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

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

- System
- Primary Application
- Software Version (Located on Programming Pendent 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: 178617-1CD
Revision: 3
MANDATORY

• This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MPO10 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 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.
WARNING

• 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. Then turn the servo power ON.

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 the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Registered Trademark

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

The following warning labels are attached to the manipulator. Always follow the warnings on the labels.

Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Fig. : Name Plate and Warning Label Locations
<table>
<thead>
<tr>
<th>Nameplate</th>
<th>A**</th>
<th>B**</th>
<th>C** A**, C**, F**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Battery Warning Label</strong></td>
<td><img src="image1" alt="A**" /></td>
<td><img src="image2" alt="B**" /></td>
<td><img src="image3" alt="C** A**, C**, F**" /></td>
</tr>
<tr>
<td><strong>Pressure Switch Unit Warning Label</strong></td>
<td><img src="image1" alt="A**" /></td>
<td><img src="image2" alt="B**" /></td>
<td><img src="image3" alt="C** A**, C**, F**" /></td>
</tr>
<tr>
<td><strong>Electrostatic Charging Label</strong></td>
<td><img src="image1" alt="A**" /></td>
<td><img src="image2" alt="B**" /></td>
<td><img src="image3" alt="C** A**, C**, F**" /></td>
</tr>
<tr>
<td><strong>Warning Label A</strong></td>
<td><img src="image1" alt="A**" /></td>
<td><img src="image2" alt="B**" /></td>
<td><img src="image3" alt="C** A**, C**, F**" /></td>
</tr>
<tr>
<td><strong>Warning Label B</strong></td>
<td><img src="image1" alt="A**" /></td>
<td><img src="image2" alt="B**" /></td>
<td><img src="image3" alt="C** A**, C**, F**" /></td>
</tr>
</tbody>
</table>
## Safety Precautions for Painting Manipulator

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

### Explosion-Proof Structure

The explosion-proof structure of the MOTOMAN-MPO10 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>FM(US) TYPE X pressurization</td>
<td>ExibpxIIBT4</td>
<td>ExibIIBT4</td>
</tr>
<tr>
<td>CLASS1,DIVISION1</td>
<td>CLASS1,DIVISION1</td>
<td></td>
</tr>
<tr>
<td>GROUPS C,D T4</td>
<td>GROUPS C,D T4</td>
<td></td>
</tr>
<tr>
<td>CLASS1,ZONE1</td>
<td>CLASS1,ZONE1</td>
<td></td>
</tr>
<tr>
<td>AExiaIIBT4</td>
<td>AExiaIIBT4</td>
<td></td>
</tr>
<tr>
<td>FM(CA) TYPE X pressurization</td>
<td>CLASS1,DIVISION1</td>
<td></td>
</tr>
<tr>
<td>CLASS1,ZONE1</td>
<td>CLASS1,DIVISION1</td>
<td></td>
</tr>
<tr>
<td>GROUPS C,D T4 Gb</td>
<td>GROUPS C,D T4 Gb</td>
<td></td>
</tr>
<tr>
<td>CLASS1,ZONE1</td>
<td>CLASS1,ZONE1</td>
<td></td>
</tr>
<tr>
<td>AExiaIIBT4Gb</td>
<td>AExiaIIBT4Gb</td>
<td></td>
</tr>
<tr>
<td>ATEX/ CAT.2</td>
<td>II2G ExibpxIIBT4Gb</td>
<td></td>
</tr>
<tr>
<td>II2G ExibIIBT4Gb</td>
<td>II2G ExibIIBT4Gb</td>
<td></td>
</tr>
</tbody>
</table>

### DANGER

In case installing the MOTOMAN-MPO10 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-MPO10, confirm that the manipulator is possible to install in that area.

### PROHIBITED

Any modification of the MOTOMAN-MPO10, 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, the manipulator drive section and the power transmission section
WARNING

• Take the following measures when teaching, correcting, inspecting, or adjusting the manipulator when the motor power supply is ON:
  1. 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.
  2. Before the operation, verify the correct robot motion and that the emergency stop works.
• Observe the following precautions during an automatic operation:
  1. Do not enter inside the safeguarding during operation.
  2. Confirm the following before starting the operation:
     (1) No person is inside the manipulator working envelope.
     (2) No obstacles such as unnecessary workpieces and tools are inside the manipulator working envelope.
     (3) The manipulator is in its standby position.
  3. When any abnormality occurs, immediately press the emergency stop button to stop the manipulator.
  4. 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 DX200.

When the brake is released with the manipulator’s power OFF, each axis falls down because of the arm weight. While two or more people are holding the arm in position before releasing the brake, change the posture of the manipulator within the minimum motion range. Use the brake release function only when absolutely necessary.
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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 six items (information for the content of optional goods are given separately):

- Manipulator
- DX200
- Programming pendant
- Manipulator cables (between the DX200 and the Manipulator)
- Pressure switch unit
- Complete set of manuals (supplied on the CD-ROM which is connected to the USB connector)

Fig. 1-1: Six Items for Standard Delivery

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

(a) DX200 (Front View)  (b) Manipulator (Top View)
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

- The mass of the manipulator is approximately 380 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the mass.
- Attached shipping bolts and brackets are designed strong enough to support the manipulator mass. Do not use them for anything other than transporting the manipulator.
- 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.
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 "Transport Using a Crane".

Fig. 2-1: Transport Using a Crane

<table>
<thead>
<tr>
<th>Axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>+4°</td>
<td>-165°</td>
<td>ST-0</td>
</tr>
<tr>
<td>Pulse</td>
<td>8713</td>
<td>-276906</td>
<td>0</td>
</tr>
</tbody>
</table>
2 Transport

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 “Transport Using a Forklift.” Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator.

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

Fig. 2-2: Transport Using a Forklift

---

**Gravity center “G” : Manipulator and Shipping bolts and brackets**

**Unit : mm**

<table>
<thead>
<tr>
<th>Axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>+4°</td>
<td>-165°</td>
<td>ST=0</td>
</tr>
<tr>
<td>Pulse</td>
<td>6713</td>
<td>276906</td>
<td>0</td>
</tr>
</tbody>
</table>
2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets at positions as shown in fig. 2-1 “Transport Using a Crane”, to protect its driving units from various external forces during transport.

- The shipping brackets are painted yellow.
- The shipping brackets are fixed with the hexagon socket head cap screw M16 (length: 40mm), Spring washer: 2H-16 and Washer:M16

NOTE

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

When storing the shipping bolts and brackets, keep them from rusting and corroding so that their functions can be shown enough at any time.
3 Installation

3.1 Installation of Safeguarding

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

Responsibility for Safeguarding (ISO10218)
The user of a manipulator or robot system shall ensure that safeguards are provided and used in accordance with Sections 6, 7, and 8 of this standard. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

3.2 Mounting Procedures for Manipulator Base

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

WARNING

- Install the safeguarding.
  Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, safeguarding, or the DX200.
  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 the 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 Installation

3.2 Mounting Procedures for Manipulator Base

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

A baseplate flatness must be kept at 0.5 mm or less: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities.

Mount the manipulator base as instructed in chapter 3.2.1 “Mounting the Manipulator on the Baseplate”.

Table 3-1: Manipulator Repulsion Force and Torque

<table>
<thead>
<tr>
<th></th>
<th>Horizontal rotation</th>
<th>Vertical rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Repulsion force $F_H$</td>
<td>Torque $M_H$</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>15680 N (1600 kgf)</td>
<td>7840 N•m (800 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/ deceleration</td>
<td>5880 N (600 kgf)</td>
<td>2940 N•m (300 kgf•m)</td>
</tr>
</tbody>
</table>

Fig. 3-1: Manipulator Repulsion Force and Torque
3 Installation
3.2 Mounting Procedures for Manipulator Base

3.2.1 Mounting the Manipulator on the Baseplate

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 32 mm or more thick, and anchor bolts of M16 or larger size.

Fix the manipulator base to the baseplate. The manipulator base is tapped for four mounting holes.

Securely fix the manipulator base to the baseplate with four hexagon head bolts M16 (recommended length: 60 mm, delivered with the manipulator). Tighten the hexagon head bolts and anchor bolts firmly so that they will not work loose during the operation.

Refer to fig. 3-2 “Mounting the Baseplate on the Floor”.
3 Installation
3.2 Mounting Procedures for Manipulator Base

Fig. 3-2: Mounting the Baseplate on the Floor

- **Manipulator base**
- **Baseplate**
- **Anchor bolt (M16 or more)**
- **Hexagon head cap screw (Delivered with the manipulator)**
- **Washer (Delivered with the manipulator)**

**Dimensions:**
- **Manipulator base:** 410 ± 0.1
- **Baseplate:** 283 ± 0.1
- **Base plate fixing hole diameter:** 18
- **Oval hole depth:** 15 mm
- **Anchor bolt diameter:** 24 mm or more

**Notes:**
- **Unit:** mm
- **Spring washer:** Delivered with the manipulator
- **M16 (4 screws, length: 60 mm):** Delivered with the manipulator
- **Tensile strength:** 1200 N/mm² or more
- **Tightening torque:** 289 N m (29.5 Kgf m)
- **Fitting depth of inside and outside fittings:** 410 ± 0.1

**Dimensions:**
- **Y Part Enlarged View:**
  - **Diameter:** 12
  - **Dia. 18 (4 holes):** Base plate fixing hole
  - **Tightening torque:** 289 N m

**Material:**
- **Ra6.3**
- **Ra5.0**

**Washers:** Delivered with the manipulator

**View X:**
- **Manipulator mounting surface**
- **Same level as manipulator mounting surface**
3 Installation

3.3 Protection Class

Environmental resistance for main part of the manipulator conforms to IP4X.

3.4 Location

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

- Ambient temperature: 0° to + 40°C
- Humidity: 20 to 80%RH (no-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive or explosive gas or liquid
- Free from excessive vibration
  (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5 mm or less

**NOTE**

During winter or when the ambient temperature is low (15°C or lower), break-in the manipulator at 40% of the maximum speed for at least 5 minute until it is warmed up before the actual operation.
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 warning may result in fire or electric shock.
4 Wiring

4.1 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(a) “Grounding Method (Manipulator)” and fig. 4-1(b) “Grounding Method (Pressure Switch Unit)”.

---

**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.

---

**MANDATORY**

- 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.
4 Wiring

4.1 Grounding

Fig. 4-1(a): Grounding Method (Manipulator)

Bolt M8 (for grounding)
Washer, Spring washer
Delivered with the manipulator

5.5mm² or more

Fig. 4-1(b): Grounding Method (Pressure Switch Unit)

Bolt M5 (for grounding)
Washer, Spring washer
Delivered with the manipulator

5.5mm² or more
4 Wiring

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 tube 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. Remove the cover at the top of the base part.
   (Refer to fig. 4-2 “Power Supply Cable Connection to the Manipulator”.)
2. Connect the power cable connector to the connector base.
   (Check the reference plate)
3. Connect the grounding cable of the power cable to the grounding cable connecting tap.
4. Connect the air tube (Dia.12) to the joint part which is mounted at IN side of the power cable.
   (Refer to fig. 4-4 “Air Tube Connection”.)
5. Attach the power cable gasket side to the base after checking that no air tubes are broken, and then fix it with the hexagon socket head cap screws (delivered with the manipulator).
6. Check that no bent or tension are found to the air tubes and cables inside the manipulator, and then re-install the cover to the top of the base part.

---

**DANGER**

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 Wiring

4.2 Cable Connection

For the power cable connecting position, refer to table 4-1 "Power Cable Connecting Position" and fig. 4-6 "Power Cable Connecting Position".
4 Wiring

4.2 Cable Connection

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

Notation on the power cable connecting part varies depending on the DX200 specifications
4 Wiring
4.2 Cable Connection

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

DX200 Back Side

Choose one out of these four

Notation on the power cable connecting part varies depending on the DX200 specifications
4 Wiring
4.2 Cable Connection

Fig. 4-4: Air Tube Connection

- (S) Type [Standard Type]
- (L) Type [Left Type]
- (R) Type [Right Type]
4 Wiring
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 bined with shield separately.

2) Controller side: Crimped terminals
   - For connecting the intrinsically safe cable to the relay barrier in the DX200
     - For terminal block P1 to N3
       - For terminal block P1 to 2
         - 3.5 min
         - 4 max
       - 3.7 dia. min

3) Controller side: Crimped terminals
   - For connecting the intrinsically safe cable to the relay barrier in the DX200
     - For terminal block P1 to N3
       - For terminal block P1 to N3
       - The cable to be connected with terminal blocks P1 to N3, and 1 to 2 are bined with shield separately.

Cable connection

<table>
<thead>
<tr>
<th>Terminal Block</th>
<th>Controller (DX200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>P1</td>
</tr>
<tr>
<td>N1</td>
<td>N1</td>
</tr>
<tr>
<td>P2</td>
<td>P2</td>
</tr>
<tr>
<td>N2</td>
<td>N2</td>
</tr>
<tr>
<td>P3</td>
<td>P3</td>
</tr>
<tr>
<td>N3</td>
<td>N3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
4.3 Power Cable Connecting Position

As shown in table 4-1 “Power Cable Connecting Position”, position for connecting the power cable can be altered depending on how it is installed.

<table>
<thead>
<tr>
<th>Type</th>
<th>Connecting position</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(S) Type</td>
<td>[Standard Type]</td>
<td>Connected to the back part of the manipulator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i) Refer to -(S) Type- in Fig. 4-6 “Power Cable Connecting Position”</td>
</tr>
<tr>
<td>(L) Type</td>
<td>[Left Type]</td>
<td>Viewed from the backside, connected to the left part of the manipulator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i) Refer to -(L) Type- in Fig. 4-6 “Power Cable Connecting Position”</td>
</tr>
<tr>
<td>(R) Type</td>
<td>[Right Type]</td>
<td>Viewed from the backside, connected to the right part of the manipulator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i) Refer to -(R) Type- in Fig. 4-6 “Power Cable Connecting Position”</td>
</tr>
</tbody>
</table>

Fig. 4-6: Power Cable Connecting Position

![Diagram of Power Cable Connecting Position]
4.3 Power Cable Connecting Position

4.3.1 Changing the Power Cable Connecting Position

1. Turn OFF the DX200 power supply.
2. Confirm the power cable connecting position by referring to table 4-1 and fig. 4-6.
3. Unscrew the hexagon socket head cap screw (1) and washers at the top side of the base part (7), and then remove the cover (8) and the gasket.
4. Unscrew the hexagon socket head button bolts (2) from the base (1) to remove the cover and the gasket (8) that are attached to the side of the base part where the power cable is to be connected.
5. Confirm the side cover mounting positions by referring to fig. 4-6 and fig. 4-8.
6. Re-install the cover and the gasket (8) to the base part (7) that were removed by unscrewing the hexagon socket head button bolts (2). And then, tighten them with the tightening torque shown in table 4-2 “Parts for Changing the Power Cable Connecting Position”.
7. By referring to the name plate shown in fig. 4-7 “Cable Cover Connector Connection” and marking on the power cable, connect the power cable connector to the case (8). And then, connect the air tube to “IN [PURGE]” side connector base shown in fig. 4-9 “Connector Base Part Connection”.
8. Connect the air tube to “IN [PURGE]” side connector base shown in fig. 4-9 “Connector Base Part Connection”.
9. With the hexagon socket head cap screws (8) and washers (8), connect the connector base part and gasket to the base part (7) with the tightening torque shown in table 4-2. At this time, be careful not to bend the air tubes inside the base part (7).
10. By preventing the air tubes from being bent and the cables from being pinched, re-install the cover (8) and the gasket to the base part (7) using the hexagon socket head cap screws (8) and washers. And then, tighten them with the tightening torque shown in table 4-2.
4 Wiring

4.3 Power Cable Connecting Position

Table 4-2: Parts for Changing the Power Cable Connecting Position

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Base HW1100748-1</td>
<td>1</td>
</tr>
<tr>
<td>②</td>
<td>Case 51200-4801</td>
<td>1</td>
</tr>
<tr>
<td>③</td>
<td>Case 51200-4801</td>
<td>1</td>
</tr>
<tr>
<td>⑤</td>
<td>Cross recessed APS bolt M5 (length 10 mm)</td>
<td>3 each</td>
</tr>
<tr>
<td></td>
<td>Washer M5</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Hexagon socket head cap screw M6 (length 18 mm)</td>
<td>18 each</td>
</tr>
<tr>
<td></td>
<td>Washer M6</td>
<td></td>
</tr>
<tr>
<td>⑨</td>
<td>Cover HW1406113-1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gasket HW1406114-1</td>
<td>1</td>
</tr>
<tr>
<td>⑩</td>
<td>Hexagon Socket Button Head Screw M8 (length 18 mm)</td>
<td>6 each</td>
</tr>
<tr>
<td>⑪</td>
<td>Cover HW1406111-1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gasket HW1406112-1</td>
<td>1</td>
</tr>
<tr>
<td>⑫</td>
<td>Hexagon socket head cap screw M8 (length 20 mm)</td>
<td>6 each</td>
</tr>
<tr>
<td></td>
<td>Washer M8</td>
<td></td>
</tr>
<tr>
<td>⑬</td>
<td>Connector base part (Power cable)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gasket</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4-7: Cable Cover Connector Connection

Name plate (for cable connection)
4 Wiring
4.3 Power Cable Connecting Position

**Fig. 4-8: Base Part Side Cover (2 places) Attaching Position**

- **(S) Type** [Standard Type]
- **(L) Type** [Left Type]
- **(R) Type** [Right Type]

**Fig. 4-9: Connector Base Part Connection**

- **IN [PURGE] side**
- **Air hose**
- **Connector base**

**View A**
- 

**View B**
- 

**View C**
-
4.4 Requirements

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

Table 4-3: 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</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>200VAC  (Voltage: -15 to +10%) 50/60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220VAC  (Voltage: -15 to +10%) 60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25 kVA (at peak)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Air supply</td>
<td>Required pressure: 0.35 MPa to 0.65 MPa</td>
<td>Use dry air for the pressurized explosion-proof construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capacity:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For pressurized type of explosion protected construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 Nl/min operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 Nl/min at purging</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dryness: Freezing at -18°C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Grounding</td>
<td>Grounding resistance: 100 Ω or less</td>
<td>For the DX200</td>
</tr>
</tbody>
</table>

CAUTION

Use dry air for the pressurized explosion-proof enclosure. Moisture in the air supply may damage the electronic parts.
4.5 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 DX200 and control panels in a location free from water drops, dust, and dirt.

Table 4-4: 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>DX200 (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>Conveyer speed detector (explosion-proof)</td>
<td>●</td>
<td>×</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Conveyer switch (explosion-proof)</td>
<td>●</td>
<td>×</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
</tbody>
</table>

DANGER

In case installing the MOTOMAN-MPO10 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-MPO10, confirm that the manipulator is possible to install in that area.

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>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YK-MPXXX00-<em>00</em>,-C00A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Horizontally Articulated</td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>10 kg</td>
<td></td>
</tr>
<tr>
<td>Horizontal load (^2)</td>
<td>245 N (25 kgf)</td>
<td></td>
</tr>
<tr>
<td>Vertical load (^2)</td>
<td>245 N (25 kgf)</td>
<td></td>
</tr>
<tr>
<td>Repeatability (^3)</td>
<td>±0.15 mm</td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td>Standard (S) Type</td>
<td></td>
</tr>
<tr>
<td>S-axis (Lower arm)</td>
<td>-150° to +150°</td>
<td></td>
</tr>
<tr>
<td>(L) Type</td>
<td>-200° to +200°</td>
<td></td>
</tr>
<tr>
<td>(M) Type</td>
<td>-80° to +200°</td>
<td></td>
</tr>
<tr>
<td>L-axis (Upper arm)</td>
<td>-165° to +165°</td>
<td></td>
</tr>
<tr>
<td>U-axis (Vertical arm)</td>
<td>0 to 350 mm</td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>S-axis (Lower arm)</td>
<td>2.27 rad/s, 130°/s</td>
</tr>
<tr>
<td>L-axis (Upper arm)</td>
<td>2.27 rad/s, 130°/s</td>
<td></td>
</tr>
<tr>
<td>U-axis (Vertical arm)</td>
<td>500 mm/s</td>
<td></td>
</tr>
<tr>
<td>Allowable Moment</td>
<td>Flange part (vertical) (^4)</td>
<td>27 Nm (2.75 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²/4)</td>
<td>Flange part (horizontal) (^5)</td>
<td>1.00 kg•m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>350 kg</td>
<td></td>
</tr>
<tr>
<td>Protective Structure</td>
<td>IP4X</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</td>
<td>Less than 4.91 m/s (0.5 G)</td>
<td></td>
</tr>
<tr>
<td>Acceleration</td>
<td></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>1.25kVA (^5)</td>
<td></td>
</tr>
<tr>
<td>Noise (^6)</td>
<td>79 dB</td>
<td></td>
</tr>
</tbody>
</table>

1. SI units are used in this table. However, gravitational unit is used in ( ).
2. For both vertical and horizontal loads applied to the manipulator, refer to fig. 6-3(a) “Horizontal Force” and fig. 6-3(b) “Vertical Force”.
3. Conformed to ISO9283.
4. For the allowable moment and allowable inertia, refer to fig. 6-1 “Moment of Flange Part Rating”.
5. Differs depending on the motion pattern.
6. 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.
   - 800mm away from the P-point maximum envelope.
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes

5.3 Manipulator Base Dimensions

Fig. 5-2: Base Dimensions

Unit: [mm]
5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Dimensions and P-point Maximum Envelope
5 Basic Specifications
5.5 Modification of S-Axis Movable Envelope

As shown in Table 5-2 “Combination of S-Axis Movable Envelope and Stopper Position”, S-axis range of motion can be modified in accordance with the installation place. Contact your YASKAWA representative when modification is needed.

<table>
<thead>
<tr>
<th>S-Axis Motion Type</th>
<th>S-Axis Movable Envelope</th>
<th>Stopper Position</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(S) Type [Standard Type]</td>
<td>-150° to +150°</td>
<td>③</td>
<td>Refer to -(S) Type- in fig. 5-5(a) “Stopper Position for -(S) Type-”</td>
</tr>
<tr>
<td>(L) Type [Left Type]</td>
<td>-200° to +60°</td>
<td>④</td>
<td>Refer to fig. 5-5(a) “Stopper Position for -(S) Type-” in fig. 5-5(a) “Stopper Position for -(S) Type-”</td>
</tr>
<tr>
<td>(R) Type [Right Type]</td>
<td>-60° to +200°</td>
<td>⑤</td>
<td>Refer to fig. 5-5(a) “Stopper Position for -(S) Type-” in fig. 5-5(a) “Stopper Position for -(S) Type-”</td>
</tr>
</tbody>
</table>

Note) S-axis movable envelope is modified above mentioned ranges only.

5.5.1 Necessary Parts

Prepare following parts before modifying the S-axis movable Envelope.

1. Stopper HW1406115-1 (2 stoppers) (delivered with the manipulator)
2. Hexagon socket head cap screw M6 (length: 30 mm) (2 bolts) (delivered with the manipulator)
3. Conical spring washer 2H-6 (2 washers) (delivered with the manipulator)

Fig. 5-4: Details of S-Axis Mechanical Stopper
5.5 Modification of S-Axis Movable Envelope

### 5.5.2 Removing S-Axis Mechanical Stopper

1. Turn OFF the DX200 power supply.
2. Unscrew the hexagon socket head cap screws and the conical spring washers from each stopper (2 stoppers).
3. Remove the stoppers (2 stoppers) from the casing.

### 5.5.3 Attaching S-Axis Mechanical Stopper

1. Turn OFF the DX200 power supply.
2. By referring to table 5-2 “Combination of S-Axis Movable Envelope and Stopper Position”, confirm the S-axis mechanical stopper position for modifying S-axis movable envelope.
3. After confirming the stopper position, attach the stoppers (2 stoppers) to the specified positions by referring to the corresponding figure among fig. 5-5(a) “Stopper Position for -(S) Type-”, fig. 5-5(b) “Stopper Position for -(L) Type-” and fig. 5-5(c) “Stopper Position for -(R) Type-”.
4. Put conical spring washers to the hexagon socket head cap screws, and then attach the stoppers (2 stoppers) to the casing with the tightening torque shown in table 5-3 “Parts List for Modifying S-Axis Movable Envelope”.

#### NOTE
Stopper attaching positions vary depending on S-axis motion type. Confirm the positions by referring to table 5-2, fig. 5-5(a), fig. 5-5(b) or fig. 5-5(c).
YASKAWA is not responsible for any incidents arising from attaching the stopper to the positions other than mentioned in table 5-2, fig. 5-5(a), fig. 5-5(b) and fig. 5-5(c).

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Casing HW1200394-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Hexagon socket head cap screw M6 (length: 30 mm) Conical spring washer 2H-6</td>
<td>2 each</td>
<td>Tightening torque 13.7 Nm</td>
</tr>
<tr>
<td>③</td>
<td>Stopper HW1406115-1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
5 Basic Specifications
5.5 Modification of S-Axis Movable Envelope

Fig. 5-5(a): Stopper Position for -(S) Type-

Fig. 5-5(b): Stopper Position for -(L) Type-

Fig. 5-5(c): Stopper Position for -(R) Type-
5.5.4 Changing S-Axis Movable Envelope Parameter

S-axis movable envelope parameter can be changed in the management mode only.

Following operations are allowed to an administrator only who inputs his ID number to change the mode to management mode.

For the details, refer to “Chapter 2 Security System” in “DX200 Maintenance Manual (RE-CHO-A113)”.

In case the S-axis parameter is changed using the programming pendant, refer to “8.17 Changing the Parameter Setting” in “DX200 Instructions (RE-CTO-A220)” together with this manual.

Pulse limit (S-Axis + direction): SICxG400
Pulse limit (S-Axis - direction): SICxG408

Please do not alter the movable envelope parameter with the software only, but in combination with the mechanical stopper.

Also, when executing the alteration, be sure to uniform the range by referring to table 5-2 "Combination of S-Axis Movable Envelope and Stopper Position" and table 5-4 "List of Parameter Combination for Modifying S-Axis Movable Envelope”.

Table 5-4: List of Parameter Combination for Modifying S-Axis Movable Envelope

<table>
<thead>
<tr>
<th>S-Axis Motion Type</th>
<th>S-Axis Movable Envelope</th>
<th>SICxG400 Pulse limit (S-Axis + direction)</th>
<th>SICxG408 Pulse limit (S-Axis - direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(S) Type [Standard Type]</td>
<td>-150° to -150°</td>
<td>+251733</td>
<td>-251733</td>
</tr>
<tr>
<td>(L) Type [Left Type]</td>
<td>+60° to -200°</td>
<td>+100693</td>
<td>-335644</td>
</tr>
<tr>
<td>(R) Type [Right Type]</td>
<td>+200° to -60°</td>
<td>+335644</td>
<td>-100693</td>
</tr>
</tbody>
</table>
5 Basic Specifications
5.5 Modification of S-Axis Movable Envelope

1. Select [Parameter] in the main menu.
2. Select [SICxG].
   - A parameter window appears.

3. Change the working envelope parameter for “Pulse limit (S-Axis + direction)”.  
4. Move the cursor to the parameter number [SICxG400] (Pulse limit (S-Axis + direction)).
5 Basic Specifications

5.5 Modification of S-Axis Movable Envelope

5. Select a parameter whose number is (SICxG400).
   - On the PARAMETER window, move the cursor to the data of (SICxG400) parameter number and then press [SELECT.

6. By referring to table 5-4 “List of Parameter Combination for Modifying S-Axis Movable Envelope”, input a parameter of the desired S-axis motion type (SICxG400: S-axis + direction).

7. Press [ENTER].

8. Change the working envelope parameter for “Pulse limit (S-Axis - direction)” *
9. Move the cursor to the parameter number \( \text{SICxG408} \) (Pulse limit (S-Axis - direction)).

10. Select a parameter whose number is \( \text{SICxG408} \).

   – On the PARAMETER window, move the cursor to the data of \( \text{SICxG408} \) parameter number and then press [SELECT].
11. By referring to Table 5-4 "List of Parameter Combination for Modifying S-Axis Movable Envelope", input the desired parameter value (SICxG408: S-axis - direction).

12. Press [ENTER].
5 Basic Specifications
5.5 Modification of S-Axis Movable Envelope

5.5.5 Confirming S-Axis Operation

When the movable envelope is changed (both mechanical stopper position and parameter are changed), do not fail to confirm the S-axis operation.

1. Select {ROBOT} in the main menu.
   – Sub menu appears.

2. Select {CURRENT POSITION}.
   – Current position is indicated.

3. By confirming the value on the current position window and mechanical stopper position, confirm S-axis + and - direction operations.

- Confirm that there is no interference between S-axis and the mechanical stopper when the axis is moved till the maximum point of its working envelope (+ and - directions).
- Confirm that S-axis stops at the maximum of the modified working envelope (+ and - directions).
5 Basic Specifications
5.5 Modification of S-Axis Movable Envelope

– Confirm that the S-axis current position when it is moved in + direction maximum working envelope, it stops at the modified parameter value.

※ Programming pendant window: (S) Type:(S-axis + direction)

– Confirm that the S-axis current position when it is moved in - direction maximum working envelope, it stops at the modified parameter value.

※ Programming pendant window: (S) Type:(S-axis - direction)
5.6 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.

**NOTE**

Due to the structural features of the MOTOMAN-MPO10, data on stopping angle and time for L- and U-axes is taken when position is 100% only.

5.6.1 Stop Category 0: Stopping Angles and Times

5.6.1.1 Position 100%

Fig. 5-6: Stop Category 0, Position 100% : Stopping Angle and Time for each Axis
5.6 Stopping Angles and Times for S-, L- and U-Axes

5.6.1.2 Position 66%

Fig. 5-7: Stop Category 0, Position 66% : Stopping Angle and Time for S-Axis
5.6 Stopping Angles and Times for S-, L- and U-Axes

5.6.1.3 Position 33%

Fig. 5-8: Stop Category 0, Position 33% : Stopping Angle and Time for S-Axis

(a) S-Axis

Stop category 0, Position 33%

- Speed (°/s)
- Angle (°)

Stop category 0, Position 33%

- Speed (°/s)
- Time (s)
5.6.2 Stop Category 1: Stopping Angles and Times

- Due to the structural features of the MOTOMAN-MPO10, data on stopping angle and time for L- and U-axes is taken when position is 100% only.
- Stopping angles and times at Stop category 1 are not subjected to the load of the manipulator.

5.6.2.1 Position 100%

*Fig. 5-9: Stop Category 1, Position 100% : Stopping Angle and Time for each Axis*

(a) S-Axis

Note: Not depends on the load

(b) L-Axis

Note: Not depends on the load

(c) U-Axis

Note: Not depends on the load
5.6.2.2 Position 66%

Fig. 5-10: Stop Category 1, Position 66% : Stopping Angle and Time for S-Axis

(a) S-Axis

Note) Note depends on the load
5.6.2.3 Position 33%

Fig. 5-11: Stop Category 1, Position 33%: Stopping Angle and Time for S-Axis

Note) Note depends on the load
6 Allowable Load for Vertical-Axis Flange

6.1 Flange Part

6.1.1 Allowable Load for Flange Part

The allowable flange part load is 10 kg at maximum. Here in this chapter, allowable load for the flange part and limits to the part are described.

For the flange part, there are limits on moment and moment of inertia shown in table 6-1 “Allowable Flange Part Load”.

When the volume load is small, refer to the moment arm rating shown in fig. 6-1.

The allowable total moment of inertia is calculated when the moment is at the maximum. Contact your YASKAWA representative beforehand when only moment of inertia, or load moment is small and moment of inertia is large.

Fig. 6-1: Moment of Flange Part Rating

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N-m (kgf-m)(^{1)} )</th>
<th>GD(^{2/4}) Total Moment of Inertia kg-m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Axis</td>
<td>27 (2.75)</td>
<td>1.98</td>
</tr>
</tbody>
</table>

1 Refer to fig. 6-1 “Moment of Flange Part Rating”.
2 ( ): Gravitational unit
6.2 Details of Flange Part

When moving the attachment, use the attachment whose fitting depth of inside and outside fittings must be 8 mm or less.

Fig. 6-2: Flange Part Details

<table>
<thead>
<tr>
<th>P.C.O.63</th>
<th>6</th>
<th>31.5±0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6 (depth:10mm)</td>
<td>(6 holes) (equally-spaced)</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>dia.</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>dia.</td>
<td>-0.030</td>
</tr>
</tbody>
</table>

Unit:[mm]
If force is applied to the flange part instead of load, refer to fig. 6-3(a) "Horizontal Force" and fig. 6-3(b) "Vertical Force". Contact YASKAWA representative for further information as assistance.

Fig. 6-3(a): Horizontal Force

Fig. 6-3(b): Vertical Force

1) Only downward load is applicable
7 Internal Connections

The fig. 7-1(a) "Internal Connection Diagram (Except for B00)", fig. 7-1(b) "Internal Connection Diagram (Except for B00)", fig. 7-2(a) "Internal Connection Diagram (for B00)", and fig. 7-2(b) "Internal Connection Diagram (for B00)" show the internal connections.
Fig. 7-1(a): Internal Connection Diagram (Except for B00)

(Expect for "-C00A,-B00")

S-AXIS
(Rotation axis between base and lower arm)

L-AXIS
(Rotation axis between lower arm and upper arm)

U-AXIS
(Vertical axis)
7 Internal Connections

Fig. 7-1(b): Internal Connection Diagram (Except for B00)
Fig. 7-2(a): Internal Connection Diagram (for B00)
Fig. 7-2(b): Internal Connection Diagram (for B00)

- Rotation axis between base and lower arm
- Rotation axis between lower arm and upper arm
- Vertical axis
8 Frequent Inspections

8.1 Frequent Inspections

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 periodical inspections listed in table 9-2 “Inspection Parts and Grease Used” in chapter 9 “Maintenance and Inspection” to ensure the long life of the robot and its performance. For the intervals of the daily inspections, refer to table 8-1 “Frequent Inspections”.

For more information about the inspection items, refer to chapter 8.2 “Daily Inspections”.

Table 8-1: Frequent Inspections

<table>
<thead>
<tr>
<th>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 and horizontal and vertical motions of each arm.</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 operation.</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tubes</td>
<td>Off or no severe wear and tear on air supply tubes.</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>5</td>
<td>Air leakage</td>
<td>No excessive air leakage from the fitting of the motor case.</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dried paint</td>
<td>Remove the dried paint on the manipulator</td>
<td>•</td>
<td>•</td>
<td>Replace the sheet. CAUTION When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
<tr>
<td>7</td>
<td>Power cable</td>
<td>No damages or wear and tear to the power cable</td>
<td>•</td>
<td>•</td>
<td>DANGER Replace the cable if any abnormalities are found.</td>
</tr>
<tr>
<td>8</td>
<td>Base mounting bolts</td>
<td>Tighten loosen bolts with spanner / wrench</td>
<td>•</td>
<td></td>
<td>WARNING Stop the manipulator when checking.</td>
</tr>
<tr>
<td>9</td>
<td>Cover mounting screws</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Frequent Inspections

#### 8.1 Frequent Inspections

**Pressure Switch Unit**

<table>
<thead>
<tr>
<th>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>Pressure set value</td>
<td>The pressure of the pressure reducing valve is within the specified range</td>
<td>✔️</td>
<td></td>
<td>WARNING  Do not make any modifications to the settings. The pressure switch unit is a safety related parts for explosion-Proof specification.</td>
</tr>
</tbody>
</table>

**Safety Devices**

<table>
<thead>
<tr>
<th>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>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>CAUTION  Inspect the manipulator while it is in its standby position and not in motion.</td>
</tr>
<tr>
<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>3. Remove the dried paint on the emergency stop button and the safety plug.</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Operation of the photoelectric intrusion detecting switch, Dried paint</td>
<td>1. The manipulator stops when the photoelectric switch is turned OFF.</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Remove the dried paint on the light beam detector.</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Operation of limit switch, Dried paint</td>
<td>1. Normal operation of the limit switch</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Remove the dried paint on the limit switch.</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
</tbody>
</table>

---

Table 8-1: Frequent Inspections
8.2 Daily Inspections

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

8.2.1 Manipulator

8.2.1.1 Exterior Inspection

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

8.2.1.2 Manipulator Motions and Noise/Vibration During Operation

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.

8.2.1.3 Tubes and Air Leakage

Check for excessive air leakage from the tubes, 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 unless 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.
8.2.1.4 Dried Paint, Dust, and Dirt

Remove any dried paint on the manipulator and other devices.
Replace the vinyl sheet if used.
Replace the jacket if it is dirty.

**DANGER**

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

**CAUTION**

- Paint stuck on the manipulator rotating parts prevents them from turning normally and smoothly. Periodically remove the paint on the manipulator rotating parts.
- Vertical part is not water/drip proof. Wipe the manipulator lightly with a cloth that is soaked in paint thinner. Be careful not to remove the original coating on the manipulator.

8.2.2 Pressure Switch Unit

8.2.2.1 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**

: 0.26 to 0.28 [MPa]

8.2.3 Safety Devices

8.2.3.1 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.
8.2.3.2 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.

8.2.3.3 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.
9 Maintenance and Inspection

9.1 Inspection Schedule

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

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

- The inspection interval depends on the total servo operation time.
- Speed reducers using VIGO Grease RE No.0 as mentioned in table 9-2 “Inspection Parts and Grease Used” may cause sounds at the initial operation or after the long shut down. It will be muffled in one or two days of running-in operation.

DANGER

- The inspection and maintenance of explosion-proof electric equipments must be performed by experienced maintenance personnel who have been trained on different types of explosion-proof enclosures, installation of electric equipment, related laws and regulations, and general principles for hazardous area classifications.
- Maintenance and inspection must be performed by specified personnel.
- Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

- Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)
- Failure to observe this caution may result in electric shock or injury.

CAUTION

- The battery unit must be connected before removing detection connector when maintenance and inspection.
- Failure to observe this caution may result in the loss of home position data.

NOTE

- The inspection interval depends on the total servo operation time.
- Speed reducers using VIGO Grease RE No.0 as mentioned in table 9-2 “Inspection Parts and Grease Used” may cause sounds at the initial operation or after the long shut down. It will be muffled in one or two days of running-in operation.
### Table 9-1: Inspection Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Manipulator exterior</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for cracks or damages</td>
<td>Specified personnel</td>
</tr>
<tr>
<td>2 Manipulator motion, noise, and vibration</td>
<td>Daily</td>
<td>Visual, Noise</td>
<td>Check for abnormality</td>
<td>Licensee</td>
</tr>
<tr>
<td>3 Air tube, air leakage</td>
<td>Daily</td>
<td>Visual, Manual</td>
<td>Check for air leakage</td>
<td>Service Company</td>
</tr>
<tr>
<td>4 Paint removal and cleaning</td>
<td>Daily</td>
<td>Visual, Manual</td>
<td>Remove adhered paint if any</td>
<td></td>
</tr>
<tr>
<td>5 Pressure switch unit setting</td>
<td>Daily</td>
<td>Visual</td>
<td>Check the value if it is within the proper value range</td>
<td></td>
</tr>
<tr>
<td>6 Base mounting bolts</td>
<td>Daily</td>
<td>Spanner, Wrench</td>
<td>Tighten loose bolts. Replace if necessary</td>
<td></td>
</tr>
<tr>
<td>7 Cover mounting screws</td>
<td>Daily</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary</td>
<td></td>
</tr>
<tr>
<td>8 SC-axis motors</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for clogging</td>
<td></td>
</tr>
<tr>
<td>9 Motor connector</td>
<td>Daily</td>
<td>Manual</td>
<td>Check for loose connectors</td>
<td></td>
</tr>
<tr>
<td>10 Inter pressure gasket</td>
<td>Daily</td>
<td>Visual</td>
<td>Replace if necessary. Refer to chapter 9.2.2</td>
<td></td>
</tr>
<tr>
<td>11 U-axis timing belt</td>
<td>Daily</td>
<td>Manual</td>
<td>Check for belt tension, wear or tear</td>
<td></td>
</tr>
<tr>
<td>12 Internal cables (S) Base part to lower-arm</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for conduction between the main connectors of the base and the intermediate connector with manually shaking the wire. Check for wear on the protective spring.</td>
<td></td>
</tr>
<tr>
<td>13 Internal cables Lower-arm to upper-arm</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for conduction between the main connectors</td>
<td></td>
</tr>
<tr>
<td>14 Internal cables Upper-arm to flange tip</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for conduction between the main connectors</td>
<td></td>
</tr>
</tbody>
</table>
**Table 9-1: Inspection Schedule**

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Battery pack</td>
<td>Daily</td>
<td>Visual</td>
<td>Replace the battery unit when the battery alarm occurs or when the manipulator has been operated for 3600H.</td>
</tr>
<tr>
<td>16</td>
<td>Power cable (movable)</td>
<td>1000H Cycle</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found).</td>
</tr>
<tr>
<td>17</td>
<td>Power cable (fixed)</td>
<td>1000H Cycle</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found).</td>
</tr>
<tr>
<td>18</td>
<td>U-axis ball screw actuator</td>
<td>1500H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. Replace (recommended).</td>
</tr>
<tr>
<td>19</td>
<td>S-axis speed reducer</td>
<td>6000H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. Replace (if necessary).</td>
</tr>
<tr>
<td>20</td>
<td>L-axis speed reducer</td>
<td>12000H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. Replace (if necessary).</td>
</tr>
<tr>
<td>21</td>
<td>Pressure switch unit</td>
<td>24000H Cycle</td>
<td></td>
<td>Confirm that the pressure switch, flow switch, solenoid valve and the pressure reducing valve operate correctly.</td>
</tr>
<tr>
<td>22</td>
<td>Chassis</td>
<td>Specified personnel</td>
<td>Licensee</td>
<td>Service Company</td>
</tr>
</tbody>
</table>

1. Inspection No. correspond to the numbers in fig. 9-1 “Inspection Parts and Inspection Numbers”.
2. When checking for conduction with multimeter, connect the battery unit to each axis connector on the motor side, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position data may be lost. (Refer to chapter 9.4 “Notes for Maintenance”.)
3. Internal cables to be replaced at 24000H inspection.
4. For grease used in speed reducers and actuator parts, refer to table 9-2 “Inspection Parts and Grease Used”.
5. The occurrence of a grease leakage indicates the possibility that grease has leaked into the motor. This can cause a motor breakdown. Contact your YASKAWA representative.
9 Maintenance and Inspection
9.1 Inspection Schedule

The numbers in table 9-1 “Inspection Schedule” correspond to the numbers in fig. 9-1 “Inspection Parts and Inspection Numbers”

Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,13</td>
<td>VIGO grease RE No. 0</td>
<td>S- and L-axis speed reducers</td>
</tr>
<tr>
<td>10,11</td>
<td>Alvania EP grease 2</td>
<td>Ball screw actuator</td>
</tr>
</tbody>
</table>

Fig. 9-1: Inspection Parts and Inspection Numbers

(Independently installed pressure switch unit)

Ex. Power cable connected to R-side of the manipulator
9.2 Notes on Maintenance Procedures

9.2.1 Notes on Grease Replenishment/Replacement

Grease replenishment/replacement is performed to the following parts of the manipulator body.

1. S-axis speed reducer part
2. L-axis speed reducer part
3. U-axis ball screw actuator part

**NOTE**

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

- If grease is added without removing the plug/screw from the grease exhaust port, an oil seal of a speed reducer will come off, which may result in damage to the speed reducer. Make sure to remove the plug/screw.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.
- Make sure to fill hoses, which are joined to the grease inlet, with grease beforehand to prevent air from intruding into the speed reducer.
9.2.1.1 S-Axis Speed Reducers

- **Grease Replenishment**
  1. Rotate S-axis for 90° (either + or - direction) from the home position, and then remove the plug on the So exhaust port.

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

   2. Remove the plug 1/8 on the Si 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: 1000 cc (900 g) (2000 cc (1800 g) for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

  3. Before re-installing a plug to So grease outlet, move S-axis for a few minutes to discharge excessive grease.

  4. Remove the grease zerk from Si grease inlet. Wipe So exhaust port and re-install plugs to each Si grease inlet and So exhaust port. (Apply seal tape on the thread part of the plug and reinstall it to the So exhaust port.)

- **Grease Replacement**
  1. Rotate S-axis for 90° (either + or - direction) from the home position, and then remove the plug from the So grease exhaust port.

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

   2. Remove the plug 1/8 from the Si 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: 2800 cc (2520 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 exhaust port. The new grease can be distinguished from the old grease by color.

  4. Before re-installing a plug to So grease outlet, move S-axis for a few minutes to discharge excessive grease.

  5. Wipe So exhaust port. Re-install a plug to Si grease inlet and So grease outlet. (Apply seal tape on the thread part plug at So grease outlet.)
If the plug (So) is installed while the grease is being exhausted, the grease will go inside the manipulator and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug (So).

*Fig. 9-2: S-Axis Speed Reducer*
9.2.1.2  L-Axis Speed Reducers

- **Grease Replenishment**
  1. Remove the plug on the Lo exhaust port.

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

     2. Remove the plug on the Li grease inlet, and install the grease zerk A-MT6X1. Inject grease by using a grease gun.
        - Grease type: VIGO grease RE No. 0
        - Amount of grease: 460 cc (414 g)  
          (910 cc (820 g) for 1st supply)
        - Air supply pressure of grease pump: 0.3 MPa or less
        - Grease injection rate: 8 g/s or less

     3. Move each axis for a few minutes to discharge excessive grease from Lo grease outlet.

     4. Wipe Lo exhaust port. Re-install plug to each Li grease inlet and Lo grease out. (Apply seal tape on the thread part plug at Lo grease outlet.)

- **Grease Replacement**
  1. Remove the plug from the Lo grease exhaust port.

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

     2. Remove the plug on the Li grease inlet and install the grease zerk A-MT6X1. Inject grease by using a grease gun.
        - Grease type: VIGO grease RE No. 0
        - Amount of grease: 1300 cc (1170g)
        - 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 Lo exhaust port. The new grease can be distinguished from the old grease by color.

     4. Move each axis for a few minutes to discharge excessive grease from Lo grease outlet.

     5. Wipe Lo exhaust port. Re-install a plug to each Li grease inlet and Lo grease out. (Apply seal tape on the thread part plug at Lo grease outlet.)
If the plug (Lo) is installed while the grease is being exhausted, the grease will go inside the manipulator and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug (Lo).

Fig. 9-3: L-Axis Speed Reducer
9.2.1.3 U-Axis Ball Screw Actuator Part

**NOTE**
To U-axis ball screw actuator part, grease is not replaced but only replenished.

**Grease Replenishment**
1. Set the height of U-axis to home position (0 mm).
2. Unscrew the hexagon socket head screws and remove the cover.
3. The grease zerk A-PT1/8 is originally equipped on the manipulator (2 places). Using the grease zerk, replenish Alvania EP Grease2 from each grease inlet U_Bi.
4. Reinstall the cover after grease is replenished. (Observe the screw tightening torque.)
   - Grease type: Alvania EP Grease 2
   - Amount of grease: 4 cc (3.6 g) to each inlet (8 cc (7.2 g) for 1st supply to each inlet)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

**NOTE**
Do not replenish grease too much grease since it is not exhausted from the ball screw part.

*Fig. 9-4: U-Axis Ball Screw Actuator Part*
9.2.2 Inspection of Gasket for Internal Air Pressure

9.2.2.1 Gasket in the Cover Part

a) Base part

Remove covers from the top of the base part, both side of the base (of these covers, one functions as a power cable cover), front side of the base part and both side of it, and then, check wear and tear of the gasket. If the oil contained in the air for keeping the internal pressure is too much, it can damage the gasket, which result in air leakage. Replace the gasket if air leakage is found.

![Fig. 9-5: Gasket in Base Part](image)

Perform “3-(1) Checking of Purging Operations” in chapter 9.3.2 “Operation Check for Internal Pressure Protection Sequence” after gasket is replaced.

**NOTE**

- Hexagon Socket Button Head Screw M8 (6 screws) (2 places) (length: 18 mm)
  - Tightening torque 20.1 N·m (2.1 kgf·m)
- Hexagon Socket Button Head Screw M8 (8 screws) (length: 18 mm)
  - Tightening torque 20.1 N·m (2.1 kgf·m)
- Hexagon Socket Head Cap Screw M8 (18 screws) (length: 18 mm)
  - Washer M8
  - Tightening torque 24.5 N·m (2.5 kgf·m)
- Hexagon Socket Head Cap Screw M6 (18 screws) (length: 18 mm)
  - Washer M6
  - Tightening torque 10.0 N·m (1.0 kgf·m)

When the power cable connection type is (R)Type
b) Lower-arm part

Unscrew the cover (four places) fixing screws. And then check the wear and tear of each gasket which is mounted on the case fitting face.

In case the oil contained in the air for keeping the internal pressure is too much, it can damage the gasket, which result in air leakage. Replace the gasket if air leakage is found.

Fig. 9-6: Lower-Arm Part Gasket Inspection
c) Upper-arm part

Remove a cover from the top side of Upper-arm. And then check the wear and tear of the gasket.

In case the oil contained in the air for keeping the internal pressure is too much, it can damage the gasket, which result in air leakage. Replace the gasket if air leakage is found.

Fig. 9-7: No.2 Arm Part and U-Arm Part Gasket Inspection
d) U-axis part

Remove covers from U-axis lower part and U-axis side part. And then check the wear and tear of the gasket.

In case the oil contained in the air for keeping the internal pressure is too much, it can damage the gasket, which result in air leakage. Replace the gasket if air leakage is found.

Fig. 9-8: U-Axis Part Gasket Inspection
9.2.3 Battery Unit Replacement

**WARNING**

Before replacing the battery unit, turn OFF the power supply to the DX200, and check that no explosive atmosphere exists around the battery unit.

Two battery units are installed in the locations shown in fig. 9-9(a) “Battery Unit Location (Except for -C00A)” and fig. 9-9(b) “Battery Unit Location (For -C00A)”.

<table>
<thead>
<tr>
<th>Battery unit type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW1471496-A</td>
<td>For S-axis (Except for B00,C00A)</td>
</tr>
<tr>
<td>HW1471496-B</td>
<td>For L-and U-axes (Except for B00,C00A)</td>
</tr>
<tr>
<td>HW1470715-BA</td>
<td>For S-axis (For B00)</td>
</tr>
<tr>
<td>HW1470715-BB</td>
<td>For L-and U-axes (For B00)</td>
</tr>
<tr>
<td>HW1373234-A</td>
<td>For S-axis (For C00A)</td>
</tr>
<tr>
<td>HW1373234-B</td>
<td>For L-and U-axes (For C00A)</td>
</tr>
</tbody>
</table>

If a battery alarm occurs in the DX200, replace the battery unit in the following procedure.
9 Maintenance and Inspection
9.2 Notes on Maintenance Procedures

Fig. 9-9(a): Battery Unit Location (Except for -C00A)

- Hexagon socket head cap screw M6
  (18 screws, length: 18 mm)
- Washer M6
  Tightening torque 10 N m (1.0 kgf m)
- Cable tie (T30)
  (4 ties, 2 places)

Battery unit for L- and U-axes
[Except for B00]:
(HW1471496-A)
[For B00]:
(HW1475715-BA)

Battery unit for S-axis
[Except for B00]:
(HW1471496-B)
[For B00]:
(HW1475715-BB)
9 Maintenance and Inspection

9.2 Notes on Maintenance Procedures

Fig. 9-9(b): Battery Unit Location (For -C00A)

- Hexagon socket head cap screw M6 (18 screws, length: 18 mm)
- Washer M6
- Tightening torque 10 N·m (1.0 kgf·m)

- Hexagon socket head cap screw M4 (2 screws, length: 60 mm)
- Washer M4 (stainless, 2 washers)
- Tightening torque: 1.2 N·m (0.12 kgf·m)

* Apply LOCTITE 243.
Fig. 9-10(a): Battery Connection (Except for -C00A)

When the internal cable is the pin terminal:

When the internal cable is the connector:
9 Maintenance and Inspection
9.2 Notes on Maintenance Procedures

Fig. 9-10(b): Battery Connection (For -C00A)

Remove the conversion cable which is connected to the spare parts battery before use.
9 Maintenance and Inspection
9.2 Notes on Maintenance Procedures

1. Turn OFF the power supply to the DX200.
2. Ventilate the circumference of the manipulator to remove explosive gas.
3. Remove the cover from the top of the base part and then, pull out a battery unit for replacing.
4. Remove cable ties that are fixing the battery unit.
5. Unscrew the hexagon socket head cap screws fixing the battery. (For C00A)
6. Remove an vinyl tape (insulation tape) protecting the connection part of the battery unit in the manipulator.
7. Connect new battery unit.
8. Remove the old battery unit.

**NOTE** Be sure to connect the new battery unit before disconnecting the old one so that the data does not disappear.

9. Protect the connection part of the battery unit in the manipulator with the vinyl tape (insulation tape).
10. Fix the battery unit to the plate with the cable tie (T30: 8 places), and then re-install the cover to the top of the base part. (Except for C00A)
11. Mount the battery on the plate by using the cable ties (T50R: 2 places), fix the hexagon socket head cap screws (2 places), and then mount the cover of the upper part of the base on the base. (For C00A)
9.3 Inspection of the Explosion-Proof Device

**WARNING**

Before replacing the battery unit, turn OFF the power supply to the DX200, and check that no explosive atmosphere exists around the battery.

9.3.1 Pressure Switch Unit Inspection

9.3.1.1 Solenoid Valve

Check if the air purge starts immediately after turning ON the power to the DX200 and if it ends approximately 3 minutes later.

9.3.1.2 Operation Method of Pressure Reducing Valve

Purging air and operation air reducing valves are equipped with a locking nut to maintain the specified pressure value. To modify the value, follow the procedures below.

1. Turn OFF the power supply to the DX200.
2. Unscrew the hexagon socket head cap screws to remove the pressure unit cover. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)
3. Loosen the locking nut equipped to the valves with a spanner (nominal size: 10 mm). (Refer to fig. 9-12 “Operation Methods of Pressure Reducing Valve”.)
4. Adjust the dial on the valve to modify the value.
5. After modification is complete, tighten the locking nut with a spanner (nominal size: 10 mm).

**CAUTION**

Do not modify the value with the locking nut tightened. The valve may malfunction.
9.3.1.3 Operation Check of Pressure Reducing Valve

Measure the air pressure for the pressure switch unit with a pressure gauge.

For the pressure gauge connection, refer to fig. 9-13 "Operation Check of Pressure Reducing Valve".

Pressure gauge, joints and hoses used for this inspection are prepared by customer.

1. Turn OFF the power supply to the DX200.
2. Unscrew the hexagon socket head cap screws to remove the pressure unit cover. (Refer to fig. 9-11.)
3. As shown in the fig. 9-13, connect the pressure gauge between the pressure switch unit and the manipulator.
4. Set the pressure of both purging air and operation air reducing valves as shown in table 9-3 "List of Setting Value for Purging Air and Operation Air Reducing Valve".
   Refer to chapter 9.3.1.2 "Operation Method of Pressure Reducing Valve" for the reducing valve operation.

Table 9-3: List of Setting Value for Purging Air and Operation Air Reducing Valve

<table>
<thead>
<tr>
<th>Pressure (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purging air reducing valve</td>
</tr>
<tr>
<td>Operation air reducing valve</td>
</tr>
</tbody>
</table>

5. Turn ON the power supply to the DX200 and start purging. Check that the pressure is keeping between 0.26 MPa and 0.28 MPa while purging.

6. After purging is complete, wait for a few minutes and check that the pressure is declined between 0.01 MPa and 0.02 MPa. (Immediately after the purging operation, pressure may fluctuate. Therefore, wait for a few minutes after completing the purging to check the pressure.)

7. Turn OFF the power supply to the DX200 and then, re-install the cover with the hexagon socket head cap screws. (Refer to fig. 9-11.)
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Fig. 9-11: Pressure Switch Unit Cover

Fig. 9-12: Operation Methods of Pressure Reducing Valve

Fig. 9-13: Operation Check of Pressure Reducing Valve

- Hexagon socket head cap screw M6 (Trivalent chromium, 4 screws, length: 12)
  - Conical spring washer 2H-6 (Trivalent chromium, 4 washers)
  - Washer M6 (Trivalent chromium, 4 washers)
  - Tightening torque 10 N•m (1.0 kgf•m)

- Hexagon socket head cap screw M6 (Trivalent chromium, 4 screws, length: 12)
  - Conical spring washer 2H-6 (Trivalent chromium, 4 washers)
  - Washer M6 (Trivalent chromium, 4 washers)
  - Tightening torque 10 N•m (1.0 kgf•m)

Purging pressure reducing valve
Pressure adjusting fit
Locking nut
Tightening tool: Spanner (nominal size: 10 mm)

Operation pressure reducing valve

Pressure gauge, joints and hoses are prepared by customer

Industrial compressed air 0.35 to 0.65 [MPa]

To manipulator (Tube 16 dia.)
From manipulator (Tube 16 dia.)

Purging pressure reducing valve 0.26 to 0.28 [MPa]
Operation pressure reducing valve 0.01 to 0.02 [MPa]
9.3.1.4 Operation Check of Pressure Detection Function

Check the operation of the pressure detector PS1 (for low pressure) and pressure adjusting valve by following the procedures below.

- **Operation check of pressure detector PS1**
  - (check of electric continuity)
  - Multimeter for this checking are prepared by customer.

1. Turn OFF the power supply to the DX200.
2. Unscrew the hexagon socket head cap screws to remove the pressure unit cover. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)
3. Set the pressure of both purging air and operation air reducing valves as shown in table 9-4 “List of Setting Value for Purging Air and Operation Air Reducing Valve”.
   - Refer to chapter 9.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

<table>
<thead>
<tr>
<th>Table 9-4: List of Setting Value for Purging Air and Operation Air Reducing Valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure reducing valve</td>
</tr>
<tr>
<td>Purging air reducing valve</td>
</tr>
<tr>
<td>Operation air reducing valve</td>
</tr>
</tbody>
</table>

4. Remove the clear cover from the pressure switch unit terminal box, and then connect a metering rod which is a multimeter. To P1, connect + side of the metering rod and - side to N1. (Refer to fig. 9-14 “Operation Check for Pressure Detector”.)
5. Confirm that “conduction is not produced” after suspending the industrial air.
6. Also, confirm that "conduction is produced" while industrial air is provided.
7. Remove the metering rod, and then re-install the clear cover to the pressure switch unit terminal box.
8. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)
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- **Operation check of pressure reducing valve**
  - A flow-meter (measurable range of 0 to 5 L/min is included) for checking the conduction is prepared by customer.

1. Turn OFF the power supply to the DX200.
2. Unscrew the hexagon socket head cap screws to remove the pressure unit cover. (Refer to fig. 9-11 "Pressure Switch Unit Cover").
3. Set the pressure of operation air reducing valve as shown in table 9-5 "Operation Pressure Reducing Valve - Adjusting Pressure 1-". Refer to chapter 9.3.1.2 "Operation Method of Pressure Reducing Valve" for the pressure reducing valve operation.

![Fig. 9-11: Pressure Switch Unit Cover](image)

Table 9-5: Operation Pressure Reducing Valve - Adjusting Pressure 1-

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation air reducing</td>
</tr>
<tr>
<td>valve</td>
</tr>
<tr>
<td>0.05</td>
</tr>
</tbody>
</table>

4. Connect the flow meter to the pressure adjusting valve exhaust side. Use the flow-meter whose measurable range of 0 to 5 L/min is included. Joints and hoses to be connected to the flow-meter are prepared by customer. The size of the plug attached to the pressure adjusting valve exhaust side is Rc1/4. (Refer to fig. 9-15 "Operation Check for Pressure Adjusting Valve").

5. Check that the flow-meter indicates 5 L/min when the operation pressure is 0.05 MPa.

6. Set the pressure of operation air reducing valve as shown in table 9-6 "Operation Pressure Reducing Valve - Adjusting Pressure 2-". Refer to chapter 9.3.1.2 for the pressure reducing valve operation.

![Fig. 9-15: Operation Check for Pressure Adjusting Valve](image)

Table 9-6: Operation Pressure Reducing Valve - Adjusting Pressure 2-

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation air reducing</td>
</tr>
<tr>
<td>valve</td>
</tr>
<tr>
<td>0.02</td>
</tr>
</tbody>
</table>

7. Check that the flow-meter indicates 0 L/min when the operation pressure is 0.02 MPa.

8. Remove the flow-meter.

9. Set the pressure of both purging air and operation air reducing valves as shown in table 9-7 "List of Setting Value for Purging Air and Operation Air Reducing Valves". Refer to chapter 9.3.1.2 for the pressure reducing valve operation.

![Fig. 9-17: Purging and Operation Air Reducing Valves](image)

Table 9-7: List of Setting Value for Purging Air and Operation Air Reducing Valves

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purging air reducing</td>
</tr>
<tr>
<td>valve</td>
</tr>
<tr>
<td>0.26 to 0.28</td>
</tr>
<tr>
<td>Operation air reducing</td>
</tr>
<tr>
<td>valve</td>
</tr>
<tr>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>
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10. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)

Fig. 9-14: Operation Check for Pressure Detector

![Diagram of Pressure Detector]

- Industrial compressed air 0.35 to 0.65 [MPa]
- Purging pressure 0.26 to 0.28 [MPa]
- Operation pressure 0.01 to 0.02 [MPa]
- Operation pressure reducing valve
- Connect a multimeter measuring rod (+ side)
- Connect a multimeter measuring rod (- side)

A Part Enlarged View

Fig. 9-15: Operation Check for Pressure Adjusting Valve

![Diagram of Pressure Adjusting Valve]

- Flowmeter (measurable range of 0 to 5 L/min is included)
- Pressure adjusting valve
- Exhaust side of pressure adjusting valve
- Operation pressure
- Purging pressure
- The size of the plug is Rc1/4

A Part Enlarged View
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9.3.1.5 Operation Check for Master Valve

1. Turn OFF the power supply to the DX200.

2. Unscrew the hexagon socket head cap screws to remove the pressure unit cover. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)

3. Set the pressure of operation air reducing valve as shown in table 9-8 “List of Setting Value for Purging Air and Operation Air Reducing Valves”. Refer to chapter 9.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

4. Re-start the DX200 and check that purging operation starts a few seconds later.

5. While purging, check that air is exhausted from the master valve exhaust port. Note that air is also exhausted from pressure adjusting exhaust port. (Refer to fig. 9-16 “Operation Check for Master Valve”.)

6. Turn OFF the power supply to the DX200 again and re-install the cover with the hexagon socket head cap screws. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)

Table 9-8: List of Setting Value for Purging Air and Operation Air Reducing Valves

<table>
<thead>
<tr>
<th></th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purging air reducing valve</td>
<td>0.26 to 0.28</td>
</tr>
<tr>
<td>Operation air reducing valve</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

Fig. 9-16: Operation Check for Master Valve
### 9.3.2 Operation Check for Internal Pressure Protection Sequence

Check the internal pressure protection sequence by following the procedures below.

1. Turn OFF the power supply to the DX200.
2. Unscrew the hexagon socket head cap screws to remove the pressure unit cover. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)
3. Perform each checking item below.

#### 3-(1) Checking of Purging Operations

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation pressure [MPa]</th>
<th>Purging Pressure [MPa]</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>0.01 to 0.02</td>
<td>0.26 to 0.28</td>
<td>Confirm the setting value of pressure switch operation pressure and purging pressure (Each value should be within the range shown in the left)</td>
</tr>
<tr>
<td>②</td>
<td></td>
<td></td>
<td>Turn ON the power supply to the DX200.</td>
</tr>
<tr>
<td>③</td>
<td></td>
<td></td>
<td>Purging start and the message “Air Purging” is indicated on the programming pendant window. While purging, confirm that no power is supplied to motors and manipulator is inoperable.</td>
</tr>
<tr>
<td>④</td>
<td></td>
<td></td>
<td>Confirm that purging completes in two minutes and a message “Air Purge Done” is indicated on the programming pendant window.</td>
</tr>
<tr>
<td>⑤</td>
<td></td>
<td></td>
<td>Press [SERVO ON READY] on the programming pendant and grip the enable switch to turn ON the power supply, and then confirm that the manipulator is operable.</td>
</tr>
</tbody>
</table>
9.3 Inspection of the Explosion-Proof Device

3-(2) Checking of Inner Pressure Error Detection Operations

Perform the following checking after above mentioned checking are completed.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation pressure [MPa]</th>
<th>Purging Pressure [MPa]</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>⑤</td>
<td>0.01 to 0.02</td>
<td>0.26 to 0.28</td>
<td>(Step 5 operation described in 3-(1)) Press [SERVO ON READY] and grip the enable switch to turn ON the power supply, and then confirm that the manipulator is operable.</td>
</tr>
<tr>
<td>⑥</td>
<td>0</td>
<td></td>
<td>Set 0 MPa to the operation pressure of pressure switch unit.</td>
</tr>
<tr>
<td>⑦</td>
<td></td>
<td></td>
<td>The mode is changed to abnormal pressure mode (LOW) and a message “AIR PRESS ERROR (LOW)” is indicated on the programming pendant window. Confirm that an alarm lamp on the DX200 lights.</td>
</tr>
<tr>
<td>⑧</td>
<td></td>
<td></td>
<td>Confirm that [SERVO ON READY] on the programming pendant goes off.</td>
</tr>
<tr>
<td>⑨</td>
<td></td>
<td></td>
<td>While the abnormal pressure (Low) error alarm is occurred, confirm that the power supply is not turned ON and the manipulator is inoperable even [SERVO ON READY] on the programming pendant is pressed and the enable switch is gripped.</td>
</tr>
</tbody>
</table>

⑩ Turn OFF the power supply to the DX200 after above checking operations are completed.

3-(3) Checking of Purging Error Detection Operations

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation pressure [MPa]</th>
<th>Purging Pressure [MPa]</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>0.01 ~ 0.02</td>
<td>0.26 ~ 0.28</td>
<td>Confirm the setting value of pressure switch unit operation pressure and purging pressure (Each value should be within the range shown in the left)</td>
</tr>
<tr>
<td>②</td>
<td></td>
<td></td>
<td>Turn ON the power supply to the DX200.</td>
</tr>
<tr>
<td>③</td>
<td></td>
<td></td>
<td>Purging start and a message “Air Purging” is indicated on the programming pendant window. While purging, confirm that no power is supplied to motors and manipulator is inoperable.</td>
</tr>
<tr>
<td>④</td>
<td></td>
<td></td>
<td>Set 0 MPa to the purging pressure of pressure switch unit.</td>
</tr>
<tr>
<td>⑤</td>
<td></td>
<td></td>
<td>The mode is changed to abnormal pressure mode (purging error) and a message “AIR PURGE ERROR” is indicated on the programming pendant window. Confirm that an alarm lamp on the DX200 lights.</td>
</tr>
<tr>
<td>⑥</td>
<td></td>
<td></td>
<td>While abnormal purging pressure error alarm is occurred, confirm that the power supply is not turned ON and the manipulator is inoperable even [SERVO ON READY] on the programming pendant is pressed and the enable switch is gripped.</td>
</tr>
</tbody>
</table>
9 Maintenance and Inspection
9.3 Inspection of the Explosion-Proof Device

TURN OFF the power supply to the DX200 after above checking operations are completed.

4. After completing all the checking operations mentioned in 3-(1), (2) and (3), turn OFF the power supply to the DX200 and set the adjusting pressure for purging pressure reducing valve and operation pressure reducing valve within each range shown in table 9-9 “List of Setting Value for Purging Air and Operation Air Reducing Valves”. Refer to chapter 9.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

Table 9-9: List of Setting Value for Purging Air and Operation Air Reducing Valves

<table>
<thead>
<tr>
<th></th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purging air reducing valve</td>
<td>0.26 to 0.28</td>
</tr>
<tr>
<td>Operation air reducing valve</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

5. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 9-11 “Pressure Switch Unit Cover”.)
9.4 Notes for Maintenance

9.4.1 Encoder Connector (with CAUTION label)

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

9.4.1.1 S- and L-Axis Motors

Connectors for connecting the battery unit are attached to S- and L-axis motors. By referring fig. 9-17 "Connection of Back Up Battery Pack for S- and L-Axis Motors", connect the battery unit according to the following procedure.

1. By unscrewing the fixing bolts, remove a cover for the back up connector which is mounted on the encoder.
2. Connect the battery unit to the connectors for battery backup (crimped contact-pin terminals) which is at the inner side of the connector cover.
3. Confirm that all connectors are connected after the maintenance, and then remove the battery.

**NOTE**

Do not remove the battery unit at the connector base side.

9.4.1.2 U-Axis Motor

Connectors for battery backup (crimped contact-pin terminals) are mounted on the encoder.

Refer to fig. 9-18 "Connection of Back Up Battery Pack for U-Axis Motor" for the battery unit connection.

1. Connect the battery unit to the connectors for battery backup (crimped contact-pin terminals) which is on the encoder connector part.
2. Confirm that all connectors are connected after the maintenance, and then remove the battery unit.
Motors for S- and L-Axis

- Power cable connector
- Encoder connector
- Filter
- Motor
- Connector cover for the battery backup
- Cover fixing screw
- Conversion cable
- Battery pack (spare parts)

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

Motor for U-Axis

- Power cable connector
- Encoder connector
- Filter
- Encoder
- Cables for motor, etc.
- Conversion cable
- New battery pack
- Battery pack (spare parts)

**CAUTION**
Connect to...
9 Maintenance and Inspection
9.4 Notes for Maintenance

Fig. 9-19: Connection Diagram

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

Fig. 9-20: Caution Label
10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-MPO10. The spare parts list for the MOTOMAN-MPO10 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 10-1: Spare Parts for the MOTOMAN-MPO10 (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</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-axis encoder (except for B00, C00A)</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Battery pack</td>
<td>HW1471600-AB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For L- and U-axes encoders (except for B00, C00A)</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Battery pack</td>
<td>HW1471600-BA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S-axis encoder (for B00)</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery pack</td>
<td>HW1471600-BB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For L- and U-axes encoders (for B00)</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery pack</td>
<td>HW1471600-DA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S-axis encoder (for C00A)</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>Battery pack</td>
<td>HW1471600-DB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For L- and U-axes encoders (for C00A)</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>Sealing compound</td>
<td>DB-1600</td>
<td>Dabond Industry Co., Ltd.</td>
<td>200ml</td>
<td>-</td>
<td>For gasket sealing</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>Seal tape</td>
<td>TB-4501</td>
<td>ThreeBond Co., Ltd.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>Thread locker</td>
<td>Locktite 243</td>
<td>Henkel Japan Ltd.</td>
<td>1</td>
<td>-</td>
<td>For screwing bolt/screw</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K. K.</td>
<td>16kg</td>
<td>-</td>
<td>For ball screw actuator</td>
</tr>
</tbody>
</table>
## Table 10-1: Spare Parts for the MOTOMAN-MPO10 (Sheet 2 of 3)

<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>11</td>
<td>Grease</td>
<td>VIGO Grease RE No.0</td>
<td>YASKAWA Electric Corporation</td>
<td>16kg</td>
<td>-</td>
<td>For S- and L-axis speed reducers</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>Grease</td>
<td>MP-1</td>
<td>NIPPON GREASE CO., LTD.</td>
<td>2.5kg</td>
<td>-</td>
<td>For oil seal</td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>Grease</td>
<td>Multemp PS No.2-A</td>
<td>KYODO YUSHI CO., LTD</td>
<td>18kg</td>
<td>-</td>
<td>For internal cable lubrication</td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td>Inner pressure keeping gasket kit</td>
<td>Y005CMPO0010A00PA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>U-axis timing belt</td>
<td>100S3M354</td>
<td>MITSUBOSHI BELTING LTD.</td>
<td>1</td>
<td>1</td>
<td>For U-axis</td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>S-axis speed reducer assy (spare parts)</td>
<td>HW1372209-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>17</td>
<td>L-axis speed reducer assy (spare parts)</td>
<td>HW1372210-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>U-axis ball screw actuator assy (spare parts)</td>
<td>HW1372211-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>19</td>
<td>Gasket</td>
<td>HW1406112-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>4</td>
<td>Cover for both sides of base, rear cover for base, front cover for base, and cover for manipulator cable</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
<td>Gasket</td>
<td>HW1406114-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Top cover for base</td>
</tr>
<tr>
<td>B</td>
<td>21</td>
<td>Gasket</td>
<td>HW1406110-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>Cover for both sides of base</td>
</tr>
<tr>
<td>B</td>
<td>22</td>
<td>Gasket</td>
<td>HW1406126-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Top cover for Lower arm</td>
</tr>
<tr>
<td>B</td>
<td>23</td>
<td>Gasket</td>
<td>HW1406139-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>Bottom cover for Lower arm and side cover for part of U-axis</td>
</tr>
<tr>
<td>B</td>
<td>24</td>
<td>Gasket</td>
<td>HW1406128-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Bottom cover for Lower arm</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>Gasket</td>
<td>HW1406124-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Top cover for Lower arm</td>
</tr>
<tr>
<td>B</td>
<td>26</td>
<td>Gasket</td>
<td>HW1406170-2</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Top cover for upper arm</td>
</tr>
<tr>
<td>B</td>
<td>27</td>
<td>Gasket</td>
<td>HW1406168-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Bottom cover for part of U-axis</td>
</tr>
<tr>
<td>C</td>
<td>28</td>
<td>S-axis AC servo motor</td>
<td>HW1383098-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>29</td>
<td>L-axis AC servo motor</td>
<td>HW1383097-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
### Table 10-1: Spare Parts for the MOTOMAN-MPO10 (Sheet 3 of 3)

<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>30</td>
<td>U-axis AC servo motor</td>
<td>HW1271993-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between base part and lower-arm (except for F00)</td>
</tr>
<tr>
<td>C</td>
<td>31</td>
<td>Internal cable</td>
<td>HW1271205-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between lower-arm and inside upper-arm (except for F00)</td>
</tr>
<tr>
<td>C</td>
<td>32</td>
<td>Internal cable</td>
<td>HW1271205-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between inside upper-arm and flange tip (except for F00)</td>
</tr>
<tr>
<td>C</td>
<td>33</td>
<td>Internal cable</td>
<td>HW1271205-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between base part and lower-arm (F00)</td>
</tr>
<tr>
<td>C</td>
<td>34</td>
<td>Internal cable</td>
<td>HW1271205-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between lower-arm and inside upper-arm (F00)</td>
</tr>
<tr>
<td>C</td>
<td>35</td>
<td>Internal cable</td>
<td>HW1271205-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between inside upper-arm and flange tip (F00)</td>
</tr>
<tr>
<td>C</td>
<td>36</td>
<td>Internal cable</td>
<td>HW1271205-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Between inside upper-arm and flange tip (F00)</td>
</tr>
<tr>
<td>C</td>
<td>37</td>
<td>Pressure switch unit</td>
<td>HW1271317-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For A00 (TIIS)</td>
</tr>
<tr>
<td>C</td>
<td>38</td>
<td>Pressure switch unit</td>
<td>HW1271317-K</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For B00 (FM) For E00 (KCs)</td>
</tr>
<tr>
<td>C</td>
<td>39</td>
<td>Pressure switch unit</td>
<td>HW1271317-E</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For C00, C00A (ATEX)</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. When the battery pack is the crimped contact-pin terminals type, prepare the battery pack by referring to the recommended spare parts list.