MOTOMAN-MPX1150 INSTRUCTIONS

TYPE:
YR-MPX1150-‘00 (STANDARD SPECIFICATION)

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

MOTOMAN INSTRUCTIONS
MOTOMAN-MPX1150 INSTRUCTIONS
MOTOMAN-MPX1150 MAINTENANCE MANUAL
INSTRUCTIONS FOR EXPLOSION-PROOF SPECIFICATIONS
DX200 INSTRUCTIONS
DX200 OPERATOR'S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

Please have the following information available when contacting Yaskawa Customer Support:
- System
- Primary Application
- Software Version (Located on Programming Pendant by selecting:
  (Main Menu) - (System Info) - (Version))
- Robot Serial Number (Located on robot data plate)
- Robot Sales Order Number (Located on controller data plate)

Part Number: 181014-1CD
Revision: 4

MANUAL NO. HW1483974 1/126
MANDATORY

• This instruction manual is intended to explain mainly on the
  mechanical part of the MOTOMAN-MPX1150 for the application to
  the actual operation and for proper maintenance and inspection. It
  describes on safety and handling, details on specifications,
  necessary items on maintenance and inspection, to explain
  operating instructions and maintenance procedures. Be sure to
  read and understand this instruction manual thoroughly before
  installing and operating the manipulator.

• General items related to safety are listed in the Chapter 1: Safety of
  the DX200 instructions. To ensure correct and safe operation,
  carefully read the DX200 instructions before reading this manual.

CAUTION

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

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

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

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

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

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

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

**DANGER**

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

**WARNING**

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

**CAUTION**

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

**MANDATORY**

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

**PROHIBITED**

Must never be performed.

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

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

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

**DANGER**

- Maintenance and inspection must be performed by specified personnel.
- Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your YASKAWA representative.
- Do not remove the motor, and do not release the brake.
- Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator’s arm.
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</td>
<td>Manipulator cable</td>
</tr>
<tr>
<td>the controller</td>
<td></td>
</tr>
</tbody>
</table>

Registered Trademark

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

Warning labels are attached on the manipulator body. Always follow the warnings on the labels. Also, identification labels with important information are placed on the body of the manipulator. Prior to operating the manipulator, thoroughly understand the contents of the label.
Fig. : Explosion-Proof Indication Label (TIIS)

<table>
<thead>
<tr>
<th>型式</th>
<th>YR-MPX1150-A00</th>
</tr>
</thead>
<tbody>
<tr>
<td>割損品番</td>
<td>マニピュレータ</td>
</tr>
<tr>
<td>萬属ユニット</td>
<td>B T4 Gb/Ex ib B T4 Gb (Ex ib B)</td>
</tr>
</tbody>
</table>

シールNo：

オーダNo：

定格

マニピュレータ

最大電圧：

AC220V (-15%,+10%) 50/60Hz

最大電流：

2.9 A

最大容量：

1.3 KW

滑面温度：

0℃～40℃

マニピュレータ：

0℃～40℃

壁面ユニット：

本安電路

バッテリパックアップ回路：

DC4.5V 37.9mA

非本安回路

許容電圧：

AC250V 50/60Hz, DC250V

保護ガスの最小供給流量：

220 L/min

隔離時の設定圧力範囲：

0.30～0.52 MPa

保護ガスの最小流量：

15 NL/min

最大取扱い量：

15 NL/min

最大内圧：

5 kPa

運用時の設定圧力範囲：

0.01～0.02 MPa

内圧保護システム

内圧保護システムに加える最大内圧力：

0.35 MPa

内圧保護システムに加える最大供給圧力：

0.65 MPa

ルーチン試験：

合格

警告

1. マニピュレータ、リレーパラ、接続パラ及びエンコーダ分解基板（壁面ユニット内蔵）は

本体安全防爆構造及び内圧防爆構造の組合せ構造ですが、構成換装、配線等を変更または

改造しないで下さい。

2. バッテリパックアップ回路は、バッテリユニット、位置検出器、エンコーダ分解基板から

構成され、製造装置の電源遮断時、または授受中に本安回路となります。

3. 壁面ユニットの接続はD形接続工事に準じて行って下さい。

4. リレーパラ、接続パラ及びエンコーダ分解基板（壁面ユニット内蔵）は非安標場所に設置

して下さい。

5. バッテリの交換は、発爆性雰囲気の恐れが無い状態を確認して行って下さい。

6. 発爆性雰囲気が存在するおそれのあるときはカバーを開けないで下さい。

7. これは、内圧容器となります。

8. 取扱説明書を参照下さい。

9. 接続または電源供給を再開する前に、この容器からすべてのホイリを取り除いて

下さい。

株式会社 安川電機

vii

HW1483974 7/126
Fig. : Explosion-Proof Indication Label (FM)

TYPE X PRESSURIZATION FOR:
CLASS I, DIVISION 1, GROUPS C,D, T4, Ta=0-40°C
CLASS I, ZONE 1, AExEx ia px IIB Gb, T4, Ta=0-40°C
FM APPROVALS CERTIFICATE NUMBER : FM17US0147
FM17CA0078

PER YASKAWA ELECTRIC DRAWING HW1385331 HW1385333
MANUFACTURER: YASKAWA ELECTRIC CORPORATION.
ADDRESS : 2-1 SHIROISHI KUROSAKI YAHATANISHI-KU
KITAKYUSHU-CITY FUKUOKA 806-0004 JAPAN
MANIPULATOR : MODEL YR-MPX1150-B00
SERIAL No. :

Minimum Purging Flow Rate: 220 L/min
Minimum Purging Duration : 3 min
Minimum Overpressure : 5 kPa
Maximum Overpressure : 50 kPa
Minimum Supply Pressure : 0.35 MPa
Maximum Supply Pressure : 0.65 MPa
Maximum Leakage Rate : 15 NL/min

"WARNING"
"ENCLOSURE SHALL NOT BE OPENED UNLESS THE AREA IS
KNOWN TO BE NONHAZARDOUS. OR UNLESS ALL DEVICES WITHIN
HAVE BEEN DE-ENERGIZED.
POWER SHALL NOT BE RESTORED AFTER THE ENCLOSURE HAS
BEEN OPENED UNTIL THE ENCLOSURE HAS BEEN PURGED FOR
3 MINUTES."

"AVERTISSEMENT"
"LE BOITIER NE DOIT PAS ETRE OUVERT SAUF SI LA PLACE EST
CONNU D'ETRE SANS DANGER. OU SAUF SI TOUS LES DISPOSITIFS
DEDANS ONT ETE MIS HORS TENSION.
LE COURANT NE DOIT PAS ETRE RESTAURE APRÈS QUE LE BOITIER
A ETE OUVERT JUSQU'A CE QUE L'AIR DANS LE BOITIER A ETE
PURGE PENDANT 3 MINUTES."
**Fig. : Explosion-Proof Indication Label (ATEX)**

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**YASKAWA ELECTRIC CORPORATION**

[Address Information]

**WARNINGs:**

- Do not make any changes of the equipment and wiring in the manipulator.
- Relay barrier, isolated barrier and encoder separation board (inside the painting unit) and combination equipment of internal pressure explosion-proof structure.
- Battery backup circuit is consisted of battery unit, position detector and encoder separation board. The circuit is intrinsically safe circuit when the power supply of the Controller is shut down or air purging.
- The painting Unit combined shall be grounded at 100 ohms or less.
- Relay barrier, isolated barrier and encoder separation board shall be installed in a non-hazardous area.
- Pressurized enclosure, do not open when energized.
- Enclosure contains lithium battery.
- Do not open when an explosive atmosphere is present.
- Refer to instructions in the manual before opening.
- Remove all dust from this enclosure before connecting or restoring the electrical supply.

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**Specifications:**

- **Ex ib pXb B T4 Gb/Ex ib B T4 Gb**
- **Comparable to:**
  - **Yaskawastr.1, D-85391 Allershausen Germany**
  - **Note 1** The place of production may be replaced with the following address, it is the ATEX-approved one.
  - **Note 1**
경고

1. 매니퓰레이터, 릴레이 배리어, 절연 배리어 및 엔코더 분리 기판(도장 유닛 내장)은 본질 안전방폭 구조 및 압력 방폭 구조의 조합 기기이므로 구성 기기, 배선 등을 변경 또는 개조하지 마십시오.
2. 배터리 백업 회로는 배터리, 위치 검출기, 엔코더 분리 기판으로 구성되고 제어장치의 전원 차단 시 또는 퍼지(Purge) 중에 본질 안전 회로가 됩니다.
3. 도장 유닛의 접지는D종 접지 공사에 따라 실시하여 주십시오.
4. 배터리 배리어, 절연 배리어 및 엔코더 분리 기판(도장 유닛 내장)은 비 위험 장소에 설치하여 주십시오.
5. 배터리 배리어는 폭발성 분위기의 위험이 없는 상태인지 확인하고 설치하여 주십시오.
6. 폭발성 분위기가 존재할 위험이 있을 때는 커버를 열지 마십시오.
7. 이것은 암약 용기입니다.
8. 취급설명서를 참조하여 주십시오.
9. 접촉 또는 전원 공급을 제개하기 전에 이 용기에서 모든 만지를 제개하여 주십시오.
Warning Labels

Fig.: Locations for the Name Plate and the Warning Label

Manipulator

Pressure Switch Unit

Battery Warning Label

Nameplate

Warning Label A
Warning Label B
(back side)

Battery Warning Label

Nameplate

Warning Label A

Warning Label B

Pressure Switch Unit Warning Label

WARNING
Explosion-proof safety device
Do not change any parameters.
### Fig. : List of Warning Labels and Nameplate

<table>
<thead>
<tr>
<th>Type</th>
<th>YR-MPX1150-A00</th>
<th>YR-MPX1150-B00</th>
<th>YR-MPX1150-C00</th>
<th>YR-MPX1150-E00</th>
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</thead>
<tbody>
<tr>
<td>Nameplate</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Battery Warning Label</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Pressure Switch Unit Warning Label</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Warning Label A</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Warning Label B</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>
Safety Precautions for Painting Manipulator

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

Standards

This manipulator meets the following requirements:

For the details of the standards, refer to "Standards" section in the instruction manual of each manipulator.

- **MOTOMAN-MPX1150 meets the following requirements:**
  - IEC60079-0: for electrical apparatus for explosive gas atmospheres
    - Part 0: General requirements
  - IEC 60079-2: for electrical apparatus for explosive gas atmospheres
    - Part 2: Pressurized enclosures "p"
  - IEC60079-11: for electrical apparatus for explosive gas atmospheres
    - Part 11: Intrinsic safety "i"

In special cases, such that the specification of areas which has a risk of explosion cannot be specified, contact the competent authorities or YASKAWA representative.
Explosion-Proof Structure

The explosion-proof structure of the MOTOMAN-MPX1150 consists of intrinsic safety and inner pressure explosion preventing system.

Following notations show the explosion-proof structure for each country’s explosion-proof standard.

<table>
<thead>
<tr>
<th>Explosion-proof structure</th>
<th>Power ON</th>
<th>Power OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIIS</td>
<td>Ex ib px IIB T4 Gb</td>
<td>Ex ib IIB T4 Gb</td>
</tr>
<tr>
<td>FM (US)</td>
<td>TYPE X pressurization CLASS I, DIVISION 1 GROUPS C,D T4 CLASS I,ZONE1, GROUPS C,D, T4 Ex ia px IIB T4</td>
<td>CLASS I,DIVISION 1 GROUPS C,D, T4 CLASS I,ZONE1, GROUPS C,D, T4</td>
</tr>
<tr>
<td>FM (CA)</td>
<td>TYPE X pressurization CLASS I, DIVISION 1 GROUPS C,D, T4 Gb CLASS I,ZONE1, Ex ia px IIB T4 Gb</td>
<td>CLASS I,DIVISION 1 GROUPS C,D, T4 Gb CLASS I,ZONE1, Ex ia IIB T4 Gb</td>
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<tr>
<td>ATEX/ CAT.2</td>
<td>Ex ib pxb IIB T4 Gb</td>
<td>Ex ib IIB T4 Gb</td>
</tr>
<tr>
<td>KCs</td>
<td>Ex ib px IIB T4</td>
<td>Ex ib IIB T4</td>
</tr>
</tbody>
</table>

**DANGER**

In case installing the MOTOMAN-MPX1150 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-MPX1150, confirm that the manipulator is possible to install in that area.

**DANGER**

The MOTOMAN-MPX1150 is a pressurized explosion-proof apparatus in which high-pressure air is contained. Do not loosen the fixing bolt of the cover on the manipulator when high-pressure air remains inside the manipulator. Failure to observe this instruction may result in serious personal injury. Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.

**PROHIBITED**

Any modification of the MOTOMAN-MPX1150, and the following is strictly prohibited:

1. Explosion-proof devices and system installation
2. Safeguarding and the safety devices mounted on these safeguards
3. Emergency stop button, and other safety devices
4. Robot control system such as the DX200 robot controller, the manipulator drive section and the power transmission section
CAUTION

• Take the following measures when teaching, correcting, inspecting, or adjusting the manipulator when the motor power supply is ON:
  
a) Appoint a personnel to stay beside the emergency stop button of the DX200. And perform the operations holding the programming pendant with the emergency stop button.

  b) Before the operation, verify the correct robot motion and that the emergency stop works.

• Observe the following precautions during an automatic operation:
  
a) Do not enter inside the safeguarding during operation.

  b) Confirm the following before starting the operation:
     • No person is inside the manipulator working envelope.
     • No obstacles such as unnecessary workpieces and tools are inside the manipulator working envelope.
     • The manipulator is in its standby position.

  c) When any abnormality occurs, immediately press the emergency stop button to stop the manipulator.

  d) Before entering inside the manipulator working envelope, be sure to stop the manipulator and turn OFF the main power supply to the DX200.

• Brake release (Optional)
A braking system is provided on each axis of the manipulator to hold the arm in its position when a failure or fault occurs. When the brake is activated, the manipulator cannot be moved manually even if the power is OFF. To change the posture of the manipulator after a failure or fault, the brake can be released by the operation from the controller.

When the brake is released with the manipulator’s power OFF, each axis falls down because of the arm weight. Before releasing the brake, hold the arm with a lifting jig or a support, and then change the posture of the manipulator within the minimum motion range.

Use the brake release function only when absolutely necessary.
5.2 Part Names and Working Axes
5.3 Dimension of the Manipulator
5.4 Dimensions and P-point Maximum Envelop
5.5 Appearance and Dimensions of the Pressure Switch Unit
5.6 Stopping Distance and Time for S-, L-, and U-Axes
  5.6.1 General Information
  5.6.2 Definition of Use
  5.6.3 Stopping Distance and Time for Stop Category 0: S-, L- and U-Axes
  5.6.4 Stop Category 1: Stopping Distance and Time for Stop Category 1: S-, L- and U-Axes
    5.6.4.1 Extension
    5.6.4.2 Stopping Distance and Time for Stop Category 1: S-Axis
    5.6.4.3 Stopping Distance and Time for Stop Category 1: L-Axis
    5.6.4.4 Stopping Distance and Time for Stop Category 1: U-Axis
5.7 Modification of S-axis Operation Range
  5.7.1 Prepared Parts
  5.7.2 Mounting the S-axis Mechanical Stopper
  5.7.3 Adjustment to the Pulse Limitation of S-Axis
6 Allowable Load for Wrist Axis Flange
  6.1 Allowable Wrist Load
  6.2 Wrist Flange
7 System Application
  7.1 Peripheral Equipment Mounts
    7.1.1 Allowable Load
    7.1.2 Position of the Payload Mounts
8 Electrical Equipment Specification
  8.1 Internal Connections
9 Frequent Inspections
  9.1 Frequent Inspections
  9.2 Daily Inspections
    9.2.1 Manipulator
      9.2.1.1 Visual Inspection
      9.2.1.2 Manipulator Motions and Noise/Vibration During the Operation
      9.2.1.3 Air Tubes and Air Leakage
      9.2.1.4 Emergency Stop Button
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.2.1.5</td>
<td>Emergency Stop Button Operation and Dried Paint</td>
<td>9-5</td>
</tr>
<tr>
<td>9.2.2</td>
<td>Pressure Switch Unit</td>
<td>9-5</td>
</tr>
<tr>
<td>9.2.2.1</td>
<td>Pressure</td>
<td>9-5</td>
</tr>
<tr>
<td>10</td>
<td>Maintenance and Inspection</td>
<td>10-1</td>
</tr>
<tr>
<td>10.1</td>
<td>Inspection Schedule</td>
<td>10-1</td>
</tr>
<tr>
<td>10.2</td>
<td>Maintenance for Manipulator</td>
<td>10-5</td>
</tr>
<tr>
<td>10.2.1</td>
<td>Grease Replenishment/Replacement</td>
<td>10-5</td>
</tr>
<tr>
<td>10.2.1.1</td>
<td>Grease Replenishment for S-axis Motor Gear</td>
<td>10-5</td>
</tr>
<tr>
<td>10.2.1.2</td>
<td>Grease Replenishment for S-axis Speed Reducer</td>
<td>10-7</td>
</tr>
<tr>
<td>10.2.1.3</td>
<td>Grease Replenishment for L-axis Speed Reducer</td>
<td>10-8</td>
</tr>
<tr>
<td>10.2.1.4</td>
<td>Grease Replenishment for U-axis Speed Reducer</td>
<td>10-10</td>
</tr>
<tr>
<td>10.2.1.5</td>
<td>Grease Replenishment for R-axis Speed Reducer</td>
<td>10-11</td>
</tr>
<tr>
<td>10.2.1.6</td>
<td>Grease Replenishment for B-axis Speed Reducer and Motor Gear</td>
<td>10-12</td>
</tr>
<tr>
<td>10.2.1.7</td>
<td>Grease Replenishment for T-axis Speed Reducer and Motor Gear</td>
<td>10-14</td>
</tr>
<tr>
<td>10.2.2</td>
<td>Inspection of Air Sealing for Internal Air Pressure</td>
<td>10-15</td>
</tr>
<tr>
<td>10.2.3</td>
<td>Battery Replacement</td>
<td>10-18</td>
</tr>
<tr>
<td>10.3</td>
<td>Inspection of the Explosion-Proof Device</td>
<td>10-24</td>
</tr>
<tr>
<td>10.3.1</td>
<td>Pressure Switch Unit Inspection</td>
<td>10-24</td>
</tr>
<tr>
<td>10.3.1.1</td>
<td>Solenoid Valve</td>
<td>10-24</td>
</tr>
<tr>
<td>10.3.1.2</td>
<td>Operation Method of Pressure Reducing Valve</td>
<td>10-24</td>
</tr>
<tr>
<td>10.3.1.3</td>
<td>Operation Check of Pressure Reducing Valve</td>
<td>10-25</td>
</tr>
<tr>
<td>10.3.1.4</td>
<td>Operation Check of Pressure Detection Function</td>
<td>10-27</td>
</tr>
<tr>
<td>10.3.1.5</td>
<td>Operation Check for Master Valve</td>
<td>10-30</td>
</tr>
<tr>
<td>10.3.2</td>
<td>Enclosure Protection Sequence</td>
<td>10-31</td>
</tr>
<tr>
<td>10.3.2.1</td>
<td>Operation Check for Enclosure Protection Sequence</td>
<td>10-34</td>
</tr>
<tr>
<td>10.4</td>
<td>Notes for Maintenance</td>
<td>10-37</td>
</tr>
<tr>
<td>10.4.1</td>
<td>Encoder Connector (with CAUTION label)</td>
<td>10-37</td>
</tr>
<tr>
<td>10.4.1.1</td>
<td>S-, L-, and U-Axis Motors</td>
<td>10-37</td>
</tr>
<tr>
<td>11</td>
<td>Recommended Spare Parts</td>
<td>11-1</td>
</tr>
</tbody>
</table>
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 cable (between the DX200 and the Manipulator)
- Pressure switch unit
- Complete set of manuals (supplied on the CD-ROM which is con-
  nected 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.
### Table 1-1: Accessories of Manipulator

<table>
<thead>
<tr>
<th>Accessories of Manipulator</th>
<th>Pcs</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagon socket head cap screw M10 (Length: 40 mm)</td>
<td>4</td>
<td>For mounting the manipulator</td>
</tr>
<tr>
<td>Washer M10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Conical spring washer</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Hexagon socket head cap screw M6 (Length: 20 mm)</td>
<td>8</td>
<td>For mounting the manipulator cable cover</td>
</tr>
<tr>
<td>Washer M6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-MT6X1</td>
<td>6</td>
<td>For grease replenishment to the S-, L-, U-, R-, B-, and T-axis</td>
</tr>
<tr>
<td>Home position jig</td>
<td>1</td>
<td>For the home position alignment</td>
</tr>
<tr>
<td>Hexagon socket head cap screw M5 (Length: 16 mm)</td>
<td>4</td>
<td>For mounting the pressure switch unit</td>
</tr>
<tr>
<td>Washer M5</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
1 Product Confirmation
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 (Back 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**

- Check that the eyebolts are securely fastened.
- The weight of the manipulator is approximately 60kg (including the shipping bolts and brackets). Use a wire rope (wire length: at least 2000 m or more) strong enough to withstand the mass.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2 Transport
2.1 Transporting Method

2.1.1 Using a Crane

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

Be sure that the manipulator is fixed with the shipping bolts and brackets before transport, and lift it in the posture as shown in fig. 2-1 “Transport Using a Crane”.

*Fig. 2-1: Transport Using a Crane*

<table>
<thead>
<tr>
<th>Gravity center “G”</th>
<th>Manipulator and Shipping bolts and brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit: [mm]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wire rope for lifting (length: 2000 mm or more)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-axis: 30°</td>
</tr>
<tr>
<td>L-axis: -10°</td>
</tr>
<tr>
<td>U-axis: -70°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hexagon socket head cap screw M8</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2 screws, 2 places, length: 20 mm)</td>
</tr>
<tr>
<td>Nut M6 (Trivalent chromium, 4 nuts)</td>
</tr>
<tr>
<td>Flat washer M6 (Stainless, 4 washers, 2 places)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tightening torque: 24.5 N•m (2.5 kgf•m)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Shipping bolts and brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Fixed to the manipulator before shipment.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hexagon socket head cap screw M5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4 screws, length: 12 mm)</td>
</tr>
<tr>
<td>Flat washer M5 (Stainless, 4 washers, 2 places)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tightening torque: 6.0 N•m (0.6 kgf•m)</th>
</tr>
</thead>
</table>

Factory setting for angle and pulse of each axis

<table>
<thead>
<tr>
<th>Axis</th>
<th>S-axis</th>
<th>L-axis</th>
<th>U-axis</th>
<th>R-axis</th>
<th>B-axis</th>
<th>T-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>0°</td>
<td>-10°</td>
<td>-70°</td>
<td>0°</td>
<td>-30°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>-13653</td>
<td>-83627</td>
<td>0</td>
<td>-27307</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]

Fix the manipulator to the pallet by using 12 dia. tapped hole (4 holes).

Bolt M10 (length: 50 mm) recommended.

<table>
<thead>
<tr>
<th>Axis</th>
<th>S-axis</th>
<th>L-axis</th>
<th>U-axis</th>
<th>R-axis</th>
<th>B-axis</th>
<th>T-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>0°</td>
<td>-10°</td>
<td>-70°</td>
<td>0°</td>
<td>-30°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>-13653</td>
<td>-83627</td>
<td>0</td>
<td>-27307</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. 2-3 "Shipping Bolts and Brackets", to protect its driving units from various external forces during transport.

Fig. 2-3: Shipping Bolts and Brackets

- The shipping brackets are painted yellow.
- The shipping bolts and brackets are fixed by using the hexagon socket head cap screw M8 (length: 20 mm) (4 screws), the hexagon socket head cap screw M5 (length: 12 mm) (4 screws), and the hexagon socket head cap screw M6 (length: 15 mm) (4 screws).

**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.
3 Installation

3.1 Installation of Safeguarding

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

Responsibility for Safeguarding (ISO 10218)

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

**WARNING**

- Install a safety fence.
  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.
- When mounting the manipulator on the ceiling or wall, the base section must have sufficient strength and rigidity to support the weight of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.
  Failure to observe this warning may result in injury or damage.

**CAUTION**

- Do not install or operate a manipulator that is damaged or lacks parts.
  Failure to observe this caution may cause injury or damage.
- Before turning ON the power, check to be sure that the shipping bolts and brackets are removed.
  Failure to observe this caution may result in damage to the driving parts.
3 Installation
3.2 Mounting Procedures for Manipulator Base

3.2 Mounting Procedures for Manipulator Base

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

Construct a solid foundation with the appropriate thickness to withstand maximum repulsion force of the manipulator. (Refer to table 3-1 “Manipulator Repulsion Force”.)

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

For installation, refer to chapter 3.2.1 “Mounting the Manipulator on the Baseplate”.

Table 3-1: Manipulator Repulsion Force

<table>
<thead>
<tr>
<th></th>
<th>Horizontal rotation</th>
<th>Vertical rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repulsion force $F_H$</td>
<td>Torque $M_H$</td>
<td>Repulsion force $F_V$</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>1815 N (185 kgf)</td>
<td>1000 N•m (102 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/ deceleration</td>
<td>640 N (65 kgf)</td>
<td>345 N•m (35 kgf•m)</td>
</tr>
</tbody>
</table>
3 Installation
3.2 Mounting Procedures for Manipulator Base

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

3.2.1 Mounting the Manipulator on the Baseplate

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 22 mm or more thick, and anchor bolts of M12 or larger size.

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate with four hexagon head bolts M10 (40 mm long is recommended).

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

Refer to fig. 3-2 “Mounting the Manipulator on the Baseplate”.

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

- Anchor bolt (M12 or larger)
- Baseplate
- Enlarged View of B
- Manipulator base
- Spring washer (Trivalent chromium) (Delivered with the manipulator)
- Washer (Trivalent chromium) (Delivered with the manipulator)
- Hexagon socket head cap screw M10 (4 screws, length: 40 mm) (Delivered with the manipulator)
- (Tightening strength: 1200 N/mm² or more)
- (Tightening torque: 48 N·m (4.9 kgf·m))

**Unit: [mm]**

- 133 ±0.1
- 115 ±0.1
- 12 dia. (4 holes) (hole for mounting)
- 12 dia. (4 holes) (or places)
- 205 ±0.1
- 205 ±0.1
- 263
- 263
- 220
- Baseplate
- Flattened: 0.5mm or less

**Enlarged View of B**

- Anchor bolt (M12 or larger)
- Baseplate
- Manipulator base
- Spring washer (Trivalent chromium) (Delivered with the manipulator)
- Washer (Trivalent chromium) (Delivered with the manipulator)
- Hexagon socket head cap screw M10 (4 screws, length: 40 mm) (Delivered with the manipulator)
- (Tightening strength: 1200 N/mm² or more)
3.2.2 How to Install the Pressure Switch

For mounting the pressure switch unit, two ways are available: the vertical installation (factory setting position) and the horizontal installation.

Fix the unit securely by using the hexagon socket head cap screw M5 (4 screws).

For the installation method, refer to fig. 3-3 “Installing the Pressure Switch Unit”.

Fig. 3-3: Installing the Pressure Switch Unit

- Vertical Installation (factory setting position)
- Horizontal Installation

Screws for installation (delivered with the manipulator)
Hexagon socket head cap screw M5 (Trivalent chromium)
(length: 16 mm, 4 screws)
Washer M5 (4 washers)
Tightening torque: 6.00 N·m (0.6 kgf·m)
3.3 Mounting methods

The MOTOMAN-MPX1150 can be mounted in three different ways: floor-mounted way, wall-mounted way, and ceiling-mounted way. For the wall-mounted and ceiling-mounted ways, the following points are different from the floor-mounted way:

- S-axis operation range
- Fixing method of the manipulator base
- Measures to prevent the manipulator from falling

3.3.1 S-axis Operation Range

For the wall-mounted way, the S-axis operating range is ±90°.

(For optional)

Table 3-2: Manipulator Mounting Methods and the S-Axis Operating Range

<table>
<thead>
<tr>
<th>Manipulator mounting methods</th>
<th>S-axis operating range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor-mounted way</td>
<td>±170°</td>
</tr>
<tr>
<td>Wall-mounted way</td>
<td>±90°</td>
</tr>
<tr>
<td>Ceiling-mounted way</td>
<td>±170°</td>
</tr>
</tbody>
</table>

Fig. 3-4: Manipulator mounting methods

(a) Floor-mounted way          (b) Wall-mounted way  (c) Ceiling-mounted way

NOTE

- For the wall-mounted way and the ceiling-mounted way, the installation angle relative to the ground must be input by using the programming pendant.
- For the input procedures, refer to Chap. 8.4 "ARM Control" in "DX200 INSTRUCTIONS (RE-CTO-A220)". Also, the operating range of S-axis must be altered by referring to chapter 5.7 "Modification of S-axis Operation Range".
3.3 Mounting methods

3.3.2 Fixing the Manipulator Base

In case of the ceiling-mounted way and wall-mounted way, make sure to use four hexagon socket head cap screws M10 (tensile strength: 1200 N/mm² or more) to fix the manipulator base. And tighten them with the tightening torque of 48 N•m.

3.3.3 Measures to Prevent the Manipulator from Falling

For the wall- or ceiling-mounted ways, take appropriate measures to avoid the falling of the manipulator in case of emergency.

Refer to fig. 3-5 “Precaution Against Falling (MPX1150)” for details.

`Fig. 3-5: Precaution Against Falling (MPX1150)`

- Hexagon socket head cap screw M10 (4 screws)
- Conical spring washer (4 washers)
  (Tightening strength: 1200 N/mm² or more)

In case of using the wall/ceiling-mounted way, inform YASKAWA of the matter when placing an order. Be sure to contact your YASKAWA representative (listed on the backcover of this instruction manual) to perform a wall/ceiling installation on site.
3.4 Protection Class

For the standard type, environmental resistance for main for the part of the manipulator conforms to IP4X; the wrist part conforms to IP65.

3.5 Location

When installing the manipulator, 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 gas or liquid, or explosive gas or liquid.
- Free from excess vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Free from the strong magnetic field
- Altitude: 1000 m or less
- Flatness for installation: 0.5 mm or less

NOTE

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

DANGER

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

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

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

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

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

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

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

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

- 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.

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. (e.g. DO NOT TURN THE POWER ON.)

Failure to observe this caution may result in electric shock or injury.
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 manipulator cable between the manipulator and the DX200 with heat insulating material, and avoid multiple cabling. Failure to observe this caution may result in burn caused by cable heat emission failure.
4 Wiring
4.1 Grounding

4.1 Grounding

Follow 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)”, fig. 4-1(b) “Grounding Method (Pressure Switch Unit)”.

⚠️ 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)

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

4.2 Cable Connection

The connection of the manipulator cable or the air tube to the manipulator, or the connection of the intrinsically safe cable to the pressure switch unit are performed by the authorized personnel who is trained by YASKAWA or your YASKAWA representative.

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.

**CAUTION**

Air tubes for purging are connected to the cover part of the power cables.

In case the tube is bent or foreign substances are stuck inside the tube, air may not be appropriately supplied which would result in malfunction.

For this reason, treat air tubes with great care when connecting.

**MANDATORY**

- 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.

**DANGER**

The MOTOMAN-MPX1150 is a pressurized explosion-proof apparatus in which high-pressure air is contained. Do not loosen the fixing bolt of the cover on the manipulator when high-pressure air remains inside the manipulator. Failure to observe this instruction may result in serious personal injury. Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.
4 Wiring
4.2 Cable Connection

Fig. 4-2: Connection of the Manipulator Cable

- Install the pressure switch unit outside of the motion range of the manipulator.
- The maximum length of the air tube between the pressure switch unit and the manipulator is 20 m. Prepare an air tube which is made of nylon and has an outside diameter of 12 mm.

*1 For the connecting position to the DX200, refer to fig. 4-4: “Manipulator Cable Connecting Position”.
*2 For mounting the pressure switch unit of the cable for intrinsic safety and the DX200, refer to chapter 4.2.4 “Intrinsically Safe Cable Connection”.
*3 For the position to connect the manipulator cable on the manipulator, refer to chapter 4.2.1 “Connecting Positions of Cables”, chapter 4.2.2 “Manipulator Cable Connection”, and chapter 4.2.3 “Changing the Manipulator Cable Position”.

Tubes used for air (except for the protective gas pressure feeding tube) are disposable items. Perform daily inspection for damages and replace them periodically.
4 Wiring

4.2 Cable Connection

Fig. 4-3: Manipulator Cable Connection (DX200 side)

Select one of four cables for intrinsic safety and connect it.

X11

X21

Back Side of the DX200

*1: Notation on the manipulator cable connection part varies depending on the DX200 specifications.
4.2 Cable Connection

4.2.1 Connecting Positions of Cables

As shown in Table 4-1 “Manipulator Cable Connecting Position”, the 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>Changeable (R) Type</td>
<td>①</td>
<td>Viewing from the backside, connect to the right side of the manipulator. Refer to (R) type in fig. 4-4 “Manipulator Cable Connecting Position”.</td>
</tr>
<tr>
<td>Changeable (L) Type</td>
<td>②</td>
<td>Viewing from the backside, connect to the left side of the manipulator. Refer to (L) type in fig. 4-4 “Manipulator Cable Connecting Position”.</td>
</tr>
<tr>
<td>Changeable (B) Type</td>
<td>③</td>
<td>Viewing from the backside, connect to the bottom side of the manipulator. Refer to (B) type in fig. 4-4 “Manipulator Cable Connecting Position”.</td>
</tr>
</tbody>
</table>

![Diagram of Manipulator Cable Connecting Position](image_base)

* Changeable (R) Type [Right Type]

* Changeable (L) Type [Left Type]

* Changeable (B) Type [Bottom Type]
4.2 Cable Connection

4.2.2 Manipulator Cable Connection

4.2.2.1 Connection of the Manipulator Cable Mounting Type (R) type or (L) type

**DANGER**

Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.

1. Loosen the hexagon socket head cap screw M6 of the covers for the right (left) side of the base and for the back side, and remove the covers (2 places).
2. Loosen the hexagon socket head cap screw M5 (2 screws) fixing the battery pack, take out the battery pack to the outside of the base. For preventing the battery pack from falling, fix it to the E part by using the hexagon socket head cap screw M6.
3. Connect the connector of the manipulator cable to the connector base. (Check “Channel Position”.)
4. Connect the purging tube to the joint on the IN-side on the manipulator cable cover.
5. Remove the battery pack from the base, and fix it to the base part.
6. Connect the ground wire (2 wires) of the manipulator cable to the tapped hole for mounting ground wire.
7. Mount the gasket face of the manipulator cable on the base so that the protective gas pressure feeding tube does not bend inside the manipulator and then mount the cover by using the hexagon socket head cap screw M6.
8. Mount the covers for the right (left) side of the base and for the back side by using the hexagon socket head cap screw M6.
4 Wiring
4.2 Cable Connection

Fig. 4-5(a): Manipulator Cable Connection

- **Standard type (R) Type**
  - 2BC-A
  - 2BC-B
  - 2BC-C
  - 2BC-D
  - 2BC-E
  - 2BC-F

- **1BC-CN1 to 1BC-CN6**

- **Connecting point for NP**

- **Base**
  - Back side cover of the base part
  - Tapped hole for the ground wire for the manipulator cable (2 places)
  - Hexagon socket head cap screw M5 (8 screws, length: 20 mm) (fixed to the manipulator)
  - Use the conical spring washer 2L-5 (fixed to the manipulator)

- **Battery pack**
  - Hexagon socket head cap screw M6 (8 screws, length: 20 mm) (delivered with the manipulator)
  - Washer M6 (8 washers) (fixed to the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)

- **Manipulator cable**
  - IN
  - OUT
  - Connecting point for the connector
  - Hexagon socket head cap screw M6 (8 screws, length: 20 mm) (fixed to the manipulator)
  - Washer M6 (8 washers) (fixed to the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)

- **Connecting point for the base part**
  - Tapped hole for the ground line of the internal wiring harness (4 places)
  - Hexagon socket head cap screw M5 (length: 16 mm) (fixed to the manipulator)
  - Conical spring washer 2L-5 (fixed to the manipulator)

- **Hexagon socket head cap screw M6**
  - (8 screws, length: 20 mm) (fixed to the manipulator)
  - Washer M6 (8 washers) (fixed to the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)
4 Wiring

4.2 Cable Connection

Fig. 4-5(b): Manipulator Cable Connection

Mounting Direction of the Manipulator Cable Cover for (L) Type

[Diagram of Manipulator Cable Connection]
4.2.2.2 Connection of the Manipulator Cable Mounting Type (B) type

**DANGER**

Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.

1. Loosen the hexagon socket head cap screw M6 of the covers for the bottom face of the base, for both sides (right and left) and for the back side, and remove the covers.
2. Loosen the hexagon socket head cap screw M5 (6 screws) fixing the battery pack and the ground lines (4 lines), and then take out the battery pack to the outside of the base. To prevent the battery pack from falling, use the hexagon socket head cap screw M6 to fix it to the A part.
3. Connect the connector of the manipulator cable to the connector base. (Check “Channel Position”.)
4. Connect the purging tube to the joint of the IN-side on the manipulator cable cover.
5. Fix the battery pack to the base.
6. Connect the ground line (2 wires) of the manipulator cable to the tapped hole for mounting the ground line.
7. Mount the gasket face of the manipulator cable on the base so that the protective gas pressure feeding tube does not bend inside of the manipulator and then mount the cover by using the hexagon socket head cap screw M6.
8. Mount the covers on the left side and the right side of the base as well as on the back side by using the hexagon socket head cap screw M6.
Fig. 4-5(c): Manipulator Cable Connection

Mounting Direction of the Manipulator Cable Cover for (B) Type
4.2.3 Changing the Manipulator Cable Position

Since the mounting position of the side cover (Refer to table 4-1 “Manipulator Cable Connecting Position”, ⑤ in fig. 4-7 “Cover (2 places) Mounting Position”) for the base part differs depending on the type of the manipulator cable position, confirm the manipulator cable position and the cover position (2 places) to change by referring to the table, fig. 4-4 “Manipulator Cable Connecting Position” and fig. 4-7.

1. Turn OFF the DX200 power supply.

2. Confirm the manipulator cable connecting position to change by referring to table 4-1 and fig. 4-4.

NOTE

Since the mounting position of the side cover (Refer to table 4-1 “Manipulator Cable Connecting Position”, ⑤ in fig. 4-7 “Cover (2 places) Mounting Position”) for the base part differs depending on the type of the manipulator cable position, confirm the manipulator cable position and the cover position (2 places) to change by referring to the table, fig. 4-4 “Manipulator Cable Connecting Position” and fig. 4-7.

DANGER

Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.

3. Unscrew the hexagon socket head cap screw ⑦ and the washer from the back side of the base ⑩, and remove the cover ⑧ and the gasket.

4. Unscrew the hexagon socket head cap screw ① and the washer from the base ① to remove the cover ⑧ and the gasket from the manipulator cable connecting position.

5. Confirm the NP of the connection destination and the marker tube (the connection destination) of the manipulator cable shown in fig. 4-6 “Manipulator Cable and Connector Connecting Diagram”, and then connect the connector of the manipulator cable to the case ④ and ⑧.

6. Connect the joint which is the “(AIR) IN” side for the cover ⑧ shown in fig. 4-8 “Manipulator Cable and Cover Connecting Diagram” to the protective gas pressure feeding tube in the manipulator.

7. Mount the cover ⑤ (for the manipulator cable) and the gasket on the base ① by using the hexagon socket head cap screw ⑦ and the washer with taking care of not bending the air tube in the base ①, tighten them with the tightening torque shown in table 4-2 “Parts Checklist of Manipulator cable Connecting Position”.

8. By referring to fig. 4-4 and fig. 4-7, confirm the position of the cover ⑤.

9. Mount the cover ⑧ and the gasket by using the hexagon socket head cap screw ⑦ and the washer with taking care of not bending the air tube or pinching the cable in the base ①, mount the cover ⑧ and the gasket on the base ⑩, and then tighten them with the tightening torque shown in table 4-2.
### Table 4-2: Parts Checklist of Manipulator Cable Connecting Position

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Base HW1100862-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Case 51200-401</td>
<td>1</td>
<td>1BC</td>
</tr>
<tr>
<td>③</td>
<td>Case PQ50WT-6U-FLJ</td>
<td>1</td>
<td>2BC</td>
</tr>
<tr>
<td>④</td>
<td>Hexagon socket head cap screw M5 (length: 16 mm) Conical spring washer 2L-5</td>
<td>2 each</td>
<td>Accessory</td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon socket head cap screw M6 (length: 20 mm) Washer M6</td>
<td>8 each</td>
<td>Tightening torque: 10.0 N•m (1.0 kgf•m) Accessory</td>
</tr>
<tr>
<td>⑥</td>
<td>Cover HW1305749-1 Gasket HW1406987-1</td>
<td>1 each</td>
<td>Cover for the back side of the base (The gasket adheres to the cover.)</td>
</tr>
<tr>
<td>⑦</td>
<td>Hexagon socket head cap screw M6 (length: 20 mm) Washer M6</td>
<td>8 each</td>
<td>Tightening torque: 10.0 N•m (1.0 kgf•m) Accessory</td>
</tr>
<tr>
<td>⑧</td>
<td>Cover HW1305915-2 Gasket HW1407220-1</td>
<td>1 each</td>
<td>Cover for the bottom side or the both lateral sides of the base (The gasket adheres to the cover.)</td>
</tr>
<tr>
<td>⑨</td>
<td>Hexagon socket head cap screw M6 (length: 20 mm) <em>trivalent chromium</em> Washer M6 <em>trivalent chromium</em></td>
<td>8 each</td>
<td>Tightening torque: 10.0 N•m (1.0 kgf•m) Accessory</td>
</tr>
<tr>
<td>⑩</td>
<td>Cover HW1305915-1 Gasket HW1407220-1</td>
<td>1 each</td>
<td>Cover for the manipulator cable (The gasket adheres to the cover.)</td>
</tr>
</tbody>
</table>

---

**Fig. 4-6: Manipulator Cable and Connector Connecting Diagram**
4 Wiring
4.2 Cable Connection

Fig. 4-7: Cover (2 places) Mounting Position

- Standard specifications
- Right side of the base (R) Type
- Bottom side of the base (B) Type
- Left side of the base (L) Type

Fig. 4-8: Manipulator Cable and Cover Connecting Diagram

- Standard specifications
- Right side of the base (R) Type
- Bottom side of the base (B) Type
- Left side of the base (L) Type
4.2.4 Intrinsically Safe Cable Connection

**Fig. 4-9: Connection of Intrinsically Safe Terminal Block of the Pressure Switch Unit and Barrier**

1) Intrinsically safe cable

- **Cable type (applied):**
  - CVV-S, 1.25 mm² (2, 4, 6, 8, 10, 12 cores),
  - CVV-SB, 1.25 mm² (2, 4, 6, 8, 10, 12 cores), or
  - UL2586-SB, 1.25 mm² (2, 4, 6, 8, 10, 12 cores)
  (SUMIDEN HITACHI CABLE Ltd.)

- The cable to be connected with terminal blocks P1 to N3, and 1 to 2 are different.
- P1 to N3 and 1 to 2 are separated by the shield.

2) Cable connection

<table>
<thead>
<tr>
<th>Intrinsically safe terminal block on the manipulator side</th>
<th>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>

Note: The barriers between P2 and N2 in the DX200 are short-circuited by the wire. Do not remove the wire. On the manipulator side, however, since a short-circuit does not exist, there is no wire. Also, no wiring exists on each manipulator side and the DX200 side between P2 and between N2.

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 1 to 2

- The intrinsically safe device connected to the relay barrier must satisfy the following conditions.

  **Intrinsically safe circuit:**
  - Pressure detection / flow switch circuit
  - **Allowable voltage:** 13.2 V
  - **Allowable current:** 14.2 mA
  - **Allowable electric power:** 46.9 mW
  - **Internal inductance:** 31.0 μH
  - **Internal capacitance:** 30.0 nF
4 Wiring
4.3 Requirements

Prepare the power supply, the air supply, and the grounding according to the following 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 200/220 VAC (Voltage: +10 to -15%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50/60 Hz (±2 Hz)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 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>At operating: 15 Nl/min or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>At purging: 1000 Nl/min or more</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 controller of the manipulator</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 Wiring

4.4 Installation Site

This section describes the conditions of the installation site for the robot system. Only devices that are approved as explosion-proof can be installed in hazardous locations. Refer to the local regulations and safety codes for the definition of a hazardous location. Install the 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>85%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) (Optional)</td>
<td>●</td>
<td>●</td>
<td>0 to 40 °C</td>
<td>85%RH</td>
</tr>
</tbody>
</table>

DANGER

• In case installing the MOTOMAN-MPX1150 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-MPX1150, 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.

The system configuration and the installation site of the MOTOMAN-MPX1150 are shown in fig. 4-10 "System Configuration and Installation Site".
4 Wiring
4.4 Installation Site

Fig. 4-10: System Configuration and Installation Site

Non-hazardous Area

- Program selection device (optional)
- Painting unit
- Intrinsic safety cable (1 or 2 cables)

Hazardous Area

- Conveyor switch (optional)
- Manipulator
- Certified terminal box (optional)
- Pressure switch unit
- Intrinsic safety terminal box (optional)
- Pressure switch unit can be installed at a maximum of 20 m away from the manipulator.

Ground resistance must be 10 Ω or less with independent ground connection.

(*) When programming pendant is in use.

Diagram showing system configuration and installation site with labeled components such as power supply, relay connector, air tube, and programming pendant.
## 5 Basic Specifications

### 5.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>5 kg</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 0.02 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>-170° to +170°</td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>-90° to +90°</td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>-70° to +90°</td>
</tr>
<tr>
<td>N-axis (wrist rot)</td>
<td>-190° to +190°</td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>-135° to +135°</td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>-360° to +360°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>1.5 m/s</td>
</tr>
<tr>
<td>Allowable Moment</td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>12 Nm (1.22 kgf·m)</td>
</tr>
<tr>
<td>B-axis</td>
<td>12 Nm (1.22 kgf·m)</td>
</tr>
<tr>
<td>T-axis</td>
<td>7 Nm (0.71 kgf·m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²)</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>0.3 kgf·m²</td>
</tr>
<tr>
<td>B-Axis</td>
<td>0.3 kgf·m²</td>
</tr>
<tr>
<td>T-Axis</td>
<td>0.1 kgf·m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>57 kg</td>
</tr>
<tr>
<td>Protective structure</td>
<td>Basic axis: IP4X</td>
</tr>
<tr>
<td></td>
<td>Wrist axis only: IP65</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to +40 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80%RH (non-condensing)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>4.91 m/s² (0.5 G) or less</td>
</tr>
<tr>
<td>Altitude</td>
<td>1000 m or less</td>
</tr>
<tr>
<td>Others</td>
<td>Free from dust, soot, or water</td>
</tr>
<tr>
<td></td>
<td>Free from excessive electrical noise (plasma).</td>
</tr>
<tr>
<td>Power Capacity</td>
<td>1.0 kVA</td>
</tr>
<tr>
<td>Applicable controller</td>
<td>UX200</td>
</tr>
<tr>
<td>Noise</td>
<td>79 dB</td>
</tr>
</tbody>
</table>

1 SI units are used in this table. However, gravitational unit is used in ( ).
2 Conformed to ISO9283.
3 Differed depending on the motion pattern or the load of the wrist axis.
4 For details on the allowable moment and the allowable inertia, refer to chapter 6.1 “Allowable Wrist Load”.
5 Conformed to ISO6926
6 Measurement is carried out when the maximum load is mounted to the manipulator and operated in the maximum speed.
7 Measurement is carried out:
   - between 1.2 m and 1.5 m above the ground.
   - 400 mm away from the P-point maximum envelope.
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes
5.3 Dimension of the Manipulator

Fig. 5-2: Dimension of the Manipulator

- 12 dia. hole (4 holes) (for installation)
- Dowel holes (2 places) 12dia. +0.018

View A

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

Fig. 5-3: Dimensions and P-point Maximum Envelope
5.5 Appearance and Dimensions of the Pressure Switch Unit

**DANGER**

Each part of the manipulator can extend within the range of the P-point maximum envelope shown in fig. 5-3 "Dimensions and P-point Maximum Envelope" at maximum. Take special consideration for this area for the safety measures.

**Operating Pressure:**
- From the manipulator (tube: outside diameter 12 dia., inside diameter 9 dia.)
- To the manipulator (tube: outside diameter 12 dia., inside diameter 9 dia.)

**Purging Pressure:**
- 0.30 to 0.32 [MPa]

**Air Inlet:**
- 0.35 to 0.65 [MPa] (tube: 12 dia.)
5.6 Stopping Distance and Time for S-, L-, and U-Axes

5.6.1 General Information

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

5.6.2 Definition of Use

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

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

Measurement Conditions

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Stopping distance (deg)</th>
<th>Stopping Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>22.8</td>
<td>0.182</td>
</tr>
<tr>
<td>L-axis</td>
<td>27.3</td>
<td>0.287</td>
</tr>
<tr>
<td>U-axis</td>
<td>36.6</td>
<td>0.230</td>
</tr>
</tbody>
</table>

NOTE
If 'category 0 stop' occurs frequently during the operation, it may result in the damage to the driving parts. Avoid the usage 'which category 0 stop' occurs frequently.
5.6.4 Stop Category 1: Stopping Distance and Time for Stop Category 1: S-, L-, and U-Axes

5.6.4.1 Extension

Refer to fig. 5-5(a) "S-Axis Extension", fig. 5-5(b) "L-Axis Extension" and fig. 5-5(c) "U-Axis Extension" for each axis arm extension.

Fig. 5-5(a): S-Axis Extension
5.6 Stopping Distance and Time for S-, L-, and U-Axes

Fig. 5-5(b): L-Axis Extension

Fig. 5-5(c): U-Axis Extension
5.6.4.2 Stopping Distance and Time for Stop Category 1: S-Axis

![Graphs showing stopping distance and time for S-axis for different positions (100%, 66%, 33%).]
5.6.4.3 Stopping Distance and Time for Stop Category 1: L-Axis

---

**Graphs of Stopping Distance and Time for Stop Category 1: L-Axis**

- **Position 100%**
  - Stopping angle [deg]
  - Stopping time [sec]
  - Speed [deg/s]

- **Position 66%**
  - Stopping angle [deg]
  - Stopping time [sec]
  - Speed [deg/s]

- **Position 33%**
  - Stopping angle [deg]
  - Stopping time [sec]
  - Speed [deg/s]
5.6.4.4 Stopping Distance and Time for Stop Category 1: U-Axis
5.7 Modification of S-axis Operation Range

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in table 5-3 “Posture of the S-axis when Mounting the S-axis Mechanical Stopper”.

If alteration is necessary, contact your YASKAWA representative in advance.

Table 5-2: S-Axis Operating Range

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis Operation Range</td>
<td>-170° - +170° (standard)</td>
</tr>
<tr>
<td></td>
<td>-150° - +150°</td>
</tr>
<tr>
<td></td>
<td>-120° - +120°</td>
</tr>
<tr>
<td></td>
<td>-90° - +90°</td>
</tr>
</tbody>
</table>

5.7.1 Prepared Parts

For changing the angle range of the S-axis, the parts shown in fig. 5-6 “Components of the S-Axis Mechanical Stopper and Stopper Mounting Position” are required. Prepare the following parts before hands.

- Hexagon socket head cap screw M8 (length: 15 mm) (2 screws) (tensile strength: 1200 N/mm² or more)

Tightening torque: 20.1 N•m (2.1 kgf•m)

Base in the rotating head: tapped hole M8 (6 places)
### Table 5-3: Posture of the S-axis when Mounting the S-axis Mechanical Stopper

<table>
<thead>
<tr>
<th>Position of the stopper</th>
<th>Set movable angle for the S-axis</th>
<th>Angle of the S-axis when mounting the S-axis mechanical stopper</th>
<th>Pulse of the S-axis when mounting the S-axis mechanical stopper</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>+150°</td>
<td>-20°</td>
<td>-26169</td>
</tr>
<tr>
<td></td>
<td>-150°</td>
<td>+20°</td>
<td>+26169</td>
</tr>
<tr>
<td>b</td>
<td>+120°</td>
<td>-50°</td>
<td>-65422</td>
</tr>
<tr>
<td></td>
<td>-120°</td>
<td>+50°</td>
<td>+65422</td>
</tr>
<tr>
<td>c</td>
<td>+90°</td>
<td>-80°</td>
<td>-104676</td>
</tr>
<tr>
<td></td>
<td>-90°</td>
<td>+80°</td>
<td>+104676</td>
</tr>
</tbody>
</table>
5.7 Modification of S-axis Operation Range

5.7.2 Mounting the S-axis Mechanical Stopper

The mechanical stopper is not necessary when the operating range is set to ±170° (standard specification).

The S-axis mechanical stopper can be set at 30° pitch intervals from 90° to 150° range.

For the combination, refer to table 5-4 “The Settable Angle for S-Axis Stopper”.

1. Remove the cover ① from the back side of the rotation head (by referring to fig. 5-6 "Components of the S-Axis Mechanical Stopper and Stopper Mounting Position").

2. By referring to table 5-3 “Posture of the S-axis when Mounting the S-axis Mechanical Stopper”, move the manipulator from the operation angle to be set to the posture (angle) to mount the S-axis stopper.

3. Turn OFF the DX200 power supply.

4. By using the hole of the cover ① which was removed at step 1, mount the base by using the hexagon socket head cap screw M8 (length: 15 mm) (tensile strength: 1200 N/mm² or more), and then tighten them with the tightening torque of 20.1 N•m. (When setting the movable angle to an angle other than ± 170°, perform the procedures from 2 to 4 again.)

5. Mount the cover ① on the rotating head.

5.7.3 Adjustment to the Pulse Limitation of S-Axis

For altering the range of motion of the S-axis, refer to Chap. 8.17 "Changing the Parameter” in "DX200 INSTRUCTIONS (R-CTO-A220)". Change the parameter as shown below by using the programming pendant.

- Pulse limit (S-axis + direction): S1CxG400
- Pulse limit (S-axis - direction): S1CxG408

<table>
<thead>
<tr>
<th>S-axis motion type</th>
<th>S-axis Operation Range</th>
<th>Pulse limit (S-axis + direction): S1CxG400</th>
<th>Pulse limit (S-axis - direction): S1CxG408</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor-mounted way</td>
<td>+150° to -150°</td>
<td>+196267</td>
<td>-196267</td>
</tr>
<tr>
<td>Wall-mounted way</td>
<td>+90° to -90°</td>
<td>+117760</td>
<td>-117760</td>
</tr>
<tr>
<td>Ceiling-mounted way</td>
<td>+150° to -150°</td>
<td>+196267</td>
<td>-196267</td>
</tr>
</tbody>
</table>

**NOTE**

1. TURN OFF the electric power supply before mounting.

2. Apply the specified components when mounting the S-Axis mechanical stopper.
Do not modify the motion range parameter with the software only, but in combination with the mechanical stopper. Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.
The settable angles for S-axis stopper are shown in Table 5-4 “The Settable Angle for S-Axis Stopper”.

Table 5-4: The Settable Angle for S-Axis Stopper
6 Allowable Load for Wrist Axis Flange

6.1 Allowable Wrist Load

The payload of the wrist axis is a maximum of 5 kg, however, requirements listed in table 6-1 “Allowable Wrist Load” must be satisfied as there are limits to moments and moments of inertia.

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

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N-m (kgf•m)¹</th>
<th>GD²/4 Total Moment of Inertia kg•m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>12 (1.22)</td>
<td>0.30</td>
</tr>
<tr>
<td>B-Axis</td>
<td>12 (1.22)</td>
<td>0.30</td>
</tr>
<tr>
<td>T-Axis</td>
<td>7 (0.71)</td>
<td>0.10</td>
</tr>
</tbody>
</table>

¹ (): Gravitational unit

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

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

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

Fig. 6-1: Moment of Arm Rating
6.2 Wrist Flange

The dimensions of the flange for the end of the wrist axis are as shown in fig. 6-2 “Wrist Flange”.

When mounting the attachment, etc., it is recommended to use the inside fitting so that the joint mark is visible. When using the inside fitting, the fitting depth is less than 5 mm for the inside fitting and 3.5 mm or less for the outside fitting.

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

**NOTE**

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

7.1 Peripheral Equipment Mounts

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

7.1.1 Allowable Load

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

Observe the following restrictions.

Set the mass of the payload on the peripheral equipment mounts to 6 kg or less including the mass of the attachment for the end of the wrist axis. Set the mass of the payload on the peripheral equipment mounts of the upper arm and the lower arm to 1 kg or less. For example, even if the mass of the payload for the end of the wrist axis is 3 kg, the mass in total for the peripheral equipment mounts of the upper and the lower arm is 1 kg.
7.1.2 Position of the Payload Mounts

*Fig. 7-1: Installing Peripheral Equipment*

- Tapped holes M6 (2 holes) (depth: 16 mm) (pitch: 1.25)
- Tapped holes M8 (4 holes) (depth: 16 mm) (pitch: 1.25)
- Tapped holes M6 (2 holes) (depth: 15 mm) (pitch: 1.0)

(Installing limitation) 90 mm or less
8 Electrical Equipment Specification

8.1 Internal Connections

The fig. 8-1(a) "Internal Connection Diagram (YR-MPX1150-A00, -C00, -E00)", fig. 8-1(b) "Internal Connection Diagram (YR-MPX1150-A00, -C00, -E00)", fig. 8-2(a) "Internal Connection Diagram (YR-MPX1150-B00)", and fig. 8-2(b) "Internal Connection Diagram (YR-MPX1150-B00)" show the internal connections.
Fig. 8-1(a): Internal Connection Diagram (YR-MPX1150-A00, -C00, -E00)
Fig. 8-1(b): Internal Connection Diagram (YR-MPX1150-A00, -C00, -E00)
Fig. 8-2(a): Internal Connection Diagram (YR-MPX1150-B00)
8.3 Internal Connections

Fig. 8-2(b): Internal Connection Diagram (YR-MPX1150-B00)
9 Frequent Inspections

9.1 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 weekly inspections listed in table 9-1 “Frequent Inspections” to ensure the long life of the robot and its performance.

For more information about the inspection items, refer to chapter 9.2 “Daily Inspections”.
### Table 9-1: Frequent Inspections (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Item</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><strong>DANGER</strong> 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><strong>DANGER</strong> Do not enter the robot working envelope.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Noise and vibration during the operation</td>
<td>No abnormal noise and vibration during the robot operation.</td>
<td></td>
<td></td>
<td></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><strong>CAUTION</strong> Use a pair of protective goggles to protect your eyes against paint or thinner that is emitted from the tube.</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><strong>CAUTION</strong> 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><strong>CAUTION</strong> When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Inspection of the manipulator cable (For moving/fixing)</td>
<td>Check damage or any abnormal wear to the power cable</td>
<td></td>
<td></td>
<td><strong>DANGER</strong> Replace the cable if any abnormalities are found.</td>
</tr>
</tbody>
</table>
### 9 Frequent Inspections

#### 9.1 Frequent Inspections

<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><strong>Manipulator</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Base mounting bolts</td>
<td>1</td>
<td>Check for damage and looseness, and then retighten loose bolts with a spanner or wrench.</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Cover mounting screws</td>
<td>2</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Battery alarm</td>
<td>10</td>
<td>Check the battery alarm by using the DX200.</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Check the operation of the emergency stop button. Remove any dried paint.</td>
<td>11</td>
<td>The manipulator stops immediately when the emergency stop button is pressed.</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pressure Switch Unit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Pressure set value</td>
<td>1</td>
<td>The pressure of the pressure reducing valve is within the specified range</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Air leakage inspection</td>
<td>2</td>
<td>Check for any air leakage from the pressure switch unit.</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

Stop the manipulator when checking. Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.

**CAUTION**

Inspect the manipulator while it is in its standby position and not in motion.

**WARNING**

Do not make any modifications to the settings. The pressure switch unit is a safety related parts for explosion-Proof specification.
9.2 Daily Inspections

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

9.2.1 Manipulator

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>The MOTOMAN-MPX1150 is a pressurized explosion-proof apparatus in which high-pressure air is contained. Do not loosen the fixing bolt of the cover on the manipulator when high-pressure air remains inside the manipulator. Failure to observe this instruction may result in serious personal injury. Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.</td>
</tr>
</tbody>
</table>

9.2.1.1 Visual Inspection

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

9.2.1.2 Manipulator Motions and Noise/Vibration During the Operation

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

Also, check for abnormal noise and vibration during the operation.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never enter inside the safeguarding and the manipulator working envelope after turning ON the power supply.</td>
</tr>
</tbody>
</table>

9.2.1.3 Air Tubes and Air Leakage

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

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

9.2.1.4 Emergency Stop Button

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

**DANGER**

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

9.2.1.5 Emergency Stop Button Operation and Dried Paint

Before operating the manipulator, check the emergency stop button operates correctly. The manipulator stops immediately when the emergency stop button is pressed. Inspect the manipulator while it is in the standby posture and not in motion with the power supply turned ON. Repeat sudden stops while the manipulator is in motion will damage the braking system.

Remove any dried paint on the emergency stop button.

**CAUTION**

Paint stuck on the manipulator rotating parts prevents them from turning normally and smoothly. Periodically remove the paint on the manipulator.
- A cloth that is soaked in paint thinner can be used for cleaning the inside of the wrist, because an anti-thinner enclosure is provided. But, be careful not to remove the original coat of paint on the manipulator.

9.2.2 Pressure Switch Unit

9.2.2.1 Pressure

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

- Pressure reducing valve for purging pressure: 0.01 to 0.02 [MPa]
- Pressure reducing valve for the operating pressure: 0.30 to 0.32 [MPa]
10 Maintenance and Inspection

10.1 Inspection Schedule

Conduct daily and periodic inspections to ensure the long life of the robot and its performance. Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation.

Inspection intervals are given in the levels shown in table 10-1 “Inspection Schedule”.

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

Only specified personnel are to do inspection work.

NOTE: The inspection interval must be based on the servo power supply ON time.
<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>6000x/Cycle</td>
<td>12000xCycle</td>
<td>24000xCycle</td>
</tr>
<tr>
<td>1 Manipulator exterior</td>
<td>Visual</td>
<td>Check for crack or damages.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Manipulator motion, noise, and vibration</td>
<td>Visual</td>
<td>Check for abnormality.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Air tube, air leakage</td>
<td>Visual</td>
<td>Check for come off, wear, or damages.</td>
<td>Check for air leakage.</td>
<td></td>
</tr>
<tr>
<td>4 Paint removal and cleaning</td>
<td>Visual</td>
<td>Remove adhered paint if any.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Pressure switch unit setting</td>
<td>Visual</td>
<td>Check the value if it is within the proper value range.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Base mounting bolts</td>
<td>Visual</td>
<td>Spanner Wrench Tighten loose bolts. Replace if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Cover mounting screws</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 S-axis motors</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Motor connectors</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Motor part</td>
<td>Visual</td>
<td>Check for filter clogging.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Air seals for enclosure</td>
<td>Visual</td>
<td>Check for wear or tear. Replace if necessary. Refer to chapter 10.2.2 &quot;Inspection of Air Sealing for Internal Air Pressure&quot;.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 L-, U-, R-, B- and T-axis timing belts</td>
<td>Visual</td>
<td>Check for belt tension, wear or tear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Internal cables</td>
<td>Visual</td>
<td>Check for conduction between the main connector of the base and the terminal by manually shaking the wire. Check for wear on the protective spring.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10-1: Inspection Schedule

Specify personnel (Customer) Licensee (Person who is qualified by YASKAWA) Service Company

1. Manipulator exterior
2. Manipulator motion, noise, and vibration
3. Air tube, air leakage
4. Paint removal and cleaning
5. Pressure switch unit setting
6. Base mounting bolts
7. Cover mounting screws
8. S-axis motors
9. Motor connectors
10. Motor part
11. Air seals for enclosure
12. L-, U-, R-, B- and T-axis timing belts
13. Internal cables

Multi-meter

Replace the cables.
### Table 10-1: 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>14</td>
<td>Battery in manipulator</td>
<td>Daily</td>
<td>Visual</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.</td>
</tr>
<tr>
<td>15</td>
<td>Power cable (Movable type)</td>
<td>10000H Cycle</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
</tr>
<tr>
<td>16</td>
<td>Power cable (Fixed type)</td>
<td>12000H Cycle</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
</tr>
<tr>
<td>17</td>
<td>S-axis motor gear</td>
<td>24000H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary). Replenish grease (6000 H cycle). Refer to chapter 10.2.1.</td>
</tr>
<tr>
<td>19</td>
<td>Pressure switch unit</td>
<td>60000H Cycle</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>
</tr>
<tr>
<td>20</td>
<td>Overhaul</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

1. Inspection No. correspond to the numbers in fig. 10-1 “Inspection Parts and Inspection Numbers”.
2. The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your YASKAWA representative.
3. When checking for conduction with multimeter, connect the battery to “BAT” and “OBT” of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position data may be lost. Refer to chapter 10.4 “Notes for Maintenance”.
4. Internal cables to be replaced at 24000H inspection.
5. For grease used in each parts, refer to table 10-2 “Inspection Parts and Grease Used”.
6. For grease used in each parts, refer to table 10-2 “Inspection Parts and Grease Used”.

---

10.1 Maintenance Schedule
10 Maintenance and Inspection

10.1 Inspection Schedule

Table 10-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Harmonic Grease SK-1A</td>
<td>S-, L-, U-, R-, B-, and T-axis speed reducers, S-axis motor gear, T-axis gear</td>
</tr>
</tbody>
</table>

Fig. 10-1: Inspection Parts and Inspection Numbers

Pressure switch unit (mounted separately)
10.2 Maintenance for Manipulator

10.2.1 Grease Replenishment/Replacement

Fig. 10-1 “Inspection Parts and Inspection Numbers” shows the location of the components of the manipulator.

Replenish or replace the grease for the following sections:

I) S-axis motor gear
II) S-axis speed reducer
III) L-, and U-axis speed reducers
IV) R-axis speed reducer
V) B-, and T-axis speed reducers and motor gear

10.2.1.1 Grease Replenishment for S-axis Motor Gear

Fig. 10-2: S-axis Motor Gear

Connecting position of the manipulator cable (for the standard specifications)

Replenish grease in accordance with the following procedures.

1. Remove the plug and the bolt from the grease inlet and the air exhaust port.

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)
3. Inject grease through the grease inlet.
   - Grease type : Harmonic Grease SK-1A
   - Amount of grease : 25 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate : 8 g/s or less

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

4. Remove the grease zerk A-MT6X1 from the grease inlet, and then re-install the bolt to the grease inlet and the air exhaust port. When re-installing the bolt, apply ThreeBond 1206C to the thread part of each bolt.
10.2.1.2 Grease Replenishment for S-axis Speed Reducer

Replenish grease in accordance with the following procedures.

1. Remove the plug and the bolt from the grease inlet and the air exhaust port.

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)

   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 25 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

3. Remove the grease zerk A-MT6X1 from the grease inlet, and re-install the plug and the bolt to the grease inlet and the air exhaust port. When re-installing the plug and the bolt, apply ThreeBond 1206C to each thread part.

   - Grease is not exhausted from the air exhaust port. Do not inject an excessive amount of grease into the grease inlet.

4. If grease is injected without removing the plug from the air exhaust port, the inner pressure is raised and it may cause the damage to the manipulator. Make sure to remove the plug and inject grease.
10.2.1.3 Grease Replenishment for L-axis Speed Reducer

**Fig. 10-4: L- and U-axis Speed Reducers**

*View A*

- **Hexagon socket head cap screw M6** (stainless, length: 6 mm) (fixed to the manipulator)
- **Washer M6** (stainless, length: 6 mm) (fixed to the manipulator)
- **Tightening torque:** 6 N•m (0.6 kgf•m)

---

**DANGER**

The MOTOMAN-MPX1150 is a pressurized explosion-proof apparatus in which high-pressure air is contained. Do not loosen the fixing bolt of the cover on the manipulator when high-pressure air remains inside the manipulator. Failure to observe this instruction may result in serious personal injury. Before loosening the fixing bolt of the cover on the manipulator, make sure to confirm that the air supply to the manipulator is stopped and that there is no residual pressure in the manipulator.
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

1. Remove the lower arm cover and the gasket, and remove the bolt from the grease inlet and the air exhaust port. (The gasket adheres to the cover.)

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)

3. Inject grease through the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 30 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. Remove the grease zerk A-MT6X1 from the grease inlet, and re-install the bolt to the grease inlet and the air exhaust port. When re-installing the bolt, apply ThreeBond 1206C to the thread part of each bolt.

5. Mount the lower arm cover and the gasket by using the tightening torque shown in fig. 10-4 “L- and U-axis Speed Reducers”.

NOTE
If grease is injected without removing the bolt from the air exhaust port, the inner pressure is raised and it may cause the damage to the manipulator. Make sure to remove the bolt and inject grease.

NOTE
Grease is not exhausted from the air exhaust port. Do not inject an excessive amount of grease into the grease inlet.
10.2.1.4 Grease Replenishment for U-axis Speed Reducer

(Refer to fig. 10-4 "L- and U-axis Speed Reducers").

1. Remove the lower arm cover and the gasket, remove the cover, and then remove the bolt and the plug from the grease inlet and the air exhaust port. (The gasket adheres to the cover.)

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)

3. Inject grease through the grease inlet.
   - Grease type : Harmonic Grease SK-1A
   - Amount of grease : 20 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate : 8 g/s or less

4. Remove the grease zerk A-MT6X1 from the grease inlet, and re-install the bolt to the grease inlet and the air exhaust port. When re-installing the bolt, apply ThreeBond 1206C to the thread part of each bolt.

5. Mount the lower arm cover and the gasket by using the tightening torque shown in fig. 10-4.

NOTE: If grease is injected without removing the plug from the air exhaust port, grease may leak inside of the motor and it may cause damage to the manipulator.

NOTE: Grease is not exhausted from the air exhaust port. Do not inject an excessive amount of grease into the grease inlet.
10.2.1.5 Grease Replenishment for R-axis Speed Reducer

Fig. 10-5: R-axis Speed Reducer

1. Remove the bolt from the grease inlet and the air exhaust port.

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)

3. Inject grease through the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

**NOTE**

If grease is injected without removing the bolt from the air exhaust port, the inner pressure is raised and it may cause damage to the manipulator. Make sure to remove the bolt and inject grease.
4. Remove the grease zerk A-MT6X1 from the grease inlet, and re-install the bolt to the grease inlet and the air exhaust port. When re-installating the bolt, apply ThreeBond 1206C to the thread part of each bolt.

10.2.1.6 Grease Replenishment for B-axis Speed Reducer and Motor Gear

**Fig. 10-6: B- and T-axis Speed Reducers and T-axis Motor Gear**

**NOTE**
Grease is not exhausted from the air exhaust port. Do not inject an excessive amount of grease into the grease inlet.
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

1. Remove the bolt and the plug from the grease inlet and the air exhaust port.

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)

3. Inject grease through the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 5 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. Remove the grease zerk A-MT6X1 from the grease inlet, and re-install the bolt and plug. When re-installing the bolt and plug, apply ThreeBond 1206C to the thread part of the bolt and plug.

**NOTE**

- If grease is injected without removing the plug from the air exhaust port, the inner pressure is raised and it may cause damage to the manipulator. Make sure to remove the plug and inject grease.

- Grease is not exhausted from the air exhaust port. Do not inject an excessive amount of grease into the grease inlet.

- Make sure to remove the plug and inject grease.
10.2.1.7 Grease Replenishment for T-axis Speed Reducer and Motor Gear

(Refer to fig. 10-6 “B- and T-axis Speed Reducers and T-axis Motor Gear”)

1. Remove the bolt and the plug from the grease inlet and the air exhaust port.

2. Install the grease zerk A-MT6X1 to the grease inlet. (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)

3. Inject grease through the grease inlet.
   - Grease type : Harmonic Grease SK-1A
   - Amount of grease : 5 cc
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less
   - Grease injection rate : 8 g/s or less

4. Remove the grease zerk A-MT6X1 from the grease inlet, and re-install the bolt and the plug to the grease inlet and the air exhaust port. When re-installing the bolt and the plug, apply ThreeBond 1206C to the thread part of the bolt and the plug.

**NOTE**

If grease is injected without removing the plug from the air exhaust port, the inner pressure is raised and it may cause the damage to the manipulator. Make sure to remove the plug and inject grease.

**NOTE**

Grease is not exhausted from the air exhaust port. Do not inject an excessive amount of grease into the grease inlet.
10.2.2 Inspection of Air Sealing for Internal Air Pressure

**NOTE**
Perform “3-(1) Checking of Purging Operations” in chapter 10.3.2 “Enclosure Protection Sequence” after gasket is replaced.

**Gasket in the Cover Part**
Remove the two-way covers of the back side of the S-head, of the back side of the base, of the lower part of the base and of both lateral sides (one of the two is for the cover of the manipulator cable) and then check the wear and the 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 necessary.

*Fig. 10-7: Gasket in Base Part Inspection*
Unscrew the cover fixing screws (three places). And then check the wear and tear of each gasket.

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

*Fig. 10-8: Lower-Arm, Casing Part Inspection*
Unscrew the cover fixing screws (two places). And then check the wear and tear of each 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 necessary.

Fig. 10-9: Upper-Arm Part Inspection
10.2.3 Battery Replacement

**WARNING**

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

Four batteries are installed in the locations shown in fig. 10-10(a) "Battery Location (Except for "-B**")" and fig. 10-10(b) "Battery Location (-B**)".

<table>
<thead>
<tr>
<th>Type</th>
<th>Battery pack type</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-MPX1150 (Except for &quot;-B**, -C**&quot;)</td>
<td>HW1372692-A, B, C</td>
</tr>
<tr>
<td>YR-MPX1150-B**</td>
<td>HW1470715-BA, BB, BC</td>
</tr>
<tr>
<td>YR-MPX1150-C**</td>
<td>HW1373234-A, B, C</td>
</tr>
</tbody>
</table>

If a battery alarm occurs in the DX200, replace the battery in the following procedures.
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

Fig. 10-10(a): Battery Location (Except for "-B")

("Connecting position of the manipulator cable in the figure is for the (R) Type, however, the location of the battery pack is the same as the (L) Type and the (B) Type.

Details of the Battery pack

- The mounting direction of the battery pack for the B- and T-axis is different from the other battery pack.
- Make sure to mount it in the correct direction.

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Left side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 6 screws, length: 20 mm)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, length: 90 mm)</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
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<td>(fixed to the manipulator)</td>
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<tr>
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<td>(fixed to the manipulator)</td>
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<td>(fixed to the manipulator)</td>
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<td>(fixed to the manipulator)</td>
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<td>(fixed to the manipulator)</td>
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<td>(fixed to the manipulator)</td>
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<td>(fixed to the manipulator)</td>
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<td>(fixed to the manipulator)</td>
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<tr>
<td></td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.

Battery pack for the U- and R-axis

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Right side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 2 screws, fixed to the manipulator)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, 2 washers)</td>
<td></td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trivalent chromium, 2 washers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.

Battery pack for the S- and L-axis

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Left side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 6 screws, length: 20 mm)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, length: 90 mm)</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.

Battery pack for the B- and T-axis

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Left side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 6 screws, length: 20 mm)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, length: 90 mm)</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.

Battery pack for the B- and T-axis (Except for "-C**")

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Left side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 6 screws, length: 20 mm)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, length: 90 mm)</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.

Battery pack for the U- and R-axis (Except for "-C**")

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Right side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 2 screws, fixed to the manipulator)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, 2 washers)</td>
<td></td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trivalent chromium, 2 washers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right side</td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right side</td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.

Battery pack for the S- and L-axis (Except for "-C**")

<table>
<thead>
<tr>
<th>Battery pack</th>
<th>Head of the cable tie (T50R)</th>
<th>Location of the outer port for the lead wire</th>
<th>Hexagon socket head cap screw M5 (2 screws, length: 16 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Left side</td>
<td>Hexagon socket head cap screw M5 (2 screws,</td>
<td>(Trivalent chromium, 6 screws, length: 20 mm)</td>
</tr>
<tr>
<td>(Except for</td>
<td></td>
<td>Trivalent chromium, length: 90 mm)</td>
<td>(fixed to the manipulator)</td>
</tr>
<tr>
<td>&quot;-C**)</td>
<td></td>
<td>(fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Washer M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nut M4 (fixed to the manipulator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left side</td>
<td>Apply LOCTITE 243 to the nut.</td>
<td></td>
</tr>
</tbody>
</table>

- Mount it in the correct direction.
10 Maintenance and Inspection
10.2 Maintenance for Manipulator

Fig. 10-10(b): Battery Location (-B**)
(*Connecting position of the manipulator cable in the figure is for the (R) Type, however, the location of the battery pack is the same as the (L) Type and the (B) Type.)

Details of the Battery pack

- Battery pack for the B- and T-axis
  HW1470715-BC
  Mount it in the correct direction.
- Battery pack for the U- and R-axis
  HW1470715-BB
  Mount it in the correct direction.
- Battery pack for the S- and L-axis
  HW1470715-BA
  Mount it in the correct direction.

- FT5 (Fir tree mount) (9 places)
- T30R (Cable tie) (9 places)

Cable tie (T30R)
(Tube)

Cover for the back side of the base

Hexagon socket head cap screw M5
(2 screws, length: 16 mm)
(fixed to the manipulator)
Conical spring washer 2L-5 (2 washers)
(fixed to the manipulator)
Tightening torque: 6 N•m (0.6 kgf•m)

Hexagon socket head cap screw M6
(2 screws, length: 20 mm)
(fixed to the manipulator)
Washer M6 (Trivalent chromium, 8 washers)
(fixed to the manipulator)
Tightening torque: 10 N•m (1.0 kgf•m)
1. Turn OFF the power to the DX200.
2. Ventilate around the manipulator to remove explosive gas.
3. Remove the cover on the back side of the base, take out the bolt from
   the battery bracket to replace the battery, and pull it out.
4. Remove the cable tie fixing the battery pack.
5. (a) Remove the bolt fixing the battery pack.
6. Remove the plastic tape (insulation tape) which is applied for
   protecting the battery connector inside of the manipulator.
7. Connect the new battery.
8. Remove the old battery.

### NOTE
Be sure to connect the new batteries before disconnecting
the old one so that the data does not disappear.

9. Protect the battery connector left in the manipulator with the plastic
   tape (insulation tape).
10. (a) Mount the battery pack by using the bolt M4 (length: 90 mm) and
    the cable ties (T50R, two cable ties, 2 places) on the bracket, and
    mount the bracket by using the screw M5 (length: 16 mm)
    (provided with the battery) on the base.
10. (b) Mount the battery pack by using the cable ties (T30R, three cable
    ties, 3 places) on the bracket, and mount the bracket by using the
    screw M5 (length: 16 mm) on the base.
11. Mount the cover on the back side of the base.
For the battery for the spare parts, the cable to convert to the contact pin for connecting the backup connector of the motor are attached in the standard specification. (Refer to chapter 10.4 “Notes for Maintenance”.) When connecting the battery above, remove the conversion cable to connect the battery.
A label varies depending on the manipulator type. For details, refer to fig. “List of Warning Labels and Nameplate”.
10.3 Inspection of the Explosion-Proof Device

**WARNING**

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

10.3.1 Pressure Switch Unit Inspection

10.3.1.1 Solenoid Valve

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

10.3.1.2 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. 10-13 “Pressure Switch Unit Cover”.)
3. Loosen the locking nut equipped to the valves with a spanner (nominal size: 10 mm). (Refer to fig. 10-14 “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.
10.3.1.3 Operation Check of Pressure Reducing Valve

Measure the air supply pressure of the air for the explosion-proof in the pressure switch unit by using a pressure gauge.

For the pressure gauge connection, refer to fig. 10-15 “Operation Check of Pressure Reducing Valve”.

The pressure gauge, joints and air tubes 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. 10-13 “Pressure Switch Unit Cover”.)
3. As shown in the fig. 10-15, 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 10-3 “List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure”. Refer to chapter 10.3.1.2 “Operation Method of Pressure Reducing Valve” for the reducing valve operation.

<table>
<thead>
<tr>
<th>Pressure reducing valve for purging pressure</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.30 to 0.32</td>
</tr>
<tr>
<td>Pressure reducing valve for the operating pressure</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

5. Turn ON the power supply to the DX200 and start purging. Check that the pressure is keeping between 0.30 MPa and 0.32 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. 10-13.)
10.3 Inspection of the Explosion-Proof Device

**Fig. 10-13: Pressure Switch Unit Cover**

Pan-head sems screw M4 (trivalent chromium, length: 8 mm, 7 screws).

**Fig. 10-14: Operation Methods of Pressure Reducing Valve**

Pressure reducing valve for purging pressure

Pressure reducing valve for operating pressure

Locking nut

Tightening tool: Spanner (nominal size: 10 mm)

**Fig. 10-15: Operation Check of Pressure Reducing Valve**

(Air tube: 12 dia.)

Industrial compressed air 0.35 to 0.65 [MPa]

From manipulator (Air tube: outside 12 dia., inside 9 dia.)

Pressure reducing valve for purging pressure 0.30 to 0.32 [MPa]

Pressure gauge

To manipulator (Air tube: outside 12 dia., inside 9 dia.)

Pressure reducing valve for operating pressure 0.01 to 0.02 [MPa]
10.3.4 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.

- 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. 10-13 “Pressure Switch Unit Cover”.)
3. Set the pressure of both purging air and operation air reducing valves as shown in table 10-4 “List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure”.
   Refer to chapter 10.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

<table>
<thead>
<tr>
<th>Pressure reducing valve for purging pressure</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.30 to 0.32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure reducing valve for the operating pressure</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.01 to 0.02</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. 10-16 “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. 10-13.)
10 Maintenance and Inspection
10.3 Inspection of the Explosion-Proof Device

Operation check of pressure reducing valve

- A flow-meter (measurable range of 0 to 5 L/min is included) and the joint or hose etc. which are connected with the flow-meter for checking the conduction are prepared by the customer.
- Note that the plug size for the exhaust side of the pressure adjusting valve is Rc1/4.
- Refer to fig. 10-17 “Operation Check for Pressure Adjusting 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. 10-13 “Pressure Switch Unit Cover”.)
3. Set the pressure of operation air reducing valve as shown in table 10-5 “Reducing Valve for Operating Pressure-Adjusting Pressure 1-”.
   Refer to chapter 10.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
<th>Pressure reducing valve for the operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

4. Connect the flow meter to the pressure adjusting valve exhaust side.
5. Check that the flow-meter indicates 5 L/min when the operating pressure is 0.05 MPa.
6. Set the pressure of operation air reducing valve as shown in table 10-6 “Reducing Valve for Operating Pressure-Adjusting Pressure 2-”.
   Refer to chapter 10.3.1.2 for the pressure reducing valve operation.

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
<th>Pressure reducing valve for the operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

7. Check that the flow-meter indicates 0 L/min when the operating 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 10-7 “List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure”.
   Refer to chapter 10.3.1.2 for the pressure reducing valve operation.

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
<th>Pressure reducing valve for purging pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30 to 0.32</td>
<td></td>
</tr>
<tr>
<td>Pressure reducing valve for the operating pressure</td>
<td></td>
</tr>
<tr>
<td>0.01 to 0.02</td>
<td></td>
</tr>
</tbody>
</table>
10 Maintenance and Inspection

10.3 Inspection of the Explosion-Proof Device

10. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 10-13 "Pressure Switch Unit Cover".)

Fig. 10-16: Operation Check for Pressure Detector

Fig. 10-17: Operation Check for Pressure Adjusting Valve
10.3.1.5 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. 10-13 “Pressure Switch Unit Cover”.)
3. Set the pressure of operation air reducing valve as shown in table 10-8 “List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure”. Refer to chapter 10.3.1.2 “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. 10-18 “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. 10-13 “Pressure Switch Unit Cover”.)

Table 10-8: List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure

<table>
<thead>
<tr>
<th>Pressure reducing valve for purging pressure</th>
<th>Pressure [MPa]</th>
<th>0.30 to 0.32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure reducing valve for the operating pressure</td>
<td>Pressure [MPa]</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

Fig. 10-18: Operation Check for Master Valve
10.3.2 Enclosure Protection Sequence

**DANGER**

When an enclosure protection sequence error occurs, stop using the manipulator, and take the following measures in accordance with the sequence below.

If the error is not resolved, contact your YASKAWA representative.

**Fig. 10-19(a): Enclosure Protection Flow Chart**

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

1. **Preparation Mode**
2. **Purging Mode**
3. **Operation Mode**
4. **Shut-down Mode**

Supply the protective gas after the following inspection.
- Loosen bolts to enclosures.
- Any damage to the enclosure.
- Re-connect the tubes.
- Tighten the bolts for covers.
- Change the enclosure.

Start Preparation Mode.

Check the pressure switch unit.
- Troubles on devices such as master valves.
- Leakage at the relief valve and the connections.

Check the setting values of the pneumatics unit.
1. Pressure reducing valve for purging pressure: 0.30 to 0.32 Mpa.
2. Pressure reducing valve for operating pressure: 0.01 to 0.02 Mpa.
3. Primary pressure into the pressure switch unit: 0.35 to 0.85 Mpa.
4. Switch on the facility prepared by user.

Turn ON the breaker of the controller by manual. Purging mode is simultaneously ready to start by turning the power ON.

Supply the protective gas into the pressure switch unit. The protective gas is regulated in proper values by the reducer valve to operate, then supply to the manipulator.

Check the setting values within the values shown in the left.
10 Maintenance and Inspection

10.3 Inspection of the Explosion-Proof Device

Fig. 10-19(b): Enclosure Protection Flow Chart

- Start Purging Mode.
  1. Switch the operation pressure to the purging pressure.
  2. Release the master valve.

- Abnormal Pressure Mode
  - Execute Abnormal Pressure Mode: (Abnormal purging)
  - When the power supply of the servo unit and the encoder is turned OFF automatically, the master valve is closed at the same time.
  - “Abnormal Purging” appears on the programming pendant and the alarm lamp on the DX200 is lit.

- Purge reset.
  - When the purging air is 20 kPa or more, has the flow reached 220 L/min?
  - Has 2 minutes passed since the purging air mode was started?

- Switch Purging Mode to Operation Mode after executing the following steps.
  1. Switch the pressure from purging to operation.
  2. Close the master valve.
  3. “Purging Completion” message appears on the programming pendant.
  4. Supplying of the power becomes available to motors, brakes and painting device.

- After these steps, the mode is switched to the operation mode.

- Abnormal Pressure Mode
  - Does the abnormal pressure occur in the first time after the first restarting?

- Start counting the purging time (3 minutes*1).

- Has 3 minutes passed since the purging count was started?

- Stop supplying the protective gas into the pressure switch unit.
10 Maintenance and Inspection
10.3 Inspection of the Explosion-Proof Device

*Abnormal Pressure Mode*

1. Abnormal pressure (LOW)
   In case the pressure in the protective gas line drops and the pressure detector (PS1) is opened, the hardware circuit (power control circuit, purging control relay, and encoder separation board) is turned OFF. And the servo unit- and encoder-power sources are automatically shut down. In case the abnormal pressure (LOW) occurs during the purging mode, the master valve is automatically shut OFF to prevent the dangerous gas from inflowing. “Abnormal Pressure (LOW)” is displayed on the programming pendant and the alarm lamp on the DX200 is lit.

2. Abnormal purging
   During the purging, if the pressure in protective gas line drops and the pressure the detector (PS3) is opened, the hardware circuit (power control circuit, purging control relay, and encoder separation board) is turned OFF. When the power supply of the servo unit and the encoder is turned OFF automatically, the master valve is closed at the same time. “Abnormal Purging (LOW)” appears on the programming pendant and the alarm lamp on the DX200 is lit.
10.3.2.1 Operation Check for Enclosure Protection Sequence

Check the enclosure 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 cover of the pressure switch unit. (Refer to fig. 10-13 “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>0.30 to 0.32</td>
<td>Confirm the setting value of pressure switch unit operating pressure and purging pressure (Each value should be within the range shown in the left)</td>
</tr>
<tr>
<td>②</td>
<td>0.01 to 0.02</td>
<td>0.30 to 0.32</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 programing pendant window. While purging, confirm that no power is supplied to motors and manipulator is inoperable. Check for abnormal noises during purging, and air leakage from the gasket of the inner pressure cover.</td>
</tr>
<tr>
<td>④</td>
<td></td>
<td></td>
<td>Confirm that purging completes in 3 to 5 minutes and a message “Air Purge Done” is indicated on the programing pendant window.</td>
</tr>
<tr>
<td>⑤</td>
<td></td>
<td></td>
<td>Press [SERVO ON READY] on the programing pendant and grip the enable switch to turn ON the power supply, and then confirm that the manipulator is operable.</td>
</tr>
</tbody>
</table>
3-(2) Checking the Inner Pressure Error (low 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>①</td>
<td>0.01 to 0.02</td>
<td>0.30 to 0.32</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>②</td>
<td>0</td>
<td></td>
<td>Set 0 MPa to the operating pressure of pressure switch unit.</td>
</tr>
<tr>
<td>③</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>④</td>
<td></td>
<td></td>
<td>Confirm that [SERVO ON READY] on the programming pendant goes off.</td>
</tr>
<tr>
<td>⑤</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>
<tr>
<td>⑥</td>
<td></td>
<td></td>
<td>※ Turn OFF the power supply to the DX200 after above checking operations are completed.</td>
</tr>
</tbody>
</table>

3-(3) Checking the Inner Pressure Error (high pressure error) Detection Operations

Perform the following checking after above mentioned checking is 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>①</td>
<td>0.01 to 0.02</td>
<td>0.30 to 0.32</td>
<td>(After completing operation ⑤ described in (3-2)) Adjust the operating pressure setting value of the pressure switch unit to 0.05 MPa.</td>
</tr>
<tr>
<td>②</td>
<td>0.05</td>
<td></td>
<td>Adjust the operating pressure setting value of the pressure switch unit to the range described on the left.</td>
</tr>
<tr>
<td>③</td>
<td></td>
<td></td>
<td>Confirm that the OUT port of the pressure adjusting valve is open and that the air is emitted.</td>
</tr>
<tr>
<td>④</td>
<td></td>
<td></td>
<td>Press [SERVO ON READY] and grip the enable switch to turn ON the power supply, then confirm that the manipulator is operable.</td>
</tr>
<tr>
<td>⑤</td>
<td>0.01 to 0.02</td>
<td></td>
<td>Confirm that the OUT port of the pressure adjusting valve is closed and that the air emission is complete.</td>
</tr>
<tr>
<td>⑥</td>
<td></td>
<td></td>
<td>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>
</tbody>
</table>

※ Turn OFF the power supply to the DX200 after above checking operations are completed.
10.3 Inspection of the Explosion-Proof Device

3-(4) Checking of Purging Error Detection Operations

<table>
<thead>
<tr>
<th>Checking item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Confirm each setting value → ② Turn ON the DX200 → ③ Start purging → ④ Abnormal purging pressure decline while purging → ⑤ Alarm → ⑥ Impossible to resume operations</td>
<td></td>
</tr>
</tbody>
</table>

<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>0.30 to 0.32</td>
<td>Confirm the setting value of pressure switch unit operating 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>Puring start and a message &quot;Air Purging&quot; 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>0</td>
<td>After one minute, 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 &quot;AIR PURGE ERROR&quot; 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>

※ 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), (3) and (4), turn OFF the power supply to the DX200 and set the adjusting pressure for purging pressure reducing valve and operating pressure reducing valve to be within each range shown in table 10-9 "List of Setting Value for Purging Air and Operation Air Reducing Valves".

Refer to table 10.3.1.2 "Operation Method of Pressure Reducing Valve" for the pressure reducing valve operation.

Table 10-9: 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 valve</td>
</tr>
<tr>
<td>Operation air reducing valve</td>
</tr>
</tbody>
</table>

5. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 10-13 "Pressure Switch Unit Cover").
10.4 Notes for Maintenance

10.4.1 Encoder Connector (with CAUTION label)

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

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

The backup connector (crimped contact-pin terminal) is mounted on the encoder connector of each motor. Refer to fig. 10-20(a) "Backup Battery Connection for S-, L-, and U-Axis Motors", fig. 10-20(b) "Backup Battery Connection for R-, B-, and T-Axis Motors", and connect the battery pack according to the following procedure.

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

**NOTE**

Do not remove the battery pack in the connector base.
10.4 Notes for Maintenance

**Fig. 10-20(a): Backup Battery Connection for S-, L-, and U-Axis Motors**

- Motor
- Encoder
- Filter
- Motor cable, etc.
- Power connector
- Motor cable, etc.
- Conversion cable
- New battery pack
- Battery pack (spare parts)
- Encoder connector
- Cautions label
- CAUTION label (Enlarged view)
- (Motor) (Internal cables)
- Connection Diagram

Internal cables

New battery pack

Battery pack (spare parts)
Fig. 10-20(b): Backup Battery Connection for R-, B-, and T-Axis Motors

R-Axis Motor

![Diagram of R-Axis Motor with connections labeled: Motor, Filter, Power connector, Encoder, Motor cable, etc., Internal cables, Encoder connector, CAUTION label (Enlarged view).]

B-, T-Axis Motor

![Diagram of B-, T-Axis Motor with connections labeled: Motor, Filter, Power connector, Encoder, Motor cable, etc., Internal cables, Encoder connector, CAUTION label (Enlarged view).]
11 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-MPX1150. The spare parts list for the MOTOMAN-MPX1150 is shown below.

Product performance cannot be guaranteed when using spare parts from any company other than YASKAWA. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts
- Rank B: Parts for which replacement may be necessary as a result of frequent operation
- Rank C: Drive units

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

Table 11-1: Spare Parts for the MOTOMAN-MPX1150-0* (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Battery pack</td>
<td>HW1471600-CA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For S-, L-axis encoder (Except for B**, C***)</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Battery pack</td>
<td>HW1471600-CB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For U-, R-axis encoder (Except for B**, C***)</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Battery pack</td>
<td>HW1471600-CC</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For B-, T-axis encoder (Except for B**, C***)</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery pack</td>
<td>HW1471600-BA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For S-, L-axis encoder (B***)</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery pack</td>
<td>HW1471600-BB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For U-, R-axis encoder (B***)</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>Battery pack</td>
<td>HW1471600-BC</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For B-, T-axis encoder (B***)</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>Battery pack</td>
<td>HW1471600-DA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For S-, L-axis encoder (C***)</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>Battery pack</td>
<td>HW1471600-DB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For U-, R-axis encoder (C***)</td>
</tr>
<tr>
<td>Rank</td>
<td>Parts No.</td>
<td>Name</td>
<td>Type</td>
<td>Manufacturer</td>
<td>Qty</td>
<td>Qty per Unit</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>-----------------------------</td>
<td>-----------------------------------</td>
<td>-----------------------------------</td>
<td>-----</td>
<td>--------------</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>Battery pack (spare parts)</td>
<td>HW1471600-DC</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>Adhesive (for fixing screw)</td>
<td>DB-1600</td>
<td>Diabond Industry Co., Ltd.</td>
<td>200 ml</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>11</td>
<td>Liquid gasket</td>
<td>1200C</td>
<td>Three Bond Co., Ltd.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>12</td>
<td>Adhesive (for fixing screw)</td>
<td>LOCTITE 243</td>
<td>Henkel Japan Ltd.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>Adhesive (for fixing screw)</td>
<td>LOCTITE 518</td>
<td>Henkel Japan Ltd.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>14</td>
<td>Adhesive (for fixing screw)</td>
<td>LOCTITE 638</td>
<td>Henkel Japan Ltd.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>15</td>
<td>Grease</td>
<td>MP-1</td>
<td>NIPPON GREASE CO., LTD.</td>
<td>2.5 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>16</td>
<td>Grease</td>
<td>Harmonic Grease SK-1A</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>17</td>
<td>Grease</td>
<td>Multemp PS No.2-A</td>
<td>KYODO YUSHI CO., LTD</td>
<td>18 kg</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
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<td>L-axis timing belt</td>
<td>100HP-SSSM375</td>
<td>Mitsubishi Belting Limited</td>
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Table 1-1: Spare Parts for the MOTOMAN-MPX1150-*0* (Sheet 2 of 3)
Table 11-1: Spare Parts for the MOTOMAN-MPX1150-*0* (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>
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