MOTOMAN-MS100I I/MH110
MAINTENANCE MANUAL

TYPE:
YR-MS100II/MH110-A00 (STANDARD SPECIFICATIONS)

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-MS100II INSTRUCTIONS
MOTOMAN-MH110 INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

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

MANDATORY

- This maintenance manual is intended to explain maintenance procedures primarily for the MOTOMAN-MS100II/MH110.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 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.
1 Introduction
1.1 Safety Standard for Industrial Robots and Robot Systems

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
1.2 Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-MS100I /MH110.

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.

**NOTE**

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.
1 Introduction
1.2 Notes for Safe Operation

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 pressing the emergency stop buttons on the front door of the 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. 1-1: 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. 1-2: 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 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 DX200 and the programming pendant.
1 Introduction

1.3 Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and manipulator cables.

In this manual, the equipment is defined as follows:

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<td>DX200</td>
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<td>Programming pendant</td>
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1.4 Description of the Operation Procedure

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

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 DX200 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 DX200 Instructions before operating the manipulator:
1.5 Registered Trademark

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

1.6 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.

Fig. 1-3: Warning Label Locations
1.7 Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.

- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.

- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

- In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

1.8 Mechanical Safety Devices

The safe operation of this equipment is ultimately the users responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
1.9 Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.
- Some operations require a standard passwords and some require special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
1.10 Maintenance Safety

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

1.11 Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.
1 Introduction
1.12 Customer Support Information

1.12 Customer Support Information

If you need assistance with any aspect of your MS100II/MH110 system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact YASKAWA Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact YASKAWA Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

- System: MS100II/MH110
- Primary Application:
- Controller: DX200
- Software Version: Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the DX200 controller data plate
2 Notes for Maintenance

2.1 Battery Pack Connection

The connectors (crimped contact-pin) for the battery backup are installed at the end point of the motors (BAT and OBT are marked). Connect the battery packs according to the following procedure.

1. Remove the cap attached to the battery backup connector of the motors.
2. Connect the battery packs (HW9470932-A) with the battery backup connectors (BAT and OBT are marked) located at the end point of the cables for the encoder. (Under this condition, remove the encoder connector and carry out the maintenance checks).
3. Confirm all connectors connected after the maintenance check, and remove the battery packs. Install the caps attached to the battery backup connectors of the motors.

Do not remove the battery pack in the connector base.

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.

For the battery pack connection, refer to section 2.1 “Battery Pack Connection”.

Fig. 2-1: Battery Pack Connection
3 Home Position Return

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" (152646-1CD) for details on the operation.

3.1.2 Home Position Return by Setting Teaching Point for Home Position Setting Before Motor Replacement

The DX200 holds the position data of the job program (hereinafter called JOB) as the pulse number from the home position of each axis. Thus, by adjusting the home position precisely, the JOB used before motor replacement can be used after the replacement without correction.

This section explains how to set the DX200.

Perform calibration and set the manipulator position in one of the following cases:

• The combination of the MOTOMAN and the control unit is changed.
• The motor or absolute encoder is replaced.
• Stored memory is cleared.
• The home position is deviated by hitting the MOTOMAN against a workpiece, etc.
• The main parts of the speed reducer, etc. are replaced or disassembled and reassembled.

When performing calibration, be sure to satisfy the following conditions:

• No external force is applied to the manipulator.
• The hand and the other parts of the wrist unit are removed.

NOTE

Perform calibration and set the manipulator position in one of the following cases:

• The combination of the MOTOMAN and the control unit is changed.
• The motor or absolute encoder is replaced.
• Stored memory is cleared.
• The home position is deviated by hitting the MOTOMAN against a workpiece, etc.
• The main parts of the speed reducer, etc. are replaced or disassembled and reassembled.

When performing calibration, be sure to satisfy the following conditions:

• No external force is applied to the manipulator.
• The hand and the other parts of the wrist unit are removed.
3 Home Position Return
3.1 Home Position Return After Motor Replacement

3.1.2.1 Preparation Before Motor Replacement

- Refer to the Fig. 3-1 “Preparation Before Motor Replacement (Example)”.

Before motor replacement, create the standard position (hereinafter called the check-point) for home position adjustment after the 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.)

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 when Replacing U-Axis’s Motor
  - The check-point cannot be created unless each axis operates. Thus, the check-point cannot be created if the axis does not move because of failure. Therefore, it is recommended to create the check-point for each axis under normal operating conditions.

  Next, check the home position of the axis whose motor will be replaced. Refer to the position screen, and move the axis to the 0-pulse position, the home position. Then, check the position of the home position mark. If it is deviated, adjust it.

  The U-axis of shown below as an example.

Fig. 3-1: Preparation Before Motor Replacement (Example)
3.1.2.2 Motor Replacement

• Refer to the Fig. 3-2 “Motor Replacement (Example)”.

CAUTION

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

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

The U-axis of shown below as an example.

Fig. 3-2: Motor Replacement (Example)

Remove the motor and replace.
3.1.2.3 Home Position Adjustment

After motor replacement, move the axis to the position of the home position mark. Perform the home position calibration only to the axis whose motor was replaced.
(For more information, refer to “DX200 INSTRUCTIONS” (165292-1CD).)

Move the axis to the check-point by the check-JOB. (Be careful when moving the axis so that the manipulator does not interfere with jigs.) Move only the axis whose motor was replaced to correct the deviation from the check-point created before calibration.

Display the position screen (COMMAND POSITION).

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

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

\[
\text{CURR} - \text{CMD} = \text{the amount of deviation}
\]

\[
U (-3067) - (-2989) = -78
\]

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

The following figure shows an example.

At this position, perform the home position calibration only for the axis whose motor was replaced.
(For more information, refer to “DX200 INSTRUCTIONS” (165292-1CD).)

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

Perform an operation check by using the JOB used before motor replacement. If no problem is found, write down the modified home position data (ABSO data) and the date in the label on the inside of the DX200.
4 Grease Replenishment and Exchange

4.1 Notes on Grease Replenishment and Exchange Procedures

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

**NOTE**

- If grease is added without removing the plug/screw from the grease exhaust port, the grease will leak inside a motor or an oil seal of a speed reducer will come off, which may result in damage to the motor. Make sure to remove the plug/screw.

- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.

- Make sure to fill hoses, which are joined to the grease inlet, with grease beforehand to prevent air from intruding into the speed reducer.
4.2 Grease Replenishment and Exchange for S-Axis Speed Reducer

Fig. 4-1: S-Axis Speed Reducer

4.2.1 Grease Replenishment

(Refer to Fig. 4-1 “S-Axis Speed Reducer”.)

1. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.
   
   • If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   
   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/4 from the grease inlet and install the grease zerk PT1/4. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.
   
   - Grease type: Molywhite RE.No.00
   - Amount of grease: 600 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. Move the S-axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth and reinstall the plug PT3/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/4. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 12 N•m (1.2 kgf•m).
4.2 Grease Replenishment and Exchange for S-Axis Speed Reducer

4.2.2 Grease Exchange

(Refer to Fig. 4-1 “S-Axis Speed Reducer”.)

1. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

   • If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/4 from the grease inlet and install the grease zerk PT1/4. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE.No.00
   - Amount of grease: 3000 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears in the grease exhaust port. The new grease can be distinguished from the old grease by color.

5. Move the S-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth and reinstall the plug PT3/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

   If the plug is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug.

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/4. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 12 N•m (1.2 kgf•m).
4.3 Grease Replenishment and Exchange for L-Axis Speed Reducer

Fig. 4-2: L-Axis Speed Reducer

4.3.1 Grease Replenishment

(Refer to Fig. 4-2 “L-Axis Speed Reducer”.)

1. Tilt the L-arm vertical to the ground.

2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

- **NOTE**
  - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
  - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

4. Inject grease through the grease inlet using a grease gun.

- **Grease type:** Molywhite RE.No.00
- **Amount of grease:** 400 cc (800 cc for 1st supply)
- **Air supply pressure of grease pump:** 0.3 MPa or less
- **Grease injection rate:** 8 g/s or less

5. Move the L-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth and reinstall the plug PT1/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
4 Grease Replenishment and Exchange

4.3 Grease Replenishment and Exchange for L-Axis Speed Reducer

4.3.2 Grease Exchange

(Refer to Fig. 4-2 “L-Axis Speed Reducer”.)

1. Tilt the L-arm vertical to the ground.

   • If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

4. Inject grease through the grease inlets using a grease gun.
   - Grease type: Molywhite RE.No.00
   - Amount of grease: 2000 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

5. The grease exchange is completed when new grease appears in the exhaust port. The new grease can be distinguished from the old grease by color.

6. Move the L-axis for a few minutes to discharge excess grease.

7. Wipe the discharged grease with a cloth and reinstall the plug PT1/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

   If the plug is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug.

8. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
4.4 Grease Replenishment and Exchange for U-Axis Speed Reducer

Fig. 4-3: U-Axis Speed Reducer

4.4.1 Grease Replenishment

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

1. Tilt the U-arm horizontal to the ground. (Refer to Fig. 4-3.) (The L-arm is in the vertical posture.)

2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

• If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

• Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE.No.00
   - Amount of grease: 200 cc
     (400 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

5. Move the U-axis for a few minutes to discharge excess grease.
4 Grease Replenishment and Exchange
4.4 Grease Replenishment and Exchange for U-Axis Speed Reducer

6. Wipe the discharged grease with a cloth and reinstall the plug PT3/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

4.4.2 Grease Exchange
(Refer to Fig. 4-3 “U-Axis Speed Reducer”.)

1. Tilt the U-arm horizontal to the ground. (Refer to Fig. 4-3.) (The L-arm is in the vertical posture.)

2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE.No.00
   - Amount of grease: 1000 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

5. The grease exchange is completed when new grease appears in the grease exhaust port. The new grease can be distinguished from the old grease by color.

6. Move the U-axis for a few minutes to discharge excess grease.

7. Wipe the discharged grease with a cloth and reinstall the plug PT3/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

   If the plug is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug.

8. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

• If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

• Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

• If the plug is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug.
4.5 Grease Replenishment and Exchange for R-, B-, T-Axis Gears in the Casing and R-Axis Speed Reducer

**Fig. 4-4: R-, B-, T- Axes Gears in the Casing and R-Axis Speed Reducer**

4.5.1 Grease Replenishment for R-, B-, T-Axes Gears in the Casing

(Refer to Fig. 4-4 “R-, B-, T- Axes Gears in the Casing and R-Axis Speed Reducer”.)

1. Remove the hexagon socket head plug PT1/8 from the grease exhaust port.

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

   - **NOTE**
   - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Inject the grease through the grease inlet using a grease gun
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 480 cc (960 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. Move the R-, B-, T-Axes for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth, and reinstall the plug to the grease inlet and to the grease exhaust port with a tightening torque of 23 N•m (2.34 kgf•m).
   (Apply ThreeBond 1206C to the thread part of the plug.)

6. Remove the grease zerk from the grease inlet and reinstall the plug. Tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
   (Apply ThreeBond 1206C to the thread part of the plug.)
4. Grease Replenishment and Exchange
4.5 Grease Replenishment and Exchange for R-, B-, T-Axis Gears in the Casing and R-Axis Speed Reducer

4.5.2 Grease Replenishment for R-Axis Speed Reducer

(Refer to Fig. 4-4 “R-, B-, T- Axes Gears in the Casing and R-Axis Speed Reducer”.)

1. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

   • If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.

   – Grease type: Molywhite RE.No.00
   – Amount of grease: 400 cc (800 cc for 1st supply)
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

4. Move the R-axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth and reinstall the plug PT3/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
4.5 Grease Replenishment and Exchange for R-, B-, T-Axis Gears in the Casing and R-Axis Speed Reducer

4.5.3 Grease Exchange for R-, B-, T-Axes Gears in the Casing

(Refer to Fig. 4-4 “R-, B-, T- Axes Gears in the Casing and R-Axis Speed Reducer”.)

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

- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: approx. 2400 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears from the exhaust port. (The new grease can be distinguished from the old grease by color.)

5. Move the R-, B-, and T-axes for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth, and reinstall the plug on the grease exhaust port. Tighten the plug with a tightening torque of 23 N•m (2.34 kgf•m). (Apply ThreeBond 1206C to the thread part of the plug.)

   If the plug is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug.

Remove the grease zerk from the grease inlet and reinstall the plug. Tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m). (Apply ThreeBond 1206C to the thread part of the plug.)
4.5 Grease Replenishment and Exchange for R-,B-,T-Axis Gears in the Casing and R-Axis Speed Reducer

4.5.4 Grease Exchange for R-Axis Speed Reducer

(Refer to Fig. 4-4 “R-, B-, T- Axes Gears in the Casing and R-Axis Speed Reducer”.)

1. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

- **NOTE**
  - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
  - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.
   - **Grease type:** Molywhite RE.No.00
   - **Amount of grease:** 2000 cc
   - **Air supply pressure of grease pump:** 0.3 MPa or less
   - **Grease injection rate:** 8 g/s or less

4. The grease exchange is completed when new grease appears from the grease exhaust port. The new grease is distinguished from the old grease by color.

5. Move the R-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth and reinstall the plug PT3/8 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 23 N•m (2.3 kgf•m).

- **NOTE**
  If the plug is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug.

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
4.6 Grease Replenishment/Exchange for B- and T-Axis Speed Reducer and Gears

Fig. 4-5: B- and T-Axis Speed Reducer and Gear

4.6.1 Grease Replenishment

(Refer to Fig. 4-5 “B- and T-Axis Speed Reducer and Gear”.)

1. Remove the hexagon socket head cap screw M6X6 from the grease exhaust port.

   • If grease is injected with the screw on, the grease will leak inside the motor and may cause a damage. Make sure to remove the screw before the grease injection.

   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.

   – Grease type: Molywhite RE.No.00
   – Amount of grease: 240 cc
     (480 cc for 1st supply)
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

4. Move the B-axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth and reinstall the screw M6X6 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the set screw, and tighten the set screw with a tightening torque of 6 N•m (0.6 kgf•m).

6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
4.6 Grease Replenishment/Exchange for B- and T-Axis Speed Reducer and Gears

4.6.2 Grease Exchange

(Refer to Fig. 4-5 “B- and T-Axis Speed Reducer and Gear”.)

1. Remove the hexagon socket head cap screw M6X6 from the grease exhaust port.

- If grease is injected with the screw on, the grease will leak inside the motor and may cause a damage. Make sure to remove the screw before the grease injection.

- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk PT1/8. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.

   - Grease type: Molywhite RE.No.00
   - Amount of grease: 1200 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears from the grease exhaust port. The new grease is distinguished from the old grease by color.

5. Move the B-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth and reinstall the screw M6X6 on the grease exhaust port. Apply Three Bond 1206C to the thread part of the set screw, and tighten the set screw with a tightening torque of 6 N•m (0.6 kgf•m).

- If the screw is installed while the grease is being exhausted, the grease will leak inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the screw.

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Apply Three Bond 1206C to the thread part of the plug, and tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
5 Disassembly and Reassembly of Motors

5.1 Disassembly and Reassembly of S-Axis Motor

- Refer to Fig. 5-1 “Disassembly and Reassembly of S-Axis Motor”.

- When replacing a motor, the backup battery does not need to be connected.

- Remove old sealing bond on each part completely before reassembly.

- Disassembly
  1. Turn OFF the DX200 power supply.
  2. Connect the backup battery to the S-axis motor.
  3. Disconnect the connector (signal, power, brake) connected to the S-axis motor.
  4. Remove the GT-SA bolt, and remove the S-axis motor from the S-head by using the tapped holes on the flange face of the S-axis motor.
  5. Remove the hexagon socket head cap screws to remove the gear, the bearing, the key, and the retaining ring.

- Reassembly
  1. Mount the gear, the bearing, the key, and the retaining ring on the S-axis motor. (The key is attached to the S-axis motor.)
  2. Put the conical spring washer on the hexagon socket head cap screw, then apply Loctite 242 to the thread part of the screw. Then, tighten it with a tightening torque shown in Table 5-1 “S-Axis Motor Parts Checklist”.
  3. Apply ThreeBond 1206C on the matching surface between the flange face of the S-axis motor and the S-head. Then, mount the S-axis motor on the S-head.
  4. Tighten the GT-SA bolt with a tightening torque shown in Table 5-1 “S-Axis Motor Parts Checklist”.
  5. Connect the connector (signal, power, brake) of the internal wiring harness to the S-axis motor.
  6. Remove the backup battery.
  7. Turn ON the DX200 power supply.

- NOTE
  When replacing a motor, the backup battery does not need to be connected.
  Remove old sealing bond on each part completely before reassembly.
5 Disassembly and Reassembly of Motors
5.1 Disassembly and Reassembly of S-Axis Motor

Table 5-1: S-Axis Motor Parts Checklist

<table>
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<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
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<td>①</td>
<td>S-axis motor HW0388669-A</td>
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<td>SGMRV-30ANA-YR1*</td>
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<td>②</td>
<td>GT-SA bolt M8 (length: 35 mm)</td>
<td>4</td>
<td>Tightening torque: 84 N•m</td>
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<td></td>
<td>Conical spring washer 2H-12</td>
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<td>③</td>
<td>Gear HW0312836-1</td>
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<tr>
<td>④</td>
<td>Key</td>
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<td>⑤</td>
<td>S-head</td>
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<td></td>
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<tr>
<td>⑥</td>
<td>Hexagon socket head cap screw M8 (length: 85 mm)</td>
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<td>Tightening torque: 40 N•m</td>
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<td></td>
<td>Conical spring washer 2H-8</td>
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<td>⑦</td>
<td>Bearing 6310</td>
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<td>Retaining ring STW-50</td>
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Fig. 5-1: Disassembly and Reassembly of S-Axis Motor
5.2 Disassembly and Reassembly of L-Axis Motor

- Refer to Fig. 5-2 “Disassembly and Reassembly of L-Axis Motor”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Connect the backup battery to the L-axis motor.
3. Disconnect the connector (signal, power, brake) connected to the L-axis motor.
4. Before removing the L-axis motor, support the L-arm with a chain block, etc. so that the L-arm does not rotate.
5. Remove the GT-SA bolt, and remove the L-axis motor from the motor base by using the tapped holes on the flange face of the L-axis motor. At this time, be careful not to damage the oil seal inside the S-head.
6. Unscrew the hexagon socket head cap screw, then the collar and the gear comes off at the same time. Then, remove the shaft, the key, and the shaft.

**Reassembly**

1. Apply ThreeBond 1206C on the matching surface between the L-axis motor and the shaft. Then, mount the shaft and the key on the L-axis motor. (The key is attached to the L-axis motor.)
2. Mount the collar, the gear and the shaft.
3. Apply Loctite 242 to the thread part of the screw. Then, tighten it with a tightening torque shown in Table 5-2 "L-Axis Motor Parts Checklist".
4. Apply ThreeBond 1206C on the matching surface between the flange face of the L-axis motor and the S-head. Then, mount the L-axis motor on the S-head. At this time, be careful not to damage the oil seal inside the S-head.
5. Apply ThreeBond 1206C to the thread part of the GT-SA bolt. Then, tighten them with a tightening torque shown in Table 5-2 "L-Axis Motor Parts Checklist".
6. Connect the connector (signal, power, brake) of the internal wiring harness to the L-axis motor.
7. Remove the backup battery.
8. Turn ON the DX200 power supply.
5 Disassembly and Reassembly of Motors
5.2 Disassembly and Reassembly of L-Axis Motor

Table 5-2: L-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
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<tr>
<td>1</td>
<td>L-axis motor HW0388671-A</td>
<td>1</td>
<td>SGMRV-44ANA-YR2*</td>
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<tr>
<td>2</td>
<td>GT-SA bolt M12 (length: 35 mm)</td>
<td>4</td>
<td>Tightening torque: 84 N•m</td>
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<tr>
<td>3</td>
<td>Collar HW1404911-1</td>
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<td>4</td>
<td>Gear HW1303989-1</td>
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<td>Shaft HW1404554-1</td>
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<tr>
<td>7</td>
<td>Key</td>
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<tr>
<td>8</td>
<td>Hexagon socket head cap screw M8 (length: 130 mm) Conical spring washer 2H-8</td>
<td>1 each</td>
<td>Tightening torque: 40 N•m</td>
</tr>
</tbody>
</table>

Fig. 5-2: Disassembly and Reassembly of L-Axis Motor
5.3 Disassembly and Reassembly of U-Axis Motor

- Refer to Fig. 5-3 “Disassembly and Reassembly of U-Axis Motor”.

**Disassembly**
1. Turn OFF the DX200 power supply.
2. Connect the backup battery to the U-axis motor.
3. Disconnect the connector (signal, power, brake) connected to the U-axis motor.
4. Support the U-arm with a chain block, etc. so that the U-arm does not rotate before removing the U-axis motor.
5. Remove the GT-SA bolts, and remove the U-axis motor from the casing. At this time, be careful not to damage the oil seal inside the casing.
6. Remove the bolt. Then, remove the gear. Then, remove the key, the shaft, and the shaft.

**Reassembly**
1. Apply ThreeBond 1206C on the matching surface between the U-axis motor and the shaft. Then, mount the shaft and the key on the U-axis motor. (The key is attached to the U-axis motor.)
2. Mount the shaft, the gear and the bolt. When mounting the bolt, pay attention to the direction of the washer.
3. Apply Loctite 242 to the thread part of the bolt. Then, tighten it with a tightening torque shown in Table 5-3 “U-Axis Motor Parts Checklist”.
4. Apply Threebond 1206C on the matching surface between the flange face of the U-axis motor and the casing. Then mount the U-axis motor on the casing carefully not to damage the oil seal inside the casing. At this time, make the direction of the motor cable joint part as the figure.
5. Apply ThreeBond 1206C to the thread parts of the GT-SA bolts. Then, tighten them with a tightening torque shown in Table 5-3 “U-Axis Motor Parts Checklist”.
6. Connect the connector (signal, power, brake) of the internal wiring harness to the U-axis motor.
7. Remove the backup battery.
8. Turn ON the DX200 power supply.
5 Disassembly and Reassembly of Motors
5.3 Disassembly and Reassembly of U-Axis Motor

Table 5-3: U-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U-axis motor HW0388669-A</td>
<td>1</td>
<td>SGMRV-30ANA-YR1*</td>
</tr>
<tr>
<td>2</td>
<td>GT-SA bolt M12 (length: 35 mm)</td>
<td>4</td>
<td>Tightening torque: 84 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Gear HW0409102-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Shaft HW9481648-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Shaft HW1304212-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Retaining ring STW-9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Bolt HW0483473-A Washers HW0408806-2</td>
<td>1 each</td>
<td>Tightening torque: 40 N•m</td>
</tr>
</tbody>
</table>

Fig. 5-3: Disassembly and Reassembly of U-Axis Motor
5.4 Disassembly and Reassembly of R-Axis Motor

- Refer to Fig. 5-4 “Disassembly and Reassembly of R-Axis Motor”.

**NOTE:** When removing the R-, B-, or T-axis motor, make the U-arm point downward to prevent grease inside the U-arm from leaking out.

### Disassembly
1. Turn OFF the DX200 power supply.
2. Connect the backup battery to the R-axis motor.
3. Disconnect the connector (signal, power) connected to the R-axis motor.
4. Remove the hexagon socket head cap screws, then remove the R-axis motor from the casing.
5. Remove the hexagon socket head cap screw. Then, remove the key, the gear, the bearing, the ring, and the retaining collar.
6. Remove the housing from the R-axis motor.

### Reassembly
1. Apply Threebond 1206C on the matching surface between the R-axis motor and the collar. Then mount the collar on the R-axis motor.
2. Apply Threebond 1206C on the matching surface between the collar and the gear. Then mount the key, the gear, the bearing and the retaining ring. (The key is supplied with the R-axis motor.)
3. Put the conical spring washer on the hexagon socket head cap screw, then apply Loctite 242 to the thread part of the screw. Then, tighten it with a tightening torque shown in Table 5-4 “R-Axis Motor Parts Checklist”.
4. Apply ThreeBond 1206C on the matching surface between the R-axis motor and the housing. Then, mount the housing on the R-axis motor.
5. Mount the oil seal between the housing and the gear (refer to A detailed drawing). When mounting the oil seal, pay attention to the direction of the oil seal.
6. Apply Threebond1206C on the matching surface between the housing and the casing. Then mount the R-axis motor and the housing on the casing.
7. Mount the conical spring washers on the hexagon socket head cap screws and apply ThreeBond 1206C to the thread parts of the hexagon socket head cap screws. Then, tighten them with a tightening torque shown in Table 5-4 “R-Axis Motor Parts Checklist”.
8. Connect the connector (signal, power) of the internal wiring harness to the R-axis motor.
9. Remove the backup battery.
10. Turn ON the DX200 power supply.
### Table 5-4: R-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R-axis motor HW0388667-A</td>
<td>1</td>
<td>SGMRV-13ANA-YR2*</td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M8 (length: 35 mm) Conical spring washer 2H-8</td>
<td>3 each</td>
<td>Tightening torque: 24.5 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Gear HW1303993-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bearing 6003</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hexagon socket head cap screw M6 (length: 65 mm) Conical spring washer 2H-6</td>
<td>1 each</td>
<td>Tightening torque: 16.5 N•m</td>
</tr>
<tr>
<td>7</td>
<td>Retaining ring ISTW-17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Housing HW1301148-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Collar HW9405257-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 5-4: Disassembly and Reassembly of R-Axis Motor**
5.5 Disassembly and Reassembly of B-Axis Motor

• Refer to Fig. 5-5 “Disassembly and Reassembly of B-Axis Motor”.

**Disassembly**
1. Turn OFF the DX200 power supply.
2. Connect the backup battery to the B-axis motor.
3. Disconnect the connector (signal, power) connected to the B-axis motor.
4. Remove the hexagon socket head cap screws, then remove the B-axis motor from the casing.
5. Remove the hexagon socket head cap screw. Then, remove the key, the gear, and the collar.
6. Remove the housing from the B-axis motor.

**Reassembly**
1. Apply ThreeBond 1206C on the matching surface between the B-axis motor and the collar. Then mount the collar on the B-axis motor.
2. Apply ThreeBond 1206C on the matching surface between the collar and the gear. Then mount the key, and the gear. (The key is supplied with the B-axis motor.)
3. Put the conical spring washer on the hexagon socket head cap screw, then apply Loctite 242 to the thread part of the screw. Then, tighten it with a tightening torque shown in Table 5-5 “B-Axis Motor Parts Checklist”.
4. Apply ThreeBond 1206C on the matching surface between the B-axis motor and the housing. Then, mount the housing on the B-axis motor.
5. Mount the oil seal between the housing and the gear (refer to a detailed drawing). When mounting the oil seal, pay attention to the direction of the oil seal.
6. Apply ThreeBond 1206C on the matching surface between the housing and the casing. Then mount the B-axis motor and the housing on the casing.
7. Put the conical spring washer on the hexagon socket head cap screws, then apply Loctite 242 to the thread parts of the screws. Then, tighten them with a tightening torque shown in Table 5-5 “B-Axis Motor Parts Checklist”.
8. Connect the connector (signal, power) of the internal wiring harness to the B-axis motor.
9. Remove the backup battery.
10. Turn ON the DX200 power supply.
5 Disassembly and Reassembly of Motors

5.5 Disassembly and Reassembly of B-Axis Motor

Table 5-5: B-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B-axis motor HW0388667-A</td>
<td>1</td>
<td>SGMRV-13ANA-YR2*</td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M8 (length: 35 mm) Conical spring washer 2H-8</td>
<td>3 each</td>
<td>Tightening torque: 24.5 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Gear HW1303992-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M6 (length: 35 mm) Conical spring washer 2H-6</td>
<td>1 each</td>
<td>Tightening torque: 16.5 N•m</td>
</tr>
<tr>
<td>6</td>
<td>Housing HW1301148-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Collar HW9405257-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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

A detailed drawing
5.6 Disassembly and Reassembly of T-Axis Motor

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

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Connect the backup battery to the T-axis motor.
3. Disconnect the connector (signal, power) connected to the T-axis motor.
4. Remove the hexagon socket head cap screws, then remove the T-axis motor from the casing.
5. Remove the hexagon socket head cap screw. Then, remove the gear, the key, and the collar.
6. Remove the housing from the T-axis motor.

**Reassembly**

1. Apply ThreeBond 1206C on the matching surface between the T-axis motor and the collar. Then mount the T-axis motor on the casing.
2. Apply ThreeBond 1206C on the matching surface between the collar and the gear. Then mount the key and the gear. (The key is supplied with the T-axis motor.)
3. Put the conical spring washer on the hexagon socket head cap screw, then apply Loctite 242 to the thread part of the screw. Then, tighten it with a tightening torque shown in Table 5-6 "T-Axis Motor Parts Checklist".
4. Apply ThreeBond 1206C on the matching surface between the T-axis motor and the housing. Then, mount the housing on the T-axis motor.
5. Mount the oil seal between the housing and the gear (refer to a detailed drawing). When mounting the oil seal, pay attention to the direction of the oil seal.
6. Apply ThreeBond 1206C on the matching surface between the housing and the casing. Then mount the T-axis motor and the housing on the casing.
7. Put the conical spring washer on the hexagon socket head cap screws, then apply Loctite 242 to the thread parts of the screws. Then, tighten them with a tightening torque shown in Table 5-6 "T-Axis Motor Parts Checklist".
8. Connect the connector (signal, power) of the internal wiring harness to the T-axis motor.
9. Remove the backup battery.
10. Turn ON the DX200 power supply.
Disassembly and Reassembly of Motors

5.6 Disassembly and Reassembly of T-Axis Motor

Table 5-6: T-Axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>T-axis motor HW0388667-A</td>
<td>1</td>
<td>SGMRV-13ANA-YR2*</td>
</tr>
<tr>
<td>②</td>
<td>Hexagon socket head cap screw M8 (length: 35 mm) Conical spring washer 2H-8</td>
<td>3 each</td>
<td>Tightening torque: 24.5 N•m</td>
</tr>
<tr>
<td>③</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Gear HW1301229-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon socket head cap screw M6 (length: 30 mm) Conical spring washer 2H-6</td>
<td>1 each</td>
<td>Tightening torque: 16.5 N•m</td>
</tr>
<tr>
<td>⑥</td>
<td>Housing HW1301148-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Collar HW9405257-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5-6: Disassembly and 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 and Reassembly of S-Axis Speed Reducer”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Remove the internal wiring harness from the S-head. (Refer to chapter 9 “Cable Wiring”.)
3. Remove the S-axis motor. (Refer to section 5.1 “Disassembly and Reassembly of S-Axis Motor”.) If the S-head is removed before removing the S-axis motor, the motor shaft may be bent or the motor may be damaged due to external force on the motor shaft.
4. Remove the hexagon socket head cap screws. Then, lift up the upper part of the manipulator including the S-head, and put it down next to the base. If the S-axis mechanical stoppers may be damaged at that time, remove them in advance.
5. Remove the parallel pin.
6. Remove the hexagon socket head cap screw. Then, remove the speed reducer from the base.
7. Remove the union from the speed reducer.
8. Remove old sealing bond.

**Reassembly**

1. Mount the union on the speed reducer. Apply ThreeBond 1206C to the thread part of the union.
2. Mount the speed reducer on the base.
3. Tighten the hexagon socket head cap screw with a tightening torque shown in Table 6-1 “S-Axis Speed Reducer Parts Checklist”.
4. Mount the parallel pin on the speed reducer.
5. Apply ThreeBond 1206C on the matching surface between the speed reducer and the S-head. Then, mount the upper part of the manipulator including the S-head on the speed reducer.
6. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-1 “S-Axis Speed Reducer Parts Checklist”. If the S-axis mechanical stoppers were removed at disassembly, mount them and tighten them with a tightening torque shown in Table 6-1 “S-Axis Speed Reducer Parts Checklist”.

**NOTE**

- When replacing the S-, L-, or U-axis speed reducer, remove the internal wiring harness.
- Connect the battery to the motor to prevent data loss.
- Remove old sealing bond on each part completely before reassembly.

- When replacing the S-, L-, or U-axis speed reducer, remove the internal wiring harness.
- Connect the battery to the motor to prevent data loss.
- Remove old sealing bond on each part completely before reassembly.
6. Disassembly and Reassembly of Speed Reducer
6.1 Disassembly and Reassembly of S-Axis Speed Reducer

7. Mount the S-axis motor. (Refer to section 5.1 “Disassembly and Reassembly of S-Axis Motor”.)
8. Connect the internal wiring harness. (Refer to chapter 9 “Cable Wiring”)
9. Inject grease (Molywhite RE No.00) through the grease inlet.
10. Turn ON the DX200 power supply.

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed reducer HW1382898-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M12 (length: 50 mm) Conical spring washer 2H-12</td>
<td>16 each</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td>3</td>
<td>GT-SA Bolt M12 (length: 35 mm)</td>
<td>2</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td>4</td>
<td>Parallel pin MSTH10-25</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M20 (length: 40 mm)</td>
<td>1</td>
<td>S-axis mechanical stopper Tightening torque: 167 N•m</td>
</tr>
<tr>
<td>6</td>
<td>Collar HW9405875-1</td>
<td>1</td>
<td>S-axis mechanical stopper</td>
</tr>
<tr>
<td>7</td>
<td>Screw HW9405032-2 Washer M6</td>
<td>1</td>
<td>S-axis limit switch options only</td>
</tr>
<tr>
<td>8</td>
<td>Hexagon socket head cap screw M12 (length: 55 mm) Conical spring washer 2H-12</td>
<td>12 each</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td>9</td>
<td>Union KQ2L10-01S</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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

6.2 Disassembly and Reassembly of L-Axis Speed Reducer

• Refer to Fig. 6-2 “Disassembly and Reassembly of L-Axis Speed Reducer”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Remove the internal wiring harness from the S-head. (Refer to chapter 9 “Cable Wiring”.)
3. Before removing the L-arm, support the L-arm with a chain block, etc. to prevent it from falling.
4. Remove the hexagon socket head cap screws and . Then, remove the L-arm from the speed reducer .
5. Remove the L-axis motor. (Refer to section 5.2 “Disassembly and Reassembly of L-Axis Motor”.) If the speed reducer is removed before removing the L-axis motor, the motor shaft may be bent or the motor may be damaged due to external force on the motor shaft.
6. Remove the hexagon socket head cap screws . Then, remove the speed reducer and the O-ring from the S-head.
7. Remove old sealing bond.

**Reassembly**

1. Mount the O-ring on the speed reducer .
2. Mount the speed reducer on the S-head. Make sure that the O-ring does not come off.
3. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-2 “L-Axis Speed Reducer Parts Checklist” on page 6-4.
4. Mount the L-axis motor. (Refer to section 5.2 “Disassembly and Reassembly of L-Axis Motor”.)
5. Apply ThreeBond 1206C on the matching surface between the speed reducer and the L-arm. Then, mount the L-arm on the speed reducer .
6. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-2 “L-Axis Speed Reducer Parts Checklist”.
7. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-2 “L-Axis Speed Reducer Parts Checklist”.
8. Connect the internal wiring harness. (Refer to chapter 9 “Cable Wiring”.)
9. Inject grease (Molywhite RE No.00) through the grease inlet.
10. Turn ON the DX200 power supply.
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**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Speed reducer HW1382456-B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Hexagon socket head cap screw M12 (length: 75 mm)</td>
<td>32 each</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>GT-SA bolt M12 (length: 35 mm)</td>
<td>18</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Hexagon socket head cap screw M16 (length: 40 mm)</td>
<td>9</td>
<td>Tightening torque: 348 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-16</td>
<td>each</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>O-ring AS(ARP)568-275</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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

![Diagram of L-axis Speed Reducer](image-url)
6.3 Disassembly and Reassembly of U-Axis Speed Reducer

- Refer to Fig. 6-3 “Disassembly and Reassembly of U-Axis Speed Reducer”.

**Disassembly**
1. Turn OFF the DX200 power supply.
2. Remove the internal wiring harness on the U-arm. (Refer to chapter 9 “Cable Wiring”.)
3. Before detaching the U-arm unit from the L-arm, support the U-arm with a chain block, etc. to prevent it from falling.
4. Remove the hexagon socket head cap screws and . Then, lift down the U-arm unit.
5. Remove the U-axis motor. (Refer to section 5.3 “Disassembly and Reassembly of U-Axis Motor”.) If the speed reducer is removed before removing the U-axis motor, the motor shaft may be bent or the motor may be damaged due to external force on the motor shaft.
6. Remove the hexagon socket head cap screws. Then, remove the speed reducer and the O-ring.
7. Remove old sealing bond.

**Reassembly**
1. Mount the O-ring on the speed reducer.
2. Mount the speed reducer on the U-arm unit. Make sure that the O-ring does not come off.
3. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-3 “U-Axis Speed Reducer Parts Checklist”.
4. Mount the U-axis motor. (Refer to section 5.3 “Disassembly and Reassembly of U-Axis Motor”.)
5. Apply ThreeBond 1206C on the matching surface between the speed reducer and the L-arm. Then, mount the U-arm unit with the speed reducer on the L-arm.
6. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-3 “U-Axis Speed Reducer Parts Checklist”.
7. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-3 “U-Axis Speed Reducer Parts Checklist”.
8. Connect the internal wiring harness. (Refer to chapter 9 “Cable Wiring”.)
9. Inject grease (Molywhite RE No.00) through the grease inlet.
10. Turn ON the DX200 power supply.
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

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed reducer HW1382715-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M16</td>
<td>6</td>
<td>Tightening torque:</td>
</tr>
<tr>
<td></td>
<td>(length: 35 mm)</td>
<td></td>
<td>348 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GT-SA bolt M8</td>
<td>15</td>
<td>Tightening torque:</td>
</tr>
<tr>
<td></td>
<td>(length: 30 mm)</td>
<td></td>
<td>40 N•m</td>
</tr>
<tr>
<td>4</td>
<td>Hexagon socket head cap screw M12</td>
<td>12</td>
<td>Tightening torque:</td>
</tr>
<tr>
<td></td>
<td>(length: 45 mm)</td>
<td></td>
<td>82 N•m</td>
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<tr>
<td></td>
<td>Conical spring washer 2H-12</td>
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<td></td>
</tr>
<tr>
<td>5</td>
<td>O-ring AS(ARP)568-270</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 6-3: Disassembly and Reassembly of U-Axis Speed Reducer
6.4 Disassembly and Reassembly of R-Axis Speed Reducer

- Refer to Fig. 6-4 “Disassembly and Reassembly of R-Axis Speed Reducer”.

**Disassembly**

1. Make the U-arm pointed as upward as possible to prevent grease from leaking out when removing the speed reducer. Then, turn OFF the DX200 power supply.
2. Remove the hexagon socket head cap screws. Then, lift down the wrist unit.
3. Remove the GT-SA bolts. Then, remove the speed reducer.
4. Remove the O-rings and from the speed reducer.
5. Remove old sealing bond.

**Reassembly**

1. Mount the O-rings and on the speed reducer.
2. Apply ThreeBond 1206C on the matching surface between the U-arm and the speed reducer. Then, mount the speed reducer on the U-arm.
3. Tighten the GT-SA bolt with a tightening torque shown in Table 6-4 “R-Axis Speed Reducer Parts Checklist”.
4. Apply ThreeBond 1206C on the matching surface between the speed reducer and the wrist unit. Then, mount the wrist unit on the speed reducer.
5. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-4 “R-Axis Speed Reducer Parts Checklist”.
6. Inject grease (Molywhite RE No.00) through the grease inlet.
7. Turn ON the DX200 power supply.
6 Disassembly and Reassembly of Speed Reducer
6.4 Disassembly and Reassembly of R-Axis Speed Reducer

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Speed reducer HW1382808-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>GT-SA bolt M6 (length: 40 mm)</td>
<td>28</td>
<td>Tightening torque: 16.5 N•m</td>
</tr>
<tr>
<td>③</td>
<td>Hexagon socket head cap screw M8 (length: 60 mm) Conical spring washer 2H-8</td>
<td>21 each</td>
<td>Tightening torque: 40 N•m</td>
</tr>
<tr>
<td>④</td>
<td>O-ring G105</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>O-ring ARP568-258</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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

View A The position loses a part without the drill hole of the R axis slowdown machine right below.

Wrist unit (Wrist base) U-arm
6.5 Disassembly and Reassembly of B-Axis Speed Reducer

- Refer to Fig. 6-5 “Disassembly and Reassembly of B-Axis Speed Reducer”.

**Disassembly**

1. Make the B-axis pointed downward. Then, turn OFF the DX200 power supply.
2. Remove the hexagon socket head cap screws, then remove the cover. If the B-axis is not pointed downward, the B-axis rotates when the hexagon socket head cap screws are removed. In this case, fix the B-axis to prevent it from rotating before removing the hexagon socket head cap screws.
3. Remove the hexagon socket head cap screws, then remove the speed reducer. Note that grease comes out at this time.
4. Remove the hexagon socket head cap screws. Then, remove the gear and the shim from the speed reducer.
5. Remove the O-ring from the speed reducer.
6. Remove old sealing bond.

**Reassembly**

1. Mount the gear and the shim on the speed reducer, then tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-5 “B-Axis Speed Reducer Parts Checklist”. (Refer to Fig. 6-6 “Adjustment of the Shim of B-Axis Gear”.)
2. Mount the O-ring on the speed reducer.
3. Apply ThreeBond 1206C on the matching surface between the speed reducer and the wristbase. Then, mount the speed reducer on the wristbase.
4. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-5 “B-Axis Speed Reducer Parts Checklist”.
5. Apply ThreeBond 1206C on the matching surface between the speed reducer and the cover. Then, mount the cover on the speed reducer.
6. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-5 “B-Axis Speed Reducer Parts Checklist”.
7. Inject grease (Molywhite RE No.00) through the grease inlet.
8. Turn ON the DX200 power supply.
6 Disassembly and Reassembly of Speed Reducer
6.5 Disassembly and Reassembly of B-Axis Speed Reducer

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Speed reducer HW1382809-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Cover HW1405047-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Hexagon socket head cap screw M6 (length: 55 mm)</td>
<td>19 each</td>
<td>Tightening torque: 16.5 N·m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Hexagon socket head cap screw M8 (length: 18 mm)</td>
<td>19 each</td>
<td>Tightening torque: 40 N·m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon socket head cap screw M8 (length: 18 mm)</td>
<td>3 each</td>
<td>Tightening torque: 40 N·m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>O-ring ARP568-258</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Gear HW1304006-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>Shim HW0401517-1 , -2 , -3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 6-5: Disassembly and Reassembly of B-Axis Speed Reducer
When the B-axis speed reducer is replaced, the shim must be adjusted.

How to select a shim:
1. Compare the dimension $L_0$ of the old speed reducer with the dimension $L$ of the new speed reducer.
   - *When $L_0$ is larger than $L$*
     Add a shim with the thickness of $L_0 - L$.
   - *When $L_0$ is smaller than $L$*
     Make the current shim thinner by $L - L_0$.

<table>
<thead>
<tr>
<th>Shim No.</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW0401517-1</td>
<td>0.05</td>
</tr>
<tr>
<td>HW0401517-2</td>
<td>0.1</td>
</tr>
<tr>
<td>HW0401517-3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Fig. 6-6: Adjustment of the Shim of B-Axis Gear

When the B-axis speed reducer is replaced, the shim must be adjusted.
6 Disassembly and Reassembly of Speed Reducer
6.6 Disassembly and Reassembly of T-Axis Speed Reducer

6.6 Disassembly and Reassembly of T-Axis Speed Reducer

- Refer to Fig. 6-7 “Disassembly and Reassembly of T-Axis Speed Reducer”.

**Disassembly**

1. Make the B-axis pointed upward to prevent grease from leaking out when removing the speed reducer. Then, turn OFF the DX200 power supply.
2. Remove the hexagon socket head cap screws, then remove the flange.
3. Remove the GT-SA bolts. Then, remove the speed reducer.
4. Remove the fine U-nut. Then, remove the washer, the gear, and the shim from the speed reducer.
5. Remove the O-ring from the speed reducer.

**Reassembly**

1. Mount the O-ring on the speed reducer.
2. Mount the washer, the gear, and the shim on the speed reducer. (The washer is attached to the speed reducer. Refer to Fig. 6-8 “Adjustment of the Shim of T-Axis Gear”.)
3. Apply Loctite 242 to the thread part of the fine U-nut. Then, tighten it with a tightening torque shown in Table 6-6 “T-Axis Speed Reducer Parts Checklist”. (The fine U-nut is attached to the speed reducer.)
4. Apply ThreeBond 1206C on the matching surface between the wrist and the speed reducer. Then, mount the speed reducer on the wrist.
5. Tighten the GT-SA bolts with a tightening torque shown in Table 6-6 “T-Axis Speed Reducer Parts Checklist”.
6. Apply ThreeBond 1206C on the matching surface between the flange and the speed reducer. Then, mount the flange on the speed reducer.
7. Tighten the hexagon socket head cap screws with a tightening torque shown in Table 6-6 “T-Axis Speed Reducer Parts Checklist”.
8. Turn ON the DX200 power supply.
### Table 6-6: T-Axis Speed Reducer Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed reducer HW1382810-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GT-SA bolt M6 (length: 35 mm)</td>
<td>16</td>
<td>Tightening torque: 16.5 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Flange HW1304011-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hexagon socket head cap screw M8 (length: 20 mm)</td>
<td>18 each</td>
<td>Tightening torque: 40 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Fine U-nut FC00SC</td>
<td>1</td>
<td>Tightening torque: 17.6 N•m</td>
</tr>
<tr>
<td></td>
<td>Washer HW0404196-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>O-ring ARP568-161</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Gear HW1304008-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Shim HW1405048-1,-2,-3,-4,-5,-6,-7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 6-7: Disassembly and Reassembly of T-Axis Speed Reducer**
When the T-axis speed reducer is replaced, the shim must be adjusted.

**How to select a shim:**

1. Compare the dimension $L_0$ of the old speed reducer with the dimension $L$ of the new speed reducer.
   - **When $L_0$ is larger than $L$**
     - Add a shim with the thickness of $L_0 - L$.
   - **When $L_0$ is smaller than $L$**
     - Make the current shim thinner by $L - L_0$.

### shim thickness chart

<table>
<thead>
<tr>
<th>Shim No.</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW1405048-1</td>
<td>0.05</td>
</tr>
<tr>
<td>HW1405048-2</td>
<td>0.1</td>
</tr>
<tr>
<td>HW1405048-3</td>
<td>0.3</td>
</tr>
<tr>
<td>HW1405048-4</td>
<td>0.4</td>
</tr>
<tr>
<td>HW1405048-5</td>
<td>0.5</td>
</tr>
<tr>
<td>HW1405048-6</td>
<td>0.6</td>
</tr>
<tr>
<td>HW1405048-7</td>
<td>0.7</td>
</tr>
</tbody>
</table>
Disassembly and Reassembly of Wrist Unit

- Refer to Fig. 7-1 “Disassembly and Reassembly of Wrist Unit”.

**NOTE**
- Refer to chapter 3 “Home Position Return”.
- Remove old sealing bond on each part completely before reassembly.

### Disassembly

1. Turn OFF the DX200 power supply.
2. Remove the hexagon socket head cap screws. Then, by using the tapped hole of the wrist unit, remove the flange from the wrist unit.

### Reassembly

1. Apply ThreeBond 1206C on the matching surface between the wrist unit and the speed reducer.
2. Mount the wrist unit on the speed reducer. Then, tighten the hexagon socket head cap screws with a tightening torque shown in Table 7-1 “Wrist Unit Parts Checklist”.
3. Inject grease (Molywhite RE No.00) through the grease inlet.
4. Turn ON the DX200 power supply.

### Table 7-1: Wrist Unit Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wrist unit HW1171617-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Speed reducer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hexagon socket head cap screw M8</td>
<td>21 each</td>
<td>Tightening torque: 40 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 60 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 7-1: Disassembly and Reassembly of Wrist Unit**
8 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 8-1 "Battery Pack Location". If the battery alarm occurs in the DX200, replace the battery in accordance with the following procedure:

Fig. 8-1: Battery Pack Location

Fig. 8-2: Battery Pack Connection
1. Turn OFF the DX200 main power supply.
2. Remove the plate fixing bolts and the plate on the connector base, then pull the battery pack out to replace it with the new one.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack to an unconnected connector on the board.
5. Remove the old battery pack from the board.

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

6. Mount the new battery pack to the battery holder.
7. Reinstall the plate.

**NOTE** Do not allow the plate to pinch the cables when reinstalling the plate.
9 Cable Wiring

To prevent loss of the encoder absolute data, make sure to connect the backup battery to all motors before disconnecting the connectors of the internal wiring harness connected to the motors.

- Disconnecting Cables

1. Remove all of the connectors, air hoses, cooling water hoses on the side of the U-arm.

   - Disconnecting Cables
   - Remove all of the connectors, air hoses, cooling water hoses on the side of the U-arm.

   - For the +24V cable
     (CM03-P4S)
   - For the D-NET cable
     (8A5000-32)
   - For the internal user I/O wiring harness
     (Receptacle JL05-2A24-28SC-FO)
   - Pan-head sems screw M3
     (length: 12 mm, 2 screws, 3 places)
   - For the encoder cable for the external axis
     (Receptacle JL05-2A20-29SC-FO)
   - For the welding power source
     (Receptacle MS3100A36-3S)
   - Pan-head sems screw M4
     (length: 16 mm, 4 screws)
   - Nut M4
   - For the power cable for the external axis
     (Receptacle JL05-2A18-1SC-FO)
   - IN1: Cooling water hose (blue)
   - OUT1: Cooling water hose (white)
   - 5-KQE12-03
   - Hexagon socket head plug PT3/8
     (stainless, 5 plugs)
   - IN2: Cooling water hose (blue)
   - OUT2: Cooling water hose (white)
   - AIR: Air hose (black)
2. Connect the backup battery to the motors of the U-, R-, B-, and T-axes. Then, disconnect the internal wiring harness connected to each motor.

3. Cut off the cable ties. Then, remove the cover on the U-arm.
4. Remove the support and the saddle. (U-arm)
Cut off the cable ties.

- Saddle FCD31 (2 pieces)
  - Hexagon socket head cap screw M5
    (length: 10mm, 4 screws)
  - Conical spring washer 2H-5
  - Washer M5
  - Tightening torque: 6 N.m

- Support HW1401419-1
  - Hexagon socket head cap screw M8
    (length: 135mm, 2 screws)
  - Conical spring washer 2H-8
  - Tightening torque: 10 N.m

- Support HW1401410-1
  - CTA bolt M8
    (length: 12mm, 2 screws)
  - Tightening torque: 6 N.m

- Cable tie T120R-HS (4 pieces)
5. Connect the backup battery to the motors of the S- and L-axes. Then, disconnect the internal wiring harness connected to each motor. Cut off the cable ties.

6. Remove the support and the saddle, and cut off the cable ties.
7. Remove the cross head APS bolts (8 bolts) which fix the connector base, and pull out the connector base slightly. Then, remove the tube connected to the back of the grease inlet.

8. Pull the connector base further out, and remove the S1 connector, cooling water connector, welding power source connector, +24V connector and D-NET connector from the connector base. Then, remove the internal wiring harness connected to the back of the 1BC connector and 2BC connector, and remove the plastic covers.

9. Remove the cross head APS bolts (6 bolts) inside, then remove the ground wire.

10. Remove the saddle CD63 CD51, and cut off the cable tie T120S.

11. Check to be sure that the backup battery is connected to the motor before detaching the connectors.

   Then, detach the connectors [X], [S], [L], [U], [R], [B], and [T], then remove the internal wiring harness from the S-head.
## Connecting Cables

1. Insert the internal wiring harness through the top of the S-head, and fix it to the connector base.

2. Put the plastic cover on the internal wiring harness. Then, connect the S1 connector, welding power source connector, and cooling water connector +24V connector and D-NET connector to the connector base. Then, connect the grease hose, 1BC connector, and 2BC connector to the back side. The 1BC connector and 2BC connector are in the sequence of 1-2-3-4-5-6 from top to bottom.

3. Connect the connectors [X], [S], [L], [U], [R], [B], and [T] of the connector base. Then, connect the ground wire to ground by using the cross head APS bolt.

4. Mount the connector base on the manipulator.

5. Fix the internal wiring harness inside the S-head, fix the protective spring by using the saddle, then mount the cover.

6. Fix the white-marked part of the internal wiring harness with the cable ties.
7. Securely fasten the velcro of the protective tubing.
   • Protective tubing type: MTK-50FR

8. Connect the wiring harness to the S- and L-axis motors. Then fix the internal wiring harness to the supports around the S-head with the cable ties.

9. Fix the internal wiring harness to the L-arm with the saddle.
10. Fix the internal wiring harness to the U-arm side supports with the cable ties. Then mount the saddle.

11. Insert the internal wiring harness though the top of the U-arm and mount the cover.

12. Connect the internal wiring harness to the U-, R-, B- and T-axis motors.

13. Fix the internal wiring harness beside the U-, R-, B- and T-axis motors with the cable ties.

14. Mount the connectors and hoses on the U-arm side supports. The connection is completed here.

15. Disconnect the backup battery connected to all the motors and mount the cover on the encoder.
10 Parts List

10.1 S-Axis Unit

Fig. 10-1: S-Axis Unit
## Table 10-1: S-Axis Unit

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>HW0102236-1</td>
<td>Base</td>
<td>1</td>
</tr>
<tr>
<td>1002</td>
<td>HW0400405-3</td>
<td>Stopper</td>
<td>1</td>
</tr>
<tr>
<td>1003</td>
<td>HW9404486-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>1004</td>
<td>2H-8</td>
<td>Conical spring washer</td>
<td>2</td>
</tr>
<tr>
<td>1005</td>
<td>M8×45</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td>1006</td>
<td>HW1382898-A</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>1007</td>
<td>KQ2L10-01S</td>
<td>Union</td>
<td>1</td>
</tr>
<tr>
<td>1008</td>
<td>NB-1075-0.43</td>
<td>Nylon tube</td>
<td>1</td>
</tr>
<tr>
<td>1009</td>
<td>HW1408161-10-25</td>
<td>Pin</td>
<td>1</td>
</tr>
<tr>
<td>1010</td>
<td>2H-12</td>
<td>Conical spring washer</td>
<td>28</td>
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<tr>
<td>1011</td>
<td>M12×55</td>
<td>Hexagon socket head cap screw</td>
<td>12</td>
</tr>
<tr>
<td>1012</td>
<td>HW1100622-1</td>
<td>S head</td>
<td>1</td>
</tr>
<tr>
<td>1013</td>
<td>HW9405875-1</td>
<td>Collar</td>
<td>1</td>
</tr>
<tr>
<td>1014</td>
<td>M20×40</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td>1015</td>
<td>M12×50</td>
<td>Hexagon socket head cap screw</td>
<td>16</td>
</tr>
<tr>
<td>1016</td>
<td>PT3/8(STAINLESS)</td>
<td>Hexagon socket head plug</td>
<td>1</td>
</tr>
<tr>
<td>1017</td>
<td>M12×35</td>
<td>GT-SA bolt</td>
<td>6</td>
</tr>
<tr>
<td>1018</td>
<td>SGMRV-30ANA-YR1*</td>
<td>Motor</td>
<td>1</td>
</tr>
<tr>
<td>1019</td>
<td>HW0312836-1</td>
<td>Gear</td>
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<tr>
<td>1020</td>
<td>STW-50</td>
<td>Retaining ring</td>
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</tr>
<tr>
<td>1021</td>
<td>6310</td>
<td>Bearing</td>
<td>1</td>
</tr>
<tr>
<td>1022</td>
<td>M8×85</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
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</tbody>
</table>
10.2 L-Axis Unit

*Fig. 10-2: L-Axis Unit*
### Table 10-2: L-Axis Unit

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>HW1100623-1</td>
<td>L-arm</td>
<td>1</td>
</tr>
<tr>
<td>2002</td>
<td>HW1382456-B</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>2003</td>
<td>M12×35</td>
<td>GT-SA bolt</td>
<td>18</td>
</tr>
<tr>
<td>2004</td>
<td>2H-16</td>
<td>Conical spring washer</td>
<td>9</td>
</tr>
<tr>
<td>2005</td>
<td>M16×40</td>
<td>Hexagon socket head cap screw</td>
<td>9</td>
</tr>
<tr>
<td>2006</td>
<td>PT1/8(STAINLESS)</td>
<td>Hexagon socket head plug</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>SW-2H-12</td>
<td>Conical spring washer</td>
<td>32</td>
</tr>
<tr>
<td>2008</td>
<td>M12×75</td>
<td>Hexagon socket head cap screw</td>
<td>32</td>
</tr>
<tr>
<td>2009</td>
<td>AS568-275</td>
<td>O-ring</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>PT3/8(STAINLESS)</td>
<td>Hexagon socket head plug</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>HW9482447-A</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>HW1404909-1</td>
<td>Plate</td>
<td>1</td>
</tr>
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10.3 U-Axis Unit

Fig. 10-3: U-Axis Unit
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10.4  R-, B-, and T-Axis Unit

Fig. 10-4: R-, B-, and T-Axis Unit
## 10 Parts List
### 10.4 R-, B-, and T-Axis Unit

**Table 10-4: R-, B-, and T-Axis Unit (Sheet 1 of 2)**

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10.5 Wrist Unit

Fig. 10-5: Wrist Unit
### Table 10-5: Wrist Unit (Sheet 1 of 2)

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Specifications are subject to change without notice for ongoing product modifications and improvements.