MOTOMAN-MPX3500
INSTRUCTIONS
FOR EXPLOSION-PROOF SPECIFICATIONS

TYPE
YR-MPX3500-'0' (L-TYPE)
YR-MPX3500-'1' (R-TYPE)

This instruction explains necessary conditions for explosion-proof specifications.
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1 Indications on Electric Equipment

1.1 Explosion-Proof Indication Label and Warning Label

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

Fig.1-1: Explosion-Proof Indication Label

Note 1: The place of production may be replaced with the following address in case it is the ATEX-approved one.
YASKAWA Europe GmbH
Yaskawastr.1, D-85391
Allershausen Germany

Note 2: This part may be replaced with the following one.

<table>
<thead>
<tr>
<th>Model Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>M0 M1 M2</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
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<td>44</td>
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<tr>
<td>45</td>
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<tr>
<td>46</td>
</tr>
<tr>
<td>47</td>
</tr>
<tr>
<td>48</td>
</tr>
</tbody>
</table>

Note: This part may be replaced with the following one.
Indications on Electric Equipment

1.1 Explosion-Proof Indication Label and Warning Label

![Diagram of MPX3500 Explosion-Proof Label]

**Fig.1-2: Warning Label**

- **Battery Warning Label**
  - Battery type:
    - HW1470715-S (for S-, L-axes)
    - HW1470715-T (for U-, R-axes)
    - HW1470715-U (for B-, T-axes)
    - HW1470715-V (for external axis)
  - Battery manufacturer: Yaskawa Electric Corporation

- **Warning Label A**
  - Warning: Moving parts may cause injury
  - Do not enter robot work area.

- **Warning Label B**
  - Warning: Moving parts may cause injury
  - Do not enter robot work area.

When replacing battery instructions are to be followed. Battery only to be replaced when the area is known to be safe. Do not change any Parameters.

Explosion-proof safety Device
1.2 Standards

The manipulator meets the following requirements:

- Directive 94/9/EC for equipment and protective systems for proper use in hazardous areas
- IEC60079-0: 2011 for electrical apparatus for explosive gas atmospheres - Part 0: General requirements
- Machinery Directive 2006/42/EC
- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- EN 1127-1 and EN 13463-1 for hazardous areas

When classifying a manipulator environment as a hazardous area (zone), observe the “Guidelines for the Avoidance of Dangers due to Explosive Atmospheres with Collection of Examples - Explosion Protection Guidelines - (EX-Directives)”.

In special cases, or if you are not sure about the specification of areas with the risk of explosion, contact the competent authorities or Yaskawa and have them decide.

1.3 Customer Service, Repairs and Modifications

Only have repairs to the manipulator carried out by the Yaskawa Customer Service responsible.

Use only genuine parts from Yaskawa for maintenance work.

Yaskawa is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product’s warranty.

Any modification of the MPX3500 itself, and of the following system components is strictly prohibited:

- Explosion-proof devices and system installation
- Safeguards and the safety devices mounted on these safeguards
- Emergency stop button and other safety devices
- Manipulator control system such as the DX200, the manipulator handling drive section and the power transmission section
1.4 Use in Hazardous Areas

In hazardous areas (zones), only operate motor units of the corresponding equipment category and temperature class. The motor unit has the following explosion protection marking:

Table 1-1: Explosion Protection Marking for Gas Hazards

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symbol for explosion-proof devices</td>
</tr>
<tr>
<td>II</td>
<td>Equipment group</td>
</tr>
<tr>
<td>2G</td>
<td>Equipment category for gas</td>
</tr>
<tr>
<td>px</td>
<td>Type of protection</td>
</tr>
<tr>
<td>IIIC</td>
<td>Gas group</td>
</tr>
<tr>
<td>T4</td>
<td>Temperature class</td>
</tr>
<tr>
<td>Gb</td>
<td>Equipment protection level for gases</td>
</tr>
</tbody>
</table>

Table 1-2: Explosion Protection Marking for Dust Hazards

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symbol for explosion-proof devices</td>
</tr>
<tr>
<td>II</td>
<td>Equipment group</td>
</tr>
<tr>
<td>p</td>
<td>Type of protection</td>
</tr>
<tr>
<td>2D</td>
<td>Equipment category for dust</td>
</tr>
<tr>
<td>IIIC</td>
<td>Dust group</td>
</tr>
<tr>
<td>T135°C</td>
<td>Maximum permissible surface temperature: 135°C</td>
</tr>
<tr>
<td>Db</td>
<td>Equipment protection level for dusts</td>
</tr>
</tbody>
</table>

1.4.1 Special Conditions For Safe Use

All equipment fitted to the enclosure shall be suitably ATEX certified and shall be installed in accordance with EN 60079-14.

Avoid the build up of dust on the enclosures.

Perform the following routine tests after the installation:

- Verify the operation of the safety devices (functional test).
- Confirm that on loss of purge and pressure the enclosure is electrically isolated.
- Record all tests.
1.5 Explanations of Explosion Protection Marking

1.5.1 Equipment Groups

1.5.1.1 Equipment Group I

Equipment group I applies to products for use in underground plants of mines and their above-ground systems which can be endangered by methane and/or flammable dusts.

1.5.1.2 Equipment Group II

Equipment group II applies to products for use in the remaining areas which can be endangered by an explosive atmosphere.

1.5.2 Equipment Categories

The equipment category describes the frequency and duration of the occurrence of explosive atmospheres in an area.

Table 1-3: Equipment Categories for Gases

<table>
<thead>
<tr>
<th>Equipment category</th>
<th>Description (in accordance with EN 1127-1)</th>
<th>Design safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1G</td>
<td>Areas in which it is to be expected that a mixture of air and flammable substances in the form of gas, vapor or mist will occur constantly, over longer periods or frequently (zone 0 area, equipment protection level Ga in accordance with IEC60079-0:2012).</td>
<td>Very high</td>
</tr>
<tr>
<td>2G</td>
<td>Areas in which it is to be expected that a mixture of air and flammable substances in the form of gas, vapor or mist will occur occasionally (zone 1 area, equipment protection level Gb in accordance with IEC60079-0:2012).</td>
<td>High</td>
</tr>
<tr>
<td>3G</td>
<td>Areas in which it is not to be expected that a mixture of air and flammable substances in the form of gas, vapor or mist will occur. However, if it does occur, then only seldom and only briefly (zone 2 area, equipment protection level Gc in accordance with IEC60079-0:2012).</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Table 1-4: Equipment Categories for Dusts or Flyings and Fibres

<table>
<thead>
<tr>
<th>Equipment category</th>
<th>Description (in accordance with EN 1127-1)</th>
<th>Design safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1D</td>
<td>Areas in which it is to be expected that a cloud of combustible dust in the air will occur constantly, over longer periods or frequently (zone 20 area, equipment protection level Da in accordance with IEC60079-0:2012).</td>
<td>Very high</td>
</tr>
<tr>
<td>2D</td>
<td>Areas in which it is to be expected that a cloud of combustible dust in the air will occur occasionally (zone 21 area, equipment protection level Db in accordance with IEC60079-0:2012).</td>
<td>High</td>
</tr>
<tr>
<td>3D</td>
<td>Areas in which it is not to be expected that a cloud of combustible dust in the air will occur. However, if it does occur, then only seldom and only briefly (zone 22 area, equipment protection level Dc in accordance with IEC60079-0:2012).</td>
<td>Normal</td>
</tr>
</tbody>
</table>
1.5.3 Types of Protection

Table 1-5: Types of Protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>Gas - Flameproof enclosures in accordance with IEC 60079-1</td>
</tr>
<tr>
<td>p</td>
<td>Gas - Pressurized enclosures in accordance with IEC 60079-2</td>
</tr>
<tr>
<td>q</td>
<td>Gas - Protection by powder filling in accordance with IEC 60079-5</td>
</tr>
<tr>
<td>0</td>
<td>Gas - Protection by oil immersion in accordance with IEC 60079-6</td>
</tr>
<tr>
<td>e</td>
<td>Gas - Increased safety in accordance with IEC 60079-7</td>
</tr>
<tr>
<td>j</td>
<td>Gas - Intrinsic safety in accordance with IEC 60079-11 and IEC 60079-27</td>
</tr>
<tr>
<td>n</td>
<td>Gas - Type of protection in accordance with IEC 60079-15 and IEC 60079-27</td>
</tr>
<tr>
<td>m</td>
<td>Gas and dust - Encapsulation in accordance with IEC 60079-18</td>
</tr>
<tr>
<td>s</td>
<td>Special protection in accordance with IEC 60079-33</td>
</tr>
</tbody>
</table>

The types of protection are subdivided into several sub-classes. Refer to the corresponding standards for detailed information.

1.5.4 Explosion Groups

1.5.4.1 Gas explosion Groups

Flammable gases and vapors are classified according to gas explosion groups (IIA, IIB, IIC and I) and temperature classes. Table 1-6 "Gas Explosion Groups" shows the classification of the most common flammable gases and vapors.

Table 1-6: Gas Explosion Groups

<table>
<thead>
<tr>
<th>Type</th>
<th>IIA</th>
<th>IIB</th>
<th>IIC</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Acetone, Ethane, Ethyl acetate, Ammonia, Ethyl chloride, Benene, Acetic acid, Carbon monoxide, Methanol, Methyl chloride, Naphthalene, Phenol, Propane, Toluene</td>
<td>Natural gas</td>
<td>Hydrogen</td>
<td>Methane</td>
</tr>
<tr>
<td>T2</td>
<td>n-Amyl acetate, n-Butane, n-Butyl alcohol, Cyclohexanon, 1,2-Dichloroethane, Acetic acid-anhydride</td>
<td>Ethylene, Ethyl alcohol</td>
<td>Acetylene</td>
<td>-</td>
</tr>
<tr>
<td>T3</td>
<td>Gasoline, Diesel fuel, Jet fuel, Heating oil, n-Hexane</td>
<td>Hydrogen sulfide</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T4</td>
<td>Acetaldehyde</td>
<td>Ethyl ether</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>T8</td>
<td>-</td>
<td>-</td>
<td>Carbon disulfide</td>
<td>-</td>
</tr>
</tbody>
</table>
1.5.4.2 Dust Explosion Groups

Explosive dust atmospheres are classified according to dust explosion groups (IIIA, IIIB and IIC).

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIIA</td>
<td>Combustible flyings</td>
</tr>
<tr>
<td>IIIB</td>
<td>Non-conductive dust</td>
</tr>
<tr>
<td>IIC</td>
<td>Conductive dust</td>
</tr>
</tbody>
</table>

1.5.5 Temperature Classes

1.5.5.1 Maximum Surface Temperature

The maximum surface temperature is the highest temperature reached by a manipulator’s surface under the most unfavorable conditions.

1.5.5.2 Ignition Temperature

The maximum manipulator surface temperature must always be lower than the lowest ignition temperature of the gas or vapor-air mixture in which it is used.

1.5.5.3 Temperature Class

The maximum surface temperature results from the manipulator’s design and is specified as the temperature class.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>450 (°C)</td>
</tr>
<tr>
<td>T2</td>
<td>300 (°C)</td>
</tr>
<tr>
<td>T3</td>
<td>200 (°C)</td>
</tr>
<tr>
<td>T4</td>
<td>135 (°C)</td>
</tr>
<tr>
<td>T5</td>
<td>100 (°C)</td>
</tr>
<tr>
<td>T6</td>
<td>85 (°C)</td>
</tr>
</tbody>
</table>
2 System Configuration

Fig. 2-1(a): System Configuration (MPX3500-*0*)
Fig. 2-1(b): System Configuration (MPX3500-*1*)

Hazardous Location

- Conveyor switch (optional)
- Solenoid valve (optional)
- Master valve
- Pressure switch unit
- Air supply (0.55MPa-0.65MPa)

Non-Hazardous Location

- Program selector (optional)
- Intrinsically safe cable (1 or 2 cables)
- Programming Pendant (not explosion proof)
- Paint unit
- Robot controller (DX200)
- Power supply 3-phase AC200/220V 50/60Hz
- Grounding resistance 100 or less
- Dedicated cables (1 cable) (Cable for painting machine) (optional)

Notes:
- Programming Pendant and the controller number should be the same.
- Non-Hazardous Location

MODEL: MOTOMAN

MASS: kg

PAYLOAD: kg

SERIAL NO.: NJ3247

YASKAWA ELECTRIC CORPORATION
MADE IN JAPAN

2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004 Japan

VIGOGREASE

ORDER: NJ1530

THE MANIPULATOR AND THE CONTROLLER NO. SHOULD HAVE SAME NUMBER.
2 System Configuration

2.1 Manipulator

The Fig. 2-1(a “System Configuration (MPX3500-*0*)” and Fig. 2-2(b “Dimensions and P-point Maximum Envelope (MPX3500-*1*)” show the dimensions and the range of motion of the MPX3500.

The explosion-proof manipulator can be installed in hazardous locations such as in the painting booth. For painting, a spray gun is mounted on the end of the wrist with special fixtures.

The Fig. 2-2(a “Dimensions and P-point Maximum Envelope (MPX3500-*0*)” and Fig. 2-2(b “Dimensions and P-point Maximum Envelope (MPX3500-*1*)” show the dimensions and the range of motion of the MX3500. The manipulator is driven by the servo motors in vertically articulated operation mode with 6 degrees of freedom on the manipulator base. The motion of the manipulator is made by six axes:

The three main axes are used for positioning the spray gun: the S-axis which turns the arm, the L-axis which moves the arm left and right, and the U-axis which moves the arm up and down.

The three wrist axes are used for changing the direction of the spray gun: the R-, B-, and T-axes.

The range of motion shown in Fig. 2-2(a) and Fig. 2-2(b) is that of the wrist axis center P-point that is made by the combination of the motions of the three main axes.

DANGER

When taking safety precautions, consider the range of motion of the manipulator shown in Fig. 2-2(a) and Fig. 2-2(b).
### 2.1 Manipulator

#### 2.1.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YR-MPX3500-<em>0</em></th>
<th>YR-MPX3500-<em>1</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>15 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability**</td>
<td>± 0.15 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>+150° - - 150°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>+140° - - 65°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>+90° - - 65°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>± 720°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>± 720°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>± 720°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>1.7 rad/s, 100 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-axis</td>
<td>1.7 rad/s, 100 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>1.9 rad/s, 110 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>5.2 rad/s, 300 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>6.2 rad/s, 360 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>6.2 rad/s, 360 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable Moment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>93.2 Nm (9.5 kgf·m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>58.8 Nm (6.0 kgf·m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>19.6 Nm (2.0 kgf·m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>590 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective Structure</td>
<td>Basic axis: IP4X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrist axis only: IP67 or equivalent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to + 40 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80 %RH (non-condensing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>Less than 4.91 m/s² (0.5 G)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Free from excessive electrical noise (plasma)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td>3.5 kVA**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1. SI units are used in this table. However, gravitational unit is used in ().
2. Conformed to ISO9283.
3. Differs depending on the motion pattern.
Fig. 2-2(a): Dimensions and P-point Maximum Envelope (MPX3500-"0")

L-axis range of motion: -65° to +115°
S-axis range of motion: 35° to +150°
Limited range of motion within ( )

Manipulator Base Dimensions

Units: mm
Fig. 2-2(b): Dimensions and P-point Maximum Envelope (MPX3500-*1*)

Fig. 2-2(b): Dimensions and P-point Maximum Envelope (MPX3500-*1*)

- L-axis range of motion: -65° to +115°
- S-axis range of motion: 35° to +150°
- P-point maximum envelope

- 17.5 dia. (8 holes)
- 212H7 dia. (2 holes)

Units: mm

Manipulator Base Dimensions

2-6

HW1481942
2.2 Robot Controller

The robot controller has a built-in microcomputer that controls all motion of the robot by saving motion signals when teaching and sending these signals to the manipulator. The power unit that supplies power to the manipulator is also built into the robot controller.

**DANGER**

- The power supply of the robot controller is 200/220 VAC. Be sure to turn OFF the primary power supply of the controller before starting maintenance.

Failure to observe this warning may result in electric shock.

2.3 Pressure Switch Unit

The pressure switch unit supplies protective air or gas to the manipulator to prevent explosive gas from entering the manipulator. Usually, the unit is attached to the side of the robot controller.

The circuit diagram and dimensions are shown in Fig. 2-4 "Pressure Switch Unit Air Circuit" and Fig. 2-5 "Pressure Switch Unit External View".

Set the air pressure so that the pressure shown on the pressure gauge of each pressure reducing valve will be within the pressure ranges shown in Fig. 2-4.

As shown in the Fig. 2-6 "Connection Overview", the distance of up to 20 m is allowed between the manipulator and the pressure switch unit. Adjust the length of the air tube (16 dia.) to be as same length as the distance between them.

It is very dangerous to disassemble/remove the pressure switch unit or to operate a robot in the explosive environment after removing the pressure switch unit.

It should be kept free of obstacles around the pressure switch unit for the high air exhausting performance when purging.
2.3 Pressure Switch Unit

**Fig. 2-3: Pressure Switch Unit Location**

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

**WARNING**
Explosion-proof safety Device
Do not change any Parameters.
Fig. 2-4: Pressure Switch Unit Air Circuit

![Air Circuit Diagram]

Fig. 2-5: Pressure Switch Unit External View

![External View Diagram]
This unit can be installed either at the side of the manipulator or point within 20 m between the manipulator and the unit.

Fig. 2-6: Connection Overview
3 Installation

3.1 Requirements

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

Table 3-1: Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
<td>3-phase 200 VAC 50/60 Hz (+10 to -15%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 VAC 60 Hz (+10 to -15%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5 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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capacity:</td>
<td>construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For pressurized type of explosion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>protected construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 N/min during operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 N/min when 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 ohm or less</td>
<td>For the robot controller</td>
</tr>
</tbody>
</table>

CAUTION

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

### Table 3-2: 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>85%RH</td>
</tr>
<tr>
<td>Controller (not explosion-proof)</td>
<td>✗</td>
<td>✗</td>
<td>0 to 45 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Pressure Switch unit (explosion-proof)</td>
<td>✗</td>
<td>✗</td>
<td>0 to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (not explosion-proof)</td>
<td>✗</td>
<td>✗</td>
<td>0 to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (explosion-proof) (Option)</td>
<td>✗</td>
<td>✗</td>
<td>0 to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Conveyor speed detector (explosion-proof)</td>
<td>✗</td>
<td>✗</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Conveyor switch (explosion-proof)</td>
<td>✗</td>
<td>✗</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
</tbody>
</table>

**WARNING**

Devices that are not explosion-proof must not be installed in hazardous locations. Failure to observe this warning may result in a fire.
3.3 Transport and Installation

Carry out the operation safely observing the following precautions.

I) Signs indicating prohibitions such as, “The lighting of fires is prohibited”

II) Clean working place that is clearly defined and free of obstacles

III) Appointment of personnel in charge

IV) Company working regulations for safe operation

3.3.1 Preparation

Before installing the MOTOMAN, do the following:

I) Confirm the installation layout and the dimensions of each device to ensure the transportation route and the installation space.

II) Check if the transportation route can support the weight of each device. If necessary, reinforce the route.

III) To lift the manipulator, use the appropriate machinery such as a forklift.
3.3.2 Receiving

When the package arrives, check the contents. Are the items and quantities in accordance with your order sheet? Was any damage incurred during shipment?

**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.

*Fig. 3-1: Location of Order Number Labels*
### 3.3.3 Installation

**WARNING**

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

**CAUTION**

- Do not install or operate a manipulator that is damaged or lacks parts. Failure to observe this caution may cause injury or damage.
- Do not install the paint gun and the gun brackets until the manipulator is firmly anchored. Any contact to the unstable manipulator 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.
3.3.3.1 Installation of Safeguarding

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

Responsibility for Safeguarding (ISO 10218)

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

Mounting Procedures for Manipulator Base

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

Construct a solid foundation with the appropriate thickness to withstand maximum repulsion force of the manipulator. (Refer to Table 3-3 "Maximum Repulsion Force of the Manipulator at Emergency Stop").

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

For installation, refer to section 3.3.3.2 "Mounting the Manipulator on the Baseplate".

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

<table>
<thead>
<tr>
<th></th>
<th>Floor-, and Ceiling mounted type</th>
<th>Wall-mounted type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque in horizontal rotation</td>
<td>31400 N·m (3200 kgf·m)</td>
<td>31400 N·m (3200 kgf·m)</td>
</tr>
<tr>
<td>Maximum torque in vertical rotation</td>
<td>46100 N·m (4700 kgf·m)</td>
<td>61000 N·m (6200 kgf·m)</td>
</tr>
</tbody>
</table>

3.3.3.2 Mounting the Manipulator on the Baseplate

The baseplate should be rugged and durable to withstand maximum repulsion force of the manipulator and to ensure that the manipulator and fixture are in the correct relative position. The thickness of the baseplate is 40 mm or more and an M20 size or larger anchor bolt is recommended.

Fix the manipulator base to the baseplate with the hexagon socket head cap screws M20 (8 screws, length of 80 mm or more is recommended) using mounting holes on the manipulator base.

Tighten the hexagon socket head cap screws and anchor bolts securely so that they will not work loose during operation.
Fig. 3-2(a): Mounting the Manipulator on the Baseplate (MPX3500-0*)

Hexagon socket head cap screw M16 (8 screws)
(Tightening strength: 1200N/mm or more)
(Tightening torque: 206 N·m (21 kgf·m))

Hexagon socket head cap screw M20 (6 screws)
(Tightening strength: 2000N/mm or more)
(Tightening torque: 402 N·m (41 kgf·m))

Manipulator base
Washer
Spring washer

Floor-Mounted Type

Wall-Mounted Type-1

Wall-Mounted Type-2

Ceiling-Mounted Type

Unit:mm

Manipulator base
0.5mm or less
Flatness

Anchor bolt
M20 or larger

Baseplate

Anchor bolt
M20 or larger

Baseplate

Anchor bolt
M20 or larger

Baseplate

Manipulator base
0.5mm or less
Flatness

Floor-Mounted Type

Wall-Mounted Type-1

Wall-Mounted Type-2

Ceiling-Mounted Type
3.3 Transport and Installation

Fig. 3-2(b): Mounting the Manipulator on the Baseplate (MPX3500-*1*)
3. The following postures are initial postures at each installation method.

Fig. 3-3: Initial Posture

- Installed on the floor
- Installed on the wall
- Installed on the ceiling
3.3.3 Location

When installing the manipulator, satisfy the following environmental conditions.

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

3.3.4 Controller and Programming Pendant

- The controller and the programming pendant are not explosion-proof (the explosion-proof programming pendant is available as an option). Never install the controller and the programming pendant that are not explosion-proof in a hazardous location.
- Keep a minimum space of 60 cm around the controller for maintenance. When the sufficient space is not available, provide equipment for maintenance such as a drawing-out system.
- An exhaust fan is provided on the back of the controller. Keep enough space behind the controller so that air can be exhausted properly.
- Do not install the controller and programming pendant close to any noise source such as the power supply for other devices.
- Install the controller in a location where the optimum atmosphere, temperature, and humidity are assured and provide protection against water drops or thinner. If necessary, install a control room to supply clean and temperature-controlled air.

3.3.5 Safety Devices

The standard safety devices are listed below. Refer to the instructions for connecting safety devices required for your system application.

Install each device considering each function.

- Emergency stop switches
- Safety plugs
- Limit switches
- Flashing lights
- Indicator lamps
- Photoelectric intrusion detecting switches
4 Connection

4.1 Wiring

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.

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.

4.1.1 Grounding

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

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

The grounding methods differ depending on the system application. Refer to the connection instructions that are provided separately.
Fig. 4-1: Grounding Method

View from A

View from B
4.2 Cable Connection

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

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

1. Connect the power cable connector to the connector base. (Check the reference sticker)
2. Connect the grounding cable of the power cable to the grounding cable connecting tap.
3. In case the built-in tube for painting is used, connect the tube to the power cable joint.
4. Attach the gasket side of the power cable to the base after checking that no tube is going to be bent, and then tighten it with the hexagon socket head cap screws.

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.

Fig. 4-2(a): Manipulator Internal Cable Connection (MPX3500-“0”)
Fig. 4-2(b): Manipulator Internal Cable Connection (MPX3500-*1*)

- Cross-recessed head cap screw M5
- Plain washers
- Spring lock washers
- Hexagon socket head cap screw M6
- Conical spring washer 2H-6
- Tensioning torque 10 N·m (1.0 kgf·m)

Use following parts for grounding the power cable:

- Hexagon socket head cap screw M6
- Conical spring washer 2H-6
- Tensioning torque 10 N·m (1.0 kgf·m)
- Plain washers
- Spring lock washers

Grounding line connecting tap

Channel Position

Cover

Gasket

Reference sticker

B

View B

Channel Position
Fig. 4-3: Power Supply Cable Connection to the DX200

- Connector 1BC-1.2,3,4,5,6 X11
- Connector 2BC-A,B,C,D,E,F,X21
- Connector 3BC-1,2,3,5
- Connector 4BC-1,2,3,4

Connect to the grounding tap

- Connector XS1 XS2
- Connector J31 J32
- Connector X11 X21

Cable gland

Manipulator

 DX200
4 Connection

4.2 Cable Connection

Fig. 4-4: Air Hose Connection

MPX3500-"0"

MPX3500-"1"
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 bled with shield separately.

2) Cable connection

<table>
<thead>
<tr>
<th>Manipulator side</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>

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 connecting the intrinsically safe cable to the insulation barrier in the DX200
     - For terminal block 1 to 2

Cable type (recommended):
- UL2586-SB, 1.25 mm² (SUMIDEN HITACHI CABLE Ltd.)
- For terminal block P1 to N3, and 1 to 2 are different.
- The group of terminal blocks P1 to N3, and 1 to 2 are bled with shield separately.

Recommended terminal:
- 1.25AF2.3B (JST Made)

Intrinsically safe cable:
- For connecting the intrinsically safe cable to the intrinsically safe terminal block
  - For terminal block P1 to 2

Cable connection:
- 3.5 min, 4 max
- 3.7 dia. min

Dimensions:
- 5.3 mm, 4.4 max
- 3.2 dia. min
4.3 Internal Connection

Fig. 4-6(a): Internal Connection Diagram
Fig. 4-6(b): Internal Connection Diagram
5 Operation (Initial start-up Included)

5.1 Enclosure Protection Sequence.

Fig. 5-1(a): Enclosure Protection Flow Chart

Flow Chart on Enclosure Protection Sequence
Our enclosure protection sequence is composed of the following four modes.
1. Preparation Mode
2. Purging Mode
3. Operation Mode
4. Abnormal pressure Mode

Preparation Mode START

- Supply the protective gas after the inspection.
- Inspect the bolting, etc.
- Inspect the insulation of the enclosure.
- Inspect the tightness of the enclosure.
- Any damages of the enclosure should not be allowed.

Check the setting values of the pressure switch unit.
- Malfunctions such as master valves, etc.
- Air leakage at connections
- Check the pressure switch unit
- Change the setting values within the values shown in the left
- Change the pressure switch unit
- Change the setting values with in the values shown in the left

Start supplying the protective gas into the pressure switch unit.
The protective gas is regulated in proper values by the reducer valve, then supplied to the manipulator.

Repair
- Repair
- Reconnect the tubes for covers
- Change the enclosure
- Repair
- Reconnect the tubes for covers
- Change the enclosure

4. Abnormal pressure Mode
3. Operation Mode
2. Purging Mode
1. Preparation Mode

Our enclosure protection sequence is composed of the following four modes.

- Preparation Mode
- Purging Mode
- Operation Mode
- Abnormal pressure Mode

Preparation Mode

- Change the setting values of the pressure switch unit.
- Check the setting values within the values shown in the left.

Turn ON the breaker of the controller by manual.
- Purging mode is simultaneously ready to start by turning the power ON.
- Turn ON the breaker of the controller by manual.
- Purging mode is simultaneously ready to start by turning the power ON.
5 Operation (Initial start-up Included)

5.1 Enclosure Protection Sequence.

Fig. 5-1(b): Enclosure Protection Flow Chart

- **Abnormal Pressure Mode**
  - Turn the breaker OFF by manual.
  - Stop supplying the protective gas into the pressure switch unit.

- **Purging Mode**
  - Switch Purging Mode to Operation Mode after executing the following steps:
    1. Switch the purging press to the operation.
    2. Close the master valve.
    3. Display "Purging Completion" on the programming pendant.
    4. Supply power will be available to motors, brakes and painting device.

- **Start counting the purging time (four minutes)**
  - Did two minutes pass since the purging mode started?
  - Did the flow rate reach 390l/min with 35kPa or more of purging air pressure?

- **Inspected**
  - Did four minutes pass since the purging mode started?
  - Is the flow rate keeping 390l/min with 35kPa or more of purging air pressure?

- **Execute Abnormal Pressure Mode**
  - Abnormal purging
  - The servo unit, encoder and painting unit power sources are automatically shut down and the master valve is automatically and automatically opened, then the protective gas is released.
  - "Abnormal Purging" is displayed on the programming pendant and the alarm lamp on the controller is lit.

After this, the mode is switched to Operation Mode.
5. Operation (Initial start-up Included)

5.1 Enclosure Protection Sequence.

*Abnormal Pressure Mode*

1. Abnormal pressure (LOW)
   If the pressure in protective gas line dropped and the detectors (PS1-1 and/or PS1-2) were opened, the servo unit-, encoder- and painting unit-power sources are automatically shut down by the hardware circuitry (power control circuitry, purging control relay and encoder separation substrate OFF).
   The Abnormal Pressure (LOW) occurred during Purging Mode, the master valve is automatically shut off to prevent from the dangerous gas coming from outside.
   "Abnormal Pressure (LOW)" is displayed on the programming pendant and the alarm lamp on the controller is lit.

2. Abnormal pressure (HIGH)
   If the pressure in protective gas line rose and the pressure detectors (PS2-1 and/or PS2-2) were opened, the servo unit-, encoder- and painting unit-power sources are automatically shut down by the hardware circuitry (power control circuitry, purging control relay and encoder separation substrate OFF), and the master valve is simultaneously opened, then the purging gas is released.
   "Abnormal Pressure (HIGH)" is displayed on the programming pendant and the alarm lamp on the controller is lit.

3. Abnormal purging
   During the purging, if the pressure in protective gas line is dropped and the detector (PS3) were opened, the servo unit-, encoder- and painting unit-power sources are automatically shut down by the hardware circuitry (power control circuitry, purging control relay, and encoder separation substrate OFF), and the master valve is simultaneously and automatically opened, then the purging gas is released.
   "Abnormal Purging" is displayed on the programming pendant and the alarm lamp on the controller is lit.
# 6 Frequent Inspections

Table 6-1: Frequent Inspections  (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Item</th>
<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>Manipulator</td>
<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></td>
<td>2</td>
<td>Motion</td>
<td>Smooth tuning, horizontal, and vertical motions of each arm. The robot's home position does not change.</td>
<td></td>
<td>⚫</td>
<td>WARNING Do not enter the robot working envelope.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Noise and vibration during operation</td>
<td>No abnormal noise and vibration during robot operation.</td>
<td></td>
<td>⚫</td>
<td>WARNING Do not enter the robot working envelope.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Tubes</td>
<td>Off or no severe wear and tear on paint and air supply tubes.</td>
<td></td>
<td>⚫</td>
<td>CAUTION Use a pair of protective glasses to protect your eyes against paint or thinner that is being removed.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Air leakage</td>
<td>No excessive air leakage from the fitting of the motor case.</td>
<td></td>
<td>⚫</td>
<td>CAUTION Make sure that the air tube is firmly inserted in the joint. Accidental disconnection of the air tube may cause injury.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Dried paint</td>
<td>Remove the dried paint on the robot.</td>
<td></td>
<td>⚫</td>
<td>CAUTION When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
<tr>
<td>Pressure Switch Unit</td>
<td>1</td>
<td>Pressure set value</td>
<td>The pressure of the pressure reducing valve is within the specified range</td>
<td></td>
<td>⚫</td>
<td>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>
# Frequent Inspections

Table 6-1: Frequent Inspections  (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Item</th>
<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>Safety Devices</td>
<td>1</td>
<td>Operation of emergency stop button and safety plug.</td>
<td>1. The manipulator stops immediately when the emergency stop button is pressed.</td>
<td>●</td>
<td></td>
<td>CAUTION Inspect the robot while it is in its standby position and not in motion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dried paint</td>
<td>2. The manipulator stops immediately when the safety plug is pulled out.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Remove the dried paint on the emergency stop button and the safety plug.</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Operation of the photoelectric intrusion detecting switch.</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>Dried paint</td>
<td>2. Remove the dried paint on the light beam detector.</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Operation of limit switch.</td>
<td>1. Normal operation of the limit switch</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dried paint</td>
<td>2. Remove the dried paint on the limit switch.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td>1</td>
<td>Operation of the gun tilt switching</td>
<td>The gun tilt changes correctly when air is supplied.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Operation of the shear pin system</td>
<td>1. The manipulator stops immediately when the shear pin is sheared.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. The test valve is closed and the tube is not broken.</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>
# 7 Maintenance and Inspection

## Table 7-1: Inspection Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Remark</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Daily</td>
<td></td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Stop the manipulator for this inspection.</td>
</tr>
<tr>
<td>2</td>
<td>1000H Cycle</td>
<td></td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Stop the manipulator for this inspection.</td>
</tr>
<tr>
<td>3</td>
<td>6000H Cycle</td>
<td>Visual</td>
<td>Visual Check for grease leakage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>12000H Cycle</td>
<td>Visual</td>
<td>Visual Check for filter clogging.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>36000H Cycle</td>
<td></td>
<td>Visual</td>
<td>Check for wear or tear. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Visual</td>
<td>Multi-meter</td>
<td>Check conduction between the main connector of the base and the intermediate connector with manually shaking the wire. Check for wear on the protective spring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Visual</td>
<td>Multi-meter</td>
<td>Check the conduction between terminals. Check for wear on the protective spring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Replace the battery unit when the battery alarm occurs or the manipulator drove for 36000H.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7-1: Inspection Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 S-, L-, and U-axis speed reducers</td>
<td>6000HCycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease4 (6000H cycle). Replace grease4 (12000H cycle).</td>
<td>● ●</td>
</tr>
<tr>
<td>12 R-, B-, and T-axis speed reducers</td>
<td>6000HCycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease4 (6000H cycle).</td>
<td>● ●</td>
</tr>
<tr>
<td>13 Wrist gear</td>
<td></td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease4 (6000H cycle).</td>
<td>● ●</td>
</tr>
<tr>
<td>14 Pressure switch unit</td>
<td></td>
<td></td>
<td>Confirm that the pressure switch, flow switch, solenoid valve and the pressure reducing valve operate correctly. Contact your Yaskawa representatives.</td>
<td>● ●</td>
</tr>
<tr>
<td>15 Overhaul</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>

1 The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your Yaskawa representative.
2 When checking for conduction with multimeter, connect the battery to "BAT" and "OBT" of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position data may be lost.
3 Internal cables to be replaced at 24000H inspection
4 For the grease, refer to your Yaskawa representative.
YASKAWA

MOTOMAN-MPX3500
INSTRUCTIONS
FOR EXPLOSION-PROOF SPECIFICATIONS

Specifications are subject to change without notice for ongoing product modifications and improvements.