

INSTALLATION MANUAL MOTOMAN-HP3L

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



Reference list

***This manual is a revised version of the YEC document:
HW0482664.***

Revision

***050415
First release of this document.***

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MOTOMAN-HP3L

1. Product confirmation

This manual is valid for the following robot models:

- ◆ Standard type, YR-HP3L-A00
- ◆ Standard type with zeroing function, YR-HP3L-B00



Warning!

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 (robot arm)
- ◆ NX100
- ◆ Programming pendant
- ◆ Manipulator cables (two cables, between manipulator and NX100)

1.1.1 Manufacturer

The mechanical structure including servo motors:

Yaskawa Electric Corporation
2-1 Kurosaki-Shiroishi Yahatanishi-Ku
Kitakyushu-shi
Japan

1.1.2 Importer

Representative within EU

Motoman Robotics Europe AB
P.O Box 504
SE-390 04 Kalmar
Sweden

1.1.3 Distributors and agents

See addresses at the back of this document

1.2 Order number confirmation



Confirm that the serial numbers of the manipulator and the NX100 match the shipping information. Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform with top accuracy as expected, and cause injury or damages to the equipment.



When ordering spare parts or communicate with Motoman engineers, always state the robot serial No. or controller serial No.

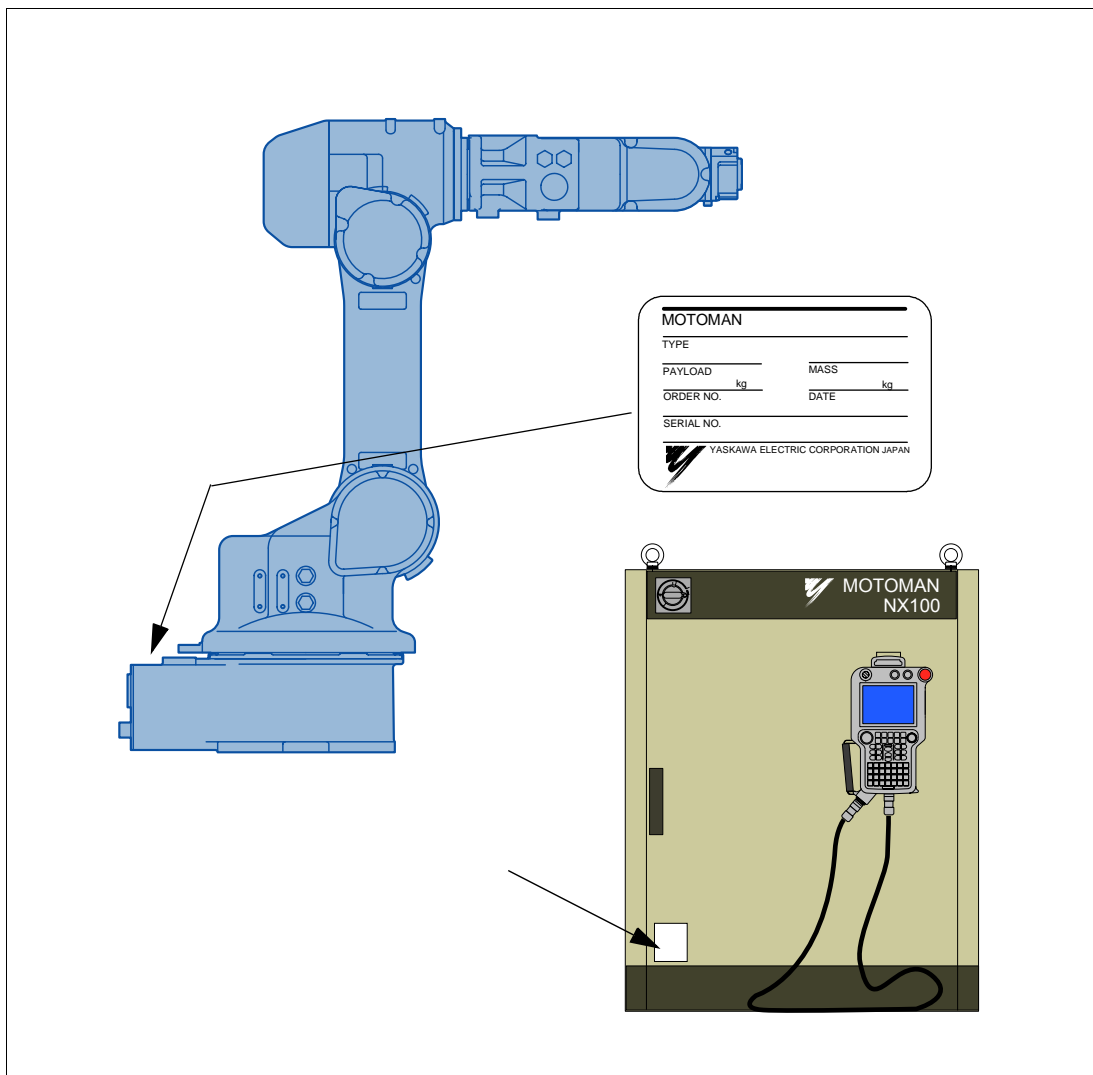


Fig.1 Location of identification and serial Nos.

2. Transporting



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 transporting.

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

2.1 Transporting method



Note!

- ◆ The weight of the manipulator is approximately 49kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- ◆ Mount the shipping bolts and brackets for transporting the manipulator.
- ◆ Avoid exerting force on the arm or motor unit when transporting, and use caution when using transporting equipment other than a crane or forklift, as injury may occur.

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 threaded through shipping bolts and brackets. Be sure the manipulator is fixed with the shipping bolts and brackets before transporting, and lift it in the posture as shown in figure.

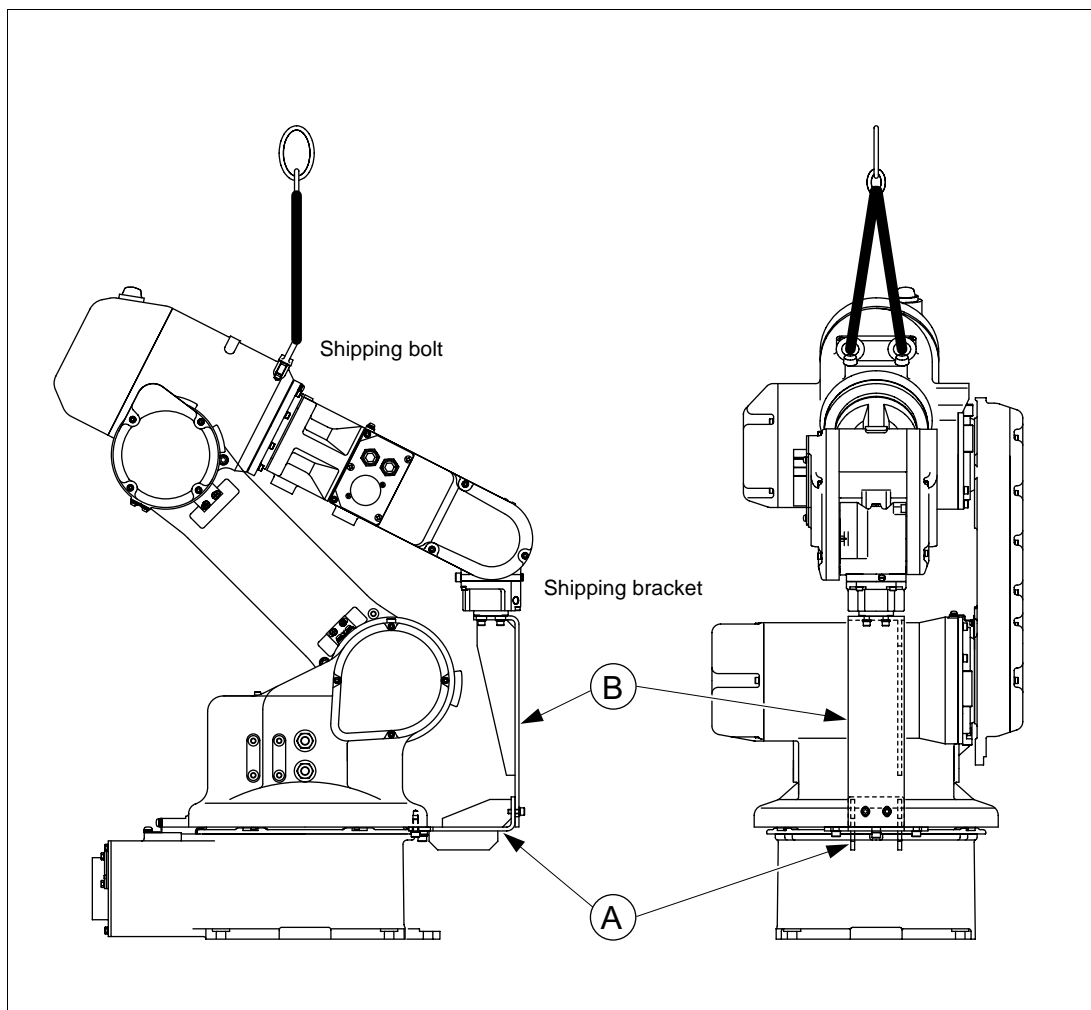


Fig.2 Transporting position

2.1.2 Using a forklift

When using a forklift, the robot should be fixed to the pallet according to the figure below. Insert the claw under the pallet and lift it. The pallet must be strong enough to support the robot. Transporting of the robot must be performed slowly in order to avoid overturning or slippage.

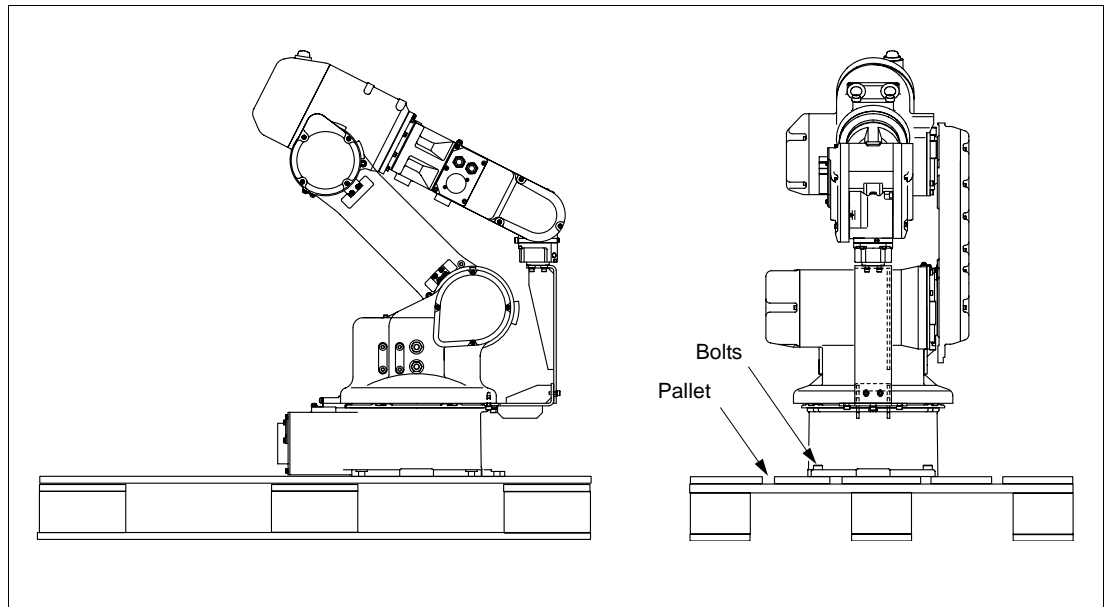


Fig.3 Using a forklift

2.2 Shipping bolts and brackets

The manipulator is provided with shipping bolts and bracket, pos. A, B and C, to minimize external force during transportation.

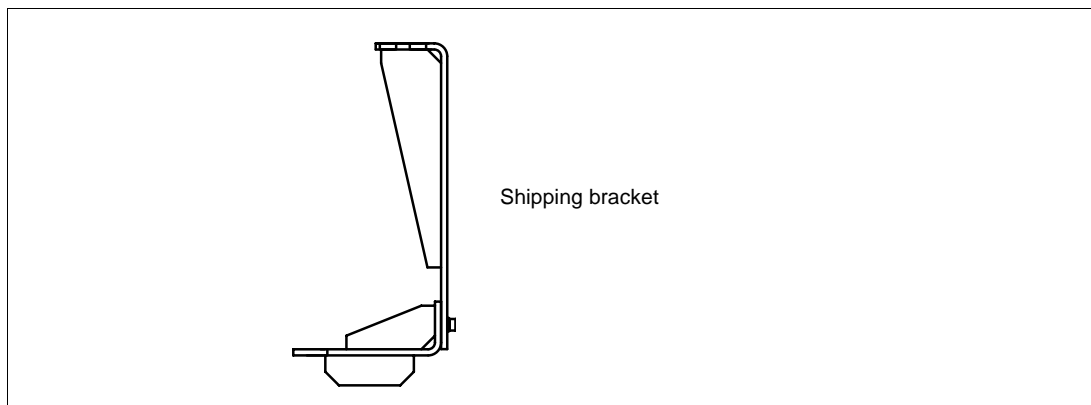


Fig.4 Shipping bolt and brackets

- ◆ The A-shipping bracket is painted in yellow.
- ◆ The B-shipping bolts: hexagon socket head cap screws
- ◆ The C-shipping bolts: hexagon socket head cap screws.

Position	Type	Pcs
A	Shipping bracket	1
B	Hexagon socket head cap screw M6 X 15 mm	2
C	Hexagon socket head cap screw M5 X 14 mm	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



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 work-piece 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.

Do not install or operate a manipulator which is damaged or lacks parts.

Failure to observe this caution may cause injury or damage.

Before turning on the power, check to be sure that the shipping bolts and brackets 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 the safeguarding. They prevent unforeseen accidents with personnel and damage to equipment. The following is quoted for your information and guidance.

■ ***Machinery directive (98/37/EEC)***

Before taking this machine into service, ensure that the machinery fulfils the demands in the Machinery directive, Annex 1 (Essential health and safety requirements relating to the design and construction of machinery).

■ ***Responsibility for safeguarding (ISO 10218)***

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

3.2 Mounting procedures for manipulator base

The manipulator should be firmly mounted on a base plate or foundation strong enough to support the manipulator and withstand repulsion forces during acceleration and deceleration. Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator referring to table “Maximum repulsion forces of the manipulator at emergency stop” and table “Endurance torque in operation”.

During installation, if the flatness is not right, the manipulator shape may change and its functional ability may be compromised. Base plate flatness must be kept at 0.5mm or less. Mount the manipulator base as in the following way: ““Mounting example” on page 13”.

Maximum repulsion forces of the manipulator at emergency stop

Horizontal rotating maximum torque (S-axis moving direction)	900 Nm (97.8 kgf • m)
Vertical rotating maximum torque (L-, U-axes moving direction)	850 Nm (86.7 kgf • m)

Endurance torque in operation

Horizontal acceleration and deceleration maximum torque	269 Nm (24.4 kgf • m)
Vertical acceleration and deceleration maximum torque	402 Nm (41.0 kgf • m)

3.2.1 Mounting example

Fix the base plate onto the floor. The base plate should be rugged and durable to prevent shifting of the manipulator or the fixture. The thickness of the base plate is 25 mm or more, and a M10 size or larger anchor bolt is recommended.

Fix the manipulator base onto the base plate with the hexagon socket head cap screw M10. The plate is tapped for M10 (length: 35 mm) screws. Tighten the screws and anchor bolts securely so that they will not work loose during operation.

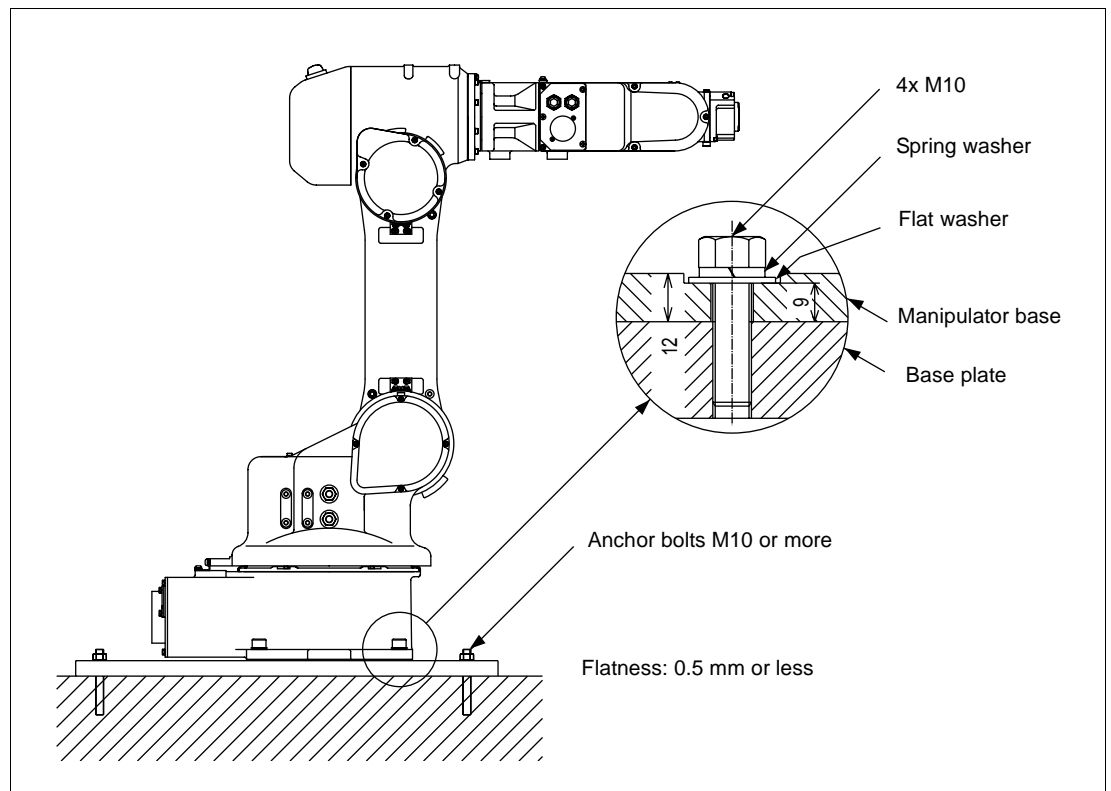


Fig.5 Mounting the manipulator on base plate

3.3 Types of mounting

The robot can as standard be mounted in three different ways: floor-mounted (standard), wall-mounted or ceiling-mounted. When mounting the robot onto the wall or ceiling, the following points are different from the floor-mounted types.

- ◆ S-axis operation range
- ◆ Fixing the robot base
- ◆ Precautions to prevent the robot from falling

3.3.1 S-axis operation range

For wall-mounted types, the S-axis motion range is limited to $\pm 30^\circ$.

See "S-axis operation range" on page 25.

3.3.2 Fixing the robot base

For the wall mounted types, be sure to use four M10 12.9 bolts. Tightening torque shall be 79 Nm.

3.3.3 Precautions to prevent the robot from falling

For the wall- or ceiling mounted types, take appropriate measures to avoid the falling of the robot in case of emergency.

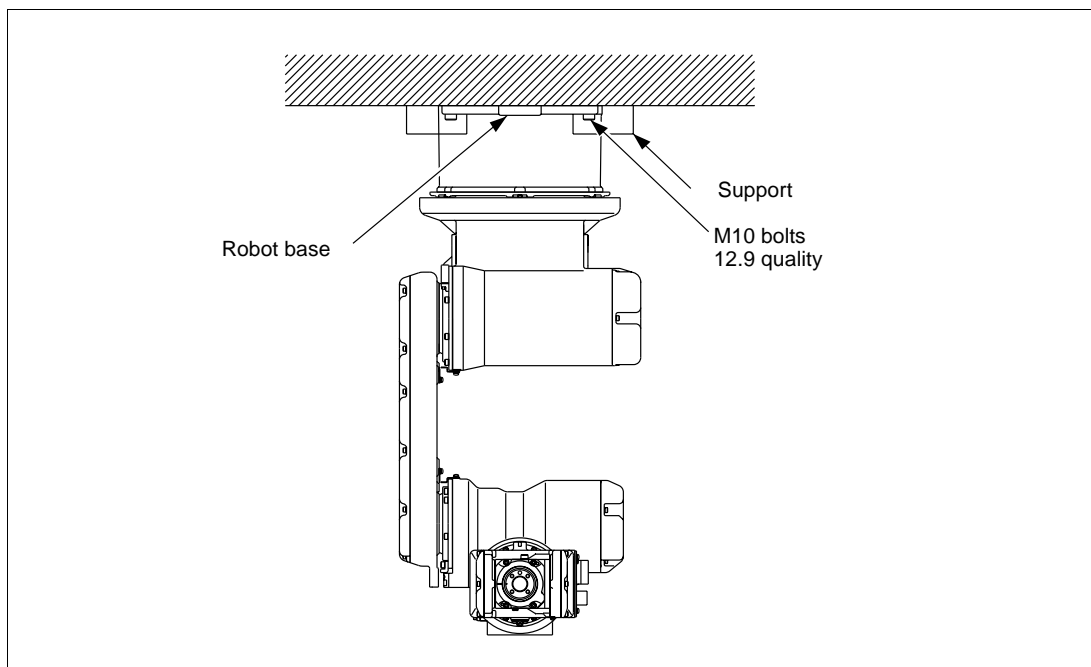


Fig.6 Precaution against falling

3.4 Location

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

- ◆ Ambient temperature:
 - Operating condition 0° to 45°C
 - Storage temperature -10°C to 60°C
- ◆ Humidity: 20 to 80%RH at constant temperature
- ◆ Free from exposure to water, oil, or dust
- ◆ Free from corrosive gas or liquid, or explosive gas
- ◆ Free from excessive shock or vibration (less than 4.9m/s² [0.5G])
- ◆ Free from large electrical noise (plasma)
- ◆ Flatness for installation is 0.5mm or less

3.4.1 IP classification

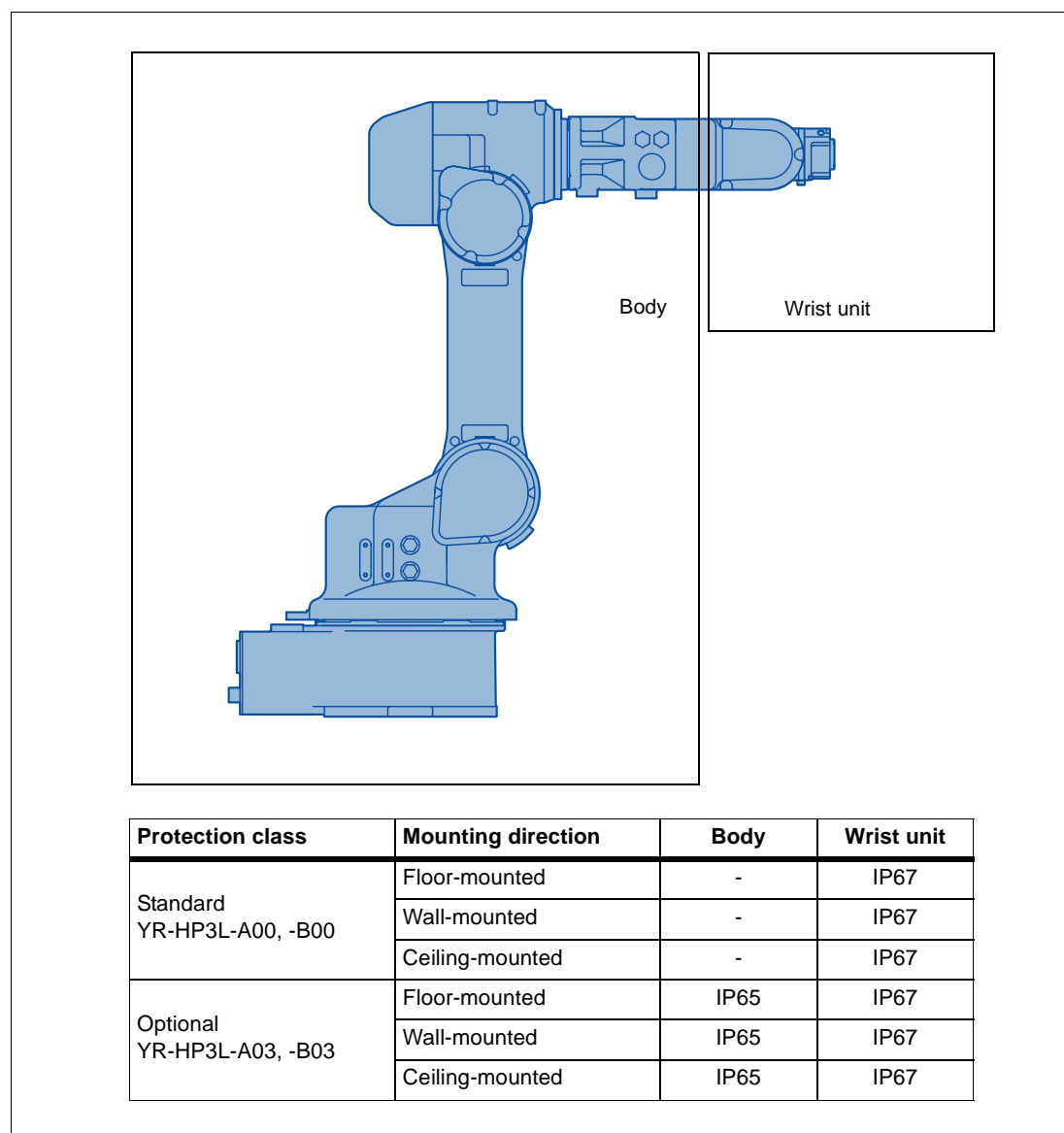


Fig.7 IP classification

4. Wiring



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.

Wiring must be performed by authorized or certified personnel.

Failure to observe this caution may result in fire or electric shock.

Do not cover the cable or allow it to tangle. Keep the cable as straight as possible.

Failure to observe this caution may result in preventing heat of the cable from being discharged.

4.1 Grounding

Follow local regulations for potential equalization (grounding) line size. A line of 6 mm² or more is recommended (included in the delivery). The other end of the line shall be connected to the terminal at the back of the robot controller. See NX100 installation guide.



Note!

- ◆ Do not use this line in common 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 local regulations, EMC and LVD directives.

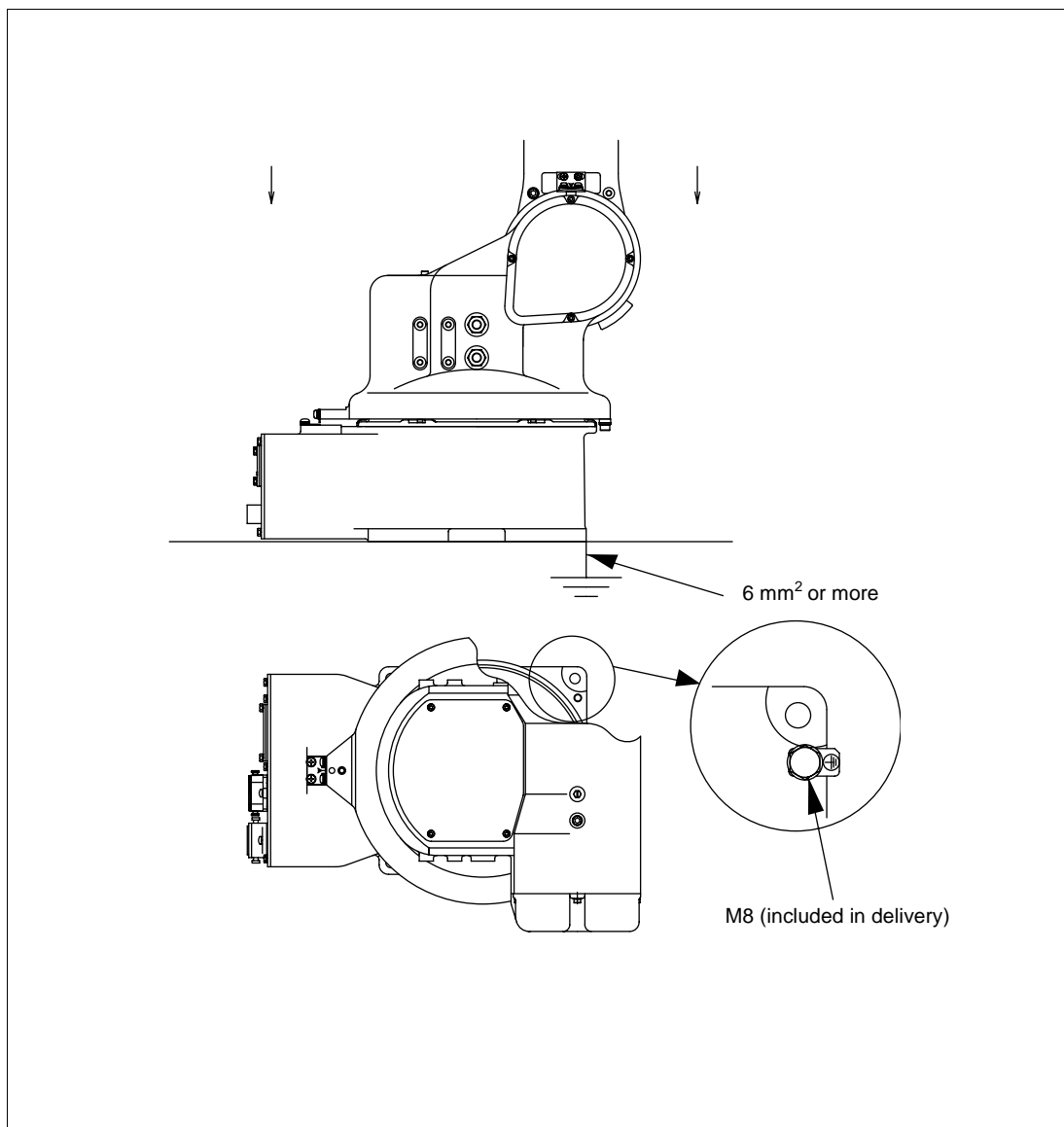


Fig.8 Grounding method

4.2 Manipulator cable connection

Two manipulator cables are provided; an encoder cable for detection (1BC) and one power cable (2BC). (Refer to " Fig. 9 Manipulator cable connections ") Connect these cables to the manipulator base connectors and the NX100. (Refer to "Details of the manipulator cable connectors (manipulator side)" on page 20).

4.2.1 Connection to the manipulator

Before connecting the manipulator cables to the manipulator, confirm the numbers: 1BC and 2BC on both the cables and the manipulator base connectors. When connecting, insert cables adjusting the cable connector positions to the main key positions of the manipulator, and then set the lever until it clicks.

4.2.2 Connection to the NX100

First connect the X1 cable then X2 cable respectively after verifying the numbers. The numbers are on both the cables and the cabinet. When connecting, insert cables adjusting the cable connector positions to the main key positions of the NX100, and then set the lever until it clicks.



Robot controller

For connection to the controller, refer to the NX100 installation manual.

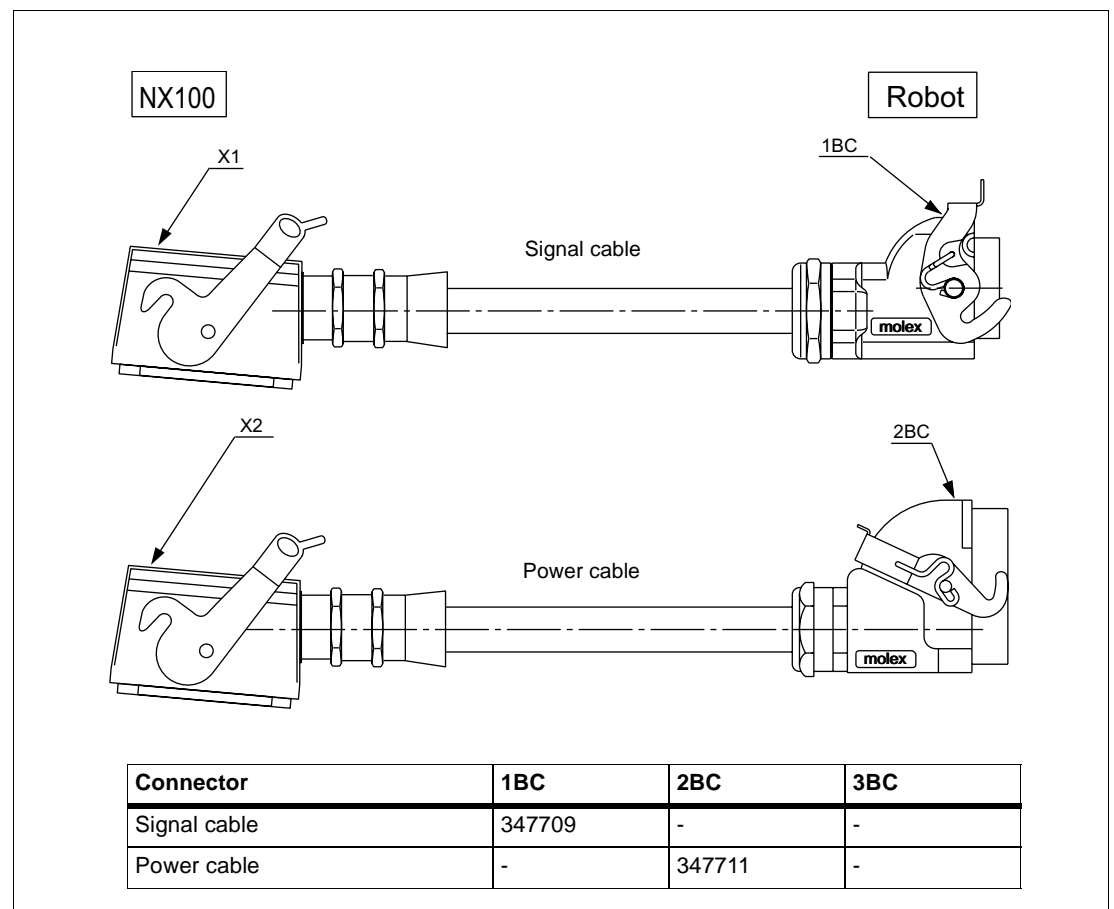


Fig.9 Manipulator cable connections

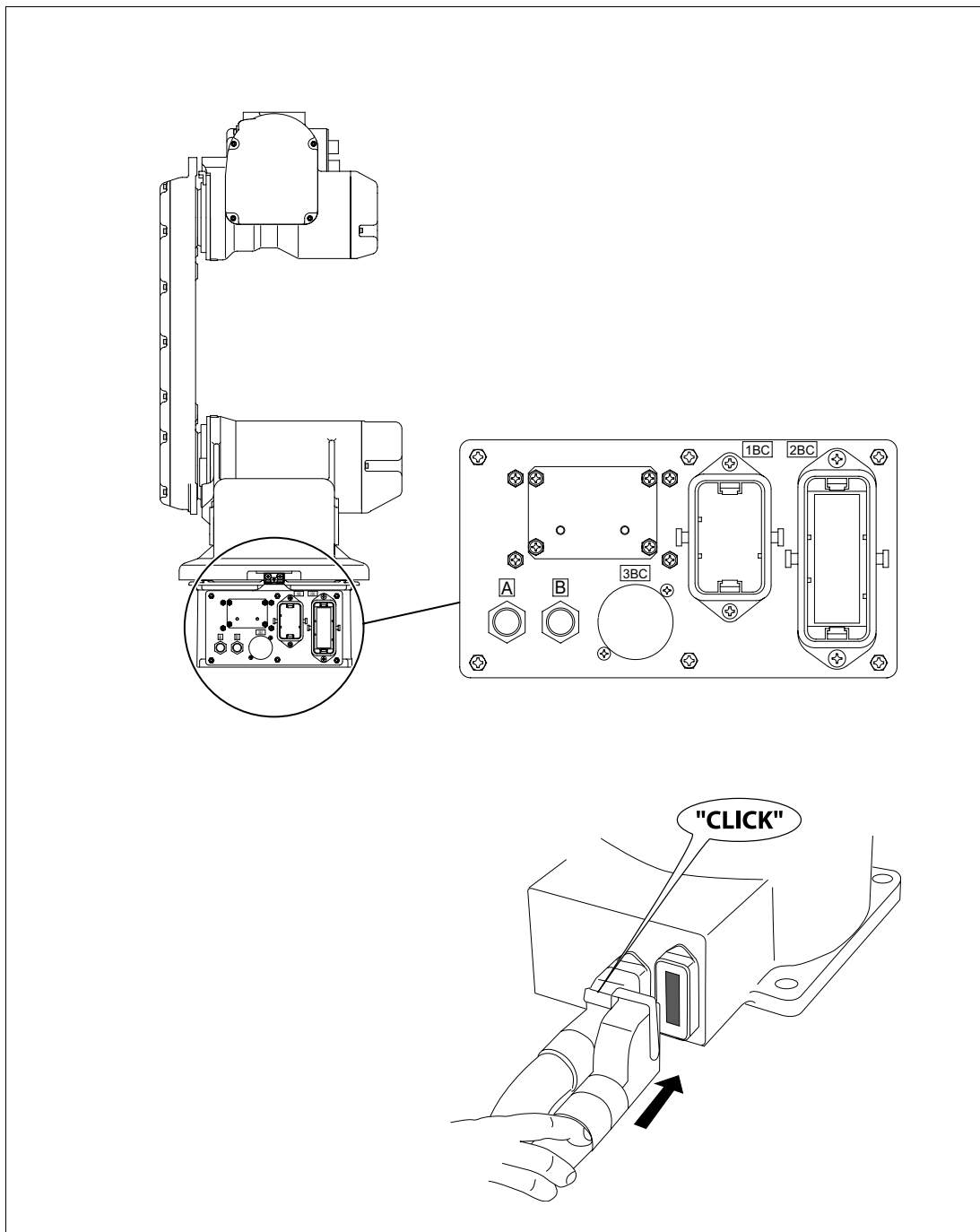


Fig.10 Details of the manipulator cable connectors (manipulator side)

5. Basic specifications

5.1 Basic specifications

Table.3 Basic specifications*1

Item	Model	MOTOMAN-HP3L
Configuration		Vertically Articulated
Degree of Freedom		6
Payload		3kg
Repeatability		±0.04mm
Range of Motion	S-Axis (turning)	±170°
	L-Axis (lower arm)	+150°, -45°
	U-Axis (upper arm)	+235°, -144°
	R-Axis (wrist roll)	±190°
	B-Axis (wrist pitch/yaw)	±125°
	T-Axis (wrist twist)	±360°
Maximum Speed	S-Axis	4.36 rad/s, 250°/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*2	R-Axis	7.25N•m (0.74kgf•m)
	B-Axis	7.25N•m (0.74kgf•m)
	T-Axis	5.21N•m (0.53kgf•m)
Allowable Inertia (GD ² /4)	R-Axis	0.30kg•m ²
	B-Axis	0.30kg•m ²
	T-Axis	0.1kg•m ²
Mass		49kg
Ambient Conditions	Temperature	0° to 45°C
	Humidity	20 to 80% RH at constant temperature
	Vibration acceleration	Less than 4.9m/s ² (0.5G)
	Others	Free from corrosive gas or liquid, or explosive gas Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)
Power Capacity		1.0kVA

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

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

5.2 Part names and working axes

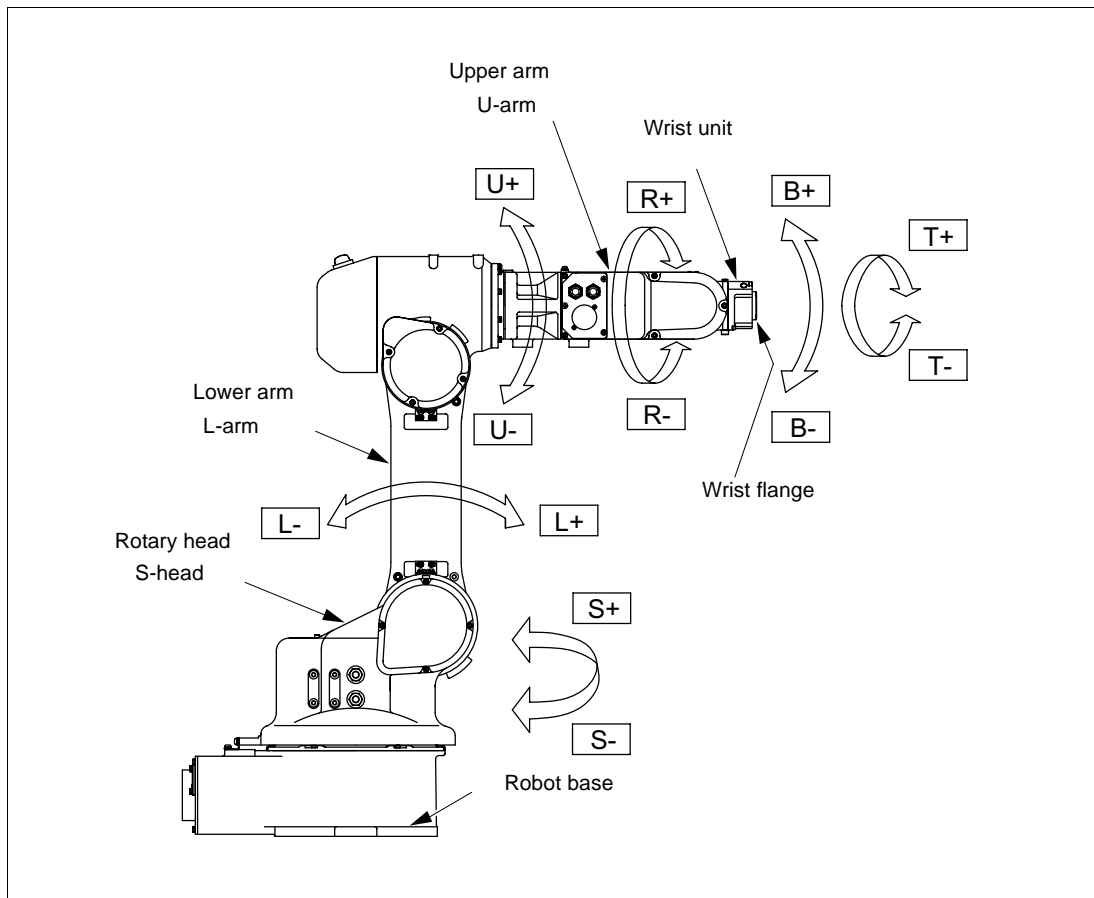


Fig.11 Part names and working axes

5.3 Manipulator base dimensions

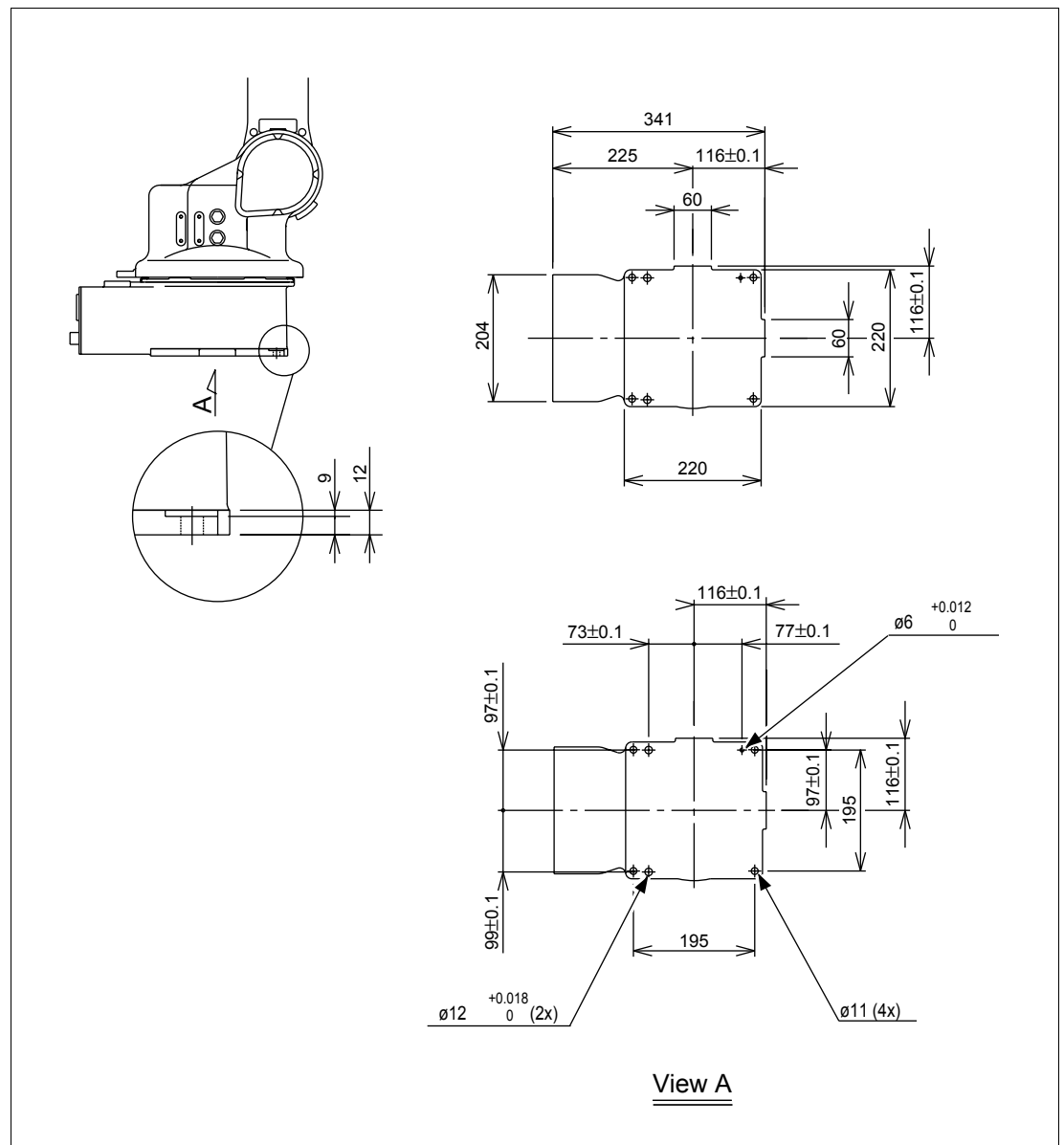


Fig.12 Manipulator base dimensions

5.4 Dimensions and P-point maximum envelope

The robot is shown in the home position posture

5.4.1 Type YR-HPL3-A00, -B00

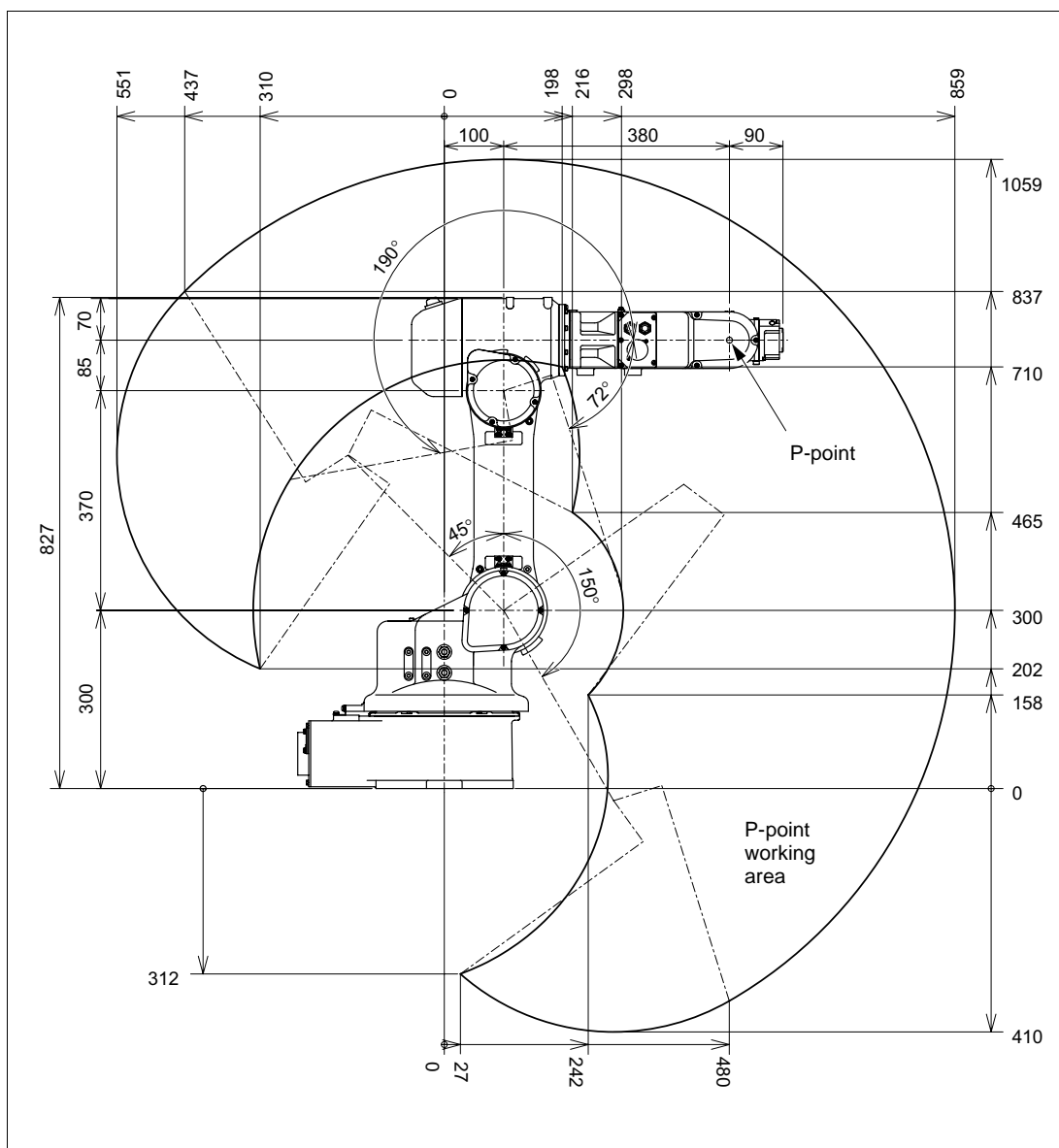


Fig.13 Dimensions and P-point maximum envelope (side)

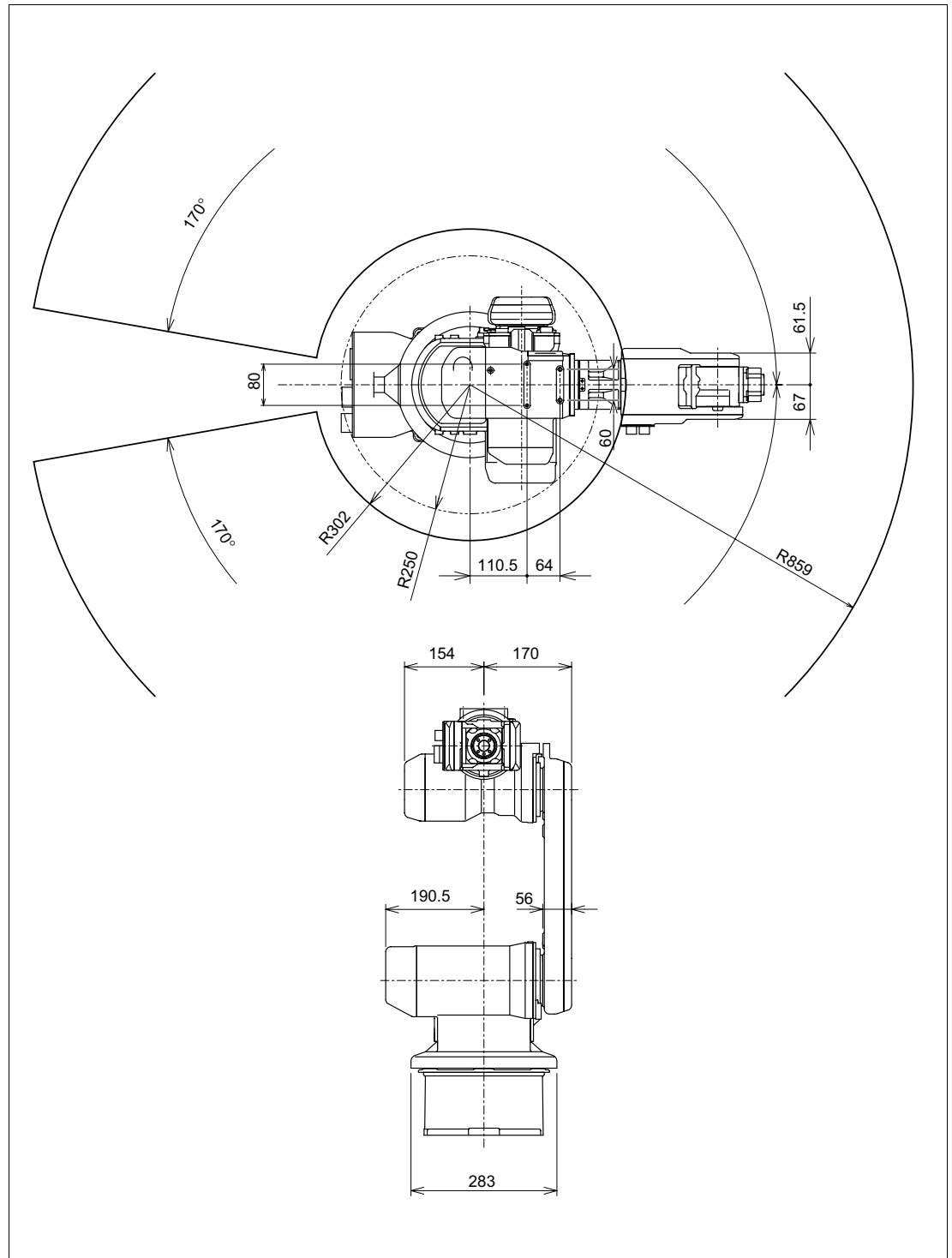


Fig.14 Dimensions and P-point maximum envelope (top and front view)

5.5 Alterable operating range

The operating range of the S-axis can be altered according to the operating conditions as shown in "S-axis operating range". If alteration is necessary, contact your Motoman representative in advance.

S-axis operating range

Item	Specifications
S-axis operating range	±170° (standard)
	±150°
	±135°
	±120°
	±105°
	±90°
	±75°
	±60°
	±45°
	±30°
	±15°

5.5.1 S-axis operation range

This chart shows the relation between the S-axis operating range in relation to the robot inclination. For wall mounted robots, S-axis is restricted to ±30°.

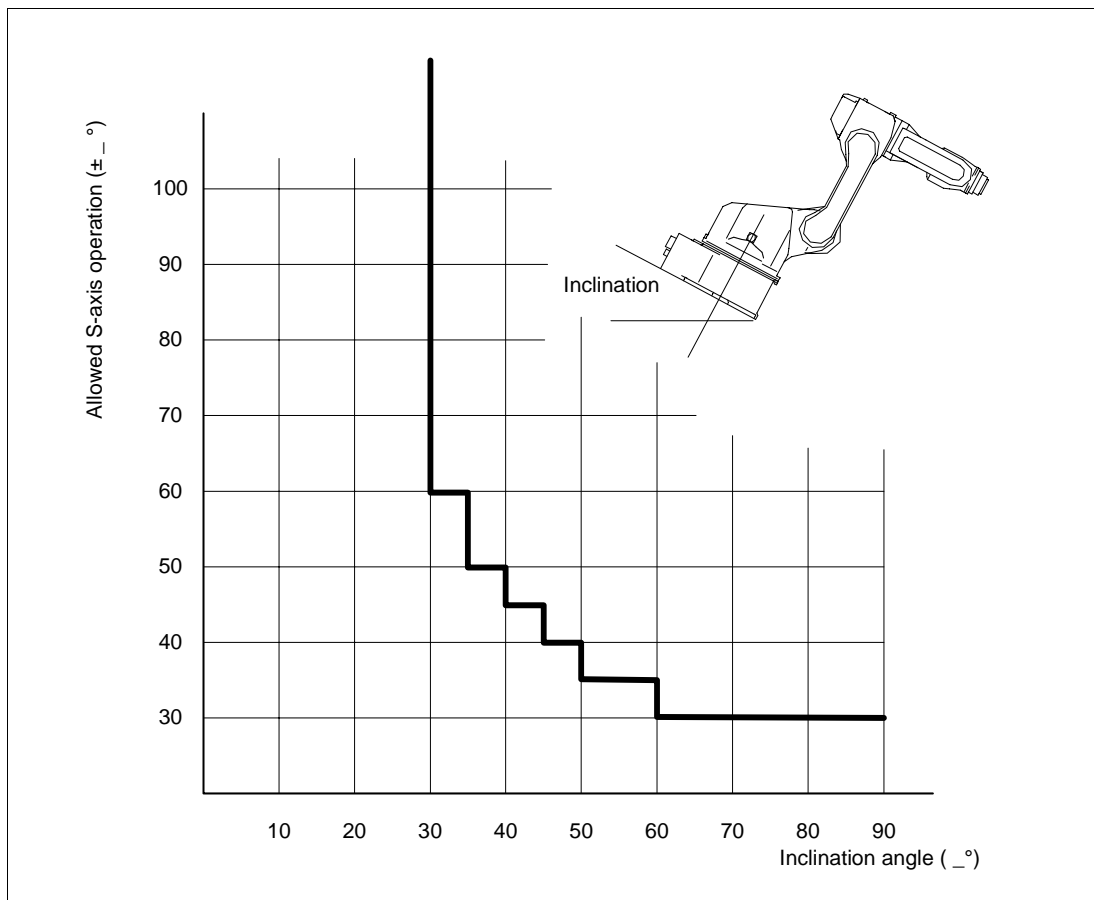


Fig.15 S-axis operation range

6. Allowable load

6.1 Allowable wrist load

The allowable wrist load including the weight of the mount/welding torch is:

◆ YR-HP3L-A00, -B00: 3kg maximum

If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in table " Allowable total moment and total inertia". Contact your Motoman representative for further information or assistance.

Allowable total moment and total inertia

Model	Axis	Moment N•m (kgf•m) ^{*1}	GD ² /4 Inertia kg•m ²
YR-HP3L	R-Axis	7.25 (0.74)	0.30
	B-Axis	7.25 (0.74)	0.30
	T-Axis	5.21 (0.53)	0.10

(): Gravitational unit

When the volume load is small, refer to the moment arm rating shown in " Fig. 16 Moment arm rating ".

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

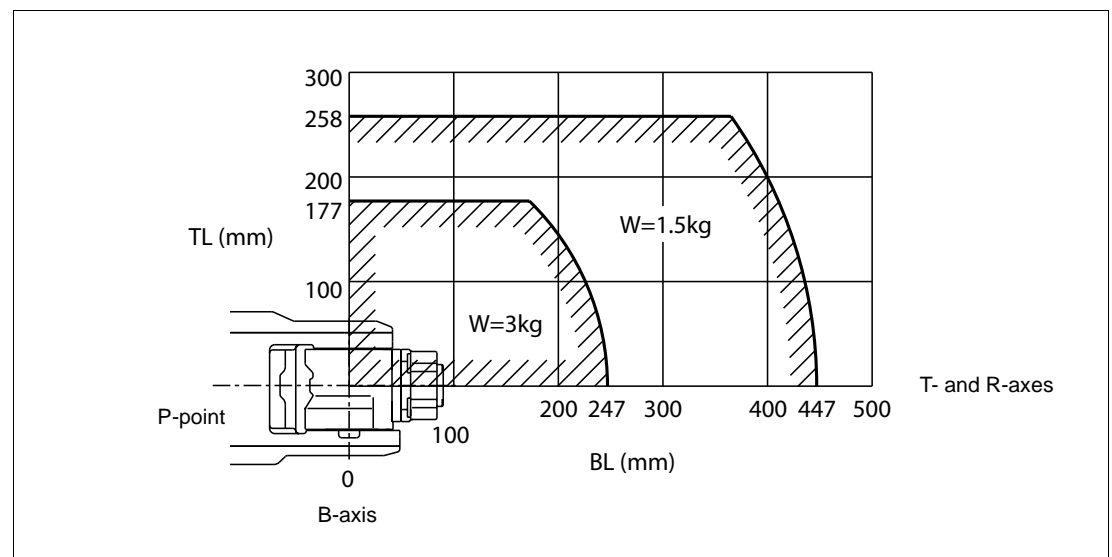


Fig.16 Moment arm rating

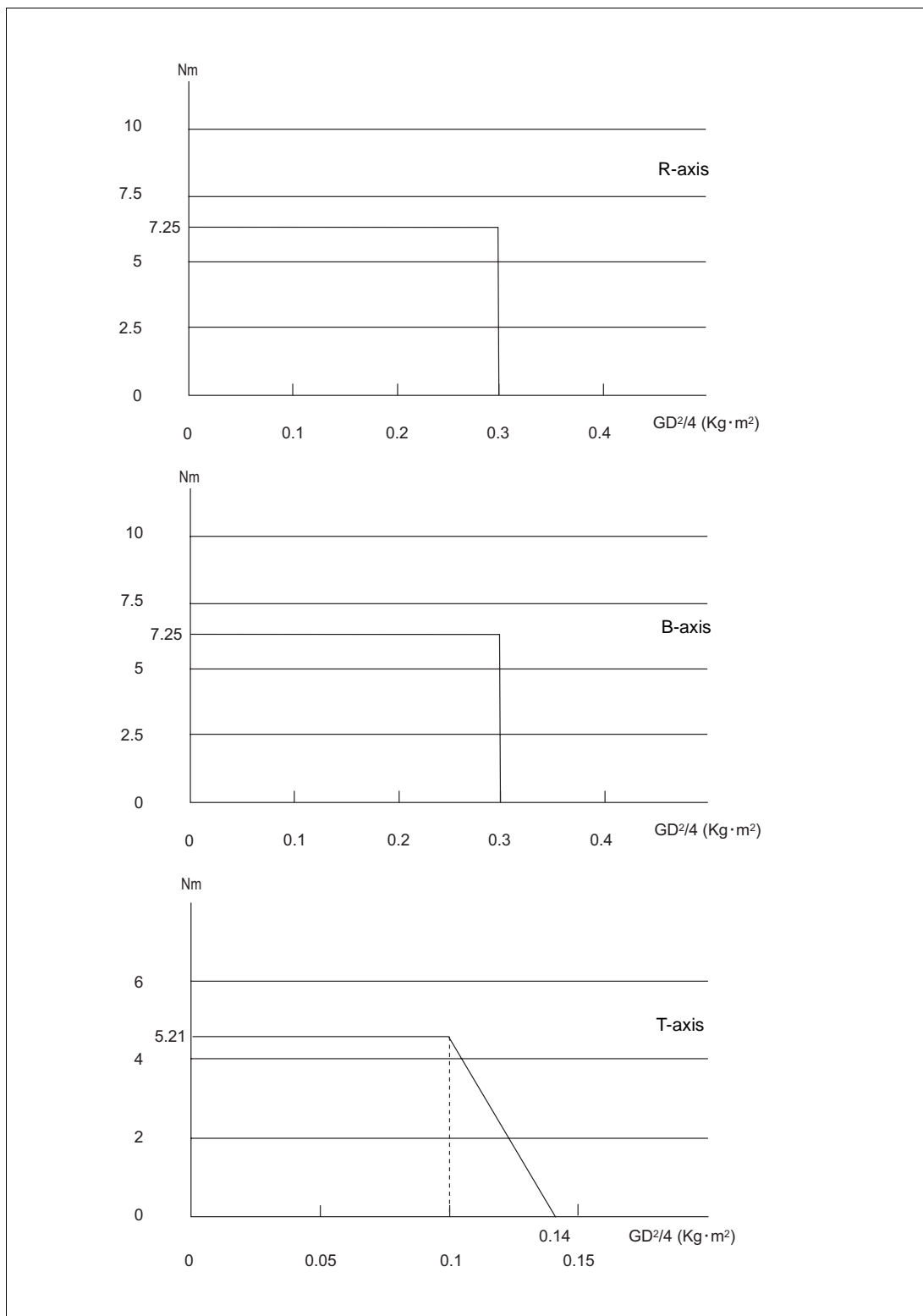


Fig.17 diagram for moment/inertia

6.2 Wrist flange

The wrist flange dimensions are shown in " Fig. 18 Wrist flange ". In order to see the alignment mark, it is recommended that the attachment be mounted inside the fitting. Fitting depth must be 6 mm or less. The attachment must be mounted on the range of 90 diameter or less with up to 5 mm height from the flange face.



Supplement

The design of the flange conforms to standard ISO9409-1:2004

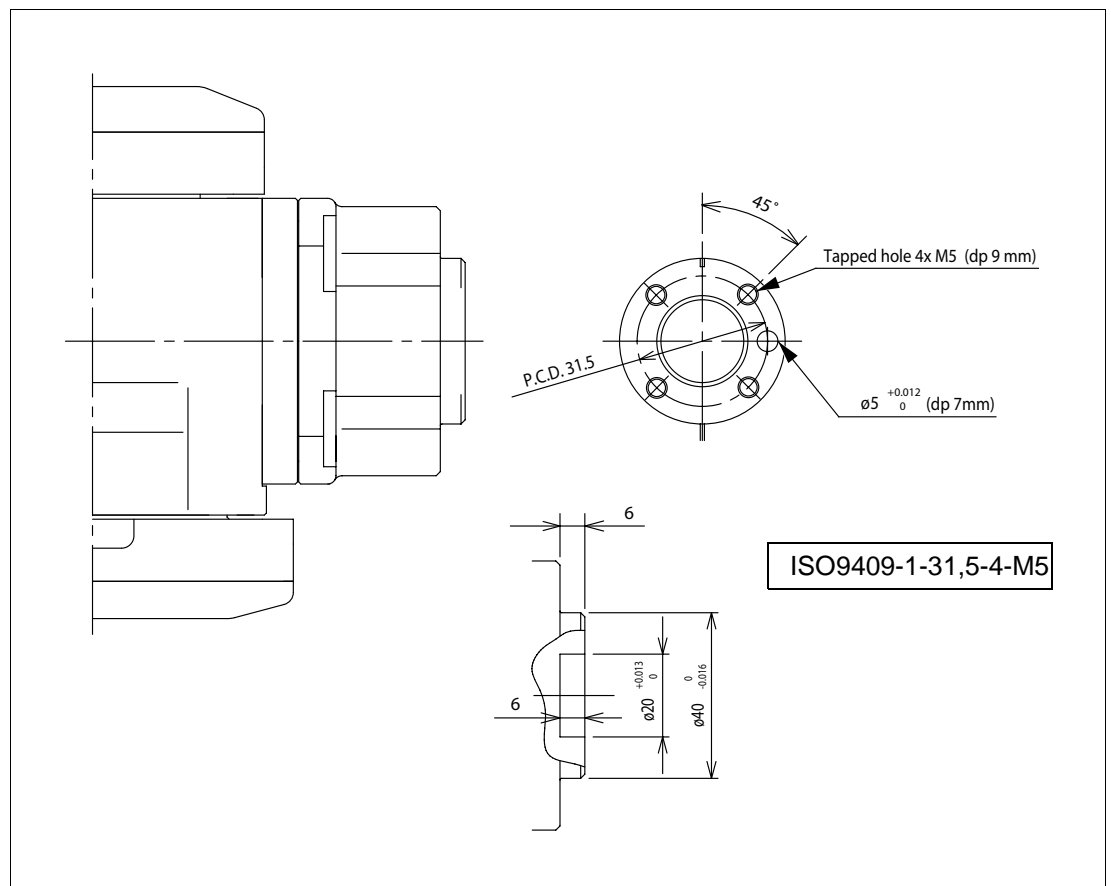


Fig.18 Wrist flange



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

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 becomes 1 kg.

	Application	Note
Flange	Payload	3 kg
A	Cable processing and valve load	4 kg max including the wrist load. (restriction according to chart below).
B S-axis	Others	Max payload 10 kg. Allowed moment of inertia (GD2/4) $0.25\text{kg}\cdot\text{m}^2$



Note!

When the robot is wall-mounted, the additional load on S-axis must be balanced, or installed in line with the arm as a part of the counter weight.

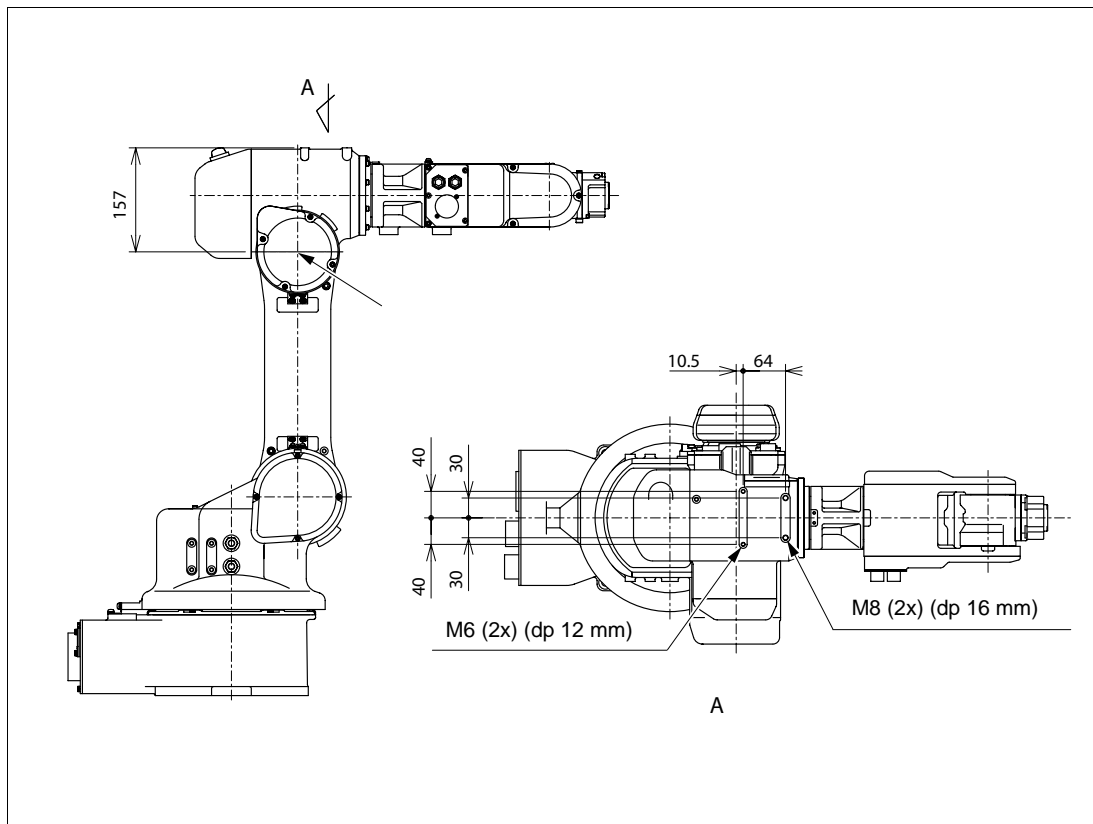


Fig.19 Installing peripheral equipment (top)

7.2 Internal user I/O wiring harness and air line

Wires and air line are incorporated into the robot for user application. 16 internal user I/O wires (0.2mm²), and two air lines are used in the robot for the drives of the peripheral devices mounted on the upper arm as shown in " Fig. 20 Connectors for internal user I/O wiring harness and air lines ".

The connector pins, and the terminals are assigned as shown in " Fig. 21 Connectors pin details ". Wiring must be performed by user.

The allowable current for wires : 3.0A or less / wire. (0.2mm²)

Maximum current for wire 1-16 is 40A.

The maximum pressure for the air lines is 0.6 MPa (6kgf/cm²) or less at 0°C to +20°C.
(The air line inside diameter: 6.5 mm dia.)

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. 20 Connectors for internal user I/O wiring harness and air lines " and table below.

Pos	Function	Connector	Plug (option)	Remark
A	Air inlets	PT-1/4	-	
B	Air outlets	PT-1/8	-	
3BC	Internal user I/O	JL05-2A20-29PC	JL05-6A20-29S	Base connector
3BC	Internal user I/O	JL05-2A20-29SC	JL05-6A20-29P	U-arm connector

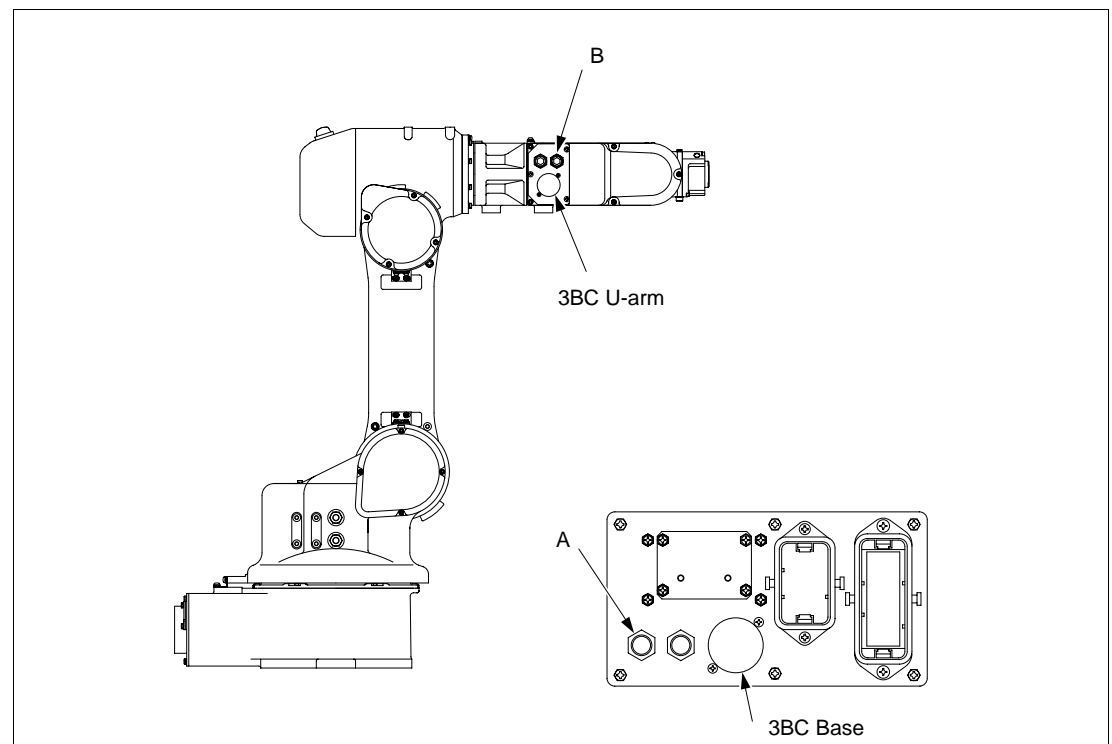


Fig.20 Connectors for internal user I/O wiring harness and air lines

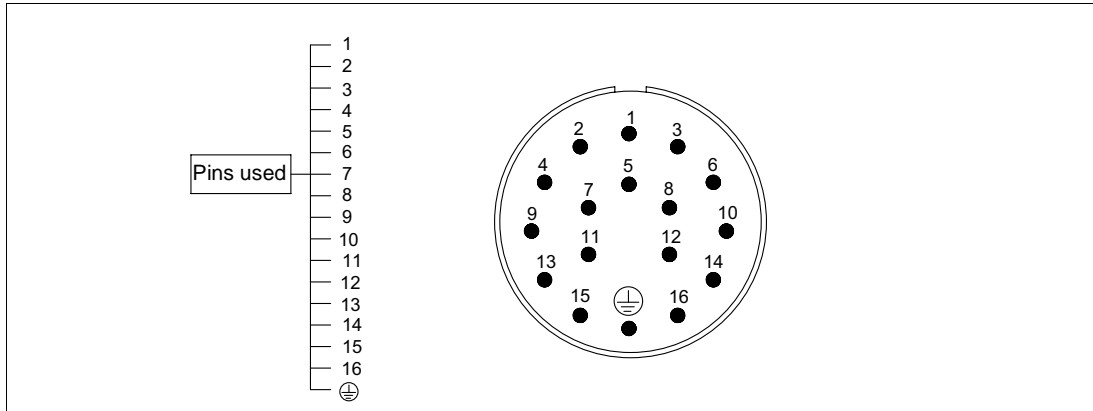


Fig.21 Connectors pin details

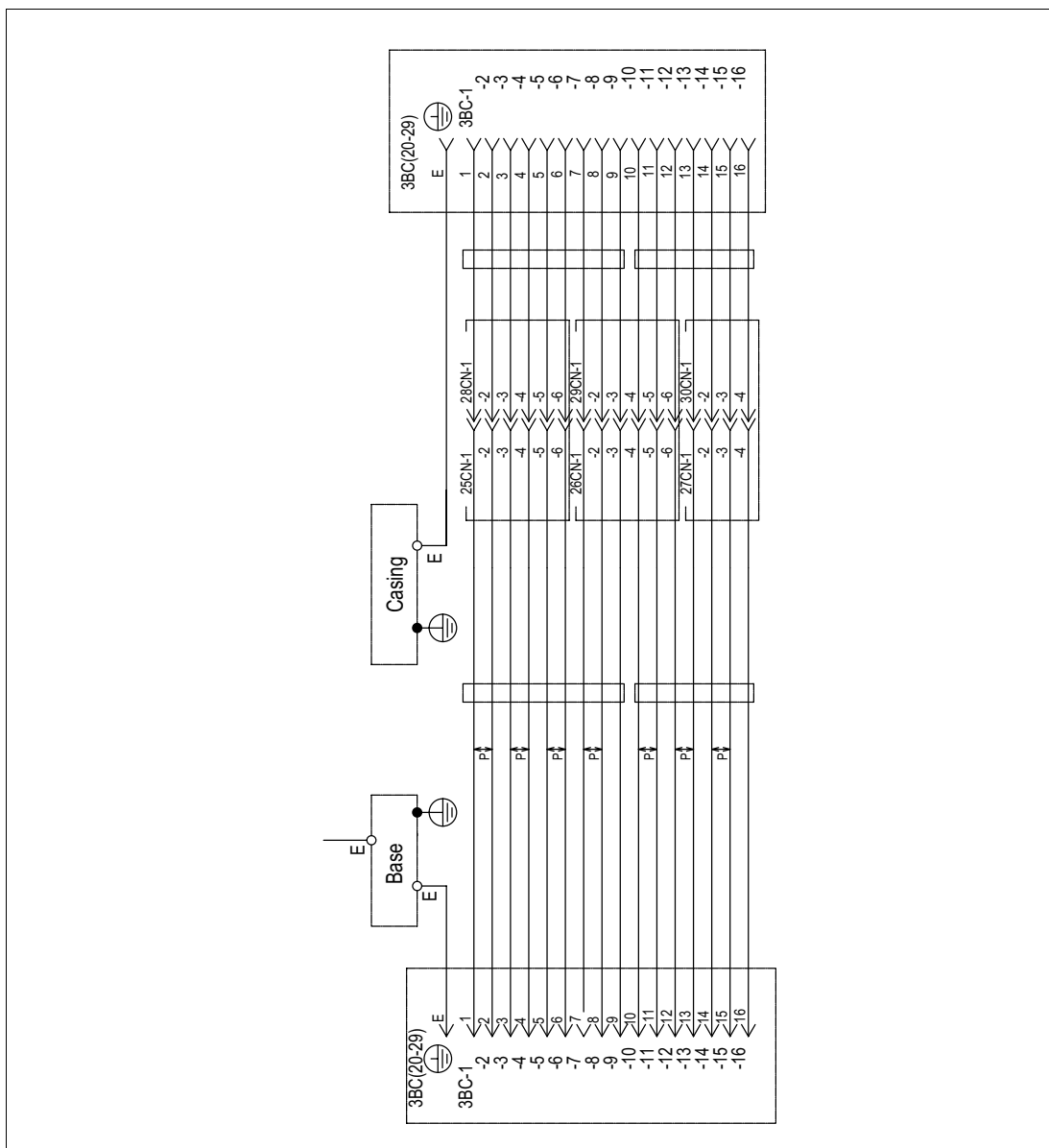


Fig.22 Internal user I/O wiring

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