YASKAWA

MOTOMAN-AR1440E
INSTRUCTIONS

TYPE:
YR-1-07VXHE6-A00
(MOTOMAN-AR1440E STANDARD SPECIFICATION)

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN-AR1440E INSTRUCTIONS
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

Have the following information available when contacting the YASKAWA Representative:
- System
- Primary Application
- Software Version *(Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})*
- Warranty ID *(Located on Robot Controller)*
- Robot Serial Number *(Located on Manipulator data plate)*
- Robot Sales Order Number *(Located on Robot controller data plate)*

Part Number: 185421-1CD
Revision: 1

MANUAL NO.
HW1485448 ① 1/97

DANGER

- This instruction manual is intended to explain mainly on the mechanical part of this manipulator for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator. Any matter not described in this manual must be regarded as “prohibited” or “improper”.
- General information related to safety are described in “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS.

CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product. The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of your manipulator.

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” and “CAUTION” .

DANGER

- Do not remove the motor, and do not release the brake.

Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

- Maintenance and inspection must be performed by specified personnel.

Failure to observe this caution may result in electric shock or injury.

- For disassembly or repair, contact your YASKAWA representative.

DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button

- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.

WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000 controller	YRC1000
YRC1000 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

Registered Trademark

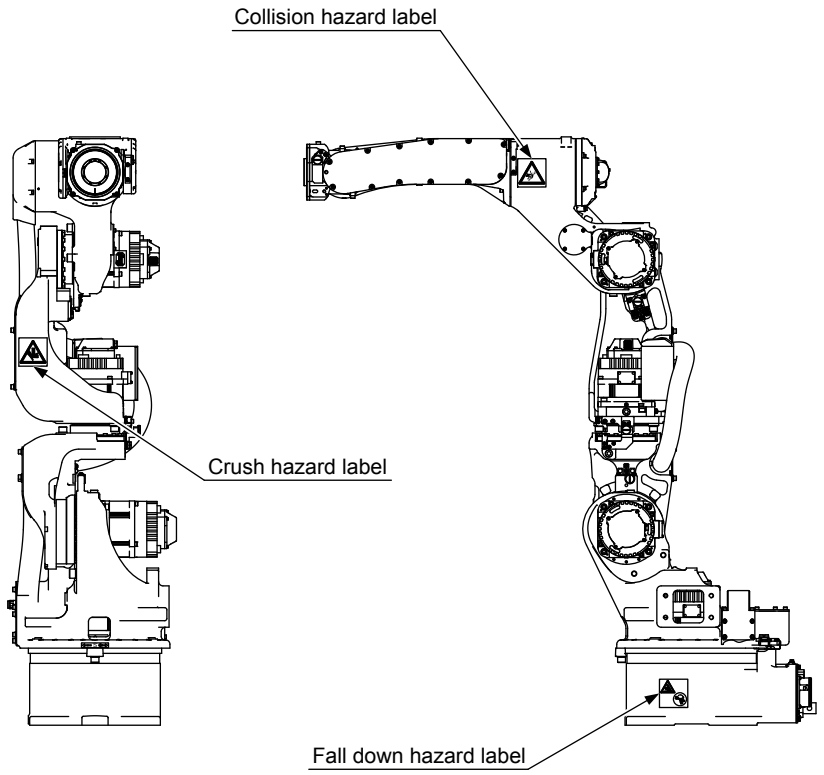
In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

Explanation of Warning Labels

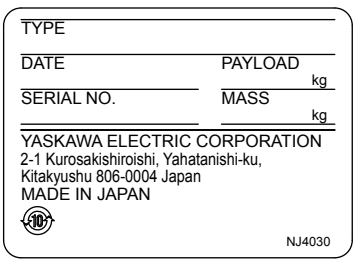
The following warning labels are attached to the manipulator. Always follow the warnings on the labels.
Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Note: Taking the maintenance-relevant trainings offered by YASKAWA is indispensable for replacing the L-axis of the balancer-equipped manipulator.

Fig. : Warning Label Locations



Nameplate



Fall down hazard label

Description

Make sure to secure the manipulator base by using the bolts of the specified sizes and by tightening the bolts with the specified tightening torques. If the power is turned ON and the manipulator is operated without securing the manipulator properly, the manipulator may fall down, which may result in personal injury and/or equipment damage.

Collision hazard label

Description

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:

- Turning ON the YRC1000 power
- Moving the manipulator by using the programming pendant
- Running the system in the check mode
- Performing automatic operations

Crush hazard label

Description

Keep clear of moving parts when performing a teaching operation within the manipulator's operating range. Failure to observe this instruction may result in personal injury.

1 Product Confirmation

CAUTION

- Confirm that the manipulator and the YRC1000 have the same order number. Pay special attention when installing two or more manipulators.

Failure to observe this instruction may cause improper movement of the manipulator, which may result in personal injury and/or equipment damage.

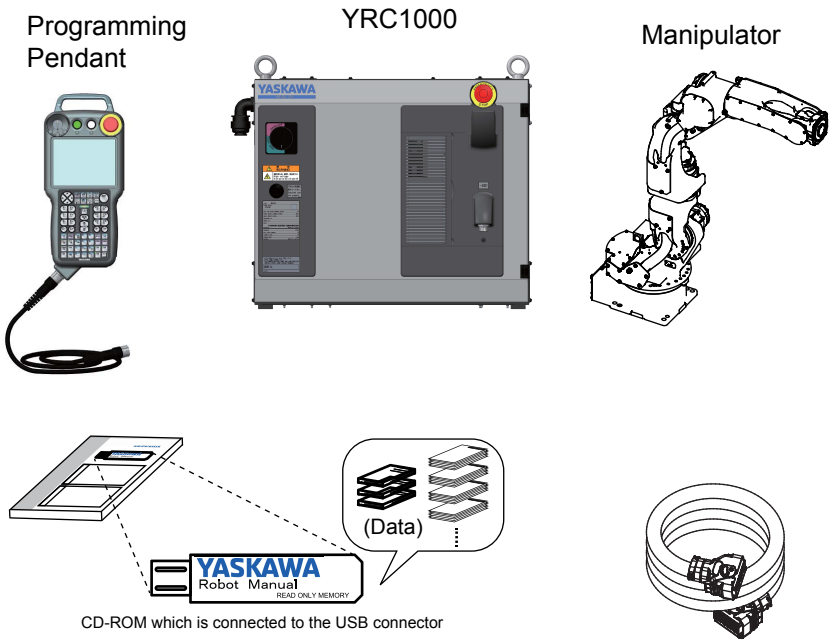
1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

Standard delivery includes the following five items (information for the content of optional goods are given separately):

- Manipulator (accessories included)
- YRC1000 (spare parts included)
- Programming pendant
- Manipulator cable (between the YRC1000 and the Manipulator)
- Manual

Fig. 1-1: Five Items for Standard Delivery



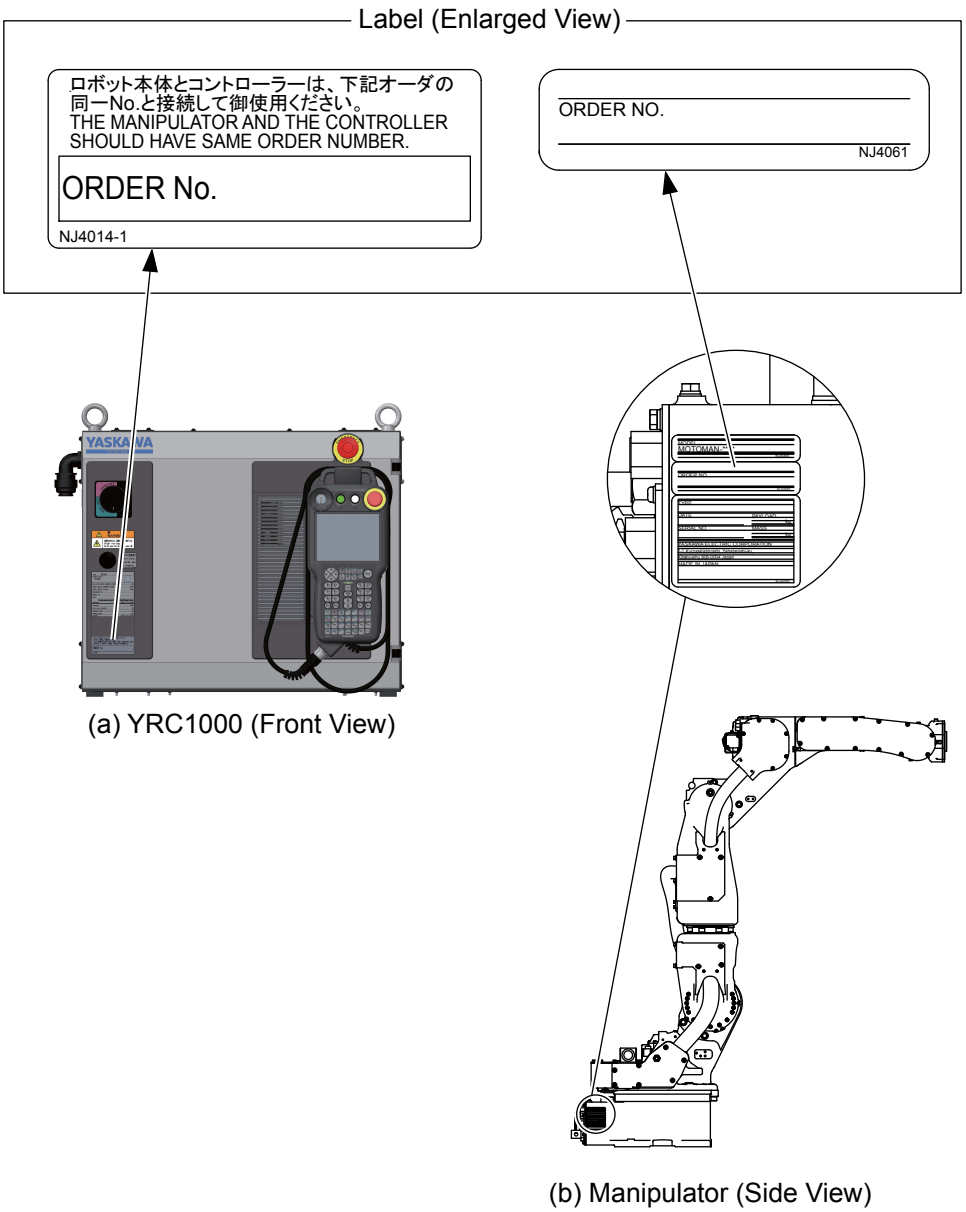
1 Product Confirmation
1.1 Contents Confirmation

Accessories of Manipulator	Pcs	Remarks
Hexagon socket head cap screw M16 (length:50 mm)	4	For mounting the manipulator
Conical spring washer 2H-16	4	
Grease zerk A-MT6X1	3	For grease replenishment of B- and T-axis
Grease zerk A-PT1/8	3	For grease replenishment for the R-axis
Grease zerk A-PT3/8	3	For grease replenishment for the S-, L-, E-, and U-axis
Cap TCV-2001-04	1	Cover of the terminal block for the welding power supply

1.2 Order Number Confirmation

Confirm the order number of the manipulator corresponds to the YRC1000. The order number is located on a label as shown below.

Fig. 1-2: Location of Order Number Labels



(a) YRC1000 (Front View)

(b) Manipulator (Side View)

2 Transport

WARNING

- Operation of the crane, sling, or forklift must be performed only by authorized personnel.

Failure to observe this instruction may result in personal injury and/or equipment damage.

NOTICE

- Avoid excessive vibration or shock while transporting or moving the manipulator.

Failure to observe this instruction may adversely affect the performance of the manipulator because it consists of precision components.

2.1 Transport Method

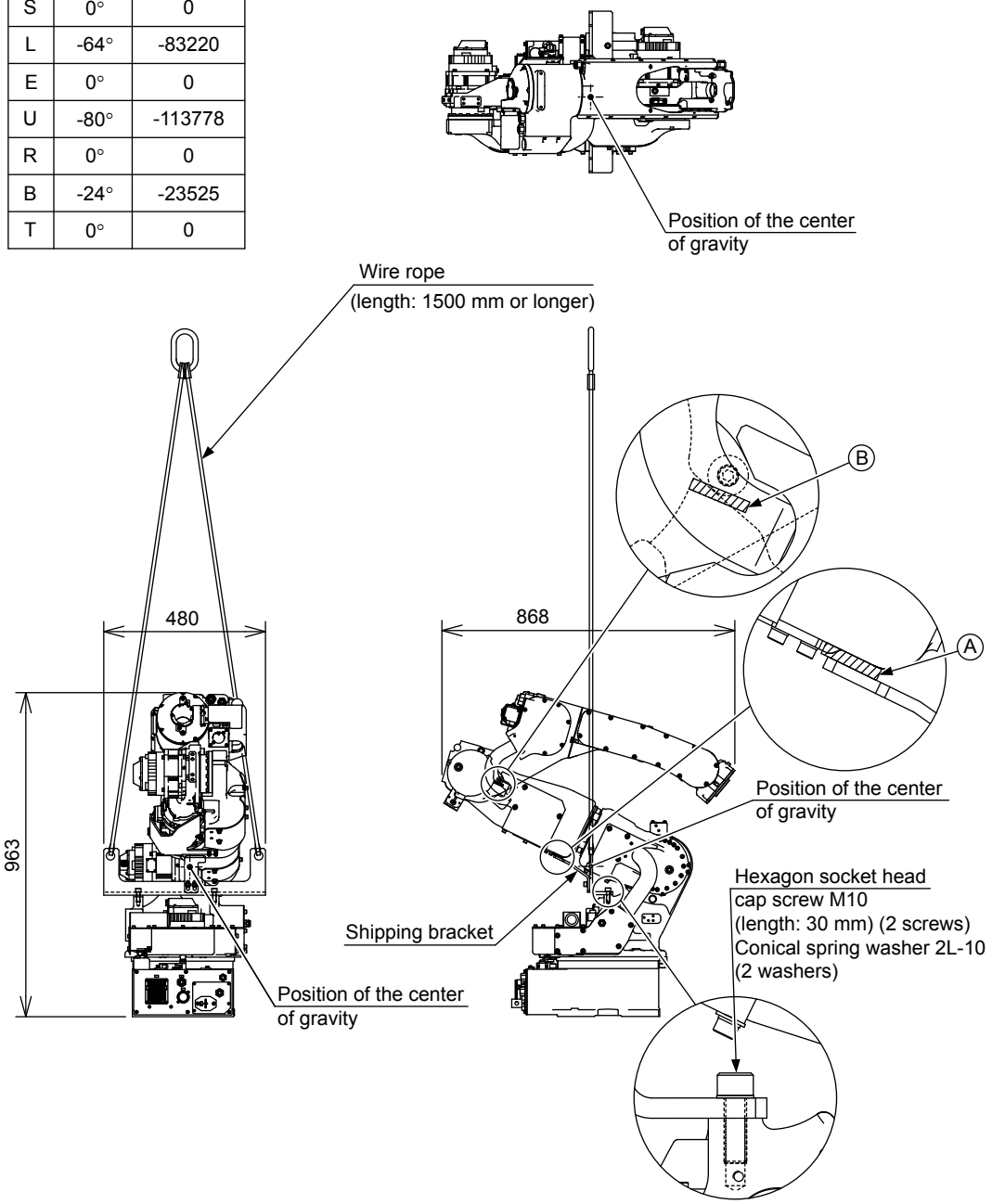
2.1.1 Using a Crane

As a rule, the manipulator must be lifted by a crane with two wire ropes when removing the manipulator from the package and moving it. Be sure to fix the manipulator with the cushioning materials for transport, and lift it in the posture as shown in *fig. 2-1 "Transporting Position (factory setting)"* . The length of the wire rope must be 1500 mm or longer.

Fig. 2-1: Transporting Position (factory setting)

Transporting Posture

Axis	Angle	Pulse
S	0°	0
L	-64°	-83220
E	0°	0
U	-80°	-113778
R	0°	0
B	-24°	-23525
T	0°	0



NOTE When lifting the manipulator, be careful not to damage the motor, connector, cable, etc.

2.1.2 Using a Forklift

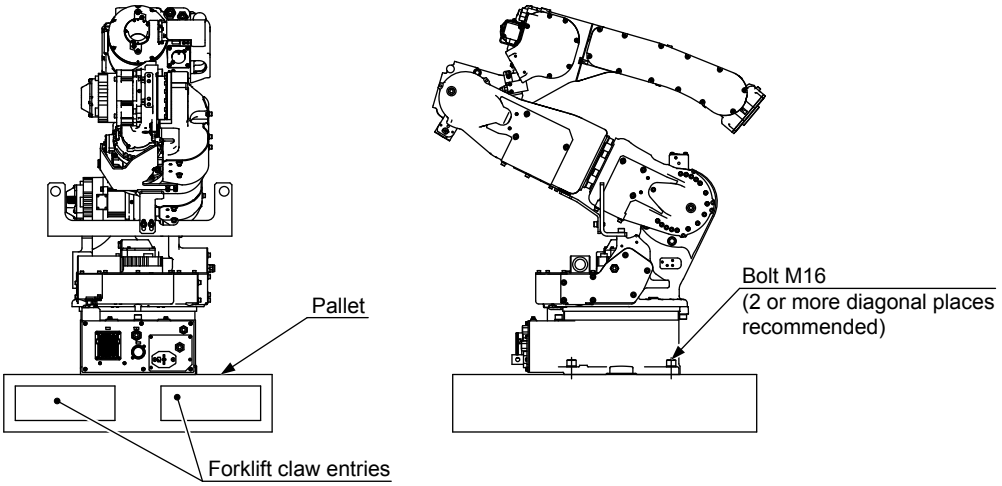
When using a forklift, attach shipping brackets to the manipulator in the posture as shown in *fig. 2-2 "Using a Forklift"* . Put a pallet under the manipulator, and secure the manipulator by using bolts or screws.

Insert claws of the forklift into the pallet, and transport the manipulator together with the pallet.

The pallet must be strong enough to support the manipulator.

Transport the manipulator slowly with due caution in order to avoid overturning or slippage.

Fig. 2-2: Using a Forklift



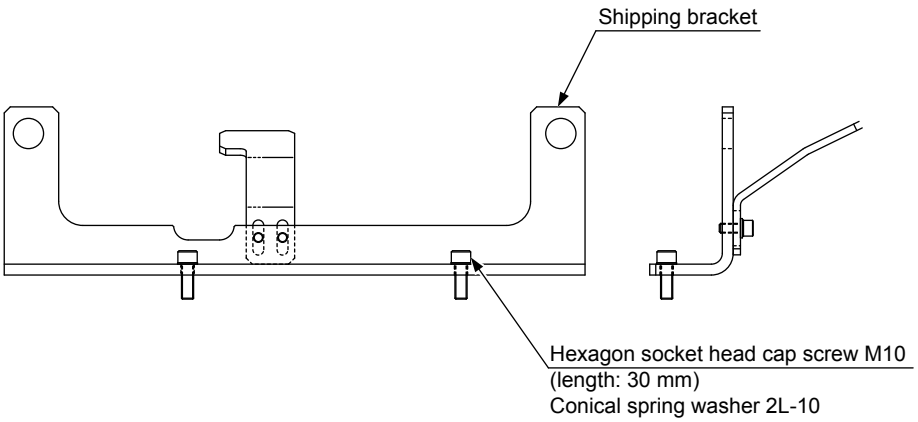
NOTE

- The weight of the manipulator is approximately 195 kg (including the shipping bolts and brackets). Use the wire strong enough to withstand the weight.
- When transporting, be sure to install the shipping brackets.
- Avoid applying external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.

2.2 Shipping Bracket

To protect the manipulator's machinery from external forces during transportation, shipping brackets are installed.
(Refer to *fig. 2-3 "Shipping Bracket"* .)

Fig. 2-3: Shipping Bracket



- The shipping brackets are painted yellow.
- The shipping bracket is fixed by using the hexagon socket head cap screws M10 (length: 30 mm) (2 screws) and the conical spring washers 2L-10.

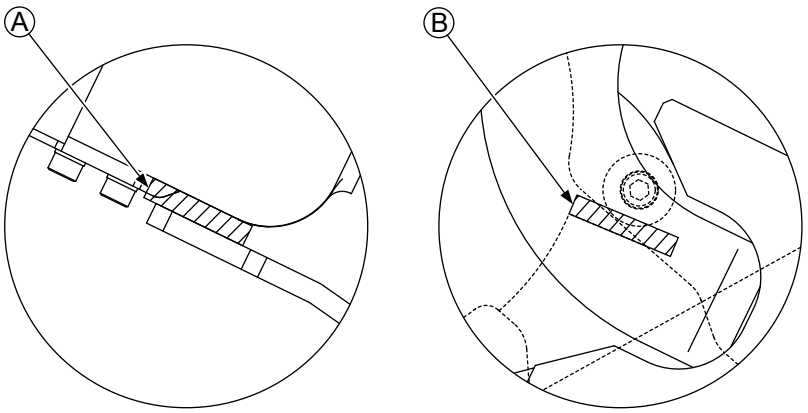
NOTE

Before turning ON the power, check to be sure that the shipping bolts/screws and brackets are removed. The shipping bolts and brackets then must be stored for future use, in the event that the manipulator must be moved again.

2.3 Cushioning Material for Transport

To protect the manipulator's machinery from external forces during transportation, the cushioning materials for transport are installed in the sections A and B. (Refer to *fig. 2-4 "Cushioning Materials for Transport"* .)

Fig. 2-4: Cushioning Materials for Transport



- A rubber cushion is respectively wedged at the sections A and B.

NOTE

Before turning ON the power, check to be sure that the cushioning materials for transport are removed.

In the event that the manipulator must be moved again, to avoid its main body from being damaged, the cushioning materials such as rubber plate, etc. must be used.

3 Installation

DANGER

- Install the safety fence.

Failure to observe this warning may result in injury or damage.

WARNING

- Do not perform the welding operation for a pedestal or etc. when the power cable is being connected.

Failure to observe this instruction may result in damage to an electric device due to the current of welding.

- Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, the safety fence, or the YRC1000, etc.

Failure to observe this warning may result in injury or damage.

- Make sure to firmly anchor the manipulator before turning ON the power and operating the manipulator.

Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.

- Do not install or operate a damaged manipulator or a manipulator any of whose components is missing.

Failure to observe this instruction may cause improper movement, etc. of the manipulator, which may result in personal injury and/or equipment damage.

NOTICE

- After completing the installation of the manipulator, make sure to remove the shipping bolts/screws and brackets before turning ON the power.

Failure to observe this instruction may result in damage to the main drive unit.

3.1 Installation of the Safety Fence

To insure safety, be sure to install safety fence. It prevents unforeseen accidents with personnel and damage to equipment. Refer to the following quoted clause for your information and guidance.

Responsibility for Safeguarding (ISO10218)

The user of a manipulator or robot system shall ensure that safety fences are provided and used in accordance with Sections 6, 7, and 8 of this standard. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

3.2 Mounting Procedures for Manipulator Base

The manipulator should be firmly mounted on a baseplate or foundation strong enough to support the manipulator and withstand reaction forces during acceleration and deceleration.

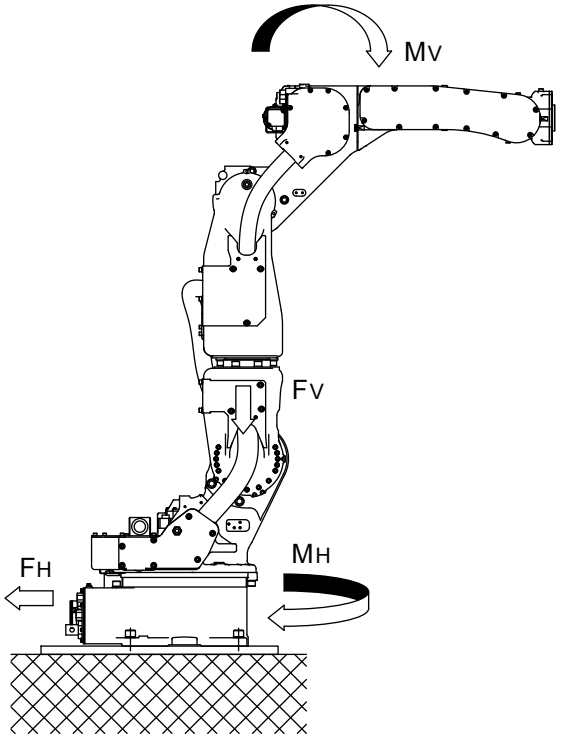
Construct a solid foundation with the appropriate thickness to withstand maximum reaction forces of the manipulator referring to *table 3-1 “Manipulator Reaction Force and Torque”* .

A baseplate flatness must be kept at 0.5 mm or less: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities. Mount the manipulator base as instructed in *chapter 3.2.1 “Mounting Example”* .

Table 3-1: Manipulator Reaction Force and Torque

	Horizontal rotation		**Vertical rotation**	
	Reaction force F_H	**Torque M_H**	**Reaction force F_V**	**Torque M_V**
Emergency stop	8340 N (850 kgf)	4120 N•m (420 kgf•m)	5885 N (600 kgf)	4120 N•m (420 kgf•m)
Acceleration/ deceleration	2945 N (300 kgf)	1275 N•m (130 kgf•m)	3480 N (350 kgf)	1670 N•m (170 kgf•m)

Fig. 3-1: Manipulator Reaction Force and Torque



3.2.1 Mounting Example

For the first process, anchor the baseplate firmly to the ground. The baseplate must be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommended to prepare a baseplate of 40 mm or more in thickness, and anchor bolts of M16 or larger size.

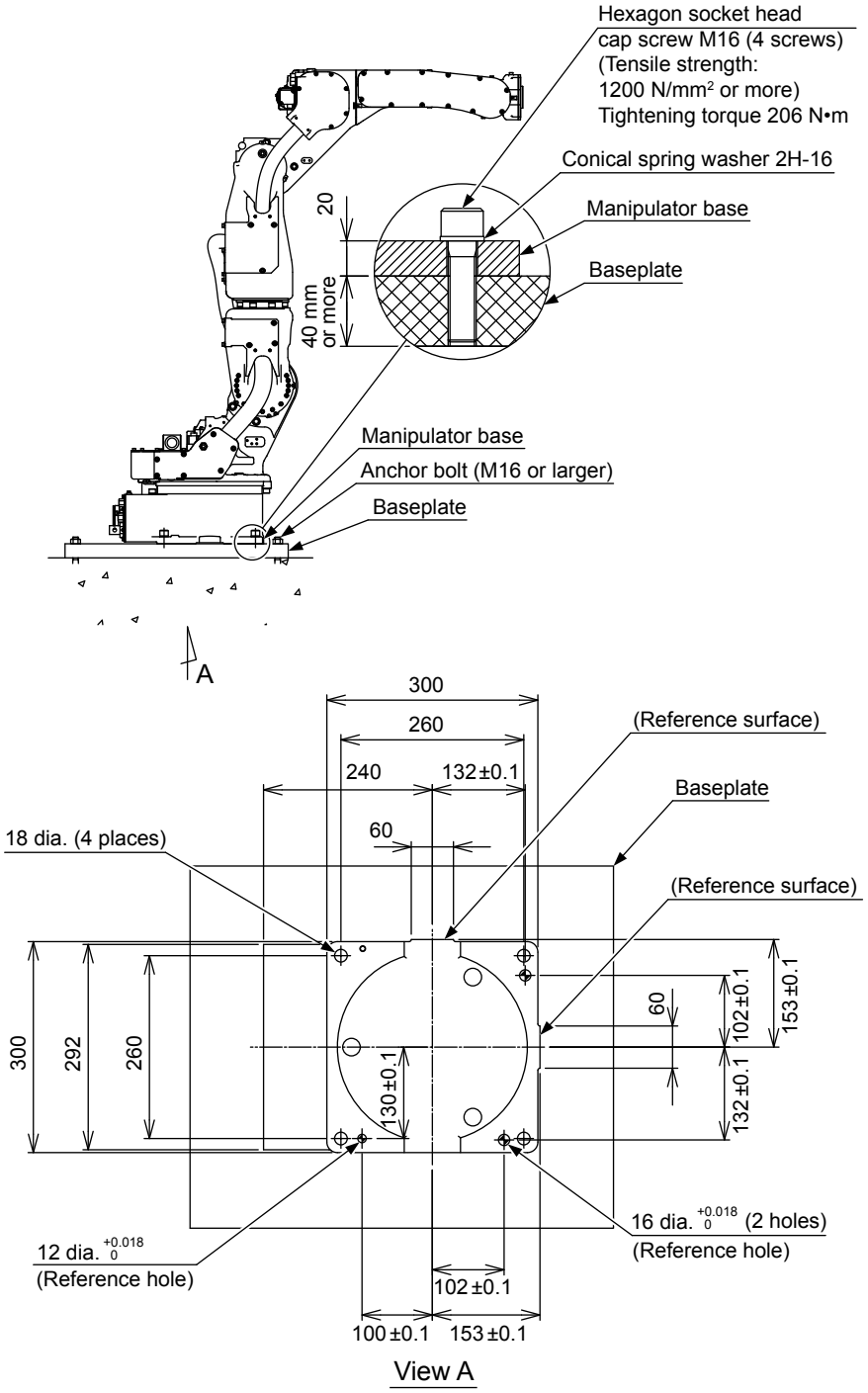
Next, fix the manipulator base to the baseplate. The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate by using four hexagon socket head cap screws M16 (Tensile strength: 1200 N/mm^2 or more) (50 mm long is recommended) by using a tightening torque 206 N·m.

Tighten the hexagon socket head cap screws and anchor bolts firmly so that they will not work loose during the operation. Refer to *fig. 3-2 “Mounting the Manipulator on Baseplate”* .

To improve the precision of installing position, holes or surface for reference are designed.

Use a nock pin or a fitting surface when precision is required for installation.

Fig. 3-2: Mounting the Manipulator on Baseplate



3.3 Mounting Method

This manipulator is mounted on the floor only.

A wall-mounted way, a tilt mounted way, and a ceiling mounted way are not available.

3.4 Location

When installing a manipulator, it is necessary to satisfy the following environmental conditions:

Table 3-2: Ambient Conditions

Type / Item	YR-1-07VXHE6-A00
Ambient temperature during operation	0°C - +45°C
Humidity	20%RH - 80%RH (no-condensing)
Vibration	4.9 m/s^2 (0.5G) or less
Altitude	1000 m or less
Flatness for installation	0.5 mm or less
Others	Free from dirt, dust, oil soot, or water
	Free from explosive and corrosive gas or liquid
	Free from excessive electrical noise (plasma)
	Free from strong magnetic field

NOTE

When the operation is started after the manipulator has been out of operation and left in the low temperature (almost 0°C) for a long period, the alarm may occur since the friction torque of the drive unit is large.
If the alarm occurs, perform the break-in for few minutes.

3.5 Notes on Dust-Proof/Water-Proof Specifications

This manipulator conforms to:

IP67 for the wrist part
IP54 for the main part of the manipulator

NOTE

< Definition of IP (protection class) >

• Definition of IP67

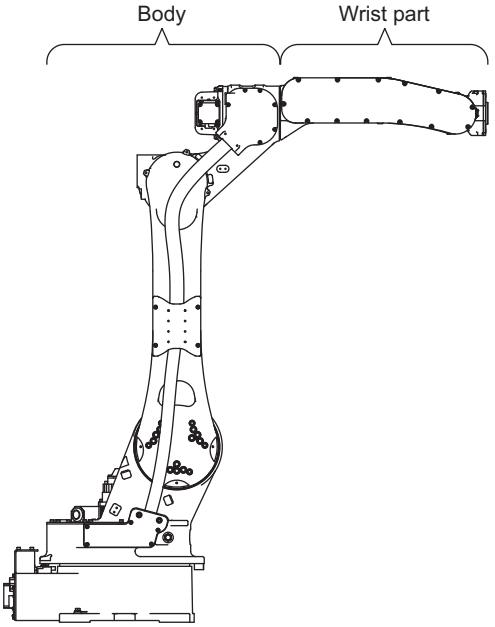
IP6□: Protection from the entry of dust.

IP □7: Protection from immersion in water with being submerged for a specified duration and pressure.

• Definition of IP54

IP5□: Protection from a certain amount of dust which is harmful enough to affect the normal operation of equipment.

IP □4: Protection from sprays and splashing of water in all directions.



Note: The illustration above shows a typical model.

However, the following precautions must be observed:

- Do not use the following liquids, because the rubber parts of the manipulator (gasket, oil seal, O-ring, etc.) may be deteriorated or corroded:
  - Organic solvent
  - Chlorine-based cutting fluid
  - Amine-based cleaning fluid
  - Corrosive substances such as acids, alkalis, or liquids/solutions causing rust
  - Other liquids/solutions to which nitrile-butadiene rubber (NBR) is not resistant
- After removing a gasket for parts replacement or maintenance/ inspection, make sure to replace the gasket with a new one.
- Do not use cutting fluid or cleaning fluid which contains unknown chemical substances.

4 Wiring

WARNING

- Ground resistance must be 100 Ω or less.

Failure to observe this warning may result in fire and/or electric shock.

- Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

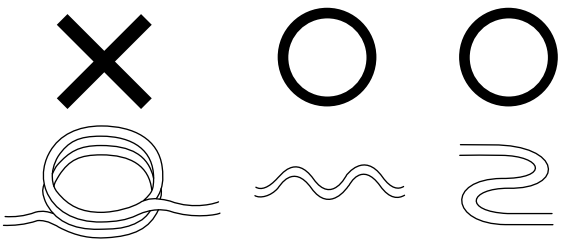
Failure to observe this warning may result in electric shock and/or personal injury.

- Wiring must be performed by authorized or certified personnel.

Failure to observe this caution may result in fire and/or electric shock.

- When laying the cables from the manipulator to the YRC1000, DO NOT cover the cable with heat insulating material and avoid multiple cabling.

Failure to observe this caution may result in burn caused by cable heat emission failure.



4.1 Grounding

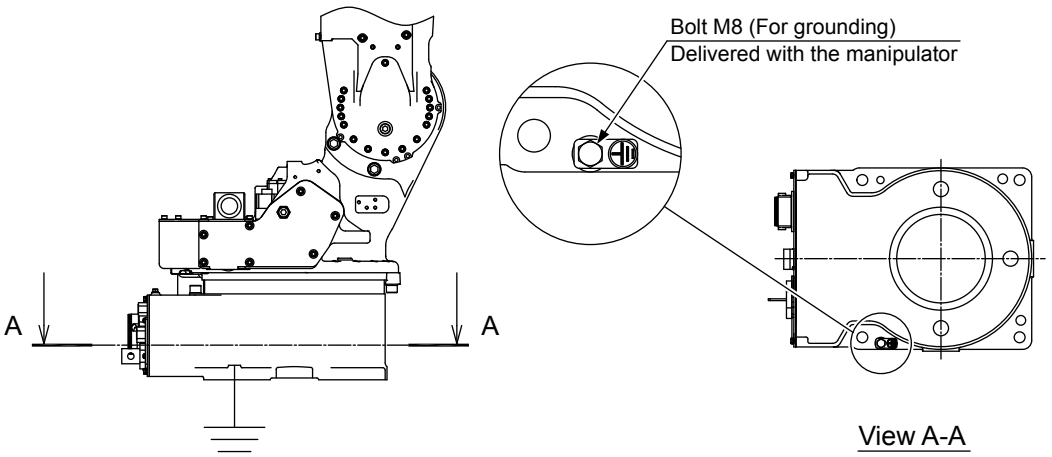
Follow electrical installation standards and wiring regulations for grounding. A ground wire of 5.5 mm^2 or more is recommended.

Refer to *fig. 4-1 "Grounding Method"* to connect the ground line directly to the manipulator.

NOTE

- Never use this wire sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with electrical installation standards.

Fig. 4-1: Grounding Method



4.2 Cable Connection

Connect the both edge of the manipulator cable to the manipulator base connectors and to the YRC1000. Before connecting the cable to the manipulator, verify the numbers on the connector as shown in *fig. 4-3 "Manipulator Cables"* .
For the connecting position, refer to *fig. 4-4 "Manipulator Cable Connection (Manipulator Side)"* and *fig. 4-5 "Manipulator Cable Connection (YRC1000 Side)"* .
Refer to *table 4-1 "Specifications of Manipulator Cable"* and *fig. 4-6 "Overhead View of Manipulator Cable Connection (Manipulator Side)"* for the outside diameter and the minimum bending radius (for fixed part and moving part) of the manipulator cable and the details of the manipulator cable connection on the manipulator side.

■ Procedures for Inserting the Connector

1. Confirm the connector lever of the manipulator cable is at the initial position. Insert the cable straight into the connector on the back side of the YRC1000. Insert the manipulator cable to a fixed depth then the lever rotates about 30 degree forward automatically.
2. Push the lever with hand and turn it (about 30 degree) until the lock is clicked.

■ Procedures for Removing the Connector

1. Release the lock by pushing the unlock part of the lever to unlock. Turn the lever about 60 degree to return to the initial position.
2. Pull out the connector straight.

Fig. 4-2: Connection of Manipulator Cable

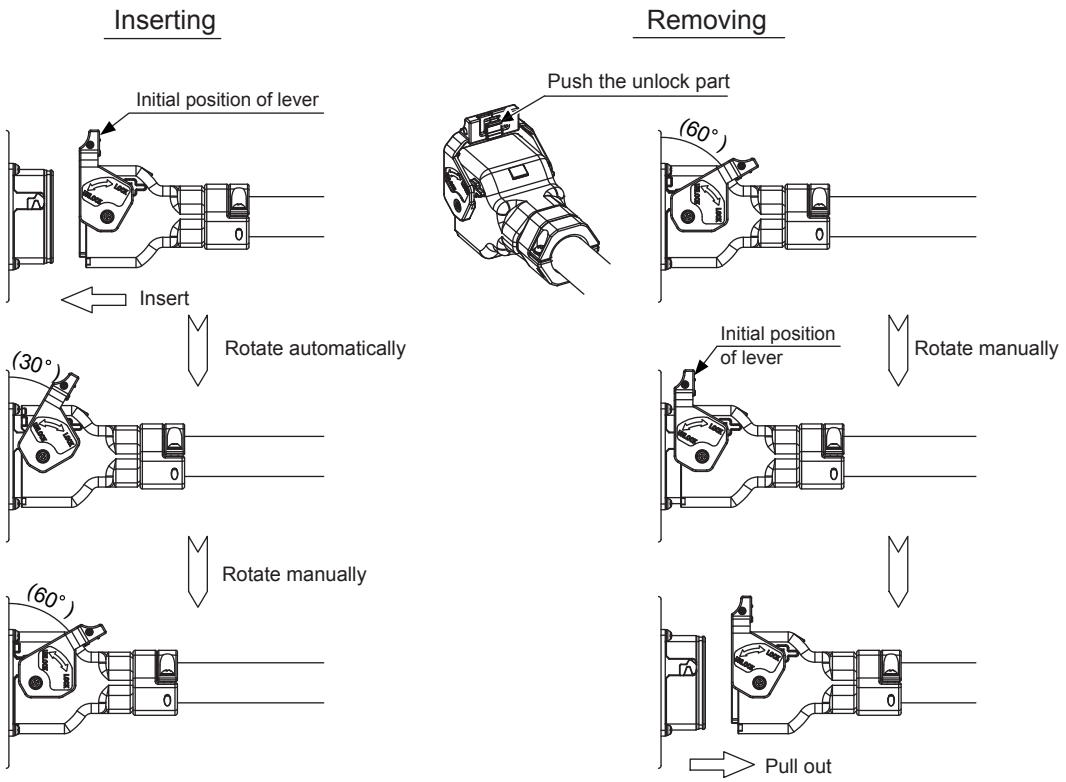


Fig. 4-3: Manipulator Cables

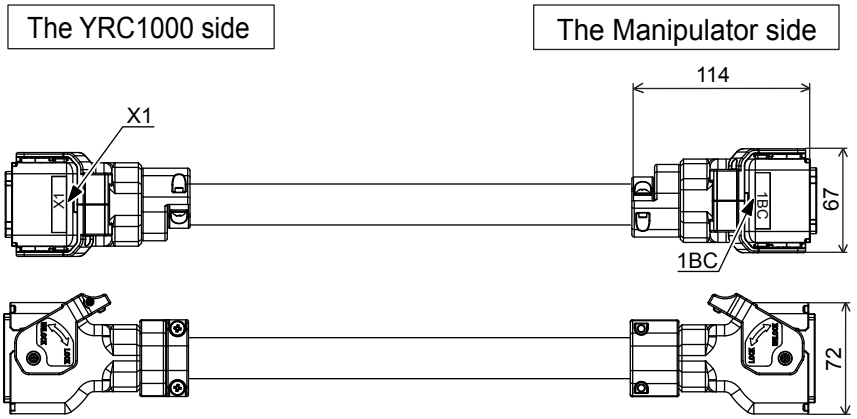


Fig. 4-4: Manipulator Cable Connection (Manipulator Side)

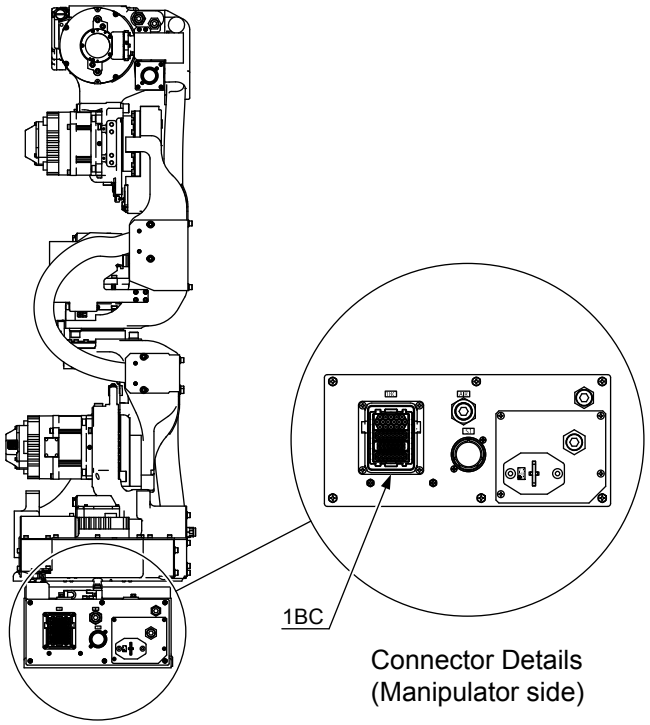


Fig. 4-5: Manipulator Cable Connection (YRC1000 Side)

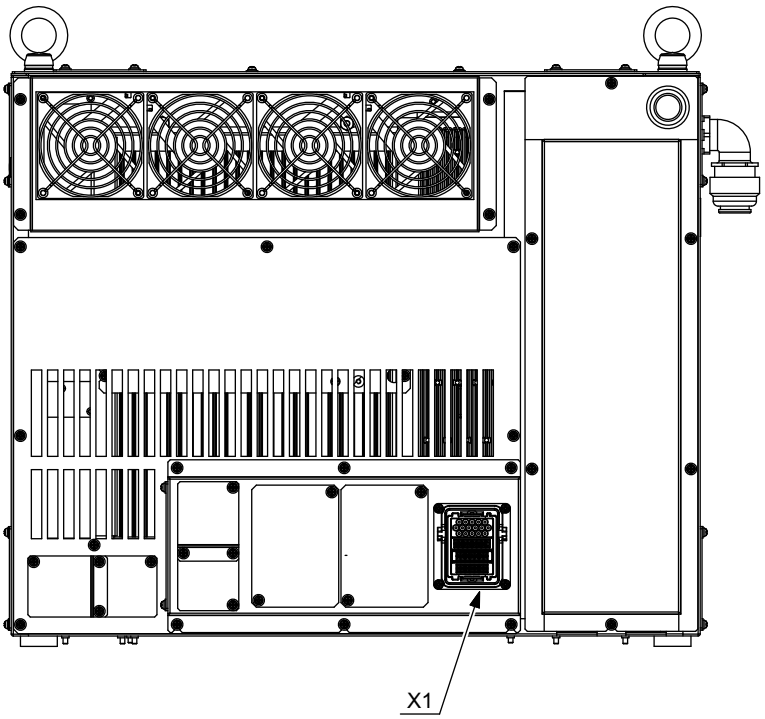
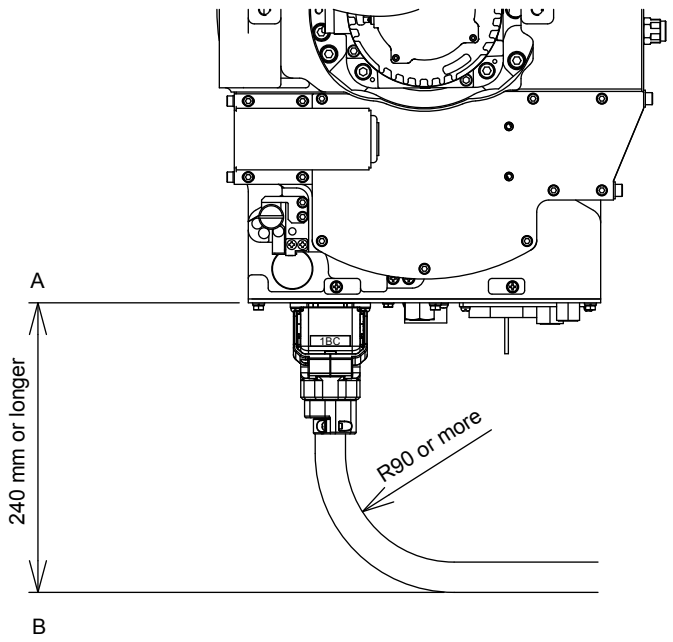


Table 4-1: Specifications of Manipulator Cable

Outside diameter (mm)	Minimum bending radius (mm)		Distance between A and B (mm)
25.1	Fixed part	Moving part	240
	90	260 [1)]	

1 The high flexible cable with a 150-mm bending radius is also available as an option.

Fig. 4-6: Overhead View of Manipulator Cable Connection (Manipulator Side)



5 Basic Specifications

5.1 Basic Specifications

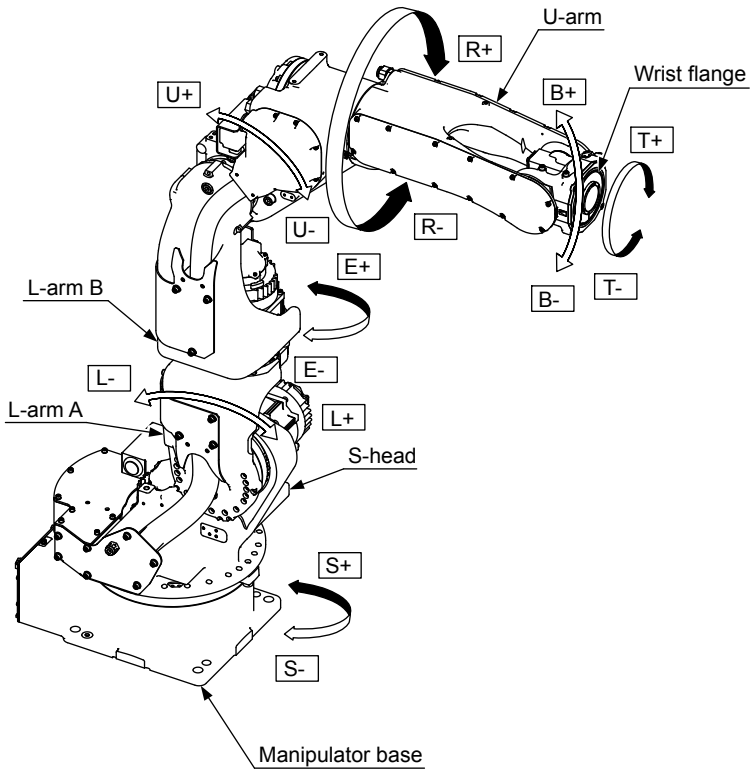
Table 5-1: Basic Specifications[1)]

Item \ Type		YR-1-07VXHE6-A00
Structure		Vertically articulated
Degree of freedom		7
Payload	Wrist part	6 kg
	U-arm	10 kg
Repeatability[2)]		0.06 mm
Range of motion	S-Axis	-170° - +170°
	L-Axis	-70° - +148°
	E-Axis	-90° - +90°
	U-Axis	-80° - +80°
	R-Axis	-200° - +200°
	B-Axis	-150° - +150°
	T-Axis	-455° - +455°
Maximum speed	S-Axis	4.53 rad/s, 260°/s
	L-Axis	4.01 rad/s, 230°/s
	E-Axis	4.53 rad/s, 260°/s
	U-Axis	4.53 rad/s, 260°/s
	R-Axis	8.20 rad/s, 470°/s
	B-Axis	8.20 rad/s, 470°/s
	T-Axis	12.2 rad/s, 700°/s
Allowable moment[3)]	R-Axis	12.5 N•m (1.28 kgf•m)
	B-Axis	12.5 N•m (1.28 kgf•m)
	T-Axis	6.0 N•m (0.61 kgf•m)
Allowable inertia[3)] ($GD^2$4)	R-Axis	0.40 kg•m^2
	B-Axis	0.40 kg•m^2
	T-Axis	0.08 kg•m^2
Approx. Mass		190 kg
Protective enclosure		Body: IP54 Wrist part: IP67
Mounting method		Floor-mounted
Power capacity		1.5 kVA
Applicable controller: YRC1000[4)]		ERAR-1000-07VXHE6-□ *□: Depends on the specification.
Equivalent continuous sound pressure level[5)]		68 dB or less

1 SI units are used in this table. However, gravitational unit is used in ( ).
2 Conformed to ISO9283
3 Refer to *chapter 6.1 "Allowable Wrist Load"* for details on the allowable moment and the allowable inertia.
4 The last digit of the type number differs depending on the specification. Refer to the YRC1000 INSTRUCTIONS (RE-CTO-A221) or YRC1000 supplementary instructions for details.
5 Conformed to equivalent continuous A-weighted sound pressure level measured in accordance with ISO11201 (EN31201).
1, Measurement is carried out when the maximum load is mounted to the manipulator and operated in the maximum speed.
2, Measurement is carried out:
-between 1.2 m and 1.5 m above the ground.
-400 mm away from the P-point maximum envelope.

5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes



5.3 Dimensions and P-Point Maximum Envelope

Fig. 5-2: Dimensions and P-Point Maximum Envelope

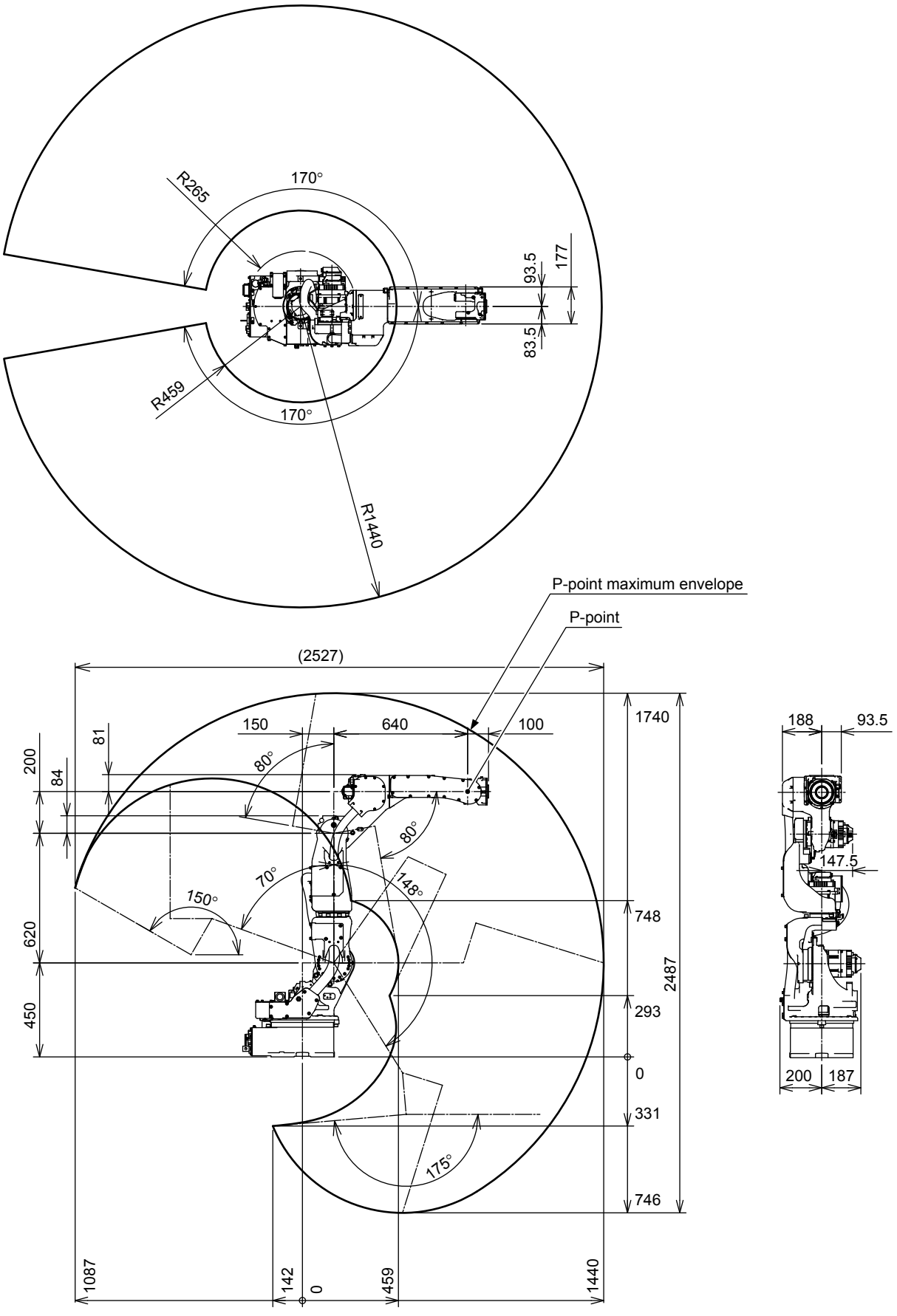
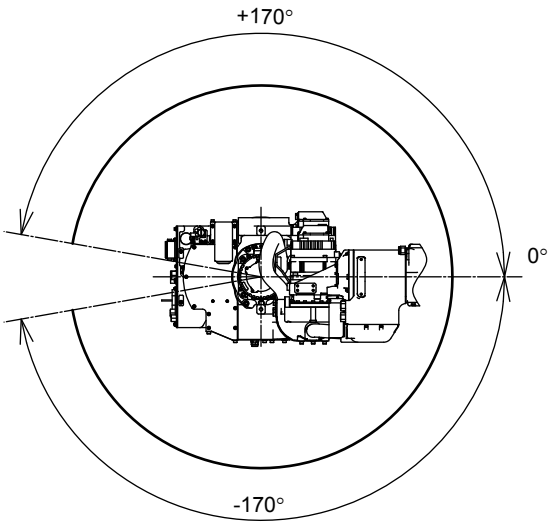
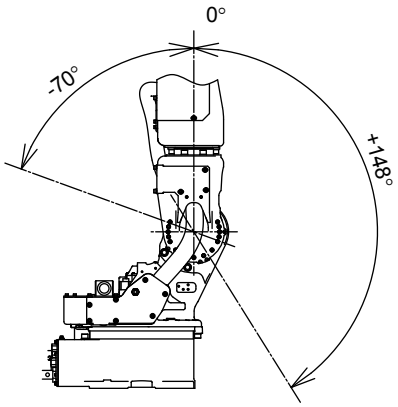


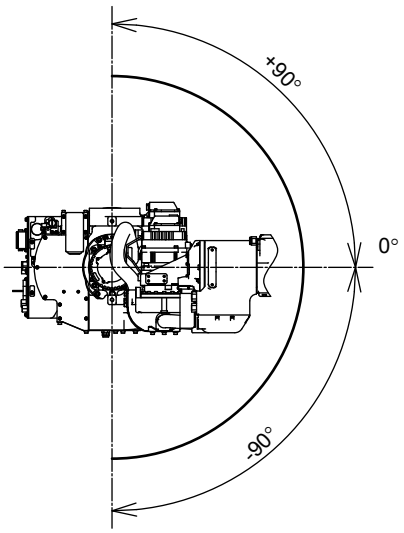
Fig. 5-3: Home Position and Operating Range of Each Axis



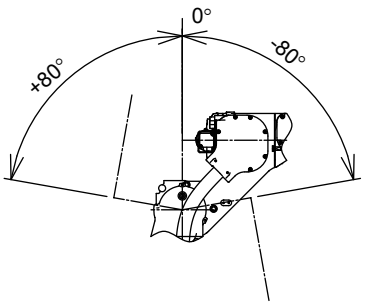
(1) S-axis



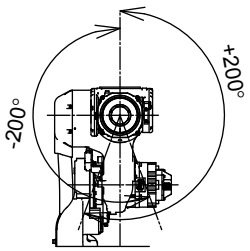
(2) L-axis



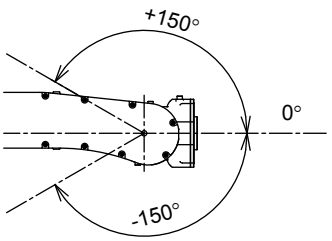
(3) E-axis



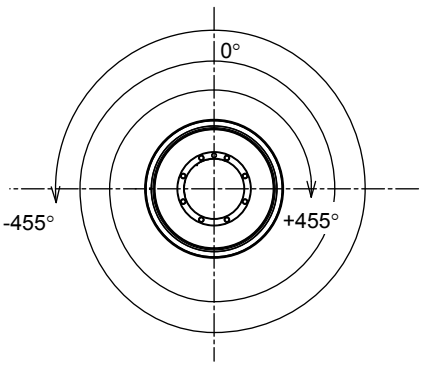
(4) U-axis



(5) R-axis



(6) B-axis



(7) T-axis

5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.1 General Information

- The stopping distance is an angle traveled by the manipulator from the moment when the stop signal is activated until the manipulator comes to a complete standstill.
- The stopping time is a time elapsed from the moment that the stop signal is activated until the manipulator comes to a complete standstill.
- The data that are given for the main axes S, L and U are the maximum displacement.
- Superposed axes motions may result in longer stopping distance.
- Stopping distance and stopping time are measured in accordance with ISO 10218-1, Annex B.
- Stop categories: According to IEC60204-1
  - Stop category 0
  - Stop category 1
- The values specified for Stop category 0 are the reference values that are determined by tests and simulations. The actual stopping distance and stopping time may differ.

5.4.2 Definition of Use

Load: Rated load weight and load on an arm

Speed: Operating speed of the manipulator

Extension: Distance between the rotation center and the P-point of each axis

5.4.3 Stopping Distance and Time for Stop Category 0: S-, L- and U-Axes

Measurement Conditions

- Load: Maximum load
- Speed: Maximum speed
- Posture: Maximum inertia generation posture

Axis	Stopping distance (deg)	Stopping time (sec)
S-axis	49.6	0.411
L-axis	40.8	0.337
U-axis	34.0	0.230

5.4.4 Stop Category 1: Stopping Distance and Time for Stop Category 1: S-, L- and U-Axes

5.4.4.1 Extension

Refer to *fig. 5-4 "S-Axis Extension"* , *fig. 5-5 "L-Axis Extension"* and *fig. 5-6 "U-Axis Extension"* for each axis arm extension.

Fig. 5-4: S-Axis Extension

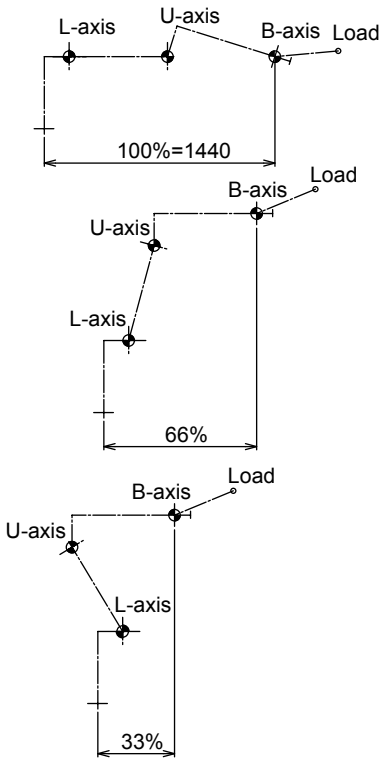


Fig. 5-5: L-Axis Extension

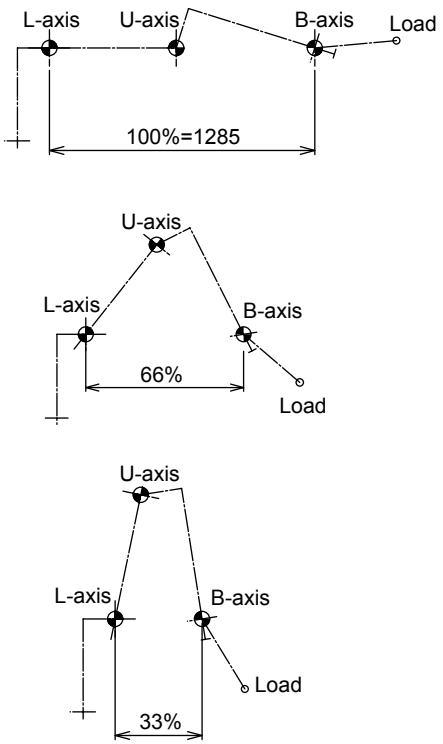
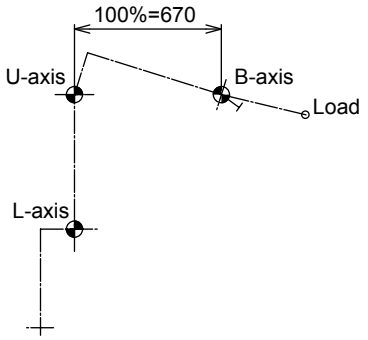
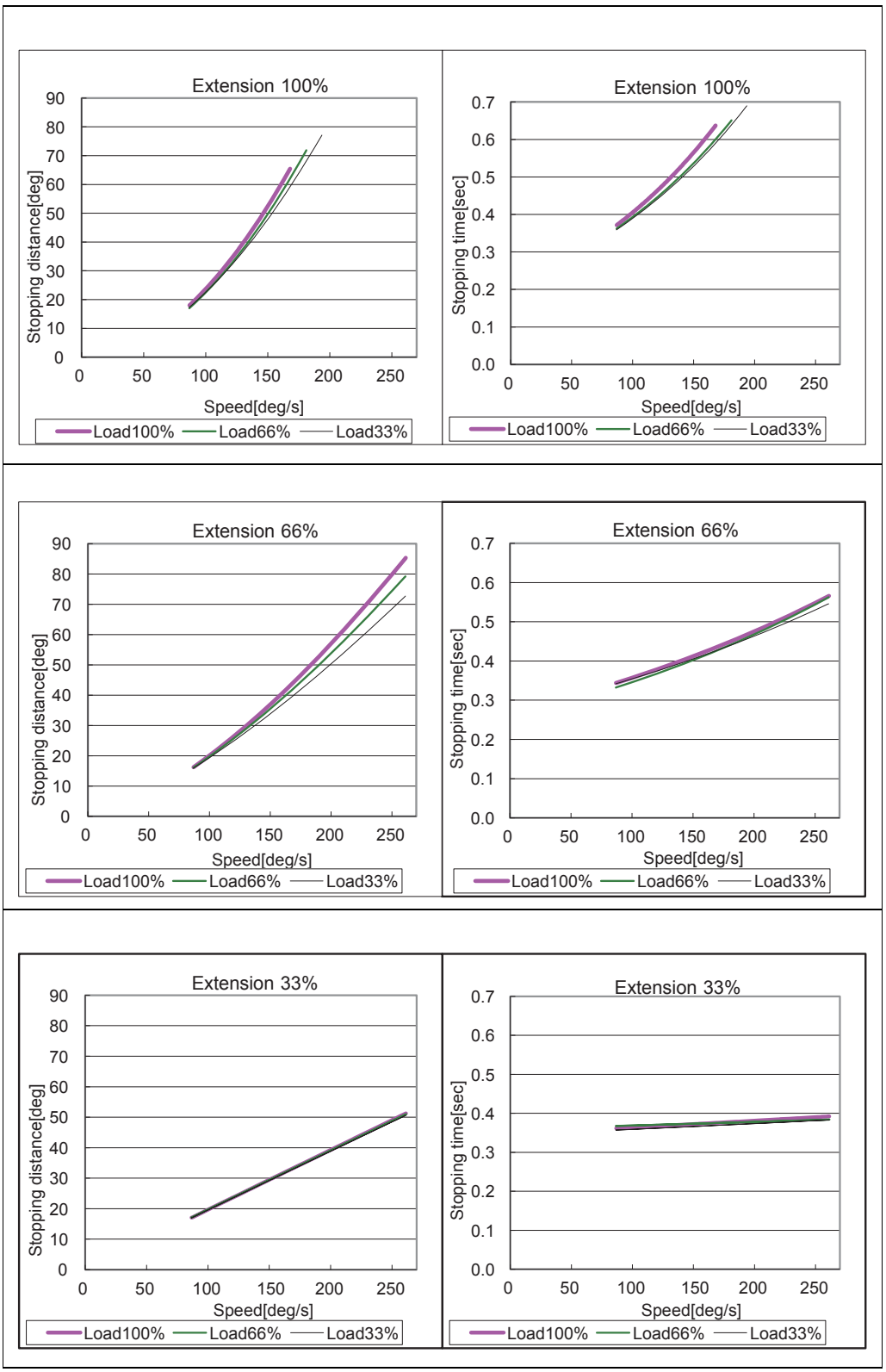


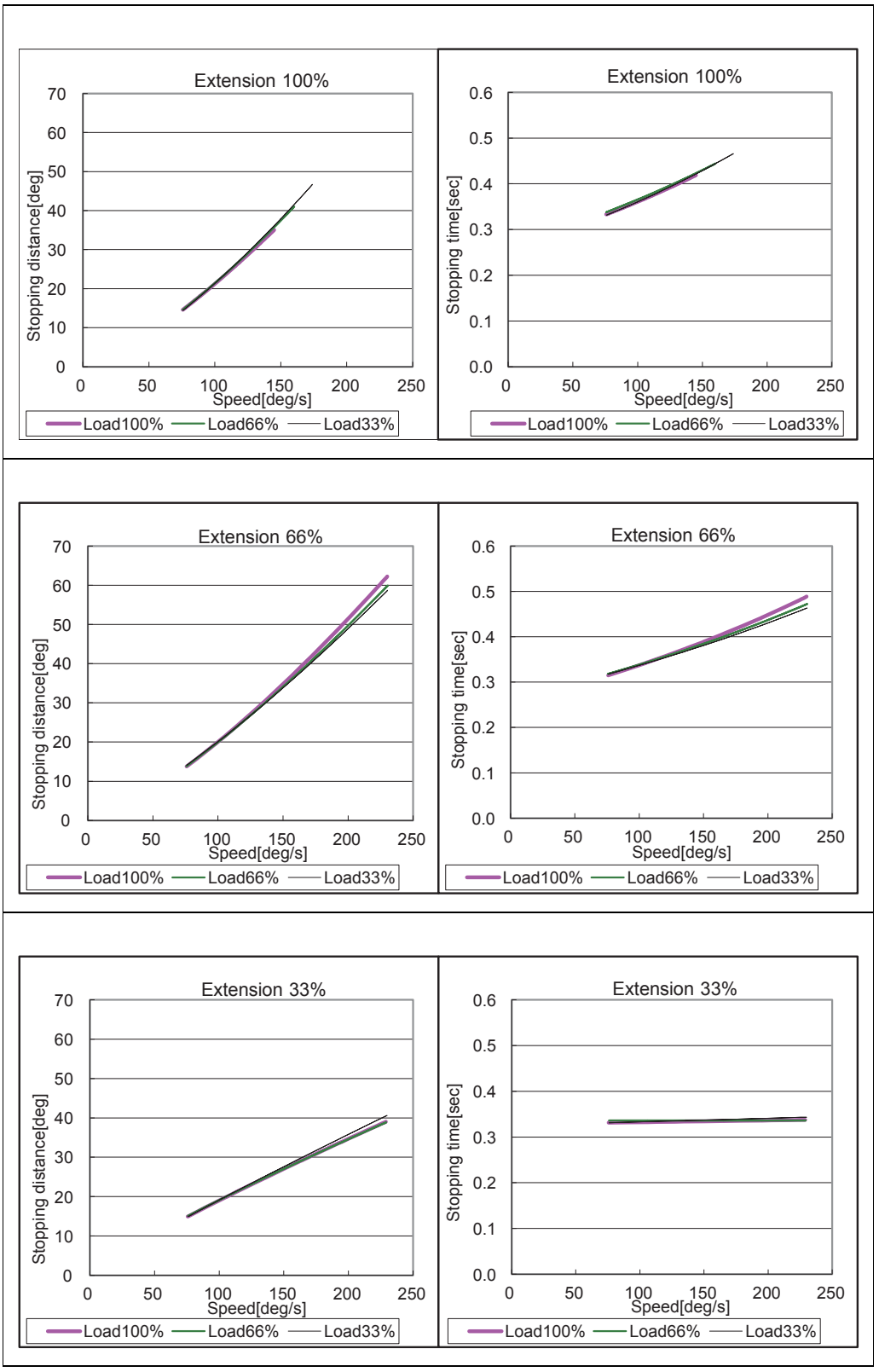
Fig. 5-6: U-Axis Extension



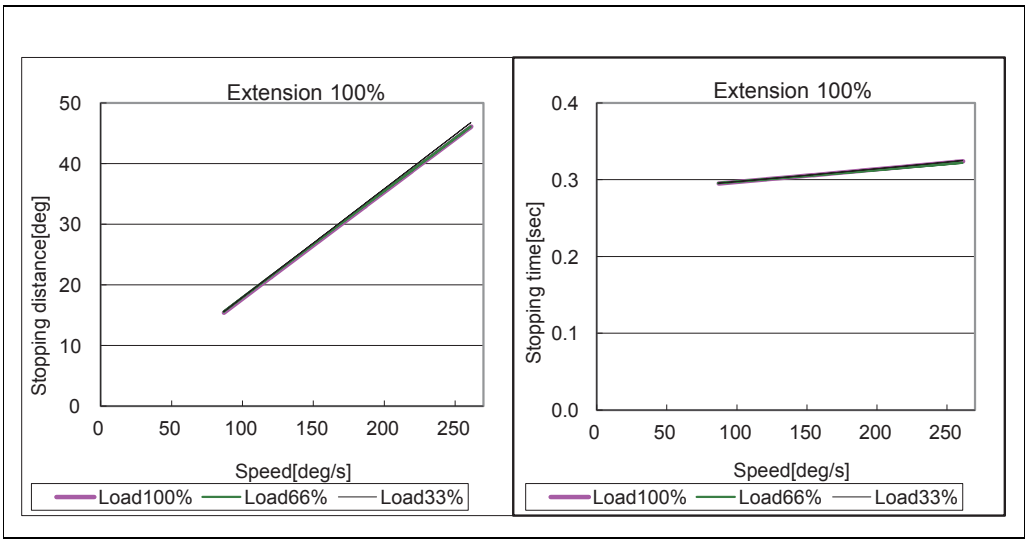
5.4.4.2 Stopping Distance and Time for Stop Category 1: S-axis



5.4.4.3 Stopping Distance and Time for Stop Category 1: L-axis



5.4.4.4 Stopping Distance and Time for Stop Category 1: U-axis



5.5 Alterable Operating Range

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in *table 5-2 "S-Axis Operating Range"* . If alteration is necessary, contact your YASKAWA representative in advance.

Table 5-2: S-Axis Operating Range

Item	Specifications
S-axis operating range*	- 170° - + 170° (standard) - 150° - + 150° - 135° - + 135° - 120° - + 120° - 105° - + 105° - 90° - + 90° - 75° - + 75° - 60° - + 60° - 45° - + 45° - 30° - + 30°

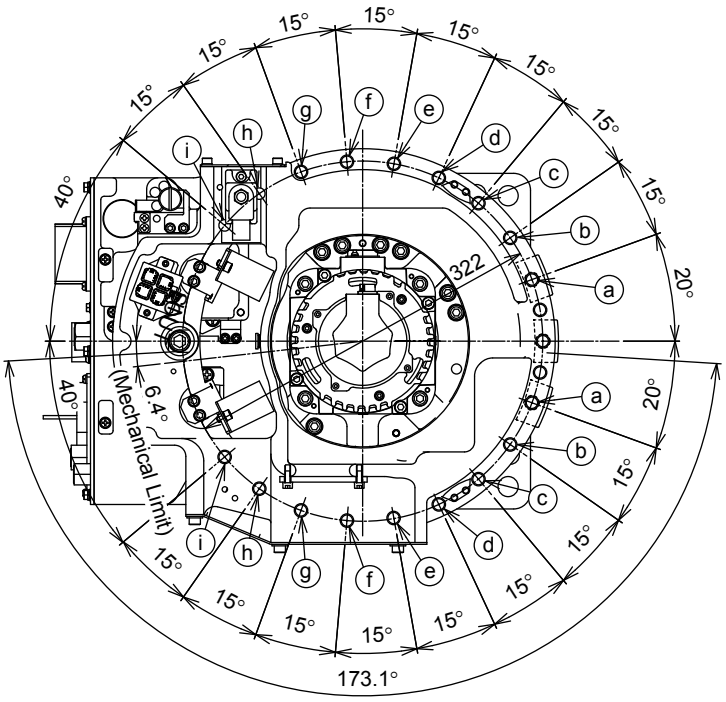
* For the settable angles, refer to *table 5-3 "The Settable Angle for S-Axis Stopper"* .

5.5.1 Components for Altering Operating Range

Arrange the components listed in *fig. 5-7 "Components of the S-Axis Stopper and Stopper Mounting Position"* , when modifying the angle of S-axis.

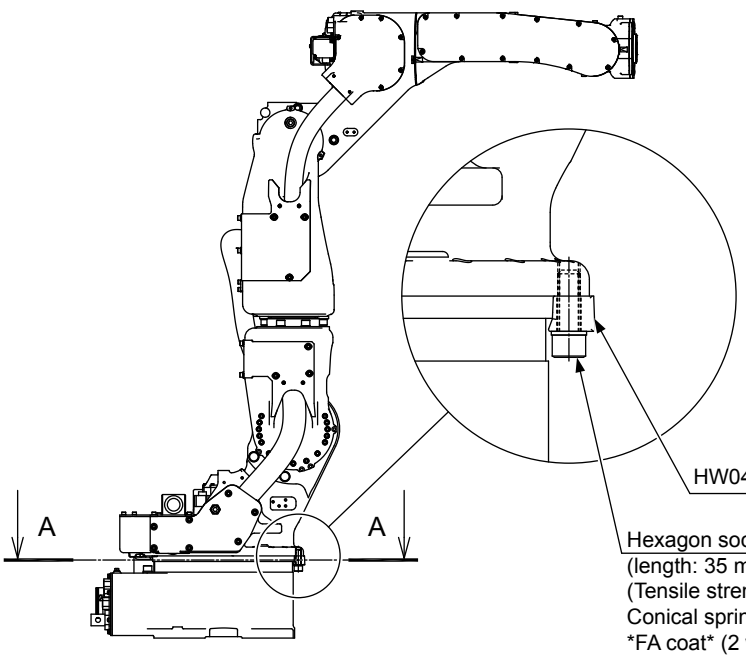
- Dog (drawing No. HW0414041-3) (2 dogs)
- Hexagon socket head cap screw M12 *FA coat* (2 screws)
  (length: 35 mm)
  (Tensile strength: 1200 N/mm^2 or more)
- Conical spring washer 2H-12 *FA coat* (2 washers)

Fig. 5-7: Components of the S-Axis Stopper and Stopper Mounting Position



(Mechanical Limit)
Tapped hole M12 (18 places)

Section A-A
Dog Mounting Position



S-axis operating angle	Stopper position
-170° - +170°	
-150° - +150°	ⓐ
-135° - +135°	ⓑ
-120° - +120°	ⓒ
-105° - +105°	ⓓ
-90° - +90°	ⓔ
-75° - +75°	ⓕ
-60° - +60°	ⓖ
-45° - +45°	ⓗ
-30° - +30°	ⓘ

HW0414041-3 (Dog) (2 dogs)

Hexagon socket head cap screw M12
(length: 35 mm) (2 screws) *FA coat*
(Tensile strength: 1200 N/mm² or more)
Conical spring washer 2H-12
FA coat (2 washers)
Tightening torque: 84 N•m (8.6 kgf•m)

5.5.2 Notes on the Mechanical Stopper Installation

When mounting the S-axis mechanical stopper, as shown in *fig. 5-7 "Components of the S-Axis Stopper and Stopper Mounting Position"* , mount the dog (HW0414041-3) by using one hexagon socket head cap screw M12 *FA coat* (length: 35 mm) and tighten the screw with a tightening torque of 84 N•m (Tensile strength: 1200 N/mm^2 or more) on the S-head. (2 places) If the operating range is ±170° (standard), mounting the mechanical stopper is not needed.

The S-axis mechanical stopper can be set at a pitch of 15° from 30° to 150° range for each direction, positive and negative.

Refer to *table 5-3 "The Settable Angle for S-Axis Stopper"* for the combination.

NOTE

1. Apply the specified components when mounting the S-Axis mechanical stopper.
2. Turn OFF the electric power supply before mounting.

5.5.3 Adjustment to the Pulse Limitation of S-Axis

For altering the range of motion of S-Axis, refer to chapter 6.13 "Softlimit Setting Function" in "YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051)". With programming pendant, input the numeric value as shown in the following table to modify the parameter.

Degree	±30°	±45°	±60°
Pulse	±43061	±64591	±86121

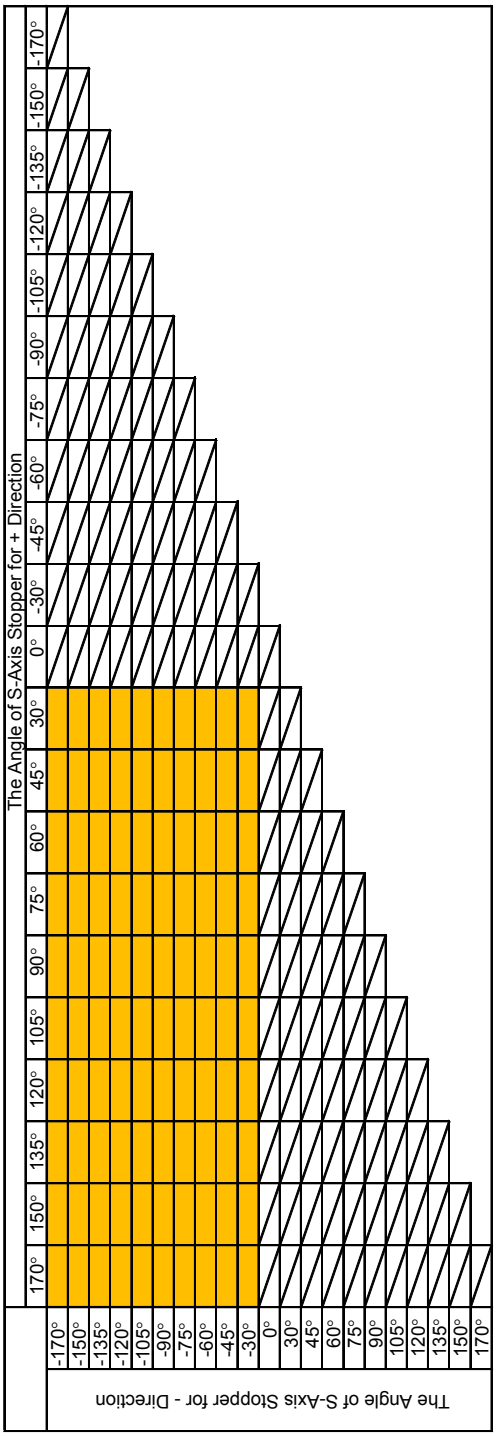
Degree	±75°	±90°	±105°	±120°	±135°
Pulse	±107651	±129182	±150712	±172242	±193772

Degree	±150°	±170°
Pulse	±215303	±244010

NOTE

Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.

Table 5-3: The Settable Angle for S-Axis Stopper



….Settable angle
….Non settable angle

Table 5-3 "The Settable Angle for S-Axis Stopper" indicates the angle range which allows S-axis to be set for + direction and - direction angles.
(Ex. -150° to +150° is settable, however 0° to +135° is not settable)

6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable payload of the wrist axis including the mass of the grip is up to 6 kg.

However, the conditions listed in *table 6-1 "Allowable Wrist Load"* must be satisfied due to limits of moments and the moment of inertia.

The values in *table 6-1* must not be exceeded even if the load is not applied as mass but applied as force.

Table 6-1: Allowable Wrist Load

Axis	**Allowable moment N•m (kgf•m)[1)]**	**Allowable inertia ($GD^2/4$) kg•m^2**
R-Axis	12.5 (1.28)	0.40
B-Axis	12.5 (1.28)	0.40
T-Axis	6.0 (0.61)	0.08

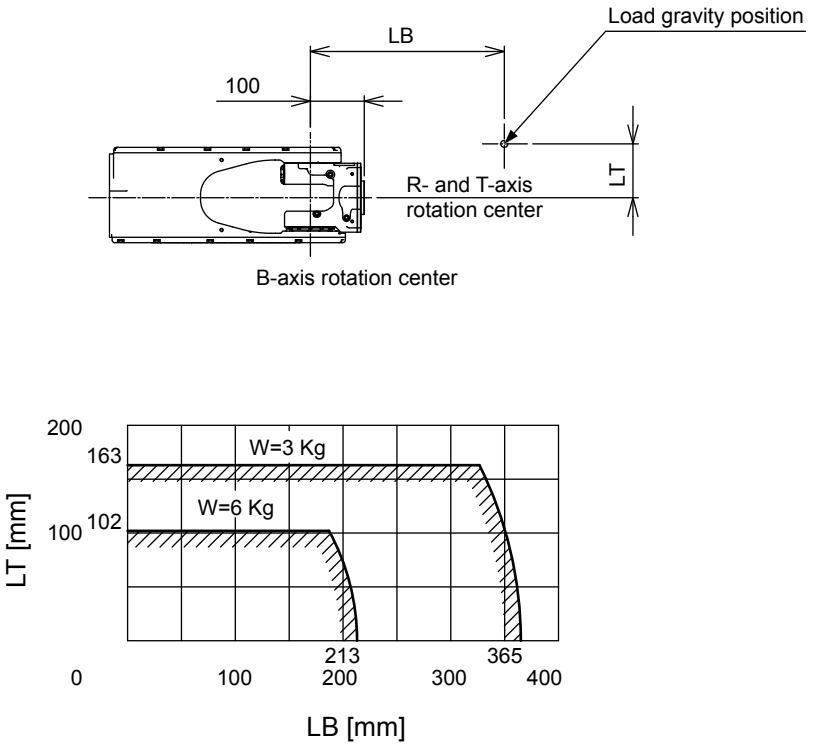
1 ( ): Gravitational unit

When the volume of the load is relatively small, refer to the moment arm rating (L_B, L_T) shown in *fig. 6-1 "Moment Arm Rating"* .
Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

When a tool is installed, the tool information and the load information must be set. For the setting, refer to chapter 8.3 "Tool Data Setting" and chapter 8.4 "ARM Control" in "YRC1000 INSTRUCTIONS (RE-CTO-A221)".

6 Allowable Load for Wrist Axis and Wrist Flange
6.1 Allowable Wrist Load

Fig. 6-1: Moment Arm Rating



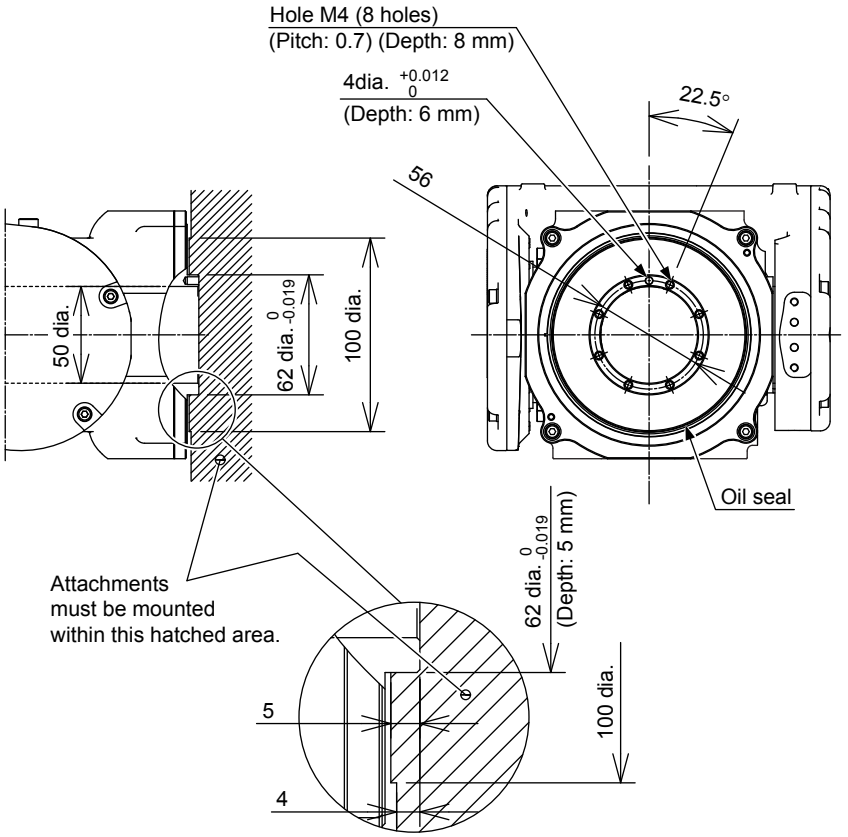
6.2 Wrist Flange

The wrist flange dimensions are shown in *fig. 6-2 "Wrist Flange"* .

When mounting the attachment, etc., using the outside fitting is recommended.

When using the outside fitting, fitting depth shall be 5 mm or less. The attachment should be mounted inside the range shown in *fig. 6-2*.

Fig. 6-2: Wrist Flange



NOTE

- Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner before mounting the tools.
- During initial operations, the lubricant may seep from the lip part of the oil seal. Wipe off the seeped lubricant with a cloth before use.

7 System Application

7.1 Peripheral Equipment Mounts

CAUTION

- Do not make any additional holes or tapped holes on the manipulator's body.

Failure to observe this instruction may adversely affect the safety and/or performance of the manipulator.

- YASKAWA provides no guarantee against damages, malfunctions, failures, etc. caused by using any means other than the tapped holes shown in the following figure. The tightening bolts used for the mechanical parts of the manipulator must be used only to secure the mechanical parts. Do not additionally secure or attach any other things by using these tightening bolts.

The peripheral equipment mounts are provided as shown in *fig. 7-1 "Installation Position"* for easier installation of the user's system applications. The following conditions shall be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

The maximum allowable load on the peripheral equipment of the U-arm (A1 and A2) is 16 kg or less, including the wrist load on the wrist point.

For instance, when the mass installed on the wrist point is 6 kg, the mass which can be installed on the peripheral equipment of the U-arm (A1 and A2) is 10 kg.

And the maximum allowable load on the peripheral equipment (A3 and A4) is 6 kg or less, including the wrist load on the wrist point.

The maximum allowable load on the peripheral equipment of the S-head (B) is up to 20 kg.

Install the peripheral equipment on the S-axis so that the moment of inertia ($GD^2/4$) from the S-axis rotation center is 1.25 kg•m² or less.

When a load is applied on the U-arm or S-head, the load setting must be performed.

For setting procedures, refer to "Chap. 8.4 ARM Control" in "YRC1000 INSTRUCTIONS (RE-CTO-A221)".

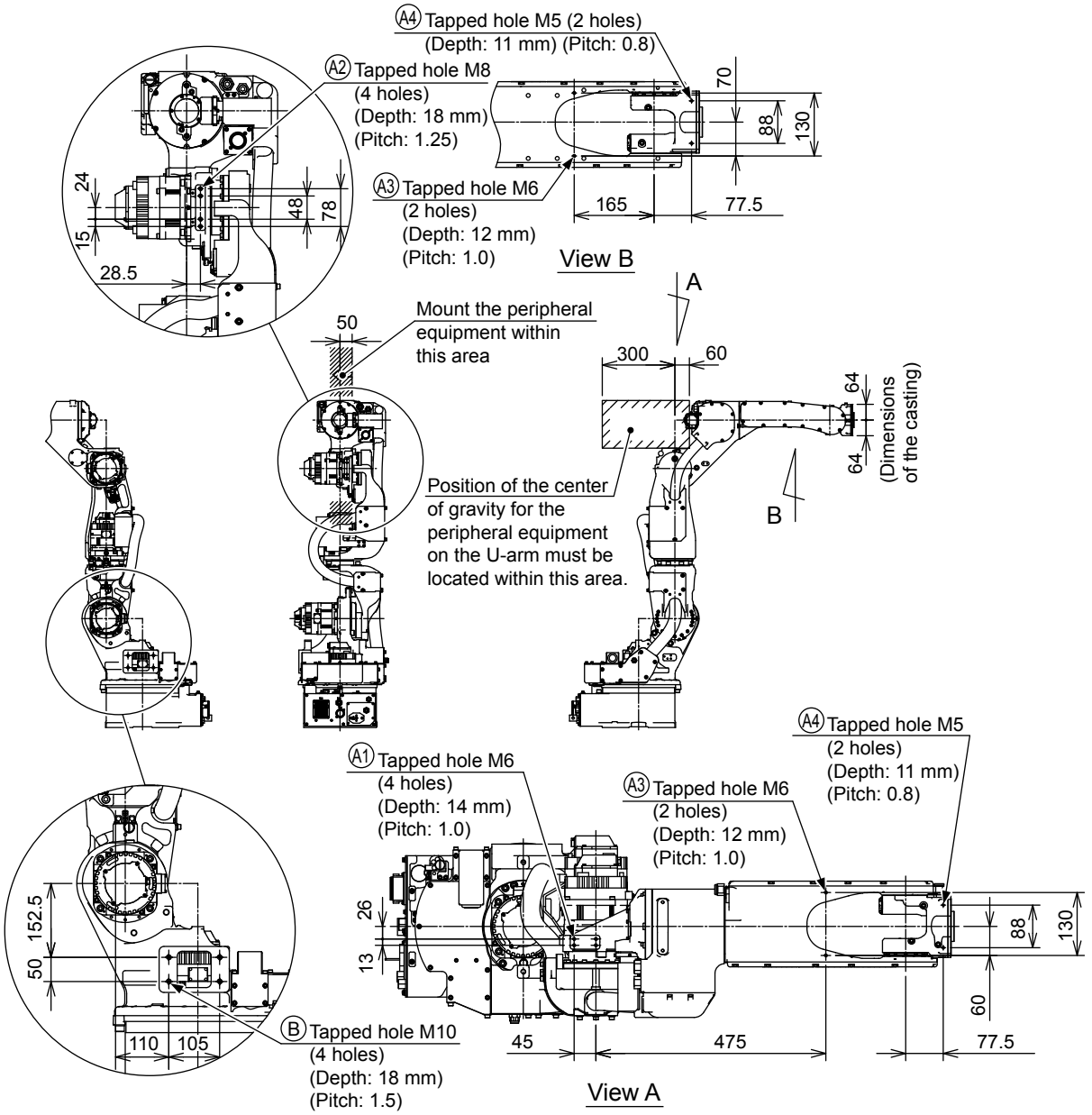
7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in *fig. 7-1 "Installation Position"* .

NOTE

When installing cables or cable guides, check cables for tortions or behaviors caused by bending using the actual manipulator so that unneccesary force is applied to the cables, manipulator or peripheral devices.

Fig. 7-1: Installation Position



7.2 Internal User I/O Wiring Harness and Air Line

Internal user I/O wiring harness (14 wires: 0.2 mm^2 × 8 wires, 0.75 mm^2 × 2 wires, 1.25 mm^2 × 4 wires) and two air lines are built in the manipulator for the drive of peripheral devices mounted on the U-arm as shown in *fig. 7-2 "Connectors for Internal User I/O Wiring Harness and Air Line"* .

The connector pins 1 to 16 are assigned as shown in *fig. 7-4 "Details of the Connector Pin Numbers"* . Wiring must be performed by the customers.

The welding cable is built in the S-axis base. The location of cables is shown in *fig. 7-3 "Location of Welding Cable"* .

The operating conditions are shown in the following table.

The allowable current for internal user I/O wiring harness	3 A or less for each wire (The total current value for the pins 1 to 16 must be 40 A or less.)
The maximum pressure of the air line	490 kPa (5 kgf/cm^2) or less (The inside diameter: 6.5 mm for air line A, 5.0 mm for air line B)
The temperature for using air line	0°C - +45°C
The allowable current for welding power cable	Rated current of 350 A or less and the rated operational ration should be 60% or less. The allowable operational ratio when it is operated with less current than the allowable current is calculated by the following formula. Allowable operational ratio = 60% × (350 A / operating current)^2

Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line

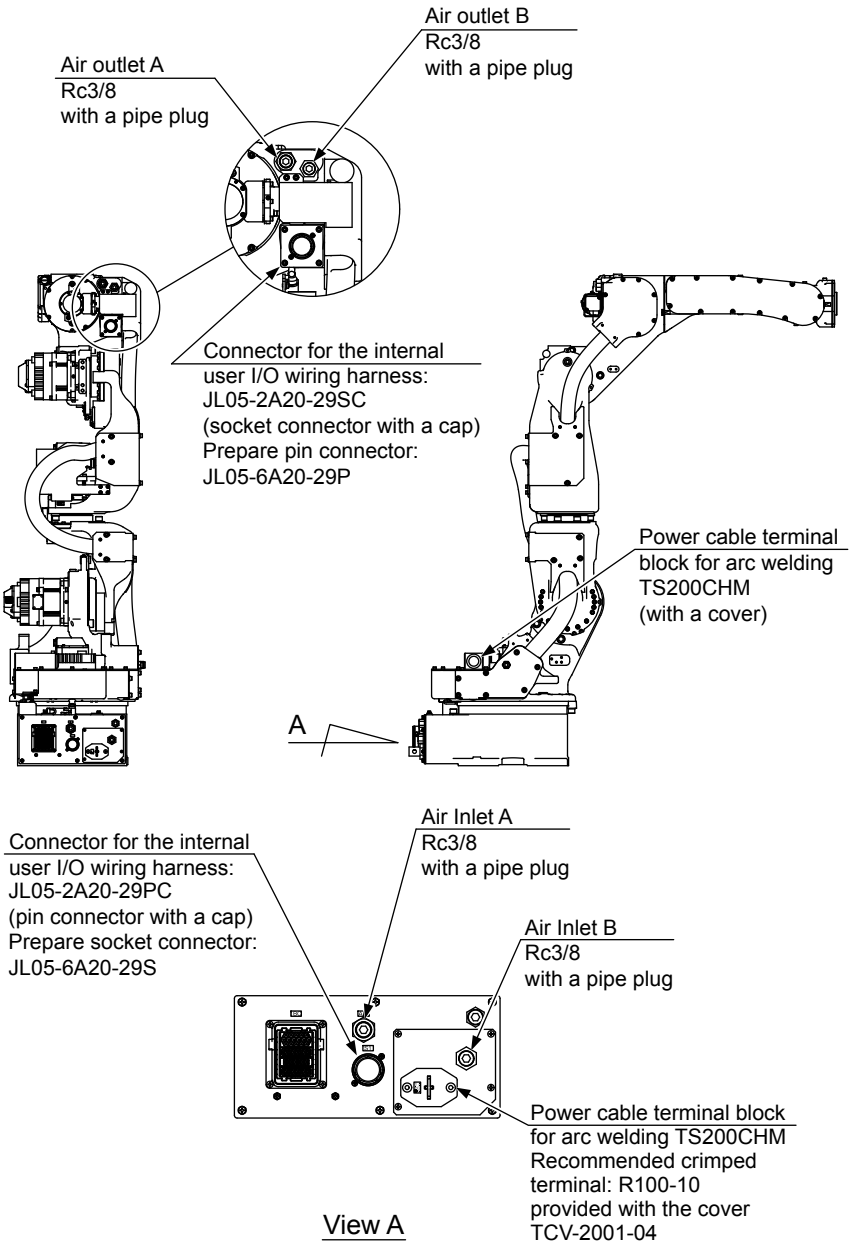


Fig. 7-3: Location of Welding Cable

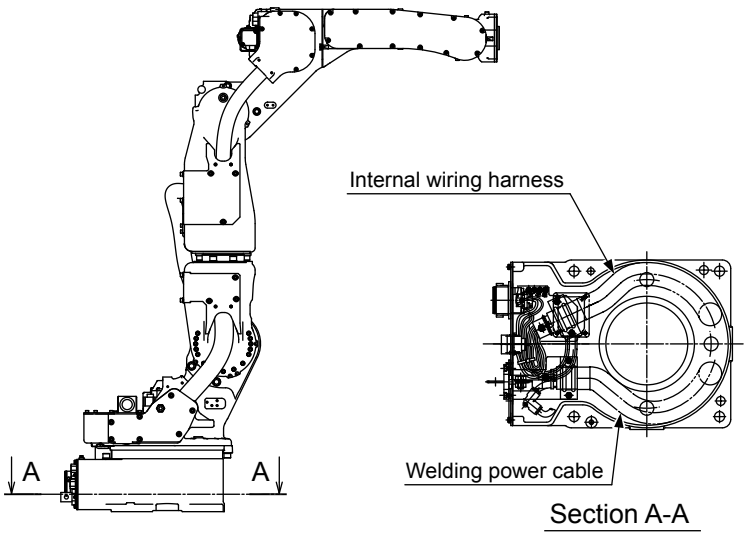
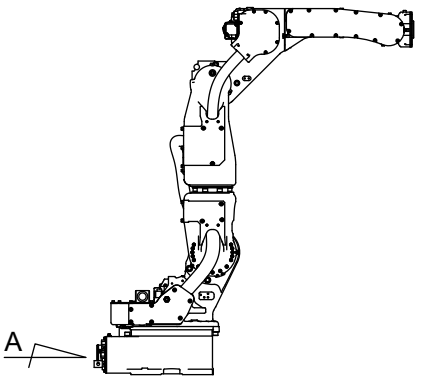
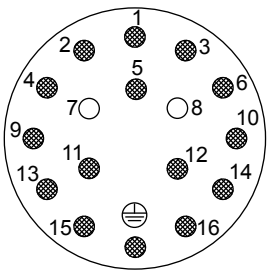


Fig. 7-4: Details of the Connector Pin Numbers



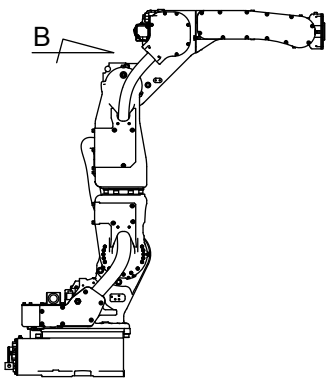
Connector for Internal User I/O Wiring Harness
(For the Connector Base: View A)

Pins used
1 (0.2 mm²)
2 (0.2 mm²)
3 (0.2 mm²)
4 (0.2 mm²)
5 (0.2 mm²)
6 (0.2 mm²)
7: (Open)
8: (Open)
9 (0.2 mm²)
10 (0.2 mm²)
11 (0.75 mm²)
12 (0.75 mm²)
13 (1.25 mm²)
14 (1.25 mm²)
15 (1.25 mm²)
16 (1.25 mm²)



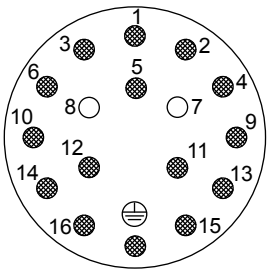
Details of the Connector Pin Numbers

Internal user I/O wiring harness
: 8×0.2 mm²
: 2×0.75 mm²
: 4×1.25 mm²



Connector for Internal User I/O Wiring Harness
(For the U-arm: View B)

Pins used
1 (0.2 mm²)
2 (0.2 mm²)
3 (0.2 mm²)
4 (0.2 mm²)
5 (0.2 mm²)
6 (0.2 mm²)
7: +24 V (1 A)
8: Shock sensor signal input
9 (0.2 mm²)
10 (0.2 mm²)
11 (0.75 mm²)
12 (0.75 mm²)
13 (1.25 mm²)
14 (1.25 mm²)
15 (1.25 mm²)
16 (1.25 mm²)



Details of the Connector Pin Numbers

Internal user I/O wiring harness
: 8×0.2 mm²
: 2×0.75 mm²
: 4×1.25 mm²

NOTE

- For the standard specification, the pins No.7 and No.8 of 3BC connector on the U-arm are respectively connected with the shock sensor power supply and shock sensor signal input port of the YRC1000.
- The pins No.7 and No.8 on both the connector base side and the U-arm side of the connector for internal user I/O wiring harness are not connected.
- For wiring, refer to *fig. 8-5(a) "Internal Connection Diagram (YRC1000)"* and *fig. 8-5(b) "Internal Connection Diagram (YRC1000)"*.

The same pin-number connectors (1 to 16) at both connector base part and arm part are connected with the single wire lead of 0.2 mm^2, 0.75 mm^2 or 1.25 mm^2.

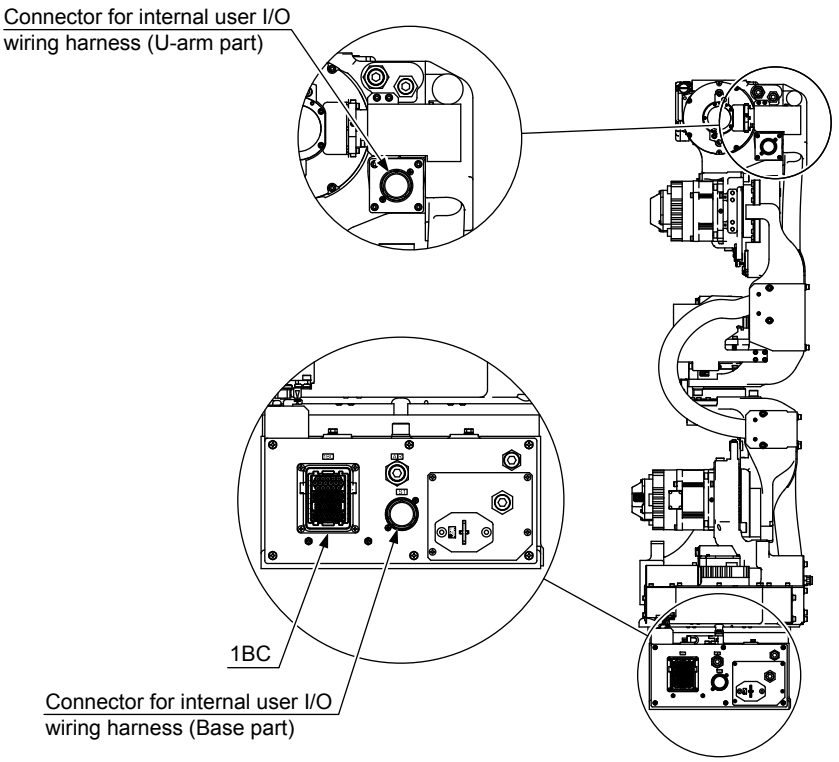
7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

The mating connector for internal user I/O wiring harness is optional.

For the position of the mating connector for internal user I/O wiring harness, refer to *fig. 7-5 "Location of Connector"* .

For the mating connector for internal user I/O wiring harness, two different types of the end bell are prepared depending on the form: Straight type and Elbow type. Select either one type.

Fig. 7-5: Location of Connector



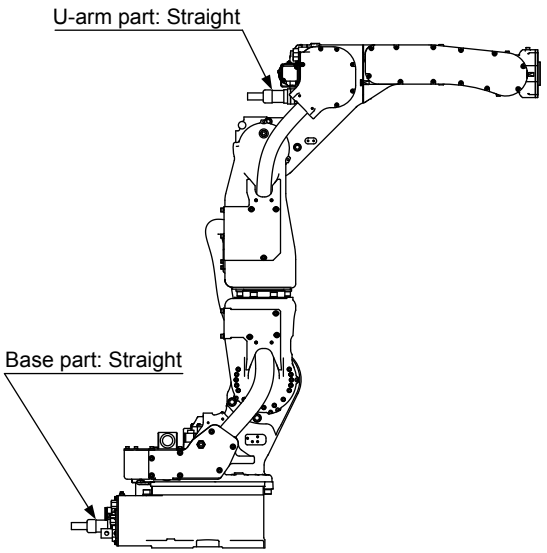
		Manipulator's base part	U-arm part
Straight type	**Plug**	JL05-6A20-29S-R or the equivalent	JL05-6A20-29P-R or the equivalent
	End bell	CE01-20BS-DS (straight form)	CE01-20BS-DS (straight form)
	Cable clamp	CE3057-12A-1-D	CE3057-12A-1-D
Elbow type	**Plug**	JL05-6A20-29S-R or the equivalent	JL05-6A20-29P-R or the equivalent
	End bell	CE01-20BS-DS (straight form)	CE-20BA-S-D (elbow form)
	Cable clamp	CE3057-12A-1-D	CE3057-12A-1-D

■ Straight Type

The appearance of the manipulator with the connector installed is shown in *fig. 7-6(a) "Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type)"* .

When operating, be careful not to let the connector and/or cable touch the other equipment.

Fig. 7-6(a): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type)

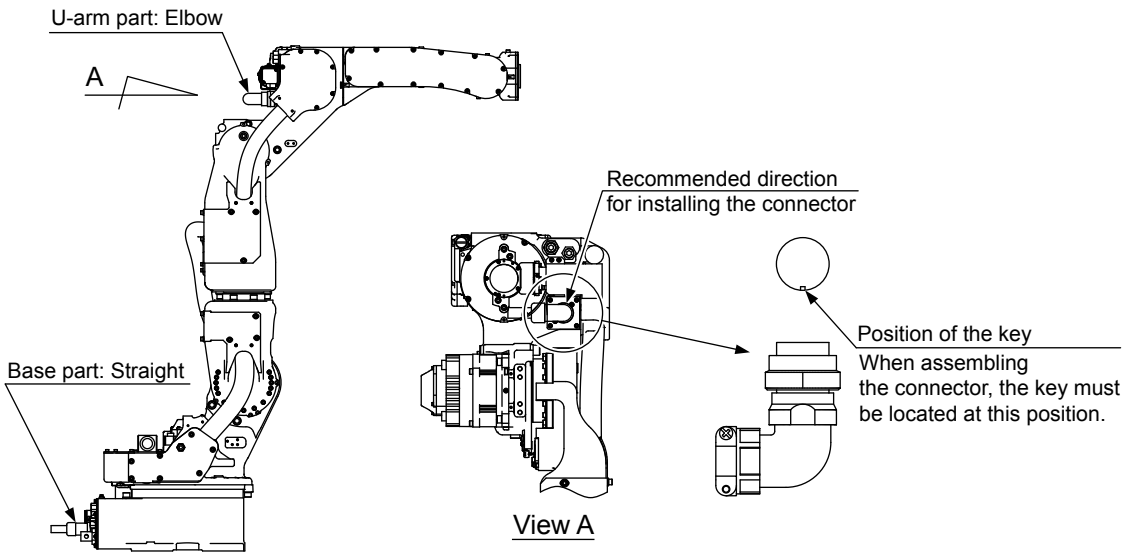


■ Elbow Type

The appearance of the manipulator with the connector installed is shown in *fig. 7-6(b) "Manipulator With the Mating Connector for Internal User I/O Wiring Harness (elbow type)"* .

When the connector with the elbow type of end bell is installed, the direction shown in the following figure is recommended for the connector installation. When assembling the connector, the key must be located at the position shown in the following figure.

Fig. 7-6(b): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (elbow type)



8 Electrical Equipment Specification

8.1 Overrun Limit Switches (Optional)

The overrun limit switches (referred to below as the limit switches) can be optionally installed for the S-, L-, and U-axes.

The soft limit and the activation angles of the limit switch for each axis when the manipulator is shipped with limit switches installed at the factory are given in *table 8-1 "Degrees of Angle (with limit switch installed)"* .

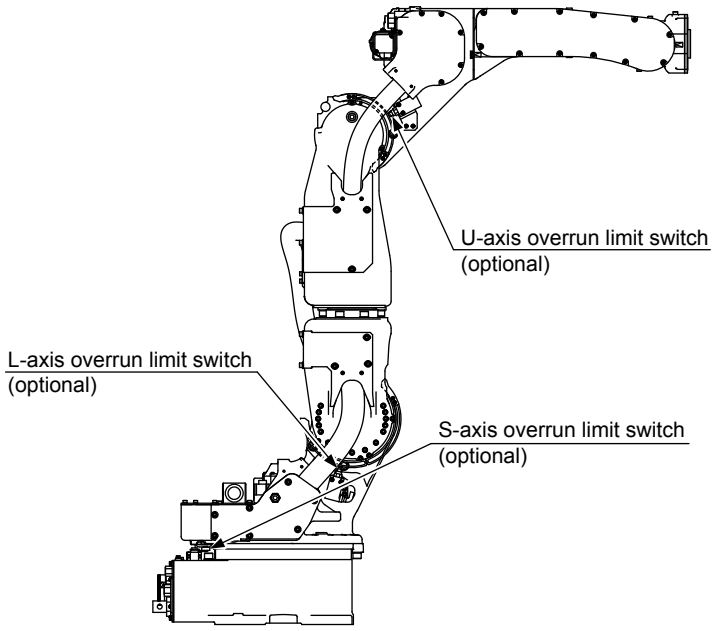
Table 8-1: Degrees of Angle (with limit switch installed)

	Soft limit	Limit switch
S-axis	-170° - +170°	-171.5° - +171.5°
L-axis	-70° - +95°	-71° - +96.5°
U-axis	-80° - +80°	-81.5° - +81.5°

8.1.1 Position of Limit Switch

For the locations of the limit switches, refer to *fig. 8-1 "Location of Limit Switches"* .

Fig. 8-1: Location of Limit Switches



8.1.2 Adjustment to the Activation Angle of Limit Switch

When altering the operating angle of the manipulator, adjust both the soft limit and the activation angle of the limit switch. The activation angle of the limit switch must be larger than the soft limit.

For adjusting soft limit, refer to chapter 6.13 “Softlimit Setting Function” in “YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051)”.

For releasing soft limit, refer to chapter 8.10 “Soft Limit Release Function” in “YRC1000 INSTRUCTIONS (RE-CTO-A221)”.
For adjusting limit switch, refer to the following page.

- Adjusting activation angle of limit switch of S-axis

  The activation angle of limit switch of S-axis can be adjusted by altering the position of the S-axis stopper. For altering the stopper's position, refer to *chapter 5.5 “Alterable Operating Range”* .

- Adjusting activation angle of limit switch of L-axis

  The activation angle of limit switch of L-axis can be adjusted by altering the position of the dog on the ring which is mounted on the L-axis. Refer to *fig. 8-2 “Adjustment of Dog (L-axis)”* .

- Adjusting activation angle of limit switch of U-axis

  The activation angle of limit switch of U-axis can be adjusted by altering the position of the dog on the ring which is mounted on the U-axis. Refer to *fig. 8-3 “Adjustment of Dog (U-axis)”* .

Fig. 8-2: Adjustment of Dog (L-axis)

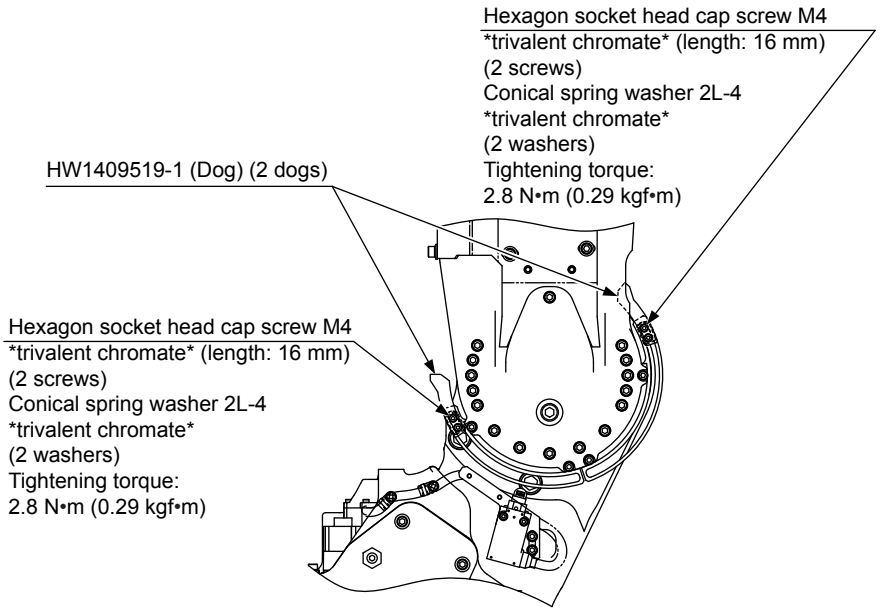
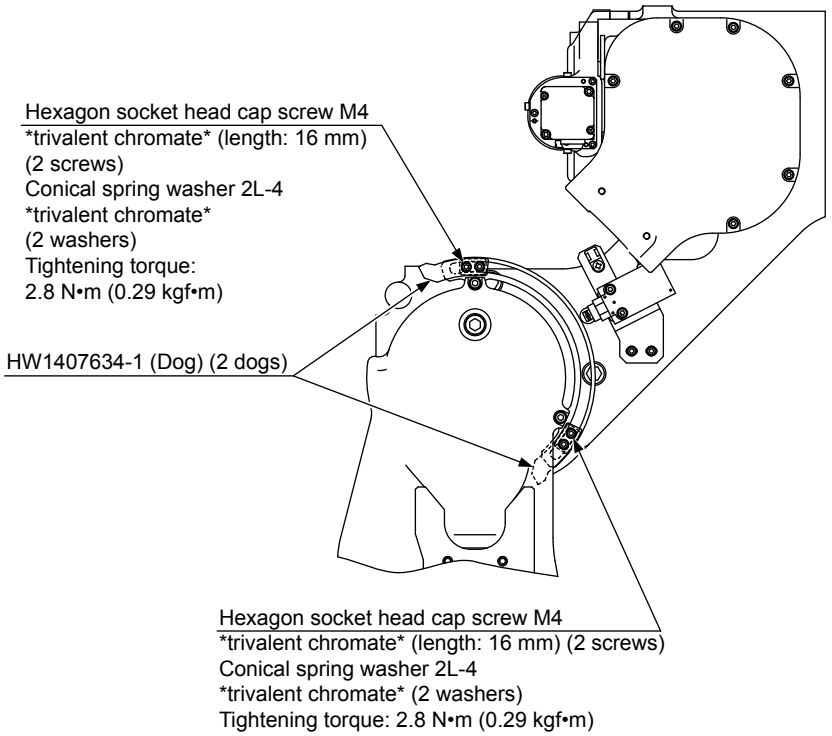


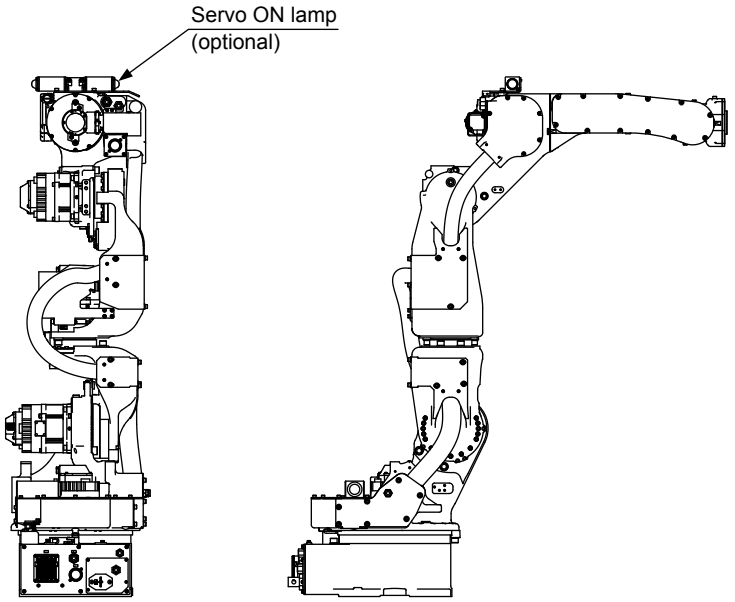
Fig. 8-3: Adjustment of Dog (U-axis)



8.2 Servo ON Lamp (Optional)

The servo ON lamp can be optionally installed. For the location of the servo ON lamp, refer to *fig. 8-4 "Location of Servo ON Lamp"* .

Fig. 8-4: Location of Servo ON Lamp



8.3 Internal Connections

Diagrams for Internal connections of the manipulator are shown in *fig. 8-5(a) “Internal Connection Diagram (YRC1000)”* , *fig. 8-5(b) “Internal Connection Diagram (YRC1000)”* .

Fig. 8-5(a): Internal Connection Diagram (YRC1000)

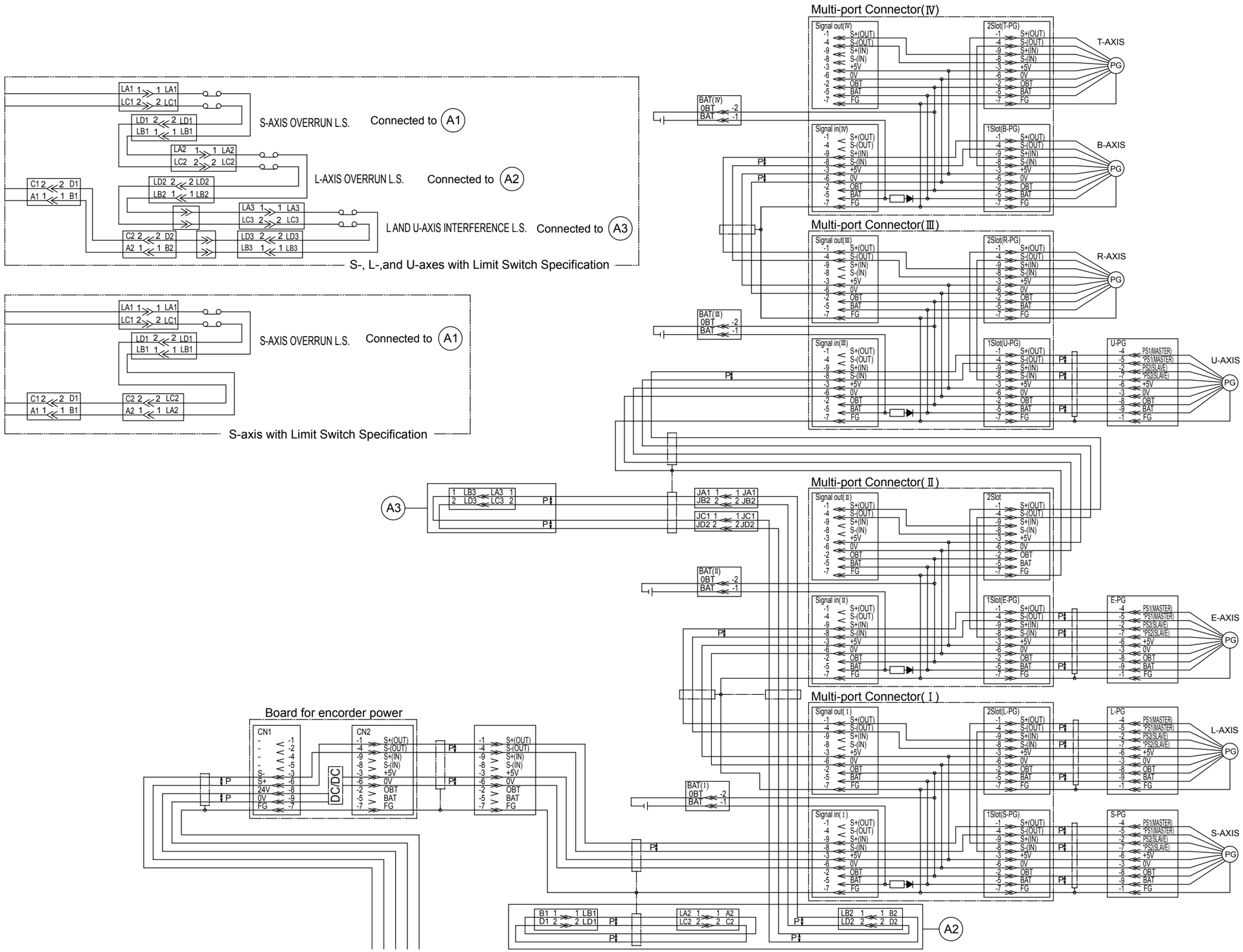
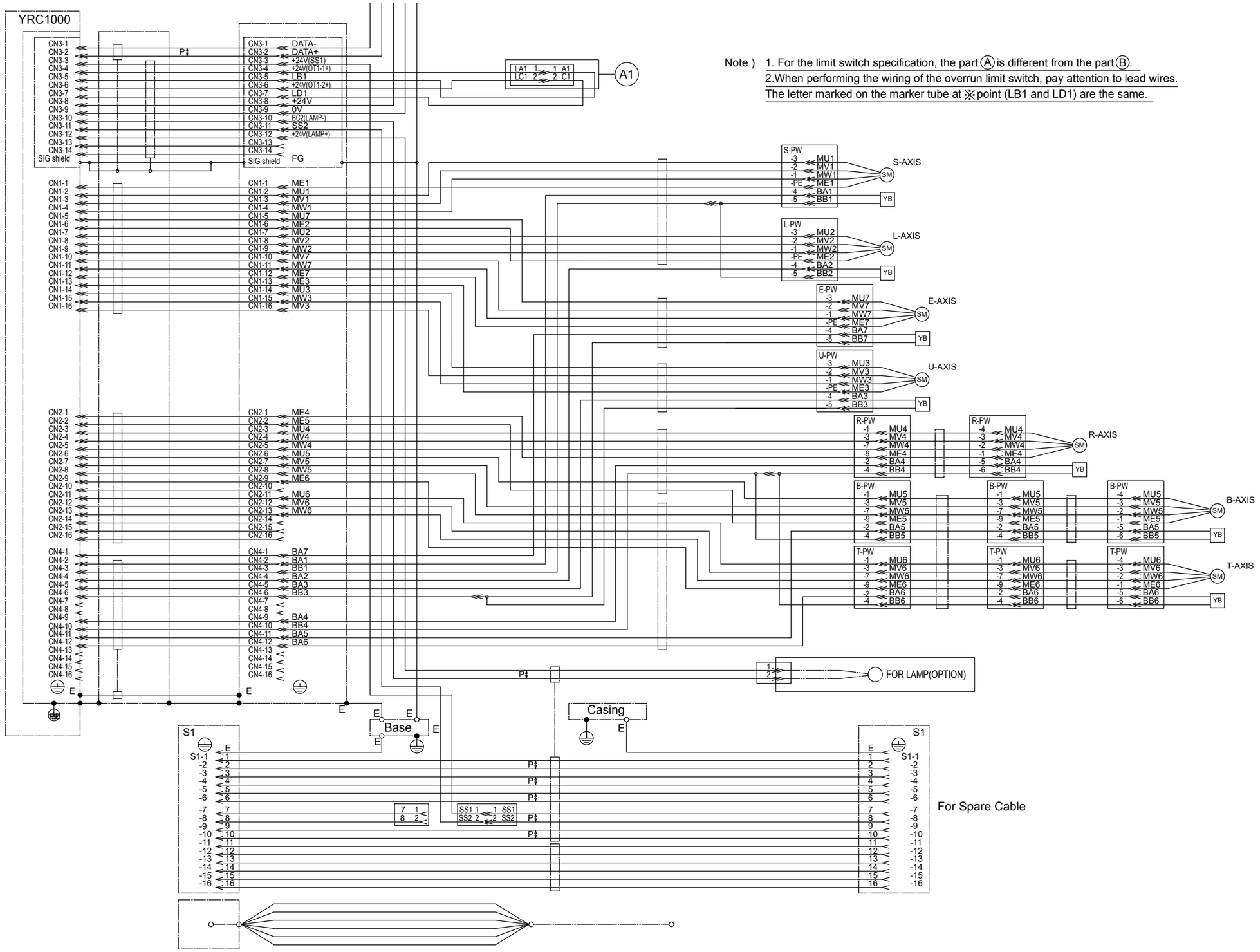


Fig. 8-5(b): Internal Connection Diagram (YRC1000)



9 Maintenance and Inspection

DANGER

- Do not remove the motor, and do not release the brake.

Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

- Maintenance and inspection must be performed by specified personnel.

Failure to observe this caution may result in electric shock or injury.

- For disassembly or repair, contact your YASKAWA representative.
- Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

Failure to observe this warning may result in electric shock or injury.

NOTICE

- Do not remove the connector between the motor and the multi-port connector during maintenance and inspection.

Failure to observe this caution may result in the loss of home position data.

9.1 Inspection Schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels as shown in *table 9-1 "Inspection Items"* .

In *table 9-1*, the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized by the user, operations to be performed by trained personnel, and operations to be performed by service company personnel. Only specified personnel shall perform the inspection work.

NOTE

- The interval between inspections is calculated according to the total servo operation time.
- If axes are used very frequently (in handling applications, etc.), inspections may be required at shorter intervals. Contact your YASKAWA representative.

Table 9-1: Inspection Items (Sheet 1 of 2)

Items [1]		Schedule					Method	Operation	Inspection Charge		
		Daily	1000 H Cycle	12000 H Cycle	24000 H	36000 H			Specified Personnel	License	Service Company
1	Alignment mark	●					Visual	Check alignment mark accordance at the home position. Check for damage. Check for misalignment of the position at the check point.	●	●	●
2	Working area and manipulator	●					Visual	Check for seeped oil. (Wipe it off if any.) Clean the work area if dust, spatter or seeped oil is present. Check for damage and outside cracks.	●	●	●
3	Baseplate mounting bolts		●				Spanner Wrench	Tighten loose bolts. Replace if necessary.	●	●	●
4	Connector for manipulator cable		●				Manual	Check for loose connectors.	●	●	●
5	Covers, bolts for the connector base		●				Screwdriver Wrench	Tighten loose bolts. Replace if necessary.	●	●	●
6	Protective tube		●				Visual	Clean the spatter. Check for holes or tears. (Replace it if any.)	●	●	●
					●		Replace		●	●	●
7	Timing belts for B- and T-axes			●			Manual Visual	Check for belt tension and the condition. (Replace if failure of tooth, swelling, or abnormal abrasion occurs.)		●	●
8	Wire harness in manipulator (Lead for the S-, L-, E-, and U-axes wires) (Power supply board included)	●					Visual	Check for damage and contamination.	●	●	●
				●			Manual Visual	Check the condition of the internal wiring harness. Check wear to the protective spring (replace if there is abnormal wear).		●	●
					●		Replace				●
9	Wire harness in manipulator (Lead for the B- and T-axes wires)			●			Visual	Check the condition of the fixed part.		●	●
					●			Replace			●
10	Battery pack in manipulator				●			Replace the battery pack when the battery alarm occurs on the YRC1000 or the manipulator drove for 24000H.	●		●

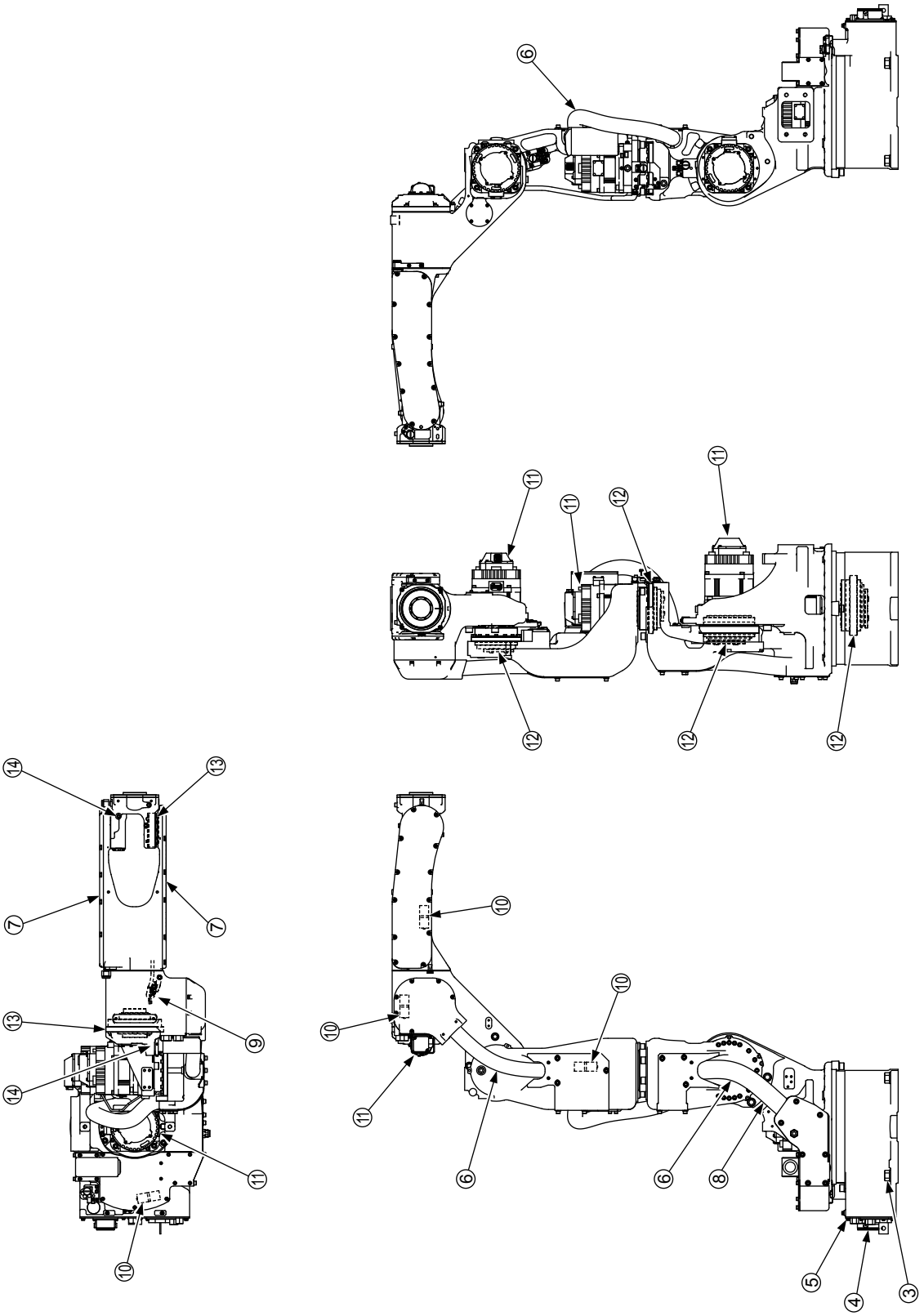
Table 9-1: Inspection Items (Sheet 2 of 2)

Items[1]		Schedule					Method	Operation	Inspection Charge		
		Daily	1000 H Cycle	12000 H Cycle	24000 H	36000 H			Specified Personnel	Licensee	Service Company
11	S-, L-, E-, U-, and R-axes motor			●				Check for grease leakage.	●	●	●
12	S-, L-, E-, and U-axes speed reducer			●			Grease Gun	Check for malfunction. (Replace if necessary.) Exchange grease[2] (12000 H cycle).		●	●
13	R- and B-axes speed reducer			●			Hand Pump Injection Syringe	Check for malfunction. (Replace if necessary.) Supply grease[2] (12000 H cycle).		●	●
14	R- and T-axes gear			●			Hand Pump Injection Syringe	Check for malfunction. (Replace if necessary.) Supply grease[2] (12000 H cycle).		●	●
15	Overhaul					●					●

1 Inspection No. correspond to the numbers in *fig. 9-1 "Inspection Items"*.
2 For grease, refer to *table 9-2 "Inspection Parts and Grease Used"*.

Table 9-2: Inspection Parts and Grease Used

No.	Grease Used	Inspected Parts
12	Molywhite RE No. 00	S-, L-, E- and U-axes speed reducers
13, 14	Harmonic Grease SK-1A	R- and B-axes speed reducers, R- and T-axes gear



The numbers in the above table correspond to the numbers in *table 9-1 "Inspection Items"*.

Fig. 9-1: Inspection Items

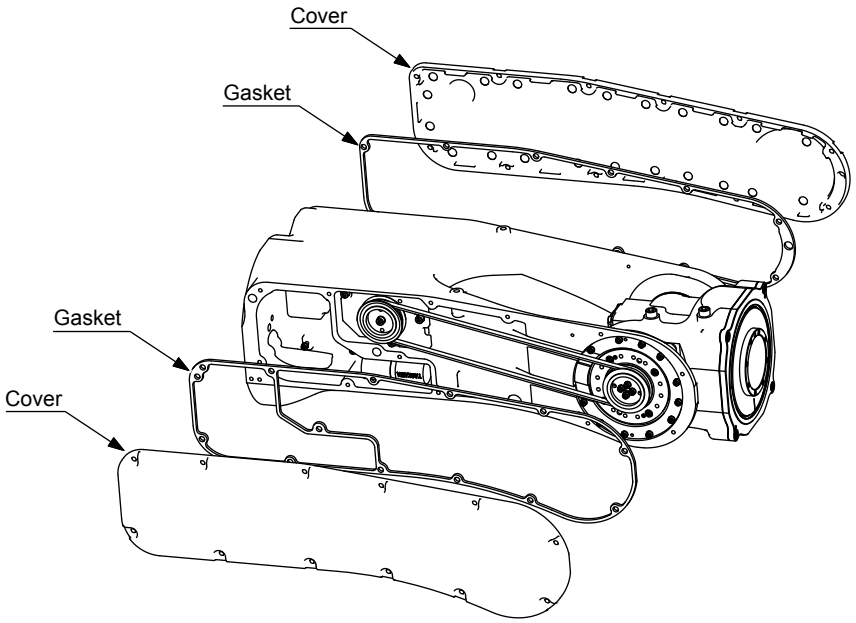
9.2 Notes for Maintenance

9.2.1 U-arm

The motor, the battery pack, and the belt drive part are located in the U-arm on the configuration, and then the mating surfaces between covers in the U-arm are sealed with gaskets in order to prevent liquid ingress or fumes of welding.

After removing the cover for maintenance, make sure to replace the gasket. (Refer to *table 10-1 "Recommend Spare Parts"* .)

Fig. 9-2: Sealing Part of U-arm



9.2.2 Multi-Port Connector

Four multi-port connectors (refer to *fig. 9-3 "Multi-Port Connector"*) for the motor signals are mounted on each part of the manipulator. (For the locations, refer to *fig. 9-9 "Location of the Battery and Multi-port Connector"*) The multi-port connector has four ports. For the connections of the multi-port connectors, refer to *fig. 9-4(a) "Wiring of Multi-Port Connector Part (S-, L-, and E-axes)"* and *fig. 9-4(b) "Wiring of Multi-Port Connector Part (U-, R-, B-, and T-axes)"* .

When disconnecting the connector of the multi-port connector during the battery replacement, be careful not to disconnect the connector between the motor and the multi-port connector. If the connector between the motor and the multi-port connector is disconnected, the encoder absolute data will disappear.

Fig. 9-3: Multi-Port Connector

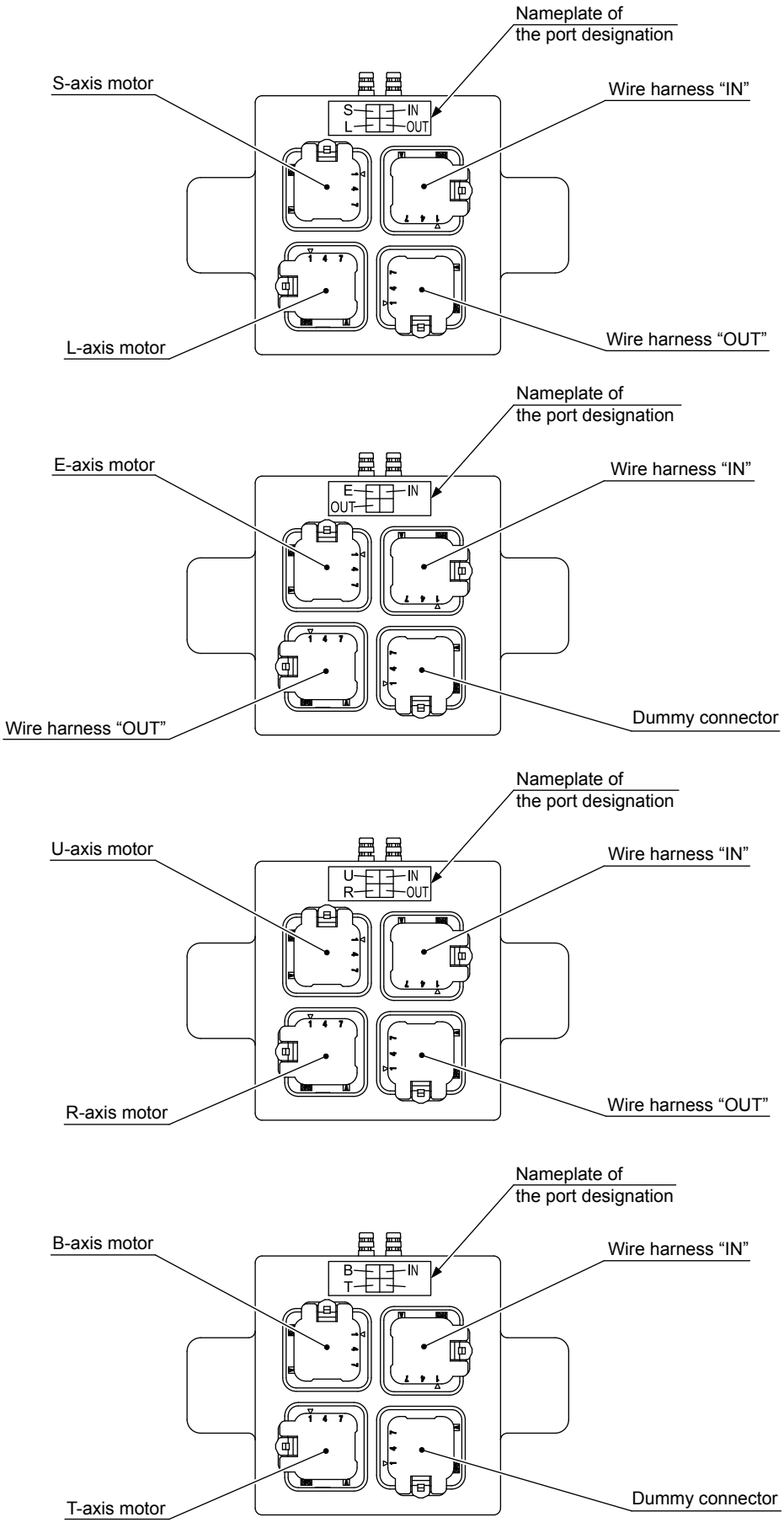


Fig. 9-4(a): Wiring of Multi-Port Connector Part (S-, L-, and E-axes)

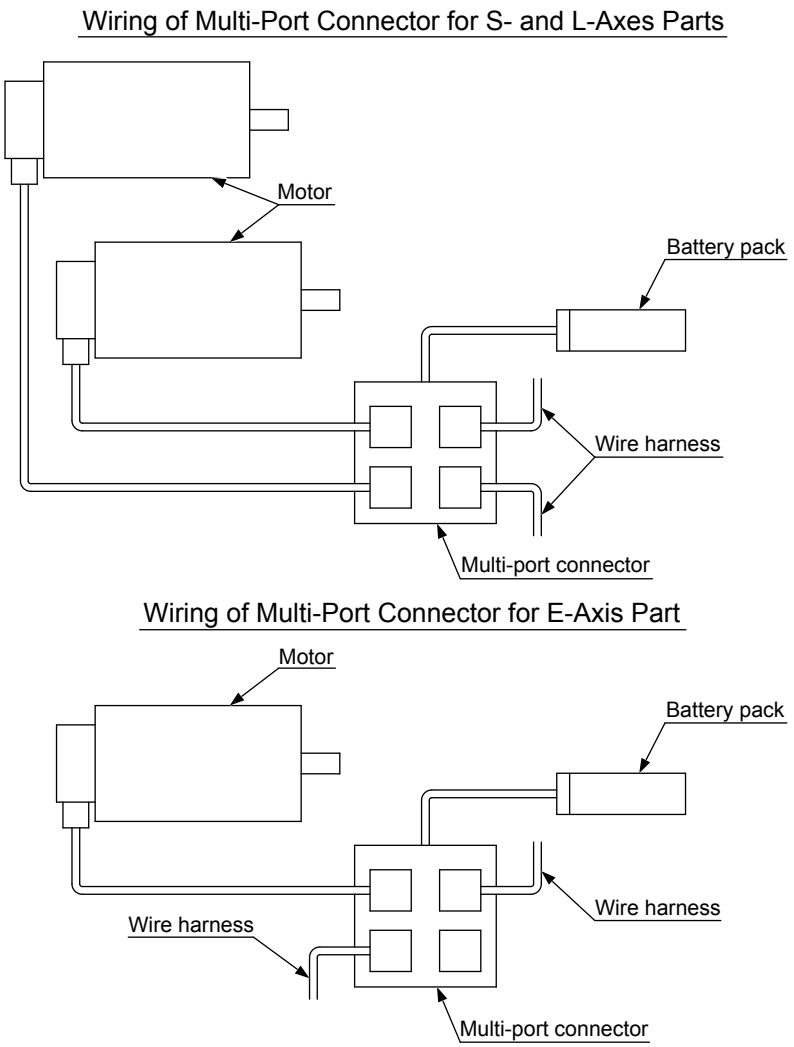
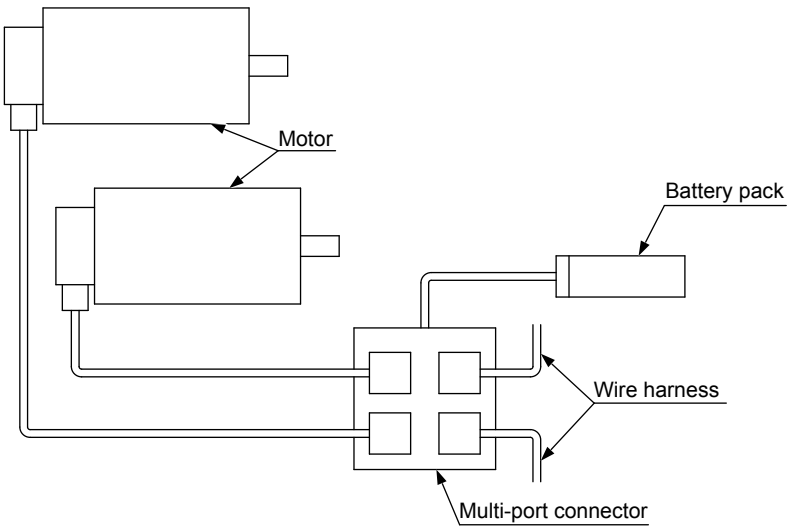
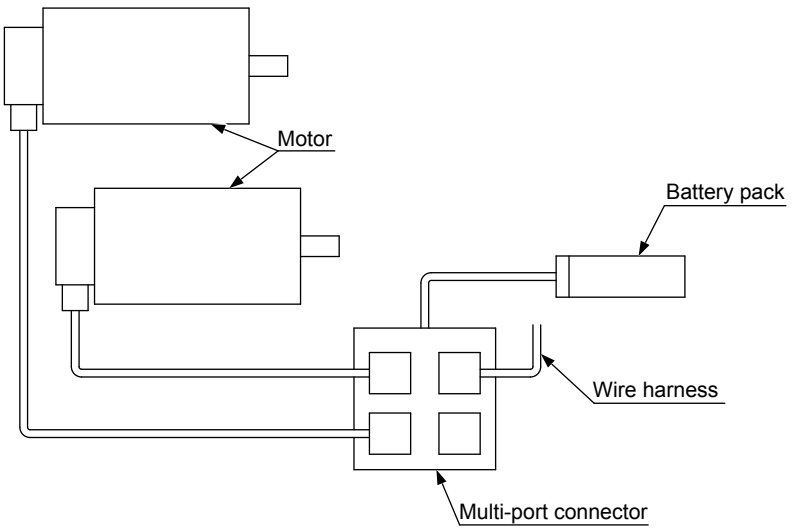


Fig. 9-4(b): Wiring of Multi-Port Connector Part (U-, R-, B-, and T-axes)

Wiring of Multi-Port Connector for U- and R-Axes Parts



Wiring of Multi-Port Connector for B- and T-Axes Parts

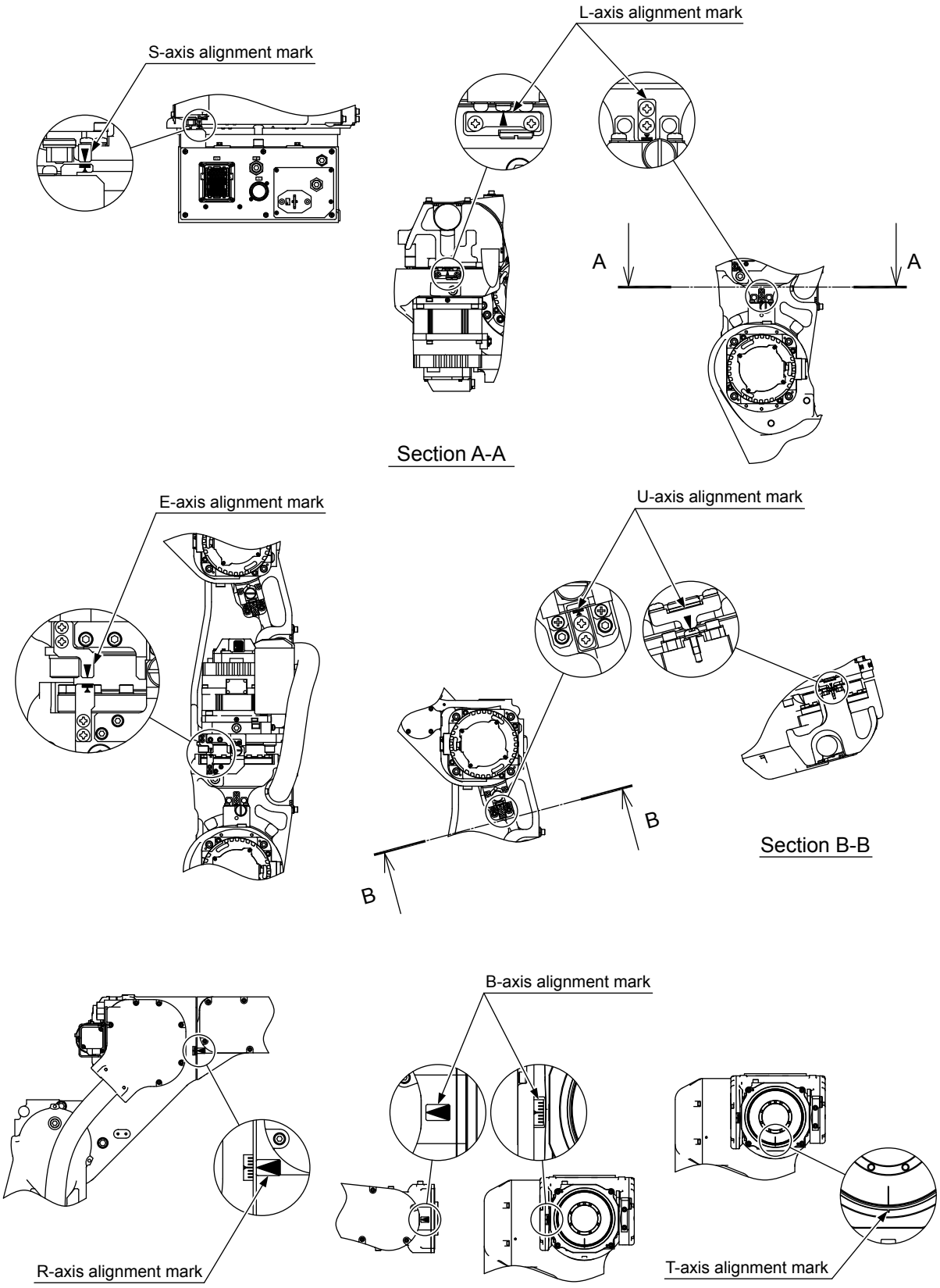


9.3 Notes on Maintenance Procedures

9.3.1 Home Position Check

There are alignment marks on each axis to check the home position (*fig. 9-5 "Alignment Mark Check"*).
With those alignment marks, periodically check for home position deviation. When home position is disappeared or deviated, contact your YASKAWA representative.

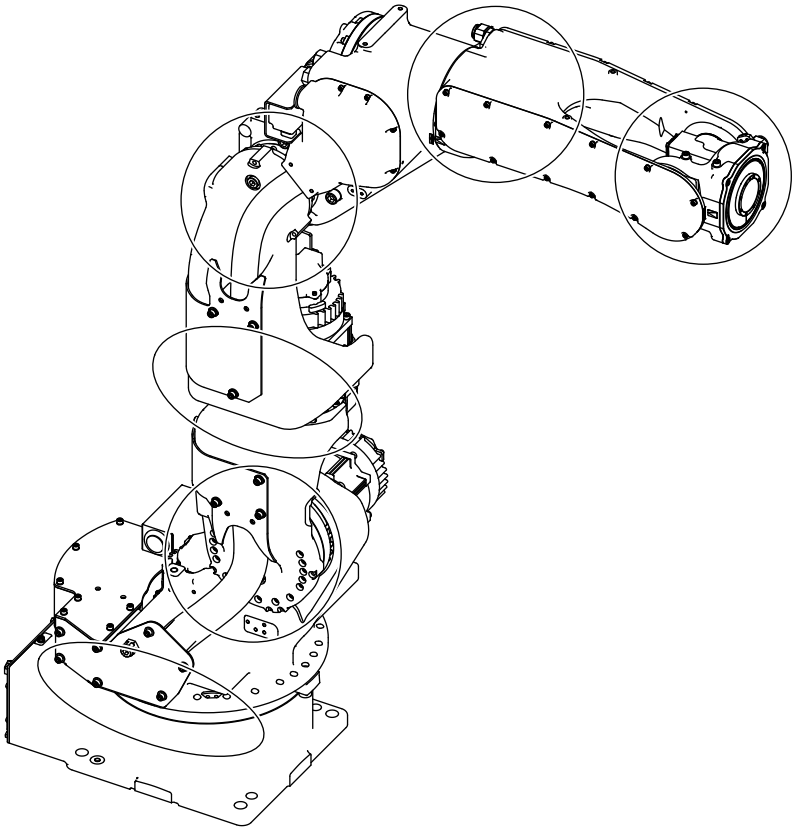
Fig. 9-5: Alignment Mark Check



9.3.2 Seeped Oil Check

Periodically check for contamination due to seeped oil or oil spot. Especially the parts indicated in *fig. 9-6 "Inspection Parts for Seeped Oil Check"* must be inspected carefully. Wipe off seeped oil or oil spot with a cloth before use.

Fig. 9-6: Inspection Parts for Seeped Oil Check



9.3.3 Protective Tube Replacement

The protective tube is installed on the external lead wire.

Clean the spatter on a regular basis. Also, check for a hole and/or a tear in the tube. Replace the tube if any.

Refer to *fig. 9-7 "Disassembly and Reassembly of Protective Tube"* .

■ **Disassembly**

1. Turn OFF the robot controller power supply.
2. Remove the protective tube ①.
3. Remove the protective tube ②.
4. Remove the protective tube ③.

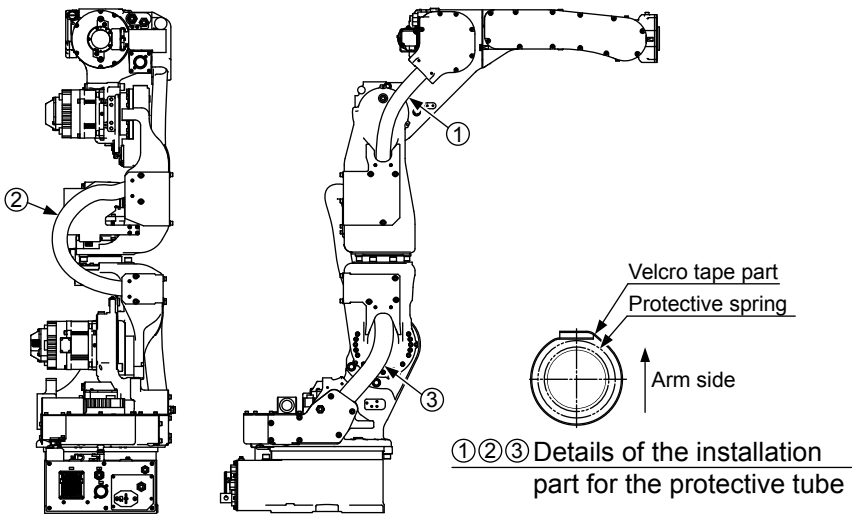
■ **Reassembly**

1. Wrap the protective tubes ①, ②, and ③ around the protective spring of the internal wiring harness.
   At this time, make sure to wrap the protective tubes ①, ②, and ③ in the direction shown in *fig. 9-7*.
2. Turn ON the robot controller power supply.

Table 9-3: Internal Wiring Harness Parts Checklist (Casing)

No.	Item	Qty.	Note
①	Protective tube MTK-50	1	350 mm
②	Protective tube MTK-50	1	570 mm
③	Protective tube MTK-50	1	350 mm

Fig. 9-7: Disassembly and Reassembly of Protective Tube



9.3.4 S-, L-, E-, U-, and R-axis Motors

For the S-, L-, E-, U-, and R-axis motors, there are holes for grease leakage detection. Remove the screws or bolts from the holes to check for grease leakage from the motor.

For the hole of each axis, refer to *fig. 9-8(a) "Positions of Grease-Leakage Detection Hole"* and *fig. 9-8(b) "Positions of Grease-Leakage Detection Hole"*. If grease leakage is detected, contact your YASKAWA representative.

Fig. 9-8(a): Positions of Grease-Leakage Detection Hole

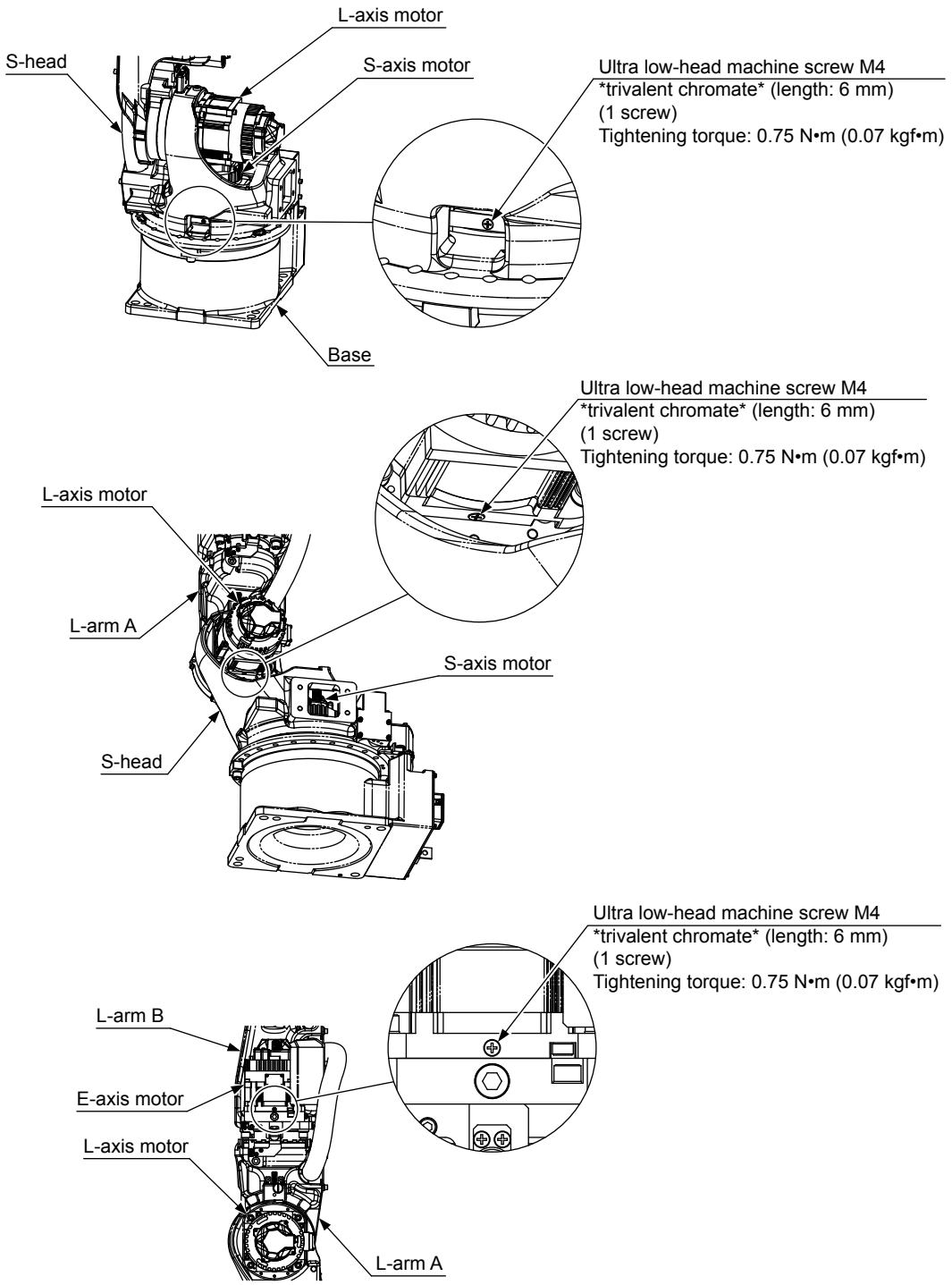
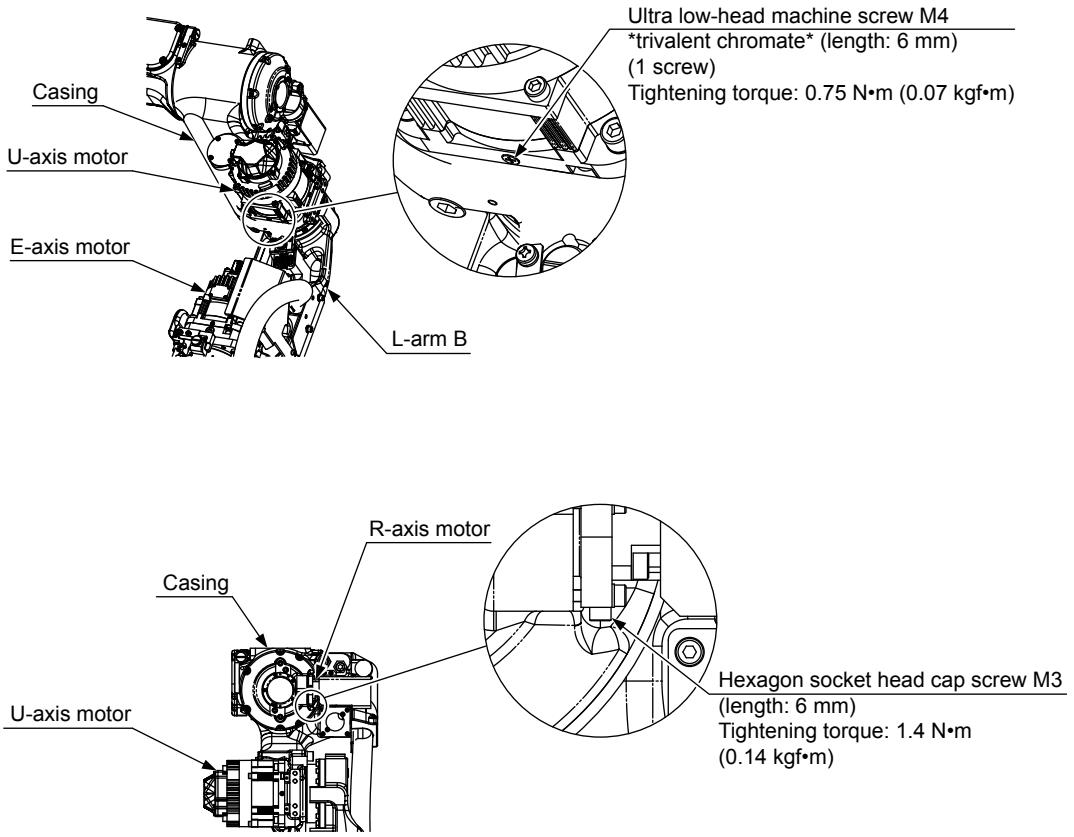


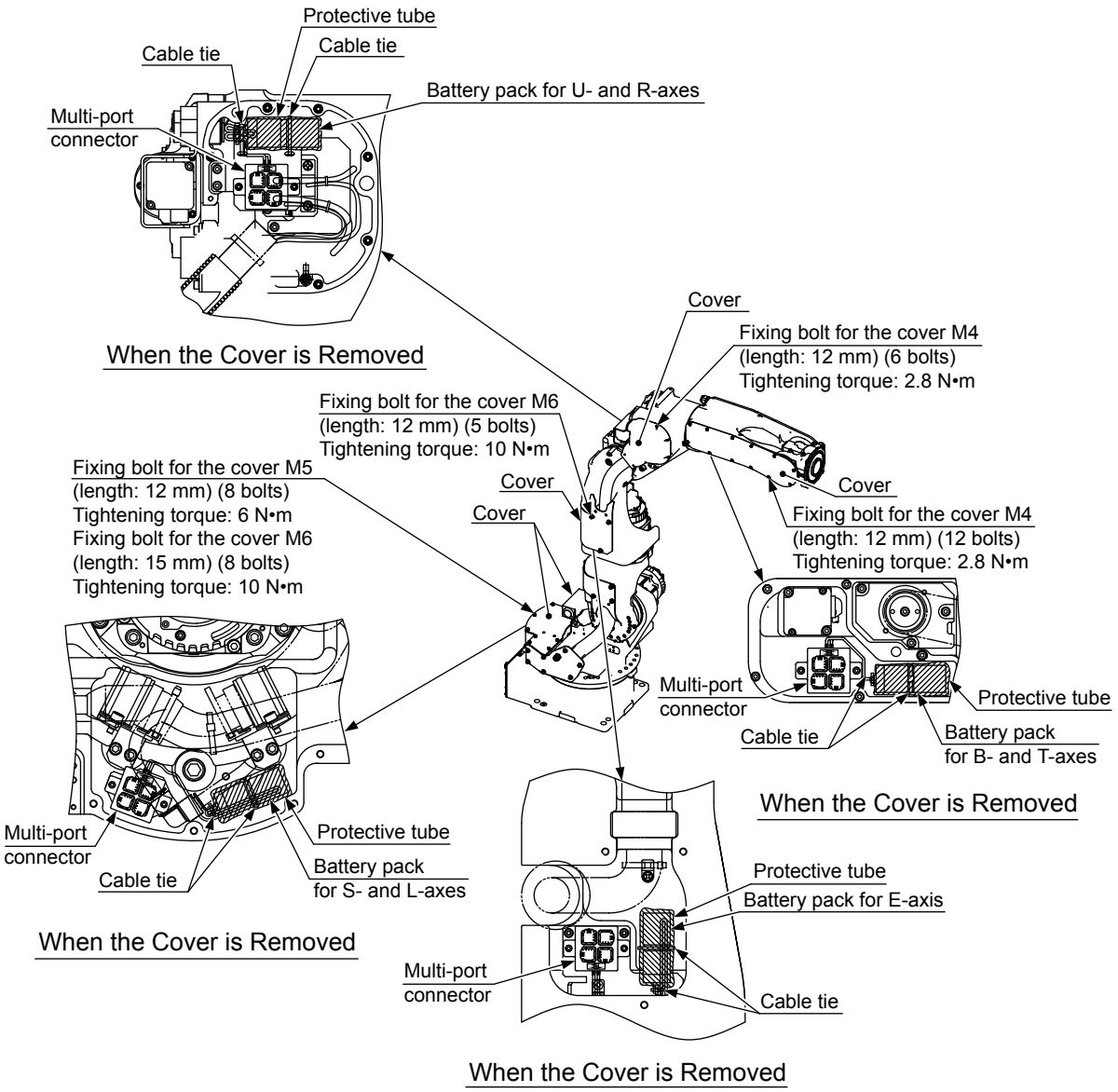
Fig. 9-8(b): Positions of Grease-Leakage Detection Hole



9.3.5 Battery Pack Replacement

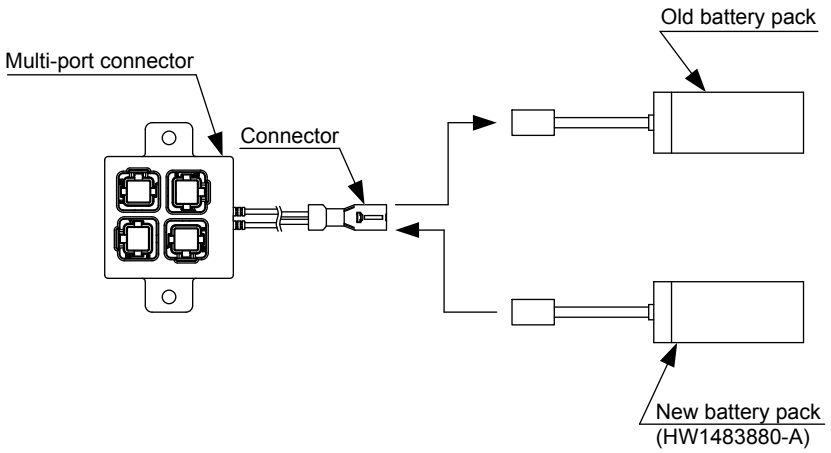
Four battery packs are installed in the position shown in *fig. 9-9 "Location of the Battery and Multi-port Connector"* . If the battery alarm occurs in the YRC1000, replace the battery in accordance with the following procedure:

Fig. 9-9: Location of the Battery and Multi-port Connector



■ **Normal (The power supply of the YRC1000 can be turned ON)**

Fig. 9-10: Battery connection (the power supply of the YRC1000 can be turned ON)



1. Turn ON the power supply of the YRC1000 and turn OFF the servo power.

DANGER

- Make sure to perform the battery replacement with the emergency stop button being pressed.

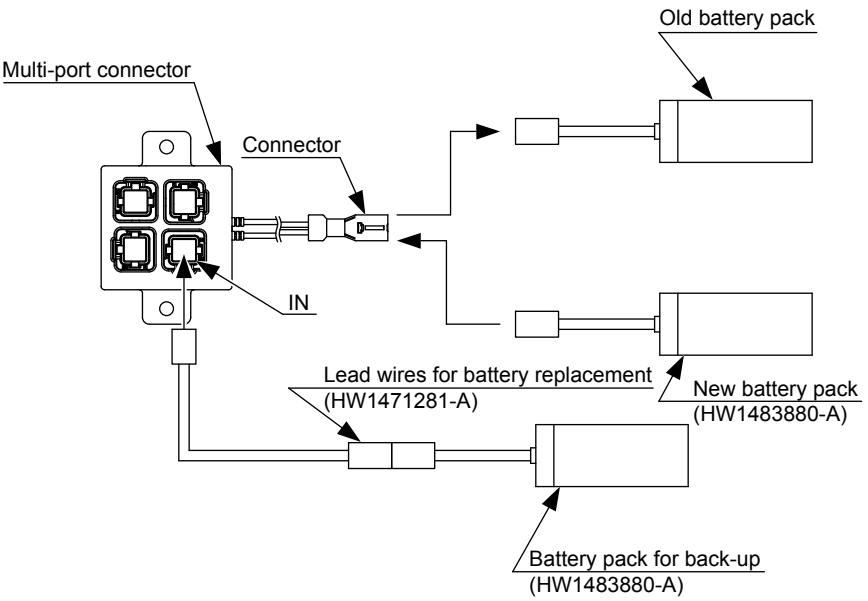
Failure to observe this instruction may cause improper movement of the manipulator which may result in personal injury and/or equipment damage.

2. Loosen the cover mounting bolts and remove the cover.
3. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.
4. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.
5. Remove the old battery pack from the multi-port connector and mount the new battery pack.
6. Fix the new battery pack by using the cable tie T18L.
7. After placing the connector and the lead wires around the connector into the protective tube, fix the opening of the protective tube by using the cable tie T18L.
8. Fix the new battery pack and the protective tube in which the connector is placed at step 7 by using the cable tie T18L.
9. Tighten the cover mounting bolts by using the tightening torque shown in *fig. 9-9 "Location of the Battery and Multi-port Connector"* to reinstall the cover.

NOTE When reinstalling the cover, be careful not to get caught the cable.

■ When the Power Supply of the YRC1000 Cannot Be Turned ON

Fig. 9-11: Battery Connection (the power supply of the YRC1000 cannot be turned ON)



1. Prepare lead wires for battery replacement and a battery pack for backup. (Apart from the new battery pack for replacement, prepare a battery pack for backup)
2. Loosen the cover mounting bolts and remove the cover.
3. Remove the connector from the “IN” port of the multi-port connector. Connect the lead wires for battery replacement to the “IN” port of the multi-port connector.
4. Connect the battery pack for backup to the lead wires for battery replacement.

NOTE Before removing the old battery pack, make sure to connect the battery pack for backup to prevent the encoder absolute data from disappearing.

5. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.
6. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.
7. Remove the old battery pack from the multi-port connector and mount the new battery pack.
8. Remove the lead wires for battery replacement and the battery pack for backup from the multi-port connector, connect the connector which has been removed at step 3 of this procedure to the “IN” port again.

NOTE If the battery pack for backup remains connected, an electric current flows from the new battery to the backup battery and which may result in the voltage drop in the new battery. Remove the battery pack for backup immediately after connecting the new battery.

9. Fix the new battery pack by using the cable tie T18L.

10. After placing the connector and the lead wires around the connector into the protective tube, fix the opening of the protective tube by using the cable tie T18L.
11. Fix the new battery pack and the protective tube in which the connector is placed at step 10 by using the cable tie T18L.
12. Tighten the cover mounting bolts by using the tightening torque shown in *fig. 9-9 "Location of the Battery and Multi-port Connector"* to reinstall the cover.

NOTE When reinstalling the cover, be careful not to get caught the cable.

9.4 Notes on Grease Replenishment/Exchange Procedures

9.4.1 Grease Exchange Procedures for S-, L-, E-, and U-axis Speed Reducer

9.4.1.1 Notes on Grease Exchange Procedures

Make sure to follow the instructions listed below at grease replenishment/ exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

NOTE

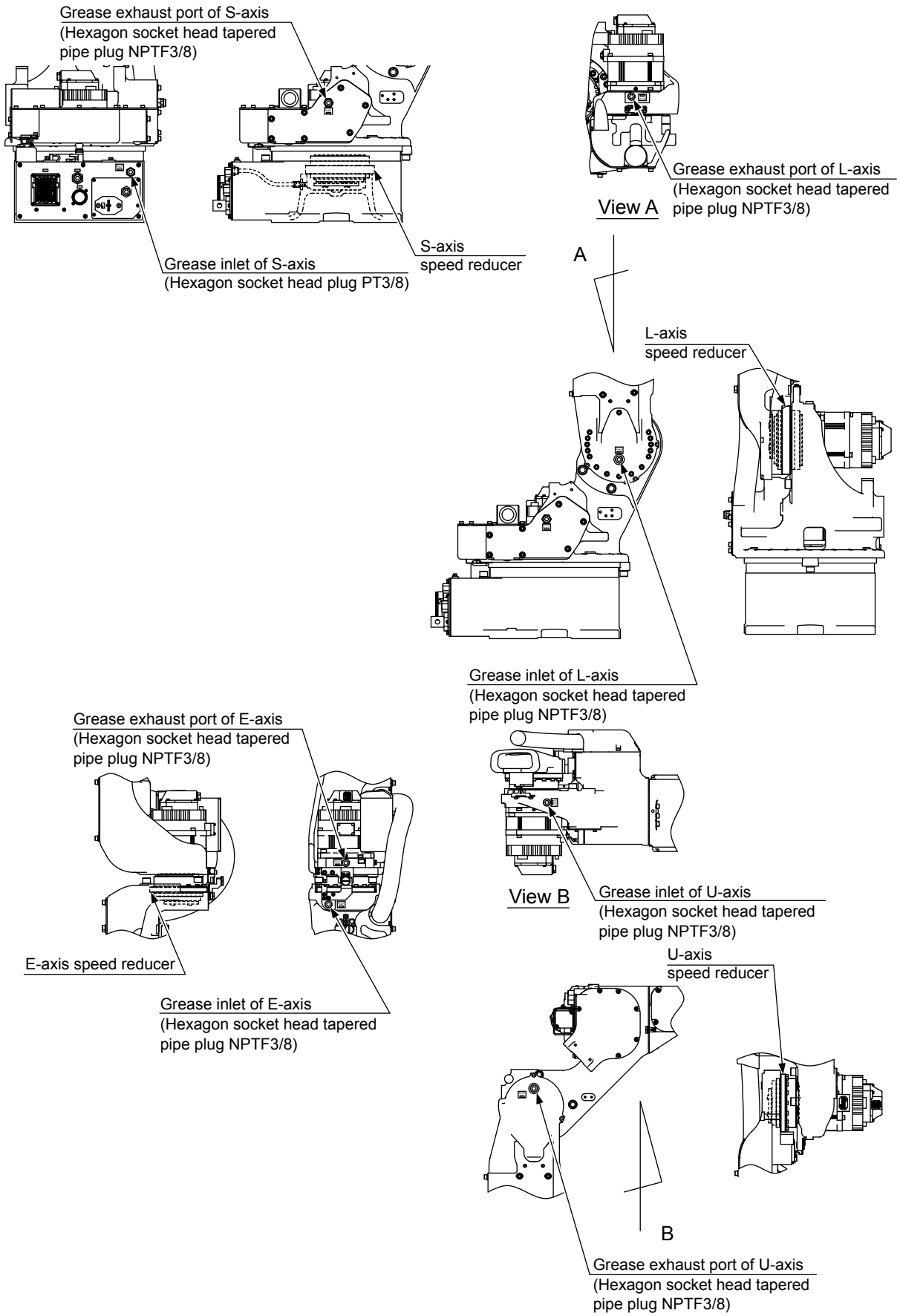
- If grease is injected without removing the plug from the grease exhaust port, grease will leak inside a motor, or an oil seal of a speed reducer will come off. Make sure to remove the plug or it may result in a failure.
  Also, when using a tube, the length must be 150 mm or shorter and the inside diameter must be 6 mm or longer. If the tube is too long, the exhaust resistance at the tube part is increased, and the inner pressure of the grease bath is raised. It may result in coming off of an oil seal.
- Make sure to use a grease pump to inject grease. Set the grease injection rate to 7 g/s or less. (Air supply pressure to the grease pump: 0.3 MPa or less (rough standard))
- When using extrusion air for discharging grease, set air supply pressure at 0.025 MPa or less.
  If the air supply pressure is higher than above mentioned value, an oil seal of a speed reducer will come off, and it may result in a failure.
- When using extrusion air for discharging grease, grease may be vigorously discharged from the exhaust port. Perform an operation such as using a tube at the grease exhaust port to pour into an appropriate container.
- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.
- After injecting grease, discharge the specified amount of grease. If insufficient, the inner pressure is raised during the operation, and grease may leak. When discharged too much, the speed reducer is not lubricated sufficiently during the operation, and it may cause the early failure of the speed reducer.
- When filling/exchanging grease, grease may flow out from the grease inlet or the grease exhaust port. Prepare a container to receive grease and a waste cloth to wipe grease in advance.
- After mounting a speed reducer or a motor, and then wait for 30 minutes or more and then inject grease.
  If grease is filled before the sealing bond is solidified, it may cause grease to leak.

WARNING

- When operating the manipulator, do not enter into the working area of the manipulator. Injury may result if anyone enter into the working area during operation.

9.4.1.2 Grease Exchange Procedure

Fig. 9-12: S-, L-, E-, and U-Axis Speed Reducer Diagram



1. Before injecting grease, the posture of the manipulator must be set as indicated in *table 9-4 "Recommended Posture for Grease Injection"* . If it is difficult to make the recommended posture because of external cabling or etc., adjust the posture as much as possible to make the position of the grease inlet located in the lower part and the position of exhaust port located in the upper part. If the exhaust port is located in the lower part, grease may not be exchanged properly.

Table 9-4: Recommended Posture for Grease Injection

Axis to inject	**Posture**						
	S-axis	L-axis	E-axis	U-axis	R-axis	B-axis	T-axis
S-axis	Any	Any	Any	Any	Any	Any	Any
L-axis	Any	0°	Any	Any	Any	Any	Any
E-axis	Any	0°	Any	Any	Any	Any	Any
U-axis	Any	0° *	Any *	0° *	Any	Any	Any
R-axis	Any	0° *	Any *	0° *	0°	0°	0°
B-axis							
T-axis							

* If the recommended posture cannot be made, make the U-arm horizontal to the ground.

2. Remove the hexagon socket head plugs from the grease inlet and grease exhaust port.
3. Install a grease zerk A-PT3/8 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Recommended grease lubricator "Powerlube P3C (made by Macnaught)"
   - Amount of grease: 7 g/s or less
     (For example, if grease is supplied from the lubricator at 2 times/s, set the amount to 3.5 g/time or less.)
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less

Table 9-5: Amount of Grease

Axis to exchange grease	**Amount of grease**
S-axis	Approx. 468 g
L-axis	Approx. 382 g
E-axis	Approx. 305 g
U-axis	Approx. 315 g

5. Injection stop:
   – <When replacing the speed reducer>
   Stop injecting grease when grease can be seen from the exhaust port.
   – <When exchanging grease>
   The old grease is discharged from the grease exhaust port. At this time, stop injection when the mixture of the old grease and the new grease in an equal ratio is seen.
   And then, skip the steps 6 and 7, and proceed to the step 8.
6. Operate each axis about 5 times in the teach mode as shown in *table 9-6 "Teaching Operation for Each Axis"* .

Table 9-6: Teaching Operation for Each Axis

Axis to replenish grease	**Angle for teaching operation**	**Speed for teaching operation**
S-axis	S-axis ±45°	User-specified
L-axis	L-axis ±45°	
E-axis	E-axis ±45°	
U-axis	U-axis ±45°	

7. Inject grease again, and when grease comes out of the exhaust port, grease injection is completed.
8. Discharge the specified amount of grease from the grease inlet or grease exhaust port. (Refer to *table 9-7 "Amount of Grease Discharged from Each Axis"* .) In order to discharge the specified amount of grease, receive the discharged grease by using a container, and then measure the weight of the discharged grease by weighing the container till the amount reaches to the specified amount.
   Use one of the following methods to discharge grease.

   Method 1: Extruding grease by air

   (1) Connect the joint and the hose to the grease inlet.
   (2) Connect the regulator to the grease exhaust port.
   (3) Inject air from the grease exhaust port to extrude grease by air. (Extrusion air pressure: 0.025 MPa or less)
   (4) If grease is not discharged enough by injecting air, operate the manipulator about 5 times in the teach mode as shown in *table 9-6*.

   Method 2: Suctioning grease out

   (1) Keep the inlet open and insert the tube into the exhaust port.
   (2) Discharge grease by suctioning grease out of the exhaust port. (Suction pressure: 0.025 MPa or less)
   (3) If grease is not discharged by suctioning, operate the manipulator again about 5 times in the teach mode as shown in *table 9-6*.

Table 9-7: Amount of Grease Discharged from Each Axis

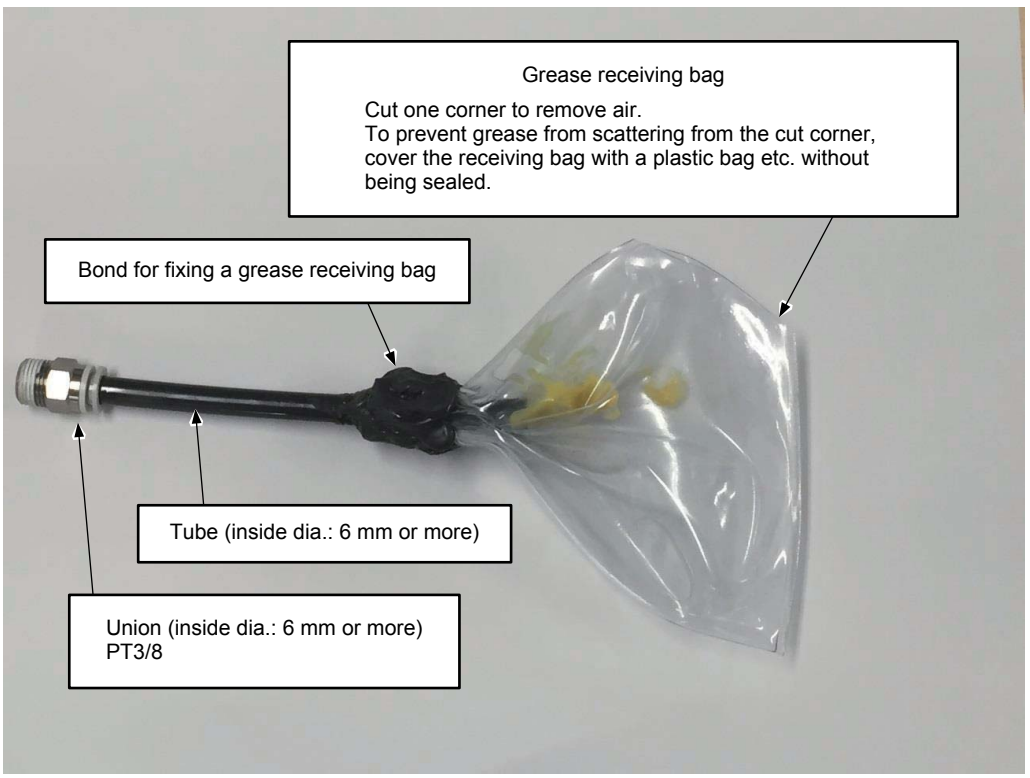
Axis to exchange grease	**Amount of exhausted grease**	
	[g]	**[cc]**
S-axis	25±5	30±5
L-axis	50±5	60±5
E-axis	30±5	35±5
U-axis	40±5	45±5

9. For the axis where grease has been exchanged, perform a playback operation indicated in *table 9-8 "Running- In Operation for Each Axis"* for running-in the speed reducer with grease. At this time, grease may be discharged during the operation. Remove the grease zerk from the grease inlet, and clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, and then attach it to the grease inlet. Tighten the plug with the tightening torque of 16.5 N•m (1.7 kgf•m). Also, discharge the excess grease in order not to increase the inner pressure of the speed reducer.
   Attach a bag to receive grease such as indicated in *fig. 9-13 "Grease Receiving Bag (Rough Standard)"* , and then perform the running-in operation.

Table 9-8: Running- In Operation for Each Axis

Axis to exchange grease	**Running-in operation**			
	Operation angle	Operation speed	Timer after each operation	Operating time
S-, L-, E-, and U-axis	±45°	MOVJ VJ=50.00	1.0 s	15 minutes

Fig. 9-13: Grease Receiving Bag (Rough Standard)



10. Wipe discharged grease with a cloth. Clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, attach it to the grease exhaust port, and then tighten the plug with the tightening toque of 16.5 N•m (1.7 kgf•m).

9.4.2 Grease Replenishment Procedures for R,B-axis Speed Reducer and R,T-axis Gear

9.4.2.1 Notes on Grease Replenishment Procedures

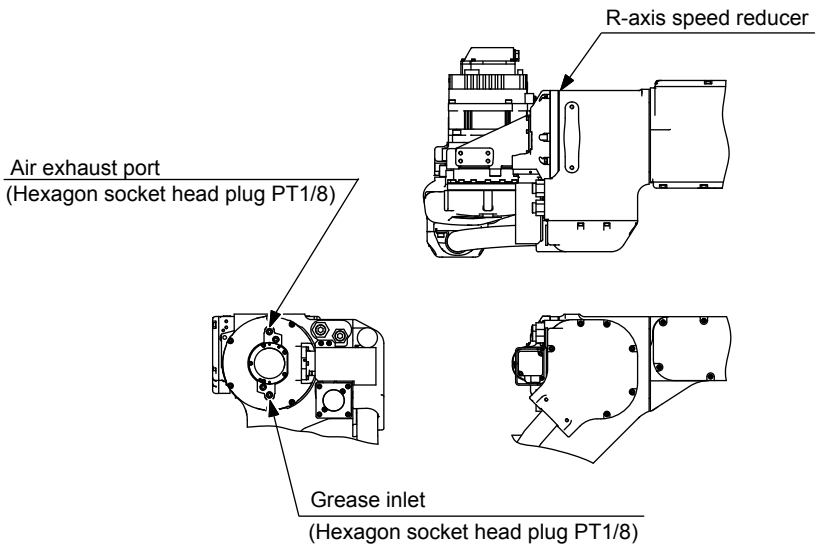
Make sure to follow the instructions listed below at grease exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

NOTE

- If grease is injected without removing the plug from the air exhaust port, grease may leak inside of the motor, and/or an oil seal of a speed reducer may come off and/or grease may leak inside of the manipulator.
  Make sure to remove the plug before injection.
- Use the hand pump or injection syringe for grease injection.
- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

9.4.2.2 Grease Replenishment Procedures for R-axis Speed Reducer

Fig. 9-14: R-Axis Speed Reducer Diagram



1. Make the posture of the U-arm horizontal to the ground.
2. Remove the hexagon socket head plugs from the grease inlet and the air exhaust port.
3. Install a grease zerk A-PT1/8 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)

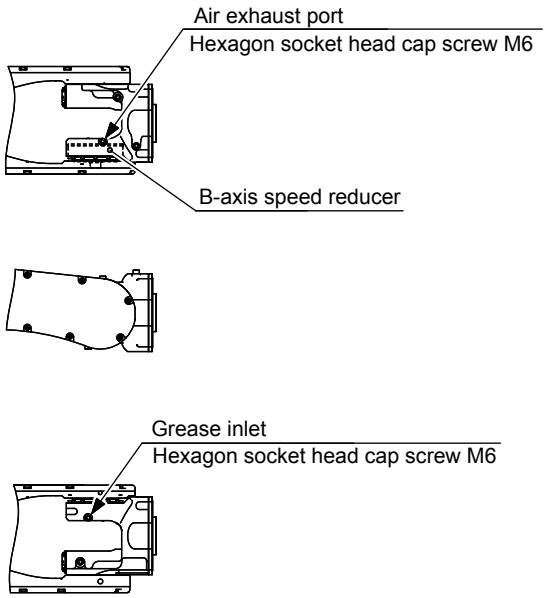
4. Inject grease through the grease inlet using a grease gun
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 7 g

NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet and install the plug. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N•m (0.49 kgf•m).
6. Install the plug to the air exhaust port. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N•m (0.49 kgf•m).

9.4.2.3 Grease Replenishment Procedures for B-axis Speed Reducer

Fig. 9-15: B-Axis Speed Reducers Diagram



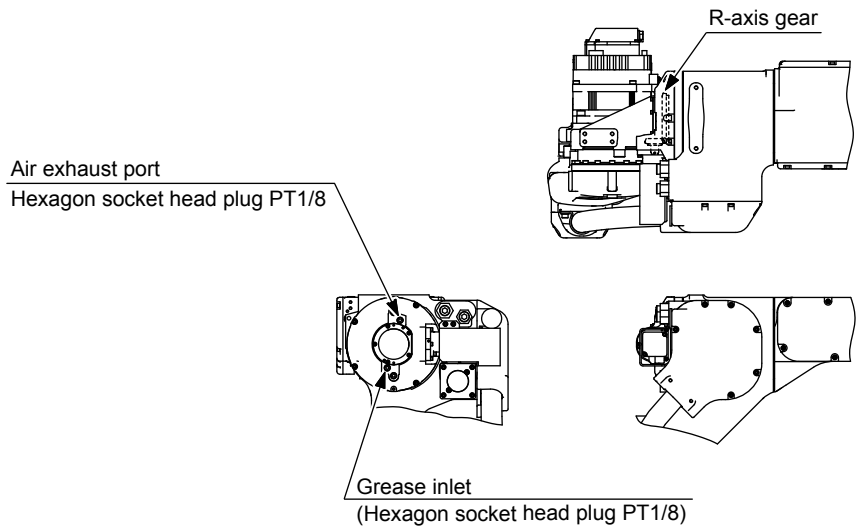
1. Adjust the posture of the manipulator to perform grease replenishment smoothly.
2. Remove the hexagon socket head cap screws M6 from the grease inlet and the air exhaust port.
3. Install a grease zerk A-MT6×1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease into the grease inlet.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 7 g

NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet. Install the hexagon socket head cap screw M6 to the grease inlet. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).
6. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).

9.4.2.4 Grease Replenishment Procedures for R-axis Gear

Fig. 9-16: R-Axis Gear Diagram



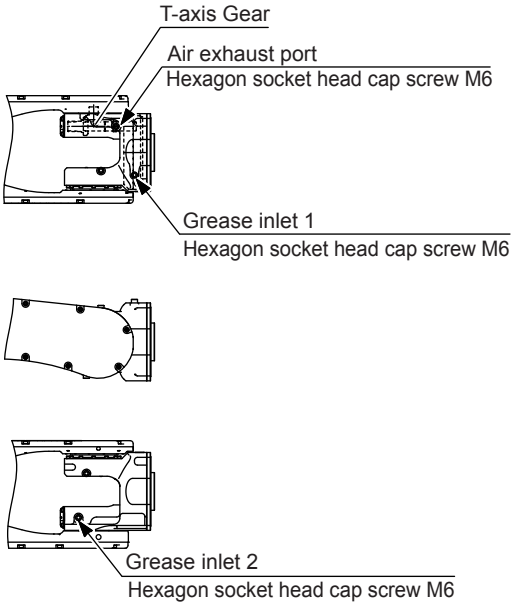
1. Make the posture of the U-arm horizontal to the ground.
2. Remove the hexagon socket head plug from the grease inlet and the air exhaust port.
3. Install a grease zerk A-PT1/8 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)
4. Inject grease into the grease inlet.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 3 g (for replenishment)
     55 g (when the speed-reducer is replaced)

NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet and install the plug. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N·m (0.49 kgf·m).
6. Install the plug to the air exhaust port.
   Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N·m (0.49 kgf·m).

9.4.2.5 Grease Replenishment Procedures for T-axis Gear

Fig. 9-17: T-Axis Gear Diagram



1. Adjust the posture of the manipulator to perform grease replenishment smoothly.
2. Remove the hexagon socket head cap screws M6 from the grease inlet 1 and the air exhaust port.
3. Install a grease zerk A-MT6×1 to the grease inlet 1.
   (The grease zerk is delivered with the manipulator.)
4. Inject grease into the grease inlet 1.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 2 g

NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet 1. Install the hexagon socket head cap screw M6 to the grease inlet 1. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).

6. Remove the hexagon socket head cap screw M6 from the grease inlet 2.
7. Install a grease zerk A-MT6×1 to the grease inlet 2.
   (The grease zerk is delivered with the manipulator.)
8. Inject grease into the grease inlet 2.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 2 g

NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

9. Remove the grease zerk from the grease inlet 2. Install the hexagon socket head cap screw M6 to the grease inlet 2. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N･m (0.6 kgf･m).
10. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N･m (0.6 kgf･m).

10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for your manipulator.

To purchase lead wires of the wire harness or etc., check the order/ manufacture no. and contact your YASKAWA representative.

Product performance cannot be guaranteed when using spare parts from any company other than YASKAWA. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts.
- Rank B: Parts for which replacement may be necessary as a result of frequent operation.
- Rank C: Drive unit.

NOTE For replacing parts in Rank B or Rank C, contact your YASKAWA representative.

Table 10-1: Recommend Spare Parts (Sheet 1 of 3)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
A	1	Grease	Molywhite RE No.00	YASKAWA Electric Corporation	16 kg	-	
A	2	Grease	Harmonic Grease SK-1A	Harmonic Drive Systems Co., Ltd.	2.5kg	-	
A	3	Grease	Multemp PS2A	KYODO YUSHI CO., LTD	2.5kg	-	
A	4	Grease	MP-1	NIPPON GREASE CO., LTD	2.5kg	-	
A	5	Liquid Gasket	TB1206C	ThreeBond Co., Ltd.	-	-	
A	6	Adhesive	LOCTITE 243	Henkel Japan Ltd.	-	-	
A	7	Seal Tape	TB4501	ThreeBond Co., Ltd.	-	-	
A	8	Battery Pack	HW1483880-A	YASKAWA Electric Corporation	1	4	
A	9	Lead Wire for Battery Replacement	HW1471281-A	YASKAWA Electric Corporation	1	-	
A	10	Protective Tube	MTK-50	YASKAWA Electric Corporation	1	1.3 m	

Table 10-1: Recommend Spare Parts (Sheet 2 of 3)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
A	11	Gasket	HW1306400-1	YASKAWA Electric Corporation	1	1	U-arm Cover Part (B-axis)
A	12	Gasket	HW1306401-1	YASKAWA Electric Corporation	1	1	U-arm Cover Part (T-axis)
A	13	Gasket	HW1407822-1	YASKAWA Electric Corporation	1	1	M-base Part (B-axis)
A	14	Gasket	HW1407823-1	YASKAWA Electric Corporation	1	1	M-base Part (T-axis)
A	15	O-ring	S30	YASKAWA Electric Corporation	1	2	
B	16	B-axis Timing Belt	60S3M603	Mitsuboshi Belting Limited	1	1	
B	17	T-axis Timing Belt	80S3M789	Mitsuboshi Belting Limited	1	1	
B	18	Replacement Kit for S-axis Speed Reducer [1)]	HW1485443-A	YASKAWA Electric Corporation	1	1	Speed Reducer HW0386621-B Input Gear HW0312734-2
B	19	Replacement Kit for L-axis Speed Reducer [1)]	HW1485444-A	YASKAWA Electric Corporation	1	1	Speed Reducer HW0387809-A Input Gear HW0312735-2
B	20	Replacement Kit for E-axis Speed Reducer [1)]	HW1485445-A	YASKAWA Electric Corporation	1	1	Speed Reducer HW1380153-A Input Gear HW1303245-1
B	21	Replacement Kit for U-axis Speed Reducer [1)]	HW1485446-A	YASKAWA Electric Corporation	1	1	Speed Reducer HW1380153-A Input Gear HW1303245-1
B	22	Replacement Kit for R-axis Speed Reducer [1)]	HW1484255-A	YASKAWA Electric Corporation	1	1	Speed Reducer HW1382521-A
B	23	Replacement Kit for B-axis Speed Reducer [1)]	HW1484256-A	YASKAWA Electric Corporation	1	1	Speed Reducer HW1382522-A
B	24	Replacement Kit for R-axis Unit	HW1484257-A	YASKAWA Electric Corporation	1	1	R-axis Motor and including Speed Reducer
B	25	Wrist Unit	HW1172936-A	YASKAWA Electric Corporation	1	1	B- and T-axis Motor and including B-axis Speed Reducer
B	26	Wire Harness in Manipulator	HW1173293-A	YASKAWA Electric Corporation	1	1	

Table 10-1: Recommend Spare Parts (Sheet 3 of 3)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
B	27	Wire Harness in Manipulator for B- and T-axis	HW1271557-A	YASKAWA Electric Corporation	1	1	
B	28	Lead Wire for S-axis Signal	HW1372597-A	YASKAWA Electric Corporation	1	1	Lead wire between S-axis motor and multi-port connector
B	29	Lead Wire for L-axis Signal	HW1372597-B	YASKAWA Electric Corporation	1	1	Lead wire between L-axis motor and multi-port connector
B	30	Lead Wire for E-axis Signal	HW1372597-BR	YASKAWA Electric Corporation	1	1	Lead wire between E-axis motor and multi-port connector
B	31	Lead Wire for U-axis Signal	HW1372597-C	YASKAWA Electric Corporation	1	1	Lead wire between U-axis motor and multi-port connector
B	32	Lead Wire for R-, B-, and T-axis Power	HW1372678-A	YASKAWA Electric Corporation	1	3	Lead wire between R-, B-, and T-axis motor and the wire harness in Manipulator
B	33	Bypass Cable	HW1471212-A	YASKAWA Electric Corporation	1	-	Signal lead wires for tentative recovery from failure
C	34	S-, E-, and U-axis AC Servomotor	SGM7G-05APK-YR1* HW1385162-A	YASKAWA Electric Corporation	1	3	
C	35	L-axis AC Servomotor	SGM7G-09APK-YR1* HW1385163-A	YASKAWA Electric Corporation	1	1	
C	36	R-, B-, and T-axis AC Servomotor	SGM7J-01APK-YR1* HW1385161-A	YASKAWA Electric Corporation	1	3	
C	37	Multi-port Connector	HW1384619-A	YASKAWA Electric Corporation	1	4	
C	38	Power Supply Board	HW1384624-A	YASKAWA Electric Corporation	1	1	
C	39	Dummy Connector	HW1471285-A	YASKAWA Electric Corporation	1	-	For the axes detachment function

1 The replacement kit for the speed reducer includes the following parts.
•Speed reducer and gear (described in Remarks)
•Required parts to change speed reducer (oil seals, bolts, or other parts)
For details of the replacement kit for the speed reducer, contact your YASKAWA representative.

MOTOMAN-AR1440E
INSTRUCTIONS

YASKAWA

YASKAWA ELECTRIC CORPORATION

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