MOTOMAN-EPX2700 INSTRUCTIONS

TYPE:
YR-EPX2700-B000 (FM SPECIFICATIONS, R-TYPE)
YR-EPX2700-B100 (FM SPECIFICATIONS, L-TYPE)

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

• This manual describes the specifications, precautions for operation and required items for maintenance or inspections, for proper application of the MOTOMAN-EPX2700. Read this manual carefully and be sure to understand its contents before handling the MOTOMAN.

• General items related to safety are listed in the Section 1: Safety of the NX100 Instructions. To ensure correct and safe operation, carefully read the NX100 Instructions before reading this manual.

• Refer to NX100 Operator’s Manual for the operation methods.

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 Operations

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN. In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.

 риск

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.

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

5 of 88
Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 and programming pendant are pressed. 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.

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.

Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
- View the manipulator from the front whenever possible.
- Always follow the predetermined operating procedure.
- 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 persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
- Turning ON the NX100 power.
- 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 the front door of the NX100 and the programming pendant.
CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the NX100 cabinet after use.
  The programming pendant can be damaged if it is left in the P-point maximum envelope of the manipulator, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the NX100 Instructions before operating the EPX2700.
Explanation of Warning Labels

The following warning labels are attached to the manipulator and NX100. Always follow the warnings on the labels.

<table>
<thead>
<tr>
<th>WARNING</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning Icon] Do not enter robot work area</td>
<td>![Warning Icon] Moving parts may cause injury</td>
</tr>
</tbody>
</table>

• The following warning labels are attached to NX100. Always follow the warnings on the labels.

Neglect of this warning may cause a serious accident.

To find these labels, please refer the Manipulator Instruction book.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables. In this manual, the equipment is designated as follows.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX100 controller</td>
<td>NX100</td>
</tr>
<tr>
<td>NX100 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>

Description of the Operation Procedure

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.
Customer Support Information

If you need assistance with any aspect of your EPX2700 system, please contact Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

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

techsupport@motoman.com

When using e-mail to contact Motoman 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 have the following information ready before you call Customer Support:

- System EPX2700
- Robots ___________________________
- Primary Application ___________________________
- Controller NX100
- 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 NX100 controller data plate

NOTE: 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 Motoman Customer Support at the telephone number shown above.
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1 Safety Precautions

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

• Specify the working regulations and the person in charge for the following operations:
  • Turning the power to the robot ON/OFF, and RUN/STOP operations
    To avoid any faulty operation, take measures such as putting up a notice to remind
    operators of procedures and precautions explained in the instruction manual.

  • Warning sign or signal to inform operator of the robot operation status
    Starting an operation while someone is in the manipulator’s working envelope or while
    someone is doing maintenance checks or repairs may cause a serious accident.
    When on standby, the manipulator can be moved by an external signal.
    To avoid these accidents caused by a lack of information, put up a board or indicator
    lamp to show the robot operation status.

  • Action to be taken in case of a failure or an accident
    Appoint a person to be contacted and the action to be taken in case of a failure or an
    accident.

  • Safety standards and the supervisor for safe operation
    Appoint a supervisor for the safe operation of the manipulator and establish the
    working regulations.

  • Appoint a person to be in charge of teaching, maintenance and inspections and
    provide training or lectures on safety and the actions to be taken in case of an
    emergency.

WARNING

Install the MOTOMAN-EPX2700 in a location that meets the requirements of Area
Classification “Division I” prescribed in FM Approval Standard.
1 Safety Precautions

- **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 NX100 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 safeguards 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 NX100.

- **Brake release (Option)**

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

  When the brake is released with the manipulator’s power OFF, each axis falls down because of the arm weight. While two or more people are holding the arm in position before releasing the brake, change the posture of the manipulator within the minimum motion range.

  Use the brake release function only when absolutely necessary.

---

### Prohibited

Any modification of the MOTOMAN-EPX2700, and the following is strictly prohibited:

1. Explosion-proof devices and system installation
2. Safeguards and the safety devices mounted on these safeguards
3. Emergency stop button, and other safety devices
4. Robot control system such as the NX100 robot controller, the manipulator drive section and the power transmission section
2 Features

The MOTOMAN-EPX2700 is designed for easy-handling and to consider safety first in operation.

2.1 Methods of Protection

The MOTOMAN-EPX2700 is evaluated as Type X Purged for use in Class I, Division 1, Groups A, B, C and D indoor hazardous (classified) locations T4, and appear in the Factory Mutual (FM) Research Approval Guide. They have the construction of protection as follows:

Method of Protection:

- **The pressurized explosion-proof method** prevents explosive gas from entering the manipulator by supplying a protective gas, such as clean air or an inert gas, to keep the internal air pressure constant.
- **The Intrinsic-safety explosion-proof method** prevents explosive gas from igniting by electric spark and heat.

DANGER

Install the MOTOMAN-EPX2700 in a location that meets the requirements of Area Classification “Division1” prescribed in FM Approval Standard.
2.2 Teaching

The target positions, the motion speed, and the ON/OFF timing of the spray can be taught with the programming pendant while moving the manipulator, which shortens the time required for teaching and, the data can be corrected at any time. Because the teaching function and the correction function are integrated, the operations such as forward/reverse run, position modification, addition/deletion of points can be performed during teaching and the management function, which manages the parameter settings, enables you to monitor the actual status during teaching. The on-screen guidance and the interactive system on the pull-down menus lead the operator through the operation procedures.

- Large-capacity backup as a standard
  A large-capacity drive for PC cards is provided as a standard feature of backup unit and enables data to be transmitted easily.

**CAUTION**

Be sure to save the backup data for the controller, such as the data for jobs and constants, on a PC card. If not, the necessary data for the manipulator may be lost if an internal memory fault occurs in the controller.

- High reliability
  - The built-in microcomputer continuously checks the I/O data and the manipulator motion to ensure high-reliability.
  - Can detect power supply faults and software faults with its self-diagnosis functions.
  - When an error such as an operation error or a controller fault occurs, the alarm code and message are displayed, and the date and time of the error occurrence with its explanation are stored in the alarm history to help you take a quick, corrective action.
3 Installation

![WARNING]

- Install the safeguarding.
  Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the manipulator’s tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or NX100 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 mass of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.
  Failure to observe these warning may result in injury or damage.

![CAUTION]

- Do not install or operate the manipulator that is damaged or lacks parts.
  Failure to observe this caution may cause injury or damage.
- Before turning ON the power, check to be sure that the shipping bolts and brackets explained in Section 4.3.2 “Shipping Bolts and Brackets” are removed.
  Failure to observe this caution may result in damage to the driving parts.
3.1 Requirements

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
<td>3-phase 200/220 VAC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(±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>5 kVA (at peak)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Air supply</td>
<td>Required pressure: 0.35 MPa to 0.65 MPa</td>
<td>Use dry air for the pressurized explosion-proof 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 protected construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 N/min usually</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 N/min usually</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dryness: Freezing at (-18 °C)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Grounding</td>
<td>Grounding resistance: 100 ohm or less (Non I.S. GND)</td>
<td>For the robot controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 ohm or less (I.S. GND)</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION

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

<table>
<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>O</td>
<td>-</td>
<td>0 to 40 °C</td>
<td>80 %RH</td>
</tr>
<tr>
<td>Controller (not explosion-proof)</td>
<td>×</td>
<td>O</td>
<td>0 to 45 °C</td>
<td>90 %RH</td>
</tr>
<tr>
<td>Pneumatic unit (not explosion-proof)</td>
<td>×</td>
<td>O</td>
<td>0 to 45 °C</td>
<td>85 %RH</td>
</tr>
<tr>
<td>Programming pendant (not explosion-proof)</td>
<td>×</td>
<td>O</td>
<td>0 to 40 °C</td>
<td>85 %RH</td>
</tr>
<tr>
<td>Programming pendant (explosion-proof) (Option)</td>
<td>O</td>
<td>O</td>
<td>0 to 40 °C</td>
<td>85 %RH</td>
</tr>
<tr>
<td>Conveyor speed detector (not explosion-proof)</td>
<td>×</td>
<td>O</td>
<td>0 to 50 °C</td>
<td>90 %RH</td>
</tr>
<tr>
<td>Conveyor speed detector (explosion-proof)</td>
<td>O</td>
<td>-</td>
<td>0 to 50 °C</td>
<td>90 %RH</td>
</tr>
<tr>
<td>Conveyor switch (explosion-proof)</td>
<td>O</td>
<td>-</td>
<td>0 to 50 °C</td>
<td>90 %RH</td>
</tr>
<tr>
<td>Work-piece supplier (explosion-proof)</td>
<td>O</td>
<td>O</td>
<td>0 to 50 °C</td>
<td>85 %RH</td>
</tr>
<tr>
<td>Control panel for work-piece supplier (not explosion-proof)</td>
<td>×</td>
<td>O</td>
<td>0 to 45 °C</td>
<td>90 %RH</td>
</tr>
</tbody>
</table>

DANGER

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

<table>
<thead>
<tr>
<th>Safety devices</th>
<th>Selected according to the requirements of the customer. Refer to the appropriate instruction manual provided separately.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box for emergency stop switches</td>
<td>× : Not acceptable</td>
</tr>
<tr>
<td>Safety plugs</td>
<td>○ : Acceptable</td>
</tr>
<tr>
<td>Limit switches</td>
<td></td>
</tr>
<tr>
<td>Flashing light</td>
<td></td>
</tr>
<tr>
<td>Indicator lamps</td>
<td></td>
</tr>
<tr>
<td>Photoelectric switches</td>
<td></td>
</tr>
</tbody>
</table>
4  Transport and Installation

4.1  Preparation

Carry out the operation safely observing the following precautions.

1) Signs indicating prohibitions such as, “The lighting of fires is prohibited”
2) Clean working place that is clearly defined and free of obstacles
3) Appointment of personnel in charge
4) Company working regulations for safe operation

4.1 Preparation

Before installing the MOTOMAN, do the following:

1) Confirm the installation layout and the dimensions of each device to ensure the transportation route and the installation space.
2) Check if the transportation route can support the weight of each device. If necessary, reinforce the route.
3) To lift the manipulator, use the appropriate machinery such as a forklift.
4.2 Receiving

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

**CAUTION**

- Confirm that the manipulator and the NX100 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.
4 Transport and Installation
4.3 Transport

4.3 Transport

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sling and crane or forklift operations must be performed by authorized personnel only.</td>
</tr>
<tr>
<td>Failure to observe this caution may result in injury or damage.</td>
</tr>
<tr>
<td>• Avoid excessive vibration or shock during transport.</td>
</tr>
<tr>
<td>The system consists of precision components. Failure to observe this caution may adversely affect performance.</td>
</tr>
</tbody>
</table>

4.3.1 Transporting Method

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The mass of the manipulator is approximately 730 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the mass.</td>
</tr>
<tr>
<td>• The attached eyebolts are designed to support the manipulator mass. Never use them for anything other than transporting the manipulator.</td>
</tr>
<tr>
<td>• Mount the shipping bolts and brackets before transporting the manipulator.</td>
</tr>
<tr>
<td>• With any transportation equipment, make sure to avoid external force on the arm or motor unit when transporting the manipulator.</td>
</tr>
</tbody>
</table>
### Using a Crane

As a rule, when uncrating the manipulator and moving it, a crane should be used. Lift the manipulator with a wire rope using the attached eyebolts. Make sure to fix the manipulator with shipping bolts and brackets before transport, and lift it in the posture as shown in Fig. 4-2 "Transport Using a Crane".
4 Transport and Installation
4.3 Transport

Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with shipping bolts and bracket as shown in Fig. 4-3 "Transport Using a Forklift". Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator. Transport the manipulator slowly with due caution in order to avoid overturn or slippage.

Fig.4-3  Transport Using a Forklift
4.3.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets at positions as shown in the figures in Fig. 4-2 "Transport Using a Crane", to protect its driving units from various external force 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.
4.4 Installation

**WARNING**

- Install the safeguarding.
  Failure to observe this warning may result in injury or damage.

- Install the manipulator in a location where the manipulator’s tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or NX100 when the arm is fully extended.
  Failure to observe this warning may result in injury or damage.

- Do not start the manipulator or even turn ON the power before it is firmly anchored.
  The manipulator may overturn and cause injury or damage.

**CAUTION**

- Do not install or operate a manipulator that is damaged or lacks parts.
  Failure to observe this caution may cause injury or damage.

- Do not install the paint gun and the gun brackets until the manipulator is firmly anchored.
  Any contact to the unstable manipulator may cause injury or damage.

- Before turning ON the power, check to be sure that the shipping bolts and brackets explained in Fig. 4-2 "Transport Using a Crane" are removed.
  Failure to observe this caution may result in damage to the driving parts.
4.4.1 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.

4.4.2 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 4-3 "Maximum Repulsion Force of the Manipulator at Emergency Stop").

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

For installation, refer to Section 4.4.3 "Mounting the Manipulator on the Baseplate".

<table>
<thead>
<tr>
<th>Table 4-3 Maximum Repulsion Force of the Manipulator at Emergency Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque in horizontal rotation</td>
</tr>
<tr>
<td>Maximum torque in vertical rotation</td>
</tr>
</tbody>
</table>

4.4.3 Mounting the Manipulator on the Baseplate

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

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

Tighten the hexagon socket head cap screws and anchor bolts securely so that they will not work loose during operation.
4 Transport and Installation

4.4 Installation

Fig. 4-4 (a) Mounting the Manipulator on the Baseplate (EPX2700-B000)

- Spring washer
- Washer
- Hexagon socket head cap screw M20 (8 screws)
  - Tensile strength: 1200 N/mm² or more,
  - Tightening torque: 402 N·m (41 kgf·m)
- Baseplate
- Center
- Anchor bolt (M20 or larger)
- Base
- Units: mm
- Flatness: 0.5 mm or less
- 22 dia. (8 holes)
- 12 dia. +0.018 ±0.1
- 96±0.1
- 30 mm or more (screw fitting depth)

Section A-A

Units: mm
Fig. 4-4 (b) Mounting the Manipulator on the Baseplate (EPX2700-B100)
4.4 Location

When installing the manipulator, satisfy the following environmental conditions.
- Ambient temperature: 0°C to 40°C
- Humidity: 20 to 80%RH at constant temperature
- Free from exposure to water, oil, or dust
- Free from 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)
- Flatness for installation is 0.5 mm or less

4.4.5 Controller and Programming Pendant

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

4.4.6 Safety Devices

The standard safety devices are listed below. Refer to the instructions for connecting safety devices required for your system application.
- Emergency stop switches
- Safety plugs
- Limit switches
- Flashing lights
- Indicator lamps
- Photoelectric intrusion detecting switches
5 System Configuration

5.1 Manipulator

The explosion-proof manipulator can be installed in hazardous locations such as in the painting booth. For painting, a spray gun is mounted on the end of the wrist with special fixtures. Fig. 5-6 (a) "Dimensions and P-point Maximum Envelope (EPX2700-B000)" and Fig. 5-6 (b) "Dimensions and P-point Maximum Envelope (EPX2700-B100)" show the dimensions and the range of motion of the EPX2700. The manipulator is driven by the servo motors in vertically articulated operation mode with 6 degrees of freedom on the manipulator base. The motion of the manipulator is made by six axes:

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

The range of motion shown in Fig. 5-6 (a) "Dimensions and P-point Maximum Envelope (EPX2700-B000)" and Fig. 5-6 (b) "Dimensions and P-point Maximum Envelope (EPX2700-B100)" is that of the wrist axis center P-point that is made by the combination of the motions of the three main axes.

WARNING

When taking safety precautions, consider the range of motion of the manipulator shown in Fig. 5-6 (a) "Dimensions and P-point Maximum Envelope (EPX2700-B000)" and Fig. 5-6 (b) "Dimensions and P-point Maximum Envelope (EPX2700-B100)".
5 System Configuration

5.1 Manipulator

Fig. 5-5 (a) System Configuration (EPX2700-B000)
5 System Configuration

5.1 Manipulator

- **Hazardous Location**
  - Programming Pendant (explosion proof, optional)
  - Air supply (0.35 MPa-0.65 MPa)
  - 3-phase AC200/220V 50/60Hz
  - Power supply
  - Grounding resistance 100 W or less
- **Non-Hazardous Location**
  - Cable for painting machine (optional)
  - Dedicated cables (2 cables)
  - 3-phase AC200/220V 50/60Hz

Fig. 5-5 (b) System Configuration (EPX2700-B100)
5 System Configuration

5.1 Manipulator

Fig. 5-6 (a) Dimensions and P-point Maximum Envelope (EPX2700-B000)
5 System Configuration

5.1 Manipulator

Fig. 5-6 (b) Dimensions and P-point Maximum Envelope (EPX2700-B100)
5.2 Robot Controller

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

![DANGER]

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

Failure to observe this warning may result in electric shock.

5.3 Pneumatic Unit

The pneumatic unit supplies protective air or gas to the manipulator to prevent explosive gas from entering the manipulator. Usually, the unit is attached to the side of the robot controller. The circuit diagram and dimensions are shown in Fig. 5-7 "Pneumatic Unit Air Circuit" and Fig. 5-8 "Pneumatic Unit External View". Set the air pressure so that the pressure shown on the pressure gauge of each pressure reducing valve will be within the pressure ranges shown in Fig. 5-7 "Pneumatic Unit Air Circuit".

![CAUTION]

The pneumatic unit is used to provide a pressurized explosion-proof barrier for the manipulator. Because the barrier is only ensured when the air supply is within the recommended pressure range, a lower air pressure will reduce the barrier’s efficiency, and a higher air pressure will damage the pneumatic unit. Be sure to keep the air pressure within the specified range.
5.3 Pneumatic Unit

Air inlet 1 (16 dia.)
(Tube external diameter)
Air inlet 2 (16 dia.)
(Tube external diameter)

P1 (the set pressure)
0.01 to 0.03 MPa

P2 (Purging air pressure)
0.15 to 0.35 MPa

P3 (controlled pressure)
0.35 to 0.65 MPa

Pressure reducing valve
for the set pressure

Pressure reducing valve
for purging air

Pressure reducing valve
for the controlled pressure

Filter

For the purging valve (6 dia.)
(Tube external diameter)

Air for the internal pressure
(16 dia.)
(Tube external diameter)

Fig. 5-7 Pneumatic Unit Air Circuit

Fig. 5-8 Pneumatic Unit External View
5.4 Tubes

Daily inspection is requested for the tubes used for supplying paints, thinner, and air (excluding the tube for supplying protective gas into the manipulator). Replace them periodically.

5.5 O-Ring and X-Ring in the Wrist

Periodically replace the O-ring and X-ring in the wrist. Contact your Yaskawa representative to replace the ring.
6 Connection

6.1 Wiring

WARNING

• Ground resistance must be 100 Ω or less.
  Failure to observe this warning may result in fire or electric shock.

• Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign.
  (ex. DO NOT TURN THE POWER ON.)
  Failure to observe this warning may result in fire or electric shock.

CAUTION

• Wiring must be performed by authorized or certified personnel.
  Failure to observe this caution may result in fire or electric shock.

• Do not cover the cable with heat insulating material, and avoid multiple cabling.
  Failure to observe this caution may result in burn caused by cable heat emission failure.
6.1.1 Grounding

Follow the local regulations for ground line size. A line of 5.5 mm² or more is recommended. Refer to Fig. 6-9 "Grounding Method".

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

The grounding methods differ depending on the system application. Refer to the connection instructions that are provided separately.

![Grounding Method Diagram](image-url)
6.2 Cable Connection

6.2.1 Connection to the Manipulator

Before connecting the cables to the manipulator, verify the connectors named 1BC-1, -2, -3, -4, -5, -6, 2BC-1, -2, -3, -4, -6, 3BC-1, -2, -3, -4, -5, -6, 4BC-1, -2, -3, -4, -5, and -6 on both cables and manipulator. Then connect each connector of cables to same-named connector of Manipulator. Fix the plate of cables 10 bolts M6 (length: 20 mm) with spring washers. The air hose for the pressure switch, the intrinsically safe cable, and the crimped terminals should be prepared by the customer.

Fig. 6-10 Manipulator Internal Cable Connection
6 Connection

6.2 Cable Connection

Fig.6-11 (a) Manipulator Internal Cable Connection (EPX2700-B000)

Use following parts for grounding the power cable:

- Hexagon socket head cap screw M5
  (length: 10 mm, 10 screws)
  Conical spring washer 2H-6
  ( dacrometized, 10 washers)
  tightening torque: 6 N·m (0.6 kgf·m)

- Hexagon socket head cap screw M6
  (dacrometized, length: 20 mm, 10 screws)
  Conical spring washer 2H-6
  (dacrometized, 10 washers)
  tightening torque: 10 N·m (1.0 kgf·m)
Connection

6.2 Cable Connection

Fig. 6-11 (b) Manipulator Internal Cable Connection (EPX2700-B100)

Hexagon socket head cap screw M6
(length: 20 mm, 10 screws)
Conical spring washer 2H-6
(length: 10 washers)
Tightening torque: 10 N€m (1.0 kgf€m)

Grounding line connecting tapping
Hexagon socket head cap screw M5
(length: 10 mm, 10 screws)
Conical spring washer 2H-6
(length: 10 washers)
Tightening torque: 6 N€m (0.6 kgf€m)
6 Connection
6.2 Cable Connection

Fig. 6-11 (c) Power Supply Cable Connection to the NX100

Connect to the grounding tap.
Connect to the grounding tap.
Connect to the grounding tap.
Connect to the grounding tap.
Fig.6-12  Air Hose Connection
6 Connection
6.2 Cable Connection

**Fig. 6-13 Connection to the Pressure Switch Unit**

- Hexagon socket head cap screw M4 (dacrotized, length: 40 mm, 4 screws) and Conical spring washer 2H-4 (dacrotized, 4 washers)
- Hexagon socket head cap screw M6 (dacrotized, length: 20 mm, 2 screws) and Conical spring washer 2H-6 (dacrotized, 2 washers)
- Hexagon socket head cap screw M6 (dacrotized, length: 20 mm, 2 screws) and Conical spring washer 2H-6 (dacrotized, 2 washers)
6.2.2 Connection to the NX100

Connect the plugs of the power cables and the signal cables as indicated in the figure below.

Fig. 6-14 Connection to the NX100
6.2.3 Manipulator Cable Installation Example

The installation example is shown below.

- **Metal Pipe Installation**

![Diagram of Metal Pipe Installation Example]

**NOTE**
- Install the power cables, the signal cables, and the peripheral device coupling cables as described above.
- The metal pipe must have sufficient strength.
- For the explosion-proof approved parts, DO NOT use sealing fitting or sealing compound other than the products described above (manufactured by Cooper Crouse-Hinds, or equivalent).
6.2.4 Cable and Air Tube Connection

The cables and tubes necessary for installation are shown in the table below. The user must prepare the power supply cable, the grounding cable, the cables for optional equipment, and the air tubes.

<table>
<thead>
<tr>
<th>Use</th>
<th>Connection</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power source cable</td>
<td>Power source to/from controller</td>
<td>CVV-3.5SQ-4C</td>
</tr>
<tr>
<td>Intrinsically-safe signal line</td>
<td>Manipulator to/from controller</td>
<td>CVV-1.25SQ-2Cx2</td>
</tr>
<tr>
<td>cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable for conveyor-speed</td>
<td>To/from controller</td>
<td>CVV-SB-1.25SQ-3C</td>
</tr>
<tr>
<td>detection device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable for optional equipment</td>
<td>To/from controller</td>
<td>CVV-SB-1.25SQ</td>
</tr>
<tr>
<td>Air tube for pressurized</td>
<td>Manipulator to/from pneumatic unit</td>
<td>16/11 polyurethane tube</td>
</tr>
<tr>
<td>explosion-proofness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air tube for air supply</td>
<td>Air supply source to/from pneumatic unit</td>
<td>16/11 polyurethane tube</td>
</tr>
</tbody>
</table>
6 Connection
6.3 Internal Connections

Fig. 15 (a) "Internal Connection Diagram" and Fig. 6-1 (a) "Internal Connection Diagram" show the internal connections.
6 Connection
6.3 Internal Connections

Fig. 15 (a) Internal Connection Diagram
6.3 Internal Connections

Fig. 6-1 (a) Internal Connection Diagram
### 7 Basic Specifications

#### 7.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YR-EPX2700-B000</th>
<th>YR-EPX2700-B100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>15 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability*2</td>
<td>± 0.15 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>+125°, -25°</td>
<td>+25°, -125°</td>
<td></td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>+140°, -65°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>+90°, -65°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>± 720°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>± 720°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>± 720°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>1.7 rad/s, 100 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-axis</td>
<td>1.7 rad/s, 100 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>1.9 rad/s, 110 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>7.8 rad/s, 450 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>7.8 rad/s, 450 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>9.6 rad/s, 550 °/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable Moment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>45.8 N•m (4.67 kgf•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>33.8 N•m (3.45 kgf•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>10.8 N•m (1.1 kgf•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>590 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to +40 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80 %RH (non-condensing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>Less than 4.91 m/s² (0.5 G)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Free from excessive electrical noise (plasma).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td>5 kVA*3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 SI units are used in this table. However, gravitational unit is used in ( ).
*2 Conformed to ISO9283.
*3 Differs depending on the motion pattern.
7.2 Part Names and Working Axes

Fig.7-2 Part Names and Working Axes
7.3 Wrist Flange

The wrist flange dimensions are shown in Fig. 7-3 "Wrist Flange". Fitting depth of inside and outside fittings must be 21 mm or less.
7.4 System Application

The device required for the system application can be mounted on the horizontal arm. Observe the following restrictions:

• Maximum allowable load: 30 kg
• Mounting position: Refer to Fig. 7-4 "Device Mounting Position".

![Diagram](image-url)
8 Frequent Inspections

8.1 Frequent Inspections

The painting robot is a precision device using advanced technology. It is important to frequently inspect the robot and remove any dried paint. Conduct the daily and weekly inspections listed in Table 8-5 "Frequent Inspections" to ensure the long life of the robot and its performance. For more information about the inspection items, refer to Table 8.2 "Daily Inspections".

<table>
<thead>
<tr>
<th>No.</th>
<th>Items to be Inspected</th>
<th>Inspection Details</th>
<th>Daily</th>
<th>Weekly</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</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>▲ DANGER Do not enter the robot working envelope.</td>
</tr>
<tr>
<td>2</td>
<td>Noise and vibration during operation</td>
<td>No abnormal noise and vibration during robot operation.</td>
<td>○</td>
<td></td>
<td>▲ DANGER Do not enter the robot working envelope.</td>
</tr>
<tr>
<td>3</td>
<td>Tubes</td>
<td>No severe wear and tear on paint and air supply tubes.</td>
<td>○</td>
<td>○</td>
<td>▲ CAUTION Use a pair of protective glasses to protect your eyes against paint or thinner that is being removed.</td>
</tr>
<tr>
<td>4</td>
<td>Air leakage</td>
<td>No excessive air leakage from the fitting of the motor case.</td>
<td>○</td>
<td>○</td>
<td>▲ CAUTION Make sure that the air tube is firmly inserted in the joint. Accidental disconnection of the air tube may cause injury.</td>
</tr>
<tr>
<td>5</td>
<td>Dried paint</td>
<td>Remove the dried paint on the robot.</td>
<td>○</td>
<td>○</td>
<td>▲ WARNING When removing the paint with a tool, be careful not to damage the robot.</td>
</tr>
<tr>
<td>1</td>
<td>Water drained from the air filter</td>
<td></td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pressure set value</td>
<td>The pressure of the pressure reducing valve is within the specified range</td>
<td>○</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 8 Frequent Inspections

#### 8.1 Frequent Inspections

**Table 8-5 Frequent Inspections**

<table>
<thead>
<tr>
<th>No.</th>
<th>Items to be Inspected</th>
<th>Inspection</th>
<th>Daily</th>
<th>Weekly</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operation of emergency stop button and safety plug. Dried paint</td>
<td>1. The manipulator stops immediately when the emergency stop button is pressed.</td>
<td>☐</td>
<td>☐</td>
<td><strong>CAUTION</strong> Inspect the robot while it is in its standby position and not in motion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. The manipulator stops immediately when the safety plug is pulled out.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Remove the dried paint on the emergency stop button and the safety plug.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Operation of the photoelectric intrusion detecting switch. Dried paint</td>
<td>1. The manipulator stops when the photoelectric switch is turned OFF.</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Remove the dried paint on the light beam detector.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Operation of limit switch. Dried paint</td>
<td>1. Normal operation of the limit switch</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Remove the dried paint on the limit switch.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Operation of the gun tilt switching</td>
<td>The gun tilt changes correctly when air is supplied.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Operation of the shear pin system</td>
<td>1. The manipulator stops immediately when the shear pin is sheared.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. The test valve is closed and the tube is not broken.</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
</tbody>
</table>
8.2 Daily Inspections

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

8.2.1 Manipulator

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

- **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.

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

- **Tubes and Air Leakage**
  Check for excessive air leakage from the tubes, the couplings, and the joint fittings of the motor on each axis when the air is supplied in the manipulator to form the anti-explosion barrier. The actual amount of air leakage is not important 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.

- **Dried Paint, Dust, and Dirt**
  Remove any dried paint on the manipulator and other devices. Replace the vinyl sheet if any. Replace the jacket if it is dirty.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>When using a tool to remove the dried paint, be careful not to damage the manipulator.</td>
</tr>
</tbody>
</table>

8 Frequent Inspections

8.2 Daily Inspections

8.2.2 Pneumatic Unit

- Drained Water from Air Filter
  Empty the water drained from the air filter on the pneumatic unit.

- Pressure
  Before moving the manipulator, check if the gauges of the pressure reducing valves on the pneumatic unit show the pressure to be within the specified range.

8.2.3 Safety Devices

- Emergency Stop Button and Safety Plug
  Before operating the manipulator, check the following to make sure that the emergency stop button and the safety plug operate correctly:
  The manipulator stops immediately when the emergency stop button is pressed.
  The manipulator stops immediately when the safety plug is pulled out.
  Inspect the manipulator while it is in the standby posture and not in motion with the power supply turned ON. Repeated sudden stops while the manipulator is in motion will damage the braking system.
  Remove any dried paint on the emergency stop button and the safety plug.

- Photoelectric Intrusion Detecting Switch
  Make sure that the photoelectric intrusion detecting switch operates correctly.
  Remove any dried paint on the light beam receiving section on the switch.
  When the air is purging, check the air for purging.

- Limit Switch
  Make sure that the limit switches for positioning workpieces, starting the robot, and return the robot to home operate correctly.
  Remove any dried paint that may obstruct the robot motion.

---

**CAUTION**

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

- **Gun Tilt Switching**
  Check if the gun changes its tilt smoothly when compressed air is supplied. If excessive shock is applied on both ends, reduce the pressure supplied to the actuator.

- **Shear Pin**
  Disconnect the air supply tube, and check if the shear pin breaks immediately to shut off the power supply to the manipulator. Also, make sure that the air tube is not bent or crushed.
9 Maintenance and Inspection

**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.

**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 this caution may result in 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.
# 9.1 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 9.1 "Inspection Schedule". In Table 9.1 "Inspection Schedule", the inspection items are classified into three types of operation: operations which can be performed by personnel authorized of the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel. Only specified personnel are to do inspection work.

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

### Table 9-6 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</td>
<td>S-, L-, and U-axis motors</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Base mounting bolts</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Cover mounting screws</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Motor connectors</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Air seals for internal pressure</td>
<td>Visual</td>
<td>Check for wear or tear. Replace if necessary.</td>
<td>○ ○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>S- and L-axis internal cables</td>
<td>Visual Multimeter</td>
<td>Check for conduction between the main connector of the base and the intermediate connector with manually shaking the wire. Check for wear on the protective spring.</td>
<td>○ ○</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*NOTE:*
The inspection interval must be based on the servo power supply ON time.
## 9.1 Inspection Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>⑦ U-arm internal cables</td>
<td>1000H Cycle</td>
<td>Visual Multimeter</td>
<td>Check the conduction between terminals. Check for wear on the protective spring.</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑧ Battery in manipulator</td>
<td>6000H Cycle</td>
<td>○</td>
<td>Replace the battery unit when the battery alarm occurs or the manipulator drove for 38000H.</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑩ S-, L-, and U-axis speed reducers</td>
<td>24000H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease<em>2 (6000H cycles). (See Par. 9.2.1.) Replace grease</em>2 (12000H cycles). (See section 9.2.1.)</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑪ R-, B-, and T-axis speed reducers</td>
<td>36000H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease*3 (6000H cycles). (See section 9.2.1)</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑫ Wrist gear</td>
<td>Specified personnel</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease*3 (6000H cycles). (See section 9.2.1)</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑬ U-arm End Shaft Gear</td>
<td>Licensee Service Company</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease*3 (6000H cycles). (See section 9.2.1)</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑭ Explosion-proof devices</td>
<td>12000H Cycle</td>
<td>○</td>
<td>Confirm that the pressure switch, the master valve, and the explosion-proof system operate correctly. (Replace if necessary.) See section 9.4.</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑮ Pneumatic unit</td>
<td>24000H Cycle</td>
<td>○</td>
<td>Confirm that the solenoid valve and the pressure reducing valve operate correctly. (Replace if necessary.) Replace the filter (6000H cycles). (See section 9.3.)</td>
<td>○ ○</td>
</tr>
</tbody>
</table>
9 Maintenance and Inspection
9.1 Inspection Schedule

*1 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 9.5.1 "Encoder Connector with Warning Label").

*2 Internal cables to be replaced at 24000H inspection.

*3 For the grease, refer to Table 9-7 "Inspection Parts and Grease Used".

*4 Inspection No. correspond to the numbers in Fig. 9-5 (a) "Inspection Parts and Inspection Numbers (EPX2700-B000)" and Fig. 9-5 (b) "Inspection Parts and Inspection Numbers (EPX2700-B100)".

*5 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.

<table>
<thead>
<tr>
<th>Item*4</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000H Cycle</td>
<td>6000H Cycle</td>
<td>12000H Cycle</td>
<td>24000H</td>
</tr>
<tr>
<td>③ Overhaul</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
9 Maintenance and Inspection

9.1 Inspection Schedule

Fig. 9-5 (a) Inspection Parts and Inspection Numbers (EPX2700-B000)
### Table 9-7 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>
9.2 Maintenance for Manipulator

9.2.1 Grease Replenishment/Replacement

Fig. 9-5 (a) "Inspection Parts and Inspection Numbers (EPX2700-B000)" and Fig. 9-5 (b) "Inspection Parts and Inspection Numbers (EPX2700-B100)" show the location of the components of the manipulator.

Replenish or replace the grease for the following sections:

1) Wrist gears
2) S-, L-, and U-axis speed reducers
3) R-, B-, and T-axis speed reducers
4) U-arm end shaft gear

**Wrist Gears**

Remove the plugs and 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.)
S-, L-, and U-Axis Speed Reducers

Grease Replenishment

1. Remove the plug on the So (Lo, Uo) exhaust port.
   
   **NOTE**
   If grease is injected with the plug (So, Lo, Uo) on, the grease will go inside the motor and may cause a damage. Make sure to remove the plug (So, Lo, Uo) before the grease injection.

2. Remove the plug 1/8 on the Si (Li, Ui) grease inlet and install the grease zerk A-PT1/8. Inject grease by using a grease gun.

<table>
<thead>
<tr>
<th>Grease type: VIGO grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease:</td>
</tr>
<tr>
<td>S-axis: 2000 cc (1740 g)</td>
</tr>
<tr>
<td>L-axis: 2000 cc (1740 g)</td>
</tr>
<tr>
<td>U-axis: 700 cc (609 g)</td>
</tr>
</tbody>
</table>

3. Move S-axis (L-axis, U-axis) for a few minutes to discharge excessive grease.
4. Remove the grease zerk on the Si (Li, Ui) grease inlet. Wipe the So (Lo, Uo) exhaust port and the Si (Li, Ui) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the So (Lo, Uo) exhaust port and the Si (Li, Ui) grease inlet.

Grease Replacement

1. Remove the plug on the So (Lo) grease exhaust port.
   
   **NOTE**
   If grease is injected with the plug (So, Lo, Uo) on, the grease will go inside the motor and may cause a damage. Make sure to remove the plug (So, Lo, Uo) before the grease injection.

2. Remove the plug 1/8 on the Si (Li, Ui) grease inlet and install the grease zerk A-PT1/8. Inject grease by using a grease gun.

<table>
<thead>
<tr>
<th>Grease type: VIGO grease RE No.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease:</td>
</tr>
<tr>
<td>S-axis: 5600 cc (4872 g)</td>
</tr>
<tr>
<td>L-axis: 5600 cc (4872 g)</td>
</tr>
<tr>
<td>U-axis: 2000 cc (1740 g)</td>
</tr>
</tbody>
</table>

3. The grease replacement is completed when new grease appears in the So (Lo, Uo) exhaust port. The new grease can be distinguished from the old grease by color.
4. Move S-axis (L-axis, U-axis) for a few minutes to discharge excessive grease.
5. Remove the grease zerk on the Si (Li, Ui) grease inlet. Wipe the So (Lo, Uo) exhaust port and the Si (Li, Ui) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the So (Lo, Uo) exhaust port and the Si (Li, Ui) grease inlet. Reinstall the cover on each axis motor side.

   **NOTE**
   If the plug (So, Lo, Uo) is installed while the grease is being exhausted, the grease will go inside the motor and may cause a damage. Ensure that the grease has been completely exhausted before installing the plug (So, Lo, Uo).
9 Maintenance and Inspection
9.2 Maintenance for Manipulator

Fig. 9-7 S-Axis Speed Reducer

Grease exhaust port (S-axis head)
(Blind hexagon socket head plug PT3/8)

Grease exhaust port (S-axis head)
(Blind hexagon socket head plug PT3/8)

Grease inlet (S-axis base)
(Blind hexagon socket head plug PT1/8)

EPX2700-B100

EPX2700-B100
9.2 Maintenance for Manipulator

Fig. 9-8 L-Axis Speed Reducer

Grease exhaust port (S-axis head) (Hexagon socket head plug PT3/8)
Grease inlet (L-arm) (Hexagon socket head plug PT1/8)

Fig. 9-9 U-Axis Speed Reducer

Grease exhaust port (Casing) (Hexagon socket head plug PT3/8, dacrotized)
Grease inlet (L-arm) (Hexagon socket head plug PT1/8)
9 Maintenance and Inspection
9.2 Maintenance for Manipulator

- **R-, B-, and T-Axis Speed Reducers**

**Grease Replenishment**

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

   - **NOTE**
     - 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.

3. Move R-axis (B-axis, T-axis) for a few minutes to discharge excessive grease.

4. Remove the grease zerk on the Ri (Bi, Ti) grease inlet. Wipe the Ro (Bo, To) exhaust port and the Ri (Bi, Ti) grease inlet. Apply seal tape on the thread part of each plug, and reinstall the plugs on the Ro (Bo, To) exhaust port and the Ri (Bi, Ti) grease inlet.

5. Install the cover and tighten each screw with the specified tightening torque.

**Grease type:** VIGO grease RE No.0

<table>
<thead>
<tr>
<th>Axis</th>
<th>Type</th>
<th>Amount of grease:</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-axis</td>
<td>25 cc (22 g)</td>
<td>(35 cc (30 g) for the 1st supply)</td>
</tr>
<tr>
<td>B-axis</td>
<td>25 cc (22 g)</td>
<td>(30 cc (26 g) for the 1st supply)</td>
</tr>
<tr>
<td>T-axis</td>
<td>20 cc (17 g)</td>
<td>(30 cc (26 g) for the 1st supply)</td>
</tr>
</tbody>
</table>

**Fig.9-10  R-, B-, and T-axes Speed Reducer**

---

NOTE

- **R-axis grease inlet** (Hexagon socket head plug PT1/8)
- **B-axis grease inlet** (Hexagon socket head plug PT1/8)
- **R-axis grease exhaust port** (Hexagon socket head plug PT1/4)
- **B-axis grease exhaust port** (Hexagon socket head plug PT1/4)

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**EPX2700-B000**

**EPX2700-B100**

---

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HW0486018
9.2 Maintenance for Manipulator

- **U-Arm End Shaft Gear**

**Grease Replenishment**

1. Remove the hexagon socket button head screws, then remove the cover.
2. Apply Alvania EP grease 2 on the gear teeth through the grease inlet by using a grease gun.
3. Reinstall the cover. (Each plug must be tightened with the specified tightening torque.)

---

Fig.9-11  U-Arm End Shaft Gear
9.2.2 Inspection of Wrist Gear and Bearing

Check if three wrist axes move smoothly.
If any of the axes does not move smoothly, the wrist should be removed and disassembled for investigation of the cause such as detective bearing, gear or sealing. Contact your Yaskawa representative.

To remove the wrist from the U-arm, firmly hold the wrist and remove the fixing bolt. If not, the wrist may fall down when the fixing bolt is removed.

9.2.3 Inspection of Air Sealing for Internal Air Pressure

- Gasket on the Motor Case
  (a) S-, L-axes
  Remove the mounting bolts on the motor case and check the gasket where the case is mounted.
  Excessive oil contained in the air used to keep the internal pressure can damage the gasket, which result in air leakage. Replace the gasket if air leakage is found.
Fig.9-13  L-Arm Motor Gasket
9.2 Maintenance for Manipulator

Fig. 9-14 U-Axis and U-Arm Motor Gasket

- Hexagon socket head cap screw M6
  - Length: 20 mm, 16 screws
  - Conical spring washer 2H-6
  - Tightening torque 10 Nm (1.0 kgf·m)

- Hexagon socket head cap screw M6
  - Length: 20 mm, 4 screws
  - Conical spring washer 2H-6
  - Tightening torque 10 Nm (1.0 kgf·m)

- Hexagon socket head cap screw M6
  - Length: 20 mm, 4 screws
  - Conical spring washer 2H-6
  - Tightening torque 10 Nm (1.0 kgf·m)

- Hexagon socket head cap screw M6
  - Length: 20 mm, 8 screws
  - Conical spring washer 2H-6
  - Tightening torque 10 Nm (1.0 kgf·m)
(b) Base

Remove the cover on the backside of the base, and check for wear and tear on the rubber gaskets.

Fig. 9-15 Rubber Gaskets on the Base

EPX2700-B000

EPX2700-B100

Tightening torque 10 Nm (1.0 kgf·m)

Hexagon socket head cap screw M6
(length: 20 mm, 10 screws)
Conical spring washer 2H-6
9.2 Maintenance for Manipulator

1. Turn OFF the power to the NX100.
2. Detach and pull out the connector base from the base.
3. Remove the battery board mounting screws.
4. Remove the electrical tape protecting connection part of the battery board in the manipulator.
5. Connect two new battery boards.
6. Remove the old battery boards.
7. Protect the connection part of the battery board in the manipulator with electrical tape.
8. Insert the battery board screws in the mounting holes on the connector base, and fix the connector base on the base.

**NOTE** Be sure to connect the new battery boards before disconnecting the old one so that the data does not disappear.
9.3 Inspection of the Pneumatic Unit

9.3.1 Solenoid Valve

Check if the air purge starts a few seconds after turning ON the power to the NX100 and if it ends approximately 3 minutes later.

9.3.2 Pressure Reducing Valve

Measure the air pressure for the pneumatic unit with a pressure gauge. Remove the test plug or the relief valve on the pneumatic unit and connect the gauge. The air pressure must always be from 0.01 MPa to 0.03 MPa under normal conditions and from 0.15 MPa to 0.35 MPa when purging.


9.4 Inspection of Explosion-Proof Devices

9.4.1 Pressure Switch

Remove the front cover of the pneumatic unit box and check the conduction of the pressure switches. The two pressure switches must be ON when the air is being supplied and OFF when the air is not being supplied.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Be sure to turn OFF the power to the NX100 before inspecting the pressure switch.</td>
</tr>
<tr>
<td>• Do not touch the pressure setting dial on the pressure switch during an inspection.</td>
</tr>
</tbody>
</table>

Changing the setting prevents the correct pressure from being detected.

9.4.2 Master Valve

While the air is being supplied from the pneumatic unit, check if the air purge starts a few seconds after the power to the NX100 is turned ON. Also, check if the air goes out of the two air outlets for the master valve during the air purge.

9.4.3 Pressurized Anti-Explosion Barrier

While the air is being supplied from the pneumatic unit, check if the air purge starts a few seconds after the power to the NX100 is turned ON and if it ends approximately 3 minutes later. Also, check the following:

(a) The alarm “AIR PRESSURE ERROR” occurs immediately after the air supply from the pneumatic unit is stopped and the power supply to the NX100 is turned ON.

(b) The alarm “AIR PRESSURE ERROR” occurs when the air supply from the pneumatic unit is stopped during air purging.
9.5 Notes for Maintenance

9.5.1 Encoder Connector with Warning Label

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

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

The connectors for the battery are prepared on each of the S-, L-, and U-axis motors. Refer to Fig. 9-17 "Backup Battery Connection for S-, L-, and U-Axis Motors", and connect the battery according to the following procedure.

1. Remove the mounting bolts, then remove the cap on the slot of the motor’s encoder.
2. Connect the battery (JARCR-XIS01) to the connectors for battery backup (crimped contact-pin terminals) on the inside of the cap.
3. Confirm all connectors connection after the maintenance check ends, and remove the battery.

- R-, B-, and T-Axis Motors

The connectors for the battery backup (crimped contact-pin terminals) are prepared on the cables from the encoder connector of each of the R-, B-, and T-axis motors (BAT and OBT are marked). Refer to Fig. 9-18 "Backup Battery Connection for R-, B-, and T-Axis Motors", and connect the battery according to the following procedure.

1. Connect the battery (JARCR-XIS01) to the connectors for the battery backup of the motor encoder connector.
2. Confirm all connectors connection after the maintenance check ends, and remove the battery.

NOTE: Do not remove the battery pack in the connector base.
### 9.5 Notes for Maintenance

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

![Diagram of Backup Battery Connection for S-, L-, and U-Axis Motors](image)

Fig. 9-17 Backup Battery Connection for S-, L-, and U-Axis Motors

**R-, B-, and T-Axis Motors**

![Diagram of Backup Battery Connection for R-, B-, and T-Axis Motors](image)

Fig. 9-18 Backup Battery Connection for R-, B-, and T-Axis Motors
Fig. 9-19 Connection Diagram

![Connection Diagram]

**CAUTION**

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

Fig. 9-20 Caution Label
It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-EPX2700. The spare parts list for the MOTOMAN-EPX2700 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>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1</td>
<td></td>
<td>Sealing compound</td>
<td>DB-1600</td>
<td>Diabond Industry Co., Ltd.</td>
<td>200 ml</td>
<td>For gasket</td>
</tr>
<tr>
<td>A 2</td>
<td></td>
<td>Seal tape</td>
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MOTOMAN-EPX2700
INSTRUCTIONS

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