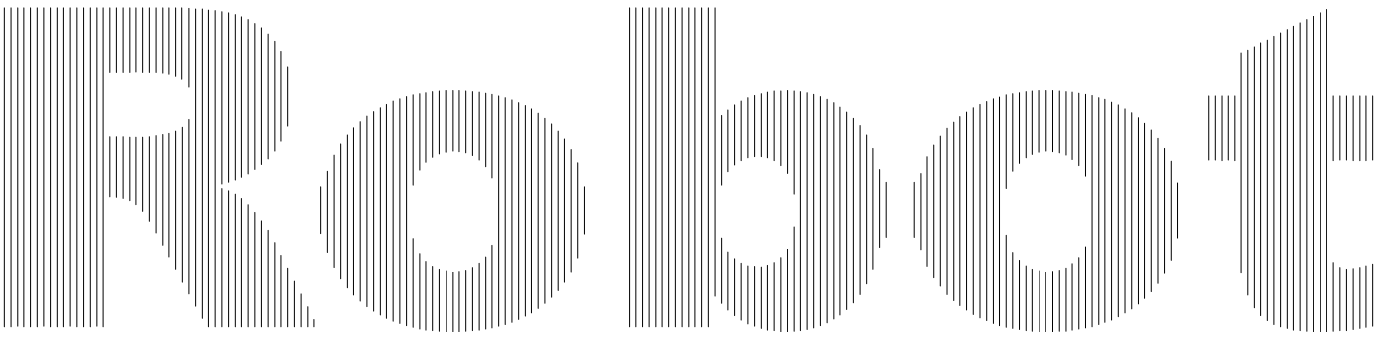
Simple and friendly

Kawasaki

Kawasaki Robot
KF19/26

Installation and Connection Manual

E Controller



Kawasaki Heavy Industries, Ltd.

90202-1116DEA

PREFACE

This manual describes the installation and connection of Kawasaki Painting Robot KF19/26 series.

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

This manual describes only the installation and connection of KF19/26 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 robot models.

KF192, KF262

KF193, KF263

KF194, KF264

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

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 out from under the lifted robot arm.**

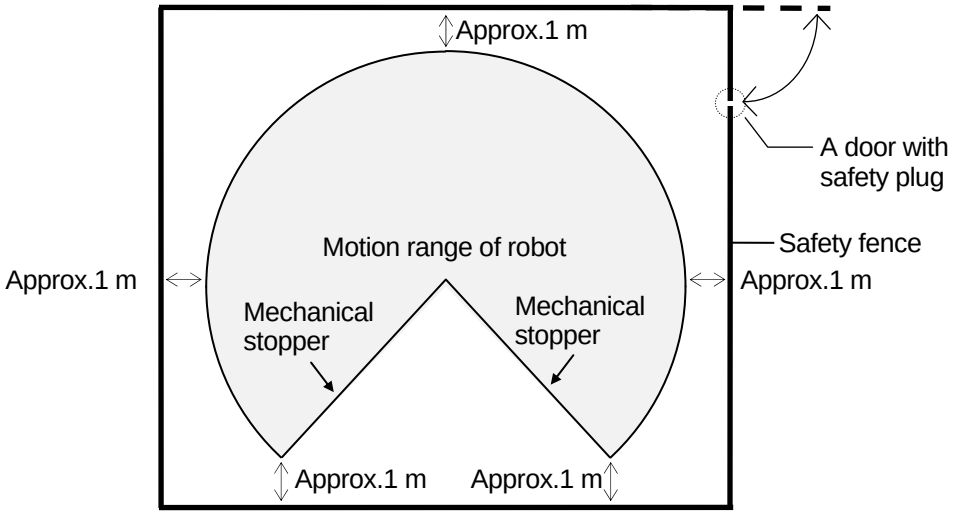
⚠ CAUTION

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

1.2 INSTALLING ENVIRONMENT 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 ±5°.
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.)
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, perform warm-up operation 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) Install safety fence so the maximum movement of fully equipped robot arm (with tools) does not cause interference.
   (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]

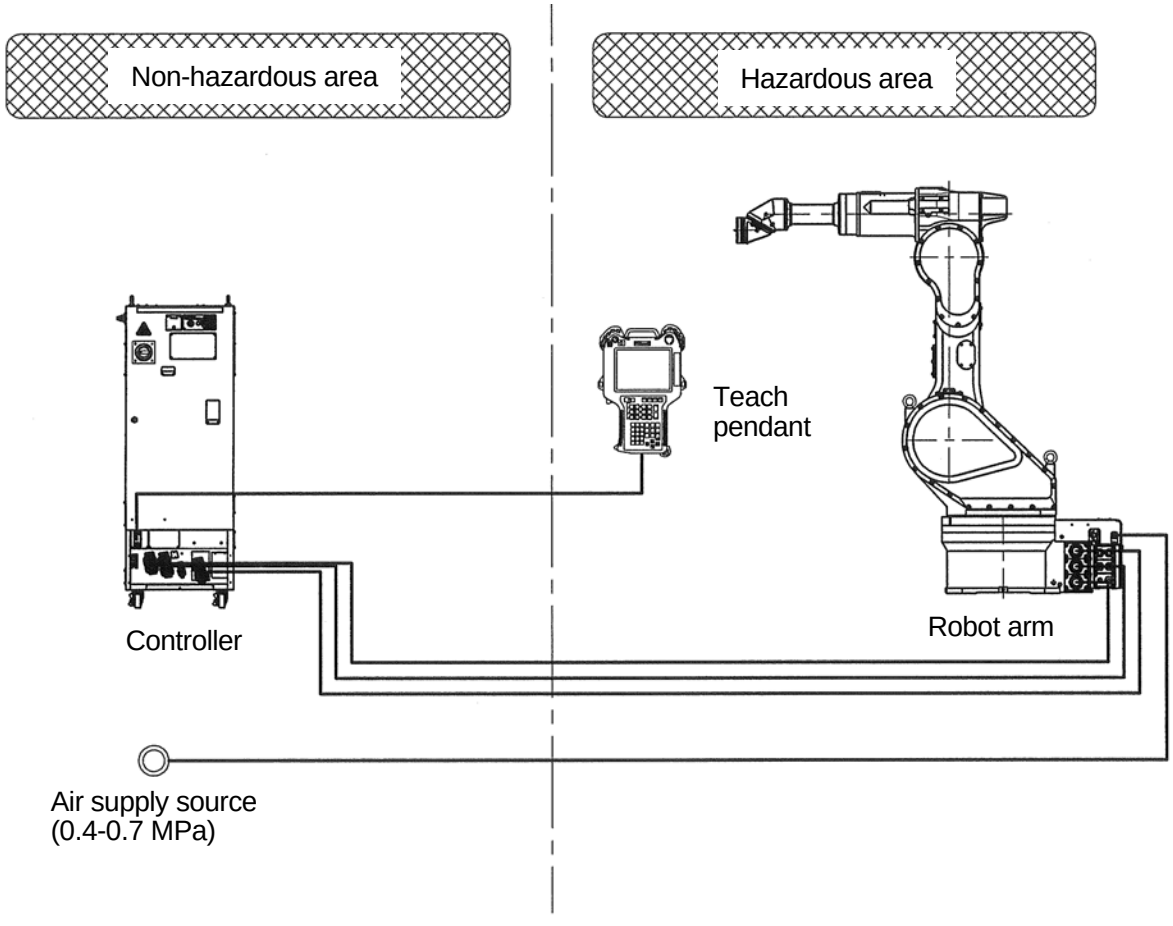
Protect sealed joints, etc. on the robot arm axes with vinyl sheets, etc. to prevent paint mist/foreign materials from entering.

1.3 CAUTIONARY INSTRUCTIONS FOR EXPLOSION-PROOF

KF19/26 series robot is an explosion-proof robot 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, inspection, or for inspection and adjustments of painting equipment, always turn OFF controller power up to the external power switch for shutting off power supply to the robot controller, close the air supply valve and confirm there is no residual pressure in any air supply lines.**

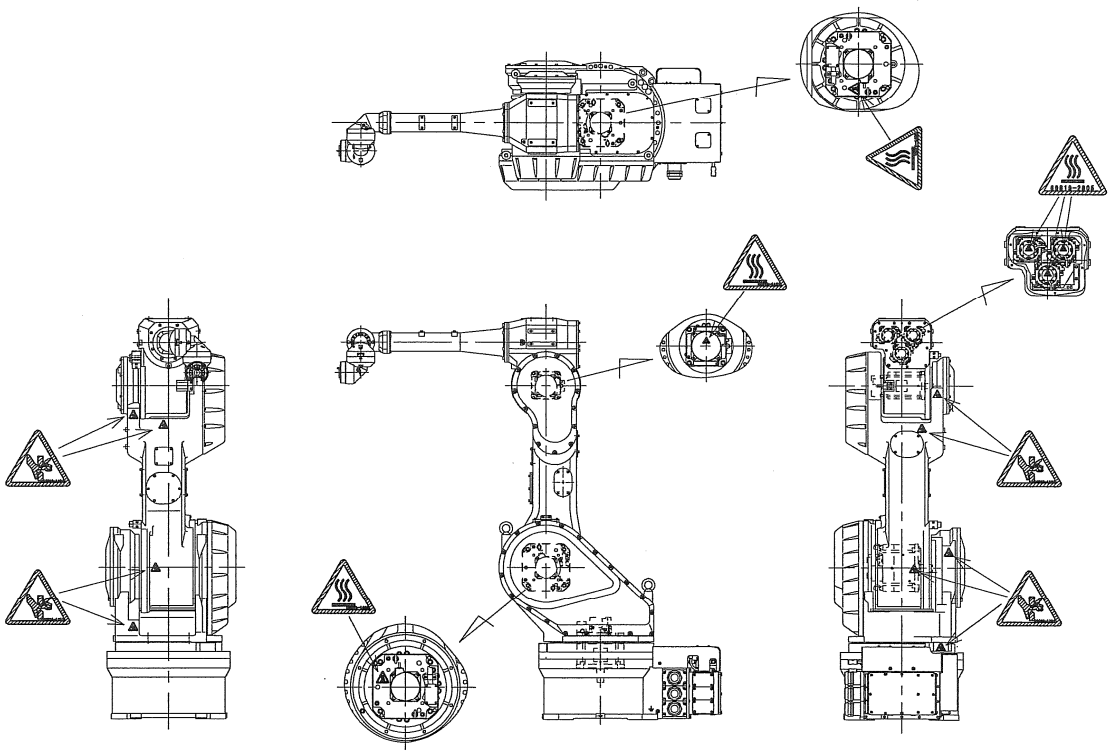


1.4 WARNING LABEL

WARNING

During operations, pay attention to the warning labels on the robot exterior as shown in the figures below.

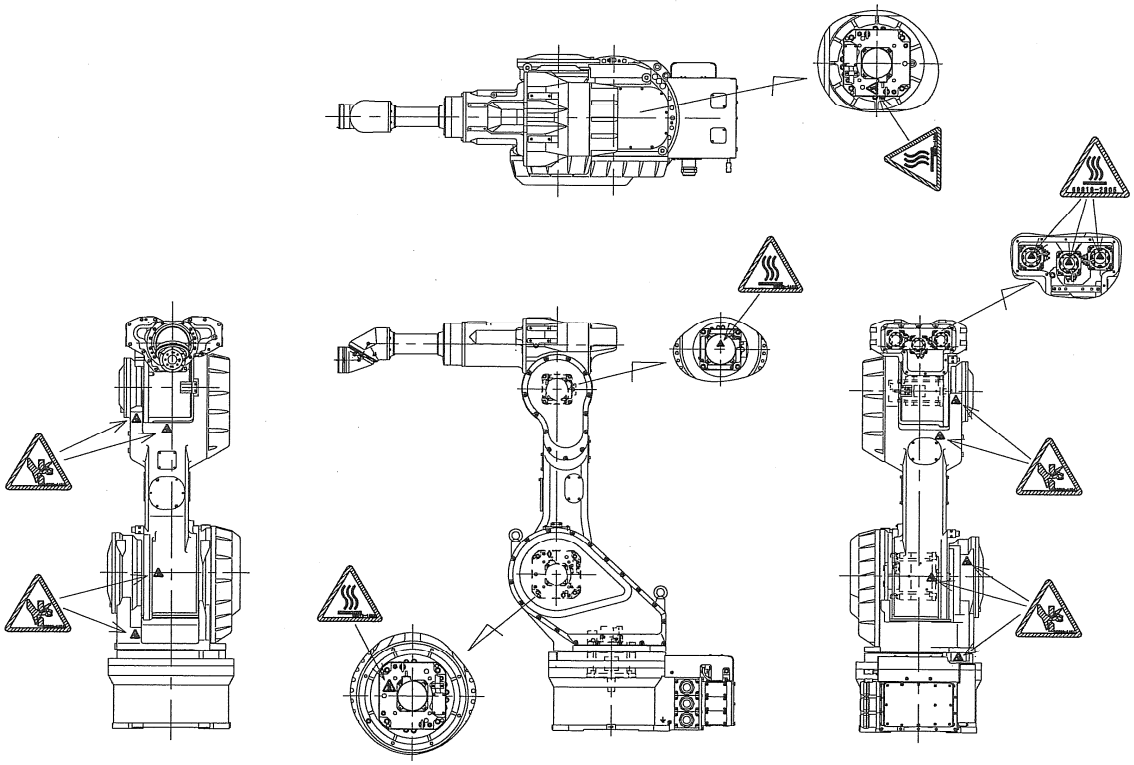
KF192, KF262



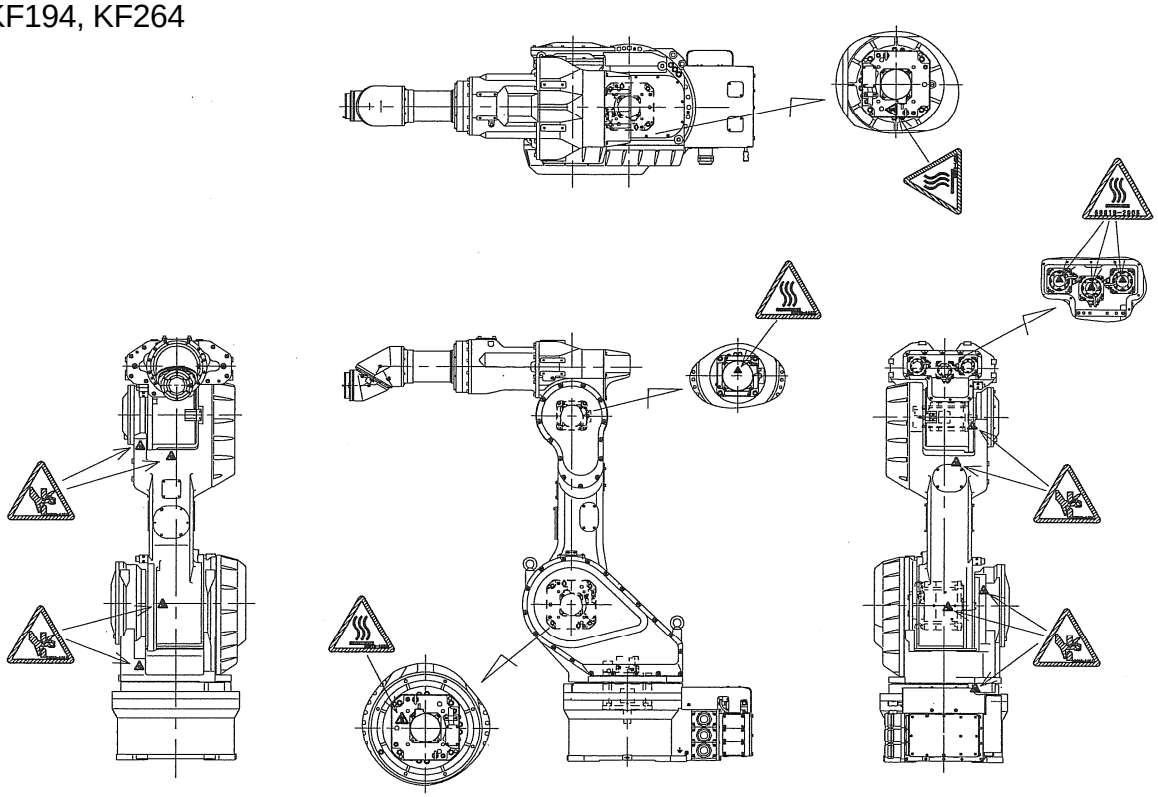
: Warning label for pinching

: Warning label for high temperature

KF193, KF263



KF194, KF264



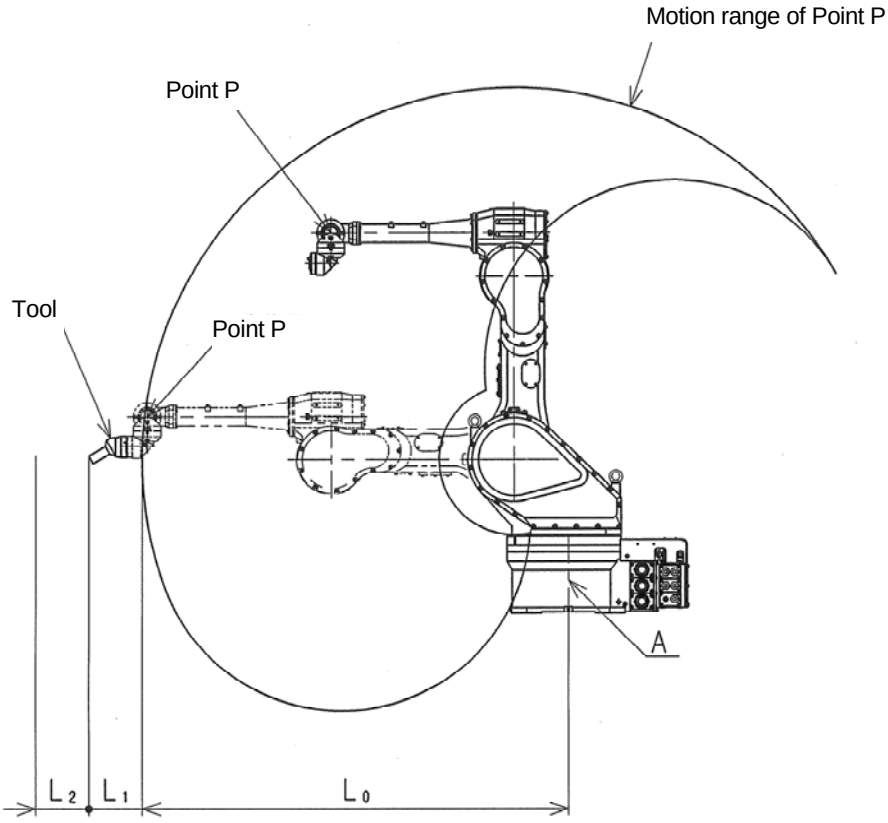
: Warning label for pinching

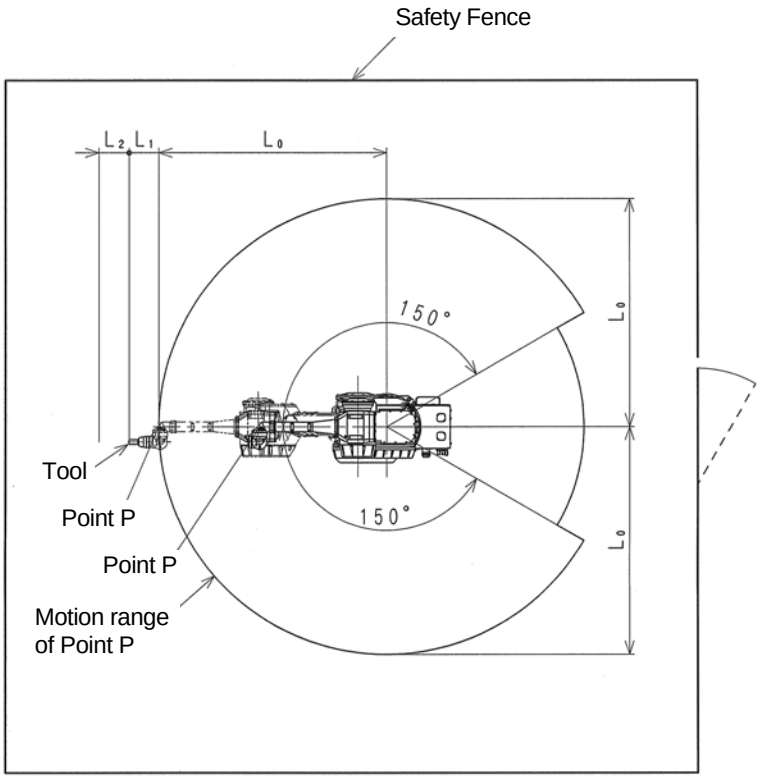
: Warning label for high temperature

2.0 MOTION RANGE & SPECIFICATIONS OF ROBOT

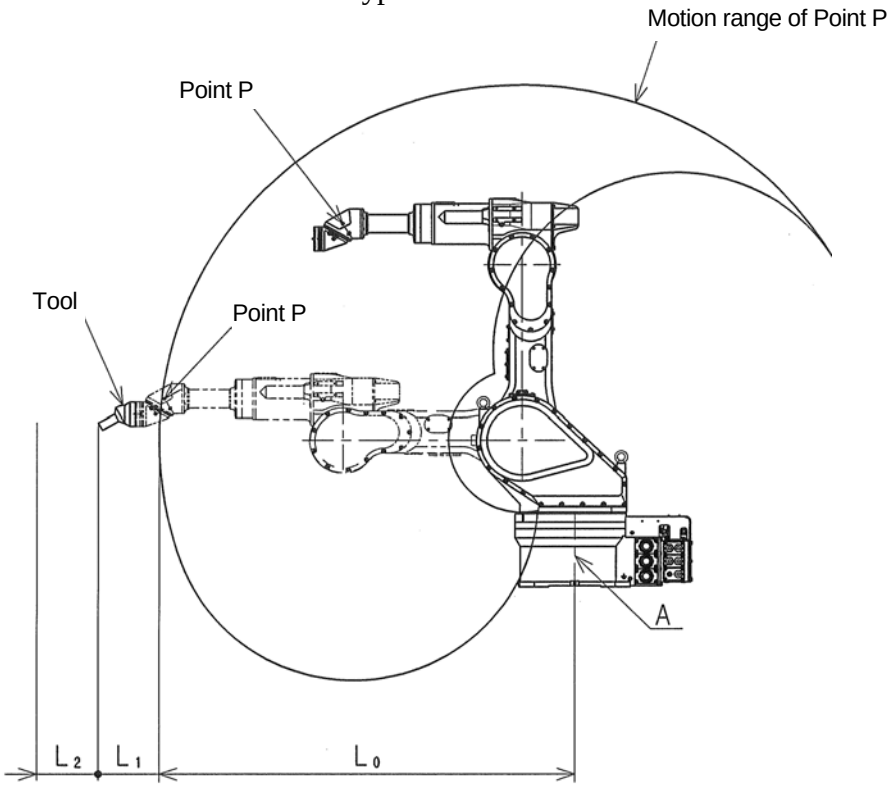
DETERMINATION OF SAFETY FENCE INSTALLATION LOCATION

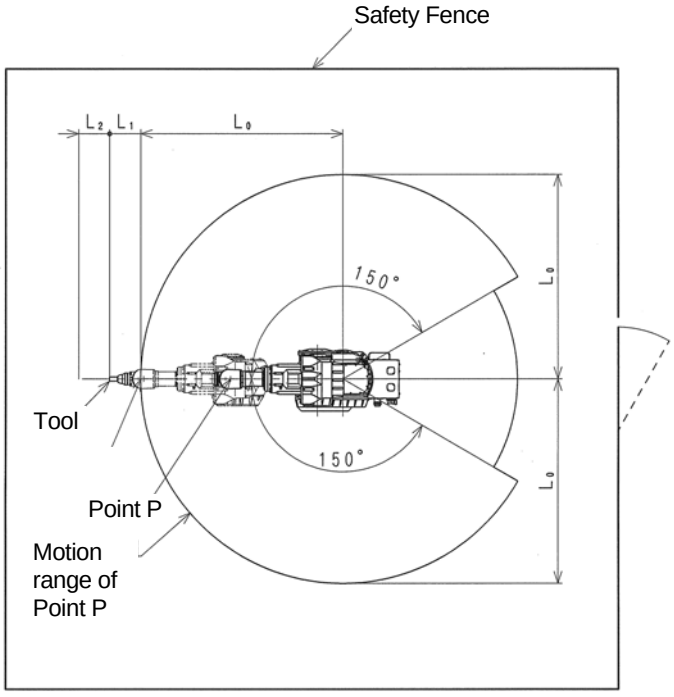
The figure below shows the robot with BBR type of wrist.





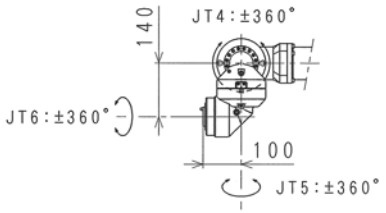
The figure below shows the robot with 3R type of wrist.



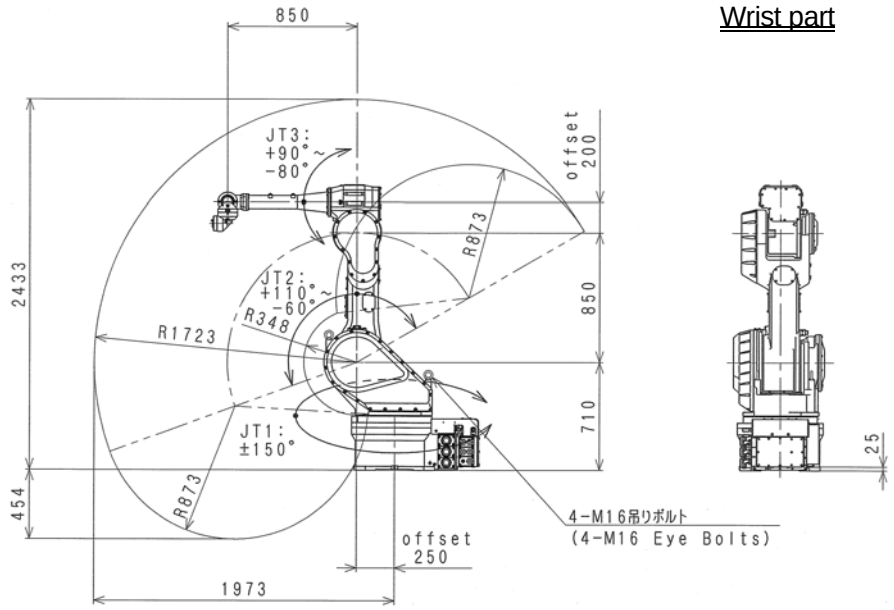


The motion range of robot arm is represented by Point P in the figure above. Accordingly, the dimensions of safety should be calculated as follows: Determine sum of L_0, L_1 and L_2 as minimum dimension. That is: dimension from the center of arm (Point A shown in the figure above) to the center of wrist ($=L_0$) + dimension from the center of wrist to the edge of tool ($=L_1$) + dimension of allowance ($=L_2$).

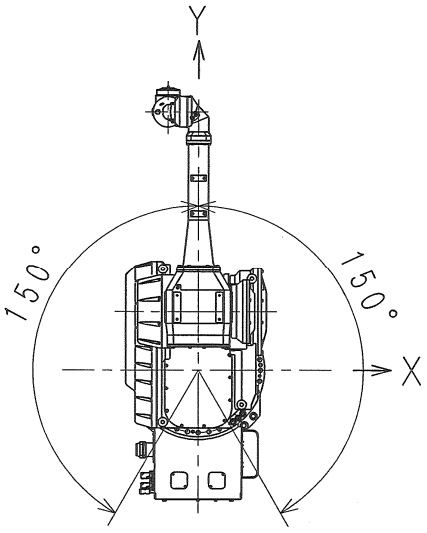
KF192



Wrist part



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	±150°	
	2	+110° - -60°	
	3	+90° - -80°	
	4	±360°	
	5	±360°	
	6	±360°	
Load capacity	Wrist section: 12 kg (on flange) Forearm section:20 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	33.3 N·m	1.28 kg·m^2
	5	28.8 N·m	0.96 kg·m^2
	6	7.9 N·m	0.10 kg·m^2
Repeatability	±0.5 mm (Face of wrist flange)		
Mass	Approx. 690 kg		
Acoustic noise	74 dB (A)*		

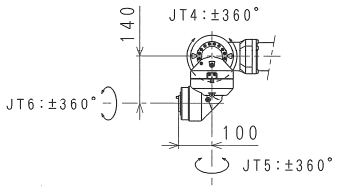


NOTE* measured condition:

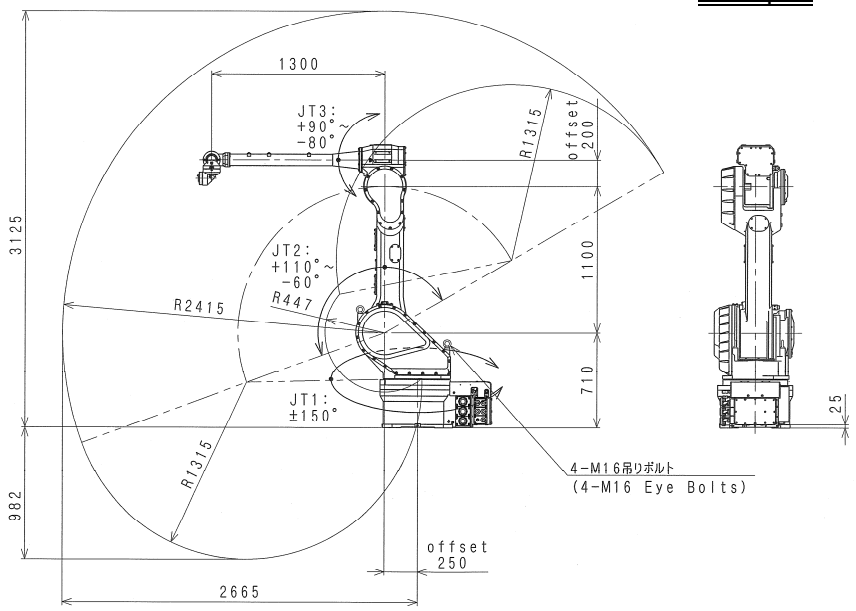
- installed on the plate rigidly fixed on the floor
- 3200 mm away from JT1 rotation center

(The noise level depends on the conditions.)

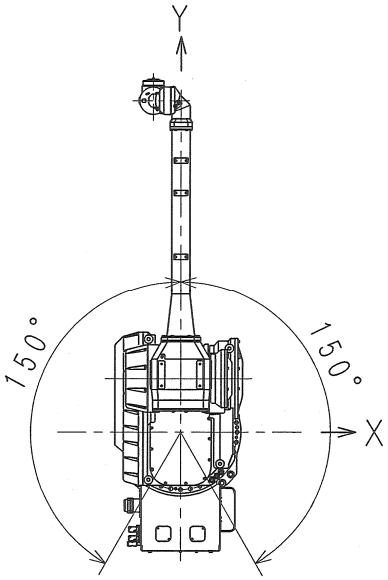
KF262



Wrist part



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	±150°	
	2	+110° - -60°	
	3	+90° - -80°	
	4	±360°	
	5	±360°	
	6	±360°	
Load capacity	Wrist section: 12 kg (on flange) Forearm section:20 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	33.3 N·m	1.28 kg·m^2
	5	28.8 N·m	0.96 kg·m^2
	6	7.9 N·m	0.10 kg·m^2
Repeatability	±0.5 mm (Face of wrist flange)		
Mass	Approx. 720 kg		
Acoustic noise	74 dB (A)*		

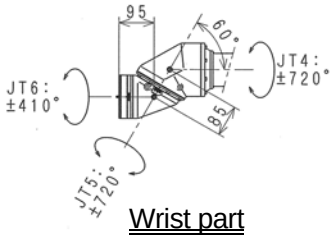


NOTE* measured condition:

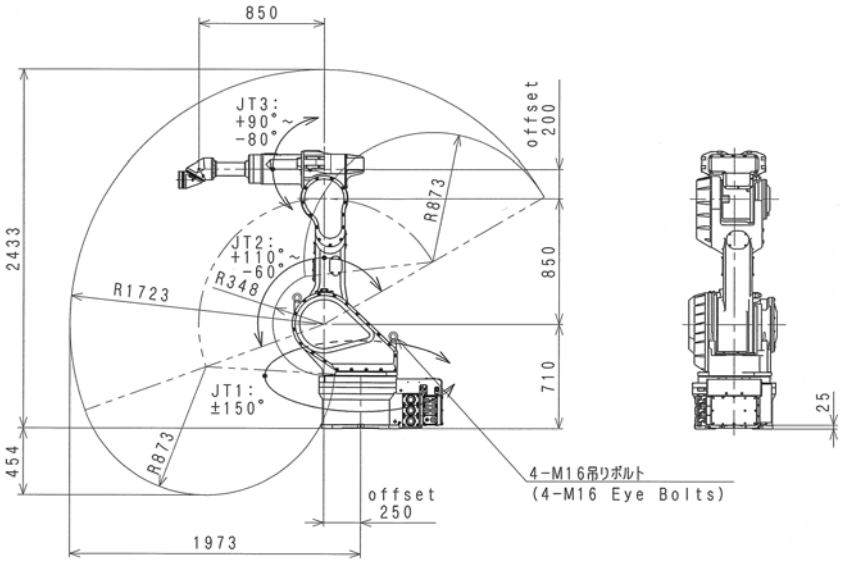
- installed on the plate rigidly fixed on the floor
- 3900 mm away from JT1 rotation center

(The noise level depends on the conditions.)

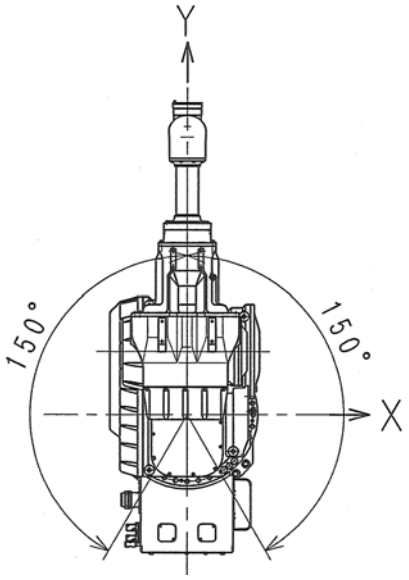
KF193



Wrist part



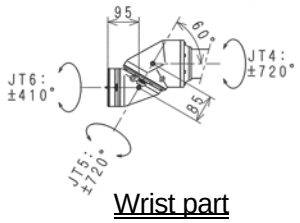
Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	±150°	
	2	+110° - -60°	
	3	+90° - -80°	
	4	±720°	
	5	±720°	
	6	±410°	
Load capacity	Wrist section: 12 kg (on flange) Forearm section:20 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	33.1 N·m	1.27 kg·m^2
	5	26.7 N·m	0.82 kg·m^2
	6	7.9 N·m	0.10 kg·m^2
Repeatability	±0.5 mm (Face of wrist flange)		
Mass	Approx. 720 kg		
Acoustic noise	74 dB (A)*		



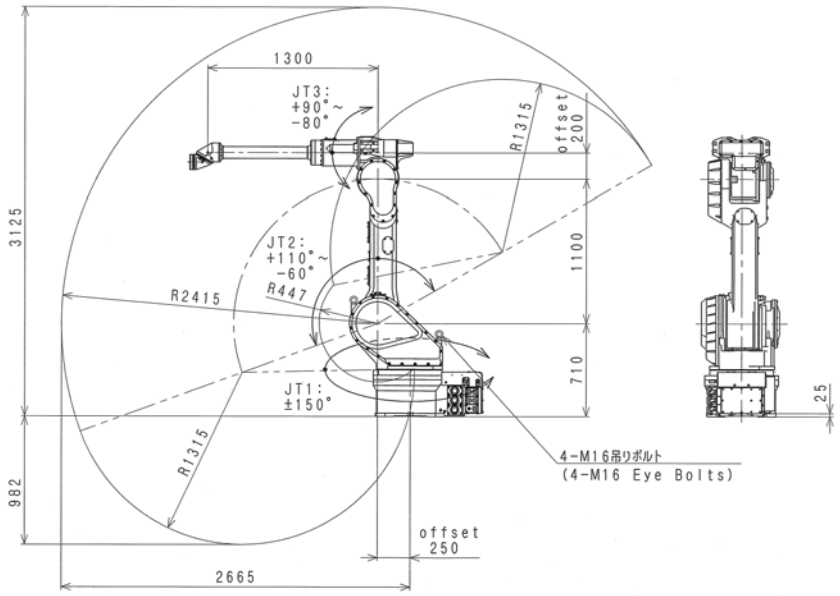
NOTE* measured condition:
- installed on the plate rigidly fixed on the floor
- 3200 mm away from JT1 rotation center

(The noise level depends on the conditions.)

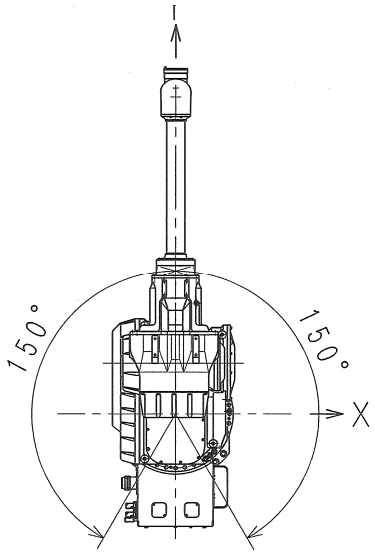
KF263



Wrist part



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	±150°	
	2	+110° - -60°	
	3	+90° - -80°	
	4	±720°	
	5	±720°	
	6	±410°	
Load capacity	Wrist section: 12 kg (on flange) Forearm section:20 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	33.1 N·m	1.27 kg·m^2
	5	26.7 N·m	0.82 kg·m^2
	6	7.9 N·m	0.10 kg·m^2
Repeatability	±0.5 mm (Face of wrist flange)		
Mass	Approx. 740 kg		
Acoustic noise	74 dB (A)*		

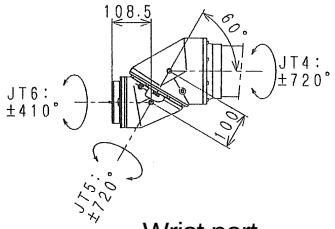


NOTE* measured condition:

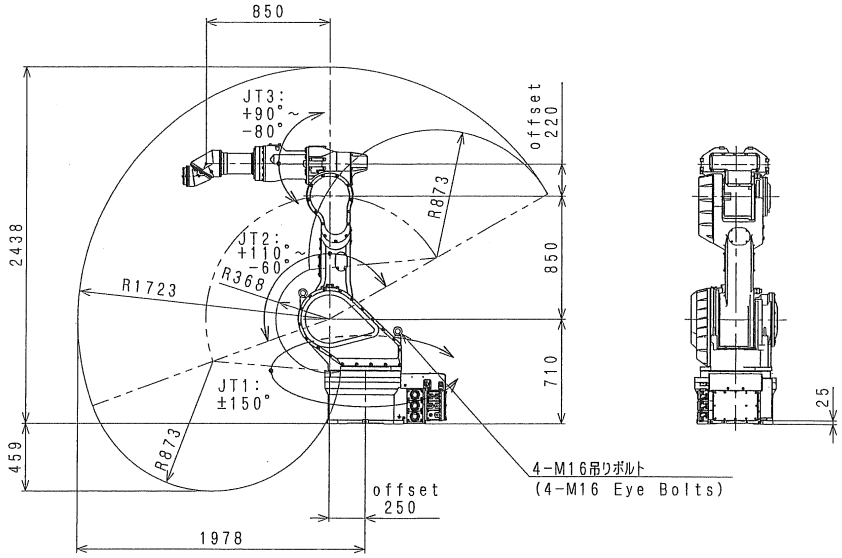
- installed on the plate rigidly fixed on the floor
- 3900 mm away from JT1 rotation center

(The noise level depends on the conditions.)

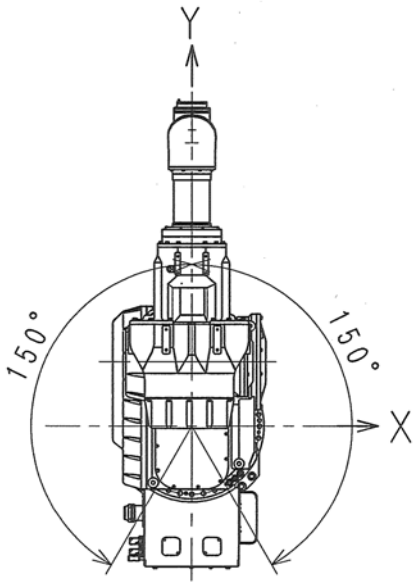
KF194



Wrist part



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	±150°	
	2	+110° - -60°	
	3	+90° - -80°	
	4	±720°	
	5	±720°	
	6	±410°	
Load capacity	Wrist section: 12 kg (on flange) Forearm section:20 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	35.3 N·m	1.44 kg·m^2
	5	27.7 N·m	0.89 kg·m^2
	6	7.9 N·m	0.10 kg·m^2
Repeatability	±0.5 mm (Face of wrist flange)		
Mass	Approx. 750 kg		
Acoustic noise	74 dB (A)*		

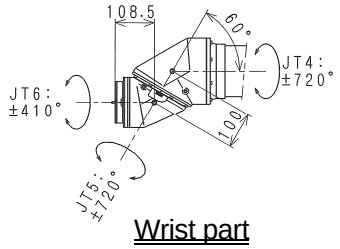


NOTE* measured condition:

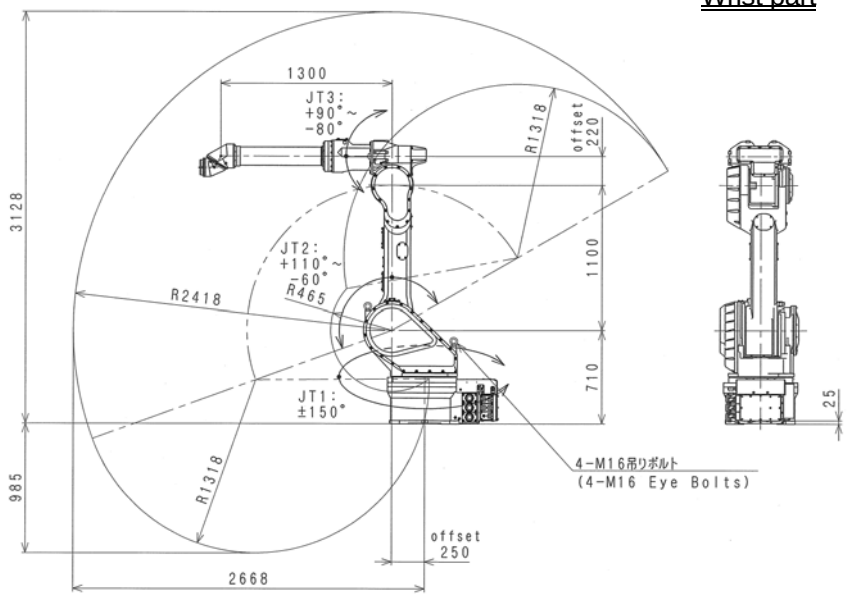
- installed on the plate rigidly fixed on the floor
- 3200 mm away from JT1 rotation center

(The noise level depends on the conditions.)

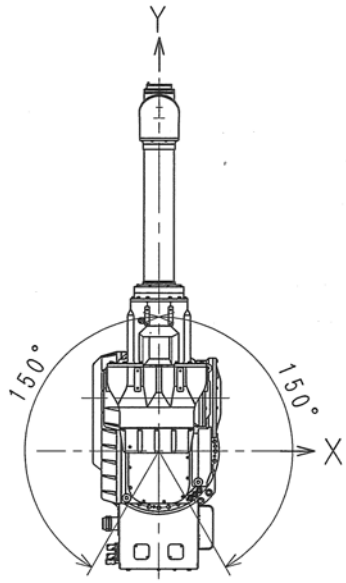
KF264



Wrist part



Type	Articulated robot		
Degree of freedom	6		
Motion range	JT	Motion range	
	1	±150°	
	2	+110° - -60°	
	3	+90° - -80°	
	4	±720°	
	5	±720°	
	6	±410°	
Load capacity	Wrist section: 12 kg (on flange) Forearm section:20 kg		
Wrist load capacity	JT	Torque	Moment of inertia
	4	35.3 N·m	1.44 kg·m^2
	5	27.7 N·m	0.89 kg·m^2
	6	7.9 N·m	0.10 kg·m^2
Repeatability	±0.5 mm (Face of wrist flange)		
Mass	Approx. 770 kg		
Acoustic noise	74 dB (A)*		



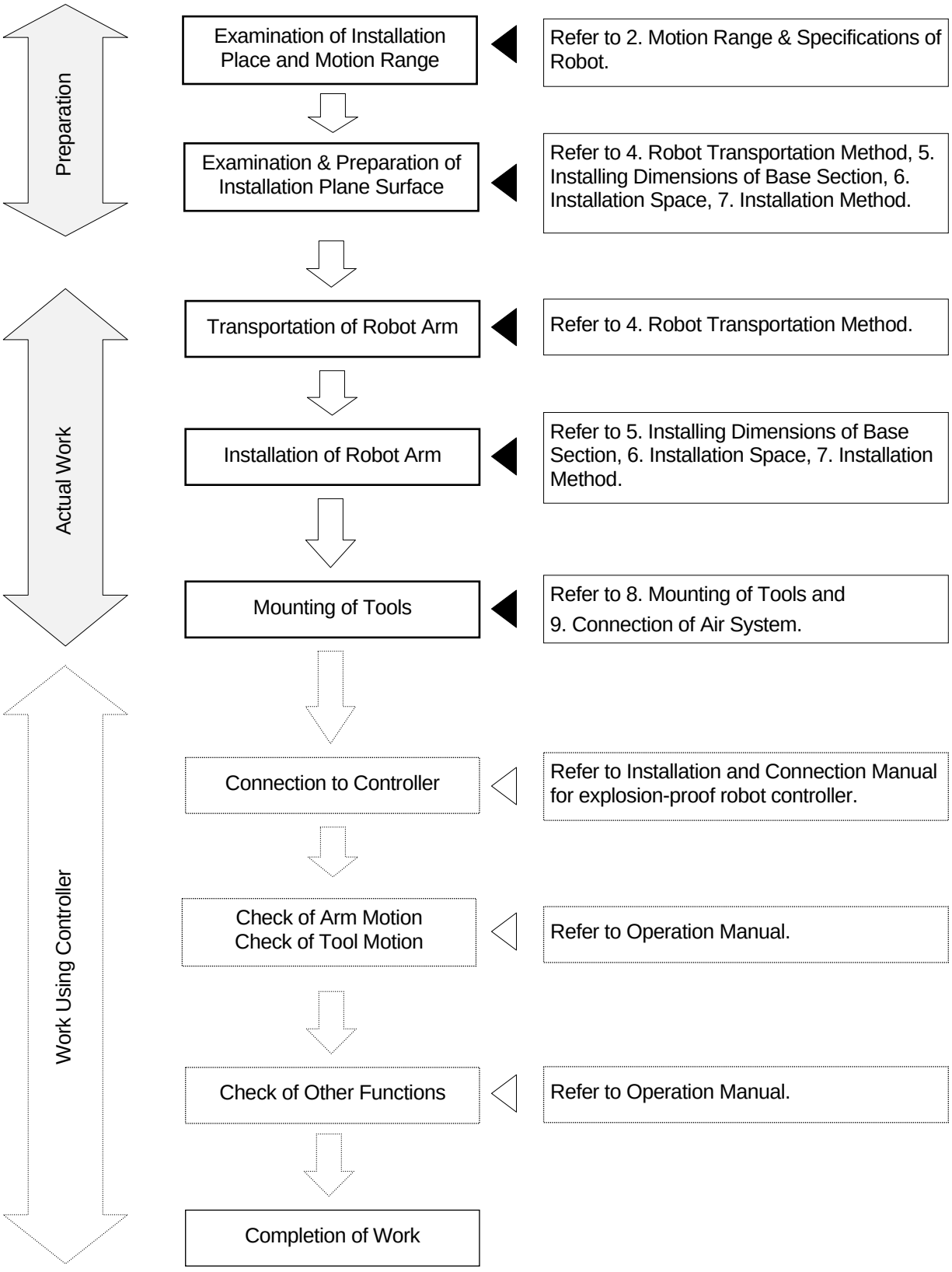
NOTE* measured condition:

- installed on the plate rigidly fixed on the floor
- 3900 mm away from JT1 rotation center

(The noise level depends on the conditions.)

3.0 WORK FLOW AT ARM INSTALLATION AND CONNECTION

This flowchart describes only the robot arm section. For the controller, refer to separate Installation and Connection Manual for Explosion-proof robot controller.



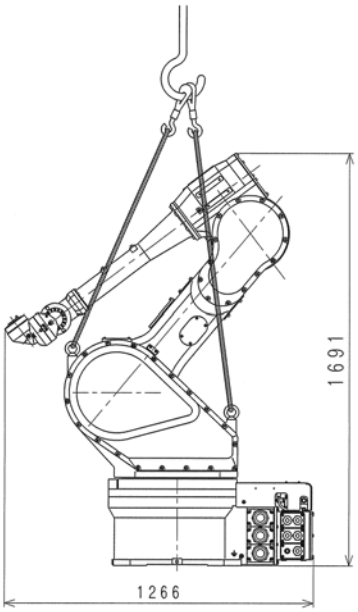
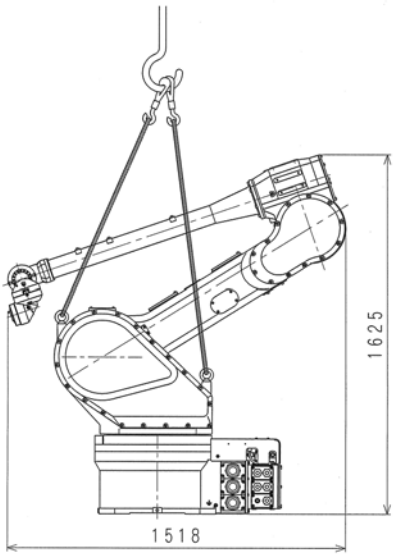
4.0 ROBOT TRANSPORTATION METHOD

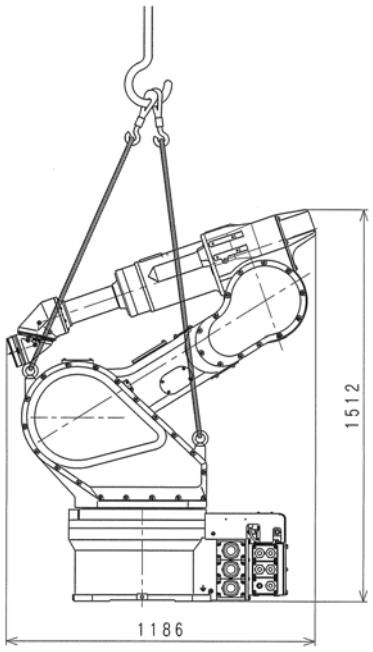
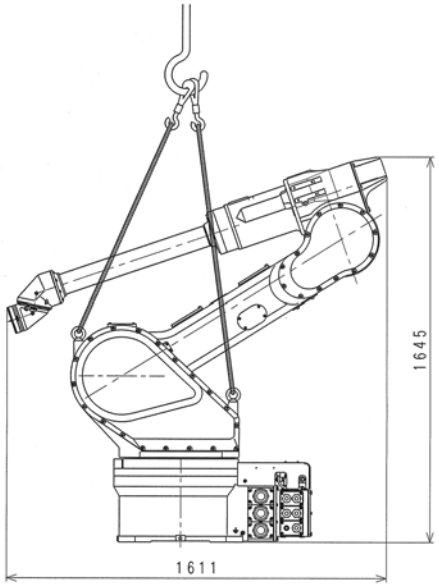
4.1 WIRE SLING

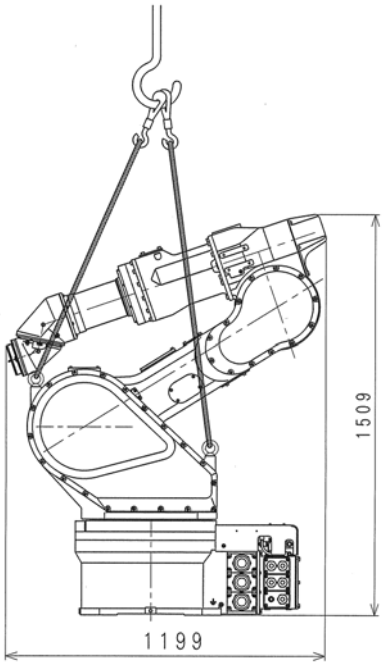
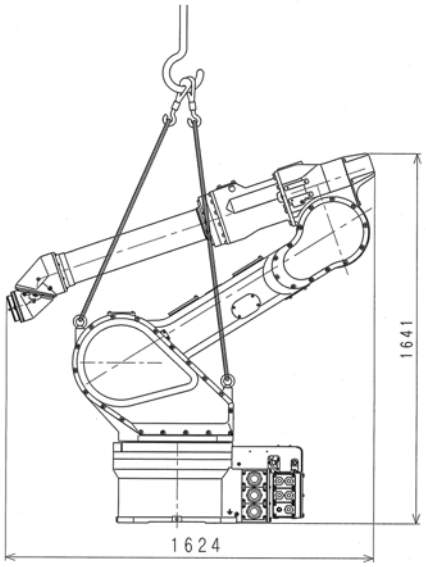
Place the wires on both sides of the arm by using the four M16 eyebolts on the arm and hoist the robot as shown in the figures below.

⚠ WARNING

1. **Adjust the length of wire using chain block, etc. because the height of front eyebolts differs from that of rear eyebolts.**
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 postures below, 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.**

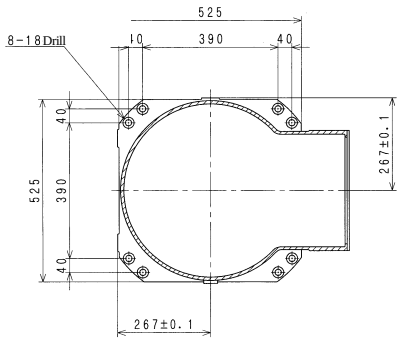
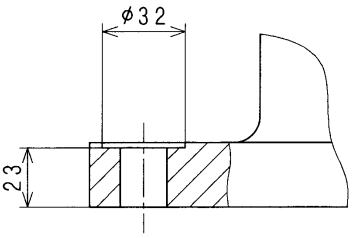
Model		KF192	KF262
Hoisted posture			
Hoisting posture	JT1	0°	0°
	JT2	-40°	-58°
	JT3	-77°	-77°
	JT4	90°	0°
	JT5	0°	0°
	JT6	0°	0°

Model		KF193	KF263
Hoisted posture			
Hoisting posture	JT1	0°	0°
	JT2	-58°	-58°
	JT3	-77°	-77°
	JT4	0°	0°
	JT5	0°	0°
	JT6	0°	0°

Model		KF194	KF264
Hoisted posture			
Hoisting posture	JT1	0°	0°
	JT2	-58°	-58°
	JT3	-77°	-77°
	JT4	0°	0°
	JT5	0°	0°
	JT6	0°	0°

5.0 INSTALLING DIMENSIONS OF BASE SECTION

When installing the robot arm, fix it firmly on the foundation with high-tension bolts through the bolt holes on the base section.

Model	KF19/26 series
Installing dimensions of base section	
Cross-section of installation bolt hole	
Bolt holes	8-ϕ18
High tension bolts	8-M16 Material: SCM435 Strength: 10.9 min.
Tightening torque	235 N·m
Levelness	Within ±5°

⚠ CAUTION

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

6.0 INSTALLATION SPACE

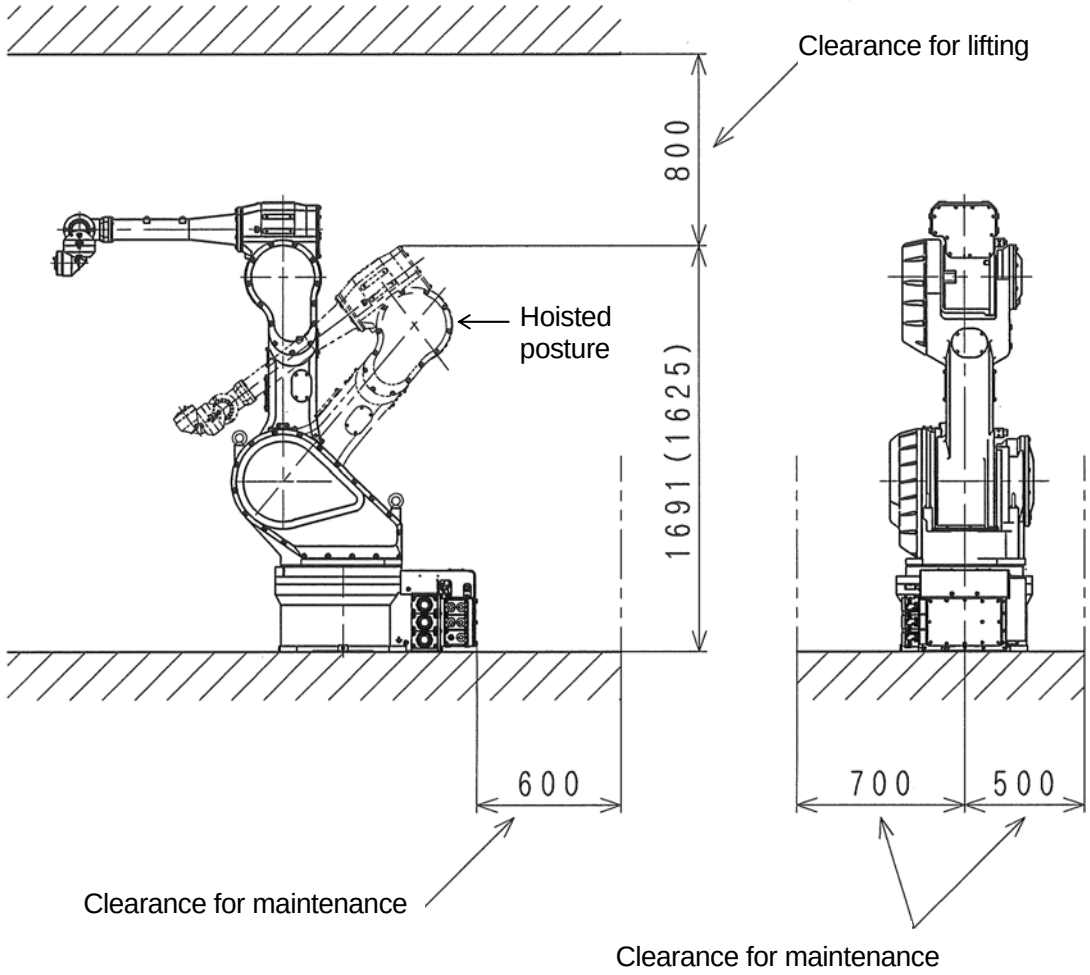
When installing the robot arm, secure the installation space for maintenance purposes as shown below.

1. For maintenance, keep clearance of at least 600 mm behind the robot arm, at least 500 mm from the center of the arm on right side of the base, and at least 700 mm from the center of the arm on left side of the base.
2. Keep clearance of at least 800 mm above the arm for lifting the robot.

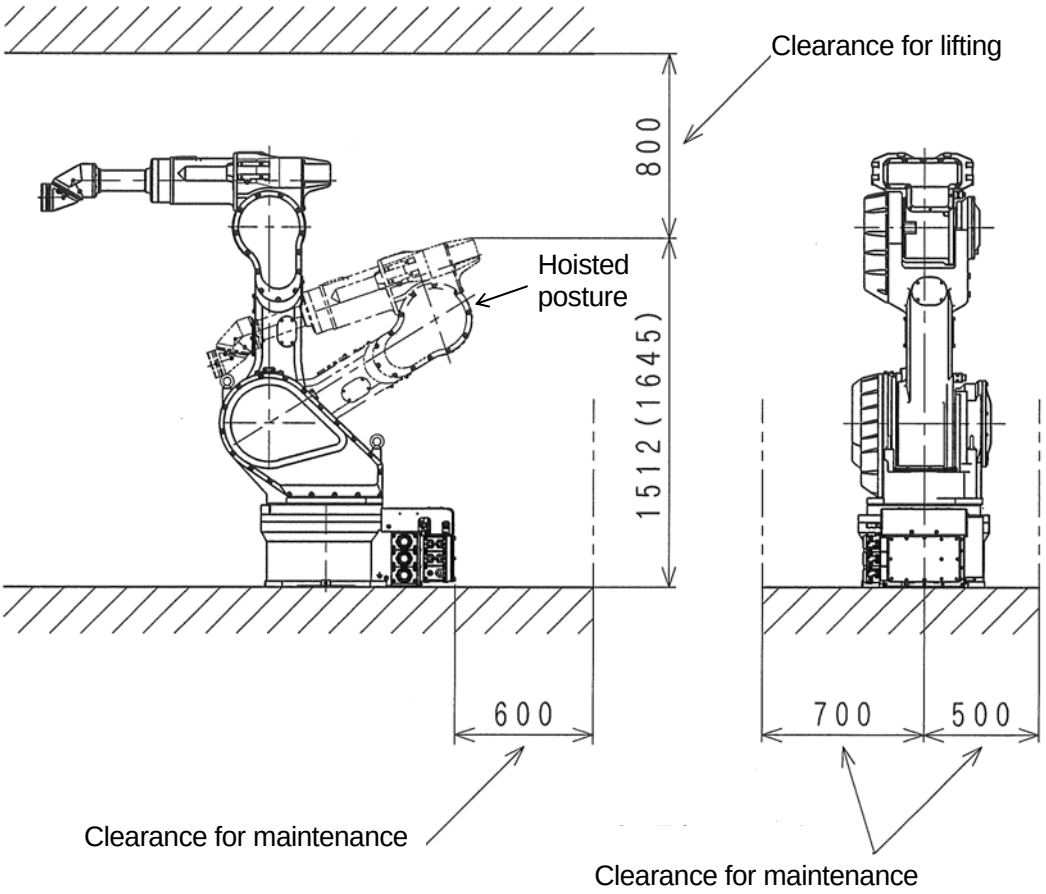
⚠ CAUTION

This chapter provides the maintenance space in robot arm installation. For installation space of safety fence, refer to 2.0 Motion Range and Specifications.

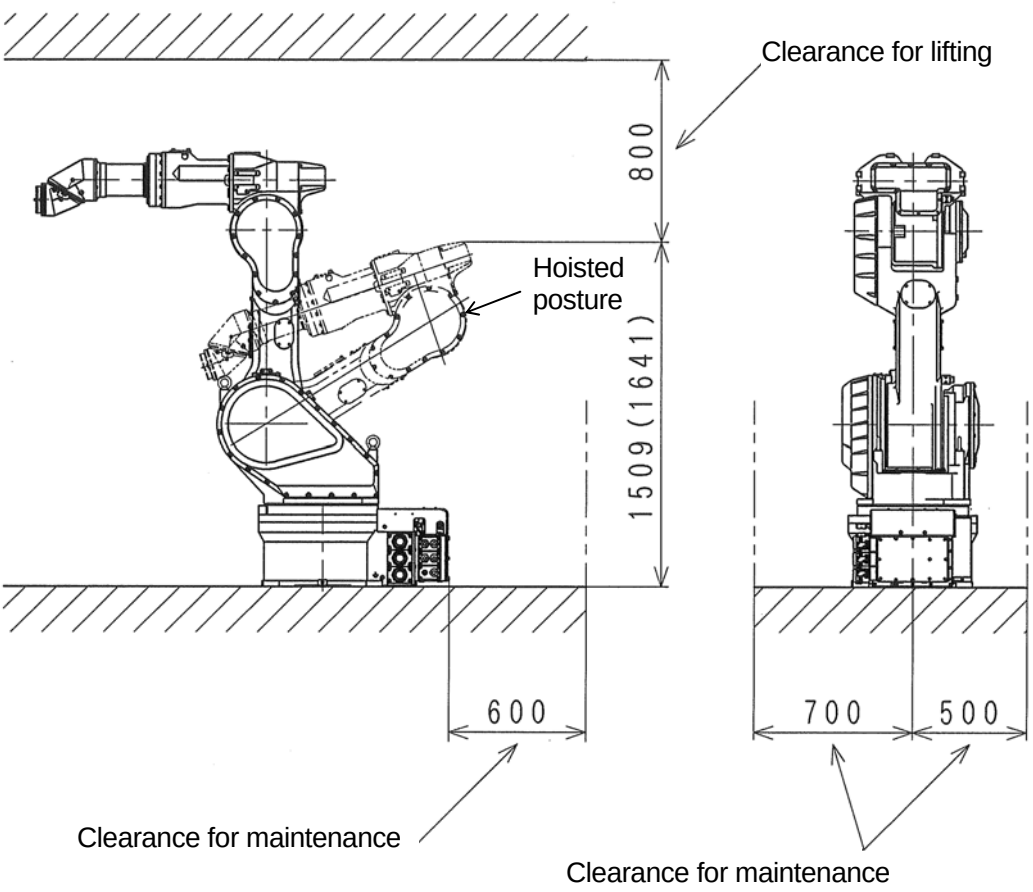
KF192 [Dimension in ( ) shows that of KF262.]



KF193 [Dimension in ( ) shows that of KF263.]

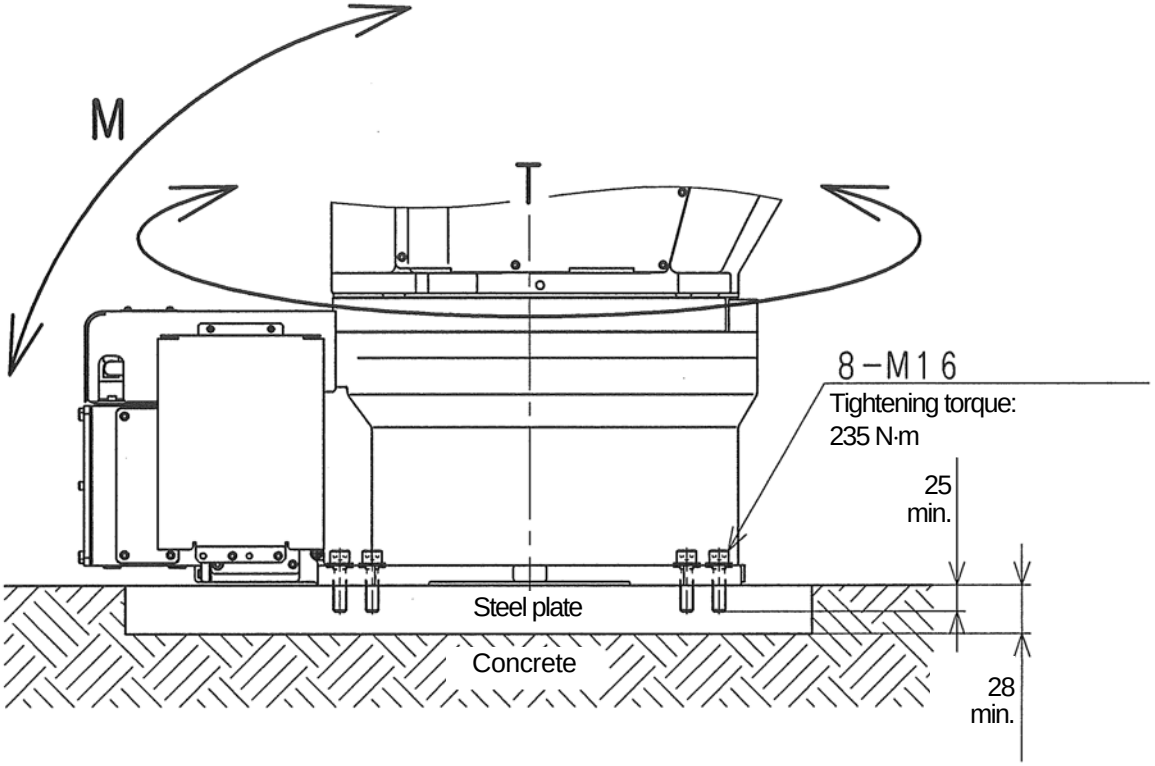


KF194 [Dimension in ( ) shows that of KF264.]



7.0 INSTALLATION METHOD

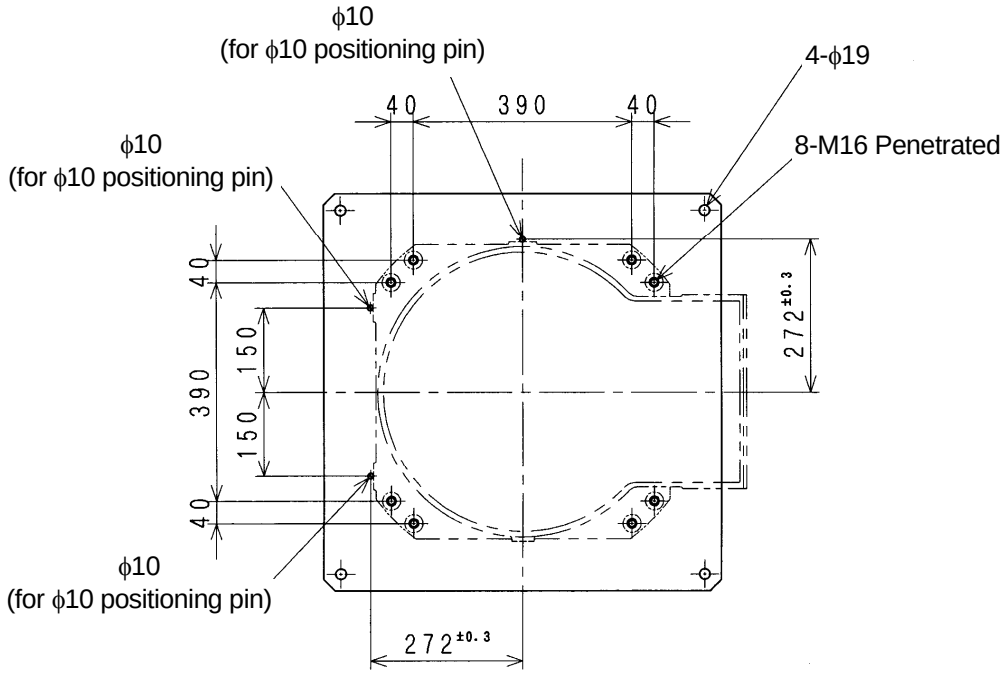
1. When installing the base section of the arm directly on the floor:
   In this case, embed steel plate (28 mm Min. thick) in the concrete floor and fix the base section on it as shown in the figure below or fix the base section directly on the concrete floor with anchors. Fix the steel plate firmly enough to endure the reaction forces produced by the robot.

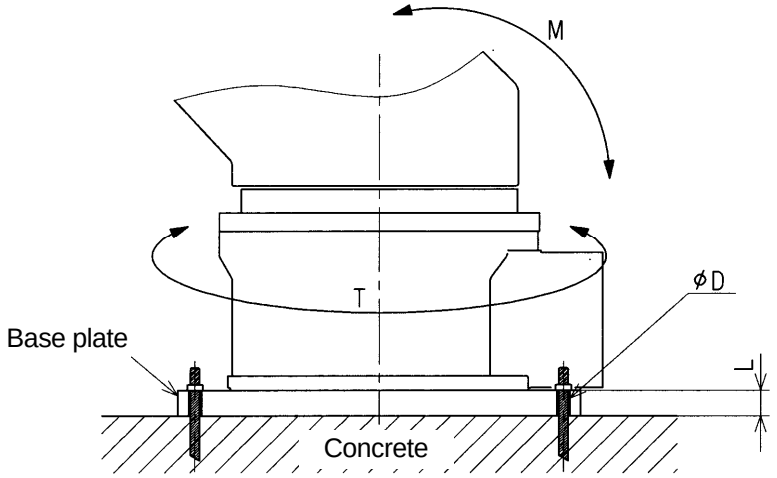


Model	KF19/26 series
M (Inversion moment)	16000 N·m
T (Rotating torque)	16000 N·m

2. When installing the base section of the arm with the robot base plate (option) (The figure below is an example.)
   Do foundation work, etc., referring to the example of arm installation with a base plate shown below. Fix the base plate on concrete floor or steel floor using 4 of ϕ19 bolt holes on the base plate and install the arm. (Robot base plate is an option.)

   The reaction force received from the robot is same with that when installing the base section of the arm directly on the floor.





Model	KF19/26 series
ϕD	ϕ16 mm
L	25 mm min.

8.0 MOUNTING OF TOOLS

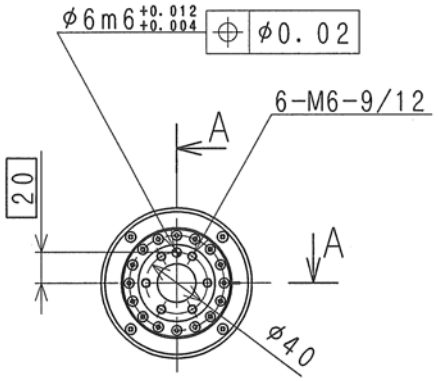
⚠ WARNING

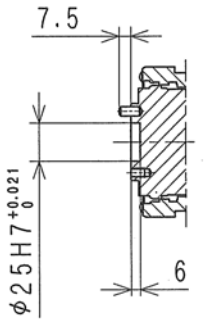
Prior to mounting tools on the robot, turn OFF the controller power switch and the external power switch. Display signs indicating clearly "Installation and connection in progress", and lockout/tagout the external power switch to prevent personnel from accidentally turning ON the power.

8.1 KF192/262

1. Dimensions of wrist end (flange)

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 ϕ40 on the flange, referring to the figure below. Moreover, position the tool by utilizing the pin hole and the spigot hole.

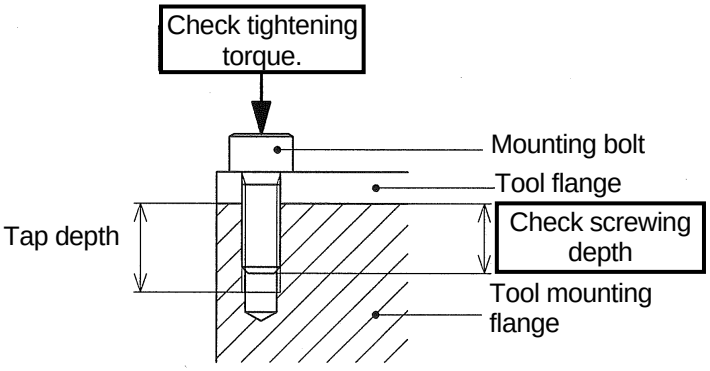




Cross-section A-A

2. Specification of mounting bolts

Select mounting bolts with proper length to secure the specified engagement length. Use high tension mounting bolts and tighten them to the torque specified in the table 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	KF192/262
Tap hole	6-M6
P.C.D	ϕ40
Pin	ϕ6m6 Length 7.5
Spigot hole	ϕ25H7
Tap depth	9 mm
Length of engagement	7.5 - 8.5 mm
High tension bolt	SCM435, 10.9 min
Tightening torque	11.76 N·m

3. Calculating the load on wrist axis

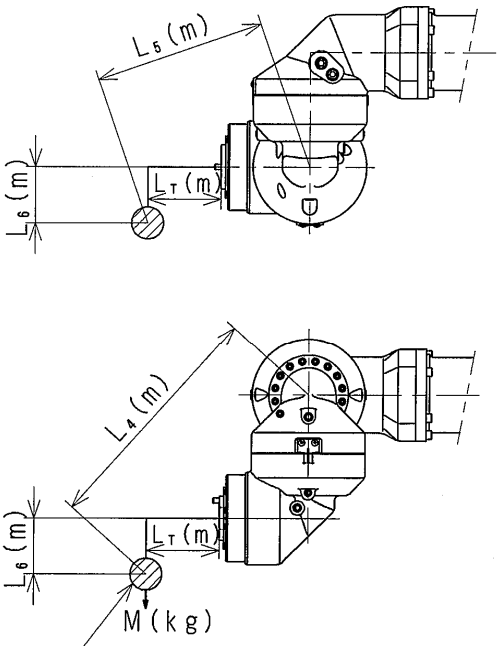
(1) The maximum load capacity of the robot is specified per robot model.
(2) Strictly observe the limiting conditions for load torque and load moment of inertia around each wrist axis (JT4, JT5, JT6) as shown below.

⚠ WARNING

Exceeding the specified load capacity may cause deterioration in motion performance and shorten the life of robot. The specified load capacity includes the mass of all attachments such as spray gun, gun bracket, piping/wiring, etc. If total mass exceeds the capacity specification, consult Kawasaki before starting operations.

The load torque and the moment of inertia can be calculated by the following formula.

Calculating formula for KF192/262



Load center of gravity

Load mass : $M \leqq Mmax.(kg)$
Load torque : $T=9.8 \cdot M \cdot L(N \cdot m)$
Load moment of inertia : $I=M \cdot L^2(kg \cdot m^2)$

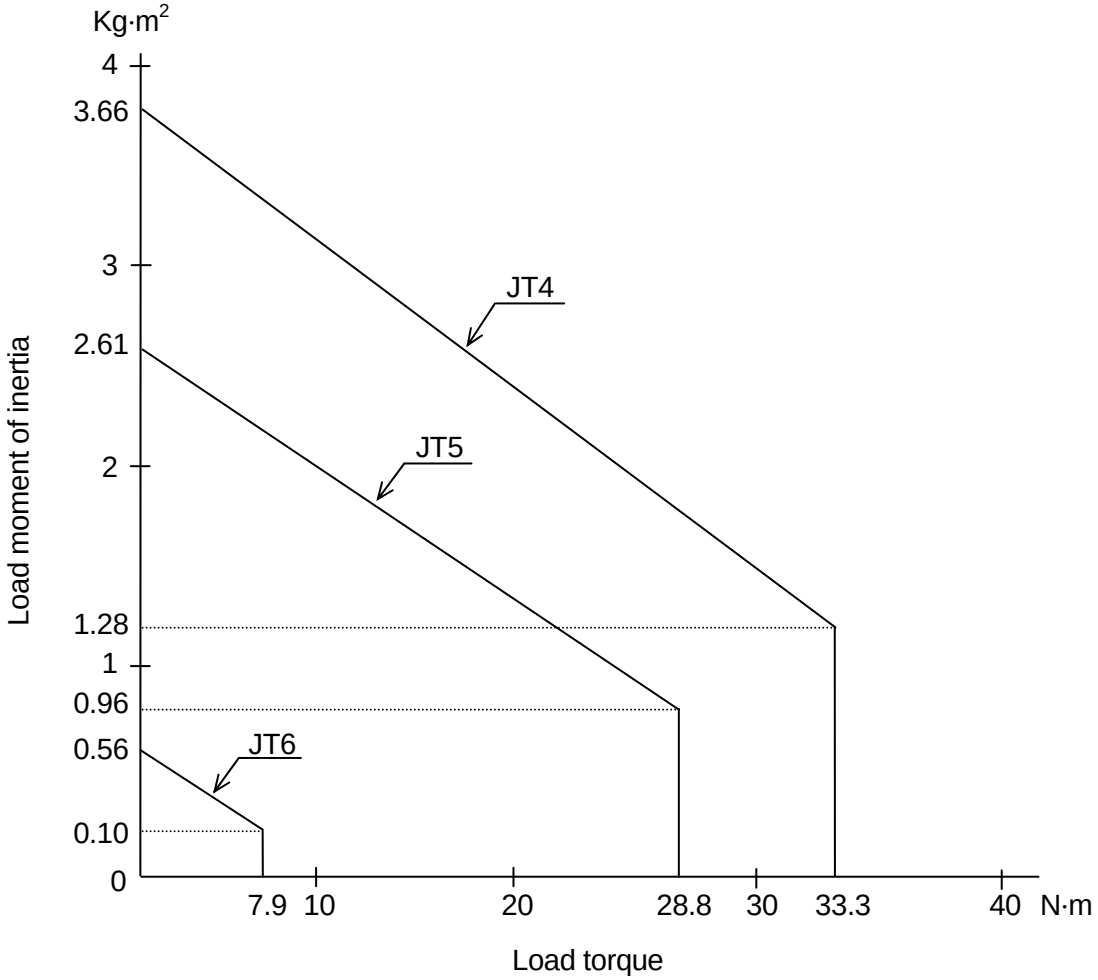
M: Load mass
Mmax.: 12 kg
$L_{(4 \sim 6)}$: Length from center of rotation axis to load center of gravity. (Unit: m) (See the left figure.)

$$L_4 = \sqrt{(L_6 + 0.14)^2 + (L_T + 0.1)^2} \ (m)$$

$$L_5 = \sqrt{L_6{}^2 + (L_T + 0.1)^2} \ (m)$$

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

KF192/262



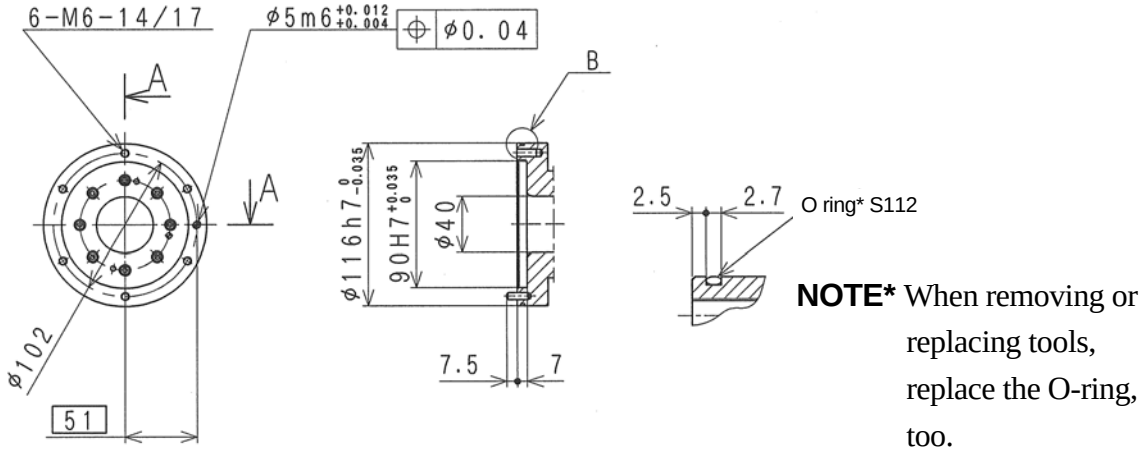
8.2 KF193/263

⚠ 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)

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 ϕ102 on the flange, referring to the figure below. Moreover, position the tool by utilizing the pin hole and the spigot hole.

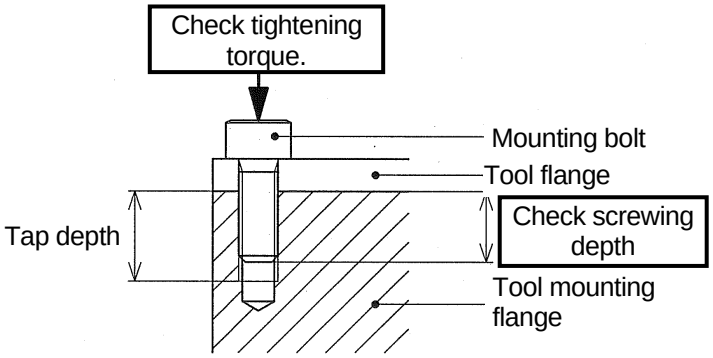


Cross-section A-A Details of B

NOTE* When removing or replacing tools, replace the O-ring, too.

2. Specification of mounting bolt

Select mounting bolts with proper length to secure the specified engagement length. Use high tension mounting bolts and tighten them to the torque specified in the table 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	KF193/263
Tap hole	6-M6
P.C.D	ϕ102
Pin	ϕ5m6 Length 7.5
Spigot hole	ϕ116h7
Tap depth	14 mm
Length of engagement	9 - 12 mm
High tension bolt	SCM435, 10.9 min
Tightening torque	11.76 N·m

3. Calculating the load on wrist axis

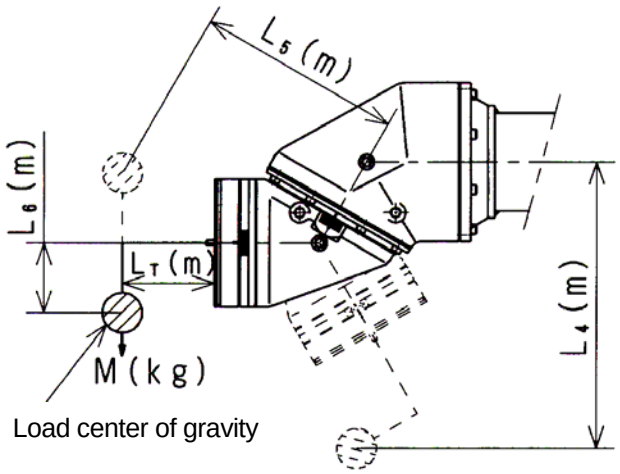
(1) The maximum load capacity of the robot is specified per robot model.
(2) Strictly observe the limiting conditions for load torque and load moment of inertia around each wrist axis (JT4, JT5, JT6) as shown below.

⚠ WARNING

Exceeding the specified load capacity may cause deterioration in motion performance and shorten the life of robot. The specified load capacity includes the mass of all attachments such as spray gun, gun bracket, piping/wiring, etc. If total mass exceeds the capacity specification, consult Kawasaki before starting operations.

The load torque and the moment of inertia can be calculated by the following formula.

Calculating formula for KF193/263

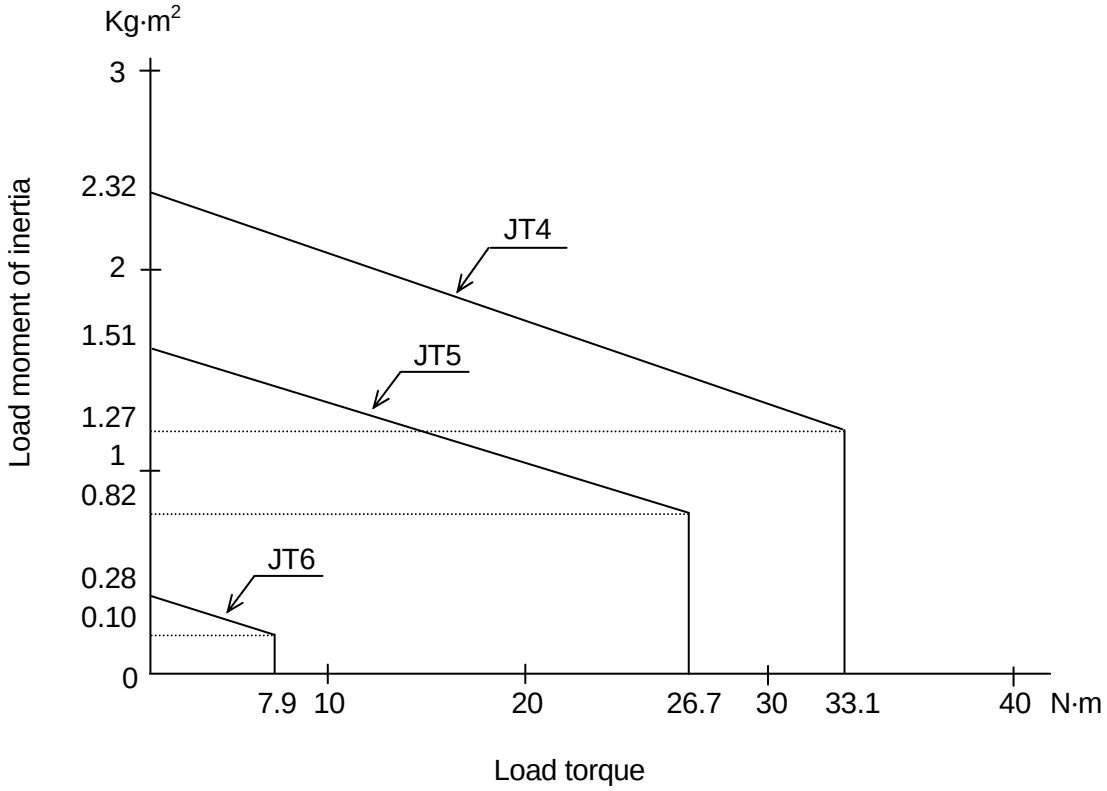


Load mass : M≦Mmax.(kg)
Load torque : T=9.8･M･L(N･m)
Load moment of inertia : $I=M･L^2(kg･m^2)$

M: Load mass
Mmax.: 12 kg
$L_{(4\sim6)}$: Length from center of rotation axis to load center of gravity. (Unit: m) (See the left figure.)
$L_4= L_T･\sin60°+ L_6･\cos30°+0.156$ (m)
$L_5= L_T･\sin60°+ L_6･\cos30°+0.083$ (m)

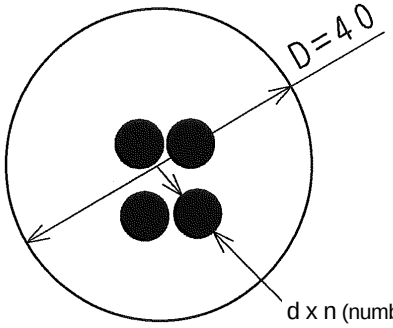
Adhere to the following limiting conditions for the load torque and the load moment of inertia around each wrist axis.

KF193/263



4. Hose(s) housed in the wrist

(1) Inside diameter of wrist of KF193/263 is ϕ40.
The recommended volume ratio of the housed hose(s) is less than 25 %.*



$$\text{volume ratio} = \underbrace{\frac{d^2}{4}\pi n}_{\text{Area of hose(s)}} \div \underbrace{\frac{D^2}{4}\pi}_{\text{Area of wrist hollow}} \times 100[\%]$$

⚠ CAUTION

If the volume ratio of the housed hose(s) exceeds the recommended volume ratio, hose lifetime may shorten significantly. The hose lifetime also changes depending on the wrist posture and the motion angle. Moreover, even if volume ratio is less than 25 %, hose lifetime may become short greatly depending on motion conditions. Accordingly, fully examine and test the hose(s) and their arrangement in wrist before starting operations.

NOTE* Consult Kawasaki at application study stage if volume ratio is required to exceed 25 % or when using a hose with ϕ12 or greater diameter.

(2) Nylon is the recommended material for the housed hose.

⚠ CAUTION

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

(3) When housing 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 inspecting hoses, 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.

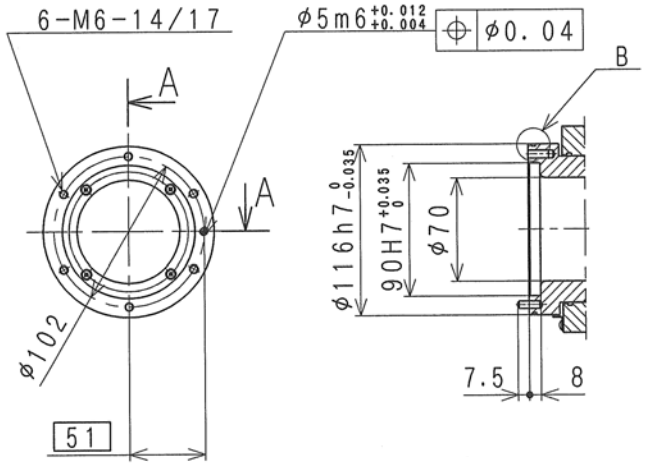
8.3 KF194/264

⚠ WARNING

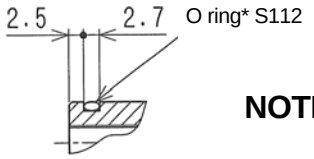
Prior to mounting tools on the robot, turn OFF the controller power switch and the external power switch. Display signs indicating clearly "Installation and connection in progress", and lockout/tagout the external power switch to prevent personnel from accidentally turning ON the power.

1. Dimensions of wrist end (flange)

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 ϕ102 on the flange, referring to the figure below. Moreover, position the tool by utilizing the pin hole and the spigot hole.



Cross-section A-A

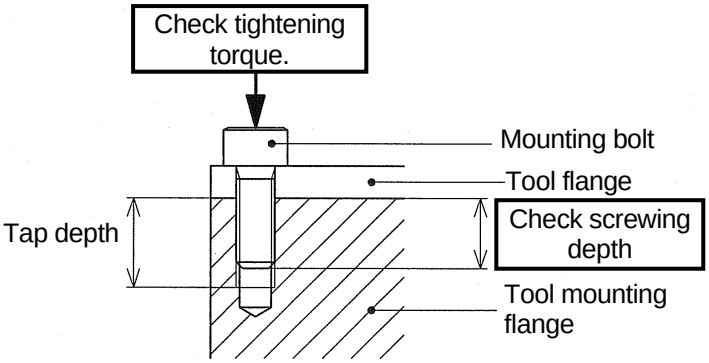


Details of B

NOTE* When removing or replacing tools, replace the O-ring, too.

2. Specification of mounting bolt

Select mounting bolts with proper length to secure the specified engagement length. Use high tension mounting bolts and tighten them to the torque specified in the table 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	KF194/264
Tap hole	6-M6
P.C.D	ϕ102
Pin	ϕ5m6 Length 7.5
Spigot hole	ϕ116h7
Tap depth	14 mm
Length of engagement	9 - 12 mm
High tension bolt	SCM435, 10.9 min
Tightening torque	11.76 N·m

3. Calculating the load on wrist axis

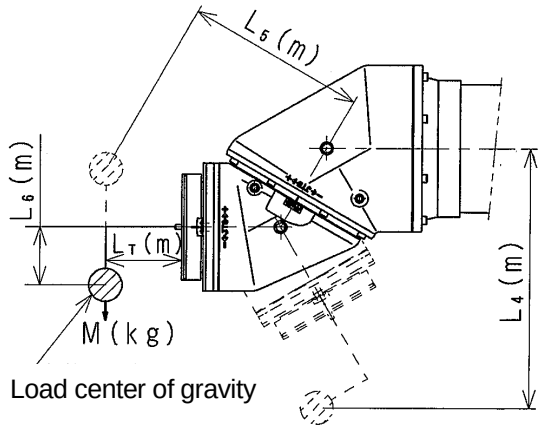
(1) The maximum load capacity of the robot is specified per robot model.
(2) Strictly observe the limiting conditions for load torque and load moment of inertia around each wrist axis (JT4, JT5, JT6) as shown below.

⚠ WARNING

Exceeding the specified load capacity may cause deterioration in motion performance and shorten the life of robot. The specified load capacity includes the mass of all attachments such as spray gun, gun bracket, piping/wiring, etc. If total mass exceeds the capacity specification, consult Kawasaki before starting operations.

The load torque and the moment of inertia can be calculated by the following formula.

Calculating formula for KF194/264

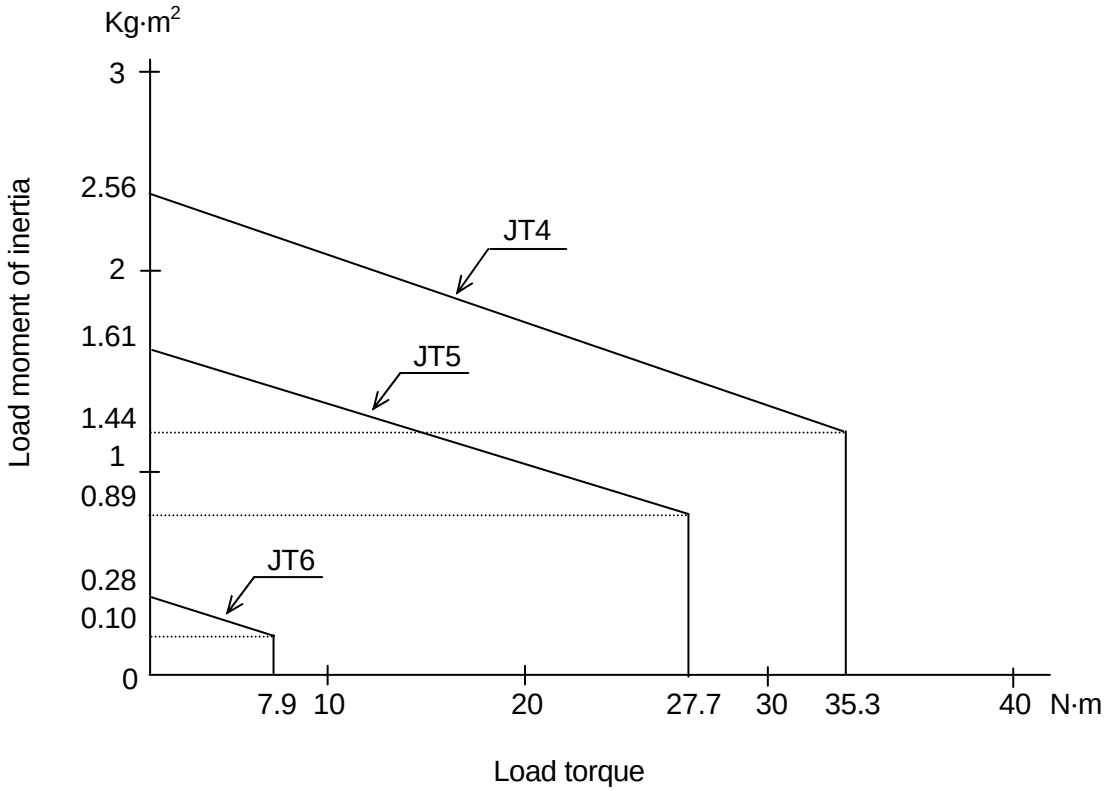


Load mass : $M \leqq Mmax.(kg)$
Load torque : $T=9.8 \cdot M \cdot L(N \cdot m)$
Load moment of inertia : $I=M \cdot L^2(kg \cdot m^2)$

M: Load mass
Mmax.: 12 kg
$L_{(4 \sim 6)}$: Length from center of rotation axis to load center of gravity. (Unit: m) (See the left figure.)
$L_4= L_T \cdot \sin 60° + L_6 \cdot \cos 30° + 0.181$ (m)
$L_5= L_T \cdot \sin 60° + L_6 \cdot \cos 30° + 0.094$ (m)

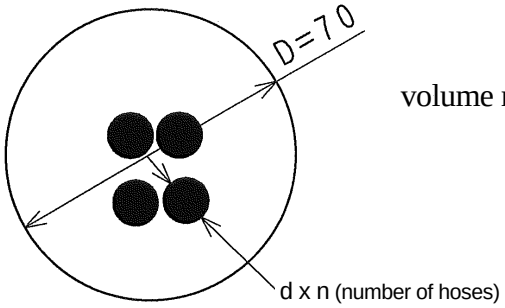
Adhere to the following limiting conditions for the load torque and the load moment of inertia around each wrist axis.

KF194/264



4. Hose(s) housed in the wrist

(1) Inside diameter of wrist of KF194/264 is ϕ70.
The recommended volume ratio of the housed hose(s) is less than 25 %.*



$$\text{volume ratio} = \underbrace{\frac{d^2}{4}\pi n}_{\text{Area of hose(s)}} \div \underbrace{\frac{D^2}{4}}_{\text{Area of wrist hollow}} \pi \times 100[\%]$$

CAUTION

If the volume ratio of the housed hose(s) exceeds the recommended volume ratio, hose lifetime may shorten significantly. The hose lifetime also changes depending on the wrist posture and the motion angle. Moreover, even if volume ratio is less than 25 %, hose lifetime may become short greatly depending on motion conditions. Accordingly, fully examine and test the hose(s) and their arrangement in wrist before starting operations.

NOTE* Consult Kawasaki at application study stage if volume ratio is required to exceed 25 % or when using a hose with ϕ12 or greater diameter.

(2) Nylon is the recommended material for the housed hose.

CAUTION

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

(3) When housing 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 inspecting hoses, 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

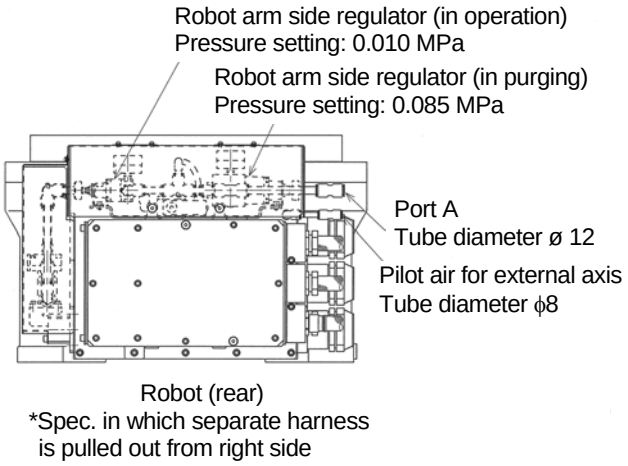
9.1 EXPLOSION-PROOF SPECIFICATIONS

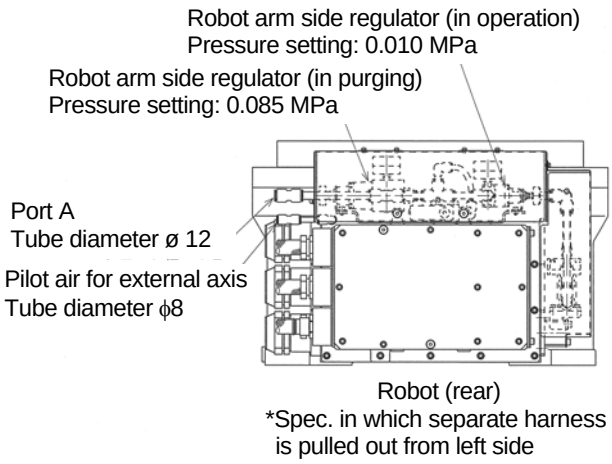
KF19/26 series robot is an explosion-proof specified robot protected by pressurized and intrinsically safe structures.

9.2 AIR SUPPLY TO ROBOT ARM

9.2.1 JAPAN EXPLOSION-PROOF SPECIFICATION

Air connecting port is provided in base section of robot arm as shown in the figure below.
Supply the air from port A (Tube diameter ϕ12) in rear of robot arm.





⚠ CAUTION

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

⚠ 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.

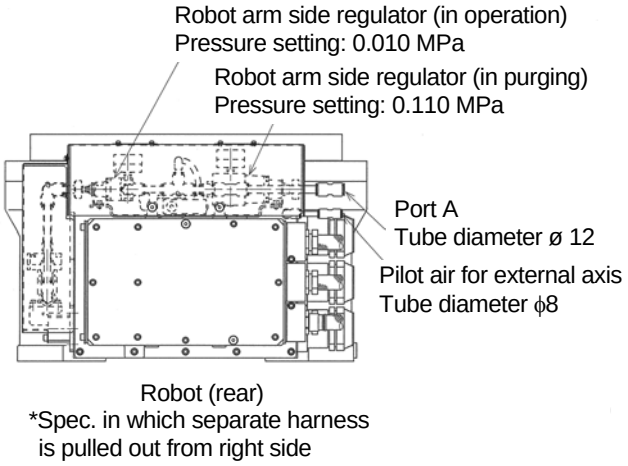
4. Input pressure ...0.4 ~ 0.7 MPa (4.1 - 7.1 kgf/cm^2)

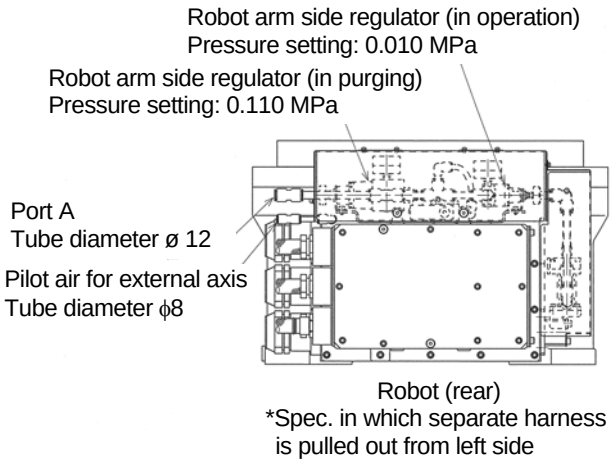
5. Input quantity ...300 L/min. (nor) (Only at purging)

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

9.2.2 CHINA EXPLOSION-PROOF SPECIFICATION

Air connecting port is provided in base section of robot arm as shown in the figure below.
Supply the air from port A (Tube diameter ϕ12) in rear of robot arm.





⚠ CAUTION

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

⚠ 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/cm^2)

5. Input quantity ...400 L/min. (nor) (Only at purging)

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

Kawasaki Robot KF19/26
Installation and Connection Manual

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