MOTOMAN-MH6D-10/MH6F-10 INSTRUCTIONS

TYPE:
YR-MH00006-A30 (10 kg PAYLOAD SPECIFICATION)
YR-MH00006-A31 (10 kg PAYLOAD AND WITH LIMIT SWITCHES FOR S-, L-, U-AXES)
YR-MH0006F-A30 (10 kg PAYLOAD SPECIFICATION)
YR-MH0006F-A31 (10 kg PAYLOAD AND WITH LIMIT SWITCHES FOR S-, L-, U-AXES)

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

MOTOMAN INSTRUCTIONS

MOTOMAN-MH6D-10/MH6F-10 INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENANCE MANUAL

FS100 INSTRUCTIONS
FS100 OPERATOR'S MANUAL
FS100 MAINTENANCE MANUAL

The DX100 of FS100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 162892-1CD
Revision: 0
MANDATORY

• This instruction manual is intended to explain mainly on the mechanical part of the MH6D-10/MH6F-10 for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator.

• General items related to safety are listed in the Chapter 1: Safety of the DX100/FS100 Instructions. To ensure correct and safe operation, carefully read the DX100/FS100 Instructions before reading this manual.

CAUTION

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.

• The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.

• YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.

• If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-MH6-10/MH6F-10.

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

- **WARNING**
  Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **CAUTION**
  Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

- **MANDATORY**
  Always be sure to follow explicitly the items listed under this heading.

- **PROHIBITED**
  Must never be performed.

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

At any rate, be sure to follow these important items

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

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

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

*Figure 1: Emergency Stop Button*

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

Injury may result from unintentional or unexpected manipulator motion.

*Figure 2: Release of Emergency Stop*

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

Improper or unintended manipulator operation may result in injury.

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

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

The emergency stop buttons are located on the right of front door of the DX100 and the programming pendant.
WARNING

• Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is pressed. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF. Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency.

Figure 3: Emergency Stop Button

• In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button. Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).

• Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it. If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON. Injury may result from unintentional or unexpected manipulator motion.

Figure 4: Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the manipulator’s operating range:
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency. Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the manipulator’s operating range and that you are in a safe location before:
  – Turning ON the FS100 power.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations. Injury may result if anyone enters the manipulator’s operating range during operation. Always press the emergency stop button immediately if there is a problem. The emergency stop button is located on the right of the programming pendant.
CAUTION

• Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  – Check for problems in manipulator movement.
  – Check for damage to insulation and sheathing of external wires.
• For the DX100, always return the programming pendant to the hook on the cabinet of the DX100 after use.
  For the FS100, always return the programming pendant to a safe place after use.
  The programming pendant can be damaged if it is left in the manipulator’s work area, on the floor, or near fixtures.
• Read and understand the Explanation of Warning Labels in the DX100/FS100 Instructions before operating the manipulator:
Definition of Terms Used Often in This Manual (DX100)

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>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Definition of Terms Used Often in This Manual (FS100)

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS100 controller</td>
<td>FS100</td>
</tr>
<tr>
<td>FS100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant dummy connector</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 TM 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.

Figure 5: Warning Label Locations
# Table of Contents

1 Product Confirmation ...................................................................................................................... 1-1  
   1.1 Contents Confirmation .............................................................................................................. 1-1  
   1.2 Order Number Confirmation ...................................................................................................... 1-2  

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

3 Installation ..................................................................................................................................... 3-1  
   3.1 Installation of the Safeguarding ............................................................................................... 3-2  
   3.2 Mounting Procedures for Manipulator Base .............................................................................. 3-2  
      3.2.1 Mounting Example .............................................................................................................. 3-3  
   3.3 Types of Mounting .................................................................................................................... 3-4  
      3.3.1 S-axis Operating Range ..................................................................................................... 3-4  
      3.3.2 Fixing the Manipulator Base ............................................................................................. 3-4  
      3.3.3 Precautions to Prevent the Manipulator from Falling ..................................................... 3-4  
   3.4 Location .................................................................................................................................. 3-5  

4 Wiring .......................................................................................................................................... 4-1  
   4.1 Grounding ............................................................................................................................... 4-1  
   4.2 Cable Connection ..................................................................................................................... 4-2  
      4.2.1 Connection to the Manipulator ...................................................................................... 4-2  
      4.2.2 Connection to the DX100/FS100 .................................................................................. 4-2  

5 Basic Specifications ...................................................................................................................... 5-1  
   5.1 Basic Specifications .................................................................................................................. 5-1  
   5.2 Part Names and Working Axes ............................................................................................... 5-2  
   5.3 Baseplate Dimensions ............................................................................................................. 5-2  
   5.4 Dimensions and P-Point Maximum Envelope ...................................................................... 5-3  
   5.5 Alterable Operating Range ..................................................................................................... 5-4  

6 Allowable Load for Wrist Axis and Wrist Flange ............................................................................ 6-1  
   6.1 Allowable Wrist Load .............................................................................................................. 6-1  
   6.2 Wrist Flange ........................................................................................................................... 6-3
7 System Application ......................................................................................................................... 7-1
  7.1 Peripheral Equipment Mounts .................................................................................................. 7-1
  7.1.1 Allowable Load .................................................................................................................... 7-1
  7.1.2 Installation Position ............................................................................................................ 7-1
  7.2 Internal User I/O Wiring Harness and Air Line ...................................................................... 7-2

8 Electrical Equipment Specification ............................................................................................. 8-1
  8.1 Location of Limit Switch ....................................................................................................... 8-1
  8.2 Internal Connections ............................................................................................................. 8-2

9 Maintenance and Inspection ..................................................................................................... 9-1
  9.1 Inspection Schedule ............................................................................................................. 9-1
  9.2 Notes on Maintenance Procedures ....................................................................................... 9-7
    9.2.1 Battery Pack Replacement ............................................................................................ 9-7
  9.3 Notes on Grease Replenishment/Exchange Procedures ........................................................ 9-9
    9.3.1 Grease Replenishment/Exchange for S-axis Speed Reducer ........................................ 9-10
      9.3.1.1 Grease Replenishment ....................................................................................... 9-10
      9.3.1.2 Grease Exchange .............................................................................................. 9-11
    9.3.2 Grease Replenishment/Exchange for L-axis Speed Reducer ....................................... 9-12
      9.3.2.1 Grease Replenishment ....................................................................................... 9-12
      9.3.2.2 Grease Exchange .............................................................................................. 9-13
    9.3.3 Grease Replenishment/Exchange for U-axis Speed Reducer ....................................... 9-14
      9.3.3.1 Grease Replenishment ....................................................................................... 9-14
      9.3.3.2 Grease Exchange .............................................................................................. 9-15
    9.3.4 Grease Replenishment for R-axis Speed Reducer ......................................................... 9-16
    9.3.5 Grease Replenishment for B- and T-axes Speed Reducers ............................................. 9-17
    9.3.6 Grease Replenishment for T-axis Gear ........................................................................... 9-18
    9.3.7 Grease Replenishment for R-axis Cross Roller Bearing .............................................. 9-19
    9.3.8 Notes for Maintenance .................................................................................................. 9-20
      9.3.8.1 Wrist Axes ........................................................................................................... 9-20
      9.3.8.2 Battery Pack Connection .................................................................................... 9-20

10 Recommended Spare Parts ....................................................................................................... 10-1
1 Product Confirmation

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives. Standard delivery includes the following four items (Information for the content of optional goods is given separately):

- Manipulator
- DX100/FS100
- Programming Pendant
- Manipulator Cable (between the DX100/FS100 and the Manipulator)

**CAUTION**

- Confirm that the manipulator and the DX100/FS100 have the same order number. Special care must be taken when more than one manipulator is to be installed.
If the numbers do not match, manipulators may not perform as expected and cause injury or damage.
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the DX100/FS100. The order number is located on a label as shown below.

Fig. 1-1: Location of Order Number Labels

(a) DX100 (Front View)  (b) Manipulator (Top View)  (c) FS100 (Front View)
2 Transport

2.1 Transport Method

CAUTION

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

NOTE

- The weight of the manipulator is approximately 135 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2.1 Transport Method

2.1.1 Using a Crane

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

Fig. 2-1: Transporting Position

2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with bolts as shown in Fig.2-2 Using a Forklift. Insert claws under the pallet and lift it. 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
2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and a shipping bracket. (See Fig. 2-3 Shipping Bolts and Brackets.)

Fig. 2-3: Shipping Bolts and Brackets

• The shipping bolts and bracket are painted yellow.
• The shipping bracket is to be fixed with the hexagon socket head cap screw M10 (2 screws).

NOTE

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

 WARNING

• Install the safeguarding.
Failure to observe this warning may result in injury or damage.
• Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, safeguarding, or controller.
Failure to observe this warning may result in injury or damage.
• Do not start the manipulator or even turn ON the power before it is firmly anchored.
The manipulator may overturn and cause injury or damage.
• When mounting the manipulator on the ceiling or wall, the base section must have sufficient strength and rigidity to support the weight of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.
Failure to observe these warnings may result in injury or damage.

 CAUTION

• Do not install or operate a manipulator that is damaged or lacks parts.
Failure to observe this caution may cause injury or damage.
• Before turning ON the power, check to be sure that the shipping bolts and brackets explained in Fig. 2-3 Shipping Bolts and Brackets on page 2-3 are removed.
Failure to observe this caution may result in damage to the driving parts.
3 Installation
3.1 Installation of the Safeguarding

3.1 Installation of the Safeguarding

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

Responsibility for Safeguarding (ISO10218)

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

3.2 Mounting Procedures for Manipulator Base

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

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

A baseplate flatness must be kept at 0.5 mm or less: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities. Mount the manipulator base as instructed in chapter 3.2.1 “Mounting Example” at page 3-3.

Table 3-1: Maximum Repulsion Forces of the Manipulator at Emergency Stop

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque in horizontal rotation (S-axis moving direction)</td>
<td>3800 N·m (390 kgf·m)</td>
</tr>
<tr>
<td>Maximum torque in vertical rotation (L-, U-axes moving direction)</td>
<td>3500 N·m (357 kgf·m)</td>
</tr>
</tbody>
</table>

Table 3-2: Endurance Torque in Operation

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurance torque in horizontal operation (S-axis moving direction)</td>
<td>900 N·m (93 kgf·m)</td>
</tr>
<tr>
<td>Endurance torque in vertical operation (L-, U-axes moving direction)</td>
<td>1500 N·m (158 kgf·m)</td>
</tr>
</tbody>
</table>
3. Installation
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 should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommend to prepare a baseplate of 40 mm or more thick, and anchor bolts of M16 or larger size.

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate with four hexagon head bolts M16 (50 mm long is recommended).

Next, fix the manipulator base to the baseplate. Tighten the hexagon head bolts and anchor bolts firmly so that they will not work loose during the operation.

Refer to Fig. 3-1 Mounting the Manipulator Baseplate.

Fig. 3-1: Mounting the Manipulator Baseplate
3.3 Types of Mounting

The MOTOMAN-MH6-10/MH6F-10 is available in three types: floor-mounted type (standard), wall-mounted type and ceiling-mounted type. For wall-mounted and ceiling-mounted types, the three points listed below are different from the floor-mounted type.

- S-axis Operating Range
- Fixing the Manipulator Base
- Precautions to Prevent the Manipulator from Falling

3.3.1 S-axis Operating Range

For the wall-mounted type, the S-axis movable range must be ±30°. (The range is adjusted prior to the shipment.)

3.3.2 Fixing the Manipulator Base

For wall- and ceiling-mounted types, be sure to use four hexagon socket head cap screws M16 (tensile strength: 1200 N/mm² or more) when fixing the manipulator base. Use a torque of 206 N•m when tightening the screws.

3.3.3 Precautions to Prevent the Manipulator from Falling

For the wall- or ceiling-mounted types, take appropriate measures to avoid the falling of the manipulator in case of emergency. Refer to *Fig.3-2 Precaution against Falling* for details.

*Fig. 3-2: Precaution against Falling*

In case of using the wall-/ceiling-mounted type, inform Yaskawa of the matter when placing an order. Be sure to contact your Yaskawa representative (listed on the back cover of this instruction manual) to perform a wall/ceiling installation on site.
3.4 Location

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

- Ambient Temperature: 0° to +45°C
- Humidity: 20 to 80%RH (non-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration (4.9 m/s² [0.5G] or less)
- Free from large electrical noise (plasma)
- The flatness for installation is 0.5 mm or less
4.1 Grounding

Follow the local regulations and electrical installation standards for grounding. A wire of 5.5 mm² or more is recommended.

Refer to Fig. 4-1 Grounding Method on page 4-1 to connect the ground line directly to the manipulator.

- 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

Two manipulator cables are delivered with the manipulator; an encoder cable (1BC) and a power cable (2BC). (Refer to fig. 4-2(a) Manipulator Cables (DX100) on page 4-3 and fig. 4-2(b) Manipulator Cables (FS100) on page 4-3.)

Connect these cables to the manipulator base connectors and to the DX100/FS100. Refer to fig. 4-3(a) Manipulator Cable Connectors (Manipulator Side) on page 4-4, fig. 4-3(b) Manipulator Cable Connectors (DX100 Side) on page 4-4, and fig. 4-3(c) Manipulator Cable Connectors (FS100 Side) on page 4-4.

4.2.1 Connection to the Manipulator

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

4.2.2 Connection to the DX100/FS100

Before connecting cables to the DX100/FS100, verify the numbers on both manipulator cables and the connectors on the DX100/FS100. When connecting, insert the cables in the order of X21, then X11, and depress each lever low until it clicks.
4. Wiring
4.2 Cable Connection

Fig. 4-2(a): Manipulator Cables (DX100)

Early side - DX100 side
- X11 - 1BC
- Encoder cable

Main side - Manipulator side
- 1BC
- X11

Fig. 4-2(b): Manipulator Cables (FS100)

Early side - FS100 side
- X11 - 1BC
- Encoder cable

Main side - Manipulator side
- 1BC
- X11
4 Wiring
4.2 Cable Connection

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

Fig. 4-3(b): Manipulator Cable Connectors (DX100 Side)

Fig. 4-3(c): Manipulator Cable Connectors (FS100 Side)
# 5 Basic Specifications

## 5.1 Basic Specifications

Table 5-1: Basic Specifications\(^a\)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
</tr>
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<tbody>
<tr>
<td>Structure</td>
<td>Vertically Articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>10 kg</td>
</tr>
<tr>
<td>Repeatability(^b)</td>
<td>±0.08 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
</tr>
<tr>
<td>S-Axis (turning)</td>
<td>-170° – +170°</td>
</tr>
<tr>
<td>L-Axis (lower arm)</td>
<td>-90° – +155°</td>
</tr>
<tr>
<td>U-Axis (upper arm)</td>
<td>-175° – +250°</td>
</tr>
<tr>
<td>R-Axis (wrist roll)</td>
<td>-180° – +180°</td>
</tr>
<tr>
<td>B-Axis (wrist pitch/yaw)</td>
<td>-45° – +225°</td>
</tr>
<tr>
<td>T-Axis (wrist twist)</td>
<td>-360° – +360°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
</tr>
<tr>
<td>S-Axis</td>
<td>2.44 rad/s, 140°/s</td>
</tr>
<tr>
<td>L-Axis</td>
<td>2.27 rad/s, 130°/s</td>
</tr>
<tr>
<td>U-Axis</td>
<td>2.36 rad/s, 135°/s</td>
</tr>
<tr>
<td>R-Axis</td>
<td>4.71 rad/s, 270°/s</td>
</tr>
<tr>
<td>B-Axis</td>
<td>4.71 rad/s, 270°/s</td>
</tr>
<tr>
<td>T-Axis</td>
<td>6.98 rad/s, 400°/s</td>
</tr>
<tr>
<td>Allowable Moment(^c)</td>
<td>R-Axis</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
</tr>
<tr>
<td>Allowable Inertia (GD²/4)</td>
<td>R-Axis</td>
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<tr>
<td></td>
<td>B-Axis</td>
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<td></td>
<td>T-Axis</td>
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<tr>
<td>Approx. Mass</td>
<td>130 kg</td>
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<td>Ambient Conditions</td>
<td>Temperature</td>
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<tr>
<td></td>
<td>Humidity</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td>1.5 kVA</td>
</tr>
</tbody>
</table>

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\(^a\) SI units are used in this table. However, gravitational unit is used in ( ).
\(^b\) Conformed to ISO9283
\(^c\) Refer to chapter 6.1 “Allowable Wrist Load” at page 6-1 for details on the permissible moment of inertia.
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes

5.3 Baseplate Dimensions

Fig. 5-2: Baseplate Dimensions
5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Dimensions and P-Point Maximum Envelope (YR-MH00006- A30, -A31)
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 5-2: S-Axis Operating Range

<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>
<tr>
<td></td>
<td>-15° - +15°</td>
</tr>
</tbody>
</table>
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 10 kg. If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in Table 6-3 Allowable Wrist Load. Contact your Yaskawa representative for further information or assistance.

Table 6-3: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N·m (kgf·m)(^a)</th>
<th>GD(^2/4) Total Moment of Inertia kg·m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>11.8 (1.2)</td>
<td>0.27</td>
</tr>
<tr>
<td>B-Axis</td>
<td>8.8 (1.0)</td>
<td>0.27</td>
</tr>
<tr>
<td>T-Axis</td>
<td>5.9 (0.6)</td>
<td>0.06</td>
</tr>
</tbody>
</table>

\(^a\): Gravitational unit

When the volume load is small, refer to the moment arm rating shown in Fig. 6-4 Moment Arm Rating.

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

Fig. 6-4: Moment Arm Rating
6  Allowable Load for Wrist Axis and Wrist Flange

6.1  Allowable Wrist Load

Fig. 6-5: The Diagram Moment/Inertia for R-axis

Fig. 6-6: The Diagram Moment/Inertia for B-axis

Fig. 6-7: The Diagram Moment/Inertia for T-axis
6.2 Wrist Flange

The wrist flange dimensions are shown in Fig. 6-8 Wrist Flange. In order to see the alignment marks, it is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside fittings must be 5 mm or less.

Fig. 6-8: Wrist Flange

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

7.1 Peripheral Equipment Mounts

The peripheral equipment mounts are provided on the U-axis (upper arm) and S-axis (rotary head) as shown in Fig. 7-1 Installing Peripheral Equipment for easier installation of the users’ system applications. The following conditions should be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

- The allowable load on the U-axis is a maximum of 15 kg, including the wrist load. For instance, when the mass installed in the wrist point is 6 kg, the mass which can be installed on the upper arm becomes 9 kg.
- The allowable load on the S-axis is a maximum of 20 kg. Install the peripheral equipment on the S-axis so that the moment of inertia (GD^2/4) from the S-axis rotation center becomes 1.25 kgm^2 or less.

7.1.2 Installation Position

There is a limitation also on the installation position. Fig. 7-2 Allowable Load on U-axis on page 7-2 shows the distance between the U-axis rotation center and the load gravity.

Fig. 7-1: Installing Peripheral Equipment
7.2 Internal User I/O Wiring Harness and Air Line

Internal user I/O wiring harness (0.2 mm² x 8, 0.75 mm² x 2 and 1.25 mm² x 4) and two air lines are incorporated in the manipulator for the drive of peripheral device mounted on the upper arm as shown in Fig. 7-3 Connectors for Internal User I/O Wiring Harness and Air Line on page 7-3.

Connectors for Internal User I/O Wiring Harness and Air Line on page 7-3. Wiring must be performed by users.

<table>
<thead>
<tr>
<th>The allowable current for internal user I/O wiring harness</th>
<th>3 A or less for each wire (The total current value for pins 1 to 16 must be 40 A or less.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The maximum pressure for the air line</td>
<td>490 kPa (5 kgf/cm²) or less (The air line inside diameter: 8.0 mm.)</td>
</tr>
</tbody>
</table>
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

Fig. 7-3: Connectors for Internal User I/O Wiring Harness and Air Line

Connector for internal user I/O wiring harness on U-axis: JL05-2A20-29SC (socket connector with a cap). Prepare pin connector JL05-6A20-29P.

Exhaust port A
Tapped holes PT3/8 with pipe plug

Exhaust port B
Tapped holes PT3/8 with pipe plug

Air inlet A
Tapped hole PT3/8 with pipe plug

Air inlet B
Tapped hole PT3/8 with pipe plug

Connector for internal user I/O wiring harness on S-axis: JL05-2A20-29PC (pin connector with a cap). Prepare socket connector JL05-6A20-29S.

View A

Fig. 7-4: Details of Connector Pin Numbers

Connector for Internal User I/O Wiring Harness on the Connector Base

Pins used
1
2
3
4
5
6
7 (Open)
8 (Open)
9
10
11 (0.75mm²)
12 (0.75mm²)
13 (1.25mm²)
14 (1.25mm²)
15 (1.25mm²)
16 (1.25mm²)

Internal user I/O wiring harness: 0.2 mm², 8 lead wires
: 0.75 mm², 2 lead wires
: 1.25 mm², 4 lead wires

Connector for Internal User I/O Wiring Harness on the U-arm

Pins used
1
2
3
4
5
6
7 (+24V (1A) for shock sensor)
8 (See Note)
9
10
11 (0.75mm²)
12 (0.75mm²)
13 (1.25mm²)
14 (1.25mm²)
15 (1.25mm²)
16 (1.25mm²)

Internal user I/O wiring harness: 0.2 mm², 8 lead wires
: 0.75 mm², 2 lead wires
: 1.25 mm², 4 lead wires

Note: DX100: Shock sensor signal input
FS100: Unused

See Note
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 mm$^2$, 0.75 mm$^2$ or 1.25 mm$^2$. 

### 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 DX100/FS100 controller.
- The pins No.7 and No.8 of respective 3BC connectors on the connector base side and the U-Arm side are not connected with each other.
- For the wiring, refer to fig. 8-3(a) Internal Connection Diagram (DX100) on page 8-3 and fig. 8-3(c) Internal Connection Diagram (FS100) on page 8-5.
8 Electrical Equipment Specification

8.1 Location of Limit Switch

The limit switches are optional. See Fig. 8-1 Location of Limit Switches. The overrun limit switches (the S- and L-axis overrun limit switches and the LU-axes interference limit switch) can be mounted only if the manipulator type are YR-MH00006D-A31 and YR-MH0006F-A31.

Fig. 8-1: Location of Limit Switches
8.2 Internal Connections

Highly reliable connectors are equipped on each connection part of the manipulator to enable easy removal and installation for maintenance and inspection. For the number and location of connectors, see Fig. 8-2 Location and Numbers of Connectors and Table 8-1 List of Connector Types.

Diagrams for internal connections of the manipulator are shown in Fig. 8-3(a) Internal Connection Diagram (DX100) on page 8-3, Fig. 8-3(b) Internal Connection Diagram (DX100) on page 8-4, Fig. 8-3(c) Internal Connection Diagram (FS100) on page 8-5, and Fig. 8-3(d) Internal Connection Diagram (FS100) on page 8-6.

Fig. 8-2: Location and Numbers of Connectors

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector for the internal user I/O wiring harness on the connector base</td>
<td>JL05-2A20-29PC (JL05-6A20-29S: Optional)</td>
</tr>
<tr>
<td>Connector for the internal user I/O wiring harness on the U-arm</td>
<td>JL05-2A20-29SC (JL05-6A20-29P: Optional)</td>
</tr>
</tbody>
</table>
8-3
Fig. 8-3(b): Internal Connection Diagram (DX100)
For the limit switch specification, the connection of the sections A, B, and C are changed as follows:

- LC1 connected to B1
- LD1 connected to S-AXIS OVERRUN L.S.
- LC2 connected to L-AXIS OVERRUN L.S.
- LD2 connected to L AND U-AXIS INTERFERENCE L.S.
- LC3 connected to B3
- LD3 connected to S-AXIS OVERRUN L.S.
- LC4 connected to U-AXIS INTERFERENCE L.S.
- LD4 connected to L AND U-AXIS INTERFERENCE L.S.
- LC5 connected to B5
- LD5 connected to S-AXIS OVERRUN L.S.
- LC6 connected to U-AXIS INTERFERENCE L.S.
- LD6 connected to L AND U-AXIS INTERFERENCE L.S.
- LC7 connected to B7
- LD7 connected to S-AXIS OVERRUN L.S.
- LC8 connected to U-AXIS INTERFERENCE L.S.
- LD8 connected to L AND U-AXIS INTERFERENCE L.S.
- LC9 connected to B9
- LD9 connected to S-AXIS OVERRUN L.S.
- LC10 connected to U-AXIS INTERFERENCE L.S.
- LD10 connected to L AND U-AXIS INTERFERENCE L.S.
- LC11 connected to B11
- LD11 connected to S-AXIS OVERRUN L.S.
- LC12 connected to U-AXIS INTERFERENCE L.S.
- LD12 connected to L AND U-AXIS INTERFERENCE L.S.
- LC13 connected to B13
- LD13 connected to S-AXIS OVERRUN L.S.
- LC14 connected to U-AXIS INTERFERENCE L.S.
- LD14 connected to L AND U-AXIS INTERFERENCE L.S.
- LC15 connected to B15
- LD15 connected to S-AXIS OVERRUN L.S.
- LC16 connected to U-AXIS INTERFERENCE L.S.
- LD16 connected to L AND U-AXIS INTERFERENCE L.S.
- LC17 connected to B17
- LD17 connected to S-AXIS OVERRUN L.S.
- LC18 connected to U-AXIS INTERFERENCE L.S.
- LD18 connected to L AND U-AXIS INTERFERENCE L.S.
- LC19 connected to B19
- LD19 connected to S-AXIS OVERRUN L.S.
- LC20 connected to U-AXIS INTERFERENCE L.S.
- LD20 connected to L AND U-AXIS INTERFERENCE L.S.
- LC21 connected to B21
- LD21 connected to S-AXIS OVERRUN L.S.
- LC22 connected to U-AXIS INTERFERENCE L.S.
- LD22 connected to L AND U-AXIS INTERFERENCE L.S.
- LC23 connected to B23
- LD23 connected to S-AXIS OVERRUN L.S.
- LC24 connected to U-AXIS INTERFERENCE L.S.
- LD24 connected to L AND U-AXIS INTERFERENCE L.S.
- LC25 connected to B25
- LD25 connected to S-AXIS OVERRUN L.S.
- LC26 connected to U-AXIS INTERFERENCE L.S.
- LD26 connected to L AND U-AXIS INTERFERENCE L.S.
- LC27 connected to B27
- LD27 connected to S-AXIS OVERRUN L.S.
- LC28 connected to U-AXIS INTERFERENCE L.S.
- LD28 connected to L AND U-AXIS INTERFERENCE L.S.
- LC29 connected to B29
- LD29 connected to S-AXIS OVERRUN L.S.
- LC30 connected to U-AXIS INTERFERENCE L.S.
- LD30 connected to L AND U-AXIS INTERFERENCE L.S.
- LC31 connected to B31
- LD31 connected to S-AXIS OVERRUN L.S.
- LC32 connected to U-AXIS INTERFERENCE L.S.
- LD32 connected to L AND U-AXIS INTERFERENCE L.S.
- LC33 connected to B33
- LD33 connected to S-AXIS OVERRUN L.S.
- LC34 connected to U-AXIS INTERFERENCE L.S.
- LD34 connected to L AND U-AXIS INTERFERENCE L.S.
- LC35 connected to B35
- LD35 connected to S-AXIS OVERRUN L.S.
- LC36 connected to U-AXIS INTERFERENCE L.S.
- LD36 connected to L AND U-AXIS INTERFERENCE L.S.
- LC37 connected to B37
- LD37 connected to S-AXIS OVERRUN L.S.
- LC38 connected to U-AXIS INTERFERENCE L.S.
- LD38 connected to L AND U-AXIS INTERFERENCE L.S.
- LC39 connected to B39
- LD39 connected to S-AXIS OVERRUN L.S.
- LC40 connected to U-AXIS INTERFERENCE L.S.
- LD40 connected to L AND U-AXIS INTERFERENCE L.S.

Diagram showing connections and labels corresponding to the text.
8 Electrical Equipment Specification

8.2 Internal Connections

Fig. 8-3(d): Internal Connection Diagram (FS100)
9 Maintenance and Inspection

9.1 Inspection Schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels as shown in Table 9-1 Inspection Items on page 9-3.

In Table 9-1 Inspection Items on page 9-3, the inspection items are classified into three types of operation: 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.

WARNING

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

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

CAUTION

• Maintenance and inspection must be performed by specified personnel.

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

• For disassembly or repair, contact your Yaskawa representative.

• The battery pack must be connected before removing detection connector when maintenance and inspection.

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

- The inspection interval depends on the total servo operation time.

- The following inspection schedule is based on the case where the manipulator is used for arc welding application. If the manipulator is used for other application or if it is used under special conditions, a case-by-case examination is required. The inspection may be conducted at shorter intervals if the manipulator is used very frequently for the application such as handling; in this case, contact your Yaskawa representative.

- Speed reducers using VIGO Grease RE No.0 as mentioned in Table 9-2 Inspection Parts and Grease Used may cause sounds at the initial operation or after the long shut down. It will be lost in two or three days of running-in operation.
### Table 9-1: Inspection Items (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Items 1)</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 Alignment mark</td>
<td></td>
<td>Visual</td>
<td>Check alignment mark accordance at the home position.</td>
<td>●</td>
</tr>
<tr>
<td>2 External lead</td>
<td></td>
<td>Visual</td>
<td>Check for damage and deterioration of leads.</td>
<td>●</td>
</tr>
<tr>
<td>3 Working area and manipulator</td>
<td></td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside cracks.</td>
<td>●</td>
</tr>
<tr>
<td>4 S.L.U-axes motor</td>
<td></td>
<td>Visual</td>
<td>Check for grease leakage 2)</td>
<td>●</td>
</tr>
<tr>
<td>5 Baseplate mounting bolts</td>
<td></td>
<td>Spanner, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>●</td>
</tr>
<tr>
<td>6 Cover mounting screws</td>
<td></td>
<td>Screwdriver, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>●</td>
</tr>
<tr>
<td>7 Base connectors</td>
<td></td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td>●</td>
</tr>
<tr>
<td>8 BT-axes timing belt</td>
<td></td>
<td>Manual</td>
<td>Check for belt tension and wear.</td>
<td>●</td>
</tr>
<tr>
<td>9 Wire harness in manipulator (SLURBT-axes leads)</td>
<td>Visual Multimeter</td>
<td></td>
<td>Check for conduction between the main connector of base and intermediate connector with manually shaking the wire. Check for wear of protective spring 3)</td>
<td>●</td>
</tr>
<tr>
<td>10 Wire harness in manipulator (BT-axes leads)</td>
<td>Visual Multimeter</td>
<td></td>
<td>Replace 4)</td>
<td>●</td>
</tr>
<tr>
<td>11 Battery pack in manipulator</td>
<td></td>
<td>Manual</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.</td>
<td>●</td>
</tr>
</tbody>
</table>
9.1 Inspection Schedule

MH6D-10/MH6F-10

Grease Gun Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle). See chapter 9.3.2 at page 9-12 and chapter 9.3.3 at page 9-14.
Replace grease\(^5\) (12000H cycle). See chapter 9.3.2 at page 9-12, chapter 9.3.3 at page 9-14 and chapter 9.3.5 at page 9-17.

13 LU-axes speed reducers
Grease Gun
Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle). See chapter 9.3.4 at page 9-16 and chapter 9.3.5 at page 9-17.

14 RBT-axes speed reducers
Grease Gun
Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle).
See chapter 9.3.4 at page 9-16 and chapter 9.3.5 at page 9-17.

15 T-axis gear
Grease Gun
Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle).
See chapter 9.3.6 at page 9-18.

16 R-axis cross roller bearing
Grease Gun
Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle). chapter 9.3.7 at page 9-19.

17 Overhaul

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

<table>
<thead>
<tr>
<th>Items(^1)</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>10000H/Cycle</td>
<td>60000H/Cycle</td>
<td>120000H/Cycle</td>
</tr>
</tbody>
</table>
| LU-axes speed reducers | ● ● | Grease Gun | Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle). See chapter 9.3.2 at page 9-12 and chapter 9.3.3 at page 9-14.
Replace grease\(^5\) (12000H cycle). See chapter 9.3.2 at page 9-12, chapter 9.3.3 at page 9-14 and chapter 9.3.5 at page 9-17. |
| RBT-axes speed reducers | ● | Grease Gun | Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle).
See chapter 9.3.4 at page 9-16 and chapter 9.3.5 at page 9-17. |
| T-axis gear | ● | Grease Gun | Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle).
See chapter 9.3.6 at page 9-18. |
| R-axis cross roller bearing | ● | Grease Gun | Check for malfunction. (Replace if necessary.)
Supply grease\(^5\) (6000H cycle). chapter 9.3.7 at page 9-19. |
| Overhaul | ● | | | |

1) Inspection No. correspond to the numbers in Fig. 9-1 Inspection Items on page 9-6.
2) The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your Yaskawa representative.
3) When checking for conduction with multimeter, connect the battery to “BAT” and “OBT” of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to chapter 9.3.8 "Notes for Maintenance" at page 9-20.)
4) Wire harness in manipulator to be replaced at 24000H inspection.
5) For the grease, refer to Table 9-2 Inspection Parts and Grease Used on page 9-5.
9 Maintenance and Inspection
9.1 Inspection Schedule

Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,13</td>
<td>VIGO Grease RE No.0</td>
<td>S-, L-, and U-axis speed reducers</td>
</tr>
<tr>
<td>14,15</td>
<td>Harmonic Grease SK-1A</td>
<td>R-, B-, and T-axis speed reducers, T-axis gear</td>
</tr>
<tr>
<td>16</td>
<td>Alvania EP Grease 2</td>
<td>R-axis cross roller bearings</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in Table 9-1 Inspection Items on page 9-3.
Fig. 9-1: Inspection Items

Note: This figure shows the standard specification manipulator in the home position.
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the position shown in *Fig. 9-2 Battery Location*. If the battery alarm occurs in the DX100/FS100, replace the battery in accordance with the following procedure:

*Fig. 9-2: Battery Location*

1. Turn OFF the DX100/FS100 main power supply.
2. Remove the plate fixing screws and the plate on the connector base, then pull the battery pack out to replace it with the new one.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack to the unoccupied connectors on the board.
5. Remove the old battery pack from the board.

**NOTE** Remove the old battery pack after connecting the new one so that the encoder absolute data does not disappear.

*Fig. 9-3: Battery Connection*
6. Mount the new battery pack on the battery holder.
7. Reinstall the plate.
   - Sealed the matched parts with sealing bond. (Three Bond 1206C, refer to Table 10-1 Spare Parts for YR-MH00006D-A30, -A31/YR-MH0006F-A30, -A31 on page 10-1)
   - Before installing the screw, apply the sealing bond on the thread part of the screw.

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

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

- If grease is injected without removing the plug/screw from the grease exhaust port, the grease will leak inside a motor or an oil seal of a speed reducer will come off, which may result in damage to the motor. Make sure to remove the plug/screw.

- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.

- Make sure to fill a hose on the grease inlet with grease to keep air from entering into the speed reducer.
9.3.1 Grease Replenishment/Exchange for S-axis Speed Reducer

(Refer to Fig. 9-4 S-axis Speed Reducer Diagram.)

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head plugs PT1/8 from the grease inlet and grease exhaust port.

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

   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

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

   – Grease type: VIGO Grease RE No. 0
   – Amount of grease: 70 cc (140 cc for 1st supply)
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

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

5. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and grease exhaust port.

   Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plugs with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.3.1.2 Grease Exchange

(Refer to Fig. 9-4 S-axis Speed Reducer Diagram on page 9-10.)

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

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

   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

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

   – Grease type: VIGO Grease RE No. 0
   – Amount of grease: approx. 450 cc
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

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

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

6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, then reinstall the hexagon socket head plug PT 1/8 to the inlet and exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.3.2 Grease Replenishment/Exchange for L-axis Speed Reducer

(Refer to Fig. 9-5 L-axis Speed Reducer Diagram.)

1. Make the L-arm vertical to ground.
2. Remove the hexagon socket head plug PT 1/8 from the grease exhaust port.
3. Remove the hexagon socket head cap screw M6 from the grease inlet.
   - If grease is injected with the exhaust plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
4. Install the grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: 65 cc (130 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
6. Move the L-axis for a few minutes to discharge the excess grease.
7. Remove the grease zerk from the grease inlet and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of each screw, then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).
9. Maintenance and Inspection
9.3 Notes on Grease Replenishment/Exchange Procedures

8. Wipe the discharged grease with a cloth and reinstall the hexagon socket head plug PT 1/8 to the exhaust port. Before installing the plug, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.2.2 Grease Exchange

(Refer to Fig. 9-5 L-axis Speed Reducer Diagram on page 9-12.)

1. Make the L-arm vertical to ground.

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

3. Remove the hexagon socket head cap screw M6 from the grease inlet.

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

   • Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

4. Install the grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is delivered with the manipulator.)

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

   – Grease type: VIGO Grease RE No. 0
   – Amount of grease: approx. 420 cc
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

6. The grease discharge is complete when new grease appears from the exhaust port. The new grease can be distinguished from the old grease by color.

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

8. Remove the grease zerk from the grease inlet and reinstall the hexagon socket head cap screw M6 to the grease inlet. Before installing the screw, apply Three Bond 1206C on the thread part of each screw, then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).

9. Wipe the discharged grease with a cloth and reinstall the plug to the exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.3.3 Grease Replenishment/Exchange for U-axis Speed Reducer

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

9.3.3.1 Grease Replenishment

(Refer to Fig. 9-6 U-axis Speed Reducer Diagram.)

1. Make the U-arm horizontal to ground.
2. Remove the hexagon socket head cap screw M6 from the grease exhaust port.
3. Remove the hexagon socket head plug PT 1/8 from the grease inlet.
4. Install the grease zerk PT 1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: 30 cc (60 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
6. Move the U-axis for a few minutes to discharge the excess grease.
7. Remove the grease zerk from the grease inlet and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m)

**NOTE** For ceiling-mounted manipulators, the grease exhaust port and the grease inlet are inverted.

• If grease is injected with the bolt on, the grease will leak inside the motor and may cause a damage. Make sure to remove the bolt before the grease injection.
• Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
8. Wipe the discharged grease with a cloth and reinstall the hexagon socket head cap screw M6 to the exhaust port. Before installing the screw, apply Three Bond 1206C on the thread part of each screw, then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).

9.3.3.2 Grease Exchange

(Refer to Fig. 9-6 U-axis Speed Reducer Diagram on page 9-14.)

1. Make the U-arm horizontal to ground.

2. Remove the hexagon socket head cap screw M6 from the grease exhaust port.

3. Remove the hexagon socket head plug PT 1/8 from the grease inlet.

- If grease is injected with the bolt on, the grease will leak inside the motor and may cause a damage. Make sure to remove the bolt before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

4. Install the grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)

5. Inject grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: approx. 200 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

6. The grease discharge is complete when new grease appears from the exhaust port. The new grease can be distinguished from the old grease by color.

7. Move the U-axes for a few minutes to discharge the excess grease.

8. Remove the grease zerk from the grease inlet and reinstall the hexagon socket head plug PT 1/8. Before installing the plug, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9. Wipe the discharged grease with a cloth and reinstall the hexagon socket head cap screw M6 to the exhaust port. Before installing the screw, apply Three Bond 1206C on the thread part of each screw, then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).
9.3.4 Grease Replenishment for R-axis Speed Reducer

*Fig. 9-7: R-axis Speed Reducer Diagram*

1. Remove a plug LP-M5 from the exhaust port.
2. Remove the pipe plug.
3. Inject grease through the grease inlet using a grease gun. (Refer to *Fig. 9-7 R-axis Speed Reducer Diagram.*)
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 8 cc (16 cc for 1st supply)

**NOTE**
The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

4. Reinstall the pipe plug.
5. Reinstall the plug LP-M5 on the exhaust port.
9.3.5 Grease Replenishment for B- and T-axes Speed Reducers

**Fig. 9-8: B- and T-axes Speed Reducers Diagram**

1. Remove the plug LP-M5 of B-axis or the hexagon socket head cap screw M6 of T-axis from the exhaust ports.

**NOTE**
Remove the U-arm cover side of the B-axis speed reducer.

2. Remove the hexagon socket head cap screws M6 from the grease inlets and install the grease zerk A-MT6 x 1. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlets using a grease gun. (Refer to Fig.9-8 B- and T-axes Speed Reducers Diagram)
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: For B-axis: 10 cc (20 cc for 1st supply)
   - Amount of grease: For T-axis: 5 cc (10 cc for 1st supply)

**NOTE**
The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlets and reinstall the screws. Before installing the screws, apply Three Bond 1206C on the thread part of them, then tighten the screws with a tightening torque of 6 N•m (0.6 kgf•m).

5. Reinstall the plug LP-M5 of B-axis or the hexagon socket head cap screw M6 of T-axis to the exhaust ports. Before installing the plug/screw, apply Three Bond 1206C on the thread part, then tighten them with a tightening torque of 6 N•m (0.6 kgf•m).

**NOTE**
Mount the U-arm cover side of the B-axis speed reducer. (Refer to chapter 9.3.8 “Notes for Maintenance” at page 9-20.)
9.3.6 Grease Replenishment for T-axis Gear

1. Remove the plug LP-M5 from the grease exhaust port.
2. Remove the hexagon socket head cap screw M6 from the grease inlet, then install the grease zerk A-MT6 x 1. (The grease zerk is delivered with the manipulator.)
3. Inject grease through the grease inlet using a grease gun. (Refer to Fig.9-9 T-axis Gear Diagram)
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 5 cc (10 cc for the 1st supply)

**NOTE** The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlet and reinstall the hexagon socket head cap screw M6. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
5. Reinstall the plug LP-M5 to the exhaust port. Apply Three Bond 1206C to screwed parts when installing the plug.
9.3.7 Grease Replenishment for R-axis Cross Roller Bearing

1. Remove the plug LP-M5 from the exhaust port.
2. Remove the hexagon socket head cap screw M6 from the grease inlet, then install the grease zerk A-MT6 x 1. (The grease zerk is delivered with the manipulator.)
3. Inject grease through the grease inlet using a grease gun. (Refer to Fig. 9-10 R-axis Cross Roller Bearing Diagram.
   - Grease type: Alvania EP grease 2
   - Amount of grease: 3 cc (6 cc for the 1st supply)

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

4. Remove the grease zerk from the grease inlet and reinstall the hexagon socket head cap screw M6. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
5. Reinstall the plug LP-M5 to the exhaust port. Apply Three Bond 1206C to screwed parts when installing the plug.
9.3.8 Notes for Maintenance

9.3.8.1 Wrist Axes

The motor and encoder units are provided with the wrist unit. To prevent fumes from penetrating into the wrist unit, the matched parts are sealed with sealing bond. Therefore, if the wrist cover is disassembled, be sure to reapply the sealing bond when reassemble the cover. (Three Bond 1206C, refer to Table 10-1 Spare Parts for YR-MH00006D-A30, -A31/YR-MH0006F-A30, -A31 on page 10-1.)

Fig. 9-11: Sealing Para of Wrist Unit

9.3.8.2 Battery Pack Connection

Before removing the encoder connector (with CAUTION label), connect the battery pack referring to the following figures.(Fig.9-12(a Battery Pack Connector Diagram for SLU-axes, fig. 9-12(b) Battery Pack Connector Diagram for RBT-axes on page 9-21)

Fig. 9-12(a): Battery Pack Connector Diagram for SLU-axes
9. Maintenance and Inspection

9.3 Notes on Grease Replenishment/Exchange Procedures

Fig. 9-12(b): Battery Pack Connector Diagram for RBT-axes

- Connect battery to encoder to save the data before removing connector.
- CAUTION label (Enlarged view)
  - a: Crimped contact-pin (socket)
  - b: Crimped contact-pin (pin)
### 10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for the MOTOMAN-MH6D-10/MH6F-10. 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: Spare Parts for YR-MH00006D-A30, -A31/YR-MH0006F-A30, -A31 (Sheet 1 of 2)

<table>
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<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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for ongoing product modifications and improvements.