MOTOMAN-MPX1950 INSTRUCTIONS

TYPE:
YR-MPX1950-*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-MPX1950 INSTRUCTIONS
MOTOMAN-MPX1950 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: 185476-1CD
Revision: 2

MANUAL NO. HW1485452 1/125
MANDATORY

- This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MPX1950 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 the MOTOMAN-MPX1950.

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.
CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX200 after use.

The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- Read and understand the Explanation of Warning Labels in the DX200 Instructions before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Registered Trademark

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

型式 YR-MPX1950-A00
防爆記号 マニピュレータ Ex ib px IIIB T4 Gb/Ex ib IIIb T4 Gb
塗装ユニット [Ex ib] IIIb
シリアルNo: 
オーダNo: 

定格
マニピュレータ
最大電圧 三相 AC220V (-15%, +10%) 50/60Hz
最大電流: 5.1 A
最大容量: 4.3 kW
最大電力: 1.75 kVA

塗装ユニット
最大電圧: 0℃〜40℃

本体回路
バッテリバックアップ回路: DC4.5V 37.9mA
ノンリターンリチウム電池(ENERGIZER L91)

本安回路
許容電圧: AC250V 50/60Hz, DC250V

保護ガスの最小換気流量: 290 L/min
換気中の設定圧力範囲: 0.28〜0.32 MPa
最小換気時間: 3 min
保護ガスの最小流量: 15 NL/min
最大換気流量: 15 NL/min
最大内圧: 50 kPa
運転時の設定圧力範囲: 0.01〜0.02 MPa
保護ガス温度範囲: 0℃〜40℃

内圧保護システムに加える最小供給圧力: 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、リレーバリア、絶縁バリア及びエンコーダ分離基板(塗装ユニット内蔵)は本質安全防爆構造及び内圧防爆構造の組合せ機器ですから、構成機器、配線等を変更または改造しないで下さい。
2. バッテリバックアップ回路は、バッテリユニット、位置検出器、エンコーダ分離基板から構成され、断続装置の電源遮断時、または断続中に本安回路となります。
3. 塗装ユニットの塗地はD種接地工事に準じて行って下さい。
4. リレーバリア、絶縁バリア及びエンコーダ分離基板(塗装ユニット内蔵)は非本安場所に設置しないで下さい。
5. バッテリの交換は、換気装置がある場合にのみ行う事を確認して行って下さい。
6. 爆発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. これからの、内圧容器となります。
8. 取扱説明書参照下さい。
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ほこりを取り除いて下さい。

（日本語表記の範囲は国内のみ使用） Nameplate that has been described in Japanese is used in Japan.
**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, AEx/Ex a px IIB Gb, T4, Ta=0–40°C  
FM APPROVALS CERTIFICATE NUMBER: FM18CA0062

PER YASKAWA ELECTRIC DRAWING HW1385958 HW1385333
MANUFACTURER: YASKAWA ELECTRIC CORPORATION.
ADDRESS: 2-1 SHIROISHI KUROSU'I YAHATANISHI-KU  
KITAKYUSHU-CITY FUKUOKA 806-0004 JAPAN
MANIPULATOR: MODEL YR-MPX1950-B00
SERIAL No.: 

Minimum Purging Flow Rate: 280 L/min  
Minimum Purging Duration: 5 min  
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 DE TROUVEE SANS DANGER, OU SAUF SI TOUS LES DISPOSITIFS
DEDANS ONT ETE MIS HORS TENSION.
LE COURANT NE DOIT PAS ETRE RESTAURE APRES QUE LE BOITIER
A ETE OUVERT JUSQUA CE QUE L'AIR DANS LE BOITIER A ETE
PURGE PENDANT 3 MINUTES:"

---

**Fig.**
**Fig.: Explosion-Proof Indication Label (ATEX)**

```
PER YASKAWA ELECTRIC DRAWING: HW1385958, HW1385333
MANUFACTURER: YASKAWA ELECTRIC CORPORATION.
ADDRESS: 2-1 SHIROISHI KUROSAKI YAHATANISHI-KU
KITAKYUSHU-CITY FUKUOKA 806-8004 JAPAN
MANIPULATOR: MODEL YR-MPX1950-XX
SERIAL No.: [Blank]

Minimum Purging Flow Rate: 280 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."
```
Warning Labels

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

Battery warning label
The label is on the cover which the battery is mounted.
HW1372692-A(For S-, L-axis)
-B(For U-, R-axis)
-C(For B-, T-axis)
Battery pack type: ENERGIZER L91
Manufacturer: YASKAWA Electric Corporation

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-MPX1950-A*</th>
<th>YR-MPX1950-B*</th>
<th>YR-MPX1950-C*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nameplate</td>
<td>![Nameplate_img]</td>
<td>![Nameplate_img]</td>
<td>![Nameplate_img]</td>
</tr>
<tr>
<td>Battery Warning Label</td>
<td>![Battery_WARNING_img]</td>
<td>![Battery_WARNING_img]</td>
<td>![Battery_WARNING_img]</td>
</tr>
<tr>
<td>Pressure Switch Unit Warning Label</td>
<td>![Pressure_WARNING_img]</td>
<td>![Pressure_WARNING_img]</td>
<td>![Pressure_WARNING_img]</td>
</tr>
<tr>
<td>Warning Label A</td>
<td>![Warning_A_img]</td>
<td>![Warning_A_img]</td>
<td>![Warning_A_img]</td>
</tr>
<tr>
<td>Warning Label B</td>
<td>![Warning_B_img]</td>
<td>![Warning_B_img]</td>
<td>![Warning_B_img]</td>
</tr>
</tbody>
</table>

**Warning**

This pressurized enclosure contains a battery which remains connected after the external power has been isolated. Refer to instructions in the manual before carrying out frequent inspection and exchanging periodically. The battery is only to be replaced by Licensee when the area is known to be safe.

**WARNING**

Dispositif de securite antideflagrant ne changez pas ancun Parametre.

**Explosion-proof safety Device**

Do not change any Parameters.

**Explosion-proof safety Device**

Do not change any Parameters.

**Voiture**

Do not change any Parameters.

**Collision hazard**

Can cause severe injury. Keep away from the robot during automatic operation.

**Crush hazard**

Can cause severe injury. Keep clear of all moving parts.

**Made in Japan**

YASKAWA ELECTRIC CORPORATION
Kitakyushu 806-0004 Japan
2-1 Kurosakishiroishi, Yahatanishi-ku,
2-1 Kurosakishiroishi, Yahatanishi-ku,
2-1 Kurosakishiroishi, Yahatanishi-ku,
2-1 Kurosakishiroishi, Yahatanishi-ku,
2-1 Kurosakishiroishi, Yahatanishi-ku,
2-1 Kurosakishiroishi, Yahatanishi-ku,
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-MPX1950 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-MPX1950 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</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CLASS I, DIVISION 1,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GROUPS C,D,T4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CLASS I, ZONE 1,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AEx ia px IIB T4</td>
<td></td>
</tr>
<tr>
<td>FM(CA)</td>
<td>TYPE X pressurization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CLASS I, DIVISION 1,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GROUPS C,D,T4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex ia px IIB T4 Gb</td>
<td></td>
</tr>
<tr>
<td>ATEX/ CAT.2</td>
<td>II 2 G Ex ib px IIB T4 Gb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Scheduled)</td>
<td></td>
</tr>
</tbody>
</table>

DANGER

In case installing the MOTOMAN-MPX1950 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-MPX1950, confirm that the manipulator is possible to install in that area.

DANGER

The MOTOMAN-MPX1950 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.
Any modification of the MOTOMAN-MPX1950, 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.
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1 Product Confirmation

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives. Standard delivery includes the following six items (information for the content of optional goods are given separately):

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

Fig. 1-1: Six Items for Standard Delivery

**CAUTION**

- Confirm that the manipulator and the DX200 have the same order number.
Special care must be taken when more than one manipulator is to be installed.
If the numbers do not match, manipulators may not perform as expected and cause injury or damage.
### 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 M16 (Length: 70 mm)</td>
<td>4</td>
<td>For mounting the manipulator</td>
</tr>
<tr>
<td>Washer M16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Conical spring washer M16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Hexagon socket head cap screw M6 (Length: 16 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-PT3/8</td>
<td>3</td>
<td>For grease replenishment to the S-, L-, U-, R-, B-, and T-axis</td>
</tr>
<tr>
<td>Grease zerk A-PT1/8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-MT6X1</td>
<td>2</td>
<td></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>
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the DX200. The order number is located on a label as shown below.

Fig. 1-2: Location of Order Number Labels
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 bolts are securely fastened.
• The weight of the manipulator is approximately 300 kg (including the shipping bolts and brackets). Use a wire rope (wire length: at least 2000 mm 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>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>-40°</td>
<td>-61.4°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>-61152</td>
<td>-81641</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
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 bracket 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*

<table>
<thead>
<tr>
<th>Gravity center &quot;G&quot;: Manipulator and Shipping bolts and brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit: [mm]</td>
</tr>
<tr>
<td>Forklift claw entries</td>
</tr>
<tr>
<td>Shipping bolt and bracket (Fixed to the manipulator before shipment.)</td>
</tr>
</tbody>
</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>$0^\circ$</td>
<td>$-40^\circ$</td>
<td>$-61.4^\circ$</td>
<td>$0^\circ$</td>
<td>$0^\circ$</td>
<td>$0^\circ$</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>-61152</td>
<td>-81641</td>
<td>0</td>
<td>0</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.

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 over-turn 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.

3-1
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>
<thead>
<tr>
<th>Table 3-1: Manipulator Repulsion Force</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Horizontal rotation</strong></td>
</tr>
<tr>
<td>Repulsion force $F_{H}$</td>
</tr>
<tr>
<td>Emergency stop</td>
</tr>
<tr>
<td>Acceleration/deceleration</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Vertical rotation</strong></td>
</tr>
<tr>
<td>Repulsion force $F_{V}$</td>
</tr>
<tr>
<td>Emergency stop</td>
</tr>
<tr>
<td>Acceleration/deceleration</td>
</tr>
</tbody>
</table>

*Fig. 3-1: Manipulator Repulsion Force*
3 Installation
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 33 mm or more thick, and anchor bolts of M16 or larger size.

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate with four hexagon head bolts M16 (70 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
### 3.2 Mounting Procedures for Manipulator Base

#### 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)

**Enlarged View of C (Fixing part)**
3 Installation
3.3 Mounting methods

3.3 Mounting methods

The MOTOMAN-MPX1950 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

- 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".

- 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 M16 (tensile strength: 1200 N/mm² or more) to fix the manipulator base. And tighten them with the tightening torque of 206 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” for details.

Fig. 3-5: Precaution Against Falling

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°C 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 excessive 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. (ex. 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.
4.1 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)
4.2 Cable Connection

**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.

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.

**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-MPX1950 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.
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 manipulator, 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 4.2.3 "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" and chapter 4.2.2 "Manipulator Cable Connection".

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)

*1: Notation on the manipulator cable connection part varies depending on the DX200 specifications.
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 4-1: Manipulator Cable Connecting Position

<table>
<thead>
<tr>
<th>Type</th>
<th>Connecting position</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back side connection</td>
<td>View A</td>
<td>Connect to the back side of the manipulator. Refer to Back Side in fig. 4-4 “Manipulator Cable Connecting Position”.</td>
</tr>
<tr>
<td>Bottom side connection</td>
<td>View B</td>
<td>Viewing from the back side, connect to the bottom side of the manipulator. Refer to Bottom Side in fig. 4-4.</td>
</tr>
</tbody>
</table>

Fig. 4-4: Manipulator Cable Connecting Position

![Manipulator Cable Connecting Position Diagram]
4 Wiring

4.2 Cable Connection

4.2.2 Manipulator Cable Connection

4.2.2.1 Back Side Connection

**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 screws M6 on the upper part of the base and on the cover of the rear part to remove the cover.
2. Mount the manipulator cable on the rear part of the base by using the hexagon socket head cap screws M6.
3. Connect the connector of the manipulator cable from the opening on the upper part of the base by referring to View A in fig. 4-5 “Manipulator Cable Connection (Back Side)”.
4. Connect the protective gas pressure feeding tube to the joint of the IN-side.
5. Connect the ground wire (2 wires) of the manipulator cable to the tapped hole for mounting ground wires in the base.
6. Check that there is no bend in the protective gas pressure feeding tube (in the manipulator) and in the wiring of the cable and the (AIR) OUT opening is not blocked.
7. Mount the cover of the upper part of the base by using the hexagon socket head cap screws M6.
Fig. 4-5: Manipulator Cable Connection (Back Side)

Hexagon socket head cap screw
M6 "Trivalent chromium"
(length: 18 mm) (8 screws)
Washer M6 "Stainless"
Tightening torque: 10 N•m (1.0 kgf•m)

© BC cable
Ground wire for the manipulator cable:
Tighten the screw only.
Cross head APS bolt M5 "Stainless"
(length: 12 mm) (3 bolts)
Tightening torque: 4.0 N•m (0.41 kgf•m)

Bracket for the signal
Bracket for the power supply
4.2.2.2 Bottom Side Connection

**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 screws M6 on the upper part of the base and on the cover of the lower part to remove the cover.
2. Mount the manipulator cable on the lower part of the base by using the hexagon socket head cap screws M6.
3. Connect the connector of the manipulator cable from the opening on the upper part of the base by referring to View A in fig. 4-6 "Manipulator Cable Connection (Bottom Side)".
4. Connect the protective gas pressure feeding tube to the joint of the IN-side.
5. Connect the ground wire (2 wires) of the manipulator cable to the tapped hole for mounting ground wires in the base.
6. Check that there is no bend in the protective gas pressure feeding tube (in the manipulator) and in the wiring of the cable and the (AIR) OUT opening is not blocked.
7. Mount the cover of the upper part of the base by using the hexagon socket head cap screws M6.
4 Wiring

4.2 Cable Connection

**Fig. 4-6: Manipulator Cable Connection (Bottom Side)**

- Hexagon socket head cap screw M6 *Trivalent chromium* (length: 18 mm) (8 screws)
- Washer M6 *Stainless*
- Tightening torque: 10 N•m (1.0 kgf•m)

Bracket for the signal
Bracket for the power supply

1BC cable (AIR) IN
2BC cable

Hexagon socket head cap screw M6 *Trivalent chromium* (length: 18 mm) (8 screws)
Washer M6 *Stainless*
Tightening torque: 10 N•m (1.0 kgf•m)
4.2.3 Intrinsically Safe Cable Connection

Fig. 4-7: 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 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 4-2: Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
<td>3-phase 200 VAC (-15% to +10%) 50/60 Hz 220 VAC (-15% to +10%) 60 Hz 2.5 kVA (at peak)</td>
<td></td>
</tr>
</tbody>
</table>
| 2   | Air supply  
Pressurized explosion-proof construction | Required pressure: 0.35 MPa to 0.65 MPa  
Capacity:  
For pressurized type of explosion protected construction  
At operating: 15 Nl/min or more  
At purging: 1000 Nl/min or more  
Dryness: Freezing at -18 °C | Use dry air for the pressurized explosion-proof construction. |
| 3   | Grounding | Grounding resistance: 100 Ω or less | For the controller of the manipulator |

**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 4-3: Installation Site

<table>
<thead>
<tr>
<th>System Components</th>
<th>Hazardous Location (Inside Painting Booth)</th>
<th>Non-hazardous location (Outside Painting Booth)</th>
<th>Ambient Temperature</th>
<th>Maximum Ambient Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulator (explosion-proof)</td>
<td>•</td>
<td>×</td>
<td>0°C to 40°C</td>
<td>80%RH</td>
</tr>
<tr>
<td>DX200 (not explosion-proof)</td>
<td>×</td>
<td>•</td>
<td>0°C to 45°C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Pressure Switch unit (explosion-proof)</td>
<td>•</td>
<td>×</td>
<td>0°C to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (not explosion-proof)</td>
<td>×</td>
<td>•</td>
<td>0°C to 40°C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (explosion-proof) (Optional)</td>
<td>•</td>
<td>•</td>
<td>0°C to 40°C</td>
<td>85%RH</td>
</tr>
</tbody>
</table>

DANGER

- In case installing the MOTOMAN-MPX1950 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-MPX1950, 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-MPX1950 are shown in fig. 4-8 “System Configuration and Installation Site”.
4 Wiring
4.4 Installation Site

Fig. 4-8: System Configuration and Installation Site

**Non-hazardous Area**
- Program selection device (optional)
- Intrinsically safe cable (1 or 2 cables)
- Painting unit
- Relay connector
- Ground resistance must be 10 Ω or less (*)
- Programmable pendant (non-explosion-proof) (PP)
- POWER SUP.
  - Three-phase AC200/220V 50/60Hz

**Hazardous Area**
- Conveyor switch (optional)
- Painting unit
- Certified terminal box (optional)
- Intrinsically safe terminal box (optional)
- Pressure switch unit
- Pressure switch unit can be installed at a maximum of 20 m away from the manipulator.
- (PP) Programming pendant (explosion-proof, optional)
- Air tube
  - Outside dia. 12, Inside dia. 9
- Air supply
  - 0.35MPa to 0.65MPa

(*) When explosion-proof programming pendant is in use.
## 5 Basic Specifications

### 5.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YR-MPX1950-*00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>7 kg</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 0.15 mm</td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>-170° ~ +170°</td>
<td></td>
</tr>
<tr>
<td>&lt;Wall-mounted&gt;</td>
<td>-90° ~ +90°</td>
<td></td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>-100° ~ +140°</td>
<td></td>
</tr>
<tr>
<td>U-axis (Relative angle between the upper arm and the lower arm)</td>
<td>-62° ~ +235°</td>
<td></td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>-200° ~ +200°</td>
<td></td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>-150° ~ +150°</td>
<td></td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>-400° ~ +400°</td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>1.5 m/s</td>
<td></td>
</tr>
<tr>
<td>Allowable Moment</td>
<td>R-axis 19.6 Nm (2.0 kgf•m)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B-axis 19.6 Nm (2.0 kgf•m)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-axis 9.8 Nm (1.0 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>Allowable Inertia (GD^2/4)</td>
<td>R-Axis 0.6 kg•m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B-Axis 0.6 kg•m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-Axis 0.16 kg•m²</td>
<td></td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>265 kg</td>
<td></td>
</tr>
<tr>
<td>Protective Structure</td>
<td>Body: IP4X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrist axis only: IP65</td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td>Temperature 0°C to +40°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Humidity 20% to 80%RH (non-condensing)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration Acceleration 4.9 m/s² (0.5 G) or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others Free from dust, soil, or water Free from excessive electrical noise (plasma).</td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td>2.5 kVA</td>
<td></td>
</tr>
<tr>
<td>Applicable Controller</td>
<td>DX200</td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td>73 dB</td>
<td></td>
</tr>
</tbody>
</table>

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

- T-axis flange
- Rotating head (S-head)
- Manipulator base
- Upper arm (U-arm)
- Lower arm (L-arm)
5.3 Dimension of the Manipulator

Fig. 5-2: Dimension of the Manipulator

- 18 dia. (4 holes) (hole for mounting)
- 12 dia. \( \frac{3}{8} \) reamed hole (2 places)
- Tapped hole M8 (pitch: 1.25) (tapped hole for grounding)

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

Fig. 5-3: Dimensions and P-point Maximum Envelope

Range of motion for the S-axis: +60° to -60°
Restricted range of motion in (\(\mathcal{R}\))

Range of motion for the S-axis: +85° to +170°, -125° to -170°
Restricted range of motion in (\(\mathcal{R}\))

* Note: When mounted on the wall, the range of motion varies.
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.

**Fig. 5-4: Outline View of the Pressure Switch Unit**

- **Purging pressure:** 0.28 to 0.32 [MPa]
- **Operating pressure:** 0.01 to 0.02 [MPa]
- **Air inlet:** 0.35 to 0.65 [MPa] (tube: 12 dia.)
- **Exhaust port:** 53/125

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

To the manipulator (tube: outside diameter 12 dia., inside diameter 9 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>20.8</td>
<td>0.199</td>
</tr>
<tr>
<td>L-axis</td>
<td>22.5</td>
<td>0.225</td>
</tr>
<tr>
<td>U-axis</td>
<td>14.0</td>
<td>0.120</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

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

Fig. 5-5(c): U-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 Stopping Distance and Time for S-, L-, and U-Axes

5.6.4.2 Stopping Distance and Time for Stop Category 1: S-Axis
5.6 Stopping Distance and Time for S-, L-, and U-Axes

5.6.4.3 Stopping Distance and Time for Stop Category 1: L-Axis

---

**Graphs showing stopping distance and time for different load and extension settings.**

- **Extension 100%**
  - Load 100%
  - Load 66%
  - Load 33%

- **Extension 66%**
  - Load 100%
  - Load 66%
  - Load 33%

- **Extension 33%**
  - Load 100%
  - Load 66%
  - Load 33%
5.6.4.4 Stopping Distance and Time for Stop Category 1: U-Axis

![Graph showing stopping distance and time for U-Axis extensions at 100%, 66%, and 33% load.]
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>-120° - +120°</td>
</tr>
<tr>
<td></td>
<td>-90° - +90°</td>
</tr>
<tr>
<td></td>
<td>-60° - +60°</td>
</tr>
<tr>
<td></td>
<td>-30° - +30°</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.

- Mechanical stopper (HW1406115-1) (2 stoppers)
- Hexagon socket head cap screw M6 (length: 30 mm) (2 screws) (tensile strength: 1200 N/mm² or more)
- Conical spring washer 2L-6 (2 washers)
5 Basic Specifications
5.7 Modification of S-axis Operation Range

Fig. 5-6: Components of the S-Axis Mechanical Stopper and Stopper Mounting Position

- Hexagon socket head cap screw M6 (length: 30 mm) (2 screws) (tensile strength: 1200 N/mm² or more)
- Conical spring washer 2L-6 (2 washers)
- Tightening torque: 10 N·m (1.0 kgf·m)

Section A-A Bolt fixing position

Rotating head: tapped hole M6 (9 places)

Standard stopper

Enlarged View of B

Hexagon socket head cap screw M6 (length: 30 mm) (2 screws) (tensile strength: 1200 N/mm² or more) Conical spring washer 2L-6 (2 washers) Tightening torque: 10 N·m (1.0 kgf·m)
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 30° to 120° range.

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

1. Without removing the standard stopper on the front side of the rotating head, mount the optional stopper and the hexagon socket head cap screws M6 on the adaptable stopper position.
2. By referring to Table 5-3 “Posture of the S-axis when Mounting the S-axis Mechanical Stopper”, move the manipulator to the S-axis mechanical stopper mounting posture (angle) from the setting operation angle.
3. Turn OFF the power supply to the DX200.
4. Tighten the stopper mounted at step 1 with the tightening torque of 10 N•m (tensile strength: 1200 N/mm² or more).

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>Pulse of the S-axis when mounting the S-axis mechanical stopper</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>+120°</td>
<td>183456</td>
</tr>
<tr>
<td></td>
<td>-120°</td>
<td>-183456</td>
</tr>
<tr>
<td>b</td>
<td>+90°</td>
<td>137592</td>
</tr>
<tr>
<td></td>
<td>-90°</td>
<td>-137592</td>
</tr>
<tr>
<td>c</td>
<td>+60°</td>
<td>91728</td>
</tr>
<tr>
<td></td>
<td>-60°</td>
<td>-91728</td>
</tr>
<tr>
<td>d</td>
<td>+30°</td>
<td>45864</td>
</tr>
<tr>
<td></td>
<td>-30°</td>
<td>-45864</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.
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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse limit (S-axis + direction):</td>
<td>S1CxG400</td>
</tr>
<tr>
<td>Pulse limit (S-axis - direction):</td>
<td>S1CxG408</td>
</tr>
</tbody>
</table>

<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>+170° to -170°</td>
<td>+259896</td>
<td>-259896</td>
</tr>
<tr>
<td>Wall-mounted way</td>
<td>+90° to -90°</td>
<td>+137592</td>
<td>-137592</td>
</tr>
<tr>
<td>Ceiling-mounted way</td>
<td>+170° to -170°</td>
<td>+259896</td>
<td>-259896</td>
</tr>
</tbody>
</table>

**NOTE**

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.
5. Basic Specifications

5.7 Modification of S-axis Operation Range

The settable angles for S-axis stopper are shown in Table 5-4 "The Settable Angle for S-Axis Stopper".

<table>
<thead>
<tr>
<th>The Angle of S-Axis Stopper for + Direction</th>
<th>170°</th>
<th>120°</th>
<th>90°</th>
<th>60°</th>
<th>30°</th>
<th>0°</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Angle of S-Axis Stopper for - Direction</td>
<td>-170°</td>
<td>-120°</td>
<td>-90°</td>
<td>-60°</td>
<td>-30°</td>
<td>0°</td>
</tr>
</tbody>
</table>

*Settable angle*  
*Non settable angle*

Table 5-4 "The Settable Angle for S-Axis Stopper" indicates the angle range which allows S-axis to be set for + direction and - direction angles. (Ex. -90° to +90° is settable, however 0° to +120° is not settable.)
6 Allowable Load for Wrist Axis Flange

6.1 Allowable Wrist Load

The payload of the wrist axis is a maximum of 7 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 6-1: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N-m (kgf•m)</th>
<th>GD^2/4 Total Moment of Inertia kg•m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>19.6 (2.0)</td>
<td>0.6</td>
</tr>
<tr>
<td>B-Axis</td>
<td>19.6 (2.0)</td>
<td>0.6</td>
</tr>
<tr>
<td>T-Axis</td>
<td>9.8 (1.0)</td>
<td>0.16</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 using the fitting, the depth of the outside fitting shall be 4 mm or less.

Fig. 6-2: Wrist Flange

Unit: [mm]

Detailed and Enlarged View of A
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. 7-2 “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 U-axis joint part and the lower arm (L-arm).

Observe the following restrictions.

The total mass mounted on the wrist end must be equal to or less than 7 kg. The total mass mounted on the mounts on the U-axis joint part and the lower arm must be equal to or less than 3 kg.

Fig. 7-1: Calculating Allowable Load

Allowable load from L-arm to casing
Allowable total moment of inertia from the L-axis rotation center
2.7 kgf - m

Example: To mount 5-kg device
2.7 kgf - m = 5kg * 0.54m
→ 5-kg load can be mounted on the L-arm (excludes loads on flange)
7.1.2 Position of the Payload Mounts

Fig. 7-2: Installing Peripheral Equipment
8 Electrical Equipment Specification
8.1 Internal Connections

fig. 8-1(a) “Internal Connection Diagram (YR-MPX1950-A00, -C00)”,
fig. 8-1(b) “Internal Connection Diagram (YR-MPX1950-A00, -C00)”,
fig. 8-2(a) “Internal Connection Diagram (YR-MPX1950-B00)”, and
fig. 8-2(b) “Internal Connection Diagram (YR-MPX1950-B00)” show the internal connections.
1. This is the internal connection diagram for the MOTOMAN-MPX1950.

Applicable model: YR-MPX1950-A*, YR-MPX1950-C*
8.3 Internal Connections

Fig. 8-1(b): Internal Connection Diagram (YR-MPX1950-A00, -C00)
8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-2(a): Internal Connection Diagram (YR-MPX1950-B00)

Note:
1. This is the internal connection diagram for the MOTOMAN-MPX1950.
   Applicable model: YR-MPX1950-B*

Applicable model: YR-MPX1950-B*
Fig. 8-2(b): Internal Connection Diagram (YR-MPX1950-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>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></td>
<td>&lt;DANGER&gt; If any deformations or cracks are found, immediately stop the operation and contact your YASKAWA representatives.</td>
</tr>
<tr>
<td>2</td>
<td>Motion</td>
<td>Smooth tuning, horizontal, and vertical motions of each arm. The robot’s home position does not change.</td>
<td>●</td>
<td></td>
<td></td>
<td>&lt;DANGER&gt; Do not enter the robot working envelope.</td>
</tr>
<tr>
<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>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tubes</td>
<td>Off or no severe wear and tear on paint and air supply tubes.</td>
<td>●</td>
<td>●</td>
<td></td>
<td>&lt;CAUTION&gt; Use a pair of protective goggles to protect your eyes against paint or thinner that is emitted from the tube.</td>
</tr>
<tr>
<td>5</td>
<td>Air leakage</td>
<td>No excessive air leakage from the fitting of the motor case.</td>
<td>●</td>
<td>●</td>
<td></td>
<td>&lt;CAUTION&gt; Make sure that the air tube is firmly inserted in the joint. Accidental disconnection of the air tube may cause injury.</td>
</tr>
<tr>
<td>6</td>
<td>Dried paint</td>
<td>Remove the dried paint on the robot.</td>
<td>●</td>
<td>●</td>
<td></td>
<td>&lt;CAUTION&gt; When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
</tbody>
</table>
## 9 Frequent Inspections

### 9.1 Frequent Inspections

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

<table>
<thead>
<tr>
<th>Item</th>
<th>No.</th>
<th>Items to be Inspected</th>
<th>Inspection</th>
<th>Daily</th>
<th>Weekly</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulator</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>DANGER Replace the cable if any abnormalities are found.</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Base mounting bolts</td>
<td>Check for damage and looseness, and then retighten loose bolts with a spanner or wrench.</td>
<td>⬤</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Cover mounting screws</td>
<td></td>
<td>⬤</td>
<td>⬤</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Battery alarm</td>
<td>Check the battery alarm by using the DX200.</td>
<td>⬤</td>
<td></td>
<td>CAUTION Inspect the manipulator while it is in its standby position and not in motion.</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Check the operation of the emergency stop button. Remove any dried paint.</td>
<td>The manipulator stops immediately when the emergency stop button is pressed.</td>
<td>⬤</td>
<td>⬤</td>
<td>CAUTION Inspect the manipulator while it is in its standby position and not in motion.</td>
</tr>
<tr>
<td>Pressure Switch Unit</td>
<td>1</td>
<td>Pressure set value</td>
<td>The pressure of the pressure reducing valve is within the specified range</td>
<td>⬤</td>
<td></td>
<td>WARNING Do not make any modifications to the settings. The pressure switch unit is a safety related parts for explosion-Proof specification.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Air leakage inspection</td>
<td>Check for any air leakage from the pressure switch unit.</td>
<td>⬤</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DANGER**
Replace the cable if any abnormalities are found.

**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.
9 Frequent Inspections
9.2 Daily Inspections

9.2 Daily Inspections

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

9.2.1 Manipulator

DANGER

The MOTOMAN-MPX1950 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.

DANGER

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

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.

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.
9.2.1.4 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
  - 0.28 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.

- The inspection interval must be based on the servo power supply ON time.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The inspection and maintenance of explosion-proof electric equipments must be performed by experienced maintenance personnel who have been trained on different types of explosion-proof enclosures, installation of electric equipment, related laws and regulations, and general principles for hazardous area classifications.</td>
</tr>
<tr>
<td>• Maintenance and inspection must be performed by specified personnel.</td>
</tr>
<tr>
<td>Failure to observe this caution may result in electric shock or injury.</td>
</tr>
<tr>
<td>• For disassembly or repair, contact your YASKAWA representative.</td>
</tr>
<tr>
<td>• Do not remove the motor, and do not release the brake.</td>
</tr>
<tr>
<td>Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator’s arm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)</td>
</tr>
<tr>
<td>Failure to observe this warning may result in electric shock or injury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The battery pack must be connected before removing detection connector when maintenance and inspection.</td>
</tr>
<tr>
<td>Failure to observe this caution may result in the loss of home position data.</td>
</tr>
</tbody>
</table>

NOTE

The inspection interval must be based on the servo power supply ON time.
### 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>Item number 1</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for crack or damages.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>Item number 2</td>
<td>1000H/Cycle</td>
<td>Visual Noise</td>
<td>Check for abnormality1)</td>
<td>Licensee (Person who is qualified by YASKAWA)</td>
</tr>
<tr>
<td>Item number 3</td>
<td>6000H/Cycle</td>
<td>Visual Manual</td>
<td>Check for come off, wear, or damages.</td>
<td>Service Company (YASKAWA)</td>
</tr>
<tr>
<td>Item number 4</td>
<td>12000H/Cycle</td>
<td>Visual Manual</td>
<td>Check for air leakage.</td>
<td></td>
</tr>
<tr>
<td>Item number 5</td>
<td>24000H/Cycle</td>
<td>Visual</td>
<td>Remove adhered paint if any.</td>
<td></td>
</tr>
<tr>
<td>Item number 6</td>
<td>36000H/Cycle</td>
<td>Visual Manual</td>
<td>Check the value if it is within the proper value range.</td>
<td></td>
</tr>
<tr>
<td>Item number 7</td>
<td></td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>Item number 8</td>
<td></td>
<td>Visual</td>
<td>Check for grease leakage.2)</td>
<td></td>
</tr>
<tr>
<td>Item number 9</td>
<td></td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td></td>
</tr>
<tr>
<td>Item number 10</td>
<td></td>
<td>Visual</td>
<td>Check for filter dogging.</td>
<td></td>
</tr>
<tr>
<td>Item number 11</td>
<td></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>
</tr>
<tr>
<td>Item number 12</td>
<td></td>
<td>Visual</td>
<td>Check for belt tension, wear or tear</td>
<td></td>
</tr>
<tr>
<td>Item number 13</td>
<td></td>
<td>Visual Multi-meter</td>
<td>Check for conduction between the main connector of the base and the terminal by manually shaking the wires. Check for wear on the protective spring.3)</td>
<td></td>
</tr>
</tbody>
</table>

---

1): Specified personnel (Customer)  
3): Visual Multi-meter  
4): 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>Daily</td>
<td></td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.</td>
<td>● ● ●</td>
</tr>
<tr>
<td>15</td>
<td>10000H cycle</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
<td>● ● ●</td>
</tr>
<tr>
<td>16</td>
<td>60000H cycle</td>
<td>Visual</td>
<td>Replace</td>
<td>● ● ●</td>
</tr>
<tr>
<td>17</td>
<td>120000H cycle</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
<td>● ● ●</td>
</tr>
<tr>
<td>18</td>
<td>240000H cycle</td>
<td>Visual</td>
<td>Replace (recommended)</td>
<td>● ● ●</td>
</tr>
<tr>
<td>19</td>
<td>360000H cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>● ● ●</td>
</tr>
<tr>
<td>18</td>
<td>120000H cycle</td>
<td>Hand pump injection syringe</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>● ● ●</td>
</tr>
<tr>
<td>19</td>
<td>120000H cycle</td>
<td>Pressure switch unit</td>
<td>Confirm that the pressure switch, flow switch, solenoid valve and the pressure reducing valve operate correctly. Contact your YASKAWA representatives.</td>
<td>● ● ●</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>Overhaul</td>
<td>● ● ●</td>
</tr>
</tbody>
</table>

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 240000H inspection.
5. For grease used in each parts, refer to table 10-2 “Inspection Parts and Grease Used.”

---

**Table Notes:**
- ●: Identified by the customer
- ●: Identified by the licensees qualified by YASKAWA
- ●: Identified by the service company provided by YASKAWA.
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>VIGO Grease RE0</td>
<td>S-, L-, and U-axis speed reducers</td>
</tr>
<tr>
<td>2</td>
<td>Harmonic Grease SK-1A</td>
<td>R- and B-axis speed reducers and T-axis gear</td>
</tr>
</tbody>
</table>

Fig. 10-1: Inspection Parts and Inspection Numbers

Pressure switch unit (mounted separately)
10.2.1 Grease Replenishment and Replacement

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

Replenish or replace grease for the following sections:

1) S-, L-, and U-axis speed reducers
2) R-axis speed reducer
3) B-axis speed reducer
4) T-axis motor gear
10.2 Maintenance for Manipulator

10.2.1.1 Grease Replenishment and Replacement Procedures for S-, L-, and U-axis Speed Reducers

**DANGER**

The MOTOMAN-MPX1950 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.

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

- If grease is injected without removing the plug from the grease exhaust port, the grease will leak inside a motor, or an oil seal of a speed reducer will come off. Make sure to remove the plug and inject grease.
  
  Also, when using a tube, the length must be 150 mm or shorter and the inside diameter must be 6 mm or longer. If the tube is too long, the exhaust resistance at the tube part is increased, and the inner pressure of the grease bath is raised. It may result in coming off of an oil seal.

- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 7 g/s or less.

- When using extrusion air for discharging the grease, set air supply pressure at 0.025 MPa or less. If the air supply pressure is higher than above mentioned value, an oil seal of a speed reducer will come off, and it may result in a failure.

- When using extrusion air for discharging grease, grease may be vigorously discharged from the exhaust port. Perform an operation such as using a tube at the grease exhaust port to pour into an appropriate container.

- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

- After injecting grease, discharge the specified amount of grease. If insufficient, the inner pressure is raised during the operation, and grease may leak. When discharged too much, the speed reducer is not lubricated sufficiently during the operation, and it may cause the early failure of the speed reducer.

- When filling/replacing grease, the grease may flow out from the grease inlet or the grease exhaust port. Prepare a container to receive the grease and a waste cloth to wipe the grease in advance.
When operating the manipulator, do not enter into the working area of the manipulator. Injury may result if anyone enter into the working area during operation.

**Fig. 10-2(a): S-, L-, and U-axis Speed Reducer (For Floor-mounted)**

**WARNING**

- **S-axis inlet**
  - Hexagon socket head plug PT1/8 (stainless)
  - Tightening torque: 4.9 N•m (0.5 kgf•m)

- **S-axis exhaust port**
  - Hexagon socket head plug PT3/8 (stainless)
  - Tightening torque: 23 N•m (2.34 kgf•m)

- **L-axis inlet**
  - Hexagon socket head plug PT3/8 (stainless)
  - Tightening torque: 23 N•m (2.34 kgf•m)

- **L-axis exhaust port**
  - Hexagon socket head plug PT3/8 (stainless)
  - Tightening torque: 23 N•m (2.34 kgf•m)

- **U-axis inlet**
  - Hexagon socket head plug PT1/8 (stainless)
  - Tightening torque: 4.9 N•m (0.5 kgf•m)

- **U-axis exhaust port**
  - Hexagon socket head plug PT3/8 (stainless)
  - Tightening torque: 23 N•m (2.34 kgf•m)

- **S-axis speed reducer**
  - Hexagon socket head cap screw M6 (trivalent chromium) (length: 20 mm) (9 screws) (delivered with the manipulator)
  - Washer M6 (stainless) (9 washers) (delivered with the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)

- **U-axis speed reducer**
  - Hexagon socket head cap screw M6 (trivalent chromium) (length: 20 mm) (9 screws) (delivered with the manipulator)
  - Washer M6 (stainless) (9 washers) (delivered with the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)
10.2 Maintenance for Manipulator

**Fig. 10-2(b): S-, L-, and U-axis Speed Reducer (For Wall-mounted)**

- **S-axis inlet**
  - Hexagon socket head plug PT1/8 (stainless)
  - Tightening torque: 4.9 N•m (0.5 kgf•m)

- **L-axis inlet**
  - Hexagon socket head plug PT3/8 (stainless)
  - Tightening torque: 23 N•m (2.34 kgf•m)

- **U-axis inlet**
  - Hexagon socket head plug PT1/8 (stainless)
  - Tightening torque: 4.9 N•m (0.5 kgf•m)

- **L-axis speed reducer**
  - Hexagon socket head cap screw M6 (trivalent chromium)
    - (length: 20 mm) (8 screws) (delivered with the manipulator)
    - Washer M6 (stainless) (9 washers) (delivered with the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)

- **U-axis speed reducer**
  - Hexagon socket head cap screw M6 (trivalent chromium)
    - (length: 20 mm) (9 screws) (delivered with the manipulator)
    - Washer M6 (stainless) (9 washers) (delivered with the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)

- **Cover**
  - Hexagon socket head cap screw M6 (trivalent chromium)
    - (length: 20 mm) (8 screws) (delivered with the manipulator)
    - Washer M6 (stainless) (8 washers) (delivered with the manipulator)
  - Tightening torque: 10 N•m (1.0 kgf•m)
10.2 Maintenance for Manipulator

![Fig. 10-2(c): S-, L-, and U-axis Speed Reducer (For Ceiling-mounted)](image)

**S-axis inlet**
- Hexagon socket head plug PT3/8 (stainless)
- Tightening torque: 23 N•m (2.34 kgf•m)

**L-axis exhaust port**
- Hexagon socket head plug PT3/8 (stainless)
- Tightening torque: 23 N•m (2.34 kgf•m)

**U-axis inlet**
- Hexagon socket head plug PT1/8 (stainless)
- Tightening torque: 4.9 N•m (0.5 kgf•m)

**S-axis speed reducer**
- Hexagon socket head cap screw M6 (trivalent chromium)
- (length: 20 mm) (8 screws) (delivered with the manipulator)
- Washer M6 (stainless) (8 washers) (delivered with the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)

**L-axis speed reducer**
- Hexagon socket head cap screw M6 (trivalent chromium)
- (length: 20 mm) (8 screws) (delivered with the manipulator)
- Washer M6 (stainless) (8 washers) (delivered with the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)

**U-axis speed reducer**
- Hexagon socket head cap screw M6 (trivalent chromium)
- (length: 18 mm) (8 screws) (delivered with the manipulator)
- Washer M6 (stainless) (8 washers) (delivered with the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)

*Remove the plug, and then extend and connect the tube (10 dia.)*
10 Maintenance and Inspection
10.2 Maintenance for Manipulator

1. Before injecting grease, the posture of the manipulator must be set as indicated in Table 10-3 "Recommended Posture for Grease Injection". If it is difficult to make the recommended posture because of external cabling or etc., adjust the posture as much as possible to make the position of grease inlet located in the lower part and the position of exhaust port located in the upper part. If the exhaust port is located in the lower part, grease may not be exchanged properly.

<table>
<thead>
<tr>
<th>Mounting Condition</th>
<th>Axle to inject</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>Floor-mounted</td>
<td>S-axis</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>Wall-mounted</td>
<td>L-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Ceiling-mounted</td>
<td>U-axis</td>
<td>Any</td>
<td>0°</td>
<td>0°</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Remove the cover shown in Fig. 10-2(a) "S-, L-, and U-axis Speed Reducer (For Floor-mounted)", Fig. 10-2(b) "S-, L-, and U-axis Speed Reducer (For Wall-mounted)", and Fig. 10-2(c) "S-, L-, and U-axis Speed Reducer (For Ceiling-mounted)" in accordance with the mounting method, and then remove the hexagon socket head plugs from the grease inlet and grease exhaust port.

![NOTE]
The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

3. Install a grease zerk A-PT3/8 or A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)

4. Inject the grease through the grease inlet using a grease gun.
   - Grease type: VIGO grease RE0
   - Recommended grease lubricator: Powerlube P3C (made by Macnaught)
   - Amount of grease: 7 g/s or less
     (For example, if grease is supplied from the lubricator at 2 times/s, set the amount to 3.5 g/time or less.)
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Approx. 1750 g</td>
</tr>
<tr>
<td>L-axis</td>
<td>Approx. 1200 g</td>
</tr>
<tr>
<td>U-axis</td>
<td>Approx. 930 g</td>
</tr>
</tbody>
</table>
5. Injection stop:
   - <When replacing the speed reducer>
     Stop injecting grease when grease can be seen from the exhaust port.
   - <When exchanging grease>
     The old grease is discharged from the grease exhaust port. At this time, stop injection when the mixture of the old grease and the new grease in an equal ratio is seen. And then, skip the steps 6 and 7, and proceed to the step 8.

6. Operate each axis about 5 times in the teach mode as shown in table 10-5 “Teaching Operation for Each Axis”.

Table 10-5: Teaching Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to replenish grease</th>
<th>Angle for teaching operation</th>
<th>Speed for teaching operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>S-axis ±45°</td>
<td>User-specified</td>
</tr>
<tr>
<td>L-axis</td>
<td>L-axis ±45°</td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>U-axis ±45°</td>
<td></td>
</tr>
</tbody>
</table>

7. Inject grease again, and when grease comes out of the exhaust port, grease injection is completed.

8. Discharge the specified amount of grease from the grease inlet or grease exhaust port. (Refer to table 10-6 “Amount of Grease Discharged from Each Axis”.) In order to discharge the specified amount of grease, receive the discharged grease by using a container, and then measure the weight of the discharged grease by weighing the container till the amount reaches to the specified amount. Use one of the following methods to discharge grease.

Method 1: Extruding grease by air
   1. Connect the joint and the hose to the grease inlet.
   2. Connect the regulator to the grease exhaust port.
   3. Inject air from the grease exhaust port to extrude grease by air. (Extrusion air pressure: 0.025 MPa or less)
   4. If the grease is not discharged enough by injecting air, operate the manipulator about 5 times in the teach mode as shown in table 10-7 “Grease Discharging Operation for Each Axis”.

Method 2: Suctioning grease out
   1. Keep the inlet open and insert the tube into the exhaust port.
   2. Discharge grease by suctioning grease out of the exhaust port. (Suction pressure: 0.025 MPa or less)
   3. If grease is not discharged by suctioning, operate the manipulator again about 5 times in the teach mode as shown in table 10-7 “Grease Discharging Operation for Each Axis”.

Table 10-6: Amount of Grease Discharged from Each Axis

<table>
<thead>
<tr>
<th>Axis to replenish grease</th>
<th>Amount of Discharge (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>120</td>
</tr>
<tr>
<td>L-axis</td>
<td>120</td>
</tr>
<tr>
<td>U-axis</td>
<td>120</td>
</tr>
</tbody>
</table>
For the axis where grease is exchanged, perform a playback operation indicated in Table 10-8 "Running-In Operation for Each Axis" for running-in the speed reducer with grease. At this time, grease may be discharged during the operation. Remove the grease zerk from the grease inlet, and clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug. Tighten the plug on the grease inlet with the tightening torque of 16.5 N·m (1.7 kgf·m). Also, discharge the excess grease in order not to increase the inner pressure of the speed reducer. Attach a bag to receive grease such as indicated in Fig. 10-3 "Grease Receiving Bag (Rough Standard)", and then perform the running-in operation.

### Table 10-6: Amount of Grease Discharged from Each Axis

<table>
<thead>
<tr>
<th>Posture</th>
<th>Axis</th>
<th>Amount of exhausted grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor-mounted</td>
<td>S-axis</td>
<td>80±5</td>
</tr>
<tr>
<td>Wall-mounted</td>
<td>L-axis</td>
<td>50±5</td>
</tr>
<tr>
<td>Ceiling-mounted</td>
<td>U-axis</td>
<td>50±5</td>
</tr>
</tbody>
</table>

### Table 10-7: Grease Discharging Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Angle for teaching operation</th>
<th>Speed for teaching operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-, L-, U-axis</td>
<td>±45°</td>
<td>User-specified</td>
</tr>
</tbody>
</table>

### Table 10-8: Running-In Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Running-in operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation angle</td>
</tr>
<tr>
<td>S, L, U-axes</td>
<td>±45° MOVJ Vij=50.00</td>
</tr>
</tbody>
</table>
10. Wipe the discharged grease with a cloth, and reinstall the plug. Clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, attach it to the grease exhaust port, and then tighten the plug with the tightening torque of 16.5 N•m (1.7 kgf•m).

11. Mount the removed cover, and then tighten it with the tightening torque shown in fig. 10-2(a) “S-, L-, and U-axis Speed Reducer (For Floor-mounted)”, fig. 10-2(b) “S-, L-, and U-axis Speed Reducer (For Wall-mounted)”, and fig. 10-2(c) “S-, L-, and U-axis Speed Reducer (For Ceiling-mounted)”. 

Fig. 10-3: Grease Receiving Bag (Rough Standard)
10.2.1.2 Grease Replenishment for R-axis Speed Reducer

Fig. 10-4: R-axis Speed Reducer

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

2. Install the grease zerk A-PT1/8 to the grease inlet.
   (The grease zerk A-PT1/8 is provided with the manipulator when shipping.)

**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 before the grease injection.
3. Inject grease through the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7 g

**NOTE**

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

4. Remove the grease zerk A-PT1/8 from the grease inlet, and re-install the plugs to the grease inlet and the air exhaust port.
Wrap the seal tape TB4501 around the plug, and then tighten it with the tightening torque of 4.9 N•m (0.5 kgf•m).
10.2.1.3 Grease Replenishment for B-axis Speed Reducer

Fig. 10-5: B-Axis Speed Reducer Diagram

1. Remove the hexagon socket head cap screws M6 from the grease inlet and the air exhaust port.

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

**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 before the grease injection.
3. Inject the grease into the grease inlet.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 5 g

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

4. Remove the grease zerk A-M6X1 from the grease inlet, and re-install the hexagon socket head cap screws M6 to the grease inlet and the air exhaust port. When installing the screws, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 4.1 N·m (0.42 kgf·m).
10.2.1.4 Grease Replenishment for T-axis Gear

Fig. 10-6: T-Axis Gear Diagram

1. Remove the hexagon socket head cap screws M6 from the grease inlet 1 and the air exhaust port.

   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 before the grease injection.

2. Install a grease zerk A-MT6X1 to the grease inlet 1.
   (The grease zerk A-MT6X1 is provided with the manipulator when shipping.)
3. Inject the grease into the grease inlet 1.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 2 g

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

4. Remove the grease zerk A-MT6X1 from the grease inlet 1. Install the hexagon socket head cap screw M6 to the grease inlet 1. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 4.1 N·m (0.42 kgf·m).

5. Remove the hexagon socket head cap screw M6 from the grease inlet 2.

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

7. Inject the grease into the grease inlet 2.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 2 g

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

8. Remove the grease zerk A-MT6X1 from the grease inlet 2. Install the hexagon socket head cap screw M6 to the grease inlet 2. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 4.1 N·m (0.42 kgf·m).

9. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 4.1 N·m (0.42 kgf·m).
10.2.2 Inspection of Air Sealing for Internal Air Pressure

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 (one of the two is for the cover of the manipulator cable) and of both lateral sides 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
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

Unscrew the cover fixing screws (six 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
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. 10-9(a) “Battery Location”.

- YR-MPX1950-A* battery pack type: HW1372692- (A to C)
- YR-MPX1950-B* battery pack type: HW1470715- (BA to BC)
- YR-MPX1950-C* battery pack type: HW1373234- (A to C)

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

**Fig. 10-9(a): Battery Location**

For details of the Y part and the X part, refer to fig. 10-9(b) “Details of Battery Pack (YR-MPX1950-A*, -C*)” and fig. 10-9(c) “Details of Battery Pack (YR-MPX1950-B*)”.
10 Maintenance and Inspection

10.2 Maintenance for Manipulator

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**Fig. 10-9(b): Details of Battery Pack (YR-MPX1950-A*, -C*)**

**Details of the Battery Pack on Y part**

- **Battery pack**: [YR-MPX1950-A*; HW1372692-A], [YR-MPX1950-C*; HW1373234-A]
- **Cable tie (T50R)** (2 places)
- **Plastic tube** (HW9405566-1)
- **Hexagon socket head cap screw M4** (length: 35 mm) (2 screws) (fixed to the manipulator)
- **Washer M4** "stainless" (2 washers) (fixed to the manipulator)
- **Tightening torque**: 0.5 N•m (0.05 kgf•m)
- *Apply LOCTITE 243 to the tip part of the screw.

**Details of the Battery Pack on X part**

- **Battery pack**: [YR-MPX1950-A*; HW1372692-B], [YR-MPX1950-C*; HW1373234-B]
- **Cable tie (T50R)** (2 places)
- **Plastic tube** (HW9405566-1)
- **Hexagon socket head cap screw M4** (length: 60 mm) (2 screws) (fixed to the manipulator)
- **Washer M4** "stainless" (2 washers) (fixed to the manipulator)
- **Tightening torque**: 0.5 N•m (0.05 kgf•m)
- *Apply LOCTITE 243 to the tip part of the screw.
10.2 Maintenance for Manipulator

Fig. 10-9(c): Details of Battery Pack (YR-MPX1950-B*)

Details of the Battery Pack on Y part

- The connector and the protective tube (electric parts) of the battery pack should be separated by the plastic tube.
- Cable tie (T50R) (2 places)
- Plastic tube (HW9405566-1)

Details of the Battery Pack on X part

- The connector and the protective tube (electric parts) of the battery pack should be separated by the plastic tube.
- Cable tie (T50R) (2 places)
- Plastic tube (HW9405566-1)

- Battery pack
- Cover

- Cable tie (T30R) (2 places)
- Head of the cable tie (T50R)
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10.2 Maintenance for Manipulator

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. 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. Mount the battery pack by using the bolt M4 (length: 60 mm), the bolt M4 (length: 35 mm), and the cable ties (T50R, two cable ties, 4 places) on the bracket, and mount the bracket by using the screw M5 (length: 16 mm) (provided with the battery) 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.
10 Maintenance and Inspection
10.2 Maintenance for Manipulator

Fig. 10-11(a): Warning Label for Battery Replacement

**WARNING**
This pressurized enclosure contains a battery which remains connected after the external power has been isolated. 
Refer to instructions in the manual before carrying out frequent inspection and exchanging periodically.
Battery only to be replaced by Licensee when the area is known to be safe.

Fig. 10-11(b): Warning Label Locations for Battery Replacement
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. 10-12 “Pressure Switch Unit Cover”.)
3. Loosen the locking nut equipped to the valves with a spanner (nominal size: 10 mm). (Refer to fig. 10-13 “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.
10.3.3 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. 10-14 “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. 10-12 “Pressure Switch Unit Cover”.)
3. As shown in the fig. 10-14, 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 10-9 “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 10-9: List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure

<table>
<thead>
<tr>
<th>Pressure reducing valve</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>for purging pressure</td>
<td>0.28 to 0.32</td>
</tr>
<tr>
<td>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 0.28 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. 10-12.)
10.3 Inspection of the Explosion-Proof Device

Fig. 10-12: Pressure Switch Unit Cover

Pan-head semi-screw M4
Tinplated chromium, length: 8 mm, 7 screws)

Fig. 10-13: 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. 10-14: Operation Check of Pressure Reducing Valve

Pressure reducing valve for purging pressure 0.28 to 0.32 [MPa]
Pressure reducing valve for operating pressure 0.01 to 0.02 [MPa]

Industrial compressed air 0.35 to 0.65 [MPa]
From manipulator (Air tube: outside 12 dia., inside 9 dia.)
To manipulator (Air tube: outside 12 dia., inside 9 dia.)

Pressure gauge
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10.3 Inspection of the Explosion-Proof Device

10.3.1.4 Operation Check of Pressure Detection Function

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

- **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. 10-12 “Pressure Switch Unit Cover”.)
3. Set the pressure of both purging air and operation air reducing valves as shown in table 10-10 "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 10-10: List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure |
|-----------------|-----------------|
| Pressure reducing valve for purging pressure | 0.28 to 0.32 MPa |
| Pressure reducing valve for the operating pressure | 0.01 to 0.02 MPa |

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. 10-15 “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. 10-12.)
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10.3 Inspection of the Explosion-Proof Device

- Operation check of pressure reducing valve
  - A flow-meter (measurable range of 0 to 10 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. 10-16 "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. 10-12 "Pressure Switch Unit Cover").
3. Set the pressure of operation air reducing valve as shown in table 10-11 "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.
4. Connect the flow meter to the pressure adjusting valve exhaust side.
5. Check that the flow-meter indicates 10 L/min when the operating pressure is 0.05 MPa.
6. Set the pressure of operation air reducing valve as shown in table 10-12 "Reducing Valve for Operating Pressure-Adjusting Pressure 2-".
   - Refer to chapter 10.3.1.2 "Operation Method of Pressure Reducing Valve" for the pressure reducing valve operation.
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 10-13 "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 the operating pressure</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td></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>0.02</td>
<td></td>
</tr>
</tbody>
</table>
10 Maintenance and Inspection

10.3 Inspection of the Explosion-Proof Device

Table 10-13: List of Setting Value for Pressure Reducing Valve for Purging Pressure and Operating Pressure

<table>
<thead>
<tr>
<th>Pressure reducing valve</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>for purging pressure</td>
<td>0.28 to 0.32</td>
</tr>
<tr>
<td>for the operating pressure</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

10. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 10-12 “Pressure Switch Unit Cover”.)

Fig. 10-15: Operation Check for Pressure Detector
10.3 Inspection of the Explosion-Proof Device

Fig. 10-16: Operation Check for Pressure Adjusting Valve

Exhaust side of pressure adjusting valve
The size of the plug is Rc1/4

Pressure adjusting valve
Flowmeter (measurable range of 0 to 10 L/min is included)
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. 10-12 “Pressure Switch Unit Cover”.)
3. Set the pressure of operation air reducing valve as shown in table 10-14 “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 10-14: 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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.28 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. 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. 10-17 “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. 10-12.)
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. 10-18(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

Start Preparation Mode

Supply the protective gas after the following inspection.
- Loose bolts to enclosure
- Any damages to the enclosure

Y

Re-connect the tubes
Tighten the bolts for covers
Change the enclosure

N

Start supplying 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.

Y

Re-connect the tubes
Tighten the bolts for covers
Change the enclosure

N

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

Y

Change the pressure switch unit.

N

Check the setting values of the pneumatics unit.

Pressure reducing valve for purging pressure
0.28 to 0.32 Mpa
Pressure reducing valve for operating pressure
0.01 to 0.02 Mpa
Primary pressure into the pressure switch unit
0.35 to 0.65 Mpa

Check the setting values within the values shown in the left.

N

Turn ON the breaker of the controller by manual.
Purging mode is simultaneously ready to start by turning the power ON.
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Fig. 10-18(b): Enclosure Protection Flow Chart

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

Purge reset.

Turn the breaker OFF by manual.
Stop supplying the protective gas into the pressure switch unit.

Has 2 minutes passed since the purging air mode was started?

Start counting the purging time (3 minutes).

Has 3 minutes passed since the purging count 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.

When the purging air is 20 kPa or more, has the flow reached 280 L/min?

When the purging air is 20 kPa or more, is the flow kept at 280 L/min?

Has 3 minutes passed since the purging count was started?

Does the abnormal pressure occur in the first time after the first restarting?

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.

When the purging air is 20 kPa or more, is the flow kept at 280 L/min?
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Fig. 10-18(c): Enclosure Protection Flow Chart

*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 infowing.
   “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” 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. 10-12 “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>0.28 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>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 programming pendant and grip the enable switch to turn ON the power supply, and then confirm that the manipulator is operable.</td>
</tr>
</tbody>
</table>
### 3-(2) Checking the Inner Pressure Error (low pressure error) Detection Operations

**Checking item**

- Abnormal pressure declines
- Alarm
- Power shut down
- Impossible to resume 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>0.28 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>
</tbody>
</table>

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

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

**Checking item**

- Abnormal inner pressure rising
- Release the OUT port of the pressure adjusting valve
- Boot up/Start operation available
- Resolving the inner pressure error
- Closing the OUT port of the pressure adjusting valve
- Boot up / Start operation available

<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>0.28 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, and 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 Maintenance and Inspection

10.3 Inspection of the Explosion-Proof Device

3-(4) Checking of Purging Error Detection Operations

Checking item

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

<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>0.28 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 programing pendant window. While purging, confirm that no power is supplied to motors and manipulator is inoperable.</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td></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 programing 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 10-15 “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 10-15: List of Setting Value for Purging Air and Operation Air Reducing Valves

<table>
<thead>
<tr>
<th>Pressure [MPa]</th>
<th>Purging air reducing valve</th>
<th>Operation air reducing valve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.28 to 0.32</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

5. Re-install the cover with the hexagon socket head cap screws. (Refer to fig. 10-12 “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. 10-19(a) "Backup Battery Connection for S-, L-, and U-Axis Motors", fig. 10-19(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.

Fig. 10-19(a): Backup Battery Connection for S-, L-, and U-Axis Motors
10 Maintenance and Inspection
10.4 Notes for Maintenance

Fig. 10-19(b): Backup Battery Connection for R-, B-, and T-Axis Motors
11 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-MPX1950. The spare parts list for the MOTOMAN-MPX1950 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

Table 11-1: Spare Parts for the MOTOMAN-MPX1950-*00 (Sheet 1 of 4)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Battery pack</td>
<td>HW1471600-CA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S-, L-axis encoder (for A***)</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>1</td>
<td>For U-, R-axis encoder (for A***)</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>1</td>
<td>For B-, T-axis encoder (for A***)</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>1</td>
<td>For S-, L-axis encoder (for 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>1</td>
<td>For U-, R-axis encoder (for 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>1</td>
<td>For B-, T-axis encoder (for 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>1</td>
<td>For S-, L-axis encoder (for 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>1</td>
<td>For U-, R-axis encoder (for C***)</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>Battery pack</td>
<td>HW1471600-DC</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For B-, T-axis encoder (for C***)</td>
</tr>
</tbody>
</table>
### Table 11-1: Spare Parts for the MOTOMAN-MPX1950-00 (Sheet 2 of 4)

<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>10</td>
<td>Adhesive</td>
<td>DB-1600</td>
<td>Diabond Industry Co., Ltd.</td>
<td>200 ml</td>
<td>For sealing the gasket</td>
</tr>
<tr>
<td>A</td>
<td>11</td>
<td>Double coated adhesive tape</td>
<td>93005LE</td>
<td>YASKAWA Electric Corporation</td>
<td>1 m</td>
<td>0.6 m</td>
</tr>
<tr>
<td>A</td>
<td>12</td>
<td>Liquid gasket</td>
<td>1206C</td>
<td>ThreeBond Co., Ltd.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>Seal tape</td>
<td>TB4501</td>
<td>ThreeBond Co., Ltd.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>14</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>15</td>
<td>Grease</td>
<td>MP-1</td>
<td>NIPPON GREASE CO., LTD.</td>
<td>2.5 kg</td>
<td>For the O-ring seal and the O-ring</td>
</tr>
<tr>
<td>A</td>
<td>16</td>
<td>Grease</td>
<td>VIGO Grease RE0</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>17</td>
<td>Grease</td>
<td>Harmonic Grease SK-1A</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5 kg</td>
<td>For R- and B-axis speed reducer and T-axis gear</td>
</tr>
<tr>
<td>A</td>
<td>18</td>
<td>Grease</td>
<td>Multemp PS 2A</td>
<td>KYODO YUSHI CO., LTD.</td>
<td>18 kg</td>
<td>For lubricating the internal wiring harness</td>
</tr>
<tr>
<td>B</td>
<td>19</td>
<td>R-axis timing belt</td>
<td>BG350UP5M10-HC</td>
<td>TSUBAKIMOTO CHAIN CO.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
<td>B-axis timing belt</td>
<td>BG957UP3M10-HC</td>
<td>Mitsuboshi Belting Limited</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>21</td>
<td>T-axis timing belt</td>
<td>1005SM750</td>
<td>TSUBAKIMOTO CHAIN CO.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>22</td>
<td>5-axis speed reducer kit</td>
<td>HW1485832-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>23</td>
<td>5-axis speed reducer kit</td>
<td>HW1485833-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>24</td>
<td>4-axis speed reducer kit</td>
<td>HW1485834-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>5-axis speed reducer kit</td>
<td>HW1485835-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>26</td>
<td>5-axis speed reducer kit</td>
<td>HW1485836-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>27</td>
<td>Wrist unit</td>
<td>HW1372940-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 11-1: Spare Parts for the MOTOMAN-MPX1950-*00 (Sheet 3 of 4)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 28</td>
<td>HW1408717-1</td>
<td>Gasket</td>
<td>HW1408717-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>Rear cover for base or bottom cover for base, cover for manipulator cable</td>
</tr>
<tr>
<td>B 29</td>
<td>HW1408720-1</td>
<td>Gasket</td>
<td>HW1408720-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Top cover for base (-A***)</td>
</tr>
<tr>
<td>B 30</td>
<td>HW1408720-2</td>
<td>Gasket</td>
<td>HW1408720-2</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Top cover for base (-B**, -C***)</td>
</tr>
<tr>
<td>B 31</td>
<td>HW1408722-1</td>
<td>Gasket</td>
<td>HW1408722-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>Cover for both sides of base</td>
</tr>
<tr>
<td>B 32</td>
<td>HW1307163-1</td>
<td>Gasket</td>
<td>HW1307163-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for S-head</td>
</tr>
<tr>
<td>B 33</td>
<td>HW1307164-1</td>
<td>Gasket</td>
<td>HW1307164-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for lower part of L-arm</td>
</tr>
<tr>
<td>B 34</td>
<td>HW1408830-1</td>
<td>Gasket</td>
<td>HW1408830-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for middle part of L-arm</td>
</tr>
<tr>
<td>B 35</td>
<td>HW1307166-1</td>
<td>Gasket</td>
<td>HW1307166-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for upper part of L-arm</td>
</tr>
<tr>
<td>B 36</td>
<td>HW1307171-1</td>
<td>Gasket</td>
<td>HW1307171-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Cover for casing</td>
</tr>
<tr>
<td>B 37</td>
<td>HW1307172-1</td>
<td>Gasket</td>
<td>HW1307172-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>Cover for U-arm</td>
</tr>
<tr>
<td>C 38</td>
<td>S-L-axis AC servo motor</td>
<td>SGMRV-13ANA-YRA1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>For S-, L-axis</td>
<td></td>
</tr>
<tr>
<td>C 39</td>
<td>U-axis AC servo motor</td>
<td>SGMRV-09ANA-YRA1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For U-axis</td>
<td></td>
</tr>
<tr>
<td>C 40</td>
<td>R-axis AC servo motor</td>
<td>SGM7J-04APK-YRA1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For R-axis</td>
<td></td>
</tr>
<tr>
<td>C 41</td>
<td>B-, T-axis AC servo motor</td>
<td>SGM7J-02APK-YRA1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>For B-, T-axis</td>
<td></td>
</tr>
</tbody>
</table>
### Table 11-1: Spare Parts for the MOTOMAN-MPX1950-*00  (Sheet 4 of 4)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>42</td>
<td>S-L-axis internal cable</td>
<td>HW1173258-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>43</td>
<td>U-axis internal cable</td>
<td>HW1173259-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>44</td>
<td>Pressure switch unit</td>
<td>HW1271459-N YASKAWA Electric Corporation</td>
<td>1</td>
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