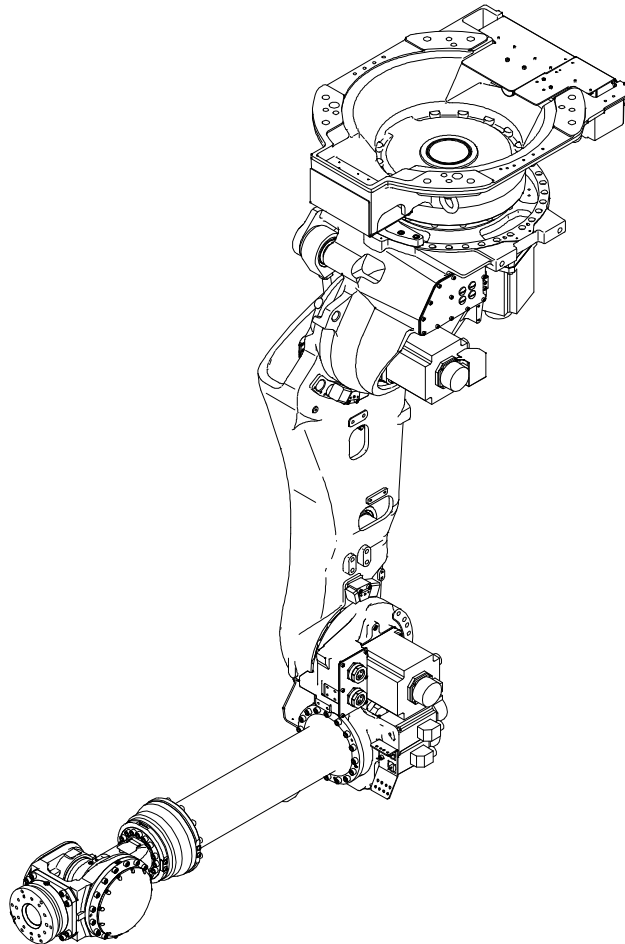




Standard specifications

SRA210V-01-FD11

1st edition



NACHI-FUJIKOSHI CORP.

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1. Outline

NACHI ROBOT "SRA210V", with its overwhelming speed of SRA series, is an inverted mounting robot to extend the flexibility of industrial robot.

Installation	Max. payload 210 kg
Inverted mount	SRA210V-01

■ Inverted mount

Inverted mounting enables to use floor space efficiently.

2. Basic specifications

Item		Specifications
Robot model		SRA210V-01
Construction		Articulated
Number of axis		6
Drive system		AC servo motor
Max. working envelope	Axis 1	± 2.88 rad ($\pm 165^\circ$)
	Axis 2	-1.40 ~ +1.05rad (-80 ~ +60°)
	Axis 3	-2.56 ~ +2.62rad (-146.5 ~ +150°)
	Axis 4	± 6.28 rad ($\pm 360^\circ$)
	Axis 5	± 2.27 rad ($\pm 130^\circ$)
	Axis 6	± 6.28 rad ($\pm 360^\circ$)
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	45kg (90kg 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		Inverted mount
Ambient conditions		Temperature: 0 to 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)
Noise *5		79.6 dB
Robot mass		990 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.
- Explosion-proof is not available.

*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.

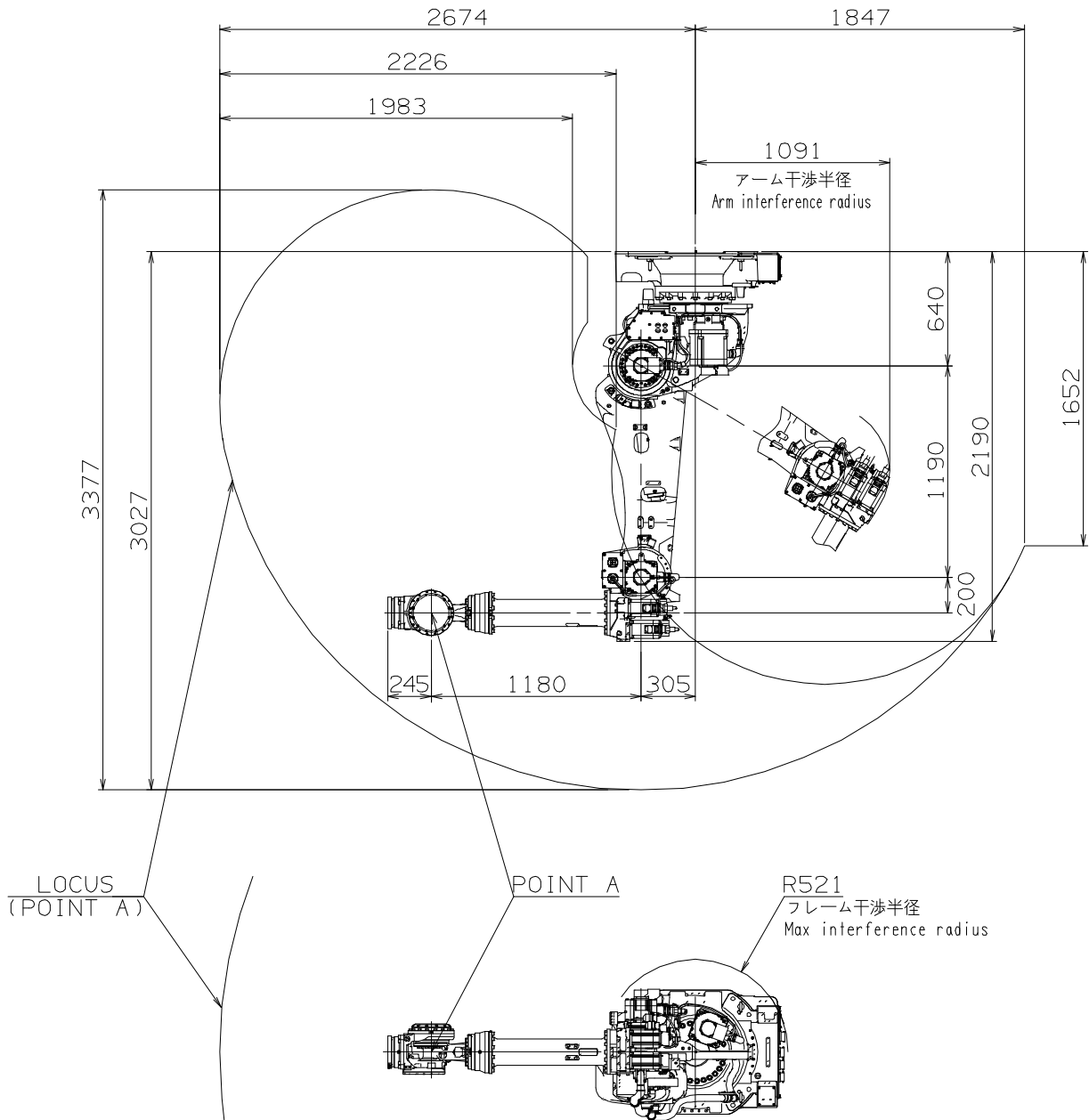
*3: This value conforms to "JIS B 8432".

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

*5: Robot noise is A-weighted equivalent sound level measured under "JIS Z 8737-1" (ISO 11201) with max. payload and max. speed.

3. Robot dimensions and working envelope



【SRA210V-01】

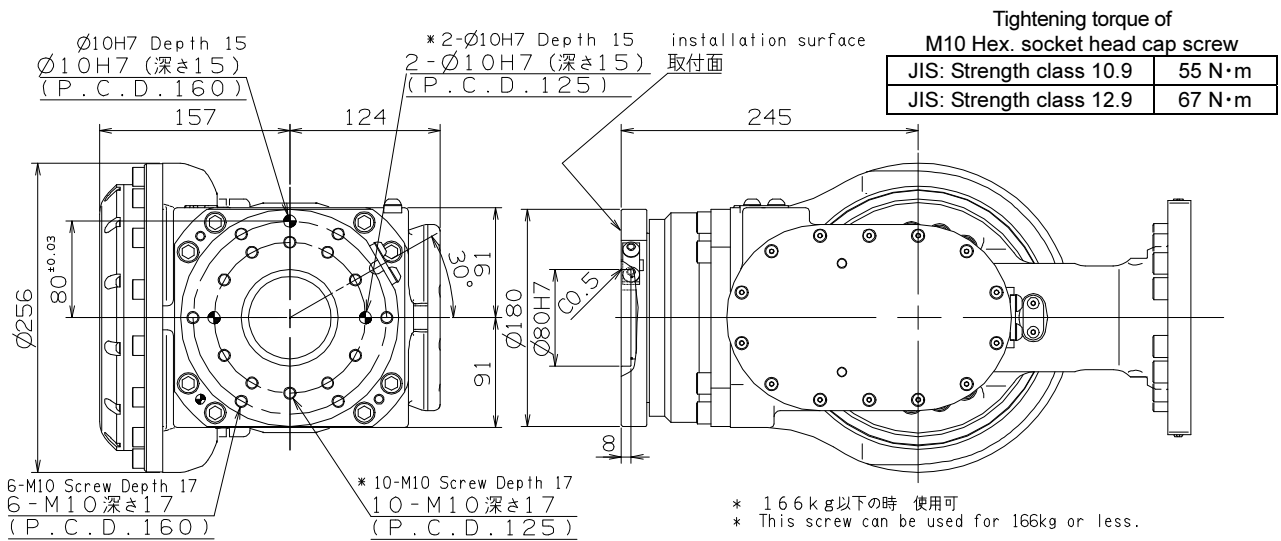


4. Detail of load mounting plate

■ Wrist

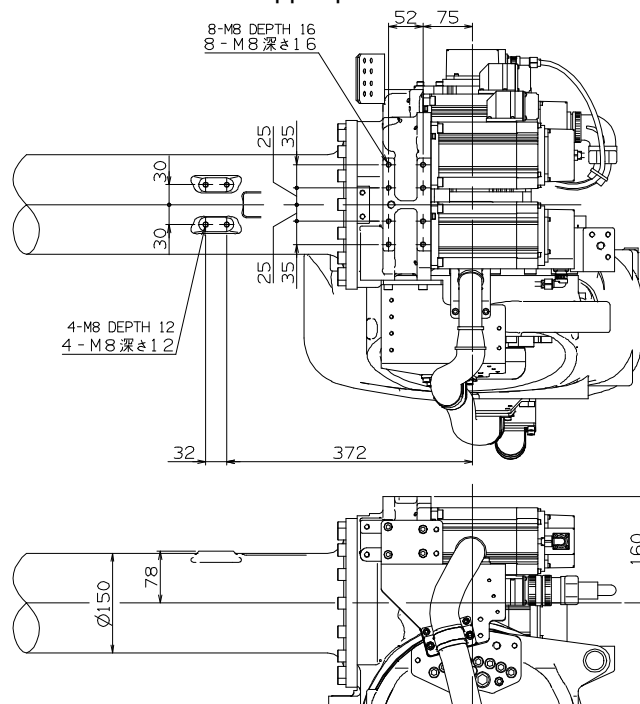
For the end effector fixing bolts, use the mounting P.C.D. shown in the following figures.
Another P.C.D. is prepared as option. Consult with each NACHI-FUJIKOSHI office for the details.

 CAUTION	Be sure to screw the M10 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.
 IMPORTANT	Be sure to use P.C.D.160 tap hole when tool weight is 166 kg or more.



■ Upper part of forearm

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




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.


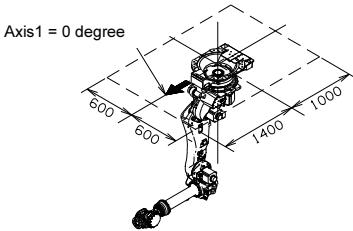
Installation

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

 <p>WARNING</p>	<p>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.</p>
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Space surrounding robot

 <p>IMPORTANT</p>	<p>When installing this robot, open space written in figure is necessary for maintenance work such as motor replacement, balancer replacement and other work.</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 not only the static loads but also the reaction force caused by robot movement.

Repair uneven spots, cracks, and others on the floor, and then install the robot under hanger. If hanger can not endure the generated force and floor concrete is not enough to endure the hanger, an independent foundation should be constructed. Inspect the foundation prior to the robot installation.




Robot Model	SRA210V-01
Thickness of floor concrete	(Do not install robot on floor)
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.

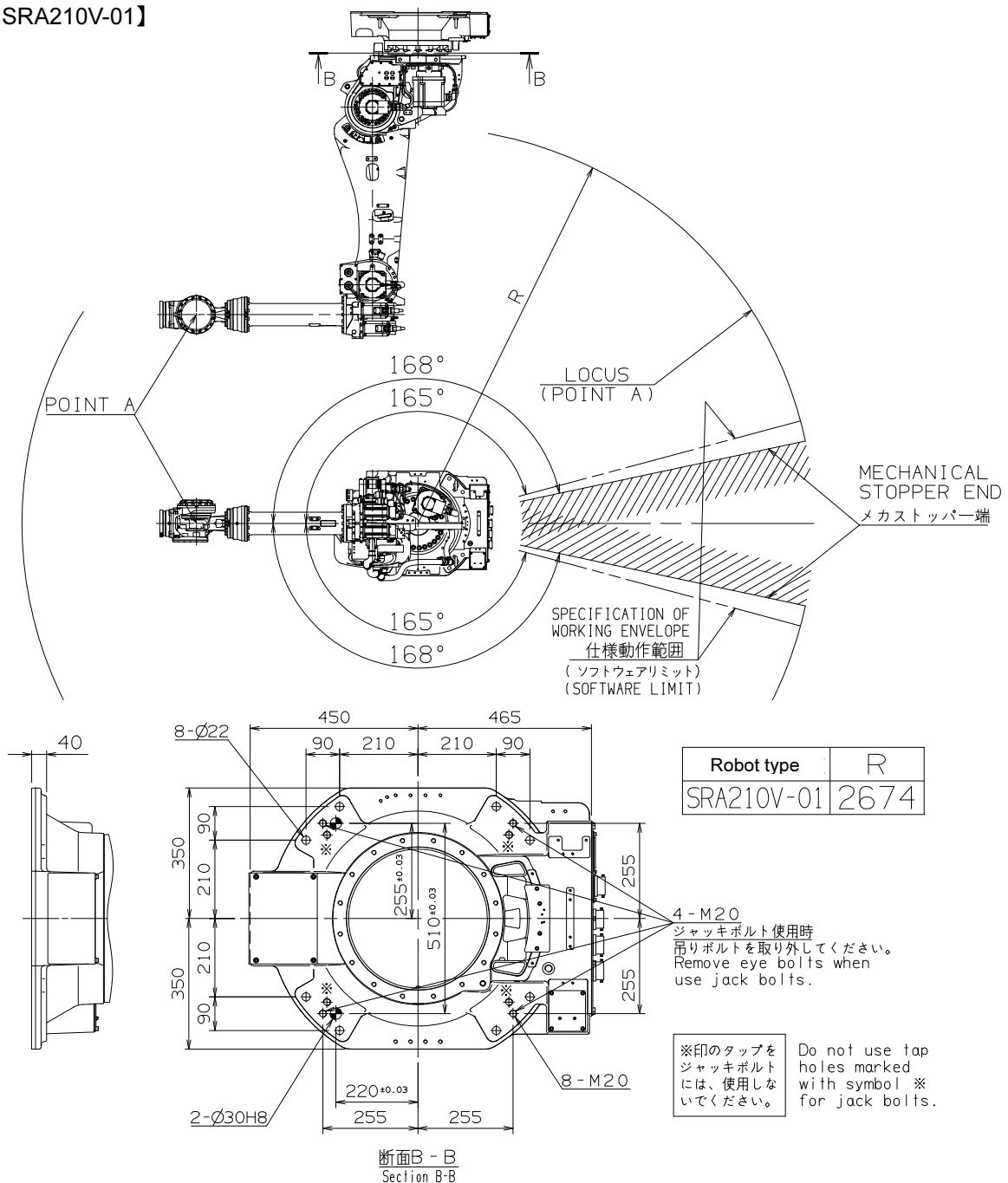
*2 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

■ 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 effector.
 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).
 WARNING	If mechanical stopper collides and robot stops, it's possible that some parts are already damaged, for example, mechanical stopper is transformed or fixing bolts are broken. In this case, sufficient intensity and function can not be kept. Mechanical stopper and reduction gear of collided joint are needed to be replaced to the new one.

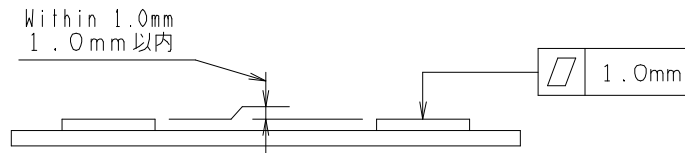
【SRA210V-01】



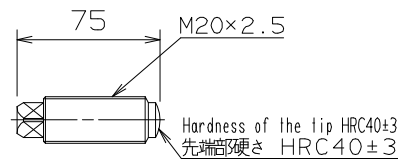
■ Accuracy of installation surface

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 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.

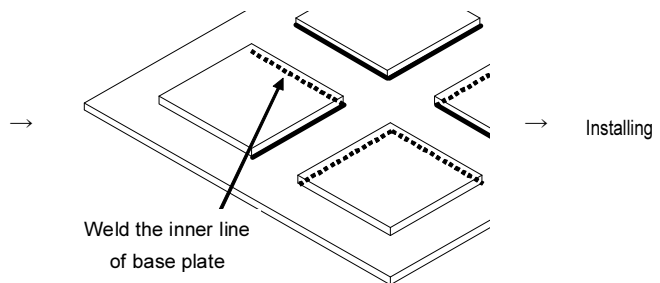
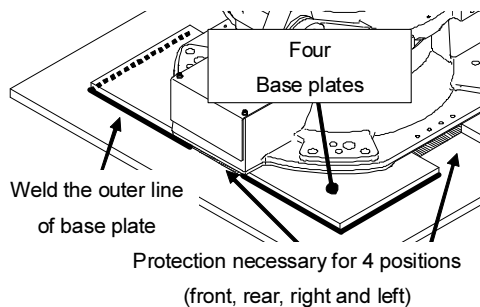


■ Welding of base plate

Protect the space (4 places of the front, back, left and right) on robot bottom and installed side by the cover etc. as follows when you weld with the base plate installed in the robot body by the welding spatter and the spark, etc. so that wiring in the robot should not receive damage. After welding the outer line, once remove the robot and weld the inner line.

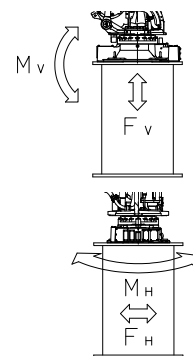
Temporary install the robot, and weld the outer line of base plate.

Once remove the robot and weld the inner line.



■ 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
SRA210V-01	52,800 N	40,500 N	113,200 N·m	98,300 N·m



6. Allowable wrist load

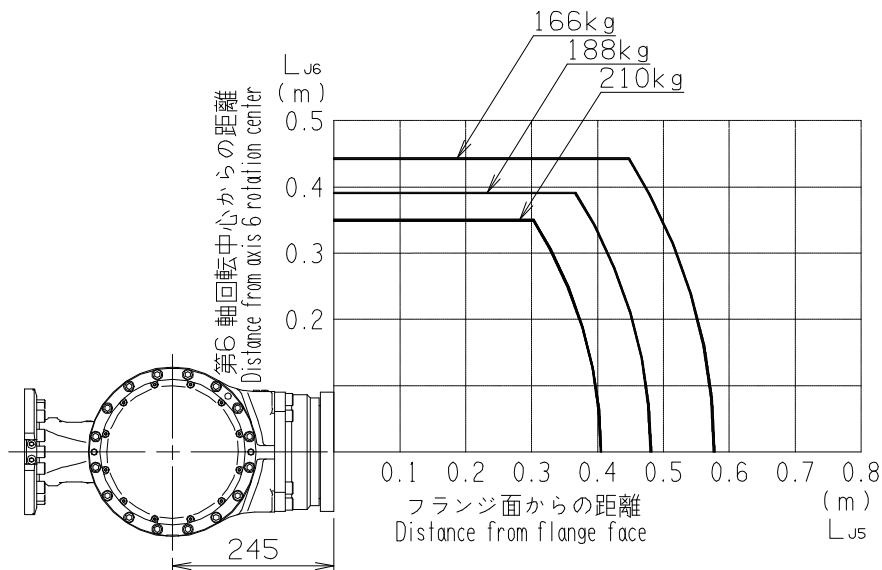


Load fixed on the tip of wrist is regulated by “allowable payload mass”, “allowable static load torque”, and “allowable moment of inertia”. Strictly keep the wrist load within each allowable value. If wrist load exceeds the allowable value, this robot is out of guarantee. Refer to the table of “2. Basic 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.

【SRA210V-01】



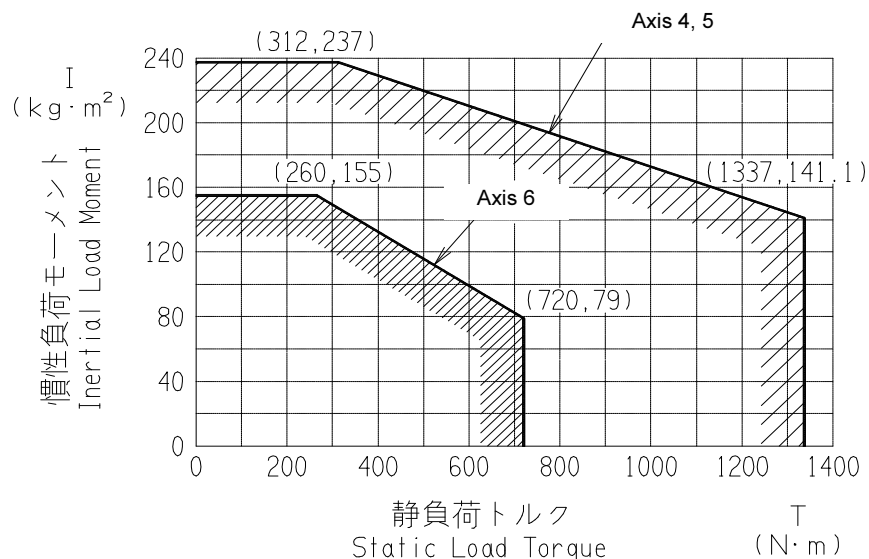
■ Wrist load conditions

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



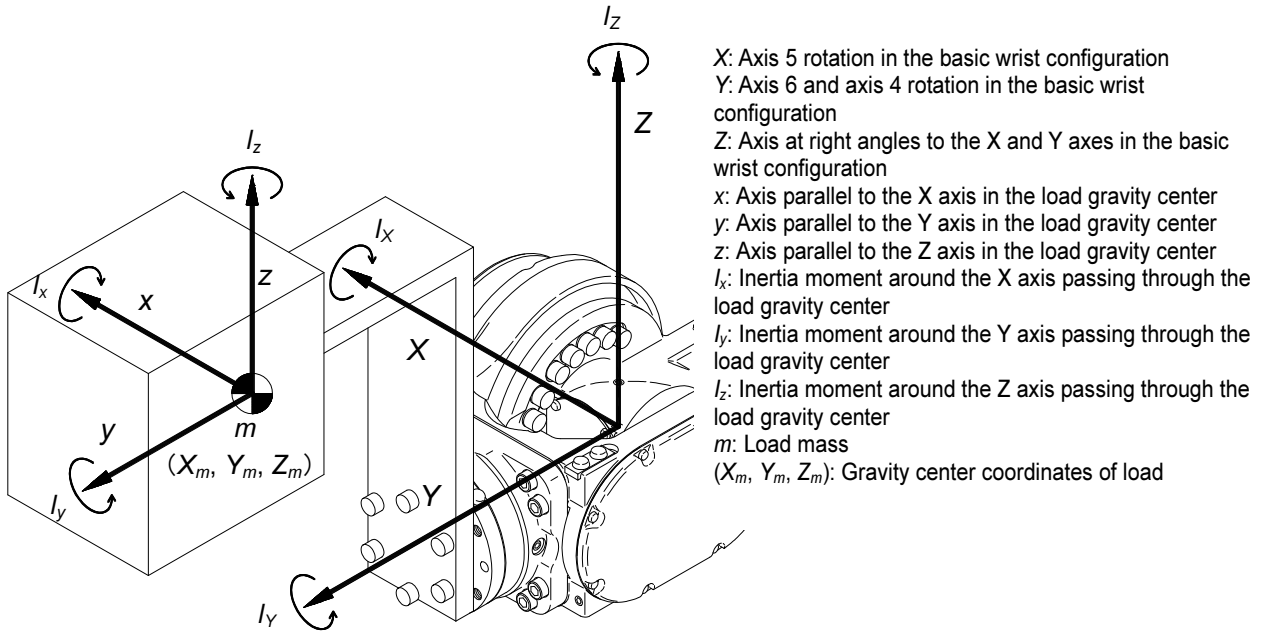
If the real inertia is over the limit written in “2. Basic specifications”, maximum speed will be restrained by software.

【SRA210V-01】



■ How to find the inertia moment of each axis

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



• Inertia moment around axis 6

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

• 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.)

$$I_{J4J5} = \max(I_x, I_z)$$

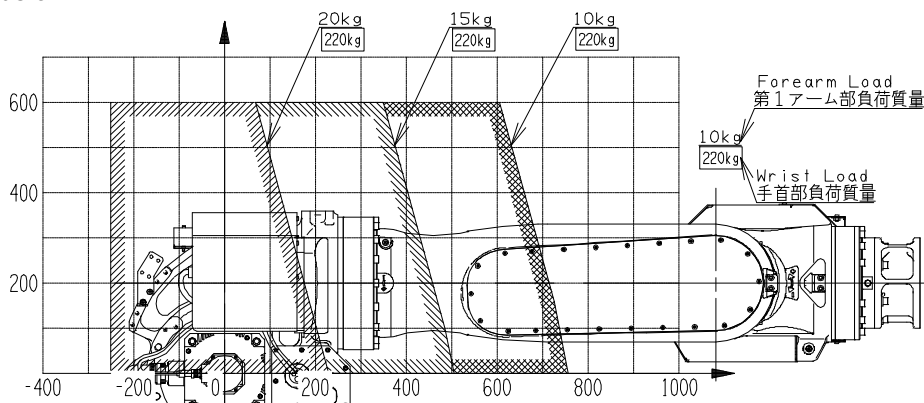
$$\therefore I_x = m \cdot (Y_m^2 + Z_m^2) + I_x$$

$$\therefore I_z = m \cdot (X_m^2 + Y_m^2) + I_z$$

■ Allowable forearm load

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

When wrist load is 210kg



7. Option specifications

○: Possible to correspond / —: Impossible to correspond

No.	Item	Specifications	Parts No.	Robot model	
				SRA210V-01	
1	Installation parts *1	Installation bolts & washers	OP-F1-027	○	
		Inverted mount Pins set (Installation pins)	OP-F5-003	○	
		Inverted mount Leveling plate (□250mm×t=32mm, 4 plates)	OP-F5-002	○	
		Inverted mount Protection block from falling down *5	OP-F5-004	○	
2	Axis 1 adjustable stopper *1, *2, *3	Restriction of axis 1 operation edge (±2.35rad~±0 rad every 0.017 rad)	OP-S5-020	○	
3	Axis 2 adjustable stopper *1, *3	Restriction of axis 2 operation edge (-0.26 and -0.52 rad from the operation edge)	OP-A5-027	○	
4	Axis 3 adjustable stopper *1, *3	Restriction of axis 3 operation edge upper limit (-0.52rad, -0.79rad, -1.05rad, -1.31rad, -1.57rad from the operation edge)	OP-A6-023	○	
5	Axis 2 adjustable LS *1, *3	Dog set for axis 2 adjustable LS	OP-S8-007	○	
6	Axis 3 adjustable LS *1, *3	Dog set for axis 3 adjustable LS	OP-S4-009	○	
7	Dual circuit limit switch	For axes 1, 2 and 3 (3pcs. of dual circuit LS)	OP-D7-010	○	
8	Big capacity application box	Big capacity BJ3 junction box	OP-E5-003	○	
9	Transfer jig	Folk bracket	OP-S2-033	○	
		Inverted mount Turning over fixture	OP-S7-009	○	
		Inverted mount Axis 2 fixing jig *6	OP-S9-008	○	
10	Zeroing pin & Zeroing block *1	For 210-240 kg payload type	OP-T2-054	○	
11	Flange adapter	For 210-240 kg payload type (P.C.D.92, 125)	OP-W3-006	○	
12	Wrist axis positioning marking	For 210-240 kg payload type	OP-N3-007	○	
13	Encoder connector Protector	For axis 3	OP-P6-005	○	
14	Bypass cable *1	Motor and encoder cable bypass	BCUNIT20-30	○	
15	Arm fixed jig *1	For axis 2	KP-ZD-005	○	
		For axis 3	KP-ZJ-011	○	
16	Scale seal	For wrist three axes	OP-N2-020	○	
17	Gas balancer unit Pressure gauge *1	Analog pressure gauge	KP-ZJ-013	○	
		Digital pressure gauge	KP-ZJ-014	○	
18	Gas balancer unit Charging equipment *1 *4	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 : A dog part for adjustable LS is included. If motion limit LS is not used, this dog is also not used.

*3 : Concerning the motion range limit options, please refer to the table in the next page.

*4: 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".

*5: Inverted mount protection block must be ordered with leveling plate OP-F5-002 together.

*6: This is used to fix axis 2 in order to transfer robot safely.

If there is height limit in customer's plant, this jig can make robot posture lower by changing axis 2 angle not to +134°.

■ Motion range limit option table (Please select the option part number to order referring to the following table.)

Function		Axis name	Motion range Limit Switch (dual circuit) 3pcs. set	Axis 1 adjustable stopper (including dog part for adjustable LS)	Axis 2 Adjustable LS dog part set	Axis 3 Adjustable LS dog part set	Axis 2 Adjustable stopper	Axis 3 Adjustable stopper	
			OP-D7-010	OP-S5-020 ^{*1}	OP-S8-007 ^{*1}	OP-S4-009 ^{*1}	OP-A5-027 ^{*1}	OP-A6-023 ^{*1}	
Without LS	Only adjustable stopper	Axis 1	—	● ^{*2}					
		Axis 2	—			●			
		Axis 3	—					●	
Dual circuit Limit Switch	Motion range Limit Switch	Axis 1·2·3 (3 pcs.set)	●						
	Adjustable LS	Axis 2			●				
		Axis 3					●		
	Adjustable stopper and Adjustable LS	Axis 1			●				
		Axis 2				●		●	
		Axis 3					●		●

*1 : These parts are packed separately from the robot. (Not attached on the robot)

*2 : Both axis 1 adjustable stopper and axis 1 adjustable LS dog part are supplied in 1 package.

(Please be sure that even if only the stopper part is used and no LS is used, the dog part is also included in this package)

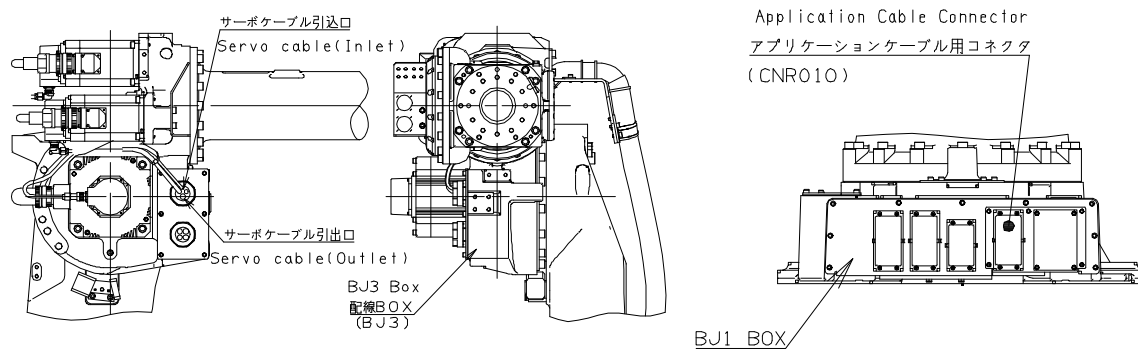
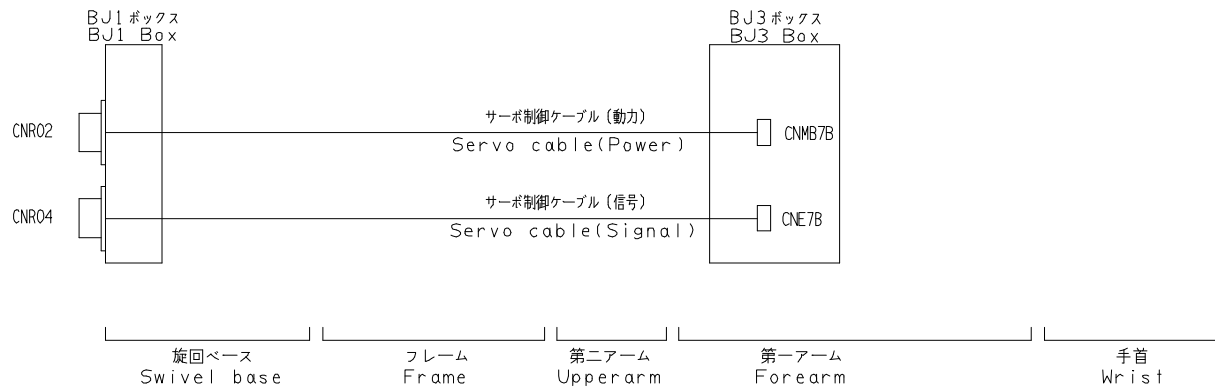
(Example 1) To add only an adjustable stopper for axis 2, please order;
OP-A5-027.

(Example 2) To add dual circuit adjustable limit switch for axis 2 and 3, please order the following options.
OP-D7-010、OP-S8-007、OP-S4-009

(To use the limit switch for axis 1 as an adjustable limit switch, OP-S5-020 is also necessary.)

8. Application wiring and piping diagram

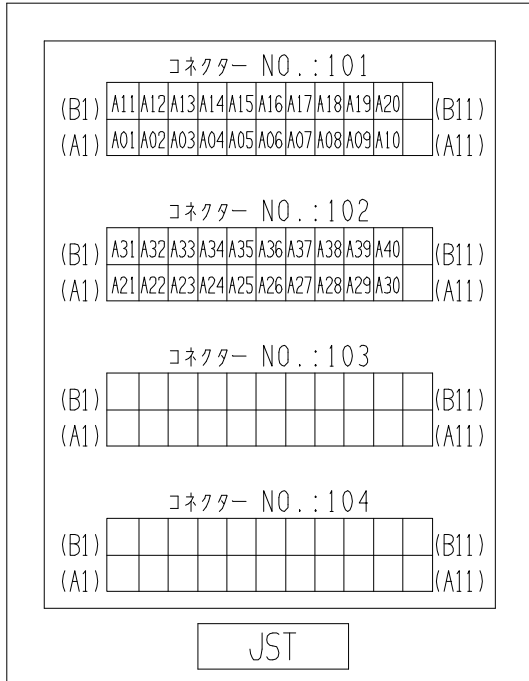
■ Standard specification



※In wiring BOX (BJ3 BOX), there is an “application connector of BJ3 side”.

■ Detailed diagram of the application connectors (option)

(1) BJ1 side (connector)



User-side Connectors

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 ~ 0.50sq)

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

Manual crimp tool:

a: YRS-8861

b: YRF-1120

Cable diameter suitable for wire-side shell:

JFM-WSA-4-A $\phi 26.2 \sim \phi 28.0$

JFM-WSA-4-C $\phi 15.5 \sim \phi 16.5$

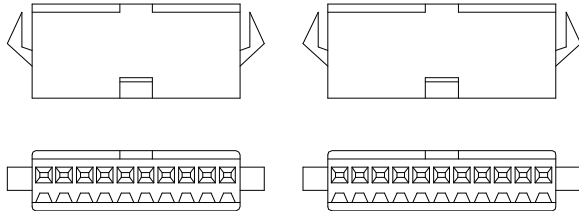
(Pin location shows the connector mounted on robot body and is the view from connecting side.)

Application wiring specification

Rated voltage Max. AC/DC 115 V

Rated current rating Max. 1 A

(2) 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

CN63

1	2	3	4	5	6	7	8	9	10
A21	A22	A23	A24	A25	A26	A27	A28	A29	A30

CN64

1	2	3	4	5	6	7	8	9	10	11
A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	ECE

Connector form (CN61, CN63)

Housing SMP-10V-BC (JST)

User-side Connectors

Housing SMR-10V-B (JST)

Contact SYM-001T-P0.6 (Wire of Application : AWG#22~28)

Pressure tool YRS-121

Connector form (CN62, CN64)

Housing SMP-11V-BC (JST)





User-side Connectors

Housing SMR-11V-B (JST)

Contact SYM-001T-P0.6 (Wire of Application : AWG#22~28)

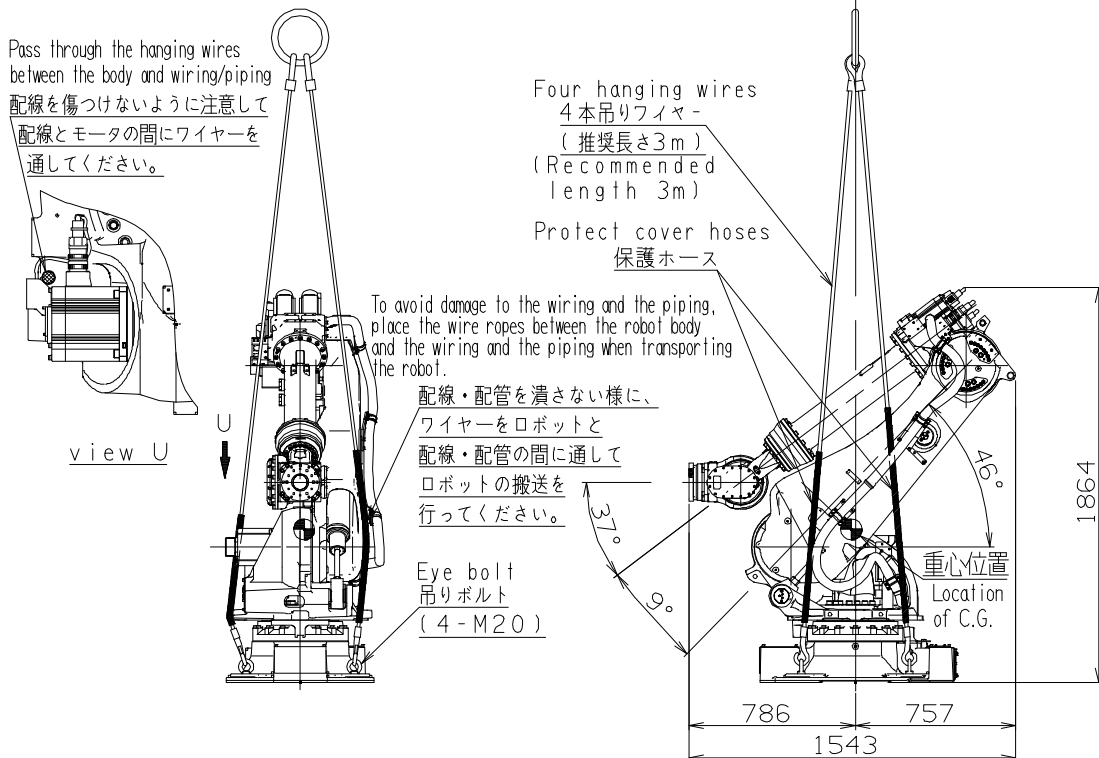
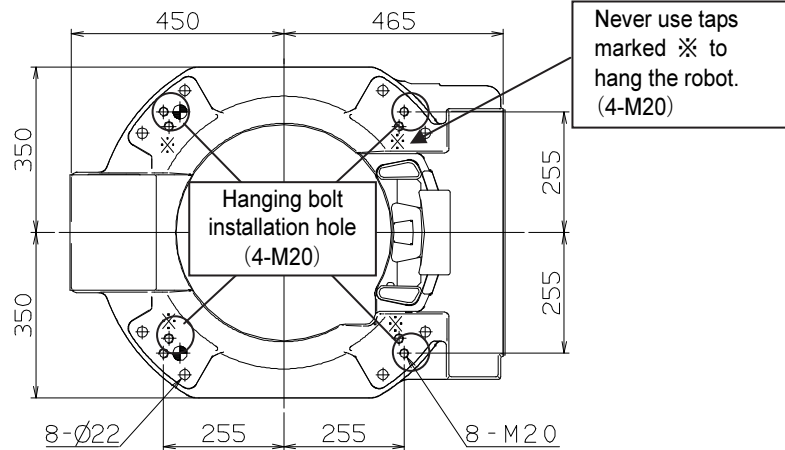
Pressure tool YRS-121

9. Safety measures against transport

 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.
 WARNING	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. Charging procedure is written in manipulator maintenance manual. (👉 Refer to "7. Option specifications")

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 M16 hanger bolts to the robot frame. Then, be sure to lift the robot using four hanging wires (recommended length is 3m). Protect areas that contact the robot by rubber hoses to cover the wire ropes. For the areas to be covered, please refer to figure.

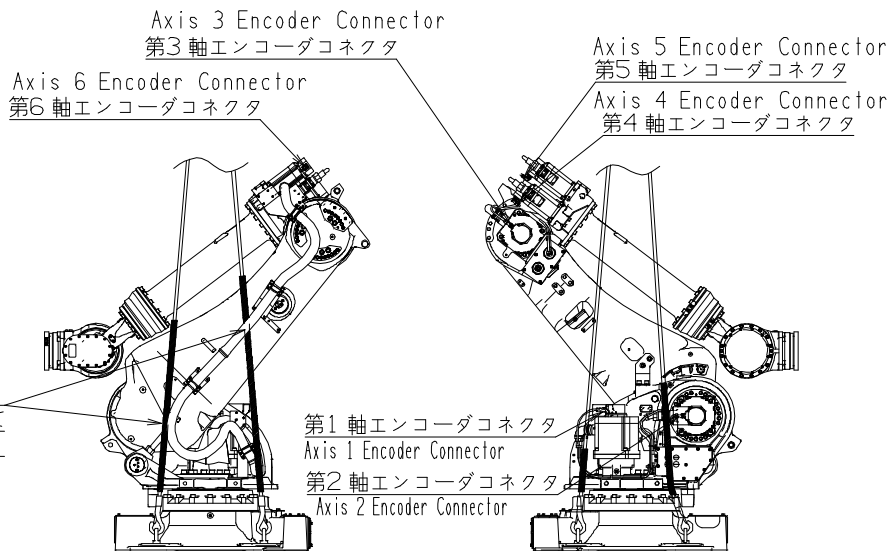




If hanging wires push the encoder connectors or wiring/piping, they may be broken when hanging the robot. When hanging the robot, please pay attention not to make the wires touch the encoder connectors and wiring/piping.

To avoid damage to the wiring and the piping, place the wire ropes between the robot body and the wiring and the piping when transporting the robot.

配線・配管を潰さない様に、ワイヤーをロボットと配線・配管の間に通してロボットの搬送を行ってください。



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Training Office	Phone: 248-334-8250	Fax: 248-334-8270	22213 Roethel Drive, Novi, Michigan 48375 U.S.A.
Greenville Service Office	Use 248-305-6545	Use 248-305-6542	South Carolina, U.S.A.
San Antonio Service Office	Use 248-305-6545	Use 248-305-6542	Texas, U.S.A.
Kentucky Branch Office	Phone: 502-695-4816	Fax: 502-695-4818	116 Collision Center Drive, Suite A, Frankfort, KY 40601 U.S.A
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Original manual is written in Japanese.

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