Motoman NX100 Controller

HP3
Manipulator Manual

Part Number: 149209-1CD
Revision: 0

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Chapter 1
Introduction

The Motoman HP3 and NX controller represent state-of-the-art technology in robotics today. The Motoman HP3 is a high speed robot with a 3 kg payload. The robot has six individual axes: Sweep, Lower arm, Upper arm, Rotate, Bend, and Twist. The NX controller coodinates the operation of the robot with external equipment such as power supply and positioning tables. The NX controller processes input and output signals, maintains variable data, and performs numeric processing to convert to and from different coordinate systems. Furthermore, it provides main logic functions, servo control, program and constant data memory, and power distribution. Please read this manual thoroughly to familiarize yourself with the many aspects of the robot and NX controller.

1.1 About This Document

This manual provides system information for the HP3 robot and NX controller and contains the following sections:

SECTION 1 - INTRODUCTION
Provides general information about the structure of this manual, a list of reference documents, and customer service information.

SECTION 2 - SAFETY
This section provides information regarding the safe use and operation of Motoman products.

SECTION 3 - HP3 INSTRUCTIONS
Provides detailed information about the HP3 robot, including installation, wiring, specifications, and maintenance.

1.2 Reference to Other Documentation

For additional information refer to the following:

- NX100 Controller Manual (P / N 149201-1)
- Concurrent I / O Manual (P / N 149230-1)
- Operator's Manual for your application
- Vendor manuals for system components not manufactured by Motoman

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (HP3)
- Application Type (arcwelding, spot welding, handling)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on back of controller)

Chapter 2
Safety

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06-1999. The address is as follows:

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

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming, Operation, and Maintenance Safety (Section 2.6)

2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.

DANGER!
Information appearing in a DANGER concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

WARNING!
Information appearing in a WARNING concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

CAUTION!
Information appearing in a CAUTION concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

Note: Information appearing in a Note provides additional information which is helpful in understanding the item being explained.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot 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 robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, 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).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's 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 R15.06-1999 safety standards, and other local codes that may pertain to the installation and use of industrial 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 fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot 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 robot should be permitted to program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope 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.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot 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 PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.
- The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.
- Check and test any new or modified program at low speed for at least one full cycle.
- 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 robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

NOTES

MOTOMAN-HP3
INSTRUCTIONS

TYPE: YR-HP3-A00 (STANDARD SPECIFICATION)

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

MOTOMAN INSTRUCTIONS

MOTOMAN-HP3 INSTRUCTIONS
NX100 INSTRUCTIONS
NX100 OPERATOR'S MANUAL
NX100 MAINTENANCE MANUAL

The NX100 operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual.

YASKAWA

MANUAL NO.
HW0482107 ①

MANDATORY

- **This instruction manual is intended to explain operating instructions and maintenance procedures primarily for the MOTOMAN-HP3.**
- **General items related to safety are listed in the Section 1: Safety of the NX100 instructions. To ensure correct and safe operation, carefully read the NX100 instructions before reading this manual.**

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.**

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-HP3 and the NX100.
In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.

 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 “CAUTION” and “WARNING”.

WARNING

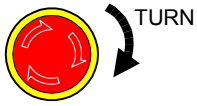
- **Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 and programing pendant are pressed.**
  When the servo power is turned OFF, the SERVO ON LED on the programing pendant is turned OFF.

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

  Emergency Stop Button 

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

  Injury may result from unintentional or unexpected manipulator motion.

  Release of Emergency Stop 

- **Observe the following precautions when performing teaching operations within the working envelope of the manipulator:**
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

  Improper or unintended manipulator operation may result in injury.

- **Confirm that no persons are present in the manipulator's work envelope and that you are in a safe location before:**
  - Turning on the NX100 power.
  - Moving the manipulator with the programing pendant.
  - Running check operations.
  - Performing automatic operations.

  Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.
  The emergency stop button is located on the right of the front door of the NX100 and programing 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 programing pendant to the hook on the NX100 cabinet after use.**

  The programing pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- **Read and understand the Explanation of the Warning Labels in the NX100 instructions before operating the manipulator.**

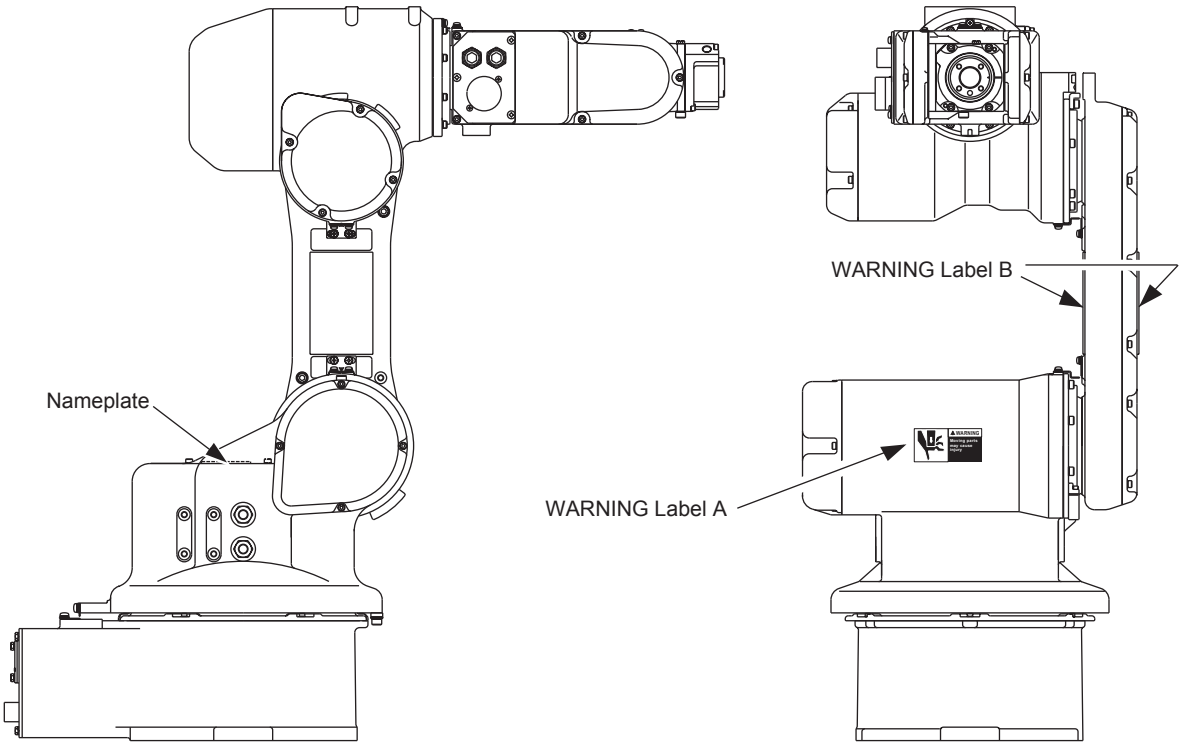
Definition of Terms Used Often in This Manual

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

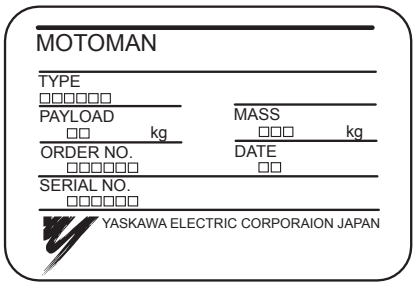
Equipment	Manual Designation
NX100 Controller	NX100
NX100 Programing Pendant	Programing Pendant
Cable between the manipulator and controller	Manipulator Cable

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.



Nameplate



WARNING Label A:

WARNING Label B:

11 Parts List

1 Product Confirmation

CAUTION

- **Confirm that the manipulator and the NX100 have the same order number. Special care must be taken when more than one manipulator is to be installed.**

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

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
- NX100
- Programing Pendant
- Manipulator Cable (2 cables)

1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the NX100. The order number is located on a label as shown below.

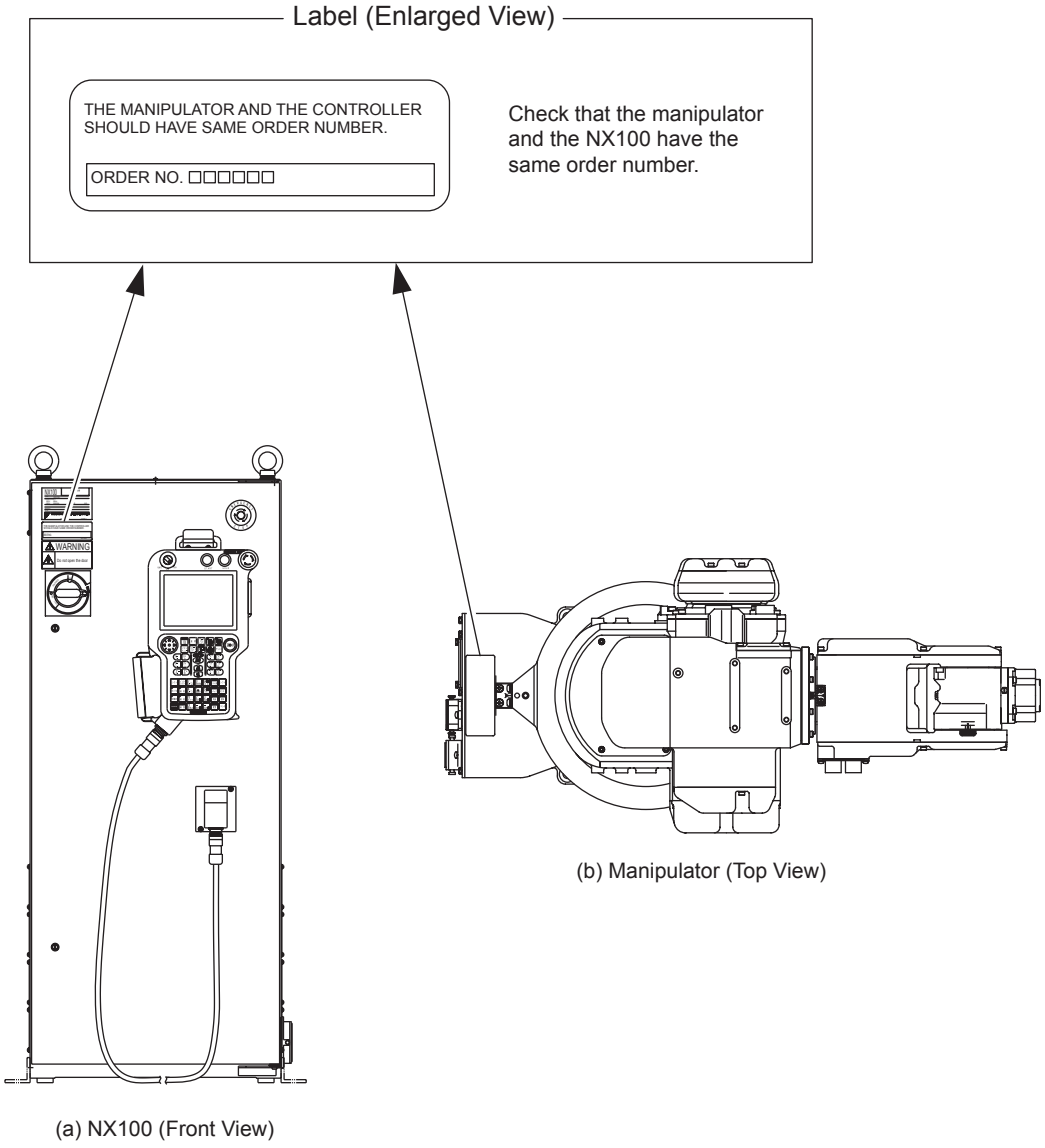


Fig. 1 Location of Order Number Labels

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.**

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

2.1 Transporting Method

NOTE

- Check that the eyebolts are securely fastened.
- The weight of the manipulator is approximately 47 kg 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, when removing the manipulator from the package and moving it, a crane should be used. The manipulator should be lifted using wire rope.
Be sure the manipulator is fixed with the shipping bolts and brackets before transporting, and lift it in the posture as shown in " Fig. 2 Transporting Position ".

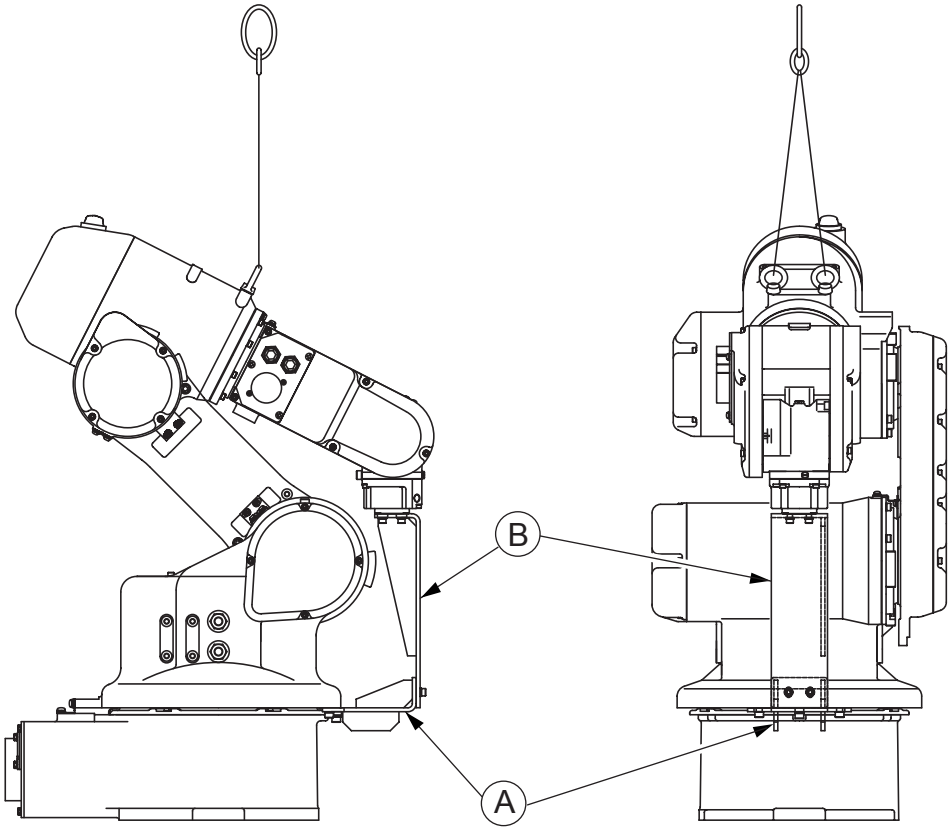


Fig. 2 Transporting Position

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. 3 Using a Forklift ". Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator. Transporting of the manipulator must be performed slowly in order to avoid overturning or slippage.

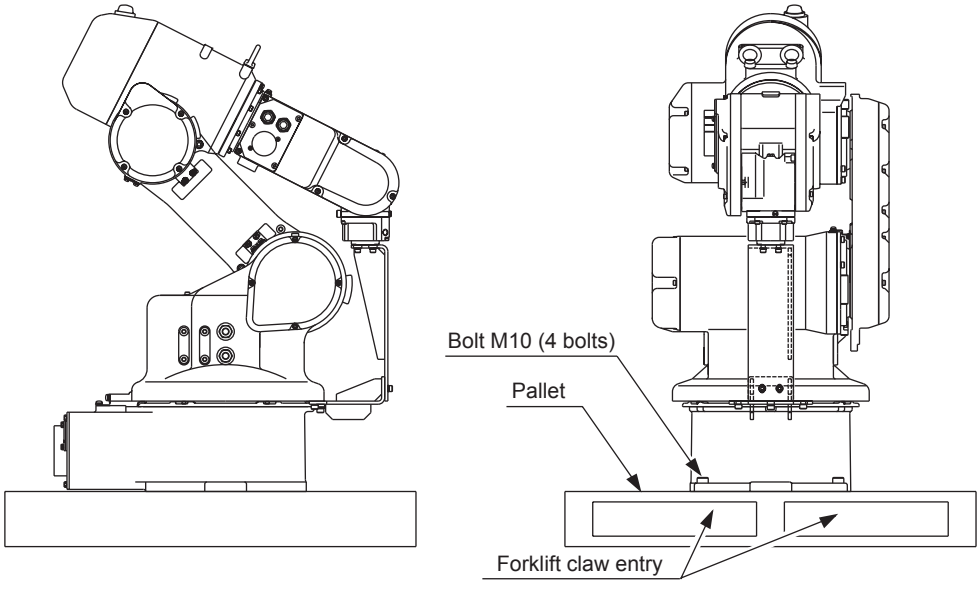


Fig. 3 Using a Forklift

2.2 Shipping Bolts and Brackets

The manipulator is equipped with shipping bolts and brackets A and B in " Fig. 2 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: 15 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

NOTE Before turning ON the power, check to be sure that the shipping bolts and brackets have been removed. The shipping bolts and brackets then must be stored for future use, in the event that the robot 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 manipulator's tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or NX100 when the arm is fully extended.**

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

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

  The manipulator may overturn and cause injury or damage.

- **When mounting the manipulator on the ceiling or wall, the base section must have sufficient strength and rigidity to support the 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 " 2.2 Shipping Bolts and Brackets " 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. 1 Maximum Repulsion Forces of the Manipulator at Emergency Stop " and " Table. 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 " 3.2.1 Mounting Example " in principle.

Table. 1 Maximum Repulsion Forces of the Manipulator at Emergency Stop

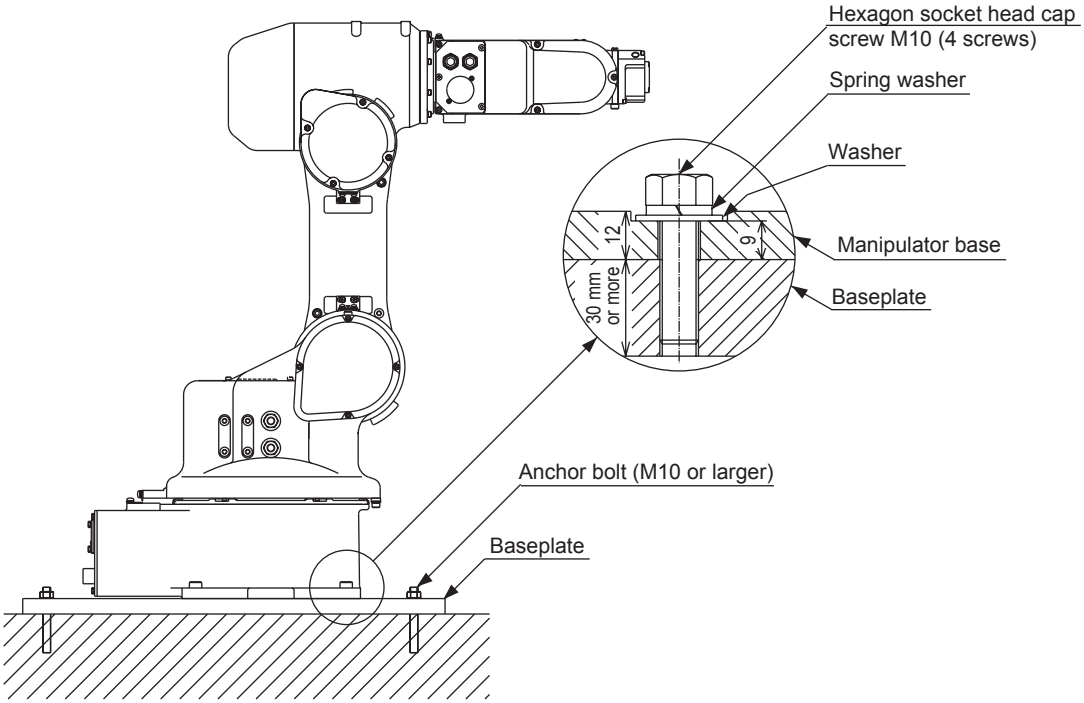
Horizontal rotating maximum torque (S-axis moving direction)	500 N • m (51.0 kgf• m)
Vertical rotating maximum torque (LU-axis moving direction)	700 N • m (71.4 kgf• m)

Table. 2 Endurance Torque in Operation

Endurance torque in horizontal operation (S-axis moving direction)	157 N • m (16.0 kgf • m)
Endurance torque in vertical operation (LU-axes moving direction)	285 N • m (29.1 kgf • m)

3.2.1 Mounting Example

Fix the baseplate onto the floor. The baseplate should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommended to prepare a baseplate in 30 mm or more thick, and anchor bolts in M10 or larger size.
Securely fix the manipulator base onto the baseplate with the hexagon socket head cap screws M10 (recommended length: 35 mm). Tighten the screws and anchor bolts securely so that they will not be loosened during operation. See " Fig. 4 Installation Example " for the method.



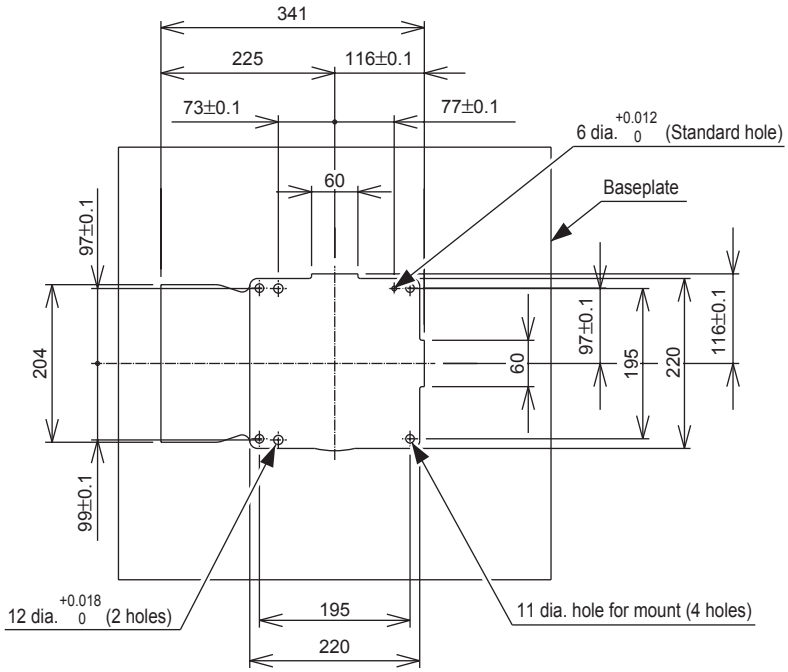


Fig. 4 Installation Example

3.3 Types of Mounting

The manipulator can be mounted in three different ways: floor-mounted (standard), wall-mounted, and ceiling-mounted types are available. For wall- and ceiling-mounted types, the following points are different from the floor-mounted types.

- S-Axis Operating Range
- Fixing 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 must be ±30°. (Adjusted prior to the shipment.)

3.3.2 Fixing the Manipulator Base

For the wall- or ceiling-mounted types, be sure to use four hexagon socket head cap screws M10 when fixing the manipulator base. Use a torque of 48N·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. 5 Precaution against Falling " for details.

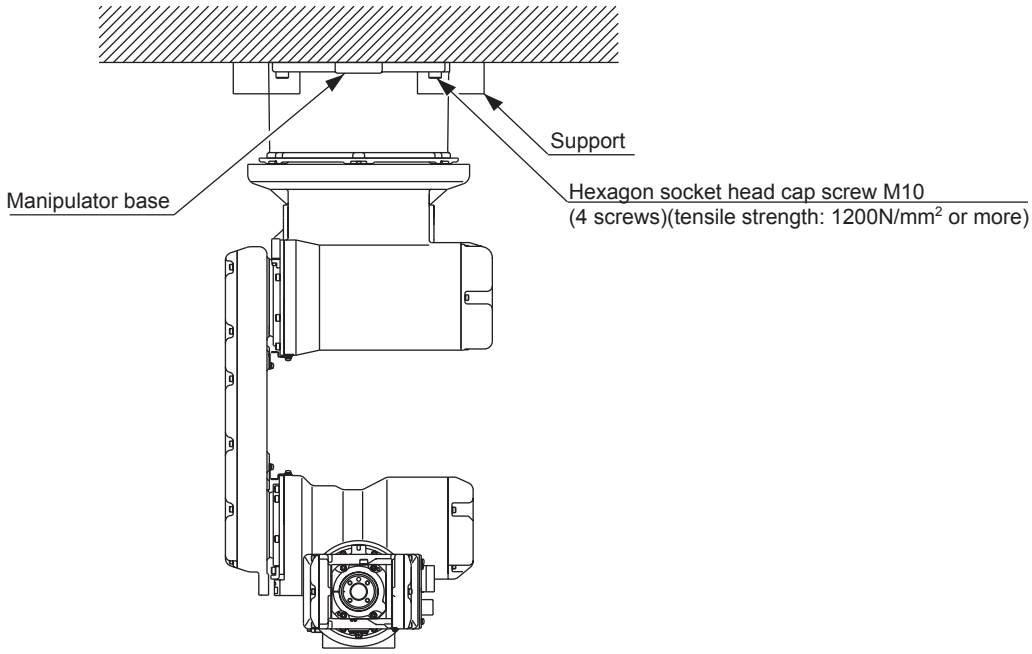


Fig. 5 Precaution against Falling

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 undermentioned environmental conditions:

- Ambient Temperature: 0° to +45°C
- Humidity: 20 to 80%RH (at constant temperature)
- Free from dust, soot, or water
- Free from corrosive gas or liquid, or explosive gas
- 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 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 the local regulations and electrical installation standards for grounding. The recommended grounding wire size is 5.5 mm^2 at minimum.
For grounding, connect the ground wire directly to the manipulator as in " Fig. 6 Grounding Method ".

NOTE
- Do not use this line in common with other ground wires 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 the local electrical installation standards.

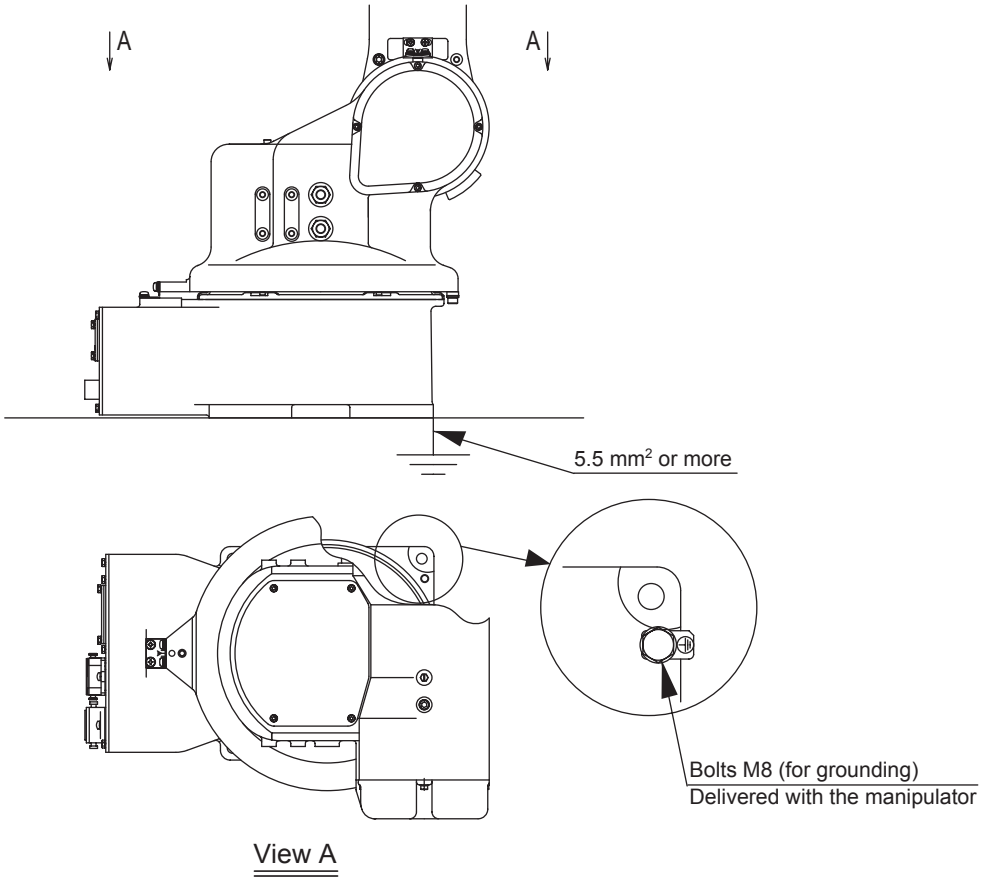


Fig. 6 Grounding Method

4.2 Cable Connection

Two manipulator cables are provided; a signal cable (1BC) and a power cable (2BC). Connect these cables to the manipulator base connectors and to the NX100. Refer to " Fig. 8 (a) Details of the Manipulator Cable Connectors (Manipulator Side) " and " Fig. 8 (b) Manipulator Cable Connections to the NX100 ".

4.2.1 Connection to the Manipulator

Before connecting the manipulator cables to the manipulator, verify the numbers: 1BC and 2BC on both the cables and the manipulator base connectors. Connect 2BC first, and then connect 1BC. After inserting the cables, set the lever low until it clicks.

4.2.2 Connection to the NX100

Before connecting the manipulator cables to the NX100, verify the numbers: X11 and X21 on both the cable connectors on NX100 side and the connectors on NX100. Connect X21 first, and then connect X11. After inserting the cables, set the lever low until it clicks.

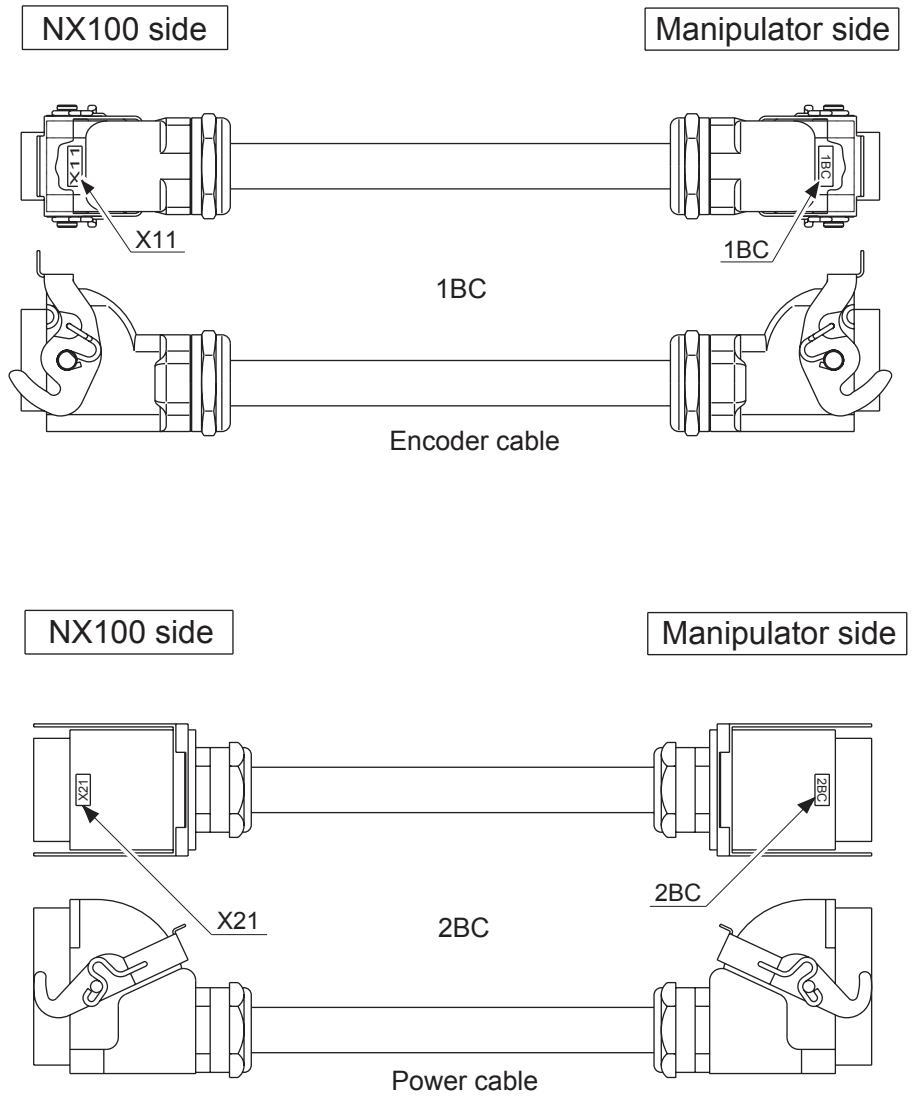


Fig. 7 Manipulator Cable Connections

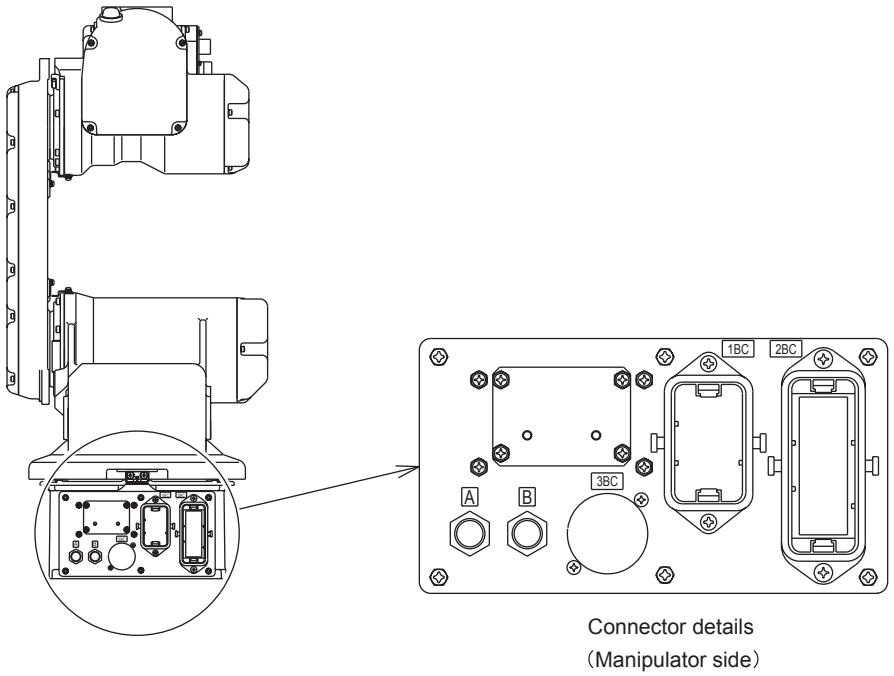


Fig. 8 (a) Details of the Manipulator Cable Connectors (Manipulator Side)

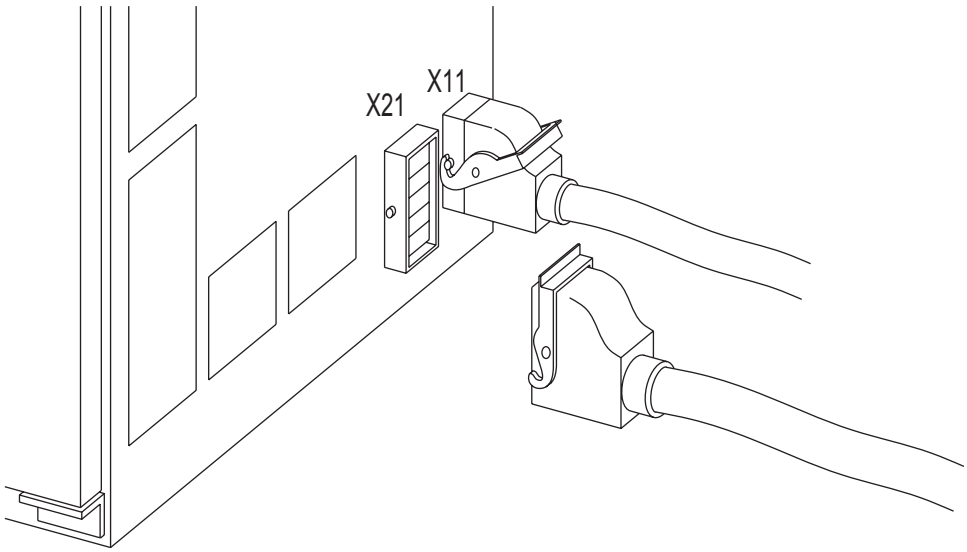


Fig. 8 (b) Manipulator Cable Connections to the NX100

5 Basic Specifications

5.1 Basic Specifications

Table. 3 Basic Specifications*1

Operation Mode		Vertically Articulated
Degree of Freedom		6
Payload		3 kg
Repetitive Positioning Accuracy*2		±0.03 mm
Motion Range	S-Axis (turning)	±170°
	L-Axis (lower arm)	+150°, -45°
	U-Axis (upper arm)	+210°, -152°
	R-Axis (wrist roll)	±190°
	B-Axis (wrist pitch/yaw)	±125°
	T-Axis (wrist twist)	±360°
Maximum Speed	S-Axis	3.66 rad/s, 210° /s
	L-Axis	3.14 rad/s, 180° /s
	U-Axis	3.93 rad/s, 225° /s
	R-Axis	6.54 rad/s, 375° /s
	B-Axis	6.54 rad/s, 375° /s
	T-Axis	8.73 rad/s, 500° /s
Allowable Moment*3	R-Axis	7.25 N•m (0.74 kgf•m)
	B-Axis	7.25 N•m (0.74 kgf•m)
	T-Axis	5.21 N•m (0.53 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
Mass		45 kg
Ambient Conditions	Temperature	0 to 45°C
	Humidity	20 to 80% RH (at constant temperature)
	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 Refer to " 6.1 Allowable Wrist Load " for details on the permissible moment of inertia.

5.2 Part Names and Working Axes

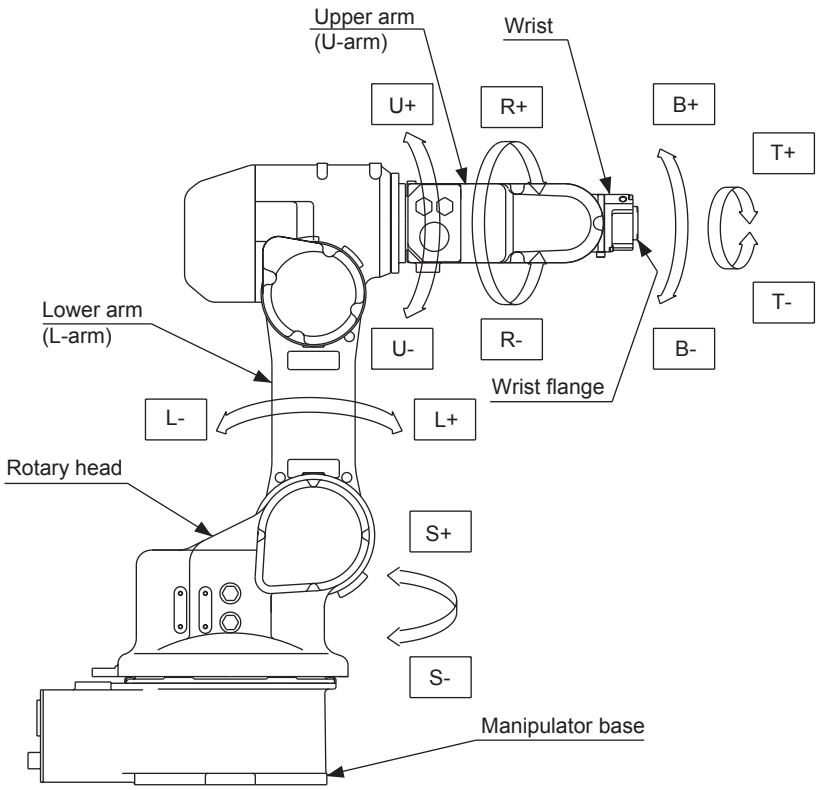


Fig. 9 Part Names and Working Axes

5.3 Baseplate Dimensions

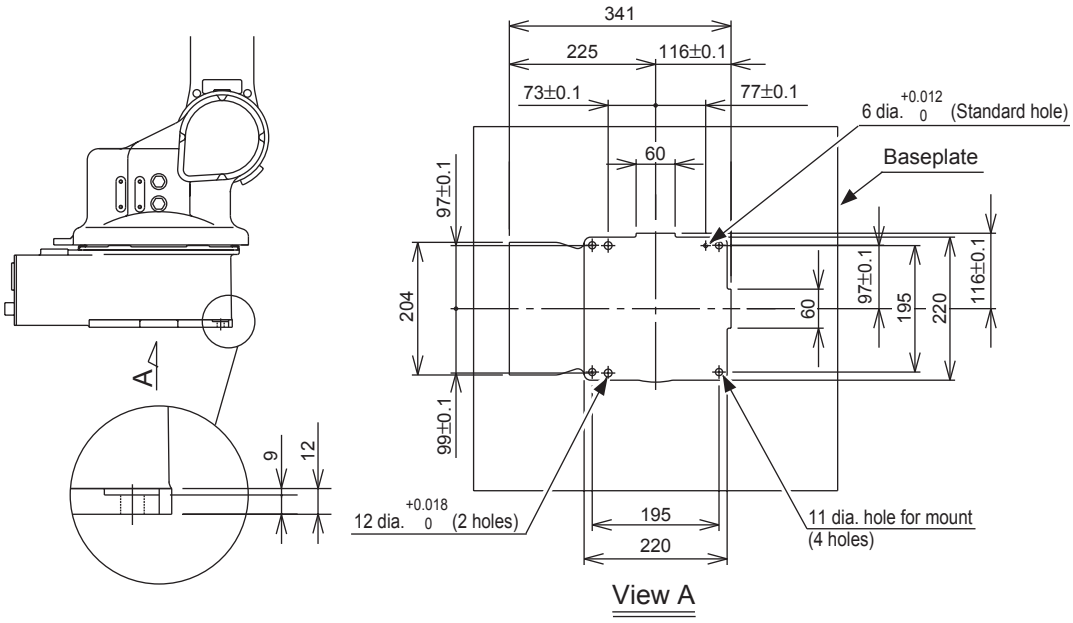


Fig. 10 Baseplate Dimensions

5.4 Dimensions and P-Point Maximum Envelope

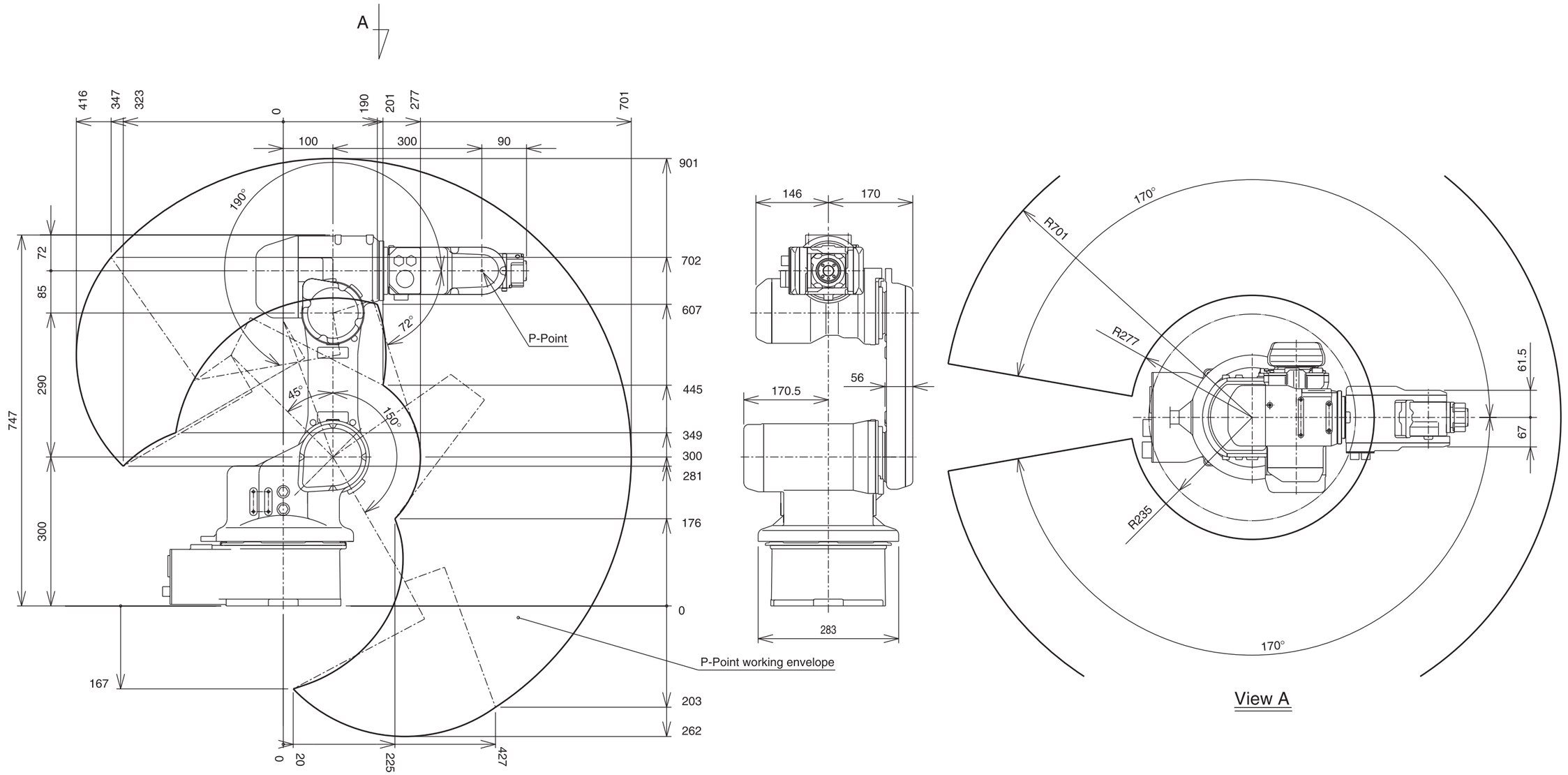


Fig. 11 Dimensions and P-Point Maximum Envelope

5.5 Alterable Operating Range

The operating range of the S-Axis can be altered as shown in " Table. 4 S-Axis Operating Range " in accordance with the operating conditions. If alteration is required, contact your Yaskawa representative in advance.

Table. 4 S-Axis Operating Range

Item	Specifications
S-Axis Working 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. 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. 5 Moment and Total Inertia ". Contact your Yaskawa representative for further information or assistance.

Table. 5 Moment and Total Inertia

Axis	Moment N•m (kgf•m)*1	$GD^2/4$ Total Inertia kg•m^2
R-Axis	7.25 (0.74)	0.30
B-Axis	7.25 (0.74)	0.30
T-Axis	5.21 (0.53)	0.10

*1 ( ): Gravitational unit

When the volume load is small, refer to the moment arm rating shown in " Fig. 12 Moment Arm Rating ".
The allowable total inertia is calculated when the moment is at the maximum. Contact your Yaskawa representative when only inertia moment, or load moment is small while inertia moment is large. Also contact your Yaskawa representative in advance in a case where the load mass is combined with an external force.

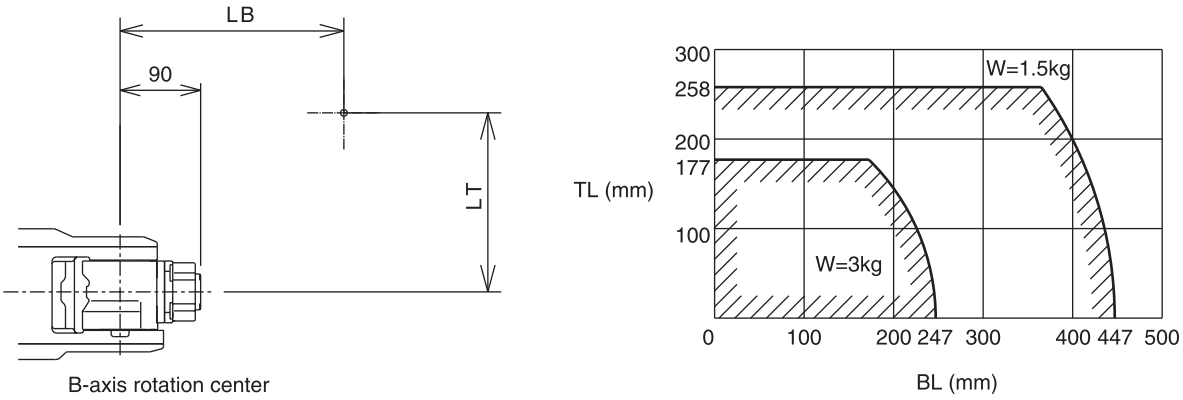


Fig. 12 Moment Arm Rating

The allowable wrist load can be extended up to 5 kg by limiting the wirst motion, as shown in "Fig. 13 Allowable Wrist Load in Limited B-axis Motion ". In this case, however, it is required to fulfill the conditions in the " Table. 5 Moment and Total Inertia ".

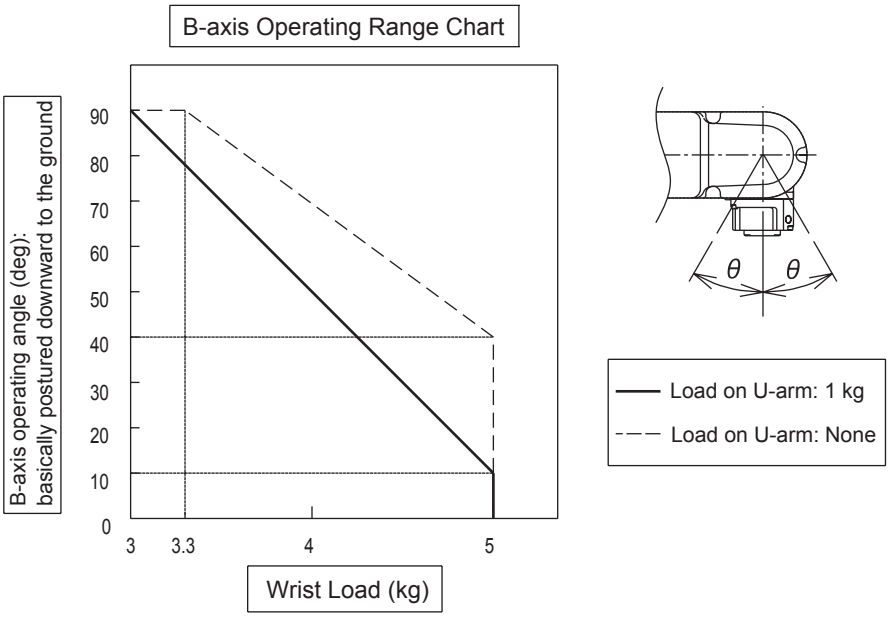


Fig. 13 Allowable Wrist Load in Limited B-axis Motion

6.2 Wrist Flange

The wrist flange dimensions are shown in " Fig. 14 Wrist Flange ". In order to see the alignment marks, it is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside fittings must be 5mm or less.

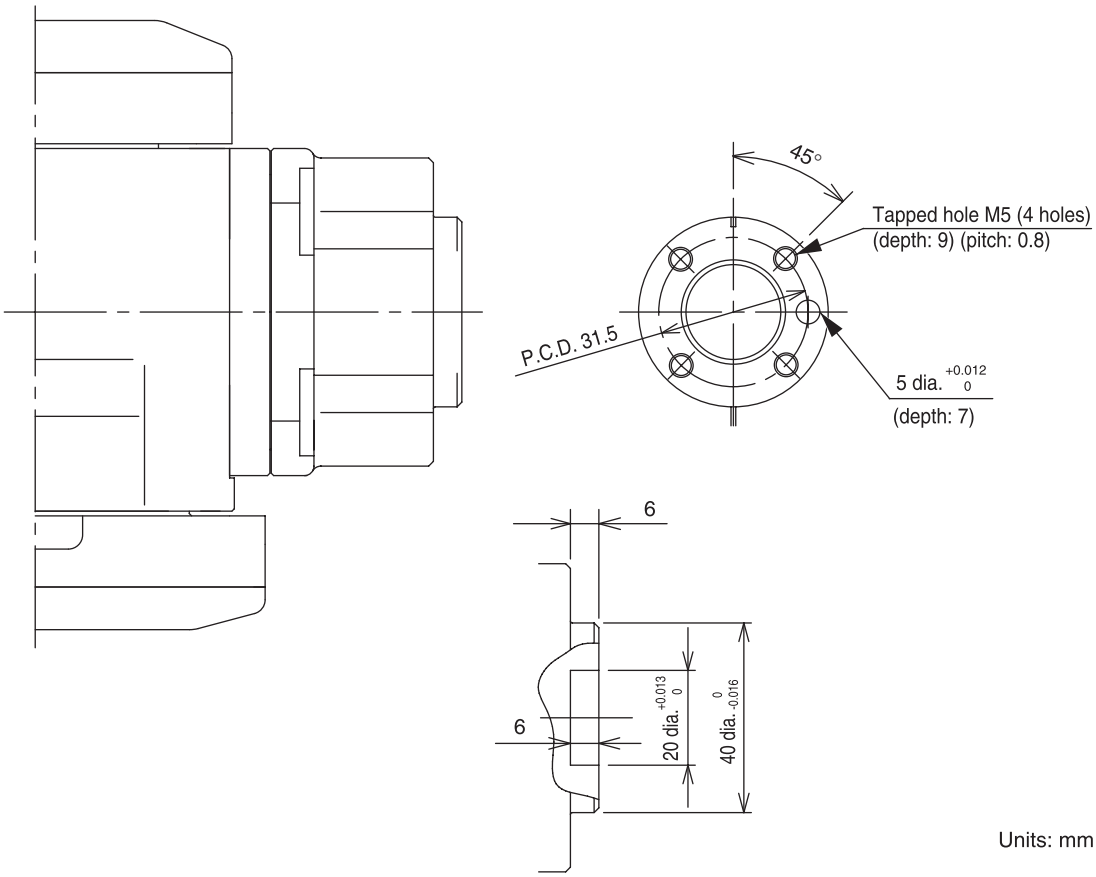


Fig. 14 Wrist Flange

NOTE • Wash off anti-corrosive paint (solid color) 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 fixed on the upper arm for easier installation of the user's system application as shown in " Fig. 15 Peripheral Equipment Mounts on Upper Arm ". When peripheral equipment is attached to the U-axis, the following conditions should be observed.

7.1.1 Allowable Load

The allowable load on the U-Axis is a maximum of 4 kg, including the wrist load.
For instance, when the mass installed in the wrist point is 3 kg, the mass which can be installed on the upper arm is 1 kg.

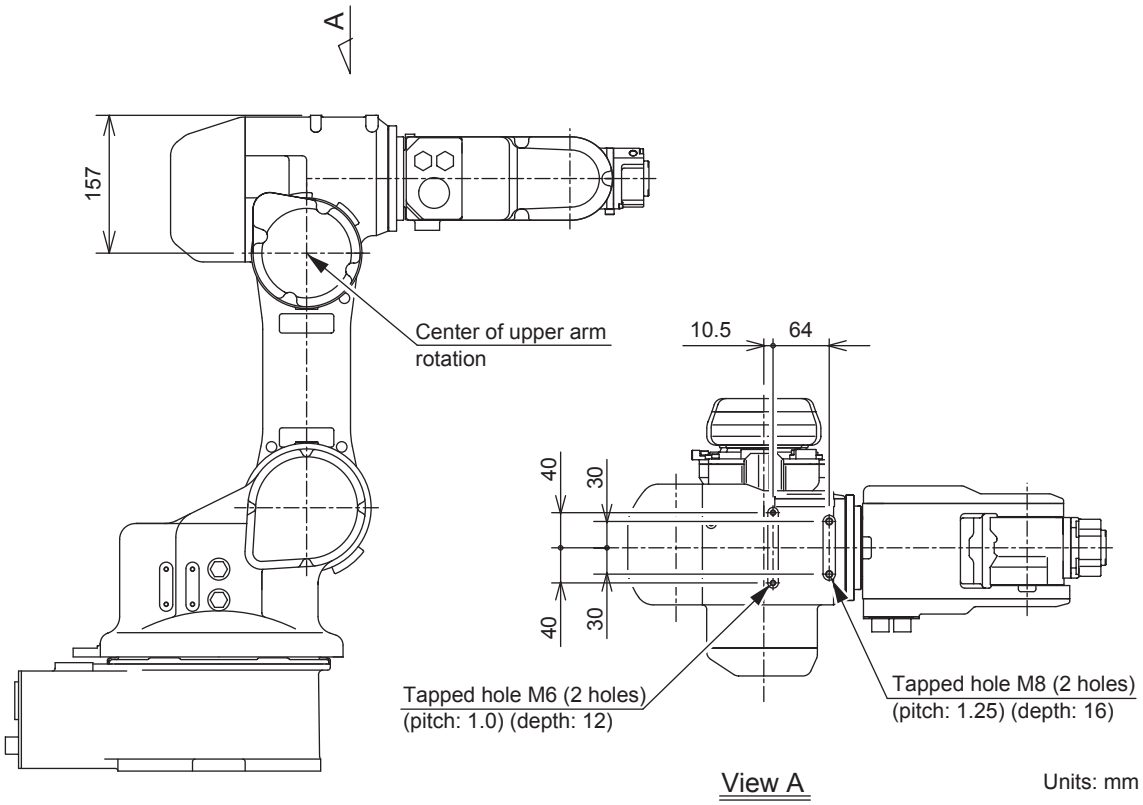


Fig. 15 Peripheral Equipment Mounts on Upper Arm

7.2 Internal User I/O Wiring Harness and Air Lines

16 wires (0.2 mm^2) and two air lines are used in the manipulator for the drives of the peripheral devices mounted on the upper arm as shown in " Fig. 16 Internal User I/O Wiring Harness and Air Lines ".
The connector pins 1 to 16 are assigned as shown in " Fig. 17 Details of Connector Pin Numbers ". Wiring must be performed by users, following the conditions below:

- The allowable current for cables: must be 3A or below per a cable.
  (The total current value for pins 1 to 16 must be 40A or less).
- The maximum pressure for the air hose: must be 490 kPa (5 kgf/cm^2) or less.
  (The air hose inside diameter: 6.5mm.)

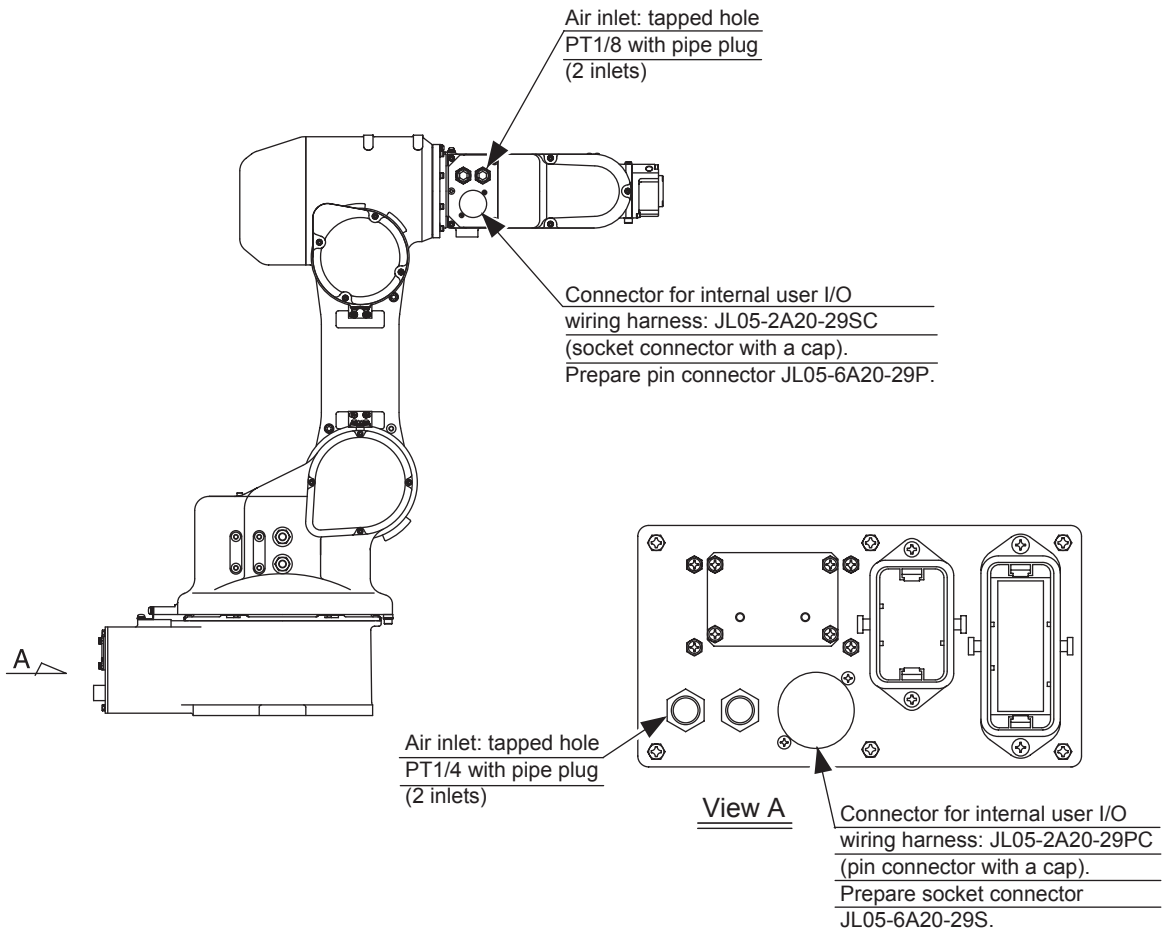
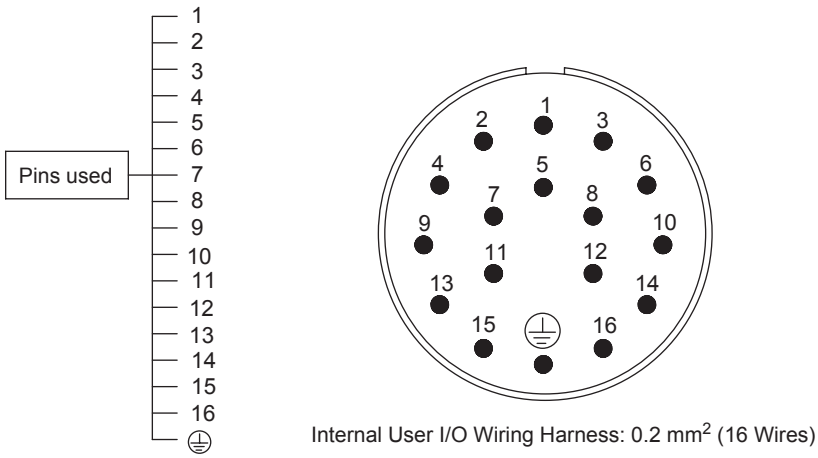


Fig. 16 Internal User I/O Wiring Harness and Air Lines



Details on Connector Pin Numbers

Fig. 17 Details of Connector Pin Numbers

The same pin number (1-16) of two connectors is connected in the lead line of single 0.2mm^2 or 1.25mm^2.

8 Electrical Equipment Specification

8.1 Internal Connections

High reliability connectors which can be easily put on and removed are used with each connector part. For the numbers, types, and locations of connectors, see " Fig. 18 Locations of Connectors ".
Diagrams for internal connections of the manipulator are shown in " Fig. 18 (a) Internal Connection Diagram " and in " Fig. 18 (b) Internal Connection Diagram ".

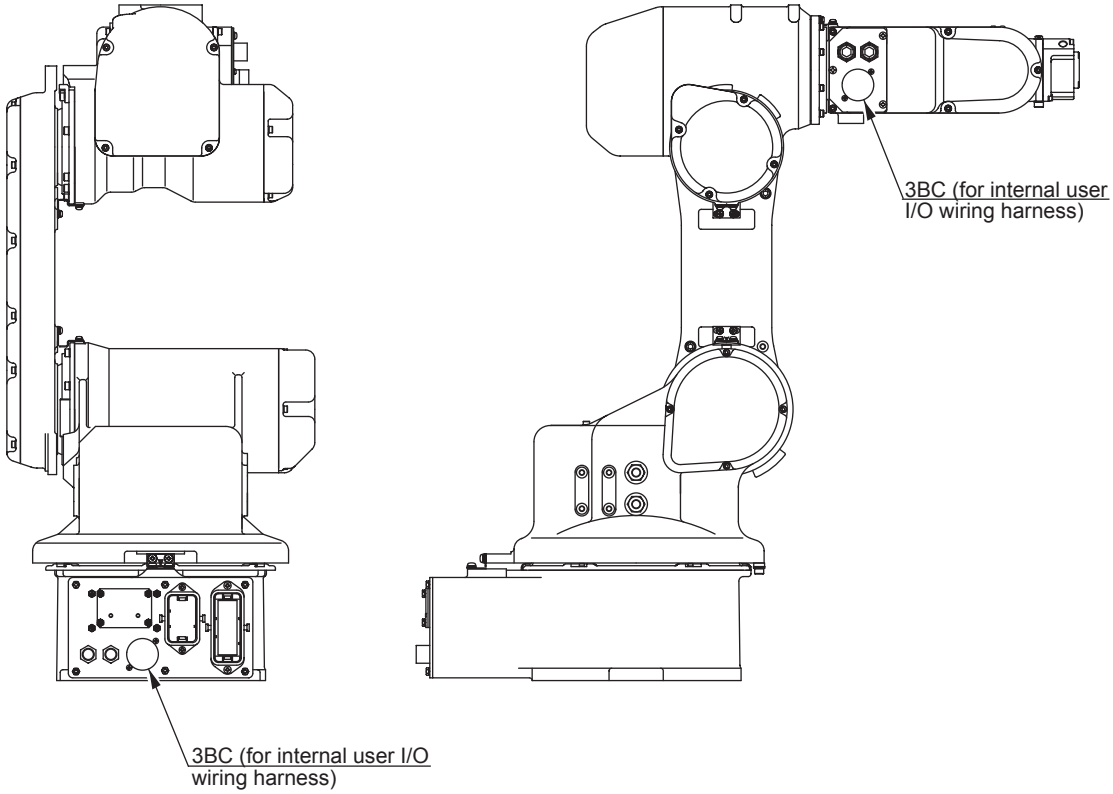


Fig. 18 Locations of Connectors

Table. 6 List of Connector Types

Name	Type of Connector
Base Connector for Internal User I/O Wiring Harness	JL05-2A20-29PC (JL05-6A20-29S: Optional)
U-arm Connector for Internal User I/O Wiring Harness	JL05-2A20-29SC (JL05-6A20-29P: Optional)

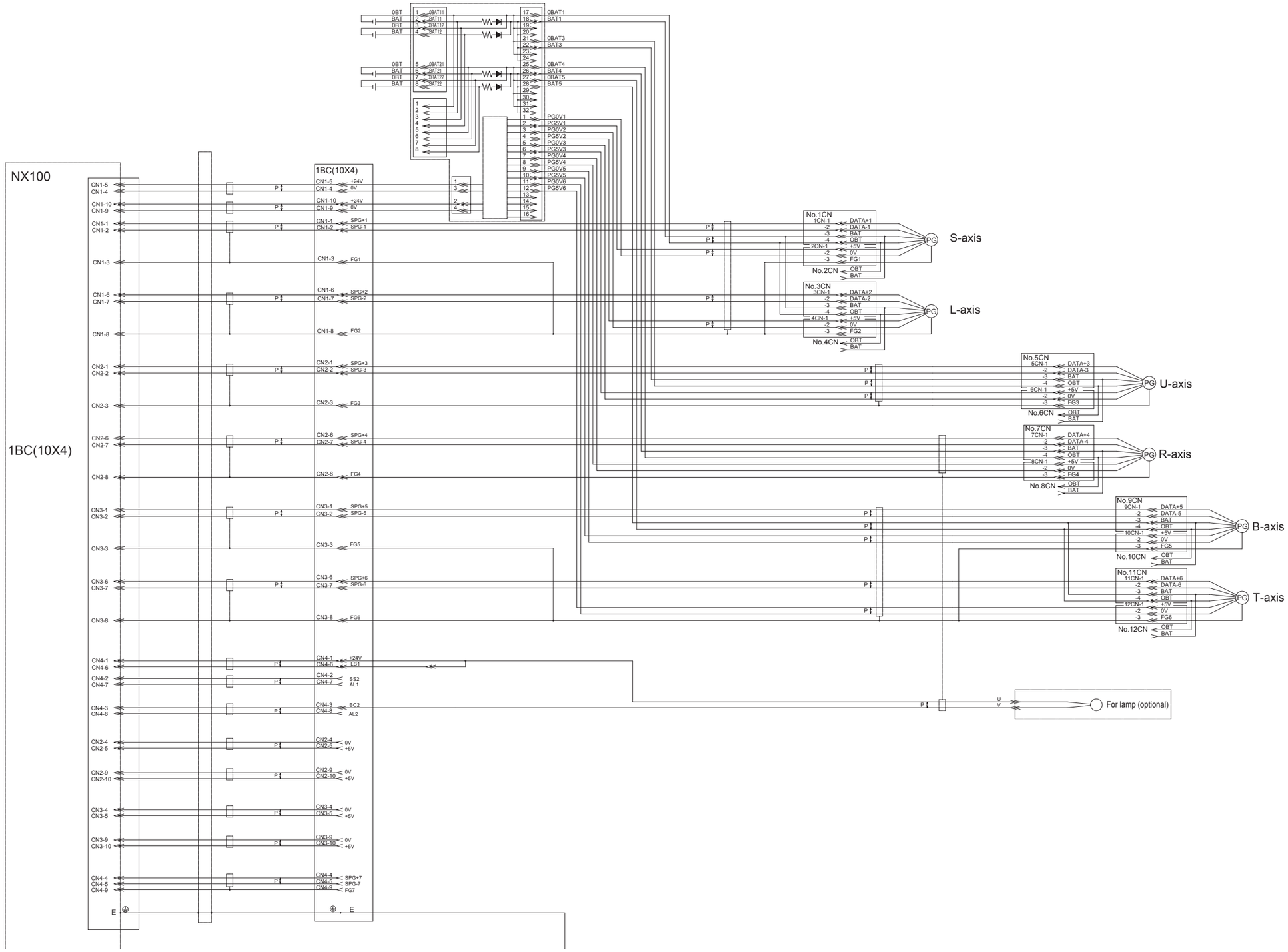


Fig. 19 (a) Internal Connection Diagram

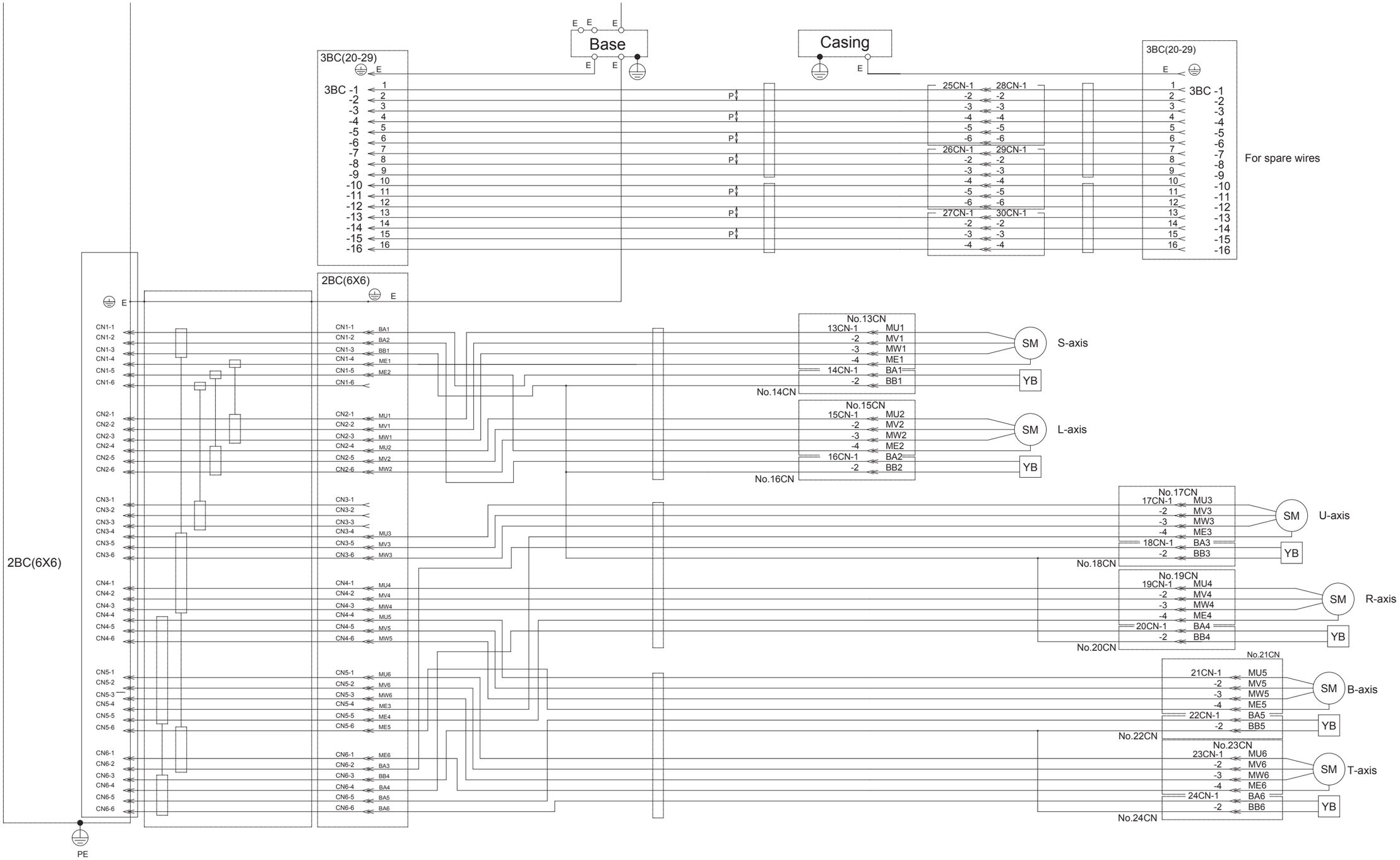


Fig. 19 (b) Internal Connection Diagram

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. Conduct periodical inspections according to the inspection schedule in " Table. 7 Inspection Items ".
In " Table. 7 Inspection Items ", the inspection items are categorized by types of operations: operations which can be performed by personnel authorized by the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel. Only specified personnel are to do the inspection work.

NOTE

- The inspection interval must be based on the servo power supply on time.
- These inspections were developed for applications where the manipulator is used for arc welding work. For any different or special applications, the inspection process should be developed on an case-by-case basis.
  For axes which are used very frequently (in handling applications, etc.), it is recommended that inspections be conducted at shorter Intervals. Contact your Yaskawa representative.

Table. 7 Inspection Items

Items*4		Schedule						Method	Operation	Inspection Charge		
		Daily	1000 H Cycle	6000 H Cycle	12000 H Cycle	24000 H	36000 H			Specified Person	Licensee	Service Company
①	Tram 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		○					Screw-driver, Wrench	Tighten loose bolts. Replace if necessary.	○	○	○
⑤	Base connectors		○					Manual	Check for loose connectors.	○	○	○
⑥	BT-axes timing belt				○			Manual	Check for belt tension and wear.		○	○
⑦	Wire harness in manipulator (SLURBT-axes leads)				○			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 *1		○	○
						○			Replace *2			○
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			○				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease *3 (6000H cycle). See Par. " 9.2.2 Grease Replenishment for S-Axis Speed Reducer "		○	○
⑩	LU-axes speed reducers			○				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease *3 (6000H cycle). See Par. " 9.2.3 Grease Replenishment for L-Axis Speed Reducer " and Par. " 9.2.4 Grease Replenishment for U-Axis Speed Reducer ".		○	○

Table. 7 Inspection Items

Items*4		Schedule						Method	Operation	Inspection Charge		
		Daily	1000 H Cycle	6000 H Cycle	12000 H Cycle	24000 H	36000 H			Specified Person	Licensee	Service Company
⑪	R-axis speed reducer			○				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease*3 (6000H cycle). See Par. " 9.2.5 Grease Replenishment for R-Axis Speed Reducer "		○	○
⑫	BT-axes speed reducers T-axis gear			○				Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease*3 (6000H cycle). See Par. " 9.2.6 Grease Replenishment for B- and T-Axes Speed Reducers "		○	○
⑬	Overhaul						○					○

1 When checking for conduction with multimeter, connect the battery to “BAT” and “OBT” of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to " 9.2.7 Notes for Maintenance ")

2 Wire harness in manipulator to be replaced at 24000H inspection.

3 For the grease, refer to " Table. 8 Inspection Parts and Grease Used ".

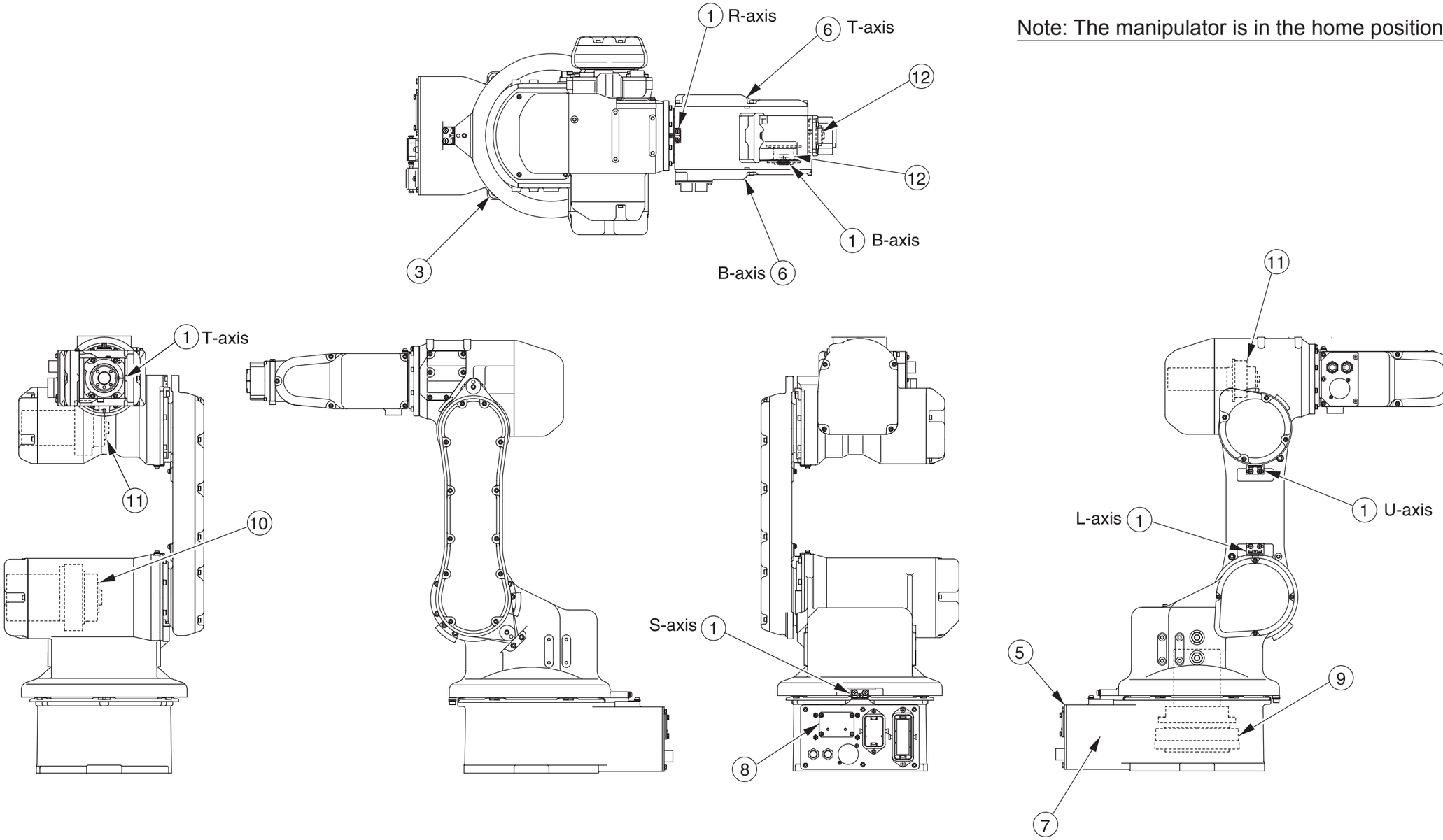
4 Inspection No. correspond to the numbers in " Fig. 20 Inspection Parts and Inspection Numbers ".

5 The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your Yaskawa representative.

Table. 8 Inspection Parts and Grease Used

No.	Grease Used	Inspected Parts
⑨⑩⑪⑫	Harmonic Grease 4B No.2	S, L, U, R, B, T-axis speed reducers, T-axis gear

The numbers in the above table correspond to the numbers in " Table. 7 Inspection Items ".



Note: The manipulator is in the home position.

Fig. 20 Inspection Parts and Inspection Numbers

9.2 Notes on Maintenance Procedures

9.2.1 Battery pack Replacement

The battery packs are attached in the two positions indicated in " Fig. 21 Battery Location ". If the battery alarm occurs in the NX100, replace the battery in accordance with the following procedure:

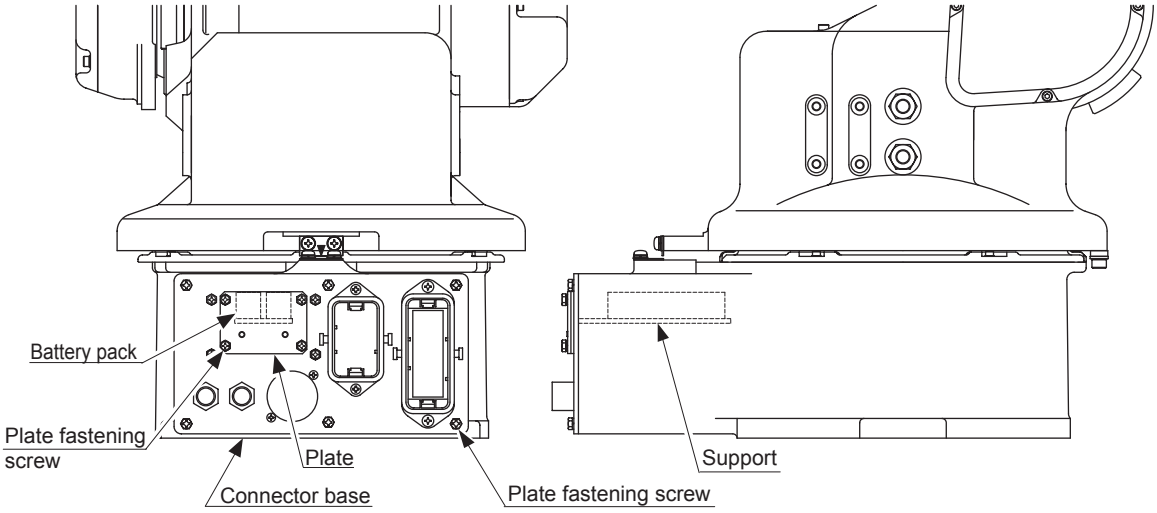


Fig. 21 Battery Location

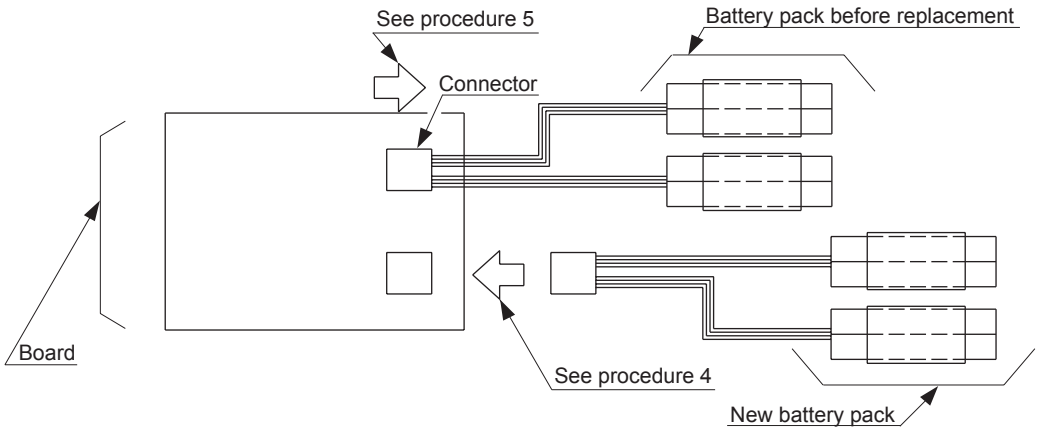


Fig. 22 Battery Connection

1. Turn OFF the NX100 main power supply.
2. Remove the plate fastening screws and the plate on the connector base.
3. Pull the battery pack out to replace with a new one and remove the battery pack from the 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 pinch the cable when the plate is installed.

9.2.2 Grease Replenishment for S-Axis Speed Reducer

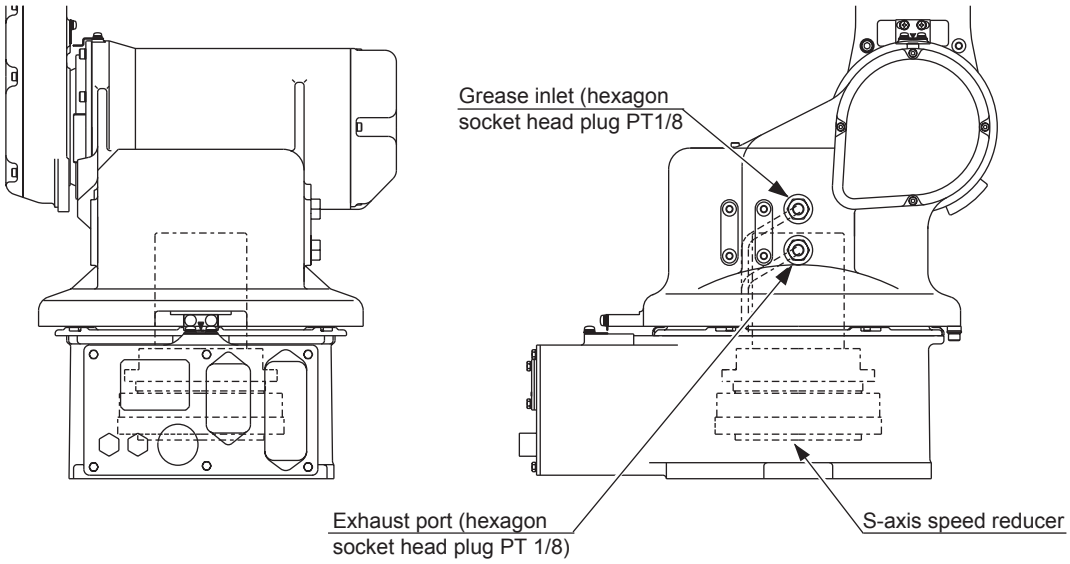


Fig. 23 S-Axis Speed Reducer Diagram

■ Grease Replenishment (Refer to " Fig. 23 S-Axis Speed Reducer Diagram ".)

Replenish the grease in accordance with the following procedure:

1. Remove plugs from exhaust port and grease inlet.

NOTE Adding grease without removing the hexagon socket head plug PT1/8 for exhaust port increases the inner pressure and may cause a damage.
Never fail to remove the plug before the grease injection.

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 4B No.2 Amount of grease: 25cc

NOTE The grease is not exhausted from the exhaust port (air flow). Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk, then reinstall the plugs to the exhaust port and the grease inlet.
   Apply Three Bond 1206C on the thread parts of the plugs.

9.2.3 Grease Replenishment for L-Axis Speed Reducer

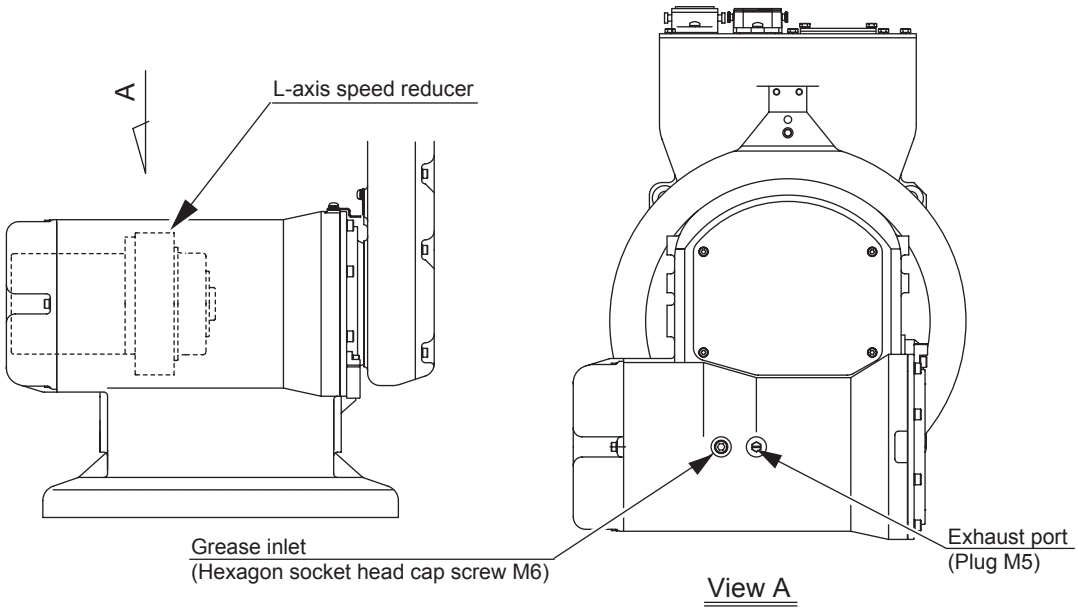


Fig. 24 L-Axis Speed Reducer Diagram

■ Grease Replenishment (Refer to " Fig. 24 L-Axis Speed Reducer Diagram ".)

1. Remove the plug and the screw from exhaust port and grease inlet respectively. .

NOTE Adding grease without removing the plug for exhaust port increases the inner pressure and may cause a damage.
Never fail to remove the plug before the grease injection.

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 4B No.2 Amount of grease: 30cc

NOTE The grease is not exhausted from the exhaust port (air flow). Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk, then reinstall the plug and the screw to the exhaust port and the grease inlet.
   Apply Three Bond 1206C on the thread parts of the plug and the screw.

9.2.4 Grease Replenishment for U-Axis Speed Reducer

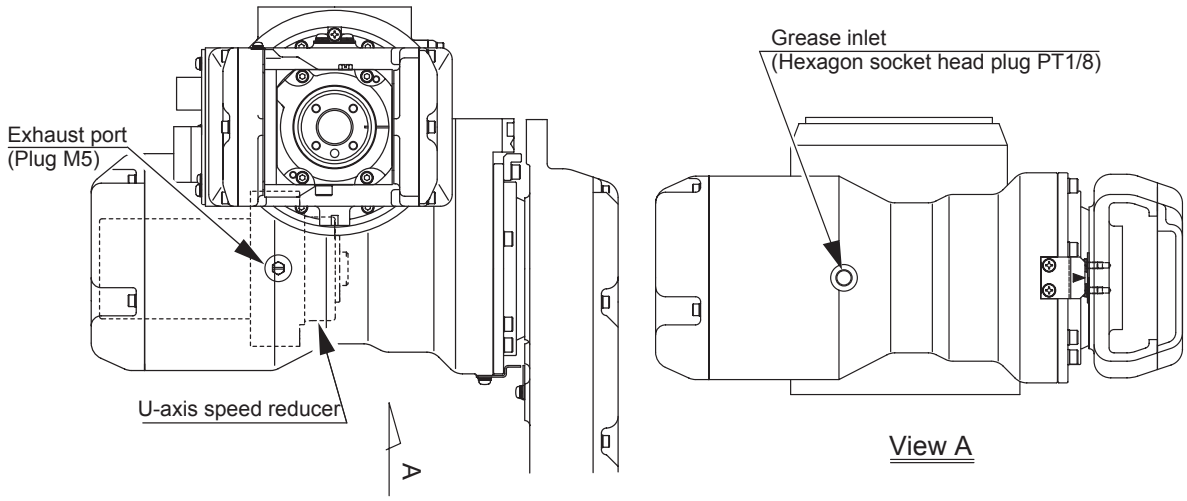


Fig. 25 U-Axis Speed Reducer Diagram

■ Grease Replenishment (Refer to " Fig. 25 U-Axis Speed Reducer Diagram ".)

1. Remove the plug and the screw from exhaust port and grease inlet respectively. .

NOTE Adding grease without removing the plug for exhaust port increases the inner pressure and may cause a damage.
Never fail to remove the plug before the grease injection.

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 4B No.2
Amount of grease: 20cc

NOTE The grease is not exhausted from the exhaust port (air flow). Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk, then reinstall the plug and the screw to the exhaust port and the grease inlet.
   Apply Three Bond 1206C on the thread parts of the plug and the screw.

9.2.5 Grease Replenishment for R-Axis Speed Reducer

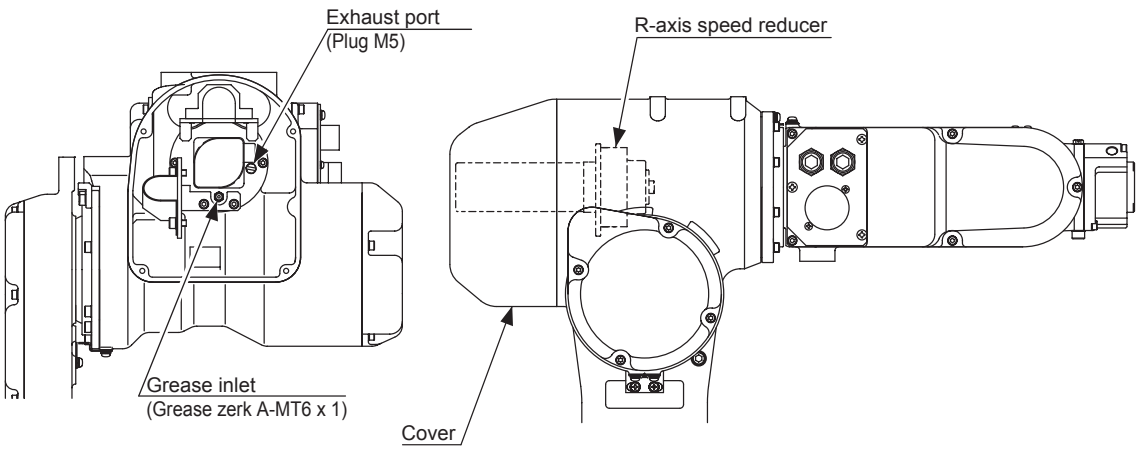


Fig. 26 R-Axis Speed Reducer Diagram

■ Grease Replenishment (Refer to " Fig. 26 R-Axis Speed Reducer Diagram ".)

1. Remove the cover, then remove the plug from exhaust port.

NOTE Adding grease without removing the plug for exhaust port increases the inner pressure and may cause a damage.
Never fail to remove the plug before the grease injection.

2. Inject grease into the grease inlet using a grease gun.

Grease type: Harmonic Grease 4B No.2 Amount of grease: 7cc

NOTE The grease is not exhausted from the exhaust port (air flow). Do not inject excessive grease into the grease inlet.

3. Reinstall the plug and the screw to the exhaust port.
   Apply Three Bond 1206C on the thread part of the plug.

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

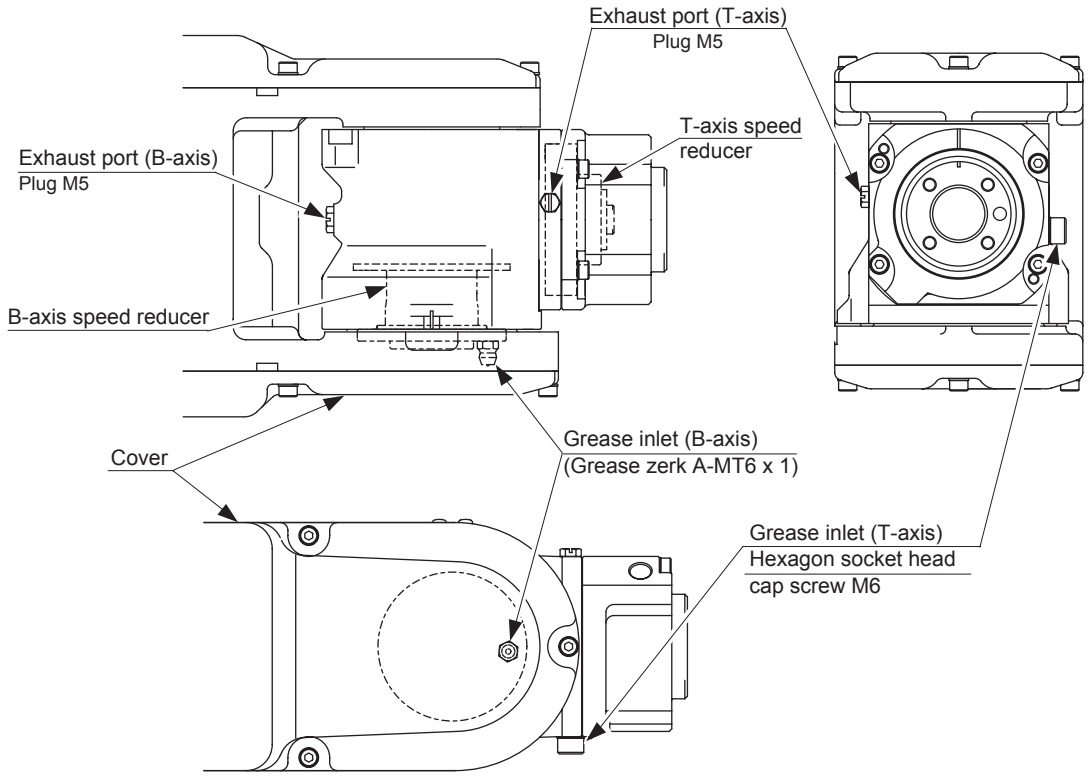


Fig. 27 B- and T-Axes Speed Reducers Diagram

■ Grease Replenishment for B-axis (Refer to " Fig. 27 B- and T-Axes Speed Reducers Diagram ".)

1. Remove the cover, then remove the plug from exhaust port.

NOTE Adding grease without removing the plug for exhaust port increases the inner pressure and may cause a damage.
Never fail to remove the plug before the grease injection.

2. Inject grease into the grease inlet using a grease gun.

Grease type: Harmonic Grease 4B No.2 Amount of grease: 5cc

NOTE The grease is not exhausted from the exhaust port (air flow). Do not inject excessive grease into the grease inlet.

3. Reinstall the plug and the screw to the exhaust port.
Apply Three Bond 1206C on the thread part of the plug.

■ Grease Replenishment for T-axis (Refer to " Fig. 27 B- and T-Axes Speed Reducers Diagram ".)

1. Remove the plug and the screw from exhaust port and grease inlet respectively. .

NOTE Adding grease without removing the plug for exhaust port increases the inner pressure and may cause a damage.
Never fail to remove the plug before the grease injection.

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 4B No.2 Amount of grease: 5cc

NOTE The grease is not exhausted from the exhaust port (air flow). Do not inject excessive grease into the grease inlet.

4. Remove the grease zerk, then reinstall the plug and the screw to the exhaust port and the grease inlet.
   Apply Three Bond 1206C on the thread parts of the plug and the screw.

9.2.7 Notes for Maintenance

■ 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. Therefore, if the wrist cover is disassembled, be sure to reapply the sealing bond when reassemble the cover again (Three Bond 1206C, refer to " Table. 9 Spare Parts for YR-HP3-A00 ").

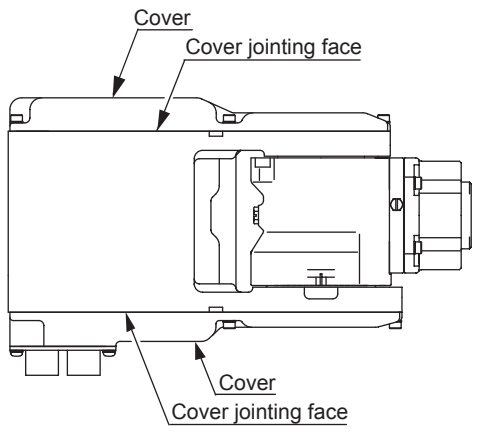


Fig. 28 Sealing Part of Wrist Unit

■ Battery Pack Connector (with CAUTION label)

Connect the battery pack with reference to the following figure before removing the encoder connector (with CAUTION label).

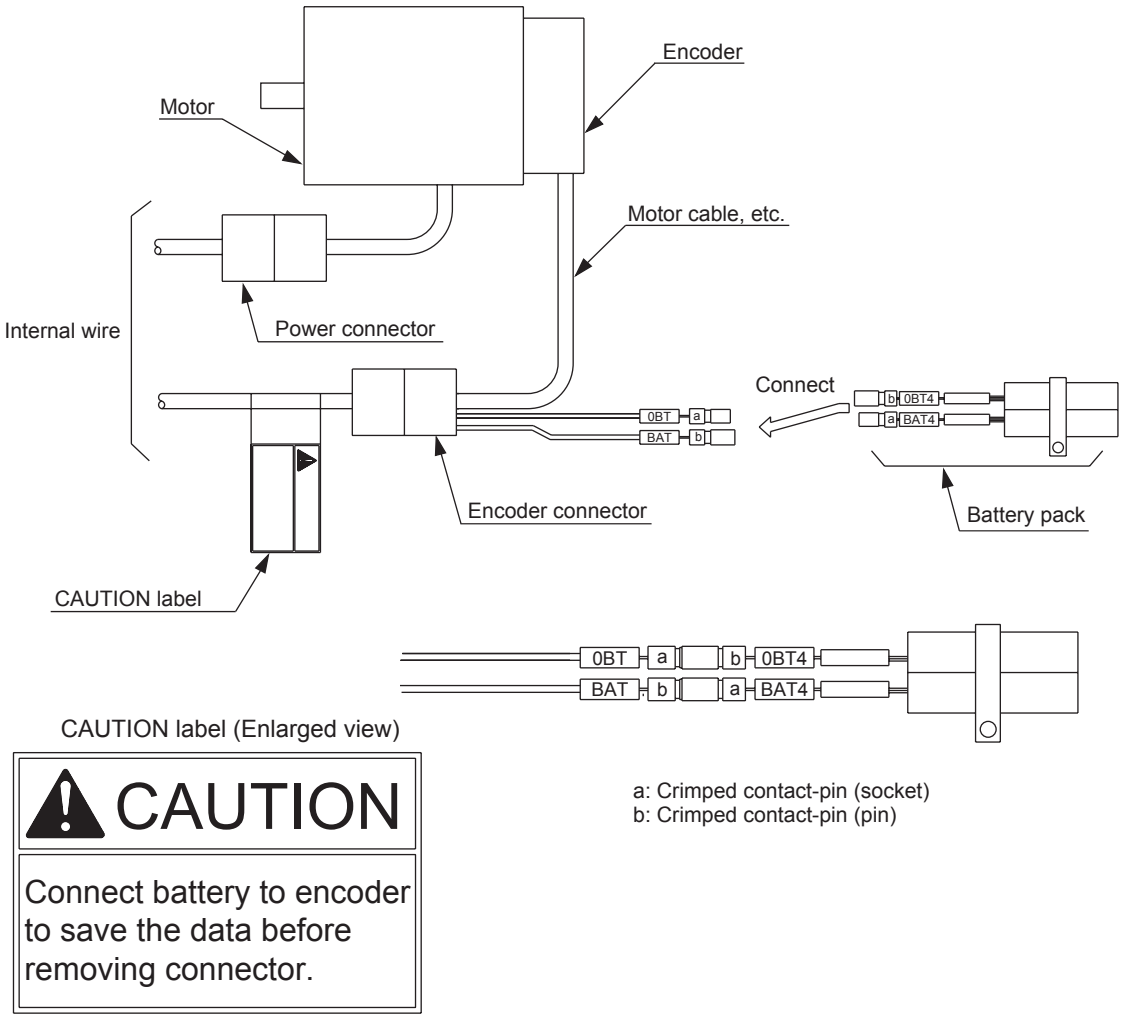


Fig. 29 Battery Pack Connector Diagram for SLU-Axes

10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-HP3. The spare parts list for the MOTOMAN-HP3 is shown below. Product performance cannot be guaranteed when using spare parts from any company other than Yaskawa. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts
- Rank B: Parts for which replacement may be necessary as a result of frequent operation
- Rank C: Drive unit

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

Table. 9 Spare Parts for YR-HP3-A00

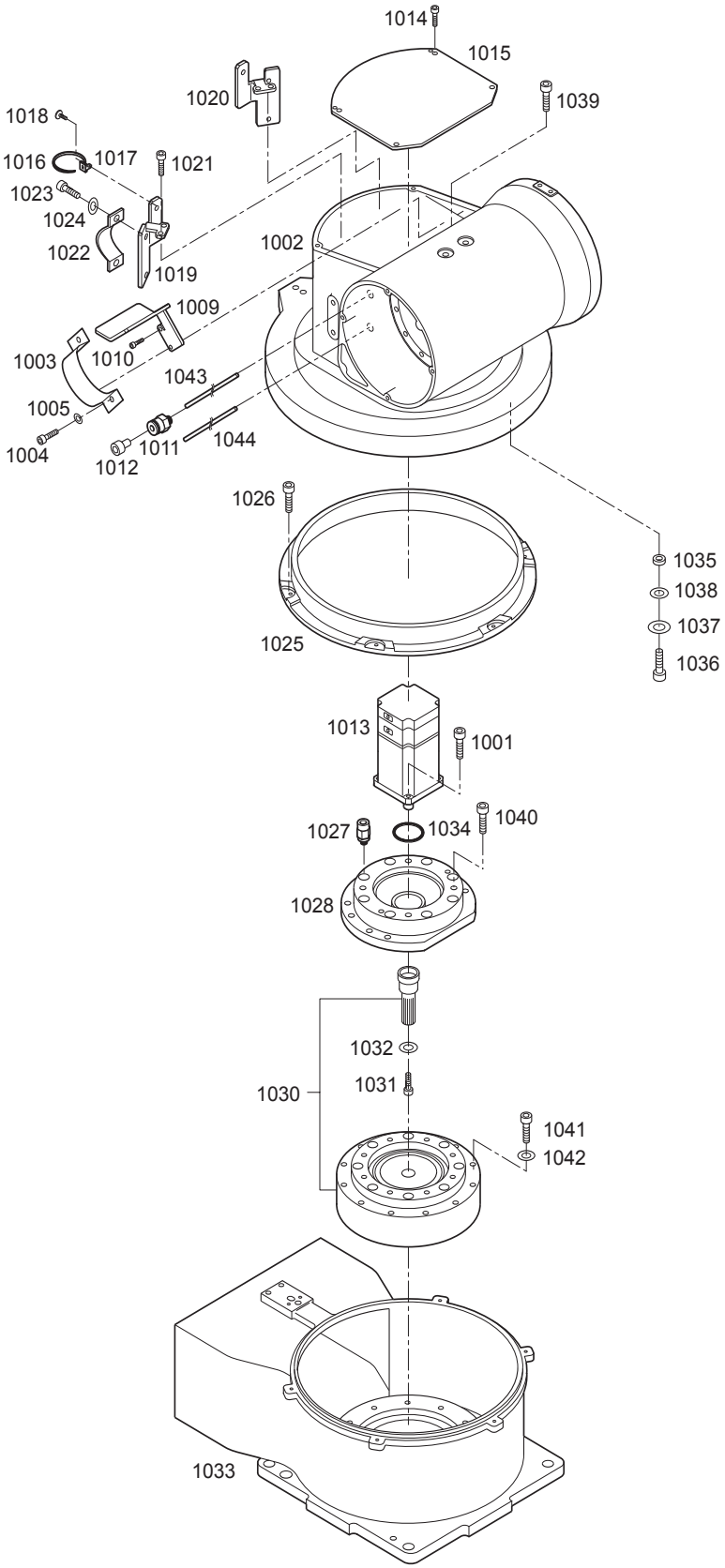
Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
A	1	Grease	Harmonic Grease 4B No.2	Harmonic Drive Systems Co., Ltd.	2.5kg	-	
A	2	Liquid Gasket	Three Bond 1206C	Three Bond Co., Ltd.	-	-	
A	3	Battery Pack	HW0470360-A	Yaskawa Electric Corporation	1	1	
A	4	Battery Pack	HW9470932-A	Yaskawa Electric Corporation	1	1	
B	5	B-Axis Timing Belt	60S4.5M279	Mitsuboshi Belting Ltd.	1	1	
B	6	T-Axis Timing Belt	60S4.5M297	Mitsuboshi Belting Ltd.	1	1	
B	7	S-Axis Speed Reducer	HW0382060-A	Yaskawa Electric Corporation	1	1	
B	8	L-Axis Speed Reducer	HW0382061-A	Yaskawa Electric Corporation	1	1	
B	9	U-Axis Speed Reducer	HW0382062-A	Yaskawa Electric Corporation	1	1	
B	10	R-Axis Speed Reducer	HW0382063-A	Yaskawa Electric Corporation	1	1	
B	11	B-Axis Speed Reducer	HW0382064-A	Yaskawa Electric Corporation	1	1	
B	12	T-Axis Speed Reducer	HW0382065-A	Yaskawa Electric Corporation	1	1	

Table. 9 Spare Parts for YR-HP3-A00

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
B	13	Wire Harness in Manipulator	HW0171287-A	Yaskawa Electric Corporation	1	1	
C	14	S-and L-Axes AC Servomotor	HW0382152-A SGMPH-02A2A-YR1*	Yaskawa Electric Corporation	1	2	
C	15	U-Axis AC Servomotor	HW0382151-A SGMPH-01A2A-YR1*	Yaskawa Electric Corporation	1	1	
C	16	R- B-, and T-Axes AC Servomotor	HW0382149-A SGMAH-A5A2A-YR1*	Yaskawa Electric Corporation	1	3	

11 Parts List

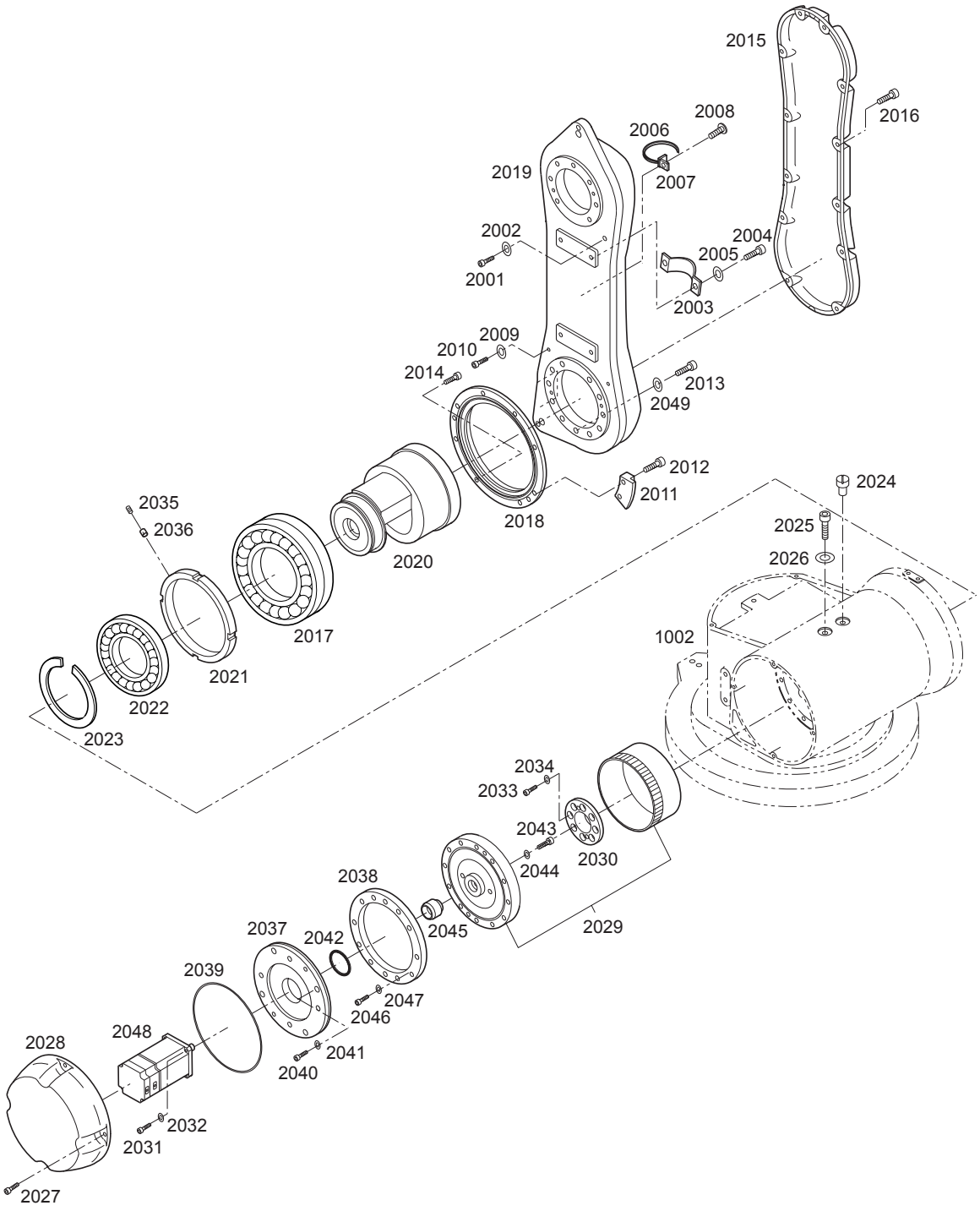
11.1 S-axis Unit



11.1 S-axis Unit

No.	DWG No.	Name	Pcs
1001	M6X20	Socket screw	4
	2H-6	Spring washer	4
1002	HW0100575-1	S-head	1
1003	CD-22	Saddle	2
1004	M5X10	Socket screw	2
	2H-5	Spring washer	2
1005	M5	Washer	2
1009	HW0404540-1	Support	1
1010	M4X16	Socket screw	2
	2H-4	Spring washer	2
1011	PMF6-01	Union	2
1012	PT1/8	Plug	2
1013	SGMPH-02A2A-YR1*	Motor	1
1014	M4X12	Socket screw	4
	2H-4	Spring washer	4
1015	HW0304355-1	Cover	1
1016	T50R	Cable tie	2
1017	TA1-S8	Clamp	2
1018	M4X8	Round head screw	2
1019	HW0404539-1	Support	1
1020	HW0404539-2	Support	1
1021	M4X12	Socket screw	4
	2H-4	Spring washer	4
1022	CD-19	Saddle	2
1023	M5X10	Socket screw	4
	2H-5	Spring washer	4
1024	M5	Washer	4
1025	HW0404736-1	Ring	1
1026	M3X10	Socket screw	6
1027	POC6-M5	Union	2
1028	HW0304268-1	M-base	1
1030	HW0382060-A	Speed reducer	1
1031	M4X50	Socket screw	1
1032	2H-4	Spring washer	1
1033	HW0100576-1	Base	1
1034	TC15257FKM	Oil seal	1
1035	HW8411125-3	Washer	1
1036	M6X16	Socket screw	1
1037	2H-6	Spring washer	1
1038	M6	Washer	1
1039	M6X30	Socket screw	7
	2H-6	Spring washer	7
1040	M5X16	Socket screw	8
	2H-5	Spring washer	8
1041	M5X45	Socket screw	12
1042	2H-5	Spring washer	12
1043	TP-6	Tube	1
1044	TP-6	Tube	1

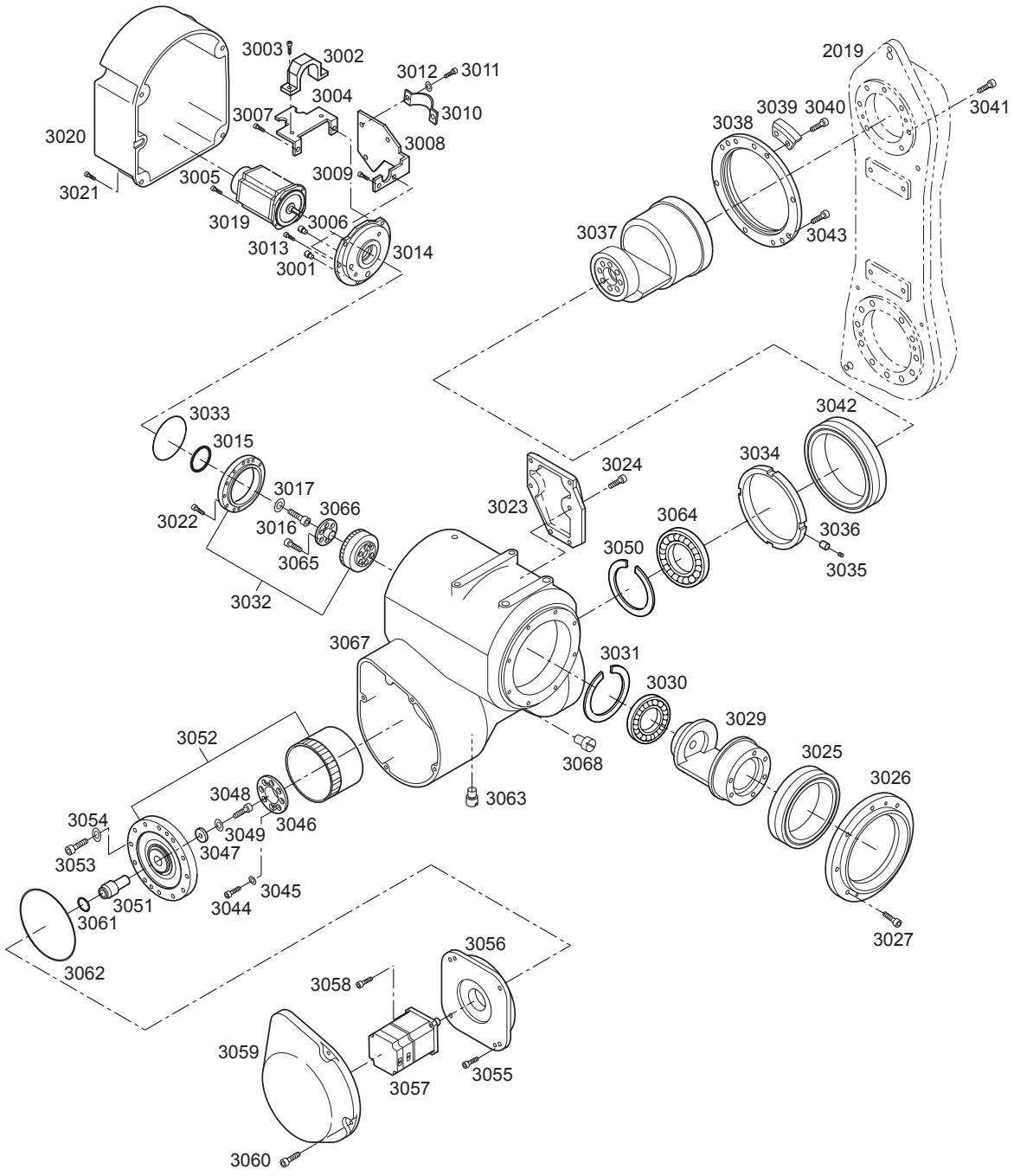
11.2 L-axis Unit



11.2 L-axis Unit

No.	DWG No.	Name	Pcs
2001	M6X10	Socket screw	1
2002	2H-6	Spring washer	1
2003	CD-22	Saddle	2
2004	M5X12	Socket screw	4
	2H-5	Spring washer	4
2005	M5	Washer	4
2006	T50R	Cable tie	1
2007	TA1-S8	Clamp	1
2008	M4X8	Round head screw	1
2009	M6X10	Socket screw	1
2010	2H-6	Spring washer	1
2011	HW0404497-1	Stopper	2
2012	M5X20	Socket screw	4
	2H-5	Spring washer	4
2013	M6X16	Socket screw	11
	2H-6	Spring washer	11
2014	M5X16	Socket screw	6
	2H-5	Spring washer	6
2015	HW020466-1	Cover	1
2016	M4X12	Socket screw	12
	2H-4	Spring washer	12
2017	HW0481905-A	Bearing	1
2018	HW0304358-1	Housing	1
2019	HW0100574-1	L-arm	1
2020	HW0306026-1	Shaft	1
2021	HW0304359-1	B-nut	1
2022	6913DDU	Bearing	1
2023	STW-65	C-stopper	1
2024	LP-M5	Plug	1
2025	M6X6	Socket screw	1
2026	2H-6	Spring washer	1
2027	M4X12	Socket screw	4
	2H-4	Spring washer	4
2028	HW0304256-1	Cover	1
2029	HW0382061-A	Reduction gear	1
2030	HW0404496-1	Shaft	1
2031	M6X16	Socket screw	4
2032	2H-6	Spring washer	4
2033	M8X20	Socket screw	8
2034	2H-8	Spring washer	8
2035	M4X6	H-set screw	2
2036	SEPN4	Setpiece	2
2037	HW0304356-1	M-base	1
2038	HW0306055-1	Spacer	1
2039	S110	Oring	1
2040	M6X16	Socket screw	4
2041	2H-6	Spring washer	4
2042	TC20305*FKM*	Oil seal	1
2043	M4X25	Socket screw	1
2044	2H-4	Spring washer	1
2045	HW0404525-1	Shaft	1
2046	M5X25	Socket screw	12
2047	2H-5	Spring washer	12
2048	SGMPH-02A2A-YR1*	Motor	1
1002	HW0100575-1	S-head	1

11.3 U(R)-axis Unit

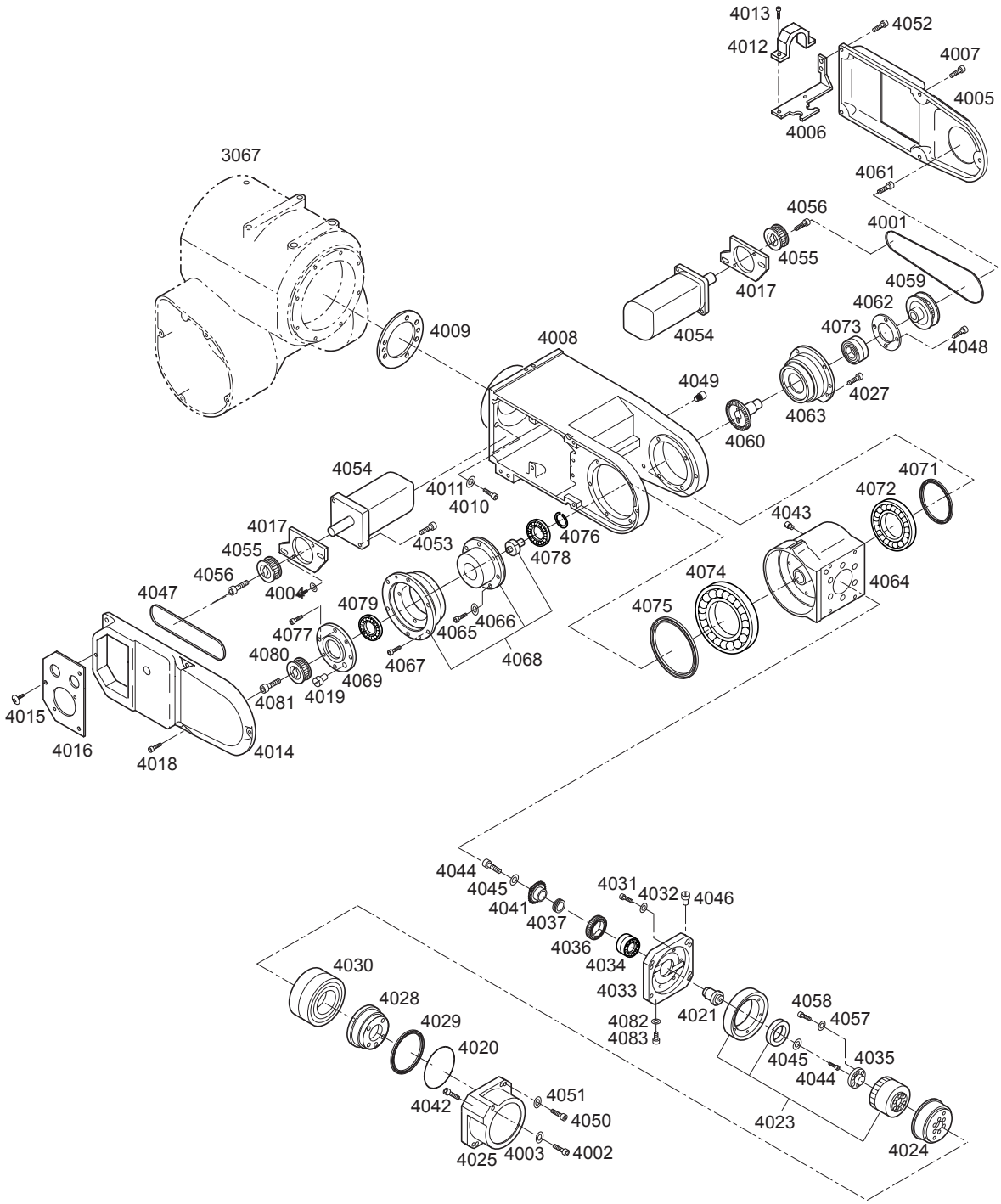


11.3 U(R)-axis Unit

No.	DWG No.	Name	Pcs
3001	LP-M5	Plug	1
3002	HW0404536-1	Saddle	1
3003	M4X16	Socket screw	2
	2H-4	Spring washer	2
3004	HW0404538-1	Support	1
3005	M4X16	Socket screw	2
	2H-4	Spring washer	2
3006	A-MT6X1	Grease zerk	1
3007	M4X16	Socket screw	2
	2H-4	Spring washer	2
3008	HW0404541-1	Support	1
3009	M4X16	Socket screw	2
	2H-4	Spring washer	2
3010	CD-22	Saddle	1
3011	M5X10	Socket screw	2
	2H-5	Spring washer	2
3012	M5	Washer	2
3013	M4X12	Socket screw	2
	2H-4	Spring washer	2
3014	HW0404482-1	M-base	1
3015	TC12227*FKM*	Oil seal	1
3016	M3X20	Socket screw	1
3017	2H-3	Spring washer	1
3019	SGMAH-A5A2A-YR11	Motor	1
3020	HW0200570-2	Cover	1
3021	M4X12	Socket screw	4
	2H-4	Spring washer	4
3022	M3X12	Socket screw	12
	2H-3	Spring washer	12
3023	HW0304802-1	Cover	1
3024	M4X12	Socket screw	6
	2H-4	Spring washer	6
3025	HW0481907-A	Bearing	1
3026	HW0304361-1	Flange	1
3027	M4X14	Socket screw	8
	2H-4	Spring washer	8
3029	HW0304285-1	Shaft	1
3030	6808LLU	Bearing	1
3031	WR40	Sirclip	1
3032	HW0382063-A	Reduction gear	1
3033	S60	O-ring	1
3034	HW0404481-1	B-nut	1
3035	M3X4	H-set screw	2
3036	SEPN3	Setpiece	2
3037	HW0304284-1	Shaft	1
3038	HW0404483-1	Housing	1
3039	HW0404498-1	Stopper	2
3040	M5X20	Socket screw	4
	2H-5	Spring washer	4
3041	M5X16	Socket screw	7
	2H-5	Spring washer	7
3042	HW0481906-A	Bearing	1
3043	M5X16	Socket screw	5
	2H-5	Spring washer	5
3044	M6X16	Socket screw	8
3045	2H-6	Spring washer	8
3046	HW0404479-1	Shaft	1
3047	HW0404500-1	Collar	1
3048	M4X40	Socket screw	1
3049	2H-4	Spring washer	1

No.	DWG No.	Name	Pcs
3050	STW-55	C-stopper	1
3051	HW0404499-1	Shaft	1
3052	HW0382062-A	Speed reducer	1
3053	M4X20	Socket screw	12
3054	2H-4	Spring washer	12
3055	M4X16	Socket screw	4
	2H-4	Spring washer	4
3056	HW0304349-1	Housing	1
3057	SGMPH-01A2A-YR12	Motor	1
3058	M5X16	Socket screw	4
	2H-5	Spring washer	4
3059	HW0304255-1	Cover	1
3060	M4X12	Socket screw	4
	2H-4	Spring washer	4
3061	TC1525*7FKM*	Oil seal	1
3062	S90	O-ring	1
3063	PT1/8	Plug	1
3064	6911DDU	Bearing	1
3065	M5X16	Socket screw	6
	2H-5	Spring washer	6
3066	HW0404480-1	Shaft	1
3067	HW0100573-1	Casing	1
3068	LP-M5	Plug	1
2019	HW0100574-1	L-arm	1

11.4 Wrist Unit



11.4 Wrist Unit

No.	DWG No.	Name	Pcs
4001	60S4.5M297	Belt	1
4002	M4X25	Socket screw	3
4003	2H-4	Spring washer	3
4004	M4X12	Socket screw	4
	2H-4	Spring washer	4
4005	HW0304253-1	Cover	1
4006	HW0404537-1	Support	1
4007	M4X12	Socket screw	5
	2H-4	Spring washer	5
4008	HW0100572-1	U-arm	1
4009	HW0406291-1	Ring	1
4010	M5X30	Socket screw	6
4011	2H-5	Spring washer	6
4012	HW0404536-1	Saddle	1
4013	M4X16	Socket screw	2
	2H-4	Spring washer	2
4014	HW0304252-1	Cover	1
4015	M4X8	Round head screw	3
4016	HW0404555-1	N-base	1
4017	HW0404764-1	M-base	2
4018	M4X12	Socket screw	5
	2H-4	Spring washer	5
4019	A-MT6X1	Grease zerk	1
4020	S63	O-ring	1
4021	HW0404428-1	Shaft	1
4023	HW0382065-A	Speed reducer	1
4024	HW0304317-1	Housing	1
4025	HW0304258-1	Housing	1
4027	M4X10	Socket screw	4
	2H-4	Spring washer	4
4028	HW0304316-1	Housing	1
4029	AB2551E0	Oil seal	1
4030	HW9480739-A	Bearing	1
4031	M3X10	Socket screw	6
4032	2H-3	Spring washer	6
4033	HW0304291-1	Housing	1
4034	HW0481908-A	Bearing	1
4035	HW0404456-1	Shaft	1
4036	HW0404743-1	B-nut	1
4037	HW0404457-*	shim	-
4041	HW0382189-A	Gear	1
4042	HW0404371-1	Screw	1
4043	LP-M5	Plug	1
4044	M4X12	Socket screw	2
4045	2H-4	Spring washer	2
4046	LP-M5	Plug	1
4047	60S4.5M279	Belt	1
4048	M4X10	Socket screw	4
	2H-4	Spring washer	4
4049	HW0404371-1	Screw	1
4050	M4X50	Socket screw	1
4051	2H-4	Spring washer	1
4052	M4X10	Socket screw	2
	2H-4	Spring washer	2
4053	M4X12	Socket screw	4
	2H-4	Spring washer	4
4054	SGMAH-A5A2A-YR1*	Motor	2
4055	HW0481909-A	Pulley	2
4056	M3X12	Socket screw	2
	2H-3	Spring washer	2
4057	2H-4	Spring washer	6
4058	M4X18	Socket screw	6
4059	HW0481910-1	Pulley	1
4060	HW0382188-1	Gear	1
4061	M4X12	Socket screw	1
	2H-4	Spring washer	1
4062	HW0404567-1	B-cover	1
4063	HW0304290-1	Flange	1
4064	HW0200465-1	Wrist base	1
4065	M3X8	Socket screw	7
	2H-3	Spring washer	7
4066	2H-3	Spring washer	7
4067	M4X10	Socket screw	6
	2H-4	Spring washer	6
4068	HW0382064-A	Speed reducer	1
4069	HW0304295-1	Flange	1
4071	TC52647	Oil seal	1
4072	6809DDU	Bearing	1
4073	HW0482077-A	Bearing purchase specification	1
4074	6812LLU	Bearing	1
4075	TC65786	Oil seal	1
4076	ISTW-10	Stopper	1
4077	M4X12	Socket screw	4
4078	6900ZZ	Bearing	1
4079	6803LLU	Bearing	1
4080	HW0481909-A	Pulley	1
4081	M3X12	Socket screw	1
	2H-3	Spring washer	1
4082	2H-6	Spring washer	1
4083	CBS6-8	Bolt	1
3067	HW0100573-1	Casing	1

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