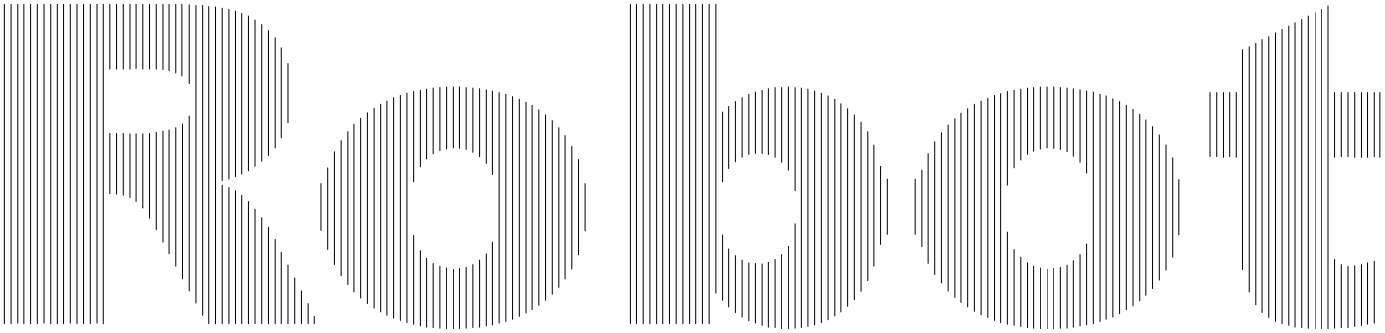
Simple and friendly

Kawasaki

Kawasaki Robot
MX Series, MD Series, MT400N

INSTALLATION AND CONNECTION



Kawasaki Heavy Industries, Ltd.

90202－1066DEE

PREFACE

This manual describes the installation and connection for the Kawasaki Robot MX series, MD series and MT400N.

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

This manual describes only the installation and connection of the robot arm section. Refer to separate Installation and Connection for controller and cables.

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

Kawasaki is not responsible for any accidents and/or damages resulting from operations/ maintenance based on only a limited reading or limited understanding of some parts of this manual.

This Manual is applicable to the following Robot Arms

MX700N, MX500N, MX420L, MX350L, MD500N, MD400N, MT400N

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 PRECAUTIONS

1.1 PRECAUTIONS DURING TRANSPORTATION AND STORAGE

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

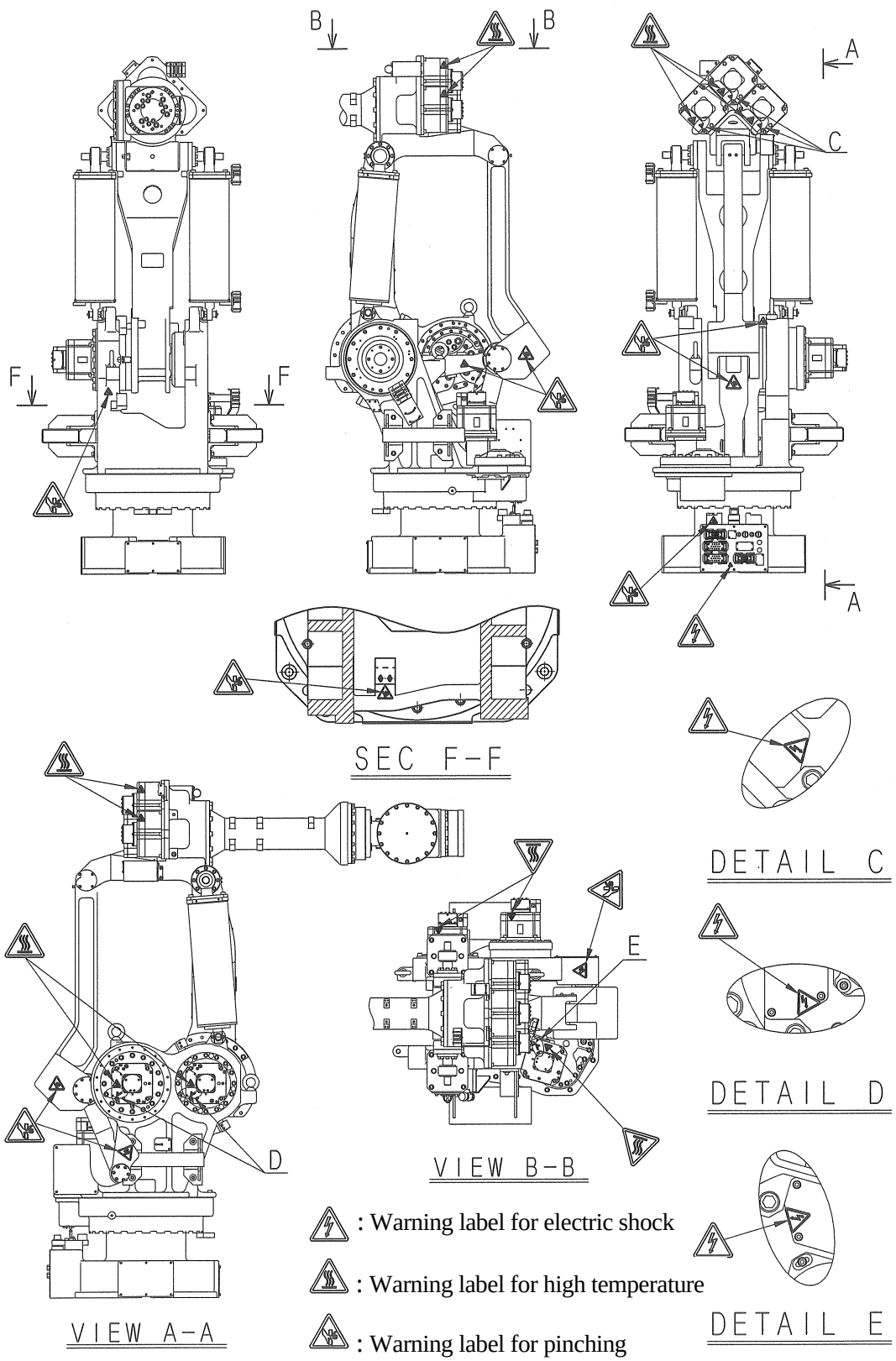
⚠ WARNING

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.**
3. **Prior to starting installation, turn OFF controller power up to the external power switch. Display signs indicating clearly "Installation in progress", and lockout/tagout the external power switch to prevent the danger of electric shock and to stop personnel from accidentally turning ON the power.**
4. **When moving the robot, do not fail to ensure safety such as abnormality of installation conditions before turning ON the motor power. Then, set the robot to the desired posture. Be careful not to be caught by or between any moving parts of the robot due to careless approach to the robot at this time. After driving robot to the specified pose, turn OFF the power and lockout/tagout the external switch again as mentioned above, and start installation.**
5. **Warning labels are affixed to the arm to identify areas with possibility of electric shock, high temperature or pinching/crushing, so check these areas beforehand. See the next page for the warning labels and their positions.**

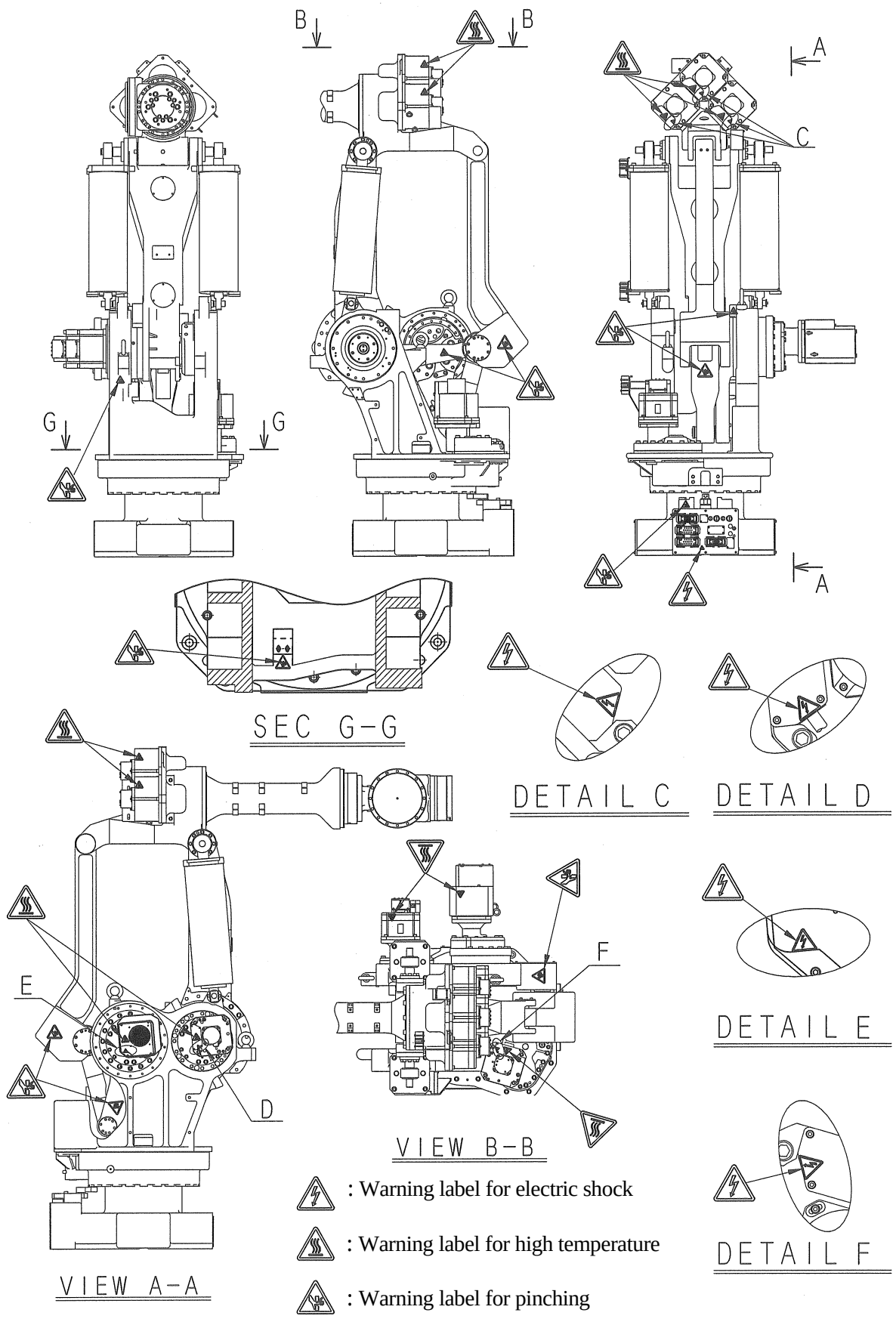
⚠ CAUTION

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 install area for transportation of the robot using a crane or forklift.**
3. **During transportation and storage;**
   (1) Keep the ambient temperature within -10 to 60 ˚C.
   (2) Ensure air is within 35 to 85 % relative humidity without dew condensation.
   (3) Ensure robot arm does not incur excessively strong shock and vibration.

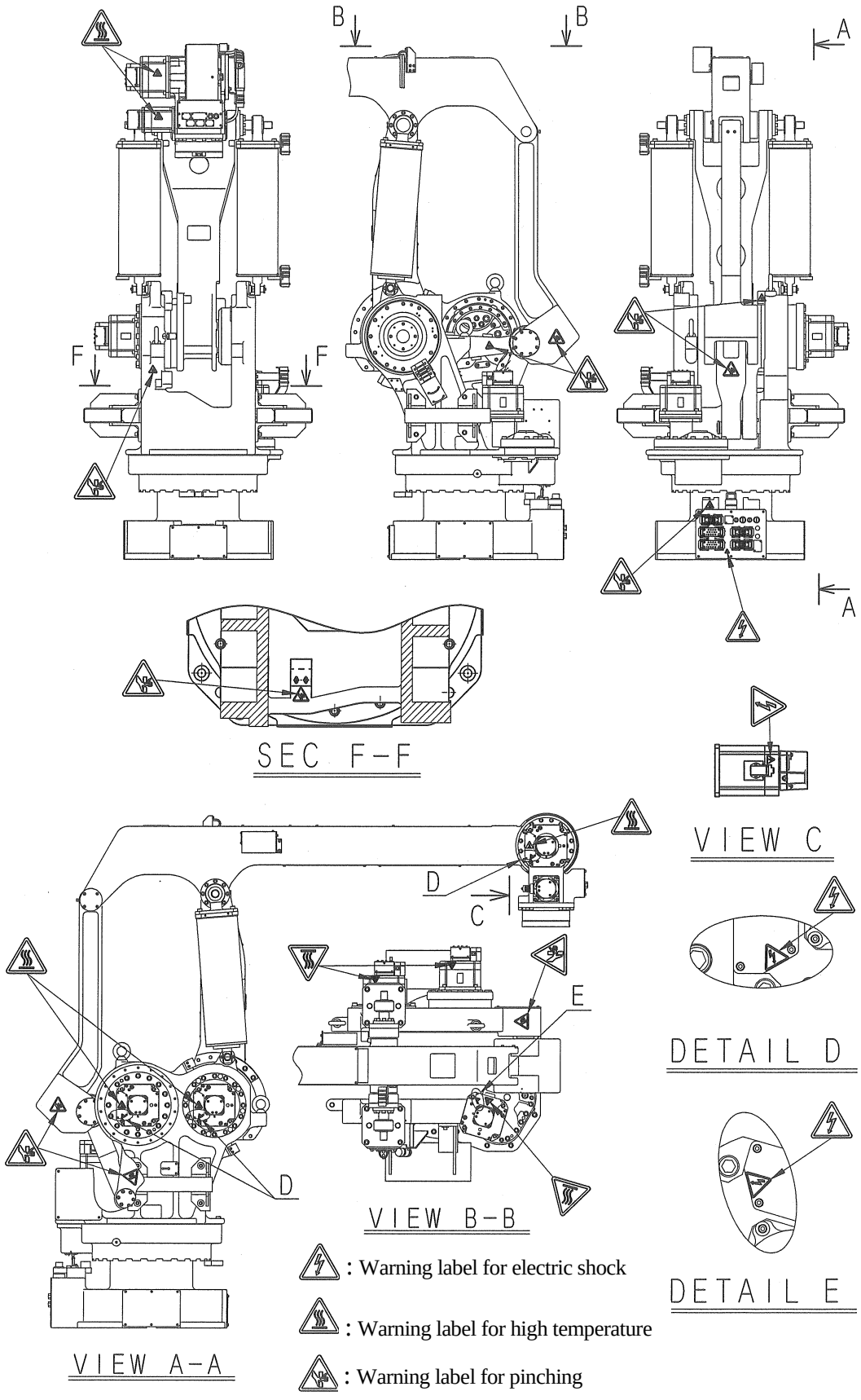
MX500N, MX420L, MX350L warning label positions



MX700N warning label positions



MD400N warning label positions



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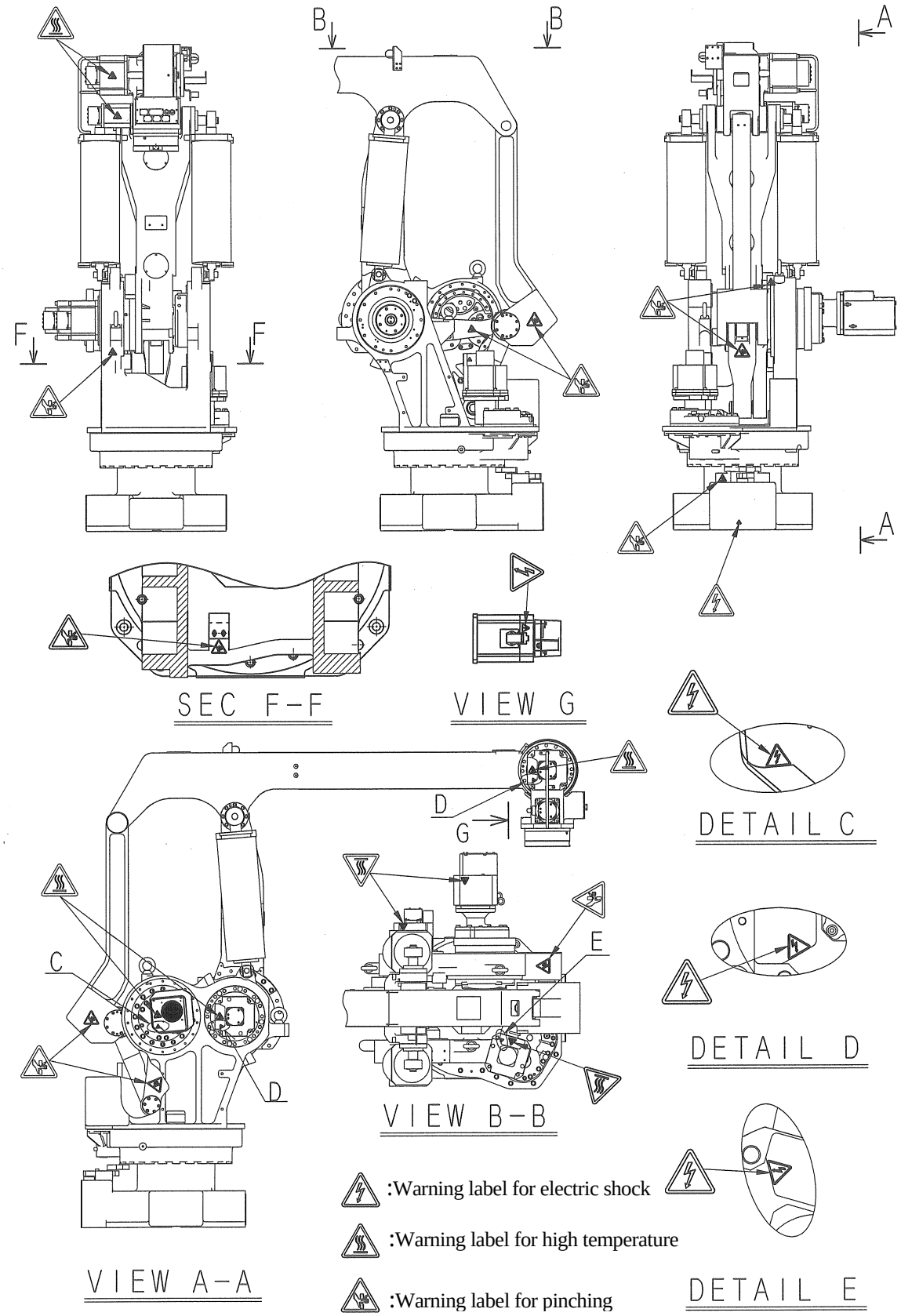
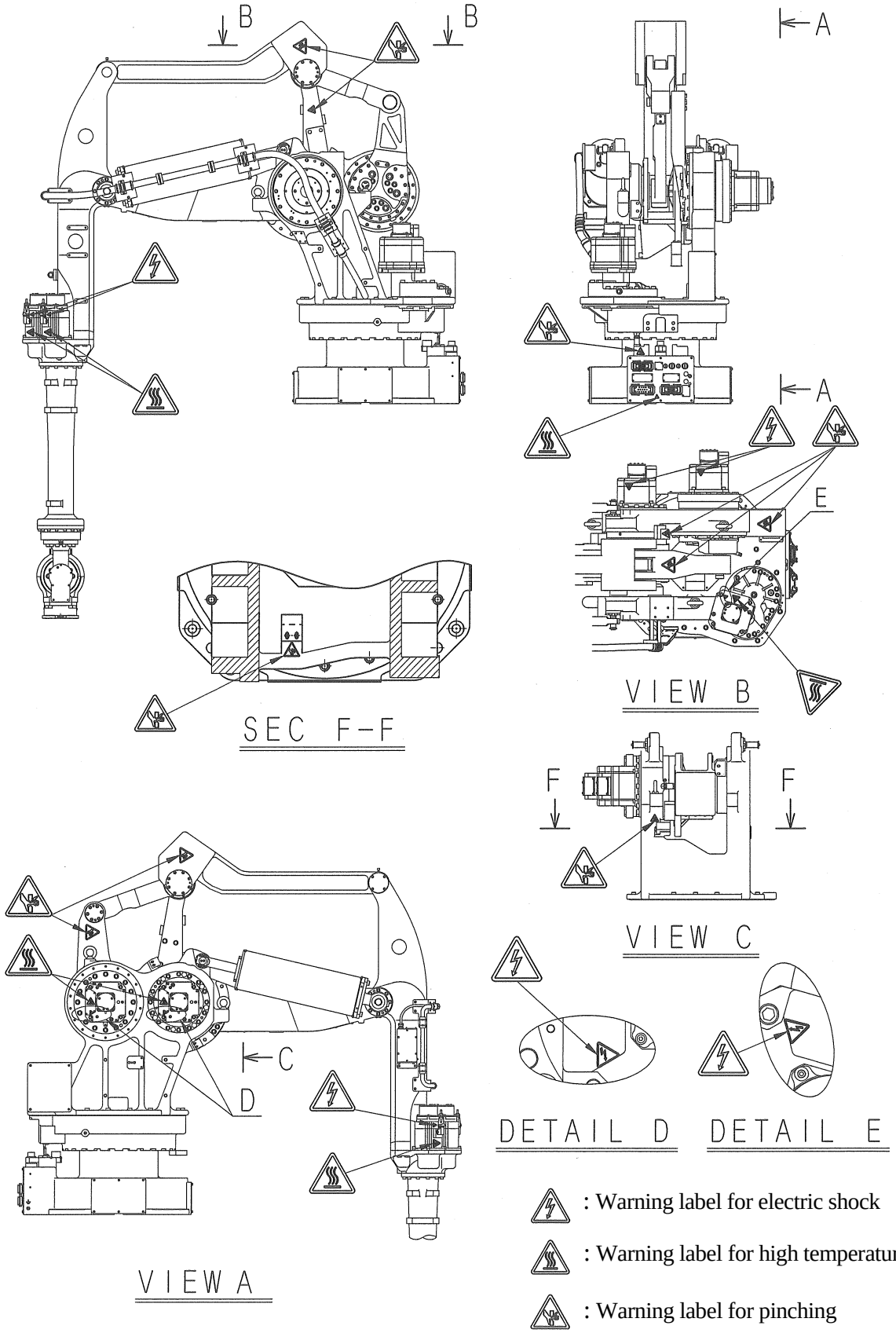


MT400N warning label positions

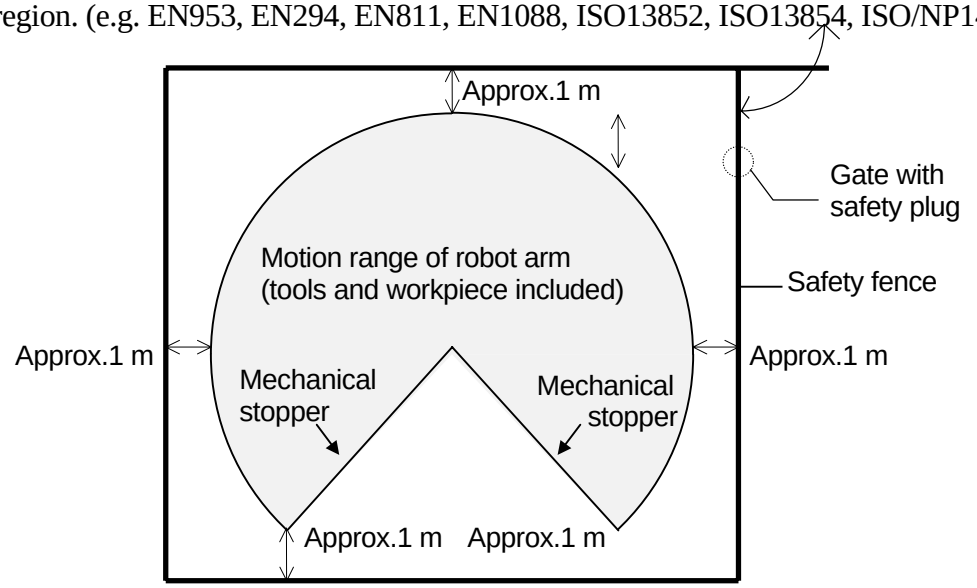


1.2 INSTALLATION ENVIRONMENTS OF ROBOT ARM

Make sure that the following environmental conditions are satisfied.

1. When robot is installed on floor, the levelness must be within +/-5 °.
2. Be sure that the floor/stand has sufficient rigidity.
3. Secure a leveled place to prevent undue force application on the install position. (If an accurate level is unobtainable, insert liners and adjust the height).
4. Keep the ambient temperature during operation within 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, warm-up robot at low speed before regular operation.)
5. During operation, keep 35 to 85 % Relative Humidity without dew condensation.
6. The robot installing place should be free from dust, dirt, smoke, water, and other foreign matters. (In dusty or moist conditions, use an Arm with dust-proof or waterproof spec.)
7. Robot installing place must 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.
9. The robot installing place should be free from electric noise interference.
10. The robot installing place must be sufficiently larger than the motion range of robot arm.
11. Safety fence must be larger than the maximum movement of fully equipped robot arm (with tools and workpiece) so it does not interfere with the surrounding objects.
12. Minimum number of entrance gates, optimally only one door, with a safety plug provided on the safety fence.*

Note* For safety fence spec. and construction, observe the requirements established for each region. (e.g. EN953, EN294, EN811, EN1088, ISO13852, ISO13854, ISO/NP14120)



2.0 MOTION RANGE & SPECIFICATIONS OF ROBOT

2.1 DETERMINATION OF SAFETY FENCE LOCATION BASED ON MOTION RANGE – MX SERIES AND MT400N

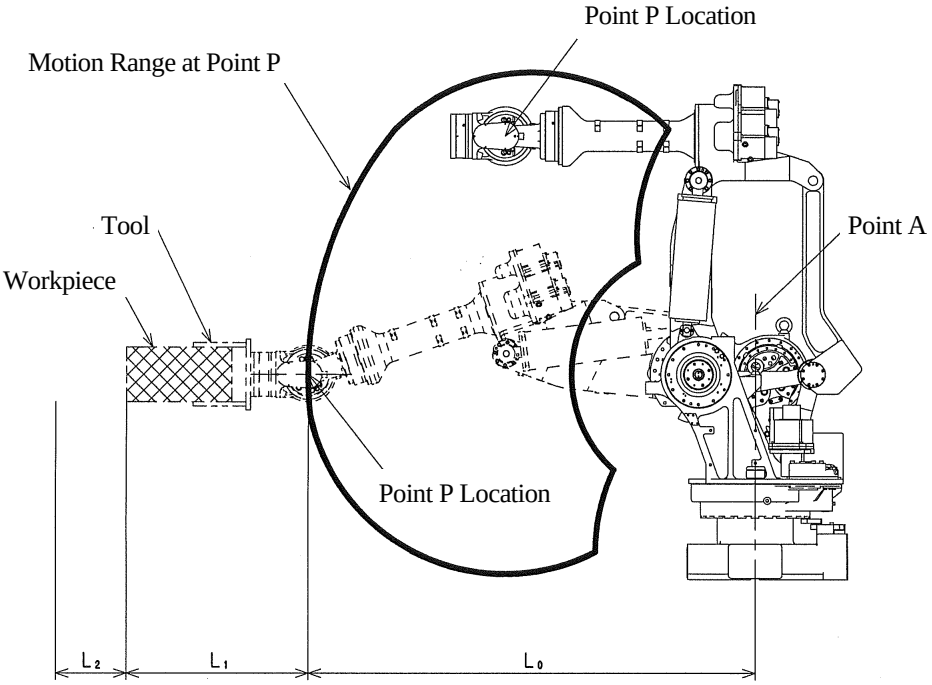
The motion range of robot arm is represented by Point P in figure below. Determine sum of $L_0+L_1+L_2$ as minimum dimension from the center of arm (Point A in the figure), assuming;

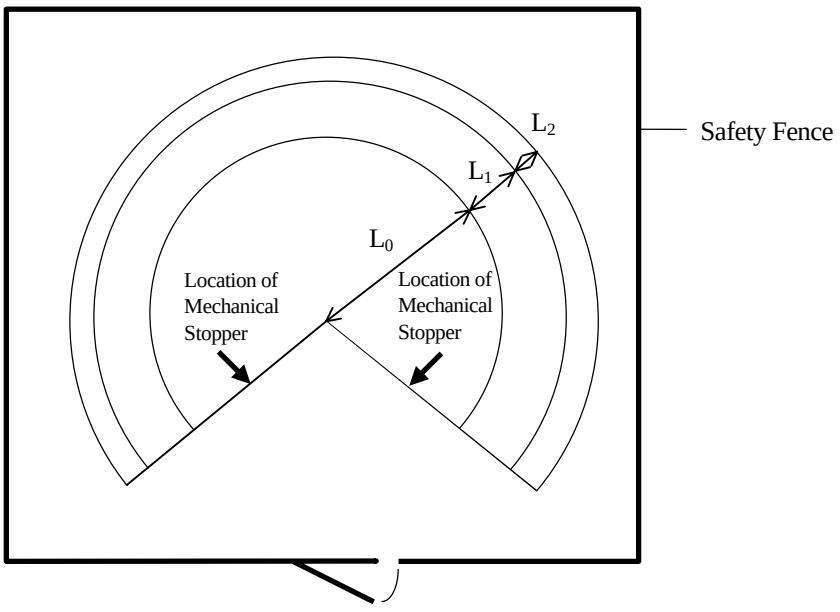
L_0: Motion range of robot (See 2.3 Motion Range & Specifications.)

L_1: Dimension from the center of wrist to the edge of workpiece

L_2: Dimension of allowance

* The figure shows the motion range for MX500N.





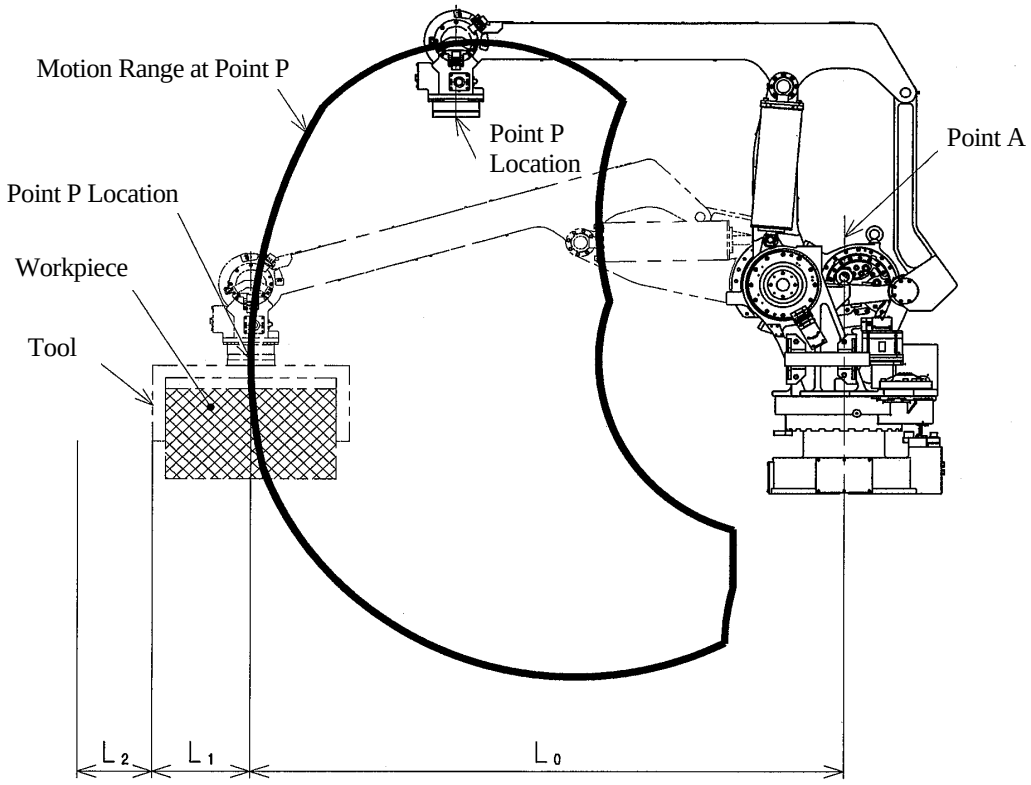
2.2 DETERMINATION OF SAFETY FENCE LOCATION BASED ON MOTION RANGE – MD SERIES

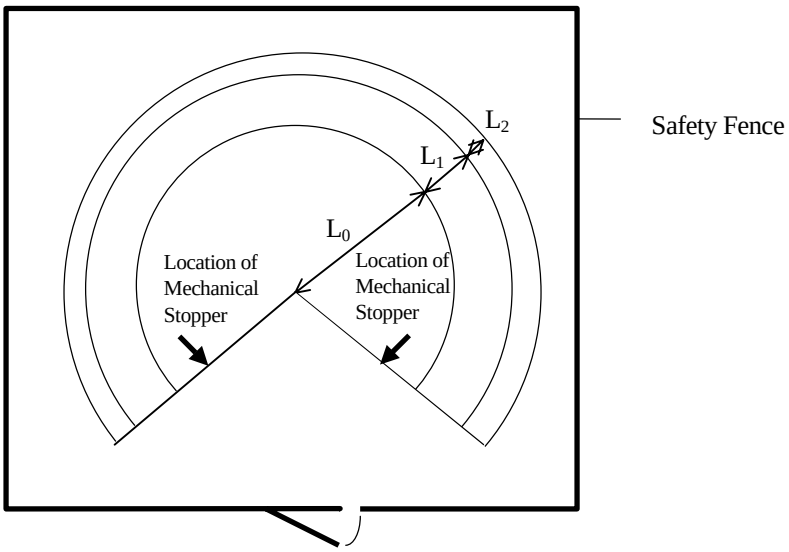
The motion range of robot arm is represented by Point P in figure below. Determine sum of $L_0+L_1+L_2$ as minimum dimension from the center of arm (Point A in the figure), assuming;

L_0: Motion range of robot (See 2.3 Motion Range & Specifications.)

L_1: Dimension from the center of wrist to the edge of workpiece

L_2: Dimension of allowance

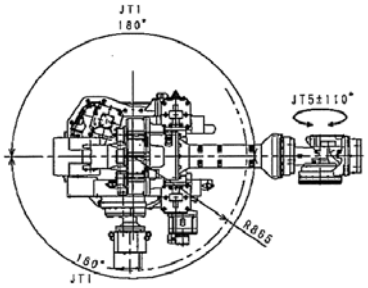


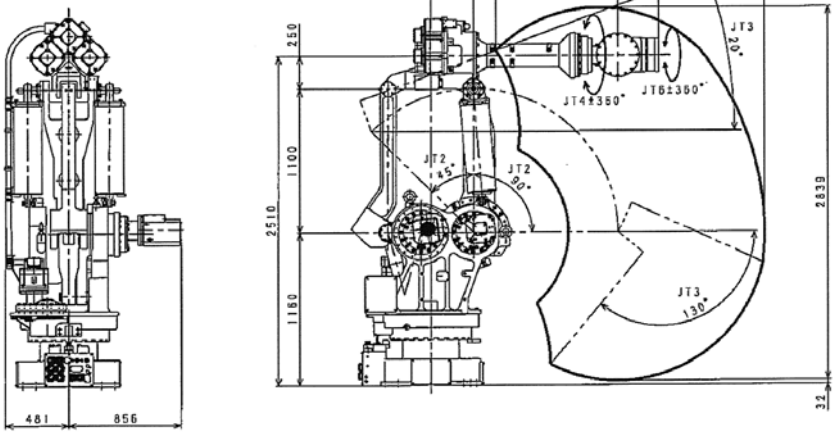


Note: For MD series, when moving JT5 with its posture of non-zero degree, its motion range exceeds L_0.

2.3 MOTION RANGE & SPECIFICATIONS

MX700N





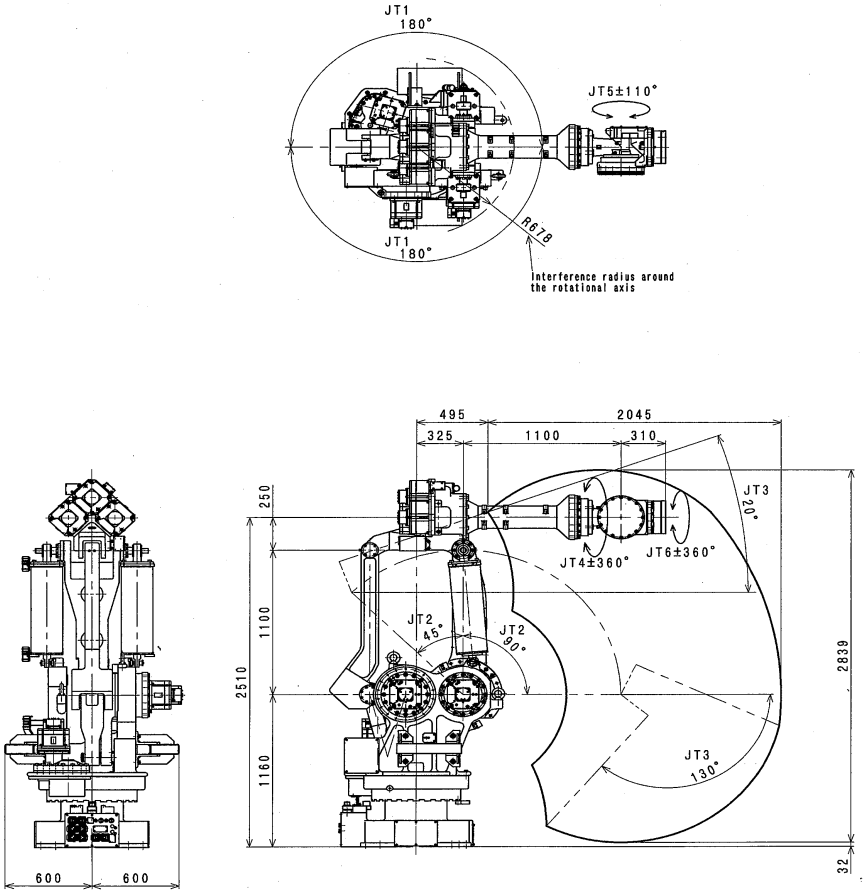
Type	Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	65 °/s
	2	+90° to -45°	50 °/s
	3	+20° to -130°	45 °/s
	4	±360°	50 °/s
	5	±110°	50 °/s
	6	±360°	95 °/s
Max. Payload	700 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	5488 N·m	600 kg·m^2
	5	5488 N·m	600 kg·m^2
	6	2744 N·m	388 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2860 kg		
Noise level	< 70 db (A)*		

***Measured condition**

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 4540 mm away from JT1 center

(Noise level varies per conditions.)

MX500N



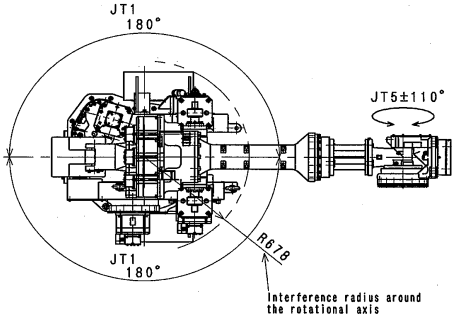
Type	Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	80 °/s
	2	+90° to -45°	70 °/s
	3	+20° to -130°	70 °/s
	4	±360°	80 °/s
	5	±110°	80 °/s
	6	±360°	120 °/s
Max. Payload	500 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	3920 N·m	400 kg·m^2
	5	3920 N·m	400 kg·m^2
	6	1960 N·m	259 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2750 kg		
Noise level	< 70 db (A)*		

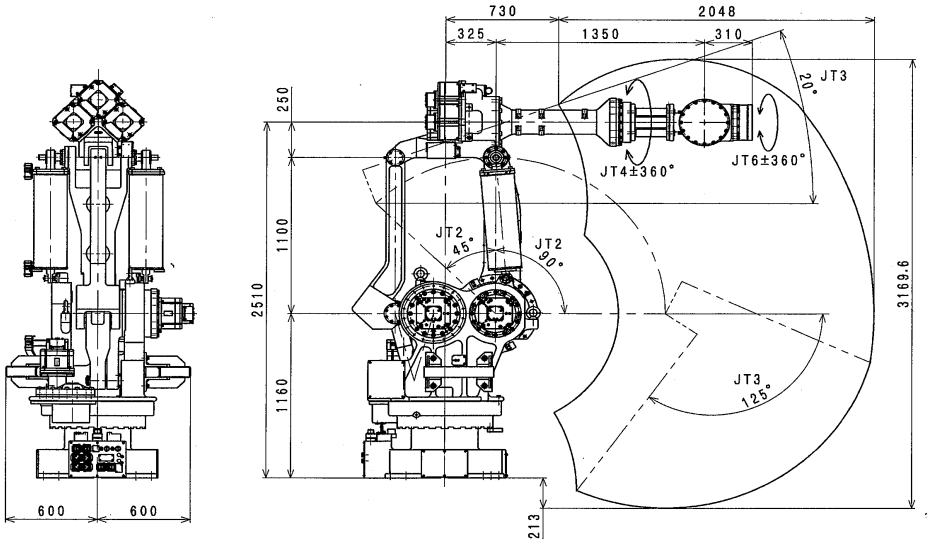
*Measured condition

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 4540 mm away from JT1 center

(Noise level varies per conditions.)

MX420L





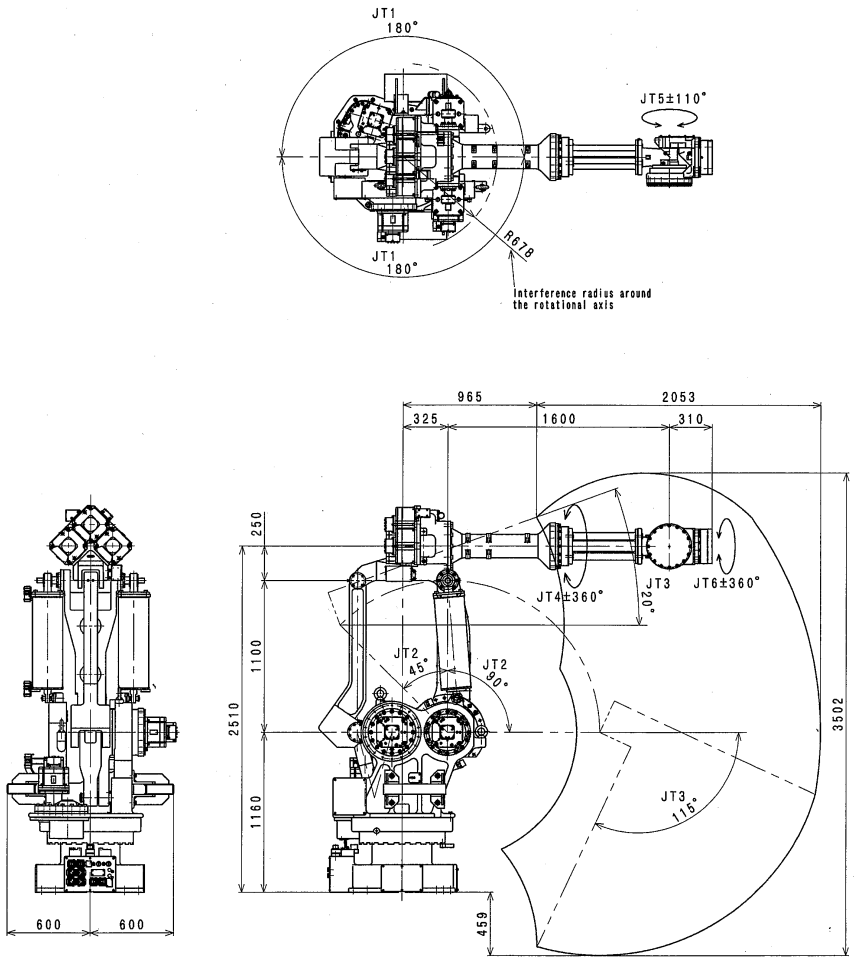
Type	Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	80 °/s
	2	+90° to -45°	70 °/s
	3	+20° to -125°	70 °/s
	4	±360°	80 °/s
	5	±110°	80 °/s
	6	±360°	120 °/s
Max. Payload	420 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	3290 N·m	400 kg·m^2
	5	3290 N·m	400 kg·m^2
	6	1960 N·m	259 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2800 kg		
Noise level	< 70 db (A)*		

*Measured condition

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 4780 mm away from JT1 center

(Noise level varies per conditions.)

MX350L



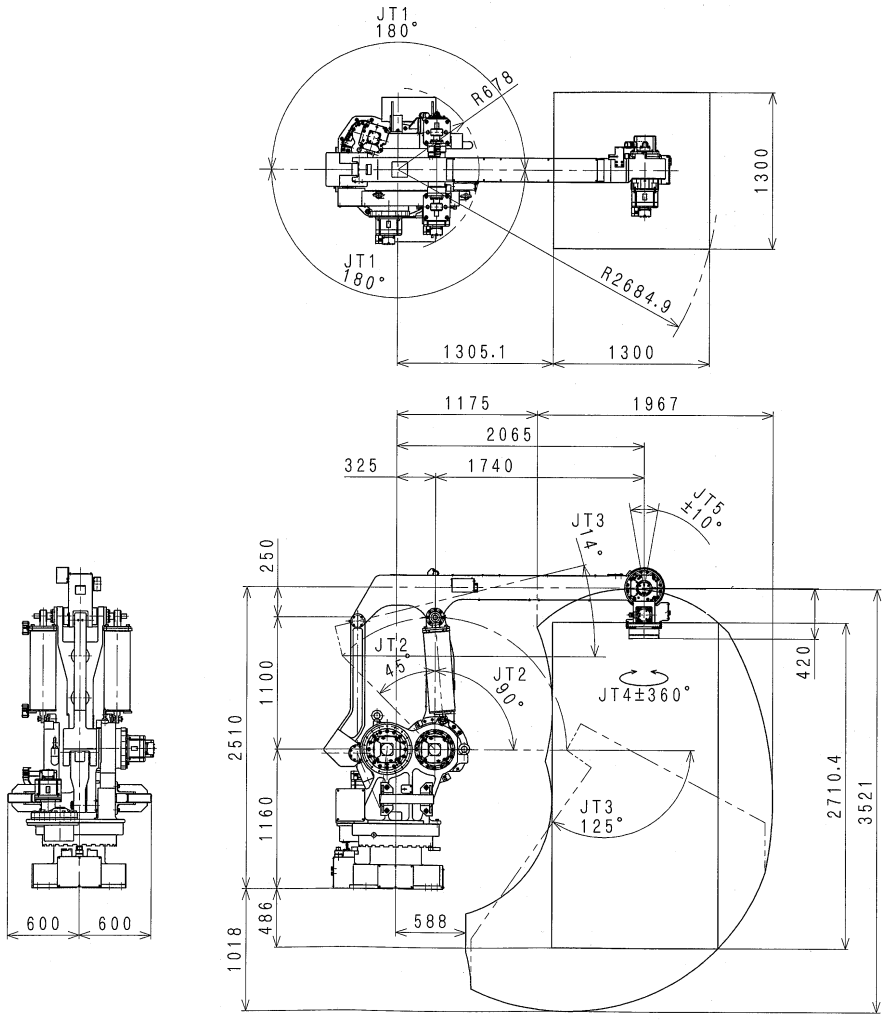
Type	Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	80 °/s
	2	+90° to -45°	70 °/s
	3	+20° to -115°	70 °/s
	4	±360°	80 °/s
	5	±110°	80 °/s
	6	±360°	120 °/s
Max. Payload	350 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	2740 N·m	400 kg·m^2
	5	2740 N·m	400 kg·m^2
	6	1960 N·m	259 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2800 kg		
Noise level	< 70 db (A)*		

*Measured condition

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 5020 mm away from JT1 center

(Noise level varies per conditions.)

MD400N



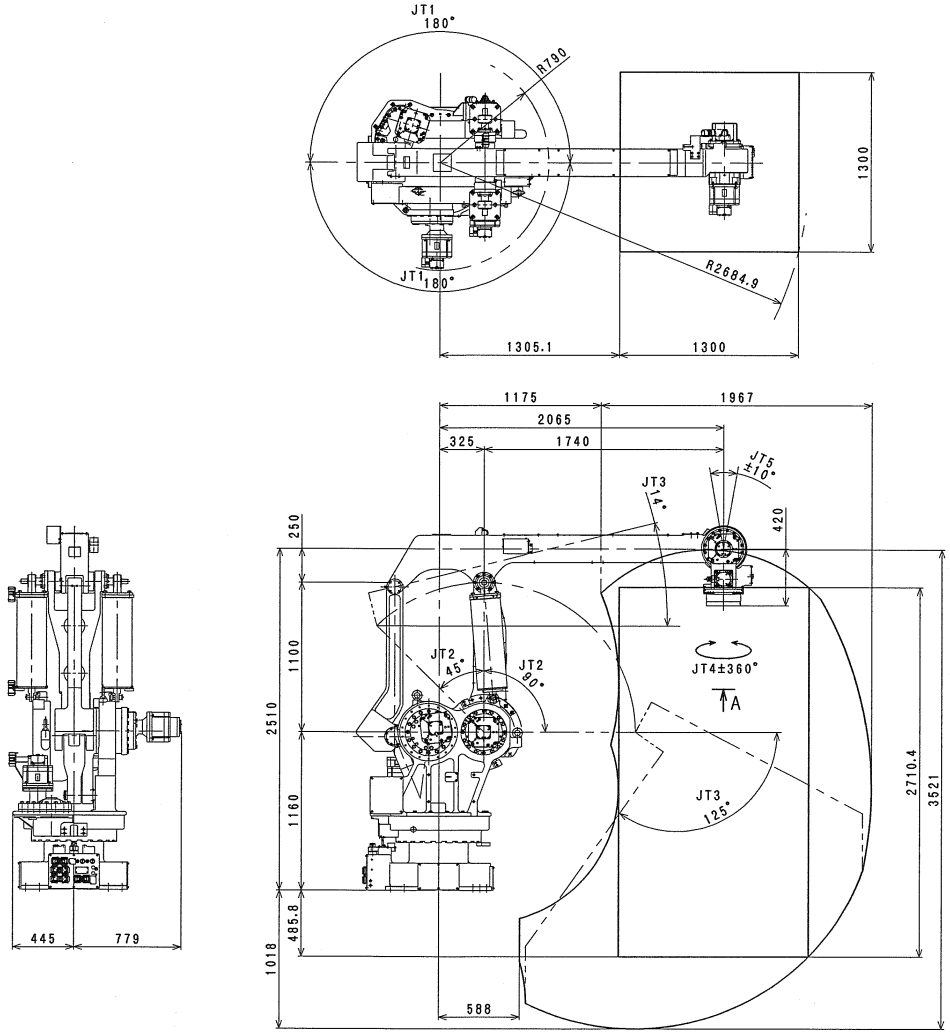
Type	Articulated Robot		
Degree of Freedom	5		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	80 °/s
	2	+90° to -45°	70 °/s
	3	+14° to -125°	70 °/s
	4	±360°	180 °/s
	5	±10°	-
	*±10° from vertical downward posture		
Max. Payload	400 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	-	200 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2650 kg		
Noise level	< 70 db (A)*		

*Measured condition

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 5142 mm away from JT1 center

(Noise level varies per conditions.)

MD500N



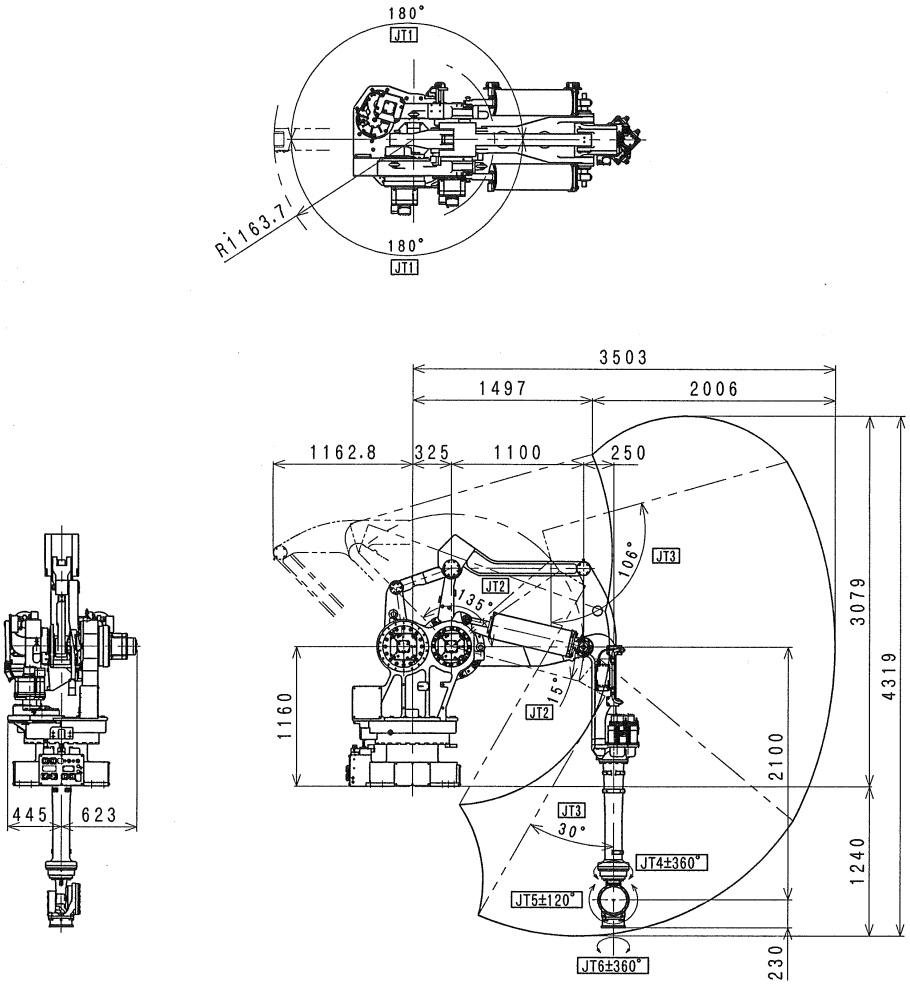
Type	Articulated Robot		
Degree of Freedom	5		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	70 °/s
	2	+90° to -45°	65 °/s
	3	+14° to -125°	45 °/s
	4	±360°	160 °/s
	5	±10°	-
	*±10° from vertical downward posture		
Max. Payload	500 kg		
Wrist Load Capacity	JT	Torque	Moment of Inertia
	4	-	250 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2680 kg		
Noise level	< 70 db (A)*		

*Measured condition

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 5142 mm away from JT1 center

(Noise level varies per conditions.)

MT400N



Type	Articulated Robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion Range	Max. Speed
	1	±180°	80 °/s
	2	+15° to -135°	70 °/s
	3	+106° to -30°	70 °/s
	4	±360°	70 °/s
	5	±120°	70 °/s
	6	±360°	130 °/s
Max. Payload	400 kg*		
Wrist Load Capacity** Load mass: below 380 kg)	JT	Torque	Moment of Inertia
	4	2150 N·m	200 kg·m^2
	5	2150 N·m	200 kg·m^2
	6	980 N·m	147 kg·m^2
Repeatability	±0.5 mm		
Mass	Approx. 2600 kg		
Noise level	< 70 db (A)***		

***If load mass exceeds 380 kg, the wrist flange surface should face downward vertically without fail.

****If load mass exceeds 380 kg, see 8.3.4.

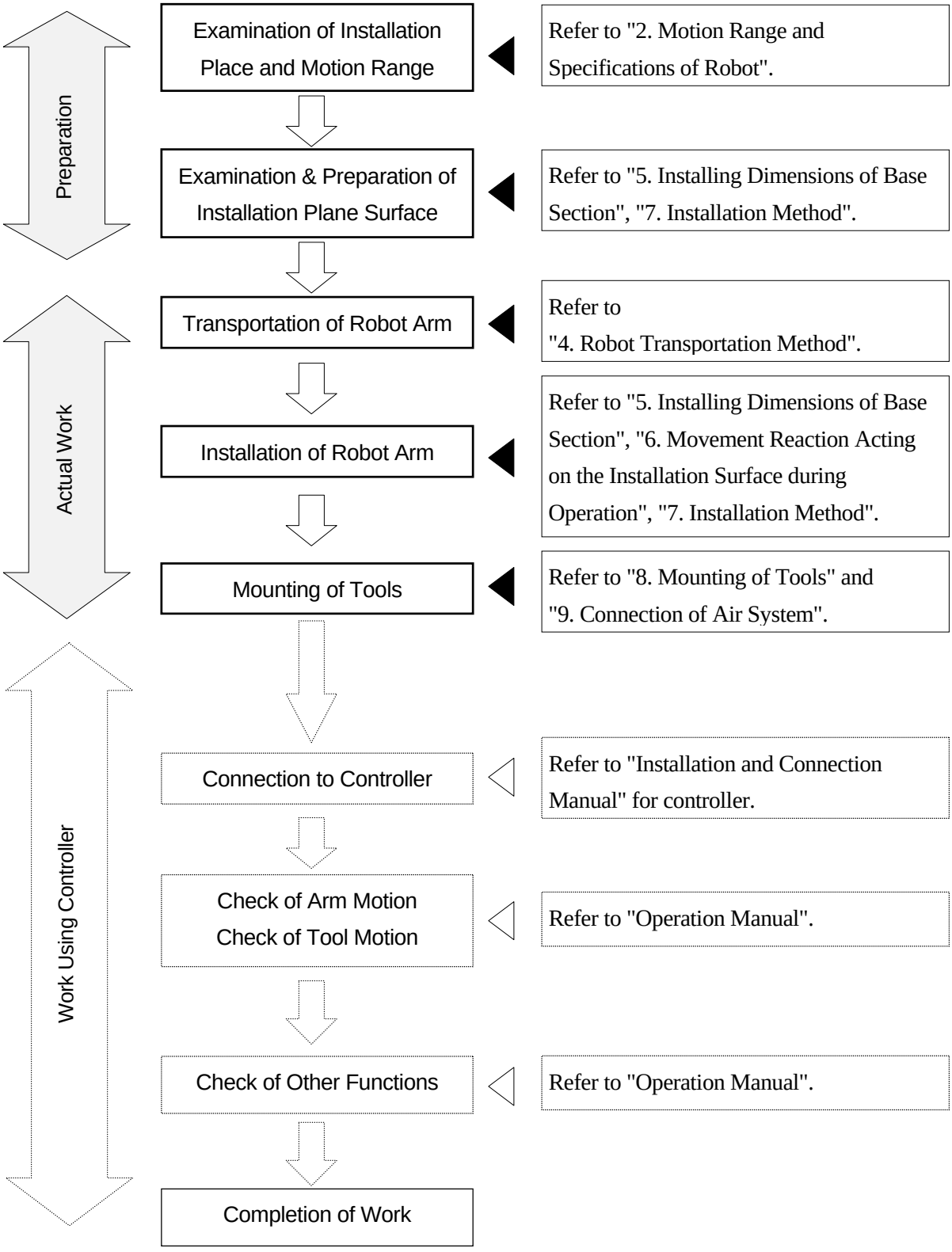
*****Measured condition

1. Robot installed on plate rigidly fixed to floor
2. Measurement point is 5020 mm away from JT1 center

(Noise level varies per conditions.)

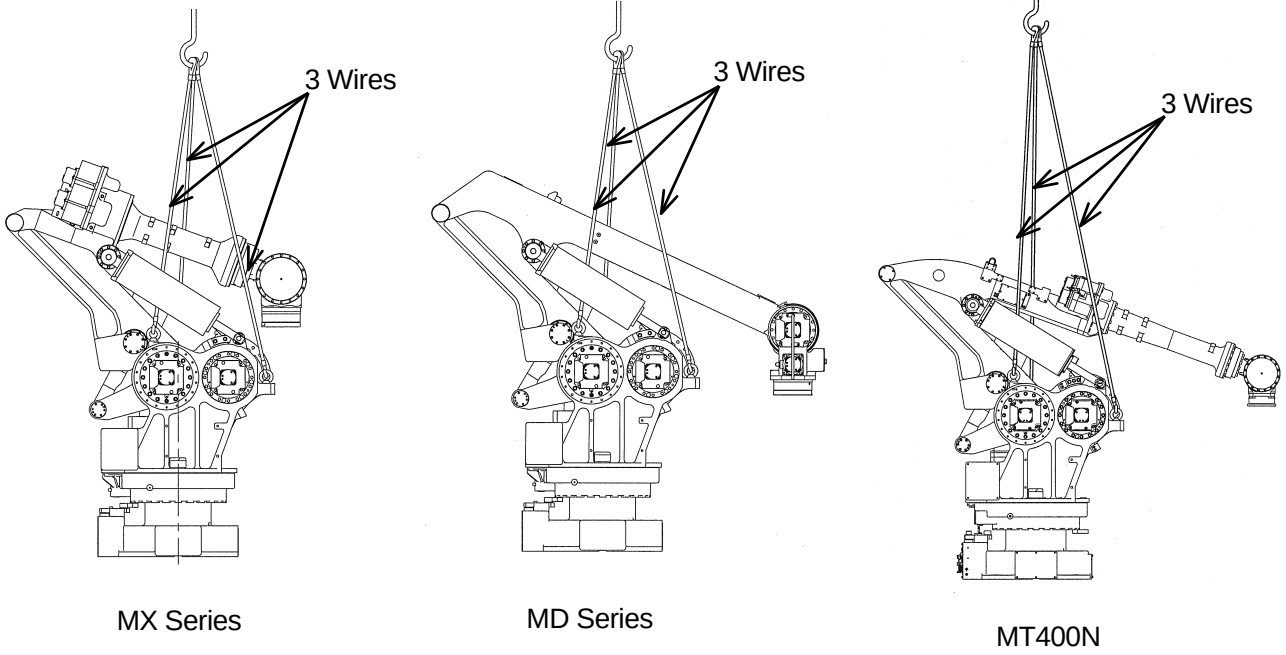
3.0 WORK FLOW AT ARM INSTALLATION AND CONNECTION

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



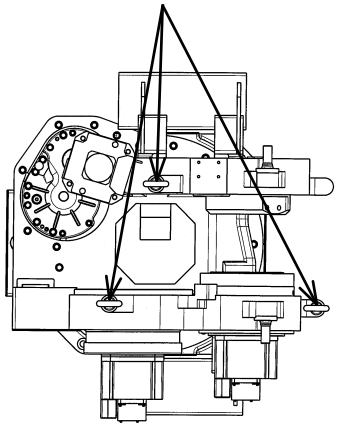
4.0 ROBOT TRANSPORTATION METHOD

4.1 WIRE SLING



MX Series MD Series MT400N

According to the figure, hoist up the robot by threading three wires through three eyebolts.



Before lifting via wire sling, set angles of each arm axis as shown in table below.

Model		MX Series	MD Series	MT400N
Angle	JT1	0 °	0 °	0 °
	JT2	-45 °	-45 °	70 °
	JT3	-23 °	-20 °	-135 °
	JT4	0 °	0 °	0 °
	JT5	0 °	0 °	70 °
	JT6	—	0 °	0 °

⚠ CAUTION

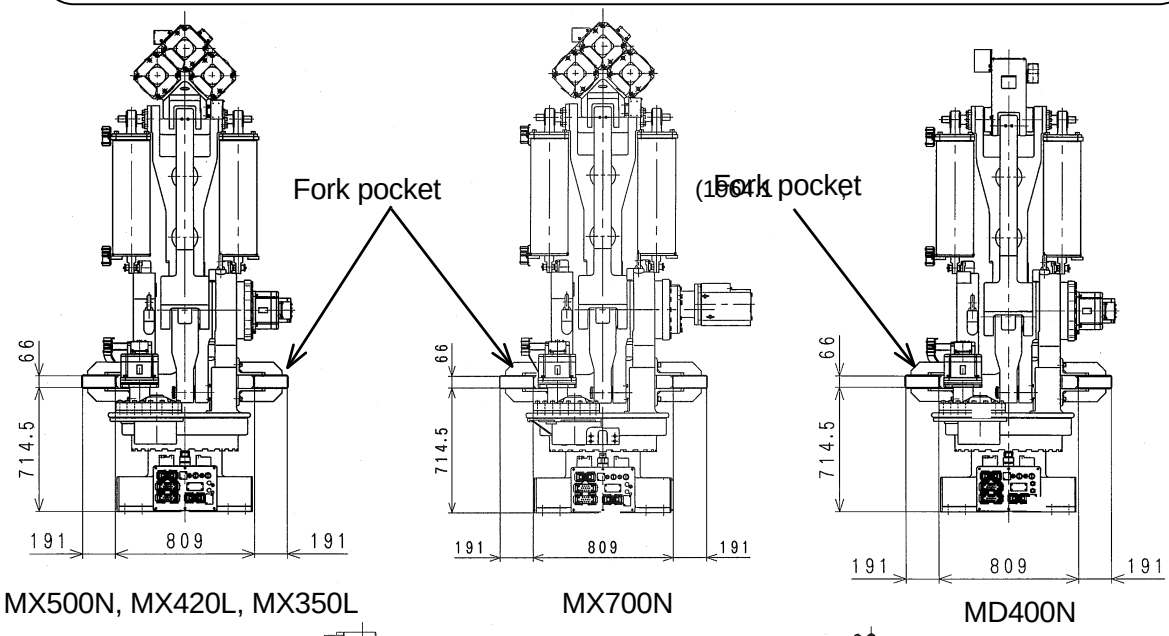
1. **When hoisting up the robot, be careful as robot may lean forward/backward depending on robot posture and mounting condition of the tool and options.**
2. **If the robot is hoisted up in an inclined posture, it may swing, or the wire may interfere with the wrist motor, harness, piping etc., or it may be damaged from interfering with surrounding objects.**
3. **Protect the robot with wear plates, etc. if wires interfere with a part of the robot (balancer, etc.).**

4.2 FORKLIFT

When carrying the robot by forklift, use the optional forklift jig which can be attached to the arm base.

⚠ CAUTION

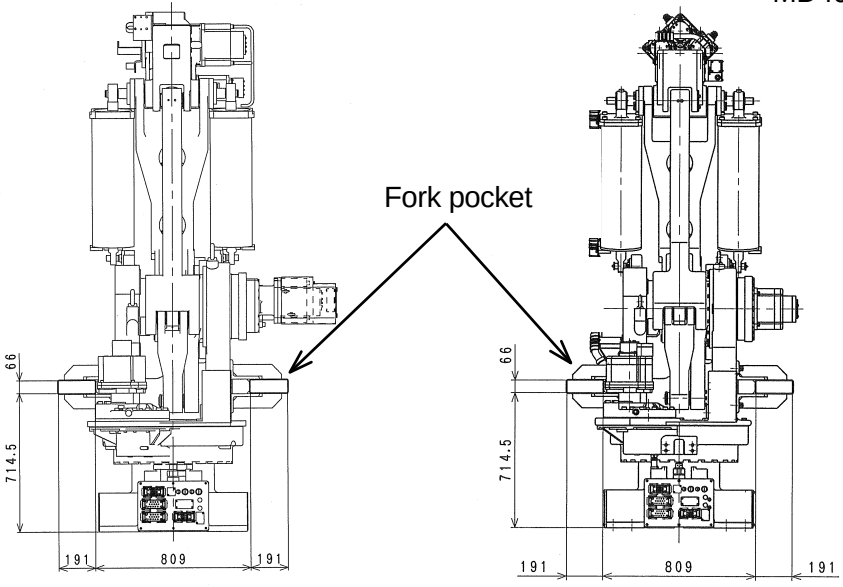
1. **When carrying MX series and MD series robot by forklift, set the robot posture so that JT2 is between 0° and -45°.**
2. **When carrying MD400N robot by forklift, set the robot posture so that JT2 is -135°.**
3. **Confirm that the forks of forklift penetrate sufficiently without fail.**
4. **When transporting robot on an inclined or rough surface, be careful to maintain balance to prevent forklift/robot from falling.**



MX500N, MX420L, MX350L

MX700N

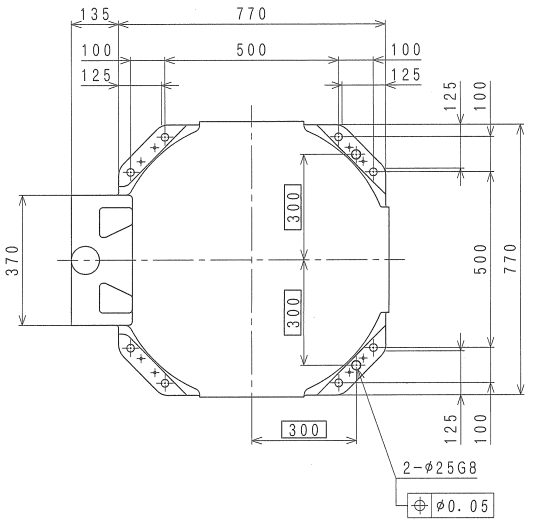
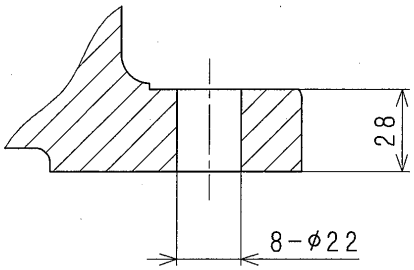
MD400N



MD500N MT400N

5.0 INSTALLING DIMENSIONS OF BASE SECTION

When installing base section, fix it with high tension bolts utilizing the bolt holes.

Installing Dimensions of Base Section	
Cross-section of Base Installation Hole	
Bolt Hole	8-ϕ22
High Tension Bolt	8-M20 Material: SCM435 Strength class: 10.9 min.
Tightening Torque	431.2 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 shown in the following pages.

(1) During Repeat operation

Model	MX700N	MX500N	MX420L	MX350L	MD500N	MD400N	MT400N
M (Inversion Moment)	48000 N·m	48000 N·m	43500 N·m	40000 N·m	37000 N·m	44500 N·m	46500 N·m
T (Rotating Torque)	15500 N·m	15500 N·m	14500 N·m	13500 N·m	14000 N·m	11500 N·m	18500 N·m

(2) When robot has interfered with an obstacle during Teach mode*

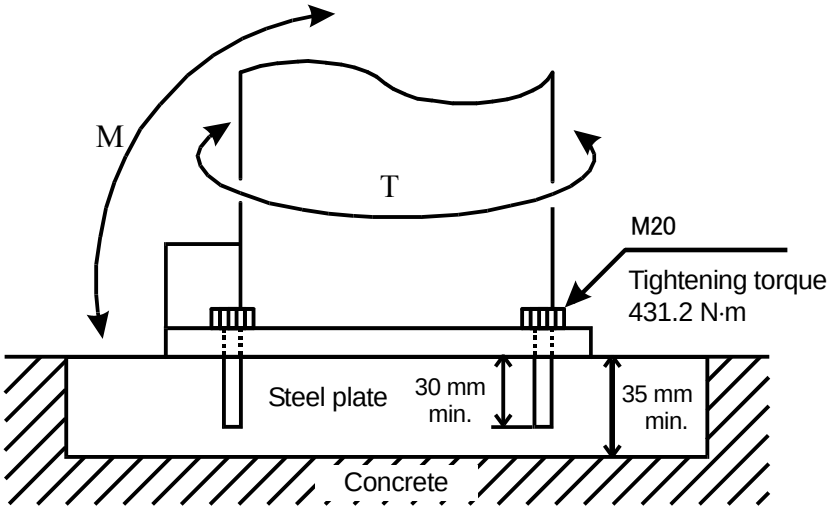
Model	MX700N	MX500N	MX420L	MX350L	MD500N	MD400N	MT400N
M (Inversion Moment)	76000 N·m	82000 N·m	71000 N·m	63000 N·m	63000 N·m	58000 N·m	58000 N·m
T (Rotating Torque)	15500 N·m	15500 N·m	15500 N·m	15500 N·m	15500 N·m	15500 N·m	18500 N·m

Note* Reaction forces when the arm interferes with obstacles in teach mode

7.0 INSTALLATION METHOD

7.1 WHEN INSTALLING THE BASE DIRECTLY ON THE FLOOR:

As shown below, bury steel plate (35 mm min. thick) in the concrete floor or fix with anchor bolts. The steel plate must be fixed firmly enough to sustain reaction forces by the robot.



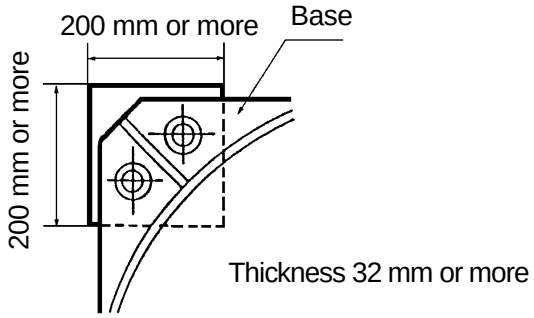
7.2 WHEN INSTALLING THE BASE PLATE WITH POSITIONING HOLES ON THE FLOOR:

Install the base plate utilizing 8 holes of ϕ22. Install the base plate on the concrete floor or the steel plate floor. Reaction forces received from robot arm are the same as when installing the base directly on the floor.

There are two pin holes on the base plate for positioning, which enable the base plate to join with the base easily by orienting the holes on the robot base side to the pin holes. Replacement of a broken robot, etc. can be done quickly and easily by orienting the holes.*
Note* Precise zeroing of JT1 is required to use this function, which is an Option.

7.3 WHEN INSTALLING WITH INSTALLATION BLOCK:

Install an installation block that satisfies the dimensions in right figure.



8.0 MOUNTING OF TOOLS

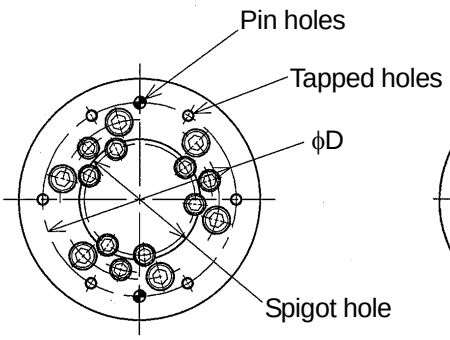
⚠ WARNING

When mounting tools, turn OFF controller power up to the external power switch. Display signs indicating clearly "Installation in progress", and lockout/tagout the external power switch to prevent the danger of electric shock and to stop personnel from accidentally turning ON the power.

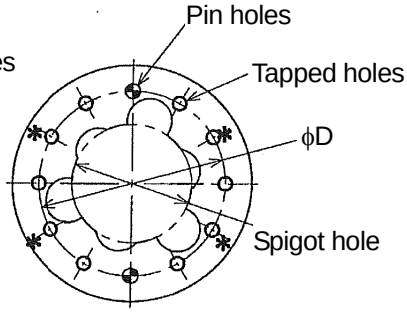
8.1 DIMENSIONS OF WRIST END (FLANGE)

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

MX and MD series flange



MT400N flange

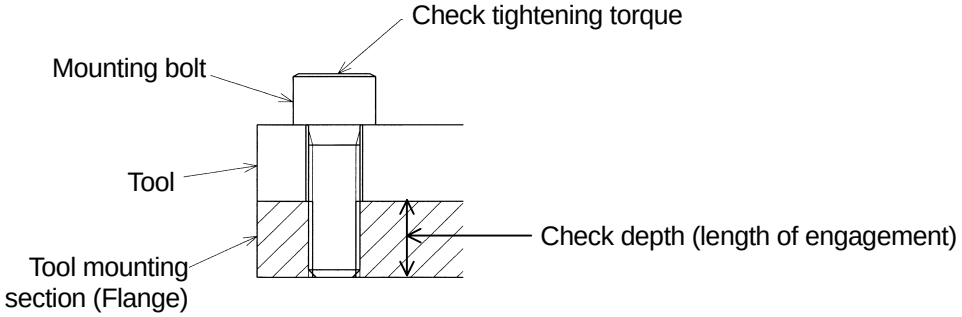


⚠ CAUTION

Use at least one pin for assured fixing to prevent the tool on the flange from moving.

8.2 SPECIFICATION OF MOUNTING BOLT

The length of mounting bolt should be selected depending on the tap depth of tool mounting flange. Moreover, the mounting bolt should be a high tension bolt and tightened with the specified torque.



⚠ CAUTION

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

Model	MX700N MX500N MX420L MX350L MD500N MD400N	MT400N
Tapped holes	6-M12	6-M10
ϕD	ϕ200	ϕ160
Pin holes	2-ϕ12H7 Depth 12	2-ϕ10H7 Depth 12
Spigot hole	ϕ125H7 Depth 8.5	ϕ100H7 Depth 8
Tap depth	29 mm	12 mm
Screwing depth	18~28 mm	10~11 mm
High tension bolt	SCM435, 10.9 Min	SCM435, 10.9 Min
Tightening torque	98.07 N·m	98.07 N·m
Pin Material	S45CⒽ*	S45CⒽ*

NOTE* S45C thermal refining steel or equivalent in strength

8.3 ALLOWABLE LOAD

The maximum payload is specified for each robot model. Mass of tools, etc. is considered payload and must be included when summing the arm's total payload for the application.

Also, the allowable moment of load and the moment of inertia in wrist section (JT4, JT5, JT6) should be calculated by the expressions on the next page.

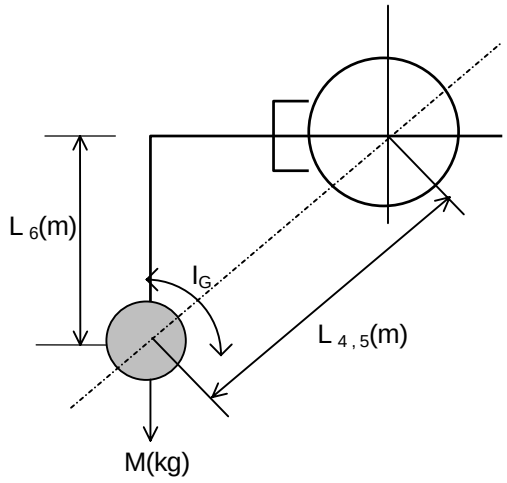
⚠ CAUTION

1. **Be advised that using the robot arm to grasp an overrated payload may degrade the arm's motion ability or shorten its service life.**
2. **Calculate total load to be carried by robot arm as the sum of the mass of hand, gun, tool changer, etc. as well as any work being grasped during the application. Ensure sum is less than the maximum payload specified for the arm model.**
3. **If the total payload exceeds the max. allowed payload for arm, consult with Kawasaki before starting operations.**

8.3.1 MX SERIES

The load torque and the moment of inertia in wrist section should be calculated by expressions below.

Formula



Load Mass (including tool): M≤Mmax.(kg)

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

Load Moment of Inertia: $I=M \cdot L^2+I_G$ (kg·m^2)

Mmax.: Rated Load Mass (kg)

MX700N : 700 kg

MX500N : 500 kg

MX420L : 420 kg

MX350L : 350 kg

L: Length from axis rotating center to load center of gravity. (m)

I_G: Moment of inertia around center of gravity. (kg·m^2)

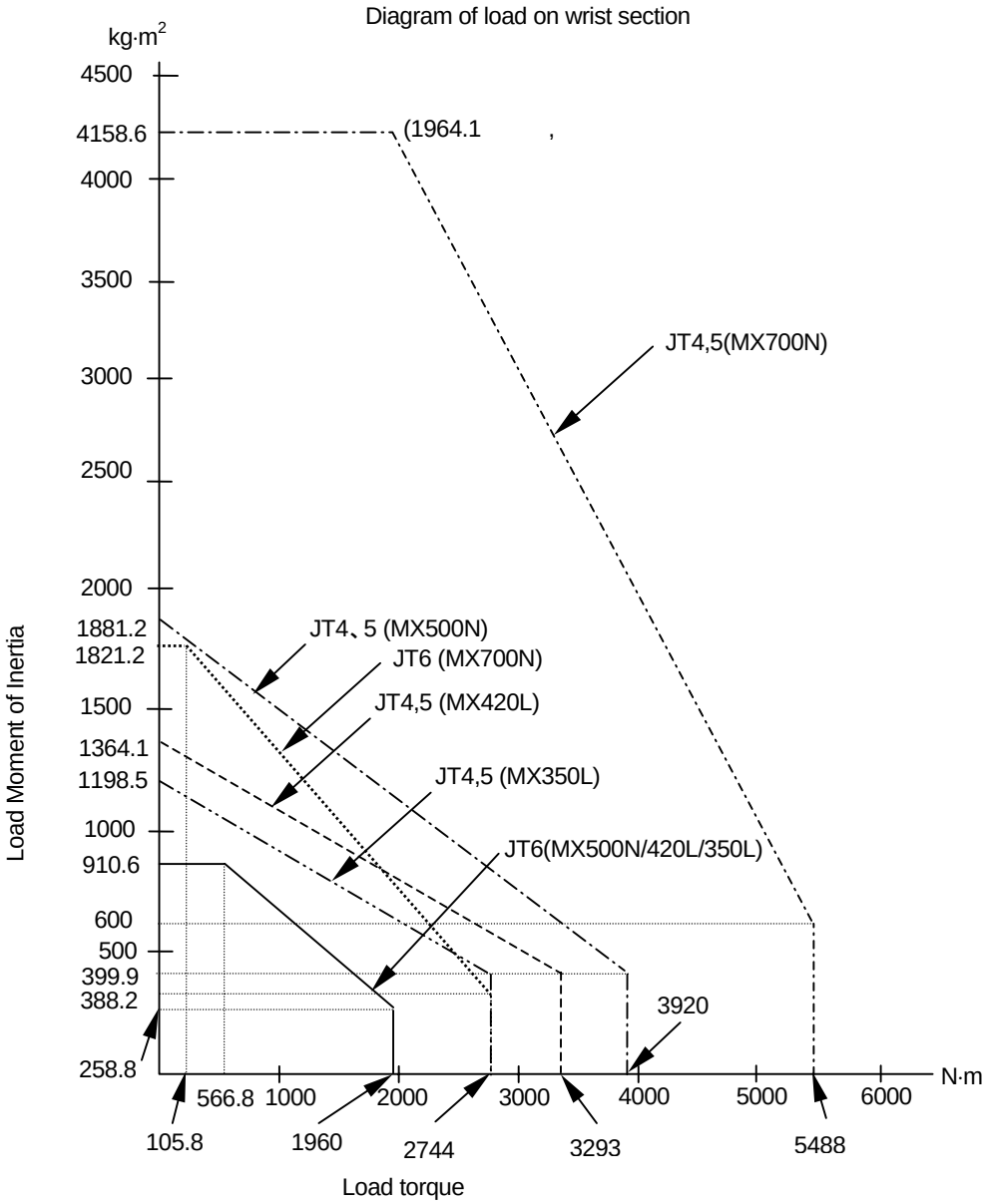
$L_{4,5}$: Length from JT4(5) axis rotating center to load center of gravity. (m)

L_6: Length from JT6 axis rotating center to load center of gravity. (m)

When calculating the load by dividing it into sections (for example, hand section, workpiece section, etc.), evaluate the load torque and inertia moment from the sum of all the sections.

Strictly observe the following restrictions applied to wrist sections.

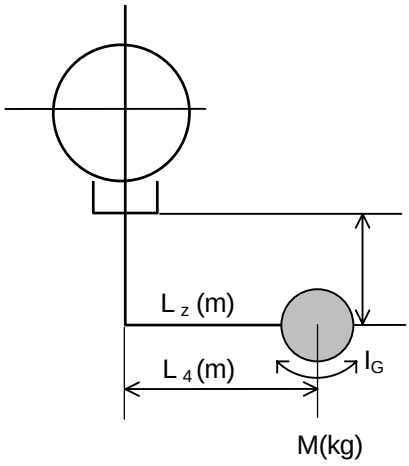
1. The allowable load including tool should be less than the Mmax. above.
2. The rotating load torque and load moment of inertia on wrist axes (JT4, JT5, JT6) should be within the allowable range shown in diagram below.



8.3.2 MD SERIES

The load torque and the moment of inertia in wrist section should be calculated by expressions below.

Formula



Load Mass (including tool): $M \leq Mmax.(kg)$

Load Torque: not specified

Load Moment of Inertia: $I=M \cdot L^2+I_G (kg \cdot m^2) \leq Imax (kg \cdot m^2)$

Center Position of Gravity (L_4, L_z): See diagrams below.

Mmax.: Rated Load Mass 400 (kg)

Imax.: Rated Load Moment of inertia 200 ($kg \cdot m^2$)

I_G: Moment of inertia around center of gravity. ($kg \cdot m^2$)

L_z: Length from flange to load center of gravity. (m)

L_4: Length from JT4 axis rotating center to load center of gravity. (m)

When calculating the load by dividing it into sections (for example, hand section, workpiece section, etc.), evaluate the inertia moment from the sum of all the sections.

Strictly observe the following restrictions applied to wrist sections.

1. The allowable load including tool should be less than the Mmax. above.
2. Restrictions are applied to the load moment of inertia in wrist section (JT4). The load moment of inertia should be below 200 $kg \cdot m^2$.
3. Restrictions are applied to the center of gravity. The center should be positioned within the allowable range shown below. There are two diagrams; when moving with JT5 facing vertically down (0º) and when moving with JT5 tilted (within +/- 10º of vertical down).
4. Even if the load is less than 100 kg, the center position of gravity should be within 100kg shown in the Diagram of load on wrist section.

Diagram of load on wrist section (MD500N, JT5:0°)

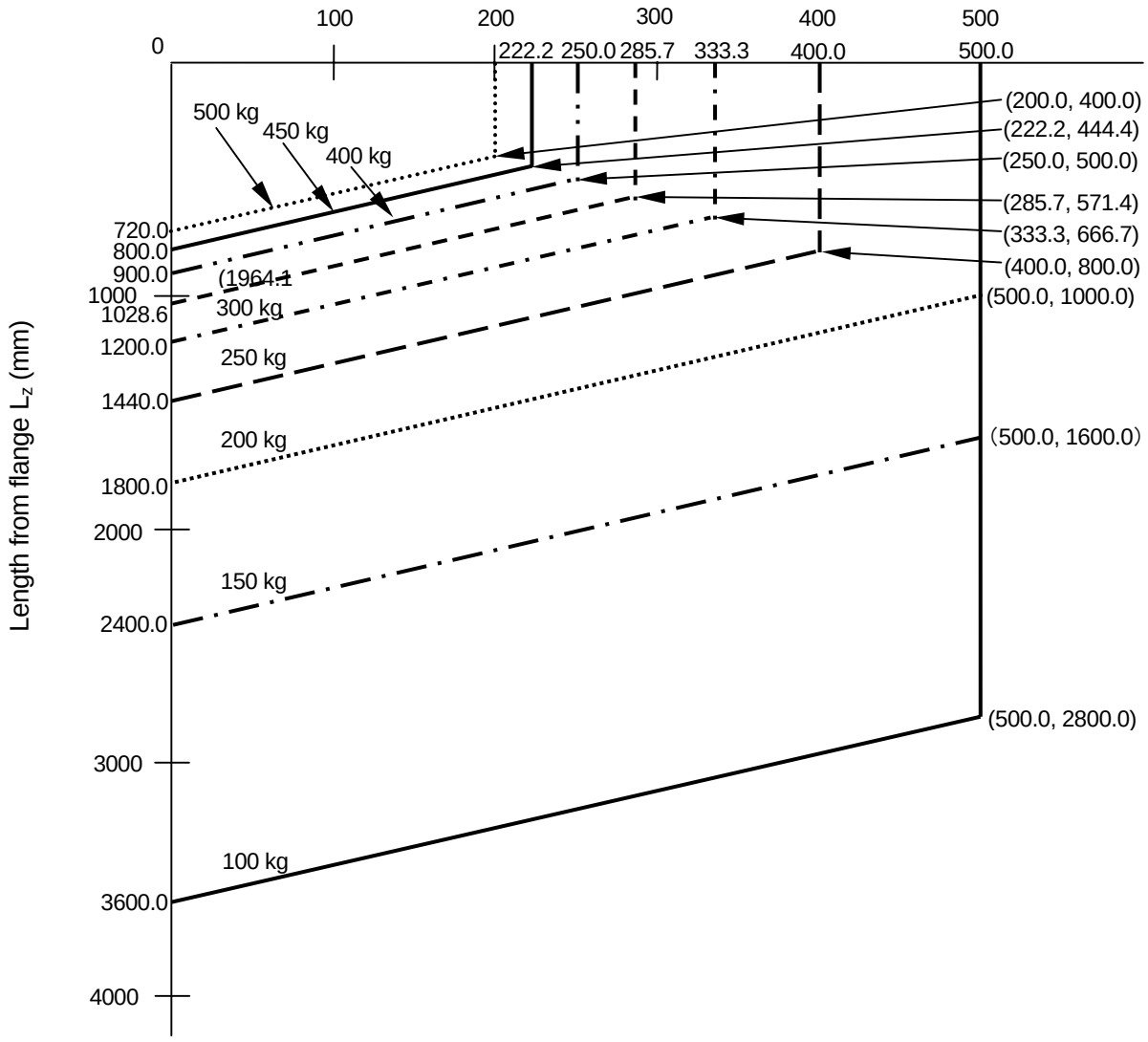
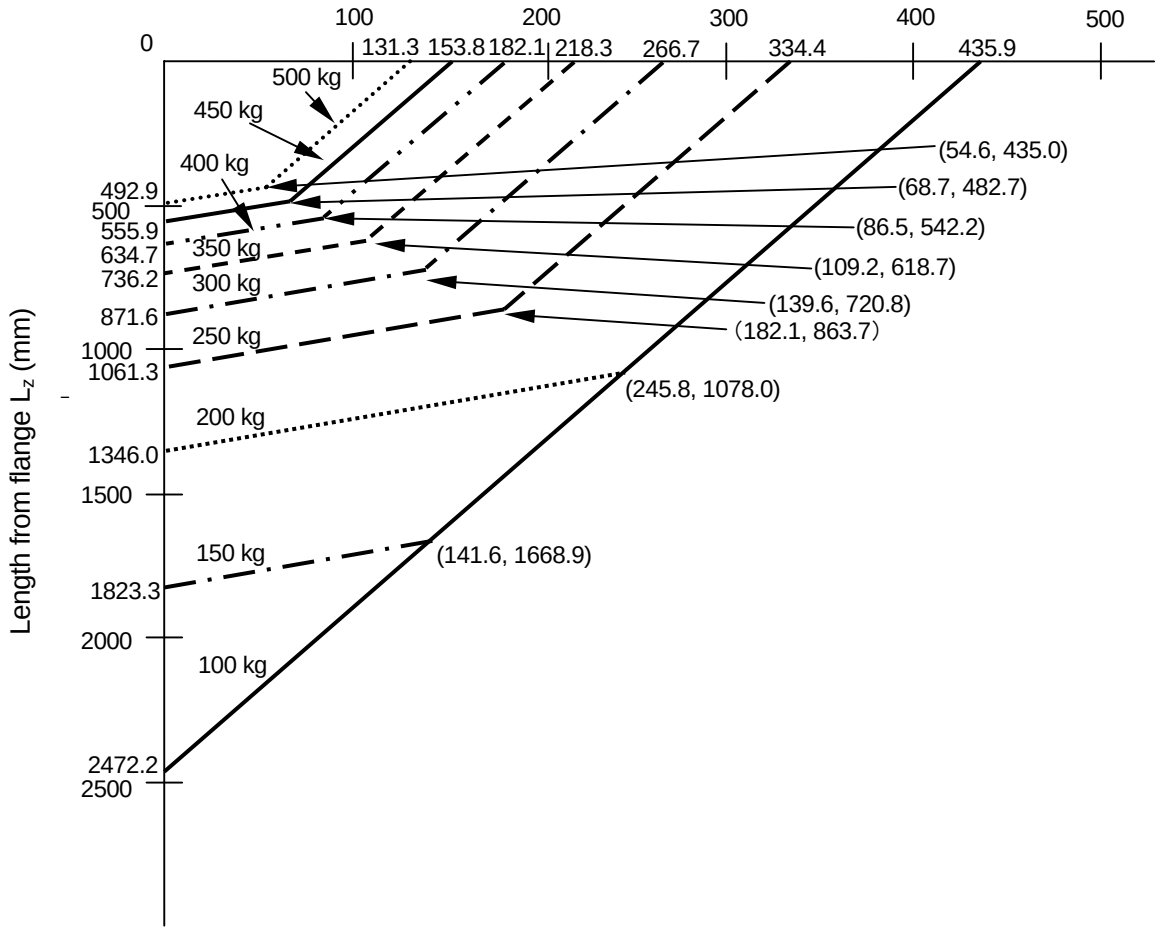


Diagram of load on wrist section (MD500N, JT5: within +/-10°)



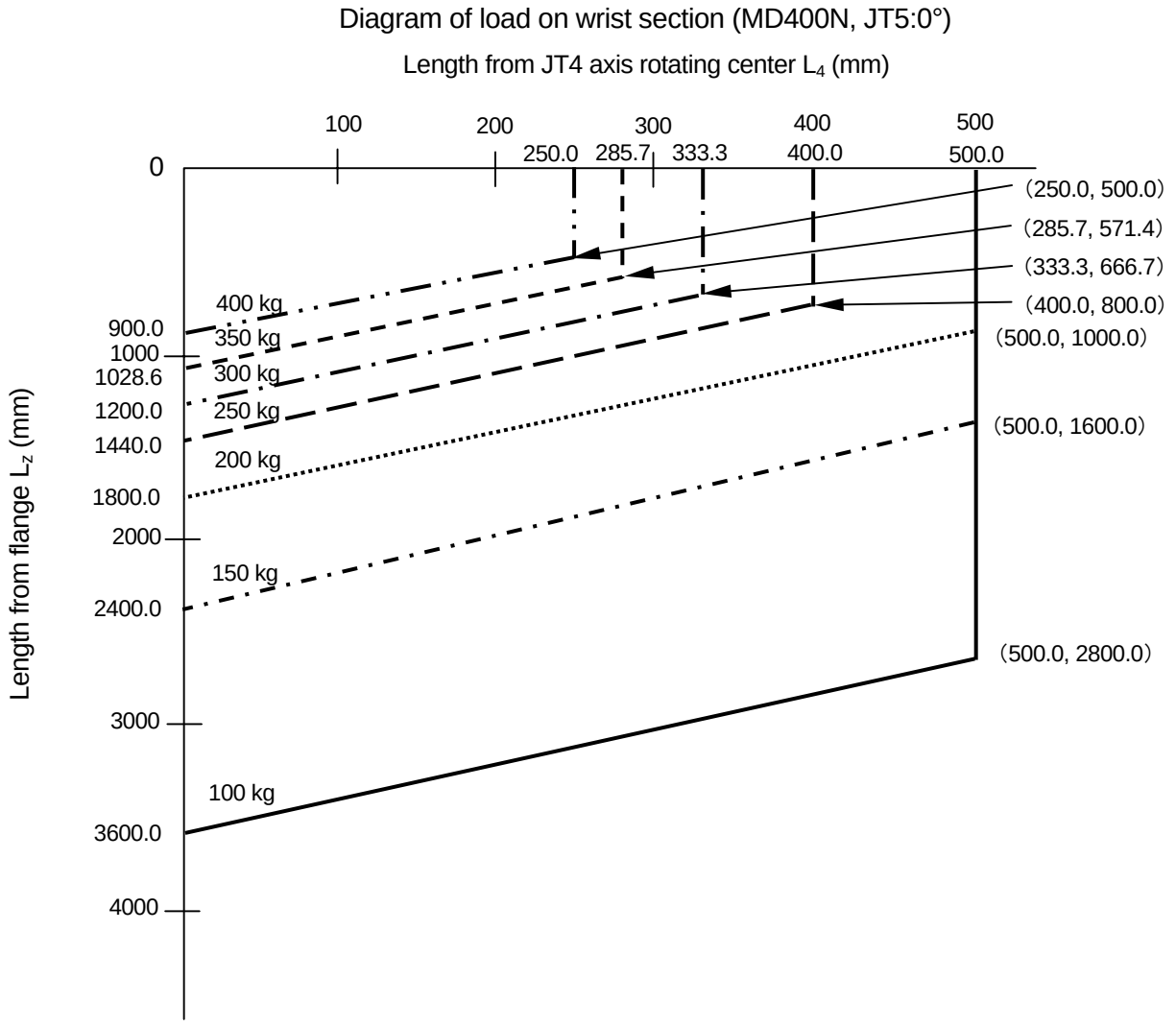
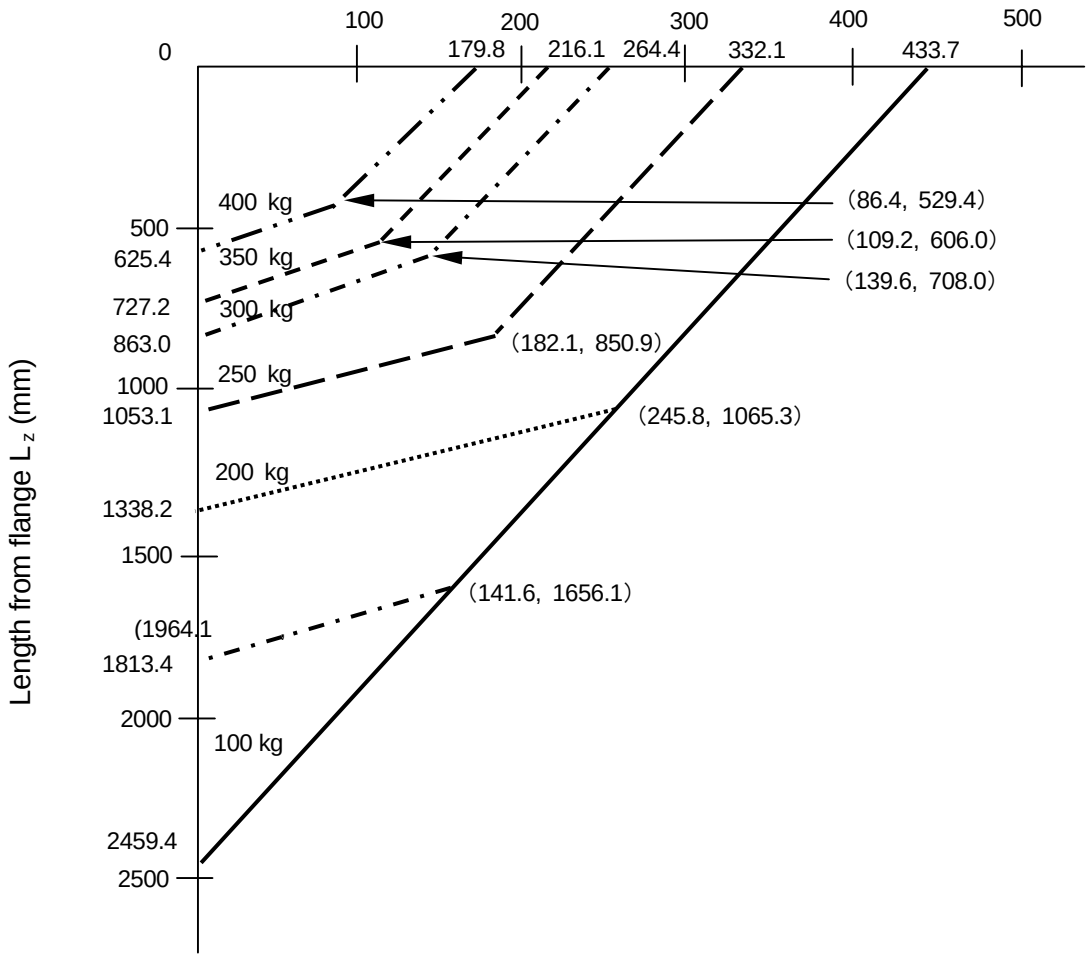


Diagram of load on wrist section (MD400N, JT5:0°)
Length from JT4 axis rotating center L_4 (mm)
Length from flange L_z (mm)
100
200
300
400
500
250.0
285.7
333.3
400.0
500.0
0
900.0
1000
1028.6
1200.0
1440.0
1800.0
2000
2400.0
3000
3600.0
4000
400 kg
350 kg
300 kg
250 kg
200 kg
150 kg
100 kg
(250.0, 500.0)
(285.7, 571.4)
(333.3, 666.7)
(400.0, 800.0)
(500.0, 1000.0)
(500.0, 1600.0)
(500.0, 2800.0)

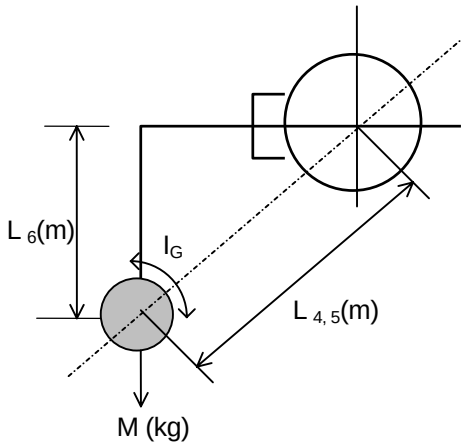
Diagram of load on wrist section (MD400N, JT5: within +/-10°)



8.3.3 MT400N – WHEN LOAD MASS IS 380 KG OR LESS

The load torque and the moment of inertia in wrist section should be calculated by expressions below.

Formula



Load Mass (including tool): M≤Mmax.(kg)

Load Torque: T=9.8·M·L (N·m)

Load Moment of Inertia: $I=M\cdot L^2+I_G$ (kg·m^2)

Mmax. = 380 kg

L: Length from axis rotating center to load center of gravity. (m)

I_G: Moment of inertia around center of gravity. (kg·m^2)

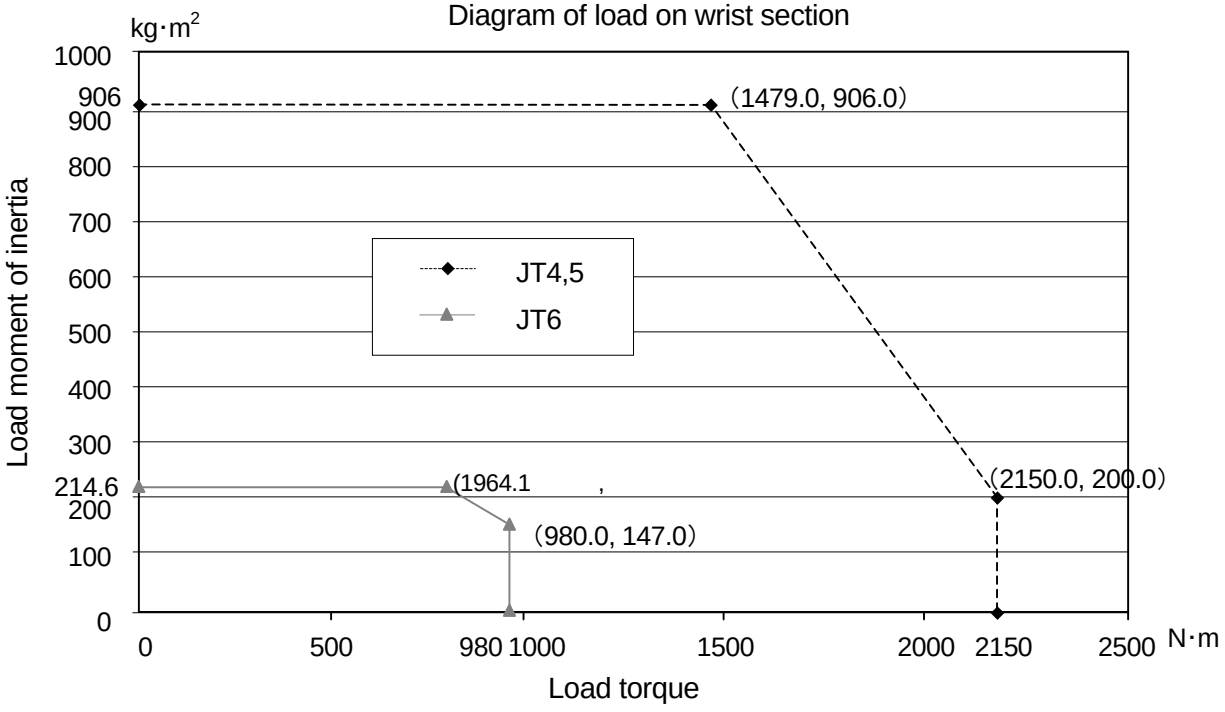
$L_{4,5}$: Length from JT4(5) axis rotating center to load center of gravity. (m)

L_6: Length from JT6 axis rotating center to load center of gravity. (m)

When calculating the load by dividing it into sections (for example, hand section, workpiece section, etc.), evaluate the load torque and inertia moment from the sum of all the sections.

Strictly observe the following restrictions applied to wrist sections.

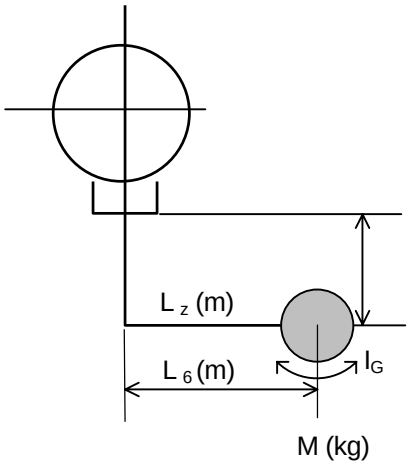
1. The allowable load including tool should be less than the Mmax. above.
2. The rotating load torque and load moment of inertia on wrist axes (JT4, JT5, JT6) should be within the allowable range shown in diagram below.



8.3.4 MT400N – WHEN LOAD MASS EXCEEDS 380 KG

If the load mass exceeds 380 kg, the wrist flange surface should face downward vertically without fail. The moment of inertia in wrist section should be calculated by expressions below.

Formula



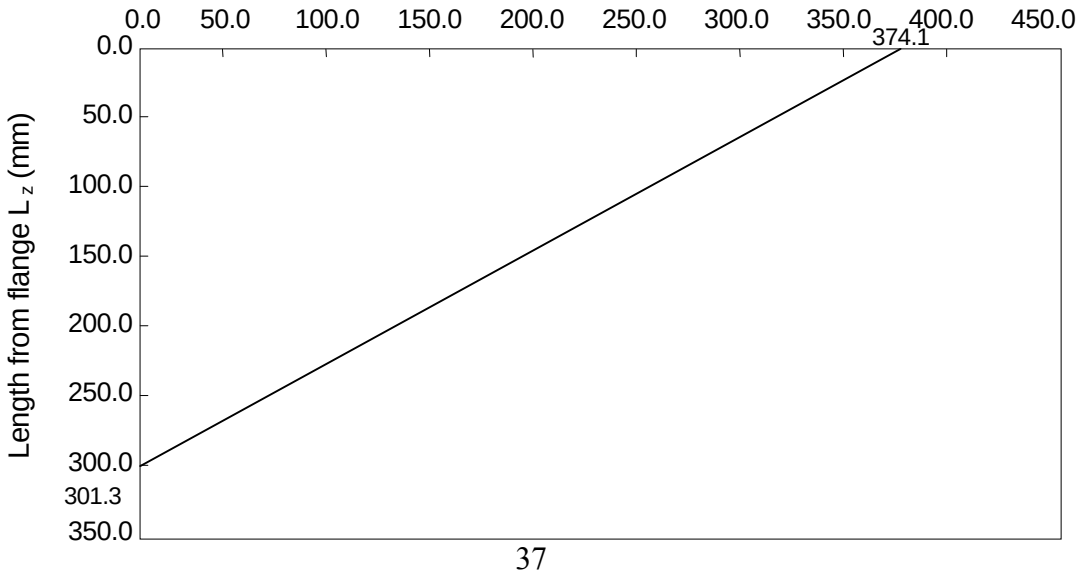
Load Mass (including tool): M≤Mmax.(kg)
Load Torque: not specified
Load Moment of Inertia: $I=M\cdot L^2+I_G$ (kg·m^2) ≤Imax.(kg・m^2)
Center Position of Gravity (L_6, L_Z): See the diagram of load on wrist section.
Mmax.: Rated Load Mass 400 (kg)
Imax. : Rated Load Mass 147 (kg・m^2)
I_G: Moment of inertia around center of gravity. (kg·m^2)
L_z: Length from flange to load center of gravity (m)
L_6: Length from JT6 axis rotating center to load center of gravity.

When calculating the load by dividing it into sections (for example, hand section, workpiece section, etc.), evaluate the load torque and inertia moment from the sum of all the sections.

Strictly observe the following restrictions applied to wrist sections.

1. The allowable load including tool should be less than the Mmax. above.
2. Restrictions are applied to the load moment of inertia in wrist section (JT4). The load moment of inertia should be below 147 kg·m^2.
3. Restrictions are applied to the center of gravity. The center should be positioned within the allowable range shown below.

Diagram of load on wrist section

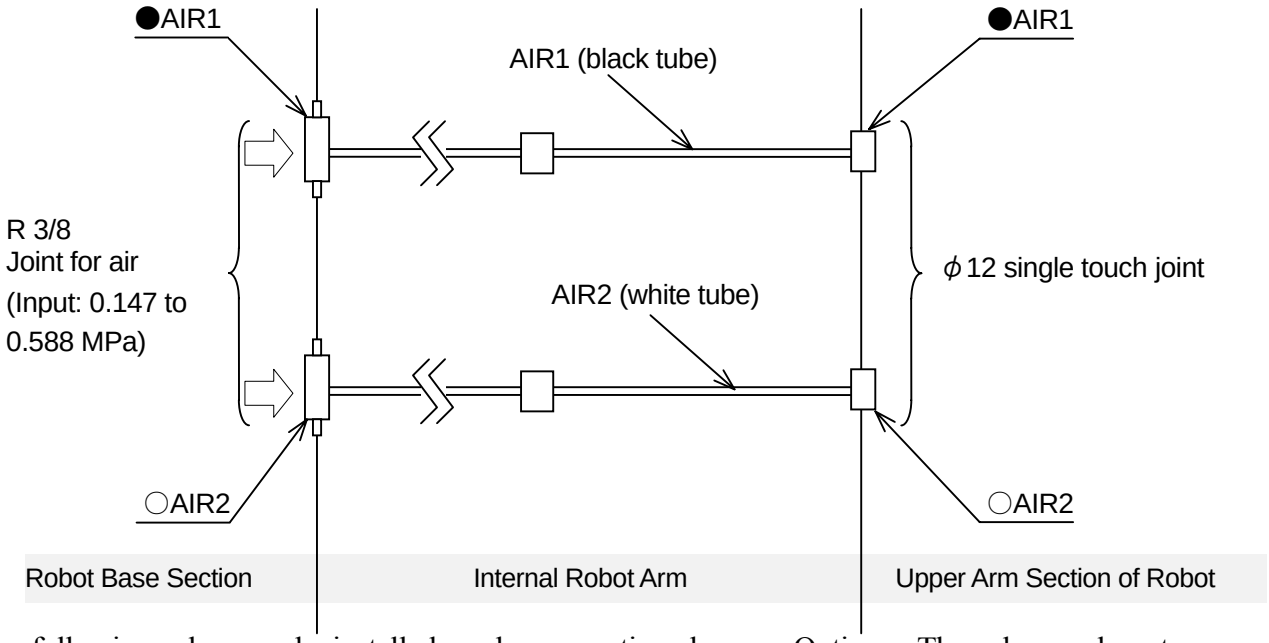


9.0 CONNECTION OF AIR SYSTEM

9.1 AIR PIPING DIAGRAM

MX series includes air piping for driving tool in the robot arm.

1. MX Series/MT400N

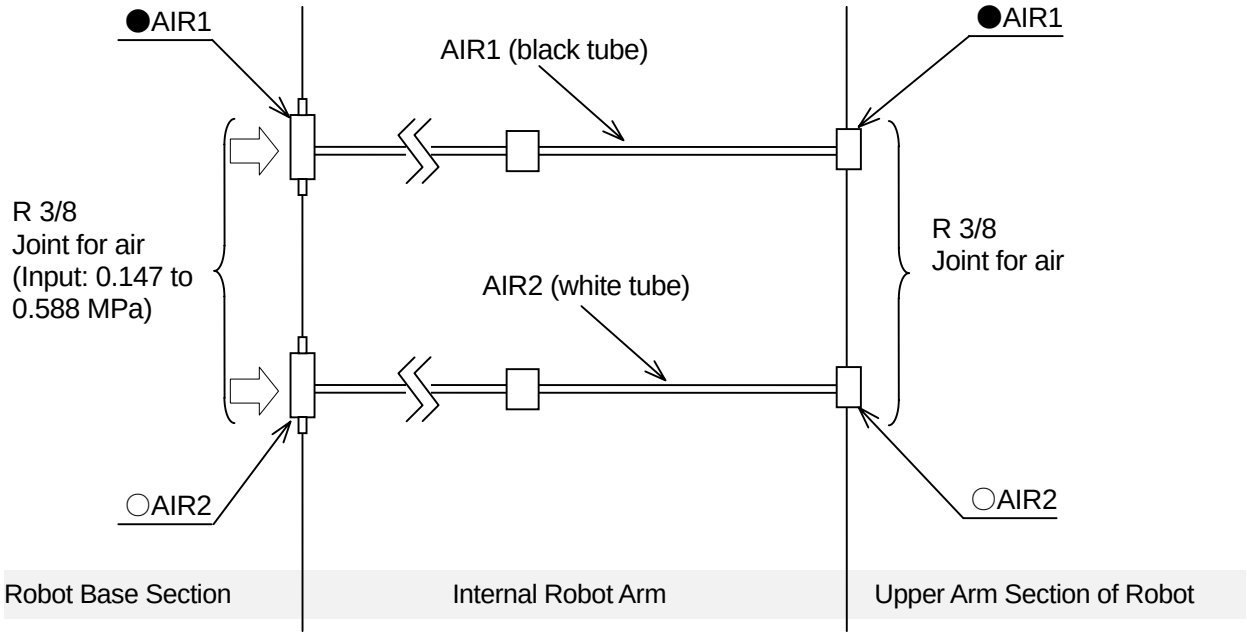


The following valves can be installed on above-mentioned arm as Option. The valve can be set ON/OFF by the Multi Function Panel (or, Teach Pendant) without need for wiring via interlock.

Option	Single Solenoid Valve 1 unit
	Single Solenoid Valve 2 units
	Single Solenoid Valve 3 units
	Double Solenoid Valve 1 unit
	Double Solenoid Valve 2 units
	Double Solenoid Valve 3 units
	Single Solenoid Valve 1 unit + Double Solenoid Valve 1 unit
	Single Solenoid Valve 1 unit + Double Solenoid Valve 2 units
	Single Solenoid Valve 2 units + Double Solenoid Valve 1 unit

Note: The valve specification is: CV value = 3.2 and 2-position.

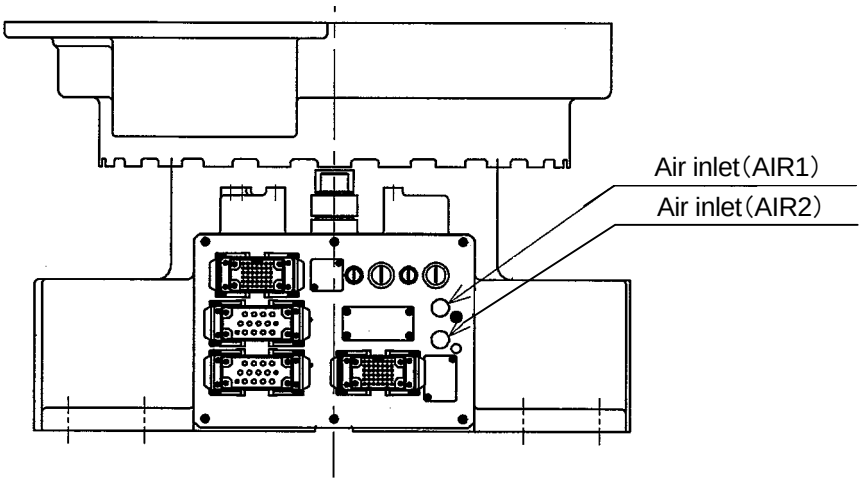
2. MD Series



Note: A vacuum hose with an internal diameter of 1 inch can be added as Option.

9.2 AIR SUPPLY TO THE ROBOT ARM

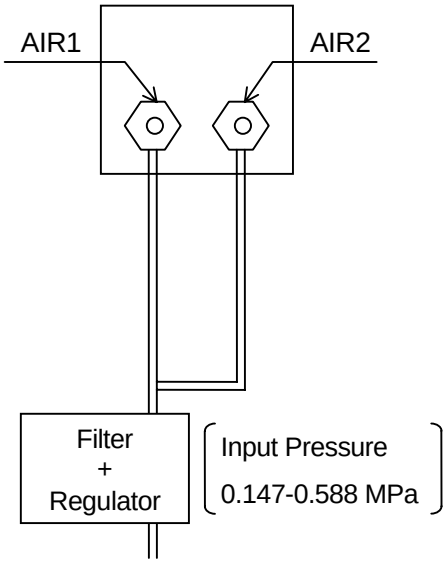
As shown in the figure below, air connection ports are provided on the base section of robot arm.



⚠ CAUTION

Supply air to the air inlet ports (R 3/8 ports, 2 places).
Air pressure; 0.15 to 0.6 MPa

< Reference >



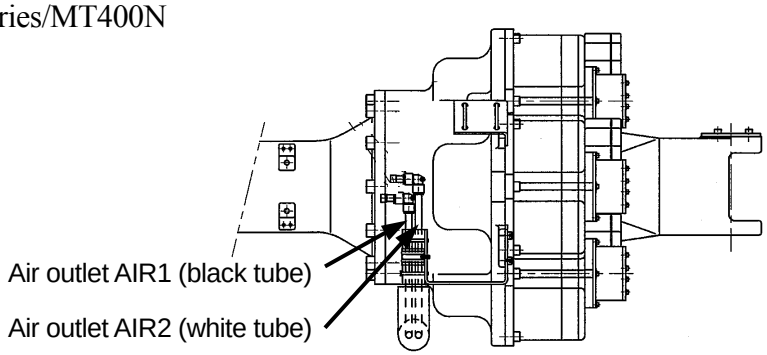
When connecting the air regulator, connect [Filter + Regulator] externally on the driving air source for the hand section.

Since the built-in valve on the upper arm is unlubricated type, do not use any lubricator (oiler).

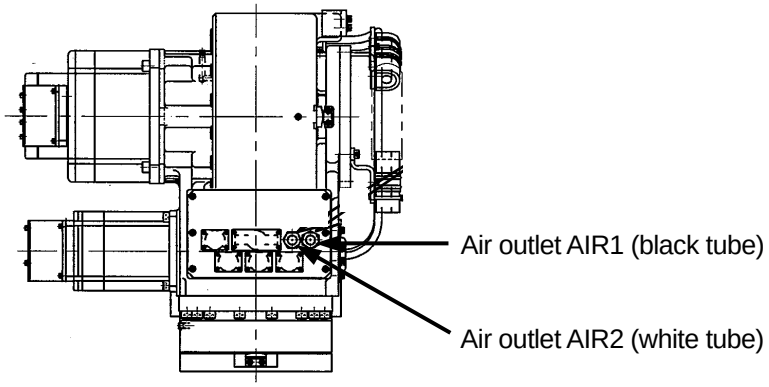
9.3 CONNECTION TO THE TOOL FROM THE AIR OUTLET PORTS

Air outlet ports are provided on MX series robot as shown in the figure below. For MX series/MT400N, the outlet ports are ϕ12 joints for air tubes on the upper arm section. For MD400N, the outlet ports are R 3/8 ports on the wrist section.

1. MX series/MT400N



2. MD Series



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