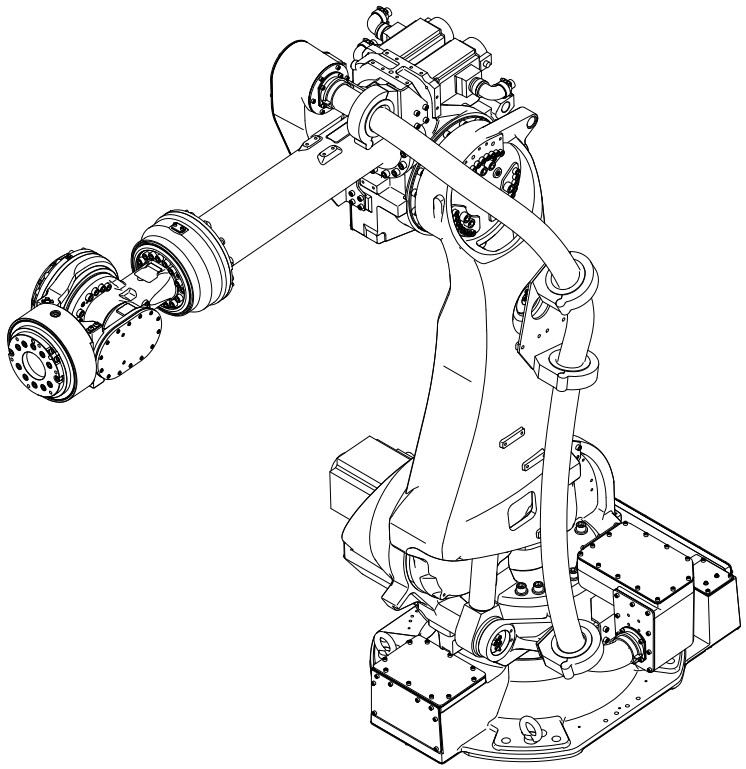
NACHI

Standard specifications

SRA210D-01-FD11

1st edition



NACHI-FUJIKOSHI CORP.

1401, SMCEN-067-001,001

NACHI

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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 and the material handling techniques.
“SRA210D” is a robot of simple highly rigid structure which is optimal for material handling applications especially in a severe environment like a cast parts factory etc.

Installation \ Max. payload	210 kg
Floor mount	SRA210D-01

■ Characteristics

1. Due to high wrist torque and high moment of inertia, this robot is suitable for handling of heavy payload.
2. Wide motion range makes easier applicability than before.
3. By installing the balance unit inside arm, swivel base becomes slim and interference radius gets substantially shorter than before.
4. Due to making higher maximum speed, cycle time is shortened. Also it is possible to get faster air-cut motion that is changing wrist attitude widely.
5. The restriction of the operation range is lightened due to the slim compact wrist. It make it possible to use the robot for more diverse applications.
6. The required installation area has been reduced by routing water, air and cables through the swivel base for material handling application.

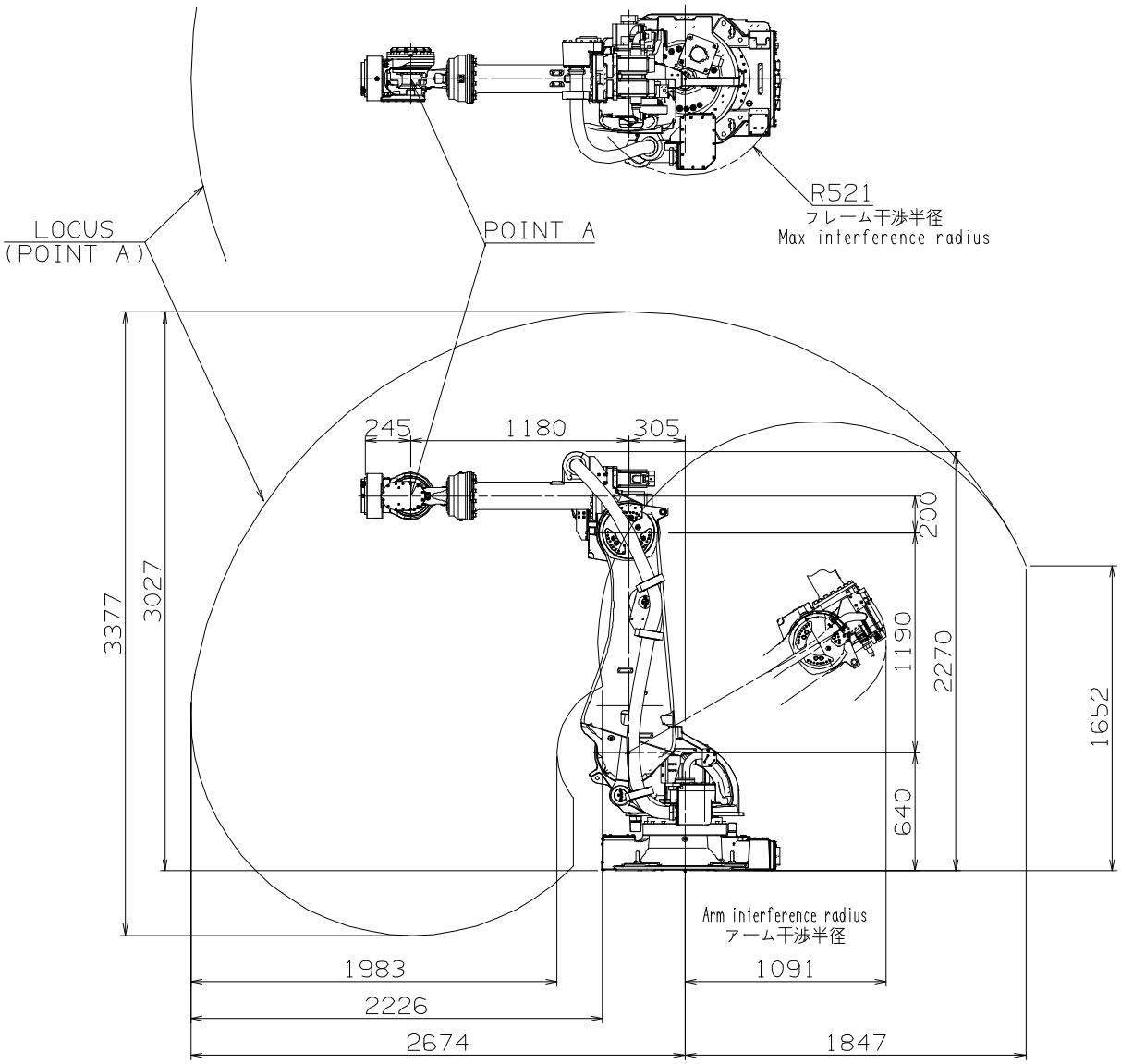
2. Basic specifications

Item		Specifications
Robot model		SRA210D-01
Construction		Articulated
Number of axis		6
Drive system		AC servo motor
Max. working envelope	Axis 1	±2.88 rad （±165°）
	Axis 2	-1.40 ～ +1.05 rad （-80 ～ +60°）
	Axis 3	-2.56 ～ +2.62 rad （-146.5 ～ +150°）
	Axis 4	±6.28 rad （±360°）
	Axis 5	±2.09 rad （±120°）
	Axis 6	±6.28 rad （±360°）
Max. speed	Axis 1	2.01 rad/s （115°/s）
	Axis 2	1.83 rad/s （105°/s）
	Axis 3	1.97 rad/s （113°/s）
	Axis 4	2.44 rad/s （140°/s）
	Axis 5	2.32 rad/s （133°/s）
	Axis 6	3.49 rad/s （200°/s）
Max. pay load	Wrist	210 kg
	Forearm *1	45 kg at maximum
Allowable static load torque	Axis 4	1,337 N·m
	Axis 5	1,337 N·m
	Axis 6	720 N·m
Allowable moment of inertia *2	Axis 4	141.1 kg·m^2
	Axis 5	141.1 kg·m^2
	Axis 6	79.0 kg·m^2
Position repeatability *3		±0.15 mm
Installation		Floor mounting
Ambient conditions		Temperature: 0 to 60 ºC *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		Wrist and upper arm;IP67 / Lower arm and base unit:IP65
Robot mass		1,100 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 specification might change without a previous notice for the improvement.

*1: This value changes by placement and load conditions of a wrist. *2: The Allowable moment of inertia of a wrist changes with load conditions of a wrist. *3: This value conforms to "JIS B 8432". *4: Permitted height is not higher than 1,000m above sea level. If used in higher place, permitted temperature is affected by height.

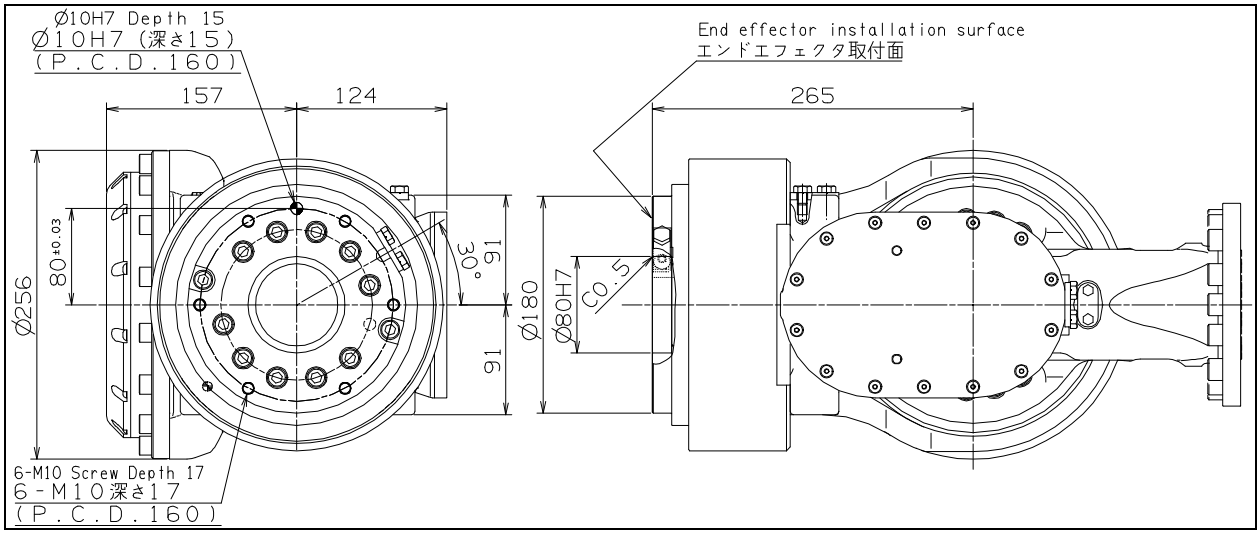
3. Robot dimensions and working envelope



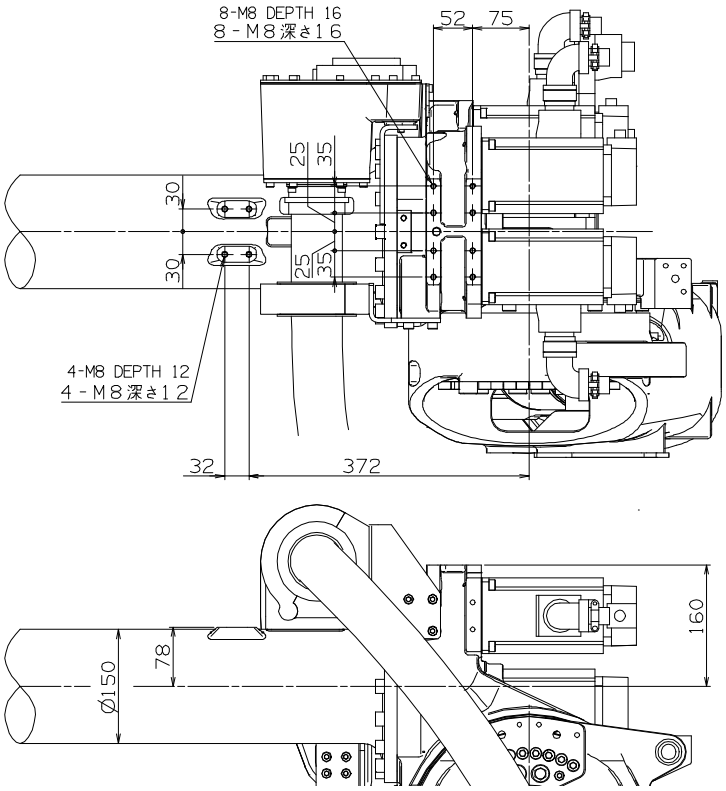
4. Detail of tool mounting plate

For the end effecter fixing bolts, use the mounting P.C.D. shown in the following figures.
Besides the mounting P.C.D., different P.C.D. (option) is available. For details, contact our service division.

CAUTION	Be sure to screw the M12 tool 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.



5. Details of upper part of forearm



6. 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	While the robot is in operation, workers are in danger of coming in contact with the robot. To avoid that, install a **Guard 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.

■ 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.

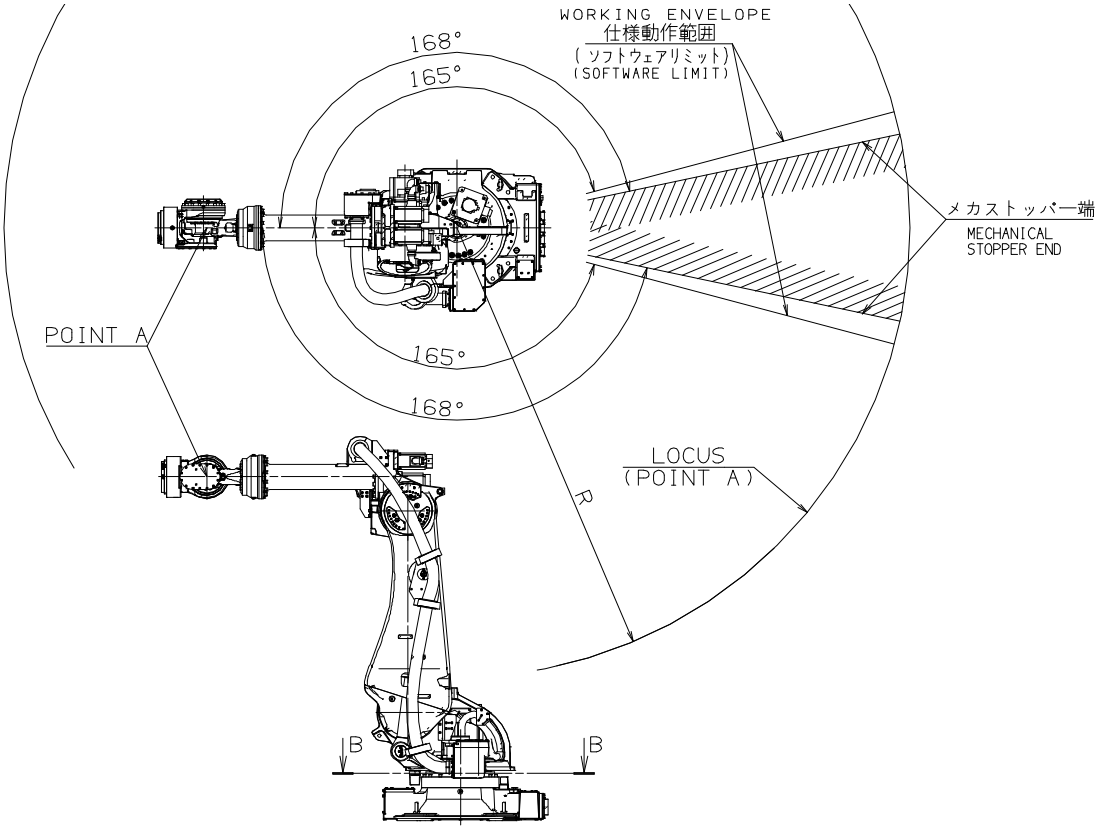
Robot Model	SRA210D-01
Thickness of floor concrete	Not less than 160 mm
Installation parts *1	8 bolts of M20 (JIS: Strength class 12.9) not less than 65mm 8 plain washers of not less than 4.5 mm in thickness and HRC35 in hardness
Tightening torque	560 ± 30 N·m
Allowable repeated tensile *2	Approximately 28,000 N

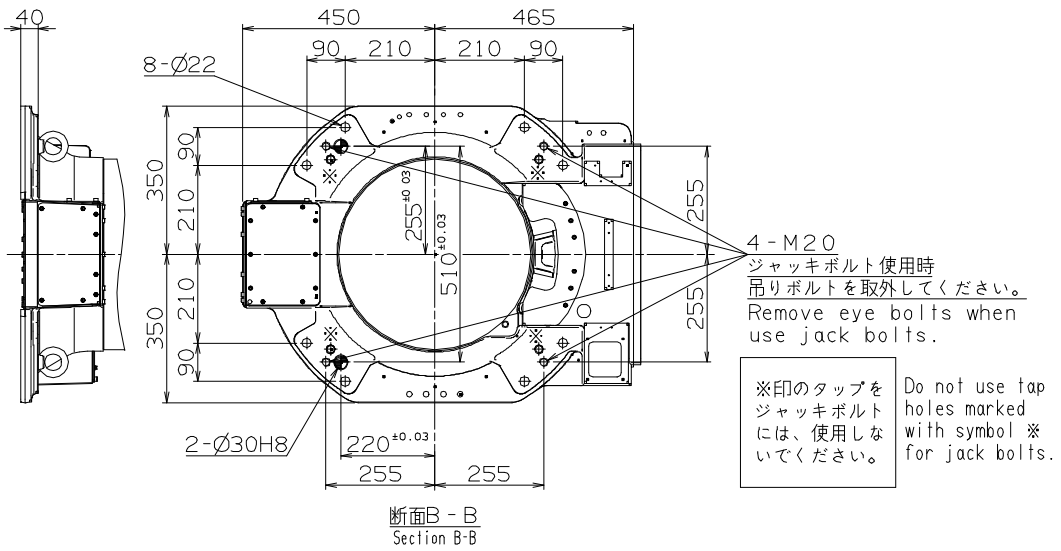
*1 : Installation parts are not accessory of robot.
*2 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

■ Installation space

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

WARNING	The mechanical stopper end is located in a position exceeding the specified working envelope (software limit) of axis 1 by 3°. To install the safety fence, with consideration given to the wrist configuration and the shape of end effecter.
WARNING	On axes 1, 2 and 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).



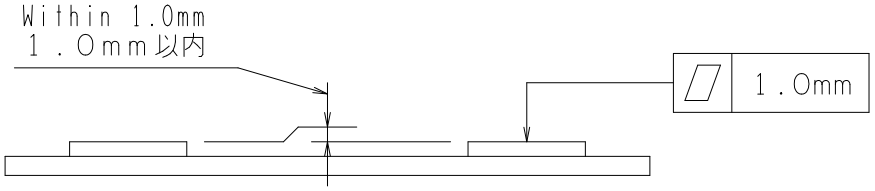


■ Accuracy of installation surface

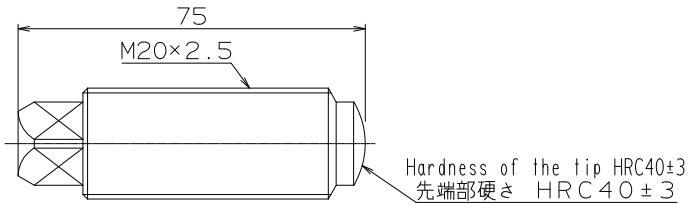
When installing robot, strictly observe precautions listed below to cause no deformation in the swivel base.

(1) Make the deviation from the flatness of the 4 plates on the robot installation surface fall within 1.0 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 1.0 mm (±0.5 mm).

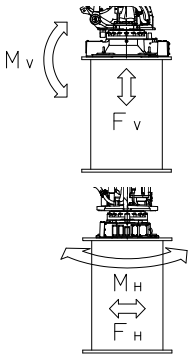


(3) If the two precautions above cannot be observed, use jack bolts to bring the four places into even contact with the installation surface.



■ Maximum robot generative force

Robot model	Max. vertical generative force F_V	Max. horizontal generative force F_H	Max. vertical generative moment M_V	Max. horizontal generative moment M_H
SRA210D-01	52,800 N	40,500 N	113,200 N·m	98,300 N·m

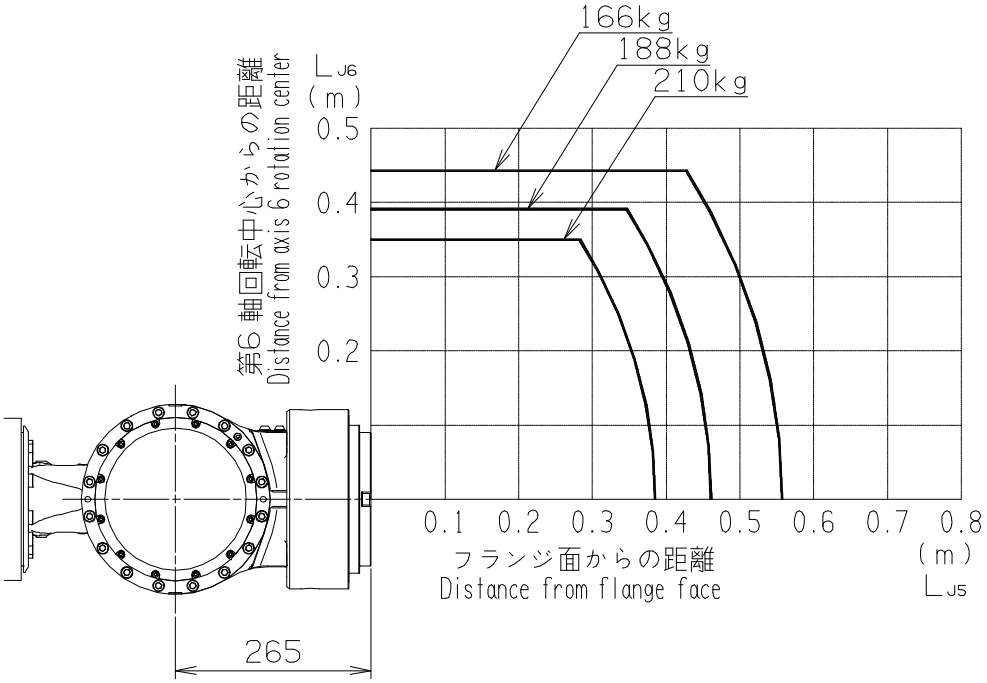


7. Allowable wrist load

CAUTION	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.

■ **Torque map**

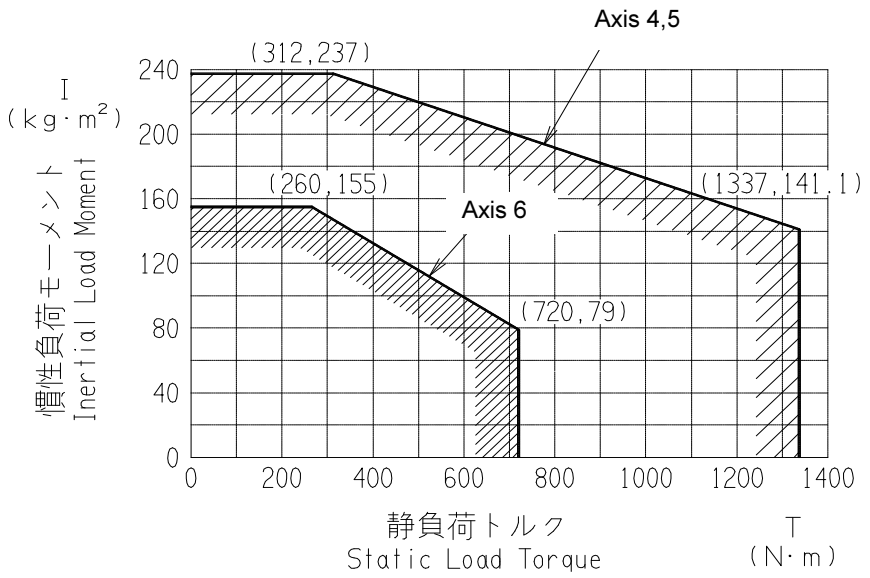
C.O.G. of wrist load should exist inside the range shown below.



■ Wrist load conditions

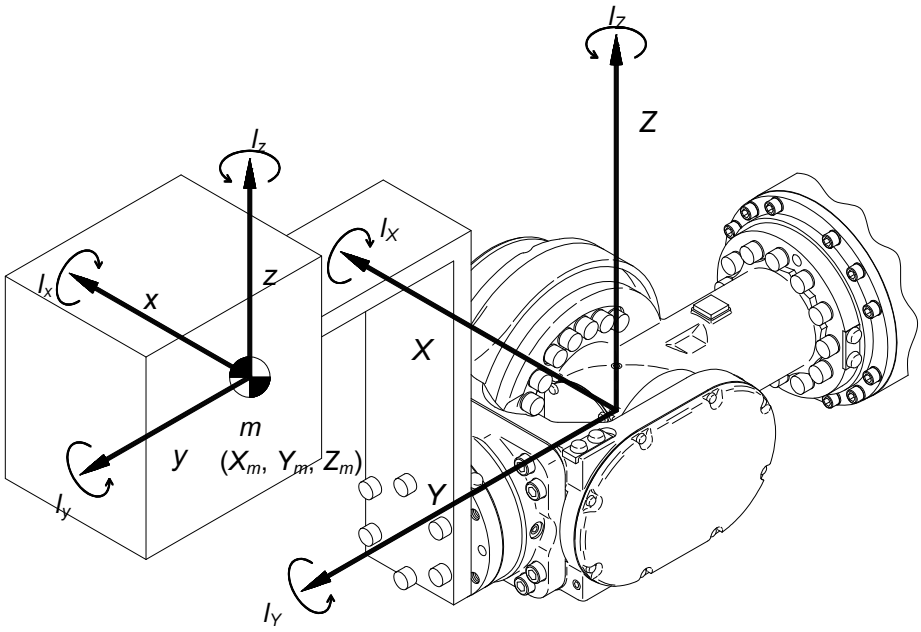
Static load torque and moment of inertia of wrist load should exist inside the range shown below.

IMPORTANT	If the real inertia is over the limit, maximum speed will be restrained by software to protect he robot.



■ How to find the inertia moment of each axis

The following section shows general methods of calculating the inertia moment around each axis.



X: Axis 5 rotation in the basic wrist configuration
Y: Axis 6 and axis 4 rotation in the basic wrist configuration
Z: Axis at right angles to the X and Y axes in the basic wrist configuration
x: Axis parallel to the X axis in the load gravity center
y: Axis parallel to the Y axis in the load gravity center
z: Axis parallel to the Z axis in the load gravity center
I_x: Inertia moment around the X axis passing through the load gravity center
I_y: Inertia moment around the Y axis passing through the load gravity center
I_z: Inertia moment around the Z axis passing through the load gravity center
m: Load mass
(X_m, Y_m, Z_m): Gravity center coordinates of load

1. Inertia moment around axis 6

The inertia moment of around axis 6 is found by the expression shown below.

$$I_{J6} = I_Y = m \cdot (X_m{}^2 + Z_m{}^2) + I_y$$

2. Inertia moment around axis 4 and axis 5

The inertia moment around axis 4 and axis 5 varies with axis 6 configuration. Consequently, in order to simplify the calculation, take a maximum value around the X and Z axes in above figure, as the inertia moment.

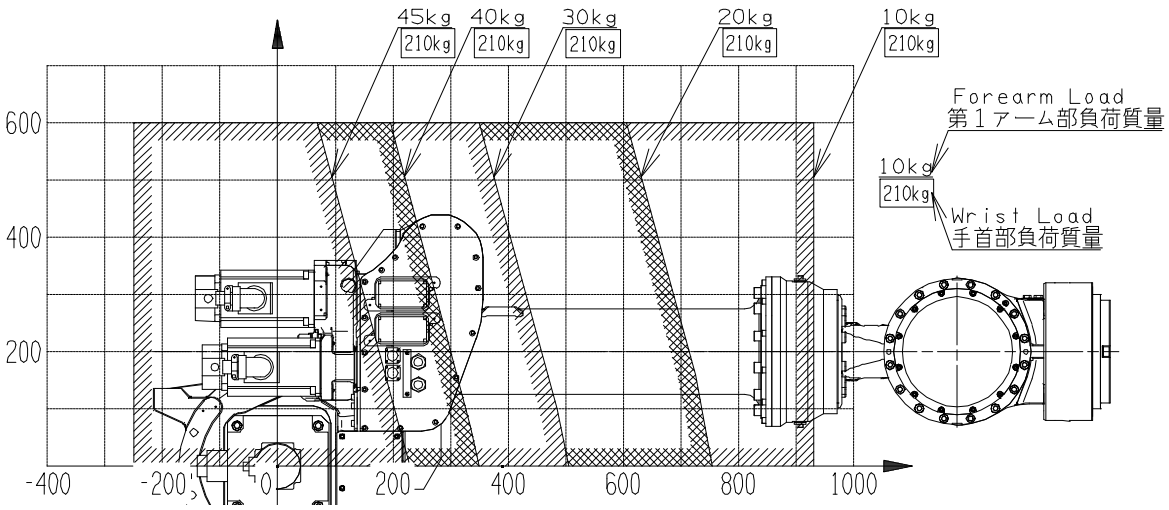
$$I_{J4J5} = \max (I_X , I_Z)$$

$$\because I_X = m \cdot (Y_m{}^2 + Z_m{}^2) + I_x$$

$$\because I_Z = m \cdot (X_m{}^2 + Y_m{}^2) + I_z$$

■ Allowable forearm load

Use the robot under condition that COG of the ancillary equipment on the forearm falls in the range shown below.



8. Option specifications

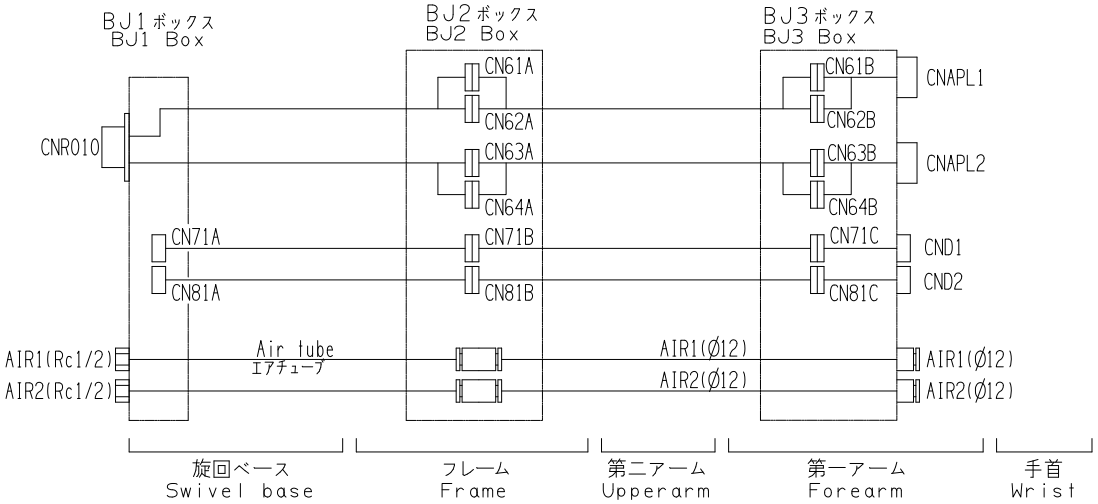
○: Possible to correspond／－: Impossible to correspond

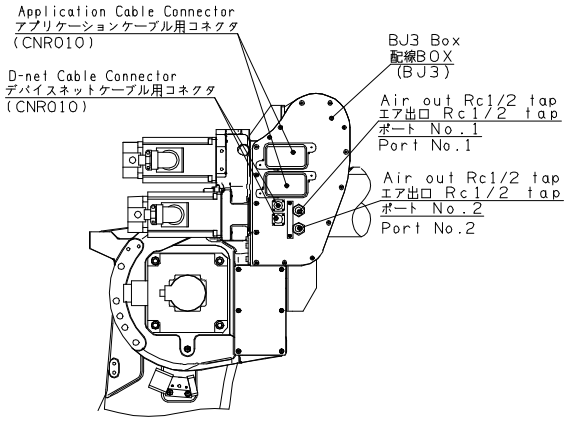
No.	Item	Specifications	Parts No.	Robot model
				SRA210D-01
1	Installation parts *1	Pins set (Installation pins & polyethylene plug)	OP-F1-025	○
		Installation bolts & washers	OP-F1-035	○
2	Axis 1 adjustable stopper *1	Restriction of axis 1 operation edge (±2.61 rad to ±0.0, every 0.17 rad)	OP-S5-024	○
3	Axis 2 adjustable stopper *1	Restriction of axis 2 operation edge (-0.26 and -0.52 rad from the operation edge)	OP-A5-030	○
4	Axis 3 adjustable stopper *1	Restriction of axis 3 operation edge (-0.52 rad, -0.79 rad, -1.05 rad, -1.31 rad, -1.57 rad from the J3 axis upper side motion end)	OP-A6-028	○
5	Transfer jig	Fork bracket	OP-S2-039	○
6	Zeroing pin & block *1		OP-T2-083	○
7	Encoder connector Protector	For axis 3	OP-P6-009	○
8	Arm fixing jig	Axis 2	KP-ZD-005	○
		Axis 3	KP-ZJ-011	○
9	Scale seal	For wrist three axes	OP-N2-20	○
10	Gas balancer unit Pressure gauge *1	Analog pressure gauge	KP-ZJ-013	○
		Digital pressure gauge	KP-ZJ-014	○
11	Gas balancer unit Charging equipment. *1, *2	Charging unit (W22,picth14,Female)	KP-ZJ-015	○
		Charging unit (W23,picth14,Male)	KP-ZJ-016	○
		Joint of Female->Male (W22)	KP-ZJ-019	○

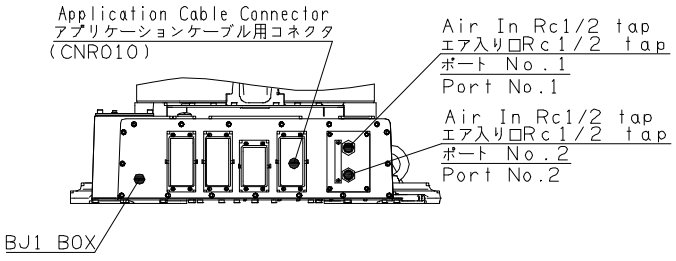
*1 : These parts are packed separately from the robot. (Not attached on the robot)
*2 : If diameter of charging equipment is “W22, pitch14, Female, Right screw, Metal contacts”, please prepare the charging equipment “KP-ZJ-015” and the joint “KP-ZJ-019”.

9. Application wiring and piping diagram

■ **Standard specification**



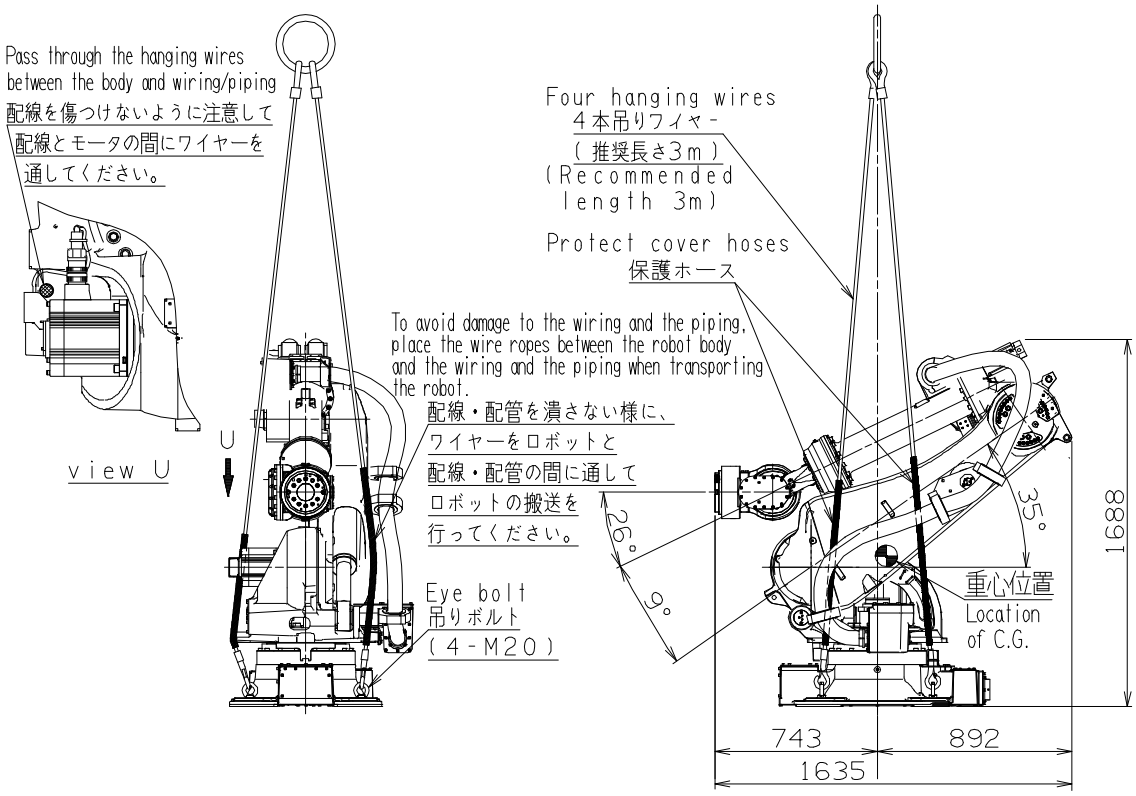


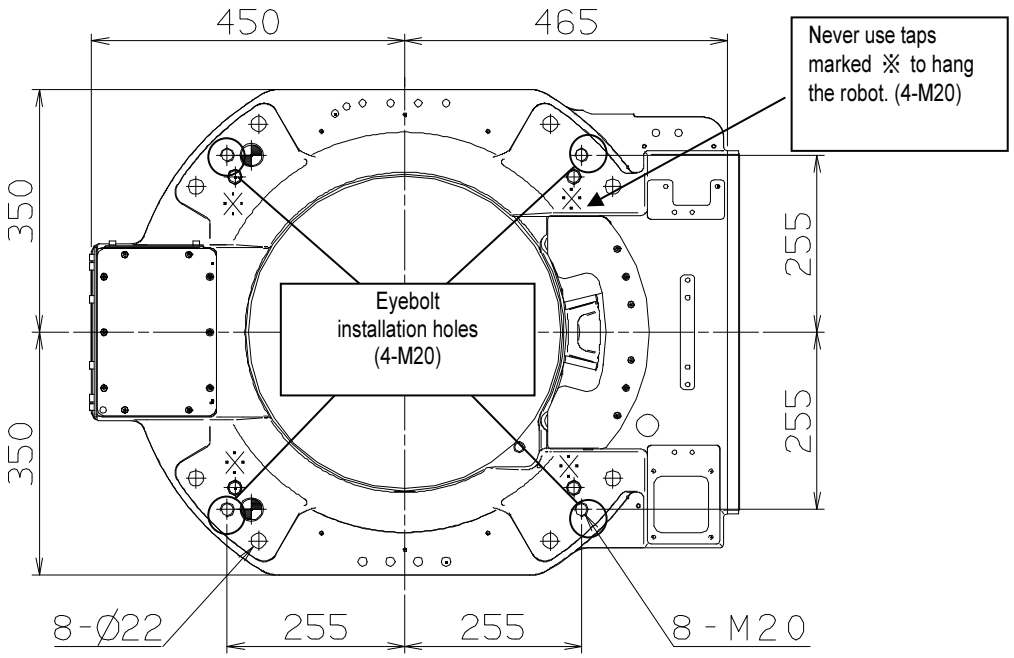


10. Transport procedure

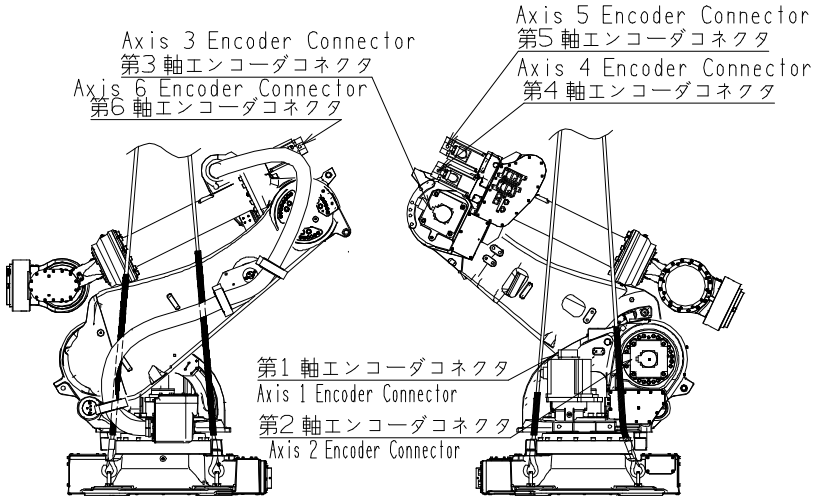
WARNING	The robot must be transported by personnel who have licenses required for slinging work, crane operation, forklift truck operation, and others. The weight of the robot and controller is listed in the Operating Manual and the Maintenance Manual. Check for the weight, and then handle them according 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.
CAUTION	Gas in balancer must be released when robot is transported by air. Gas in balancer must be charged before using robot, so customer needs to prepare the nitrogen gas and charging unit. Please contact to NACHI-FUJIKOSHI office to order the charging unit. Charging procedure is written in manipulator maintenance manual.

To transport the robot, make it a rule to use a crane.
At first, move the robot to the configuration shown in figure and mount four M20 hanger bolts to the robot frame. Then, be sure to lift the robot using four hanging wires (recommended length is 3.5m). Protect areas that contact the robot by rubber hoses to cover the wire ropes. For the areas to be covered, please refer to figure.





CAUTION	If hanging wires push the encoder connectors or wiring/piping, they may be broken when hanging the robot. When hanging the robot, please pay attention not to make the wires touch the encoder connectors and wiring/piping by referring to the following picture.



11. Delivery style (specification which contains a robot)

1. There are three styles as shown below.

	Style	Details
1	Delivery on the truck	Robot is delivered on the truck near the entrance of customer's plant. (Installation and test-run is not included)
2	Delivery after installation and test-run	Robot is installed and test-run is done. (Teaching with work piece is not included.)
3	Delivery after installation and teaching with work piece	After style 2, teaching with work piece is done.

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

Gas in balancer is not filled when robot is transported by air. Gas in balancer must be charged before using robot, so customer needs to prepare the nitrogen gas and charging unit. Please contact to NACHI-FUJIKOSHI office to order the charging unit. Charging procedure is written in manipulator maintenance manual.

2. Operation and maintenance education

The special spot operation guide and the special spot preservation guide are the outside of the estimation. Consult with each NACHI-FUJIKOSHI office for the details as for the schooling system.

12. Consuming power (Robot + Controller)

7.0 kVA at maximum (may vary according to the application and motion pattern.)

13. Paint color

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

14. Warranty

Elapse of 1 year after delivery. (8 hours/day running)

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

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株式会社 不二越

http://www.nachi-fujikoshi.co.jp/

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