MOTOMAN-MH5L
INSTRUCTIONS

TYPE: YR-MH00005L-B00 (STANDARD SPECIFICATION)

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

MOTOMAN INSTRUCTIONS

MOTOMAN-MH5L INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator's manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 156483-1CD
Revision: 0

YASKAWA

MANUAL NO.
HW0484981

MANDATORY

- This instruction manual is intended to explain operating instructions and maintenance procedures primarily for the MOTOMAN-MH5L.
- General items related to safety are listed in the Chapter 1: Safety of the DX100 instructions. To ensure correct and safe operation, carefully read the DX100 instructions before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications.
  If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-MH5L and the DX100.

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

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

Fig. : 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.

Fig. : Release of Emergency Stop

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

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

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

The emergency stop buttons are located on the right of front door of the DX100 and the programming pendant.

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately,
  and be sure that all other necessary processing has been performed.
  -Check for problems in manipulator movement.
  -Check for damage to insulation and sheathing of external wires.
- Always return the programing pendant to the hook on the DX100 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 DX100 instructions before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programing pendant, and manipulator cables.

In this manual, the equipment is designated as follows:

Equipment	**Manual Designation**
DX100 Controller	DX100
DX100 Programing Pendant	Programing Pendant
Cable between the manipulator and controllers	Manipulator Cable

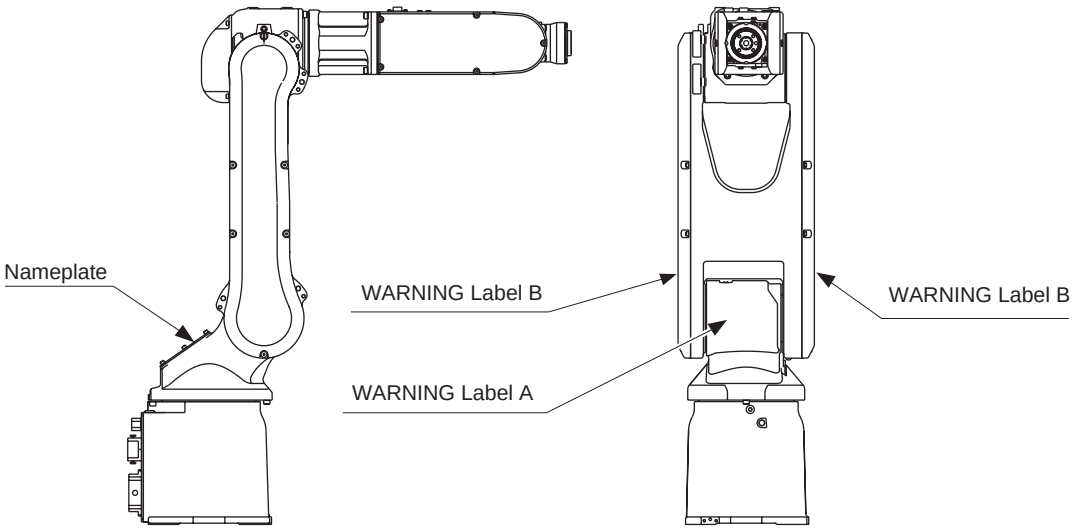
Explanation of Warning Labels

The following warning labels are attached to the manipulator.

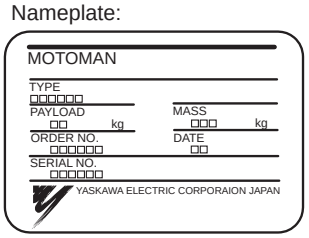
Always follow the warnings on the labels.

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

Fig. : Warning Label Locations

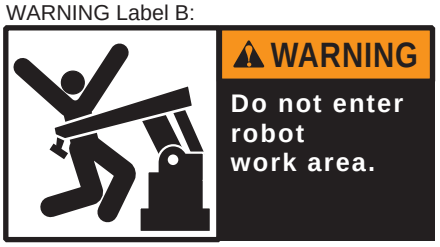


Nameplate:



WARNING Label A:

WARNING Label B:



1 Product Confirmation

CAUTION

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

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

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

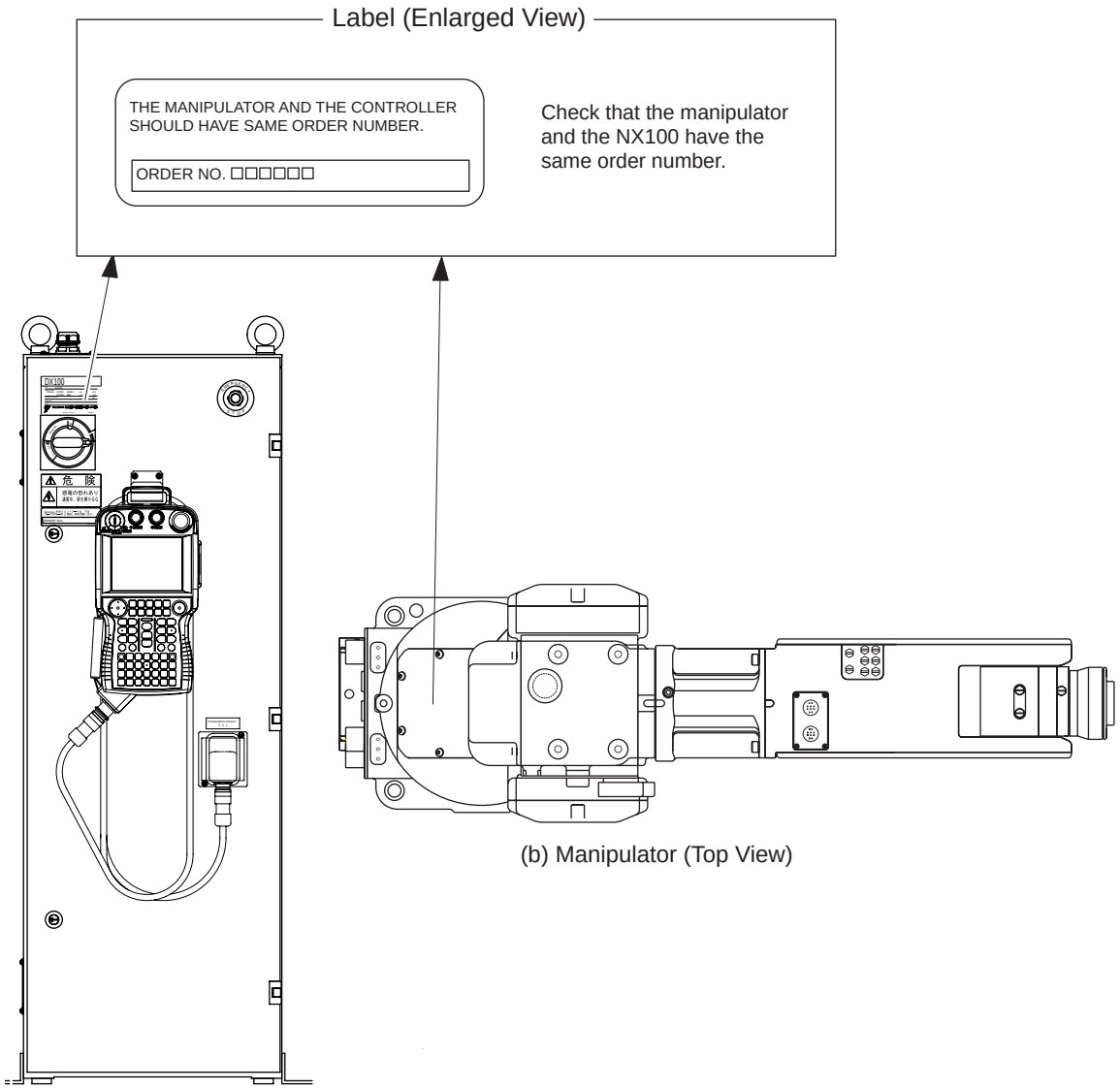
Standard delivery includes the following four items (Information for the content of optional goods is given separately):

- Manipulator
- DX100
- Programing pendant
- Manipulator cable (between the DX100 and manipulator)

1.2 Order Number Confirmation

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

Fig. 1-1: Location of Order Number Labels



(a) DX100 (Front View)

(b) Manipulator (Top View)

2 Transport

CAUTION

- Sling applications and crane or forklift operations must be performed by authorized personnel only.

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

- Avoid excessive vibration or shock during transport.

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

2.1 Transport Method

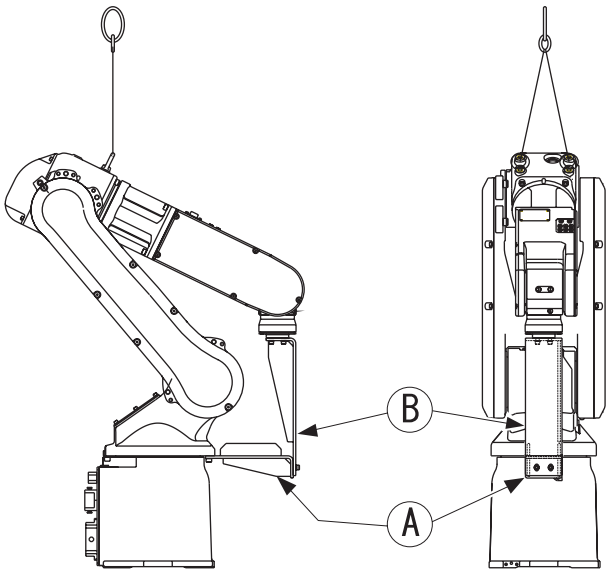
NOTE

- Check that the eyebolts are securely fastened.
- The mass of the manipulator is approximately 29 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the mass.
- 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 exerting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment, as injury may occur.

2.1.1 Using a Crane

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

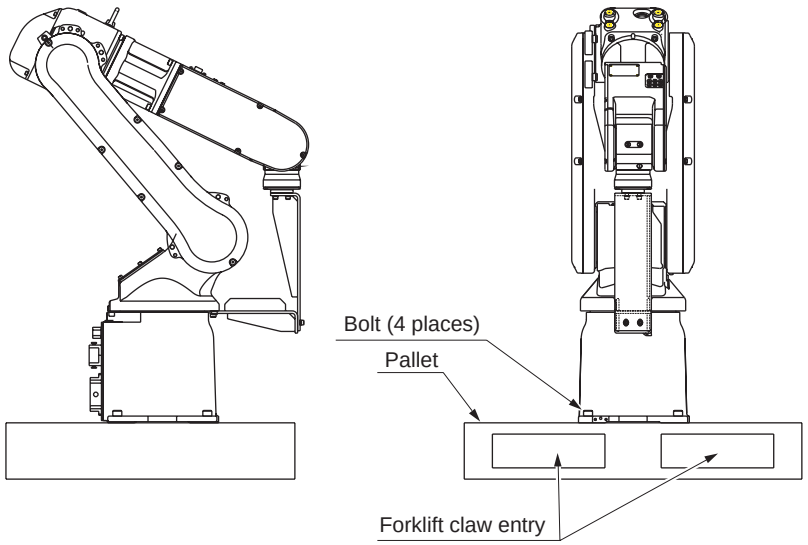
Fig. 2-1: Transporting Position



2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet with shipping bolts 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 in order to avoid overturning or slippage.

Fig. 2-2: Using a Forklift



2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets as illustrated at A and B in " Fig. 2-1 Transporting Position ", to minimize external force during the transportation.

- The shipping bolts and brackets are painted yellow.

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

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 DX100 when the arm is fully extended.

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

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

The manipulator may overturn and cause injury or damage.

- When mounting the manipulator on the ceiling or wall, the base section must have sufficient strength and rigidity to support the mass 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 in 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" at page 2-2* 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: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities. Mount the manipulator base as shown in *chapter 3.2.1 "Installation Example"* in principle.

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

Horizontal rotating maximum torque (S-axis moving direction)	900 N • m (91.8 kgf• m)
Vertical rotating maximum torque (LU-axis moving direction)	750 N • m 76.5 kgf• m)

Table 3-2: Endurance Torque in Operation

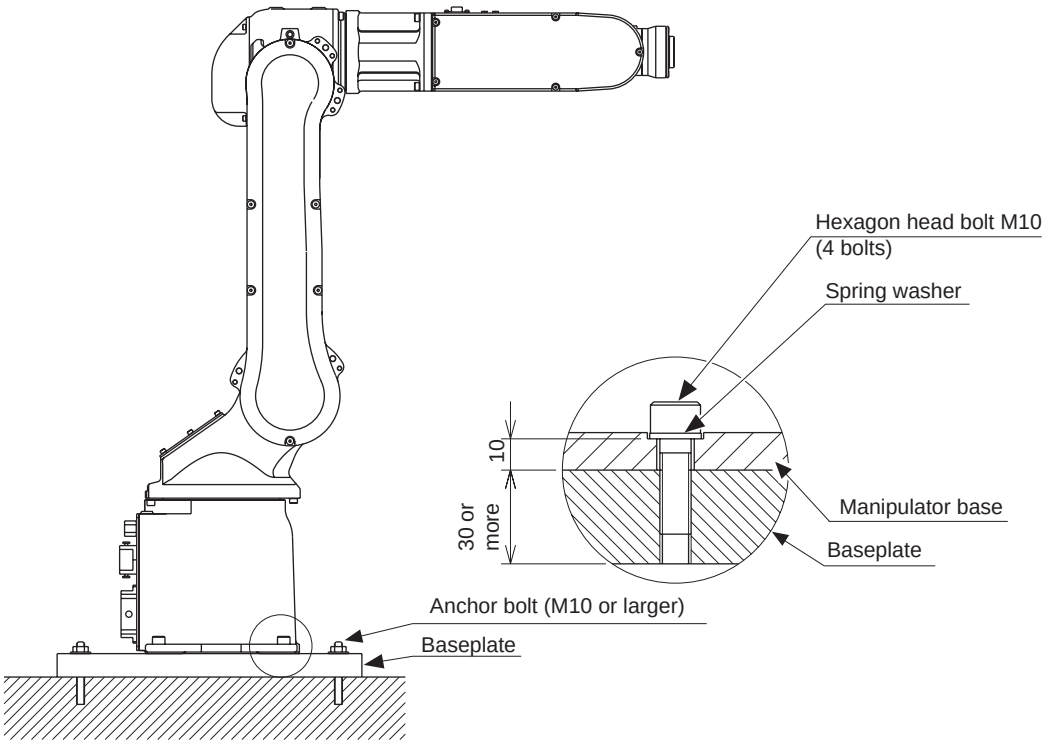
Endurance torque in horizontal operation (S-axis moving direction)	220 N • m (22.4 kgf • m)
Endurance torque in vertical operation (LU-axis moving direction)	350 N • m (35.7 kgf • m)

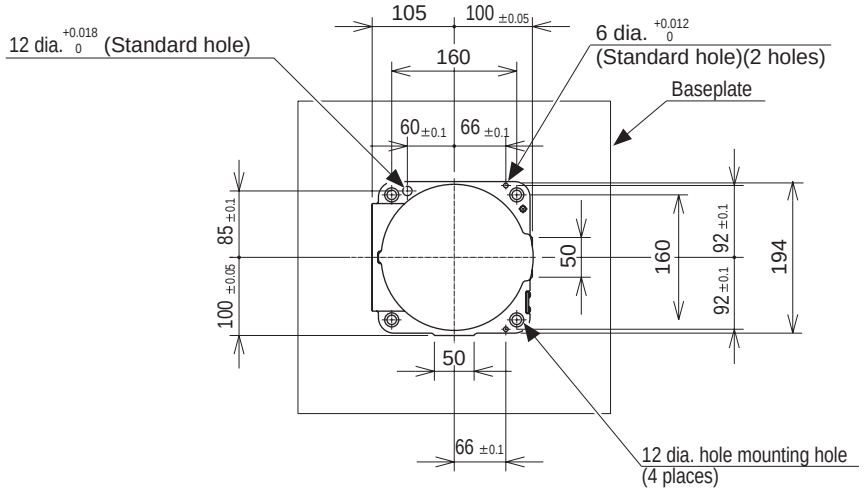
3.2.1 Installation Example

At the first setout, anchor the baseplate firmly 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.

Then, securely fix the manipulator base to the baseplate with the hexagon socket head cap screws M10 (recommended length: 35 mm or more) using mounting holes of the manipulator base. The manipulator base is tapped for four mounting holes. Tighten the screws and anchor bolts securely so that they will not work loose during operation. See *fig. 3-1 ".Mounting the Manipulator on Baseplate"* for the method.

Fig. 3-1: .Mounting the Manipulator on Baseplate





3.3 Types of Mounting

The MOTOMAN-MH5L is available in three types: floor-mounted (standard), wall-mounted, and ceiling-mounted type. For wall- and ceiling-mounted types, the three points listed below are different from the floor-mounted types

- 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 must be ±30°. (Adjusted prior to the shipment.)

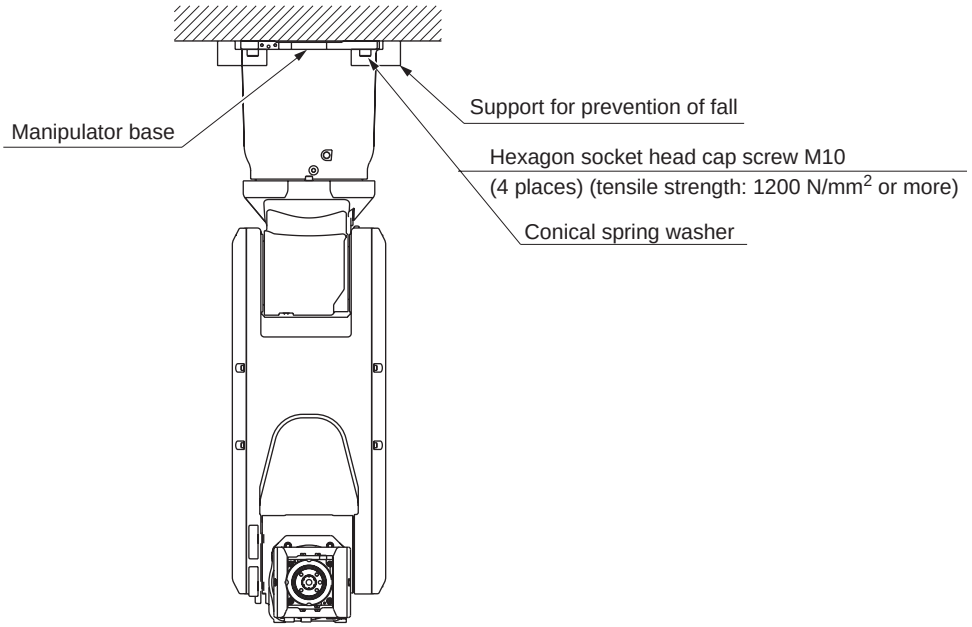
3.3.2 Fixing the Manipulator Base

For the wall- or ceiling-mounted types, be sure to use four hexagon socket head cap screws M10 for 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 perform a wall/ceiling installation on site.

3.4 Location

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

- Ambient Temperature: 0° to +45°C
- Humidity: 20 to 80%RH (no-condensing)
- Free from dust, soot, oil or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration (vibration acceleration: 4.9m/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

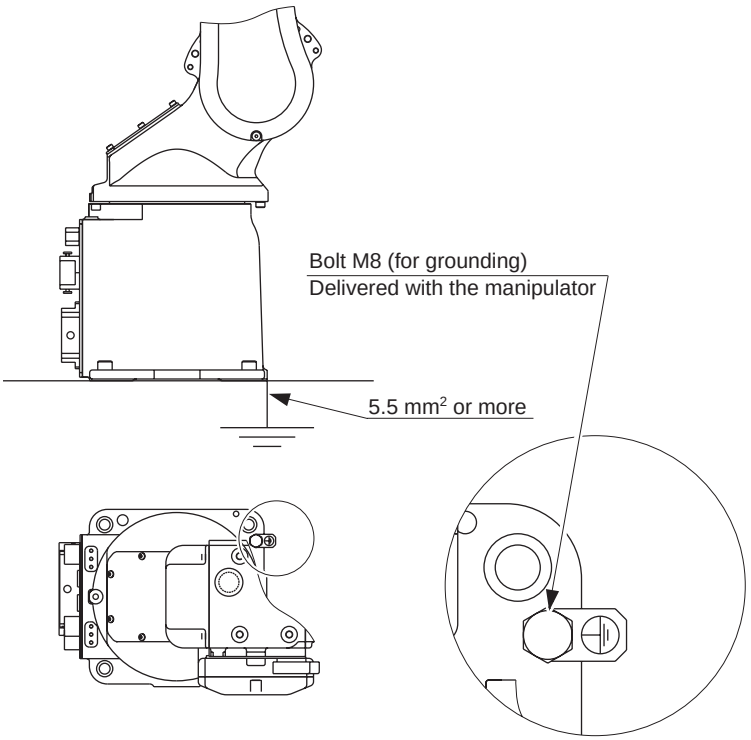
Follow electrical installation standards and wiring regulations for grounding . A ground wire of 5.5 mm^2 or more is recommended.

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

NOTE

- Do not 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 Manipulator Cable Connection

Two manipulator cables are delivered with the manipulator; an encoder cable (1BC) and a power cable (2BC). Refer to *fig. 4-2 “Manipulator Cables (DX100)” at page 4-4* .

Connect these cables to the manipulator base connectors and the DX100. Refer to *fig. 4-3(a) “Manipulator Cable Connection (Manipulator Side)” at page 4-5* and *fig. 4-3(b) “Manipulator Cable Connection (DX100 Side)” at page 4-5* .

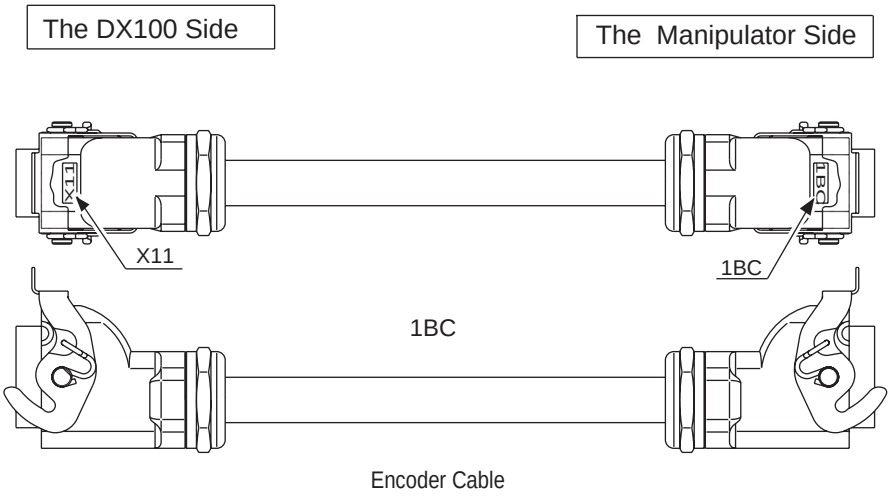
4.2.1 Connection to the Manipulator

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

4.2.2 Connection to the DX100

Before connecting the manipulator cables to the DX100, verify the numbers manipulator cables and the connectors on the DX100. When connecting, insert the cables in the order of X21, then X11, and depress each lever until they click.

Fig. 4-2: Manipulator Cables (DX100)



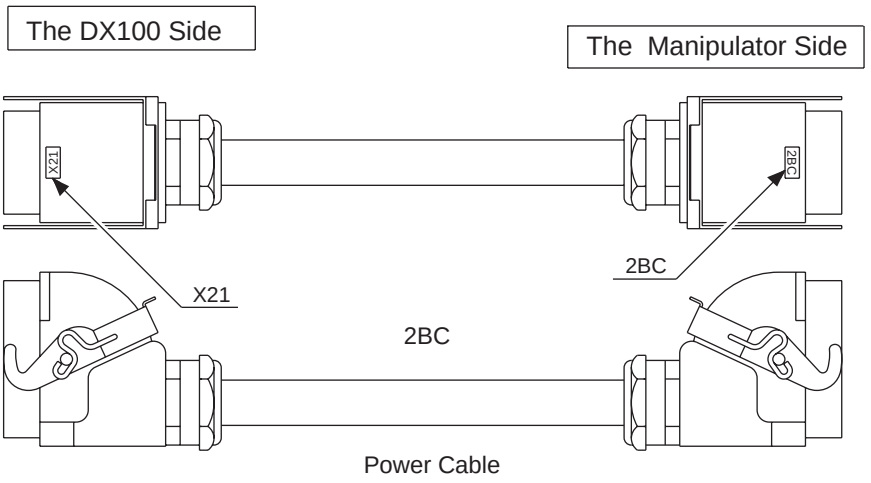


Fig. 4-3(a): Manipulator Cable Connection (Manipulator Side)

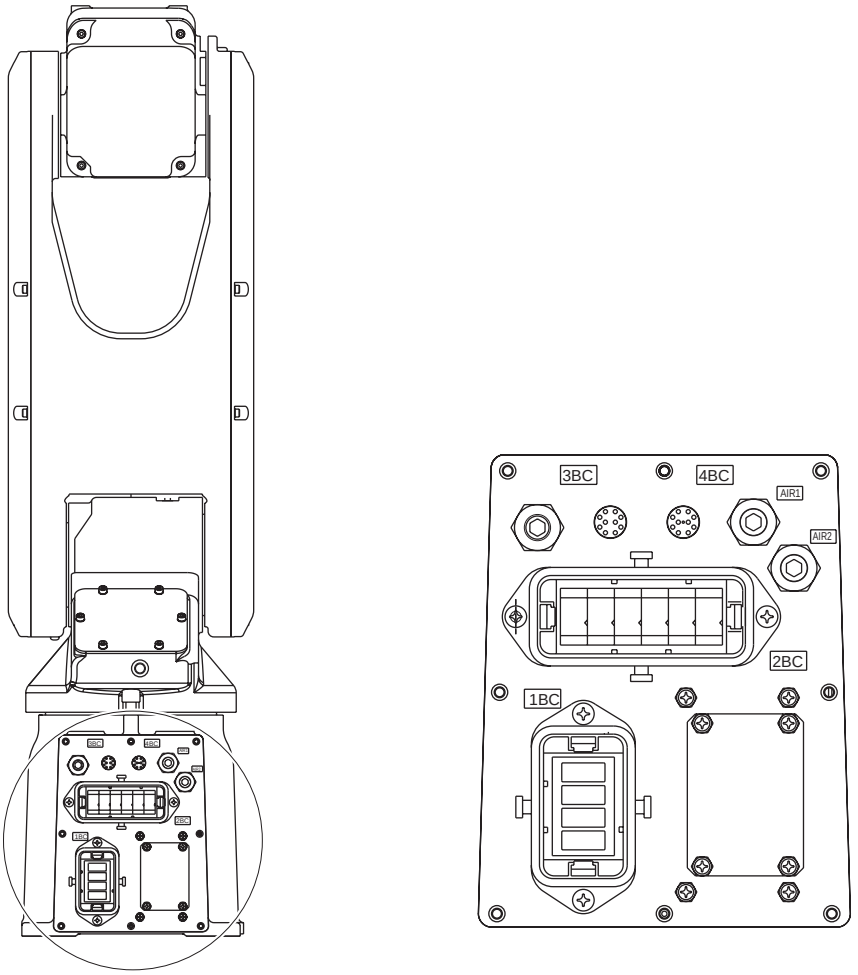
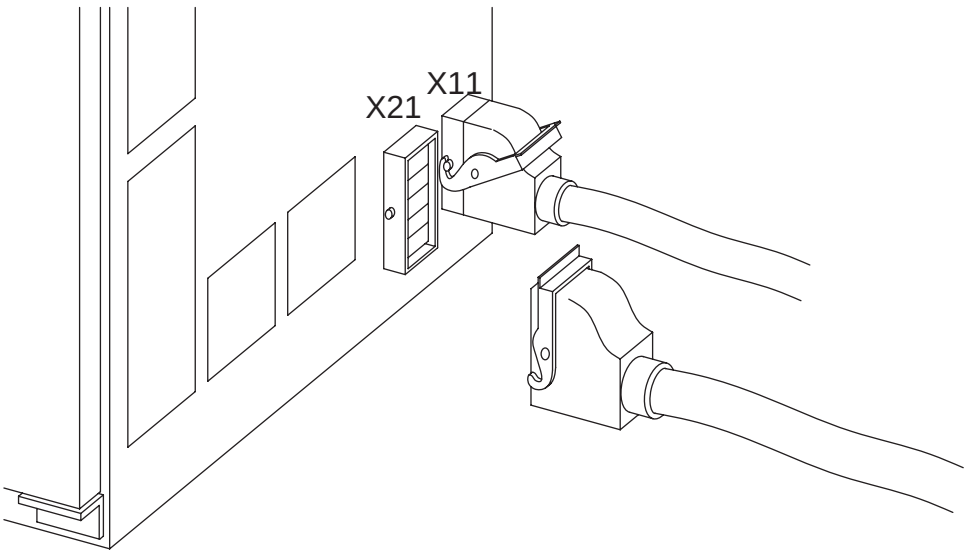


Fig. 4-3(b): Manipulator Cable Connection (DX100 Side)



5 Basic Specifications

5.1 Basic Specifications

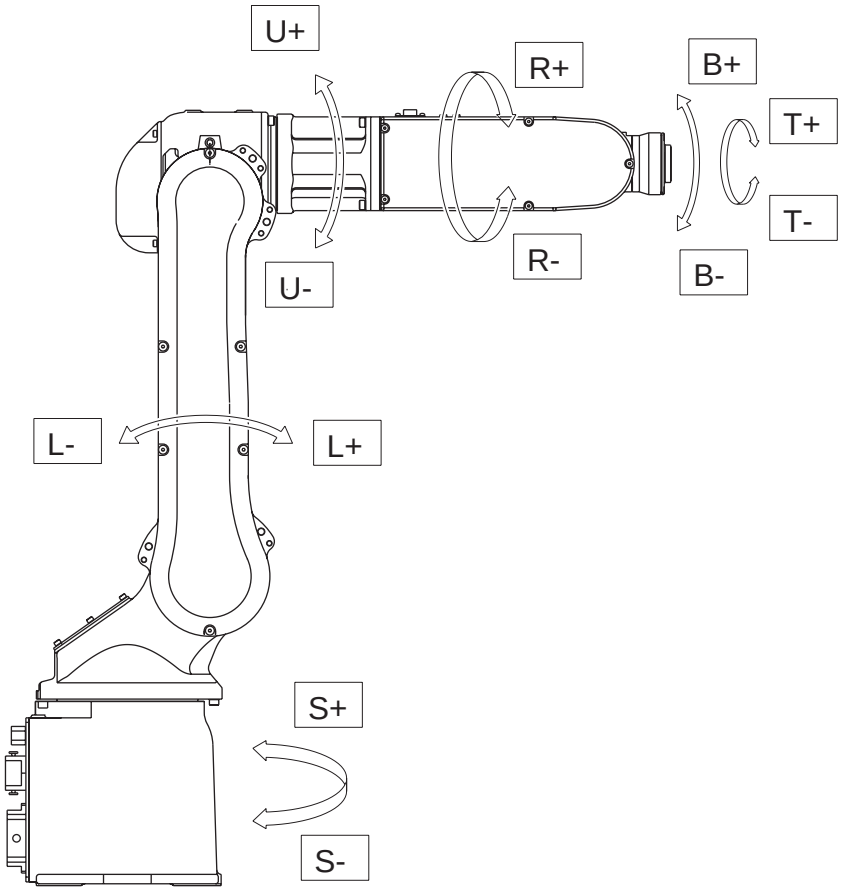
Table 5-1: Basic Specifications[1)]

Item \ Types		MOTOMAN-MH5L
Application		Handling
Structure		Vertically Articulated
Degree of Freedom		6
Payload		5kg
Repeatability[2)]		±0.03 mm
Range of Motion	S-Axis (turning)	±170°
	L-Axis (lower arm)	+150°, -65°
	U-Axis (upper arm)	+255°, -138°
	R-Axis (wrist roll)	±190°
	B-Axis (wrist pitch/yaw)	±125°
	T-Axis (wrist twist)	±360°
Maximum Speed	S-Axis	4.71 rad/s, 270° /s
	L-Axis	4.89 rad/s, 280° /s
	U-Axis	5.24 rad/s, 300° /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[3)]	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		29 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 Requirement		1 kVA

1 SI units are used in this table. However, gravitational unit is used in ( ).
2 Conforms to ISO9283
3 Refer to *chapter 6.1 "Allowable Wrist Load" at page 6-1* for details on the permissible moment of inertia.

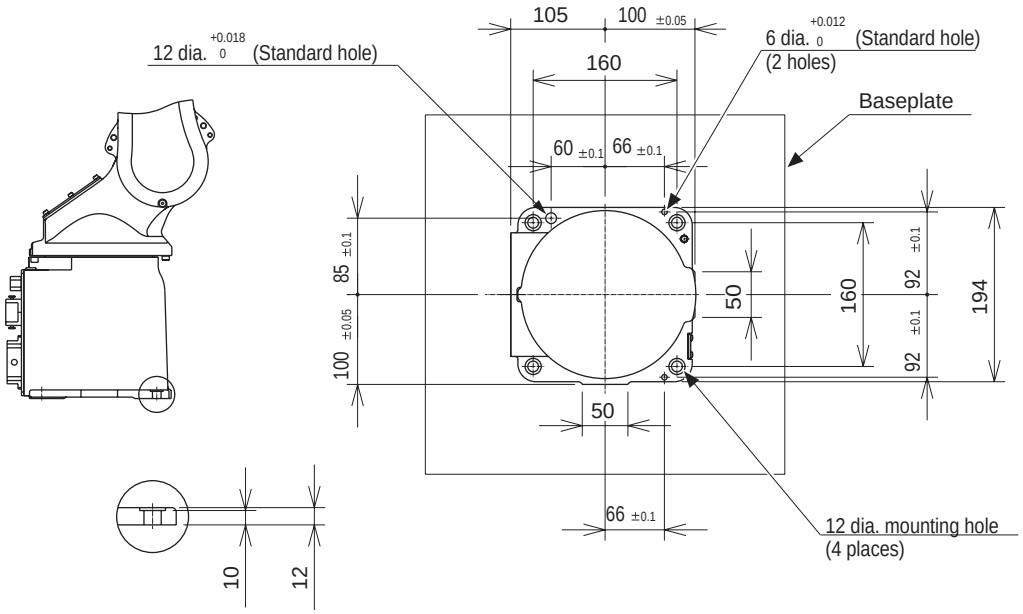
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes



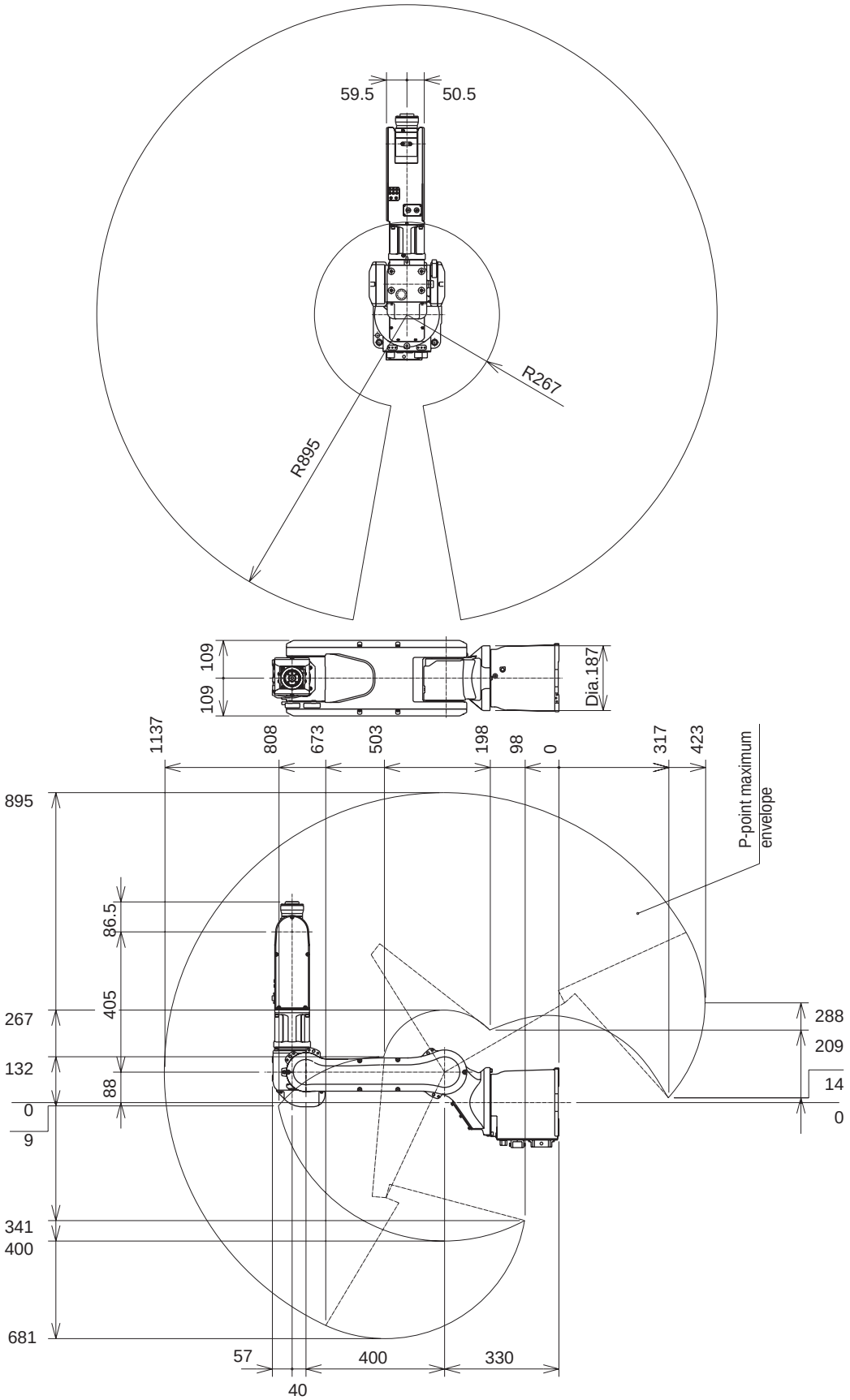
5.3 Baseplate Dimensions

Fig. 5-2: Manipulator Base Dimensions



5.4 Dimensions and P-Point Maximum Envelope

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



6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 5 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 6-1 "Moment and Total Inertia"* . Contact your YASKAWA representative for further information or assistance.

Table 6-1: Moment and Total Inertia

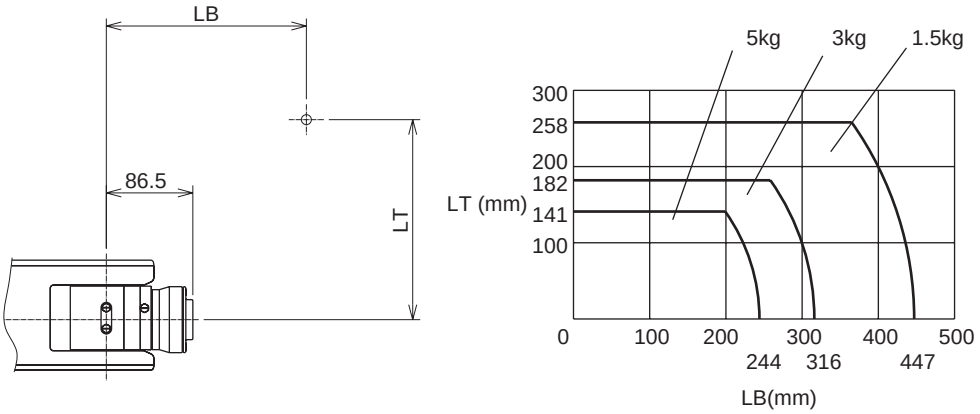
Axis	Moment N•m (kgf•m)[1)]	$GD^2/4$ Total Inertia kg•m^2
R-Axis	12 (1.22)	0.30
B-Axis	12 (1.22)	0.30
T-Axis	7 (0.571)	0.10

1 ( ): Gravitational unit

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

The allowable total moment of 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.

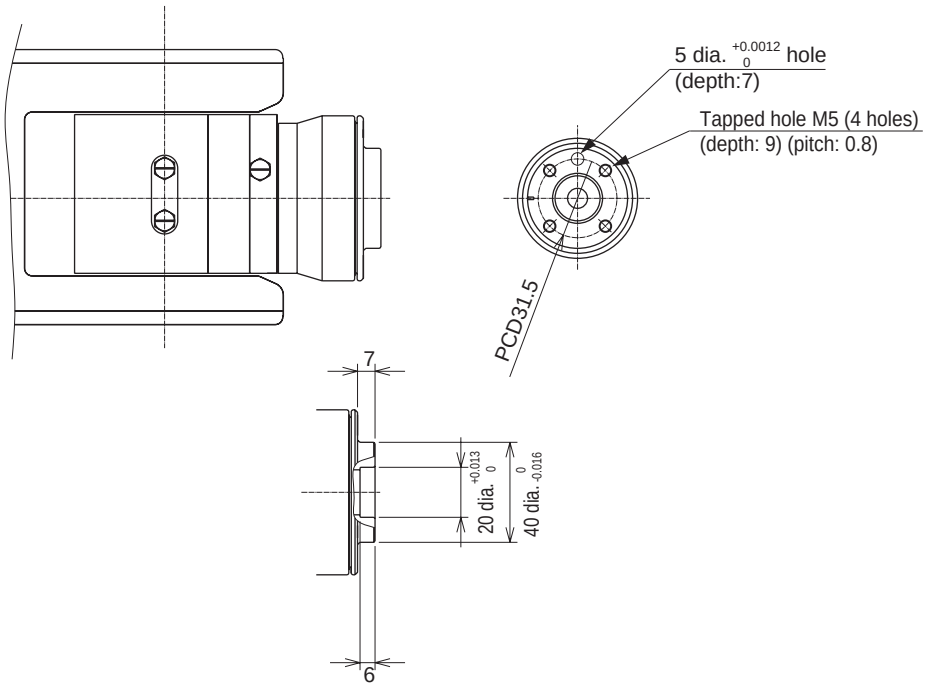
Fig. 6-1: Moment of Arm Rating



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

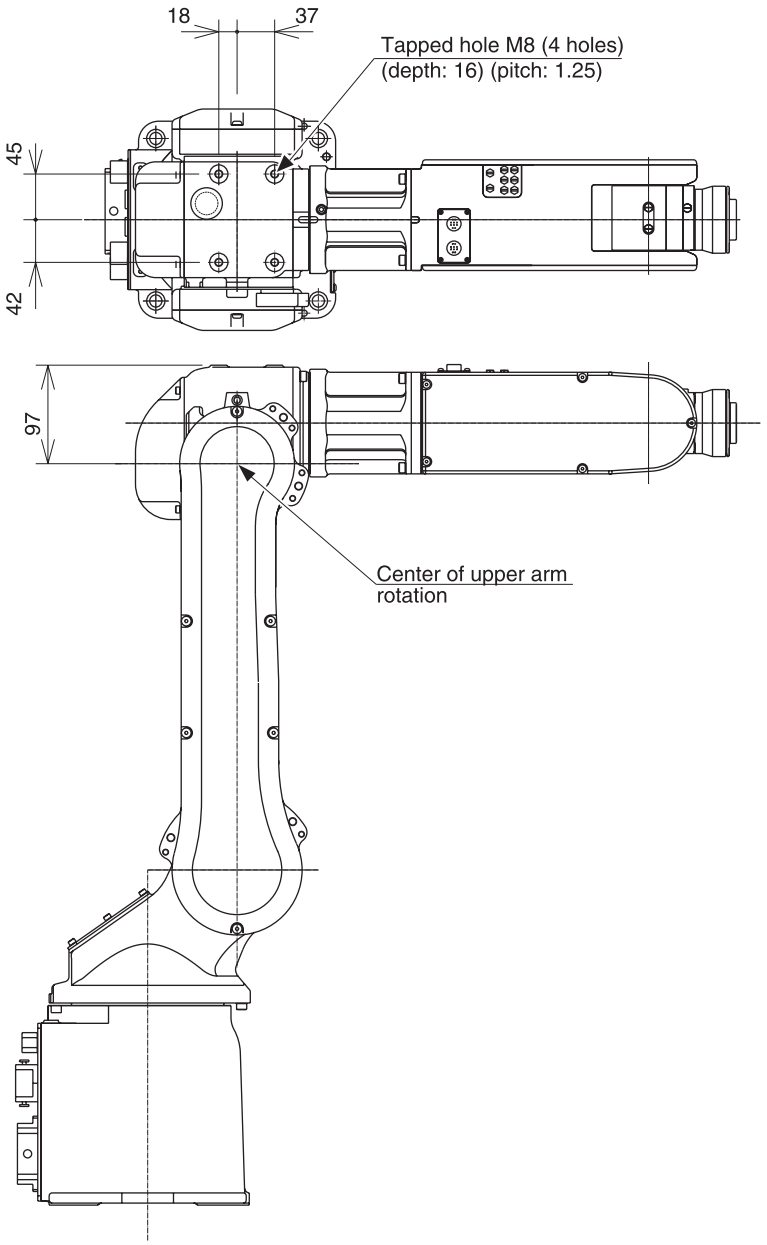
The peripheral equipment mounts are provided on the upper arm for easier installation of
the user's system application as shown in *fig. 7-1 "Installing Peripheral Equipment"* ". When peripheral equipment is attached to the U-axis, the following conditions should be observed.

7.1.1 Allowable Load

The allowable load on the U-axis is a maximum of 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 (3BC:0.2 $mm^2 \times 10$ wires, 4BC:0.2 $mm^2 \times$ 6 wires) and two air lines are incorporated in the manipulator for the drive of peripheral device 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" at page 7-3*. Wiring must be performed by users, following the 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 line inside diameter: 4.0mm .)

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

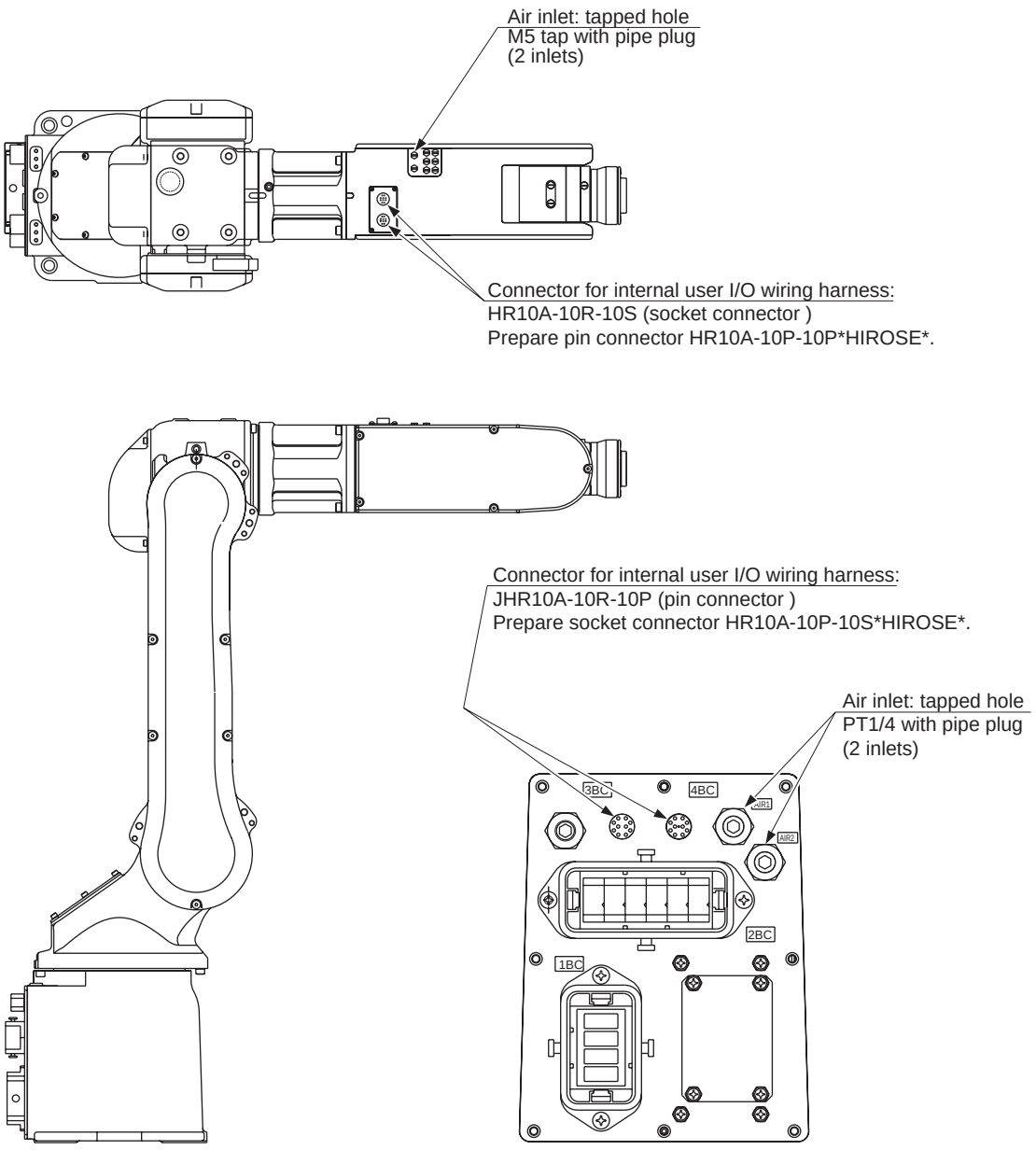
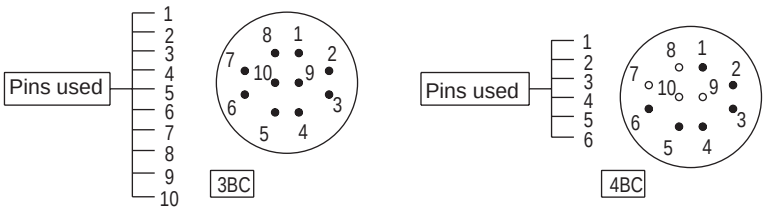


Fig. 7-3: Details of the Connector Pin Numbers



(Internal User I/O Wiring Harness: 0.2 mm^2 X 10 wires, 0.2 mm^2 X 6 wires)

Details of Connector Pin Numbers

The same pin-number connectors (1 to 10, 1 to 6) at both connector base part and arm part are connected with the wingle wire lead of single 0.2 mm^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. 8-1 “Locations and Numbers of Connectors”* .

Diagrams for internal connections of the manipulator and the DX100 are shown in *fig. 8-2(a) “Internal Connection Diagram” at page 8-2* and in *fig. 8-2(b) “Internal Connection Diagram” at page 8-3* .

Fig. 8-1: Locations and Numbers of Connectors

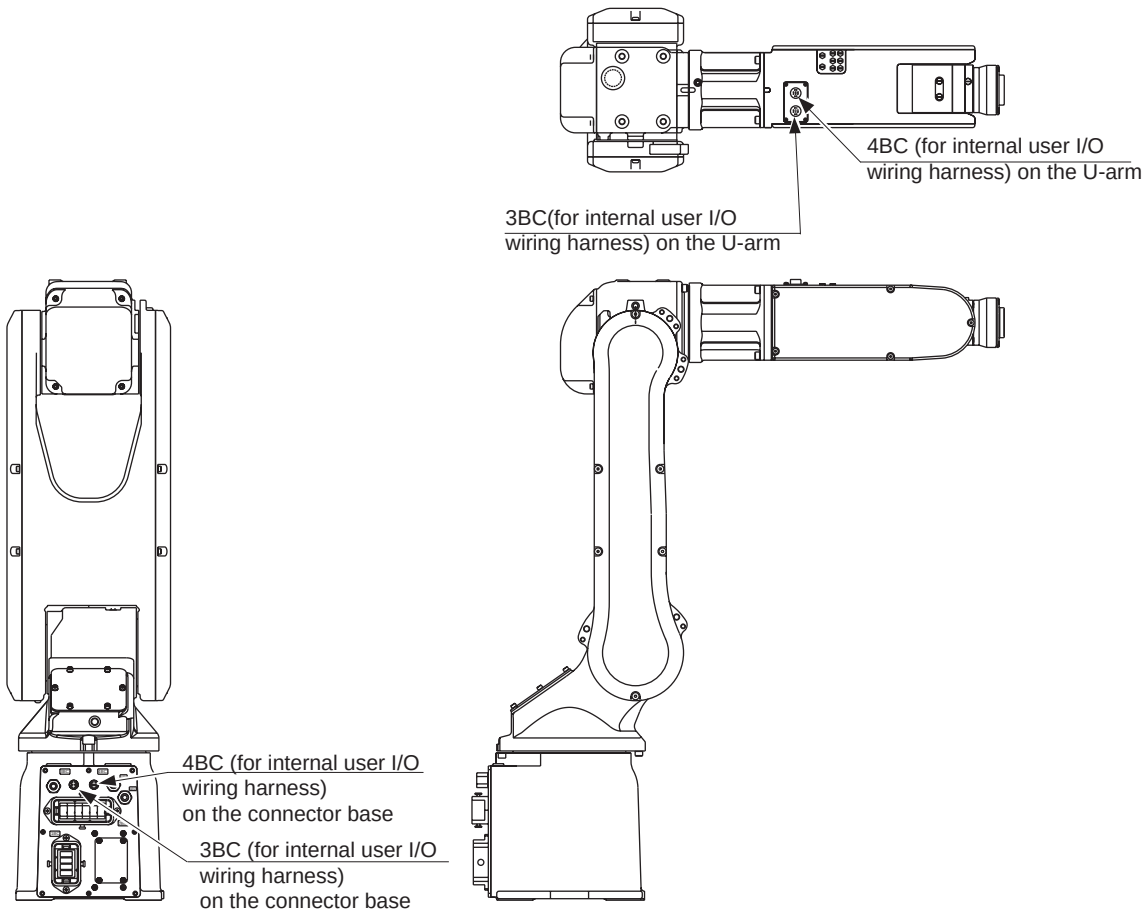


Table 8-1: List of Connector Types

Name	Type of Connector
Connector for the internal user I/O wiring harness on the connector base	HR10A-10R-10P (HR10A-10P-10S*HIROSE*:Optional)
Connector for the internal use I/O wiring harness on the U-arm	HR10A-10R-10S (HR10A-10P-10P*HIROSE*:Optional)

Fig. 8-2(a): Internal Connection Diagram

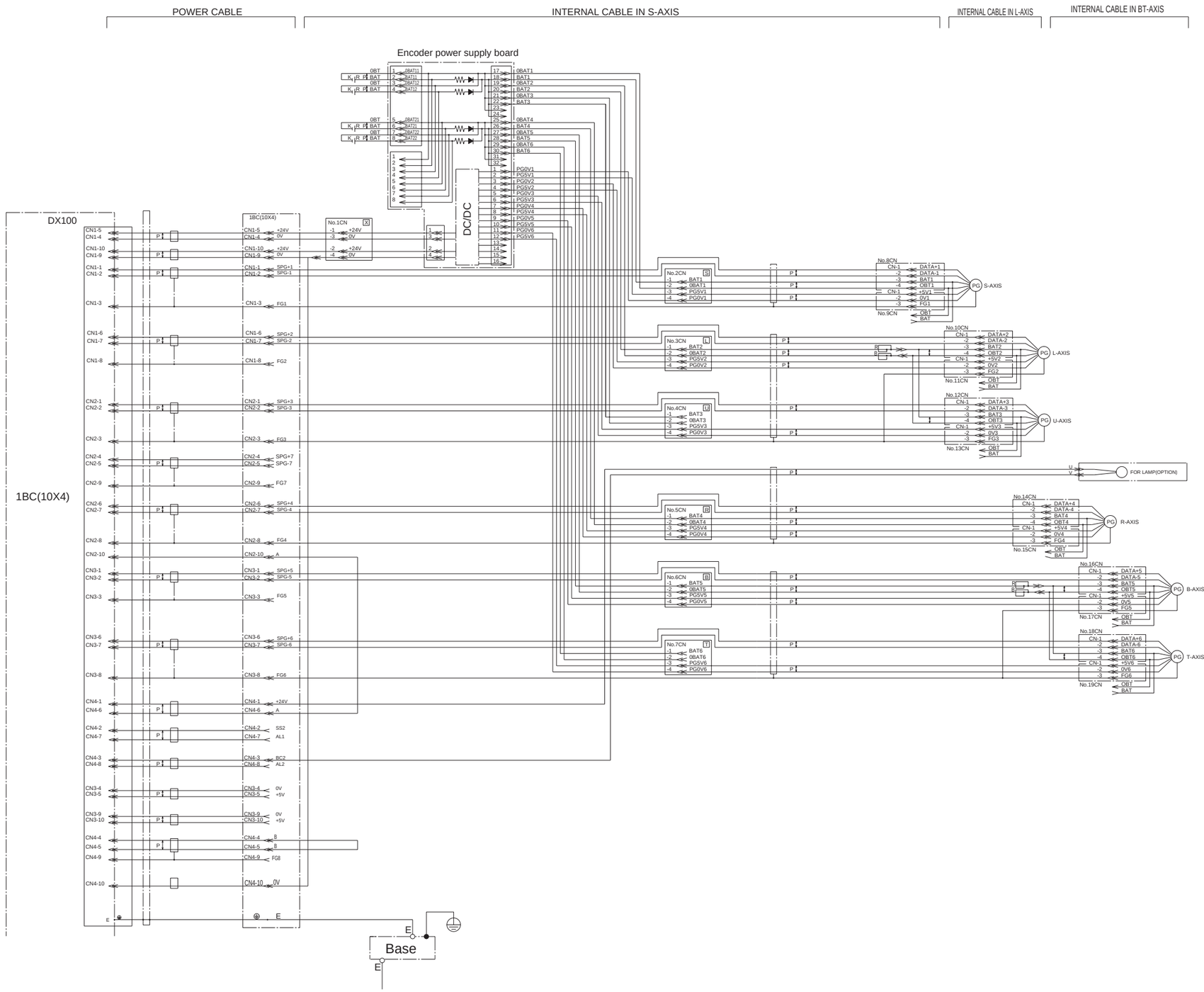
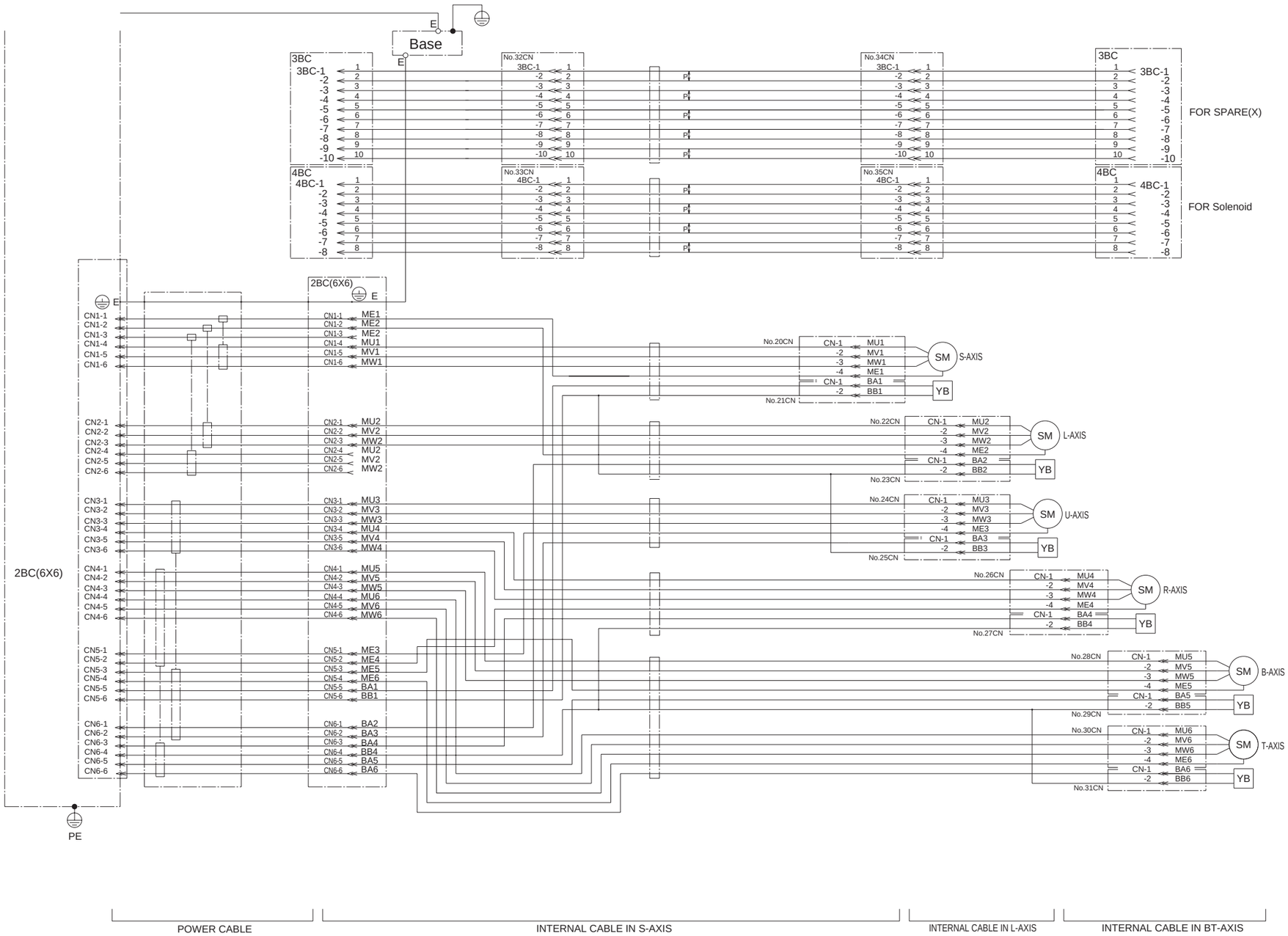


Fig. 8-2(b): Internal Connection Diagram



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 9-1 "Inspection Items" at page 9-2*.

In *table 9-1 "Inspection Items"* , the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized by the user, operations to be performed by personnel being trained, 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.
- 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.

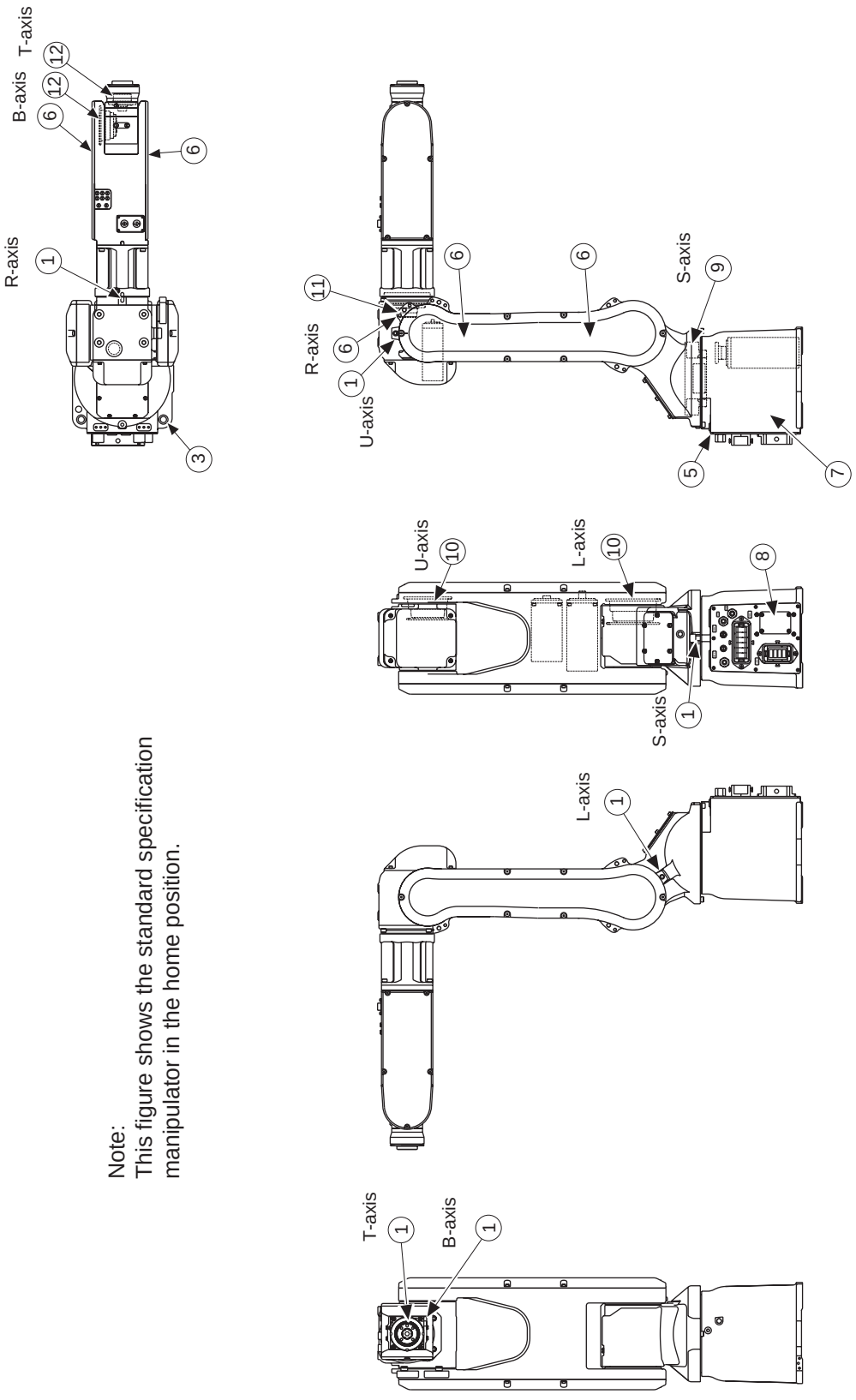
Table 9-1: Inspection Items (Sheet 1 of 2)

Items[1]		Schedule							Method	Operation	Inspection Charge		
		Daily	1000HCycle	6000HCycle	12000HCycle	24000H	36000H				Specified Personnel	Licensee	Service Company
1	Alignment mark	●							Visual	Check alignment mark accordance and damage at the home position.	●	●	●
2	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	Connector base		●						Manual	Check for loose connectors.	●	●	●
6	LURBT-axis 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 *chapter 9.3.1*		●	●
10	LU-axes speed reducers			●					Grease Gun	Check for malfunction. (Replace if necessary.) Supply grease[4] (6000H cycle). See *chapter 9.3.3* and *chapter 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 *chapter 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 "*chapter 9.3.6*	●	●	●
13	Overhaul						●					

1 Inspection No. correspond to the numbers in *fig. 9-1 "Inspection Items" at page 9-4*.
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 *chapter 9.3.7 "Notes for Maintenance" at page 9-16*)
3 Internal cables (for S, L, U, R, B, and T axes) in manipulator to be replaced at 24000H inspection.
4 For the grease, refer to *table 9-2 "Inspection Parts and Grease Used" at page 9-5*.



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
9,10,12	Harmonic Grease 4B No.2	S, L, U, B, T-axis speed reducers, S, T-axis gears
11	Harmonic Grease SK-1A	R-axis speed reducer

The numbers in the above table correspond to the numbers in *table 9-1 “Inspection Items” at page 9-2*.

9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

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

Fig. 9-2: Battery Location

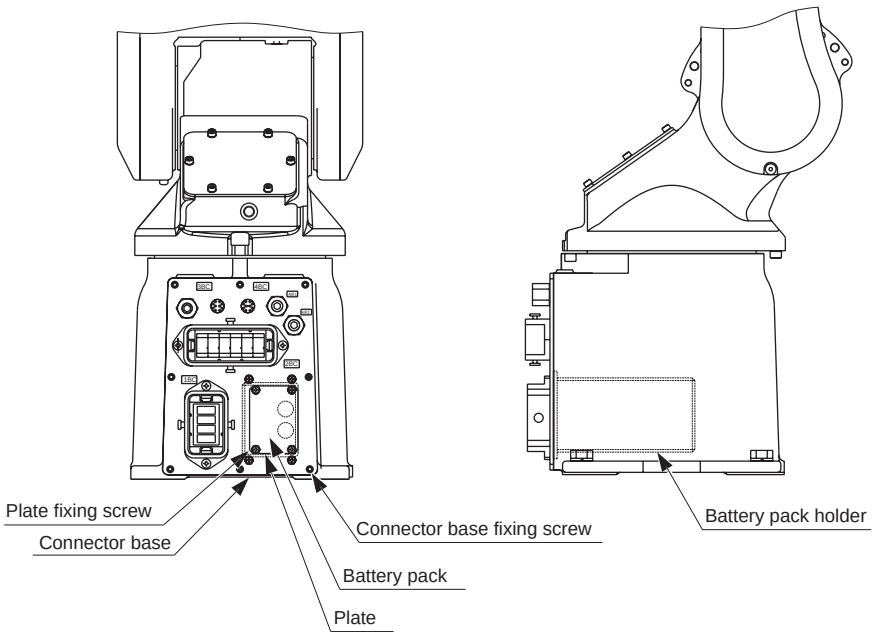
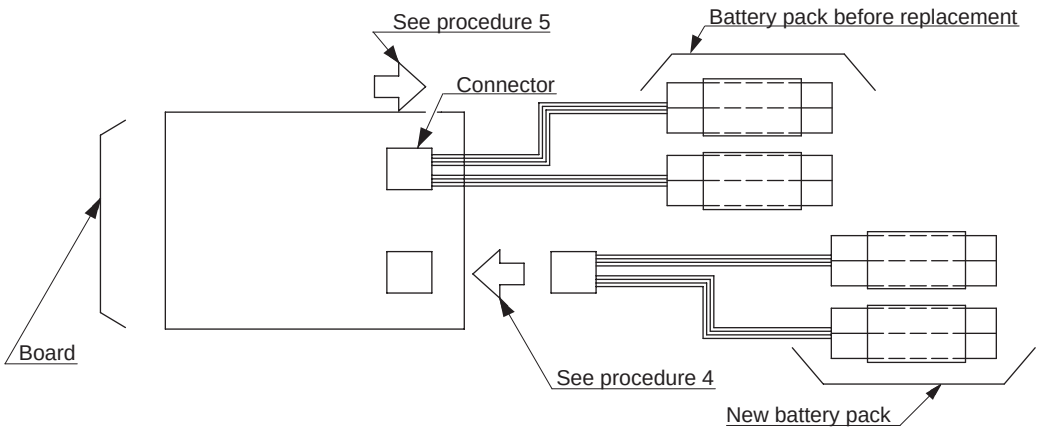


Fig. 9-3: Battery Connection



1. Turn OFF the DX100 main power supply.
2. Remove the plate fastening screws and the plate on the connector base, then pull the battery pack out to replace it with the new one.
3. Remove the battery pack from the holder.
4. Connect the new battery pack to the unoccupied connector 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 date does not disappear.

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

NOTE Do not allow plate to pinch the cable installing the plate.

9.3 Notes on Grease Replenishment/Exchange Procedures

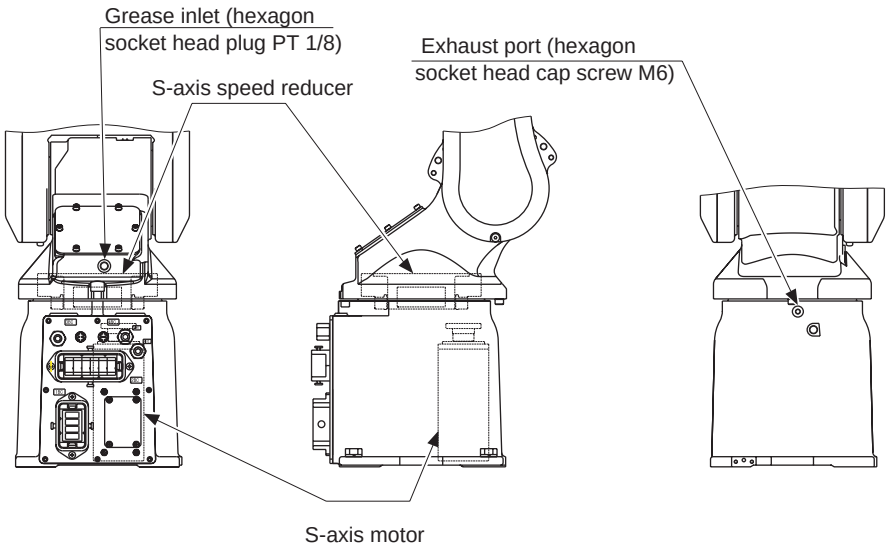
Make sure to follow the instructions listed below at grease replenishment. Failure to observe the following notes may result in damage to motor and speed reducer.

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

NOTE

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

2. Install a grease zerk PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease 4B No.2
   - Amount of grease: 25cc

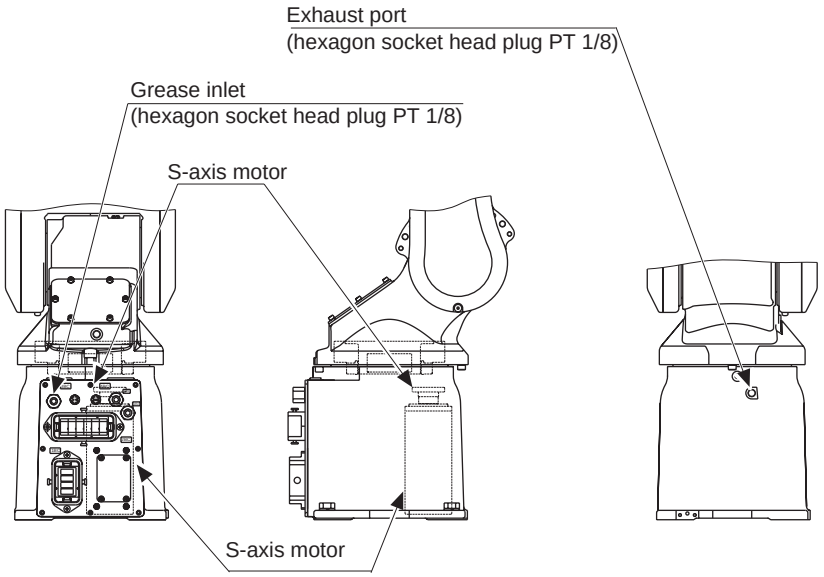
NOTE

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

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.

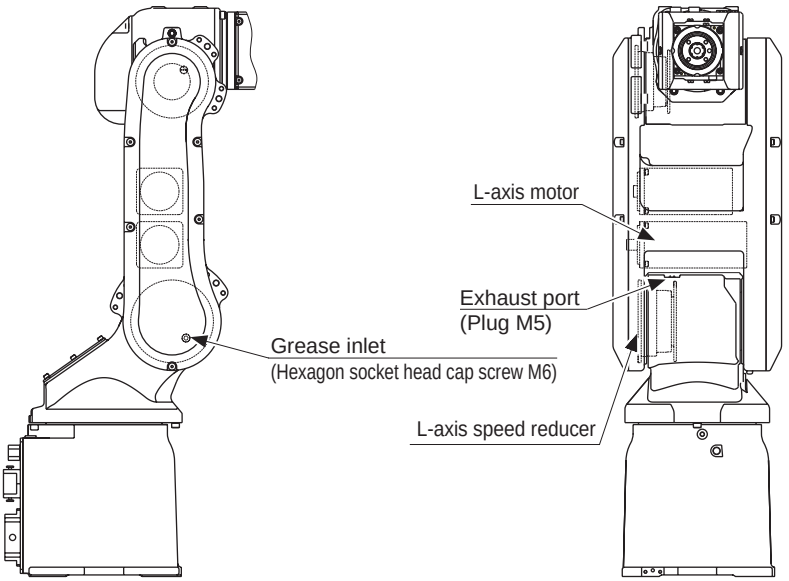
2. Install the grease zerk PT1/8 to the grease inlet. (The grease zerk is packed with the manipulator on the shipment.)
3. Inject the grease into the grease inlet using a grease gun.
   – Grease type: Harmonic Grease 4B No.2
   – Amount of grease: 25cc

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 plug M5 from the exhaust port and the hexagon socket head 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.

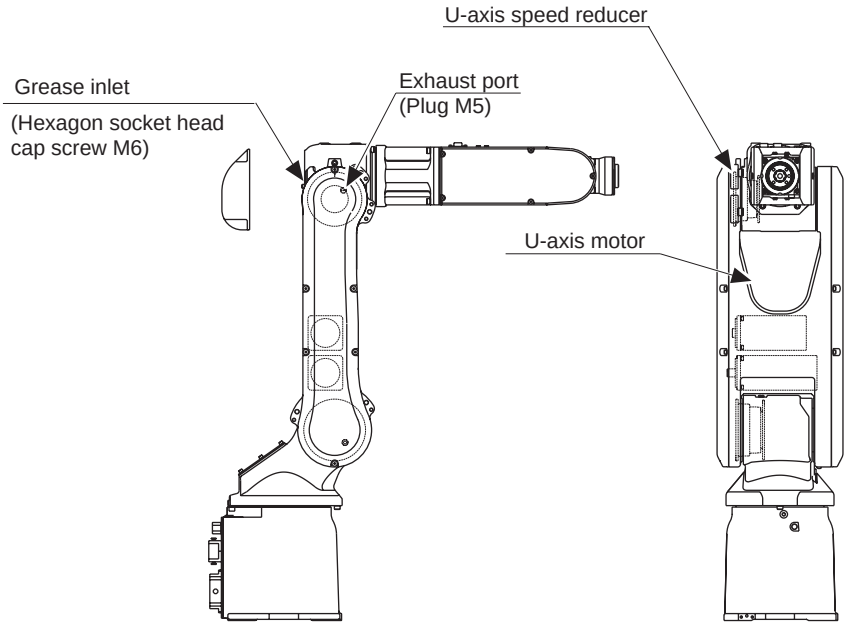
2. Install a grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject grease into the grease inlet using a grease gun.
   – Grease type: Harmonic Grease 4B No.2
   – Amount of grease: 30cc

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.

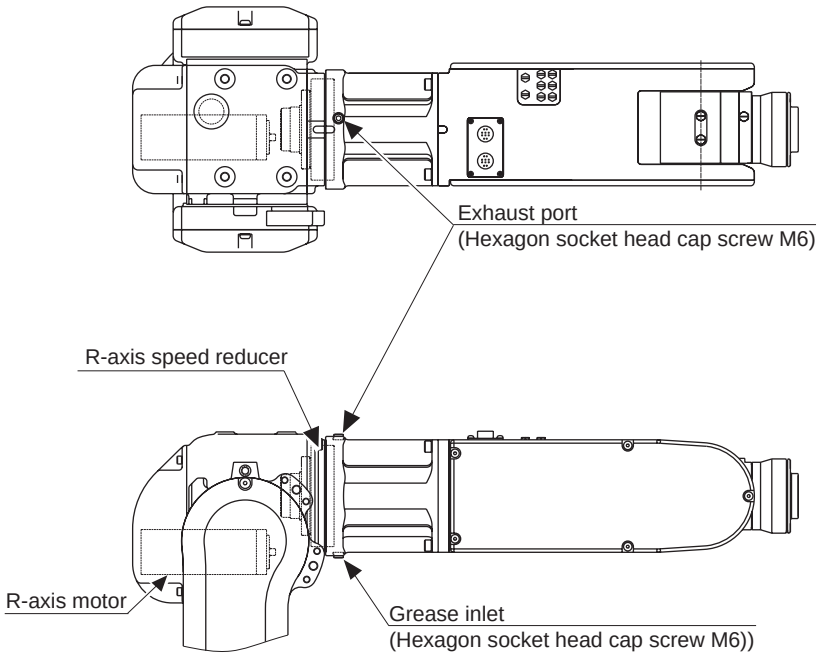
2. Install a grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease 4B No.2
   - Amount of grease: 20cc

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 hexagon socket head cap screw M6 from the exhaust port.

NOTE

- If grease is injected with the screw on, the grease will leak inside the motor and may cause a damage. Make sure to remove the screw 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

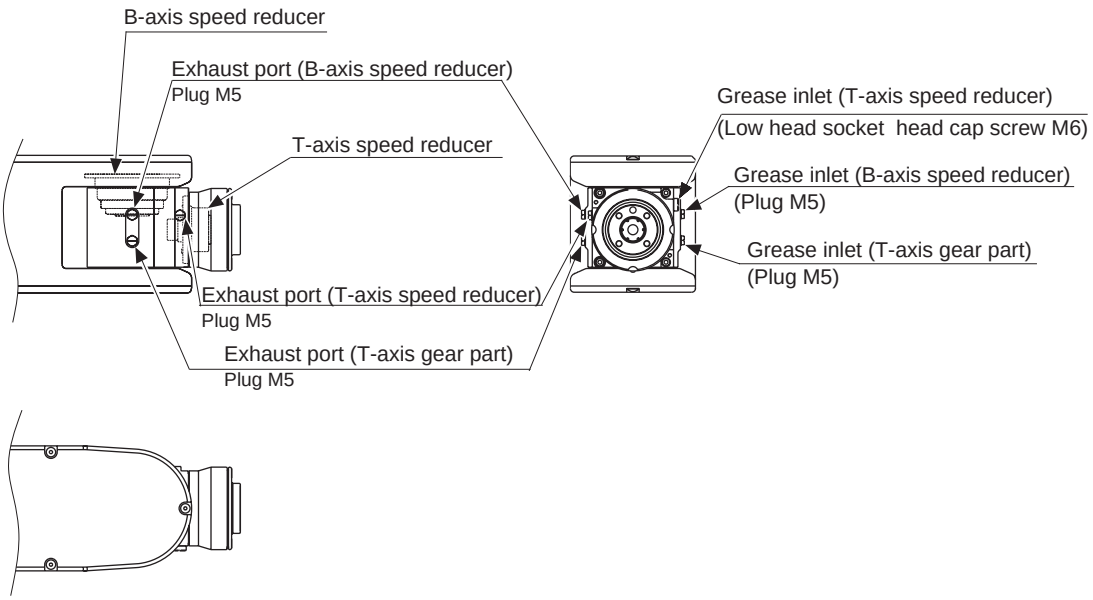
NOTE

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 screw to the exhaust port. Apply Three Bond 1206C on the thread part of the screw.

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

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



9.3.6.1 Grease Replenishment for B-Axis (Refer to *fig. 9-9 "B- and T-Axis 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 4B No.2
   - 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-Axis Speed Reducers Diagram" at page 9-14*.)

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 a grease zerk A-MT6 x 1 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject grease into the grease inlet using a grease gun.
   - Grease type: Harmonic Grease 4B No.2
   - 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.

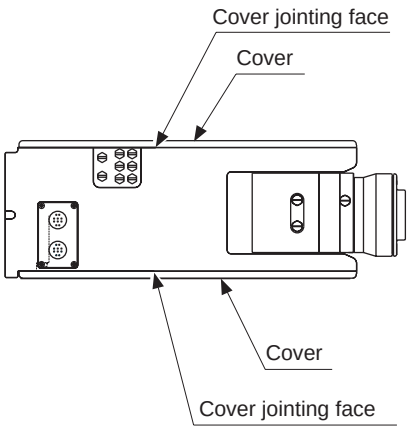
4. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet and reinstall thescrew M6, and the plug M5 to the exhaust port.
   Apply Three Bond 1206C on the thread parts of the plug/screw.

9.3.7 Notes for Maintenance

9.3.7.1 Wrist Unit

The motor and encoder unit are provided with the wrist unit. To prevent fumes from penetrating into the wrist unit, the matched parts are sealed with sealing bond. If the wrist cover is disassembled, make sure to reseal with sealing bond (Three Bond 1206C, refer to *table 10-1 "Spare Parts for YR-MH0005L-B00" at page 10-1*).

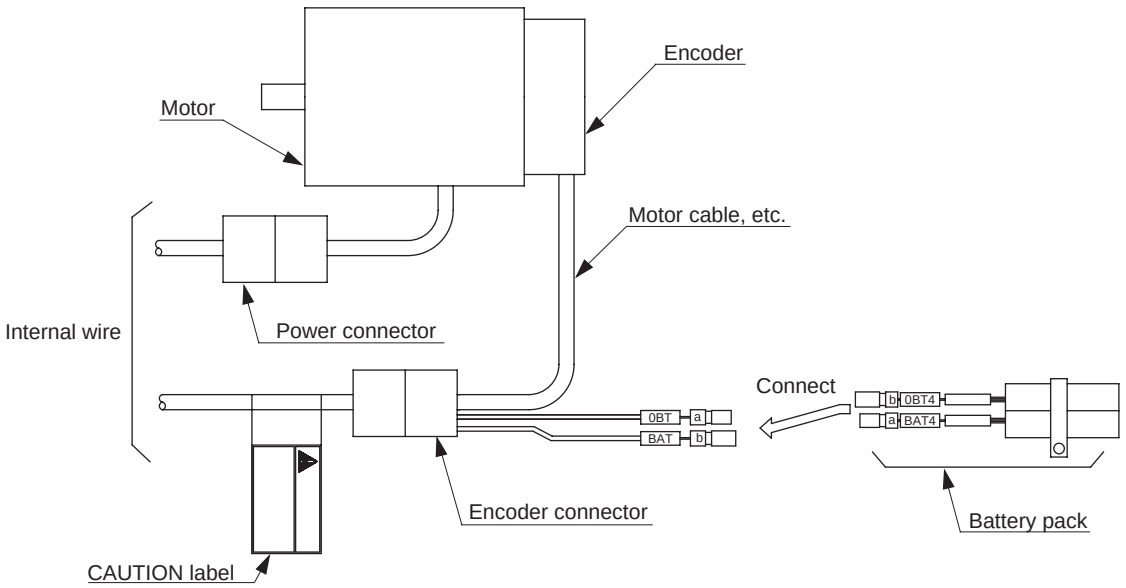
Fig. 9-10: Sealing Part of Wrist Unit



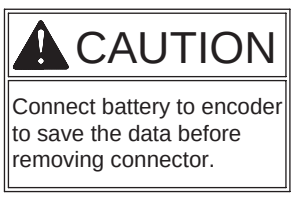
9.3.7.2 Battery Pack Connector (with CAUTION label)

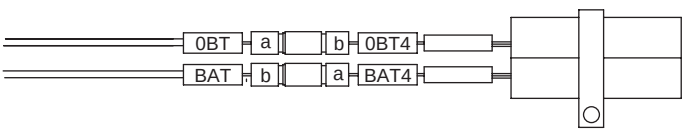
Before removing the encoder connector (with CAUNTION label), connect the battery pack referring to the following figures.

Fig. 9-11: Battery Pack Connection Diagram



CAUTION label (Enlarged view)





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

10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-MH5L. The spare parts list for the MOTOMAN-MH5L 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 10-1: Spare Parts for YR-MH0005L-B00

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	Grease	Harmonic Grease SK-1A	Harmonic Drive Systems Co., Ltd.	2.5kg	-	
A	3	Liquid Gasket	Three Bond 1206C	Three Bond Co., Ltd.	-	-	
A	4	Battery Pack	HW0470360-A	Yaskawa Electric Corporation	1	1	
A	5	Battery Pack	HW9470932-A	Yaskawa Electric Corporation	1	1	
B	6	L-Axis Timing Belt	100S5M305	Yaskawa Electric Corporation	1	1	
B	7	U-Axis Timing Belt	100S5M560	Yaskawa Electric Corporation	1	1	
B	8	R-Axis Timing Belt	060S3M219	Yaskawa Electric Corporation	1	1	
B	9	B- and T-Axis BrakeTiming Belt	060S3M150	Yaskawa Electric Corporation	1	2	
B	10	B-Axis Timing Belt	060S3M300	Mitsuboshi Belting Ltd.	1	1	
B	11	T-Axis Timing Belt	060S3M285	Mitsuboshi Belting Ltd.	1	1	
B	12	S-Axis Speed Reducer	HW0389176-A	Yaskawa Electric Corporation	1	1	
B	13	L-Axis Speed Reducer	HW0388706-A	Yaskawa Electric Corporation	1	1	
B	14	U-Axis Speed Reducer	HW0388707-A	Yaskawa Electric Corporation	1	1	

Table 10-1: Spare Parts for YR-MH0005L-B00

Rank	Parts No.	Name	Type	Manufacturer	Qty	Qty per Unit	Remarks
B	15	R-Axis Speed Reducer	HW0388708-A	Yaskawa Electric Corporation	1	1	
B	16	B-Axis Speed Reducer	HW0388709-A	Yaskawa Electric Corporation	1	1	
B	17	T-Axis Speed Reducer	HW0388710-A	Yaskawa Electric Corporation	1	1	
B	18	Wire Harness in Manipulator	HW0175097-A	Yaskawa Electric Corporation	1	1	
C	19	S-and L-Axis AC Servomotor	HW0388651-A SGMAV-04ANA-YR1*	Yaskawa Electric Corporation	1	2	
C	20	U-Axis AC Servomotors	HW0388650-A SGMAV-02ANA-YR1*	Yaskawa Electric Corporation	1	1	
C	21	R-Axis AC Servomotor	HW0388647-A SGMAV-A5ANA-YR1*	Yaskawa Electric Corporation	1	1	
C	22	B- and T-Axis AC Servomotor	HW0388794-A SGMAV-A5ANA-YR2*	Yaskawa Electric Corporation	1	2	
C	23	B- and T-Axes Brake	HW0472643-A	Yaskawa Electric Corporation	1	2	

11 Parts List

11.1 S-Axis Unit

Fig. 11-1: S-Axis Unit

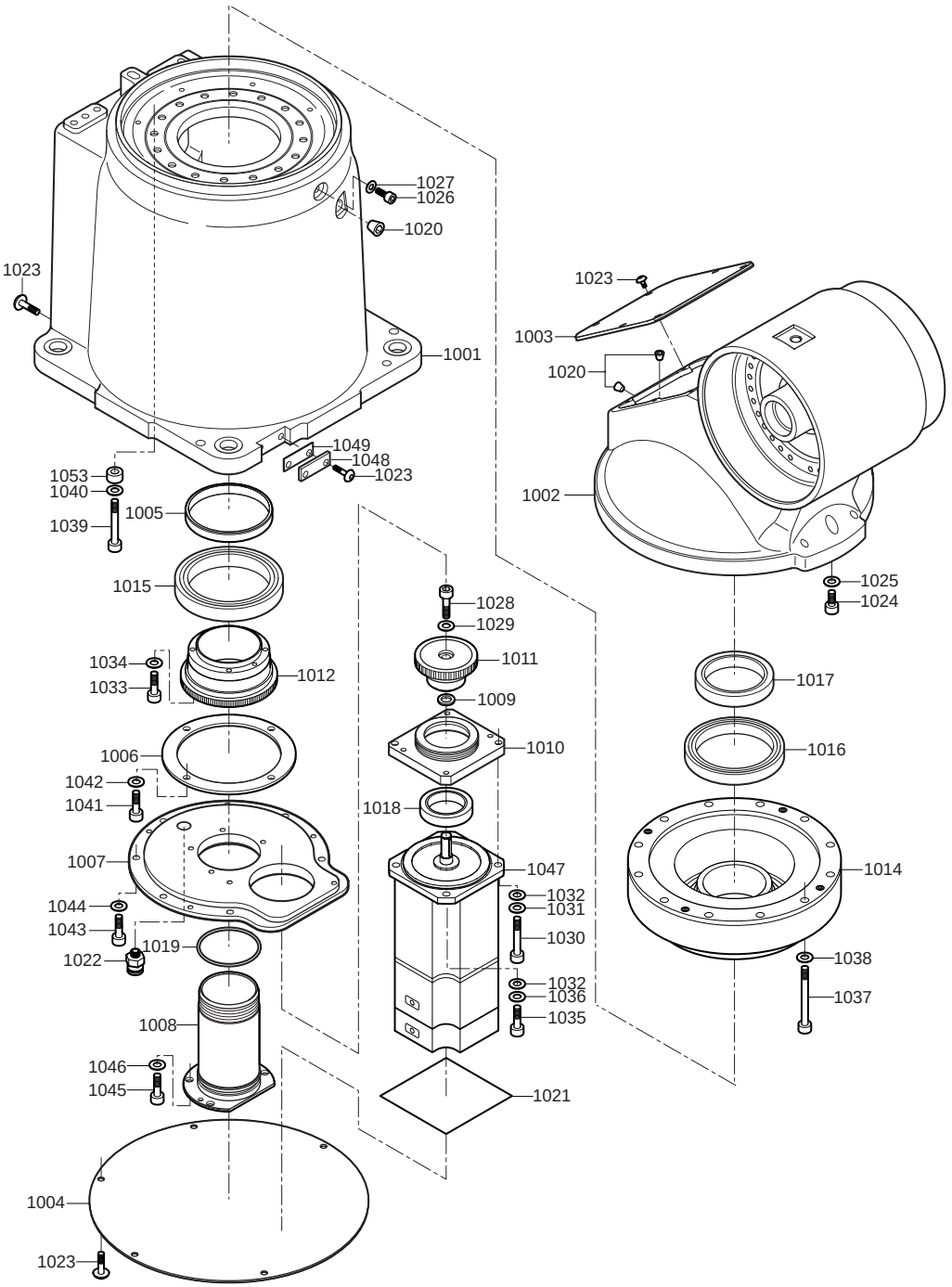


Table 11-1: S-Axis Unit (Sheet 1 of 2)

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
1014	HW0389176-B	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	21
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	Socket screw	4
1042	2H-4	Spring washer	4
1043	M4X16	Socket screw	7
1044	2H-4	Spring washer	7
1045	M4X12	Socket screw	4

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

No.	DWG No.	Name	Pcs
1046	2H-4	Spring washer	4
1047	SGMAV-04ANA-YR11	Motor	1
1048	HW0414483-1	Cover	1
1049	HW0414484-1	Packing	1
1050	HW0414485-1	Spacer	1
1051	VR-150A	V ring	1
1052	CBSA4-10	Socket screw	4
1053	HW8411125-2	Washer	16

11.2 L-, U-Axes Unit

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

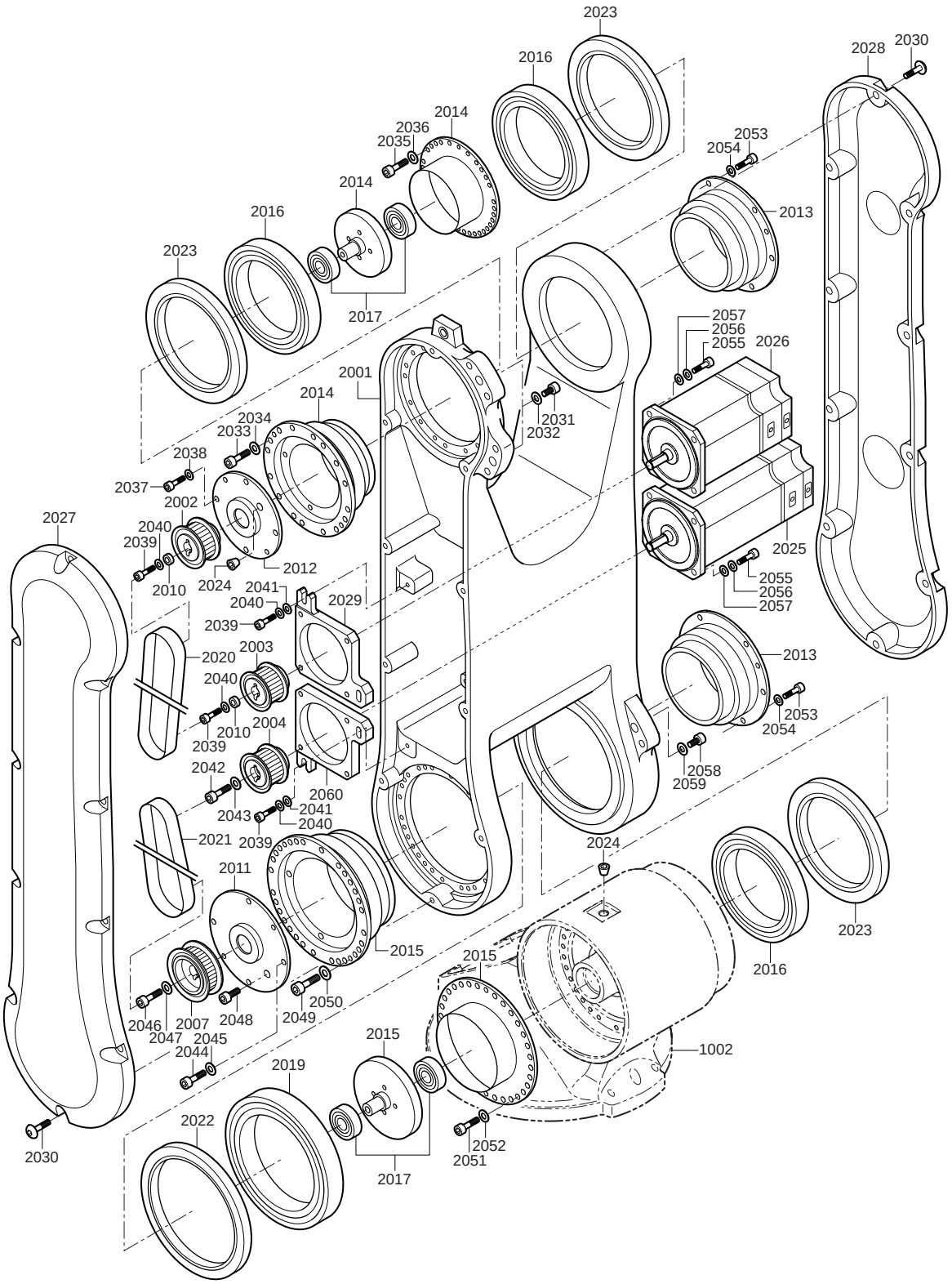


Table 11-2: L-, U-Axes Unit (Sheet 1 of 2)

No.	DWG No.	Name	Pcs
2001	HW0102485-1	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-B	Speed reducer	1
2015	HW0388706-B	Speed reducer	1
2016	6913DDU	Bearing	3
2017	6000DDU	Bearing	4
2019	6916DDU	Bearing	1
2020	100S5M560	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	HW0201253-1	Cover	1
2028	HW0201253-2	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	Socket screw	4
2038	2H-4	Spring washer	4
2039	M4X18	Socket screw	6
2040	2H-4	Spring washer	6
2041	M4	Washer	4
2042	M5X16	Socket screw	1
2043	2H-5	Spring washer	1
2044	M4X10	Socket screw	4
2045	2H-4	Spring washer	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	M4X12	Socket screw	12
2054	2H-4	Spring washer	12
2055	M4X16	Socket screw	8
2056	2H-4	Spring washer	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

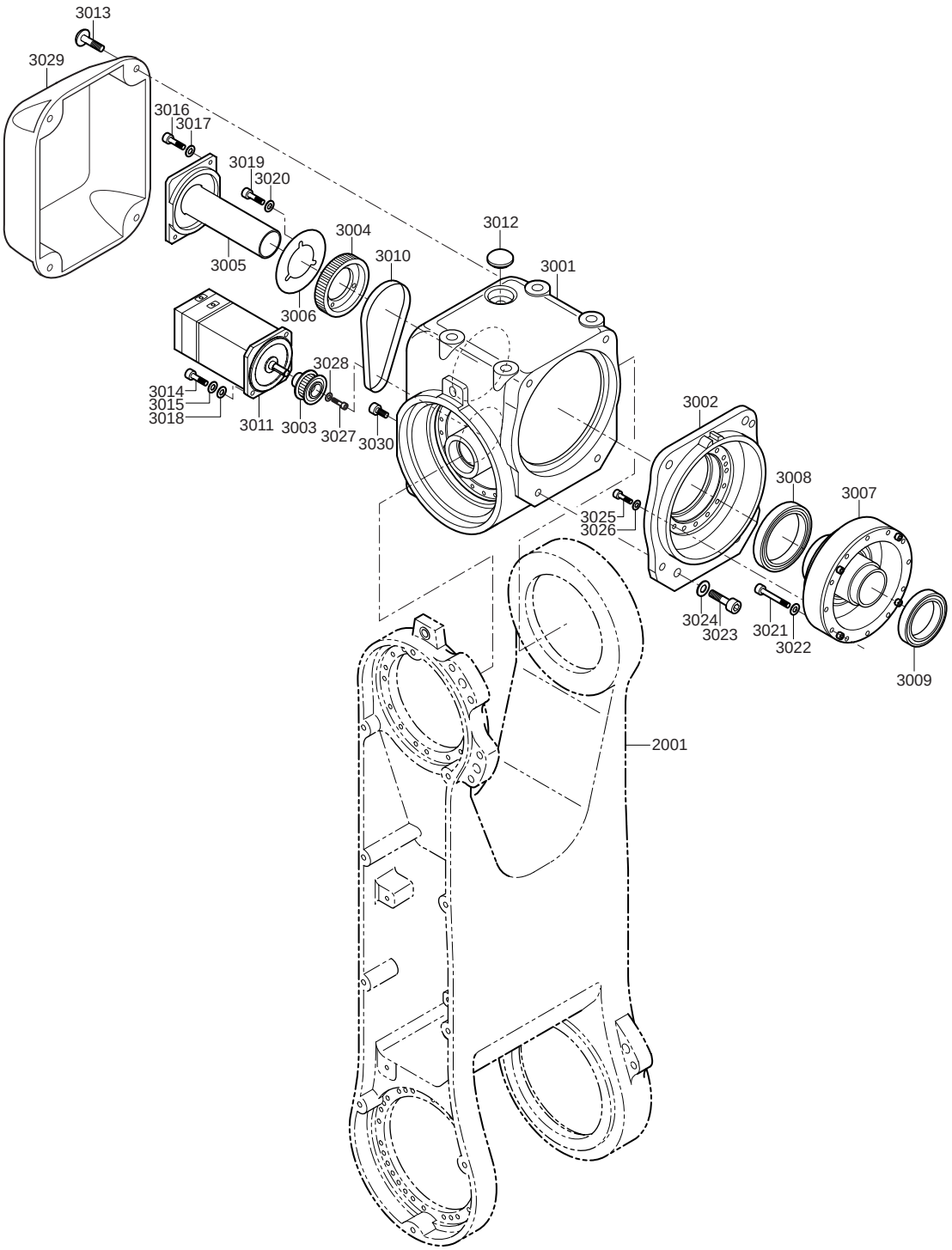


Table 11-3: R-Axis Unit

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	HW0388708-1	Speed reducer	1
3008	6808VV	Bearing	1
3009	6806LLU	Bearing	1
3010	060S3M219	Belt	1
3011	SGMAV-A5ANA-YR11	Motor	1
3012	OB-31	Plug	1
3013	M4X10	Button bolt	4
3014	M3X12	Socket screw	2
3015	2H-3	Spring washer	2
3016	M3X12	Socket screw	2
3017	2H-3	Spring washer	2
3018	M3	Washer	2
3019	M3X10	Socket screw	3
3020	2H-3	Spring washer	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	M6X8	Socket screw	1
2001	HW0102485-1	L arm	1

11.4 Spare Unit

Fig. 11-4: Spare Unit

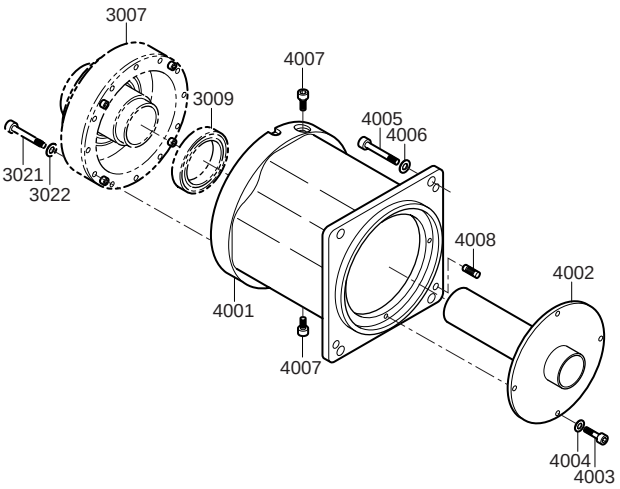


Table 11-4: Spare Unit

No.	DWG No.	Name	Pcs
4001	HW0201525-1	Spacer	1
4002	HW0414068-A	Support	1
4003	M3X10	Socket screw	4
4004	2H-3	Spring washer	4
4005	M6X20	Socket screw	4
4006	2H-6	Spring washer	4
4007	M5X6	Socket screw	2
4008	MS4-8	Pin	1
3007	HW0388708-1	Speed reducer	1
3009	6806DDU	Bearing	1
3021	M3X30	Socket screw	12
3022	2H-3	Spring washer	12

11.5 Wrist Unit

Fig. 11-5: Wrist Unit

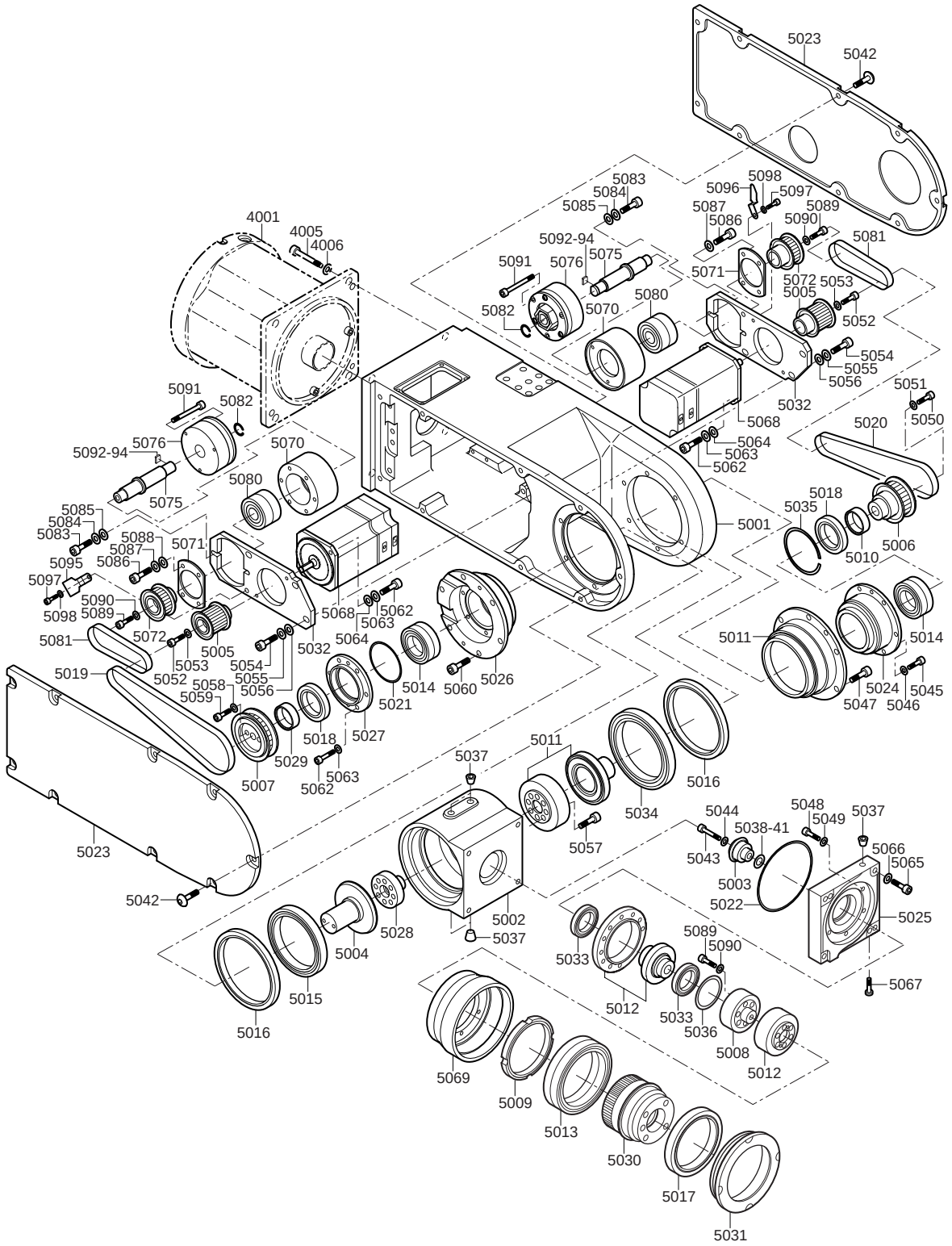


Table 11-5: Wrist Unit (Sheet 1 of 3)

No.	DWG No.	Name	Pcs
5001	HW0102483-1	U arm	1
5002	HW0313997-1	Wrist base	1
5003	HW0388712-A	Gear	1
5004	HW0388711-A	Gear	1
5005	HW0414075-A	Pulley	2
5006	HW0414076-A	Pulley	1
5007	HW0414078-A	Pulley	1
5008	HW9406260-1	Housing	1
5009	HW9406266-1	B nut	1
5010	HW0414031-1	Collar	1
5011	HW0388709-A	Speed reducer	1
5012	HW0388710-A	Speed reducer	1
5013	HW9480739-B	Bearing	1
5014	6903ZZ	Bearing	4
5015	6809DDU	Bearing	1
5016	TC56665	Oil seal	2
5017	AB2551E0	Oil seal	1
5018	SC20304	Oil seal	2
5019	060S3M300	Belt	1
5020	060S3M285	Belt	1
5021	S31.5	O ring	1
5022	S56	O ring	1
5023	HW0201199-1	Cover	2
5024	HW0314324-1	Shaft	1
5025	HW0314348-1	Housing	1
5026	HW0414067-1	Flange	1
5027	HW0414065-1	B holder	1
5028	HW0414066-1	Housing	1
5029	HW0414032-1	Collar	1
5030	HW0314333-1	M base	1
5031	HW0414028-1	B nut	1
5032	HW0414079-1	M base	2
5033	6803ZZ	Bearing	2
5034	6810VV	Bearing	1
5035	RTW-30	Retaining rings	1
5036	IRTW-26	Retaining rings	1
5037	LP-M5	Plug	5
5038	SPS-010005	Shim	1
5039	SP-009010	Shim	1
5040	SP-009015	Shim	1
5041	SP-009020	Shim	1
5042	M4X10	Button bolt	18
5043	M4X20	Socket screw	1
5044	2H-4	Spring washer	1

Table 11-5: Wrist Unit (Sheet 2 of 3)

No.	DWG No.	Name	Pcs
5045	M3X10	Socket screw	6
5046	2H-3	Spring washer	6
5047	M4X10	GT-SA bolt	6
5048	M3X12	Socket screw	6
5049	2H-3	Spring washer	6
5050	M4X20	Socket screw	1
5051	2H-4	Spring washer	1
5052	M3X16	Socket screw	2
5053	2H-3	Spring washer	2
5054	M4X15	Socket screw	6
5055	2H-4	Spring washer	6
5056	M4	Washer	6
5057	M4X16	Socket screw	8
5058	2H-3	Spring washer	2
5059	M3X10	Socket screw	2
5060	M4X10	GT-SA bolt	6
5051	2H-4	Spring washer	1
5052	M3X16	Socket screw	2
5053	2H-3	Spring washer	2
5054	M4X15	Socket screw	6
5055	2H-4	Spring washer	6
5056	M4	Washer	6
5057	M4X16	Socket screw	8
5058	2H-3	Spring washer	2
5059	M3X10	Socket screw	2
5060	M4X10	GT-SA bolt	6
5062	M3X12	Socket screw	10
5063	2H-3	Spring washer	10
5064	M3	Washer	4
5065	M4X10	Socket screw	4
5066	2H-4	Spring washer	4
5067	CBSTS6-6	Socket screw	1
5068	SGMAV-A5ANA-YR21	Motor	2
5069	HW0414026-1	Housing	1
5070	HW0314323-1	Housing	2
5071	HW0414080-1	B holder	2
5072	HW0414077-A	Pulley	2
5075	HW0414030-1	Shaft	2
5076	HW0472643-A	Break	2
5080	6000ZZ	Bearing	4
5081	060S3M150	Belt	2
5082	STW-8	Retaining rings C-type	2
5083	M3X12	Socket screw	4
5084	2H-3	Spring washer	4

Table 11-5: Wrist Unit (Sheet 3 of 3)

No.	DWG No.	Name	Pcs
5085	M3	Washer	4
5086	M3X10	Socket screw	8
5087	2H-3	Spring washer	8
5089	M4X12	Socket screw	2
5090	2H-4	Spring washer	2
5091	M2.5X25	Socket screw	6
5092	HW0414829-1	Shim	2
5093	HW0414829-2	Shim	2
5094	HW0414829-3	Shim	2
5095	HW0414824-1	Cover	1
5096	HW0414825-1	Cover	1
5097	M4X6	Socket screw	2
5098	2H-4	Spring washer	2
4001	HW0201525-1	Spacer	1
4005	M6X20	Socket screw	4
4006	2H-6	Spring washer	4

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