

Simple  friendly



**Kawasaki Robot
MG Series**

**Installation and
Connection Manual**

Robot

Kawasaki Heavy Industries, Ltd.

90202-1152DEA

PREFACE

This manual describes installation and connection procedures for Kawasaki Robot MG Series.

Read and understand the contents of this and safety manuals thoroughly and strictly observe all rules for safety before proceeding with any operation. Kawasaki cannot take any responsibility for any accidents and/or damages caused by operations that are based on only the limited part of this manual.

This manual describes only the installation and connection of the robot arm. Please refer to the following manual for installation and connection of Controller.

“Installation and Connection Manual” for controller

This manual is applicable to the following robot arms.

MG10HL


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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.

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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 damages 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. Should any unexplained questions or problems arise, please contact Kawasaki.**
- 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 explanation described in each chapter, and prepare safety measures suitable for actual work.**

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1.0 PRECAUTIONS

1.1 PRECAUTIONS DURING TRANSPORTATION, INSTALLATION 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.
3. Prior to installation, turn OFF the controller power switch and the external power switch for shutting down power supply to the controller. Display signs indicating clearly “Installation and connection in progress”, and lockout/tagout the external power switch to prevent accidents of electric shock etc. caused when someone accidentally turns ON the power.
4. Prior to moving robot, ensure safety by first confirming no abnormality is observed in installing condition, etc., and then turn ON motor power to set robot to the desired pose. Be careful not to be caught by/between any moving parts due to careless approach to robot. After setting robot to the specified pose, turn OFF the controller power and the external power switch again as mentioned above. Display signs indicating clearly “Installation and connection in progress”, and lockout/tagout the external power switch before starting installation and connection.



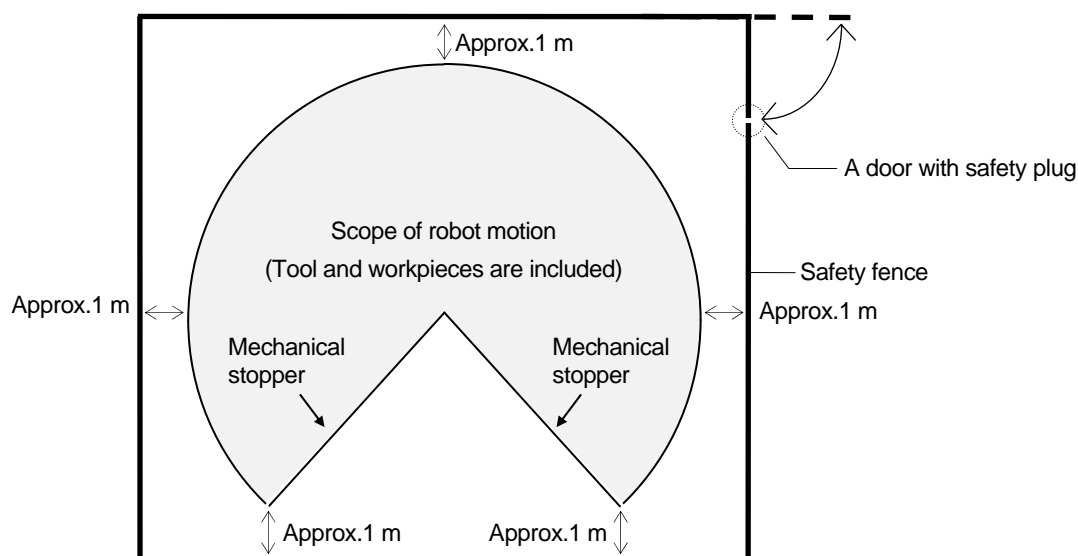
CAUTION

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.
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.

1.2 INSTALLING ENVIRONMENT OF ROBOT ARM

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

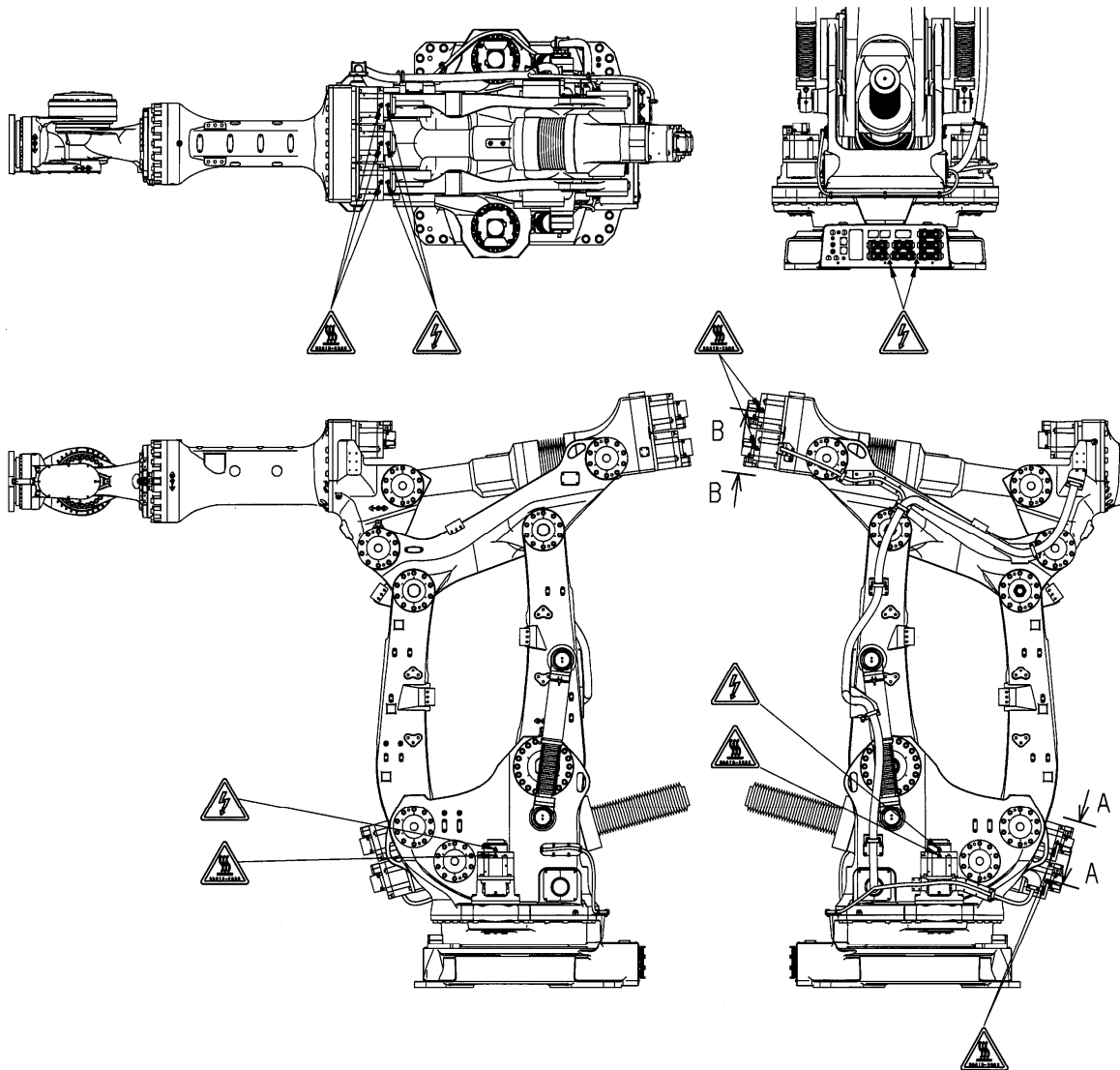
1. When robot is installed on the floor, the levelness must be within $\pm 5^\circ$.
2. Be sure that the installation floor/pedestal has sufficient rigidity.
3. Secure a flatness to prevent undue force applied to the installation section. (If sufficient flatness is unobtainable, insert liners and adjust the flatness.)
4. Keep the ambient temperature during operation within the range of 0 to 45 °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, oil, smoke, water, and other foreign matters.
7. The robot installing place should be free from flammable or corrosive liquid or gas.
8. The robot installing place should be free from excessively strong vibration. (0.5 G or less)
9. The robot installing place should be free from electric noise interference.
10. 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 and workpieces) does not cause interference.
 - (2) Minimize the number of entrance gates (only one is best) and equip the entrance gate with a safety plug.
 - (3) Observe the requirements of JIS B8433, etc. established in each region for details of the safety fence.





1.3 RESIDUAL RISKS DURING WORK

⚠ WARNING
 Pay attention to the hazardous places listed in the drawings below.

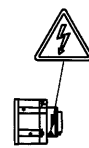
Hazardous places for high temperature and electric shock



-  Hazardous place for high temperature
-  Hazardous place for electric shock

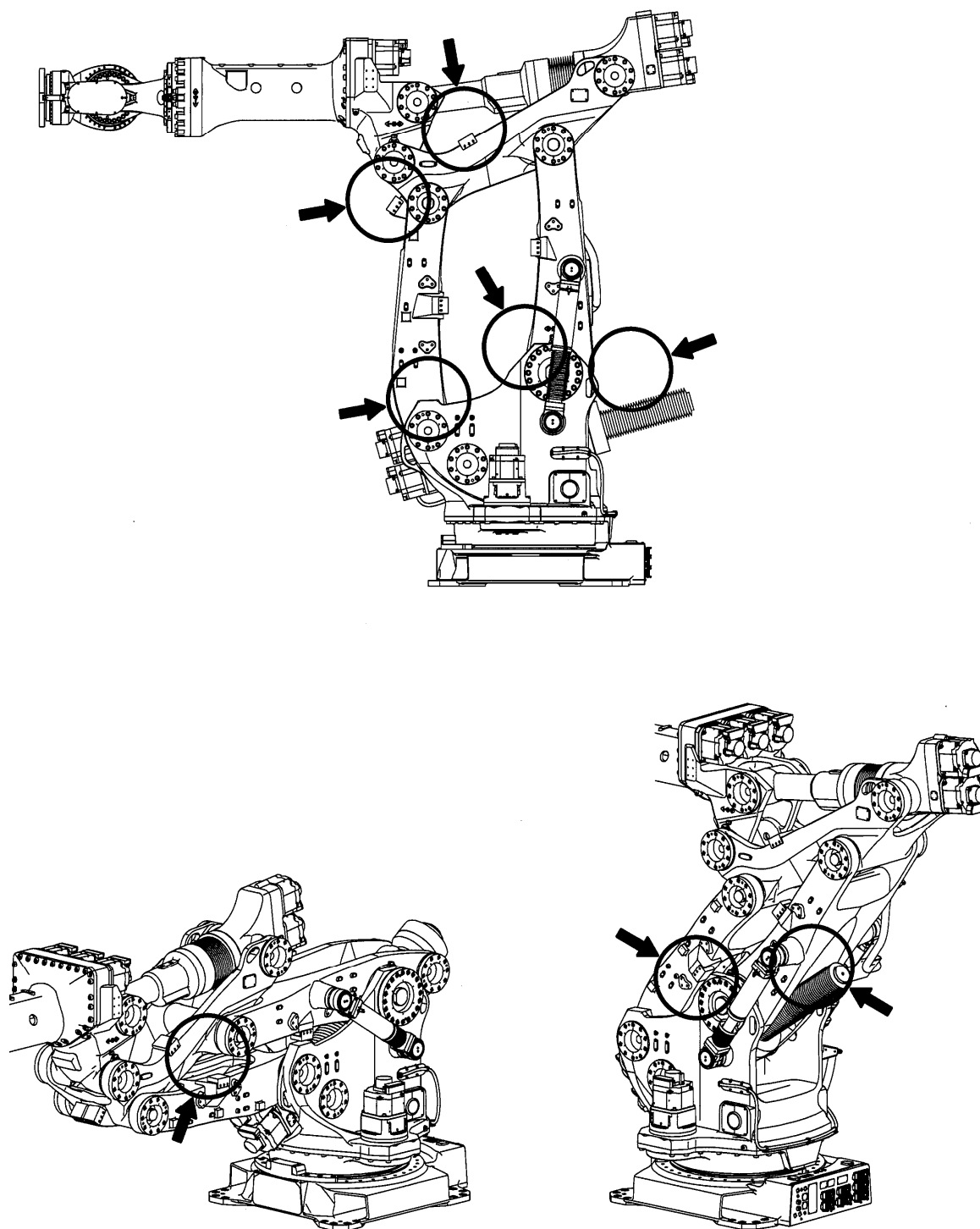


View B



View A

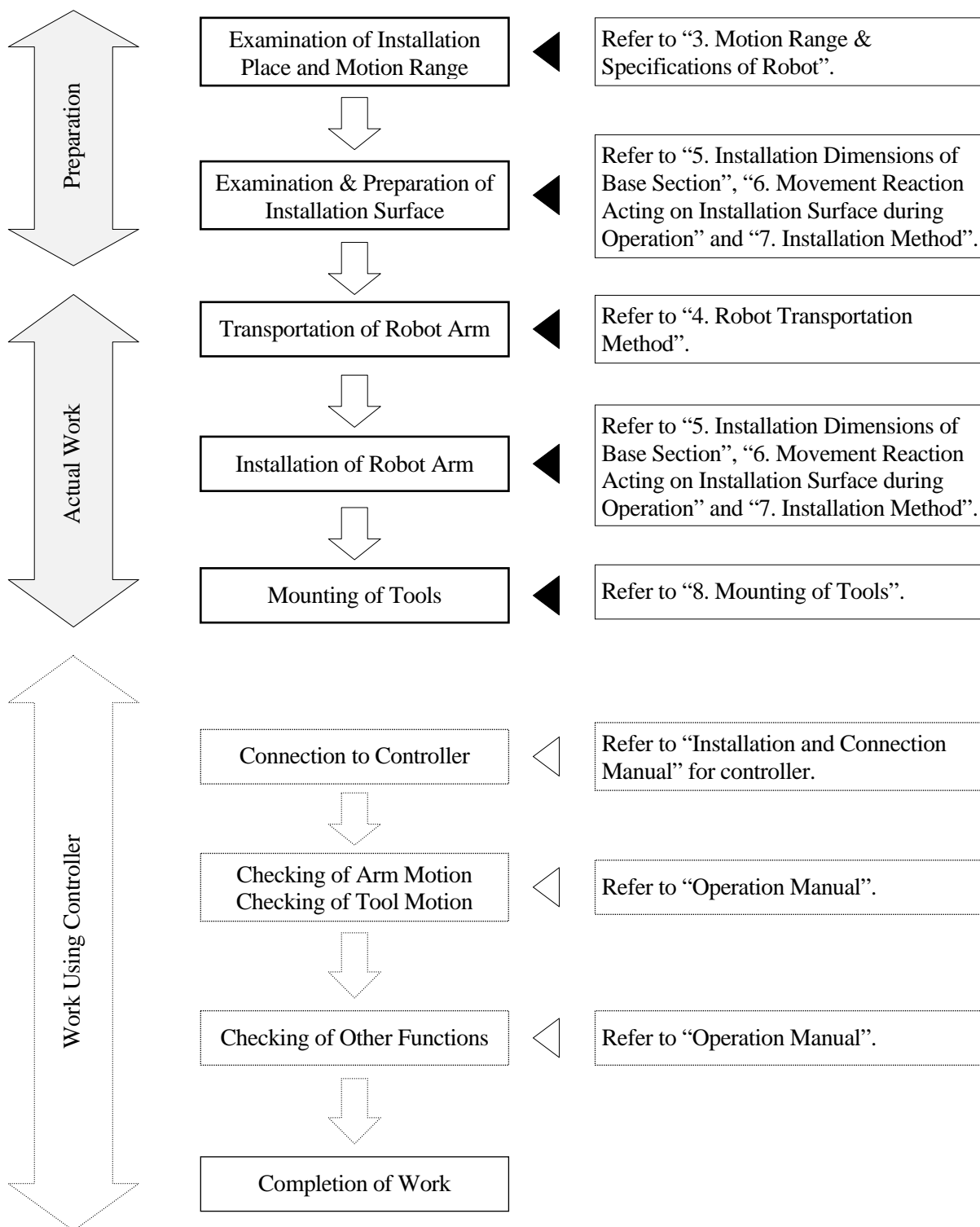
Hazardous places for pinching



○ Hazardous place
for pinching

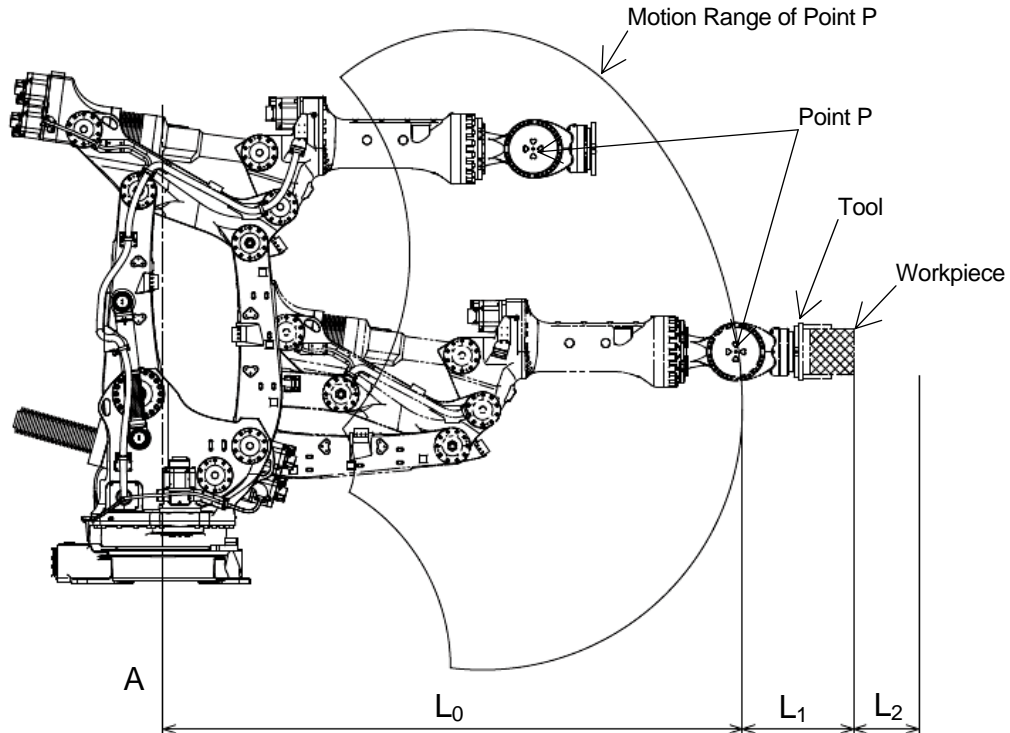
2.0 WORK FLOW AT ARM INSTALLATION AND CONNECTION

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

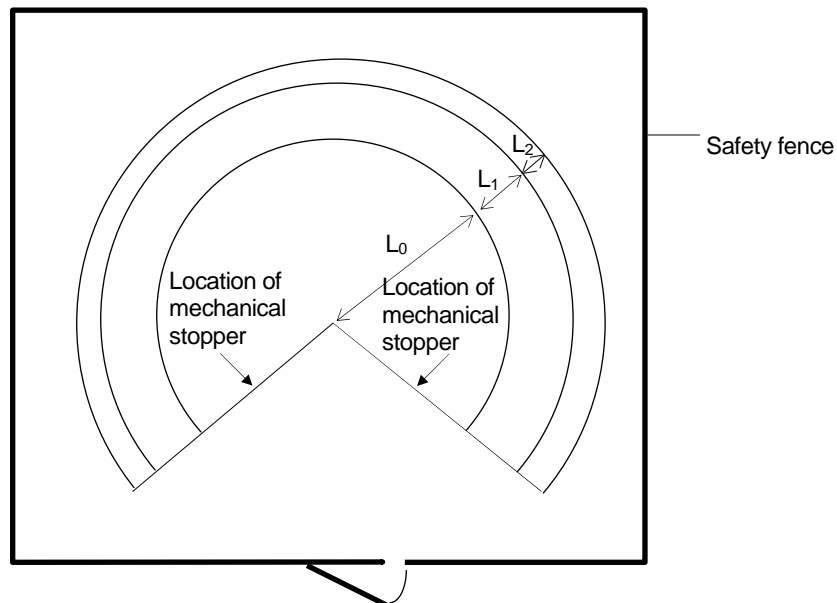


3.0 MOTION RANGE & SPECIFICATIONS OF ROBOT

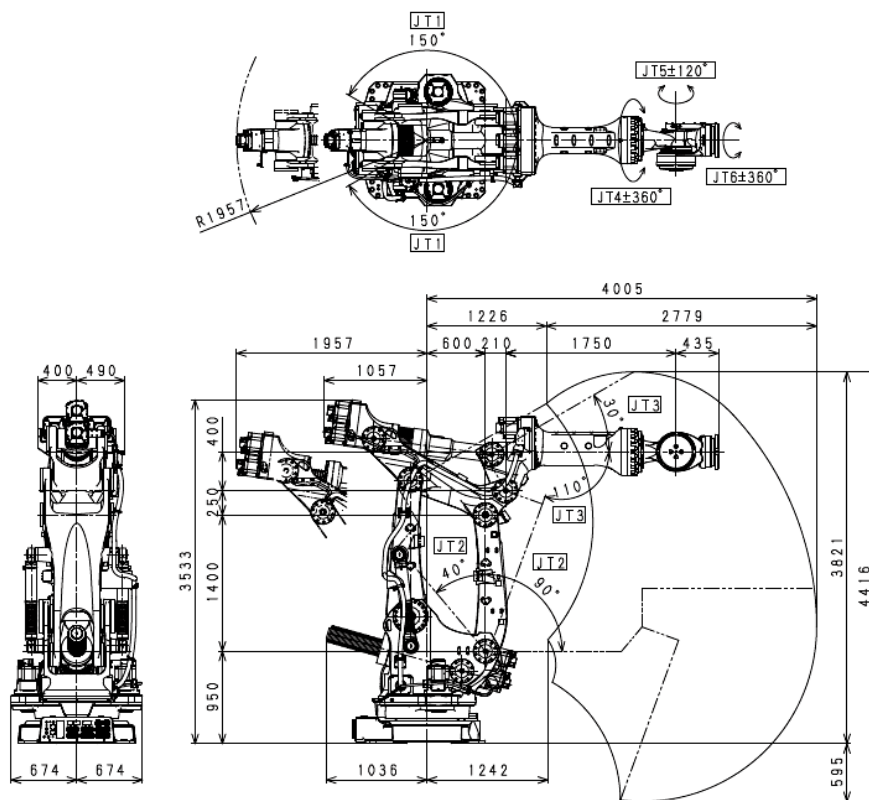
3.1 DETERMINATION OF SAFETY FENCE INSTALLATION LOCATION



The motion range of the robot is represented by the maximum area that can be covered by point P in the figure above. Therefore, as shown in the figure below, install the safety fence outside circle whose radius is $L_0+L_1+L_2$. Where; L_0 is the length from the center line of arm (point A shown above) to the farthest point of P, L_1 is the length from point P to the farthest point of wrist flange, tool and workpiece, and L_2 is safety margin. For the length of L_0 , refer to the drawings in the section 3.2.



3.2 MOTION RANGE & SPECIFICATIONS OF ROBOT



Type	Vertical Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±150°	65 °/s
	2	+90° to -40°	33.5 °/s
	3	+30° to -110°	37.5 °/s
	4	±360°	65 °/s
	5	±120°	65 °/s
6	±360°	80 °/s	
Max. Payload	1000 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	8800 N·m	1800 kg·m ²
	5	8800 N·m	1800 kg·m ²
6	4410 N·m	1200 kg·m ²	
Repeatability	±0.1 mm		
Mass	6,500 kg (exc. options)		
Acoustic Noise	<80 db (A)*		

*Measured condition: installed on the plate rigidly fixed on the floor

6000 mm away from JT1 center

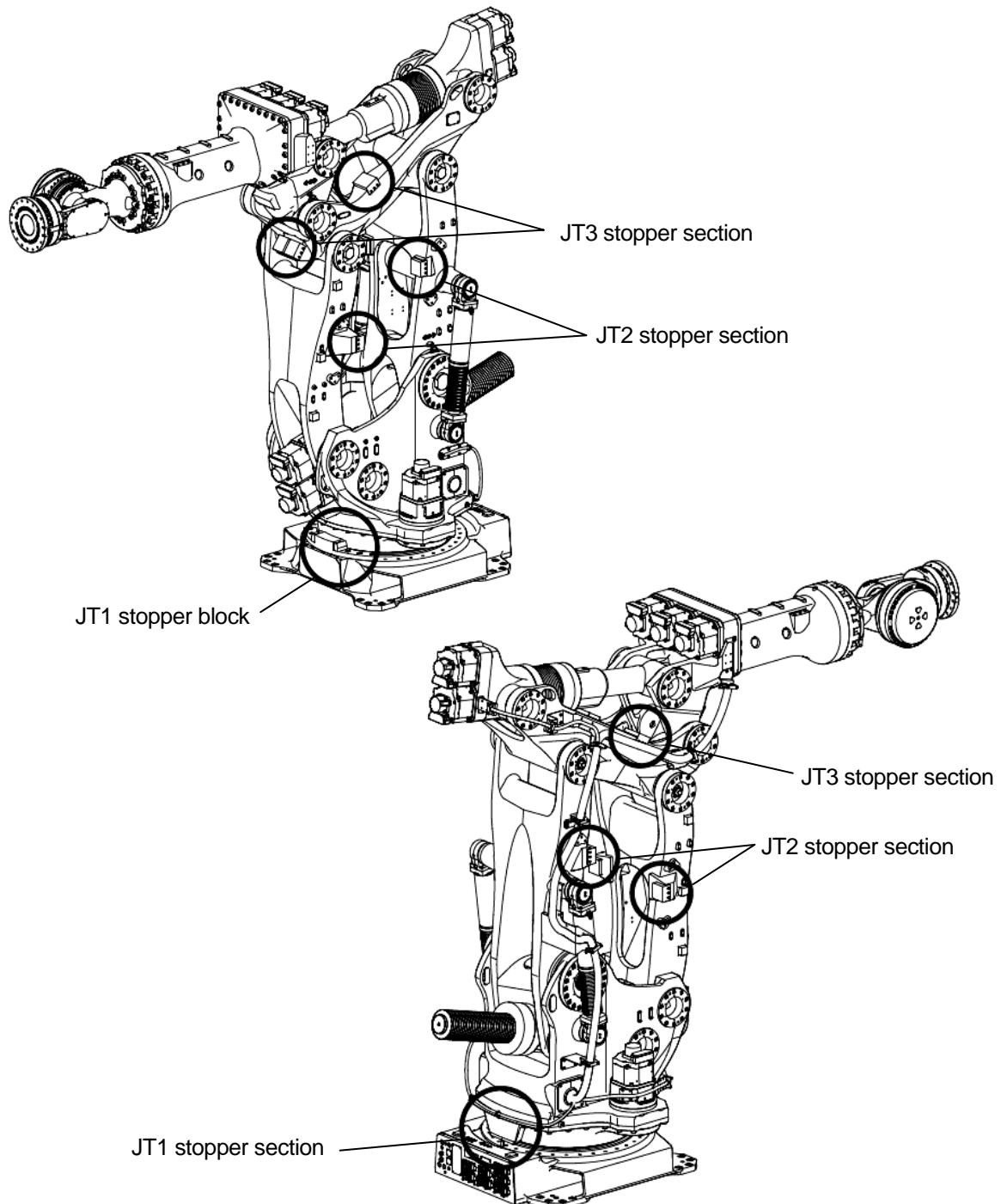
Motion in real handling application

[The noise level depends on the conditions.]

3.3 MECHANICAL STOPPERS

For JT1, JT2 and JT3 of base axes, mechanical stoppers are mounted at the places shown in the figure below. Among them, the motion range of JT1 can be changed by adding stopper block of stopper member on the fixed (base) side.

However, when the motion range is changed, it is necessary to change the motion range limits to the corresponding values by Auxiliary function 0507.



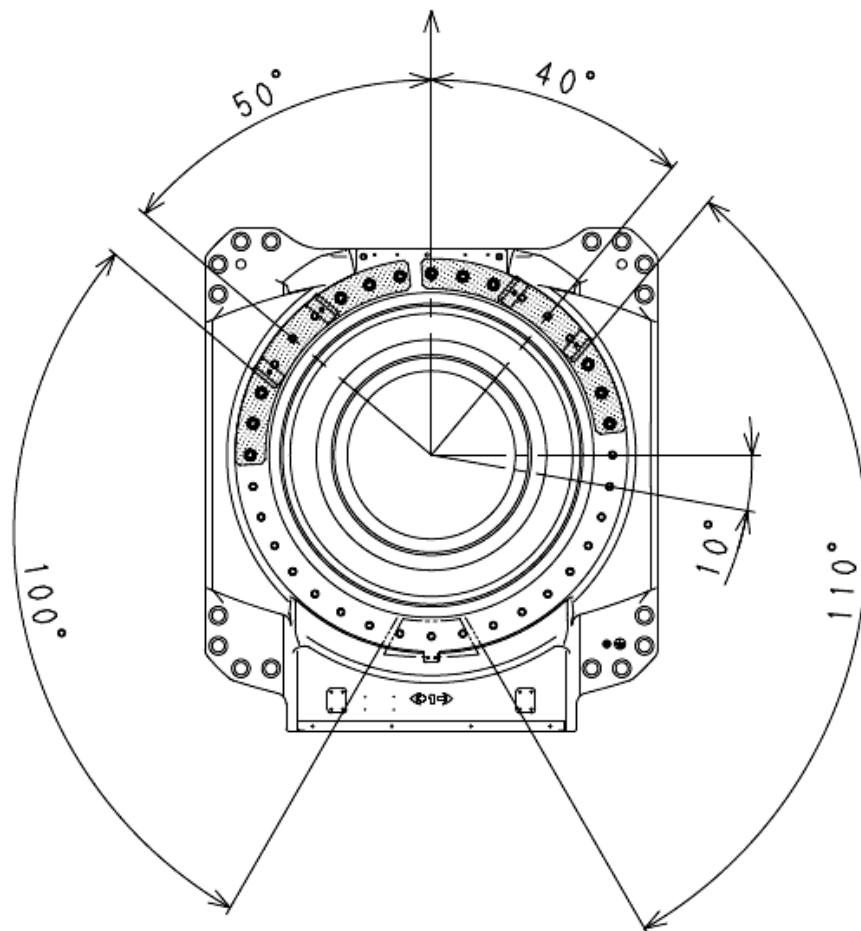
3.3.1 JT1 STOPPER BLOCK

Mounting position of JT1 stopper block can be changed by angular unit of 10 degrees, and reducing the motion range is possible by mounting two stopper blocks as an option.

! **CAUTION**

The motion range is 150° on both plus and minus sides due to the restriction from control, and harness treatment and total motion range of both plus and minus sides is 300°. Do not change the mounting position when mounting a stopper block because the motion range on plus (or minus) side exceeds 150° if the mounting position is changed.

Mounting two stopper blocks as shown below makes it possible to reduce the motion range to 110° on the plus side and 100° on the minus side.



4.0 ROBOT TRANSPORTATION METHOD

4.1 USING WIRE SLING

Using wire slings, robot can be hoisted up in two different arm poses.



WARNING

1. Use wire slings with proper length to distribute the load to all slings without slack of the wire slings.
2. When hoisting up the robot, recognize the gravity center of arm and be careful so that the arm does not fall in hoisting and transporting.

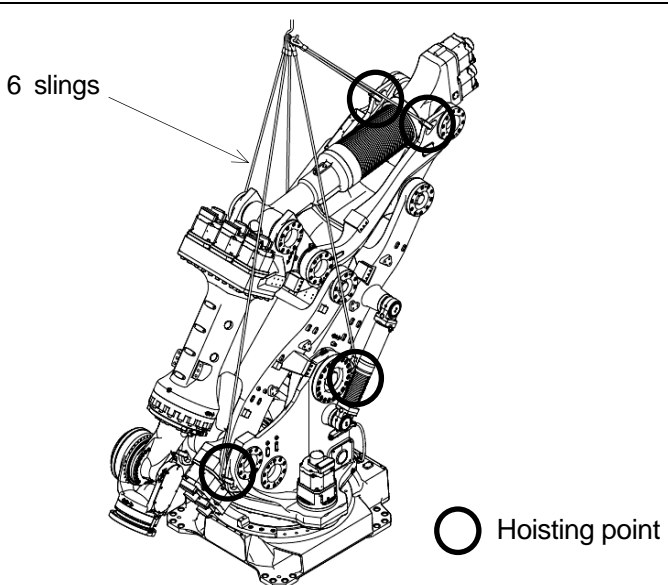
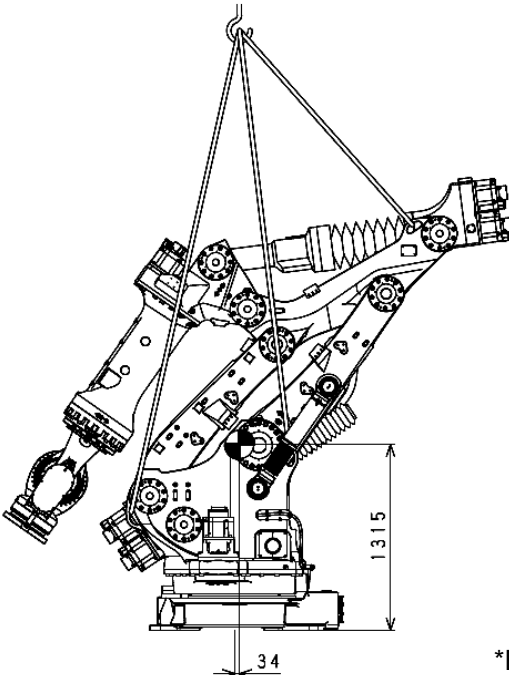


CAUTION

1. When hoisting up the robot, do not hoist up the robot with wire slings touching ball screws or motors to avoid early damage on the ball screws and the motors.
2. When hoisting up the robot, be careful as robot may lean forward/backward depending on robot posture and installation condition of the options. If the robot is hoisted up in an inclined posture, it may swing, damage or the wire may interfere with the harness, piping etc., or it may damage due to interfering with surrounding objects.
3. Remove the hoisting jig attached to the arm once the transportation of robot is complete.

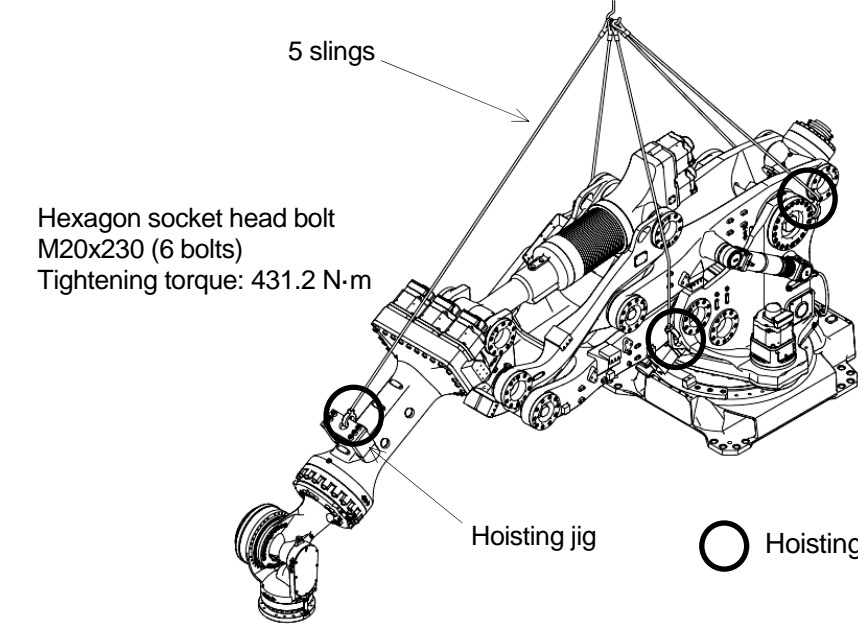
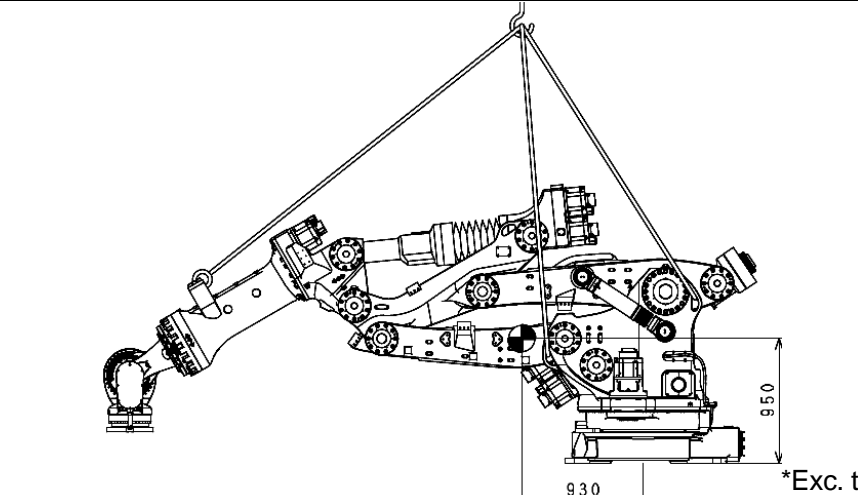
4.1.1 WHEN WIRING ON ARM DIRECTLY WITH THE ARM FOLDED

As shown in the figure below, hoist up the robot by hanging hooks to the six hoisting points of the arm.

Model		MG10HL	
Hoisted up posture			
Hoisted up posture	JT1	0°	
	JT2	-40°	
	JT3	-55°	
	JT4	0°	
	JT5	0°	
	JT6	0°	
Center of gravity		 <p>*Exc. tool mass</p>	

4.1.2 WHEN USING HOISTING JIG IN FORWARD-BENT POSTURE OF THE ARM

As shown in the figure below, attach a hoisting jig (60154-6675) on the forearm and hoist up the robot by hanging hooks to the four hoisting points of the arm and a point of the jig.

Model		MG10HL
Hoisted up posture		 <p>5 slings</p> <p>Hexagon socket head bolt M20x230 (6 bolts) Tightening torque: 431.2 N-m</p> <p>Hoisting jig</p> <p>○ Hoisting point</p>
Hoisted up posture	JT1	0°
	JT2	90°
	JT3	-30°
	JT4	0°
	JT5	-60°
	JT6	0°
Center of gravity		 <p>930</p> <p>950</p> <p>*Exc. tool mass</p>

⚠ WARNING

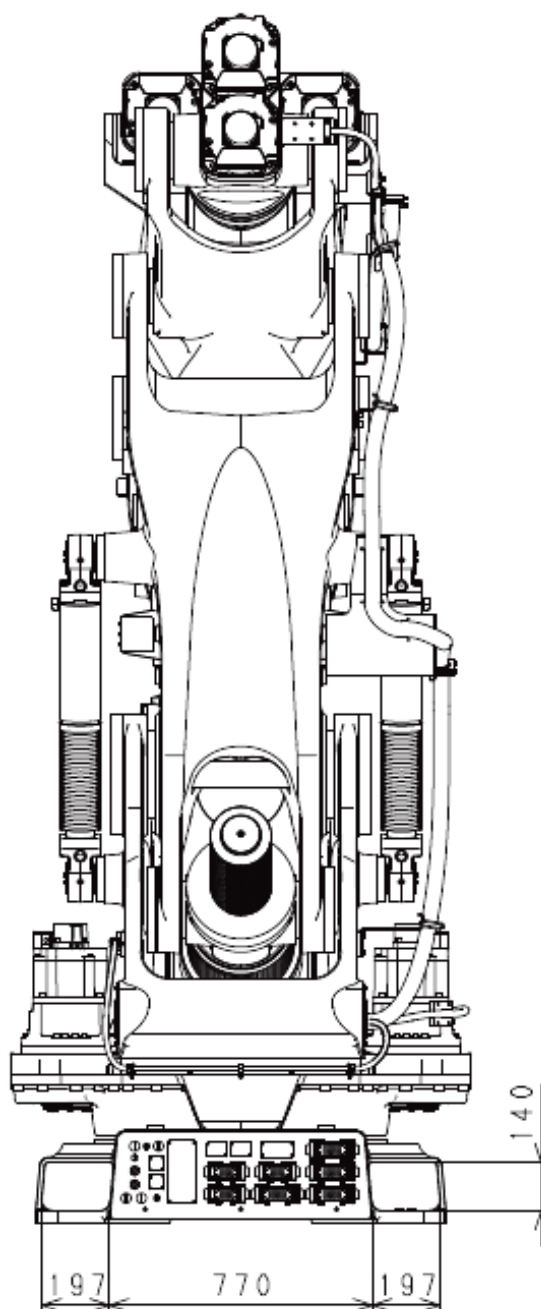
Use a hoisting jig without fail when hoisting up robot in the posture shown in the figure above. If the robot is hoisted up without using the jig, robot may fall.

4.2 FORKLIFT

Transport the robot by using a forklift pocket on the base section as shown below.

⚠ CAUTION

- 1. Check if a fork of the forklift penetrates the forklift pocket sufficiently without fail.**
- 2. When transporting robot on an inclined or rough surface, be careful to maintain balance to prevent forklift/robot from falling.**



5.0 INSTALLATION DIMENSIONS OF BASE SECTION

When installing a robot, fix the base section with high tension bolts through the bolt holes.

Model	MG10HL
Dimensions for installation	
Cross-section of installation section	
Bolt hole	16-φ33
High tension bolt	16-M30 Material: SCM435 Strength class: 10.9 min.
Tightening torque	1700 N·m
Levelness	Within ±5°

6.0 MOVEMENT REACTION ACTING ON INSTALLATION SURFACE DURING OPERATION

Refer to the list below for the movement reaction that acts on the installation surface during operation. Consider these values at installation.

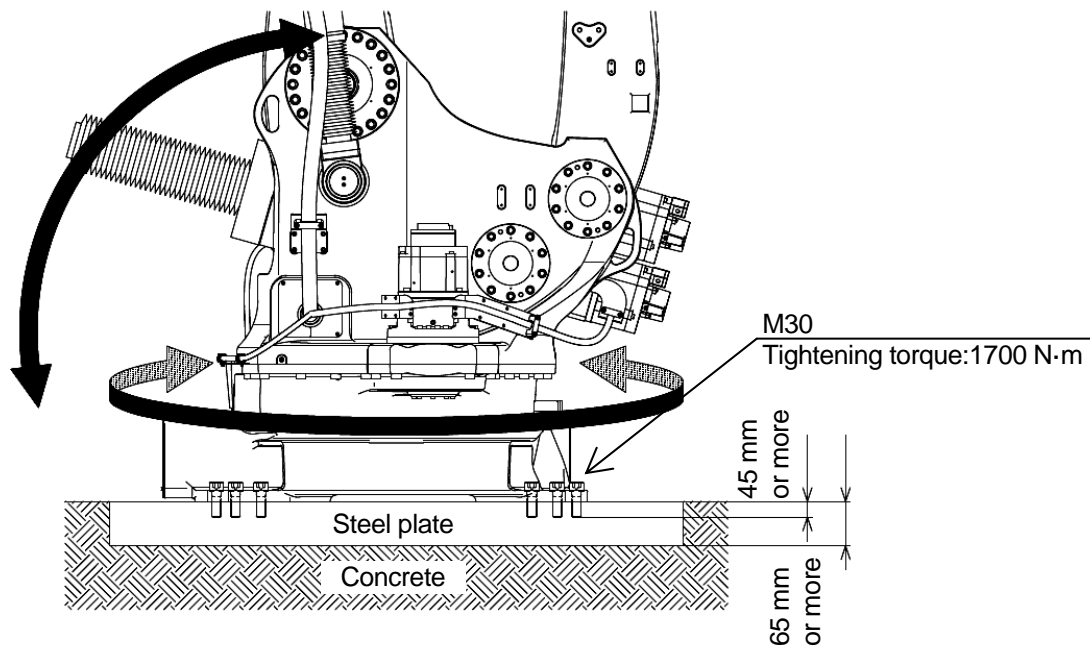
M: Inversion Moment N·m	T: Rotating Torque N·m
160000	55000

See the next chapter for M and T.

7.0 INSTALLATION METHOD

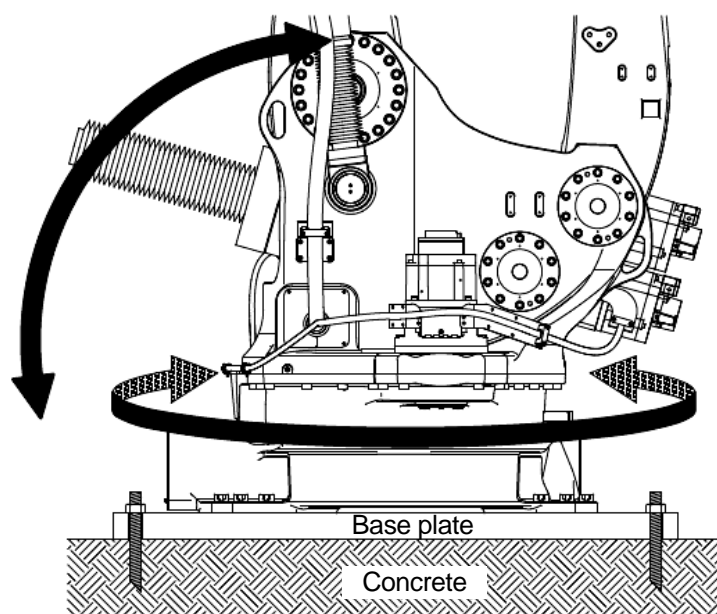
7.1 WHEN INSTALLING THE BASE DIRECTLY ON THE FLOOR

In this case, bury steel plate (65 mm min. thickness) in the concrete floor as shown in the figure below or fix it with anchors. Fix the steel plate firmly enough to endure the reaction forces produced by the robot.



7.2 WHEN INSTALLING THE ROBOT BASE PLATE ON THE FLOOR

In this case, install the base plate on concrete floor or steel plate using bolt holes on the base plate. Reaction forces received from robot are the same as when installing the base directly on the floor.



8.0 MOUNTING OF TOOLS



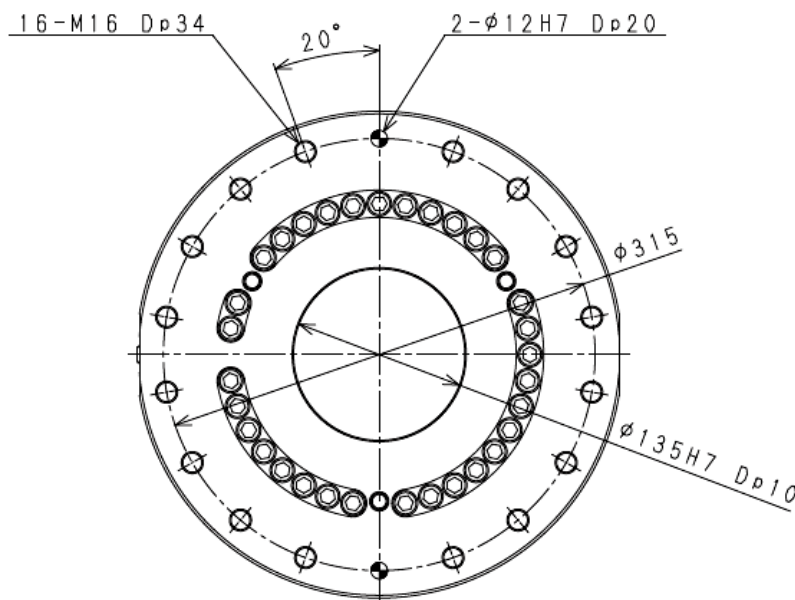
WARNING

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.

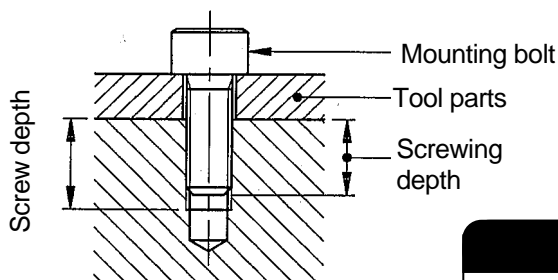
8.1 DIMENSIONS OF WRIST END

In the robot arm end section, a flange is provided on which tools are mounted. Screw the mounting bolts (M16) into the tapped holes (depth: 34) on the circumference of $\phi 315$ on the flange, referring to the figure below. (Tightening torque: 235.2 N·m)

Moreover, position the tool by utilizing the pin holes (2- $\phi 12H7$, Depth: 20).



8.2 SPECIFICATION OF MOUNTING BOLT



Select mounting bolts with proper length to secure the specified screwing depth according to the tapped depth of tool mounting flange. Use high tension mounting bolt (SCM435, min. 10.9) and tighten them to the specified torque.



CAUTION

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

8.3 LOAD CAPACITY

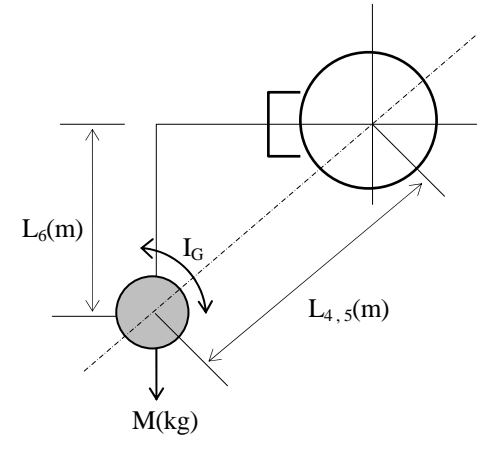
Load mass applicable to robot is specified for each model and includes the mass of tool, etc. Applicable load torque and moment of inertia around wrist axes (JT4, JT5, JT6) are also specified. Strictly observe the following restrictions on them.

! CAUTION

Using the robot beyond its specified load may result in degradation of movement performance and shortening of machine service life. The load mass includes the tool mass such as hand, tool changer, spot welding gun, 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



L_6 (m)

M (kg)

I_G

$L_{4,5}$ (m)

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

Load torque : $T = 9.8 \cdot M \cdot L$ (N·m)

Load moment of inertia: $I = M \cdot L^2 + I_G$ (kg·m²)

M_{max} : Maximum load mass: See 3.2.

$L_{4,5}$: Length from JT4(5) axis rotation center to load center of gravity

I_G : Moment of inertia around center of gravity (Unit: kg·m²)

L : Length from axis rotation center to load center of gravity (Unit: m) (See the figure.)

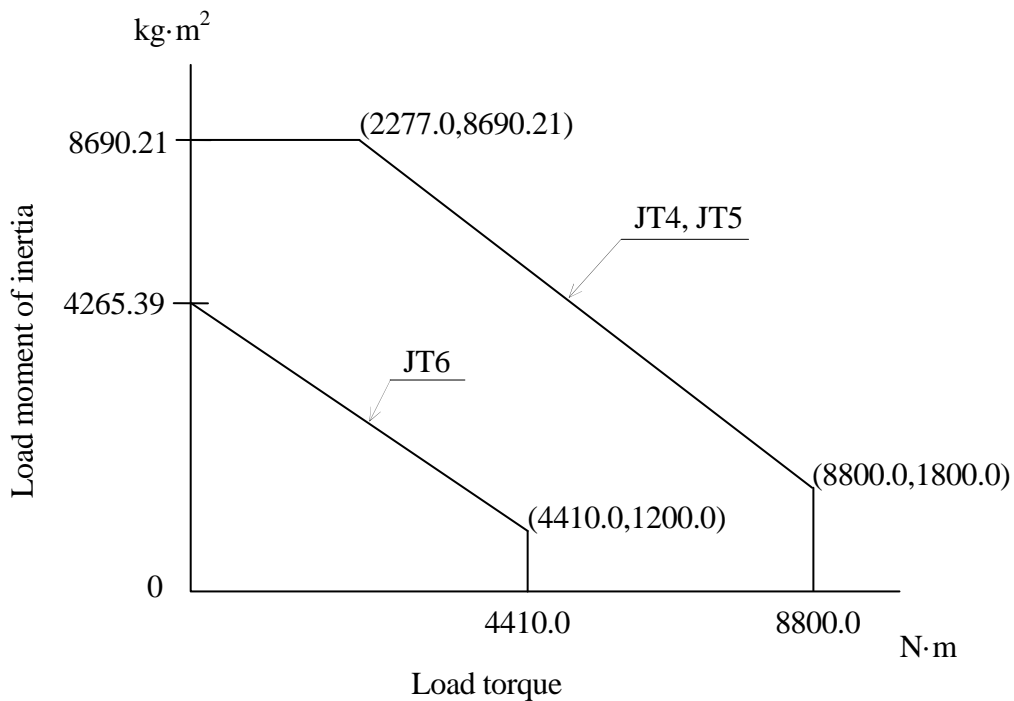
L_6 : Length from JT6 axis rotation center to load center of gravity

If calculation of load is made by dividing the load into construction parts, such as tools and workpieces, use the total calculation values of each part as load torque and moment of inertia.

1. The load mass of the wrist section including tool mass should be less than 1000 kg.
2. The load torque and the moment of inertia around each wrist axis (JT4, JT5, JT6) should be within the following restriction.

⚠ CAUTION

Set the load data via Auxiliary function 0304 after mounting of tools without fail. Operating robot with wrong settings may cause vibrations in motion, degradation of movement performance and shortening of machine service life.



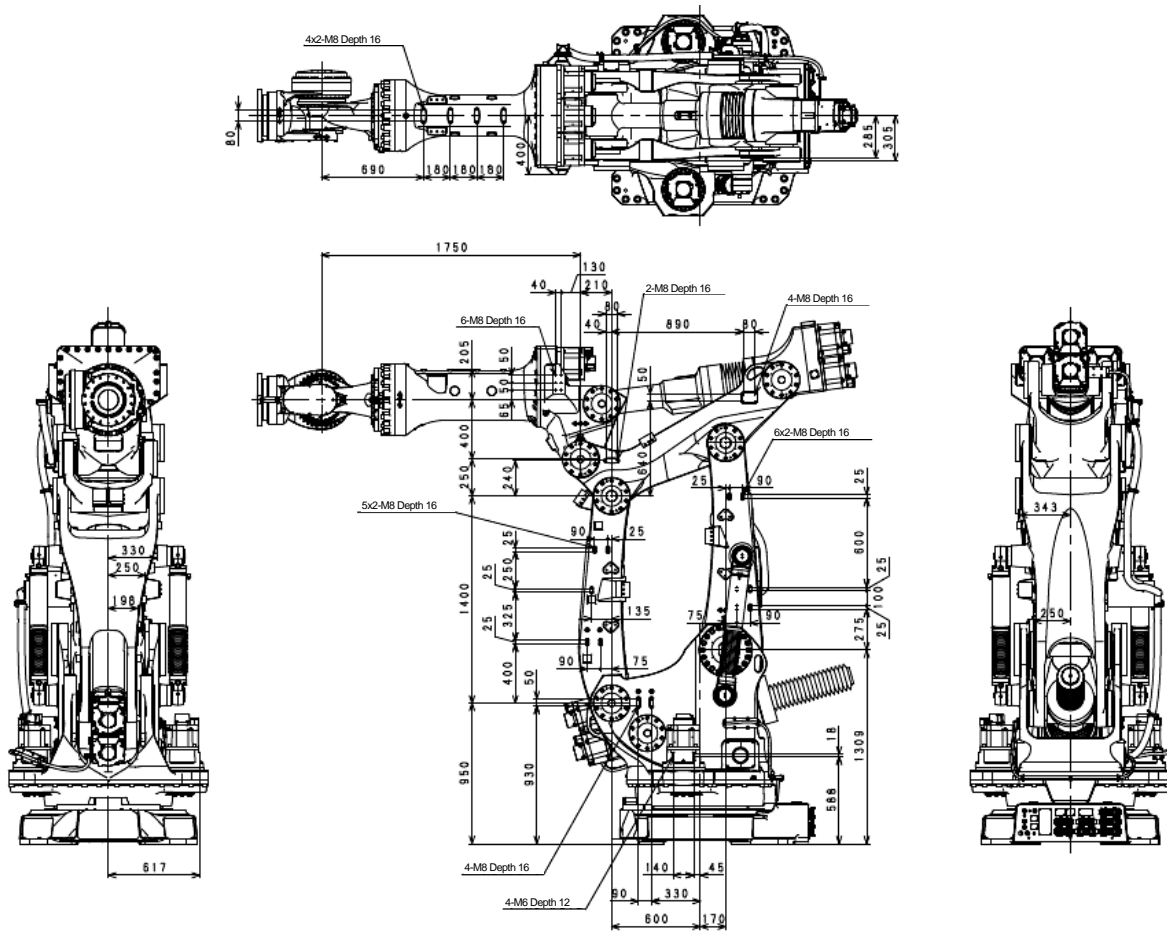
9.0 MOUNTING EXTERNAL EQUIPMENT

9.1 SERVICE TAPPED HOLE POSITIONS

Service tapped holes shown in the figure below are available to mount wiring brackets and external equipment on each part of robot arm.

⚠ CAUTION

Check the robot movement very carefully and confirm that mounted brackets and external equipment do not interfere with peripheral equipment and robot arm itself.





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