚠ **CAUTION** ————————————————————————————————

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE. WHEN REASSEMBLING THE HARMONIC DRIVE, BE CAREFUL TO KEEP THE CIRCULAR SPLINE FROM COMING OFF. IF IT COMES OFF, THE HARMONIC DRIVE AXIS WILL DEVIATE FROM THE CENTER CAUSING A TROUBLE.

————————————————————————————————

19) Apply small amounts of "Screw Lock" to the M4 set screws (2 pieces) and tighten them to secure the pulley to the wave generator.

20) Check that the timing belt is fitted on the wave generator pulley and motor pulley, and then secure the motor plate. (See Fig. 5-15.)

⚠ **CAUTION** ————————————————————————————————

IT IS NECESSARY TO APPLY CORRECT TENSION TO THE TIMING BELT DURING REASSEMBLY. REFER TO "8 ADJUSTING THE TIMING BELT TENSION" IN CHAPTER 4.

————————————————————————————————

21) Fit a new O-ring into the O-ring groove on the fastening plate and also replace the edge seal on the fastening plate with new one. (See Fig. 5-17.) Next, secure the fastening plate to the harmonic drive with the button bolts (M3×20L, 6 pieces) you removed earlier. (See Fig. 5-13.) At this point, be careful to keep the spline shaft from coming off the spline nut.

⚠ **CAUTION** ————————————————————————————————

THE HARMONIC DRIVE SERVICE LIFE MAY SHORTEN IF THE EDGE SEAL EFFECT IS INSUFFICIENT, SO CAREFULLY REASSEMBLE THE PARTS.

————————————————————————————————
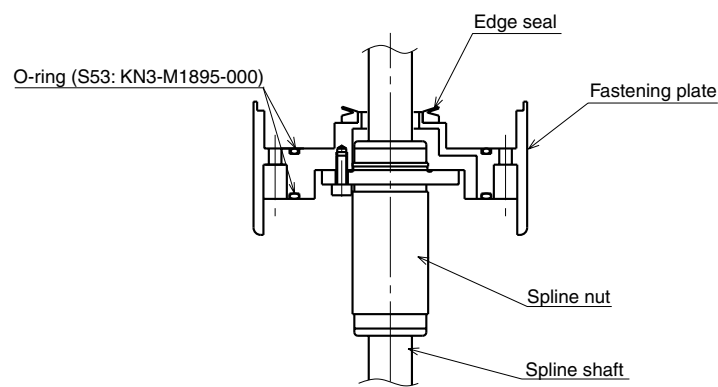
Fig. 5-17

22) Insert the spline into the holder, fit the bearing onto the spline and tighten the U-nut to secure the baring. (Utilize the φ5 through-hole when tightening the U-nut like you did to loosen it.) (See Fig. 5-11 and Fig. 5-12.)

23) Attach the bearing mount plate to the holder and fasten them with the bolts you removed earlier (M4×8L, 4 pieces).

24) Reattach the Y-axis arm upper cover.

25) Go outside the safeguard enclosure.

26) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION**

AFTER THE HARMONIC DRIVE IS REPLACED, THE ABSOLUTE RESET MUST BE PERFORMED, AND THE POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

5-2-2   R6YXC500, R6YXC600

The following steps describe procedures and precautions when replacing the harmonic drives of the R6YXC500 and R6YXC600.
For the bolt tightening torques in this work, refer to Table 5-2.

1. X-axis

1) Prepare the following tools and items.
    • Harmonic grease 4B No.2
    • Waste cloth (rag)
    • Phillips-head screwdriver
    • Hex wrench set
    • Screw Lock (thread sealant)
    • Ratchet handle
    • Hexagonal socket set
    • Extension bar
    • Torque-limiting wrench
    • Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic	SHF-25-80	KN4-M2110-001	
O-ring	S90(JIS)	KN4-M2143-000	Top of harmonic drive
	Rubber wire diameter 1.78mm x Ring inner diameter 85.00mm	KN4-M2159-000	Base (robot pedestal)
	Rubber wire diameter 1.78mm x Ring inner diameter 69.57mm	KN5-M2143-000	Motor
	Rubber wire diameter 1.30mm x Ring inner diameter 66.50mm	KN5-M257L-000	Supplied with harmonic drive

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the base (robot pedestal) front and rear covers and the X-axis arm upper cover.
    Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

6) Disconnect the connectors on the X-axis motor power cable XM and resolver cable XP.

7) Remove the bolts (M6×20L, 4 pieces) securing the motor holder by using the ratchet handle, M6 hexagonal socket, socket adapter and extension bar. (See Fig. 5-18.)
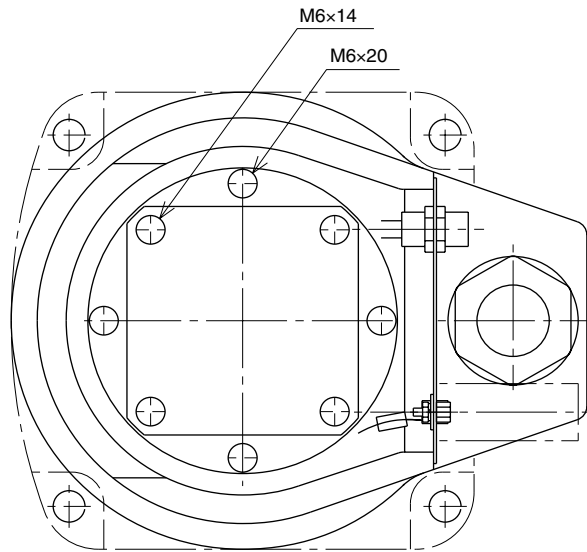
Fig. 5-18

8) With the motor still attached to the motor holder, pull out the motor by swaying it gently right and left. If it is difficult to remove the motor holder, slowly rotate the X-axis arm and again try removing the motor holder.

⚠ **CAUTION**

CAREFULLY REMOVE THE MOTOR HOLDER SO AS NOT TO LET HANDS OR FINGERS GET PINCHED BETWEEN THE MOTOR HOLDER AND THE BASE.
AN O-RING IS FITTED TO THE MOTOR HOLDER, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

9) Remove the bolts (M6×14L, 4 pieces) securing the motor and remove the motor from the motor holder. (See Fig. 5-18.)

⚠ **CAUTION**

AN O-RING IS FITTED TO THE MOTOR, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

10) Remove the wave generator from the motor shaft. The wave generator is secured with an M4 set screw and keyway. (See Fig. 5-22.)

⚠ **CAUTION**

A SPACER IS INSERTED BETWEEN THE WAVE GENERATOR AND THE MOTOR, SO BE CAREFUL NOT TO LOSE IT.

⚠ **WARNING** _____

WHEN YOU REMOVE THE X-AXIS ARM INSTALLATION BOLTS
(M4×40L, 8 PIECES) IN THE NEXT STEP, THE X-AXIS ARM MAY COME
OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL
TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS
ATTACHED TO THE ARM TIP.

⚠ **WARNING** _____

REMOVING THE X-AXIS ARM IS DANGEROUS FOR JUST ONE PERSON.
ALWAYS USE TWO OR MORE PEOPLE, OR REMOVE THE Y-AXIS ARM
IN ADVANCE.
REFER TO "2. Y-AXIS" OF "5-2-2" FOR REMOVING THE Y-AXIS ARM.

11) Remove the X-axis arm installation bolts (M4×40L, 8 pieces). (See
    Fig. 5-19.)
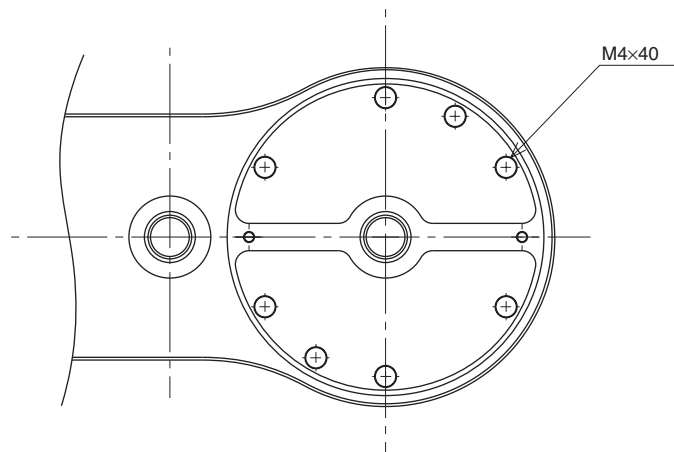
Fig. 5-19

12) Remove the X-axis arm and place it where it will not obstruct the work.

⚠ **CAUTION** _____

AN O-RING IS FITTED TO THE X-AXIS ARM, SO BE CAREFUL NOT TO
LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-20.)
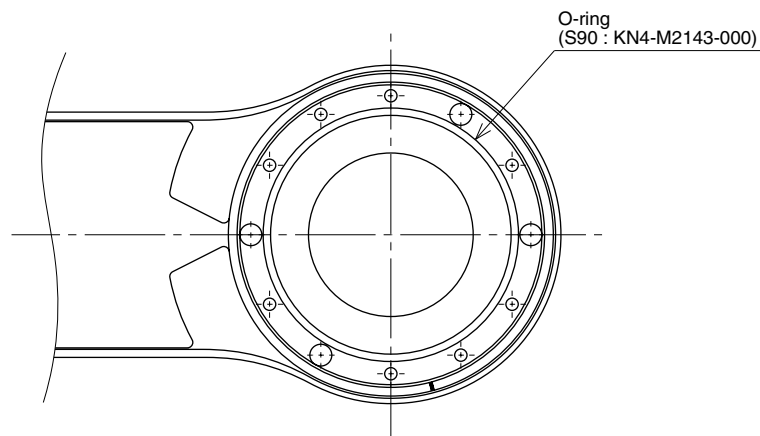
Fig. 5-20

13) Remove the bolts (M4×20L, 12 pieces) securing the X-axis harmonic drive. (See Fig. 5-21.)
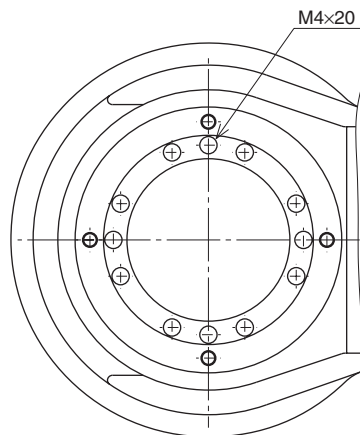
Fig. 5-21

14) Remove the X-axis harmonic drive from the top of the base.

⚠ **CAUTION** ─────────────────────────────────

AN O-RING IS FITTED TO THE X-AXIS HARMONIC DRIVE, SO BE CAREFUL NOT TO LET IT DROP INTO THE BASE OR PERIPHERAL UNIT.

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15) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive. (See Fig. 5-22.) Apply small amounts of "Screw Lock" to the bolts (M4×20L, 12 pieces) and tighten them to secure the harmonic drive from the backside of the base. (See Fig. 5-21.)

⚠ **CAUTION** ─────────────────────────────────

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

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16) Apply harmonic grease to the new wave generator and flexible spline. See Fig. 5-22 for applying grease properly.

17) Fit a new O-ring into the O-ring groove on the X-axis arm (see Fig. 5-20) and secure it to the harmonic drive. Then apply small amounts of "Screw Lock" to the bolts (M4×40L, 8 pieces) you removed earlier and tighten them uniformly to secure the X-axis arm. (See Fig. 5-19.)

⚠ **CAUTION** ─────────────────────────────────

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

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18) Fit the spacer and wave generator onto the motor shaft, and fully insert them against the motor. Then, apply small amounts of "Screw Lock" to the M4 set screw (1 piece) you removed earlier and tighten it to secure the wave generator onto the motor shaft. (See Fig. 5-22.)

Fit O-ring (supplied) into this groove
Harmonic drive will be damaged if O-ring is caught out of groove.
O-ring : KN5-M257L-000
Apply grease to entire oldham coupling.
O-ring : KN5-M2143-000
M4 set screw
Spacer
Wave generator
Apply grease to sufficiently fill in the ball space.
Apply grease to the thickness equal to the ball diameter.
Circular spline
Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

Fig. 5-22

19) Fit the O-ring to the motor and secure the motor to the motor holder with the bolts (M6×14L, 4 pieces) you removed earlier. (See Fig. 5-18 and Fig. 5-22.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

20) Fit a new O-ring coated with harmonic grease into the O-ring groove on the motor holder and tighten the bolts (M6×20L, 4 pieces) you removed earlier to temporarily secure the motor holder to the base. (See Fig. 5-18.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

21) Uniformly tighten the four bolts (M6×20L) temporarily fastened in the previous step while moving the X-axis by hand slowly left and right through 45°. If any jamming or catching is felt while moving the axis at this time, then reassemble from the beginning.

22) Reattach the connectors on the X-axis motor power cable XM and resolver cable XP.

23) Reattach the base (robot pedestal) front and rear covers and the X-axis arm upper cover.

24) Go outside the safeguard enclosure.

25) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION**

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

2. Y-axis

1) Prepare the following tools and items.
   - Harmonic grease 4B No.2
   - Waste cloth (rag)
   - Phillips-head screwdriver
   - Hex wrench set
   - Screw Lock (thread sealant)
   - Torque-limiting wrench
   - Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic drive	SHF-20-80	KN4-M2510-001	
O-ring	Rubber wire diameter 1.78mm x Ring inner diameter 72.75mm	KN4-M257K-000	Lower part of harmonic drive
	Rubber wire diameter 1.50mm x Ring inner diameter 49.00mm	KN3-M2143-000	For motor
	Rubber wire diameter 0.99mm x Ring inner diameter 53.28mm	KN3-M2144-000	Supplied with harmonic drive

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis arm upper cover. Place the cover on the robot base (pedestal) side with the machine harness still connected. Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

6) Disconnect the connectors on the Y-axis motor power cable YM and resolver cable YP.

7) Remove the Y-axis motor installation bolts (M5×14L, 4 pieces) and then remove the Y-axis motor by swaying it gently right and left.(See Fig. 5-23.)
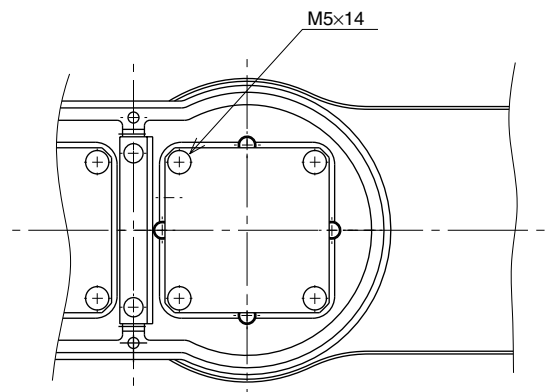
Fig. 5-23

⚠ **CAUTION**

AN O-RING IS FITTED TO THE MOTOR, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

8) Remove the wave generator from the motor shaft. The wave generator is secured with an M4 set screws. (See Fig. 5-27.)

⚠ WARNING

WHEN YOU REMOVE THE Y-AXIS ARM INSTALLATION BOLTS (M3×20L, 12 PIECES) IN THE NEXT STEP, THE Y-AXIS ARM MAY COME OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED TO THE ARM TIP.

9) Remove the Y-axis arm installation bolts (M3×20L, 12 pieces). (See Fig. 5-24.)
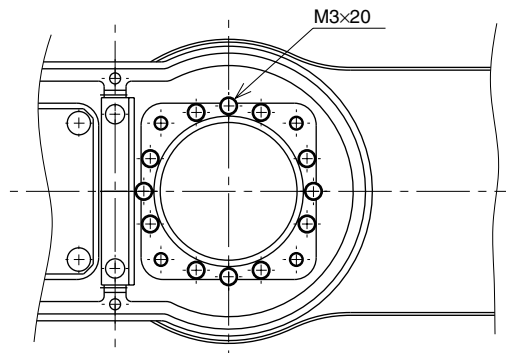
Fig. 5-24

10) Remove the Y-axis arm and place it where it will not obstruct the work.

⚠ CAUTION

AN O-RING IS FITTED TO THE UPPER SURFACE OF THE HARMONIC DRIVE, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

11) Remove the Y-axis harmonic drive installation bolts (M3×40L, 8 pieces) from the bottom of the arm. (See Fig. 5-25.)
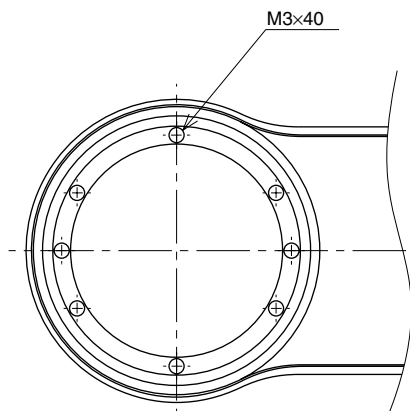
Fig. 5-25

12) Remove the Y-axis harmonic drive from the top of the X-axis arm.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE UPPER SURFACE OF THE X-AXIS, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-26.)
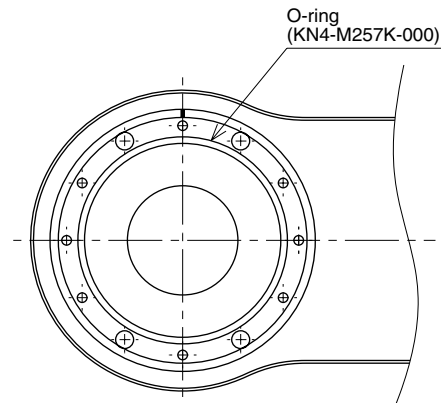
O-ring
(KN4-M257K-000)

Fig. 5-26

13) Fit a new O-ring coated with harmonic grease into the O-ring groove on the X-axis arm. (See Fig. 5-26.)

14) Place the new harmonic drive on the X-axis arm, and secure it with the bolts (M3×40L, 8 pieces) you removed earlier. Apply small amounts of "Screw Lock" to the bolts and tighten them uniformly to secure the harmonic drive from the backside. (See Fig. 5-25.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

15) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive. (See Fig. 5-27.)

16) Secure the Y-axis arm to the harmonic drive with the bolts (M3×20L, 12 pieces) you removed earlier. Apply small amounts of "Screw Lock" to the bolts and tighten them uniformly to secure the Y-axis arm. (See Fig. 5-24.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Apply harmonic grease to the new wave generator and flexible spline. See Fig. 5-27 for applying grease properly.

18) Fit the wave generator onto the motor shaft, and fully insert it against the motor. Then, apply small amounts of "Screw Lock" to the M4 set screw (1 piece) you removed earlier and tighten it to secure the wave generator. (See Fig. 5-27.)
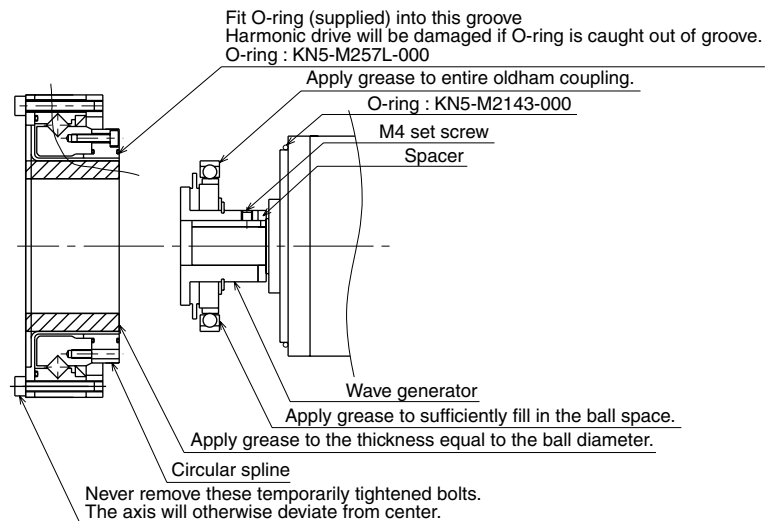
Fit O-ring (supplied) into this groove
Harmonic drive will be damaged if O-ring is caught out of groove.
O-ring : KN3-M2144-000

M4 set screw
Apply grease to entire oldham coupling.
O-ring : KN3-M2143-000

Wave generator
Apply grease to sufficiently fill in the ball space.
Apply grease to the thickness equal to the ball diameter.
Circular spline
Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

Fig. 5-27

19) Fit a new O-ring to the motor and tighten the bolts (M5×14L, 4 pieces) you removed earlier to temporarily secure the motor to the Y-axis arm. (See Fig. 5-23 and Fig. 5-27.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF GROOVE.

20) Uniformly tighten the four bolts (M5×12L) temporarily fastened in the previous step while moving the Y-axis by hand slowly left and right through 45°. If any jamming or catching is felt while moving the axis at this time, then reassemble from the beginning.

21) Reattach the connectors on the Y-axis motor power cable YM and resolver cable YP.

22) Reattach the Y-axis arm upper cover.

23) Go outside the safeguard enclosure.

24) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION**

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

3. R-axis

1) Prepare the following tools and items.
   • Harmonic grease 4B No.2
   • Waste cloth (rag)
   • Phillips-head screwdriver
   • Hex wrench set
   • Screw Lock (thread sealant)
   • Torque-limiting wrench
   • Hook wrench
   • Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic drive	SHF-17-50	KN4-M1821-000	
O-ring	Rubber wire diameter 1.78mm x Ring inner diameter 63.22mm	KN4-M1896-000	Lower part of harmonic drive Upper part of bellows (2 pieces)
	Rubber wire diameter 0.80mm x Ring inner diameter 45.40mm	KN3-M257L-000	Supplied with harmonic drive
Edge seal	VR22A	KN4-M1886-000	

2) Turn off the controller.
3) Place a sign indicating that the robot is being inspected, to keep others from operating the controller switch.
4) Enter the safeguard enclosure.
5) Remove the Y-axis upper cover and bellows. Place the cover on the robot base (pedestal) side with the machine harness still connected.
   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing and reattaching the covers. Refer to "6 Replacing the bellows" in Chapter 5 for removing and reattaching the bellows.

⚠ **WARNING**

THE Z-AXIS WILL SLIDE DOWN WHEN THE SPLINE MOUNTING BOLTS (M5×16L, 4 PIECES) ARE REMOVED IN THE NEXT STEP, CAUSING A HAZARDOUS SITUATION. PROP THE Z-AXIS WITH A SUPPORT STAND BEFORE LOOSENING THESE BOLTS.

6) Remove the bolts (M5×16L, 4 pieces) securing the bearing to the upper end of the spline and remove the spline and bearing from the holder. (See Fig. 5-28.)

Holder

Bearing

M5×16

Spline shaft

Fig. 5-28

7) While placing a steel rod or similar tool through the 7mm diameter hole at the lower part of the spline, loosen the U-nut at the top of the spline with the wrench, and remove the bearing and bearing mount plate.
(See Fig. 5-29.)
Use a round steel rod with a diameter slightly smaller than 7mm. Avoid using a square rod because the spline might be damaged by the edge of the rod.
At this point, be careful to keep the spline shaft from coming off the spline nut.
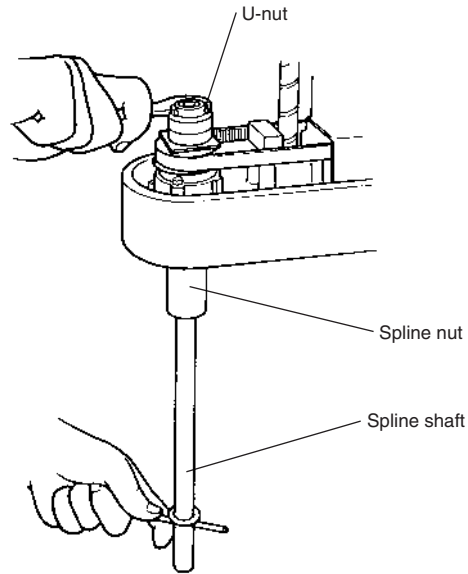
Fig. 5-29

8) Remove the bolts (M3×25L, 8 pieces) on the underside of the Y-axis arm and remove the plate fastening the spline and the harmonic drive.
(See Fig. 5-30.)
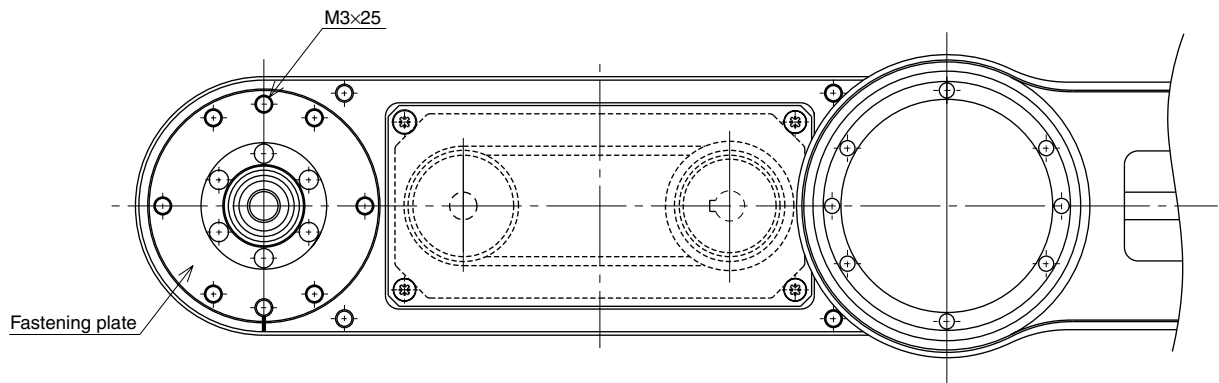
Fig. 5-30

⚠ **CAUTION**

> AN O-RING IS FITTED TO THE FASTENING PLATE, SO BE CAREFUL
> NOT TO LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-31.)

O-ring : KN4-M1896-000
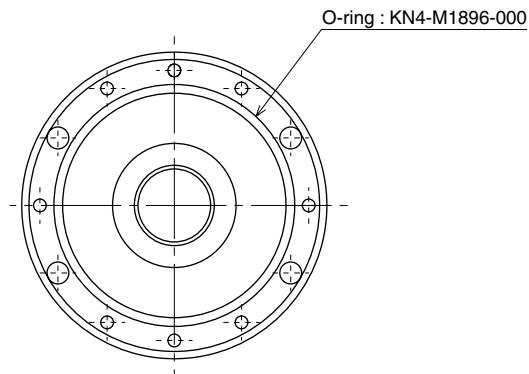
Fig. 5-31

9) Remove the bolts (M4×10L, 4 pieces) securing the R-axis motor plate at the top of the Y-axis arm. (See Fig. 5-32.)

10) Loosen the pulley set screw (M4, 2 pieces) and remove the pulley from the wave generator. (See Fig. 5-32.)

11) Remove the harmonic drive installation bolts (M3×16L, 9 pieces) and pull out the harmonic drive from the bottom of the Y-axis arm. (See Fig. 5-32.)

M3×16
M4 set screw
M4×10
Pulley
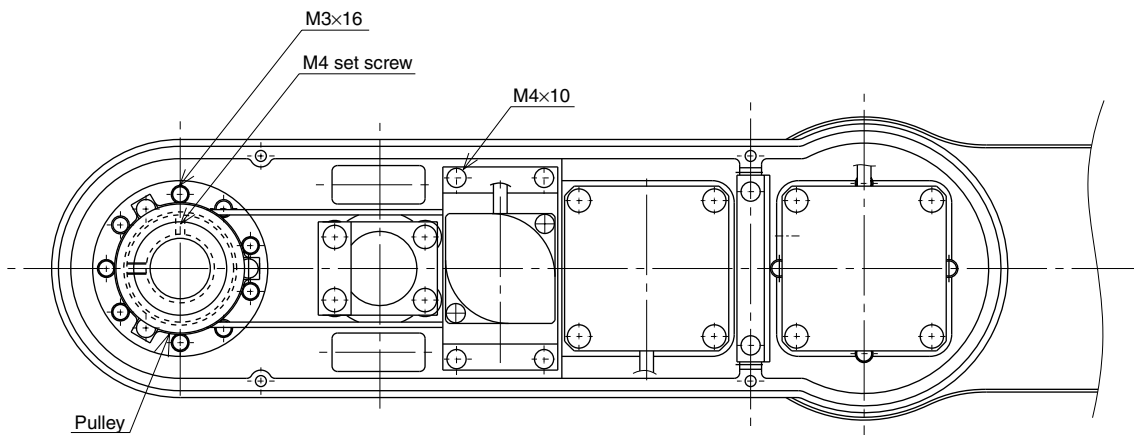
Fig. 5-32

⚠ **CAUTION**

> AN O-RING IS FITTED TO THE FASTENING PLATE, SO BE CAREFUL
> NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

12) Remove the retaining ring for the wave generator and pull out the wave generator from the bottom of the Y-axis arm.

13) Apply harmonic grease to the new wave generator. See Fig. 5-33 for applying grease properly.

Wave generator

Retaining ring groove

Apply grease to sufficiently fill in the ball space.

Fit O-ring (supplied) into this groove
Harmonic drive will be damaged if O-ring is
caught out of groove.
O-ring : KN3-M257L-000

Apply grease to entire oldham coupling.

Apply grease to the thickness equal to the ball diameter.

Remove the temporarily tightened bolts when assembling
Keep the circular spline from coming off when assembling

Circular spline

Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

Fig. 5-33

14) Insert the new wave generator into the Y-axis arm from the bottom, and secure it with the retaining ring. The chamfered side of the retaining ring should face downwards.

15) Apply harmonic grease to the circular spline.
See Fig. 5-33 for applying grease properly.

16) Remove the four bolts temporarily tightened to the new harmonic drive.

⚠ **CAUTION**

REMOVE ONLY THE FOUR BOLTS SHOWN IN FIG. 5-33 AT THIS POINT. NEVER REMOVE THE BOLTS ON THE OPPOSITE SIDE. IF THEY ARE REMOVED, THE HARMONIC DRIVE AXIS MAY DEVIATE FROM THE CENTER CAUSING A TROUBLE.

17) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive. (See Fig. 5-33.) Apply small amounts of "Screw Lock" to the bolts (M3×16L, 9 pieces) and tighten them to secure the harmonic drive to the Y-axis arm from the top of the Y-axis arm. (See Fig. 5-32.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE. WHEN REASSEMBLING THE HARMONIC DRIVE, BE CAREFUL TO KEEP THE CIRCULAR SPLINE FROM COMING OFF. IF IT COMES OFF, THE HARMONIC DRIVE AXIS WILL DEVIATE FROM THE CENTER CAUSING A TROUBLE.

18) Apply small amounts of "Screw Lock" to the M4 set screws (2 pieces) and tighten them to secure the pulley to the wave generator. (See Fig. 5-32.)

19) Fit the timing belt onto the wave generator pulley and motor pulley, and then secure the motor plate. (See Fig. 5-32.)

⚠ **CAUTION** ───────────────────────────────

IT IS NECESSARY TO APPLY CORRECT TENSION TO THE TIMING BELT DURING REASSEMBLY. REFER TO "8 ADJUSTING THE TIMING BELT TENSION" IN CHAPTER 4.

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20) Fit a new O-ring into the O-ring groove on the fastening plate and also replace the edge seal with new one. Then secure the fastening plate to the harmonic drive with the bolts (M3×25L, 8 pieces) you removed earlier. (See Fig. 5-30 and Fig. 5-34.)
At this point, be careful to keep the spline shaft from coming off the spline nut.

⚠ **CAUTION** ───────────────────────────────

THE HARMONIC DRIVE SERVICE LIFE MAY SHORTEN IF THE EDGE SEAL EFFECT IS INSUFFICIENT, SO CAREFULLY REASSEMBLE THE PARTS.

───────────────────────────────────────

21) Insert the bearing mount plate and bearing onto the spline from the top, and tighten the U-nut to secure the baring. (Utilize the φ7 through-hole when tightening the U-nut like you did to loosen it.) (See Fig. 5-29.)

22) Insert the spline and bearing through the holder and secure them with the bolts you removed earlier (M5×16L, 4 pieces). (See Fig. 5-28.)

23) Reattach the Y-axis arm upper cover.

24) Go outside the safeguard enclosure.

25) Check that no one is inside the safeguard enclosure, and then turn on the controller.

O-ring : KN4-M1896-000
Edge seal
Fastening plate
Spline nut
Spline shaft
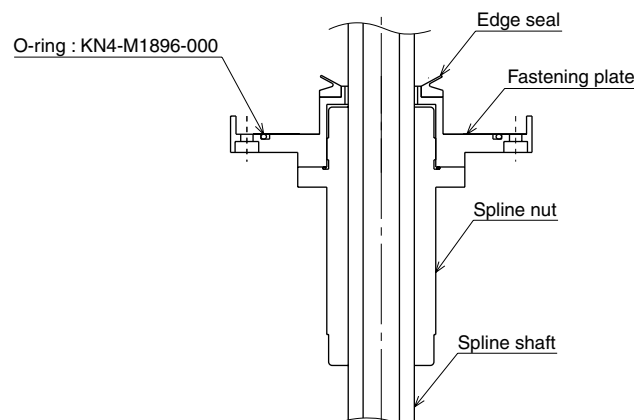
Fig. 5-34

5-2-3   R6YXC700, R6YXC800, R6YXC1000

The following steps describe procedures and precautions when replacing the harmonic drives of the R6YXC700, R6YXC800 and R6YXC1000.
For the bolt tightening torques in this work, refer to Table 5-2.

1. X-axis

1) Prepare the following tools and items.
    • Harmonic grease 4B No.2
    • Waste cloth (rag)
    • Phillips-head screwdriver
    • Hex wrench set
    • Screw Lock (thread sealant)
    • Ratchet handle
    • Hexagonal socket set
    • Extension bar
    • Torque-limiting wrench
    • Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic drive	SHF-32-80	KN5-M2110-001	R6YXC700, R6YXC800
	SHF-32-100	KN5-M2110-101	R6YXC1000
O-ring	S115(JIS)	KN5-M2159-000	Top of harmonic drive
	Rubber wire diameter 1.78mm x Ring inner diameter 78.97mm	KN5-M2144-000	Base (robot pedestal)
	Rubber wire diameter 1.78mm x Ring inner diameter 69.57mm	KN5-M2143-000	Motor
	Rubber wire diameter 1.50mm x Ring inner diameter 87.50mm	KN5-M2199-000	Supplied with harmonic drive

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the base (robot pedestal) front and rear covers and the X-axis arm upper cover.
Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

6) Disconnect the connectors on the X-axis motor power cable XM and resolver cable XP.

7) Remove the bolts (M6×20L, 4 pieces) securing the motor by using the ratchet handle, M6 hexagonal socket, socket adapter and extension bar. (See Fig. 5-35.)
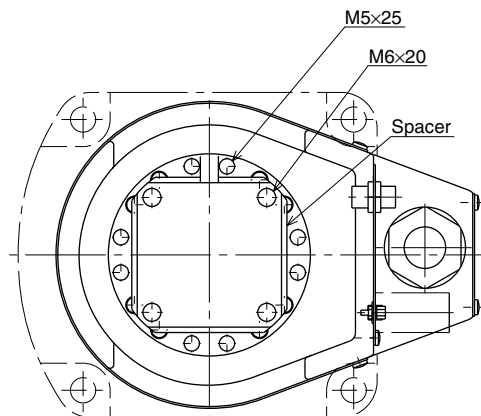
Fig. 5-35

8) Slowly pull out the motor while holding it slantways. (See Fig. 5-36.) If it is difficult to remove the motor, slowly rotate the X-axis arm and again try removing the motor.

⚠ **CAUTION**

CAREFULLY REMOVE THE MOTOR SO AS NOT TO LET HANDS OR FINGERS GET PINCHED BETWEEN THE MOTOR AND THE BASE.
AN O-RING IS FITTED TO THE MOTOR AND THE SPACER, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

Fig. 5-36

9) Remove the wave generator from the motor shaft. The wave generator is secured with an M4 set screw and keyway. (See Fig. 5-40.)

⚠ **WARNING** _____

WHEN YOU REMOVE THE X-AXIS ARM INSTALLATION BOLTS (M5×55L, 8 PIECES) IN THE NEXT STEP, THE X-AXIS ARM MAY COME OFF CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED TO THE ARM TIP.

⚠ **WARNING** _____

REMOVING THE X-AXIS ARM IS DANGEROUS FOR JUST ONE PERSON. ALWAYS USE TWO OR MORE PEOPLE, OR REMOVE THE Y-AXIS ARM IN ADVANCE.
REFER TO "2. Y-AXIS" OF "5-2-3" FOR REMOVING THE Y-AXIS ARM.

10) Remove the X-axis arm installation bolts (M5×55L, 8 pieces). (See Fig. 5-37.)
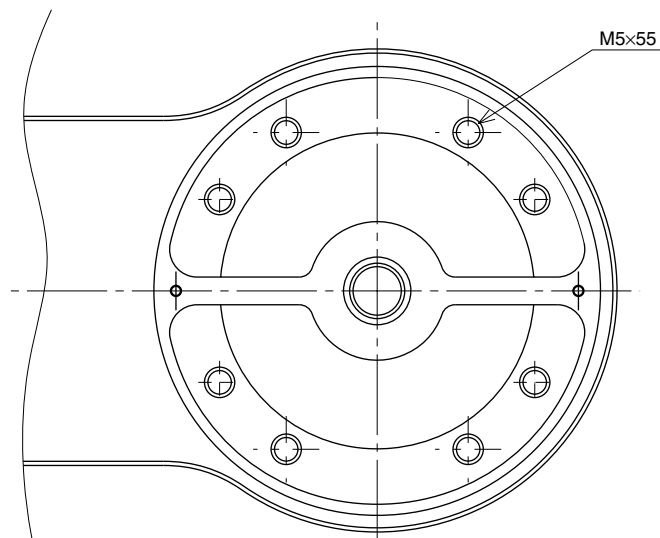
Fig. 5-37

11) Remove the X-axis arm and place it where it will not obstruct the work.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE X-AXIS ARM, SO BE CAREFUL NOT TO
LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-38.)
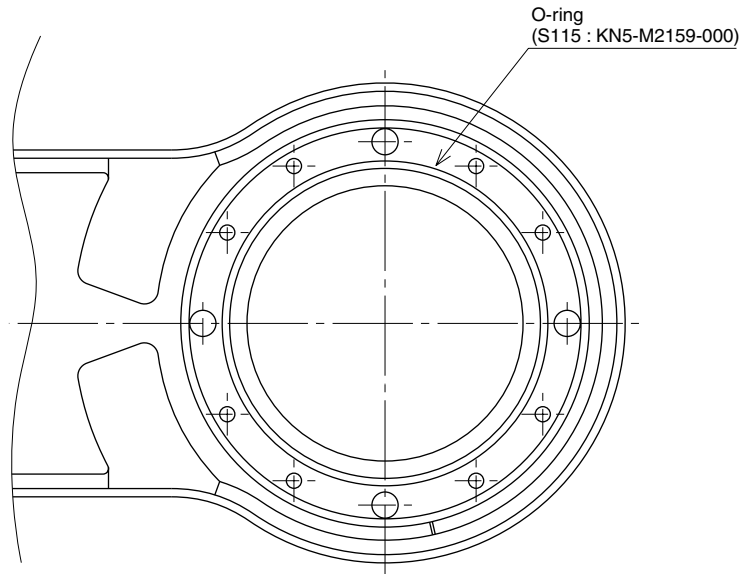
Fig. 5-38

12) Remove the bolts (M5×25L 8 pieces and M5×35L 8 pieces) securing the
X-axis harmonic drive. (See Fig. 5-39.)
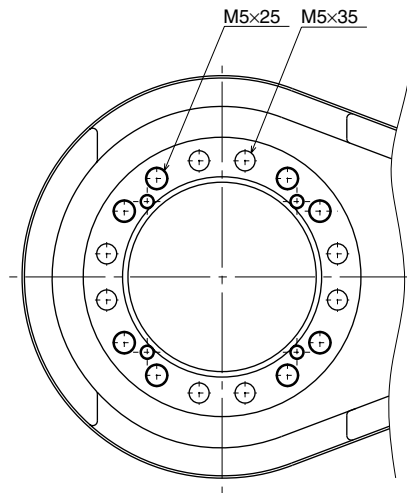
Fig. 5-39

13) Remove the X-axis harmonic drive from the top of the base.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE X-AXIS HARMONIC DRIVE, SO BE
CAREFUL NOT TO LET IT DROP INTO THE BASE OR PERIPHERAL UNIT.

14) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive. (See Fig. 5-40.) Apply small amounts of "Screw Lock" to the bolts (M5×25L 8 pieces and M5×35L 8 pieces) and tighten them to secure the harmonic drive from the backside of the base. (See Fig. 5-39.)

⚠ **CAUTION**
_____

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

_____

15) Apply harmonic grease to the new wave generator and flexible spline. See Fig. 5-40 for applying grease properly.

16) Fit a new O-ring into the O-ring groove on the X-axis arm and secure it to the harmonic drive. Then apply small amounts of "Screw Lock" to the bolts (M5×55L, 8 pieces) you removed earlier and tighten them uniformly to secure the X-axis arm. (See Fig. 5-37 and Fig. 5-38.)

⚠ **CAUTION**
_____

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

_____

17) Fit the wave generator onto the motor shaft, and fully insert it against the motor. Then, apply small amounts of "Screw Lock" to the M4 set screw (1 piece) you removed earlier and tighten it to secure the wave generator onto the motor shaft. (See Fig. 5-40.)

Fit O-ring (supplied) into this groove
Harmonic drive will be damaged if O-ring is caught out of groove.
O-ring : KN5-M2199-000

Apply grease to entire oldham coupling.

O-ring : KN5-M2143-000

M4 set screw

Wave generator

Apply grease to sufficiently fill in the ball space.

Apply grease to the thickness equal to the ball diameter.

Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

Fig. 5-40

18) Fit a new O-ring to the motor and temporarily fasten the motor and spacer to the base with the bolts (M6×20L, 4 pieces) you removed earlier. Insert a new O-ring between the spacer and the base at this point.
Insert the motor with the wave generator into the harmonic drive while holding the motor slantways. If it is difficult to insert the motor, try inserting it again while slowly rotating the X-axis arm. (See Fig. 5-36.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

19) Uniformly tighten the four bolts (M6×20L) temporarily fastened in the previous step while moving the X-axis by hand slowly left and right through 45°. If any jamming or catching is felt while moving the axis at this time, then reassemble from the beginning.

20) Reattach the connectors on the X-axis motor power cable XM and resolver cable XP.

21) Reattach the base (robot pedestal) front and rear covers and the X-axis arm upper cover.

22) Go outside the safeguard enclosure.

23) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION**

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

2. Y-axis

1) Prepare the following tools and items.
   - Harmonic grease 4B No.2
   - Waste cloth (rag)
   - Phillips-head screwdriver
   - Hex wrench set
   - Screw Lock (thread sealant)
   - Torque-limiting wrench
   - Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic drive	SHF-25-80	KN4-M2110-001	
O-ring	S90(JIS)	KN4-M2143-000	Lower part of harmonic drive
	Rubber wire diameter 1.78mm x Ring inner diameter 69.57mm	KN5-M2143-000	For motor
	Rubber wire diameter 1.30mm x Ring inner diameter 66.50mm	KN5-M257L-000	Supplied with harmonic drive

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the Y-axis arm upper cover. Place the cover on the robot base (pedestal) side with the machine harness still connected.

   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing the covers.

6) Disconnect the connectors on the Y-axis motor power cable YM and resolver cable YP.

7) Remove the Y-axis motor installation bolts (M6×20L, 4 pieces) and then remove the Y-axis motor by swaying it gently right and left.(See Fig. 5-41.)
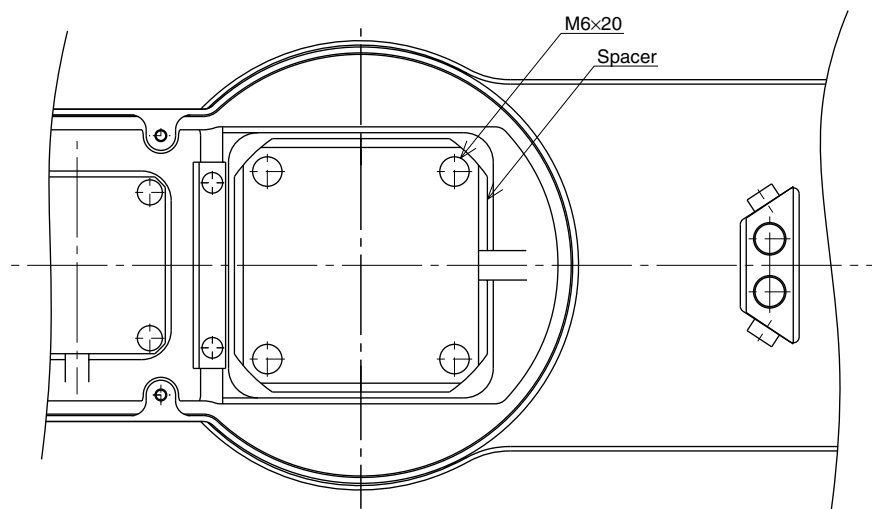
Fig. 5-41

⚠ **CAUTION**
_____

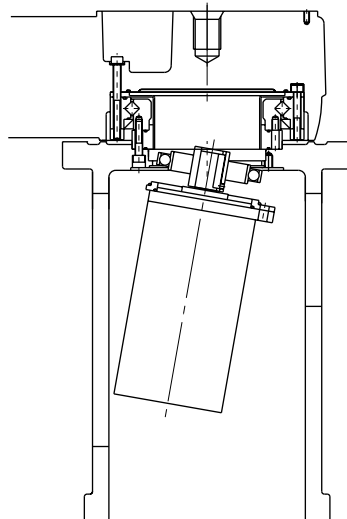AN O-RING IS FITTED TO THE MOTOR, SO BE CAREFUL NOT TO LET IT
DROP INTO THE PERIPHERAL UNIT.

_____

8) Remove the wave generator from the motor shaft. The wave generator is
   secured with an M4 set screws. (See Fig. 5-45.)

⚠ **CAUTION**
_____

WHEN YOU REMOVE THE Y-AXIS ARM INSTALLATION BOLTS (M4×20L,
16 PIECES) IN THE NEXT STEP, THE Y-AXIS ARM MAY COME OFF
CAUSING A HAZARDOUS SITUATION. BE ESPECIALLY CAREFUL TO
KEEP THE ARM FROM FALLING WHEN A HEAVY TOOL IS ATTACHED
TO THE ARM TIP.

_____

9) Remove the Y-axis arm installation bolts (M4×20L, 16 pieces).
   (See Fig. 5-42.)
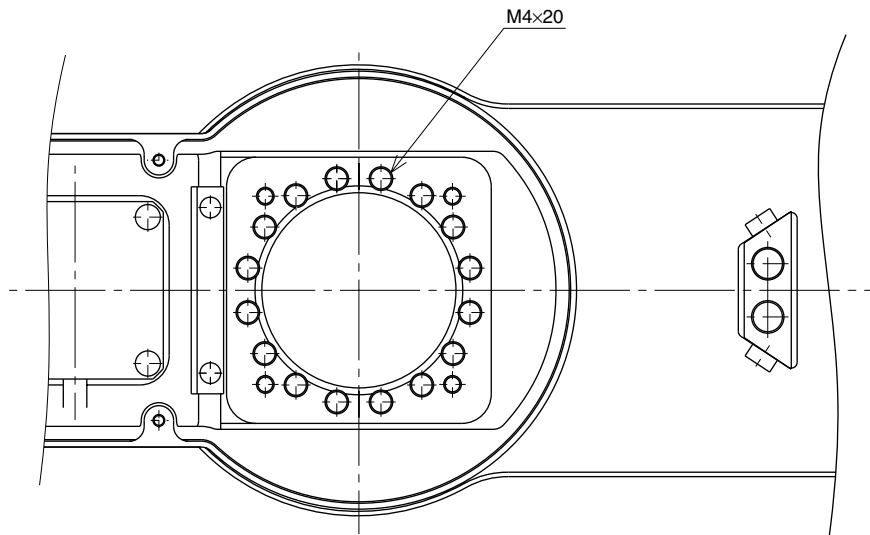
Fig. 5-42

10) Remove the Y-axis arm and place it where it will not obstruct the work.

⚠ **CAUTION**
_____

AN O-RING IS FITTED TO THE UPPER SURFACE OF THE HARMONIC
DRIVE, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL
UNIT.

_____

11) Remove the Y-axis harmonic drive installation bolts (M4×45L, 8 pieces). (See Fig. 5-43.)

M4×45
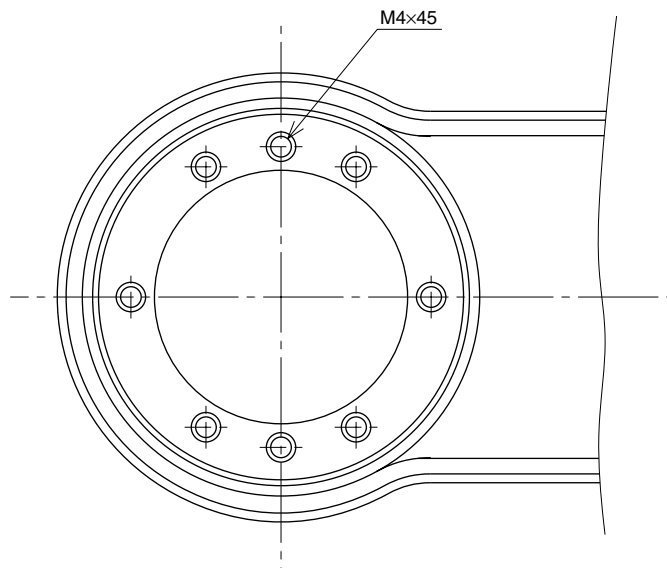
Fig. 5-43

12) Remove the Y-axis harmonic drive from the top of the X-axis arm.

⚠ **CAUTION**

AN O-RING IS FITTED TO THE UPPER SURFACE OF THE X-AXIS, SO BE CAREFUL NOT TO LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-44.)

O-ring
(S90 : KN4-M2143-000)
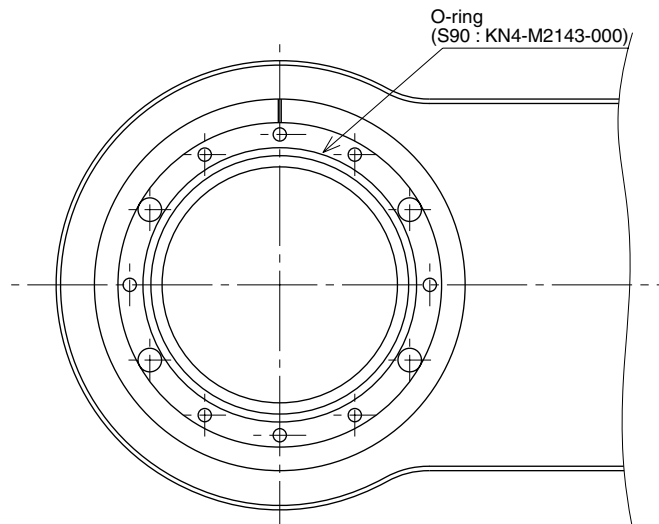
Fig. 5-44

13) Fit a new O-ring coated with harmonic grease into the O-ring groove on the X-axis arm. (See Fig. 5-44.)

14) Place the new harmonic drive on the X-axis arm, and secure it with the bolts (M4×45L, 8 pieces) you removed earlier. Apply small amounts of "Screw Lock" to the bolts and tighten them uniformly to secure the harmonic drive from the backside. (See Fig. 5-43.)

⚠**CAUTION**

> DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE
> DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS
> OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

15) Fit an O-ring (supplied with the harmonic drive) coated with harmonic
grease into the O-ring groove on the new harmonic drive. (See Fig. 5-45.)

16) Secure the Y-axis arm to the harmonic drive with the bolts (M4×20L, 16
pieces) you removed earlier. Apply small amounts of "Screw Lock" to the
bolts and tighten them uniformly to secure the Y-axis arm. (See Fig. 5-42.)

⚠**CAUTION**

> DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE
> DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS
> OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Apply harmonic grease to the new wave generator and flexible spline.
See Fig. 5-45 for applying grease properly.

18) Fit the wave generator onto the motor shaft, and fully insert it against the
motor. Then, apply small amounts of "Screw Lock" to the M4 set screw (1
piece) you removed earlier and tighten it to secure the wave generator.
(See Fig. 5-45.)

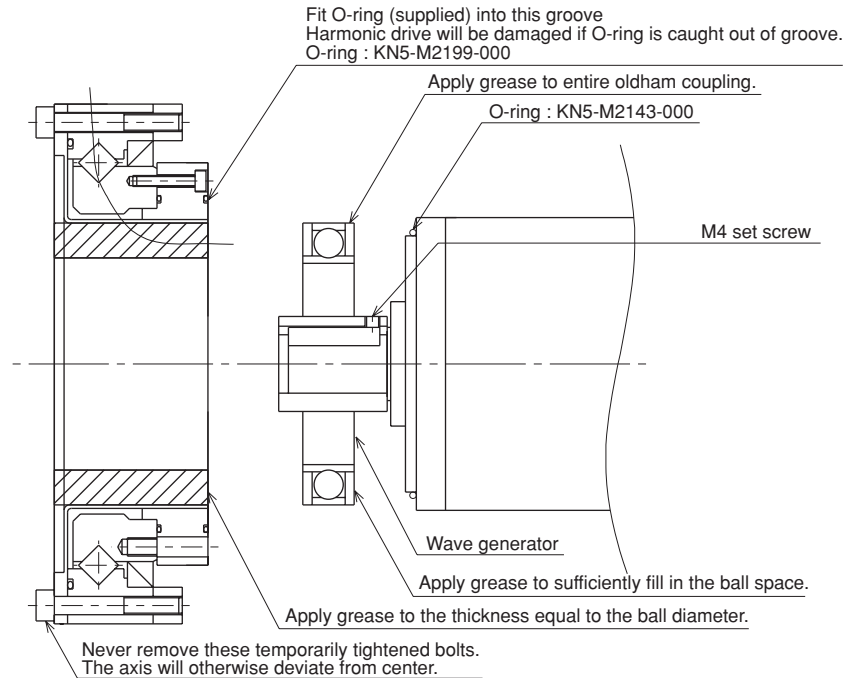Fit O-ring (supplied) into this groove
Harmonic drive will be damaged if O-ring is caught out of groove.
O-ring : KN5-M257L-000
Apply grease to entire oldham coupling.
O-ring : KN5-M2143-000
M4 set screw
Wave generator
Apply grease to sufficiently fill in the ball space.
Apply grease to the thickness equal to the ball diameter.
Circular spline
Never remove these temporarily tightened bolts.
The axis will otherwise deviate from center.

Fig. 5-45

19) Fit a new O-ring to the motor and tighten the bolts (M6×20L, 4 pieces) you removed earlier to temporarily secure the motor to the Y-axis arm.
(See Fig. 5-41.)
Insert a new O-ring between the spacer and the Y-axis arm at this point.

⚠ **CAUTION** ——————————————————————————

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

——————————————————————————

20) Uniformly tighten the four bolts (M6×20L) temporarily fastened in the previous step while moving the Y-axis by hand slowly left and right through 45°. If any jamming or catching is felt while moving the axis at this time, then reassemble from the beginning.

21) Reattach the connectors on the Y-axis motor power cable YM and resolver cable YP.

22) Reattach the Y-axis arm upper cover.

23) Go outside the safeguard enclosure.

24) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION** ——————————————————————————

AFTER THE HARMONIC DRIVE IS REPLACED, AN ABSOLUTE RESET MUST BE PERFORMED, AND THE STANDARD COORDINATE AND POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

——————————————————————————

3. R-axis

1) Prepare the following tools and items.
   - Harmonic grease 4B No.2
   - Waste cloth (rag)
   - Phillips-head screwdriver
   - Hex wrench set
   - Screw Lock (thread sealant)
   - Torque-limiting wrench
   - Hook wrench
   - Replacement parts (See table below.)

Replacement parts			
Parts name	Type No .	OMRON Parts No.	Note
Harmonic drive	SHF-20-50	KN5-M1821-001	
O-ring	S63(JIS)	KN9-M1895-200	Upper part of bellows (2 pieces)
	S71(JIS)	KN3-M2159-000	Lower part of harmonic drive
	Rubber wire diameter 0.99mm x Ring inner diameter 53.28mm	KN3-M2144-000	Supplied with harmonic drive
Edge seal	VR28A	KN5-M1886-000	

2) Turn off the controller.
3) Place a sign indicating that the robot is being inspected, to keep others from operating the controller switch.
4) Enter the safeguard enclosure.
5) Remove the Y-axis upper cover and bellows. Place the cover on the robot base (pedestal) side with the machine harness still connected.
   Refer to "7 Removing the Robot Covers" in Chapter 4 for removing and reattaching the covers. Refer to "6 Replacing the bellows" in Chapter 5 for removing and reattaching the bellows.

⚠ **WARNING**

THE Z-AXIS WILL SLIDE DOWN WHEN THE SPLINE MOUNTING BOLTS (M5×16L, 4 PIECES) ARE REMOVED IN THE NEXT STEP, CAUSING A HAZARDOUS SITUATION. PROP THE Z-AXIS WITH A SUPPORT STAND BEFORE LOOSENING THESE BOLTS.

6) Remove the bolts (M5×16L, 4 pieces) securing the bearing to the upper end of the spline and remove the spline and bearing from the holder. (See Fig. 5-46.)

Fig. 5-46

7) While placing a steel rod or similar tool through the 8mm diameter hole at the lower part of the spline, loosen the U-nut at the top of the spline with the hook wrench, and remove the bearing and bearing mount plate.
(See Fig. 5-47.)
Use a round steel rod with a diameter slightly smaller than 8mm. Avoid using a square rod because the spline might be damaged by the edge of the rod.
At this time, be careful to keep the spline shaft from coming off the spline nut.
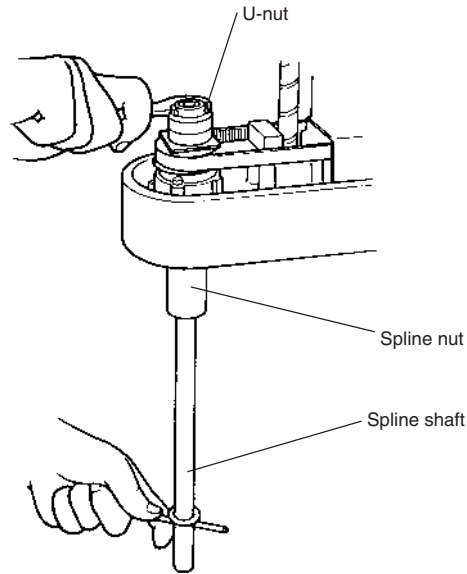
Fig. 5-47

8) Remove the bolts (M3×30L, 8 pieces) on the underside of the Y-axis arm and remove the plate fastening the spline and the harmonic drive.
(See Fig. 5-48)
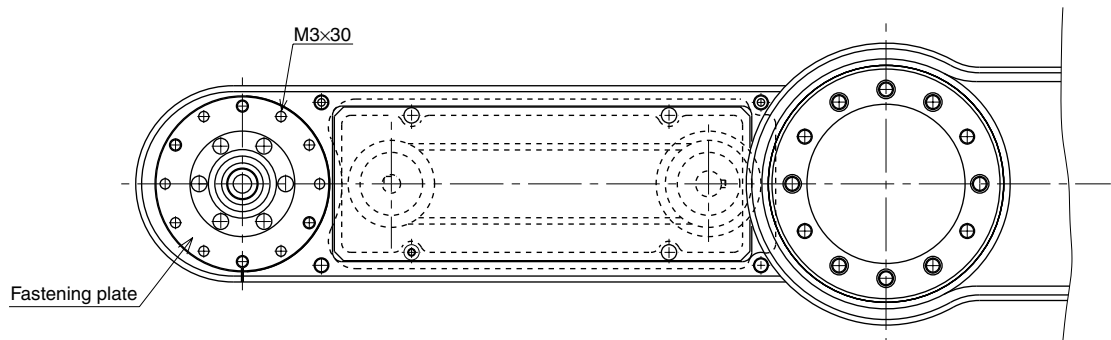
Fig. 5-48

⚠ **CAUTION**

AN O-RING IS FITTED TO THE FASTENING PLATE, SO BE CAREFUL
NOT TO LET IT DROP INTO THE PERIPHERAL UNIT. (SEE FIG. 5-49.)

O-ring : KN3-M2159-000
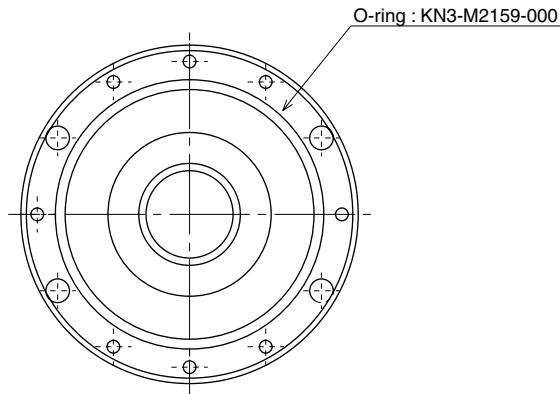
Fig. 5-49

9) Remove the bolts (M4×15L, 4 pieces) securing the R-axis motor plate at the top of the Y-axis arm. (See Fig. 5-50.)

10) Loosen the pulley set screw (M4, 2 pieces) and remove the pulley from the wave generator. (See Fig. 5-50.)

11) Remove the harmonic drive installation bolts (M3×30L, 13 pieces) and pull out the harmonic drive from the bottom of the Y-axis arm. (See Fig. 5-50.)

M4 Set screw
M3×30
M4×15
Pulley
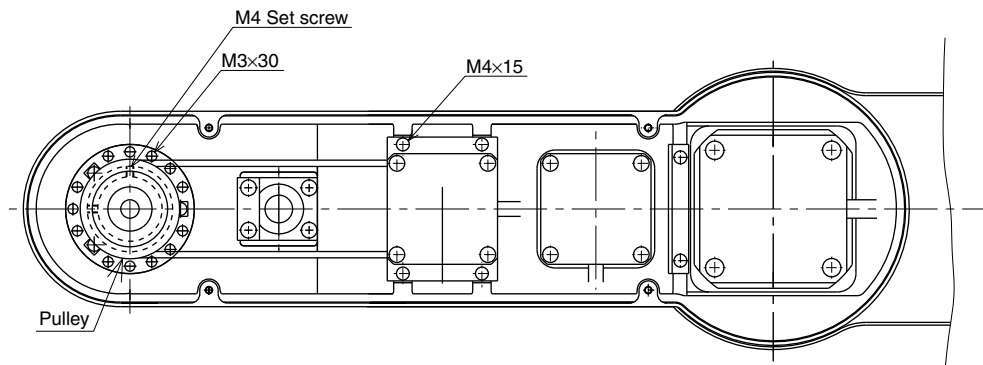
Fig. 5-50

⚠ **CAUTION**

AN O-RING IS FITTED TO THE FASTENING PLATE, SO BE CAREFUL
NOT TO LET IT DROP INTO THE PERIPHERAL UNIT.

12) Remove the retaining ring for the wave generator and pull out the wave generator from the bottom of the Y-axis arm.

13) Apply harmonic grease to the new wave generator. See Fig. 5-51 for applying grease properly.
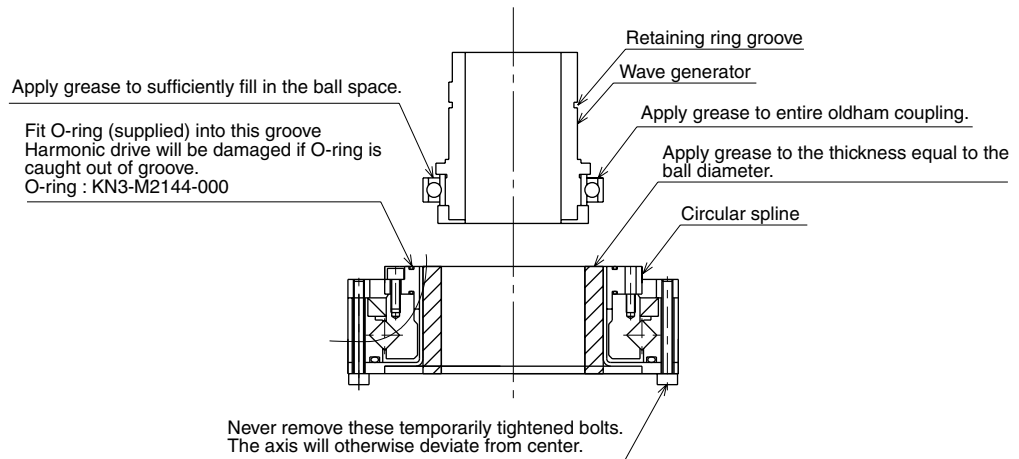
Fig. 5-51

14) Insert the new wave generator into the Y-axis arm from the bottom, and secure it with the retaining ring. The chamfered side of the retaining ring should face downwards.

15) Apply harmonic grease to the circular spline.
See Fig. 5-51 for applying grease properly.

16) Fit an O-ring (supplied with the harmonic drive) coated with harmonic grease into the O-ring groove on the new harmonic drive. (See Fig. 5-51.) Apply small amounts of "Screw Lock" to the bolts (M3×30L, 13 pieces) and tighten them to secure the harmonic drive to the Y-axis arm from the top of the Y-axis arm. (See Fig. 5-50.)

⚠ **CAUTION**

DO NOT ALLOW THE O-RING TO GET CAUGHT OUT OF THE GROOVE DURING REASSEMBLY. A TROUBLE WILL OCCUR IF THE ROBOT IS OPERATED WITH THE O-RING LEFT CAUGHT OUT OF THE GROOVE.

17) Apply small amounts of "Screw Lock" to the M4 set screws (2 pieces) and tighten them to secure the pulley to the wave generator. (See Fig. 5-50.)

18) Fit the timing belt onto the wave generator pulley and motor pulley, and then secure the motor plate. (See Fig. 5-50.)

⚠ **CAUTION**

IT IS NECESSARY TO APPLY CORRECT TENSION TO THE TIMING BELT DURING REASSEMBLY. REFER TO "8 ADJUSTING THE TIMING BELT TENSION" IN CHAPTER 4.

19) Fit a new O-ring into the O-ring groove on the fastening plate and also replace the edge seal with new one. Then secure the fastening plate to the harmonic drive with the bolts (M3×30L, 8 pieces) you removed earlier. (See Fig. 5-48 and Fig. 5-52.)

At this point, be careful to keep the spline shaft from coming off the spline nut.

⚠ **CAUTION** ────────────────────────────────

THE HARMONIC DRIVE SERVICE LIFE MAY SHORTEN IF THE EDGE SEAL EFFECT IS INSUFFICIENT, SO CAREFULLY REASSEMBLE THE PARTS.

──
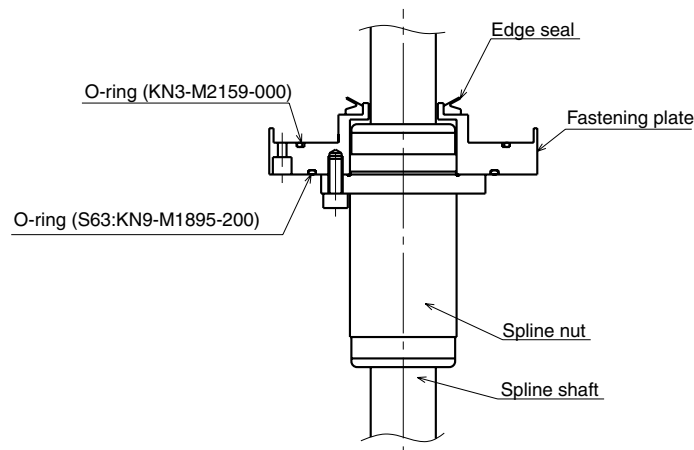
Fig. 5-52

20) Insert the bearing mount plate and bearing onto the spline from the top, and tighten the U-nut to secure the baring. (Utilize the φ8 through-hole when tightening the U-nut like you did to loosen it.) (See Fig. 5-47.)

21) Insert the spline and bearing through the holder and secure them with the bolts you removed earlier (M5×16L, 4 pieces). (See Fig. 5-46.)

22) Reattach the Y-axis arm upper cover.

23) Go outside the safeguard enclosure.

24) Check that no one is inside the safeguard enclosure, and then turn on the controller.

⚠ **CAUTION** ────────────────────────────────

AFTER THE HARMONIC DRIVE IS REPLACED, THE ABSOLUTE RESET MUST BE PERFORMED, AND THE POINT DATA MUST BE RESET. REFER TO "CHAPTER 4 ADJUSTMENT" TO ADJUST IT.

──

6   Replacing the bellows

The XC series robots use bellows to prevent dust generation from the spline shaft. If the bellows are broken, replace them as explained below. For bolt tightening torque in this work, see Table 5-2. Perform the replacement work while referring to Table 5-3 and Fig. 5-53.

⚠ **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 FELL DOWN SUFFICIENTLY.

_____

1) Prepare the following tools and items.
   - Hex wrench set
   - Phillips-head screwdriver

2) Turn off the controller.

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

4) Enter the safeguard enclosure.

5) Remove the end effector.

6) Loosen set screws 3, 9, 15 located on the bellows bottom clamp plate. (There are two pieces each.)

7) Remove the screws and bolts 1, 7, 13 on the bellows top clamp plate.

8) Pull out the bellows bottom clamp plates from the spline shaft.

⚠ **CAUTION**   _____

O-RINGS 4, 10, 16 ARE FITTED TO THE TOP OF THE BELLOWS, SO BE CAREFUL NOT TO DROP THEM INTO PERIPHERAL UNITS.

_____

⚠ **CAUTION**   _____

O-RINGS 5, 11, 17 ARE FITTED TO THE BOTTOM OF THE BELLOWS, SO BE CAREFUL NOT TO DROP THEM INTO PERIPHERAL UNITS.

_____

9) Replace O-rings 6, 12, 18 fitted to the spline shaft with new ones.

10) Fit new O-rings 5, 11, 17 to one of the bellows bottom clamp plates, insert the bellows end between the two clamp plates, and tighten bolts 2, 8, 14 to fasten them.

⚠ **CAUTION** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

USE CAUTION NOT TO LET O-RINGS TO PROTRUDE FROM THEIR
GROOVES AND BE PINCHED. IF THE ROBOT IS OPERATED WHILE AN
O-RING IS STILL PINCHED, THE CLEANLINESS DEGREE MAY
DEGRADE.

━━

11) Attach the clamp plate to the top of the bellows.

12) Fit O-rings 4, 10, 16 into the O-ring grooves on the robot body.

13) Attach the bellows to the spline shaft. A little bit large force is required due
    to O-rings, but fully insert the bellows all the way into the position. (Refer
    to Fig, 5-53 for installation height.)

14) Tighten bolts 1, 7, 13 to secure the bellows top clamp plate.

⚠ **CAUTION** ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━

USE CAUTION NOT TO LET O-RINGS TO PROTRUDE FROM THEIR
GROOVES AND BE PINCHED. IF THE ROBOT IS OPERATED WHILE AN
O-RING IS STILL PINCHED, THE CLEANLINESS DEGREE MAY
DEGRADE.

━━

15) Rotate the bellows bottom clamp plates to correct a twist in the bellows.

16) Tighten set screws 3, 9, 15 on the bellows bottom clamp plate. (There are 2
    pieces each.)

17) Reattach the end effector.

18) Go outside the safeguard enclosure.

19) Check that no one is inside the safeguard enclosure, and then turn on the
    controller.

Table 5-3 (See also Fig. 5-53.)

Robot model	Part name	No.	Size/spec	Q'ty
R6YXCH250	Hex socket head bolt	1	M3x12	8
R6YXCH350	Hex socket head bolt	2	M3x12	8
R6YXCH400	Set screw	3	M4x6	2
	O-ring	4	S53	1
	O-ring	5	S50	1
	O-ring	6	S14	1
R6YXC500	Hex socket head bolt	7	M3x10	12
R6YXC600	Hex socket head bolt	8	M3x10	8
	Set screw	9	M4x6	2
	O-ring	10	S63	1
	O-ring	11	S50	1
	O-ring	12	S16	1
R6YXC700	Hex socket head bolt	13	M3x8	12
R6YXC800	Hex socket head bolt	14	M3x10	8
R6YXC1000	Set screw	15	M4x6	2
	O-ring	16	S63	1
	O-ring	17	S50	1
	O-ring	18	P18	1

R6YXCH250, R6YXCH350, R6YXCH400

R6YXC500, R6YXC600

R6YXC700, R6YXC800, R6YXC1000
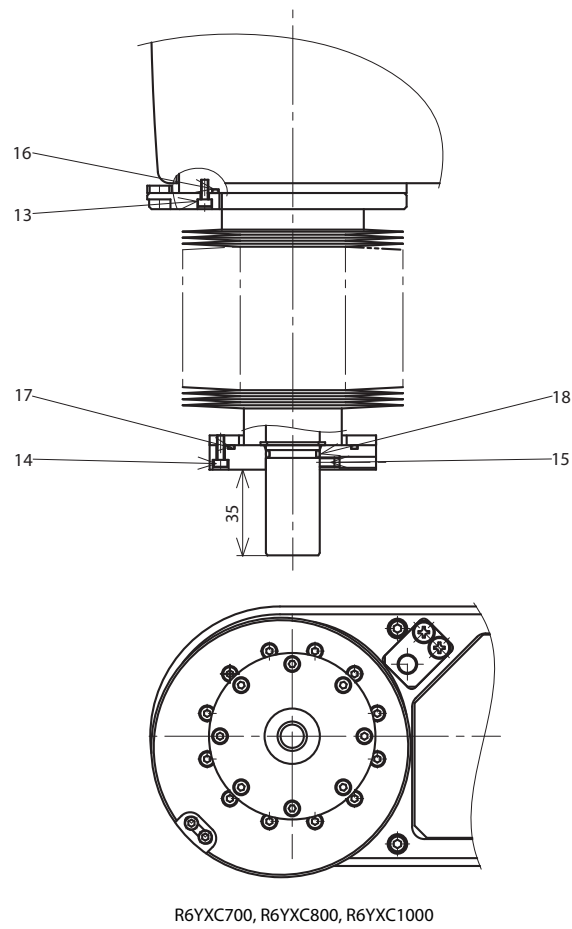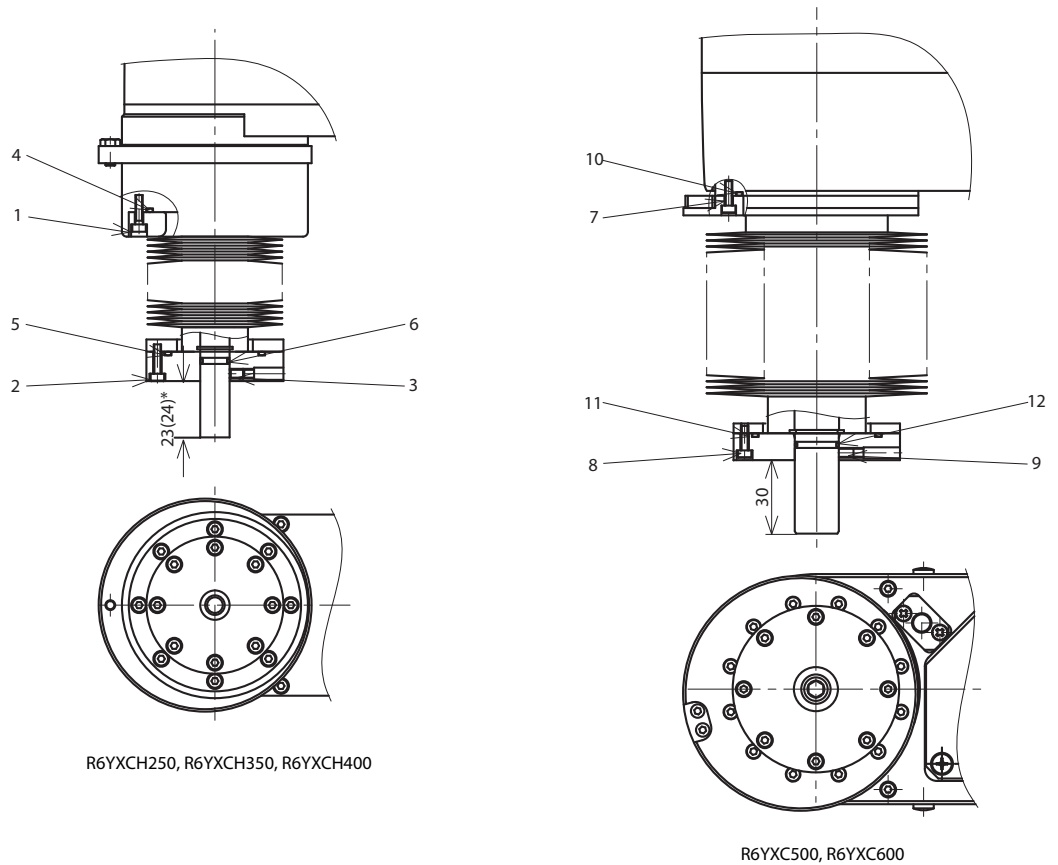
Fig. 5-53

CHAPTER 6

Specifications

1   Manipulator

1-1   Basic specification

Robot model			R6YXCH250	R6YXCH350	R6YXCH400
Axis specifi-cations	X-axis	Arm length	125mm	225mm	225mm
		Rotation angle	±115º	±115º	±115º
	Y-axis	Arm length	125mm	125mm	175mm
		Rotation angle	±130º	±128º	±143º
	Z-axis	Stroke	150mm	150mm	150mm
	R-axis	Rotation angle	±180º	±180º	±180º
Motor		X-axis	200W	200W	200W
		Y-axis	100W	100W	100W
		Z-axis	100W	100W	100W
		R-axis	100W	100W	100W
Maximum speed		XY resultant	4.0m/s	5.0m/s	6.0m/s
		Z-axis	1.0m/s	1.0m/s	1.0m/s
		R-axis	1020°/s	1020°/s	1020°/s
Repeatability *1		XY-axes	±0.01mm	±0.01mm	±0.01mm
		Z-axis	±0.01mm	±0.01mm	±0.01mm
		R-axis	±0.005º	±0.005º	±0.005º
Payload			3kg	3kg	3kg
R-axis tolerable moment of inertia *2			$0.05 kgm^2 (0.5 kgfcms^2)$		
User wiring			10 cables	10 cables	10 cables
User tubing (Outer diameter)			4x3	4x3	4x3
Travel limit			1.Soft limit 2.Mechanical limit (XYZ-axes)		
Robot cable			3.5m (option: 5m, 10m)		
Weight			16kg	16kg	16kg
Cleanliness class			Class 10 (0.1 micron base, during air suction)		
Suction air flow			60 Nl/min		

*1 At constant ambient temperature (XY)

*2 There are limits to acceleration coefficient settings.

Robot model			R6YXC500	R6YXC600
Axis specifi-cations	X-axis	Arm length	250mm	350mm
		Rotation angle	±120º	±120º
	Y-axis	Arm length	250mm	250mm
		Rotation angle	±142º	±145º
	Z-axis	Stroke	200, 300mm	200, 300mm
	R-axis	Rotation angle	±180º	±180º
Motor		X-axis	400W	400W
		Y-axis	200W	200W
		Z-axis	200W	200W
		R-axis	100W	100W
Maximum speed		XY resultant	4.9m/s	5.6m/s
		Z-axis	1.7m/s	1.7m/s
		R-axis	876°/s	876°/s
Repeatability *1		XY-axes	±0.02mm	±0.02mm
		Z-axis	±0.01mm	±0.01mm
		R-axis	±0.005º	±0.005º
Payload			10kg	10kg
R-axis tolerable moment of inertia *2			0.12kgm^2 (1.2kgfcms^2)	
User wiring			20 cables	20 cables
User tubing (Outer diameter)			6x3	6x3
Travel limit			1.Soft limit 2.Mechanical limit (XYZ-axes)	
Robot cable			3.5m (option: 5m, 10m)	
Weight			31kg	33kg
Cleanliness class			Class 10 (0.1 micron base, during air suction)	
Suction air flow			60 Nl/min	

*1 At constant ambient temperature (XY)

*2 There are limits to acceleration coefficient settings.

Robot Model			R6YXC700	R6YXC800	R6YXC1000
Axis specifi-cations	X-axis	Arm length	350mm	450mm	550mm
		Rotation angle	±120º	±120º	±120º
	Y-axis	Arm length	350mm	350mm	450mm
		Rotation angle	±145º	±145º	±145º
	Z-axis	Stroke	200, 400mm	200, 400mm	200, 400mm
	R-axis	Rotation angle	±180º	±180º	±180º
Motor		X-axis	800W	800W	800W
		Y-axis	400W	400W	400W
		Z-axis	400W	400W	400W
		R-axis	200W	200W	200W
Maximum speed		XY resultant	6.7m/s	7.3m/s	8.0m/s
		Z-axis	1.7m/s	1.7m/s	1.7m/s
		R-axis	600°/s	600°/s	600°/s
Repeatability *1		X,Y-axes	±0.02mm	±0.02mm	±0.02mm
		Z-axis	±0.01mm	±0.01mm	±0.01mm
		R-axis	±0.005º	±0.005º	±0.005º
Payload			20kg	20kg	20kg
R-axis tolerable moment of inertia *2			$0.32 kgm^2 (3.2 kgfcms^2)$		
User wiring			20 cables	20 cables	20 cables
User tubing (Outer diameter)			6x3	6x3	6x3
Travel limit			1.Soft limit 2.Mechanical limit (XYZ-axes)		
Robot cable			3.5m,option:5m,10m		
Weight			57kg	58kg	59kg
Cleanliness class			Class 10 (0.1 micron base, during air suction)		
Suction air flow			60 Nl/min		

∗1 At constant ambient temperature (XY)

∗2 There are limits to acceleration coefficient settings.

Sound level

Robot model	Maximum sound pressure level of robot (lat 10dB or more difference from background sound pressure level)	Position of maximum sound pressure level
R6YXCH250, R6YXCH350, R6YXCH400	69.8dB	1.0m away from the rear of robot, 1.6m height
R6YXC500, R6YXC600	69.7dB	1.0m away from the rear of robot, 1.6m height
R6YXC700, R6YXC800, R6YXC1000	69.4dB	1.0m away from the rear of robot, 1.6m height

Note: Sound level may increase when sound reflecting objects are located near the robot   .

1-2   Robot inner wiring diagram
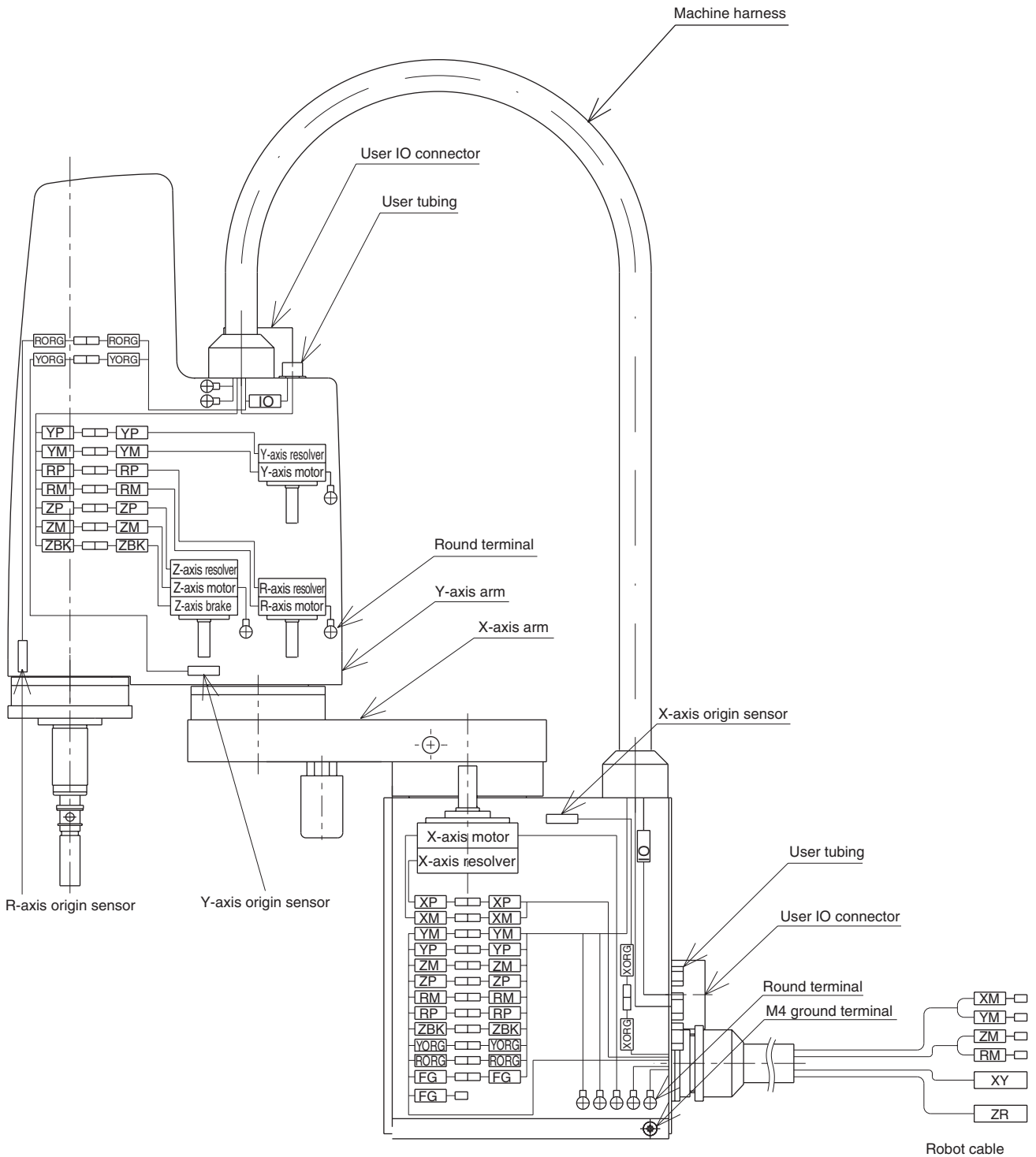
Fig. 6-1 YK250XC(H), YK350XC(H), YK400XC(H)
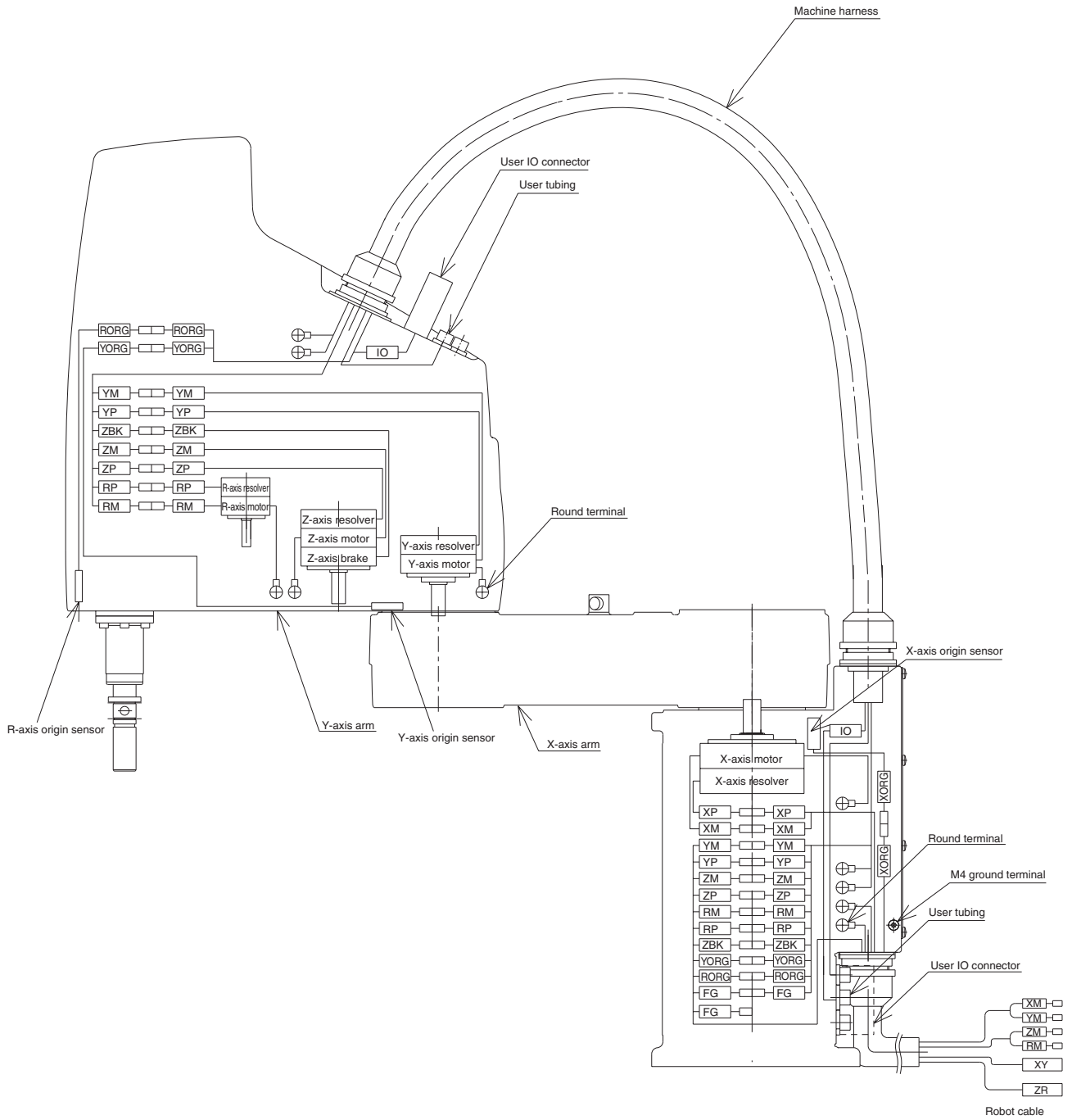
Fig. 6-2 YK500XC, YK600XC, YK700XC, YK800XC, YK1000XC

1-3 Wiring table

Robot cable wiring table

Signal		Connector	No	Connection	No	Connector	Color	Wire
Resolver	S2	XP	1		1	XY	Blue	0.15sq
	S4		2		2		Orange	Twisted pair
	S1		3		3		Green	0.15sq
	S3		4		4		Brown	Twisted pair
	R1		5		5		Gray	0.15sq
	R2		6		6		Red	Twisted pair
	DG		7		7		Green	0.3sq
Resolver	S2	YP	1		19		Black	0.15sq
	S4		2		20		Yellow	Twisted pair
	S1		3		21		Pink	0.15sq
	S3		4		22		Purple	Twisted pair
	R1		5		23		White	0.15sq
	R2		6		24		Blue/Red	Twisted pair
	DG		7		25		Green	0.3sq
FG		FG	1		18		Orange/White	0.15sq
					36		Green/White	0.15sq
HLIM					10		Green	0.3sq
GND24					11			
HLIM					28		Green	0.3sq
GND24					29			
Origin Sensor	GND	XORG	3		13		Yellow/Black	0.15sq
	ORG		2		12		Pink/Black	Twisted pair
	24V		1		9		Purple/White	0.15sq
Origin Sensor	24V	YORG	1		27		White/Blue	Twisted pair
	ORG		2		30		Blue/Red2	0.15sq
	GND		3		31		Orange/White2	Twisted pair
U		XM	1		2	XM	Black	0.75sq
V			2		3		Red	0.75sq
W			3		4		White	0.75sq
FG		Round terminal			1		Yellow/Green	0.75sq
U		YM	1		2	YM	Yellow	0.75sq
V			2		3		Brown	0.75sq
W			3		4		Blue	0.75sq

Signal		Connector	No	Connection	No	Connector	Color	Wire
Resolver	S2	ZP	1		1	ZR	Blue	0.15sq
	S4		2		2		Orange	Twisted pair
	S1		3		3		Green	0.15sq
	S3		4		4		Brown	Twisted pair
	R1		5		5		Gray	0.15sq
	R2		6		6		Red	Twisted pair
	DG		7		7		Green	0.3sq
Brake	MB+	ZBK	1		14		Black	0.15sq
	MB-		2		16		Yellow	Twisted pair
					15		Pink	0.15sq
					17		Purple	Twisted pair
Resolver	S2	RP	1		19		White	0.15sq
	S4		2		20		Blue/Red	Twisted pair
	S1		3		21		Orange/White	0.15sq
	S3		4		22		Green/White	Twisted pair
	R1		5		23		Brown/White	0.15sq
	R2		6		24		Gray/White	Twisted pair
	DG		7		25		Green	0.3sq
	FG	FG	1		18		Red/White	0.15sq
					36		Black/White	0.15sq
	HLIM				10		Green	0.3sq
	GND24				11			
	HLIM				28		Green	0.3sq
	GND24				29			
Origin Sensor	24V	RORG	1		27		White/Blue	0.15sq
	ORG		2		30		Blue/Red2	0.15sq
	GND		3		31		Orange/White2	Twisted pair
	U	ZM	1		2	ZM	Black	0.75sq
	V		2		3		Red	0.75sq
	W		3		4		White	0.75sq
	FG	Round terminal			1		Yellow/Green	0.75sq
	U	RM	1		2	RM	Yellow	0.75sq
	V		2		3		Brown	0.75sq
	W		3		4		Blue	0.75sq

Machine harness wiring table
YK250XC(H), YK350XC(H), YK400XC(H)

Y-axis arm side					Base side		
Signal	Connector	No	Connection	No	Connector	Color	Wire
Y-axis Resolver S2		1		1		Brown	0.2mm^2
S4	YP	2		2	YP	White	Twisted pair
S1		3		3		Red	0.2mm^2
S3		4		4		White	Twisted pair
R1		5		5		Orange	0.2mm^2
R2		6		6		White	Twisted pair
DG		7		7		Green	Shield
Z-axis Resolver S2		1		1		Brown	0.2mm^2
S4		2		2		Black	Twisted pair
S1		3		3		Red	0.2mm^2
S3	ZP	4		4	ZP	Black	Twisted pair
R1		5		5		Orange	0.2mm^2
R2		6		6		Black	Twisted pair
DG		7		7		Green	Shield
R-axis Resolver S2		1		1		Brown	0.2mm^2
S4		2		2		Gray	Twisted pair
S1		3		3		Red	0.2mm^2
S3	RP	4		4	RP	Gray	Twisted pair
R1		5		5		Orange	0.2mm^2
R2		6		6		Gray	Twisted pair
DG		7		7		Green	Shield
Y-axis motor U		1		1		Brown	
V	YM	2		2	YM	Red	0.75mm^2
W		3		3		Orange	
Z-axis motor U		1		1		Blue	
V	ZM	2		2	ZM	Purple	0.75mm^2
W		3		3		Gray	
R-axis motor U		1		1		Black	
V	RM	2		2	RM	White	0.75mm^2
W		3		3		Red	
Z-axis brake 1	ZBK	1		1	ZBK	Purple	0.3mm^2
Z-axis brake 2		2		2		Gray	
		1		1		Brown	
		2		2		Red	
		3		3		Orange	
		4		4		Blue	0.2mm^2
		5		5		Purple	
User signal line	IO	6		6	IO	Gray	
		7		7		White	
		8		8		Brown	
		9		9		Red	
		10		10		Orange	
		11		11			0.2mm^2
		12		12			
		13		13			
		14		14			
Frame ground		15		15		Green	Shield
Frame ground				1	FG	Green	Shield
Origin Sensor 24V		1		1		White	
ORG	YORG	2		2	YORG	Purple	0.2mm^2
GND		3		3		Gray	
Origin Sensor 24V		1		1		White	
ORG	RORG	2		2	RORG	Blue	0.2mm^2
GND		3		3		Gray	
	Round terminal				Round terminal	Yellow/Green	0.75sq
	Round terminal				Round terminal	Blue	0.75sq

Machine harness wiring table
YK500XC, YK600XC, YK700XC, YK800XC, YK1000XC

Signal		Connector	No	Connection	No	Connector	Color	Wire
Y-axis Resolver	S2	YP	1		1	YP	Brown	0.2mm² Twisted pair
	S4		2		2		White	
	S1		3		3		Red	0.2mm² Twisted pair
	S3		4		4		White	
	R1		5		5		Orange	0.2mm² Twisted pair
	R2		6		6		White	
	DG		7		7		Green	Shield
Z-axis Resolver	S2	ZP	1		1	ZP	Brown	0.2mm² Twisted pair
	S4		2		2		Black	
	S1		3		3		Red	0.2mm² Twisted pair
	S3		4		4		Black	
	R1		5		5		Orange	0.2mm² Twisted pair
	R2		6		6		Black	
	DG		7		7		Green	Shield
R-axis Resolver	S2	RP	1		1	RP	Brown	0.2mm² Twisted pair
	S4		2		2		Gray	
	S1		3		3		Red	0.2mm² Twisted pair
	S3		4		4		Gray	
	R1		5		5		Orange	0.2mm² Twisted pair
	R2		6		6		Gray	
	DG		7		7		Green	Shield
Y-axis motor	U	YM	1		1	YM	Brown	
	V		2		2		Red	0.75mm²
	W		3		3		Orange	
Z-axis motor	U	ZM	1		1	ZM	Blue	
	V		2		2		Purple	0.75mm²
	W		3		3		Gray	
R-axis motor	U	RM	1		1	RM	Black	
	V		2		2		White	0.75mm²
	W		3		3		Brown	
Z-axis brake	1	ZBK	1		1	ZBK	White	0.3mm²
Z-axis brake	2		2		2		Black	
User signal line		IO	1		1	IO	Brown	0.2mm²
			2		2		Red	
			3		3		Orange	
			4		4		Blue	
			5		5		Purple	
			6		6		Gray	
			7		7		White	
			8		8		Black	
			9		9		Brown	
			10		10		Red	
			11		11		Orange	
			12		12		Blue	
			13		13		Brown	
			14		14		Red	
			15		15		Orange	
			16		16		Blue	
			17		17		Purple	
			18		18		Gray	0.2mm²
			19		19		White	
			20		20		Black	
			21		21		Brown	
			22		22		Red	
			23		23		Orange	
			24		24		Blue	
Frame ground			25		25		Green	Shield
Frame ground					1	FG	Green	Shield
Origin Sensor	24V	YORG	1		1	YORG	Brown	0.2mm²
	ORG		2		2		Red	
	GND		3		3		Orange	
Origin Sensor	24V	RORG	1		1	RORG	Brown	0.2mm²
	ORG		2		2		Blue	
	GND		3		3		Orange	
		Round terminal				Round terminal	Yellow/Green	0.75sq
		Round terminal				Round terminal	Black	0.75sq

Y-axis arm side   Base side

Motor wiring table
YK250XC(H), YK350XC(H), YK400XC(H), YK500XC, YK600XC, YK700XC, YK800XC, YK1000XC

Signal		Color	Connection	No.	Connector
Resolver	S2	Yellow		1	XP,YP,ZP,RP
	S4	Blue		2	
	S1	Red		3	
	S3	Black		4	
	R1	White		5	
	R2	Green		6	
	SHIELD	Black		7	
Motor	U	Red		1	XM, YM, ZM, RM
	V	White		2	
	W	Black		3	
	PE	Yellow/Green		1	Round terminal
Brake	BK	Yellow		1	ZBK (Z-axis motor only)
	BK	Yellow		2	

Origin sensor wiring table

Signal	Color	Connection	No.	Connector
+24V	Brown		1	XORG, YORG, RORG
ORG	Black		2	
0V	Blue		3	

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

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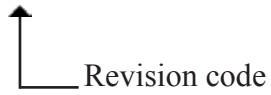
└── Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous revision.

Revision code	Date	Revised content
01	April 2010	Original production