MOTOMAN-SIA204D INSTRUCTIONS

TYPE
YR-SIA204D-A20 (DUST PROOF, DRIP PROOF SPECIFICATION)

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

MOTOMAN INSTRUCTIONS

MOTOMAN-SIA204D INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR’S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 Operator’s Manual above corresponds to specific usage. Be sure to use the appropriate manual.
MANDATORY

• This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-SIA204D for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator.

• General items related to safety are listed in Chapter 1: Safety of the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 instructions before reading this manual.

CAUTION

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

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

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

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

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

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

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

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

Read this manual carefully before installation, operation, maintenance, or inspection of the DX100.

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

DANGER

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

WARNING

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

CAUTION

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

MANDATORY

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

PROHIBITED

Must never be performed.

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

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

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

DANGER

- Maintenance and inspection must be performed by specified personnel.
  Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your Yaskawa representative.
- Do not remove the motor, and do not release the brake.
  Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.
WARNING

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

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

*Figure 1: Emergency Stop Button*

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

Injury may result from unintentional or unexpected manipulator motion.

*Figure 2: Release of Emergency Stop*

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

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the power for the DX100.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

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

The emergency stop buttons are located on the right of front door of the DX100 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 DX100 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 the Warning Labels in the DX100 instructions before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and manipulator 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>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Registered Trademark

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

The following warning labels are attached to the manipulator. Always follow the warnings on the labels. Also, the nameplate with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Figure 3: Warning Label Location

Nameplate Warning Label A

WARNING
Do not enter robot work area.

Nameplate Warning Label B

WARNING
Moving parts may cause injury

Nameplate Warning Label A

WARNING
Moving parts may cause injury

Nameplate Warning Label B

WARNING
Do not enter robot work area.
Customer Support Information

If you need assistance with any aspect of your SIA204D 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 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.

Please have the following information ready before you call:

- System: SIA204D
- Robots: MA1440
- Primary Application: Arc Welding
- Controller: DX200
- Software Version: Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the controller data plate
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9.3.4.3  Removal and Reinstallation of Cover for Elevation Axis

9.3.4.4  Gasket Replacement Procedure

10  Recommended Spare Parts
1  Product Confirmation

1.1  Contents Confirmation

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

- Manipulator
- DX100
- Programming Pendant
- Manipulator Cables (between the DX100 and the manipulator)
- Set of instruction manuals

CAUTION

- Confirm that the manipulator and the DX100 have the same order number. Special care must be taken when more than one manipulator is to be installed.

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

Check that the order number of the manipulator corresponds to the DX100. The order number is located on a label as shown below.

**Fig. 1-1: Location of Order Number Labels**

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**THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE SAME ORDER NUMBER.**

Check that the manipulator and the DX100 have the same order number.

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(a) DX100 (Front View)

(b) Manipulator (Side View)
## 2 Transport

### 2.1 Transporting Method

[CAUTION]

- Sling applications 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 performances.

[NOTE]

- Before transporting the manipulator, check if the eyebolts are firmly fixed to the manipulator.
- When installing the cover, be sure not to let the gasket folded and pinched.
- The weight of the manipulator is approximately 190 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- The attached eyebolts are designed to support the manipulator mass. Never use them for anything other than transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2.1 Transporting Method

2.1.1 Using a Crane

As a rule, when removing the manipulator from the package and moving it, a crane should be used. The manipulator should be lifted using wire ropes threaded through the attached eyebolts. Be sure to lift the manipulator in the posture as shown in Fig. 2-1 “Transporting Position”.

Fig. 2-1: Transporting Position

<table>
<thead>
<tr>
<th>Axis</th>
<th>S-axis</th>
<th>L-axis</th>
<th>U-axis</th>
<th>R-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle</td>
<td>0 mm</td>
<td>-100°</td>
<td>-65°</td>
<td>0°</td>
</tr>
<tr>
<td>Pulse</td>
<td>0</td>
<td>-102400</td>
<td>-74695</td>
<td>0</td>
</tr>
</tbody>
</table>

Hexagon socket head cap screw M5

- Dacrotized, length: 12 mm, 4 screws each on right and left
- Conical spring washer 2H-5
- Dacrotized, 4 washers each on right and left
- Tightening torque: 6 N-m (0.6 kgf-m)

Since this is drip proof specification, the covers are installed on the eyebolt installation positions. By referring to Fig. 2-1 “Transporting Position”, remove the covers, etc. and install the eyebolts, and then lift the manipulator. (The eyebolts are installed at the factory.)

After the manipulator is transported, remove the eyebolts and reinstall the covers and gaskets and fix them with the specified tightening torque.
2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with screws as shown in Fig. 2-2 “Using a Forklift”. Insert forklift forks into the entries of 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 overturning or slippage.

Fig. 2-2: Using a Forklift
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 DX100 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 the manipulator which is damaged or lacks parts.
  Failure to observe this caution may cause injury or damage.
3.1 Installation of Safeguarding

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

**Responsibility for Safeguarding (ISO 10218)**

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

3.2 Mounting Procedures for Manipulator Base

The manipulator shall be firmly mounted on a baseplate or a foundation which is strong enough to support the manipulator and withstands repulsion forces during acceleration and deceleration.

Refer to Table 3-1 "Maximum Repulsion Forces of Manipulator in Emergency Stop" and Table 3-2 "Endurance Torque in Operation" to construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator.

The 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.

Mount the manipulator base as described in section 3.2.1 "Mounting Example" on page 3-3.

<table>
<thead>
<tr>
<th>Table 3-1: Maximum Repulsion Forces of Manipulator in Emergency Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load in vertical direction (S-axis moving direction)</td>
</tr>
<tr>
<td>Maximum torque in horizontal rotation (L-, U-, R-axis moving direction)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3-2: Endurance Torque in Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurance load in vertical operation (S-axis moving direction)</td>
</tr>
<tr>
<td>Endurance torque in horizontal operation (L-, U-, R-axis moving direction)</td>
</tr>
</tbody>
</table>
3.2.1 Mounting Example

Fix the baseplate firmly to the wall. The wall should be rugged and durable enough to prevent shifting of the baseplate and manipulator. It is recommended to prepare a baseplate of 32 mm or more in thickness and anchor bolts of M16 or larger in size.

Next, fix the manipulator base to the baseplate. The manipulator base is tapped for 6 mounting holes. Securely fix the manipulator base to the baseplate with hexagon socket head cap screws M16 (50 mm long is recommended). Tighten the hexagon socket head cap screws firmly so that they will not work loose during the operation.

Refer to Fig. 3-1 “Mounting Manipulator on Baseplate”.

Fig. 3-1: Mounting Manipulator on Baseplate
3.2.2 Notes on Mounting Procedures

The covers are installed on the manipulator body at the factory. Before mounting the manipulator, remove the covers by following the procedure below (see also section 9.1 “Preparation for Maintenance and Inspection” on page 9-2), and after mounting the manipulator, reinstall them.

1. Move the manipulator to the installation site.
2. Remove the eyebolts.
3. Remove the screws, nuts, and washers which fix the covers on the manipulator body, and then remove the covers. At this time, be sure not to fold or damage the gaskets between the manipulator top and the covers and between the covers.
4. Mount and fix the manipulator.
5. Reinstall the covers on the manipulator body and the covers on the eyebolts.
   To reinstall the covers on the eyebolts, refer to Fig. 2-1 “Transporting Position” on page 2-2.

Fig. 3-2: Manipulator with Covers Installed at Factory
3.3 Location

When installing a manipulator, it is necessary to satisfy the following environmental conditions:

- Ambient temperature: 0 to 60°C \(^1\)
- Humidity: 20 to 80% RH (non-condensing)
- Use LUBCASTER (20-fold dilution) or Deltaforge (30-fold dilution) as lubricant. \(^2\)
- Free from corrosive gas or liquid, or explosive gas or liquid
- Free from excessive shock or vibration
  (Vibration acceleration: 4.9 m/s\(^2\) [0.5G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5 mm or less

---

\(^1\) This is the ambient temperature when performing air purge (dry air) at the flow rate of 150 L/min.

\(^2\) When using another lubricant, contact your Yaskawa representative.
4 Wiring

4.1 Manipulator Cable Connection

Two manipulator cables are delivered with the manipulator: an encoder cable (1BC) and a power cable (2BC). (Refer to Fig. 4-1 “Manipulator Cables”) Connect these cables to the manipulator base connectors and to the DX100. Refer to Fig. 4-2(a) "Manipulator Cable Connection (Manipulator Side)” on page 4-2 and Fig. 4-2(b) "Manipulator Cable Connection (DX100 Side)” on page 4-3 “.

4.1.1 Connection to Manipulator

Before connecting the manipulator cables to the manipulator, verify the numbers on both manipulator cables and the connectors on the connector base of the manipulator. When connecting, adjust the cable connector positions to the main key positions of the manipulator, and insert the cables in the order of 2BC, and then 1BC. After inserting the cable, depress the lever until it clicks.

4.1.2 Connection to DX100

Before connecting cables to the DX100, verify the numbers on both manipulator cables and the connectors on the DX100. When connecting, insert the cables in the order of X21, and then X11. After inserting the cable, depress the lever until it clicks.

---

**WARNING**

- Ground resistance must be 100Ω or less.
  Failure to observe this warning may result in fire or electric shock.
- Before wiring, make sure to turn OFF the primary power supply, and put up a warning sign. (e.g. 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.
4.1 Manipulator Cable Connection

4.1.3 Removal and Reinstallation of Protective Cover for Manipulator Cable

When removing and reinstalling the manipulator cables, remove and reinstall the protective cover for the manipulator cables by referring to Fig. 4-2(a) Manipulator Cable Connection (Manipulator Side).

- The protective cover for the manipulator cables is not installed at the factory.

Fig. 4-2(a): Manipulator Cable Connection (Manipulator Side)
4  Wiring
4.1  Manipulator Cable Connection

Fig. 4-2(b): *Manipulator Cable Connection (DX100 Side)*
5 Basic Specifications

5.1 Basic Specifications

Table 5-1: Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>YR-SIA204D-A20</td>
</tr>
<tr>
<td>Configuration</td>
<td>Vertically articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>4</td>
</tr>
<tr>
<td>Payload</td>
<td>20 kg</td>
</tr>
<tr>
<td>Repetitive Positioning Accuracy(^2)</td>
<td>±0.1 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>-75 mm to +75 mm</td>
</tr>
<tr>
<td>L-axis</td>
<td>-110° to +100°</td>
</tr>
<tr>
<td>U-axis</td>
<td>-150° to +150°</td>
</tr>
<tr>
<td>R-axis</td>
<td>-180° to +180°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>500 mm/sec</td>
</tr>
<tr>
<td>L-axis</td>
<td>170°/s</td>
</tr>
<tr>
<td>U-axis</td>
<td>200°/s</td>
</tr>
<tr>
<td>R-axis</td>
<td>400°/s</td>
</tr>
<tr>
<td>Mass</td>
<td>190 kg</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0°C to 60°C (^3)</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH (non-condensing)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>4.9 m/s² (0.5G) or less</td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Free from corrosive gas or liquid, or explosive gas or liquid</td>
</tr>
<tr>
<td></td>
<td>• Use LUBCASTER (20-fold dilution) or Deltaforge (30-fold dilution) as lubricant (^4)</td>
</tr>
<tr>
<td></td>
<td>• Free from excessive electrical noise (plasma)</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>For 1 Unit</td>
</tr>
<tr>
<td></td>
<td>1.5 kVA</td>
</tr>
</tbody>
</table>

1 SI units are used in this table. However, gravitational unit is used in ( ).
2 Conformed to ISO9283
3 This is the ambient temperature when performing air purge (dry air) at the flow rate of 150 L/min.
4 When using another lubricant, contact your Yaskawa representative.
5.2 Part Names and Working Axes

*Fig. 5-1: Part Names and Working Axes*

- Base coordinate and robot coordinate origin
- Base coordinate and robot coordinate origin
- L-axis
- U-axis
- R-axis
- S-axis
- XF, YF, ZF: Flange coordinate
5.3 Manipulator Base Dimensions

Fig. 5-2: Manipulator Base Dimensions

Unit: mm

18 dia. (6 holes) +0.018

12 dia. $\phi 0.018$ (2 holes)

View A: Manipulator Bottom View (Enlarged)
5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Dimensions and P-Point Maximum Envelope
5.5 Internal Cooling Air

For the SIA204D, the inside of the manipulator is cooled by air. Air supplied through the air inlet (IN) on the connector base is emitted from the end of the air hose in the manipulator, pass through the inside of the manipulator, and then exhausted through the air exhaust port (OUT).

When using, remove the plugs PT3/8 from the air inlet (IN) and the air exhaust port (OUT), and then supply air (dry air) through the air inlet (IN).

Fig. 5-4: Internal Cooling Air

- Use only air. Do not use water, etc. instead of air.
- Supply filtered air (dry air) at the flow rate of 150 L/min.
- Be sure not to mistake the air inlet (IN) for the air exhaust port (OUT). Be sure to supply air through the air inlet (IN).
- When supplying air, be sure to open the air exhaust port (OUT). If air is supplied with the air exhaust port (OUT) closed, internal pressure increases and equipment failure may be caused.
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 20 kg maximum. If force is applied to the wrist instead of the load, the forces on the wrist axis should be within the values shown in Table 6-1 “Allowable Moment and Total Inertia of Wrist Axis”. Contact your Yaskawa representative for further information or assistance.

Table 6-1: Allowable Moment and Total Inertia of Wrist Axis

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N·m (kgf·m)</th>
<th>GD²/4 Inertia kg·m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-axis</td>
<td>29.4 (3.0)</td>
<td>2.0</td>
</tr>
</tbody>
</table>

1 ( ): Gravitational unit
2 The moment herein means the load applied in the direction shown in Fig. 6-1 “Wrist Axis Moment Direction”.

Fig. 6-1: Wrist Axis Moment Direction

CAUTION

- Be sure to set tool load information.

For the details of the setting, refer to section 8.4 “ARM Control” in the “DX100 INSTRUCTIONS”. 
6.2 Wrist Flange

The wrist flange dimensions are shown in Fig. 6-2 “Wrist Flange”.

- Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner or light oil before mounting the tools.
- When mounting an attachment, use a tap with the length of 14 mm or less to prevent adverse effect on the robot performance.
7 System Application

7.1 Internal User I/O Wiring Harness and Air Line

An internal user I/O wiring harness (0.1 mm², 9 wires) and two air lines are incorporated in the manipulator for the drive of the peripheral devices mounted on the flange as shown in Fig. 7-1 “Connectors for Internal User I/O Wiring Harness and Air Line”.

The connector pins and terminals are assigned as shown in Fig. 7-2 “Details of Connector Pin Numbers” on page 7-2. Wiring must be performed by the user.

<table>
<thead>
<tr>
<th>Allowable current for internal user I/O wiring harness</th>
<th>1.0A or less for each wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>The maximum pressure for air line</td>
<td>490 kPa (5 kgf/cm²) or less</td>
</tr>
</tbody>
</table>

Fig. 7-1: Connectors for Internal User I/O Wiring Harness and Air Line

[Diagram showing connectors and wiring details]
Fig. 7-2: Details of Connector Pin Numbers

[Diagram showing Connector Pin Numbers on Base side and Arm side]
8 Electrical Equipment Specification

8.1 Internal Connections

Diagrams for internal connections of the manipulator are shown in Fig. 8-1(a) "Internal Connection Diagram" on page 8-2 and Fig. 8-1(b) "Internal Connection Diagram" on page 8-3.
Fig. 8-1(a): Internal Connection Diagram
8.1 Internal Connections

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

- DX100 Power cable Elevation axis To Fig. 8-1 (a)
- 2BC(12X6) S1-1 S1-2
- 2BC(12X6) No.21CN No.3CN No.4CN No.14CN No.15CN No.16CN No.17CN No.8CN No.9CN No.10CN No.11CN No.12CN No.13CN No.18CN
- S1 Internal user I/O wiring harness

SM S-AXIS YB

Manipulator
Base Arm

PW L-AXIS YB
PW U-AXIS YB
PW R-AXIS YB
9 Maintenance and Inspection

DANGER

- Maintenance and inspection must be performed by specified personnel.
  Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your Yaskawa representative.
- Do not remove the motor, and do not release the brake.
  Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

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

CAUTION

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

Remove the drip-proof covers (IP53) before maintenance and inspection, and reinstall them after maintenance and inspection. Refer to Fig. 9-1 "Removal and Reinstallation of Covers".

Fig. 9-1: Removal and Reinstallation of Covers

- **B**: for cover for manipulator cable
  - Hexagon socket head cap screw M5 (dacrotized, length: 12 mm, 7 screws)
  - Conical spring washer 2H-5 (dacrotized)
  - Flat washer 5.5 x 13.0 x 0.8 (stainless)
  - Tightening torque: 6 N·m (0.6 kgf·m)
  - (Apply sealing bond 1206C on washer and screw surface.)

- **C**: for cover for manipulator body and elevation axis
  - Hexagon socket head cap screw M5 (dacrotized, length: 10 mm, 4 screws)
  - Flat washer 5.5 x 13.0 x 0.8 (stainless)
  - Tightening torque: 6 N·m (0.6 kgf·m)

- **D**: for fixing connector base together
  - Hexagon socket head cap screw M5 (dacrotized, length: 12 mm, 4 screws)
  - Conical spring washer 2H-5 (dacrotized)
  - Flat washer 5.5 x 13.0 x 0.8 (stainless)
  - Tightening torque: 6 N·m (0.6 kgf·m)

- **E**: for fixing L-and R- side covers for manipulator body
  - Hexagon socket head cap screw M5 (dacrotized, length: 16 mm, 10 screws)
  - Conical spring washer 2H-5 (dacrotized)
  - Tightening torque: 6 N·m (0.6 kgf·m)

- **F**: for fixing L-and R- side covers for manipulator body
  - Hexagon nut M5 (10 nuts)
9.1.1 Drip-Proof Cover Removal Procedure

1. Remove the screws B, and then remove the cover for manipulator cables.
2. Remove the screws C and D.
3. Remove the screws E and nuts F, and then separate the covers and remove them from the manipulator.

9.1.2 Drip-Proof Cover Reinstallation Procedure

Reinstall the covers in the reverse order of removal.

• Tighten the screws with the tightening torque shown in Fig. 9-1 “Removal and Reinstallation of Covers” on page 9-2.

NOTE

When installing the covers, be sure that the gaskets do not overlap or fall.

9.2 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 classified into six levels as shown in Table 9-1 “Inspection Items” on page 9-4.

In Table 9-1 “Inspection Items” on page 9-4, the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized by the user, operations to be performed by trained personnel, and operations to be performed by service company personnel. Only specified personnel shall perform the inspection work.

NOTE

• The inspection interval depends on the total servo operation time.
• The following inspection schedule is based on the case where the manipulator is used for handling application. If the manipulator is used for other applications or if it is used under special conditions, a case-by-case examination is required. The inspection may be conducted at shorter intervals if the manipulator is used very frequently even in case of the handling application. For details, contact your Yaskawa representative.
<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Alignment mark</td>
<td>Daily, 1000 H Cycle, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Visual</td>
<td>Check alignment mark accordance and damage at the home position.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>2 Working area and whole exterior of manipulator</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside cracks.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>3 S-axis ball screw and linear motion guide</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Visual</td>
<td>Wipe off foreign objects if any. Check for damage and outside cracks.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>4 L-, U-, and R-axis actuators</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Visual</td>
<td>Check for grease leakage. 1) Wipe the slide part if it is dirty.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>5 Baseplate mounting bolts</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Spanner, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>7 S-axis ball screw</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Replenish grease 2) (3000 H cycle). Refer to section 9.3.2 &quot;Grease Replenishment&quot; on page 9-8.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>8 S-axis timing belt</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Manual</td>
<td>Check the tension and wear of the belt.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>9 Cover mounting screws</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Screwdriver, Wrench</td>
<td>Tighten loose screws. Replace if necessary.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
<tr>
<td>10 Connector base</td>
<td>Daily, 3000 H Cycle, 6000 H Cycle, 12000 H Cycle, 24000 H Cycle</td>
<td>Manual</td>
<td>Check for loose connectors and tighten if necessary.</td>
<td>Specified Personnel Licensee Service Company</td>
</tr>
</tbody>
</table>
### 9.2 Maintenance and Inspection Schedule

**Table 9-1: Inspection Items**

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 Wire harness in arm</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for damages.</td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td>✪ Replace.</td>
</tr>
<tr>
<td></td>
<td>3000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Battery pack in manipulator</td>
<td>Daily</td>
<td>Visual</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator has driven for 24000 H.</td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Gasket (for covers for manipulator body)</td>
<td>At every removal and reinstallation of covers</td>
<td>Visual</td>
<td>Replace the gaskets with new ones at every removal and reinstallation of the covers.</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td></td>
<td>• HW1402686-1: Refer to chapter 2 &quot;Transport&quot;.</td>
</tr>
<tr>
<td></td>
<td>3000 H Cycle</td>
<td></td>
<td>• HW1402543-2, HW1402544-2, HW1402545-2, HW0415317-1: Refer to section 9.1 “Preparation for Maintenance and Inspection” on page 9-2.</td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasket (for ball screw)</td>
<td>Daily</td>
<td>Visual</td>
<td>Replace the gaskets when the manipulator has driven for 24000 H.</td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td>✪ Replace.</td>
</tr>
<tr>
<td></td>
<td>3000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 When a grease leakage is found, promptly contact your Yaskawa representative.
2 For grease, refer to Table 9-2 "Inspection Parts and Grease Used" on page 9-6.
3 Wire harnesses must be replaced at 24000 H inspection.
Fig. 9-2: Inspection Parts and Inspection Numbers

Note:
This figure shows the manipulator in the home position.

Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease used</th>
<th>Inspected parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Unilite FS No. (manufactured by Yaskawa)</td>
<td>L-axis actuator</td>
</tr>
<tr>
<td></td>
<td>Harmonic grease SK-1A (manufactured by Harmonic Drive Systems Inc.)</td>
<td>U-, R-axis actuators</td>
</tr>
<tr>
<td>6, 7</td>
<td>AFF (manufactured by THK Co., Ltd.)</td>
<td>S-axis linear motion guide and ball screw</td>
</tr>
</tbody>
</table>

Inspection numbers correspond to the numbers in Table 9-1 "Inspection Items" on page 9-4.
9.3 Notes on Maintenance Procedures

9.3.1 Battery Pack Replacement

The battery packs are installed in the positions shown in Fig. 9-3 “Battery Location”.

If a battery alarm occurs in the DX100, replace the battery in accordance with the following procedure:

Fig. 9-3: Battery Location

To prevent loss of the encoder absolute data, make sure to connect the new battery pack before disconnecting the old one.

1. Turn OFF the DX100 main power supply.
2. Remove the battery holder fixing screws (4 screws) and pull out the battery holder.
3. Connect the new battery pack to the unoccupied connector on the board.
4. Remove the old battery connectors from the board.
5. Remove the old battery pack from the battery holder and mount the new battery pack.
6. Mount the battery holder back to the original position.

**NOTE**  Do not allow plate to pinch the cables when reinstalling the plate.

### 9.3.2 Grease Replenishment

**Fig. 9-4: Grease Inlets and Air Exhaust Ports**

- **IN**: Grease inlet
- **OUT**: Air exhaust port (when replenishing grease)
- **OUT**: Grease exhaust port (when exchanging grease)

**Table 9-3: Grease Inlet Specifications**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Grease inlet</th>
<th>Grease zerK</th>
<th>Grease exhaust port (air exhaust port)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>B-PT1/8</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>L-, U-, R-axes</td>
<td>Hexagon socket head cap screw M6 (tightening torque: 10 N·m [1.0kgf·m])</td>
<td>A-MT6X1</td>
<td>Plug LP-M5</td>
</tr>
</tbody>
</table>
9.3 Notes on Maintenance Procedures

9.3.2.1 Grease Replenishment for S-Axis

Inject grease of the specified amount through the S-axis grease inlet shown in Fig. 9-4 "Grease Inlets and Air Exhaust Ports" on page 9-8. (Refer to Table 9-3 "Grease Inlet Specifications" on page 9-8 and Table 9-4 "Grease Type and Amount of Grease" on page 9-9.)

<table>
<thead>
<tr>
<th>Axis</th>
<th>Number of grease inlets</th>
<th>Schedule</th>
<th>Amount</th>
<th>Grease type</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis linear motion guide</td>
<td>4</td>
<td>3,000 H cycle</td>
<td>3.4 cc</td>
<td>AFF (manufactured by THK Co., Ltd.)</td>
</tr>
<tr>
<td>S-axis ball screw</td>
<td>1</td>
<td>3,000 H cycle</td>
<td>5 cc</td>
<td></td>
</tr>
<tr>
<td>L-axis</td>
<td>1</td>
<td>Exchange</td>
<td>12,000 H cycle</td>
<td>47 cc</td>
</tr>
<tr>
<td>U-axis</td>
<td>1</td>
<td>Replenishment</td>
<td>6,000 H cycle</td>
<td>15 cc (16 cc for 1st supply)</td>
</tr>
<tr>
<td>R-axis</td>
<td>1</td>
<td>Replenishment</td>
<td>6,000 H cycle</td>
<td>9 cc (10 cc for 1st supply)</td>
</tr>
</tbody>
</table>

9.3.2.2 Grease Replenishment for U-, and R-Axes

1. Remove the plug LP-M5 from the air exhaust port.

| NOTE | Be sure to remove the plug from the air exhaust port. Injecting grease without removing the plug may cause equipment failure. |

2. Remove the hexagon socket head cap screw M6 from the grease inlet, and then install the grease zerk A-MT6X1.

(The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease zerk. (Refer to Table 9-4 "Grease Type and Amount of Grease" on page 9-9.)

| NOTE | The air exhaust port is for air flow: When replenishing grease, grease is not exhausted from the air exhaust port. Do not inject excess grease. |

4. Move the axis for a few minutes to discharge excess grease.

5. Remove the grease zerk from the grease inlet. Apply ThreeBond 1206C to the thread part of the hexagon socket head cap screw M6, and then reinstall the screw to the grease inlet. Tighten the screw with a tightening torque of 10 N·m (1.0 kgf·m).

6. Reinstall the plug LP-M5 to the air exhaust port.
9.3.2.3 Grease Exchange for L-Axis

1. When the ambient temperature is 20°C or lower, operate the axis for grease exchange for a few minutes.

2. Remove the plug LP-M5 from the grease exhaust port.

   • Make sure to remove the plug LP-M5 from the air exhaust port. If grease is injected without removing the plug, the internal pressure increases, and damage may be caused.
   • If the temperature of grease is low, the viscosity of it is high, and the old grease may not be exhausted enough. Thus, operate the axis for a few minutes before exchanging grease.

3. Remove the hexagon socket head cap screw M6 from the grease inlet and install a grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is delivered with the manipulator.)

4. Inject grease through the grease inlet using a grease gun. Refer to Table 9-4 “Grease Type and Amount of Grease”.

5. The grease exchange is completed when new grease appears in the grease exhaust port. (New grease can be distinguished from old grease by color.)

6. Put a plastic bag on the grease exhaust port. (Keep the exhausted grease to measure the amount of grease exhausted during running-in.)

7. Perform running-in operation of the axis with grease injected for approximately 10 minutes to discharge excess grease. (Refer to Table 9-5 “Rough Standard of the Amount of Exhausted Grease”). For the operation pattern of the running-in, if possible, set the speed to 100% and the amount of movement to 40000 pulses or more. Also, set the timer of JOB to avoid overheat. If the amount of exhausted grease is less than the amount shown in Table 9-5 even after the running-in operation for 10 minutes, discharge excess grease as follows:
   (1) Remove the grease zerk from the grease inlet.
   (2) Supply air from the grease inlet to discharge excess grease from the grease exhaust port. At this time, set the air pressure to 0.03 MPa or less.
   (3) If the amount of exhausted grease is still less than the amount shown in Table 9-5 even after discharging excess grease once, perform running-in operation one cycle, and then perform the step (2) again. Supply air while performing the oscillating operation of the grease-injected axis to discharge grease faster if safety is ensured to do so under the relevant local safety standards.
9.3 Notes on Maintenance Procedures

(4) Repeat the step (3) until the amount of exhausted grease exceeds the amount shown in Table 9-5.

Note: To confirm the amount of exhausted grease, put a plastic bag on the grease exhaust port and measure the mass of grease, or put the exhausted grease into a container with which the volume of the grease can be measured such as an injection syringe. When supplying air, making a small air hole on the plastic bag makes the work easier.

Table 9-5: Rough Standard of the Amount of Exhausted Grease

<table>
<thead>
<tr>
<th>Axis</th>
<th>Rough standard of the amount of exhausted grease (unit: cc, mass shown inside ())</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-axis</td>
<td>19 cc ± 4 cc (16.5 g ± 3.4 g)</td>
</tr>
</tbody>
</table>

8. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head cap screw M6. Before installing the screw, apply ThreeBond 1206C on the thread part of the screw. Then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).

9. Reinstall the plug LP-M5 into the grease exhaust port.
9.3.3 Home Position Calibration

After replacing the motor or actuator, recalibrate the manipulator home position as described below. Use the parts shown in Table 9-6 “Parts List”.

For the home position registration, refer to section 9.3.3.3 “Home Position Registration: Registering All Axes at One Time” on page 9-14 or section 9.3.3.4 “Home Position Registration: Registering Axes Individually” on page 9-16.

Table 9-6: Parts List

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Configuration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracket for home position adjustment</td>
<td>HW0414468-3</td>
<td>Yaskawa</td>
<td>1</td>
<td></td>
<td>For S-axis Attached as accessory</td>
</tr>
<tr>
<td>Positioning key</td>
<td>HW0414488-1</td>
<td>Yaskawa</td>
<td>1</td>
<td></td>
<td>For L-, U-, R-axes Attached as accessory</td>
</tr>
</tbody>
</table>

9.3.3.1 Home Position Calibration for S-Axis

Fig. 9-5: Home Position Calibration for S-Axis
9.3 Notes on Maintenance Procedures

1. Put the bracket for home position adjustment at the position shown in Fig. 9-5 “Home Position Calibration for S-Axis”.

2. Move the S-axis until the bottom of the movable part base touches the bracket for home position adjustment.

3. Register the home position.

4. Remove the bracket for home position adjustment.

9.3.3.2 Home Position Calibration for L-, U-, and R-Axes

Using the programming pendant, adjust each axis position to fit the positioning key into the key slot as shown in Fig. 9-6 “Home Position Calibration for L-, U-, and R-Axes” so that the manipulator takes the home position posture, and then register each position to the DX100.

Fig. 9-6: Home Position Calibration for L-, U-, and R-Axes
9.3.3 Home Position Registration: Registering All Axes at One Time

1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
   - The HOME POSITIONING window appears.
3. Select {EDIT} under the menu.
   - The pull-down menu appears.
9.3 Notes on Maintenance Procedures

4. Select {SELECT ALL AXES}.
   – The confirmation dialog box appears.

5. Select {YES}.
   – Displayed position data of all axes are registered as home position.
     When {NO} is selected, the registration will be canceled.
9.3.3.4 Home Position Registration: Registering Axes Individually

1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
   - Perform steps 3 and 4 described in section 9.3.3.3 “Home Position Registration: Registering All Axes at One Time” on page 9-14 to select the desired control group.
4. Select the axis to be registered.
   - Move the cursor to the axis to be registered, and select it.
   - A confirmation dialog box appears.
5. Select {YES}.
   - Displayed position data of the axis is registered as home position. When {NO} is selected, the registration will be canceled.
9.3.4 Replacement of Gasket for Ball Screw

9.3.4.1 Precautions

When removing or replacing the covers, inform your Yaskawa representative of the manual number on the front cover of this manual.

Yaskawa is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product’s warranty.

9.3.4.2 Removal and Reinstallation of Cover for Manipulator Body

When removing and reinstalling the cover for the manipulator body, refer to section 9.1 “Preparation for Maintenance and Inspection” on page 9-2.

9.3.4.3 Removal and Reinstallation of Cover for Elevation Axis

• Refer to Table 9-8 “Parts List (Removal and Reinstallation of Gasket for Ball Screw)” on page 9-23.

On the elevation axis, the cover 1 is installed to protect the ball screw as shown in Fig. 9-7 “Elevation Axis Cover”. Remove the hexagon socket head cap screw M4X10 *dacrotized* and conical spring washer 2H-4 *dacrotized* (each 8 piece), and pull out the cover 1 in the direction of the arrow A. (Reinstall the cover in the reverse order of removal.)

Fig. 9-7: Elevation Axis Cover

![Elevation Axis Cover Diagram]
9.3.4.4 Gasket Replacement Procedure

- ThreeBond 1206C must be supplied by the user.
- Refer to Table 9-8 "Parts List (Removal and Reinstallation of Gasket for Ball Screw)" on page 9-23.

Fig. 9-8: Installation Location of Gasket

1. Move the manipulator to the position shown in Table 9-7 "Manipulator Fixing Position".

Table 9-7: Manipulator Fixing Position

<table>
<thead>
<tr>
<th>Item</th>
<th>S-axis</th>
<th>L-axis</th>
<th>U-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle (S-axis: distance)</td>
<td>+75 mm</td>
<td>-90°</td>
<td>-60°</td>
</tr>
<tr>
<td>Pulse</td>
<td>+15360</td>
<td>-92160</td>
<td>-68949</td>
</tr>
</tbody>
</table>

2. Turn OFF the DX100 main power supply.

3. Remove the covers for the manipulator body and the cover for the elevation axis by referring to section 9.3.4.2 “Removal and Reinstallation of Cover for Manipulator Body” on page 9-17 and section 9.3.4.3 “Removal and Reinstallation of Cover for Elevation Axis” on page 9-17.
4. Removal and reinstallation of the support (see Fig. 9-9 “Removal and Reinstallation of Support 1”):

- **Removal procedure**
  
  (1) Remove the hexagon socket head cap screws M4 (4 screws), the conical spring washers 2H-4, and flat washers, and then remove the supports 7 and 8.

- **Reinstallation procedure**
  
  (1) Put the conical spring washers 2H-4 and the flat washers on the hexagon socket head cap screws M4, and then reinstall the supports 7 and 8. (Tightening torque: 2.8 N·m (0.29 kgf·m) Fix the supports 7 and 8 to make the covers 4 and 5 pressed on the ball screw support nut.

*Fig. 9-9: Removal and Reinstallation of Support 1*
5. Removal and reinstallation of the gaskets 2 (see Fig. 9-10 “Removal and Reinstallation of Support Outside Gasket”):

- Removal procedure

(1) Remove the gaskets 2 (10) and (11).

- Reinstallation procedure

(1) Apply ThreeBond 1206C on the molded surfaces of the gaskets 2 (10) and (11) and the contact surfaces of the covers (4) and (5), and then press-fit them in the direction of the arrow F. At this time, support the covers (4) and (5) manually so that they do not fall down from the ball screw support nut.

Fig. 9-10: Removal and Reinstallation of Support Outside Gasket
6. Removal and reinstallation of the support (see Fig. 9-11 “Removal and Reinstallation of Support 2”):

  • Removal procedure
    (1) Remove the hexagon socket head cap screws M4 (2 screws) and the conical spring washers 2H-4, and then remove the covers 4 and 5 from the ball screw support nut.

  • Reinstallation procedure
    (1) Apply ThreeBond 1206C on the contact surfaces (hatched area) of the covers 4 and 5 before reinstalling them.
    (2) Fit the covers 4 and 5 into the ball screw support nut as shown in Fig. 9-11 “Removal and Reinstallation of Support 2”. (Be sure not to let the gasket 3 attached on the covers 4 and 5 fall off.)
    (3) Put the conical spring washers 2H-4 on the hexagon socket head cap screws M4 (2 screws), and then fix the covers 4 and 5. (Tightening torque: 2.8 N·m (0.29 kgf·m)
    At this time, manually press-fit the covers 4 and 5 on the top of the ball screw support nut. Be sure that the cover contact surfaces are even.

Fig. 9-11: Removal and Reinstallation of Support 2
7. Removal and reinstallation of the gasket (see Fig. 9-12 “Removal and Reinstallation of Support Inside Gasket”):

- Removal procedure

(1) Remove the gaskets ③ from the supports ④ and ⑤.

- Reinstallation procedure

(1) Attach the gaskets ③ (hatched part) on the inside of the tops of the covers ④ and ⑤.

**Fig. 9-12: Removal and Reinstallation of Support Inside Gasket**
## Table 9-8: Parts List (Removal and Reinstallation of Gasket for Ball Screw)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cover HW0314716-1</td>
<td>1</td>
</tr>
</tbody>
</table>
| 2   | Hexagon socket head cap screw M4 (length: 10 mm) *dacrotized*  
Conical spring washer 2H-4 *dacrotized*  
Order number: S80L01-77Z or later | 8 |
| 3   | Gasket 1 HW1401901-1 | 2 |
| 4   | Cover HW1401558-1 (right)  
Cover HW1402007-1 (front) | 1 |
| 5   | Cover HW1401558-2 (left)  
Cover HW1402007-2 (rear) | 1 |
| 6   | Hexagon socket head cap screw M4 (length: 20 mm),  
Conical spring washer 2H-4 | 2 |
| 7   | Support HW1401559-1  
Support HW1402086-1 | 1 |
| 8   | Support HW1401559-2  
Support HW1402086-1 | 1 |
| 9   | Hexagon socket head cap screw M4 (length: 10 mm),  
Conical spring washer 2H-4,  
Flat washer 4.3 × 12.0 × 0.8 | 4 |
| 10  | Gasket 2 HW1401902-1  
Gasket 2 HW1402008-1 | 1 |
| 11  | Gasket 2 HW1401902-2  
Gasket 2 HW1402008-2 | 1 |
10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for the MOTOMAN-SIA204D. 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 Unit

To replace parts in Rank B or Rank C, make sure to contact your Yaskawa representative.

### Table 10-1: Spare Parts for YR-SIA204D-A20 (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Grease</td>
<td>AFF</td>
<td>THK Co., Ltd.</td>
<td>-</td>
<td>-</td>
<td>for S-axis</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Grease</td>
<td>Unilite FS No.0</td>
<td>Yaskawa</td>
<td>-</td>
<td>-</td>
<td>for L-axis</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Grease</td>
<td>Harmonic grease SK-1A</td>
<td>Harmonic Drive Systems Inc.</td>
<td>-</td>
<td>-</td>
<td>for U-, R-axes</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery pack</td>
<td>HW0373737-B</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>Wire harness in elevation axis</td>
<td>HW0273293-B</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>Wire harness in arm</td>
<td>HW0273295-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>S-axis motor</td>
<td>SGMRV-05ANA-YR2*</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>450 W motor</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>Timing belt</td>
<td>100MTS5M475</td>
<td>Mitsuboshi Belting Ltd.</td>
<td>2</td>
<td>2</td>
<td>For S-axis</td>
</tr>
<tr>
<td>C</td>
<td>9</td>
<td>Pulley (small)</td>
<td>HW0485374-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>For S-axis</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
<td>Pulley (large)</td>
<td>HW0485410-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>For S-axis</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>Linear motion guide</td>
<td>HW0383871-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>For S-axis</td>
</tr>
<tr>
<td>C</td>
<td>12</td>
<td>Ball screw</td>
<td>HW0389912-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>For S-axis</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>L-axis actuator</td>
<td>SGAGS-172LA29-YR6*</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>14</td>
<td>U-axis actuator</td>
<td>SGAGS-761KA2A-YR6*</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>R-axis actuator</td>
<td>SGAGS-381KA25-YR6*</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>Gasket</td>
<td>HW1402543-2</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>Refer to Fig. 9-1 &quot;Removal and Reinstallation of Covers&quot; on page 9-2.</td>
</tr>
<tr>
<td>B</td>
<td>17</td>
<td>Gasket</td>
<td>HW1402544-2</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>Gasket</td>
<td>HW1402545-2</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>19</td>
<td>Gasket</td>
<td>HW0415317-1</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>Refer to Fig. 9-12 &quot;Removal and Reinstallation of Support Inside Gasket&quot; on page 9-22.</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
<td>Gasket 1</td>
<td>HW1401901-1</td>
<td>Yaskawa</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Table 10-1: Spare Parts for YR-SIA204D-A20 (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>21</td>
<td>Gasket 2</td>
<td>(Order number: S8R531-1) HW1401902-1</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>Refer to Fig. 9-10 “Removal and Reinstallation of Support Outside Gasket” on page 9-20.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Order number: S1R601-1 or later) HW1402008-1</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>22</td>
<td>Gasket 2</td>
<td>(Order number: S8R531-1) HW1401902-1</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Order number: S1R601-1 or later) HW1402008-2</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>23</td>
<td>Gasket</td>
<td>HW1402686-1-1</td>
<td>Yaskawa</td>
<td>2</td>
<td>2</td>
<td>Refer to Fig. 2-1 “Transporting Position” on page 2-2.</td>
</tr>
<tr>
<td>C</td>
<td>24</td>
<td>Board</td>
<td>SGDR-EFBA02A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
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