MOTOMAN-MH5
INSTRUCTIONS

TYPE:
YR-MH00005-C00 (STANDARD SPECIFICATION DX100)
YR-MH0005N-C00 (STANDARD SPECIFICATION NXC100)

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

MOTOMAN INSTRUCTIONS

MOTOMAN-MH5 INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENANCE MANUAL

NXC100 INSTRUCTIONS
NX100 OPERATOR'S MANUAL
NXC100 MAINTENANCE MANUAL

The DX/NX100 Operator's Manuals above correspond to specific usage.
Be sure to use the appropriate manual.

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Yaskawa America, Inc.
Motoman Robotics Division
100 Automation Way
Miamisburg, OH 45342
Phone: 937-847-6200

www.motoman.com

MANDATORY

- This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MH5 for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator.
- General items related to safety are listed in the Chapter 1: Safety of the DX100/NXC100 instructions. To ensure correct and safe operation, carefully read the DX100/NXC100 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-MH5.

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

DANGER	Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.
MANDATORY	Always be sure to follow explicitly the items listed under this heading.
PROHIBITED	Must never be performed.

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

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

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

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/NXC100 and the programming pendant.
  When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

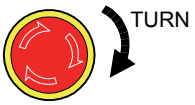
Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

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/NXC100.
  - 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/NXC100 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/NXC100 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/NXC100 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 programing pendant, and supply cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
DX100/NXC100 Controller	DX100/NXC100
DX100/NXC100 Programing Pendant	Programing Pendant
Cable between the manipulator and the controller	Manipulator Cable

Description of the Operation Procedure

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

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.

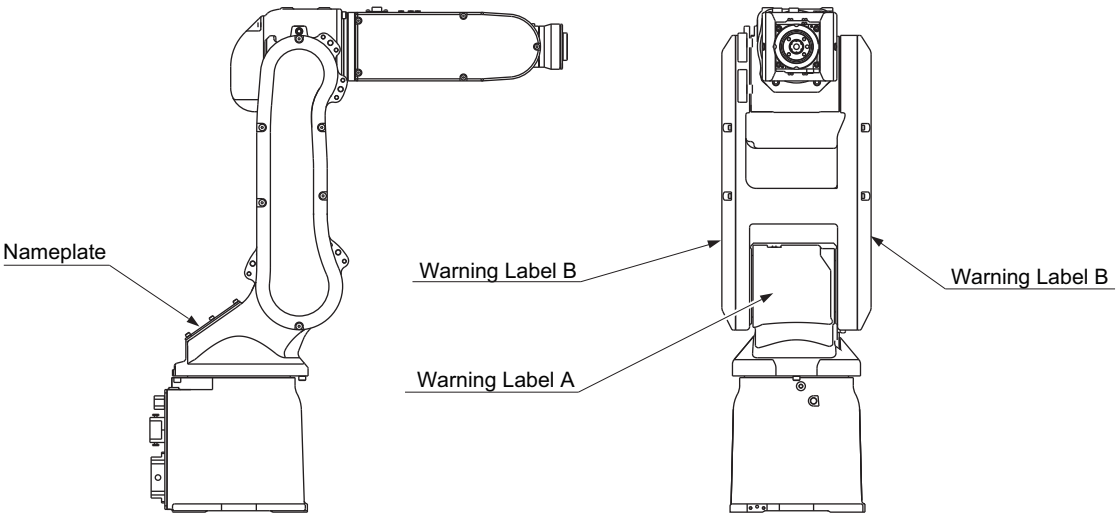
Explanation of Warning Labels

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

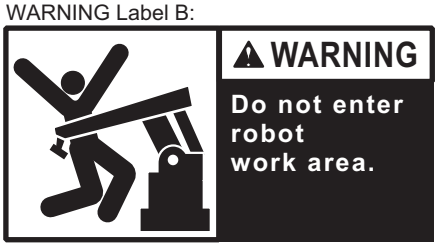


Nameplate

YASKAWA
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 NJ3878

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 Motoman Customer Support.

Customer Support Information

If you need assistance with any aspect of your MH5 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	MH5
• Robots	_____
• Primary Application	_____
• Controller	DX100/NXC100
• 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/NXC100 controller data plate

Table of Contents

1 Product Confirmation

CAUTION

- Confirm that the manipulator and the DX100/NXC100 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.

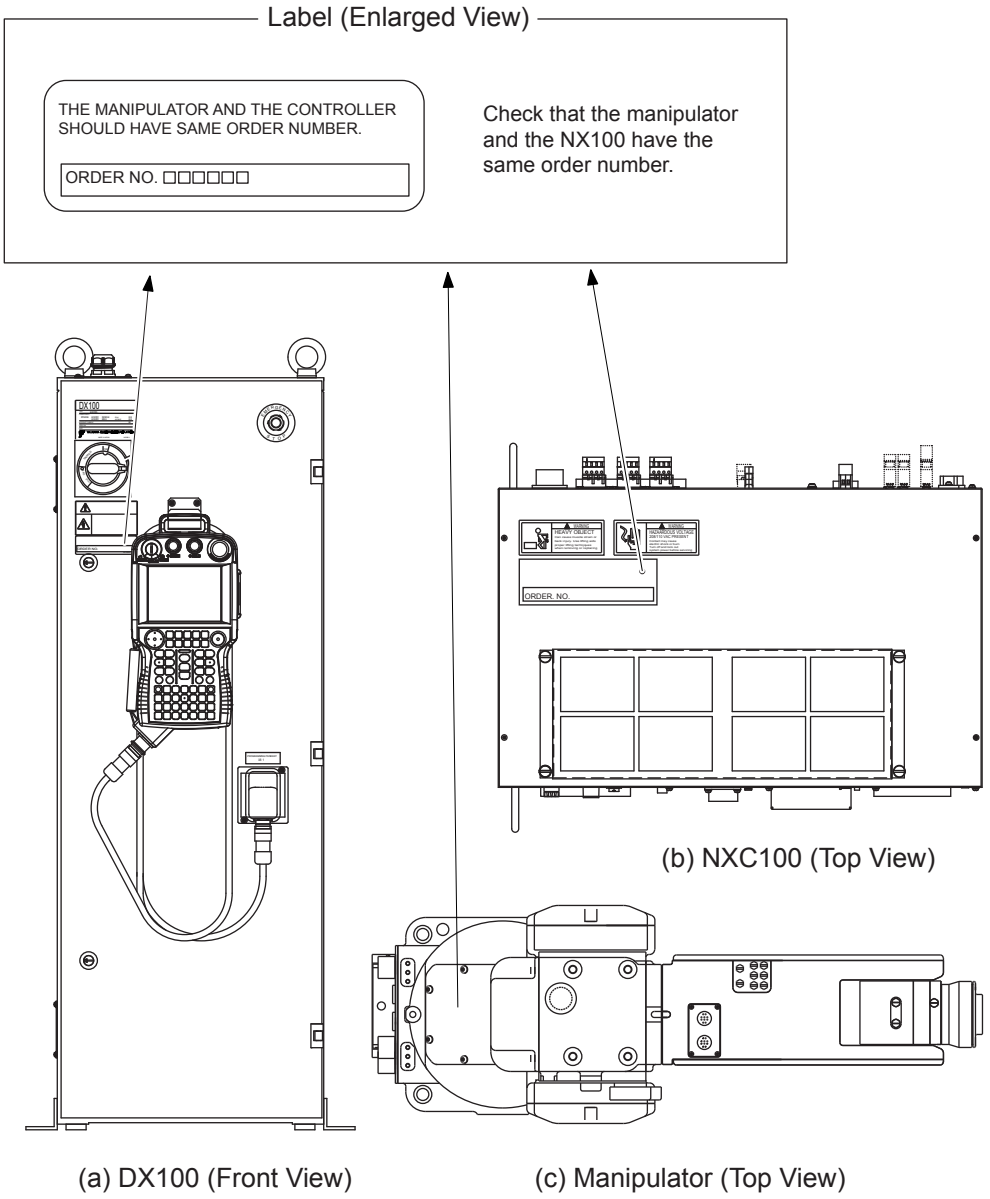
Standard delivery includes the following four items (Information for the content of optional goods is given separately):

- Manipulator
- DX100/NXC100
- Programing Pendant
- Manipulator cables (between the DX100/NXC100 and the manipulator)

1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the DX100/NXC100. The order number is located on a label as shown below.

Fig. 1-1: Location of Order Number Labels



2 Transporting

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 transportation.

The system consists of precision components. Failure to observe the caution may adversely affect performance.

2.1 Transporting Method

NOTE

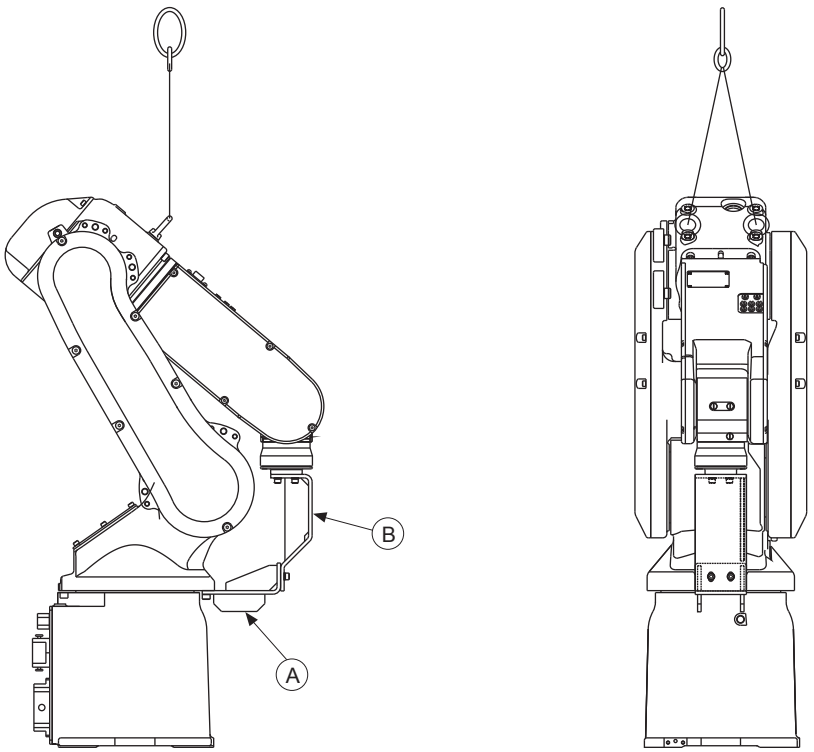
- Check that the eyebolts are securely fastened.
- The weight of the manipulator is approximately 27kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- Attached eyebolts are designed to support the manipulator mass. Do not use them for anything other than transporting the manipulator.
- 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 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

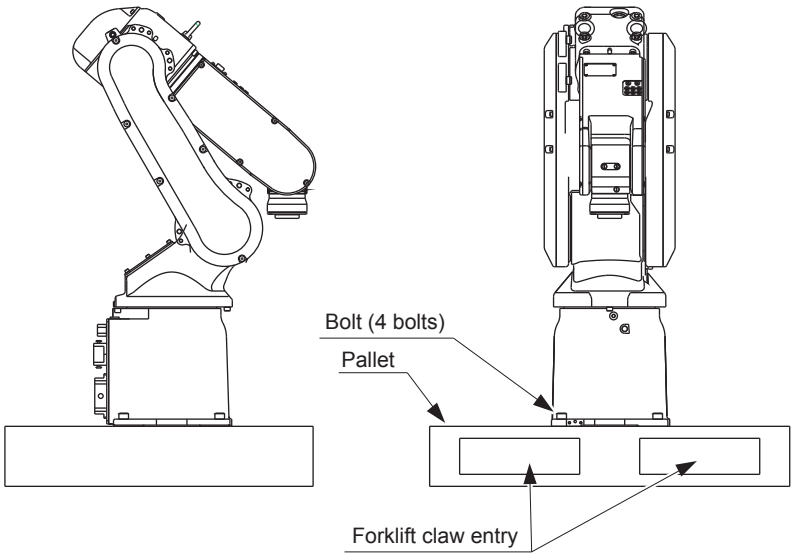


2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with shipping bolts and brackets 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 equipped with shipping bolts and brackets at A and B as shown in *Fig. 2-1 "Transporting Position"* to minimize external force during the transportation.

- The shipping bolts and brackets are painted yellow

NOTE

Before turning ON the power, make 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.

Position	Bolt Type	Pcs
A	Hexagon socket head cap screw M6 (length: 20 mm) (tensile strength: 1200 N/mm^2 or more)	2
B	Hexagon socket head cap screw M5 (length: 14 mm) (tensile strength: 1200 N/mm^2 or more)	6

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 ceiling or wall, the base section must have sufficient strength and rigidity to support the weight of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.**

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

CAUTION

- Do not install or operate a manipulator which is damaged or lacking 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. 2-1 "Transporting Position"* are removed.

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

3.1 Installation of the Safeguarding

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

Responsibility for Safeguarding (ISO10218)

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 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 as shown in *Table 3-1 "Maximum Repulsion Forces of the Manipulator at Emergency Stop"* and *Table 3-2 "Endurance Torque in Operation"*.

The flatness for installation must be kept at 0.5 mm or less: if the flatness of the mounting face is insufficient, the manipulator shape may change and its functional ability may be compromised. Mount the manipulator base as shown in *section 3.2.1 “Mounting Example”* in principle.

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

Horizontal rotating maximum torque (S-axis moving direction)	700 N • m (71.4 kgf• m)
Vertical rotating maximum torque (LU-axis moving direction)	700 N • m (71.4 kgf• m)

Table 3-2: Endurance Torque in Operation

Endurance torque in horizontal operation (S-axis moving direction)	220 N • m (22.4 kgf • m)
Endurance torque in vertical operation (LU-axes moving direction)	270 N • m (27.6 kgf • m)

3.2.1 Mounting Example

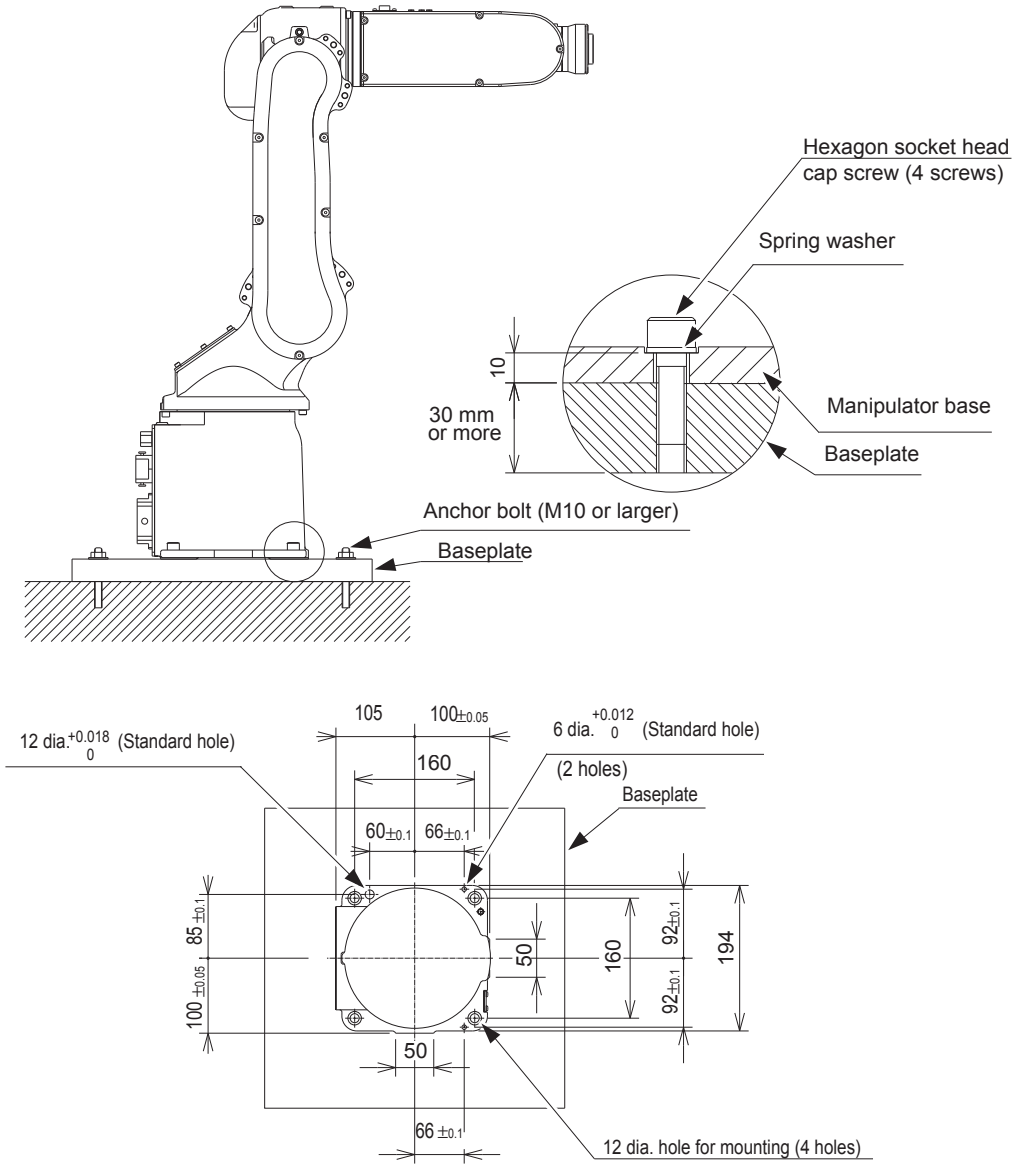
For the first process, anchor the base plate firmly to the ground. The baseplate should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommended to be prepare a balseplate of 30 mm or more thick , and anchor bolts of M10 or larger size.

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate with four hexagon socket head cap screws M10 (recommended length: 35 mm).

Next ,fix the manipulator base to the baseplate. Tighten the hexagon socket head cap screws 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-MH5 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.

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

3.3.1 S-Axis Operating Range

For the wall-mounted type, the S-axis movable range is ±30°.
(The range is adjusted prior to the shipment.)

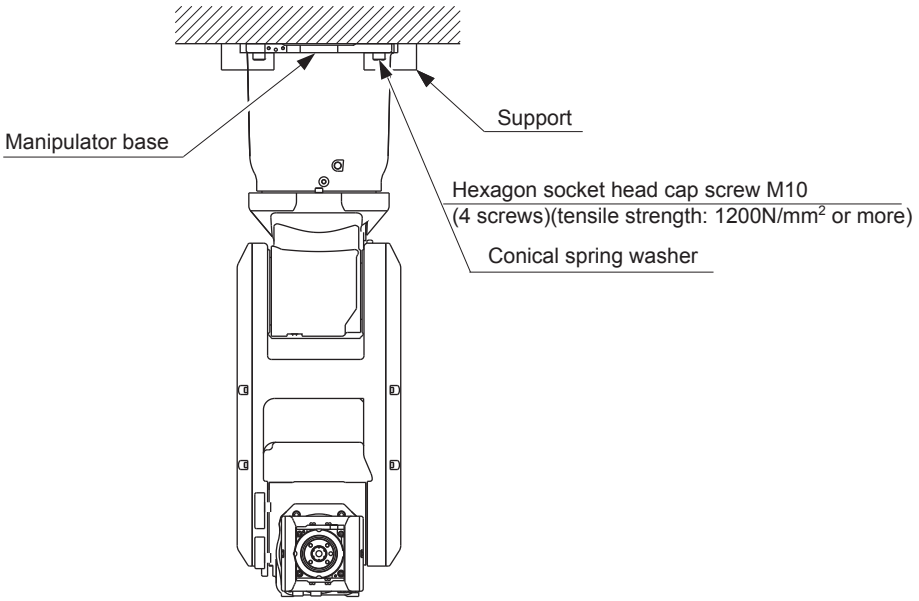
3.3.2 Fixing the Manipulator Base

For the wall- and ceiling-mounted types, be sure to use four hexagon socket head cap screws M10 (tensile strength: 1200 N/mm^2 or more) when fixing the manipulator base. Use a torque of 48 N·m when tightening the 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



NOTE

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

3.4 Location

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

- Ambient Temperature: 0° to +45°C
- Humidity: 20 to 80%RH (non-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: 4.9m/s^2 [0.5G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5mm or less

4 Wiring

WARNING

- **Ground resistance must be 100 W 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

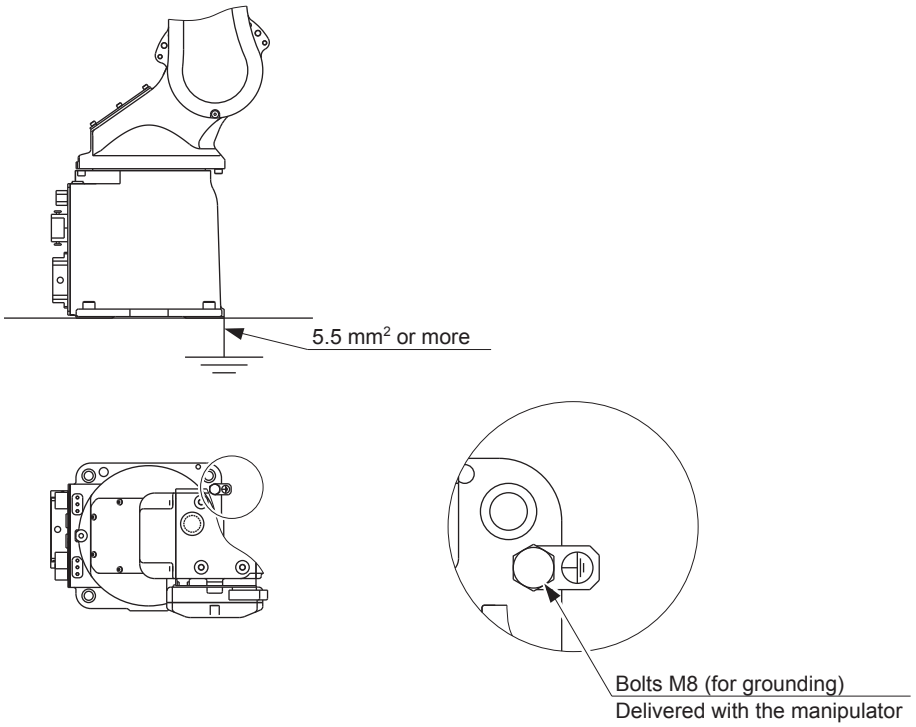
Follow the electrical installation standards and wiring regulations for grounding. A ground wire of 5.5 mm^2 or more is recommended.

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

NOTE

- 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(a) "Manipulator Cables for DX100"* and *Fig. 4-2(b) "Manipulator Cables for NXC100"*.)

Connect the cables to the manipulator base connectors and to the DX100/ NXC100. Refer to *Fig. 4-3(a) "Manipulator Cable Connection (Manipulator Side)"* , *Fig. 4-3(b) "Manipulator Cable Connection (DX100 Side)"* and *Fig. 4-3(c) "Manipulator Cable Connection (NXC100 Side)"*

4.2.1 Connection to the Manipulator

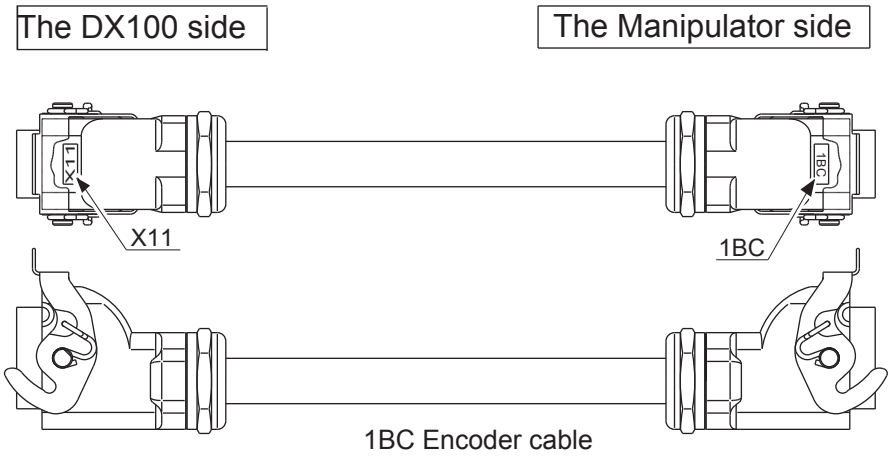
Before connecting cables to the manipulator, verify the numbers on both the manipulator cables and the connectors on the connector base of the manipulator. When connecting, adjust the cable connector positions to the main key positions of the manipulator, and insert cables in the order of 2BC, then 1BC.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

4.2.2 Connection to the DX100/NXC100

Before connecting cables to the DX100/NXC100, verify the numbers on both manipulator cables and the connectors on the DX100/NXC100.

- DX100
  When connecting, insert the cables in the order of X21, then X11, and depress each lever low until they click.
- NXC100
  After connecting 2BC to X21on the NXC100, connect 1BC to X11 on the NXC100 and depress each lever low until they click.

Fig. 4-2(a): Manipulator Cables for DX100



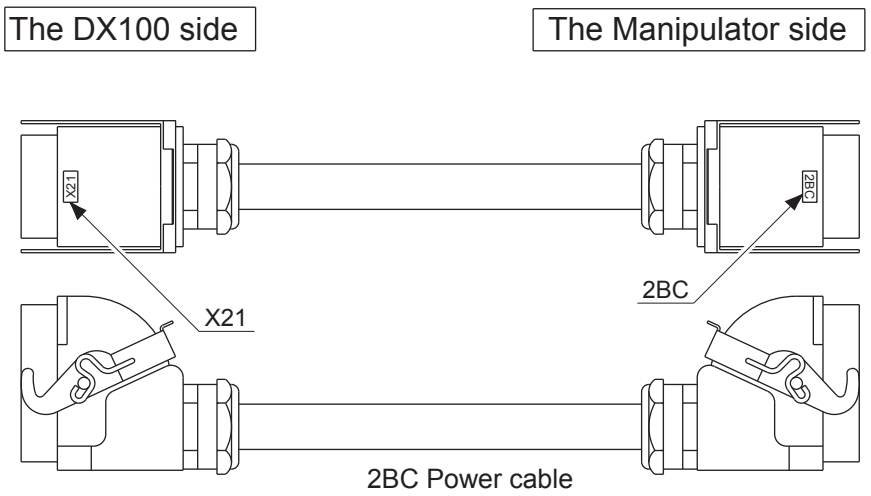
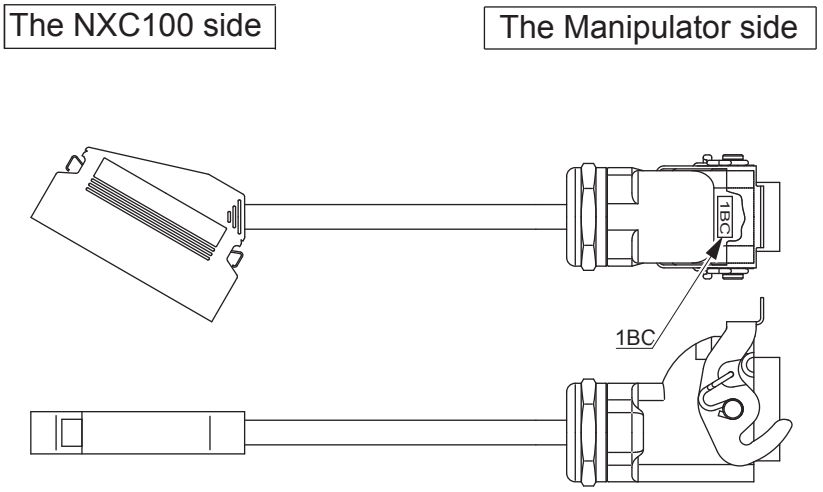
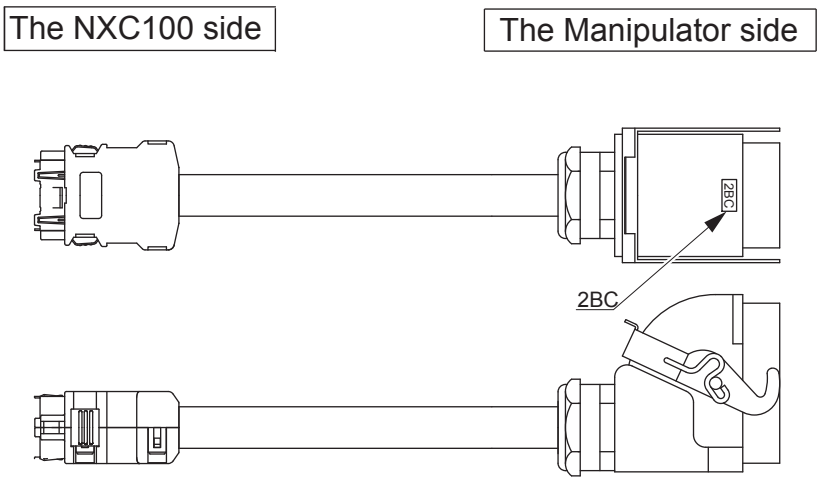


Fig. 4-2(b): Manipulator Cables for NXC100



1BC Encoder cable



2BC Power cable

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

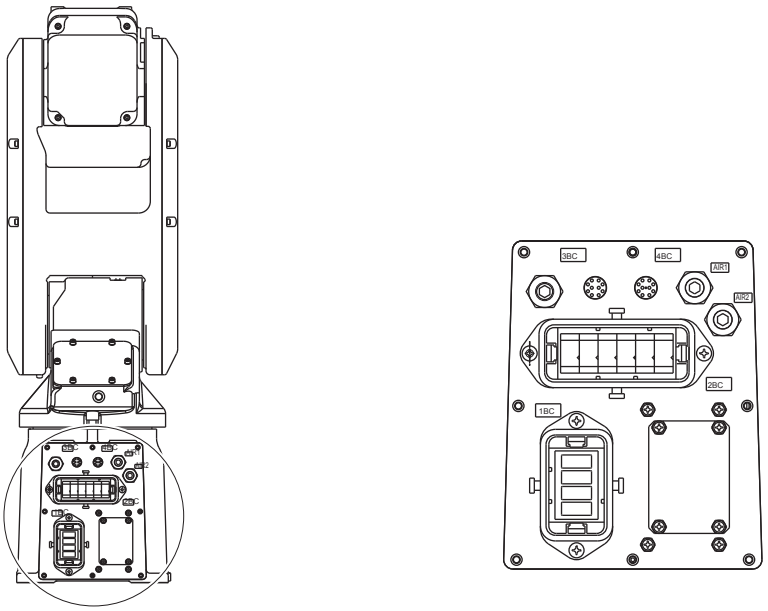


Fig. 4-3(b): Manipulator Cable Connection (DX100 Side)

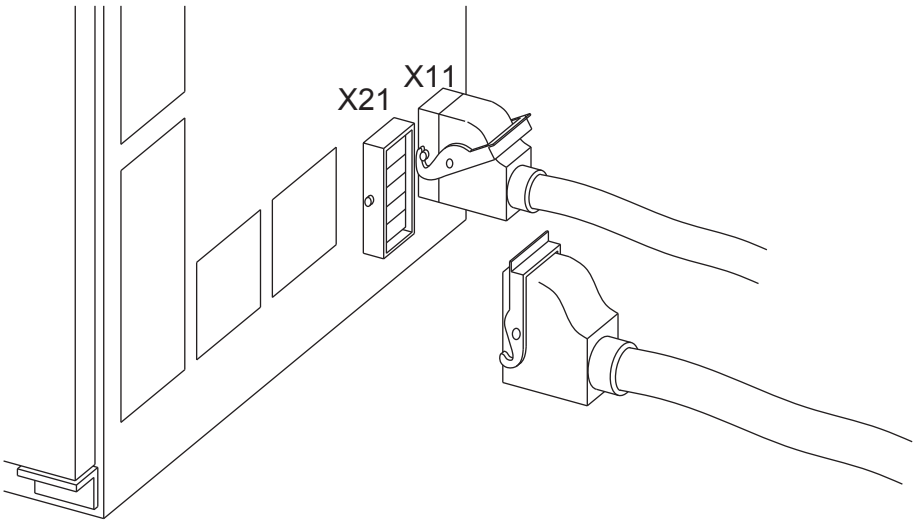
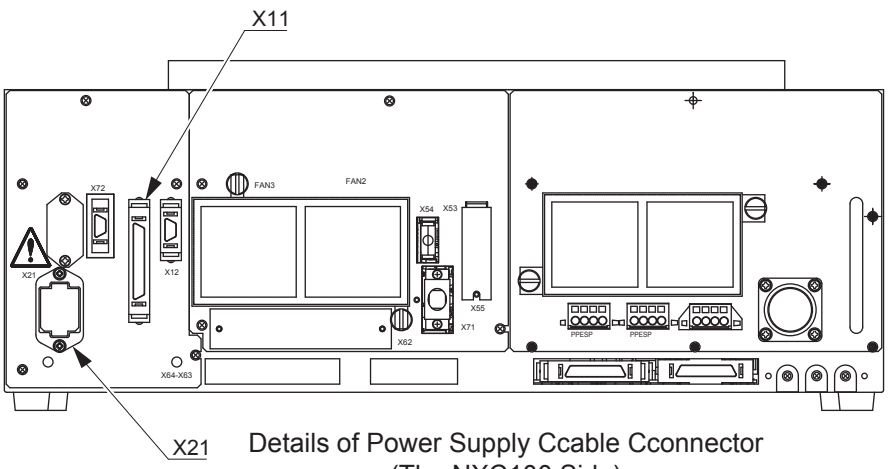


Fig. 4-3(c): Manipulator Cable Connection (NXC100 Side)



Details of Power Supply Ccable Cconnector
(The NXC100 Side)

5 Basic Specifications

5.1 Basic Specifications

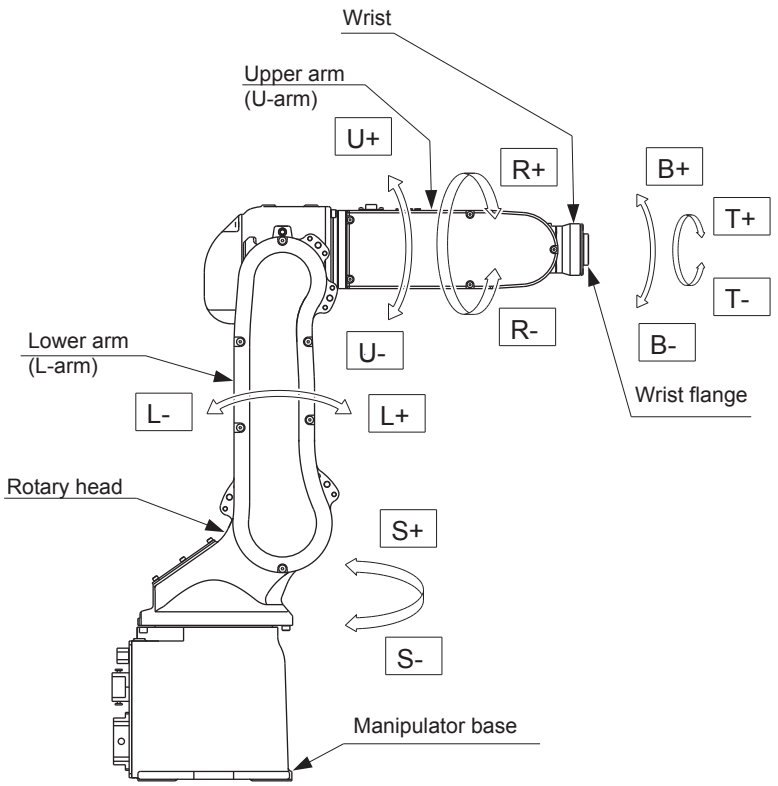
Table 5-1: Basic Specifications[1)]

Item \ Model		MOTOMAN-MH5
Application		Handling
Structure		Vertically Articulated
Degree of freedom		6
Payload		5 kg
Repeatability[2)]		±0.02 mm
Range of Motion	S-Axis (turning)	±170°
	L-Axis (lower arm)	+150°, -65°[3)]
	U-Axis (upper arm)	+255°, -136°[3)]
	R-Axis (wrist roll)	±190°[3)]
	B-Axis (wrist pitch/yaw)	±125°
	T-Axis (wrist twist)	±360°
Maximum Speed	S-Axis	6.56 rad/s, 376° /s
	L-Axis	6.11 rad/s, 350° /s
	U-Axis	6.98 rad/s, 400° /s
	R-Axis	7.85 rad/s, 450° /s
	B-Axis	7.85 rad/s, 450° /s
	T-Axis	12.57 rad/s, 720° /s
Allowable Moment[4)]	R-Axis	12 N•m (1.22 kgf•m)
	B-Axis	12 N•m (1.22 kgf•m)
	T-Axis	7 N•m (0.71 kgf•m)
Allowable Inertia ($GD^2$4)	R-Axis	0.30 kg•m^2
	B-Axis	0.30 kg•m^2
	T-Axis	0.10 kg•m^2
Approx. Mass		27 kg
Ambient Conditions	Temperature	0 to 45°C
	Humidity	20 to 80% RH (non-condensing)
	Vibration	4.9 m/s^2 (0.5G) or less
	Others	Free from corrosive gas or liquid, or explosive gas Free from dust, soot, or water Free from excessive electrical noise (plasma)
Power Capacity		1 kVA

1 SI units are used in this table. However, gravitational unit is used in ( )
2 Conformed to ISO9283
3 Each L-, U- and R-axes has the limit of motion depending on the postures.
4 Refer to *Fig. 6-1 "Moment Arm Rating"* for details on the permissible moment of inertia.

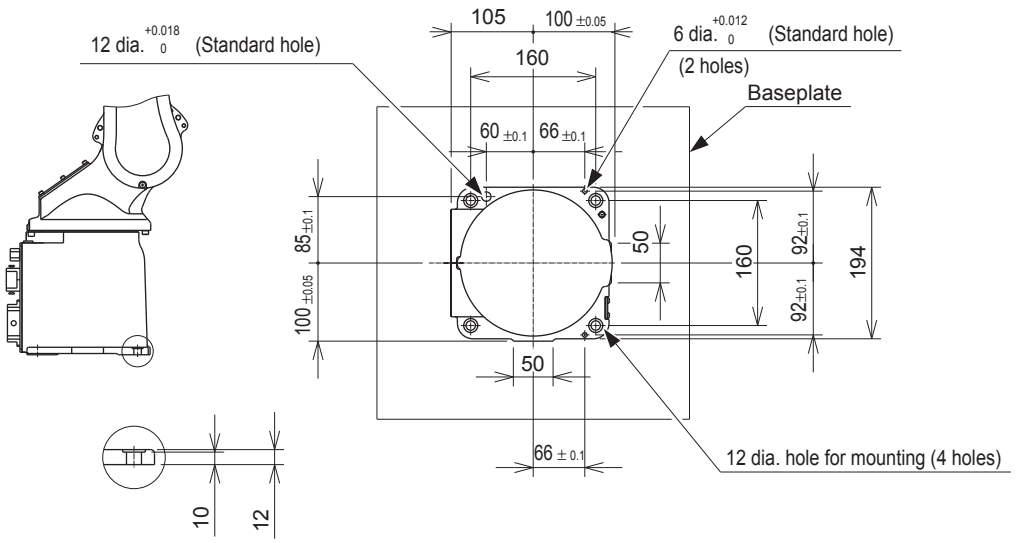
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes



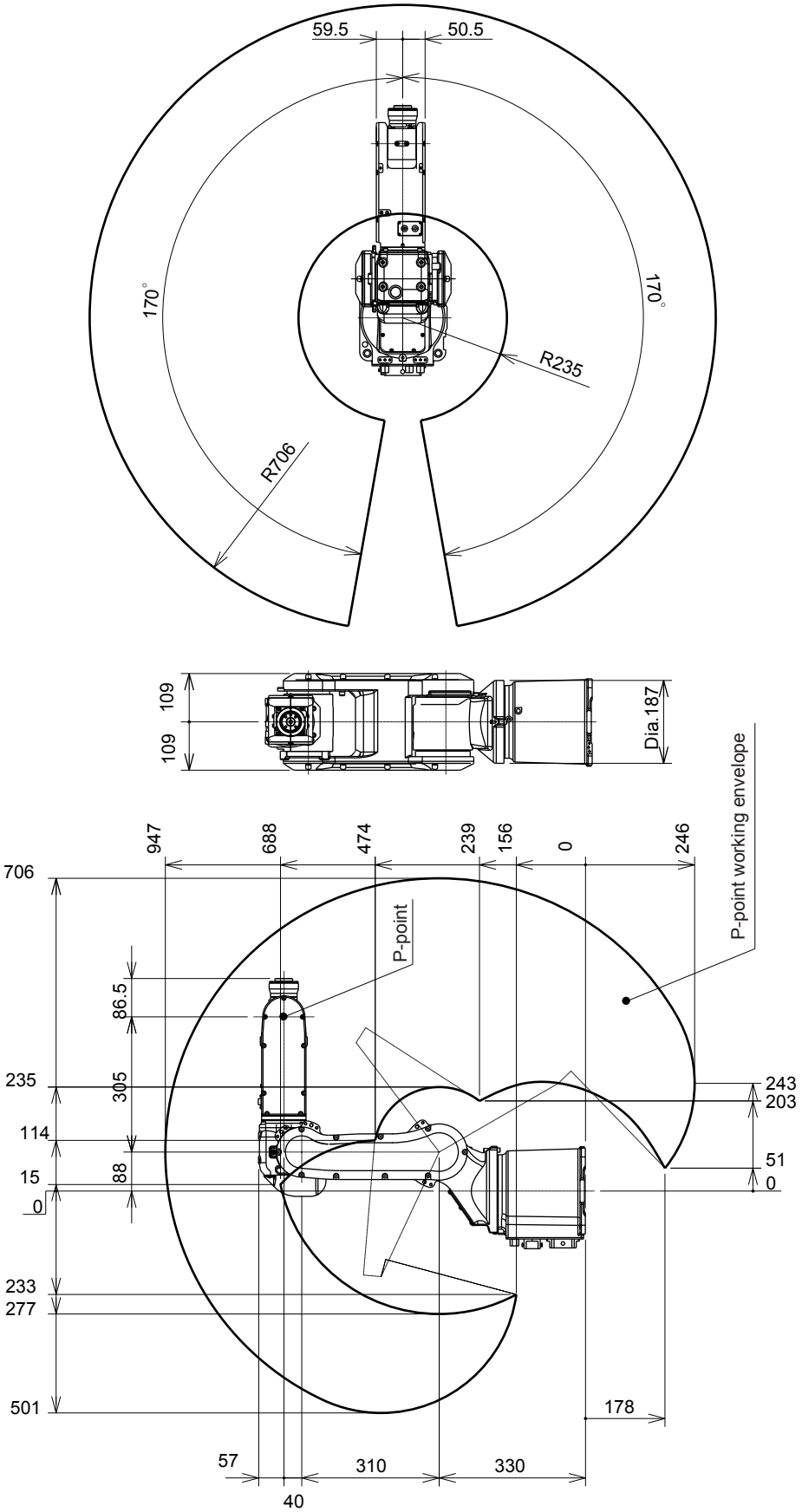
5.3 Baseplate Dimensions

Fig. 5-2: Manipulator Base Dimensions



5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Dimensions and P-Point Maximum Envelope (mm)



6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 5 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

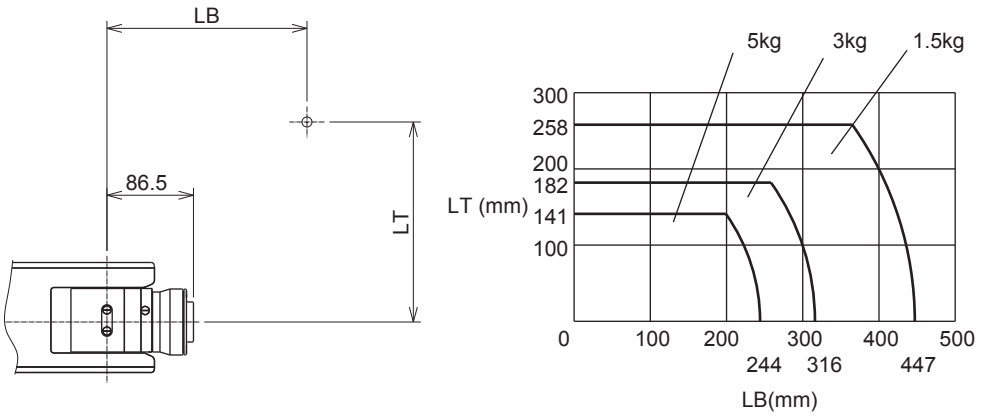
Axis	Moment N•m (kgf•m)[1)]	$GD^2/4$ Total Inertia kg•m^2
R-Axis	12 (1.22)	0.30
B-Axis	12 (1.22)	0.30
T-Axis	7 (0.71)	0.10

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 inertia is calculated when the moment is at the maximum. Contact your YASKAWA representative beforehand when moment of inertia is the only load, or load moment is smaller than moment of inertia . Also contact your YASKAWA representative in advance in a case where the load mass is combined with an external force.

Fig. 6-1: Moment Arm Rating

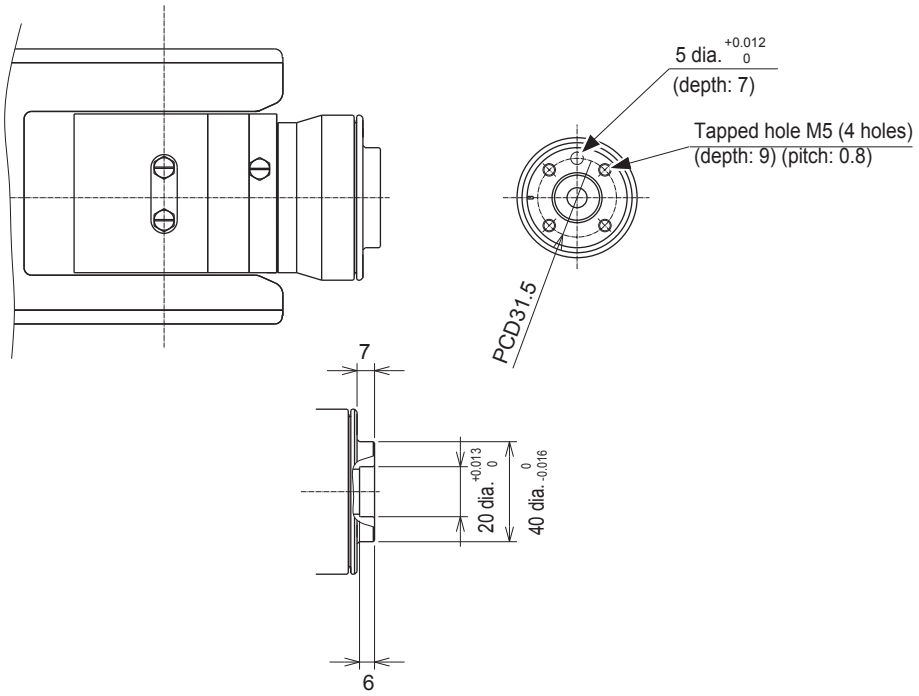


6.2 Wrist Flange

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 5 mm or less.

Fig. 6-2: Wrist Flange



NOTE 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

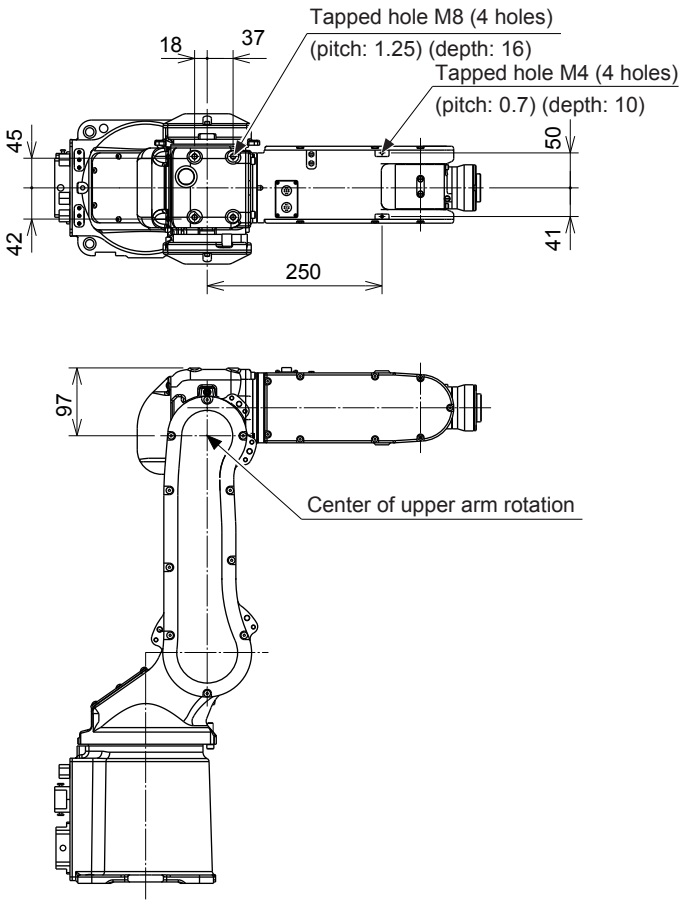
The peripheral equipment mounts are provided on the U-axis (upper arm) as shown in *Fig. 7-1 "Installing Peripheral Equipment"* for easier installation of the user's system applications. The following conditions shall be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

The allowable load on the U-Axis is a maximum of 6 kg, including the wrist load.

For instance, when the mass installed in the wrist point is 5 kg, the mass which can be installed on the upper arm is 1 kg.

Fig. 7-1: Installing Peripheral Equipment



7.2 Internal User I/O Wiring Harness and Air Lines

Internal user I/O wiring harness (16 wires :0.2 mm^2) and two air lines are incorporated in the manipulator for the drive of the 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"*. Wiring must be performed by users. conditions below:

The allowable current for internal user I/O wiring harness	2.5 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 hose inside diameter: 4mm)

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

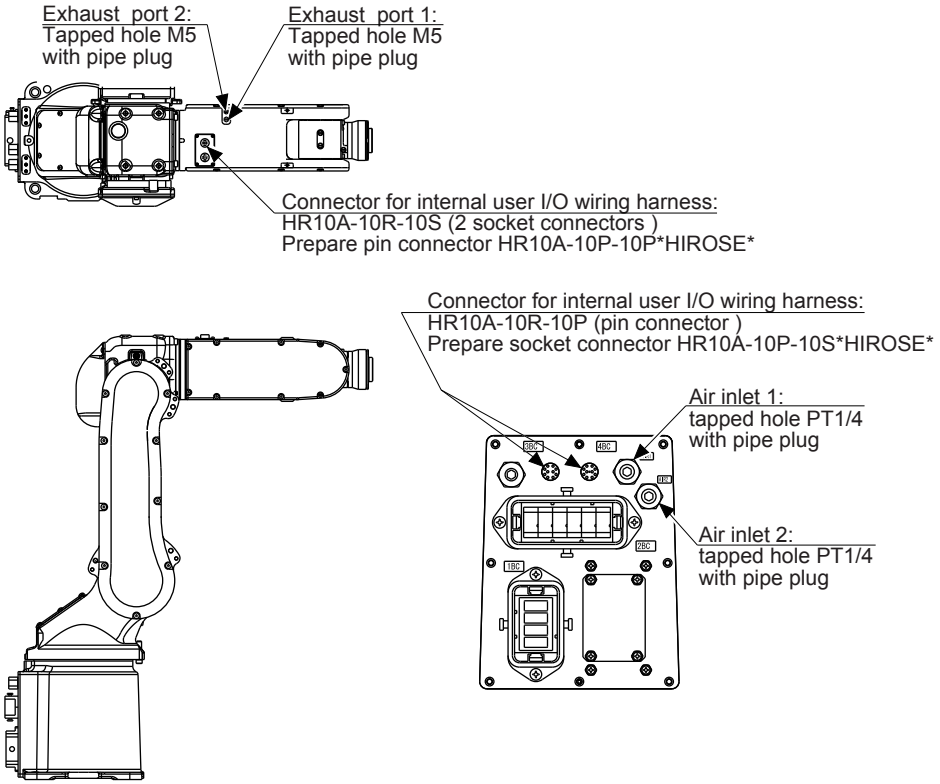
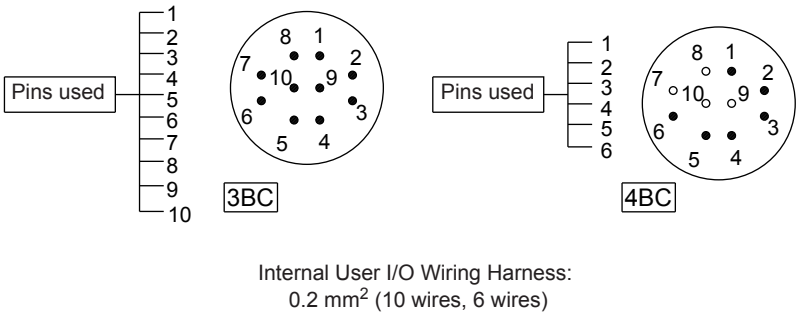


Fig. 7-3: Details of the Connector Pin Numbers



The same pin-number connectors (1-16) at both connector base part and arm part are connected with the single wire lead of 0.2mm^2.

8 Electrical Equipment Specification

8.1 Internal Connections

High reliability 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. 8-1 "Locations and Numbers of Connectors"*.

Diagrams for internal connections of the manipulator are shown in *Fig. 8-1(a) "Internal Connection Diagram for DX100"*, *Fig. 8-1(b) "Internal Connection Diagram for DX100"*, *Fig. 8-1(c) "Internal Connection Diagram for NXC100"* and *Fig. 8-1(d) "Internal Connection Diagram for NXC100"*.

Fig. 8-1: Locations and Numbers of Connectors

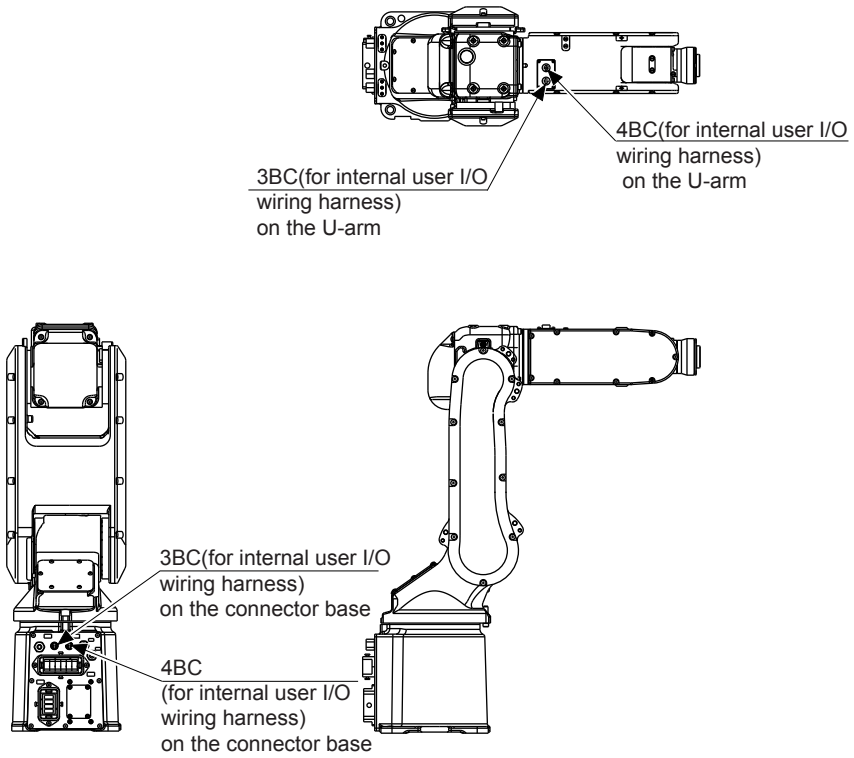


Table 8-1: List of Connector Types

Name	Type of Connector
Connector for Internal User I/O Wiring Harness on the connector base	HR10A-10R-10P (HR10A-10P-10P*HIROSE*: Optional)
Connector for Internal User I/O Wiring Harness on the U-arm	HR10A-10R-10S (HR10A-10P-10S*HIROSE*: Optional)

Fig. 8-1(a): Internal Connection Diagram for DX100

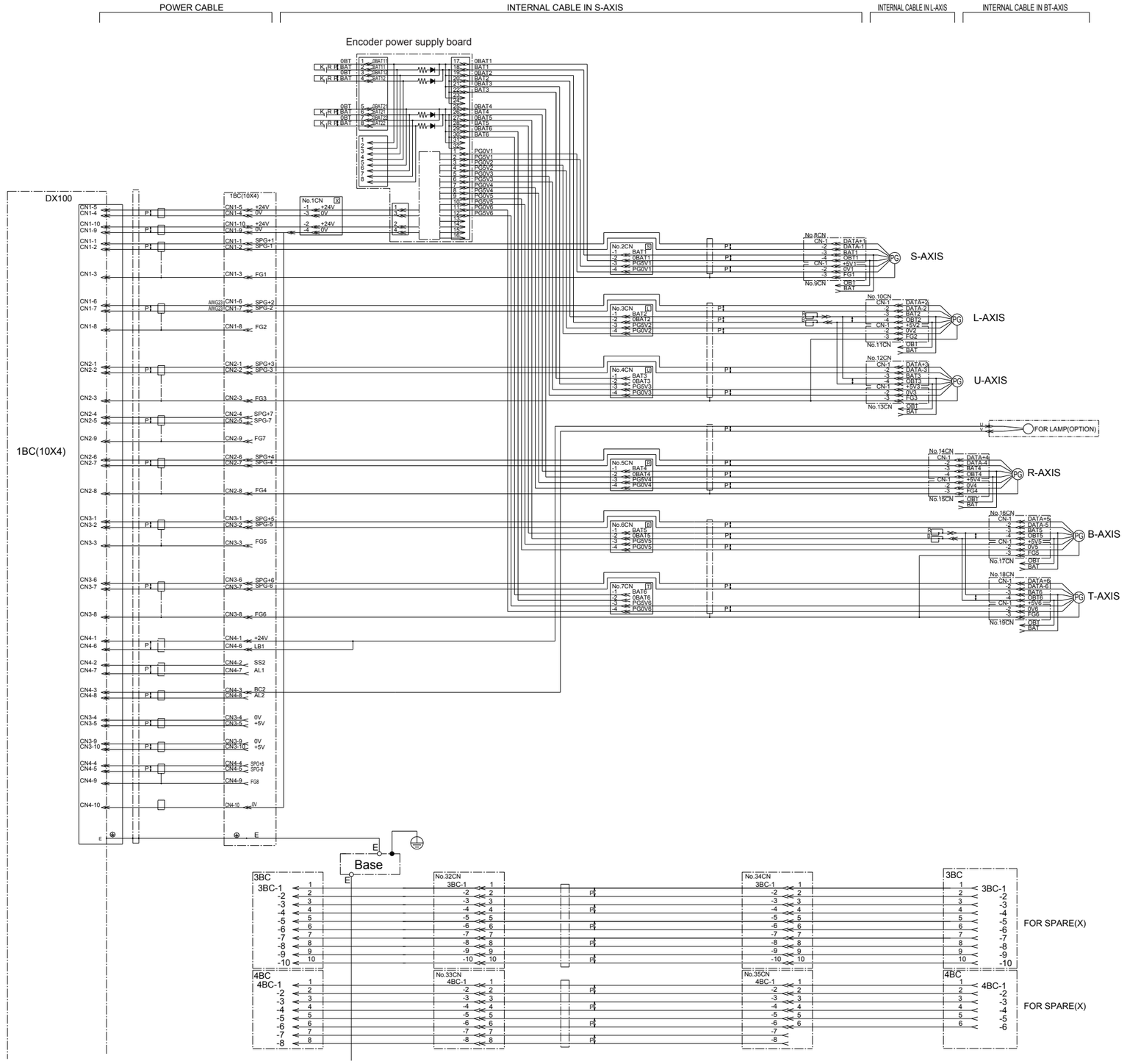


Fig. 8-1(b): I*nternal Connection Diagram for DX100*

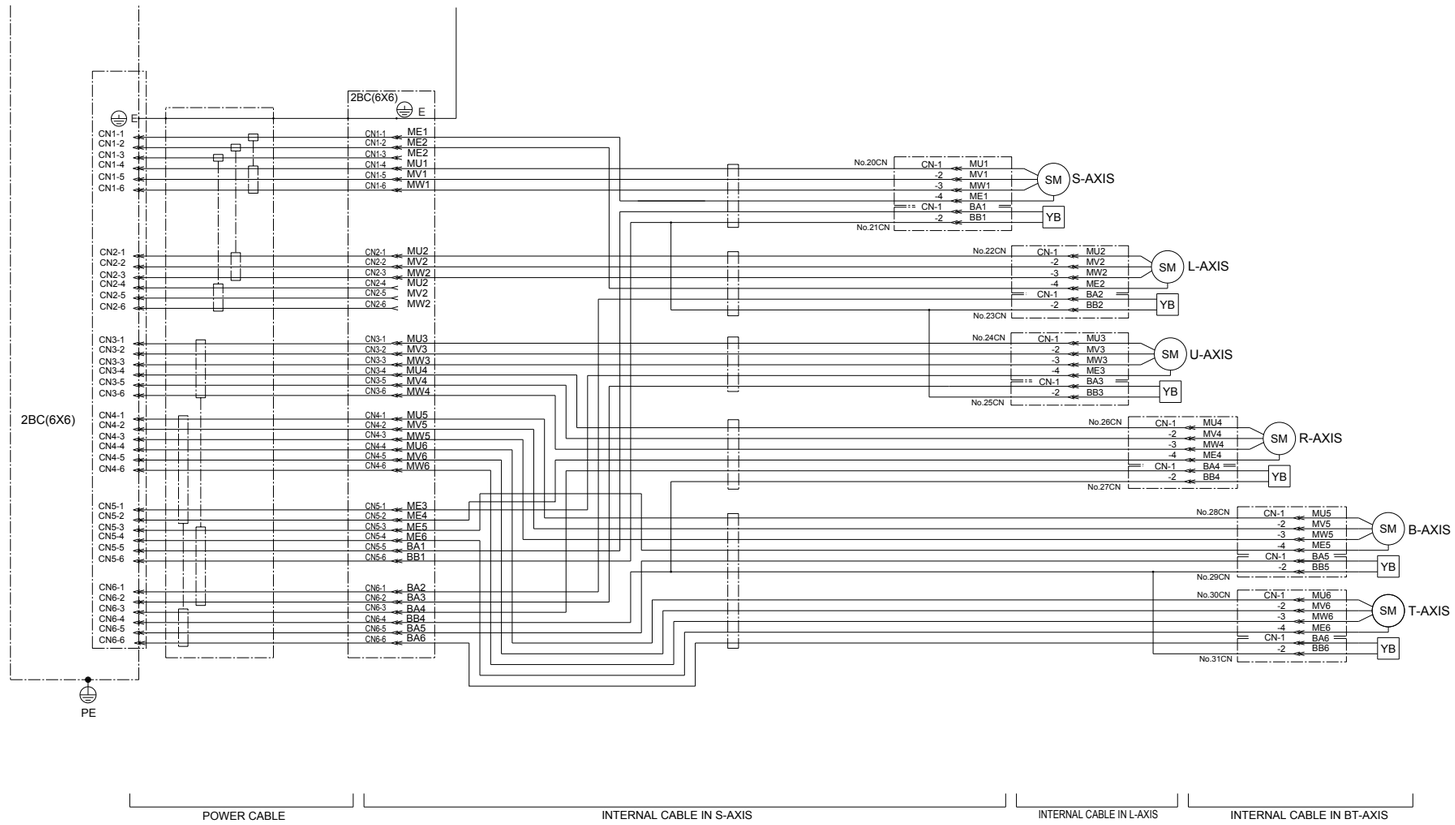


Fig. 8-1(c): Internal Connection Diagram for NXC100

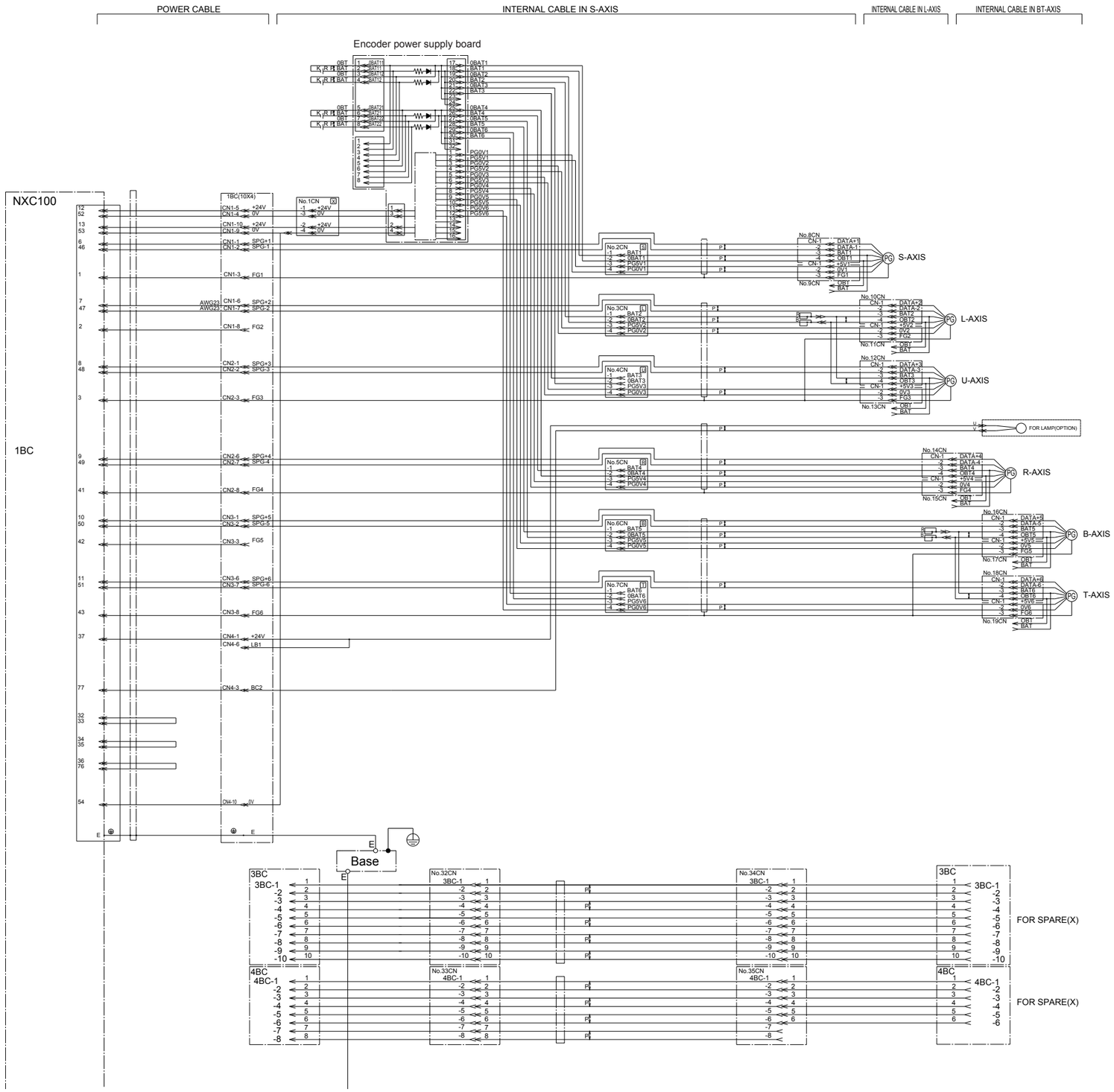
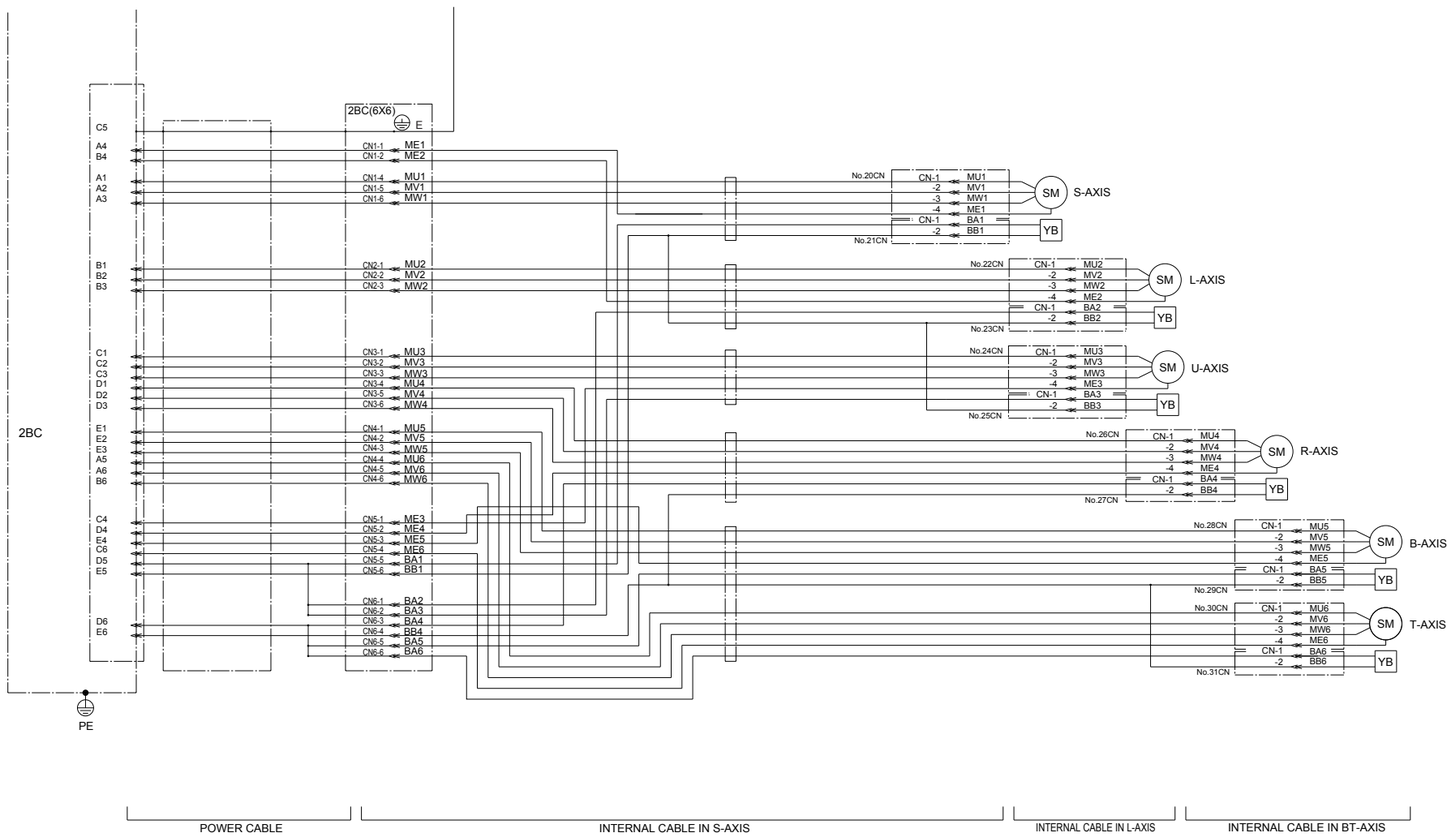


Fig. 8-1(d): Internal Connection Diagram for NXC100



9 Maintenance and Inspection

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

- 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.
- 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 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"*.

In *Table 9-1*, the inspection items are categorized by 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 must be based on the servo power supply on 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.

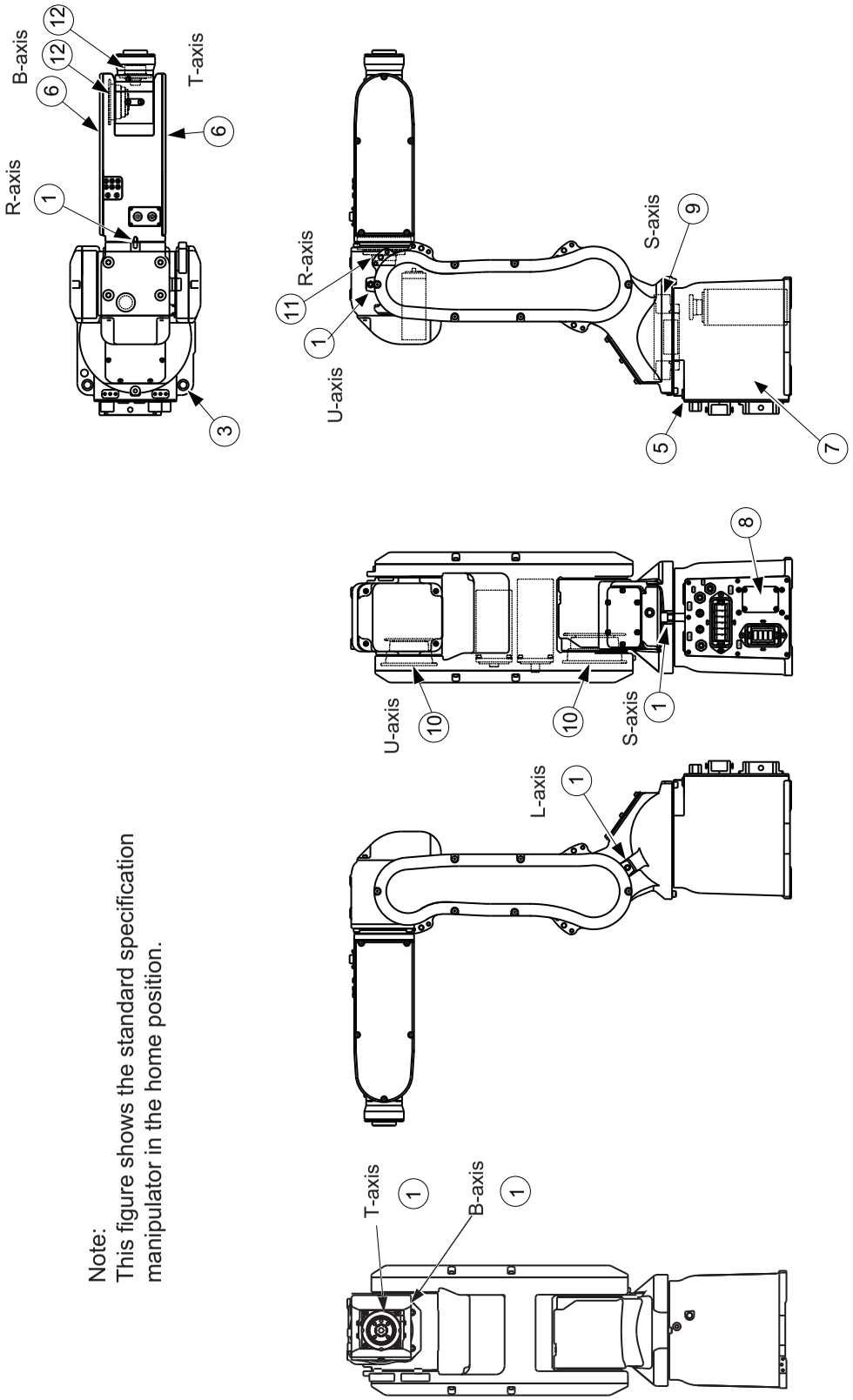
Table 9-1: Inspection Items (Sheet 1 of 2)

Items[1)]		Schedule						Method	Operation	Inspection Charge		
		Daily	1000HCycle	6000HCycle	12000HCycle	24000H	36000H			Specified Personnel	Licensee	Service Company
1	Alignment mark	●						Visual	Check tram mark accordance and damage at the home position.	●	●	●
2	Working area and manipulator	●						Visual	Clean the work area if dust or spatter is present. Check for damage and outside cracks.	●	●	●
3	Baseplate mounting bolts		●					Spanner Wrench	Tighten loose bolts. Replace if necessary.	●	●	●
4	Cover mounting screws		●					Screwdriver, Wrench	Tighten loose bolts. Replace if necessary.	●	●	●
5	Connector base		●					Manual	Check for loose connectors.	●	●	●
6	LURBT-axes timing belt				●			Manual	Check for belt tension and wear.		●	●
7	Wire harness in manipulator				●			Visual Multimeter	Check for conduction between the main connecter of base and intermediate connector with manually shaking the wire. Check for wear of protective spring[2)]		●	●
						●			Replace[3)]			●
8	Battery pack in manipulator						●		Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.		●	●
9	S-axis speed reducer S-axis gear			●				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease[4)] (6000H cycle). See *section 9.3.1*		●	●
10	LU-axes speed reducers			●				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease[4)] (6000H cycle). See *section 9.3.3* and *section 9.3.4*.		●	●

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
11	R-axis speed reducer			●				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease[4)] (6000H cycle). See *section 9.3.5*		●	●
12	BT-axes speed reducers T-axis gear			●				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease[4)] (6000H cycle). See *section 9.3.6*		●	●
13	Overhaul						●					●

1 Inspection No. correspond to the numbers in *Fig. 9-1 “Inspection Items”*.
2 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 9.3.7 “Notes for Maintenance”*)
3 Wire harness in manipulator (S-, L-, U-, R-, B-, T-axis part) to be replaced at 24000H inspection.
4 For the grease, refer to *Table 9-2 "Inspection Parts and Grease Used"*.



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

Fig. 9-1: Inspection Items

Table 9-2: Inspection Parts and Grease Used

No.	Grease Used	Inspected Parts
9,10,11, 12	Harmonic Grease SK-1A	S, L, U, R, B and T-axes speed reducers, T- and S-axes gears

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/NXC100, replace the battery in accordance with the following procedure:

Fig. 9-2: Battery Location

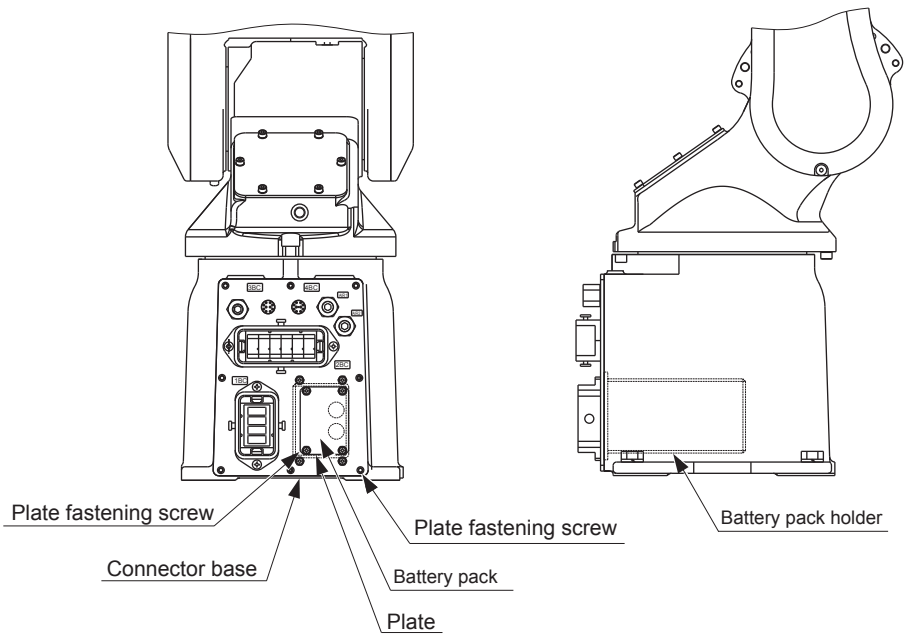
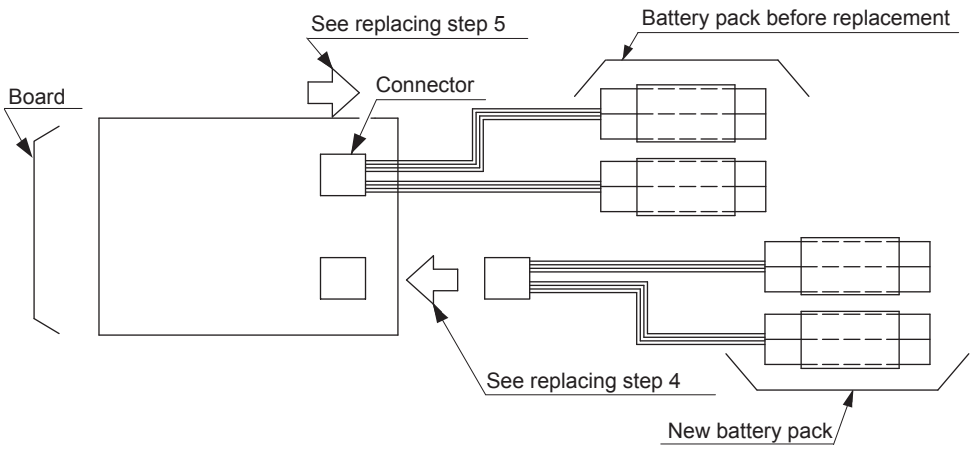


Fig. 9-3: Battery Connection



1. Turn OFF the DX100/NXC100 main power supply.
2. Remove the plate fastening screws and the plate on the connector base, then pull the battery pack put 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 connectors on the board.
5. Remove the old battery pack from the board.

NOTE 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 on the battery holder.
7. Reinstall the plate.

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

9.3 Notes on Grease Replenishment/Exchange Procedures

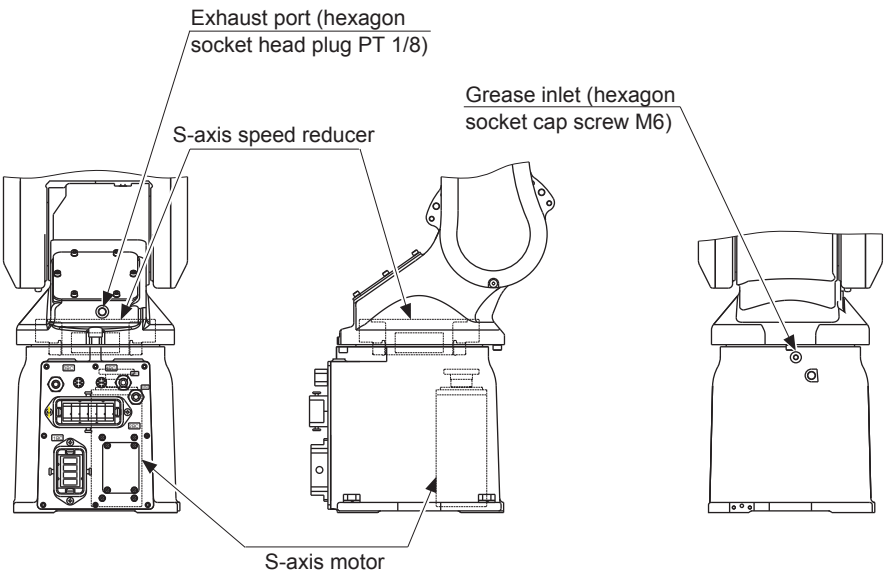
Make sure to follow the instructions listed below at grease replenishment/ exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

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 for S-Axis Speed Reducer

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



9.3.1.1 Grease Replenishment

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

Replenish the grease in accordance with the following procedure:

1. Remove the hexagon socket head cap screw M6 from the grease inlet and the hexagon socket head plug PT1/8 from the exhaust port.

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.

2. Install the grease zerk PT1/8 to the grease inlet. (The grease zerk is packed with the manipulator on the shipment.)
3. Inject the grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 25cc

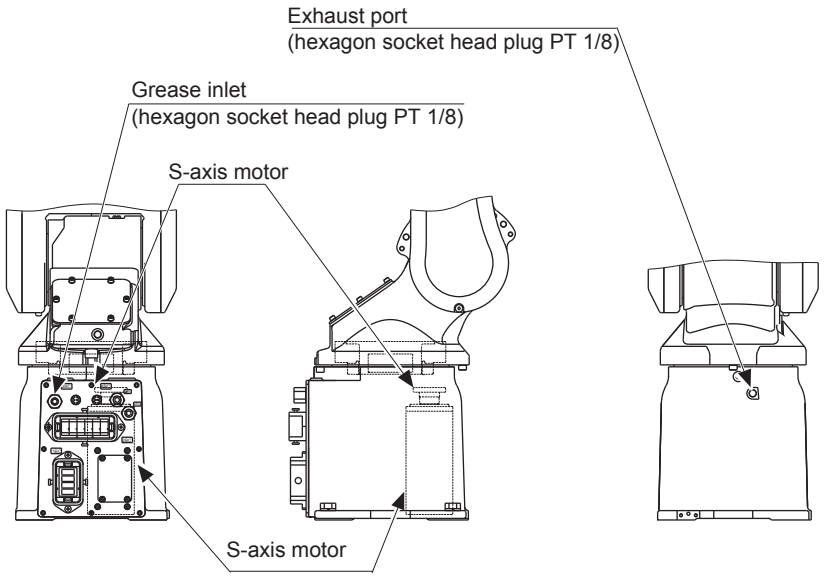
NOTE

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.

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 screw M6, and the plug PT1/8 to the exhaust port.
   Apply Three Bond 1206C on the thread part of the screw/plug.

9.3.2 Grease Replenishment for S-Axis Gear

Fig. 9-5: S-Axis Gear Diagram



9.3.2.1 Grease Replenishment

(Refer to *Fig. 9-5 "S-Axis Gear Diagram"*.)

Replenish the grease in accordance with the following procedure:

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

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.

2. Install the grease zerk PT1/8 to the grease inlet. (The grease zerk is packed with the manipulator on the shipment.)
3. Inject the grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 25cc

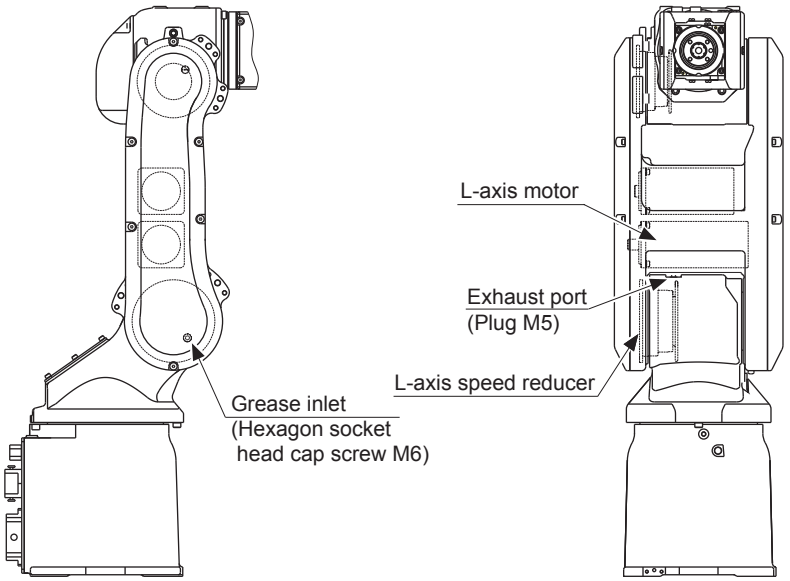
NOTE

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.

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 plug PT1/8 to the grease inlet and to the exhaust port.
   Apply Three Bond 1206C on the thread part of the plug.

9.3.3 Grease Replenishment for L-Axis Speed Reducer

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



9.3.3.1 Grease Replenishment

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

1. Remove the cover to unscrew the hexagon socket head cap screw M6 from the grease inlet and the plug M5 from the exhaust port.

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.

2. Install the grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is packed with the manipulator on the shipment.)
3. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 30cc

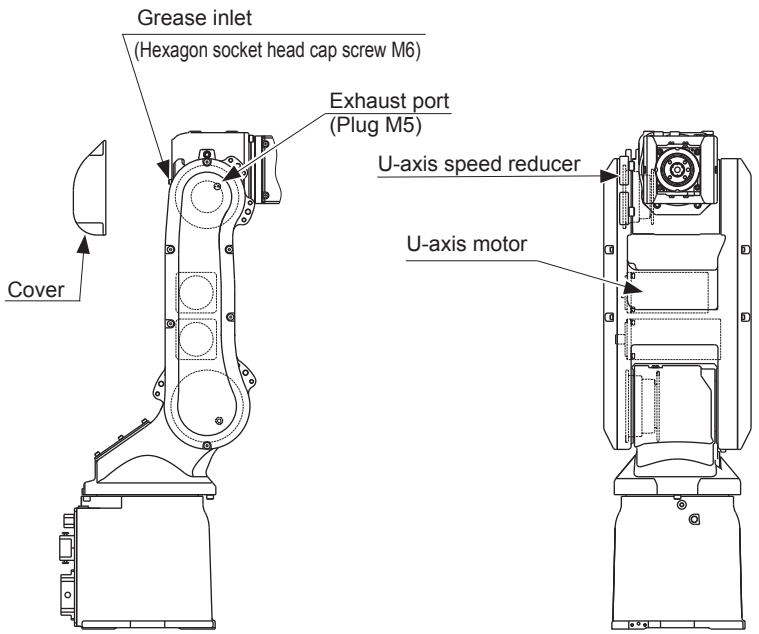
NOTE

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.

4. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet and reinstall the screw M6, and the plug M5 to the exhaust port before reinstalling the cover.
   Apply Three Bond 1206C on the thread part of the screw/plug.

9.3.4 Grease Replenishment for U-Axis Speed Reducer

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



9.3.4.1 Grease Replenishment

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

1. Remove the cover to unscrew hexagon socket head cap screw M6 from the grease inlet and the plug M5 from the exhaust port.

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.

2. Install the grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is packed with the manipulator on the shipment.)
3. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 20cc

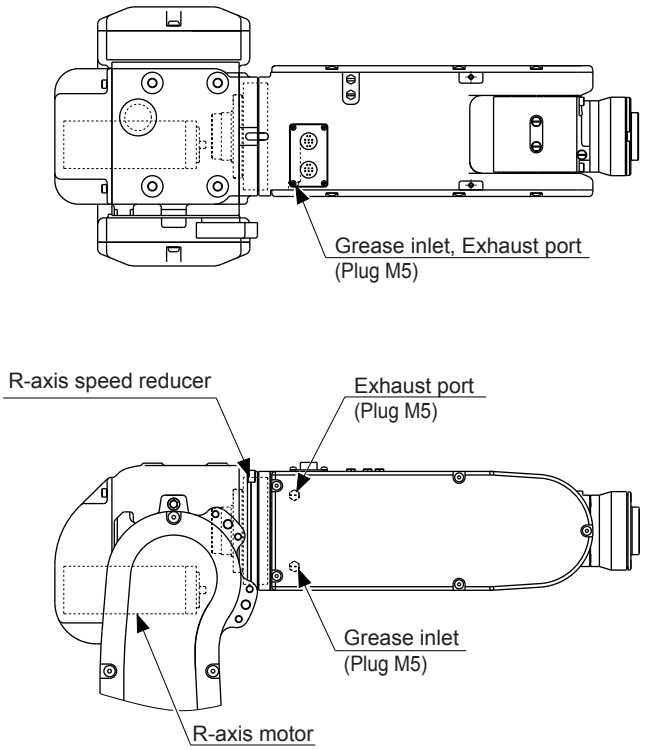
NOTE

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.

4. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet and reinstall the screw M6, and the plug M5 to the exhaust port before reinstalling the cover.
   Apply Three Bond 1206C on the thread part of the screw/plug.

9.3.5 Grease Replenishment for R-Axis Speed Reducer

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



9.3.5.1 Grease Replenishment

(Refer to *Fig. 9-8 "R-Axis Speed Reducer Diagram"*.)

1. Remove the cover to unscrew the plug M5 from exhaust port.

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.

2. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7cc

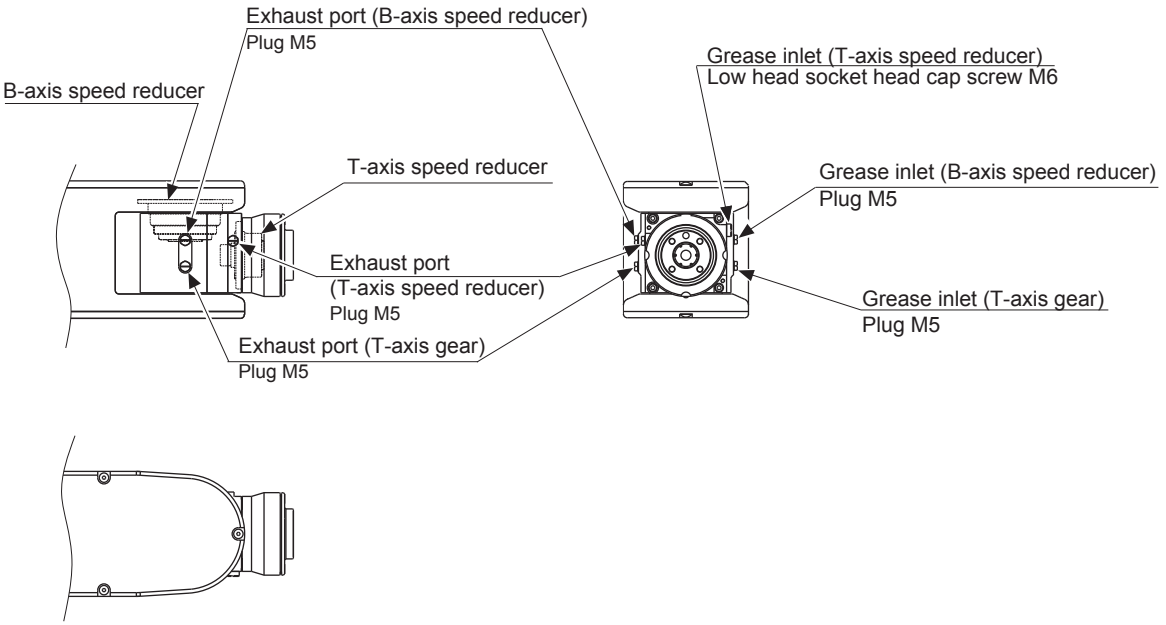
NOTE

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.

3. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet and reinstall the plug to the exhaust port before reinstalling the cover.
   Apply Three Bond 1206C on the thread part of the plug.

9.3.6 Grease Replenishment for B- and T-Axes Speed Reducers

Fig. 9-9: B- and T-Axes Speed Reducers Diagram



9.3.6.1 Grease Replenishment for B-axis

(Refer to "*Fig. 9-9 "B- and T-Axes Speed Reducers Diagram"*.)

1. Remove the cover to unscrew the plug M5 from the exhaust port.

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.

2. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 5cc

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.

3. Wipe the discharged grease with a cloth. Reinstall the plug to the exhaust port before reinstalling the cover.
   Apply Three Bond 1206C on the thread part of the plug.

9.3.6.2 Grease Replenishment for T-axis

(Refer to *Fig. 9-9 "B- and T-Axes Speed Reducers Diagram"*.)

1. Remove the plug M5 from the exhaust port and the low head socket head cap screw M6 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.

2. Install the grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is packed with the manipulator on the shipment.)
3. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 5cc

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.

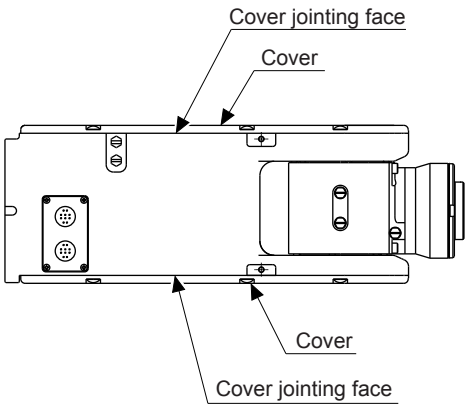
4. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet and reinstall the screw M6, and the plug M5 to the exhaust port.
   Apply Three Bond 1206C on the thread parts of the plug/screw.

9.3.7 Notes for Maintenance

9.3.7.1 Wrist Unit

The motor and encoder units are provided with the wrist unit. To prevent fumes from penetrating into the wrist unit, the jointed faces 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-MH00005-C00/YR-MH0005N-C00"*.

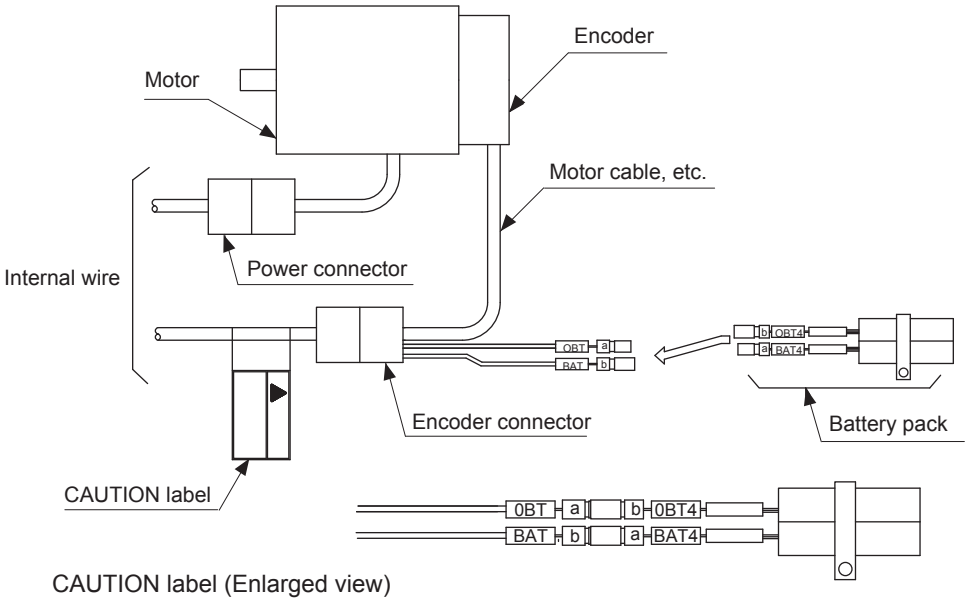
Fig. 9-10: Sealing Part of Wrist Unit



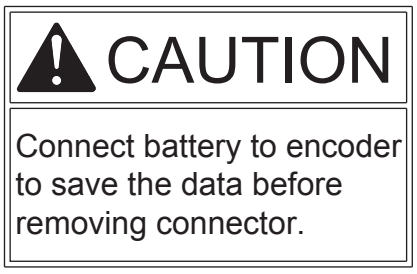
9.3.7.2 Battery Pack Connector (with CAUTION label)

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

Fig. 9-11: Encoder Connector Diagram (with CAUTION label)



CAUTION label (Enlarged view)



a: Crimped contact-pin (socket)
b: Crimped contact-pin (pin)

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-MH5. 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

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

Table 10-1: Spare Parts for the YR-MH00005-C00/YR-MH0005N-C00 (Sheet 1 of 2)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
A	1	Grease	Harmonic Grease SK-1A	Harmonic Drive Systems Co., Ltd.	2.5 kg	-	
A	2	Liquid Gasket	Three Bond 1206C	Three Bond Co., Ltd.	-	-	
A	3	Battery Pack	HW0470360-A	YASKAWA	1	1	
A	4	Battery Pack	HW9470932-A	YASKAWA	1	1	
B	5	L-Axis Timing Belt	100S5M305	Mitsuboshi Belting Ltd.	1	1	
B	6	U-Axis Timing Belt	100S5M390	Mitsuboshi Belting Ltd.	1	1	
B	7	R-Axis Timing Belt	060S3M219	Mitsuboshi Belting Ltd.	1	1	
B	8	BT-Axis Break Timing Belt	060S3M150	Mitsuboshi Belting Ltd.	1	2	
B	9	B-Axis Timing Belt	060S3M285	Mitsuboshi Belting Ltd.	1	1	
B	10	T-Axis Timing Belt	060S3M300	Mitsuboshi Belting Ltd.	1	1	
B	11	S-Axis Speed Reducer	HW0389176-A	YASKAWA	1	1	
B	12	L-Axis Speed Reducer	HW0388706-A	YASKAWA	1	1	
B	13	U-Axis Speed Reducer	HW0388707-A	YASKAWA	1	1	
B	14	R-Axis Speed Reducer	HW0388708-A	YASKAWA	1	1	
B	15	B-Axis Speed Reducer	HW0388709-A	YASKAWA	1	1	

Table 10-1: Spare Parts for the YR-MH00005-C00/YR-MH0005N-C00 (Sheet 2 of 2)

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
B	16	T-Axis Speed Reducer	HW0388710-A	YASKAWA	1	1	
B	17	Wire Harness in Manipulator	HW0175096-A	YASKAWA	1	1	
C	18	S-and L-Axes AC Servomotor	HW0388651-A SGMAV-04ANA-YR1*	YASKAWA	1	2	
C	19	U-Axis AC Servomotor	HW038650-A SGMAV-02ANA-YR1*	YASKAWA	1	1	
C	20	R-Axis AC Servomotor	HW0388708-1 SGMAV-A5ANA-YR1*	YASKAWA	1	1	
C	21	R- B-, and T-Axes AC Servomotor	HW0388794-A SGMAV-A5ANA-YR2*	YASKAWA	1	2	
C	22	B-and T-Axes Brake	HW0472643	YASKAWA	1	2	

11 Parts List

11.1 S-Axis Unit

Fig. 11-1: S-Axis Unit

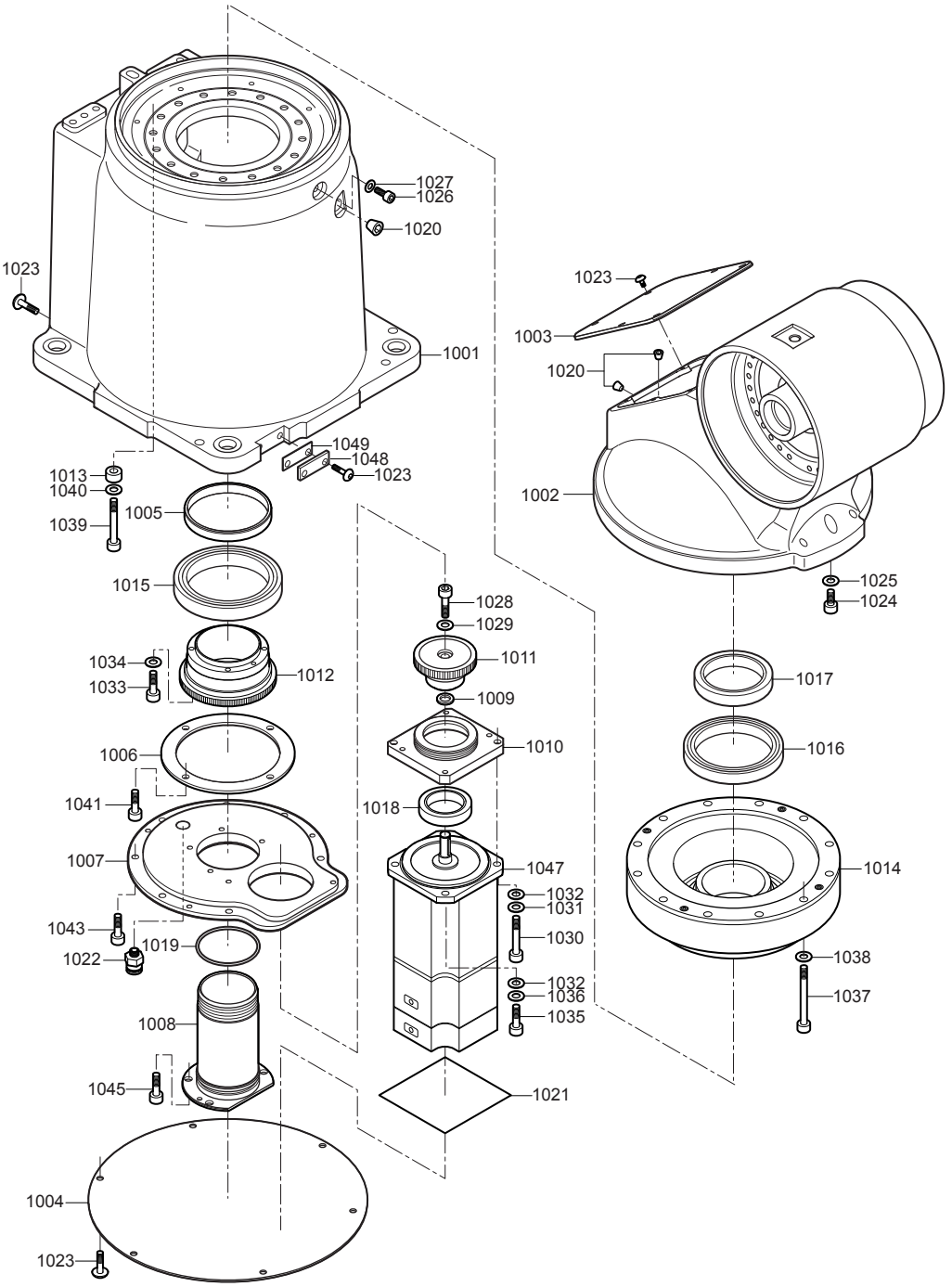


Table 11-1: S-Axis Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs
1001	HW0102487-1	Base	1
1002	HW0102486-1	S head	1
1003	HW0314329-1	Cover	1
1004	HW0314328-1	Cover	1
1005	HW0414024-1	Collar	1
1006	HW0414025-1	B holder	1
1007	HW0414034-1	M base	1
1008	HW0314319-1	Shaft	1
1009	HW0412383-1	Packing	1
1010	HW0414064-1	M base	1
1011	HW0314707-1	Gear	1
1012	HW0314708-2	Gear	1
1013	HW8411125-2	Washer	16
1014	HW0389176-A	Speed reducer	1
1015	6811LLU	Bearing	1
1016	6810VV	Bearing	1
1017	TC405208	Oil seal	1
1018	TC25X35X6FKM	Oil seal	1
1019	S39	O ring	1
1020	PT1/8	Plug	3
1021	HW9482404-A	Sheet	1
1022	POC6-01M	Union	1
1023	M4X10	Button bolt	22
1024	M8X16	Socket screw	1
1025	2H-8	Spring washer	1
1026	M6X8	Socket screw	1
1027	2H-6	Spring washer	1
1028	M5X16	Socket screw	1
1029	2H-5	Spring washer	1
1030	M4X25	Socket screw	2
1031	2H-4	Spring washer	2
1032	M4	Washer	4
1033	M3X30	Socket screw	6
1034	2H-3	Spring washer	6
1035	M4X14	Socket screw	2
1036	2H-4	Spring washer	2
1037	M5X40	Socket screw	12
1038	2H-5	Spring washer	12
1039	M5X30	Socket screw	16
1040	2H-5	Spring washer	16
1041	M4X10	GT-SA bolt	4
1043	M4X16	GT-SA bolt	7
1045	M4X12	GT-SA bolt	4

Table 11-1: S-Axis Unit (Sheet 2 of 2)

No.	DWG No.	Name	Pcs
1047	SGMAV-04ANA-YR11	Motor	1
1048	HW0414483-1	Cover	1
1049	HW0414484-1	Packing	1

11.2 L-, U-Axes Unit

Fig. 11-2: L-, U-Axes Unit

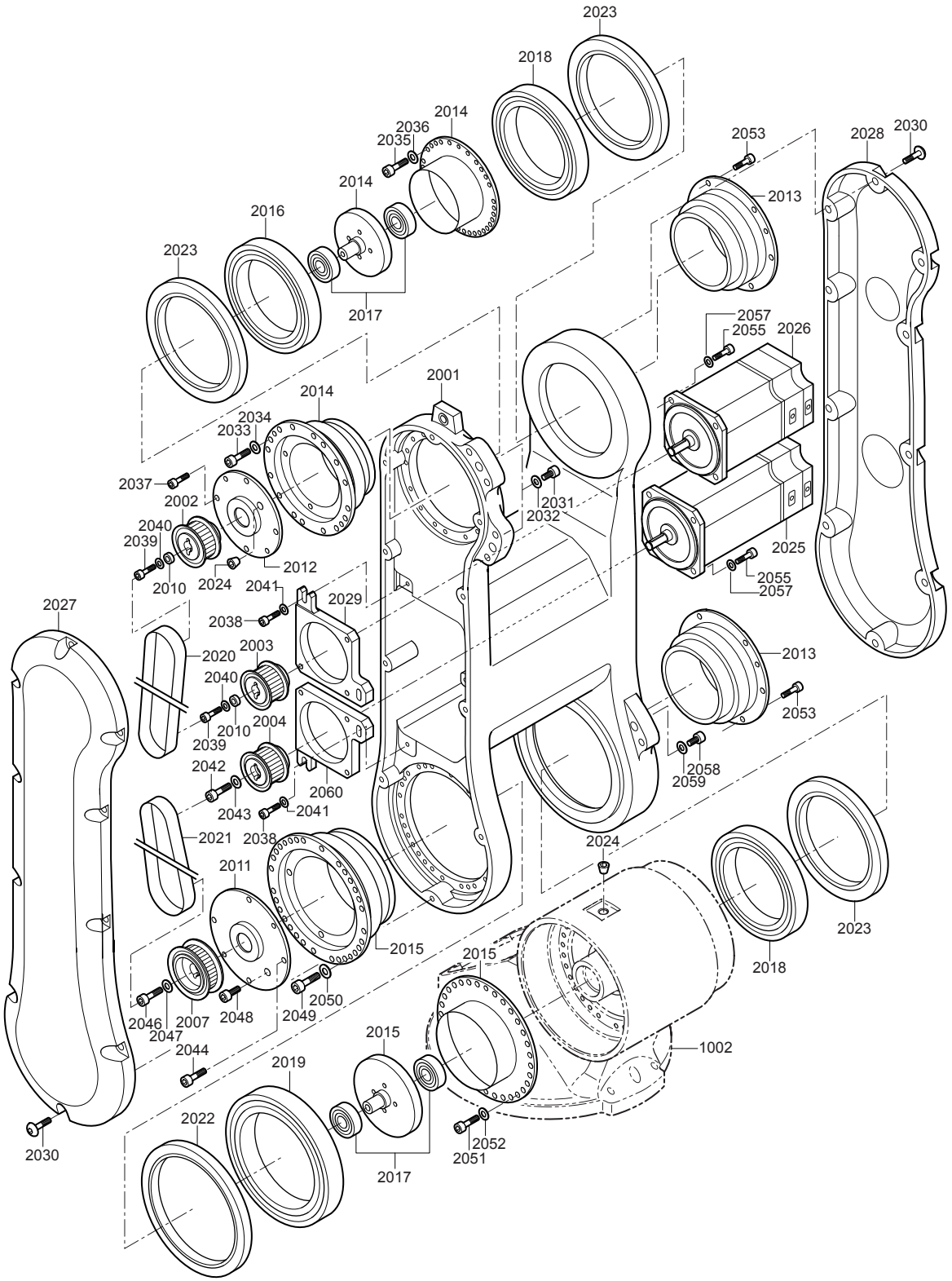


Table 11-2: L-, U-Axes Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs
2001	HW0102585-1	L arm	1
2002	HW0414073-A	Pulley	1
2003	HW0414072-A	Pulley	1
2004	HW0414070-B	Pulley	1
2007	HW0414071-B	Pulley	1
2010	HW8411125-1	Collar	2
2011	HW0408927-2	Housing	1
2012	HW0408928-2	Housing	1
2013	HW0408931-1	Housing	2
2014	HW0388707-A	Speed reducer	1
2015	HW0388706-A	Speed reducer	1
2016	6913DDU	Bearing	1
2017	6000ZZ	Bearing	4
2018	6913ZZ	Bearing	2
2019	6916DDU	Bearing	1
2020	100S5M390	Belt	1
2021	100S5M305	Belt	1
2022	SC901107	Oil seal	1
2023	SC751007	Oil seal	3
2024	LP-M5	Plug	2
2025	SGMAV-04ANA-YR11	Motor	1
2026	SGMAV-02A2A-YR11	Motor	1
2027	HW0200555-1	Cover	1
2028	HW0200555-2	Cover	1
2029	HW0414027-1	M base	1
2030	M5X10	Button bolt	20
2031	M8X16	Socket screw	2
2032	2H-8	Spring washer	2
2033	M4X14	Socket screw	16
2034	2H-4	Spring washer	16
2035	M3X10	Socket screw	32
2036	2H-3	Spring washer	32
2037	M4X10	GT-SA bolt	4
2038	M4X16	GT-SA bolt	4
2039	M4X18	Socket screw	2
2040	2H-4	Spring washer	2
2041	M4	Washer	4
2042	M5X16	Socket screw	1
2043	2H-5	Spring washer	1
2044	M4X10	GT-SA bolt	4
2046	M5X20	Socket screw	1
2047	2H-5	Spring washer	1
2048	M6X8	Socket screw	1
2049	M4X12	Socket screw	29

Table 11-2: L-, U-Axes Unit (Sheet 2 of 2)

No.	DWG No.	Name	Pcs
2050	CDW4L	Spring washer	29
2051	M4X16	Socket screw	30
2052	2H-4	Spring washer	30
2053	M4X10	GT-SA bolt	12
2055	M4X16	GT-SA bolt	8
2057	M4	Washer	8
2058	M8X16	Socket screw	2
2059	2H-8	Spring washer	2
2060	HW0414027-2	M base	1
1002	HW0102486-1	S head	1

11.3 R-Axis Unit

Fig. 11-3: R-Axis Unit

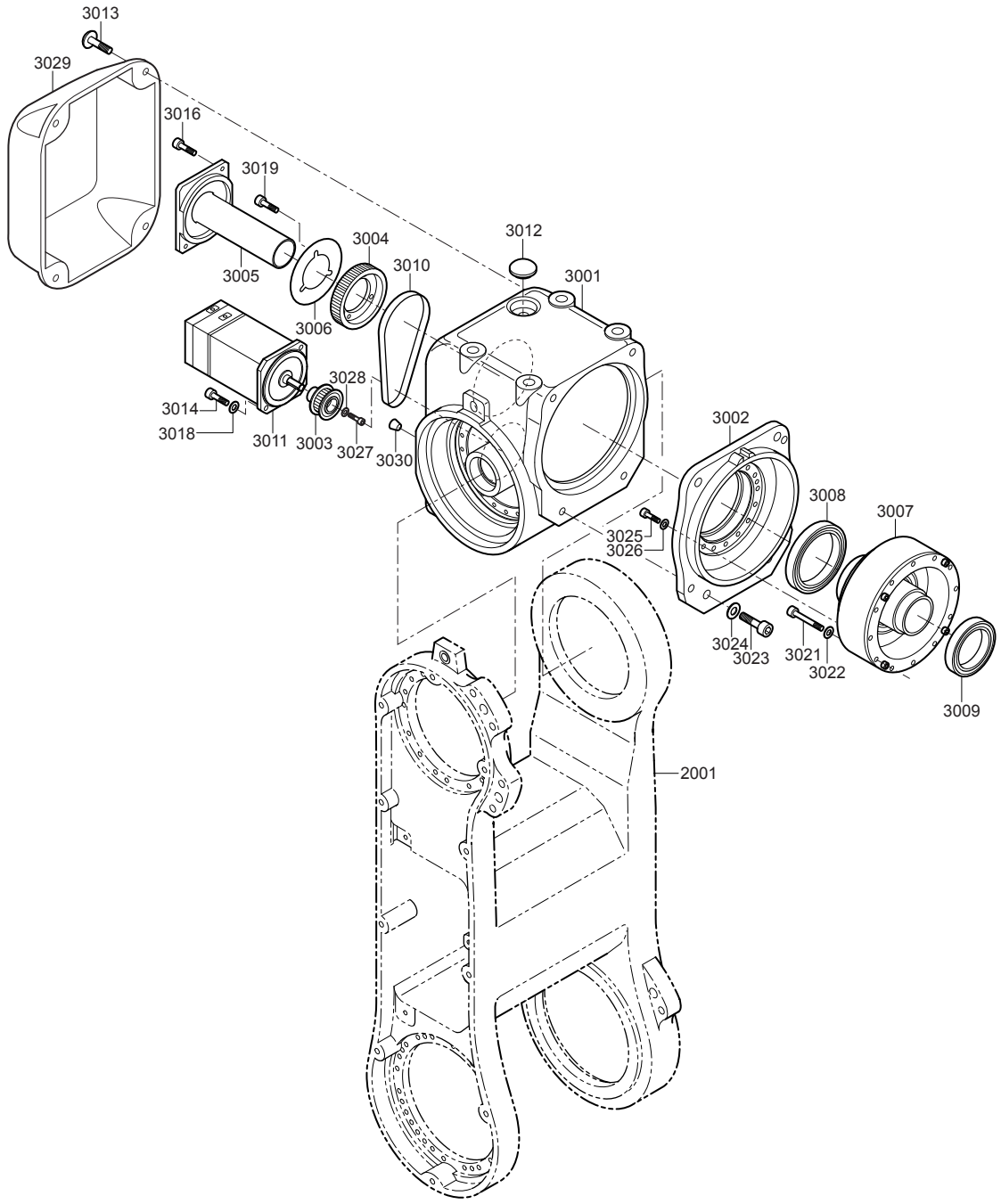


Table 11-3: R-Axis Unit

No.	DWG No.	Name	Pcs
3001	HW0102484-1	Casing	1
3002	HW0314334-1	Housing	1
3003	HW0414074-A	Pulley	1
3004	HW0483421-B	Pulley	1
3005	HW9406285-E	Pipe	1
3006	HW9406278-2	Washer	1
3007	HW0388708-A	Speed reducer	1
3008	6808ZZ	Bearing	1
3009	6806ZZ	Bearing	1
3010	060S3M219	Belt	1
3011	SGMAV-A5ANA-YR11	Motor	1
3012	OB-31	Plug	1
3013	M4X10	Button bolt	4
3014	M3X12	GT-SA bolt	2
3016	M3X12	GT-SA bolt	2
3018	M3	Washer	2
3019	M3X10	GT-SA bolt	3
3021	M3X30	Socket screw	12
3022	2H-3	Spring washer	12
3023	M6X16	Socket screw	4
3024	2H-6	Spring washer	4
3025	M3X20	Socket screw	16
3026	2H-3	Spring washer	16
3027	M3X12	Socket screw	1
3028	2H-3	Spring washer	1
3029	HW0201198-1	Cover	1
3030	LP-M5	Plug	1
2001	HW0102485-1	L arm	1

11.4 Wrist Unit

Fig. 11-4: Wrist Unit

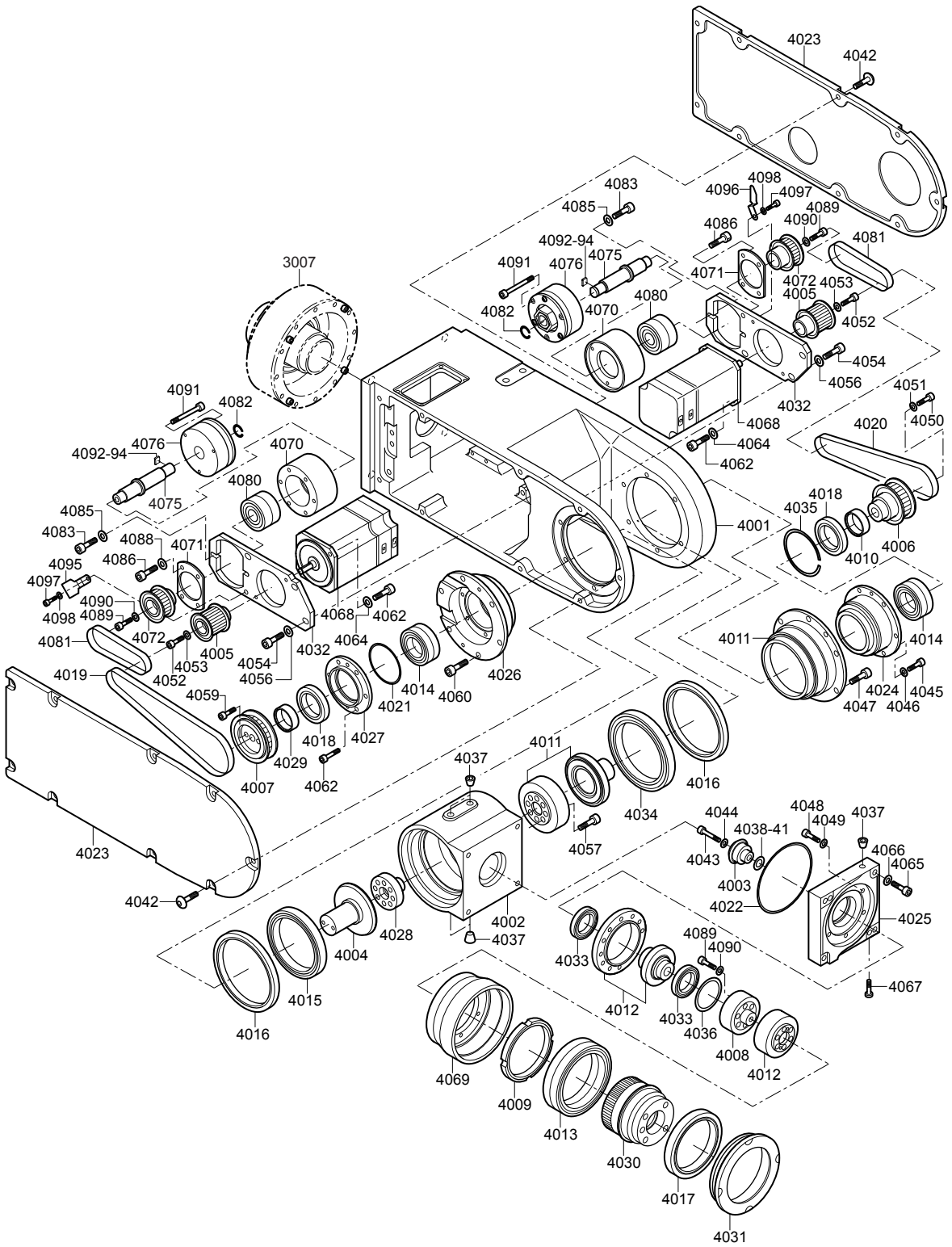


Table 11-4: Wrist Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs
4001	HW0102483-1	U arm	1
4002	HW0313997-1	Wrist base	1
4003	HW0388712-A	Gear	1
4004	HW0388711-A	Gear	1
4005	HW0414075-A	Pulley	2
4006	HW0414076-A	Pulley	1
4007	HW0414078-A	Pulley	1
4008	HW9406260-1	Housing	1
4009	HW9406266-1	B nut	1
4010	HW0414031-1	Collar	1
4011	HW0388709-A	Speed reducer	1
4012	HW0388710-A	Speed reducer	1
4013	HW9480739-B	Bearing	1
4014	6903ZZ	Bearing	4
4015	6809ZZ	Bearing	1
4016	TC56665	Oil seal	2
4017	AB2551E0	Oil seal	1
4018	SC20304	Oil seal	2
4019	060S3M300	Belt	1
4020	060S3M285	Belt	1
4021	S31.5	O ring	1
4022	S56	O ring	1
4023	HW0201199-1	Cover	2
4024	HW0314324-1	Shaft	1
4025	HW0314348-1	Housing	1
4026	HW0414067-1	Flange	1
4027	HW0414065-1	B holder	1
4028	HW0414066-1	Housing	1
4029	HW0414032-1	Collar	1
4030	HW0314333-1	M base	1
4031	HW0414028-1	B nut	1
4032	HW0414079-1	M base	2
4033	6803ZZ	Bearing	2
4034	6810VV	Bearing	1
4035	RTW-30	Retaining rings	1
4036	IRTW-26	Retaining rings	1
4037	LP-M5	Plug	5
4038	SPS-010005	Shim	1
4039	SP-009010	Shim	1
4040	SP-009015	Shim	1
4041	SP-009020	Shim	1
4042	M4X10	Button bolt	18
4043	M4X20	Socket screw	1
4044	2H-4	Spring washer	1

Table 11-4: Wrist Unit (Sheet 2 of 2)

No.	DWG No.	Name	Pcs
4045	M3X10	Socket screw	6
4046	2H-3	Spring washer	6
4047	M4X10	GT-SA bolt	6
4048	M3X12	Socket screw	6
4049	2H-3	Spring washer	6
4050	M4X20	Socket screw	1
4051	2H-4	Spring washer	1
4052	M3X16	Socket screw	2
4053	2H-3	Spring washer	2
4054	M4X16	GT-SA bolt	6
4056	M4	Washer	6
4057	M4X16	Socket screw	8
4059	M3X10	GT-SA bolt	2
4060	M4X10	GT-SA bolt	6
4062	M3X12	GT-SA bolt	10
4064	M3	Washer	4
4065	M4X10	GT-SA bolt	4
4067	CBSTS6-6	Socket screw	1
4068	SGMAV-A5ANA-YR21	Motor	2
4069	HW0414026-1	Housing	1
4070	HW0314323-1	Housing	2
4071	HW0414080-1	B holder	2
4072	HW0414077-A	Pulley	2
4075	HW0414030-1	Shaft	2
4076	HW0472643-A	Break	2
4080	6000ZZ	Bearing	4
4081	060S3M150	Belt	2
4082	STW-8	Retaining rings C-type	2
4083	M3X12	GT-SA bolt	4
4085	M3	Washer	4
4086	M3X10	GT-SA bolt	8
4089	M4X12	Socket screw	2
4090	2H-4	Spring washer	2
4091	M2.5X25	Socket screw	6
4092	HW0414829-1	Shim	2
4093	HW0414829-2	Shim	2
4094	HW0414829-3	Shim	2
4095	HW0414824-1	Cover	1
4096	HW0414825-1	Cover	1
4097	M4X6	Socket screw	2
4098	2H-4	Spring washer	2
3007	HW0388708-A	Speed reducer	1

MOTOMAN-MH5
INSTRUCTIONS

HEAD OFFICE
2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone +81-93-645-7703 Fax +81-93-645-7802

YASKAWA America Inc. (Motoman Robotics Division)
100 Automation Way, Miamisburg, OH 45342, U.S.A.
Phone +1-937-847-6200 Fax +1-937-847-6277

YASKAWA Europe GmbH（Robotics Divsion ）
Yaskawastrasse 1, 85391 Allershausen, Germany
Phone +49-8166-90-100 Fax +49-8166-90-103

YASKAWA Nordic AB
Verkstadsgatan 2, Box 504 ,SE-385 25 Torsas, Sweden
Phone +46-480-417-800 Fax +46-486-414-10

YASKAWA Electric (China) Co., Ltd.
22F, One Corporate Avenue, No.222, Hubin Road, Huangpu District, Shanghai 200021, China
Phone +86-21-5385-2200 Fax ＋86-21-5385-3299

YASKAWA SHOUGANG ROBOT Co. Ltd.
No7 Yongchang North Road, Beijing E&T Development Area, China 100176
Phone +86-10-6788-2858 Fax +86-10-6788-2878

YASKAWA India Private Ltd. (Robotics Division)
#426, Udyog Vihar, Phase- IV, Gurgaon, Haryana, India
Phone +91-124-475-8500 Fax +91-124-475-8542

YASKAWA Electric Korea Corporation
35F, Three IFC, 10 Gukjegeumyung-ro, Yeongdeungpo-gu, Seoul, Korea 07326
Phone +82-2-784-7844 Fax +82-2-784-8495

YASKAWA Electric Taiwan Corporation
12F, No.207, Sec. 3, Beishin Rd., Shindian District, New Taipei City 23143, Taiwan
Phone +886-2-8913-1333 Fax +886-2-8913-1513

YASKAWA Electric (Singapore) PTE Ltd.
151 Lorong Chuan, #04-02A, New Tech Park, Singapore 556741
Phone +65-6282-3003 Fax +65-6289-3003

YASKAWA Electric (Thailand) Co., Ltd.
59,1st-5th Floor, Flourish Building, Soi Ratchadapisek 18,Ratchadapisek Road,
Huaykwang, Bangkok 10310, THAILAND
Phone +66-2-017-0099 Fax +66-2-017-0199

PT. YASKAWA Electric Indonesia
Secure Building-Gedung B Lantai Dasar & Lantai 1 JI. Raya Protokol Halim Perdanakusuma,
Jakarta 13610, Indonesia
Phone +62-21-2982-6470 Fax +62-21-2982-6741