

MOTOMAN-GP120RL INSTRUCTIONS

TYPE:**YR-1-06VRL120-A00****(MOTOMAN-GP120RL STANDARD SPECIFICATION)**

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

MOTOMAN INSTRUCTIONS**MOTOMAN-GP120RL INSTRUCTIONS****YRC1000 INSTRUCTIONS****YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)****YRC1000 MAINTENANCE MANUAL****YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)**

MANUAL NO.

HW1486107 



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. 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 upper 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.

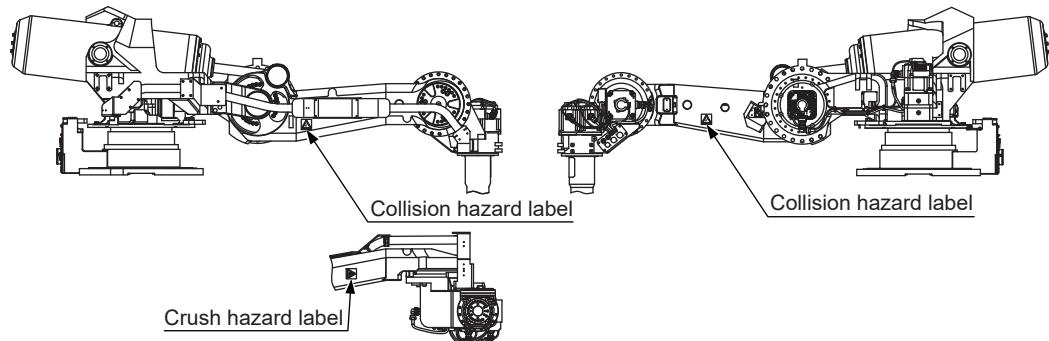
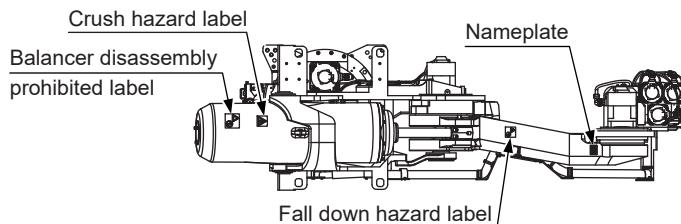
Explanation of Warning Labels

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

TYPE	PAYLOAD	kg
DATE		
SERIAL NO.	MASS	kg
YASKAWA ELECTRIC CORPORATION		
2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004 Japan		
MADE IN JAPAN		
 		NJ4030

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

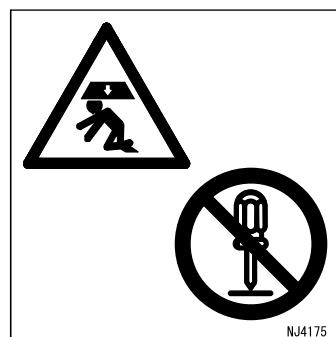
Crush hazard label**Description**

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.

Balancer disassembly prohibited label**Description**

Do not disassemble the balancer.

When disassembling the balancer, the internal energy is released and the L-arm rotates. Failure to observe this caution may result in injury or malfunction.

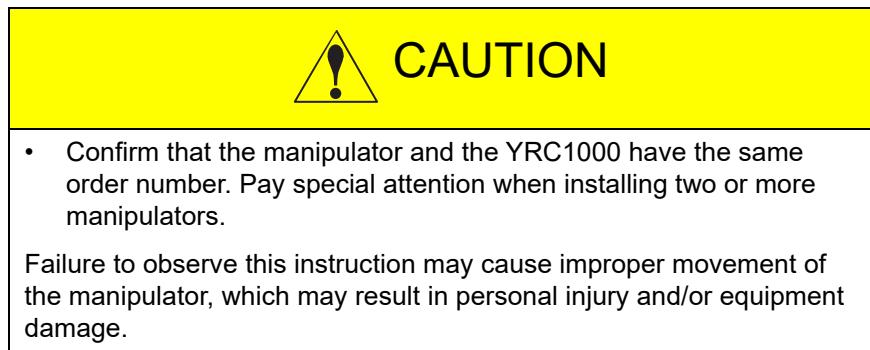
Motor removing prohibited label**Description**

Do not remove the motor without mounting the jig for fixing the motor. Failure to observe this safety precaution may result in injury from unexpected turning of the manipulator's arm.

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1 Product Confirmation



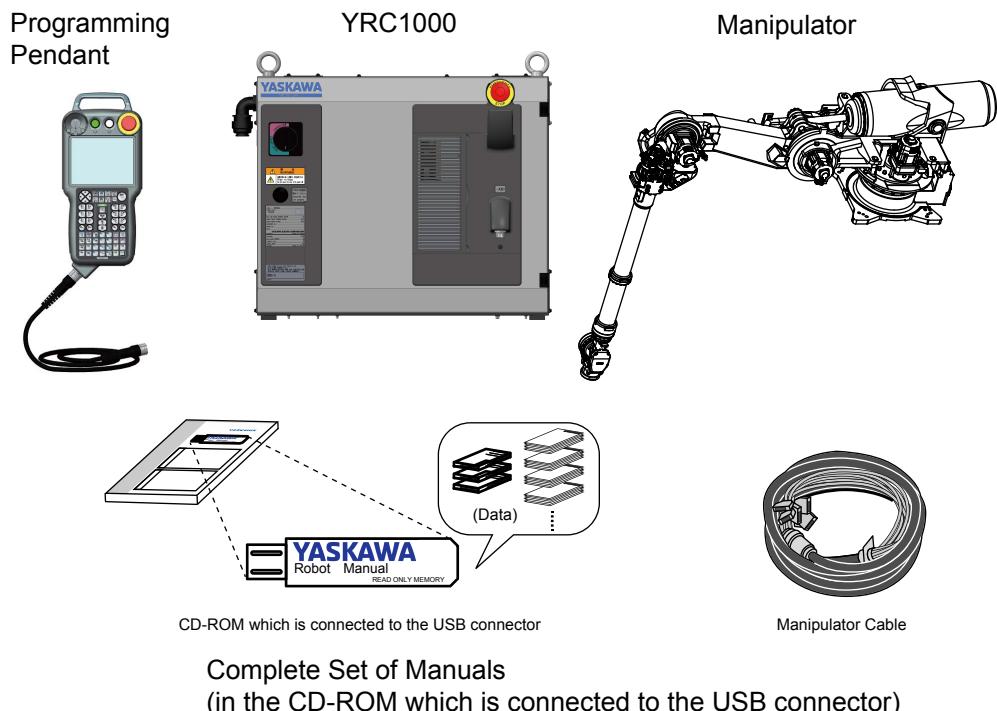
1.1 Contents Confirmation

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

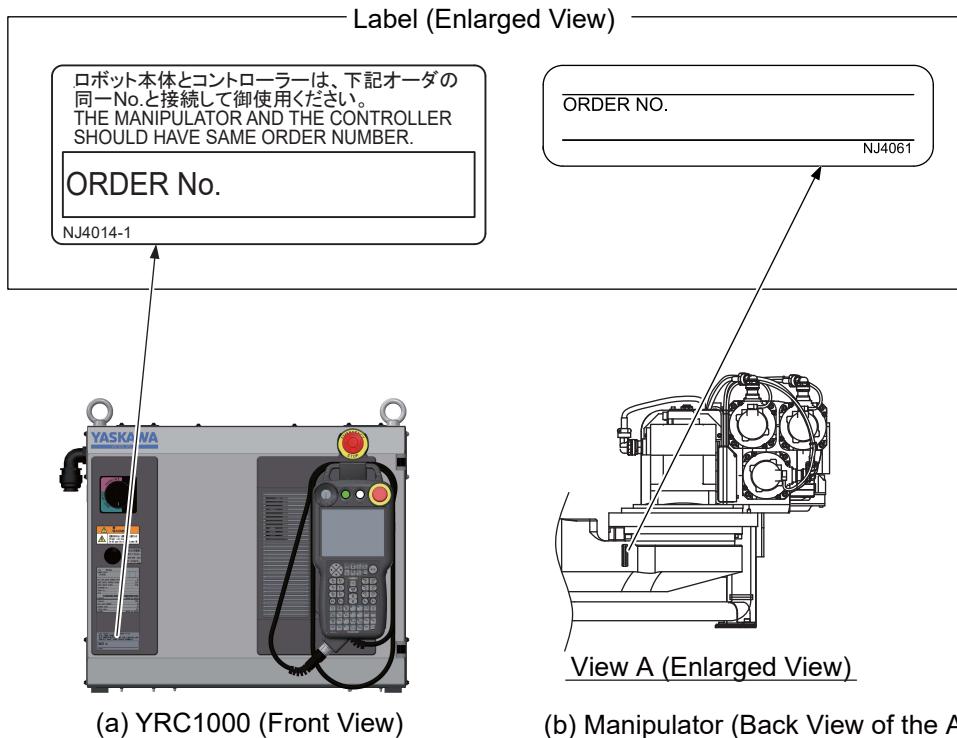
Accessories of Manipulator	Pcs	Remarks
Hexagon socket head cap screw M20 (length:80 mm)	8	
Spring washer M20 *stainless*	8	For mounting the manipulator
Washer M20 *stainless*	8	
	4	For grease replenishment of L-, U-, R-, B-, and T-axes
Grease zerk A-PT1/8	1	For grease replenishment for the R-, B-, and T-axis gear in the casing
	3	For grease replenishment for the joint of the balancer
Grease zerk A-PT1/4	1	For grease replenishment of S-axis

1 Product Confirmation
1.2 Order Number Confirmation

1.2 Order Number Confirmation

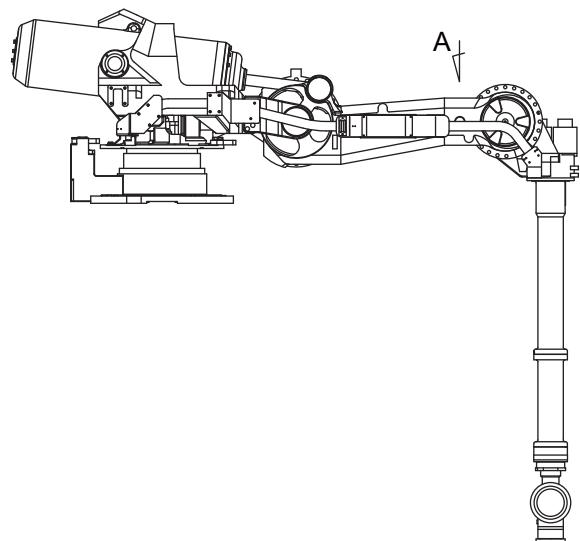
Confirm the order number of the manipulator corresponds to the YRC1000. The order number is located on a label as shown below.

Fig. 1-2: Location of Order Number Labels



(a) YRC1000 (Front View)

(b) Manipulator (Back View of the Arm)



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

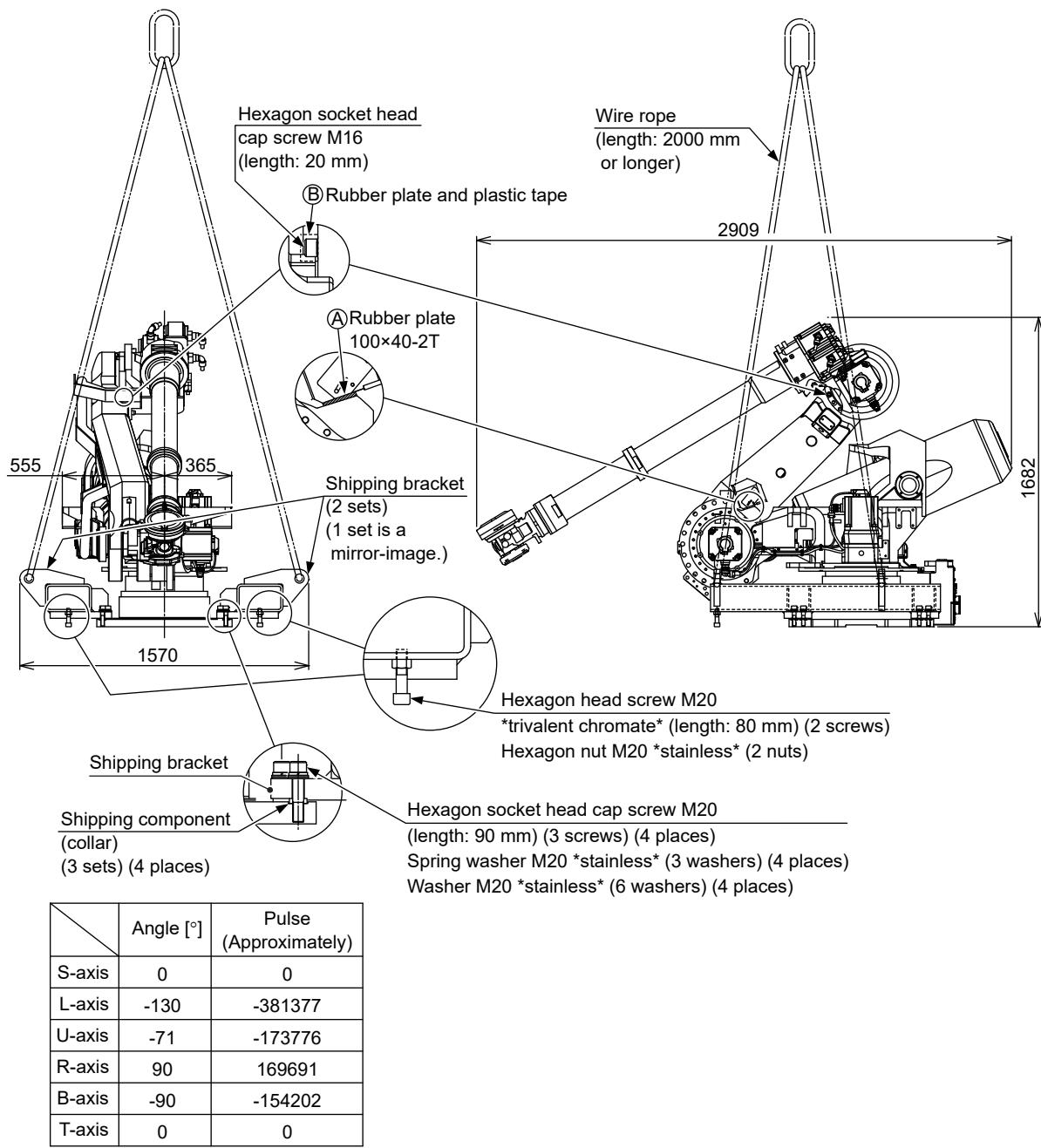
As a rule, the manipulator must be lifted by a crane with four wire ropes when removing the manipulator from the package and moving it. Be sure to fix the manipulator with the shipping brackets and the cushioning materials for transport, and lift it in the posture as shown in *fig. 2-1 “Transporting Position”*.

The length of the wire rope must be 2000 mm or longer.

2 Transport

2.1 Transport Method

Fig. 2-1: Transporting Position



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

2.1.2 Using a Forklift

When using a forklift, there are two methods to transport the manipulator: using shipping brackets or using a pallet. For either method, transport the manipulator in the posture as shown in *fig. 2-2 "Using a Forklift"*.

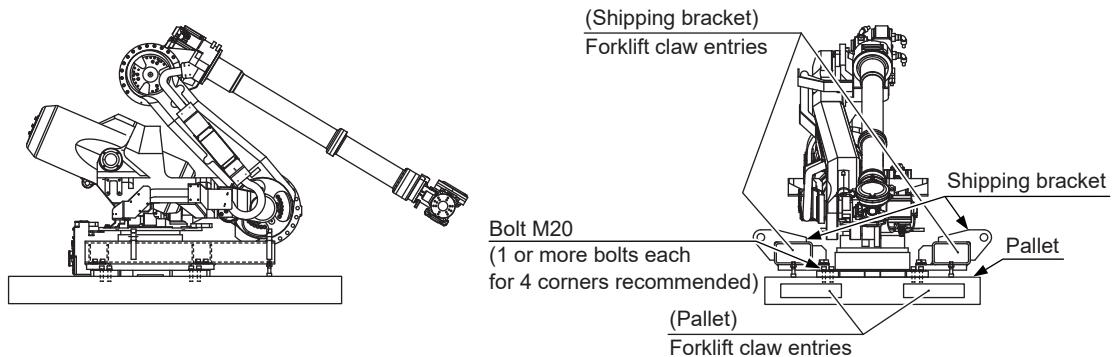
When using the shipping brackets, insert claws of the forklift into the brackets and transport the manipulator.

When using the pallet, put the pallet under the manipulator and secure the manipulator by using bolts or screws. Insert the 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



The approximate weight of the manipulator is shown below.

2085 kg (including the shipping bolts/screws and brackets)

Use a wire rope strong enough to withstand the weight.



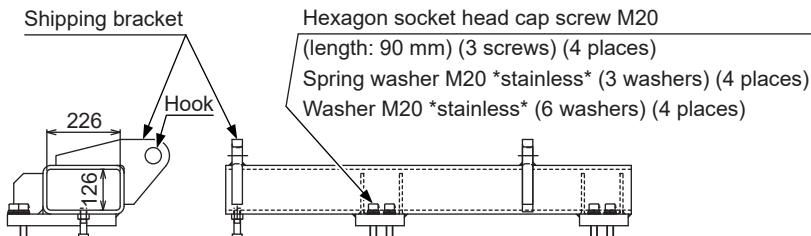
- When transporting, be sure to install the shipping brackets and the cushioning materials for transport.
- Avoid applying external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.

 2 Transport
 2.2 Shipping Bracket

2.2 Shipping Bracket

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

Fig. 2-3: Shipping Bracket



- The shipping brackets are painted yellow.
- The shipping brackets are fixed with the hexagon socket head cap screw M20 (length: 90 mm) (three screws) (four places), the spring washer M20 *stainless* (three washers) (four places), and the washer M20 *stainless* (six washers) (four places).

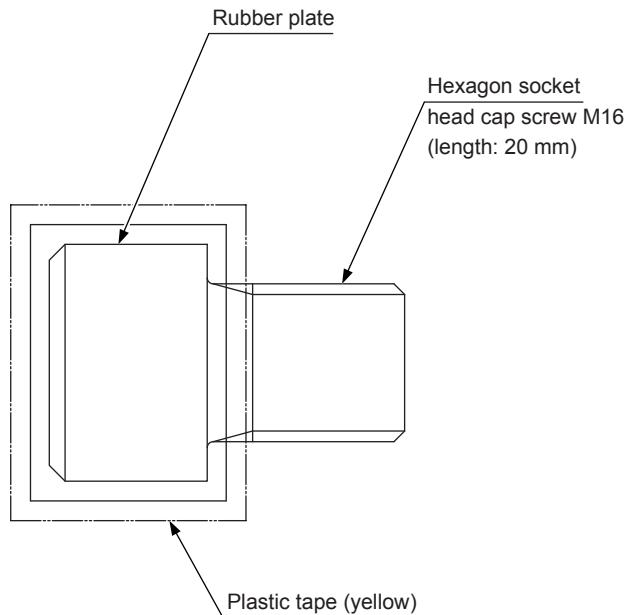


Before turning ON the power, check to be sure that the shipping bolts/screws and brackets are removed. The shipping bolts/screws and brackets then must be stored for future use, in the event that the manipulator must be moved again.

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. (See *fig. 2-1 "Transporting Position"* and *fig. 2-4 "Cushioning Materials for Transport"*.)

Fig. 2-4: Cushioning Materials for Transport



- A section: Rubber plate (thickness: 2 mm)
- B section: Refer to *fig. 2-4 "Cushioning Materials for Transport"* , wrap the rubber plate around the bolt head and wrap yellow plastic tape around that.



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 for transport 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 and the cushioning materials for transport 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.

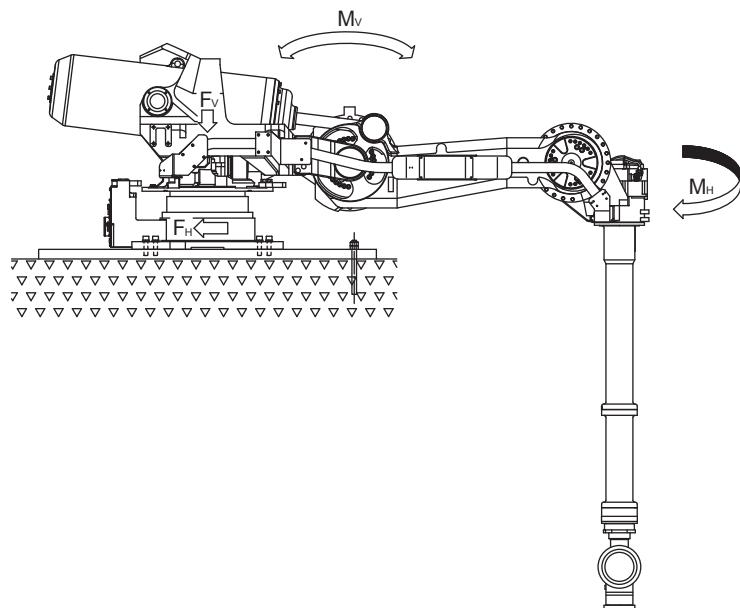
Construct a solid foundation with the appropriate thickness to withstand maximum reaction forces of the manipulator referring to *table 3-1 "Manipulator Reaction Force and Torque"*.

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	18620 N (1900 kgf)	37670 N·m (3840 kgf·m)	43120 N (4400 kgf)	88300 N·m (9000 kgf·m)
Acceleration/deceleration	5880 N (600 kgf)	7850 N·m (800 kgf·m)	18620 N (1900 kgf)	22070 N·m (2250 kgf·m)

Fig. 3-1: Manipulator Reaction Force and Torque



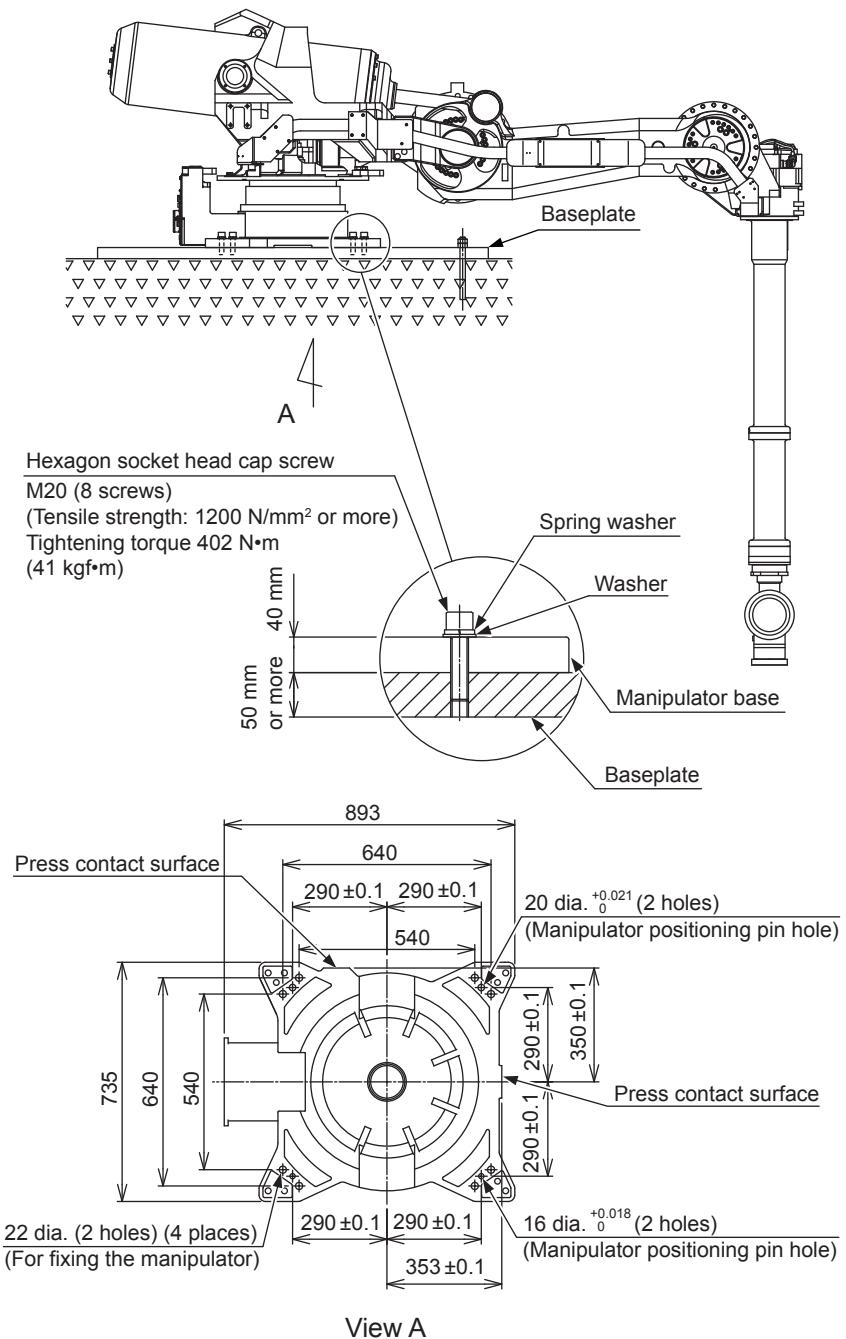
3.2.1 Mounting Example

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 50 mm or more in thickness, and anchor bolts of M20 or larger size.

The manipulator base is tapped for eight mounting holes; securely fix the manipulator base to the baseplate with eight hexagon socket head cap screws M20 (Tensile strength: 1200 N/mm² or more) (80 mm long is recommended) by using a tightening torque 402 N·m.

Next, fix the manipulator base to the baseplate. 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".

Fig. 3-2: Mounting the Manipulator on Baseplate



3.3 Mounting Method

This manipulator is mounted on a shelf (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

Item	Type YR-1-06VRL120-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



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

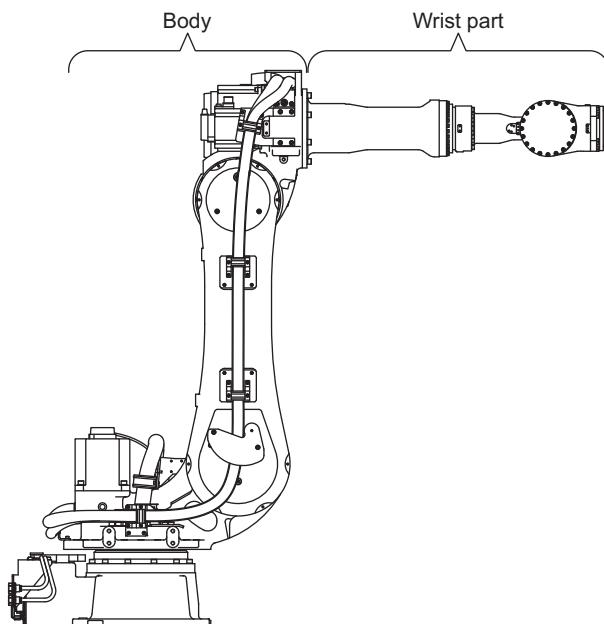
This manipulator conforms to:

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



< 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 equipments.
- 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:

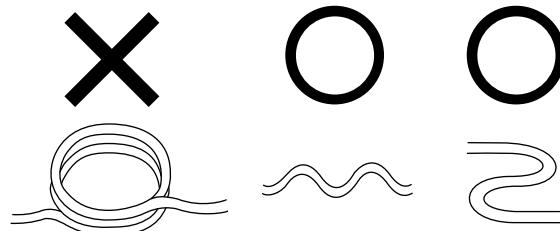
- Do not use the following liquids, because the rubber parts of the manipulator (gasket, oil seal, O-ring, etc.) may be deteriorated or corroded:
 - Organic solvent
 - Chlorine-based cutting fluid
 - Amine-based cleaning fluid
 - Corrosive substances such as acids, alkalis, or liquids/solutions causing 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 100Ω 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.

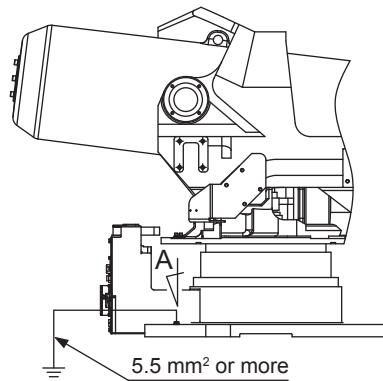


- Never use this wire sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with electrical installation standards.

Fig. 4-1: Grounding Method

Bolt M8 (For grounding)
Delivered with the manipulator

View A



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.

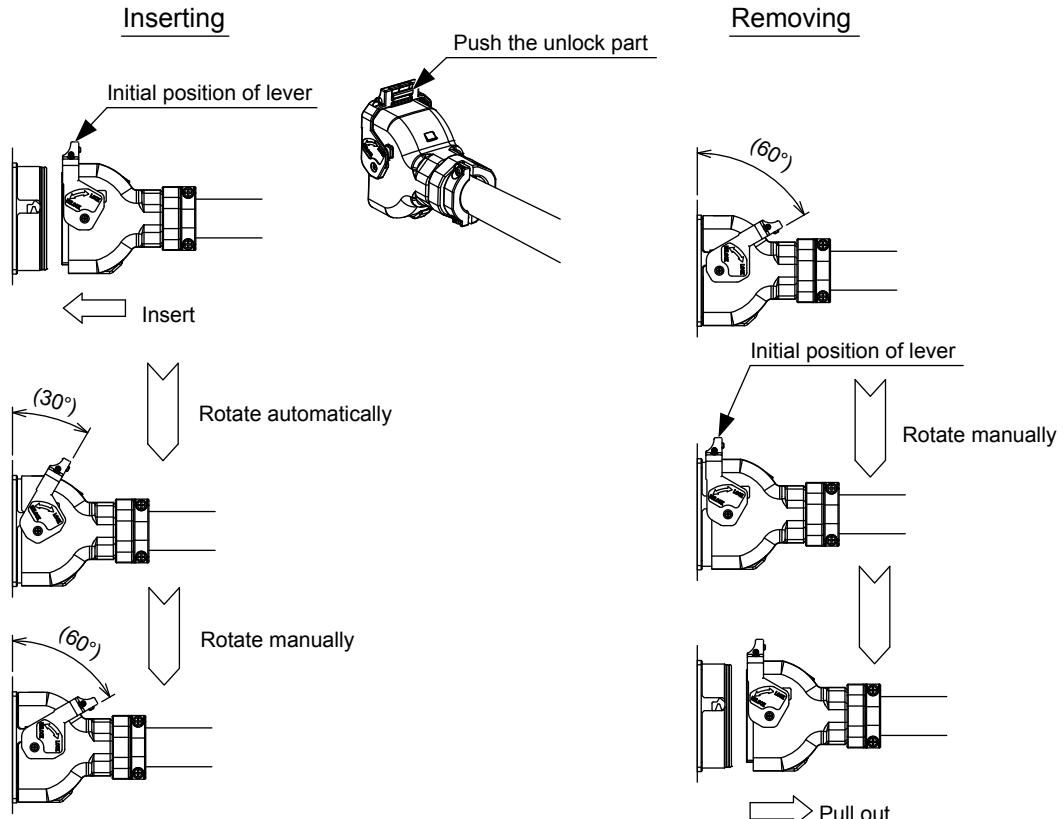
■ Procedures for Inserting the Connector

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



4 Wiring
4.2 Cable Connection

Fig. 4-3: Manipulator Cables

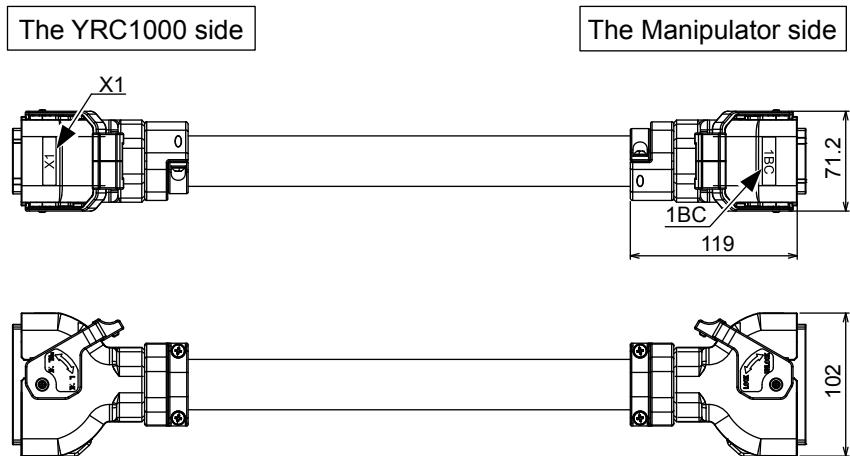


Fig. 4-4: Manipulator Cable Connection (Manipulator Side)

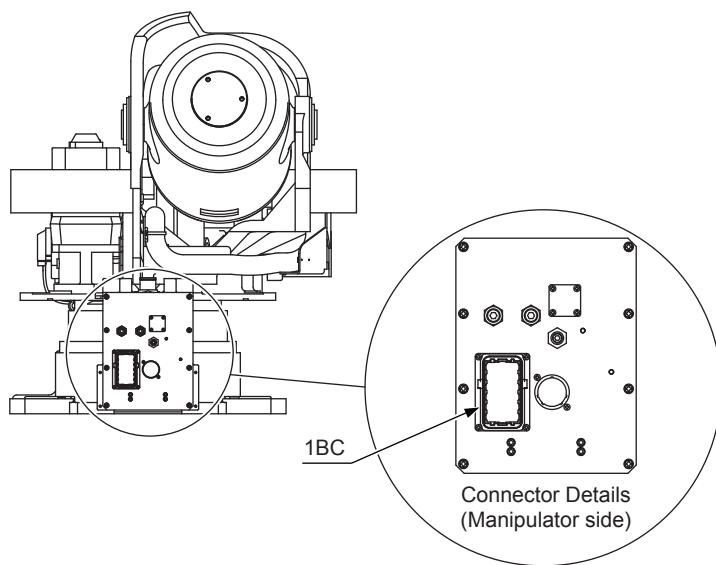


Fig. 4-5: Manipulator Cable Connection (YRC1000 Side)

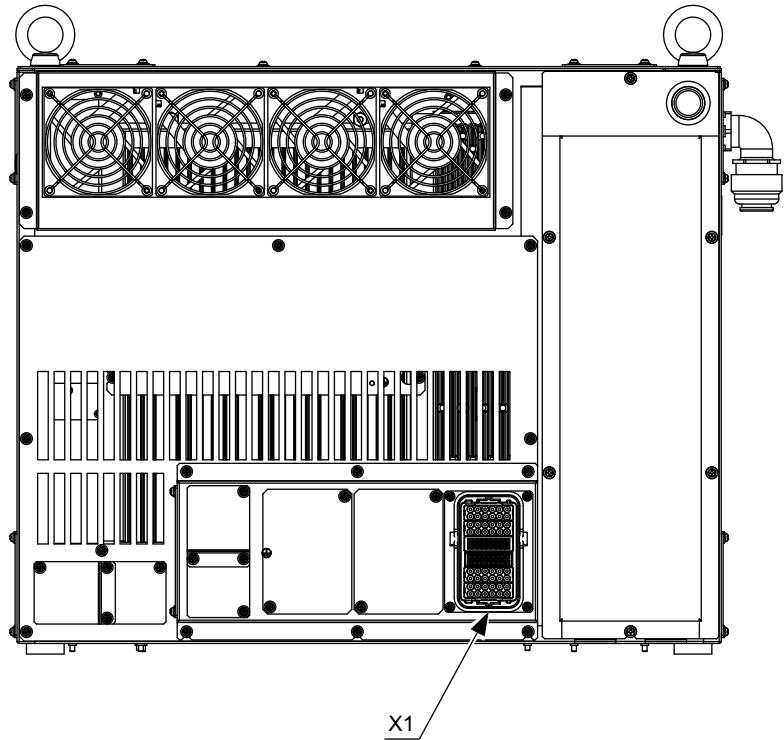
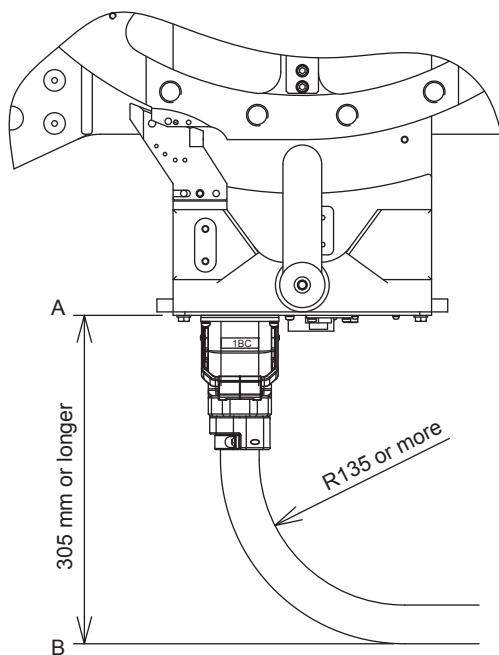


Table 4-1: Specifications of Manipulator Cable

Outside diameter (mm)	Minimum bending radius (mm)		Distance between A and B (mm)
	Fixed part	Moving part	
	135	320 ¹⁾	

1 The high flexible cable with a 250-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 Specifications¹⁾

Item	Type	YR-1-06VRL120-A00
Structure		Vertically articulated
Degree of freedom		6
Payload	Wrist part	120 kg
	U-arm	30 kg
Repeatability ²⁾		0.2 mm
Range of Motion	S-Axis (turning)	-180° - +180°
	L-Axis (lower arm)	-130° - +80°
	U-Axis (upper arm)	-78.4° - +90°
	R-Axis (wrist roll)	-360° - +360°
	B-Axis (wrist pitch/yaw)	-130° - +130°
	T-Axis (wrist twist)	-360° - +360°
Maximum Speed	S-Axis	1.57 rad/s, 90°/s
	L-axis	1.48 rad/s, 85°/s
	U-Axis	1.48 rad/s, 85°/s
	R-Axis	3.05 rad/s, 175°/s
	B-Axis	2.62 rad/s, 150°/s
	T-Axis	4.19 rad/s, 240°/s
Allowable Moment ³⁾	R-Axis	833 N·m (85 kgf·m)
	B-Axis	833 N·m (85 kgf·m)
	T-Axis	490 N·m (50 kgf·m)
Allowable Inertia ³⁾ ($GD^2/4$)	R-Axis	75 kg·m ²
	B-Axis	75 kg·m ²
	T-Axis	25 kg·m ²
Approx. Mass		1830 kg
Protective enclosure		Body: IP54 Wrist part: IP67
Mounting method		Shelf-mounted
Power Capacity		5.0 kVA
Applicable controller: YRC1000 ⁴⁾	ERAR-1000-06VX280-□ *□: Depends on the specification.	
Equivalent continuous sound pressure level ⁵⁾	67 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 "YRC1000 INSTRUCTIONS (RE-CTO-A221)" and 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.

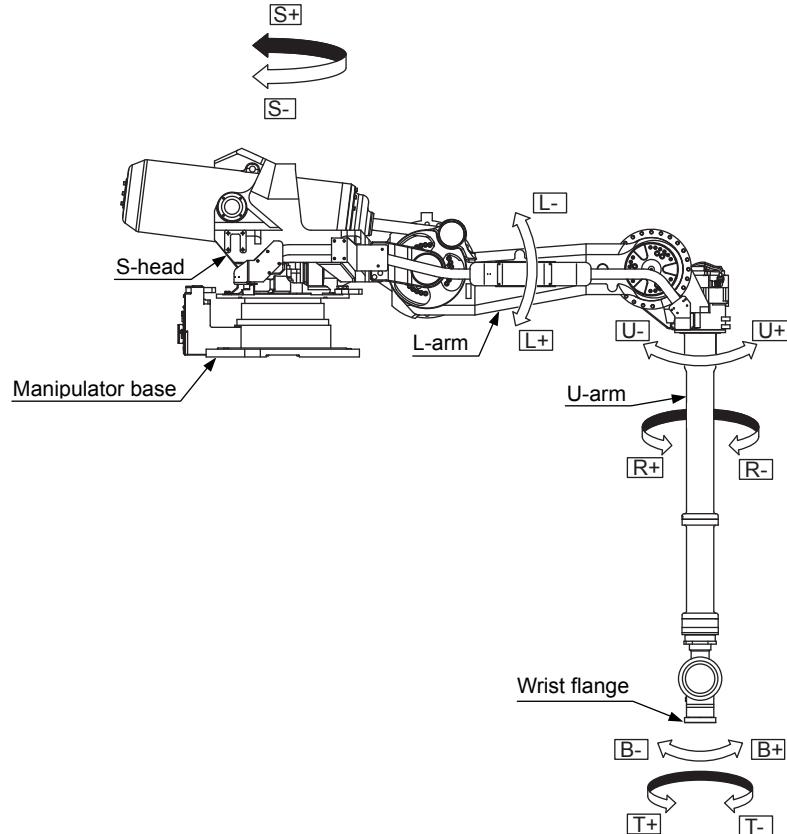
2, Measurement is carried out:

-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

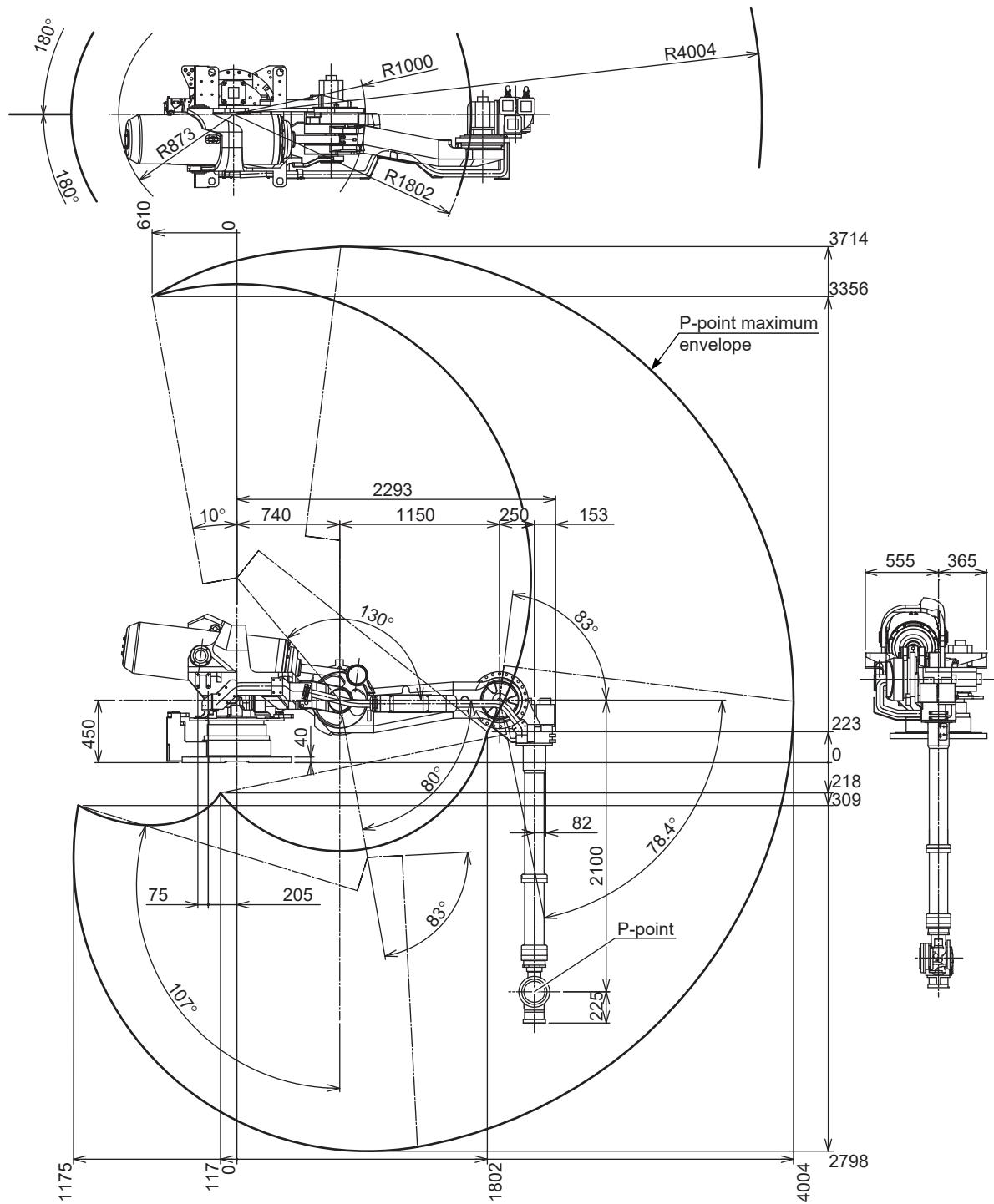
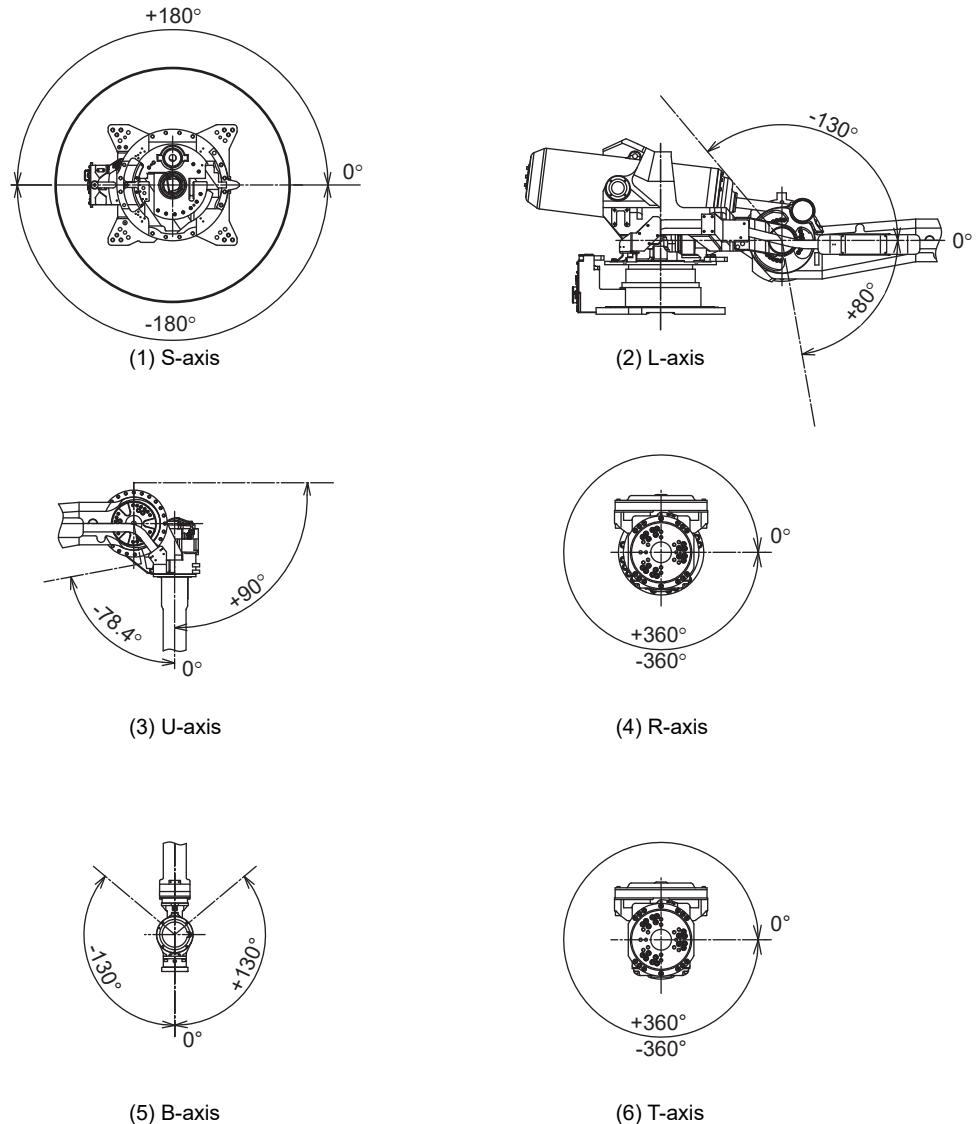


Fig. 5-3: Home Position and Operating Range of Each Axis



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

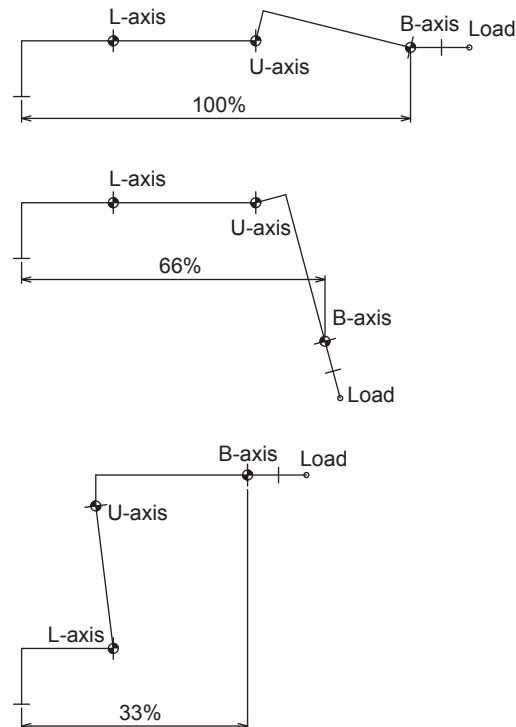
Table 5-2: YR-1-06VRL120-A00

Axis	Stopping distance (deg)	Stopping time (sec)
S-axis	37.7	0.859
L-axis	28.7	0.712
U-axis	22.7	0.595

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

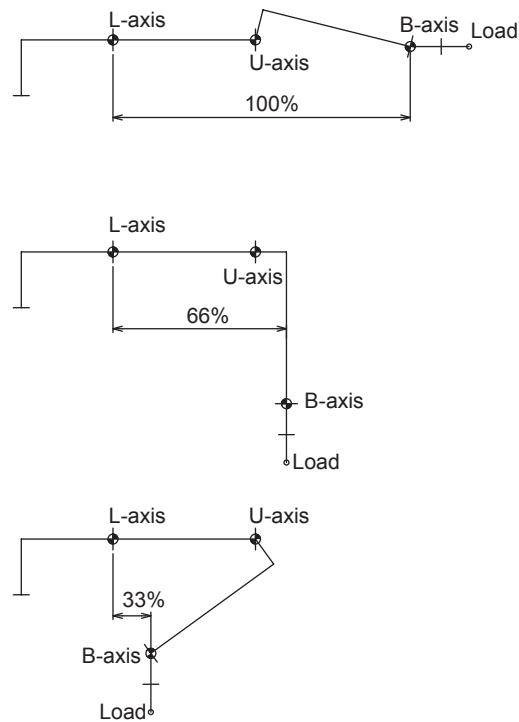


Type	100% extension length (mm)
YR-1-06VRL120-A00	4004

5 Basic Specifications

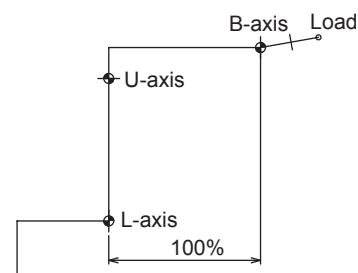
5.4 Stopping Distance and Time for S-, L-, and U-Axes

Fig. 5-5: L-Axis Extension



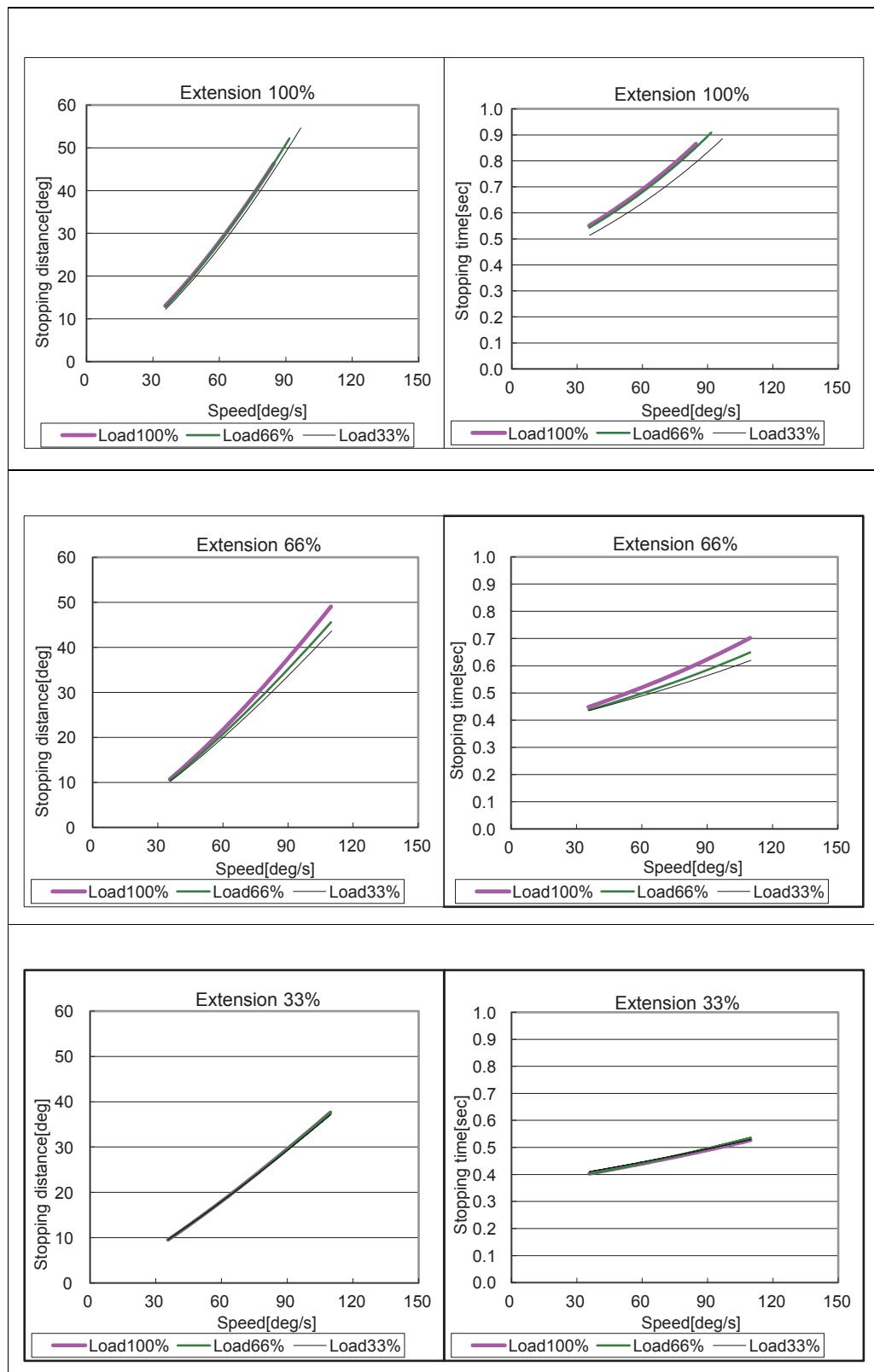
Type	100% extension length (mm)
YR-1-06VRL120-A00	3264

Fig. 5-6: U-Axis Extension



Type	100% extension length (mm)
YR-1-06VRL120-A00	2100

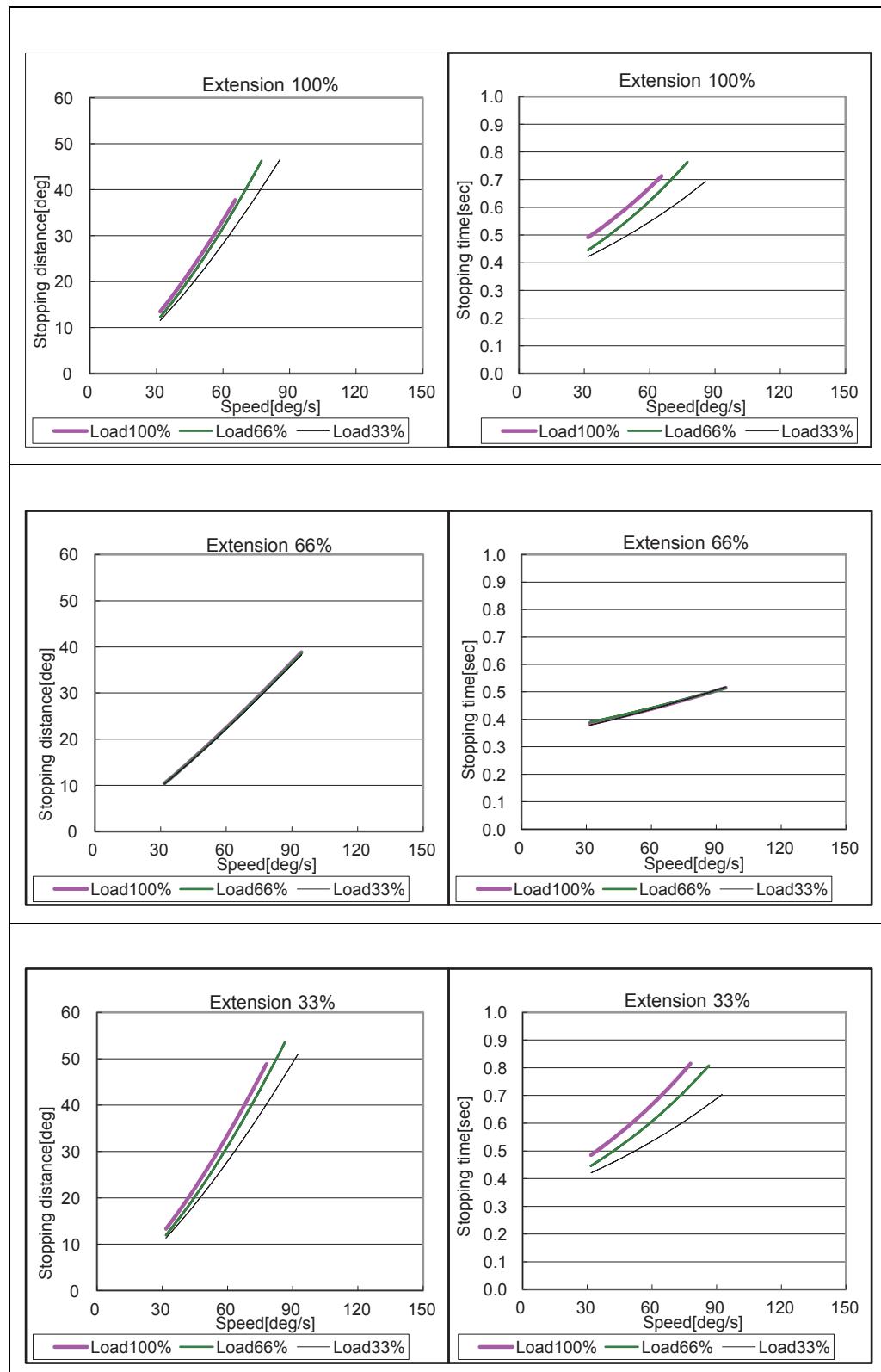
5.4.4.2 Stopping Distance and Time for Stop Category 1: S-axis



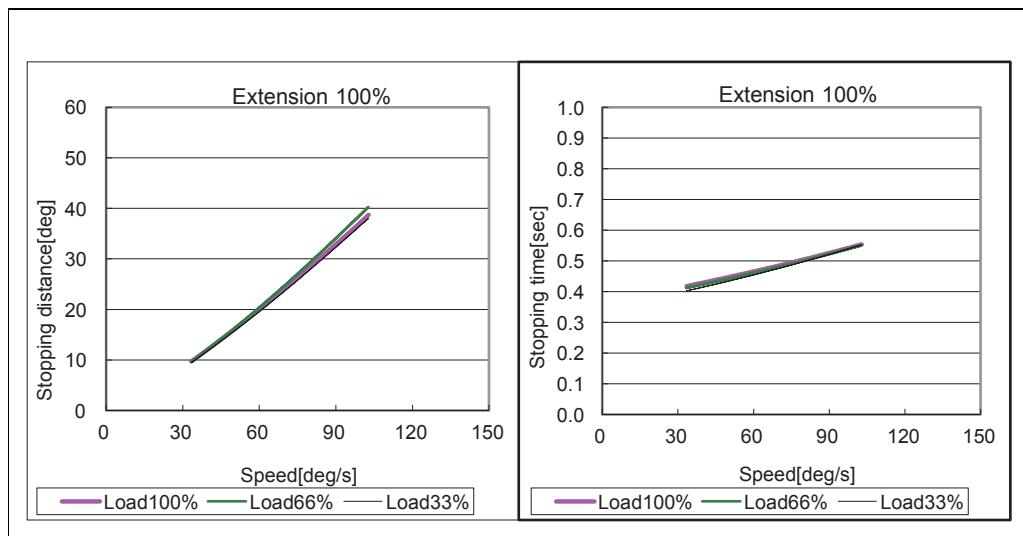
5 Basic Specifications

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

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 5-3 “S-Axis Operating Range”*. If alteration is necessary, contact your YASKAWA representative in advance.

Table 5-3: S-Axis Operating Range

Item	Specifications
S-axis operating range	- 180° - + 180° (standard) (- 165° - + 165°) ¹⁾ - 150° - + 150° - 135° - + 135° - 120° - + 120° - 105° - + 105° - 90° - + 90° - 75° - + 75° - 60° - + 60° - 45° - + 45° - 30° - + 30° (-15° - +15°) ¹⁾

1 Only 60° or wider is supported for the spacing between stoppers.



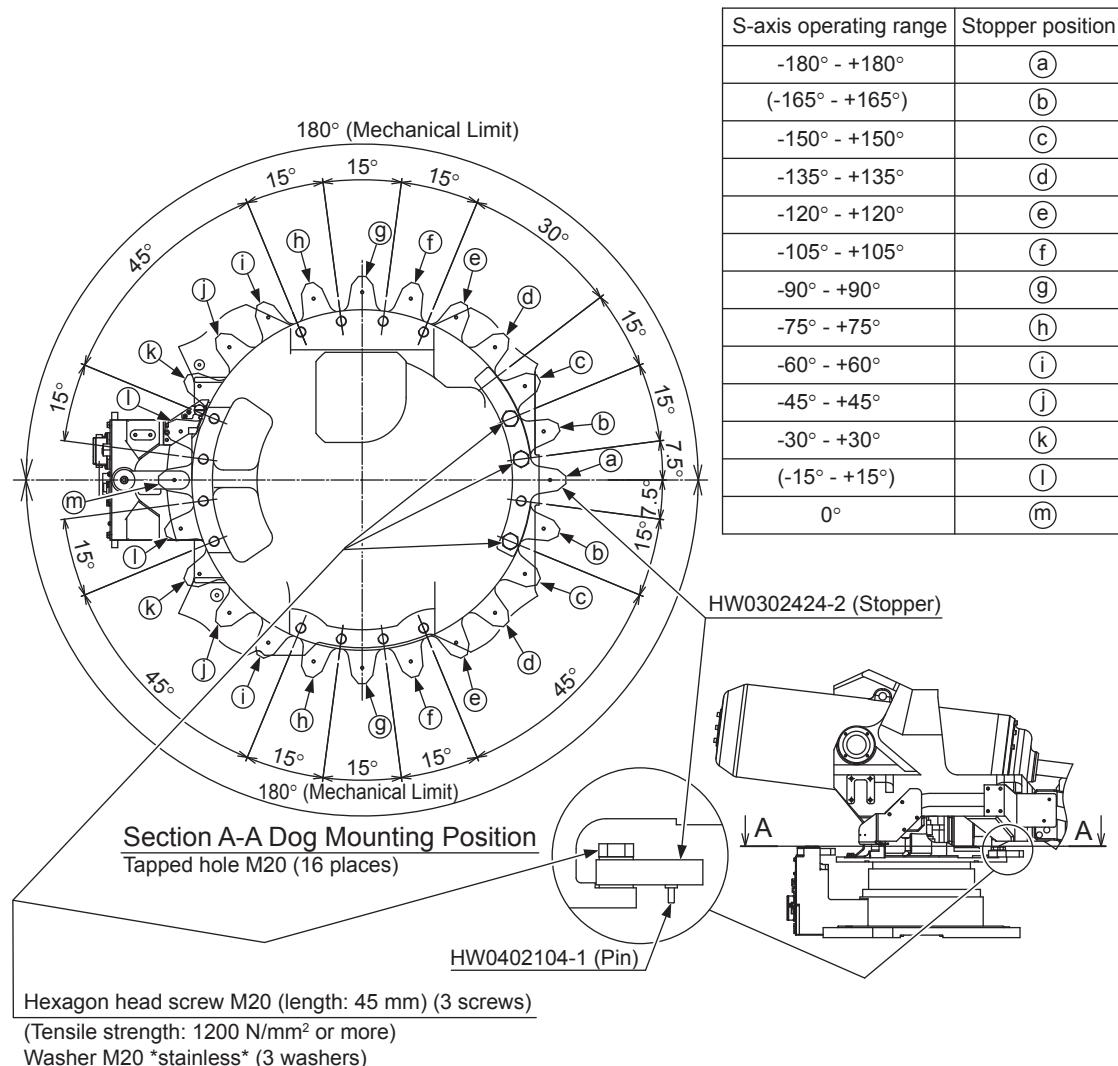
Contact your YASKAWA representative for a setting of -15° to +15° or -165° to +165°.

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.

- Pin (drawing No. HW0402104-1) (1 pin)
- Stopper (drawing No. HW0302424-2) (1 pc)
- Hexagon head screw M20
(length: 45 mm) (3 screws)
(Tensile strength: 1200 N/mm² or more)
- Washer M20 *stainless* (3 washers)

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



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 a pin (HW0402104-1) down on the stopper (HW0302424-2). When mounting the pin on the stopper, apply LOCTITE 243 to the thread part.

Mount the stopper by using the hexagon socket head cap screw M20 (length: 45 mm) (Tensile strength: 1200 N/mm² or more) (three screws) on the S head and tighten them with the tightening torque 167 N·m.

If the operating range is $\pm 180^\circ$, the mechanical stopper is mounted as shown in *fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”*.

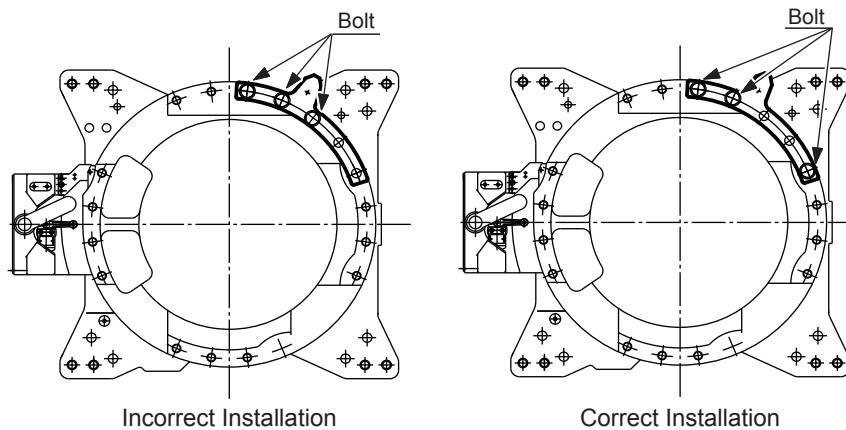
The S-axis mechanical stopper can be set at a pitch of 15° , however, stoppers may be overlapped, for example, $\pm 15^\circ$ or $\pm 165^\circ$. Therefore, mount the S-axis mechanical stopper using the combinations in *table 5-4 “The Settable Angle for S-Axis Stopper”*.

Because of problems with the stopper strength, do not tighten screws on only one side of the projection section as in *fig. 5-8 “Correct Installation for Stopper”*. When mounting, refer to *fig. 5-8* and always fasten bolts on both sides of the projection section.

Also, when the operating range is other than at $\pm 30^\circ$, $\pm 60^\circ$, $\pm 120^\circ$, and $\pm 150^\circ$, mounting on either the front or rear of the stopper is allowed.

When not mounting in the usable angle range of *table 5-4*, mount reversing the front and rear of the stopper.

Fig. 5-8: Correct Installation for Stopper



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	0°	(±15°)*	±30°	±45°	±60°
Pulse	0	±35840	±71680	±107520	±143360

Degree	±75°	±90°	±105°	±120°	±135°
Pulse	±179200	±215040	±250880	±286720	±322560

Degree	±150°	(±165°)*	±180°
Pulse	±358400	±394240	±430080

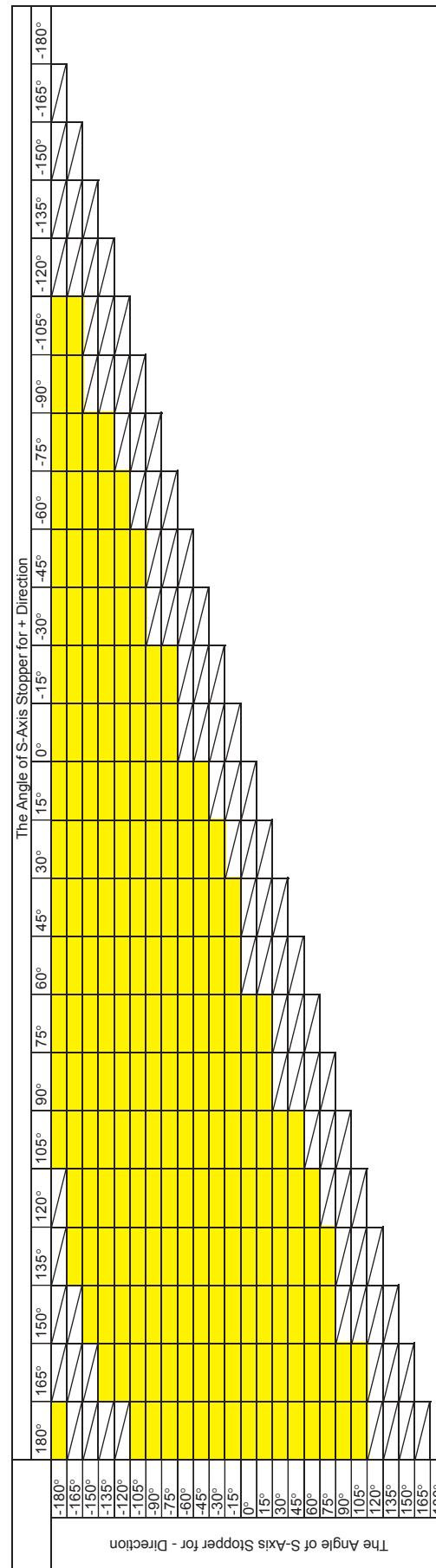
* Refer to chapter 5.5 “Alterable Operating Range”.



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

5 Basic Specifications
5.5 Alterable Operating Range

Table 5-4: The Settable Angle for S-Axis Stopper



Vertical axis is the setting angle of the S-axis -direction. Horizontal axis is the setting angle of the S-axis +direction.
(E.g.: -180° to +180° can be set, but -165° to +180° cannot be set.)

...Angle that can be set
...Angle that cannot be set

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 shown below.

: 120 kg

(Refer to *fig. 5-2 “Dimensions and P-Point Maximum Envelope”*.)

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	Without flange for cabling	
	Allowable moment N·m (kgf·m) ¹⁾	Allowable inertia (GD ² /4) kg·m ²
R-Axis	833 (85)	75
B-Axis	833 (85)	75
T-Axis	490 (50)	25

1 (): Gravitational unit

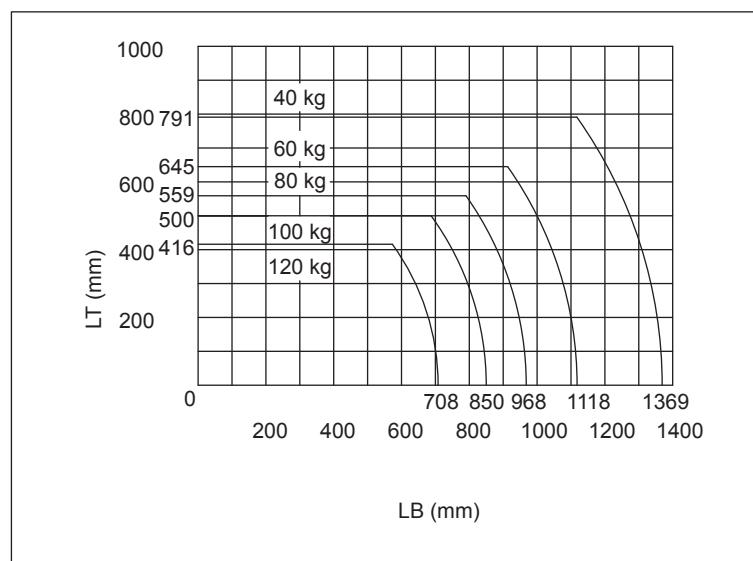
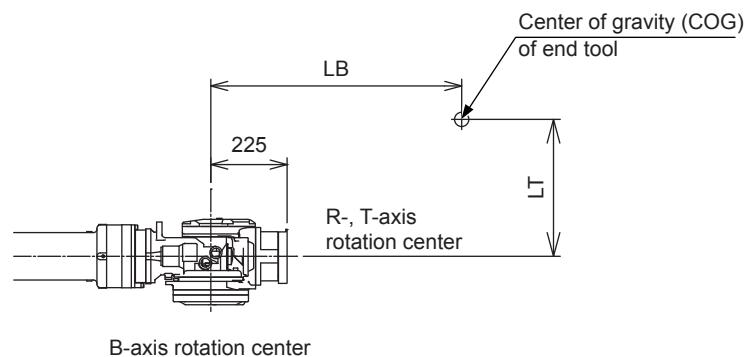
When the volume of the load is relatively small, refer to the moment arm rating (LB, LT) shown in *fig. 6-1 “Moment Arm Rating”*.

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

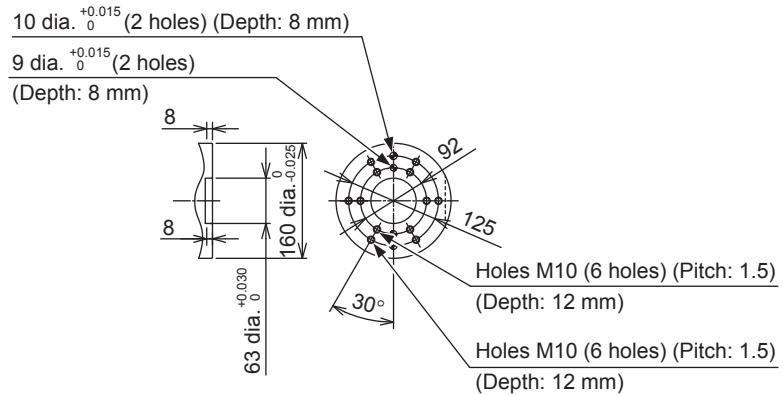


6.2 Wrist Flange

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

It is recommended that the attachment be mounted inside the fitting in order to identify the alignment marks. Fitting depth shall be 8 mm or less.

Fig. 6-2: Wrist Flange



Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner before mounting the tools.

7 System Application



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.

7.1 Peripheral Equipment Mounts

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

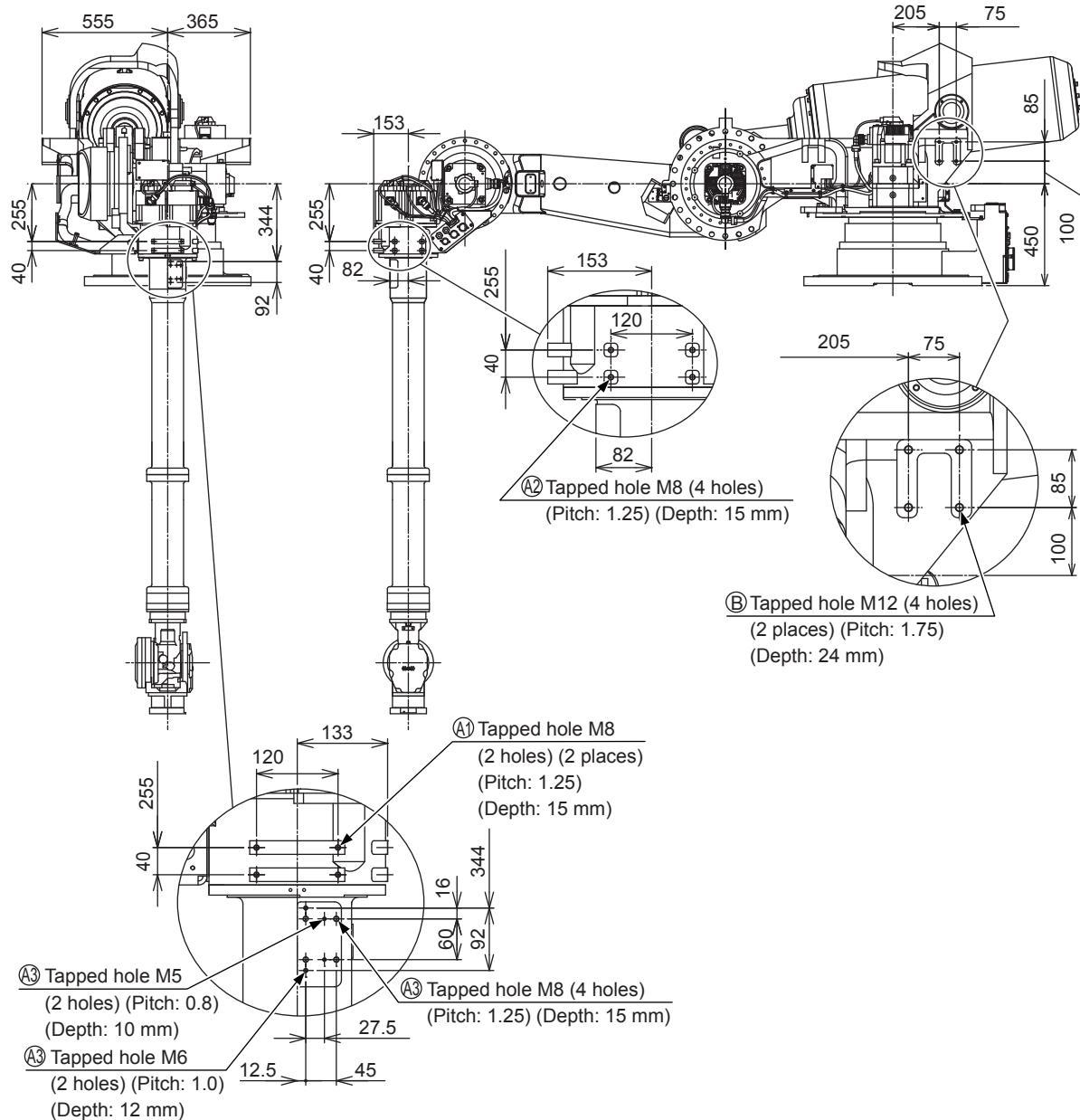
The allowable load on the peripheral equipment mounts of the U-arm (A1, A2, and A3) is 30 kg or less in total. And the amount of increase for the upper arm moment must be 49 N·m (5 kgf·m) or less when loading the allowable load. The allowable load on the peripheral equipment mounts (B) of the S-head is up to 200 kg.

When a load is applied on the U-arm or the S-head, the load setting must be performed. For setting procedures, refer to chapter 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".

Fig. 7-1: Installation Position



7.2 Internal User I/O Wiring Harness and Air Line

The valve cables ($0.75 \text{ mm}^2 \times 6$ cables), internal user I/O wiring harness ($0.5 \text{ mm}^2 \times 6$ wires, $0.3 \text{ mm}^2 \times 12$ wires), the cable of the external 1 axis ($2.0 \text{ mm}^2 \times 4$ cables, $0.75 \text{ mm}^2 \times 2$ cables, $0.2 \text{ mm}^2 \times 6$ cables) and two air lines are incorporated into the manipulator for driving peripheral devices mounted on the U-arm as shown in *fig. 7-2 “Connectors for Internal User I/O Wiring Harness and Air Line”*.

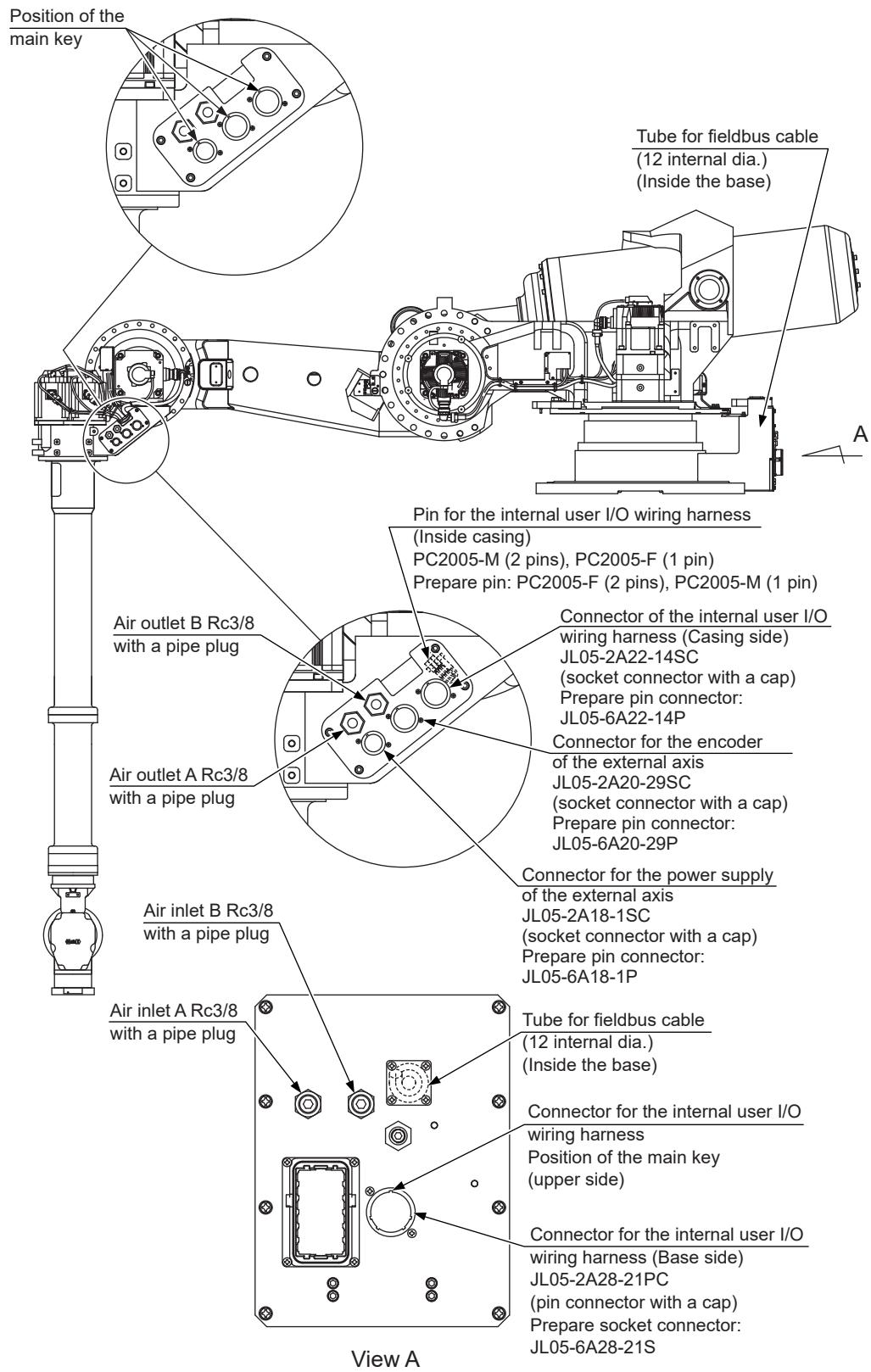
The connector pins are assigned as shown in *fig. 7-3 “Details of the Connector Pin Numbers”*. Wiring must be performed by user.

The operating conditions are shown in the following table.

The allowable current for cables	13.0 A or less for each wire (2.0 mm^2) 10.0 A or less for each wire (0.75 mm^2) 7.5 A or less for each wire (0.5 mm^2) 3.0 A or less for each wire (0.2 mm^2)
The total current value for connectors	51.4 A or less (connector for the power of the external axis) 12.9 A or less (connector for the encoder of the external axis) 21.0 A or less (connector for the internal user I/O wiring harness)
The maximum pressure for the air line	490 kPa (5 kgf/cm^2) or less. (The inside diameter: 8.0 mm)
The allowable temperature range of the air line	0°C - +45°C

7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

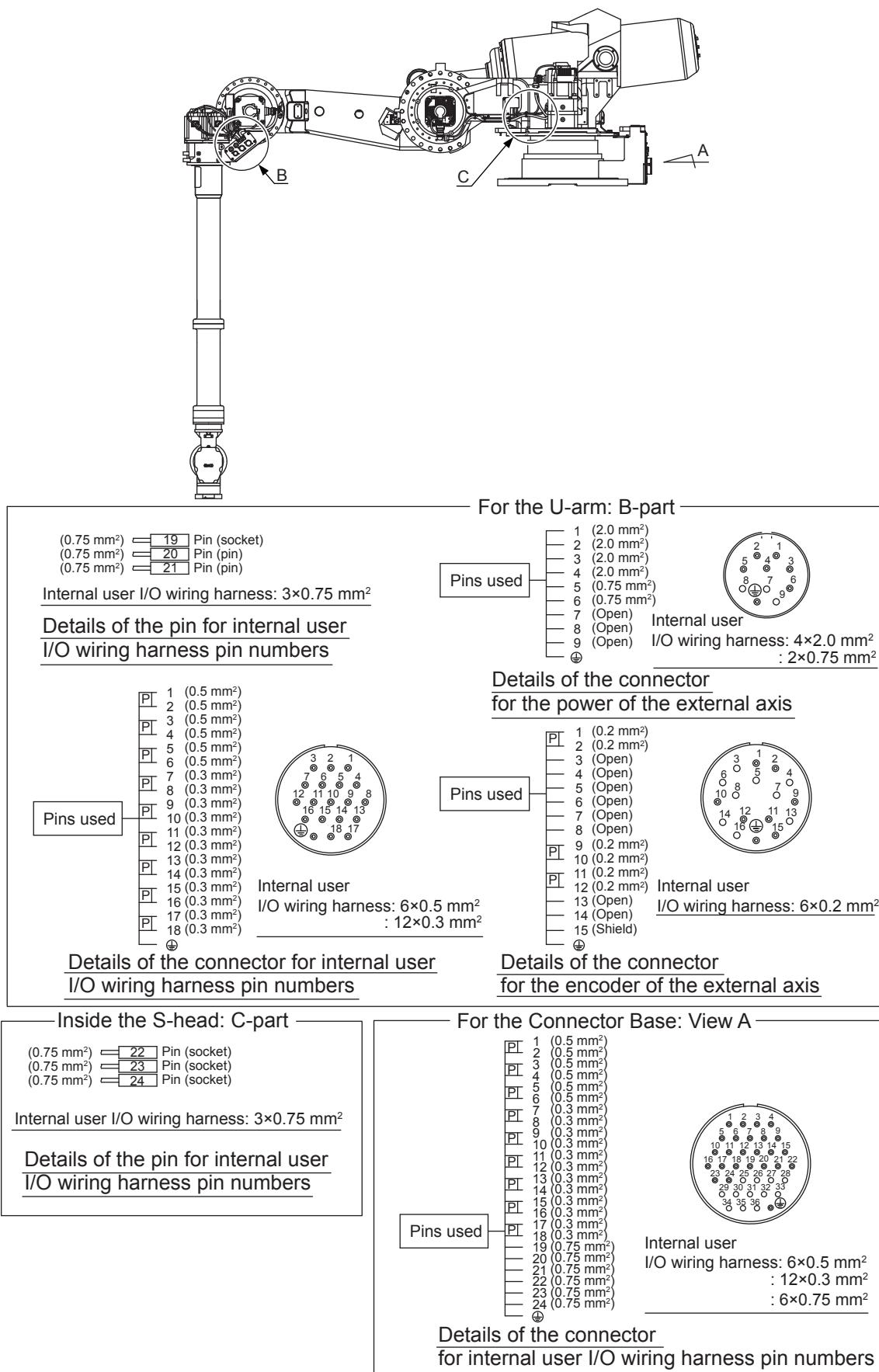
Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line



7 System Application

7.2 Internal User I/O Wiring Harness and Air Line

Fig. 7-3: Details of the Connector Pin Numbers



 **NOTE**

- Pins No. 7, 8, and 9 of the connector for the power of the external axis and pins No. 3, 4, 5, 6, 7, 8, 13, 14, and 16 of the connector for the encoder of the external axis are not connected.
- For wiring, refer to *fig. 8-3(a) "Internal Connection Diagram (YRC1000)"* *fig. 8-3(b) "Internal Connection Diagram (YRC1000)"*.

The same pin No. connectors (1 to 18) of the connector for the internal user I/O wiring harness are connected with a single lead wire of 0.3 mm² or 0.5 mm².

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

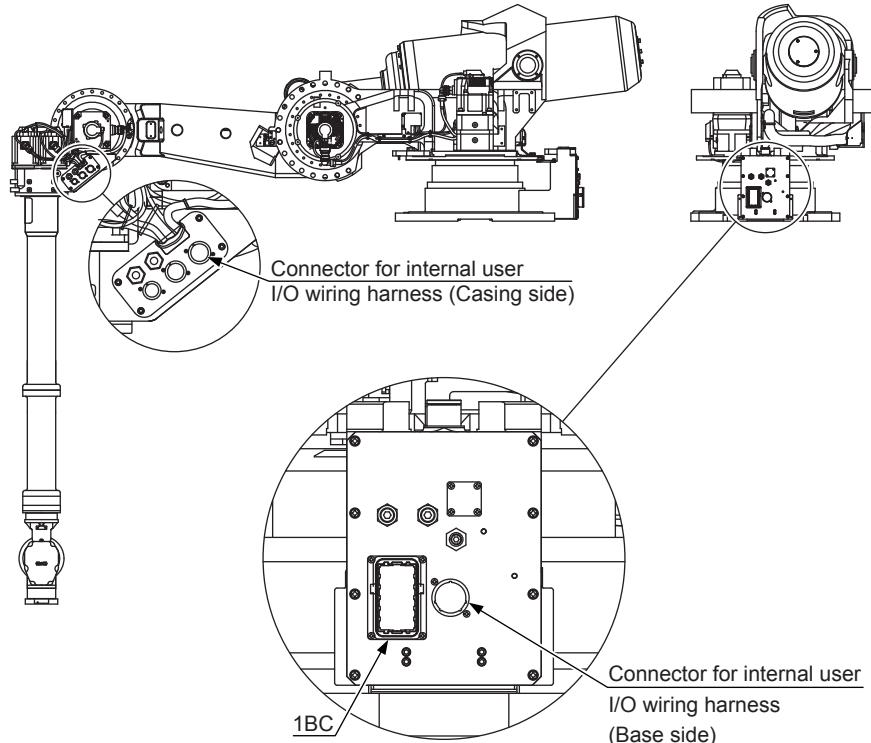
7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

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. 7-4 "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. 7-4: Location of Connector



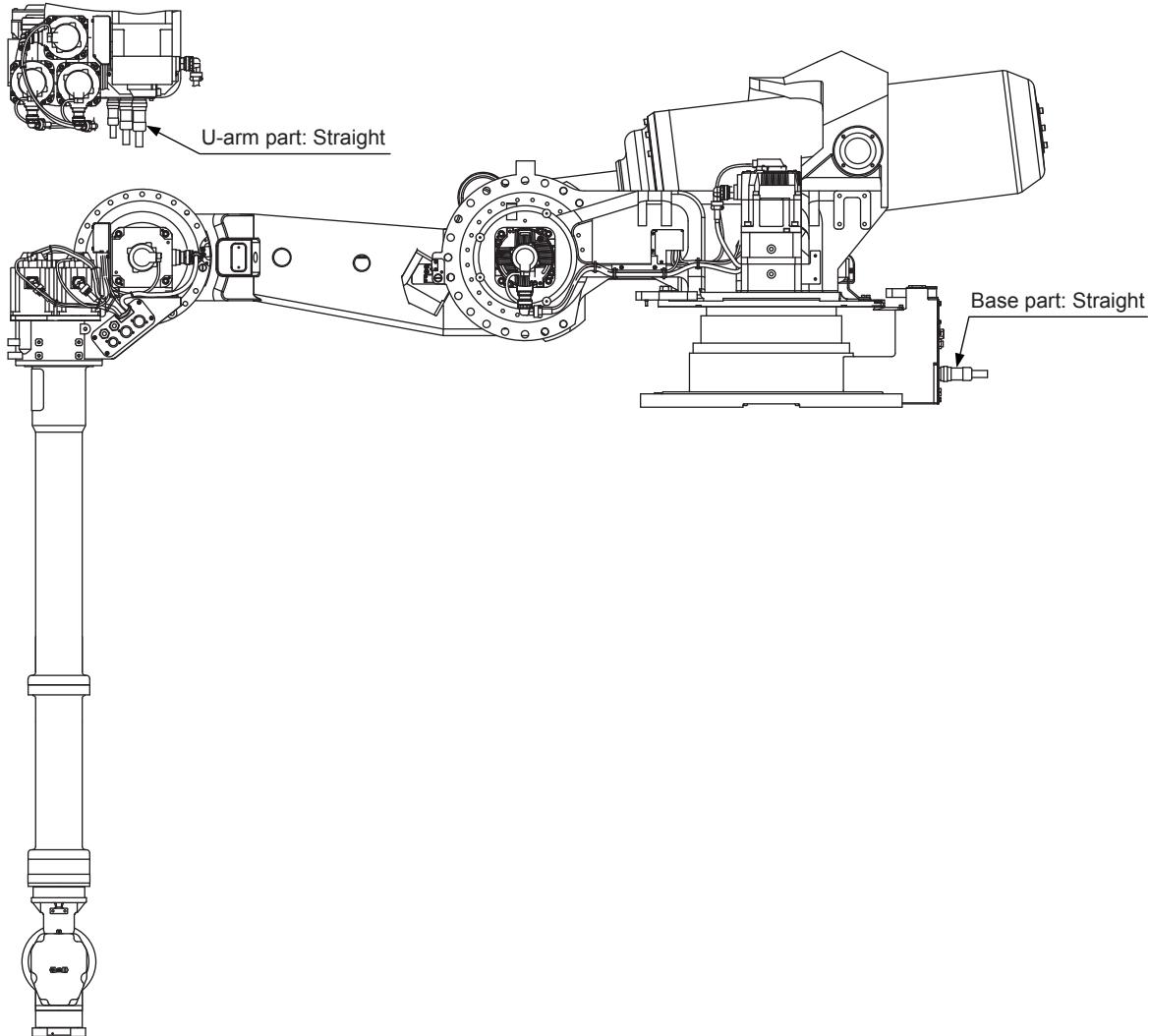
		Manipulator's base part	U-arm part
Straight Type	Plug	JL05-6A28-21S-R or the equivalent	JL05-6A22-14P-R or the equivalent
	End bell	JL05-28EB1A-R (straight form)	JL05-22EB1A-R (straight form)
	Cable clamp	N/MS3057-16A	N/MS3057-12A
Elbow Type	Plug	JL05-6A28-21S-R or the equivalent	JL05-6A22-14P-R or the equivalent
	End bell	JL05-28EB1A-R (straight form)	CE-22BA-S-D (elbow form)
	Cable clamp	N/MS3057-16A	N/MS3057-12A

■ **Straight Type**

The appearance of the manipulator with the connector installed is shown in *fig. 7-5(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. 7-5(a): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type)



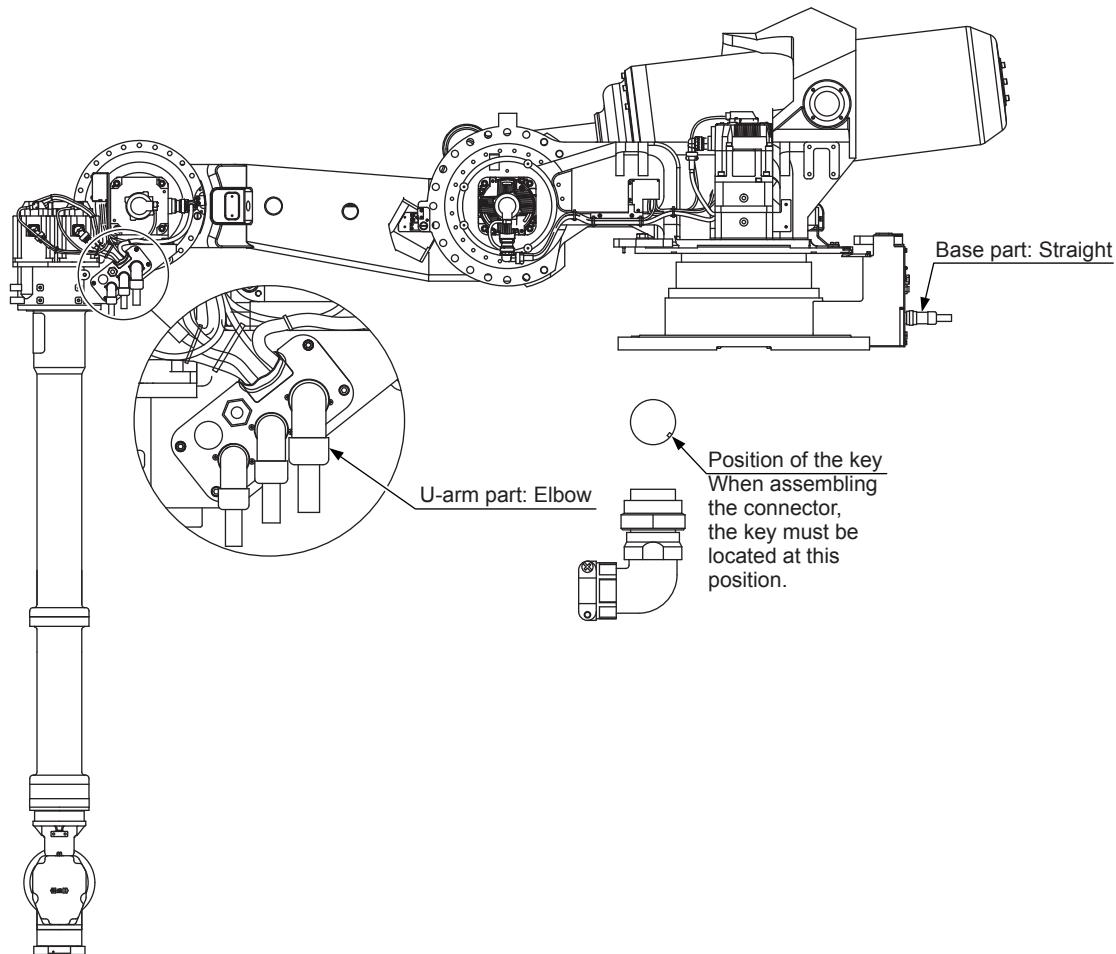
7 System Application
7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

■ Elbow Type

The appearance of the manipulator with the connector installed is shown in *fig. 7-5(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. 7-5(b): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (elbow type)

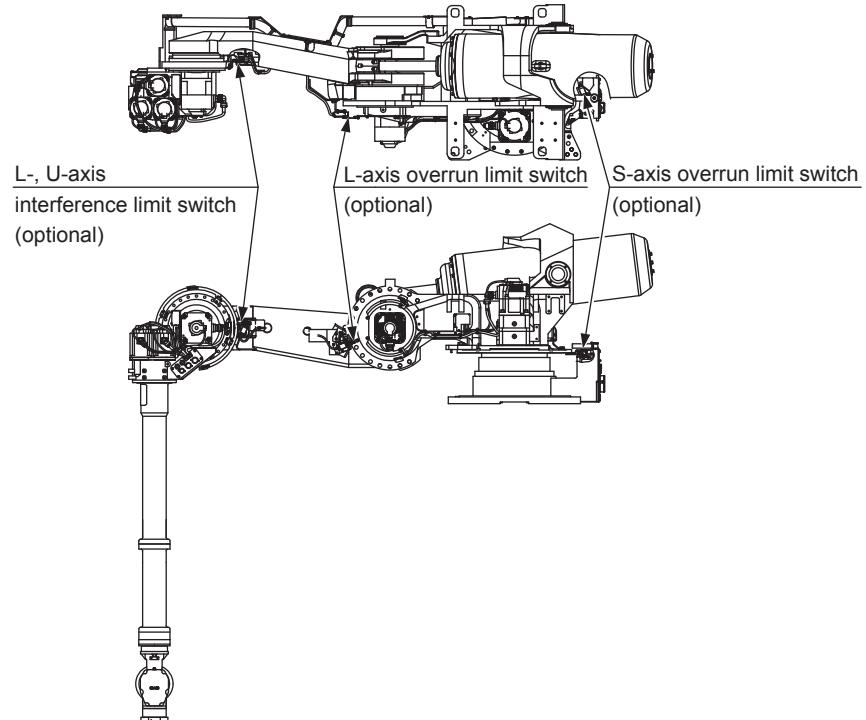


8 Electrical Equipment Specification

8.1 Position of Limit Switch (Optional)

The limit switches are optional. See *fig. 8-1(a) "Location of Limit Switches"*.

Fig. 8-1(a): Location of Limit Switches



The angles of the soft limit and the limit switch for S-, L-, and U-axes are set as the factory setting. Refer to *table 8-1 "Degrees of Angle (with limit switch installed)"*.

When altering the operating angle of the manipulator, adjust both the soft limit and the limit switch. The 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.

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

	Soft limit	Limit switch
S-axis	-180° - +180°	-181° - +181°
L-axis	-130° - +80°	-131° - +81°
L- and U-axis interference	-78.4° - +90°	-81° - +91°

 8 Electrical Equipment Specification
 8.1 Position of Limit Switch (Optional)

- Adjusting limit switch of S-axis

The 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”*.

- L-axis overrun limit switch setting range

The operating range of the L-axis can be set continuously from -131° to $+81^\circ$ with the L-axis limit switch.

- L- and U-axis interference limit switch setting range

For L- and U-axis interference, a mechanism is used to check the angle of interference between the L-axis and U-axis. The operating range of the U-axis can be set continuously from -81° to $+91^\circ$.

Fig. 8-1(b): L-axis Overrun Limit Switch Setting Range

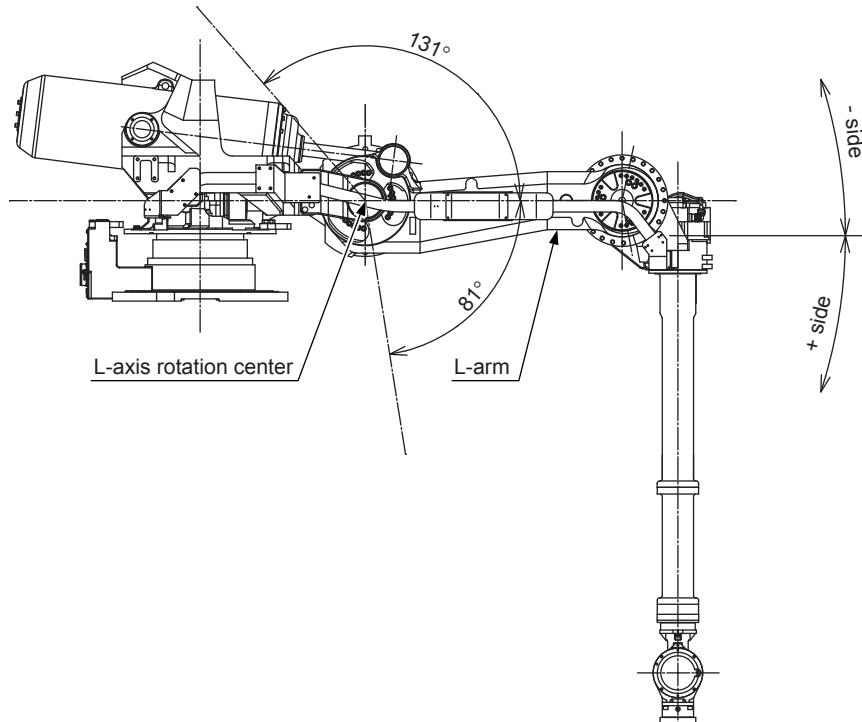
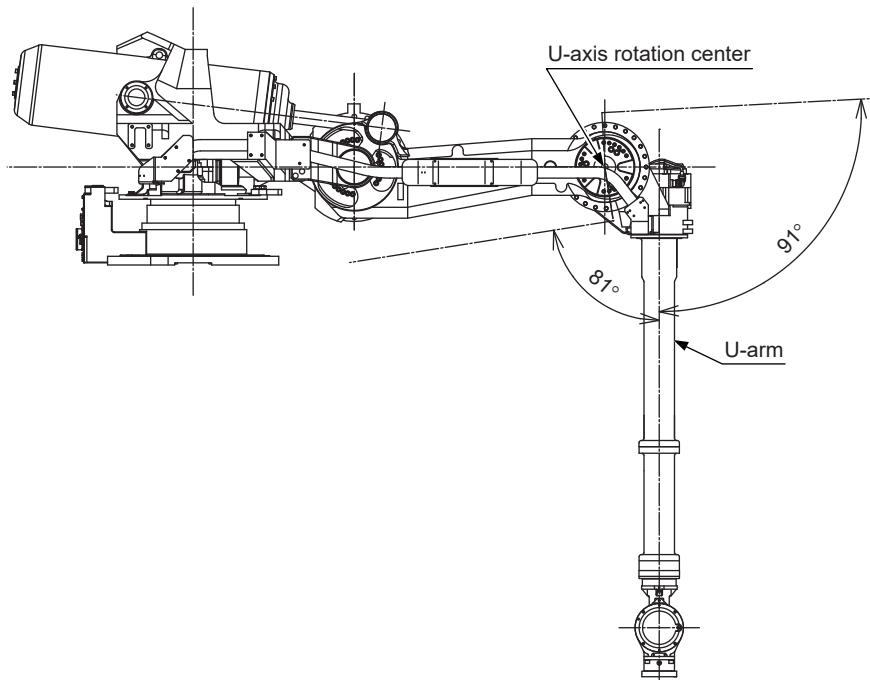


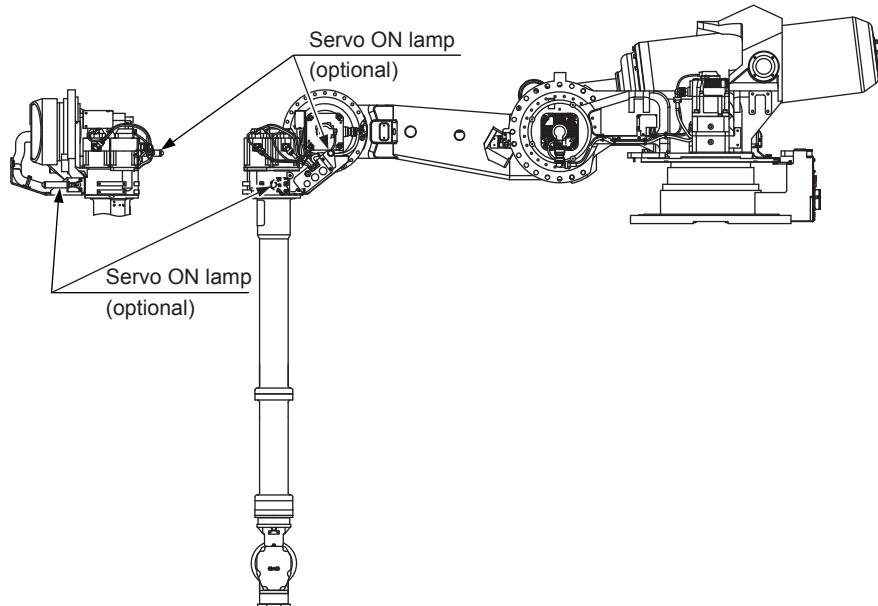
Fig. 8-1(c): L- and U-axis Interference Limit Switch Setting Range



8.2 Position of Servo ON Lamp

The servo ON lamp is optional. See *fig. 8-2 "Location of Servo ON Lamp"*.

Fig. 8-2: Location of Servo ON Lamp



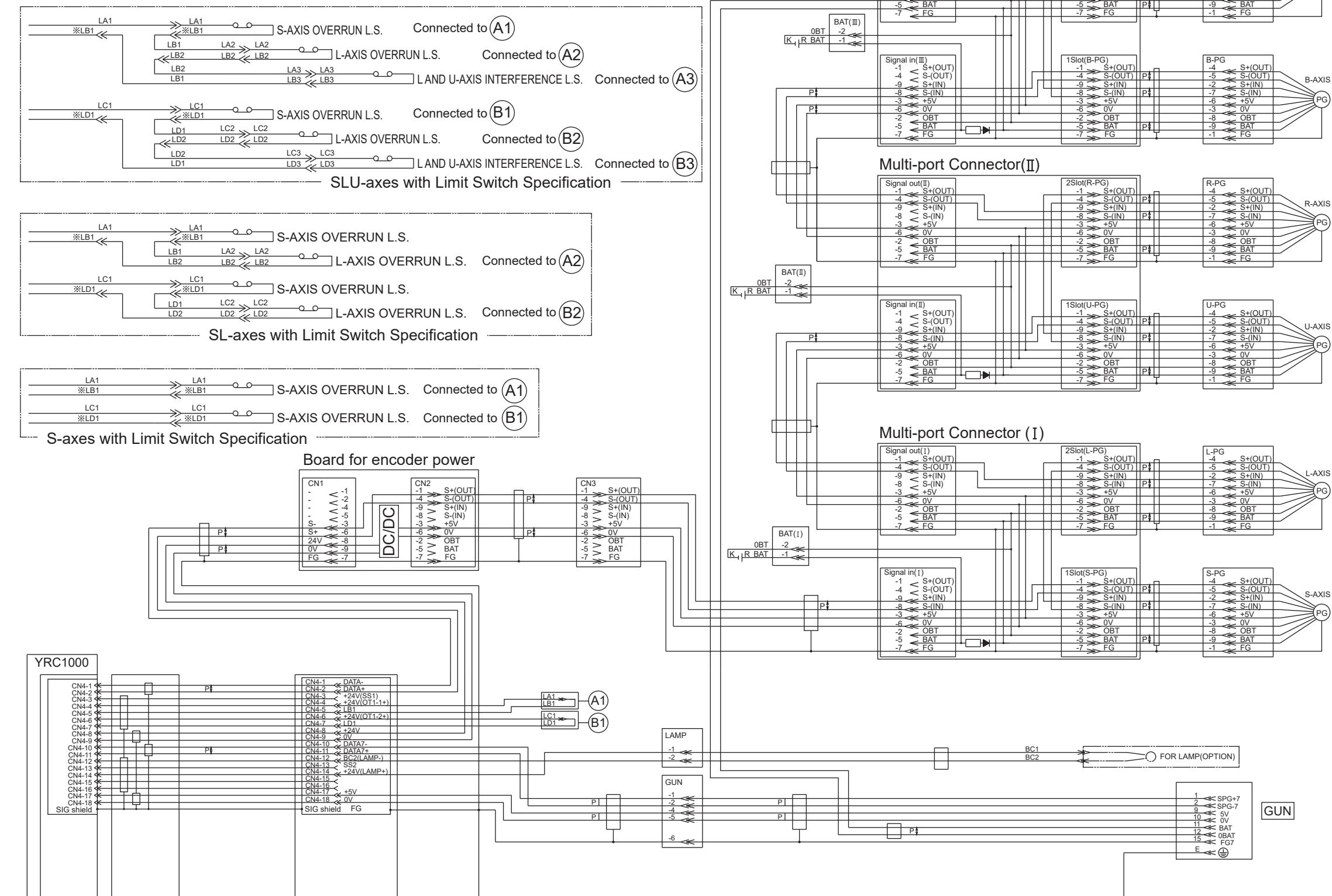
8.3 Internal Connections

Diagrams for Internal connections of the manipulator are shown in
*fig. 8-3(a) “Internal Connection Diagram (YRC1000)”, fig. 8-3(b) “Internal
Connection Diagram (YRC1000)”*.

8 Electrical Equipment Specification
8.3 Internal Connections

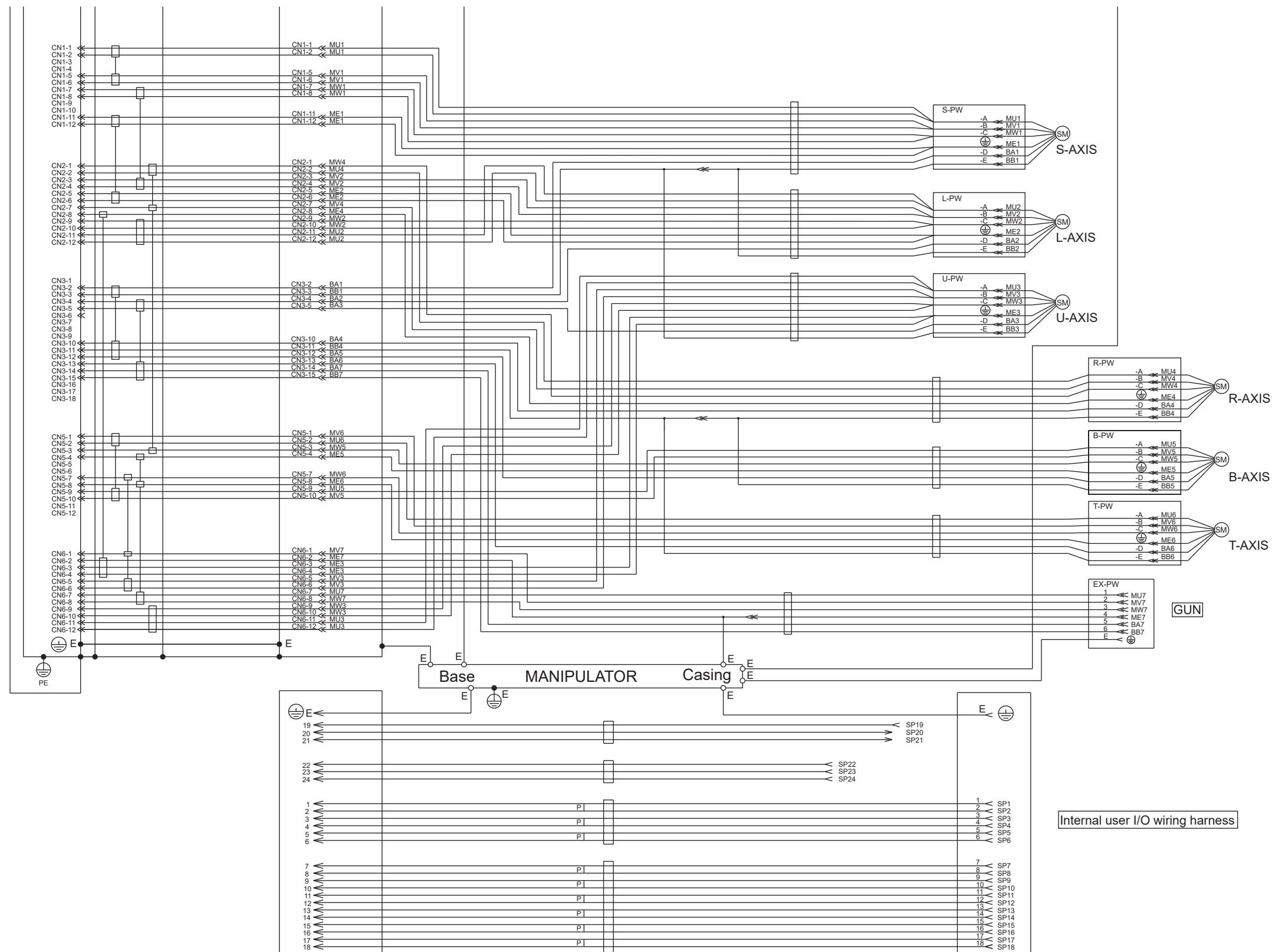
Fig. 8-3(a): Internal Connection Diagram (YRC1000)

Note) 1. For the limit switch specification, the part **(A)** is different from the part **(B)**.
2. When performing the wiring of the overrun limit switch, pay attention to lead wires.
The letter marked on the marker tube at \times point (LB1 and LD1) are the same.



8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-3(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 your YASKAWA representative. Only specified personnel shall perform the inspection work.



- 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.

9 Maintenance and Inspection
 9.1 Inspection Schedule

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

Items ¹⁾	Schedule	Method	Operation	Inspection Charge	Your YASKAWA representative
				Specified Personnel Licensee	
1 Alignment mark	• Daily	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	• 24000 h	Visual	Check for seeped oil. Clean the work area if dust, spatter or seeped oil is present. Check for damage and outside cracks.	•	
3 Baseplate mounting bolts	• 6000 h Cycle	Spanner Wrench	Tighten loose bolts. Replace if necessary.	•	
4 Covers, bolts for the connector base	• 12000 h Cycle	Driver Wrench	Tighten loose bolts. Replace if necessary.	•	
5 Connector for manipulator cable	• 1000 h Cycle	Manual	Check for loose connectors.	•	
6 Protective tubing	• 36000 h	Visual	Clean the spatter. Check for holes or tears. (Replace it if any.)	•	
7 Wire harness in manipulator (Lead wires for the S-, L-, U-, R-, B-, and T-axes) (Power supply board included)	•	Visual	Check for damage and contamination. Check the condition of the internal wiring harness. Check wear to the protective spring (replace if there is abnormal wear). Replace.	•	
8 Battery pack in manipulator	•		Replace the battery pack when the battery alarm occurs or the manipulator drove for 24000 h.	•	
9 Motors for all axes	•	Visual	Check for grease leakage.	•	
10 Speed reducers for all axes	•	Grease Gun	Check for malfunction. (Replace if necessary.) Replace grease ²⁾ (12000 h cycle).	•	
11 R-, B-, and T-axis gear	•	Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease ²⁾ (12000 h cycle).	•	

9 Maintenance and Inspection
9.1 Inspection Schedule

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

Items ¹⁾	Schedule	Method	Operation	Inspection Charge
				Representative
12	Joint of the spring balancer	36000 h	Grease Gun	● Your YASKAWA Personnel
13	Overhaul	24000 h	●	● Licensee

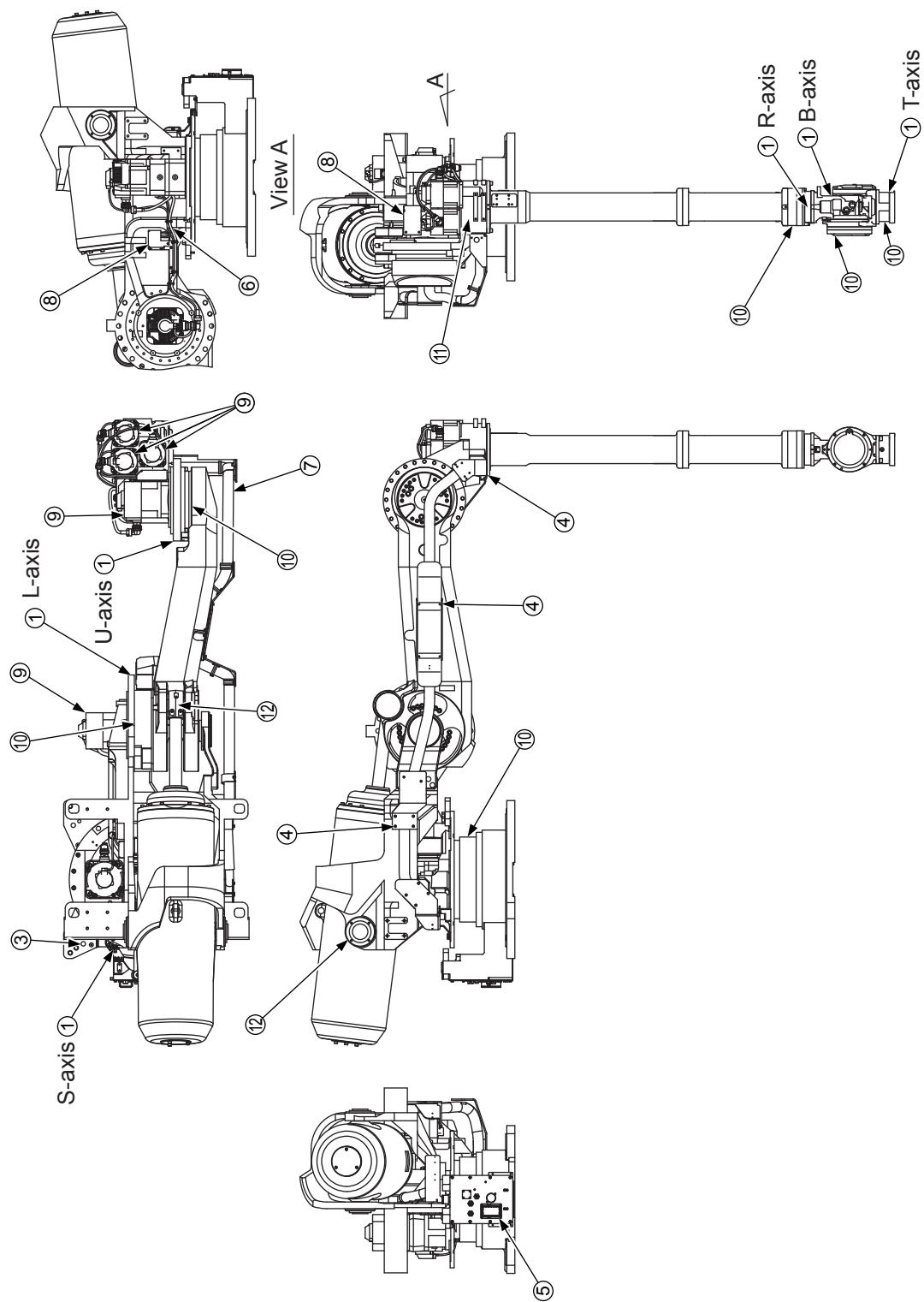
1 Inspection No. correspond to the numbers in fig. 9-1 "Inspection Items (Home position figure)".
2 For the grease, refer to table 9-2 "Inspection Parts and Grease Used".

Table 9-2: Inspection Parts and Grease Used

No.	Grease Used	Inspected Parts
10, 11	Molywhite RE No. 00	Speed reducers for all axes R-, B-, and T-axis gear
12	Alvania EP grease 2	Joint of the balancer

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

Fig. 9-1: Inspection Items (Home position figure)



9.2 Notes for Maintenance

9.2.1 Multi-Port Connector

Multi-port connectors (refer to *fig. 9-2 "Multi-Port Connector"*) for the motor signals are mounted on each part of the manipulator. (For the locations, refer to *fig. 9-7 "Location of the Battery and Multi-port Connector"*) The multi-port connector has four ports: two for the motor and the other two for the wire harness. (Refer to *fig. 9-3 "Wiring of Multi-Port Connector Part"*)

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. 9-2: Multi-Port Connector

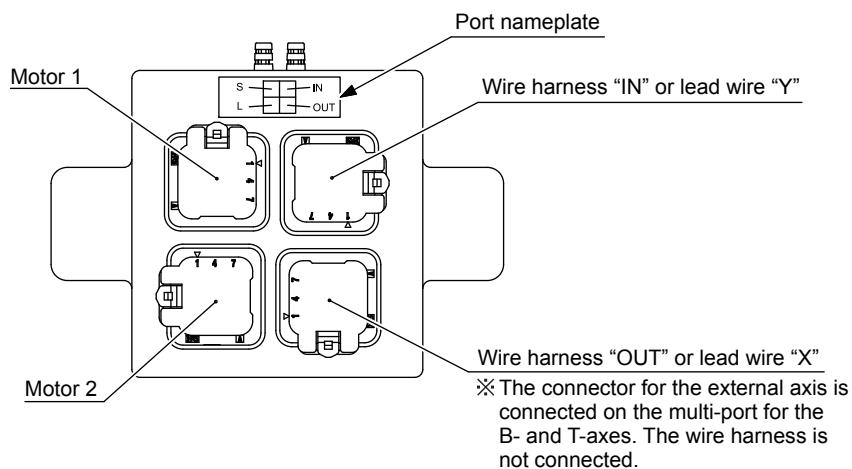
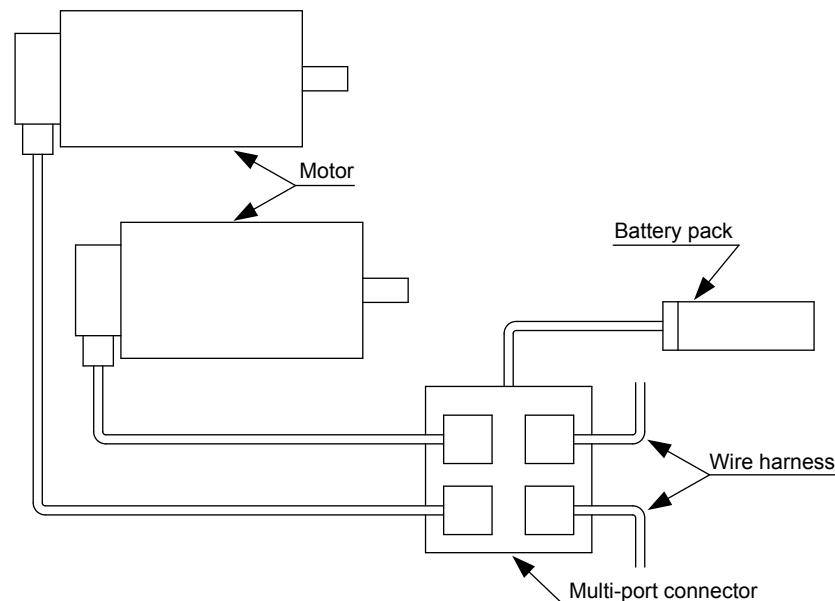


Fig. 9-3: Wiring of Multi-Port Connector Part

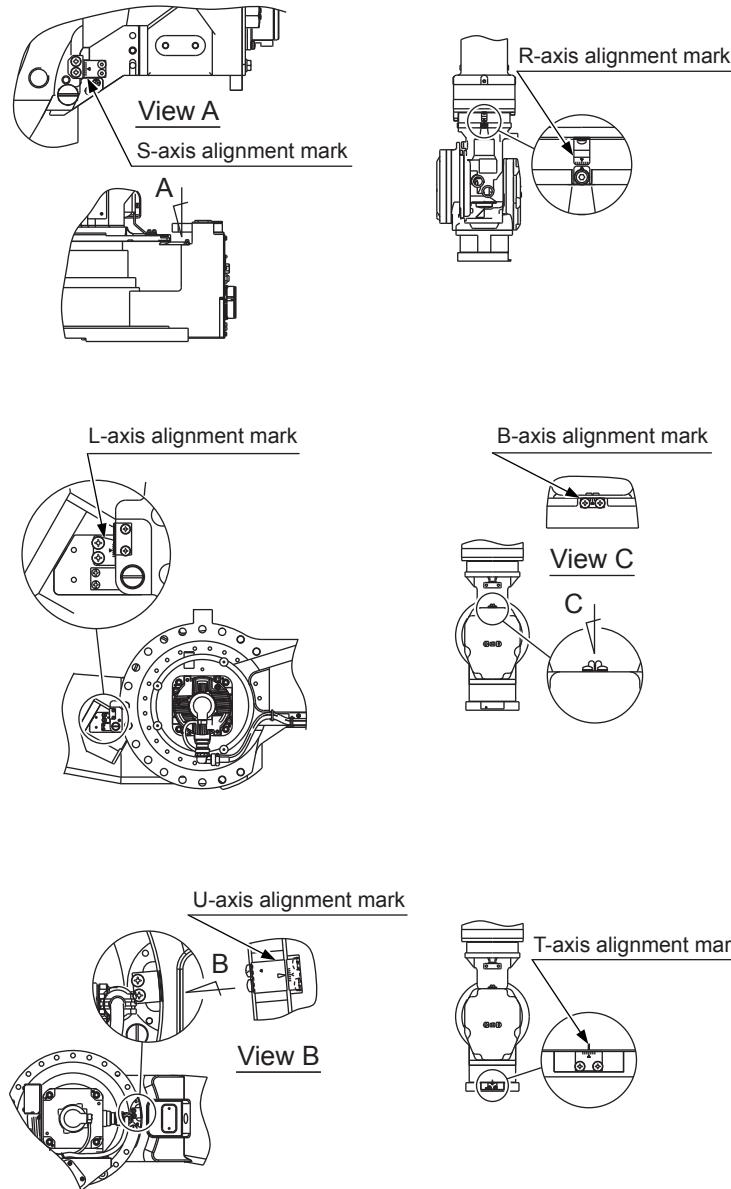


9.3 Notes on Maintenance Procedures

9.3.1 Home Position Check

There are alignment marks on each axis to check the home position. With those alignment marks, periodically check for home position deviation. When home position is disappeared or deviated, contact your YASKAWA representative.

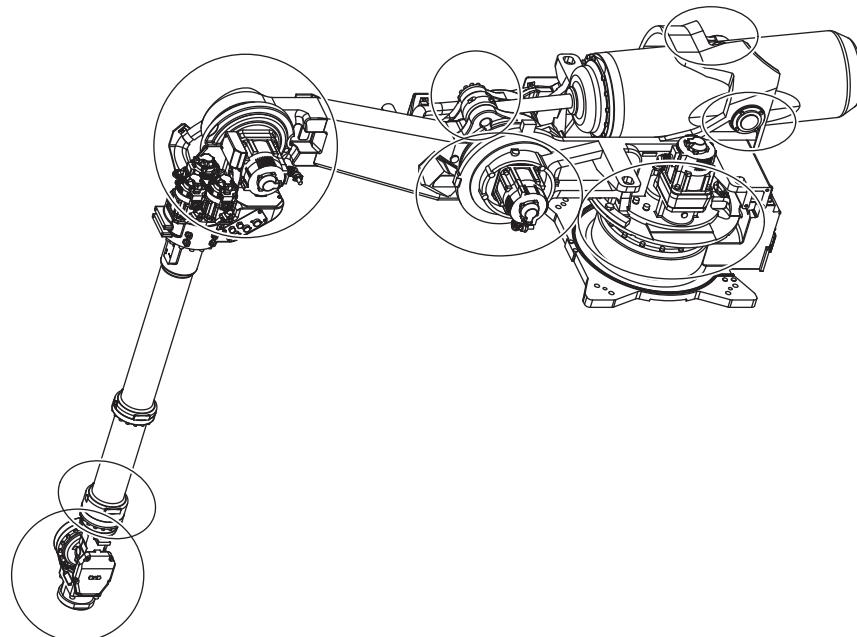
Fig. 9-4: Alignment Mark Check



9.3.2 Seeped Oil Check

Periodically check for contamination due to seeped oil or oil spot. Especially the parts indicated in *fig. 9-5 “Inspection Parts for Seeped Oil Check”* must be inspected carefully. Wipe off seeped oil or oil spot with a cloth before use.

Fig. 9-5: Inspection Parts for Seeped Oil Check



9.3.3 L- and U-axis Motors

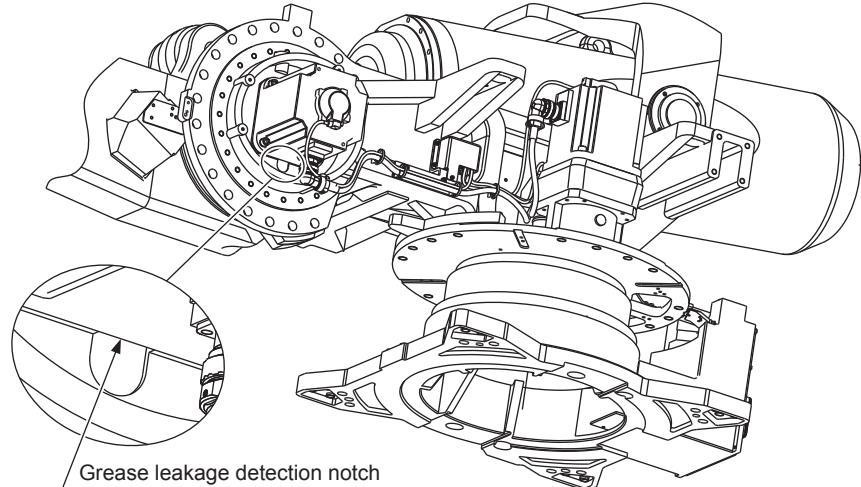
For castings of the L- and U-axis motor, there are a notch and tubes for detecting grease leakage.

Check if grease is leaking from the notch and tubes.

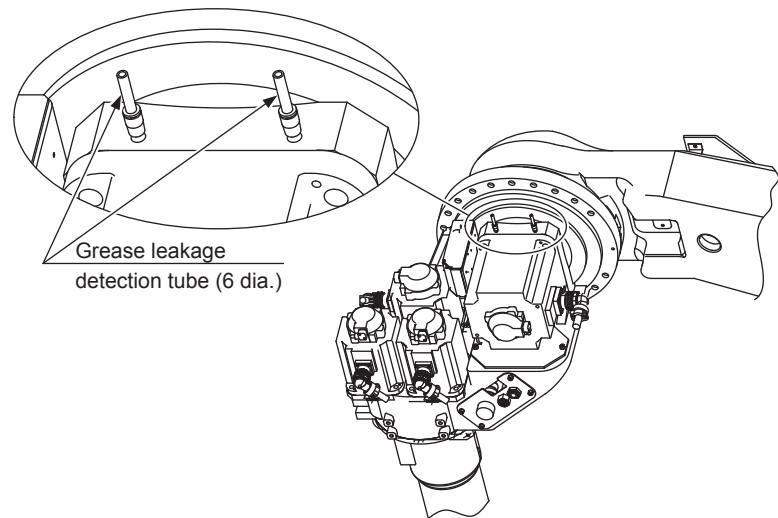
For positions of the notch and tubes of each axis, refer to *fig. 9-6 "Positions of Grease-Leakage Detection Notch and Tubes"*.

If grease leakage is detected, contact your YASKAWA representative.

Fig. 9-6: Positions of Grease-Leakage Detection Notch and Tubes



Position of Grease-Leakage Detection Notch (L-axis)

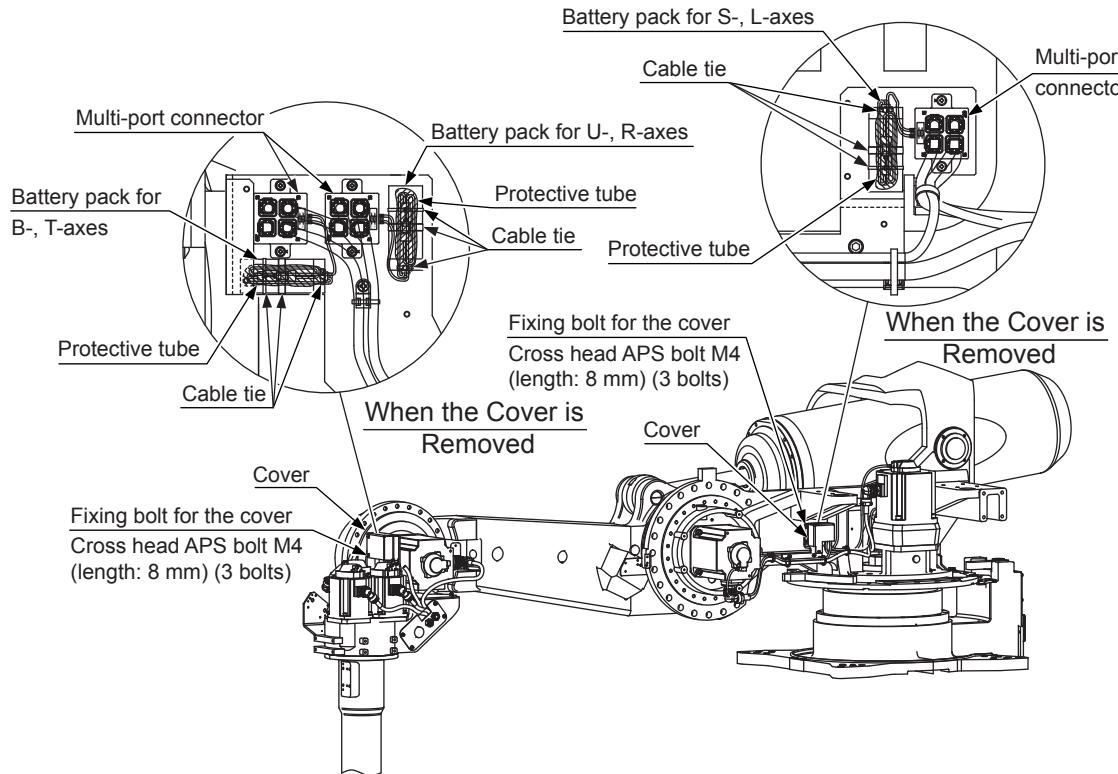


Position of Grease-Leakage Detection Tubes (U-axis)

9.3.4 Battery Pack Replacement

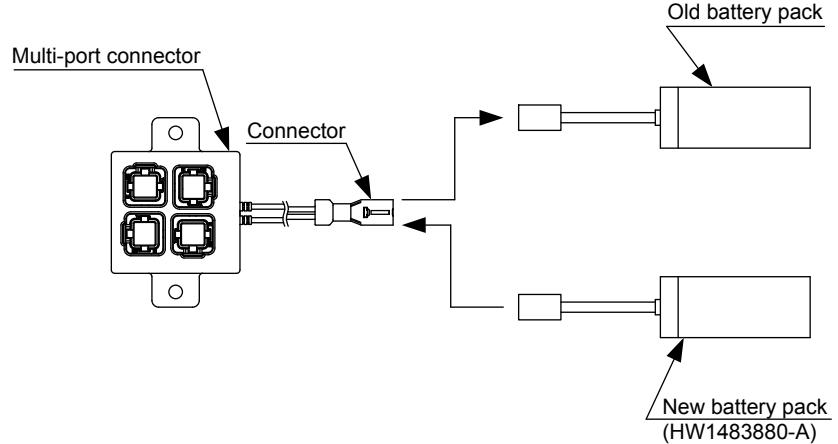
The battery packs are installed in the position shown in *fig. 9-7 "Location of the Battery and Multi-port Connector"*. If the battery alarm occurs in the YRC1000, replace the battery in accordance with the following procedure:

Fig. 9-7: Location of the Battery and Multi-port Connector



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

Fig. 9-8: 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 T50R-HSW.
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-HSW.
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-HSW.
9. Tighten the cover mounting bolts to reinstall the cover.

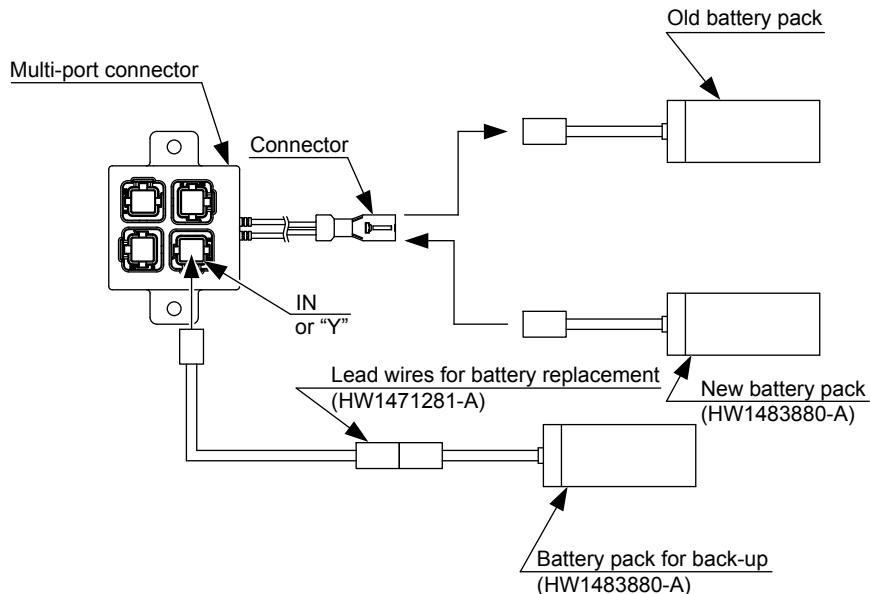


When reinstalling the cover, be careful not to get caught the cable.

9 Maintenance and Inspection
9.3 Notes on Maintenance Procedures

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

Fig. 9-9: 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" or "Y" port of the multi-port connector.
Connect the lead wires for battery replacement to the "IN" or "Y" port of the multi-port connector.
4. Connect the battery pack for backup to the lead wires for battery replacement.



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" or "Y" port again.



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 T50R-HSW.

9 Maintenance and Inspection
9.3 Notes on Maintenance Procedures

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-HSW.
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-HSW.
12. Tighten the cover mounting bolts to reinstall the cover.



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 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.



- If grease is injected without removing the plug from the grease exhaust port, the 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 the 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, the grease may flow out from the grease inlet or the grease exhaust port. Prepare a container to receive the grease and a waste cloth to wipe the 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.

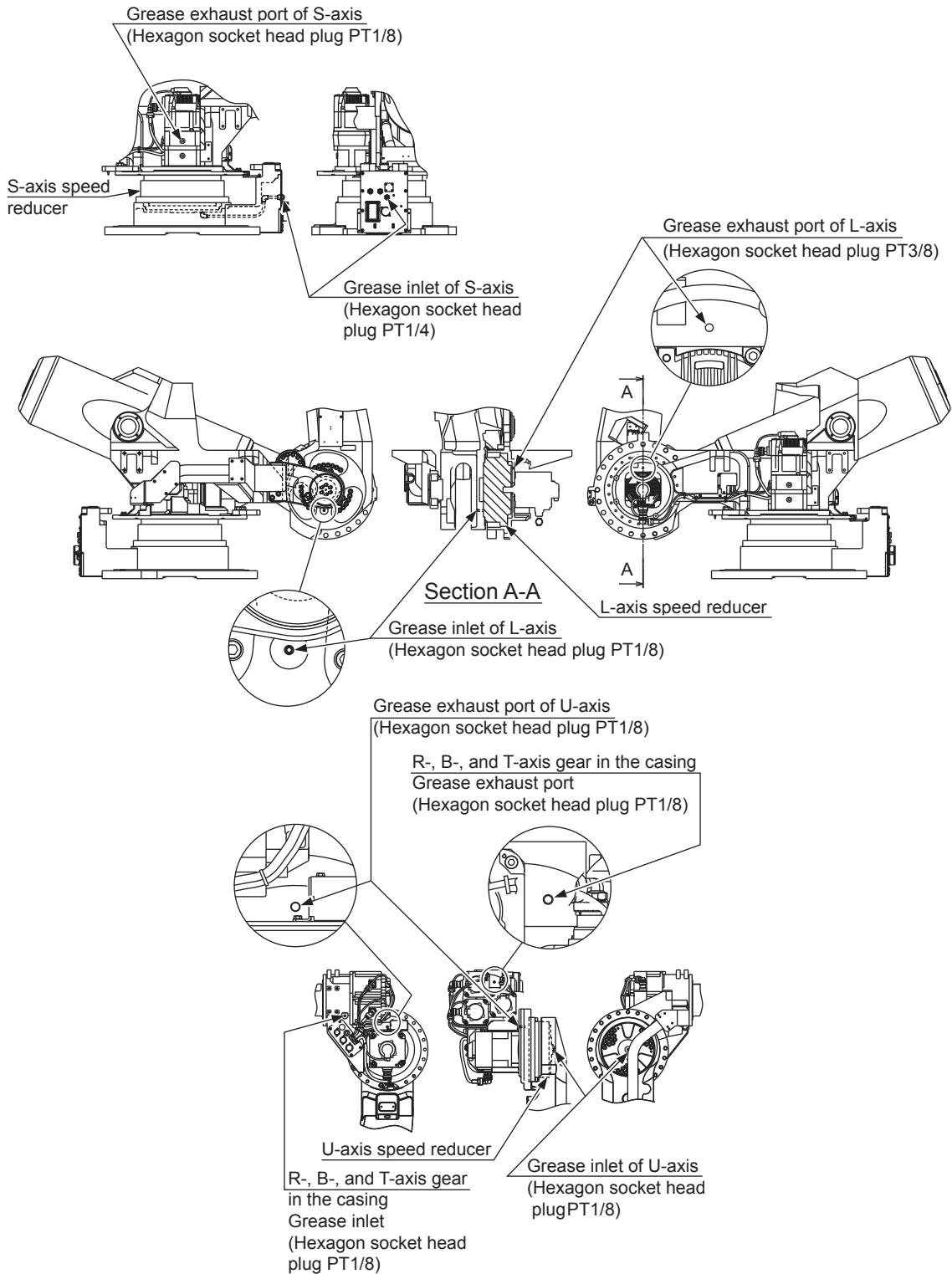


WARNING

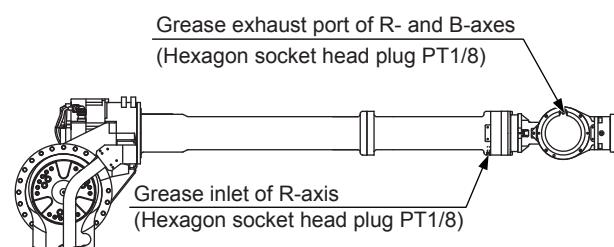
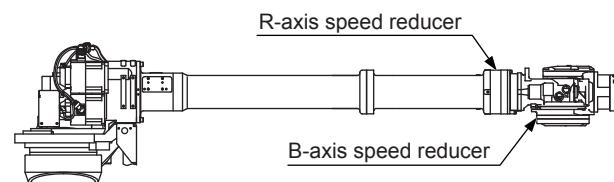
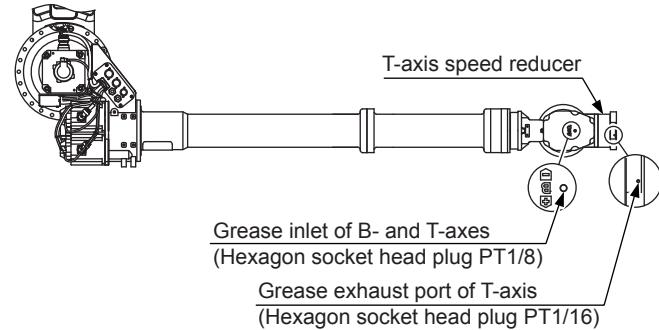
- When operating the manipulator, do not enter into the working area of the manipulator. Injury may result if anyone enter into the working area during operation.

9.4.1.2 Grease Exchange Procedure

Fig. 9-10: Grease Inlets and Exhaust Ports for Each Axis



9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures



1. Before injecting grease, the posture of the manipulator must be set as indicated in *table 9-3 “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 9-3: Recommended Posture for Grease Injection

Axis to inject	Posture (Angle from the posture at the home position of each axis)					
	S-axis	L-axis	U-axis	R-axis	B-axis	T-axis
S-axis	Any	Any	Any	Any	Any	Any
L-axis	Any	-90°	Any	Any	Any	Any
U-axis	Any	-90°	0° *	Any	Any	Any
R-axis						
B-axis	Any	-90°	0° *	0°	0°	0°
T-axis						

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

2. Remove the hexagon socket head plugs from the grease inlet and grease exhaust port.

 9 Maintenance and Inspection
 9.4 Notes on Grease Replenishment/Exchange Procedures

3. Install a grease zerk (A-PT1/4 for the S-axis or A-PT1/8 for the L-, U-, R-, B-, and T-axes) to the grease inlet.
(The grease zerk is delivered with the manipulator.)
4. Inject the 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 9-4: Amount of Grease

Axis to exchange grease	Amount of grease
S-axis	Approx. 6090 g
L-axis	Approx. 1220 g
U-axis	Approx. 1570 g
R-, B-, and T-axis gear in the casing	Approx. 1740 g
R-axis	Approx. 1780 g
B-, and T-axes	Approx. 1130 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 9-5 “Teaching Operation for Each Axis” .

Table 9-5: Teaching Operation for Each Axis

Axis to replenish grease	Angle for teaching operation	Speed for teaching operation
S-axis	S-axis $\pm 45^\circ$	User-specified
L-axis	L-axis $\pm 45^\circ$	
U-axis	U-axis $\pm 45^\circ$	
In the casing	R-axis $\pm 90^\circ$	
R-, B-, and T-axis gear	B-axis $\pm 45^\circ$	
R-, B-, and T-axis	T-axis $\pm 90^\circ$	

7. Inject grease again, and when grease comes out of the exhaust port, grease injection is completed.

 9 Maintenance and Inspection
 9.4 Notes on Grease Replenishment/Exchange Procedures

8. Discharge the specified amount of grease from the grease inlet or grease exhaust port. (Refer to *table 9-6 "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 the grease is not discharged enough by injecting air, operate the manipulator about 5 times in the teach mode as shown in *table 9-5 "Teaching Operation for Each Axis"*.

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 9-5*.

Table 9-6: Amount of Grease Discharged from Each Axis

Axis to exchange grease	Amount of exhausted grease	
	[g]	[cc]
S-axis	0 [unnecessary]	0 [unnecessary]
L-axis	60±10	70±10
U-axis	230±30	265±35
R-, B-, and T-axis gear in the casing	90±10	100±15
R-axis	90±10	105±15
B-, and T-axes	55±5	65±10

 9 Maintenance and Inspection
 9.4 Notes on Grease Replenishment/Exchange Procedures

9. For the axis where grease is exchanged, perform a playback operation indicated in *table 9-7 “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 shown in *table 9-8 “Plug Type and Tightening Torque for Each Axis”*. 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. 9-11 “Grease Receiving Bag (Rough Standard)”*, and then perform the running-in operation.

Table 9-7: Running- In Operation for Each Axis

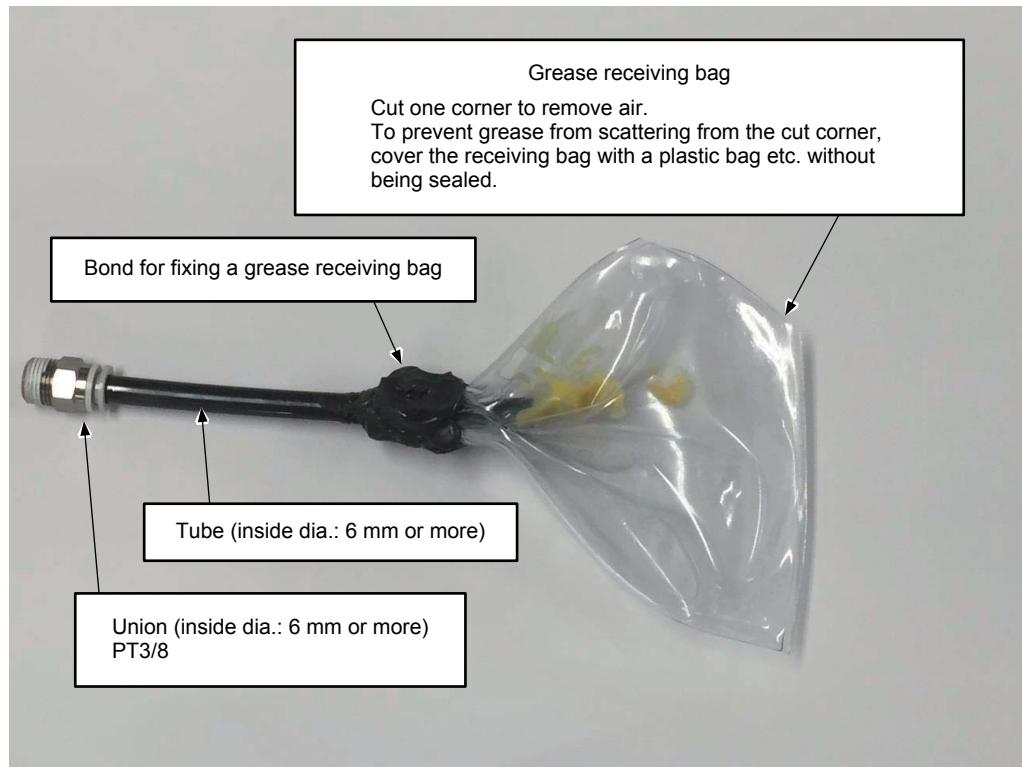
Axis to exchange grease	Running-in operation			
	Operation angle	Operation speed	Timer after each operation	Operating time
S-axis	S-axis $\pm 45^\circ$	MOVJ VJ=50.00	1.0 s	15 minutes
L-axis	L-axis $\pm 45^\circ$	MOVJ VJ=50.00	1.0 s	15 minutes
U-axis	U-axis $\pm 45^\circ$	MOVJ VJ=50.00	1.0 s	15 minutes
In the casing R-, B-, and T-axis gear R-, B-, and T-axis	R-axis $\pm 90^\circ$ B-axis $\pm 45^\circ$ T-axis $\pm 90^\circ$	MOVJ VJ=50.00	1.0 s	15 minutes

Table 9-8: Plug Type and Tightening Torque for Each Axis

Axis to exchange grease	Plug for the grease inlet		Plug for the grease exhaust port	
	Plug type	Tightening torque	Plug type	Tightening torque
S-axis	PT1/4	12 N·m (1.2 kgf·m)	PT1/8	4.9 N·m (0.5 kgf·m)
L-axis			PT3/8	23 N·m (2.34 kgf·m)
U-axis				
In the casing R-, B-, and T-axis gear	PT1/8	4.9 N·m (0.5 kgf·m)	PT1/8	4.9 N·m (0.5 kgf·m)
R-axis				
B-axis				
T-axis			PT1/16	3.9 N·m (0.4 kgf·m)

9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures

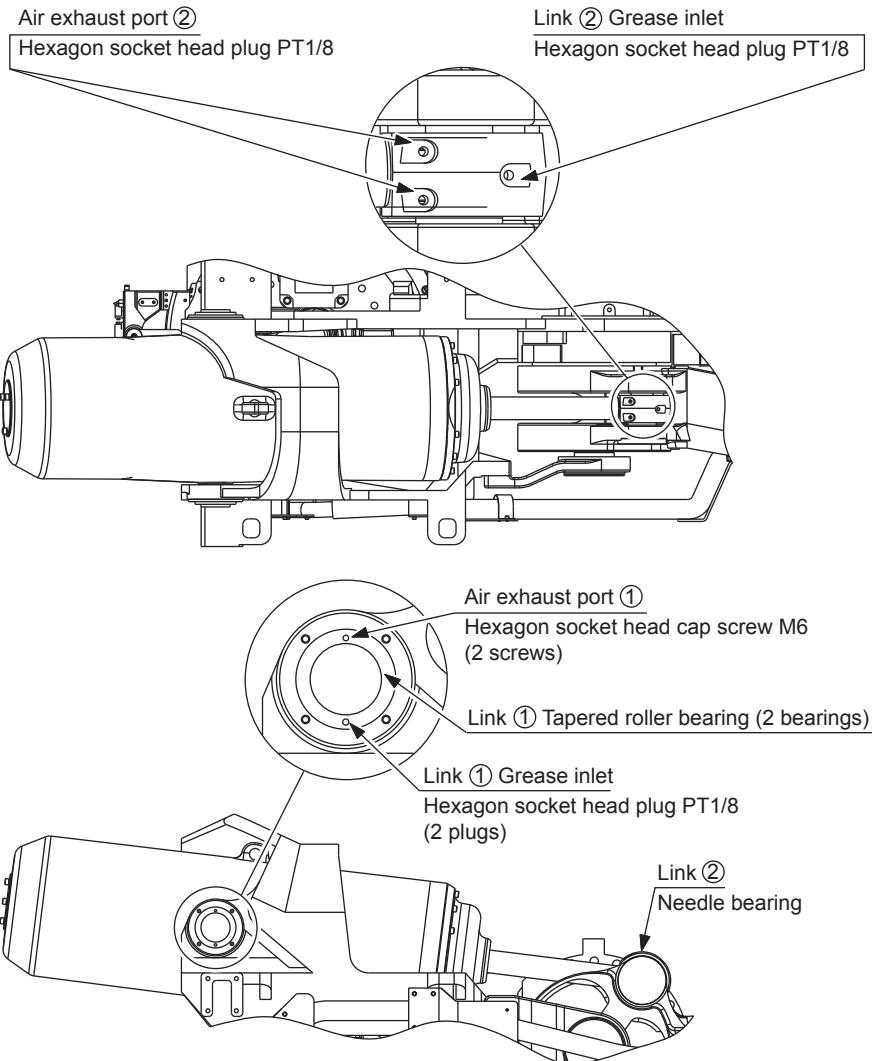
Fig. 9-11: Grease Receiving Bag (Rough Standard)



10. Wipe the discharged grease with a cloth, and reinstall the plug. Clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, attach the plug with seal tape to the grease exhaust port, and then tighten it with the tightening torque shown in *table 9-8 “Plug Type and Tightening Torque for Each Axis”*.

9.4.2 Grease Replenishment for Balancer Link Part

Fig. 9-12: Balancer Link Part



1. Remove the plugs and screws of the grease inlet and the air exhaust port of the link ① and ②. (Refer to *fig. 9-12 "Balancer Link Part"*.)
2. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject grease through the grease inlet using a grease gun.
 - Grease type: Alvania EP grease 2
 - Amount of grease: 5 cc
(10 cc for 1st supply)

NOTE

Grease will not flow out of the air exhaust port.

Be careful not to inject too much grease.

4. Reinstall the plugs and screws to the air exhaust port of the link ① and ②. Before installing the plug and screw, clean and degrease the thread part of the plug and screw. Wrap the seal tape TB4501 around the thread part, and then tighten the plug and screw with a tightening torque of 4.9 N·m (0.5 kgf·m).

9 Maintenance and Inspection

9.4 Notes on Grease Replenishment/Exchange Procedures

5. Remove the grease zerk from the grease inlet of the link ① and ②, and reinstall the plug. Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug and screw with a tightening torque of 4.9 N•m (0.5 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.



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

Table 10-1: Recommend Spare Parts for the YR-1-06VRL120-A00 (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	Alvania EP grease 2	Showa Oil Co., Ltd.	16 kg	-	
A	3	Liquid Gasket	TB1206C	Three Bond Co., Ltd.	-	-	
A	4	Adhesive	LOCTITE243	Henkel Japan Ltd	-	-	
A	5	Seal Tape	TB4501	Three Bond Co., Ltd.	-	-	
A	6	Battery Pack	HW1483880-A	YASKAWA Electric Corporation	1	3	
A	7	Lead Wire for Battery Replacement	HW1471281-A	YASKAWA Electric Corporation	1	-	
B	8	Replacement Kit for S-Axis Speed Reducer ¹⁾	HW1486117-A	YASKAWA Electric Corporation	1	1	Speed reducer: HW0388208-A Input gear: HW0314717-1
B	9	Replacement Kit for L-Axis Speed Reducer ¹⁾	HW1486118-A	YASKAWA Electric Corporation	1	1	Speed reducer: HW0390225-B Input gear: HW0301778-1
B	10	Replacement Kit for U-Axis Speed Reducer ¹⁾	HW1486119-A	YASKAWA Electric Corporation	1	1	Speed reducer: HW0388210-A Input gear: HW0301780-1
B	11	Replacement Kit for R-Axis Speed Reducer ¹⁾	HW1486120-A	YASKAWA Electric Corporation	1	1	Speed reducer: HW1382917-A
B	12	Replacement Kit for B-Axis Speed Reducer ¹⁾	HW1486121-A	YASKAWA Electric Corporation	1	1	Speed reducer: HW9380961-D
B	13	Replacement Kit for T-Axis Speed Reducer ¹⁾	HW1486122-A	YASKAWA Electric Corporation	1	1	Speed reducer: HW0389174-A

Table 10-1: Recommend Spare Parts for the YR-1-06VRL120-A00 (Sheet 2 of 3)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
B	14	Wrist Unit	HW1173009-A	YASKAWA Electric Corporation	1	1	
B	15	Internal Wiring Harness	HW1173150-B	YASKAWA Electric Corporation	1	1	
B	16	Lead Wire for S-Axis Signal	HW1372910-E	YASKAWA Electric Corporation	1	1	Lead wire between the S-axis motor and the multi-port connector
B	17	Lead Wire for L-Axis Signal	HW1372910-F	YASKAWA Electric Corporation	1	1	Lead wire between the L-axis motor and the multi-port connector
B	18	Lead Wire for U-Axis Signal	HW1372597-K	YASKAWA Electric Corporation	1	1	Lead wire between the U-axis motor and the multi-port connector
B	19	Lead Wire for R-Axis Signal	HW1372597-L	YASKAWA Electric Corporation	1	1	Lead wire between the R-axis motor and the multi-port connector
B	20	Lead Wire for B-Axis Signal	HW1372597-M	YASKAWA Electric Corporation	1	1	Lead wire between the B-axis motor and the multi-port connector
B	21	Lead Wire for T-Axis Signal	HW1372597-N	YASKAWA Electric Corporation	1	1	Lead wire between the T-axis motor and the multi-port connector
B	22	Lead Wire	HW1471359-A	YASKAWA Electric Corporation	1	1	Lead wire between the multiport in the S-head and the multiport
C	23	Bypass Cable	HW1471212-C	YASKAWA Electric Corporation	1	1	Signal lead wires for tentative recovery from failure
C	24	S- and L-Axis AC Servomotor	SGM7G-37APK-YR1* HW1385397-A	YASKAWA Electric Corporation	1	2	
C	25	U-Axis AC Servomotor	SGM7G-44APK-YR2* HW1385399-A	YASKAWA Electric Corporation	1	1	
C	26	R-, B-, and T-Axis AC Servomotor	SGM7G-13APK-YR1* HW1385395-A	YASKAWA Electric Corporation	1	3	

Table 10-1: Recommend Spare Parts for the YR-1-06VRL120-A00 (Sheet 3 of 3)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
C	27	Multi-port Connector	HW1384619-A	YASKAWA Electric Corporation	1	3	
C	28	Power Supply Board	HW1372943-A	YASKAWA Electric Corporation	1	1	
C	29	Dummy Connector	HW1471285-A	YASKAWA Electric Corporation	1	-	For dismounting function of the axis

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-GP120RL INSTRUCTIONS

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