

- 24-hour Telephone Number: (937) 847-3200

Use for urgent or emergency needs for technical support, service and/or replacement parts

- Routine Technical Inquiries: [techsupport@motoman.com](mailto:techsupport@motoman.com)

Allow up to 36 hours for response

## MOTOMAN-GP25-12 MAINTENANCE MANUAL

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### TYPE:

**YR-1-06VXH25-C10**

**(ENVIRONMENTAL RESISTANCE SPECIFICATION)**

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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.

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### MOTOMAN INSTRUCTIONS

MOTOMAN-GP25-12 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*)

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# 1 Introduction



## DANGER

- This maintenance manual is intended to describe procedures for safety, maintenance, and inspection for the mechanical part of the manipulator. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator. Any process 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”.

**DANGER**

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.

**WARNING**

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.

**CAUTION**

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**

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”.

---

## 1 Introduction

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### 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 <sup>TM</sup> are omitted.

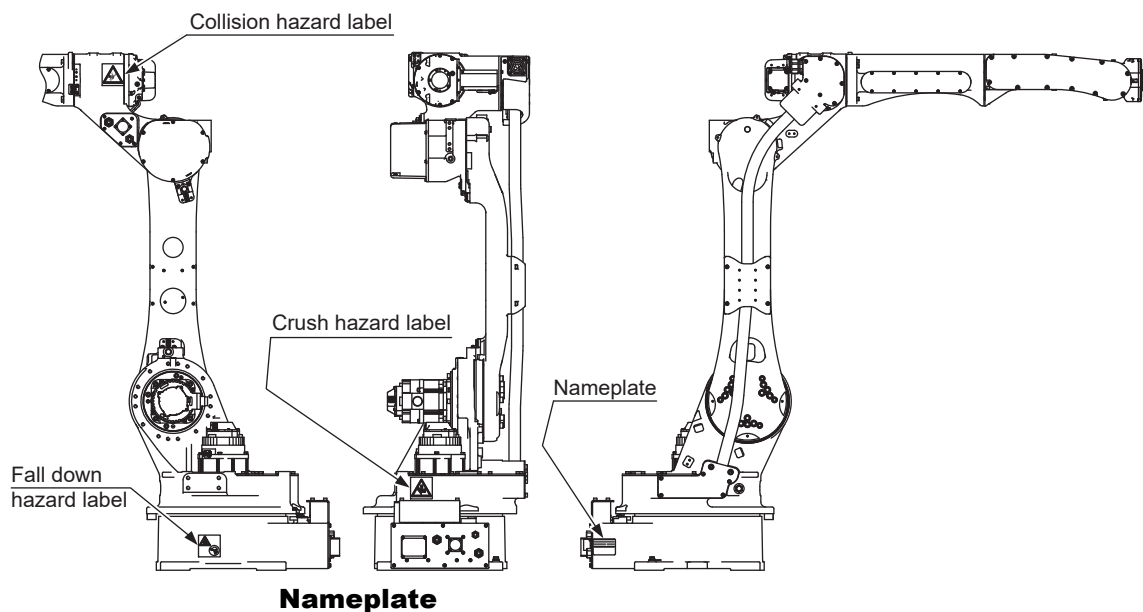
## Explanation of Warning Labels

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



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

### Fall down hazard label



### Description

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

**Collision hazard label****Description**

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

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

**Crush hazard label****Description**

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



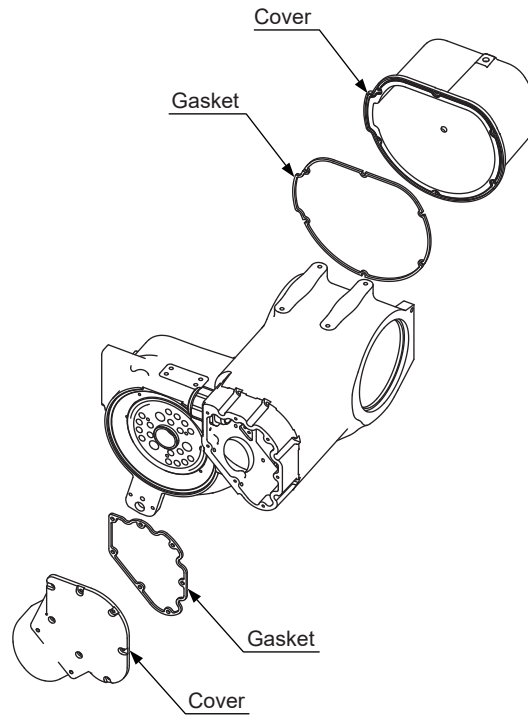
## 2 Notes for Maintenance

### 2.1 Casing

Because the motor and the battery pack are located in the casing, the casing and the mating surfaces between the covers are sealed by using gaskets to prevent the ingress of liquids.

After removing the cover for maintenance, make sure to replace the gasket.

*Fig. 2-1: Sealing Part of the Casing*

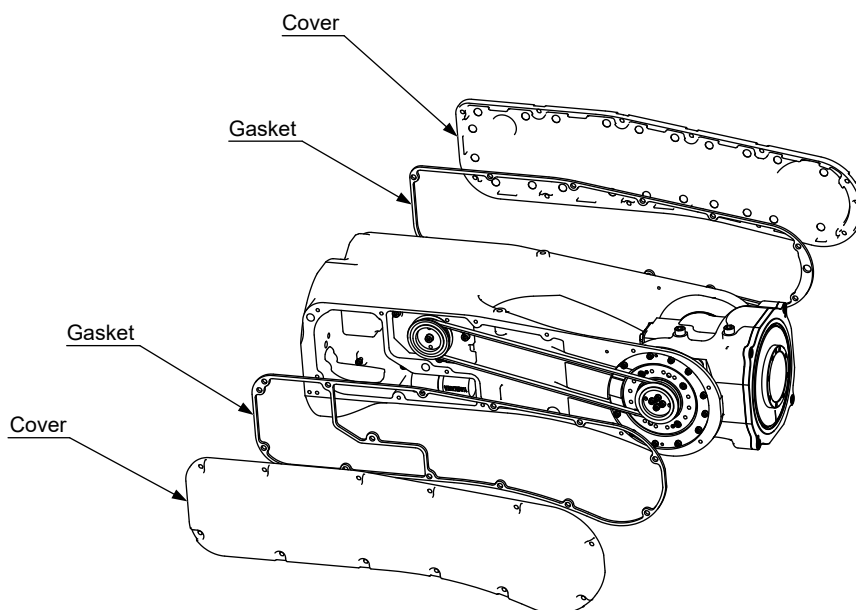


## 2.2 U-Arm

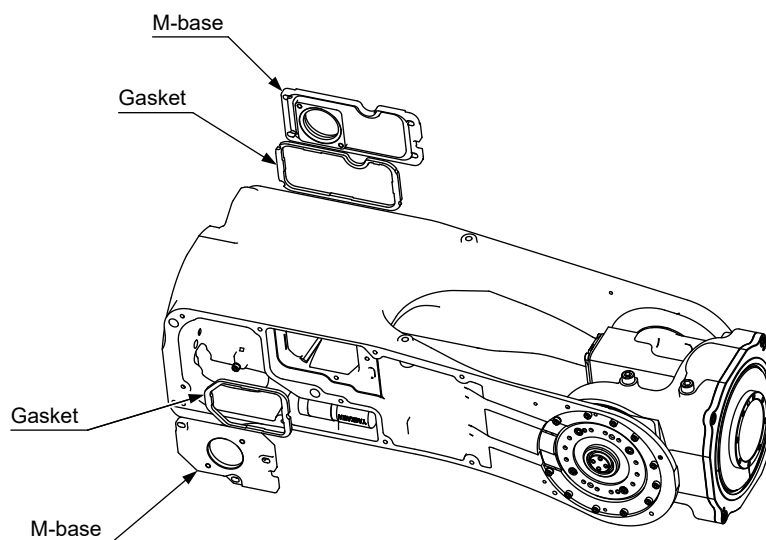
Because the motor, the battery pack, and the belt drive part are located in the U-arm, the mating surfaces between the U-arm and the covers and the mating surfaces between the B-axis and T-axis and the M-bases are sealed by using gaskets to prevent the ingress of liquids.

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

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



*Fig. 2-3: Sealing Part of the M-Base*

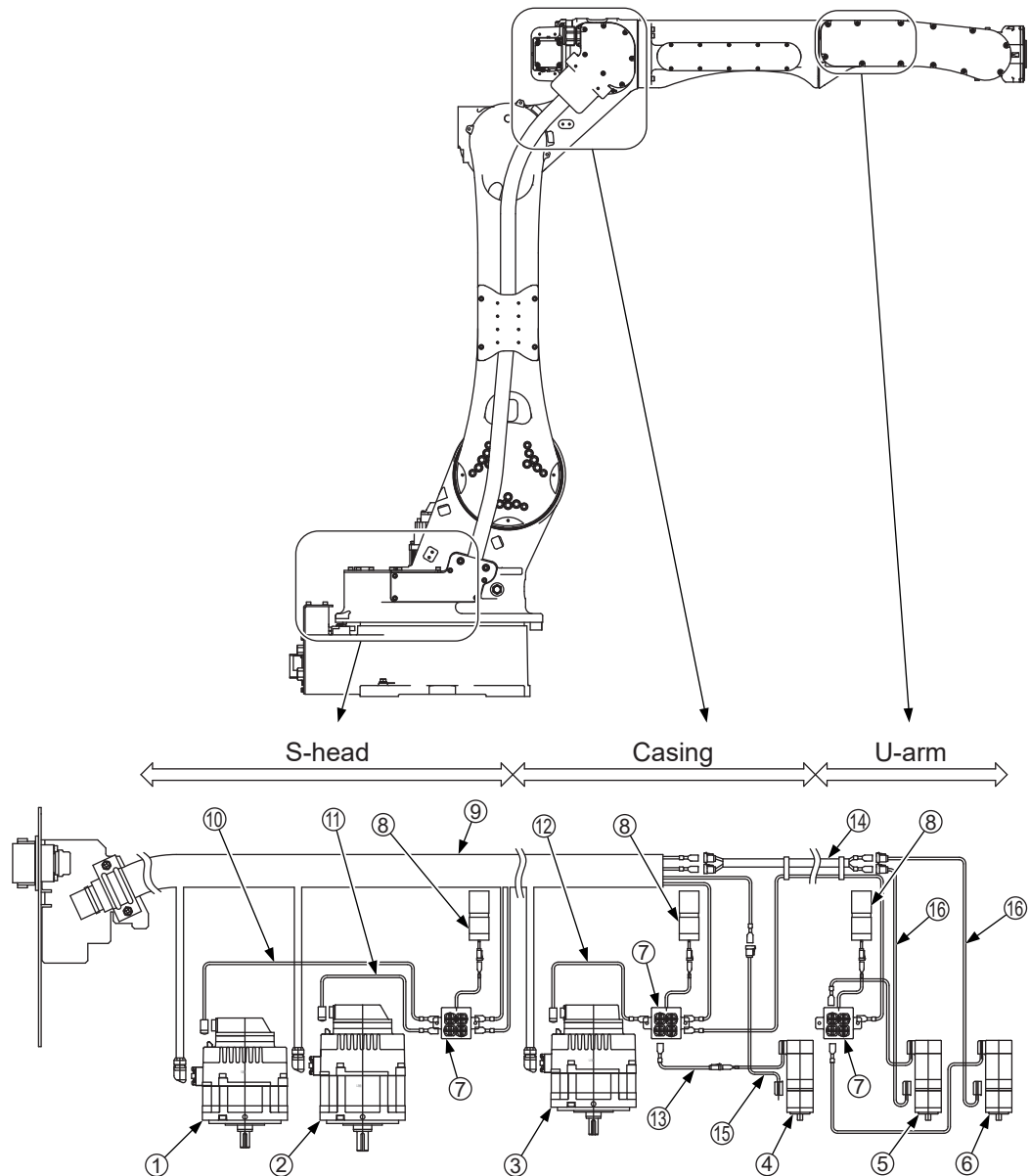


### 2.3 Details of Internal Connections

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. 2-4 "Details of Internal Connections"* and *table 2-1 "Details of Internal Connections"*.

*Fig. 2-4: Details of Internal Connections*



## 2 Notes for Maintenance

### 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 HW1173642-A	1	
⑩	S-axis encoder cable HW1372597-D	1	
⑪	L-axis encoder cable HW1372597-E	1	
⑫	U-axis encoder cable HW1372597-F	1	
⑬	Extension cable for the R-axis encoder HW1372642-D		
⑭	Wire harness for the B-axis and T-axis HW1271723-B	1	
⑮	Power cable for the R-axis HW1373495-A	1	
⑯	Power cable for the B- and T-axis HW1372678-A	2	

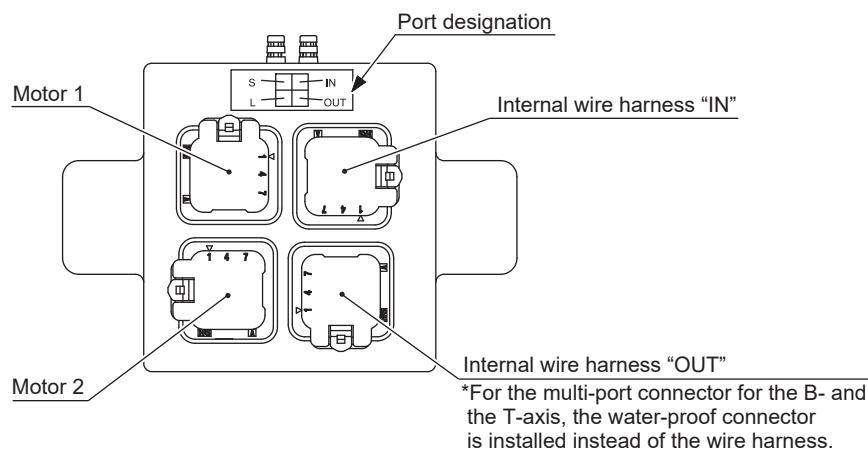
## 2.4 Multi-Port Connector

Three multi-port connectors (refer to *fig. 2-5 "Multi-Port Connector"*) for the encoders of the motors are provided on the manipulator. (For the locations, refer to *fig. 2-7 "Locations of Battery Pack and Multi-Port Connector"*.)

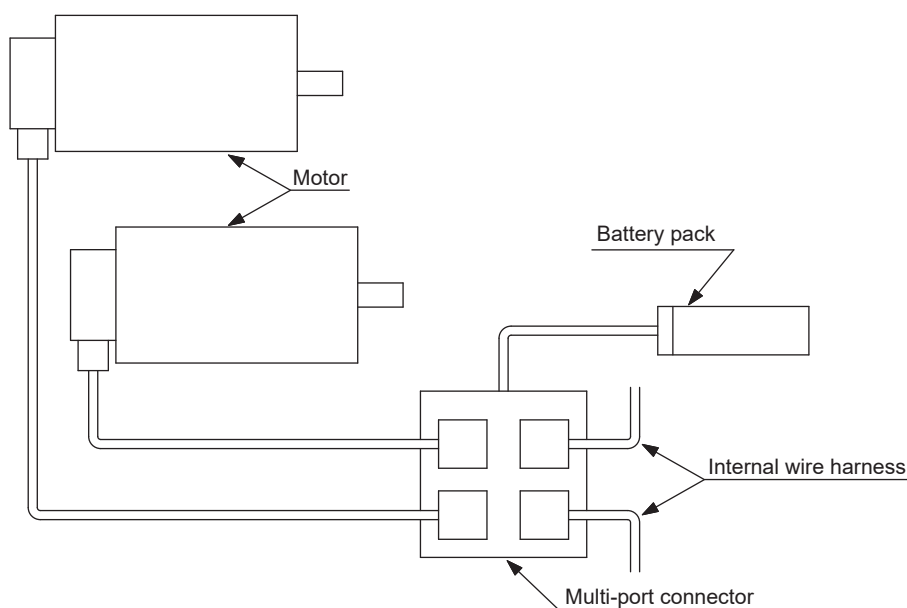
A multi-port connector has four ports: two for the motor and the other two for the internal wire harness. (Refer to *fig. 2-6 "Wiring Connection of Multi-Port Connector"*.)

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. 2-5: Multi-Port Connector*



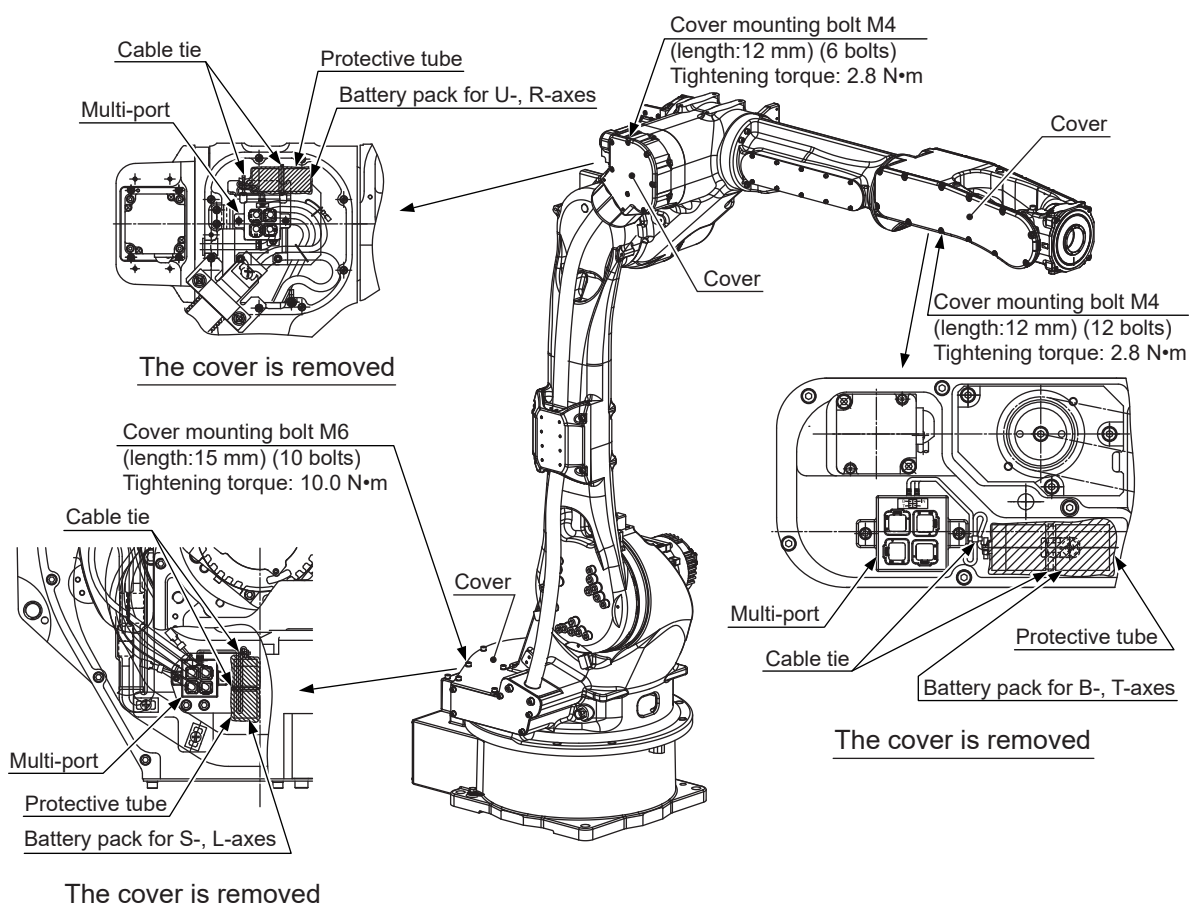
*Fig. 2-6: Wiring Connection of Multi-Port Connector*



## 2 Notes for Maintenance

### 2.4 Multi-Port Connector

Fig. 2-7: Locations of Battery Pack and Multi-Port Connector



## 3 Home Position Return

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:



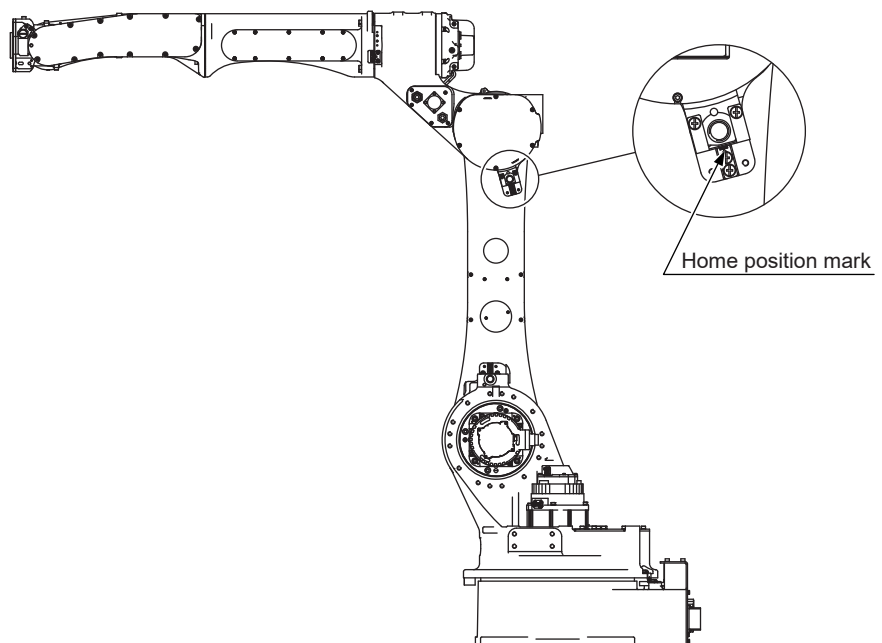
- The motor or absolute encoder is replaced.
- Stored memory is cleared due to the run-out of the internal battery.
- The home position is deviated by hitting the MOTOMAN against a workpiece, etc.
- A main part such as a speed reducer is replaced or disassembled and reassembled.

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 GP25-12 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 Home Position Return

### 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*

Method \ Case	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

Perform the replacement 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 the procedure of home position calibration in “YRC1000 INSTRUCTIONS” (manual No. 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).

### 3 Home Position Return

#### 3.3 Methods for Home Position Return

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

DATA	EDIT	DISPLAY	UTILITY	12						
COMMAND POSITION										
INTR: LINEAR					SPEED: 558 cm/min					
[COMMAND] TOOL: 00					[CURRENT] TOOL: 00					
R1 :S	3458	R1 :S	3458							
L	5638	L	5638							
U	-2989	U	-3067							
R	80	R	80							
B	-10754	B	-10754							
T	-10	T	-10							

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.

DATA	EDIT	DISPLAY	UTILITY	12						
COMMAND POSITION										
INTR: LINEAR					SPEED: 558 cm/min					
[COMMAND] TOOL: 00					[CURRENT] TOOL: 00					
R1 :S	58	R1 :S	58							
L	0	L	0							
U	0	U	-78							
R	0	R	0							
B	-11700	B	-11700							
T	0	T	0							

At this position, perform home position calibration only for the axis whose motor or speed reducer was replaced. For details, refer to the procedure of home position calibration in "YRC1000 INSTRUCTIONS" (manual No. 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

Home Position Return

3.3

Methods for Home Position Return

3.3.2 Using Keys

As a preparation, write down the difference of the pulse numbers between the key position and the factory-set home position of the manipulator on the home position label inside of the YRC1000. If the home position data disappears, 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.

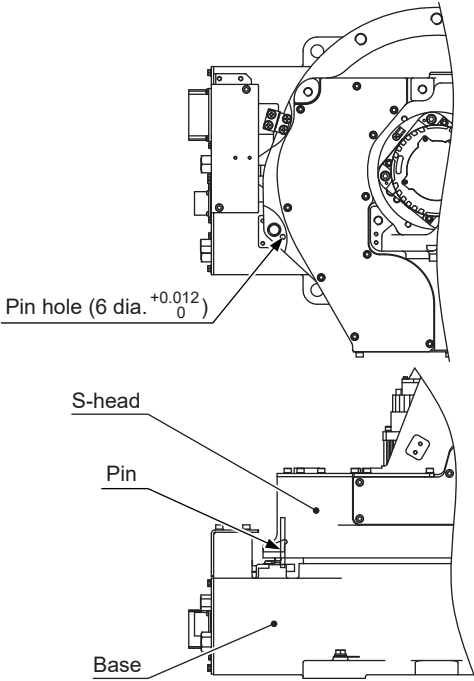
The parts in *table 3-2 “Parts List”* are required. Prepare them beforehand.

Table 3-2: Parts List

Drawing No.	Name	Qty.	Note
HW1408504-1	Pin	1	For S-, L-, U-, R-, and B-axes

1.
- S-Axis Positioning
- As shown in *fig. 3-2 “S-Axis Positioning”*, insert the pin (HW1408504-1) from the pin hole (6 dia.  $\begin{smallmatrix} +0.012 \\ 0 \end{smallmatrix}$ ) on the S-head and perform positioning by using the programming pendant so that the pin fits into the slot of the base.

Fig. 3-2: S-Axis Positioning



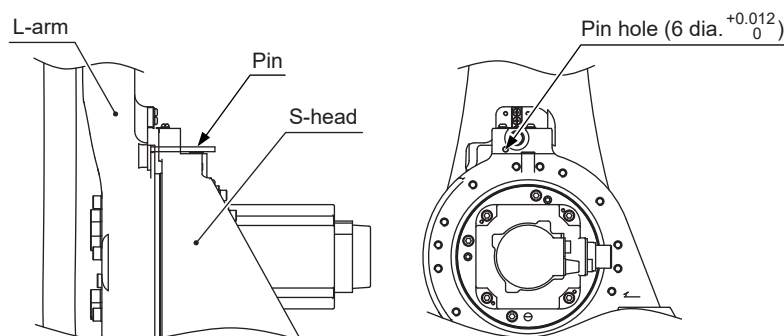
### 3 Home Position Return

#### 3.3 Methods for Home Position Return

#### 2. L-Axis Positioning

As shown in *fig. 3-3 "L-Axis Positioning"*, insert the pin (HW1408504-1) from the pin hole (6 dia.  $^{+0.012}_0$ ) on the S-head and perform positioning by using the programming pendant so that the pin fits into the slot of the L-arm.

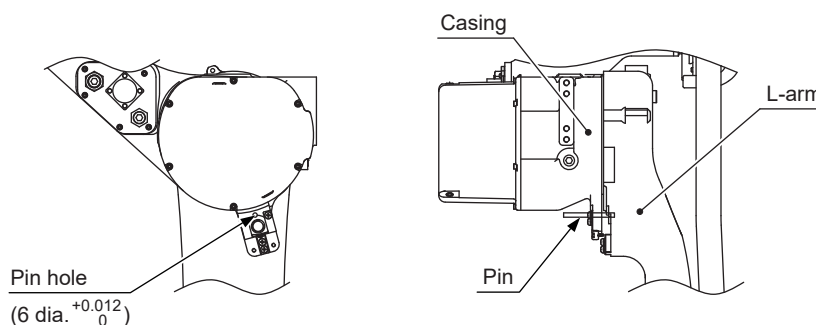
*Fig. 3-3: L-Axis Positioning*



#### 3. U-Axis Positioning

As shown in *fig. 3-4 "U-Axis Positioning"*, insert the pin (HW1408504-1) from the pin hole (6 dia.  $^{+0.012}_0$ ) on the casing and perform positioning by using the programming pendant so that the pin fits into the slot of the L-arm.

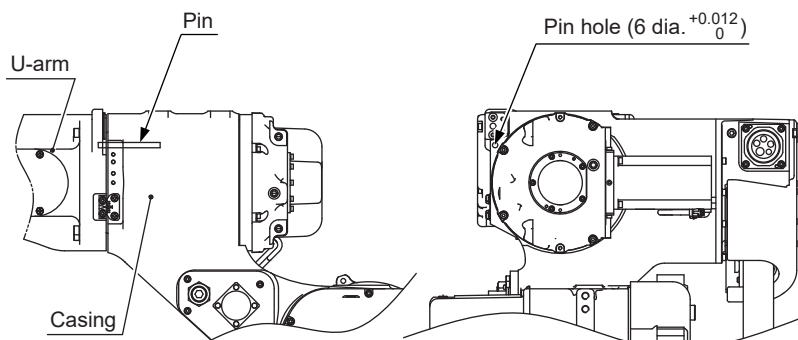
*Fig. 3-4: U-Axis Positioning*



#### 4. R-Axis Positioning

As shown in *fig. 3-5 "R-Axis Positioning"*, insert the pin (HW1408504-1) from the pin hole (6 dia.  $^{+0.012}_0$ ) on the casing and perform positioning by using the programming pendant so that the pin fits into the slot of the U-arm.

*Fig. 3-5: R-Axis Positioning*



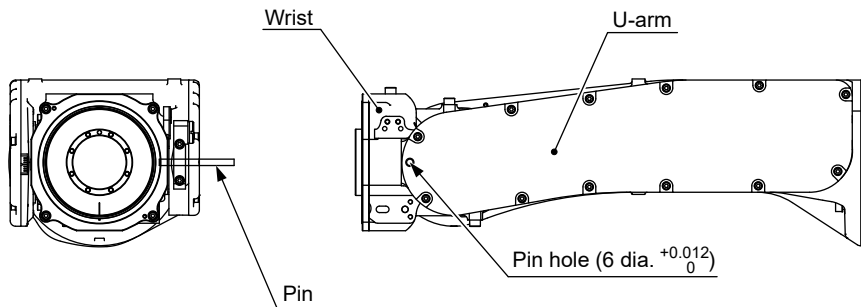
### 3 Home Position Return

#### 3.3 Methods for Home Position Return

##### 5. B-Axis Positioning

As shown in *fig. 3-6 "B-Axis Positioning"*, insert the pin (HW1408504-1) from the pin hole (6 dia.  $^{+0.012}_0$ ) on the U-arm cover and perform positioning by using the programming pendant so that the pin fits into the slot of the wrist.

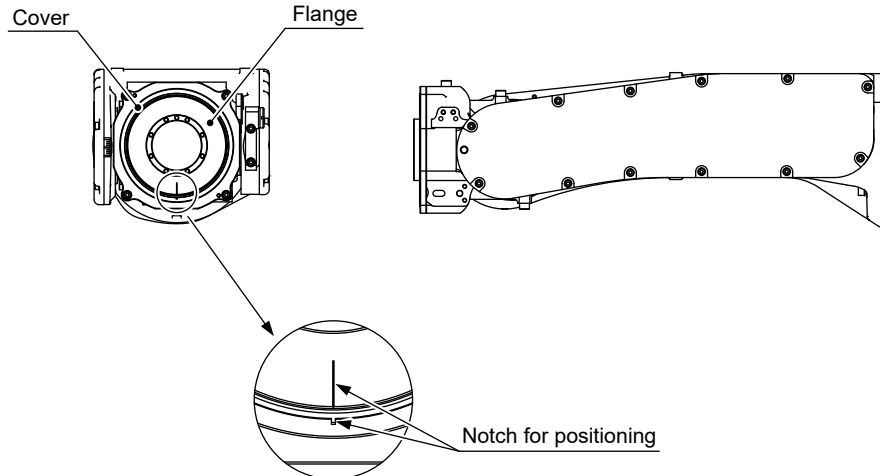
*Fig. 3-6: B-Axis Positioning*



##### 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" (manual No. 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 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.



- 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

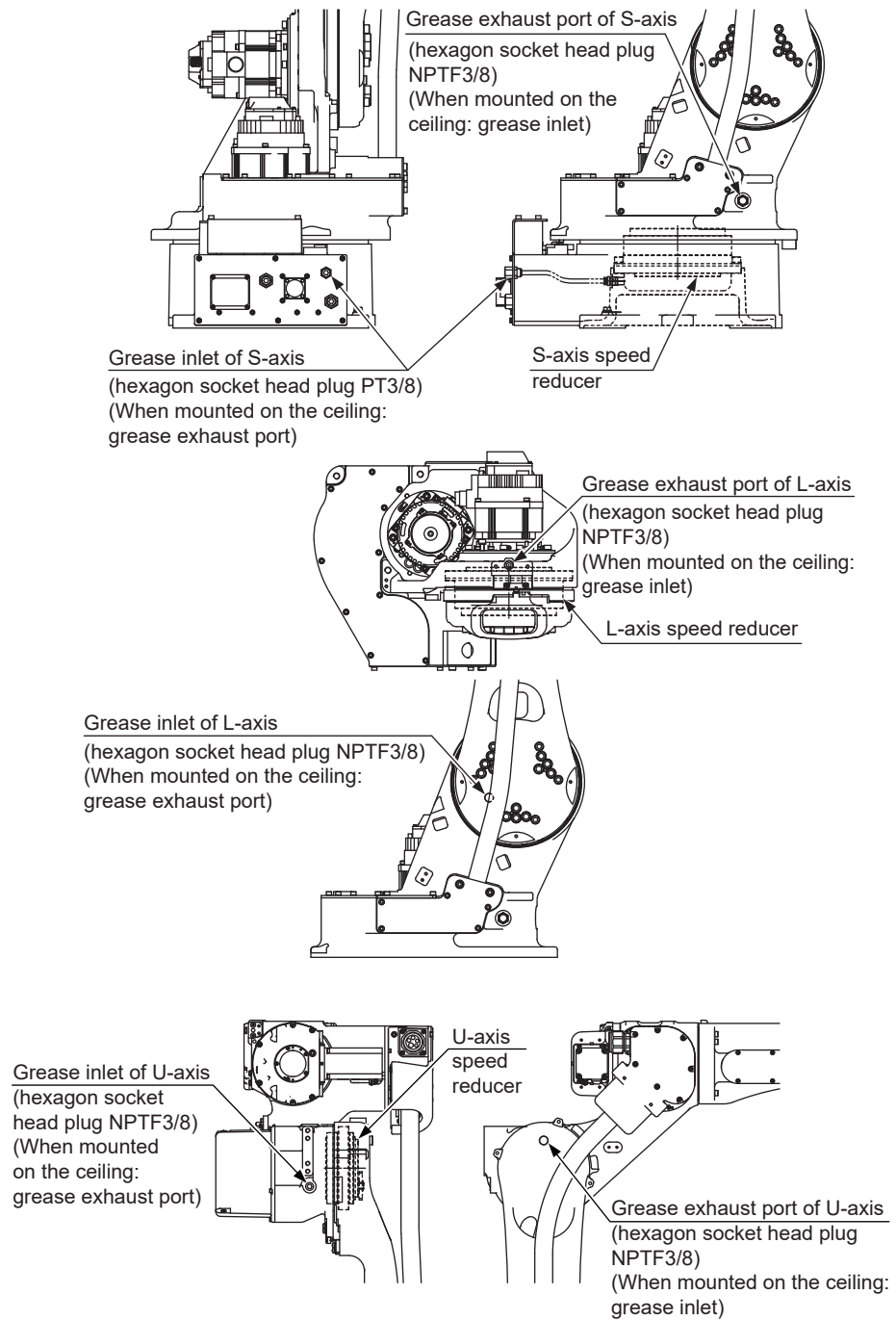
- When operating the manipulator, do not enter into the working area of the manipulator. Injury may result if anyone enter into the working area during the operation.

## 4 Notes on Grease Replenishment/Exchange Procedures

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

#### 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.

4 Notes on Grease Replenishment/Exchange Procedures  
 4.1 Grease Exchange Procedures for S-, L-, U-Axis Speed Reducer

Table 4-1: Recommended Posture for Grease Injection

Mounting Condition	Axis to inject grease	Posture					
		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.

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



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

- Install a grease zerk A-PT3/8 to the grease inlet.  
(The grease zerk is delivered with the manipulator.)
- Inject the grease through the grease inlet using a grease gun
  - Grease type: RV Grease LB00
  - 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. 1650 g
L-axis	Approx. 750 g
U-axis	Approx. 370 g



## 4 Notes on Grease Replenishment/Exchange Procedures

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

#### 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 $\pm 45^\circ$	User-specified
L-axis	L-axis $\pm 45^\circ$	
U-axis	U-axis $\pm 45^\circ$	

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	50 $\pm$ 5	57 $\pm$ 5
L-axis	90 $\pm$ 5	103 $\pm$ 5
U-axis	60 $\pm$ 5	69 $\pm$ 5

## 4 Notes on Grease Replenishment/Exchange Procedures

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

**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	$\pm 45^\circ$	User-specified

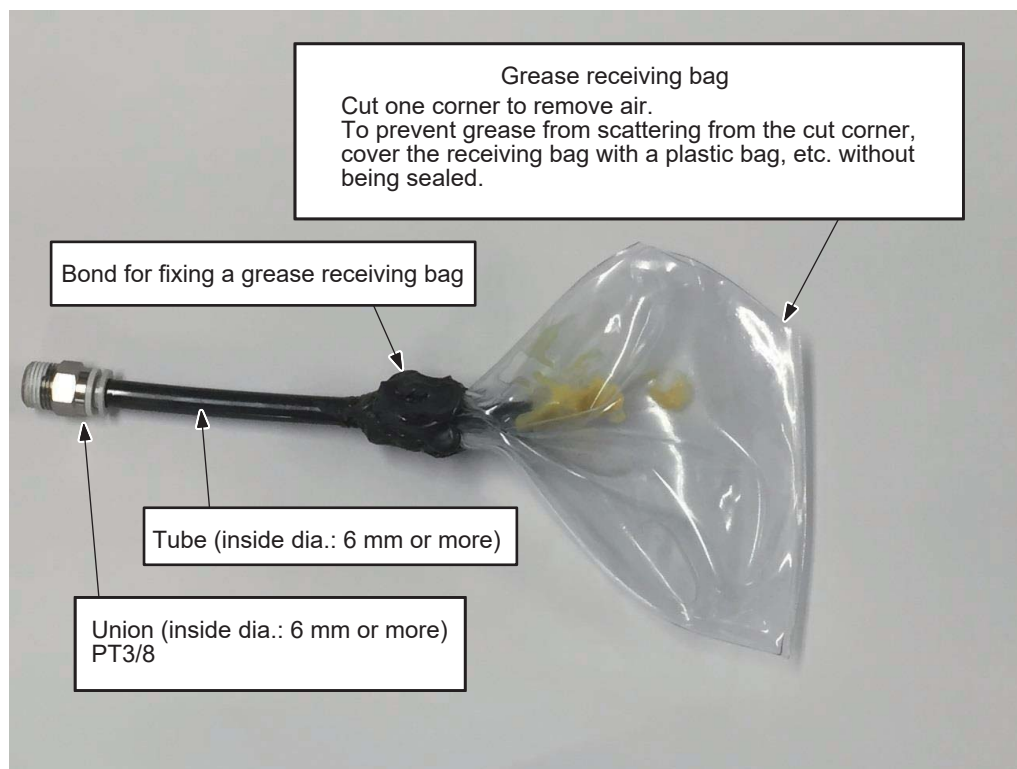
9. For the axis where grease is exchanged, perform a playback operation indicated in *table 4-6 "Running-In Operation for Each Axis"* for running-in the speed reducer with grease.

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	$\pm 45^\circ$	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 exhaust port, and tighten the plug with the tightening torque of 16.5 N·m (1.7 kgf·m).

- 4 Notes on Grease Replenishment/Exchange Procedures
- 4.2 Grease Replenishment Procedures for R-, B-Axis Speed Reducer and R-, T-Axis Gear

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

### 4.2.1 Notes on Grease Replenishment Procedures

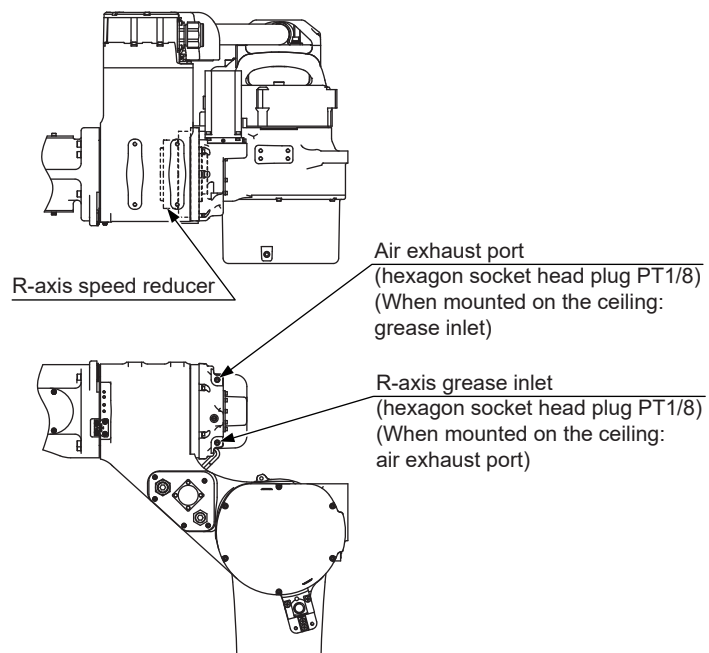
Make sure to follow the instructions listed below at grease exchange. Failure to observe the following notes may result in damage to motor and speed reducer.



- 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.



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 Notes on Grease Replenishment/Exchange Procedures

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

4. Inject the grease through the grease inlet using a grease gun.
  - Grease type: Harmonic Grease SK-1A
  - Amount of grease: 7 g (7.6 cc)

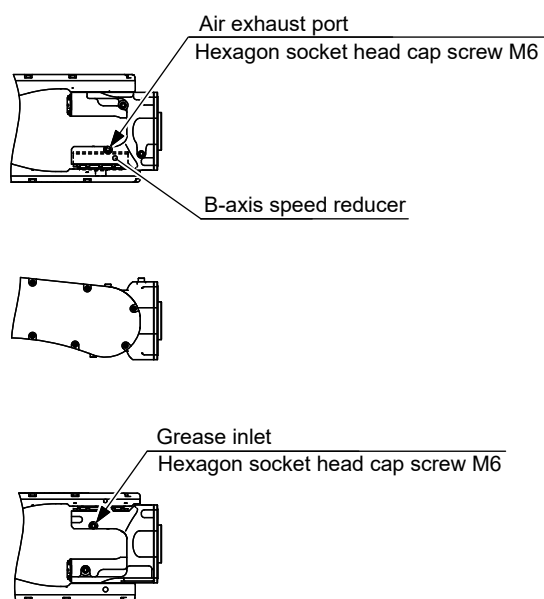


Grease is not exhausted from the air exhaust port.  
Do not inject excessive grease into the grease inlet.

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 (7.6 cc)



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

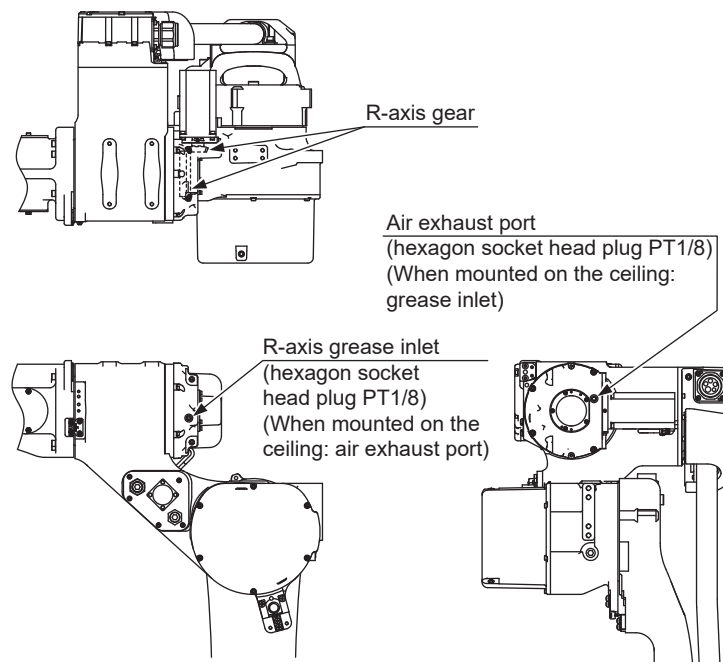
#### 4 Notes on Grease Replenishment/Exchange Procedures

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

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.



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 (3.3 cc) (for replenishment)  
85 g (92.4 cc) (when the speed-reducer is replaced)



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

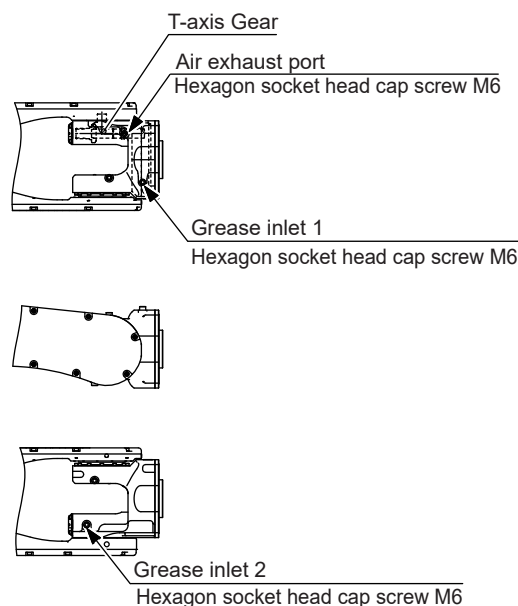
#### 4 Notes on Grease Replenishment/Exchange Procedures

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

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 (2.2 cc)



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.)

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4 Notes on Grease Replenishment/Exchange Procedures  
4.2 Grease Replenishment Procedures for R-, B-Axis Speed Reducer  
and R-, T-Axis Gear

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8. Inject the grease into the grease inlet 2.
- Grease type: Harmonic Grease SK-1A
  - Amount of grease: 2 g (2.2 cc)



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



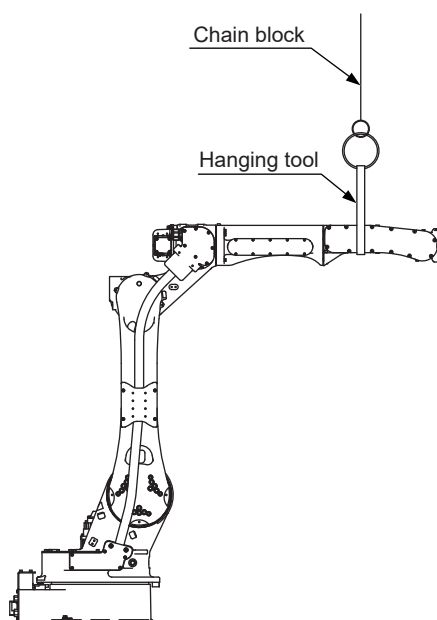
### WARNING

Because the motor is removed, the manipulator cannot keep its posture during the replacement of the motor. When removing the motor at the replacement, hold the falling part by using a hanging tool (e.g., chain block).

Failure to observe this caution may cause a hazardous condition. Replace the motor or speed reducer with due care.

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

*Fig. 5-1: Replacement (Example)*



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

## 5.1 Disassembly/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 screw ⑥, and then remove the key ④ and the input gear ③.
6. When replacing the motor, unscrew the thin head screws ⑦ from the S-axis motor ①.

### ■ Reassembly

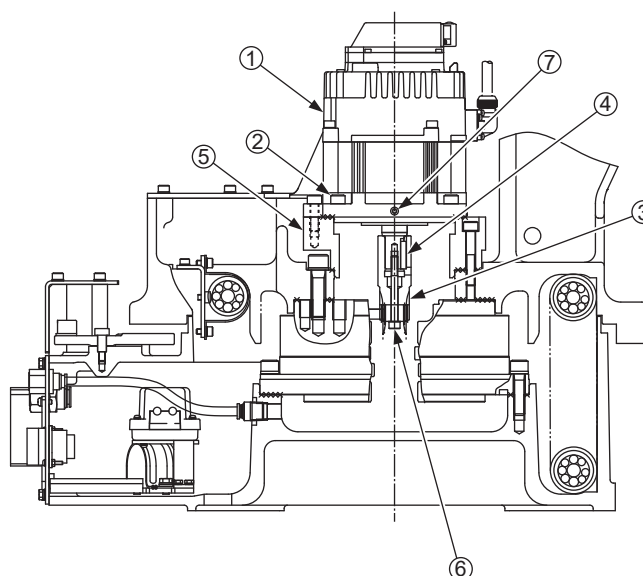
1. When replacing the motor, reinstall the thin head screws ⑦ to the S-axis motor ① and tighten the screws with the tightening torque shown in *table 5-1 "S-Axis Motor Parts Checklist"*.
2. Install the key ④ and the input gear ③ on the S-axis motor ①.  
(The key ④ is provided with the S-axis motor ①.)
3. Attach the conical spring washer to the hexagon socket head cap screw ⑥, 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 "S-Axis Motor Parts Checklist"*.
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 screws ② 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/Reassembly of the S-Axis Motor

*Table 5-1: S-Axis Motor Parts Checklist*

No.	Item	Qty.	Note
①	S-axis motor	1	SGM7G-09APK-YR1*
②	Hexagon socket head cap screw M8 (length: 25 mm) *trivalent chromate"	3	Tightening torque 24.5 N•m
③	Input gear HW0313491-2	1	
④	Key	1	Provided with the motor
⑤	M-base HW1305446-2	1	
⑥	Hexagon socket head cap screw M6 (length: 60 mm) Conical spring washer 2L-6	1 each	Tightening torque 16.5 N•m
⑦	Thin head screw M4 (length: 6 mm) *trivalent chromate"	4	Tightening torque 0.75 N•m

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



5	Disassembly/Reassembly of the Motor
5.2	Disassembly/Reassembly of the L-Axis Motor

## 5.2 Disassembly/Reassembly of the L-Axis Motor

- Refer to *fig. 5-3(a) "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 motor① (fixing bolt: pan-head screw M2) and remove the encoder cable.
3. Turn the connector on the cable side of the power connector for the L-axis motor ①, and then disconnect the power cable.  
If the connector does not turn, remove the connector by holding the connector on the cable side with a pair of plastic pliers etc.
4. Support the L-arm by using a chain block, etc. to prevent it from rotating before removing the L-axis motor ①.
5. Unscrew the hexagon socket head cap screws②, and remove the L-axis motor ① from the M-base ⑤ by using the tapped hole on the motor flange.
6. Unscrew the hexagon socket head cap screw ⑥, and remove the plate ⑦, the key ④, and the input gear ③.

### ■ Reassembly

1. Apply ThreeBond1206C to the contact surfaces among the L-axis motor ①, the plate ⑦, and the input gear ③, and mount the plate ⑦, the key ④, and the input gear ③ on the L-axis motor ①.  
(The key ④ is provided with the L-axis motor ①)
2. Install the conical spring washer to the hexagon socket head cap screw ⑥, 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 "L-Axis Motor Parts Checklist"*.
3. Apply ThreeBond 1206C to the contact surface of the L-axis motor ① and the M-base ⑤, and mount the L-axis motor ① on the M-base ⑤.
4. Tighten the hexagon socket head cap screws ② with the tightening torque shown in *table 5-2*.
5. 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.)
6. Insert the power connector to the L-axis motor ① by aligning the key position as shown in *fig. 5-3(b) "Motor Power Cable"*, and turn the coupling nut of the connector on the cable side until it makes a clicking sound. Confirm that the arrow marks on the connector on the motor side and the connector on the wiring harness side match.
7. Turn ON the YRC1000 power supply.

5 Disassembly/Reassembly of the Motor  
 5.2 Disassembly/Reassembly of the L-Axis Motor

Table 5-2: L-Axis Motor Parts Checklist

No.	Item	Qty.	Note
①	L-axis motor	1	SGM7G-13APK-YR1*
②	Hexagon socket head cap screw M8 (length: 25 mm) *trivalent chromate*	4	Tightening torque 24.5 N•m
③	Input gear HW1304336-1	1	
④	Key	1	Provided with the motor
⑤	M-base HW1305341-2		
⑥	Hexagon socket head cap screw M6 (length: 90 mm) Conical spring washer 2L-6	1 each	Tightening torque 16.5 N•m
⑦	Plate HW0401506-1	1	

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

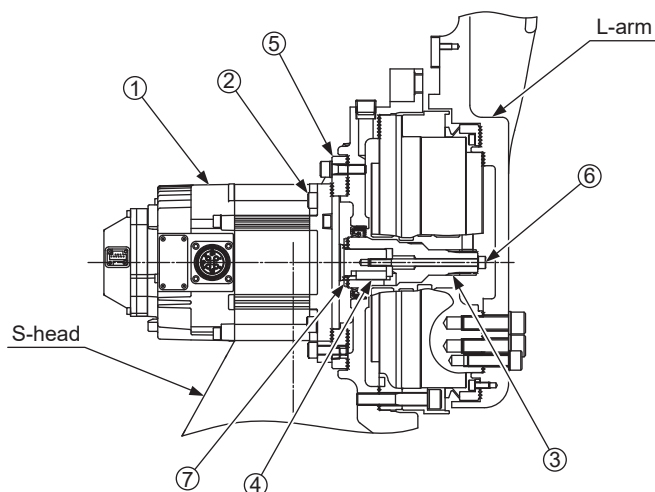
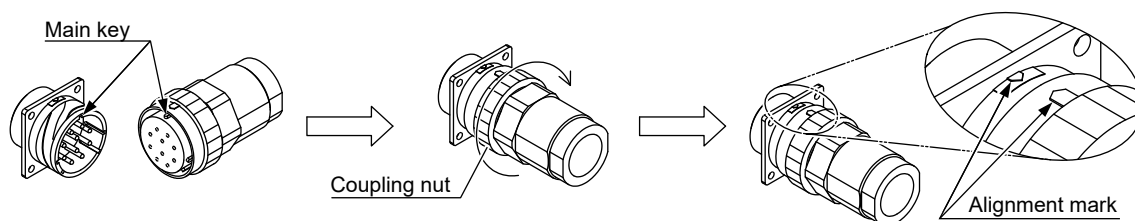


Fig. 5-3(b): Motor Power Cable



- 5 Disassembly/Reassembly of the Motor
- 5.3 Disassembly/Reassembly of the U-Axis Motor

### 5.3 Disassembly/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 motor① (fixing bolt: pan-head screw M2) and remove the encoder cable.
3. Disconnect the connector of the U-axis motor① (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.

#### ■ Reassembly

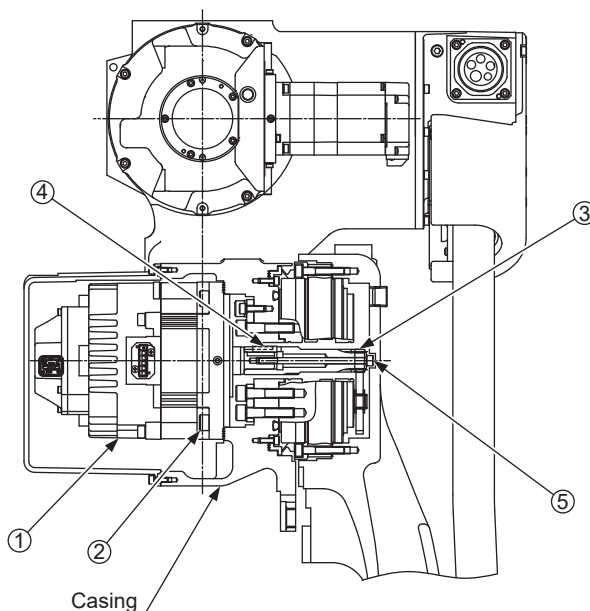
1. Install the key④ and the input gear③ on the U-axis motor①.  
(The key④ is provided with the U-axis motor①.)
2. Install the conical spring washer to the hexagon socket head cap screw⑤, and then apply LOCTITE 243 to the thread part of the screw and tighten the screw with the tightening torque shown in *table 5-3 “U-Axis Motor Parts Checklist”*.
3. Apply ThreeBond 1206C to the mating surface between the U-axis motor① and the casing, and then mount the U-axis motor① onto the casing.
4. Tighten the hexagon socket head cap screws② with the tightening torque shown in *table 5-3*.
5. Connect the encoder cable to the U-axis motor①, 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.)
6. Connect the power cable to the U-axis motor①, 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.)
7. Turn ON the YRC1000 power supply.

5 Disassembly/Reassembly of the Motor  
 5.3 Disassembly/Reassembly of the U-Axis Motor

*Table 5-3: U-Axis Motor Parts Checklist*

No.	Item	Qty.	Note
①	U-axis motor	1	SGM7G-05APK-YR2*
②	Hexagon socket head cap screw M8 (length: 25 mm) *trivalent chromate*	4	Tightening torque 24.5 N•m
③	Input gear HW1304321-1	1	
④	Key	1	Provided with the motor
⑤	Hexagon socket head cap screw M5 (length: 90 mm) Conical spring washer 2L-5	1 each	Tightening torque 10.0 N•m

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



- 5 Disassembly/Reassembly of the Motor
- 5.4 Disassembly/Reassembly of the R-Axis Motor

## 5.4 Disassembly/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 from the extension cable for the R-axis encoder.
5. Unscrew the cap nut of the union ⑫, and pull out the cable of the R-axis motor ① from the union ⑫.  
Remove the gasket of the union ⑫ from the cable of the R-axis motor ① at this time.
6. Unscrew the GT-SA bolts ②, and then remove the R-axis motor unit (the unit including the R-axis motor ①, the gear ⑥, and the M-base ⑤) from the housing.
7. Measure the size of part A of the R-axis motor unit by using a vernier caliper, etc., and take a note of the size. (Approx. 15.6 to 15.65 mm)
8. Unscrew the hexagon socket head cap screw ⑦, and remove the gear ⑥ and the O-ring ④.  
(To secure the gear ⑥, use 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 and the O-ring ⑧ from the M-base ⑤.
10. Remove the shim from the gear ⑥ and the R-axis motor ①.
11. Loosen the connector of the power cable (fixing bolt: pan-head screws M2), and remove the power cable from the R-axis motor ①.
12. If the oil seal ⑪ is replaced, remove the oil seal ⑪ from the M-base ⑤.

### ■ Reassembly

1. If the oil seal ⑪ was removed, mount the oil seal ⑪ on the M-base ⑤.
2. Fit the O-ring ⑧ to the groove of the M-base ⑤.
3. Mount the M-base ⑤ on the R-axis motor ①, and tighten the hexagon socket head cap screws ③ with the tightening torque shown in *table 5-4 "R-Axis Motor Parts Checklist"*.
4. Apply MP-1 grease to the lip part of the oil seal ⑪.
5. Confirm that the O-ring ④ is mounted on the gear ⑥, and mount the gear ⑥ on the R-axis motor ①.  
Make sure not to damage the oil seal ⑪ at this time.
6. Install the conical spring washer to the hexagon socket head cap screw ⑦, and tighten them temporarily with the tightening torque shown in *table 5-4*. (Since this is temporary tightening, it is not necessary to apply LOCTITE 243.)
7. Measure the size of part A of the R-axis motor unit by using a vernier caliper, etc., and take a note of the size. (Approx. 15.6 to 15.65 mm)

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5 Disassembly/Reassembly of the Motor  
 5.4 Disassembly/Reassembly of the R-Axis Motor

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8. By referring to *table 5-5 "Shim for R-Axis Gear"*, select a shim with the same thickness as the gap with the measured size so as to be the same size of the part A which has measured before disassembly. If no shim is matched with the gap, select a thin shim so as not to exceed the size before disassembly.
9. Unscrew the temporarily tightened hexagon socket head cap screw ⑦, and remove the gear ⑥.
10. Mount the selected shim on the shaft of the R-axis motor ①.
11. Install the conical spring washer to the hexagon socket head cap screw ⑦, apply LOCTITE 243 to the thread part, and then tighten them with the tightening torque shown in *table 5-4 "R-Axis Motor Parts Checklist"*.
12. Apply ThreeBond 1206C to the contact surface of the housing on the M-base ⑤, and mount the housing on the M-base ⑤.
13. Tighten the GT-SA bolts ② with the tightening torque shown in *table 5-4*.
14. Connect the power cable with the R-axis motor ①, and tighten the connector fixing bolt (pan-head sems screw M2) with the tightening torque of 0.15 N·m.  
(The connector fixing bolt is provided with the connector.)
15. Put the encoder cable and the power cable of the R-axis motor ① through the gasket and the cap nut of the union ⑫, and then insert the cable to the union ⑫ to tighten the cap nut.
16. Connect the power cable of the R-axis motor ① with the internal wiring harness. Connect the encoder cable of the R-axis motor ① with the extension cable for the R-axis encoder.
17. Enclose the connecting part of the power cable in the protective tube and secure it by using the cable tie, and then put it into the casing.
18. Mount the cover ⑨ by using the GT-SA bolts ⑩.
19. Tighten the GT-SA bolts ⑩ with the tightening torque shown in *table 5-4*.
20. Turn ON the YRC1000 power supply.



5 Disassembly/Reassembly of the Motor  
 5.4 Disassembly/Reassembly of the R-Axis Motor

Table 5-4: R-Axis Motor Parts Checklist

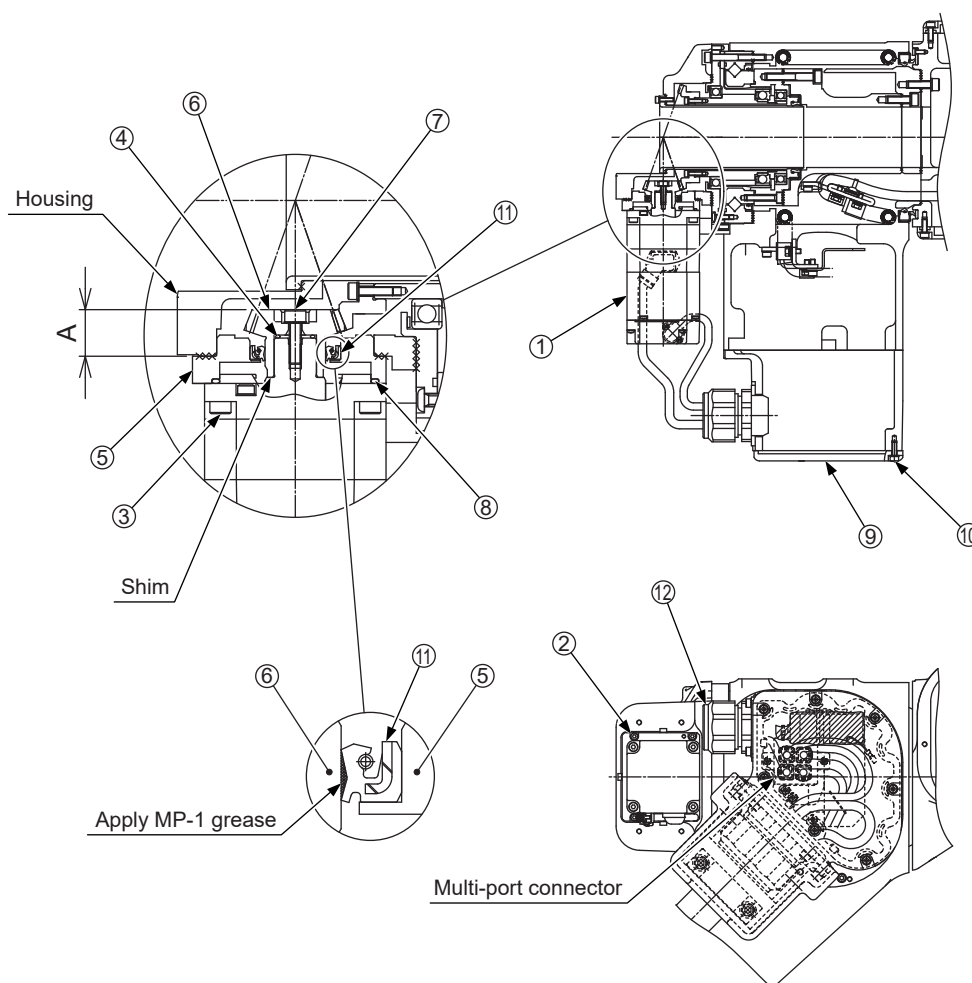
No.	Item	Qty.	Note
①	R-axis motor	1	SGM7J-02APK-YR1*
②	GT-SA bolt M3 (length: 12 mm)	4	Tightening torque 1.4 N•m
③	Hexagon socket head cap screw M4 (length: 12 mm) *trivalent chromate*	4	Tightening torque 2.8 N•m
④	O-ring S10	1	
⑤	M-base HW1408198-1	1	
⑥	Gear HW1304320-2	1	This gear is set with HW1304319-1
⑦	Hexagon socket head cap screws M4 (length: 14 mm) Conical spring washer 2L-4	1 each	Tightening torque 4.8 N•m
⑧	O-ring S50	1	
⑨	Cover HW1101193-1	1	
⑩	GT-SA bolt M4 (length: 12 mm)	7	Tightening torque 2.8 N•m
⑪	Oil seal TC20305*FKM*	1	
⑫	Union	1	C2MBG24-6+7×3P+9

Table 5-5: Shim for R-Axis Gear

Thickness of shim (mm)	Type
0.1	HW2402219-2
0.15	HW2402219-5
0.2	HW2402219-3
0.3	HW2402219-4

5 Disassembly/Reassembly of the Motor  
 5.4 Disassembly/Reassembly of the R-Axis Motor

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



After replacing the R-axis motor, check if the R-axis makes no abnormal noise during the 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	Disassembly/Reassembly of the Motor
5.5	Disassembly/Reassembly of B-Axis Motor

## 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 bolts ⑩, and then remove the cover ⑨.
4. Remove the gasket ⑪ from the cover ⑨.
5. Disconnect the power cable of the B-axis motor ① from the internal wiring harness for the B- and T-axes, and disconnect the encoder cable of the B-axis motor ① from the port “B” of the multi-port connector.
6. Unscrew the GT-SA bolts ⑥, and then remove the B-axis motor ① unit (the unit including the B-axis motor ①, the pulley ③, and the M-base ⑤) from the U-arm.
7. Unscrew the hexagon socket head cap screw ④, and then remove the pulley ③. (To secure the pulley ③, use the two grooves on the surface of the pulley ③.)
8. Unscrew the GT-SA bolts ②, and then remove the B-axis motor ① and the O-ring ⑦.
9. Remove the gasket ⑧ from the M-base ⑤.
10. Disconnect the connector of the B-axis motor ① (fixing bolt: pan-head screws M2), and then remove the power cable.

### ■ Reassembly

1. Connect the power cable to the B-axis motor ①, 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 gasket ⑧ into the groove of the M-base ⑤.
3. Fit the O-ring ⑦ to the B-axis motor ①.
4. Mount the B-axis motor ① onto the M-base ⑤. Make sure not to damage the O-ring ⑦ at this time. Tighten the GT-SA bolts ② with the tightening torque shown in *table 5-6 “B-Axis Motor Parts Checklist”*.
5. Mount the pulley ③ to the B-axis motor ①.
6. Install the conical spring washer to the hexagon socket head cap screw ④, 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-base ⑤ onto the U-arm, and then put the belt on the pulley ③.
8. Tighten the GT-SA bolts ⑥ 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 motor ① to the internal wiring harness for the B- and T-axes. Connect the encoder cable of the B-axis motor ① to the port “B” of the multi-port connector.

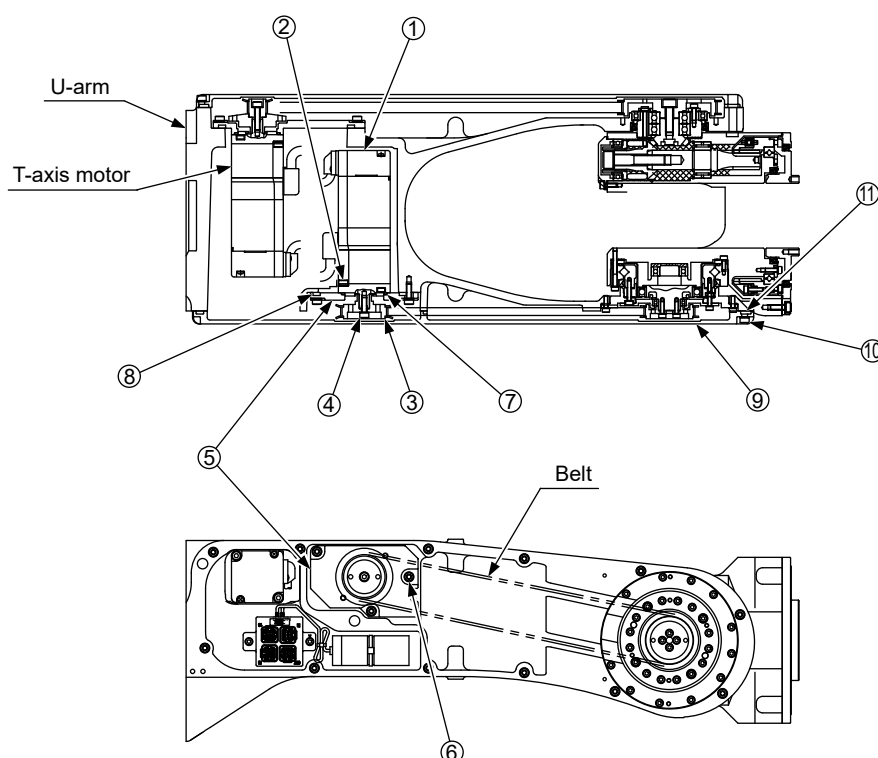
5 Disassembly/Reassembly of the Motor  
 5.5 Disassembly/Reassembly of B-Axis Motor

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	Disassembly/Reassembly of the Motor
5.6	Disassembly/Reassembly of T-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 bolts<sup>⑪</sup>, and then remove the cover<sup>⑩</sup>.
4. Remove the gasket<sup>⑫</sup> from the cover<sup>⑩</sup>.
5. Unscrew the GT-SA bolts<sup>⑭</sup>, and then remove the cover<sup>⑬</sup>.
6. Remove the gasket<sup>⑮</sup> from the cover<sup>⑬</sup>.
7. Disconnect the power cable of the T-axis motor<sup>①</sup> from the internal wiring harness for the B- and T-axes, and disconnect the encoder cable of the T-axis motor<sup>①</sup> from the port “T” of the multi-port connector.
8. Unscrew the GT-SA bolts<sup>⑦</sup>, and then remove the T-axis motor<sup>①</sup> unit (the unit including the T-axis motor<sup>①</sup>, the pulley<sup>③</sup>, the flywheel<sup>④</sup>, and the M-base<sup>⑥</sup>) and the belt from the U-arm.
9. Unscrew the hexagon socket head cap screw<sup>⑤</sup>, and then remove the pulley<sup>③</sup> and the flywheel<sup>④</sup>. (To secure the flywheel<sup>④</sup>, use the two slots on the surface of the flywheel<sup>④</sup>.)
10. Unscrew the GT-SA bolts<sup>②</sup>, and then remove the T-axis motor<sup>①</sup> and the O-ring<sup>⑧</sup>.
11. Remove the gasket<sup>⑨</sup> from the M-base<sup>⑥</sup>.
12. Disconnect the connector of the T-axis motor<sup>①</sup> (fixing bolt: pan-head sems screw M2), and then remove the power cable.

### ■ Reassembly

1. Connect the power cable to the T-axis motor<sup>①</sup>, 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 gasket<sup>⑨</sup> into the groove of the M-base<sup>⑥</sup>.
3. Fit the O-ring<sup>⑧</sup> to the T-axis motor<sup>①</sup>.
4. Mount the T-axis motor<sup>①</sup> onto the M-base<sup>⑥</sup>. Make sure not to damage the O-ring<sup>⑧</sup> at this time. Tighten the GT-SA bolts<sup>②</sup> with the tightening torque shown in *table 5-7 “T-Axis Motor Parts Checklist”*.
5. Mount the flywheel<sup>④</sup> and the pulley<sup>③</sup> to the T-axis motor<sup>①</sup>.
6. Install the conical spring washer to the hexagon socket head cap screw<sup>⑤</sup>, 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-base<sup>⑥</sup> onto the U-arm, and then put the belt on the pulley<sup>③</sup>.
8. Tighten the GT-SA bolts<sup>⑦</sup> 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”*.)

5 Disassembly/Reassembly of the Motor  
 5.6 Disassembly/Reassembly of T-Axis Motor

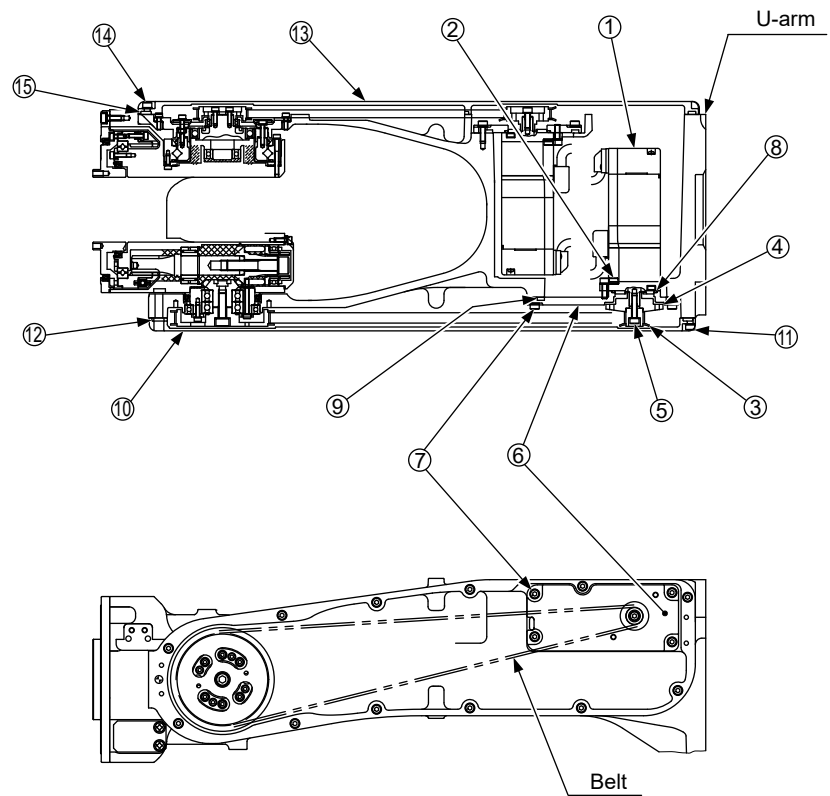
9. Connect the power cable of the T-axis motor ① to the internal wiring harness for the B- and T-axes. Connect the encoder cable of the T-axis motor ① to the port "T" of the multi-port connector.
10. Enclose the connecting part of the power cable's connector in the protective tube, and then put it into the space between the T-axis motor and the U-arm.
11. Fit the gasket ⑫ in the groove of the cover ⑩.
12. Mount the cover ⑩ by using the GT-SA bolts ⑪, 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	

5 Disassembly/Reassembly of the Motor  
5.6 Disassembly/Reassembly of T-Axis Motor

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



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

## 6 Disassembly/Reassembly of Speed Reducer



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 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. Turn OFF the YRC1000 power supply.
2. Perform “Disassembly” in chapter 5.1 “Disassembly/Reassembly of the S-Axis Motor” and remove the S-axis motor.
3. Unscrew the hexagon socket head cap screws③, and remove the M-base⑥ by using the stud bolt.
4. Unscrew the hexagon socket head cap screws⑦. Then, by using the chain block, lift up the upper part of the manipulator including the S-head, and put it aside from the base.  
(When putting it down, put it on a base and handle it with care not to pinch its internal lead.)
5. Unscrew the hexagon socket head cap screws②, and remove the speed reducer① by using the stud bolt.
6. Clean off the accumulated grease inside the base.

#### ■ Reassembly

1. Apply ThreeBond 1206C to the surface of the base where the speed reducer① will be mounted, and then mount the speed reducer① onto the base.
2. Install the conical knurled spring washers to the hexagon socket head cap screws②, and tighten them with the tightening torque shown in table 6-1 “S-Axis Speed Reducer Parts Checklist”.
3. Apply ThreeBond 1206C to the surface of the S-head where the speed reducer① will be mounted.
4. Lift the S-head by using the chain block, and mount it on the speed reducer①.
5. Install the conical spring washers to the hexagon socket head cap screws⑦, apply ThreeBond 1206C to the thread part, and then tighten them with the tightening torque shown in table 6-1.
6. Apply ThreeBond 1206C to the surface of the M-base⑥ where the S-head will be mounted.



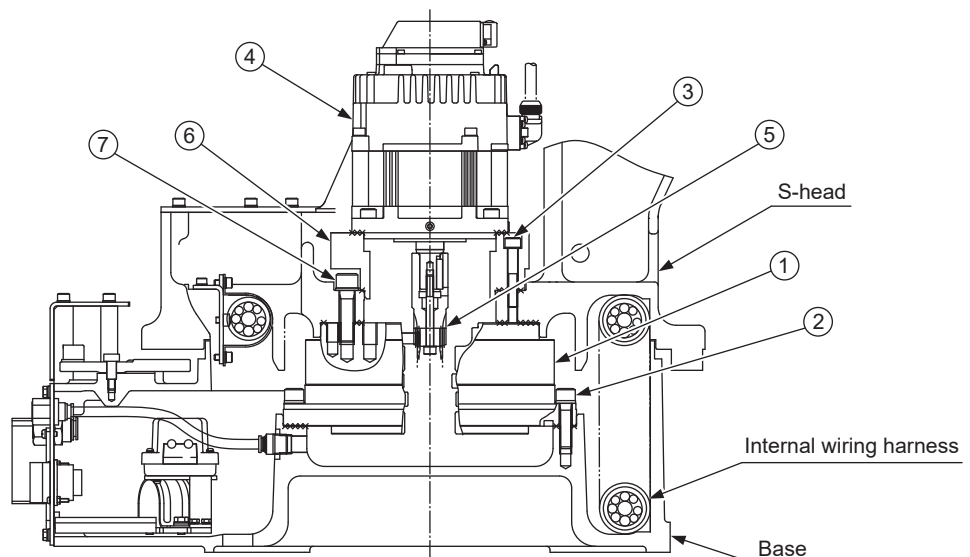
6 Disassembly/Reassembly of Speed Reducer  
 6.1 Disassembly/Reassembly of S-Axis Speed Reducer

7. Mount the M-base ⑥ on the S-head, install the conical spring washers to the hexagon socket head cap screws ③, and then tighten them with the tightening torque shown in *table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
8. Perform "Reassembly" in *chapter 5.1* and install the S-axis motor.  
 (When replacing the speed reducer ①, replace the input gear ⑤, too.)
9. Perform *chapter 4.1.2 "Grease Exchange Procedure"* and replenish grease (RV Grease LB00).
10. Turn ON the YRC1000 power supply.

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

No.	Item	Qty.	Note
①	Speed reducer HW0387753-B	1	
②	Hexagon socket head cap screw M10 (length: 40 mm) Conical knurled spring washer SW-2H-10	16 each	Tightening torque 82.0 N•m
③	Hexagon socket head cap screw M8 (length: 50 mm) Conical spring washer 2L-8	3 each	Tightening torque 24.5 N•m
④	S-axis motor	1	SGM7G-05APK-YR1*
⑤	Input gear HW0313491-2	1	
⑥	M-base HW1305446-2	1	
⑦	Hexagon socket head cap screw M12 (length: 45 mm) Conical spring washer 2H-12	8 each	Tightening torque 142 N•m

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



- 6 Disassembly/Reassembly of Speed Reducer
- 6.2 Disassembly/Reassembly of L-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/Reassembly of the L-Axis Motor”* and remove the L-axis motor ③.
4. Unscrew the hexagon socket head cap screws ⑤ and ⑥, and remove the L-arm by using the stud bolt.
5. Remove V-ring ⑦.
6. Unscrew the hexagon socket head cap screws ②, and remove the housing ⑧ by using the stud bolt.
7. Remove the speed reducer ① by using the stud bolt.

### ■ Reassembly

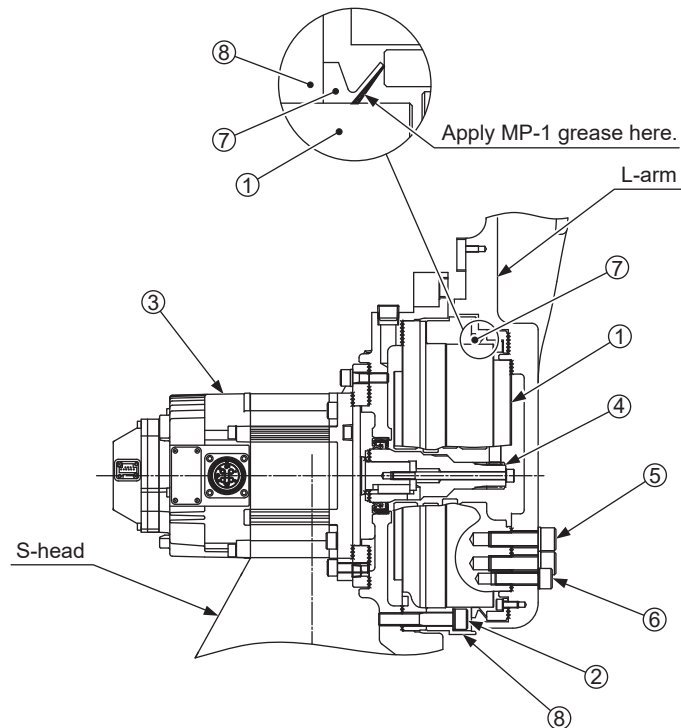
1. Apply ThreeBond 1206C to the surface of the speed reducer ① which will face the S-head, and then mount the speed reducer ① onto the S-head.
2. Mount the housing ⑧ on the speed reducer ①.
3. Install the conical knurled spring washers to the hexagon socket head cap screws ②, and tighten them with the tightening torque shown in *table 6-2 “L-Axis Speed Reducer Parts Checklist”*.
4. Apply MP-1 grease to the lip part of the V-ring ⑦.
5. Insert the V-ring ⑦ to the speed reducer ①.
6. Apply ThreeBond 1206C to the surface of the speed reducer ① where the L-arm will be mounted, and then mount the L-arm on the speed reducer ①.
7. Install the conical spring washers to the hexagon socket head cap screws ⑤ and ⑥, and tighten them with the tightening torque shown in *table 6-2*.
8. Perform *“Reassembly”* in *chapter 5.2* and install the L-axis motor ③. (When replacing the speed reducer ①, replace the input gear ④, too.)
9. Perform *chapter 4.1.2 “Grease Exchange Procedure”* and replenish grease (RV Grease LB00).
10. Turn ON the YRC1000 power supply.

6 Disassembly/Reassembly of Speed Reducer  
 6.2 Disassembly/Reassembly of L-Axis Speed Reducer

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

No.	Item	Qty.	Note
①	Speed reducer HW0387753-G	1	
②	Hexagon socket head cap screw M10 (length: 60 mm) Conical knurled spring washer SW-2H-10	16 each	Tightening torque 82.0 N•m
③	L-axis motor	1	SGM7G-13APK-YR1*
④	Input gear HW1304336-1	1	
⑤	Hexagon socket head cap screw M12 (length: 40 mm) Conical spring washer 2H-12	12 each	Tightening torque 142 N•m
⑥	Hexagon socket head cap screw M10 (length: 35 mm) Conical spring washer 2L-10	6 each	Tightening torque 82.0 N•m
⑦	V-ring VR199A	1	
⑧	Housing HW1308023-1	1	

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



- 6 Disassembly/Reassembly of Speed Reducer
- 6.3 Disassembly/Reassembly of U-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/Reassembly of the U-Axis Motor”* and remove the U-axis motor ⑤.
4. Unscrew the hexagon socket head cap screws ③, and remove the U-arm unit by using the stud bolt.
5. Remove V-ring ⑦.
6. Unscrew the hexagon socket head cap screws ②, and remove the housing ⑧ by using the stud bolt.
7. Remove the speed reducer ① by using the stud bolt.

#### ■ Reassembly

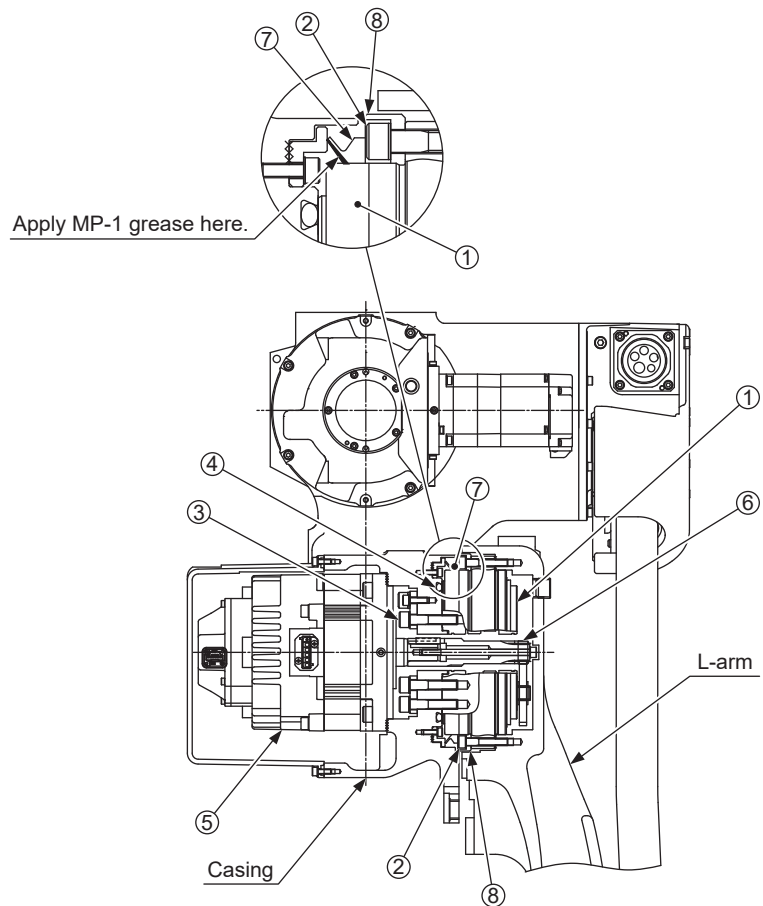
1. Apply ThreeBond 1206C to the surface of the speed reducer ① which will face the L-arm, and then mount the speed reducer ① onto the L-arm.
2. Mount the housing ⑧ on the speed reducer ①.
3. Install the conical knurled spring washers to the hexagon socket head cap screws ②, and tighten them with the tightening torque shown in *table 6-3 “U-Axis Speed Reducer Parts Checklist”*.
4. Apply MP-1 grease to the lip part of the V-ring ⑦.
5. Insert the V-ring ⑦ to the speed reducer ①.
6. Fit the O-ring ④ to the groove of the casing, and mount the U-arm unit on the speed reducer ①.
7. Install the conical knurled spring washers to the hexagon socket head cap screws ③, and tighten them with the tightening torque shown in *table 6-3*.
8. Perform “Reassembly” in *chapter 5.3* and install the U-axis motor ⑤. (When replacing the speed reducer ①, replace the input gear ⑥, too.)
9. Perform *chapter 4.1.2 “Grease Exchange Procedure”* and replenish grease (RV Grease LB00).
10. Turn ON the YRC1000 power supply.

6 Disassembly/Reassembly of Speed Reducer  
 6.3 Disassembly/Reassembly of U-Axis Speed Reducer

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

No.	Item	Qty.	Note
①	Speed reducer HW0386621-C	1	
②	Hexagon socket head cap screw M6 (length: 35 mm) Conical knurled spring washer SW-2H-6	16 each	Tightening torque 16.5 N•m
③	Hexagon socket head cap screw M8 (length: 40 mm) Conical knurled spring washer SW-2H-8	18 each	Tightening torque 40.0 N•m
④	O-ring P105	1	
⑤	U-axis motor	1	SGM7G-05APK-YR2*
⑥	Input gear HW1304321-1	1	
⑦	V-ring VR140A	1	
⑧	Housing HW1308012-1	1	

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



- 6 Disassembly/Reassembly of Speed Reducer
- 6.4 Disassembly/Reassembly of R-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/Reassembly of the R-Axis Motor"* and remove the R-axis motor cable and the 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 Unit"* and remove the wrist unit.
6. Unscrew the hexagon socket head cap screws ⑩, and then remove the shaft ⑮ by using the stud bolt.
7. Unscrew the GT-SA bolts ⑫, and then remove the shaft ⑪ by using the stud bolt.
8. Unscrew the GT-SA bolts ⑩, and then remove the housing ⑨ and the R-axis motor unit by using the stud bolt.
9. Unscrew the hexagon socket head cap screws ⑧, and then remove the gear ⑦.  
(Secure the output axis to prevent it from rotating.)
10. By using a vernier caliper, etc., measure the size of the part B of the speed reducer ① and the shim, and take a note of the size.  
(Approx. 14.1 to 14.2 mm)
11. Unscrew the hexagon socket head cap screws ②, and then remove the unit of the speed reducer ① and the shafts ④ and ⑥ at one time by using stud bolts.  
For the locations of the tapped holes on the speed reducer ①, refer to *fig. 6-4*.
12. Unscrew the hexagon socket head cap screws ⑤, and then remove the shaft ⑥ by using the stud bolt.
13. Unscrew the hexagon socket head cap screws ③, and then remove the shaft ④ by using the stud bolt.
14. To replace the oil seal ⑬, remove the oil seal ⑬ from the shaft ④.
15. To replace the oil seal ⑭, remove the oil seal ⑭ from the casing.

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## 6 Disassembly/Reassembly of Speed Reducer

### 6.4 Disassembly/Reassembly of R-Axis Speed Reducer

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#### ■ Reassembly

1. If the oil seal<sup>⑭</sup> was removed, mount the oil seal<sup>⑭</sup> on the casing.
2. If the oil seal<sup>⑬</sup> was removed, mount the oil seal<sup>⑬</sup> on the shaft<sup>④</sup>.
3. Apply the MP-1 grease to the lip part of the oil seal<sup>⑬</sup>.
4. Apply ThreeBond 1206C to the surface of the speed reducer<sup>①</sup> where the shaft<sup>④</sup> will be mounted, and then mount the shaft<sup>④</sup>.
5. Install the conical spring washers to the hexagon socket head cap screws <sup>③</sup>, and tighten them with the tightening torque shown in *table 6-4 "R-Axis Speed Reducer Parts Checklist"*.
6. Apply ThreeBond 1206C to the surface of the shaft<sup>④</sup> where the shaft<sup>⑥</sup> will be mounted, and then mount the shaft<sup>⑥</sup>.
7. Install the conical spring washers to the hexagon socket head cap screws <sup>⑤</sup>, and tighten them with the tightening torque shown in *table 6-4*.
8. Apply the MP-1 grease to the lip part of the oil seal<sup>⑭</sup>.
9. Apply ThreeBond 1206C to the surface of the casing where the speed reducer<sup>①</sup> will be mounted, and then mount the unit of the speed reducer<sup>①</sup> and the shaft<sup>④</sup> and <sup>⑥</sup> onto the casing.  
At this time, make sure to mount the unit in the correct position by referring to *fig. 6-4*. Make sure not to damage the oil seal<sup>⑭</sup>.
10. Install the conical spring washers to the hexagon socket head cap screws <sup>②</sup>, and tighten them 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 reducer<sup>①</sup>.  
(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 gear <sup>⑦</sup>, install the conical spring washers to the hexagon socket head cap screws <sup>⑧</sup>, and tighten them with the tightening torque shown in *table 6-4*.
14. Apply ThreeBond 1206C to the surface of the housing<sup>⑨</sup> which will face the speed reducer<sup>①</sup>, and then mount the unit of the housing<sup>⑨</sup> and the R-axis motor.
15. Tighten the GT-SA bolts<sup>⑩</sup> with the tightening torque shown in *table 6-4*.
16. Apply ThreeBond 1206C to the surface of the shaft<sup>⑪</sup> which will face the housing<sup>⑨</sup>, and then mount the shaft<sup>⑪</sup>. Make sure not to damage the oil seal<sup>⑬</sup> at this time.
17. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts<sup>⑫</sup>, and tighten them with the tightening torque shown in *table 6-4*.
18. Apply ThreeBond 1206C to the surface of the shaft<sup>⑥</sup> which will face the shaft<sup>⑮</sup>, and then install the conical spring washers to the hexagon socket head cap screws<sup>⑯</sup>, and tighten them with the tightening torque shown in *table 6-4*.

- 6 Disassembly/Reassembly of Speed Reducer  
 6.4 Disassembly/Reassembly of R-Axis Speed Reducer

19. Perform “Reassembly” in chapter 7 “Disassembly/Reassembly of Unit” and mount the wrist unit.
20. 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.
21. Perform the steps 15 to 18 of “Reassembly” in chapter 5.4 “Disassembly/Reassembly of the R-Axis Motor” and mount the R-axis motor cable and the cover.
22. 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.)
23. 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	Hexagon socket head cap screws M5 (length: 45 mm) Conical spring washer 2L-5	8 each	Tightening torque 6.0 N*m
③	Hexagon socket head cap screws M6 (length: 40 mm) Conical spring washer 2L-6	7 each	Tightening torque 10.0 N*m
④	Shaft HW1304069-3	1	
⑤	Hexagon socket head cap screws M6 (length: 20 mm) Conical spring washer 2L-6	10 each	Tightening torque 10.0 N*m
⑥	Shaft HW1306703-2	1	
⑦	Gear HW1304319-1	1	
⑧	Hexagon socket head cap screws M3 (length: 12 mm) Conical spring washer CDW-L3	6 each	Tightening torque 1.4 N*m
⑨	Housing HW1200370-2	1	
⑩	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N*m
⑪	Shaft HW1303257-3	1	
⑫	GT-SA bolt M3 (length: 12 mm)	5	Tightening torque 1.4 N*m
⑬	Oil seal MHSA52709	1	
⑭	Oil seal HMSH1171401014J	1	
⑮	Shaft HW1307283-1	1	
⑯	Hexagon socket head cap screws M6 (length: 20 mm) Conical spring washer 2L-6	8 each	Tightening torque 10.0 N*m



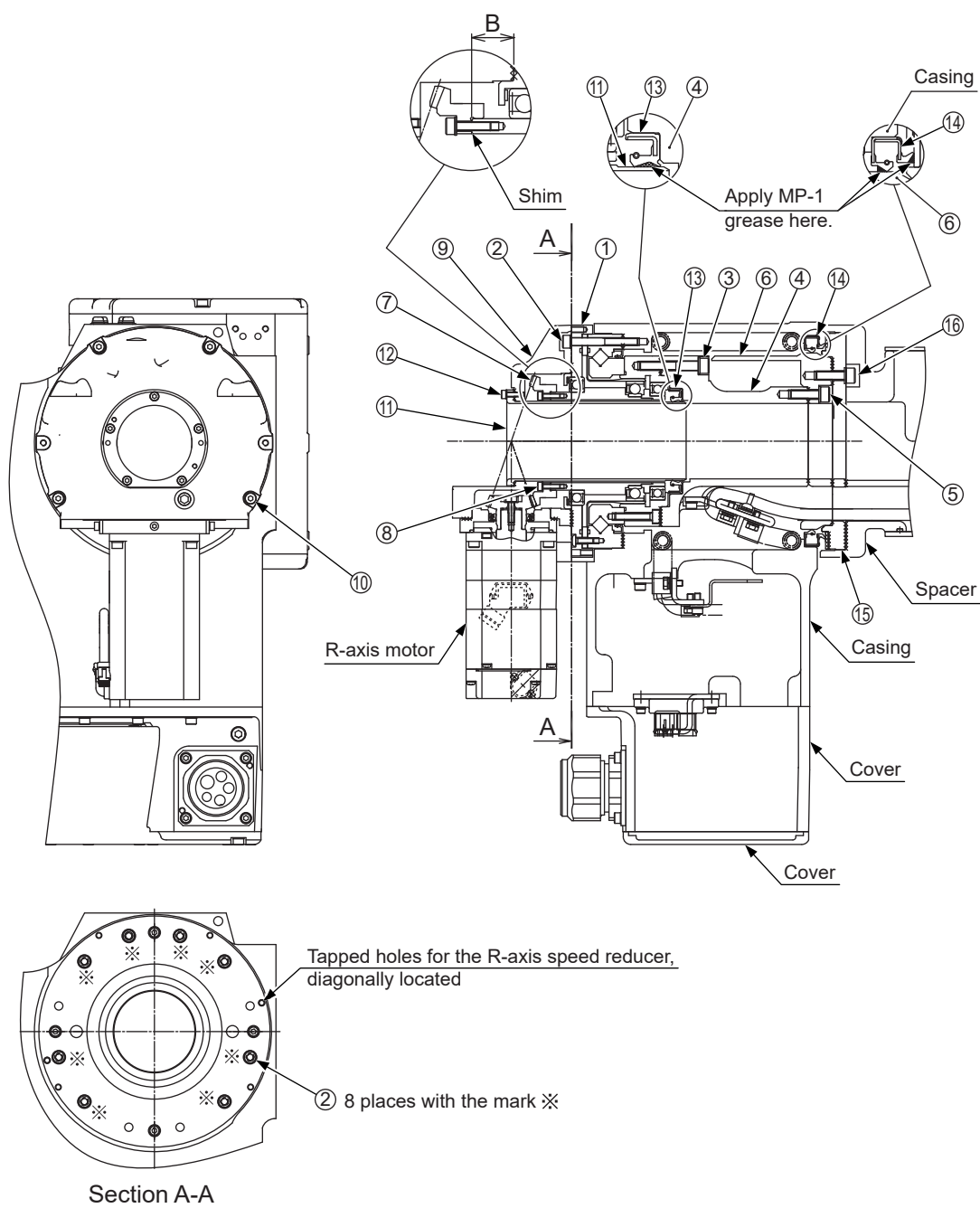
6	Disassembly/Reassembly of Speed Reducer
6.4	Disassembly/Reassembly of R-Axis Speed Reducer

*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

6 Disassembly/Reassembly of Speed Reducer  
 6.4 Disassembly/Reassembly of R-Axis Speed Reducer

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 the 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	Disassembly/Reassembly of Speed Reducer
6.5	Disassembly/Reassembly of B-Axis Speed Reducer

## 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 bolts<sup>⑮</sup>, and then remove the cover<sup>⑮</sup>.
4. Remove the gasket<sup>⑮</sup> from the cover<sup>⑮</sup>.
5. Loosen the GT-SA bolts<sup>⑭</sup>, and then remove the timing belt<sup>⑰</sup>.
6. Unscrew the hexagon socket head cap screws<sup>⑧</sup>, and then remove the housing unit (the pulley<sup>⑨</sup>, the housing<sup>⑥</sup>, the speed reducer<sup>②</sup> (wave generator), and the bearings<sup>⑪</sup> and<sup>⑬</sup>).
7. Unscrew the hexagon socket head cap screws<sup>⑩</sup>, and then remove the pulley<sup>⑨</sup> from the housing unit.  
(To secure the pulley<sup>⑨</sup>, use the two slots on the surface of the pulley<sup>⑨</sup>.)
8. Remove the speed reducer<sup>②</sup> (wave generator) and the bearing<sup>⑬</sup> from the housing unit.
9. Remove the retaining ring<sup>⑫</sup>, the bearing<sup>⑪</sup>, and the O-ring<sup>⑳</sup> from the housing unit.
10. Remove the bearing<sup>⑬</sup> from the speed reducer<sup>②</sup> (wave generator).
11. Unscrew the GT-SA bolts<sup>⑤</sup> and<sup>⑦</sup>, and then remove the shaft<sup>④</sup> by using the stud bolt.
12. Remove the oil seal<sup>⑱</sup>, unscrew the hexagon socket head cap screws<sup>③</sup>, and remove the speed reducer<sup>①</sup> by using the stud bolt.  
(Insert the stud bolt into the tapped hole inside the wrist unit.)

### ■ Reassembly

1. Press fit the bearing<sup>⑪</sup> into the housing<sup>⑥</sup>, and then attach the retaining ring<sup>⑫</sup>.  
(When replacing the speed reducer, replace the bearing<sup>⑪</sup>, too.)
2. Insert the O-ring<sup>⑳</sup> to the housing<sup>⑥</sup>.
3. Press fit the bearing<sup>⑬</sup> into the speed reducer<sup>②</sup> (wave generator).  
(When replacing the speed reducer, replace the bearing<sup>⑬</sup>, too.)
4. Apply Harmonic Grease SK-1A to the bearing part of the speed reducer<sup>②</sup> (wave generator).  
(Refer to *fig. 6-7 "Example of B-Axis Grease Application (Wave Generator)"*.)
5. Press fit the speed reducer<sup>②</sup> (wave generator) unit assembled in the step 2 into the housing unit assembled in the step 1.
6. Mount the pulley<sup>⑨</sup> on the housing unit assembled in the step 4, install the conical spring washers to the hexagon socket head cap screws<sup>⑩</sup>, and then tighten them with the tightening torque shown in *table 6-6 "B-Axis Speed Reducer Parts Checklist"*.

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6 Disassembly/Reassembly of Speed Reducer  
 6.5 Disassembly/Reassembly of B-Axis Speed Reducer

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7. Apply ThreeBond 1206C to the surface of the speed reducer① mating to the wrist, and then mount the speed reducer① on the wrist. When mount the speed reducer①, adjust the phase of bolts M3 (4 places) and holes (7 dia.) (4 places) on the wrist.  
 (Refer to *fig. 6-6 "Notes on the Speed Reducer Installation for B-axis"* ).
8. Install the conical spring washers to the hexagon socket head cap screws③, and tighten them with the tightening torque shown in *table 6-6 "B-Axis Speed Reducer Parts Checklist"* .
9. Apply Harmonic Grease SK-1A to the sliding part inside the flex spline of the speed reducer①.  
 (Refer to *fig. 6-8 "Example of B-Axis Grease Application (Flex Spline)"* .)
10. Apply MP-1 grease to the lip part of the oil seal⑯, and then press fit it into the wrist until it contacts the head surface of the hexagon socket head cap screws③.  
 (When replacing the speed reducer, replace the oil seal⑯, too.)
11. Apply ThreeBond 1206C to the surface of the speed reducer① mating to the shaft④.
12. Apply ThreeBond 1206C to the surface of the shaft④ mating to the U-arm, and then mount the shaft④ on the U-arm. (Be careful not to turn up the lip part of the oil seal⑯ at this time.)
13. Tighten the GT-SA bolts⑦ with the tightening torque shown in *table 6-6*.
14. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts⑤, and then tighten them with the tightening torque shown in *table 6-6*.
15. Apply Harmonic Grease SK-1A to the bearing⑬ part of the housing unit assembled in the step 5.  
 (Refer to *fig. 6-9 "Example of B-Axis Grease Application (Bearing)"* .)
16. Mount the housing unit on the U-arm, install the conical spring washers to the hexagon socket head cap screws⑧, and then tighten them with the tightening torque shown in *table 6-6*.
17. Mount the timing belt⑰ on the pulley⑨.
18. Tighten the GT-SA bolts④ 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"* .)
19. Press fit the gasket⑱ into the groove of the cover⑮.
20. Mount the cover⑮ by using the GT-SA bolts⑥, and then tighten the bolts with the tightening torque shown in *table 6-6*.
21. Turn ON the YRC1000 power supply.

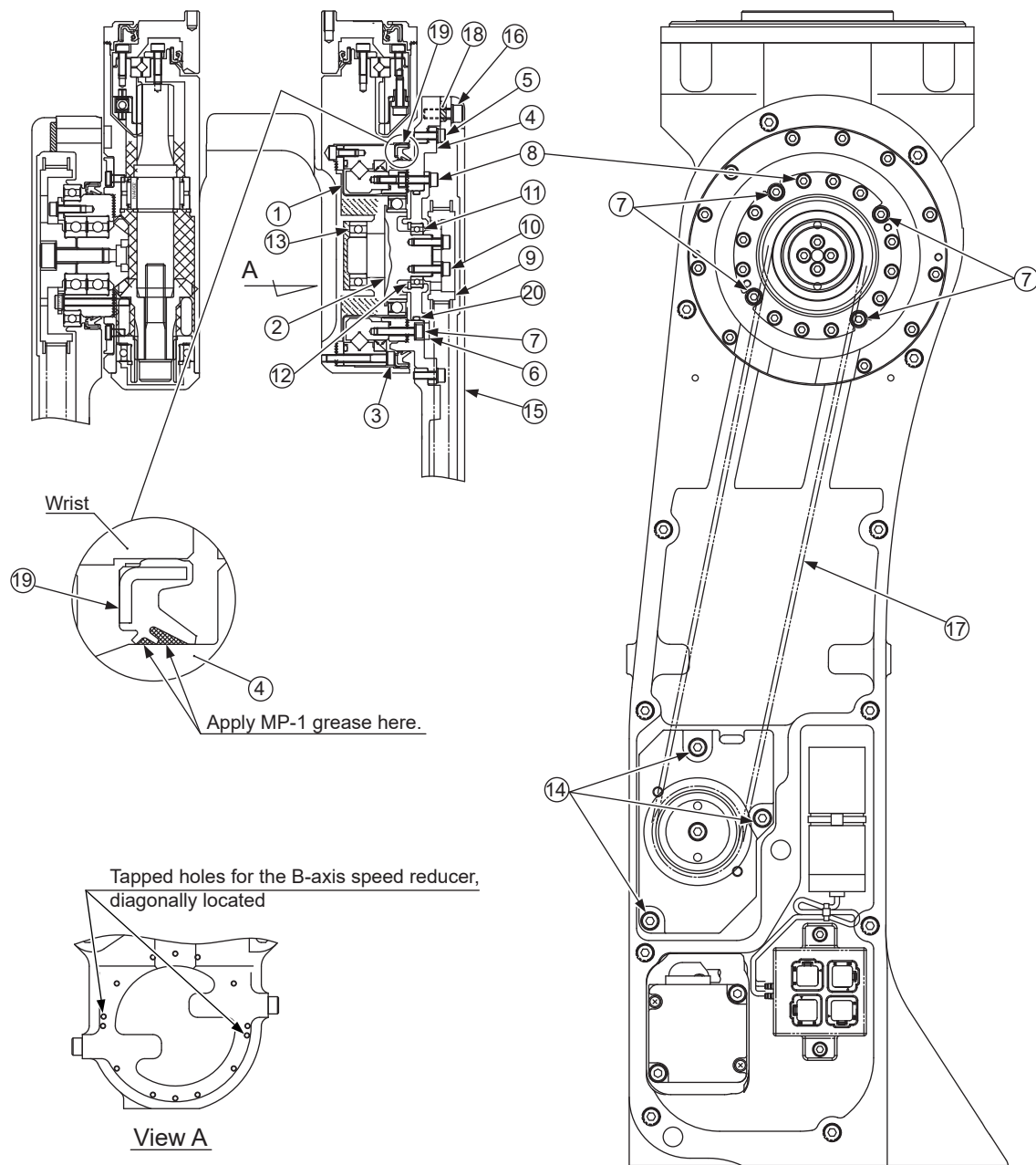
6 Disassembly/Reassembly of Speed Reducer  
 6.5 Disassembly/Reassembly of B-Axis Speed Reducer

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

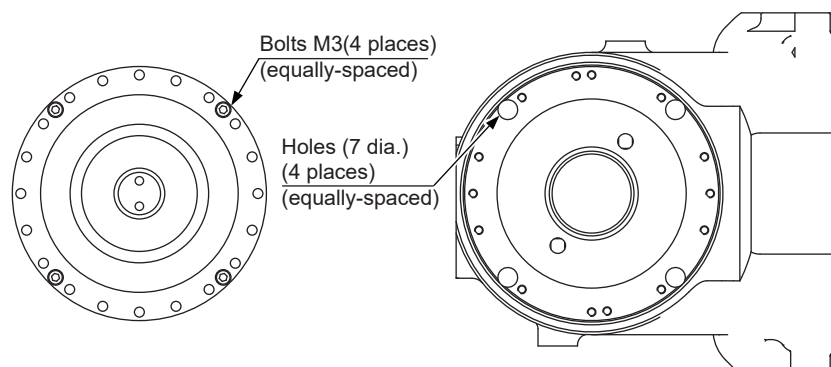
No.	Item	Qty.	Note
①	Speed reducer HW1382522-A	1	Unit of flex spline and circular spline
②			Wave generator
③	Hexagon socket head cap screws M3 (length: 25 mm) Conical spring washer CDW-L3	12 each	Tightening torque 1.4 N·m
④	Shaft HW1308131-1	1	
⑤	GT-SA bolt M3 (length: 10 mm)	11	Tightening torque 1.4 N·m
⑥	Housing HW1409646-1	1	
⑦	GT-SA bolt M3 (length: 16 mm)	4	Tightening torque 2.25 N·m
⑧	Hexagon socket head cap screws M3 (length: 22 mm) Conical spring washer CDW-L3	12 each	Tightening torque 2.25 N·m
⑨	Pulley HW1409738-A	1	
⑩	Hexagon socket head cap screws M3 (length: 12 mm) Conical spring washer CDW-L3	4 each	Tightening torque 2.25 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)	13	Tightening torque 2.8 N·m
⑰	Timing belt 60S3M603	1	
⑱	Gasket HW1306400-1	1	
⑲	Oil seal HW1485584-A	1	
⑳	O-ring S50	1	

6 Disassembly/Reassembly of Speed Reducer  
 6.5 Disassembly/Reassembly of B-Axis Speed Reducer

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

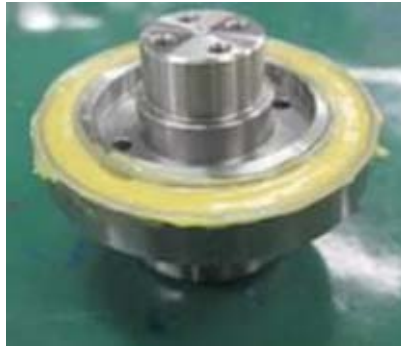


*Fig. 6-6: Notes on the Speed Reducer Installation for B-axis*



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- 6 Disassembly/Reassembly of Speed Reducer
  - 6.5 Disassembly/Reassembly of B-Axis Speed Reducer
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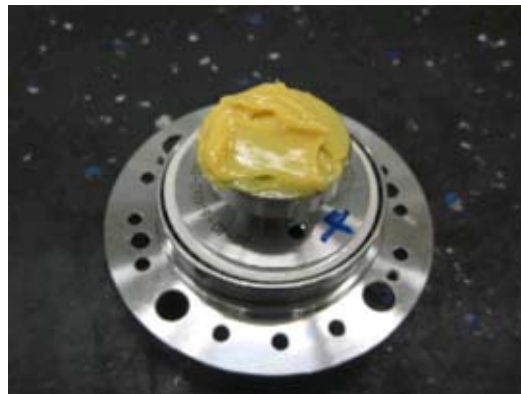
*Fig. 6-7: Example of B-Axis Grease Application (Wave Generator)*



*Fig. 6-8: Example of B-Axis Grease Application (Flex Spline)*



*Fig. 6-9: Example of B-Axis Grease Application (Bearing)*



- 7 Disassembly/Reassembly of Unit
- 7.1 Disassembly/Reassembly of Wrist Unit and Spacer Part

## 7 Disassembly/Reassembly of Unit



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

Remove old sealing from each part before assembling.

### 7.1 Disassembly/Reassembly of Wrist Unit and Spacer Part

- Refer to *fig. 7-1 “Disassembly/Reassembly of Wrist Unit and Spacer Part”*.

#### ■ 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 bolts⑤, and then remove the multi-port connector④. At the same time, cut off the cable tie⑦ and remove the battery pack⑥.  
Be careful not to remove the encoder cable of the B- and T-axis motor.
4. Unscrew the hexagon socket head cap screws③, and then remove the wrist unit①.  
(Note that one of the eight hexagon socket head cap screws③ is located inside the U-arm.)
5. Unscrew the hexagon socket head cap screws⑩, and remove the spacer②.

#### ■ Reassembly

1. Apply ThreeBond 1206C on the surface of the shaft in the U-arm unit where the spacer will be mounted.
2. Mount the spacer② on the shaft, and then tighten the hexagon socket head cap screws⑩ with the tightening torque shown in *table 7-1 “Wrist Unit and Spacer Part Parts Checklist”*.
3. Apply ThreeBond 1206C to mounting surface of the spacer② where the wrist unit① will be mounted.
4. Mount the wrist unit① on the spacer②, and tighten the hexagon socket head cap screws③ with the tightening torque shown in *table 7-1*.
5. Mount the clamp⑧, and then tighten the pan-head sems screw⑨ with the tightening torque shown in *table 7-1*.
6. Mount the multi-port connector④, and then tighten the GT-SA bolts⑤ with the tightening torque shown in *table 7-1*. At the same time, secure the battery pack⑥ by using the cable tie⑦.
7. Turn ON the YRC1000 power supply.



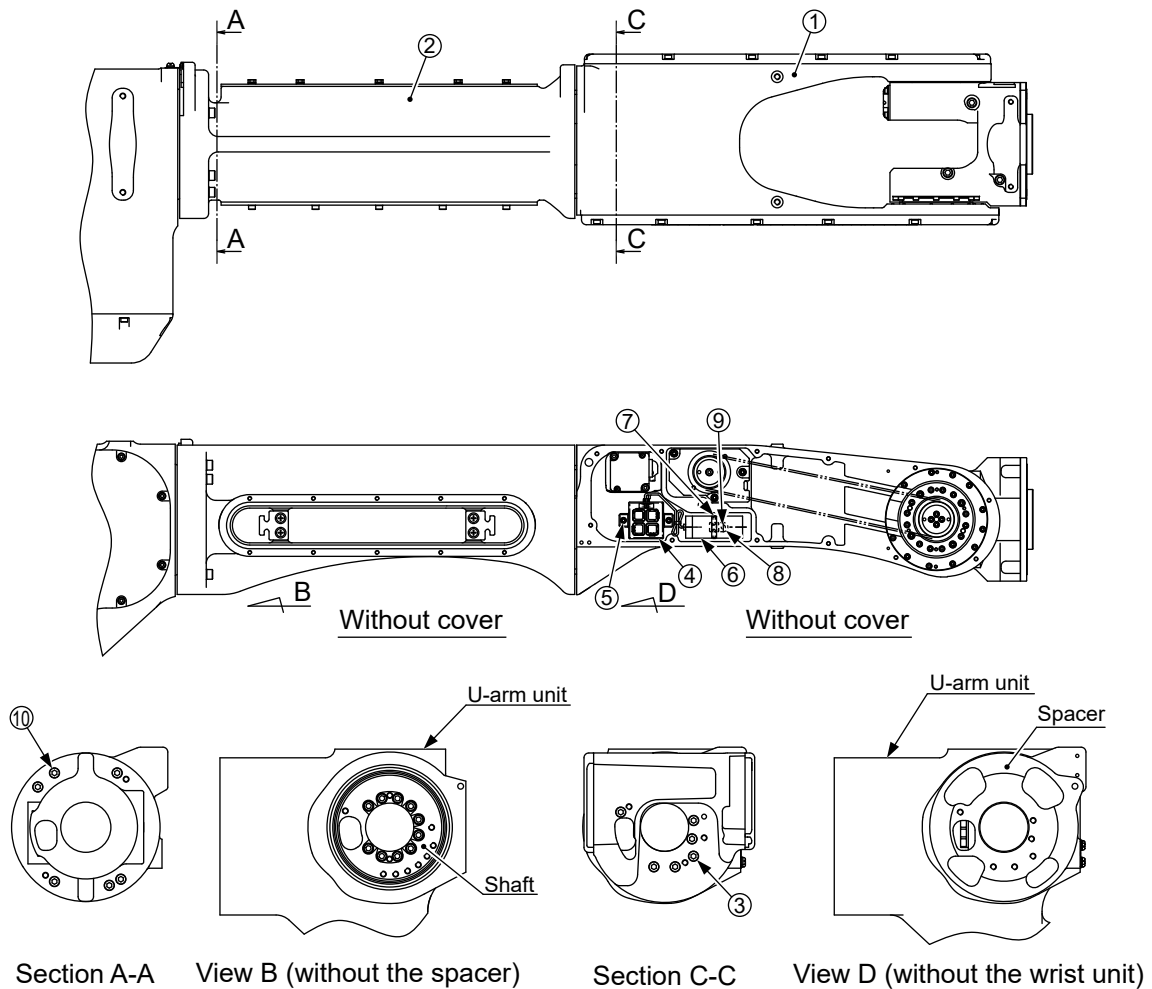
## 7 Disassembly/Reassembly of Unit

### 7.1 Disassembly/Reassembly of Wrist Unit and Spacer Part

**Table 7-1: Wrist Unit and Spacer Part Parts Checklist**

No.	Item	Qty.	Note
①	Wrist unit HW1172936-A	1	
②	Spacer HW1200682-1	1	
③	Hexagon socket head cap screws M6 (length: 25 mm) Conical spring washer 2L-6 Washer HW8411125-3	6 each	Tightening torque 10.0 N*m
④	Multi-port connector HW1384619-A	1	
⑤	GT-SA bolt M3 (length: 10 mm) Washer M3 *stainless*	2 each	Tightening torque 0.2 N*m
⑥	Battery pack HW1483880-A	1	
⑦	Cable tie T18L	1	
⑧	Clamp TA1-S8	1	
⑨	Pan-head sems screw M4 (length: 6 mm) *stainless*	1	Tightening torque 0.75 N*m
⑩	Hexagon socket head cap screws M6 (length: 25 mm) Conical spring washer 2L-6	6 each	Tightening torque 10.0 N*m

**Fig. 7-1: Disassembly/Reassembly of Wrist Unit and Spacer Part**



- 7 Disassembly/Reassembly of Unit
- 7.2 Disassembly/Reassembly of R-Axis Unit

## 7.2 Disassembly/Reassembly of R-Axis Unit

- Refer to *fig. 7-2 "Disassembly and Reassembly of R-Axis Unit"*.

### ■ Disassembly

#### 1. Casing

1. Set the manipulator's posture to the home position posture, etc. to make it easy to hang the arm, and turn OFF the YRC1000 power supply.
2. Support the wrist unit by using the chain block, etc. to prevent it from falling.
3. Perform the steps 3 to 4 of ■ *"Disassembly"* in *chapter 5.4 "Disassembly/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 of the B- and T-axes.
5. Perform ■ *"Disassembly"* in *chapter 7.1 "Disassembly/Reassembly of Wrist Unit and Spacer Part"*, and remove the wrist unit.
6. Unscrew the hexagon socket head cap screws<sup>⑭</sup>, and then remove the shaft<sup>⑬</sup> by using the stud bolt.
7. Unscrew the GT-SA bolts<sup>⑧</sup>, and remove the housing<sup>⑦</sup> and the unit of the R-axis motor by using the stud bolt.
8. Unscrew the hexagon socket head cap screws<sup>②</sup>, and remove unit of the speed reducer<sup>①</sup> and the shafts<sup>④</sup> and<sup>⑥</sup> at one time by using the stud bolts. For the locations of the tapped holes on the speed reducer<sup>①</sup>, refer to *fig. 7-2*.
9. Unscrew the hexagon socket head cap screws<sup>⑤</sup>, and remove the shaft<sup>⑥</sup> by using the stud bolt.
10. Unscrew the hexagon socket head cap screws<sup>③</sup>, and remove the shaft<sup>④</sup> by using the stud bolt.
11. To replace the oil seal<sup>⑪</sup>, remove the oil seal<sup>⑪</sup> from the shaft<sup>④</sup>.
12. To replace the oil seal<sup>⑫</sup>, remove the oil seal<sup>⑫</sup> from the casing.

#### 2. R-axis unit (for the replacement)

1. Unscrew the GT-SA bolt<sup>⑩</sup>, and remove the shaft<sup>⑨</sup> by using the stud bolt.
2. Unscrew the GT-SA bolts<sup>⑧</sup>, and remove the unit of the housing<sup>⑦</sup> and the R-axis motor by using the stud bolt.

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## 7 Disassembly/Reassembly of Unit

### 7.2 Disassembly/Reassembly of R-Axis Unit

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#### ■ Reassembly

1. If the oil seal ⑫ was removed, mount the oil seal ⑫ on the casing.
2. If the oil seal ⑪ was removed, mount the oil seal ⑪ on the shaft ④.
3. Apply MP-1 grease to the lip part of the oil seal ⑪.
4. Apply ThreeBond 1206C to the surface of the speed reducer ① where the shaft ④ will be mounted, and then mount the shaft ④.
5. Install the conical spring washers to the hexagon socket head cap screws ③, and tighten them with the tightening torque shown in *table 7-2 "R-Axis Unit Parts Checklist"*.
6. Apply ThreeBond 1206C to the surface of the shaft ⑥ where the shaft ④ will be mounted, and then mount the shaft ⑥.
7. Install the conical spring washers to the hexagon socket head cap screws ⑤, and tighten them with the tightening torque shown in *table 7-2*.
8. Apply MP-1 grease to the lip part of the oil seal ⑫.
9. Apply ThreeBond 1206C to the surface of the casing where the speed reducer ① will be mounted, and then mount the unit of the speed reducer ① and the shaft ④ and ⑥ onto the casing.  
At this time, make sure to mount the unit in the correct position by referring to *fig. 7-2 "Disassembly and Reassembly of R-Axis Unit"*. Make sure not to damage the oil seal ⑫.
10. Install the conical spring washers to the hexagon socket head cap screws ②, and tighten them with the tightening torque shown in *table 7-2*.
11. Apply ThreeBond 1206C to the surface of the housing ⑦ which will face the speed reducer ①, and then mount unit of the housing ⑦ and the R-axis motor.
12. Tighten the GT-SA bolt ⑧ with the tightening torque shown in *table 7-2*.
13. Apply ThreeBond 1206C to the surface of the shaft ⑨ which will face the housing ⑦, and then mount the shaft ⑨.  
Make sure not to damage the oil seal ⑪.
14. Apply ThreeBond 1206C to the thread part of the GT-SA bolt ⑩, and then tighten them with the tightening torque shown in *table 7-2*.
15. Apply ThreeBond 1206C to the surface of the shaft ⑥ which will face the shaft ⑬, and then install the conical spring washers to the hexagon socket head cap screws ⑭, and tighten them with the tightening torque shown in *table 7-2*.
16. Perform ■ "Reassembly" in *chapter 7.1 "Disassembly/Reassembly of Wrist Unit and Spacer Part"*, and mount the wrist unit.
17. Perform ■ "Reassembly" in *chapter 9.2 "Disassembly/Reassembly of Internal Wiring Harness for B- and T-Axes"*, and connect the internal wiring harness of the B- and T-axes.
18. Perform the steps 15 to 18 of ■ "Reassembly" in *chapter 5.4 "Disassembly/Reassembly of the R-Axis Motor"*, connect the R-axis motor cable and mount the cover.

- 7 Disassembly/Reassembly of Unit  
 7.2 Disassembly/Reassembly of R-Axis Unit

19. 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.)

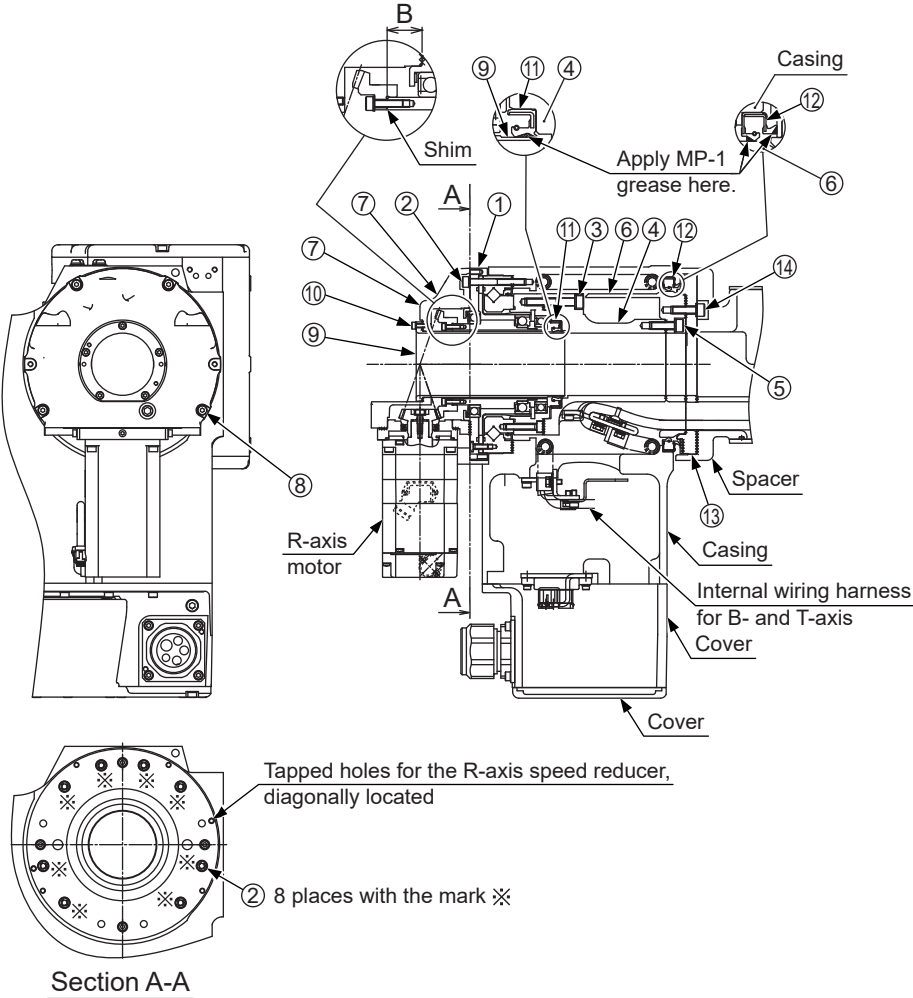
20. Turn ON the YRC1000 power supply.

**Table 7-2: R-Axis Unit Parts Checklist**

No.	Item	Qty.	Note
①	Speed reducer HW1382521-A	1	
②	Hexagon socket head cap screws M5 (length: 45 mm) Conical spring washer 2L-5	8 each	Tightening torque 6.0 N*m
③	Hexagon socket head cap screws M6 (length: 40 mm) Conical spring washer 2L-6	7 each	Tightening torque 10.0 N*m
④	Shaft HW1304069-3	1	
⑤	Hexagon socket head cap screws M6 (length: 20 mm) Conical spring washer 2L-6	10 each	Tightening torque 10.0 N*m
⑥	Shaft HW1306703-2	1	
⑦	Housing HW1200370-2	1	
⑧	GT-SA bolt M4 (length: 12 mm)	4	Tightening torque 2.8 N*m
⑨	Shaft HW1303257-3	1	
⑩	GT-SA bolt M3 (length: 12 mm)	5	Tightening torque 1.4 N*m
⑪	Oil seal MHSA52709	1	
⑫	Oil seal HMSH1171401014J	1	
⑬	Shaft HW1307283-1	1	
⑭	Hexagon socket head cap screws M6 (length: 20 mm) Conical spring washer 2L-6	8 each	Tightening torque 10.0 N*m

7     Disassembly/Reassembly of Unit  
7.2   Disassembly/Reassembly of R-Axis Unit

Fig. 7-2: Disassembly and Reassembly of R-Axis Unit



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

## 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 bolts ⑨ and ⑫, and then remove the covers ⑦ and ⑩.
2. Remove the gaskets ⑧ and ⑪ from the covers ⑦ and ⑩.
3. Loosen the GT-SA bolts ⑥, and then remove the B-axis timing belt ①.
4. Loosen the GT-SA bolts ④, and then remove the T-axis timing belt ②.

#### ■ Reassembly

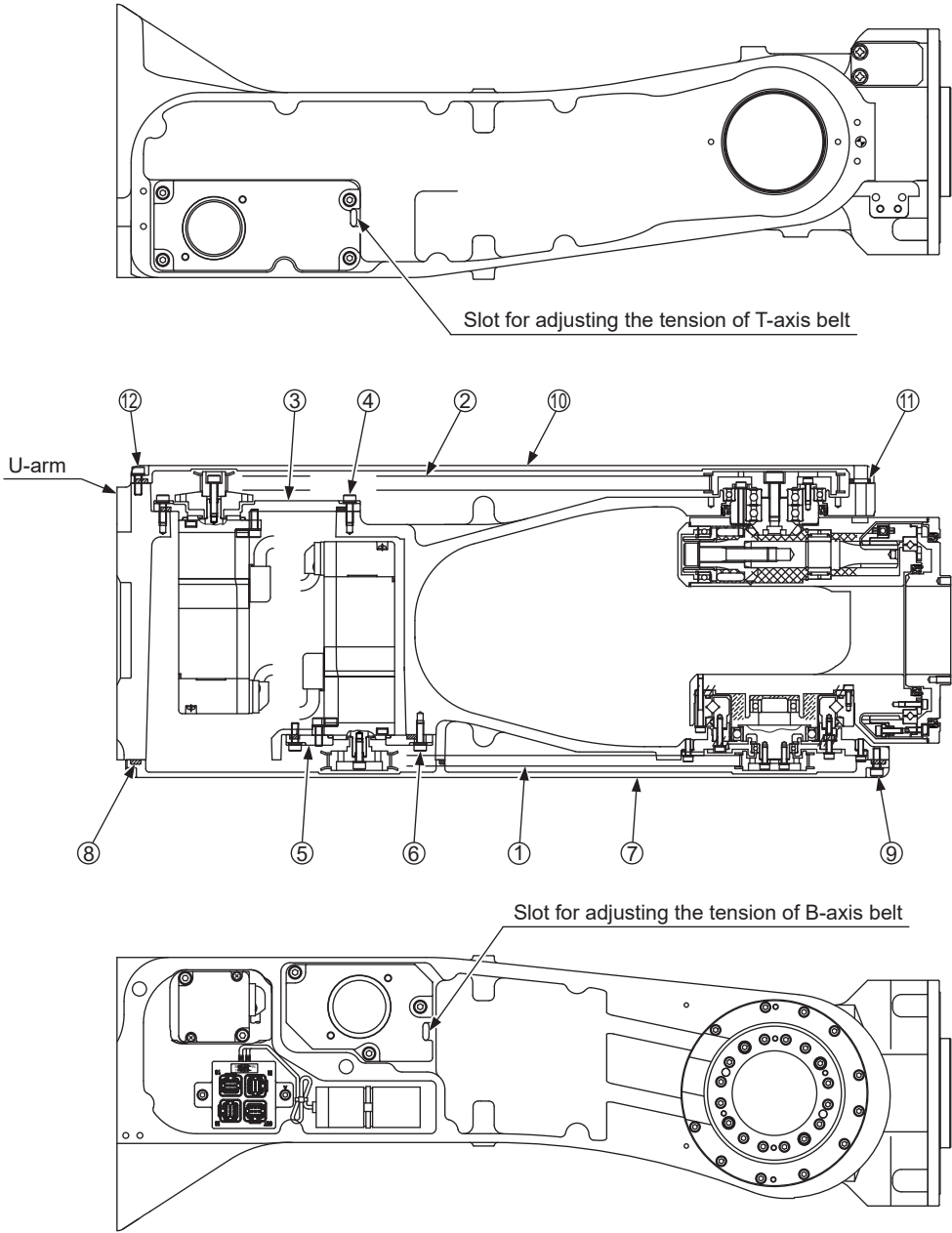
1. Mount the T-axis timing belt ②, and then tighten the GT-SA bolts ④ with the tightening torque shown in *table 8-1* to secure the M-base ③.
2. Mount the B-axis timing belt ①, and then tighten the GT-SA bolts ⑥ with the tightening torque shown in *table 8-1* to secure the M-base ⑤.
3. Attach the gaskets ⑧ and ⑪ to the covers ⑦ and ⑩.
4. Mount the covers ⑦ and ⑩ on the U-arm, and then tighten the GT-SA bolts ⑨ and 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*



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

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## 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



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 GT-SA bolts②, and remove the cover③.
  3. Cut off the cable tie④.
  4. Disconnect the "IN" connector of the internal wiring harness① from the "IN" port of the multi-port connector in the casing.  
Be careful not to remove the connector of the "U" and "R" port.
  5. Cut off the cable ties⑤, and take the connector out of the protective tubes⑥. Disconnect the "B-PW" connector and the "T-PW" connector of the B- and T-axis internal wiring harness, the "R" connector of the R-axis power cable, and the "SA", "SB", and "SC" connectors of the internal user I/O wiring harness connected to the internal wiring harness①.
  6. Disconnect the "U-PW" connector of the U-axis power cable connected to the internal wiring harness①.
  7. Remove the air hose of the internal wiring harness① from the unions⑦ and ⑧.
  8. Unscrew the GT-SA bolts⑨, and remove the clamp⑩.
  9. Unscrew the GT-SA bolts⑪, and remove the support⑫.
  10. Unscrew the cap nut of the union⑬, and pull out the internal wiring harness① from the union⑬.
  11. Remove the gasket of the union⑬ from the internal wiring harness① at this time.

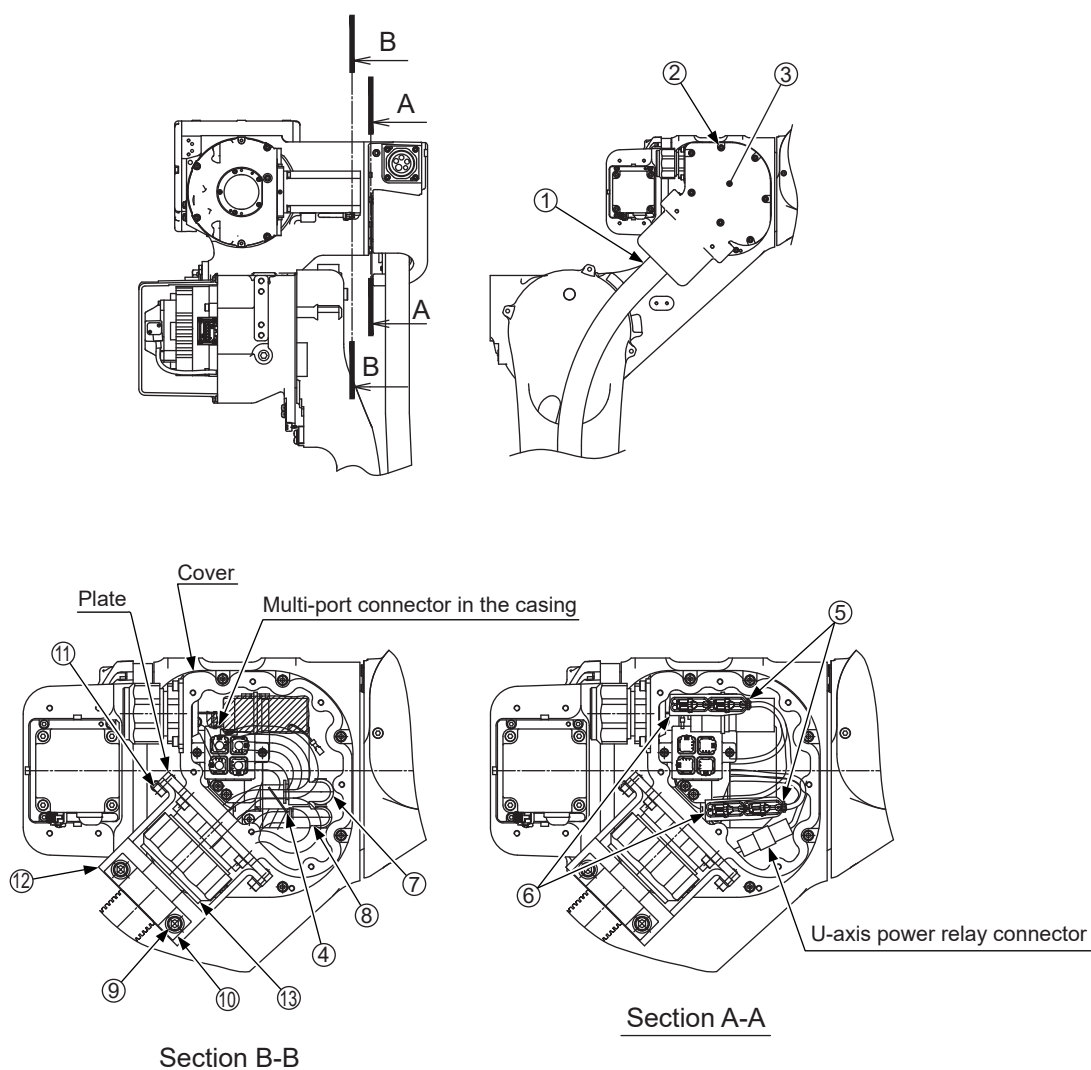
## 9 Cable Wiring

## 9.1 Disassembly/Reassembly of Internal Wiring Harness

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

No.	Item	Qty.	Note
①	Internal wiring harness HW1173642-A	1	
②	GT-SA bolt M4 (length: 12 mm)	7	Tightening torque 2.8 N*m
③	Cover HW1101193-1	1	
④	Cable tie T18L	1	
⑤	Cable tie T18L	2	
⑥	Protective tube HW1407859-1	2	
⑦	Union KQ2L10-00A	1	
⑧	Union KQ2L08-00A	1	
⑨	GT-SA bolt M6 (length: 12 mm) Washer M6 *stainless*	2 each	Tightening torque 2.8 N*m
⑩	Clamp BGH-29	1	
⑪	GT-SA bolt M5 (length: 12 mm)	2	Tightening torque 6.0 N*m
⑫	Support HW1409666-1	1	
⑬	Union C2MBG40-7+8×6P+10	1	

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



9

Cable Wiring

9.1

Disassembly/Reassembly of Internal Wiring Harness

2. L-arm

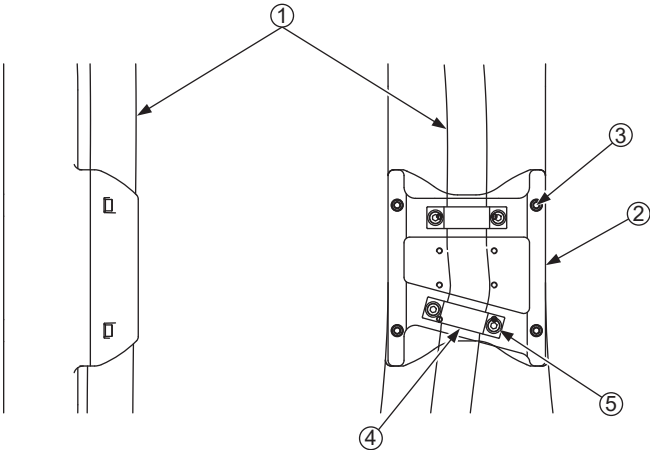
- Refer to *table 9-2 “Internal Wiring Harness Parts Checklist (L-Arm)”* and *fig. 9-2 “Disassembly & Reassembly of Internal Wiring Harness (L-Arm)”*.

- Unscrew the GT-SA bolts ③, and remove the cover ②.
- Unscrew the GT-SA bolts ⑤, and remove the clamps ④.

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

No.	Item	Qty.	Note
①	Internal wiring harness HW1173642	1	
②	Cover HW1306781-1	1	
③	GT-SA bolt M6 (length: 30 mm)	4	Tightening torque 10.0 N*m
④	Clamp BGH-29	2	
⑤	GT-SA bolt M6 (length: 15 mm) Washer M6 *stainless*	4 each	Tightening torque 2.8 N*m

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



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## 9 Cable Wiring

### 9.1 Disassembly/Reassembly of Internal Wiring Harness

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#### 3. S-head

- Refer to *fig. 9-3 "Disassembly & Reassembly of Internal Wiring Harness (S-Head)"*.

1. Unscrew the GT-SA bolts ②, and remove the cover ③.
2. Unscrew the GT-SA bolts ④, and remove the cover ⑤.
3. Unscrew the hexagon socket head cap screws ⑥, and remove the clamp ⑦.
4. Cut off the cable ties ⑧ and ⑨.
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. Disconnect the "IN" connector and the "OUT" connector of the internal wiring harness ① from the "IN" port and the "OUT" port of the multi-port connector in the S-head.  
Be careful not to remove the connector of the "S" and "L" port.
7. Disconnect the air hose from the union ⑩.
8. Cut off the cable tie ⑬.
9. Unscrew the GT-SA bolts ⑰, and remove the support ⑱.
10. Unscrew the GT-SA bolts ⑲, and remove the saddle ⑳.
11. Cut off the cable tie ⑪.
12. Unscrew the GT-SA bolts ⑫, and remove the support ⑬.
13. Unscrew the GT-SA bolts ⑭, and remove the saddle ⑮.
14. Unscrew the cross head APS bolts ⑳.
15. Disconnect the S-axis grease hose from the connector base.
16. Pass the internal wiring harness ① through the S-head, and pull it out to the base side.

9 Cable Wiring  
 9.1 Disassembly/Reassembly of Internal Wiring Harness

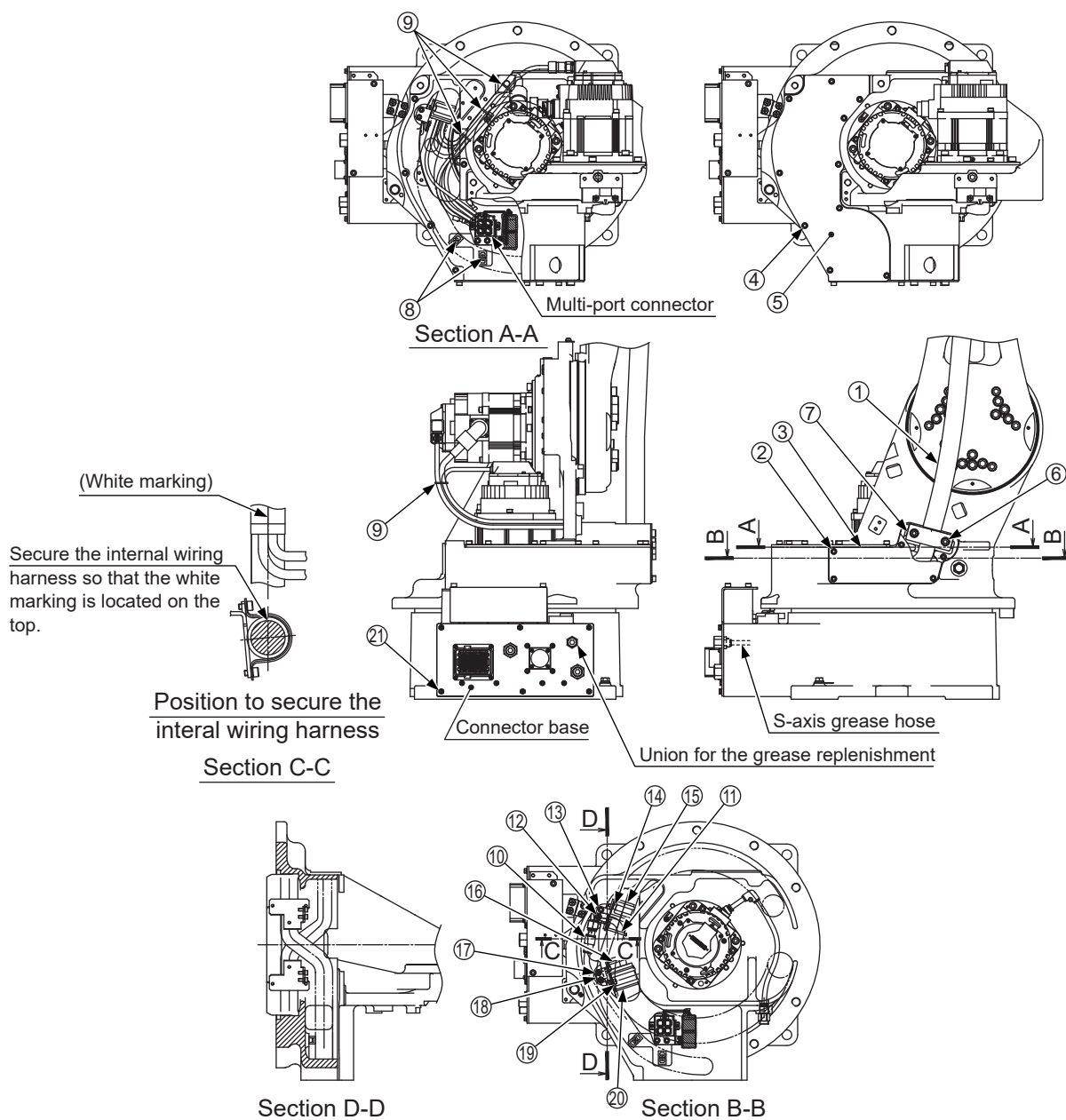
*Table 9-3: Internal Wiring Harness Parts Checklist (S-Head)*

No.	Item	Qty.	Note
①	Internal wiring harness HW1173642-A	1	
②	GT-SA bolt M6 (length: 15 mm)	5	Tightening torque 10.0 N*m
③	Cover HW1408196-1	1	
④	GT-SA bolt M6 (length: 15 mm)	10	Tightening torque 10.0 N*m
⑤	Cover HW1306702-3	1	
⑥	Hexagon socket head cap screws M8 (length: 80 mm) Conical spring washer 2L-8	2 each	Tightening torque 6.0 N*m
⑦	Clamp BGPS-29	1	
⑧	Cable tie T120R	2	
⑨	Cable tie T18L	4	
⑩	Union KQ2H10-12A	1	
⑪	Cable tie T50R	1	
⑫	GT-SA bolt M5 (length: 12 mm)	2	Tightening torque 6.0 N*m
⑬	Support HW1405431-1	1	
⑭	GT-SA bolt M5 (length: 8 mm)	2	Tightening torque 6.0 N*m
⑮	Saddle CD31	1	
⑯	Cable tie T50R	1	
⑰	GT-SA bolt M5 (length: 12 mm)	2	Tightening torque 6.0 N*m
⑱	Support HW1405589-1	1	
⑲	GT-SA bolt M5 (length: 8 mm)	2	Tightening torque 6.0 N*m
⑳	Saddle CD39	1	
㉑	Cross head APS bolt M5 (length: 10 mm) *stainless*	6	Tightening torque 4.0 N*m

## 9 Cable Wiring

### 9.1 Disassembly/Reassembly of Internal Wiring Harness

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



## 9 Cable Wiring

### 9.1 Disassembly/Reassembly of Internal Wiring Harness

#### ■ 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)"*.

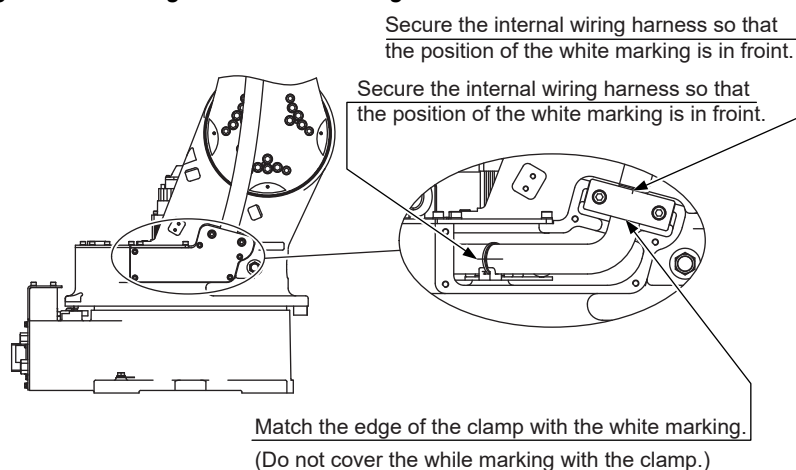
1. Apply Multemp PS2A Grease all over the protective spring of the internal wiring harness ①.
2. Pass the internal wiring harness ① from the base to the S-head side.
3. Connect the S-axis grease hose to the connector base.
4. Tighten the cross head APS bolts ② with the tightening torque shown in *table 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 harness ① to the support ⑬ by using the saddle ⑮, and then tighten the GT-SA bolts ⑭ with the tightening torque shown in *table 9-3*.  
At this time, make sure that the white marking of the internal wiring harness ① is located as shown in *fig. 9-3*.
6. Put the cable tie ⑪ through the clamp, and secure the internal wiring harness ① to the support ⑬.  
At this time, secure the cable tie ⑪ at the white marking of the internal wiring harness ①.
7. Mount the support ⑬ to the S-head, and then tighten the GT-SA bolts ⑫ with the tightening torque shown in *table 9-3*.
8. Secure the protective spring for the internal wiring harness ① on the air hose side to the support ⑮ by using the saddle ⑲, and then tighten the GT-SA bolts ⑱ with the tightening torque shown in *table 9-3*.
9. Put the cable tie ⑯ through the clamp, and secure the air hose of the internal wiring harness ① to the support ⑮.  
At this time, secure the cable tie ⑯ at the white marking of the air hose of the internal wiring harness ①.
10. Mount the support ⑮ to the S-head, and then tighten the GT-SA bolts ⑰ with the tightening torque shown in *table 9-3*.
11. Connect the air hose to the union ⑩.
12. Connect the "IN" connector and the "OUT" connector of the internal wiring harness ① respectively to the "IN" port and the "OUT" port of the multi-port connector in the S-head.
13. 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.)
14. Tie the power cables and the encoder cables of the S- and L-axes together by using the cable ties ⑨.
15. Secure the flexible hose of the internal wiring harness ① by using the clamp ⑦.  
At this time, mount the clamp ⑦ along the white marking of the flexible hose.  
(Refer to *fig. 9-4 "Securing the Internal Wiring Harness in S-Head"*.)

## 9 Cable Wiring

### 9.1 Disassembly/Reassembly of Internal Wiring Harness

16. Install the conical spring washers to the hexagon socket head cap screws ⑥, and tighten them with the tightening torque shown in *table 9-3 "Internal Wiring Harness Parts Checklist (S-Head)"*.
17. Put the cable ties ⑧ through the clamp, and secure the internal wiring harness ①.  
At this time, secure it by using the cable ties ⑧ at the white marking of the internal wiring harness ①. Also, make sure that the white marking for positioning the internal wiring harness ① is located in front. (Refer to *fig. 9-4 "Securing the Internal Wiring Harness in S-Head"*.)
18. Mount the cover ⑤, and tighten the GT-SA bolts ④ with the tightening torque shown in *table 9-3*.
19. Mount the cover ③, and tighten the GT-SA bolts ② with the tightening torque shown in *table 9-3*.

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





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9 Cable Wiring9.1 Disassembly/Reassembly of Internal Wiring Harness

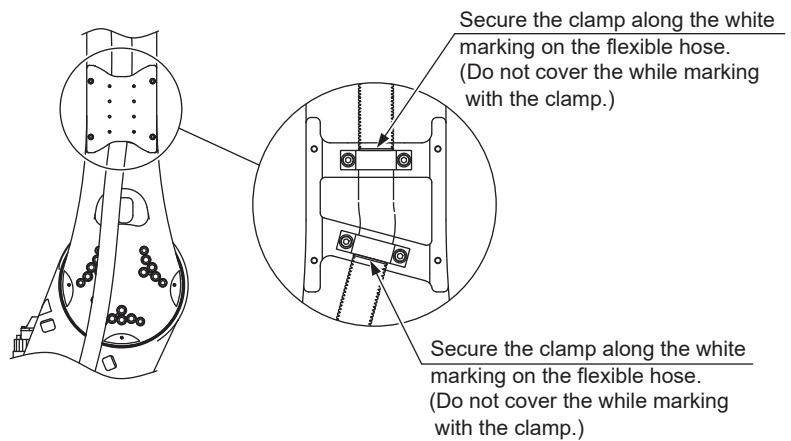
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**2. L-arm**

- 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 clamps④.  
At this time, mount the clamps④ 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 bolts⑤ with the tightening torque shown in *table 9-2*.
3. Mount the cover②, and tighten the GT-SA bolts③ with the tightening torque shown in *table 9-2*.

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



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9 Cable Wiring  
 9.1 Disassembly/Reassembly of Internal Wiring Harness

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### 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. Install the cap nut of the union<sup>⑬</sup> to the internal wiring harness<sup>①</sup>, and then mount the gasket of the union<sup>⑬</sup> to the internal wiring harness<sup>①</sup>. At this time, match the colored marking on the cable of the internal wiring harness<sup>①</sup> and the hole size of the gasket, and then match the white marking of the internal wiring harness<sup>①</sup> and the edge face of the gasket. (Refer to *fig. 9-6 "Securing the Internal Wiring Harness in Casing"*.)
2. Put the internal wiring harness<sup>①</sup> through the union<sup>⑬</sup>.
3. Tighten the cap nut of the union<sup>⑬</sup>, and secure the internal wiring harness<sup>①</sup>.  
At this time, make sure that the white marking for positioning the internal wiring harness<sup>①</sup> is located in front. (Refer to *fig. 9-6*.)
4. Mount the support<sup>⑫</sup> to the plate, and then tighten the GT-SA bolts<sup>⑪</sup> with the tightening torque shown in *table 9-1*.
5. Secure the flexible hose of the internal wiring harness<sup>①</sup> by using the clamp<sup>⑩</sup>.  
At this time, mount the clamp<sup>⑩</sup> along the white marking on the flexible hose.
6. Install the washers to the GT-SA bolts<sup>⑨</sup>, and then tighten them with the tightening torque shown in *table 9-1*.
7. Connect the air hose of the internal wiring harness<sup>①</sup> to the unions<sup>⑦</sup> and <sup>⑧</sup>.
8. Connect the "R-PW" connector of the internal wiring harness<sup>①</sup> with the "R" connector of the R-axis power cable.
9. Enclose the connecting part of the R-axis power cable's connector in the protective tubes<sup>⑥</sup>, and secure it by using the cable tie<sup>⑤</sup>.
10. Connect the "B-PW" connector of the internal wiring harness<sup>①</sup> with the "B-PW" connector of the internal wiring harness for the B- and T-axes, and connect the "T-PW" connector of the internal wiring harness<sup>①</sup> with the "T-PW" connector of the internal wiring harness for the B- and T-axes.
11. Enclose the connecting parts of the B- and T-axis power cables' connectors in the protective tubes<sup>⑥</sup>, and secure it by using the cable tie<sup>⑤</sup>.
12. Connect the "U-PW" connector of internal wiring harness<sup>①</sup> with the "U-PW" connector of the U-axis power cable.
13. Connect the "SA", "SB", and "SC" connectors of internal wiring harness<sup>①</sup> with the "SA", "SB", and "SC" connectors of the internal user I/O wiring harness.
14. Enclose the connector parts of the internal user I/O wiring harness in the protective tubes<sup>⑥</sup>, and secure it by using the cable ties<sup>⑤</sup>.
15. Connect the "IN" connector of the internal wiring harness<sup>①</sup> to the "IN" port of the multi-port connector in the casing.
16. Put each connector part into the casing.

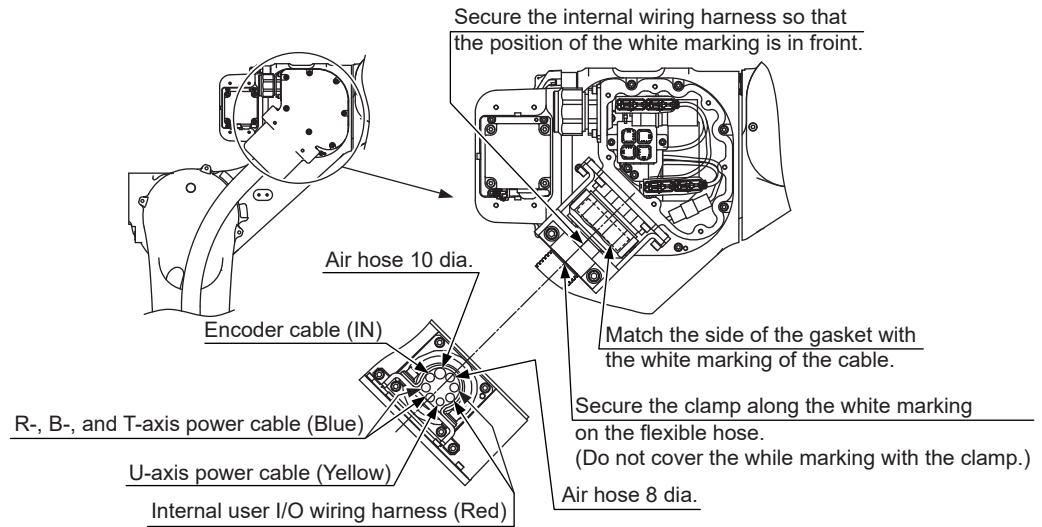
## 9 Cable Wiring

### 9.1 Disassembly/Reassembly of Internal Wiring Harness

17. Mount the cover③, and tighten the GT-SA bolts② with the tightening torque shown in *table 9-1 “Internal Wiring Harness Parts Checklist (Casing)”*.

18. Turn ON the YRC1000 power supply.

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



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

## 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"*.



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 bolts ⑫, and remove the cover ⑬.
3. Remove the gasket ⑭ from the cover ⑬.
4. Disconnect the "IN" connector of the internal wiring harness for the B- and T-axes ① 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-axes ①.

#### Spacer

6. Unscrew the GT-SA bolts ⑮ and remove the cover ⑯.
7. Remove the O-ring ⑰ from the spacer.
8. Cut off the cable tie ⑱.

#### Casing

9. Perform ■ *"Disassembly"* in *chapter 9.1 "Disassembly/Reassembly of Internal Wiring Harness"* and remove the internal wiring harness.
10. Disconnect the "OUT" connector of the internal wiring harness for the B- and T-axes ① from the "OUT" port of the multi-port connector in the casing.
11. Remove the cap nut of the union ②.  
At this time, be sure not to disconnect the connector on the "R" port.
12. Unscrew the GT-SA bolts ③, and remove the support ④.  
At this time, be sure not to disconnect the connectors on the "U" port and the "R" port.
13. Unscrew the hexagon socket head cap screws ⑤ and ⑥, and then remove the cover ⑦ from the casing by using the tapped hole.
14. Unscrew the GT-SA bolts ⑧, and remove the cover ⑨.
15. Unscrew the GT-SA bolts ⑩ and ⑪, and pull out the internal wiring harness for the B- and T-axes ①.

---

## 9 Cable Wiring

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

---

#### ■ Reassembly

##### Casing

1. Pass the internal wiring harness for the B- and T-axes① on the B- and T-axis motors side through from the opening of the casing to the U-arm side.
2. Apply Multemp PS2A Grease to the entire circumference of the protective spring in the 5 g application range.  
\* After applying grease, remove the grease around the parts other than the leads. (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 it by using the GT-SA bolts⑩.
4. Tighten the GT-SA bolts⑩ with the tightening torque shown in *table 9-4 "Internal Wiring Harness for B- and T-Axes Parts Checklist"*.
5. Apply Multemp PS2A Grease to the entire circumference of the protective spring in the 13 g application range.  
\* After applying grease, remove the grease around the parts other than the leads. (Refer to *fig. 9-8(b) "Example of B- and T-axes grease application"*)
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 bolts⑪, and tighten the bolts with the tightening torque shown in *table 9-4*.
8. Mount the cover⑨, and tighten the GT-SA bolts⑧ with the tightening torque shown in *table 9-4*.
9. Apply ThreeBond 1206C to the surface of the cover⑦ where the casing will be mounted, and then mount the cover⑦ to the casing.
10. Install the conical spring washers to the hexagon socket head cap screws⑤ and ⑥, and then tighten them with the tightening torque shown in *table 9-4*.
11. Mount the support④ to the cover⑦, and tighten the GT-SA bolts③ with the tightening torque shown in *table 9-4*.
12. Tighten the cap nut of the union②.
13. 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.
14. Perform ■ "Reassembly" in *chapter 9.1 "Disassembly/Reassembly of Internal Wiring Harness"* and mount the internal wiring harness.

##### Spacer

15. Secure the internal wiring harness for the B- and T-axes with the cable ties⑱.
16. Fit the O-ring⑰ into the slot of the spacer.
17. Mount the cover⑬, and tighten the GT-SA bolts⑮ with the tightening torque shown in *table 9-4*.

## 9 Cable Wiring

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

#### U-arm

18. Connect the "B-PW" connector of the internal wiring harness for the B- and T-axes ① 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-axes ① with the "T" connector of the T-axis power cable.
19. Enclose the connecting part in the protective tube and secure it by using a cable tie, and then put it into the space between the T-axis motor and the U-arm.
20. Connect the "IN" connector of the internal wiring harness for the B- and T-axes ① to the "IN" port of the multi-port connector in the U-arm.
21. Fit the gasket ⑭ into the slot of the cover ⑬.
22. Mount the cover ⑬, and tighten the GT-SA bolts ⑫ with the tightening torque shown in *table 9-4 "Internal Wiring Harness for B- and T-Axes Parts Checklist"*.  
At this time, be sure not to fall off the gasket ⑭ from the cover ⑬.
23. 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 HW1271723-B	1	
②	Union C2MBG24-6+7×3P+9	1	
③	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N*m
④	Support HW1409667-1	1	
⑤	Hexagon socket head cap screws M4 (length: 15 mm) Conical spring washer 2L-4	5 each	Tightening torque 2.8 N*m
⑥	Hexagon socket head cap screws M4 (length: 45 mm) Conical spring washer 2L-4	4 each	Tightening torque 2.8 N*m
⑦	Cover HW1101193-1	1	
⑧	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N*m
⑨	Cover HW1405459-1	1	
⑩	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N*m
⑪	GT-SA bolt M4 (length: 12 mm)	2	Tightening torque 2.8 N*m
⑫	GT-SA bolt M4 (length: 12 mm)	12	Tightening torque 2.8 N*m
⑬	Cover HW1200523-1	1	
⑭	Gasket HW1306400-1	1	
⑮	GT-SA bolt M4 (length: 12 mm)	10	Tightening torque 2.8 N*m
⑯	Cover HW1408866-1	1	
⑰	O-ring AS568-172	1	
⑱	Cable tie T18R	2	

9

Cable Wiring

9.2

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

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

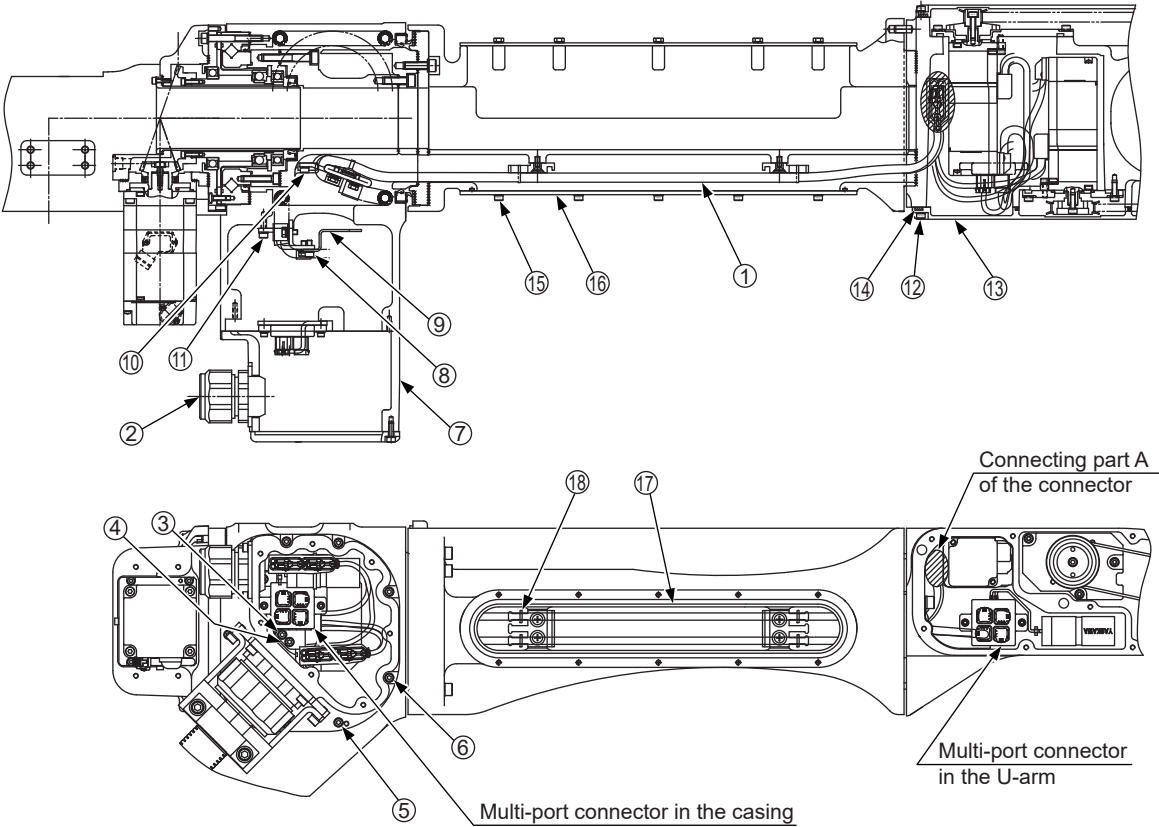


Fig. 9-8(a): Example of B- and T-axes grease application

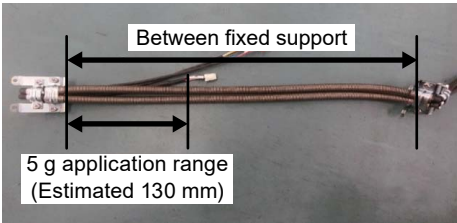
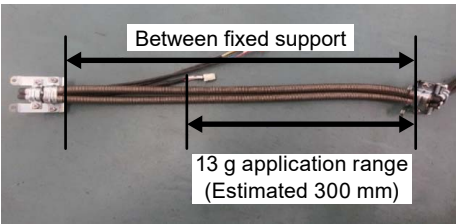


Fig. 9-8(b): Example of B- and T-axes grease application



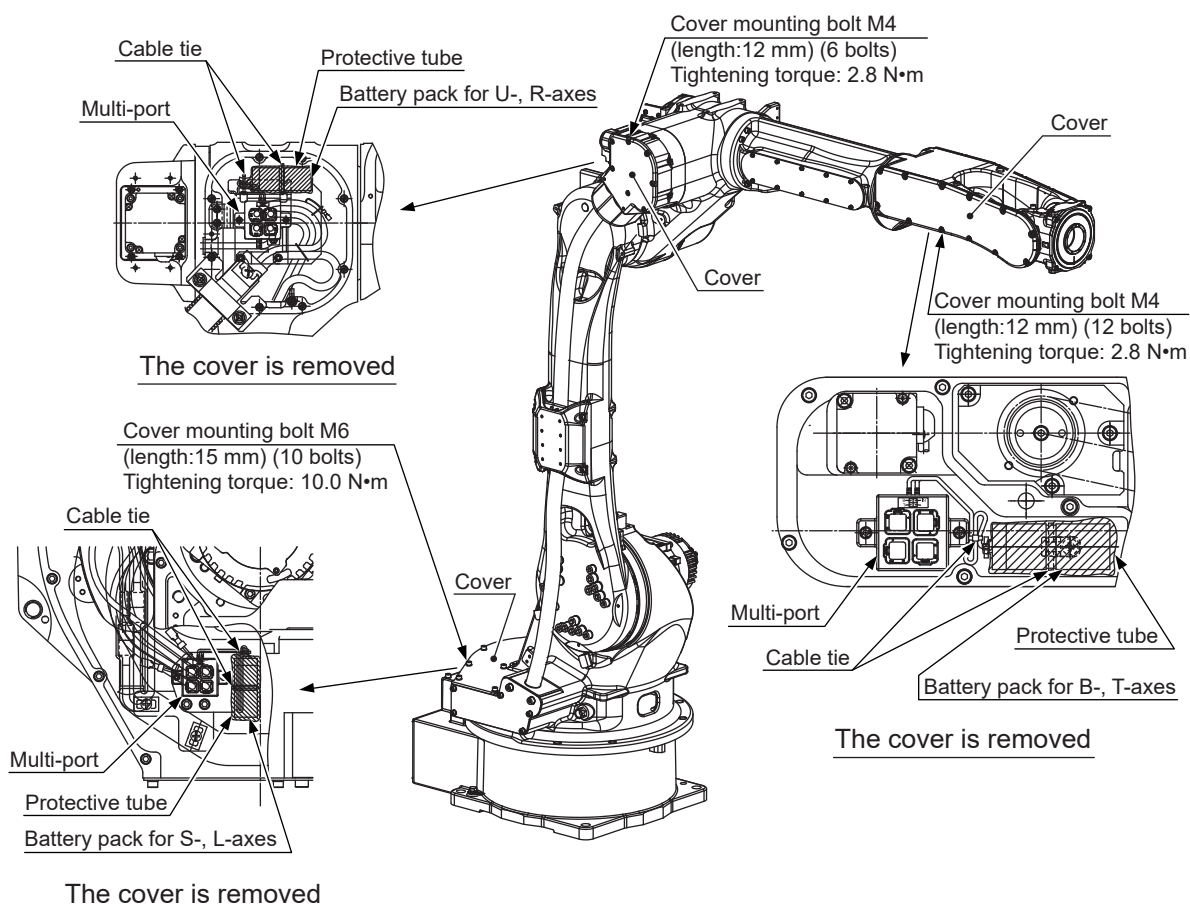
## 10 Battery Pack Replacement

Three battery packs are installed with the multi-port connectors as shown in *fig. 10-1 "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.

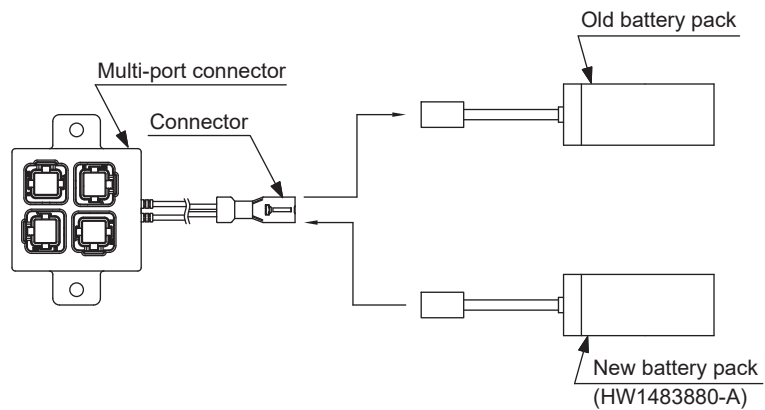
*Fig. 10-1: Location of the Battery and Multi-Port Connector*





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

*Fig. 10-2: 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. 10-1 "Location of the Battery and Multi-Port Connector"* and reinstall the cover.

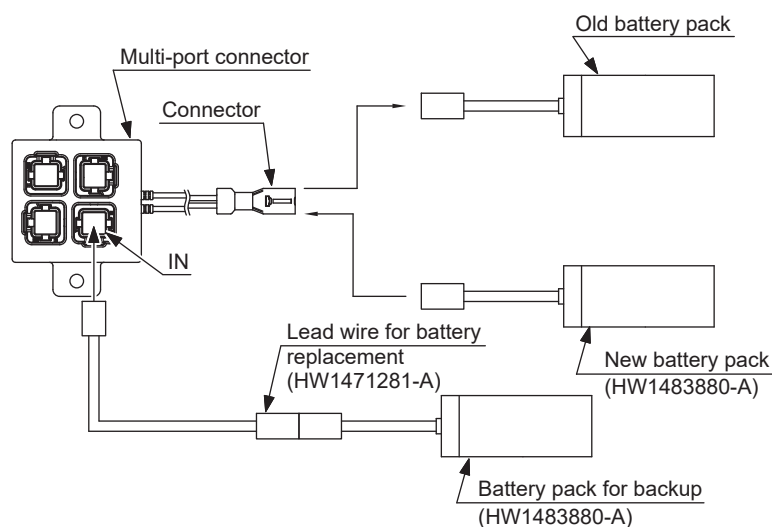


When reinstalling the cover, be careful not to let the cable get caught.

## 10 Battery Pack Replacement

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

Fig. 10-3: 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.



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.



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.

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## 10 Battery Pack Replacement

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9. Tighten the cover mounting bolts with the tightening torque shown in *fig. 10-1 "Location of the Battery and Multi-Port Connector"* and reinstall the cover.



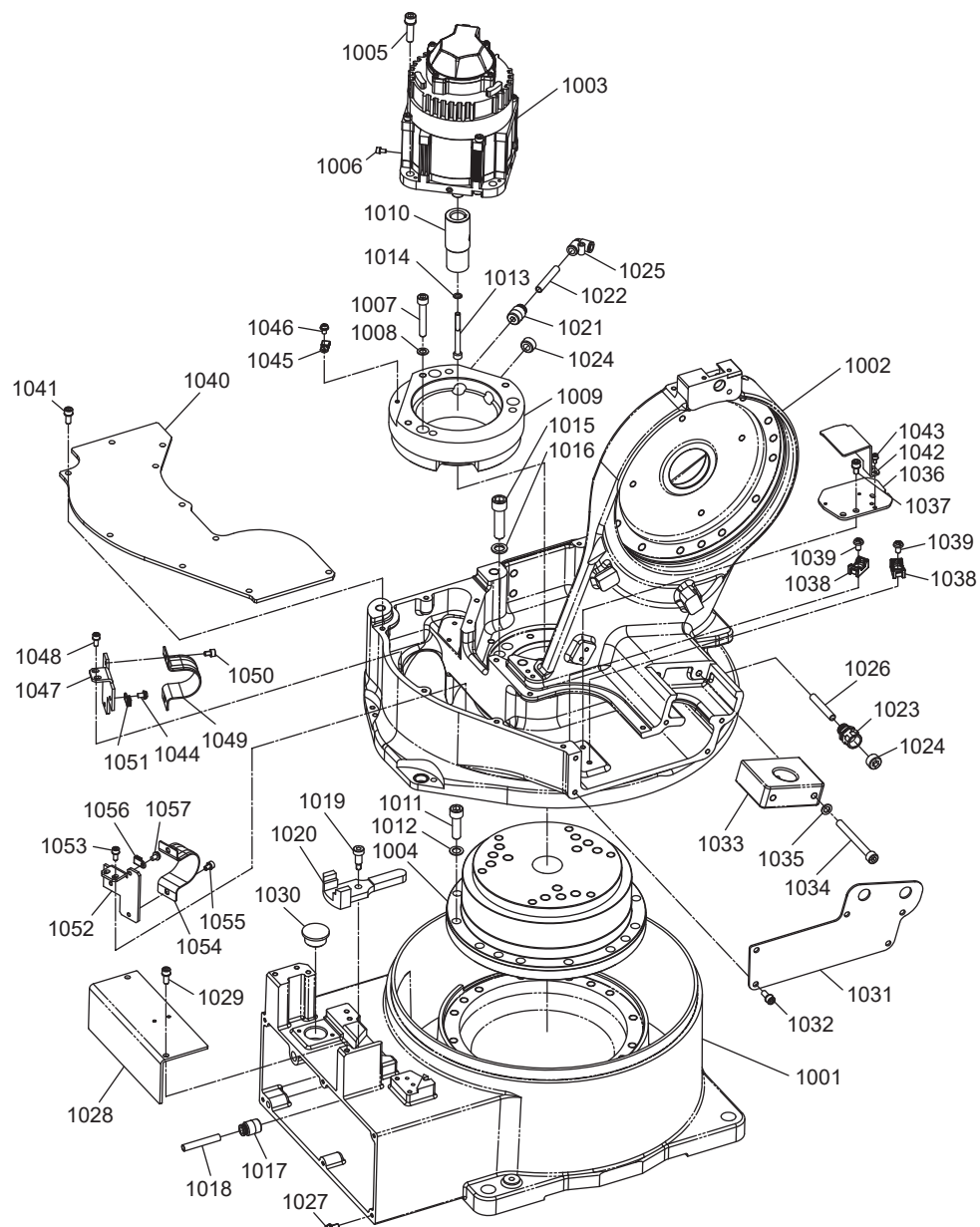
When reinstalling the cover, be careful not to let the cable get caught.

11 Parts List  
11.1 S-Axis Unit

## 11 Parts List

### 11.1 S-Axis Unit

Fig. 11-1: S-Axis Unit



11 Parts List  
11.1 S-Axis Unit

Table 11-1: S-Axis Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs.
1001	HW1100683-1	Base	1
1002	HW1101009-1	S-head	1
1003	SGM7G-09APK-YR1*	Motor	1
1004	HW0387753-B	Speed reducer	1
1005	M8×25 (TRIVALENT CHROMATE)	Hexagon socket head cap screw	3
1006	M4×6 (TRIVALENT CHROMATE)	Slim-head machine screw	4
1007	M8×50	Hexagon socket head cap screw	3
1008	2L-8	Conical spring washer	3
1009	HW1306670-1	M-base	1
1010	HW0313491-2	Gear	1
1011	M10×40	Hexagon socket head cap screw	16
1012	SW-2H-10	Conical knurled spring washer	16
1013	M6×60	Hexagon socket head cap screw	1
1014	2L-6	Conical spring washer	1
1015	M12×45	Hexagon socket head cap screw	8
1016	2H-12	Conical spring washer	8
1017	ATSH8-03	Union	1
1018	NB-0860-0.3	Tube	1
1019	HW1408106-1	Shoulder bolt	1
1020	HW0400645-3	Lever	1
1021	ATSH8-03	Union	1
1022	NB-0860-0.06	Tube	1
1023	PMF8-03	Union	1
1024	NPT3/8 (STAINLESS)	Hexagon socket head tapered piping plug (NPTF type)	2
1025	KQ2L08-00	Union	1
1026	NB-0860-0.24	Tube	1
1027	M5×10 (STAINLESS)	Cross head APS bolt	6
1028	HW1304382-1	Cover	1
1029	M6×15	GT-SA bolt	2
1030	HW1405970-2	Bush	1
1031	HW1408196-1	Cover	1
1032	M6×15	GT-SA bolt	5
1033	BGPS-29	Clamp	1
1034	M8×80	Hexagon socket head cap screw	2
1035	2L-8	Conical spring washer	2
1036	HW1408322-2	Support	1

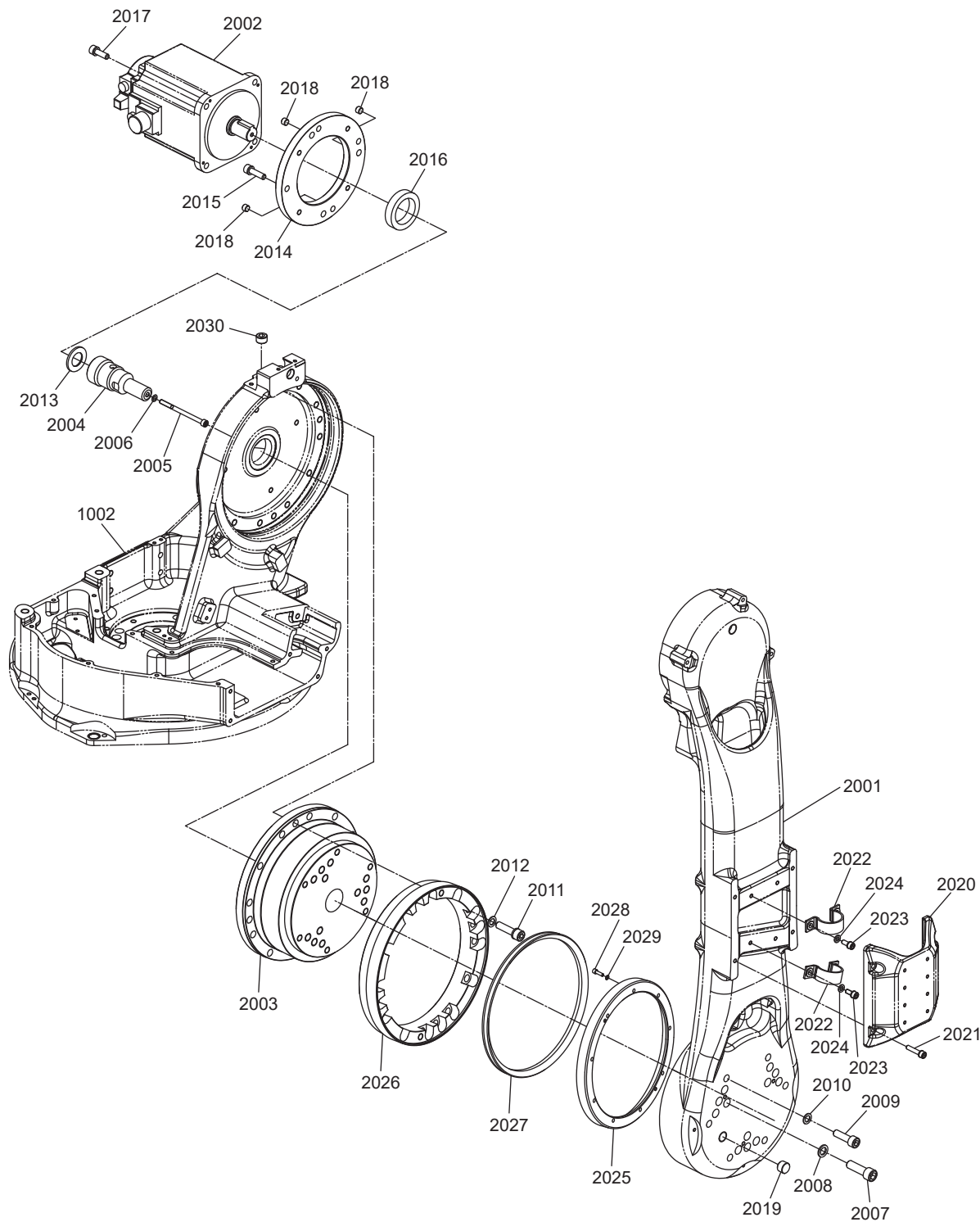
11 Parts List  
11.1 S-Axis Unit

*Table 11-1: S-Axis Unit (Sheet 2 of 2)*

<b>No.</b>	<b>DWG No.</b>	<b>Name</b>	<b>Pcs.</b>
1037	M6×12	GT-SA bolt	2
1038	KR8G5	Clamp	2
1039	M6×10 (STAINLESS)	Pan-head screw	2
1040	HW1306702-1	Cover	1
1041	M6×15	GT-SA bolt	10
1042	HW1409670-1	Support	1
1043	M4×8	GT-SA bolt	2
1044	M5×8 (STAINLESS)	Pan-head sems screw	1
1045	TA1-S10	Clamp	1
1046	M5×8 (STAINLESS)	Pan-head sems screw	1
1047	HW1405431-1	Support	1
1048	M5×12	GT-SA bolt	2
1049	CD31	Saddle	1
1050	M5×8	GT-SA bolt	2
1051	TA1-S10	Clamp	1
1052	HW1405589-1	Support	1
1053	M5×12	GT-SA bolt	2
1054	CD39	Saddle	1
1055	M5×8	GT-SA bolt	2
1056	TA1-S10	Clamp	1
1057	M5×8 (STAINLESS)	Pan-head sems screw	1

11.2   L-Axis Unit

Fig. 11-2: L-Axis Unit



11 Parts List  
11.2 L-Axis Unit

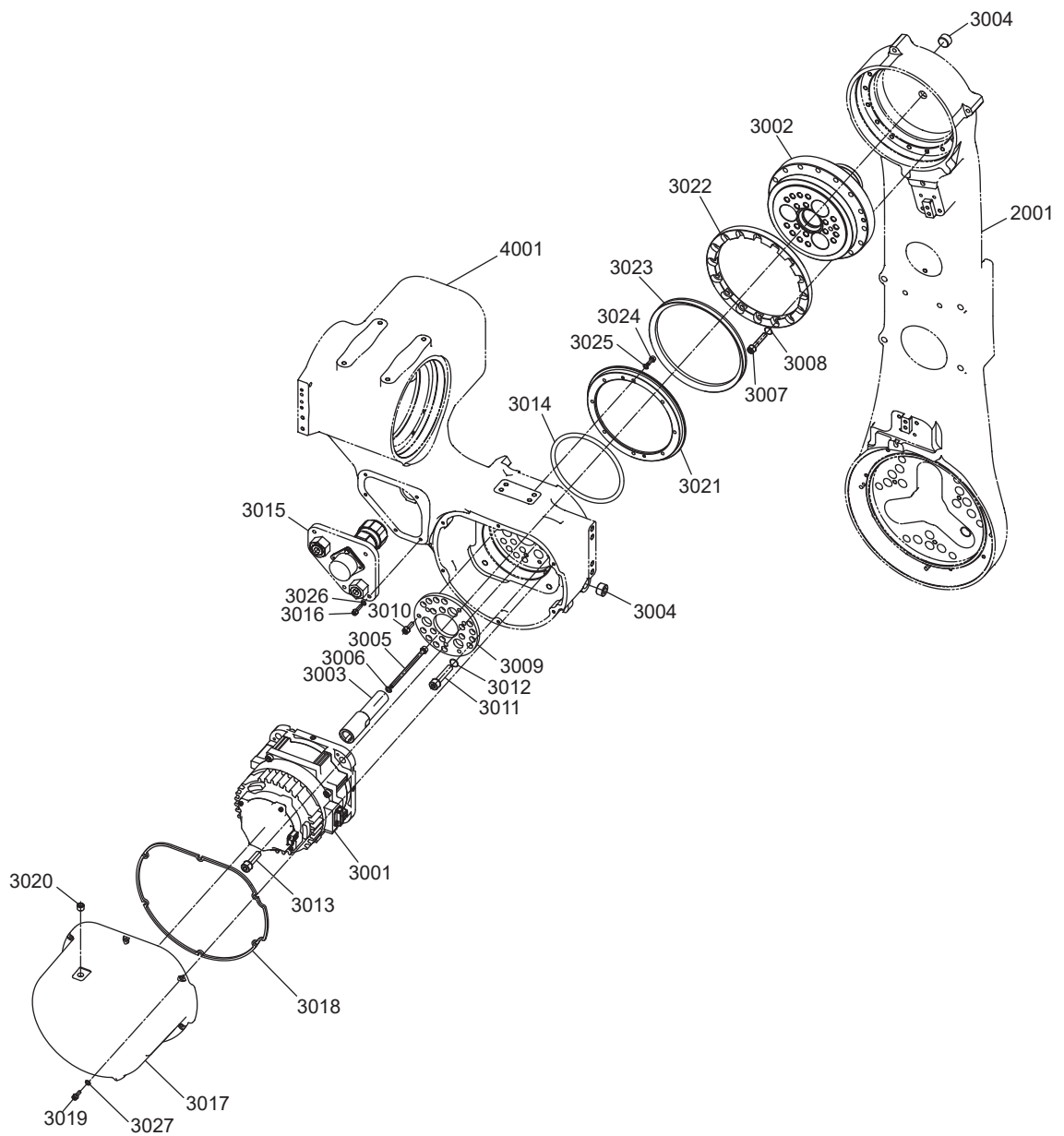
*Table 11-2: L-Axis Unit*

No.	DWG No.	Name	Pcs.
2001	*HW1308028-1* HW1101010-1	L-arm	1
2002	SGM7G-13APK-YR-1*	Motor	1
2003	HW0387753-G	Speed reducer	1
2004	HW1304336-1	Gear	1
2005	M6×90	Hexagon socket head cap screw	1
2006	2L-6	Conical spring washer	1
2007	M12×40	Hexagon socket head cap screw	12
2008	2H-12	Conical spring washer	12
2009	M10×35	Hexagon socket head cap screw	6
2010	2L-10	Conical spring washer	6
2011	M10×60	Hexagon socket head cap screw	16
2012	SW-2H-10	Conical knurled spring washer	16
2013	HW0401506-1	Plate	1
2014	HW1305341-2	M-base	1
2015	M8×30	GT-SA bolt	4
2016	Y426012.5	Oil seal	1
2017	M8×25 (TRIVALENT CHROMATE)	Hexagon socket head cap screw	4
2018	PT1/8 (STAINLESS)	Hexagon socket head plug	3
2019	NPT3/8 (STAINLESS)	Hexagon socket head tapered piping plug (NPTF type)	1
2020	HW1306781-1	Cover	1
2021	M6×30	GT-SA bolt	4
2022	BGH-29	Clamp	2
2023	M6×15	GT-SA bolt	4
2024	M6 (STAINLESS)	Washer	4
2025	HW1308024-1	Ring	1
2026	HW1308023-1	Housing	1
2027	VR199A	V-ring	1
2028	M5×12	Hexagon socket head cap screw	9
2029	2L-5	Conical spring washer	9
2030	NPT3/8 (STAINLESS)	Hexagon socket head tapered piping plug (NPTF type)	1
1002	HW1101009-1	S-head	1



### 11.3 U-Axis Unit

*Fig. 11-3: U-Axis Unit*



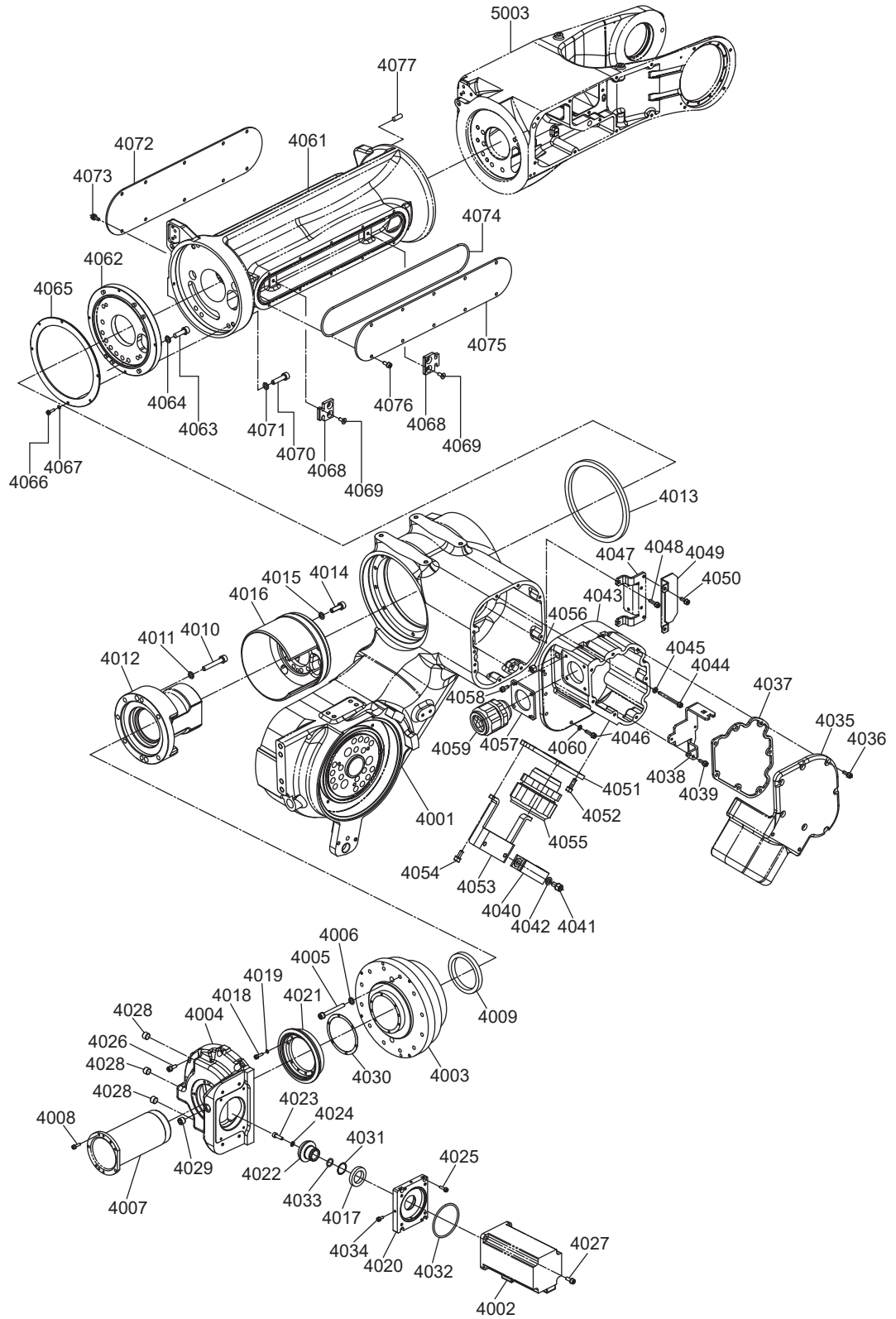
11 Parts List  
11.3 U-Axis Unit

*Table 11-3: U-Axis Unit*

No.	DWG No.	Name	Pcs.
3001	SGM7G-05APK-YR2*	Motor	1
3002	HW0386621-C	Speed reducer	1
3003	HW1304321-1	Gear	1
3004	NPT3/8 (STAINLESS)	Hexagon socket head tapered piping plug (NPTF type)	2
3005	M5×90	Hexagon socket head cap screw	1
3006	2L-5	Conical spring washer	1
3007	M6×35	Hexagon socket head cap screw	16
3008	SW-2H-6	Conical knurled spring washer	16
3009	HW1405391-2	Plate	1
3010	M5×16 (Unused since January 2021 assembly)	GT-SA bolt	3
3011	M8×40	Hexagon socket head cap screw	18
3012	SW2H-8	Conical knurled spring washer	18
3013	M8×25 (TRIVALENT CHROMATE)	Hexagon socket head cap screw	4
3014	P105	O-ring	1
3015	HW1271814-A	Wire harness	1
3016	M4×16 (STAINLESS)	Hexagon socket head cap screw	5
3017	*HW1308030-1* HW1304834-1	Cover	1
3018	HW1308044-1	Gasket	1
3019	M4×14	Hexagon socket head cap screw	6
3020	PT1/8	Hexagon socket head plug	2
3021	HW1308013-1	Ring	1
3022	HW1308012-1	Housing	1
3023	VR140A	V-ring	1
3024	M4×12	Hexagon socket head cap screw	8
3025	2L-4	Conical spring washer	8
3026	2H-4 (STAINLESS)	Conical spring washer	5
3027	2L-4	Conical spring washer	6
2001	*HW1308028-1* HW1101010-1	L-arm	1
4001	*HW1308029-1* HW1101027-1	Casing	1

## 11.4 R-Axis Unit

Fig. 11-4: R-Axis Unit



11 Parts List  
11.4 R-Axis Unit

Table 11-4: R-Axis Unit (Sheet 1 of 3)

No.	DWG No.	Name	Pcs.
4001	*HW1308029-1* HW1101027-1	Casing	1
4002	SGM7J-02APK-YR1*	Motor	1
4003	HW1382521-A	Speed reducer	1
4004	HW1200370-2	Housing	1
4005	M5×45	Hexagon socket head cap screw	8
4006	2L-5	Conical spring washer	8
4007	HW1303257-3	Shaft	1
4008	M3×12	GT-SA bolt	5
4009	MHSA52709	Oil seal	1
4010	M6×40	Hexagon socket head cap screw	7
4011	2L-6	Conical spring washer	7
4012	HW1304069-3	Shaft	1
4013	HMSH1171401014J	Oil seal	1
4014	M6×20	Hexagon socket head cap screw	10
4015	2L-6	Conical spring washer	10
4016	HW1306703-2	Shaft	1
4017	TC20305-FKM	Oil seal	1
4018	M3×12	Hexagon socket head cap screw	6
4019	CDW-L3	Conical spring washer	6
4020	HW1408198-1	M-base	1
4021	HW1304319-1	Gear set (Gear 1)	1
4022	HW1304320-2	Gear set (Gear 2)	1
4023	M4×14	Hexagon socket head cap screw	1
4024	2L-4	Conical spring washer	1
4025	M3×12	GT-SA bolt	4
4026	M4×12	GT-SA bolt	4
4027	M4×12 (TRIVALENT CHROMATE)	Hexagon socket head cap screw	4
4028	PT1/8 (STAINLESS)	Hexagon socket head plug	3
4029	PT1/8 (STAINLESS)	Hexagon socket head plug	1
4030	HW1404157-*	Shim	1
4031	HW2402219-*	Shim	1
4032	S50	O-ring	1
4033	S10	O-ring	1
4034	M3×6	Hexagon socket head cap screw	3
4035	HW1101193-1	Cover	1
4036	M4×12	GT-SA bolt	7
4037	HW1308043-1	Gasket	1
4038	HW1409667-1	Support	1

11 Parts List  
11.4 R-Axis Unit

*Table 11-4: R-Axis Unit (Sheet 2 of 3)*

No.	DWG No.	Name	Pcs.
4039	M4×12	GT-SA bolt	2
4040	BGH-29	Clamp	1
4041	M6×12	GT-SA bolt	2
4042	M6 (STAINLESS)	Washer	2
4043	HW1101192-1	Casing cover	1
4044	M4×45	Hexagon socket head cap screw	4
4045	2L-4	Conical spring washer	4
4046	M4×15	Hexagon socket head cap screw	5
4047	HW1405430-1	Support (provided with the internal wiring harness)	1
4048	M4×12	GT-SA bolt	2
4049	HW1405459-1	Cover	1
4050	M4×12	GT-SA bolt	2
4051	HW1409664-1	Plate	1
4052	M5×16	GT-SA bolt	4
4053	HW1409666-1	Support	1
4054	M5×12	GT-SA bolt	2
4055	C2MBG40-8+10×4P+12	Union	1
4056	PT1/8 (STAINLESS)	Hexagon socket head plug	1
4057	HW1409665-1	Plate	1
4058	M4×10	GT-SA bolt	4
4059	C2MBG24-28	Union	1
4060	2L-4	Conical spring washer	5
4061	HW1200806-1	Spacer	1
4062	HW1308597-1	Shaft	1
4063	M6×20	Hexagon socket head cap screw	8
4064	2L-6	Conical spring washer	8
4065	HW1410202-1	Plate	1
4066	M3×6	Hexagon socket cap low head bolt	4
4067	CDW-L3	Conical spring washer	4
4068	HW1409083-1	Support	2
4069	M4×8 (STAINLESS)	Countersunk screw	4
4070	M6×25	Hexagon socket head cap screw	6
4071	2L-6	Conical spring washer	6
4072	HW1405367-1	Cover	1
4073	M4×10 (STAINLESS)	Cross head APS bolt	10
4074	AS568-172	O-ring	1
4075	HW1408866-1	Cover	1

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11 Parts List  
11.4 R-Axis Unit

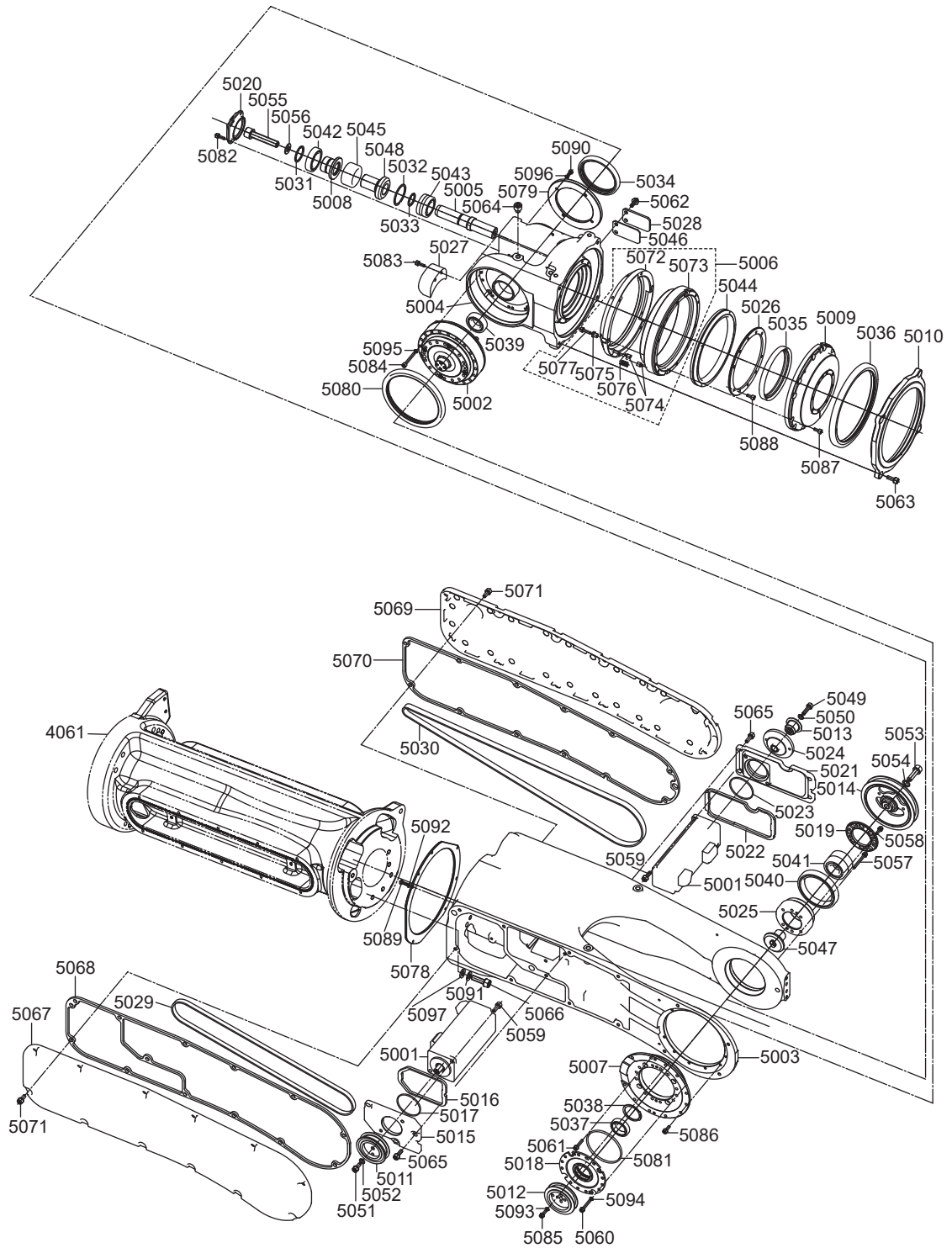
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*Table 11-4: R-Axis Unit (Sheet 3 of 3)*

<b>No.</b>	<b>DWG No.</b>	<b>Name</b>	<b>Pcs.</b>
4076	M4×12	GT-SA bolt	10
4077	HW1408161-6-15	Parallel pin	1
5003	*HW1308031-1* HW1101029-1	U-arm	1

## 11.5 Wrist Unit

Fig. 11-5: Wrist Unit



11 Parts List  
11.5 Wrist Unit

Table 11-5: Wrist Unit (Sheet 1 of 3)

No.	DWG No.	Name	Pcs.
5001	SGM7J-01APK-YR1*	Motor	2
5002	HW1382522-A	Speed reducer	1
5003	*HW1308119-1* HW1100926-1	U-arm	1
5004	*HW1308120-1* HW1100619-1	Wrist	1
5005	HW1303250-1	Gear	1
5006	D-HW1371294-B	Gear assy	1
5007	HW1308131-1	Shaft	1
5008	HW1303260-1	Shaft	1
5009	HW1308009-2	Flange	1
5010	HW1308010-1	Cover	1
5011	HW1407201-A	Pulley	1
5012	HW1409738-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	HW1409646-1	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	Holder	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	HW1485581-A	Oil seal	1
5035	HW1485583-A	Oil seal	1
5036	HW1485585-A	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



11 Parts List  
11.5 Wrist Unit

*Table 11-5: Wrist Unit (Sheet 2 of 3)*

No.	DWG No.	Name	Pcs.
5043	NA4902	Needle bearing	1
5044	RA9008C0	Cross roller bearing	1
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	M4×18	Hexagon socket head cap screw	1
5050	2L-4	Conical spring washer	1
5051	M4×12	Hexagon socket head cap screw	1
5052	2L-4	Conical spring washer	1
5053	M6×20	Hexagon socket head cap screw	1
5054	2L-6	Conical spring washer	1
5055	M8×40	Hexagon socket head cap screw	1
5056	2L-8	Conical spring washer	1
5057	M3×28	GT-SA bolt	6
5058	M3×10	GT-SA bolt	4
5059	M4×12	GT-SA bolt	4
5060	M3×22	Hexagon socket head cap screw	12
5061	M3×16	GT-SA bolt	4
5062	M4×10 (STAINLESS)	Cross head APS bolt	2
5063	M4×12	GT-SA bolt	4
5064	M6×6	Hexagon socket head cap screw	5
5065	M4×12	GT-SA bolt	7
5066	M6×25	Hexagon socket head cap screw	6
5067	HW1200523-1	Cover	1
5068	HW1306400-1	Gasket	1
5069	HW1200524-1	Cover	1
5070	HW1306401-1	Gasket	1
5071	M4×12	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	Spring	3
5077	M3×12	GT-SA bolt	2
5078	HW1409892-1	Plate	1
5079	HW1409655-1	Plate	1
5080	HW1485584-A	Oil seal	1

11 Parts List  
11.5 Wrist Unit

*Table 11-5: Wrist Unit (Sheet 3 of 3)*

<b>No.</b>	<b>DWG No.</b>	<b>Name</b>	<b>Pcs.</b>
5081	S50	O-ring	1
5082	M3×10	GT-SA bolt	4
5083	M3×10 (TRIVALENT CHROMATE)	Hexagon socket head cap screw	2
5084	M3×25	Hexagon socket cap low head bolt	12
5085	M3×12	Hexagon socket cap low head bolt	4
5086	M3×10	GT-SA bolt	11
5087	M3×10	GT-SA bolt	6
5088	M3×10	GT-SA bolt	8
5089	M3×6	Hexagon socket cap low head bolt	5
5090	M3×6	Hexagon socket cap low head bolt	4
5091	2L-6	Conical spring washer	6
5092	CDW-L3	Conical spring washer	5
5093	CDW-L3	Conical spring washer	4
5094	CDW-L3	Conical spring washer	12
5095	CDW-L3	Conical spring washer	12
5096	CDW-L3	Conical spring washer	4
5097	HW8411125-3	Washer	6
4061	HW1200806-1	Spacer	1

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**For inquiries or after-sales service on this product, contact your local YASKAWA representative as shown below.**

**YASKAWA ELECTRIC CORPORATION**

2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu, 806-0004, Japan  
Phone: +81-93-645-7703 Fax: +81-93-645-7802  
[www.yaskawa.jp](http://www.yaskawa.jp)

**YASKAWA AMERICA, INC. (MOTOMAN ROBOTICS DIVISION)**

100 Automation Way, Miamisburg, OH 45342, U.S.A.  
Phone: +1-937-847-6200 Fax: +1-937-847-6277  
[www.motoman.com](http://www.motoman.com)

**YASKAWA EUROPE GmbH (ROBOTICS DIVISION)**

Yaskawastrasse 1, 85391, Allerhausen, Germany  
Phone: +49-8166-90-0 Fax: +49-8166-90-103  
[www.yaskawa.eu.com](http://www.yaskawa.eu.com)

**YASKAWA NORIDC AB**

Verkstadsgatan 2, Box 504, SE-385 25 Torsås, Sweden  
Phone: +46-480-417-800 Fax: +46-486-414-10  
[www.yaskawa.com.cn](http://www.yaskawa.com.cn)

**YASKAWA ELECTRIC (CHINA) CO., LTD.**

22F, One Corporate Avenue, No.222 Hubin Road, Huangpu District, Shanghai 200021, China  
Phone: +86-21-5385-2200 Fax: +86-21-5385-3299  
[www.yaskawa.com.cn](http://www.yaskawa.com.cn)

**YASKAWA SHOUGANG ROBOT CO., LTD.**

No.2 Building, No.6 Rongchang East Street, Beijing E&T Development Area, Beijing 100176, China  
Phone: +86-10-6788-0545  
[www.yasr-motoman.cn](http://www.yasr-motoman.cn)

**YASKAWA ELECTRIC KOREA CORPORATION**

6F, 11, LS-ro, Dongang-gu, Anyang-si, Gyeonggi-do, 14118, Korea  
Phone: +82-31-8015-4224 Fax: +82-31-8015-5034  
[www.yaskawa.co.kr](http://www.yaskawa.co.kr)

**YASKAWA ELECTRIC TAIWAN CORPORATION**

12F, No.207, Sec. 3, Beishin Rd., Shindian District, New Taipei City 23143, Taiwan  
Phone: +886-2-8913 Fax: +886-2-8913-1513  
[www.yaskawa.com.tw](http://www.yaskawa.com.tw)

**YASKAWA ASIA PACIFIC PTE. LTD.**

30A Kallang Place, #06-01, 339213, Singapore  
Phone: +65-6282-3003 Fax: +65-6289-3003  
[www.yaskawa.com.sg](http://www.yaskawa.com.sg)

**YASKAWA ELECTRIC (THAILAND) CO., LTD.**

59, 1<sup>st</sup>-5<sup>th</sup> Floor, Flourish Building, Soi Ratchadapisek 18, Ratchadapisek Road, Huaykwang, Bangkok 10310, Thailand  
Phone: +66-2-017-099 Fax: +66-2-017-0199  
[www.yaskawa.co.th](http://www.yaskawa.co.th)

**PT. YASKAWA ELECTRIC INDONESIA**

Secure Building-Gedung B Lantai Dasar & Lantai 1 Jl. Raya Protokol Halim Perdanakusuma, Jakarta 12610, Indonesia  
Phone: +62-21-2982-6470 Fax: +62-21-2982-6471  
[www.yaskawa.co.id](http://www.yaskawa.co.id)

**YASKAWA INDIA PRIVATE LIMITED (ROBOTICS DIVISION)**

No. 136, Sector-8, Industrial Estate, IMT Manesar, Gurugram, Haryana 122050, India  
Phone: +91-124-475-8500  
[www.yaskawaindia.in](http://www.yaskawaindia.in)

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