

MOTOMAN-VA1400

INSTRUCTIONS

TYPE:**YR-VA01400-A00 (STANDARD SPECIFICATION)****YR-VA01400-A01 (SLU-AXES WITH LIMIT SWITCHES)****YR-VA01400-A10 (CEILING-MOUNTED SPECIFICATION)****YR-VA01400-A11 (CEILING-MOUNTED, SLU-AXES WITH
LIMIT SWITCHES)**

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

MOTOMAN INSTRUCTIONS**MOTOMAN-VA1400 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.

Part Number: 155556-1CD

Revision: 3

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MANDATORY

- This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-VA1400 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 MOTOMAN-VA1400.

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”, “CAUTION” and “WARNING.”



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.

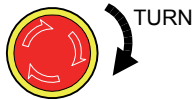
Figure 1: Emergency Stop Button



- 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 cabinet of the DX100 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 DX100 Instructions before operating the manipulator:

Definition of Terms Used 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:

Equipment	Manual Designation
DX100 controller	DX100
DX100 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

Registered Trademark

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

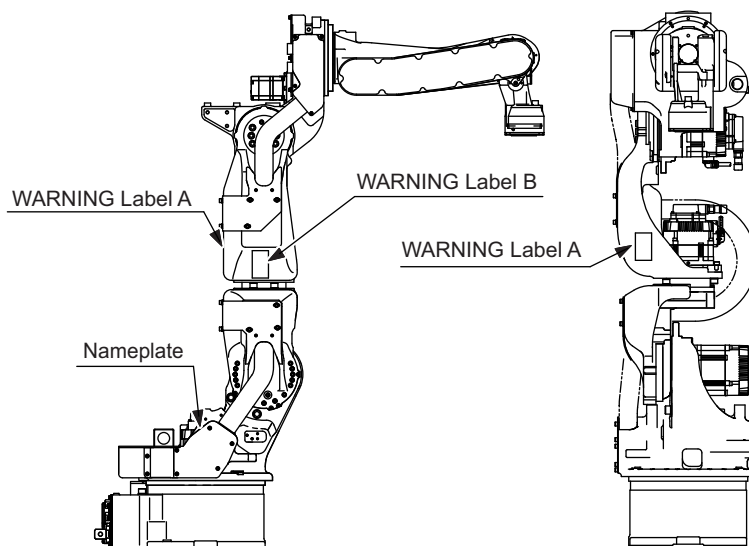
Explanation of Warning Labels

The following warning labels are attached to the manipulator.

Always follow the warnings on the labels.

Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Figure 3: Warning Label Locations



Nameplate:

YASKAWA MOTOMAN	
MODEL MOTOMAN- TYPE	
PAYLOAD _____ kg	MASS _____ kg
ORDER NO. _____	DATE _____
SERIAL NO. _____	
YASKAWA ELECTRIC CORPORATION 2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004 Japan MADE IN JAPAN NJ3247	

WARNING Label A:



WARNING Label B:



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 Notes.

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

Customer Support Information

If you need assistance with any aspect of your VA1400 system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

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

techsupport@motoman.com

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



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

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

- | | |
|----------------------------|--|
| • System | VA1400 |
| • Robots | _____ |
| • Primary Application | _____ |
| • Controller | DX100 |
| • 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 DX100 controller data plate |

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1 Product Confirmation



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.

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

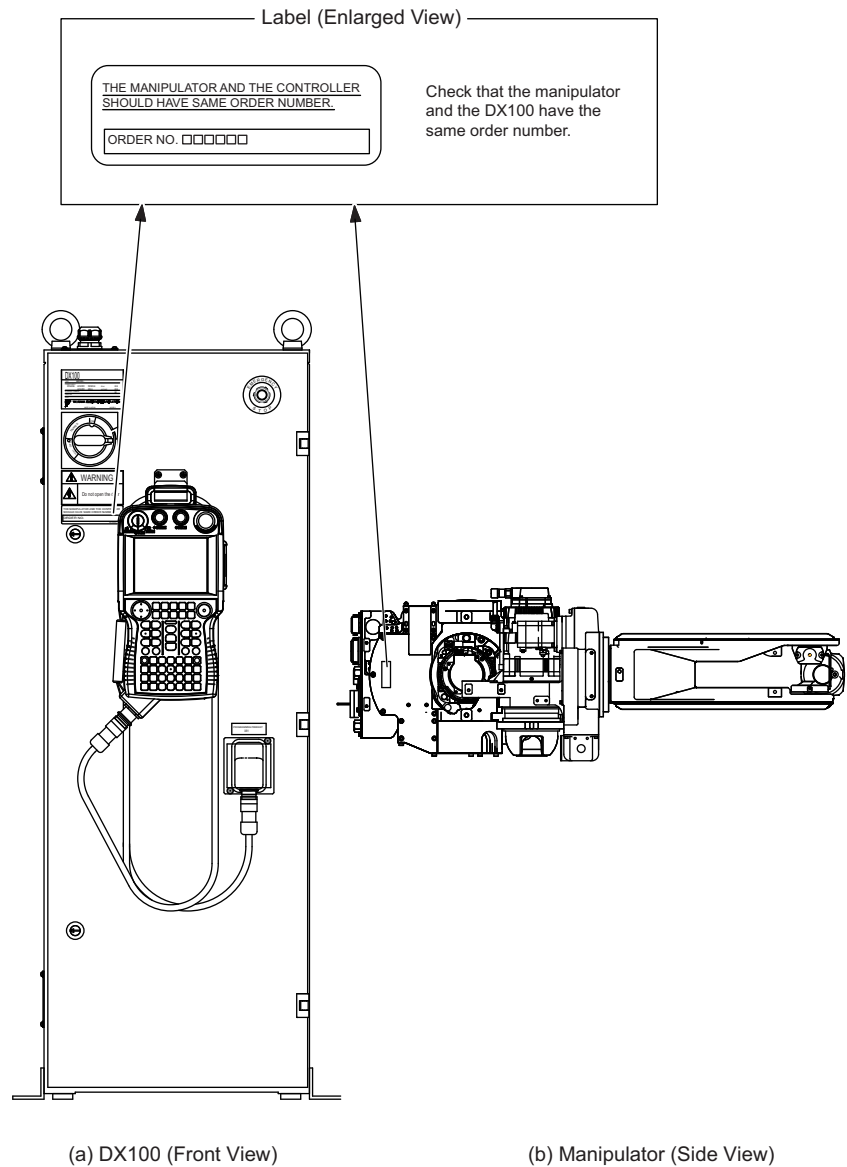
Standard delivery includes the following four items (information for the content of optional goods are given separately):

- Manipulator
- DX100
- Programming pendant
- Manipulator cables (between the DX100 and the Manipulator)

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



2 Transport



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 performance.

2.1 Transport Method

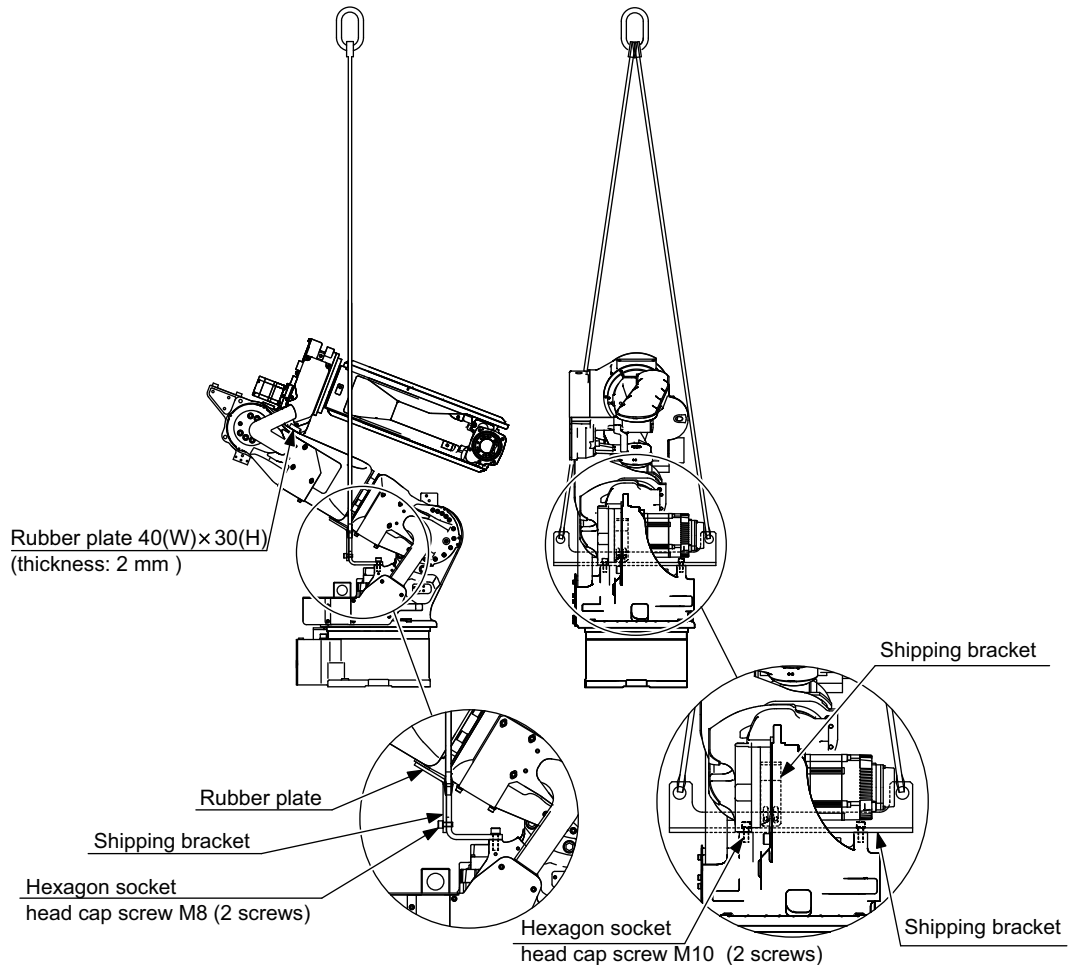


- The weight of the manipulator is approximately 150 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.

2.1.1 Using a Crane

As a rule, the manipulator should be lifted by a crane with two wire ropes when removing it from the package and moving it. Be sure that the manipulator is fixed with the shipping bolts and brackets before transport, and lift it in the posture as shown in Fig. 2-1 "Transporting Position".

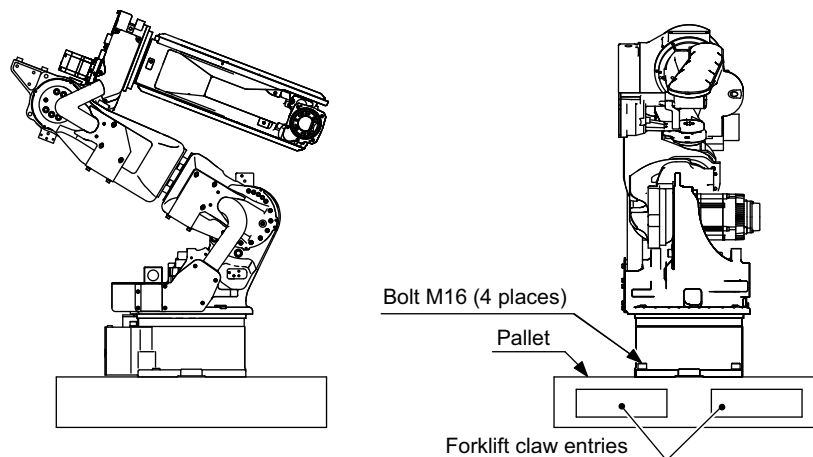
Fig. 2-1: Transporting Position



2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with shipping bolts as shown in Fig. 2-2 "Using a Forklift". Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator. Transport the manipulator slowly with due caution in order to avoid overturning or slippage.

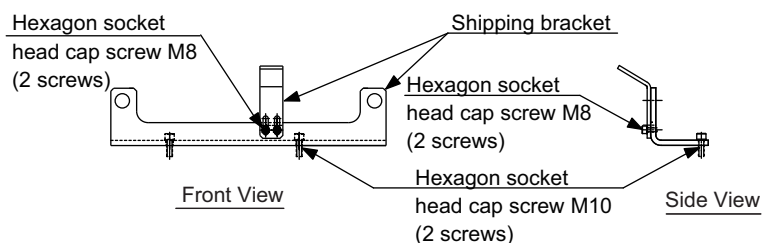
Fig. 2-2: Using a Forklift



2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and a shipping brackets. (See Fig. 2-1 "Transporting Position".)

Fig. 2-3: Shipping Bolts and Brackets



- The shipping bolts and bracket are painted yellow.
- The shipping bracket is to be fixed with the hexagon socket head cap screws M10 (2 screws).



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

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 tool or the workpiece held by its fully extended arm will not reach the wall, safeguarding, or controller.

Failure to observe this warning may result in injury or damage.

- Do not start the manipulator or even turn ON the power before it is firmly anchored.

The manipulator may overturn and cause injury or damage.

- When mounting the manipulator on the wall, the base section must have sufficient strength and rigidity to support the weight of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.

Failure to observe these warnings may result in injury or damage.



CAUTION

- Do not install or operate the manipulator that is damaged or lacks parts.

Failure to observe this caution may cause injury or damage.

- Before turning ON the power, check to be sure that the shipping bolts and brackets explained in *Fig. 2-3 "Shipping Bolts and Brackets"* are removed.

Failure to observe this caution may result in damage to the driving parts.

3.1 Safeguarding Installation

To insure safety, be sure to install safeguarding. It prevents unforeseen accidents with personnel and damage to equipment. Refer to the quoted clause for your information and guidance.

Responsibility for Safeguarding (ISO10218)

The user of a manipulator or robot system shall ensure that safeguards are 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 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 forces of the manipulator referring to *Table 3-1 "Maximum Repulsion Forces of the Manipulator at Emergency Stop"* and *Table 3-2 "Endurance Torque in Operation"*.

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. Mount the manipulator base as instructed in *section 3.2.1 "Mounting Example"*.

Table 3-1: Maximum Repulsion Forces of the Manipulator at Emergency Stop

Maximum torque in horizontal rotation (S-axis moving direction)	3800 N•m (390 kgf•m)
Maximum torque in vertical rotation (L-, U-axes moving direction)	3500 N•m (357 kgf•m)

Table 3-2: Endurance Torque in Operation

Endurance torque in horizontal operation (S-axis moving direction)	900 N•m (93 kgf•m)
Endurance torque in vertical operation (L-, U-axes moving direction)	1500 N•m (158 kgf•m)

3.2.1 Mounting Example

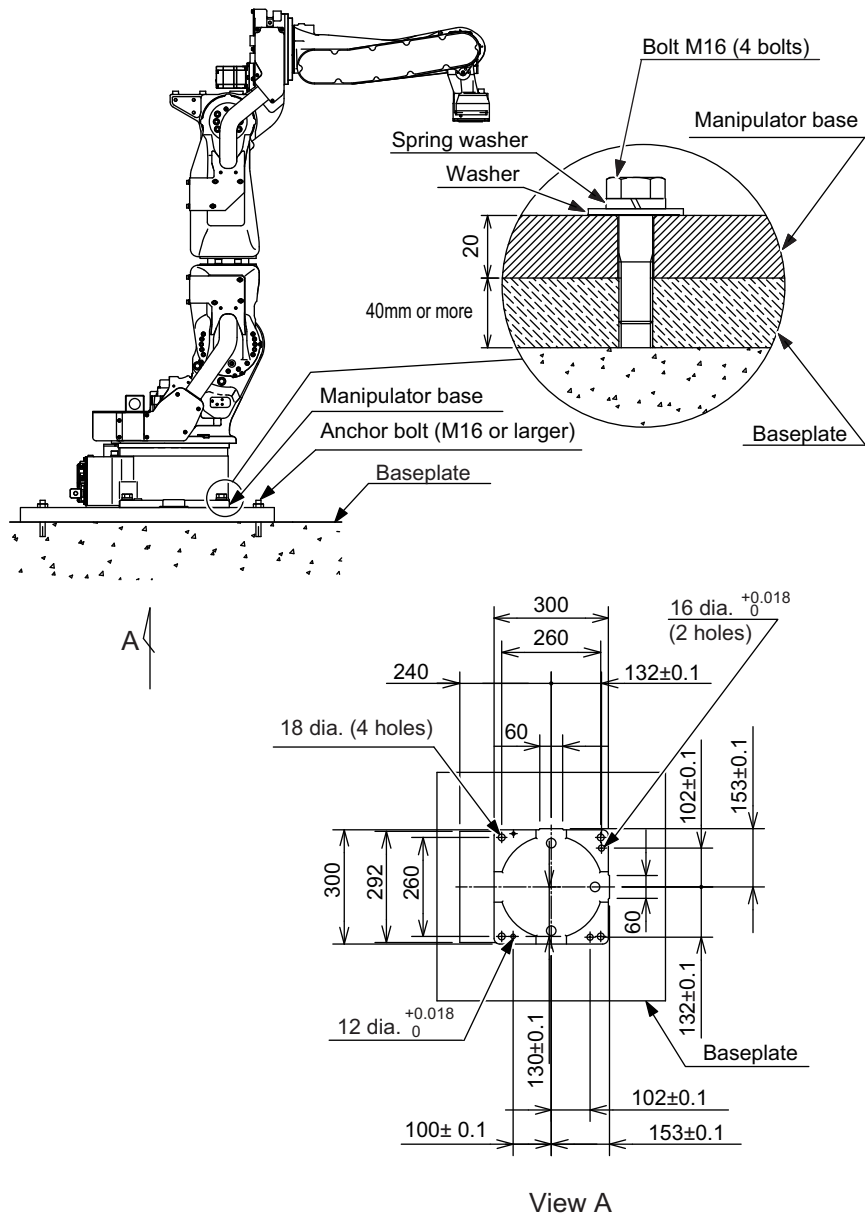
For the first process, anchor the baseplate firmly to the ground. The baseplate should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommended to prepare a baseplate of 40 mm or more thick, and anchor bolts of M16 or larger size.

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate with four hexagon head bolts M16 (50 mm long is recommended).

Next, fix the manipulator base to the baseplate. Tighten the hexagon head bolts and anchor bolts firmly so that they will not work loose during the operation.

Refer to Fig. 3-1 "Mounting the Manipulator on Baseplate".

Fig. 3-1: Mounting the Manipulator on Baseplate



3.3 Types of Mounting

The MOTOMAN-VA1400 is available in three types: floor-mounted type (standard), wall-mounted type and ceiling-mounted type. For wall-mounted and ceiling-mounted types, the three points listed below are different from the floor-mounted type.

The ceiling-mounted type manipulator are YR-VA01400-A10 and A11.

- S-Axis Operating Range
- Fixing the Manipulator Base
- Precautions to Prevent the Manipulator from Falling

3.3.1 S-Axis Operating Range

For wall-mounted type, the S-axis operating range is $\pm 30^\circ$.
(The range is adjusted prior to the shipment.)

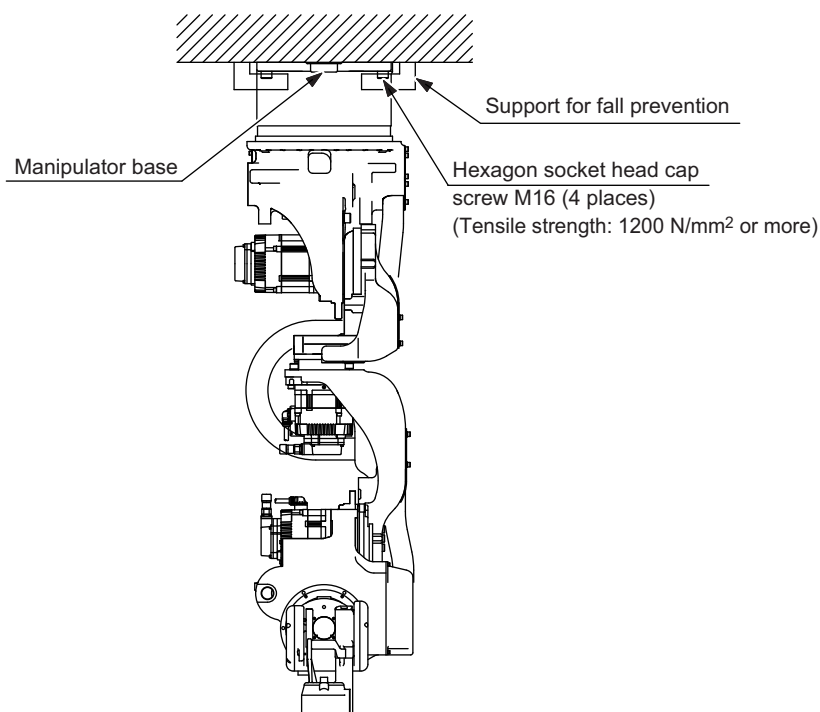
3.3.2 Fixing the Manipulator Base

For wall- and ceiling-mounted types, be sure to use four hexagon socket head cap screws M16 (tensile strength: 1200 N/mm² or more) when fixing the manipulator base. Use a torque of 206 N·m when tightening screws.

3.3.3 Precautions to Prevent the Manipulator from Falling

For the wall- or ceiling-mounted types, take appropriate measures to avoid the falling of the manipulator in case of emergency. Refer to Fig. 3-2 "Precaution Against Falling" for details.

Fig. 3-2: Precaution Against Falling



In case of using the wall-/ceiling-mounted type, inform YASKAWA of the matter when placing an order. Be sure to contact your YASKAWA representative (listed on the back cover of this instruction manual) to perform a wall/ceiling installation on site.

3.4 Location

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

- Ambient temperature: 0° to + 45°C
- Humidity: 20 to 80%RH (no-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration (Vibration acceleration: 4.9 m/s^2 [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5 mm or less

4 Wiring



WARNING

- Ground resistance must be 100 Ω or less.
Failure to observe this warning may result in fire or electric shock.
- Before wiring, make sure to turn the primary power supply off, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)
Failure to observe this warning may result in fire or electric shock.



CAUTION

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

4.1 Grounding

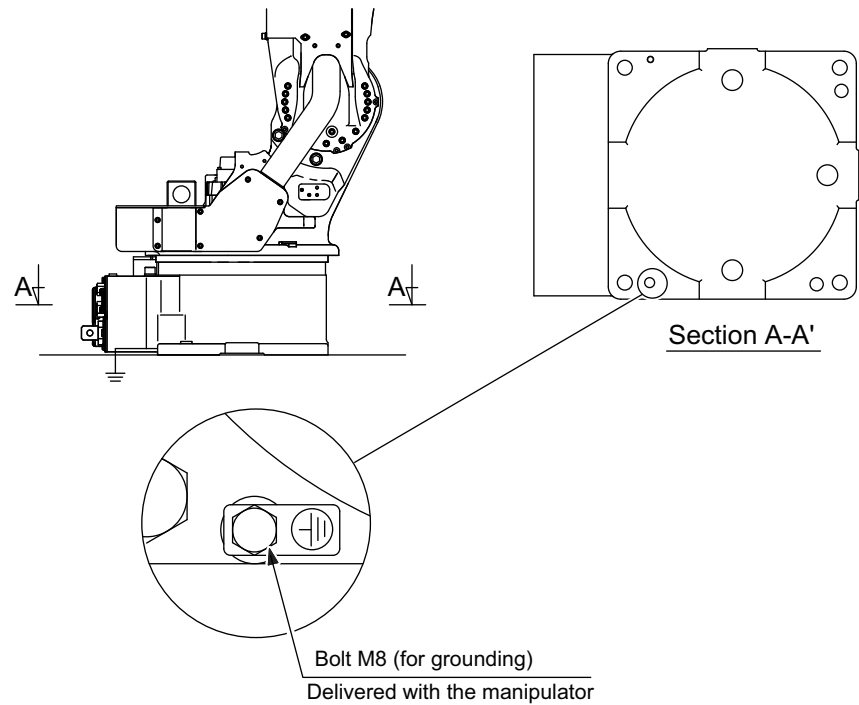
Follow electrical installation standards and wiring regulations for grounding. A ground wire of 5.5 mm² or more is recommended.

Refer to *Fig. 4-1 "Grounding Method"* to connect the ground line directly to the manipulator.



- Never use this wire sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with electrical installation standards.

Fig. 4-1: Grounding Method



4.2 Cable Connection

Two manipulator cables are delivered with the manipulator; an encoder cable (1BC) and a power cable (2BC). (Refer to Fig. 4-2 “Manipulator Cables”.)

Connect these cables to the manipulator base connectors and to the DX100. Refer to Fig. 4-3(a) “Manipulator Cable Connectors (Manipulator Side)” and Fig. 4-3(b) “Manipulator Cable Connection (DX100 Side)”.

4.2.1 Connection to the Manipulator

Before connecting two 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 cables in the order of 2BC, then 1BC. After inserting the cables, depress the lever until it clicks.

4.2.2 Connection to the 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, then X11, and depress each lever low until it clicks.

Fig. 4-2: Manipulator Cables

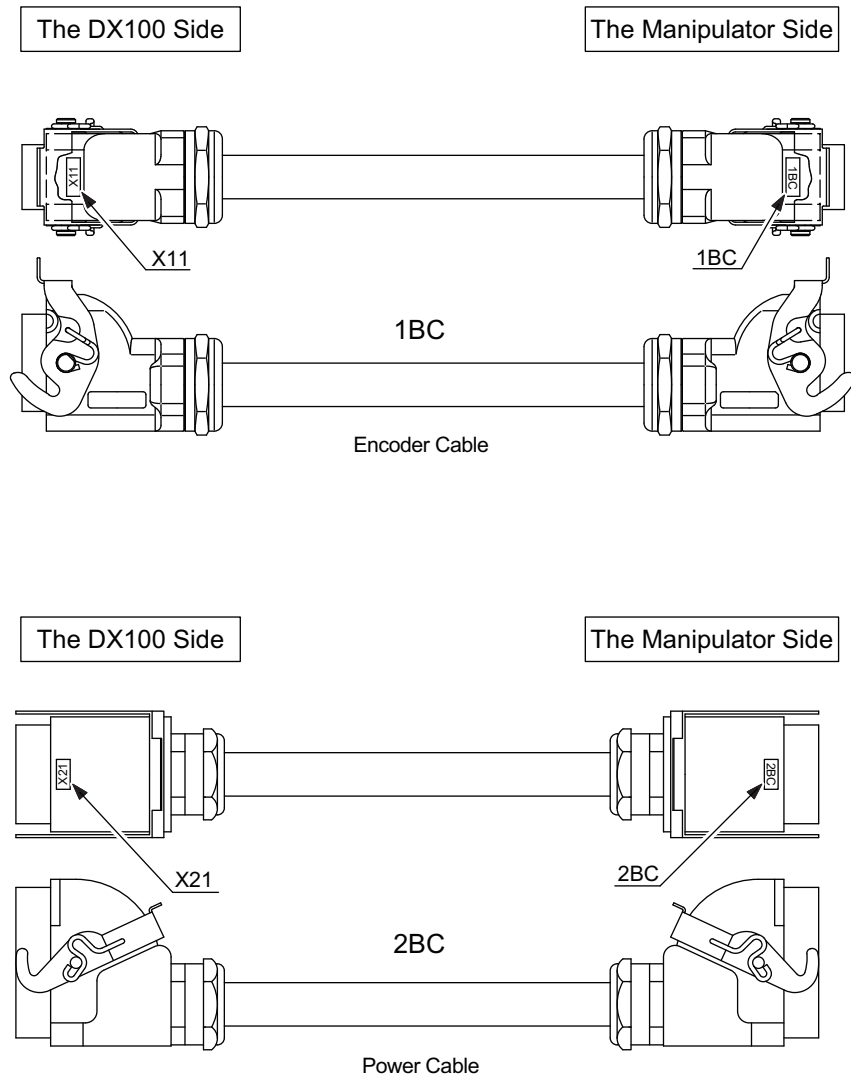


Fig. 4-3(a): Manipulator Cable Connectors (Manipulator Side)

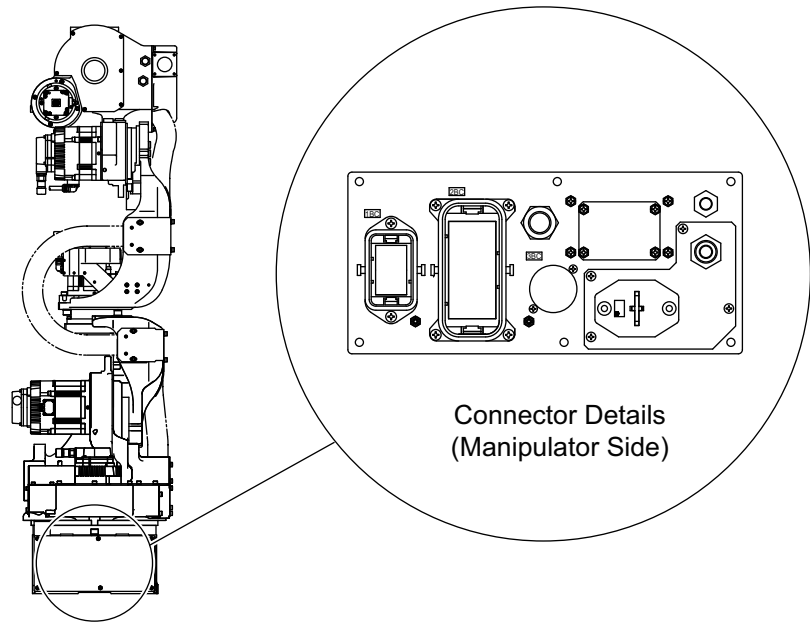
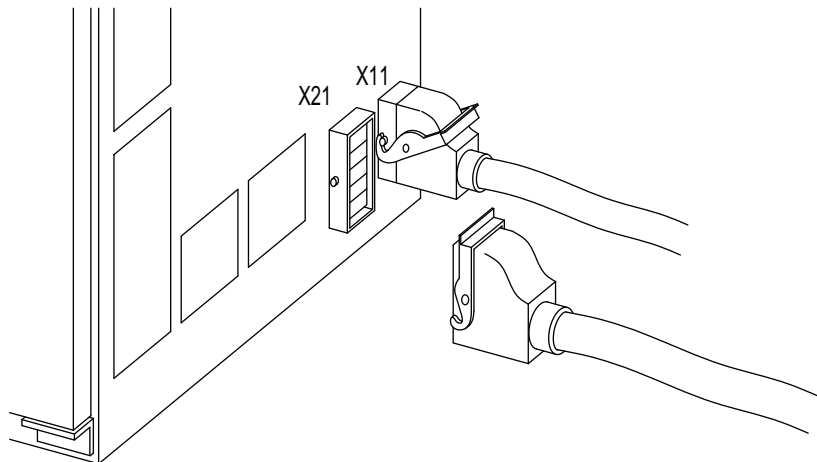


Fig. 4-3(b): Manipulator Cable Connection (DX100 Side)



5 Basic Specifications

5.1 Basic Specifications

Table 5-1: Basic Specifications¹⁾

Item	Model	MOTOMAN-VA1400
Application		Arc Welding
Structure		Vertically Articulated
Degree of Freedom		7
Payload		3 kg
Repeatability ²⁾		±0.08 mm
Range of Motion	S-Axis (turning)	±170°
	L-Axis (lower arm)	+148°, -70°
	U-Axis (upper arm)	+150°, -175°
	R-Axis (wrist roll)	±150°
	B-Axis (wrist pitch/yaw)	+180°, -45°
	S-Axis (turning)	±200°
	E-Axis (elbow)	±90°
Maximum Speed	S-Axis	3.84 rad/s, 220°/s
	L-Axis	3.49 rad/s, 200°/s
	U-Axis	3.84 rad/s, 220°/s
	R-Axis	7.16 rad/s, 410°/s
	B-Axis	7.16 rad/s, 410°/s
	T-Axis	10.65 rad/s, 610°/s
	E-Axis	3.84 rad/s, 220°/s
Allowable Moment ³⁾	R-Axis	8.8 N•m (0.9 kgf•m)
	B-Axis	8.8 N•m (0.9 kgf•m)
	T-Axis	2.9 N•m (0.3 kgf•m)
Allowable Inertia (GD ² /4)	R-Axis	0.27 kg•m ²
	B-Axis	0.27 kg•m ²
	T-Axis	0.03 kg•m ²
Approx. Mass		150 kg
Ambient Conditions	Temperature	0° C to 45° C
	Humidity	20 to 80% RH (non-condensing)
	Vibration Acceleration	4.9 m/s ² or less (0.5 G)
	Others	Free from corrosive gasses or liquids, or explosive gasses Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)
Power Requirements		1.5 kVA

1 SI units are used in this table. However, gravitational unit is used in ().

2 Conformed to ISO9283

3 Refer to chapter 6.1 "Allowable Wrist Load" for details on the permissible moment of inertia.

5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3(a): Dimensions and P-Point Maximum Envelope (YR-VA01400-A00, -A01)

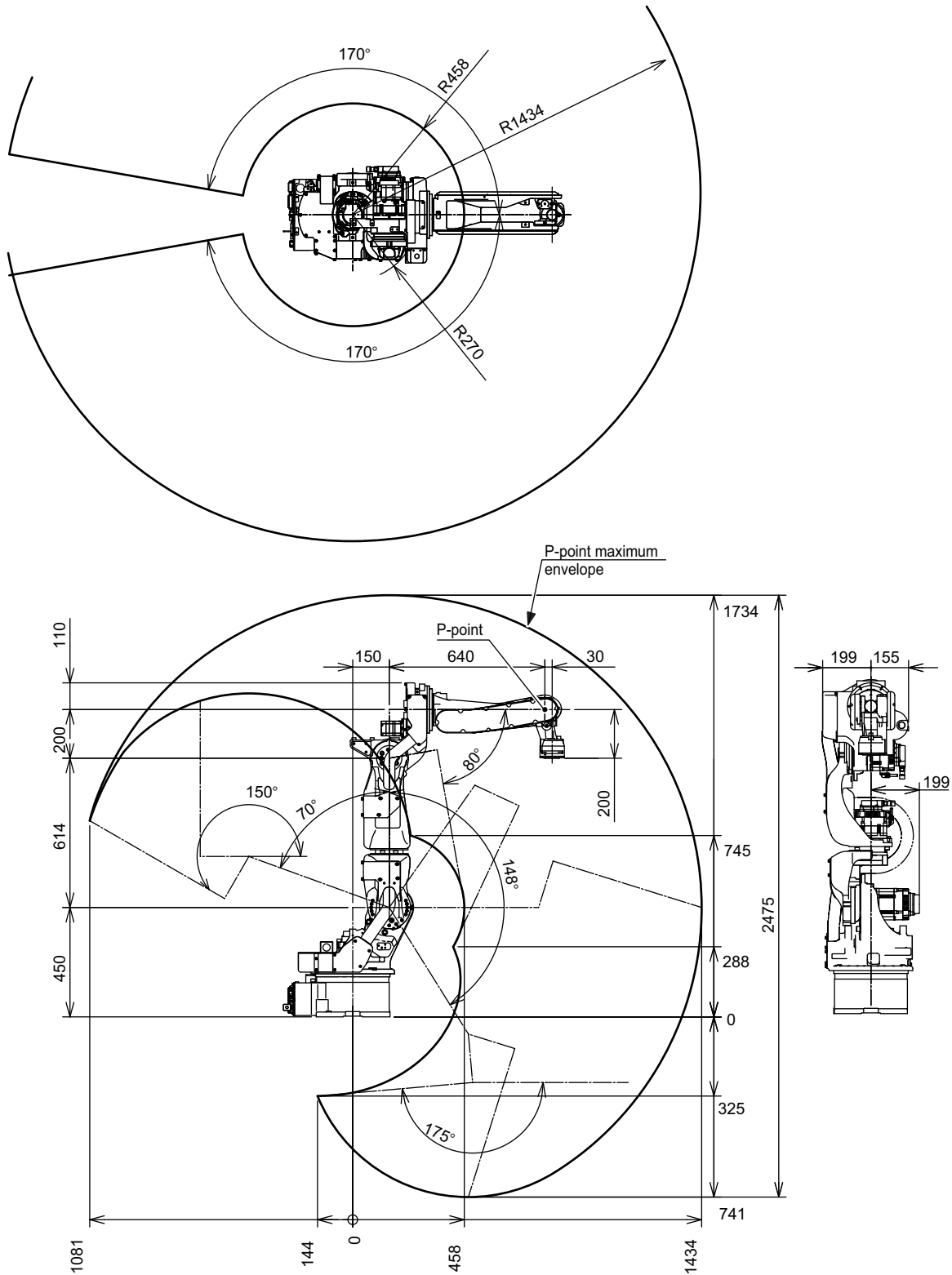
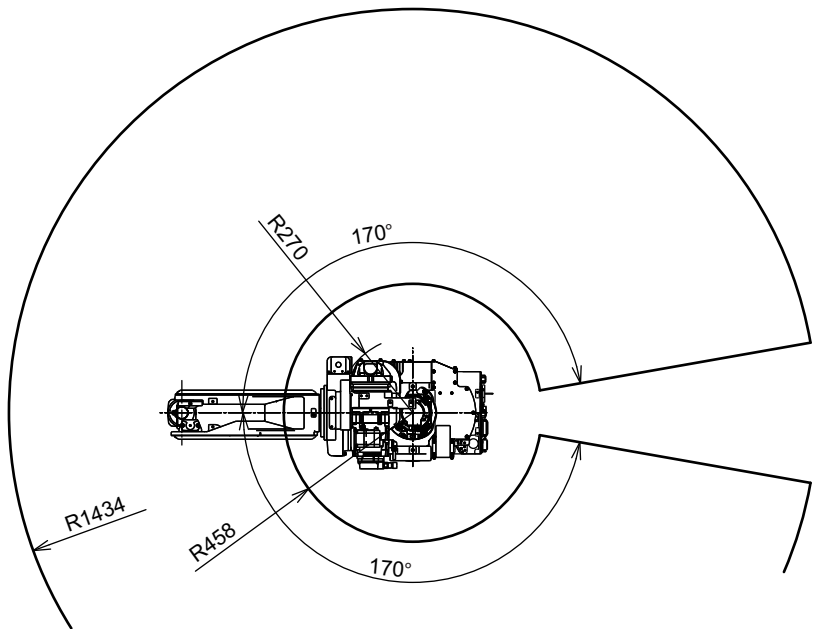
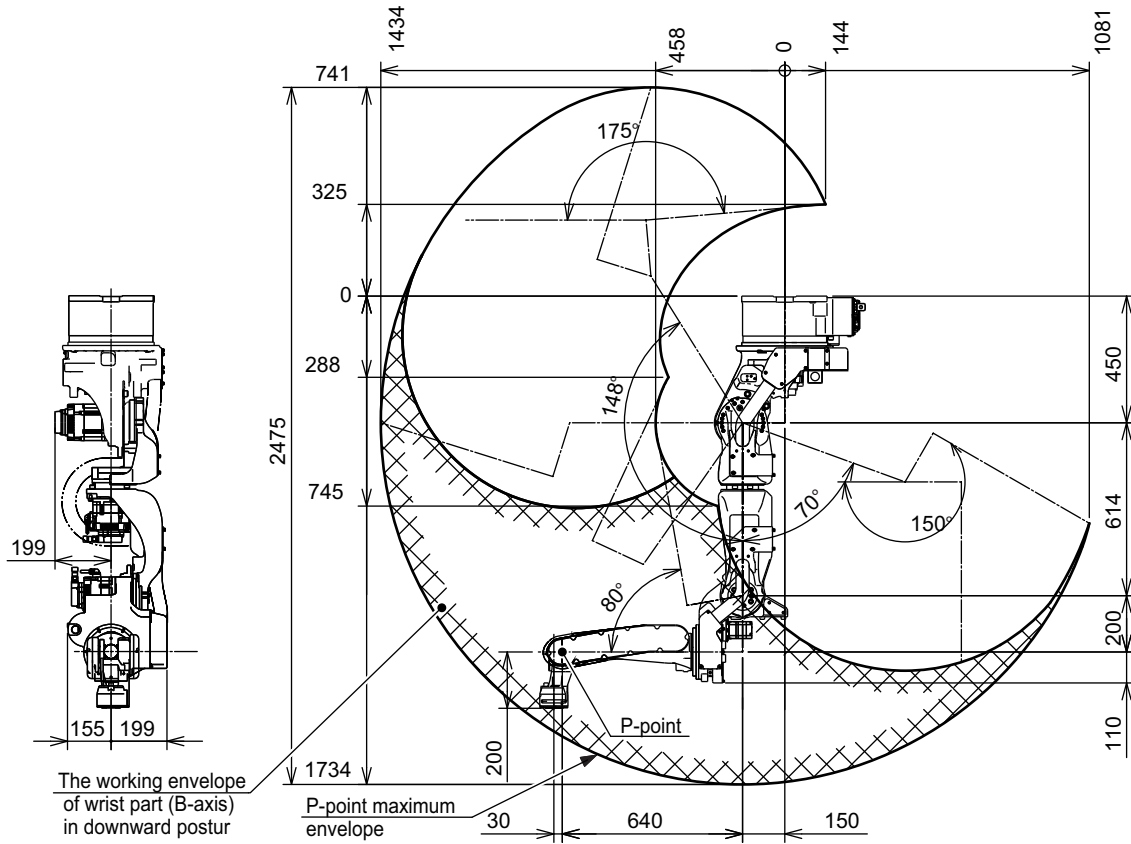


Fig. 5-3(b): Dimensions and P-Point Maximum Envelope (YR-VA01400-A 10,-A11)



5.5 Alterable Operating Range

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in *Table 5-2 "S-Axis Operating Range"*. If alteration is necessary, contact your YASKAWA representative in advance.

Table 5-2: S-Axis Operating Range

Item	Specifications
S-Axis Operating Range	±170°(standard) ±150° ±135° ±120° ±105° ± 90° ± 75° ± 60° ± 45° ± 30° ± 15°

6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 3 kg maximum. If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in *Table 6-1 "Allowable Wrist Load"*. Contact your YASKAWA representative for further information or assistance.

Table 6-1: Allowable Wrist Load

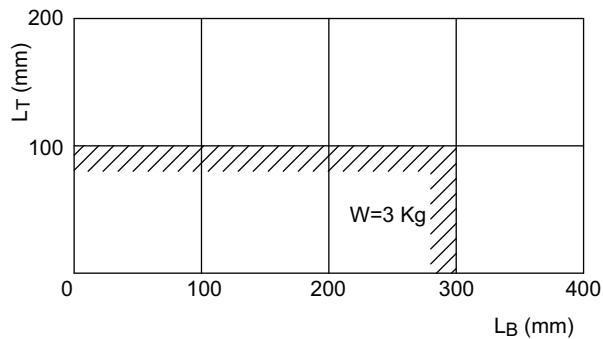
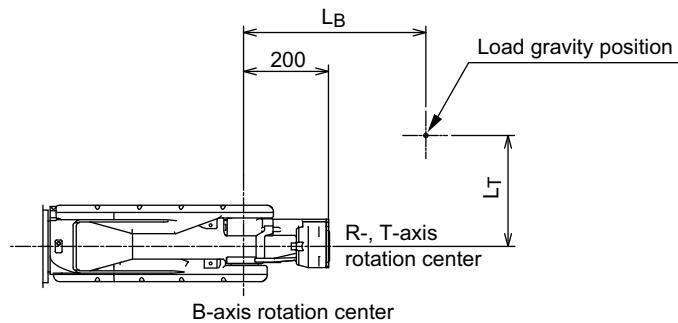
Axis	Moment N·m (kgf·m) ¹⁾	GD ² /4 Total Moment of Inertia kg·m ²
R-Axis	8.8 (0.9)	0.27
B-Axis	8.8 (0.9)	0.27
T-Axis	2.9 (0.3)	0.03

1 (): Gravitational unit

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

The allowable total moment of inertia is calculated when the moment is at the maximum. Contact your YASKAWA representative beforehand when only moment of inertia, or load moment is small and moment of inertia is large. Also, when the load mass is combined with an outside force, contact your YASKAWA representative beforehand.

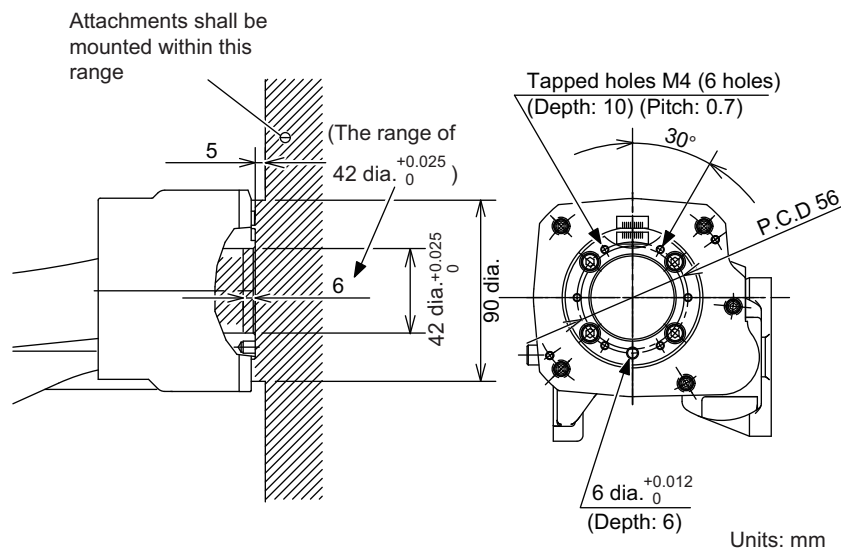
Fig. 6-1: Moment Arm Rating



6.2 Wrist Flange

The wrist flange dimensions are shown in *Fig. 6-2 "Wrist Flange"*. It is recommended that the attachment be mounted inside the fitting in order to identify the alignment marks. Fitting depth shall be 6 mm or less. As shown in the figure below, the attachment shall be mounted on the range of 90 diameter or less with up to 5 mm height from the flange face.

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.

7 System Application

7.1 Peripheral Equipment Mounts

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

7.1.1 Allowable Load

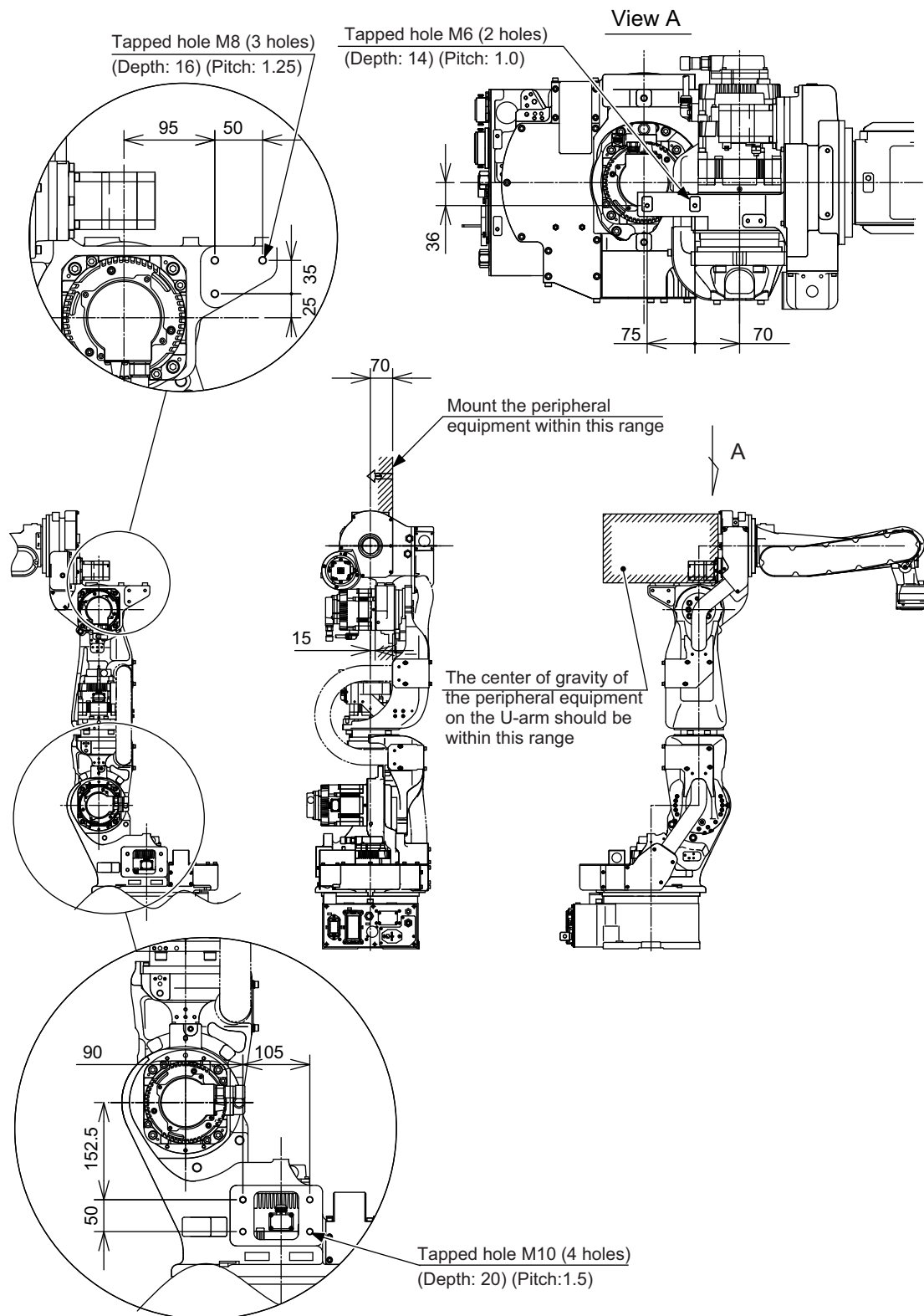
The maximum allowable load on the U-axis is 12 kg, including the wrist load. For instance, when the mass installed on the wrist point is 3 kg, the mass which can be installed on the upper arm is 9 kg.

The maximum allowable load on the S-axis is 20 kg. Install the peripheral equipment on the S-axis so that the moment of inertia ($GD^2/4$) from the S-axis rotation center is $1.25 \text{ kg}\cdot\text{m}^2$ or less.

7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in *Fig. 7-1 "Installing Peripheral Equipment"* on the following page.

Fig. 7-1: Installing Peripheral Equipment



7.2 Internal User I/O Wiring Harness and Air Line

Internal user I/O wiring harness (14 wires: 0.2 mm² x 8 wires, 0.75 mm² x 2 wires and 1.25 mm² x 4 wires), and two air lines are incorporated in the manipulator for the drive of peripheral devices mounted on the upper arm as shown in *Fig. 7-2 "Connectors for Internal User I/O Wiring Harness and Air Line"*.

The connector pins 1 to 16 are assigned as shown in *Fig. 7-3 "Details of the Connector Pin Numbers"* on the following page. Wiring must be performed by users.

The allowable current for internal user I/O wiring harness	3 A or less for each wire (The total current value for pins 1 to 16 must be 40 A or less.)
The maximum pressure for the air line	490 kPa (5 kgf/cm ²) or less (The air line inside diameter: 8.0 mm and 6.5 mm.)
The allowable current for arc welding power cable	Rated current of 350A or less and the rated operational ratio should be 60% or lower. The allowable operational ratio when it is operated with less current than the allowable current is calculated by the following formula. Allowable operational ratio = 60% x (350A/operating current) ²

Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line

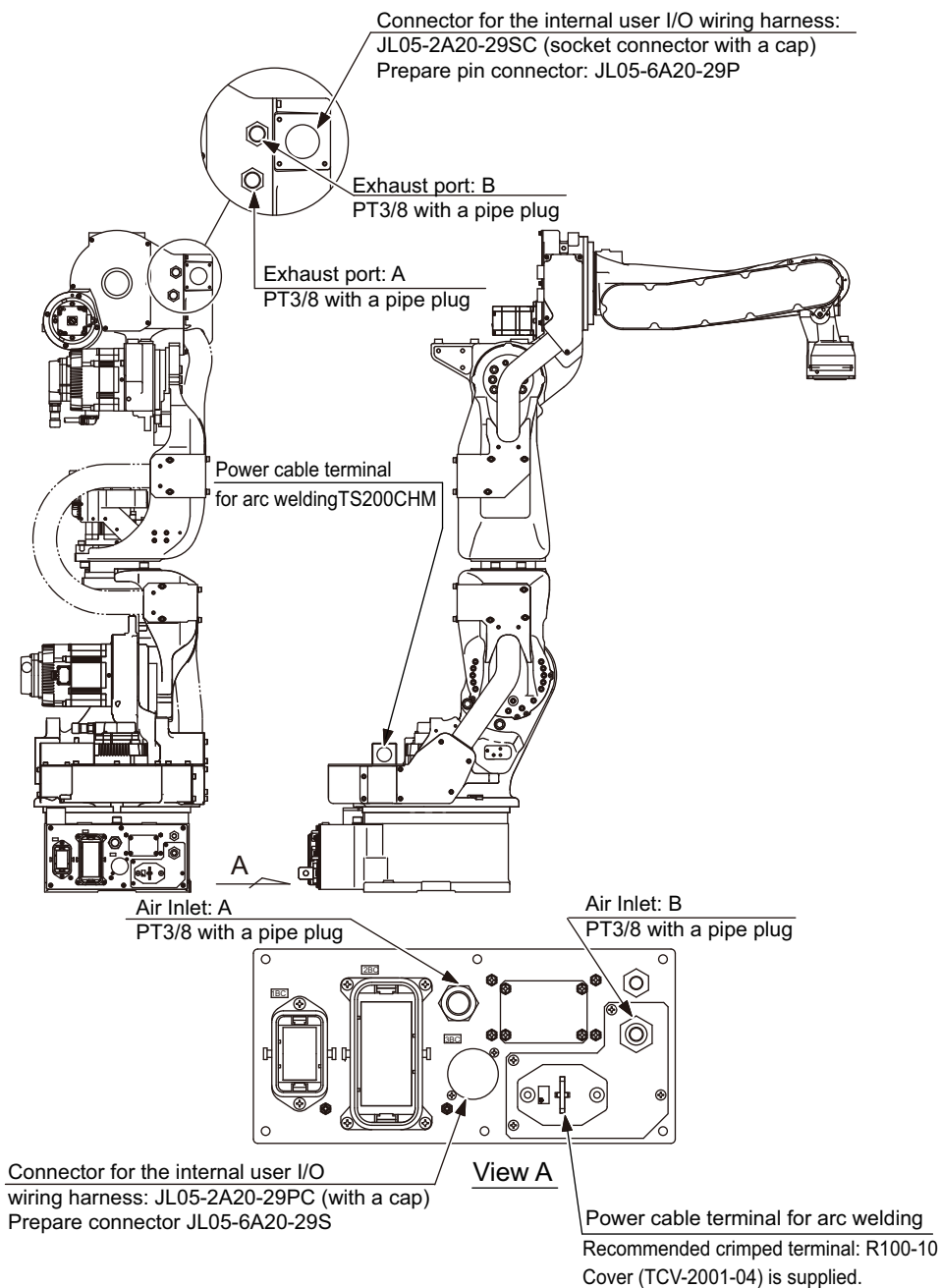
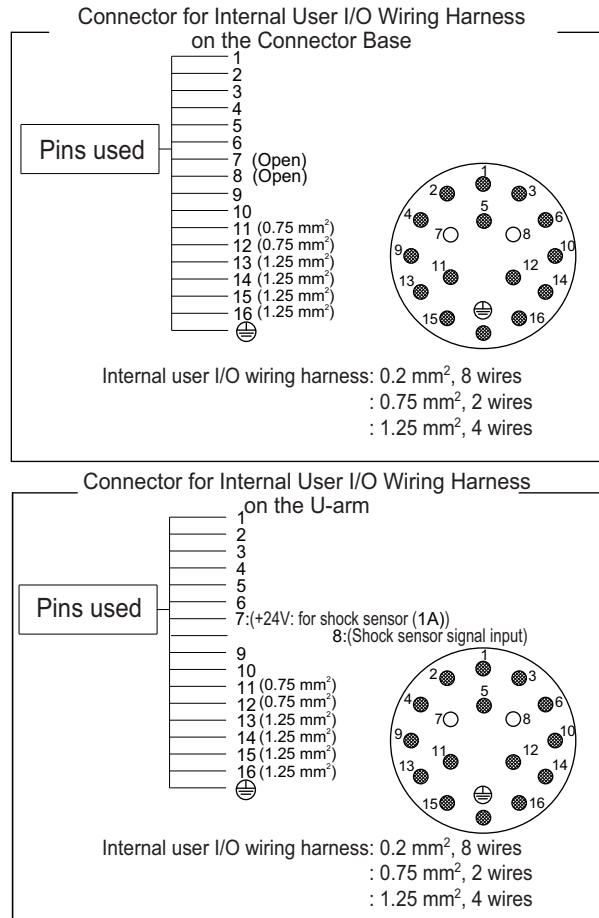


Fig. 7-3: Details of the Connector Pin Numbers



- For the standard specification, the pins No.7 and No.8 of 3BC connector on the U-arm are respectively connected with the shock sensor power supply and shock sensor signal input port of the DX100 controller.
- The pins No.7 and No.8 of respective 3BC connectors on the connector base side and the U-arm side are not connected with each other.
- For wiring, refer to Fig. 8-3(a) "Internal Connection Diagram".

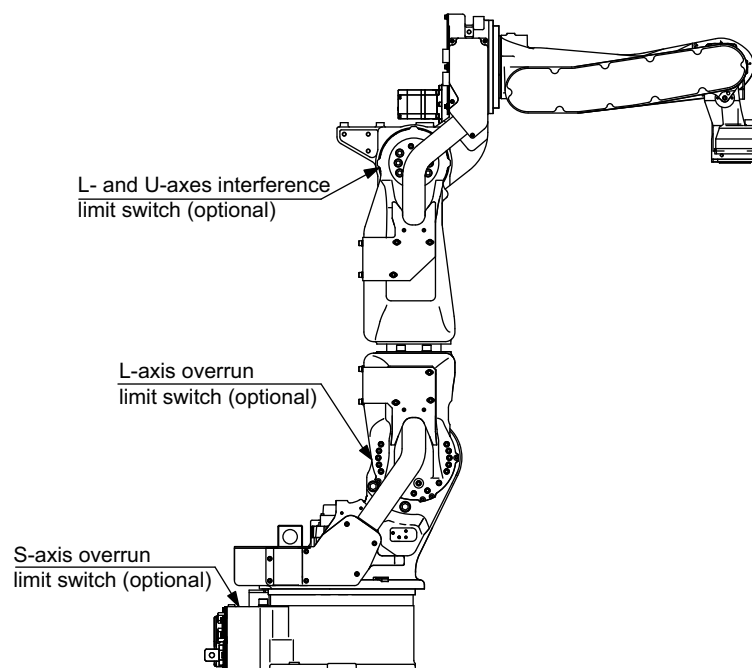
The same pin-number connectors (1 to 16) at both connector base part and arm part are connected with the single wire lead of 0.2 mm², 0.75 mm² or 1.25 mm².

8 Electrical Equipment Specification

8.1 Position of Limit Switch

The limit switches are optional. See Fig. 8-1 “Location of Limit Switches”. The manipulator with S- and L-axis overrun limit switches, and L-, U-axes interference limit switches are the type YR-VA01400-A01 (standard specification) or YR-VA01400-A11 (ceiling-mounted specification).

Fig. 8-1: Location of Limit Switches



8.2 Internal Connections

Highly reliable connectors are equipped on each connection part of the manipulator to enable easy removal and installation for maintenance and inspection. For the number and location of connectors, see Fig. 8-2 "Locations and Numbers of Connectors".

Diagrams for Internal connections of the manipulator are shown in Fig. 8-3(a) "Internal Connection Diagram" and Fig. 8-3(b) "Internal Connection Diagram".

Fig. 8-2: Locations and Numbers of Connectors

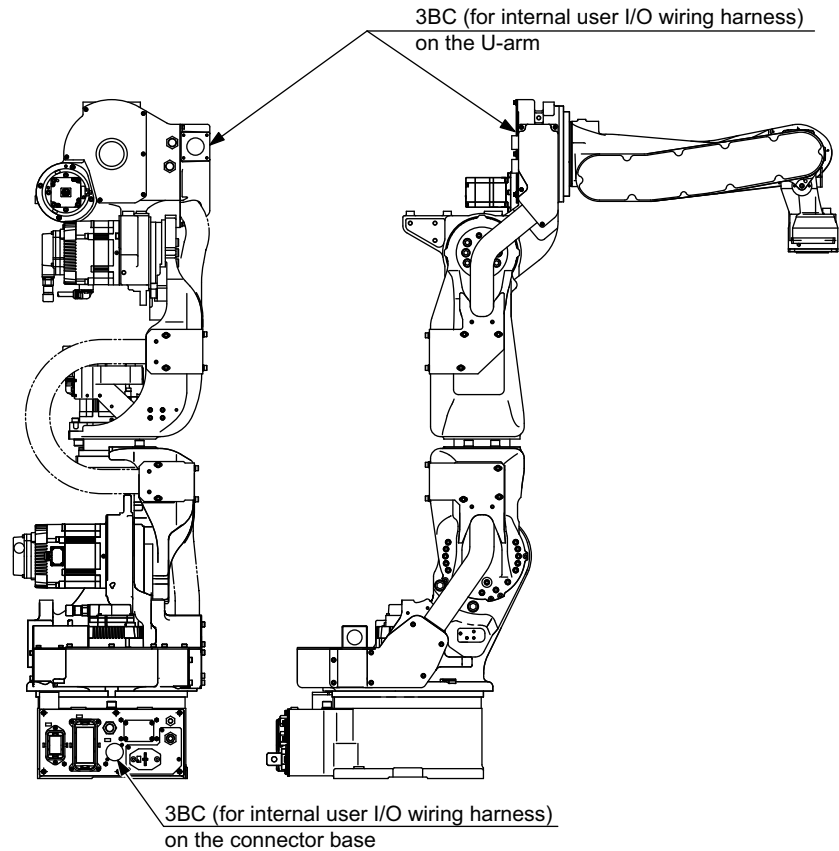


Table 8-1: List of Connector Types

Name	Type of Connector
Connector for the internal user I/O wiring harness on the connector base	JL05-2A20-29PC (JL05-6A20-29S: Optional)
Connector for the internal user I/O wiring harness on the U-arm	JL05-2A20-29SC (JL05-6A20-29P: Optional)

Fig. 8-3(a): Internal Connection Diagram

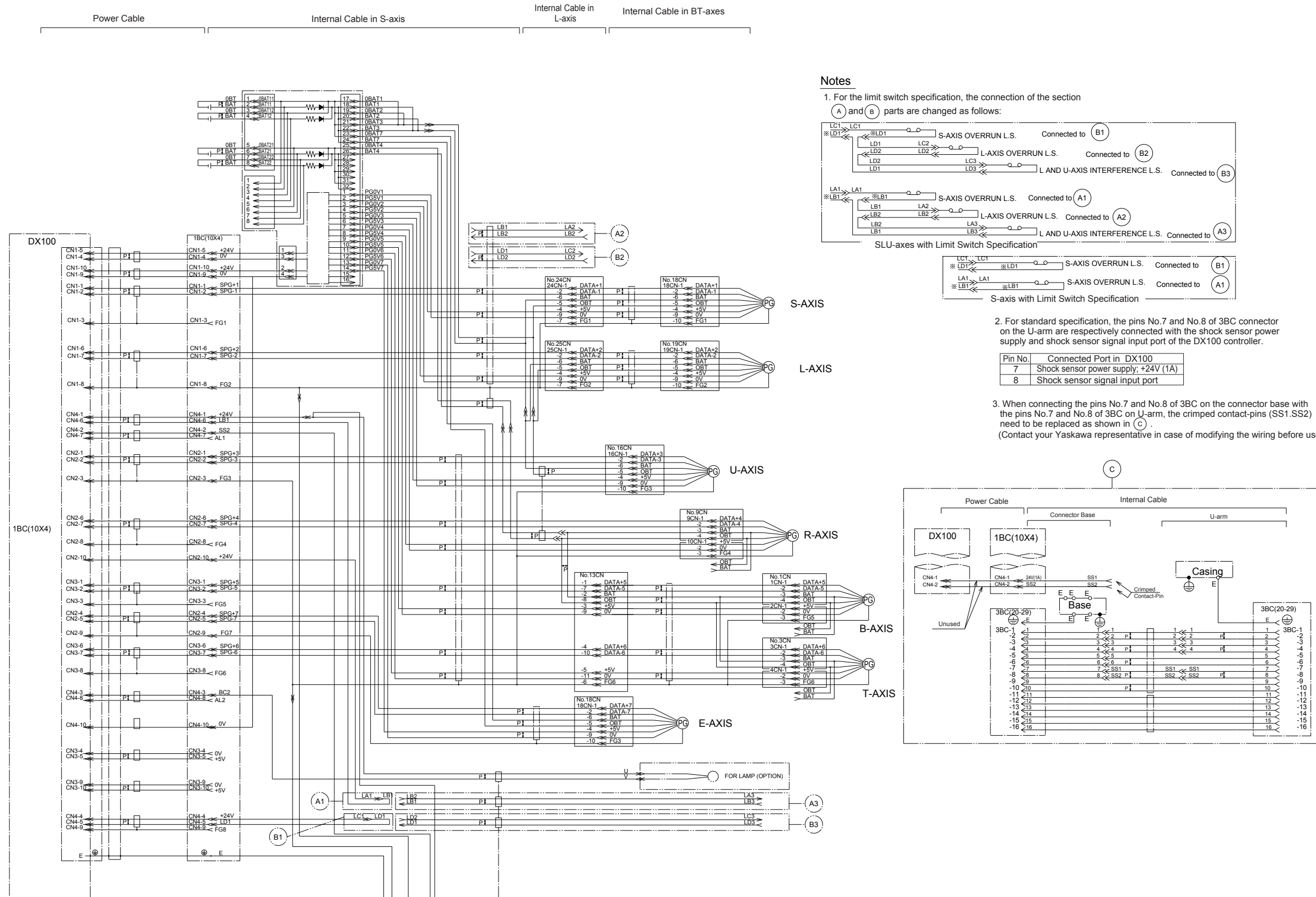
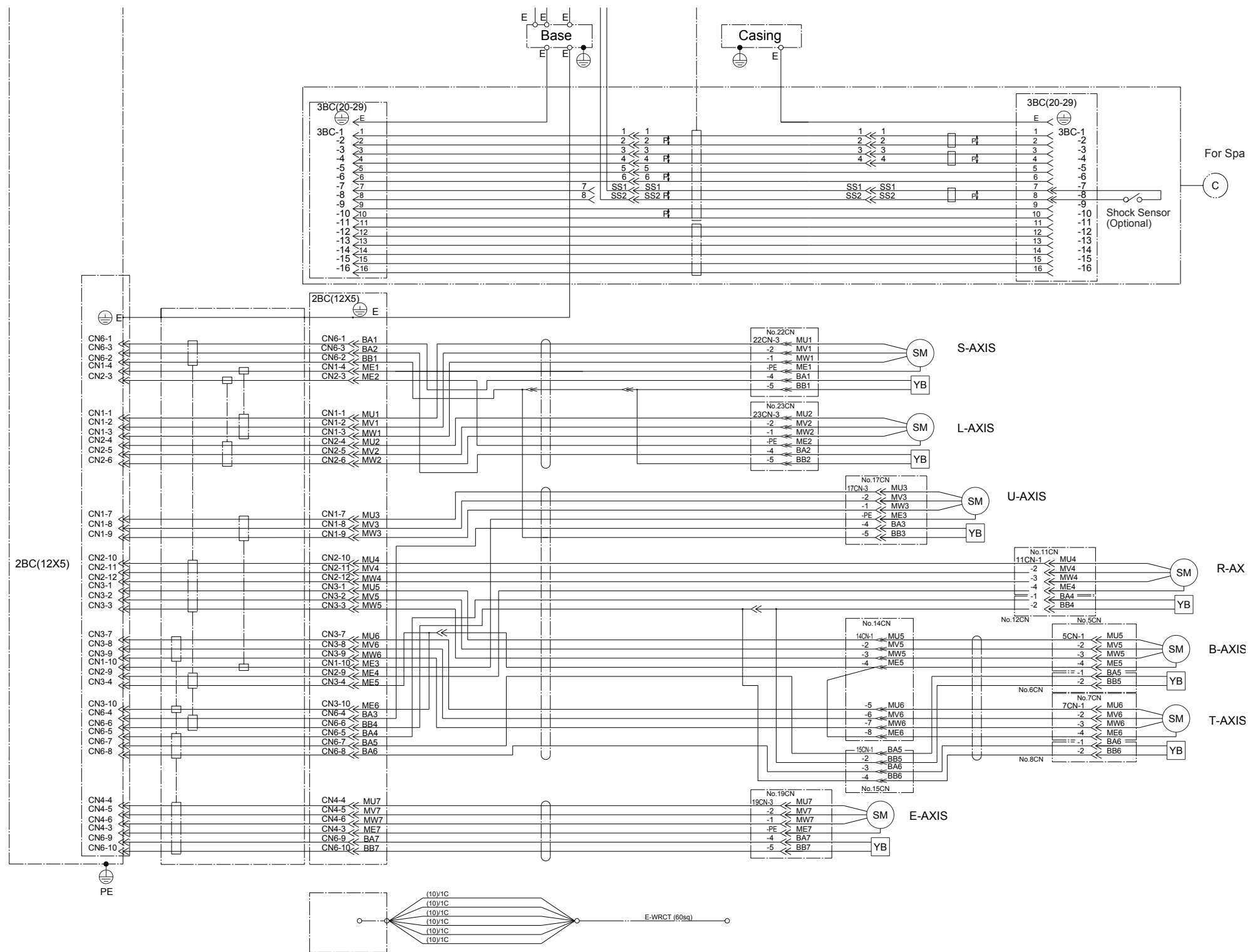


Fig. 8-3(b): Internal Connection Diagram



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 this caution may result in injury from unexpected turning of the manipulator's arm.



WARNING

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



CAUTION

- The battery pack must be connected before removing detection connector when maintenance and inspection.
- Failure to this caution may result in the 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 classified into several levels as shown in *Table 9-1 "Inspection Items"*.

In *Table 9-1*, 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.



- 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 arc welding application. If the manipulator is used for other application 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 for the application such as handling; in this case, contact your YASKAWA representative.

Table 9-1: Inspection Items (Sheet 1 of 2)

Items ¹⁾	Schedule						Method	Operation	Inspection Charge		
	Daily	1000HCycle	6000HCycle	12000HCycle	24000H	36000H			Specified Personnel	Licensee	Service Company
1	Alignment mark	●					Visual	Check alignment mark accordance and damage at the home position.	●	●	●
2	External lead	●					Visual	Check for damage and deterioration of leads.	●	●	●
3	Working area and manipulator	●					Visual	Clean the work area if dust or spatter is present. Check for damage and outside cracks.	●	●	●
4	Motors for S-, L-, U-axes	●					Visual	Check for grease leakage. ²⁾	●	●	●
5	Baseplate mounting bolts		●				Spanner Wrench	Tighten loose bolts. Replace if necessary.	●	●	●
6	Cover mounting screws		●				Screwdriver, Wrench	Tighten loose bolts. Replace if necessary.	●	●	●
7	Connector base		●				Manual	Check for loose connectors.	●	●	●
8	Timing belts for B- and T-axes				●		Manual	Check for belt tension and wear.		●	●
9	Wire harness in manipulator (SLUE-axis wires) (RBT-axis wires)				●		Visual, Multimeter	Check for conduction between the main connector of base and intermediate connector with manually shaking the wires. Check for wear of protective spring. ³⁾		●	●
						●		Replace ⁴⁾			●
10	Wire harness in manipulator (BT-axis wires)				●		Visual, Multimeter	Check for conduction between terminals and wear of protective spring. ³⁾		●	●
						●		Replace ⁴⁾			●
11	Battery pack in manipulator					●		Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.		●	●
12	S-axis speed reducer			●	●		Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease ⁵⁾ (6000H cycle). See section 9.3.1. Replace grease ⁵⁾ . (12000H cycle) See section 9.3.1.		●	●

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Table 9-1: Inspection Items (Sheet 2 of 2)

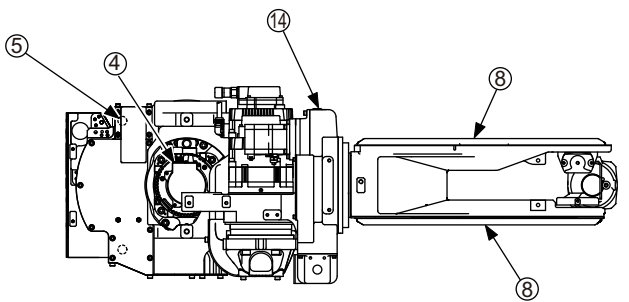
Items ¹⁾	Schedule					Method	Operation	Inspection Charge			
	Daily	1000HCycle	6000HCycle	12000HCycle	24000H			36000H	Specified Personnel	Licensee	Service Company
13	Speed reducers for LUE-axes			●	●		Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease ⁵⁾ (6000H cycle). See Par.section 9.3.2, section 9.3.3and section 9.3.4. Replace grease ⁵⁾ (12000H cycle). See section 9.3.2, section 9.3.3 and section 9.3.4.		●	●
14	R-axis speed reducer			●			Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease ⁵⁾ (6000H cycle). See section 9.3.5.		●	●
15	B-axis speed reducer			●			Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease ⁵⁾ (6000H cycle). See section 9.3.6.		●	●
16	T-axis gear			●			Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease ⁵⁾ (6000H cycle). See section 9.3.7		●	●
17	Overhaul					●					●

- 1 Inspection No. correspond to the numbers in Fig. 9-1 "Inspection Items".
- 2 The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your YASKAWA representative.
- 3 When checking for conduction with multimeter, connect the battery to "BAT" and "OBT" of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to section 9.3.9 "Notes for Maintenance".
- 4 Wire harness in manipulator to be replaced at 24000H inspection.
- 5 For the grease, refer to Table 9-2 "Inspection Parts and Grease Used".

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Fig. 9-1: Inspection Items



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

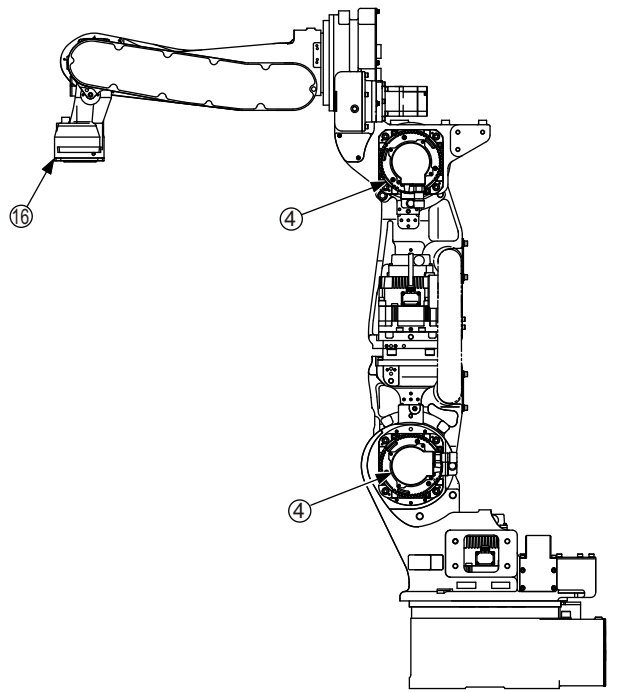
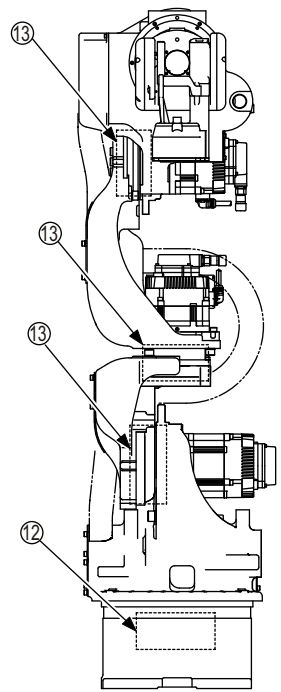
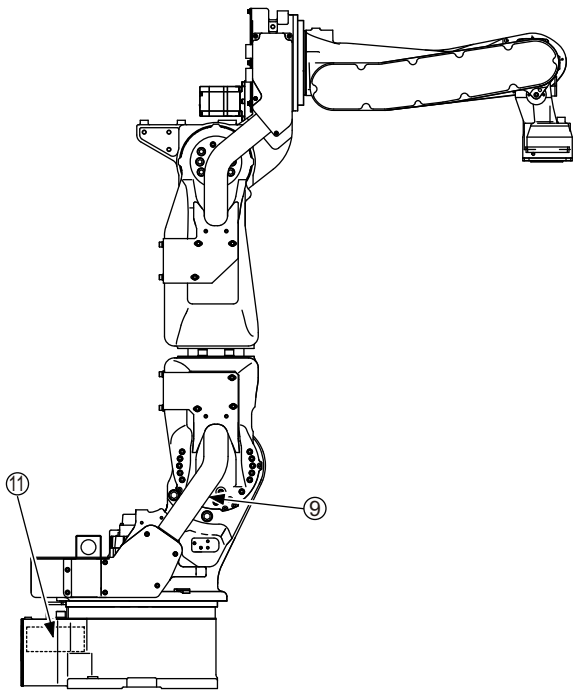


Table 9-2: Inspection Parts and Grease Used

No.	Grease Used	Inspected Parts
12, 13	VIGO Grease RE No. 0	Speed reducers for S-, L-, U- and E-axes
14	Harmonic Grease 4B No. 2	R-axis speed reducer
15	Harmonic Grease SK-1A	B-axis speed reducer
16	Alvania EP Grease 2	T-axis gear

The numbers in the above table correspond to the numbers in *Table 9-1 "Inspection Items"*.

9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the position shown in *Fig. 9-2 "Battery Location"*. If the battery alarm occurs in the DX100, replace the battery in accordance with the following procedure:

Fig. 9-2: Battery Location

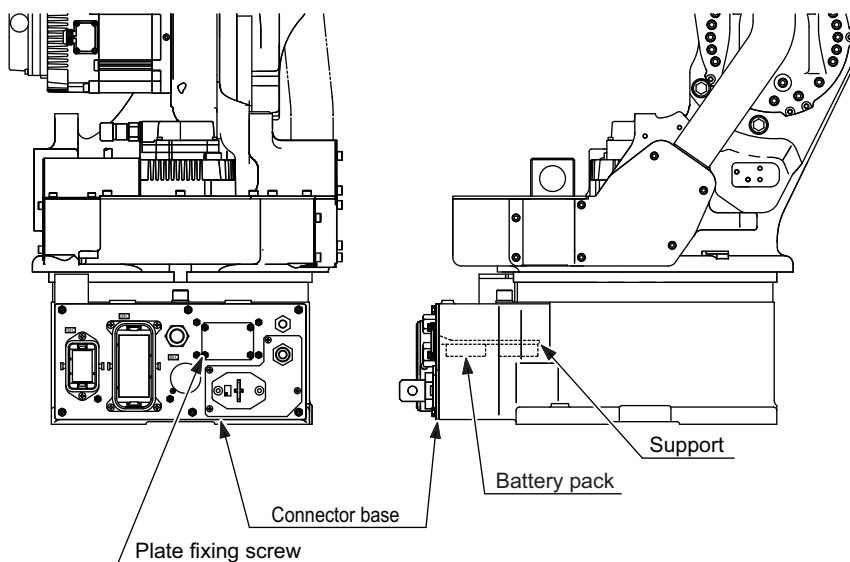
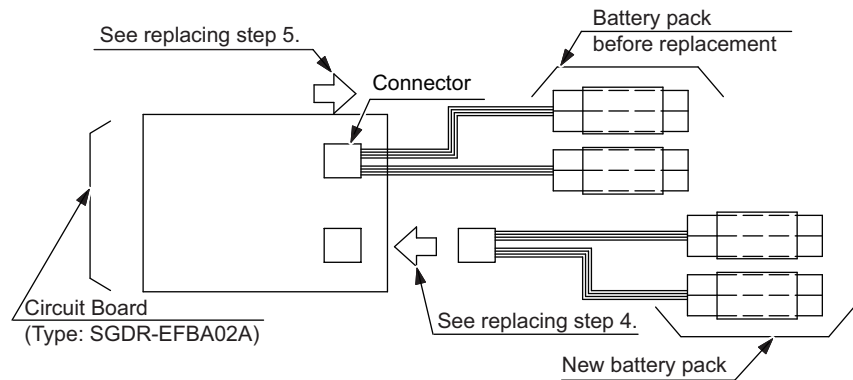


Fig. 9-3: Battery Connection



1. Turn OFF the DX 100 main power supply.
2. Remove the plate fixing screws and the plate on the connector base, then pull the battery pack out to replace it with the new one.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack to the unoccupied connector on the board.
5. Remove the old battery pack from the board.



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

6. Mount the new battery pack to the holder.
7. Reinstall the plate.



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

9.3 Notes on Grease Replenishment/Exchange Procedures

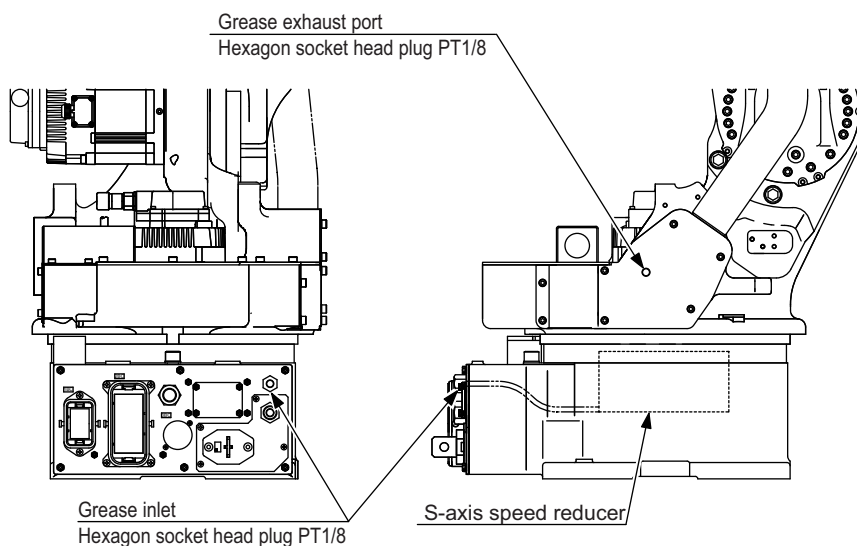
Make sure to follow the instructions listed below at grease replenishment/exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

NOTE

- If grease is added without removing the plug/screw from the grease exhaust port, the grease will leak inside a motor or an oil seal of a speed reducer will come off, which may result in damage to the motor. Make sure to remove the plug/screw.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.
- Make sure to fill hoses, which are joined to the grease inlet, with grease beforehand to prevent air from intruding into the speed reducer.

9.3.1 Grease Replenishment/Exchange for S-Axis Speed Reducer

Fig. 9-4: S-Axis Speed Reducer Diagram



NOTE

For the ceiling-mounted manipulator, the grease exhaust port and the grease inlet are inverted.

9.3.1.1 Grease Replenishment

(Refer to Fig. 9-4 "S-Axis Speed Reducer Diagram".)

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head plugs PT1/8 from the grease inlet and grease exhaust port.



- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: 70 cc (140 cc for 1st supply)
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
4. Move the S-axis for a few minutes to discharge excess grease.
5. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.1.2 Grease Exchange

(Refer to Fig. 9-4 "S-Axis Speed Reducer Diagram".)

1. Remove the hexagon socket head plugs PT1/8 from the grease inlet and grease exhaust port.

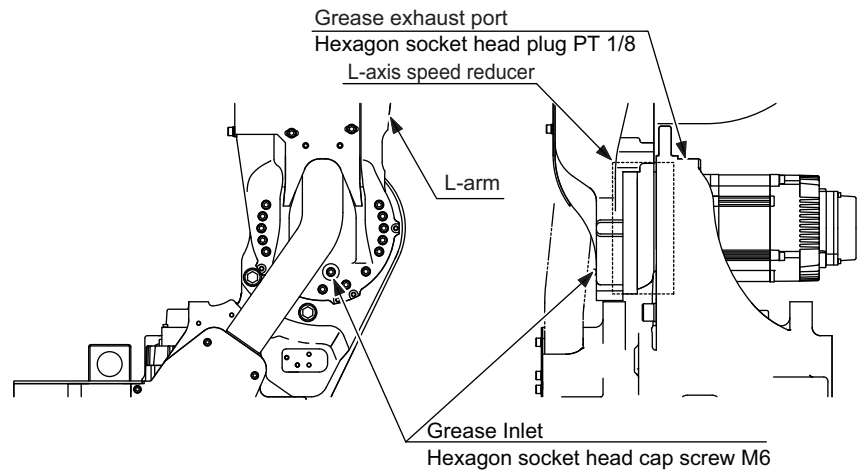


- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun.
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: approx. 450 cc
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
4. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)
5. Move the S-axis for a few minutes to discharge excess grease.
6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.2 Grease Replenishment/Exchange for L-Axis Speed Reducer

Fig. 9-5: L-Axis Speed Reducer Diagram



For the ceiling-mounted manipulator, the grease exhaust port and the grease inlet are inverted.

9.3.2.1 Grease Exchange

(Refer to Fig. 9-5 “L-Axis Speed Reducer Diagram”.)

1. Make the L-arm vertical to the ground.
2. Remove the hexagon socket head plug PT1/8 from the grease exhaust port.
3. Remove the hexagon socket head cap screw M6 from the grease inlet.



- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

4. Install a grease zerk A-MT6X1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun.
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: 65 cc (130 cc for 1st supply)
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
6. Move the L-axis for a few minutes to discharge excess grease.
7. Remove the grease zerk from the grease inlet, and reinstall the screw. Before installing the screw, apply Three Bond 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 Maintenance and Inspection

9.3 Notes on Grease Replenishment/Exchange Procedures

8. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug. Then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.2.2 Grease Exchange

(Refer to Fig. 9-5 "L-Axis Speed Reducer Diagram".)

1. Make the L-arm vertical to the ground.
2. Remove the hexagon socket head plug PT1/8 from the grease exhaust port.
3. Remove the hexagon socket head cap screw M6 from the grease inlet.



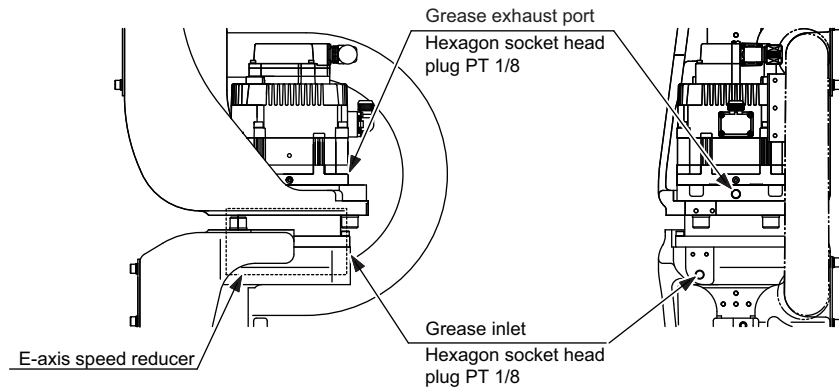
- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

4. Install a grease zerk A-MT6X1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun.

– Grease type:	VIGO Grease RE No. 0
– Amount of grease:	approx. 420 cc
– Air supply pressure of grease pump:	0.3 MPa or less
– Grease injection rate:	8 g/s or less
6. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)
7. Move the L-axis for a few minutes to discharge excess grease.
8. Remove the grease zerk from the grease inlet, and reinstall the screw. Before installing the screw, apply Three Bond 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. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.3 Grease Replenishment/Exchange for E-Axis Speed Reducer

Fig. 9-6: E-Axis Speed Reducer Diagram



For the ceiling-mounted manipulator, the grease exhaust port and the grease inlet are inverted.

9.3.3.1 Grease Replenishment

(Refer to Fig. 9-6 “E-Axis Speed Reducer Diagram”.)

1. Remove the hexagon socket head plug PT1/8 from grease exhaust port.
2. Remove the hexagon socket head plug PT1/8 from the grease inlet.



- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: 45 cc (90 cc for 1st supply)
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
5. Move the E-axis for a few minutes to discharge excess grease.
6. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

7. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the screw, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 10 N•m (1.0 kgf•m).

9.3.3.2 Grease Exchange

(Refer to Fig. 9-6 "E-Axis Speed Reducer Diagram".)

1. Remove the hexagon shead plug PT1/8 from the grease exhaust port.
2. Remove the hexagon socket head cap plug PT1/8 from the grease inlet.

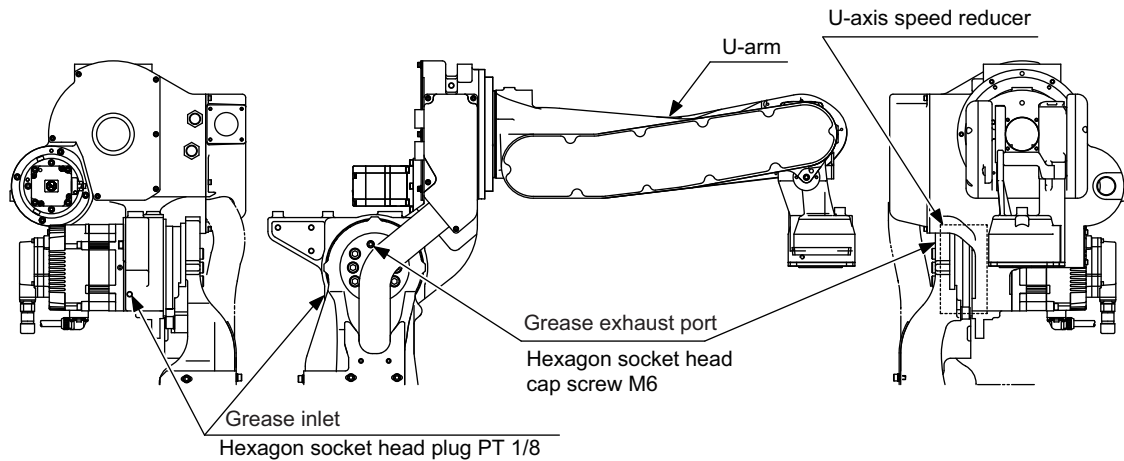
NOTE

- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

3. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: approx. 300 cc
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
5. The grease exchange is complete when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)
6. Move the E-axis for a few minutes to discharge excess grease.
7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
8. Wipe the discharged grease with a cloth, and reinstall the plug to the grease exhaust port. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 10 N•m (1.0 kgf•m).

9.3.4 Grease Replenishment/Exchange for U-Axis Speed Reducer

Fig. 9-7: U-Axis Speed Reducer Diagram



For the ceiling-mounted manipulator, the grease exhaust port and the grease inlet are inverted.

9.3.4.1 Grease Replenishment

(Refer to Fig. 9-7 “U-Axis Speed Reducer Diagram”).

1. Make the U-arm horizontal to the ground.
2. Remove the hexagon socket head cap screw M6 from grease exhaust port.
3. Remove the hexagon socket head plug PT1/8 from the grease inlet.



- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

4. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun.
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: 40 cc (80 cc for 1st supply)
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
6. Move the U-axis for a few minutes to discharge excess grease.
7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9 Maintenance and Inspection

9.3 Notes on Grease Replenishment/Exchange Procedures

8. Wipe the discharged grease with a cloth, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).

9.3.4.2 Grease Exchange

(Refer to Fig. 9-7 "U-Axis Speed Reducer Diagram".)

1. Make the U-arm horizontal to the ground.
2. Remove the hexagon socket head cap screw M6 from the grease exhaust port.
3. Remove the hexagon socket head cap plug PT1/8 from the grease inlet.

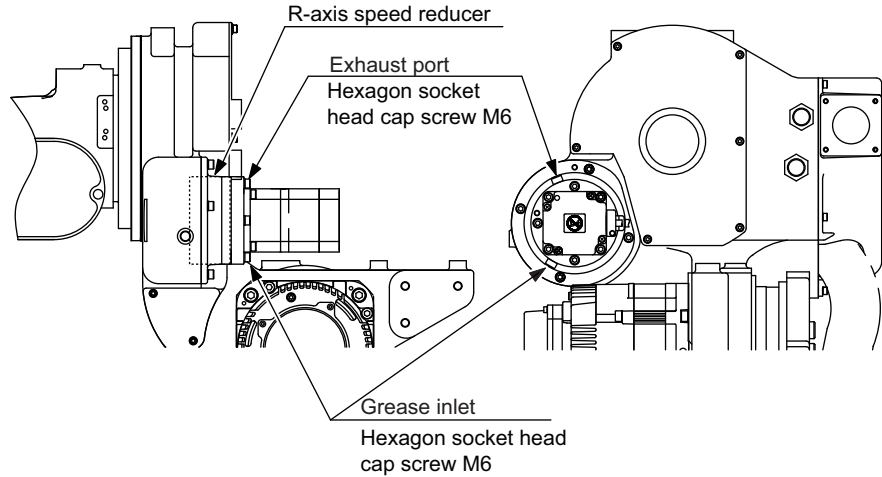


- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

4. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun.
 - Grease type: VIGO Grease RE No. 0
 - Amount of grease: approx. 250 cc
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
6. The grease exchange is complete when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)
7. Move the U-axis for a few minutes to discharge excess grease.
8. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
9. Wipe the discharged grease with a cloth, and reinstall the screw to the grease exhaust port. Before installing the plug, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 10 N•m (1.0 kgf•m).

9.3.5 Grease Replenishment for R-Axis Speed Reducer

Fig. 9-8: R-Axis Speed Reducer Diagram



NOTE

For the ceiling-mounted manipulator, the exhaust port and the grease inlet are inverted.

1. Remove the hexagon socket head cap screw M6 from the exhaust port.
2. Remove the hexagon socket head cap screw M6 from the grease inlet.
3. Install a grease zerk A-MT6X1 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 Fig. 9-8 "R-Axis Speed Reducer Diagram".)
 - Grease type: Harmonic grease 4B No.2
 - Amount of grease: 12 cc (24cc for the first supply)

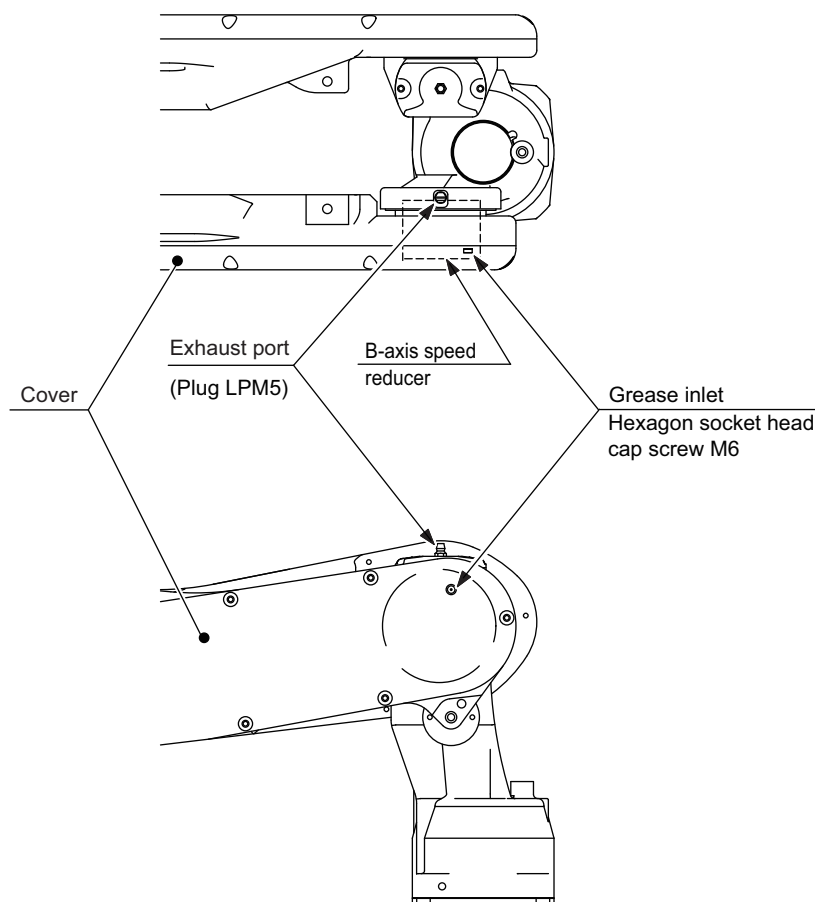
NOTE

The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

5. Remove the grease zerk from the grease inlet, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
6. Reinstall the screw to the exhaust port. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).

9.3.6 Grease Replenishment for B-Axis Speed Reducer

Fig. 9-9: B-Axis Speed Reducers Diagram



1. Remove the plug LPM5 from the exhaust port.
2. Remove the hexagon socket head cap screw M6 from the grease inlet.
3. Install a grease zerk A-MT6X1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Remove the cover, then inject grease through the grease inlet using a grease gun. (Refer to Fig. 9-9 "B-Axis Speed Reducers Diagram".)
 - Grease type: Harmonic grease SK-1A
 - Amount of grease: 7 cc (14 cc for the 1st supply)

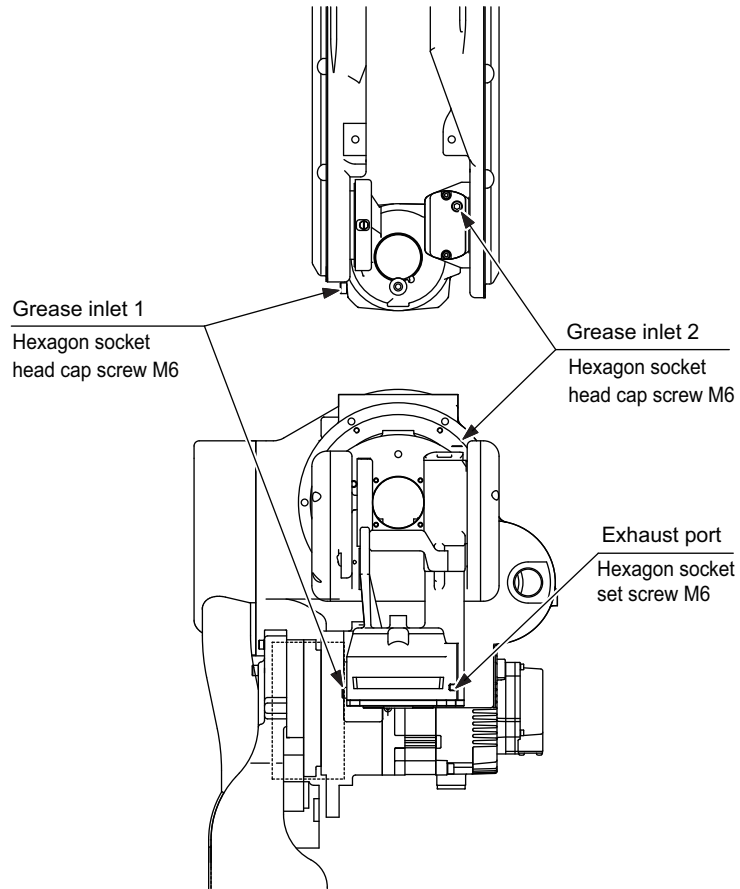


The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

5. Remove the grease zerk from the grease inlet, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
6. Reinstall the plug to the exhaust port, then reinstall the cover.

9.3.7 Grease Replenishment for T-Axis Gear

Fig. 9-10: T-Axis Gear Diagram



1. Remove the hexagon socket set screw M6 from the exhaust port.
2. Remove the hexagon socket head cap screw M6 from the grease inlet 1.
3. Install a grease zerk A-MT6X1 to the grease inlet 1. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet 1 using a grease gun.
 - Grease type: Alvania EP Grease 2
 - Amount of grease: 5 cc



The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

5. Remove the grease zerk from the grease inlet 1, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
6. Remove the hexagon socket head cap screw M6 from the grease inlet 2.

7. Install a grease zerk A-MT6X1 to the grease inlet 2. (The grease zerk is delivered with the manipulator.)
8. Inject grease through the grease inlet 2 using a grease gun.
 - Grease type: Alvania EP Grease 2
 - Amount of grease: 5 cc

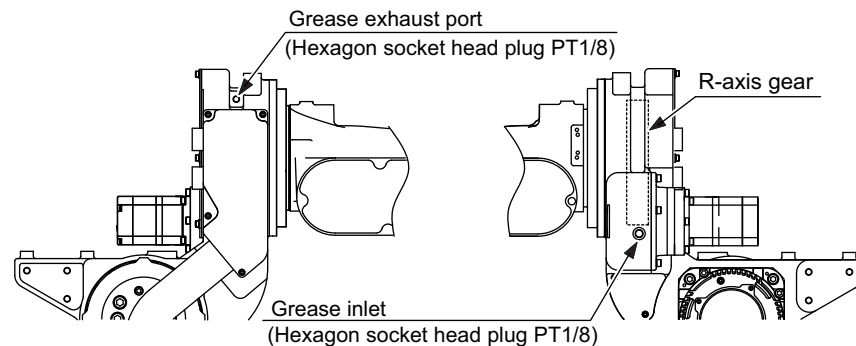


The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

9. Remove the grease zerk from the grease inlet 2, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
10. Reinstall the set screw to the exhaust port. Before installing the set screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 2.9 N•m (0.29 kgf•m).

9.3.8 Grease Replenishment for R-Axis Gear

Fig. 9-11: R-Axis Gear Diagram



For the ceiling-mounted manipulator, the grease exhaust port and the grease inlet are inverted.

1. Make the U-arm horizontal to the ground.
2. Remove the hexagon socket head plug PT1/8 from grease exhaust port.
3. Remove the hexagon socket head plug PT1/8 from the grease inlet



- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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9.3 Notes on Grease Replenishment/Exchange Procedures

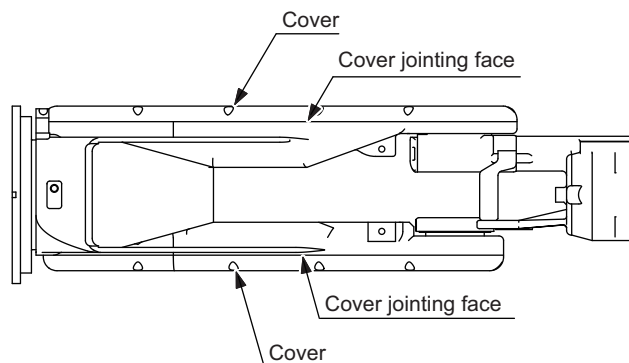
4. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
5. Inject grease through the grease inlet using a grease gun. (Refer to *Fig. 9-11 "R-Axis Gear Diagram"*.)
 - Grease type: Harmonic grease 4B No.2
 - Amount of grease: 55 cc (110 cc for 1st supply)
 - Air supply pressure of grease pump: 0.3 MPa or less
 - Grease injection rate: 8 g/s or less
6. Move the R-axis for a few minutes to discharge excess grease.
7. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
8. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.9 Notes for Maintenance

9.3.9.1 Wrist Unit

The motor and encoder units are provided with the wrist unit. To prevent fumes from penetrating through the wrist unit, the matched parts are sealed with sealing bond. If the wrist cover is disassembled, make sure to reseal with sealing bond (Three Bond 1206C, refer to *Table 10-1 "Spare Parts for the YR-VA01400-A00, -A01, -A10, -A11"*).

Fig. 9-12: Sealing Part of Wrist Unit



9.3.9.2 Battery Pack Connection

Before removing the encoder connector (with CAUTION label), connect the battery pack referring to the following figures.

Fig. 9-13(a): Encoder connector Diagram (for S-, L-, U-and E- Axes)

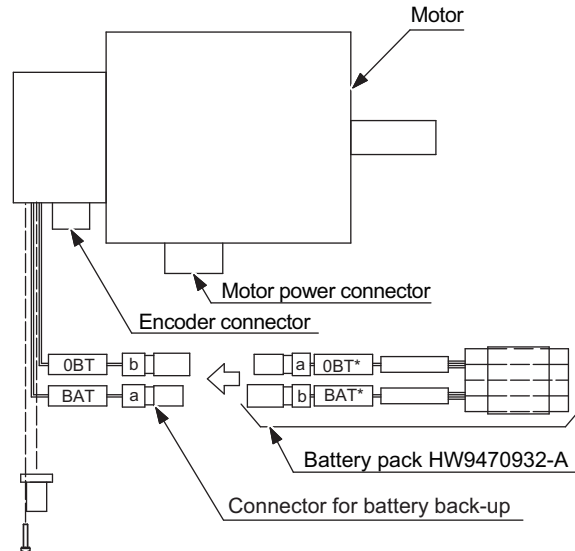
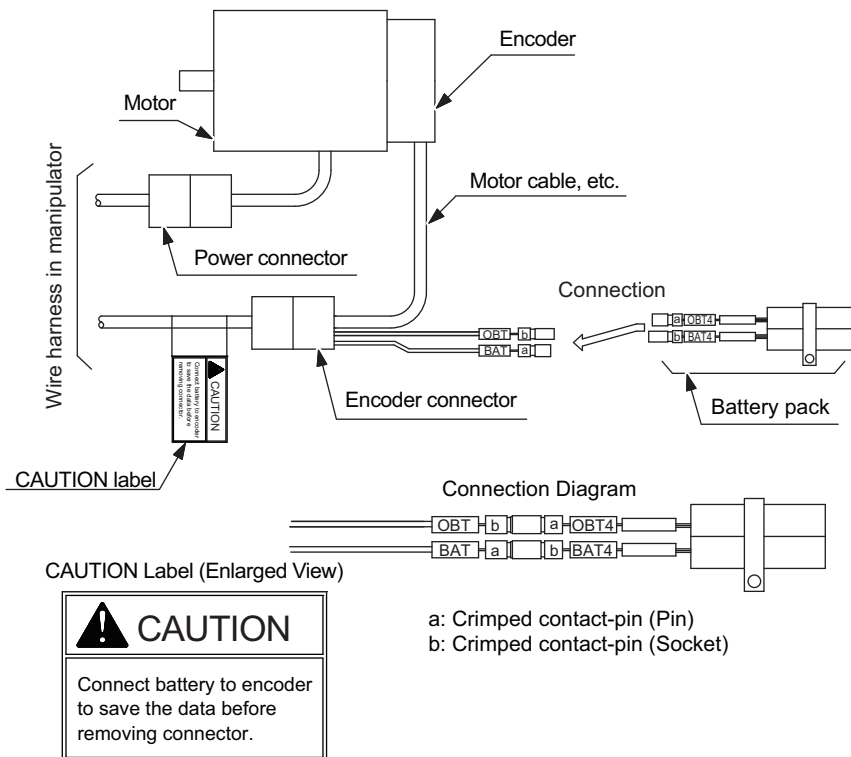


Fig. 9-13(b): Encoder Connector Diagram (for R-, B-, and T-Axes)



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-VA1400. 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.



For replacing parts in Rank B or Rank C, contact your YASKAWA representative.

Table 10-1: Spare Parts for the YR-VA01400-A00, -A01, -A10, -A11 (Sheet 1 of 2)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
A	1	Grease	VIGO Grease RE No. 0	YASKAWA	16 kg	-	
A	2	Grease	Harmonic Grease 4B No.2	Harmonic Drive Systems Co., Ltd.	2.5 kg	-	
A	3	Grease	Harmonic Grease SK-1A	Harmonic Drive Systems Co., Ltd.	2.5 kg	-	
A	4	Grease	Alvania EP Grease 2	Showa Shell Sekiyu K.K.	16 kg	-	
A	5	Liquid Seal	Three Bond 1206C	Three Bond Co., Ltd.	-	-	
A	6	Battery Pack	HW0470360-A	YASKAWA	1	1	
A	7	Battery Pack	HW9470932-A	YASKAWA	1	-	
B	8	B-Axis Timing Belt	60S4.5 M 711	Mitsuboshi Belting Limited	1	1	
B	9	T-Axis Timing Belt	60S4.5 M 932	Mitsuboshi Belting Limited	1	1	
B	10	S-Axis Speed Reducer	H 0386621-B	YASKAWA	1	1	
B	11	S-Axis Input Gear	HW0312734-1	YASKAWA	1	1	
B	12	L-Axis Speed Reducer	HW0387809-A	YASKAWA	1	1	
B	13	L-Axis Input Gear	HW0312735-1	YASKAWA	1	1	
B	14	E-Axis Speed Reducer	HW0387811-A	YASKAWA	1	1	
B	15	E-Axis Input Gear	HW0312736-2	YASKAWA	1	1	
B	16	U-Axis Speed Reducer	HW9280738-B	YASKAWA	1	1	
B	17	U-Axis Input Gear	HW0303277-4	YASKAWA	1	1	
B	18	R-Axis Speed Reducer	HW0381645-A	YASKAWA	1	1	
B	19	B-Axis Speed Reducer	HW0381646-A	YASKAWA	1	1	
B	20	R-Axis Gear	HW0303288-A	YASKAWA	1	1	
B	21	R-Axis Gear Unit	HW0370905-A	YASKAWA	1	1	

Table 10-1: Spare Parts for the YR-VA01400-A00, -A01, -A10, -A11 (Sheet 2 of 2)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
B	22	T-Axis Gear Unit	HW0372792-A	YASKAWA	1	1	
B	23	T-Axis Gear (Input Side)	HW0310757-A	YASKAWA	1	1	
B	24	Internal Wire Harness	HW0174026-A	YASKAWA	1	1	
B	25	Internal Cable for B- and T-Axes	HW0270867-A	YASKAWA	1	1	
C	26	AC Servomotor for S-, U-and E-Axes	SGMRV-05ANA-YR2* HW0388664-A	YASKAWA	1	3	
C	27	L-Axis AC Servomotor	SGMRV-09ANA-YR1* HW0388665-A	YASKAWA	1	1	
C	28	R-Axis AC Servomotor	SGMPH-01ANA-YR1* HW0389297-A	YASKAWA	1	1	
C	29	AC Servo Motor for B- and T-Axes	SGMAV-0 ANA-YR1* HW0389294-A	YASKAWA	1	2	
C	30	Circuit board	SGDR-EFBA02A	YASKAWA	1	1	

11 Parts List

11.1 S-Axis Unit

Fig. 11-1: S-Axis Unit

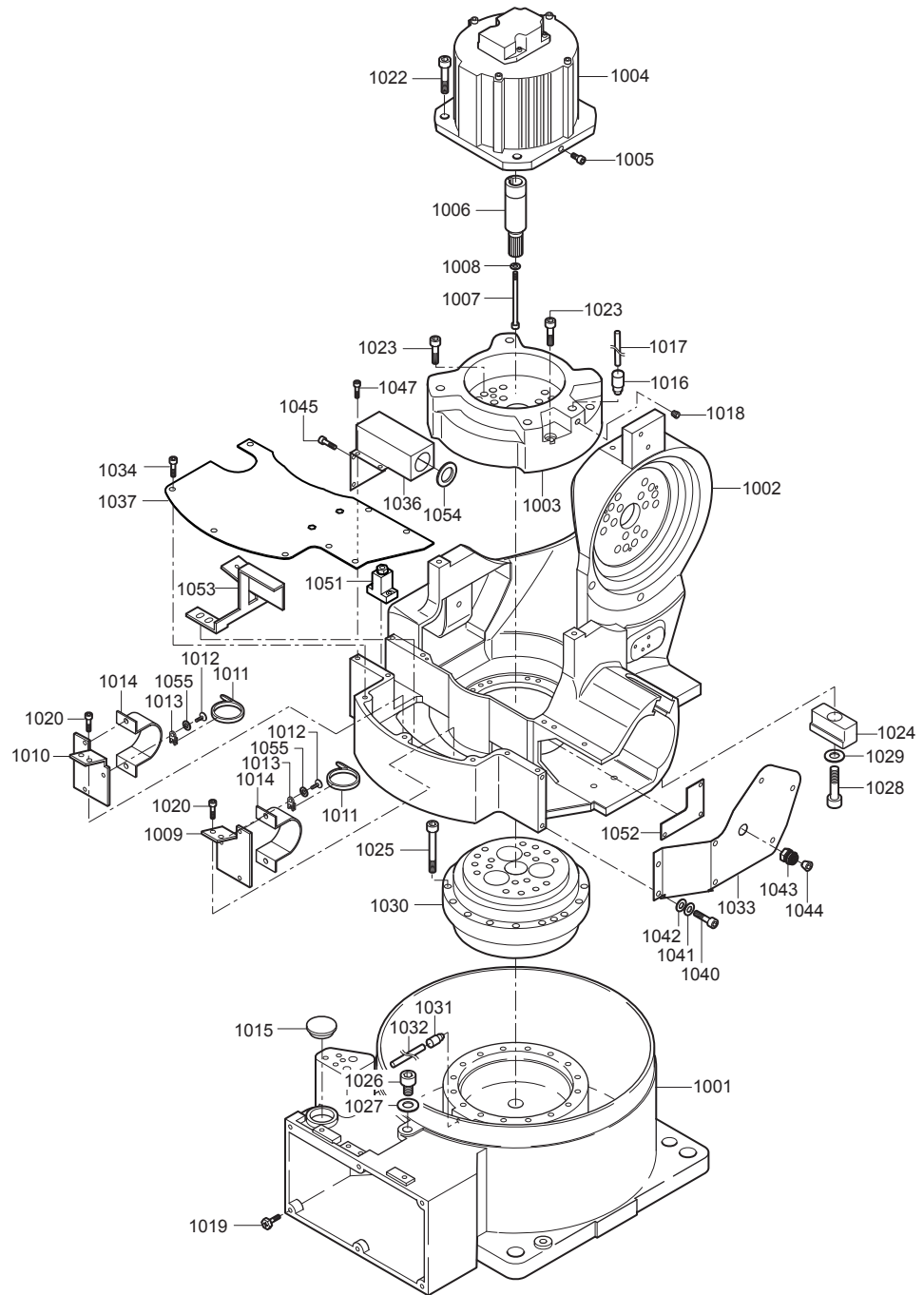


Table 11-1: S-Axis Unit

No.	DWG No.	Name	Pcs
1001	HW0102222-1	Base	1
1002	HW0102223-1	S head	1
1003	HW0312732-1	M base	1
1004	SGMRV-05ANA-YR2*	Motor	1
1005	M4X10	GT-SA bolt	1
1006	HW0312734-1	Gear	1
1007	M5X85	Socket screw	1
1008	2H-5	Spring washer	1
1009	HW0412662-1	Support	1
1010	HW0412662-2	Support	1
1011	TA1-S10	Clamp	2
1012	M5X8	Round Head Screw with Spring Washer	2
1013	T50R	Insulok	2
1014	CD-31	Saddle	2
1015	EZ5036A0	Cap	1
1016	POC6-01	Union	1
1017	NB-0640-0.2	Tube	1
1018	PT1/8	Plug	1
1019	M5X10	APS bolt	6
1020	M6X15	GT-SA bolt	4
1022	M8X30	GT-SA bolt	3
1023	M8X30	GT-SA bolt	25
1024	HW0413455-1	Dog	1
1025	M6X35	GT-SA bolt	16
1026	M12X20	Socket screw	1
1027	2H-12	Spring washer	1
1028	M12X35	Socket screw	1
1029	2H-12	Spring washer	1
1030	HW0386621-B	Speed reducer	1
1031	TSH6-01M	Union	1
1032	NB-0640-0.3	Tube	1
1033	HW0313539-1	Cover	1
1034	M6X15	GT-SA bolt	8
1036	HW0312987-1	Cover	1
1037	HW0313540-A	Cover	1
1040	M6X12	Socket screw	7
1041	2H-6	Spring washer	7
1042	M6	GT-LH washer	5
1043	PMF6-01	Union	1
1044	PT1/8	Plug	1
1045	M5X12	GT-SA bolt	4
1047	M5X12	GT-SA bolt	4
1051	TS200CHM	Tarminal	1

Table 11-1: S-Axis Unit

No.	DWG No.	Name	Pcs
1052	HW0411175-1	Cover	1
1053	HW0314103-1	Support	1
1054	C-30-SG-30A	Glomet	1
1055	2H-5	Spring washer	2

11.2 L-Axis Unit

Fig. 11-2: L-Axis Unit

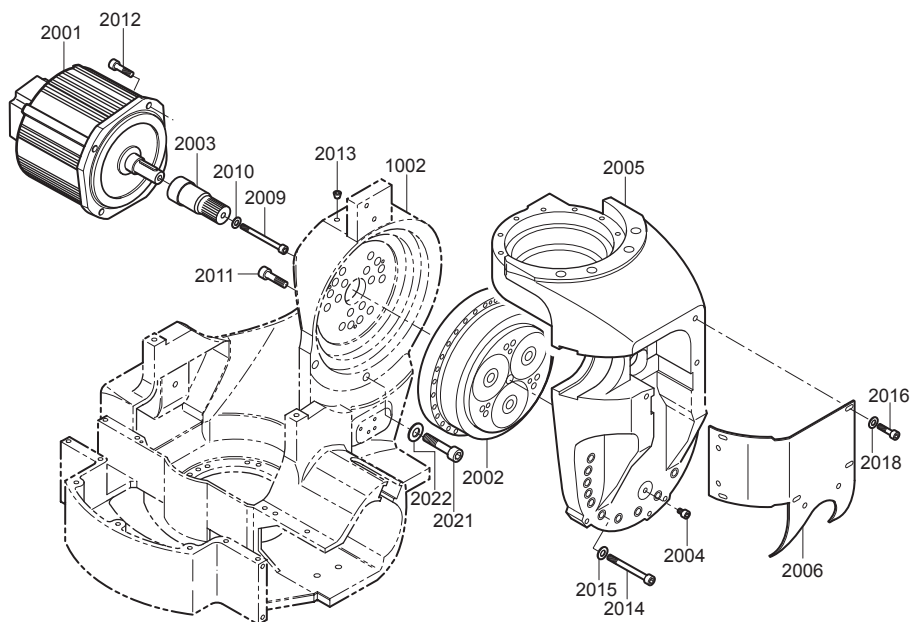


Table 11-2: L-Axis Unit

No.	DWG No.	Name	Pcs
2001	SGMRV-09ANA-YR1*	Motor	1
2002	HW0387809-A	Speed reducer	1
2003	HW0312735-1	Gear	1
2004	M6X6	Socket screw	1
2005	HW0102225-1	L arm A	1
2006	HW0313098-A	Cover	1
2009	M6X75	Socket screw	1
2010	2H-6	Spring washer	1
2011	M8X25	GT-SA bolt	18
2012	M8X30	GT-SA bolt	4
2013	PT1/8	Plug	1
2014	M6X50	Socket screw	16
2015	2H-6	Spring washer	16
2016	M6X12	GT-SA bolt	5
2018	M6	Washer	5
2021	M14X20	Socket screw	2
2022	M14	GT-SH washer	2
1002	HW0102223-1	S head	1

11.3 U-Axis Unit

Fig. 11-3: U-Axis Unit

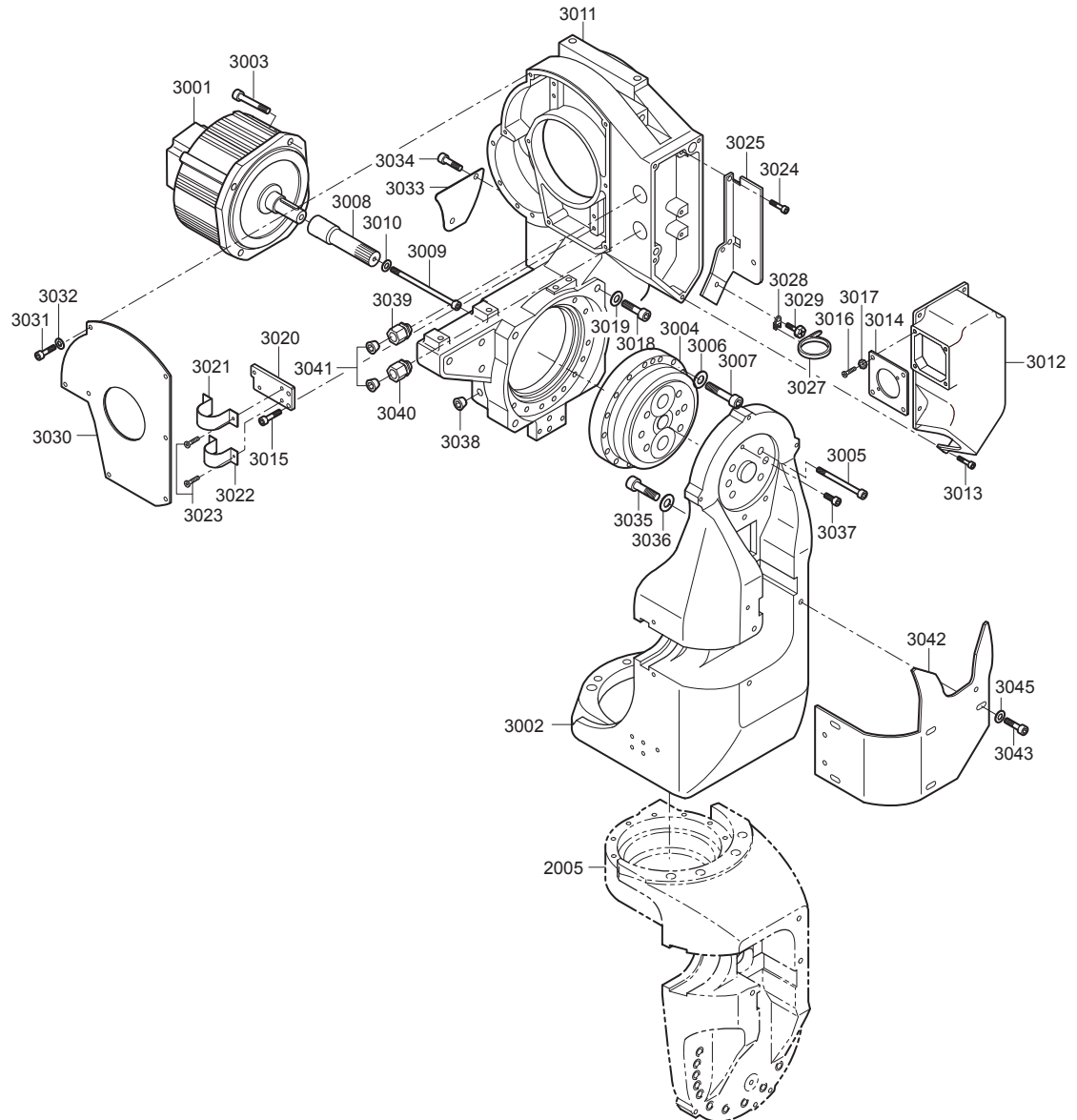


Table 11-3: U-Axis Unit

No.	DWG No.	Name	Pcs
3001	SGMRV-05ANA-YR2*	Motor	1
3002	HW0102226-1	L arm B	1
3003	M8X30	GT-SA bolt	4
3004	HW9280738-B	Speed reducer	1
3005	M10X30	GT-SA bolt	6
3006	2H-6	Spring washer	16
3007	M6X35	GT-SA bolt	16
3008	HW0303277-4	Gear	1
3009	M5X65	Socket screw	1
3001	SGMRV-05ANA-YR2*	Motor	1
3002	HW0102226-1	L arm B	1
3003	M8X30	GT-SA bolt	4
3004	HW9280738-B	Speed reducer	1
3005	M10X30	GT-SA bolt	6
3006	2H-6	Spring washer	16
3007	M6X35	GT-SA bolt	16
3008	HW0303277-4	Gear	1
3009	M5X65	Socket screw	1
3010	2H-5	Spring washer	1
3011	HW0102227-1	Casing	1
3012	HW0200494-1	Cover	1
3013	M4X12	GT-SA bolt	4
3014	HW0404554-2	N base	1
3015	M4X12	GT-SA bolt	4
3016	M3X16	Round Head Screw with Spring Washer	2
3017	M3	Nut	2
3018	M12X20	Socket screw	2
3019	2H-12	Spring washer	2
3020	HW0404719-2	Plate	1
3021	PZ1212	Saddle	1
3022	PZ1208	Saddle	1
3023	M4X10	APS bolt	4
3024	M4X12	GT-SA bolt	2
3025	HW0304458-2	Support	1
3027	TA1-S10	Clamp	2
3028	T50R	Insulok	2
3029	M5X8	APS bolt	2
3030	HW0304454-1	Cover	1
3031	M4X12	GT-SA bolt	7
3032	M4	Washer	7
3033	HW0412661-1	Cover	1
3034	M4X10	GT-SA bolt	2
3035	M12X20	Socket screw	2

Table 11-3: U-Axis Unit

No.	DWG No.	Name	Pcs
3036	2H-12	Spring washer	2
3037	M6X6	Socket screw	1
3038	PT1/8	Plug	1
3039	KQE10-03	Union	1
3040	KQE12-03	Union	1
3041	PT3/8*dacro*	Plug	1
3042	HW0313099-A	Cover	1
3043	M6X15	GT-SA bolt	5
3045	M6	Washer	5
2005	HW0102225-1	L arm A	1

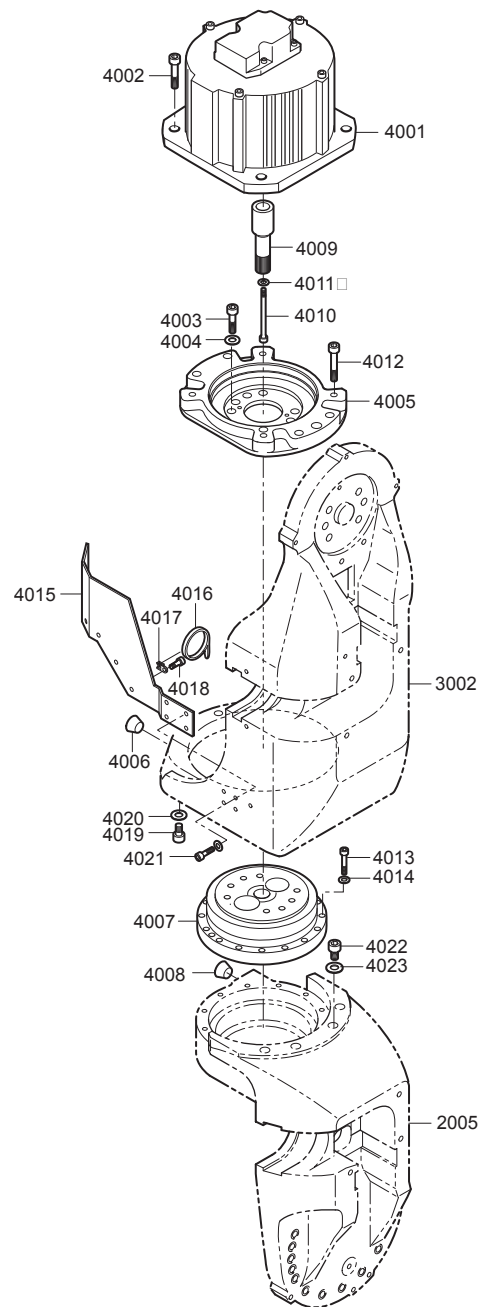
11.4 E-Axis Unit*Fig. 11-4: E-Axis Unit*

Table 11-4: E-Axis Unit

No.	DWG No.	Name	Pcs
4001	SGMRV-05ANA-YR2*	Motor	1
4002	M8X25	GT-SA bolt	4
4003	M8X20	Socket screw	8
4004	2H-8	Spring washer	8
4005	HW0312733-1	M base	1
4006	PT1/8	Plug	1
4007	HW0387811-A	Speed reducer	1
4008	PT1/8	Plug	1
4009	HW0312736-2	Gear	1
4010	M5X70	Socket screw	1
4011	2H-5	Spring washer	1
4012	M8X35	GT-SA bolt	4
4013	M5X25	Socket screw	12
4014	2H-5	Spring washer	12
4015	HW0313153-1	Support	1
4016	TA1-S10	Clamp	2
4017	T50R	Insulok	2
4018	M5X10	APS bolt	2
4019	M12X16	Socket screw	2
4020	2H-12	Spring washer	2
4021	M5X20	GT-SA bolt	4
4022	M12X20	Socket screw	2
4023	2H-12	Spring washer	2
2005	HW0102225-1	L arm A	1
3002	HW0102226-1	L arm B	1

11.5 R-Axis Unit

Fig. 11-5: R-Axis Unit

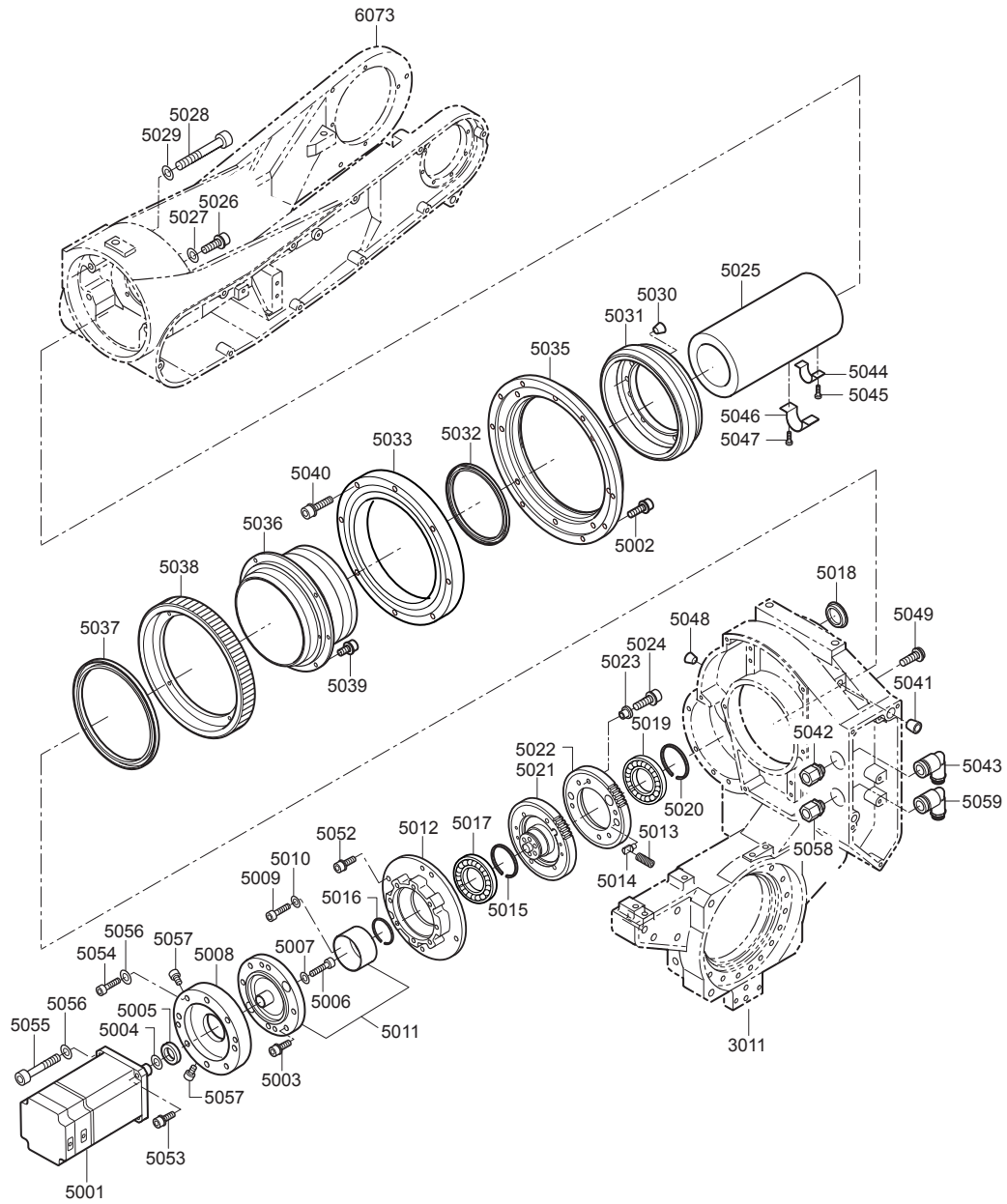


Table 11-5: R-Axis Unit

No.	DWG No.	Name	Pcs
5001	SGMPH-01ANA-YR1*	Motor	1
5002	M5X20	GT-SA bolt	6
5003	M5X16	GT-SA bolt	2
5004	HW0404304-1	Packin	1
5005	AE0478G	Oil seal	1
5006	M4X16	Socket screw	1
5007	2H-4	Spring washer	1
5008	HW0410364-1	M base	1
5009	M5X16	Socket screw	6
5010	2H-6	Spring washer	6
5011	HW0381645-A	Speed reducer	1
5012	HW0304452-1	Housing	1
5013	SWB8-20	Spring	2
5014	HW0403980-1	Pin	4
5015	RTW47	Retaining Ring	1
5016	STW-30	Retaining Ring-C type	1
5017	6906DDU	Bearing	1
5018	EZ5036A0	Cap	1
5019	6905	Bearing	1
5020	STW-25	Retaining Ring-C type	1
5021	HW0303725-1	Gear	1
5022	HW0303724-1	Gear	1
5023	HW0403979-1	Coller	2
5024	M4X16	GT-SA bolt	2
5025	HW0304451-1	Shaft	1
5026	M4X14	Socket screw	4
5027	2H-4	Spring washer	4
5028	M6X55	Socket screw	5
5029	2H-6	Spring washer	5
5030	M5X16	GT-SA bolt	6
5031	HW0303345-1	Shaft	1
5032	TC1301427	Oil seal	1
5033	CRBH11016AUE01	Cross roller bearing	1
5035	HW0304453-1	Flange	1
5036	HW0303343-1	Shaft	1
5037	TC1101226	Oil seal	1
5038	HW0303288-1	Gear	1
5039	M4X10	GT-SA bolt	4
5040	M6X30	GT-SA bolt	8
5041	PT1/8	Plug	1
5042	KQE10-03	Union	1
5043	KQL10-00	Coupling	1
5044	PZ1208	Saddle	2
5045	M4X6	APS bolt	2

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11 Parts List
11.5 R-Axis Unit

Table 11-5: R-Axis Unit

No.	DWG No.	Name	Pcs
5046	PZ1212	Saddle	2
5047	M4X10	APS bolt	2
5048	PT1/8	Plug	1
5049	M4X10	APS bolt	1
5052	M5X16	GT-SA bolt	4
5053	M5X12	GT-SA bolt	2
5054	M5X35	Socket screw	3
5055	M5X40	Socket screw	2
5056	2H-5	Spring washer	5
5057	M6X6	Socket screw	2
5058	KQE12-03	Union	1
5059	KQL12-00	Coupling	1
3011	HW0102227-1	Casing	1
6073	HW0100617-1	U arm	1

11.6 Wrist Unit

Fig. 11-6: Wrist Unit

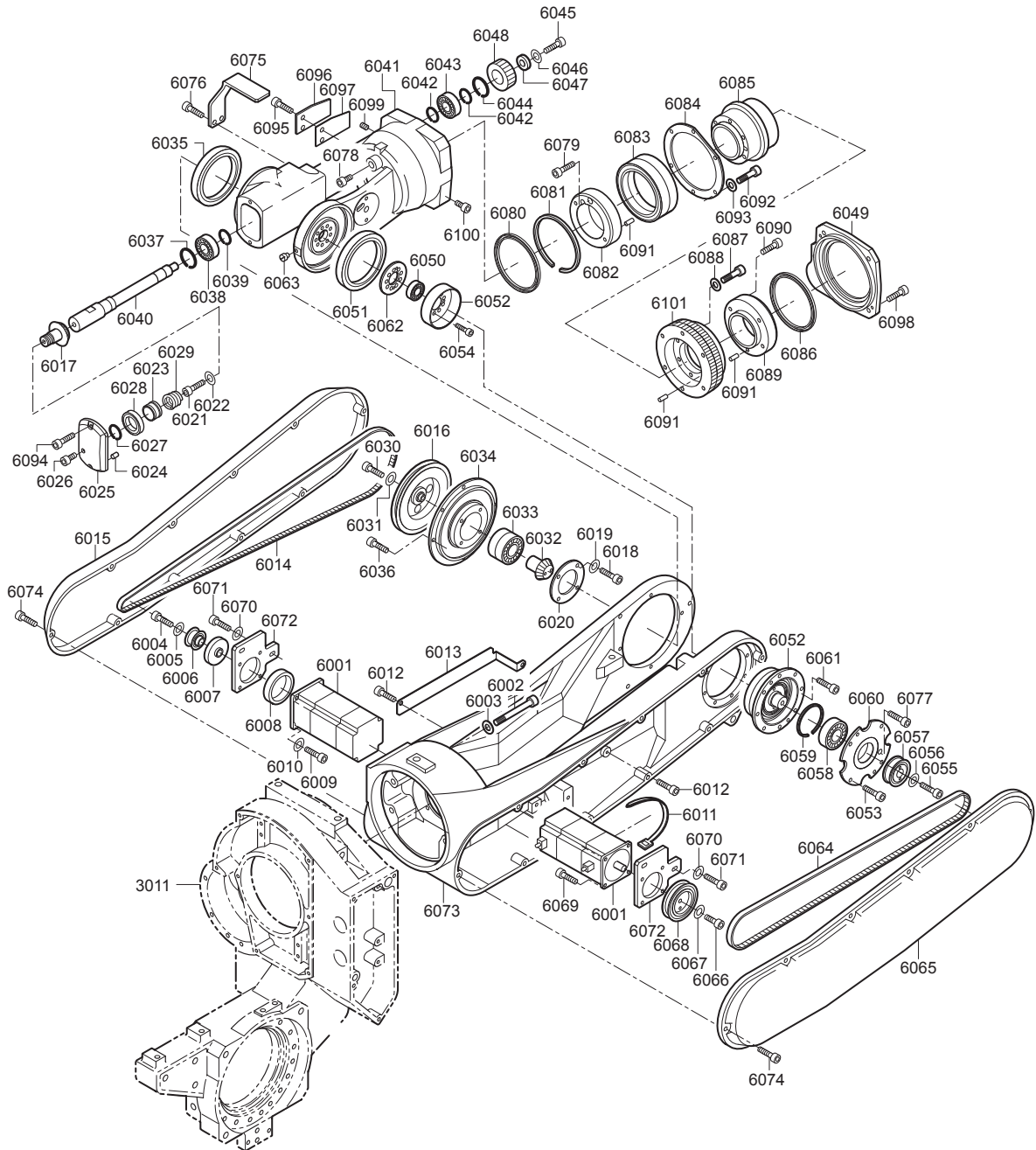


Table 11-6: Wrist Unit

No.	DWG No.	Name	Pcs
6001	SGMAV-01ANA-YR1*	Motor	2
6002	M6X55	Socket screw	5
6003	2H-6	Spring washer	5
6004	M4X25	Socket screw	1
6005	2H-4	Spring washer	1
6006	HW0480866-B	Pulley	1
6007	HW0404353-1	Fly wheel	1
6008	HW0404354-1	Spacer	1
6009	M4X25	Socket screw	2
6010	2H-4	Spring washer	2
6011	T50L	Insulok	1
6012	M4X10	GT-SA bolt	2
6013	HW0403207-1	Cover	1
6014	60S4.5M932	Belt	1
6015	HW0100621-1	Cover	1
6016	HW0480867-B	Pulley	1
6017	HW0311225-1	Gear	1
6018	CBS4-12	Bolt	4
6019	2H-4	Spring washer	4
6020	HW0401553-1	B cover	1
6021	M5X35	Socket screw	1
6022	2H-5	Spring washer	1
6023	HW0410762-1	Shaft	1
6024	MS4-10	Pin	2
6025	HW0410930-1	Cover	1
6026	M6X6	Socket screw	1
6027	WR20	Sirclip	1
6028	6804DDU	Bearing	1
6029	WB22-20	Spring	1
6030	M5X16	Socket screw	1
6031	2H-5	Spring washer	1
6032	HW0301300-2	Gear	1
6033	HW9482218-A	Bearing	1
6034	HW0301310-2	Shaft	1
6035	6811LLU	Bearing	1
6036	M4X12	GT-SA bolt	4
6037	AR28	Sirclip	1
6038	NA4902	Needle bearing	1
6039	WR15	Sirclip	1
6040	HW0311214-1	Shaft	1
6041	HW0100618-2	Wrist	1
6042	WR12	Sirclip	2
6043	NA4901	Needle bearing	1
6044	IRTW-24	Retaining ring	1

Table 11-6: Wrist Unit

No.	DWG No.	Name	Pcs
6045	M6X25	Socket screw	1
6046	2H-6	Spring washer	1
6047	HW8411125-3	Washer	1
6048	HW0310757-1	Gear	1
6049	HW0310758-1	Housing	1
6050	688A	Bearing	1
6051	6812LLU	Bearing	1
6052	HW0381646-A	Speed reducer	1
6053	M4X16	GT-SA bolt	4
6054	M4X12	GT-SA bolt	9
6055	M5X16	Socket screw	1
6056	2H-5	Spring washer	1
6057	HW0481692-A	Pulley	1
6058	6902ZZ*NS7*	Bearing	1
6059	RTW28	Retaining Ring-C type	1
6061	M4X12	GT-SA bolt	4
6062	HW0404303-2	Coller	1
6063	LP-M5	Plug	1
6064	60S4.5M711	Belt	1
6065	HW0100622-1	Cover	1
6066	M4X12	Socket screw	1
6067	2H-4	Spring washer	1
6068	HW0481429-A	Pulley	1
6069	M4X10	GT-SA bolt	2
6070	M4	Washer	4
6071	M4X16	GT-SA bolt	4
6072	HW0404547-1	M base	2
6073	HW0100617-1	U arm	1
6074	M4X10	GT-SA bolt	22
6075	HW0303390-1	Cover	1
6076	M4X10	APS bolt	2
6077	M6X6	Socket screw	1
6078	HW0404371-2	Bolt	1
6079	M4X16	GT-SA bolt	6
6080	TC65786	Oil seal	1
6081	AR78	Sirclip	1
6082	HW0310763-1	Shaft	1
6083	6812DBLU	Bearing	1
6084	HW0401552-1	B cover	1
6085	HW0310762-1	Housing	1
6086	TC70826	Oil seal	1
6087	M4X12	Socket screw	6
6088	2H-4	Spring washer	6
6089	HW0310761-1	Flange	1
6090	M5X16	GT-SA bolt	4

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11 Parts List
11.6 Wrist Unit

Table 11-6: Wrist Unit

No.	DWG No.	Name	Pcs
6091	MS4-10	Pin	3
6092	CBS4-12	Bolt	6
6093	2H-4	Spring washer	6
6094	M4X12	GT-SA bolt	2
6095	M5X10	APS bolt	2
6096	HW0404365-1	Cover	1
6097	HW0404366-1	Packin	1
6098	M4X12	GT-SA bolt	5
6099	M6X6	H set screw	1
6100	M6X6	Socket screw	1
6101	HW0372792-A	Gear ASSY	1
3011	HW0102227-1	Casing	1

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