MOTOMAN-MPX2600 INSTRUCTIONS

TYPE:
YR-MPX2600-*00 (STANDARD SPECIFICATION)

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

MOTOMAN INSTRUCTIONS

The DX200 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 180788-1CD
Revision: 0
MANDATORY

• This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MPX2600 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.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-MPX2600.

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

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

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

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

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

PROHIBITED
Must never be performed.

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

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

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

DANGER

• Maintenance and inspection must be performed by specified personnel.

Failure to observe this caution may result in electric shock or injury.

• For disassembly or repair, contact your YASKAWA representative.

• Do not remove the motor, and do not release the brake.

Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator’s arm.
WARNING

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Fig. : Emergency Stop Button

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the power for the DX200.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX200 and the programming pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
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<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

<table>
<thead>
<tr>
<th>型式</th>
<th>YR-MPX2600-A00</th>
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<tr>
<td>防爆記号</td>
<td>Ex ibpIIB T4 Gb/Ex ibIIB</td>
</tr>
<tr>
<td>塗装ユニット</td>
<td>[Ex ib]IIB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>シリアルNo:</th>
<th></th>
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<tr>
<td>オーダNo:</td>
<td></td>
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<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>マニュレータ</td>
<td>三相 AC200V (-15%,+10%)  50/60Hz</td>
</tr>
<tr>
<td></td>
<td>AC220V (-15%,+10%)  60Hz</td>
</tr>
<tr>
<td>最大電流:</td>
<td>8.7  A</td>
</tr>
<tr>
<td>最大容量:</td>
<td>9.9  KW</td>
</tr>
<tr>
<td>最大電力:</td>
<td>3.0  KVA</td>
</tr>
<tr>
<td>周囲温度</td>
<td></td>
</tr>
<tr>
<td>マニュレータ:</td>
<td>0℃〜+40℃</td>
</tr>
<tr>
<td>塗装ユニット:</td>
<td>0℃〜+45℃</td>
</tr>
</tbody>
</table>

| 本安回路       | DC4.5V 37.9mA                       |

| 非本安回路     | AC250V 50/60Hz,DC250V                |
|               |                                      |
| 保護ガスの最小換気量: | 320 L/min                           |
| 掃気時の設定圧力範囲: | 0.18〜0.20 MPa                       |
| 最小換気時間:   | 4 min                                |
| 保護ガスの最小流量: | 15 NL/min                           |
| 最大換気量:     | 15 NL/min                            |
| 最小内圧:      | 5 kPa                                |
| 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曝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、制御装置の電源遮断時、または掃気中に本安回路となります。
3. 塗装ユニットの接続はB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)は非危険場所に設置
**Explosion-Proof Indication Label and Warning**

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

**YASKAWA ELECTRIC CORPORATION**

2-1 Kurosakishiroishi, Yahatanishi-ku

Kitakyushu 806-0004 Japan

**Explosion-Proof Indication Label (ATEX)**

<table>
<thead>
<tr>
<th>Notified Body Number</th>
<th>Certificate Number</th>
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<tbody>
<tr>
<td>CML 17ATEX1034X</td>
<td>YR-MPX2600-C00</td>
</tr>
<tr>
<td>Ex ib pxb ⧼B T4 Gb/Ex ib ⧼B T4 Gb</td>
<td>[Ex ib Gb] ⧼B</td>
</tr>
</tbody>
</table>

**Serial No:**

- Year of Manufacture: 2023
- Maximum Voltage: 3Px200V (-15%,+10%)50/60Hz
- Maximum Current: 8.7 A
- Maximum Capacity: 9.9 kW
- Maximum Power: 3.0 KVA
- Ambient Temperature:
  - Manipulator: 0°C to +40°C
  - Painting Unit: 0°C to +45°C
- Intrinsically Safe Circuitry:
  - Battery Back Up Circuitry: DC4.5V 37.9mA
  - Lithium/Iron Disulfide Battery (ENERGIZER L91)
- Non-Intrinsic safety circuit:
  - Allowable Voltage: AC250V 50/60Hz, DC250V
  - Minimum Dilution Flow Rate: 320 L/min
  - Setting Pressure for Purging: 0.18 to 0.20 MPa
  - Minimum Purge Flow Time: 4 min
  - Minimum Flow Rate of Protective Gas: 15 NL/min
  - Maximum Leakage: 15 NL/min
  - Minimum Over Pressure (input): 5 kPa
  - Maximum Over Pressure (input): 50 kPa
  - Setting Pressure for Operating: 0.01 to 0.02 MPa
  - Protective Gas Temperature: 0°C to +40°C
- Pressurization System:
  - Minimum Line Pressure: 0.35 MPa
  - Maximum Line Pressure: 0.65 MPa
- Routine Test: Pass

**WARNINGS:**

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

**Note 1:** The place of production may be replaced with the following address it is the ATEX-approved one.

YASKAWA Europe GmbH
Yaskawastr.1, D-85391
Allershausen Germany
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

Nameplate
YASKAWA MODEL MOTO6MAN-
PAYLOAD MASS
ORDER NO. DATE
SERIAL NO.

Warning label A
Warning label B

Pressure switch unit warning label
Explosion-proof safety Device
Do not change any Parameters.
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-MPX2600 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-MPX2600 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>
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</thead>
<tbody>
<tr>
<td>TIIS</td>
<td>ExibpxIIBT4Gb</td>
<td>ExibIIBT4Gb</td>
</tr>
<tr>
<td>ATEX/ CAT.2</td>
<td>II2G ExibpxbIIBT4Gb</td>
<td>II2G ExibIIBT4Gb</td>
</tr>
</tbody>
</table>

**DANGER**

In case installing the MOTOMAN-MPX2600 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-MPX2600, confirm that the manipulator is possible to install in that area.

**PROHIBITED**

- Any modification of the MOTOMAN-MPX2600, 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.
Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the users responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.
- Some operations require a standard passwords and some require special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
**Maintenance Safety**

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

**Summary of Warning Information**

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.
Customer Support Information

If you need assistance with any aspect of your MPX2600 system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact YASKAWA Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact YASKAWA Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

- System: MPX2600
- Primary Application: ___________________________
- Controller: DX200
- Software Version: Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the DX200 controller data plate
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<td>10-23</td>
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<td>10.3.2</td>
<td>Enclosure Protection Sequence</td>
<td>10-24</td>
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<tr>
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<td>10-30</td>
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<td>Recommended Spare Parts</td>
<td>11-1</td>
</tr>
</tbody>
</table>
1 Product Confirmation

CAUTION

- Confirm that the manipulator and the DX200 have the same order number.

Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform as expected and cause injury or damage.

1.1 Contents Confirmation

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

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

Fig. 1-1: Six Items for Standard Delivery

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

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Pcs</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagon socket head cap screw M20 (Length: 90 mm)</td>
<td>4</td>
<td>For mounting the manipulator</td>
</tr>
<tr>
<td>Washer M20</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Conical spring washer M20</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-PT3/8</td>
<td>3</td>
<td>For grease replenishment</td>
</tr>
<tr>
<td>Grease zerk A-PT1/8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Hexagon socket head cap screw M4 (Length: 12 mm)</td>
<td>2</td>
<td>For mounting the bracket to the manipulator cable.</td>
</tr>
<tr>
<td>Conical spring washer M4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Hexagon socket head cap screw M5 (Length: 8 mm)</td>
<td>2</td>
<td>For mounting the grounding wire of the manipulator cable.</td>
</tr>
<tr>
<td>Conical spring washer M5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cable tie T50L</td>
<td>4</td>
<td>For tying up the plastic cover for the manipulator cable.</td>
</tr>
<tr>
<td>Hexagon socket head cap screw M6 (Length: 25 mm)</td>
<td>14</td>
<td>For mounting the manipulator cable</td>
</tr>
<tr>
<td>Conical spring washer M6</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Key</td>
<td>1</td>
<td>For positioning of the wrist axis</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*

(a) DX200 (Front View)

(b) Manipulator (Back View)
2 Transport

2.1 Transporting Method

CAUTION

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

NOTE

- Check that the eyebolts are securely fastened.
- The weight of the manipulator is approximately 550 kg (including the shipping bolts and brackets for the floor-mounted model. For the wall-mounted model, the weight of the manipulator is approximately 600 kg. For the ceiling-mounted model, the weight of the manipulator is approximately 580 kg). Use a wire rope strong enough to withstand the mass.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2.1 Transporting Method

2.1.1 Using a Crane

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

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

Fig. 2-1(a): Transport Using a Crane (Floor-mounted)

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>
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<tbody>
<tr>
<td>Angle</td>
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<td>0°</td>
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<td>0°</td>
<td>0°</td>
<td>0°</td>
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<tr>
<td>Pulse</td>
<td>0</td>
<td>0</td>
<td>-144625</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Fig. 2-1(b): Transport Using a Crane (Wall-mounted) (Optional)

- Gravity center "G": Manipulator and Shipping bolts and brackets

**Factory setting for angle and pulse of each axis**

<table>
<thead>
<tr>
<th>Axis</th>
<th>S-axis</th>
<th>L-axis</th>
<th>U-axis</th>
<th>R-axis</th>
<th>B-axis</th>
<th>T-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>0°</td>
<td>0°</td>
<td>-60°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
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<td>0</td>
<td>-144625</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
2 Transport

2.1 Transporting Method

Fig. 2-1(c): Transport Using a Crane (Ceiling-mounted) (Optional)

The manipulator is in the nailed wooden box when it is delivered.

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>
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</thead>
<tbody>
<tr>
<td>Angle</td>
<td>0°</td>
<td>0°</td>
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<td>0°</td>
<td>0°</td>
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<tr>
<td>Pulse</td>
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<td>0</td>
<td>-144625</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
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(a) “Transport Using a Forklift (Floor-mounted)”.

Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator. When this manipulator is mounted on the floor, it can be transported without a pallet by inserting the claws of the forklift into the entry of the shipping bolts and bracket.

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

Fig. 2-2(a): Transport Using a Forklift (Floor-mounted)

| Unit: [mm] |

Fix the manipulator to the base for transportation by using 22 dia. tapped hole (4 holes).

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

### 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>
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</tbody>
</table>
Fig. 2-2(b): Transport Using a Forklift (Floor-mounted)

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

Unit: [mm]

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>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
2 Transport

2.1 Transporting Method

Fig. 2-2(c): Transport Using a Forklift (Wall-mounted) (Optional)

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

Fix the manipulator to the base for transportation by using 17.5 dia. tapped hole (4 holes) (3 places).

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>
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<td>-60°</td>
<td>0°</td>
<td>0°</td>
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<td>0</td>
<td>-144625</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Unit: [mm]
Fix the jig with the wooden frame by using 17.5 dia. tapped hole (4 holes).

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>
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</thead>
<tbody>
<tr>
<td>Angle</td>
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<td>0°</td>
<td>0°</td>
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<td>0</td>
<td>-144625</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(a) “Shipping Bolts and Brackets (Floor-mounted)”, to protect its driving units from various external forces during transport.

- The shipping brackets are painted yellow.

**NOTE**

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

*Fig. 2-3(a): Shipping Bolts and Brackets (Floor-mounted)*

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

Shipping bolt and bracket (Fixed to the manipulator before shipment.)
2 Transport
2.2 Shipping Bolts and Brackets

Fig. 2-3(b): Shipping Bolts and Brackets (Wall-mounted) (Optional)

- Hexagon socket head cap screw M10 (4 screws, length: 35 mm)
- Conical spring washer 2L-10 (2 washers)
- Tightening torque: 48 N•m (4.9 kgf•m)

- Hexagon socket head cap screw M8 (4 screws, length: 30 mm)
- Conical spring washer 2L-8 (4 washers)
- Tightening torque: 24.5 N•m (2.5 kgf•m)

Fig. 2-3(c): Shipping Bolts and Brackets (Ceiling-mounted) (Optional)

- Hexagon socket head cap screw M10 (4 screws, length: 35 mm)
- Conical spring washer 2L-10 (2 washers)
- Tightening torque: 48 N•m (4.9 kgf•m)

- Hexagon socket head cap screw M8 (4 screws, length: 30 mm)
- Conical spring washer 2L-8 (4 washers)
- Tightening torque: 24.5 N•m (2.5 kgf•m)

- Hexagon socket head cap screw M10 (2 screws, length: 35 mm)
- Conical spring washer 2L-10 (2 washers)
- Tightening torque: 48 N•m (4.9 kgf•m)
3 Installation

3.1 Installation of Safeguarding

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

**Responsibility for Safeguarding (ISO 10218)**

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

---

**WARNING**

- Install the safeguarding.
  Failure to observe this warning may result in injury or damage.
  - Install the manipulator in a location where the manipulator’s tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or DX200 when the arm is fully extended.
  Failure to observe this warning may result in injury or damage.
  - Do not start the manipulator or even turn ON the power before it is firmly anchored.
  The manipulator may overturn and cause injury or damage.
  - When mounting the manipulator on the ceiling or wall, the base section must have sufficient strength and rigidity to support the weight of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.
  Failure to observe this warning may result in injury or damage.

**CAUTION**

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

---
3 Installation
3.2 Mounting Procedures for Manipulator Base

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 section 3.2.1 “Mounting the Manipulator on the Baseplate”.

Table 3-1: Manipulator Repulsion Force

<table>
<thead>
<tr>
<th>Repulsion force $F_H$</th>
<th>Torque $M_H$</th>
<th>Repulsion force $F_V$</th>
<th>Torque $M_V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency stop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20580 N (2100 kgf)</td>
<td>25480 N•m (2600 kgf•m)</td>
<td>17640 N (1800 kgf)</td>
<td>25480 N•m (2600 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/ deceleration</td>
<td>6370 N (650 kgf)</td>
<td>7670 N•m (780 kgf•m)</td>
<td>6860 N (700 kgf)</td>
</tr>
</tbody>
</table>

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

3.2.1 Mounting the Manipulator on the Baseplate

Anchor the baseplate firmly to the ground. The baseplate should be rugged and durable to prevent shifting of the manipulator or the mounting fixture.

It is recommend to prepare a baseplate of 45 mm or more thick, and anchor bolts of M20 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 M20 (90 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”.

Note that there are holes in the manipulator base for positioning or the fitting surface. For reproducing the mounting position, set the knock pin (12 dia. +0.018 /0 is recommended) or the fitting surface.

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 (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)**
3.3 Mounting methods

The MOTOMAN-MPX2600 can be mounted in three different ways: floor mounting 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
- Installing direction
- 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)

3.3.2 Installing Direction

For the installing direction of wall-mounted way, refer to the Fig. 3-4 "Installing Direction". (For optional)

Fig. 3-4: Installing Direction

<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>0°</td>
<td>-60°</td>
<td>0°</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>0</td>
<td>-144625</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
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.

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 IP67.

### 3.5 Location

When installing the manipulator, satisfy the following environmental conditions.

- Ambient temperature: 0° to +40°C
- Humidity: 20 to 80%RH (no-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from 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.

- Wiring must be performed by authorized or certified personnel.

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

- Do not cover the cable with heat insulating material, and avoid multiple cabling.

Failure to observe this caution may result in burn caused by cable heat emission failure.
Fig. 4-1: System Configuration

Non-hazardous Area

1. Conveyor switch (optional)
2. DX200
3. Painting unit
4. Programming pendant (non-explosion-proof)
   - Power supply
   - 3-phase AC200/220V 50/60Hz
   - Relay connector
   - Ground resistance must be 10 Ω or less with independent ground connection.
5. Programming pendant (explosion-proof, optional)
6. Cable
7. Air line

Hazardous Area

1. Manipulator
2. Certified terminal box (optional)
3. Air tube (outside 16 dia., inside 12 dia.)
4. Programming pendant (explosion-proof, optional)
5. Pressure switch unit
   - Intrinsically safe terminal box (optional)
6. Air supply (0.35MPa to 0.65MPa)
7. Signal

Ground resistance must be 100 Ω or less with independent ground connection.

(*) When programming pendant is in use.

The pressure switch unit can be installed at a maximum of 20 m away from the manipulator.

(*) When programming pendant is in use.

Painting unit DX200

Ground resistance must be 100 Ω or less with independent ground connection.

Intrinsically safe cable (1 or 2 cables)

Relay connector

Cable

Air line

Hazardous Area

Non-hazardous Area
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. 4-2(a) “Grounding Method (Manipulator)”, Fig. 4-2(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.

*Fig. 4-2(a): Grounding Method (Manipulator)*

- Bolt M8
- Washer (for grounding) (Delivered with the Manipulator)
- 5.5 mm² or more
4 Wiring
4.1 Grounding

Fig. 4-2(b): Grounding Method (Pressure Switch Unit)

Cross recessed APS screw M5, Washer (for grounding) (Delivered with the Manipulator)

5.5 mm² or more

Vertical Installation

Horizontal Installation
4.2 Cable Connection

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
</table>
| 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.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
</table>
| • For the cable gland, it is required to use the specified one for the explosion-proof certification.  
It is highly recommend to use the cable gland prepared by YASKAWA which is the exclusively one.  
Also, please do not detach reassemble or remodel the cable gland since it is already an assembled parts.  
Contact your YASKAWA representatives when any abnormalities are found. |
Fig. 4-3: Connection of the Manipulator Cable and the Air Tube

- **DX200 side**
  - X11
  - Encoder cable (wire blade)
  - Power cable
  - Cable gland
  - Pressure switch unit (mounted separately)
  - Air supply
  - Air tube (16 dia.) (prepared by the customer)

- **Manipulator side**
  - Connect to the grounding tap
  - Gasket
  - Cover
  - AIR SUP
  - Protective gas pressure feeding tube in the manipulator (16 dia.)

**Tubes used for air are disposable item. Perform daily inspection for damages and replace them periodically.**

* 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 16 mm.

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

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

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

X11

X21

Back Side of the DX200

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

4.2.1 Connecting Positions of Cables

As shown in Table 4-1 "Manipulator Cable Connecting Position" and Table 4-2 "Battery Mounting 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>Standard type (C) Type</td>
<td>①</td>
<td>Connect to the back side of the manipulator. Refer to (C) type in Fig. 4-5 &quot;Manipulator Cable Connecting Position&quot;.</td>
</tr>
<tr>
<td>[Center Type]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>※ Changeable (L) Type</td>
<td>②</td>
<td>Viewing from the backside, connect to the left side of the manipulator. Refer to (L) type in Fig. 4-5 &quot;Manipulator Cable Connecting Position&quot;.</td>
</tr>
<tr>
<td>[Left Type]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>※ Changeable (R) Type</td>
<td>③</td>
<td>Viewing from the backside, connect to the right side of the manipulator. Refer to (R) type in Fig. 4-5 &quot;Manipulator Cable Connecting Position&quot;.</td>
</tr>
<tr>
<td>[Right Type]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 4-5: Manipulator Cable Connecting Position**
4 Wiring
4.2 Cable Connection

<table>
<thead>
<tr>
<th>Type</th>
<th>Connecting position</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard type (L) Type [Left Type]</td>
<td>①</td>
<td>Viewing from the backside, connect to the left side of the manipulator. Refer to (L) type in Fig. 4-6 “Battery Mounting Position”.</td>
</tr>
<tr>
<td>※ Changeable (C) Type [Center Type]</td>
<td>②</td>
<td>Connect to the back side of the manipulator. Refer to (C) type in Fig. 4-6 “Battery Mounting Position”.</td>
</tr>
<tr>
<td>※ Changeable (R) Type [Right Type]</td>
<td>③</td>
<td>Viewing from the backside, connect to the right side of the manipulator. Refer to (R) type in Fig. 4-6 “Battery Mounting Position”.</td>
</tr>
</tbody>
</table>

* Changeable (C) Type

* Changeable (R) Type

---

**Table 4-2: Battery Mounting Position**

**Fig. 4-6: Battery Mounting Position**
4.2.2 Manipulator Cable Connection

1. If connecting the manipulator cable to the manipulator of (L) Type or (R) Type specification, remove the cover which is mounted on the connector. For (L) type specification, the battery is installed, as the standard specification, to the place which the cover of the connector will be mounted. When (L) Type is chosen for the connection type of the manipulator cable, change the battery position beforehand in accordance with section 4.2.3 “Changing the Battery Position”.

2. Mount the bracket of the internal wiring harness side on the bracket of the manipulator cable by using the hexagon socket head cap screws.

3. Connect the manipulator cable to the connector of the internal wiring harness.

4. Connect the ground wires (2 wires) of the manipulator cable to the tapped hole for mounting the ground wires of the bracket on the internal wiring harness side.

5. Cover the unwound part of the internal wiring harness with the insulated plastic cover and fix it with cable ties. (For the encoder cable and the power cable)

6. Connect the purging tube to the joint on the IN side of the manipulator cable cover.

7. Mount the gasket pressure of the manipulator cable to the base so that the protective gas force feeding tube does not bend inside the manipulator, and then mount the cover by using the hexagon socket head cap screws M6.

*Fig. 4-7(a): Manipulator Cable Connection Standard Specification (C) Type*
4 Wiring
4.2 Cable Connection

Fig. 4-7(b): Manipulator Cable Connection (L) Type

(L) Type

Fig. 4-7(c): Manipulator Cable Connection (R) Type

(R) Type
4.2.3 Changing the Battery Position

1. Turn OFF the DX200 power supply.
2. Refer to Table 4-2 “Battery Mounting Position” and Fig. 4-6 “Battery Mounting Position”, and confirm the battery position to change to.
3. Remove the cover where the battery is mounted or the cover of the place which will be mounted or the C base.
4. Loosen the hexagon socket head cap screws M3 (length: 10 mm) and separate the battery plate from the cover.
5. Move the battery to the desired mounting location in the base together with the battery plate.
   Be careful not to get caught up in the other internal wiring harness or to exert excessive stress to the air tube.
6. Mount the battery plate on the cover.
7. Mount the cover on the manipulator base.

Fig. 4-8: Battery Connection

**L TYPE**
- Hexagon socket head cap screw M6 (Trivalent chromium, 14 screws, length: 25 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (fixed to the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)

**C TYPE**
- Hexagon socket head cap screw M6 (Trivalent chromium, 14 screws, length: 25 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (fixed to the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)

**R TYPE**
- Hexagon socket head cap screw M6 (Trivalent chromium, 14 screws, length: 25 mm) (fixed to the manipulator)
- Conical spring washer 2H-6 (fixed to the manipulator)
- Tightening torque: 10 N•m (1.0 kgf•m)
4.2.4 Intrinsically Safe Cable Connection

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

1) Intrinsically safe cable

1. 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>P1</th>
<th>N1</th>
<th>P2</th>
<th>N2</th>
<th>P3</th>
<th>N3</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;</td>
<td>&gt;</td>
<td>&lt;</td>
<td>&gt;</td>
<td>&lt;</td>
<td>&gt;</td>
</tr>
<tr>
<td>DX200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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.

2) Pressure switch unit side: Crimped terminals
   For connecting the intrinsically safe cable to the intrinsically safe terminal block
   - For terminal block P1 to 2

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

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

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: 32.9 μH
Internal capacitance: 32.6 nF
4.3 Requirements

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

Table 4-3: Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
<td>3-phase 200/220 VAC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Voltage: +10 to -15%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50/60 Hz (±2 Hz)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0 kVA (at peak)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Air supply</td>
<td>Required pressure: 0.35 MPa to 0.65 MPa</td>
<td>Use dry air for the pressurized explosion-proof construction.</td>
</tr>
<tr>
<td></td>
<td>Pressurized explosion-proof</td>
<td>Capacity:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>construction</td>
<td>For pressurized type of explosion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>protected construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>At operating: 15 Nl/min or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>At purging:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 Nl/min or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dryness:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Freezing at -18 °C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Grounding</td>
<td>Grounding resistance: 100 Ω or less</td>
<td>For the DX200</td>
</tr>
</tbody>
</table>

CAUTION

Use dry air for the pressurized explosion-proof enclosure. Moisture in the air supply may damage the electronic parts.
4.3.1 Pressure Switch Unit

The pressure switch unit supplies protective air or gas to the manipulator to prevent explosive gas from entering the manipulator. Usually, the unit is installed on the side of the DX200.

The circuit diagram and dimensions are shown in Fig. 4-10 “Electrical/Air Circuit of the Pressure Switch Unit”. Set the air pressure so that the pressure shown on the pressure gauge of each pressure reducing valve to be within the pressure ranges shown in fig. 4-10.

Fig. 4-10: Electrical/Air Circuit of the Pressure Switch Unit
4.4 Installation Site

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

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

**DANGER**

- In case installing the MOTOMAN-MPX2600 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-MPX2600, confirm that the manipulator is possible to install in that area.

**WARNING**

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

### 5.1 Basic Specifications

**Table 5-1: Basic Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>Wrist part (T-axis): 15 kg Arm part (U-axis): 20 kg</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 0.2 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td>S-axis (turning) -150° − +150° &lt;Wall-mounted&gt; -90° − +90° L-axis (lower arm) −65° − +130° U-axis (upper arm) −65° − +150° R-axis (wrist roll) -720° − +720° B-axis (wrist pitch/yaw) -720° − +720° T-axis (wrist twist) -720° − +720°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>2.0 m/s</td>
</tr>
<tr>
<td>Each Axis Maximum Speed</td>
<td>S-axis 2.09 rad/s, 120 °/s L-axis 2.09 rad/s, 120 °/s U-axis 2.18 rad/s, 125 °/s R-axis 6.28 rad/s, 360 °/s B-axis 6.28 rad/s, 360 °/s T-axis 6.28 rad/s, 360 °/s</td>
</tr>
<tr>
<td>Allowable Moment</td>
<td>R-axis 93.2 N•m (9.5 kgf•m) B-axis 58.8N•m (6.0 kgf•m) T-axis 19.6 N•m (2.0 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²)</td>
<td>R-Axis 3.75 kg•m² B-Axis 2.225 kg•m² T-Axis 0.20 kg•m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>485 kg</td>
</tr>
<tr>
<td>Protective Structure</td>
<td>Basic axis: IP4X Wrist axis only: IP67 or equivalent</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td>Temperature 0 to + 40 °C Humidity 20 to 80%RH (non-condensing) Vibration Acceleration 4.91 m/s² (0.5 G) or less Altitude 1000 m or less Others Free from dust, soot, or water Free from excessive electrical noise (plasma). Free from strong magnetic field</td>
</tr>
<tr>
<td>Power Capacity</td>
<td>3.0 kVA</td>
</tr>
<tr>
<td>Applicable controller</td>
<td>DX200</td>
</tr>
<tr>
<td>Noise</td>
<td>72 dB</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 section 6.1 “Allowable Wrist Load”.
5. Conformed to ISO6926

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

Fig. 5-1: Part Names and Working Axes
5.3 Manipulator Base Dimensions

*Fig. 5-2: Base Dimensions*

![Manipulator Base Dimensions Diagram](image-url)
5.4 Dimensions and P-point Maximum Envelope

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

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.
5.5 Appearance and Dimensions of the Pressure Switch Unit

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

- Purging pressure: 0.18 to 0.20 [MPa]
- Operating pressure: 0.01 to 0.02 [MPa]
- Air inlet from the manipulator (tube: 16 dia.)
- Air inlet 0.35 to 0.65 [MPa] (tube: 16 dia.)
- Exhaust port
- To the manipulator (tube: 16 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>17.1</td>
<td>0.230</td>
</tr>
<tr>
<td>L-axis</td>
<td>22.6</td>
<td>0.317</td>
</tr>
<tr>
<td>U-axis</td>
<td>14.7</td>
<td>0.189</td>
</tr>
</tbody>
</table>
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 Basic Specifications
5.6 Stopping Distance and Time for S-, L-, and U-Axes

Fig. 5-5(c): U-Axis Extension
5.6.5 Stopping Angles and Times for S-, L- and U-Axes

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

5.6.5.1 Position 100%

**NOTE**

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

5.6.5.2 Stopping Distance and Time for Stop Category 1: S-Axis

![Graphs showing stopping distance and time for S-Axis at different speeds and load percentages.](image-url)
5.6.5.3 Stopping Distance and Time for Stop Category 1: L-Axis

![Graphs showing stopping distance and time for L-axis with different loads and extensions.]
5.6.5.4 Stopping Distance and Time for Stop Category 1: U-Axis

![Graph showing stopping distance and time for different loads and speeds for U-Axis.](image)
5.7 Modification of S-Axis Movable Envelope

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in Table 5-2 “S-Axis Operating Range”. 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 Operating Range</td>
<td>-150° - +150° (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>

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

Stopper position (standard specification)
- Hexagon socket head cap screw M20 (length: 45 mm)
- Conical spring washer 2H-20
- Tightening torque: 167 N•m (16.9 kgf•m)

Rotating head
Stopper for the fixing side
Base

Section A-A
Tapped hole M20 (12 places)
5.7 Modification of S-Axis Movable Envelope

5.7.1 Changing the S-axis Mechanical Stopper

The mechanical stopper is not necessary when the operating range is set to ±150° (standard specification).

The S-axis mechanical stopper can be set at 30° pitch intervals.

1. Apply the specified components when mounting the S-Axis mechanical stopper.
2. TURN OFF the electric power supply before mounting.

1. Remove the mechanical stopper under the rotating head. If it is difficult to remove the mechanical stopper, turn ON the DX200 power supply. Move the rotating axis to a position where the stopper can be removed. Then turn OFF the DX200 power supply, and remove the mechanical stopper.

2. Mount the removed mechanical stopper in the desired position. (Mounting torque: 167 N•m (16.9 kgf•m)
If it is difficult to mount the mechanical stopper, turn ON the DX200 power supply. Move the rotating axis to a position where the stopper can be mounted. Then turn OFF the DX200 power supply, and mount the mechanical stopper.

5.7.2 Adjustment to the Pulse Limitation of S-Axis

For altering the range of motion of the S-axis, refer to section 8.17 "Changing the Parameter" in "DX200 INSTRUCTIONS (165292-1CD)".
Change the parameter as shown below by using the programming pendant.

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

<table>
<thead>
<tr>
<th>Degree</th>
<th>± 150°</th>
<th>± 120°</th>
<th>± 90°</th>
<th>± 60°</th>
<th>± 30°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pulse</td>
<td>± 291431</td>
<td>± 233145</td>
<td>± 174859</td>
<td>± 116573</td>
<td>± 58287</td>
</tr>
</tbody>
</table>

Do not modify the motion range parameter with the software only, but in combination with the mechanical stopper. Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.
The settable angles for S-axis stopper are shown in Table 5-3 “The Settable Angle for S-Axis Stopper”.

**Table 5-3: The Settable Angle for S-Axis Stopper**

<table>
<thead>
<tr>
<th>Angle (°)</th>
<th>Settable</th>
<th>Non-settable</th>
</tr>
</thead>
<tbody>
<tr>
<td>-150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Table 5-3 indicates the angle range which allows S-axis to be set for *direction angles. (Ex. -90° to +90° is settable, however 0° to +150° is not settable)*
6 Allowable Load for Wrist Axis Flange

6.1 Allowable Wrist Load

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

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N·m (kgf·m)(^1)</th>
<th>GD(^{2/4}) Total Moment of Inertia kg·m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>93.2 (9.5)</td>
<td>3.75</td>
</tr>
<tr>
<td>B-Axis</td>
<td>58.8 (6.0)</td>
<td>2.225</td>
</tr>
<tr>
<td>T-Axis</td>
<td>19.6 (2.0)</td>
<td>0.20</td>
</tr>
</tbody>
</table>

\(^1\) (): Gravitational unit

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

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

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

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

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

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

Fig. 6-2: Wrist Flange
7 System Application

7.1 Peripheral Equipment Mounts

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

7.1.1 Allowable Load

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

Observe the following restrictions.

• Total payload for the upper arm (U-arm) and the lower arm (L-arm): 20 kg or less
7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in fig. 7-1.

Fig. 7-1: Installing Peripheral Equipment
8  Electrical Equipment Specification

8.1 Internal Connections

The Fig. 8-1(a) "Internal Connection Diagram", Fig. 8-1(b) "Internal Connection Diagram" show the internal connections.
Fig. 8-1(a): Internal Connection Diagram

Controller

BATTERY

EE

Internal cable ASSY (HW9470921-G)

A terminal

HW1484370
Fig. 8-1(b): Internal Connection Diagram

From "Fig. 8-1(a)"

Internal cable ASSY (HW9470921-G)
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 section 9.2 “Daily Inspections”.

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

<table>
<thead>
<tr>
<th>Item</th>
<th>No.</th>
<th>Items to be Inspected</th>
<th>Inspection</th>
<th>Daily</th>
<th>Weekly</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulator</td>
<td>1</td>
<td>Exterior</td>
<td>No deformations or cracks to the pressurized explosion-proof enclosure. Covers are appropriately mounted. No other exterior abnormality.</td>
<td></td>
<td></td>
<td><img src="image" alt="DANGER" /> If any deformations or cracks are found, immediately stop the operation and contact your YASKAWA representatives.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Motion</td>
<td>Smooth tuning, horizontal, and vertical motions of each arm. The robot’s home position does not change.</td>
<td></td>
<td></td>
<td><img src="image" alt="DANGER" /> Do not enter the robot working envelope.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Noise and vibration during operation</td>
<td>No abnormal noise and vibration during robot operation.</td>
<td></td>
<td></td>
<td><img src="image" alt="DANGER" /> Do not enter the robot working envelope.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Tubes</td>
<td>Off or no severe wear and tear on paint and air supply tubes.</td>
<td></td>
<td></td>
<td><img src="image" alt="CAUTION" /> Make sure that the air tube is firmly inserted in the joint. Accidental disconnection of the air tube may cause injury.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Air leakage</td>
<td>No excessive air leakage from the fitting of the motor case.</td>
<td></td>
<td></td>
<td><img src="image" alt="CAUTION" /> When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Dried paint</td>
<td>Remove the dried paint on the robot.</td>
<td></td>
<td></td>
<td><img src="image" alt="DANGER" /> Replace the sheet.</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Inspection of the manipulator cable (For moving/fixing)</td>
<td>Check damage or any abnormal wear to the power cable</td>
<td></td>
<td></td>
<td><img src="image" alt="DANGER" /> Replace the cable if any abnormalities are found.</td>
</tr>
</tbody>
</table>
## Frequent Inspections

### 9.1 Frequent Inspections

1. **Base mounting bolts**
   - Check for damage and looseness, and then retighten loose bolts with a spanner or wrench.
   - **WARNING**
     - Stop the manipulator when checking.

2. **Cover mounting screws**
   - **CAUTION**
     - Inspect the manipulator while it is in its standby position and not in motion.

3. **Battery alarm**
   - Check the battery alarm by using the DX200.

4. **Check the operation of the emergency stop button. Remove any dried paint.**
   - 1. The manipulator stops immediately when the emergency stop button is pressed.
   - 2. Remove any dried paint from the emergency stop button.

5. **Pressure Switch Unit**
   - **WARNING**
     - Do not make any modifications to the settings.
     - The pressure switch unit is a safety related parts for explosion-Proof specification.

   1. **Pressure set value**
      - The pressure of the pressure reducing valve is within the specified range

   2. **Air leakage inspection**
      - Check for any air leakage from the pressure switch unit.
9.2 Daily Inspections

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

9.2.1 Manipulator

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

9.2.1.2 Manipulator Motions and Noise/Vibration during Operation
Check if the manipulator home posture does not change when turning ON the power supply using the eye mark.
Also, check for abnormal noise and vibration during operation.

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

9.2.1.3 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 Paint Removal and Cleaning
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 Daily Inspections

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.

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 : 0.18 to 0.20 [MPa]
- Pressure reducing valve for the operating pressure : 0.01 to 0.02 [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.

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

**CAUTION**

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

**NOTE**

The inspection interval 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>1 Buyers and maintenance personnel</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual</td>
<td>Check for crack or damages.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>2 Manipulator exterior</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual</td>
<td>Check for crack or damages.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>3 Air tube, air leakage</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Manual</td>
<td>Check for abnormality/ Wear / Damage / Leakage.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>4 Paint removal and cleaning</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Manual</td>
<td>Remove adhered paint if any.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>5 Pressure switch unit setting</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual</td>
<td>Check the value if it is within the proper value range.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>6 Base mounting bolts</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>7 Cover mounting screws</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>8 S-, L-, and U-axis motors</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>9 Motor connectors</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>10 Motor part</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual</td>
<td>Check for filter clogging.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>11 Air seals for enclosure</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual</td>
<td>Check for wear or tear. Replace if necessary.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>12 Internal cables</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Visual Multi-meter</td>
<td>Check for conduction between the main connector of the base and the terminal by manually shaking the wire. Check for wear on the protective spring.</td>
<td>Specified personnel (Customer)</td>
</tr>
<tr>
<td>13 Battery in manipulator</td>
<td>Daily, 1000H, 2000H, 3000H</td>
<td>Manual</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.</td>
<td>Specified personnel (Customer)</td>
</tr>
</tbody>
</table>
### 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></td>
<td>Daily</td>
<td>1000HCycle</td>
<td>6000HCycle</td>
<td>12000HCycle</td>
</tr>
<tr>
<td>15</td>
<td>Power cable (Movable type)</td>
<td>●</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
</tr>
<tr>
<td>16</td>
<td>Power cable (Fixed type)</td>
<td>●</td>
<td>Visual</td>
<td>Check for damages (replace if any damages are found)</td>
</tr>
<tr>
<td>17</td>
<td>S-, L-, and U-axis speed reducers</td>
<td>●</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)&lt;sup&gt;2&lt;/sup&gt; Replenish grease&lt;sup&gt;5&lt;/sup&gt; (6000 H cycle). Refer to section 10.2.1.</td>
</tr>
<tr>
<td>18</td>
<td>R-, B-, and T-axis speed reducers</td>
<td>●</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)&lt;sup&gt;2&lt;/sup&gt; Replenish grease&lt;sup&gt;5&lt;/sup&gt; (6000 H cycle). Refer to section 10.2.1.</td>
</tr>
<tr>
<td>19</td>
<td>Wrist gear</td>
<td>●</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.)&lt;sup&gt;2&lt;/sup&gt; Replenish grease&lt;sup&gt;5&lt;/sup&gt; (6000 H cycle). Refer to section 10.2.1.</td>
</tr>
<tr>
<td>20</td>
<td>Pressure switch unit</td>
<td>●</td>
<td></td>
<td>Confirm that the pressure switch, flow switch, solenoid valve and the pressure reducing valve operate correctly. Contact your YASKAWA representatives.</td>
</tr>
<tr>
<td>21</td>
<td>Overhaul</td>
<td>●</td>
<td></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 section 10.4 “Notes for Maintenance”.
4. Internal cables to be replaced at 24000H inspection.
5. For grease used in each parts, refer to Table 10-2 “Inspection Parts and Grease Used”.

---

#### Table 10-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>Grease</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium complex grease</td>
<td>Motor bearings</td>
</tr>
<tr>
<td>Lithium complex grease</td>
<td>Gear reducers</td>
</tr>
<tr>
<td>Silicone grease</td>
<td>Motor seals</td>
</tr>
<tr>
<td>Molykote grease</td>
<td>Pressure switch, flow switch, solenoid valve</td>
</tr>
</tbody>
</table>

---

**Note:** The above table is a representation of the inspection schedule for maintenance and inspection. Each item requires specific checks and operations at different cycles, and the personnel responsible for each inspection vary depending on the level of expertise required.
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 RE No. 0</td>
<td>S-, L-, U-, R-, B-, and T-axis speed reducers</td>
</tr>
<tr>
<td>2</td>
<td>Alvania EP Grease 2</td>
<td>Wrist gear</td>
</tr>
</tbody>
</table>

Fig. 10-1: Inspection Parts and Inspection Numbers

Pressure switch unit (mounted separately)
10.2 Maintenance for Manipulator

10.2.1 Grease Replenishment/Replacement

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

Replenish or replace the grease for the following sections:

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

10.2.1.1 Grease Replacement Procedures for Wrist Gears

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

Fig. 10-2: Wrist Gears
10.2.1.2 Grease Replacement Procedures for S-, L-, and U-Axis Speed Reducers

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.

1. 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.

2. 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.

3. 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.

4. 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.

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

6. 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.

7. 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.

---

**WARNING**

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.
10 Maintenance and Inspection
10.2 Maintenance for Manipulator

**Fig. 10-3(a): S-, L-, U-Axis Speed Reducer Diagram (Floor-mounted)**

Grease inlet (S-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (U-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease inlet (L-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (S-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

**Fig. 10-3(b): S-, L-, U-Axis Speed Reducer Diagram (Wall-mounted) (Optional)**

Grease inlet (S-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (L-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease inlet (L-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (S-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease inlet (U-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (L-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease inlet (L-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (S-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease inlet (S-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease exhaust port (U-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)

Grease inlet (U-axis) Plug PT3/8 (Stainless) Tightening torque: 23 N•m (2.34 kgf•m)
Fig. 10-3(c): S-, L-, U-Axis Speed Reducer Diagram (Ceiling-mounted) (Optional)
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>Axis 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></td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td></td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>Wall-mounted</td>
<td>U-axis</td>
<td>Any</td>
<td>0°</td>
<td>0°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling-mounted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Remove the hexagon socket head plugs from the grease inlet and grease exhaust port.

3. Install a grease zerk A-PT3/8 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 RE No.0
   - 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

5. 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.

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

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Approx.4200 g</td>
</tr>
<tr>
<td>L-axis</td>
<td>Approx.2300 g</td>
</tr>
<tr>
<td>U-axis</td>
<td>Approx.1650 g</td>
</tr>
</tbody>
</table>
6. Discharge the specified amount of grease from the grease inlet or grease exhaust port. (Refer to Table 10-5 “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 10-6 “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 10-6 “Grease Discharging Operation for Each Axis”.

**Table 10-5: 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></td>
<td>[g]</td>
<td>[cc]</td>
</tr>
<tr>
<td>Floor-mounted</td>
<td>S-axis</td>
<td>384±5</td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>110±5</td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td>0</td>
</tr>
<tr>
<td>Wall-mounted</td>
<td>S-axis</td>
<td>11±5</td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>100±5</td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td>49±5</td>
</tr>
<tr>
<td>Ceiling-mounted</td>
<td>S-axis</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>110±5</td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 10-6: 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>
7. For the axis where grease is exchanged, perform a playback operation indicated in Table 10-7 “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 designated tightening torque. 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. 10-4 “Grease Receiving Bag (Rough Standard)”, and then perform the running-in operation.

Table 10-7: Running-In Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Operation angle</th>
<th>Operation speed</th>
<th>Timer after each operation</th>
<th>Operating time</th>
</tr>
</thead>
<tbody>
<tr>
<td>S,L,U-axes</td>
<td>±45°</td>
<td>MOVJ VJ=50.00</td>
<td>1.0 s</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

Fig. 10-4: Grease Receiving Bag (Rough Standard)

8. 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 inlet, and then tighten the plug with the designated tightening torque.
10 Maintenance and Inspection
10.2 Maintenance for Manipulator

10.2.1.3 Grease Replenishment Procedures for S-, L-, and U-axis Speed Reducer

**Grease Replenishment**

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

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

2. Remove the plug on the Ri (Bi, Ti) grease inlet, and install the grease zerk PT1/8. Inject grease by using a grease gun.

   - Grease type: VIGO grease RE No. 0
   - Amount of grease:
     - R-axis: 25 cc (22 g) (35 cc (30 g) for the 1st supply)
     - B-axis: 25 cc (22 g) (35 cc (30 g) for the 1st supply)
     - T-axis: 20 cc (17 g) (30 cc (26 g) for the 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

3. Before re-installing a plug to Ro (Bo, To) exhaust port, move each axis for a few minutes to discharge excessive grease.

4. Wipe the discharged grease with the cloth when the grease is discharged completely, and reinstall the plug. (Apply seal tape on the thread part of each plug.)

*Fig. 10-5: R-, B-, and T-axes Speed Reducer*
10.2.2 Inspection of Air Sealing for Internal Air Pressure

**NOTE**

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

- **Gasket in the Cover Part**

  Remove the covers from the back side of the base part, both side of the base (of these covers, one functions as a cover for the manipulator cable), and then check wear and tear of the gasket.

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

  Replace the whole set of the gasket, the screws, and the conical spring washers if significant air leakage is found.

  *Fig. 10-6: Gasket in Base Part Inspection*

---

Hexagon socket head cap screw M6
(trivalent chromium, length: 25 mm, 14 screws)
Conical spring washer 2H-6
(trivalent chromium, 14 washers)
Tightening torque: 10 N•m (1.0 kgf•m)

Gasket (Adhered to the cover)

Cover

Rotating head

Base

Hexagon socket head cap screw M6
(trivalent chromium, length: 25 mm, 14 screws)
Conical spring washer 2H-6
(trivalent chromium, 14 washers)
Tightening torque: 10 N•m (1.0 kgf•m)

Cover

Gasket (Adhered to the cover)

Rotating head

Base

Manipulator cable

Gasket (Adhered to the cover)
Unscrew the cover fixing screws (five 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 completely the gasket, the screws, and the conical spring washers if significant air leakage is found.

*Fig. 10-7: Rotating Head, 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. 10-8 “Battery Location”.

Battery pack type: HW1372692-A, -B, -C

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

*Fig. 10-8: Battery Location*

1. Turn OFF the power to the DX200.
2. Ventilate the environment around the manipulator to remove explosive gas.
3. Remove the cover (the battery warning label attached) on which the battery is mounted.
4. Unscrew the bolts fixing the battery and remove the cable ties.
5. Remove an vinyl tape (insulation tape) protecting connection part of the battery in the manipulator.
6. In accordance with Table 10-8 “Battery Type and Label”, connect the new battery.
7. Remove the old batteries.

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

8. Protect the connection part of the battery in the manipulator with the vinyl tape (insulation tape).

9. Mount the battery to the bracket by using the bolt M4 (length: 85 mm) and the cable ties (T50L for two places and T18R for one place).

10. And then re-install the cover to the base part.

*Fig. 10-9: Battery Connection*

<table>
<thead>
<tr>
<th>Battery pack type</th>
<th>Label</th>
<th>Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW1372692-A</td>
<td>BAT1</td>
<td>S-, L-axis</td>
</tr>
<tr>
<td>HW1372692-B</td>
<td>BAT3</td>
<td>U-, R-axis</td>
</tr>
<tr>
<td>HW1372692-C</td>
<td>BAT5</td>
<td>B-, T-axis</td>
</tr>
</tbody>
</table>
10.3 Inspection of the Explosion-Proof Device

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 4 to 6 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. 10-10 "Pressure Switch Unit Cover".)
3. Loosen the locking nut equipped to the valves with a spanner (nominal size: 10 mm). (Refer to Fig. 10-11 “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).

**WARNING**

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

**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. 10-12 “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. 10-10 “Pressure Switch Unit Cover”.)
3. As shown in the Fig. 10-12, 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 section 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 for purging pressure</th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.18 to 0.20</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>

5. Turn ON the power supply to the DX200 and start purging. Check that the pressure is keeping between 0.18 MPa and 0.20 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. 10-10.)
10.3 Inspection of the Explosion-Proof Device

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

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

**Fig. 10-11: 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. 10-12: Operation Check of Pressure Reducing Valve**

- Pressure reducing valve for purging pressure: 0.18 to 0.20 [MPa]
- Pressure reducing valve for operating pressure: 0.01 to 0.02 [MPa]
- Industrial compressed air: 0.35 to 0.65 [MPa]
- Air tube: outside 16 dia., inside 12 dia.
10 Maintenance and Inspection
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. 10-10 “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 section 10.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

| Pressure reducing valve for purging pressure | 0.18 to 0.20 |
| Pressure reducing valve for the operating pressure | 0.01 to 0.02 |

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. 10-13 “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. 10-10.)
10.3 Inspection of the Explosion-Proof Device

- **Operation check of pressure reducing valve**
  - A flow-meter (measurable range of 0 to 5 L/min is included) and the joint or hose etc. which are connected with the flow-meter for checking the conduction are prepared by the customer.
  - Note that the plug size for the exhaust side of the pressure adjusting valve is Rc1/4.
  - Refer to Fig. 10-14 “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. 10-10 “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 section 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 5 L/min when the operating pressure is 0.05 MPa.
  6. Set the pressure of operation air reducing valve as shown in Table 10-12 “Reducing Valve for Operating Pressure-Adjusting Pressure 2-”. Refer to section 10.3.1.2 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 section 10.3.1.2 for the pressure reducing valve operation.

### Table 10-11: Reducing Valve for Operating Pressure-Adjusting Pressure 1-

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

### Table 10-12: Reducing Valve for Operating Pressure-Adjusting Pressure 2-

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

### Table 10-13: 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>0.18 to 0.20</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>
10. Re-install the cover with the hexagon socket head cap screws. (Refer to Fig. 10-10 "Pressure Switch Unit Cover").

**Fig. 10-13: Operation Check for Pressure Detector**

**Fig. 10-14: Operation Check for Pressure Adjusting Valve**

- Connect a multimeter metering rod (+ side)
- Connect a multimeter metering rod (- side)

---

**Pressure reducing valve for purging pressure**
0.18 to 0.20 [MPa]

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

---

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

---

**Flowmeter**
(measurable range of 0 to 5 L/min is included)
10.3 Inspection of the Explosion-Proof Device

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. 10-10 “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 section 10.3.1.2 “Operation Method of Pressure Reducing Valve” for the pressure reducing valve operation.

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

5. While purging, check that air is exhausted from the master valve exhaust port. Note that air is also exhausted from pressure adjusting valve exhaust port. (Refer to Fig. 10-15 “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. 10-10 “Pressure Switch Unit Cover”.)

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>0.18 to 0.20</td>
<td></td>
</tr>
</tbody>
</table>

| Pressure reducing valve for the operating pressure | 0.01 to 0.02 |

Fig. 10-15: Operation Check for Master Valve

※While purging, air is also exhausted from pressure adjusting valve exhaust side.
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. 10-16(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.
- Loosen bolts to enclosures.
- Any damages to the enclosure.

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

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.

Change the pressure switch unit.

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

Change the pressure switch unit.

Check the setting values of the pneumatics unit.
1. Pressure reducing valve for purging pressure 0.13 to 0.20 Mpa.
2. Pressure reducing valve for operating pressure 0.01 to 0.02 Mpa.
3. Primary pressure into the pressure switch unit 0.35 to 0.65 Mpa.

Check on the facility prepared by user.

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

Turn ON the breaker of the controller by manual. Purging mode is simultaneously ready to start by turning the power ON.
Start Purging Mode.  
1. Switch the operation pressure to the purging pressure.  
2. Release the master valve.

When the purging air is 20 kPa or more, has the flow reached 320 L/min?

- Y: Start counting the purging time (four minutes*1).

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?

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

Start counting the purging time (four minutes*1).

Abnormal Pressure Mode

- Y: Execute Abnormal Pressure Mode. (Abnormal purging) (36)
  - 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.

- N: Does the abnormal pressure occurs in the first time after the first restarting?

When the purging air is 20 kPa or more, is the flow kept at 320 L/min?

- Y: Execute Abnormal Pressure Mode. (Abnormal purging) (36)
  - 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.

- N: Has 4 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.

- Y: Execute Abnormal Pressure Mode. (Abnormal purging) (36)
  - 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.

- N: Does the abnormal pressure occurs in the first time after the first restarting?

- Y: Execute Abnormal Pressure Mode. (Abnormal purging) (36)
  - 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.

- N: Purge reset.
10.3 Inspection of the Explosion-Proof Device

Fig. 10-16(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-, encoder- and painting device-power sources are automatically shut down. In case the abnormal pressure (LOW) occurs during the purging mode, the master valve is automatically shut OFF to prevent the dangerous gas from inflowing. “Abnormal Pressure (LOW)” is displayed on the programming pendant and the alarm lamp on the DX200 is lit.

2. Abnormal purging
   During the purging, if the pressure in protective gas line drops and the pressure the detector (PS3) is opened, the hardware circuit (power control circuit, purging control relay, and encoder separation board) is turned OFF. When the power supply of the servo unit and the encoder is turned OFF automatically, the master valve is closed at the same time. “Abnormal Purging” 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. 10-10 “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>0.18 to 0.20</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 four - six minutes and a message “Air Purge Done” is indicated on the programing pendant window.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Press [SERVO ON READY] on the programing pendant and grip the enable switch to turn ON the power supply, and then confirm that the manipulator is operable.</td>
</tr>
</tbody>
</table>
3-(2) Checking of Inner Pressure Error Detection Operations

Perform the following checking after above mentioned checking are completed.

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

Checking item

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation pressure [MPa]</th>
<th>Purging Pressure [MPa]</th>
<th>Details</th>
</tr>
</thead>
</table>
| 1   | 0.01 to 0.02             | 0.18 to 0.20           | (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. |
| 2   | 0                        |                        | Set 0 MPa to the operating pressure of pressure switch unit. |
| 3   | 0                        |                        | 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. |
| 4   |                          |                        | Confirm that [SERVO ON READY] on the programming pendant goes off. |
| 5   |                          |                        | 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. |

※ 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

<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>0.18 to 0.20</td>
<td>(After completing operation (5) described in (3-2))</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 0.05 MPa.</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>Adjust the operating pressure setting value of the pressure switch unit to the range described on the left.</td>
</tr>
<tr>
<td>6</td>
<td></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>7</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.
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 ~ 0.02</td>
<td>0.18 ~ 0.20</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 a message “Air Purging” 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></td>
<td>0</td>
<td>After one minute, set 0 MPa to the purging pressure of pressure switch unit.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>The mode is changed to abnormal pressure mode (purging error) and a message “AIR PURGE ERROR” 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></th>
<th>Pressure [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purging air reducing valve</td>
<td>0.18 to 0.20</td>
</tr>
<tr>
<td>Operation air reducing valve</td>
<td>0.01 to 0.02</td>
</tr>
</tbody>
</table>

5. Re-install the cover with the hexagon socket head cap screws. (Refer to Fig. 10-10 “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. 10-17(a) “Backup Battery Connection for S-, L-, and U-Axis Motors”, Fig. 10-17(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. 10-17(a): Backup Battery Connection for S-, L-, and U-Axis Motors

Connect battery to encoder to save the data before removing connector.
Fig. 10-17(b): Backup Battery Connection for R-, B-, and T-Axis Motors

R-Axis Motor

![Diagram of R-Axis Motor with connections and labels]

B-, T-Axis Motor

![Diagram of B- and T-Axis Motor with connections and labels]

**CAUTION**

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

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-MPX2600. The spare parts list for the MOTOMAN-MPX2600 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

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

Table 11-1: Spare Parts for the MOTOMAN-MPX2600-11" (Sheet 1 of 2)

<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>HW1372692-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S-, L-axis encoder</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Battery pack</td>
<td>HW1372692-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For U-, R-axis encoder</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Battery pack</td>
<td>HW1372692-C</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For B-, T-axis encoder</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Sealing compound</td>
<td>DB-1600</td>
<td>Diabond Industry Co., Ltd.</td>
<td></td>
<td>200ml</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Seal tape</td>
<td>TB-4501</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
<td>For gasket cohesion</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K. K.</td>
<td>1</td>
<td>1</td>
<td>For bearing and gear inside the wrist part</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>Grease</td>
<td>VIGO Grease RE No.0</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For S-, U-, R-, B-, T-axis speed reducer</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>S(L)-axis speed reducer kit</td>
<td>Y005C-MPX2600A00S (Y005C-MPX2600A00L)</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
<td>This kit can be commonly used for S- and L-axis of MPX2600</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>U-axis speed reducer kit</td>
<td>Y005C-MPX2600A00U</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Table 11-1: Spare Parts for the MOTOMAN-MPX2600-*0* (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Rank No.</th>
<th>Parts No.</th>
<th>Name Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 10</td>
<td>10</td>
<td>R(B)(T) -axis speed reducer kit Y005C-MPX2600A00R (Y005C-MPX2600A00B) (Y005C-MPX2600A00T)</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>B 11</td>
<td>11</td>
<td>Internal cable HW1172448-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 12</td>
<td>12</td>
<td>Lead wire for U-axis power HW1372335-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 13</td>
<td>13</td>
<td>Lead wire for U-axis encoder HW1372336-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 14</td>
<td>14</td>
<td>Wrist unit HW1171980-C</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C 15</td>
<td>15</td>
<td>S,L-axis AC servo motor SGMRV-37ANA-YRA2</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C 16</td>
<td>16</td>
<td>U-axis AC servo motor SGMRV-13ANA-YRA1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C 17</td>
<td>17</td>
<td>R,B,T-axis AC servo motor SGMAV-04ANA-YR22</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>C 18</td>
<td>18</td>
<td>Pressure switch unit HW1271459-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Specifications are subject to change without notice for ongoing product modifications and improvements.