MOTOMAN-AR1440E INSTRUCTIONS

TYPE:
YR-1-07VXHE6-A00
(MOTOMAN-AR1440E STANDARD SPECIFICATION)

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

MOTOMAN INSTRUCTIONS

YRC1000 INSTRUCTIONS
YRC1000 OWNER'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

The YRC1000 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual. The YRC1000 operator’s manual above consists of “GENERAL” and “SUBJECT SPECIFIC”. The YRC1000 alarm codes above consists of “MAJOR ALARMS” and “MINOR ALARMS”.

Please have the following information available when contacting Yaskawa Customer Support:

- System
- Primary Application
- Software Version (Located on Programming Pendant by selecting: [Main Menu] - [System Info] - [Version])
- Robot Serial Number (Located on robot data plate)
- Robot Sales Order Number (Located on controller data plate)

Part Number: 185421-1CD
Revision: 0
DANGER

- This instruction manual is intended to explain mainly on the mechanical part of this manipulator for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator. Any matter not described in this manual must be regarded as “prohibited” or “improper”.
- General information related to safety are described in “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS.

CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place 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 is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- 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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of your manipulator.

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

**DANGER**
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

**CAUTION**
Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to "NOTICE".

**NOTICE**
NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to "NOTICE", the word "CAUTION" without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as "CAUTION" may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

**NOTE**
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "DANGER", "WARNING" and "CAUTION".
DANGER

- Do not remove the motor, and do not release the brake. Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

- 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.
DANGER

• Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  – Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  – Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode)
If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button

• Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.
Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  – Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  – Ensure a safe place to retreat in case of emergency.
Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

• Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  – Turning ON the YRC1000 power
  – Moving the manipulator by using the programming pendant
  – Running the system in the check mode
  – Performing automatic operations
Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

• Read and understand the Explanation of the Warning Labels before operating the manipulator.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and 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>YRC1000 controller</td>
<td>YRC1000</td>
</tr>
<tr>
<td>YRC1000 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>

Registered Trademark

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

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

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

Fig. : Warning Label Locations

Nameplate

Crush hazard label

Collision hazard label

Fall down hazard label
Fall down hazard label

Description
Make sure to secure the manipulator base by using the bolts of the specified sizes and by tightening the bolts with the specified tightening torques. If the power is turned ON and the manipulator is operated without securing the manipulator properly, the manipulator may fall down, which may result in personal injury and/or equipment damage.

Collision hazard label

Description
Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:

• Turning ON the YRC1000 power
• Moving the manipulator by using the programming pendant
• Running the system in the check mode
• Performing automatic operations
Crush hazard label

Description
Keep clear of moving parts when performing a teaching operation within the manipulator's operating range. Failure to observe this instruction may result in personal injury.
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1 Product Confirmation

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives. Standard delivery includes the following five items (information for the content of optional goods are given separately):

- Manipulator (accessories included)
- YRC1000 (spare parts included)
- Programming pendant
- Manipulator cable (between the YRC1000 and the Manipulator)
- Manual

Fig. 1-1: Five Items for Standard Delivery

CAUTION

- Confirm that the manipulator and the YRC1000 have the same order number. Pay special attention when installing two or more manipulators.

Failure to observe this instruction may cause improper movement of the manipulator, which may result in personal injury and/or equipment damage.

Complete Set of Manuals (in the CD-ROM which is connected to the USB connector)
## 1 Product Confirmation
### 1.1 Contents Confirmation

<table>
<thead>
<tr>
<th>Accessories of Manipulator</th>
<th>Pcs</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagon socket head cap screw M16 (length: 50 mm)</td>
<td>4</td>
<td>For mounting the manipulator</td>
</tr>
<tr>
<td>Conical spring washer 2H-10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-MT6X1</td>
<td>3</td>
<td>For grease replenishment of B- and T-axis</td>
</tr>
<tr>
<td>Grease zerk A-PT1/8</td>
<td>3</td>
<td>For grease replenishment for the R-axis</td>
</tr>
<tr>
<td>Grease zerk A-PT3/8</td>
<td>3</td>
<td>For grease replenishment for the S-, L-, E-, and U-axis</td>
</tr>
<tr>
<td>Cap TCV-2001-04</td>
<td>1</td>
<td>Cover of the terminal block for the welding power supply</td>
</tr>
</tbody>
</table>
1.2 Order Number Confirmation

Confirm the order number of the manipulator corresponds to the YRC1000. The order number is located on a label as shown below.

*Fig. 1-2: Location of Order Number Labels*
2 Transport

2.1 Transport Method

2.1.1 Using a Crane

As a rule, the manipulator must be lifted by a crane with two wire ropes when removing the manipulator from the package and moving it. Be sure to fix the manipulator with the cushioning materials for transport, and lift it in the posture as shown in fig. 2-1 “Transporting Position (factory setting)”. The length of the wire rope must be 1500 mm or longer.

WARNING

- Operation of the crane, sling, or forklift must be performed only by authorized personnel. Failure to observe this instruction may result in personal injury and/or equipment damage.

NOTICE

- Avoid excessive vibration or shock while transporting or moving the YRC1000. Failure to observe this instruction may adversely affect the performance of the YRC1000 because it consists of precision components.
## 2 Transport

### 2.1 Transport Method

**Fig. 2-1: Transporting Position (factory setting)**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Angle</th>
<th>Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>0°</td>
<td>0</td>
</tr>
<tr>
<td>L</td>
<td>0°</td>
<td>-83220</td>
</tr>
<tr>
<td>E</td>
<td>0°</td>
<td>0</td>
</tr>
<tr>
<td>U</td>
<td>-90°</td>
<td>-113778</td>
</tr>
<tr>
<td>R</td>
<td>0°</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>-24°</td>
<td>-23525</td>
</tr>
<tr>
<td>T</td>
<td>0°</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Position of the center of gravity**
- **Wire rope** (length: 1500 mm or longer)

**NOTE**

When lifting the manipulator, be careful not to damage the motor, connector, cable, etc.

- **Shipping bracket**
- **Position of the center of gravity**

**Wire rope** (length: 1500 mm or longer)

**NOTE**

When lifting the manipulator, be careful not to damage the motor, connector, cable, etc.
2 Transport

2.1 Transport Method

2.1.2 Using a Forklift

When using a forklift, fix the manipulator on a pallet by using shipping bolts as shown in Fig. 2-2 "Using a Forklift".

Insert the claws of the forklift under the pallet, and transport the manipulator together with the pallet.

The pallet must be strong enough to support the manipulator.

Transport the manipulator slowly with due caution in order to avoid overturning or slippage.

Fig. 2-2: Using a Forklift

- The weight of the manipulator is approximately 195 kg (including the shipping bolts and brackets). Use the wire strong enough to withstand the weight.
- When transporting, be sure to install the shipping brackets.
- Avoid applying external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2.2 Shipping Bracket

To protect the manipulator’s machinery from external forces during transportation, shipping brackets are installed. (Refer to fig. 2-3 “Shipping Bracket”.)

Fig. 2-3: Shipping Bracket

- The shipping brackets are painted yellow.
- The shipping bracket is fixed by using the hexagon socket head cap screws M10 (length: 30 mm) (2 screws) and the conical spring washers 2L-10.

NOTE

Before turning ON the power, check to be sure that the shipping bolts/screws and brackets are removed. The shipping bolts and brackets then must be stored for future use, in the event that the manipulator must be moved again.
To protect the manipulator's machinery from external forces during transportation, the cushioning materials for transport are installed in the sections A and B. (Refer to fig. 2-4 "Cushioning Materials for Transport".)

Fig. 2-4: Cushioning Materials for Transport

- A rubber cushion is respectively wedged at the sections A and B.

**NOTE**

Before turning ON the power, check to be sure that the cushioning materials for transport are removed.

In the event that the manipulator must be moved again, to avoid its main body from being damaged, the cushioning materials such as rubber plate, etc. must be used.
3 Installation

DANGER

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

WARNING

• Do not perform the welding operation for a pedestal or etc. when the power cable is being connected.
Failure to observe this instruction may result in damage to an electric device due to the current of welding.
• Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, the safety fence, or the YRC1000, etc.
Failure to observe this warning may result in injury or damage.
• Make sure to firmly anchor the manipulator before turning ON the power and operating the manipulator.
Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.
• Do not install or operate a damaged manipulator or a manipulator any of whose components is missing.
Failure to observe this instruction may cause improper movement, etc. of the manipulator, which may result in personal injury and/or equipment damage.

NOTICE

• After completing the installation of the manipulator, make sure to remove the shipping bolts/screws and brackets before turning ON the power.
Failure to observe this instruction may result in damage to the main drive unit.
3 Installation

3.1 Installation of the Safety Fence

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

Responsibility for Safeguarding (ISO10218)

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

3.2 Mounting Procedures for Manipulator Base

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

Construct a solid foundation with the appropriate thickness to withstand maximum reaction forces of the manipulator referring to table 3-1 “Manipulator Reaction Force and Torque”.

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

<table>
<thead>
<tr>
<th></th>
<th>Horizontal rotation</th>
<th>Vertical rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reaction force F_H</td>
<td>Torque M_H</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>8340 N (850 kgf)</td>
<td>4120 N•m (420 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/</td>
<td>2945 N (300 kgf)</td>
<td>1275 N•m (130 kgf•m)</td>
</tr>
<tr>
<td>deceleration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2 Mounting Procedures for Manipulator Base

3.2.1 Mounting Example

For the first process, anchor the baseplate firmly to the ground. The baseplate must be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommended to prepare a baseplate of 40 mm or more in thickness, and anchor bolts of M16 or larger size.

Next, fix the manipulator base to the baseplate. The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate by using four hexagon socket head cap screws M16 (Tensile strength: 1200 N/mm² or more) (50 mm long is recommended) by using a tightening torque 206 N·m.

Tighten the hexagon socket head cap screws and anchor bolts firmly so that they will not work loose during the operation. Refer to fig. 3-2 “Mounting the Manipulator on Baseplate”.

To improve the precision of installing position, holes or surface for reference are designed.

Use a nock pin or a fitting surface when precision is required for installation.
3 Installation
3.2 Mounting Procedures for Manipulator Base

Fig. 3-2: Mounting the Manipulator on Baseplate

- **Manipulator base**
- **Baseplate**
- **Anchor bolt (M16 or larger)**

**View A**

- **Hexagon socket head cap screw M16 (4 screws)**
  - (Tensile strength: 1200 N/mm² or more)
  - Tightening torque 200 N·m
- **Conical spring washer 2H-16**
- **Manipulator base**
- **Baseplate**

**Dimensions**

- 60 mm
- 132 ± 0.1
- 260 mm
- 102 ± 0.1
- 153 ± 0.1
- 18 dia. (4 places)
- 240 mm
- 132 ± 0.1
- 60 mm
- 12 dia. (2 holes)
- (Reference hole)
- 92 ± 0.1
- 18 dia. (4 places)
- (Reference hole)
- 300 mm
- 260 mm
- 100 ± 0.1
- 153 ± 0.1
- 18 dia. (4 places)
- (Reference hole)
3.3 Mounting Method

This manipulator is mounted on the floor only. A wall-mounted way, a tilt mounted way, and a ceiling mounted way are not available.
### 3.4 Location

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

- Ambient temperature: 0°C to +45°C
- Humidity: 20% to 80%RH (no-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Free from the strong magnetic field
- Altitude: 1000 m or less
- Flatness for installation: 0.5 mm or less

**NOTE**

When the operation is started after the manipulator has been out of operation and left in the low temperature (almost 0°C) for a long period, the alarm may occur since the friction torque of the drive unit is large.

If the alarm occurs, perform the break-in for few minutes.
3.5 Notes on Dust-Proof/Water-Proof Specifications

This manipulator conforms to:

- IP67 for the wrist part
- IP54 for the main part of the manipulator

However, the following precautions must be observed:

- Do not use the following liquids, because the rubber parts of the manipulator (oil seal, O-ring, etc.) may be deteriorated or corroded:
  - Organic solvent
  - Chlorine-based cutting fluid
  - Amine-based cleaning fluid
  - Corrosive substances such as acids, alkalis, or liquids/solutions causing rust
  - Other liquids/solutions to which nitrile-butadiene rubber (NBR/FKM) is not resistant
- Do not use cutting fluid or cleaning fluid which contains unknown chemical substances.

< Definition of IP (protection class) >

- Definition of IP67
  - IP6: Protection from the entry of dust
  - IP 7: Protection from immersion in water with being submerged for a specified duration and pressure.

- Definition of IP54
  - IP5: Protection from a certain amount of dust which is harmful enough to affect the normal operation of equipments.
  - IP 4: Protection from sprays and splashing of water in all directions.
4 Wiring

WARNING

• Ground resistance must be 100 Ω or less. Failure to observe this warning may result in fire and/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 electric shock and/or personal injury.
• Wiring must be performed by authorized or certified personnel. Failure to observe this caution may result in fire and/or electric shock.
• When laying the cables from the manipulator to the YRC1000, DO NOT cover the cable with heat insulating material and avoid multiple cabling. Failure to observe this caution may result in burn caused by cable heat emission failure.
4 Wiring
4.1 Grounding

4.1 Grounding

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

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

Fig. 4-1: Grounding Method
4.2 Cable Connection

Connect both edges of the manipulator cable to the manipulator base connectors and to the YRC1000. Before connecting the cable to the manipulator, verify the numbers on the connector as shown in fig. 4-3 "Manipulator Cables".

For the connecting position, refer to fig. 4-4 "Manipulator Cable Connection (Manipulator Side)" and fig. 4-5 "Manipulator Cable Connection (YRC1000 Side)".

Refer to table 4-1 "Specifications of Manipulator Cable" and fig. 4-6 "Overhead View of Manipulator Cable Connection (Manipulator Side)" for the outside diameter and the minimum bending radius (for fixed part and moving part) of the manipulator cable and the details of the manipulator cable connection on the manipulator side.

- Procedures for Inserting the Connector
  1. Confirm the connector lever of the manipulator cable is at the initial position. Insert the cable straight into the connector on the back side of the YRC1000. Insert the manipulator cable to a fixed depth then the lever rotates about 30 degree forward automatically.
  2. Push the lever with hand and turn it (about 30 degree) until the lock is clicked.

- Procedures for Removing the Connector
  1. Release the lock by pushing the unlock part of the lever to unlock. Turn the lever about 60 degree to return to the initial position.
  2. Pull out the connector straight.

Fig. 4-2: Connection of Manipulator Cable

<table>
<thead>
<tr>
<th>Inserting</th>
<th>Removing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial position of lever</td>
<td>Push the unlock part</td>
</tr>
<tr>
<td>Insert</td>
<td>Initial position of lever</td>
</tr>
<tr>
<td>Rotate automatically</td>
<td>Rotate manually</td>
</tr>
<tr>
<td>Rotate manually</td>
<td>Pull out</td>
</tr>
</tbody>
</table>
4 Wiring
4.2 Cable Connection

Fig. 4-3: Manipulator Cables
The YRC1000 side The Manipulator side

Fig. 4-4: Manipulator Cable Connection (Manipulator Side)
4 Wiring

4.2 Cable Connection

Fig. 4-5: Manipulator Cable Connection (YRC1000 Side)

![Diagram of YRC1000 Side Manipulator Cable Connection]

Table 4-1: Specifications of Manipulator Cable

<table>
<thead>
<tr>
<th>Outside diameter (mm)</th>
<th>Minimum bending radius (mm)</th>
<th>Distance between A and B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.1</td>
<td>Fixed part 90</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>Moving part 200</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4-6: Overhead View of Manipulator Cable Connection (Manipulator Side)

![Diagram of Overhead View Manipulator Cable Connection]

Table 4-1: Specifications of Manipulator Cable

<table>
<thead>
<tr>
<th>Outside diameter (mm)</th>
<th>Minimum bending radius (mm)</th>
<th>Distance between A and B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.1</td>
<td>Fixed part 90</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>Moving part 200</td>
<td></td>
</tr>
</tbody>
</table>
### 5 Basic Specifications

#### 5.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YR-1-07VXHE6-A00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>Vertically articulated</td>
<td></td>
</tr>
<tr>
<td>Degree of freedom</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>Wrist part</td>
<td>6 kg</td>
</tr>
<tr>
<td></td>
<td>U-arm</td>
<td>10 kg</td>
</tr>
<tr>
<td>Repeatability[^2]</td>
<td>±0.08 mm</td>
<td></td>
</tr>
<tr>
<td>Range of motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-Axis</td>
<td>-170° - +170°</td>
<td></td>
</tr>
<tr>
<td>L-Axis</td>
<td>-70° - +148°</td>
<td></td>
</tr>
<tr>
<td>E-Axis</td>
<td>-90° - +90°</td>
<td></td>
</tr>
<tr>
<td>U-Axis</td>
<td>-80° - +80°</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>-200° - +200°</td>
<td></td>
</tr>
<tr>
<td>B-Axis</td>
<td>-150° - +150°</td>
<td></td>
</tr>
<tr>
<td>T-Axis</td>
<td>-455° - +455°</td>
<td></td>
</tr>
<tr>
<td>Maximum speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-Axis</td>
<td>4.53 rad/s, 260°/s</td>
<td></td>
</tr>
<tr>
<td>L-Axis</td>
<td>4.01 rad/s, 230°/s</td>
<td></td>
</tr>
<tr>
<td>E-Axis</td>
<td>4.53 rad/s, 260°/s</td>
<td></td>
</tr>
<tr>
<td>U-Axis</td>
<td>4.53 rad/s, 260°/s</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>8.20 rad/s, 470°/s</td>
<td></td>
</tr>
<tr>
<td>B-Axis</td>
<td>8.20 rad/s, 470°/s</td>
<td></td>
</tr>
<tr>
<td>T-Axis</td>
<td>12.2 rad/s, 700°/s</td>
<td></td>
</tr>
<tr>
<td>Allowable moment[^3]</td>
<td>R-Axis</td>
<td>12.5 N•m (1.28 kgf•m)</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>12.5 N•m (1.28 kgf•m)</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>6.0 N•m (0.61 kgf•m)</td>
</tr>
<tr>
<td>Allowable inertia[^3] (GD^2)</td>
<td>R-Axis</td>
<td>0.40 kgf•m^2</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>0.40 kgf•m^2</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>0.08 kgf•m^2</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>190 kg</td>
<td></td>
</tr>
<tr>
<td>Protective enclosure</td>
<td>Body: IP54</td>
<td>Wrist part: IP67</td>
</tr>
<tr>
<td>Mounting method</td>
<td>Floor-mounted</td>
<td></td>
</tr>
<tr>
<td>Ambient conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0°C - 45°C</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>20% - 80%RH</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>4.9 m/s² (0.5 G) or less</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>1000 m or less</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Free from corrosive gas or liquid, or explosive gas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free from dust, soot, or water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free from excessive electrical noise (plasma)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free from strong magnetic field</td>
<td></td>
</tr>
<tr>
<td>Power capacity</td>
<td>1.5 kVA</td>
<td></td>
</tr>
<tr>
<td>Applicable controller</td>
<td>YRC1000</td>
<td></td>
</tr>
<tr>
<td>Equivalent continuous sound pressure level[^4]</td>
<td>68 dB or less</td>
<td></td>
</tr>
</tbody>
</table>

[^1]: SI units are used in this table. However, gravitational unit is used in ( ).
[^2]: Measurement is carried out:
- between 1.2 m and 1.5 m above the ground.
- 400 mm away from the P-point maximum envelope.
[^3]: Refer to chapter 6.1 “Allowable Wrist Load” for details on the allowable moment and the allowable inertia.
[^4]: Conformed to equivalent continuous A-weighted sound pressure level measured in accordance with ISO11201 (EN31201).
[^11]: Conformed to ISO9283
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes

- Manipulator base
- S-head
- L-arm A
- L-arm B
- Wrist flange
- U-arm
- S+ and S-
- L+ and L-
- E+ and E-
- T+ and T-
- U+ and U-
- B+ and B-
- R+ and R-
5.3 Dimensions and P-Point Maximum Envelope

Fig. 5-2: Dimensions and P-Point Maximum Envelope
Fig. 5-3: Home Position and Operating Range of Each Axis

(1) S-axis

(2) L-axis

(3) E-axis

(4) U-axis

(5) R-axis

(6) B-axis

(7) T-axis
5 Basic Specifications
5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.1 General Information

• The stopping distance is an angle traveled by the manipulator from the moment when the stop signal is activated until the manipulator comes to a complete standstill.
• The stopping time is a time elapsed from the moment that the stop signal is activated until the manipulator comes to a complete standstill.
• The data that are given for the main axes S, L and U are the maximum displacement.
• Superposed axes motions may result in longer stopping distance.
• Stopping distance and stopping time are measured in accordance with ISO 10218-1, Annex B.
• Stop categories: According to IEC60204-1
  • Stop category 0
  • Stop category 1
• The values specified for Stop category 0 are the reference values that are determined by tests and simulations. The actual stopping distance and stopping time may differ.

5.4.2 Definition of Use

Load: Rated load weight and load on an arm
Speed: Operating speed of the manipulator
Extension: Distance between the rotation center and the P-point of each axis

5.4.3 Stopping Distance and Time for Stop Category 0: S-, L- and U-Axes

Measurement Conditions

• Load: Maximum load
• Speed: Maximum speed
• Posture: Maximum inertia generation posture

<table>
<thead>
<tr>
<th>Axis</th>
<th>Stopping distance (deg)</th>
<th>Stopping time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>49.6</td>
<td>0.411</td>
</tr>
<tr>
<td>L-axis</td>
<td>40.8</td>
<td>0.337</td>
</tr>
<tr>
<td>U-axis</td>
<td>34.0</td>
<td>0.230</td>
</tr>
</tbody>
</table>
5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.4 Stop Category 1: Stopping Distance and Time for Stop Category 1: S-, L- and U-Axes

5.4.4.1 Extension

Refer to fig. 5-4 “S-Axis Extension”, fig. 5-5 “L-Axis Extension” and fig. 5-6 “U-Axis Extension” for each axis arm extension.

Fig. 5-4: S-Axis Extension

Fig. 5-5: L-Axis Extension

Fig. 5-6: U-Axis Extension
5.4 Stopping Distance and Time for S-, L-, and U-Axes

Fig. 5-6: U-Axis Extension
5.4.4.2 Stopping Distance and Time for Stop Category 1: S-axis
5 Basic Specifications
5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.4.3 Stopping Distance and Time for Stop Category 1: L-axis

[Graphs showing stopping distance and time for different loads and extensions]
5.4.4.4 Stopping Distance and Time for Stop Category 1: U-axis

![Graph showing stopping distance and time for U-axis with different load conditions.]

- Extension 100%
- Load 100%
- Load 66%
- Load 33%
5.5 Alterable Operating Range

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis operating range*</td>
<td>-170° - +170° (standard)</td>
</tr>
<tr>
<td></td>
<td>-150° - +150°</td>
</tr>
<tr>
<td></td>
<td>-135° - +135°</td>
</tr>
<tr>
<td></td>
<td>-120° - +120°</td>
</tr>
<tr>
<td></td>
<td>-105° - +105°</td>
</tr>
<tr>
<td></td>
<td>-90° - +90°</td>
</tr>
<tr>
<td></td>
<td>-75° - +75°</td>
</tr>
<tr>
<td></td>
<td>-60° - +60°</td>
</tr>
<tr>
<td></td>
<td>-45° - +45°</td>
</tr>
<tr>
<td></td>
<td>-30° - +30°</td>
</tr>
</tbody>
</table>

* For the settable angles, refer to Table 5-3 “The Settable Angle for S-Axis Stopper”.

5.5.1 Components for Altering Operating Range

Arrange the components listed in Fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”, when modifying the angle of S-axis.

- Dog (drawing No. HW0414041-3) (2 dogs)
- Hexagon socket head cap screw M12 ”FA coat” (2 screws)
  (length: 35 mm)
  (Tensile strength: 1200 N/mm² or more)
- Conical spring washer 2H-12 ”FA coat” (2 washers)
5 Basic Specifications
5.5 Alterable Operating Range

Fig. 5-7: Components of the S-Axis Stopper and Stopper Mounting Position

<table>
<thead>
<tr>
<th>S-axis operating angle</th>
<th>Stopper position</th>
</tr>
</thead>
<tbody>
<tr>
<td>-170° - +170°</td>
<td>☐</td>
</tr>
<tr>
<td>-150° - +150°</td>
<td>☐</td>
</tr>
<tr>
<td>-135° - +135°</td>
<td>☐</td>
</tr>
<tr>
<td>-120° - +120°</td>
<td>☐</td>
</tr>
<tr>
<td>-105° - +105°</td>
<td>☐</td>
</tr>
<tr>
<td>-90° - +90°</td>
<td>☐</td>
</tr>
<tr>
<td>-75° - +75°</td>
<td>☐</td>
</tr>
<tr>
<td>-60° - +60°</td>
<td>☐</td>
</tr>
<tr>
<td>-45° - +45°</td>
<td>☐</td>
</tr>
<tr>
<td>-30° - +30°</td>
<td>☐</td>
</tr>
</tbody>
</table>

Hexagon socket head cap screw M12
(length: 35 mm) (2 screws) "FA coat"
(Tensile strength: 1200 N/mm² or more)
Conical spring washer 2H-12 "FA coat" (2 washers)
Tightening torque: 84 Nm (8.6 kgf·m)
5 Basic Specifications
5.5 Alterable Operating Range

5.5.2 Notes on the Mechanical Stopper Installation
When mounting the S-axis mechanical stopper, as shown in fig. 5-7 "Components of the S-Axis Stopper and Stopper Mounting Position", mount the dog (HW0414041-3) by using one hexagon socket head cap screw M12 "FA coat" (length: 35 mm) and tighten the screw with a tightening torque of 84 N•m (Tensile strength: 1200 N/mm² or more) on the S-head. (2 places) If the operating range is ±170° (standard), mounting the mechanical stopper is not needed.

The S-axis mechanical stopper can be set at a pitch of 15° from 30° to 150° range for each direction, positive and negative.
Refer to table 5-3 “The Settable Angle for S-Axis Stopper” for the combination.

1. Apply the specified components when mounting the S-Axis mechanical stopper.
2. Turn OFF the electric power supply before mounting.

5.5.3 Adjustment to the Pulse Limitation of S-Axis
For altering the range of motion of S-Axis, refer to chapter 6.13 “Softlimit Setting Function” in “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051)”. With programming pendant, input the numeric value as shown in the following table to modify the parameter.

<table>
<thead>
<tr>
<th>Degree</th>
<th>±30°</th>
<th>±45°</th>
<th>±60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>±43061</td>
<td>±64591</td>
<td>±86121</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree</th>
<th>±75°</th>
<th>±90°</th>
<th>±105°</th>
<th>±120°</th>
<th>±135°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>±107651</td>
<td>±129182</td>
<td>±150712</td>
<td>±172242</td>
<td>±193772</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree</th>
<th>±150°</th>
<th>±170°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>±215303</td>
<td>±244010</td>
</tr>
</tbody>
</table>

Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.
### 5.5 Alterable Operating Range

Table 5-3: The Settable Angle for S-Axis Stopper

<table>
<thead>
<tr>
<th>Angle (°)</th>
<th>Settable for + Direction</th>
<th>Settable for - Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table indicates the angle range which allows S-axis to be set for + direction and - direction angles. (Ex. -150° to +150° is settable, however, 0° to +135° is not settable.)
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable payload of the wrist axis including the mass of the grip is up to 6 kg.

However, the conditions listed in table 6-1 “Allowable Wrist Load” must be satisfied due to limits of moments and the moment of inertia.

The values in table 6-1 must not be exceeded even if the load is not applied as mass but applied as force.

Table 6-1: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Axis</th>
<th>Allowable moment N•m (kgf•m)</th>
<th>Allowable inertia (GD²/4) kg•m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>12.5 (1.28)</td>
<td>0.40</td>
</tr>
<tr>
<td>B-Axis</td>
<td>12.5 (1.28)</td>
<td>0.40</td>
</tr>
<tr>
<td>T-Axis</td>
<td>6.0 (0.61)</td>
<td>0.08</td>
</tr>
</tbody>
</table>

1 ( ): Gravitational unit

When the volume of the load is relatively small, refer to the moment arm rating (Lg, Lt) shown in fig. 6-1 “Moment Arm Rating”.

Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

When a tool is installed, the tool information and the load information must be set. For the setting, refer to chapter 8.3 “Tool Data Setting” and chapter 8.4 “ARM Control” in “YRC1000 INSTRUCTIONS (RE-CTO-A221)”. 
6 Allowable Load for Wrist Axis and Wrist Flange
6.1 Allowable Wrist Load

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

<table>
<thead>
<tr>
<th>LB [mm]</th>
<th>LT [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>102</td>
</tr>
<tr>
<td>365</td>
<td>200</td>
</tr>
<tr>
<td>163</td>
<td>100</td>
</tr>
</tbody>
</table>

---

**R- and T-axis rotation center**

---

**B-axis rotation center**
6 Allowable Load for Wrist Axis and Wrist Flange

6.2 Wrist Flange

The wrist flange dimensions are shown in fig. 6-2 “Wrist Flange”. When mounting the attachment, etc., using the outside fitting is recommended.

When using the outside fitting, fitting depth shall be 5 mm or less. The attachment should be mounted inside the range shown in fig. 6-2.

**Fig. 6-2: Wrist Flange**

- Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner before mounting the tools.
- During initial operations, the lubricant may seep from the lip part of the oil seal. Wipe off the seeped lubricant with a cloth before use.
7 System Application

7.1 Peripheral Equipment Mounts

CAUTION

- Do not make any additional holes or tapped holes on the manipulator's body. Failure to observe this instruction may adversely affect the safety and/or performance of the manipulator.
- YASKAWA provides no guarantee against damages, malfunctions, failures, etc. caused by using any means other than the tapped holes shown in the following figure. The tightening bolts used for the mechanical parts of the manipulator must be used only to secure the mechanical parts. Do not additionally secure or attach any other things by using these tightening bolts.

The peripheral equipment mounts are provided as shown in fig. 7-1 “Installation Position” for easier installation of the user's system applications. The following conditions shall be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

The maximum allowable load on the peripheral equipment of the U-arm (A1 and A2) is 16 kg or less, including the wrist load on the wrist point. For instance, when the mass installed on the wrist point is 6 kg, the mass which can be installed on the peripheral equipment of the U-arm (A1 and A2) is 10 kg. And the maximum allowable load on the peripheral equipment (A3 and A4) is 6 kg or less, including the wrist load on the wrist point. The maximum allowable load on the peripheral equipment of the S-head (B) is up to 20 kg. Install the peripheral equipment on the S-axis so that the moment of inertia (GD²/4) from the S-axis rotation center is 1.25 kgm² or less. When a load is applied on the U-arm or S-head, the load setting must be performed. For setting procedures, refer to “Chap. 8.4 ARM Control” in “YRC1000 INSTRUCTIONS (RE-CTO-A221)”. 
7 System Application
7.1 Peripheral Equipment Mounts

7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in fig. 7-1 "Installation Position".

NOTE
When installing cables or cable guides, check cables for torsions or behaviors caused by bending using the actual manipulator so that unnecessary force is applied to the cables, manipulator or peripheral devices.

Fig. 7-1: Installation Position
7.2 Internal User I/O Wiring Harness and Air Line

Internal User I/O wiring harness (14 wires: 0.2 mm² × 8 wires, 0.75 mm² × 2 wires, 1.25 mm² × 4 wires) and two air lines are built in the manipulator for the drive of peripheral devices mounted on the U-arm as shown in fig. 7-2 “Connectors for Internal User I/O Wiring Harness and Air Line”. The connector pins 1 to 16 are assigned as shown in fig. 7-4 “Details of the Connector Pin Numbers”. Wiring must be performed by the customers.

The welding cable is built in the S-axis base. The location of cables is shown in fig. 7-3 “Location of Welding Cable”.

The operating conditions are shown in the following table.

| The allowable current for internal user I/O wiring harness | 3 A or less for each wire (The total current value for the pins 1 to 16 must be 40 A or less.) |
| The maximum pressure of the air line | 490 kPa (5 kgf/cm²) or less (The inside diameter: 6.5 mm for air line A, 5.0 mm for air line B) |
| The temperature for using air line | 0°C ~ +45°C |
| The allowable current for welding power cable | Rated current of 350 A or less and the rated operational ratio should be 60% or less. The allowable operational ratio when it is operated with less current than the allowable current is calculated by the following formula. Allowable operational ratio = 60% × (350 A / operating current)² |
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line

Fig. 7-3: Location of Welding Cable
Fig. 7-4: Details of the Connector Pin Numbers

**Connector for Internal User I/O Wiring Harness**

(For the Connector Base: View A)

<table>
<thead>
<tr>
<th>Pins used</th>
<th>Details of the Connector Pin Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0.2 mm²)</td>
<td>1 (0.2 mm²)</td>
</tr>
<tr>
<td>2 (0.2 mm²)</td>
<td>2 (0.2 mm²)</td>
</tr>
<tr>
<td>3 (0.2 mm²)</td>
<td>3 (0.2 mm²)</td>
</tr>
<tr>
<td>4 (0.2 mm²)</td>
<td>4 (0.2 mm²)</td>
</tr>
<tr>
<td>5 (0.2 mm²)</td>
<td>5 (0.2 mm²)</td>
</tr>
<tr>
<td>6 (0.2 mm²)</td>
<td>6 (0.2 mm²)</td>
</tr>
<tr>
<td>7 (Open)</td>
<td>7 (Open)</td>
</tr>
<tr>
<td>8 (0.2 mm²)</td>
<td>8 (0.2 mm²)</td>
</tr>
<tr>
<td>9 (0.75 mm²)</td>
<td>9 (0.75 mm²)</td>
</tr>
<tr>
<td>10 (1.25 mm²)</td>
<td>10 (1.25 mm²)</td>
</tr>
<tr>
<td>11 (1.25 mm²)</td>
<td>11 (1.25 mm²)</td>
</tr>
<tr>
<td>12 (1.25 mm²)</td>
<td>12 (1.25 mm²)</td>
</tr>
<tr>
<td>13 (1.25 mm²)</td>
<td>13 (1.25 mm²)</td>
</tr>
<tr>
<td>14 (1.25 mm²)</td>
<td>14 (1.25 mm²)</td>
</tr>
<tr>
<td>15 (1.25 mm²)</td>
<td>15 (1.25 mm²)</td>
</tr>
<tr>
<td>16 (1.25 mm²)</td>
<td>16 (1.25 mm²)</td>
</tr>
</tbody>
</table>

**Connector for Internal User I/O Wiring Harness**

(For the U-arm: View B)

<table>
<thead>
<tr>
<th>Pins used</th>
<th>Details of the Connector Pin Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0.2 mm²)</td>
<td>1 (0.2 mm²)</td>
</tr>
<tr>
<td>2 (0.2 mm²)</td>
<td>2 (0.2 mm²)</td>
</tr>
<tr>
<td>3 (0.2 mm²)</td>
<td>3 (0.2 mm²)</td>
</tr>
<tr>
<td>4 (0.2 mm²)</td>
<td>4 (0.2 mm²)</td>
</tr>
<tr>
<td>5 (0.2 mm²)</td>
<td>5 (0.2 mm²)</td>
</tr>
<tr>
<td>6 (0.2 mm²)</td>
<td>6 (0.2 mm²)</td>
</tr>
<tr>
<td>7 (24 V (1 A))</td>
<td>7 (24 V (1 A))</td>
</tr>
<tr>
<td>8 (Shock sensor signal input)</td>
<td>8 (Shock sensor signal input)</td>
</tr>
<tr>
<td>9 (0.2 mm²)</td>
<td>9 (0.2 mm²)</td>
</tr>
<tr>
<td>10 (0.2 mm²)</td>
<td>10 (0.2 mm²)</td>
</tr>
<tr>
<td>11 (0.75 mm²)</td>
<td>11 (0.75 mm²)</td>
</tr>
<tr>
<td>12 (1.25 mm²)</td>
<td>12 (1.25 mm²)</td>
</tr>
<tr>
<td>13 (1.25 mm²)</td>
<td>13 (1.25 mm²)</td>
</tr>
<tr>
<td>14 (1.25 mm²)</td>
<td>14 (1.25 mm²)</td>
</tr>
<tr>
<td>15 (1.25 mm²)</td>
<td>15 (1.25 mm²)</td>
</tr>
<tr>
<td>16 (1.25 mm²)</td>
<td>16 (1.25 mm²)</td>
</tr>
</tbody>
</table>

**NOTE**

- For the standard specification, the pins No.7 and No.8 of 3BC connector on the U-arm are respectively connected with the shock sensor power supply and shock sensor signal input port of the YRC1000.
- The pins No.7 and No.8 on both the connector base side and the U-arm side of the connector for internal user I/O wiring harness are not connected.
- For wiring, refer to fig. 8-5(a) "Internal Connection Diagram (YRC1000)" and fig. 8-5(b) "Internal Connection Diagram (YRC1000)".

The same pin-number connectors (1 to 16) at both connector base part and arm part are connected with the single wire lead of 0.2 mm², 0.75 mm² or 1.25 mm².
7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

The mating connector for internal user I/O wiring harness is optional. For the position of the mating connector for internal user I/O wiring harness, refer to fig. 7-5 “Location of Connector”.

For the mating connector for internal user I/O wiring harness, two different types of the end bell are prepared depending on the form: Straight type and Elbow type. Select either one type.

Fig. 7-5: Location of Connector

<table>
<thead>
<tr>
<th>Type</th>
<th>Manipulator’s base part</th>
<th>U-arm part</th>
</tr>
</thead>
</table>
| Straight Type  | Plug: JL05-6A20-29S-R or the equivalent  
End bell: JL05-20EB1A-R  
Cable clamp: N/MS3057-12A  
(straight form) | Plug: JL05-6A20-29P-R or the equivalent  
End bell: JL05-20EB1A-R  
Cable clamp: N/MS3057-12A  
(straight form) |
| Elbow Type     | Plug: JL05-6A20-29S-R or the equivalent  
End bell: JL05-20EB1A-R  
Cable clamp: N/MS3057-12A  
(straight form) | Plug: JL05-6A20-29P-R or the equivalent  
End bell: CE-20BA-S-D  
Cable clamp: N/MS3057-12A  
(elbow form) |
7 System Application
7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

- **Straight Type**

The appearance of the manipulator with the connector installed is shown in fig. 7-6(a) “Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type).”

When operating, be careful not to let the connector and/or cable touch the other equipment.

Fig. 7-6(a): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type)

- **Elbow Type**

The appearance of the manipulator with the connector installed is shown in fig. 7-6(b) “Manipulator With the Mating Connector for Internal User I/O Wiring Harness (elbow type).”

When the connector with the elbow type of end bell is installed, the direction shown in the following figure is recommended for the connector installation. When assembling the connector, the key must be located at the position shown in the following figure.

Fig. 7-6(b): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (elbow type)
8 Electrical Equipment Specification

8.1 Overrun Limit Switches (Optional)

The overrun limit switches (referred to below as the limit switches) can be optionally installed for the S-, L-, and U-axes.

The soft limit and the activation angles of the limit switch for each axis when the manipulator is shipped with limit switches installed at the factory are given in Table 8-1 “Degrees of Angle (with limit switch installed)”. Table 8-1: Degrees of Angle (with limit switch installed)

<table>
<thead>
<tr>
<th></th>
<th>Soft Limit</th>
<th>Limit Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>-170° - +170°</td>
<td>-171.5° - +171.5°</td>
</tr>
<tr>
<td>L-axis</td>
<td>-70° - +95°</td>
<td>-71° - +96.5°</td>
</tr>
<tr>
<td>U-axis</td>
<td>-80° - +80°</td>
<td>-81.5° - +81.5°</td>
</tr>
</tbody>
</table>

8.1.1 Position of Limit Switch

For the locations of the limit switches, refer to Fig. 8-1 “Location of Limit Switches”.

Fig. 8-1: Location of Limit Switches
8.1.2 Adjustment to the Activation Angle of Limit Switch

When altering the operating angle of the manipulator, adjust both the soft limit and the activation angle of the limit switch. The activation angle of the limit switch must be larger than the soft limit.

For adjusting soft limit, refer to chapter 6.13 “Softlimit Setting Function” in “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051)”. For releasing soft limit, refer to chapter 8.10 “Soft Limit Release Function” in “YRC1000 INSTRUCTIONS (RE-CTO-A221)”. For adjusting limit switch, refer to the following page.

- Adjusting activation angle of limit switch of S-axis
  The activation angle of limit switch of S-axis can be adjusted by altering the position of the S-axis stopper. For altering the stopper’s position, refer to chapter 5.5 “Alterable Operating Range”.

- Adjusting activation angle of limit switch of L-axis
  The activation angle of limit switch of L-axis can be adjusted by altering the position of the dog on the ring which is mounted on the L-axis. Refer to fig. 8-2 “Adjustment of Dog (L-axis)”.

- Adjusting activation angle of limit switch of U-axis
  The activation angle of limit switch of U-axis can be adjusted by altering the position of the dog on the ring which is mounted on the U-axis. Refer to fig. 8-3 “Adjustment of Dog (U-axis)”.
8 Electrical Equipment Specification
8.1 Overrun Limit Switches (Optional)

Fig. 8-2: Adjustment of Dog (L-axis)

Hexagon socket head cap screw M4
*trivalent chromate* (length: 16 mm) (2 screws)
Conical spring washer 2L-4
*trivalent chromate* (2 washers)
Tightening torque: 2.8 N•m (0.29 kgf•m)

Fig. 8-3: Adjustment of Dog (U-axis)

Hexagon socket head cap screw M4
*trivalent chromate* (length: 16 mm) (2 screws)
Conical spring washer 2L-4
*trivalent chromate* (2 washers)
Tightening torque: 2.8 N•m (0.29 kgf•m)
8.2 Servo ON Lamp (Optional)

The servo ON lamp can be optionally installed. For the location of the servo ON lamp, refer to fig. 8-4 “Location of Servo ON Lamp”.

Fig. 8-4: Location of Servo ON Lamp
8.3 Internal Connections

Diagrams for Internal connections of the manipulator are shown in fig. 8-5(a) "Internal Connection Diagram (YRC1000)", fig. 8-5(b) "Internal Connection Diagram (YRC1000)". 
Fig. 8-5(a): Internal Connection Diagram (YRC1000)
Note:
1. For the limit switch specification, the part (A) is different from the part (B).
2. When performing the wiring of the overrun limit switch, pay attention to lead wires. The letter marked on the marker tube at the point (LB1 and LD1) are the same.
9 Maintenance and Inspection

9.1 Inspection Schedule

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

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

- The interval between inspections is calculated according to the total servo operation time.
- If axes are used very frequently (in handling applications, etc.), inspections may be required at shorter intervals. Contact your YASKAWA representative.

DANGER

- Do not remove the motor, and do not release the brake. Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

- 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.
- 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.

NOTICE

- Do not remove the connector between the motor and the multi-port connector during maintenance and inspection. Failure to observe this caution may result in the loss of home position data.
<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></td>
<td></td>
<td>Specified Personnel</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alignment mark</td>
<td>✔</td>
<td>Visual</td>
<td>Check alignment mark accordance at the home position. Check for damage, Check for misalignment of the position at the check point.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working area and manipulator</td>
<td>✔</td>
<td>Visual</td>
<td>Check for seeped oil. (Wipe it off if any.) Clean the work area if dust, spatter or seeped oil is present. Check for damage and outside cracks.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseplate mounting bolts</td>
<td>✔</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector for manipulator cable</td>
<td>✔</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Covers, bolts for the connector base</td>
<td>✔</td>
<td>Screwdriver Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective tube</td>
<td>✔</td>
<td>Visual</td>
<td>Clean the spatter. Check for holes or tears. (Replace it if any.)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timing belts for B- and T-axes</td>
<td>✔</td>
<td>Manual</td>
<td>Visual</td>
<td>Check for belt tension and the condition. (Replace if failure of tooth, swelling, or abnormal abrasion occurs.)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire harness in manipulator (Lead for the S-, L-, E-, and U-axes wires) (Power supply board included)</td>
<td>✔</td>
<td>Manual</td>
<td>Visual</td>
<td>Check the condition of the internal wiring harness. Check wear to the protective spring (replace if there is abnormal wear).</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire harness in manipulator (Lead for the B- and T-axes wires)</td>
<td>✔</td>
<td>Visual</td>
<td>Replace</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery pack in manipulator</td>
<td>✔</td>
<td>Visual</td>
<td>Replace the battery pack when the battery alarm occurs on the YRC1000 or the manipulator drive for 24000H</td>
<td></td>
</tr>
</tbody>
</table>
### 9.1 Inspection Schedule

#### 9-3

1. **Check for grease leakage.**
2. **Grease Gun**
   - Check for malfunction. (Replace if necessary.)
   - Exchange grease 2) (12000 H cycle).
3. **Hand Pump**
   - Check for malfunction. (Replace if necessary.)
   - Supply grease 2) (12000 H cycle).
4. **Overhaul**

---

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

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Daily</td>
<td></td>
<td>Check for grease leakage.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Daily</td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Exchange grease 2) (12000 H cycle).</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Daily</td>
<td>Hand Pump Injection Syringe</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease 2) (12000 H cycle).</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Daily</td>
<td>Hand Pump Injection Syringe</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease 2) (12000 H cycle).</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Daily</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Inspection No. correspond to the numbers in fig. 9-1 “Inspection Items”.
2. For grease, refer to table 9-2 “Inspection Parts and Grease Used”.

---

#### Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Motywhite RE No. 00</td>
<td>S-, L-, E-, and U-axes speed reducers</td>
</tr>
<tr>
<td>13</td>
<td>Harmonic Grease SK-1A</td>
<td>R- and B-axes speed reducers, R- and T-axes gear</td>
</tr>
</tbody>
</table>

---

1. For grease, refer to table 9-2 “Inspection Parts and Grease Used”.

---

**Note:** The table mentions Grease Gun, Hand Pump, and Injection Syringe as methods for checking parts. The schedule includes daily checks and cycles of 1000 H, 12000 H, 24000 H, and 36000 H.

**Table:**

- **Items:** Schedule: Daily, Method: Grease Gun, Operation: Check for malfunction, Change: Grease 2) (12000 H cycle).
- **Inspected Parts:** S-, L-, E-, and U-axes speed reducers, R- and B-axes speed reducers, R- and T-axes gear.

---

**Additional Notes:**

- Inspection No. correspond to the numbers in fig. 9-1 “Inspection Items”.
- For grease, refer to table 9-2 “Inspection Parts and Grease Used”.

---

**Table 9-2**

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Motywhite RE No. 00</td>
<td>S-, L-, E-, and U-axes speed reducers</td>
</tr>
<tr>
<td>13</td>
<td>Harmonic Grease SK-1A</td>
<td>R- and B-axes speed reducers, R- and T-axes gear</td>
</tr>
</tbody>
</table>

---

**Table:**

- **Grease Used:** Motywhite RE No. 00, Harmonic Grease SK-1A.
- **Inspected Parts:** S-, L-, E-, and U-axes speed reducers, R- and B-axes speed reducers, R- and T-axes gear.
The numbers in the above table correspond to the numbers in table 9-1, "Inspection Items".

Fig. 9-1: Inspection Items
9.2 Notes for Maintenance

9.2.1 U-arm

The motor, the battery pack, and the belt drive part are located in the U-arm on the configuration, and then the mating surfaces between covers in the U-arm are sealed with gaskets in order to prevent liquid ingress or fumes of welding.

After removing the cover for maintenance, make sure to replace the gasket. (Refer to table 10-1 “Recommend Spare Parts”.)

![Fig. 9-2: Sealing Part of U-arm](image)

9.2.2 Multi-Port Connector

Four multi-port connectors (refer to fig. 9-3 “Multi-Port Connector”) for the motor signals are mounted on each part of the manipulator. (For the locations, refer to fig. 9-9 “Location of the Battery and Multi-port Connector”) The multi-port connector has four ports. For the connections of the multi-port connectors, refer to fig. 9-4(a) "Wiring of Multi-Port Connector Part (S-, L-, and E-axes)" and fig. 9-4(b) "Wiring of Multi-Port Connector Part (U-, R-, B-, and T-axes)".

When disconnecting the connector of the multi-port connector during the battery replacement, be careful not to disconnect the connector between the motor and the multi-port connector. If the connector between the motor and the multi-port connector is disconnected, the encoder absolute data will disappear.
9 Maintenance and Inspection
9.2 Notes for Maintenance

Fig. 9-3: Multi-Port Connector

S-axis motor

L-axis motor

E-axis motor

U-axis motor

R-axis motor

B-axis motor

T-axis motor

Nameplate of the port designation

Wire harness “IN”

Wire harness “OUT”

Dummy connector

Wire harness “OUT”
9 Maintenance and Inspection
9.2 Notes for Maintenance

Fig. 9-4(a): Wiring of Multi-Port Connector Part (S-, L-, and E-axes)

Wiring of Multi-Port Connector for S- and L-Axes Parts

Wiring of Multi-Port Connector for E-Axis Part
9 Maintenance and Inspection
9.2 Notes for Maintenance

*Fig. 9-4(b): Wiring of Multi-Port Connector Part (U-, R-, B-, and T-axes)*

Wiring of Multi-Port Connector for U- and R-Axes Parts

Wiring of Multi-Port Connector for B- and T-Axes Parts
9.3 Notes on Maintenance Procedures

9.3.1 Home Position Check

There are alignment marks on each axis to check the home position (fig. 9-5 “Alignment Mark Check”).

With those alignment marks, periodically check for home position deviation. When home position is disappeared or deviated, contact your YASKAWA representative.
9 Maintenance and Inspection

9.3 Notes on Maintenance Procedures

Fig. 9-5: Alignment Mark Check

- S-axis alignment mark
- L-axis alignment mark
- Section A-A
- F-axis alignment mark
- U-axis alignment mark
- B-axis alignment mark
- E-axis alignment mark
- L-axis alignment mark
- T-axis alignment mark
- R-axis alignment mark
- Section B-B
9.3.2 Seeped Oil Check

Periodically check for contamination due to seeped oil or oil spot. Especially the parts indicated in Fig. 9-6: “Inspection Parts for Seeped Oil Check” must be inspected carefully. Wipe off seeped oil or oil spot with a cloth before use.

*Fig. 9-6: Inspection Parts for Seeped Oil Check*
9.3.3 Protective Tube Replacement

The protective tube is installed on the external lead wire.
Clean the spatter on a regular basis. Also, check for a hole and/or a tear in the tube. Replace the tube if any.
Refer to fig. 9-7 “Disassembly and Reassembly of Protective Tube”.

- **Disassembly**
  1. Turn OFF the robot controller power supply.
  2. Remove the protective tube ①.
  3. Remove the protective tube ②.
  4. Remove the protective tube ③.

- **Reassembly**
  1. Wrap the protective tubes ①, ②, and ③ around the protective spring of the internal wiring harness.
    At this time, make sure to wrap the protective tubes ①, ②, and ③ in the direction shown in fig. 9-7.
  2. Turn ON the robot controller power supply.

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Qty.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Protective tube MTK-50</td>
<td>1</td>
<td>350 mm</td>
</tr>
<tr>
<td>②</td>
<td>Protective tube MTK-50</td>
<td>1</td>
<td>570 mm</td>
</tr>
<tr>
<td>③</td>
<td>Protective tube MTK-50</td>
<td>1</td>
<td>350 mm</td>
</tr>
</tbody>
</table>

*Fig. 9-7: Disassembly and Reassembly of Protective Tube*
9.3 Notes on Maintenance Procedures

9.3.4 S-, L-, E-, U-, and R-axis Motors

For the S-, L-, E-, U-, and R-axis motors, there are holes for grease leakage detection. Remove the screws or bolts from the holes to check for grease leakage from the motor.

For the hole of each axis, refer to fig. 9-8(a) "Positions of Grease-Leakage Detection Hole" and fig. 9-8(b) "Positions of Grease-Leakage Detection Hole". If grease leakage is detected, contact your YASKAWA representative.

Fig. 9-8(a): Positions of Grease-Leakage Detection Hole
9.3 Notes on Maintenance Procedures

Fig. 9-8(b): Positions of Grease-Leakage Detection Hole

Ultra low-head machine screw M4

*trivalent chromate* (length: 6 mm)

(1 screw)

Tightening torque: 0.75 N•m (0.07 kgf•m)

Hexagon socket head cap screw M3

(length: 6 mm)

Tightening torque: 1.4 N•m

(0.14 kgf•m)
9.3.5 Battery Pack Replacement

Four battery packs are installed in the position shown in Fig. 9-9 “Location of the Battery and Multi-port Connector”. If the battery alarm occurs in the YRC1000, replace the battery in accordance with the following procedure:

Fig. 9-9: Location of the Battery and Multi-port Connector
9 Maintenance and Inspection
9.3 Notes on Maintenance Procedures

- **Normal (The power supply of the YRC1000 can be turned ON)**

  Fig. 9-10: Battery connection (the power supply of the YRC1000 can be turned ON)

1. Turn ON the power supply of the YRC1000 and turn OFF the servo power.

   ![Diagram](HW1483880-A)

   - **DANGER**
     - Make sure to perform the battery replacement with the emergency stop button being pressed.
     - Failure to observe this instruction may cause improper movement of the manipulator which may result in personal injury and/or equipment damage.

2. Loosen the cover mounting bolts and remove the cover.
3. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.
4. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.
5. Remove the old battery pack from the multi-port connector and mount the new battery pack.
6. Fix the new battery pack by using the cable tie T18L.
7. After placing the connector and the lead wires around the connector into the protective tube, fix the opening of the protective tube by using the cable tie T18L.
8. Fix the new battery pack and the protective tube in which the connector is placed at step 7 by using the cable tie T18L.
9. Tighten the cover mounting bolts by using the tightening torque shown in fig. 9-9 “Location of the Battery and Multi-port Connector” to reinstall the cover.

   - **NOTE**
     - When reinstalling the cover, be careful not to get caught the cable.
When the Power Supply of the YRC1000 Cannot Be Turned ON

Fig. 9-11: Battery Connection (the power supply of the YRC1000 cannot be turned ON)

1. Prepare lead wires for battery replacement and a battery pack for backup. (Apart from the new battery pack for replacement, prepare a battery pack for backup)
2. Loosen the cover mounting bolts and remove the cover.
3. Remove the connector from the “IN” port of the multi-port connector. Connect the lead wires for battery replacement to the “IN” port of the multi-port connector.
4. Connect the battery pack for backup to the lead wires for battery replacement.

**NOTE**

Before removing the old battery pack, make sure to connect the battery pack for backup to prevent the encoder absolute data from disappearing.

5. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.
6. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.
7. Remove the old battery pack from the multi-port connector and mount the new battery pack.
8. Remove the lead wires for battery replacement and the battery pack for backup from the multi-port connector, connect the connector which has been removed at step 3 of this procedure to the “IN” port again.

**NOTE**

If the battery pack for backup remains connected, an electric current flows from the new battery to the backup battery and which may result in the voltage drop in the new battery. Remove the battery pack for backup immediately after connecting the new battery.

9. Fix the new battery pack by using the cable tie T18L.

1. Prepare lead wires for battery replacement and a battery pack for backup. (Apart from the new battery pack for replacement, prepare a battery pack for backup)
2. Loosen the cover mounting bolts and remove the cover.
3. Remove the connector from the “IN” port of the multi-port connector. Connect the lead wires for battery replacement to the “IN” port of the multi-port connector.
4. Connect the battery pack for backup to the lead wires for battery replacement.

**NOTE**

Before removing the old battery pack, make sure to connect the battery pack for backup to prevent the encoder absolute data from disappearing.

5. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.
6. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.
7. Remove the old battery pack from the multi-port connector and mount the new battery pack.
8. Remove the lead wires for battery replacement and the battery pack for backup from the multi-port connector, connect the connector which has been removed at step 3 of this procedure to the “IN” port again.

**NOTE**

If the battery pack for backup remains connected, an electric current flows from the new battery to the backup battery and which may result in the voltage drop in the new battery. Remove the battery pack for backup immediately after connecting the new battery.

9. Fix the new battery pack by using the cable tie T18L.
10. After placing the connector and the lead wires around the connector into the protective tube, fix the opening of the protective tube by using the cable tie T18L.

11. Fix the new battery pack and the protective tube in which the connector is placed at step 10 by using the cable tie T18L.

12. Tighten the cover mounting bolts by using the tightening torque shown in fig. 9-9 “Location of the Battery and Multi-port Connector” to reinstall the cover.

**NOTE**

When reinstalling the cover, be careful not to get caught the cable.
9.4 Notes on Grease Replenishment/Exchange Procedures

9.4.1 Grease Exchange Procedures for S-, L-, E-, and U-axis Speed Reducer

9.4.1.1 Notes on Grease Exchange Procedures

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

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

• Make sure to use a grease pump to inject grease. Set the grease injection rate to 7 g/s or less. (Air supply pressure to the grease pump: 0.3 MPa or less (rough standard))

• When using extrusion air for discharging grease, set air supply pressure at 0.025 MPa or less. If the air supply pressure is higher than above mentioned value, an oil seal of a speed reducer will come off, and it may result in a failure.

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

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

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

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

• After mounting a speed reducer or a motor, and then wait for 30 minutes or more and then inject grease. If grease is filled before the sealing bond is solidified, it may cause grease to leak.
9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures

**WARNING**

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

Fig. 9-12: S-, L-, E-, and U-Axis Speed Reducer Diagram

Grease inlet of S-axis
(Hexagon socket head plug PT3/8)

Grease exhaust port of S-axis
(Hexagon socket head tapered pipe plug NPTF3/8)

Grease inlet of L-axis
(Hexagon socket head tapered pipe plug NPTF3/8)

Grease exhaust port of L-axis
(Hexagon socket head tapered pipe plug NPTF3/8)

Grease inlet of E-axis
(Hexagon socket head tapered pipe plug NPTF3/8)

Grease exhaust port of E-axis
(Hexagon socket head tapered pipe plug NPTF3/8)

Grease inlet of U-axis
(Hexagon socket head tapered pipe plug NPTF3/8)

Grease exhaust port of U-axis
(Hexagon socket head tapered pipe plug NPTF3/8)
1. Before injecting grease, the posture of the manipulator must be set as indicated in table 9-4 "Recommended Posture for Grease Injection". If it is difficult to make the recommended posture because of external cabling or etc., adjust the posture as much as possible to make the position of the grease inlet located in the lower part and the position of the exhaust port located in the upper part. If the exhaust port is located in the lower part, grease may not be exchanged properly.

### Table 9-4: Recommended Posture for Grease Injection

<table>
<thead>
<tr>
<th>Axis to inject</th>
<th>Posture</th>
<th>S-axis</th>
<th>L-axis</th>
<th>E-axis</th>
<th>U-axis</th>
<th>R-axis</th>
<th>B-axis</th>
<th>T-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>L-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>E-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>U-axis</td>
<td>Any</td>
<td>0° *</td>
<td>Any *</td>
<td>0° *</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>R-axis</td>
<td>Any</td>
<td>0° *</td>
<td>Any *</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>B-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>*</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
<td></td>
</tr>
</tbody>
</table>

* If the recommended posture cannot be made, make the U-arm horizontal to the ground.

2. Remove the hexagon socket head plugs from the grease inlet and grease exhaust port.

3. Install a grease zerk A-PT3/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Recommended grease lubricator: "Powerlube P3C (made by Macnaught)"
   - Amount of grease: 7 g/s or less
     (For example, if grease is supplied from the lubricator at 2 times/s, set the amount to 3.5 g/time or less.)
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less

### Table 9-5: Amount of Grease

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Approx. 468 g</td>
</tr>
<tr>
<td>L-axis</td>
<td>Approx. 362 g</td>
</tr>
<tr>
<td>E-axis</td>
<td>Approx. 305 g</td>
</tr>
<tr>
<td>U-axis</td>
<td>Approx. 315 g</td>
</tr>
</tbody>
</table>
5. Injection stop:
   - <When replacing the speed reducer>
     Stop injecting grease when grease can be seen from the exhaust port.
   - <When exchanging grease>
     The old grease is discharged from the grease exhaust port. At this time, stop injection when the mixture of the old grease and the new grease in an equal ratio is seen.
     And then, skip the steps 6 and 7, and proceed to the step 8.

6. Operate each axis about 5 times in the teach mode as shown in table 9-6 “Teaching Operation for Each Axis”.

Table 9-6: Teaching Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to replenish grease</th>
<th>Angle for teaching operation</th>
<th>Speed for teaching operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>S-axis ±45°</td>
<td>User-specified</td>
</tr>
<tr>
<td>L-axis</td>
<td>L-axis ±45°</td>
<td></td>
</tr>
<tr>
<td>E-axis</td>
<td>E-axis ±45°</td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>U-axis ±45°</td>
<td></td>
</tr>
</tbody>
</table>

7. Inject grease again, and when grease comes out of the exhaust port, grease injection is completed.

8. Discharge the specified amount of grease from the grease inlet or grease exhaust port. (Refer to table 9-7 “Amount of Grease Discharged from Each Axis”.) In order to discharge the specified amount of grease, receive the discharged grease by using a container, and then measure the weight of the discharged grease by weighing the container till the amount reaches to the specified amount. Use one of the following methods to discharge grease.
   Method 1: Extruding grease by air
   (1) Connect the joint and the hose to the grease inlet.
   (2) Connect the regulator to the grease exhaust port.
   (3) Inject air from the grease exhaust port to extrude grease by air.
       (Extrusion air pressure: 0.025 MPa or less)
   (4) If grease is not discharged enough by injecting air, operate the manipulator about 5 times in the teach mode as shown in table 9-6.
   Method 2: Suctioning grease out
   (1) Keep the inlet open and insert the tube into the exhaust port.
   (2) Discharge grease by suctioning grease out of the exhaust port.
       (Suction pressure: 0.025 MPa or less)
   (3) If grease is not discharged by suctioning, operate the manipulator again about 5 times in the teach mode as shown in table 9-6.
9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures

9. For the axis where grease has been exchanged, perform a playback operation indicated in Table 9-8 “Running-In Operation for Each Axis” for running-in the speed reducer with grease. At this time, grease may be discharged during the operation. Remove the grease zerk from the grease inlet, and clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, and then attach it to the grease inlet. Tighten the plug with the tightening torque of 16.5 N•m (1.7 kgf•m). Also, discharge the excess grease in order not to increase the inner pressure of the speed reducer. Attach a bag to receive grease such as indicated in Fig. 9-13 “Grease Receiving Bag (Rough Standard)”, and then perform the running-in operation.

Table 9-7: Amount of Grease Discharged from Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of exhausted grease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g</td>
</tr>
<tr>
<td>S-axis</td>
<td>25±5</td>
</tr>
<tr>
<td>L-axis</td>
<td>50±5</td>
</tr>
<tr>
<td>E-axis</td>
<td>30±5</td>
</tr>
<tr>
<td>U-axis</td>
<td>40±5</td>
</tr>
</tbody>
</table>

Table 9-8: Running-In Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Running-in operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation angle</td>
</tr>
<tr>
<td>S-, L-, E-, and U-axis</td>
<td>±45°</td>
</tr>
</tbody>
</table>

Fig. 9-13: Grease Receiving Bag (Rough Standard)

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

Bond for fixing a grease receiving bag

Tube (inside dia.: 6 mm or more)

Union (inside dia.: 6 mm or more) PT3/8
9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures

10. Wipe discharged grease with a cloth. Clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, attach it to the grease exhaust port, and then tighten the plug with the tightening torque of 16.5 N•m (1.7 kgf•m).
9.4.2 Grease Replenishment Procedures for R,B-axis Speed Reducer and R,T-axis Gear

9.4.2.1 Notes on Grease Replenishment Procedures

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

**NOTE**

- If grease is injected without removing the plug from the air exhaust port, grease may leak inside of the motor, and/or an oil seal of a speed reducer may come off and/or grease may leak inside of the manipulator. Make sure to remove the plug before injection.
- Use the hand pump or injection syringe for grease injection.
- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

9.4.2.2 Grease Replenishment Procedures for R-axis Speed Reducer

Fig. 9-14: R-Axis Speed Reducer Diagram

1. Make the posture of the U-arm horizontal to the ground.
2. Remove the hexagon socket head plugs from the grease inlet and the air exhaust port.
3. Install a grease zerk A-PT1/8 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)
9.4 Notes on Grease Replenishment/Exchange Procedures

4. Inject grease through the grease inlet using a grease gun
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7 g

5. Remove the grease zerk from the grease inlet and install the plug.
   Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N·m (0.49 kgf·m).

6. Install the plug to the air exhaust port.
   Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N·m (0.49 kgf·m).

9.4.2.3 Grease Replenishment Procedures for B-axis Speed Reducer

Fig. 9-15: B-Axis Speed Reducers Diagram

1. Adjust the posture of the manipulator to perform grease replenishment smoothly.
2. Remove the hexagon socket head cap screws M6 from the grease inlet and the air exhaust port.
3. Install a grease zerk A-MT6×1 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)
4. Inject grease into the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7 g

NOTE
Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

NOTE
Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.
9.4 Notes on Grease Replenishment/Exchange Procedures

5. Remove the grease zerk from the grease inlet. Install the hexagon socket head cap screw M6 to the grease inlet. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N-m (0.6 kgf-m).

6. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N-m (0.6 kgf-m).

9.4.2.4 Grease Replenishment Procedures for R-axis Gear

Fig. 9-16: R-Axis Gear Diagram

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

2. Remove the hexagon socket head plug from the grease inlet and the air exhaust port.

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

4. Inject grease into the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 3 g (for replenishment)
     55 g (when the speed-reducer is replaced)

NOTE
Grease is not exhausted from the air exhaust port. Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet and install the plug. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N-m (0.49 kgf-m).

6. Install the plug to the air exhaust port. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N-m (0.49 kgf-m).
9.4.2.5 Grease Replenishment Procedures for T-axis Gear

Fig. 9-17: T-Axis Gear Diagram

1. Adjust the posture of the manipulator to perform grease replenishment smoothly.
2. Remove the hexagon socket head cap screws M6 from the grease inlet 1 and the air exhaust port.
3. Install a grease zerk A-MT6×1 to the grease inlet 1. (The grease zerk is delivered with the manipulator.)
4. Inject grease into the grease inlet 1.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 2 g

**NOTE**
Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet 1. Install the hexagon socket head cap screw M6 to the grease inlet 1. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).
6. Remove the hexagon socket head cap screw M6 from the grease inlet 2.
7. Install a grease zerk A-MT6×1 to the grease inlet 2. (The grease zerk is delivered with the manipulator.)
8. Inject grease into the grease inlet 2.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 2 g

9. Remove the grease zerk from the grease inlet 2. Install the hexagon socket head cap screw M6 to the grease inlet 2. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).
10. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).

**NOTE**
Grease is not exhausted from the air exhaust port. Do not inject excessive grease into the grease inlet.
10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for your manipulator.

To purchase lead wires of the wire harness or etc., check the order/ manufacture no. 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
For replacing parts in Rank B or Rank C, contact your YASKAWA representative.

Table 10-1: Recommend Spare Parts (Sheet 1 of 3)

<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>Molywhite RE No.00</td>
<td>YASKAWA Electric Corporation</td>
<td>16 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Grease</td>
<td>Harmonic Grease SK-1A</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Grease</td>
<td>Multemp PS2A</td>
<td>KYODO YUSHI CO., LTD</td>
<td>2.5kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Grease</td>
<td>MP-1</td>
<td>NIPPON GREASE CO., LTD</td>
<td>2.5kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Liquid Gasket</td>
<td>TB1206C</td>
<td>ThreeBond Co., Ltd.</td>
<td>-</td>
<td>-</td>
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<tr>
<td>A</td>
<td>6</td>
<td>Adhesive</td>
<td>LOCTITE 243</td>
<td>Henkel Japan Ltd.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>Seal Tape</td>
<td>TB4501</td>
<td>ThreeBond Co., Ltd.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>Battery Pack</td>
<td>HW1483880-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
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</tr>
<tr>
<td>A</td>
<td>9</td>
<td>Lead Wire for Battery Replacement</td>
<td>HW1471281-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>Protective Tube</td>
<td>MTK-50</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1.3 m</td>
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Table 10-1: Recommended Spare Parts (Sheet 2 of 3)

<table>
<thead>
<tr>
<th>Rank</th>
<th>No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>A</td>
<td>11</td>
<td>Gasket</td>
<td>HW1306400-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>U-arm Cover Part (B-axis)</td>
</tr>
<tr>
<td>A</td>
<td>12</td>
<td>Gasket</td>
<td>HW1306401-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>U-arm Cover Part (T-axis)</td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>Gasket</td>
<td>HW1407822-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>M-base Part (B-axis)</td>
</tr>
<tr>
<td>A</td>
<td>14</td>
<td>Gasket</td>
<td>HW1407823-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>M-base Part (T-axis)</td>
</tr>
<tr>
<td>A</td>
<td>15</td>
<td>O-ring</td>
<td>S30</td>
<td>YASKAWA Electric Corporation</td>
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<td>2</td>
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<tr>
<td>B</td>
<td>16</td>
<td>B-axis Timing Belt</td>
<td>60S3M603</td>
<td>Mitsuboshi Belting Limited</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>B</td>
<td>17</td>
<td>T-axis Timing Belt</td>
<td>80S3M789</td>
<td>Mitsuboshi Belting Limited</td>
<td>1</td>
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</tr>
<tr>
<td>B</td>
<td>18</td>
<td>Replacement Kit for S-axis Speed Reducer</td>
<td>HW1485443-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 Speed Reducer HW0388621-B Input Gear HW0312734-2</td>
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<tr>
<td>B</td>
<td>19</td>
<td>Replacement Kit for L-axis Speed Reducer</td>
<td>HW1485444-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 Speed Reducer HW0387809-A Input Gear HW0312735-2</td>
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</tr>
<tr>
<td>B</td>
<td>20</td>
<td>Replacement Kit for E-axis Speed Reducer</td>
<td>HW1485445-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 Speed Reducer HW1380153-A Input Gear HW1303245-1</td>
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</tr>
<tr>
<td>B</td>
<td>21</td>
<td>Replacement Kit for U-axis Speed Reducer</td>
<td>HW1485446-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 Speed Reducer HW1380153-A Input Gear HW1303245-1</td>
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<tr>
<td>B</td>
<td>22</td>
<td>Replacement Kit for R-axis Speed Reducer</td>
<td>HW1484255-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 Speed Reducer HW1382521-A</td>
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<tr>
<td>B</td>
<td>23</td>
<td>Replacement Kit for B-axis Speed Reducer</td>
<td>HW1484256-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 Speed Reducer HW1382522-A</td>
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<tr>
<td>B</td>
<td>24</td>
<td>Replacement Kit for R-axis Unit</td>
<td>HW1484257-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 R-axis Motor and including Speed Reducer</td>
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</tr>
<tr>
<td>B</td>
<td>25</td>
<td>Wrist Unit</td>
<td>HW1172936-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 B- and T-axis Motor and including B-axis Speed Reducer</td>
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<tr>
<td>B</td>
<td>26</td>
<td>Wire Harness in Manipulator</td>
<td>HW1173293-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
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## Table 10-1: Recommended Spare Parts (Sheet 3 of 3)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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<tr>
<td>B</td>
<td>B 27</td>
<td>Wire Harness in Manipulator for B- and T-axis</td>
<td>HW1271557-A YASKAWA Electric Corporation</td>
<td>1</td>
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<tr>
<td>B</td>
<td>B 28</td>
<td>Lead Wire for S-axis Signal</td>
<td>HW1372597-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Lead wire between S-axis motor and multi-port connector</td>
</tr>
<tr>
<td>B</td>
<td>B 29</td>
<td>Lead Wire for L-axis Signal</td>
<td>HW1372597-B YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Lead wire between L-axis motor and multi-port connector</td>
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<tr>
<td>B</td>
<td>B 30</td>
<td>Lead Wire for E-axis Signal</td>
<td>HW1372597-BR YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Lead wire between E-axis motor and multi-port connector</td>
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<tr>
<td>B</td>
<td>B 31</td>
<td>Lead Wire for U-axis Signal</td>
<td>HW1372597-C YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Lead wire between U-axis motor and multi-port connector</td>
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<tr>
<td>B</td>
<td>B 32</td>
<td>Lead Wire for R-, B-, and T-axis Power</td>
<td>HW1372678-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>3</td>
<td>Lead wire between R-, B-, and T-axis motor and the wire harness in Manipulator</td>
</tr>
<tr>
<td>B</td>
<td>B 33</td>
<td>Bypass Cable</td>
<td>HW1471212-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
<td>Signal lead wires for tentative recovery from failure</td>
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<tr>
<td>C</td>
<td>C 34</td>
<td>S-, E-, and U-axis AC Servomotor</td>
<td>SGM7G-05APK-YRT* HW1385162-A YASKAWA Electric Corporation</td>
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<td>C</td>
<td>C 35</td>
<td>L-axis AC Servomotor</td>
<td>SGM7G-09APK-YRT* HW1385163-A YASKAWA Electric Corporation</td>
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</tr>
<tr>
<td>C</td>
<td>C 36</td>
<td>R-, B-, and T-axis AC Servomotor</td>
<td>SGM7J-01APK-YRT* HW1385161-A YASKAWA Electric Corporation</td>
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<tr>
<td>C</td>
<td>C 37</td>
<td>Multi-port Connector</td>
<td>HW1384619-A YASKAWA Electric Corporation</td>
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<td>C</td>
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<td>Power Supply Board</td>
<td>HW1384624-A YASKAWA Electric Corporation</td>
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<tr>
<td>C</td>
<td>C 39</td>
<td>Dummy Connector</td>
<td>HW1471285-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
<td>For the axes detachment function</td>
</tr>
</tbody>
</table>

#### Remarks

* The replacement kit for the speed reducer includes the speed reducer and the input gear which are listed on Remarks.

For details about the replacement kit for the speed reducer, contact your YASKAWA representative.