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.

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-MH180.
- 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.
1.1 Safety Standards 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-MH180.

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.
WARNING

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

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

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

Injury may result from unexpected manipulator motion.

• Before operating the manipulator, check that servo power is turned OFF by pressing the emergency stop buttons on the front door of the 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. : 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. : 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.
## 1.3 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:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 Controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 Programming Pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

### 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.

### 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.

---

**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.
1.6 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.

Note: Taking the maintenance-relevant trainings offered by Yaskawa is indispensable for replacing the L-axis of the balancer-equipped manipulator.

Fig. : Warning Label Locations

WARNING Label B

WARNING Label A

WARNING Label C

Nameplate
(On the manipulator manufactured after June 2014)

Nameplate
(On the manipulator manufactured by May 2014)

WARNING Label C

WARNING Label B

WARNING Label C

WARNING Label A:

WARNING
Moving parts may cause injury

WARNING Label B:

WARNING
Do not enter robot work area.

WARNING Label C:

DANGER
Do not remove the motor, and do not release the brake. Failure to observe this caution may result in injury from unexpected turning of the manipulator arm. Please contact your Yaskawa representative.
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.
1.12 Customer Support Information

If you need assistance with any aspect of your MH180 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:

technicalsupport@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: MH180
- 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 for Motor

The connectors (crimped contact-pin) for the battery backup are installed at the end point of the encoder cables for the motor (BAT and OBT are marked).

Connect the battery pack according to the following procedure.

1. Remove the caps attached to the battery backup connectors of the motor.

2. Connect the battery pack (HW9470932-A) with the battery backup connectors located at the end point of the encoder cable. Under this condition, remove the encoder connector and carry out the maintenance checks.

3. After the maintenance check, confirm that all the connectors are connected, then remove the battery pack. Install the caps attached to the battery backup connectors of the motor.

**NOTE**

- 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 Fig. 2-1 “Battery Pack Connection”.

Do not remove the battery pack in the connector base.

**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 Zeroing Function

The zeroing function is an optional function which automatically allows the restoration of the home position data when the manipulator’s home position data disappears.

For the details of this function, refer to “INSTRUCTIONS FOR ZEROING FUNCTION”.

3.1.2 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.

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.
3.1.3 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.

3.1.3.1 Preparation before Motor Replacement

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

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.
3 Home Position Return
3.1 Home Position Return after Motor Replacement

Example of Check-Point Creation when Replacing U-Axis’s Motor of MOTOMAN-MH180

- 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 MOTOMAN-MH180 is shown below as an example.

Fig. 3-1: Preparation before Motor Replacement (Example)
3.1.3.2 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 MOTOMAN-MH180 is shown below as an example.

*Fig. 3-2: Motor Replacement (Example)*

Remove the motor and replace it.
3 Home Position Return
3.1 Home Position Return after Motor Replacement

3.1.3.3 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 values of the U-axis is shown below as an example.

![Position Screen Example](image)

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.

An example is shown below.

![Position Screen Example](image)

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  L-Axis Fixing Jig

In the MOTOMAN-MH180, the "Linkless mechanism with the balancer" is adopted. Therefore, releasing L-axis holding power (for removing the L-axis motor and releasing the brake, etc.) is seriously dangerous since it will cause a L-arm rotation which is different from the conventional model, depending on the edge load, the wrist load posture, the U-axis posture, and the L-axis posture. (For outlined mechanism, refer to section 4.2 "Mechanism" in this chapter.) When releasing the L-axis holding power, be sure to hold the L-arm with the fixing jigs specified in this manual by following the procedure.

DANGER

- The maintenance operation should be carried out by a specified person.
- Execute disassembly and reassembly of the L-axis motor after mounting the L-axis fixing jig on the balancer. Also, be sure to confirm that the L-axis is firmly fixed by releasing the L-axis motor brake. Failure to observe this leads unexpected L-arm rotation at the moment when the L-axis motor is removed and it may result in damage to machinery or death or serious injury.

4.1  Fixing Jig

In the MOTOMAN-MH180, the "Linkless mechanism with the balancer" is adopted. Therefore, releasing L-axis holding power (for removing the L-axis motor and releasing the brake, etc.) is seriously dangerous since it will cause a L-arm rotation which is different from the conventional model, depending on the edge load, the wrist load posture, the U-axis posture, and the L-axis posture. (For outlined mechanism, refer to section 4.2 "Mechanism" in this chapter.) When releasing the L-axis holding power, be sure to hold the L-arm with the fixing jigs specified in this manual by following the procedure.
4.2 Mechanism

- Refer to Fig. 4-1 “The L-arm Rotation Direction”.

The L-arm rotational direction of when L-axis holding power is released depends on the extent of the torque $T_b$ generated by the balancer, and the load torque $T_l$ generated around the L-axis.

When no force is applied to the front edge and the U-arm is in a horizontal posture, the torque $T_b$ generated by the balancer is generated in the direction where the L-arm posture becomes $-10^\circ$ to keep balance with the load torque $T_l$. The extent of the torque $T_b$ varies depending on the L-axis angle. Also, the load torque $T_l$ which is generated around the L-axis works around the center of the L-axis rotation, and its direction and extent vary depending on the edge load, posture of the wrist, the U-arm, and the L-arm.

When no load is applied to the edge, for the L-arm rotational direction, three patterns are assumed as described in the Fig. 4-1 “The L-arm Rotation Direction”.

It is quite difficult to accurately compare the extent of the torque which works around the L-axis and the extent of the torque which is generated by the balancer on the actual work site, and also, the rotational direction cannot be identified in this unit. Therefore, handling this unit in the same way as other manipulators is seriously dangerous, as the L-arm may rotate in an unexpected direction.

![Fig. 4-1: The L-arm Rotation Direction](image)
4.3 Fixing Jig Installation

L-axis fixing jig needs to be installed to each specified position depending on the L-axis posture; -60° to +20° or +20° to +76°.

The following explains how to fix the L-arm at the posture shown in the Fig. 4-2 “L-axis Posture (-60° to +20°) Exterior View” and at the posture shown in the Fig. 4-3 “L-axis Posture (+20° to +76°) Exterior View”. The angle of L-axis posture can be checked by the L-axis pulse with a programming pendant. Judge the L-axis posture angle whether it is in the positive side or in the negative side in comparison with +20° by the amount of pulse. The +20° is equal to 61252 in the L-axis pulse, so if the amount of L-axis pulse is less than 61252, use the fixing jigs in the procedure shown in the section 4.3.1 “Installation Posture and Position of L-axis Fixing Jig (L-axis Posture: -60° to +20°)”. If the amount of L-axis pulse is 61252 or more, use the fixing jigs in the procedure shown in the section 4.3.2 “Installation Posture and Position of L-axis Fixing Jig (L-axis Posture: +20° to +76°)”.

Before installing jigs, rotate the U-arm so that the relative angle between the L-axis and the U-axis can be minimized. When releasing the brake of L-axis motor after installing the L-axis fixing jigs, the L-arm rotates 5° maximum at conversion rate on output-side. This is because of the "looseness" of L-axis fixing jigs, bearings, or speed reducers, and also the effect caused by the gas pressure. This rotation angle is equal to the P-point moving distance of about 210 mm when the L-arm is aligned with the U-arm, or the P-point moving distance of about 165 mm when the L-arm and the U-arm form a right angle. To minimize the P-point moving distance is the reason for rotating the U-arm so that the relative angle of the L-axis and U-axis can be minimized.

4.3.1 Installation Posture and Position of L-axis Fixing Jig (L-axis Posture: -60° to +20°)

As mentioned in the section 4.3 “Fixing Jig Installation”, rotate the U-arm so that the relative angle between the L-axis and the U-axis can be minimized. At this time, care must be taken so that the arm may not interfere with the peripheral devices including the work and hand, and the main unit of the manipulator.

Install the L-axis fixing jig to section A and B in the Fig. 4-2 “L-axis Posture (-60° to +20°) Exterior View”. For avoidance of the wrong installation, jig for section B can be installed only when the L-axis posture is -60° to +20°.

Fig. 4-2: L-axis Posture (-60° to +20°) Exterior View
4.3.2 Installation Posture and Position of L-axis Fixing Jig (L-axis Posture: +20° to +76°)

As mentioned in the section 4.3 “Fixing Jig Installation”, rotate the U-arm so that the relative angle between the L-axis and U-axis can be minimized. At this time, care must be taken so that the arm may not interfere with the peripheral devices including the work and hand, and the main unit of the manipulator.

Install the L-axis fixing jig to the section A and C shown in the Fig. 4-3 “L-axis Posture (+20° to +76°) Exterior View”. For avoidance of the wrong installation, jig for section C can be installed only when the L-axis posture is +20° to +76°.

*Fig. 4-3: L-axis Posture (+20° to +76°) Exterior View*
4.3.3 Recommended Mounting Posture

When using this fixing jig, operating the manipulator in the posture shown in Fig. 4-4 "Recommended Posture" is recommended, if it is possible.

Avoid operating the manipulator in the posture shown in Fig. 4-5 "Avoided Posture" as much as possible. If it is unavoidable, be sure to secure a distance of 300mm or more from the surroundings.

**Fig. 4-4: Recommended Posture**

![Recommended Posture Diagram]

Fold the U-arm whenever possible.

It is not necessary to remove the edge load, however assure enough distance from the surroundings.

**Fig. 4-5: Avoided Posture**

![Avoided Posture Diagram]

Because the edge may move greatly, be sure to assure a distance of 300mm or more from the surroundings.
4.4 Assembly and Disassembly

4.4.1 Assembly and Disassembly (L-axis Posture: -60° to +20°)

When assembling, refer to the following procedures and operate in order.

Assembly procedure (For L-axis posture: -60° to +20°)

1. Disconnecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

2. Assembling fixing jigs of section A
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

3. Assembling fixing jigs of section B
   (For L-axis posture: -60° to +20°)

4. Assembling fixing jigs between section A and B
   (For L-axis posture: -60° to +20°)

5. Assembling brake release unit
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

When disassembling, refer to the following procedures and operate in order.

Disassembly procedure (For L-axis posture: -60° to +20°)

1. Disassembling brake release unit
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

2. Disassembling fixing jigs between section A and B
   (For L-axis posture: -60° to +20°)

3. Disassembling fixing jigs of section B
   (For L-axis posture: -60° to +20°)

4. Disassembling fixing jigs of section A
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

5. Connecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

• Gross weight of L-axis fixing jig is 62.5 kg. (One part weighs 8.7 kg maximum.) This operation must be performed by more than two workers. Failure to observe this caution may result in an injury.

• To disassemble L-axis fixing jigs, confirm that the brake of the L-axis motor is not released, then operate in the opposite way to the assembly procedure. If the brake of the L-axis motor is released, L-arm may rotate because of the balancer torque.

• When removing the internal wiring harness, do not apply any forces to the internal wiring harness while the operation. Failure to observe this note may result in a damage to the internal wiring harness.

• Do not operate the manipulator with the fixing jigs on it. Failure to observe this note may result in a damage to the devices.
### Assembling Procedure (For L-axis Posture: -60° to +20°)

1. Disconnecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   
   - Refer to Fig. 4-6 “Disconnecting Internal Wiring Harness (Common for L-axis Posture: -60° to +20°/+20° to +76°)” and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.

   1. Remove the plate and GT-SA bolts M5 (length: 12 mm) (2 places each) from the support attached to section A.

   2. Remove the support and hexagon socket head cap screws M8 (length: 12 mm).
2. Assembling fixing jig of section A  
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

   * Refer to Fig. 4-7 “Assembling Fixing Jig of Section A (Common for L-axis Posture: -60° to +20°/+20° to +76°)” and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.

   (1) Install the shaft⑥ to the shaft⑤ on the upper part of the balancer, with hexagon socket head cap screws⑦ M12 (length: 50 mm) (tightening torque: 84 N-m).

   (2) Install the cover⑨ to the shaft⑥, then install the shaft⑧ to the block⑩ with hexagon socket head cap screws⑪ M12 (length: 35 mm) (tightening torque: 84 N-m). (It is possible to perform this procedure in advance.)

   (3) Insert the shaft⑧ to the shaft⑥.

   (4) Install the cover⑨ to the shaft⑧ with hexagon socket head cap screws⑫ M10 (length: 25 mm) (tightening torque: 48 N-m).

Fig. 4-7: Assembling Fixing Jig of Section A  
(Common for L-axis Posture: -60° to +20°/+20° to +76°)
3. Assembling fixing jigs of section B (For L-axis posture: -60° to +20°)
   - Refer to Fig. 4-8 "Assembling Fixing Jig of Section B (For L-axis Posture: -60° to +20°)" and Fig. 4-11 "Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)" on page 4-16.

   (1) Install the bracket 13 to the side face of the S-head with hexagon socket head cap screws 14 M20 (length: 180 mm) (tightening torque: 402 N·m).

   (2) Install the cover 9 to the shaft 15, then install the shaft 15 to the block 16 with hexagon socket head cap screws 11 M12 (length: 35 mm) (tightening torque: 84 N·m). (It is possible to perform this procedure in advance.)

   (3) Insert the shaft 15 to the bracket 13.

   (4) Install the cover 9 to the bracket 13 with hexagon socket head cap screws 12 M10 (length: 25 mm) (tightening torque: 48 N·m).

Fig. 4-8: Assembling Fixing Jig of Section B
(For L-axis Posture: -60° to +20°)
4. Assembling fixing jigs between section A and B  
(For L-axis posture: -60° to +20°)

- Refer to Fig. 4-9(a “Detail of Screw” on page 4-11, Fig. 4-9(b “Detail of Measuring Point” on page 4-11, Fig. 4-9(c “Assembling Fixing Jig Between A and B (For L-axis Posture: -60° to +20°)” on page 4-12 and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.

1. Insert the long side of the screw to the block from its bottom side, and install the plate to the screw from its top side. At this time, be sure to pass the screw through the plate. Also, adjust the position of holes of the plate (4 places) to come on the tapped holes of the block.

2. Install the joint to the screw. At this time, engage the thread of the joint with the thread of the screw 30 mm or more. Measure the distance from the groove edge of the screw to the edge of the joint, and if the distance is 90 mm or less, the thread of the joint and the thread of the screw are engaged 30 mm or more.

3. Insert the long side of the screw to the block from its top side. At this time, engage the thread of the joint with the thread of the screw 30 mm or more. Measure the distance from the edge of the joint to the groove edge of the screw, and if the distance is 90 mm or less, the thread of the joint and the thread of the screw are engaged 30 mm or more.

4. Install the plate to the screw from its bottom side. At this time, engage all the thread of the plate with the thread of the screw (4 places) to come on the tapped holes of the block.

5. Tighten the plate of section A and the block with the hexagon socket head cap screws M12 (length: 50 mm) (tightening torque: 84 N·m).

6. Tighten the plate of section B and the block with the hexagon socket head cap screws M12 (length: 50 mm) (tightening torque: 84 N·m). When the tapped hole does not fit or there is space between the plate and the block, rotate the joint to adjust the space.

7. To reduce the rotation amount at the time of releasing the brake, the followings are recommended.  
(If the servo monitor window does not appear because of the power malfunction etc. or there is enough space from the surroundings, the followings are not necessary to perform.)  
While confirming the torque command value at the servo monitor window, rotate the joint.  
The joint should be rotated in the direction where the torque command value is down.  
Because the rotating direction varies depending on the edge load, the wrist posture and the U-arm posture, be careful about the direction.  
(For the servo monitor, refer to section 7.9 “Servo Monitoring” of the DX200 Maintenance manual.)
4 L-Axis Fixing Jig
4.4 Assembly and Disassembly

**Fig. 4-9(a): Detail of Screw**

![Diagram of Screw](image1)

- **Thread part 115 mm**
- **Thread part 375 mm**

- **M45 (Pitch: 4.5mm)**
- **(coarse thread)**

- **Mark**

| HW1304148-5 | Right screw | Mark : R |
| HW1304148-6 | Left screw  | Mark : L |

**Fig. 4-9(b): Detail of Measuring Point**

![Diagram of Measuring Point](image2)

- **Measuring Point: 90 mm or less**
- **Joint part: 30 mm or more**

- **Shrink in this direction**
Fig. 4-9(c): Assembling Fixing Jig Between A and B
(For L-axis Posture: -60° to +20°)
5. Assembling brake release unit  
(Common for L-axis posture: -60° to +20°/+20° to +76°)

- Refer to Fig. 4-10 “Assembling brake release unit (Common for L-axis Posture: -60° to +20°/+20° to +76°)”.

(1) Turn OFF the DX200 power supply.

(2) Disconnect the manipulator side connector of 2BC power supply cable, which is installed between the manipulator and the controller, and connect the brake release unit cable to the 2BC connector.

(3) Connect the brake release unit cable to the 2CN connector of brake release unit.

(4) Connect the 1PC of the brake release unit to the 100 V receptacle.

(5) Turn ON the 1CP of the brake release unit, then turn ON the brake release switch.

(6) After ensuring safety of surroundings, press the L-axis brake release button bit by bit and repeatedly. Then confirm that the L-axis cannot move at all. The brake is released only while the button is pressed. At this time, do not press any other buttons than L-axis brake release button. L-axis fixing jig corresponds only to release the brake unit of L-axis motor. If the brake of other axis motor is released, it is very dangerous because the other axis can be rotated depending on the condition of front edge load, wrist axis posture, U-axis posture, and L-axis posture.

Fig. 4-10: Assembling brake release unit  
(Common for L-axis Posture: -60° to +20°/+20° to +76°)
Disassembly Procedure (For L-axis Posture: -60° to +20°)

1. Disassembling brake release unit
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   - Refer to Fig. 4-10 “Assembling brake release unit (Common for L-axis Posture: -60° to +20°/+20° to +76°)” on page 4-13.
   (1) Turn OFF the brake release switch of brake release unit\(^{27}\), then turn the 1CP OFF.
   (2) Disconnect the 1PC of the brake release unit\(^{27}\) from the 100 V receptacle.
   (3) Disconnect the brake release unit cable\(^{28}\) connected to the manipulator from the 2BC connector, then connect the 2BC power supply cable to the 2BC connector of manipulator side.

2. Disassembling fixing jigs between section A and B
   (For L-axis posture: -60° to +20°)
   - Refer to Fig. 4-9(c “Assembling Fixing Jig Between A and B (For L-axis Posture: -60° to +20°)” on page 4-12 and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.
   (1) Remove the hexagon socket head cap screws\(^{21}\) M12 (length: 50 mm) installed to the section A and B, then remove the plate\(^{18}\) of section B.
   (2) Remove the screw\(^{23}\) from the joint\(^{19}\), then remove the joint\(^{19}\) from the screw\(^{17}\).
   (3) Remove the plate\(^{18}\) of section A from the screw\(^{17}\).

3. Disassembling fixing jigs of section B (For L-axis posture: -60° to +20°)
   - Refer to Fig. 4-8 “Assembling Fixing Jig of Section B (For L-axis Posture: -60° to +20°)” on page 4-9 and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.
   (1) Remove the hexagon socket head cap screws\(^{22}\) M10 (length: 25 mm), then remove the cover\(^{9}\).
   (2) Remove the block\(^{16}\) and the shaft\(^{15}\).
   (3) Remove the hexagon socket head cap screws\(^{14}\) M20 (length: 180 mm), then remove the bracket\(^{13}\).
4. Disassembling fixing jigs of section A
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   • Refer to Fig. 4-7 “Assembling Fixing Jig of Section A (Common for L-axis Posture: -60° to +20°/+20° to +76°)” on page 4-8 and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.

   (1) Remove the hexagon socket head cap screws 12 M10 (length: 25 mm), then remove the cover 9.
   (2) Remove the block 10 and the shaft 8.
   (3) Remove the hexagon socket head cap screws 7 M12 (length: 50 mm), then remove the shaft 6.

5. Connecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   • Refer to Fig. 4-6 “Disconnecting Internal Wiring Harness (Common for L-axis Posture: -60° to +20°/+20° to +76°)” on page 4-7 and Fig. 4-11 “Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)” on page 4-16.

   (1) Install the support 1 to section A with the hexagon socket head cap screws 4 M8 (length: 20 mm) (tightening torque: 24.5 N-m).
   (2) Install the plate 2 to the support 1 with the GT-SA bolts 5 M5 (length: 12 mm) (tightening torque: 6 N-m).
4 L-Axis Fixing Jig

4.4 Assembly and Disassembly

Fig. 4-11: Assembly/Disassembly of L-axis Fixing Jig (For L-axis Posture: -60° to +20°)
### Table 4-1: Parts Check List of L-Axis Fixing Jig (For L-axis Posture: -60° to +20°)

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
<th>Common parts for L-axis posture: -60° to +20°/ +20° to +76°</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HW1303711-A</td>
<td>Support</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>HW0403915-1</td>
<td>Plate</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M5×12</td>
<td>GT-SA bolt</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>M8×20 2H-8</td>
<td>Hexagon socket head cap screw Conical spring washer</td>
<td>4</td>
<td></td>
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<td>4</td>
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<td>4</td>
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</tr>
<tr>
<td>5</td>
<td>HW1304620-1</td>
<td>Shaft</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>HW1304771-1</td>
<td>Shaft</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>M12×50 2H-12</td>
<td>Hexagon socket head cap screw Conical spring washer</td>
<td>Section A: 4 each</td>
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<td>Shaft</td>
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<td>Cover</td>
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<td>11</td>
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<td>Section B: 3 each</td>
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<td>Bracket</td>
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<td>Shaft</td>
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</tr>
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<td>Block</td>
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<td></td>
</tr>
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<td>17</td>
<td>HW1304148-5</td>
<td>Screw</td>
<td>1</td>
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</tr>
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<tr>
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<td>HS1370337-A</td>
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<td>27</td>
<td>HE0301921-A</td>
<td>Brake release unit</td>
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<td></td>
</tr>
</tbody>
</table>
4.4.2 Assembly and Disassembly (For L-axis Posture: +20° to +76°)

When assembling, refer to the following procedures and operate in order.

Assembling procedure (For L-axis posture: +20° to +76°)

1. Disconnecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
2. Assembling fixing jigs of section A
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
3. Assembling fixing jigs of section C
   (For L-axis posture: +20° to +76°)
4. Assembling fixing jigs between section A and C
   (For L-axis posture: +20° to +76°)
5. Assembling brake release unit
   (Common for L-axis posture: -60° to +20°/+20° to +76°)

When disassembling, refer to the following procedures and operate in order.

Disassembling procedure (For L-axis posture: +20° to +76°)

1. Disassembling brake release unit
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
2. Disassembling fixing jigs between section A and C
   (For L-axis posture: +20° to +76°)
3. Disassembling fixing jigs of section C
   (For L-axis posture: +20° to +76°)
4. Disassembling fixing jigs of section A
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
5. Connecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
Assembly Procedure

1. Disconnecting internal wiring harness
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   • Refer to Fig. 4-12 “Disconnecting Internal Wiring Harness (Common for L-axis Posture: -60° to +20°/+20° to +76°)” on page 4-19 and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.

   (1) Remove the plate 2 and GT-SA bolts 3 M5 (length: 12 mm) (2 places each) from the support 1 attached to section A.

   (2) Remove the support 1 and hexagon socket head cap screws 4 M8 (length: 12 mm).

Fig. 4-12: Disconnecting Internal Wiring Harness
(Common for L-axis Posture: -60° to +20°/+20° to +76°)
2. Assembling fixing jig of section A
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   - Refer to Fig. 4-13 “Assembling Fixing Jig of Section A (Common for L-axis Posture: -60° to +20°/+20° to +76°)” and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.

   (1) Install the shaft(6) to the shaft(5) on the upper part of the balancer, with hexagon socket head cap screws M12 (length: 50 mm) (tightening torque: 84 N·m).

   (2) Install the cover(9) to the shaft(8), then install the shaft(6) to the block(10) with hexagon socket head cap screws M12 (length: 35 mm) (tightening torque: 84 N·m). (It is possible to perform this procedure in advance.)

   (3) Insert the shaft(3) to the shaft(6).

   (4) Install the cover(3) to the shaft(5) with hexagon socket head cap screws M10 (length: 25 mm) (tightening torque: 48 N·m).

---

**Fig. 4-13: Assembling Fixing Jig of Section A**

(Common for L-axis Posture: -60° to +20°/+20° to +76°)
3. Assembling fixing jigs of section C (For L-axis posture: +20° to +76°)

- Refer to Fig. 4-14 “Assembling Fixing Jig of Section C (For L-axis Posture: +20° to +76°)” and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.

(1) Remove the cover\textsuperscript{22} installed to section C, then remove hexagon socket head cap screws\textsuperscript{23} M5 (length: 10 mm).

(2) Install the shaft\textsuperscript{24} to the shaft\textsuperscript{25} of section C with hexagon socket head cap screws\textsuperscript{7} M12 (length: 50 mm) (tightening torque: 84 N-m).

(3) Pass the cover\textsuperscript{9} through the shaft\textsuperscript{15}, then install the shaft\textsuperscript{15} to the block\textsuperscript{16} with hexagon socket head cap screws\textsuperscript{11} M12 (length: 35 mm) (tightening torque: 84 N-m). (It is possible to perform this procedure in advance.)

(4) Insert the shaft\textsuperscript{15} and the block\textsuperscript{16} to the shaft\textsuperscript{25}.

(5) Install the cover\textsuperscript{9} to the shaft\textsuperscript{25} with hexagon socket head cap screws\textsuperscript{12} M10 (length: 25 mm) (tightening torque: 48 N-m).

\textit{Fig. 4-14: Assembling Fixing Jig of Section C (For L-axis Posture: +20° to +76°)}
4. Assembling fixing jigs between section A and C
(For L-axis posture: +20° to +76°)

- Refer to Fig. 4-15(a) “Detail of Screw” on page 4-23, Fig. 4-15(b) “Detail of Measuring Point” on page 4-23, Fig. 4-15(c) “Assembling Fixing Jig Between A and C (For L-axis Posture: +20° to +76°)” on page 4-24 and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.

1. Insert the long side of the screw 17 to the block 10 from its bottom side, and install the plate 18 to the screw 17 from its top side. At this time, be sure to pass the screw 17 through the plate 18. Also, adjust the position of holes of the plate 18 (4 places) to come on the tapped holes of the block 10.

2. Install the joint 19 to the screw 17. At this time, engage the thread of the joint 19 with the thread of the screw 17 30 mm or more. Measure the distance from the groove edge of the screw 17 to the edge of the joint 19, and if the distance is 90 mm or less, the thread of the joint 19 and the thread of the screw 17 are engaged 30 mm or more.

3. Insert the long side of the screw 23 to the block 16 from its top side. At this time, engage the thread of the joint 20 with the thread of the screw 19 30 mm or more. Measure the distance from the edge of the joint 19 to the groove edge of the screw 17, and if the distance is 90 mm or less, the thread of the joint 19 and the thread of the screw 17 are engaged 30 mm or more.

4. Install the plate 18 to the screw 23 from its bottom side. At this time, engage all the thread of the plate 18 with the thread of the screw 23. Also, adjust the position of holes of the plate 18 (4 places) to come on the tapped holes of the block 13.

5. Tighten the plate 18 of section A and the block 10 with the hexagon socket head cap screws 21 M12 (length: 50 mm) (tightening torque: 84 N·m).

6. Tighten the plate 18 of section B and the block 16 with the hexagon socket head cap screws 21 M12 (length: 50 mm) (tightening torque: 84 N·m). When the tapped hole does not fit or there is space between the plate 18 and the block 16, rotate the joint 19 to adjust that.

7. To reduce the rotation amount at the time of releasing the brake, the followings are recommended.
- If the servo monitor window does not appear because of the power malfunction etc. or there is enough space from the surroundings, the followings are not necessary to perform.
- While confirming the torque command value at the servo monitor window, rotate the joint 19.
- The joint should be rotated in the direction where the torque command value is down.
- Because the rotating direction varies depending on the edge load, the wrist posture and the U-arm posture, be careful about the direction.
- (For the servo monitor, refer to section 7.9 “Servo Monitoring” of the DX200 Maintenance manual.)
4.4 Assembly and Disassembly

Fig. 4-15(a): Detail of Screw

Mark

M45 (Pitch: 4.5mm) (coarse thread)

(530)

Thread part 115 mm

5

Thread part 375 mm

M45 (Pitch: 4.5mm) (coarse thread)

HW1304148-5
Right screw
Mark: R

HW1304148-6
Left screw
Mark: L

Fig. 4-15(b): Detail of Measuring Point

Measuring Point: 90 mm or less

Joint part: 30 mm or more

Schrink in this direction
Fig. 4-15(c): Assembling Fixing Jig Between A and C
(For L-axis Posture: +20° to +76°)
5. Assembling brake release unit
   (Common for L-axis posture: -60° to +20°/ +20° to +76°)
   • Refer to Fig. 4-16 “Assembling brake release unit (L-axis Posture: -60° to +20°/ +20° to +76°)”.
   (1) Turn OFF the DX200 power supply.
   (2) Disconnect the manipulator side connector of 2BC power supply cable, which is installed between the manipulator and the controller, and connect the brake release unit cable to the 2BC connector.
   (3) Connect the brake release unit cable to the 2CN connector of brake release unit.
   (4) Connect the 1PC of the brake release unit to the 100 V receptacle.
   (5) Turn ON the 1CP of the brake release unit, then turn ON the brake release switch.
   (6) After ensuring safety of surroundings, press the L-axis brake release button bit by bit and repeatedly. Then confirm that the L-axis cannot move at all.
   The brake is released only while the button is pressed.
   At this time, do not press any other buttons than L-axis brake release button. L-axis fixing jig corresponds only to release the brake unit of L-axis motor. If the brake of other axis motor is released, it is very dangerous because the other axis can be rotated depending on the condition of front edge load, wrist axis posture, U-axis posture, and L-axis posture.

Fig. 4-16: Assembling brake release unit
(L-axis Posture: -60° to +20°/ +20° to +76°)
4.4 Assembly and Disassembly

**Disassembly Procedure (For L-axis Posture: +20° to +76°)**

1. Disassembling brake release unit  
   (Common for L-axis posture: -60° to +20°/+20° to +76°)
   - Refer to Fig. 4-16 "Assembling brake release unit (L-axis Posture: -60° to +20°/+20° to +76°)" on page 4-25.
   1. Turn OFF the brake release switch of brake release unit, then turn the 1CP OFF.
   2. Disconnect the 1PC of the brake release unit from the 100 V receptacle.
   3. Disconnect the brake release unit cable connected to the manipulator from the 2BC connector, then connect the 2BC power supply cable to the 2BC connector of manipulator side.

2. Disassembling fixing jigs between section A and C  
   (For L-axis posture: +20° to +76°)
   - Refer to Fig. 4-15(c “Assembling Fixing Jig Between A and C (For L-axis Posture: +20° to +76°)” on page 4-24 and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.
   1. Remove the hexagon socket head cap screws M12 (length: 50 mm) installed to the section A and C, then remove the plate of section C.
   2. Remove the screw from the joint, then remove the joint from the screw.
   3. Remove the plate of section A from the screw.

3. Disassembling fixing jigs of section C  
   (For L-axis posture: +20° to +76°)
   - Refer to Fig. 4-14 “Assembling Fixing Jig of Section C (For L-axis Posture: +20° to +76°)” on page 4-21 and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.
   1. Remove the hexagon socket head cap screws M10 (length: 25 mm) installed to section C, then remove the cover.
   2. Remove the block and the shaft.
   3. Remove the hexagon socket head cap screws M12 (length: 50 mm), then remove the shaft.
   4. Install the cover to the shaft with hexagon socket head cap screws M5 (length: 10 mm) (tightening torque: 6 N-m).
4. Disassembling fixing jigs of section A
(Common for L-axis posture: -60° to +20°/+20° to +76°)

- Refer to Fig. 4-13 “Assembling Fixing Jig of Section A (Common for L-axis Posture: -60° to +20°/+20° to +76°)” on page 4-20 and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.

1. Remove the hexagon socket head cap screws M10 (length: 25 mm), then remove the cover.
2. Remove the block and the shaft.
3. Remove the hexagon socket head cap screws M12 (length: 50 mm), then remove the shaft.

5. Connecting internal wiring harness
(Common for L-axis posture: -60° to +20°/+20° to +76°)

- Refer to Fig. 4-12 “Disconnecting Internal Wiring Harness (Common for L-axis Posture: -60° to +20°/+20° to +76°)” on page 4-19 and Fig. 4-17 “Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)” on page 4-28.

1. Install the support to section A with the hexagon socket head cap screws M8 (length: 20 mm) (tightening torque: 24.5 N·m).
2. Install the plate to the support with the GT-SA bolts M5 (length: 12 mm) (tightening torque: 6 N·m).
Fig. 4-17: Assembly/Disassembly of L-axis fixing jig (For L-axis Posture: +20° to +76°)
### Table 4-2: Parts Check List of L-Axis Fixing Jig (For L-axis Posture: +20° to +76°)

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
<th>Common Parts for L-axis posture: -60° to +20°/ +20° to +76°</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HW1303711-A</td>
<td>Support</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>2</td>
<td>HW0403915-1</td>
<td>Plate</td>
<td>2</td>
<td>○</td>
</tr>
<tr>
<td>3</td>
<td>M5×12</td>
<td>GT-SA bolt</td>
<td>4</td>
<td>○</td>
</tr>
<tr>
<td>4</td>
<td>M8×20</td>
<td>Hexagon socket head cap screw</td>
<td>4</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>2H-8</td>
<td>Conical spring washer</td>
<td>4</td>
<td>○</td>
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<tr>
<td>5</td>
<td>HW1304620-1</td>
<td>Shaft</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>6</td>
<td>HW1304771-1</td>
<td>Shaft</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>7</td>
<td>M12×50</td>
<td>Hexagon socket head cap screw</td>
<td></td>
<td>Section A: 4 each Section C: 3 each ○</td>
</tr>
<tr>
<td></td>
<td>2H-12</td>
<td>Conical spring washer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>HW1404929-1</td>
<td>Shaft</td>
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<td>○</td>
</tr>
<tr>
<td>9</td>
<td>HW1404917-1</td>
<td>Cover</td>
<td>2</td>
<td>○</td>
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<tr>
<td>10</td>
<td>HW1405123-1</td>
<td>Block</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>11</td>
<td>M12×35</td>
<td>Hexagon socket head cap screw</td>
<td></td>
<td>Section A: 4 each Section C: 3 each ○</td>
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<tr>
<td></td>
<td>2H-12</td>
<td>Conical spring washer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>M10×25</td>
<td>Hexagon socket head cap screw</td>
<td>8</td>
<td>○</td>
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<tr>
<td></td>
<td>2H-10</td>
<td>Conical spring washer</td>
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<tr>
<td>15</td>
<td>HW1405121-1</td>
<td>Shaft</td>
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<td>○</td>
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<tr>
<td>16</td>
<td>HW1405126-1</td>
<td>Block</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>17</td>
<td>HW1304148-5</td>
<td>Screw</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>18</td>
<td>HW1405124-3</td>
<td>Plate</td>
<td>2</td>
<td>○</td>
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<tr>
<td>19</td>
<td>HW1304147-3</td>
<td>Joint</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>20</td>
<td>HW1304148-6</td>
<td>Screw</td>
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<td>○</td>
</tr>
<tr>
<td>21</td>
<td>M12×50</td>
<td>Hexagon socket head cap screw</td>
<td>8</td>
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<td></td>
<td>2H-12</td>
<td>Conical spring washer</td>
<td>8</td>
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<tr>
<td>22</td>
<td>HW1405158-1</td>
<td>Cover</td>
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<tr>
<td>23</td>
<td>M5×10</td>
<td>Hexagon socket head cap screw</td>
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<td>○</td>
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<td></td>
<td>2H-5</td>
<td>Conical spring washer</td>
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<td></td>
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<tr>
<td>24</td>
<td>HW1304620-2</td>
<td>Shaft</td>
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<td></td>
</tr>
<tr>
<td>25</td>
<td>HW1304771-2</td>
<td>Shaft</td>
<td>1</td>
<td></td>
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<tr>
<td>26</td>
<td>HS1370337-A</td>
<td>Brake release unit cable</td>
<td>1</td>
<td>○</td>
</tr>
<tr>
<td>27</td>
<td>HE0301921-A</td>
<td>Brake release unit</td>
<td>1</td>
<td>○</td>
</tr>
</tbody>
</table>
5 Grease Replenishment and Exchange

5.1 Notes on Grease Filling/Exchange Procedures

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

- If grease is injected without removing the plug from the grease exhaust port, the grease will leak inside the motor, or an oil seal of a speed reducer will come off. Make sure to remove the plug or it may result in a failure. Also, when using a tube, the length must be 150 mm or shorter and the inside diameter must be 6 mm or longer. If the tube is too long, the exhaust resistance at the tube part is increased, and the inner pressure of the grease bath is raised. It may result in coming off of an oil seal.

- Make sure to use a grease pump to inject grease. Set grease injection rate to 7 g/s or less. (Air supply pressure to the grease pump: 0.3 MPa or less (rough standard)) If not, an oil seal of a speed reducer will come off, and may result in a failure.

- When using extrusion air for discharging the grease, set air supply pressure at 0.025 MPa or less. If not, a speed reducer oil seal will come off, and may result in a failure.

- Make sure to fill the hose on the grease inlet with grease before to prevent air from leaking into the speed reducer.

- After injecting grease, discharge the specified amount of grease. If insufficient, the inner pressure is raised during the operation, and grease may leak. If discharged too much, the speed reducer is not lubricated sufficiently during the operation, and it may cause the early failure of the speed reducer.

- When filling/exchanging grease, the grease may flow out from the grease inlet or the grease exhaust port. Prepare a container to receive the grease and a waste cloth to wipe the grease in advance.

- After mounting a speed reducer or a motor, leave it 30 minutes or more and inject grease. If grease is filled before the sealing bond is solidified, it may cause the grease leakage.

---

**WARNING**

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

**CAUTION**

When using extrusion air for discharging the grease, the grease may be vigorously discharged from the exhaust port. Perform an operation such as using a tube at the grease exhaust port to pour into an appropriate container.
5.2 List of Necessary Items

Prepare necessary items as indicated in Table 5-1 “List of Necessary Items”. “S”, “L”, “U”, “R”, and “BT” in the table mean grease filling/exchange to each axis, and “Casing” means grease filling/exchange to the R-, B-, and T-gear in a casing.

Table 5-1: List of Necessary Items

<table>
<thead>
<tr>
<th>Items</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>Casing</th>
<th>R</th>
<th>BT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease zerk A-PT1/4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-PT1/8</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Hexagon bit tool, width across flat: 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexagon bit tool, width across flat: 6</td>
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<td>Hexagon bit tool, width across flat: 8</td>
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<td></td>
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</tr>
<tr>
<td>Torque wrench (Range of use: 4.9 N•m - 23 N•m)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Torque wrench, Extension bar for hexagon bit (30 mm or longer)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ThreeBond 1206C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended grease lubricator: Powerlube P3C by Macnaught</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air supply (air supply pressure: 0.3 MPa or less)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint and hose for grease discharging (Approx. 150 mm)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Container for grease discharging (Checking the cubical content (cc) inside this container should be available,)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulator for grease discharging (Recommendation: ARP30-02G by SMC)</td>
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<td></td>
</tr>
<tr>
<td>Weight scale (Minimum display should be 1 g. Range of use: 0 g - 2,000 g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.3 Grease Filling/Exchange

5.3.1 Grease Filling/Exchange for S-, L-, U-, R-, B-, and T-axis Speed Reducer

1. Make the posture as indicated in Fig. 5-1 “Recommended Posture of Each Axis While Injecting” to remove the plugs of the grease inlets and the grease exhaust ports. (Refer to Fig. 5-2 “Plug Position of S- and L-axis Speed Reducer”, Fig. 5-3 “Plug Position of U-axis Speed Reducer and R-, B-, and T-gear in a casing”, and Fig. 5-4 “Plug Position of R-, B-, and T-axis”.) If it is difficult to make the recommended posture because of external cabling or etc., adjust the posture as much as possible to make the position of grease inlet located in the lower part and the position of exhaust port located in the upper part. Thus, grease can be filled/exchanged more properly as the recommended posture.

*Fig. 5-1: Recommended Posture of Each Axis While Injecting*
5.3 Grease Filling/Exchange

Fig. 5-2: Plug Position of S- and L-axis Speed Reducer

- L-axis grease inlet
  - Hexagon socket head plug PT1/8

- S-axis grease exhaust port
  - Hexagon socket head plug PT1/4

Fig. 5-3: Plug Position of U-axis Speed Reducer and R-, B-, and T-gear in a casing

- R-, B-, T-gear inside the casing grease exhaust port
  - Hexagon socket head plug PT3/8

- U-axis grease inlet
  - Hexagon socket head plug PT1/8

Fig. 5-4: Plug Position of R-, B-, and T-axis

- B-, T-axis grease exhaust port
  - Hexagon socket head plug PT1/8

- R-axis grease inlet
  - Hexagon socket head plug PT1/8

- R-, T-axis grease exhaust port
  - Hexagon socket head plug PT3/8
2. Install the grease zerk to the grease inlet. (Refer to Fig. 5-2 “Plug Position of S- and L-axis Speed Reducer”, Fig. 5-3 “Plug Position of U-axis Speed Reducer and R-, B-, and T-gear in a casing”, and Fig. 5-4 “Plug Position of R-, B-, and T-axis”.) (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
   - Recommended grease lubricator: Powerlube P3C by Macnaught
   - Grease injection rate: 7 g/s or less
     When the grease is discharged at 2 times/s from the lubricator, set the discharge amount as 3.5 g/time or less. (Rough standard)
   - Air supply pressure of grease pump: 0.3 MPa or less
     (Rough standard)
   - Grease injection rate (Rough standard):
     Refer to Table 5-2 “Amount of Grease to Inject (as a guide only)”.

Table 5-2: Amount of Grease to Inject (as a guide only)

<table>
<thead>
<tr>
<th>Grease filling/exchanging point</th>
<th>Amount of Grease to Inject (as a guide only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>4350 g</td>
</tr>
<tr>
<td>L-axis</td>
<td>2180 g</td>
</tr>
<tr>
<td>U-axis</td>
<td>2180 g</td>
</tr>
<tr>
<td>R/B/T-gear in the casing</td>
<td>2260 g</td>
</tr>
<tr>
<td>R-axis</td>
<td>1910 g</td>
</tr>
<tr>
<td>B/T-axis</td>
<td>1130 g</td>
</tr>
</tbody>
</table>

[When replacing the speed reducer]

4-A. Stop injection when grease appears from the grease exhaust port.
   * For injecting grease to the L-axis, U-axis, gear in the casing, R-axis, and B/T-axis, proceed to the step 5.
   * For injecting the grease to the S-axis, proceed to the step 8.

[When replacing the grease]

4-B. The grease is discharged from the grease exhaust port. At this time, stop injection when the mixture of the used grease and the new grease in an equal ratio is seen.
   * For injecting the grease to the L-axis, U-axis, R/B/T-gear in the casing, R-axis, and B/T-axis, proceed to the step 7.
   * For injecting the grease to the S-axis, proceed to the step 8.

5. Perform the teaching operation for each axis indicated in Table 5-3 “Teaching Operation of Each Axis” approximately five times.
5 Grease Replenishment and Exchange
5.3 Grease Filling/Exchange

6. Inject the grease again. When the grease is overflowed from the grease exhaust port, injection is completed.

7. Discharge the specified amount of grease from the grease inlet or exhaust port (Refer to Table 5-4 “Amount of Grease Discharged from Each Axis”). In order to exhaust the specified amount of grease, discharge the grease into a container, and measure it with a weighing scale each time.

Use one of the following methods to discharge the grease.

Discharging method 1: Extruding the grease by air injected from the exhaust port.
- Connect the joint and the hose to the grease inlet.
- Connect the regulator to the grease exhaust port.
- Extrude the grease by injecting the air from the exhaust port.
  (Extrusion air pressure: 0.025 MPa or less)

If the grease is not discharged enough by extruding air, operate the manipulator again as shown in Table 5-3 “Teaching Operation of Each Axis”.

Discharging method 2: Sucking out the grease from the exhaust port.
- Leave the inlet open and insert the tube into the exhaust port.
- Discharge the grease by suction using the tube.
  (Suction pressure: 0.025 MPa or less)

If the grease is not discharged enough by suction, operate the manipulator again as shown in Table 5-3

---

**Table 5-3: Teaching Operation of Each Axis**

<table>
<thead>
<tr>
<th>Grease filling/exchanging point</th>
<th>Operation angle at teaching operation</th>
<th>Teaching speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-axis</td>
<td>L-axis ±45°</td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>U-axis ±45°</td>
<td></td>
</tr>
<tr>
<td>R/B/T-gear in the casing, R-axis, and B/T-axis</td>
<td>R-axis ±90°</td>
<td>Arbitrary</td>
</tr>
<tr>
<td></td>
<td>T-axis ±45°</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-axis ±90°</td>
<td></td>
</tr>
</tbody>
</table>

---

**Table 5-4: Amount of Grease Discharged from Each Axis**

<table>
<thead>
<tr>
<th>Grease filling/exchanging point</th>
<th>Amount of exhausted grease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[g]</td>
</tr>
<tr>
<td>S-axis</td>
<td>0 [Unnecessary]</td>
</tr>
<tr>
<td>L-axis</td>
<td>240±30</td>
</tr>
<tr>
<td>U-axis</td>
<td>295±40</td>
</tr>
<tr>
<td>R/B/T-gear in the casing, R-axis, and B/T-axis</td>
<td>115±15</td>
</tr>
<tr>
<td>R-axis</td>
<td>95±10</td>
</tr>
<tr>
<td>B/T-axis</td>
<td>55±5</td>
</tr>
</tbody>
</table>
8. For the point where the grease is filled/exchanged, perform a playback operation indicated in Table 5-5 “Running-in Operation of Each Axis” for running-in the speed reducer with the grease. At this time, in case the grease is discharged during the operation, remove the grease zerk from the grease inlet, clean and degrease the thread part and the tap part of the plug. And then, apply ThreeBond 1206C to the thread part of the plug to mount the plug to the grease inlet. Tighten the plug with the tightening torque indicated in Table 5-6 “Plug Type and Tightening Torque of Each Axis”. Also, discharge the excess grease not to increase the inner pressure of the speed reducer. Attach a bag to collect grease such as indicated in Fig. 5-5 “Grease Receiving Bag (Rough Standard)”, and then perform the running-in operation.

**Table 5-5: Running-in Operation of Each Axis**

<table>
<thead>
<tr>
<th>Grease filling/exchanging point</th>
<th>Operation angle</th>
<th>Operation speed</th>
<th>Timer after each operation</th>
<th>Operation time</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>S-axis ±90°</td>
<td>MOVJ VJ= 50.00</td>
<td>1.0s</td>
<td>15 minutes</td>
</tr>
<tr>
<td>L-axis</td>
<td>L-axis ±45°</td>
<td>MOVJ VJ= 50.00</td>
<td>1.0s</td>
<td>15 minutes</td>
</tr>
<tr>
<td>U-axis</td>
<td>U-axis ±45°</td>
<td>MOVJ VJ= 50.00</td>
<td>1.0s</td>
<td>15 minutes</td>
</tr>
<tr>
<td>R-, B-, and T-gear in the casing</td>
<td>R-axis ±90°</td>
<td>MOVJ VJ= 50.00</td>
<td>1.0s</td>
<td>15 minutes</td>
</tr>
<tr>
<td>R-, B-, and T-axis</td>
<td>B-axis ±45°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-axis ±90°</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 5-6: Plug Type and Tightening Torque of Each Axis**

<table>
<thead>
<tr>
<th>Grease filling/exchanging point</th>
<th>Plug for grease inlet</th>
<th>Plug type</th>
<th>Tightening torque</th>
<th>Plug type</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td></td>
<td>PT1/4</td>
<td>12.0 N•m (1.2 kgf•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-axis</td>
<td></td>
<td>PT1/8</td>
<td>4.9 N•m (0.5 kgf•m)</td>
<td>PT1/8</td>
<td>4.9 N•m (0.5 kgf•m)</td>
</tr>
<tr>
<td>U-axis</td>
<td></td>
<td>PT1/4</td>
<td>12.0 N•m (1.2 kgf•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-, B-, and T-gear in the casing</td>
<td></td>
<td>PT1/8</td>
<td>4.9 N•m (0.5 kgf•m)</td>
<td>PT1/8</td>
<td>4.9 N•m (0.5 kgf•m)</td>
</tr>
</tbody>
</table>
9. Wipe the discharged grease using a waste cloth. After cleaning and degreasing the thread part and the tap part of the plug, apply ThreeBond 1206C to the thread part of the plug. Mount the plug to the grease exhaust port, and tighten it with the tightening torque indicated in Table 5-6 “Plug Type and Tightening Torque of Each Axis”.

---

**Fig. 5-5: Grease Receiving Bag (Rough Standard)**

Grease receiving bag
Cut one corner to remove air.
To prevent grease from scattering from the cut corner, cover the receiving bag with a plastic bag etc. without being sealed.

Bond for fixing a grease receiving bag

Tube (inside dia.: 6 mm or more)

Union (inside dia.: 6 mm or more)
PT3/8 or PT1/8
5.3.2 Grease Replenishment for Gas Balancer Link Part

Fig. 5-6: Gas Balancer Link Part

1. Remove the plugs from the grease inlet and from the grease exhaust port of the link ① and ②.

2. Inject grease through the grease inlet of the link ① and ② using a grease gun.
   - Grease type: Alvania EP Grease 2
   - Amount of grease: to the link ①: 8 cc (30 cc for 1st supply) to the link ②: 8 cc (30 cc for 1st supply)

3. Wipe the discharged grease with a cloth at the grease exhaust port and reinstall the plug to the exhaust port of the link ① and ②. Apply ThreeBond 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. Reinstall the plug to the grease inlet of the link ① and ②. Apply ThreeBond 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).
6 Gas Maintenance Procedure in the Gas Balancer

6.1 Notes on Gas in the Gas Balancer Maintenance Procedure

Be sure to read the following precautions thoroughly and understand the contents before performing gas inspections or discharging/injecting gas. Failure to observe this may cause malfunctions of the gas balancer or occurrence of accidents or injury.

**DANGER**

- This gas balancer uses high-pressure nitrogen gas.
- Do not inject other gas than nitrogen gas to this gas balancer. Failure to observe this may cause malfunctions of the gas balancer or occurrence of accidents or injury.
- There is a possibility of suffocation accident in the high-density nitrogen gas environment. For this reason, enough ventilation is required when performing the operations.
- Before inspecting the gas pressure in the gas balancer or discharging/filling the gas from/into the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed so that it will not rotate. Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.

**CAUTION**

When handling high-pressure gas, sufficient caution and observing of the related laws and local government regulations are required.

**NOTE**

To maintain the sealing performance, small quantity of oil used may leak from the bottom part of the gas balancer.
6.2 Gas Pressure Inspection

6.2.1 Adequate Gas Pressure

Adequate nitrogen gas pressure in the gas balancer varies depending on the temperature. Refer to Table 6-1 “Adequate Gas Pressure per Gas Balancer Surface Temperature.”

<table>
<thead>
<tr>
<th>Gas balancer surface temperature</th>
<th>-10°</th>
<th>-5°</th>
<th>0°</th>
<th>5°</th>
<th>10°</th>
<th>15°</th>
<th>20°</th>
<th>25°</th>
<th>30°</th>
<th>35°</th>
<th>40°</th>
<th>45°</th>
<th>50°</th>
<th>55°</th>
<th>60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate gas pressure (MPa)</td>
<td>10.5</td>
<td>10.8</td>
<td>11.1</td>
<td>11.4</td>
<td>11.6</td>
<td>11.9</td>
<td>12.2</td>
<td>12.4</td>
<td>12.7</td>
<td>13.0</td>
<td>13.2</td>
<td>13.5</td>
<td>13.8</td>
<td>14.1</td>
<td>14.4</td>
</tr>
</tbody>
</table>

Fig. 6-1: Adequate Gas Pressure per Gas Balancer Surface Temperature

6.2.2 Necessary Devices

Prepare following devices when checking the gas pressure.

- Digital service gauge: YSDSG-1
- Quick connector: T2-770-G1/8
- Thermometer (for measuring the gas balancer surface)
6.2 Gas Pressure Inspection

6.2.3 Inspection Procedures

**DANGER**

Before inspecting the gas pressure in the gas balancer or discharging/filling the gas from/into the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed so that it will not rotate. Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.

1. Move the manipulator to the home position and turn OFF the power supply of the DX200.
2. Remove the cover and the hexagon socket head screw plug with flange, which are mounted to the gas inlet, and insert the quick connector.
3. Connect the digital service gauge to the quick connector.
4. Check the temperature of the gas balancer surface.
5. Check that the pressure indicated on the digital service gauge is satisfying the value shown in the Table 6-1 “Adequate Gas Pressure per gas Balancer Surface Temperature” on page 6-2. Depending on the value, procedures after this are subject to change.
   - **Case 1:** When the value is exceeding the adequate value
     → Discharge the gas till the value satisfies the adequate value.
     (Refer to section 6.3 “Gas Discharging Procedures” on page 6-5)
   - **Case 2:** When the value is lower than the adequate value by 0.5 MPa or more.
     → Inject the gas till the value satisfies the adequate value.
     (Refer to section 6.4 “Gas Injecting Procedure” on page 6-7.)
   - Other than Case 1 and 2:
     → Proceed to Step 5
6. Disconnect the digital service gauge from the quick connector.
7. Remove the quick connector and mount the cover, then tighten the hexagon socket head screw plug with flange by using a tightening torque of 4.9 N•m (0.5 kgf•m).
8. Mount the cover and tighten the hexagon socket head cap screws M4 (length: 6mm) with a tightening torque of 2.8 N•m (0.29 kgf•m.)
9. Turn ON the power supply of the DX200.
6.2 Gas Pressure Inspection

**Fig. 6-2: Gas in Gas Balancer Pressure Inspection**

- **Gas inlet/gas exhaust port**
- **Hexagon socket head cap screw M4 (length: 6 mm) (2 pieces)**
- **Conical spring washer 2H-4 (2 pieces)**
- **Cover (HW1405134-1)**
- **Surface temperature measuring point**
- **Lever (A part)**

Measure on the surface of the gas balancer after removing the cover.

**A part**
Enlarged figure
6.3 Gas Discharging Procedures

### MANDATORY

- Discharge all gas from the gas balancer in the following cases.
  - When dismounting the gas balancer from the manipulator.
  - When air-flight the gas balancer.
  (It is treated as a hazardous material when the gas balancer is air-flight with gas filled.)

6.3.1 Necessary Devices

Prepare following devices when discharging gas

- Digital service gauge: YSDSG-1
- Quick connector : T2-770-G1/8
- Thermometer (for measuring the gas balancer surface)

6.3.2 Gas Discharging Procedure

### DANGER

Before discharging/filling the gas from/into the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed so that it will not rotate. Failure to observe this may cause very dangerous situation. Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.

### MANDATORY

When discharging the gas, the valve of service gauge must not be fully open. Take time and discharge the gas little by little. If the valve of service gauge is fully open with high internal pressure, the non-return valve in the gas balancer may be damaged.

6.3.2.1 When Discharging All Gas

1. Move the manipulator to the home position and turn OFF the power supply of the DX200.
2. Remove the cover and the hexagon socket head screw plug M6 with flange, which are mounted to the gas inlet, and insert the quick connector.
3. Connect the digital service gauge to the quick connector.
4. Discharge gas by releasing the valve of the digital service gauge.
5. Disconnect the digital service gauge from the quick connector.
6. Remove the quick connector and mount the cover, then tighten the hexagon socket head screw plug M6 with flange by using a tightening torque of 4.9 N•m (0.5 kgf•m).
7. Mount the cover and tighten the hexagon socket head cap screws M4 (length: 6mm) with a tightening torque of 2.8 N•m (0.29 kgf•m.)
8. Turn ON the power supply of the DX200.
6.3.2.2 When Discharging Gas for Adjusting Pressure

1. Move the manipulator to the home position and turn OFF the power supply of the DX200.
2. Remove the cover and the hexagon socket head screw plug M6 with flange, which are mounted to the gas inlet, and insert the quick connector.
3. Connect the digital service gauge to the quick connector.
4. Check the temperature of the gas balancer surface.
5. Discharge gas by releasing the valve of the digital service gauge till the gas pressure satisfies the value shown in the Table 6-1 "Adequate Gas Pressure per gas Balancer Surface Temperature" on page 6-2.

**NOTE**

After discharging/injecting gas, wait for a few minutes to stabilize the gas pressure, and then measure the gas pressure.

6. Disconnect the digital service gauge from the quick connector.
7. Remove the quick connector and mount the cover, then tighten the hexagon socket head screw plug M6 with flange by using a tightening torque of 4.9 N•m (0.5 kgf•m).
8. Mount the cover and tighten the hexagon socket head cap screws M4 (length: 6mm) with a tightening torque of 2.8 N•m (0.29 kgf•m.)
9. Turn ON the power supply of the DX200.

Fig. 6-3: Gas Discharging Operation
6.4 Gas Injecting Procedure

6.4.1 Necessary Devices

Prepare following devices when injecting gas:
- Nitrogen gas cylinder
- Gas injecting device: Prepare an appropriate device for the gas container used at each area. For the details, contact your Yaskawa representative.
- Digital service gauge: YSDSG-1
- Quick connector: T2-770-G1/8
- Thermometer (for measuring the gas balancer surface)

6.4.2 Gas Injecting Procedures

---

**DANGER**

Before discharging/filling the gas from/into the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed so that it will not rotate. Failure to observe this may cause very dangerous situation. Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.

---

1. Move the manipulator to the home position and turn OFF the power supply of the DX200.
2. Remove the cover and the hexagon socket head screw plug M6 with flange, which are mounted to the gas inlet, and insert the quick connector.
3. Connect the digital service gauge to the quick connector.
4. Check the temperature of the gas balancer surface.
5. Connect the injecting device to the nitrogen gas cylinder.
6. Connect the digital service gauge with the injecting device.
7. Release the gas cylinder valve after confirming that the releasing valve of both injecting device and digital service gauge are firmly closed.
8. By rotating the injecting device regulator handle, set the gas pressure slightly higher than the adequate pressure shown in Table 6-1 “Adequate Gas Pressure per gas Balancer Surface Temperature” on page 6-2.
9. Release the injecting device releasing valve bit by bit to inject gas till the gas pressure indicated by the digital service shows a little bit higher pressure than the adequate pressure shown in Table 6-1 “Adequate Gas Pressure per gas Balancer Surface Temperature” on page 6-2.
6.4 Gas Injecting Procedure

10. Wait for a few minutes to stabilize the gas pressure, then confirm that the gas pressure finally reached the adequate pressure shown in Table 6-1 “Adequate Gas Pressure per Gas Balancer Surface Temperature” on page 6-2. If the pressure is higher than the adequate pressure, discharge the gas gradually and stabilize the gas pressure, then confirm that the gas pressure finally reached the adequate value.

**NOTE**
After discharging/injecting gas, wait for a few minutes to stabilize the gas pressure, and then measure the gas pressure.

11. Close the nitrogen gas cylinder valve.

12. Disconnect the digital service gauge from the quick connector.

13. Remove the quick connector and mount the cover, then tighten the hexagon socket head screw plug M6 with flange by using a tightening torque of 4.9 N•m (0.5 kgf•m).

14. Mount the cover and tighten the hexagon socket head cap screws M4 (length: 6mm) with a tightening torque of 2.8 N•m (0.29 kgf•m.).

15. Release the injecting device releasing valve and regulator, and then discharge the gas in the hose.

16. Disconnect the injecting device from the nitrogen gas cylinder.

17. Turn ON the power supply of the DX200.

*Fig. 6-4: Gas Injecting Operation*
7 Removing, Applying, Assembling of Sealing Bond

7.1 Removing Sealing Bond from Sealing Surface and Cleaning

1. Remove the sealing bond of the sealing surface of the manipulator on which the speed reducer or the motor was mounted with using a spatula etc.

2. In order to remove dust, dirt, foreign objects, and oil, wipe whole surface of the speed reducer or motor for replacement using a waste cloth. (Refer to Fig. 7-1 “Wiping Whole Surface of Speed Reducer”.) If not wiping whole surface of the speed reducer, the rust preventive oil adhered to the speed reducer gradually flows out to the outside of the manipulator, and a phenomenon considered as oil leakage occurs (mis-recognition as oil leakage).

3. Saturate a clean cloth with the degreasing and cleaning agent, and sufficiently degrease the sealing surface of the manipulator side and the sealing surface of the speed reducer or the motor to be replaced.

**NOTE**

Do not pour the degreasing and cleaning agent directly to the sealing surface. When the agent remains inside and at the concave part of the speed reducer, the sealing bond would no be solidified and this may cause grease leakage.

Fig. 7-1: Wiping Whole Surface of Speed Reducer
7.2 Applying Sealing Bond to Sealing Surface

1. Check that the degreasing and cleaning agent of the sealing surface is dried. (Refer to Fig. 7-2 “Checking the Dryness”.) If not dried, wipe the agent with a new cloth. (Refer to the fig. Fig. 7-3 “Wiping the Agent”.) For the part where wiping cannot be performed such as the concave part, use air to blow off.

2. Apply sealing bond (ThreeBond 1206C) to the sealing surface.

The points to apply sealing bond depend on the axes. When applying sealing bond, make sure to refer to chapter 8 “Disassembly and Reassembly of Motors” and chapter 9 “Disassembly and Reassembly of Speed Reducer” of each axis.

Fig. 7-2: Checking the Dryness

Fig. 7-3: Wiping the Agent
7.3 Assembling After Applying Sealing Bond

1. After applying sealing bond, pay attention to the following and immediately perform assembling.
   - Remove any dust, dirt, foreign objects, and oil on the sealing surface.
   - Align the screw hole positions etc. before applying the sealing bond, and then contact the surfaces. Without this procedure, unevenness of the sealing bond on the sealing surface may decline the sealing efficiency. And it may cause grease leakage.
   - The rust preventive oil is applied inside of the speed reducer. Immediately perform assembling so that the rust preventive oil does not flow out to the sealing surface.

2. After assembling, fix them with screws as soon as possible. For tightening the screws, tighten them with the tightening torque indicated in chapter 8 “Disassembly and Reassembly of Motors” and chapter 9 “Disassembly and Reassembly of Speed Reducer”.

3. With a waste cloth, wipe the exceeded sealing bond after assembling. (Refer to Fig. 7-4 “Wiping Stray Sealing Bond”.)

   **NOTE**
   If grease is filled before the sealing bond is solidified, it may cause the grease leakage. After tightening the screws, leave it 30 minutes or more, and then fill it with grease.

Fig. 7-4: Wiping Stray Sealing Bond (Following Photos are Typical Example)
8 Disassembly and Reassembly of Motors

8.1 Disassembly and Reassembly of S-Axis Motor

- Refer to chapter 3 “Home Position Return”, chapter 5 “Grease Replenishment and Exchange”, chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Remove the connector (encoder, brake, power) connected to the S-axis motor.
   When disconnecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.
3. Remove the hexagon socket head cap screws, and the hexagon socket head plug, and insert the stud bolts M6 (length: 50 mm or more) into 2 tapped holes for the motor on the motor-flange face. As a rough standard, screw the stud bolts into the tapped holes so that the clearance between the motor and the matching surface is 30 mm or more.
4. Install 2 eyebolts to the thread part M8 (2 places) of the motor. Use the eyebolts to remove the S-axis motor and the spacer vertically from the S head.
5. Remove the GT-SA bolts from the spacer and insert the stud bolts M6 (length: 50 mm or more) into 2 tapped holes M6. As a rough standard, screw the stud bolts into the tapped holes so that the clearance between the motor and the matching surface is 5 mm or more.
6. Remove the hexagon socket head cap screw. Remove the unit [the input gear, the retaining ring, the bearing, the flywheel, and the key].
7. Remove the spacer form the S-axis motor.
8.1 Disassembly and Reassembly of S-Axis Motor

1. Mount the key 4 to the S-axis motor 1. (The key 4 is delivered with the S-axis motor 1.)

2. Before installing the S-axis motor 1 to the spacer 5, apply sealing bond (ThreeBond 1206C) to the matching surface between them. For the points to apply sealing bond, refer to Fig. 8-1(b) “Surface to Apply Sealing Bond on the Part of S-axis Motor Part”.

3. Tighten the GT-SA bolts 9 with the tightening torque shown in Table 8-1 “S-Axis Motor Parts Checklist” on page 8-2.

4. Mount the input gear 3 and the flywheel 7 to the S-axis motor 1 and the spacer 5.

5. Tighten the hexagon socket head cap screw 6 (Loctite 243 applied on the thread part) with the tightening torque shown in Table 8-1 “S-Axis Motor Parts Checklist” on page 8-2.

6. Before installing the S head to the spacer 5, apply sealing bond (ThreeBond 1206C) to the matching surface between them. For the points to apply sealing bond, refer to Fig. 8-1(c) “Surface to Apply Sealing Bond on the Part of S-axis Space Part”.

7. Tighten the hexagon socket head cap screws 2 with the tightening torque shown in Table 8-1 “S-Axis Motor Parts Checklist” on page 8-2.

8. Connect the internal wiring harness connectors (encoder, brake, power) to the S-axis motor 1. When connecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.

9. Replenish grease (Molywhite RE No.00) from the grease inlet. (Refer to chapter 5 “Grease Replenishment and Exchange”.)

10. Turn ON the DX200 power supply.

---

**Table 8-1: S-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>S-axis motor HW0388670-A</td>
<td>1</td>
<td>SGMRV-37ANA-YR1*</td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M12 (length: 60 mm) Conical spring washer 2H-12</td>
<td>4 each</td>
<td>Tightening torque: 84.0 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Input gear HW1303369-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Key</td>
<td>1</td>
<td>Delivered with the S-axis motor 1</td>
</tr>
<tr>
<td>5</td>
<td>Spacer HW1303371-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hexagon socket head cap screw M8 (length: 70 mm) Conical spring washer 2H-8</td>
<td>1 each</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
<tr>
<td>7</td>
<td>Flywheel HW1404226-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hexagon socket head plug PT3/8 <em>Stainless</em></td>
<td>1</td>
<td>Tightening torque: 23.0 N•m</td>
</tr>
<tr>
<td>9</td>
<td>GT-SA bolts M6 (length: 30 mm)</td>
<td>2</td>
<td>Tightening torque: 10 N•m</td>
</tr>
</tbody>
</table>
8 Disassembly and Reassembly of Motors
8.1 Disassembly and Reassembly of S-Axis Motor

Fig. 8-1(a): Assembling View of S-Axis (Disassembly and Reassembly of Motors)

Fig. 8-1(b): Surface to Apply Sealing Bond on the Part of S-axis Motor Part

Apply sealing bond evenly to whole surface.
8 Disassembly and Reassembly of Motors
8.1 Disassembly and Reassembly of S-Axis Motor

Fig. 8-1(c): Surface to Apply Sealing Bond on the Part of S-axis Space Part

Apply sealing bond evenly to whole surface.
8 Disassembly and Reassembly of Motors
8.2 Disassembly and Reassembly of L-Axis Motor

**DANGER**

- Execute disassembly and reassembly of the L-axis motor after mounting the L-axis fixing jig on the balancer. Also, be sure to confirm that the L-axis is firmly fixed by releasing the L-axis motor brake.

Failure to observe this leads unexpected L-arm rotation at the moment when the L-axis motor is removed and it may result in damage to machinery or death or serious injury.

- Refer to chapter 4 “L-Axis Fixing Jig” in this manual on how to fix the balancer.

- Refer to Fig. 8-2(a) “Assembling View of L-axis (Disassembly and Reassembly of Motors)”, Table 8-2 “L-Axis Motor Parts Checklist”

- Refer to chapter 4 “L-Axis Fixing Jig” in this manual on how to fix the balancer.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Support the U-arm with a chain block, etc.
3. Attach the L-axis fixing jig and fix it firmly to avoid the L-arm from rotating. (Refer to chapter 4 “L-Axis Fixing Jig”)
4. Remove the connectors (encoder, brake, power) connected to the L-axis motor. When disconnecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.
5. Confirm that the DX200 power supply is OFF, and disconnect the cables (encoder, brake cables, and power) of the L-axis motor with the internal wiring harness.
6. Install the brake releasing devices, and release the brake.
7. Before removing L-axis motor, confirm again that the L-arm is firmly supported by L-axis fixing jig to avoid the L-arm from rotating.
8. Remove the GT-SA bolts and the hexagon socket head plug, and insert the stud bolts M6 (length: 30 mm or more) into 4 tapped holes M6 on the motor-flange face. As a rough standard, screw the stud bolts into the tapped holes so that the clearance between the motor and the matching surface is 5 mm or more.

**CAUTION**

When removing the motor of the L-arm, a lot of grease comes out from the outlet of the motor. Make sure to protect peripheral equipment in advance.
9. Remove the L-axis motor 1 from the S-head in a horizontally position. Be careful not to damage the oil seal in the S-head when removing the L-axis motor 1.

10. Remove the hexagon socket head plug 3, then remove the input gear 3, shaft 7, shaft 8, and the key 4.

### Reassembly

For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 8 “Disassembly and Reassembly of Motors”.

1. Mount the key 4 on the L-axis motor 1. (The key 4 comes with the L-axis motor 1.)

2. Before mounting the shaft 8 to the L-axis motor 1, apply sealing bond ThreeBond 1206C to the contact surface of them. For the points to apply sealing bond, refer to “Surface to apply sealing bond 1” in Fig. 8-2(b) “Surface to Apply Sealing Bond on the Part on L-axis Motor Part”

3. Tighten the hexagon socket head bolt 5 (Loctite 243 applied on the thread part) with the tightening torque shown in Table 8-2 “L-Axis Motor Parts Checklist” on page 8-7.

4. Before installing the L-axis motor 1 to the S-head, apply sealing bond ThreeBond 1206C to the contact surface of them. At this time, be careful not to damage the oil seal inside the S-head. For the points to apply sealing bond, refer to “Surface to apply sealing bond 2” in Fig. 8-2(b) “Surface to Apply Sealing Bond on the Part on L-axis Motor Part”

5. Tighten the GT-SA bolts 2 with the tightening torque shown in Table 8-2 “L-Axis Motor Parts Checklist” on page 8-7.

6. Connect the internal wiring harness connectors (encoder, brake, power) to the L-axis motor 1. When connecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.

7. Remove the L-axis fixing jig. (Refer to chapter 4 “L-Axis Fixing Jig” on page 4-1)

8. Remove the chain block.

9. Replenish grease (Molywhite RE No.00) from the grease inlet. (Refer to chapter 5 “Grease Replenishment and Exchange”)

10. Turn ON the DX200 power supply.
Table 8-2: L-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>L-axis motor HW0388670-A</td>
<td>1</td>
<td>SGMRV-37ANA-YR1*</td>
</tr>
<tr>
<td>2</td>
<td>GT-SA bolt M12 (length: 35 mm)</td>
<td>4</td>
<td>Tightening torque: 84.0 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Input gear HW1303887-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Key</td>
<td>1</td>
<td>Delivered with the L-axis motor</td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M8</td>
<td>1</td>
<td>Tightening torque: 40 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 145 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hexagon socket head plug PT3/8</td>
<td>1</td>
<td>Tightening torque: 23.0 N•m</td>
</tr>
<tr>
<td></td>
<td><em>Stainless</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Shaft HW1404554-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Shaft HW1303630-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 8-2(a): Assembling View of L-axis (Disassembly and Reassembly of Motors)
8 Disassembly and Reassembly of Motors
8.2 Disassembly and Reassembly of L-Axis Motor

Fig. 8-2(b): Surface to Apply Sealing Bond on the Part on L-axis Motor Part

Apply sealing bond evenly to whole surface.

Surface to apply sealing bond 1

Apply sealing bond evenly to whole surface.

Surface to apply sealing bond 2
8.3 Disassembly and Reassembly of U-Axis Motor

- Refer to Fig. 8-3(a) “Assembling View of U-axis (Disassembly and Reassembly of Motors)”, Table 8-3 “U-Axis Motor Parts Checklist”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Remove the connectors (encoder, brake, power) connected to the U-axis motor. When disconnecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.
3. For fall protection, hold the U-arm by using a chain block, etc. before removing the U-axis motor.
4. Release the brake.
5. Remove the hexagon socket head cap screws, and insert the stud bolts M6 (length: 30 mm or more) into 4 tapped holes M6 on the motor-flange face. As a rough standard, screw the stud bolts into the tapped holes so that the clearance between the motor and the matching surface is 5 mm or more.
6. Remove the U-axis motor vertically from the casing. At this time, be careful not to damage the oil seal inside the casing.

**CAUTION**

When removing the motor of the L-arm, a lot of grease comes out from the casing. Make sure to protect peripheral equipment in advance.

7. Remove the hexagon socket head bolt, then remove the input gear, the key, the shaft and the washer.

**Reassembly**

1. Mount the key on the U-axis motor. (The key comes with the U-axis motor.)
2. Apply sealing bond ThreeBond 1206C to the contact surfaces of the shaft, the U-axis motor and the U-axis motor. And then, mount the input gear, the shaft and the washer to the U-axis motor. For the points to apply sealing bond, refer to “Surface to apply sealing bond 1” in Fig. 8-3(b) “Surface to Apply Sealing Bond on the Part of U-axis Motor Part”.
3. Tighten the hexagon socket head bolt (Loctite 243 applied on the thread part) to which the input gear is attached with the tightening torque shown in Table 8-3 “U-Axis Motor Parts Checklist” on page 8-10.

**NOTE**

For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

---

**8 Disassembly and Reassembly of Motors**

**8.3 Disassembly and Reassembly of U-Axis Motor**
4. Before installing the U-axis motor to the casing, apply sealing bond ThreeBond 1206C to the contact surface of them. For the points to apply sealing bond, refer to “Surface to apply sealing bond 2” in Fig. 8-3(b) “Surface to Apply Sealing Bond on the Part of U-axis Motor Part”

5. Tighten the GT-SA bolts with the tightening torque shown in Table 8-3 “U-Axis Motor Parts Checklist” on page 8-10.

6. Connect the internal wiring harness connectors (encoder, brake, power) to the U-axis motor. When connecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.

7. Replenish grease (Molywhite RE No.00) from the grease inlet. (Refer to chapter 5 “Grease Replenishment and Exchange”.)

8. Turn ON the DX200 power supply.

Table 8-3: 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 HW0388670-A</td>
<td>1</td>
<td>SGMRV-37ANA-YR1*</td>
</tr>
<tr>
<td>2</td>
<td>GT-SA bolt M12 (length: 35 mm)</td>
<td>4</td>
<td>Tightening torque: 84.0 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Input gear HW1303890-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Key</td>
<td>1</td>
<td>Delivered with the U-axis motor</td>
</tr>
<tr>
<td>5</td>
<td>Shaft HW9482306-E</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Shaft HW9481343-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Washer HW0408806-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hexagon socket head cap screw HW0481083-A</td>
<td>1 each</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
</tbody>
</table>
8 Disassembly and Reassembly of Motors
8.3 Disassembly and Reassembly of U-Axis Motor

Fig. 8-3(a): Assembling View of U-axis (Disassembly and Reassembly of Motors)

Fig. 8-3(b): Surface to Apply Sealing Bond on the Part of U-axis Motor Part
8.4 Disassembly and Reassembly of R-, B-, T-Axis Motor

- Refer to Fig. 8-4(a) “Assembling View of R-, B-, T-axis (Disassembly and Reassembly of Motors”, Table 8-4 “R-, B-, T-Axis Motor Parts Checklist”.

**Disassembly**

1. Turn OFF the DX200 power supply.

2. Remove the connectors (encoder, brake, power) connected to the R-, B-, T-axis motor.
   When disconnecting the connector for power, nip the connector on the cable side with using a pair of plastic pliers, etc. to remove it.

3. Before removing R-, B-, T-axis motor support the U-arm with a chain block, etc. to avoid the U-arm from rotating.

4. Release the brake.

5. Remove the GT-SA bolts, and insert the stud bolts M4 (length: 20 mm or more) into 2 tapped holes M4 on the motor-flange face. As a rough standard, screw the stud bolts into the tapped holes so that the clearance between the motor and the contact surface is 6 mm or more.

6. For R-axis:
   Remove the retaining ring. Remove the collar and the inner ring of bearing. Remove the hexagon socket head cap screw.
   Remove the key, the input gear and the plate from the motor.

   For B-axis:
   Remove the hexagon socket head cap screw. Remove the key, input gear, and the plate from the motor.

   For T-axis:
   Remove the hexagon socket head cap screw. Remove the key, input gear and plate from the motor.

For the removal of the key and the input gear, refer to Fig. 8-4(c) “Removal procedures of Key and Input gear”.

• Make the U-arm point downwards as much as possible at disassembly or reassembly of the R-, B-, T-axis. If the U-arm points upwards when removing the motor, a lot of grease comes out, which makes disassembly or reassembly difficult.

• Fix the wrist part with a base, etc. before removing the R-, B-, T-axis motor. Otherwise, the wrist part may rotate unexpectedly.
Disassembly and Reassembly of Motors

8.4 Disassembly and Reassembly of R-, B-, T-Axis Motor

Reassembly

For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

1. Apply sealing bond ThreeBond 1206C on the matching surface of both sides of the plate
2. Mount the key
3. For R-axis:
   Mount the input gear on the motor. Apply Loctite 243 to the threading part of the hexagon socket head cap screw and tighten it with a tightening torque of 16.5 N-m. Mount the inner ring of bearing and the collar on the input gear, and fix them with the retaining ring. When mounting the collar, the collar’s part with a larger external diameter must face to the body of the motor.
4. Before mounting the R-, B-, T-axis motor to the ceasing, apply sealing bond (ThreeBond 1206C) to the contact surfaces of each motor and the casing. For the points to apply sealing bond, refer to “Surface to apply sealing bond 2” in Fig. 8-4(b) “Surface to Apply Sealing Bond on the Part on R-, B-, and T-axis Motor Part”.
5. Apply sealing bond (ThreeBond 1206C) on the thread part of the GT-SA bolts, then tighten them with the tightening torque shown in Table 8-4 “R-, B-, T-Axis Motor Parts Checklist” on page 8-14.
6. Connect the internal wiring harness connectors (encoder, brake, power) to each R-, B-, T-axis motor. When disconnecting the connector for power, fix the connector on the cable side by using a pair of plastic pliers, etc.
7. Remove the backup battery.
8. Replenish grease (Molywhite RE No.00) from the grease inlet. (Refer to chapter 5 “Grease Replenishment and Exchange”.)
9. Turn ON the DX200 power supply.
### Table 8-4: R-, B-, 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>Motor R-, B- and T-axis HW0388933-A</td>
<td>1 for each axis</td>
<td>SGMRV-13ANA-YR1*</td>
</tr>
<tr>
<td>2</td>
<td>GT-SA bolt M8 (length: 25 mm)</td>
<td>3 for each axis</td>
<td>Tightening torque: 24.5 N·m</td>
</tr>
<tr>
<td>3</td>
<td>Key</td>
<td>1 for each axis</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Gear R-axis HW1303889-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gear B-axis HW1303377-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gear T-axis HW1303378-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M6 (length: 25 mm) Conical spring washer 2H-6</td>
<td>1 for each axis</td>
<td>Tightening torque: 16.5 N·m</td>
</tr>
<tr>
<td>6</td>
<td>Casing HW1100592-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Retaining ring ISTW-36</td>
<td>1</td>
<td>(for R-axis only)</td>
</tr>
<tr>
<td>8</td>
<td>Collar HW0402390-1</td>
<td>1</td>
<td>(for R-axis only)</td>
</tr>
<tr>
<td>9</td>
<td>Bearing TAFI405520</td>
<td>1</td>
<td>(for R-axis only)</td>
</tr>
<tr>
<td>10</td>
<td>Plate HW0401506-1</td>
<td>1</td>
<td>(for R-, B-, T-axes)</td>
</tr>
<tr>
<td>11</td>
<td>Hexagon socket head plug PT3/8 <em>Stainless</em></td>
<td>1</td>
<td>Tightening torque: 23.0 N·m</td>
</tr>
</tbody>
</table>
8 Disassembly and Reassembly of Motors

8.4 Disassembly and Reassembly of R-, B-, T-Axis Motor

Fig. 8-4(a): Assembling View of R-, B-, T-axis (Disassembly and Reassembly of Motors)

Apply sealing bond here

Fig. 8-4(b): Surface to Apply Sealing Bond on the Part on R-, B-, and T-axis Motor Part

Apply sealing bond evenly to whole surface.
**Fig. 8-4(c): Removal procedures of Key and Input gear**

* For the R-axis

1. Put the flat head screw driver into the hole of the side of the gear and tilt it in the direction of the arrow mark to make a space between the gear and the motor.

2. Put the flat head screw driver into a space between the gear and the motor, and tilt it in the direction of the arrow mark to remove the gear.
9 Disassembly and Reassembly of Speed Reducer

When disassembling and reassembling the speed reducer, the arm of the manipulator and the speed reducer should be lifted.

For the operation in a place without a ceiling crane, the following jigs are prepared.
Contact your Yaskawa representative when necessary.

Replacing the S-axis speed reducer

When disassembling the S-axis

Replacing the L-, U-axis speed reducer

When disassembling the L-axis

Refer to chapter 3 “Home Position Return”, chapter 5 “Grease Replenishment and Exchange”, chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

NOTE
9.1 Disassembly and Reassembly of S-Axis Speed Reducer

- Refer to Fig. 9-2(a) “Assembling View of L-axis (Disassembly and Reassembly of Speed Reducer)”. Table 9-2 “L-Axis Speed Reducer Parts Checklist”.

## Disassembly

1. Turn OFF the DX200 power supply.
2. Disconnect the internal wiring harness, only for the rotation part of S-axis. Refer to chapter 10 “Cable Wiring”.
3. Remove the S-axis motor ⑥ and the input gear ⑦. (Refer to section 8.1 “Disassembly and Reassembly of S-Axis Motor”.)
4. Remove the hexagon socket head cap screws ⑤, and insert the stud bolts M10 (length: 50 mm or more) into 2 tapped holes M10 on the S-head. Screw the stud bolts into the tapped holes until clearance is made between the contact surfaces of the S-head and the speed reducer ①.
5. Lift up the upper part of the manipulator including the S-head, and put it down next to the base. Be sure not to lose the pin ③.
6. Remove the hexagon socket head cap screws ②, and insert the stud bolts M12 (length: 35 mm or more) into 2 tapped holes M12 on the speed reducer ①. Screw the stud bolts into the tapped holes until clearance is made between the contact surfaces of the base and the speed reducer ①.
7. Install eye bolts diagonally to the tapped holes M16 (2 places) on the base. Use the eye bolts to remove the speed reducer ① vertically. At this time, also remove the O-ring ④.
8. Remove the pins ③ from the speed reducer ①.
9 Disassembly and Reassembly of Speed Reducer
9.1 Disassembly and Reassembly of S-Axis Speed Reducer

Reassembly

1. Apply sealing bond ThreeBond 1206C to the contact surface of the base and the speed reducer 1. For the points to apply sealing bond, refer to Fig. 9-1(b) “Surface to Apply Sealing Bond on the Part of S-Axis Speed Reducer Part”.

2. Mount the O-ring 4 to the speed reducer 1, and mount the pins 3 to the base (2 places: View B-B, C-C). While aligning the pin hole positions of the speed reducer, mount the unit [the speed reducer 1, the O-ring 4] to the base. Make sure that the O-ring 4 is not stuck between the speed reducer 1 and the base.

3. Tighten the hexagon socket head cap screws 2 with the tightening torque of 142 N•m shown in Table 9-1 “S-Axis Speed Reducer Parts Checklist”.

4. Apply sealing bond ThreeBond 1206C to the contact surface of the speed reducer 1 and the S-head. For the points to apply sealing bond, refer to “S-head side” in Fig. 9-1(b) “Surface to Apply Sealing Bond on the Part of S-axis Speed Reducer Part”.

5. Mount the S-head to the speed reducer 1. At this time, match the pin holes on the speed reducer 1 and the S-head as shown in the figure (section A-A’) below, and mount the pin 3.

6. Tighten the hexagon socket head cap screws 5 with the tightening torque of 348 N•m shown in Table 9-1 “S-Axis Speed Reducer Parts Checklist”.

7. Assemble the S-axis motor 6, and mount the S-axis motor 6 to the S-head. (Refer to section 8.1 “Disassembly and Reassembly of S-Axis Motor”.)

8. Connect the internal wiring harness. (Refer to chapter 10 “Cable Wiring”.)

Remove the hexagon socket head plugs at grease inlets and the grease exhaust ports, and then replenish grease (Molywhite RE No.00) from the grease inlets. After replenishment, mount the hexagon socket head plugs at the grease inlets and the grease exhaust ports. Refer to chapter 5 “Grease Replenishment and Exchange” (S-axis).

If the grease is filled before the sealing bond is solidified, it may cause the grease leakage. After tightening a bolt, leave it 30 minutes or more, and then fill the grease.
Disassembly and Reassembly of Speed Reducer

9.1 Disassembly and Reassembly of S-Axis Speed Reducer

Table 9-1: 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 HW0388208-B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M12</td>
<td>16</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 50 mm) Conical spring washer 2H-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Pin MSTH12-36</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>O-ring G415</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M16</td>
<td>12</td>
<td>Tightening torque: 348 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 55mm) Washer GT-SH-16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S-axis motor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Input gear HW1303369-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 9-1(a): Assembling View of S-axis (Disassembly and Reassembly of Speed Reducer)
Fig. 9-1(b): Surface to Apply Sealing Bond on the Part of S-axis Speed Reducer Part

Apply sealing bond evenly to whole surface.

S-head side

Base side
9.2 Disassembly and Reassembly of L-Axis Speed Reducer

**NOTE**
Refer to chapter 12 “Gas Balancer Replacement”.

---

**DANGER**
Make sure that the L-arm motor brake function is functioning and it is supported by a chain block, etc. to keep it from rotating before releasing gas from the gas balancer.

It is seriously dangerous in case the gas is released while the L-axis is supported only by the gas balancer, the arm may rotate after the release.

- Refer to Fig. 9-2(a) “Assembling View of L-axis (Disassembly and Reassembly of Speed Reducer)”. Table 9-2 “L-Axis Speed Reducer Parts Checklist”.

---

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Support and fix the L-arm and the upper part of the manipulator to keep the L-arm from falling off or rotating.
3. Remove the gas balancer ⑧. (Refer to chapter 12 “Gas Balancer Replacement”.)
4. Remove the L-axis motor ⑦ and the input gear ⑨. (Refer to table 8-2(a) “Assembling View of L-axis (Disassembly and Reassembly of Motors)”.)
5. Remove the hexagon socket head cap screws ⑤, then insert the stud bolts M12 (length: 75 mm or more) into 2 tapped holes M12 on the L-arm ⑥. Screw the stud bolts into the tapped holes until clearance is made between the contact surfaces of the L-arm ⑥ the speed reducer ①.
6. Remove the L-arm ⑥ from the speed reducer ①.
7. Remove the hexagon socket head cap screws ② and ③, and insert the stud bolts M12 (length: 35 mm or more) into 2 tapped holes M12 on the S-head. Screw the stud bolts into the tapped holes until clearance is made between the contact surfaces of the S-head and the speed reducer ①.
8. Install the jig diagonally to the tapped holes M12 (2 places) on the speed reducer ①. Use the jig to remove the speed reducer ① to a horizontal level. At this time, also remove the O-ring ⑦.
Reassembly

For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

1. Mount the O-ring ④ on the speed reducer ①.
2. Apply sealing bond ThreeBond 1206C to the contact surface of the S-head and the speed reducer ①. For the points to apply sealing bond, refer to “S-head side” in Fig. 9-1(b) “Surface to Apply Sealing Bond on the Part of S-axis Speed Reducer Part”
3. Mount the speed reducer ① to the S-head. Tighten the hexagon socket head cap screws ② with the tightening torque of 348 N•m, and tighten the hexagon socket head cap screws ③ with the tightening torque of 142 N•m shown in Table 9-2 “L-Axis Speed Reducer Parts Checklist”.
4. Apply sealing bond ThreeBond 1206C to the contact surface of the speed reducer ① and the L-arm. For the points to apply sealing bond, refer to “L-arm side” in Fig. 9-1(b) “Surface to Apply Sealing Bond on the Part of S-axis Speed Reducer Part”.
5. Mount the O-ring ④ on the speed reducer ①, and then mount the L-arm ⑥ to the speed reducer ①. When mount the O-ring ④, make sure that the O-ring ④ is not stuck between the speed reducer ① and the L-arm ⑥. Tighten the hexagon socket head cap screws ⑤ with the tightening torque of 142 N•m shown in Table 9-2 “L-Axis Speed Reducer Parts Checklist”.
6. Assembly the L-axis motor ⑦, and mount the L-axis motor ⑦ to the S-head. (Refer to section 8.2 “Disassembly and Reassembly of L-Axis Motor”.)
7. Remove the hexagon socket head plugs at grease inlets and the grease exhaust ports, and then replenish grease (Molywhite RE No.00) from the grease inlets. After replenishment, mount the hexagon socket head plugs at the grease inlets and the grease exhaust ports. Refer to chapter 5 “Grease Replenishment and Exchange”(L-axis).

If the grease is filled before the sealing bond is solidified, it may cause the grease leakage. After tightening a bolt, leave it 30 minutes or more, and then fill the grease.

8. Reinstall the gas balancer ⑧. (Refer to chapter 12 “Gas Balancer Replacement”.)
9. Turn ON the DX200 power supply.
9 Disassembly and Reassembly of Speed Reducer

9.2 Disassembly and Reassembly of L-Axis Speed Reducer

Table 9-2: 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 HW1382455-C</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M16 (length: 35 mm)</td>
<td>6 each</td>
<td>Tightening torque: 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>Hexagon socket head cap screw M12 (length: 30 mm)</td>
<td>23 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>4</td>
<td>O-ring AS(ARP)568-275</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M12 (length: 75 mm)</td>
<td>25 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>6</td>
<td>L-arm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>L-axis motor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Gas balancer HW1382567-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Input gear HW1304057-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 9-2(a): Assembling View of L-axis (Disassembly and Reassembly of Speed Reducer)
9.2 Disassembly and Reassembly of L-Axis Speed Reducer

Fig. 9-2(b): Surface to Apply Sealing Bond on the Part of L-axis Speed Reducer Part

Apply sealing bond evenly from the edge surface of sealing bond contacting part to the border line for applying sealing bond without any break.
9.3 Disassembly and Reassembly of U-Axis Speed Reducer

- Refer to Fig. 9-3(a) "Assembling View of U-axis (Disassembly and Reassembly of Speed Reducer)", Table 9-3 “U-Axis Speed Reducer Parts Checklist”.

1. Turn OFF the DX200 power supply.

2. For fall protection, hold the U-arm unit by using a chain block, etc. before removing the U-axis motor.

3. Remove the U-axis motor and input gear. (Refer to section 7.3 “Assembling After Applying Sealing Bond”.)

4. Remove the hexagon socket head cap screws, and insert the stud bolts M8 (length: 45 mm or more) into 2 tapped holes M8 on the L-arm. Screw the stud bolts into the tapped holes until clearance is made between the matching surfaces of the L-arm and the speed reducer.

5. Remove the U-arm unit from the manipulator main body.

6. Remove the hexagon socket head cap screws, and insert the stud bolts M8 (length: 55 mm or more) into 3 tapped holes M8 on the speed reducer. Screw the stud bolts into the tapped holes until clearance is made between the matching surfaces of the casing and the speed reducer.

7. Install eyebolts diagonally to the tapped holes M12 (2 places) on the speed reducer. Use the eyebolts to remove the speed reducer vertically. At this time, also remove the O-ring.
Reassembly

1. Mount the O-ring ⑤ on the speed reducer ①.

2. Apply sealing bond (ThreeBond 1206C) to the contact surface of the speed reducer ① and the L-arm unit ④. For the points to apply sealing bond, refer to “Casing side” in Fig. 9-3(b) “Surface to Apply Sealing Bond on the Part of U-axis Speed Reducer Part”.

3. Mount the speed reducer ① on the U-arm unit ④, and tighten the hexagon socket head bolts ⑦ with the tightening torque shown in Table 9-3 “U-Axis Speed Reducer Parts Checklist”. Make sure that the O-ring ⑤ is not stuck between the speed reducer ① and the U-arm unit ④.

4. Apply sealing bond (ThreeBond 1206C) to the contact surface of the speed reducer ① and the L-arm which is at the main body side and tighten the hexagon socket head cap screws ② and ③ with the tightening torque shown in Table 9-3 “U-Axis Speed Reducer Parts Checklist”. For the points to apply sealing bond to the L-arm, refer to Fig. 9-3(c) “Surface to Apply Sealing Bond Between U-axis Speed Reducer and L-arm (L-arm Side)”.

5. Mount the input gear ⑧ to the U-axis motor ⑤. (Be sure to replace the input gear ⑧ whenever the speed reducer is replaced. Refer to section 8.3 “Disassembly and Reassembly of U-Axis Motor”).

6. Reinstall the U-axis motor ⑤. (Refer to section 8.3 “Disassembly and Reassembly of U-Axis Motor”).

7. Remove the hexagon socket head plugs at grease inlets and the grease exhaust ports, and then replenish grease (Molywhite RE No.00) from the grease inlets. After replenishment, mount the hexagon socket head plugs at the grease inlets and the grease exhaust ports. Refer to chapter 5 “Grease Replenishment and Exchange” (U-axis).

8. Turn ON the DX200 power supply.

NOTE: If the grease is filled before the sealing bond is solidified, it may cause the grease leakage. After tightening a bolt, leave it 30 minutes or more, and then fill the grease.
## Table 9-3: 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 HW0388209-F</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: 348 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 35 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hexagon socket head cap screw M10</td>
<td>18</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 25 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>U-arm unit</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>O-ring G270</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>U-axis motor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hexagon socket head cap screw M12</td>
<td>16</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 55mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer SW-2H-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hexagon socket head cap screw HW0481083-A</td>
<td>1</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
<tr>
<td></td>
<td>Retaining ring ISTW-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Washer HW0408806-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Shaft HW9481343-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Shaft HW9482306-E</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 9-3(a): Assembling View of U-axis (Disassembly and Reassembly of Speed Reducer)
9 Disassembly and Reassembly of Speed Reducer

9.3 Disassembly and Reassembly of U-Axis Speed Reducer

**Fig. 9-3(b): Surface to Apply Sealing Bond on the Part of U-axis Speed Reducer Part**

Especially for the part A, apply sealing bond evenly without any break.

**Fig. 9-3(c): Surface to Apply Sealing Bond Between U-axis Speed Reducer and L-arm (L-arm Side)**

Apply in the bead shape

Bead cross-section

(indicated in the figure, the bead height should be 1 mm, and the width 3 mm.)
9.4 Disassembly and Reassembly of R-Axis Speed Reducer

- Refer to Fig. 9-4(a) “Assembling View of R-axis (Disassembly and Reassembly of Speed Reducer)”, Table 9-4 “R-Axis Speed Reducer Parts Checklist”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Remove the wrist unit (4) from the speed reducer (1). (Refer to chapter 11 “Disassembly and Reassembly of Wrist Unit”.)
3. Remove the hexagon socket head cap screws (2), and insert the stud bolts M10 (length: 30 mm or more) into 2 tapped holes M8 on the speed reducer (1). Screw the stud bolts into the tapped holes until clearance is made between the matching surfaces of the U-arm (5) and the speed reducer (1).
4. Remove the speed reducer (1) from the U-arm (5).

**Reassembly**

- For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

1. Mount the pin (7) to the speed reducer (1).
2. Before mounting the U-arm (3) on the speed reducer (1), apply sealing bond (Threebond 1206C) to the contact surface of them. Tighten the hexagon socket head cap screw (2) with the tightening torque shown in Table 9-4 “R-Axis Speed Reducer Parts Checklist” on page 9-16.
3. Apply sealing bond ThreeBond 1206C to the contact surface of the wrist unit (4) and the speed reducer (1). For the points to apply sealing bond, refer to "Wrist base side" in Fig. 9-4(b).
4. Mount the O-ring (6) on the wrist unit (4), and then mount the wrist unit (4) on the speed reducer (1). Refer to chapter 11 “Disassembly and Reassembly of Wrist Unit”. Make sure that the O-ring (6) is not stuck between the speed reducer (1) and the wrist unit (4). Tighten the hexagon socket head cap screws (3) with the tightening torque shown in Table 9-4 “R-Axis Speed Reducer Parts Checklist” on page 9-16.
5. Tighten the hexagon socket head cap screws (3) with the tightening torque shown in Table 9-4 “R-Axis Speed Reducer Parts Checklist”.
6. Remove the hexagon socket head plugs at grease inlets and the grease exhaust ports, and then replenish grease (Molywhite RE No.00) from the grease inlets. After replenishment, mount the hexagon socket head plugs at the grease inlets and the grease exhaust ports. Refer to chapter 5 “Grease Replenishment and Exchange” (R-axis).
7. Turn ON the DX200 power supply.
9 Disassembly and Reassembly of Speed Reducer

9.4 Disassembly and Reassembly of R-Axis Speed Reducer

Table 9-4: 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 HW0386260-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head bolt M8 (length: 95 mm) Conical spring washer 2H-8</td>
<td>16 each</td>
<td>Tightening torque: 82.0 N•m</td>
</tr>
<tr>
<td>3</td>
<td>Hexagon socket head bolt M12 (length: 35 mm) Conical spring washer 2H-12</td>
<td>8 each</td>
<td>Tightening torque: 142 N•m</td>
</tr>
<tr>
<td>4</td>
<td>Wrist unit HW1171565-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>U-arm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>O-ring G110</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pin MSTH6-15</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 9-4(a): Assembling View of R-axis (Disassembly and Reassembly of Speed Reducer)

Fig. 9-4(b): Surface to Apply Sealing Bond on the Part of R-axis Speed Reducer Part.

Install so that the tap M5 of the speed reducer comes to this position.

Apply sealing bond evenly to whole surface.

Wristbase side

U-arm side
9.5 Disassembly and Reassembly of B-Axis Speed Reducer

- Refer to Fig. 9-5(a) “Assembling View of B-axis (Disassembly and Reassembly of Speed Reducer)”, Table 9-5 “B-Axis Speed Reducer Parts Checklist”.

### Disassembly

1. Turn OFF the DX200 power supply.
2. Remove the hexagon socket head cap screws ③, and remove the cover ②.
3. Before removing the speed reducer ①, fix the B-axis so that it does not rotate when removing the speed reducer ①.
4. Remove the hexagon socket head cap screws ④ ⑤ ⑥ ⑦, and insert the stud bolts M10 (length: 25 mm or more) into 2 tapped holes M10 on the speed reducer ①. Screw the stud bolts into the tapped holes until clearance is made between the matching surfaces of the wrist ⑩ and the speed reducer ①.
5. Remove the speed reducer ①, shim ⑧, gear ⑨, and bearing ⑪ altogether from the wrist ⑩.
6. Remove the hexagon socket head cap screws ⑦, and remove the shim ⑧, gear ⑨, and the bearing ⑪ from the speed reducer ①.

### Reassembly

1. Adjust the shims before mounting the gear ⑨.
2. Mount the bearing ⑪, shim ⑧, and gear ⑨ on the speed reducer ①, then tighten the hexagon socket head cap screws ⑦ with the tightening torque shown in Table 9-5 “B-Axis Speed Reducer Parts Checklist” on page 9-18.
3. Apply sealing bond (ThreeBond 1206C) to the contact surface of the speed reducer ① and the wrist ⑩, and tighten the hexagon socket head cap screws ④ ⑤ ⑥ ⑦ with the tightening torque shown in Table 9-5 “B-Axis Speed Reducer Parts Checklist” on page 9-18. For the points to apply sealing bond, refer to “Wrist base side” in Fig. 9-5(b) “Disassembly and Reassembly of B-Axis Speed Reducer (Shim Adjustment)”.
4. Before mounting the cover ② on the wrist ⑩, apply sealing bond (ThreeBond 1206C) to the contact surface of them. For the points to apply sealing bond, refer to “Speed reducer side” in Fig. 9-5(b).
5. Mount the O-ring ③ on the speed reducer ①.
6. Tighten the hexagon socket head bolts ③ with the tightening torque shown in Table 9-5 “B-Axis Speed Reducer Parts Checklist” on page 9-18.

For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

**NOTE**
7. Remove the hexagon socket head plugs at grease inlets and the grease exhaust ports, and then replenish grease (Molywhite RE No.00) from the grease inlets. After replenishment, mount the hexagon socket head plugs at the grease inlets and the grease exhaust ports. Refer to chapter 5 “Grease Replenishment and Exchange” (B-axis).

If the grease is filled before the sealing bond is solidified, it may cause the grease leakage. After tightening a bolt, leave it 30 minutes or more, and then fill the grease.

8. Turn ON the DX200 power supply.

Table 9-5: 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 HW9380961-G</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cover HW0300889-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hexagon socket head bolt M6 (length: 25 mm) Conical spring washer 2H-6</td>
<td>6 each</td>
<td>Tightening torque: 13.75 N•m</td>
</tr>
<tr>
<td>4</td>
<td>Hexagon socket head bolt M8 (length: 40 mm) Conical spring washer 2H-8</td>
<td>14 each</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
<tr>
<td>5</td>
<td>O-ring ARP568-263</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hexagon socket head bolt M8 (length: 20 mm) Conical spring washer 2H-8</td>
<td>16 each</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
<tr>
<td>7</td>
<td>Hexagon socket head bolt M8 (length: 20 mm) Conical spring washer 2H-8</td>
<td>3 each</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
<tr>
<td>8</td>
<td>Shim HW0401517</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Gear HW0301231-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Wrist HW1100594-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Bearing 6009 C-type retaining ring STW-45</td>
<td>1 each</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Hexagon socket head bolt M8 (length: 85 mm) Conical spring washer 2H-8</td>
<td>6 each</td>
<td>Tightening torque: 40.0 N•m</td>
</tr>
</tbody>
</table>
Fig. 9-5(a): Assembling View of B-axis (Disassembly and Reassembly of Speed Reducer)
Shim adjustment:
When installing the gear 9, measure the space indicated with "★★ ★" mark, and decide a shim to meet the dimensions in this figure.

Apply sealing bond evenly from the edge surface of sealing bond contacting part to the border line for applying sealing bond without any break.

Apply sealing bond evenly to whole surface.
Disassembly and Reassembly of T-Axis Speed Reducer

• Refer to Fig. 9-6(a) “Assembling View of T-axis (Disassembly and Reassembly of Speed Reducer)”, Table 9-6 “T-Axis Speed Reducer Parts Checklist”.

- Disassembly
  1. Turn OFF the DX200 power supply.
  2. Remove the hexagon socket head cap screws, and remove the flange.
  3. Remove the hexagon socket head cap screws, and insert the stud bolts M8 (length: 20 mm or more) into 2 tapped holes M8 on the speed reducer. Screw the stud bolts into the tapped holes until clearance is made between the matching surfaces of the wrist and the speed reducer.
  4. Remove the speed reducer, gear and shim altogether from the wrist.
  5. Remove the fine U-nut. Remove the gear, shim and washer from the speed reducer.

- Reassembly

  ![NOTE]

  For removing/applying of sealing bond and assembling after applying sealing bond, refer to chapter 7 “Removing, Applying, Assembling of Sealing Bond”.

  1. Adjust the shim before mounting the gear.
  2. Mount the gear, shim and washer on the speed reducer, and tighten the fine U-nut (Loctite 243 applied on the thread part) with the tightening torque shown in Table 9-6 “T-Axis Speed Reducer Parts Checklist” on page 9-22.
  3. Apply sealing bond ThreeBond 1206C to the contact surface of the speed reducer and the wrist, and tighten the hexagon socket head cap screws with the tightening torque shown in Table 9-6 “T-Axis Speed Reducer Parts Checklist” on page 9-22. For the points to apply sealing bond, refer to “Wrist side of the speed reducer” in Fig. 9-6(b) “Surface to Apply Sealing Bond on the Part of T-axis Speed Reducer Part”.
  4. Apply sealing bond ThreeBond 1206C to the contact surfaces between the speed reducer and the flange. Then, mount the flange on the speed reducer. For the points to apply sealing bond, refer to “Flange side” in Fig. 9-6(b) “Surface to Apply Sealing Bond on the Part of T-axis Speed Reducer Part”.
  5. Tighten the hexagon socket head cap screws with the tightening torque shown in Table 9-6 “T-Axis Speed Reducer Parts Checklist” on page 9-22.
6. Remove the hexagon socket head plugs at grease inlets and the grease exhaust ports, and then replenish grease (Molywhite RE No.00) from the grease inlets. After replenishment, mount the hexagon socket head plugs at the grease inlets and the grease exhaust ports. Refer to chapter 5 “Grease Replenishment and Exchange” (T-axis)

![NOTE]

If the grease is filled before the sealing bond is solidified, it may cause the grease leakage. After tightening a bolt, leave it 30 minutes or more, and then fill the grease.

7. Turn ON the DX200 power supply.

Table 9-6: 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 HW0389174-C</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M8 (length: 15 mm)</td>
<td>14</td>
<td>Tightening torque: 40 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td>each</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Flange HW1303903-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hexagon socket head cap screw M4 (length: 40 mm)</td>
<td>14</td>
<td>Tightening torque: 226 N•m</td>
</tr>
<tr>
<td></td>
<td>GT-SH washer M14</td>
<td>each</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Gear HW0301227-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Shim HW0406766-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
| 7   | Fine U-nut FU00SC                                         | 1    | Tightening torque: 17.6 N•m
|     | Delivered with the speed reducer(1)                       |      |                                            |
| 8   | Washer                                                    | 1    | Delivered with the speed reducer(1)        |
| 9   | Wrist HW1100594-1                                         | 1    |                                            |
**9.6 Disassembly and Reassembly of T-Axis Speed Reducer**

*Fig. 9-6(a): Assembling View of T-axis (Disassembly and Reassembly of Speed Reducer)*

Apply sealing bond here

Shim adjustment:
When installing the gear 5, decide a shim to meet the dimensions as shown in this figure.

*Fig. 9-6(b): Surface to Apply Sealing Bond on the Part of T-axis Speed Reducer Part*

Apply sealing bond evenly to whole surface.

Wrist side of speed reducer

Flange side
10.1 Cable Disconnection

1. Remove the GT-SA bolt M6 (four bolts) (length: 15 mm) attached to the side face of U-arm, and remove the cover.

2. Remove the pan-head sems screw M3 (four screws) (length: 16 mm) and the pan-head sems screw M4 (two screws) (length: 16 mm), then remove the connector.

3. Remove the air horse connected to the back side of union from the cover.

Before disconnecting the connector of the internal wiring harness which is connected to the motor, install the backup battery to all motors to prevent the absolute data from disappearing. (Refer to chapter 2 “Notes for Maintenance.”)
4. Attach the battery for backup to each motor of U-, R-, B-, T-axes. Then disconnect the internal wiring harness connected to each motor.
5. Cut off cable ties and remove the GT-SA bolts M5 (two bolts) (length: 12 mm) and remove the plate.
6. Attach the backup battery to each motor of S- and L-axes, and disconnect the internal wiring harness of each motor. Then cut off the cable ties T120S (six pieces) on the S head, and remove the GT-SA bolt M5 (two bolts) (length: 16 mm) and remove the plate.

7. Remove the cross head APS bolts (10 bolts) which are fixing the connector base, and pull the connector base little bit and disconnect the tube which is connected to the back side of the grease inlet. Be careful so that grease doesn’t leak from the tube.
10 Cable Wiring
10.1 Cable Disconnection

8. Pull the connector base more and remove the GT-SA bolts M6 (four bolts) (length: 15 mm), then remove the support from the connector base.

9. Remove the pan-head sems screw M4 (two bolts) (length: 16 mm) attached to the connector base and remove the S1 connector. Disconnect the internal wiring harnesses connected to the back side of 1BC connector and the 2BC connector.

10. Remove the hexagon socket head cap screw M6 (13 screws) (length: 12 mm), then remove the ground wirings.

11. Remove the GT-SA bolt M6 (two bolts) (length: 15 mm) and remove the plate.

12. Detach the connectors [X], [S], [L], [U], [R], [B], [T], and [7] from the connector base box, and remove the internal wiring harness from the S-head. Make sure again that the backup battery is attached to the motor before detaching the connectors.
10.1 Cable Disconnection

**Plastic Cover Detail View**
- T30L (cable tie) (2 pieces)
- X.S.L.U.R.B.T (Universal MATE-N-LOK connectors)
- Waterproof tape
- HW9404942-A (plastic cover)

**Connect to the tube for greasing (KQ2L10-01S)**

**S1 Connector Detail View**
- Nut M4 (2 nuts) (stainless)
- HW9481087-E (Gasket)
- Pan-head screw M4 (2 screws) (length: 16 mm) (stainless)

**CD-42 (Saddle)**
- GT-SA bolt M6 (2 bolts) (length: 15 mm)
- Washer M6 (stainless)
- Tightening torque: 10 N·m (1.0 kgf·m)

**Hexagon socket head cap screw M6**
- (length: 12 mm)
- Conical spring washer 2H-6

**GT-SA bolt M6 (4 bolts) (length: 15 mm)**
- Tightening torque: 10 N·m (1.0 kgf·m)
10.2 Cable Connection

1. Pass the internal wiring harness through the top of the S head.

2. Connect the connectors [X], [S], [L], [U], [R], [B], [T], and [7] in the connector base box, then wrap the connectors with waterproof tape surely so that no water can come into the connectors.

3. Earth the ground wirings with the hexagon socket head cap screw M6 (13 screws) (length: 12 mm).

4. Attach the saddle CD42 to the support and fix it with the GT-SA bolt M6 (two bolts) (length: 15 mm).

5. Attach the plastic cover around the internal wiring harness, then attach the S1 connector to the connector base and fix it with the pan-head sems screw M4 (two bolts) (length: 16 mm). Connect the grease horse, the 1BC connector, and the 2BC connector to the back side of the connector base. The 1BC connectors are 1, 2, 3, 4, 5, and 6 from the top to the bottom. The 2BC connectors are A, B, C, D, E, and F from the bottom to the top.

6. Attach the cross head APS bolts M6 (10 bolts) (length: 10 mm), then install the connector base to the manipulator main body.

7. Install the internal wiring harness to the plate in the S-head, then fix with the GT-SA bolt M5 (two bolts) (length: 16 mm) and fix the internal wiring harness with cable ties (six pieces) on the white marked part.

8. Set the protection tubing alongside the L-arm. At this time, make the Velcro tape part of the protection tubing toward the L-arm.

   • Protective tubing type: MTK-50FR
Protective tubing direction of Velcro tape

Keep the Velcro fastened as shown between B2 and B3.

Protective tubing description

Velcro of protective tubing

L-arm

B3

B2
9. Connect the internal wiring harness to S- and L-axes motors, and fix the internal wiring harness around the S-head with cable ties T120S (six pieces).

10. Install the plate between B2 and B3 of L-arm, then fix the internal wiring harness.

11. Pass the internal wiring harness through the upper part of U-arm, and fix with cable ties T120S (four pieces).

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

13. Install the connector to the cover, and fix with the pan-head sems screw M3 (four screws) (length:16 mm) and the pan-head sems screw M4 (two screws) (length:16 mm). Attach the connector key so that the position of the key comes to the top. Connect the ground wiring as shown in the figure below.

14. Connect the air line to the union from the back side of the cover.

15. Install the cover to the side face of the U-arm and tighten with the GT-SA bolt M6 (four bolts) (length:15 mm).

16. Remove the backup battery attached to all motors, then install the cover.
11 Disassembly and Reassembly of Wrist Unit

- Refer to Fig. 11-1 “Disassembly and Reassembly of Wrist Unit” on page 11-2.

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

### Disassembly

1. Make the wrist vertical to the U-arm (refer to Fig. 11-1 “Disassembly and Reassembly of Wrist Unit” on page 11-2). Then, turn OFF the DX200 power supply.

2. Remove the hexagon socket head cap screws. Remove the wrist unit from the speed reducer by using the tapped holes on the wrist base.

### Reassembly

1. Apply sealing bond ThreeBond 1206C to the contact surface of the wrist unit and the speed reducer, then mount the wrist unit on the speed reducer. At this time, be careful not to pinch the O ring, which is delivered with the wrist unit, between the wrist unit and the speed reducer.

2. Tighten the hexagon socket head cap screws with the tightening torque shown in Table 11-1 “Wrist Unit Parts Checklist” on page 11-2.

3. Turn ON the DX200 power supply.
Table 11-1: 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 HW1171565-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Wrist base</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hexagon socket head cap screw M12 (length: 35 mm) Conical spring washer 2H-12</td>
<td>8 each</td>
<td>Tightening torque: 142 N·m</td>
</tr>
<tr>
<td>4</td>
<td>Speed reducer HW1382917-A</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 11-1: Disassembly and Reassembly of Wrist Unit
12 Gas Balancer Replacement

CAUTION

• Maintenance and inspection must be performed by specified personnel.

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

NOTE

• Refer to chapter 5 “Grease Replenishment and Exchange”.

• Although the gas balancer position would not deviate, create checkpoints before replacement just in case.
12.1 Replacing the Gas Balancer

Follow the instructions below when replacing the gas balancer.

**PROHIBITED**

- Do not damage the rod part of the gas balancer.
- Do not apply any horizontal forces to the rod part.
- When lifting the gas balancer, do not attach lifting jigs to the rod or to the tip of the rod part.
- Do not use the gas balancer with foreign substances at the rod part or the entry of the rod to the cylinder.

Failure to observe this may damage the sealing inside the gas balancer and this may cause the gas leakage.

**DANGER**

Be sure to discharge all the gas from the gas balancer when dismounting it from the manipulator or disassembling it. Should unscrew the fixing bolt without discharging the gas, the gas balancer rod can unexpectedly extends and may cause injury or accidents.

**DANGER**

Before disassembling the gas balancer or discharging the gas from the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed so that it will not rotate.

Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.
12 Gas Balancer Replacement

12.2 Necessary Parts

**Fig. 12-1: Notes when Replacing the Gas Balancer**

Prevent foreign substances from attaching

Rod part

Gas Balancer

### 12.2 Necessary Parts

Table 12-1: Gas Balancer 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>Gas balancer HW1382567-A</td>
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</tr>
<tr>
<td>2</td>
<td>Clevis HW1303707-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oil seal VB75956</td>
<td>1</td>
<td>Apply Alvania EP Grease 2 to its lip part</td>
</tr>
<tr>
<td>4</td>
<td>Bearing 22212EAE4</td>
<td>1</td>
<td>Fill Alvania EP Grease 2 to its inside</td>
</tr>
<tr>
<td>5</td>
<td>Retaining ring STW-60</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>B holder HW1404638-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Oil seal VB60789</td>
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<td>Apply Alvania EP Grease 2 to its lip part</td>
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<tr>
<td>8</td>
<td>O ring G105</td>
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<td></td>
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<tr>
<td>9</td>
<td>Hexagon socket head cap screw M8 (length: 20 mm) Conical spring washer 2H-8</td>
<td>6 each</td>
<td>Tightening torque: 24.5 N•m</td>
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<tr>
<td>10</td>
<td>Housing HW1404637-1</td>
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</tr>
<tr>
<td>11</td>
<td>Hexagon socket head cap screw M5 (length: 16 mm) Conical spring washer 2H-5</td>
<td>6 each</td>
<td>Tightening torque: 6.0 N•m</td>
</tr>
<tr>
<td>12</td>
<td>Support HW1303711-A</td>
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</tr>
<tr>
<td>13</td>
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<td>4 each</td>
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<tr>
<td>14</td>
<td>Spacer HW1303932-1</td>
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<td>15</td>
<td>Spacer HW1303931-1</td>
<td>1</td>
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</tr>
<tr>
<td>16</td>
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<td>4 each</td>
<td>Tightening torque: 24.5 N•m</td>
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<tr>
<td>17</td>
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<td>4 each</td>
<td>Tightening torque: 24.5 N•m</td>
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<tr>
<td>18</td>
<td>Pin MSTH6-20</td>
<td>2</td>
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<tr>
<td>19</td>
<td>Saddle CD-36</td>
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</tr>
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</table>
12 Gas Balancer Replacement

12.2 Necessary Parts

Table 12-1: Gas Balancer Parts Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>GT-SA bolt M5 (length: 16 mm)</td>
<td>4</td>
<td>Tightening torque: 6.0 N•m</td>
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<tr>
<td></td>
<td>Washer M6</td>
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<td>21</td>
<td>Spacer HW1404231-1</td>
<td>1</td>
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<tr>
<td>22</td>
<td>Cover HW1302689-1</td>
<td>1</td>
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<tr>
<td>23</td>
<td>Hexagon socket head cap screw M8</td>
<td>4</td>
<td>Tightening torque: 24.5 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 20 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hexagon socket head cap screw M8</td>
<td>4</td>
<td>Tightening torque: 24.5 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 20 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Clevis HW1303707-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Hexagon socket head cap screw M8</td>
<td>4</td>
<td>Tightening torque: 24.5 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 20 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Others:

- Chain block and wire rope (4900 N or more payload)
- Torque wrench
- Grease (Alvania EP Grease 2)
- Sealing bond (ThreeBond 1206C)
- Screws for removal

Prepare following devices when injecting gas

- Nitrogen gas cylinder
- Gas injecting device: Prepare an appropriate device for the gas container used at each area. For the details, contact your Yaskawa representative.
- Digital service gauge: YSDSG-1
- Quick connector: T2-770-G1/8
- Thermometer (for measuring the gas balancer surface)
12.3 Disassembling the Gas Balancer

DANGER

Be sure to discharge all the gas from the gas balancer when dismounting it from the manipulator or disassembling it. Should unscrew the fixing bolt without discharging the gas, the gas balancer rod can unexpectedly extends and may cause injury or accidents.

DANGER

Before disassembling the gas balancer or discharging the gas from the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed with fixing jigs so that the L-arm will not rotate.
Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.

MANDATORY

- When discharging the gas, the valve of service gauge must not be fully open. Take time and discharge the gas little by little. If the valve of service gauge is fully open with high internal pressure, the non-return valve in the gas balancer may be damaged.

Refer to Fig. 12-2 “Gas Balancer Replacing Procedures” on page 12-7.

1. Make the L-arm vertical to the ground.
2. Turn OFF the power supply of the DX200.
3. Discharge all the nitrogen gas from the gas balancer. (Refer to section 6.3 “Gas Discharging Procedures” on page 6-5.)
4. Unscrew the GT-SA bolts and remove the plate.
5. Unscrew the hexagon socket head cap screws and remove the support.
6. Unscrew the hexagon socket head cap screws and remove the cover from the spacer, then fix the cover temporarily to the cover of L-arm side with adhesive tape.
7. Unscrew the hexagon socket head cap screws and remove the spacer from the clevis.
8. Unscrew the hexagon socket head cap screws and remove the spacer from the gas balancer. At this time, apply bolts to the tapped holes M6 around the spacer and fix them with a T-handle wrench, etc. to avoid the spacer from rotating.
9. Remove the adhesive tape attached for temporary fixing, and remove the cover gently not to damage the rod.

10. Unscrew the hexagon socket head cap screws and remove the cover gently not to damage the rod.

11. Unscrew the hexagon socket head cap screws, and remove the gas balancer and the spacer from the spacer. The total weight of the gas balancer and the spacer is 18 kg. Remove them carefully.

12. Unscrew the hexagon socket head cap screws and remove the pin, and then remove the spacer from the gas balancer.
12 Gas Balancer Replacement

12.3 Disassembling the Gas Balancer

Fig. 12-2: Gas Balancer Replacing Procedures

View A (Enlarged)
View B (Enlarged)
View C (Enlarged)

D (cross-section view)

* ② is a component of ①
12.4 Reassembling the Gas Balancer

---

DANGER
Do not fill the gas to the gas balancer before mounting it on the manipulator. When the gas balancer is filled with the gas, it becomes impossible to mount the gas balancer by flexibly extending the rod or the rod can unexpectedly extends and may cause injury or accidents.

---

DANGER
Before disassembling the gas balancer or discharging the gas from the gas balancer, confirm that the L-axis motor brake is appropriately functioning and L-axis is firmly fixed with fixing jigs so that the L-arm will not rotate.
Failure to observe this may cause very dangerous situation due to releasing of the L-axis motor brake. Because the L-axis without retaining force leads the L-arm to rotate by the lengthened or shortened gas balancer.

Refer to Fig. 12-2 “Gas Balancer Replacing Procedures” on page 12-7.

1. When unpacking the gas balancer, confirm that the rod has not fallen into the cylinder and check that there is no damage on the rod.
2. Apply the spacer to the gas balancer, and tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1 “Gas Balancer Parts Checklist” on page 12-3.
3. Discharge the gas from the gas balancer. (Refer to the procedure 2 to 6 of section 6.3 “Gas Discharging Procedures” on page 6-5.) When discharging gas, operate just before installation so that the rod doesn’t fall into the cylinder. When inserting, make the visible length of the rod to half or less.
4. Mount the spacer and the gas balancer to the spacer, then tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1.
5. Mount the cover gently not to damage the rod. Then tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1.
6. Insert the cover gently not to damage the rod, and fix the cover temporarily with adhesive tape.
7. Remove the protection net delivered with the rod.
8. Apply the spacer to the gas balancer, and tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1. At this time, apply bolts to the tapped holes M6 around the spacer and fix them with a T-handle wrench, etc. to avoid the spacer from rotating.
12 Gas Balancer Replacement
12.4 Reassembling the Gas Balancer

9. Apply the spacer to the clevis, and tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1. When applying, make sure that fingers are not stuck between spacer and the clevis. Also, give attention to the phase of hole position (three places) for applying the gas balancer cover. When tightening, be careful so that the torque wrench head doesn’t touch the rod.

10. Inject nitrogen gas into the gas balancer. (Refer to section 6.4 “Gas Injecting Procedure”.)

11. Make sure the dust seal is properly mounted. If there is any space between the dust seal and the place to mount, adjust the position of the dust seal. (Refer to section 12.5 “Procedures for Mounting the Dust Seal”.)

12. Remove the adhesive tape used for temporary fixing, and apply the cover to the spacer and tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1.

13. Apply the support to the housing, and tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1.

14. Apply the plate to the support, and tighten the hexagon socket head cap screws with the tightening torque shown in Table 12-1.
12.5 Procedures for Mounting the Dust Seal

Refer to Fig. 12-3 “Procedures for Mounting the Dust seal to Gas balancer”.

1. Mount the dust seal by equally pushing the circumference of the dust seal by hand.
2. Make sure all the circumference of the dust seal is mounted to the position which is deeper than the top surface of the balancer.

*Fig. 12-3: Procedures for Mounting the Dust seal to Gas balancer*
13 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 13-1(a) “Battery Pack Location (Back View)” and Fig. 13-1(b) “Battery Pack Location (Top View)

If the battery alarm occurs in the DX200, replace the battery in accordance with the following procedure:

**Fig. 13-1(a): Battery Pack Location (Back View)**

**Fig. 13-1(b): Battery Pack Location (Top View)**
1. Turn OFF the DX200 main power supply.
2. Remove the plate from the connector base, then pull the battery pack out to replace it with a 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.
14 Parts List

14.1 S-Axis Unit

Fig. 14-1: S-Axis Unit
Table 14-1: 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>HW0388208-B</td>
<td>Speed reducer</td>
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</tr>
<tr>
<td>1002</td>
<td>SGMRV-37ANA-YR12</td>
<td>Motor</td>
<td>1</td>
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<tr>
<td>1003</td>
<td>TC12015014</td>
<td>Oil seal</td>
<td>1</td>
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<td>1004</td>
<td>STW-50</td>
<td>Retaining rings C-type</td>
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<td>1005</td>
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<td>HW1303369-1</td>
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<td>1008</td>
<td>HW1100521-1</td>
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<td>Stopper</td>
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<td>HW9404486-1</td>
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<td>KQ2L10-01S</td>
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<td>1015</td>
<td>PT3/8 (STAINLESS)</td>
<td>Hexagon socket head plug</td>
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<td>1016</td>
<td>G415</td>
<td>O ring</td>
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<td>1017</td>
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<td>M12X50</td>
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14.2 L-Axis Unit

Fig. 14-2: L-Axis Unit
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### Table 14-2: L-Axis Unit (Sheet 2 of 2)

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14 Parts List
14.3 URBT-Axes Unit

14.3 URBT-Axes Unit

Fig. 14-3: URBT-Axes Unit
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14.4 U-Arm Unit

Fig. 14-4: U-Arm Unit
Table 14-4: U-Arm Unit

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14.5 Wrist Unit

Fig. 14-5: Wrist Unit
Table 14-5: Wrist Unit (Sheet 1 of 2)

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