

MOTOMAN-MH5(L)S/F, -MH5(L)SII MAINTENANCE MANUAL

TYPE: YR-MH0005S-A0*, YR-MH0005S-B0*
YR-MH0005F-A0*, YR-MH005LS-A0*
YR-MH005LS-B0*, YR-MH005LF-A0*
YR-MH0005S-J0*, YR-MH005LS-J0*
YR-MH0005S-K0*, YR-MH005LS-K0*

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

MOTOMAN INSTRUCTIONS

MOTOMAN-MH5(L)S/F INSTRUCTIONS

DX100 INSTRUCTIONS

DX100 OPERATOR'S MANUAL (for each purpose)

DX100 MAINTENACE MANUAL

FS100 INSTRUCTIONS

FS100 OPERATOR'S MANUAL (for each purpose)

FS100 MAINTENACE MANUAL

The operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual..

MOTOMAN-MH5(L)SII INSTRUCTIONS

DX200 INSTRUCTIONS

DX200 OPERATOR'S MANUAL (for each purpose)

DX200 MAINTENACE MANUAL

The DX200 operator's manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 170781-1CD
Revision: 0

MH5(L)S/F,
MH5(L)SII

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1 Introduction



MANDATORY

- This maintenance manual is intended to explain maintenance procedures primarily for the MOTOMAN-MH5(L)S/F, MH5(L)SII .
- General items related to safety are listed in Chapter 1: Safety of the DX100/DX200/FS100 Instructions. To ensure correct and safe operation, carefully read the DX100/DX200/FS100 instructions before reading this manual.



CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating and maintenance this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX100/DX200/FS100.

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



DANGER

Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.



MANDATORY

Always be sure to follow explicitly the items listed under this heading.



PROHIBITED

Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items.



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



DANGER

- 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.
- 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.

<DX100/DX200>



WARNING

- Before maintenance, inspection, or wiring, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

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

- After maintenance, check the home position before operating the manipulator.

Injury may result from unexpected manipulator motion.

- Before operating the manipulator, check that servo power is turned OFF by pressing the emergency stop buttons on the front door of the DX100/DX200 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

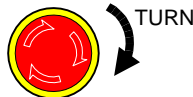
Fig. 1: Emergency Stop Button



- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Fig. 2: Release of Emergency Stop



- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
 - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
 - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
 - Turning ON the power for the DX100/DX200.
 - Moving the manipulator with the programming pendant.
 - Running the system in the check mode.
 - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX100/DX200 and the programming pendant.

<FS100>

**WARNING**

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is pressed.

When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency.

Fig. 3: Emergency Stop Button



- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button. Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).
- Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Fig. 4: Release of Emergency Stop



- Observe the following precautions when performing teaching operations within the manipulator's operating range:
 - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
 - Always follow the predetermined operating procedure.
 - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
 - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the manipulator's operating range and that you are in a safe location before:
 - Turning ON the FS100 power.
 - Moving the manipulator with the programming pendant.
 - Running the system in the check mode.
 - Performing automatic operations.

Injury may result if anyone enters the manipulator's operating range during operation. Always press the emergency stop button immediately if there is a problem.

The emergency stop button is located on the right of the programming pendant.



CAUTION

- Perform maintenance inspection with the specific person who took the maintenance training course in Yaskawa.

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

- When the maintenance inspection is performed, be sure to mount the battery pack before removing the motor encoder connector.

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

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX100/DX200/FS100 after use.

The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- Read and understand the Explanation of Warning Labels in the DX100/DX200/FS100 Instructions before operating the manipulator:

Definition of Terms Used Often in This Manual (DX100/DX200)

The MOTOMAN manipulator is the YASKAWA industrial robot product.

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

In this manual, the equipment is defined as follows:

Equipment	Manual Definition
DX100/DX200 Controller	DX100/DX200
DX100/DX200 Programming Pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

Definition of Terms Used Often in This Manual (FS100)

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
FS100 controller	FS100
FS100 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator Cable
FS100 programming pendant dummy connector	Programming pendant dummy connector

Registered Trademark

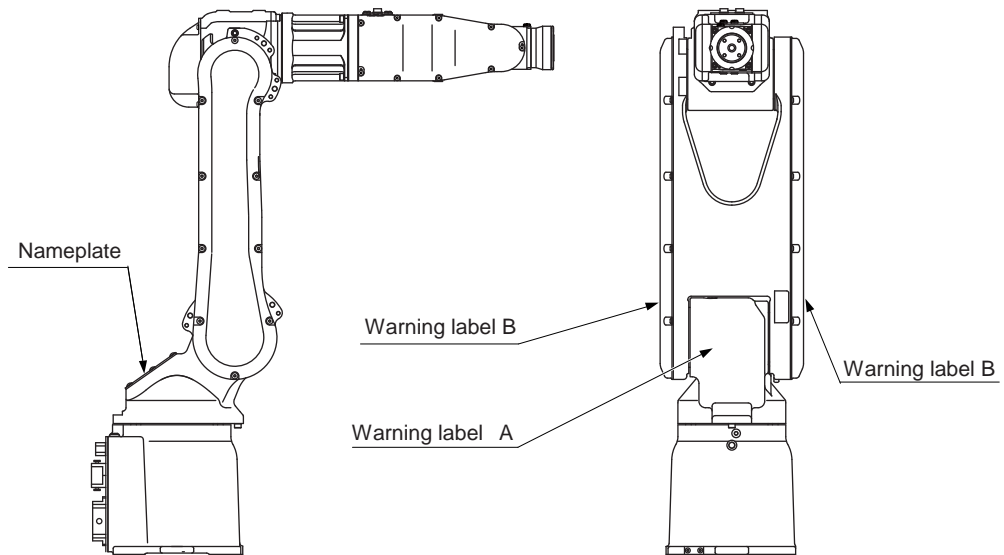
In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

Explanation of Warning Labels


The following warning labels are attached to the manipulator.

Always follow the warnings on the labels.

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



Nameplate

 YASKAWA MOTOMAN	
MODEL MOTOMAN- TYPE	
PAYLOAD _____	MASS _____
kg	kg
ORDER NO. _____	DATE _____
SERIAL NO. _____	
YASKAWA ELECTRIC CORPORATION 2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004 Japan MADE IN JAPAN	
NJ3247	

Warning label A:



Warning Label B:



2 Notes for Maintenance



When performing maintenance such as replacement of a wire harness in the manipulator, the encoder connector may be necessary to be removed. In this case, be sure to connect the battery pack to the battery backup connector before removing the encoder connector.

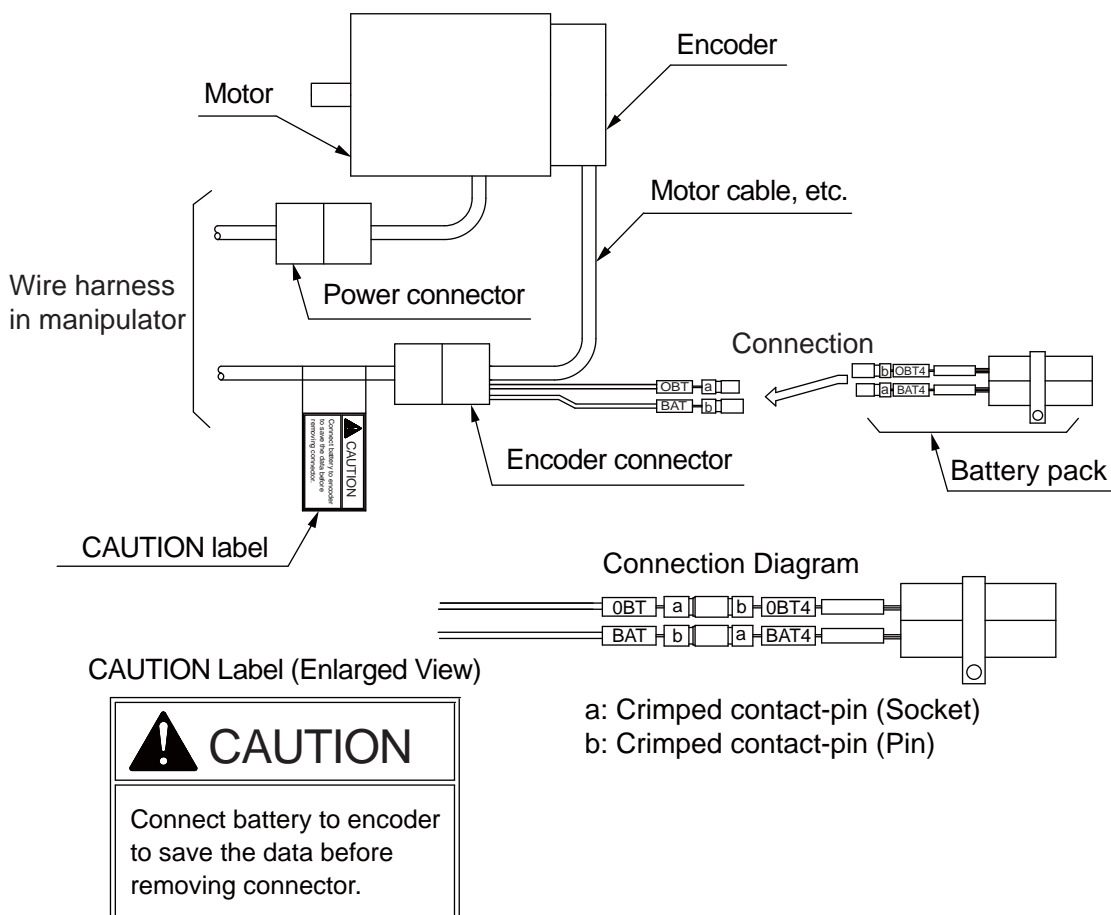
Removing the encoder connector without connecting the battery pack leads to disappearance of the encoder absolute data.

Do not remove the battery unit on the base connector.

2.1 Battery Pack Connection

Before removing the encoder connector (with CAUTION label), connect the battery pack referring to the following figures.

Fig. 2-1: Encoder connector Diagram



3 Home Position Return

In the following cases, perform calibration and set the manipulator geometrical position.

- Change in the combination of the MOTOMAN and the control unit
- Replacement of the motor or encoder
- Clearing stored memory
- Home position deviation caused by hitting the MOTOMAN against a workpiece, etc.
- Replacement, disassembly, and reassembly of the main parts such as speed reducers etc.



Before the calibration, be sure that the manipulator satisfies the following conditions.

- No external force is exerted on the manipulator.

The hand and other parts attached to the wrist unit are removed.

3.1 Home Position Return after Motor Replacement

3.1.1 Home Position Return by Robot Calibration (MOTOCALV EG)

The MOTOCALV EG allows the home position reset by teaching the five-point-in-five-posture.

Refer to "MOTOCALV EG for Windows Operator's Manual" for details on the operation.

3.1.2 Home Position Return by Setting the Teaching Point for Home Position Setting before Replacement

The DX100/DX200/FS100 holds the position data of the job program (hereinafter called as JOB) as the pulse number from the home position of each axis. Stated differently, the precise adjustment of home position allows use of the JOB, which had been used before the motor replacement, without correction even after the motor replacement.

This section explains how to set the DX200.

■ Preparation before Replacement

- Refer to the *Fig. 3-1 "Preparation before Replacement (Example)"* on page 3-2.

Before replacement, create the standard position (hereinafter called the check-point) for home position adjustment after replacement. The check-point must satisfy the conditions below. Furthermore, create the JOB so that the manipulator safely moves to the check-point from the standby position. (The JOB created in this manner will be hereinafter called the check-JOB.)

3 Home Position Return

3.1 Home Position Return after Motor Replacement

① The position should not be deviated by turning the power ON or OFF, or lowering air pressure. Do not create the check point in the working 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.

② Use pointed jigs to create the position so that the deviation is easily found.

Keep a distance as long as possible from the rotational center of the replacing axis.

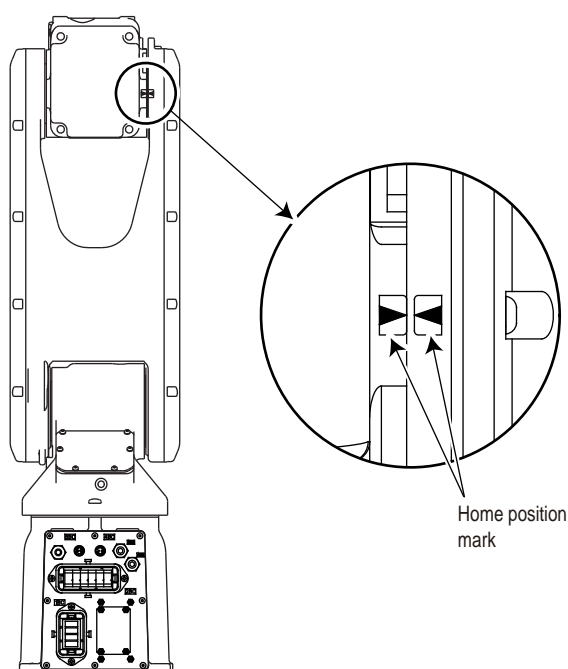
③ Considering the moving direction of the replacing axis, create the position at the point where any deviation is easily found and the axis will not interfere with jigs even if it is deviated.

Example of Check-point Creation

- The check-point cannot be created unless each axis moves to operate. Stated differently, the check-point cannot be created if the axis does not move due to a failure. It is, therefore, recommended to create the check-point for each axis under normal operating conditions.
- Check the home position of the replacing axis. Use the position screen and move the replacing axis to the 0-pulse position: the home position, then check the position of the home position mark. Please execute the adjustment if it is deviated.

Fig. 3-1 "Preparation before Replacement (Example)" shows the MH005LS-A00 U-axis replacement as an example.

Fig. 3-1: Preparation before Replacement (Example)



■ Replacement

- Refer to the *Fig. 3-2 "Replacement (Example)"*.

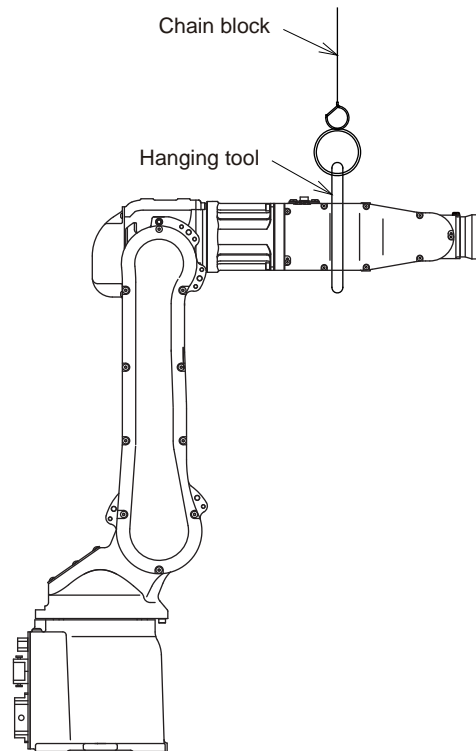
Since the motor is removed, the manipulator cannot keep its posture during the replacement operation. When replacing the motor, hold the manipulator arm with a chain block, etc.

Failure to observe this caution may cause a hazardous condition. Also, when replacing the motor with due care.

Fig. 3-2 "Replacement (Example)" shows the motor in MH005LS-A00 U-axis replacement as an example.

Remove the motor, then conduct the replacement of the U-axis.

Fig. 3-2: Replacement (Example)



■ Home Position Adjustment

After replacement, move the replaced axis to the position of the home position mark. Perform the home position alignment only to the replaced axis.

(For more detailed information, refer to "DX100/DX200/FS100 INSTRUCTIONS".)

Move the axis to the check-point by the check-JOB. (Be careful when moving the axis so that the manipulator may not interfere with jigs.) Move only the replaced axis to adjust the deviation from the check-point created before alignment.

Display the position screen (command value).

The following figure shows the position screen for U-axis.

Command position	R1		
S : 007	INTR : LINK	SPEED : 25.00%	
[COMMAND]	TOOL : 0	[CURRENT]	TOOL : 0
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

Using the above values, calculate the amount of deviation. (Subtract the command value from the present value.)

Present value - Command value = the amount of deviation

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

Perform stepping back, etc. of the check JOB and move the replaced axis to the position where the replaced axis will not interfere with jigs when it moves to the home position. (Be careful when moving the axis so that the manipulator may not interfere with jigs.) Use the position screen and move the replaced axis to the pulse position equal to the amount of deviation.

Refer to the example below:

Command position	R1		
S : 007	INTR : LINK	SPEED : 25.00%	
[COMMAND]	TOOL : 0	[CURRENT]	TOOL : 0
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

3 Home Position Return

3.1 Home Position Return after Motor Replacement

Perform the home position alignment only for the replaced axis on this position. (For more detailed information, refer to the home position calibration of "USER FUNCTIONS MANUAL".)

Move the axis again to the check-point by the check-JOB. Check if the axis is in the check-point created before the operation to complete the adjustment. (If it is deviated, repeat the adjustment procedures.)

Perform an operation check by using the JOB program used before the replacement. If no problem is found, write down the modified home position data (ABS0 data) and the date in the label attached inside the DX100/DX200/FS100.

3.2 Homing Method When the Robot-Axis Motor Battery Runs Out

3.2.1 With the Home Position Calibration Function for Restoration from the Battery Back Up

This is the method to return the manipulator to its home position by executing the "Backup alarm restoration" software on the programming pendant after moving the manipulator close to its home position (within the motor rotation).

The home position returned by this function updates the multi-turn data for motor.

3.2.2 With the Return Keys (S-, L- and U-axes only)

This is the method to return the manipulator to its home position by writing down the difference of the pulse between the key position and the home position, which is set when MOTOMAN is delivered, on the home position label affixed inside of the DX100/DX200/FS100.

When the home position data disappears, move the manipulator to the key position and set the position where the above mentioned difference of the pulse is reflected in the key position as the home position.

■ Calibration Operation

The parts in *Table 3-1 "Parts List"* is required for calibration.

Table 3-1: Parts List

Drawing No.	Name	Qty.	Remark
SFJW6-50	Shaft	3	For S-,L- and U-axes

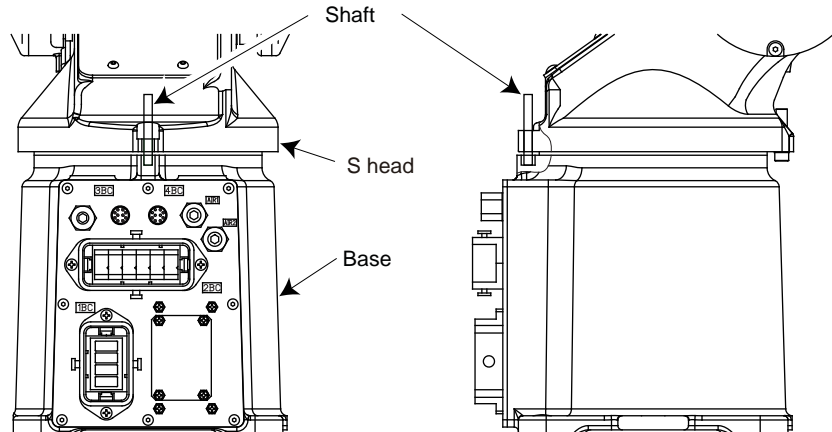
3 Home Position Return

3.2 Homing Method When the Robot-Axis Motor Battery Runs Out

1. S-axis Positioning

As shown in *Fig. 3-3 "S-Axis Positioning"*, insert the shaft SFJW6-50 from the pin hole ($6^{+0.012}_0$ dia.) on the S-head and perform positioning with the programming pendant so that the shaft fits into the slot of the base.

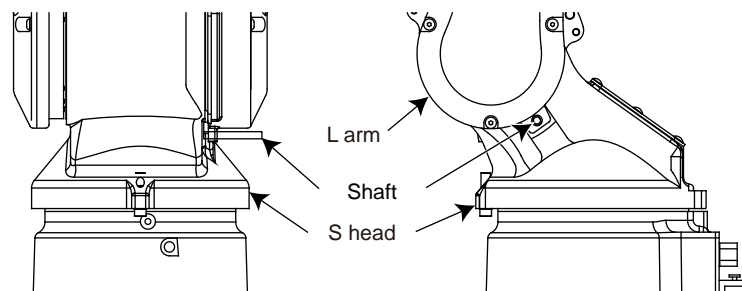
Fig. 3-3: S-Axis Positioning



2. L-axis Positioning

As shown in *Fig. 3-4 "L-Axis Positioning"*, insert the shaft SFJW6-50 in the pin hole ($6^{+0.012}_0$ dia.) on the L-arm and perform positioning with the programming pendant so that the shaft fits into the slot of the S-head.

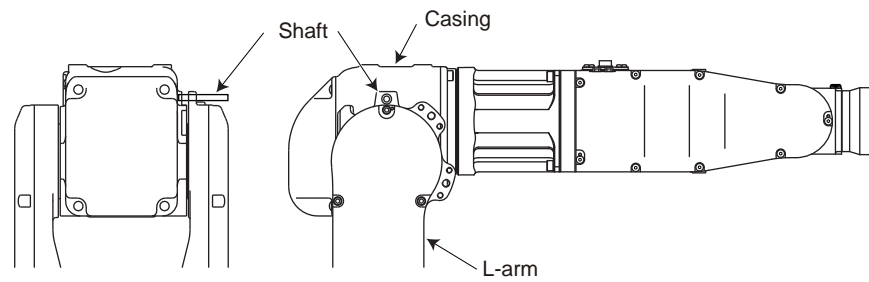
Fig. 3-4: L-Axis Positioning



3. U-axis Positioning

As shown in *Fig. 3-5 "U-Axis Positioning"*, insert the shaft SFJW6-50 in the pin hole ($6^{+0.012}_0$ dia.) on the casing and perform positioning with the programming pendant so that the shaft fits into the slot of the L-arm.

Fig. 3-5: U-Axis Positioning

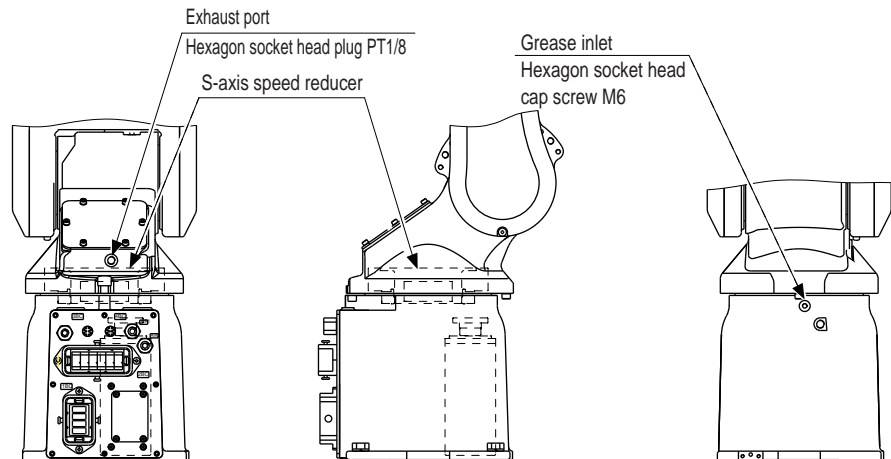


4 Grease Replenishment

4.1 Grease Replenishment for S-Axis Speed Reducer

- Refer to *Fig. 4-1 "S-Axis Speed Reducer Diagram"*.

Fig. 4-1: S-Axis Speed Reducer Diagram



■ Grease Replenishment

(Refer to *Fig. 4-1 "S-Axis Speed Reducer Diagram"*.)

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head cap screw M6 from the grease inlet and the hexagon socket head plug PT1/8 from the exhaust port.



Adding grease without removing the hexagon socket head plug PT1/8 for exhaust port increases the inner pressure and may cause a damage.

Never fail to remove the plug before the grease injection.

2. Install a grease zerk A-MT6X1 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 25 cc



The grease is not exhausted from the exhaust port.

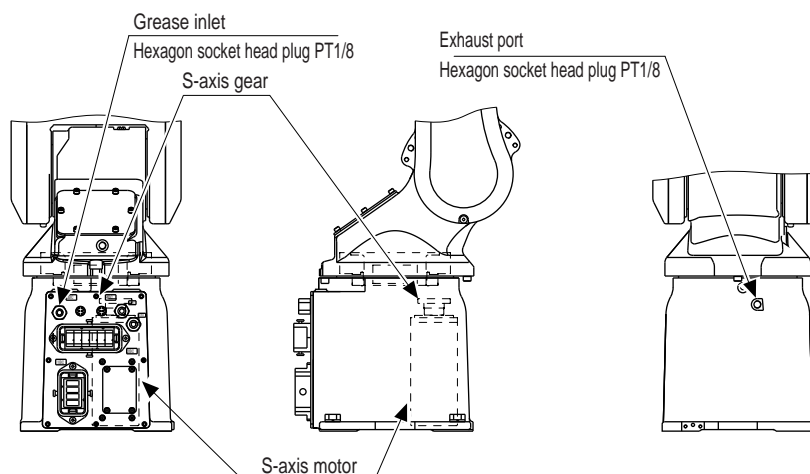
Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head plug PT1/8 to the exhaust port and the hexagon socket head cap screw M6 (with a tightening torque of 10 N•m (1.0 kgf•m)) to the grease inlet. Before installing the screw and the plug, apply Three Bond 1206C on each thread part of them.

4.2 Grease Replenishment for S-Axis Gear

- Refer to Fig. 4-2 "S-Axis Gear".

Fig. 4-2: S-Axis Gear



■ Grease Replenishment (Refer to Fig. 4-2 "S-Axis Gear".)

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head plugs PT1/8 from the grease inlet and the exhaust port.



Adding grease without removing the hexagon socket head plug PT1/8 for exhaust port increases the inner pressure and may cause a damage.

Never fail to remove the plug before the grease injection.

2. Install a grease zerk PT1/8 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 25 cc



The grease is not exhausted from the exhaust port.

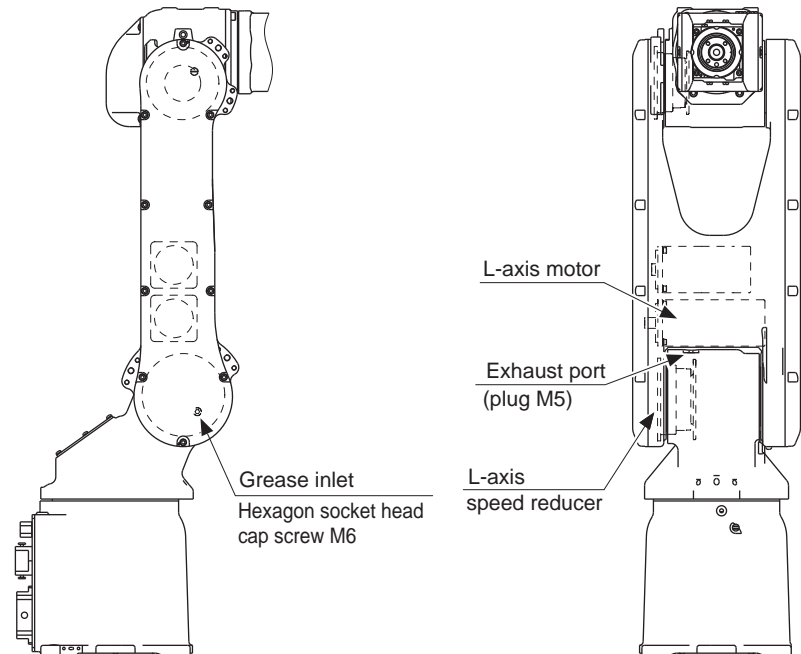
Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head plugs PT1/8 (with a tightening torque of 4.9 N•m (0.5 kgf•m) to the grease inlet and the exhaust port. Before installing the plugs, apply Three Bond 1206C on each thread part of them.

4.3 Grease Replenishment for L-Axis Speed Reducer

- Refer to Fig. 4-3 “L-Axis Speed Reducer Diagram”.

Fig. 4-3: L-Axis Speed Reducer Diagram



■ Grease Replenishment

(Refer to Fig. 4-3 “L-Axis Speed Reducer Diagram”).

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head cap screw M6 from the grease inlet and the plug LP-M5 from the exhaust port.

NOTE

Adding grease without removing the plug LP-M5 for exhaust port increases the inner pressure and may cause a damage.

Never fail to remove the plug before the grease injection.

2. Install a grease zerk A-MT6X1 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 30 cc

NOTE

The grease is not exhausted from the exhaust port.

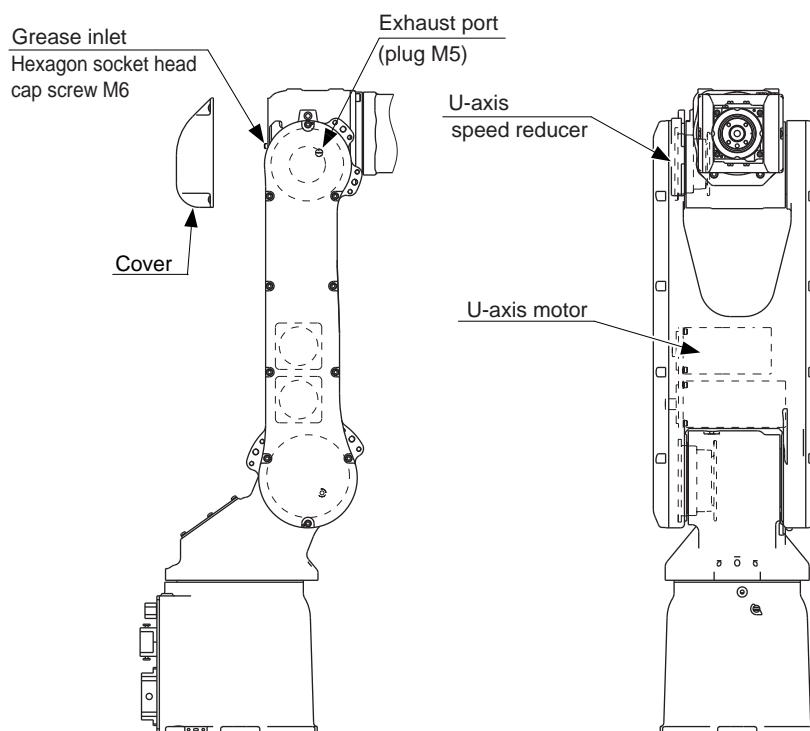
Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the plug LP-M5 to the exhaust port and the hexagon socket head cap screw M6 (with a tightening torque of 10 N•m (1.0 kgf•m) to the grease inlet. Before installing the screw and the plug, apply Three Bond 1206C on each thread part of them.

4.4 Grease Replenishment for U-Axis Speed Reducer

- Refer to Fig. 4-4 “U-Axis Speed Reducer Diagram”.

Fig. 4-4: U-Axis Speed Reducer Diagram



■ Grease Replenishment

(Refer to Fig. 4-4 “U-Axis Speed Reducer Diagram”).

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head cap screw M6 from the grease inlet and the plug LP-M5 from the exhaust port.



Adding grease without removing the plug LP-M5 for exhaust port increases the inner pressure and may cause a damage.

Never fail to remove the plug before the grease injection.

2. Install a grease zerk A-MT6X1 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 20 cc



The grease is not exhausted from the exhaust port.

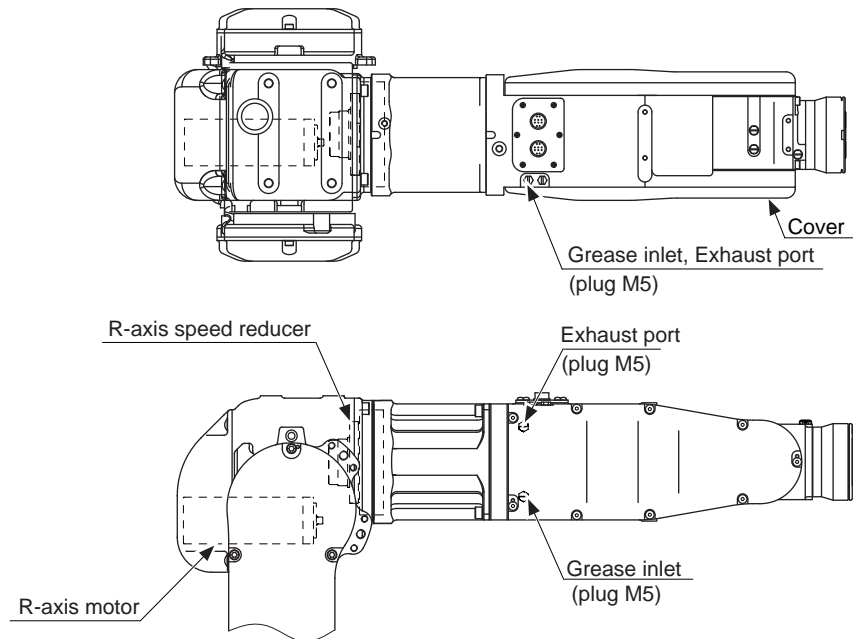
Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the plug LP-M5 to the exhaust port and the hexagon socket head cap screw M6 (with a tightening torque of 10 N•m (1.0 kgf•m) to the grease inlet. Before installing the screw and the plug, apply Three Bond 1206C on each thread part of them.

4.5 Grease Replenishment for R-Axis Speed Reducer

- Refer to *Fig. 4-5 "R-Axis Speed Reducer Diagram"*.

Fig. 4-5: R-Axis Speed Reducer Diagram



■ Grease Replenishment

(Refer to *Fig. 4-5 "R-Axis Speed Reducer Diagram"*.)

Replenish the grease according to the following procedure:

1. Remove the cover and then the plugs from the grease inlet and the exhaust port.



Adding grease without removing the plug LP-M5 for exhaust port increases the inner pressure and may cause a damage.

Never fail to remove the plug before the grease injection.

2. Install a grease zerk M5 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 7 cc



The grease is not exhausted from the exhaust port.

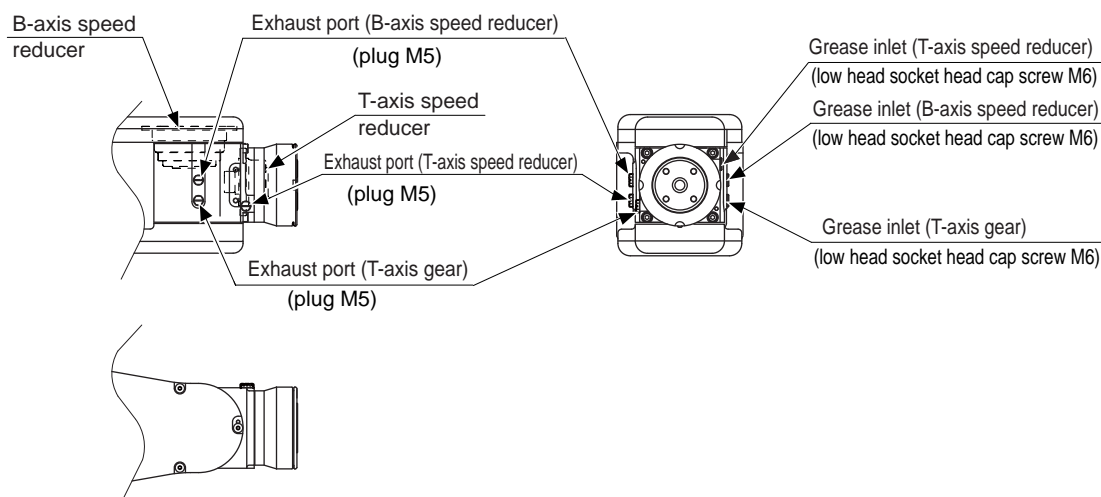
Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the plugs LP-M5 to the grease inlet and the exhaust port.
Before installing the screw and the plug, apply Three Bond 1206C on each thread part of them.

4.6 Grease Replenishment for B- and T-Axes Speed Reducers

- Refer to Fig. 4-6 “B- and T-Axes Speed Reducers Diagram”.

Fig. 4-6: B- and T-Axes Speed Reducers Diagram



■ Grease Replenishment for B-axis (Refer to Fig. 4-6 “B- and T-Axes Speed Reducers Diagram”).

Replenish the grease according to the following procedure:

1. Remove the plugs LP-M5 from the grease inlets and the exhaust ports.



Adding grease without removing the plugs LP-M5 for exhaust ports increases the inner pressure and may cause a damage.

Never fail to remove the plugs before the grease injection.

2. Install a grease zerk M5 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 5 cc



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

4. Remove the grease zerk from the grease inlet, and reinstall the plugs LP-M5 to the grease inlets and the exhaust ports.

■ Grease Replenishment for T-axis

(Refer to Fig. 4-6 "B- and T-Axes Speed Reducers Diagram".)

Replenish the grease according to the following procedure:

1. Remove the plugs LP-M5 from the grease inlets and the exhaust ports.



Adding grease without removing the plugs LP-M5 for exhaust ports increases the inner pressure and may cause a damage.

Never fail to remove the plugs before the grease injection.

2. Install a grease zerk M5 to the grease inlet.
(The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: Harmonic Grease SK-1A
 - Amount of grease: 5 cc



The grease is not exhausted from the exhaust port.

Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the plugs LP-M5 to the grease inlets and the exhaust ports.

5 Disassembly and Reassembly of the Motor

5.1 Disassembly and Reassembly of the S-axis Motor

- Refer to *Fig. 5-1 "Disassembly & Assembly of S-Axis Motor"*.



Refer to *chapter 3 "Home Position Return"* and *chapter 4 "Grease Replenishment"* in this manual.

If you replace the motor, you don't need to insert the backup battery.

Remove old sealing from each parts before starting assembling.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the installation bolts and put the manipulator down sideways. Before unscrew the bolts, be sure to perform positioning to restore the installed position. If the installed position is changed after the motor replacement, all the teaching points for the JOBs need to be modified.
3. Unscrew the hexagon socket button head screws ③ and remove the cover ⑦.
4. Connect the backup battery with the cable of S-axis motor ①. (Refer to *chapter 2 "Notes for Maintenance"*.)
5. Disconnect the cables (both encoder and power-cables) of the S-axis motor ① from the internal wiring harness.
6. Unscrew the hexagon socket head cap screws ⑥ ② and remove the S-axis motor with the M-base ⑤, using the tap of the hexagon socket head cap screw as a removal tap.
7. Unscrew the hexagon socket head cap screws ④ and remove the gear ③.
8. Unscrew the hexagon socket head cap screws ② and remove the M-base ⑤ from the S-axis motor ①.

■ Reassembly

1. Install the M-base ⑤ on the S-axis motor ①. At this time, be careful not to damage the oil seal of the M-base ⑤.
2. Tighten the hexagon socket head cap screws ⑥ with the tightening torque shown in *Table 5-1 "S-Axis Motor Parts Checklist"*.
3. Mount the gasket ⑧ and then the gear ③ on the S-axis motor ①.
4. Attach the conical spring washer to the hexagon socket head cap screw ④, then apply LOCTITE 242 to its thread part and tighten it with the tightening torque shown in *Table 5-1 "S-Axis Motor Parts Checklist"*.
5. Before mounting the S-axis motor ① which is reassembled to the step 3 on the base, apply Three Bond 1206C to the matching face between the M-base ⑤ and the base.
6. Tighten the GT-SA bolts ② with the tightening torque shown in *Table 5-1 "S-Axis Motor Parts Checklist"*.
7. Connect the cables (both encoder and power-cables) of the S-axis motor ① with the internal wiring harness.

5 Disassembly and Reassembly of the Motor
5.1 Disassembly and Reassembly of the S-axis Motor

8. Remove the backup battery.
9. Mount the cover ⑦ and tighten the hexagon socket button head screws ⑧ with the tightening torque shown in *Table 5-1 "S-Axis Motor Parts Checklist"*. For the type A01, apply LOCTITE 242 to the thread part.
10. Install the manipulator at the original position.
11. Turn ON the DX100/DX200/FS100 power supply.

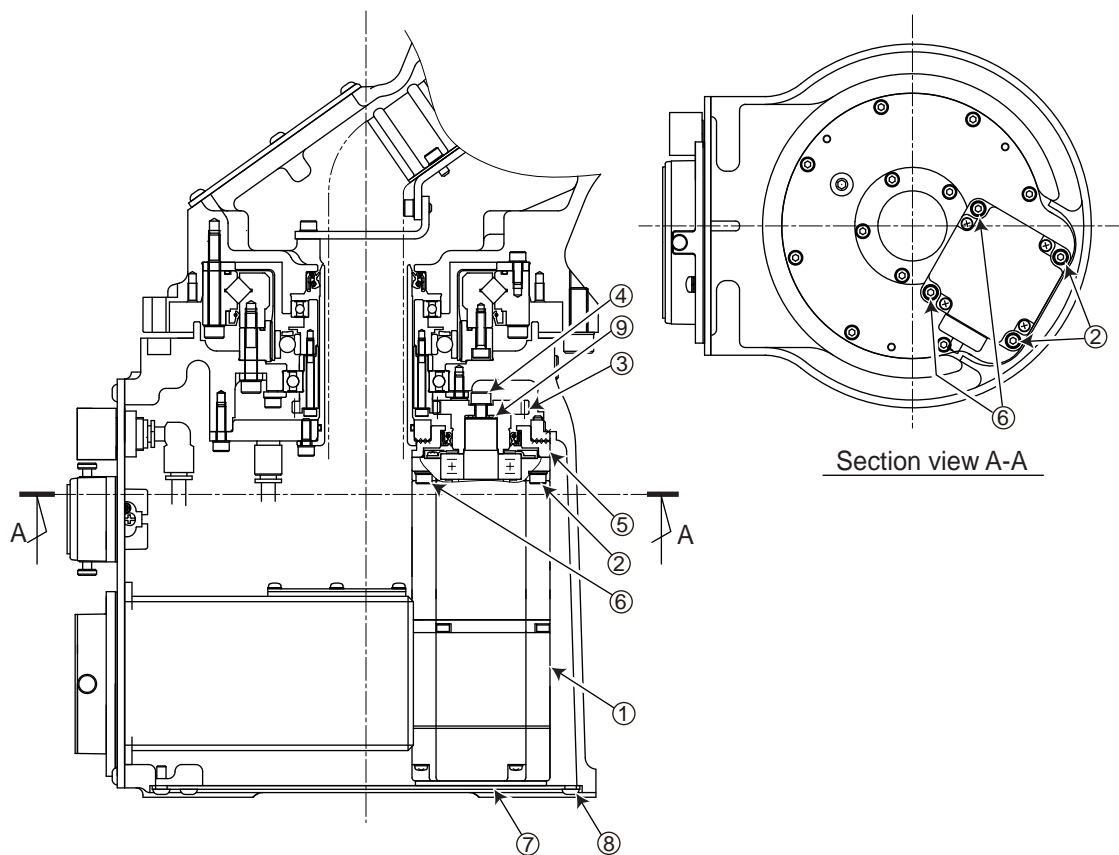
Table 5-1: S-Axis Motor Parts Checklist

No	Item	Qty	Remark
①	S-axis motor HW0388651-A	1	
②	Hexagon socket head cap screw M4 (length: 25 mm) Conical Spring Washer 2H-4 Washer M4	2	Tightening Torque 2.8 N•m
③	Gear HW0314707-1	1	
④	Hexagon socket head cap screw M5 (length: 16 mm) Conical Spring Washer 2H-5	1	Tightening Torque 10 N•m
⑤	M-base HW0414064-1	1	
⑥	Hexagon socket head cap screw M4 (length: 14 mm) Conical Spring Washer 2H-4 Washer M4	2	Tightening Torque 2.8 N•m
⑦	Cover HW0314328-1 (MH5(L)S/F-A00, BO*, MH5(L)S-J00, K0*)	1	
	Cover HW0314328-2 (MH5(L)S/F-A01, MH5(L)S-J01)	1	
⑧	Hexagon socket button head screw M4 (length: 10 mm) (MH5(L)S/F-A00, BO*, MH5(L)S-J00, K0*)	6	Tightening Torque 1.4 N•m
	Extra low head cap screw (hexagon socket) CBSA4-10 (MH5(L)S/F-A01, MH5(L)S-J01)	6	Tightening Torque 2.35 N•m
⑨	Gasket HW0412383-1	1	

MH5(L)S/F,
MH5(L)SII

5 Disassembly and Reassembly of the Motor
5.1 Disassembly and Reassembly of the S-axis Motor

Fig. 5-1: Disassembly & Assembly of S-Axis Motor



5.2 Disassembly and Reassembly of the L-axis Motor

- Refer to *Fig. 5-2 "Disassembly & Assembly of L-Axis Motor"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑨ and remove the covers on the right and left sides ⑦ ⑧
3. Connect the backup battery with the cable of L-axis motor ①.
(Refer to *chapter 2 "Notes for Maintenance"*.)
4. Disconnect the cables (both encoder and power-cables) of the L-axis motor ① from the internal wiring harness.
5. Unscrew the GT-SA bolts ② and remove the L-axis motor ① with the M-base ⑤. When remove the motor, support the U-arm to avoid it from rotating.
6. Unscrew the GT-SA bolts ② and remove the M-base ⑤ from the L-axis motor ①.
7. Unscrew the hexagon socket head cap screw ④ and remove the pulley ③.

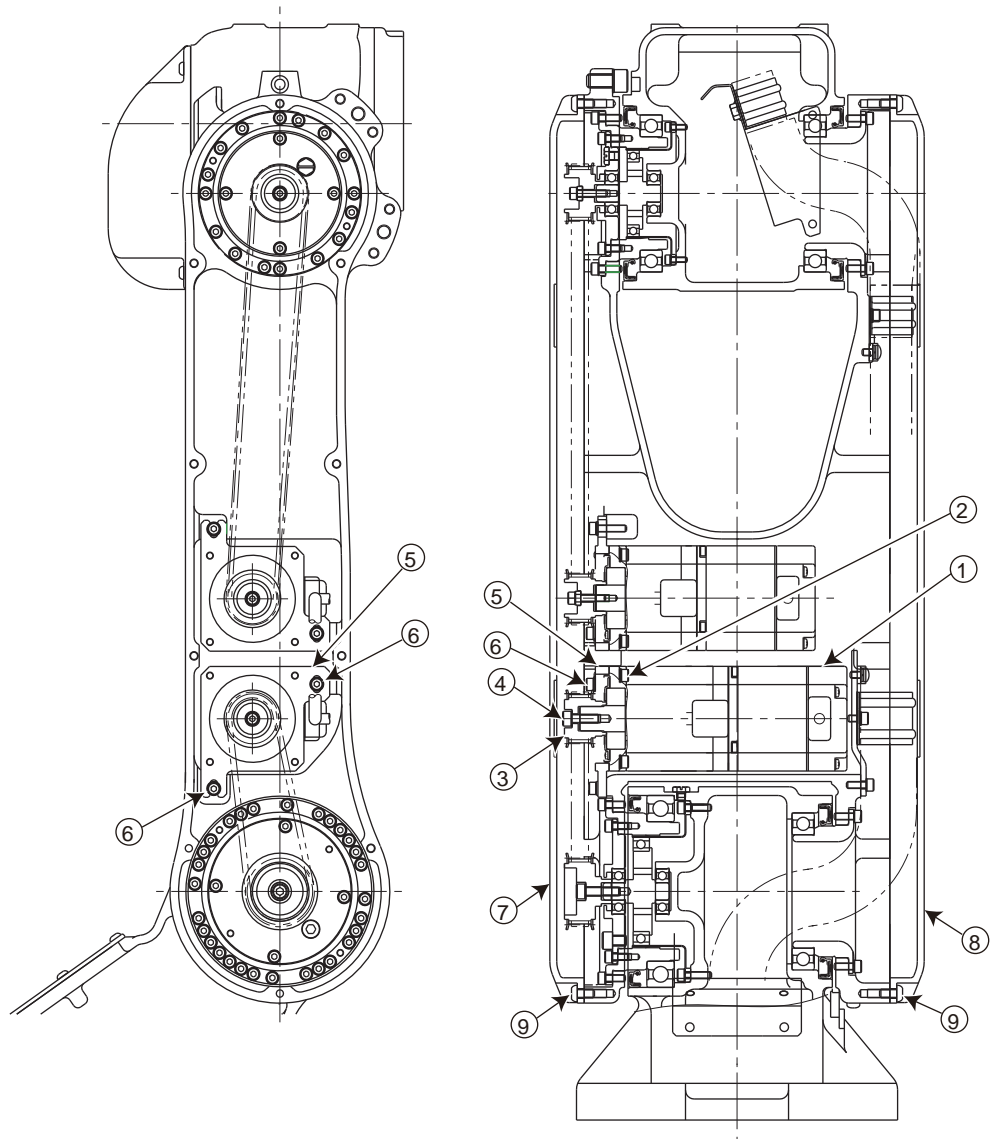
■ Reassembly

1. Mount the pulley ③ on the L-axis motor ①.
2. Attach the conical spring washer to the hexagon socket head cap screw ④, then apply LOCTITE 242 to the thread part and tighten it with the tightening torque shown in *Table 5-2 "L-Axis Motor Parts Checklist"*.
3. Mount the M-base ⑤ on the L-axis motor ① and tighten the GT-SA bolts ② with the tightening torque shown in *Table 5-2 "L-Axis Motor Parts Checklist"*.
4. Mount the L-axis motor ① which is reassembled to the step 3 on the U-arm and put the timing belt on the pulley ③.
5. Attach the conical spring washers to the GT-SA bolts ②, tighten them with the tightening torque shown in *Table 5-2 "L-Axis Motor Parts Checklist"*. (Refer to *section 8.1 "Disassembly and Reassembly of L- and U-axis Timing Belts"* and adjust the initial tension of the timing belt.)
6. Connect the cables (both encoder and power-cables) of the L-axis motor ① with the internal wiring harness.
7. Remove the backup battery.
8. Mount the cover ⑦ ⑧ and tighten the hexagon socket button head screws ⑨ with the tightening torque shown in *Table 5-2 "L-Axis Motor Parts Checklist"*
9. Turn ON the DX100/DX200/FS100 power supply.

Table 5-2: L-Axis Motor Parts Checklist

No	Item	Qty	Remark
①	L-axis motor HW0388651-A	1	
②	GT-SA bolt M4 (length:16 mm) Washer M4	3	Tightening Torque 2.8 N•m
③	Pulley HW0414070-B	1	
④	Hexagon socket head cap screw M5 (length: 16mm) Conical spring washer 2H-5	1	Tightening Torque 10 N•m
⑤	M-base HW0414027-2	1	
⑥	GT-SA bolt M4 (length:16 mm) Washer M4	2	Tightening Torque 2.8 N•m
⑦	Cover HW1200089-2 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-2 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-1 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW1200149-1 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑧	Cover HW1200089-1 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-1 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-2 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW0201253-2 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑨	Hexagon socket button head screw M5 (length: 10 mm)	20	Tightening Torque 1.4 N•m (for type A00) Tightening Torque 2.8 N•m (for type A01, B0*)

Fig. 5-2: Disassembly & Assembly of L-Axis Motor



5.3 Disassembly and Reassembly of the U-axis Motor

- Refer to *Fig. 5-3 "Disassembly & Assembly of U-Axis Motor"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑨ and remove the covers on the right and left sides ⑦ ⑧.
3. Connect the backup battery with the cable of U-axis motor ①.
(Refer to *chapter 2 "Notes for Maintenance"*.)
4. Disconnect the cables (both encoder and power-cables) of the U-axis motor ① from the internal wiring harness.
5. Unscrew the hexagon socket head cap screws ⑥ and remove the U-axis motor ① with the M-base ⑤. When remove the motor, support the U-arm to avoid it from rotating.
6. Unscrew the GT-SA bolts ② and remove the M-base ⑤ from the U-axis motor ①.
7. Unscrew the hexagon socket head cap screw ④ and remove the pulley ③.

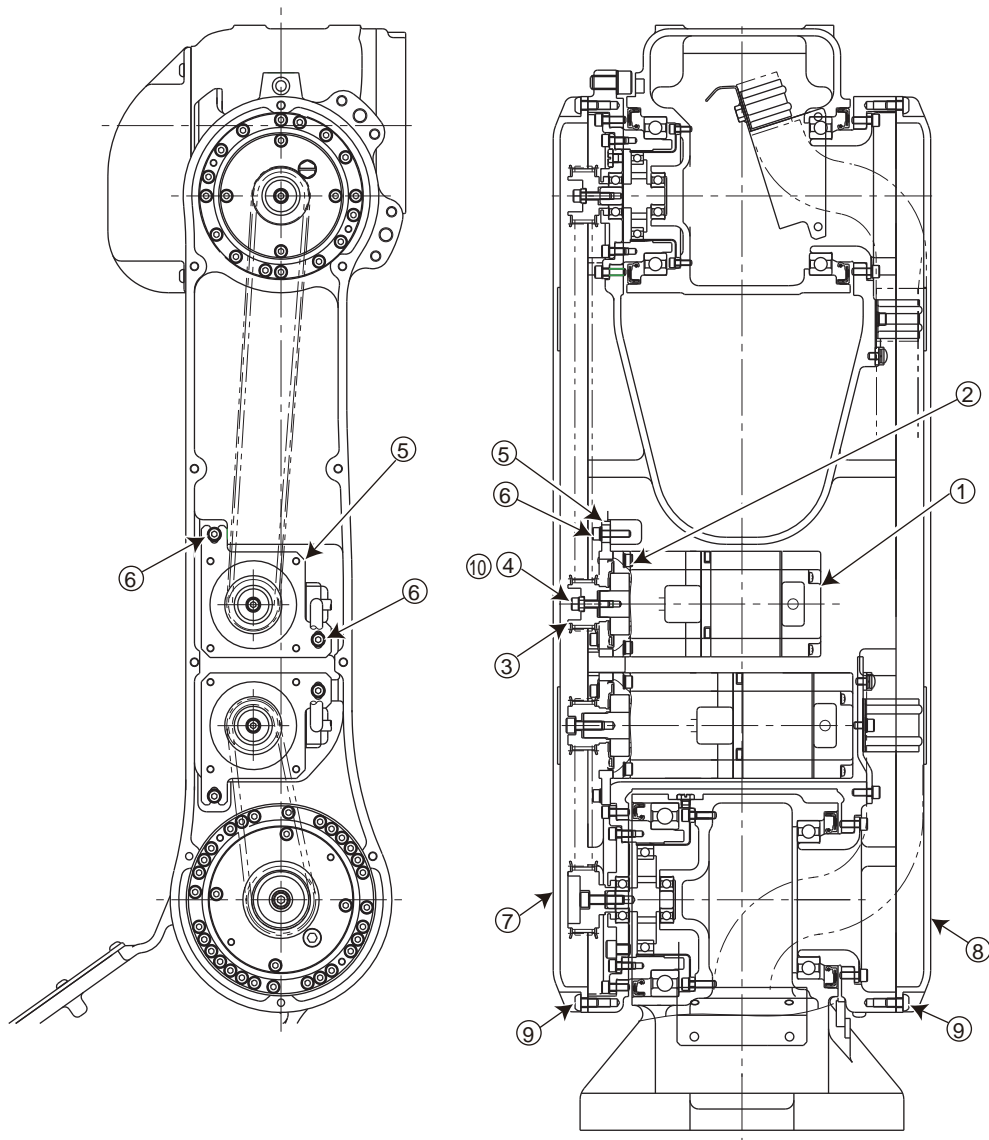
■ Reassembly

1. Mount the pulley ③ on the U-axis motor ①.
2. Attach the conical spring washer and the washer ⑩ to the hexagon socket head cap screw ④, then apply LOCTITE 242 to the thread part and tighten it with the tightening torque shown in *Table 5-3 "U-Axis Motor Parts Checklist"*.
3. Mount the M-base ⑤ on the U-axis motor ① and tighten the GT-SA bolts ② with the tightening torque shown in *Table 5-3 "U-Axis Motor Parts Checklist"*.
4. Mount the U-axis motor ① which is reassembled to the step 3 on the U-arm and put the timing belt on the pulley ③.
5. Attach the conical spring washer to the hexagon socket head cap screws ⑥, tighten them with the tightening torque shown in *Table 5-3 "U-Axis Motor Parts Checklist"*. (Refer to *section 8.1 "Disassembly and Reassembly of L- and U-axis Timing Belts"* and adjust the initial tension of the timing belt.)
6. Connect the cables (both encoder and power-cables) of the U-axis motor ① with the internal wiring harness.
7. Remove the backup battery.
8. Mount the cover ⑦ ⑧ and tighten the hexagon socket button head screws ⑨ with the tightening torque shown in *Table 5-3 "U-Axis Motor Parts Checklist"*.
9. Turn ON the DX100/DX200/FS100 power supply.

Table 5-3: U-Axis Motor Parts Checklist

No	Item	Qty	Remark
①	U-axis Motor HW0388650-A	1	
②	GT-SA bolt M4 (length: 16mm) Washer M4	3	Tightening Torque 2.8 N•m
③	Pulley HW0414072-A	1	
④	Hexagon socket head cap screw M4 (length: 18mm) Conical spring washer 2H-4	1	Tightening Torque 4.8 N•m
⑤	M-base HW0414027-1	1	
⑥	Hexagon socket head cap screw M4 (length: 18mm) Conical spring washer 2H-4 Washer M4	2	Tightening Torque 2.8 N•m
⑦	Cover HW1200089-2 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-2 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-1 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW1200149-1 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑧	Cover HW1200089-1 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-1 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-2 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW0201253-2 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑨	Hexagon socket button head screw M5 (length: 10mm)	20	Tightening Torque 1.4 N•m (for type A00) Tightening Torque 2.8 N•m (for type A01, B0*)
⑩	Washer HW8411125-1	1	

Fig. 5-3: Disassembly & Assembly of U-Axis Motor



5.4 Disassembly and Reassembly of the R-axis Motor

- Refer to *Fig. 5-4 "Disassembly & Assembly of R-Axis Motor"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑥ and remove the cover ⑤.
3. Unscrew the hexagon socket head cap screws ⑦ and pull out the internal wiring harness.
4. Connect the backup battery with the cable of the R-axis motor ①.
(Refer to *chapter 2 "Notes for Maintenance"*.)
5. Disconnect the cables (both encoder and power-cables) of the R-axis motor ① from the internal wiring harness.
6. Unscrew the GT-SA bolts ② and remove the R-axis motor ① from the casing.
7. Unscrew the hexagon socket head cap screw ④ and remove the pulley ③.

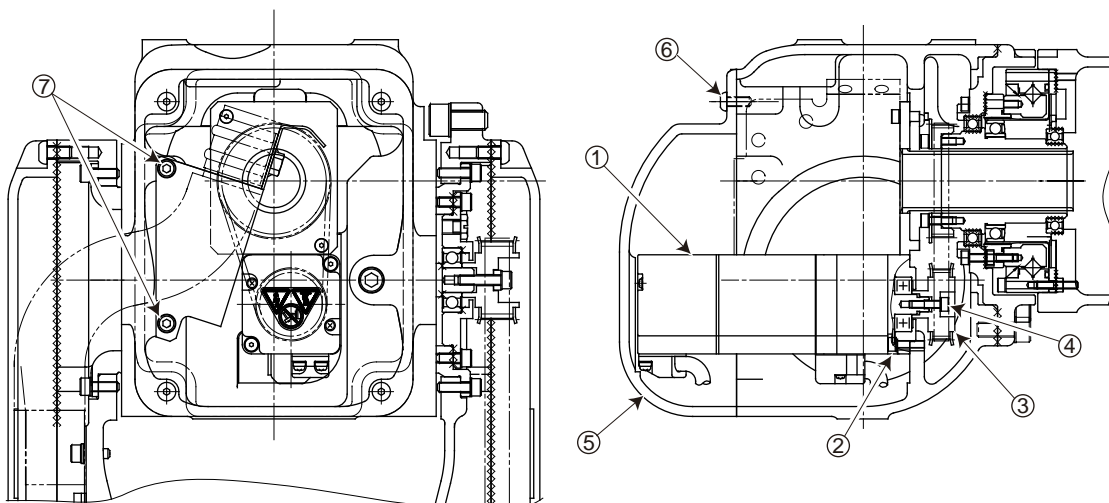
■ Reassembly

1. Mount the pulley ③ on the R-axis motor ①.
2. Attach the conical spring washer to the hexagon socket head cap screw ④, then apply LOCTITE 242 to the thread part and tighten it with the tightening torque shown in *Table 5-4 "R-Axis Motor Parts Checklist"*.
3. Mount the R-axis motor ① on the casing and put the timing belt on the pulley ③.
4. Tighten the GT-SA bolts ② with the tightening torque shown in *Table 5-4 "R-Axis Motor Parts Checklist"*. (Refer to *section 8.2 "Disassembly and Reassembly of R-axis Timing Belt"* and adjust the initial tension of the timing belt.)
5. Attach the conical spring washers to the hexagon socket head cap screws ⑦ and tighten them with the tightening torque shown in *Table 5-4 "R-Axis Motor Parts Checklist"*.
6. Connect the cables (both encoder and power-cables) of the R-axis motor ① with the internal wiring harness.
7. Remove the backup battery.
8. Put the internal wiring harness back to the original state.
9. Mount the cover ⑤ and tighten the hexagon socket button head screws ⑥ with the tightening torque shown in *Table 5-4 "R-Axis Motor Parts Checklist"*.
10. Turn ON the DX100/DX200/FS100 power supply.

Table 5-4: R-Axis Motor Parts Checklist

No	Item	Qty	Remark
①	R-axis motor HW0388647-A	1	
②	GT-SA bolt M3 (length: 12mm) Washer M3	2	Tightening Torque 1.4 N•m
③	Pulley HW0414074-A	1	
④	Hexagon socket head cap screw M3 (length: 12mm) Conical spring washer 2H-3	1	Tightening Torque 2.25 N•m
⑤	Cover HW1200087-1 (MH5(L)S/F-A00, MH5(L)S-J00)	1	
	Cover HW1200150-1 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	1	
⑥	Hexagon socket button head screw M4 (length: 10mm)	4	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
⑦	Hexagon socket head cap screw M4 (length: 10mm) Conical Spring Washer 2H-4	2	Tightening Torque 2.8 N•m

Fig. 5-4: Disassembly & Assembly of R-Axis Motor



5.5 Disassembly and Reassembly of B-Axis Motor

- Refer to *Fig. 5-5 "Disassembly & Reassembly of B-Axis Motor"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑥ and remove the covers ⑤.
3. Connect the backup battery with the cable of the B-axis motor ①.
(Refer to *chapter 2 "Notes for Maintenance"*.)
4. Disconnect the cables (both encoder and power-cables) of the B-axis motor ① from the internal wiring harness.
5. Unscrew the GT-SA bolts ⑧ and remove the B-axis motor ① with the M-base ⑦ from the U-arm.
6. Unscrew the GT-SA bolts ② and remove the M-base ⑦.
7. Unscrew the hexagon socket head cap screw ④ and remove the pulley ③.

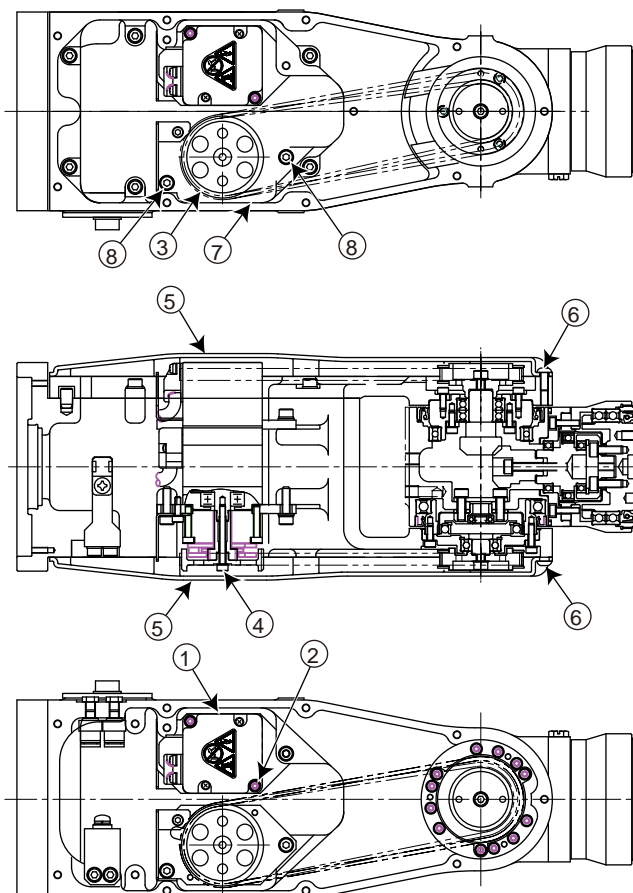
■ Reassembly

1. Mount the pulley ③ on the B-axis motor ①.
2. Attach the conical spring washer to the hexagon socket head cap screw ④, then apply LOCTITE 242 to the thread part and tighten it with the tightening torque shown in *Table 5-5 "B-Axis Motor Parts Checklist"*.
3. Mount the M-base ⑦ on the B-axis motor ① and tighten the GT-SA bolts ② with the tightening torque shown in *Table 5-5 "B-Axis Motor Parts Checklist"*.
4. Mount the B-axis motor ① which is reassembled to the step 3 on the U-arm and put the timing belt on the pulley ③.
5. Tighten the GT-SA bolts ⑧ with the tightening torque shown in *Table 5-5 "B-Axis Motor Parts Checklist"*. (Refer to *section 8.3 "Disassembly and Reassembly of B- and T-axes Timing Belts"* and adjust the initial tension of the timing belt.)
6. Connect the cables (both encoder and power-cables) of the B-axis motor ① with the internal wiring harness.
7. Remove the backup battery.
8. Mount the covers ⑤ and tighten the hexagon socket button head screws ⑥ with the tightening torque shown in *Table 5-5 "B-Axis Motor Parts Checklist"*.
9. Turn ON the DX100/DX200/FS100 power supply.

Table 5-5: B-Axis Motor Parts Checklist

No	Item	Qty	Remark
①	B-axis motor HW0388794-A	1	
②	GT-SA bolt M3 (length: 10 mm) Washer M3	2	Tightening torque 1.4 N*m
③	Pulley HW1401268-1	1	
④	Hexagon socket head cap screw M3 (length: 30 mm) Conical spring washer 2H-3	1	Tightening torque 2.25 N*m
⑤	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	2	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	2	
⑥	Hexagon socket button head screw M4 (length: 10mm)	18	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
⑦	M-base HW1401215-1	1	
⑧	GT-SA bolt M4 (length: 16 mm) Washer M4	2	Tightening torque 2.8 N*m

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



5.6 Disassembly and Reassembly of T-Axis Motor

- Refer to *Fig. 5-6 "Disassembly & Reassembly of T-Axis Motor"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑥ and remove the covers ⑤.
3. Connect the backup battery with the cable of the T-axis motor ①.
(Refer to *chapter 2 "Notes for Maintenance"*.)
4. Disconnect the cables (both encoder and power-cables) of the T-axis motor ① from the internal wiring harness.
5. Unscrew the GT-SA bolts ⑧ and remove the T-axis motor ① with the M-base ⑦ from the U-arm.
6. Unscrew the GT-SA bolts ② and remove the M-base ⑦.
7. Unscrew the hexagon socket head cap screw ④ and remove the pulley ③.

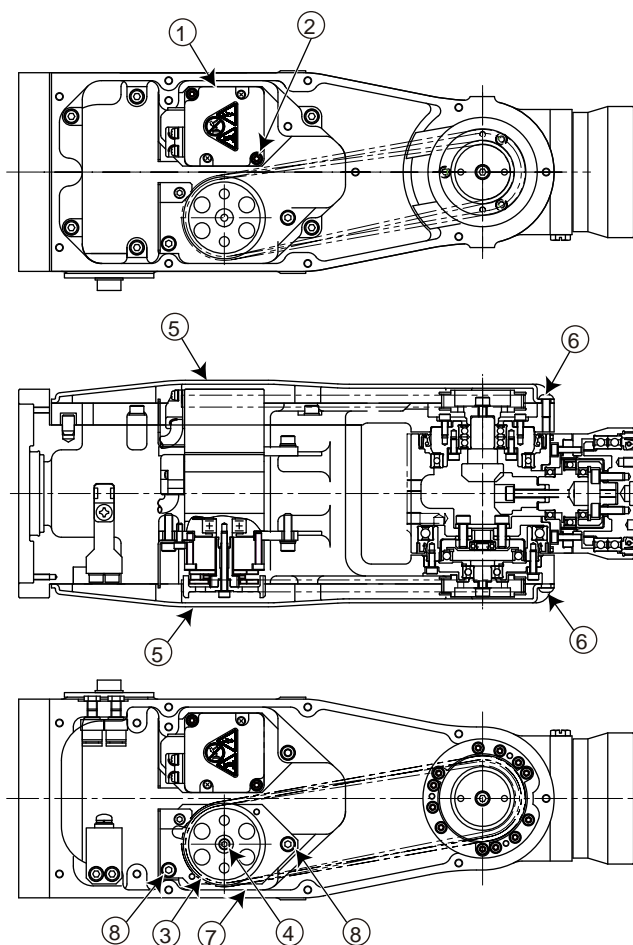
■ Reassembly

1. Mount the pulley ③ on the T-axis motor ①.
2. Attach the conical spring washer to the hexagon socket head cap screw ④, then apply LOCTITE 242 to the thread part and tighten it with the tightening torque shown in *Table 5-6 "T-Axis Motor Parts Checklist"*.
3. Mount the M-base ⑦ on the T-axis motor ① and tighten the GT-SA bolts ② with the tightening torque shown in *Table 5-6 "T-Axis Motor Parts Checklist"*.
4. Mount the T-axis motor ① which is reassembled to the step 3 on the U-arm and put the timing belt on the pulley ③.
5. Tighten the GT-SA bolts ⑧ with the tightening torque shown in *Table 5-6 "T-Axis Motor Parts Checklist"*. (Refer to *section 8.3 "Disassembly and Reassembly of B- and T-axes Timing Belts"* and adjust the initial tension of the timing belt.)
6. Connect the cables (both encoder and power-cables) of the T-axis motor ① with the internal wiring harness.
7. Remove the backup battery.
8. Mount the covers ⑤ and tighten the hexagon socket button head screws ⑥ with the tightening torque shown in *Table 5-6 "T-Axis Motor Parts Checklist"*. Mount the covers ⑤ with the hexagon socket button head screws ⑥.
9. Turn ON the DX100/DX200/FS100 power supply.

Table 5-6: T-Axis Motor Parts Checklist

No	Item	Qty	Remark
①	T-axis motor HW0388794-A	1	
②	GT-SA bolt M3 (length: 10 mm) Washer M3	2	Tightening torque 1.4 N m
③	Pulley HW1401269-1	1	
④	Hexagon socket head cap screw M3 (length: 30 mm) Conical spring washer 2H-3	1	Tightening torque 2.25 N m
⑤	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	2	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	2	
⑥	Hexagon socket button head screw M4 (length: 10mm)	18	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
⑦	M-base HW1401215-1	1	
⑧	GT-SA bolt M4 (length: 16 mm) Washer M4	2	Tightening torque 2.8 N m

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



6 Disassembly and Reassembly of Speed Reducer

6.1 Disassembly and Reassembly of S-axis Speed Reducer.

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

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Connect the backup batteries with the S-, L-, U-, R-, B- and T-axes motors. After disconnect all the cables connected to the internal wiring harness, remove the internal wiring harness from the manipulator. (Refer to *chapter 10 "Cable Wiring"*.)
3. Remove the S-axis motor. (Refer to *section 5.1 "Disassembly and Reassembly of the S-axis Motor"*.)
4. Unscrew the GT-SA bolts ① and remove the M-base ② together with the shaft ③.
5. Unscrew the GT-SA bolts ⑤ and remove the support B ⑥.
6. Unscrew the hexagon socket head cap screws ④ and remove the gear ⑦.
7. Unscrew the hexagon socket head cap screws ⑧. Then detach the base from the S-head with the removal tap for the base.
8. Remove the bearing ⑩ from the M-base.
9. Unscrew the hexagon socket head cap screws ⑫ and remove the circular spline/ the flex spline ⑬ from the S-head.
10. Remove the wave generator ⑭ from the bearing ⑮ and the bearing ⑮ and the oil seal ⑯ from the S-head as well.
11. Remove old sealing from each parts.

■ Reassembly

1. Mount the oil seal ⑯ on the S-head.
2. Apply ThreeBond 1206C to the matching face between the circular spline/ the flex spline ⑬ and the S-head. Then mount the circular spline/ the flex spline ⑬ on the S-head.
3. Attach the conical spring washers to the hexagon socket head cap screws ⑫ and tighten them with the tightening torque shown in *Table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
4. Press fit the bearing ⑮ into the wave generator ⑭. (When replace the speed reducer, replace the bearings ⑩ ⑮ too.)
5. Apply Harmonic Grease SK-1A to the bearing of the wave generator ⑭. Then insert the wave generator ⑭ in the circular spline/ the flex spline ⑬.
6. Press fit the bearing ⑩ into the base. (The bearing ⑩ has the sealing on one side. Turn the sealing side to the gear (the base side) and the non-sealing side to the S-head.)
7. Mount the collar ⑦ on the gear ⑦. Then mount them on the S-base.
8. Apply ThreeBond 1206C to the matching face between the circular spline/ the flex spline ⑬ and the base. Then mount the circular spline/ the flex spline ⑬ on the base.

6 Disassembly and Reassembly of Speed Reducer
6.1 Disassembly and Reassembly of S-axis Speed Reducer.

9. Attach the conical spring washers and the washer ⑨ to the hexagon socket head cap screws ⑫ and tighten them with the tightening torque shown in *Table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
10. Attach the conical spring washers to the hexagon socket head cap screws ④ and tighten them with the tightening torque shown in *Table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
11. Mount the support B ⑥ on the base and tighten the GT-SA bolts ⑤ with the tightening torque shown in *Table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
12. Apply ThreeBond 1206C around the gear ⑦.
13. Apply ThreeBond 1206C to the matching face between the M-base ② and the base. Then mount the M-base ② on the base.
14. Tighten the GT-SA bolts ① with the tightening torque shown in *Table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
15. Mount the shaft ③ on the M-base ②. (Be careful so that the O-ring and the oil seal are not rolled up.)
16. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts ⑩ and tighten them with the tightening torque shown in *Table 6-1 "S-Axis Speed Reducer Parts Checklist"*.
17. Mount the S-axis motor. (Refer to *section 5.1 "Disassembly and Reassembly of the S-axis Motor"*.)
18. Put the internal wiring harness back and mount the cover. (Refer to *chapter 10 "Cable Wiring"*.)
19. Turn ON the DX100/DX200/FS100 power supply.

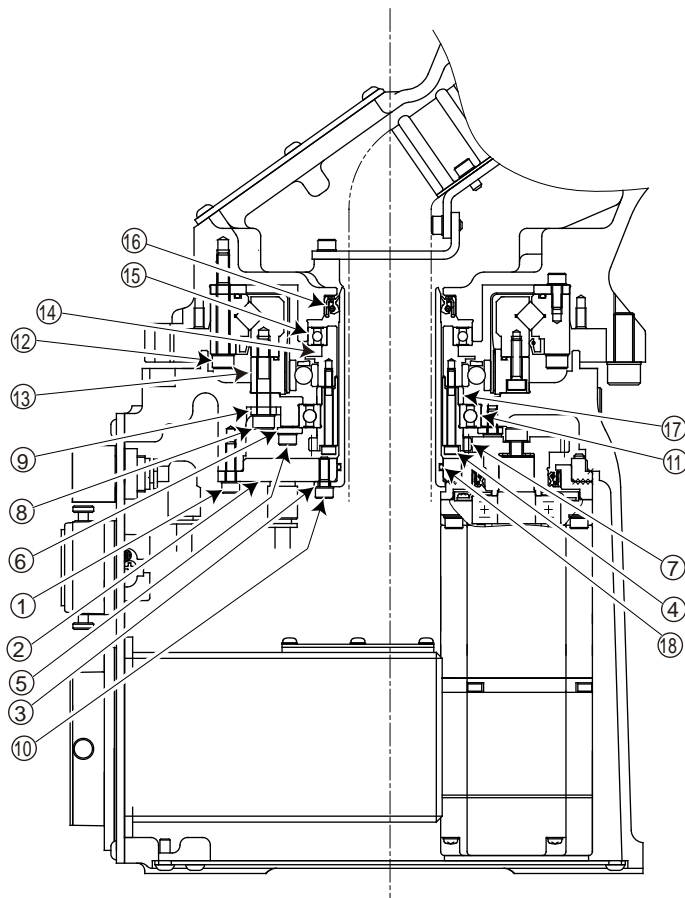
Table 6-1: S-Axis Speed Reducer Parts Checklist

No	Item	Qty	Remark
①	GT-SA bolt M4 (length: 16 mm)	7	Tightening Torque 2.8 N•m
②	M-base HW0414034-1	1	
③	Shaft HW0314319-1	1	
④	Hexagon socket head cap screw M3 (length: 30 mm) Conical spring washer 2H-3	6	Tightening Torque 2.25 N•m
⑤	GT-SA bolt M4 (length: 10 mm)	4	Tightening Torque 2.8 N•m
⑥	Support B HW0414025-1	1	
⑦	Gear HW0314708-2	1	
⑧	Hexagon socket head cap screw M5 (length: 30mm) Conical spring washer 2H-5	16	Tightening Torque 10 N•m
⑨	Washer HW8411125-2	16	
⑩	GT-SA bolt M4 (length: 12mm)	4	Tightening Torque 2.8 N•m
⑪	Bearing 6811LLU	1	
⑫	Hexagon socket head cap screw M5 (length: 40 mm) Conical spring washer 2H-5	12	Tightening Torque 8.4 N•m

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

No	Item	Qty	Remark
⑬	Speed reducer HW0389176-A	1	Circular spline
⑭			Flex spline
⑮	Bearing 6810VV*NS7*	1	Wave generator
⑯	Oil seal AE 2343 E0	1	TC405208
⑰	Collar HW0414024-1	1	
⑱	O-ring S39	1	

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



6.2 Disassembly and Reassembly of L-Axis Speed Reducer

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

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Connect the backup batteries with the L-, U-, R-, B- and T-axes motors. After disconnect all the cables connected to the internal wiring harness, pull out the internal wiring harness to the S-head side. (Refer to *chapter 10 "Cable Wiring"*.)
3. Unscrew the hexagon socket button head screws ⑭ and remove the cover ⑬.
4. Remove the timing belt ⑮. (Refer to *section 8.1 "Disassembly and Reassembly of L- and U-axis Timing Belts"*.)
Because the L-arm cannot keep its posture without the timing belt ⑮, be sure to support the L-arm before removing the timing belt ⑮.
5. Unscrew the GT-SA bolts ⑥. Then remove the housing ⑨, the wave generator ③, the bearings ⑯ and the pulley ⑧ with the removal tap.
6. Unscrew the hexagon socket head cap screws ⑦ from the removed wave generator ③ and remove the pulley ⑧ and the housing ⑨.
7. Unscrew the GT-SA bolts ④. Then remove the circular spline ① with the removal tap.
8. Unscrew the GT-SA bolts ⑫. Then remove the housing ⑪ with the removal tap. Because the L-arm and the S-head are detached without the housing ⑪, be sure to support the L-arm before removing the housing ⑪.
9. Remove the bearing ⑰, the oil seal ⑱ and the hexagon socket head cap screws ⑤. Then remove the flex spline ②.
10. Remove the bearing ⑩ and the oil seal ⑲.
11. Remove old sealing from each parts.

■ Reassembly

1. Mount the flex spline ② on the S-head. At this time, apply Harmonic Grease SK-1A to the inside wall of the flex spline ② in thickness of 5 mm or so.
2. Attach the conical spring washers to the hexagon socket head cap screws ⑤ and apply ThreeBond 1206C to the thread parts. Then tighten them with the tightening torque shown in *Table 6-2 "L-Axis Speed Reducer Parts Checklist"*.
3. Press fit the bearings ⑩ ⑰ into the S-head. Apply ThreeBond 1206C to the outside wall of the bearings ⑩ ⑰ and LOCTITE 638 to the matching face with the S-head. Smooth the surplus sealing or adhesive with a spatula. However, be careful not to spread the sealing inside the bearings ⑩ ⑰. (When replace the speed reducer, replace the bearings ⑩ ⑰ too.)
4. Press fit the oil seal ⑱ ⑲ into the S-head. (Before the press fit, remove the sealing adhering to the S-head so that the sealing does not adhere to the oil seal when press fit into the bearing.)
5. Put the housing ⑪ through the L-arm and the bearing ⑩ and connect the S-head with the L-arm.

6. Temporarily tighten the GT-SA bolts ②.
7. Apply Harmonic Grease SK-1A on the surface between the teeth of flex spline ② and the circular spline ① and insert the circular spline ① in the L-arm.
8. Attach the conical spring washers ② to the hexagon socket head cap screws ④ and tighten them with the tightening torque shown in *Table 6-2 "L-Axis Speed Reducer Parts Checklist"*.
9. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts ④ and tighten them with the tightening torque shown in *Table 6-2 "L-Axis Speed Reducer Parts Checklist"*.
10. Insert the bearings ⑩ in the wave generator ③. Then insert it in the housing ⑨. (Apply ThreeBond 1206C to the outside and inside walls of ⑩ *a and insert it in the housing ⑨ and the wave generator ③.) (When replace the speed reducer, replace the bearings ⑩ too.)
11. Tighten the GT-SA bolts ⑥ with the tightening torque shown in *Table 6-2 "L-Axis Speed Reducer Parts Checklist"*.
12. Mount the pulley ⑧ on the wave generator ③.
13. Attach the conical spring washer to the hexagon socket head cap screw ⑦ and apply LOCTITE 638 to its thread part. Then tighten it with the tightening torque shown in *Table 6-2 "L-Axis Speed Reducer Parts Checklist"*.
14. Apply ThreeBond 1206C to the matching face between the housing ⑨ mounted the wave generator ③ and the circular spline ①. Then mount the housing ⑨ and the circular spline ①.
15. Put the timing belt on the pulley ⑧. (Refer to *section 8.1 "Disassembly and Reassembly of L- and U-axis Timing Belts"*.)
16. Put the internal wiring harness back and mount the cover. (Refer to *chapter 10 "Cable Wiring"*.)
17. Turn ON the DX100/DX200/FS100 power supply.

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

No	Item	Qty	Remark
①	Speed reducer HW0388706-A (MH5S/F)	1	Circular spline
②	Speed reducer HW0388706-B (MH5LS/LF)		Flex spline
③			Wave generator
④	Hexagon socket head cap screw M4 (length: 12mm) Conical spring washer 2H-4	29	Tightening Torque 2.8 N•m
⑤	Hexagon socket head cap screw M4 (length: 16mm) Conical spring washer 2H-4	30	Tightening Torque 2.8 N•m
⑥	GT-SA bolt M4 (length: 10 mm)	4	Tightening Torque 2.8 N•m
⑦	Hexagon socket head cap screw M5 (length: 20 mm) Conical spring washer 2H-5	1	Tightening Torque 10 N•m
⑧	Pulley HW0414071-B	1	24S5M0120
⑨	Housing HW0408927-2	1	
⑩	Bearing 6913ZZ	1	

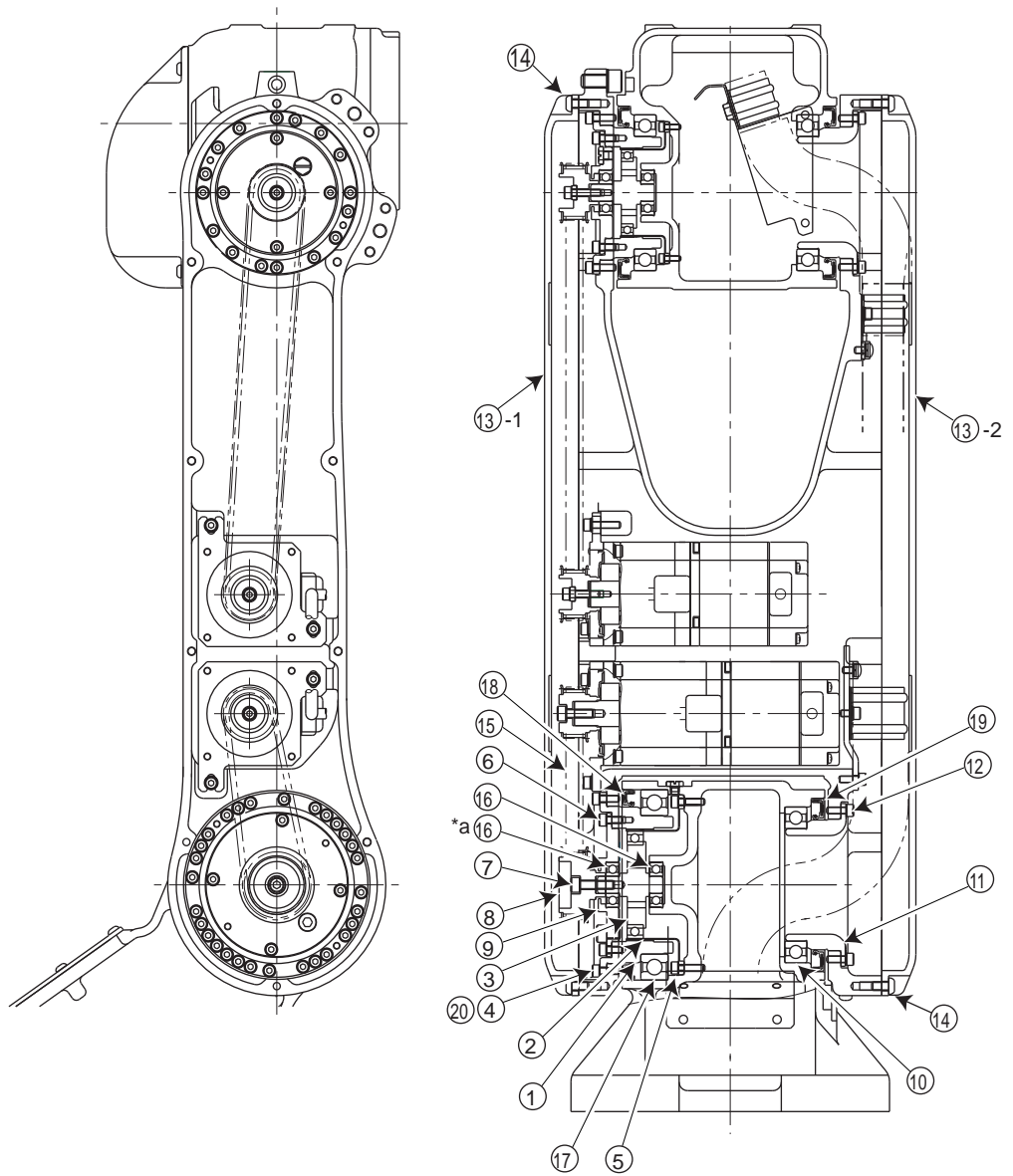
MH5(L)S/F,
MH5(L)SII

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

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

No	Item	Qty	Remark
⑪	Housing HW0408931-3	1	
⑫	GT-SA bolt M4 (length: 10 mm)	6	Tightening Torque 2.8 N•m
⑬ -1	Cover HW1200089-2 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-2 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-1 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW1200149-1 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑬ -2	Cover HW1200089-1 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-1 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-2 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW0201253-2 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑭	Hexagon socket button head screw M5 (length: 10mm)	20	Tightening Torque 1.4 N•m (for type A00) Tightening Torque 2.8 N•m (for type A01, B0*)
⑮	Belt 100S5M305	1	
⑯	Bearing 600ZZ	2	
⑰	Bearing 6916DDU	1	
⑱	Oil seal SC901107	1	
⑲	Oil seal SC751007	1	
⑳	Conical spring washer CDW4L	29	

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



6.3 Disassembly and Reassembly of U-Axis Speed Reducer

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

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Connect the backup batteries with the R-, B- and T-axes motors. After disconnect all the cables connected to the internal wiring harness, remove the internal wiring harness to the L-arm side. (Refer to *chapter 10 "Cable Wiring"*.)
3. Unscrew the hexagon socket button head screws ⑭ and remove the cover ⑬.
4. Remove the timing belt ⑮. (Refer to *section 8.1 "Disassembly and Reassembly of L- and U-axis Timing Belts"*.)
Because the U-arm cannot keep its posture without the timing belt ⑮, be sure to support the U-arm before removing the timing belt ⑮.
5. Unscrew the GT-SA bolts ⑥. Then remove the housing ⑨, the wave generator ③, the bearings ⑯ and the pulley ⑧ with the removal tap.
6. Unscrew the hexagon socket head cap screw ⑦ from the removed wave generator ③ and remove the pulley ⑧ and the housing ⑨.
7. Unscrew the GT-SA bolts ④. Then remove the circular spline ① with the removal tap.
8. Unscrew the GT-SA bolts ④. Then remove the housing ⑪ with the removal tap. Because the casing and the L-arm are detached without the housing ⑪, be sure to support the U-arm before removing the housing ⑪.
9. Remove the bearing ⑰, the oil seal ⑱ and the hexagon socket head cap screws ⑤. Then remove the flex spline ②.
10. Remove the bearing ⑩ and the oil seal ⑲.
11. Remove old sealing from each parts.

■ Reassembly

1. Mount the flex spline ② on the casing. At this time, apply Harmonic Grease SK-1A to the inside wall of the flex spline ② in thickness of 5mm or so.
2. Attach the conical spring washers to the hexagon socket head cap screws ⑤ and apply ThreeBond 1206C to the thread parts. Then tighten them with the tightening torque shown in *Table 6-3 "U-Axis Speed Reducer Parts Checklist"*.
3. Press fit the bearings ⑩ ⑰ into the casing. Apply ThreeBond 1206C to the outside walls of the bearings ⑩ ⑰ and LOCTITE 638 to the matching face with the casing. Smooth the surplus sealing or adhesive with a spatula. However, be careful not to spread the sealing inside the bearings ⑩ ⑰. (When replace the speed reducer, replace the bearings ⑩ ⑰ too.)
4. Press fit the oil seal ⑱ into the casing. (Before the press fit, remove the sealing adhering to the casing so that the sealing does not adhere to the oil seal when press fit into the bearing.) Align the oil seal side with the casing side.
5. Put the housing ⑪ through the L-arm and the bearing ⑩ and connect the casing with the L-arm.

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

6. Temporarily tighten the GT-SA bolts ④.
7. Apply Harmonic Grease SK-1A on the surface between the teeth of flex spline ② and the circular spline ① and insert the circular spline ① in the L-arm.
8. Tighten the hexagon socket head cap screws ④ with the tightening torque shown in *Table 6-3 "U-Axis Speed Reducer Parts Checklist"*.
9. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts ⑫ and tighten them with the tightening torque shown in *Table 6-3 "U-Axis Speed Reducer Parts Checklist"*.
10. Insert the bearings ⑩ in the wave generator ③. Then insert it in the housing ⑨. (Apply ThreeBond 1206C to the outside and inside walls of ⑩ *a and insert it in the housing ⑨ and the wave generator ③.) (When replace the speed reducer, replace the bearings ⑩ too.)
11. Tighten the GT-SA bolts ⑥ with the tightening torque shown in *Table 6-3 "U-Axis Speed Reducer Parts Checklist"*.
12. Mount the pulley ⑧ on the wave generator ③.
13. Attach the conical spring washer and the washer ⑳ to the hexagon socket head cap screw ⑦ and apply LOCTITE 638 to its thread part. Then tighten it with the tightening torque shown in *Table 6-3 "U-Axis Speed Reducer Parts Checklist"*.
14. Apply ThreeBond 1206C to the matching face between the housing ⑨ mounted the wave generator ③ and the circular spline ①. Then mount the housing ⑨ with the circular spline ①.
15. Put the timing belt on the pulley ⑧. (Refer to *section 8.1 "Disassembly and Reassembly of L- and U-axis Timing Belts"*.)
16. Put the internal wiring harness back and mount the cover. (Refer to *chapter 10 "Cable Wiring"*.)
17. Turn ON the DX100/DX200/FS100 power supply.

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

No	Item	Qty	Remark
①	Speed Reducer HW0388707-A (MH5S/F)	1	Circular spline
②	Speed Reducer HW0388707-B (MH5LS/LF)		Flex spline
③			Wave generator
④	Hexagon socket head cap screw M4 (length: 12 mm)	16	Tightening Torque 2.8 N•m
⑤	Hexagon socket head cap screw M3 (length: 10mm) Conical spring washer 2H-3	32	Tightening Torque 1.4 N•m
⑥	GT-SA bolt M4 (length: 10 mm)	4	Tightening Torque 2.8 N•m
⑦	Hexagon socket head cap screw M4 (length: 18 mm) Conical spring washer 2H-4	1	Tightening Torque 4.8 N•m
⑧	Pulley HW0414073-A	1	20S5M0120
⑨	Housing HW0408928-2	1	
⑩	Bearing 6913ZZ	1	
⑪	Housing HW0408931-3	1	

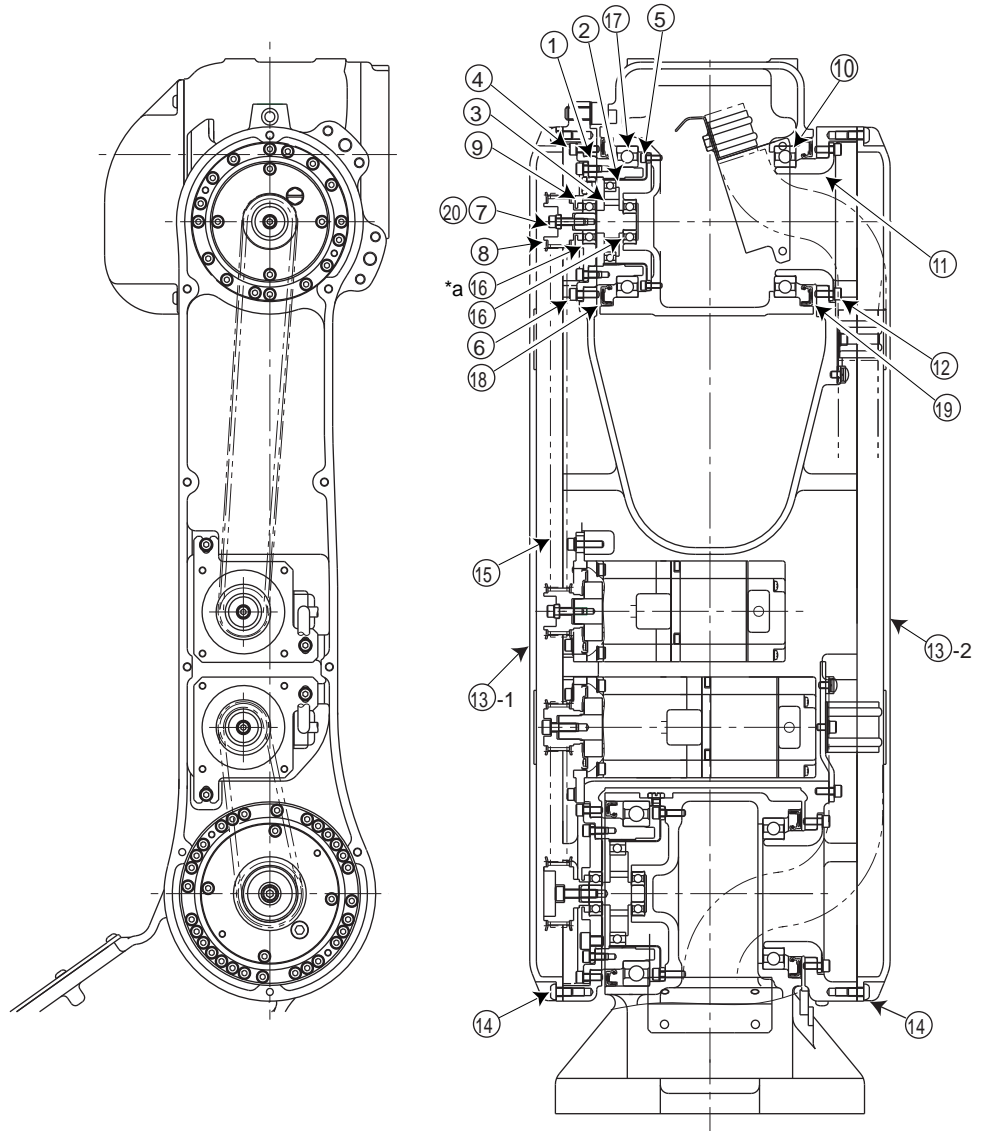
MH5(L)S/F,
MH5(L)SII

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

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

No	Item	Qty	Remark
⑫	GT-SA bolt M4 (length: 10 mm)	6	Tightening Torque 2.8 N•m
⑬ -1	Cover HW1200089-2 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-2 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-1 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW1200149-1 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑬ -2	Cover HW1200089-1 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-1 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-2 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW0201253-2 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑭	Hexagon socket button head screw M5 (length: 10 mm)	20	Tightening Torque 1.4 N•m (for type A00) Tightening Torque 2.8 N•m (for type A01, B0*)
⑮	Belt 100S5M590 (MH5S/F)	1	
	Belt 100S5M560 (MH5LS/LF)	1	
⑯	Bearing 6000ZZ	2	
⑰	Bearing 6913DDU	1	
⑱	Oil seal SC751007	1	
⑲	Oil seal SC751007	1	
⑳	Washer HW8411125-1	1	

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



6.4 Disassembly and Reassembly of R-Axis Speed Reducer

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

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Connect the backup batteries with the R-, B- and T-axes motors. After disconnect all the cables connected to the internal wiring harness, pull out the internal wiring harness to the S-head side. (Refer to *chapter 10 "Cable Wiring"*.)
3. Remove the R-axis motor. (Refer to *section 5.4 "Disassembly and Reassembly of the R-axis Motor"*.)
4. Unscrew the GT-SA bolts ⑬ and remove the pipe ⑭. Then remove the belt ① hung on the pulley ⑫. (Refer to *section 8.2 "Disassembly and Reassembly of R-axis Timing Belt"*.)
5. Unscrew the hexagon socket head cap screws ⑩ and remove the wrist unit from the casing. (Refer to *chapter 7 "Disassembly and Reassembly of Wrist Unit"*.)
6. Unscrew the GT-SA bolts ⑨ and remove the pulley ⑫ and the washer ⑧ from the wave generator ②.
7. Unscrew the hexagon socket head cap screws ⑥. Then remove the housing ⑦ from the circular spline/ flex spline ① with the removal tap for the housing ⑦.
8. Pull out the wave generator ② with the bearings ④ ⑤.
9. Unscrew the hexagon socket head cap screws ③ and remove the circular spline/ flex spline ① from the U-arm.
10. Remove old sealing from each parts.

■ Reassembly

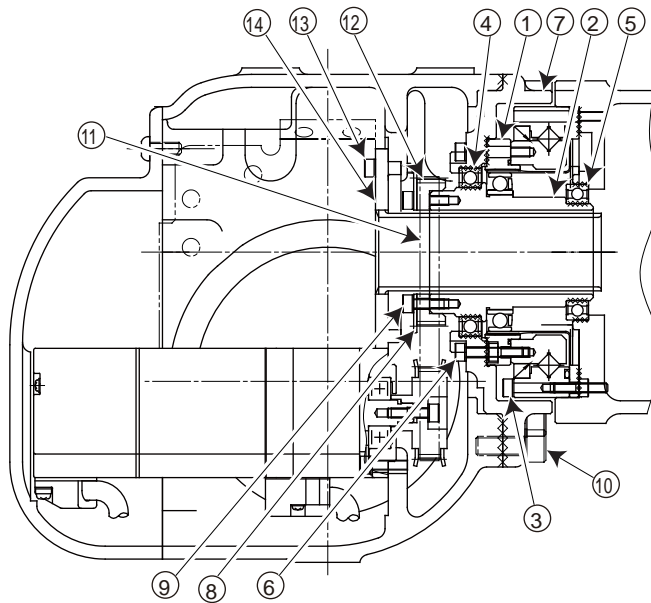
1. Apply ThreeBond 1206C to the matching face between the circular spline/ the flex spline ① and the U-arm. Then mount the circular spline/ the flex spline ① on the U-arm.
2. Attach the conical spring washers to the hexagon socket head cap screws ③ and apply ThreeBond 1206C to the thread parts. Then tighten them with the tightening torque shown in *Table 6-4 "R-Axis Speed Reducer Parts Checklist"*.
3. Press fit the bearings ④ ⑤ into the wave generator ②. Apply ThreeBond 1206C to the joint part of the inside walls of the bearings ④ ⑤ (application amount: about 1 g). (When replace the speed reducer, replace the bearings ④ ⑤ too.)
4. Insert the wave generator ② in the circular spline/ the flex spline ①. (Apply Harmonic Grease SK-1A to the bearing of the wave generator ② (application amount: about 2 g).) (When insert the wave generator ②, apply ThreeBond 1206C to the joint part of the outside wall of the bearing ⑤ (application amount: about 1 g).)
5. Apply ThreeBond 1206C to the matching face between the housing ⑦ and the circular spline/ the flex spline ①. Then mount the housing ⑦ on the circular spline/ the flex spline ①. (When mount the housing ⑦, apply ThreeBond 1206C to the joint part of the outside wall of the bearing ④ (application amount: about 1 g).)

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

6. Attach the conical spring washers to the hexagon socket head cap screws ⑥ and tighten them with the tightening torque shown in *Table 6-4 "R-Axis Speed Reducer Parts Checklist"*.
7. Mount the pulley ⑫ and the washer ⑧ on the wave generator ②.
8. Tighten the GT-SA bolts ⑨ with the tightening torque shown in *Table 6-4 "R-Axis Speed Reducer Parts Checklist"*.
9. Mount the wrist unit on the casing. (Refer to *chapter 7 "Disassembly and Reassembly of Wrist Unit"*.)
10. Attach the conical spring washers to the hexagon socket head cap screws ⑩ and apply ThreeBond 1206C to their thread parts. Then tighten them with the tightening torque shown in *Table 6-4 "R-Axis Speed Reducer Parts Checklist"*.
11. Mount the R-axis motor on the casing, put the belt ⑪ on the pulley ⑫ and adjust the tension. (Refer to *section 5.4 "Disassembly and Reassembly of the R-axis Motor"* and *section 8.3 "Disassembly and Reassembly of B- and T-axes Timing Belts"*.)
12. Be careful about the direction to mount the pipe ⑭, and tighten the GT-SA bolts ⑬ with the tightening torque shown in *Table 6-4 "R-Axis Speed Reducer Parts Checklist"*.
13. Put the internal wiring harness back and mount the cover. (Refer to *chapter 10 "Cable Wiring"*.)
14. Turn ON the DX100/DX200/FS100 power supply.

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

No	Item	Qty	Remark
①	Speed reducer HW0388708-A	1	Circular spline Flex spline
②			Wave generator
③	Hexagon socket head cap screw M3 (length: 30 mm) Conical spring washer 2H-3	12	Tightening Torque 1.4 N•m
④	Bearing 6808ZZ*NS7*	1	
⑤	Bearing 6806ZZ	1	
⑥	Hexagon socket head cap screw M3 (length: 20 mm) Conical spring washer 2H-3	16	Tightening Torque 1.4 N•m
⑦	Housing HW0314334-1	1	
⑧	Washer HW9406278-2	1	
⑨	GT-SA bolt M3 (length: 10 mm)	3	Tightening Torque 1.4 N•m
⑩	Hexagon socket head cap screw M6 (length: 16 mm) Conical spring washer 2H-6	4	Tightening Torque 10 N•m
⑪	Belt 060S3M219	1	
⑫	Pulley HW0483421-B	1	48S3M0060
⑬	GT-SA bolt M3 (length: 12 mm)	2	Tightening Torque 1.4 N•m
⑭	Pipe HW9406285-E	1	

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

6.5 Disassembly and Reassembly of B-Axis Speed Reducer

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

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑪ and remove the cover. (For the type A01, B0*, use the removal tap.)
3. Unscrew the GT-SA bolts ⑭-a which mount the B- and T-axes motor unit and remove the timing belt ⑤. (Refer to *section 8.3 "Disassembly and Reassembly of B- and T-axes Timing Belts"*.)
4. Remove the B- and T-axes motor unit from the U-arm.
5. Unscrew the GT-SA bolts ⑭-c and remove the T-axis unit with the removal tap.
6. Unscrew the GT-SA bolts ⑭-b and remove the U-arm 2 unit. (For the type A01, B0*, use the removal tap.)
7. Unscrew the hexagon socket head cap screw ⑦ and remove the pulley ⑥.
8. Unscrew the hexagon socket head cap screws ④. With the removal tap, remove the circular spline ①, flex spline ②, wave generator ③, bearing ⑩, retaining ring ⑬, housing ⑰, housing ⑱, hexagon socket head cap screws ⑫, bearing ⑧, hexagon socket head cap screws ⑨ and housing ⑮ together with the wrist base from the U-arm.
9. Unscrew the hexagon socket head cap screws ⑨. With the removal tap, remove the housing ⑮, bearing ⑧, retaining ring ⑬ and wave generator ③ together.
10. Remove the wave generator ③ and the retaining ring ⑬ from the housing ⑮. Then remove the bearing ⑧.
11. Remove the bearing ⑩ from the wave generator ③.
12. Unscrew the hexagon socket head cap screws ⑫. With the removal tap, remove the housing ⑰.
13. With the removal tap, remove the flex spline ② and the housing ⑱ from the wrist base.
14. With the removal tap, remove the flex spline ② from the housing ⑱.
15. Remove the circular spline ① from the wrist base, then the oil seal ⑯ and the bearing ⑫.
16. Remove old sealing from each parts.

■ Reassembly

1. Press fit the bearing ⑫ into the wrist base. (Apply to MP-1 grease to the sliding part of the oil seal.)
2. Attach the conical spring washers to the hexagon socket head cap screws ⑫ and apply LOCTITE 515 to the thread parts. Also, apply LOCTITE 515 to the matching faces of the housing ⑱, flex spline ② and housing ⑰. Then tighten them to the wrist base with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.
3. Press fit the bearing ⑧ into the housing ⑮ and attach the retaining ring ⑬. (When replace the speed reducer, replace the bearing ⑧, retaining ring ⑬ and oil seal ⑯, too.)

MH5(L)S/F,
MH5(L)SII

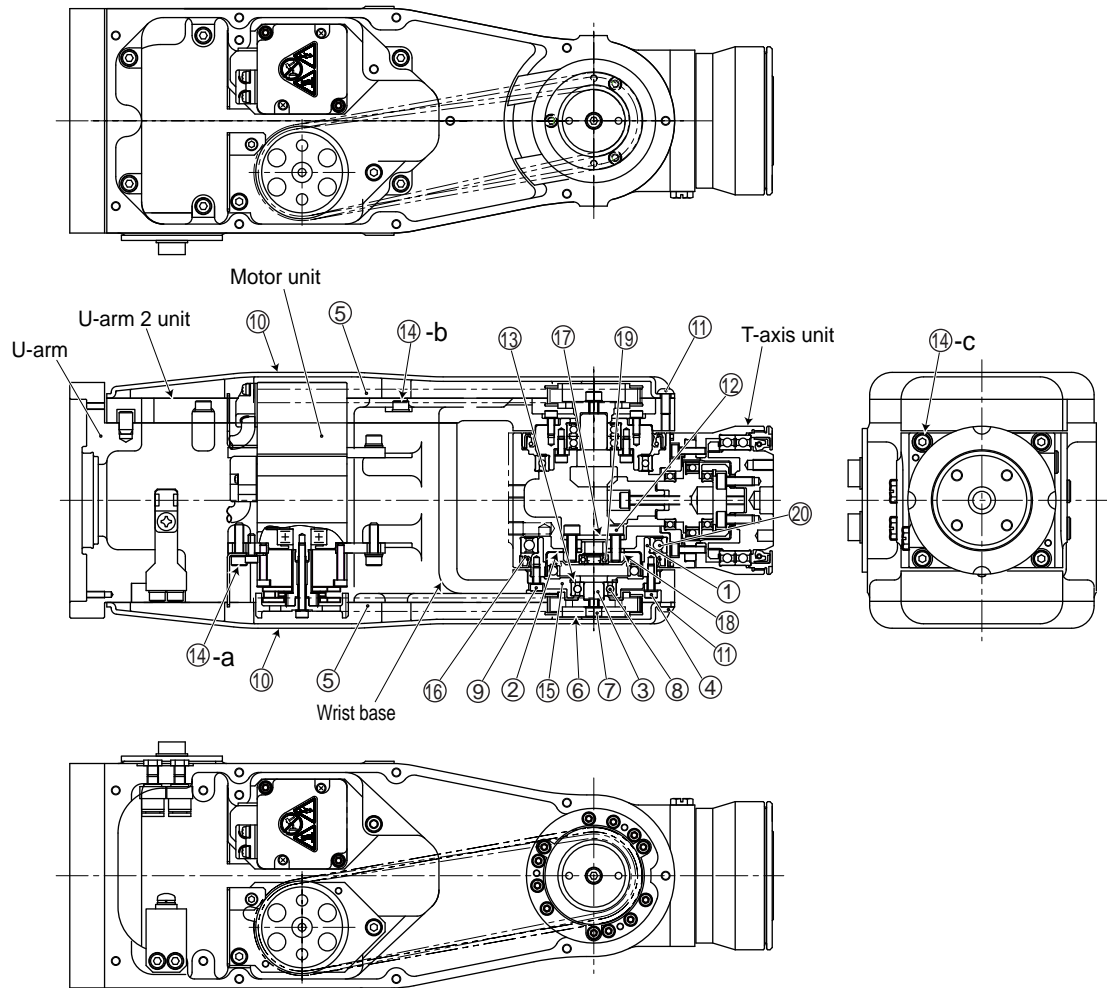
6 Disassembly and Reassembly of Speed Reducer
6.5 Disassembly and Reassembly of B-Axis Speed Reducer

4. Insert the wave generator ③ in the housing ⑮ and press fit the bearing ⑲.
5. Attach the conical spring washers to the hexagon socket head cap screws ⑨ and mount the housing ⑮ on the wrist base. (For the type A01, B0*, apply ThreeBond 1206C to the matching face of the housing ⑮ and tighten them with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.)
6. Attach the conical spring washers to the hexagon socket head cap screws ④ and mount the whole wrist unit reassembled from the step 1 to 8 on the U-arm. Tighten them with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.
7. Mount the pulley ⑥ on the wave generator ③.
8. Apply LOCTITE 242 to the thread part of the hexagon socket head cap screw ⑦ and tighten it with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.
9. Mount the U-arm 2 unit on the U-arm with the GA-SA bolts ⑭-b. Tighten them with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*. (For the type A01, B0*, apply ThreeBond 1206C to the matching face of the U-arm 2 unit.)
10. Mount the T-axis unit on the U-arm with the GA-SA bolts ⑭-c. Tighten them with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.
11. Mount the B- and T-axes motor unit on the U-arm and hang the timing belt ⑤.
12. Adjust the tension of the timing belt ⑤. (Refer to *section 8.3 "Disassembly and Reassembly of B- and T-axes Timing Belts"*.)
13. Mount the B- and T-axes motor unit with the GA-SA bolts ⑭-a. Tighten them with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.
14. Mount the cover ⑩ with the hexagon socket button head screws ⑪ and tighten them with the tightening torque shown in *Table 6-5 "B-Axis Speed Reducer Parts Checklist"*.
15. Turn ON the DX100/DX200/FS100 power supply.

Table 6-5: B-Axis Speed Reducer Parts Checklist

No	Item	Qty	Remark
①	Speed reducer HW1380238-A	1	Circular Spline
②			Flex Spline
③			Wave Generator
④	Hexagon socket head cap screw M3 (length: 12 mm) Conical spring washer 2H-3	9	Tightening Torque 1.4 N•m
⑤	Timing belt 060S3M396	2	
⑥	Pulley HW1400570-A	1	44S3M0060
⑦	Hexagon socket head cap screw M4 (length: 12 mm) Conical spring washer 2H-4	1	Tightening Torque 2.8 N•m
⑧	Bearing 699ZZ	1	
⑨	Hexagon socket head cap screw M3 (length: 8 mm) Conical spring washer 2H-3	3	Tightening Torque 1.4 N•m
⑩	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	2	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	2	
⑪	Hexagon socket button head screw M4 (length: 10 mm) *trivalent chromium white*	18	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
⑫	Hexagon socket head cap screw M4 (length: 12 mm) Conical spring washer CDW4L	8	Tightening Torque 4.8 N•m
⑬	Retaining ring RTW-20	1	
⑭ -a	GT-SA bolt M4 (length: 16 mm) Washer M4	4	Tightening Torque 2.8 N•m
⑭ -b	GT-SA bolt M4 (length: 16 mm)	6	Tightening Torque 4.0 N•m
⑭ -c	GT-SA bolt M4 (length: 10 mm)	4	Tightening Torque 2.8 N•m
⑮	Housing HW1400304-1	1	
⑯	Oil seal BE4772-E00X9	1	
⑰	Housing HW1400299-1	1	
⑱	Housing HW1400413-1	1	
⑲	Bearing 686	1	
⑳	Bearing 6810VV*NS7*	1	

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



6.6 Disassembly and Reassembly of T-Axis Speed Reducer

- Refer to *Fig. 6-6 "Disassembly & Reassembly of the T-Axis Speed Reducer"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the GT-SA bolts ⑩ and remove the T-axis unit including from the wrist base to the gear ⑦.
3. Unscrew the hexagon socket head cap screw ⑧ and remove the gear ⑦ and the shim ⑨.
4. Unscrew the hexagon socket head cap screws ⑫ and remove the housing ⑪ with the removal tap.
5. Remove the circular spline ① with the removal tap.
6. Remove the wave generator ③ and the bearings ⑭.
7. Remove the retaining ring ⑥.
8. Unscrew the hexagon socket head cap screws ④ and remove the housing ⑪ and the flex spline ②.
9. Remove old sealing and LOCTITE from each parts.

■ Reassembly

1. Put the housing ⑪ through the flex spline ②, then mount the flange.
2. Tighten the hexagon socket head cap screws ④ with the tightening torque shown in *Table 6-6 "T-Axis Speed Reducer Parts Checklist"*
3. Attach the retaining ring ⑥ to the housing ⑪. (When replace the speed reducer, replace the retaining ring ⑥ too)
4. Apply LOCTITE 515 to the matching face between the housing ⑤ and the circular spline ① and mount the circular spline ① on the housing ⑤. Also, apply Harmonic Grease SK-1A on the surface between the teeth of flex spline ② and the circular spline ①.
5. Press fit the bearings ⑭ into the wave generator ③. Then insert it in the housing ⑪. (When replace the speed reducer, replace the bearings ⑭ too.) Also, apply Harmonic Grease SK-1A to the inside wall of the flex spline ② in thickness of roughly equal to the bearing diameter of the wave generator ③ (application amount: about 8 g).
6. Apply LOCTITE 515 to the matching face between the housing ⑪ and the circular spline ①. Then mount the housing ⑪ on the circular spline ①.
7. Tighten the hexagon socket head cap screws ⑫ with the tightening torque shown in *Table 6-6 "T-Axis Speed Reducer Parts Checklist"*.
8. Mount the gear ⑦ and the shim ⑨.
9. Attach the conical spring washer to the hexagon socket head cap screw ⑧ and apply LOCTITE 242 to its thread part. Then tighten it with the tightening torque shown in *Table 6-6 "T-Axis Speed Reducer Parts Checklist"*.
10. Mount the O-ring ⑬ on the housing ⑪. (When replace the speed reducer, replace the O-ring ⑬ too)
11. Mount the T-axis unit reassembled from step 1 through 10 on the wrist unit.

12. Temporary tighten the GT-SA bolts ⑩.
13. Check if the backlash is proper, and adjust the shim as follows when necessary: Remove the GT-SA bolts ⑩ and the hexagon socket head cap screw ⑧, then remove the gear ⑦. Adjust the backlash by inserting the shim(s) ⑨ on the list below between the gear ⑦ and the wave generator. ③ Set the backlash to 0.05 to 0.1 mm on the pitch circle diameter of 20 mm of the gear ⑦.

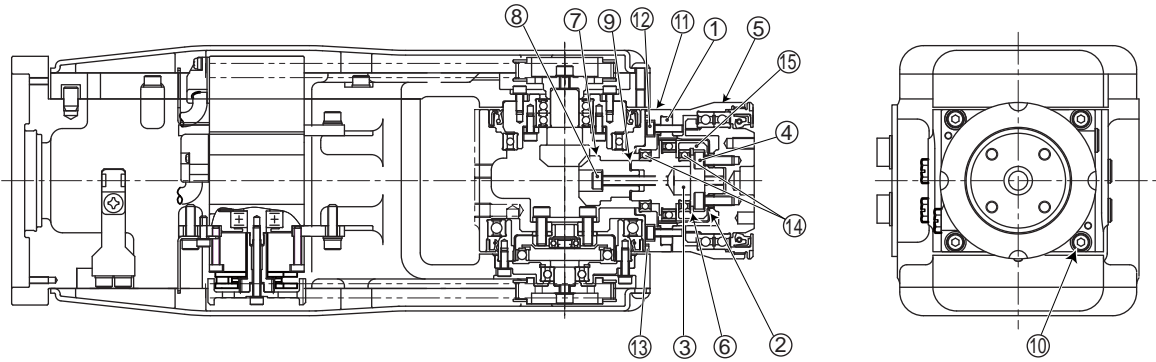
Shim Type	Thickness (mm)
SPS-010005	0.05
SP-009010	0.1
SP-009015	0.15
SP-009020	0.2

14. Confirm the backlash is correct. Then tighten the GT-SA bolts ⑦ with the tightening torque shown in *Table 6-6 "T-Axis Speed Reducer Parts Checklist"*.
15. Turn ON the DX100/DX200/FS100 power supply.

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

No	Item	Qty	Remark
①	Speed reducer HW0388710-A	1	Circular Spline
②			Flex Spline
③			Wave Generator
④	Hexagon socket head cap screw M4 (length: 12 mm) Conical spring washer 2H-4	6	Tightening Torque 4.8 N•m
⑤	Housing HW0414026-1	1	
⑥	Retaining ring IRTW-26	1	
⑦	Gear HW1380199-A	1	
⑧	Hexagon socket head cap screw M4 (length: 25 mm) Conical spring washer 2H-4	1	Tightening Torque 2.8 N•m
⑨	Shim (Refer to the previous page.)		
⑩	GT-SA bolt M4 (length: 10 mm)	4	Tightening Torque 2.8 N•m
⑪	Housing HW1300207-1	1	
⑫	Hexagon socket head cap screw M3 (length: 12mm) Conical spring washer 2H-3	6	Tightening Torque 1.4 N•m
⑬	O-ring S56	1	
⑭	Bearing 6803ZZ*NS7	2	
⑮	Housing HW9406260-1	1	

Fig. 6-6: Disassembly & Reassembly of the T-Axis Speed Reducer



7 Disassembly and Reassembly of Wrist Unit

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



Refer to the following chapters in this manual as needed: *chapter 2 "Notes for Maintenance"*, *chapter 3 "Home Position Return"*, *chapter 5 "Disassembly and Reassembly of the Motor"* and *chapter 10 "Cable Wiring"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑫ and remove the cover ⑪.
3. Connect backup batteries with the B- and T-axes motors.
4. Disconnect the connectors of the B- and T-axes connected to the internal wiring harness.
5. Unscrew the pan-head sems screws ⑩, pull out the connected base ⑨ and disconnect the connected internal wiring harness and the air hoses.
6. Unscrew the hexagon socket button head screws ③ and remove the cover ②. Unscrew the GT-SA bolts ⑬ and pull out the internal wiring harness to the casing side. (Refer to *chapter 10 "Cable Wiring"*.)
7. Unscrew the GT-SA bolts ⑤ and remove the pipe ④.
8. Remove the R-axis motor ⑥. (Refer to *section 5.4 "Disassembly and Reassembly of the R-axis Motor"*.)
9. Remove the timing belt ⑭. (Refer to *section 8.2 "Disassembly and Reassembly of R-axis Timing Belt"*.)
10. Unscrew the hexagon socket head cap screws ⑧. With the removal tap, remove the wrist unit.
11. Remove old sealing from each parts.

■ Reassembly

1. Apply Three Bond 1206C to the matching face between the casing and the wrist unit ①.
2. Mount the wrist unit ① on the casing.
3. Attach the conical spring washers to the hexagon socket head cap screws ⑧ and apply Three Bond 1206C to their thread parts. Then tighten them with the tightening torque shown in *Table 7-1 "Wrist Unit Parts Checklist"*.
4. Mount the R-axis motor ⑥. (Refer to *section 5.4 "Disassembly and Reassembly of the R-axis Motor"*.)
5. Put the timing belt ⑭ on the pulley ⑦. (Refer to *section 8.2 "Disassembly and Reassembly of R-axis Timing Belt"*.)
6. Mount the pipe ④ and tighten the GT-SA bolts ⑤ with the tightening torque shown in *Table 7-1 "Wrist Unit Parts Checklist"*.
7. Connect the internal wiring harness to wire. (Refer to *chapter 10 "Cable Wiring"*.)

7 Disassembly and Reassembly of Wrist Unit

8. Tighten the GT-SA bolts ③ with the tightening torque shown in *Table 7-1 "Wrist Unit Parts Checklist"*.
9. Remove the backup batteries from the B- and T-axes motors.
10. Apply Three Bond 1206C to the matching face between the wrist unit ① and the cover.
11. Mount the covers ② ⑪ with the hexagon socket button head screws ③ ⑫ (tighten them with the tightening torque shown in *Table 7-1 "Wrist Unit Parts Checklist"*) and the connector base ⑨ with the pan-head sems screws ⑩. When mount the connector base ⑨, accommodate the air hoses with care not to bend them in the wrist unit. (For the type A01, apply Three Bond 1206C to the matching face between the connector base ⑨ and the wrist, also to the pan-head sems screws ⑩).
12. Turn ON the DX100/DX200/FS100 power supply.

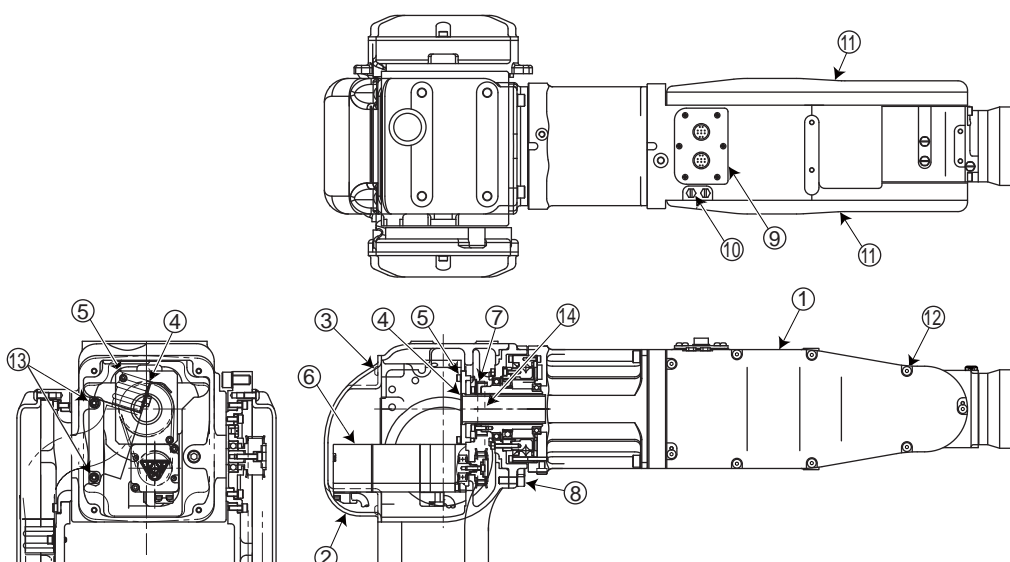
Table 7-1: Wrist Unit Parts Checklist

No	Item	Qty	Remark
①	Wrist unit	1	
②	Cover HW1200087-1 (MH5(L)S/F-A00, MH5(L)S-J00)	1	
	Cover HW1200150-1 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	1	
③	Hexagon socket button head screw M4 (length: 10 mm)	4	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
④	Pipe HW9406285-E	1	
⑤	GT-SA bolt M3 (length: 12 mm)	2	Tightening Torque 1.4 N•m
⑥	R-axis motor HW0388647-A	1	
⑦	Pulley HW0483421-B	1	
⑧	Hexagon socket head cap screw M6 (length: 16 mm) Conical spring washer 2H-6	4	Tightening torque 10 N m
⑨	Connector base HW0472743-A (MH5(L)S/F-A00, B0*, MH5(L)S-J00, K0*)	1	
	Connector base HW0472743-B (MH5(L)S/F-A01, MH5(L)S-J01)	1	
⑩	Pan-head sems screw M3 (length: 8 mm) Washer M3	6	
⑪	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	2	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	2	

Table 7-1: Wrist Unit Parts Checklist

No	Item	Qty	Remark
⑫	Hexagon socket button head screw M4 (length: 10mm)	18	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
⑬	GT-SA bolt M4 (length: 10mm)	2	Tightening Torque 2.8 N•m
⑭	Belt 060S3M219	1	

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



8 Disassembly and Reassembly and Adjustment of Timing Belts

8.1 Disassembly and Reassembly of L- and U-axis Timing Belts

- Refer to *Fig. 8-1 "Disassembly & Reassembly of L- and U-Axis Timing Belts"*.



Refer to *chapter 3 "Home Position Return"* and *chapter 5 "Disassembly and Reassembly of the Motor"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Unscrew the hexagon socket button head screws ⑥ and remove the cover ⑤. For the type A01, use the removal tap.
3. Unscrew the GT-SA bolts ③ and remove the L-axis timing belt ①. However, without the L-axis timing belt ①, its posture cannot be kept. So when remove the L-axis timing belt, support the L-arm to avoid it from rotating.
4. Unscrew the GT-SA bolts ④ and remove the U-axis timing belt ②. However, without the U-axis timing belt ②, its posture cannot be kept as the L-axis. So when remove the U-axis timing belt, support the U-arm to avoid it from rotating.

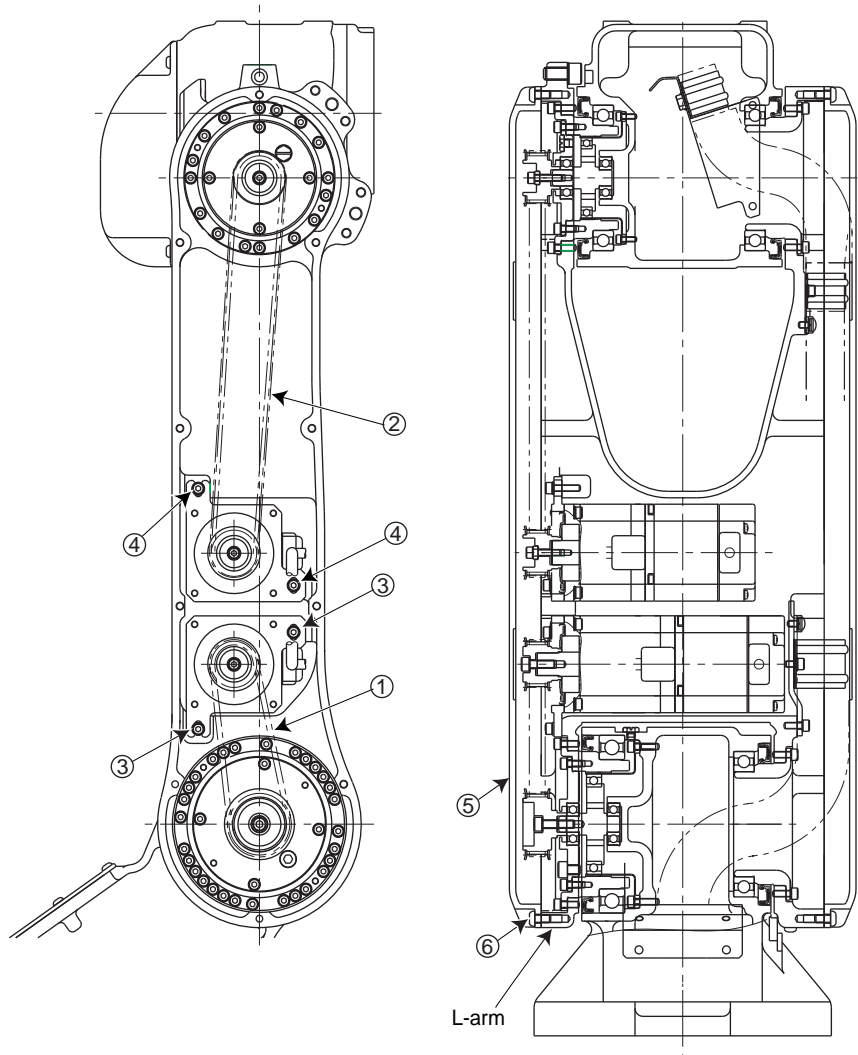
■ Reassembly

1. Mount the L-axis timing belt ① and the U-axis timing belt ②.
2. Adjust the initial tension of the timing belt. (Refer to *section 8.4 "Adjustment of Timing Belts"*.) Then tighten the GT-SA bolts ③ ④ with the tightening torque shown in *Table 8-1 "L- and U-Axis Timing Belts Parts Checklist"*.
3. For the type A01, B0*, apply Three Bond 1206C to the matching face between the L-arm and the cover.
4. Mount the cover ⑤ and tighten the hexagon socket button head screws ⑥ with the tightening torque shown in *Table 8-1 "L- and U-Axis Timing Belts Parts Checklist"*. (For the type A01, apply Three Bond 1206C to the hexagon socket button head screws.)
5. Turn ON the DX100/DX200/FS100 power supply.

Table 8-1: L- and U-Axis Timing Belts Parts Checklist

No	Item	Qty	Remark
①	L-axis timing belt 100S5M305	1	
②	U-axis timing belt 100S5M390 (MH5S/F)	1	
	U-axis timing belt 100S5M560 (MH5LS/LF)	1	
③	GT-SA bolt M4 (length: 18 mm) Washer M4	2	Tightening torque 2.8 Nm
④	GT-SA bolt M4 (length: 18 mm) Washer M4	2	Tightening torque 2.8 Nm
⑤	Cover HW1200089-2 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-2 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-1 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW1200149-1 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	
⑥	Hexagon socket button head screw M5 (length: 10mm)	10	Tightening Torque 1.4 N•m (for type A00)
	Hexagon socket button head screw M5 (length: 10 mm)	10	Tightening Torque 2.8 N•m (for type A01, B0*)

Fig. 8-1: Disassembly & Reassembly of L- and U-Axis Timing Belts



8.2 Disassembly and Reassembly of R-axis Timing Belt

- Refer to *Fig. 8-2 "Disassembly & Reassembly of R-Axis Timing Belt"*.

■ Disassembly

1. Turn OFF the DX100/DX200/FS100 power supply.
2. Connect the backup batteries with the R-, B- and T-axes motors.
3. Unscrew the hexagon socket button head screws ⑦ and remove the cover ⑥. For the type A01, B0*, use the removal tap.
4. Remove the internal wiring harness in the wrist unit and the casing to the L-arm side. (Refer to *chapter 10 "Cable Wiring"*.)
5. Unscrew the GT-SA bolts ⑤ and remove the pipe ④.
6. Unscrew the GT-SA bolts ③ and remove the R-axis motor ②. (Refer to *section 5.4 "Disassembly and Reassembly of the R-axis Motor"*.)
7. Remove the R-axis timing belt ①.

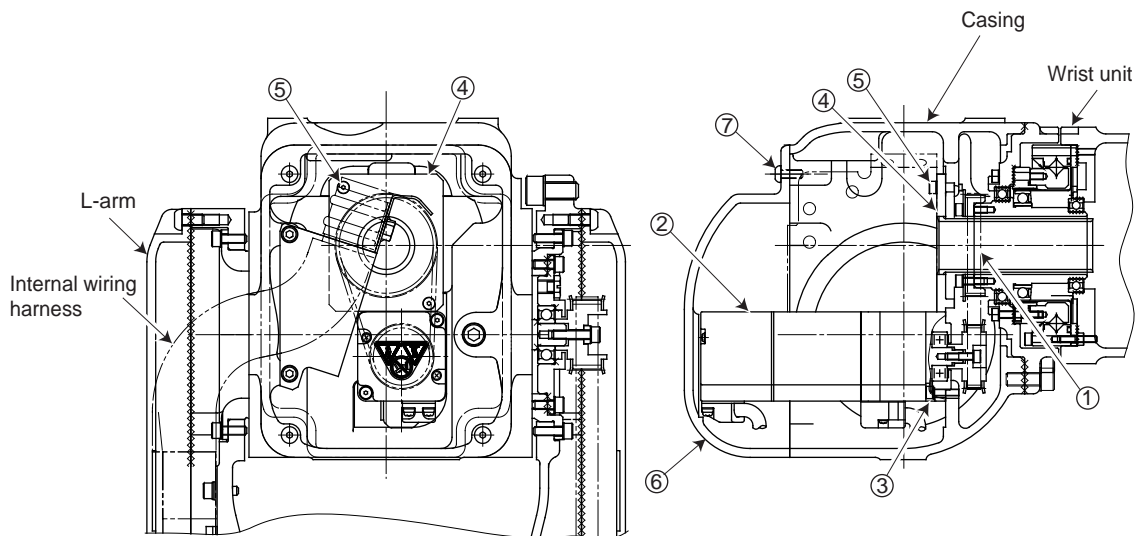
■ Reassembly

1. Mount the R-axis timing belt ①.
2. Mount the R-axis motor ②. (Refer to *section 5.4 "Disassembly and Reassembly of the R-axis Motor"*.) Then hang the timing belt ①.
3. Adjust the initial tension of the timing belt. (Refer to *section 8.4 "Adjustment of Timing Belts"*) Then tighten the GT-SA bolts ③ with the tightening torque shown in *Table 8-2 "R-Axis Timing Belt Parts Checklist"*.
4. Mount the pipe ④ and tighten the GT-SA bolts ⑤ with the tightening torque shown in *Table 8-2 "R-Axis Timing Belt Parts Checklist"*.
5. Connect the internal wiring harness to the casing and the wrist unit. (Refer to *chapter 10 "Cable Wiring"*.)
6. Remove the backup batteries from the R-, B- and T-axes motors.
7. For the type A01, B0*, apply Three Bond 1206C to the matching face between the casing and the cover.
8. Mount the cover ⑥ and tighten the hexagon socket button head screws ⑦ with the tightening torque shown in *Table 8-2 "R-Axis Timing Belt Parts Checklist"*. For the type A01, apply Three Bond 1206C to the hexagon socket button head screws.
9. Turn ON the DX100/DX200/FS100 power supply.

Table 8-2: R-Axis Timing Belt Parts Checklist

No	Item	Qty	Remark
①	R-axis timing belt 060S3M219	1	
②	R-axis motor HW0388647-A	1	
③	GT-SA bolt M3 (length: 12 mm) Washer M3	2	Tightening torque 1.4 N m
④	Pipe HW9406285-E	1	
⑤	GT-SA bolt M3 (length: 12 mm)	2	Tightening Torque 1.4 N•m
⑥	Cover HW1200087-1 (MH5(L)S/F-A00, MH5(L)S-J00)	1	
	Cover HW1200150-1 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	1	
⑦	Hexagon socket button head screw M4 (length: 10mm)	4	Tightening Torque 1.0 N•m(for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)

Fig. 8-2: Disassembly & Reassembly of R-Axis Timing Belt



8.3 Disassembly and Reassembly of B- and T-axes Timing Belts

- Refer to Fig. 8-3 "Disassembly & Reassembly of B- and T-Axes Timing Belts".

■ Disassembly

(Refer to section 5.5 "Disassembly and Reassembly of B-Axis Motor" and section 5.6 "Disassembly and Reassembly of T-Axis Motor".)

1. Unscrew the hexagon socket button head screws ⑥ and remove the cover ⑤.
2. Unscrew the GT-SA bolts ② and remove the B-axis timing belt ①.
3. Unscrew the hexagon socket button head screws ③ and remove the cover ⑦.
4. Unscrew the GT-SA bolts ④ and remove the T-axis timing belt ③.

■ Reassembly

(Refer to section 5.5 "Disassembly and Reassembly of B-Axis Motor" and section 5.6 "Disassembly and Reassembly of T-Axis Motor".)

1. Mount the R-axis timing belt ③ and adjust the initial tension of the timing belt. (Refer to section 8.4 "Adjustment of Timing Belts".) Then tighten the GT-SA bolts ② with the tightening torque shown in Table 8-3 "B- and T-Axes Timing Belts Parts Checklist".
2. Mount the B-axis timing belt ① and adjust the initial tension of the timing belt. (Refer to section 8.4 "Adjustment of Timing Belts".) Then tighten the GT-SA bolts ② with the tightening torque shown in Table 8-3 "B- and T-Axes Timing Belts Parts Checklist".
3. Apply Three Bond 1206C to the matching face between the U-arm and the cover
4. Mount the cover ⑤ and tighten the hexagon socket button head screws ⑥ with the tightening torque shown in Table 8-3 "B- and T-Axes Timing Belts Parts Checklist".

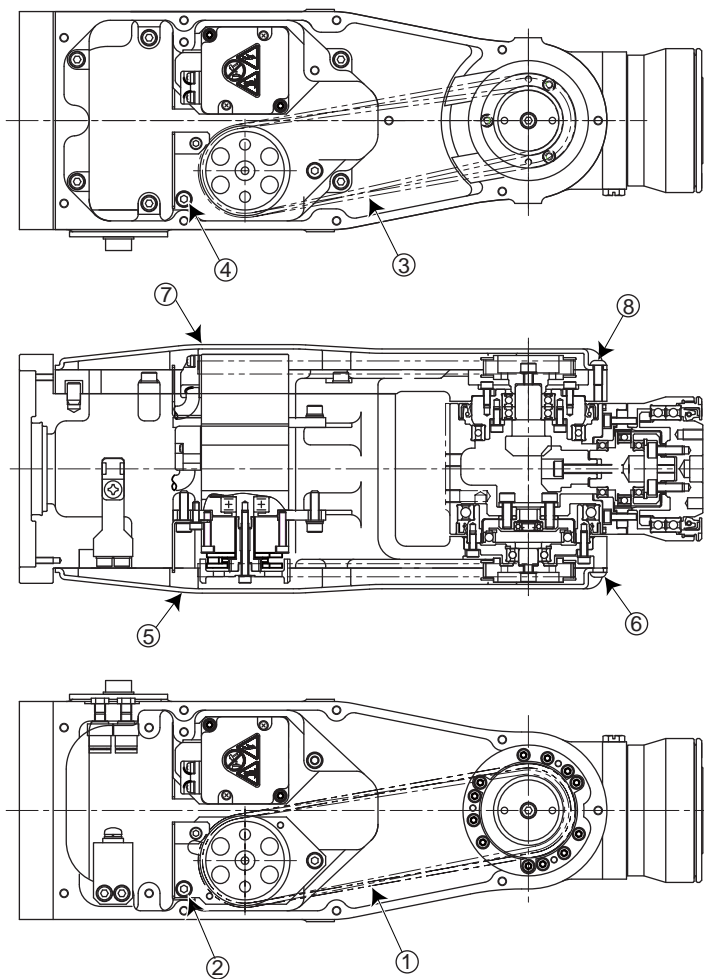
Table 8-3: B- and T-Axes Timing Belts Parts Checklist

No	Item	Qty	Remark
①	B-axis timing belt 060S3M396	1	
②	GT-SA bolt M4 (length: 16 mm) Washer M4	2	Tightening Torque 2.8 N•m
③	T-Axis timing belt 060S3M396	1	
④	GT-SA bolt M4 (length: 16 mm) Washer M4	2	Tightening Torque 2.8 N•m
⑤	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	1	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	1	
⑥	Hexagon socket button head screw M4 (length: 10mm)	9	Tightening Torque 1.0 N•m(for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)

Table 8-3: B- and T-Axes Timing Belts Parts Checklist

No	Item	Qty	Remark
⑦	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	1	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	1	
⑧	Hexagon socket button head screw M4 (length: 10mm)	9	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)

Fig. 8-3: Disassembly & Reassembly of B- and T-Axes Timing Belts



8.4 Adjustment of Timing Belts

- **L-axis**
Refer to *Fig. 8-1 "Disassembly & Reassembly of L- and U-Axis Timing Belts"*. Loosen the GT-SA bolts ③ and adjust the initial tension to be the specific initial tension as shown in *Table 8-4 "Initial Tension of Timing Belt"* with the tension meter. Then tighten them with the specified tightening torque.
- **U-axis**
Refer to *Fig. 8-1 "Disassembly & Reassembly of L- and U-Axis Timing Belts"*. Loosen the GT-SA bolts ④ and adjust the initial tension to be the specific initial tension as shown in *Table 8-4 "Initial Tension of Timing Belt"* with the tension meter. Then tighten them with the specified tightening torque.
- **R-axis**
Refer to *Fig. 8-2 "Disassembly & Reassembly of R-Axis Timing Belt"*. Loosen the GT-SA bolts ③ and adjust the initial tension to be the specific initial tension as shown in *Table 8-4 "Initial Tension of Timing Belt"* with the tension meter. Then tighten them with the specified tightening torque.
- **B-axis**
Refer to *Fig. 8-3 "Disassembly & Reassembly of B- and T-Axes Timing Belts"*. Loosen the GT-SA bolts ② and adjust the initial tension to be the specific initial tension as shown in *Table 8-4 "Initial Tension of Timing Belt"* with the tension meter. Then tighten them with the specified tightening torque.
- **T-axis**
Refer to *Fig. 8-3 "Disassembly & Reassembly of B- and T-Axes Timing Belts"*. Loosen the GT-SA bolts ④ and adjust the initial tension to be the specific initial tension as shown in *Table 8-4 "Initial Tension of Timing Belt"* with the tension meter. Then tighten them with the specified tightening torque.

Table 8-4: Initial Tension of Timing Belt

	Initial Tension
L-axis	57.9 to 77.5N (5.9 to 7.9 kgf)
U-axis	57.9 to 77.5N (5.9 to 7.9 kgf)
R-axis	19.6 to 26.5N (2.0 to 2.7 kgf)
B-axis	19.6 to 26.5N (2.0 to 2.7 kgf)
T-axis	19.6 to 26.5N (2.0 to 2.7 kgf)

9 Battery Pack Replacement

- Refer to *Fig. 9-1 "Battery Location"*, *Fig. 9-2 "Battery Replacement"* and *Fig. 9-3 "Battery Connection"*

9.1 Battery Pack Replacement

The battery packs are installed in the position shown in *Fig. 9-1 "Battery Location"*. If the battery alarm occurs in the DX100/DX200/FS100, replace the battery in accordance with the following procedure:

Fig. 9-1: Battery Location

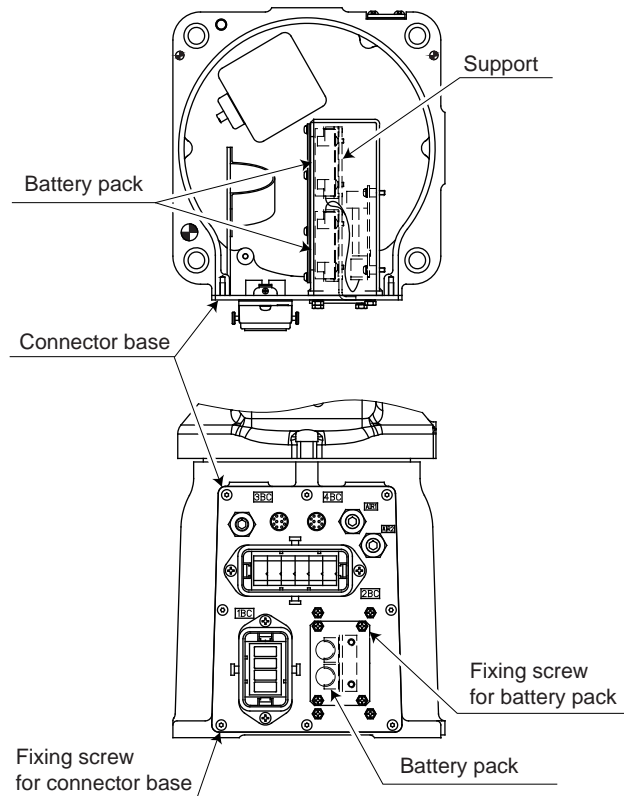


Fig. 9-2: Battery Replacement

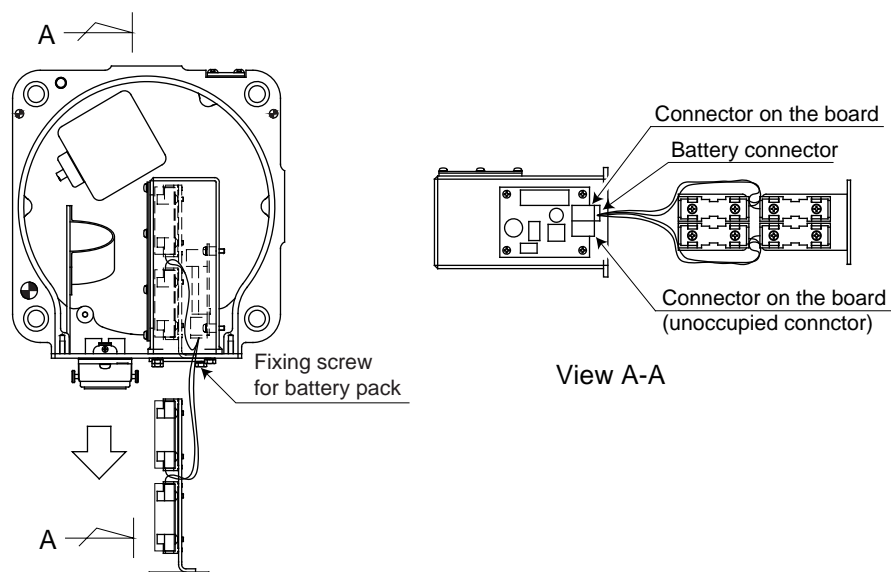
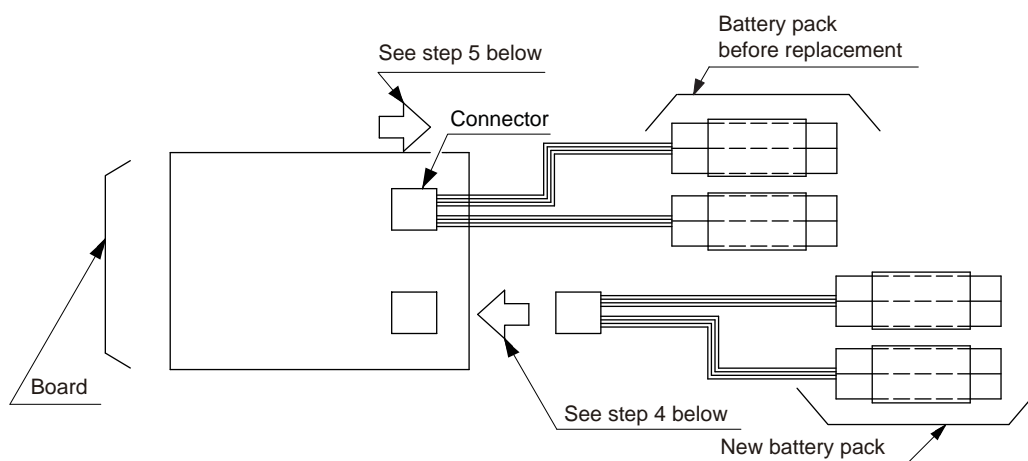


Fig. 9-3: Battery Connection



1. Turn OFF the DX100/DX200/FS100 main power supply.
2. Unscrew the fixing screws for battery pack and pull out the support from the connector base.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack connector to the unoccupied connector on the board.
5. Remove the old battery pack from the connector on the board.
6. Mount the new battery pack to the holder.
7. Reinstall the support in the connector base with the fixing screws for the battery pack..



Remove the old battery pack after connecting the new one so that the encoder absolute data does not disappear.

Be careful not to pinch the cables when reinstalling the battery holder.

10 Cable Wiring



To prevent loss of the encoder absolute data, make sure to connect the new backup battery before disconnecting the encoder connector. (Refer to *chapter 2 “Notes for Maintenance”*.)

10.1 Disconnecting Cables

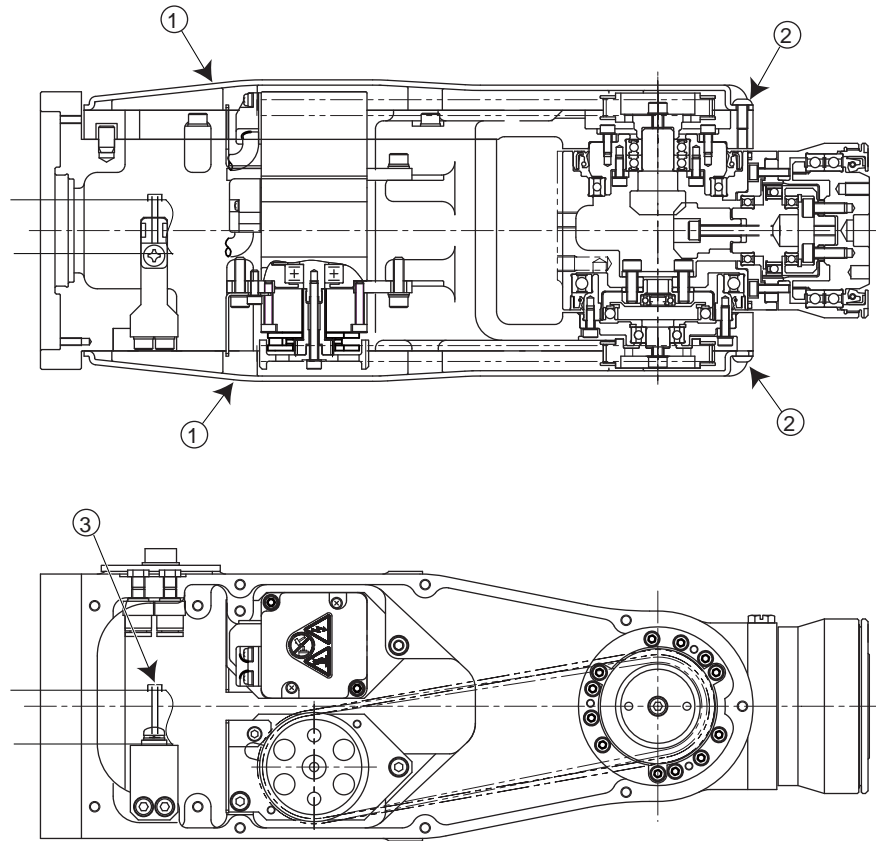
10.1.1 Wrist Unit

- Refer to *Table 10-1 “Checklist for Cable Wiring Parts in Wrist Unit”* and *Fig. 10-1 “Cable Wiring in Wrist Unit”*.
1. Unscrew the hexagon socket button head screws ② and remove the cover ①.
 2. Connect the backup batteries with the B- and T-axes motors.
 3. Remove the B- and T-axes motor connectors connected to the internal wiring harness.
 4. Remove the air hoses and the internal user I/O wiring harness connectors “3BC” and “4BC”.
 5. Cut off the cable tie ③ and pull out the internal wiring harness to the U-arm side.

Table 10-1: Checklist for Cable Wiring Parts in Wrist Unit

No.	Name	Qty.	Notes
①	Cover HW1301269-1 (MH5(L)S/F-A00, MH5(L)S-J00)	2	
	Cover HW1300211-3 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	2	
②	Hexagon socket button head screw M4 (length: 10mm)	18	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
③	Cable tie T-50R	1	

Fig. 10-1: Cable Wiring in Wrist Unit



10.1.2 Casing and L-arm

- Refer to *Table 10-2 "Checklist for Cable Wiring Parts in Casing and L-arm"* and *Fig. 10-2 "Cable Wiring in Casing and L-arm"*.
1. Unscrew the hexagon socket button head screws ② and remove the cover ①.
 2. Unscrew the hexagon socket head cap screws ③ and pull out the support ④.
 3. Connect the backup battery with the R-axis motor and disconnect the R-axis connector connected to the internal wiring harness.
 4. Cut off all the cable ties which fix the internal wiring harness and unscrew the hexagon socket head cap screw ⑤. Then remove the saddle ⑥ and the support ④.
 5. Unscrew the hexagon socket button head screws ⑧, remove the cover ⑦ and pull out the internal wiring harness to the L-arm side.
 6. Connect the backup batteries with the L- and U-axis motors and disconnect the L- and U-axis connectors connected to the internal wiring harness.
 7. Cut off all the cable ties which fix the internal wiring harness and unscrew the hexagon socket head cap screws ⑩ ⑫. Then remove the saddles ⑨ ⑪.

Table 10-2: Checklist for Cable Wiring Parts in Casing and L-arm

No.	Name	Qty.	Notes
①	Cover HW1200087-1 (MH5(L)S/F-A00, MH5(L)S-J00)	1	
	Cover HW1200150-1 (MH5(L)S/F-A01, B0*, MH5(L)S-J01, K0*)	1	
②	Hexagon socket button head screw M4 (length: 10mm)	4	Tightening Torque 1.0 N•m (for type A00) Tightening Torque 1.4 N•m (for type A01, B0*)
③	Hexagon socket head cap screw M4 (length: 10 mm) Conical spring washer 2H-4	2	Tightening torque: 2.8 N•m
④	Support HW0314493-1	1	
⑤	Hexagon socket head cap screw M5 (length: 8 mm) Conical spring washer 2H-5 Washer M5	1	Tightening torque: 10 N•m
⑥	Saddle CH-19	1	
⑦	Cover HW1200089-1 (MH5S/F-A00, MH5S-J00)	1	
	Cover HW0200555-1 (MH5S/F-A01, B0*, MH5S-J01, K0*)	1	
	Cover HW1200088-2 (MH5LS/LF-A00, MH5LS-J00)	1	
	Cover HW0201253-2 (MH5LS/LF-A01, B0*, MH5LS-J01, K0*)	1	

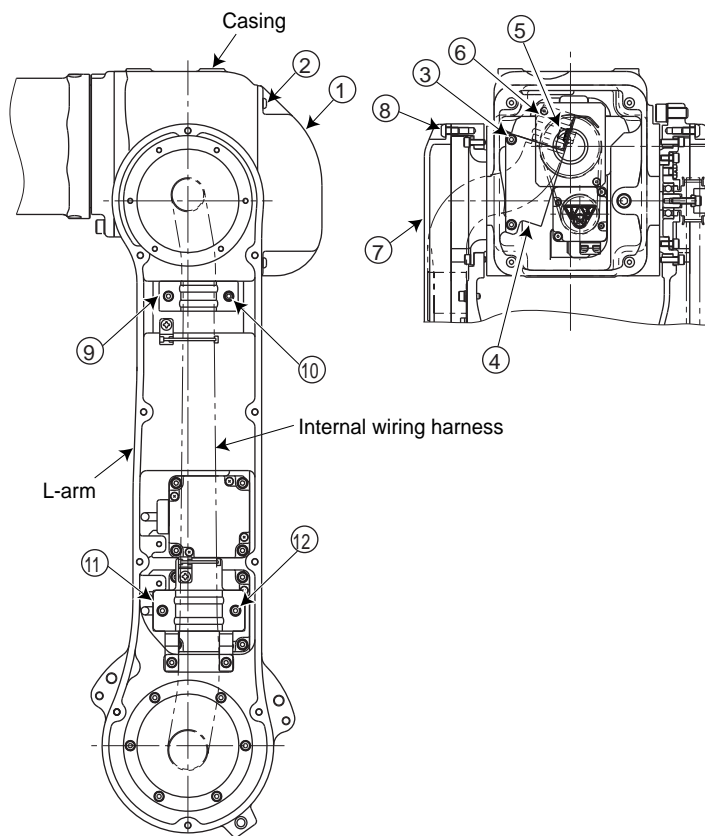
MH5(L)S/F,
MH5(L)SII

10 Cable Wiring
10.1 Disconnecting Cables

Table 10-2: Checklist for Cable Wiring Parts in Casing and L-arm

No.	Name	Qty.	Notes
⑧	Hexagon socket button head screw M5 (length: 10 mm)	10	Tightening Torque 1.4 N•m (for type A00) Tightening Torque 2.8 N•m (for type A01, B0*)
⑨	Saddle CH-19	1	
⑩	Hexagon socket head cap screw M4 (length: 8 mm) Conical spring washer 2H-4 Washer M4	2	Tightening torque: 2.8 N•m
⑪	Saddle CD-25	1	
⑫	Hexagon socket head cap screw M4 (length: 6 mm) Conical spring washer 2H-4 Washer M4	2	Tightening torque: 2.8N•m

Fig. 10-2: Cable Wiring in Casing and L-arm



10.1.3 S-head and Base

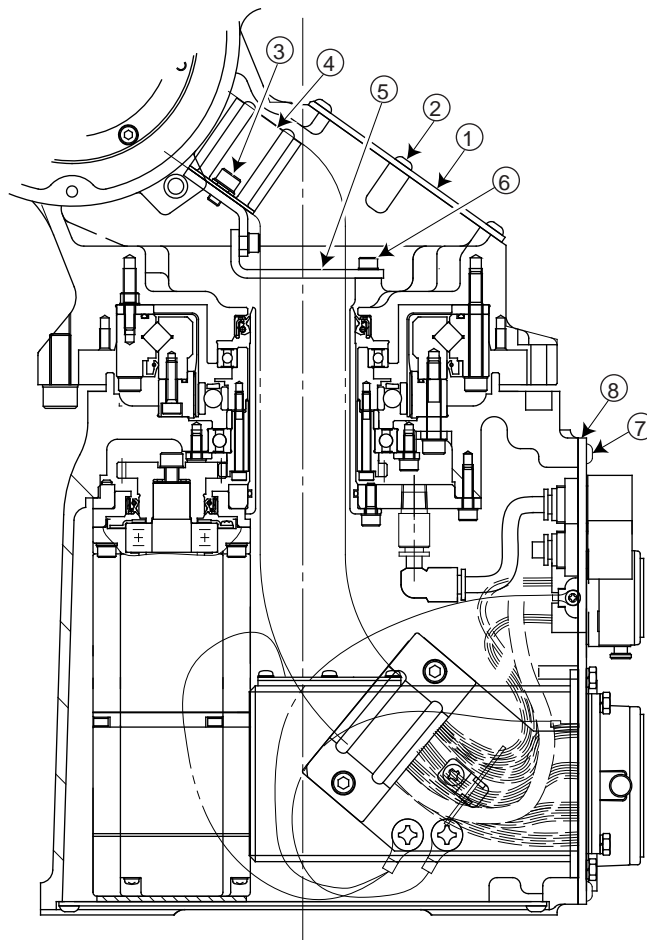
- Refer to *Table 10-3 "Checklist for Cable Wiring Parts in S-head and Base"* and *Fig. 10-3 "Cable Wiring in S-head and Base"*.

1. Unscrew the hexagon socket button head screws ② and remove the cover ①.
2. Unscrew the GT-SA bolt ③ and the saddle ④. Then pull out the internal wiring harness with the support ⑤ from the S-head.
3. Unscrew the GT-SA bolts ⑥ and remove the support ⑤.
4. Unscrew the hexagon socket button head screws ⑦ and remove the base connector ⑧ (attached to the power cable).
5. Pull out the C-base ⑧ and connect the backup battery with the S-axis motor.
6. Disconnect the S-axis connector connected to the internal wiring harness.
7. While pull out the base connector ⑧, remove the internal wiring harness.

Table 10-3: Checklist for Cable Wiring Parts in S-head and Base

No.	Name	Qty.	Notes
①	Cover HW1302004-1	1	
②	Hexagon socket button head screw M4 (length: 10 mm)	6	Tightening Torque 1.4 N•m
③	GT-SA bolt M5 (length: 10 mm) Washer M5	1	Tightening Torque 6.0 N•m
④	Saddle CD-25	1	
⑤	Support HW0414036-1	1	with HW0414035-1
⑥	GT-SA bolt M4 (length: 12 mm)	2	Tightening Torque 1.4 N•m
⑦	Hexagon socket button head screw M4 (length: 10 mm)	8	Tightening Torque 1.4 N•m
⑧	Base connector HW0273515-A (MH5S/F-A00, B0*, MH5S-J00, K0)	1	
	Base connector HW0273515-B (MH5S/F-A01, MH5S-J01)	1	
	Base connector HW0273515-C (MH5LS/LF-A00, B0*, MH5LS-J00, K0*)	1	
	Base connector HW0273515-D (MH5LS/LF-A01, MH5LS-J01)	1	

Fig. 10-3: Cable Wiring in S-head and Base



10.2 Connecting Cables

10.2.1 S-head and Base

- Refer to *Table 10-3 "Checklist for Cable Wiring Parts in S-head and Base"* and *Fig. 10-3 "Cable Wiring in S-head and Base"*.
1. Insert the internal wiring harness mounted the base connector ⑧ in the S-head from the back side of the manipulator.
 2. Mount the support ⑤ on the internal wiring harness. Mount the saddle ④ on the spring part of the internal wiring harness (at the second or third winding from the top). Then fix it with the GT-SA bolt ③.
 3. Mount the support ⑤ on the S-head with the GT-SA bolts ⑥. Tighten the GT-SA bolts ⑥ with a tightening torque shown in *Table 10-3 "Checklist for Cable Wiring Parts in S-head and Base"*.
 4. Connect the connector of the S-axis motor to the internal wiring harness and remove the backup battery.
 5. Push the internal wiring harness in the base and accommodate it. At this time, be very careful not to pinch the cable between the base and the connector.
 6. After accommodate the internal wiring harness, mount the base connector ⑧ on the base with the hexagon socket button head screws ⑦.
 7. Insert the internal wiring harness to the L-arm side.
 8. Mount the cover ① with the hexagon socket button head screws ②.

10.2.2 U-arm and Casing

- Refer to *Table 10-2 "Checklist for Cable Wiring Parts in Casing and L-arm"* and *Fig. 10-2 "Cable Wiring in Casing and L-arm"*.
1. Insert the internal wiring harness in the casing.
 2. Connect the connectors of the L- and U-axis motors to the internal wiring harness and remove the backup batteries.
 3. Mount the saddles ⑨ ⑩ on the spring part of the internal wiring harness (at the second or third winding from the top). Fix it with the hexagon socket head cap screws ⑪ ⑫ and the white-marked part of the internal wiring harness with the cable tie.
 4. Mount the cover ⑦ on the L-arm with the hexagon socket button head screws ⑧.
 5. Mount the support ④ on the internal wiring harness in the casing. Mount the saddle ⑥ on the spring part of the internal wiring harness (at the second or third winding from the top). Fix it with the hexagon socket head cap screw ⑤ and the white-marked part of the internal wiring harness with the cable tie.
 6. Connect the connector of the R-axis motor to the internal wiring harness and remove the backup battery.
 7. Insert the internal wiring harness in the wrist unit.
 8. Mount the support ④ on the casing with the hexagon socket head cap screws ③.

9. Tighten the hexagon socket head cap screws ③ with a tightening torque shown in *Table 10-2 "Checklist for Cable Wiring Parts in Casing and L-arm"*.
10. Mount the cover ① on the casing with the hexagon socket button head screws ②.

10.2.3 Wrist Unit

- Refer to *Table 10-1 "Checklist for Cable Wiring Parts in Wrist Unit"* and *Fig. 10-1 "Cable Wiring in Wrist Unit"*.

1. Insert the cable in the wrist unit and fix the white-marked part of the internal wiring harness with the cable tie ③.
2. Mount two air hoses and the internal user I/O wiring harness connectors. Refer to *section 10.1.2 "Casing and L-arm"* and mount the air hoses, "A-black" and "B-blue". Mounting them on the wrong places makes the air lines interchanged in the manipulator and causes the malfunction of the devices as the hand incorporated to the manipulator.
Also, make sure that the air hoses are inserted completely and not removed.
Connect the internal user I/O wiring harness connectors to the connectors "3BC" and "4BC".
3. Connect the connectors of the B- and T-axes motors to the internal wiring harness and remove the backup batteries.
4. After accommodate the internal wiring harness in the wrist unit, mount the cover ① on the wrist unit with the hexagon socket button head screws ②.

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

No.	DWG No.	Name	Pcs
1001	HW0102487-1	Base	1
1002	HW0102486-1	S head	1
1003	HW0314329-1	Cover	1
1004	HW0314328-1	Cover	1
1005	HW0414024-1	Collar	1
1006	HW0414025-1	Support B	1
1007	HW0414034-1	M base	1
1008	HW0314319-1	Shaft	1
1009	HW0412383-1	Gasket	1
1010	HW0414064-1	M base	1
1011	HW0314707-1	Gear	1
1012	HW0314708-2	Gear	1
1014	HW0389176-B	Speed reducer	1
1015	6811LU	Bearing	1
1016	6810VV	Bearing	1
1017	TC405208	Oil seal	1
1018	TC25X35X6FKM	Oil seal	1
1019	S39	O-ring	1
1020	PT1/8	Plug	3
1021	HW9482404-A	Heat conduction sheet	1
1022	POC6-01M	Union	1
1023	M4X10	Hexagon socket button head screw	22
1024	M8X16	Hexagon socket head cap screw	1
1025	2H-8	Conical spring washer	1
1026	M6X8	Hexagon socket head cap screw	1
1027	2H-6	Conical spring washer	1
1028	M5X16	Hexagon socket head cap screw	1
1029	2H-5	Conical spring washer	1
1030	M4X25	Hexagon socket head cap screw	2
1031	2H-4	Conical spring washer	2
1032	M4	Washer	4
1033	M3X30	Hexagon socket head cap screw	6
1034	2H-3	Conical spring washer	6
1035	M4X14	Hexagon socket head cap screw	2
1036	2H-4	Conical spring washer	2
1037	M5X40	Hexagon socket head cap screw	12
1038	2H-5	Conical spring washer	12

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

No.	DWG No.	Name	Pcs
1039	M5X30	Hexagon socket head cap screw	16
1040	2H-5	Conical spring washer	16
1041	M4X10	Hexagon socket head cap screw	4
1042	2H-4	Conical spring washer	4
1043	M4X16	Hexagon socket head cap screw	7
1044	2H-4	Conical spring washer	7
1045	M4X12	Hexagon socket head cap screw	4
1046	2H-4	Conical spring washer	4
1047	SGMAV-04ANA-YR11	Motor	1
1048	HW0414483-1	Cover	1
1049	HW0414484-1	Gasket	1
1053	HW8411125-2	Washer	16

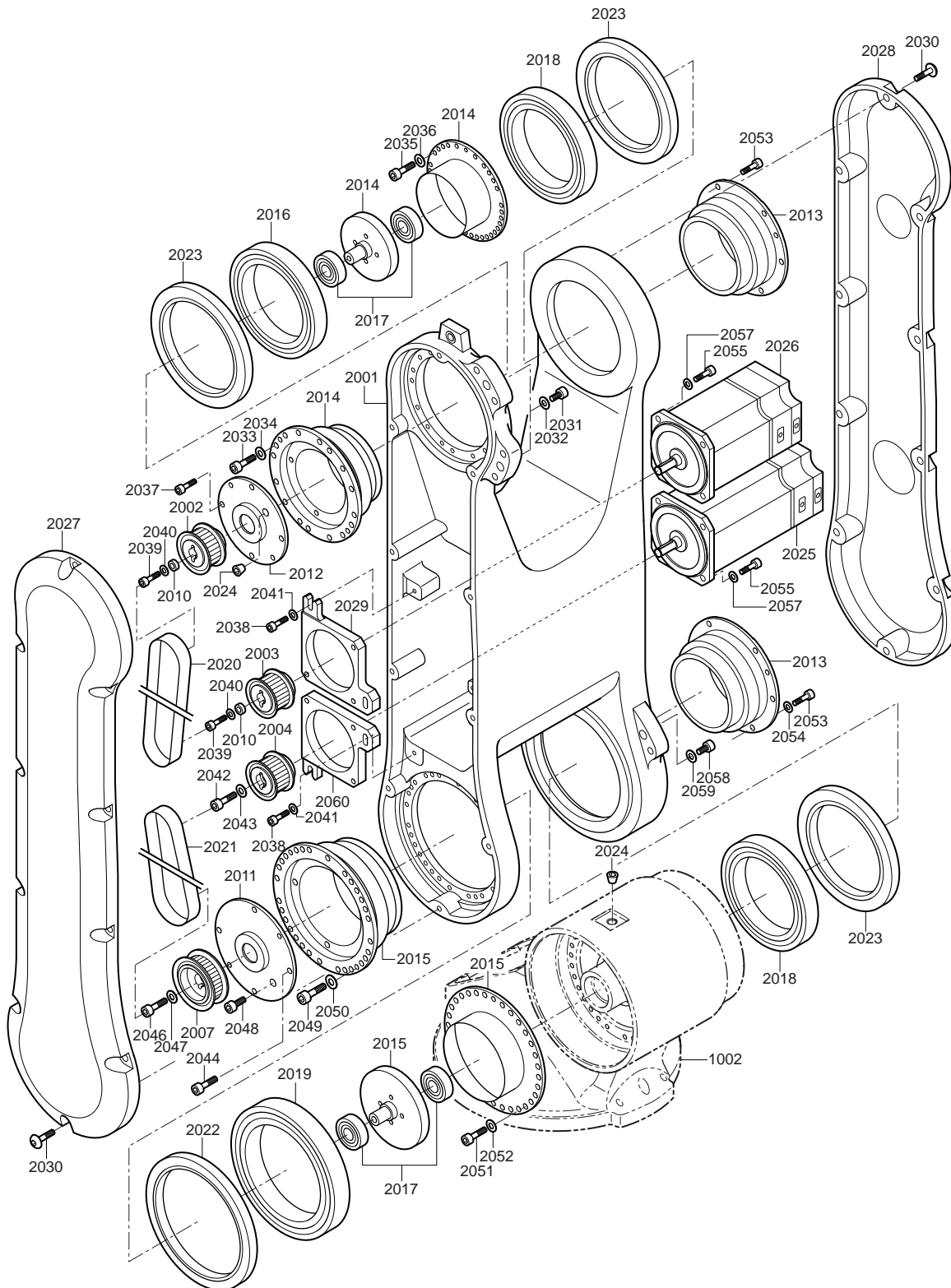
11.2 L- and U-Axis Unit*Fig. 11-2: L- and U-Axis Unit*

Table 11-2: L- and U-Axis Unit

No.	DWG No.	Name	Pcs
2001	HW0102485-1	L arm	1
2002	HW0414073-A	Pulley	1
2003	HW0414072-A	Pulley	1
2004	HW0414070-B	Pulley	1
2007	HW0414071-B	Pulley	1
2010	HW8411125-1	Washer	2
2011	HW0408927-2	Housing	1
2012	HW0408928-2	Housing	1
2013	HW0408931-1	Housing	2
2014	HW0388707-B	Speed reducer	1
2015	HW0388706-B	Speed reducer	1
2016	6913DDU	Bearing	1
2017	6000ZZ	Bearing	4
2018	6913ZZ	Bearing	2
2019	6916DDU	Bearing	1
2020	100S5M560	Belt	1
2021	100S5M305	Belt	1
2022	SC901107	Oil seal	1
2023	SC751007	Oil seal	3
2024	LP-M5	Plug	2
2025	SGMAV-04ANA-YR11	Motor	1
2026	SGMAV-02A2A-YR11	Motor	1
2027	HW0201253-1	Cover	1
2028	HW0201253-2	Cover	1
2029	HW0414027-1	M base	1
2030	M5X10	Hexagon socket button head screw	20
2031	M8X16	Hexagon socket head cap screw	2
2032	2H-8	Conical spring washer	2
2033	M4X14	Hexagon socket head cap screw	16
2034	2H-4	Conical spring washer	16
2035	M3X10	Hexagon socket head cap screw	32
2036	2H-3	Conical spring washer	32
2037	M4X10	GT-SA bolt	4
2038	M4X16	GT-SA bolt	4
2039	M4X18	Hexagon socket head cap screw	2
2040	2H-4	Conical spring washer	2
2041	M4	Washer	4

MH5(L)S/F,
MH5(L)SII

11 Parts List
11.2 L- and U-Axis Unit

Table 11-2: L- and U-Axis Unit

No.	DWG No.	Name	Pcs
2042	M5X16	Hexagon socket head cap screw	1
2043	2H-5	Conical spring washer	1
2044	M4X10	GT-SA bolt	4
2046	M5X20	Hexagon socket head cap screw	1
2047	2H-5	Conical spring washer	1
2048	M6X8	Hexagon socket head cap screw	1
2049	M4X12	Hexagon socket head cap screw	29
2050	CDW4L	Conical spring washer	29
2051	M4X16	Hexagon socket head cap screw	30
2052	2H-4	Conical spring washer	30
2053	M4X10	GT-SA bolt	12
2055	M4X16	GT-SA bolt	8
2057	M4	Washer	8
2058	M8X16	Hexagon socket head cap screw	2
2059	2H-8	Conical spring washer	2
2060	HW0414027-2	M base	1
1002	HW0102486-1	S head	1

11.3 R-Axis Unit

Fig. 11-3: R-Axis Unit

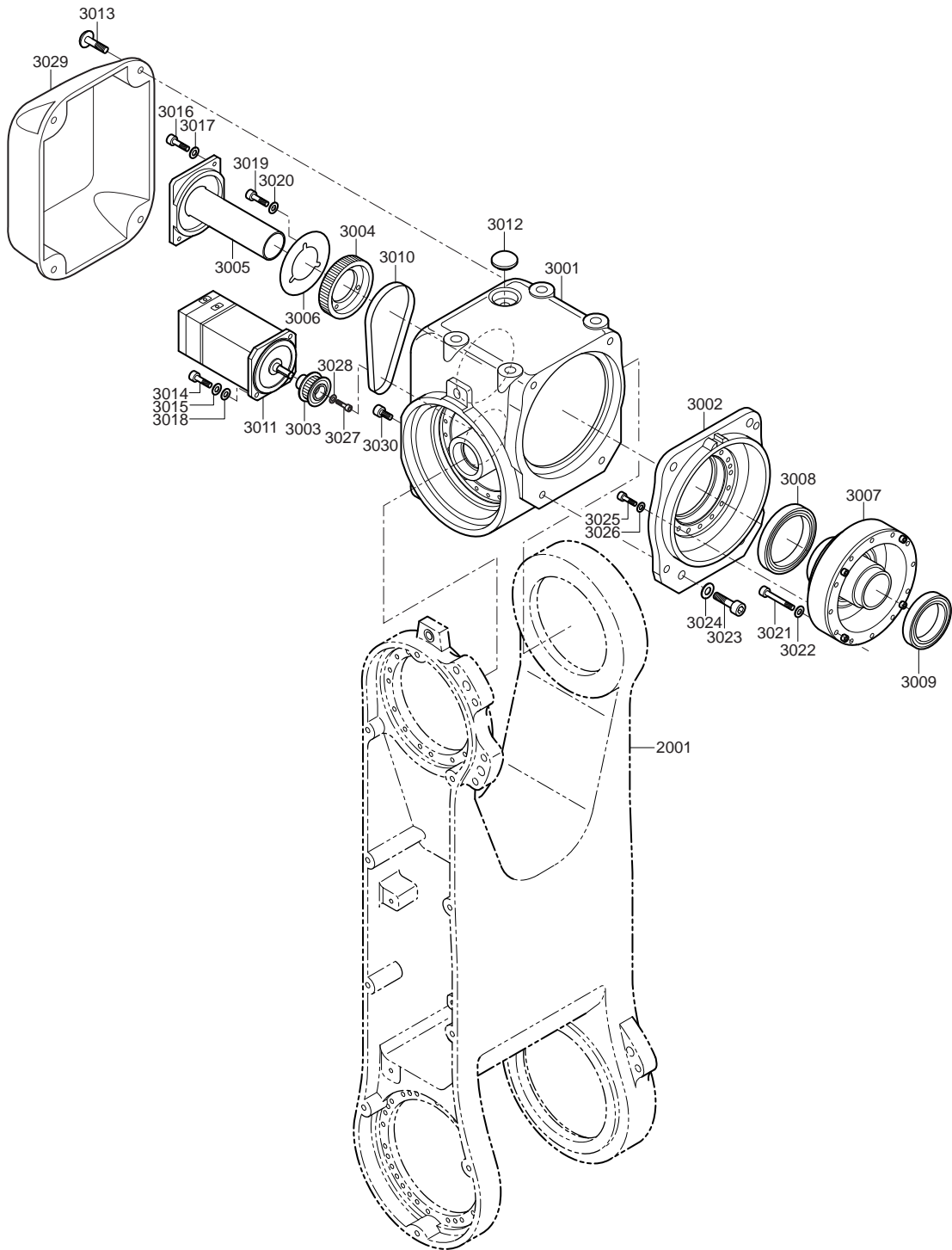
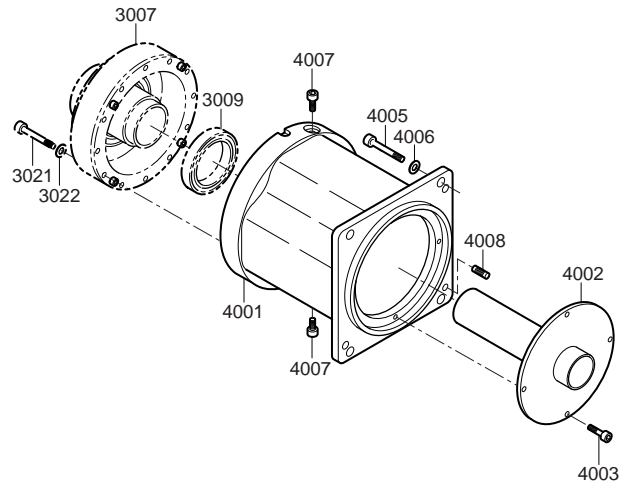


Table 11-3: R-Axis Unit

No.	DWG No.	Name	Pcs
3001	HW0102484-1	Casing	1
3002	HW0314334-1	Housing	1
3003	HW0414074-A	Pulley	1
3004	HW0483421-B	Pulley	1
3005	HW9406285-E	Pipe	1
3006	HW9406278-2	Washer	1
3007	HW0388708-A	Speed reducer	1
3008	6808VV	Bearing	1
3009	6806LLU	Bearing	1
3010	060S3M219	Belt	1
3011	SGMAV-A5ANA-YR11	Motor	1
3012	OB-31	Plug	1
3013	M4X10	Hexagon socket button head screw	4
3014	M3X12	Hexagon socket head cap screw	2
3015	2H-3	Conical spring washer	2
3016	M3X12	Hexagon socket head cap screw	2
3017	2H-3	Conical spring washer	2
3018	M3	Washer	2
3019	M3X10	Hexagon socket head cap screw	3
3020	2H-3	Conical spring washer	3
3021	M3X30	Hexagon socket head cap screw	12
3022	2H-3	Conical spring waster	12
3023	M6X16	Hexagon socket head cap screw	4
3024	2H-6	Conical spring waster	4
3025	M3X20	Hexagon socket head cap screw	16
3026	2H-3	Conical spring waster	16
3027	M3X12	Hexagon socket head cap screw	1
3028	2H-3	Conical spring waster	1
3029	HW0201198-1	Cover	1
3030	M6X8	Hexagon socket head cap screw	1
2001	HW0102485-1	L arm	1

11.4 Spacer Unit*Fig. 11-4: Spacer Unit**Table 11-4: Spacer Unit*

No.	DWG No.	Name	Pcs
4001	HW0201525-1	Spacer	1
4002	HW0414068-A	Support	1
4003	M3X10	GT-SA bolt	4
4005	M6X20	Hexagon socket head cap screw	4
4006	2H-6	Conical spring waster	4
4007	M5X6	Hexagon socket head cap screw	2
4008	MS4-8	Pin	1
3007	HW0388708-A	Speed reducer	1
3009	6806ZZ	Bearing	1
3021	M3X30	Hexagon socket head cap screw	12
3022	2H-3	Conical spring waster	12

11.5 Wrist Unit

Fig. 11-5: Wrist Unit

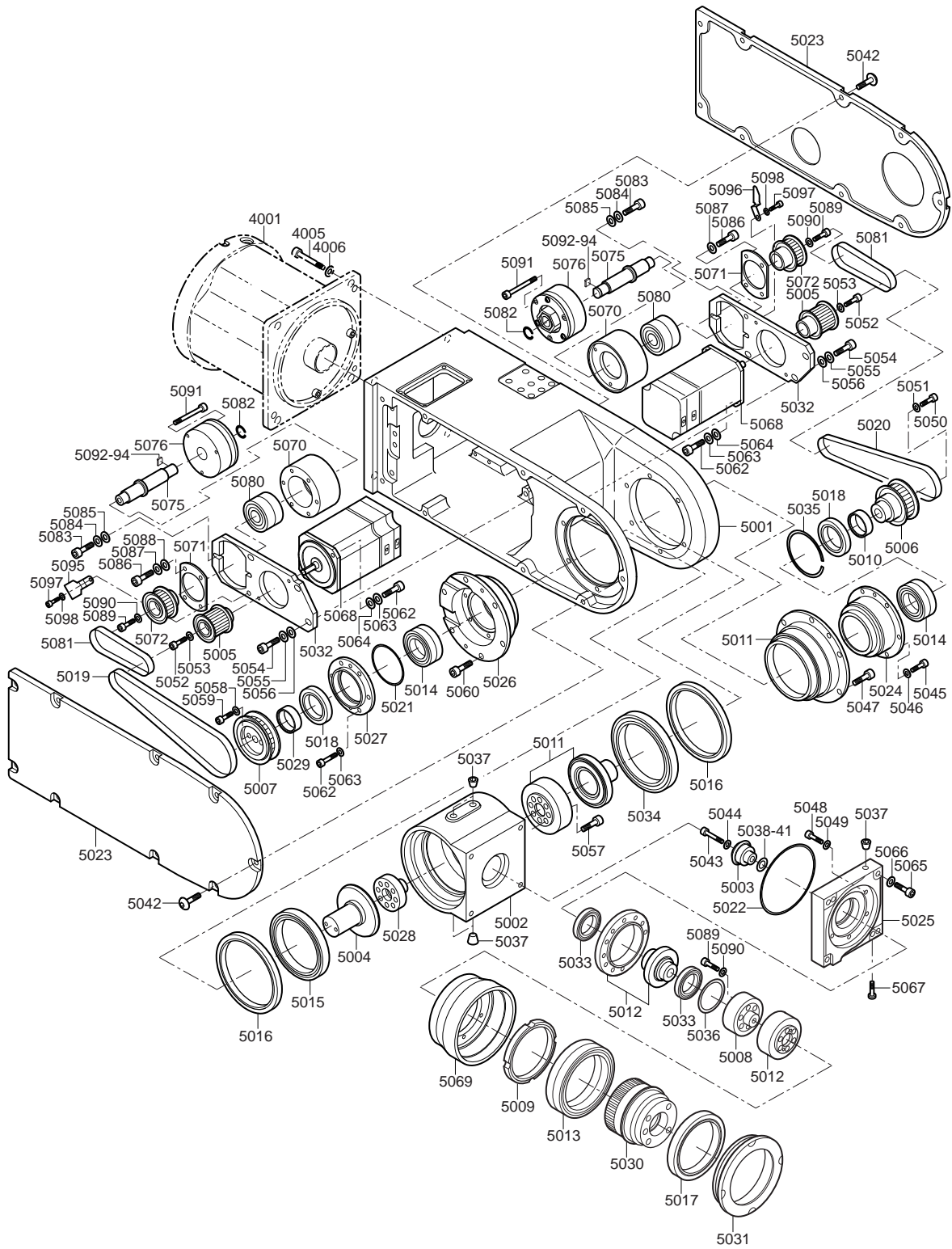


Table 11-5: Wrist Unit

No.	DWG No.	Name	Pcs
5001	HW0102483-1	U-arm	1
5002	HW0313997-1	Wrist base	1
5003	HW0388712-A	Gear	1
5004	HW0388711-A	Gear	1
5005	HW0414075-A	Pulley	2
5006	HW0414076-A	Pulley	1
5007	HW0414078-A	Pulley	1
5008	HW9406260-1	Housing	1
5009	HW9406266-1	B nut	1
5010	HW0414031-1	Collar	1
5011	HW0388709-A	Speed reducer	1
5012	HW0388710-A	Speed reducer	1
5013	HW9480739-B	Bearing	1
5014	6903ZZ	Bearing	4
5015	6809ZZ	Bearing	1
5016	TC56665	Oil seal	2
5017	AB2551E0	Oil seal	1
5018	SC20304	Oil seal	2
5019	060S3M300	Belt	1
5020	060S3M285	Belt	1
5021	S31.5	O-ring	1
5022	S56	O-ring	1
5023	HW0201199-1	Cover	2
5024	HW0314324-1	Shaft	1
5025	HW0314348-1	Housing	1
5026	HW0414067-1	Flange	1
5027	HW0414065-1	Support B	1
5028	HW0414066-1	Housing	1
5029	HW0414032-1	Collar	1
5030	HW0314333-1	M base	1
5031	HW0414028-1	B nut	1
5032	HW0414079-1	M base	2
5033	6803ZZ	Bearing	2
5034	6810VV	Bearing	1
5035	RTW-30	Retaining ring	1
5036	IRTW-26	Retaining ring	1
5037	LP-M5	Plug	5
5038	SPS-010005	Shim	1
5039	SP-009010	Shim	1
5040	SP-009015	Shim	1
5041	SP-009020	Shim	1
5042	M4X10	Hexagon socket button head screw	18

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11 Parts List
11.5 Wrist Unit

Table 11-5: Wrist Unit

No.	DWG No.	Name	Pcs
5043	M4X20	Hexagon socket head cap screw	1
5044	2H-4	Conical spring washer	1
5045	M3X10	Hexagon socket head cap screw	6
5046	2H-3	Conical spring washer	6
5047	M4X10	GT-SA bolt	6
5048	M3X12	Hexagon socket head cap screw	6
5049	2H-3	Conical spring washer	6
5050	M4X20	Hexagon socket head cap screw	1
5051	2H-4	Conical spring washer	1
5052	M3X16	Hexagon socket head cap screw	2
5053	2H-3	Conical spring washer	2
5054	M4X15	Hexagon socket head cap screw	6
5055	2H-4	Conical spring washer	6
5056	M4	Washer	6
5057	M4X16	Hexagon socket head cap screw	8
5058	2H-3	Conical spring washer	2
5059	M3X10	Hexagon socket head cap screw	2
5060	M4X10	GT-SA bolt	6
5062	M3X12	Hexagon socket head cap screw	10
5063	2H-3	Conical spring washer	10
5064	M3	Washer	4
5065	M4X10	Hexagon socket head cap screw	4
5066	2H-4	Conical spring washer	4
5067	CBSTS6-6	Hexagon socket head cap screw	1
5068	SGMAV-A5ANA-YR21	Motor	2
5069	HW0414026-1	Housing	1
5070	HW0314323-1	Housing	2
5071	HW0414080-1	Support B	2
5072	HW0414077-A	Pulley	2
5075	HW0414030-1	Shaft	2

Table 11-5: Wrist Unit

No.	DWG No.	Name	Pcs
5076	HW0472643-A	Brake	2
5080	6000ZZ	Bearing	4
5081	060S3M150	Belt	2
5082	STW-8	Retaining ring	2
5083	M3X12	Hexagon socket head cap screw	4
5084	2H-3	Conical spring washer	4
5085	M3	Washer	4
5086	M3X10	Hexagon socket head cap screw	8
5087	2H-3	Conical spring washer	8
5089	M4X12	Hexagon socket head cap screw	2
5090	2H-4	Conical spring washer	2
5091	M2.5X25	Hexagon socket head cap screw	6
5092	HW0414829-1	Shim	2
5093	HW0414829-2	Shim	2
5094	HW0414829-3	Shim	2
5095	HW0414824-1	Cover	1
5096	HW0414825-1	Cover	1
5097	M4X6	Hexagon socket head cap screw	2
5098	2H-4	Conical spring washer	2
4001	HW0201525-1	Spacer	1
4005	M6X20	Hexagon socket head cap screw	4
4006	2H-6	Conical spring washer	4

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Revision History

Revision History

Date	CEN / ECN	Revision No.	Reason For Revision	Initials
8/26/2014	M2094/ 55593	0	Original Release	JFC

MOTOMAN-MH5(L)S/F, -MH5(L)SII MAINTENANCE MANUAL

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