

NACHI

Standard specifications

MC35/50/70-01-AX20/FD11

11th edition

NACHI-FUJIKOSHI CORP.

1309, SMCEN-021-011, 001

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1. Outline

"NACHI ROBOT" has used mechatronic techniques, cultivated throughout the last few decades, to supply robots suited for industries utilizing welding, spray painting and the material handling techniques.

"MC series" is a compact handling robot with a powerful load capacity. "MC50" is the basic model, and 3 types of robots are featured in the "MC series".

Load weight	35 kg	50 kg	70 kg
Installation			
Floor mount Ceiling mount (option) Wall mount (option) Angle mount (option)	MC35-01	MC50-01	MC70-01

In case of wall mount and angle mount, working envelope of axis 1 is limited. Consult with each NACHI-FUJIKOSHI office for detail.

■ Characteristic

1. The swivel interference radius is small enough to make more free space. This fact enables high-density layouts of the robots.
2. It came to be able to handle loading of heavy weights, because the wrist became powerful.
3. Applicability has improved, because the stroke in the back and forth became the maximum in its class.
4. The application that can be applied has extended, because the environmental resistance became IP67 in wrist (standard), IP65 in main body (motor cover option) and IP67 (full cover option).
5. It became easy to add the cables and the hoses for the application by installing "S-Trac" and "A-Trac".

2. Basic specifications

Item		Specifications		
Robot model		MC35-01	MC50-01	MC70-01
Construction		Articulated		
Number of axis		6		
Drive system		AC servo motor		
Max. working envelope	Axis 1	±2.88 rad (±165 °) *3		
	Axis 2	+1.39 ~ -2.35 rad (+00 ~ -135 °)		
	Axis 3	+4.54 ~ -2.55 rad (+260 ~ -146 °)		
	Axis 4	±6.28 rad (±360 °)		
	Axis 5	±2.18 rad (±125 °)		
	Axis 6	±7.84 rad (±450 °)		
Max. speed	Axis 1	3.23 rad/s (185 °/s)	3.14 rad/s (180 °/s)	3.05 rad/s (175 °/s)
	Axis 2	3.14 rad/s (180 °/s)		2.53 rad/s (145 °/s)
	Axis 3	3.32 rad/s (190 °/s)	3.14 rad/s (180 °/s)	2.88 rad/s (165 °/s)
	Axis 4	5.32 rad/s (305 °/s)	4.45 rad/s (255 °/s)	4.10 rad/s (235 °/s)
	Axis 5	5.32 rad/s (305 °/s)	4.45 rad/s (255 °/s)	4.10 rad/s (235 °/s)
	Axis 6	7.33 rad/s (420 °/s)	6.46 rad/s (370 °/s)	6.11 rad/s (350 °/s)
Max. pay load	Wrist	35 kg	50 kg	70 kg
	Forearm	15 kg		
Allowable static load torque	Axis 4	160 N·m	210 N·m	300 N·m
	Axis 5	160 N·m	210 N·m	300 N·m
	Axis 6	90 N·m	130 N·m	150 N·m
Allowable moment of inertia *1	Axis 4	16 kg·m ²	30 kg·m ²	
	Axis 5	16 kg·m ²	30 kg·m ²	
	Axis 6	5 kg·m ²	12 kg·m ²	
Position repeatability *2		±0.07 mm		
Air pressure		0.49 MPa (5.0 kgf/cm ²) or less		
Installation *3		Floor mount		
Ambient conditions		Temperature: 0 ~ 45 °C *4 Humidity: 20 to 85%RH (No dew condensation allowed) Vibration to the installation face: Not more than 0.5G (4.9 m/s ²)		
Dust-proof / Drip-proof performance *5	Body	IP54 equivalent (standard) IP65 equivalent (with motor cover option) IP67 equivalent (with fully covered option)		
	Wrist	IP67 (standard)		
Robot mass		640 kg		

1 [rad] = 180 / π [°], 1 [N·m] = 1 / 9.8 [kgf·m]

- On controller display, axis 1 to 6 is displayed J1 to J6 for each.

- The specification and externals described in this specifications might change without a previous notice for the improvement.

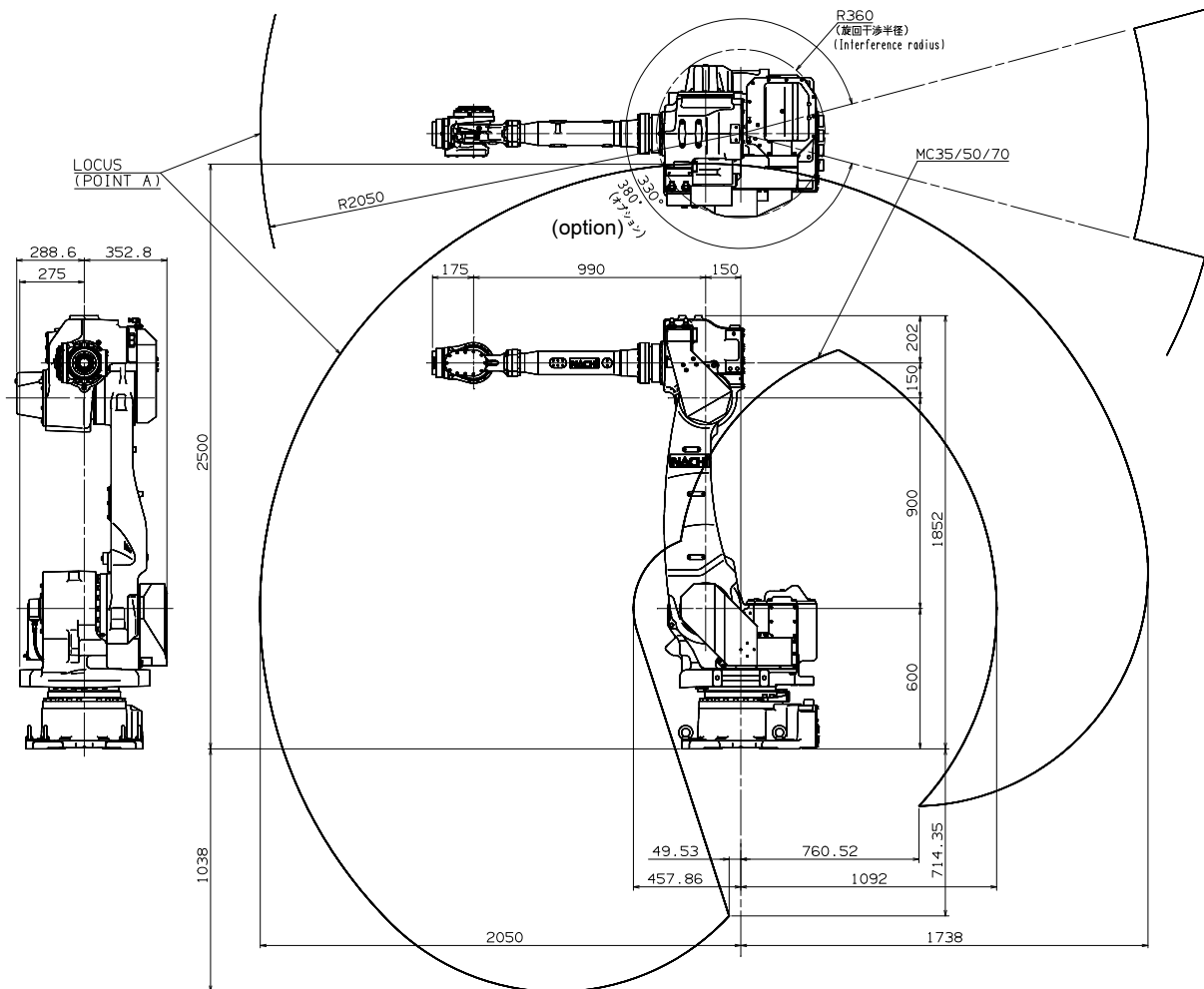
*1: This value changes by placement and load conditions of a wrist. *2: This value conforms to "JIS B 8432" standard. *3: Ceiling mount, wall mount and angle mount are the options. In case of wall mount or angle mount, operating range of axis 1 is limited.

*4: Permitted height is not higher than 1,000m above sea level. If used in higher place, permitted temperature is affected by height.

*5: Liquid such as organic compound, acidity, alkalinity, chlorine or gasoline cutting fluid which deteriorates the seal material are not available to use.

3. Robot dimensions and working envelope


【MC35-01】【MC50-01】【MC70-01】



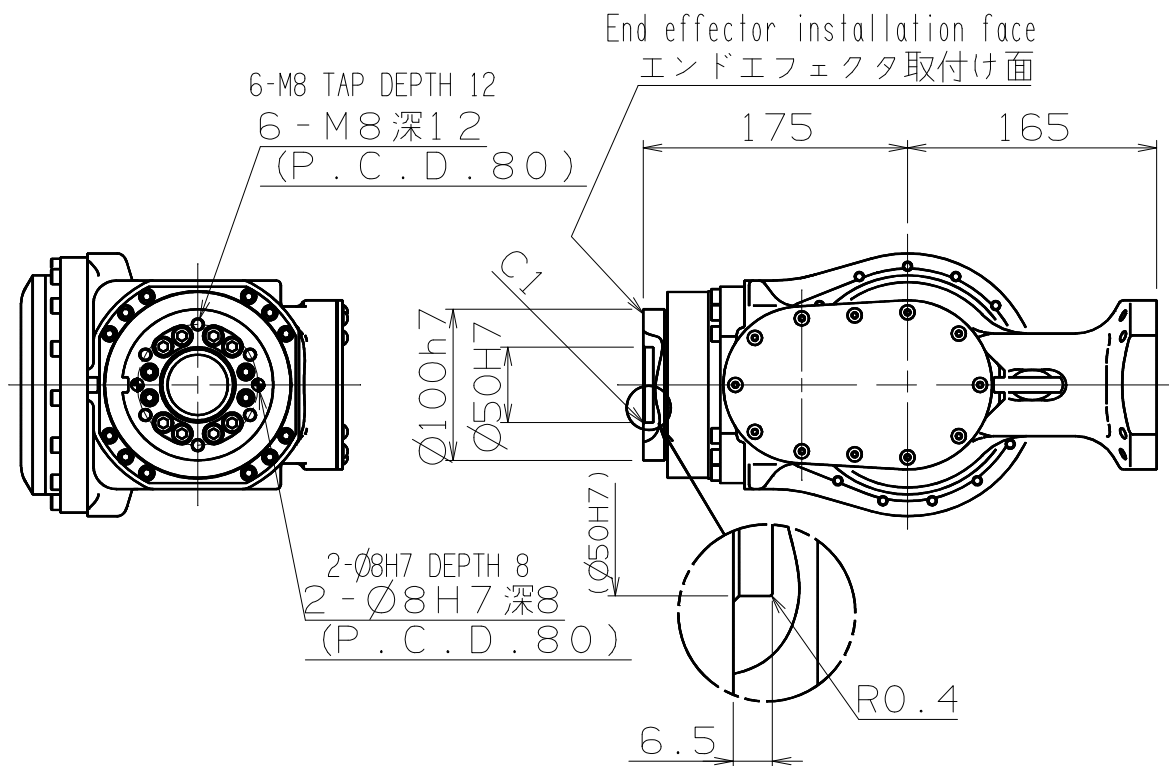
4. Details of load mounting face

■ Wrist

For the end effector fixing bolts, use the mounting P.C.D. shown below.

 CAUTION	Be sure to screw the M8 end effector fixing bolts in the wrist not deeper than the screw depth in the mounting face. Screwing the bolts deeper than the screw depth may damage the wrist.
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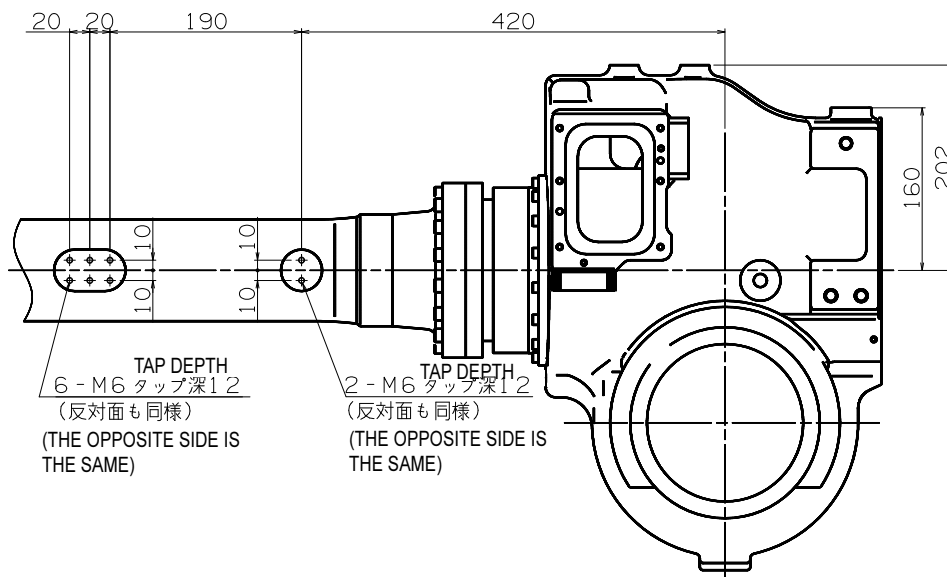
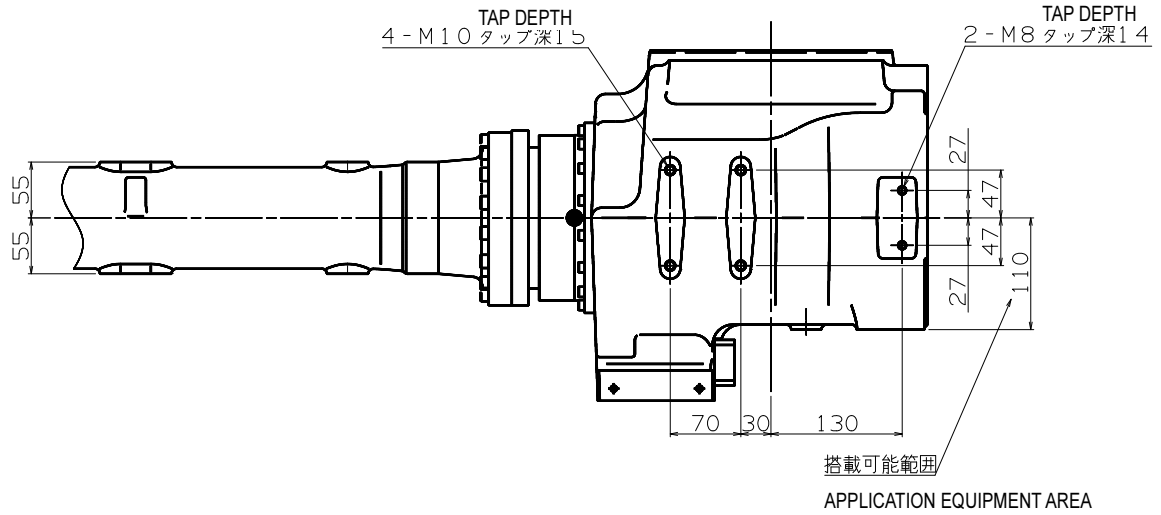
【MC35-01】【MC50-01】【MC70-01】



■ Upper part of forearm

Ancillary equipment can be mounted to the upper part of robot forearm.

【MC35-01】【MC50-01】【MC70-01】




5. Installation procedure

The installation location and the installation procedure of the robot are critical factors to maintain robot functions. The ambient conditions of installation location not only have influence on the life of mechanical sections of the robot, but also get involved in safety issues. Consequently, strictly observe the environmental conditions shown below. Furthermore, utmost care should be exerted for the installation procedure and the foundation for the robot in order to maintain the robot performance. Strictly observe the installation procedure for the robot provided below.

Installation

To install the robot, give it first priority to thoroughly consider safety of workers and take safety measures. The following describes precautions for this purpose.

Safety measures against entry in the robot operating area

 WARNING	<p>While the robot is in operation, workers are in danger of coming in contact with the robot. To avoid that, install a Safety fence so as to keep the worker away from the robot. Not doing so will cause the workers or other persons to accidentally enter the operating area, thus resulting in accidents.</p>
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■ Installation location and ambient conditions

Conditions (temperature, humidity, height and vibration) are written in “2. Basic Specifications”. Further ambient conditions listed below must be observed.

- (1) Location with the drainage structure so that swivel base is not flooded, when the liquid such as water or cutting fluid is splashed on the robot body
- (2) Location with no flammable or corrosive fluid or gas.
- (3) Type D grounding (the grounding resistance is 100Ω or less) is necessary.

■ Installation procedure

While robot moves, large reaction force is applied to the swiveling base from all directions. Consequently, the robot should be installed in such a manner that the foundation endures reaction force caused by accelerating or decelerating the speed to lock the robot, not to mention that it endures static loads.

Repair uneven spots, cracks, and others on the floor, and then install the robot by following to the table below. If thickness of floor concrete is less than needed level, an independent foundation should be constructed. Inspect the foundation prior to the robot installation, and then construct the foundation, if necessary.



Robot Model	MC35-01, MC50-01, MC70-01
Thickness of floor concrete	Not less than 150 mm
Installation parts *1	4 bolts of M20X65 (JIS: Strength class 12.9) 4 plain washers of not less than 4.5 mm in thickness and HRC35 in hardness
Tightening torque	560 ± 30 N·m
Allowable repeated tensile *2	Approximately 36,154 N

*1 : Installation parts are not accessory of robot.

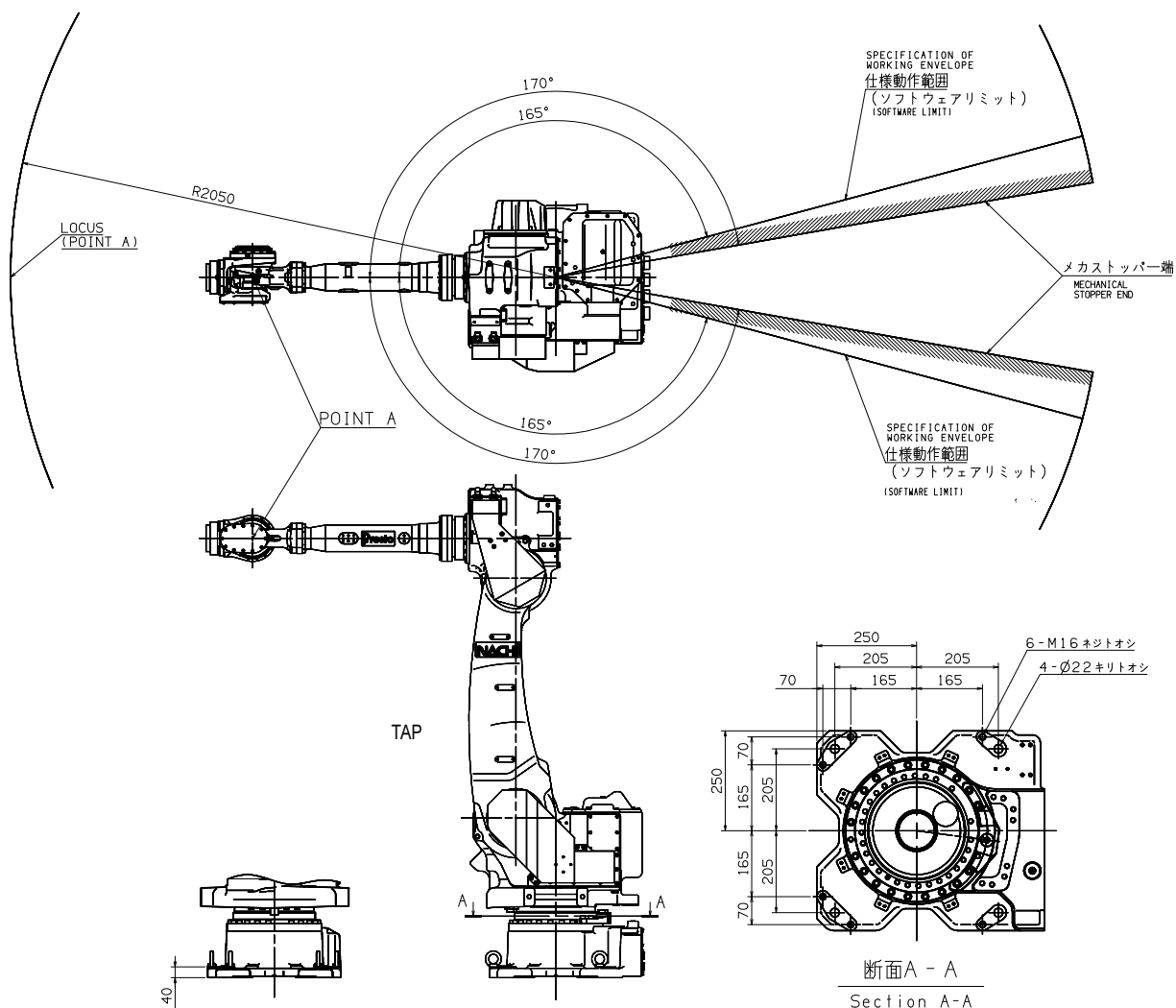
*2 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

■ Installation space

To install the robot, lock the swiveling base of the robot.

 WARNING	<p>The mechanical stopper end is located in a position exceeding the specified working envelope (software limit) of axis 1 by 4°. To install the safety fence, with consideration given to the wrist configuration and the shape of end effector.</p>
 WARNING	<p>On axis 1, axis 2 and axis 3, the robot working envelope can be regulated for safety (optional function). Since optional parts should be installed to enable this function, do not independently move the standard parts (e.g. mechanical stopper).</p>

【MC35-01】【MC50-01】【MC70-01】



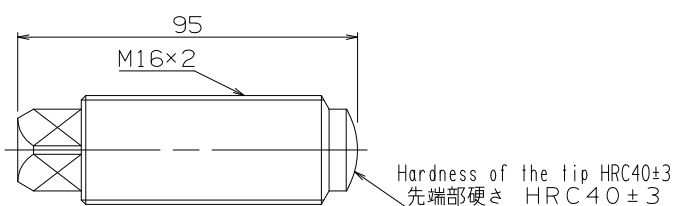
■ Accuracy of installation surface

When installing robot, strictly observe precautions listed below to cause no deformation in the swivel base.

- (1) Make the deviation from the flatness of the 4 plates on the robot installation surface fall within 0.5 mm.
- (2) Make the deviation in height between the 4 places of each base plate installation surface and the robot installation surface fall in the range of 0.5 mm (± 0.25 mm).

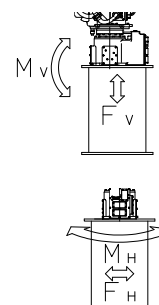


- (3) If the two precautions above cannot be observed, use jack bolts to bring the four places into even contact with the installation surface.




■ Maximum robot generative force

Robot model	Maximum vertical generative force FV	Maximum horizontal generative force FH	Maximum Vertical generative moment MV	Maximum horizontal generative moment MH
MC35-1 MC50-1 MC70-1	23,700 N	16,700 N	32,900 N·m	28,300 N·m



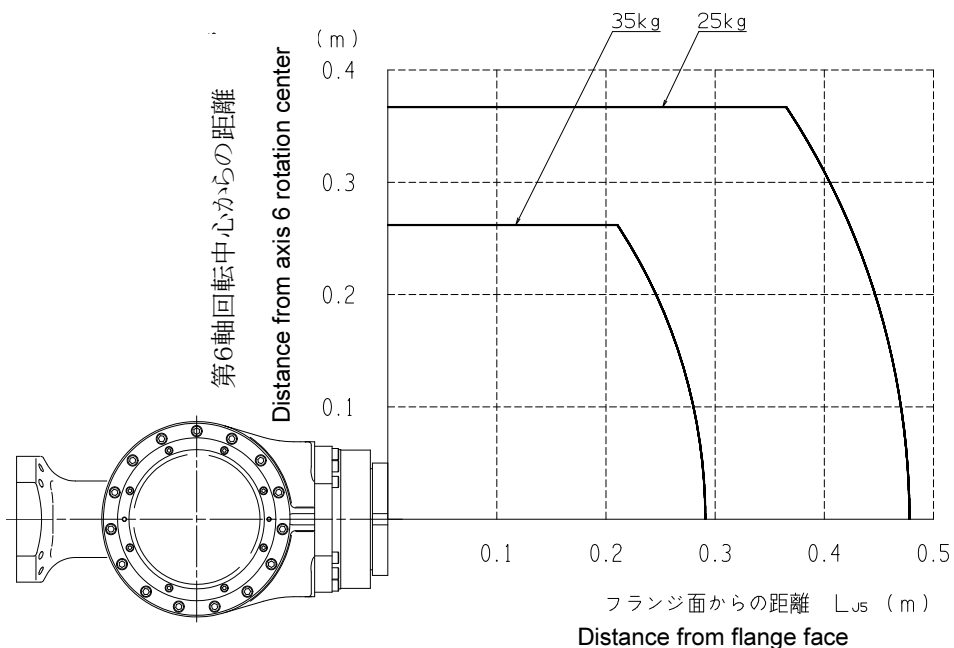
6. Allowable wrist load

 CAUTION	<p>Load fixed on the tip of wrist is regulated by “allowable payload mass”, “allowable static load torque”, and “allowable moment of inertia”. Strictly keep the wrist load within each allowable value. If wrist load exceeds the allowable value, this robot is out of guarantee. Refer to the table of “2. Basic specifications” and following figures for the detail of each specification.</p>
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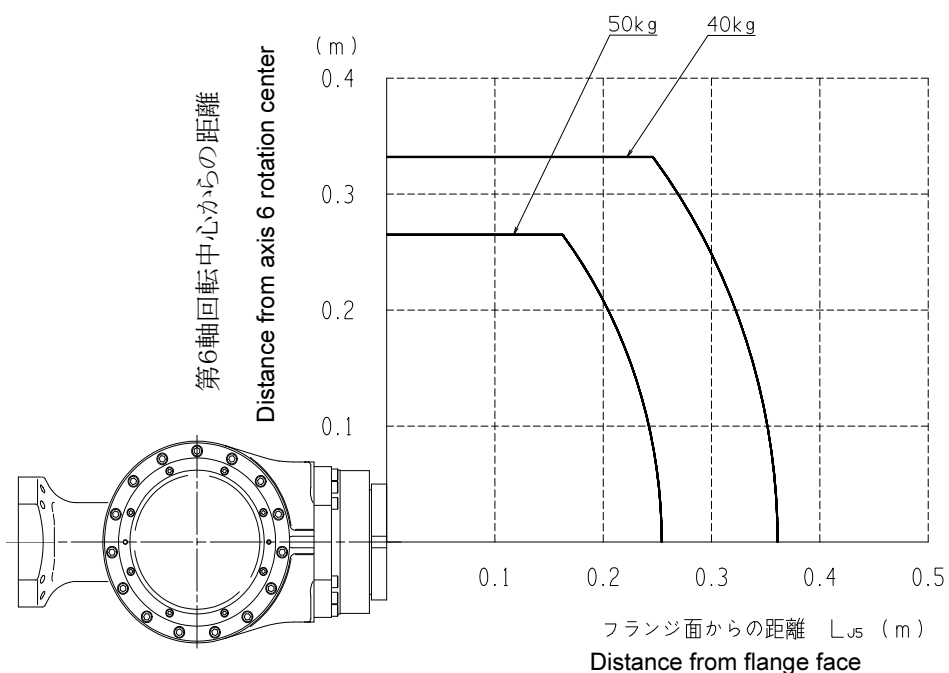
■ Torque map

C.O.G. of wrist load should exist inside the range shown below.

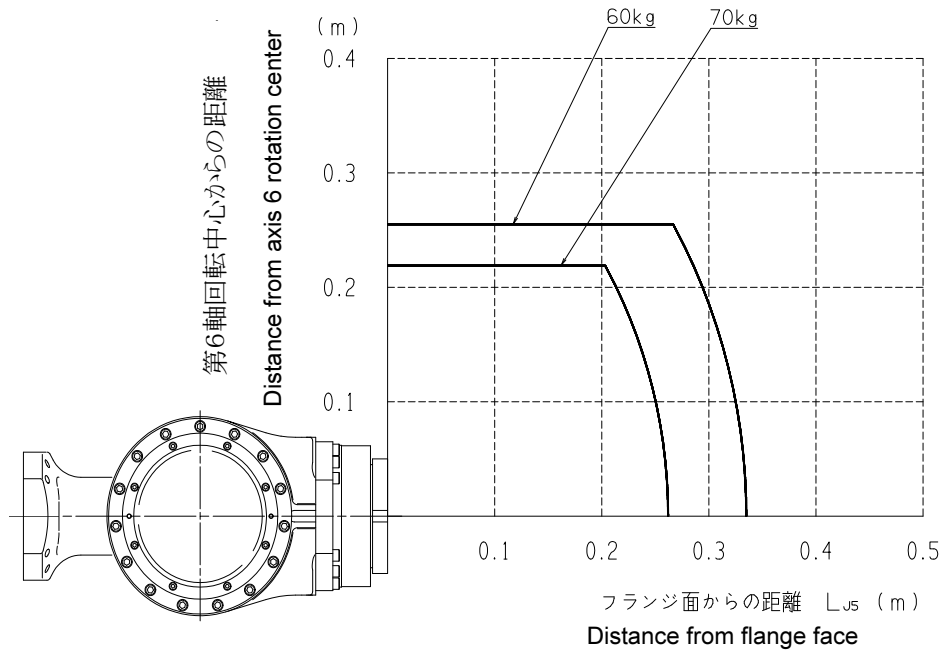
【MC35-01】



【MC50-01】



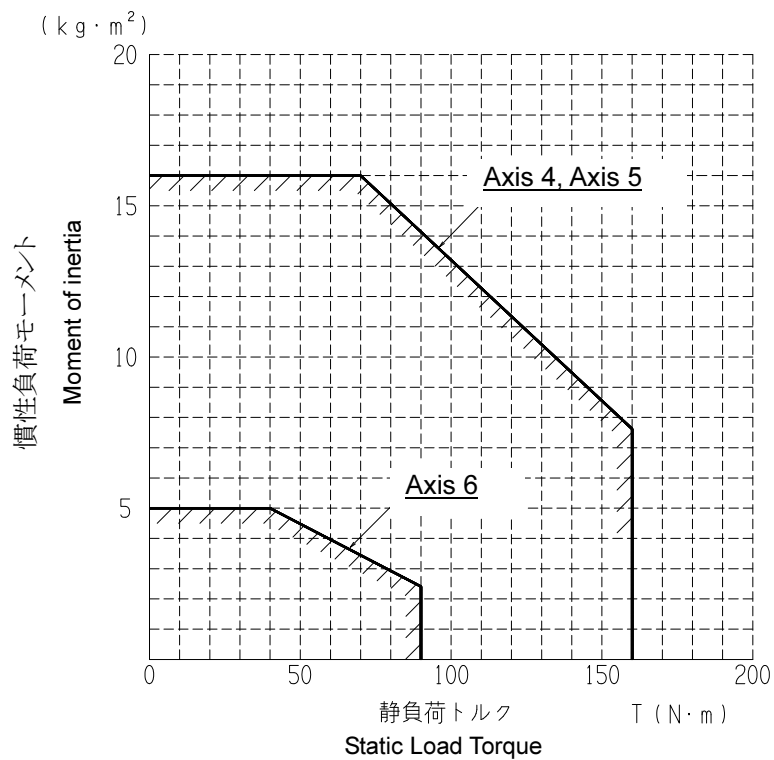
【MC70-01】



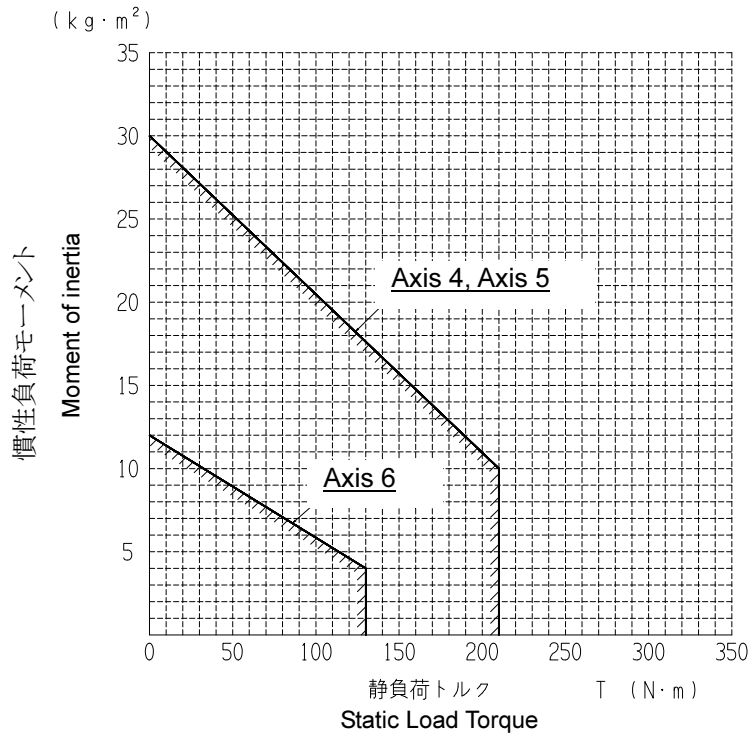
■ Moment of inertia map

Static load torque and moment of inertia of wrist load should exist inside the range shown below.

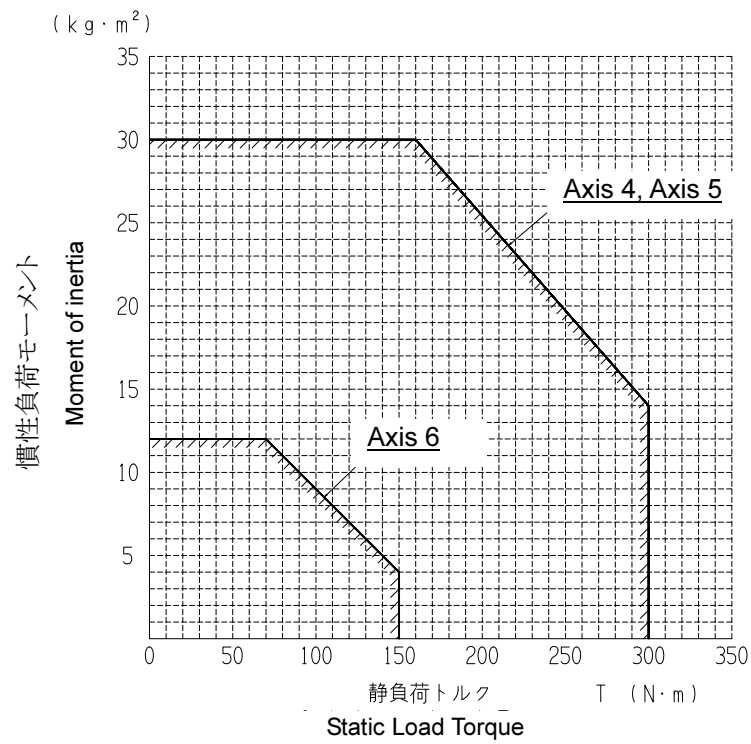
【MC35-01】



【MC50-01】





【MC70-01】

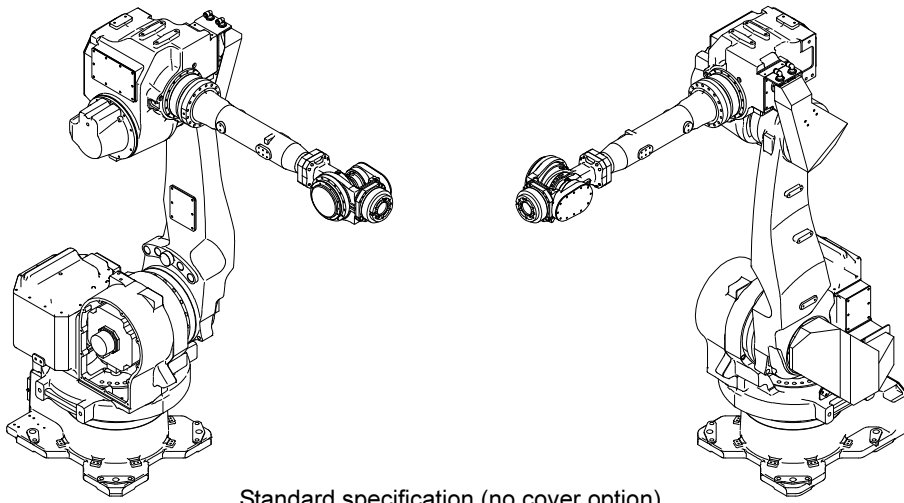


7. Option specifications

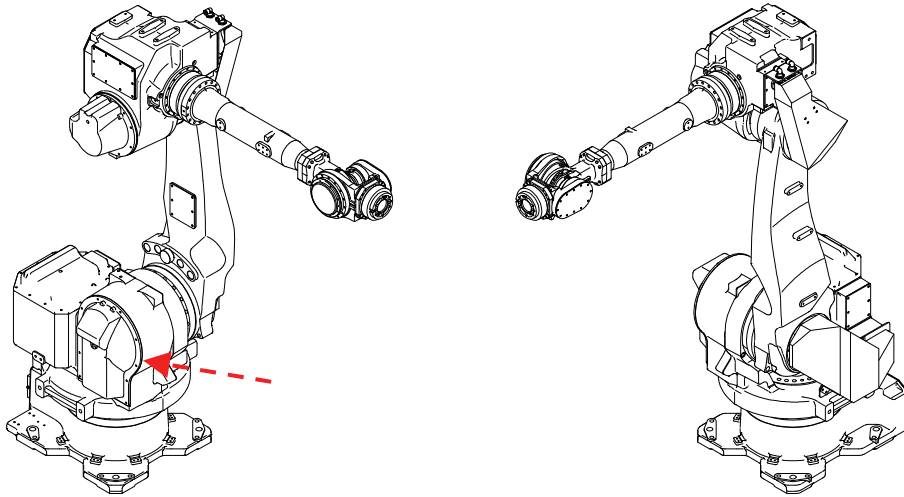
○: Possible to correspond / —: Impossible to correspond

No.	Item	Specifications	Parts No.	MC35/50/70-01
1	Installation parts	Chemical anchor specification (Installation plate with welded base plate + chemical anchor bolts)	OP-F1-020	○
		Ore anchor specification (Installation plate with welded base plate + ore anchor bolts)	OP-F2-016	○
		Leveling plate (□180mm x t=25m 4 plates)	OPJ-F1-0055	○
		Installation bolts and washers (Robot installation bolts and washers)	OPJ-F1-0047	○
2	Axis 1 380° stopper	Axis 1 ±190° operation	OP-S3-011	○
3	Axis 1 adjustable stopper	Restriction of axis 1 operation edge (-2.88~+2.88 rad, every 0.26 rad)	OP-S5-016	○
4	Axis 2 adjustable stopper	Restriction of axis 2 operation edge (From the advancement edge and the retreat edge to 0.52rad, every 0.26 rad)	OP-A5-020	○
5	Axis 3 Working envelope restriction stopper	Restriction of axis 3 operation edge (The upper side 1.57 rad)	OP-A6-019	○
6	Adjustable limit switch	Axis 2, 3 adjustable limit switch		—
7	Axis 1 base LS	For axis 1 zone detection	With LS, 1 base	—
			No LS, 1 base	—
			With LS, 3 base	—
			No LS, 3 base	—
8	Axis 2 arm clear LS	For axis 2 zeroing point and shelter point confirmation	The dog installation plate attachment	—
			No dog installation plate	—
9	Axis 3 motor guard	Protection of encoder and connectors of J3 axis motor		Unnecessary
10	Wrist axis motor guard	Protection of encoder and connectors of axis 4, axis 5, axis 6 motor		
11	Air tubing	2 systems (inside diameter φ6.5X2), from swivel base to axis 3 gear box		Standard
12	Application signal line	20 wires (0.2 mm ²), from swivel axis to axis 3 gear box		Standard
13	Solenoid valve	Built-in type		—
14	Transfer jig	Fork bracket	OP-S2-037	○
15	Transfer fixed jig	Arm fixed jig (for axis 2)		Unnecessary
16	Zeroing pin & Zeroing block	J1~J4 axis: Pin hole, axis 5, axis 6: Block	OP-T2-052	○
17	Axis 2 motor protection cover	IP65 spec. (Motor cover for axis 2)  Refer to figure of next page	OP-C1-006	○
18	Full cover	IP67 spec. (Motor cover for axis 2+Wiring protection cover)  Refer to figure of next page	OP-C2-004	○
19	Flange adaptor	ISO Flange		Standard
20	Bypass cable		BCUNIT20-50	○
21	Wrist match mark	Wrist axes reference position adjustment (sticker)	OP-N2-021	○
22	Cable	ID registration cable	MR20-OP03-A	○
23	Bearing installation jig for axis 1	Axis 1 motor shaft portion	KP-ZJ-007	○
24	Bearing installation jig for wrist axes	Axis 4 – axis 6 motor shaft portions	KP-ZJ-008	○
25	Jig for ceiling mount	Jig to install the ceiling mount robot	OP-S7-008	○
26	Name plate for ceiling mount	Name plates to install the ceiling mount robot	OP-N3-010	○ MC35-01
			OP-N3-009	○ MC50-01
			OP-N3-011	○ MC70-01
27	Water proof coolant paint	Double liquid type urethane resin paint	OP-N5-018	○

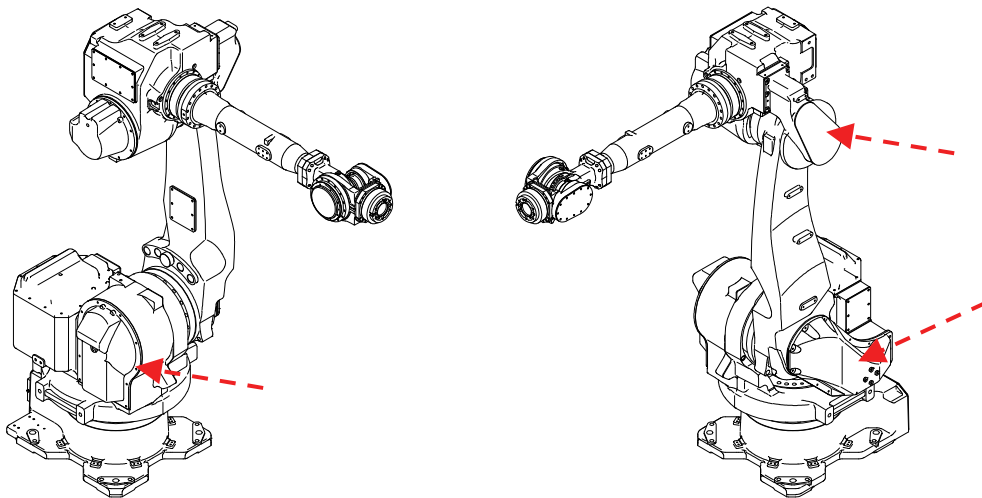
※ The specification and externals described in this specifications might change without a previous notice for the improvement.



Standard specification (no cover option)



Axis 2 motor protection cover option (OP-C1-006)



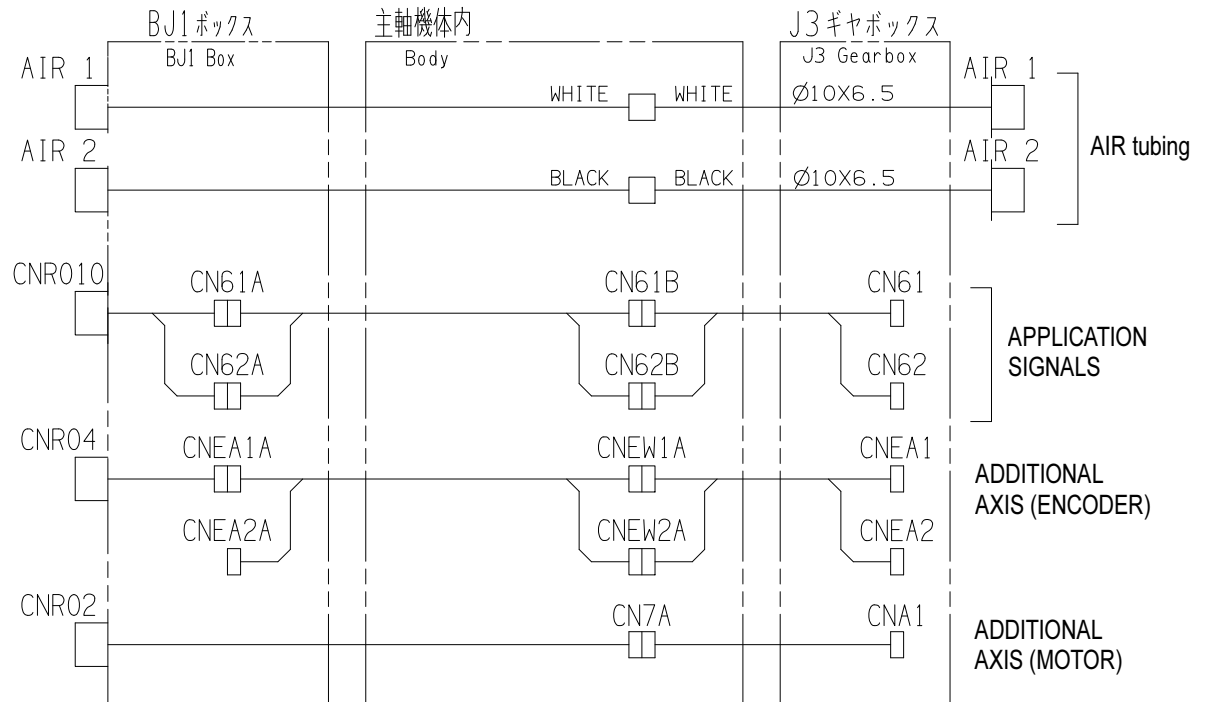
Full cover option (OP-C2-004)

Cover options appearance

8. Application wiring and tubing diagram

■ Wiring and tubing diagram

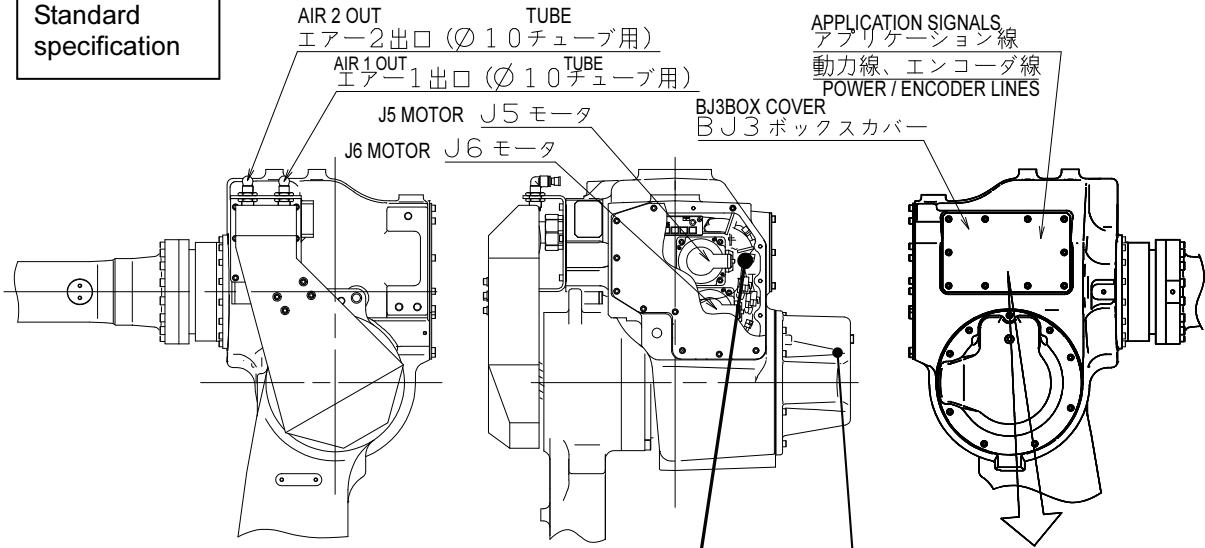
【MC35-01】【MC50-01】【MC70-01】



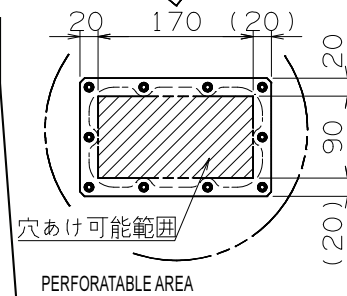
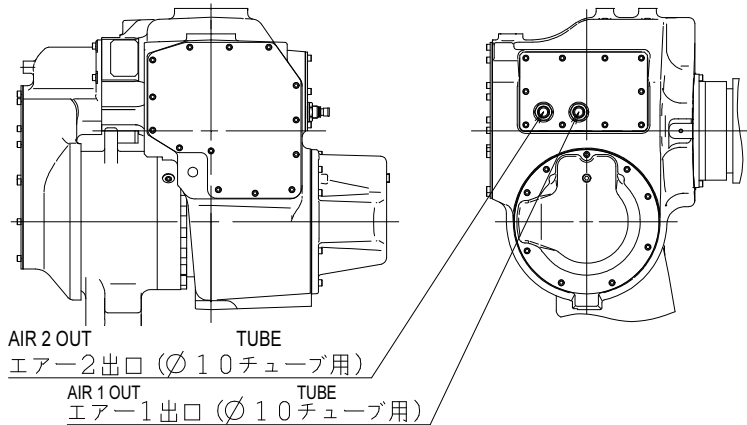
■ Details of base and flame

【MC35-01】【MC50-01】【MC70-01】

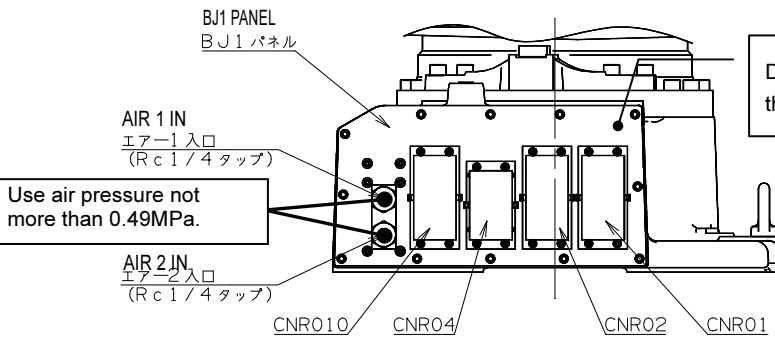
Standard specification



Full cover option specification



Application cables are inside the box. When pulling them out from the box to use, drill the cover and install a cable clamp. The cable clamp must be water-proof type.

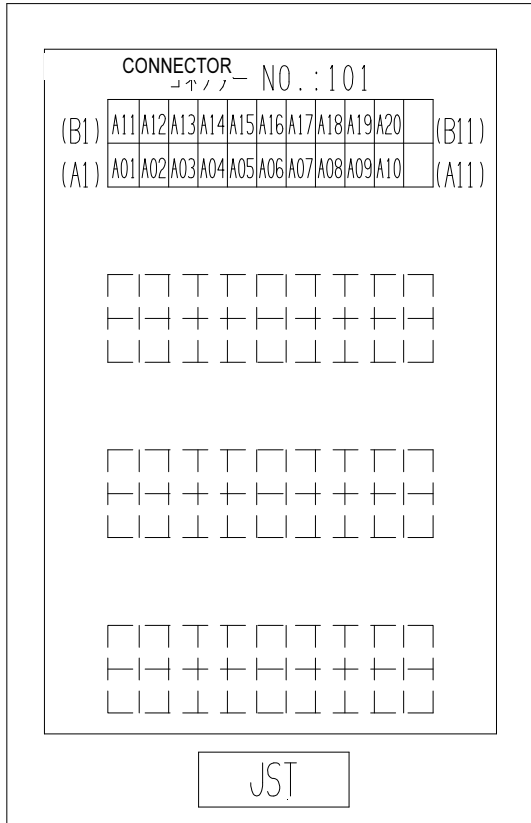


Do not install anything on the BJ1 panel.

■ Detailed diagram of application connectors

【MC35-01】【MC50-01】【MC70-01】

BJ1 side (connector)



Partner connector

Wire-side shell: JFM-WSA-4-A (JST)
or JFM-WSA-4-C (JST)

Guide plate A kit: JFM-GPAK-4 (JST)

Receptacle housing: JFM2FDN-22V-K (JST)

Receptacle contact:

(a) SJ2F-01GF-P1.0 (JST) (0.20 ~ 0.50 mm²)

(b) SJ2F-21GF-P1.0 (JST) (0.30 ~ 0.75 mm²)

Manual crimp tool:

for (a) YRS-8861

for (b) YRF-1120

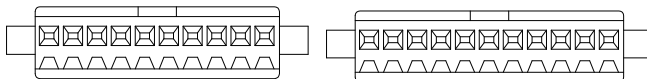
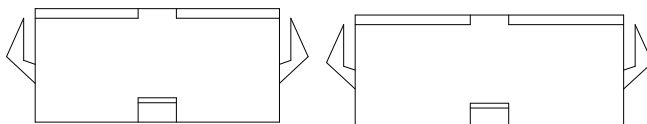
Cable diameter suitable for wire-side shell:

JFM-WSA-4-A φ26.2 ~ φ28.0

JFM-WSA-4-C φ15.5 ~ φ16.50

(Shown pin assignment is a view from an insertion face of robot side connector.)

BJ3 side (connector)



CN61

1	2	3	4	5	6	7	8	9	10
A01	A02	A03	A04	A05	A06	A07	A08	A09	A10

CN62

1	2	3	4	5	6	7	8	9	10	11
A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	ECE

Connector type (CN61)

Housing: SMP-10V-BC (JST)

Partner connector

Housing: SMR-10V-B (JST)

Contact: SYM-001T-P0.6

(Applicable wire : AWG#22~28)

Pressure tool: YRS-121

Connector type (CN62)

Housing: SMP-11V-BC (JST)

Partner connector

Housing: SMR-11V-B (JST)

Contact: SYM-001T-P0.6

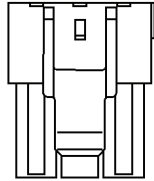
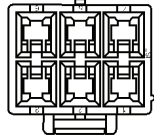
(Applicable wire : AWG#22~28)

Manual crimp tool: YRS-121

(Shown pin assignment is a view from an insertion face of robot side connector.)

■ Details of additional axis connectors

BJ3 side (intermediate connector)



CNA1

3	W7	2	V7	1	U7
6	BA7	5	PB6	4	G

Connector type (CNA1)

Housing
VLP-06V (JST)

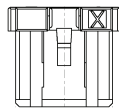
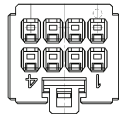
Partner connector

Housing
VLR-06V (JST)
Retainer
VLS-03V (JST)
Contact
SVM-42T-P2.0
(Applicable wire : AWG#22~16)
Contact
SVM-61T-P2.0
(Applicable wire : AWG#20~14)

Manual crimp tool:

YC-592:(AWG#22~16)
YC-590:(AWG#20~14)

(Shown pin assignment is a view from an insertion face of robot side connector.)



CNEA1

B4	M3E	B3	ECE	B2	SA1-	B1	M5E
A4	P3E	A3		A2	SA1+	A1	P5E

CNEA2

B4	M3E	B3	ECE	B2	SA2-	B1	M5E
A4	P3E	A3		A2	SA2+	A1	P5E

Connector form (CNEA1,CNEA2)

Housing
1-1827864-4 (AMP)

Partner connector

Housing
1-1903130-4 (AMP)
Contact
1903116-2
(Applicable wire : AWG#28 - 22)




Manual crimp tool : 1762846-1

(Shown pin assignment is a view from an insertion face of robot side connector.)

9. Transport procedure

Safety measures against transport

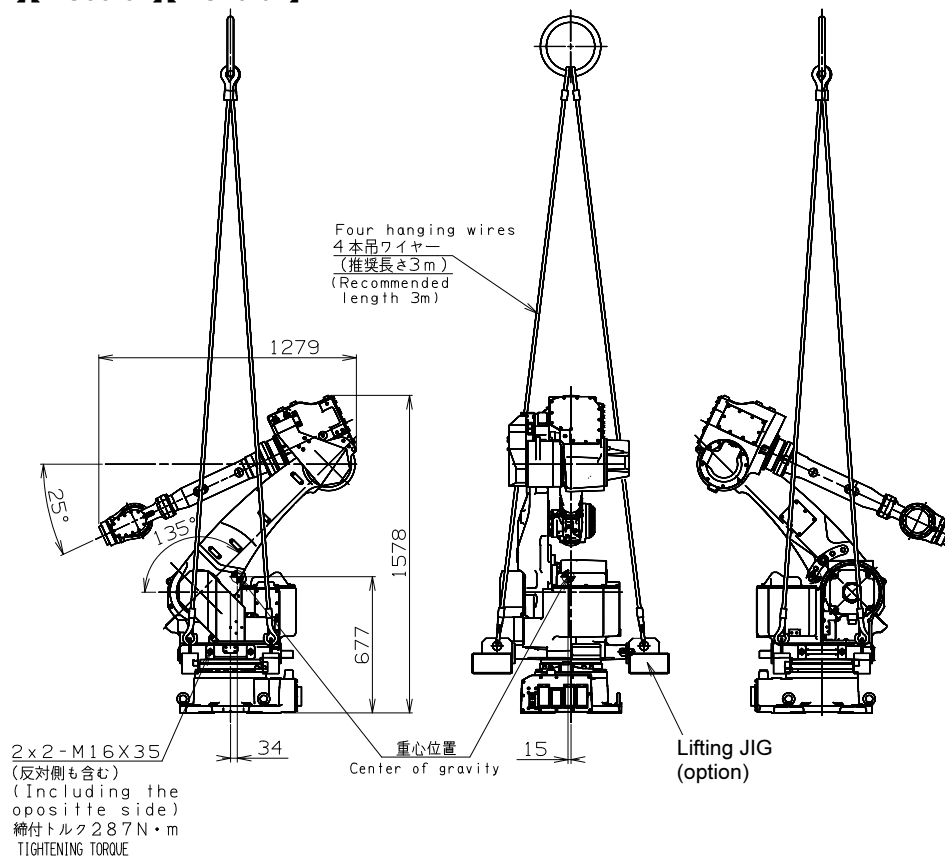
The following describes precautions for transporting the robot. Fully understand the precautions for safe transport work.

 WARNING	The robot must be transported by personnel who have licenses required for slinging work, crane operation, forklift truck operation, and others. The weight of the robot and controller is listed in the Operating Manual and the Maintenance Manual. Check for the weight, and then handle them according to procedures suitable for the weight.
 WARNING	To lift the robot or the controller, follow the procedures specified in the Maintenance Manual. Following any procedures other than those specified will cause the robot to topple over or drop during transport, thus resulting in accidents.
 WARNING	During transport or installation work of the robot, pay utmost care not to cause damage to wirings. Furthermore, after installing the robot, take protective measures such as using protective guards so that the wirings will not be damaged by workers or other persons, or forklift trucks or else.

To transport the robot, make it a rule to use a crane.

First, put the robot into the configuration shown in figure below and mount the two carrier brackets dedicated to the transport of the robot to both sides of the robot frame. Then, lift the robot using four hanging wires. Fix these dedicated brackets with the two M16 X 35 bolts. The tightening torque is 287 N·m. Recommended length of the hanging wires is 3 m.

【MC35-01】【MC50-01】【MC70-01】



10. Installation (specification which contains a robot)

1. Delivery condition

Because the expense is different, which form to choose be sufficiently examined.

	Condition	Details
1	Delivery on the truck	Robot is delivered on the truck near the entrance of customer's plant.
2	Delivery after installation and test-run	Robot is installed and test-run done.
3	Delivery after installation and test-run with work piece	After style 2, teaching with work piece is done.

2. Operation and maintenance education

The special spot operation guide and the special spot preservation guide are the outside of the estimation. Also, there is schooling system in the Toyama factory, too.

Consult with each NACHI-FUJIKOSHI office for the details.

3. The type D grounding (the grounding resistance is 100Ω or less) is necessary.

11. Consuming power (Robot + Controller)

5.0kVA (Peak power)

12. Paint color

Standard color Controller cabinet Munsell 10GY9/1
 Robot body Munsell 10GY9/1

Water proof coolant paint option is useful for the circumstance such as that coolant splashes on robot body. Please refer to "7 Option specifications" for the type of this option.

13. Warranty

Elapse of 1 year after delivery.

The specification and externals described in this document might change without a previous notice for the improvement.

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