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Chapter 1

Introduction

1.1 About This Document

This manual provides information for the UP130RN-A2 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 - UP130RN-A2 SUPPLEMENTARY INSTRUCTIONS
Provides supplementary information for the UP130RN-A2 manipulator.

CHAPTER 4 - EPH130R INSTRUCTIONS
Provides detailed information for the UP130RN-A2 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:

- Product (UP130RN-A2)
- 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).
Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

The NX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.
MANDATORY

• This instruction manual is intended to explain operating instructions and maintenance procedures primarily for the MOTOMAN-UP130RLN.

• 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.

CAUTION

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating 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 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 are problems. The emergency stop button is located on the right of front door of the NX100 and the programming pendant.
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 NX100 cabinet 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 NX100 instructions before operating the manipulator.

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>
Explanation of Warning Labels

The following warning labels are attached to the manipulator. Always follow the warnings on the labels. Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Nameplate:

<table>
<thead>
<tr>
<th>MOTOMAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>P/N</td>
</tr>
<tr>
<td>PAYLOAD</td>
</tr>
<tr>
<td>MASS</td>
</tr>
<tr>
<td>ORDER NO.</td>
</tr>
<tr>
<td>DATE</td>
</tr>
<tr>
<td>SERIAL NO.</td>
</tr>
</tbody>
</table>

YASKAWA ELECTRIC CORPORATION JAPAN

WARNING label A:

⚠️ WARNING

Moving parts may cause injury

WARNING label B:

⚠️ WARNING

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

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   2.1 Transporting Method ........................................... 2-1
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   2.2 Shipping Bolts and Bracket ................................. 2-3

3 Installation
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            (Refer to "Fig. 20 JT1-Axis Speed Reducer and Gear Diagram "). 9-8
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■ Grease Replenishment
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10 Recommended Spare Parts
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 is given separately):

• Manipulator
• NX100
• Programming pendant
• Manipulator cables (4 cables, between the NX100 and the manipulator)

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.
1.2 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.

Label (Enlarged View)

THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE SAME ORDER NUMBER

ORDER No. □ □ □ □ □

Check that the manipulator and the NX100 have the same order number.

(a) NX100 (Front View)

(b) Manipulator (Top View)

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.

---

- Check that the eyebolts are securely fastened.
- The mass of the manipulator is approximately 1445 kg including the shipping bolts and bracket. Use a wire rope strong enough to withstand the mass.
- Attached eyebolts are designed to support the manipulator mass. Do not use them for anything other than transporting the manipulator.
- Mount the shipping bolts and bracket for transporting the manipulator.
- Avoid external force on the arm or motor unit when transporting. Use caution when using transporting equipment other than a crane or forklift, as injury may occur.
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 wire rope threaded through attached eyebolts. Be sure the manipulator is fixed with shipping bolts and bracket before transporting, and lift it in the posture as shown in "Fig. 2 Transporting Position."
2.2 Shipping Bolts and Bracket

The manipulator is provided with shipping bolts and bracket illustrated at A, B, and C in "Fig. 2 Transporting Position."

- The bolts and brackets illustrated at A, B, and C are painted yellow.

<table>
<thead>
<tr>
<th>Position</th>
<th>Bolt Type</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hexagon socket head cap screw M8 × 25 mm</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(Tensile strength: 1200 N/mm² or more)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Hexagon head nut M12</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>Hexagon head nut M12</td>
<td>2</td>
</tr>
</tbody>
</table>

Before turning ON the power, check to be sure that the shipping bolts and bracket have been removed. The shipping bolts and bracket 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 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.

![CAUTION]

- **Do not install or operate a manipulator that is damaged or lacking 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 Transporting Position" 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. It prevents 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 the 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 as shown in "Table. 1 Maximum Repulsion Forces of the Manipulator".

During installation, if the flatness is not right, the manipulator may be deformed and its functional ability may be compromised. The flatness for baseplate must be kept at 0.5 mm or less. Fix the manipulator base as shown in "3.2.1 When the Manipulator and Fixture are Mounted on a Baseplate".

<table>
<thead>
<tr>
<th>Table. 1 Maximum Repulsion Forces of the Manipulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Horizontal rotating maximum torque (JT1-axis moving direction)</td>
</tr>
<tr>
<td>② Vertical rotating maximum torque (JT2- and JT3-axis moving direction)</td>
</tr>
</tbody>
</table>
### 3.2.1 When the Manipulator and Fixture are Mounted on a Baseplate

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. Refer to "Table. 1 Maximum Repulsion Forces of the Manipulator". The manipulator base is tapped for 8 mounting holes. Fix the manipulator base onto the baseplate with the hexagon socket head cap screw M24 (tensile strength: 1000 N/mm² or more, length: 85 mm is recommended). Tighten the screws and anchor bolts securely so that they will not work loose during operation. Refer to "Fig. 3 Mounting the Manipulator on Baseplate."

![Diagram of Mounting the Manipulator on Baseplate](image)

### 3.2.2 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 (non-condensing)
- Free from exposure to water, oil, or dust
- Free from corrosive gases or liquids, or explosive gases
- Free from large electrical noise (plasma)
- Free from excessive shock or vibration (4.9 m/s² [0.5G] or less)
- The flatness for installation is 0.5 mm or less.
4.1 Grounding

Follow local regulations for grounding line size. A line of 5.5 mm\(^2\) or more is recommended. Refer to "Fig. 4 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.
4.2 Manipulator Cable Connection

Four manipulator cables are delivered with the manipulator; 1BC, 2BC, 3BC, and 4BC. (Refer to "Fig. 5 Manipulator Cables"). Connect these cables to the manipulator base connectors and the NX100. For details, refer to "Fig. 6 (a) Manipulator Cable Connectors (Manipulator Side)" and "Fig. 6 (b) Manipulator Cable Connection to the NX100."

4.2.1 Connection to the Manipulator

Before connecting four cables to the manipulator, verify the numbers: 1BC, 2BC, 3BC, and 4BC on both manipulator cables and the manipulator base connectors. When connecting, adjust the cable connector positions to the main key positions of the manipulator, and insert cables in the order of 2BC, 3BC, 4BC, and 1BC, and then set the lever until it clicks.

4.2.2 Connection to the NX100

Before connecting four cables to the NX100, verify the numbers: 1BC, 2BC, 3BC, and 4BC on both manipulator cables and the NX100 board connectors. When connecting, adjust the cable connector positions to the main key positions of the NX100, and insert cables in the order of X21, X22, X23, and X11, and then set the lever until it clicks.
4.2 Manipulator Cable Connection

CAUTION

Do not cover the cable or allow it to tangle. Keep the cable as straight as possible.

Failure to observe this caution may result in preventing heat of the cable from being discharged.

Fig. 5 Manipulator Cables
4.2 Manipulator Cable Connection

Fig. 6 (a) Manipulator Cable Connectors (Manipulator Side)

Fig. 6 (b) Manipulator Cable Connection to the NX100
# 5 Basic Specifications

## 5.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>MOTOMAN-UP130RLN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td>Vertically Articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>130 kg</td>
</tr>
<tr>
<td>Repeatability*2</td>
<td>±0.3 mm</td>
</tr>
<tr>
<td>JT1-axis (turning)</td>
<td>±160°</td>
</tr>
<tr>
<td>JT2-axis (lower arm)</td>
<td>+70°, -130°</td>
</tr>
<tr>
<td>JT3-axis (upper arm)</td>
<td>+95°, -70°</td>
</tr>
<tr>
<td>JT4-axis (wrist roll)</td>
<td>±360°</td>
</tr>
<tr>
<td>JT5-axis (wrist pitch/yaw)</td>
<td>±130°</td>
</tr>
<tr>
<td>JT6-axis (wrist twist)</td>
<td>±360°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
</tr>
<tr>
<td>JT1-axis</td>
<td>1.92 rad/s, 110°/s</td>
</tr>
<tr>
<td>JT2-axis</td>
<td>1.92 rad/s, 110°/s</td>
</tr>
<tr>
<td>JT3-axis</td>
<td>1.92 rad/s, 110°/s</td>
</tr>
<tr>
<td>JT4-axis</td>
<td>3.75 rad/s, 215°/s</td>
</tr>
<tr>
<td>JT5-axis</td>
<td>3.14 rad/s, 180°/s</td>
</tr>
<tr>
<td>JT6-axis</td>
<td>5.23 rad/s, 300°/s</td>
</tr>
<tr>
<td>Allowable Moment*3</td>
<td></td>
</tr>
<tr>
<td>JT4-Axis</td>
<td>735 N•m (75 kgf•m)</td>
</tr>
<tr>
<td>JT5-Axis</td>
<td>735 N•m (75 kgf•m)</td>
</tr>
<tr>
<td>JT6-Axis</td>
<td>421 N•m (43 kgf•m)</td>
</tr>
<tr>
<td>Mass</td>
<td>1425 kg</td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to 45°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80 % RH (non-condensing)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>Less than 4.9 m/s² (0.5G)</td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free from corrosive gasses or liquids, or explosive gasses</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 Conforms to ISO9283

*3 Refer to "6.1 Allowable Load" for details on the permissible moment of inertia.
5.2 Part Names and Working Axes

Fig. 7 Part Names and Working Axes

5.3 Manipulator Base Dimensions

Fig. 8 Manipulator Base Dimensions
5.4 Dimensions and P-Point Maximum Envelope

Fig. 9 Dimensions and P-Point Maximum Envelope

Units: mm
5.5 JT5-Axis Operating Range

The operating range of the JT5-axis maintains a constant angle to the center of U-arm as shown in "Fig. 10 JT5-Axis Operating Range".

5.6 Alterable Operating Range

The operating range of the JT1-axis can be altered according to the operating conditions as shown in "Table. 3 JT1-axis Operating Range". If alteration is necessary, contact your Yaskawa representative in advance.

Table. 3 JT1-axis Operating Range

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>JT1-axis Operating Range</td>
<td>±160° (standard)</td>
</tr>
<tr>
<td></td>
<td>±125°</td>
</tr>
<tr>
<td></td>
<td>±90°</td>
</tr>
<tr>
<td></td>
<td>±60°</td>
</tr>
<tr>
<td></td>
<td>±30°</td>
</tr>
</tbody>
</table>
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

This section describes the allowable values and various limitations. The allowable wrist load including the weight of the gripper is 130 kg maximum.

1. The following conditions as described in "Table. 4 Allowable Moment for Wrist Axis" have to be met since the moment weight is limited.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N•m (kgf•m)*1</th>
</tr>
</thead>
<tbody>
<tr>
<td>JT4-axis</td>
<td>735 (75)</td>
</tr>
<tr>
<td>JT5-axis</td>
<td>735 (75)</td>
</tr>
<tr>
<td>JT6-axis</td>
<td>421 (43)</td>
</tr>
</tbody>
</table>

   *1 (·): Gravitational unit

2. The allowable inertia varies depending on the load torque, as shown in "Fig. 11 (a) JT4- and JT5-axis Allowable Inertia Diagram (Measured Value from the P-point)" and "Fig. 11 (b) JT6-axis Allowable Inertia Diagram (Measured Value from the Rotation Center of the JT6-axis Flange Face)". Use and operate the manipulator to meet these conditions. For example, when the load torque of JT6-axis is 421 N•m, the allowable inertia would be 15 kg·m², while the allowable inertia would be 52 kg·m² when the load torque is 0 N•m.
6.2 Wrist Flange

The wrist flange dimensions are shown in "Fig. 12 Wrist Flange." In order to see the alignment marks, it is recommended that the attachment be mounted inside the fitting. Fitting depth of both inside and outside fitting must be 8 mm or less.

Wash off anti-corrosive paint (yellow color) on the wrist flange surface with thinner or light oil before mounting the tools.
7.1 Peripheral Equipment Mounts

When peripheral equipment is attached to the U-arm, the following conditions described in "Table. 5 Constraint for Attaching" should be observed.

**Fig. 13 Installing Peripheral Equipment**

<table>
<thead>
<tr>
<th>Application</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Attaching load mass is 130 kg max. including wrist load.</td>
</tr>
<tr>
<td>B</td>
<td>30 kg max. 48 N·m (4.9 kgf·m) max. for moment increase amount of upper arm</td>
</tr>
</tbody>
</table>
7.2 Internal User I/O Wiring Harness and Air Line

Internal user I/O wiring harness (0.75 mm², 34 lead wires) and one air line are incorporated in the manipulator for the drives of the peripheral devices mounted on the upper arm as shown in "Fig. 14 Internal User I/O Wiring Harness and Air Line".

The connector pins (1 to 34) and terminal are assigned as shown in "Fig. 14 Internal User I/O Wiring Harness and Air Line". Wiring must be performed by user.

- The allowable current for internal user I/O wiring harness: 6.6 A or less for each lead wires (The total current value for pins 1 to 34 must be 60 A or less.)
- The maximum pressure for the air line: 490 kPa (5.0 kgf/cm²) or less
The same pin number (1-34) of two connectors is connected with the lead wire of single 0.75 mm².
8 Motoman Construction

8.1 Internal Connections

High reliability connectors which can be easily put on and removed are used with each connector part. For the number and location of connectors, refer to "Fig. 15 Location of Connectors" and "Table. 6 List of Connector Types". "Fig. 16 (a) Internal Connection Diagram" and "Fig. 16 (b) Internal Connection Diagram" show the internal connections between the inside of the manipulator and the NX100.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector for internal user I/O wiring harness on connector base</td>
<td>JL05-2A24-28PC (JL05-6A24-28S: Optional)</td>
</tr>
<tr>
<td>Connector for internal user I/O wiring harness on U-arm</td>
<td>JL05-2A24-28SC (JL05-6A24-28P: Optional)</td>
</tr>
</tbody>
</table>
Fig. 16 (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 displayed in six levels. Conduct periodical inspections according to the inspection schedule in "Table. 7 Inspection Items."

In "Fig. 7 Inspection Items", the inspection items are classified into three types of operation: operations which can be performed by personnel authorized of 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.

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.
### Table 7 Inspection Items

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>1000 H Cycle</td>
<td>6000 H Cycle</td>
<td>12000 H Cycle</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 exterior cracks.</td>
<td>○</td>
</tr>
<tr>
<td>4 JT2, 3-axis motors</td>
<td>○</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td>○</td>
</tr>
<tr>
<td>5 Manipulator base mounting bolts</td>
<td>○</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>○</td>
</tr>
<tr>
<td>6 Cover mounting screws</td>
<td>○</td>
<td>Phillips screwdriver, wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>○</td>
</tr>
<tr>
<td>7 JT1, 2, 3-axis motor connectors</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 and tighten if necessary.</td>
<td>○</td>
</tr>
<tr>
<td>9 JT4, 5, 6-axis timing belts</td>
<td>○</td>
<td>Manual</td>
<td>Check for belt tension and wear.</td>
<td>○</td>
</tr>
<tr>
<td>10 Wire harness in manipulator (Lead wires for JT1, 2, 3-axes) (Lead wires for JT4, 5, 6-axes)</td>
<td>○</td>
<td>Visual</td>
<td>Check for conduction between the main connector of connector base and each connector with manually shaking the wire. Check for wear of protective spring.</td>
<td>○</td>
</tr>
<tr>
<td>11 JT2, 3-axis arm connection parts</td>
<td>○</td>
<td>Visual</td>
<td>Check for a backlash of the bearing by moving the JT2, 3-axes back and forth, and up and down. Supply grease.</td>
<td>○</td>
</tr>
<tr>
<td>12 Battery pack in manipulator</td>
<td>○</td>
<td>Visual</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000 H.</td>
<td>○</td>
</tr>
</tbody>
</table>
### 9.1 Inspection Schedule

#### Table 7 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></td>
<td></td>
<td>Daily</td>
<td>1000 H Cycle</td>
<td>6000 H Cycle</td>
</tr>
<tr>
<td>JT1-axis speed reducer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JT2, 3-axis speed reducers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JT4-axis gear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JT5, 6-axis speed reducers and gears</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JT1, 2-axis cross roller bearings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhaul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^4\) Specified person is responsible for the inspection and maintenance of the items listed above.

---

**Note:**
- Check for malfunction. (Replace if necessary.)
- Supply grease \(^3\) (6000H cycle). See Par. 9.2.2.
- Replace grease \(^3\) (12000H cycle). See Par. 9.2.2.
- Supply grease \(^3\) (6000H cycle). See Par. 9.2.3 and 9.2.4.
- Replace grease \(^3\) (12000H cycle). See Par. 9.2.3 and 9.2.4.
- Supply grease \(^3\) (6000H cycle). See Par. 9.2.5.
- Replace grease \(^3\) (12000H cycle). See Par. 9.2.5.
- Supply grease \(^3\) (6000H cycle). See Par. 9.2.6 and 9.2.7.
- Replace grease \(^3\) (12000H cycle). See Par. 9.2.6 and 9.2.7.
- Supply grease \(^3\) (6000H cycle). See Par. 9.2.8 and 9.2.9.
- Replace grease \(^3\) (12000H cycle). See Par. 9.2.8 and 9.2.9.
9.1 Inspection Schedule

*1 When checking for conduction with multimeter, connect the battery pack 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 "9.2.11 Notes for Maintenance."

*2 Internal cables (for JT1, 2, 3, 4, 5, 6-axes) to be replaced at 24000H inspection.

*3 For the grease, refer to "Table. 8 Inspection Parts and Grease Used."

*4 Inspection No. correspond to the numbers in "Fig. 17 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. 8 Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>13, 14</td>
<td>Molywhite RE No. 00</td>
<td>All axis-speed reducers</td>
</tr>
<tr>
<td>15, 16</td>
<td></td>
<td>JT5- and JT6-axis gears</td>
</tr>
<tr>
<td>11, 17</td>
<td>Alvania EP Grease 2</td>
<td>JT1- and JT2-axis cross roller bearings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tapered roller bearings in the link part</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in "Table. 7 Inspection Items."
The manipulator is in the home position.

Fig. 17  Inspection Parts and Inspection Numbers (The Manipulator in the Home Position)
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

Battery packs are located as illustrated in "Fig. 18 Battery Pack Location."

If the battery alarm occurs in the NX100, replace the battery packs according to the following procedure:

Fig. 18 Battery Pack Location

Fig. 19 Battery Connection
9.2 Notes on Maintenance Procedures

1. Turn the NX100 main power supply OFF.
2. Remove the battery pack mounting screws on the connector base, and pull the battery pack out to replace it with the 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 battery pack into the connector base with mounting screws.
9.2.2 Grease Replenishment/Exchange for JT1-Axis Speed Reducer and Gear

Grease Replenishment (Refer to "Fig. 20 JT1-Axis Speed Reducer and Gear Diagram ").

1. Remove the hexagon socket head plug PT1/4 from the grease exhaust port JT1o.

   **NOTE**  If grease is added with the plug on, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

2. Inject the grease into the grease inlet JT1i using a grease gun.

   Grease type: Molywhite RE No.00  
   Amount of grease: 600cc  
   (1200cc for 1st supply)

3. Move the JT1-axis for a few minutes to discharge the excess grease.
4. Wipe the grease exhaust port JT1o with a cloth and reinstall the plug PT1/4. 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.
9.2 Notes on Maintenance Procedures

Grease Exchange (Refer to "Fig. 20 JT1-Axis Speed Reducer and Gear Diagram ")

1. Remove the hexagon socket head plug PT1/4 from the grease exhaust port JT1o.

   ![NOTE]
   If grease is added with the plug on, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

2. Inject the grease into the grease inlet JT1i using a grease gun.

   | Grease type: Molywhite RE No.00  |
   | Amount of grease: Approx. 3000cc |

3. The grease exchange is complete when new grease appears in the grease exhaust port JT1o. The new grease can be distinguished from the old grease by color.

4. Move the JT1-axis for a few minutes to discharge the excess grease.

5. Wipe the grease exhaust port JT1o with a cloth and reinstall the plug PT1/4. 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.
9.2.3 Grease Replenishment/Exchange for JT2-Axis Speed Reducer

Fig. 21 JT2-Axis Speed Reducer Diagram
9.2 Notes on Maintenance Procedures

**Grease Replenishment (Refer to "Fig. 21 JT2-Axis Speed Reducer Diagram ")**

1. Tilt the L-arm as illustrated in "Fig. 21 JT2-Axis Speed Reducer Diagram ".
2. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT2o.

   **NOTE**
   If grease is added with the plug on, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

3. Inject the grease into the grease inlet JT2i using a grease gun.

   | Grease type: Molywhite RE No.00 |
   | Amount of grease: 400cc          |
   | (800cc for 1st supply)           |

4. Move the JT2-axis for a few minutes to discharge the excess grease.
5. Wipe the grease exhaust port JT2o with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of $5 \text{ N} \cdot \text{m} (0.51 \text{ kgf} \cdot \text{m})$. Apply Three Bond 1206C to the thread part of the plug.

**Grease Exchange (Refer to "Fig. 21 JT2-Axis Speed Reducer Diagram ")**

1. Tilt the L-arm as illustrated in "Fig. 21 JT2-Axis Speed Reducer Diagram ".
2. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT2o.

   **NOTE**
   If grease is added with the plug on, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

3. Inject the grease into the grease inlet JT2i using a grease gun.

   | Grease type: Molywhite RE No.00 |
   | Amount of grease: approx. 2000cc |

4. 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.
5. Move the JT2-axis for a few minutes to discharge the excess grease.
6. Wipe the grease exhaust port JT2o with a cloth and reinstall the plug PT1/8. Tighten the plug with a tightening torque of $5 \text{ N} \cdot \text{m} (0.51 \text{ kgf} \cdot \text{m})$. Apply Three Bond 1206C to the thread part of the plug.
9.2.4 Grease Replenishment/Exchange for JT3-Axis Speed Reducer

1. Tilt the U-arm as illustrated in "Fig. 22 JT3-Axis Speed Reducer Diagram".
2. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT3o.
3. Inject the grease into the grease inlet JT3i using a grease gun.
4. Move the JT3-axis for a few minutes to discharge the excess grease.
5. Wipe the grease exhaust port JT3o 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.

**NOTE**: If grease is added with the plug on, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

Grease type: Molywhite RE No.00
Amount of grease: 180cc
(360cc for 1st supply)

Fig. 22 JT3-Axis Speed Reducer Diagram
Grease Exchange (Refer to "Fig. 22 JT3-Axis Speed Reducer Diagram").

1. Tilt the U-arm as illustrated in "Fig. 22 JT3-Axis Speed Reducer Diagram".
2. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT3o.

**NOTE**

If grease is added with the plug on, the grease will go inside the motor and may damage it. It is absolutely necessary to remove the plug.

3. Inject the grease into the grease inlet JT3i using a grease gun.

<table>
<thead>
<tr>
<th>Grease type: Molywhite RE No.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease: approx. 800cc</td>
</tr>
</tbody>
</table>

4. The grease exchange is complete when new grease appears in the grease exhaust port JT3o. The new grease can be distinguished from the old grease by color.
5. Move the JT3-axis for a few minutes to discharge the excess grease.
6. Wipe the grease exhaust port JT3o 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.
9.2.5 Grease Replenishment/Exchange for JT4-Axis Speed Reducer

Grease Replenishment (Refer to "Fig. 23 JT4-Axis Speed Reducer Diagram ".)

1. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT4o.

   If grease is added with the plug on, the grease will go outside the grease box and may damage it. It is absolutely necessary to remove the plug.

2. Inject the grease into the grease inlet JT4i using a grease gun.

   Grease type: Molywhite RE No.00
   Amount of grease: 28cc
   (56cc for first supply)

3. Move the JT4-axis for a few minutes to discharge the excess grease.
4. Wipe the grease exhaust port JT4o 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.
9.2 Notes on Maintenance Procedures

Grease Exchange (Refer to "Fig. 23 JT4-Axis Speed Reducer Diagram ").

1. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT4o.

   **NOTE** If grease is added with the plug on, the grease will go outside the grease box and may damage it. It is absolutely necessary to remove the plug.

2. Inject the grease into the grease inlet JT4i using a grease gun.

   
   | Grease type: Molywhite RE No.00 |
   | Amount of grease: approx. 140cc |

3. The grease exchange is complete when new grease appears in the grease exhaust port JT4o. The new grease can be distinguished from the old grease by color.

4. Move the JT4-axis for a few minutes to discharge the excess grease.

5. Wipe the grease exhaust port JT4o 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.
9.2.6 Grease Replenishment/Exchange for JT5-Axis Speed Reducer and Gear

Fig. 24 JT5-Axis Speed Reducer and Gear Diagram

- Grease Replenishment (Refer to "Fig. 24 JT5-Axis Speed Reducer and Gear Diagram ")

1. Remove the hexagon socket head plug PT 1/8 from the grease exhaust port JT5o.

   **NOTE:** If grease is added with the plug on, the grease will go outside the grease box and may damage it. It is absolutely necessary to remove the plug.

2. Inject the grease into the grease inlet JT5i using a grease gun.

   Grease type: Molywhite RE No.00  
   Amount of grease: 200cc  
   (400cc for first supply)

3. Move the JT5-axis for a few minutes to discharge the excess grease.

4. Wipe the grease exhaust port JT5o 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.
Grease Exchange (Refer to "Fig. 24 JT5-Axis Speed Reducer and Gear Diagram ").

1. Remove the hexagon socket head plug PT1/8 from the grease exhaust port JT5o.

   **NOTE**: If grease is added with the plug on, the grease will go outside the grease box and may damage it. It is absolutely necessary to remove the plug.

2. Inject the grease into the grease inlet JT5i using a grease gun.

<table>
<thead>
<tr>
<th>Grease type: Molywhite RE No.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease: approx. 900cc</td>
</tr>
</tbody>
</table>

3. The grease exchange is complete when new grease appears in the grease exhaust port JT5o. The new grease can be distinguished from the old grease by color.

4. Move the JT5-axis for a few minutes to discharge the excess grease.

5. Wipe the grease exhaust port JT5o 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.
9.2.7 Grease Replenishment/Exchange for JT6-Axis Speed Reducer and Gear

Grease Replenishment (Refer to "Fig. 25 JT6-Axis Speed Reducer and Gear Diagram ")

1. Remove the hexagon socket set screw M6 from the grease exhaust port JT6o.

   **NOTE** If grease is added with the set screw on, the grease will go outside the grease box and may damage it. It is absolutely necessary to remove the set screw.

2. Inject the grease into the grease inlet JT6i using a grease gun.

   **Grease type:** Molywhite RE No.00
   **Amount of grease:** 200cc
   (400cc for first supply)

3. Move the JT6-axis for a few minutes to discharge the excess grease.
4. Wipe the grease exhaust port JT6o with a cloth and reinstall the set screw M6. Apply Three Bond 1206C to the thread part of the set screw.
9.2 Notes on Maintenance Procedures

Grease Exchange (Refer to " Fig. 25 JT6-Axis Speed Reducer and Gear Diagram ").

1. Remove the hexagon socket set screw M6 from the grease exhaust port JT6o.

   **NOTE** If grease is added with the set screw on, the grease will go outside the grease box and may damage it. It is absolutely necessary to remove the set screw.

2. Inject the grease into the grease inlet JT6i using a grease gun.

   Grease type: Molywhite RE No.00
   Amount of grease: approx. 900cc

3. The grease exchange is complete when new grease appears in the grease exhaust port JT6o. The new grease can be distinguished from the old grease by color.

4. Move the JT6-axis for a few minutes to discharge the excess grease.

5. Wipe the grease exhaust port JT6o with a cloth and reinstall the set screw M6. Apply Three Bond 1206C to the thread part of the set screw.
9.2.8 Grease Replenishment for JT1 Cross Roller Bearing

Fig. 26 JT1-Axis Cross Roller Bearing Diagram

- Grease Replenishment (Refer to "Fig. 26 JT1-Axis Cross Roller Bearing Diagram ".)

1. Inject the grease into the grease inlet JT1c using a grease gun.

![Diagram showing Grease Replenishment for JT1 Cross Roller Bearing]

Grease type: Alvania EP grease 2
Amount of grease: 20cc
9.2.9 Grease Replenishment for JT2-Axis Cross Roller Bearing

1. Remove the hexagon socket set screw M6 from the exhaust port. (Refer to "Fig. 27 JT2-Axis Cross Roller Bearing Diagram ".)
2. Inject the grease into the grease inlet JT2c using a grease gun.

Grease type: Alvania EP grease 2
Amount of grease: 19cc

**NOTE** The exhaust port is used for air flow.

3. Reinstall the set screw M6 for the exhaust port. Apply Three Bond 1206C to the thread part of the set screw.
9.2.10 Grease Replenishment for Tapered Roller Bearing in the Link Part

1. Remove the hexagon socket set screw M6 (6 set screws from 3 spots) from the exhaust ports. (Refer to "Fig. 28 Link Part Diagram ".)

2. Inject the grease into the grease inlets Hc (6 spots) of the connections.

<table>
<thead>
<tr>
<th>Grease type: Alvania EP grease 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease: 6cc</td>
</tr>
<tr>
<td>(12cc for 1st supply)</td>
</tr>
</tbody>
</table>

3. Reinstall the set screws M6 for the exhaust ports of the connections. Apply Three Bond 1206C to the thread part of the set screw.

**NOTE**
The exhaust port is used for air flow. Do not inject excessive grease into the grease inlets.
### 9.2.11 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. 29 Battery Pack Connection for Motor".

#### Battery Pack Connection for Motor

The connector (insertion contact-pin terminal) for the battery backup is installed in the end point of the motor (BAT and OBT are marked).

Connect the battery pack according to the following procedure.

1. Remove the cap attached to the battery backup connector of the motor.
2. Connect the battery pack (HW9470932) to the battery backup connector. (With the battery pack connected to the battery backup connector, remove the encoder connector and perform the maintenance.)
3. After the maintenance, confirm that all connectors are connected and then remove the battery pack connection cable and battery pack.
4. Install the attached cap to the battery backup connector.

**NOTE** Do not remove the battery pack in the connector base.
10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-UP130RLN. The spare parts list for the MOTOMAN-UP130RLN is shown below.

For preparing lead wires for wire harness in the manipulator, etc., check the serial number and contact your Yaskawa representative.

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

![NOTE] To replace parts in Rank B or Rank C, contact your Yaskawa representative.

### Table. 9  Spare Parts for the MOTOMAN-UP130RLN

<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>A</td>
<td>1</td>
<td>Battery Pack</td>
<td>HW9470932-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For JT1, 2, 3-axes</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Battery Pack</td>
<td>HW9470932-B</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For JT4, 5, 6-axes</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>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Grease</td>
<td>Molywhite RE No. 00</td>
<td>Yaskawa Electric Corporation</td>
<td>16 kg</td>
<td>-</td>
<td>For all axis-speed reducers and wrist unit</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K.K.</td>
<td>16 kg</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>JT4-axis Timing Belt</td>
<td>200S8M896</td>
<td>Mitsuboshi Belt- ing Ltd.</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>B</td>
<td>7</td>
<td>JT5-axis Timing Belt</td>
<td>200S8M800</td>
<td>Mitsuboshi Belt- ing Ltd.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>JT6-axis Timing Belt</td>
<td>200S8M656</td>
<td>Mitsuboshi Belt- ing Ltd.</td>
<td>1</td>
<td>1</td>
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<tr>
<td>B</td>
<td>9</td>
<td>JT1-axis Speed Reducer</td>
<td>HW9381220-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Table 9 Spare Parts for the MOTOMAN-UP130RLN

<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>10</td>
<td>JT2-axis Speed Reducer</td>
<td>HW9381442-B</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
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<tr>
<td>B</td>
<td>11</td>
<td>JT3-axis Speed Reducer</td>
<td>HW9381324-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>JT4-axis Speed Reducer</td>
<td>HW9381399-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>JT5-axis Speed Reducer</td>
<td>HW9380061-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>B</td>
<td>14</td>
<td>JT6-axis Speed Reducer</td>
<td>HW9381400-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>JT1-axis cross roller bearing</td>
<td>HW9381222-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>JT2-axis cross roller bearing</td>
<td>HW9482144-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
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<tr>
<td>C</td>
<td>17</td>
<td>Wrist Unit</td>
<td>HW9171451-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>C</td>
<td>18</td>
<td>AC Servo Motor for JT1, 2, 3-axes</td>
<td>HW0382157-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>3</td>
<td></td>
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<tr>
<td>C</td>
<td>19</td>
<td>AC Servo Motor for JT4, 5, 6-axes</td>
<td>HW0382156-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>Wire Harness in Manipulator</td>
<td>HW0171318-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>