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

<table>
<thead>
<tr>
<th>MOTOMAN INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOMAN-EPX2050 INSTRUCTIONS</td>
</tr>
<tr>
<td>NX100 INSTRUCTIONS</td>
</tr>
<tr>
<td>NX100 OPERATOR’S MANUAL</td>
</tr>
<tr>
<td>NX100 MAINTENANCE MANUAL</td>
</tr>
</tbody>
</table>

The NX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 174761-1CD
Revision: 1
This manual describes the specifications, precautions for operation and required items for maintenance or inspections, for proper application of the MOTOMAN-EPX2050. 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.

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. 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.

**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".
NOTES FOR SAFE OPERATION

• Before operating the manipulator, check that servo power is turned off when the emergency stop button on the front door of the NX100 and the programming pendant is pressed. When the servo power is turned OFF, the SERVO ON READY lamp on 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.

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 OFF the servo power.

Injury may result from unintentional or unexpected manipulator motion.

Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the working 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 manipulator’s work envelope and that you are in a safe location before:
  - Turning ON the NX100 power.
  - Moving the manipulator with the programming pendant.
  - Running check operations.
  - Performing automatic operations.

Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop button is located on the right of the front door of the NX100 and the programming pendant.
Definition of Terms Used Often in This Manual

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

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

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 manipulator’s work area, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the NX100 Instructions before operating the manipulator.

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.
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 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 Notice.

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 EPX2050-B300 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:

technicalsupport@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 have the following information ready before you call Customer Support:

- **System**: EPX2050-B300
- **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

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.
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- **2.2 Teaching**

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- **3.2 Installation Site**

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10 Recommended Spare Parts
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.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install the MOTOMAN-EPX2050 in a location that meets the requirements of Area Classification ‘Division I’ prescribed in FM Approval Standard.</td>
</tr>
</tbody>
</table>
1 Safety Precautions

WARNING

- 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:
  (c) Do not enter inside the safeguards during operation.
  (d) 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
  (e) When any abnormality occurs, immediately press the emergency stop button to stop the manipulator.
  (f) 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-EPX2050, and the following are 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-EPX2050 is designed for easy-handling and to consider safety first in operation.

2.1 Methods of Protection

The MOTOMAN-EPX2050 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.

**WARNING**

Install the MOTOMAN-EPX2050 in a location that meets the requirements of Area Classification ‘Division I’ 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 feature
  
  The large-capacity drive for PC cards is provided as a standard feature of backup unit and enables data to be transmitted easily.
2 Features

- 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.

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.
3 Installation

3.1 Requirements

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

Table 1 Specifications

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Specifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
<td>3-phase 200/220 VAC (±10%)</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 enclosure.</td>
</tr>
<tr>
<td></td>
<td>Spray ON/OFF</td>
<td>Capacity:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gun-lift switching</td>
<td>For the pressurized explosion-proof</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressurized</td>
<td>50 Nl/min usually</td>
<td></td>
</tr>
<tr>
<td></td>
<td>explosion-proof</td>
<td>1000 Nl/min when purging</td>
<td></td>
</tr>
<tr>
<td></td>
<td>enclosure</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.


### 3.2 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>Controller (not explosion-proof)</td>
<td>×</td>
<td>○</td>
<td>0 to 45 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Pneumatic unit (not explosion-proof)</td>
<td>×</td>
<td>○</td>
<td>0 to 45 °C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (not explosion-proof)</td>
<td>×</td>
<td>○</td>
<td>0 to 40 °C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Programming pendant (explosion-proof) (Option)</td>
<td>○</td>
<td>○</td>
<td>0 to 40 °C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Conveyer speed detector (not explosion-proof)</td>
<td>×</td>
<td>○</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Conveyer speed detector (explosion-proof)</td>
<td>○</td>
<td>-</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Converyer switch (explosion-proof)</td>
<td>○</td>
<td>-</td>
<td>0 to 50 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Workpiece supplier (explosion-proof)</td>
<td>○</td>
<td>○</td>
<td>0 to 50 °C</td>
<td>85%RH</td>
</tr>
<tr>
<td>Control panel for workpiece supplier (not explosion-proof)</td>
<td>×</td>
<td>○</td>
<td>0 to 45 °C</td>
<td>90%RH</td>
</tr>
<tr>
<td>Safety devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box for emergency stop switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety plugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator lamps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photoelectric switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selected according to the requirements of the customer. Refer to the appropriate instruction manual provided separately.

- : Not acceptable
  ○ : Acceptable
WARNING

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

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.
4.3 Transport

**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.

4.3.1 Transporting Method

**NOTE**

- The mass of the manipulator is approximately 350 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the mass.
- The attached eyebolts are designed to support the manipulator mass. Never use them for anything other than transporting the manipulator.
- Mount the shipping bolts and brackets before transporting the manipulator.
- With any transportation equipment, make sure to avoid external force on the arm or motor unit when transporting the manipulator.
Using a Crane

The manipulator must be lifted only by qualified and authorized personnel. The manipulator weighs approximately 350 kg (EPX2050). Use a wire, belt, or chain block strong enough to support the weight. Carefully check the length and the tension of the wire and belt to maintain the equilibrium of the manipulator while lifting.

<Lifting method>
Attach the eyebolts in two locations on the turning section of the S-axis and in one location on the top of the U-arm of the manipulator. Slowly lift the manipulator to form the posture shown in Fig. 1 "Transport Using a Crane" using wire or a belt threaded through the eyebolts. Use the eyebolt on the top of the U-arm for adjusting the posture of the manipulator and the two eyebolts on the S-axis for lifting.

When the manipulator is lifted to the desired height, adjust the posture of the manipulator by adjusting the length of the chain block and then install the manipulator.
4.4 Installation

**WARNING**

- Install safeguarding.  
  Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the fully extended arm and tool will not reach the wall, safeguarding, and the NX100.  
  Failure to observe this warning may result in injury or damage.
- Do not turn ON the power before the manipulator is firmly anchored.  
  The manipulator may turn over, and cause injury or damage.

**CAUTION**

- Do not install or operate a manipulator that is damaged or lacking parts.  
  Failure to observe this caution may result in injury or damage.
- Do not install the painting 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. 1 “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 safeguards are provided and used in accordance with Section 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 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 "4.4.3 Mounting the Manipulator on the Baseplate".

<table>
<thead>
<tr>
<th>Maximum torque in horizontal rotation (S-axis moving direction)</th>
<th>31400 N·m (3200 kgf·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque in vertical rotation (L-, U-axes moving direction)</td>
<td>59800 N·m (6100kgf·m)</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.

Fig. 2 Mounting the Manipulator on the Baseplate (EPX2800-B300)
4.4.4 When the Manipulator is Mounted Directly on the Floor

The floor should be strong enough to support the manipulator. Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator. As a rough standard, when there is a concrete thickness (floor) of 150 mm or more, the manipulator base can be fixed directly on the floor with M16 anchor bolts. Make the floor surface even and repair all the cracks. A non-concrete floor or a concrete floor less than 150 mm thick is insufficient to install the manipulator directly.

![Diagram of direct mounting on the floor](image)
4.4.5 Location

When installing the manipulator, satisfy the following environmental conditions.
- Ambient temperature: 0° 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

4.4.6 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.

4.4.7 Safety Devices

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

5.1 Wiring

**WARNING**

- Ground resistance must be 100 Ω or less. (Non I.S. GND)
  - **10 Ω or less. (I.S. GND)**
  
  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.
5.1.1 Grounding

Follow the local regulations for ground line size. A line of 5.5 mm² or more is recommended.

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

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

![Fig. 4 Grounding Method](image-url)
5.2 Cable Connection

5.2.1 Connection to the Manipulator

Before connecting the cables to the manipulator, verify the connectors named 1BC-1, -2, -3, -4, -5, -6, 2BC-1, -3, -4, -6, 3BC-1, -2, and -3 on both cables and manipulator. Then connect each connector of cables to same-named connector of Manipulator. Fix the plate of cables with 6 bolts M6 (4 bolts 12 mm long and 2 bolts 20 mm long recommended) with spring washers and washers. The air hose for the pressure switch, the intrinsically safe cable, and the crimped terminals should be prepared by the customer.
5.2.2 Connection to the NX100

Remove the cover on the NX100 side. Pass the signal cable for detection (1BC) and power cable (2BC) through the opening for the cables, and then fasten bolts on the opening. Connect the 1BC cable to the boards. Be sure to verify the numbers on both cables and board connectors before connecting, and to fasten the bolts on connectors to prevent cables from loosening.

Connect the 2BC cable to the terminals inside of the NX100. Be sure to verify the numbers on both the cable and board connectors before connecting.

Fig. 6 Connection to the NX100
5.2.3 Manipulator Cable Installation Example

The installation example is shown below.

- Install the power cable, the signal cable and the peripheral device coupling cable as mentioned 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).
5.2.4 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 to</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply cable</td>
<td>Power supply to/from the controller</td>
<td>CVV-3.5SQ-4C</td>
</tr>
<tr>
<td>Intrinsically safe signal cable</td>
<td>Manipulator to/from the controller</td>
<td>CVV-1.25SQ-2Cx2</td>
</tr>
<tr>
<td>Cable for the conveyor speed detection device</td>
<td>To/from the controller</td>
<td>CVV-SB-1.25SQ-3C</td>
</tr>
<tr>
<td>Cable for the optional equipment</td>
<td>To/from the controller</td>
<td>CVV-SB-1.25SQ</td>
</tr>
<tr>
<td>Air tube for pressurized explosion-proofness</td>
<td>Manipulator to/from the pneumatic unit</td>
<td>ø12/9, ø6/4 nylon tube (each line)</td>
</tr>
<tr>
<td>Air tube for air supply</td>
<td>Air supply to/from the pneumatic unit</td>
<td>ø12/9 nylon tube</td>
</tr>
</tbody>
</table>

5.3 Internal Connections

Fig. 8 “Internal Connection Diagram” shows the internal connections.
6 Connection

6.3 Internal Connections

Fig. 8 Internal Connection Diagram
6 System Configuration

Fig. 9 "System Configuration" shows the system configuration of the MOTOMAN-EPX2050.

6.1 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. 10 "Dimensions and P-point Maximum Envelope (EPX2050)" shows the dimensions and the range of motion of the EPX2050. The manipulator is driven by the servo motor in vertically articulated operation mode with 6 degrees of freedom on the manipulator base. The motion of the manipulator is made by 6 axes:

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

The range of motion shown in Fig. 10 "Dimensions and P-point Maximum Envelope (EPX2050)" is that of the wrist axis center point P that is made by the combination of the motions of the three main axes.

When taking safety precautions, consider the range of motion of the manipulator shown in Fig. 10 "Dimensions and P-point Maximum Envelope (EPX2050)".
Fig. 9 System Configuration
Fig. 10 Dimensions and P-point Maximum Envelope (EPX2050)
6.2 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.

**WARNING**

- 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.

6.3 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 of the unit are shown in Fig. 11 "Pneumatic Unit Air Circuit" and Fig. 12 "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. 11 "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.
Manufacturer is requested to strictly observe that the supply air is between 0.35 MPa to
0.65 MPa. The pressurized explosion-proof will not operate properly without the required
amount of air pressure, if air pressure is low. If the air pressure is increased, the
pneumatic equipment for the pressurized explosion-proof system will be caused for
equipment damage.

![Fig. 11 Pneumatic Unit Air Circuit](image)

![CAUTION](image)

![Fig. 12 Pneumatic Unit External View](image)
6.4 O-ring in the Wrist

Periodically replace the O-rings in the wrist. Contact your Yaskawa representative to replace the rings.

6.5 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.
## 7 Basic Specifications

### 7.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>MOTOMAN-EPX2050-B300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td>Vertically Articulated</td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>10 kg</td>
<td></td>
</tr>
<tr>
<td>Repetitive Positioning</td>
<td>± 0.5 mm</td>
<td></td>
</tr>
<tr>
<td>Positioning Accuracy</td>
<td>± 0.5 mm</td>
<td></td>
</tr>
<tr>
<td>Motion Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>± 90°</td>
<td></td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>+100° to -50°</td>
<td></td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>+123° to -125°</td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>±260° (wrist roll)</td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>±140° (wrist yaw/pitch)</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>±260° (wrist twist)</td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>2 m/s</td>
<td></td>
</tr>
<tr>
<td>Allowable Moment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>34.1 Nm (3.5 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>34.1 Nm (3.5 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>9.8 Nm (1.0 kgf•m)</td>
<td></td>
</tr>
<tr>
<td>Allowable Moment of Inertia (GD²/4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>1.21 kg•m²</td>
<td></td>
</tr>
<tr>
<td>B-axis</td>
<td>1.21 kg•m²</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>0.1 kg•m²</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>370 kg</td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to +45 °C</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 90%RH (non-condensing)</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>4.9 m/s² (0.5 G) or less</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Free from excessive electrical noise</td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td>5 kVA</td>
<td></td>
</tr>
</tbody>
</table>

*1 SI units are used in the table. Gravitational units are also described in parentheses.

*2 Conformed to ISO9283.
7.2 Wrist Flange

The wrist flange dimensions are shown in Fig. 13 "Wrist Flange (for EPX2050-B300)". Fitting depth of inside fittings must be 6 mm or less.

Fig. 13 Wrist Flange (for EPX2050-B300)
7.3 System Application

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

- Maximum allowable load: 10 kg
- Mounting position: refer to Fig. 14 "Device Mounting Position (for EPX2050)".

![Fig. 14 Device Mounting Position (for EPX2050)]
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 5 "Frequent Inspections" to ensure the long life of the robot and its performance.

Table 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>Motion</td>
<td>Smooth tuning, horizontal, and vertical motions of each arm. The robot’s standby position does not change.</td>
<td>○</td>
<td></td>
<td><img src="https://via.placeholder.com/15" alt="WARNING" /> 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><img src="https://via.placeholder.com/15" alt="WARNING" /> Do not enter the robot working envelope.</td>
</tr>
</tbody>
</table>
| 3   | Tubes                      | No severe wear and tear on paint and air supply tubes. | ○     | ○      | ![CAUTION](https://via.placeholder.com/15) Use protective glasses to protect your eyes against paint or thinner that is being removed.  
    |                            | ![CAUTION](https://via.placeholder.com/15) Make sure that the air tube is firmly inserted in the joint. Accidental disconnection of the air tube may cause injury. |
| 4   | Air leakage                | No excessive air leakage from the fitting of the motor case. | ○     | ○      | ![WARNING](https://via.placeholder.com/15) Replace the sheet.  
    |                            | ![WARNING](https://via.placeholder.com/15) When removing the paint with a tool, be careful not to damage the robot. |
| 5   | Dried paint                | Remove the dried paint on the robot. | ○     | ○      | ![WARNING](https://via.placeholder.com/15) No need for the automatic system |
| 1   | Water drained from the air filter | ![WARNING](https://via.placeholder.com/15) No need for the automatic system |
| 2   | Pressure set value          | The pressure of the pressure reducing valve is within the specified range | ○     |        |
## 8 Frequent Inspections

### Table 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>CAUTION: 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>WARNING</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>
```
8.2.2 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 paint on the emergency stop button and the safety plug.

- Photoelectric Intrusion Detecting Switch
  Make sure that the photoelectric intrusion detecting switch operates correctly.
  - 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.
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

### WARNING

- Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign such as "DO NOT TURN THE POWER ON".

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

### CAUTION

- Maintenance and inspection must be performed by the specified personnel.
  Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your Yaskawa representative.
- Do not disconnect the motor, and do not release the brake.
  Unexpected arm motion may cause injury or damage to the equipment.
- Be sure to connect the battery board before disconnecting the connectors for detection at maintenance and inspection.
  Failure to observe this caution may result in loss of home position data.

9.1 Inspection Schedule

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 displayed in the levels shown in Table 6 "Inspection Schedule". Conduct periodical inspections according to the inspection schedule in Table 6 "Inspection Schedule". In Table 6 "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 6 Inspection Schedule

<table>
<thead>
<tr>
<th>Maintenance and Inspection</th>
<th>Item</th>
<th>Schedule</th>
<th>Operation</th>
<th>Inspection charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1000 H cycle</td>
<td>6000 H cycle</td>
<td>12000 H cycle</td>
</tr>
<tr>
<td>Gear inside the wrist</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>Harmonic drive speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>Harmonic drive speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>Harmonic drive speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
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<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
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<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
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<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
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<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<tr>
<td>RV speed reducer</td>
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<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
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<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
<td>RV speed reducer</td>
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<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
<tr>
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<td>Replace grease</td>
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<td>⚠️ ○</td>
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<tr>
<td>RV speed reducer</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
<td>⚠️ ○</td>
<td>Replace grease</td>
</tr>
</tbody>
</table>
When replenishing or replacing the grease, be careful not to let any grease into the motor. Grease in the motor may cause motor failure. When any grease enters the motor, contact your Yaskawa representative.

When checking the conduction with multimeter, connect the battery to "BAT" and "0BT" 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.

Replace the internal cables of S-, L-, U-, R-, B-, and T-axes at 24,000H inspection.

When replacing a pneumatic unit filter, check the operation of the solenoid valve and the pressure reducing valve.

Check the operation of the solenoid valve.

Check the operation of the pressure reducing valve.

Check the operation of the pressure switch.

Check the operation of the solenoid valve.

Check the operation of the pressure reducing valve.

Check the operation of the solenoid valve.

Check the operation of the master valve.

Check the operation of the explosion-proof enclosure.

Check the conduction.

Check the operation of the pressure switch.

Check the operation of the pressure reducing valve.

Check the operation of the solenoid valve.

Check the operation of the master valve.

Check the operation of the explosion-proof enclosure.

Swinging the lead wire, check the conduction of the main connector and the intermediate connector of the box. Check for the wears on the protective spring.

Check the conduction. Check for the wears on the protective spring.

Check if the connectors are securely inserted.

Replace the battery when the battery alarm is displayed on the NX100.

Contact your Yaskawa representative.

Table. 6 Inspection Schedule

<table>
<thead>
<tr>
<th>Maintenance and Inspection</th>
<th>Item</th>
<th>Schedule</th>
<th>Operation</th>
<th>Inspection change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1000 H</td>
<td>6000 H</td>
<td>12000 H</td>
</tr>
<tr>
<td>Replacement of pneumatic unit filter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace the pneumatic unit filter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the solenoid valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the pressure reducing valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the pressure switch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the solenoid valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the pressure reducing valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the pressure switch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspection of explosion-proof devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the operation of the explosion-proof enclosure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement of the battery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor connector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check if the connectors are securely inserted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery in manipulator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace the battery when the battery alarm is displayed on the NX100.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhaul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact your Yaskawa representative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.2 Maintenance for Manipulator

9.2.1 Grease Replenishment/Replacement

Fig. 15 "Locations of Components" shows the location of the components of the manipulator. Replenish or replace the grease for the following:

1) Gears on the wrist and the end of the U-arm
2) Harmonic Drive speed reducers for the U- and T-axes
3) RV speed reducers for the S- and L-axes
4) Belleville springs in the wrist
Gears

Remove the cover and the plug. Inject Alvania EP grease 2 by using a grease gun to the gear teeth. See Fig. 16 "Injecting Grease at Wrist and End of U-arm (for EPX2050-B300)."
Harmonic Drive speed reducer

For the U-Axis Harmonic Drive speed reducer, the customer is responsible for replenishing the grease. But for the T-Axis speed reducer, contact your Yaskawa representative.

**Grease Replenishment**

Refer to Fig. 17 "U-axis Harmonic Drive Speed Reducer".

1. Remove the plug in the Uo air flow.

   **NOTE** The grease is not exhausted from the Uo air flow. Do not inject excessive grease.

2. Remove the plug 1/8 from the Ui grease inlet, and install the grease zerk A-PT1/8 to inject grease.

   Grease type: Harmonic grease 4B No.2
   Amount of grease: 70 cc
   (140 cc for 1st supply)

3. Reinstall the plugs on the Ui grease inlet and the Uo air outlet. Apply ThreeBond 1104 on screwed part.

   Fig. 17 U-axis Harmonic Drive Speed Reducer
RV speed reducer

Grease Replenishment

Refer to Fig. 18 "S-axis RV Speed Reducer" and Fig. 19 "L-axis RV Speed Reducer".

1. Remove the plug in the So (Lo) grease exhaust port. Remove the cover on the L-axis motor side.

- If grease is added without removing the plug, the internal pressure will be higher and may damage it. It is absolutely necessary to remove the plug.
- When injecting grease into the L-axis speed reducer, grease may come out from the air flow on the motor base. Remove the cover on the motor side to check if excessive grease is coming out. If there is any grease, wipe it off.

2. Inject grease into the Si (Li) grease inlet. Before injecting grease in the Li port, remove the plug on Li and install a grease zerk A-PT1/8.

<table>
<thead>
<tr>
<th>Grease type: Molywhite RE No. 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease: 700 cc for S-axis; 600 cc for L-axis</td>
</tr>
<tr>
<td>(For 1st supply: 1400 cc for S-axis, 1200 cc for L-axis)</td>
</tr>
</tbody>
</table>

3. Move the S-axis (L-axis) for a few minutes to discharge the excessive grease.

4. Wipe the So (Lo) exhaust port with a cloth and reinstall plugs in So (Li and Lo) exhaust port. Apply ThreeBond 1104 on screwed parts. Reinstall the cover on the L-axis motor side.

Grease Replacement

Refer to Fig. 18 "S-axis RV Speed Reducer" and Fig. 19 "L-axis RV Speed Reducer".

1. Remove the plug in the So (Lo) grease exhaust port. Remove the cover on the L-axis motor side.

- If grease is added without removing the plug, the internal pressure will be higher and may damage it. It is absolutely necessary to remove the plug.
- When injecting grease into the L-axis speed reducer, grease may come out from the air flow on the motor base. Remove the cover on the motor side to check if excessive grease is coming out. If there is any grease, wipe it off.

2. Inject grease into the Si (Li) grease inlet. Before injecting grease in the Li port, remove the plug on Li and install a grease zerk A-PT1/8.

<table>
<thead>
<tr>
<th>Grease type: Molywhite RE No. 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease: 1700 cc for S-axis; 2000 cc for L-axis</td>
</tr>
</tbody>
</table>

3. The grease replacement is complete when new grease appears in the So (Lo) exhaust port. The new grease can be distinguished from the old grease by color.

4. Move the S-axis (L-axis) for a few minutes to discharge the excessive grease.

5. Wipe the So (Lo) exhaust port with a cloth and reinstall the plugs in the So (Li and Lo) exhaust port. Apply ThreeBond 1104 on screwed parts. Reinstall the cover on the L-axis motor side.
If the plug is installed when the grease is being exhausted, the grease will go inside the motor and may damage it. Reinstall the plug after the excessive grease is completely discharged.

**NOTE**

(with hexagon socket head plug 1/8)

Si: Grease inlet
(with grease zerk A-PT1/4)

So: Grease exhaust port
(with hexagon socket head plug 1/8)

Si: Grease inlet
(with grease zerk A-PT1/4)

So: Grease exhaust port
(with hexagon socket head plug 1/8)

Li: Grease inlet
(Note: Remove the hexagon socket head plug and install a grease zerk A-PT1/8 before injecting grease)

Lo: Grease exhaust port

 fig. 18 S-axis RV Speed Reducer

 fig. 19 L-axis RV Speed Reducer
9.2.2 Lubricating Oil Replacement for R- and B-axes Speed Reducers

Contact your Yaskawa representative because motors and drive shafts for the R- and B-axes need to be removed to replace the lubricating oil.

- Recommended lubricating oil: Renolin PG220 made by Fuchs Lubricants Co. Viscosity = ISO VG200

9.2.3 Tightening Bolts

Tighten the bolts shown in Fig. 20 "Manipulator Base Box Fixing Bolts" and Fig. 22 "Terminal Box in Manipulator Base Box".

![Manipulator Base Box Fixing Bolts](image1)

![Wrist Fixing Bolts (for EPX2050-B300)](image2)
9.2.4 Wrist Speed Reducer and Bearing

Check if the three wrist axes move smoothly or not. If the wrist does not move smoothly, contact your Yaskawa representative. Removing and disassembling the wrist to find the faulty axis will be needed for repair or replacement of the bearing, the speed reducer, or the sealing compounds.

CAUTION

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.
9.2.5 Air Sealings for Internal Air Pressure

- Gasket on the motor case

(a) S-, L-, and U-axes

Remove the mounting bolts on the motor case and check the gasket where the case is mounted.

Remove the cover for the cable inlet in the motor case, and check the gasket where the cover is attached. Excessive oil in the air that is used for the internal air pressure can damage the gasket, which results in air leakage. Replace the gasket if air leakage is found.

Refer to Fig. 23 "S- and L-axes Motor Gaskets" to Fig. 25 "R-, B-, and T-axes Motor Gaskets" for more information on the gasket of each axis motor.

![Diagram of S- and L-axes Motor Gaskets](image-url)
The gasket is provided on the joint fitting between the back of the U-arm and the motor case. Remove the mounting bolts to check for wear and tear on the gasket. Refer to Fig. 25 "R-, B-, and T-axes Motor Gaskets".

(b) R-, B-, and T-axes
The gasket is provided on the joint fitting between the back of the U-arm and the motor case. Remove the mounting bolts to check for wear and tear on the gasket. Refer to Fig. 25 "R-, B-, and T-axes Motor Gaskets".
9.3 Maintenance and 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 8.5 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 0.02 MPa (0.2 kg/cm²) to 0.04 MPa (0.4 kg/cm²) under normal conditions, and from 0.3 MPa (3.0 kg/cm²) to 0.45 MPa (4.5 kg/cm²) 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 switch. The pressure switch 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>
<tr>
<td>Changing the setting prevents the correct pressure from being detected.</td>
</tr>
</tbody>
</table>

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 8.5 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.
10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-EPX2050. The spare parts list is shown below. Product performance can not 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 7  Spare Parts for MOTOMAN-EPX2050-B300

<table>
<thead>
<tr>
<th>Rank</th>
<th>Part No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty. per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Sealing compound</td>
<td>DB-1600</td>
<td>Diabond Industries Co., Ltd.</td>
<td>200 ml</td>
<td>For gasket</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Sealing tape</td>
<td>1104</td>
<td>ThreeBond Co., Ltd.</td>
<td>200 g</td>
<td>For plug seal</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Grease</td>
<td>Alvania EP grease 2</td>
<td>Showa Oil Co., Ltd.</td>
<td>16 kg</td>
<td>For the bevel gear in wrist</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Grease</td>
<td>VIGO grease No.0</td>
<td>Yaskawa Electric Corporation</td>
<td>16 kg</td>
<td>For RV speed reducer</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Grease</td>
<td>Harmonic grease No. 2</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5 kg</td>
<td>For Harmonic Drive speed reducer</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>Belleville spring</td>
<td>BD-19B</td>
<td>Iwatani Denko Corporation</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>S-axis speed reducer</td>
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</table>
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Specifications are subject to change without notice for ongoing product modifications and improvements.