MOTOMAN-ES200D INSTRUCTIONS

TYPE: YR-ES0200D-A00 (STANDARD SPECIFICATION)
YR-ES0200D-A01 (SLU-AXES WITH LIMIT SWITCHES)

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN-ES200D INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR’S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator’s manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 155977-1CD
Revision: 7
This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-ES200D for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator.

General items related to safety are listed in Chapter 1: Safety of the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 Instructions before reading this manual.

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 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.
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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-ES200D.

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

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 "CAUTION" and "WARNING".
WARNING

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 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.

Figure 1: Emergency Stop Button

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

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

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

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

The emergency stop buttons are located on the right of front door of the DX100 and the programming pendant.
Definition of Terms Used In this Manual

The MOTOMAN is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows:

<table>
<thead>
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<th>Manual Designation</th>
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<tr>
<td>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 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>

CAUTION

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

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

• Read and understand the Explanation of Warning Labels in the DX100 Instructions before operating the manipulator:
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.

Figure 3: Warning Label Locations

```plaintext
Nameplate:

WARNING Label A:

WARNING Label B:

WARNING Label B

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Customer Support Information

If you need assistance with any aspect of your ES200D system, please contact Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

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

techsupport@motoman.com

When using e-mail to contact Motoman 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 Motoman Customer Support at the telephone number shown above.

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

- System: ES200D
- Primary Application: 
- Controller: DX100
- 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 DX100 controller data plate
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<td>Grease Replenishment</td>
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<td>Grease Exchange for R-Axis Speed Reducer</td>
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<td>Grease Exchange for B-Axis Speed Reducer</td>
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<td>Grease Exchange for T-Axis Speed Reducer</td>
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1 Product Confirmation

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

Standard delivery includes the following four items (information for the content of optional goods are given separately):

- Manipulator
- DX100
- Programming pendant
- Manipulator cables (3 cables between the DX100 and the Manipulator)

**CAUTION**

- Confirm that the manipulator and the DX100 have the same order number. Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform as expected and cause injury or damage.
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the DX100. The order number is located on a label as shown below.

*Fig. 1-1: Location of Order Number Labels*

(a) DX100 (Front View)  (b) Manipulator (Side View)
2 Transport

2.1 Transport Method

**CAUTION**

- Sling applications and crane or forklift operations must be performed by authorized personnel only. Failure to observe this caution may result in injury or damage.
- Avoid excessive vibration or shock during transport. The system consists of precision components. Failure to observe this caution may adversely affect performances.

**NOTE**

- The weight of the manipulator is approximately 1130 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- Shipping bolts and brackets are designed to support the manipulator weight. Do not use them for anything other than transporting the manipulator.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2.1.1 Using a Crane

As a rule, the manipulator should be lifted by a crane with four wire ropes when removing it from the package and moving it. Be sure that the manipulator is fixed with the shipping bolts and brackets before transport, and lift it in the posture as shown in Fig. 2-1 “Transporting Position”.

Fig. 2-1: Transporting Position

<table>
<thead>
<tr>
<th>Axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
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<tbody>
<tr>
<td>Angle</td>
<td>0°</td>
<td>-60°</td>
<td>-63.9°</td>
<td>0°</td>
<td>-86.1°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>-176014</td>
<td>-156393</td>
<td>0</td>
<td>-195054</td>
<td>0</td>
</tr>
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*When equipped with external cabling, those settings are subject to change depending on the specifications.*
2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets at position A and with the hexagon socket head cap screws at point B. (Fig. 2-1 “Transporting Position” on page 2-2).

Fig. 2-2: Shipping Bolts and Brackets

- The A-shipping brackets are painted in yellow.
- The B-shipping bolt: hexagon socket head cap screw is taped in yellow.

<table>
<thead>
<tr>
<th>Position</th>
<th>Bolt Type</th>
<th>Pcs</th>
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<tbody>
<tr>
<td>A</td>
<td>Hexagon socket head cap screw M20 X 70 mm</td>
<td>12</td>
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<tr>
<td>B</td>
<td>Hexagon socket head cap screw M16 X 20 mm</td>
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</tbody>
</table>

Before turning ON the power, check to be sure that the shipping bolts and brackets are removed. The shipping bolts and brackets then must be stored for future use, in the event that the manipulator must be moved again.
3 Installation

WARNING

• Install the safeguarding.
Failure to observe this warning may result in injury or damage.

• Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, safeguarding, or controller.
Failure to observe this warning may result in injury or damage.

• Do not start the manipulator or even turn ON the power before it is firmly anchored.
The manipulator may overturn and cause injury or damage.

CAUTION

• Do not install or operate the manipulator that is damaged or lacks parts.
Failure to observe this caution may cause injury or damage.

• Before turning ON the power, check to be sure that the shipping bolts and brackets explained in Fig. 2-2 “Shipping Bolts and Brackets” on page 2-3 are removed.
Failure to observe this caution may result in damage to the driving parts.
3.1 Safeguarding Installation

To insure safety, be sure to install Safeguarding. It prevents unforeseen accidents with personnel and damage to equipment. Refer to the quoted clause for your information and guidance.

Responsibility for Safeguarding (ISO10218)

The user of a manipulator or robot system shall ensure that safeguards are provided and used in accordance with Sections 6, 7, and 8 of this standard. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

3.2 Mounting Procedures for Manipulator Base

The manipulator should be firmly mounted on a baseplate or foundation strong enough to support the manipulator and withstand repulsion forces during acceleration and deceleration.

Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator referring to Table 3-1 "Maximum Repulsion Forces of the Manipulator at Emergency Stop" and Table 3-2 "Endurance Torque in Operation".

A baseplate flatness must be kept at 0.5 mm or less; insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities. Mount the manipulator base as instructed in section 3.2.1 "Mounting Example".

<table>
<thead>
<tr>
<th>Table 3-1: Maximum Repulsion Forces of the Manipulator at Emergency Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque in horizontal rotation (S-axis moving direction)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Maximum torque in vertical rotation (L-, U-axes moving direction)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3-2: Endurance Torque in Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurance torque in horizontal operation (S-axis moving direction)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Endurance torque in vertical operation (L-, U-axes moving direction)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
3.2.1 Mounting Example

For the first process, anchor the baseplate firmly to the ground. The baseplate should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommend to prepare a baseplate of 50 mm or more thick, and anchor bolts of M20 or larger size.

The manipulator base is tapped for eight mounting holes; securely fix the manipulator base to the baseplate with eight hexagon head bolts M20 (80 mm long is recommended). Next, fix the manipulator base to the baseplate. Tighten the hexagon head bolts and anchor bolts firmly so that they will not work loose during the operation.

Refer to Fig. 3-1 “Mounting the Manipulator on Baseplate” on page 3-3.

Fig. 3-1: Mounting the Manipulator on Baseplate

3.3 Location

When installing a manipulator, it is necessary to satisfy the following environmental conditions:

- Ambient temperature: 0°C to + 45°C
- Humidity: 20 to 80%RH (no-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration
  (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5 mm or less
4  Wiring

4.1  Grounding

Follow electrical installation standards and wiring regulations for grounding. A ground wire of 5.5 mm² or more is recommended. Refer to Fig. 4-1 “Grounding Method” on page 4-2 to connect the ground line directly to the manipulator.

**WARNING**

- Ground resistance must be 100 Ω or less.
- Before wiring, make sure to turn the primary power supply off, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

**CAUTION**

- Wiring must be performed by authorized or certified personnel.
- Do not cover the cable or allow it to tangle. Keep the cable as straight as possible.

**NOTE**

- Never use this line sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with electrical installation standards.
4.2 Cable Connection

Three manipulator cables are delivered with the manipulator; an encoder cable for detection (1BC) and two power cables (2BC and 3BC). (Refer to Fig. 4-2 "Manipulator Cables" on page 4-3.)

• with electrical installation standards.

Connect these cables to the manipulator base connectors and to the DX100. Refer to Fig. 4-3(a) "Manipulator Cable Connectors (Manipulator Side)" on page 4-4 and Fig. 4-3(b) "Manipulator Cable Connection (DX100 Side)" on page 4-4.

4.2.1 Connection to the Manipulator

Before connecting three cables to the manipulator, verify the numbers on both manipulator cables and the connectors on the connector base of the manipulator. When connecting, adjust the cable connector positions to the main key positions of the manipulator, and insert cables in the order of 2BC, 1 BC, then 3BC. After inserting the cables, depress the lever until it clicks.

4.2.2 Connection to the DX100

Before connecting cables to the DX100, verify the numbers on both manipulator cables and the connectors on the DX100. When connecting, insert the cables in the order of X21, X22, then X11, and depress each lever low until it clicks.
4 Wiring
4.2 Cable Connection

Fig. 4-2: Manipulator Cables

The DX100 Side

The Manipulator Side

Encoder Cable

Power Cable

Power Cable
4. Wiring
4.2 Cable Connection

Fig. 4-3(a): Manipulator Cable Connectors (Manipulator Side)

Fig. 4-3(b): Manipulator Cable Connection (DX100 Side)
## 5 Basic Specifications

### 5.1 Basic Specifications

**Table 5-1: Basic Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Spot Welding</td>
</tr>
<tr>
<td>Structure</td>
<td>Vertically Articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>200 kg</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.2 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
</tr>
<tr>
<td>S-Axis (turning)</td>
<td>-180° - +180°</td>
</tr>
<tr>
<td>L-Axis (lower arm)</td>
<td>-60° - +76°</td>
</tr>
<tr>
<td>U-Axis (upper arm)</td>
<td>-142.5° - +230°</td>
</tr>
<tr>
<td>R-Axis (wrist roll)</td>
<td>-360° - +360°</td>
</tr>
<tr>
<td>B-Axis (wrist pitch/yaw)</td>
<td>-125° - +125°</td>
</tr>
<tr>
<td>T-Axis (wrist twist)</td>
<td>-360° - +360°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
</tr>
<tr>
<td>S-Axis</td>
<td>1.67 rad/s, 95°/s</td>
</tr>
<tr>
<td>L-Axis</td>
<td>1.58 rad/s, 90°/s</td>
</tr>
<tr>
<td>U-Axis</td>
<td>1.67 rad/s, 95°/s</td>
</tr>
<tr>
<td>R-Axis</td>
<td>2.11 rad/s, 120°/s</td>
</tr>
<tr>
<td>B-Axis</td>
<td>2.11 rad/s, 120°/s</td>
</tr>
<tr>
<td>T-Axis</td>
<td>3.32 rad/s, 190°/s</td>
</tr>
<tr>
<td>Allowable Moment</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>1344 N•m (137 kgf•m)</td>
</tr>
<tr>
<td>B-Axis</td>
<td>1344 N•m (137 kgf•m)</td>
</tr>
<tr>
<td>T-Axis</td>
<td>715 N•m (73 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²/4)</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>143 kg•m²</td>
</tr>
<tr>
<td>B-Axis</td>
<td>143 kg•m²</td>
</tr>
<tr>
<td>T-Axis</td>
<td>80 kg•m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>1130 kg</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0° C to 45° C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH (non-condensing)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>4.9 m/s² or less (0.5 G)</td>
</tr>
<tr>
<td>Others</td>
<td>Free from corrosive gasses or liquids, or explosive gasses Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>5.0 kVA</td>
</tr>
</tbody>
</table>

1. SI units are used in this table. However, gravitational unit is used in ( ).
2. Conformed to ISO9283
3. Refer to chapter 6.1 "Allowable Wrist Load" for details on the permissible moment of inertia.
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes

5.3 Manipulator Base Dimensions

Fig. 5-2: Manipulator Base Dimensions

Units: mm

- 22 dia. (8 holes) (For fixing the manipulator)
- 20\( ^{+0.021} \) dia. (2 holes) (Pin hole for manipulator positioning)
- 16\( ^{-0.010} \) dia. (2 holes) (Pin hole for manipulator positioning)
5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Dimensions and P-Point Maximum Envelope
5.5 Alterable Operating Range

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in Table 5-2 "S-Axis Operating Range". If alteration is necessary, contact your Yaskawa representative in advance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-Axis Operating Range</td>
<td>-180° - +180° (standard)</td>
</tr>
<tr>
<td></td>
<td>*(165° - ±165°)</td>
</tr>
<tr>
<td></td>
<td>-150° - +150°</td>
</tr>
<tr>
<td></td>
<td>-135° - +135°</td>
</tr>
<tr>
<td></td>
<td>-120° - +120°</td>
</tr>
<tr>
<td></td>
<td>-105° - +105°</td>
</tr>
<tr>
<td></td>
<td>-90° - +90°</td>
</tr>
<tr>
<td></td>
<td>-75° - +75°</td>
</tr>
<tr>
<td></td>
<td>-60° - +60°</td>
</tr>
<tr>
<td></td>
<td>-45° - +45°</td>
</tr>
<tr>
<td></td>
<td>-30° - +30°</td>
</tr>
<tr>
<td></td>
<td>*(15° - ±15°)</td>
</tr>
</tbody>
</table>

* The interval between stoppers must be 60° or more.

**NOTE**

When altering the operating range to ±15° or ±165°, please contact your Yaskawa representative.
5.5.1 Components for Altering Operating Range

Arrange the components listed in Fig. 5-4 “The Components of the S-Axis Stopper”, when modifying the angle of S-axis.

1. Pin (drawing No. HW0402104-1, 1 pin)
2. Stopper (drawing No. HW0302424-2, 1 stopper)
3. Hexagon socket head cap screw M20 (length: 45 mm) (3 screws) (tightening torque: 402 N•m)
4. Flat washer M20 (3 flat washers)

Fig. 5-4: The Components of the S-Axis Stopper
5.5.2 Notes on the Mechanical Stopper Installation

- For S-Axis mechanical stopper, install the stopper (drawing No. HW0302424-2) with the pin which is used bottom up (drawing No. HW0402104-1) as in Fig. 5-4 “The Components of the S-Axis Stopper” on page 5-5.

- DO NOT forget to apply the locktite 242 to the thread part of pin before inserting it into the stopper.

- Mount the stopper to the S-head with three hexagon head screws M20 (length: 45 mm) and tighten the screws to the tightening torque of 402 N•m (tensile strength: 1200 N/mm² or more). The stopper is to be installed as shown in the Fig. 5-4 “The Components of the S-Axis Stopper” on page 5-5 when the operating range is ±180°.

- The stopper can be installed by every 15 degree pitch, however, to avoid the mechanical troubles caused by interference between stoppers (e.g. ±15°, ±165°), install the S-axis mechanical stopper referring to Table 5-3 “The settable angle for S-Axis Stopper” on page 5-8.

- Confirm to stabilize both sides of the protrusion with the hexagon socket head cap screws as in Fig. 5-5 “Properly-Mounted Image” on account of the limitation of strength to the unit.

- Refer to the figures: Fig. 5-6(a) to Fig. 5-6(g) as adjusting the setting angle of the S-Axis mechanical stopper. When mounting the S-Axis mechanical stopper by inverse angle to the examples in the figures: Fig. 5-6(a) to Fig. 5-6(g), settle the machinery symmetrical to those models.

- As in the figures: Fig. 5-6(a) to Fig. 5-6(g), the component is reversible that both sides of the machinery can be attached to the stopper, except for the angles of ±30, ±60, ±120, ±150 degrees. Flip side and retry installing the S-Axis mechanical stopper if finding any difficulty to set the machinery to the stopper based on Fig. 5-4 “The Components of the S-Axis Stopper” on page 5-5.

Fig. 5-5: Properly-Mounted Image

**NOTE**

1. Apply the specified components when mounting the S-Axis mechanical stopper.
2. TURN OFF the electric power supply before mounting.
5.5.3 Adjustment to the Pulse Limitation of S-Axis

Apply the Instruction for “DX100 Instructions section 8.17 Changing the Parameter Setting” (162536-1CD) as part of reference materials for adjusting the programming pendant when modifying the range of motion of S-Axis.

The limitation to the pulse (Pulse Soft Limit + 1st Axis) : SICxG400
The limitation to the pulse (Pulse Soft Limit - 1st Axis) : SICxG408

<table>
<thead>
<tr>
<th>Degree</th>
<th>±0°</th>
<th>*(±15°)</th>
<th>±30°</th>
<th>±45°</th>
<th>±60°</th>
<th>±75°</th>
<th>±90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pulse</td>
<td>±0</td>
<td>±35840</td>
<td>±71680</td>
<td>±107520</td>
<td>±143360</td>
<td>±179200</td>
<td>±215040</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree</th>
<th>±105°</th>
<th>±120°</th>
<th>±135°</th>
<th>±150°</th>
<th>*(±165°)</th>
<th>±180° (Standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pulse</td>
<td>±250880</td>
<td>±286720</td>
<td>±322560</td>
<td>±358400</td>
<td>±394240</td>
<td>±430080</td>
</tr>
</tbody>
</table>

* Refer to section 5.5 “Alterable Operating Range” on page 5-4.

NOTE: Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.
Table 5-3: The settable angle for S-Axis Stopper

<table>
<thead>
<tr>
<th>Settable angle</th>
<th>Non settable angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>165</td>
</tr>
<tr>
<td>165</td>
<td>150</td>
</tr>
<tr>
<td>150</td>
<td>135</td>
</tr>
<tr>
<td>135</td>
<td>120</td>
</tr>
<tr>
<td>120</td>
<td>105</td>
</tr>
<tr>
<td>105</td>
<td>90</td>
</tr>
<tr>
<td>90</td>
<td>75</td>
</tr>
<tr>
<td>75</td>
<td>60</td>
</tr>
<tr>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
</tr>
<tr>
<td>-15</td>
<td>-30</td>
</tr>
<tr>
<td>-30</td>
<td>-45</td>
</tr>
<tr>
<td>-45</td>
<td>-60</td>
</tr>
<tr>
<td>-60</td>
<td>-75</td>
</tr>
<tr>
<td>-75</td>
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</tr>
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<td>-105</td>
<td>-120</td>
</tr>
<tr>
<td>-120</td>
<td>-135</td>
</tr>
<tr>
<td>-135</td>
<td>-150</td>
</tr>
<tr>
<td>-150</td>
<td>-165</td>
</tr>
<tr>
<td>-165</td>
<td>-180</td>
</tr>
</tbody>
</table>

The Angle of S-Axis Stopper for + Direction

The Angle of S-Axis Stopper for - Direction

"Table 5-3 The settable angle for S-Axis Stopper" indicates the angle range which allows S-axis to be set for + direction and - direction angles.
5.5 Alterable Operating Range

Fig. 5-6(a): The Properly-Mounted Models for S-Axis Stopper

The stopper is reversible. Either side of the stopper can be used.

Installation at + 180°

Installation at + 165°
5 Basic Specifications
5.5 Alterable Operating Range

Fig. 5-6(b): The Properly-Mounted Models for S-Axis Stopper

The stopper is irreversible.
Only this side of the stopper can be used at this angle.

Installation at $+150^\circ$

The stopper is reversible.
Either side of the stopper can be used.

Installation at $+135^\circ$
5.5 Alterable Operating Range

The stopper is irreversible.
Only this side of the stopper can be used at this angle.

Installation at +120°

The stopper is reversible.
Either side of the stopper can be used.

Installation at +105°
5.5 Alterable Operating Range

Fig. 5-6(d): The Properly-Mounted Models for S-Axis Stopper
5.5 Alterable Operating Range

Fig. 5-6(e): The Properly-Mounted Models for S-Axis Stopper

- **Installation at + 60°**
  - The stopper is irreversible.
  - Only this side of the stopper can be used at this angle.

- **Installation at + 45°**
  - The stopper is reversible.
  - Either side of the stopper can be used.
5.5 Alterable Operating Range

Fig. 5-6(f): The Properly-Mounted Models for S-Axis Stopper

The stopper is reversible. Either side of the stopper can be used.

Installation at +30°

Fig. 5-6(g): The Properly-Mounted Models for S-Axis Stopper

The stopper is irreversible. Only this side of the stopper can be used at this angle.

Installation at +15°

Hexagon head screws

Installation at 0°
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load including the weight of the mount/gripper is:

- YR-ES0200D-A00, -A01: 200 kg maximum

If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in Table 6-1 “Allowable Wrist Load”. Contact your Yaskawa representative for further information or assistance.

Table 6-1: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N-m (kgf•m)(^1)</th>
<th>GD(^2/4) Total Moment of Inertia kg•m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>1344 (137)</td>
<td>143</td>
</tr>
<tr>
<td>B-Axis</td>
<td>1344 (137)</td>
<td>143</td>
</tr>
<tr>
<td>T-Axis</td>
<td>715 (73)</td>
<td>80</td>
</tr>
</tbody>
</table>

\(^1\) ( ): Gravitational unit

When the volume load is small, refer to the moment arm rating shown in Fig. 6-1 “Moment Arm Rating”.

The allowable total moment of inertia is calculated when the moment is at the maximum. Contact your Yaskawa representative beforehand when only moment of inertia, or load moment is small and moment of inertia is large. Also, when the load mass is combined with an outside force, contact your Yaskawa representative beforehand.
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

**Fig. 6-1: Moment Arm Rating**

![Diagram of Moment Arm Rating](image-url)
6.2 Wrist Flange

The wrist flange dimensions are shown in Fig. 6-2 “Wrist Flange”. In order to see the alignment mark, it is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside must be 8 mm or less.

Fig. 6-2: Wrist Flange

NOTE: Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner or light oil before mounting the tools.
7 System Application

7.1 Peripheral Equipment Mounts

The peripheral equipment mounts are provided on the U-axis (upper arm) and S-axis (rotary head) as shown in Fig. 7-1 “Installing Peripheral Equipment” for easier installation of the users’ system applications.

The following conditions shall be observed to attach or install peripheral equipment. (Refer to Table 7-1 “Conditions for Installation”.)

Fig. 7-1: Installing Peripheral Equipment

<table>
<thead>
<tr>
<th>Application</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1, A2</td>
<td>Cable Processing and Valve Load</td>
</tr>
<tr>
<td></td>
<td>30 kg max.</td>
</tr>
<tr>
<td></td>
<td>49 N•m (5 kgf•m) max. for moment increase amount of upper arm</td>
</tr>
<tr>
<td>B</td>
<td>Others</td>
</tr>
<tr>
<td></td>
<td>250 kg max.</td>
</tr>
</tbody>
</table>
7.2 Internal User I/O Wiring Harness and Air Line

6 cables for valves (0.75 mm²), 18 internal user I/O wires (0.5 mm² x 6 wires, 0.3 mm² x 12 wires), the cables for the external axis (1.25 mm² x 7 cables, 0.75 mm² x 2 cables, 0.2 mm² x 4 cables), and an air line are used in the manipulator for the drives of the peripheral devices mounted on the upper arm as shown in Fig. 7-2 "Connectors for Internal User I/O Wiring Harness and Air Line" on page 7-3.

The connector pins, and the terminals are assigned as shown in Fig. 7-2 "Connectors for Internal User I/O Wiring Harness and Air Line" on page 7-3 and Fig. 7-3 "Details of the Connector Pin Numbers" on page 7-4. Wiring must be performed by user.

<table>
<thead>
<tr>
<th>The allowable current for internal user I/O wiring harness</th>
<th>8.0 A or less / wire. (1.25 mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.0 A or less / wire. (0.75 mm²)</td>
</tr>
<tr>
<td></td>
<td>3.5 A or less / wire. (0.5 mm²)</td>
</tr>
<tr>
<td></td>
<td>2.8 A or less / wire. (0.3 mm²)</td>
</tr>
<tr>
<td></td>
<td>2.3 A or less / wire. (0.2 mm²)</td>
</tr>
</tbody>
</table>

The maximum pressure for the air line 490 kPa (5 kgf/cm²) or less
(The air line inside diameter: 8.0 mm)
Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line

Connector for the external axis (Encoder cable):
JL05-2A20-29SC
(socket connector with cap).
Prepare pin connector: JL05-6A20-29P.

Connector for the external axis
(Power cable):
JL05-2A18-1SC
(socket connector with cap).
Prepare pin connector: JL05-6A18-1P.

Connector for internal user
I/O wiring harness (Casing):
JL05-2A22-14SC
(socket connector with cap).
Prepare pin connector: JL05-6A22-14P.

Connector for internal user
I/O wiring harness (Base):
JL05-2A28-21PC (pin connector with cap).
Prepare socket connector: JL05-6A28-21S.

Air inlet (air flow)
Tapped holes PT3/8 with pipe plug

View A
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

Fig. 7-3: Details of the Connector Pin Numbers

Pin details for internal user I/O wiring harness
(Base side)

Pin details for internal user I/O wiring harness
(Casing side)

Pin details for external axis power cable

Pin details for external axis encoder cable
8 Electrical Equipment Specification

8.1 Position of Limit Switch

8.1.1 Specification of Limit Switch

1. The interference limit switch at S-, L- and U-axes electrically limit the operating range of respective axes by adjusting the position of the dog using the limit switch. The positions of the mechanical limits (mechanical stoppers) at S-, L- and U-axes are changeable. When the limit switch is activated, the power supply to the manipulator is interrupted, then the manipulator makes an emergency stop as a result. Refer to section 8.9 “Overrun/Tool Shock Sensor Releasing” in the “DX100 INSTRUCTIONS” for releasing the status of this overrun.

2. The range of S-, L- and U-axes limit switches are set to the maximum operating range before shipping.

In case of re-adjusting the operating range of each subject axis, it is also required to change the dog location and limit values in software. Contact your Yaskawa representative if re-adjustment is required.

8.1.2 Position of Limit Switch

The limit switches are optional. For the S, L, and U-Axes with limit switches specifications, L.S. are located on S-Axis, L-Axis, and U-Axis respectively. For the location, refer to Fig. 8-1 “Location of Limit Switches”. The inspection and adjustment of the limit switches should be made after removing the cover.

Fig. 8-1: Location of Limit Switches
8.1.3 Setting of Operation Range

8.1.3.1 S-Axis Operation Range

By the S-axis limit switch, S-axis operation range can be set to those ranges mentioned in Table 5-2 "S-Axis Operating Range" on page 5-4.

8.1.3.2 L-Axis Operation Range

By the L-axis limit switch, the L-axis operation range can be set to any angles within -61° to +77° as mentioned in the figure below.

Fig. 8-2: L-Axis Overrun Limit Switch Setting Range
8.1.3.3 Setting Range of LU-Axes Interference Angle

L- and U-axes interference limit switches are designed to check the interference angle of L- and U-axes.

As shown in Fig. 8-3 “LU-Axes Interference Angle”, the operation range of U-axis can be set to any angles within +8° to +288° as the interference angle with L-axis.

Fig. 8-3: LU-Axes Interference Angle
8.2 Internal Connections

Highly reliable connectors are equipped on each connection part of the manipulator to enable easy removal and installation for maintenance and inspection. For the number and location of connectors, see Fig. 8-4 "Locations and Numbers of Connectors".

Diagrams for Internal connections of the manipulator are shown in Fig. 8-5(a) "Internal Connection Diagram" on page 8-5 and Fig. 8-5(b) "Internal Connection Diagram" on page 8-6.

**Fig. 8-4: Locations and Numbers of Connectors**

![Diagram of Connectors](image)

**Table 8-1: List of Connector Types**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector Base</td>
<td>Connector for internal user I/O wiring harness (JL05-2A28-21PC (JL05-6A28-21S: Optional))</td>
</tr>
<tr>
<td>U-arm</td>
<td>Connector for internal user I/O wiring harness (JL05-2A22-14SC (JL05-6A22-14P: Optional))</td>
</tr>
<tr>
<td></td>
<td>Connector for external axis (Encoder cable) (JL05-2A20-29SC (JL05-6A20-29P: Optional))</td>
</tr>
<tr>
<td></td>
<td>Connector for external axis (Power cable) (JL05-2A18-1SC (JL05-6A18-1P: Optional))</td>
</tr>
</tbody>
</table>
Fig. 8-5(a): Internal Connection Diagram

Notes
1. For the limit switch specification, the connection of the section
2. Bat11
3. P
4. Bat20
5. 0bat1
6. Bat18
7. LA1
8. LA2
9. LB1
10. LB2
11. BAT11
12. BAT12
13. BAT1
14. BAT2
15. BAT3
16. BAT4
17. BAT5
18. BAT6
19. DX100
20. No.22CN
21. No.17CN
22. No.16CN
23. No.15CN
24. No.14CN
25. No.13CN
26. No.12CN
27. No.11CN
28. No.10CN
29. No.9CN
30. No.8CN
31. No.7CN
32. No.6CN
33. No.5CN
34. No.4CN
35. No.3CN
36. No.2CN
37. No.1CN

---

8 Electrical Equipment Specification
8.2 Internal Connections
8 Electrical Equipment Specification
8.2 Internal Connections

Fig. 8-5(b): Internal Connection Diagram
9 Maintenance and Inspection

9.1 Inspection Schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels as shown in Table 9-1 "Inspection Items" on page 9-2.

In Table 9-1, the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized by the user, operations to be performed by trained personnel, and operations to be performed by service company personnel. Only specified personnel shall perform the inspection work.

- The inspection interval depends on the total servo operation time.
- For any different or special applications, the inspection process should be developed on an case-by-case basis.
- For axes which are used very frequently (in handling applications, etc.), it is recommended that inspections be conducted at shorter intervals. Contact your Yaskawa representative.

WARNING

- Before maintenance or inspection, 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.

CAUTION

- 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 this caution may result in injury from unexpected turning of the manipulator’s arm.
- The battery pack must be connected before removing detection connector when maintenance and inspection.

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

NOTE

• The inspection interval depends on the total servo operation time.
• For any different or special applications, the inspection process should be developed on an case-by-case basis.
• For axes which are used very frequently (in handling applications, etc.), it is recommended that inspections be conducted at shorter intervals. Contact your Yaskawa representative.
### Table 9-1: Inspection Items (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Alignment mark</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Visual</td>
<td>Check alignment mark accordance and damage at the home position.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
<tr>
<td>2 External lead</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Visual</td>
<td>Check for damage and deterioration of leads.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
<tr>
<td>3 Working area and manipulator</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside cracks.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
<tr>
<td>5 Baseplate mounting bolts</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
<tr>
<td>6 Cover mounting screws</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Screwdriver, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
<tr>
<td>10 Wire harness in manipulator (SLU-axis wires)</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Visual, Multimeter</td>
<td>Check for conduction between the main connector of base and intermediate connector with manually shaking the wires. Check for wear of protective spring.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
<tr>
<td>11 Battery pack in manipulator</td>
<td>Daily, 1000H/Cycle, 6000H/Cycle, 12000H/Cycle, 24000H, 36000H</td>
<td>Replacement</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.</td>
<td>Specified Personnel, Licensee, Service Company</td>
</tr>
</tbody>
</table>
## Inspection Schedule

1. **R-axis speed reducer**
   - **Grease Gun Check for malfunction.** (Replace if necessary.)
   - Supply grease (6000H cycle). See section 1 on page 9-15.
   - Replace grease (12000H cycle). See section 9.3.4 on page 9-14.

2. **B- and T-axes speed reducer, B- and T-axes gear**
   - **Grease Gun Check for malfunction.** (Replace if necessary.)
   - Supply grease (6000H cycle). See section 6 on page 9-16.
   - Replace grease (12000H cycle). See section 9.3.4 on page 9-14.

3. **Overhaul**
   - **Inspection**

---

### Table 9-1: Inspection Items (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Inspection No. correspond to the numbers in Fig. 9-1 “Inspection Items” on page 9-4.
2. The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your Yaskawa representative.
3. When checking for conduction with multimeter, connect the battery to “BAT” and “OBT” of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to section 9.3.6 “Notes for Maintenance” on page 9-21)
4. Wire harness in manipulator to be replaced at 24000H inspection.
5. For the grease, refer to Table 9-2 “Inspection Parts and Grease Used” on page 9-5.
Check that no grease is leaked into the tube (2 tubes).
Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>12, 13,</td>
<td>Molywhite RE No. 00</td>
<td>Speed Reducers for all Axes R-, B-, and T-Axes gears</td>
</tr>
<tr>
<td>14, 15, 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Alvania EP Grease 2</td>
<td>L-Axis Balancer</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in Table 9-1 “Inspection Items” on page 9-2
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 9-2(a) “Battery Location (Back View)” and Fig. 9-2(b) “Battery Location (Top View)".

If a battery alarm occurs in the DX100, replace the battery in accordance with the following procedure:

Fig. 9-2(a): Battery Location (Back View)

Fig. 9-2(b): Battery Location (Top View)
9.2 Notes on Maintenance Procedures

**Fig. 9-3: Battery Connection**

1. Turn OFF the DX100 main power supply.
2. Remove the plate fixing screws and the plate on the connector base, then pull the battery pack out to replace it with the new one.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack to the unoccupied 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 holder.
7. Reinstall the plate.

**NOTE** Do not allow plate to pinch the cables when reinstalling the plate.
9.3 Notes on Grease Replenishment/Exchange Procedures

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

- If grease is added without removing the plug/screw from the grease exhaust port, the grease will leak inside a motor or an oil seal of a speed reducer will come off, which may result in damage to the motor. Make sure to remove the plug/screw.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.
- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

9.3.1 Grease Replenishment/Exchange for S-Axis Speed Reducer

*Fig. 9-4: S-Axis Speed Reducer Diagram*
9.3.1.1 Grease Replenishment

(Refer to Fig. 9-4 “S-Axis Speed Reducer Diagram” on page 9-8.)

Replenish the grease according to the following procedure:

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

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

2. Install a grease zerk A-PT1/4 to the grease inlet. (The grease zerk is delivered with the manipulator.)

3. Inject the grease through the grease inlet using a grease gun
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 1200 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

5. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

9.3.1.2 Grease Exchange

(Refer to Fig. 9-4 “S-Axis Speed Reducer Diagram” on page 9-8.)

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

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

2. Install a grease zerk A-PT1/4 to the grease inlet. (The grease zerk is delivered with the manipulator.)

3. Inject the grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No. 00
   - Amount of grease: approx. 7000 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

5. Move the S-axis for a few minutes to discharge excess grease.
6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

**NOTE**
If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it.

### 9.3.2 Grease Replenishment/Exchange for L-Axis Speed Reducer

*Fig. 9-5: L-Axis Speed Reducer Diagram*

#### 9.3.2.1 Grease Exchange

(Refer to *Fig. 9-5 “L-Axis Speed Reducer Diagram”.*)

1. Make the L-arm vertical to the ground.
2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.
3. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)

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

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 280 cc
     (560 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

5. Move the L-axis for a few minutes to discharge excess grease.
6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).
9.3.2.2 Grease Exchange

(Refer to Fig. 9-5 “L-Axis Speed Reducer Diagram” on page 9-10.)

1. Make the L-arm vertical to the ground.
2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

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

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

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No. 00
   - Amount of grease: approx. 1400 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

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

7. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).
9.3.3 Grease Replenishment/Exchange for U-Axis Speed Reducer

Fig. 9-6: U-Axis Speed Reducer Diagram

9.3.3.1 Grease Replenishment

(Refer to Fig. 9-6 “U-Axis Speed Reducer Diagram”.)

1. Make the U-arm horizontal to the ground.

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

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

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 280 cc
     (560 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).
9.3.3.2 Grease Exchange

(Refer to Fig. 9-6 “U-Axis Speed Reducer Diagram” on page 9-12.)

1. Make the U-arm horizontal to the ground.

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

   **NOTE**

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

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

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

   - Grease type: Molywhite RE No. 00
   - Amount of grease: approx. 1800 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

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

7. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

   **NOTE**

   If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it.
9.3.4 Grease Replenishment/Exchange for U-Arm

*Fig. 9-7: U-Arm Diagram*

- Grease inlet (R-, B-, and T-gears in the casing)
  - Grease zerk A-PT1/8

- Grease exhaust port
  - (T-axis speed reducer)
  - Hexagon socket head plug PT1/16

- T-axis speed reducer
- Grease inlet
  - (B-, and T-axes speed reducer)
  - Hexagon socket head plug PT1/8

- B-axis speed reducer

- Grease exhaust port
  - (R- and B-axes speed reducer)
  - Hexagon socket head plug PT1/8

- R-axis speed reducer
  - Grease inlet
    - (R-axis speed reducer)
    - Hexagon socket head plug PT1/8

- Grease exhaust port
  - (R-, B-, and T-gears in the casing)
  - Hexagon socket head plug PT1/8

- View A
9.3 Notes on Grease Replenishment/Exchange Procedures

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

(Refer to Fig. 9-7 “U-Arm Diagram”.)

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

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

3. Inject the grease through the grease inlet using a grease gun
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 300 cc (600 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

5. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

6. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

9.3.4.2 Grease Replenishment for R-Axis Speed Reducer

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

3. Inject the grease through the grease inlet using a grease gun
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 350 cc (700 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

**NOTE**
If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
9.3 Notes on Grease Replenishment/Exchange Procedures

5. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

6. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

9.3.4.3 Grease Replenishment for B-Axis Speed Reducer

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

3. Inject the grease through the grease inlet using a grease gun
   - Grease type: Molywhite RE No. 00
   - Amount of grease: 260 cc (520 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

5. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

6. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

9.3.4.4 Grease Replenishment for T-Axis Speed Reducer

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

NOTE

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

9.3 Notes on Grease Replenishment/Exchange Procedures

3. Inject the grease through the grease inlet using a grease gun
   – Grease type: Molywhite RE No. 00
   – Amount of grease: 260 cc
     (520 cc for 1st supply)
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

4. Move the T-Axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

6. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

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

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

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

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

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

6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

NOTE: If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
9.3 Notes on Grease Replenishment/Exchange Procedures

9.3.4.6 Grease Exchange for R-Axis Speed Reducer

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

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

3. Inject the grease through the grease inlet using a grease gun
   
   - Grease type: Molywhite RE No. 00
   - Amount of grease: approx. 2050 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

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

6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

9.3.4.7 Grease Exchange for B-Axis Speed Reducer

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

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

3. Inject the grease through the grease inlet using a grease gun
   
   - Grease type: Molywhite RE No. 00
   - Amount of grease: approx. 1300 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)
5. Move the B-Axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

9.3.4.8 Grease Exchange for T-Axis Speed Reducer

(Refer to Fig. 9-7 “U-Arm Diagram” on page 9-14.)

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

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

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

3. Inject the grease through the grease inlet using a grease gun
   - Grease type: Molywhite RE No. 00
   - Amount of grease: approx. 1300 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

5. Move the T-Axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).

7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).
9.3.5 Grease Replenishment for Balancer Connection Part

*Fig. 9-8: Balancer Connection Part*

1. Remove the hexagon socket head plugs of connection ① and ②. (Refer to Fig. 9-8 “Balancer Connection Part”.)
   - Grease type: Alvania EP grease 2
   - Amount of grease: 5 cc (10 cc for 1st supply)

2. Inject grease through grease inlets of connection ① and ② using a grease gun.

   The exhaust port is used only for air flow.
   **NOTE**
   Do not inject excessive grease through the gear grease inlet.

3. Reinstall the plugs PT1/8 of connection ① and ②. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 5 N•m (0.51 kgf•m).
9.3.6 Notes for Maintenance

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

**NOTE**

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. 9-9 “Battery Pack Connection” on page 9-21.

9.3.6.1 Battery Pack Connection

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

1. Removed the cap attached to the battery backup connector of the motors.

2. Connect the battery packs (HW9470932-A) with the battery backup connectors (BAT and OBT are marked) located at the end point of the cables for the encoder. (Under this condition, remove the encoder connector and carry out the maintenance checks).

3. Confirm all connectors connected after the maintenance check, and remove the battery packs. Install the caps attached to the battery backup connectors of the motors.

**NOTE**

Do not remove the battery pack in the connector base.

*Fig. 9-9: Battery Pack Connection*
10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for the MOTOMAN-ES200D. Product performance cannot be guaranteed when using spare parts from any company other than Yaskawa. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts.
- Rank B: Parts for which replacement may be necessary as a result of frequent operation.
- Rank C: Drive unit.

For replacing parts in Rank B or Rank C, contact your Yaskawa representative.

Table 10-1: Spare Parts for the YR-ES0200D-A00, -A01 (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
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<tr>
<td>A</td>
<td>1</td>
<td>Grease</td>
<td>Molywhite RE No. 00</td>
<td>Yaskawa</td>
<td>16 kg</td>
<td>for all axes speed reducers and wrist units</td>
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<tr>
<td>A</td>
<td>2</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Oil Co.,Ltd.</td>
<td>16 kg</td>
<td>for balancer joint part</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Liquid Seal</td>
<td>Three Bond 1206C</td>
<td>Three Bond Co., Ltd.</td>
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<td></td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery Pack</td>
<td>HW0470360-A</td>
<td>Yaskawa</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery Pack</td>
<td>HW9470932-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>For wire harness in manipulator replacing</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>S-Axis Speed Reducer</td>
<td>HW0388208-A</td>
<td>Yaskawa</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>S-Axis Input Gear</td>
<td>HW0314016-1</td>
<td>Yaskawa</td>
<td>1</td>
<td></td>
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<tr>
<td>B</td>
<td>8</td>
<td>L-Axis Speed Reducer</td>
<td>HW0390225-B</td>
<td>Yaskawa</td>
<td>1</td>
<td></td>
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<td>B</td>
<td>9</td>
<td>L-Axis Input Gear</td>
<td>HW0301778-1</td>
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<td>B</td>
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<td>B</td>
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<td>B</td>
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<td>C</td>
<td>16</td>
<td>AC Servo Motor for S-, L-, and U-Axes</td>
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<td>Yaskawa</td>
<td>1</td>
<td>3</td>
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<tr>
<td>C</td>
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<td>AC Servo Motor for R-Axis</td>
<td>SGMRV-13ANA-YR1* HW0388666-A</td>
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<td>1</td>
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## Table 10-1: Spare Parts for the YR-ES0200D-A00, -A01 (Sheet 2 of 2)

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<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
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<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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<td>2</td>
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<td>C</td>
<td>19</td>
<td>Internal Wire Harness</td>
<td>HW0174287-A</td>
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<td>1</td>
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<tr>
<td>C</td>
<td>20</td>
<td>Connector Base Set</td>
<td>HW0374283-A</td>
<td>Yaskawa</td>
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<td>1</td>
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<td>C</td>
<td>21</td>
<td>Board</td>
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<td>C</td>
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<td>Limit switch set for S-axis</td>
<td>HW0371747-A</td>
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<tr>
<td>C</td>
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<td>Limit switch set for L-axis</td>
<td>HW0374590-A</td>
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<td>1</td>
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<tr>
<td>C</td>
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<td>1</td>
<td>Treatment of -A01 lead terminal is done</td>
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</table>
11 Parts List

11.1 S-Axis Unit

Fig. 11-1: S-Axis Unit
## Part List

### 11.1 S-Axis Unit

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<th>Name</th>
<th>Pcs</th>
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<td>1001</td>
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<td>Speed reducer</td>
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<td>1002</td>
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<td>Motor</td>
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<td>1003</td>
<td>TC12015014</td>
<td>Oil seal</td>
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<td>1004</td>
<td>STW-50</td>
<td>Retaining rings</td>
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<td>1005</td>
<td>6310</td>
<td>Bearing</td>
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<td>1006</td>
<td>HW0314016-1</td>
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<td>HW0402102-1</td>
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<td>M20X45(12.9)</td>
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11 Parts List
11.2 L-Axis Unit

Fig. 11-2: L-Axis Unit
## Table 11-2: L-Axis Unit

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<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
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<td>HW0390225-B</td>
<td>Speed reducer</td>
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<tr>
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<td>SGMRV-37ANA-YR1*</td>
<td>Motor</td>
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<tr>
<td>2003</td>
<td>Y507212.5</td>
<td>Oil seal</td>
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<tr>
<td>2004</td>
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<td>Retaining rings</td>
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<td>HR32916J</td>
<td>Bearing</td>
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<td>HW0100647-2</td>
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11.3 URBT-Axes Unit

Fig. 11-3: URBT-Axes Unit
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11.4 U-Arm Unit

Fig. 11-4: U-Arm Unit
# Table 11-4: U-Arm Unit

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11.5 Wrist Unit

Fig. 11-5: Wrist Unit
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### Table 11-5: Wrist Unit (Sheet 2 of 2)

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11.6 Balancer Unit

Fig. 11-6: Balancer Unit
### Table 11-6: Balancer Unit

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for ongoing product modifications and improvements.