MOTOMAN-MPX3500 INSTRUCTIONS

TYPE:
YR-MPX3500-‘0’ (L-TYPE)
YR-MPX3500-‘1’ (R-TYPE)

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

MOTOMAN INSTRUCTIONS
MOTOMAN-MPX3500 INSTRUCTIONS
MOTOMAN-MPX3500 INSTRUCTIONS FOR EXPLOSION-PROOF SPECIFICATIONS
MOTOMAN-MPX3500 MAINTENANCE MANUAL
MOTOMAN-MPX3500 INSTRUCTIONS FOR MANIPULATOR OPTIONAL SPECIFICATIONS
DX200 INSTRUCTIONS FOR EXPLOSION-PROOF SPECIFICATIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL FOR PAINTING
DX200 MAINTENANCE MANUAL

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: 174110-1CD
Revision: 6

MANUAL NO.
HW1482773 1/96
MANDATORY

- This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MPX3500 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 DX200 instructions. To ensure correct and safe operation, carefully read the DX200 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 your manipulator.

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

![DANGER]
Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

![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 "DANGER", "WARNING" and "CAUTION".

---

**DANGER**

- Maintenance and inspection must be performed by specified personnel.
  
  Failure to observe this caution may result in electric shock or injury.
  
  - For disassembly or repair, contact your YASKAWA representative.
  
  - Do not remove the motor, and do not release the brake.
  
  Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.
• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 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.

Fig. : 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. Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – 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 DX200.
  – 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 DX200 and the programming pendant.
**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>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and</td>
<td>Manipulator cable</td>
</tr>
<tr>
<td>the controller</td>
<td></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.
<table>
<thead>
<tr>
<th>Type</th>
<th>Type</th>
<th>Type</th>
<th>Type</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nameplate</td>
<td>A**</td>
<td>B**</td>
<td>C<strong>A, C</strong>, F**</td>
<td>EE**</td>
</tr>
<tr>
<td>Battery Warning Label</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Switch Unit Warning Label</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Label A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Label B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Safety Precautions

Respect the law, local regulations, and safety codes for connecting the painting robot.

Explosion-Proof Structure

The explosion-proof structure of the MOTOMAN-MPX3500 consists of intrinsic safety and inner pressure explosion preventing system. Following notations show the explosion-proof structure for each country’s explosion-proof standard.

<table>
<thead>
<tr>
<th>Explosion-proof structure</th>
<th>Power ON</th>
<th>Power OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIIS</td>
<td>ExibpxIIBT4</td>
<td>ExibIIBT4</td>
</tr>
<tr>
<td>FM(US) TYPE X pressurization</td>
<td>CLASS1,DIVISION1 GROUPS C,D T4 CLASS1,ZONE1 AExpixIIBT4</td>
<td>CLASS1,DIVISION1 GROUPS C,D T4 CLASS1,ZONE1 AEixaIIBT4</td>
</tr>
<tr>
<td>FM(CA) TYPE X pressurization</td>
<td>CLASS1,DIVISION1 GROUPS C,D T4 Gb CLASS1,ZONE1 ExpxiaIIBT4Gb</td>
<td>CLASS1,DIVISION1 GROUPS C,D T4 Gb CLASS1,ZONE1 ExaxIIBT4Gb</td>
</tr>
<tr>
<td>ATEX/CAT.2</td>
<td>II2G ExibpxIIBT4Gb</td>
<td>II2G ExibIIBT4Gb</td>
</tr>
<tr>
<td>KCs</td>
<td>Ex ib px IIB T4</td>
<td>Ex ib px IIB T4</td>
</tr>
<tr>
<td>Taiwan</td>
<td>ExibpxIIBT4Gb</td>
<td>ExibIIBT4Gb</td>
</tr>
</tbody>
</table>

DANGER

In case installing the MOTOMAN-MPX3500 in the hazardous area, classify the manipulator environment by following the local explosion-proof standard and then, on the basis of the explosion-proof structure notation on the MOTOMAN-MPX3500, confirm that the manipulator is possible to install in that area.

PROHIBITED

- Any modification of the MOTOMAN-MPX3500, and the following is strictly prohibited:
  1. Explosion-proof devices and system installation
  2. Safeguarding and the safety devices mounted on these safeguards
  3. Emergency stop button, and other safety devices
  4. Robot control system such as the DX200 robot controller, the manipulator drive section and the power transmission section
• Take the following measures when teaching, correcting, inspecting, or adjusting the manipulator when the motor power supply is ON:
  a) Appoint a personnel to stay beside the emergency stop button of the DX200. And perform the operations holding the programming pendant with the emergency stop button.
  b) Before the operation, verify the correct robot motion and that the emergency stop works.

• Observe the following precautions during an automatic operation:
  a) Do not enter inside the safeguarding during operation.
  b) Confirm the following before starting the operation:
    • No person is inside the manipulator working envelope.
    • No obstacles such as unnecessary workpieces and tools are inside the manipulator working envelope.
    • The manipulator is in its standby position.
  c) When any abnormality occurs, immediately press the emergency stop button to stop the manipulator.
  d) Before entering inside the manipulator working envelope, be sure to stop the manipulator and turn OFF the main power supply to the DX200.

• Brake release (Option)
A braking system is provided on each axis of the manipulator to hold the arm in its position when a failure or fault occurs. When the brake is activated, the manipulator cannot be moved manually even if the power is OFF. To change the posture of the manipulator after a failure or fault, the brake can be released by the operation from the controller.
When the brake is released with the manipulator’s power OFF, each axis falls down because of the arm weight. Before releasing the brake, hold the arm with a lifting jig or a support, and then change the posture of the manipulator within the minimum motion range.
Use the brake release function only when absolutely necessary.
Definition of Directions

As definitions of "L-arm side" and "opposite side of L-arm" described in this manual, "L-arm side" shall be from the center of the manipulator to the side where the L-arm is installed.

The contents of this manual are written based on "YR-MPX3500-*0* (L-TYPE)".

When "YR-MPX3500-*0* (R-TYPE)" is used, it is symmetrical with respect to the center of the manipulator.
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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 (provided with the pressure switch unit)
- DX200
- Programming pendant
- Manipulator cables (between the DX200 and the Manipulator)
- Complete set of manuals (supplied on the CD-ROM which is connected to the USB connector)

![Fig. 1-1: Five Items for Standard Delivery](image)

**CAUTION**

- Confirm that the manipulator and the DX200 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 DX200. The order number is located on a label or a nameplate as shown below.

*Fig. 1-2: Location of Label or Nameplate*
2 Transport

2.1 Transporting Method

CAUTION

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

NOTE

- Check that the eyebolts are securely fastened.
- The mass of the manipulator is approximately 730 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the mass.
- 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 Transport
2.1 Transporting Method

2.1.1 Using a Crane

As a rule, the manipulator should be lifted by a crane with four wire ropes when removing it from the package and moving it.

Be sure that the manipulator is fixed with the shipping bolts and brackets before transport, and lift it in the posture as shown in fig. 2-1(a) "Transport Using a Crane (MPX3500-"0")" and fig. 2-1(b) "Transport Using a Crane (MPX3500-"1")".

Fig. 2-1(a): Transport Using a Crane (MPX3500-"0")

<table>
<thead>
<tr>
<th>Axis</th>
<th>Angle</th>
<th>Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>0°</td>
<td>110000</td>
</tr>
<tr>
<td>L</td>
<td>-42°</td>
<td>64110</td>
</tr>
<tr>
<td>U</td>
<td>-64.1°</td>
<td>-156000</td>
</tr>
<tr>
<td>R</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>B</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>T</td>
<td>0°</td>
<td>0°</td>
</tr>
</tbody>
</table>
2 Transport

2.1 Transporting Method

Fig. 2-1(b): Transport Using a Crane (MPX3500-*1*)

<table>
<thead>
<tr>
<th>Axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>0°</td>
<td>-42°</td>
<td>-64.1°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>119825</td>
<td>156000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Factory setting for angle and pulse of each axis.
2.1 Transporting Method

2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with shipping bolts and brackets as shown in fig. 2-2(a) "Transport Using a Forklift (MPX3500-0)" and fig. 2-2(b) "Transport Using a Forklift (MPX3500-1)".

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 overturn or slippage.

Fig. 2-2(a): Transport Using a Forklift (MPX3500-0)
2 Transport

2.1 Transporting Method

Fig. 2-2(b): Transport Using a Forklift (MPX3500-*1*)
2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets at positions as shown in Fig. 2-3 “Shipping Bolts and Brackets”, to protect its driving units from various external forces during transport.

Fig. 2-3: Shipping Bolts and Brackets

- Hexagon socket head cap screw M16 (4 screws, length: 90 mm)
- Conical spring washer 2H-16 (4 washers)
- Plain washer M16 (4 washers)
  Tightening torque: 206 Nm (21 kgf m)

- Hexagon socket head cap screw M16 (4 screws, length: 50 mm)
- Conical spring washer 2H-16 (4 washers)
- Plain washer M16 (4 washers)
  Tightening torque: 206 Nm (21 kgf m)

• The shipping brackets are painted yellow.
• The shipping brackets are fixed with the hexagon socket head cap screw M16 (four screws, length: 50mm,90mm).

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

3.1 Installation of Safeguarding

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

Responsibility for Safeguarding (ISO 10218)

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

WARNING

- Install the safeguarding.
Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the manipulator’s tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or DX200 when the arm is fully extended.
Failure to observe this warning may result in injury or damage.
- Do not start the manipulator or even turn ON the power before it is firmly anchored.
The manipulator may overturn and cause injury or damage.

CAUTION

- Do not install or operate a manipulator that is damaged or 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 are removed.
Failure to observe this caution may result in damage to the driving parts.
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 force of the manipulator. (Refer to table 3-1 "Manipulator Repulsion Force").

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.

For installation, refer to chapter 3.2.1 “Mounting Example”.

Table 3-1: Manipulator Repulsion Force

<table>
<thead>
<tr>
<th></th>
<th>Horizontal rotation</th>
<th>Vertical rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repulsion force $F_H$</td>
<td>Torque $M_H$</td>
<td>Repulsion force $F_V$</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>17200 N (1800 kgf)</td>
<td>31400 N•m (3350 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/deceleration</td>
<td>8600 N (900 kgf)</td>
<td>15700 N•m (1650 kgf•m)</td>
</tr>
</tbody>
</table>

Fig. 3-1: Manipulator Repulsion Force
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 recommended to prepare a baseplate of 40 mm or more thick, and anchor bolts of M20 or larger size.

The manipulator base is tapped for eight mounting holes; securely fix the manipulator base to the baseplate with eight hexagon head bolts M16 (60 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. 3-2(a) “Mounting the Manipulator on the Baseplate (MPX3500-*0*)” and fig. 3-2(b) “Mounting the Manipulator on the Baseplate (MPX3500-*1*)”.

Fig. 3-2(a): Mounting the Manipulator on the Baseplate (MPX3500-*0*)
3 Installation
3.2 Mounting Procedures for Manipulator Base

Fig. 3-2(b): Mounting the Manipulator on the Baseplate (MPX3500-*1*)
3.3 Protection Class

For the standard type, environmental resistance for main part of the manipulator conforms to IP4X; the wrist part conforms to IP67.

3.3.1 Location

When installing the manipulator, satisfy the following environmental conditions.

- Ambient temperature: 0°C to 40°C
- Humidity: 20 to 80%RH at constant temperature
- Free from exposure to water, oil, or dust
- Free from excessive vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation is 0.5 mm or less
4 Connection

4.1 Wiring

DANGER

• For the manipulator main body, due to its explosion-proof structure, motors and connectors in the pressurized enclosure (arm) are protected from the explosive gases.

However, power cables that connect the manipulator's main body with the DX200 are not protected by the pressurized air.

In case the power cable, which is not protected, is split over large amount of solvent or the covering of the cable is damaged, fire may outbreak due to short-circuit or ground.

In this regard, whenever connecting the power cable, fixed type or movable type, please be sure to provide protection materials to it.

• For protecting the cable, use flexible tubes to the movable type cable and wire blade (optional) or hard covering materials, etc. to the fixed type cable.

• Please do not fail to check the surface of the power cable and its coverings. In case any abnormalities are found, immediately stop the operation and replace it with the new cable.

• For the movable type power cable, replace it in every 24,000 hours regardless of any damages.

• For the fixed type power cable, it is recommend to replace it in every 36,000 hours regardless of any damages.

WARNING

• Ground resistance must be 100 Ω or less.

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

• Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

Failure to observe this caution may result in electric shock or injury.
4 Connection
4.1 Wiring

4.1.1 Grounding

Follow the local regulations for ground line size. Use a line of 5.5 mm² or more with round crimping terminal. Refer to fig. 4-1 "Grounding Method".

**CAUTION**

- Wiring must be performed by authorized or certified personnel. Failure to observe this caution may result in fire or electric shock.
- Do not cover the cable with heat insulating material, and avoid multiple cabling. Failure to observe this caution may result in burn caused by cable heat emission failure.

**NOTE**

- Do not use this line sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with Electric Equipment Technical Standards.

The grounding methods differ depending on the system application. Refer to the connection instructions that are provided separately.
4 Connection
4.1 Wiring

Fig. 4-1: Grounding Method

Screw M8 (for grounding) (Delivered with the Manipulator)

View A

View B

Screw M8 (for grounding) (Delivered with the Manipulator)
4.2 Cable Connection

Refer to the DX200 Instruction Manual for the connection of the power cable and the intrinsically safe cable to the DX200. The air hose for the pressure switch, the intrinsically safe cable, and the crimped terminals should be prepared by the customer.

Furthermore, inside the painting booth, the power supply cables are required to be protected by the wire blade prepared by YASKAWA (length should be specified) or to be put either in the ditch on the floor and be covered with the metal plate or through the metal pipe.

1. Connect the power cable connector to the connector base.

2. Connect the grounding cable of the power cable to the grounding cable connecting tap.

3. In case the built-in tube for painting is used, connect the tube to the power cable joint.

4. Attach the gasket side of the power cable to the base after checking that no tube is bent, and then tighten the cover with the hexagon socket head cap screws.

5. After the cable is connected, confirm that the air is appropriately supplied.

For the cable gland, it is required to use the specified one for the explosion-proof certification. It is highly recommend to use the cable gland prepared by YASKAWA which is the exclusively one. Also, please do not detach reassemble or remodel the cable gland since it is already an assembled parts. Contact your YASKAWA representatives when any abnormalities are found.
4 Connection
4.2 Cable Connection

**Fig. 4-2(a): Manipulator Internal Cable Connection (MPX3500-*0*)**

- Grounding cable connecting tap
- Use following parts for grounding the power cable:
  - Cross-recessed head machine screws M5
  - Plain washers
  - Spring lock washers

**Fig. 4-2(b): Manipulator Internal Cable Connection (MPX3500-*1*)**

- Hexagon socket head cap screw M6
  - Trivalent chromium, length 20 mm, 8 screws
  - Conical spring washer 2H-6
  - Trivalent chromium, 8 washers
  - Tightening torque 10 N·m (1.0 kgf·m)
- Use following parts for grounding the power cable:
  - Cross-recessed head machine screws M5
  - Plain washers
  - Spring lock washers

**Channel Position**

**Connector base**

**Section A-A**

**Section B-B**
4 Connection
4.2 Cable Connection

Fig. 4-3(a): Power Supply Cable Connection to the DX200 (Except for B**)

- **Power Cable** (Standard)
- **Encoder Cable** (Standard)
- **CC-Link, DeviceNet, Ethernet** Cable (Optional)
- **Electro-pneumatic Valve** cable (Optional)

Connect to the grounding tap:
- 1BC-1, 2, 3, 4, 5, 6
- 2BC-A, B, C, D, E, F
- 3BC-3, 5
- 4BC-1, 2
- 4BC-3, 4
- 4BC-4

*1 The cable diameter differs depending on the communication specifications.
CC-Link: 12 dia.
DeviceNet: 9 dia.
Ethernet: 6.8 dia.
4 Connection
4.2 Cable Connection

Fig. 4-3(b): Power Supply Cable Connection to the DX200 (For B**)

Note: Construction method (and parts) in a penetration part from hazardous location to non-hazardous location is end user scope. Respect the local regulations and safety codes when performing the above mentioned construction.
Prepare tubes with 16 mm outside diameter. Tubes used for supplying paints, thinner, and air (excluding the tube for supplying protective gas into the manipulator) are disposable item. Perform daily inspection for damages and replace them periodically.
4 Connection
4.2 Cable Connection

Fig. 4-5: Pressure Switch Unit Connection to Intrinsically Safe Terminal Block and Barrier

1) Intrinsically safe cable
   - Cable type (recommended): UL2586-SB, 1.25 mm² (SUMIDEN HITACHI CABLE Ltd.)
   - The cable to be connected with terminal blocks P1 to N3, and 1 to 2 are different.
   - The group of terminal blocks P1 to N3, and 1 to 2 are binned with shield separately.
   - Controller side: Crimped terminals

<table>
<thead>
<tr>
<th>Connector Side</th>
<th>Terminal blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>P1 to N3, 1 to 2</td>
</tr>
<tr>
<td>Manipulator</td>
<td>P1 to N3, 1 to 2</td>
</tr>
<tr>
<td>P1</td>
<td>N1</td>
</tr>
<tr>
<td>P2</td>
<td>N2</td>
</tr>
<tr>
<td>P3</td>
<td>N3</td>
</tr>
<tr>
<td>N1</td>
<td>P1</td>
</tr>
<tr>
<td>N2</td>
<td>P2</td>
</tr>
<tr>
<td>N3</td>
<td>P3</td>
</tr>
<tr>
<td>1</td>
<td>N5</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

2) Manipulator side: Crimped terminals
   - For connecting the intrinsically safe cable to the intrinsically safe terminal block
   - For terminal block P1 to 2
   - Cable type (recommended): UL2586-SB, 1.25 mm² (SUMIDEN HITACHI CABLE Ltd.)
   - The cable to be connected with terminal blocks P1 to N3, and 1 to 2 are different.
   - The group of terminal blocks P1 to N3, and 1 to 2 are binned with shield separately.

3) Controller side: Crimped terminals
   - For connecting the intrinsically safe cable to the relay barrier in the DX200
   - For terminal P1 to 3
   - For terminal P1 to N3
   - For terminal 1 to 2
   - Cable connection

- For terminal block P1 to 2

- For connecting the intrinsically safe cable to the insulation barrier in the DX200

- For terminal block 1 to 2

1.25AF2.3B (J.S.T. Mfg. Co., Ltd. made) (Recommended terminal)
4.3 Requirements

Prepare the power supply, the air supply, and the grounding according to the following specifications.

Table 4-1: Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
<td>3-phase 200 VAC (-15% to +10%) 50/60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 VAC (-15% to +10%) 60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0 kVA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Grounding</td>
<td>Grounding resistance: 100 Ω or less</td>
<td>For the controller of the manipulator</td>
</tr>
</tbody>
</table>

Table 4-2: Air Specifications

<table>
<thead>
<tr>
<th>Item (for pressurized explosion-proof construction)</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required pressure</td>
<td>0.35 MPa to 0.65 MPa</td>
<td>Use clean, dry air as the air for the pressurized explosion-proof construction.</td>
</tr>
<tr>
<td>Capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>・ At operation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 NL/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>・ At purging:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000 NL/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid matter</td>
<td>0.3 μm or less</td>
<td></td>
</tr>
<tr>
<td>Oil content (oil mist concentration)</td>
<td>1 mg/m^3 (ANR) or less</td>
<td></td>
</tr>
<tr>
<td>Moisture content</td>
<td>Atmospheric dew point -18°C or lower</td>
<td>Do not use ultra dry air with an atmospheric dew point of -30°C or lower for the pressurized explosion-proof construction.</td>
</tr>
</tbody>
</table>

CAUTION

- Always pass the air for the pressurized explosion-proof construction through a filter so that it meets the following specifications.
  - Oil content: 1 mg/m^3 (ANR) or less
  - Solid matter: 0.3 μm or less
There is a risk of device malfunction due to foreign matter being mixed in the air.
- For the air for the pressurized explosion-proof construction, install an air dryer so the atmospheric dew point is -18°C or lower to reduce the occurrence of condensate in the air.
There is a risk of failure in electronic parts due to humidity.
- Do not use ultra dry air with an atmospheric dew point of -30°C or lower for the pressurized explosion-proof construction.
There is a risk of failure in electronic parts due to drying.
4 Connection

4.4 Installation Site

4.4 Installation Site

This section describes the conditions of the installation site for the robot system. Only devices that are approved as explosion-proof can be installed in hazardous locations. Refer to the local regulations and safety codes for the definition of a hazardous location. Install the controller and control panels in a location free from water drops, dust, and dirt.

Table 4-3: Installation Site

<table>
<thead>
<tr>
<th>System Components</th>
<th>Hazardous Location (Inside Painting Booth)</th>
<th>Non-hazardous location (Outside Painting Booth)</th>
<th>Ambient Temperature</th>
<th>Maximum Ambient Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulator (explosion-proof)</td>
<td>●</td>
<td>×</td>
<td>0 to 40°C</td>
<td>80%RH</td>
</tr>
<tr>
<td>Controller (not explosion-proof)</td>
<td>×</td>
<td>●</td>
<td>0 to 45°C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Pressure Switch unit (explosion-proof)</td>
<td>●</td>
<td>●</td>
<td>0 to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (not explosion-proof)</td>
<td>×</td>
<td>●</td>
<td>0 to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (explosion-proof) (Option)</td>
<td>●</td>
<td>●</td>
<td>0 to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Converyor speed detector (explosion-proof)</td>
<td>●</td>
<td>×</td>
<td>0 to 50°C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Converyor switch (explosion-proof)</td>
<td>●</td>
<td>×</td>
<td>0 to 50°C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Safety devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box for emergency stop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety plugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flashing light</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator lamps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photoelectric switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selected according to the requirements of the customer. Refer to the appropriate instruction manual provided separately.

- Not acceptable
- Acceptable
- Should be always mounted within the painting booth.

WARNING

Devices that are not explosion-proof must not be installed in hazardous locations. Failure to observe this warning may result in a fire.
5 Basic Specifications

5.1 Basic Specifications

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YR-MPX3500-<em>0</em>,-<em>1</em>,-C**A (Floor-mounting specification)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>15 kg</td>
<td></td>
</tr>
<tr>
<td>Repeatability(^2)</td>
<td>± 0.15 mm</td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>-150° ~ +150°</td>
<td></td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>-65° ~ +140°</td>
<td></td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>-65° ~ +90°</td>
<td></td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>-720° ~ +720°</td>
<td></td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>-720° ~ +720°</td>
<td></td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>-720° ~ +720°</td>
<td></td>
</tr>
<tr>
<td>Maximum Speed(^3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>1.75 rad/s, 100 °/s</td>
<td></td>
</tr>
<tr>
<td>L-axis</td>
<td>1.75 rad/s, 100 °/s</td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>1.92 rad/s, 110 °/s</td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>5.24 rad/s, 300 °/s</td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>6.28 rad/s, 360 °/s</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>6.28 rad/s, 360 °/s</td>
<td></td>
</tr>
<tr>
<td>Allowable Moment(^4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>93.2 Nm (9.5 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>58.8 Nm (6.0 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>19.6 Nm (2.0 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>Allowable Inertia(^4) (GD(^2))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>3.75 kgf•m(^2)</td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>2.225 kgf•m(^2)</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>0.20 kgf•m(^2)</td>
<td></td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>590 kg</td>
<td></td>
</tr>
<tr>
<td>Protective Structure</td>
<td>Basic axis: IP4X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrist axis only: IP67 or equivalent</td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to +40 °C</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80%RH (non-condensing)</td>
<td></td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>Less than 4.91 m/s(^2) (0.5 G)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Free from excessive electrical noise (plasma).</td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td>3.0kVA(^2)</td>
<td></td>
</tr>
<tr>
<td>Noise(^5)</td>
<td>71 dB</td>
<td></td>
</tr>
</tbody>
</table>

1 SI units are used in this table. However, gravitational unit is used in ( ).
2 Conformed to ISO9283.
3 Differs depending on the motion pattern or the load of the wrist axis.
4 For details on the allowable moment and the allowable inertia, refer to chapter 6.1 "Allowable Wrist Load".
5 Conformed to ISO6926

\(^1\) Measurement is carried out when the maximum load is mounted to the manipulator and operated in the maximum speed.
\(^2\) Measurement is carried out:
- between 1.2m and 1.5m above the ground.
- 400mm away from the P-point maximum envelope.
5.2 Part Names and Working Axes

*Fig. 5-1: Part Names and Working Axes*

- **(L-arm)** Lower arm
- **(S-head)** Rotary head
- **Base**
- **(U-arm)** Upper arm
- **Wrist flange**
- **Wrist**
- **MPX3500-*0*”**

- **MPX3500-*1**
- **VIGOGREASE**
- **RE0**

- **OUT**
### 5.3 Manipulator Base Dimensions

**Fig. 5-2(a): Base Dimensions (MPX3500-*0*)**

<table>
<thead>
<tr>
<th>S-axis rotation center</th>
<th>25</th>
<th>365±0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.5dia.(8holes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12H7dia.(2holes)</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Unit:mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 5-2(b): Base Dimensions (MPX3500-*1*)**

<table>
<thead>
<tr>
<th>S-axis rotation center</th>
<th>25</th>
<th>365±0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.5dia.(8holes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12H7dia.(2holes)</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Unit:mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.4 Dimensions and P-point Maximum Envelop

Fig. 5-3(a): Dimensions and P-point Maximum Envelope (MPX3500-*0*)

- **S-axis range of motion:** +95° to +150°
  - Limited range of motion within (-95° to -150°)
- **L-axis range of motion:** -65° to +105°
  - Limited range of motion within (-95° to -150°)
- **P-point maximum envelope**
5 Basic Specifications

5.4 Dimensions and P-point Maximum Envelop

Fig. 5-3(b): Dimensions and P-point Maximum Envelope (MPX3500-*1*)
5 Basic Specifications
5.5 Stopping Angles and Times for S-, L- and U-Axes

5.5 Stopping Angles and Times for S-, L- and U-Axes

Following data on stopping angle and time for each axis measured under the standard of ISO10218.

5.5.1 Stop Category 0: Stopping Angles and Times

5.5.1.1 Position 100%

*Fig. 5-4: Stop Category 0, Position 100%: Stopping Angle and Time for each Axis*
5.5 Stopping Angles and Times for S-, L- and U-Axes

5.5.1.2 Position 66%

Fig. 5-5: Stop Category 0, Position 66%: Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.5 Stopping Angles and Times for S-, L- and U-Axes

5.5.3 Position 33%

Fig. 5-6: Stop Category 0, Position 33%: Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.5 Stopping Angles and Times for S-, L- and U-Axes

5.5.2 Stop Category 1: Stopping Angles and Times

NOTE Stopping angles and times at Stop category 1 are not subjected to the load of the manipulator.

5.5.2.1 Position 100%

Fig. 5-7, Stop Category 1, Position 100%: Stopping Angle and Time for each Axis

(a) S-Axis

Notes) Not depends on the load of the manipulator

(b) L-Axis

Notes) Not depends on the load of the manipulator

(c) U-Axis

Notes) Not depends on the load of the manipulator
5.5.2.2 Position 66%

Fig. 5-8: Stop Category 1, Position 66%. Stopping Angle and Time for each Axis

(a) S-Axis
Notes) Not depends on the load of the manipulator

(b) L-Axis
Notes) Not depends on the load of the manipulator

(c) U-Axis
Notes) Not depends on the load of the manipulator
5.5.2.3 Position 33%

Fig. 5-9: Stop Category 1, Position 33%: Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis

Notes: Not depends on the load of the manipulator
6 Allowable Load for Wrist Axis Flange

6.1 Allowable Wrist Load

The allowable wrist load is 15 kg maximum. If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in Table 6-1 “Allowable Wrist Load”. Contact your YASKAWA representative for further information or assistance.

Table 6-1: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N·m (kgf·m)</th>
<th>GD^2/4 Total Moment of Inertia (kg·m^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>93.2 (9.5)</td>
<td>3.75</td>
</tr>
<tr>
<td>B-Axis</td>
<td>58.8 (6.0)</td>
<td>2.225</td>
</tr>
<tr>
<td>T-Axis</td>
<td>19.6 (2.0)</td>
<td>0.20</td>
</tr>
</tbody>
</table>

1 ( ): Gravitational unit

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

The allowable total moment of inertia is calculated when the moment is at the maximum.

Contact your YASKAWA representative beforehand when the moment of inertia is the only load or the load moment is smaller than moment of inertia.

Also, when the load is combined as a force but a mass, contact your YASKAWA representative.

Fig. 6-1: Moment of Arm Rating
6 Allowable Load for Wrist Axis Flange
6.2 Wrist Flange

The wrist flange dimensions are shown in fig. 6-2 “Wrist Flange”. Fitting depth of inside and outside fittings must be 21 mm or less.

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

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Tapped hole M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2 dia. +0.012</td>
<td>(Depth:10, 2 holes)</td>
</tr>
<tr>
<td>140 dia.</td>
<td>(Six holes, Depth:12, Pitch:1.0)</td>
</tr>
<tr>
<td>51 ±0.02</td>
<td>51 ±0.02</td>
</tr>
<tr>
<td>116</td>
<td>0.035</td>
</tr>
<tr>
<td>21.5 ±0.1</td>
<td></td>
</tr>
</tbody>
</table>

Unit: mm
7 System Application

7.1 System Application

The peripheral equipment mounts are provided on the U-axis (upper arm) and S-axis (rotary head) as shown in fig. 7-1(a) "Installing Peripheral Equipment (MPX3500-*0*)", fig. 7-1(b) "Installing Peripheral Equipment (MPX3500-*1*)", fig. 7-2(a) "Installing Built-in Equipment in Pressurized Enclosure (MPX3500-*0*)", and fig. 7-2(b) "Installing Built-in Equipment in Pressurized Enclosure (MPX3500-*1*)" for easier installation of the users' system applications. The following conditions shall be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

The device required for the system application can be mounted on the upper arm (U-arm).

Observe the following restrictions.

- Maximum allowable load: 25 kg or less

7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in fig. 7-1(a) "Installing Peripheral Equipment (MPX3500-*0*)" and fig. 7-1(b) "Installing Peripheral Equipment (MPX3500-*1*)" on the following page.

Fig. 7-1(a): Installing Peripheral Equipment (MPX3500-*0*)
7.1.3 Installation Position of Built-in Equipment in Pressurized Enclosure

The followings are the installation positions of electrical equipment*1 (electro-pneumatic regulator, solenoid valve) which are built in the pressurized enclosure.

For installation, refer to fig. 7-2(a) “Installing Built-in Equipment in Pressurized Enclosure (MPX3500-*0*)” and fig. 7-2(b) “Installing Built-in Equipment in Pressurized Enclosure (MPX3500-*1*)”.

An electro-pneumatic regulator can be installed on Part A, and a solenoid valve on Part B.

For the electro-pneumatic regulator, use hoses with descriptions "EP1", "EP2", "EP3", and "EP4" in the manipulator, and for the solenoid valve, use hoses with description "Solenoid".

*1 The electrical equipment which are built in the pressurized enclosure are the special specifications. For the details, contact your YASKAWA representatives.

*2 For the joint used for the connection destination of the solenoid valve hose (48 ports), POC6-MSM (made by PISCO) is recommended.

Table 7-1: Maximum Number of Ports of Electrical Equipment

<table>
<thead>
<tr>
<th>Pump-Axis</th>
<th>Mounted on lower or upper/lower sides</th>
<th>Mounted centrally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electro-pneumatic regulator</td>
<td>4 ports</td>
<td></td>
</tr>
<tr>
<td>Solenoid valve</td>
<td>48 ports</td>
<td>32 ports</td>
</tr>
</tbody>
</table>

Fig. 7-1(b): Installing Peripheral Equipment (MPX3500-*1*)

![Diagram of equipment installation](image-url)
7 System Application

7.1 System Application

Fig. 7-2(a): Installing Built-in Equipment in Pressurized Enclosure (MPX3500-"0")

Fig. 7-2(b): Installing Built-in Equipment in Pressurized Enclosure (MPX3500-"1")

Details of View C
MPX3500-"0" (L-TYPE)

Details of View C
MPX3500-"1" (R-TYPE)
8 Electrical Equipment Specification

8.1 Internal Connections

The fig. 8-1(a) "Internal Connection Diagram (Except for B**, C**A)", fig. 8-1(b) "Internal Connection Diagram (Except for B**, C**A)", fig. 8-2(a) "Internal Connection Diagram (For B**)", and fig. 8-2(b) "Internal Connection Diagram (For B**)", show the internal connections. The fig. 8-3(a) "Internal Connection Diagram (for C**A)" and fig. 8-3(b) "Internal Connection Diagram (for C**A)" show the internal connections.
Fig. 8-1(a): Internal Connection Diagram (Except for B**, C**A)
Fig. 8-1(b): Internal Connection Diagram (Except for B**, C**A)
Fig. 8-2(a): Internal Connection Diagram (For B")
Fig. 8-2(b): Internal Connection Diagram (For B**)
8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-3(b): Internal Connection Diagram (for C**A)
The painting robot is a precision device using advanced technology. It is important to frequently inspect the robot and remove any dried paint. Conduct the daily and weekly inspections listed in Table 9-1 "Frequent Inspections" to ensure the long life of the robot and its performance. For more information about the inspection items, refer to Chapter 9.2 "Daily Inspections".

Table 9-1: Frequent Inspections (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Items to be Inspected</th>
<th>Inspection</th>
<th>Daily</th>
<th>Weekly</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exterior</td>
<td>No deformations or cracks to the pressurized explosion-proof enclosure. Covers are appropriately mounted. No other exterior abnormality.</td>
<td>●</td>
<td></td>
<td>DANGER If any deformations or cracks are found, immediately stop the operation and contact your YASKAWA representatives.</td>
</tr>
<tr>
<td>2</td>
<td>Motion</td>
<td>Smooth tuning, horizontal, and vertical motions of each arm. The robot’s home position does not change.</td>
<td>●</td>
<td></td>
<td>DANGER Do not enter the robot working envelope.</td>
</tr>
<tr>
<td>3</td>
<td>Noise and vibration during operation</td>
<td>No abnormal noise and vibration during robot operation.</td>
<td>●</td>
<td></td>
<td>DANGER Do not enter the robot working envelope.</td>
</tr>
<tr>
<td>4</td>
<td>Tubes</td>
<td>Off or no severe wear and tear on paint and air supply tubes.</td>
<td>●</td>
<td>●</td>
<td>CAUTION Use a pair of protective glasses to protect your eyes against paint or thinner that is being removed.</td>
</tr>
<tr>
<td>5</td>
<td>Air leakage</td>
<td>No excessive air leakage from the fitting of the motor case.</td>
<td>●</td>
<td>●</td>
<td>CAUTION Make sure that the air tube is firmly inserted in the joint. Accidental disconnection of the air tube may cause injury.</td>
</tr>
<tr>
<td>6</td>
<td>Dried paint</td>
<td>Remove the dried paint on the robot.</td>
<td>●</td>
<td>●</td>
<td>CAUTION When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
</tbody>
</table>

DANGER DANGER DANGER

CAUTION CAUTION CAUTION
### Table 9-1: Frequent Inspections  (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Item</th>
<th>No.</th>
<th>Items to be Inspected</th>
<th>Inspection Details</th>
<th>Daily</th>
<th>Weekly</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manipulator</strong></td>
<td>7</td>
<td>Power cable</td>
<td>No damages to the power cable</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td><strong>Pressure Switch Unit</strong></td>
<td>1</td>
<td>Pressure set value</td>
<td>The pressure of the pressure reducing valve is within the specified range</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td><strong>Safety Devices</strong></td>
<td>1</td>
<td>Operation of emergency stop button and safety plug. Dried paint</td>
<td>1. The manipulator stops immediately when the emergency stop button is pressed.</td>
<td>●</td>
<td></td>
<td>▶️DANGER Replace the cable if any abnormalities are found.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. The manipulator stops immediately when the safety plug is pulled out.</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Remove the dried paint on the emergency stop button and the safety plug.</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Options</strong></td>
<td>1</td>
<td>Operation of the gun tilt switching</td>
<td>The gun tilt changes correctly when air is supplied.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Operation of the shear pin system</td>
<td>1. The manipulator stops immediately when the shear pin is sheared.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. The test valve is closed and the tube is not broken.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>
9.2 Daily Inspections

Inspect the robot daily to ensure its high performance and early detection of any abnormalities.

9.2.1 Manipulator

9.2.1.1 Visual Inspection

Before turning ON the power to the manipulator, check if any abnormality are found on the manipulator. Remove the jacket if it is attached.

9.2.1.2 Manipulator Motions and Noise/Vibration during Operation

Check if the manipulator home posture does not change when turning ON the power supply using the eye mark.

Also, check for abnormal noise and vibration during operation.

DANGER

Never enter inside the safeguarding and the manipulator working envelope after turning ON the power supply.

9.2.1.3 Tubes and Air Leakage

Check for excessive air leakage from the tubes (for air exhaust), the couplings, and the joint fittings of the motor on each axis when the air is supplied in the manipulator to form the anti-explosion barrier.

The actual amount of air leakage is not important if a fault in the internal air pressure does not occur. However, if internal air pressure faults occur frequently, check if the pressure of the air source and the pressure setting of the pressure reducing valve are correct and if excessive air is leaking.

9.2.1.4 Dried Paint, Dust, and Dirt

Remove any dried paint on the manipulator and other devices.

Replace the vinyl sheet if any.

Replace the jacket if it is dirty.

WARNING

When using a tool to remove the dried paint, be careful not to damage the manipulator.
9 Frequent Inspections

9.2 Daily Inspections

### 9.2.2 Pressure Switch Unit

#### 9.2.2.1 Pressure

Before moving the manipulator, check if the gauge of the pressure reducing valves on the pressure switch unit show the pressure to be within the specified range.

- Pressure reducing valve for the operating pressure: 0.01 to 0.02 [MPa]
- Pressure reducing valve for purging air: 0.28 to 0.30 [MPa]

---

### 9.2.3 Safety Devices

#### 9.2.3.1 Emergency Stop Button and Safety Plug

Before operating the manipulator, check the following to make sure that the emergency stop button and the safety plug operate correctly:

- The manipulator stops immediately when the emergency stop button is pressed.
- The manipulator stops immediately when the safety plug is pulled out.
- Inspect the manipulator while it is in the standby posture and not in motion with the power supply turned ON. Repeated sudden stops while the manipulator is in motion will damage the braking system.
- Remove any dried paint on the emergency stop button and the safety plug.

#### 9.2.3.2 Photoelectric Intrusion Detecting Switch

Make sure that the photoelectric intrusion detecting switch operates correctly.

- Remove any dried paint on the light beam receiving section on the switch.
- When the air is purging, check the air for purging.

#### 9.2.3.3 Limit Switch

Make sure that the limit switches for positioning workpieces, starting the robot, and return the robot to home operate correctly.

- Remove any dried paint that may obstruct the robot motion.

---

**CAUTION**

Paint stuck on the manipulator rotating parts prevents them from turning normally and smoothly. Periodically remove the paint on the manipulator.

- A cloth that is soaked in paint thinner can be used for cleaning the inside of the wrist, because an anti-thinner enclosure is provided. But, be careful not to remove the original coat of paint on the manipulator.
10 Maintenance and Inspection

10.1 Inspection Schedule

Conduct daily and periodic inspections to ensure the long life of the robot and its performance.

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 given in the levels shown in table 10-1 "Inspection Schedule".

In table 10-1, the inspection items are classified into three types of operation: operations which can be performed by personnel authorized of the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel.

Only specified personnel are to do inspection work.

The inspection interval must be based on the servo power supply ON time.
## 10.1 Inspection Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Remark</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Daily</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Stop the manipulator for this inspection.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>2</td>
<td>Daily</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Stop the manipulator for this inspection.</td>
<td>Licensee qualified by YASKAWA</td>
</tr>
<tr>
<td>3</td>
<td>6000 H Cycle</td>
<td>Visual</td>
<td>Check for grease leakage. 1)</td>
<td></td>
<td>Service Company</td>
</tr>
<tr>
<td>4</td>
<td>Visual</td>
<td>Visual</td>
<td>Check for filter clogging.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Visual</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Visual</td>
<td>Visual</td>
<td>Check for wear or tear. Replace if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Visual</td>
<td>Manual</td>
<td>Visual Multi-meter</td>
<td>Replace the cables. 2)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Visual</td>
<td>Visual</td>
<td>Check the conduction between terminals.</td>
<td>Replace the cables. 3)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Visual</td>
<td>Manual</td>
<td>Replace the battery unit when the battery alarm occurs or the manipulator drove for 36000 H.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 10.1 Inspection Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Remark</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td></td>
<td></td>
<td></td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td></td>
<td>1000HCycle</td>
<td></td>
<td></td>
<td></td>
<td>Licencee (Person who is qualified by YASKAWA)</td>
</tr>
<tr>
<td></td>
<td>2000HCycle</td>
<td></td>
<td></td>
<td></td>
<td>Service Company (YASKAWA)</td>
</tr>
<tr>
<td></td>
<td>6000HCycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000HCycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000HCycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000HCycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Power cable (Movable type)</td>
<td>•</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td>12 Power cable (Fixed type)</td>
<td>•</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td>13 S-, L-, and U-axis speed reducers</td>
<td>• ●</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Replenish grease (6000H cycle).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Replace grease (12000H cycle).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 R-, B-, and T-axis speed reducers</td>
<td>•</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Replenish grease (6000H cycle).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Pump-axis speed reducers</td>
<td>•</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Replenish grease (6000H cycle).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Wrist gear</td>
<td>•</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Replenish grease (6000H cycle).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Pressure switch unit</td>
<td>•</td>
<td>•</td>
<td>Confirm that the pressure switch, flow switch, solenoid valve and</td>
<td>● ● ●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the pressure reducing valve operate correctly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contact your YASKAWA representatives.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Overhaul</td>
<td></td>
<td></td>
<td></td>
<td>● ●</td>
<td></td>
</tr>
</tbody>
</table>

1. 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.

2. 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 data may be lost.

3. Internal cables to be replaced at 24000H inspection.
10 Maintenance and Inspection

10.1 Inspection Schedule

For the grease, refer to your YASKAWA representative.

Table 10-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VIGO grease RE No. 0</td>
<td>S-, L-, U-, R-, B-, T-, and Pump-axis speed reducers</td>
</tr>
<tr>
<td>2</td>
<td>Alvania EP grease 2</td>
<td>Wrist gear</td>
</tr>
</tbody>
</table>

Fig. 10-1(a): Inspection Parts and Inspection Numbers (MPX3500-*0*)

Fig. 10-1(b): Inspection Parts and Inspection Numbers (MPX3500-*1*)
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

10.2.1 Grease Replenishment/Replacement

Fig. 10-1(a) “Inspection Parts and Inspection Numbers (MPX3500-*0*)” and Fig. 10-1(b) “Inspection Parts and Inspection Numbers (MPX3500-*1*)” show the location of the components of the manipulator.

Replenish or replace the grease for the following sections:

- I) Wrist gears
- II) S-, L-, and U-axis speed reducers
- III) R-, B-, and T-axis speed reducers
- IV) Pump-axis speed reducers

10.2.1.1 Wrist Gears

Remove the plugs and apply Alvania EP grease 2 on the gear teeth of gears R1, B1, B2, T1, T2, and T3 by using a grease gun. Apply seal tape on the thread part of each plug, then reinstall the plugs. (Each plug must be tightened with the specified tightening torque.)

Fig. 10-2: Wrist Gears

- Hexagon socket head cap screw M4 (trivalent chromium, length: 12 mm, 6 screws)
- Conical spring washer 2H-4 (trivalent chromium, 6 washers)
- Tightening torque 2.4 N·m (0.24 kgf·m)
10.2 Maintenance for Manipulator

10.2.1.2 S-, L-, and U-Axis Speed Reducers

- **Grease Replenishment**
  1. Remove the plug on the So (Lo, Uo) exhaust port.

- **NOTE**
  If grease is injected with the plug (So, Lo, Uo) on, the grease will go inside the motor and may cause a damage. Make sure to remove the plug (So, Lo, Uo) before the grease injection.

2. Remove the plug 1/8 on the Si (Li, Ui) grease inlet and install the grease zerk A-PT1/8. Inject grease by using a grease gun.
   - **Grease type:** VIGO grease RE No. 0
   - **Amount of grease:**
     - S-axis: 2000 cc (1740 g)
     - (4000 cc (3600 g) for the 1st supply)
     - L-axis: 2000 cc (1740 g)
     - (4000 cc (3600 g) for the 1st supply)
     - U-axis: 800 cc (720 g)
     - (1600 cc (1440 g) for the 1st supply)
   - **Air supply pressure of grease pump:** 0.3 MPa or less
   - **Grease injection rate:** 8 g/s or less
3. Move S-axis (L-axis, U-axis) for a few minutes to discharge excessive grease.
4. Remove the grease zerk on the Si (Li, Ui) grease inlet. Wipe the So (Lo, Uo) exhaust port and the Si (Li, Ui) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the So (Lo, Uo) exhaust port and the Si (Li, Ui) grease inlet.
Grease Replacement

1. Remove the plug on the So (Lo) grease exhaust port.

2. Remove the plug 1/8 on the Si (Li, U)) grease inlet and install the grease zerk A-PT1/8. Inject grease by using a grease gun.
   - Grease type: VIGO grease RE No. 0
   - Amount of grease:
     - S-axis: 5600 cc (5040 g)
     - L-axis: 5600 cc (5040 g)
     - U-axis: 2300 cc (2070 g)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

3. The grease replacement is completed when new grease appears in the So (Lo, Uo) exhaust port. The new grease can be distinguished from the old grease by color.

4. Move S-axis (L-axis, U-axis) for a few minutes to discharge excessive grease.

5. Remove the grease zerk on the Si (Li, U) grease inlet. Wipe the So (Lo, Uo) exhaust port and the Si (Li, U) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the So (Lo, Uo) exhaust port and the Si (Li, U) grease inlet. Reinstall the cover on each axis motor side.

NOTE
If grease is injected with the plug (So, Lo, Uo) on, the grease will go inside the motor and may cause a damage. Make sure to remove the plug (So, Lo, Uo) before the grease injection.

If the plug (So, Lo, Uo) is installed while the grease is being exhausted, the grease will go inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug (So, Lo, Uo).
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

**Fig. 10-3: S-Axis Speed Reducer**

Grease exhaust port (S-axis head) So
(Hexagon socket head plug PT3/8)
\[ \text{Tightening torque 23 Nm (2.34 kgf.m)} \]

Grease inlet (S-axis base) Si
(Hexagon socket head plug PT3/8)
\[ \text{Tightening torque 23 Nm (2.34 kgf.m)} \]

**Fig. 10-4: L-Axis Speed Reducer**

Grease exhaust port (S-axis head) Lo
(Hexagon socket head plug PT3/8)
\[ \text{Tightening torque 23 Nm (2.34 kgf.m)} \]

Grease inlet (L-arm) Li
(Hexagon socket head plug PT3/8)
\[ \text{Tightening torque 23 Nm (2.34 kgf.m)} \]
Fig. 10-5: U-Axis Speed Reducer

Grease exhaust port (Casing) Uo (Hexagon socket head plug PT3/8) Tightening torque 23 Nm (2.34 kgf·m)

Grease inlet (L-arm) Ui (Hexagon socket head plug PT3/8) Tightening torque 23 Nm (2.34 kgf·m)

Grease inlet (L-arm) Ui Tightening torque 23 Nm (2.34 kgf·m)

Grease exhaust port (Casing) Uo (Hexagon socket head plug PT3/8) Tightening torque 23 Nm (2.34 kgf·m)

MPX3500-*0*

MPX3500-*1*
10.2.1.3 R-, B-, and T-Axis Speed Reducers

**Grease Replenishment**

1. Remove the plug on the Ro (Bo, To) exhaust port.

   **NOTE**
   If grease is injected with the plug (Ro, Bo, To) on, the grease will go inside the motor and may cause a damage. Make sure to remove the plug (Ro, Bo, To) before the grease injection. Note that grease replacement is not necessary for R-, B-, and T-axes.

2. Remove the plug on the Ri (Bi, Ti) grease inlet, and install the grease zerk PT1/8. Inject grease by using a grease gun.
   - Grease type: VIGO grease RE No. 0
   - Amount of grease:
     - R-axis: 25 cc (23 g)
     - B-axis: 25 cc (23 g)
     - T-axis: 20 cc (18 g)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

3. Move R-axis (B-axis, T-axis) for a few minutes to discharge excessive grease.

4. Remove the grease zerk on the Ri (Bi, Ti) grease inlet. Wipe the Ro (Bo, To) exhaust port and the Ri (Bi, Ti) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the Ro (Bo, To) exhaust port and the Ri (Bi, Ti) grease inlet.
10.2 Maintenance for Manipulator

Fig. 10-6: R-, B-, and T-axes Speed Reducer

- Grease inlet (R-axis) Ri
  - Hexagon socket head plug PT1/8
  - Grease inlet (B-axis) Bi
  - Hexagon socket head plug PT1/8
  - Grease inlet (T-axis) Ti
  - Hexagon socket head plug PT1/8
- Grease exhaust port (R-axis) Ro
  - Grease exhaust port (B-axis) Bo
  - Grease exhaust port (T-axis) To
  - Tightening torque 12 N•m (1.2 kgf•m)

Hexagon socket head plug PT1/8
- Tightening torque 4.9 N•m (0.5 kgf•m)
10.2.1.4 Pump-Axis Speed Reducers

**Grease Replenishment**

1. Remove the plug on the P1o (P2o) exhaust port.

   **NOTE**
   
   If grease is injected with the plug (P1o, P2o) on, the grease will go inside the motor and may cause a damage. Make sure to remove the plug (P1o, P2o) before the grease injection. Note that grease replacement is not necessary for Pump-axis.

2. Remove the plug on the P1i (P2i) grease inlet, and install the grease zerk PT1/8. Inject grease by using a grease gun.
   
   - Grease type: VIGO grease RE No. 0
   - Amount of grease: Pump-axis: 20 cc (18 g)
     (30 cc (27 g) for the 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

3. Move Pump-axis for a few minutes to discharge excessive grease.

4. Remove the grease zerk on the P1i (P2i) grease inlet. Wipe the P1o (P2o) exhaust port and the P1i (P2i) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the P1o (P2o) exhaust port and the P1i (P2i) grease inlet.
10.2 Maintenance for Manipulator

Fig. 10-7: Pump-Axis Speed Reducer

Grease inlet (Pump-axis) P1
- Hexagon socket head plug PT1/8
- Tightening torque 4.9 N•m (0.5 kgf•m)

Grease inlet (Pump-axis) P2
- Hexagon socket head plug PT1/8
- Tightening torque 4.9 N•m (0.5 kgf•m)

Grease exhaust port (Pump-axis) P1o
- Hexagon socket head plug PT1/4
- Tightening torque 12 N•m (1.2 kgf•m)

Grease exhaust port (Pump-axis) P2o
- Hexagon socket head plug PT1/4
- Tightening torque 12 N•m (1.2 kgf•m)
10.2.2 Inspection of Wrist Gear and Bearing

Check if three wrist axes move smoothly. If any of the axes does not move smoothly, the wrist should be removed and disassembled for investigation of the cause such as defective bearing, gear or sealing. Contact your YASKAWA representative.

**CAUTION**

To remove the wrist from the U-arm, firmly hold the wrist and remove the fixing bolt. If not, the wrist may fall down when the fixing bolt is removed.

10.2.3 Inspection of Air Sealing for Internal Air Pressure

10.2.3.1 Gasket on the Motor Case

Check for wear and tear on the rubber gaskets at each part.

*Fig. 10-8: S- and L-Axis Motor Gasket*

- Hexagon socket head cap screw M6
  (trivalent chromium, length: 25 mm, 21 screws)
- Conical spring washer 2H-6
  (trivalent chromium, 21 washer)
- Tightening torque 10 N·m (1.0 kgf·m)
Fig. 10-9: L-Arm Motor Gasket

- Hexagon socket head cap screw M6
  - Trivalent chromium, length: 25 mm, 12 screws
  - Conical spring washer 2H-6
  - Trivalent chromium, 12 washers
  - Tightening torque 10 N·m (1.0 kgf·m)

- Hexagon socket head cap screw M6
  - Trivalent chromium, length: 35 mm, 18 screws
  - Conical spring washer 2H-6
  - Trivalent chromium, 18 washers
  - Tightening torque 10 N·m (1.0 kgf·m)
10.2 Maintenance for Manipulator

Fig. 10-10: U-Axis and U-Arm Motor Gasket

- Hexagon socket head cap screw M6  
  (trivalent chromium, length: 20 mm, 16 screws)
- Conical spring washer 2H-6  
  (trivalent chromium, 16 washers)

Motor cover
Gasket HW1405290-1
Cover
Adherend

Tightening torque 10 N·m (1.0 kgf·m)

Fig. 10-11: Rubber Gaskets on the Base

- Hexagon socket head cap screw M6  
  (trivalent chromium, length: 25 mm, 8 screws)
- Conical spring washer 2H-6  
  (trivalent chromium, 8 washers)

Tightening torque 10 N·m (1.0 kgf·m)
10.2.4 Battery Replacement

Four batteries are installed in the locations shown in fig. 10-12(a) “Battery Location (Except for C**A)” and fig. 10-12(b) “Battery Location (For C**A)”.

- Battery: HW1471496-A (to D) (Except for B**, C**A)
- Battery: HW1470715-BA (to BD) (For B**)
- Battery: HW1373234-A (to D) (For C**A)

If a battery alarm occurs in the DX200, replace the battery in the following procedure.

Fig. 10-12(a): Battery Location (Except for C**A)
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

Fig. 10-12(b): Battery Location (For C**A)

- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to the manipulator)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 25 mm, 12 screws)
- Conical spring washer 2H-6 (trivalent chromium, 8 washers) (fixed to the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)

- Battery pack for the Pump1 and Pump2 (HW1373234-D) *Mount it in the correct direction.
- Battery pack for the S- and L-axis (HW1373234-A) *Mount it in the correct direction.
- Battery pack for the U- and R-axis (HW1373234-B) *Mount it in the correct direction.
- Battery pack for the B- and T-axis (HW1373234-C) *Mount it in the correct direction.

- Head of the cable tie (T50R)
- Hexagon socket head cap screw M4 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Washer M4 (trivalent chromium, 2 washers) (fixed to manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)
- Battery bracket
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)
- Battery bracket
- Nut M4 (trivalent chromium, 2 nuts) (fixed to the manipulator)

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M4 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Washer M4 (trivalent chromium, 2 washers) (fixed to manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)
- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)
- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
- Head of the cable tie (T50R)
- Hexagon socket head cap screw M6 (trivalent chromium, 2 screws, length: 15 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (2 washers) (fixed to manipulator)

- Battery bracket

- Head of the cable tie (T50R)
- Cable tie (T50R) (2 places)
Except for C**A

1. Turn OFF the power to the DX200.
2. Ventilate the circumference explosive gas of the manipulator.
3. Detach and pull out the cover from the base.
4. Remove the battery mounting screws.
5. Remove the electrical tape protecting connection part of the battery in the manipulator.
6. Connect four new batteries.
7. Remove the old batteries.

8. Protect the connection part of the battery in the manipulator with electrical tape.
9. Insert the battery screws in the mounting holes on the connector base, and fix the connector base on the base.

For C**A

1. Turn OFF the power to the DX200.
2. Ventilate around the manipulator to remove explosive gas.
3. Remove the cover on the bottom side of the base, take out the bolt from the battery bracket to replace the battery, and pull it out.
4. Remove the cable tie fixing the battery pack.
5. Remove the bolt fixing the battery pack.
6. Remove the cable tie and remove the vinyl tube protecting the battery connector.
7. Remove the plastic tape (insulation tape) which is applied for protecting the battery connector inside of the manipulator.
8. Connect three or four new battery packs.
   (If there is a pump axes, four battery packs are required.)
9. Remove the old battery.
10. Protect the battery connector left in the manipulator with the plastic tape (insulation tape).
11. Protect the connector with a vinyl tube using a cable tie (T50R, two cable ties, 2 places).
12. Mount the battery pack by using the bolt M4 (length: 90 mm/40 mm) and the cable ties (T50R, two cable ties, 2 places) on the bracket, and mount the bracket by using the screw M6 (length: 15 mm) (provided with the battery) on the base.
13. Mount the cover on the bottom side of the base.

NOTE

Be sure to connect the new batteries before disconnecting the old one so that the data does not disappear.
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

Fig. 10-13(a): Battery Connection When the Internal Cable is the Pin Terminal (Except for C**A)

Battery pack for Pump-axis
before replacement

Battery pack (spare parts)

Battery pack for S-, L-axis
before replacement

Battery pack (spare parts)

Battery pack for U-, R-axis
before replacement

Battery pack (spare parts)

Battery pack for B-, T-axes
before replacement

Battery pack (spare parts)

See step 5

See step 6

See step 7

See step 8
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

Fig. 10-13(b): Battery Connection When the Internal Cable is the connector (Except for C**A)

See step 7

See step 8

See step 6

See step 5

See step 7

See step 8

See step 6

See step 5

See step 7

See step 8

See step 6

See step 5

See step 7

See step 8

See step 6

See step 5

New battery pack

Battery pack for S-, L-axis before replacement

Battery pack for U-, R-axis before replacement

Battery pack for B-, T-axes before replacement

Battery pack for Pump-axis before replacement

New battery pack

New battery pack

New battery pack

New battery pack
Remove the conversion cable which is connected to the spare parts battery before use.
10.2 Maintenance for Manipulator

10.2.5 O-Ring and X-Ring (in the wrist unit)

Periodically replace the O-ring and X-ring in the wrist unit.

(Contact your YASKAWA representative when replacing the ring.)
10.3 Inspection of the Pressure Switch Unit

Before inspection, please turn OFF the power supply to the DX200 and check that no explosive atmosphere exist around it.

10.3.1 Solenoid Valve
Check if the air purge starts right after turning ON the power to the DX200 and if it ends four minutes later.

10.3.2 Pressure Reducing Valve
Measure the air pressure for the pressure switch unit with a pressure gauge. Connect the gauge to the unit. The air pressure must always be from 0.01 MPa to 0.02 MPa under operating conditions and from 0.28 MPa to 0.30 MPa when purging.

10.4 Inspection of Pressurization System

10.4.1 Pressure Switch Unit
Remove the front cover of the pressure switch unit box and check the conduction of the pressure switches (monitor the low pressure side).

Conduction of the connectors P1 and N1 on the pressure switch unit (for monitoring the conduction at lower pressure side) must be [ON] when the air is being supplied and [OFF] when the air is not being supplied.
(Connect P1 to +, and N1 to - before checking the conduction.)

CAUTION
Be sure to turn OFF the power to the DX200 before inspecting the pressure switch.

10.4.2 Master Valve
While the air is being supplied from the pressure switch unit, check if the air purge starts right after the power to the DX200 is turned ON. Also, check if the air goes out of the two air outlets for the master valve during the air purge.

10.4.3 Protection Sequence Operation Confirmation
While the air is being supplied from the pressure switch unit, check if the air purge starts right after the power to the DX200 is turned ON and if it ends four minutes later.

Also, check the following:

a) The alarm “AIR PRESSURE ERROR” occurs immediately after the air supply from the pressure switch unit is stopped and the power supply to the DX200 is turned ON.

b) The alarm “PURGE AIR ERROR” occurs when the air supply from the pressure switch unit is stopped during air purging.
10.5 Notes for Maintenance

10.5.1 Encoder Connector (with CAUTION label)

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

10.5.1.1 S-, L-, and U-Axis Motors

The connectors for the battery are prepared on each of the S-, L-, and U-axis motors. Refer to fig. 10-15(a) "Backup Battery Connection for S-, L-, and U-Axis Motors" and connect the battery according to the following procedure.

1. Remove the mounting bolts, then remove the cap on the slot of the motor’s encoder.
2. Connect the battery to the connectors for battery backup (crimped contact-pin terminals) on the inside of the cap.
3. Confirm all connectors connection after the maintenance check ends, and remove the battery.

10.5.1.2 R-, B-, T-, and Pump-Axis Motors

The connectors for the battery backup (crimped contact-pin terminals) are prepared on the cables from the encoder connector of each of the R-, B-, and T-axis motors (BAT and OBT are marked). Refer to fig. 10-15(b) "Backup Battery Connection for R-, B-, T-, and Pump-Axis Motors", and connect the battery according to the following procedure.

1. Connect the battery to the connectors for the battery backup of the motor encoder connector.
2. Confirm all connectors connection after the maintenance check ends, and remove the battery.

NOTE
Do not remove the battery pack in the connector base.
Fig. 10-15(a): Backup Battery Connection for S-, L-, and U-Axis Motors

S-, L-, and U-Axis Motors

<table>
<thead>
<tr>
<th>Component</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Internal cables</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Encoder</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Power connector</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Encoder connector</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Filter</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Connector cover for the backup battery</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Cover mounting screw</td>
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<td>Connection diagram</td>
</tr>
<tr>
<td>Connect battery to encoder to save the data before removing connector</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Battery assy</td>
<td></td>
<td>Connection diagram</td>
</tr>
<tr>
<td>Battery pack (spare parts)</td>
<td></td>
<td>Connection diagram</td>
</tr>
</tbody>
</table>

**CAUTION**
Connect battery to encoder to save the data before removing connector.

Caution Label (Enlarged View)
Fig. 10-15(b): Backup Battery Connection for R-, B-, T-, and Pump-Axis Motors

R-, B-, T-, and Pump-Axis Motors

- Connect battery to encoder to save the data before removing connector.

CAUTION

Connect battery to encoder to save the data before removing connector.
11 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-MPX3500. The spare parts list for the MOTOMAN-MPX3500 is shown below.

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 units

NOTE

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

Table 11-1: Spare Parts for the MOTOMAN-MPX3500-0*, -1* (Sheet 1 of 4)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name (spare parts)</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Battery pack</td>
<td>HW1471600-AA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S,L-axes encoder (Except for B**, C**A)</td>
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<td>2</td>
<td>Battery pack</td>
<td>HW1471600-AB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For U,R-axes encoder (Except for B**, C**A)</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Battery pack</td>
<td>HW1471600-AC</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For B,T-axes encoder (Except for B**, C**A)</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery pack</td>
<td>HW1471600-AD</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For Pump-axis encoder (Except for B**, C**A)</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery pack</td>
<td>HW1471600-BA</td>
<td>YASKAWA Electric Corporation</td>
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<td>1</td>
<td>For S,L-axes encoder (For B**)</td>
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<td>Battery pack</td>
<td>HW1471600-BB</td>
<td>YASKAWA Electric Corporation</td>
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<td>For U,R-axes encoder (For B**)</td>
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<td>1</td>
<td>For B,T-axes encoder (For B**)</td>
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### Table 11-1: Spare Parts for the MOTOMAN-MPX3500-*0*, -*1* (Sheet 2 of 4)

<table>
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<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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<td>A 8</td>
<td>Battery pack (spare parts)</td>
<td>HW1471600-BD</td>
<td>YASKAWA Electric Corporation</td>
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<td>1</td>
<td>For Pump-axis encoder (For B***)</td>
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<td>Battery pack (spare parts)</td>
<td>HW1471600-DA</td>
<td>YASKAWA Electric Corporation</td>
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<td>For S,L-axes encoder (For C**A)</td>
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<td>Battery pack (spare parts)</td>
<td>HW1471600-DB</td>
<td>YASKAWA Electric Corporation</td>
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<td>1</td>
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<td>A 11</td>
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<td>YASKAWA Electric Corporation</td>
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<td>Battery pack (spare parts)</td>
<td>HW1471600-DD</td>
<td>YASKAWA Electric Corporation</td>
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<td>For Pump-axis encoder (For C**A)</td>
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<td>A 13</td>
<td>Sealing compound</td>
<td>DB-1600</td>
<td>Diabond Industry Co., Ltd.</td>
<td>200 ml</td>
<td>For gasket cohesion</td>
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<td>A 14</td>
<td>Double coated adhesive tape</td>
<td>93005LE</td>
<td>YASKAWA Electric Corporation</td>
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<td>For gasket cohesion</td>
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<td>A 15</td>
<td>Seal tape</td>
<td>TB-4501</td>
<td>YASKAWA Electric Corporation</td>
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<td></td>
</tr>
<tr>
<td>A 16</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K. K.</td>
<td>1</td>
<td>1</td>
<td>For bearing For gear inside the wrist part</td>
</tr>
<tr>
<td>A 17</td>
<td>Grease</td>
<td>VIGO Grease RED</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S-,L-,U-,R-,B-,T,-Pump-axis speed reducer</td>
</tr>
<tr>
<td>B 18</td>
<td>S(L)-axis speed reducer kit</td>
<td>Y005C-MPX3500A00S (Y005C-MPX3500A00L)</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>This kit can be commonly used for S- and L-axis</td>
</tr>
<tr>
<td>B 19</td>
<td>U-axis speed reducer kit</td>
<td>Y005C-MPX3500A00U</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B 20</td>
<td>R(B)-axis speed reducer kit</td>
<td>Y005C-MPX3500A00R (Y005C-MPX3500A00B)</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>This kit can be commonly used for R- and B-axis</td>
</tr>
<tr>
<td>B 21</td>
<td>T-axis speed reducer kit</td>
<td>Y005C-MPX3500A00T</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B 22</td>
<td>Pump-axis speed reducer kit</td>
<td>Y005C-MPX3500A01FG</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 (2)</td>
<td>For -<em>1</em>, and -<em>3</em>, Two pump axes are used for -<em>3</em>.</td>
</tr>
</tbody>
</table>
### Table 11-1: Spare Parts for the MOTOMAN-MPX3500-*0*, -*1* (Sheet 3 of 4)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>23</td>
<td>Pump-axis speed reducer kit</td>
<td>Y005C-MPX3500A02EV YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For <strong>2</strong></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>24</td>
<td>Internal cable</td>
<td>HW1171758-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Inside S- and L-axis (Except for B**, F**)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>Internal cable</td>
<td>HW1171758-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Inside U-axis (Except for B**, F**)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>26</td>
<td>Internal cable</td>
<td>HW1172512-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Inside S- and L-axis (For B**)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>27</td>
<td>Internal cable</td>
<td>HW1172513-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Inside U-axis (For B**)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>28</td>
<td>Internal cable</td>
<td>HW1171758-B YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Inside S- and L-axis (For F**)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>29</td>
<td>Internal cable</td>
<td>HW1171758-B YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Inside U-axis (For F**)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>Wrist unit</td>
<td>HW1171980-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>31</td>
<td>Gasket</td>
<td>HW1405269-1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>3</td>
<td>Cover for side of base, cover for manipulator cable</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>32</td>
<td>Gasket</td>
<td>HW1405274-1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for S-head</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>33</td>
<td>Gasket</td>
<td>HW1405277-1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for lower part of L-arm</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>34</td>
<td>Gasket</td>
<td>HW1407752-1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for middle part of L-arm</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>35</td>
<td>Gasket</td>
<td>HW1405279-1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for upper part of L-arm</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>36</td>
<td>Gasket</td>
<td>HW1405290-1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for casing</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>37</td>
<td>S.L-axis AC servo motor</td>
<td>SGMRV-37ANA-YRA2 YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>38</td>
<td>U-axis AC servo motor</td>
<td>SGMRV-13ANA-YRA1 YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 11-1: Spare Parts for the MOTOMAN-MPX350-*0*,-*1*  (Sheet 4 of 4)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>39</td>
<td>R, B, T-axis AC servo motor</td>
<td>SGMAV-04ANA-YR22</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>40</td>
<td>Pump-axis AC servo motor</td>
<td>SGMAV-02ANA-YR31</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1 (2)</td>
<td>Two pump axes are used only when **3.</td>
</tr>
<tr>
<td>C</td>
<td>41</td>
<td>Pressure switch unit</td>
<td>HW1271102-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For A**, AA** (TiiS) For GG** (Taiwan)</td>
</tr>
<tr>
<td>C</td>
<td>42</td>
<td>Pressure switch unit</td>
<td>HW1271576-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For B** (FM)</td>
</tr>
<tr>
<td>C</td>
<td>43</td>
<td>Pressure switch unit</td>
<td>HW1271102-C</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For C**, C**A (ATEX)</td>
</tr>
<tr>
<td>C</td>
<td>44</td>
<td>Pressure switch unit</td>
<td>HW1271102-D</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For EE** (KCs)</td>
</tr>
</tbody>
</table>

1 Battery pack connection part of the new internal cable is changed to the connector type from the crimped contact-pin terminals type.

For A**, AA** (TiiS) For GG** (Taiwan).

For B** (FM).

For C**, C**A (ATEX).

For EE** (KCs).

When the battery pack is the crimped contact-pin terminals type, prepare the battery unit by referring to the recommended spare parts list.