

**Kawasaki Robot
KJ Series**

**Installation and
Connection Manual**

(E Controller)

Robot

Kawasaki Heavy Industries, Ltd.

PREFACE

This manual describes the installation and connection of Kawasaki Painting Robot KJ series.

Read and understand the contents of this and safety manuals thoroughly and strictly observe all rules for safety before proceeding with any operation.

This manual describes only the installation and connection of KJ series robot arm. For installation and connection of the controller and cables, see the separate manual “Installation and Connection Manual” for the controller for explosion-proof robot.

Kawasaki will not take any responsibility for any accidents and/or damages caused by operations that are based on only a limited reading of this manual.

This manual is applicable to the following KJ series robot models.

KJ314	: model with left-hand rear arm	“KJ314■-D0” “KJ314■-D4”
	: model with right-hand rear arm	“KJ314■-D1” “KJ314■-D5”
KJ264 (Floor mounted spec.)	: model with left-hand rear arm	“KJ264■-B0” “KJ264■-B4”
	: model with right-hand rear arm	“KJ264■-B1” “KJ264■-B5”
KJ264 (Wall mounted (left) spec.)	: model with left-hand rear arm	“KJ264■-D0” “KJ264■-D4”
	: model with right-hand rear arm	“KJ264■-D1” “KJ264■-D5”
KJ264 (Wall mounted (right) spec.)	: model with left-hand rear arm	“KJ264■-F0” “KJ264■-F4”
	: model with right-hand rear arm	“KJ264■-F1” “KJ264■-F5”
KJ264 (Shelf mounted spec.)	: model with left-hand rear arm	“KJ264■-H0” “KJ264■-H4”
	: model with right-hand rear arm	“KJ264■-H1” “KJ264■-H5”


(■: J=Japan explosion-proof C=China explosion-proof
U=North America explosion-proof E=Europe explosion-proof)
Refer to the standard specifications for robot's shape.

1. This manual does not constitute a guarantee of the systems in which the robot is utilized. Accordingly, Kawasaki is not responsible for any accidents, damages, and/or problems relating to industrial property rights as a result of using the system.
2. It is recommended that all personnel assigned for activation of operation, teaching, maintenance or inspection of the robot attend the necessary education/training course(s) prepared by Kawasaki, before assuming their responsibilities.
3. Kawasaki reserves the right to change, revise, or update this manual without prior notice.
4. This manual may not, in whole or in part, be reprinted or copied without the prior written consent of Kawasaki.
5. Store this manual with care and keep it available for use at any time. If the robot is reinstalled or moved to a different site or sold off to a different user, attach this manual to the robot without fail. In the event the manual is lost or damaged severely, contact Kawasaki.


SYMBOLS

The items that require special attention in this manual are designated with the following symbols.


Ensure proper and safe operation of the robot and prevent physical injury or property damage by complying with the safety matters given in the boxes with these symbols.

 **DANGER**

Failure to comply with indicated matters can result in imminent injury or death.

 **WARNING**


Failure to comply with indicated matters may possibly lead to injury or death.

 **CAUTION**

Failure to comply with indicated matters may lead to physical injury and/or mechanical damage.

[NOTE]

Denotes precautions regarding robot specification, handling, teaching, operation, and maintenance.

 **WARNING**

- 1. The accuracy and effectiveness of the diagrams, procedures, and detail explanations given in this manual cannot be confirmed with absolute certainty. Accordingly, it is necessary to give one's fullest attention when using this manual to perform any work.**
- 2. Safety related contents described in this manual apply to each individual work and not to all robot work. In order to perform every work in safety, read and fully understand the safety manual, all pertinent laws, regulations and related materials as well as all the safety explanations described in each chapter, and prepare safety measures suitable for actual work.**

CONTENTS

Preface	1
Symbols	2
1.0 Precautions	4
1.1 Precautions during Transportation and Storage	4
1.2 Installing Environments of Robot Arm	5
1.3 Cautionary Instructions for Explosion-Proof	6
1.4 Warning Label	8
2.0 Motion Range & Specifications of Robot	13
3.0 Work Flow at Arm Installation and Connection	23
4.0 Robot Transportation Method	24
4.1 Using Wire Sling	24
5.0 Installation Dimensions of Base Section	29
6.0 Installation Space	32
7.0 Installation Method	35
8.0 Mounting of Tools	40
9.0 Connection of Air System	44
9.1 Adjustment Method of Regulator	45
9.2 For Japan/China/North America Explosion-Proof Specifications	48
9.3 For Europe Explosion-Proof Specification	52
9.4 Parameters of Purge Control Unit	55

1.0 PRECAUTIONS

This chapter only describes safety precautions during installation and connection of the robot arm. For all other safety matters, refer to the “Safety Manual”, a separate-volume.

1.1 PRECAUTIONS DURING TRANSPORTATION AND STORAGE

When transporting the Kawasaki Robot to its installation site, strictly observe the following cautions.



WARNING

1. When the robot arm is to be transported by using a crane or forklift, never support the robot arm manually.
2. During transportation, never climb on the robot arm or stay under the hoisted robot arm.



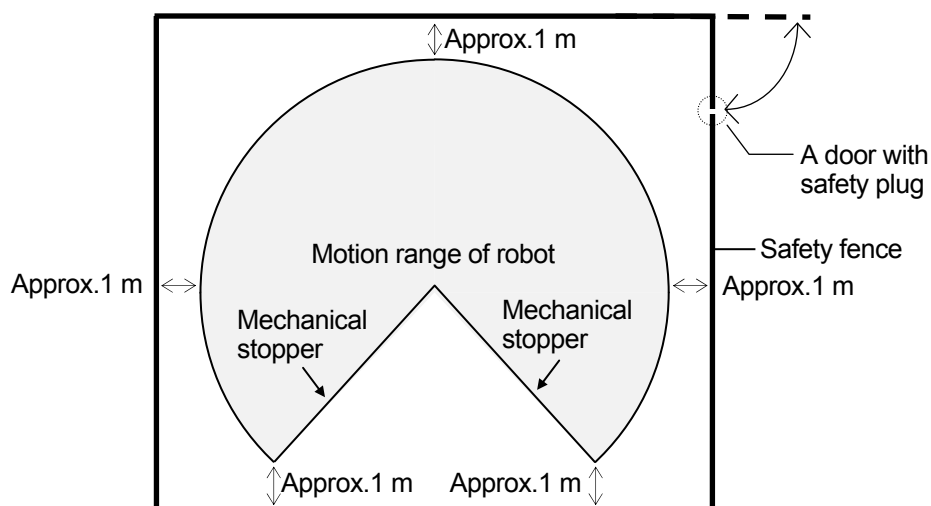
CAUTION

1. Since the robot arm is composed of precision parts, be careful not to apply excessive shocks during transportation.
2. When transporting the robot arm using a crane or forklift, remove all obstacles prior to installation and clear a passage to the installation area so the installation is carried out smoothly and safely.
3. During transportation and storage,
 - (1) Keep the ambient temperature within the range of minus 10 to 60 °C,
 - (2) Keep the relative humidity within the range of 35 to 85 % RH without dew condensation,
 - (3) Keep free from excessively strong vibration and shock.

1.2 INSTALLING ENVIRONMENTS OF ROBOT ARM

The robot arm must be installed in a place that satisfies all the following environmental conditions:

1. When robot is installed on the floor, the levelness must be within $\pm 5^\circ$.
2. Be sure that the installation floor/pedestal has sufficient rigidity.
3. Secure a flatness to prevent undue force applied to the installation section. (If sufficient flatness is unobtainable, insert liners and adjust the flatness within 0.3 mm of the surface.)
4. Keep the ambient temperature during operation within the range of 0 - 40 °C. (Deviation or overload error may occur due to high viscosity of grease/oil when starting operation at low temperatures. In this case, warm-up robot at low speed before regular operation.)
5. Keep the relative humidity during operation within the range of 35-85 %RH without dew condensation.
6. The robot installing place should be free from dust, dirt, smoke, water, and other foreign matters.
7. The robot installing place should be free from excessively strong vibration.
8. The robot installing place should be free from electric noise interference.
9. The robot installing place should be sufficiently larger than the motion range of robot arm.
 - (1) Set up a safety fence around the robot providing adequate space for the robot's maximum motion range and without causing any interference to the tools on the robot arm.
 - (2) Provide an entrance door with a safety plug for the safety fence.
 - (3) Follow national/local standards regarding safety fence construction/function.
(e.g. EN953, EN294, EN811, EN1088, ISO13852, ISO13854, ISO/NP14120)



[NOTE]

Protect sealed joints, etc. on the robot arm axes with vinyl sheets, etc. to prevent paint mist/foreign materials from entering.

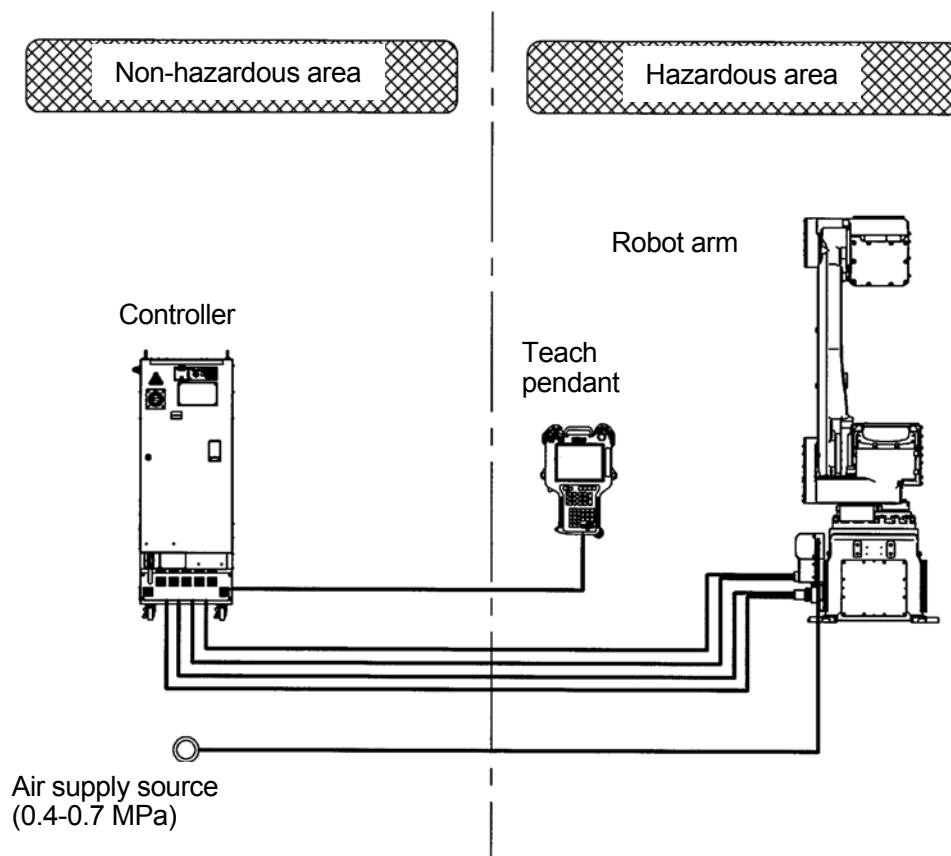
1.3 CAUTIONARY INSTRUCTIONS FOR EXPLOSION-PROOF

KJ series are explosion-proof specified robots protected by pressurized and intrinsically safe structures. Strictly observe the following instructions for safe operation.



DANGER

1. **This painting robot has pressurized enclosures for explosion-proof specifications. Before loosening the bolts from any pressurized enclosure, always follow instructions from the person in charge.**
 - (1) **Do not loosen tightening bolts of pressurized enclosures without instructions from the person in charge.**
 - (2) **Do not open the cover of a pressurized enclosure while electricity is supplied to robot.**
2. **Install controller in a non-hazardous area where there is no possibility of explosion. Before accessing the robot for maintenance and inspection of the robot, or for making adjustments to painting system, always turn OFF controller power switch and external power switch, close the air supply valve and confirm there is no residual pressure.**

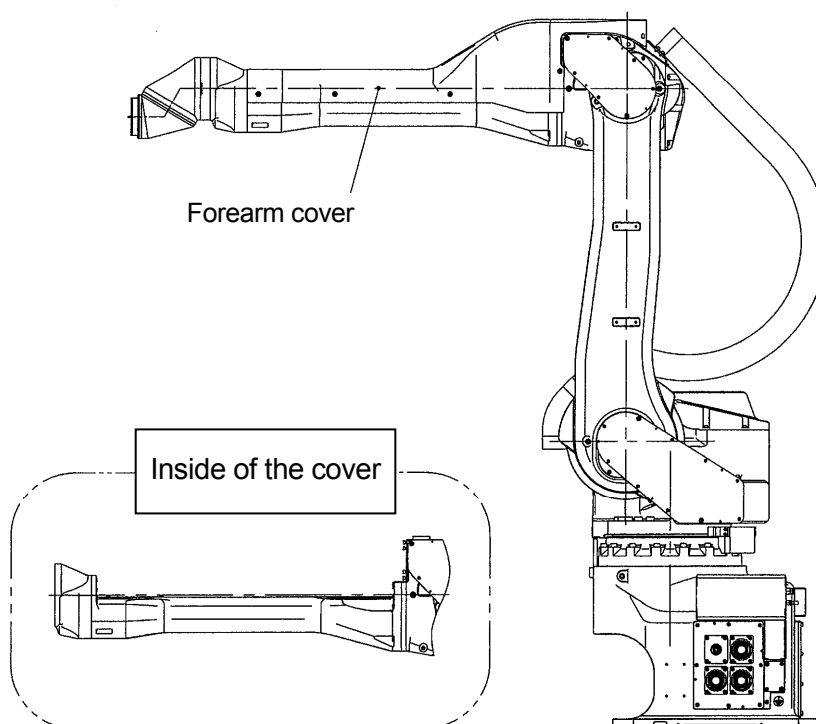


The forearm cover for KJ series robot is made of FRP, and the flexible tube for protecting paint piping/wiring is made of polyamide plastic. For safety, pay attention to the followings when working in a hazardous area where there is possibility of explosion.



WARNING

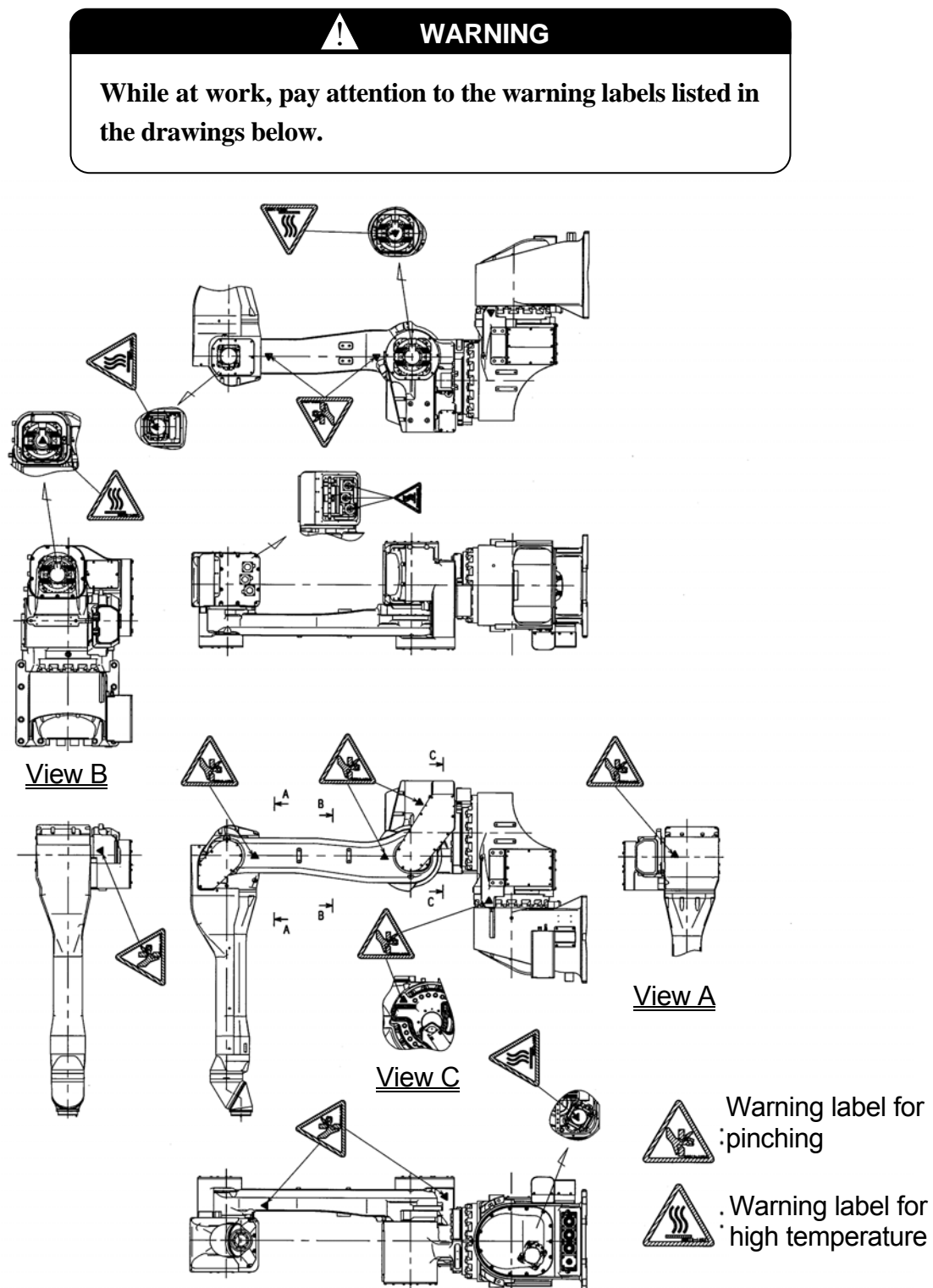
1. If static electricity is charged in plastic part, it may spark and cause ignition. Conduct working after discharging static electricity using neutralizing apparatus, etc.
2. During maintenance/inspection, use only anti-static tools to prevent electrification of robot parts.



1.4 WARNING LABEL

KJ314

(The shape and residual risk places of models with right-hand and left hand rear arms are in mirror symmetry.)



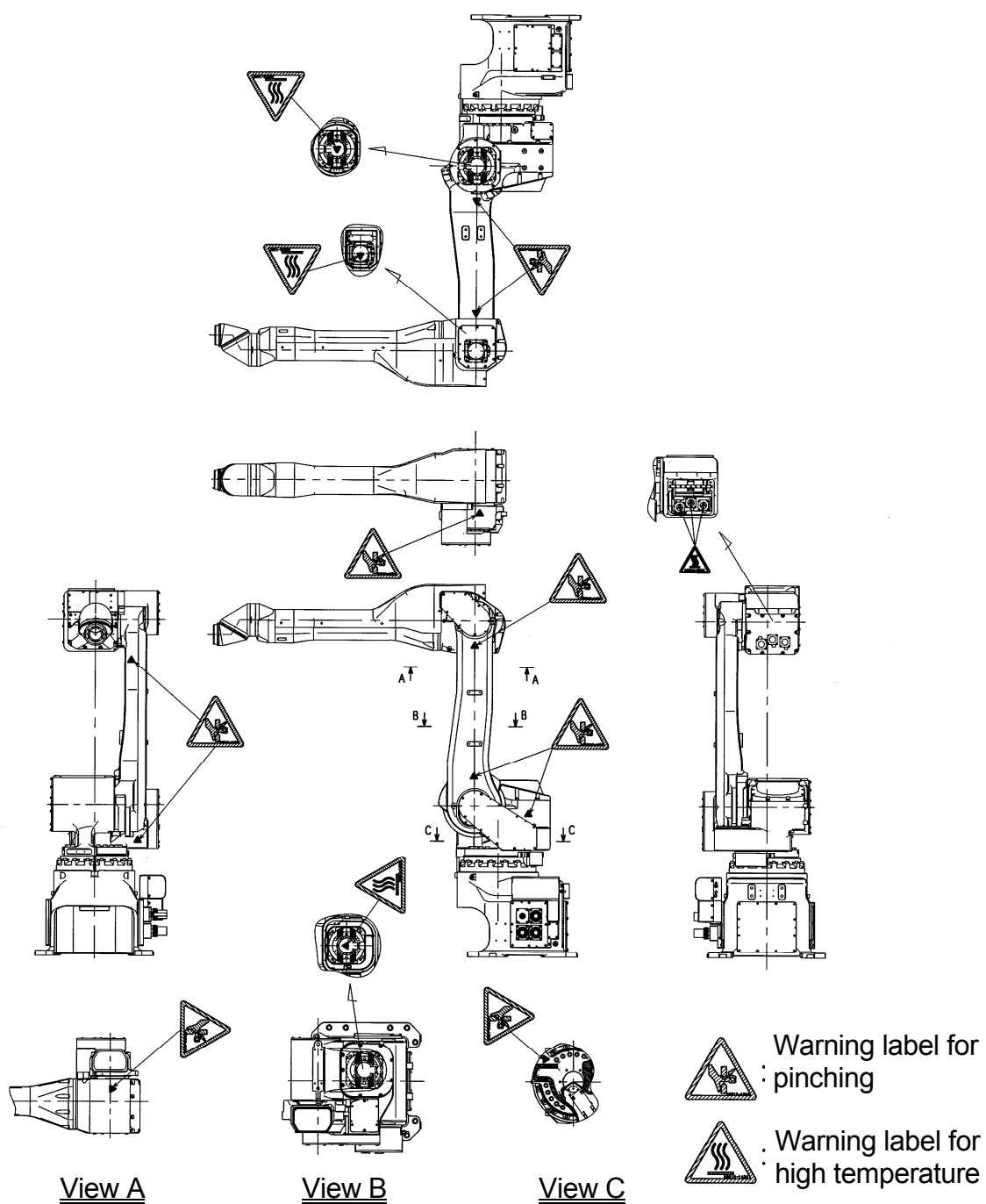
KJ264 (Floor mounted spec.)

(The shape and residual risk places of models with right-hand and left hand rear arms are in mirror symmetry.)



WARNING

While at work, pay attention to the warning labels listed in the drawings below.



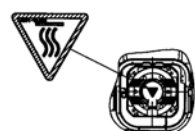
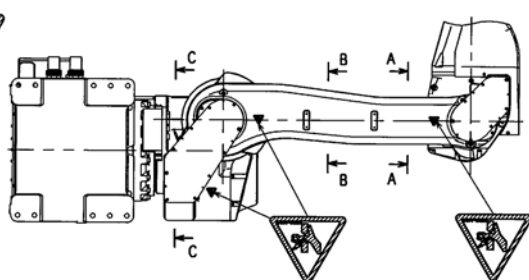
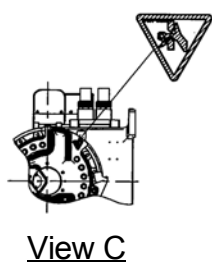
KJ264 (Wall mounted (left) spec.)

(The shape and residual risk places of models with right-hand and left hand rear arms are in mirror symmetry.)

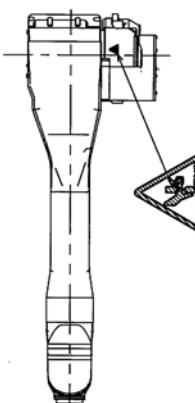
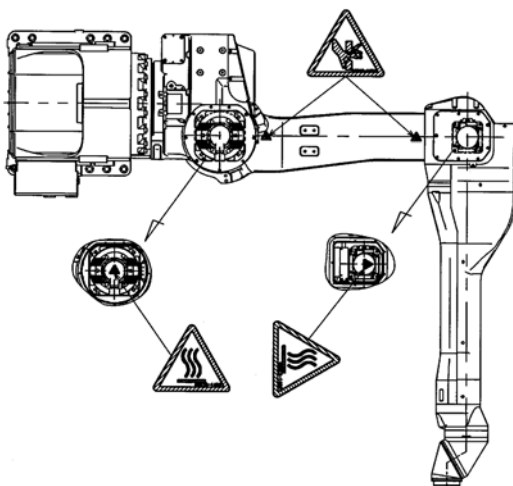
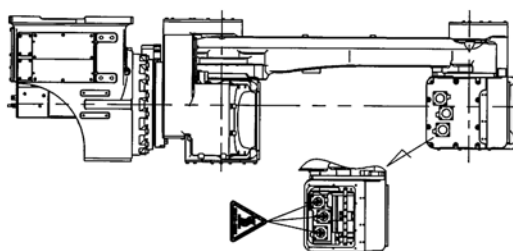
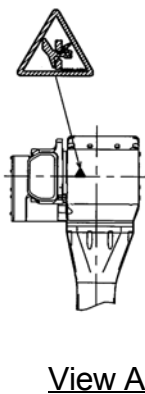


WARNING

While at work, pay attention to the warning labels listed in the drawings below.



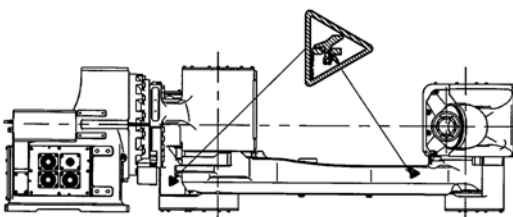
View B



: Warning label for pinching

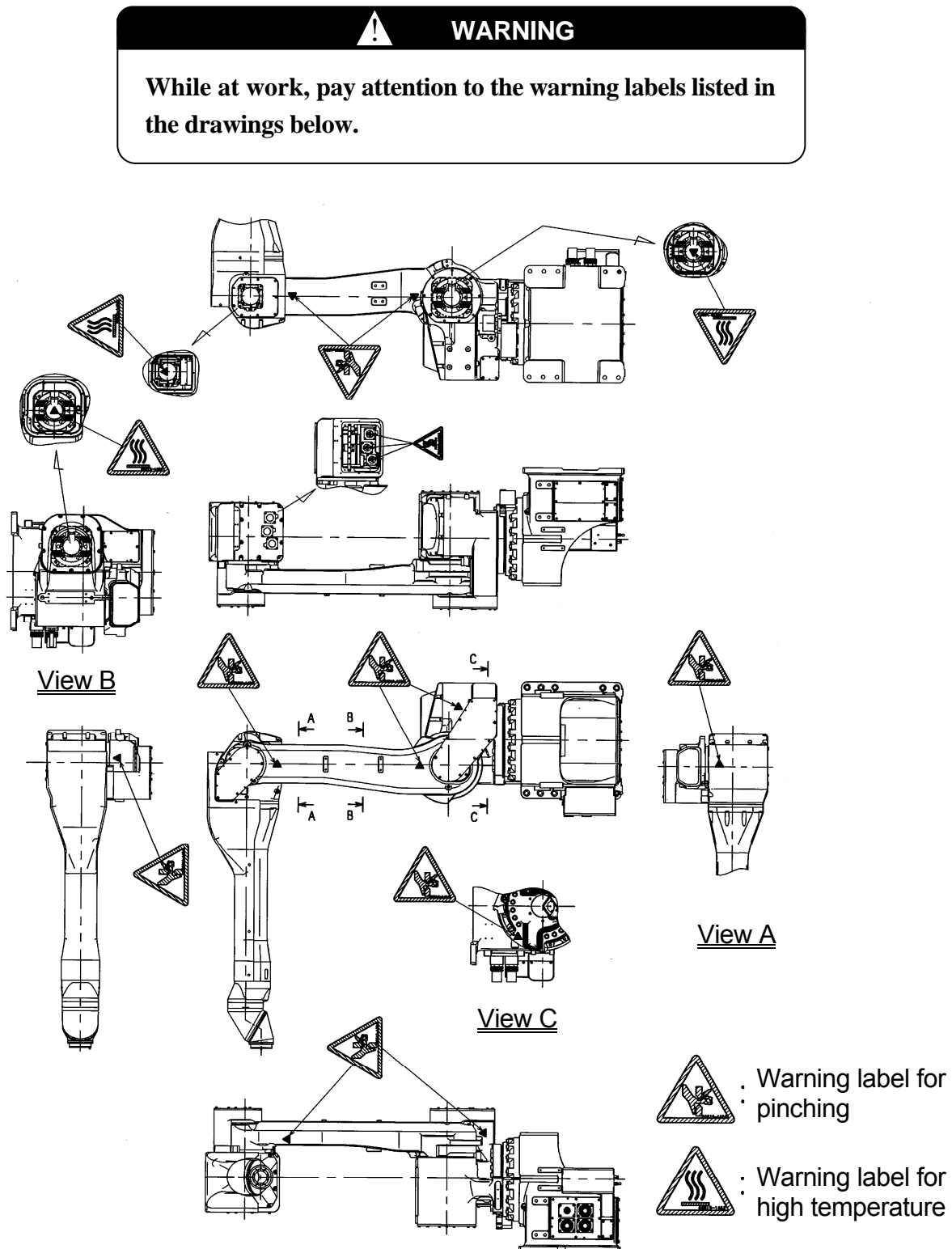


: Warning label for high temperature



KJ264 (Wall mounted (right) spec.)

(The shape and residual risk places of models with right-hand and left hand rear arms are in mirror symmetry.)



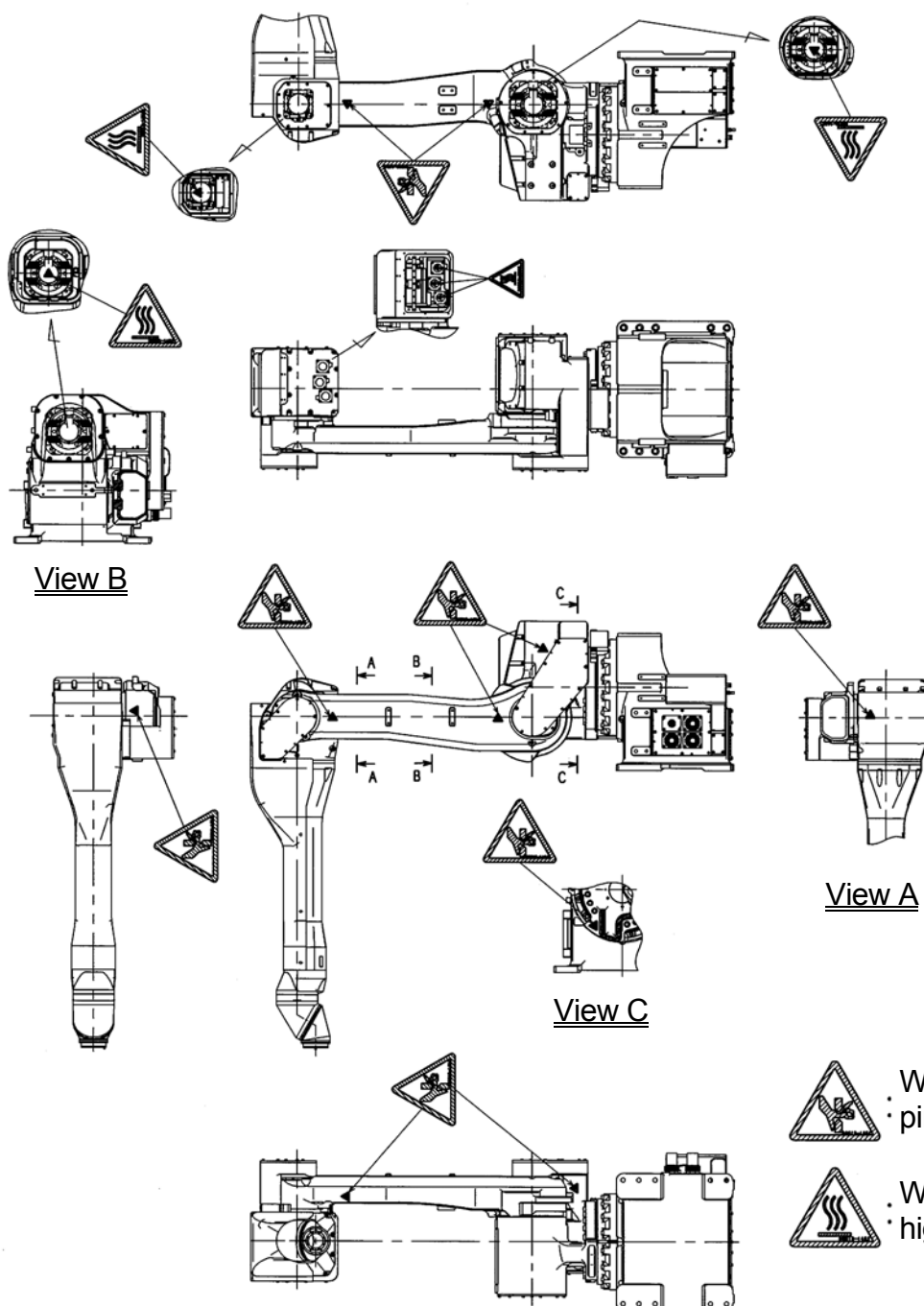
KJ264 (Shelf mounted spec.)

(The shape and residual risk places of models with right-hand and left hand rear arms are in mirror symmetry.)



WARNING

While at work, pay attention to the warning labels listed in the drawings below.



2.0 MOTION RANGE & SPECIFICATIONS OF ROBOT

Determination of safety fence installation location based on motion range of the robot.

KJ314

(The motion ranges are the same between models with left-hand and right-hand rear arms.)

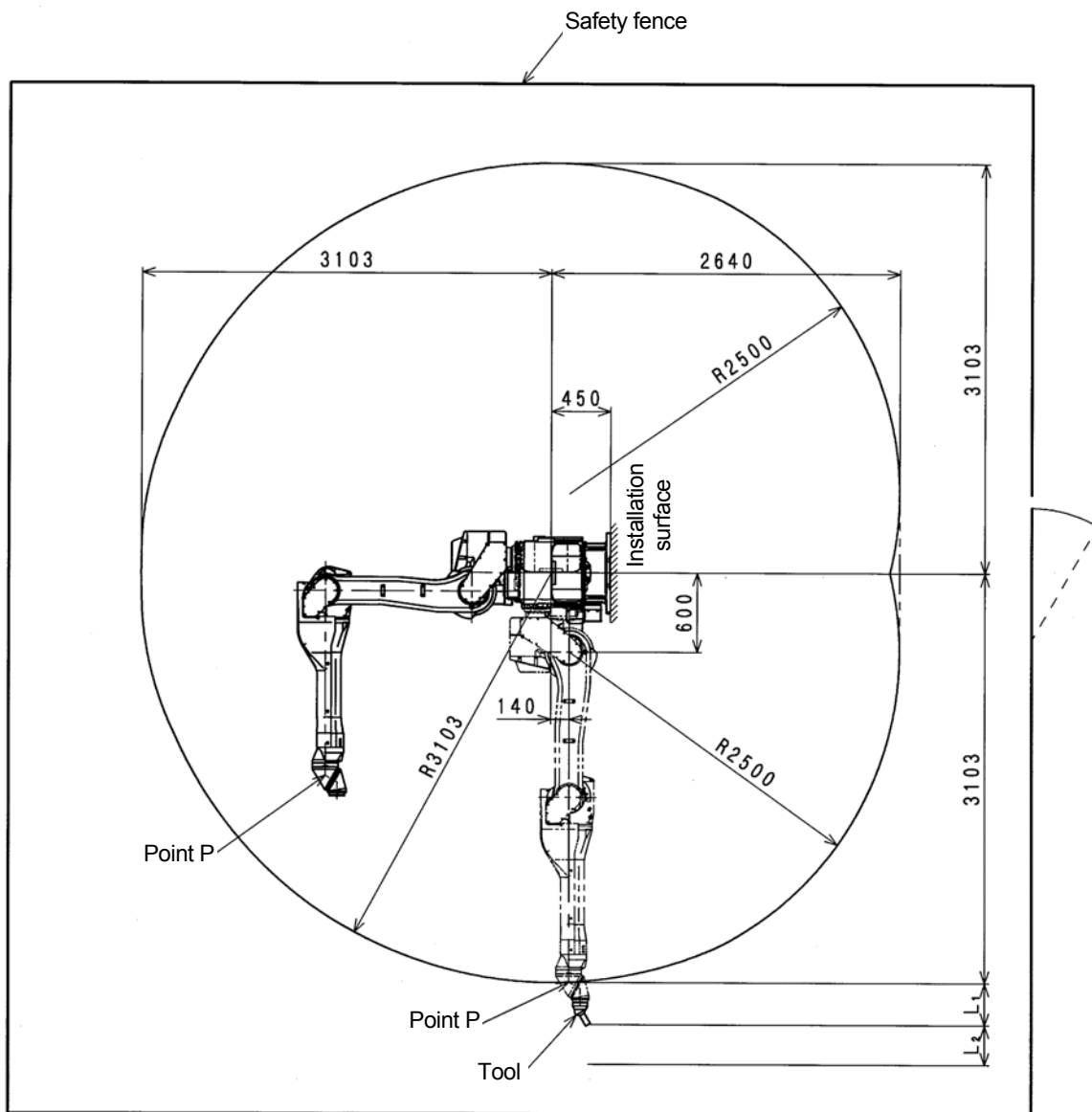


Figure above shows top view of robot, and the maximum motion range of the robot is indicated based on the point P. Safety fence dimensions must exceed the sum distance calculated as: maximum motion range of robot + $L_1 + L_2$, where L_1 is max. distance from the point P to tool tip, and L_2 is distance for safety allowance.

KJ264 (Floor mounted spec.)

(The motion ranges are the same between models with left-hand and right-hand rear arms.)

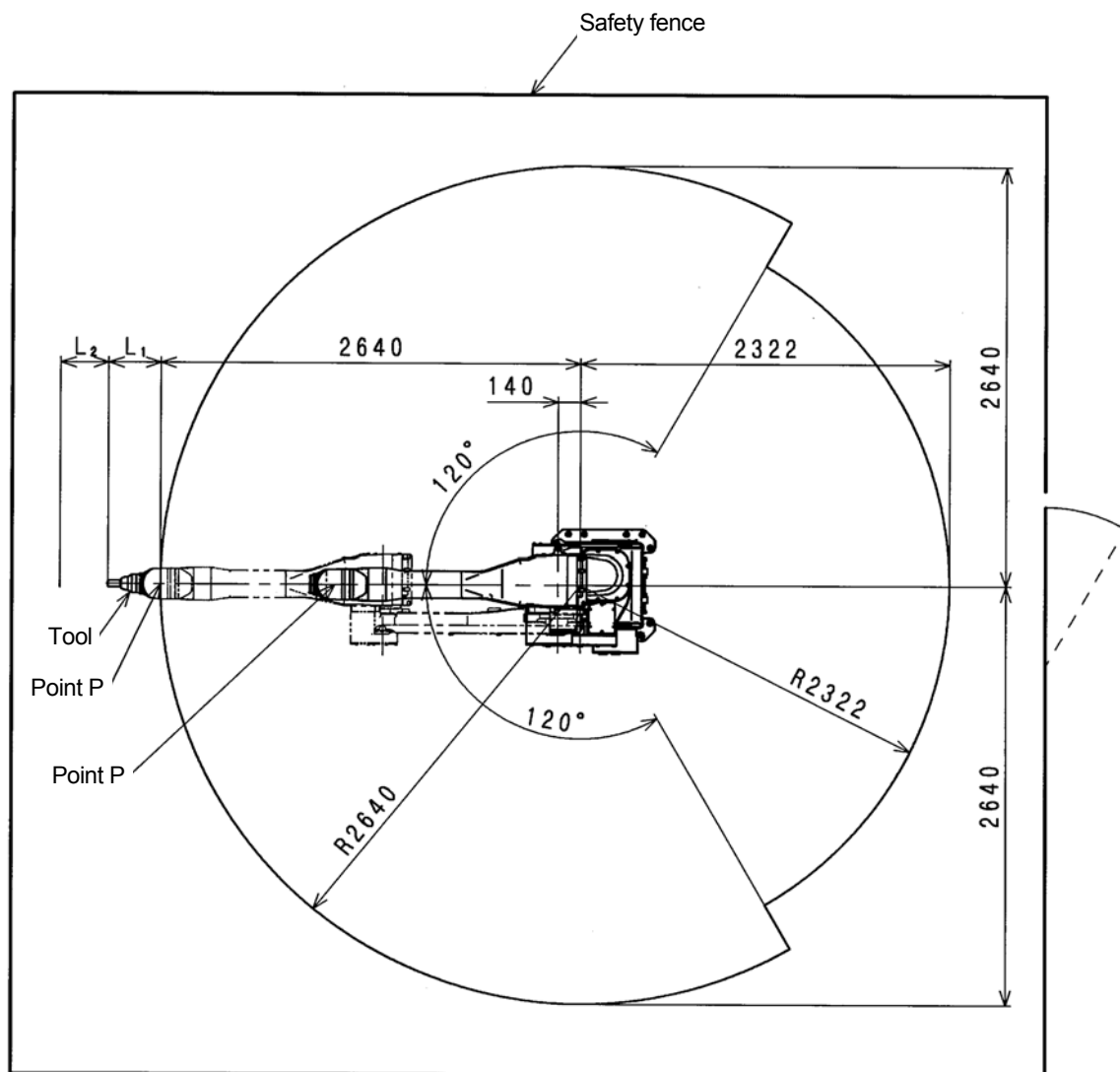


Figure above shows top view of robot, and the maximum motion range of the robot is based on the point P. Safety fence dimensions must exceed the sum distance calculated as: maximum motion range of robot + $L_1 + L_2$, where L_1 is max. distance from the point P to tool tip, and L_2 is distance for safety allowance.

KJ264 (Wall mounted (left) spec.)

(The motion ranges are the same between models with left-hand and right-hand rear arms.)

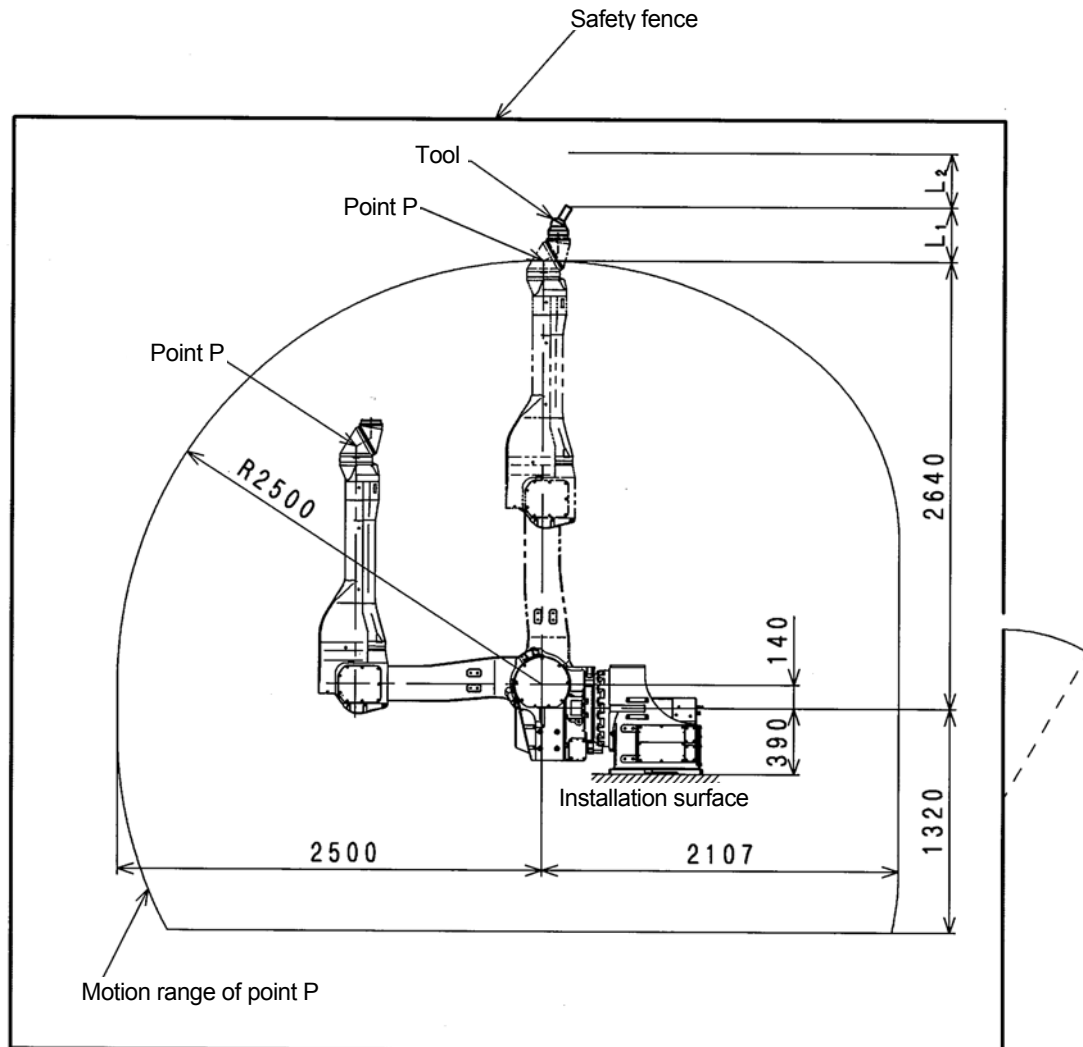


Figure above shows top view of robot, and the maximum motion range of the robot is based on the point P. Safety fence dimensions must exceed the sum distance calculated as: maximum motion range of robot + $L_1 + L_2$, where L_1 is max. distance from the point P to tool tip, and L_2 is distance for safety allowance.

KJ264 (Wall mounted (right) spec.)

(The motion ranges are the same between models with left-hand and right-hand rear arms.)

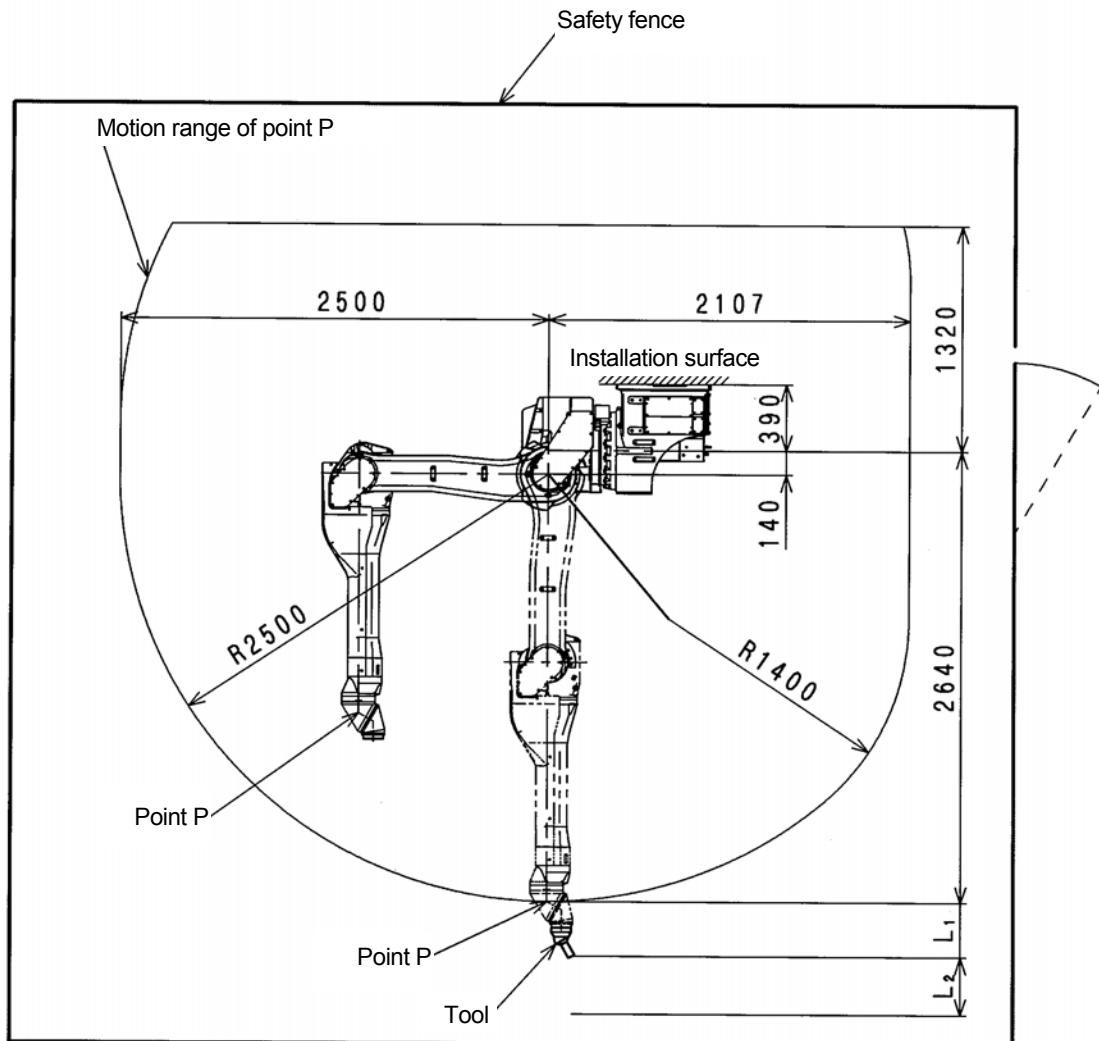


Figure above shows top view of robot, and the maximum motion range of the robot is based on the point P. Safety fence dimensions must exceed the sum distance calculated as: maximum motion range of robot + $L_1 + L_2$, where L_1 is max. distance from the point P to tool tip, and L_2 is distance for safety allowance.

KJ264 (Shelf mounted spec.)

(The motion ranges are the same between models with left-hand and right-hand rear arms.)

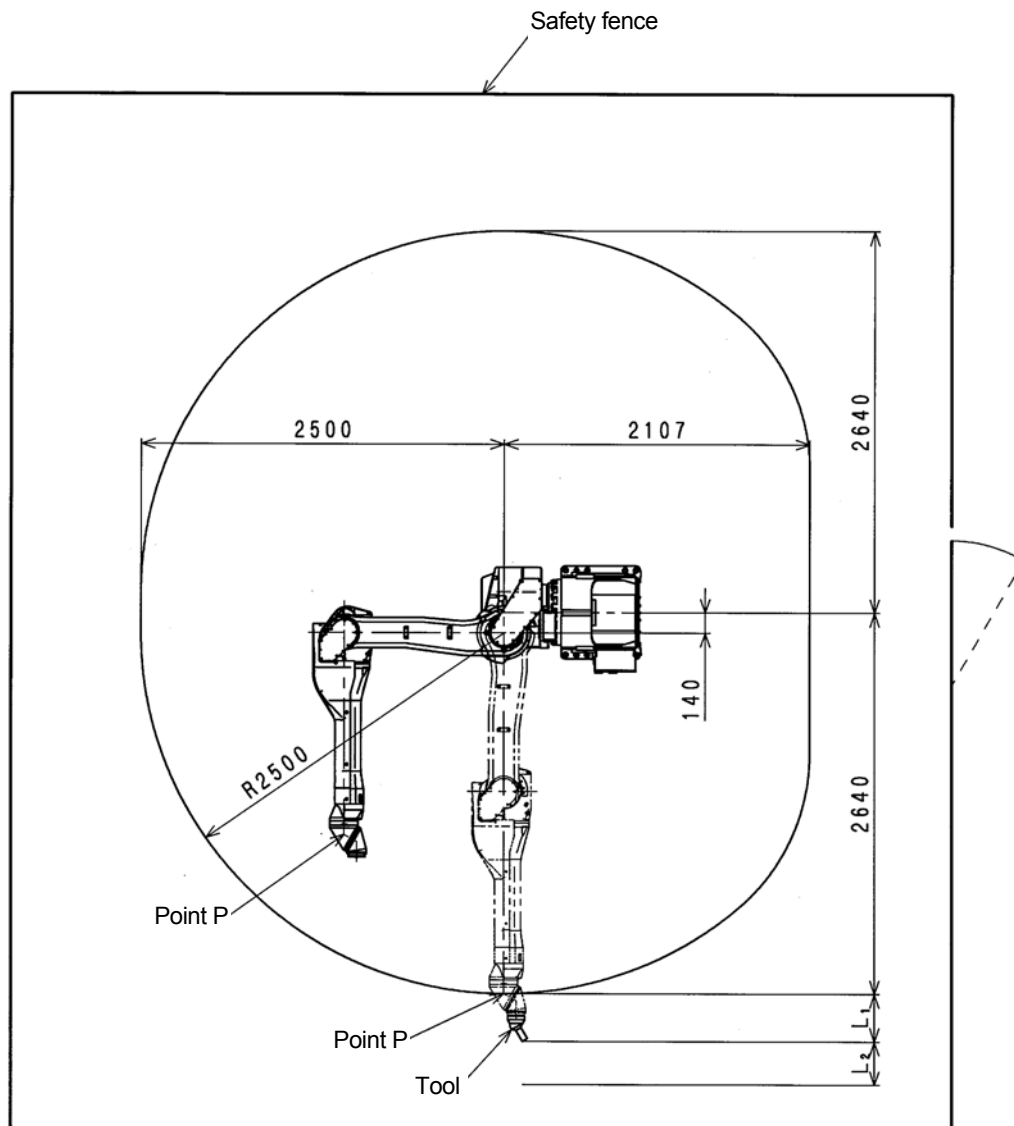
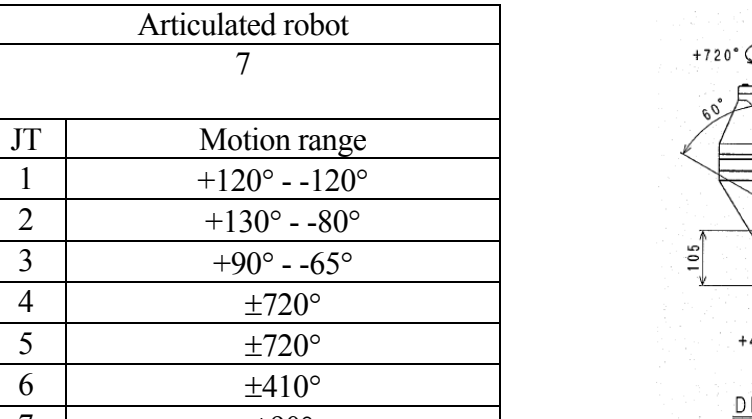


Figure above shows top view of robot, and the maximum motion range of the robot is based on the point P. Safety fence dimensions must exceed the sum distance calculated as: maximum motion range of robot + $L_1 + L_2$, where L_1 is max. distance from the point P to tool tip, and L_2 is distance for safety allowance.

(The specifications are the same between models with left-hand and right-hand rear arms.)



Technical drawing of Detail A, showing a cross-section of a structural component. The drawing includes a central vertical section with a 60-degree angle, a 105mm height, and a 100mm width. It also shows a 10mm thick section at the top, labeled JT4, and a 10mm thick section at the bottom, labeled JT6. The top section is rotated +720 degrees and -720 degrees, and the bottom section is rotated +410 degrees and -410 degrees. The right side of the drawing shows a 100mm width and a 720-degree rotation, labeled JT5.

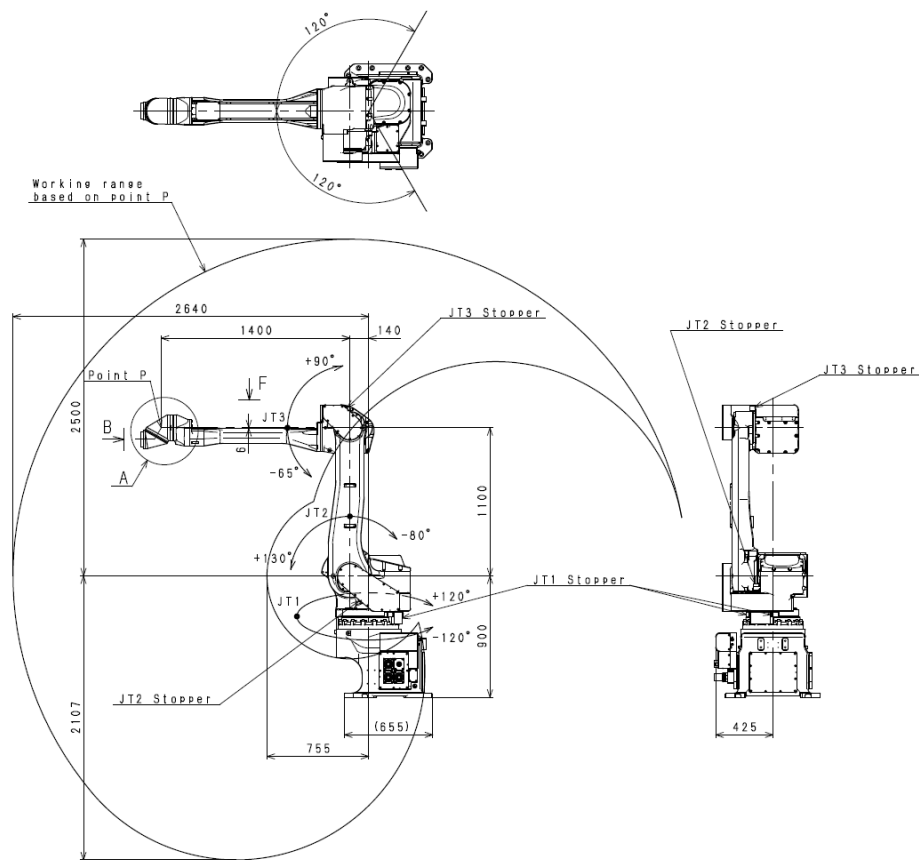
DETAIL A

- installed on the plate rigidly fixed on the floor.
- 2000 mm away from the maximum motion range

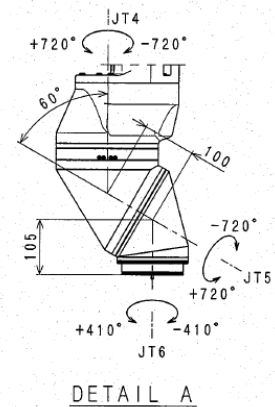
(The noise level depends on the conditions.)

KJ264 (Floor mounted spec.)

(The specifications are the same between models with left-hand and right-hand rear arms.)



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	+120° - -120°	
	2	+130° - -80°	
	3	+90° - -65°	
	4	±720°	
	5	±720°	
	6	±410°	
Max. payload	Wrist section: 15 kg Forearm section: 25 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	56.2 N·m	2.19 kg·m ²
	5	43.4 N·m	1.31 kg·m ²
	6	22.0 N·m	0.33 kg·m ²
Repeatability	±0.5 mm (Wrist flange surface)		
Mass	Approx. 540 kg		
Acoustic noise	79 dB (A)*		

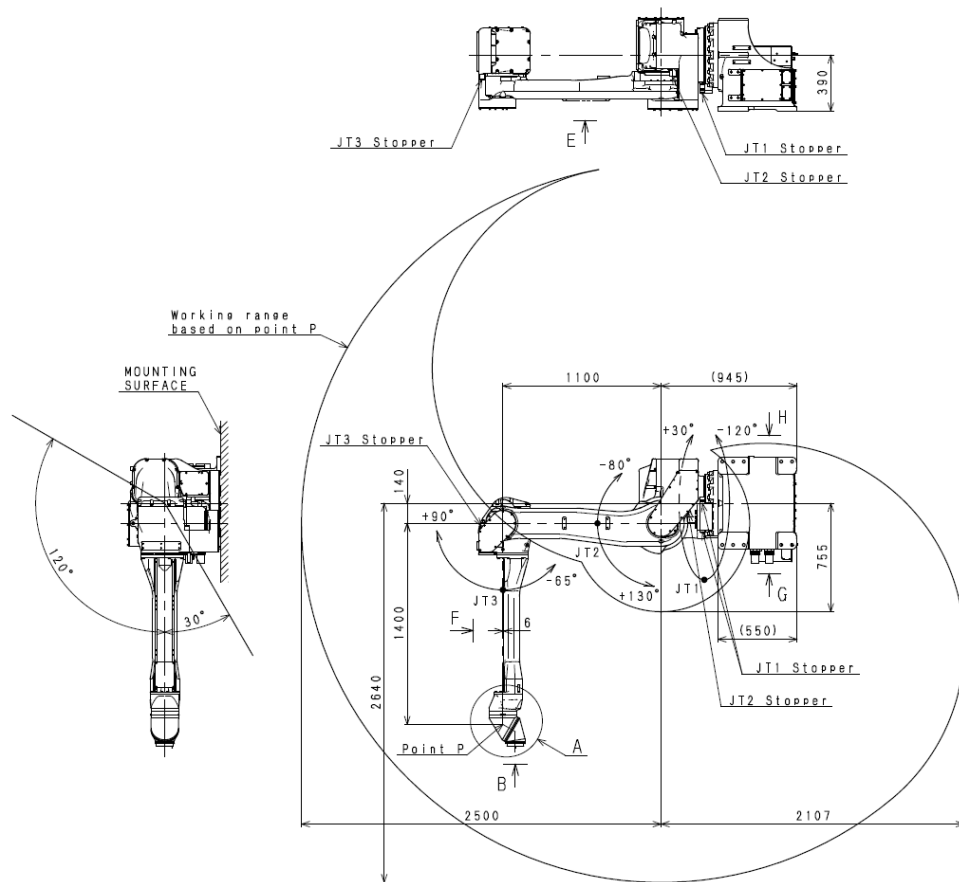


NOTE* measured condition:

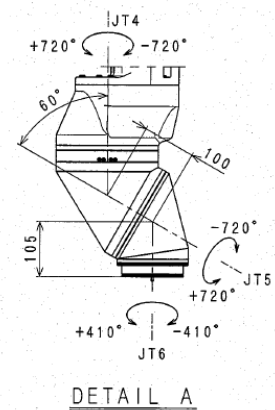
- installed on the plate rigidly fixed on the floor.
 - 2000 mm away from the maximum motion range
- (The noise level depends on the conditions.)

KJ264 (Wall mounted (left) spec.)

(The specifications are the same between models with left-hand and right-hand rear arms.)



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	+120° - -30°	
	2	+130° - -80°	
	3	+90° - -65°	
	4	±720°	
	5	±720°	
	6	±410°	
Max. payload	Wrist section: 15 kg Forearm section: 25 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	56.2 N·m	2.19 kg·m ²
	5	43.4 N·m	1.31 kg·m ²
	6	22.0 N·m	0.33 kg·m ²
Repeatability	±0.5 mm (Wrist flange surface)		
Mass	Approx. 530 kg		
Acoustic noise	79 dB (A)*		

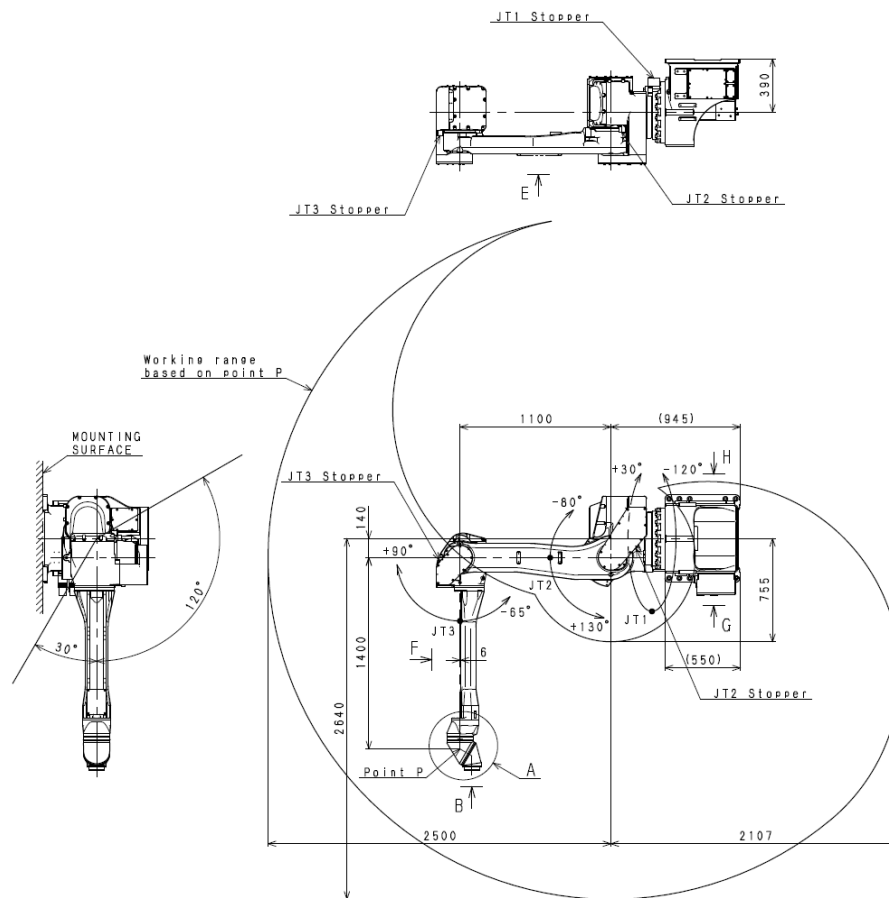
**NOTE*** measured condition:

- installed on the plate rigidly fixed on the floor.
- 2000 mm away from the maximum motion range

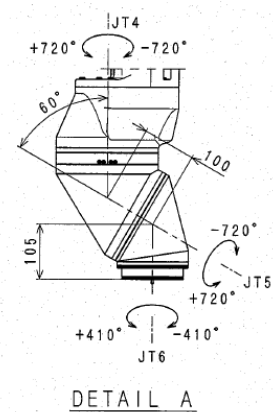
(The noise level depends on the conditions.)

KJ264 (Wall mounted (right) spec.)

(The specifications are the same between models with left-hand and right-hand rear arms.)



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	+30° - -120°	
	2	+130° - -80°	
	3	+90° - -65°	
	4	±720°	
	5	±720°	
	6	±410°	
Max. payload	Wrist section: 15 kg Forearm section: 25 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	56.2 N·m	2.19 kg·m ²
	5	43.4 N·m	1.31 kg·m ²
	6	22.0 N·m	0.33 kg·m ²
Repeatability	±0.5 mm (Wrist flange surface)		
Mass	Approx. 530 kg		
Acoustic noise	79 dB (A)*		



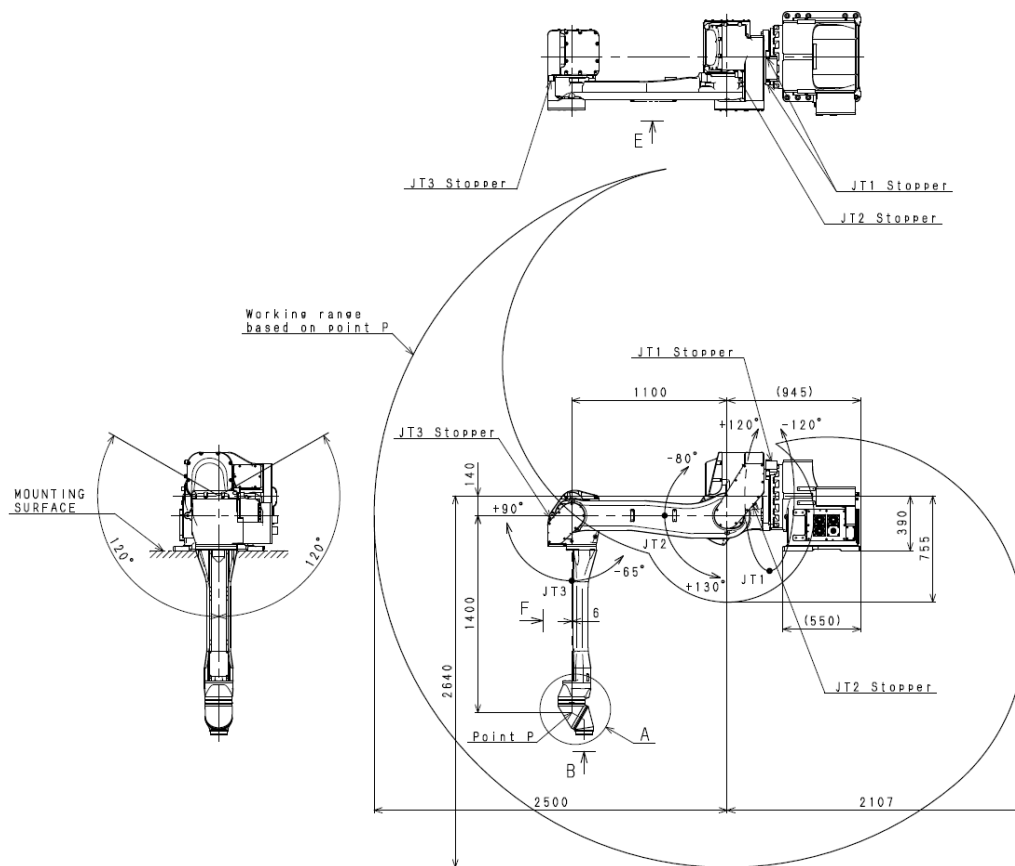
NOTE* measured condition:

- installed on the plate rigidly fixed on the floor.
- 2000 mm away from the maximum motion range

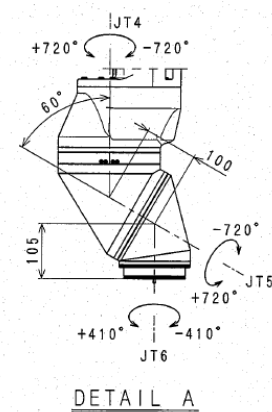
(The noise level depends on the conditions.)

KJ264 (Shelf mounted spec.)

(The specifications are the same between models with left-hand and right-hand rear arms.)



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	+120° - -120°	
	2	+130° - -80°	
	3	+90° - -65°	
	4	±720°	
	5	±720°	
	6	±410°	
Max. payload	Wrist section: 15 kg Forearm section: 25 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	56.2 N·m	2.19 kg·m ²
	5	43.4 N·m	1.31 kg·m ²
	6	22.0 N·m	0.33 kg·m ²
Repeatability	±0.5 mm (Wrist flange surface)		
Mass	Approx. 530 kg		
Acoustic noise	79 dB (A)*		

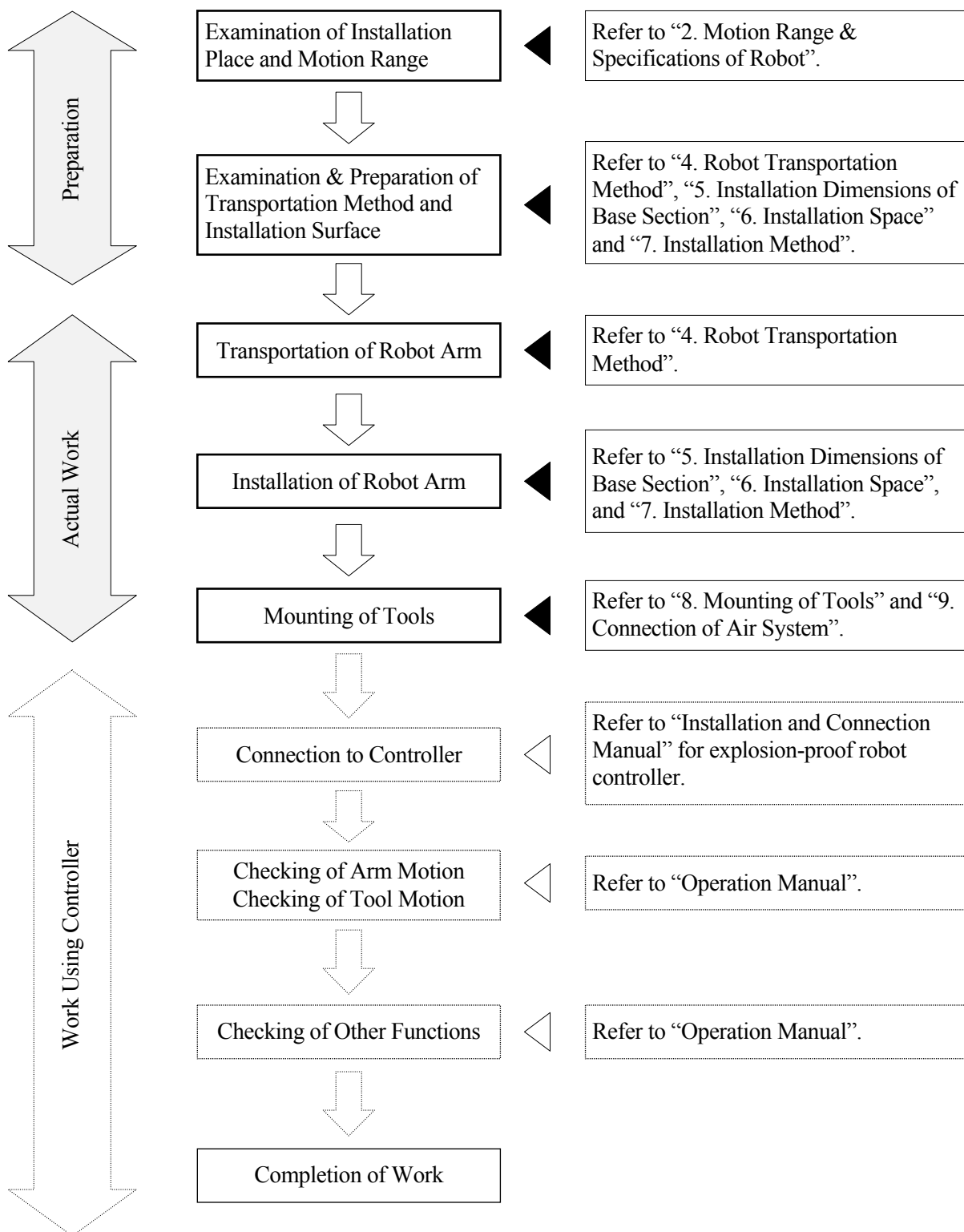
**NOTE*** measured condition:

- installed on the plate rigidly fixed on the floor.
- 2000 mm away from the maximum motion range

(The noise level depends on the conditions.)

3.0 WORK FLOW AT ARM INSTALLATION AND CONNECTION

This workflow describes only the robot arm section. For the controller, refer to “Installation and Connection Manual” for explosion-proof robot controller.



4.0 ROBOT TRANSPORTATION METHOD

4.1 USING WIRE SLING

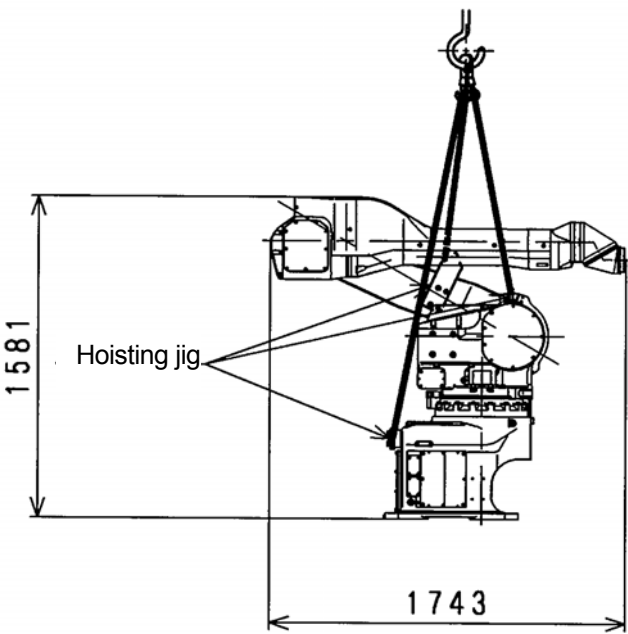
Lift the robot by fastening the wires between the M20 eyebolts on the robot arm and the hoisting jig as shown in the figure below. Remove the hoisting jig after working.

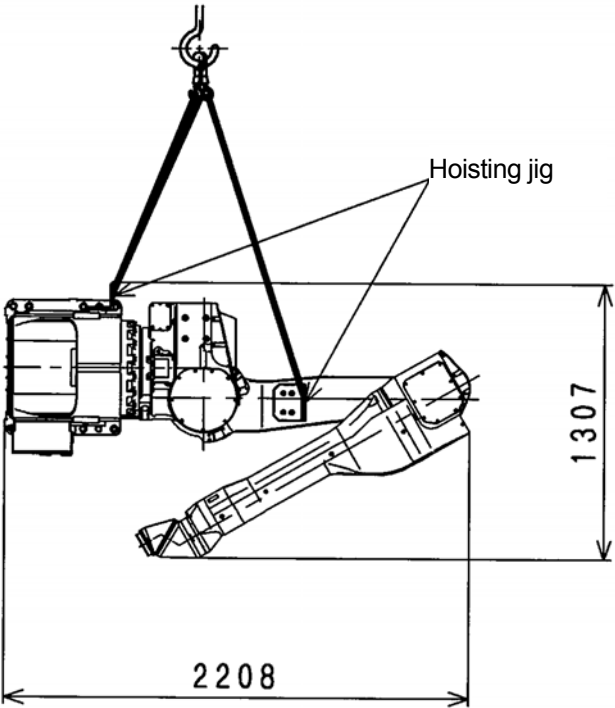


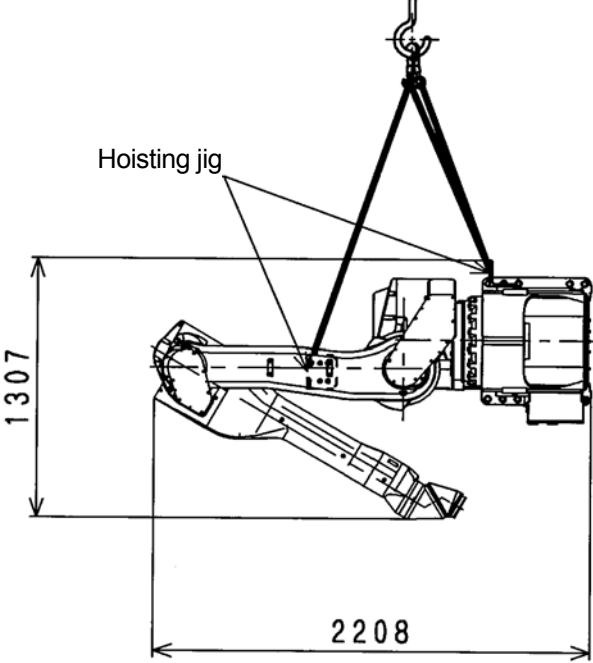
WARNING

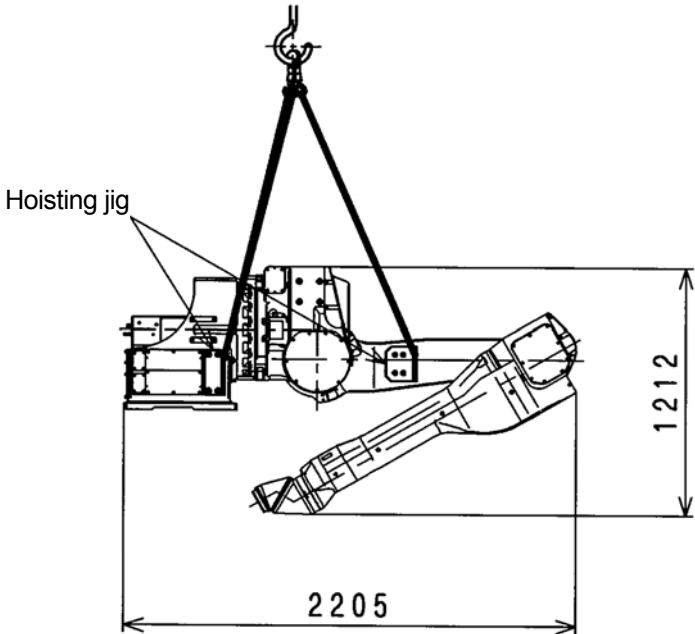
1. Adjust the length of wire using chain block, etc. because the height of hoisting jig differs from that of eyebolt. Do not hoist the robot using only one hoisting jig.
2. When hoisting up robot, be careful as robot may lean forward/backward/left/right depending on the robot posture. Be sure to hoist the robot in the specified hoisting posture on the following pages, otherwise it may swing excessively or the wire may interfere with other objects, resulting in damage. In places where wire touches the arm, protect arm with board, cloth, etc.

Model		KJ314 (The hoisted/hoisting postures are the same between models with left-hand and right-hand rear arms.)	
Hoisted posture			
Hoisting posture	JT1	0°	
	JT2	0°	
	JT3	-60°	
	JT4	0°	
	JT5	0°	
	JT6	0°	
	JT7	0°	

Model		KJ264 (Floor mounted spec.) (The hoisted/hoisting postures are the same between models with left-hand and right-hand rear arms.)	
Hoisted posture			
Hoisting posture	JT1	0°	
	JT2	-65°	
	JT3	-65°	
	JT4	0°	
	JT5	0°	
	JT6	0°	

Model		KJ264 (Wall mounted (left) spec.) (The hoisted/hoisting postures are the same between models with left-hand and right-hand rear arms.)	
Hoisted posture			
Hoisting posture	JT1	0°	
	JT2	0°	
	JT3	-60°	
	JT4	0°	
	JT5	0°	
	JT6	0°	

Model		KJ264 (Wall mounted (right) spec.) (The hoisted/hoisting postures are the same between models with left-hand and right-hand rear arms.)	
Hoisted posture			
Hoisting posture	JT1	0°	
	JT2	0°	
	JT3	-60°	
	JT4	0°	
	JT5	0°	
	JT6	0°	

Model		KJ264 (Shelf mounted spec.) (The hoisted/hoisting postures are the same between models with left-hand and right-hand rear arms.)	
Hoisted posture			
Hoisting posture	JT1	0°	
	JT2	0°	
	JT3	-60°	
	JT4	0°	
	JT5	0°	
	JT6	0°	

5.0 INSTALLATION DIMENSIONS OF BASE SECTION

When installing the robot arm, fix it by using high-tension bolts and plain washers in the bolt holes on the base section.

Model	KJ314 (The installation dimensions are the same between models with left-hand and right-hand rear arms.)
Dimensions of base installation section	
Cross-section of installation bolt hole	
Bolt holes	12-φ20
High tension bolts	12-M16 Material: SCM435 Strength level: 10.9 or more
Tightening torque	235 N·m
Levelness	Within ±5°
Plain washer	Material: S45CⒽ Hardness: HRC38-45 Part No: RHTWM1645



CAUTION

Be sure to install the robot arm on a surface with flatness of 0.3 mm or less, otherwise robot arm may suffer damage.

Model	KJ264 (Floor mounted spec.) (The installation dimensions are the same between models with left-hand and right-hand rear arms.)
Dimensions of base installation section	
Cross-section of installation bolt hole	
Bolt holes	12-φ20
High tension bolts	12-M16 Material: SCM435 Strength level: 10.9 or more
Tightening torque	235 N·m
Levelness	Within ±5°
Plain washer	Material: S45CⓂ Hardness: HRC38-45 Part No: RHTWM1645



CAUTION

Be sure to install the robot arm on a surface with flatness of 0.3 mm or less, otherwise robot arm may suffer damage.

Model	<p>KJ264 (Wall mounted (left) spec.) KJ264 (Wall mounted (right) spec.) KJ264 (Shelf mounted spec.) (The installation dimensions are the same between models with left-hand and right-hand rear arms.)</p>
Dimensions of base installation section	
Cross-section of installation bolt hole	
Bolt holes	10-φ20
High tension bolts	<p>10-M16 Material: SCM435 Strength level: 10.9 or more</p>
Tightening torque	235 N·m
Levelness	Within ±5°
Plain washer	<p>Material: S45CⒽ Hardness: HRC38-45 Part No: RHTWM1645</p>



CAUTION

Be sure to install the robot arm on a surface with flatness of 0.3 mm or less, otherwise robot arm may suffer damage.

6.0 INSTALLATION SPACE

Secure the installation space for robot arm as below.

1. For maintenance purposes, leave at least 600 mm clearance behind the robot arm and at least 900 mm from the center of the robot on sides of the base.
2. Leave at least 1600 mm clearance over the robot arm for hoisting up the robot arm.

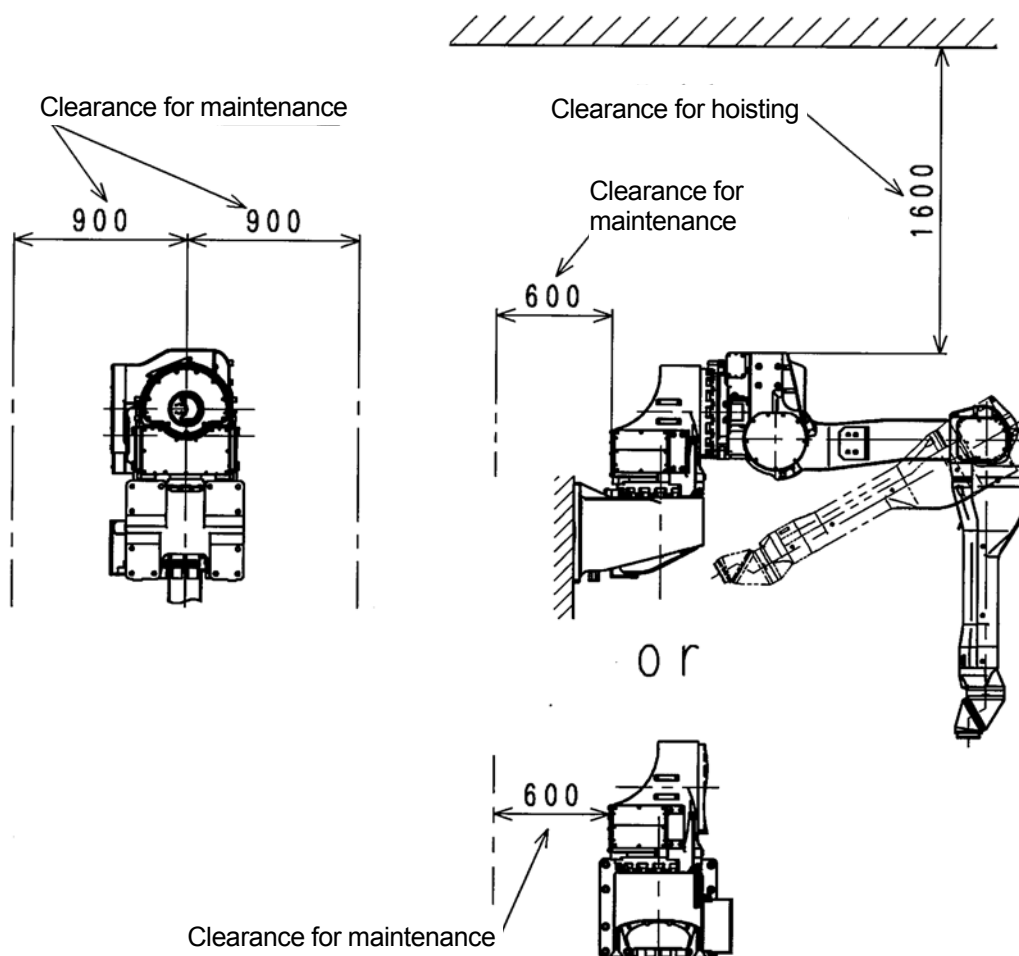


CAUTION

Secure the maintenance space shown in the figure below in robot arm installation. For installation space of safety fence, refer to 2.0 Motion Range & Specifications of Robot.

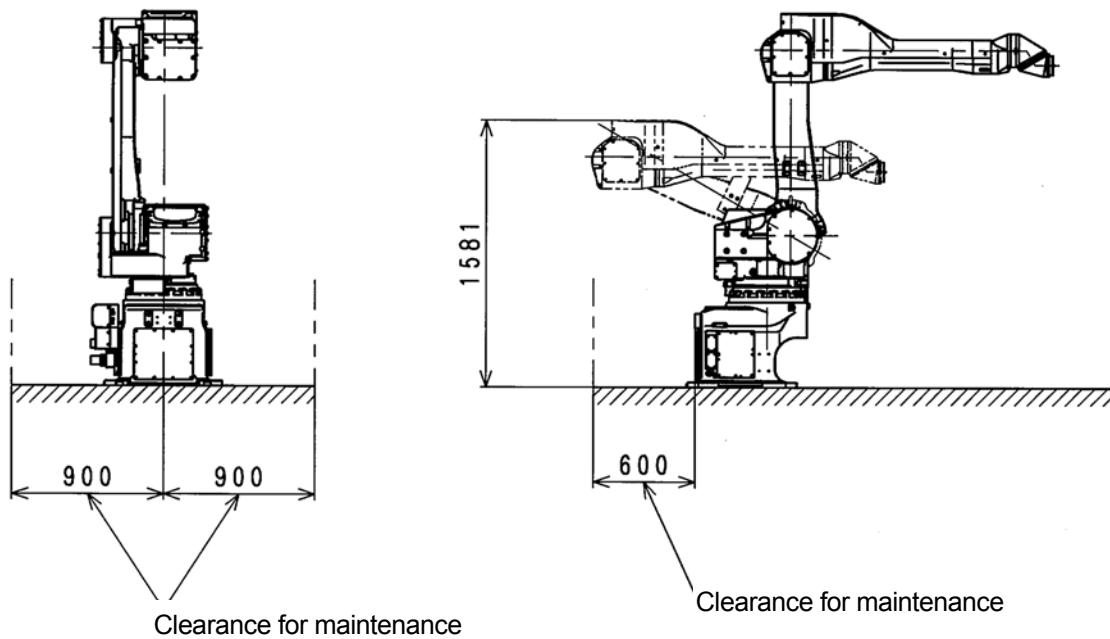
KJ314

(The installation spaces are the same between models with left-hand and right-hand rear arms.)



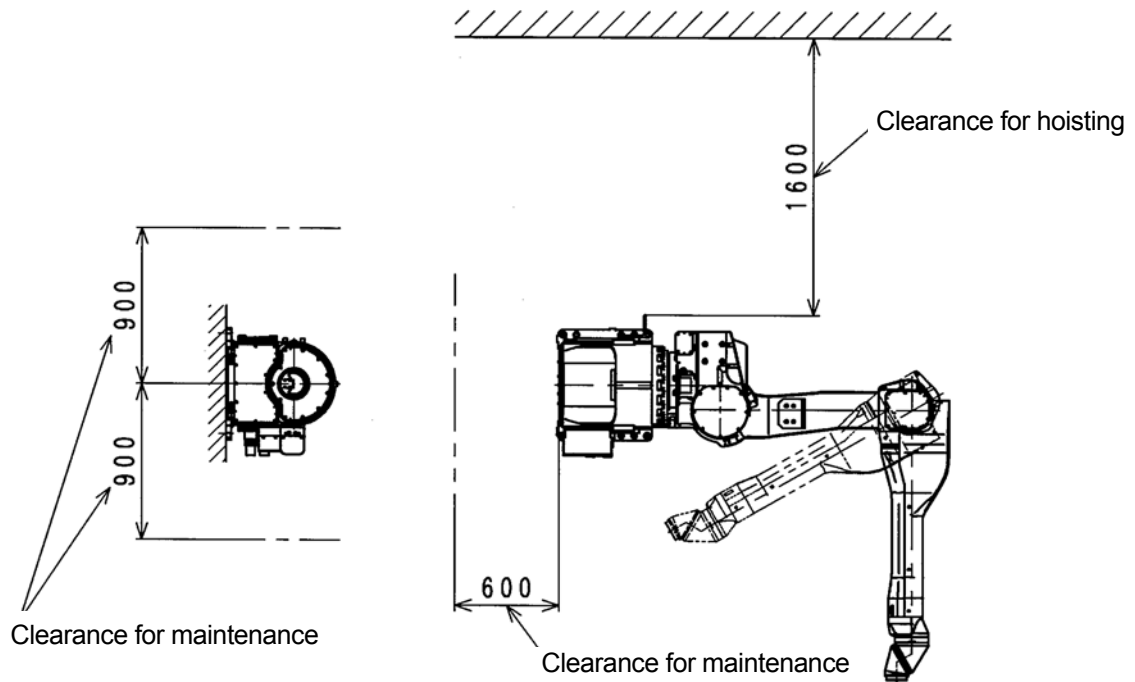
KJ264 (Floor mounted spec.)

(The installation spaces are the same between models with left-hand and right-hand rear arms.)



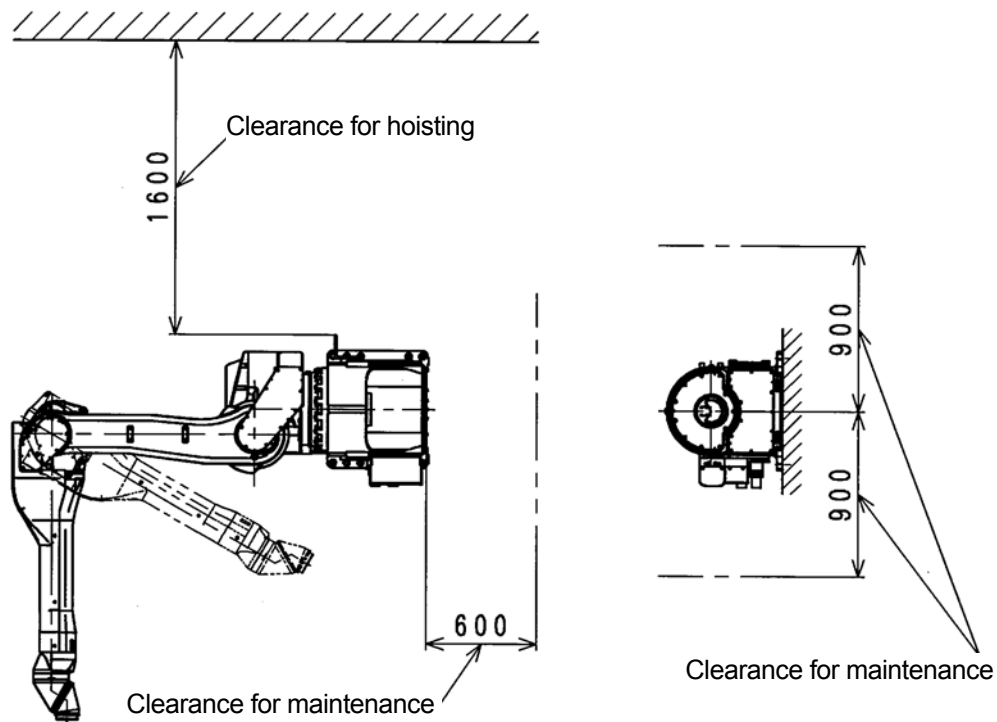
KJ264 (Wall mounted (left) spec.)

(The installation spaces are the same between models with left-hand and right-hand rear arms.)



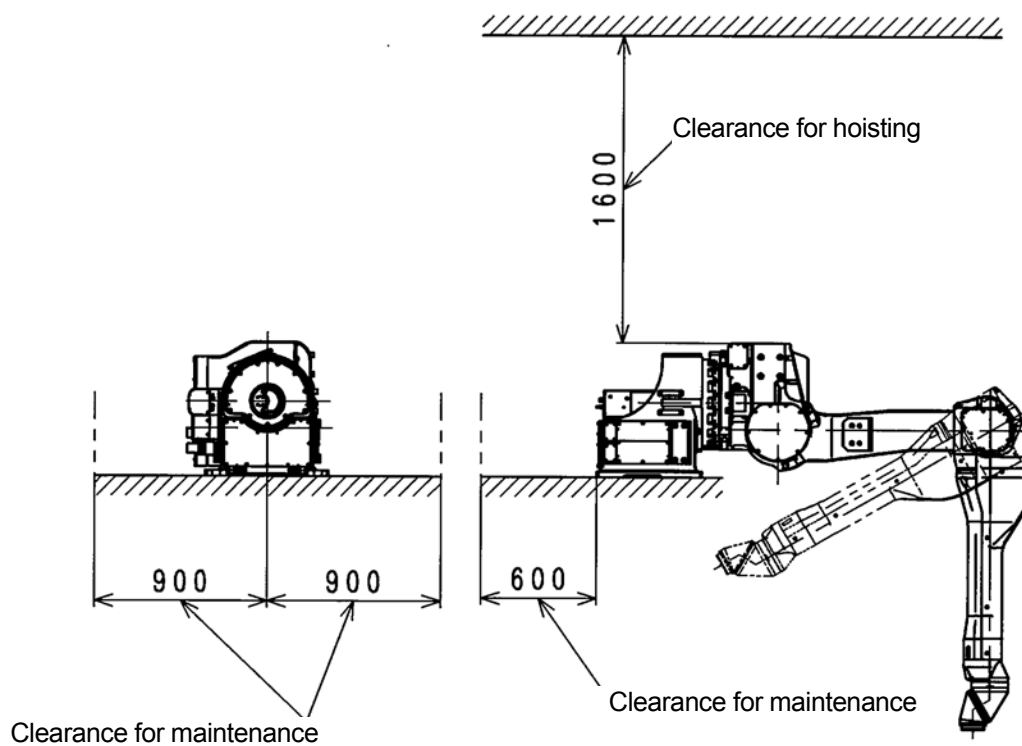
KJ264 (Wall mounted (right) spec.)

(The installation spaces are the same between models with left-hand and right-hand rear arms.)



KJ264 (Shelf mounted spec.)

(The installation spaces are the same between models with left-hand and right-hand rear arms.)

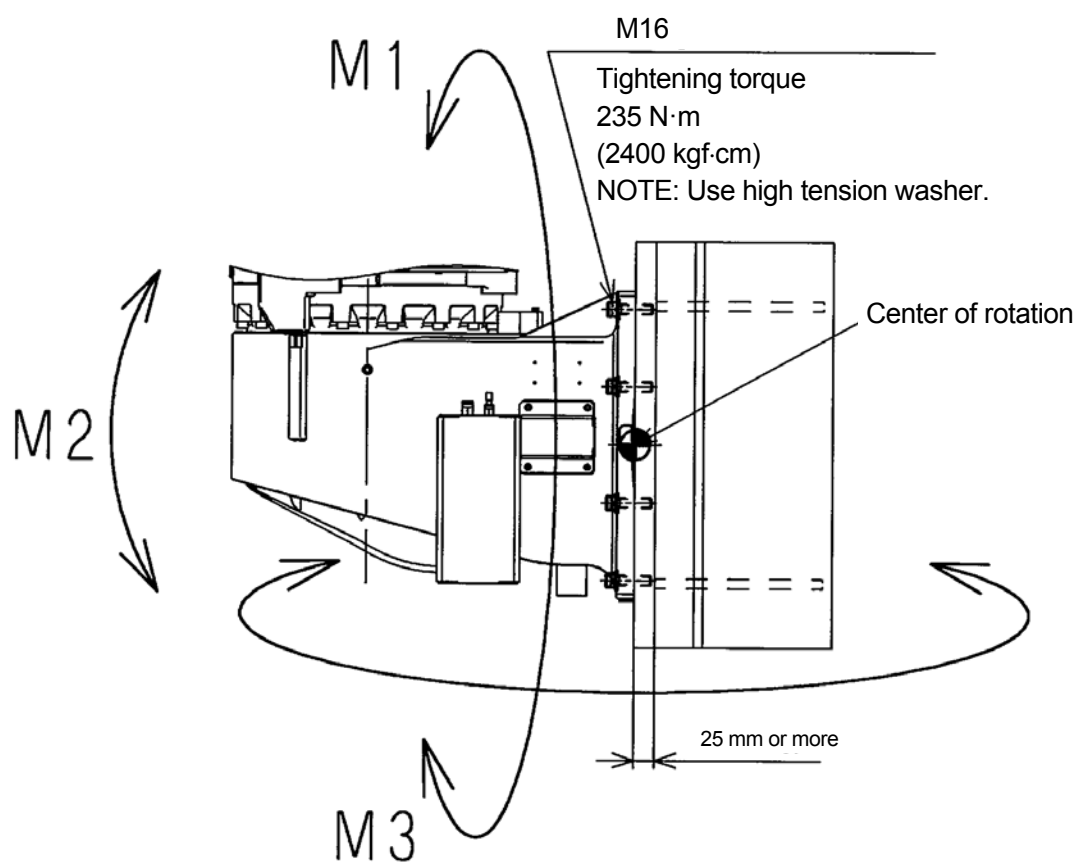


7.0 INSTALLATION METHOD

When installing the robot arm on the steel pedestal, the thickness of the steel plate must be 25 mm or more. Fix the steel pedestal on the floor as firmly as possible to withstand the reaction forces from the robot arm.

KJ314

(The installation method is the same between models with left-hand and right-hand rear arms.)

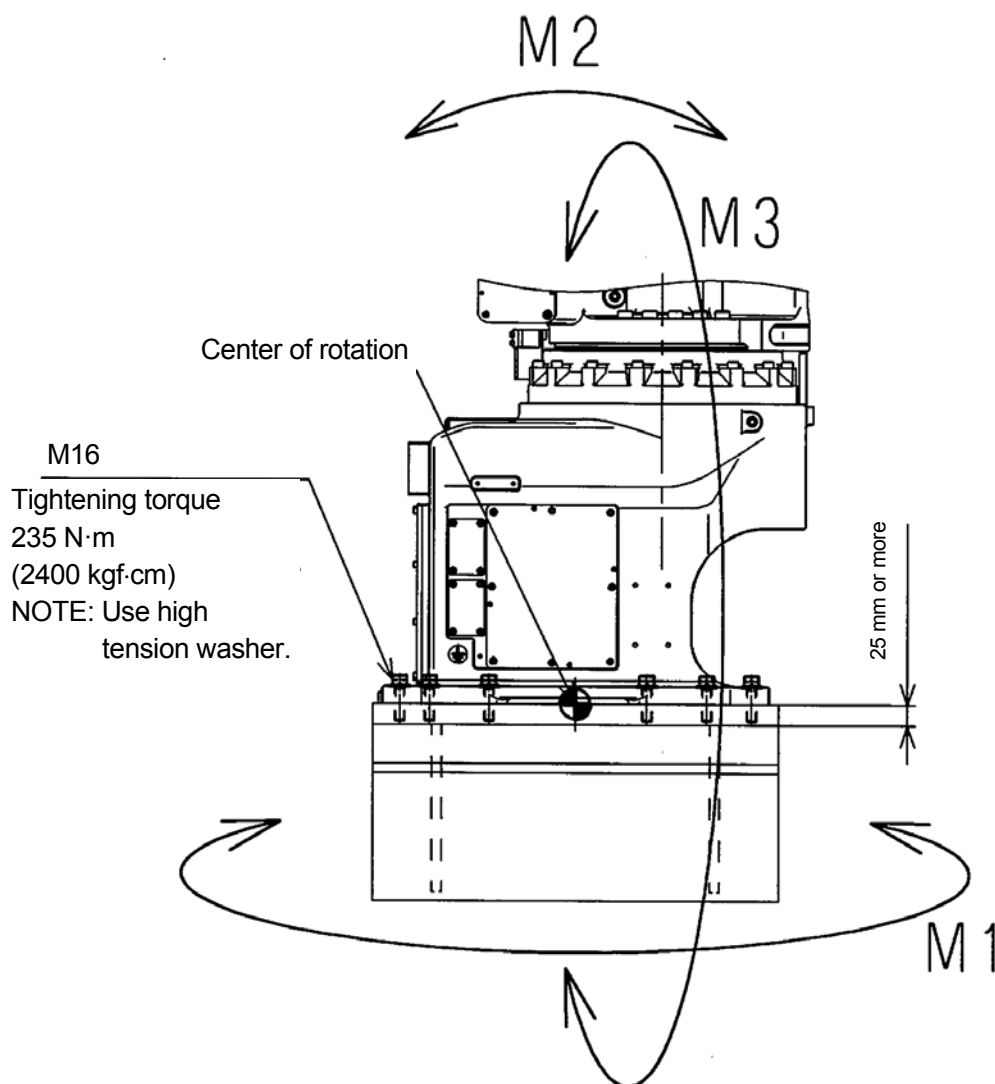


The center of installation surface is the center of rotation for each moment.

Model	KJ314
M1	31000 N·m
M2	33000 N·m
M3	33000 N·m

KJ264 (Floor mounted spec.)

(The installation method is the same between models with left-hand and right-hand rear arms.)

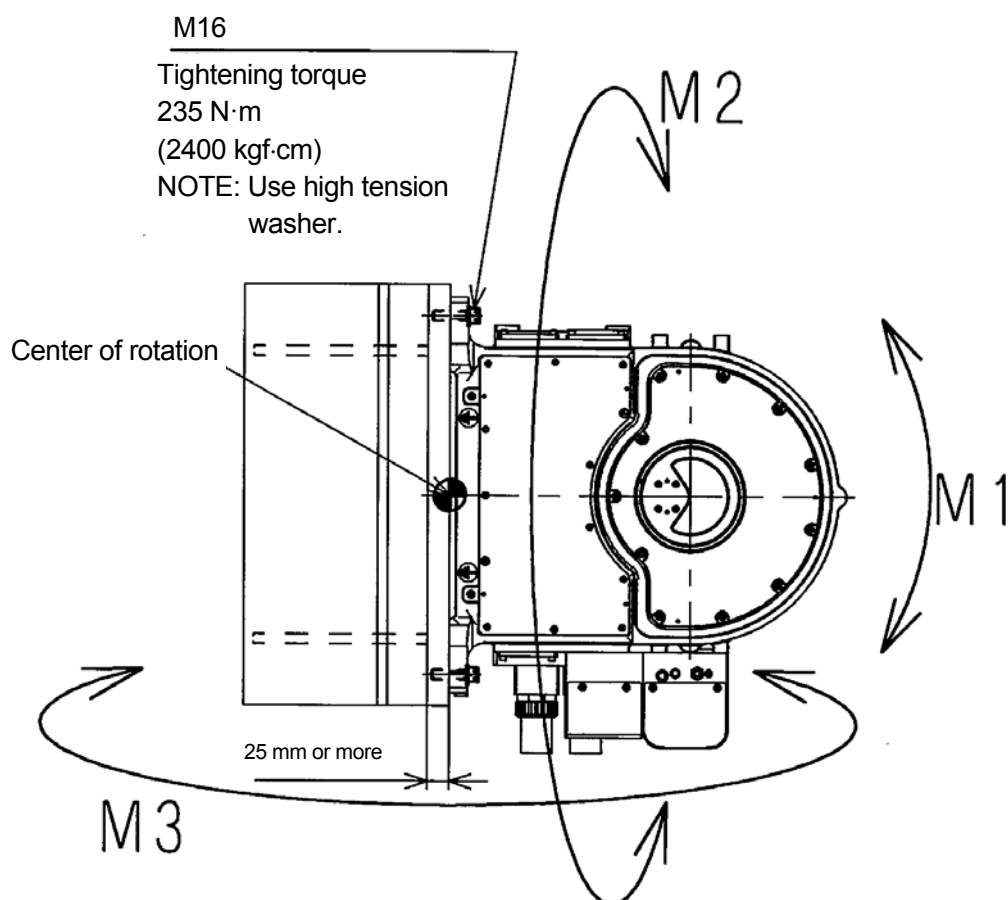


The center of installation surface is the center of rotation for each moment.

Model	KJ264 (Floor mounted spec.)
M1	27000 N·m
M2	31000 N·m
M3	31000 N·m

KJ264 (Wall mounted (left) spec.)

(The installation method is the same between models with left-hand and right-hand rear arms.)

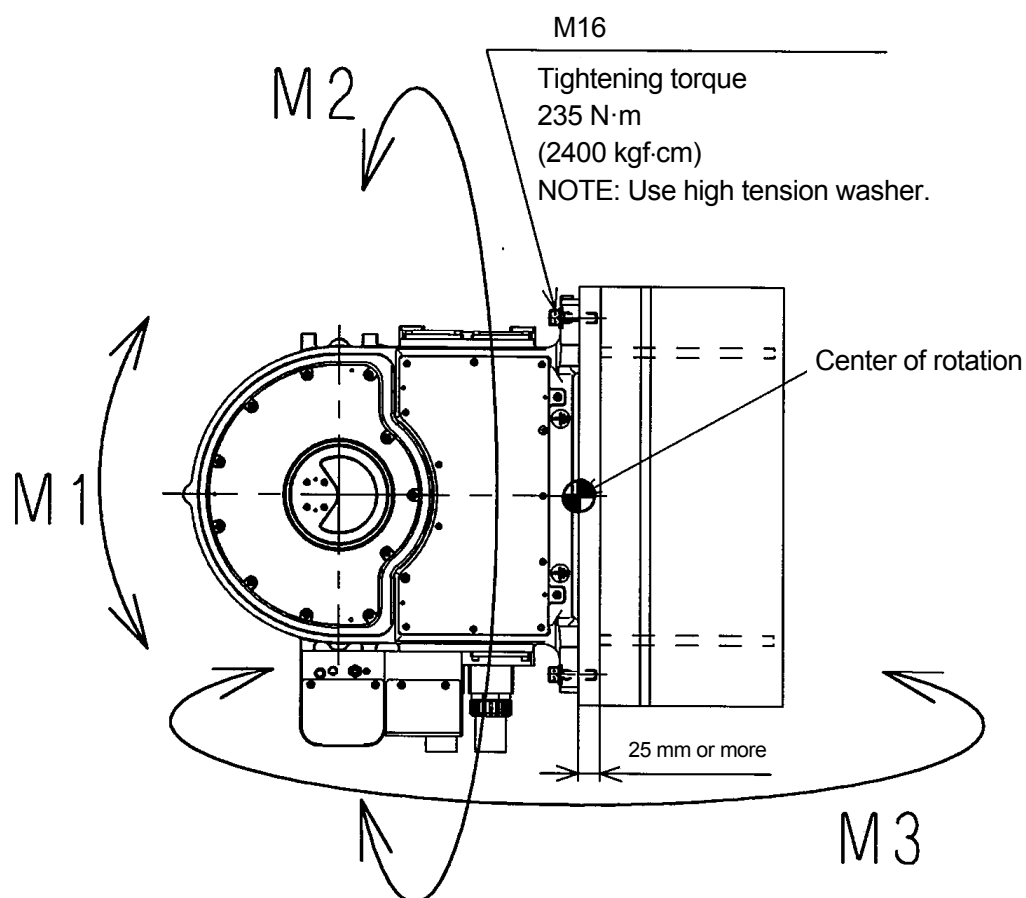


The center of installation surface is the center of rotation for each moment.

Model	KJ264 (Wall mounted (left) spec.)
M1	32000 N·m
M2	28000 N·m
M3	28000 N·m

KJ264 (Wall mounted (right) spec.)

(The installation method is the same between models with left-hand and right-hand rear arms.)

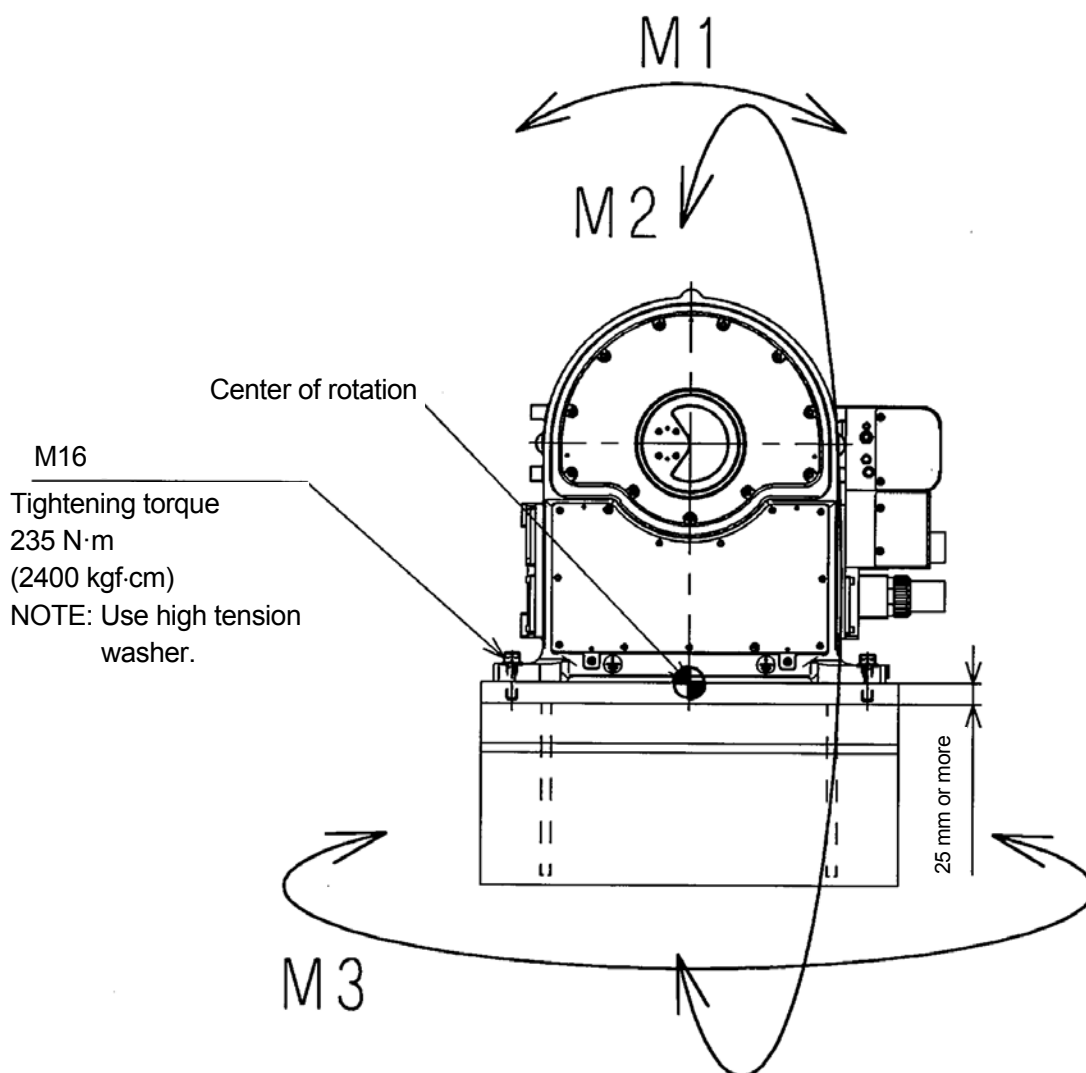


The center of installation surface is the center of rotation for each moment.

Model	KJ264 (Wall mounted (right) spec.)
M1	32000 N·m
M2	28000 N·m
M3	28000 N·m

KJ264 (Shelf mounted spec.)

(The installation method is the same between models with left-hand and right-hand rear arms.)



The center of installation surface is the center of rotation for each moment.

Model	KJ264 (Shelf mounted spec.)
M1	32000 N·m
M2	28000 N·m
M3	28000 N·m

8.0 MOUNTING OF TOOLS

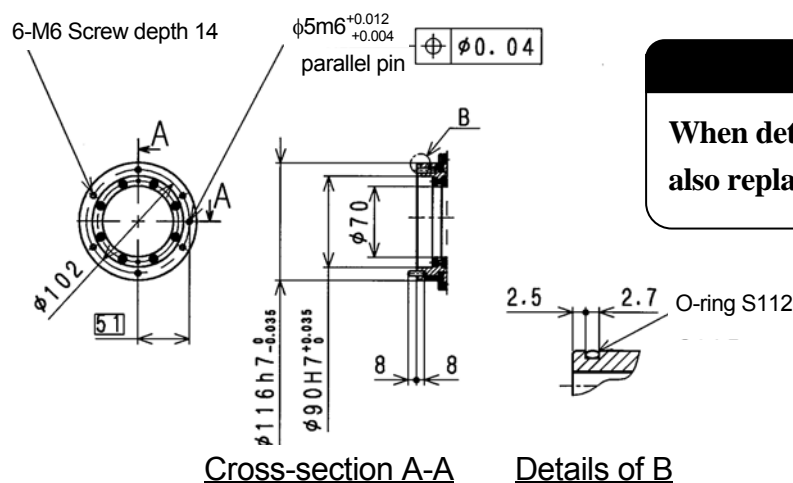


WARNING

Prior to mounting tools on the robot, turn OFF the controller power switch and the external power switch. Display signs indicating clearly “Installation and connection in progress”, and lockout/tagout the external power switch to prevent personnel from accidentally turning ON the power.

1. Dimensions of wrist end (flange face)

In the robot arm end section, a flange is provided on which tools are mounted. Screw the mounting bolts into the tap holes on the circumference of $\phi 102$ on the flange, referring to the figure below. Moreover, position the tool by utilizing the pin hole and the positioning shaft.



Cross-section A-A

Details of B

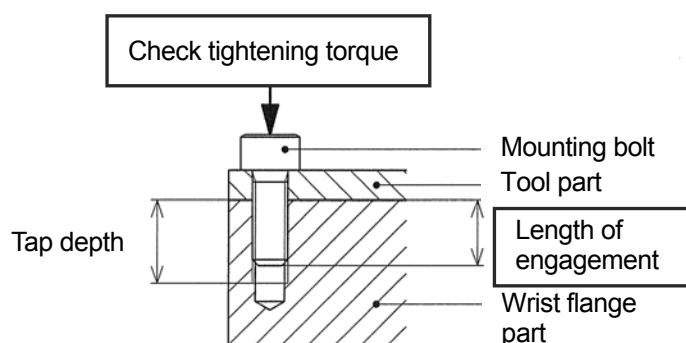


CAUTION

When detaching or replacing the tools, also replace the O-ring.

2. Specification of mounting bolts

Select mounting bolts with proper length to secure the specified engagement length. Use high tension bolt and tighten them to the specified torque shown below.



CAUTION

If the engagement length has exceeded the specified value, the mounting bolt might bottom out, and the tool will not be fixed securely.

Model	KJ series
Tap holes	6-M6
P.C.D. of tap holes	$\phi 102$
Pin	$\phi 5m6$ Length 8
Positioning shaft	$\phi 116h7$
Tap depth	14 mm
Length of engagement	9-12 mm
High tension bolts	SCM435, 10.9 or more
Tightening torque	12.0 N·m

3. Calculating the load on wrist axis

- (1) The maximum load capacity of the robot is specified per robot model.
- (2) Strictly observe the limiting conditions for load torque and load moment of inertia around each wrist axis (JT4, JT5, JT6) as shown below.

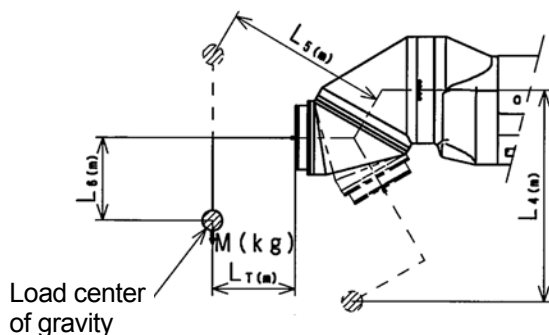


WARNING

Using the robot beyond its specified load may result in degradation of movement performance and shortening of machine service life. The specified load capacity includes the mass of all attachments such as spray gun, gun bracket, piping/wiring, etc. If using the robot in excess of its load capacity, first contact Kawasaki without fail.

The load torque and the moment of inertia can be calculated by the expression below:

Calculation Expression



Load mass: $M \leq M_{\max.}(\text{kg})$

Load torque: $T = 9.8 \cdot M \cdot L(\text{N} \cdot \text{m})$

Load moment of inertia: $I = M \cdot L^2 + I_G(\text{kg} \cdot \text{m}^2)$

M: Load capacity

$M_{\max.}$: 15 kg

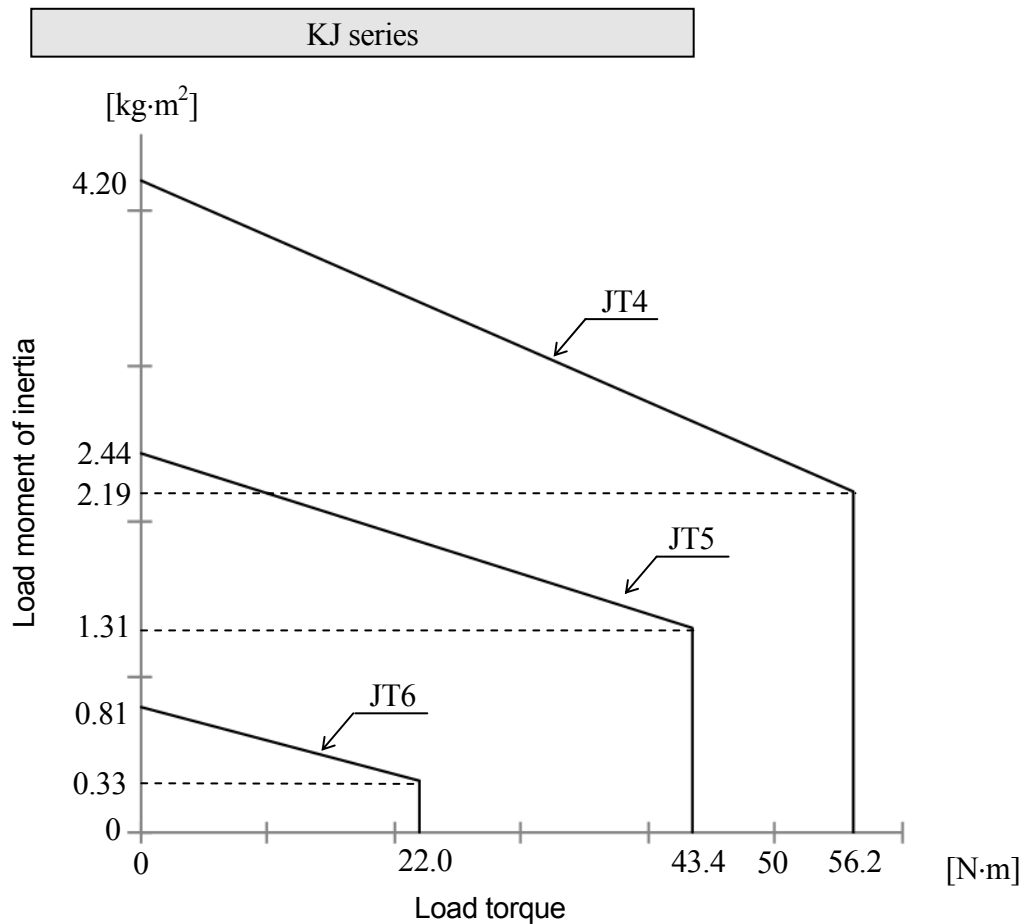
I_G : Load moment of inertia around center of gravity

$L_{(4-6)}$: Length from axis rotation center to load center of gravity (Unit: m) (See figure left.)

$L_4 = L_T \cdot \sin 60^\circ + L_6 \cdot \cos 60^\circ + 0.180 \text{ (m)}$

$L_5 = L_T \cdot \sin 60^\circ + L_6 \cdot \cos 60^\circ + 0.095 \text{ (m)}$

Adhere to the following limiting conditions for the load torque and the load moment of inertia around each wrist axis.

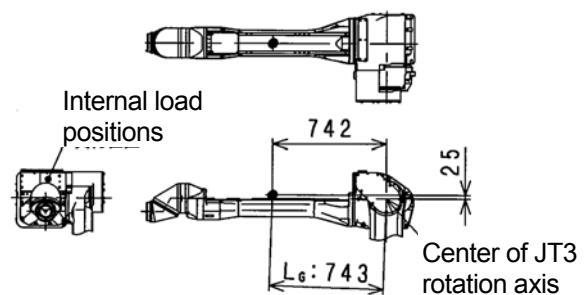


4. Load capacity of the forearm

For load on forearm, obey below conditions. Load mass of parts mounted inside forearm is included in spec.

Load conditions of the forearm

- Load mass: $M \leq M_{\max}$ (kg)
- Load position: $M \cdot L \leq M_{\max} \cdot L_G$
 L : Length from center of JT3 rotation axis (mm)
 M_{\max} : 25 kg
 L_G : 743 mm

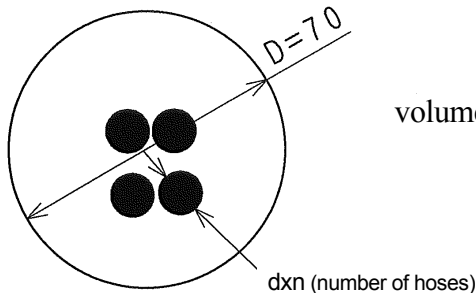


5. Paint wiring/piping

5.1 Hose(s) housed in the wrist

- (1) Inside diameter of hollow wrist is $\phi 70$.

The recommended volume ratio of the housed hose(s) is less than 25 %.* The volume ratio is calculated by the following expression.



$$\text{volume ratio} = \frac{\frac{d^2}{4} \pi n}{\frac{D^2}{4} \pi} \times 100[\%]$$

Area of hose(s) Area of wrist hollow



CAUTION

As calculated above, if sum cross-sectional area of the hose(s) exceeds the 25 % of cross-sectional area of the wrist hollow, hose lifetime will shorten. Also, even if sum volume ratio is less than 25 %, hose lifetime may become short depending on posture/angle of the wrist. Therefore, fully examine and test the hose(s) and their arrangement in wrist before starting operations.

NOTE* Consult Kawasaki before starting operations if volume ratio exceeds 25 % or when using a hose with $\phi 12$ or greater diameter.

- (2) Nylon is the recommended material for the enclosed hose.



CAUTION

Using a non-nylon hose may significantly reduce hose lifetime.

- (3) When installing the hose in the wrist, always apply lubricants, such as vaseline etc., to the entire hose. Inspect the housed hoses regularly** and replace them when any indication of failure or damage is found.

Recommended inspection period: every 500 hours

Replacement period of hoses (estimated): every 10000 hours

NOTE** Also, whenever hoses are inspected, apply lubricants to the entire housed hoses.

[NOTE]

The above replacement period is a recommended standard and is not meant as a period guaranteeing the life of the hoses.

9.0 CONNECTION OF AIR SYSTEM

Painting robots (KJ series) are explosion-proof robots protected by pressurized and intrinsically safe structures that comply with national laws and safety standards. The following explains the air supply to robot arm.



CAUTION

Regulator on side of robot arm is adjusted at factory shipment, however, check the regulator setting in installation and change it if necessary. Pilot air for external axis is connected to the pilot air inlet of external axis when an external axis is connected to the robot and is blocked when no external axis is used. Therefore, do not remove tube and plug.



CAUTION

Use clean air that meets specifications below.

- 1. Solid material0.01 μm or less**
- 2. Oil contentMist separation: 99.9999 % or more**
- 3. HumidityDew point: -17 °C or less at atmospheric pressure**
- 4. Input pressure0.4-0.7 MPa (4.1-7.1 kgf/cm^2)**
- 5. Input quantity350 L/min. (nor) (Only at purging)**

[NOTE]

When purging completes, the air operated valve set on exhaust port closes. After that, air consumption is minimized to only a little air leakage from various sealed sections.



CAUTION

When trying to operate the robot with insufficient air pressure (e.g. immediately after a compressor which supplies air is activated), an error occurs due to insufficient inner pressure and robot cannot be operated. Accordingly, operate the robot after sufficient air pressure is obtained.

9.1 ADJUSTMENT METHOD OF REGULATOR

If the setting value of the regulator on the robot arm side deviates from the standard value, adjust it in the procedure below. The standard value differs depending on the installation posture and explosion-proof spec. (Japan, China, North America and Europe). Accordingly, adjust to keep the standard value in accordance with each specification.

Procedure

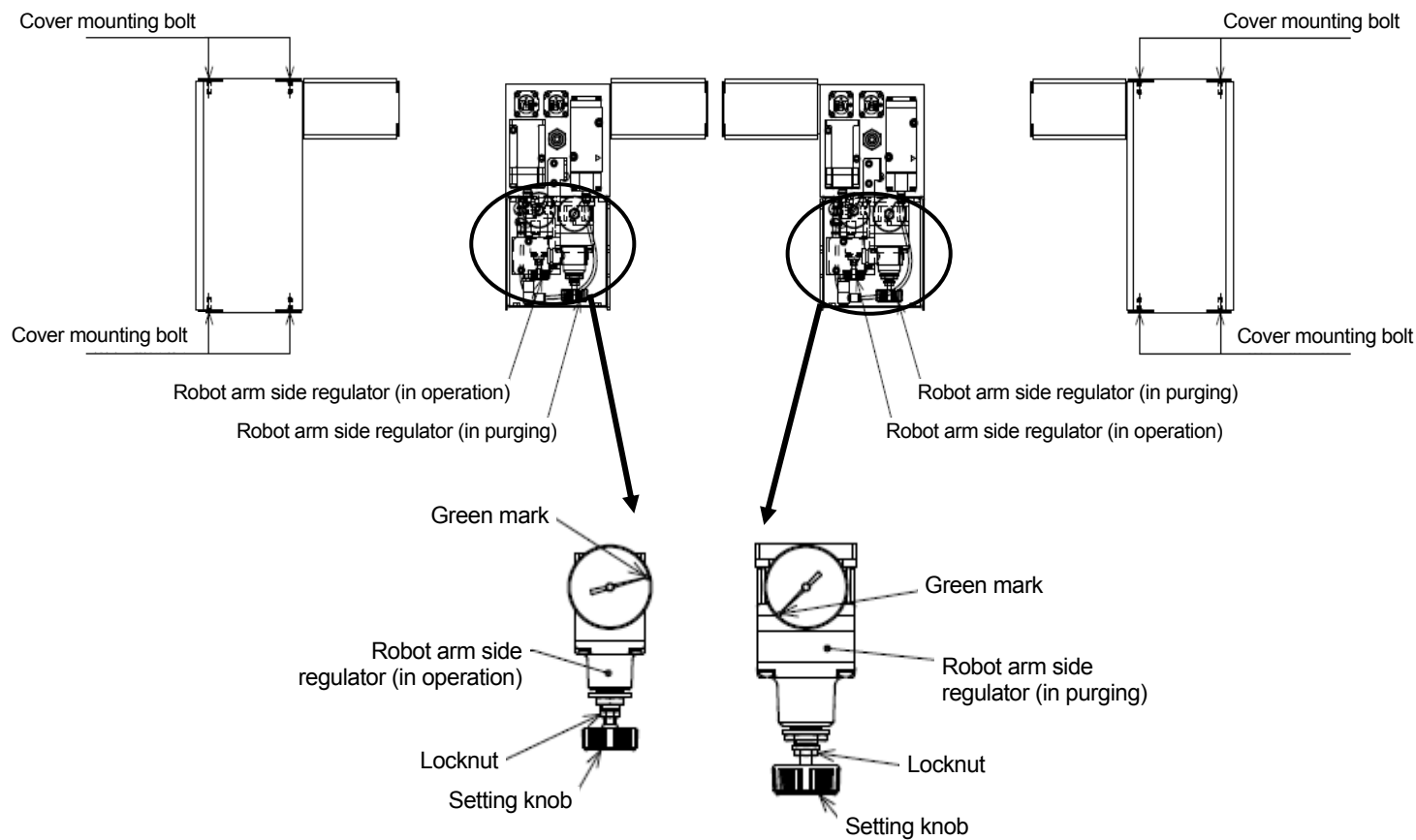
1. Turn OFF the controller power.
2. Dismount the air unit cover.
3. Loosen the locknut of the regulator on the robot arm side.
4. Turn the knob to set the regulator on the robot arm side, and adjust the setting value.



CAUTION

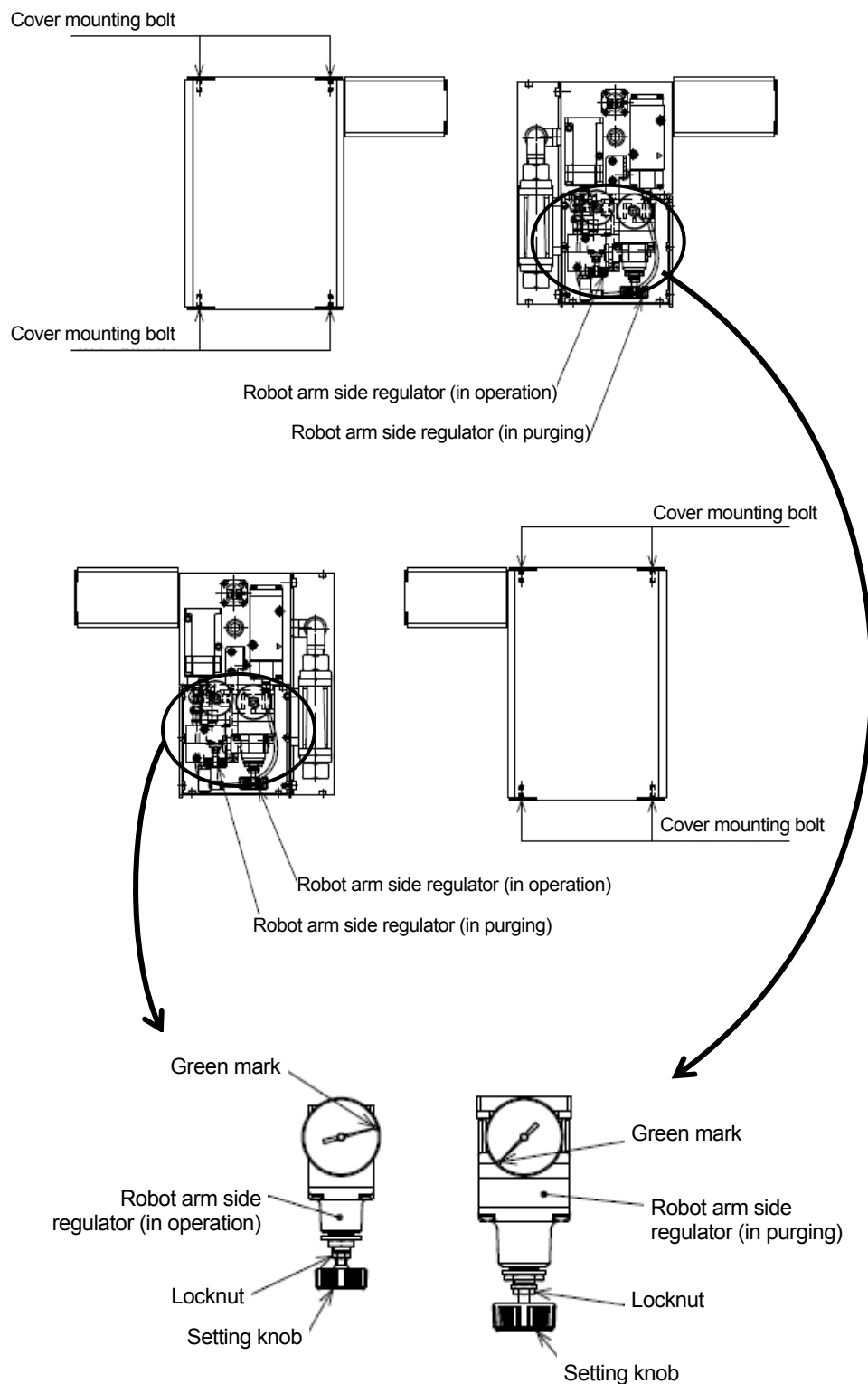
Adjust the regulator by turning the knob of the regulator toward the direction of increase of pressure little by little.

5. Screw and fix the locknut of the regulator on the robot arm side.
6. Wait at least two minutes after the adjustment, and check the setting value again. (Return to 3. if the setting value deviates.)
7. Turn ON the controller power.
8. Confirm that the purging completes normally.
9. Remount the air unit cover.



Japan/China
Explosion-proof spec.

Bolt type	Tightening torque [N·m]
M5 hexagon socket head flush bolt	3.4



North America Explosion-proof spec.	Bolt type	Tightening torque [N·m]
	M5 hexagon socket head flush bolt	3.4

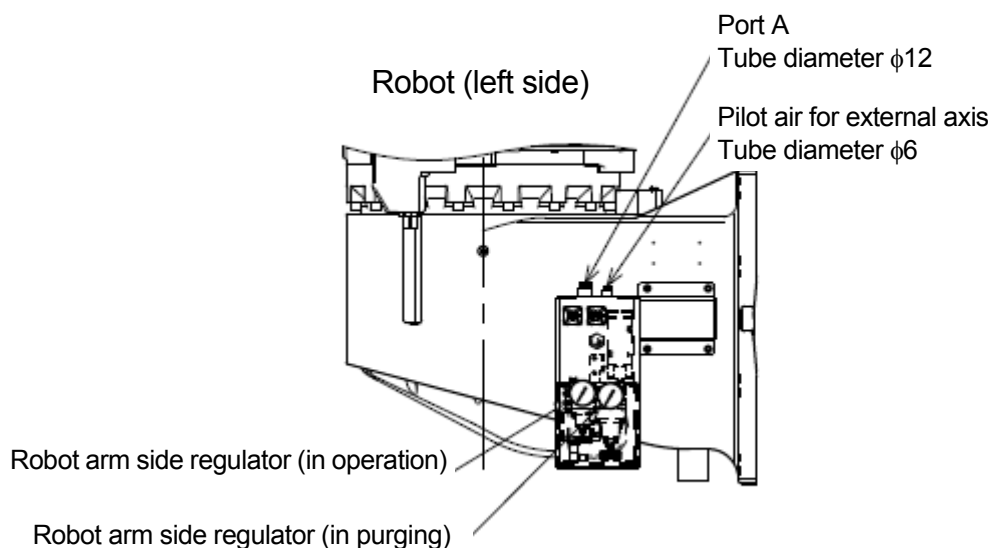
See 9.3 for Europe explosion-proof spec.

9.2 FOR JAPAN/CHINA/NORTH AMERICA EXPLOSION-PROOF SPECIFICATIONS

KJ314

(There are no differences between models with left-hand and right-hand rear arms.)

Air connecting port is provided on the swing unit of robot arm. Supply air from the air inlet of port A (tube diameter: $\phi 12$) on the rear of robot arm as shown in the figure below.



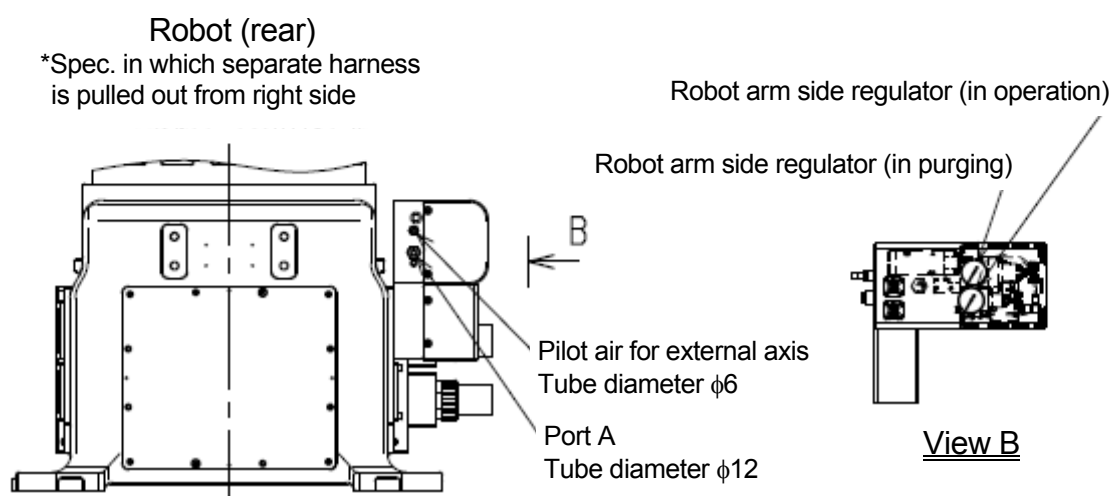
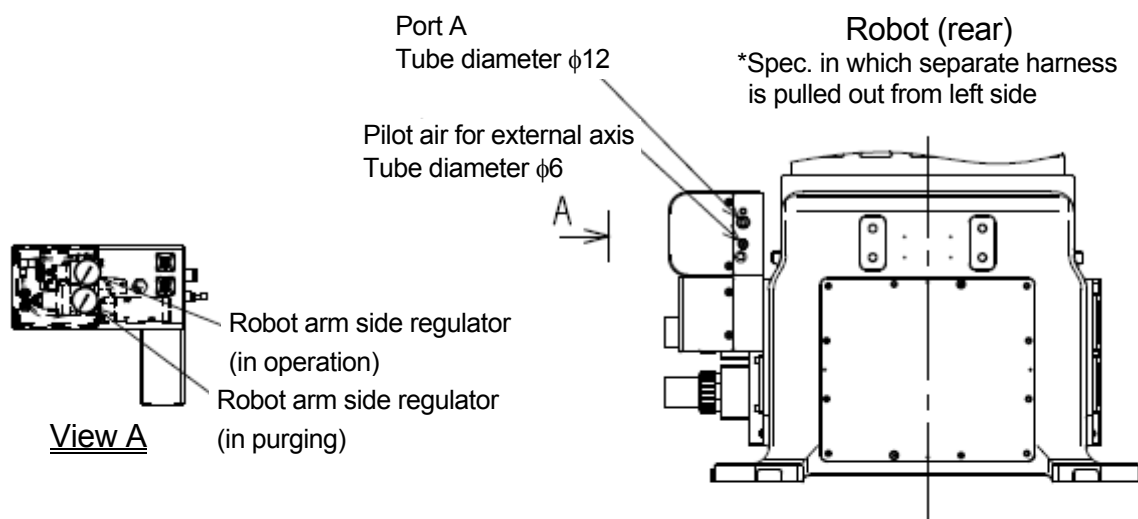
	Regulator on robot arm side (in operation)	Regulator on robot arm side (in purging)
Japan explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
China explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
North America explosion-spec.	15 [kPa] (0.015 [MPa])	145 [kPa] (0.145 [MPa])

Standard values of regulator

KJ264 (Floor mounted spec.)

(There are no differences between models with left-hand and right-hand rear arms.)

Air connecting port is provided on the base unit of robot arm. Supply air from the air inlet of port A (tube diameter: $\phi 12$) on the rear of robot arm as shown in the figure below.



	Regulator on robot arm side (in operation)	Regulator on robot arm side (in purging)
Japan explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
China explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
North America explosion-spec.	15 [kPa] (0.015 [MPa])	145 [kPa] (0.145 [MPa])

Standard values of regulator

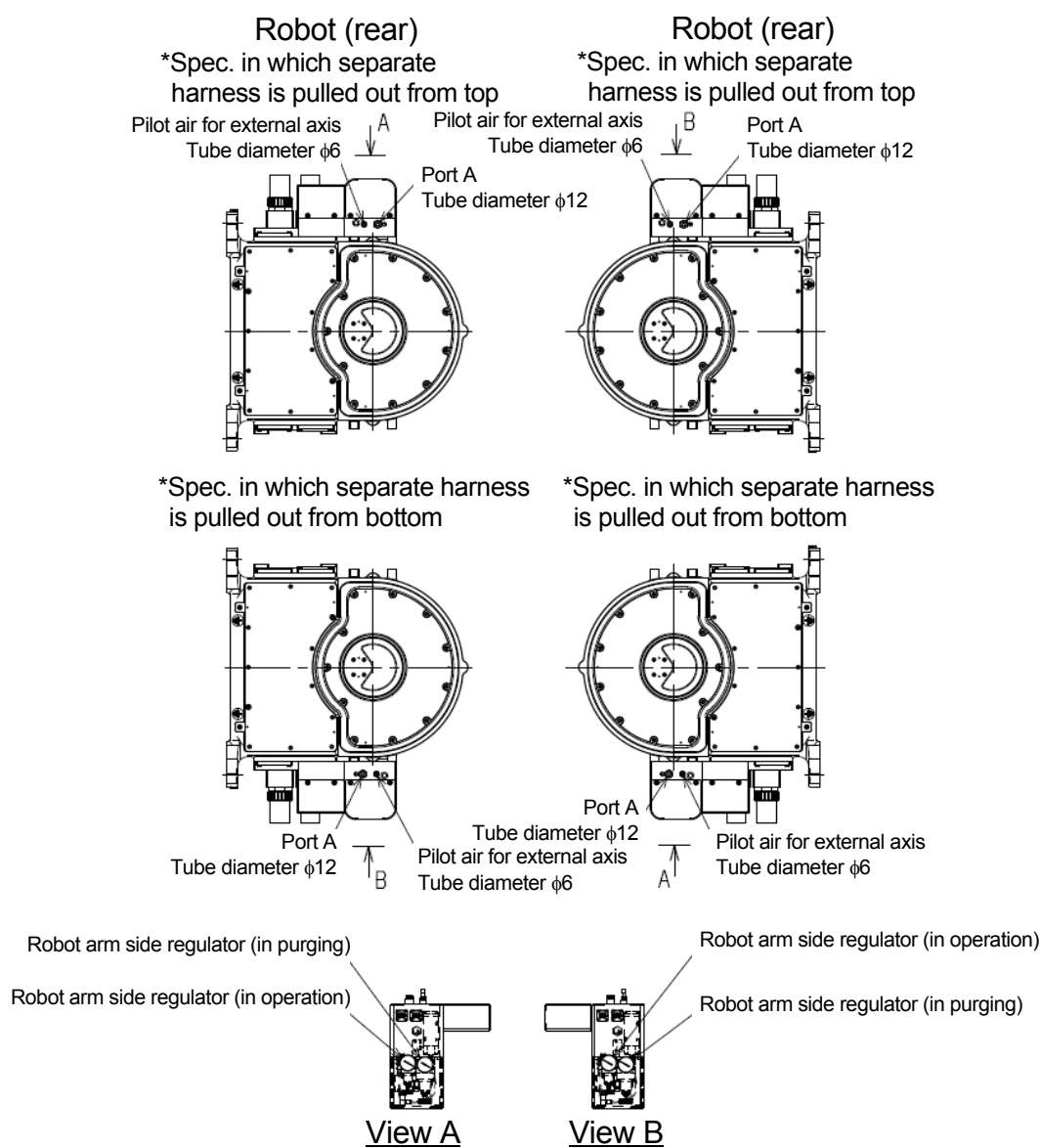
KJ264 (Wall mounted (left) spec.)

(There are no differences between models with left-hand and right-hand rear arms.)

KJ264 (Wall mounted (right) spec.)

(There are no differences between models with left-hand and right-hand rear arms.)

Air connecting port is provided on the base unit of robot arm. Supply air from the air inlet of port A (tube diameter: $\phi 12$) on the rear of robot arm as shown in the figure below.



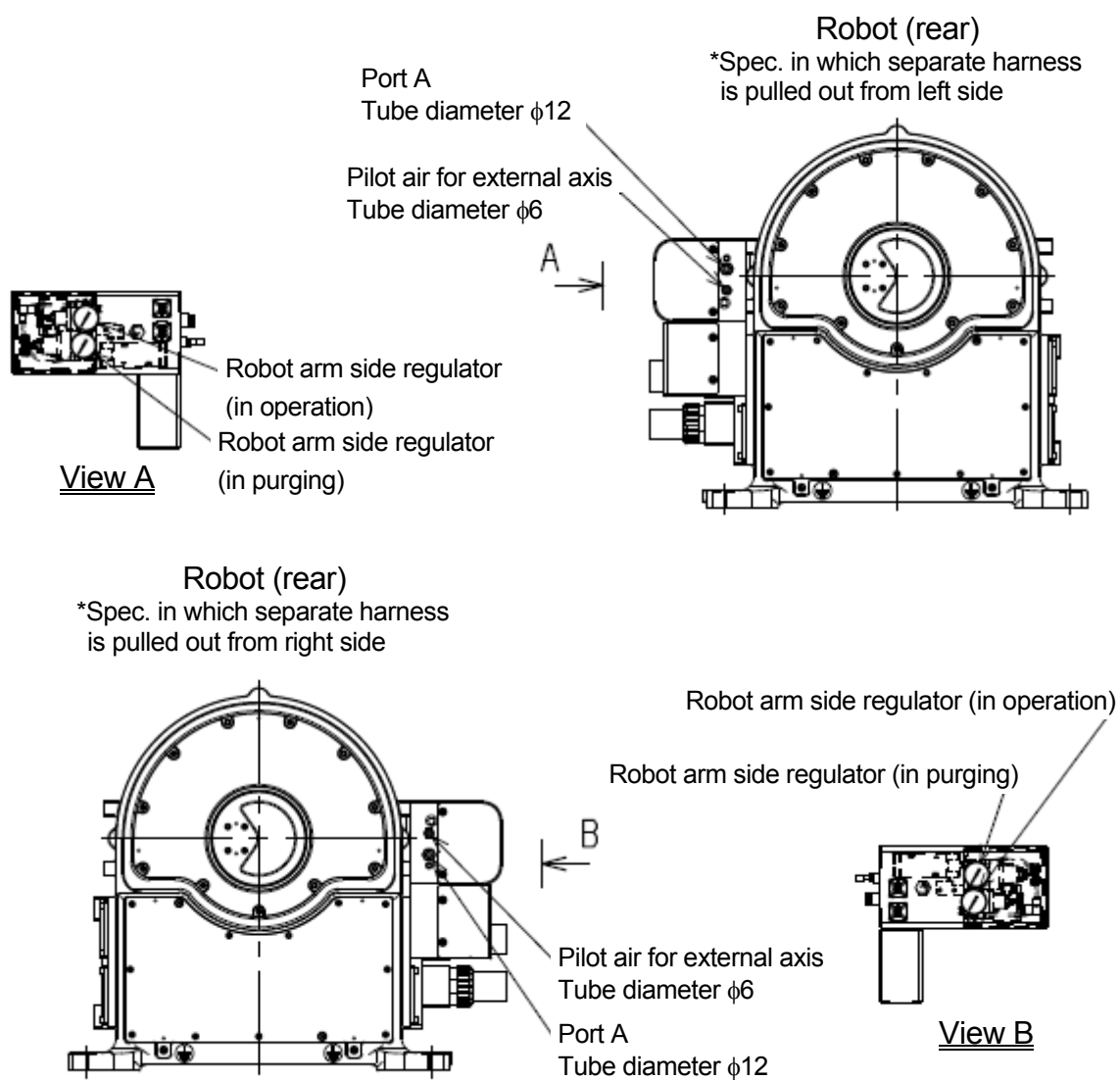
	Regulator on robot arm side (in operation)	Regulator on robot arm side (in purging)
Japan explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
China explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
North America explosion-spec.	15 [kPa] (0.015 [MPa])	145 [kPa] (0.145 [MPa])

Standard values of regulator

KJ264 (Shelf mounted spec.)

(There are no differences between models with left-hand and right-hand rear arms.)

Air connecting port is provided on the base unit of robot arm. Supply air from the air inlet of port A (tube diameter: $\phi 12$) on the rear of robot arm as shown in the figure below.



	Regulator on robot arm side (in operation)	Regulator on robot arm side (in purging)
Japan explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
China explosion-spec.	15 [kPa] (0.015 [MPa])	160 [kPa] (0.160 [MPa])
North America explosion-spec.	15 [kPa] (0.015 [MPa])	145 [kPa] (0.145 [MPa])

Standard values of regulator

9.3 FOR EUROPE EXPLOSION-PROOF SPECIFICATION

Air connecting port is provided in base section of robot arm. Supply air from the air inlet of port A (tube diameter: $\phi 12$) on the rear of robot arm as shown in the figure below.

NOTE: Air flow rate leaked from robot arm is approximately 20 L/min. (nor).



CAUTION

Do not change regulator setting on side of robot arm as it is adjusted at factory shipment.

Purge control unit

Manufacturer: Gönheimer Elektronik GmbH
Model: FS850S.6.8.1

Digital solenoid valve

Manufacturer: Gönheimer Elektronik GmbH
Model: SVP.5



CAUTION

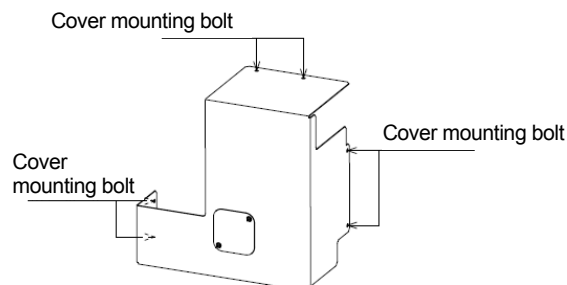
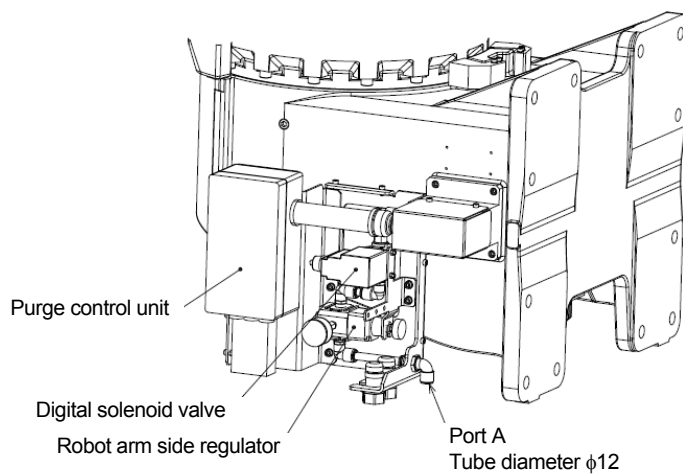
Use clean air that meets specifications below.

- 1. Solid material.... 0.01 μm or less**
- 2. Oil content..... Mist separation: 99.9999 % or more**
- 3. Humidity Dew point: -17 °C or less at atmospheric pressure.**
- 4. Input pressure .. 0.4-0.7 MPa (4.1-7.1 kgf/cm²)**
- 5. Input quantity... 500 L/min. (nor) (Only at purging)**

For EN Explosion-proof spec arm, the digital solenoid valve set on the purging side is changed to the leakage compensation side when purging is completed. After that, air is required to compensate for exhausted cooling air and small air leaks from sealed parts in various places.

KJ314

(There are no differences between models with left-hand and right-hand rear arms.)

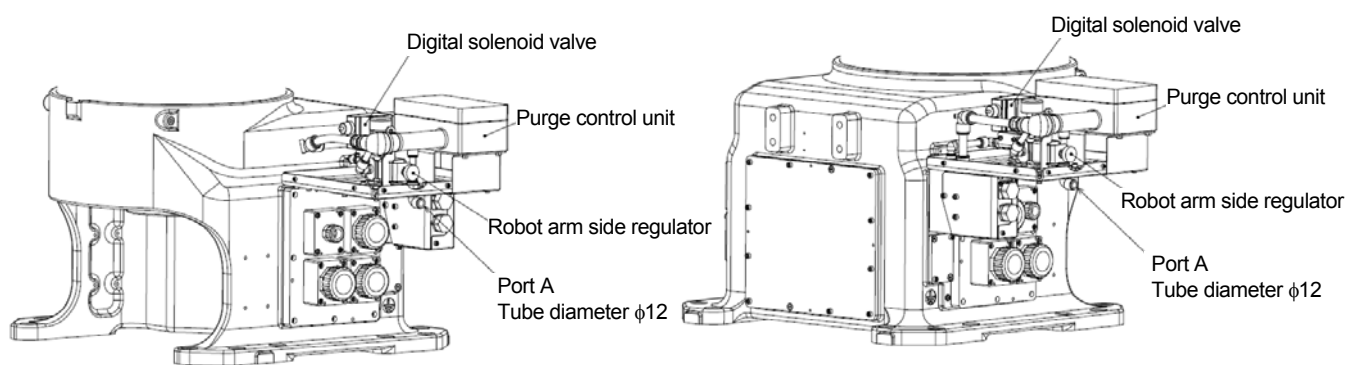


Bolt type	Tightening torque [N·m]
M5 hexagon socket head flush bolt	6.9

Regulator on robot arm side
300 [kPa] (0.30 [MPa])

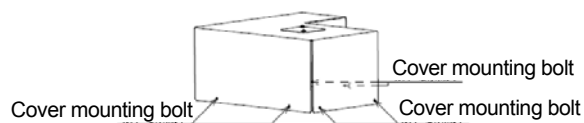
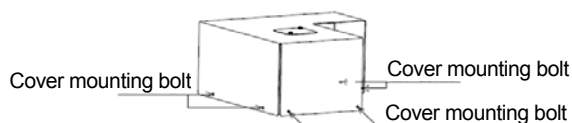
KJ264 (Floor mounted spec.)

(There are no differences between models with left-hand and right-hand rear arms.)



Regulator on robot arm side
300 [kPa] (0.30 [MPa])

Bolt type	Tightening torque [N·m]
M5 hexagon socket head flush bolt	6.9



KJ264 (Wall mounted (left) spec.)

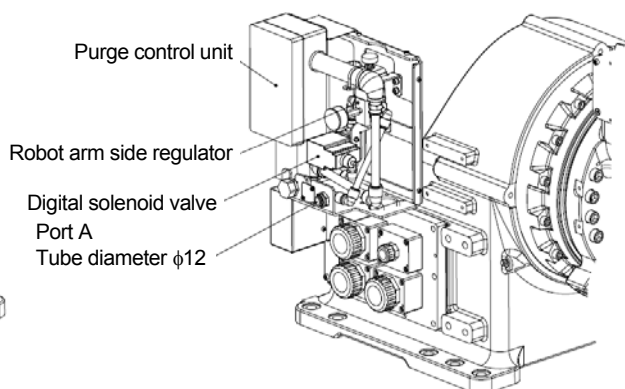
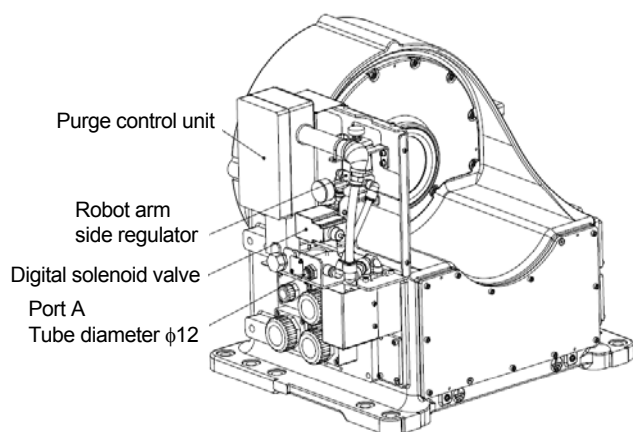
(There are no differences between models with left-hand and right-hand rear arms.)

KJ264 (Wall mounted (right) spec.)

(There are no differences between models with left-hand and right-hand rear arms.)

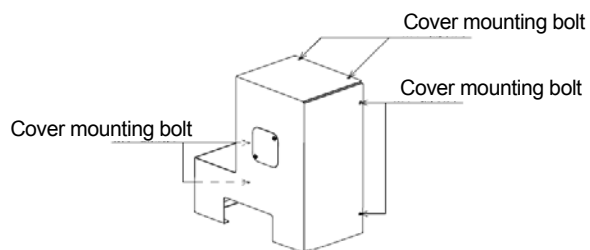
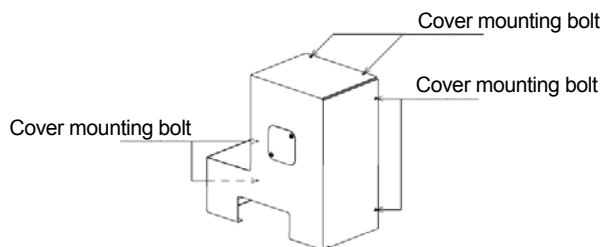
KJ264 (Shelf mounted spec.)

(There are no differences between models with left-hand and right-hand rear arms.)



Bolt type	Tightening torque [N·m]
M5 hexagon socket head flush bolt	6.9

Regulator on robot arm side
300 [kPa] (0.30 [MPa])



9.4 PARAMETERS OF PURGE CONTROL UNIT (ONLY FOR EN EXPLOSION-PROOF SPEC. ARM)

The parameters of purge control unit are set as shown below.

1. Pur. Vol.:	7050 ℓ
2. Min. Fl. P.:	4.7 ℓ/s
3. Min. Pres.:	1.5 mbar
4. Max. Pres.:	27 mbar
5. R. Pre. Pu.:	20.4 mbar
6. Rated Pr.:	3 mbar
7. Sig. Pr.:	2 mbar

NOTE* This setting value ensures that the purging flow rate is more than 420 L/min (nor).



WARNING

Do not change the setting parameter approved by Explosion-protection Notified Bodies (ExNB).



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Installation and Connection Manual

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