YASKAWA

MOTOMAN-GP12/AR1440
MAINTENANCE MANUAL

TYPE:
YR-1-06VXH12-A00 (STANDARD SPECIFICATION)
YR-1-06VXH12-A01 (BUILT-IN WELDING CABLE SPECIFICATION)

Procedures described in this maintenance manual should be carried out by the person who took the maintenance-relevant trainings offered by YASKAWA.
Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN-GP12/AR1440 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: 179319-1CD
Revision: 3

MANUAL NO.
HW1484062 ③

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1 Introduction

DANGER

- This maintenance manual is intended to describe safety measures, necessary items on maintenance and inspection, and maintenance procedures for proper maintenance and inspection of the mechanical part of the MOTOMAN-GP12/AR1440. 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 product.

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.

NOTICE

- When performing maintenance and inspection, make sure to connect the battery unit before removing the encoder connector.

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

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 ™ are omitted.

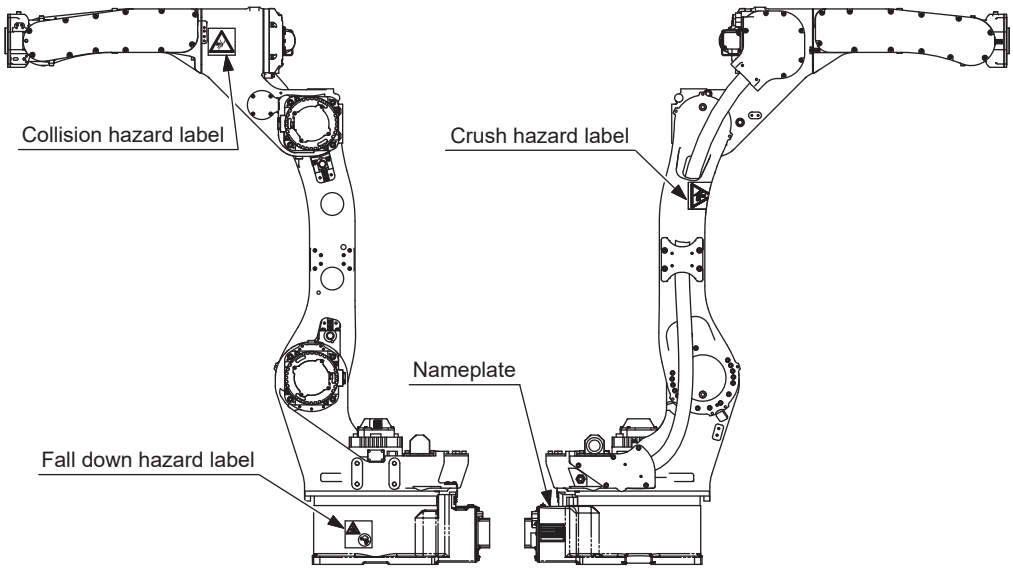
Explanation of Warning Labels

The following warning labels are attached to the manipulator.
Always follow the warnings on the labels.

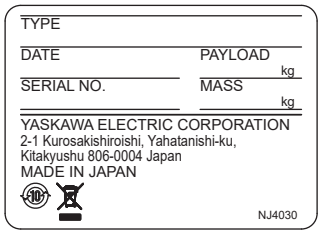
Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Note: Taking the maintenance-relevant trainings offered by your YASKAWA representative 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.

2 Notes for Maintenance

2.1 U-Arm

Because the motor, the battery pack, and the belt drive part are located in the U-arm, the mating surfaces between the U-arm and the covers and the mating surfaces between the B-axis and T-axis and the M-bases are sealed by using gaskets to prevent the ingress of liquids or fumes generated by welding.

After removing the cover or M-base for maintenance, make sure to replace the gasket.

Fig. 2-1: Sealing Part of the U-Arm

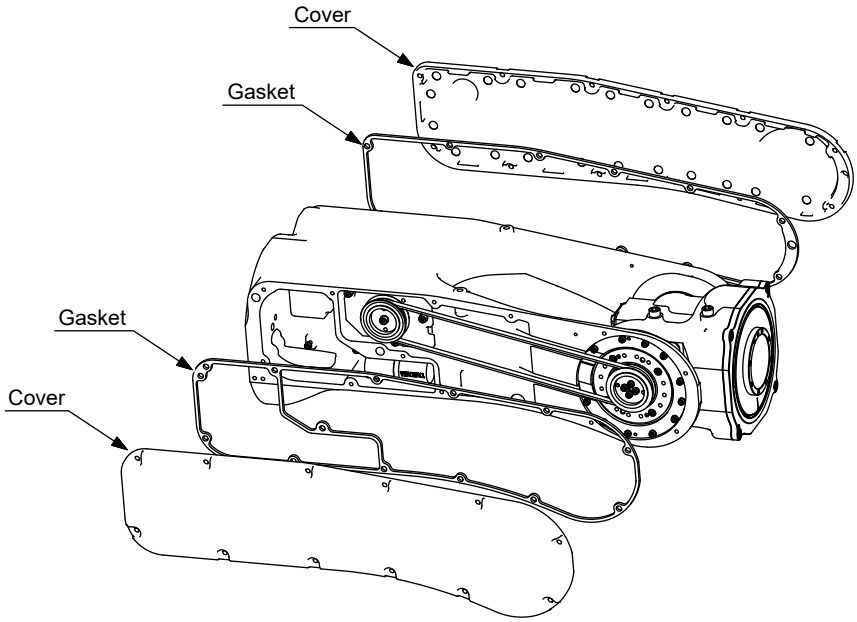
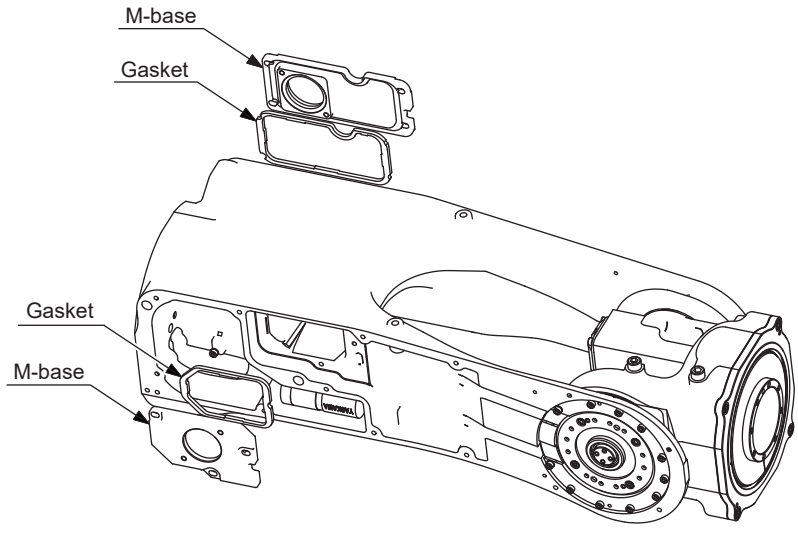


Fig. 2-2: Sealing Part of the M-Base



2.2 Details of Internal Connections

For the encoder and the power supply of the motor of each axis, lead wires are connected to each part of the manipulator.

When replacing a motor or lead wire, prepare the necessary parts and perform maintenance operations by referring to *fig. 2-3 "Details of Internal Connections"* and *table 2-1 "Details of Internal Connections"* .

Fig. 2-3: Details of Internal Connections

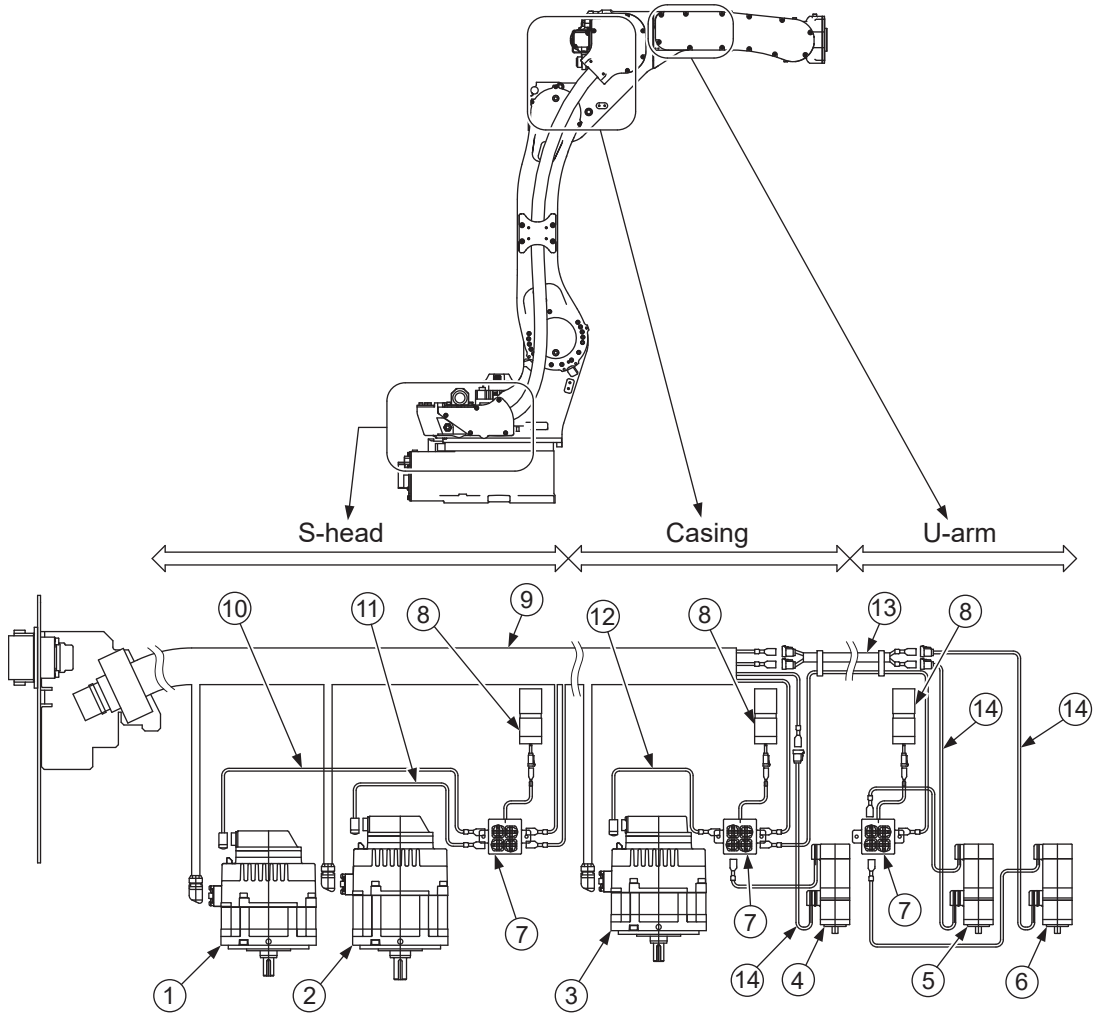


Table 2-1: Details of Internal Connections

No.	Item	Qty.	Note
①	S-axis motor	1	Encoder cable: Not provided with the motor Power cable: Not provided with the motor
②	L-axis motor	1	Encoder cable: Not provided with the motor Power cable: Not provided with the motor
③	U-axis motor	1	Encoder cable: Not provided with the motor Power cable: Not provided with the motor
④	R-axis motor	1	Encoder cable: Provided with the motor Power cable: Not provided with the motor
⑤	B-axis motor	1	Encoder cable: Provided with the motor Power cable: Not provided with the motor
⑥	T-axis motor	1	Encoder cable: Provided with the motor Power cable: Not provided with the motor
⑦	Multi-port connector HW1384619-A	3	
⑧	Battery pack HW1483880-A	3	
⑨	Wire harness HW1172795-A (-A00) HW1172795-B (-A01)	1	
⑩	S-axis encoder cable HW1372597-A	1	
⑪	L-axis encoder cable HW1372597-B	1	
⑫	U-axis encoder cable HW1372597-C	1	
⑬	Wire harness for the B-axis and T-axis HW1271557-A	1	
⑭	Power cable for the R-axis, B-axis, and T-axis HW1372678-A	3	

2.3 Multi-Port Connector

Three multi-port connectors (refer to *fig. 2-4 "Multi-Port Connector"*) for the encoders of the motors are provided on the manipulator. (For the locations, refer to *fig. 2-6 "Locations of Battery Pack and Multi-Port Connector"* .)

A multi-port connector has four ports: two for the motor and the other two for the internal wire harness. (Refer to *fig. 2-5 "Wiring Connection of Multi-Port Connector"* .)

When disconnecting the multi-port connector for a battery replacement, etc., 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 be lost.

Fig. 2-4: Multi-Port Connector

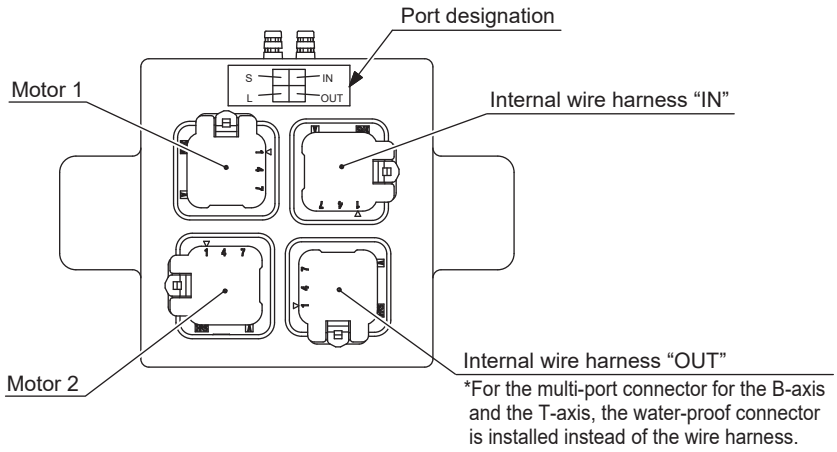


Fig. 2-5: Wiring Connection of Multi-Port Connector

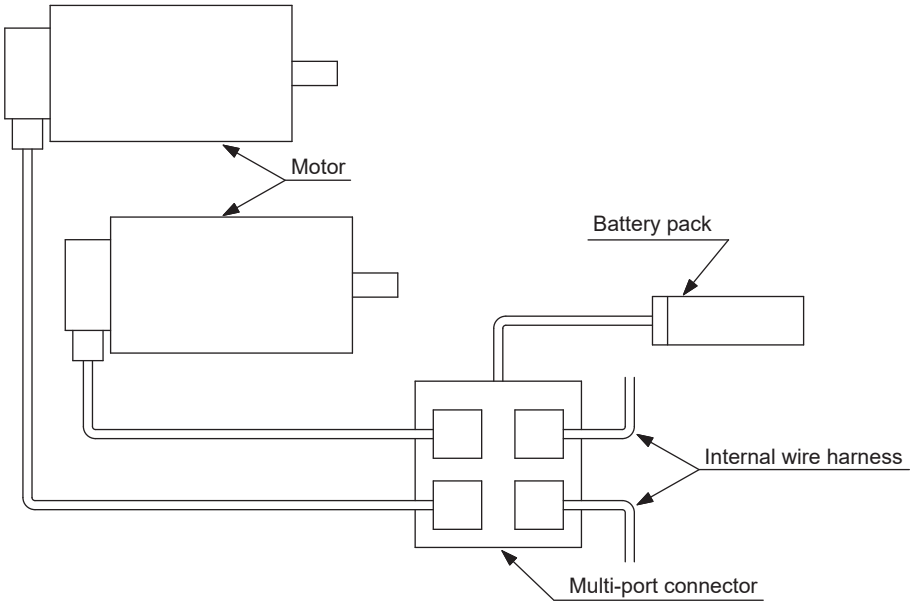
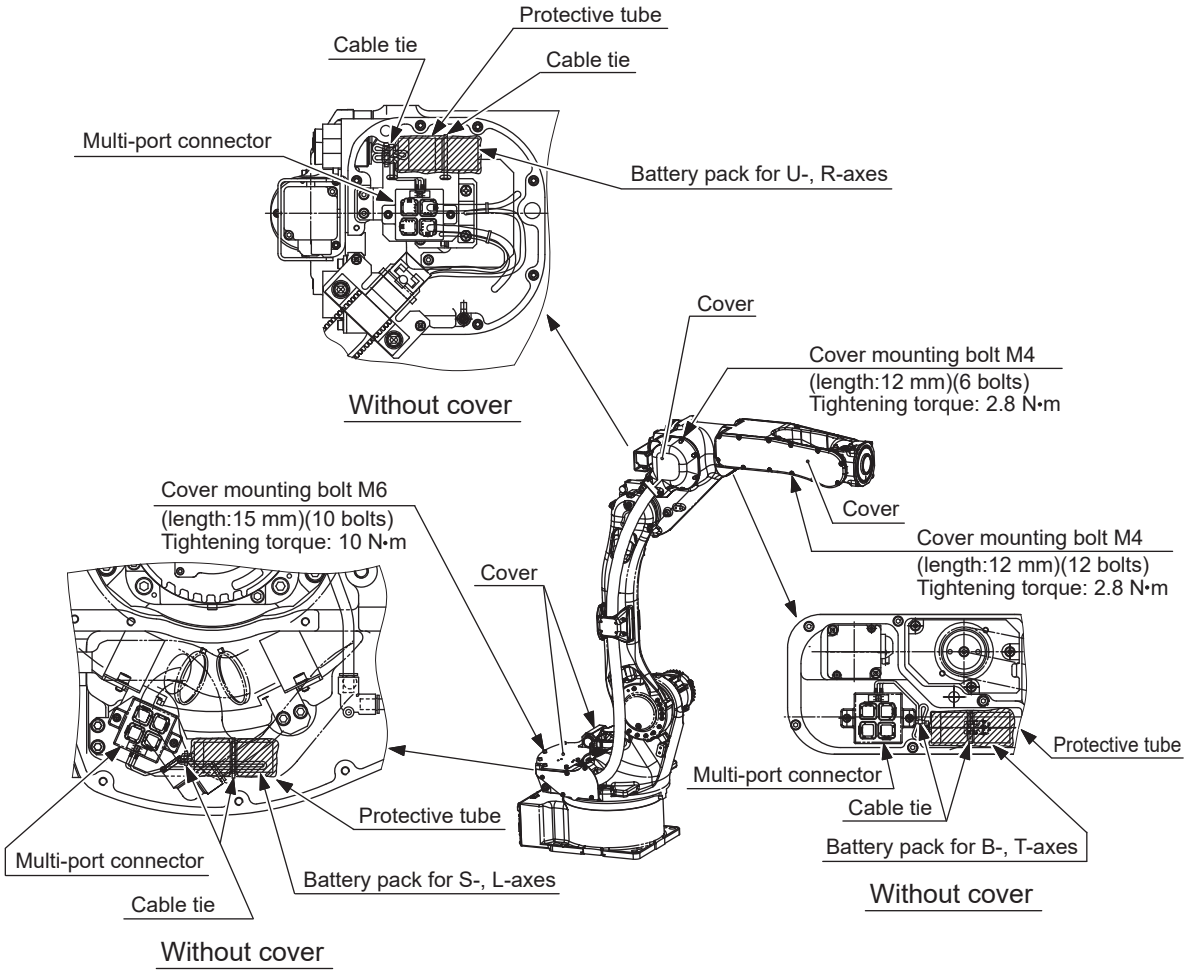


Fig. 2-6: Locations of Battery Pack and Multi-Port Connector



3 Home Position Return

NOTE

Reset the home position of the manipulator if the home position is cleared or deviated. The YRC1000 stores the position data of the job program (hereinafter called JOB) as the pulse number from the home position of each axis. Thus, by precisely resetting the home position, the JOB used before resetting can be used without correction.

Perform home position return in one of the following cases:

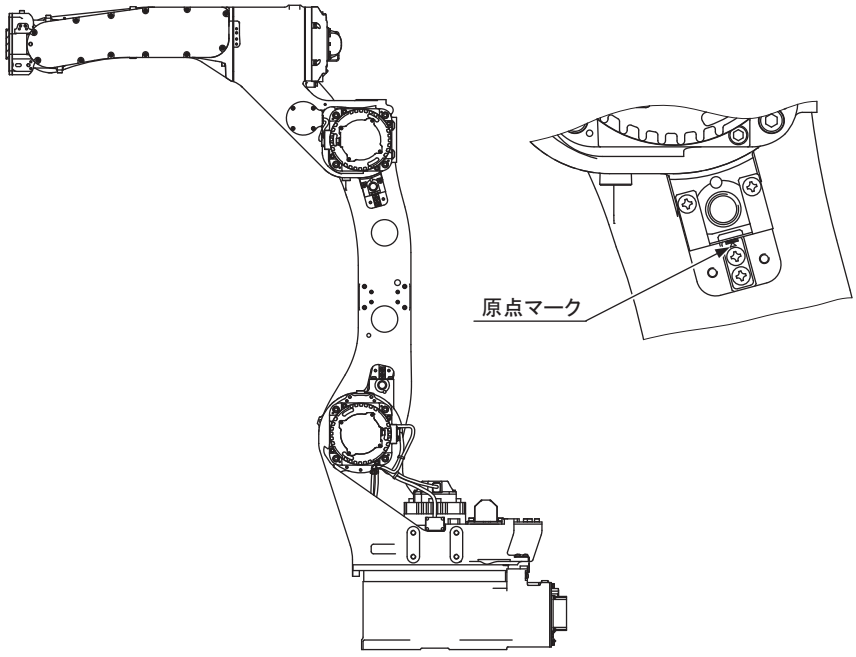
- The motor or absolute encoder is replaced.
- Stored memory is cleared due to the run-out of the internal battery.
- The home position is deviated by hitting the MOTOMAN against a workpiece, etc.
- A main part such as a speed reducer is replaced or disassembled and reassembled.

When performing home position return, be sure that no external force is applied to the manipulator.

3.1 Home Position Posture of Manipulator

The home position of GP12 is shown in *fig. 3-1 "Home Position Posture"* . Each axis has a home position mark as a guide for the home position. The home position mark of the U-axis is shown below as an example.

Fig. 3-1: Home Position Posture



3.2 Types of Methods for Home Position Return

This section explains the types of methods for home position return in detail.

3.2.1 Using a Teaching Point for Setting the Home Position

As a preparation, create the standard position for home position adjustment under normal operating conditions. After the replacement of the motor, etc., move the manipulator to the created position to adjust the deviation.

3.2.2 Using Keys

As a preparation, on the home position label inside of the YRC1000, write down the difference of the pulse numbers between the key position and the factory-set home position of the manipulator. If the home position data disappear, move the manipulator to the key position, and set the position where the above difference of the pulse numbers is reflected as the home position.

3.2.3 Using Encoder Backup Error Recovery Function

If the stored memory is cleared due to the run-out of the internal battery and the “Encoder Backup Error” alarm occurs, run the “Backup Alarm Restoration” software on the programming pendant.

This function cannot be used when the motor or absolute encoder is replaced.

3.2.4 Robot Calibration (MOTOCALV EG)

If any method described above in *chapter 3.2.1* to *chapter 3.2.3* cannot be performed, perform robot calibration to reset the home position of the manipulator.

Perform teaching of the five-point-in-five-posture (25 points in total) by using the manipulator, and adjust the home position and tool data of the manipulator by using its position data.

3.2.5 Table of Suitable Methods for Home Position Return

Suitable methods to return the home position for each case are shown in *table 3-1 “Table of Suitable Methods for Home Position Return”* .

Table 3-1: Table of Suitable Methods for Home Position Return

Case / Method	Replacement of motor or encoder	Run-out of internal battery	Hitting against a workpiece	Replacing a main part
Teaching point	High	N/A	N/A	High
Key	Mid	Mid	N/A	Mid
Encoder backup error recovery function	N/A	High	N/A	N/A
Robot calibration	Low	Low	Low	Low

Accuracy of home position return is categorized as follows:
High, Mid, Low (possible to obtain a more accurate home position, but the home position of all axes are changed),
N/A (not applicable)

3.3 Methods for Home Position Return

3.3.1 Using a Teaching Point for Setting the Home Position

3.3.1.1 Preparation

Before the replacement of a motor or a speed reducer, the standard position (hereinafter called the check-point) must be created for home position adjustment. The standard position is used after the replacement. Create the check-point by satisfying the following conditions. Also, create the JOB so that the manipulator safely moves from the standby position, etc. to the check-point. (The JOB created in this manner is hereinafter called the check-JOB.)

- The position of the check-point must not be deviated by turning the power ON or OFF, or lowering air pressure.
  Do not create the check-point in the movable part of the tool (end-effector) or the jigs (related unit including the rotary table). It is recommended to use a specific jig if necessary.
- Use a pointed object (stylus, etc.) to create the check-point so that deviation is easily found.
  Keep the distance between the check-point and the rotational center of the axis under home position adjustment as far as possible.
- Consider the moving direction of the axis under home position adjustment, and create the check-point where deviation can be easily found and the axis does not interfere with jigs, etc. even if it deviates.

It is recommended to create the check-point for each axis under normal operating conditions beforehand. To create the check-point, each axis must operate normally. The check-point cannot be created if the axis does not move because of failure.

3.3.1.2 Replacement of Motor or Speed Reducer

Replace the motor and speed reducer by referring to *chapter 5 "Disassembly/Reassembly of the Motor"* and *chapter 6 "Disassembly/Reassembly of Speed Reducer"* .

3.3.1.3 Home Position Adjustment

After the replacement, move the axis whose motor or speed reducer was replaced to the position of the home position mark, and register the home position tentatively. For details, refer to chapter 8.1 “Home Position Calibration” in “YRC1000 INSTRUCTIONS (RE-CTO-A221)”.

Move the axis to the check-point by the check-JOB. Ensure that the manipulator does not interfere with jigs, etc. when moving the axis. Correct the deviation from the check-point created before the replacement by moving only the axis whose motor or speed reducer was replaced.

Display the position screen (COMMAND POSITION).

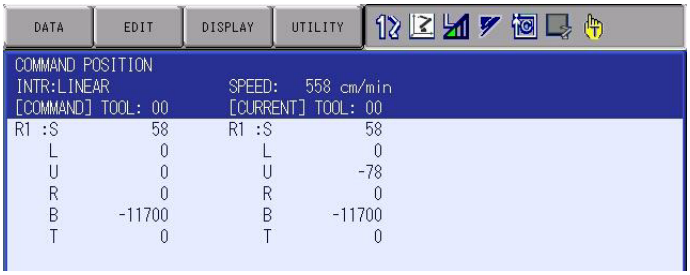
The following figure shows the values of the U-axis as an example.

By using the above values, calculate the amount of deviation. (Subtract the CMD (command value) from the CURR (current value).)

U(-3067) - (-2989) = -78

Perform stepping back, etc. of the check JOB to move the axis to the position where the axis does not interfere with jigs, etc. when it moves to the home position. Ensure that the manipulator does not interfere with jigs, etc. when moving the axis. Refer to the position screen, and move the axis to the position where the pulse number is equal to the amount of deviation.

The following figure shows an example.



At this position, perform home position calibration only for the axis whose motor or speed reducer was replaced. For details, refer to chapter 8.1 “Home Position Calibration” in “YRC1000 INSTRUCTIONS (RE-CTO-A221)”.

Move the axis again to the check-point by the check-JOB. Confirm that the axis is at the check-point created before the replacement. (If it is deviated, repeat the adjustment procedure.)

Check the manipulator operation by using the JOB used before the replacement. If there is no problem, write down the modified home position data (ABSO data) and the date on the label inside of the YRC1000.

Move the axis to the modified home position and check the position of the home position mark. If the home position mark is deviated, modify the home position mark.

3.3.2 Using Keys

As a preparation, on the home position label inside of the YRC1000, write down the difference of the pulse numbers between the key position and the factory-set home position of the manipulator. If the home position data disappear, move the manipulator to the key position, and set the position where the above difference of the pulse numbers is reflected as the home position.

■ **Robot Calibration**

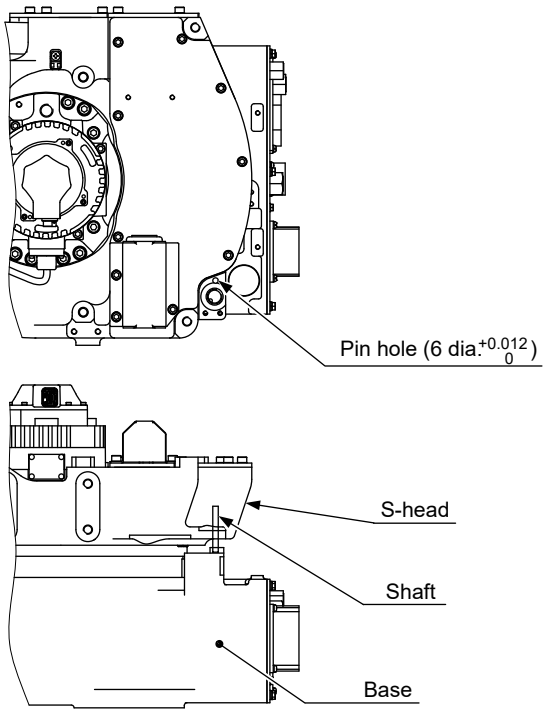
The parts in *table 3-2 "Parts List"* are required. Prepare them beforehand.

Table 3-2: Parts List

Drawing No.	Name	Qty.	Note
SFJW6-70	Shaft	1	For S-, L-, U-, R-, and B-axes

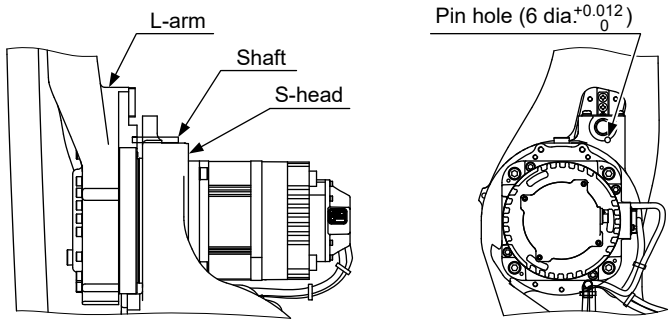
1. S-Axis Positioning
   As shown in *fig. 3-2 "S-Axis Positioning"*, insert the shaft SFJW6-70 from the pin hole ($6^{+0.012}_{0}$dia.) on the S-head and perform positioning by using the programming pendant so that the shaft fits into the slot of the base.

Fig. 3-2: S-Axis Positioning



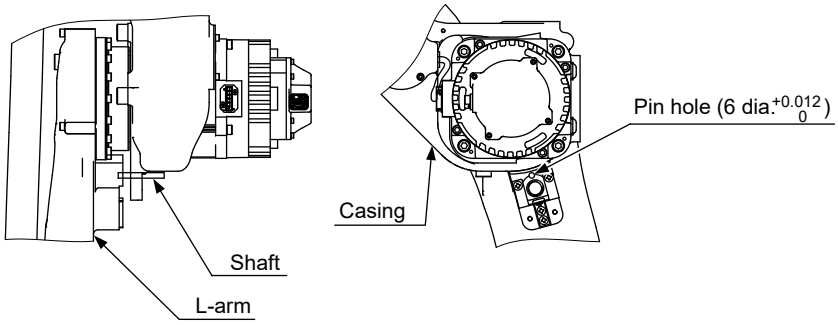
2. L-Axis Positioning
   As shown in *fig. 3-3 "L-Axis Positioning"* , insert the shaft SFJW6-70 from the pin hole ($6^{+0.012}_{0}$ dia.) on the S-head and perform positioning by using the programming pendant so that the shaft fits into the slot of the L-arm.

Fig. 3-3: L-Axis Positioning



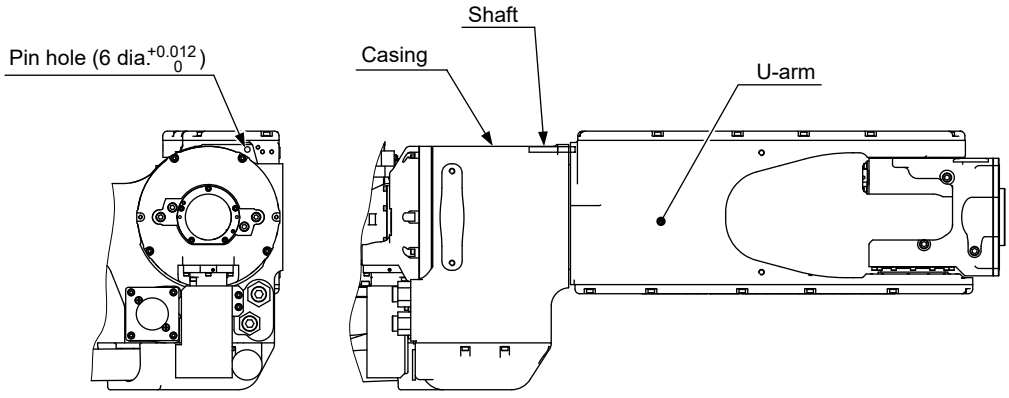
3. U-Axis Positioning
   As shown in *fig. 3-4 "U-Axis Positioning"* , insert the shaft SFJW6-70 from the pin hole ($6^{+0.012}_{0}$ dia.) on the casing and perform positioning by using the programming pendant so that the shaft fits into the slot of the L-arm.

Fig. 3-4: U-Axis Positioning



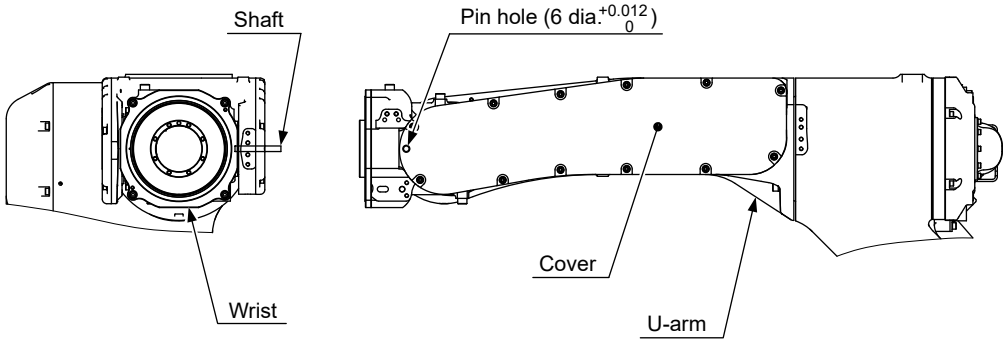
4. R-Axis Positioning
   As shown in *fig. 3-5 "R-Axis Positioning"* , insert the shaft SFJW6-70 from the pin hole ($6^{+0.012}_{0}$ dia.) on the casing and perform positioning by using the programming pendant so that the shaft fits into the slot of the U-arm.

Fig. 3-5: R-Axis Positioning



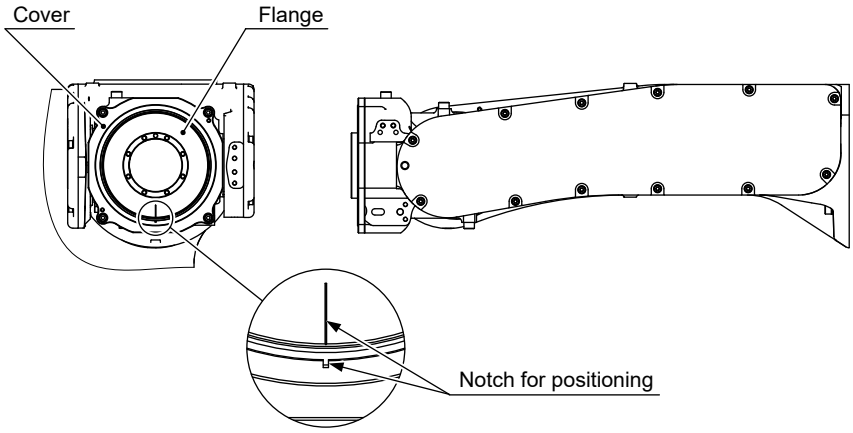
5. B-Axis Positioning
   As shown in *fig. 3-6 "B-Axis Positioning"* , insert the shaft SFJW6-70 from the pin hole ($6^{+0.012}_{0}$ dia.) on the U-arm cover and perform positioning by using the programming pendant so that the shaft fits into the slot of the wrist.

Fig. 3-6: B-Axis Positioning



6. T-Axis Positioning
   T-axis positioning cannot be performed by using a pin. Thus, as shown in *fig. 3-7 "T-Axis Positioning"* , perform positioning by visually confirming that the notch of the flange and the notch of the cover are aligned.

Fig. 3-7: T-Axis Positioning



3.3.3 Using Encoder Backup Error Recovery Function

For details on the encoder backup error recovery function, refer to "YRC1000 INSTRUCTIONS (RE-CTO-A221)".

3.3.4 Robot Calibration (MOTOCALV EG)

Contact your YASKAWA representative for the procedure of robot calibration.

4 Notes on Grease Replenishment/Exchange Procedures

4.1 Grease Exchange Procedures for S-, L-, U-Axis Speed Reducer

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

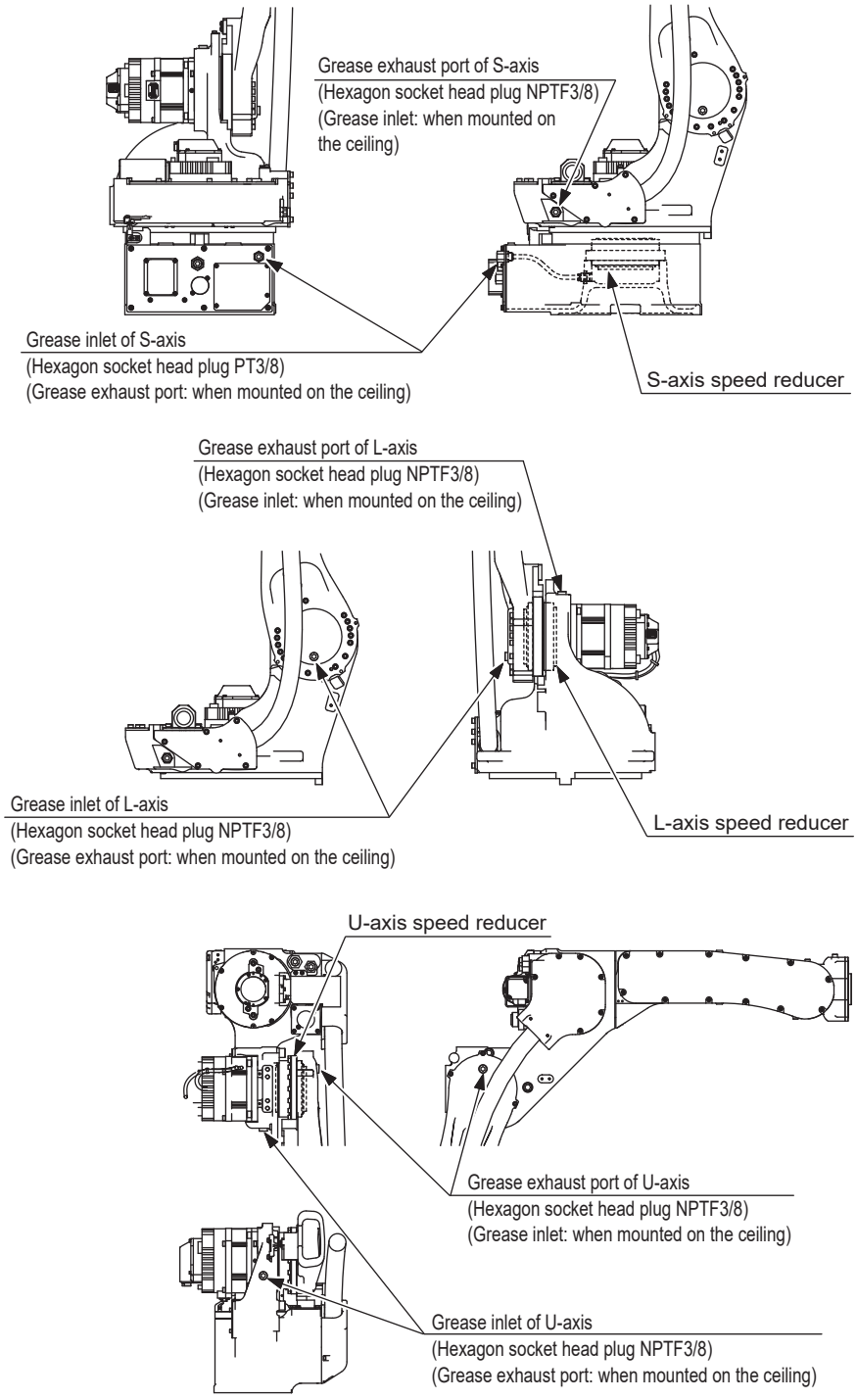
- If grease is injected without removing the plug from the grease exhaust port, the grease will leak inside a motor, or an oil seal of a speed reducer will come off. Make sure to remove the plug or it may result in a failure.
  Also, when using a tube, the length must be 150 mm or shorter and the inside 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.

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.

4.1.2 Grease Exchange Procedure

Fig. 4-1: S-, L-, U-Axis Speed Reducer Diagram



1. Before injecting grease, the posture of the manipulator must be set as indicated in *table 4-1 "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 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 4-1: Recommended Posture for Grease Injection

		Posture					
Mounting Condition	Axis to inject grease	S-axis	L-axis	U-axis	R-axis	B-axis	T-axis
Floor-mounted	S-axis	0°	Any	Any	Any	Any	Any
	L-axis	Any	0°	Any			
	U-axis	Any	0°	0° *			
Ceiling-mounted	S-axis	0°	Any	Any			
	L-axis	Any	0°	Any			
	U-axis	Any	0°	0° *			
Wall-mounted	S-axis	0°	Any	Any			
	L-axis	0°	±90°	Any			
	U-axis	0°	±90°	±90° *			

* 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.

NOTE The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

3. Install a grease zerk A-PT3/8 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
   - Grease lubricator: Air-operated grease gun
     (e.g., Powerlube P3-01JC 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 4-2: Amount of Grease

Axis to exchange grease	**Amount of grease**
S-axis	Approx. 700 g
L-axis	Approx. 450 g
U-axis	Approx. 350 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 *fig. 4-3 "Teaching Operation for Each Axis"* .

Table 4-3: 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°	
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 4-4 "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 4-5 "Grease Discharging 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 4-5 "Grease Discharging Operation for Each Axis"* .

Table 4-4: 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±10
U-axis	40±5	45±10

Table 4-5: Grease Discharging Operation for Each Axis

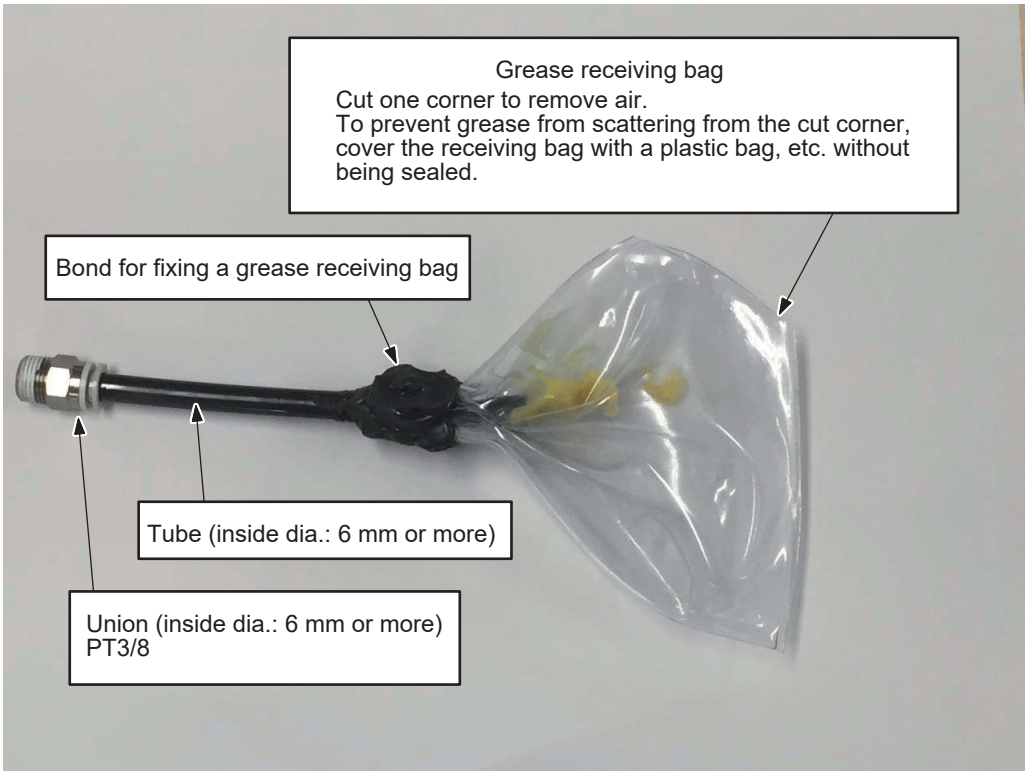
Axis to exchange grease	Angle for teaching operation	Speed for teaching operation
S-, L-, U-axis	±45°	User-specified

9. For the axis where grease is exchanged, perform a playback operation indicated in *table 4-6 "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. Tighten the plug on the grease inlet 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. 4-2 "Grease Receiving Bag (Example)"* , and then perform the running-in operation.

Table 4-6: 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-, U-axis	±45°	MOVJ VJ=50.00	1.0 s	15 minutes

Fig. 4-2: Grease Receiving Bag (Example)



10. Wipe the 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. Reinstall the plug on the grease inlet, and tighten the plug with the tightening torque of 16.5 N•m (1.7 kgf•m).

4.2 Grease Replenishment Procedures for R-, B-Axis Speed Reducer and R-,T-Axis Gear

4.2.1 Notes on Grease Replenishment Procedures

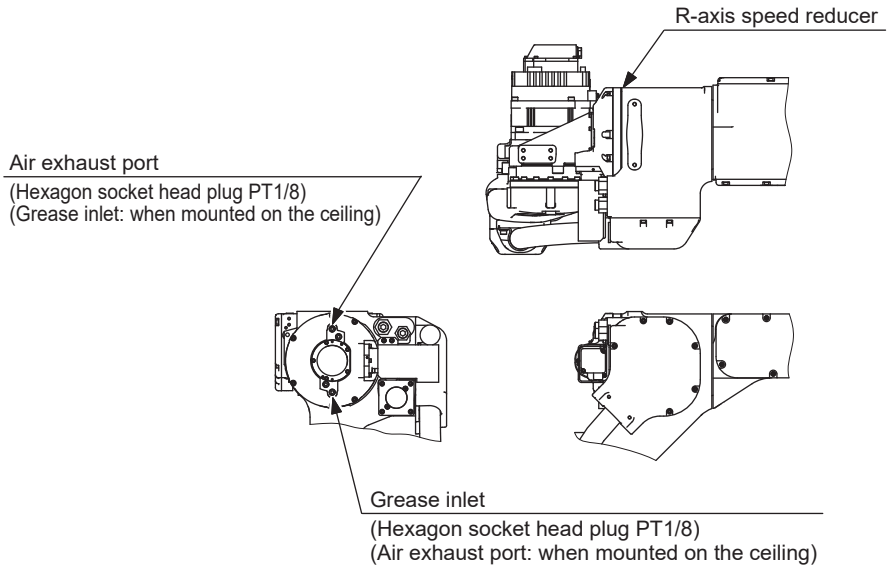
Make sure to follow the instructions listed below at grease exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

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.

4.2.2 Grease Replenishment Procedures for R-Axis Speed Reducer

Fig. 4-3: 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.

NOTE

The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

3. Install a grease zerk A-PT1/8 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)

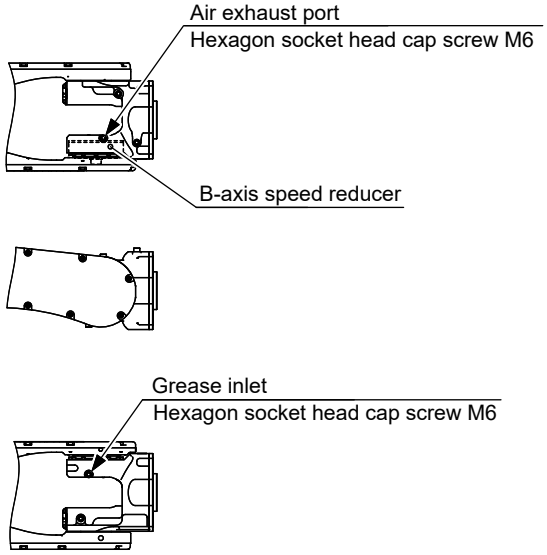
4. Inject the grease through the grease inlet using a grease gun.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 7 g

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 kg•fm).
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 kg•fm).

4.2.3 Grease Replenishment Procedures for B-Axis Speed Reducer

Fig. 4-4: B-Axis Speed Reducer 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 the grease into the grease inlet.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 7 g

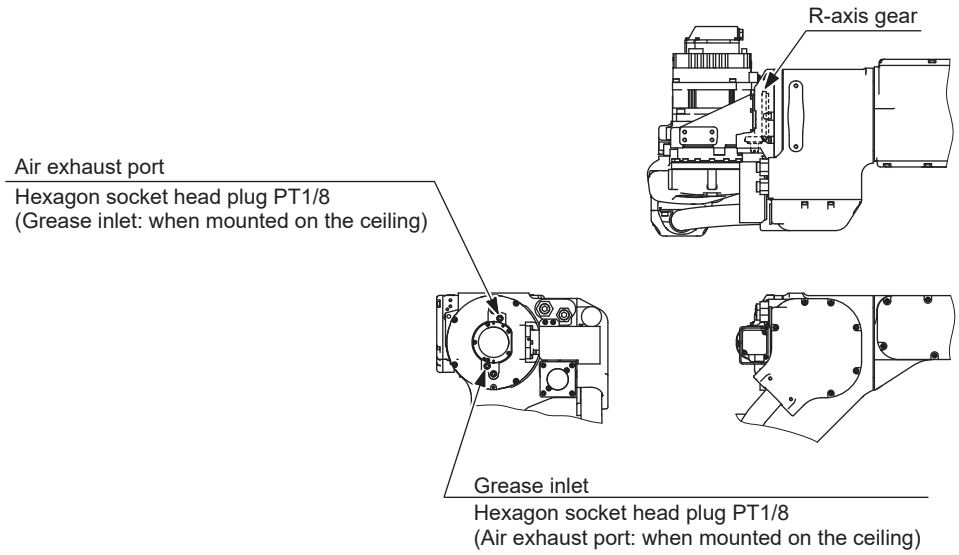
NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

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 Three Bond 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 Three Bond 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).

4.2.4 Grease Replenishment Procedures for R-Axis Gear

Fig. 4-5: 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.

NOTE The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

3. Install a grease zerk A-PT1/8 to the grease inlet.
(The grease zerk is delivered with the manipulator.)

4. Inject the 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)

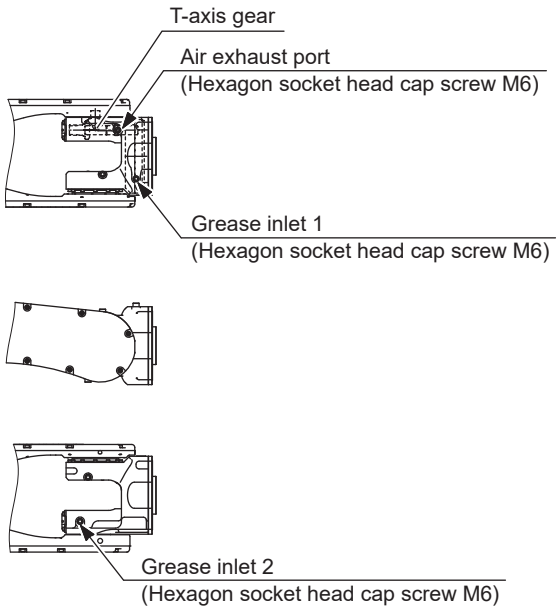
NOTE Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

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 kg･fm).

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 kg･fm).

4.2.5 Grease Replenishment Procedures for T-Axis Gear

Fig. 4-6: 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 the 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 Three Bond 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 the 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 Three Bond 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 Three Bond 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).

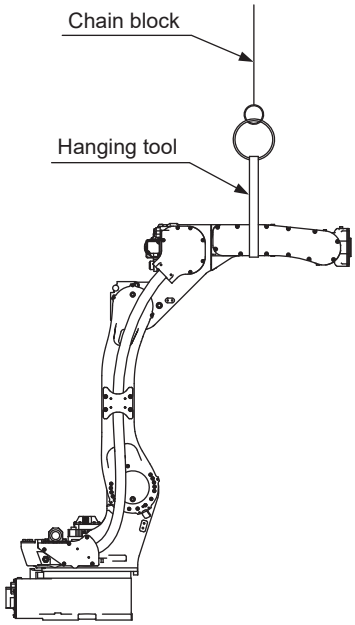
5 Disassembly/Reassembly of the Motor

WARNING

- Because the motor is removed, the manipulator cannot keep its posture during the replacement of the motor. When replacing the motor, hold the manipulator arm by using a hanging tool (e.g., chain block). Failure to observe this caution may cause a hazardous condition. Replace the motor with due care.

The U-axis is shown below as an example. Refer to *fig. 5-1 "Replacement (Example)"* .

Fig. 5-1: Replacement (Example)



NOTE

Refer to *chapter 2 "Notes for Maintenance"* , *chapter 3 "Home Position Return"* , *chapter 4 "Notes on Grease Replenishment/Exchange Procedures"* , *chapter 5 "Disassembly/Reassembly of the Motor"* , and *chapter 8 "Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts"* in this manual.

Remove old sealing from each part before starting assembling.

5.1 Disassembly and Reassembly of the S-Axis Motor

• Refer to *fig. 5-2 "Disassembly & Reassembly of S-Axis Motor"* .

■ Disassembly

1. Turn OFF the YRC1000 power supply.
2. Disconnect the connector of the S-axis motor ① (fixing bolt: pan-head screw M2) and remove the encoder cable.
3. Disconnect the connector of the S-axis motor ① (fixing bolt: pan-head screw M3) and remove the power cable.
4. Unscrew the hexagon socket head cap screws ②, and then remove the S-axis motor ① from the M-base ⑤ by using the tapped holes on the motor flange face.
5. Unscrew the hexagon socket head cap screw⑥, and then remove the key④ and the input gear③.
6. To replace the motor, unscrew the slim-head machine screw⑦ from the S-axis motor①.

■ Reassembly

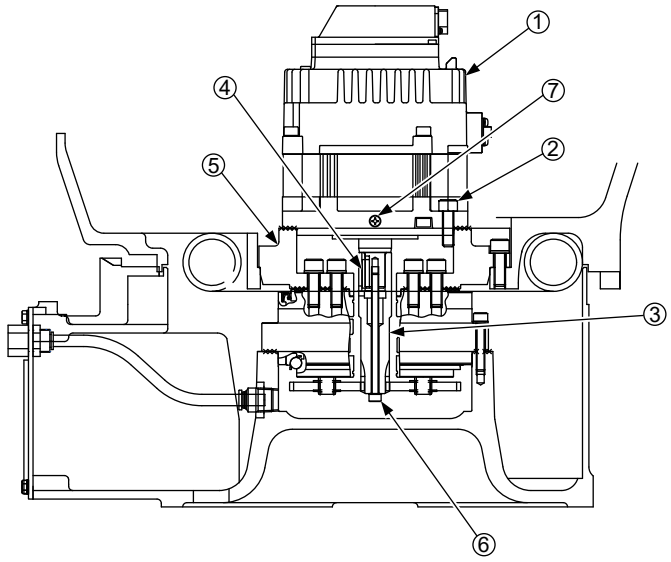
1. When the motor is replaced as the step 6 above, tighten the slim-head machine screw⑦ to the grease-leakage detection hole of the S-axis motor① with the tightening torque shown in *table 5-1 "S-Axis Motor Parts Checklist"* .
2. Install the key④ and the input gear③ on the S-axis motor①.
   (The key④ is provided with the S-axis motor①.)
3. Attach the conical spring washer to the hexagon socket head cap screw⑥, and then apply LOCTITE 243 to the thread part of the screw and tighten the screw with the tightening torque shown in *table 5-1*.
4. Apply ThreeBond 1206C to the mating surface between the S-axis motor ① and the M-base ⑤, and then mount the S-axis motor ① onto the M-base ⑤.
5. Tighten the hexagon socket head cap screws② with the tightening torque shown in *table 5-1*.
6. Connect the encoder cable to the S-axis motor ①, and tighten the connector fixing bolt (pan-head screw M2) with the tightening torque of 0.2 N•m.
   (The connector fixing bolt is provided with the connector.)
7. Connect the power cable to the S-axis motor ①, and tighten the connector fixing bolt (pan-head screw M3) with the tightening torque of 0.2 N•m.
   (The connector fixing bolt is provided with the connector.)
8. Turn ON the YRC1000 power supply.

5 Disassembly/Reassembly of the Motor
5.1 Disassembly and Reassembly of the S-Axis Motor

Table 5-1: S-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	S-axis motor	1	SGM7G-05APK-YR1*
②	Hexagon socket head cap screw M8 (length: 25 mm) *trivalent chromate”	3	Tightening torque 24.5 N•m
③	Input gear HW0312734-2	1	
④	Key	1	Provided with the motor
⑤	M-base HW1407929-1	1	
⑥	Hexagon socket head cap screw M5 (length: 85 mm) Conical spring washer 2L-5	1 each	Tightening torque 10.0 N•m
⑦	Slim-head machine screw M4 (length: 6 mm) *trivalent chromate*	4	Tightening torque 0.75 N•m

Fig. 5-2: Disassembly & Reassembly of S-Axis Motor



5.2 Disassembly and Reassembly of the L-Axis Motor

• Refer to *fig. 5-3 "Disassembly & Reassembly of L-Axis Motor"* .

■ Disassembly

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the arm, and then turn OFF the YRC1000 power supply.
2. Disconnect the connector of the L-axis motor ① (fixing bolt: pan-head screw M2) and remove the encoder cable.
3. Disconnect the connector of the L-axis motor ① (fixing bolt: pan-head screw M3) and remove the power cable.
4. Support the L-arm by using a chain block, etc. to prevent it from rotating before removing the L-axis motor①.
5. Unscrew the hexagon socket head cap screws②, and then remove the L-axis motor ① from the S-head by using the tapped holes on the flange face of the L-axis motor①.
6. Unscrew the hexagon socket head cap screw⑤, and then remove the key④ and the input gear③.
7. To replace the motor, unscrew the slim-head machine screw⑥ from the L-axis motor①.

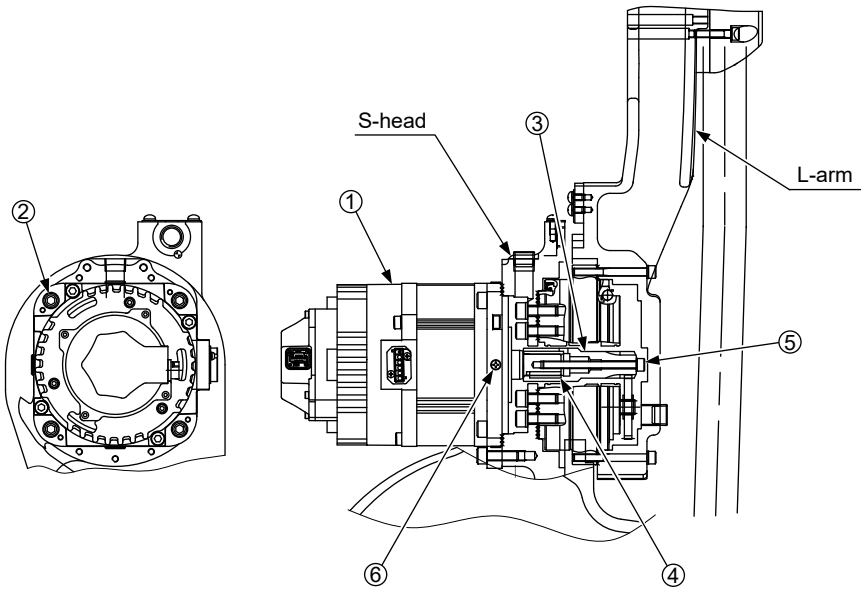
■ Reassembly

1. When the motor is replaced as the step 7 above, tighten the slim-head machine screw⑥ to the L-axis motor① with the tightening torque shown in *table 5-2 "L-Axis Motor Parts Checklist"* .
2. Install the key④ and the input gear③ on the L-axis motor①.
   (The key④ is provided with the L-axis motor①.)
3. Attach the conical spring washer to the hexagon socket head cap screw⑤, and then apply LOCTITE 243 to the thread part of the screw and tighten the screw with the tightening torque shown in *table 5-2*.
4. Apply ThreeBond 1206C to the mating surface between the L-axis motor ① and the S-head, and then mount the L-axis motor ① onto the S-head.
5. Tighten the hexagon socket head cap screws② with the tightening torque shown in *table 5-2*.
6. Connect the encoder cable to the L-axis motor ①, and tighten the connector fixing bolt (pan-head screw M2) with the tightening torque of 0.2 N•m.
   (The connector fixing bolt is provided with the connector.)
7. Connect the power cable to the L-axis motor ①, and tighten the connector fixing bolt (pan-head screw M3) with the tightening torque of 0.2 N•m.
   (The connector fixing bolt is provided with the connector.)
8. Turn ON the YRC1000 power supply.

Table 5-2: L-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	L-axis motor	1	SGM7G-09APK-YR1*
②	Hexagon socket head cap screw M8 (length: 25 mm) *trivalent chromate*	4	Tightening torque 24.5 N•m
③	Input gear HW0312735-2	1	
④	Key	1	Provided with the motor
⑤	Hexagon socket head cap screw M6 (length: 75 mm) Conical spring washer 2L-6	1 each	Tightening torque 16.5 N•m
⑥	Slim-head machine screw M4 (length: 6 mm) *trivalent chromate*	4	Tightening torque 0.75 N•m

Fig. 5-3: Disassembly & Reassembly of L-Axis Motor



5.3 Disassembly and Reassembly of the U-Axis Motor

• Refer to *fig. 5-4 "Disassembly & Reassembly of U-Axis Motor"* .

■ Disassembly

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the arm, and then turn OFF the YRC1000 power supply.
2. Disconnect the connector of the U-axis motor ① (fixing bolt: pan-head screw M2) and remove the encoder cable.
3. Disconnect the connector of the U-axis motor ① (fixing bolt: pan-head screw M3) and remove the power cable.
4. Support the U-arm by using a chain block, etc. to prevent it from rotating before removing the U-axis motor①.
5. Unscrew the hexagon socket head cap screws②, and then remove the U-axis motor ① from the casing by using the tapped holes on the flange face of the U-axis motor①.
6. Unscrew the hexagon socket head cap screw⑤, and then remove the key④ and the input gear③.
7. To replace the motor, unscrew the slim-head machine screw⑥ from the U-axis motor①.

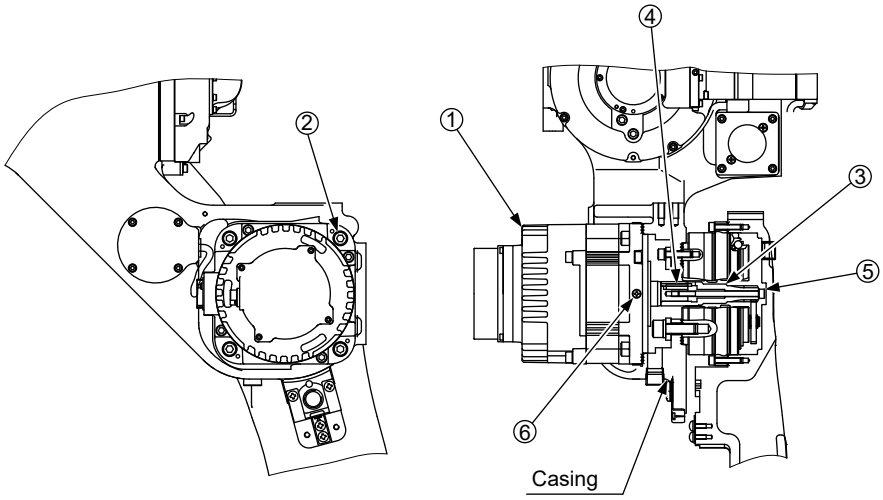
■ Reassembly

1. When the motor is replaced as the step 7 above, tighten the slim-head machine screw⑥ to the U-axis motor① with the tightening torque shown in *table 5-3 "U-Axis Motor Parts Checklist"* .
2. Install the key④ and the input gear③ on the U-axis motor①.
   (The key④ is provided with the U-axis motor①.)
3. Attach the conical spring washer to the hexagon socket head cap screw⑤, and then apply LOCTITE 243 to the thread part of the screw and tighten the screw with the tightening torque shown in *table 5-3*.
4. Apply ThreeBond 1206C to the mating surface between the U-axis motor ① and the casing, and then mount the U-axis motor ① onto the casing.
5. Tighten the hexagon socket head cap screws② with the tightening torque shown in *table 5-3*.
6. Connect the encoder cable to the U-axis motor ①, and tighten the connector fixing bolt (pan-head screw M2) with the tightening torque of 0.2 N•m.
   (The connector fixing bolt is provided with the connector.)
7. Connect the power cable to the U-axis motor ①, and tighten the connector fixing bolt (pan-head screw M3) with the tightening torque of 0.2 N•m.
   (The connector fixing bolt is provided with the connector.)
8. Turn ON the YRC1000 power supply.

Table 5-3: U-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	U-axis motor	1	SGM7G-05APK-YR1*
②	Hexagon socket head cap screw M8 (length: 30 mm) *trivalent chromate*	4	Tightening torque 24.5 N•m
③	Input gear HW1303245-1	1	
④	Key	1	Provided with the motor
⑤	Hexagon socket head cap screw M5 (length: 75 mm) Conical spring washer 2L-5	1 each	Tightening torque 10.0 N•m
⑥	Slim-head machine screw M4 (length: 6 mm) *trivalent chromate*	4	Tightening torque 0.75 N•m

Fig. 5-4: Disassembly & Reassembly of U-Axis Motor



5.4 Disassembly and Reassembly of the R-Axis Motor

• Refer to *fig. 5-5 "Disassembly & Reassembly of R-Axis Motor"* .

■ Disassembly

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the arm, and then turn OFF the YRC1000 power supply.
2. Support the U-arm by using a chain block, etc. to prevent it from rotating.
3. Unscrew the GT-SA bolts ⑩, and then remove the cover ⑨.
4. Disconnect the power cable of the R-axis motor ① from the internal wiring harness, and disconnect the encoder cable of the R-axis motor ① from the port "R" of the multi-port connector.
5. Unscrew the hexagon socket head cap screws ④, and then remove the cover ⑧.
6. Unscrew the GT-SA bolts ②, and then remove the R-axis motor ① unit (the unit including the R-axis motor ①, the gear ⑥, and the M-base ⑤) from the housing.
7. By using a vernier caliper, etc., measure the size of the part A of the R-axis motor ① unit, and take a note of the size.
   (Approx. 18.8 to 18.85 mm)
8. Unscrew the hexagon socket head cap screw ⑦, and then remove the gear ⑥. (To secure the gear ⑥, use the two grooves on the surface of the gear ⑥.)
9. Unscrew the hexagon socket head cap screws ③, and remove the R-axis motor ① from the M-base ⑤.
10. Remove the shim from the gear ⑥ and the R-axis motor ①.
11. Disconnect the connector of the R-axis motor ① (fixing bolt: pan-head sems screw M2), and then remove the power cable.
12. To replace the oil seal ⑪, remove the oil seal ⑪ from the M-base ⑤.

■ Reassembly

1. If the oil seal ⑪ was removed, mount the oil seal ⑪ to the M-base ⑤.
2. Mount the M-base ⑤ onto the R-axis motor ① by using the hexagon socket head cap screws ③. Tighten the screws ③ with the tightening torque shown in *table 5-4 "R-Axis Motor Parts Checklist"* .
3. Apply the MP-1 grease on the lip part of the oil seal ⑪.
4. Confirm that the gasket ⑫ is attached to the gear ⑥, and then mount the gear ⑥ onto the R-axis motor ①.
   Make sure not to damage the oil seal ⑪ at this time.
5. Attach the conical spring washer to the hexagon socket head cap screw ⑦, and tighten it with the tightening torque shown in *table 5-4* as temporary tightening.
   (Since this is temporary tightening, it is not necessary to apply LOCTITE 243.)
6. By using a vernier caliper, etc., measure the size of the part A of the R-axis motor ① unit. (Approx. 18.35 to 18.85 mm)

7. To make the size of the part A equal to the size measured before the disassembly, refer to *table 5-4 "R-Axis Motor Parts Checklist"* and select a shim with the thickness equal to the difference between the sizes measured before and after the disassembly.
   If no shim matches the difference exactly, select a shim thinner than the actual difference so that the size of the part A does not exceed the size measured before the disassembly.
8. Unscrew the temporarily-tightened hexagon socket head cap screw⑦, and remove the gear⑥.
9. Mount the selected shim to the shaft of the R-axis motor①.
10. Attach the conical spring washer to the hexagon socket head cap screw⑦, and then apply LOCTITE 243 to the thread part of the screw and tighten the screw with the tightening torque shown in *table 5-4 "R-Axis Motor Parts Checklist"* .
11. Apply ThreeBond 1206C to the mating surface between the M-base⑤ and the housing, and then mount the M-base⑤ onto the housing.
12. Tighten the GT-SA bolts② with the tightening torque shown in *table 5-4*.
13. Connect the power cable to the R-axis motor①, and tighten the connector fixing bolt (pan-head screw M2) with the tightening torque of 0.15 N•m.
    (The connector fixing bolt is provided with the connector.)
14. Connect the power cable of the R-axis motor① to the internal wiring harness. Connect the encoder cable of the R-axis motor① to the port "R" of the multi-port connector.
15. Enclose the connecting part of the power cable's connector in the protective tube, secure with a cable tie, and then put it into the casing.
16. Mount the cover⑨ by using the GT-SA bolts⑩.
17. Tighten the GT-SA bolts⑩ with the tightening torque shown in *table 5-4*.
18. Mount the cover⑧ by using the hexagon socket head cap screws④.
19. Tighten the hexagon socket head cap screws④ with the tightening torque shown in *table 5-4*.
20. Turn ON the YRC1000 power supply.

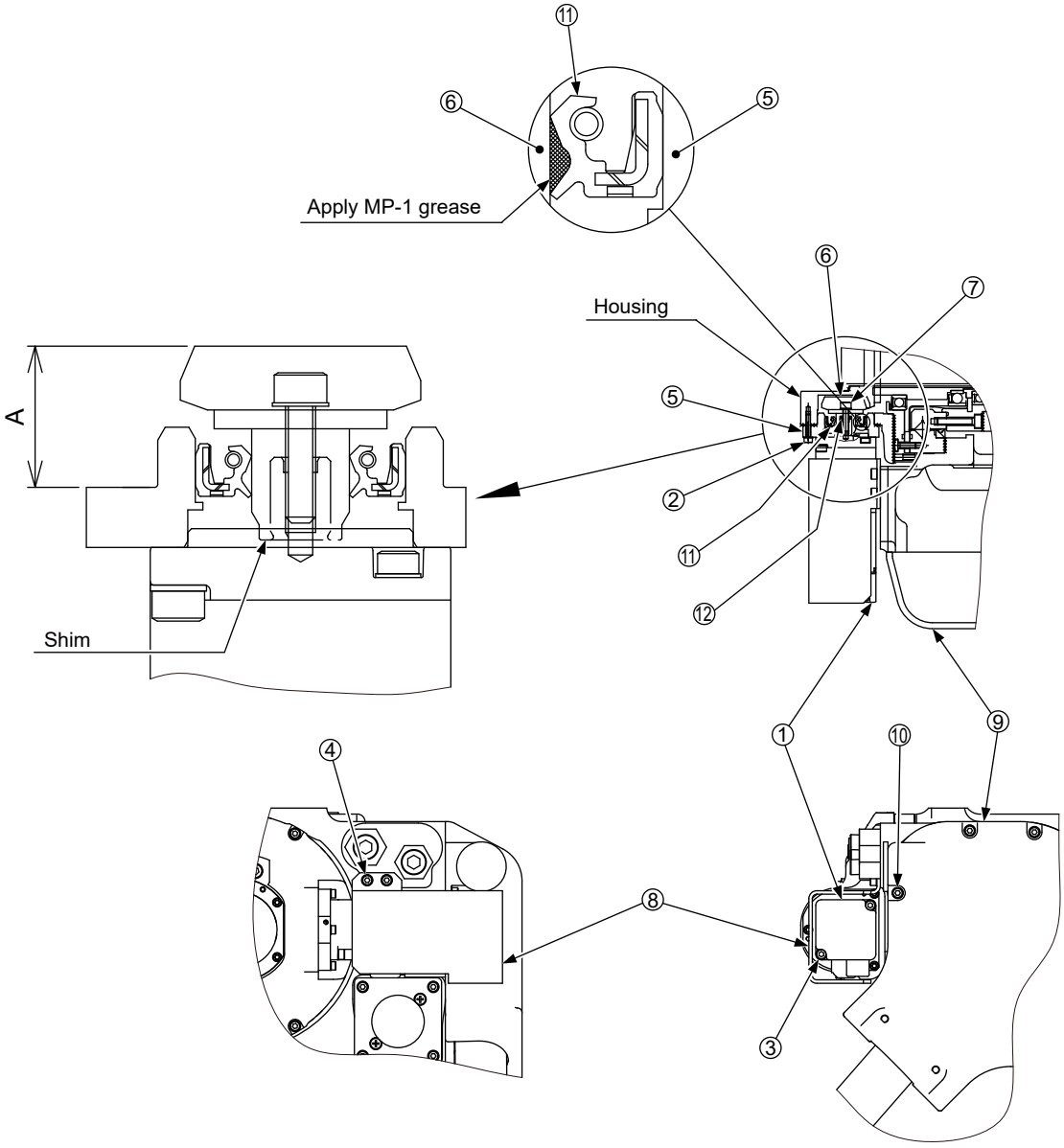
Table 5-4: R-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	R-axis motor	1	SGM7J-01APK-YR1*
②	GT-SA bolt M3 (length: 16 mm)	3	Tightening torque 1.4 N•m
③	Hexagon socket head cap screw M4 (length: 12 mm) *trivalent chromate*	2	Tightening torque 2.8 N•m
④	Hexagon socket head cap screw M4 (length: 12 mm) *trivalent chromate*	2	Tightening torque 2.8 N•m
⑤	M-base HW1407821-1	1	
⑥	Gear HW1306389-1	1	
⑦	Hexagon socket head cap screws M4 (length: 16 mm) Conical spring washer 2L-4	1 each	Tightening torque 4.8 N•m
⑧	Cover HW1407212-1	1	
⑨	Cover HW1306162-1	1	
⑩	GT-SA bolt M4 (length: 12 mm)	6	Tightening torque 2.8 N•m
⑪	Oil seal AE0478G	1	
⑫	Gasket HW0404304-2	1	

Table 5-5: Shim for R-Axis Gear

Thickness of shim (mm)	Type
0.05	HW1405521-1
0.1	HW1405521-2
0.2	HW1405521-3
0.3	HW1405521-4

Fig. 5-5: Disassembly & Reassembly of R-Axis Motor



NOTE

After replacing the R-axis motor, check if the R-axis makes no abnormal noise during operation.

If an abnormal noise is heard, replace the shim in the R-axis motor with a thinner shim.

If the operation is continued without correcting the abnormal noise, mechanical failure may be resulted, such as a damage to the R-axis gear.

5.5 Disassembly/Reassembly of B-Axis Motor

• Refer to *fig. 5-6 "Disassembly & Reassembly of B-Axis Motor"* .

■ Disassembly

1. Turn OFF the YRC1000 power supply.
2. Support the wrist by using a chain block, etc. to prevent it from rotating.
3. Unscrew the GT-SA bolts⑩, and then remove the cover⑨.
4. Remove the gasket⑪ from the cover⑨.
5. Disconnect the power cable of the B-axis motor① from the internal wiring harness for the B- and T-axes, and disconnect the encoder cable of the B-axis motor① from the port "B" of the multi-port connector.
6. Unscrew the GT-SA bolts⑥, and then remove the B-axis motor① unit (the unit including the B-axis motor①, the pulley③, and the M-base ⑤) from the U-arm.
7. Unscrew the hexagon socket head cap screw④, and then remove the pulley③. (To secure the pulley③, use the two grooves on the surface of the pulley③.)
8. Unscrew the GT-SA bolts②, and then remove the B-axis motor① and the O-ring⑦.
9. Remove the gasket⑧ from the M-base⑤.
10. Disconnect the connector of the B-axis motor① (fixing bolt: pan-head sems screw M2), and then remove the power cable.

■ Reassembly

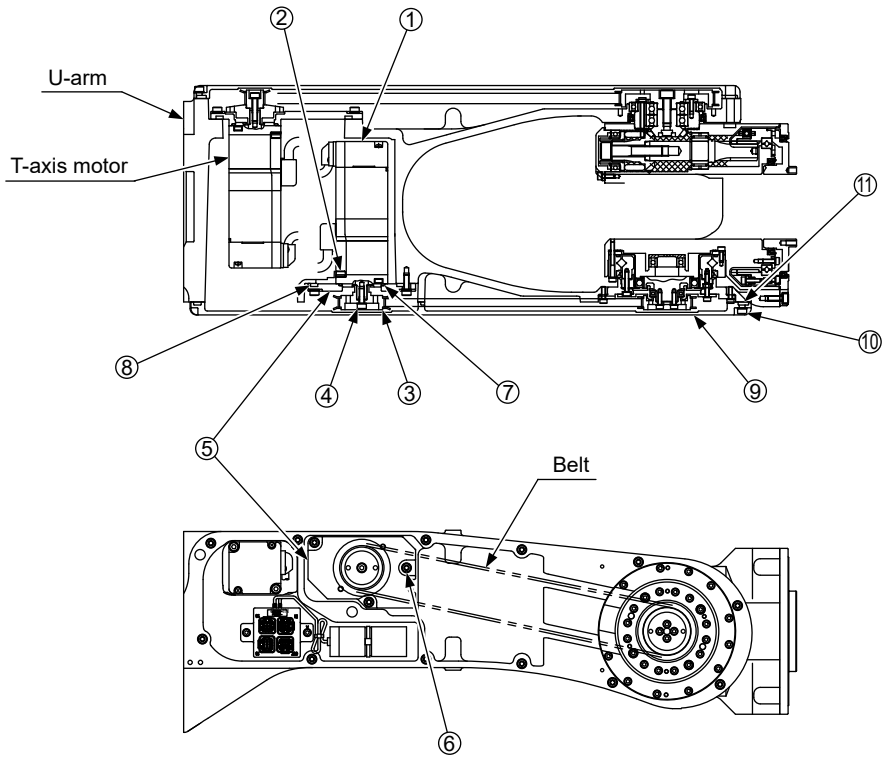
1. Connect the power cable to the B-axis motor①, and tighten the connector fixing bolt (pan-head screw M2) with the tightening torque of 0.15 N•m.
   (The connector fixing bolt is provided with the connector.)
2. Fit the gasket⑧ into the groove of the M-base⑤.
3. Fit the O-ring⑦ to the B-axis motor①.
4. Mount the B-axis motor① onto the M-base ⑤. Make sure not to damage the O-ring⑦ at this time. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts②, and tighten them with the tightening torque shown in *table 5-6 "B-Axis Motor Parts Checklist"* .
5. Mount the pulley③ to the B-axis motor①.
6. Attach the conical spring washer to the hexagon socket head cap screw④, apply LOCTITE 243 to the thread part of the screw, and then tighten it with the tightening torque shown in *table 5-6*.
7. Mount the M-base⑤ onto the U-arm, and then put the belt on the pulley③.
8. Tighten the GT-SA bolts⑥ with the tightening torque shown in *table 5-6*. (Adjust the tension of the belt by referring to *chapter 8 "Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts"* .)
9. Connect the power cable of the B-axis motor① to the internal wiring harness for the B- and T-axes. Connect the encoder cable of the B-axis motor① to the port "B" of the multi-port connector.

10. Enclose the connecting part of the power cable's connector in the protective tube, and then put it into the space between the T-axis motor and the U-arm.
11. Fit the gasket⑪ in the groove of the cover⑨.
12. Mount the cover⑨ by using the GT-SA bolts⑩, and tighten the bolts with the tightening torque shown in *table 5-6*.
13. Turn ON the YRC1000 power supply.

Table 5-6: B-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	B-axis motor	1	SGM7J-01APK-YR1*
②	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
③	Pulley HW1407201-A	1	
④	Hexagon socket head cap screw M4 (length: 12 mm) Conical spring washer 2L-4	1 each	Tightening torque 4.8 N•m
⑤	M-base HW1407616-1	1	
⑥	GT-SA bolt M4 (length: 12 mm)	3	Tightening torque 2.8 N•m
⑦	O-ring S30	1	
⑧	Gasket HW1407822-1	1	
⑨	Cover HW1200523-1	1	
⑩	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m
⑪	Gasket HW1306400-1	1	

Fig. 5-6: Disassembly & Reassembly of B-Axis Motor



5.6 Disassembly/Reassembly of T-Axis Motor

• Refer to *fig. 5-7 "Disassembly & Reassembly of T-Axis Motor"* .

■ Disassembly

1. Turn OFF the YRC1000 power supply.
2. Support the flange part by using a chain block, etc. to prevent it from rotating.
3. Unscrew the GT-SA bolts⑪, and then remove the cover⑩.
4. Remove the gasket⑫ from the cover⑩.
5. Unscrew the GT-SA bolts⑭, and then remove the cover⑬.
6. Remove the gasket⑮ from the cover⑬.
7. Disconnect the power cable of the T-axis motor① from the internal wiring harness for the B- and T-axes, and disconnect the encoder cable of the T-axis motor① from the port "T" of the multi-port connector.
8. Unscrew the GT-SA bolts⑦, and then remove the T-axis motor① unit (the unit including the T-axis motor①, the pulley③, the flywheel④, and the M-base ⑥) and the belt from the U-arm.
9. Unscrew the hexagon socket head cap screw⑤, and then remove the pulley③ and the flywheel④. (To secure the flywheel④, use the two slots on the surface of the flywheel④.)
10. Unscrew the GT-SA bolts②, and then remove the T-axis motor① and the O-ring⑧.
11. Remove the gasket⑨ from the M-base⑥.
12. Disconnect the connector of the T-axis motor① (fixing bolt: pan-head sems screw M2), and then remove the power cable.

■ Reassembly

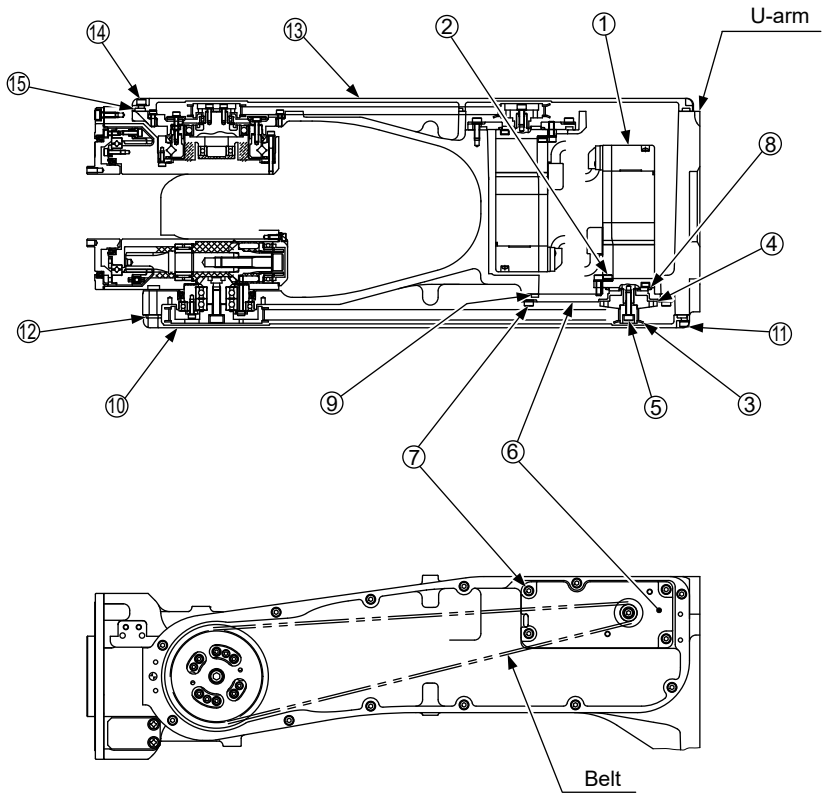
1. Connect the power cable to the T-axis motor①, and tighten the connector fixing bolt (pan-head screw M2) with the tightening torque of 0.15 N•m.
   (The connector fixing bolt is provided with the connector.)
2. Fit the gasket⑨ into the groove of the M-base⑥.
3. Fit the O-ring⑧ to the T-axis motor①.
4. Mount the T-axis motor① onto the M-base ⑥. Make sure not to damage the O-ring⑧ at this time. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts②, and tighten them with the tightening torque shown in *table 5-7 "T-Axis Motor Parts Checklist"* .
5. Mount the flywheel④ and the pulley③ to the T-axis motor①.
6. Attach the conical spring washer to the hexagon socket head cap screw⑤, apply LOCTITE 243 to the thread part of the screw, and then tighten it with the tightening torque shown in *table 5-7*.
7. Mount the M-base⑥ onto the U-arm, and then put the belt on the pulley③.
8. Tighten the GT-SA bolts⑦ with the tightening torque shown in *table 5-7*. (Adjust the tension of the belt by referring to *chapter 8 "Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts"* .)

9. Connect the power cable of the T-axis motor① to the internal wiring harness for the B- and T-axes. Connect the encoder cable of the T-axis motor① to the port “T” of the multi-port connector.
10. Enclose the connecting part of the power cable’s connector in the protective tube, and then put it into the space between the T-axis motor and the U-arm.
11. Fit the gasket⑫ in the groove of the cover⑩.
12. Mount the cover⑩ by using the GT-SA bolts⑪, and tighten the bolts with the tightening torque shown in *table 5-7 “T-Axis Motor Parts Checklist”*.
13. Turn ON the YRC1000 power supply.

Table 5-7: T-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	T-axis motor	1	SGM7J-01APK-YR1*
②	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
③	Pulley HW1404038-B	1	
④	Flywheel HW1407246-1	1	
⑤	Hexagon socket head cap screw M4 (length: 18 mm) Conical spring washer 2L-4	1 each	Tightening torque 4.8 N•m
⑥	M-base HW1407617-1	1	
⑦	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N•m
⑧	O-ring S30	1	
⑨	Gasket HW1407823-1	1	
⑩	Cover HW1200524-1	1	
⑪	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m
⑫	Gasket HW1306401-1	1	
⑬	Cover HW1200523-1	1	
⑭	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m
⑮	Gasket HW1306400-1	1	

Fig. 5-7: Disassembly & Reassembly of T-Axis Motor



6 Disassembly/Reassembly of Speed Reducer

NOTE

Refer to *chapter 2 "Notes for Maintenance"* , *chapter 3 "Home Position Return"* , *chapter 4 "Notes on Grease Replenishment/Exchange Procedures"* , *chapter 5 "Disassembly/Reassembly of the Motor"* , *chapter 7 "Disassembly/Reassembly of Wrist Unit"* , and *chapter 8 "Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts"* .

Remove old sealing from each part before assembling.

6.1 Disassembly/Reassembly of S-Axis Speed Reducer

- Refer to *fig. 6-1 "Disassembly & Reassembly of S-Axis Speed Reducer"* .

■ Disassembly

1. Make sure that the S-head and upper part of the manipulator will not fall, and then turn OFF the YRC1000 power supply.
2. Perform *"Disassembly"* in *chapter 5.1 "Disassembly and Reassembly of the S-Axis Motor"* and remove the S-axis motor.
3. Unscrew the GT-SA bolts ③ ⑦, and then remove the M-base ⑥ by using the removal bolt.
4. Unscrew the GT-SA bolts ②, and then remove the speed reducer ① by using the removal bolt.
5. Clean off the accumulated grease inside the base.

■ Reassembly

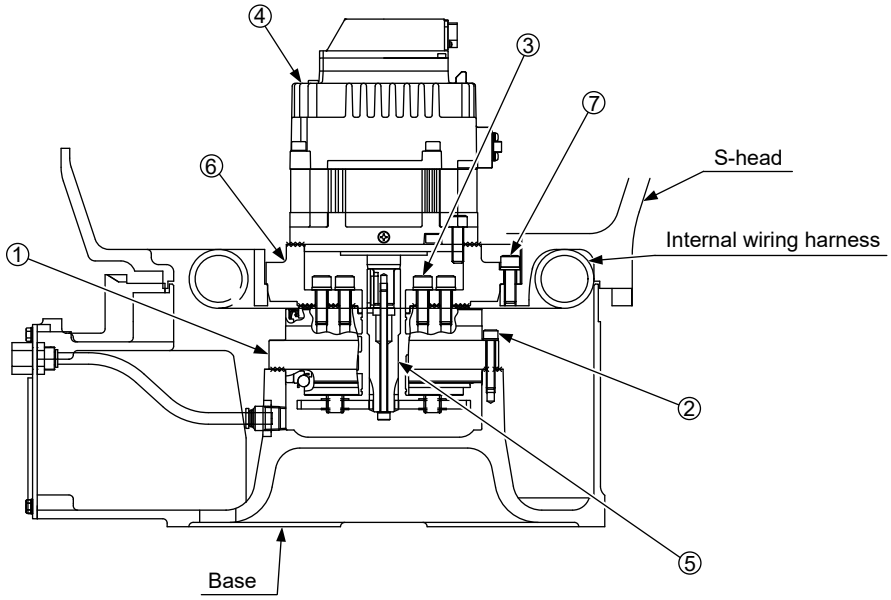
1. Apply ThreeBond 1206C on the surface of the base where the speed reducer ① will be mounted, and then mount the speed reducer ① onto the base.
2. Tighten the GT-SA bolts ② with the tightening torque shown in *table 6-1 "S-Axis Speed Reducer Parts Checklist"* .
3. Apply ThreeBond 1206C on the surface of the speed reducer ① where the M-base ⑥ will be mounted.
4. Mount the M-base ⑥ on the S-head, and then tighten the GT-SA bolts ③ ⑦ with the tightening torque shown in *table 6-1*.
5. Perform *"Reassembly"* in *chapter 5.1* and install the S-axis motor. (When replacing the speed reducer ①, replace the input gear ⑤, too.)
6. Perform *chapter 4.1.2 "Grease Exchange Procedure"* and replenish grease (Molywhite RE No. 00).
7. Turn ON the YRC1000 power supply.

6 Disassembly/Reassembly of Speed Reducer
6.1 Disassembly/Reassembly of S-Axis Speed Reducer

Table 6-1: S-Axis Speed Reducer Parts Checklist

No.	Item	Qty.	Note
①	Speed reducer HW0386621-B	1	
②	GT-SA bolt M6 (length: 35 mm)	16	Tightening torque 16.5 N•m
③	GT-SA bolt M8 (length: 25 mm)	18	Tightening torque 24.5 N•m
④	S-axis motor	1	SGM7G-05APK-YR1*
⑤	Input gear HW0312734-2	1	
⑥	M-base HW1303263-1	1	
⑦	GT-SA bolt M8 (length: 25 mm)	7	Tightening torque 24.5 N•m

Fig. 6-1: Disassembly & Reassembly of S-Axis Speed Reducer



6.2 Disassembly/Reassembly of L-Axis Speed Reducer

- Refer to *fig. 6-2 "Disassembly & Reassembly of L-Axis Speed Reducer"* .

■ Disassembly

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the arm, and then turn OFF the YRC1000 power supply.
2. Support the L-arm and upper part of the manipulator by using a chain block, etc. to prevent it from falling.
3. Perform *"Disassembly"* in *chapter 5.2 "Disassembly and Reassembly of the L-Axis Motor"* and remove the L-axis motor④.
4. Unscrew the GT-SA bolts③, and then remove the L-arm by using the removal bolt.
5. Unscrew the GT-SA bolts②, and then remove the speed reducer① by using the removal bolt.

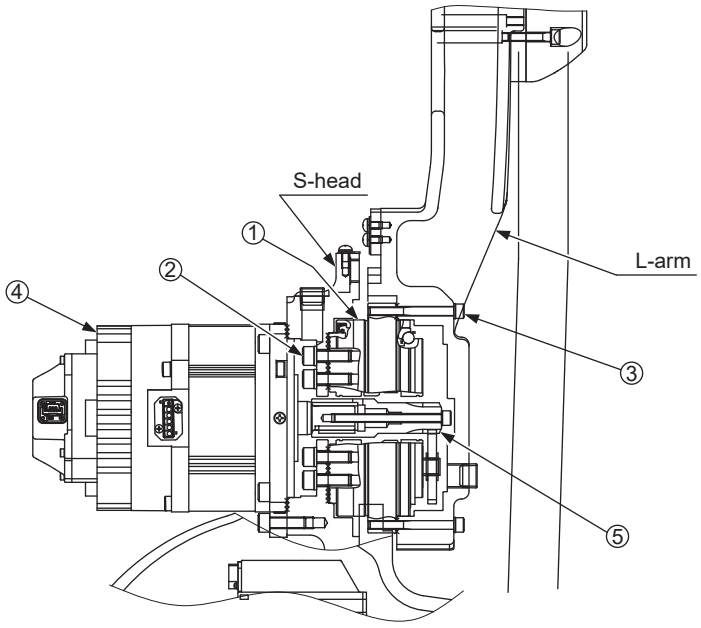
■ Reassembly

1. Apply ThreeBond 1206C on the surface of the speed reducer① which will face the S-head, and then mount the speed reducer① onto the S-head.
2. Attach the conical knurled spring washer to the hexagon socket head cap screw②. Tighten it with the tightening torque shown in *table 6-2 "L-Axis Speed Reducer Parts Checklist"* .
3. Apply ThreeBond 1206C on the surface of the speed reducer① where the L-arm will be mounted, and then mount the L-arm on the speed reducer①.
4. Tighten the GT-SA bolts③ with the tightening torque shown in *table 6-2*.
5. Perform *"Reassembly"* in *chapter 5.2* and install the L-axis motor④. (When replacing the speed reducer①, replace the input gear⑤, too.)
6. Perform *chapter 4.1.2 "Grease Exchange Procedure"* and replenish grease (Molywhite RE No. 00).
7. Turn ON the YRC1000 power supply.

Table 6-2: L-Axis Speed Reducer Parts Checklist

No.	Item	Qty.	Note
①	Speed reducer HW0387809-A	1	
②	Hexagon socket head cap screw M8 (length: 25 mm) Conical knurled spring washer 2H-8	18	Tightening torque 40.0 N•m
③	GT-SA bolt M6 (length: 60 mm)	16	Tightening torque 16.5 N•m
④	L-axis motor	1	SGM7G-09APK-YR1*
⑤	Input gear HW0312735-2	1	

Fig. 6-2: Disassembly & Reassembly of L-Axis Speed Reducer



6.3 Disassembly/Reassembly of U-Axis Speed Reducer

- Refer to *fig. 6-3 "Disassembly & Reassembly of U-Axis Speed Reducer"* .

■ Disassembly

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the U-arm, and then turn OFF the YRC1000 power supply.
2. Support the U-arm unit by using a chain block, etc. to prevent it from falling.
3. Perform *"Disassembly"* in *chapter 5.3 "Disassembly and Reassembly of the U-Axis Motor"* and remove the U-axis motor⑤.
4. Unscrew the GT-SA bolts③④, and then remove the U-arm unit by using the removal bolt.
5. Unscrew the GT-SA bolts②, and then remove the speed reducer① by using the removal bolt.

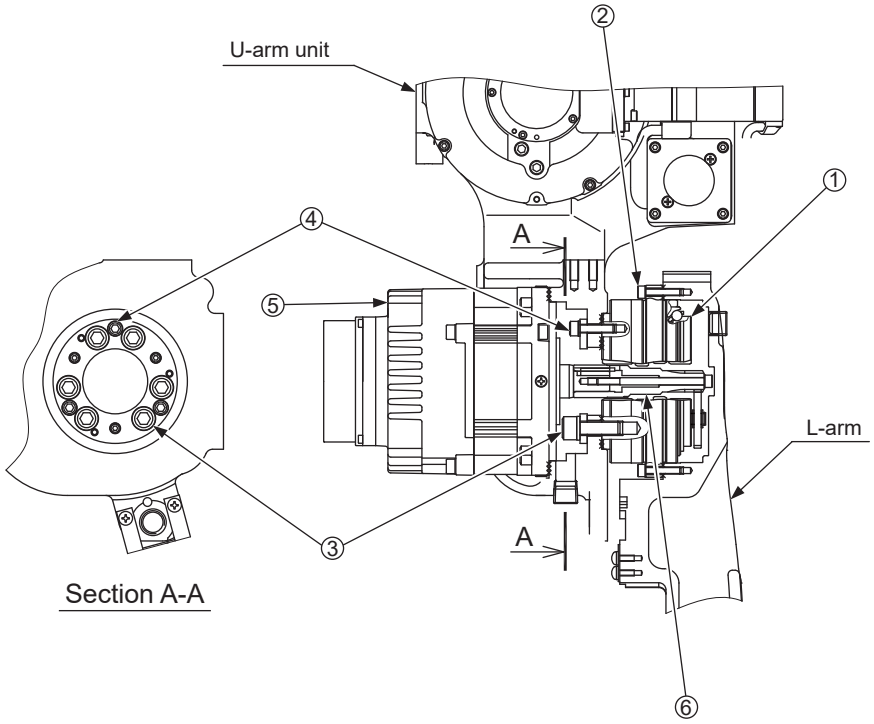
■ Reassembly

1. Apply ThreeBond 1206C on the surface of the L-arm where the speed reducer① will be mounted, and then mount the speed reducer① onto the L-arm.
2. Tighten the GT-SA bolts② with the tightening torque shown in *table 6-3 "U-Axis Speed Reducer Parts Checklist"* .
3. Apply ThreeBond 1206C on the surface of the speed reducer① where the U-arm unit will be mounted, and then mount the U-arm unit on the speed reducer①.
4. Tighten the GT-SA bolts③④ with the tightening torque shown in *table 6-3*.
5. Perform *"Reassembly"* in *chapter 5.3* and install the U-axis motor⑤. (When replacing the speed reducer①, replace the input gear⑥, too.)
6. Perform *chapter 4.1.2 "Grease Exchange Procedure"* and replenish grease (Molywhite RE No. 00).
7. Turn ON the YRC1000 power supply.

Table 6-3: U-Axis Speed Reducer Parts Checklist

No.	Item	Qty.	Note
①	Speed reducer HW1380153-A	1	
②	GT-SA bolt M5 (length: 25 mm)	16	Tightening torque 10.0 N•m
③	GT-SA bolt M10 (length: 30 mm)	6	Tightening torque 82.0 N•m
④	GT-SA bolt M6 (length:25 mm)	3	Tightening torque 16.5 N•m
⑤	U-axis motor	1	SGM7G-05APK-YR1*
⑥	Input gear HW1303245-1	1	

Fig. 6-3: Disassembly & Reassembly of U-Axis Speed Reducer



6.4 Disassembly/Reassembly of R-Axis Speed Reducer

- Refer to *fig. 6-4 "Disassembly & Reassembly of R-Axis Speed Reducer"* .

■ Disassembly

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the arm, and then turn OFF the YRC1000 power supply.
2. Support the wrist unit by using a chain block, etc. to prevent it from falling.
3. Perform the steps 2 to 4 of *"Disassembly"* in *chapter 5.4 "Disassembly and Reassembly of the R-Axis Motor"* and remove the R-axis motor cable and the R-axis motor cover.
4. Perform *"Disassembly"* in *chapter 9.2 "Disassembly/Reassembly of Internal Wiring Harness for B- and T-Axes"* and remove the internal wiring harness for the B- and T-axes.
5. Perform *"Disassembly"* in *chapter 7 "Disassembly/Reassembly of Wrist Unit"* and remove the wrist unit.
6. Unscrew the GT-SA bolts⑫, and then remove the shaft⑪ by using the removal bolt.
7. Unscrew the GT-SA bolts⑩, and then remove the housing⑨ and the R-axis motor unit by using the removal bolt.
8. Unscrew the GT-SA bolts⑧, and then remove the gear⑦. (Secure the output shaft to prevent it from rotating.)
9. By using a vernier caliper, etc., measure the size of the part B of the speed reducer① and the shim, and take a note of the size. (Approx. 14.1 to 14.2 mm)
10. Unscrew the GT-SA bolts②, and then remove the unit of the speed reducer① and the shafts④ ⑥ at one time by using removal bolts. For the locations of the tapped holes on the speed reducer①, refer to *fig. 6-4*.
11. Unscrew the GT-SA bolts⑤, and then remove the shaft⑥ by using the removal bolt.
12. Unscrew the GT-SA bolts③, and then remove the shaft④ by using the removal bolt.
13. To replace the oil seal⑬, remove the oil seal⑬ from the shaft④.
14. To replace the oil seal⑭, remove the oil seal⑭ from the casing.

■ Reassembly

1. If the oil seal⑭ was removed, mount the oil seal⑭ to the casing.
2. If the oil seal⑬ was removed, mount the oil seal⑬ to the shaft④.
3. Apply the MP-1 grease on the lip part of the oil seal⑬.
4. Apply ThreeBond 1206C on the surface of the speed reducer① where the shaft④ will be mounted, and then mount the shaft④.
5. Tighten the GT-SA bolts③ with the tightening torque shown in *table 6-4 "R-Axis Speed Reducer Parts Checklist"* .

6. Apply ThreeBond 1206C on the surface of the shaft④ where the shaft⑥ will be mounted, and then mount the shaft⑥.
7. Tighten the GT-SA bolts⑤ with the tightening torque shown in *table 6-4*.
8. Apply the MP-1 grease on the lip part of the oil seal⑭.
9. Apply ThreeBond 1206C on the surface of the casing where the speed reducer① will be mounted, and then mount the unit of the speed reducer① and the shaft④⑥ onto the casing.
   At this time, make sure to mount the unit in the correct position by referring to *fig. 6-4*.
10. Tighten the GT-SA bolts② with the tightening torque shown in *table 6-4*.
11. By using a vernier caliper, etc., measure the size of the part B of the speed reducer①.
    (Approx. 13.8 to 14.0 mm)
12. To make the size of the part B equal to the size measured before the disassembly, refer to *table 6-5 "Shim for R-Axis Gear"* and select a shim with the thickness equal to the difference between the sizes measured before and after the disassembly.
    If no shim matches the difference exactly, select a shim thinner than the actual difference so that the size of the part B does not exceed the size measured before the disassembly.
13. Mount the gear⑦, and tighten the GT-SA bolts⑧ with the tightening torque shown in *table 6-4*.
14. Apply ThreeBond 1206C on the surface of the housing⑨ which will face the speed reducer①, and then mount the unit of the housing⑨ and the R-axis motor.
15. Tighten the GT-SA bolts⑩ with the tightening torque shown in *table 6-4*.
16. Apply ThreeBond 1206C on the surface of the shaft⑪ which will face the housing⑨, and then mount the shaft⑪. Make sure not to damage the oil seal⑬ at this time.
17. Apply ThreeBond 1206C on the thread parts of the GT-SA bolts⑫, and tighten them with the tightening torque shown in *table 6-4*.
18. Perform *"Reassembly"* in *chapter 7 "Disassembly/Reassembly of Wrist Unit"* and mount the wrist unit.
19. Perform *"Reassembly"* in *chapter 9.2 "Disassembly/Reassembly of Internal Wiring Harness for B- and T-Axes"* and mount the internal wiring harness for the B- and T-axes.
20. Perform the steps 8 to 13 of *"Reassembly"* in *chapter 5.4 "Disassembly and Reassembly of the R-Axis Motor"* and mount the R-axis motor cable and the R-axis motor cover.
21. Perform *chapter 4.2.4 "Grease Replenishment Procedures for R-Axis Gear"* and replenish Harmonic Grease SK-1A in the R-axis gear.
    (Since grease is already replenished in a new R-axis speed reducer, grease must be replenished only in the R-axis gear.)
22. Turn ON the YRC1000 power supply.

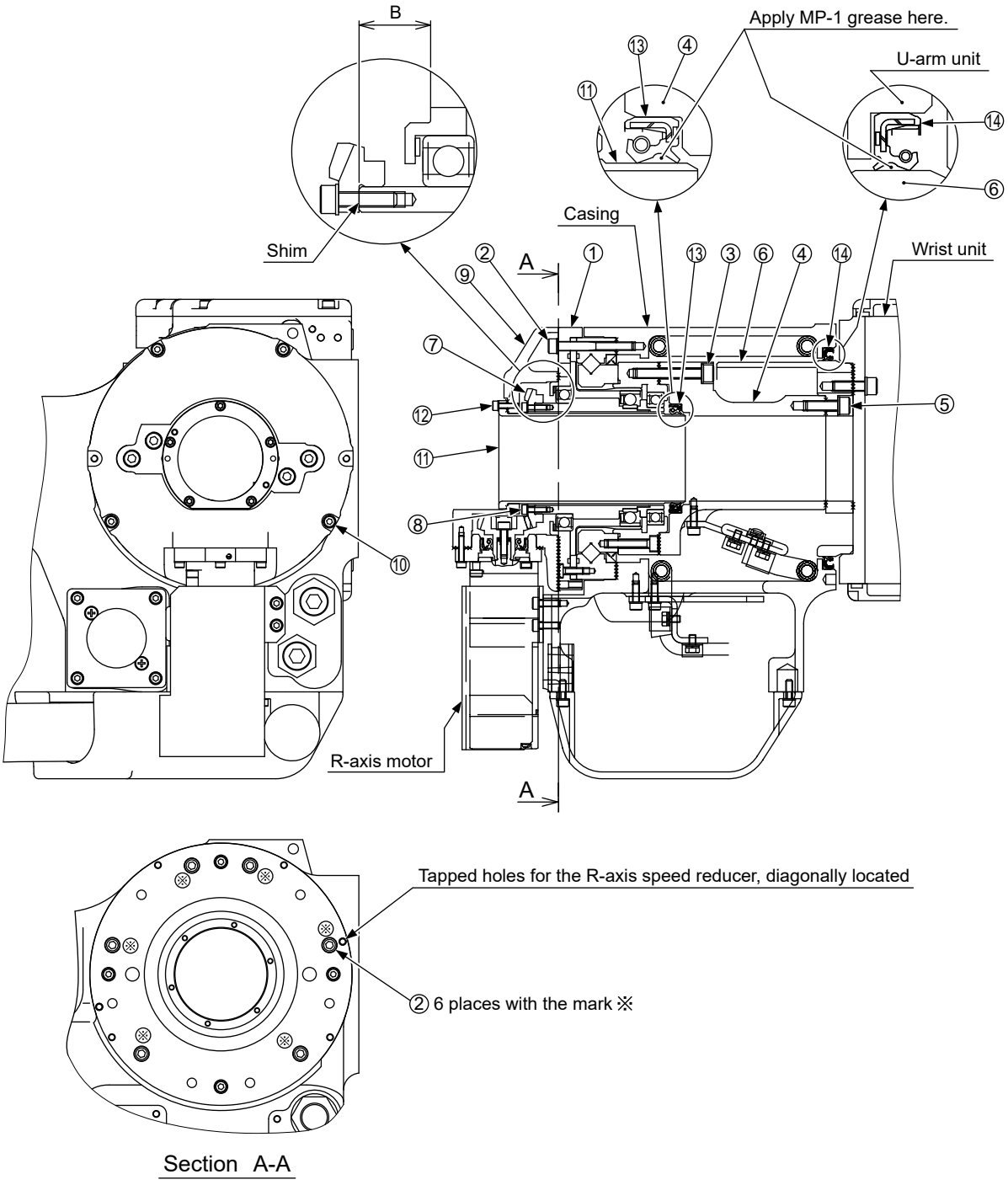
Table 6-4: R-Axis Speed Reducer Parts Checklist

No.	Item	Qty.	Note
①	Speed reducer HW1382521-A	1	
②	GT-SA bolt M5 (length: 45 mm)	6	Tightening torque 6.0 N▪m
③	GT-SA bolt M6 (length: 40 mm)	7	Tightening torque 10.0 N▪m
④	Shaft HW1305906-1	1	
⑤	GT-SA bolt M6 (length: 20 mm)	7	Tightening torque 10.0 N▪m
⑥	Shaft HW1306399-1	1	
⑦	Gear HW1306390-1	1	
⑧	GT-SA bolt M3 (length: 12 mm)	6	Tightening torque 1.4 N▪m
⑨	Housing HW1303905-1	1	
⑩	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N▪m
⑪	Shaft HW1303257-1	1	
⑫	GT-SA bolt M3 (length: 12 mm)	5	Tightening torque 1.4 N▪m
⑬	Oil seal TC52647	1	
⑭	Oil seal TC1151306	1	

Table 6-5: Shim for R-Axis Gear

Thickness of shim (mm)	Type
0.05	HW1404157-1
0.1	HW1404157-2
0.15	HW1404157-8
0.2	HW1404157-9
0.3	HW1404157-3

Fig. 6-4: Disassembly & Reassembly of R-Axis Speed Reducer



NOTE

After replacing the R-axis motor, check if the R-axis makes no abnormal noise during operation.

If an abnormal noise is heard, replace the shim in the R-axis motor with a thinner shim.

If the operation is continued without correcting the abnormal noise, mechanical failure may be resulted, such as a damage to the R-axis gear.

6.5 Disassembly/Reassembly of B-Axis Speed Reducer

- Refer to *fig. 6-5 "Disassembly & Reassembly of B-Axis Speed Reducer"* .

■ Disassembly

1. Turn OFF the YRC1000 power supply.
2. Support the wrist by using a chain block, etc. to prevent it from rotating.
3. Unscrew the GT-SA bolts⑯, and then remove the cover⑮.
4. Remove the gasket⑱ from the cover⑮.
5. Loosen the GT-SA bolts⑭, and then remove the timing belt⑰.
6. Unscrew the GT-SA bolts⑧, and then remove the housing⑥ unit (the pulley⑨, the housing⑥, the speed reducer② (wave generator), and the bearings⑪⑬).
7. Unscrew the GT-SA bolts⑩, and then remove the pulley⑨ from the housing⑥ unit.
   (To secure the pulley⑨, use the two slots on the surface of the pulley⑨.)
8. Remove the speed reducer② (wave generator) and the bearing⑬ from the housing⑥ unit.
9. Remove the retaining ring⑫ and the bearing⑪ from the housing⑥ unit.
10. Remove the bearing⑬ from the speed reducer② (wave generator).
11. Unscrew the GT-SA bolts⑤⑦, and then remove the shaft④ by using the removal bolt.
12. Unscrew the GT-SA bolts③, and then remove the speed reducer① by using the removal bolt.
    (Insert the removal bolt into the tapped hole inside the wrist unit.)

■ Reassembly

1. Press fit the bearing⑪ into the housing⑥, and then attach the retaining ring⑫.
   (When replacing the speed reducer, replace the bearing⑪, too.)
2. Press fit the bearing⑬ into the speed reducer② (wave generator).
   (When replacing the speed reducer, replace the bearing⑬, too.)
3. Apply Harmonic Grease SK-1A on the bearing part of the speed reducer② (wave generator).
   (Refer to *fig. 6-6 "Example of B-Axis Grease Application (Wave Generator)"* .)
4. Press fit the speed reducer② (wave generator) unit assembled in the step 2 into the housing⑥ unit assembled in the step 1.
5. Mount the pulley⑨ on the housing⑥ unit assembled in the step 4, and then tighten the GT-SA bolts⑩ with the tightening torque shown in *table 6-6 "B-Axis Speed Reducer Parts Checklist"* .
6. Apply ThreeBond 1206C on the surface of the speed reducer① mating to the wrist, and then mount the speed reducer① on the wrist.
7. Tighten the GT-SA bolts③ with the tightening torque shown in *table 6-6*.

8. Apply Harmonic Grease SK-1A on the sliding part inside the flex spline of the speed reducer①.
(Refer to *fig. 6-7 "Example of B-Axis Grease Application (Flex Spline)"* .)
9. Apply ThreeBond 1206C on the surface of the speed reducer① mating to the shaft④.
10. Apply ThreeBond 1206C on the surface of the shaft④ mating to the U-arm, and then mount the shaft④ on the U-arm.
11. Tighten the GT-SA bolts⑦ with the tightening torque shown in *table 6-6*.
12. Apply ThreeBond 1206C on the thread parts of the GT-SA bolts⑤, and then tighten them with the tightening torque shown in *table 6-6*.
13. Apply Harmonic Grease SK-1A on the bearing⑬ part of the housing⑥ unit assembled in the step 5.
(Refer to *fig. 6-8 "Example of B-Axis Grease Application (Bearing)"* .)
14. Mount the housing⑥ unit on the U-arm, and then tighten the GT-SA bolts⑧ with the tightening torque shown in *table 6-6*.
15. Put the timing belt⑰ on the pulley⑨.
16. Tighten the GT-SA bolts⑭ with the tightening torque shown in *table 6-6*. (Adjust the tension of the belt by referring to *chapter 8 "Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts"* .)
17. Press fit the gasket⑱ into the groove of the cover⑮.
18. Mount the cover⑮ by using the GT-SA bolts⑯, and then tighten the bolts with the tightening torque shown in *table 6-6*.
19. Turn ON the YRC1000 power supply.

Table 6-6: B-Axis Speed Reducer Parts Checklist

No.	Item	Qty.	Note
①	Speed reducer HW1382522-A	1	Unit of flex spline and circular spline
②			Wave generator
③	GT-SA bolt M3 (length: 28 mm)	12	Tightening torque 1.4 N•m
④	Shaft HW1305901-1	1	
⑤	GT-SA bolt M3 (length: 10 mm)	11	Tightening torque 1.4 N•m
⑥	Housing HW1404047-1	1	
⑦	GT-SA bolt M3 (length: 16 mm)	4	Tightening torque 1.4 N•m
⑧	GT-SA bolt M3 (length: 20 mm)	12	Tightening torque 1.4 N•m
⑨	Pulley HW1404037-A	1	
⑩	GT-SA bolt M3 (length: 10 mm)	4	Tightening torque 1.4 N•m
⑪	Bearing 6803LLU	1	
⑫	Retaining ring IRTW26	1	
⑬	Bearing 6902	1	
⑭	GT-SA bolt M4 (length: 12 mm)	3	Tightening torque 2.8 N•m
⑮	Cover HW1200523-1	1	
⑯	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m
⑰	Timing belt 60S3M603	1	
⑱	Gasket HW1306400-1	1	

Fig. 6-5: Disassembly & Reassembly of B-Axis Speed Reducer

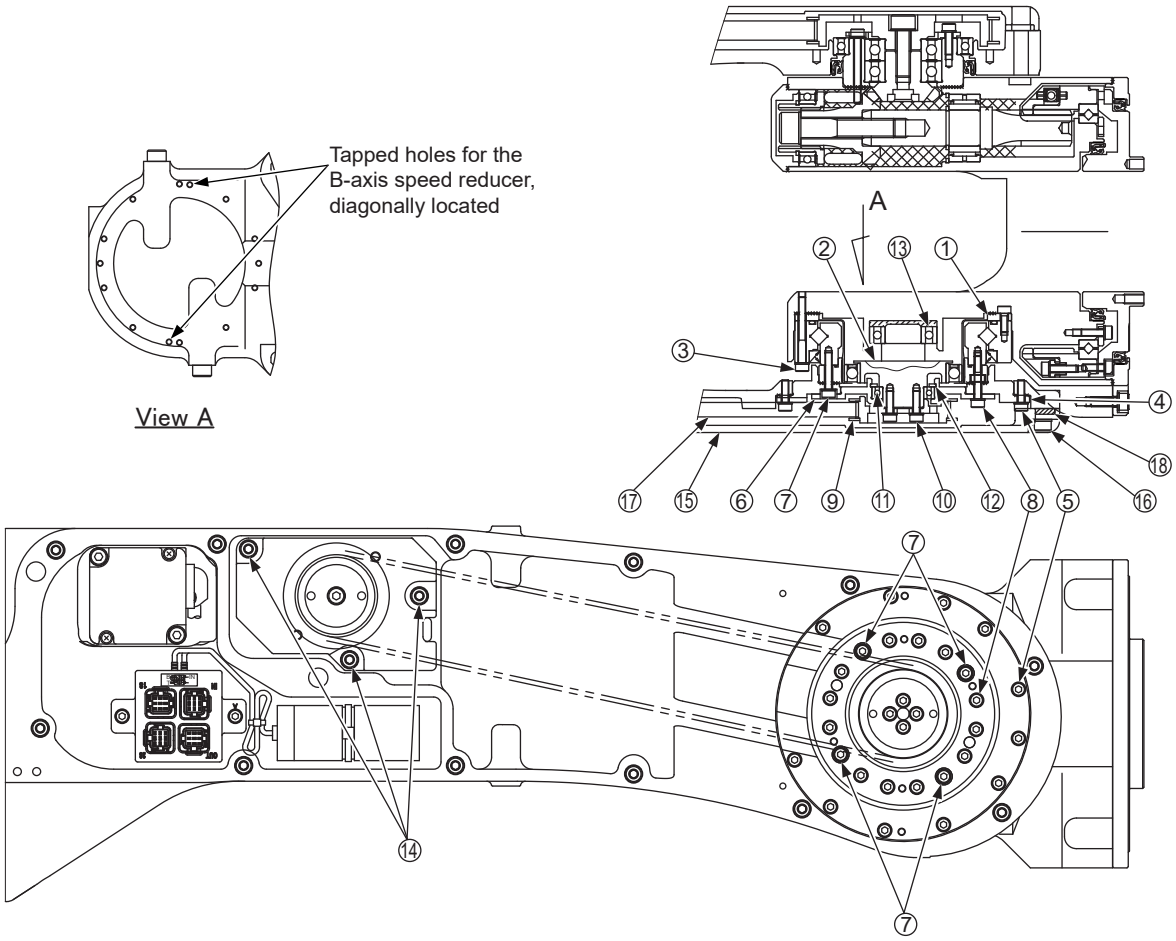


Fig. 6-6: Example of B-Axis Grease Application (Wave Generator)

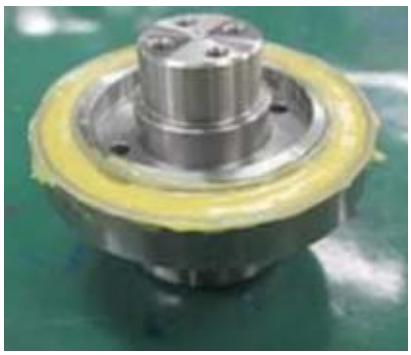
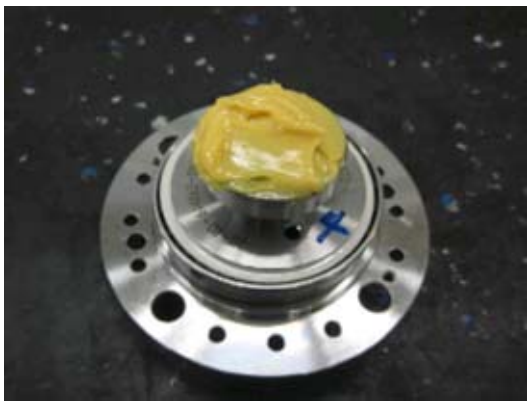


Fig. 6-7: Example of B-Axis Grease Application (Flex Spline)

Fig. 6-8: Example of B-Axis Grease Application (Bearing)



7 Disassembly/Reassembly of Wrist Unit

• Refer to *fig. 7-1 "Disassembly & Reassembly of Wrist Unit"* .

NOTE

Refer to *chapter 2 "Notes for Maintenance"* and *chapter 3 "Home Position Return"* .

Remove old sealing from each part before assembling.

■ Disassembly

1. Turn OFF the YRC1000 power supply.
2. Perform *"Disassembly"* in *chapter 9.2 "Disassembly/Reassembly of Internal Wiring Harness for B- and T-Axes"* and remove the internal wiring harness for the B- and T-axes.
3. Unscrew the GT-SA bolts④, and then remove the multi-port connector③. At the same time, cut off the cable tie⑥ and remove the battery pack⑤.
4. Unscrew the pan-head sems screw⑧, and remove the clamp⑦.
5. Unscrew the GT-SA bolts②, and then remove the wrist unit①. (Note that one of the six GT-SA bolts② is located inside the U-arm.)

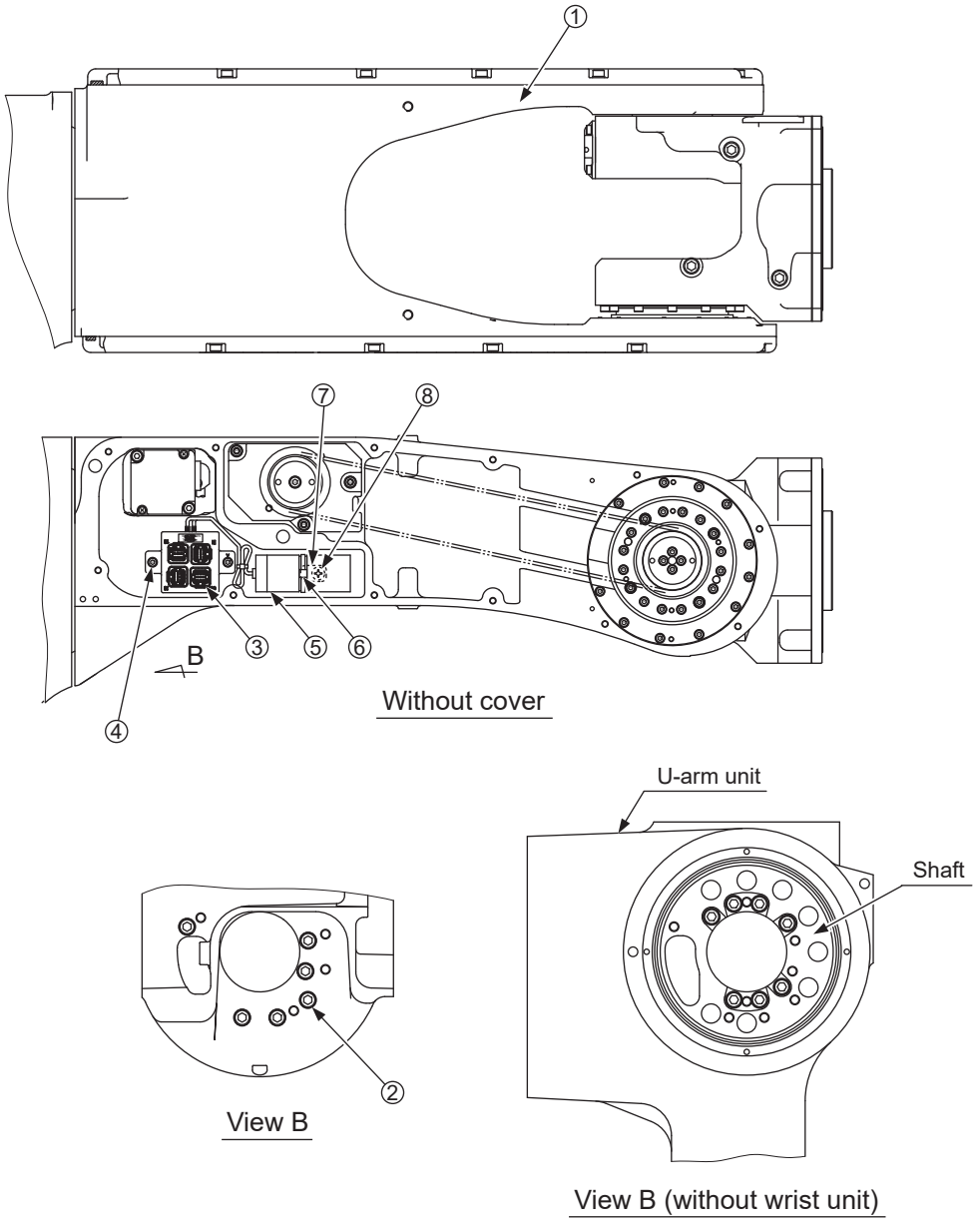
■ Reassembly

1. Apply ThreeBond 1206C on the surface of the shaft in the U-arm unit where the wrist unit will be mounted.
2. Mount the wrist unit① on the shaft, and then tighten the GT-SA bolts② with the tightening torque shown in *table 7-1 "Wrist Unit Parts Checklist"* .
3. Mount the clamp⑦, and then tighten the pan-head sems screw⑧ with the tightening torque shown in *table 7-1*.
4. Mount the multi-port connector③, and then tighten the GT-SA bolts④ with the tightening torque shown in *table 7-1*. At the same time, secure the battery pack⑤ by using the cable tie⑥.
5. Turn ON the YRC1000 power supply.

Table 7-1: Wrist Unit Parts Checklist

No.	Item	Qty.	Note
①	Wrist unit HW1172936-A	1	
②	GT-SA bolt M6 (length: 20 mm)	6	Tightening torque 10.0 N▪m
③	Multi-port connector HW1384619-A	1	
④	GT-SA bolt M3 (length: 10 mm) Washer M3 *stainless*	2 each	Tightening torque 0.2 N▪m
⑤	Battery pack HW1483880-A	1	
⑥	Cable tie T18L	1	
⑦	Clamp TA1-S8	1	
⑧	Pan-head sems screw M4 (length: 6 mm) *stainless*	1	Tightening torque 0.75 N▪m

Fig. 7-1: Disassembly & Reassembly of Wrist Unit



8 Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts

8.1 Disassembly/Reassembly of B- and T-axis Timing Belts

- Refer to *table 8-1 "B- and T-Axis Timing Belts Parts Checklist"* and *fig. 8-1 "Disassembly & Reassembly of B- and T-Axis Timing Belts"*.

■ Disassembly

1. Unscrew the GT-SA bolts⑨ ⑫, and then remove the covers⑦ ⑩.
2. Remove the gaskets⑧ ⑪ from the covers⑦ ⑩.
3. Loosen the GT-SA bolts⑥, and then remove the B-axis timing belt①.
4. Loosen the GT-SA bolts④, and then remove the T-axis timing belt②.

■ Reassembly

1. Mount the T-axis timing belt②, and then tighten the GT-SA bolts④ with the tightening torque shown in *table 8-1* to secure the M-base③.
2. Mount the B-axis timing belt①, and then tighten the GT-SA bolts⑥ with the tightening torque shown in *table 8-1* to secure the M-base⑤.
3. Attach the gaskets⑧ ⑪ to the covers⑦ ⑩.
4. Mount the covers⑦ ⑩ on the U-arm, and then tighten the GT-SA bolts⑨ ⑫ with the tightening torque shown in *table 8-1*.

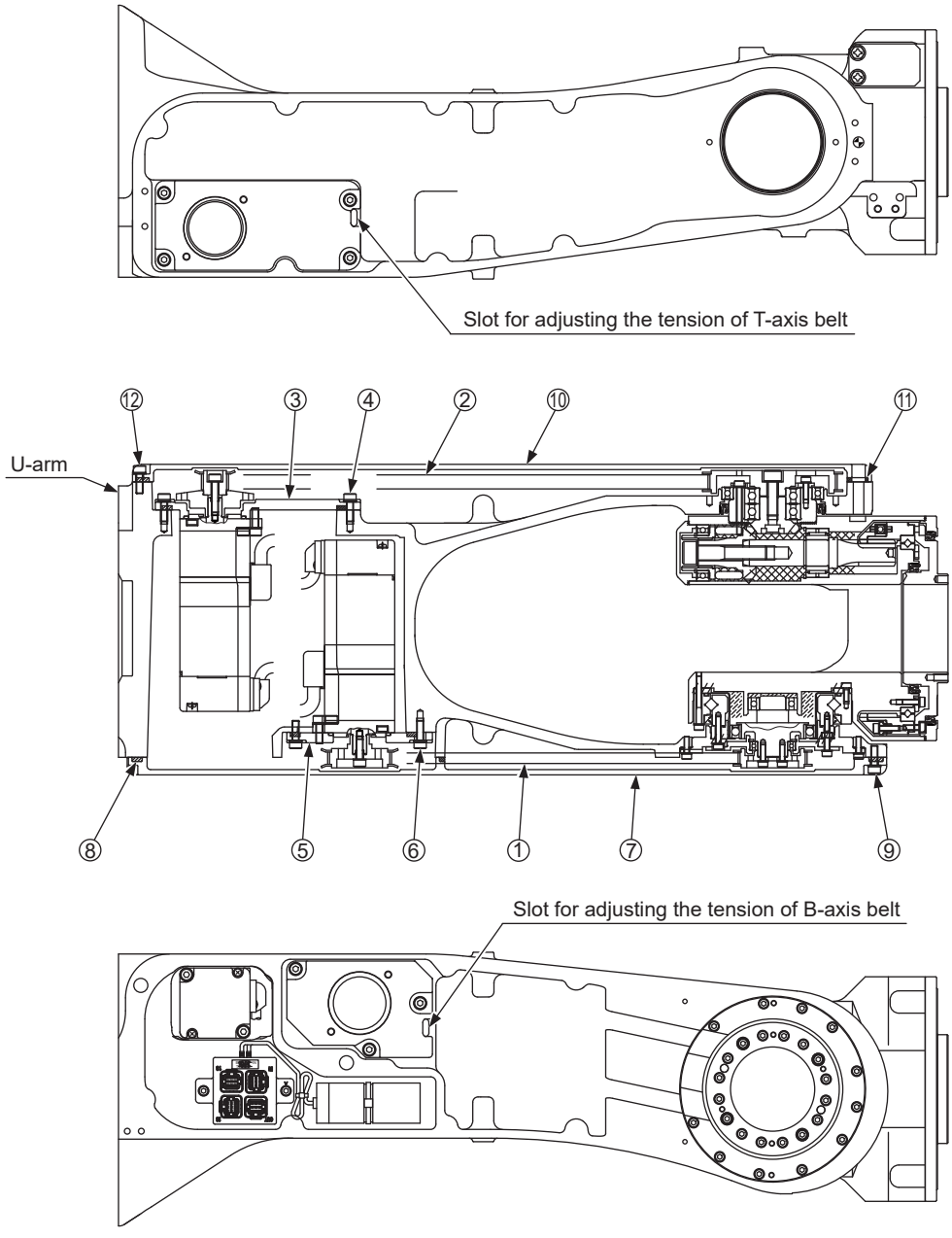
Table 8-1: B- and T-Axis Timing Belts Parts Checklist

No.	Item	Qty.	Note
①	B-axis timing belt 60S3M603	1	
②	T-axis timing belt 80S3M789	1	
③	M-base HW1407617-1	1	
④	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N•m
⑤	M-base HW1407616-1	1	
⑥	GT-SA bolt M4 (length: 12 mm)	3	Tightening torque 2.8 N•m
⑦	Cover HW1200523-1	1	
⑧	Gasket HW1306400-1	1	
⑨	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m
⑩	Cover HW1200524-1	1	
⑪	Gasket HW1306401-1	1	
⑫	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m

8 Disassembly/Reassembly and Adjustment of B- and T-Axis Timing Belts

8.1 Disassembly/Reassembly of B- and T-axis Timing Belts

Fig. 8-1: Disassembly & Reassembly of B- and T-Axis Timing Belts



8.2 Adjustment of B- and T-Axis Timing Belts

Refer to *table 8-1 "B- and T-Axis Timing Belts Parts Checklist"* and *fig. 8-1 "Disassembly & Reassembly of B- and T-Axis Timing Belts"* .

■ **B-axis**

1. Loosen the GT-SA bolts⑥.
2. Insert a flathead screwdriver, etc. into the slot for adjusting the belt tension of the U-arm, and then use leverage and pull the M-base⑤
3. Use a tension meter and adjust the initial tension of the timing belt to the value shown in *table 8-2 "Initial Tension of Timing Belt"* .
4. Tighten the GT-SA bolts⑥ with the tightening torque shown in *table 8-1*.

■ **T-axis**

1. Loosen the GT-SA bolts④.
2. Insert a flathead screwdriver, etc. into the slot for adjusting the belt tension of the U-arm, and then use leverage and pull the M-base③
3. Use a tension meter and adjust the initial tension of the timing belt to the value shown in *table 8-2*.
4. Tighten the GT-SA bolts④ with the tightening torque shown in *table 8-1*.

Table 8-2: Initial Tension of Timing Belt

	Initial tension	**Width**	**Span**	**Mass/(Width, Length)**
B-axis	19.6 to 26.5 N (for a new belt)	6 mm	240.5 mm	19 g/ (W=10 mm, L=1 m)
	13.7 to 19.6 N (for a used belt)			
T-axis	27.0 to 36.3 N (for a new belt)	8 mm	320.4 mm	
	18.9 to 27.0 N (for a used belt)			

9 Cable Wiring

9.1 Disassembly/Reassembly of Internal Wiring Harness

NOTE Refer to *chapter 2 "Notes for Maintenance"* and *chapter 3 "Home Position Return"*.

■ Disassembly

1. Casing

- Refer to *table 9-1 "Internal Wiring Harness Parts Checklist (Casing)"* and *fig. 9-1 "Disassembly & Reassembly of Internal Wiring Harness (Casing)"*.

1. Turn OFF the YRC1000 power supply.
2. Unscrew the hexagon socket head cap screws②, and remove the cover③.
3. Unscrew the GT-SA bolts④, and remove the cover⑤.
4. Cut off the cable ties⑥.
5. Disconnect the "IN" connector of the internal wiring harness① from the "IN" port of the multi-port connector in the casing.
   At this time, be sure not to disconnect the connectors on the "U" port and the "R" port.
6. Unscrew the GT-SA bolts⑦, and remove the support⑧.
7. Cut off the cable tie⑩, and take the connector out of the protective tube⑨. Disconnect the "B-PW" connector and the "T-PW" connector of the B- and T-axis internal wiring harness connected to the internal wiring harness①.
8. Cut off the cable tie⑩, and take the connector out of the protective tube⑨. Disconnect the "R" connector of the R-axis power cable connected to the internal wiring harness①.
9. Unscrew the GT-SA bolts⑪, and remove the cover⑫.
10. Disconnect the connector of the U-axis motor (fixing bolt: pan-head screw M3), and remove the U-axis power cable.
11. Cut off the cable tie⑭, and take the U-axis power cable out of the gasket⑬.
12. Pass the U-axis power cable through the casing, and pull the cable out to the cover⑤ mounting surface side of the casing.
13. Unscrew the GT-SA bolt⑮ securing the ground terminal.
14. Disconnect the air hose connected to the union.
15. Unscrew the GT-SA bolts⑯ and the pan-head sems screws⑰, and remove the N-base⑱ and the gasket⑲.
16. Pull the connector for the internal user I/O wiring harness out to the cover⑤ mounting surface side of the casing.

17. Cut off the cable tie⑳.

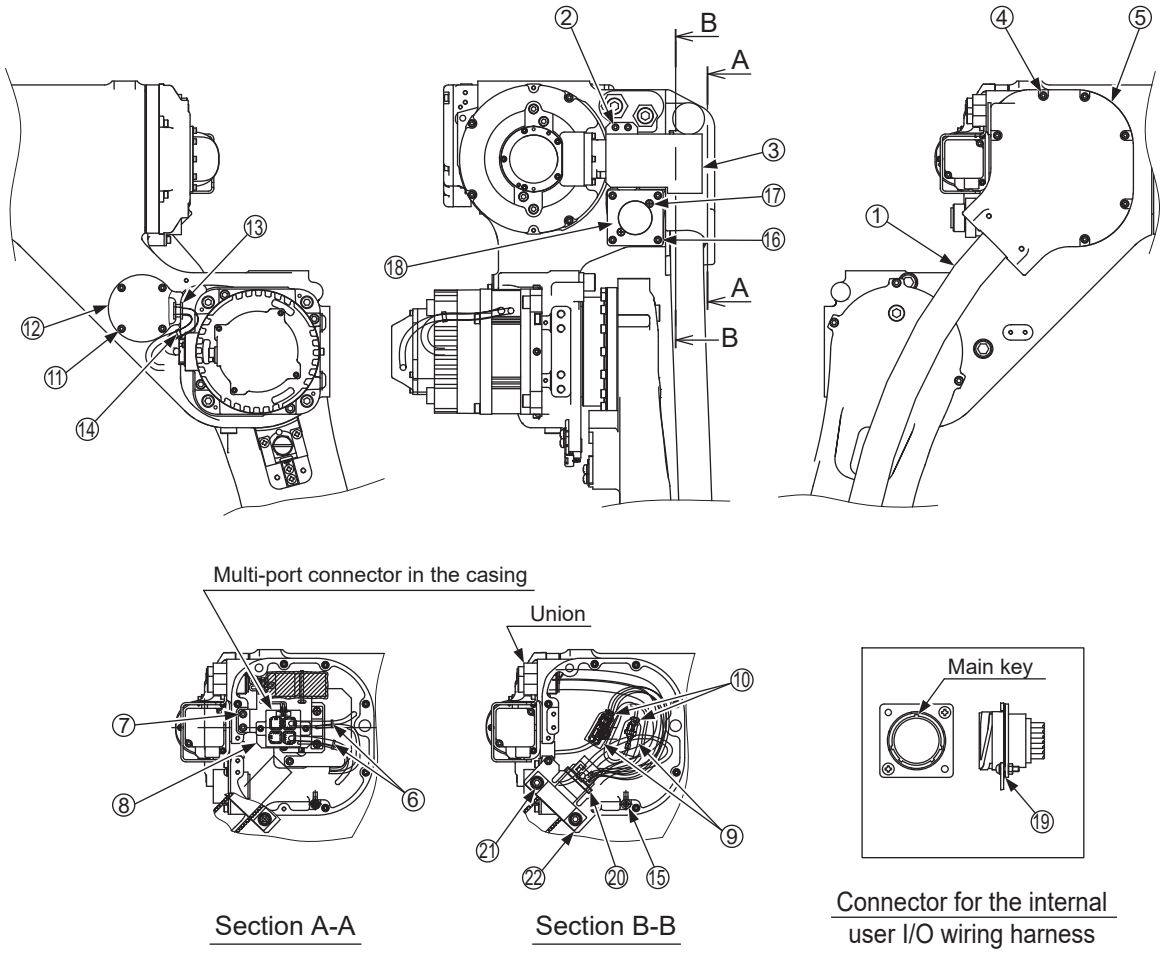
18. Unscrew the GT-SA bolts㉑, and remove the clamp㉒.

Table 9-1: Internal Wiring Harness Parts Checklist (Casing)

No.	Item	Qty.	Note
①	Internal wiring harness HW1172795-A (B)	1	HW1172795-A: for -A00
			HW1172795-B: for -A01
②	Hexagon socket head cap screw M4 (length: 12 mm) *trivalent chromate*	2	Tightening torque 2.8 N•m
③	Cover HW1407212-1	1	
④	GT-SA bolt M4 (length: 12 mm)	6	Tightening torque 2.8 N•m
⑤	Cover HW1306162-1	1	
⑥	Cable tie T18L	2	
⑦	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
⑧	Support HW1407856-1	1	
⑨	Tube HW1407859-1	2	
⑩	Cable tie T18L	2	
⑪	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N•m
⑫	Cover HW1404057-1	1	
⑬	Gasket HW1404517-1	1	
⑭	Cable tie T18R	1	
⑮	GT-SA bolt M4 (length: 12 mm)	1	Tightening torque 2.8 N•m
⑯	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N•m
⑰	Pan-head sems screw M3 (length: 16 mm) *stainless* Nut M3 *stainless*	2 each	Tightening torque 0.32 N•m
⑱	N base HW0404554-2	1	
⑲	Gasket HW9481087-A	1	
⑳	Cable tie T120R	1	
㉑	GT-SA bolt M6 (length: 12 mm) Washer M6 *stainless*	2 each	Tightening torque 2.8 N•m
㉒	Clamp BGH-29	1	

9 Cable Wiring
9.1 Disassembly/Reassembly of Internal Wiring Harness

Fig. 9-1: Disassembly & Reassembly of Internal Wiring Harness (Casing)



2. L-arm

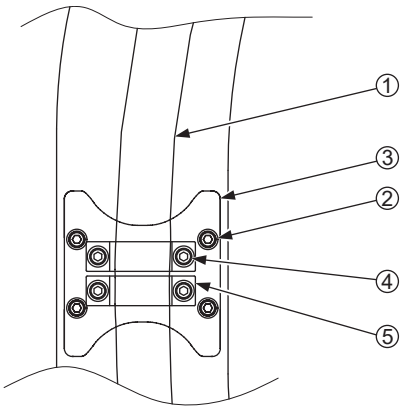
- Refer to *table 9-2 "Internal Wiring Harness Parts Checklist (L-Arm)"* and *fig. 9-2 "Disassembly & Reassembly of Internal Wiring Harness (L-Arm)"* .

1. Unscrew the GT-SA bolts②, and remove the cover③.
2. Unscrew the GT-SA bolts④, and remove the clamps⑤.

Table 9-2: Internal Wiring Harness Parts Checklist (L-Arm)

No.	Item	Qty.	Note
①	Internal wiring harness HW1172795-A (B)	1	HW1172795-A: for -A00
			HW1172795-B: for -A01
②	GT-SA bolt M6 (length: 30 mm)	4	Tightening torque 10 N▪m
③	Cover HW1306163-1	1	
④	GT-SA bolt M6 (length: 15 mm) Washer M6 *stainless*	4 each	Tightening torque 2.8 N▪m
⑤	Clamp BGH-29	2	

Fig. 9-2: Disassembly & Reassembly of Internal Wiring Harness (L-Arm)



3. S-head

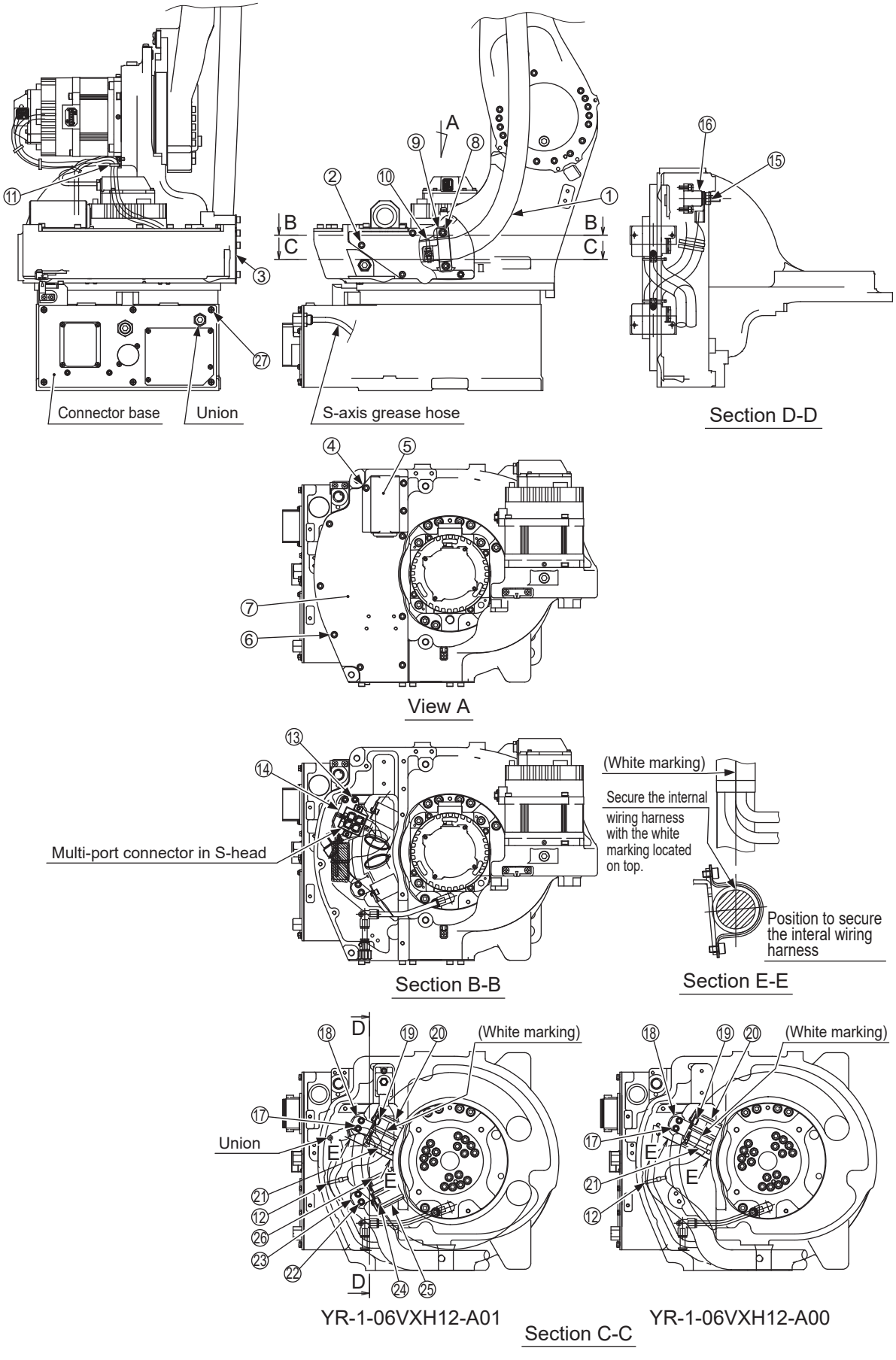
- Refer to *table 9-3 "Internal Wiring Harness Parts Checklist (S-Head)"* and *fig. 9-3 "Disassembly & Reassembly of Internal Wiring Harness (S-Head)"*.
- The steps marked with ※ are necessary only for YR-1-06VXH12-A01 (Built-in welding cable specification).

1. Unscrew the GT-SA bolts②, and remove the cover③.
2. Unscrew the GT-SA bolts④⑥, and remove the covers⑤⑦.
3. Unscrew the GT-SA bolts⑧, and remove the clamp⑨.
4. Cut off the cable ties⑩⑪.
5. Disconnect the connectors of the S- and L-axis motors (fixing bolts: pan-head screws M3), and remove the S- and L-axis power cables.
6. Cut off the cable tie⑫.
7. ※ Disconnect the air hose from the union.
8. Disconnect the "IN" connector and the "OUT" connector of the internal wiring harness① from the "IN" port and the "OUT" port of the multi-port connector in the S-head.
   At this time, be sure not to disconnect the connectors on the "S" port and the "L" port.
9. Unscrew the GT-SA bolts⑬, and remove the support⑭.
10. ※ Loosen the nut⑮, and remove the terminal of the power cable for arc welding from the terminal block⑯.
11. ※ Cut off the cable tie㉖.
12. ※ Unscrew the GT-SA bolts㉒, and remove the support㉓.
13. ※ Unscrew the GT-SA bolts㉔, and remove the saddle㉕.
14. Cut off the cable tie㉑.
15. Unscrew the GT-SA bolts⑰, and remove the support⑱.
16. Unscrew the GT-SA bolts⑲, and remove the saddle⑳.
17. Unscrew the cross head APS bolts㉗.
18. Disconnect the S-axis grease hose from the union of the connector base.
19. Pass the internal wiring harness① through the S-head, and pull it out to the base side.

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

No.	Item	Qty.	Note
①	Internal wiring harness HW1172795-A (B)	1	HW1172795-A: for -A00
			HW1172795-B: for -A01
②	GT-SA bolt M6 (length: 15 mm)	5	Tightening torque 10 N▪m
③	Cover HW1407912-1	1	
④	GT-SA bolt M6 (length: 15 mm)	3	Tightening torque 10 N▪m
⑤	Cover HW1304381-1	1	
⑥	GT-SA bolt M6 (length: 15 mm)	7	Tightening torque 10 N▪m
⑦	Cover HW1306503-1	1	
⑧	GT-SA bolt M6 (length: 15 mm) Washer M6 *stainless*	2 each	Tightening torque 2.8 N▪m
⑨	Clamp BGH-29	1	
⑩	Cable tie T120R	1	
⑪	Cable tie T18L	4	
⑫	Cable tie T18L	1	
⑬	GT-SA bolt M6 (length: 15 mm)	2	Tightening torque 10 N▪m
⑭	Support HW1407255-1	1	
⑮	Nut M10	1	Tightening torque 6 N▪m
⑯	Terminal block TS200CHM	1	
⑰	GT-SA bolt M6 (length: 15 mm)	2	Tightening torque 10 N▪m
⑱	Support HW0414670-2	1	
⑲	GT-SA bolt M5 (length: 8 mm)	2	Tightening torque 6 N▪m
⑳	Saddle CD31	1	
㉑	Cable tie T50R	1	
㉒	GT-SA bolt M6 (length: 15 mm)	2	Tightening torque 10 N▪m
㉓	Support HW0414670-1	1	
㉔	GT-SA bolt M5 (length: 8 mm)	2	Tightening torque 6 N▪m
㉕	Saddle CD31	1	
㉖	Cable tie T50R	1	
㉗	Cross head APS bolt M5 (length: 10 mm) *stainless*	6	Tightening torque 4 N▪m

Fig. 9-3: Disassembly & Reassembly of Internal Wiring Harness (S-Head)



■ Reassembly

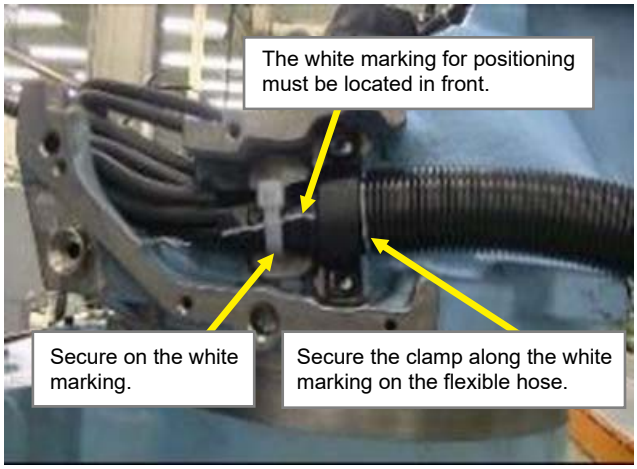
1. S-head

- Refer to *table 9-3 "Internal Wiring Harness Parts Checklist (S-Head)"* and *fig. 9-3 "Disassembly & Reassembly of Internal Wiring Harness (S-Head)"* .
- The steps marked with ※ are necessary only for YR-1-06VXH12-A01 (Built-in welding cable specification).

1. Apply Multemp PS2A Grease all over the protective spring of the internal wiring harness.
2. Pass the internal wiring harness① from the base to the S-head side.
3. Connect the S-axis grease hose to the union of the connector base.
4. Tighten the cross head APS bolts㉗ with the tightening torque shown in *table 9-3*.
   At this time, make sure not to let the lead wire get caught in the connector base.
5. Secure the protective spring for the internal wiring harness① to the support⑱ by using the saddle⑳, and then tighten the GT-SA bolts⑲ with the tightening torque shown in *table 9-3*.
   At this time, make sure that the white marking of the internal wiring harness① is located as shown in *fig. 9-3*.
6. Put the cable tie㉑ through the clamp, and secure the internal wiring harness① to the support⑱.
   At this time, secure the cable tie㉑ at the white marking of the internal wiring harness①.
7. ※ Secure the protective spring for the power cable for arc welding of the internal wiring harness① to the support㉓ by using the saddle㉕, and then tighten the GT-SA bolts㉔ with the tightening torque shown in *table 9-3*.
8. ※ Put the cable tie㉖ through the clamp, and secure the power cable for arc welding of the internal wiring harness① to the support㉓.
   At this time, secure the cable tie㉖ at the white marking of the power cable for arc welding.
9. Mount the support⑱ to the S-head, and then tighten the GT-SA bolts⑰ with the tightening torque shown in *table 9-3*.
10. ※ Mount the support㉓ to the S-head, and then tighten the GT-SA bolts㉒ with the tightening torque shown in *table 9-3*.
11. ※ Connect the terminal of the power cable for arc welding to the terminal block⑯, and then tighten the nut⑮.
    At this time, be sure to keep the terminal away from the S-head. If the terminal is in contact with the S-head, a ground fault may result.
12. Mount the support⑭ to the S-head, and then tighten the GT-SA bolts⑬ with the tightening torque shown in *table 9-3*.
13. Connect the "IN" connector and the "OUT" connector of the internal wiring harness① respectively to the "IN" port and the "OUT" port of the multi-port connector in the S-head.
14. ※ Connect the air hose to the union.
15. Tie the internal wiring harness and the air hose together by using the cable tie⑫.

16. Connect the power cables to the S- and L-axis motors, and tighten the connector fixing bolts (pan-head screws M3) with the tightening torque of 0.2 N•m.
    (The connector fixing bolts are provided with the connectors.)
17. Tie the power cables and the encoder cables of the S- and L-axes together by using the cable ties⑪.
18. Secure the flexible hose of the internal wiring harness① by using the clamp⑨.
    At this time, mount the clamp⑨ along the white marking of the flexible hose. (Refer to *fig. 9-4 "Securing the Internal Wiring Harness in S-Head"* .)
19. Tighten the GT-SA bolts⑧ with the tightening torque shown in *table 9-3*.
20. Put the cable tie⑩ through the clamp, and secure the internal wiring harness①.
    At this time, secure the cable tie⑩ at the white marking of the internal wiring harness①. Also, make sure that the white marking for positioning the internal wiring harness① is located in front. (Refer to *fig. 9-4*.)
21. Mount the cover⑦, and tighten the GT-SA bolts⑥ with the tightening torque shown in *table 9-3*.
22. Mount the cover⑤, and tighten the GT-SA bolts④ with the tightening torque shown in *table 9-3*.
23. Mount the cover③, and tighten the GT-SA bolts② with the tightening torque shown in *table 9-3*.

Fig. 9-4: Securing the Internal Wiring Harness in S-Head

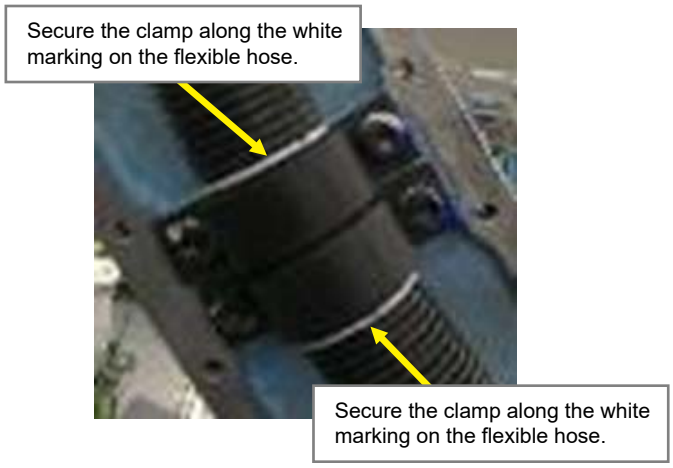


2. L-arm

- Refer to *table 9-2 "Internal Wiring Harness Parts Checklist (L-Arm)"* and *fig. 9-2 "Disassembly & Reassembly of Internal Wiring Harness (L-Arm)"* .

1. Secure the flexible hose of the internal wiring harness① by using the clamps⑤.
   At this time, mount the clamps⑤ along the white marking on the flexible hose. (Refer to *fig. 9-5 "Securing the Internal Wiring Harness in L-Arm"* .)
2. Tighten the GT-SA bolts④ with the tightening torque shown in *table 9-2*.
3. Mount the cover③, and tighten the GT-SA bolts② with the tightening torque shown in *table 9-2*.

Fig. 9-5: Securing the Internal Wiring Harness in L-Arm



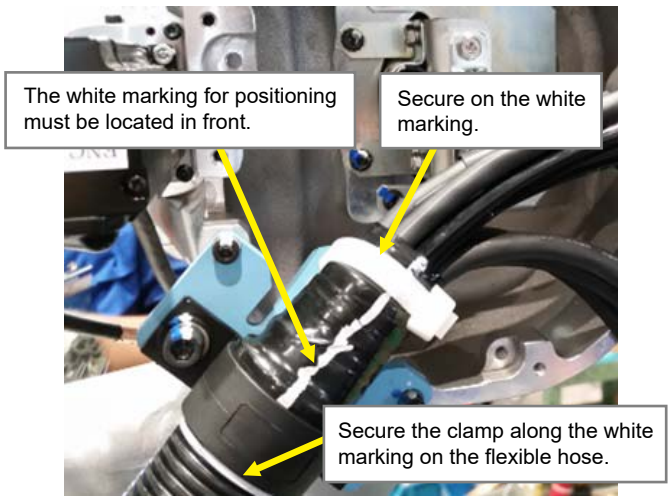
3. Casing

- Refer to *table 9-1 "Internal Wiring Harness Parts Checklist (Casing)"* and *fig. 9-1 "Disassembly & Reassembly of Internal Wiring Harness (Casing)"* .

1. Secure the flexible hose of the internal wiring harness① by using the clamp㉒.
   At this time, mount the clamp㉒ along the white marking on the flexible hose. (Refer to *fig. 9-6 "Securing the Internal Wiring Harness in Casing"* .)
2. Tighten the GT-SA bolts㉑ with the tightening torque shown in *table 9-1*.
3. Put the cable tie⑳ through the clamp, and secure the internal wiring harness①.
   At this time, secure the cable tie⑳ at the white marking of the internal wiring harness①. Also, make sure that the white marking for positioning the internal wiring harness① is located in front. (Refer to *fig. 9-6*.)
4. Pass the connector for the internal user I/O wiring harness through the casing.
5. Mount the gasket⑲ between the connector for the internal user I/O wiring harness and the N-base⑱, and then tighten the pan-head sems screws⑰ with the tightening torque shown in *table 9-1*.
   At this time, make sure to mount the connector for the internal user I/O wiring harness in the direction shown in *fig. 9-1*.
6. Mount the N-base⑱ to the casing, and tighten the GT-SA bolts⑯ with the tightening torque shown in *table 9-1*.
7. Connect the air hose of the internal wiring harness① to the union.
8. Mount the ground terminal of the internal wiring harness① to the casing by using the GT-SA bolt⑮, and tighten the GT-SA bolt⑮ with the tightening torque shown in *table 9-1*.
9. Pass the U-axis power cable through to the U-axis motor side.
10. Connect the power cable to the U-axis motor, and tighten the connector fixing bolt (pan-head screw M3) with the tightening torque of 0.2 N•m.
    (The connector fixing bolt is provided with the connector.)
11. Put the encoder cable and the power cable of the U-axis through the gasket⑬, and then fit it into the casing.
12. Tie the encoder cable and the power cable of the U-axis together by using the cable tie⑭.
13. Mount the cover⑫, and tighten the GT-SA bolts⑪ with the tightening torque shown in *table 9-1*.
14. Connect the "R-PW" connector of the internal wiring harness① with the "R" connector of the R-axis power cable.
15. Enclose the connecting part of the R-axis power cable's connector in the protective tube⑨, and secure with the cable tie⑩.
16. Connect the "B-PW" and "T-PW" connectors of the internal wiring harness for the B- and T-axes① with the respective "B-PW" and "T-PW" connectors of the internal wiring harness.

17. Enclose the connecting parts of the B- and T-axis power cables' connectors in the protective tube⑨, and secure with the cable tie⑩.
18. Put the connecting parts of the R-axis power cable's connector and the B- and T-axis power cables' connectors into the casing.
19. Mount the support⑧, and tighten the GT-SA bolts⑦ with the tightening torque shown in *table 9-1 "Internal Wiring Harness Parts Checklist (Casing)"*.
    Connect the "IN" connector of the internal wiring harness① to the "IN" port of the multi-port connector in the casing.
20. Tie the lead wire for the U-axis limit switch of the internal wiring harness① and the "IN" lead wire together by using the cable tie⑥, and tie the lead wire for the SERVO ON lamp and the "OUT" lead wire together by using the cable tie⑥.
21. Mount the cover⑤, and tighten the GT-SA bolts④ with the tightening torque shown in *table 9-1*.
22. Mount the cover③, and tighten the hexagon socket head cap screws② with the tightening torque shown in *table 9-1*.
23. Turn ON the YRC1000 power supply.

Fig. 9-6: Securing the Internal Wiring Harness in Casing



9.2 Disassembly/Reassembly of Internal Wiring Harness for B- and T-Axes

- Refer to *fig. 9-7 "Disassembly & Reassembly of Internal Wiring Harness for B- and T-Axes"* .

NOTE Refer to *chapter 2 "Notes for Maintenance"* and *chapter 3 "Home Position Return"* .

■ Disassembly

U-arm

1. Turn OFF the YRC1000 power supply.
2. Unscrew the GT-SA bolts⑩, and remove the cover⑪.
3. Remove the gasket⑫ from the cover⑪.
4. Disconnect the "IN" connector of the internal wiring harness for the B- and T-axes① from the "IN" port of the multi-port connector in the U-arm.
5. Take out the connecting part A of the connector from the space between the U-arm and the T-axis motor. Take the connector out of the protective tube, and then disconnect the "B" connector and the "T" connector of the B- and T-axis power cables connected to the internal wiring harness for the B- and T-axes①.

Casing

6. Unscrew the GT-SA bolts②, and remove the cover③.
7. Disconnect the "OUT" connector of the internal wiring harness for the B- and T-axes① from the "OUT" port of the multi-port connector in the casing.
   At this time, be sure not to disconnect the connectors on the "U" port and the "R" port.
8. Unscrew the GT-SA bolts④, and remove the support⑤.
9. Take out the connecting part B of the connector from the casing. Take the connector out of the protective tube, and then disconnect the "B-PW" connector and the "T-PW" connector of the internal wiring harness connected to the internal wiring harness for the B- and T-axes①.
10. Unscrew the GT-SA bolts⑥, and remove the cover⑦.
11. Unscrew the GT-SA bolts⑧⑨, and pull out the internal wiring harness for the B- and T-axes①.

■ Reassembly

Casing

1. Pass the B- and T-axis motors side end of the internal wiring harness for the B- and T-axes① through from the opening of the casing to the U-arm side.
2. Apply 5g of Multemp PS2A Grease around the entire circumference of the protective spring in the Grease Application Range.
   *After applying the grease, remove grease on areas other than the internal wiring harness.
   (Refer to *fig. 9-8(a) "Example of B- and T-axes grease application"*)
3. Push the support of the internal wiring harness for the B- and T-axes① into the opening of the casing, and secure with the GT-SA bolts⑨.
4. Apply 13g of Multemp PS2A Grease around the entire circumference of the protective spring in the Grease Application Range.
   *After applying the grease, remove grease on areas other than the internal wiring harness.
   (Refer to *fig. 9-8(b) "Example of B- and T-axes grease application"*)
5. Apply Multemp PS2A Grease all over the protective spring of the internal wiring harness for the B- and T-axes①.
6. Put the protective spring of the internal wiring harness for the B- and T-axes① into the opening of the casing.
   At this time, be sure not to let the two wire leads cross each other.
7. Mount the internal wiring harness for the B- and T-axes① by using the GT-SA bolts⑧, and tighten the bolts with the tightening torque shown in *table 9-4 "Internal Wiring Harness for B- and T-Axes Parts Checklist"* .
8. Mount the cover⑦, and tighten the GT-SA bolts⑥ with the tightening torque shown in *table 9-4*.
9. Connect the "B-PW" and "T-PW" connectors of the internal wiring harness for the B- and T-axes① with the respective "B-PW" and "T-PW" connectors of the internal wiring harness.
10. Enclose the connecting part in the protective tube and secure with a cable tie, and then put it into the casing.
11. Connect the "OUT" connector of the internal wiring harness for the B- and T-axes① to the "OUT" port of the multi-port connector in the casing.
12. Mount the support⑤ to the casing, and tighten the GT-SA bolts④ with the tightening torque shown in *table 9-4*.
    At this time, be sure not to let the lead wire get caught.
13. Mount the cover③ onto the casing, and tighten the GT-SA bolts② with the tightening torque shown in *table 9-4*.

U-arm

14. Connect the "B-PW" connector of the internal wiring harness for the B- and T-axes① with the "B" connector of the B-axis power cable, and connect the "T-PW" connector of the internal wiring harness for the B- and T-axes① with the "T" connector of the T-axis power cable.
15. Enclose the connecting part in the protective tube and secure with a cable tie, and then put it into the space between the T-axis motor and the U-arm.

16. Connect the “IN” connector of the internal wiring harness for the B- and T-axes① to the “IN” port of the multi-port connector in the U-arm.
17. Fit the gasket⑫ into the slot of the cover⑪.
18. Mount the cover⑪, and tighten the GT-SA bolts⑩ with the tightening torque shown in *table 9-4 “Internal Wiring Harness for B- and T-Axes Parts Checklist”* .
19. Turn ON the YRC1000 power supply.

Table 9-4: Internal Wiring Harness for B- and T-Axes Parts Checklist

No.	Item	Qty.	Note
①	Internal wiring harness for the B- and T-axes HW1271557-A	1	
②	GT-SA bolt M4 (length: 12 mm)	6	Tightening torque 2.8 N•m
③	Cover HW1306162-1	1	
④	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
⑤	Support HW1407856-1	1	
⑥	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
⑦	Cover HW1404499-1	1	
⑧	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
⑨	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N•m
⑩	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N•m
⑪	Cover HW1200523-1	1	
⑫	Gasket HW1306400-1	1	

Fig. 9-7: Disassembly & Reassembly of Internal Wiring Harness for B- and T-Axes

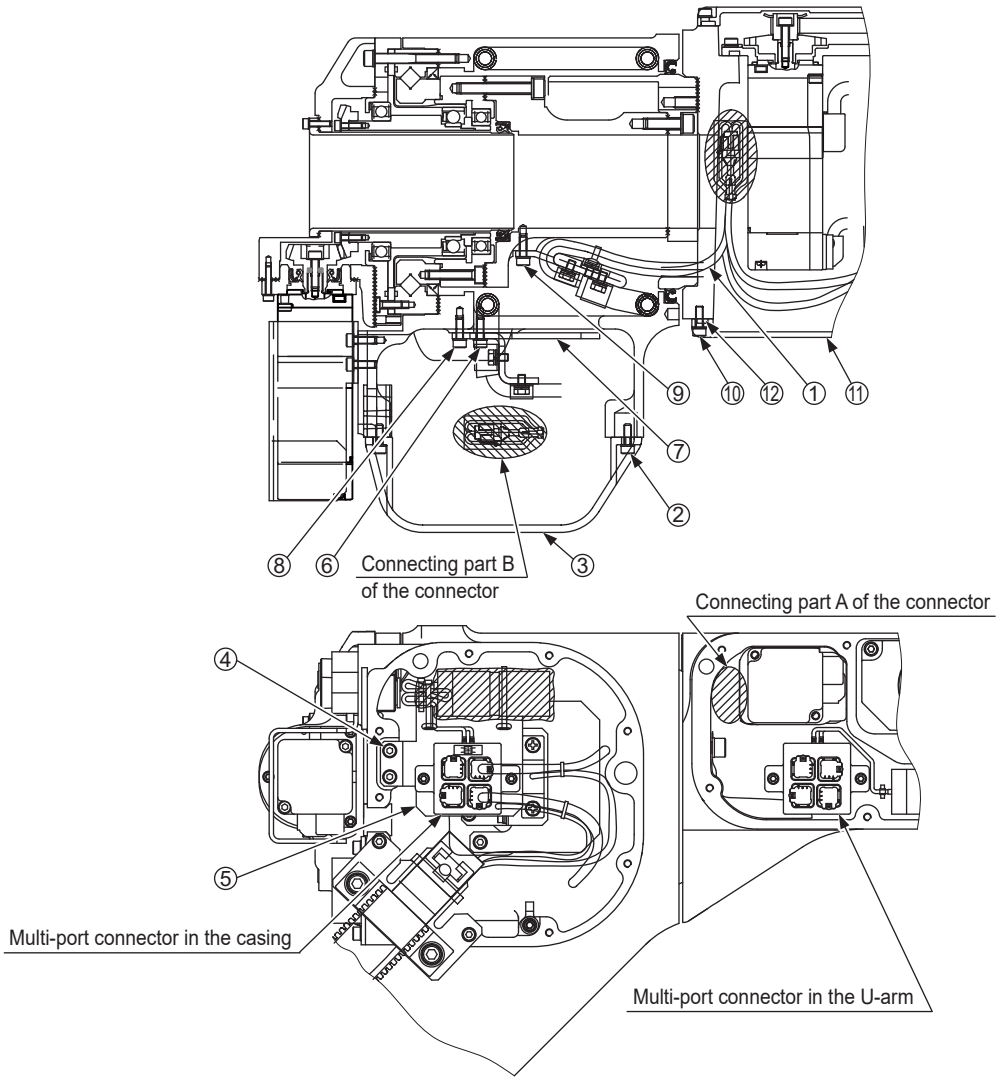


Fig. 9-8(a): Example of B- and T-axes grease application

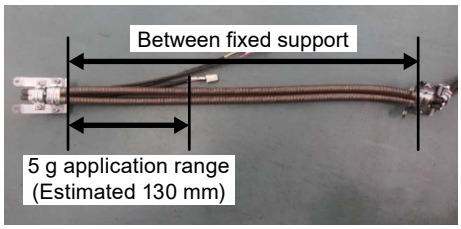
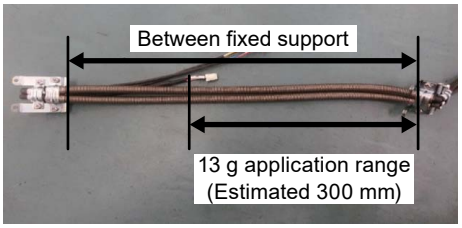


Fig. 9-8(b): Example of B- and T-axes grease application



10 Protective Tube Replacement

The protective tube is installed on the external lead for arc welding only. 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. 10-1 "Disassembly & Reassembly of Protective Tube"* .

■ Disassembly

1. Turn OFF the YRC1000 power supply.
2. Cut off the cable ties②, and then remove the protective tube①.
3. Cut off the cable ties④, and then remove the protective tube③.

■ Reassembly

1. By referring to *fig. 10-2 "Marking of Protective Tube"* , add marking lines on both ends of the protective tubes① ③.
2. Wrap the protective tubes① ③ around the internal wiring harness. At this time, make sure to wrap the protective tubes① ③ in the direction shown in *fig. 10-1*.
3. Align each end of the protective tube③ with the end of each clamp, and secure the protective tube③ by using the cable ties④ at the positions of the marking lines added in the step 1.
4. Align the top end of the protective tube① with the end of the cover, align the bottom end of the protective tube① with the end of the clamp, and then secure the protective tube① by using the cable ties② at the positions of the marking lines added in the step 1.
5. Turn ON the YRC1000 power supply.

Table 10-1: Internal Wiring Harness Parts Checklist (Casing)

No.	Item	Qty.	Note
①	Protective tube MTK-40	1	500 mm
②	Cable tie T50L-W	2	
③	Protective tube MTK-40	1	580 mm
④	Cable tie T50L-W	2	

10 Protective Tube Replacement

Fig. 10-1: Disassembly & Reassembly of Protective Tube

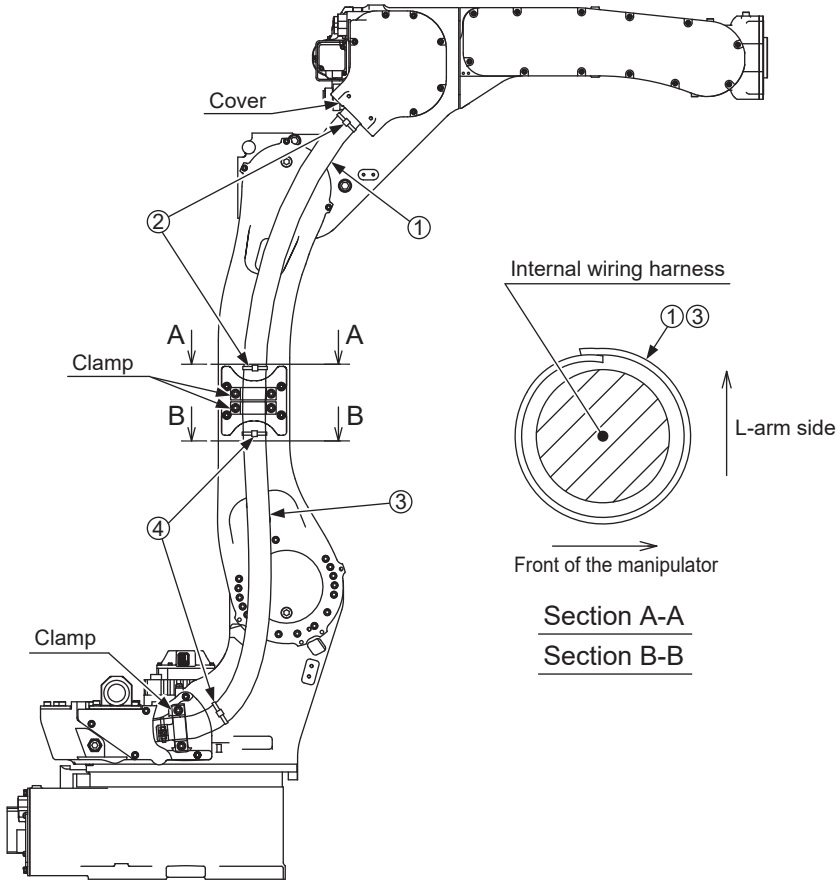
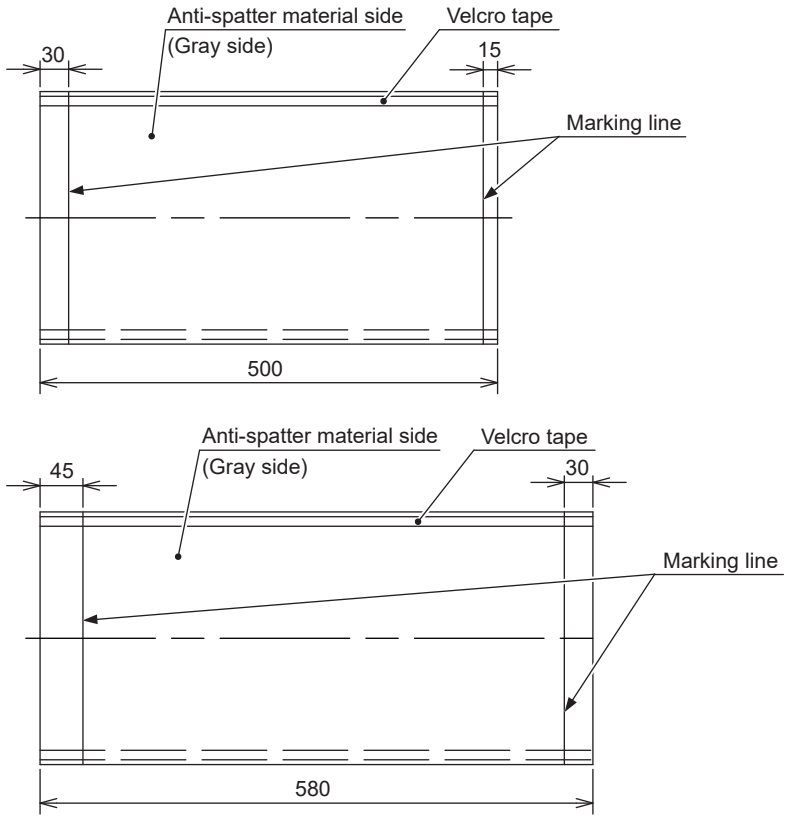


Fig. 10-2: Marking of Protective Tube



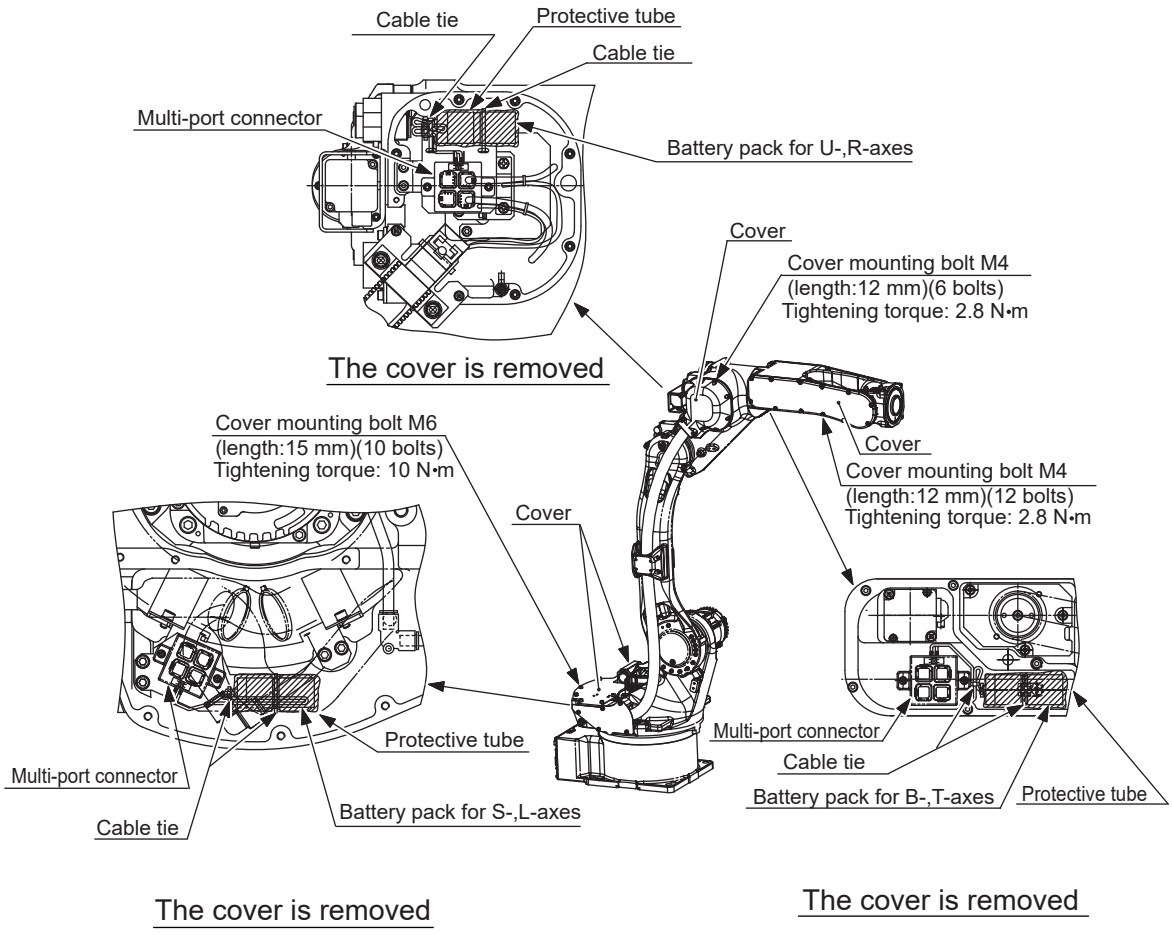
11 Battery Pack Replacement

Three battery packs are installed with the multi-port connectors as shown in *fig. 11-1 "Location of the Battery and Multi-Port Connector"* .

If the battery alarm appears on the programming pendant, replace the battery pack by following one of the procedures described as follows.

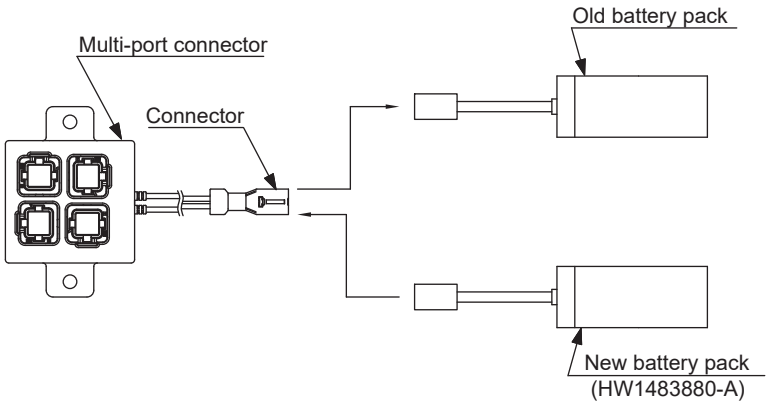
Make sure to refer to *chapter 2 "Notes for Maintenance"* when replacing the battery pack.

Fig. 11-1: Location of the Battery and Multi-Port Connector



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

Fig. 11-2: Battery connection (when the control power supply of the YRC1000 can be turned ON)



1. Turn ON the control 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.

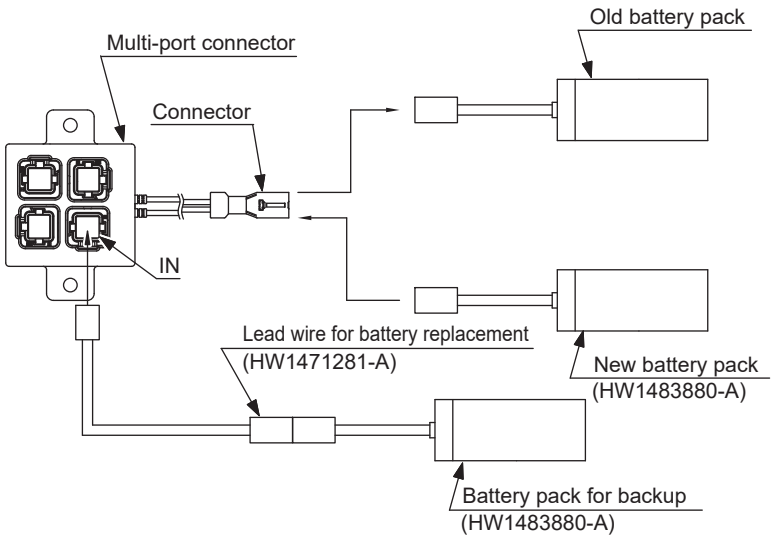
Failure to observe this instruction may cause improper movement of the manipulator which may result in personal injury and/or equipment damage.

2. Loosen the cover mounting bolts and remove the cover.
3. The old battery pack is secured by using the protective tube and the cable ties. Cut off the cable ties and remove the old battery pack from the protective tube.
4. Remove the old battery pack from the multi-port connector and mount the new battery pack.
5. Place the new battery pack into the protective tube, and then secure it by using the cable ties T18L.
6. Tighten the cover mounting bolts with the tightening torque shown in *fig. 11-1 "Location of the Battery and Multi-Port Connector"* and reinstall the cover.

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

■ When the control power supply of the YRC1000 cannot be turned ON

Fig. 11-3: Battery connection (when the control power supply of the YRC1000 cannot be turned ON)



1. Prepare the lead wire for battery replacement and a battery pack for backup. (In addition to a new battery pack for replacement, an extra battery pack for backup is necessary.)
2. Loosen the cover mounting bolts and remove the cover.
3. Disconnect the connector from the “IN” port of the multi-port connector. Connect the lead wire for battery replacement to the “IN” port of the multi-port connector.
4. Connect the battery pack for backup to the lead wire for battery replacement.
5. The old battery pack is secured by using the protective tube and the cable ties. Cut off the cable ties and remove the old battery pack from the protective tube.

NOTE To prevent the loss of the encoder absolute data, make sure to connect the battery pack for backup before removing the old battery pack.

6. Remove the old battery pack from the multi-port connector and mount the new battery pack.
7. Disconnect the lead wire for battery replacement and remove the battery pack for backup from the multi-port connector. Connect again the connector disconnected in the step 3 above to the “IN” port.

NOTE If the battery pack for backup is kept connected, an electric current may flow from the new battery pack to the battery pack for backup, which may decrease the voltage in the new battery pack.
After connecting the new battery pack, immediately remove the battery pack for backup.

8. Place the new battery pack into the protective tube, and then secure it by using the cable ties T18L.

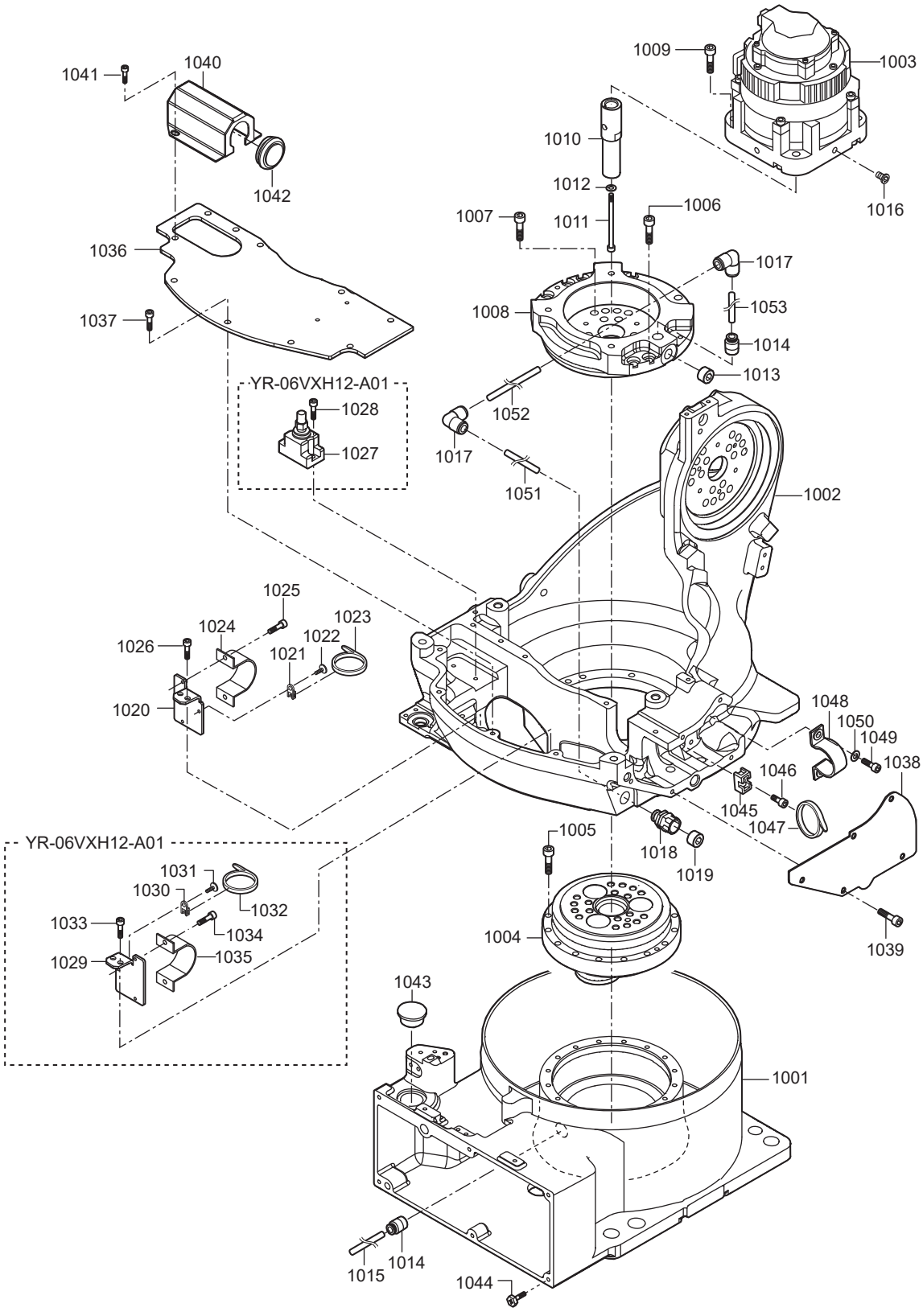
9. Tighten the cover mounting bolts with the tightening torque shown in *fig. 11-1 "Location of the Battery and Multi-Port Connector"* and reinstall the cover.

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

12 Parts List

12.1 S-Axis Unit

Fig. 12-1: S-Axis Unit



12 Parts List
12.1 S-Axis Unit

Table 12-1: S-Axis Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs.
1001	HW1100498-1	Base	1
1002	HW1100883-1	S head	1
1003	SGM7G-05APK-YR1*	Motor	1
1004	HW0386621-B	Speed reducer	1
1005	M6X35	GT-SA bolt	16
1006	M8X25	GT-SA bolt	7
1007	M8X25	GT-SA bolt	18
1008	HW1303263-1	M base	1
1009	M8X25 (3 CHROMATE)	Hexagon socket head cap screw	3
1010	HW0312734-2	Gear	1
1011	M5X85	Hexagon socket head cap screw	1
1012	2L-5	Conical spring washer	1
1013	PT3/8	Hexagon socket head plug	1
1014	ATSH8-03	Union	2
1015	NB-0860-0.26	Tube	1
1016	M4X6 (3 CHROMATE)	Slim-head machine screw	4
1017	KQ2L08-00A	Union	2
1018	PMF8-03	Union	1
1019	NPTF3/8 (STAINLESS)	Hexagon socket head tapered pipe plug (NPTF type)	1
1020	HW0414670-2	Support	1
1021	TA1-S10	Clamp	1
1022	M5X8 (STAINLESS)	Pan-head sems screw	1
1023	T50R	Cable tie	1
1024	CD-31	Saddle	1
1025	M5X8	GT-SA bolt	2
1026	M6X15	GT-SA bolt	2
1027	TS200CHM	Terminal block	1
1028	M5X16	GT-SA bolt	2
1029	HW0414670-1	Support	1
1030	TA1-S10	Clamp	1
1031	M5X8 (STAINLESS)	Pan-head sems screw	1
1032	T50R	Cable tie	1
1033	M6X15	GT-SA bolt	2
1034	M5X8	GT-SA bolt	2
1035	CD-31	Saddle	1
1036	HW1306503-1	Cover	1
1037	M6X15	GT-SA bolt	7
1038	HW1407912-1	Cover	1
1039	M6X15	GT-SA bolt	5
1040	HW1304381-1	Cover	1

12 Parts List
12.1 S-Axis Unit

Table 12-1: S-Axis Unit (Sheet 2 of 2)

No.	DWG No.	Name	Pcs.
1041	M6X15	GT-SA bolt	3
1042	C-30-SG-30A	Grommet	1
1043	HW1405970-2	Bush	1
1044	M5X10 (STAINLESS)	APS bolt	6
1045	KR8G5	Clamp	1
1046	M6X10 (STAINLESS)	Pan-head screw	1
1047	T120R	Cable tie	1
1048	BGH-29	Clamp	1
1049	M6X15	GT-SA bolt	2
1050	M6 (STAINLESS)	Washer	2
1051	NB-0860-0.055	Tube	1
1052	NB-0860-0.135	Tube	1
1053	NB-0860-0.055	Tube	1

12.2 L-Axis Unit

Fig. 12-2: L-Axis Unit

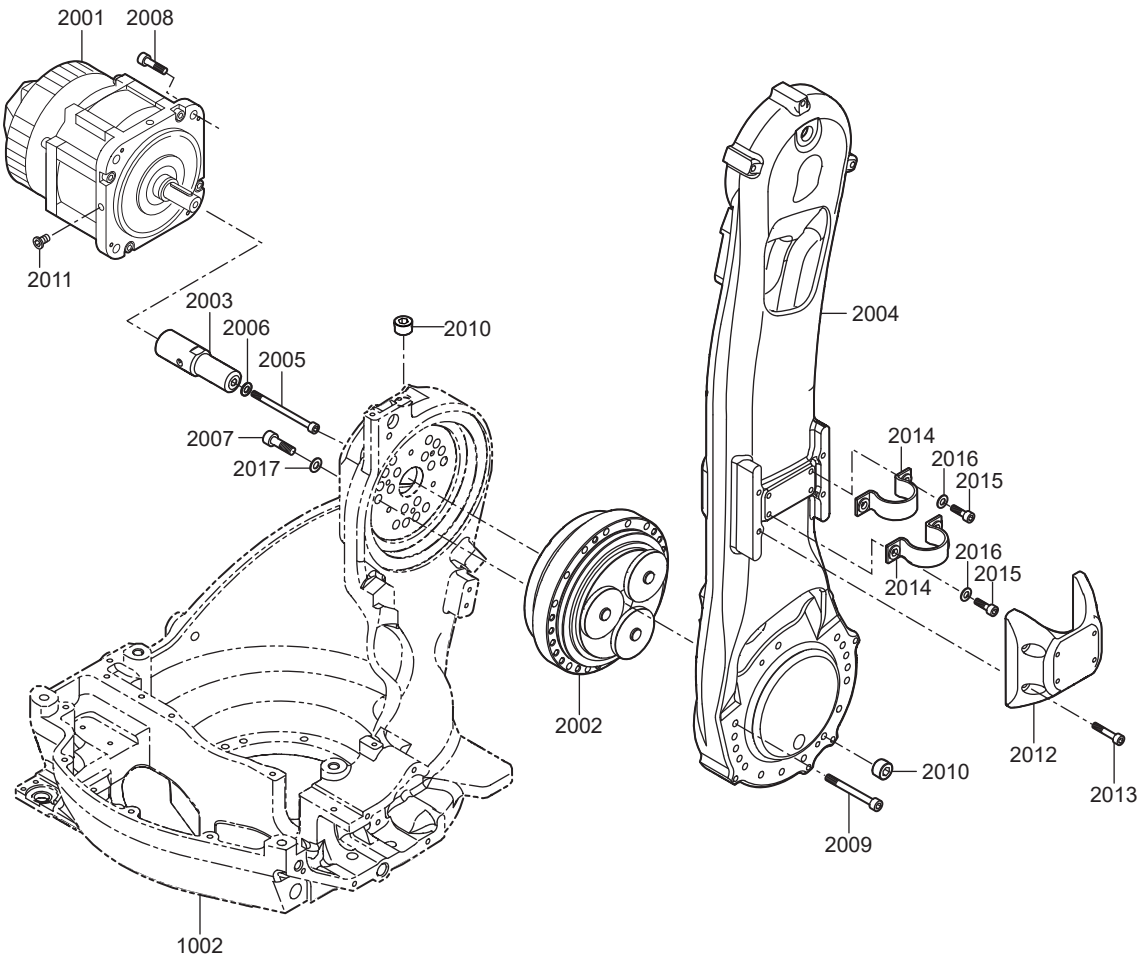


Table 12-2: L-Axis Unit

No.	DWG No.	Name	Pcs.
2001	SGM7G-09APK-YR1*	Motor	1
2002	HW0387809-A	Speed reducer	1
2003	HW0312735-2	Gear	1
2004	HW1100867-1	L arm	1
2005	M6X75	Hexagon socket head cap screw	1
2006	2L-6	Conical spring washer	1
2007	M8X25	Hexagon socket head cap screw	18
2008	M8X25 (3 CHROMATE)	Hexagon socket head cap screw	4
2009	M6X60	GT-SA bolt	16
2010	NPTF3/8 (STAINLESS)	Hexagon socket head tapered pipe plug (NPTF type)	2
2011	M4X6 (3 CHROMATE)	Slim-head machine screw	4
2012	HW1306163-1	Cover	1
2013	M6X30	GT-SA bolt	4
2014	BGH-29	Clamp	2
2015	M6X15	GT-SA bolt	4
2016	M6 (STAINLESS)	Washer	4
2017	SW-2H-8	Conical spring washer	18
1002	HW1100883-1	S head	1

12.3 U-Axis Unit

Fig. 12-3: U-Axis Unit

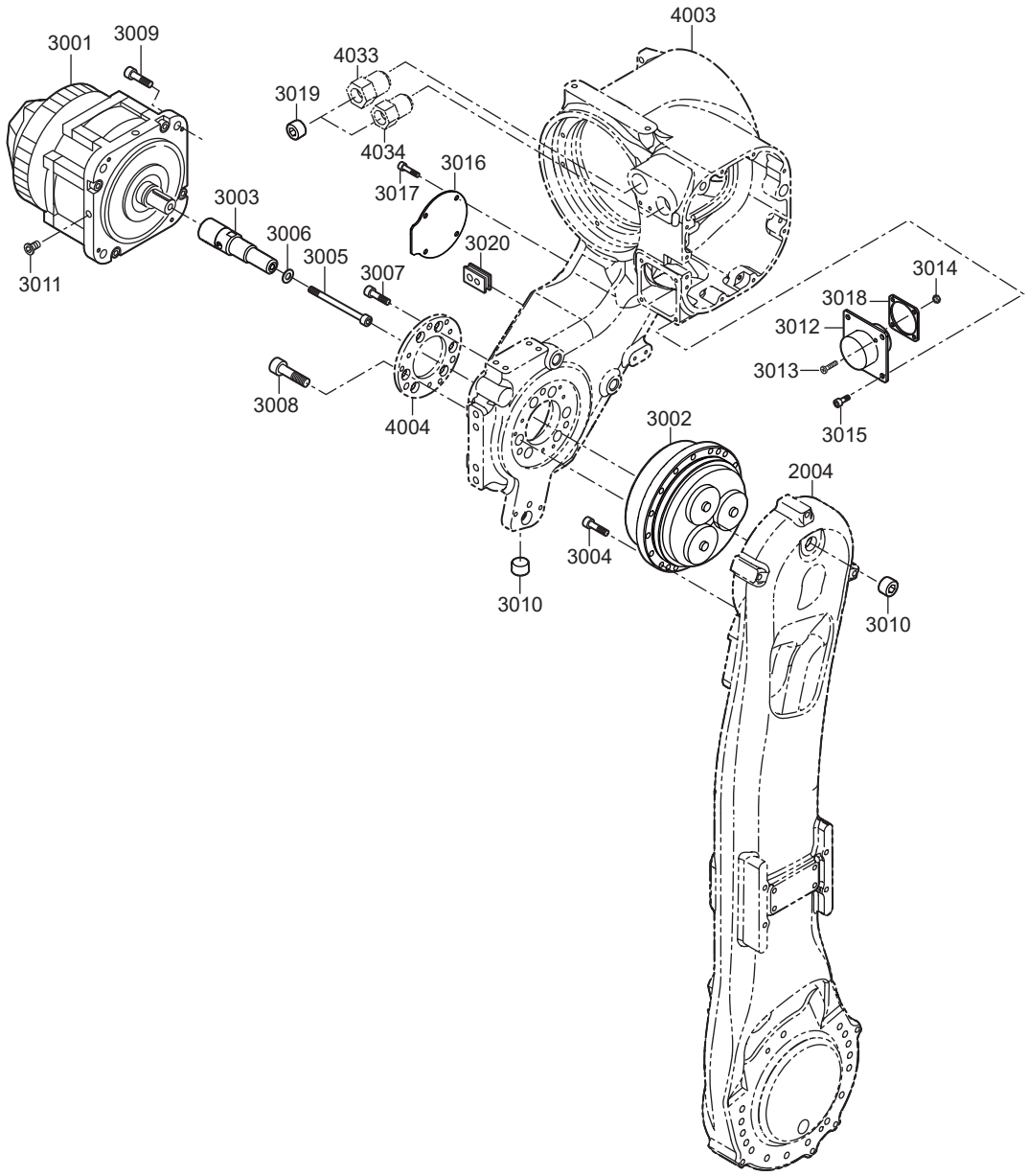


Table 12-3: U-Axis Unit

No.	DWG No.	Name	Pcs.
3001	SGM7G-05APK-YR1*	Motor	1
3002	HW1380153-A	Speed reducer	1
3003	HW1303245-1	Gear	1
3004	M5X25	GT-SA bolt	16
3005	M5X75	Hexagon socket head cap screw	1
3006	2L-5	Conical spring washer	1
3007	M6X25	GT-SA bolt	3
3008	M10X30	GT-SA bolt	6
3009	M8X30 (3 CHROMATE)	Hexagon socket head cap screw	4
3010	NPTF3/8 (STAINLESS)	Hexagon socket head tapered pipe plug (NPTF type)	2
3011	M4X6 (3 CHROMATE)	Slim-head machine screw	4
3012	HW0404554-2	N base	1
3013	M3X16 (STAINLESS)	Pan-head sems screw	2
3014	M3 (STAINLESS)	Nut	2
3015	M4X12	GT-SA bolt	4
3016	HW1404057-1	Cover	1
3017	M4X12	GT-SA bolt	4
3018	HW9481087-A	Gasket	1
3019	PT3/8 (STAINLESS)	Hexagon socket head plug	2
3020	HW1404517-1	Gasket	1
2004	HW1100867-1	L arm	1
4003	HW1100617-1	Casing	1
4004	HW1404044-1	Plate	1
4033	KQ2E12-03A	Union	1
4034	KQ2E10-03A	Union	1

12.4 R-Axis Unit

Fig. 12-4: R-Axis Unit

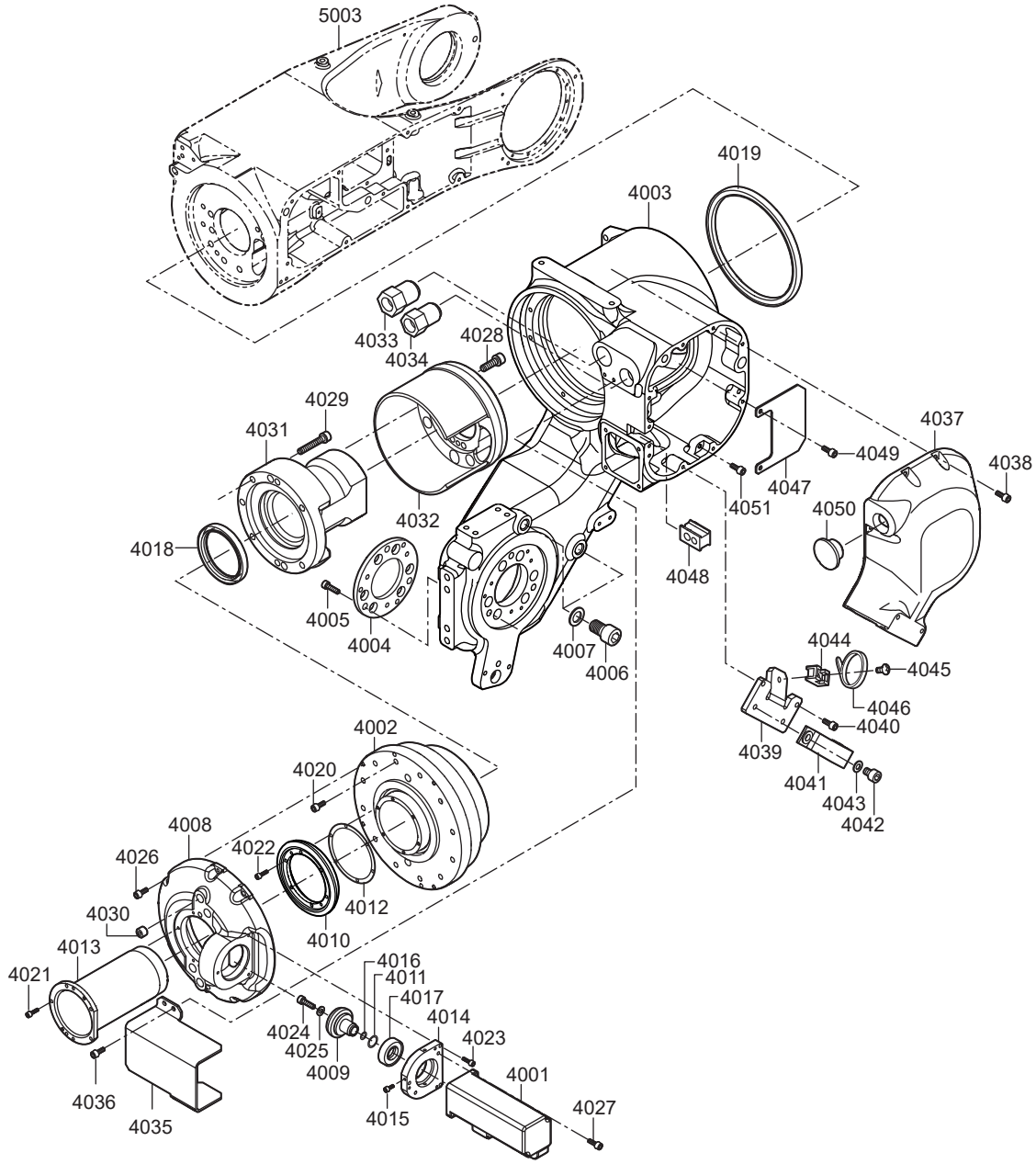


Table 12-4: R-Axis Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs.
4001	SGM7J-01APK-YR1*	Motor	1
4002	HW1382521-A	Speed reducer	1
4003	HW1100617-1	Casing	1
4004	HW1404044-1	Plate	1
4005	M4X12	GT-SA bolt	3
4006	M12X20	Hexagon socket head cap screw	2
4007	2H-12	Conical spring washer	2
4008	HW1303905-1	Housing	1
4009	HW1484046-A (HW1306389-1)	Gear set (Gear 1)	1
4010	HW1484046-A (HW1306390-1)	Gear set (Gear 2)	1
4011	HW1405521-*	Shim	1
4012	HW1404157-*	Shim	1
4013	HW1303257-1	Shaft	1
4014	HW1407821-1	M base	1
4015	M3X6	Hexagon socket head cap screw	3
4016	HW0404304-2	Gasket	1
4017	AE0478G	Oil seal	1
4018	TC52647	Oil seal	1
4019	TC1151306	Oil seal	1
4020	M5X45	GT-SA bolt	6
4021	M3X12	GT-SA bolt	5
4022	M3X12	GT-SA bolt	6
4023	M3X16	GT-SA bolt	3
4024	M4X16	Hexagon socket head cap screw	1
4025	2L-4	Conical spring washer	1
4026	M4X12	GT-SA bolt	4
4027	M4X12 (3 CHROMATE)	Hexagon socket head cap screw	2
4028	M6X20	GT-SA bolt	7
4029	M6X40	GT-SA bolt	7
4030	PT1/8 (STAINLESS)	Hexagon socket head plug	4
4031	HW1305906-1	Shaft	1
4032	HW1306399-1	Shaft	1
4033	KQ2E12-03A	Union	1
4034	KQ2E10-03A	Union	1
4035	HW1407212-1	Cover	1
4036	M4X12 (3 CHROMATE)	Hexagon socket head cap screw	2
4037	HW1306162-1	Cover	1
4038	M4X12	GT-SA bolt	6
4039	HW1407874-1	Support	1

Table 12-4: R-Axis Unit (Sheet 2 of 2)

No.	DWG No.	Name	Pcs.
4040	M4X12	GT-SA bolt	2
4041	BGH-29	Clamp	1
4042	M6X12	GT-SA bolt	2
4043	M6 (STAINLESS)	Washer	2
4044	KR8G5	Saddle	1
4045	M6X10 (STAINLESS)	Pan-head screw	1
4046	T120R	Cable tie	1
4047	HW1404499-1	Cover	1
4048	HW1404786-1	Gasket	1
4049	M4X12	GT-SA bolt	2
4050	HW1405970-1	Bush	1
4051	M4X12	GT-SA bolt	1
5003	HW1100926-1	U arm	1

12.5 Wrist Unit

Fig. 12-5: Wrist Unit

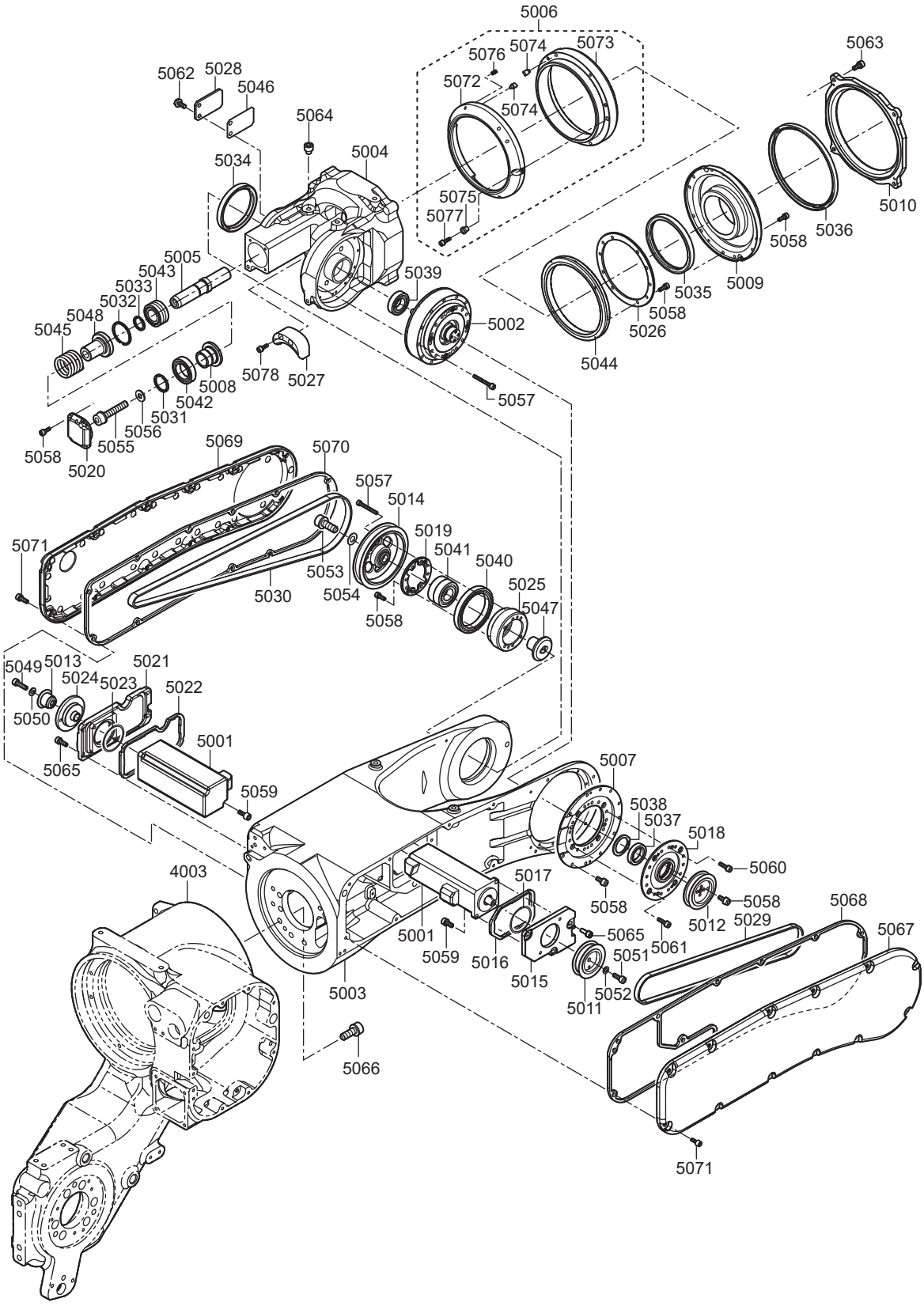


Table 12-5: Wrist Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs.
5001	SGM7J-01APK-YR1*	Motor	2
5002	HW1382522-A	Speed reducer	1
5003	HW1100926-1	U arm	1
5004	HW1100619-1	Wrist	1
5005	HW1303250-1	Gear	1
5006	D-HW1371294-B	Gear assy	1
5007	HW1305901-1	Shaft	1
5008	HW1303260-1	Shaft	1
5009	HW1303261-1	Flange	1
5010	HW1303262-1	Cover	1
5011	HW1407201-A	Pulley	1
5012	HW1404037-A	Pulley	1
5013	HW1404038-B	Pulley	1
5014	HW1407200-A	Pulley	1
5015	HW1407616-1	M base	1
5016	HW1407822-1	Gasket	1
5017	S30	O ring	1
5018	HW1404047-1	Housing	1
5019	HW1407204-1	B support	1
5020	HW1404049-1	Cover	1
5021	HW1407617-1	M base	1
5022	HW1407823-1	Gasket	1
5023	S30	O ring	1
5024	HW1407246-1	Fly wheel	1
5025	HW1407202-1	Shaft	1
5026	HW1404055-1	B-support	1
5027	HW1405971-1	Cover	1
5028	HW1404069-1	Cover	1
5029	60S3M603	Belt	1
5030	80S3M789	Belt	1
5031	WR20	Circlip	1
5032	AR28	Circlip	1
5033	WR15	Circlip	1
5034	TC50606	Oil seal	1
5035	TC64746	Oil seal	1
5036	TC1001105	Oil seal	1
5037	6803LLU	Bearing	1
5038	IRTW-26	Retaining ring	1
5039	6902	Bearing	1
5040	6809DDU	Bearing	1
5041	HW1481728-A	Bearing	1
5042	6804DDU	Bearing	1
5043	NA4902	Needle bearing	1
5044	RA9008C0	Cross roller bearing	1

Table 12-5: Wrist Unit (Sheet 2 of 2)

No.	DWG No.	Name	Pcs.
5045	HW1404059-6	Spring	1
5046	HW1404060-1	Gasket	1
5047	HW1484045-A (HW1305902-1)	Gear set (Gear 1)	1
5048	HW1484045-A (HW1306568-1)	Gear set (Gear 2)	1
5049	M4X18	Hexagon socket head cap screw	1
5050	2L-4	Conical spring washer	1
5051	M4X12	Hexagon socket head cap screw	1
5052	2L-4	Conical spring washer	1
5053	M6X20	Hexagon socket head cap screw	1
5054	2L-6	Conical spring washer	1
5055	M8X40	Hexagon socket head cap screw	1
5056	2L-8	Conical spring washer	1
5057	M3X28	GT-SA bolt	18
5058	M3X10	GT-SA bolt	37
5059	M4X12	GT-SA bolt	4
5060	M3X20	GT-SA bolt	12
5061	M3X16	GT-SA bolt	4
5062	M4X10 (STAINLESS)	APS bolt	2
5063	M4X12	GT-SA bolt	4
5064	M6X6	Hexagon socket head cap screw	5
5065	M4X12	GT-SA bolt	7
5066	M6X20	GT-SA bolt	6
5067	HW1200523-1	Cover	1
5068	HW1306400-1	Gasket	1
5069	HW1200524-1	Cover	1
5070	HW1306401-1	Gasket	1
5071	M4X12	GT-SA bolt	24
5072	HW1303252-1	Gear	1
5073	HW1304700-1	Gear	1
5074	HW1404050-1	Pin	6
5075	HW1405885-1	Collar	2
5076	HW1405463-1	Coil spring	3
5077	M3X12	GT-SA bolt	2
5078	M3X10 (3 CHROMATE)	Hexagon socket head cap screw	2
4003	HW1100617-1	Casing	1

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June 2023 17-03

MANUAL NO.
HW1484062 ③