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 **Kawasaki**

**Kawasaki Robot
ZH100U-A**

**Installation and
Connection Manual**

Robot

Kawasaki Heavy Industries, Ltd.

90202-1103DEA

PREFACE

This manual explains installing and connecting procedures for Kawasaki Robot ZH series.

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

Never proceed with any operation until you understand the contents of this manual completely.

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 the following Robot Arms
ZH100U


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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.**
- 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.**

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1.0 CAUTIONS

This manual explains only cautions when installing and connecting robot arm. Refer to the separate safety manual for other items.

1.1 TRANSPORTATION AND STORAGE

When transporting the Kawasaki robot to its installation position, strictly observe the following precautions:



WARNING

1. When transporting robot using a crane or a forklift, never support the robot manually.
2. During transportation, never climb on, or stay under the hoisted up robot.



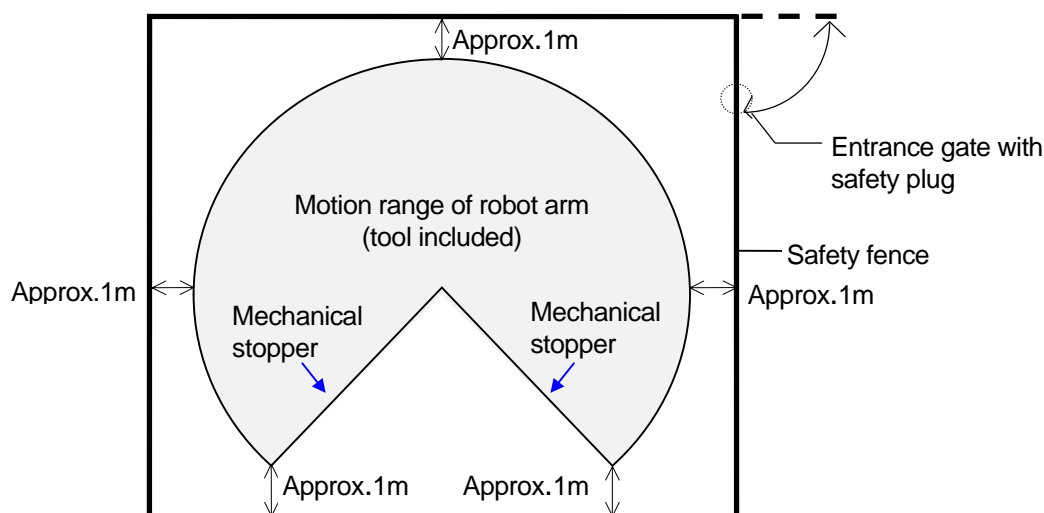
CAUTION

1. Since the robot body is composed of precision parts, be careful not to apply excessive shocks or vibrations to the robot during transportation.
2. Prior to installing the robot, remove all obstacles so the installation is carried out smoothly and safely. Clear a passage to the installation area for transportation of the robot using a crane or forklift.
3. During transportation and storage,
 - (1) Keep the ambient temperature within the range of -10°C ~ 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 INSTALLATION ENVIRONMENTS OF ROBOT ARM

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

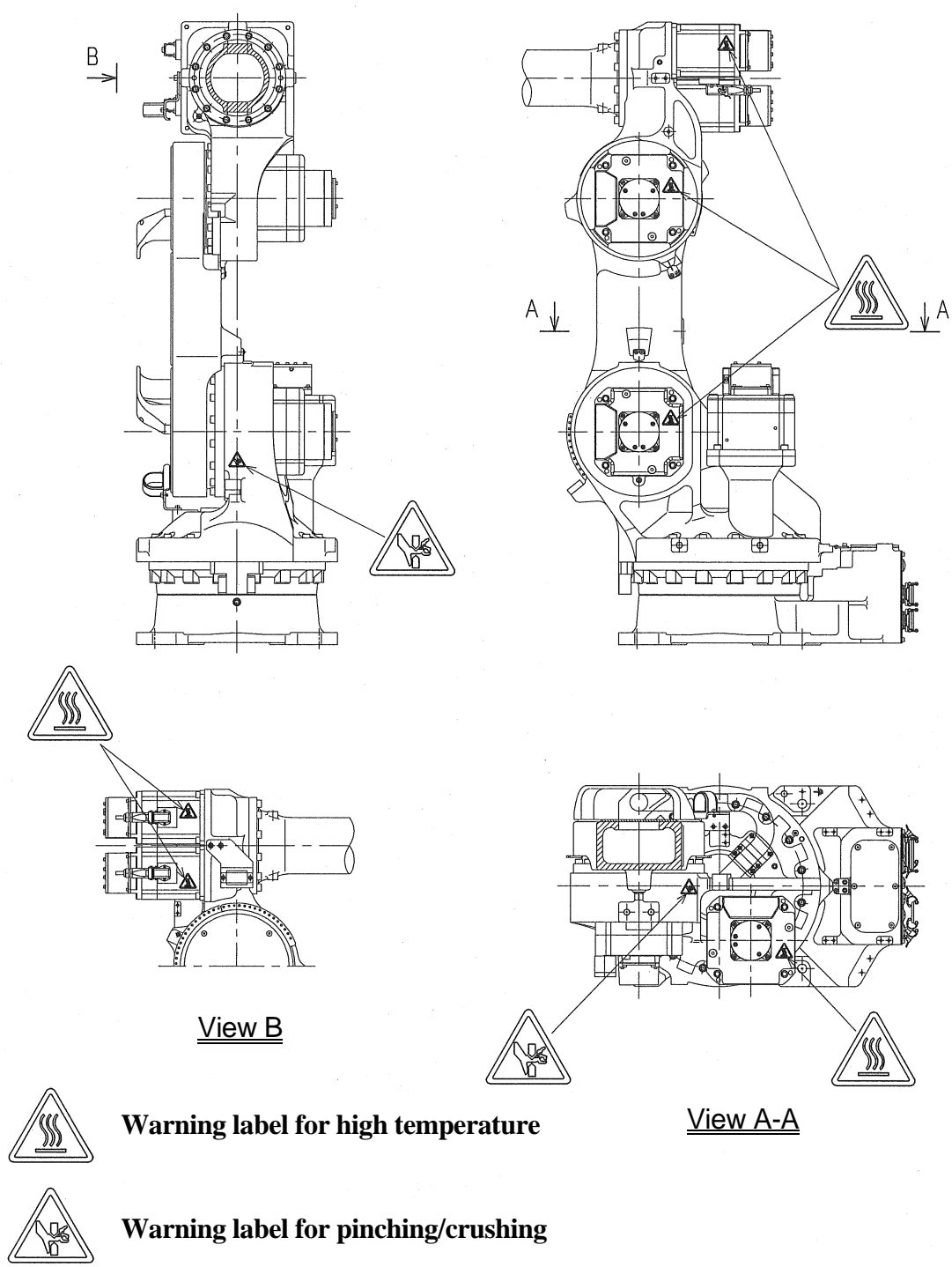
1. When robot is installed on the floor, the levelness must be within $\pm 5^\circ$.
2. Be sure that the floor/stand has sufficient rigidity.
3. Secure a flat place to prevent the base section from receiving undue force.
(If an accurate flatness is unobtainable, insert liners and adjust the flatness).
4. Keep the ambient temperature during operation within the range of $0^\circ\text{C} \sim 45^\circ\text{C}$.
(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. (In dusty or moist condition, use an Arm with dust-proof or waterproof spec.)
7. The robot installing place should be free from flammable or corrosive liquid or gas. (Use an explosion-proof arm in a flammable environment.)
8. The robot installing place should be free from excessively strong vibration. (0.5G 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. Safety fence must enclose area larger than the maximum motion range of the robot arm fully equipped (with tools) so it does not interfere with the surrounding objects.
 - (1) An entrance gate with a safety plug should be provided to the safety fence.
 - (2) About details of the safety fence, observe the requirements which are established in each region. (JIS B8433)



1.3 WARNING LABEL

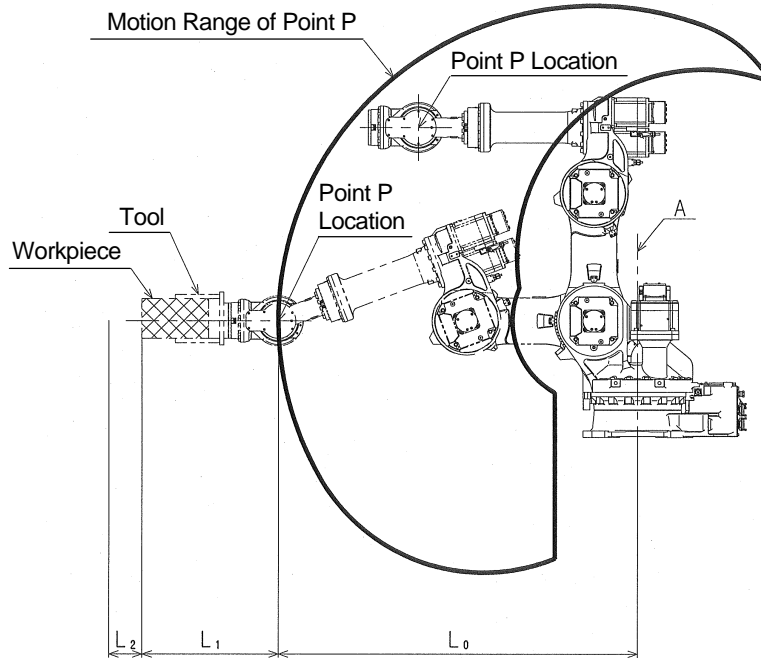
⚠ WARNING

Pay attention to the warning labels listed in the drawings during operation.

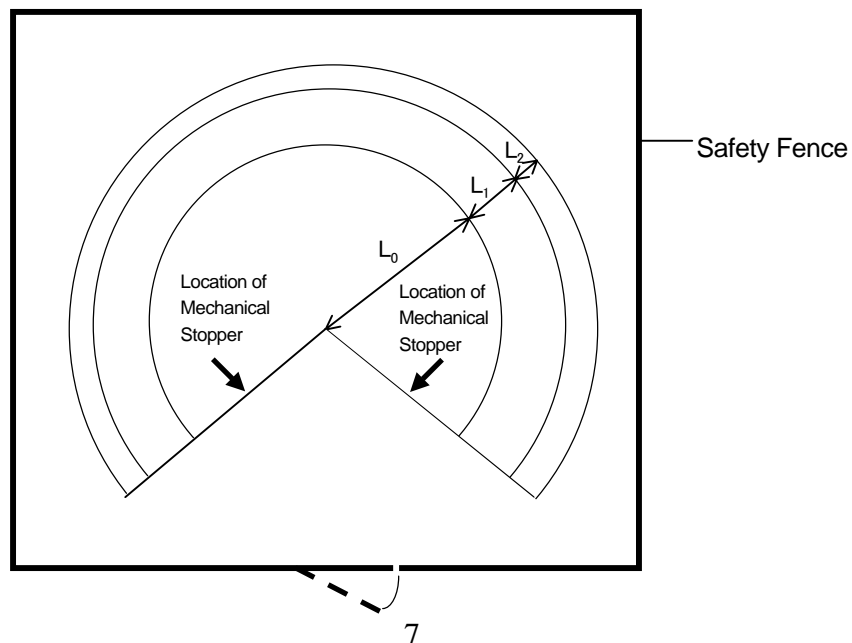


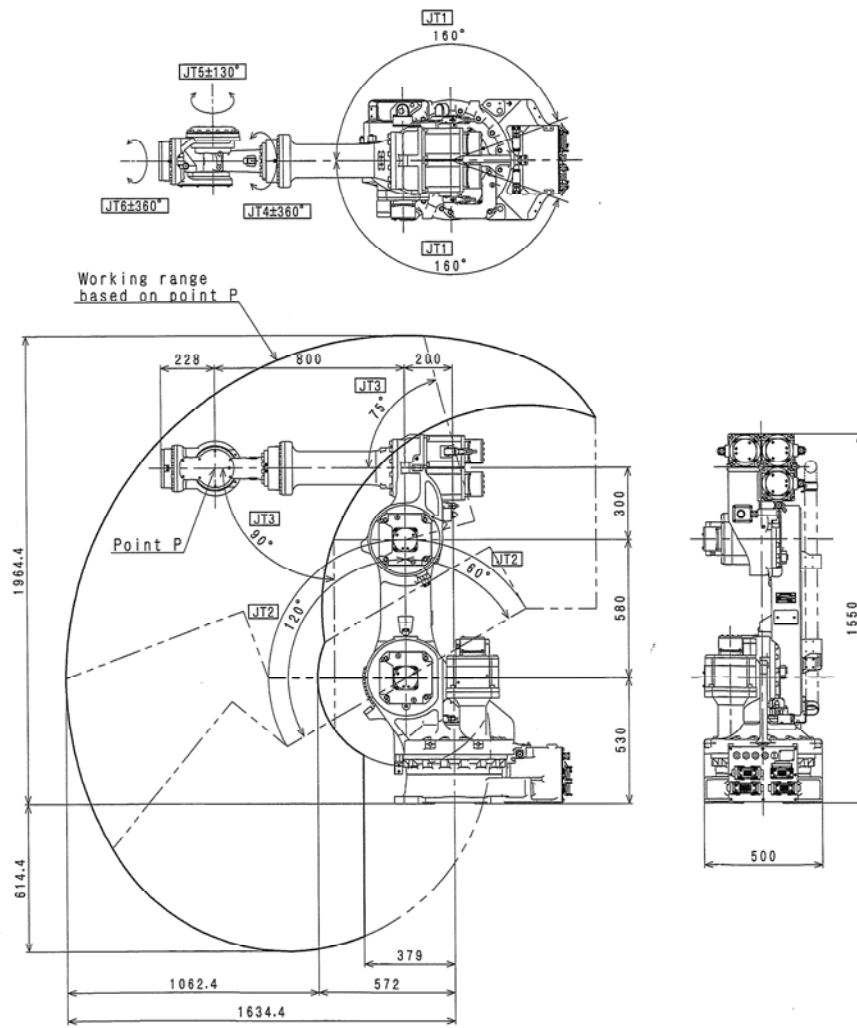
2.0 MOTION RANGE & SPECIFICATION OF ROBOT

DETERMINATION OF SAFETY FENCE LOCATION BASED ON MOTION RANGE:



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/workpiece ($=L_1$) + dimension of allowance ($=L_2$). For the dimensions of L_0 , refer to the drawings of Motion Range & Specifications of Robot given in the following page.





Type	Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±160°	140 °/s
	2	+120° ~ -60°	100 °/s
	3	+75° ~ -90°	100 °/s
	4	±360°	150 °/s
	5	±130°	150 °/s
6	±360°	250 °/s	
Max. Payload	100 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	874.8 N·m	90 kg·m ²
	5	874.8 N·m	90 kg·m ²
6	392.0 N·m	20 kg·m ²	
Repeatability	±0.3 mm		
Mass	Approx. 750 kg		
Acoustic Noise	< 70db (A) *		

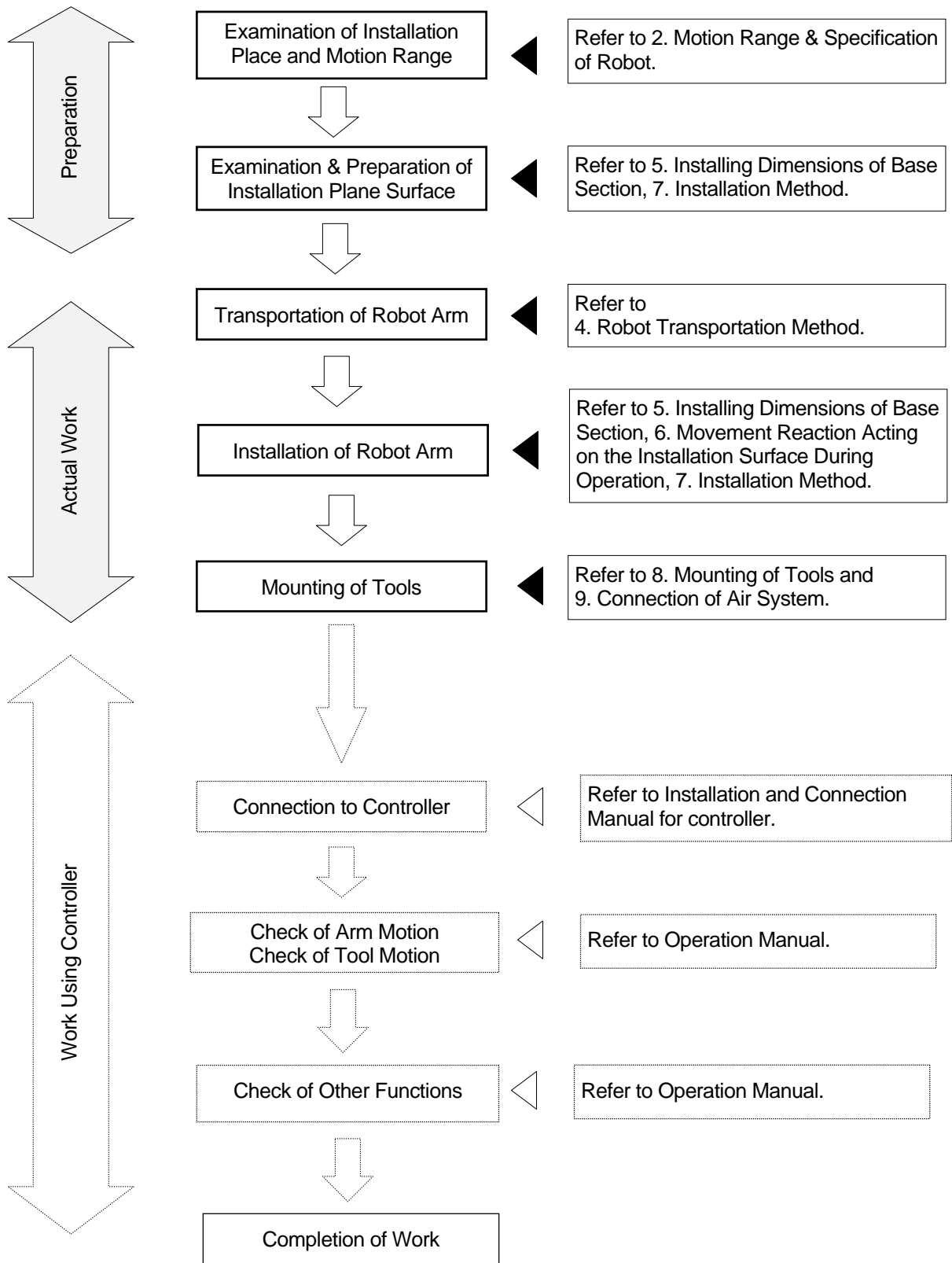
*measured condition

- installed on the plate rigidly fixed on the floor
- 3634.4 mm away from JT1 center

(The noise level depends on the conditions.)

3.0 WORK FLOW AT ARM INSTALLATION AND CONNECTION

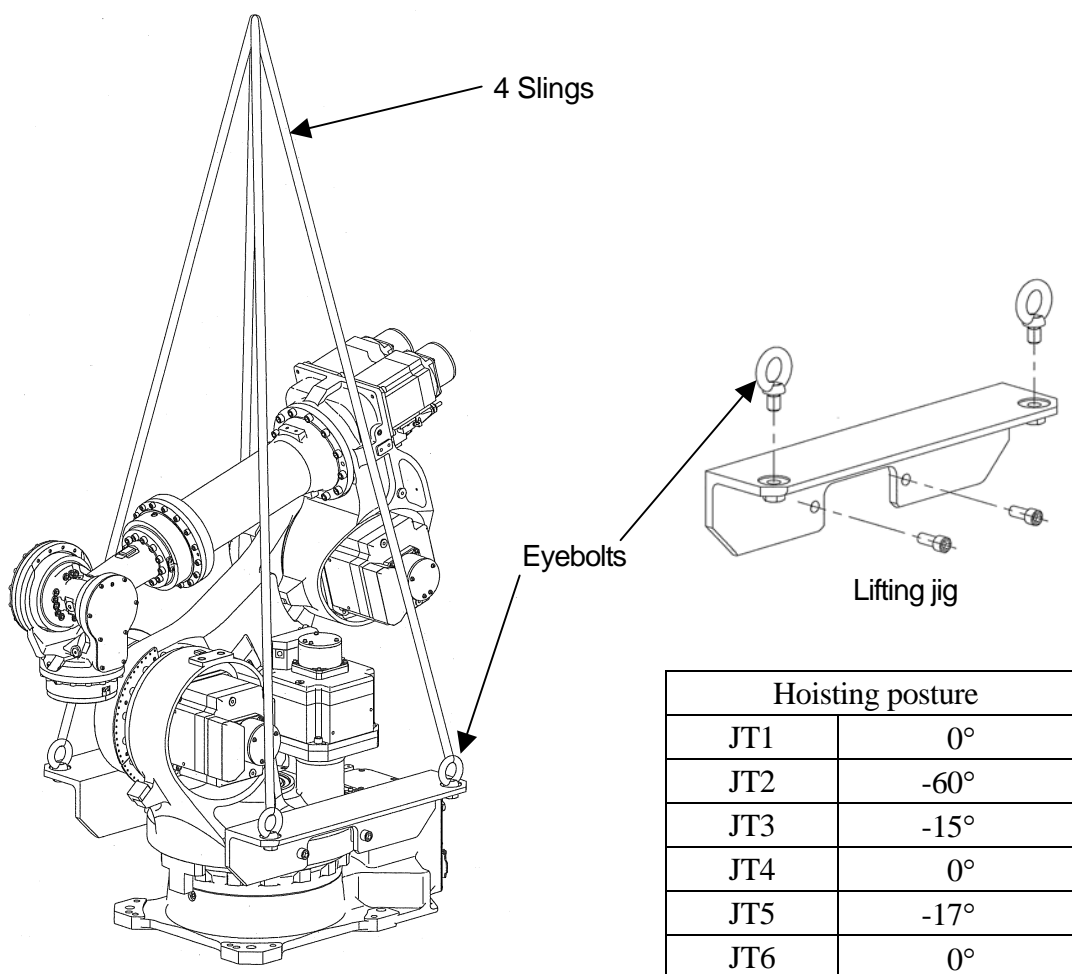
This flowchart describes only the robot arm section. For the controller, refer to separate Installation and Connection Manual for Controller.



4.0 ROBOT TRANSPORTATION METHOD

4.1 WIRE SLING

According to the figure, mount a lifting jig and eyebolts. Hoist up the robot by four slings through four eyebolts.



CAUTION

When hoisting up the robot, be careful as robot may lean forward/backward depending on robot posture and mounting condition of the tool and options. If the robot is hoisted up with the base section inclined, it may swing, or the sling may interfere with the wrist motor, harness, piping etc., or it may be damaged from interfering with surrounding objects.

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.

<p>Installation Dimensions of Base Section</p>	
<p>Cross-section of Base Installation Hole</p>	
<p>Bolt Hole</p>	<p>4- φ 22</p>
<p>High Tension Bolt</p>	<p>4-M20 Material: SCM435 Strength class: 10.9 min.</p>
<p>Tightening Torque</p>	<p>431.2 N·m</p>
<p>Levelness</p>	<p>Within ±5°</p>

6.0 MOVEMENT REACTION ACTING ON INSTALLATION SURFACE DURING OPERATION

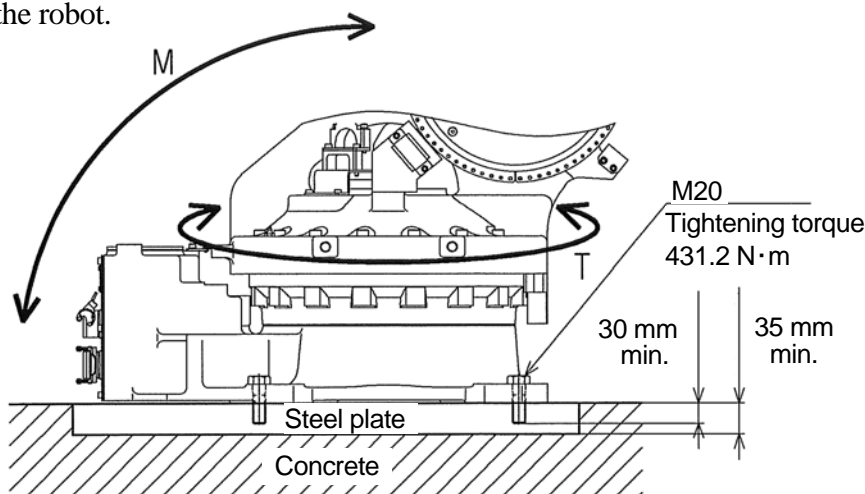
Refer to the list below for the movement reaction that acts on the installation surface during operation. Consider these values at installation shown in the following pages.

Model	ZH100U
M (Inversion Moment)	22000 N·m
T (Rotating Torque)	9000 N·m

7.0 INSTALLATION METHOD

7.1 INSTALLING BY FIXING THE BASE SECTION OF THE ROBOT ARM DIRECTLY ON THE FLOOR

As shown in the figure below, embed steel plate (35 mm Min. thick) in the concrete floor as a foundation and fix the base section on it, or fix the base section directly on the concrete floor with anchors. The steel plate should be embedded securely enough to endure the reaction forces produced by the robot.



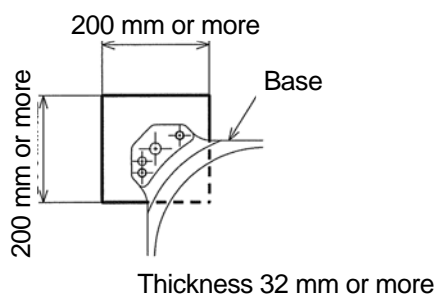
7.2 WHEN INSTALLING THE BASE PLATE WITH POSITIONING HOLES ON THE FLOOR

There are four holes of $\phi 22$ for anchor bolts in the base plate. Fix the base plate onto the concrete floor using the holes to install the robot arm. Reaction forces from the robot are the same as when installing the base section of the robot arm directly on the floor.

There are two pin holes on the base plate for positioning the base section of the robot arm precisely, which enables quick and easy replacement of a broken robot with JT1 precisely zeroed. (Beware that usually JT1 is not precisely zeroed. This function is only provided as Option.)

7.3 WHEN INSTALLING WITH INSTALLATION BLOCK

Install the installation block confirming the following dimensions are satisfied.



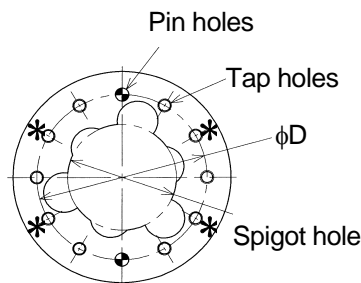
8.0 MOUNTING OF TOOLS

WARNING

When mounting tools, shut off controller power up to the external power switch for shutting off power supply to the robot controller. Display signs indicating clearly “Inspection and Maintenance in progress”, and lockout/tagout the external power switch to prevent personnel from accidentally turning on the power.

8.1 DIMENSIONS OF WRIST END (FLANGE)

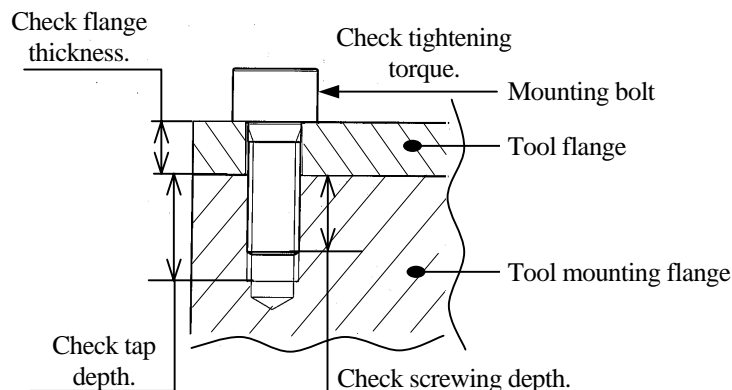
At the end of robot arm, a flange is provided for mounting a tool. Screw the mounting bolts into the tap holes machined on circumference of ϕD as shown below. Position tool with pin holes and spigot hole.



NOTE: 4 tap holes marked * require no tightening.

8.2 SPECIFICATION OF MOUNTING BOLTS

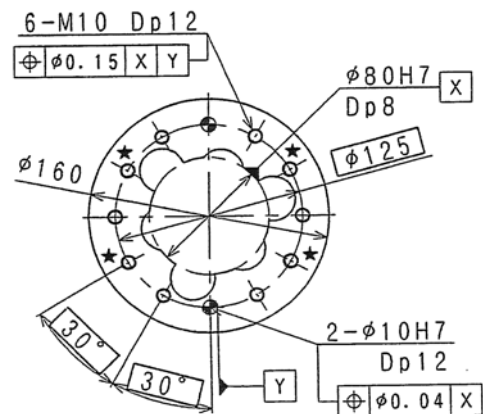
Select the length of mounting bolts according to the tap depth of tool mounting flange and thickness of tool parts so that the specified screwing engagement can be attained. Use high tension mounting bolts and tighten them to the specified torque (See the table on the next page).



CAUTION

If the length of engagement (screw depth) exceeds the specified depth, the mounting bolt bottoms out and the tool cannot be fixed.

Model	ZH100U
Tap holes	6-M10
φD	φ 125
Pin holes	2- φ 10H7 Depth 12
Spigot hole	φ 80H7 Depth 8
Tap depth	12 mm
Screwing depth	10~11 mm
High tension bolt	SCM435, 10.9 min
Tightening torque	56.84 N·m

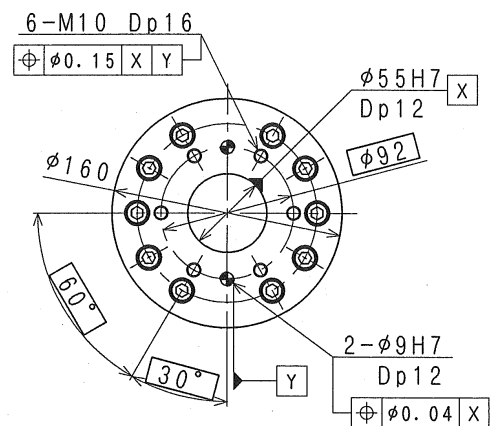


NOTE: 4 tap holes marked * require no tightening.

[NOTE]

The above mounting size is based on ISO. For the size below, insert the adapter plate (option) prior to mounting tools.

Model	ZH100U
Tap holes	6-M10
φD	φ 92
Pin holes	2- φ 9H7 Depth 12
Spigot hole	φ 55H7 Depth 12
Tap depth	16 mm
Screwing depth	14~15 mm
High tension bolt	SCM435, 10.9 min
Tightening torque	56.84 N·m



8.3 LOAD CAPACITY

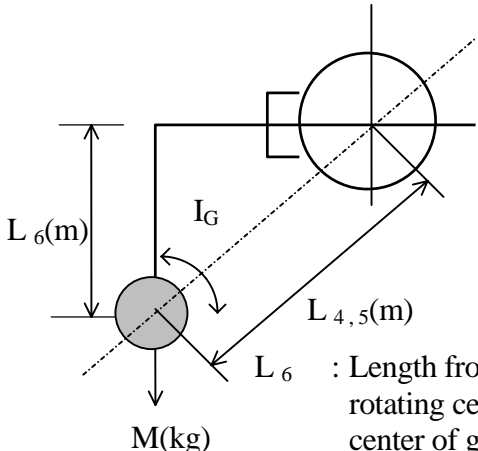
1. The load capacity of robot is specified for each model and includes the mass of tool, etc. Also, the load capacity of wrist section is provided with limiting conditions.
2. In addition, strictly observe the wrist load capacities in the tables on page 8. Do not exceed the max. allowable load torque and load moment of inertia specified for each wrist axes (JT4, JT5, JT6).

! CAUTION

Using the robot beyond its specified load capacity may result in degradation of movement performance and shortening of machine service life. The specified mass capacity includes the tool mass such as hand, tool changer, spot weld gun, etc. If load exceeds the load capacity, contact Kawasaki before starting operations.

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

Calculating formula



L_6 : Length from JT6 axis rotating center to load center of gravity.
 $L_{4,5}$: Length from JT4(5) axis rotating center to load center of gravity.

Load Mass (including tool): $M \leq M_{max}(\text{kg})$
 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_{max} .: Rated Load Mass
 ZH100U: 100 kg
 L : Length from axis rotating center to load center of gravity. (Unit: m)
 I_G : Moment of inertia around center of gravity. (Unit : $\text{kg} \cdot \text{m}^2$)

When calculating the load by dividing it into sections (e.g. tool section, workpiece section, etc.), evaluate the load torque and inertia moment from the total value of each section.

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