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Chapter 1
Introduction

1.1 About This Document

This manual provides information for the EH200 manipulator and contains the following sections:

CHAPTER 1 - INTRODUCTION
Provides general information about the structure of this manual, a list of reference documents, and customer service information.

CHAPTER 2 - SAFETY
This section provides information regarding the safe use and operation of Motoman products.

CHAPTER 3 - EH200 INSTRUCTIONS
Provides detailed information for the EH200 manipulator.

1.2 Reference to Other Documentation

For additional information refer to the following:

• NX100 Controller Manual (P/N 149201-1)
• Concurrent I/O Manual (P/N 149230-1)
• Operator’s Manual for your application
• Vendor manuals for system components not manufactured by Motoman

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

• Robot Type (EH200)
• Application Type (welding, handling, etc.)
• Robot Serial Number (located on back side of robot arm)
• Robot Sales Order Number (located on back of controller)
Chapter 2

Safety

2.1 Introduction

It is the purchaser’s responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06-1999. The address is as follows:

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

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. The robot must not be operated by personnel who have not been trained!

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.
This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming, Operation, and Maintenance Safety (Section 2.6)

## 2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.

**DANGER!**

Information appearing in a DANGER concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

**WARNING!**

Information appearing in a WARNING concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

**CAUTION!**

Information appearing in a CAUTION concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

*Note: Information appearing in a Note provides additional information which is helpful in understanding the item being explained.*
2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot 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 robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, 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).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's 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 R15.06-1999 safety standards, and other local codes that may pertain to the installation and use of industrial 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 fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot 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 robot should be permitted to program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope 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.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot 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 PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

• Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.

• The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.

• Check and test any new or modified program at low speed for at least one full cycle.

• 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 robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
Notes
MOTOMAN-EH200
INSTRUCTIONS

TYPE: YR-EH200-A00 (STANDARD SPECIFICATION)
YR-EH200-A03 (SLU-AXES WITH L.S. SPECIFICATION)
YR-EH200-A20 (FOR SPECIFIED USE)

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

MOTOMAN INSTRUCTIONS
MOTOMAN-EH200 INSTRUCTIONS
NX100 INSTRUCTIONS
NX100 OPERATOR’S MANUAL
NX100 MAINTENANCE MANUAL

The NX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.
• This instruction manual is intended to explain operating instructions and maintenance procedures primarily for the MOTOMAN-EH200.

• General items related to safety are listed in Section 1: Safety of the NX100 Instructions. To ensure correct and safe operation, carefully read the NX100 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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the NX100.

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”.

• Before operating the manipulator, check that servo power is turned off when the emergency stop buttons on the front door of the NX100 and programming pendant are pressed. When the servo power is turned off, the SERVO ON LED on the programming pendant is turned off.

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

• 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.

• 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.
  - 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 persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the NX100 power
  - Moving the manipulator with the programming pendant
  - Running check operations
  - 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 are problems. The emergency stop button is located on the right of front door of the NX100 and the programming pendant.
Definition of Terms Used Often in This Manual

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

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX100 Controller</td>
<td>NX100</td>
</tr>
<tr>
<td>NX100 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>
Explaination 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.

![Diagram of a robot with warning labels]

**Nameplate:**

<table>
<thead>
<tr>
<th>MOTOMAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>PAYLOAD</td>
</tr>
<tr>
<td>ORDER NO</td>
</tr>
<tr>
<td>SERIAL NO</td>
</tr>
</tbody>
</table>

![Warning label A]

**WARNING label A:**

Moving parts may cause injury

![Warning label B]

**WARNING label B:**

Do not enter robot work area.
1  Product Confirmation
   1.1  Contents Confirmation  ........................................... 1-1
   1.2  Order Number Confirmation  ................................. 1-2

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   2.1  Transporting Method  ........................................... 2-1
       2.1.1  Using a Crane  ........................................... 2-1
   2.2  Shipping Bolts and Brackets  ................................. 2-3

3  Installation
   3.1  Installation of Safeguarding  ................................. 3-2
   3.2  Mounting Procedures for Manipulator Base  .............. 3-2
       3.2.1  Mounting Example  ..................................... 3-3
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4  Wiring
   4.1  Grounding  ................................................... 4-2
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7  System Application
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              ■ Grease Replenishment (Refer to "Fig. 25 S-Axis Speed
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              ■ Grease Exchange (Refer to "Fig. 27 U-Axis Speed
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              ■ Grease Replenishment for R-, B- T-Axis Gears in the
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                  (Refer to "Fig. 28 U-Arm Diagram "). .................. 9-15
9.3.5 Grease Replenishment for Balancer Connection Part. 9-21
9.3.6 Notes for Maintenance 9-22

10 Recommended Spare Parts
1  Product Confirmation

CAUTION

• Confirm that the manipulator and the NX100 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.

1.1 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 is given separately):

• Manipulator
• NX100
• Programming Pendant
• Manipulator cables (3 cables, between the NX100 and the manipulator)
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the NX100. The order number is located on a label as shown below.

Fig. 1 Location of Order Number Labels
2 Transporting

2.1 Transporting Method

CAUTION

- Sling 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 transporting.

The system consists of precision components, so failure to observe this caution may adversely affect performance.

2.1.1 Using a Crane

As a rule, when removing the manipulator from the package and moving it, a crane should be used. The manipulator should be lifted using a four-leg bridle sling threaded through shipping bolts and brackets. Be sure the manipulator is fixed with the shipping bolts and brackets before transporting, and lift it in the posture as shown in "Fig. 2 Transporting Position".
2.1 Transporting Method

Fig. 2 Transporting Position
The manipulator is provided with shipping bolts and brackets at position A and with the hexagon socket head cap screw at point B. ("Fig. 2 Transporting Position")

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

<table>
<thead>
<tr>
<th>Position</th>
<th>Bolt Type</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hexagon head bolt M20 X 70 mm (Tensile strength: 1200 N/mm² or more)</td>
<td>4 × 3</td>
</tr>
<tr>
<td>B</td>
<td>Hexagon socket head cap screw M16 X 20 mm (Tensile strength: 1200 N/mm² or more)</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
</table>
| • Install the safeguarding.  
  Failure to observe this warning may result in injury or damage.  
• Install the manipulator in a location where the manipulator’s tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or NX100 when the arm is fully extended.  
  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. |

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
</table>
| • Do not install or operate a 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. 3 Shipping Bolts and Brackets" are removed.  
  Failure to observe this caution may result in damage to the driving parts. |
3.1 Installation of Safeguarding

To insure safety, be sure to install the safeguarding. They prevent unforeseen accidents with personnel and damage to equipment. The following is quoted for your information and guidance.

**Responsibility for Safeguarding (ISO 10218)**
The user of a manipulator or robot system shall ensure that safeguarding is 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. Refer to "Table. 1 Maximum Repulsion Forces of the Manipulator" and "Table. 2 Endurance Torque in Operation".

During installation, if the flatness is not right, the manipulator may be deformed and its functional ability may be compromised. Mount the manipulator base as described in "3.2.1 Mounting Example".

| Table. 1   Maximum Repulsion Forces of the Manipulator |
|------------|-----------------------------------------------|
| Horizontal rotating maximum torque (S-axis moving direction) | 32000 N • m (3265 kgf • m) |
| Vertical rotating maximum torque (LU-axis moving direction) | 78500 N • m (8000 kgf • m) |

| Table. 2   Endurance Torque in Operation |
|------------|-----------------------------------------|
| Horizontal acceleration and deceleration maximum torque | 9400 N • m (960 kgf • m) |
| Vertical acceleration and deceleration maximum torque | 23900 N • m (2434 kgf • m) |
### 3.2.1 Mounting Example

The baseplate should be rugged and durable to withstand maximum repulsion forces of the manipulator and to ensure that the manipulator and fixture are in the correct relative position. The thickness of the baseplate is 50 mm or more and an M20 size or larger anchor bolt is recommended.

Fix the manipulator base to the baseplate with the hexagon head bolt M20 (8 bolts, length: 80 mm or more is recommended) using mounting holes of the manipulator base. The manipulator base is tapped for eight mounting holes. Tighten the hexagon head bolts and anchor bolts securely so that they will not work loose during operation.

![Mounting the Manipulator on Baseplate](image_url)

### 3.3 Location

When the manipulator is installed, it is necessary to satisfy the undermentioned environmental conditions:

- Ambient temperature: 0° to 45°C
- Humidity: 20 to 80%RH at constant temperature
- Free from exposure to water, oil, or dust
- Free from corrosive gas or liquid, or explosive gas or liquid
- Free from excessive vibration (less than 4.9 m/s² [0.5 G])
- Free from large electrical noise (plasma)
- Flatness for installation is 0.5 mm or less
4 Wiring

WARNING

• Ground resistance must be 100 Ω or less.
Failure to observe this warning may result in fire or electric shock.

• Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)
Failure to observe this warning may result in fire or electric shock.

CAUTION

• Wiring must be performed by authorized or certified personnel.
Failure to observe this caution may result in fire or electric shock.

• Do not cover the cable with heat insulating material, and avoid multiple cabling.
Failure to observe this caution may result in preventing heat of the cable from being discharged.
4.1 Grounding

Follow local regulations for grounding line size. A line of 5.5 mm² or more is recommended. Refer to "Fig. 5 Grounding Method" to connect the ground line directly to the manipulator.

- Do not use this line in common 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 Electric Equipment Technical Standards.

Fig. 5 Grounding Method

4.2 Manipulator Cable Connection

Three manipulator cables are delivered with the manipulator: an encoder cable (1BC) and two power cables (2BC and 3BC). Refer to "Fig. 6 Manipulator Cables". Connect these cables to the connectors on the manipulator connector base and the NX100 board connectors.

4.2.1 Connection to the Manipulator

The manipulator cable connectors on the manipulator side and connectors on the manipulator connector base are numbered 1BC, 2BC, and 3BC. Verify the numbers and connect the cables to the connectors on the manipulator connector base in the order of 2BC, 3BC, and 1BC. Refer to "Fig. 7 (a) Manipulator Cable Connectors (Manipulator Side)". When connecting, insert the cables adjusting cable connector positions to the main key positions of the manipulator, and push the lever down until it clicks.
4.2.2 Connection to the NX100

The manipulator cable connectors on the NX100 side and the NX100 board connectors are numbered X11, X21, and X22. Verify the numbers and connect the cables to the NX100 board connectors in the order of 2BC, 3BC, and 1BC. Refer to "Fig. 7 (b) Manipulator Cable Connections to the NX100". When connecting, insert the cables adjusting cable connector positions to the main key positions of the NX100, and push the lever down until it clicks.

Fig. 6 Manipulator Cables
4.2 Manipulator Cable Connection

Fig. 7 (a) Manipulator Cable Connectors (Manipulator Side)

Fig. 7 (b) Manipulator Cable Connections to the NX100
# 5 Basic Specifications

## 5.1 Basic Specifications

Table 3. Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>MOTOMAN-EH200</td>
</tr>
<tr>
<td>Vertical Articulated</td>
<td></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°</td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>+76°, -60°</td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>+230°, -137.5°</td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>±360°</td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>±130°</td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>±360°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>1.75 rad/s, 100°/s</td>
</tr>
<tr>
<td>L-axis</td>
<td>1.48 rad/s, 85°/s</td>
</tr>
<tr>
<td>U-axis</td>
<td>1.69 rad/s, 97°/s</td>
</tr>
<tr>
<td>R-axis</td>
<td>2.01 rad/s, 115°/s</td>
</tr>
<tr>
<td>B-axis</td>
<td>1.92 rad/s, 110°/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 (wrist roll)</td>
<td>1274 N•m (130 kgf•m)</td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>1274 N•m (130 kgf•m)</td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>686 N•m (70 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²/4)</td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>120 kg•m²</td>
</tr>
<tr>
<td>B-axis</td>
<td>120 kg•m²</td>
</tr>
<tr>
<td>T-axis</td>
<td>70 kg•m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>1545 kg</td>
</tr>
<tr>
<td>Temperature</td>
<td>0°C to 45°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH at constant temperature</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>Less than 4.9 m/s² (0.5 G)</td>
</tr>
<tr>
<td>Others</td>
<td>• Free from corrosive gas or liquid, or explosive gas</td>
</tr>
<tr>
<td></td>
<td>• Free from water, oil, or dust</td>
</tr>
<tr>
<td></td>
<td>• Free from excessive electrical noise (plasma)</td>
</tr>
<tr>
<td>Power Capacity</td>
<td>10 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 "6.1 Allowable Wrist Load" for details on the allowable moment of inertia.
5.2 Part Names and Working Axes

Fig. 8 Part Names and Working Axes

5.3 Manipulator Base Dimensions

Fig. 9 Manipulator Base Dimensions

Units: mm
5.4 Dimensions and P-Point Maximum Envelope

Fig. 10 Dimensions and P-Point Maximum Envelope
5.5 Alterable Operating Range

The operating range of the S-axis can be altered according to the operating conditions as shown in "Table. 4 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° (standard)</td>
</tr>
<tr>
<td></td>
<td>±165°</td>
</tr>
<tr>
<td></td>
<td>±150°</td>
</tr>
<tr>
<td></td>
<td>±135°</td>
</tr>
<tr>
<td></td>
<td>±120°</td>
</tr>
<tr>
<td></td>
<td>±105°</td>
</tr>
<tr>
<td></td>
<td>±90°</td>
</tr>
<tr>
<td></td>
<td>±70°</td>
</tr>
<tr>
<td></td>
<td>±60°</td>
</tr>
<tr>
<td></td>
<td>±45°</td>
</tr>
<tr>
<td></td>
<td>±30° (±15°)</td>
</tr>
</tbody>
</table>

NOTE: The interval between a stopper and a stopper corresponds only by 60° or more.
5.5 Alterable Operating Range

### 5.5.1 Components for Altering Operating Range

Prepare the following components as shown in "Fig. 11 Components of the S-Axis Stopper", when modifying the angle of S-axis.

- Pin (drawing No. HW0402104-1, 1 pin)
- Stopper (drawing No. HW0308765-1, 1 stopper)
- Hexagon head bolt M20
  (length: 60 mm) (3 bolts) (tightening torque: 1200 N/mm²)
- Flat washer M20 (3 washers)
5.5.2 Installation of S-Axis Mechanical Stopper

1. Install the pin (HW0402104-1) in the stopper (HW0308765-1) so that the pin is set with its bottom up, as shown in "Fig. 11 Components of the S-Axis Stopper". Apply Loc-tite 242 on the thread part of the pin.
2. Install the stopper to the S-head with the hexagon head bolts M20 (60 mm long, 3 bolts) fastening by the tightening torque 402 N·m (tensile strength: 1200 N/mm² or more). The stopper is to be installed as shown in "Fig. 11 Components of the S-Axis Stopper" when the operating range is ±180°.

Notes on S-Axis Mechanical Stopper Installation

- The stopper can be installed by every 15 degree pitch, however, to avoid the mechanical troubles caused by interference between stoppers, install the S-axis mechanical stopper referring to "Table. 5 Settable Angle for S-Axis Stopper".
- To ensure stopper strength, be sure to fix both sides of the protrusion with screws as shown in properly mounted example in "Fig. 12 Properly-Mounted Image". Do not fix the hexagon head bolts on one side of the stopper protrusion.
- "Fig. 13 Properly-Mounted Models for S-Axis Stopper" represents the stopper installations in positive angles: to fix the stopper in negative angle, install the stopper at the position symmetrical to the horizontal center line in the figure.
- As shown in the figures in Fig. 13, the stopper is reversible that both sides of the stopper can be installed to the S-head except for the installation at the angles of ±30°, ±60°, ±120°, ±150°. If there is any difficulty in installing the stopper in accordance with "Table. 5 The Settable Angle of S-Axis Stopper", flip the stopper to the other side and retry the installation.

Fig. 12 Properly-Mounted Image

- Be sure to use the specified components when installing the S-axis mechanical stopper.
- Be sure to turn OFF the power supply before the installation.
5.5.3 Adjustment to the Pulse Limitation of S-Axis

Apply the Instruction for NX100 Concurrent I/O · Parameter (Manual No. RE-CKI-A442) as part of reference materials for adjusting the programming pendant when modifying the range of motion of S-axis.

The limitation to the pulse (positive (+) direction of the S-axis): SICxG200
The limitation to the pulse (negative (-) direction of the S-axis): SICxG208

<table>
<thead>
<tr>
<th>Angle</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>Pulse</td>
<td>±0</td>
<td>±30496</td>
<td>±60991</td>
<td>±91487</td>
<td>±121983</td>
<td>±152479</td>
<td>±182974</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Angle</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>Pulse</td>
<td>±213470</td>
<td>±243966</td>
<td>±274462</td>
<td>±304957</td>
<td>±335453</td>
<td>±365949</td>
</tr>
</tbody>
</table>

**NOTE** Limitation of the range of S-axis motion must be made on both the software and mechanical stopper in the same setting: range of motion cannot be limited with software modification alone.
The following "Table. 5 Settable Angle for S-Axis Stopper" shows the angles which can be set by a stopper.

Table. 5 Settable Angle for S-Axis Stopper

The Angle of S-Axis Stopper for + Direction

The Angle of S-Axis Stopper for - Direction

Note: Horizontal axis of the table indicates set angles in + direction for S-axis. Vertical axis of the table indicates set angles in - direction for S-axis. (e.g. S-axis can be set within the angle range between +180 and -180, but cannot be set within the angle range between +180 and -165.)
Mounting the S-Axis Stopper by Settable Angles

The stopper can be utilized by either side.

The Settled Model of +180 Degree

The Settled Model of +165 Degree

Fig. 13 (a) The Properly-Mounted Models for S-Axis Stopper
The stopper can be only utilized by one side with this angle.

The stopper can be utilized by either side.

Fig. 13 (b) The Properly-Mounted Models for S-Axis Stopper
5.5 Alterable Operating Range

Fig. 13 (c) The Properly-Mounted Models for S-Axis Stopper

The stopper could be utilized by one side with this angle.

The stopper can be only utilized by one side with this angle.

The stopper could be utilized by either side.

The Settled Model of +120 Degree

The Settled Model of +105 Degree
5.5 Alterable Operating Range

Fig. 13 (d) The Properly-Mounted Models for S-Axis Stopper

- The stopper can be utilized by either side.
- Hexagon head bolts

The Settled Model of + 90 Degree

The Settled Model of + 75 Degree
5.5 Alterable Operating Range

The stopper is only utilized by one side with this angle.

The stopper could be utilized by either side.

Fig. 13 (e) The Properly-Mounted Models for S-Axis Stopper
5.5 Alterable Operating Range

The stopper can be only utilized by one side with this angle.

The stopper can be utilized by either side.

Fig. 13 (f) The Properly-Mounted Models for S-Axis Stopper
5.5 Alterable Operating Range

The stopper could be utilized by either side.

Hexagon head bolts

The Settled Model of 0 Degree

Fig. 13 (g) The Properly-Mounted Models for S-Axis Stopper
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-EH200-A00, -A03, -A20 : 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 as shown in "Table. 6 Allowable Total Moment and Total Inertia". Contact your Yaskawa representative for further information or assistance.

Table. 6 Allowable Total Moment and Total Inertia

<table>
<thead>
<tr>
<th>Model</th>
<th>Axis</th>
<th>Moment N•m (kgf•m)*</th>
<th>GD²/4 Inertia kg•m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-EH200-A00, -A03, -A20</td>
<td>R-Axis</td>
<td>1274 (130)</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>1274 (130)</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>686 (70)</td>
<td>70</td>
</tr>
</tbody>
</table>

*1 ( ) : Gravitational unit

When the volume load is small, refer to the moment arm rating shown in "Fig. 14 Moment Arm Rating".

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

Fig. 14 Moment Arm Rating
6.2 Wrist Flange

The wrist flange dimensions are shown in "Fig. 15 Wrist Flange". In order to see the alignment marks, it is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside fittings must be 8 mm or less.

Fig. 15 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

When peripheral equipment is attached to the manipulator, the following conditions should be observed.

<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 increased moment amount of upper arm</td>
</tr>
<tr>
<td>B</td>
<td>Others</td>
</tr>
<tr>
<td></td>
<td>250 kg or less</td>
</tr>
</tbody>
</table>

Fig. 16 Installing Peripheral Equipment

Table. 7 Constraint for Attaching

Units: mm
7.2 Internal User I/O Wiring Harness and Air Lines

23 internal user I/O wires (0.75 mm) and two air lines are used in the manipulator for the drives of the peripheral devices mounted on the upper arm as shown in "Fig. 17 Connectors for internal user I/O wiring harness and air lines".

The connector pins, and the terminals are assigned as shown in "Fig. 18 Connectors for Internal User I/O Wiring Harness and Air Line (Pin Details)". Wiring must be performed by user.

- The allowable current for wires: 6.6 A or less / wire. (0.75 mm²)
  The total current value for pins 1 to 23 must be 60 A or less.

- The maximum pressure for the air line is 490 kPa (5 kgf/cm²) or less
  (The air line inside diameter: 8 mm dia.)
7.2 Internal User I/O Wiring Harness and Air Lines

Fig. 17 Connectors for internal user I/O wiring harness and air lines

Connector for internal user I/O wiring harness (Casing):
JL05-2A24-28SC (socket connector with cap).
Prepare pin connector:
JL05-6A24-28P.

Exhaust port A (air flow)
Tapped hole PT3/8 with pipe plug

Exhaust port B (air flow)
Tapped hole PT3/8 with pipe plug

Air inlet A
Tapped hole PT3/8 with pipe plug

Air inlet B
Tapped hole PT3/8 with pipe plug

Connector for internal user I/O wiring harness (base):
JL05-2A24-28PC (pin connector with cap).
Prepare socket connector: JL05-6A24-28S
Fig. 18 Connectors for Internal User I/O Wiring Harness and Air Line (Pin Details)
8 Motoman Construction

8.1 Position of S-Axis Limit Switch

Limit switches are optional. For axes with limit switch specifications, limit switches are located on S-axis, L-axis, and U-axis. Refer to "Fig. 19 Location of Limit Switches" for the location. The inspection and adjustment of the limit switches should be made after removing the cover.

Fig. 19 Location of Limit Switches
8.2 Internal Connections

High reliability connectors which can be easily put on and removed are used with each connector part. For the numbers, types, and locations of connectors, see "Fig. 20 Location of Connectors" and "Table. 8 List of Connector Types".

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector Base</td>
<td>for internal user I/O wiring harness JL05-2A24-28PC</td>
</tr>
<tr>
<td></td>
<td>(JL05-6A24-28S: Optional)</td>
</tr>
<tr>
<td>U-arm Connector</td>
<td>for internal user I/O wiring harness JL05-2A24-28SC</td>
</tr>
<tr>
<td></td>
<td>(JL05-6A24-28P: Optional)</td>
</tr>
</tbody>
</table>

Fig. 20 Location of Connectors
Fig. 21 (a) Internal Connection Diagram

Note:
For the manipulator with limit switches, the connection of the section (A) is changed.
Fig. 21 (b) Internal Connection Diagram
9  Maintenance and Inspection

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.

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 displayed in six levels. Conduct periodical inspections according to the inspection schedule in “Table. 9 Inspection Items”.

In “Table. 9 Inspection Items”, the inspection items are classified into three types of operation: operations which can be performed by personnel authorized by the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel. Only specified personnel are to do inspection work.
The inspection interval must be based on the servo power supply on time.

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 Inspection Items

<table>
<thead>
<tr>
<th>Items&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily 1000 H Cycle</td>
<td></td>
<td></td>
<td>Specified Person</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Licensee</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Service Company</td>
</tr>
<tr>
<td>① Alignment mark</td>
<td>○</td>
<td>Visual</td>
<td>Check alignment mark accordance and damage at the home position.</td>
<td>○</td>
</tr>
<tr>
<td>② External lead</td>
<td>○</td>
<td>Visual</td>
<td>Check for damage and deterioration of leads.</td>
<td>○</td>
</tr>
<tr>
<td>③ Working area and manipulator</td>
<td>○</td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside cracks.</td>
<td>○</td>
</tr>
<tr>
<td>④ L-, U-axis motors</td>
<td>○</td>
<td>Visual</td>
<td>Check for grease leakage.&lt;sup&gt;5&lt;/sup&gt;</td>
<td>○</td>
</tr>
<tr>
<td>⑤ Baseplate mounting bolts</td>
<td>○</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>○</td>
</tr>
<tr>
<td>⑥ Cover mounting screws</td>
<td>○</td>
<td>Screw-driver, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>○</td>
</tr>
<tr>
<td>⑦ SLU-axis motor connector</td>
<td>○</td>
<td>Manual</td>
<td>Check for loose connectors and tighten if necessary.</td>
<td>○</td>
</tr>
<tr>
<td>⑧ Connector base</td>
<td>○</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td>○</td>
</tr>
<tr>
<td>⑨ Balancer</td>
<td>○</td>
<td>Grease Gun</td>
<td>Supply grease. See Par. 9.3.5</td>
<td>○</td>
</tr>
<tr>
<td>⑩ Wire harness in manipulator</td>
<td>○</td>
<td>Multimeter</td>
<td>Check for conduction between the main connector of base and intermediate connector with manually shaking the wire. Check for wear of protective spring.&lt;sup&gt;4&lt;/sup&gt;</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Replace&lt;sup&gt;2&lt;/sup&gt;</td>
<td>○</td>
</tr>
<tr>
<td>⑪ Battery pack in manipulator</td>
<td>○</td>
<td></td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000h.&lt;sup&gt;4&lt;/sup&gt;</td>
<td>○</td>
</tr>
</tbody>
</table>
9.1 Inspection Schedule

*1 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 9.3.6)

*2 Wire harness in manipulator (for S, L, U, R, B, and T axes) to be replaced at 24000H inspection.

*3 For the grease, refer to "Table. 10 Inspection Parts and Grease Used ".

*4 Inspection No. corresponds to the numbers in "Fig. 22 Inspection Parts and Inspection Numbers ".

*5 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.

---

<table>
<thead>
<tr>
<th>Items*4</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis speed reducer, S-axis gear</td>
<td>1000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.1. Exchange grease *3 (12000H cycle). See Par. 9.3.1.</td>
</tr>
<tr>
<td>L-axis speed reducer</td>
<td>6000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.2. Exchange grease *3 (12000H cycle). See Par. 9.3.2.</td>
</tr>
<tr>
<td>U-axis speed reducer</td>
<td>12000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.3. Exchange grease *3 (12000H cycle). See Par. 9.3.3.</td>
</tr>
<tr>
<td>R-axis speed reducer</td>
<td>24000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.4. Exchange grease *3 (12000H cycle). See Par. 9.3.4.</td>
</tr>
<tr>
<td>B-, T-axis speed reducer</td>
<td>36000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.4. Exchange grease *3 (12000H cycle). See Par. 9.3.4.</td>
</tr>
<tr>
<td>Overhaul</td>
<td>Specified Person Licensee Service Company</td>
<td><strong>O</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Table. 9 Inspection Items**

<table>
<thead>
<tr>
<th>Items*4</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis speed reducer, S-axis gear</td>
<td>Daily</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.1. Exchange grease *3 (12000H cycle). See Par. 9.3.1.</td>
</tr>
<tr>
<td>L-axis speed reducer</td>
<td>6000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.2. Exchange grease *3 (12000H cycle). See Par. 9.3.2.</td>
</tr>
<tr>
<td>U-axis speed reducer</td>
<td>12000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.3. Exchange grease *3 (12000H cycle). See Par. 9.3.3.</td>
</tr>
<tr>
<td>R-axis speed reducer</td>
<td>24000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.4. Exchange grease *3 (12000H cycle). See Par. 9.3.4.</td>
</tr>
<tr>
<td>B-, T-axis speed reducer</td>
<td>36000 H Cycle</td>
<td><strong>O</strong></td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease *3 (6000H cycle). See Par. 9.3.4. Exchange grease *3 (12000H cycle). See Par. 9.3.4.</td>
</tr>
<tr>
<td>Overhaul</td>
<td>Specified Person Licensee Service Company</td>
<td><strong>O</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table. 10  Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>③</td>
<td>VIGO Grease RE No. 0</td>
<td>Speed Reducers for all Axes R-, B-, and T-Axes gears</td>
</tr>
<tr>
<td>⑽</td>
<td>Alvania EP Grease 2</td>
<td>L-Axis Balancer</td>
</tr>
</tbody>
</table>

Inspection numbers correspond to the numbers in "Table. 9  Inspection Items ".

Note: The manipulator is in the home position.

Fig. 22 Inspection Parts and Inspection Numbers
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the two positions as shown in "Fig. 23 (a) Battery Location (Back View)" and "Fig. 23 (b) Battery Location (Top View)".

If a battery alarm occurs in the NX100, replace the battery in accordance with the following procedure:

![Fig. 23 (a) Battery Location (Back View)](image)

![Fig. 23 (b) Battery Location (Top View)](image)
1. Turn the NX100 main power supply OFF.
2. Remove the plate fastening screws M4 and the plate from the connector base and pull the battery pack out to replace with a new battery pack.
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 battery holder.
7. Reinstall the plate and fix it with the plate fastening screws M4.

**NOTE** Do not pinch the cable when the plate is installed.
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 instructions may result in damage to a motor and a speed reducer.

- If grease is added with a plug on, the grease will go inside a motor or an oil seal of a speed reducer will come off, which may result in damage to the motor. It is absolutely necessary to remove the plug.
- Do not install a joint, a hose, etc. to a 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 infusion rate at 8 g/s or less.
- Make sure to fill a hose, etc. on the grease inlet side with grease to keep air from entering into the speed reducer.

9.3.1 Grease Replenishment/Exchange for S-Axis Speed Reducer and Gear

- Grease Replenishment (Refer to "Fig. 25 S-Axis Speed Reducer and Gear Diagram ").

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

- If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
2. Remove the hexagon socket head plug PT1/4 from the grease inlet and install the grease zerk A-PT1/4. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 2050 cc</td>
</tr>
<tr>
<td>(4100 cc for 1st supply)</td>
<td></td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. Move the S-axis for a few minutes to discharge excess grease.
4. Wipe the grease exhaust port with a cloth and reinstall the plug PT3/8. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
5. Remove the grease zerk from the grease inlet and reinstall the plug PT1/4. Tighten the plug to a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

**Grease Exchange** (Refer to "Fig. 25 S-Axis Speed Reducer and Gear Diagram ")

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

- If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/4 from the grease inlet and install the grease zerk A-PT1/4. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 12000 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. The grease exchange is completed when new grease appears in the exhaust port. The new grease can be distinguished from the old grease by color.
4. Move the S-axis for a few minutes to discharge excess grease.
5. Wipe the grease exhaust port with a cloth and reinstall the plug PT3/8. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it. Make sure that the grease exhaustion is completed before installing the plug.
9.3 Notes on Grease Replenishment/Exchange Procedures

6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/4. Tighten the plug to a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

9.3.2 Grease Replenishment/Exchange for L-Axis Speed Reducer

Grease Replenishment (Refer to "Fig. 26 L-Axis Speed Reducer Diagram").

1. Tilt the L-arm vertical to ground.
2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.
3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlets using a grease gun. (The grease zerk is delivered with the manipulator.)

   • If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 460 cc</td>
</tr>
<tr>
<td></td>
<td>(920 cc for 1st supply)</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>
5. Wipe the grease exhaust port with a cloth and reinstall the plug PT3/8. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug to a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

### Grease Exchange (Refer to "Fig. 26  L-Axis Speed Reducer Diagram ".)

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

   - If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlets using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 2300 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

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

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

6. Wipe the grease exhaust port with a cloth and reinstall the plug PT3/8. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

   If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it. Make sure that the grease exhaustion is completed before installing the plug.

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug to a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
9.3.3 Grease Replenishment/Exchange for U-Axis Speed Reducer

Grease Replenishment (Refer to "Fig. 27 U-Axis Speed Reducer Diagram ")

1. Tilt the U-arm horizontal to ground.
2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

- If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 290 cc</td>
</tr>
<tr>
<td></td>
<td>(580 cc for 1st supply)</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

4. Move the U-axis for a few minutes to discharge excess grease.
5. Wipe the grease exhaust port with a cloth and reinstall the plug PT3/8. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug to a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

**Grease Exchange (Refer to "Fig. 27 U-Axis Speed Reducer Diagram ")**

1. Tilt the U-arm horizontal to ground.
2. Remove the hexagon socket head plug PT3/8 from the grease exhaust port.

- If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 1900 cc</td>
</tr>
<tr>
<td>Air supply pressure</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

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 U-axis for a few minutes to discharge excess grease.
6. Wipe the grease exhaust port with a cloth and reinstall the plug PT3/8. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it. Make sure that the grease exhaustion is completed before installing the plug.

7. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug to a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
9.3.4 Grease Replenishment/Exchange for U-Arm

Fig. 28 U-Arm Diagram
9.3 Notes on Grease Replenishment/Exchange Procedures

Grease Replenishment for R-, B- T-Axis Gears in the Casing (Refer to "Fig. 28 U-Arm Diagram ")

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 go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 300 cc</td>
</tr>
<tr>
<td></td>
<td>(600 cc for 1st supply)</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. Move the R-, B-, T-axes for a few minutes to discharge excess grease.
4. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
5. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

Grease Replenishment for R-Axis Speed Reducer (Refer to "Fig. 28 U-Arm Diagram ")

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 go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 350 cc</td>
</tr>
<tr>
<td></td>
<td>(700 cc for 1st supply)</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>
3. Move the R-axis for a few minutes to discharge excess grease.
4. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
5. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

**Grease Replenishment for B-Axis Speed Reducer (Refer to "Fig. 28 U-Arm Diagram ").**

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 go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 260 cc</td>
</tr>
<tr>
<td></td>
<td>(520 cc for 1st supply)</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. Move the B-axis for a few minutes to discharge excess grease.
4. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
5. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
9.3 Notes on Grease Replenishment/Exchange Procedures

Grease Replenishment for T-Axis Speed Reducer (Refer to " Fig. 28 U-Arm Diagram ").

1. Remove the hexagon socket head plug PT1/16 from the grease exhaust port.

- If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 260 cc</td>
</tr>
<tr>
<td></td>
<td>(520 cc for 1st supply)</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. Move the T-axis for a few minutes to discharge excess grease.

4. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/16. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

5. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
9.3 Notes on Grease Replenishment/Exchange Procedures

- Grease Exchange for R-, B- T-Axis Gears in the Casing (Refer to "Fig. 28 U-Arm Diagram ").
  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 go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
  - Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

  2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 2000 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

  3. The grease exchange is completed when new grease appears from the grease exhaust port. The new grease is distinguished from the old grease by color.
  4. Move the R-, B-, T-axes for a few minutes to discharge excess grease.
  5. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
  6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

- Grease Exchange for R-Axis Speed Reducer (Refer to "Fig. 28 U-Arm Diagram ").
  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 go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
  - Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

  2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 2050 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>
3. The grease exchange is completed when new grease appears from the grease exhaust port. The new grease is distinguished from the old grease by color.
4. Move the R-axis for a few minutes to discharge excess grease.
5. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

- **Grease Exchange for B-Axis Speed Reducer (Refer to "Fig. 28 U-Arm Diagram ")**

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 go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
     - Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 1300 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. The grease exchange is completed when new grease appears from the grease exhaust port. The new grease is distinguished from the old grease by color.
4. Move the B-axis for a few minutes to discharge excess grease.
5. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
6. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
9.3 Notes on Grease Replenishment/Exchange Procedures

**Grease Exchange for T-Axis Speed Reducer (Refer to " Fig. 28 U-Arm Diagram ").**

1. Remove the hexagon socket head plug PT1/16 from the grease exhaust port.

   ![NOTE]

   - If grease is injected with the plug on, the grease will go outside the grease box and may cause a damage. Never fail to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Remove the hexagon socket head plug PT1/8 from the grease inlet and install the grease zerk A-PT1/8. Inject grease into the grease inlet using a grease gun. (The grease zerk is delivered with the manipulator.)

<table>
<thead>
<tr>
<th>Grease type</th>
<th>VIGO Grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>approx. 1300 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump</td>
<td>0.3 MPa or less</td>
</tr>
<tr>
<td>Grease infusion rate</td>
<td>8 g/s or less</td>
</tr>
</tbody>
</table>

3. Move the T-axis for a few minutes to discharge excess grease.

4. Wipe the grease exhaust port with a cloth and reinstall the plug PT1/16. Tighten the plug with a tightening torque of 3.9 N·m (0.4 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)

5. Remove the grease zerk from the grease inlet and reinstall the plug PT1/8. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread part of the plug.)
9.3.5 Grease Replenishment for Balancer Connection Part

1. Remove the hexagon socket head plugs from the exhaust ports of connection ① and ②. (Refer to " Fig. 29 Balancer Connection Part ".)
2. Inject grease into grease inlets of connection ① and ② using a grease gun.

<table>
<thead>
<tr>
<th>Grease type: Alvania EP</th>
<th>Alvania EP grease 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease</td>
<td>5 cc</td>
</tr>
<tr>
<td></td>
<td>(10 cc for 1st supply)</td>
</tr>
</tbody>
</table>

The exhaust port ① and ② are for AIR exhaust: the grease is not exhausted from the exhaust ports.

Do not inject excessive grease into the grease inlets.

3. Reinstall the plugs on the exhaust port of connection ① and ②. Tighten the plugs with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C to the thread parts of the plug.)
9.3 Notes on Grease Replenishment/Exchange Procedures

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. 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. 30 Battery Pack Connection".

Battery Pack Connections

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

1. Remove a cap attached to battery backup connectors of a motor.
2. Connect a battery pack (HW9470932-A) to the battery backup connectors (BAT and OBT are marked) located at the end point of an encoder cable. With the battery pack connected to the battery backup connectors, carry out maintenance checks.
3. Confirm all connectors are connected after the maintenance checks, and remove the battery pack. Reinstall the cap onto the battery backup connectors of the motor.

Do not remove battery pack in the connector base.

Fig. 30 Battery Pack Connection
10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the Motoman-EH200. The spare parts list for the Motoman-EH200 is shown below. For preparing lead wires for internal wiring, etc., check the serial number and contact your Yaskawa representative.

Product performance can not 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

**NOTE**

To replace parts in Rank B or Rank C, contact your Yaskawa representative.

<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>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Grease</td>
<td>VIGO Grease RE No.0</td>
<td>Yaskawa Electric Corporation</td>
<td>16 kg</td>
<td>- for all axes speed reducers and wrist units</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K.K.</td>
<td>16 kg</td>
<td>- for balancer joint part</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Liquid Gasket</td>
<td>Three Bond 1206C</td>
<td>ThreeBond Co., Ltd.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery Pack</td>
<td>HW0470360-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery Pack</td>
<td>HW9470932-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>Parts for S-Axis Speed Reducer</td>
<td>HW0385489-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>S-Axis Input Gear</td>
<td>HW0307565-4</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>Parts for L-Axis Speed Reducer</td>
<td>HW0386672-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table. 11  Spare Parts for the MOTOMAN-EH200

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>9</td>
<td>L-Axis Input Gear</td>
<td>HW0410011-1</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>Parts for U-Axis Speed Reducer</td>
<td>HW0386673-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>11</td>
<td>U-Axis Input Gear</td>
<td>HW0410012-1</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>R-Axis Speed Reducer</td>
<td>HW0380780-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>B-Axis Speed Reducer</td>
<td>HW9381453-B</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td>T-Axis Speed Reducer</td>
<td>HW0380794-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>Wrist Unit</td>
<td>HW0170621-C</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>AC Servomotor for S-, L- and U-Axes</td>
<td>HW0383524-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>17</td>
<td>AC Servomotor for R-, B-, and T-Axes</td>
<td>HW0382156-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>Wire Harness in Manipulator</td>
<td>HW0173134-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>19</td>
<td>Wire Harness in Manipulator</td>
<td>HW0372174-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Assembled with connector base</td>
</tr>
</tbody>
</table>