FANUC Robot R-2000*i*B

MECHANICAL UNIT
OPERATOR'S MANUAL

B-82234EN/14

• Original Instructions

Thank you very much for purchasing FANUC Robot.
Before using the Robot, be sure to read the "FANUC Robot series SAFETY HANDBOOK (B-80687EN)" and understand the content.

This manual can be used with controllers labeled R-30*i*A or R-J3*i*C. If you have a controller labeled R-J3*i*C, you should read R-30*i*A as R-J3*i*C throughout this manual.

The products in this manual are controlled based on Japan's "Foreign Exchange and Foreign Trade Law". The export from Japan may be subject to an export license by the government of Japan. Further, re-export to another country may be subject to the license of the government of the country from where the product is re-exported. Furthermore, the product may also be controlled by re-export regulations of the United States government. Should you wish to export or re-export these products, please contact FANUC for advice.

In this manual, we endeavor to include all pertinent matters. There are, however, a very large number of operations that must not or cannot be performed, and if the manual contained them all, it would be enormous in volume. It is, therefore, requested to assume that any operations that are not explicitly described as being possible are "not possible".

SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to enable the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.

For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipment installed in a work cell.
For safe use of FANUC robots, you must read and follow the instructions in the “FANUC Robot series SAFETY HANDBOOK (**B-80687EN)**”.

1 PERSONNEL

Personnel can be classified as follows.

Operator:
- Turns the robot controller power ON/OFF
- Starts the robot program from operator panel

Programmer or Teaching operator:
- Operates the robot
- Teaches the robot inside the safeguarded space

Maintenance technician:
- Operates the robot
- Teaches the robot inside the safeguarded space
- Performs maintenance (repair, adjustment, replacement)

- The operator is not allowed to work in the safeguarded space.
- The programmer or teaching operator and maintenance technician are allowed to work in the safeguarded space. Work carried out in the safeguarded space include transportation, installation, teaching, adjustment, and maintenance.
- To work inside the safeguarded space, the person must be trained on proper robot operation.

Table 1 (a) lists the work outside the safeguarded space. In this table, the symbol "○" means the work allowed to be carried out by the specified personnel.

Table 1 (a) List of work outside the Safeguarded Space

	Operator	Programmer or Teaching operator	Maintenance technician
Turn power ON/OFF to Robot controller	○	○	○
Select operating mode (AUTO/T1/T2)		○	○
Select remote/local mode		○	○
Select robot program with teach pendant		○	○
Select robot program with external device		○	○
Start robot program with operator's panel	○	○	○
Start robot program with teach pendant		○	○
Reset alarm with operator's panel		○	○
Reset alarm with teach pendant		○	○
Set data on teach pendant		○	○
Teaching with teach pendant		○	○
Emergency stop with operator's panel	○	○	○
Emergency stop with teach pendant	○	○	○
Operator's panel maintenance			○
Teach pendant maintenance			○

During robot operation, programming and maintenance, the operator, programmer, teaching operator and maintenance technician take care of their safety using at least the following safety protectors:

- Use clothes, uniform, overall adequate for the work
- Safety shoes
- Helmet

2 DEFINITION OF SAFETY NOTATIONS

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "**WARNING**" or "**CAUTION**" according to its severity. Supplementary information is indicated by "**NOTE**". Read the contents of each **"WARNING**", "**CAUTION**" and "**NOTE**" before using the robot.

Symbol	Definitions
⚠**WARNING**	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠**CAUTION**	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

3 PROCEDURE TO MOVE ARM WITHOUT DRIVE POWER IN EMERGENCY OR ABNORMAL SITUATIONS

(1) For emergency or abnormal situations (e.g. persons trapped in or pinched by the robot), brake release unit can be used to move the robot axes without drive power.
Please order following unit and cable.

Name	Specification
Brake release unit	A05B-2450-J350 (Input Voltage AC100-115V single-phase) A05B-2450-J351 (Input Voltage AC200-240V single-phase)
Robot connection cable	A05B-2450-J360 (5m) A05B-2450-J361(10m)
Power cable	A05B-2525-J010 (5m) (AC100-115V Power plug) (*) A05B-2525-J011(10m) (AC100-115V Power plug) (*) A05B-2450-J364 (5m) (AC100-115V or AC200-240V No power plug) A05B-2450-J365(10m) (AC100-115V or AC200-240V No power plug)

(*) These do not support CE marking.

(2) Please make sure that adequate numbers of brake release units are available and readily accessible for robot system before installation.
(3) Regarding how to use brake release unit, please refer to Robot controller maintenance manual.

⚠ **CAUTION**
Robot systems installed without adequate number of brake release units or similar means are not in compliance with EN ISO 10218-1 and the Machinery Directive and therefore cannot bear the CE marking.

⚠ **WARNING**
Robot arm would fall down by releasing its brake because of the gravity. Especially because spring balancer is used for J2-axis, it is hard to predict J2-arm movement by the condition of Robot posture and end effector. Therefore it is strongly recommended to take adequate measures such as hanging Robot arm by a crane before releasing a brake.(There is no balancer for R-2000*i*B/170CF/150U/220U/220US/165CF)

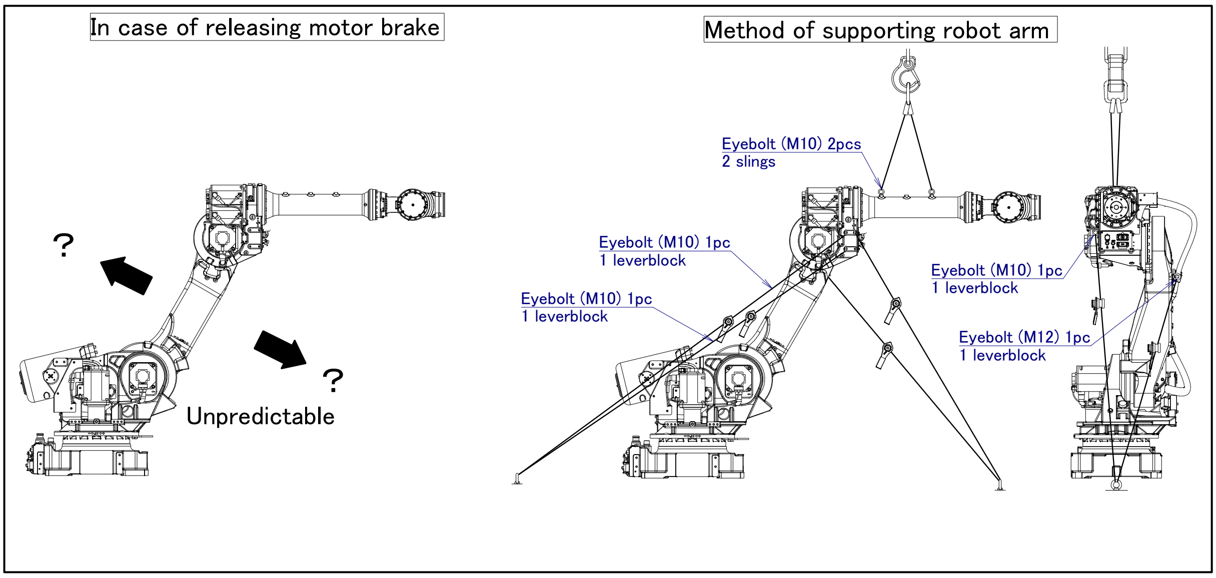


Fig. 3 (a) Releasing J2 motor brake and measures
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H)

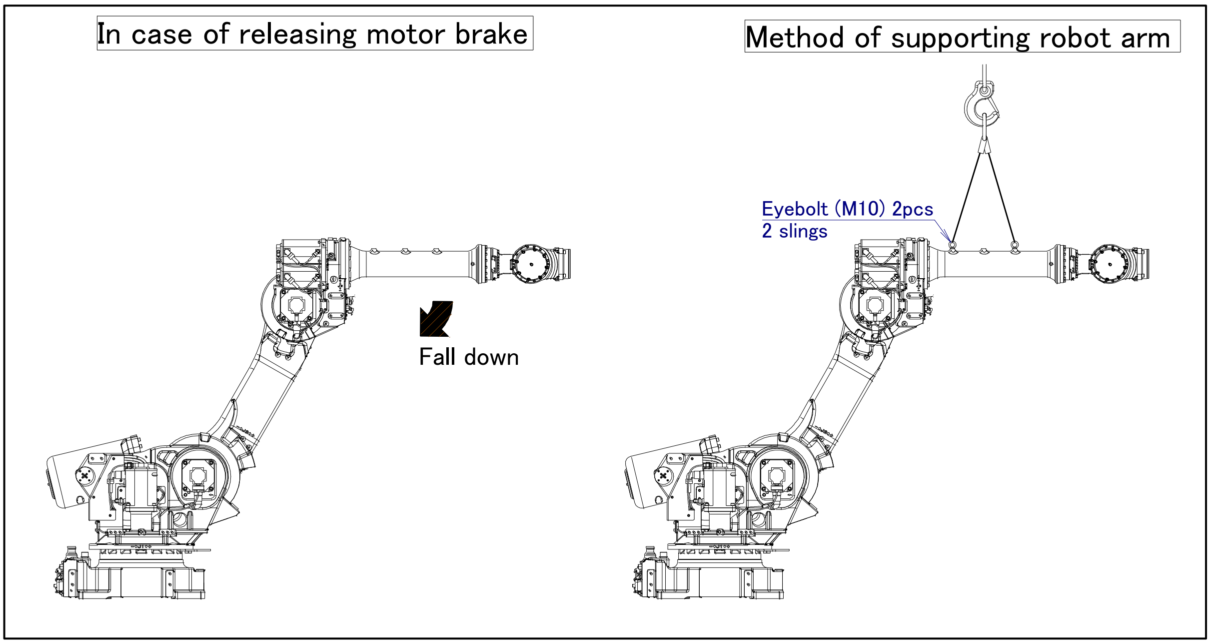


Fig. 3 (b) Releasing J3 motor brake and measures
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H)

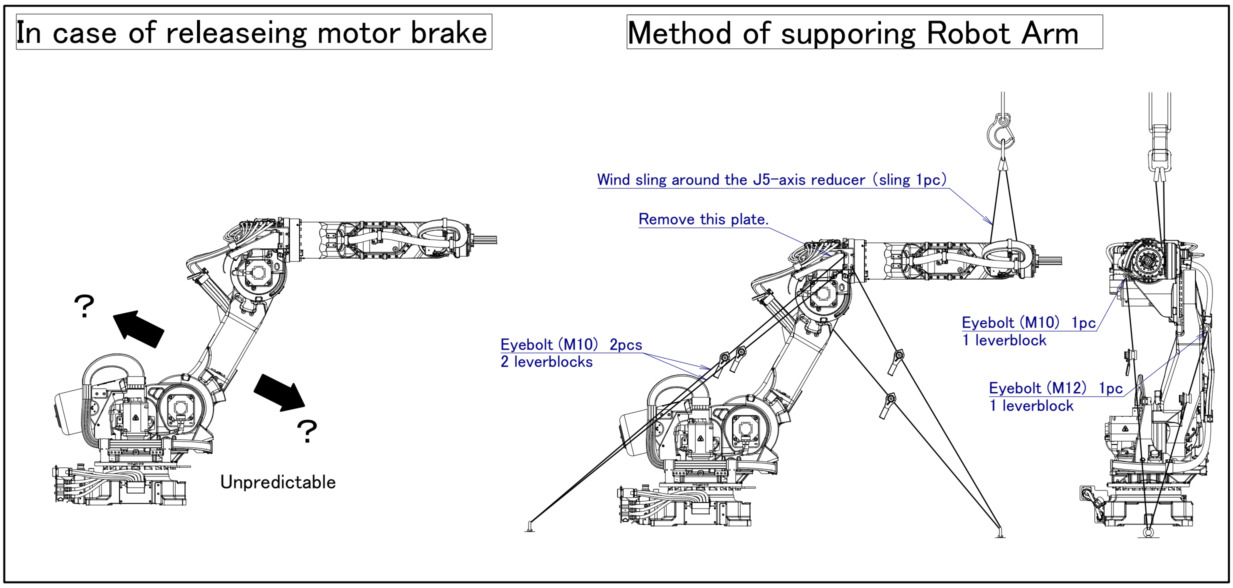


Fig. 3 (c) Releasing J2 motor brake and measures (R-2000*i*B/210FS)

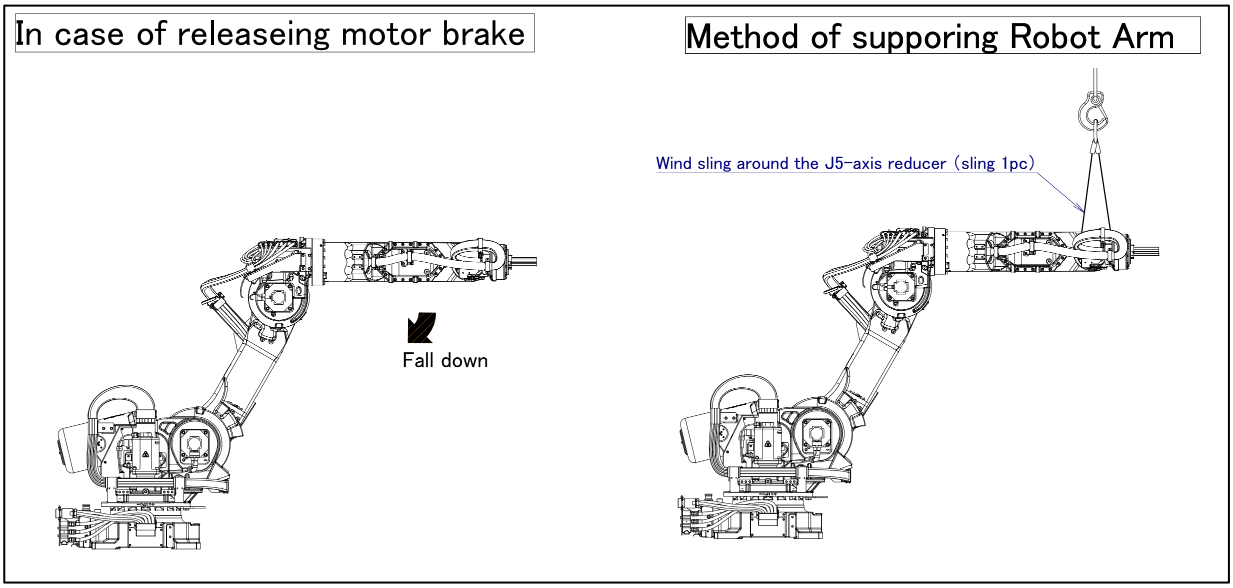


Fig. 3 (d) Releasing J3 motor brake and measures (R-2000*i*B/210FS)

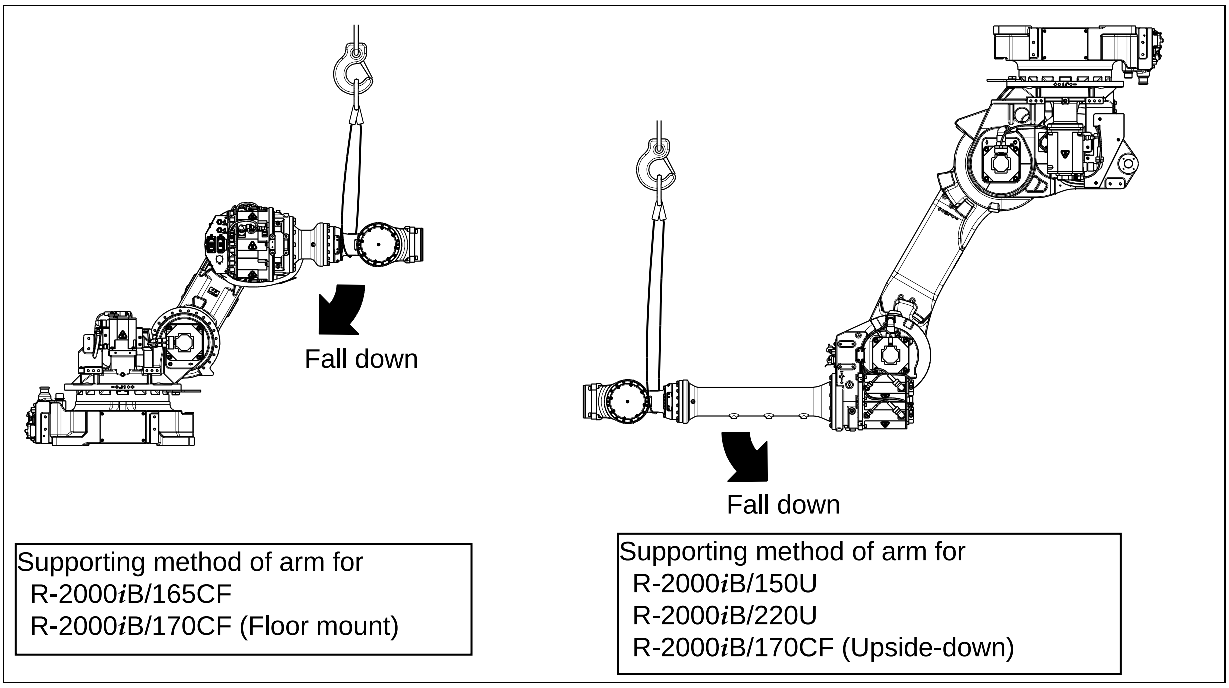


Fig. 3 (e) Releasing J2 and J3 motor brake and measures (R-2000*i*B/170CF/150U/220U/165CF)

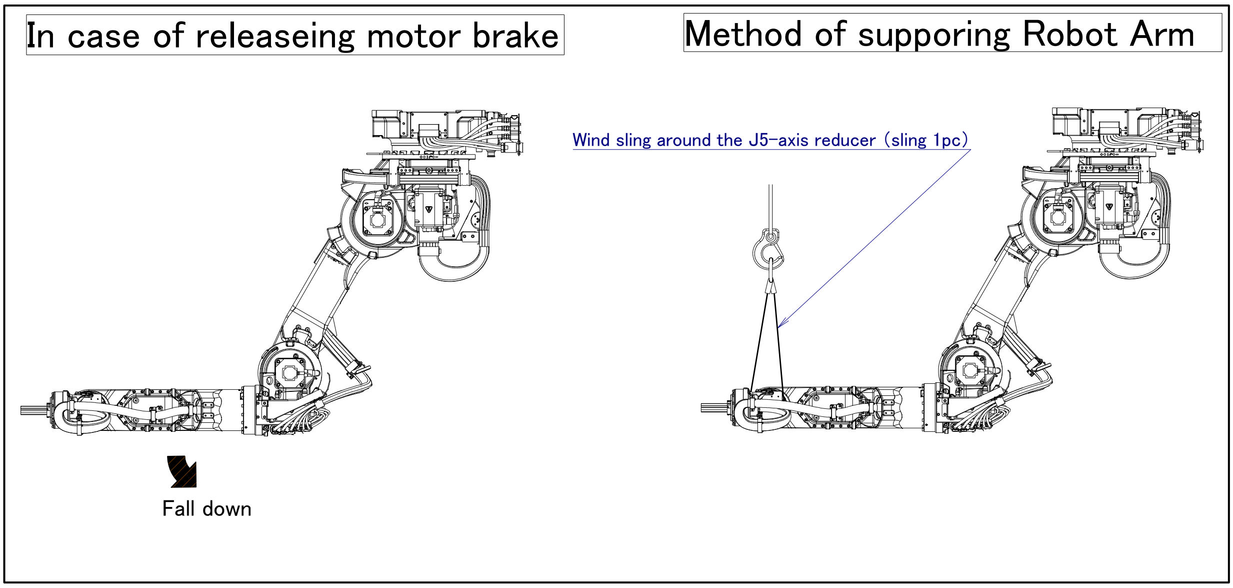


Fig. 3 (f) Releasing J2 and J3 motor brake and measures (R-2000*i*B/220US)

4 PRECAUTIONS FOR MECHANISM

In case of washing robot, perform air purge constantly when robot is in washing booth. Please refer to piping and wiring to the end effector chapter of mechanical unit operator’s manual (B-82234EN) about purge air inlet and purge pressure.

5 WARNING & CAUTION LABEL

(1) Greasing and degreasing label

Fig. 5 (a) Greasing and degreasing label

Description

When greasing and degreasing, observe the instructions indicated on this label.

1) When greasing, be sure to keep the grease outlet open.
2) Use a manual pump to grease.
3) Be sure to use a specified grease.

> ⚠ **CAUTION**
> See Chapter 7 ″CHECKS AND MAINTENANCE″ for explanations about specified grease, the grease amount, and the locations of grease and degrease outlets for individual models.

(2) Disassembly prohibitive label

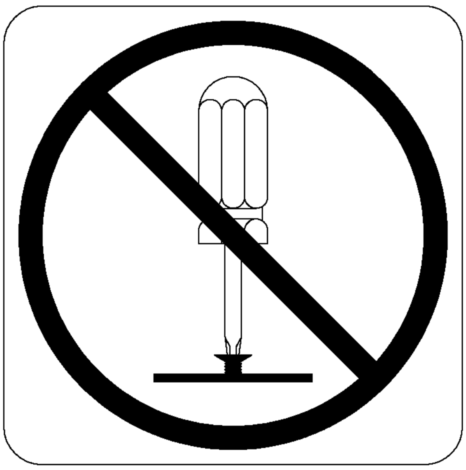


Fig. 5 (b) Disassembly prohibitive label

Description

Do not disassemble the balancer unit because it contains a spring, which may cause serious danger (for the R-2000*i*B, a disassembly prohibitive label is affixed only to the balancer).

(3) Step-on prohibitive label

Fig. 5 (c) Step-on prohibitive label

Description

Do not step on or climb the robot or controller as it may adversely affect the robot or controller and you may get hurt if you lose your footing as well.

(4) High-temperature warning label

Fig. 5 (d) High-temperature warning label

Description

Be cautious about a section where this label is affixed, as the section generates heat.
If you have to inevitably touch such a section when it is hot, use a protective tool such as heat-resistant gloves.

(5) Transportation label

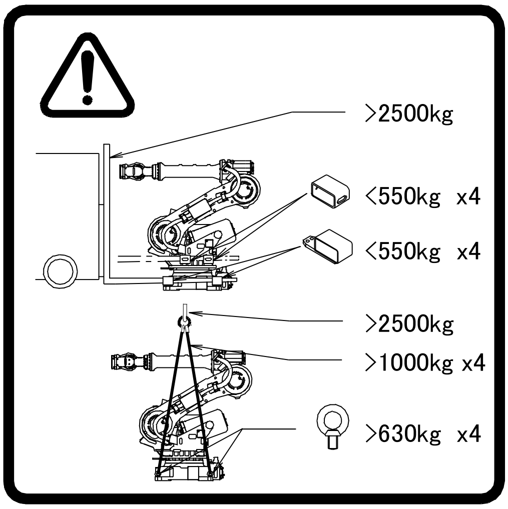


Fig. 5 (e) Transportation label (R-2000*i*B/165F/210F/250F/210WE/125L/175L/100H/150U/220U/210FS/220US)

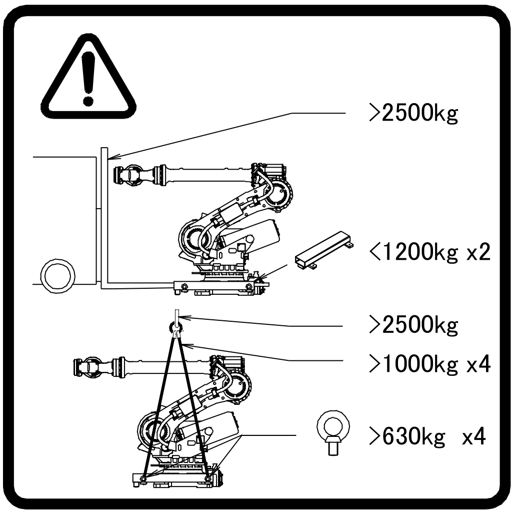


Fig. 5 (f) Transportation label (R-2000*i*B/185L)

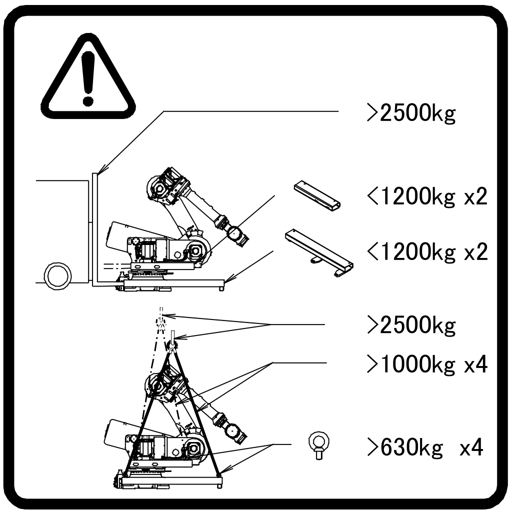


Fig. 5 (g) Transportation label (R-2000*i*B/165R/200R/100P)

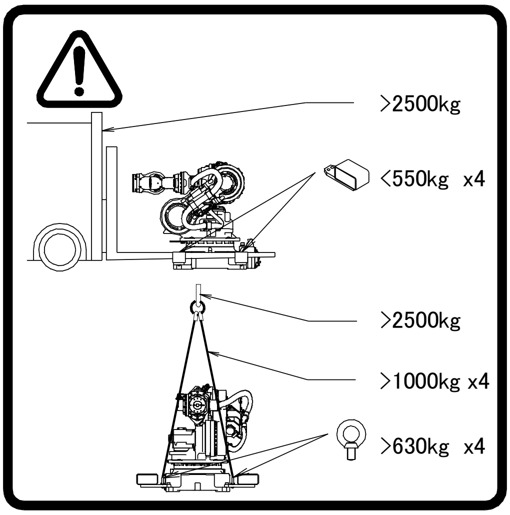


Fig. 5 (h) Transportation label (R-2000*i*B/170CF)

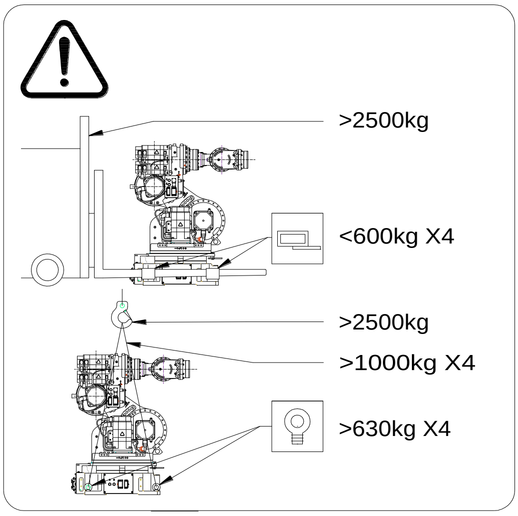


Fig. 5 (i) Transportation label (R-2000*i*B/165CF)

Description

When transporting the robot, observe the instructions indicated on this label.

1) Using a forklift
- Use a forklift having a load capacity of 2500 kg or greater.
- Keep the total weight of the robot to be transported to within 2200 kg, because the allowable load of the forklift bracket (option) is 5390 N (550 kgf).

2) Using a crane
- Use a crane with a load capacity of 2500 kg or greater.
- Use four slings each with each load capacity of 1000 kg or greater.
- In case of using eyebolts, use at least four eyebolts with each allowable load of 6174 N (630 kgf) or greater.
- Keep the total weight of the robot to be transported to within 2200 kg, because the allowable load of the forklift bracket (option) is 5390 N (550 kgf).

> ⚠ **CAUTION**
> Transportation labels are model-specific. Before transporting the robot, see the transportation label affixed to the J2 base side.
> See Subsection 1.1 TRANSPORTATION for explanations about the posture a specific model should take when it is transported.

(6) Balancer replacement label

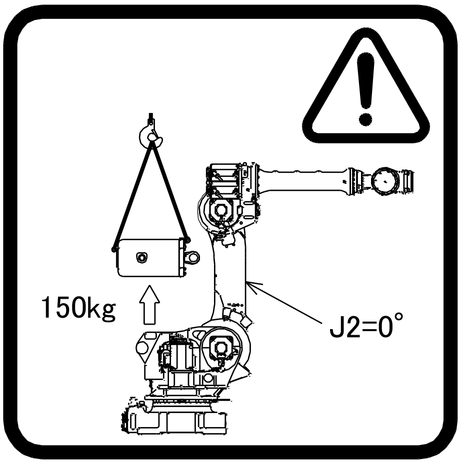


Fig. 5 (j) Balancer replacement label (R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/210FS)

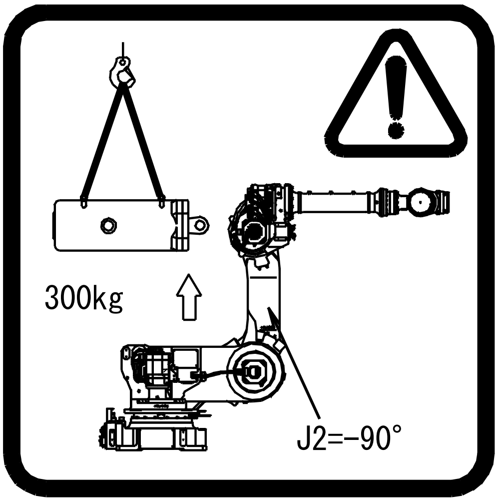


Fig. 5 (k) Balancer replacement label (R-2000*i*B/165R/200R/100P)

Description

When replacing the balancer, observe the instructions indicated on this label.
The above balancer replacement label indicates the following:

- While replacing the balancer, keep the J2-axis at 0° for the R-2000*i*B/165F/210F/185L/250F/210WE/210FS/125L/175L/100H and keep the J2-axis at -90° for the R-2000*i*B/165R/200R/100P.
- For the R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/210FS the mass of the balancer is 150 kg.
- For the R-2000*i*B/165R/200R/100P the mass of the balancer is 300 kg.
- The R-2000*i*B/165CF/170CF/150U/220U/220US have no balancer.

> ⚠ **CAUTION**
> For information about balancer replacement, contact your local FANUC representative.

(7) Operating space and payload label

In the case of CE specification, the following label is added:

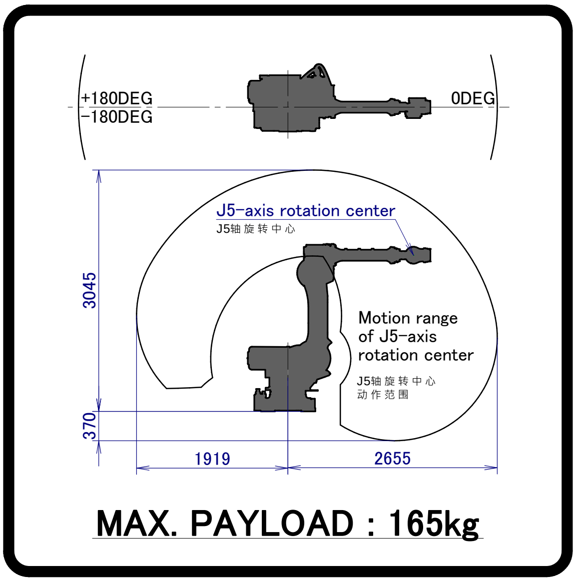


Fig. 5 (l) Operating space and payload label (example of R-2000*i*B/165F)

(8) Transportation prohibitive label

(When transport equipment option is specified.)

Fig. 5 (m) Transportation caution label (for eyebolt option)

Description

Do not pull eyebolts sideways when transporting the robot.

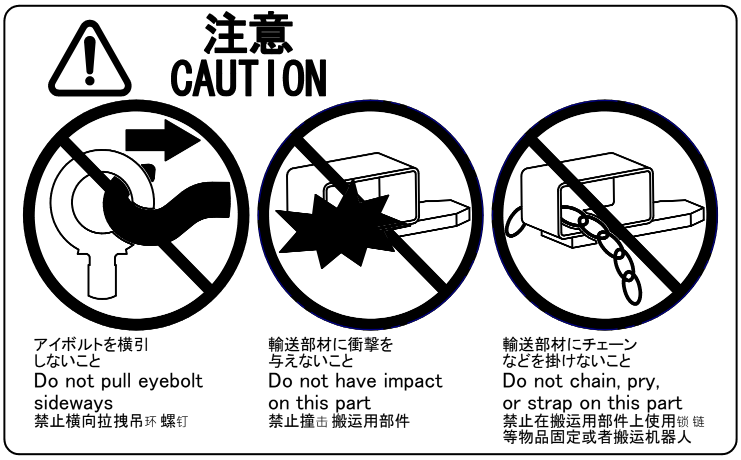


Fig. 5 (n) Transportation caution label (when transport equipment option is specified)

Description

Keep the following in mind when transporting the robot.

1) Do not pull eyebolts sideways
2) Prevent the forks of the forklift from having impact on a transport equipment
3) Do not thread a chain or the like through a transport equipment.

(9) Transportation caution label

(When transportation equipment option A05B-1329-H075 is specified.)

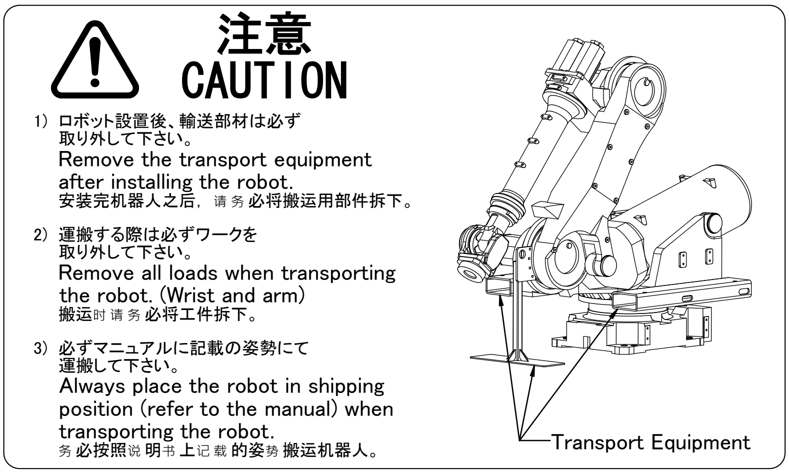


Fig. 5 (o) Transportation caution label

Description

1) Remove the transport equipment after installing the robot.
2) Remove all loads when transporting the robot. (Wrist and arm)
3) Always place the robot in shipping position (refer to the manual) when transporting the robot.

(10) High voltage attention label (R-2000*i*B/210WE)

Fig. 10 (p) High voltage attention label

Description

Do not open this cover except the repair person of FANUC.

(11) Battery case attention label (R-2000*i*B/210WE)

Fig. 10 (q) Battery case cover attention label

Description

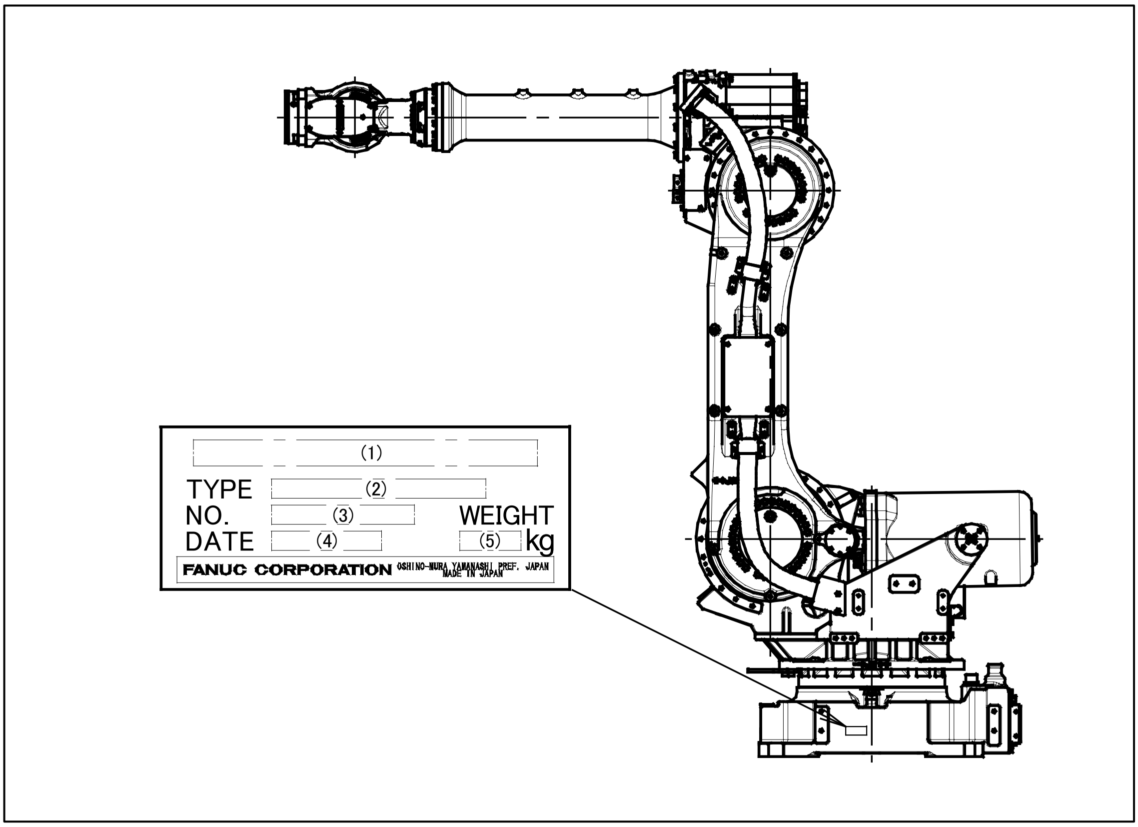
Battery case is inside. For replacing batteries, open this cover. Once you open this, you should replace bolts and a gasket with new ones.

PREFACE

This manual explains maintenance procedures for the following mechanical units:

Model name	Mechanical unit specification No.	Maximum load
FANUC Robot R-2000*i*B/165F	A05B-1329-B201	165kg
FANUC Robot R-2000*i*B/210F	A05B-1329-B205	210kg
FANUC Robot R-2000*i*B/185L	A05B-1329-B211	185kg
FANUC Robot R-2000*i*B/250F	A05B-1329-B215	250kg
FANUC Robot R-2000*i*B/165R	A05B-1329-B221	165kg
FANUC Robot R-2000*i*B/200R	A05B-1329-B225	200kg
FANUC Robot R-2000*i*B/100P	A05B-1329-B231	100kg
FANUC Robot R-2000*i*B/170CF	A05B-1329-B241	170kg
FANUC Robot R-2000*i*B/210WE	A05B-1329-B255	210kg
FANUC Robot R-2000*i*B/210WE	A05B-1329-B256	210kg
FANUC Robot R-2000*i*B/125L	A05B-1329-B261	125kg
FANUC Robot R-2000*i*B/175L	A05B-1329-B265	175kg
FANUC Robot R-2000*i*B/100H	A05B-1329-B271	100kg
FANUC Robot R-2000*i*B/150U	A05B-1329-B291	150kg
FANUC Robot R-2000*i*B/220U	A05B-1329-B295	220kg
FANUC Robot R-2000*i*B/210FS	A05B-1329-B305	210kg
FANUC Robot R-2000*i*B/220US	A05B-1329-B395	220kg
FANUC Robot R-2000*i*B/165CF	A05B-1324-B541	165kg

The label stating the mechanical unit specification number is affixed in the following position. Before reading this manual, verify the specification number of the mechanical unit.



Position of label indicating mechanical unit specification number

TABLE 1

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
CONTENTS	**MODEL NAME**	**TYPE**	**No.**	**DATE**	**WEIGHT kg (Without controller)**
LETTERS	FANUC Robot R-2000*i*B/165F	A05B-1329-B201	SERIAL NO. IS PRINTED	PRODUCTION YEAR AND MONTH ARE PRINTED	1170
	FANUC Robot R-2000*i*B/210F	A05B-1329-B205			1240
	FANUC Robot R-2000*i*B/185L	A05B-1329-B211			1290
	FANUC Robot R-2000*i*B/250F	A05B-1329-B215			1270
	FANUC Robot R-2000*i*B-165R	A05B-1329-B221			1480
	FANUC Robot R-2000*i*B-200R	A05B-1329-B225			1540
	FANUC Robot R-2000*i*B/100P	A05B-1329-B231			1560
	FANUC Robot R-2000*i*B/170CF	A05B-1329-B241			800
	FANUC Robot R-2000*i*B/210WE	A05B-1329-B255			1280
	FANUC Robot R-2000*i*B/210WE	A05B-1329-B256			1280
	FANUC Robot R-2000*i*B/125L	A05B-1329-B261			1190
	FANUC Robot R-2000*i*B/175L	A05B-1329-B265			1260
	FANUC Robot R-2000*i*B/100H	A05B-1329-B271			1150
	FANUC Robot R-2000*i*B/150U	A05B-1329-B291			1070
	FANUC Robot R-2000*i*B/220U	A05B-1329-B295			1150
	FANUC Robot R-2000*i*B/210FS	A05B-1329-B305			1250
	FANUC Robot R-2000*i*B/220US	A05B-1329-B395			1160
	FANUC Robot R-2000*i*B/165CF	A05B-1324-B541			1050

RELATED MANUALS

For the FANUC Robot series, the following manuals are available:

<table>
<tr><td colspan="2">Safety handbook B-80687EN
All persons who use the FANUC Robot and system designer must read and understand thoroughly this handbook</td><td>Intended readers :
Operator, System designer
Topics :
Safety items for robot system design, Operation, Maintenance</td></tr>
<tr><td rowspan="2">R-30iA controller</td><td>Operations manual
SPOT TOOL+
B-83124EN-1
HANDLING TOOL
B-83124EN-2
DISPENSE TOOL
B-83124EN-4
Servo Gun Function
B-82634EN
Alarm Code List
B-83124EN-6</td><td>Intended readers :
Operator, programmer, Teaching operator, Maintenance technician, System designer
Topics :
Robot functions, Operations, Programming, Setup, Interfaces, Alarms
Use :
Robot operation, Teaching, System design</td></tr>
<tr><td>Maintenance manual
B-82595EN
B-82595EN-1
(For Europe)
B-82595EN-2
(For RIA)</td><td>Intended readers :
Maintenance technician, system designer
Topics :
installation, start-up, connection, maintenance
Use :
installation, start-up, connection, maintenance</td></tr>
<tr><td rowspan="2">R-30iB/R-30iB Plus controller</td><td>OPERATOR'S MANUAL
(Basic Operation)
B-83284EN
OPERATOR'S MANUAL
(Alarm Code List)
B-83284EN-1
Optional Function
OPERATOR'S MANUAL
B-83284EN-2
Spot Welding Function
OPERATOR’S MANUAL
B-83284EN-4
Dispense Function
OPERATOR’S MANUAL
B-83284EN-5
Servo Gun Function
OPERATOR’S MANUAL
B-83264EN</td><td>Intended readers :
Operator, programmer, Teaching operator, Maintenance technician, System designer
Topics :
Robot functions, Operations, Programming, Setup, Interfaces, Alarms
Use :
Robot operation, Teaching, System design</td></tr>
<tr><td>Maintenance manual
B-83195EN</td><td>Intended readers :
Maintenance technician, system designer
Topics :
installation, start-up, connection, maintenance
Use :
installation, start-up, connection, maintenance</td></tr>
</table>

NOTE

R-30*i*B Plus Controller supports only R-2000*i*B/170CF.

This manual uses following terms.

Name	Terms in this manual
Connection cable between robot and controller	Robot connection cable
Robot mechanical unit	Mechanical unit

TABLE OF CONTENTS

APPENDIX

1 TRANSPORTATION AND INSTALLATION

1.1 TRANSPORTATION

Use a crane or a forklift to transport the robot. When transporting the robot, be sure to change the posture of the robot to that shown below and lift by using the eyebolts and the transport equipment at their points.

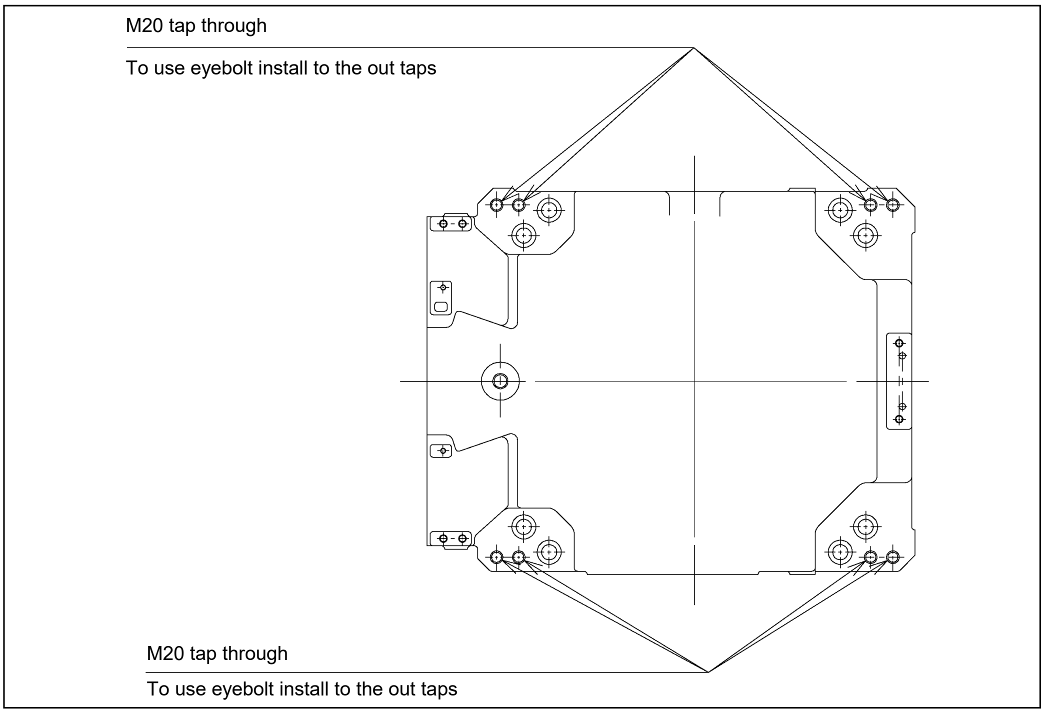


Fig. 1.1 (a) Position of the eyebolts and transportation equipment

(1) Transportation using a crane (Fig. 1.1 (b) to (l))
Fasten M20 eyebolts or the transport equipment and eyebolts or the transport equipment at the four points and lift the robot by the four slings. (Some transport equipment does not need eyebolts.)
There are two kinds of transportation equipment about the type installed on the J1 base and the type installed on the J2 base for the R-2000*i*B/165R/200R/100P. (There is no type installed on the J2 base in other models.)

> ⚠ **CAUTION**
> When lifting the robot, be careful not to damage motors, connectors, or cables of the robot by slings.

(2) Transportation using a fork lift (Fig. 1.1 (m) to (w))
The robot is transported with the specific transport equipment attached.
For the R-2000*i*B/165F/210F/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U/210FS/220US there are two types of transport equipment: one to be attached to the J1 base and the other to the J2 base.
For the R-2000*i*B/185L/170CF/165CF, there is a type of transport equipment to be attached to the J1 base.
Transport equipment are prepared as an option.

⚠ **WARNING**

1 When hoisting or lowering the robot with a crane or forklift, move it slowly with great care. When placing the robot on the floor, exercise care to prevent the installation surface of the robot from striking the floor.

2 Detach the end effectors and the floor plate before transporting the robot. If the robot need to be transported with the floor plate or end effectors attached, take the following precautions:
- The entire position of center of gravity is changed by installing the end effector and the floor plate. Please note the balance enough.
- The end effector swings by the vibration when transported, and there is a possibility that an excessive load acts on the robot. Secure the end effector firmly according to Subsection 1.1.1.
- When you lift robot with the floor plate installed, please lift up not the robot but the floor plate.

NOTE

1 If the transport equipment of the J2 base type for the R-2000*i*B/165R/200R/100P is used with a crane or forklift to hoist or lower the robot in the state where the robot is tilted, all load may be imposed on the strut bar used to protect against falling, thus deforming the strut bar. When you operate a crane or fork lift, please confirm whether the robot is the horizontal enough.

2 LOCTITE 263 (rust preventive) may be applied to the mounting bolts used to secure the transport equipment of the J2 base type. When removing those mounting bolts, be careful not to damage the heads of the bolts.

⚠ **WARNING**

Use the forklift transport equipment only to transport the robot with a forklift. Do not use the forklift transport equipment to secure the robot.
Before moving the robot by using transport equipment, check the bolts on the transport equipment and tighten any loose bolts if any.
In case of R-2000*i*B/165F/210F/185L/250F/165R/200R/125L/175L/100H/150U/220U/210FS/220US/165CF, when J1/J2-axis motor covers (option) are installed, be sure to remove them before transporting robot with a crane.
(In case of R-2000*i*B/210WE, motor cover is installed normally.)

Note)
1. Machine mass.
R-2000*i*B/165F : 1170kg , R-2000*i*B/150U : 1070kg
R-2000*i*B/210F : 1240kg , R-2000*i*B/250F : 1270kg
R-2000*i*B/125L : 1190kg , R-2000*i*B/175L : 1260kg
R-2000*i*B/220U : 1150kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

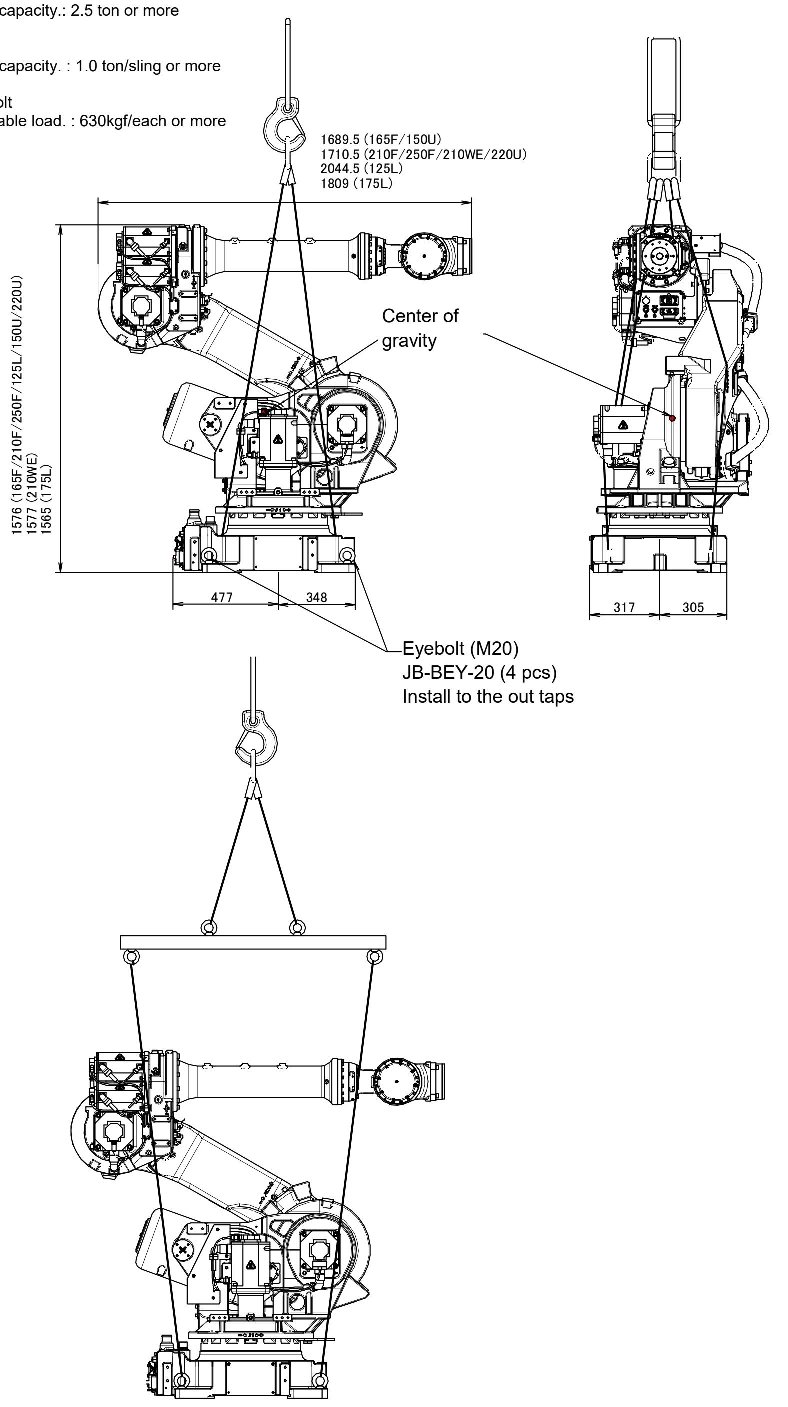


Fig. 1.1 (b) Transportation using a crane (R-2000*i*B/165F/210F/250F/210WE/125L/175L/150U/220U)

Note)
1. Machine mass.
R-2000*i*B/165F : 1170kg , R-2000*i*B/150U : 1070kg
R-2000*i*B/210F : 1240kg , R-2000*i*B/250F : 1270kg
R-2000*i*B/125L : 1190kg , R-2000*i*B/175L : 1260kg
R-2000*i*B/220U : 1150kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pc

Transport equipment (option)

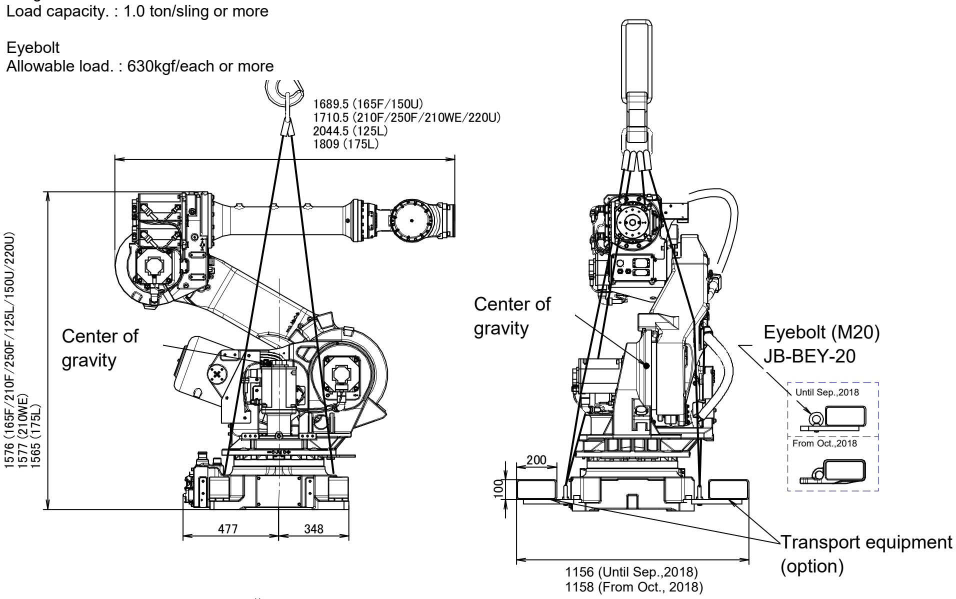
Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º



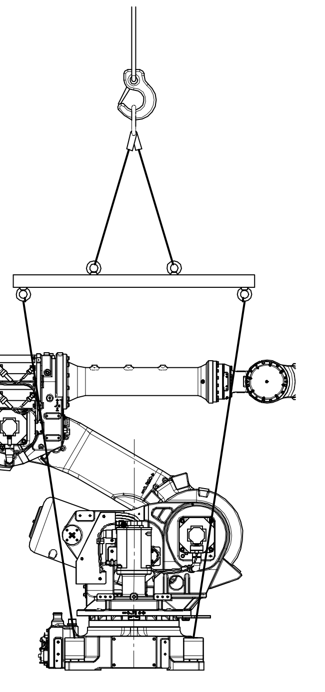


Fig. 1.1 (c) Transportation using a crane
(R-2000*i*B/165F/210F/250F/210WE/125L/175L/150U/220U when using the transport equipment)

Note)
1. Machine mass.: 1290kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

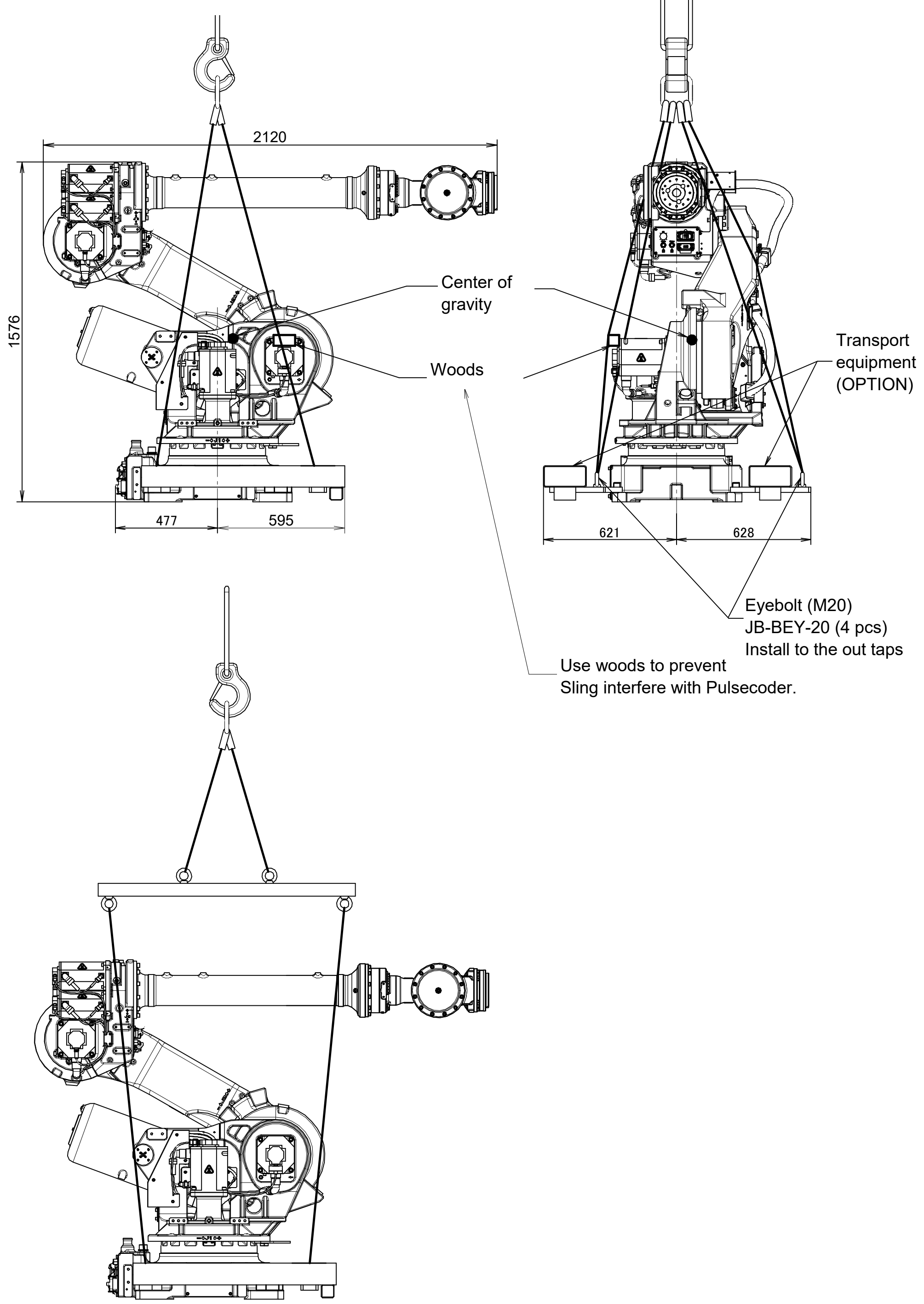


Fig. 1.1 (d) Transportation using a crane (R-2000*i*B/185L)

Note)
1. Machine mass
R-2000*i*B/165R : 1480kg , R-2000*i*B/150U : 1540kg
R-2000*i*B/100P : 1560kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º
J2	-120º
J3	49º (165R/200R) 41º (100P)
J4	0º
J5	-49º (165R/200R) -41º (100P)
J6	-0º

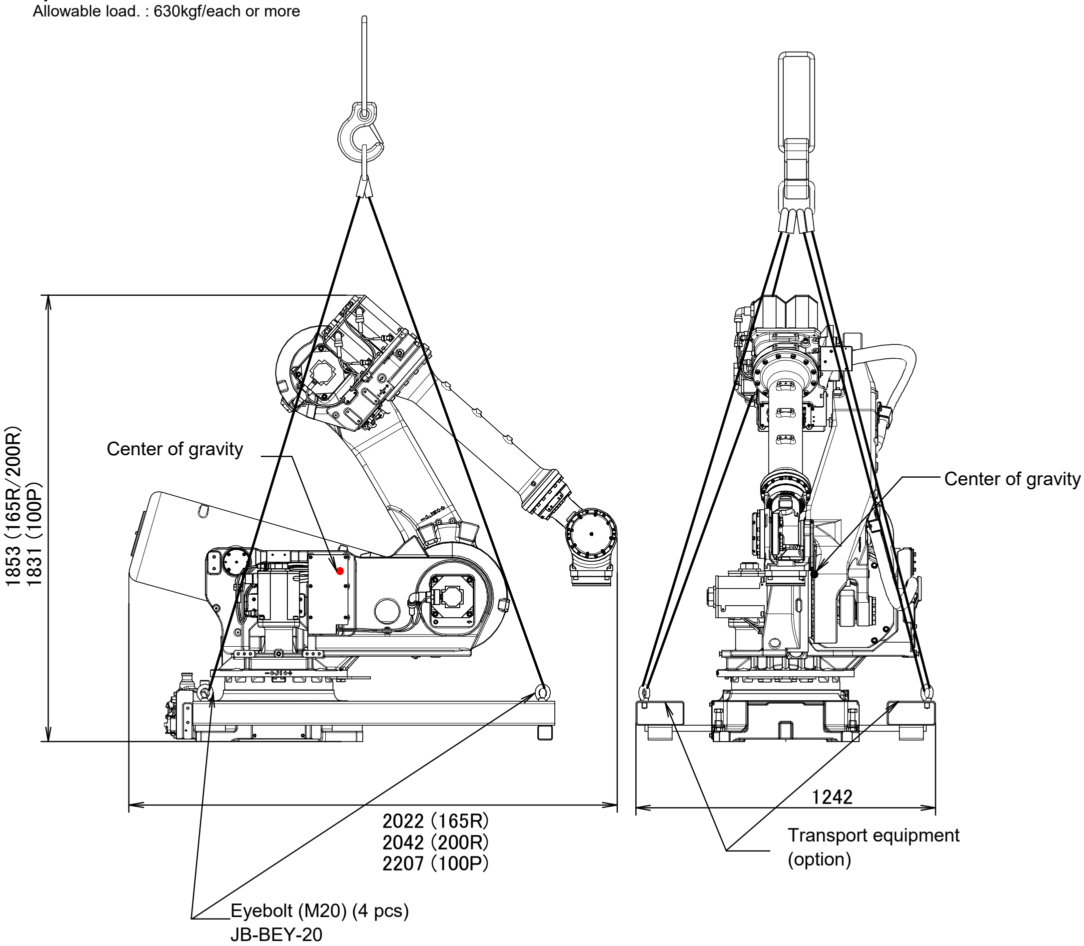


Fig. 1.1 (e) Transportation using a crane (R-2000*i*B/165R/200R/100P J1 base type)

Note)
1. Machine mass. 800kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º or ±180º
J2	-55º
J3	0º
J4	0º
J5	0º
J6	0º

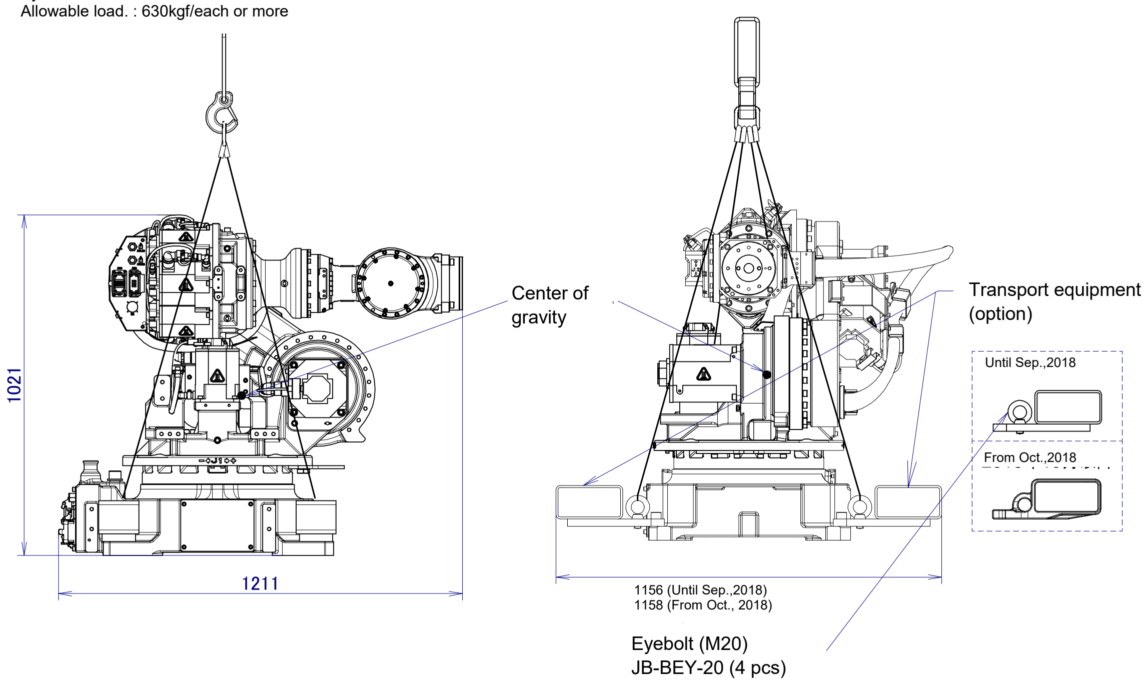


Fig. 1.1 (f) Transportation using a crane (R-2000*i*B/170CF)

Note)
1. Machine mass.
R-2000*i*B/165R : 1480kg , R-2000*i*B/150U : 1540kg
R-2000*i*B/100P : 1560kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs
4. When transporting a robot, please be sure to transport it by the posture for transportation.
5. When transporting a robot, remove all tools.
6. Be sure to remove transport equipment after setting robot up.

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º
J2	-120º
J3	49º (165R/200R) 41º (100P)
J4	0º
J5	-49º (165R/200R) -41º (100P)
J6	0º

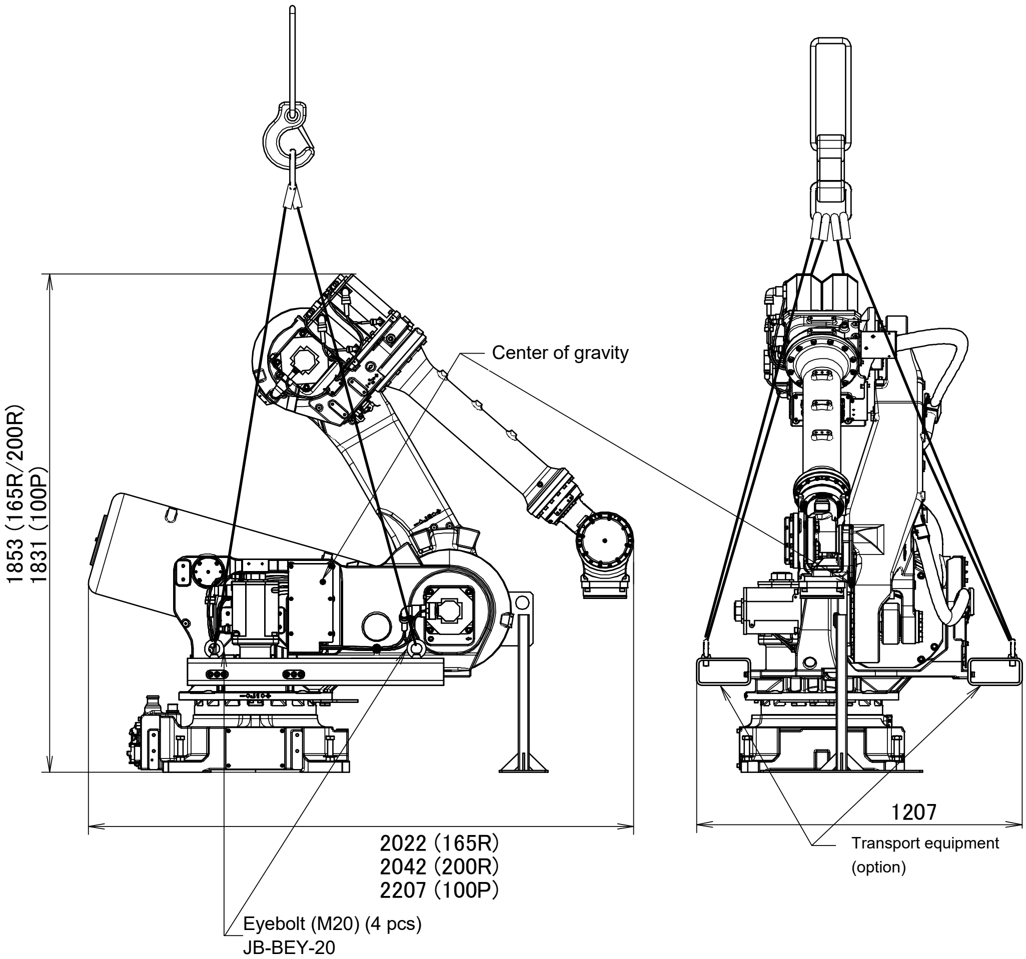


Fig. 1.1 (g) Transportation using a crane (R-2000*i*B/165R/200R/100P J2 base type)

Note)
1. Machine mass. : 1150kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

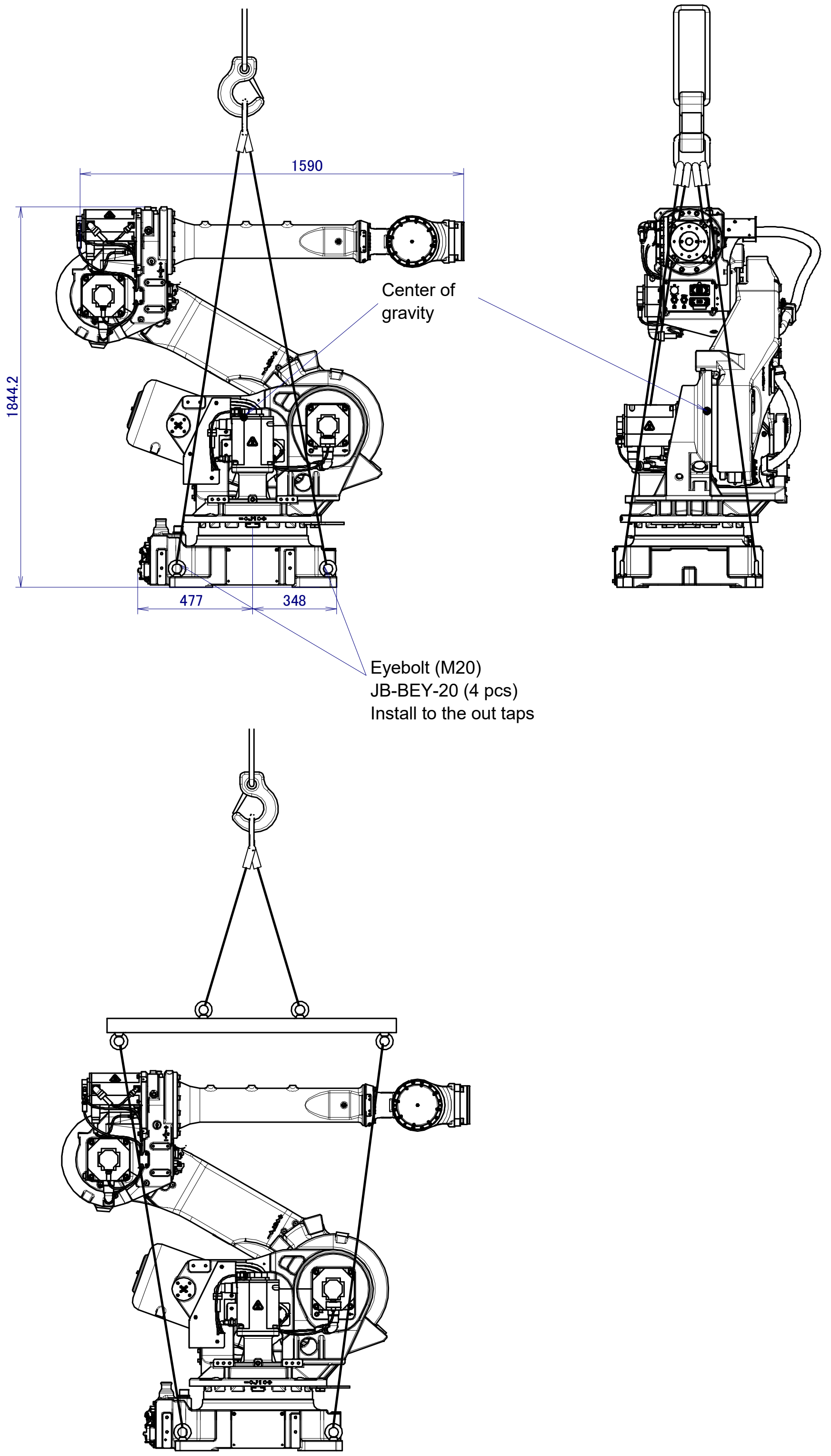


Fig. 1.1 (h) Transportation using a crane (R-2000*i*B/100H)

Note)
1. Machine mass. : 1150kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

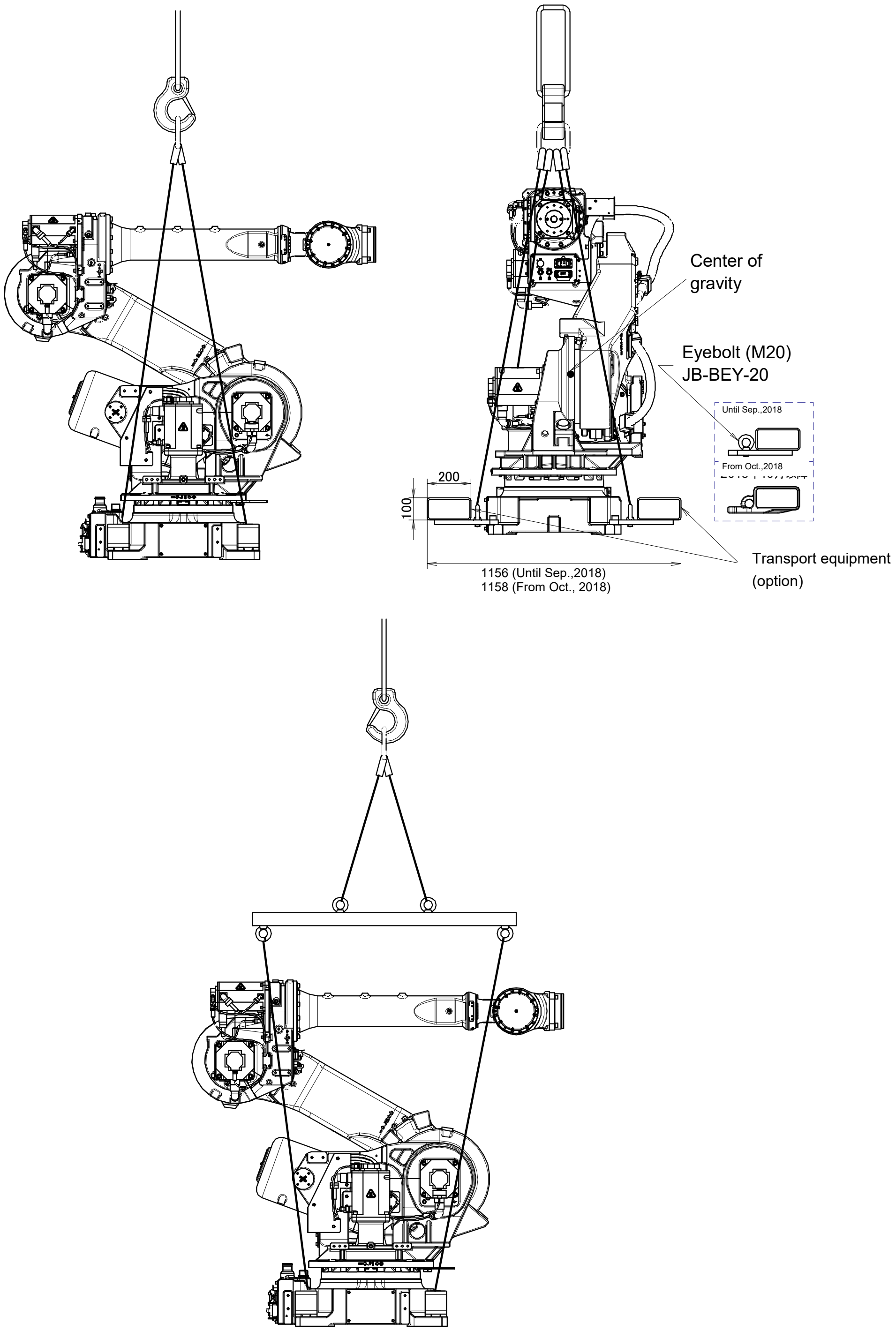


Fig. 1.1 (i) Transportation using a crane (R-2000*i*B/100H when using the transport equipment)

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

Note)
1. Machine mass.
   R-2000iB/210FS: 1250kg, R-2000iB/220US: 1160kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

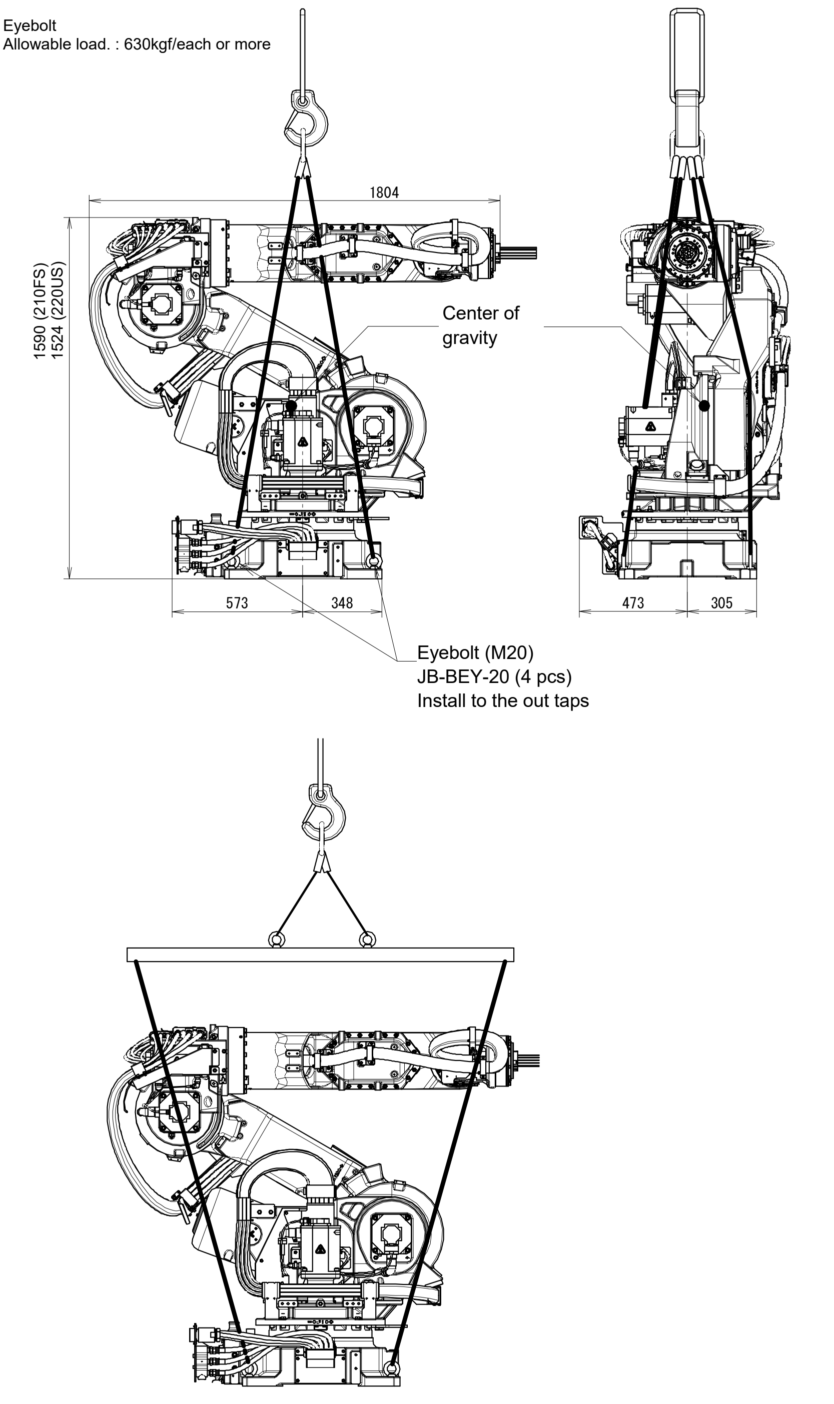


Fig. 1.1 (j) Transportation using a crane (R-2000*i*B/210FS/220US)

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	-0º

Note)
1. Machine mass.
   R-2000iB/210FS: 1250kg, R-2000iB/220US: 1160kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

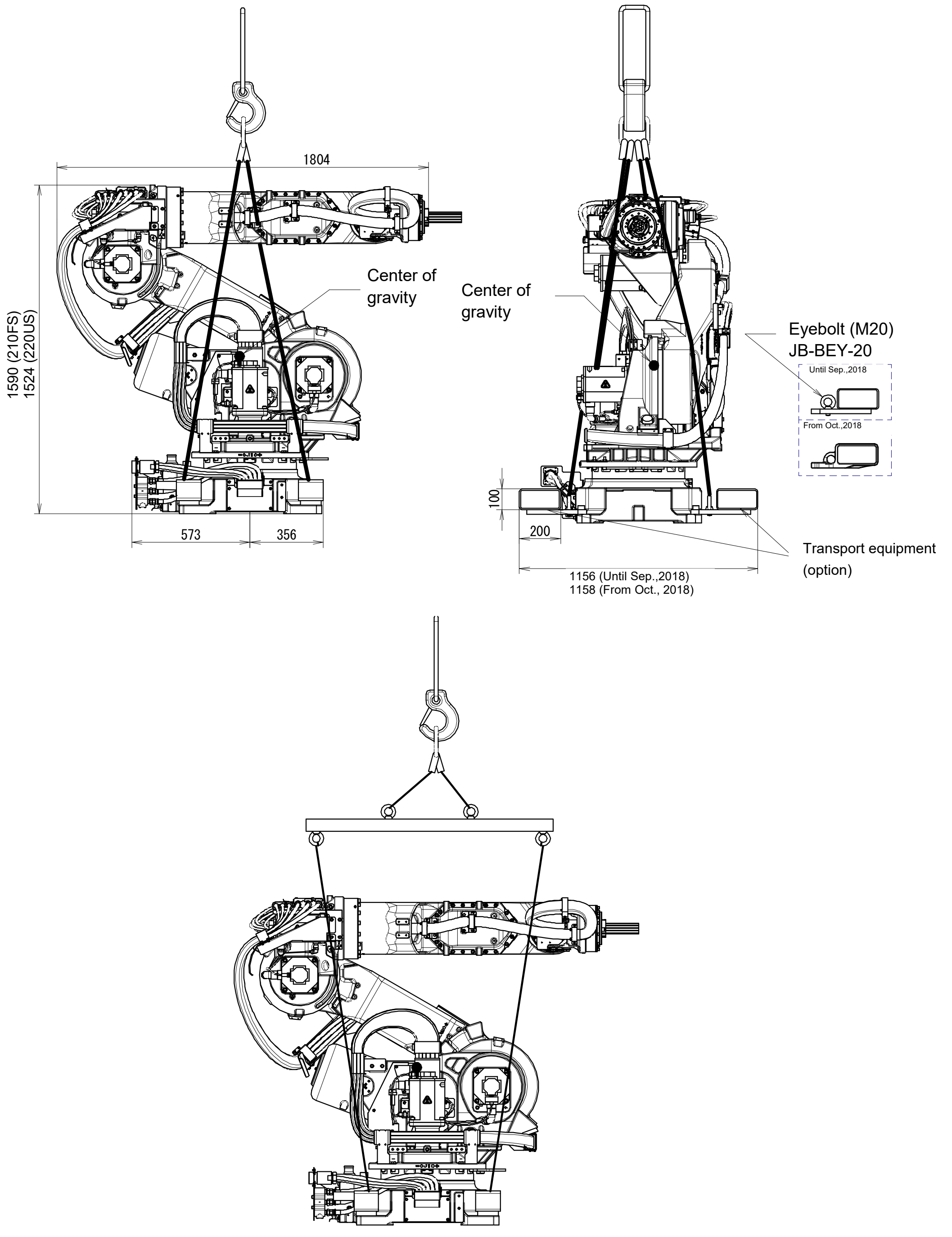


Fig. 1.1 (k) Transportation using a crane (R-2000*i*B/210FS/220US when using the transport equipment)

Note)
1. Machine mass. 1050kg
2. Eyebolt complied with JIS B 1168.
3. Quantity eyebolt 4 pcs, sling 4 pcs
4. Be sure to place the cable protection plate to Prevent the slings from compressing cables.

Crane
Load capacity.: 2.5 ton or more

Sling
Load capacity. : 1.0 ton/sling or more

Eyebolt
Allowable load. : 630kgf/each or more

Robot posture on transportation

J1	0º
J2	-55º
J3	0º
J4	0º
J5	0º
J6	0º

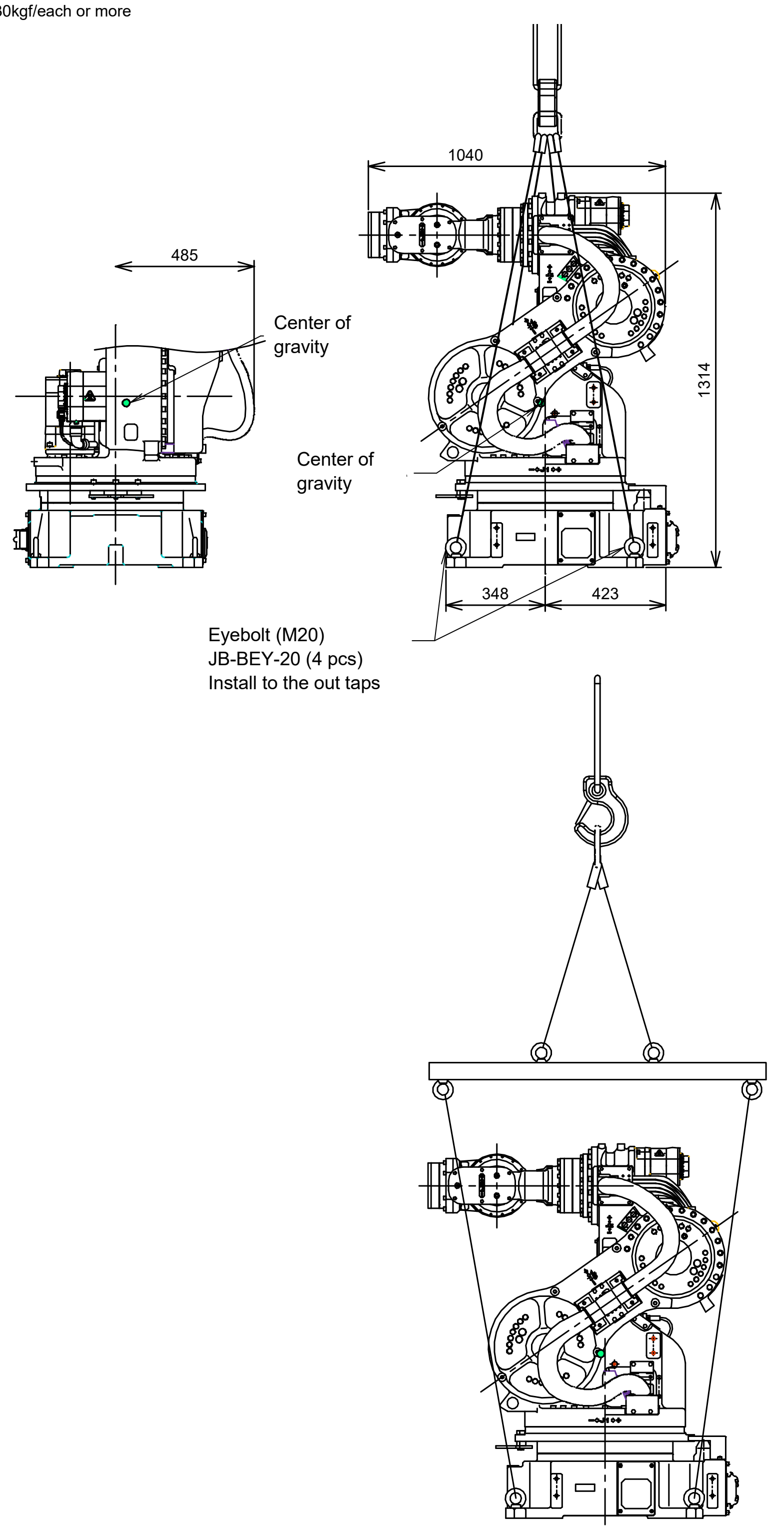


Fig. 1.1 (l) Transportation using a crane (R-2000*i*B/165CF)

Robot posture on transportation

Note)
1. See the list of specification for machine mass.
.
.

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

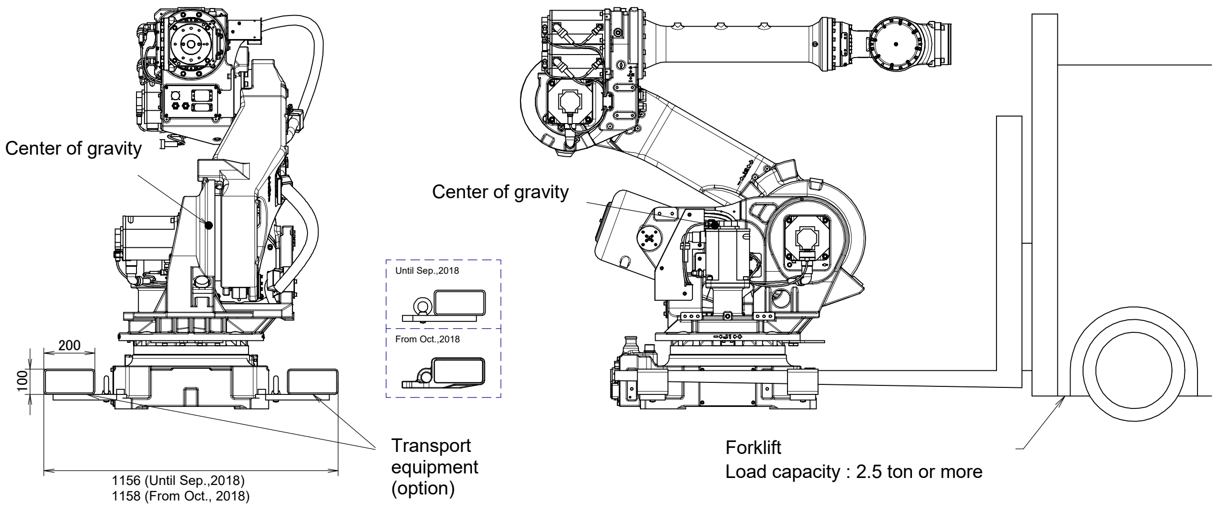


Fig. 1.1 (m) Transportation using a forklift
(R-2000*i*B/165F/210F/250F/210WE/125L/175L/150U/220U J1 base type)

Robot posture on transportation

Note)
1. See the list of specification for machine mass.
2. There is a case that LOCTITE is attached to the bolt
   In that case, do not spoil the head of the bolt when detaching it.
.

J1	Arbitrary
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

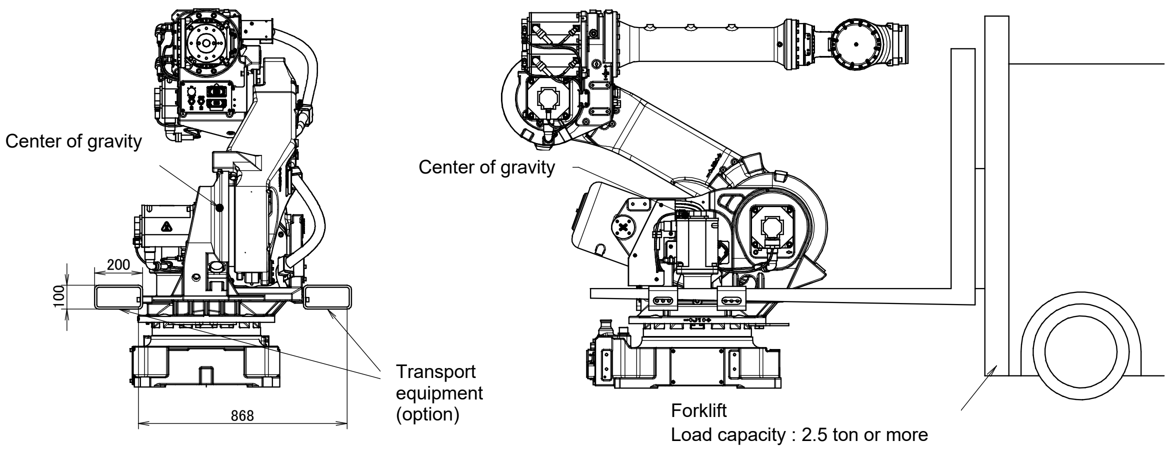


Fig. 1.1 (n) Transportation using a forklift
(R-2000*i*B/165F/210F/250F/210WE/125L/175L/150U/220U J2 base type)

⚠ **CAUTION**
Be careful not to strike the transport equipment with the forklift forks.

Robot posture on transportation

Note)
1. Machine mass. : 1290 kg

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

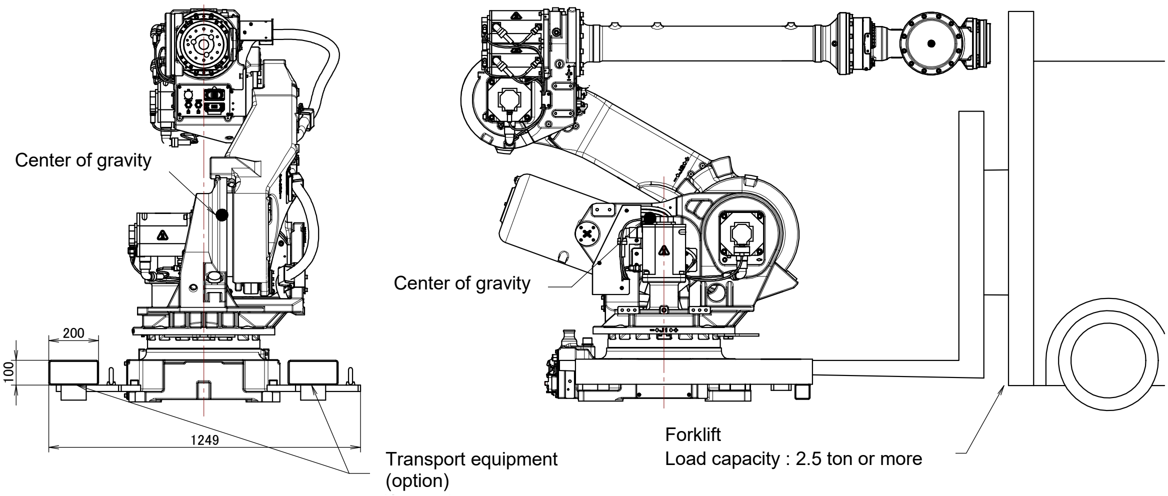


Fig. 1.1 (o) Transportation using a forklift (R-2000*i*B/185L J1 base type)

Robot posture on transportation

Note)
1. Machine mass. :
R-2000*i*B/165R :1480kg
R-2000*i*B/200R :1540kg
R-2000*i*B/100P :1560kg

J1	0º
J2	-120º
J3	49º (165R/200R) 41º (100P)
J4	0º
J5	-49º (165R/200R) -41º (100P)
J6	0º

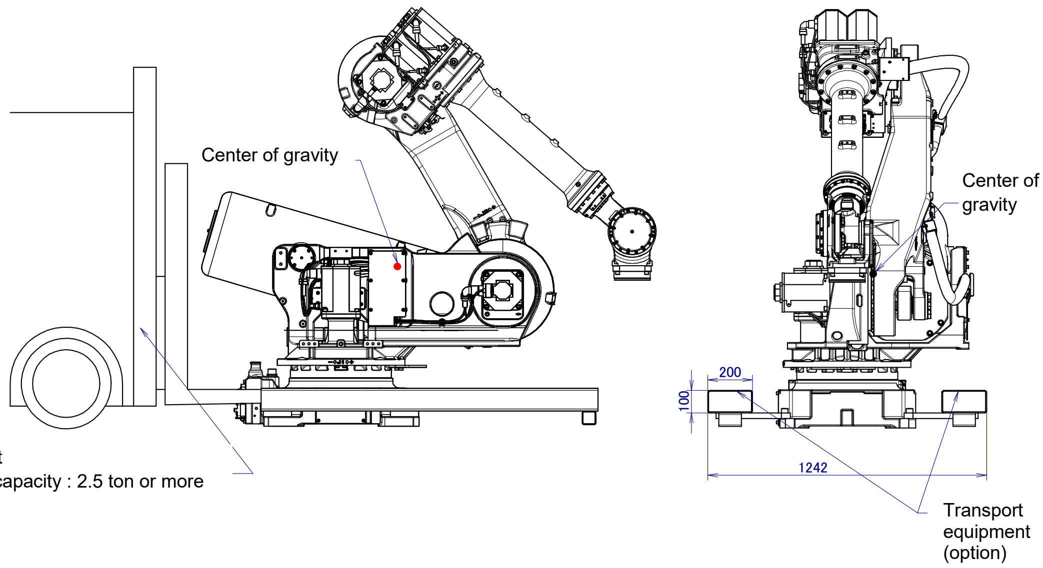


Fig. 1.1 (p) Transportation using a forklift (R-2000*i*B/165R/200R/100P J1 base type)

> ⚠ **CAUTION**
> Be careful not to strike the transport equipment with the forklift forks.

Note)
1. Machine mass. :
R-2000*i*B/165R :1480kg
R-2000*i*B/200R :1540kg
R-2000*i*B/100P :1560kg
2. When transporting a robot, please be sure to transport it by the posture for transportation.
3. When transporting a robot, remove all tools.
4. Be sure to remove transport equipment after setting robot up.

Robot posture on transportation

J1	0º
J2	-120º
J3	49º (165R/200R) 41º (100P)
J4	0º
J5	-49º (165R/200R) -41º (100P)
J6	0º

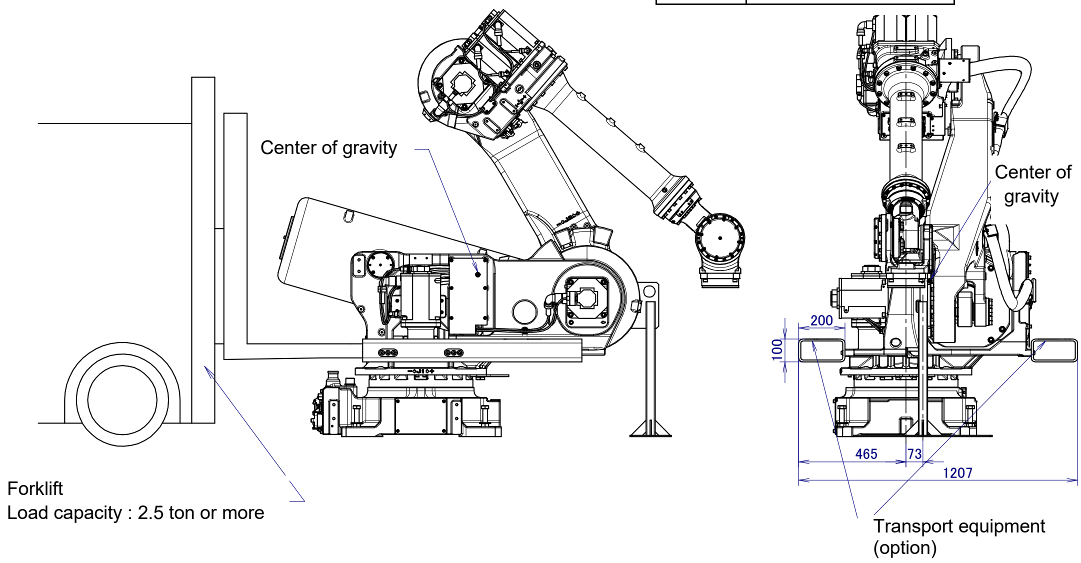


Fig. 1.1 (q) Transportation using a forklift (R-2000*i*B/165R/200R/100P J2 base type)

> ⚠ **CAUTION**
> Be careful not to strike the transport equipment with the forklift forks.

Note)
1. Machine mass. : 1150 kg

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º

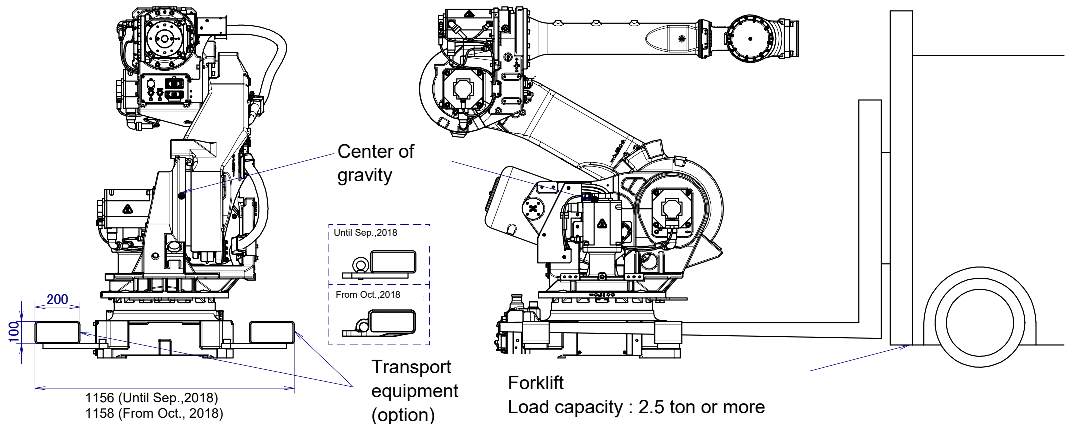


Fig. 1.1 (r) Transportation using a forklift (R-2000*i*B/100H J1 base type)

Note)
1. Machine mass. : 1150 kg
2. There is a case that LOCTITE is attached to the bolt
   In that case, do not spoil the head of the bolt when detaching it.

Robot posture on transportation

J1	Arbitrary
J2	-60º
J3	0º
J4	0º
J5	0º

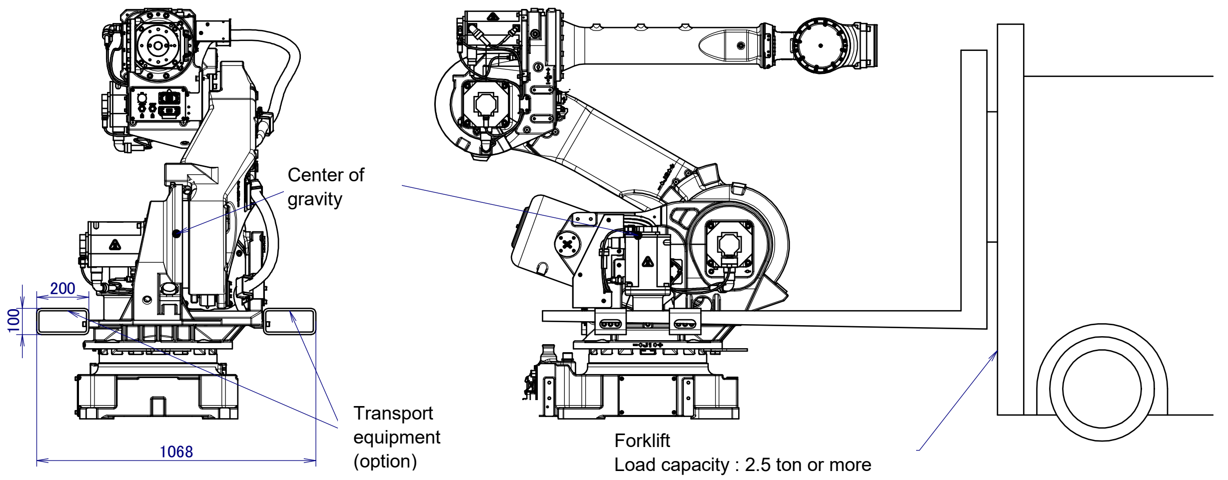


Fig. 1.1 (s) Transportation using a forklift (R-2000*i*B/100H J2 base type)

> ⚠ **CAUTION**
> Be careful not to strike the transport equipment with the forklift forks.

Robot posture on transportation

J1	0º or ±180º
J2	-55º
J3	0º
J4	0º
J5	0º
J6	0º

Note)
1. Machine mass. : 800 kg

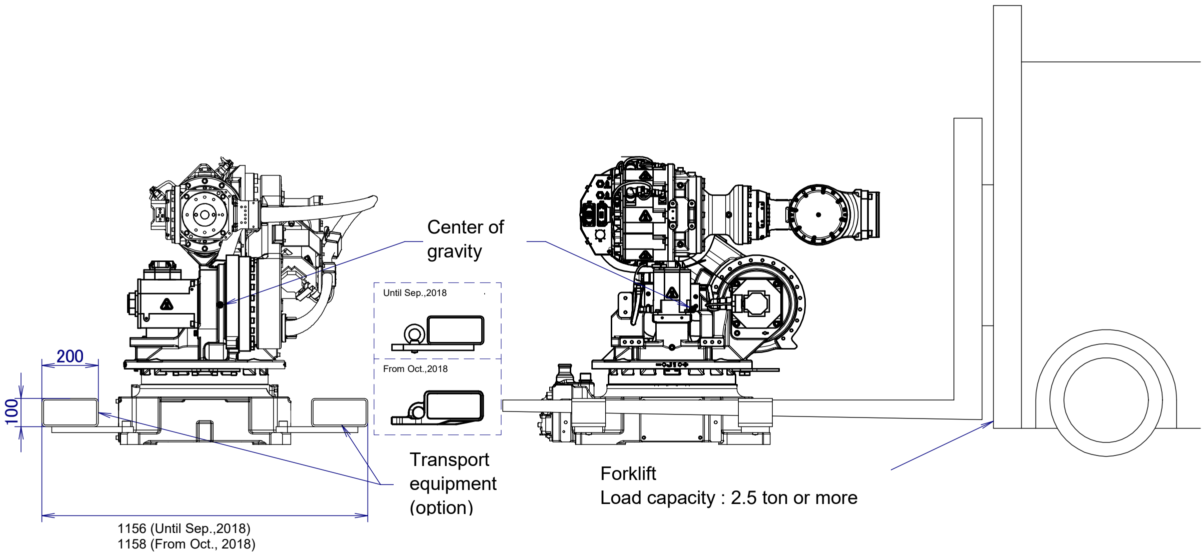


Fig. 1.1 (t) Transportation using a forklift (R-2000*i*B/170CF)

Robot posture on transportation

J1	0º or ±180º
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

Note)
1. Machine mass.
R-2000*i*B/210FS: 1250 kg, R-2000*i*B/220US: 1160 kg

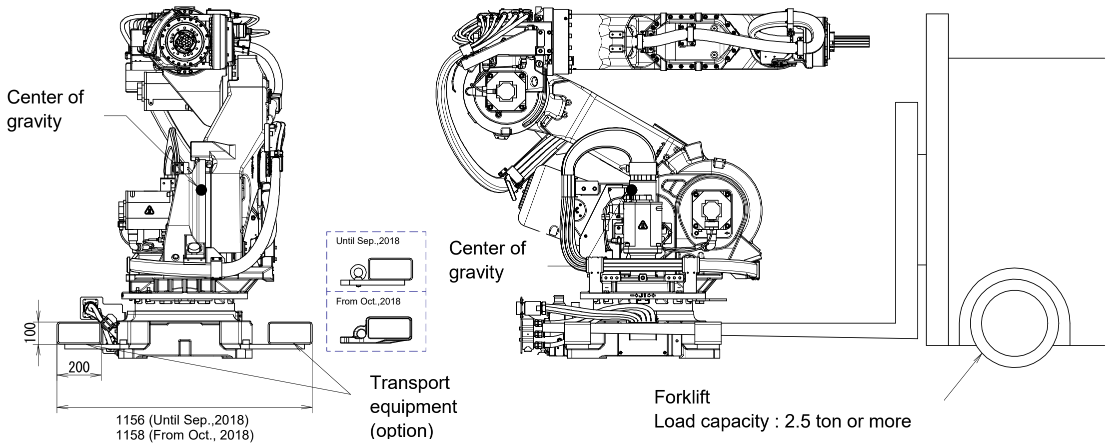


Fig. 1.1 (u) Transportation using a forklift (R-2000*i*B/210FS/220US J1 base type)

> ⚠ **CAUTION**
> Be careful not to strike the transport equipment with the forklift forks.

Note)
1. Machine mass.
R-2000*i*B/210FS: 1250 kg, R-2000*i*B/220US: 1160 kg

Robot posture on transportation

J1	Arbitrary
J2	-60º
J3	0º
J4	0º
J5	0º
J6	0º

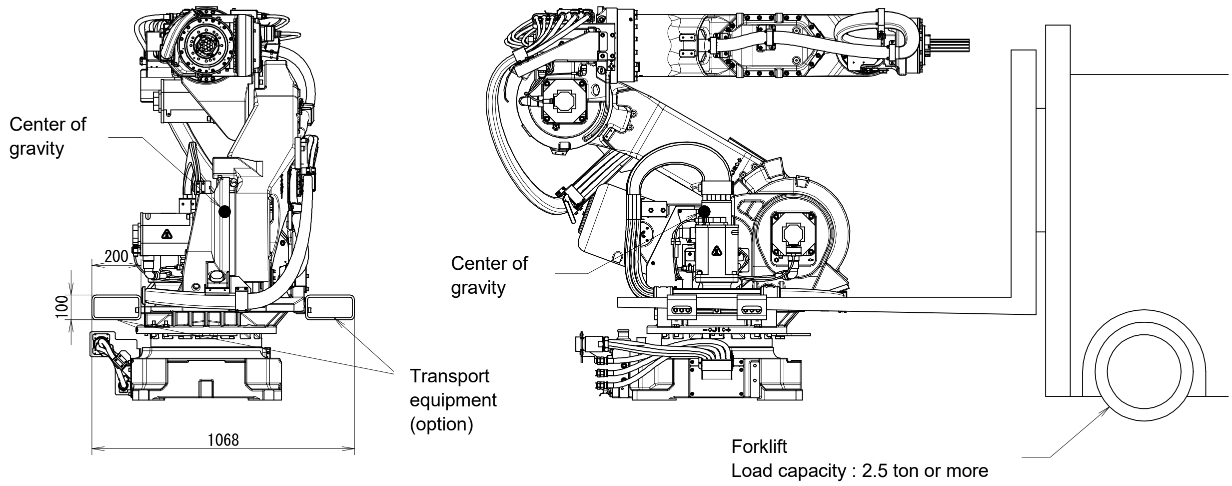


Fig. 1.1 (v) Transportation using a forklift (R-2000*i*B/210FS/220US J2 base type)

Note)
1. Machine mass. : 1050 kg

Robot posture on transportation

J1	0º
J2	-55º
J3	0º
J4	0º
J5	0º
J6	0º

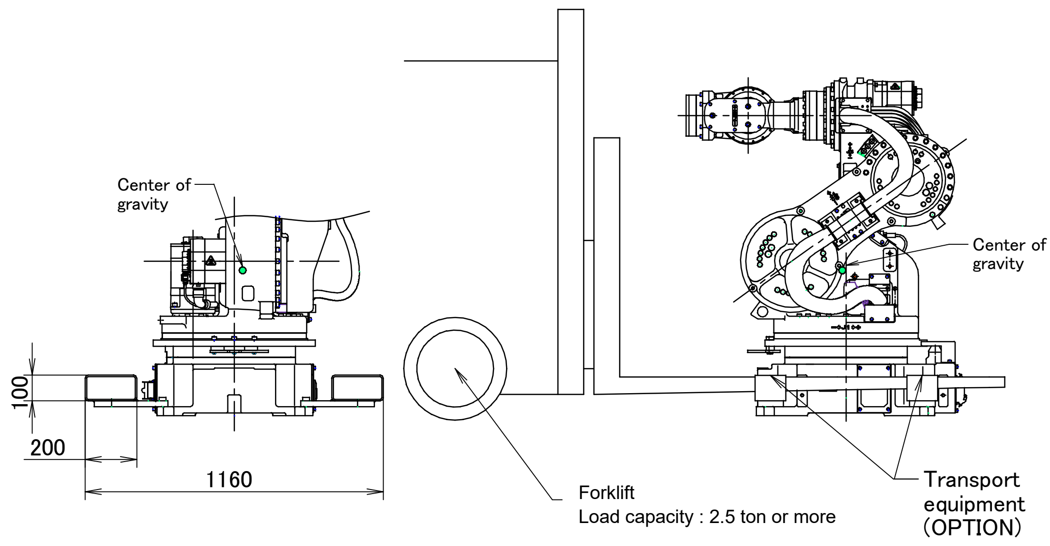


Fig. 1.1 (w) Transportation using a forklift (R-2000*i*B/165CF)

⚠ **CAUTION**
Be careful not to strike the transport equipment with the forklift forks.

1.1.1 Transportation with an End Effector Attached

When transporting a robot with an end effector such as a welding gun or hand attached, secure the arm with wood. If the arm is not secured, the end effector may oscillate for a cause such as vibration during transportation, thus imposing a large impact load on the reducer of the robot and damaging the reducer at an earlier stage.

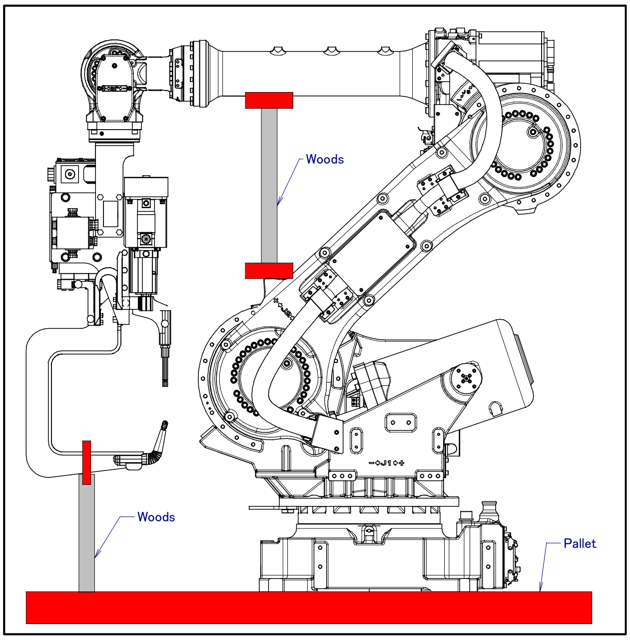


Fig. 1.1.1 (a) Example of securing the arm during transportation when an end effector is attached

If the user cannot prepare a material for securing the arm, an optional securing fixture kit for transportation is available.

Specification: A05B-1329-K011 (R-2000*i*B/165F/210F/185L/250F/125L/100H/150U/220U)
A05B-1329-K012 (R-2000*i*B/175L)

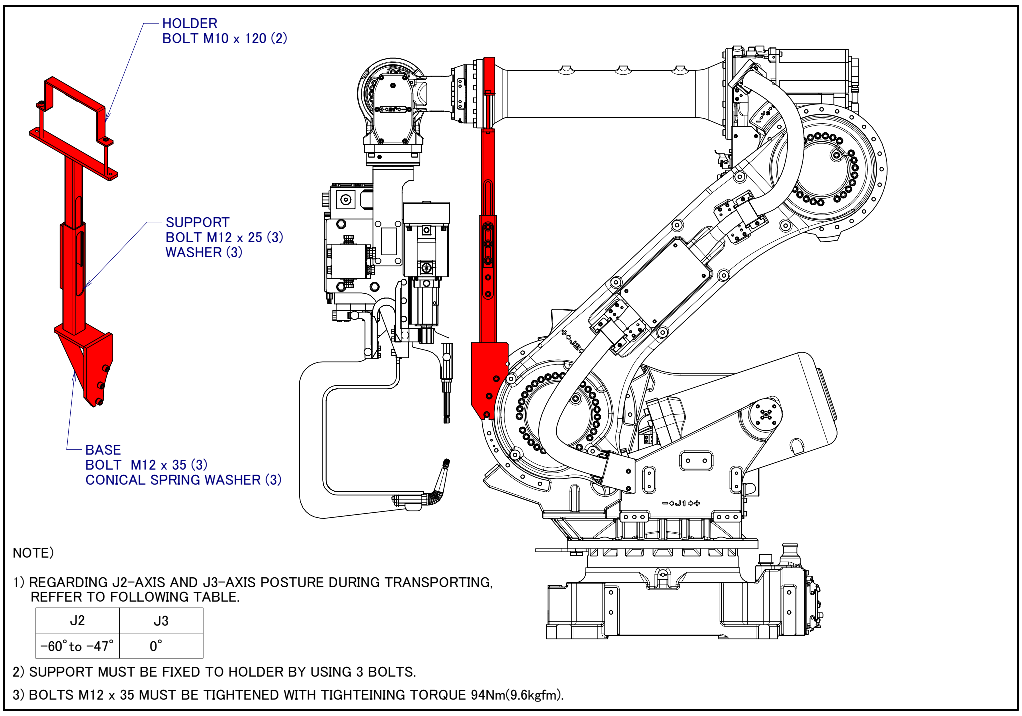


Fig. 1.1.1 (b) Securing fixture kit for transportation

1.2 INSTALLATION

Fig. 1.2 (a) shows the robot base dimensions. Avoid placing any object in front of the robot on the locating surface to facilitate the installation of the mastering fixture. (Shaded portion)

NOTE
For the R-2000*i*B/165R/200R/100P, the mastering fixture is placed below the J1 base installation surface.

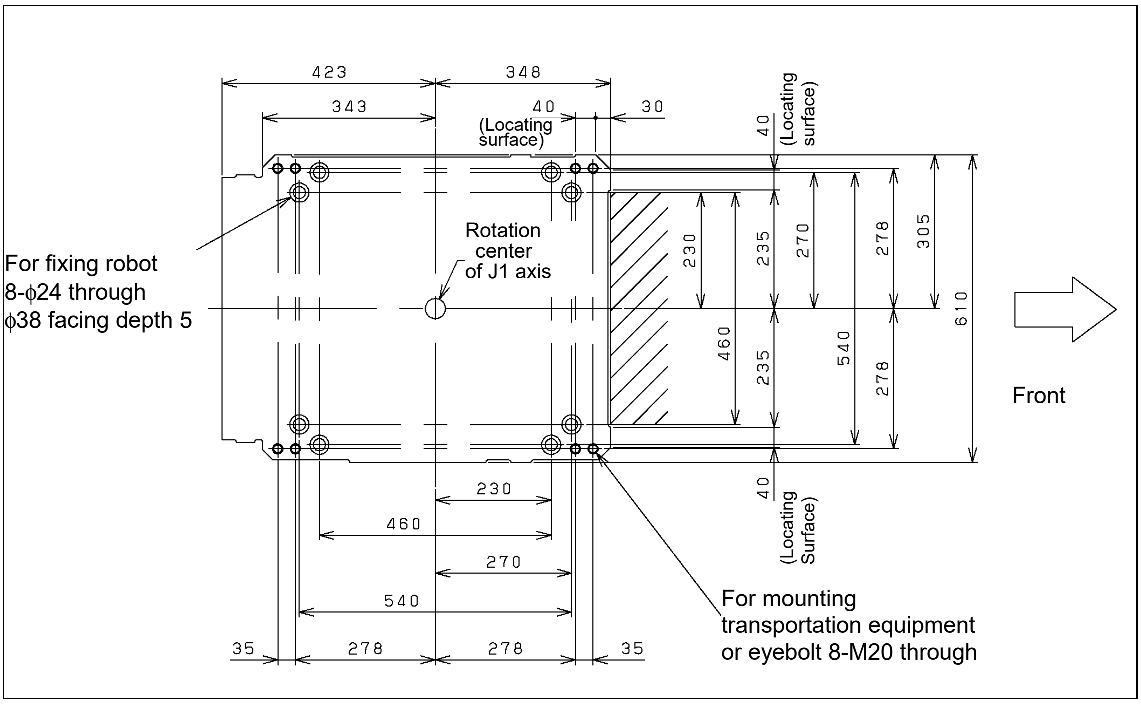


Fig. 1.2 (a) Dimensions of the robot base

1.2.1 Actual Installation Example

The following show three actual examples of the robot installation. Select a method according to the customer's installation environment, and install the robot.

- Installation example I Fig. 1.2.1 (a)
  The floor plate is imbedded in concrete and fastened with twelve M20 (Tensile strength 400N/mm^2 or more) chemical anchors. Also fasten the base plate to the robot base using eight M20 x 65 bolts (Tensile strength 1200N/mm^2 or more). Next, position the robot, and weld the base plate to the floor plate. (Floor length is 10 to 15mm.) (The base plate is prepared as the option.)

- Installation example II Fig. 1.2.1 (b)
  The floor plate is not imbedded in concrete. The floor plate is fastened at the twelve points with M20 chemical anchors (Tensile strength 400N/mm^2 or more) and the inclination of the floor plate is adjusted with the four fixing screws. The robot is positioned with the robot base pushed against the three ϕ20 parallel pins inserted into the base and the robot base is fastened on the floor plate with eight M20 x 65 bolts (Tensile strength 1200N/mm^2 or more).

- Installation example III Fig. 1.2.1 (c)
  The installation method is generally the same as described above except that the parallel pins for pushing the robot base are not used.

The strength of the chemical anchor depends on the concrete strength. See the design guideline of the manufacturer for the execution of the chemical anchor and consider the safety ratio sufficiently before use.

The following parts are required to install the robot.

Required parts	Remarks	Example I	Example II	Example III
Robot mounting bolts	M20 x 65 (Tensile strength 1200N/mm^2 or more) 8 pcs	○	○	○
Chemical anchors	M20 (Tensile strength 400N/mm^2 or more) 12 pcs	○	○	○
Floor plate	Thickness 32t 1pc	○	○	○
Base plates	Thickness 32t 4pcs	○		
Fixing screws	M20 4 pcs		○	○
Nuts	M20 4 pcs		○	○
Parallel pins	ϕ20 3 pcs		○	

NOTE

- When the robot is operated with a combination other than the above, it may be damaged.
- Arrangements for installation work (such as welding and anchoring) need to be made by customers.
- Flatness of robot installation surface must be less than or equal to 0.5mm. Inclination of robot installation surface must be less than or equal to 0.5º. If robot base is placed on uneven ground, it may result in the base breakage or low performance of the robot.

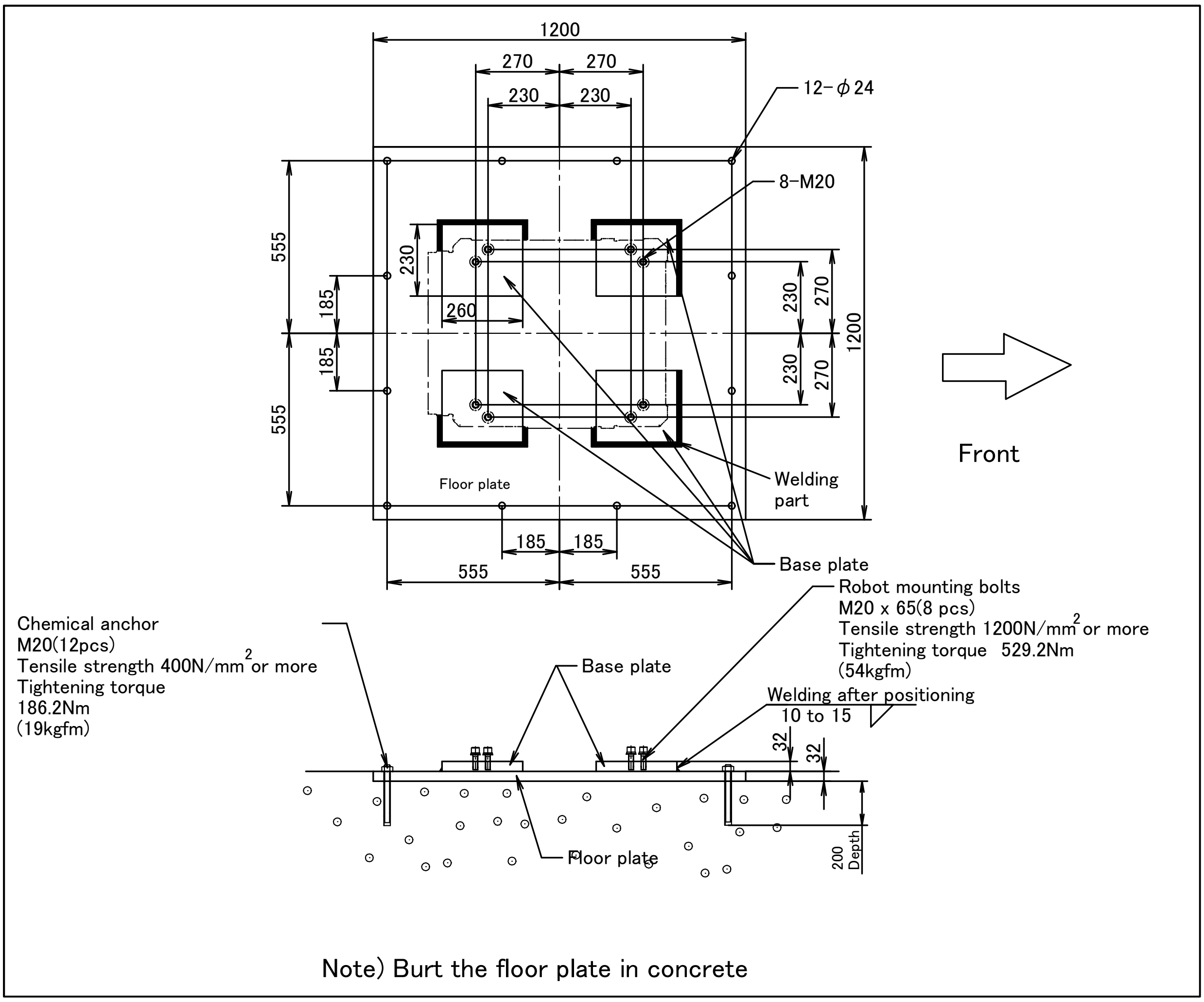


Fig. 1.2.1 (a) Installation example Ⅰ

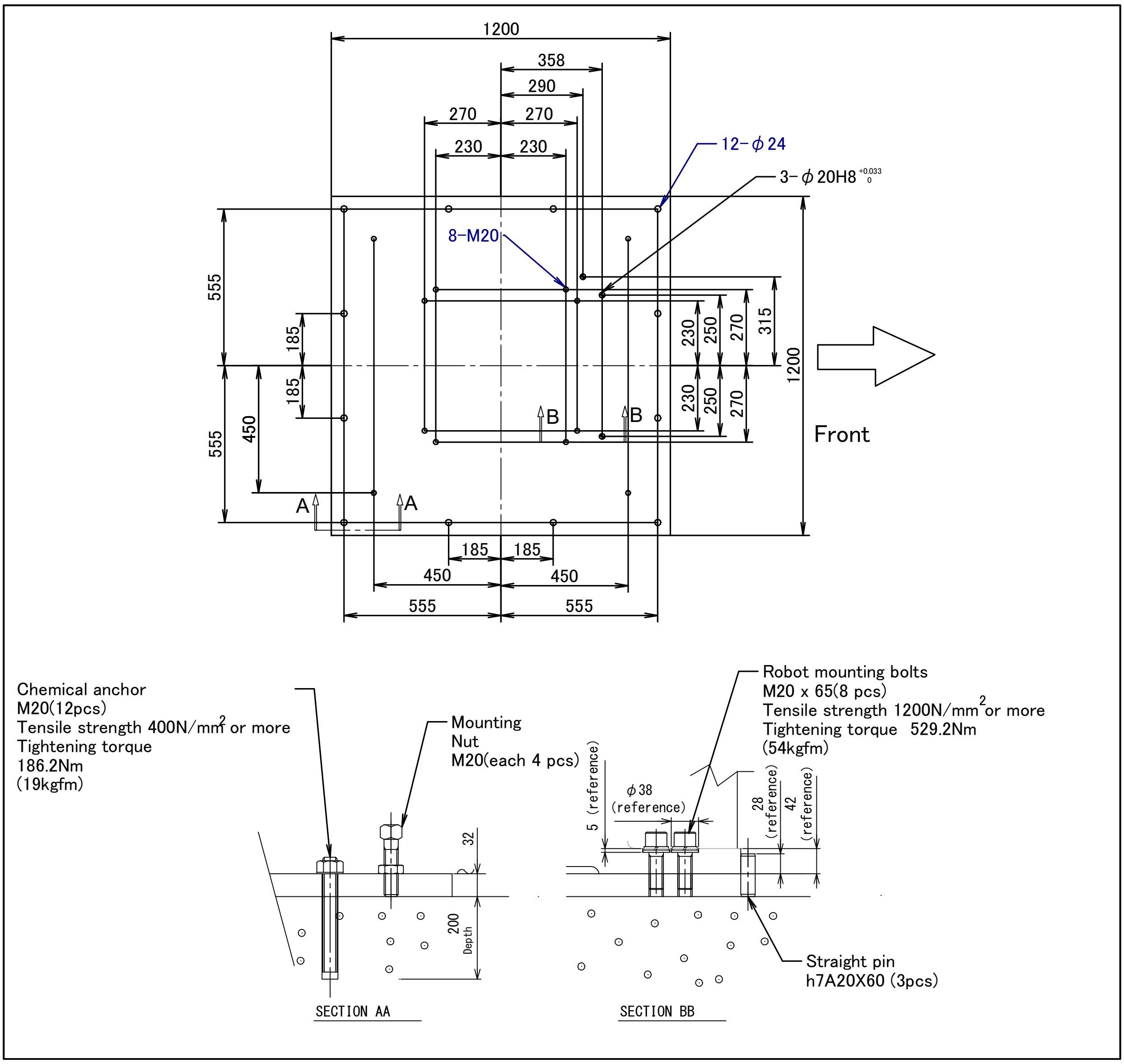


Fig. 1.2.1 (b) Installation example II

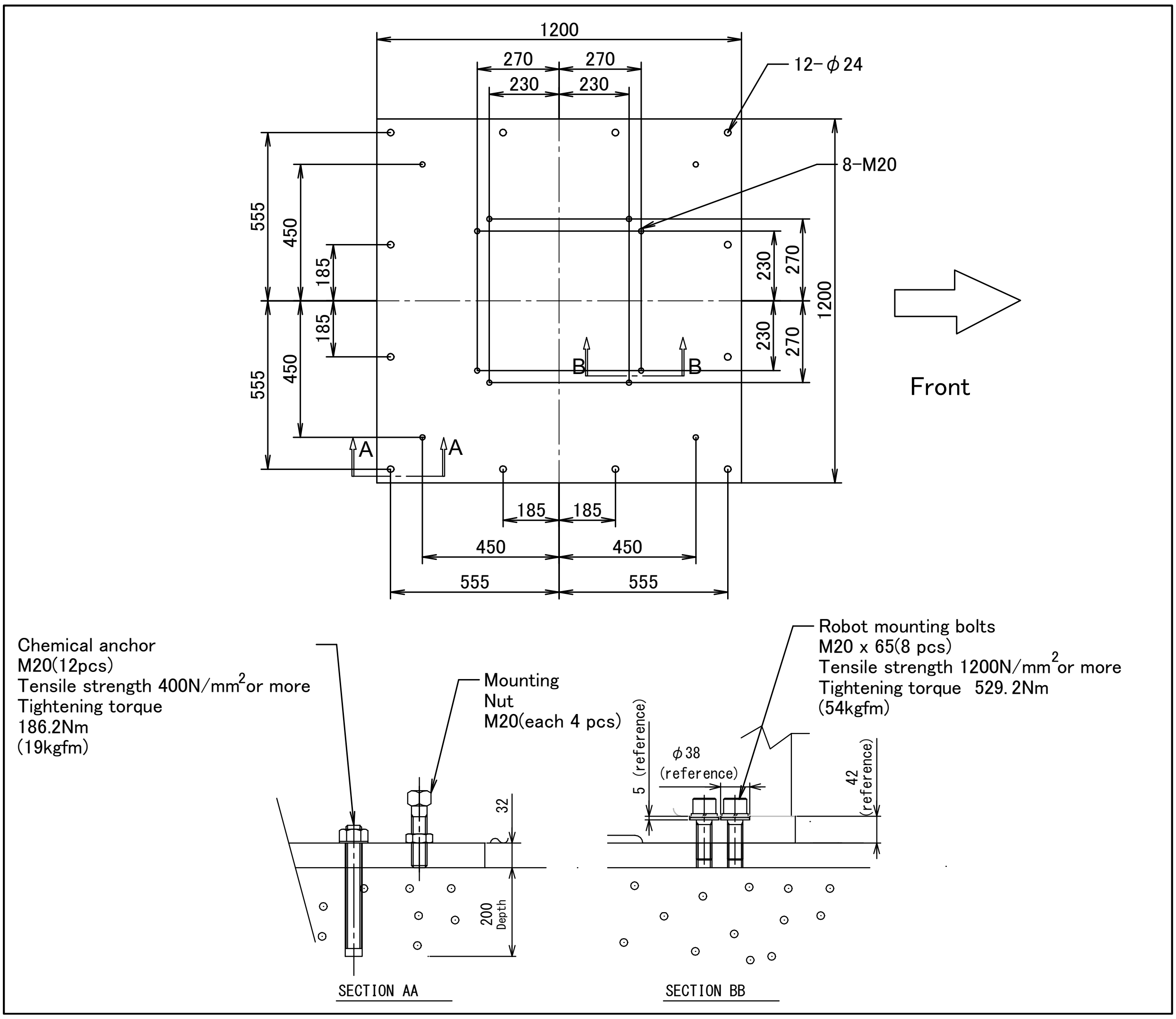


Fig. 1.2.1 (c) Installation example Ⅲ

Fig. 1.2.1 (d) and Table 1.2.1 (a) indicate the force and moment applied to the base plate at the time of Power-off stop of the robot. Table 1.2.1 (b), (c) indicate the stopping distance and time of the J1 to J3 axis until the robot stopping by Power-Off stop or by Controlled stop after input of the stop signal. Refer to the data when considering the strength of the installation face.

Table 1.2.1 (a) Force and moment during Power-Off stop

Model	Vertical moment M_V [kNm(kgfm)]	Force in vertical direction F_V [kN(kgf)]	Horizontal moment M_H [kNm(kgfm)]	Force in horizontal direction F_H [kN(kgf)]
R-2000*i*B/165F	62.72 (6400)	37.24 (3800)	24.50 (2500)	26.46 (2700)
R-2000*i*B/210F/210WE	73.50 (7500)	41.16 (4200)	25.48 (2600)	27.44 (2800)
R-2000*i*B/185L	74.48 (7600)	39.20 (4000)	25.48 (2600)	25.48 (2600)
R-2000*i*B/250F	75.46 (7700)	41.16 (4200)	25.48 (2600)	28.42 (2900)
R-2000*i*B/165R	75.46 (7700)	39.20 (4000)	25.48 (2600)	28.42 (2900)
R-2000*i*B/200R	84.28 (8600)	41.16 (4200)	25.48 (2600)	27.44 (2800)
R-2000*i*B/100P	77.42 (7900)	38.22 (3900)	25.48 (2600)	26.46 (2700)
R-2000*i*B/170CF	37.24 (3800)	33.32 (3400)	9.80 (1000)	22.54 (2300)
R-2000*i*B/125L	61.74 (6300)	35.28 (3600)	24.50 (2500)	25.48 (2600)
R-2000*i*B/175L	71.54 (7300)	38.22 (3900)	25.48 (2600)	26.46 (2700)
R-2000*i*B/100H	53.90 (5500)	34.30 (3500)	19.60 (2000)	25.48 (2600)
R-2000*i*B/150U	63.70 (6500)	36.26 (3700)	23.52 (2400)	26.46 (2700)
R-2000*i*B/220U	69.58 (7100)	38.22 (3900)	24.50 (2500)	26.46 (2700)
R-2000*i*B/210FS	72.52 (7400)	41.16 (4200)	25.48 (2600)	29.40 (3000)
R-2000*i*B/220US	68.60 (7000)	35.28 (3600)	25.48 (2600)	27.44 (2800)
R-2000*i*B/165CF	31.36 (3200)	29.40 (3000)	17.64 (1800)	17.64 (1800)

Table 1.2.1 (b) Stopping time and distance until the robot stopping by Power-Off stop after input of stop signal

Model		J1-axis	J2-axis	J3-axis
R-2000*i*B/165F	Stopping time [ms]	372	333	145
	Stopping distance [deg] (rad)	22.2 (0.39)	15.0 (0.26)	7.5 (0.13)
R-2000*i*B/210F/210WE	Stopping time [ms]	335	271	151
	Stopping distance [deg] (rad)	16.4 (0.29)	14.2 (0.25)	8.4 (0.15)
R-2000*i*B/185L	Stopping time [ms]	526	422	190
	Stopping distance [deg] (rad)	24.8 (0.43)	16.8 (0.29)	8.9 (0.16)
R-2000*i*B/250F	Stopping time [ms]	494	422	246
	Stopping distance [deg] (rad)	22.9 (0.40)	17.2 (0.30)	9.3 (0.16)
R-2000*i*B/165R	Stopping time [ms]	519	352	202
	Stopping distance [deg] (rad)	26.8 (0.47)	15.3 (0.27)	8.5 (0.15)
R-2000*i*B/200R	Stopping time [ms]	483	267	169
	Stopping distance [deg] (rad)	22.2 (0.39)	10.7 (0.19)	8.3 (0.14)
R-2000*i*B/100P	Stopping time [ms]	542	349	282
	Stopping distance [deg] (rad)	30.2 (0.53)	15.9 (0.28)	13.1 (0.23)
R-2000*i*B/170CF	Stopping time [ms]	448	203	135
	Stopping distance [deg] (rad)	26.6 (0.46)	9.8 (0.17)	8.0(0.13)
R-2000*i*B/125L	Stopping time [ms]	370	375	200
	Stopping distance [deg] (rad)	20.5 (0.36)	18.7 (0.33)	9.0 (0.16)
R-2000*i*B/175L	Stopping time [ms]	380	403	210
	Stopping distance [deg] (rad)	19.2 (0.34)	17.4 (0.30)	9.5 (0.17)
R-2000*i*B/100H	Stopping time [ms]	435	316	186
	Stopping distance [deg] (rad)	29.2 (0.51)	16.6 (0.29)	11.2 (0.20)
R-2000*i*B/150U	Stopping time [ms]	359	246	177
	Stopping distance [deg] (rad)	19.9(0.35)	7.9(0.14)	9.4 (0.16)
R-2000*i*B/220U	Stopping time [ms]	476	356	206
	Stopping distance [deg] (rad)	21.1 (0.37)	14.3 (0.25)	10.5 (0.18)
R-2000*i*B/210FS	Stopping time [ms]	455	304	198
	Stopping distance [deg] (rad)	26.2 (0.46)	11.7 (0.20)	9.5 (0.17)
R-2000*i*B/220US	Stopping time [ms]	464	302	186
	Stopping distance [deg] (rad)	21.7 (0.38)	12.8 (0.22)	9.7 (0.17)
R-2000*i*B/165CF	Stopping time [ms]	300	231	140
	Stopping distance [deg] (rad)	17.4 (0.30)	10.2 (0.18)	8.2 (0.14)

Table 1.2.1 (c) Stopping time and distance until the robot stopping by Controlled stop after input of stop signal

Model		J1-axis	J2-axis	J3-axis
R-2000*i*B/165F	Stopping time [ms]	720	868	778
	Stopping distance [deg] (rad)	41.0 (0.72)	39.8 (0.69)	42.8 (0.75)
R-2000*i*B/210F/210WE	Stopping time [ms]	623	632	640
	Stopping distance [deg] (rad)	35.1 (0.61)	33.7 (0.59)	35.1 (0.61)
R-2000*i*B/185L	Stopping time [ms]	854	854	854
	Stopping distance [deg] (rad)	42.0 (0.73)	33.4 (0.58)	33.4 (0.58)
R-2000*i*B/250F	Stopping time [ms]	854	854	854
	Stopping distance [deg] (rad)	43.6 (0.76)	32.9 (0.57)	37.8 (0.66)
R-2000*i*B/165R	Stopping time [ms]	838	944	894
	Stopping distance [deg] (rad)	47.9 (0.84)	41.1 (0.72)	47.8 (0.83)
R-2000*i*B/200R	Stopping time [ms]	818	866	842
	Stopping distance [deg] (rad)	40.2 (0.70)	37.1 (0.65)	40.9 (0.71)
R-2000*i*B/100P	Stopping time [ms]	856	960	950
	Stopping distance [deg] (rad)	49.0 (0.85)	39.0 (0.68)	49.0 (0.85)
R-2000*i*B/170CF	Stopping time [ms]	544	664	569
	Stopping distance [deg] (rad)	34.2 (0.60)	34.7 (0.61)	33.8 (0.59)
R-2000*i*B/125L	Stopping time [ms]	730	785	740
	Stopping distance [deg] (rad)	44.0 (0.77)	44.7 (0.78)	44.1 (0.77)
R-2000*i*B/175L	Stopping time [ms]	840	900	905
	Stopping distance [deg] (rad)	40.5 (0.71)	37.5 (0.65)	46.5 (0.81)
R-2000*i*B/100H	Stopping time [ms]	702	826	713
	Stopping distance [deg] (rad)	47.9 (0.84)	48.6 (0.85)	48.1 (0.84)
R-2000*i*B/150U	Stopping time [ms]	705	789	748
	Stopping distance [deg] (rad)	41.0 (0.72)	31.6 (0.55)	41.2 (0.72)
R-2000*i*B/220U	Stopping time [ms]	964	956	948
	Stopping distance [deg] (rad)	49.1 (0.86)	38.9 (0.68)	47.8 (0.83)
R-2000*i*B/210FS	Stopping time [ms]	1070	1035	1022
	Stopping distance [deg] (rad)	56.3 (0.99)	41.8 (0.73)	47.1 (0.82)
R-2000*i*B/220US	Stopping time [ms]	965	1015	1010
	Stopping distance [deg] (rad)	56.7 (0.99)	37.8 (0.66)	47.5 (0.83)
R-2000*i*B/165CF	Stopping time [ms]	478	317	384
	Stopping distance [deg] (rad)	26.2 (0.46)	17.3 (0.30)	16.2 (0.28)

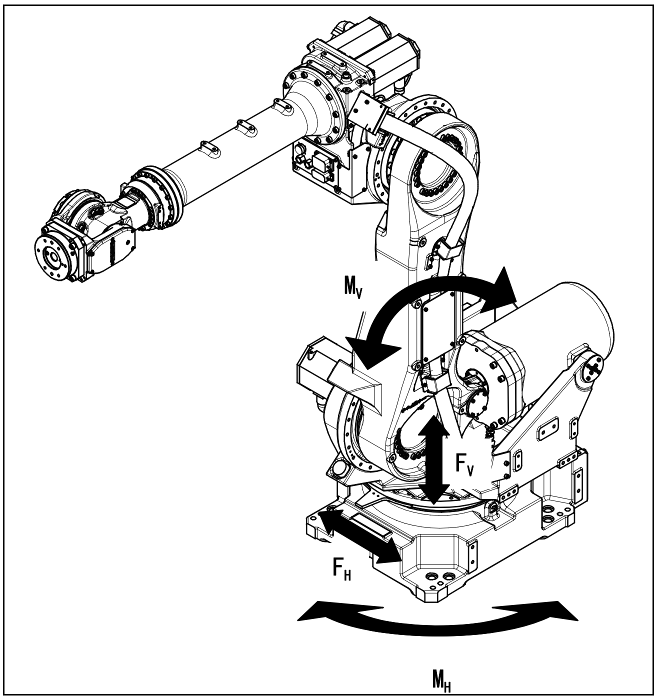


Fig. 1.2.1 (d) Force and moment during Power-Off stop

1.2.2 Angle of Mounting Surface Setting

If R-2000*i*B//170CF/150U/220U/220US are installed as upside-down mount, be sure to set the mounting angle referring to the procedure below. Refer to specifications in Section 3.1 for installation type.

1 Turn on the controller with the [PREV] and the [NEXT] key pressed.
2 Then select [3 Controlled start].
3 Press the [MENU] key and select “9 MAINTENANCE”.
4 Select the robot for which you want to set the mount angle and press the [ENTER] key.

```
ROBOT MAINTENANCE        CTRL START MANU

Setup Robot System Variables

  Group  Robot Library/Option Ext Axes
  1     R-2000iB/220U             0









[TYPE]ORD NO     AUTO     MANUAL
```

5 Press the [F4] key.
6 Press the [ENTER] key until screen below is displayed.

```
*******Group 1 Initialization************
*************R-2000iB/220U***************


--- Mount Type Setting---

  0: Floor Mount
  1: Upside-Down Mount
Select mount type ?
Default value = 0
```

7 To change to the upside-down mount, input “1”.
8 Press the [ENTER] key. Then the following screen will be displayed.

```
ROBOT MAINTENANCE          CTRL START MANU

Setup Robot System Variables

  Group  Robot Library/Option Ext Axes
  1      R-2000iB/220U              0





[TYPE]ORD NO      AUTO      MANUAL
```

9 Press the [FCTN] key and select ”1 START (COLD)”.

1.3 MAINTENANCE AREA

Fig. 1.3 (a) to (e) show the maintenance area of the mechanical unit. Dotted line area is necessary for fixture position mastering. Be sure to leave enough room for the robot to be mastered. Contact your local FANUC representative for fixture position mastering.

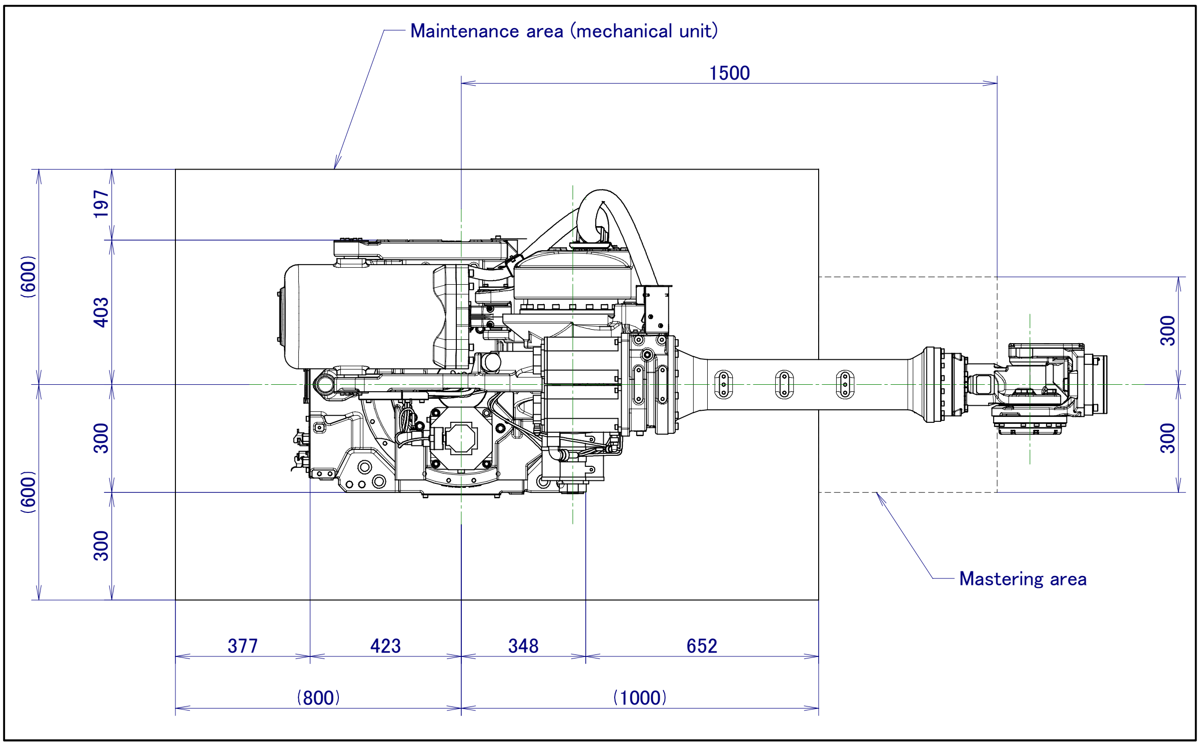


Fig. 1.3 (a) Maintenance area (R-2000*i*B/165F/210F/185L/250F/125L/175L/100H/150U/220U/210FS/220US)

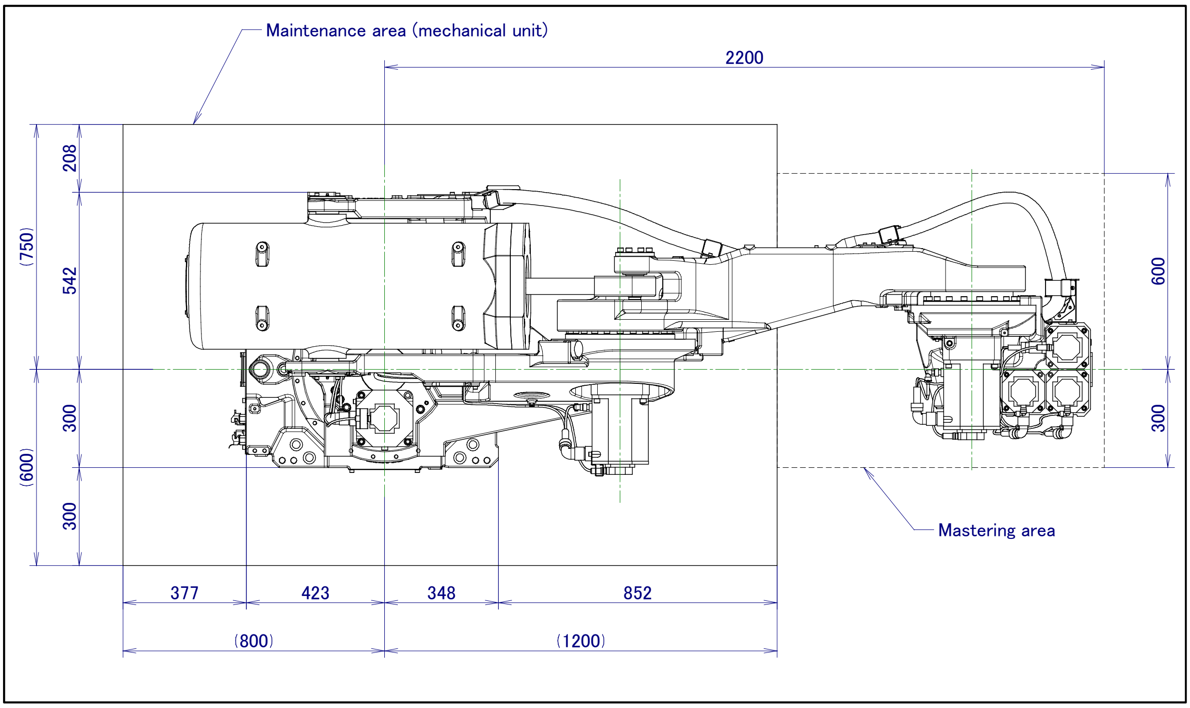


Fig. 1.3 (b) Maintenance area (R-2000*i*B/165R/200R/100P)

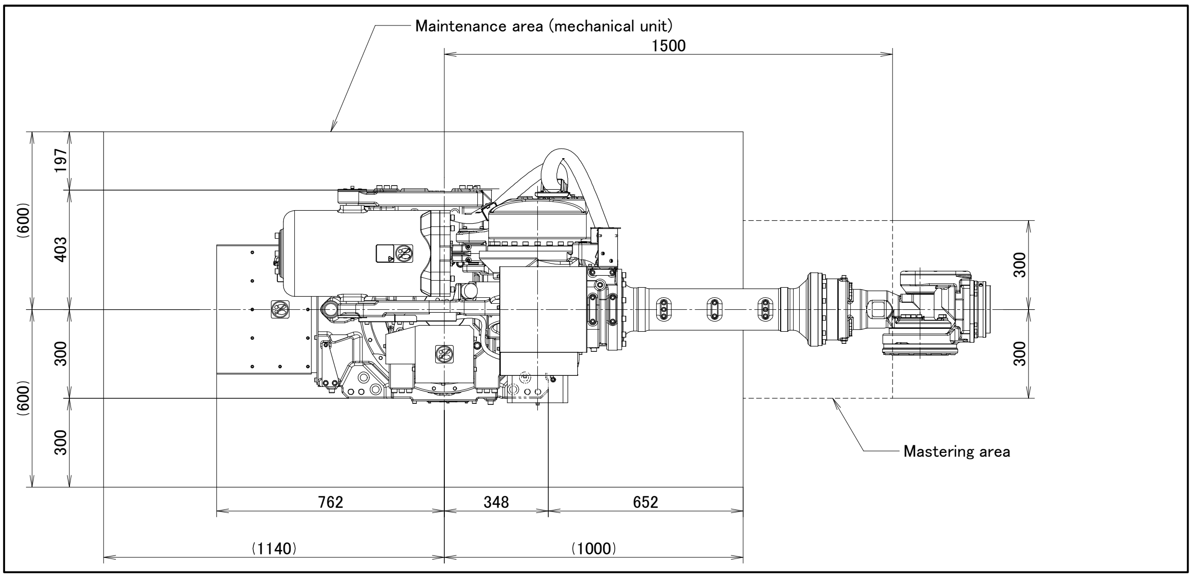


Fig. 1.3 (c) Maintenance area (R-2000*i*B/210WE)

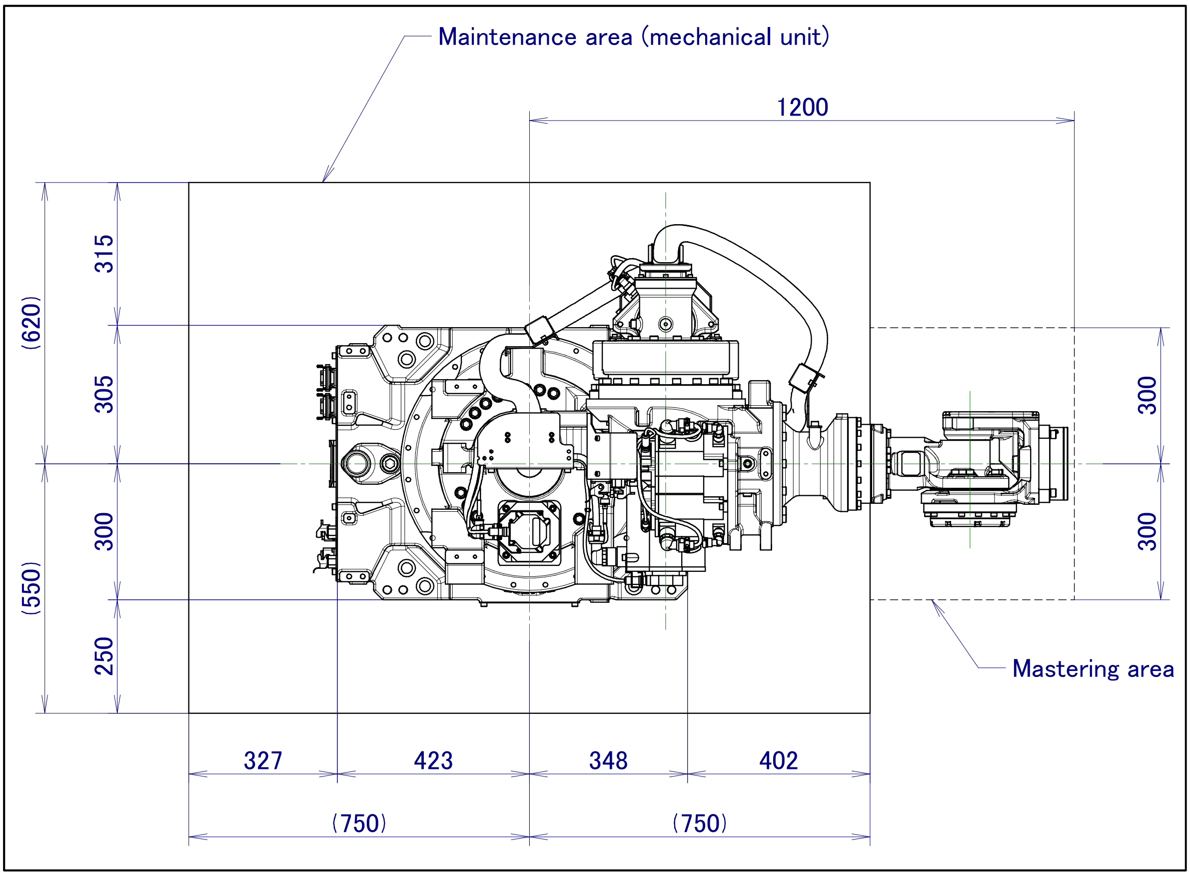


Fig. 1.3 (d) Maintenance area (R-2000*i*B/170CF)

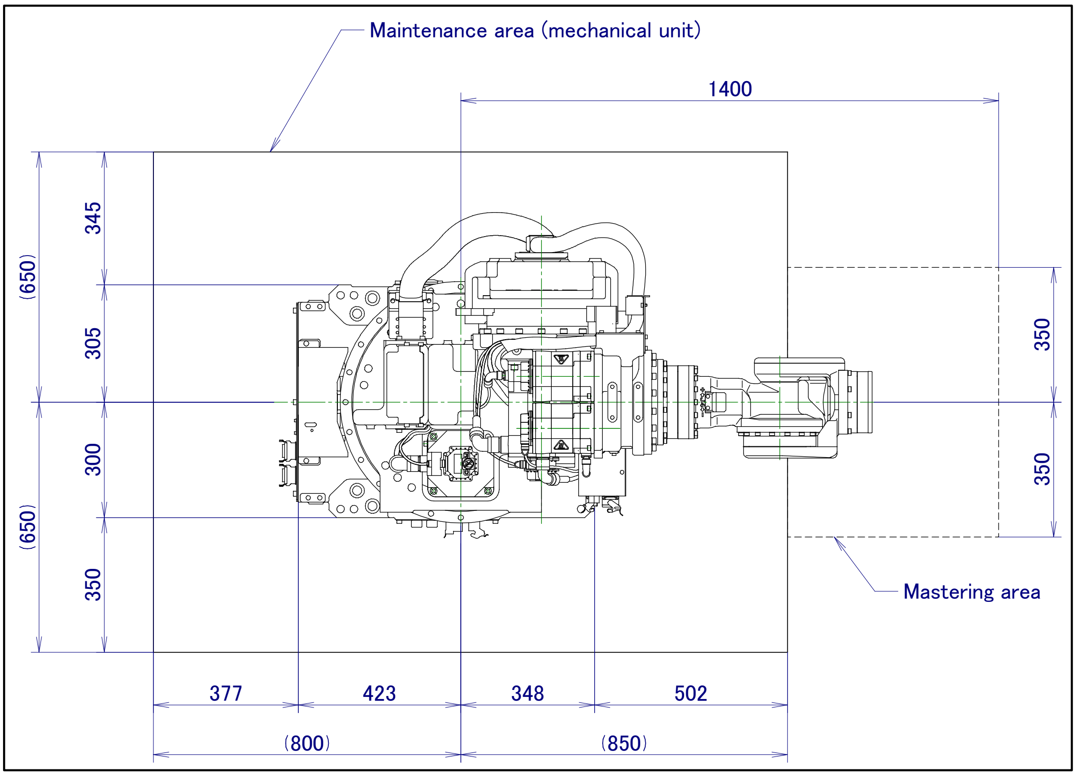


Fig. 1.3 (e) Maintenance area (R-2000*i*B/165CF)

1.4 INSTALLATION CONDITIONS

See Section 3.1 and caution below about robot installation specifications.

> **CAUTION**
>
> 1 Contact the service representative, if the robot is to be used in an environment or a place subjected to severe vibrations, heavy dust, cutting oil splash and or other foreign substances.
> If the robot is used especially in an adverse environment stated below, grease the balancer as required.
> - Dusty environment; for example, an application in which the robot is used to handle tiles or bricks.
> - Environment full of spatters developed in spot welding; for example, an application in which welding spatters deposit and accumulate on and around the balancer
>
> In addition, if the robot is used in a special environment stated below, use a robot jacket or some other means to protect the balancer support part (which joins with the J2 arm and J2 base) and rod sliding part.
> - Environment where glass abrasive powders and others are used; for example, and application in which the robot or balancer is subjected to splashes of powders in handling and other operations during glass abrasion.
> - Environment where metal powders are used; for example, an application in which the robot or balancer is subjected to splashes of powders in handling and other operations during metal working.
>
> 2 Damage to the cable jacket can cause water intrusion. Take care not to damage the cable jacket when installing the robot. Replace the cable if it is damaged.

2 CONNECTION WITH THE CONTROLLER

The robot is connected with the controller via the power cable, the signal cable and the earth cable. Connect these cables to the connectors on the back of the base.

For details on air and option cables, see Chapter 5.

> ⚠ **WARNING**
> Before turning on controller power, be sure to connect the robot and controller with the earth line (ground). Otherwise, there is the risk of electrical shock.

> ⚠ **CAUTION**
> 1 Before connecting the cables, be sure to turn off the controller power.
> 2 Don't use 10m or longer coiled cable without first untying it. The long coiled cable could heat up and become damaged.

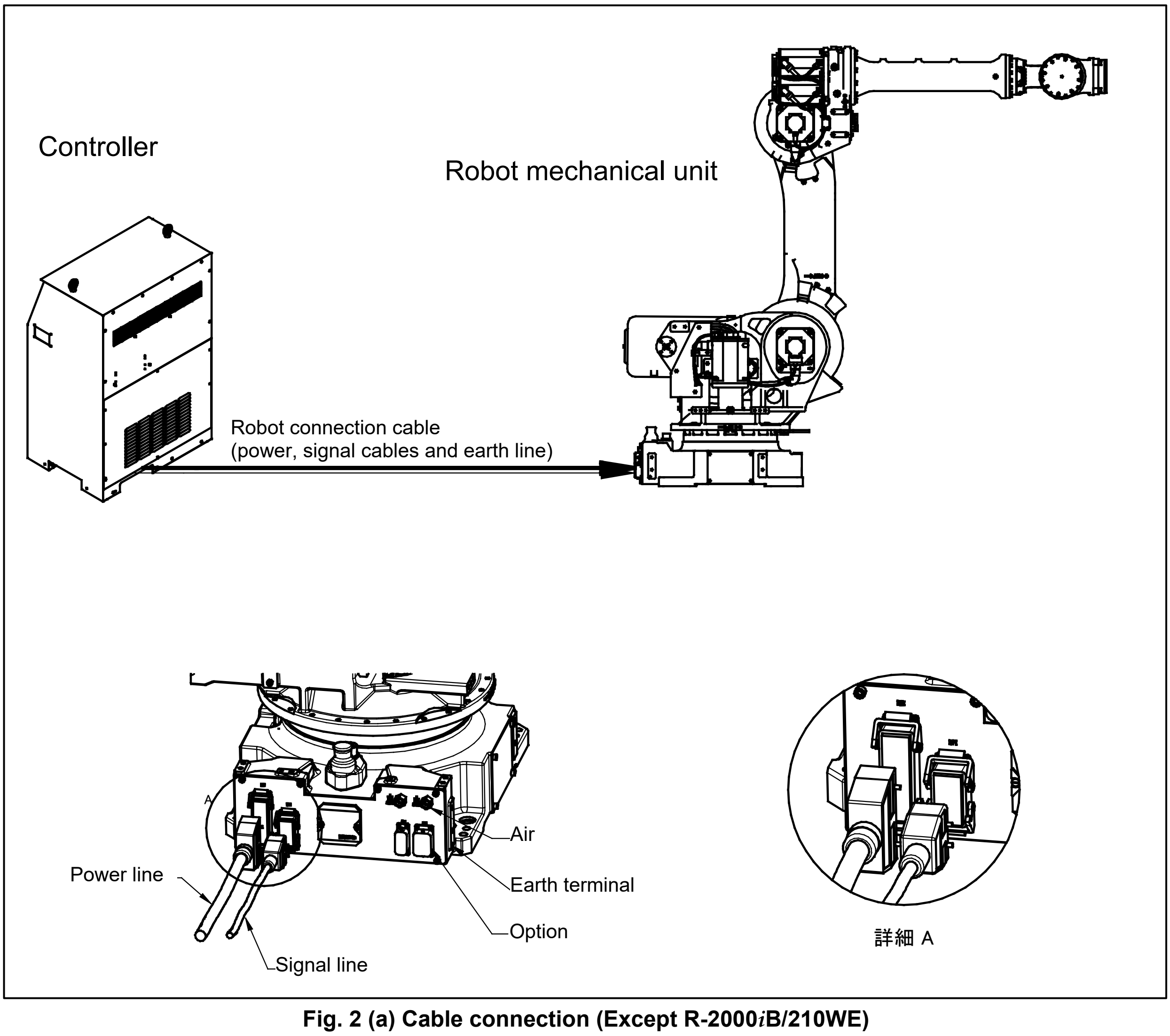


Fig. 2 (a) Cable connection (Except R-2000*i*B/210WE)

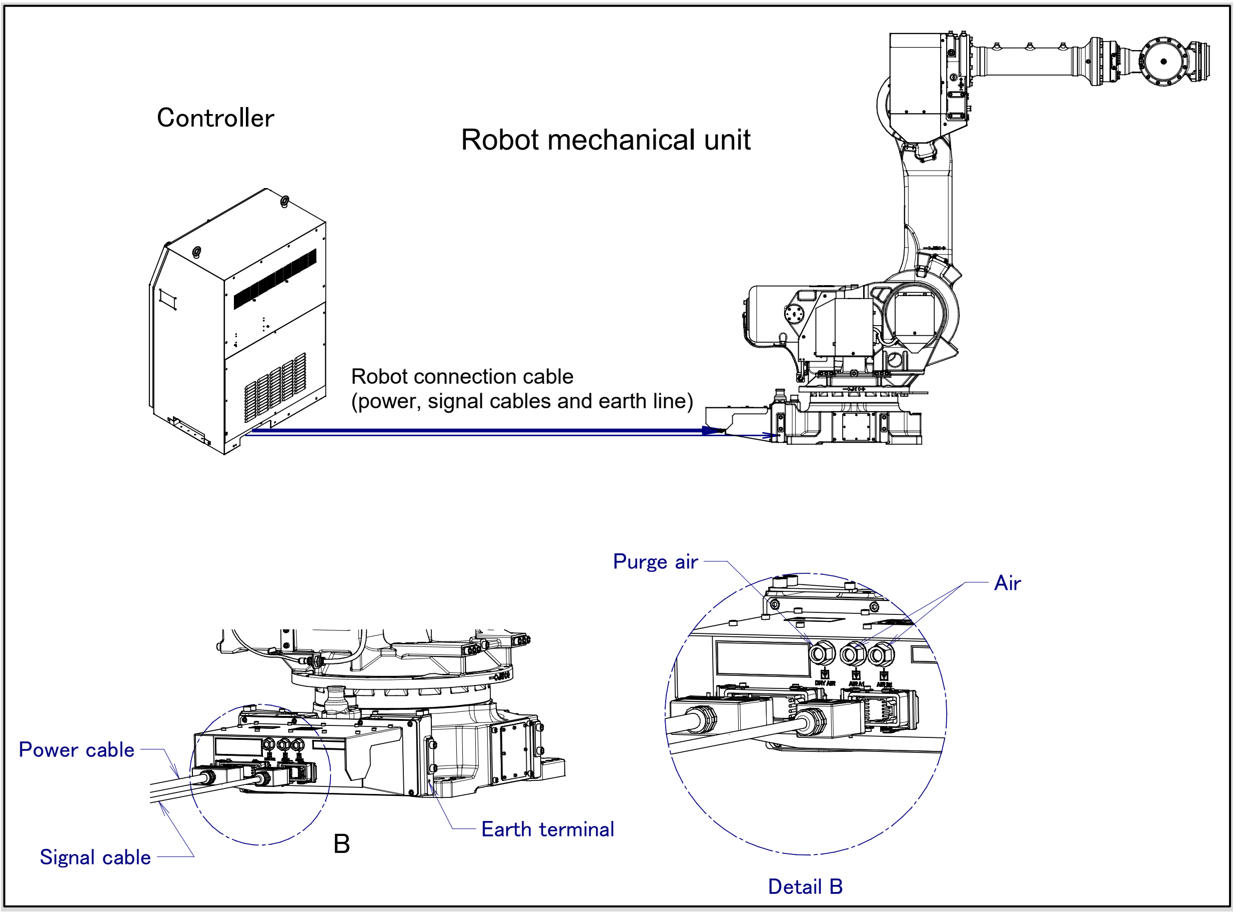


Fig. 2 (b) Cable connection (R-2000*i*B/210WE)

3 BASIC SPECIFICATIONS

3.1 ROBOT CONFIGURATION

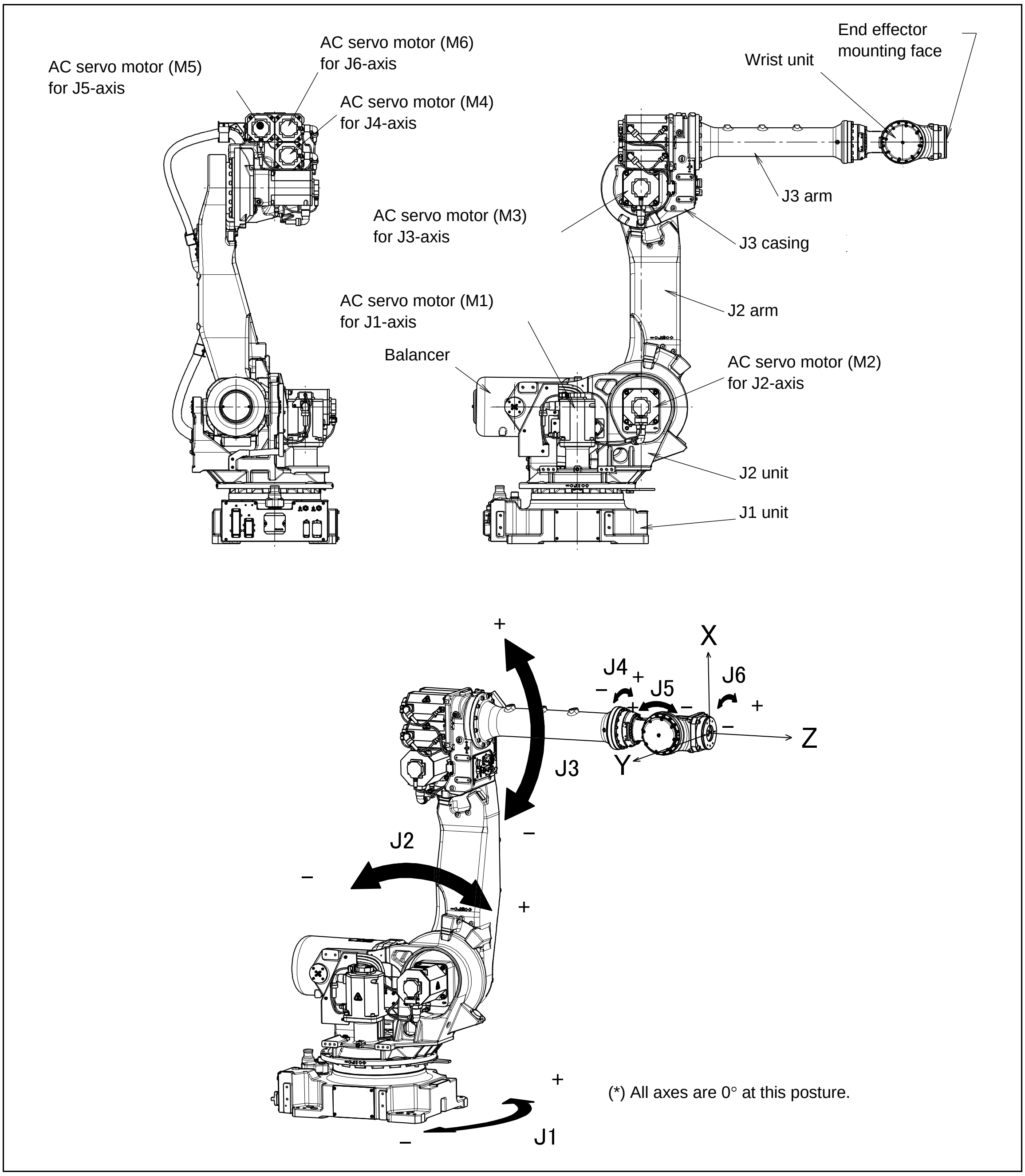


Fig. 3.1 (a) Mechanical unit configuration, each axis coordinates, and mechanical interface coordinates (R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/150U/220U)

NOTE

1 There is no balancer for R-2000*i*B/150U/220U.
2 The end effector mounting face center is 0, 0, 0 of the mechanical interface coordinates.

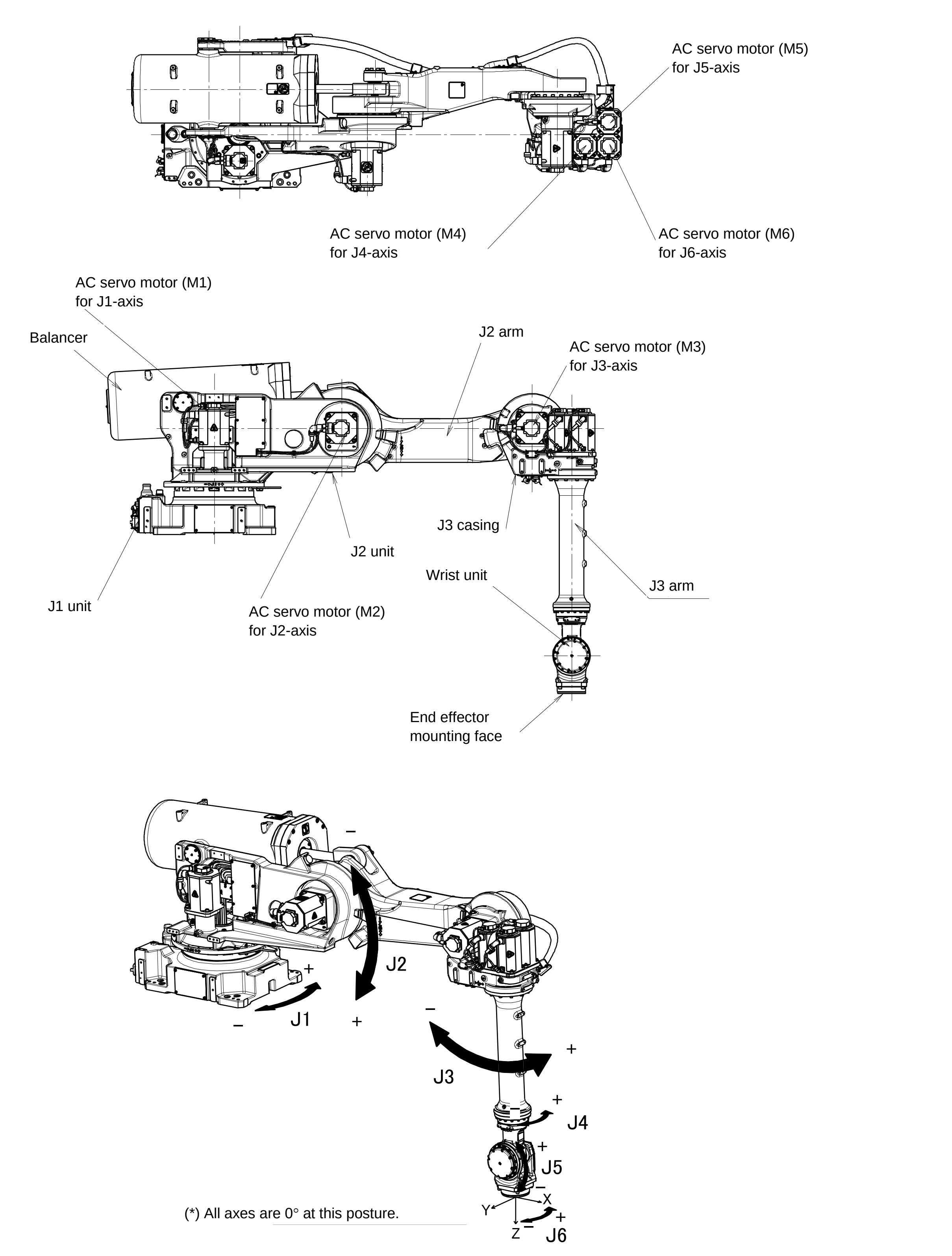


Fig. 3.1 (b) Mechanical unit configuration, each axis coordinates, and mechanical interface coordinates (R-2000*i*B/165R/200R/100P)

NOTE

The end effector mounting face center is 0, 0, 0 of the mechanical interface coordinates.

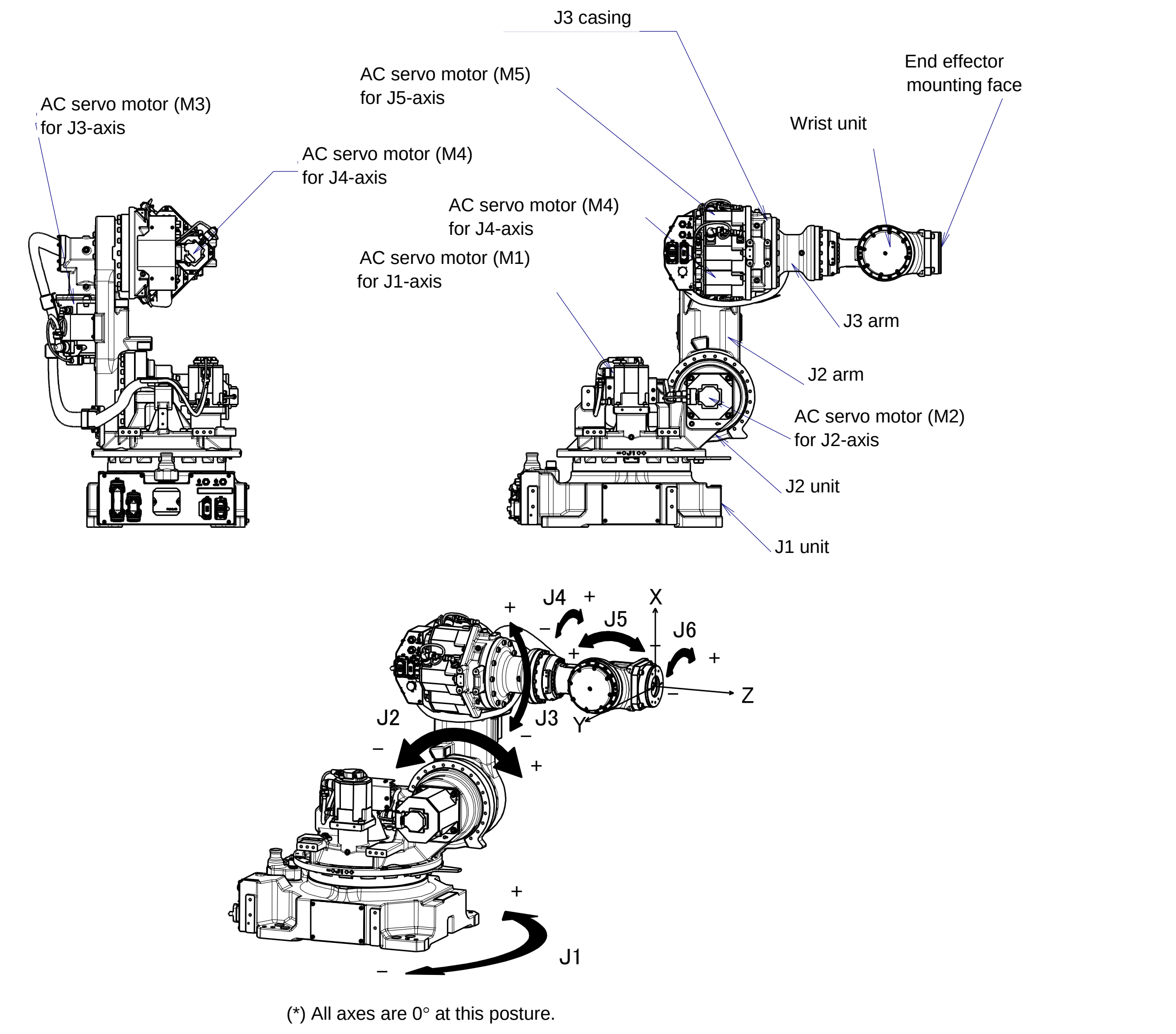


Fig. 3.1 (c) Mechanical unit configuration, each axis coordinates, and mechanical interface coordinates (R-2000*i*B/170CF)

> **NOTE**
> The end effector mounting face center is 0, 0, 0 of the mechanical interface coordinates.

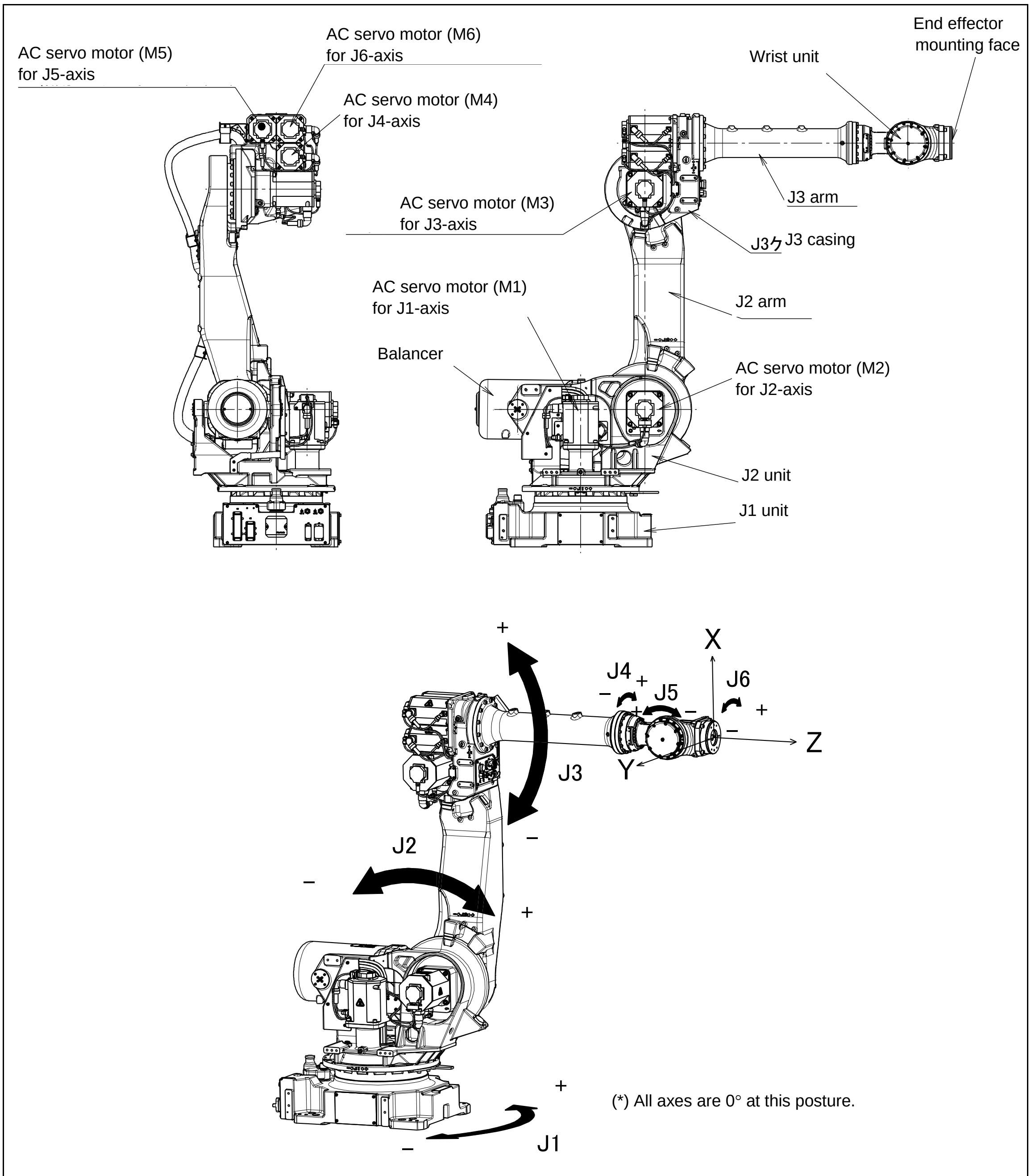


Fig. 3.1 (d) Mechanical unit configuration, each axis coordinates, and mechanical interface coordinates (R-2000*i*B/100H)

> **NOTE**
> The end effector mounting face center is 0, 0, 0 of the mechanical interface coordinates.

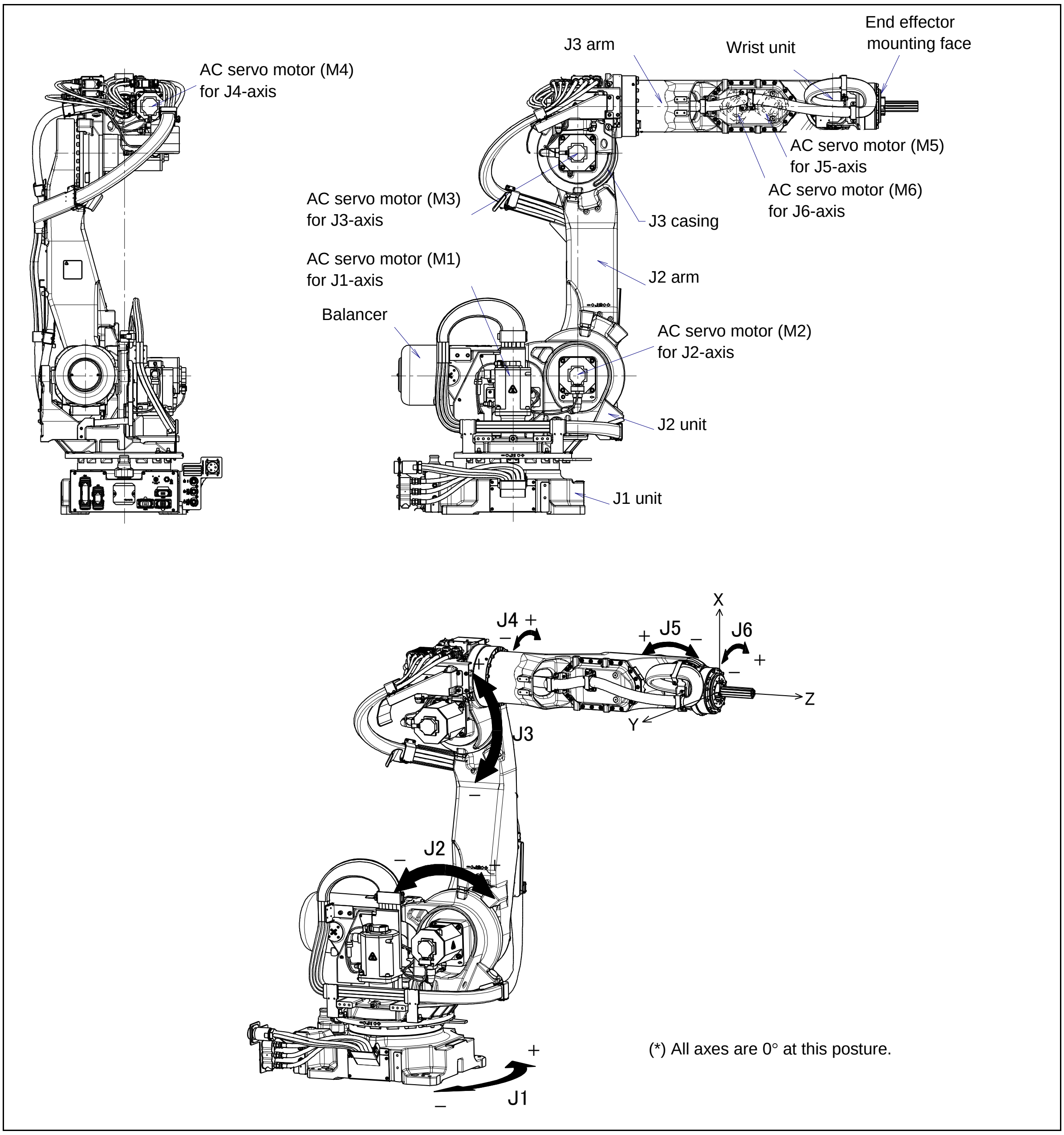


Fig. 3.1 (e) Mechanical unit configuration, each axis coordinates, and mechanical interface coordinates (R-2000*i*B/210FS/220US)

NOTE

1 There is no balancer for R-2000*i*B/220US.

2 The end effector mounting face center is 0, 0, 0 of the mechanical interface coordinates.

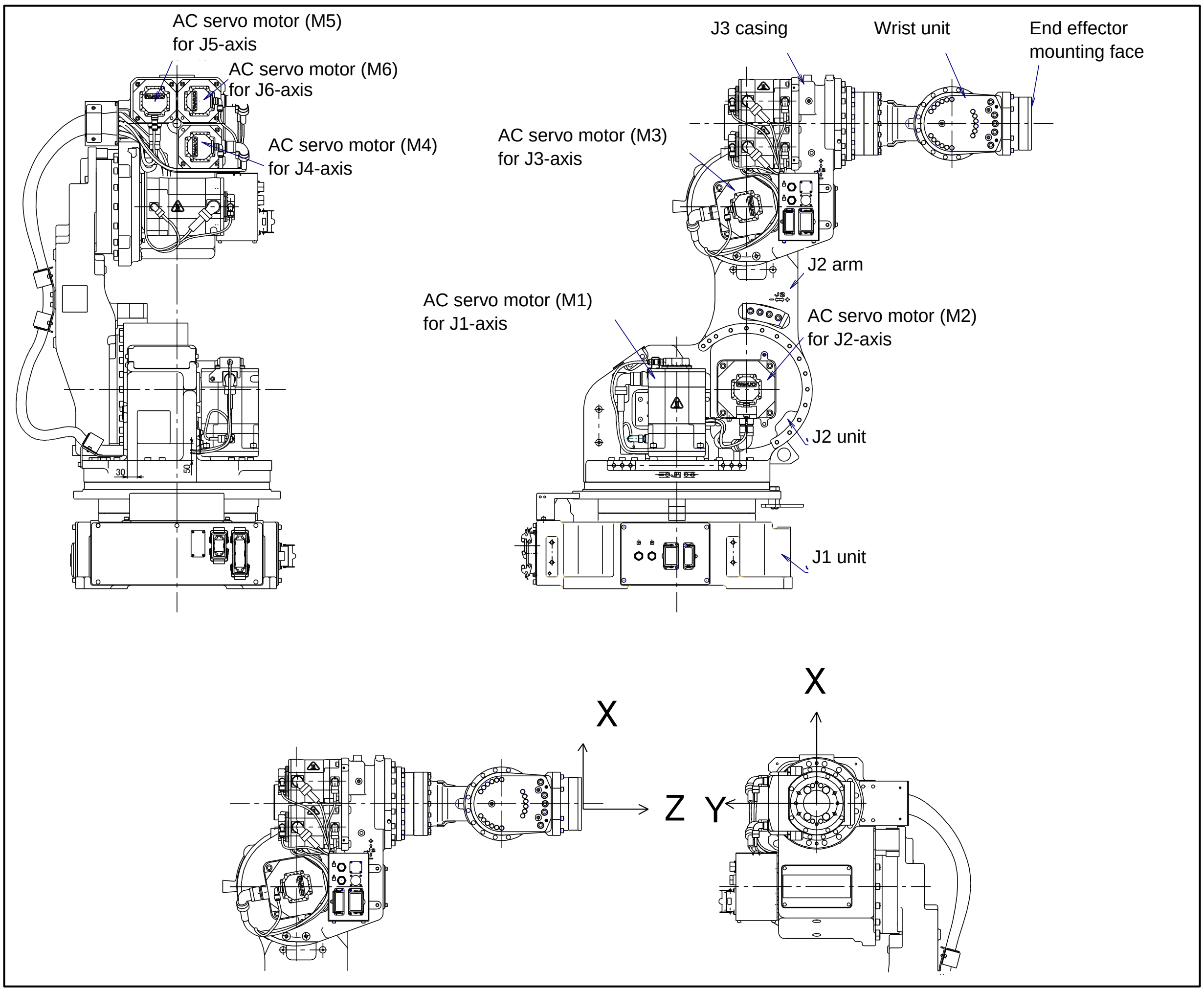


Fig. 3.1 (f) Mechanical unit configuration and mechanical interface coordinates (R-2000*i*B/165CF)

> **NOTE**
> The end effector mounting face center is 0, 0, 0 of the mechanical interface coordinates.

Specifications (Note 1) (1/6)

Model			R-2000*i*B/165F	R-2000*i*B/210F/210WE	R-2000*i*B/185L
Type			Articulated Type		
Controlled axis			6 axes (J1,J2,J3,J4,J5,J6)		
Installation			Floor mount		
Motion range	J1-axis	Upper limit	180° (3.14rad)	180° (3.14rad)	180° (3.14rad)
		Lower limit	-180° (-3.14rad)	-180° (-3.14rad)	-180° (-3.14rad)
	J2-axis	Upper limit	76° (1.33rad)	76° (1.33rad)	76° (1.33rad)
		Lower limit	-60° (-1.05rad)	-60° (-1.05rad)	-60° (-1.05rad)
	J3-axis	Upper limit	230° (4.01rad)	230° (4.01rad)	225° (3.93rad)
		Lower limit	-132° (-2.30rad)	-132° (-2.30rad)	-121° (-2.11rad)
	J4-axis	Upper limit	360° (6.28rad)	360° (6.28rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-360° (-6.28rad)	-360° (-6.28rad)
	J5-axis	Upper limit	125° (2.18rad)	125° (2.18rad)/	125° (2.18rad)
		Lower limit	-125° (-2.18rad)	-125° (-2.18rad)	-125° (-2.18rad)
	J6-axis	Upper limit	360° (6.28rad)	360° (6.28rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-360° (-6.28rad)	-360° (-6.28rad)
Max. speed (Note 2)	J1-axis		110°/s (1.92rad/s)	95°/s (1.66rad/s)	95°/s (1.66rad/s)
	J2-axis		110°/s (1.92rad/s)	90°/s (1.57rad/s)	85°/s (1.48rad/s)
	J3-axis		110°/s (1.92rad/s)	95°/s (1.66rad/s)	88°/s (1.54rad/s)
	J4-axis		150°/s (2.62rad/s)	120°/s (2.09rad/s)	120°/s (2.09rad/s)
	J5-axis		150°/s (2.62rad/s)	120°/s (2.09rad/s)	120°/s (2.09rad/s)
	J6-axis		220°/s (3.84rad/s)	190°/s (3.32rad/s)	190°/s (3.32rad/s)
Max. load capacity	At wrist		165kg	210kg	185kg
	On J3 arm		25kg	25kg	-
	On J3 casing		-	-	25kg
	On J2 base		550kg	550kg	550kg
Allowable load moment at wrist	J4		921N·m (94kgf·m)	1333N·m (136kgf·m)	1225N·m (125kgf·m)
	J5		921N·m (94kgf·m)	1333N·m (136kgf·m)	1225N·m (125kgf·m)
	J6		461N·m (47kgf·m)	706N·m (72kgf·m)	706N·m (72kgf·m)
Allowable load inertia at wrist	J4		Note 3) 78.4kg·m^2 (800kgf·cm·s^2)	Note 3) 141.1kg·m^2 (1440kgf·cm·s^2)	Note 3) 141.1kg·m^2 (1440kgf·cm·s^2)
			Note 3) 117.6kg·m^2 (1200kgf·cm·s^2)	Note 3) 225.4kg·m^2 (2300kgf·cm·s^2)	Note 3) 225.4kg·m^2 (2300kgf·cm·s^2)
	J5		Note 3) 78.4kg·m^2 (800kgf·cm·s^2)	Note 3) 141.1kg·m^2 (1440kgf·cm·s^2)	Note 3) 141.1kg·m^2 (1440kgf·cm·s^2)
			Note 3) 117.6kg·m^2 (1200kgf·cm·s^2)	Note 3) 225.4kg·m^2 (2300kgf·cm·s^2)	Note 3) 225.4kg·m^2 (2300kgf·cm·s^2)
	J6		Note 3) 40.2kg·m^2 (410kgf·cm·s^2)	Note 3) 78.4kg·m^2 (800kgf·cm·s^2)	Note 3) 78.4kg·m^2 (800kgf·cm·s^2)
			Note 3) 98kg·m^2 (1000kgf·cm·s^2)	Note 3) 196kg·m^2 (2000kgf·cm·s^2)	Note 3) 196kg·m^2 (2000kgf·cm·s^2)
Drive method			Electric servo drive by AC servo motor		
Repeatability			±0.2mm	±0.3mm	
Weight of machine unit			1170kg	1240kg (210F) /1280kg(210WE)	1290kg
Acoustic noise level			71.3dB (Note 4)		
Installation environment			Ambient temperature: 0 to 45°C (Note 5) Ambient humidity: Normally 75%RH or less. (No condensation allowed.) Short time (within one month) Max 95%RH (No condensation allowed.) Permitted altitude: Up to 1000 m above sea level. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 6) (Note 7)		

Note 1) Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

Note 2) During short distance motions, the axis speed may not reach the maximum value stated.

Note 3) The allowable load in standard inertia mode is shown in upper half and the allowable load in high inertia mode in lower half. For details, see Section 4.5.

Note 4) This value is equivalent continuous A-weighted sound pressure level that applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

Note 5) When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

Note 6) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other contaminations.

Note 7) Liquid intrusion into the balancer inside might cause corrosion of the spring. Be careful to prevent liquid splashing to the balancer.

Specifications (Note 1) (2/6)

Model			R-2000*i*B/250F	R-2000*i*B/165R	R-2000*i*B/200R
Type			Articulated Type		
Controlled axis			6 axes(J1,J2,J3,J4,J5,J6)		
Installation			Floor mount	Rack mount	
Motion range	J1-axis	Upper limit	180° (3.14rad)	180° (3.14rad)	180° (3.14rad)
		Lower limit	-180° (-3.14rad)	-180° (-3.14rad)	-180° (-3.14rad)
	J2-axis	Upper limit	76° (1.33rad)	65° (1.13rad)	65° (1.13rad)
		Lower limit	-60° (-1.05rad)	-120° (-2.09rad)	-120° (-2.09rad)
	J3-axis	Upper limit	225° (3.93rad)	270° (4.71rad)	270° (4.71rad)
		Lower limit	-132° (-2.36rad)	-95° (-1.66rad)	-95° (-1.66rad)
	J4-axis	Upper limit	360° (6.28rad)	360° (6.28rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-360° (-6.28rad)	-360° (-6.28rad)
	J5-axis	Upper limit	125° (2.18rad)	125° (2.18rad)	125° (2.18rad)
		Lower limit	-125° (-2.18rad)	-125° (-2.18rad)	-125° (-2.18rad)
	J6-axis	Upper limit	360° (6.28rad)	360° (6.28rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-360° (-6.28rad)	-360° (-6.28rad)
Max. speed (Note 2)	J1-axis		95°/s (1.66rad/s)	110°/s (1.92rad/s)	90°/s (1.57rad/s)
	J2-axis		85°/s (1.48rad/s)	100°/s (1.75rad/s)	85°/s (1.48rad/s)
	J3-axis		88°/s (1.54rad/s)	110°/s (1.92rad/s)	95°/s (1.66rad/s)
	J4-axis		120°/s (2.09rad/s)	150°/s (2.62rad/s)	120°/s (2.09rad/s)
	J5-axis		120°/s (2.09rad/s)	150°/s (2.62rad/s)	120°/s (2.09rad/s)
	J6-axis		190°/s (3.32rad/s)	220°/s (3.84rad/s)	190°/s (3.32rad/s)
Max. load capacity	At wrist		250kg	165kg	200kg
	On J3 arm		25kg	-	-
	On J3 casing		-	25kg	-
	On J2 base		550kg	550kg	550kg
Allowable load moment at wrist	J4		1382N·m (141kgf·m)	921N·m (94kgf·m)	1333N·m (136kgf·m)
	J5		1382N·m (141kgf·m)	921N·m (94kgf·m)	1333N·m (136kgf·m)
	J6		715N·m (73kgf·m)	461N·m (47kgf·m)	706N·m (72kgf·m)
Allowable load inertia at wrist	J4		Note 3) 141.1kg·m^2 (1440kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)	141.1kg·m^2 (1440kgf·cm·s^2)
			Note 3) 225.4kg·m^2 (2300kgf·cm·s^2)		
	J5		Note 3) 141.1kg·m^2 (1440kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)	141.1kg·m^2 (1440kgf·cm·s^2)
			Note 3) 225.4kg·m^2 (2300kgf·cm·s^2)		
	J6		Note 3) 78.4kg·m^2 (800kgf·cm·s^2)	40.2kg·m^2 (410kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)
			Note 3) 196kg·m^2 (2000kgf·cm·s^2)		
Drive method			Electric servo drive by AC servo motor		
Repeatability			±0.3mm		
Weight of machine unit			1270kg	1480kg	1540kg
Acoustic noise level			71.3dB (Note 4)		
Installation environment			Ambient temperature: 0 to 45°C (Note 5) Ambient humidity: Normally 75%RH or less. (No condensation allowed.) Short time (within one month) Max 95%RH (No condensation allowed.) Permitted altitude: Up to 1000 m above sea level. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 6) (Note 7)		

Note 1) Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

Note 2) During short distance motions, the axis speed may not reach the maximum value stated.

Note 3) The allowable load in standard inertia mode is shown in upper half and the allowable load in high inertia mode in lower half. For details, see Section 4.5.

Note 4) This value is equivalent continuous A-weighted sound pressure level that applied with ISO11201 (EN31201). This value is measured with the following conditions.

- Maximum load and speed
- Operating mode is AUTO

Note 5) When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

Note 6) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other contaminations.

Note 7) Liquid intrusion into the balancer inside might cause corrosion of the spring. Be careful to prevent liquid splashing to the balancer.

Specifications (Note 1) (3/6)

Model			R-2000*i*B/100P	R-2000*i*B/170CF	R-2000*i*B/125L
Type			Articulated Type		
Controlled axis			6 axes(J1,J2,J3,J4,J5,J6)		
Installation			Rack mount	Floor mount(or top mount)	Floor mount
Motion range	J1-axis	Upper limit	180° (3.14rad)	180° (3.14rad)	180° (3.14rad)
		Lower limit	-180° (-3.14rad)	-180° (-3.14rad)	-180° (-3.14rad)
	J2-axis	Upper limit	65° (1.13rad)	135° (2.35rad)	76° (1.33rad)
		Lower limit	-120° (-2.09rad)	-55° (-0.96rad)	-60° (-1.05rad)
	J3-axis	Upper limit	270° (4.71rad)	220° (3.84rad)	230° (4.01rad)
		Lower limit	-95° (-1.66rad)	-112° (-1.95rad)	-122.5° (-2.14rad)
	J4-axis	Upper limit	360° (6.28rad)	360° (6.28rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-360° (-6.28rad)	-360° (-6.28rad)
	J5-axis	Upper limit	125° (2.18rad)	125° (2.18rad)	125° (2.18rad)
		Lower limit	-125° (-2.18rad)	-125° (-2.18rad)	-125° (-2.18rad)
	J6-axis	Upper limit	360° (6.28rad)	360° (6.28rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-360° (-6.28rad)	-360° (-6.28rad)
Max. speed (Note 2)	J1-axis		110°/s (1.92rad/s)	110°/s (1.92rad/s)	110°/s (1.92rad/s)
	J2-axis		90°/s (1.57rad/s)	110°/s (1.92rad/s)	110°/s (1.92rad/s)
	J3-axis		110°/s (1.92rad/s)	110°/s (1.92rad/s)	110°/s (1.92rad/s)
	J4-axis		120°/s (2.09rad/s)	150°/s (2.62rad/s)	170°/s (2.97rad/s)
	J5-axis		120°/s (2.09rad/s)	150°/s (2.62rad/s)	170°/s (2.97rad/s)
	J6-axis		190°/s (3.32rad/s)	220°/s (3.84rad/s)	260°/s (4.54rad/s)
Max. load capacity	At wrist		100kg	170kg	125kg
	On J3 arm		-	-	20kg
	On J3 casing		25kg	25kg	—
	On J2 base		550kg	550kg (Floor mount only)	550kg
Allowable load moment at wrist	J4		980N·m (100kgf·m)	921N·m (94kgf·m)	588N·m (60kgf·m)
	J5		980N·m (100kgf·m)	921N·m (94kgf·m)	588N·m (60kgf·m)
	J6		706N·m (72kgf·m)	461N·m (47kgf·m)	343N·m (35kgf·m)
Allowable load inertia at wrist	J4		225.4kg·m^2 (2300kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)	58.8kg·m^2 (600kgf·cm·s^2)
	J5		225.4kg·m^2 (2300kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)	58.8kg·m^2 (600kgf·cm·s^2)
	J6		196kg·m^2 (2000kgf·cm·s^2)	40.2kg·m^2 (410kgf·cm·s^2)	22.5kg·m^2 (230kgf·cm·s^2)
Drive method			Electric servo drive by AC servo motor		
Repeatability			±0.3mm	±0.15mm	±0.2mm
Weight of machine unit			1560kg	800kg	1190kg
Acoustic noise level			71.3dB (Note 3)		
Installation environment			Ambient temperature:0 to 45°C (Note 4) Ambient humidity: Normally 75%RH or less. (No condensation allowed.) Short time (within one month) Max 95%RH (No condensation allowed.) Permitted altitude: Up to 1000 m above sea level. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 5) (Note 6)		

Note 1) Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

Note 2) During short distance motions, the axis speed may not reach the maximum value stated.

Note 3) This value is equivalent continuous A-weighted sound pressure level that applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

Note 4) When robot is used in low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC in a holiday or the night, collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

Note 5) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other contaminations.

Note 6) Liquid intrusion into the balancer inside might cause corrosion of the spring. Be careful to prevent liquid splashing to the balancer. (There is no balancer for R-2000*i*B/170CF.)

Specifications (Note 1) (4/6)

Model			R-2000*i*B/175L	R-2000*i*B/100H	R-2000*i*B/150U
Type			Articulated Type		
Controlled axis			6 axes(J1,J2,J3,J4,J5,J6)	5 axes (J1,J2,J3,J4,J5)	6 axes (J1,J2,J3,J4,J5,J6)
Installation			Floor mount		Upside-down
Motion range	J1-axis	Upper limit	180° (3.14rad)	180° (3.14rad)	180° (3.14rad)
		Lower limit	-180° (-3.14rad)	-180° (-3.14rad)	-180° (-3.14rad)
	J2-axis	Upper limit	76° (1.33rad)	76° (1.33rad)	76° (1.33rad)
		Lower limit	-60° (-1.05rad)	-60° (-1.05rad)	-60° (-1.05rad)
	J3-axis	Upper limit	230° (4.01rad)	230° (4.01rad)	230° (4.01rad)
		Lower limit	-126.1° (-2.20rad)	-132° (-2.30rad)	-132° (-2.30rad)
	J4-axis	Upper limit	360° (6.28rad)	125° (2.18rad)	360° (6.28rad)
		Lower limit	-360° (-6.28rad)	-125° (-2.18rad)	-360° (-6.28rad)
	J5-axis	Upper limit	125° (2.18rad)	360° (6.28rad)	125° (2.18rad)
		Lower limit	-125° (-2.18rad)	-360° (-6.28rad)	-125° (-2.18rad)
	J6-axis	Upper limit	360° (6.28rad)	–	360° (6.28rad)
		Lower limit	-360° (-6.28rad)		-360° (-6.28rad)
Max. speed (Note 2)	J1-axis		95°/s (1.66rad/s)	130°/s (2.27rad/s)	110°/s (1.92rad/s)
	J2-axis		90°/s (1.57rad/s)	130°/s (2.27rad/s)	85°/s (1.48rad/s)
	J3-axis		95°/s (1.66rad/s)	130°/s (2.27rad/s)	110°/s (1.92rad/s)
	J4-axis		120°/s (2.09rad/s)	170°/s (2.97rad/s)	150°/s (2.62rad/s)
	J5-axis		120°/s (2.09rad/s)	360°/s (6.28rad/s)	150°/s (2.62rad/s)
	J6-axis		190°/s (3.32rad/s)	–	220°/s (3.84rad/s)
Max. load capacity	At wrist		175kg	100kg	150kg
	On J3 arm		20kg	–	10kg
	On J2 base		550kg	550kg	–
Allowable load moment at wrist	J4		1225N·m (125kgf·m)	441N·m (45kgf·m)	833N·m (85kgf·m)
	J5		1225N·m (125kgf·m)	245N·m (25kgf·m)	833N·m (85kgf·m)
	J6		706N·m (72kgf·m)	–	421N·m (43kgf·m)
Allowable load inertia at wrist	J4		225.4kg·m^2 (2300kgf·cm·s^2)	39.2kg·m^2 (400kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)
	J5		225.4kg·m^2 (2300kgf·cm·s^2)	15.7kg·m^2 (160kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)
	J6		196kg·m^2 (2000kgf·cm·s^2)	–	40.2kg·m^2 (2000kgf·cm·s^2)
Drive method			Electric servo drive by AC servo motor		
Repeatability			±0.3mm	±0.2mm	
Weight of machine unit			1260kg	1150kg	1070kg
Acoustic noise level			71.3dB (Note 3)		
Installation environment			Ambient temperature: 0 to 45°C (Note 4) Ambient humidity: Normally 75%RH or less. (No condensation allowed.) Short time (within one month) Max 95%RH (No condensation allowed.) Permitted altitude: Up to 1000 m above sea level. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 5) (Note 6)		

Note 1) Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

Note 2) During short distance motions, the axis speed may not reach the maximum value stated.

Note 3) This value is equivalent continuous A-weighted sound pressure level that applied with ISO11201 (EN31201). This value is measured with the following conditions.

- Maximum load and speed
- Operating mode is AUTO

Note 4) When robot is used in low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC in a holiday or the night, collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

Note 5) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other contaminations.

Note 6) Liquid intrusion into the balancer inside might cause corrosion of the spring. Be careful to prevent liquid splashing to the balancer. (There is no balancer for R-2000*i*B/150U.)

Specifications (Note 1) (5/6)

Model			R-2000*i*B/220U	R-2000*i*B/210FS	R-2000*i*B/220US
Type			Articulated Type		
Controlled axis			6 axes (J1,J2,J3,J4,J5,J6)		
Installation			Upside-down	Floor mount	Upside-down
Motion range	J1-axis	Upper limit	180° (3.14rad)	180° (3.14rad)	180° (3.14rad)
		Lower limit	-180° (-3.14rad)	-180° (-3.14rad)	-180° (-3.14rad)
	J2-axis	Upper limit	76° (1.33rad)	76° (1.33rad)	76° (1.33rad)
		Lower limit	-60° (-1.05rad)	-60° (-1.05rad)	-60° (-1.05rad)
	J3-axis	Upper limit	230° (4.01rad)	100° (1.74rad)	100° (1.74rad)
		Lower limit	-132° (-2.30rad)	-134° (-2.34rad)	-134° (-2.34rad)
	J4-axis	Upper limit	360° (6.28rad)	210° (3.66rad)	210° (3.66rad)
		Lower limit	-360° (-6.28rad)	-210° (-3.66rad)	-210° (-3.66rad)
	J5-axis	Upper limit	125° (2.18rad)	125° (2.18rad)	125° (2.18rad)
		Lower limit	-125° (-2.18rad)	-125° (-2.18rad)	-125° (-2.18rad)
	J6-axis	Upper limit	360° (6.28rad)	210° (3.66rad)	210° (3.66rad)
		Lower limit	-360° (-6.28rad)	-210° (-3.66rad)	-210° (-3.66rad)
Max. speed (Note 2)	J1-axis		95°/s (1.66rad/s)	110°/s (1.92rad/s)	110°/s (1.92rad/s)
	J2-axis		85°/s (1.48rad/s)	90°/s (1.57rad/s)	85°/s (1.48rad/s)
	J3-axis		95°/s (1.66rad/s)	95°/s (1.66rad/s)	95°/s (1.66rad/s)
	J4-axis		120°/s (2.09rad/s)	130°/s (2.27rad/s)	130°/s (2.27rad/s)
	J5-axis		120°/s (2.09rad/s)	130°/s (2.27rad/s)	130°/s (2.27rad/s)
	J6-axis		190°/s (3.32rad/s)	200°/s (3.49rad/s)	200°/s (3.49rad/s)
Max. load capacity	At wrist		220kg	210kg	220kg
	On J3 arm		25kg	–	–
	On J2 base		–	550kg	–
Allowable load moment at wrist	J4		1333N·m (136kgf·m)	1333N·m (136kgf·m)	1333N·m (136kgf·m)
	J5		1333N·m (136kgf·m)	1333N·m (136kgf·m)	1333N·m (136kgf·m)
	J6		706N·m (72kgf·m)	706N·m (72kgf·m)	706N·m (72kgf·m)
Allowable load inertia at wrist	J4		141.1kg·m^2 (1440kgf·cm·s^2)	141.1kg·m^2 (1440kgf·cm·s^2)	141.1kg·m^2 (1440kgf·cm·s^2)
	J5		141.1kg·m^2 (1440kgf·cm·s^2)	141.1kg·m^2 (1440kgf·cm·s^2)	141.1kg·m^2 (1440kgf·cm·s^2)
	J6		78.4kg·m^2 (800kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)	78.4kg·m^2 (800kgf·cm·s^2)
Drive method			Electric servo drive by AC servo motor		
Repeatability			±0.3mm		
Weight of machine unit			1150kg	1250kg	1160kg
Acoustic noise level			71.3dB (Note 3)	73.5dB (Note 3)	
Installation environment			Ambient temperature: 0 to 45°C (Note 4) Ambient humidity: Normally 75%RH or less. (No condensation allowed.) Short time (within one month) Max 95%RH (No condensation allowed.) Permitted altitude: Up to 1000 m above sea level. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 5) (Note 6)		

Note 1) Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

Note 2) During short distance motions, the axis speed may not reach the maximum value stated.

Note 3) This value is equivalent continuous A-weighted sound pressure level that applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

Note 4) When robot is used in low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC in a holiday or the night, collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

Note 5) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other contaminations.

Note 6) Liquid intrusion into the balancer inside might cause corrosion of the spring. Be careful to prevent liquid splashing to the balancer. (There is no balancer for R-2000iB/220U/220US.)

Specifications (Note 1) (6/6)

Model			R-2000*i*B/165CF
Type			Articulated Type
Controlled axis			6 axes (J1,J2,J3,J4,J5,J6)
Installation			Floor mount
Motion range	J1-axis	Upper limit	180° (3.14rad)
		Lower limit	-180° (-3.14rad)
	J2-axis	Upper limit	110° (1.92rad)
		Lower limit	-55° (-0.96rad)
	J3-axis	Upper limit	120° (2.09rad)
		Lower limit	-130° (-2.27rad)
	J4-axis	Upper limit	360° (6.28rad)
		Lower limit	-360° (-6.28rad)
	J5-axis	Upper limit	125° (2.18rad)
		Lower limit	-125° (-2.18rad)
	J6-axis	Upper limit	360° (6.28rad)
		Lower limit	-360° (-6.28rad)
Max. speed (Note 2)	J1-axis		110°/s (1.92rad/s)
	J2-axis		90°/s (1.57rad/s)
	J3-axis		100°/s (1.75rad/s)
	J4-axis		130°/s (2.27rad/s)
	J5-axis		130°/s (2.27rad/s)
	J6-axis		210°/s (3.67rad/s)
Max. load capacity	At wrist		165kg
	On J3 casing		25kg
	On J2 base		550kg
Allowable load moment at wrist	J4		911N・m (93kgf・m)
	J5		911N・m (93kgf・m)
	J6		451N・m (46kgf・m)
Allowable load inertia at wrist	J4		88.2kg・m^2 (800kgf・cm・s^2)
	J5		88.2kg・m^2 (800kgf・cm・s^2)
	J6		44.1kg・m^2 (450kgf・cm・s^2)
Drive method			Electric servo drive by AC servo motor
Repeatability			±0.15mm
Weight of machine unit			1050kg
Acoustic noise level			78.1dB (Note 3)
Installation environment			Ambient temperature: 0 to 45°C (Note 4) Ambient humidity: Normally 75%RH or less. (No condensation allowed.) Short time (within one month) Max 95%RH (No condensation allowed.) Permitted altitude: Up to 1000 m above sea level. Vibration acceleration: 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 5) (Note 6)

Note 1) Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

Note 2) During short distance motions, the axis speed may not reach the maximum value stated.

Note 3) This value is equivalent continuous A-weighted sound pressure level that applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

Note 4) When robot is used in low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC in a holiday or the night, collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

Note 5) Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, cutting oil splash and or other contaminations.

The following table lists the IEC60529-based Severe dust/liquid protection characteristics of the R-2000*i*B. Refer to Chapter 10 about severe dust/liquid protection package (option).

	Standard	Severe dust/liquid protection package (option)
J3 arm and wrist section	IP67	IP67
Drive unit of the main body	IP66	IP66
Main body	IP54 (*)	IP56

(*) Except some connectors

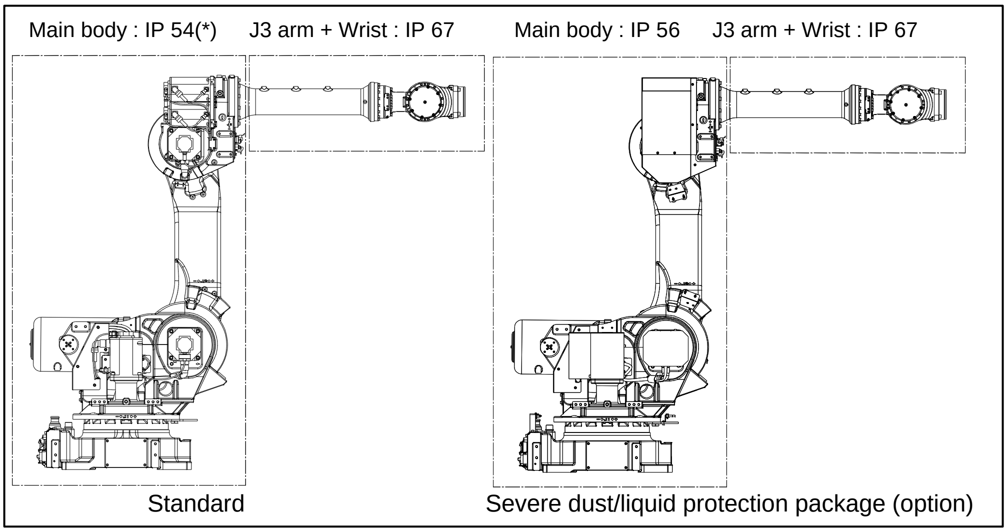


Fig. 3.1 (g) Severe dust/liquid protection characteristics of R-2000*i*B

> **NOTE**
> Definition of IP code
> Definition of IP 67
> 6=Dust-tight
> 7=Protection from water immersion
> Definition of IP 66
> 6=Dust-tight
> 6=Protection from powerful water jets
> Definition of IP 54
> 5=Dust-protected
> 4=Protection from splashing water
> Definition of IP 56
> 5=Dust-protected
> 6=Protection from powerful water jets

Performance of resistant chemicals and resistant solvents

1 The robot (including severe dust/liquid protection model) cannot be used with the following liquids. Potentially these liquids will cause irreversible damage to the rubber parts (such as: gaskets, oil seals, O-rings etc.). (As exception to this only liquids tested and approved by FANUC can be used with the robot.)
   (a) Organic solvents
   (b) Cutting fluid or detergent including chlorine / gasoline
   (c) Amine type cutting fluid or detergent
   (d) Acid, alkali and liquid causing rust
   (e) Other liquids or solutions, that will harm NBR or CR rubber
2 When the robots work in the environment, using water or liquid, complete draining of J1 base must be done. Incomplete draining of J1 base will make the robot break down.
3 Don not use unconfirmed liquid.
4 Do not use the robot immersed in water, neither temporary nor permanent. Robot must not be wet permanently.
   * Example : In case motor surface is exposed to water for a long time, liquid may invade inside the motor and cause failure.
   * In case of liquid splashing to the balancer, it might cause corrosion and deterioration of the spring and failures.

Please refer to Section 3.6 for R-2000*i*B/210WE.

3.2 MECHANICAL UNIT EXTERNAL DIMENSIONS AND OPERATING SPACE

Fig. 3.2 (a) to (q) show the robot operating space. When installing peripheral devices, be careful not to interfere with the robot and its operating space.

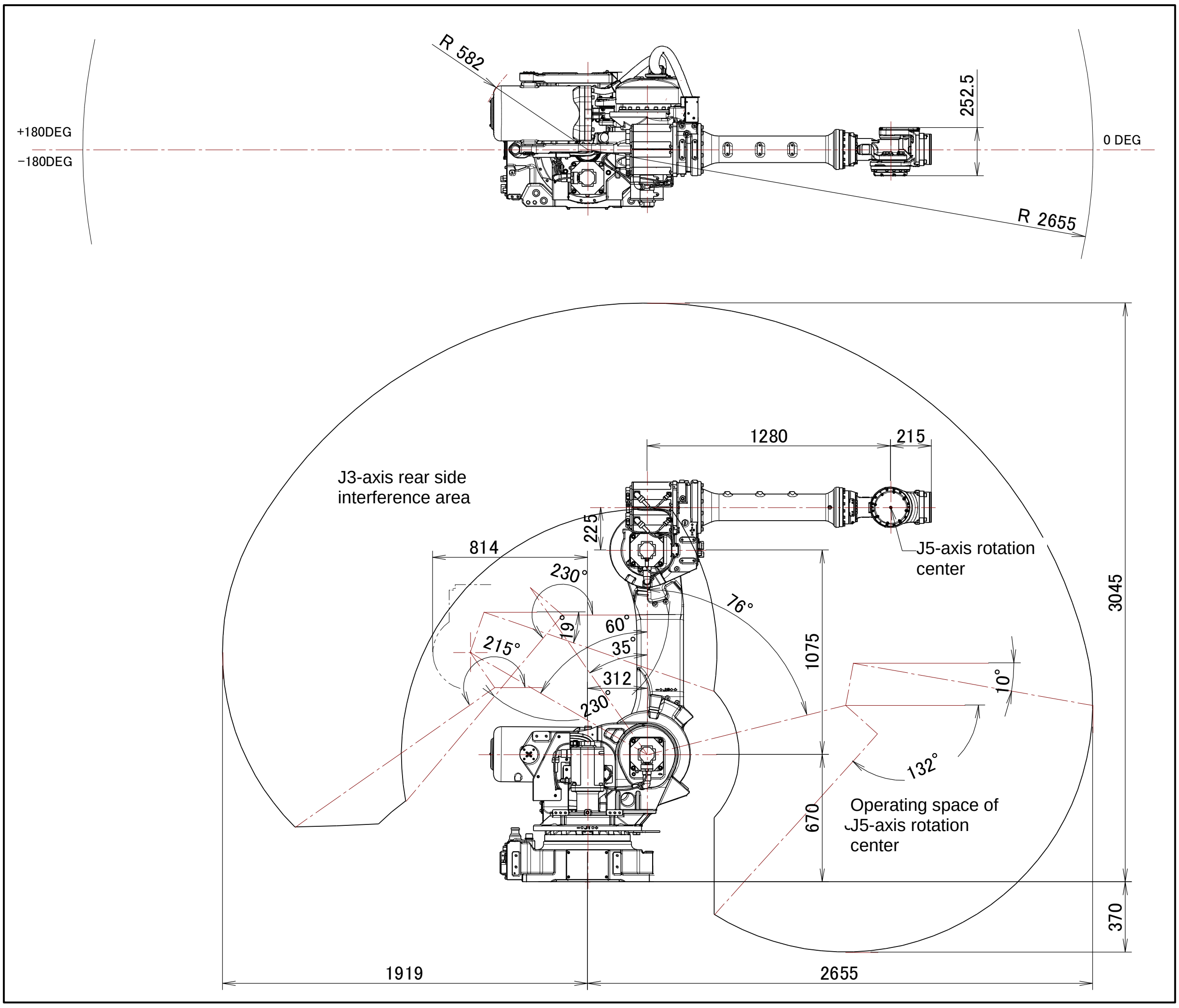


Fig. 3.2 (a) Operating space (R-2000*i*B/165F)

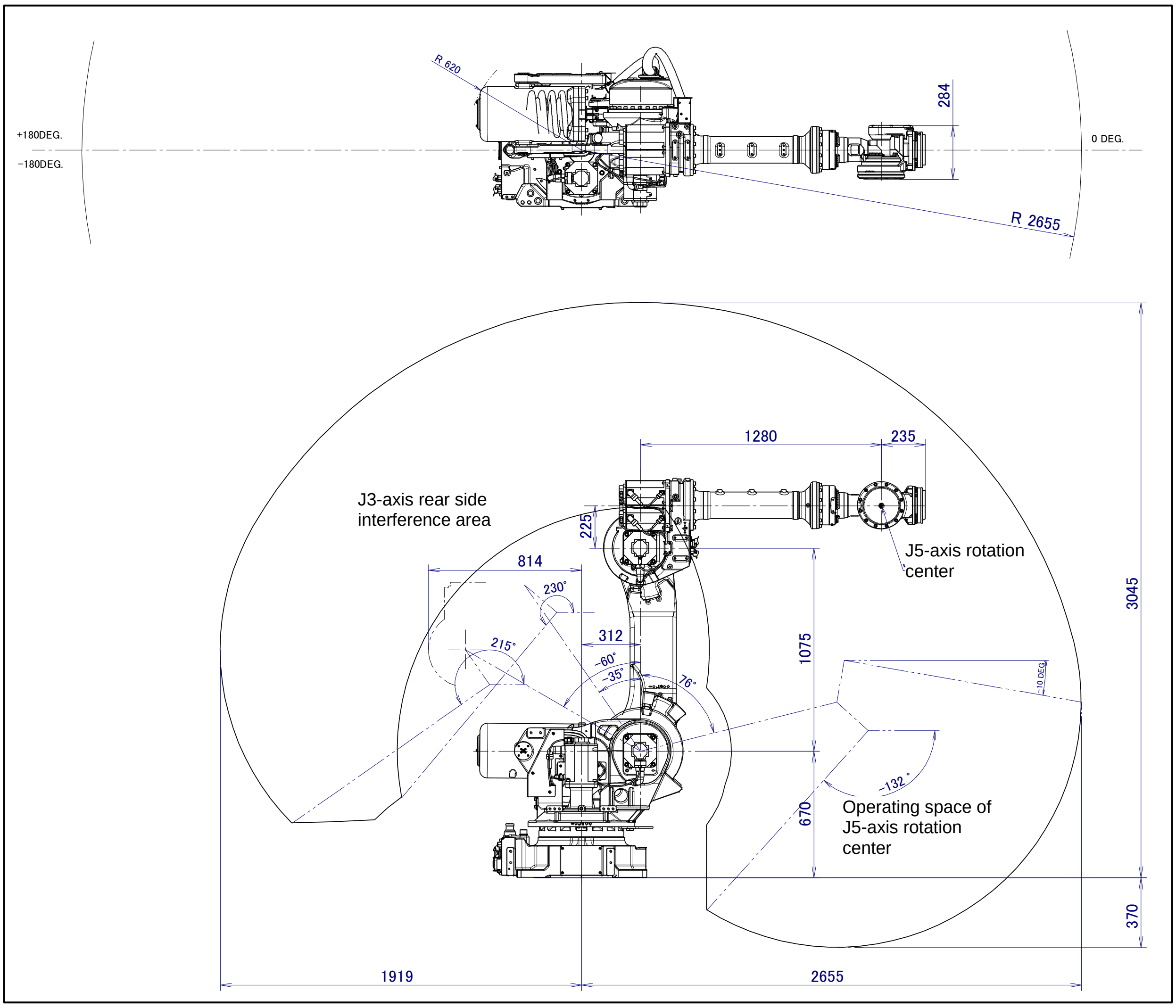


Fig. 3.2 (b) Operating space (R-2000*i*B/210F)

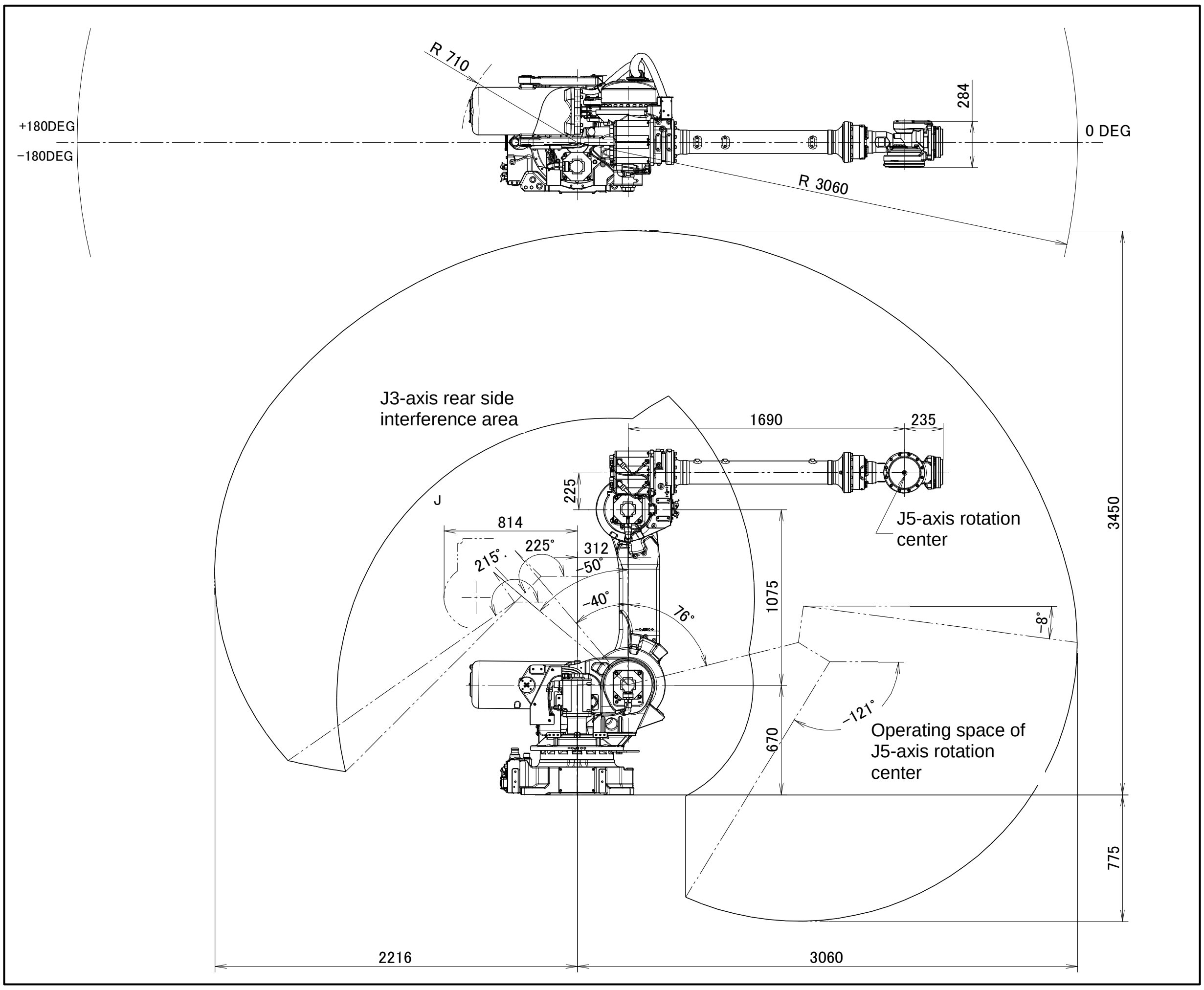


Fig. 3.2 (c) Operating space (R-2000*i*B/185L)

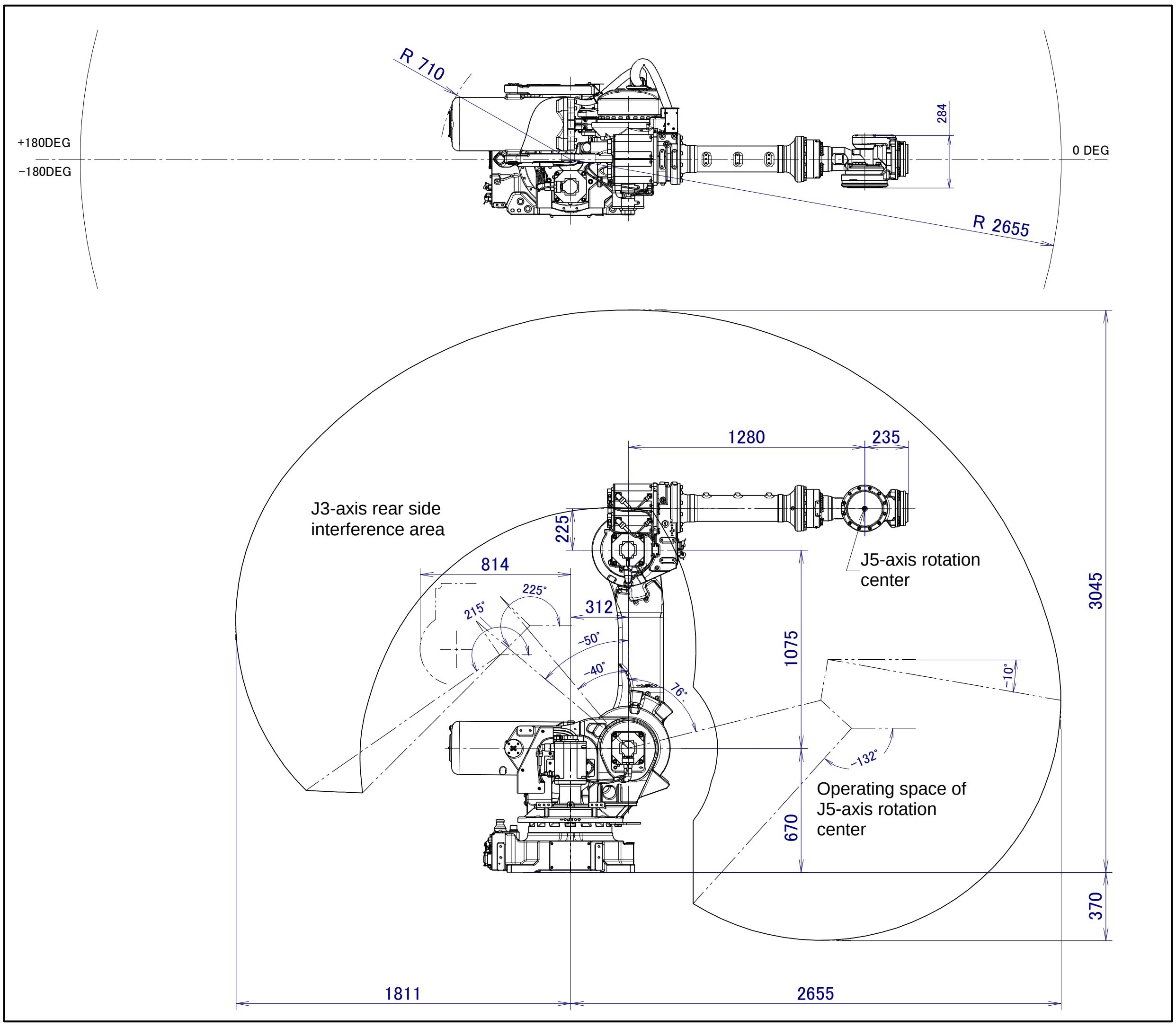


Fig. 3.2 (d) Operating space (R-2000*i*B/250F)

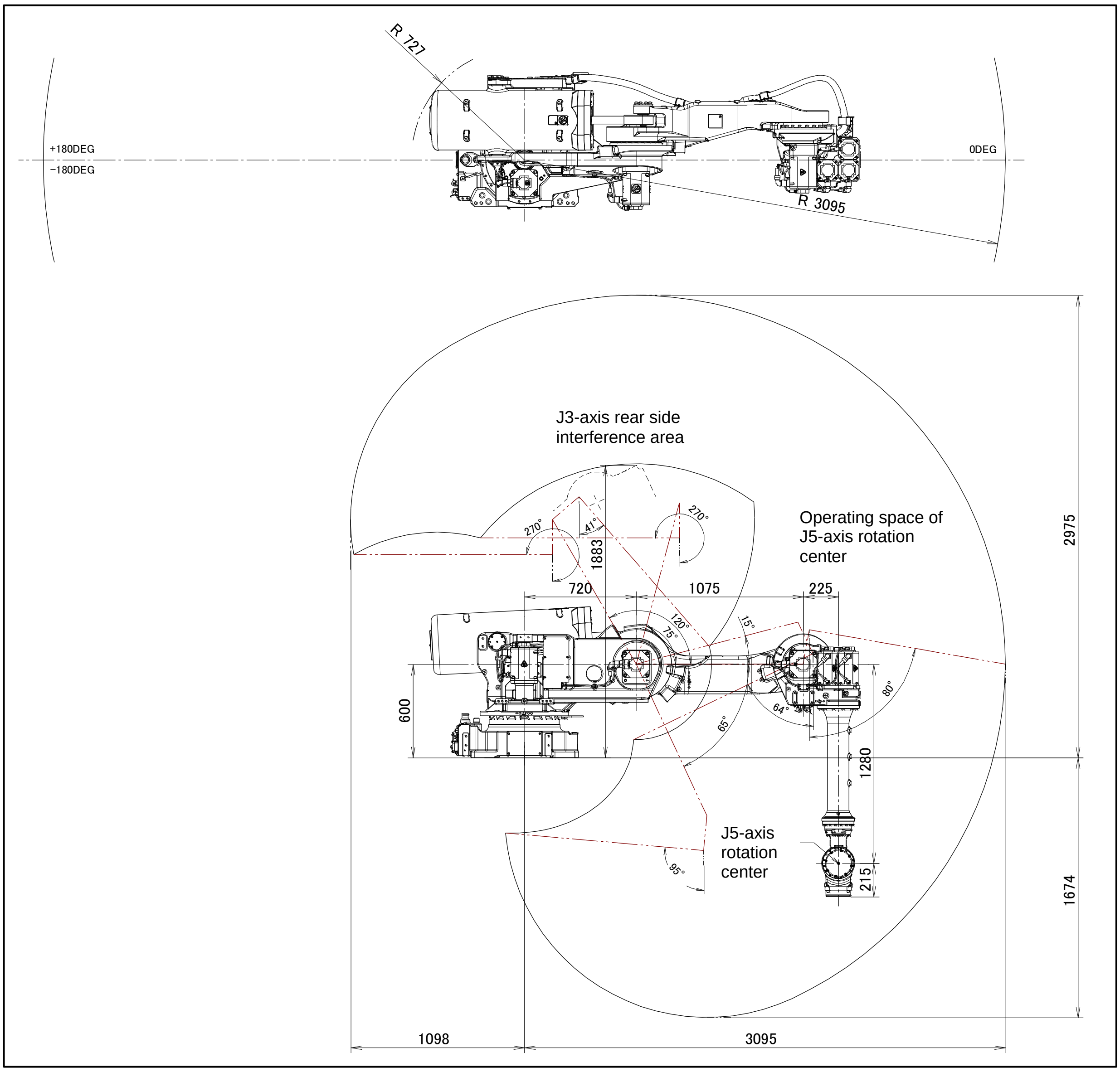


Fig. 3.2 (e) Operating space (R-2000*i*B/165R)

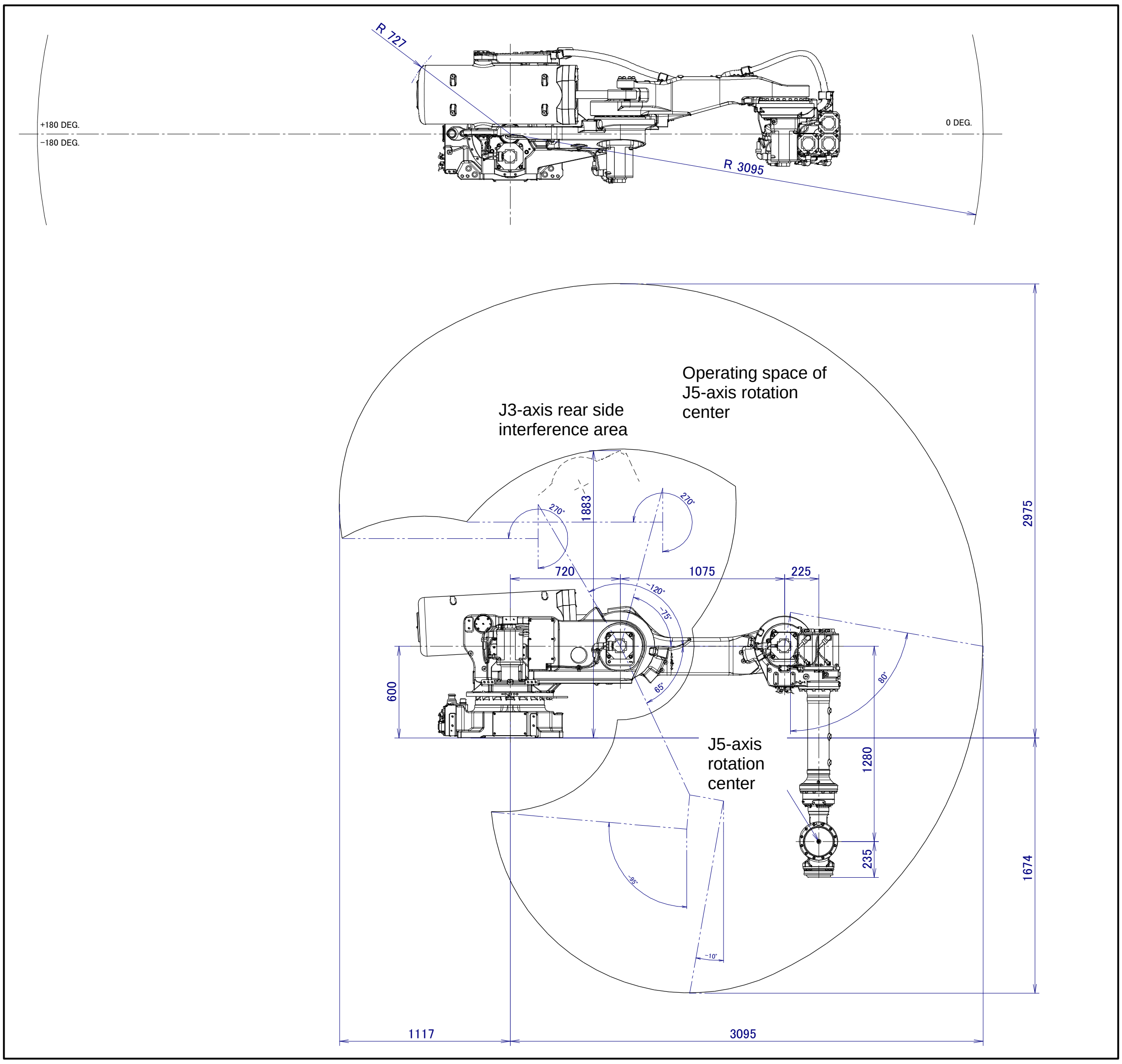


Fig. 3.2 (f) Operating space (R-2000*i*B/200R)

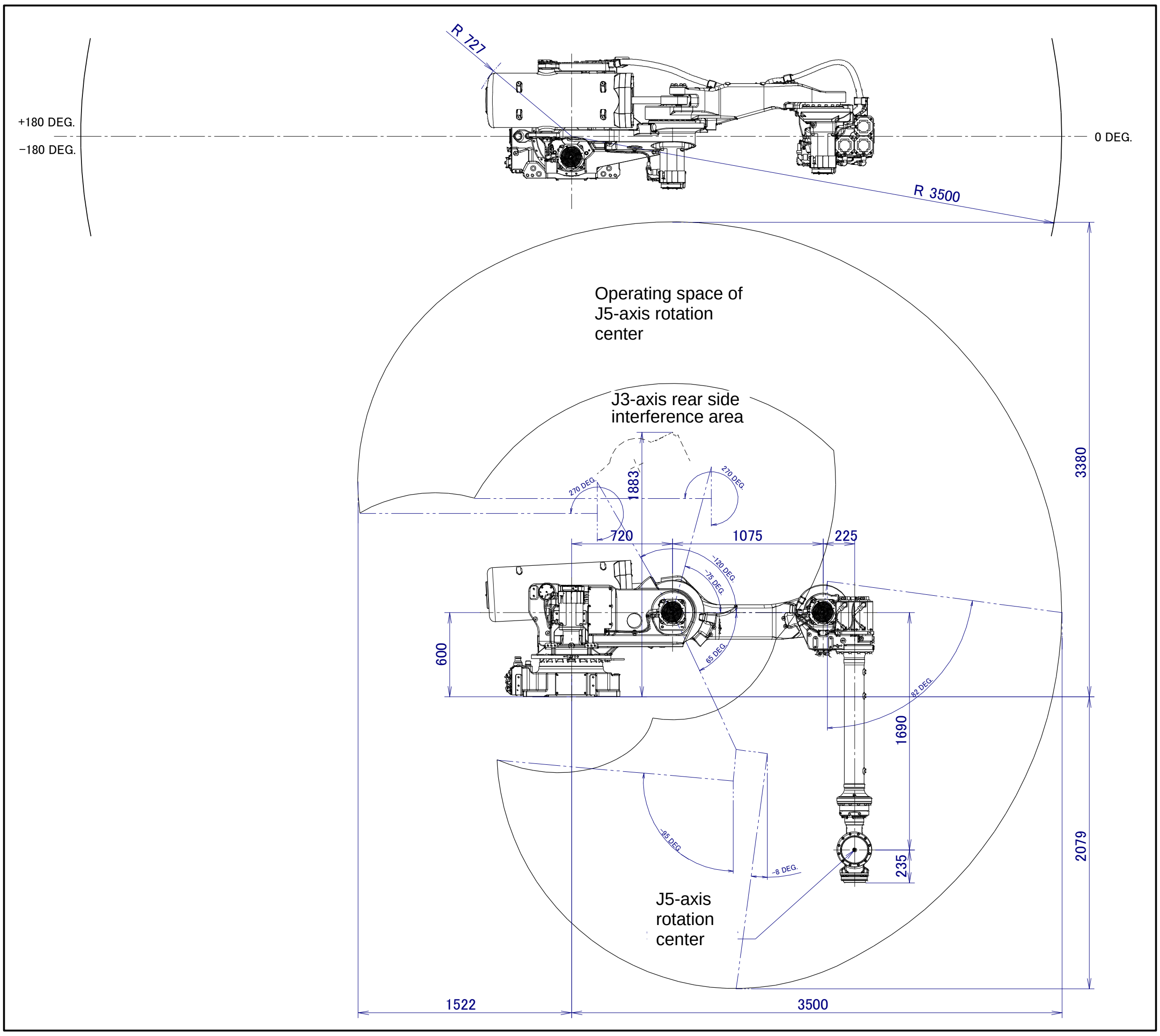


Fig. 3.2 (g) Operating space (R-2000*i*B/100P)

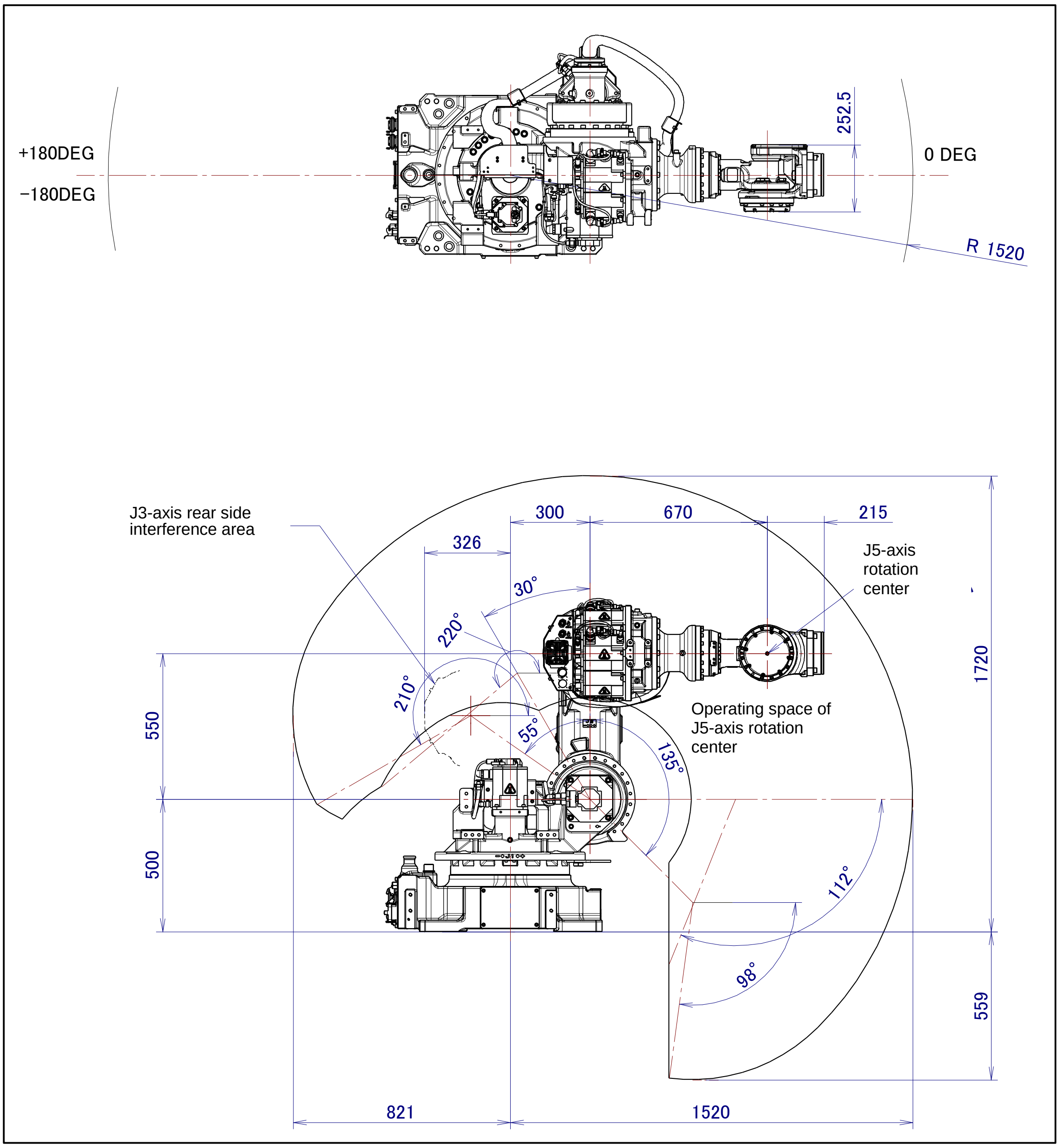


Fig. 3.2 (h) Operating space (R-2000*i*B/170CF)

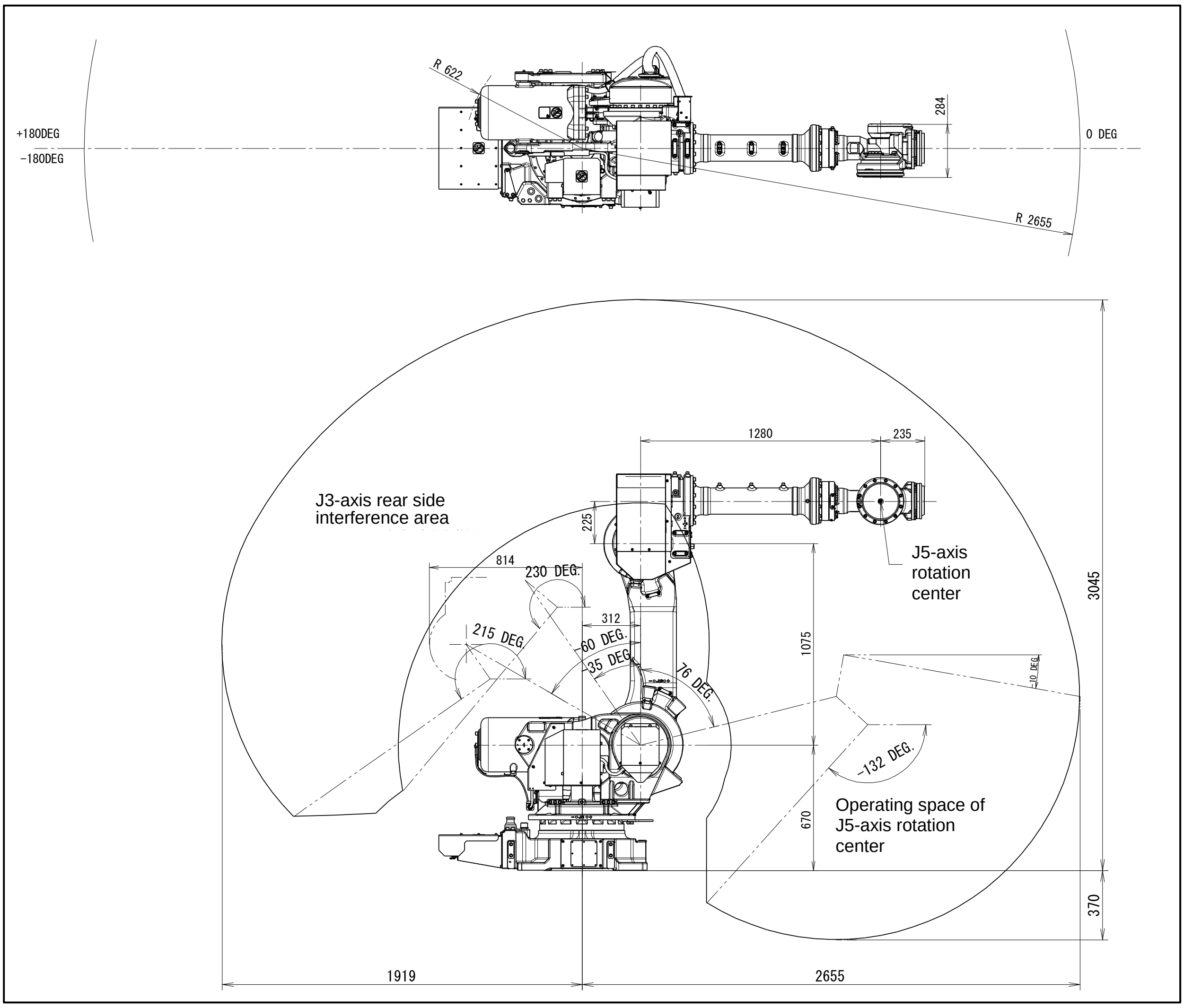


Fig. 3.2 (i) Operating space (R-2000*i*B/210WE)

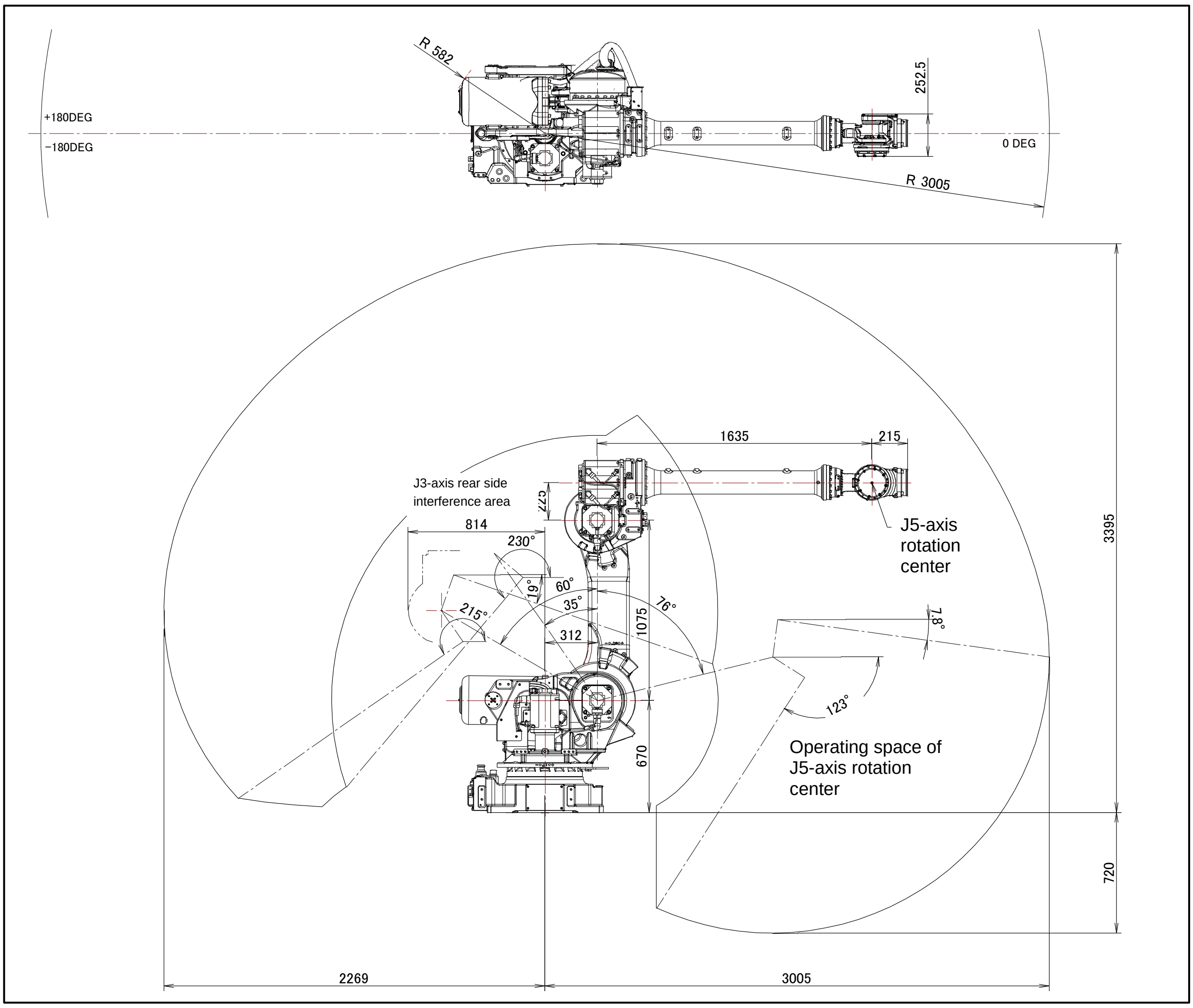


Fig. 3.2 (j) Operating space (R-2000*i*B/125L)

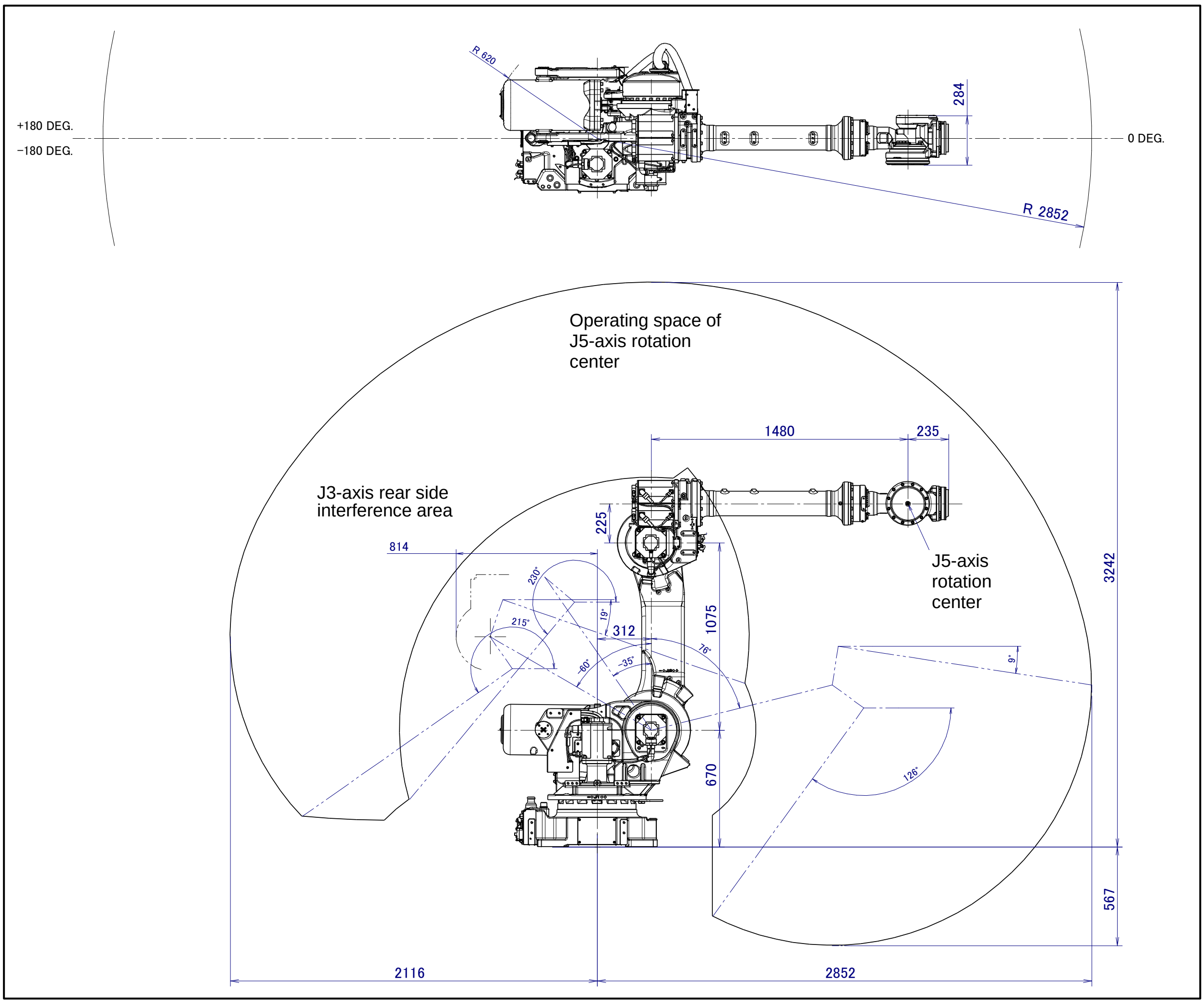


Fig. 3.2 (k) Operating space (R-2000*i*B/175L)

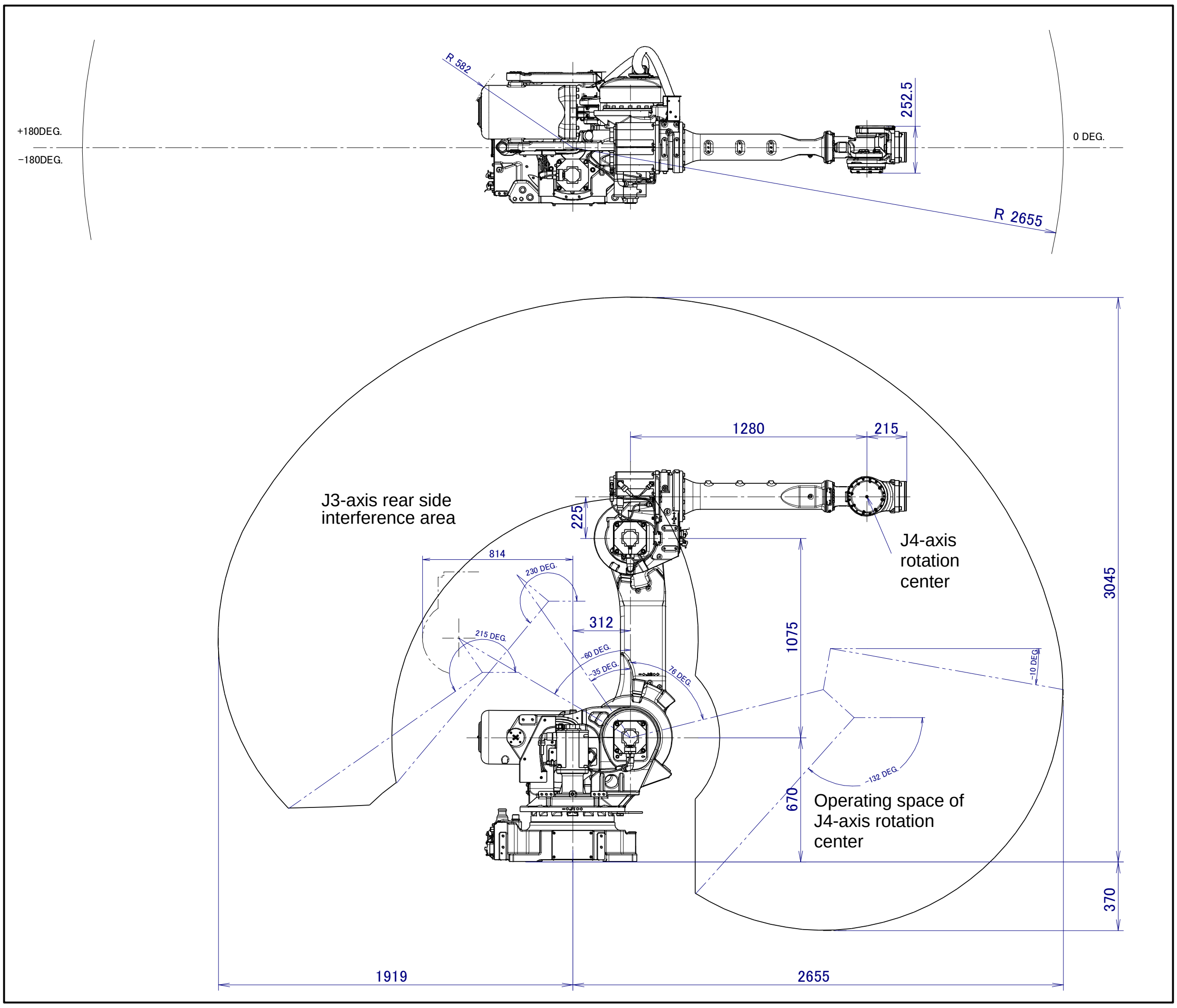


Fig. 3.2 (l) Operating space (R-2000*i*B/100H)

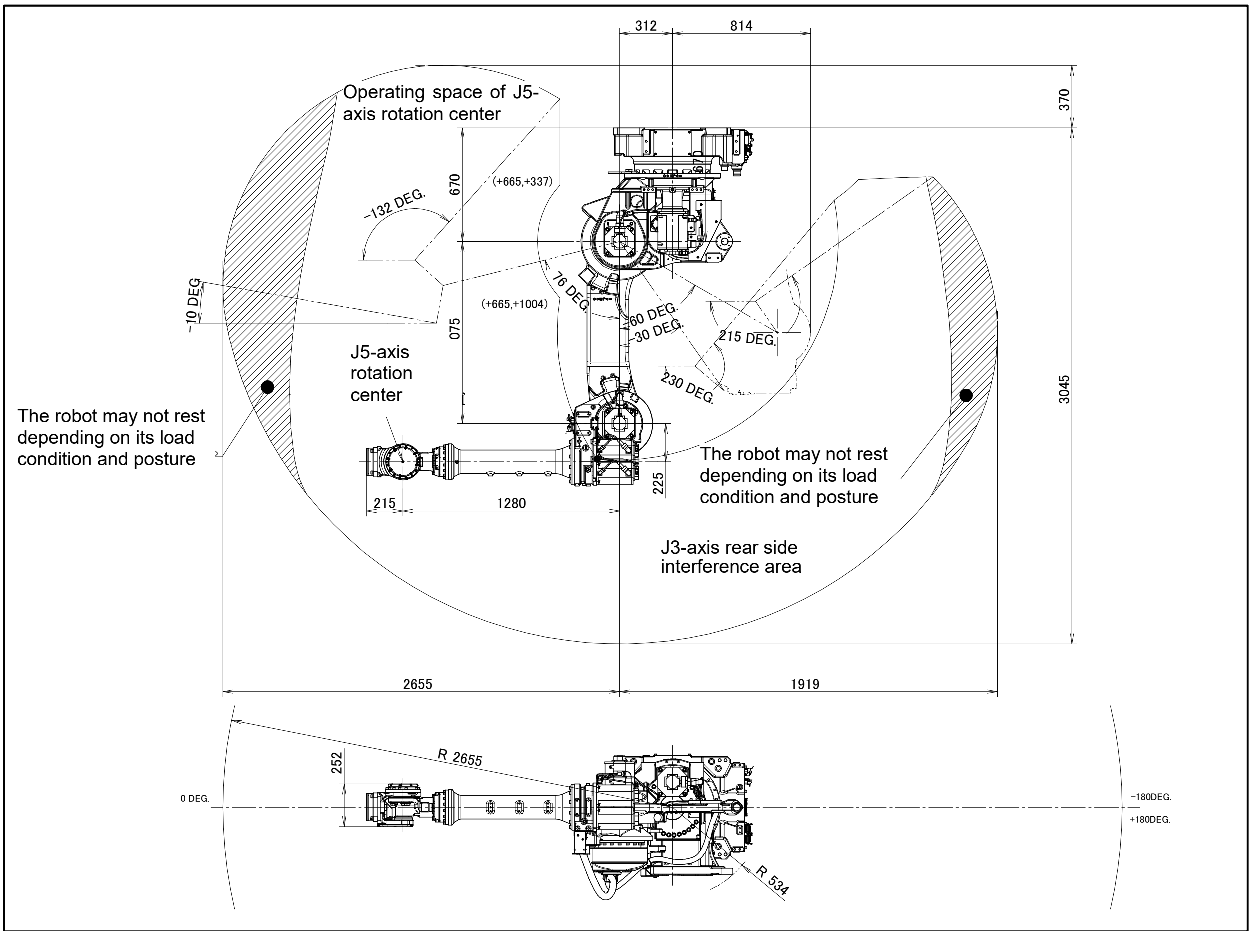


Fig. 3.2 (m) Operating space (R-2000*i*B/150U)

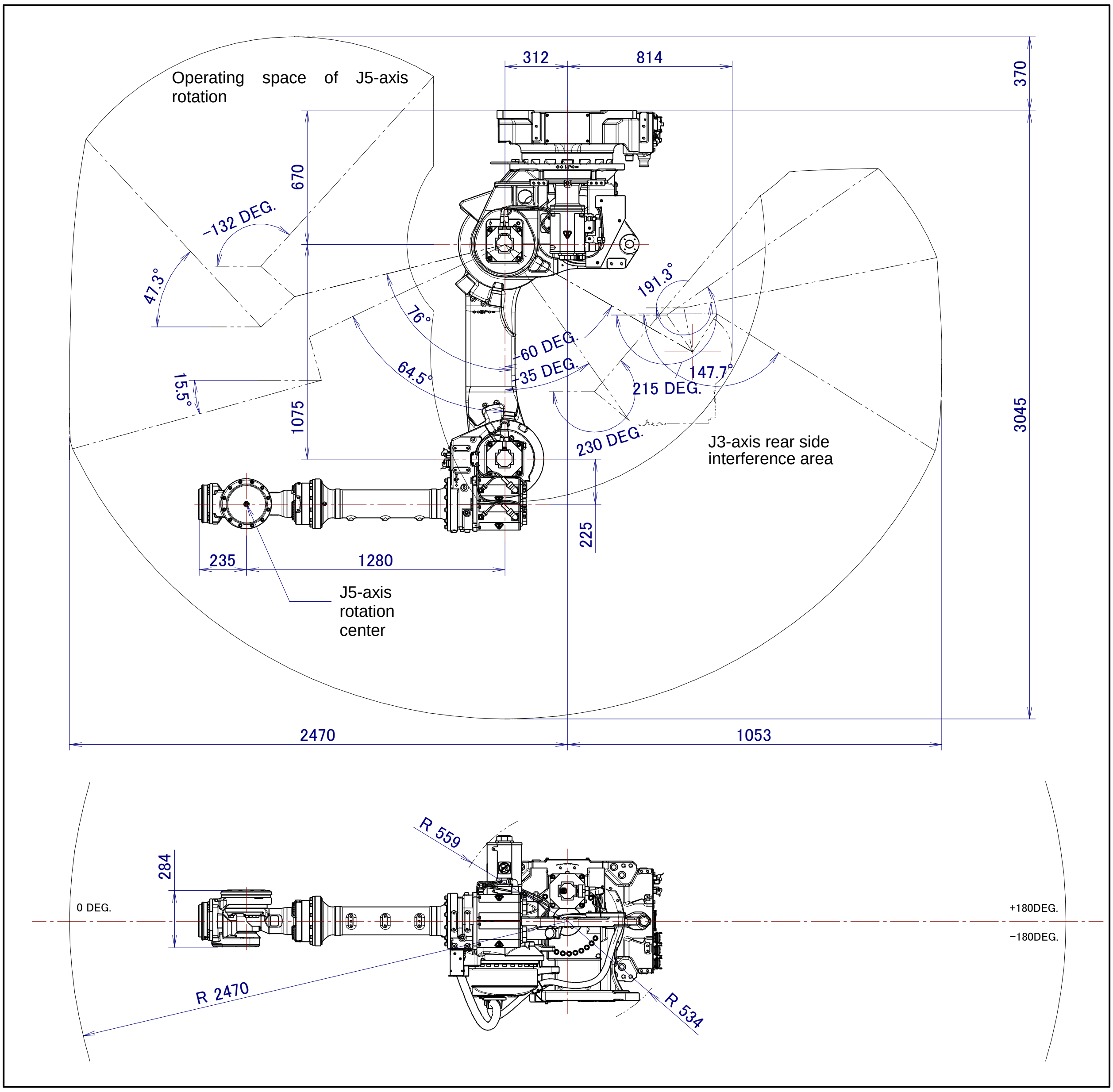


Fig. 3.2 (n) Operating space (R-2000*i*B/220U)

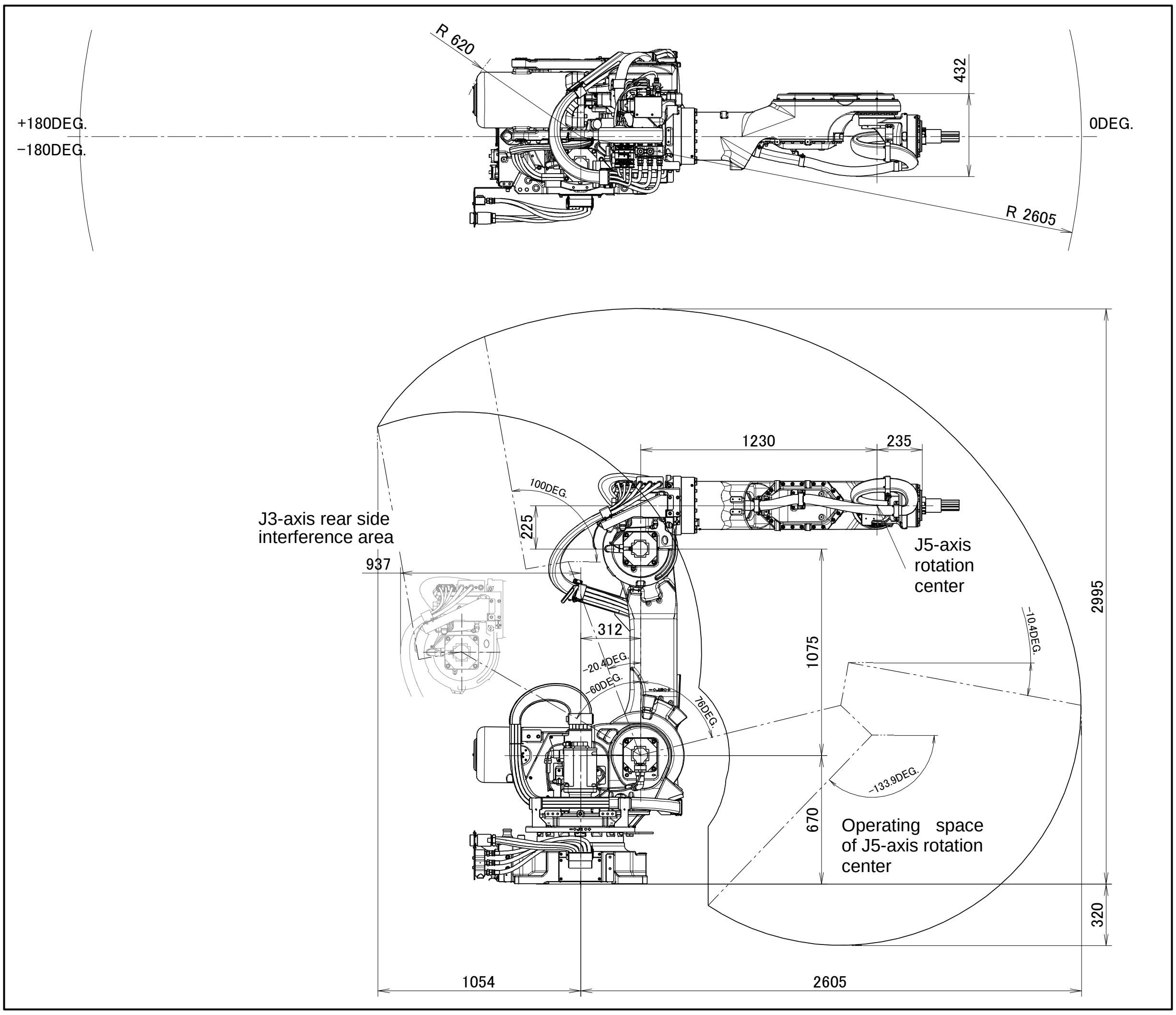


Fig. 3.2 (o) Operating space (R-2000*i*B/210FS)

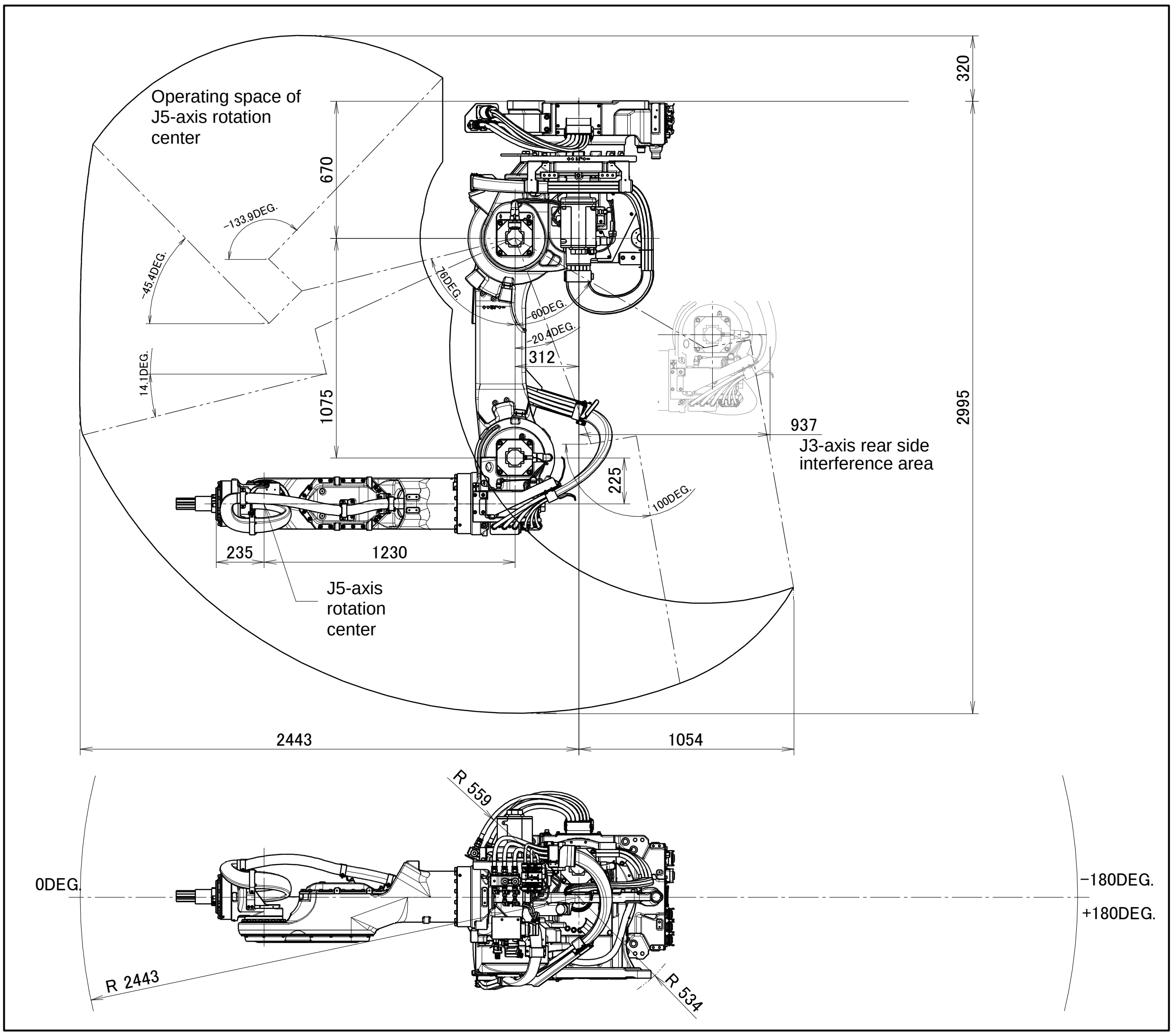


Fig. 3.2 (p) Operating space (R-2000*i*B/220US)

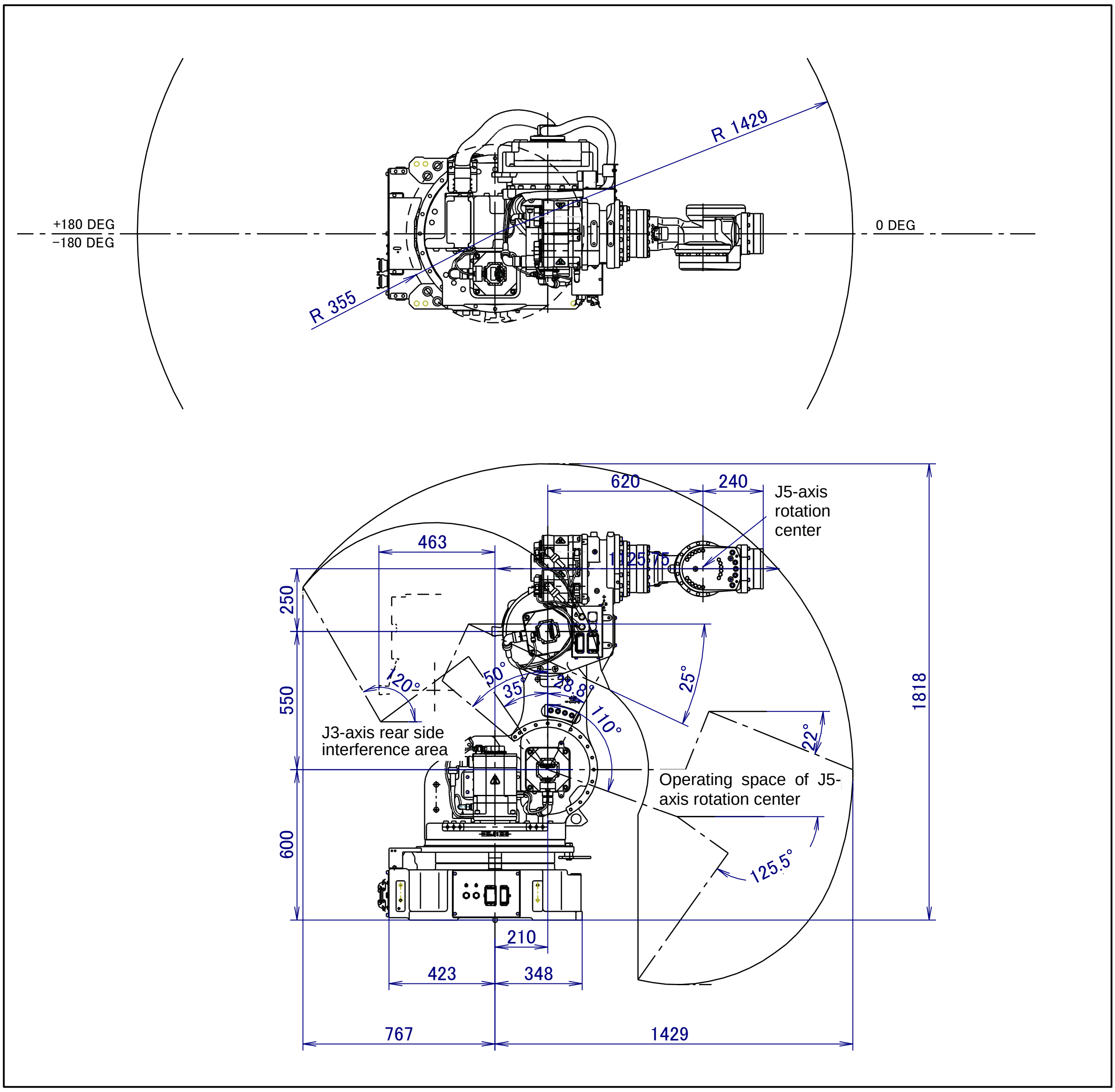


Fig. 3.2 (q) Operating space (R-2000*i*B/165CF)

3.3 ZERO POINT POSITION AND MOTION LIMIT

Zero point and motion range are provided for each controlled axis. Exceeding the software motion limit of a controlled axis is called overtravel (OT). Overtravel is detected at both ends of the motion limit for each axis. The robot cannot exceed the motion range unless there is a loss of zero point position due to abnormalities in servo system or system error. In addition, the motion range limit by a mechanical stopper or limit switch is also prepared to improve safety.

Only in case of J1 for R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/210FS/220US robot stops by transforming mechanical stopper.
In case of J1 to J3 for R-2000*i*B/165CF, robot stops by transforming mechanical stopper.
Be sure to replace transformed stopper to new one. Don’t reconstruct the mechanical stopper. There is a possibility that the robot doesn't stop normally. Tighten bolts with regulated torque referring to Appendix B [MOUNTING BOLT TORQUE LIST].
Replace mechanical stopper of J1-axis referring to Fig. 3.3 (a) to (c) for R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/210FS/220US.
Replace mechanical stopper of J1 to J3-axis referring to Fig. 3.3 (d) for R-2000*i*B/165CF.

> ⚠ **WARNING**
> Do not reconstruct the fixed mechanical stopper. There is a possibility that the robot doesn't stop normally.

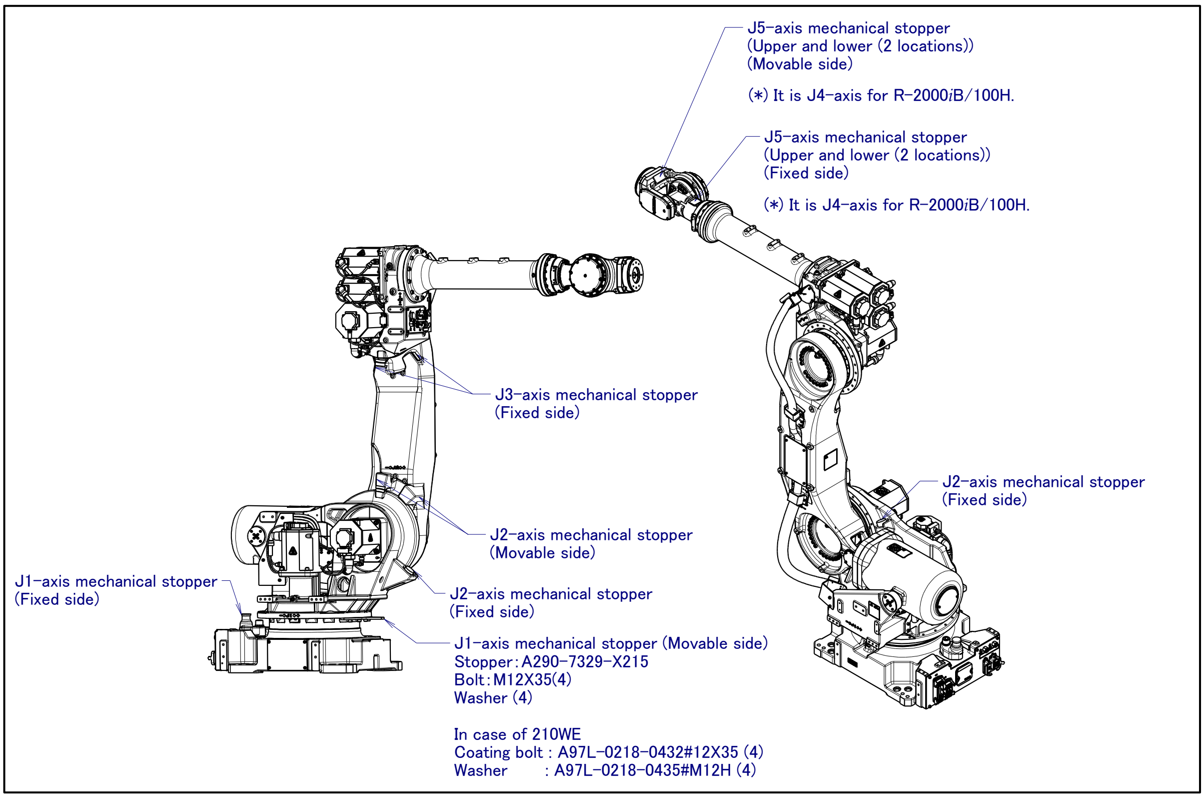


Fig. 3.3 (a) Position of mechanical stopper
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U)

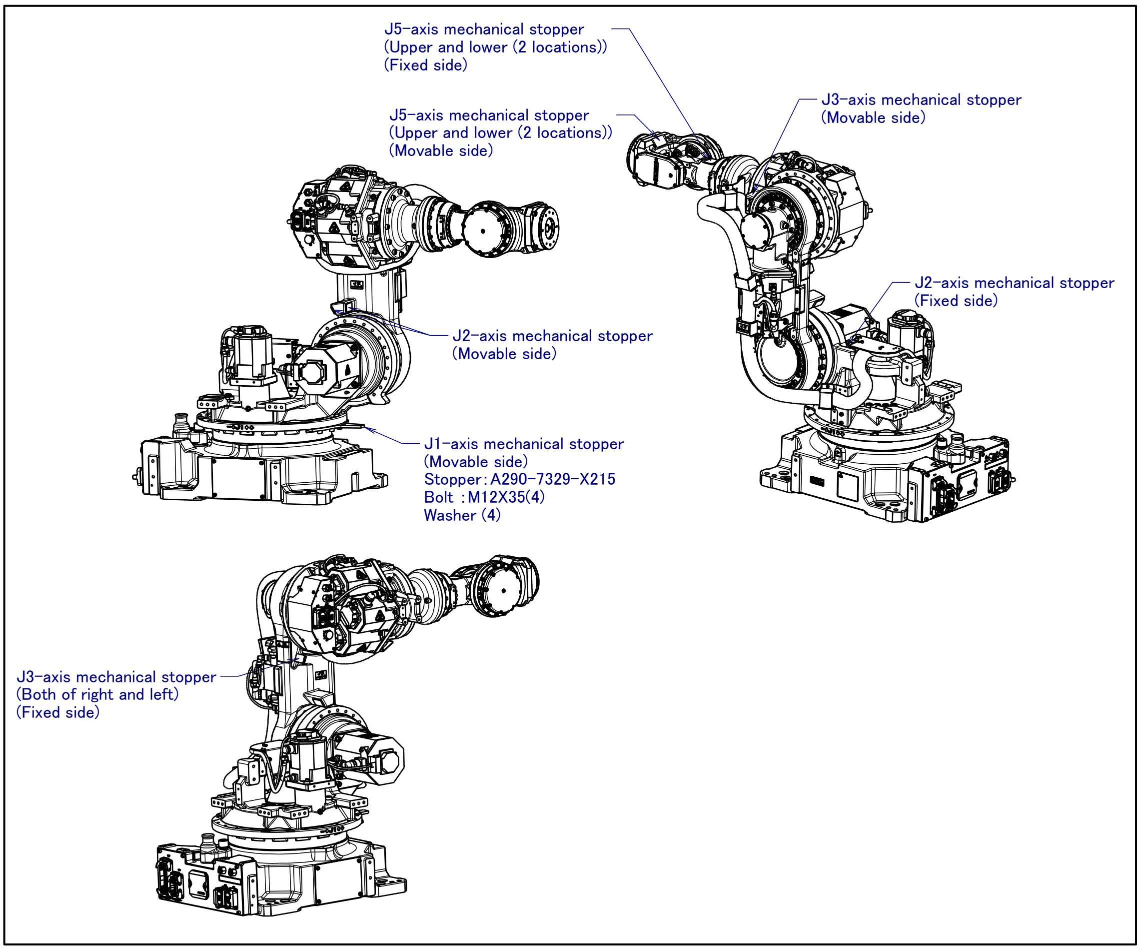


Fig. 3.3 (b) Position of mechanical stopper (R-2000*i*B/170CF)

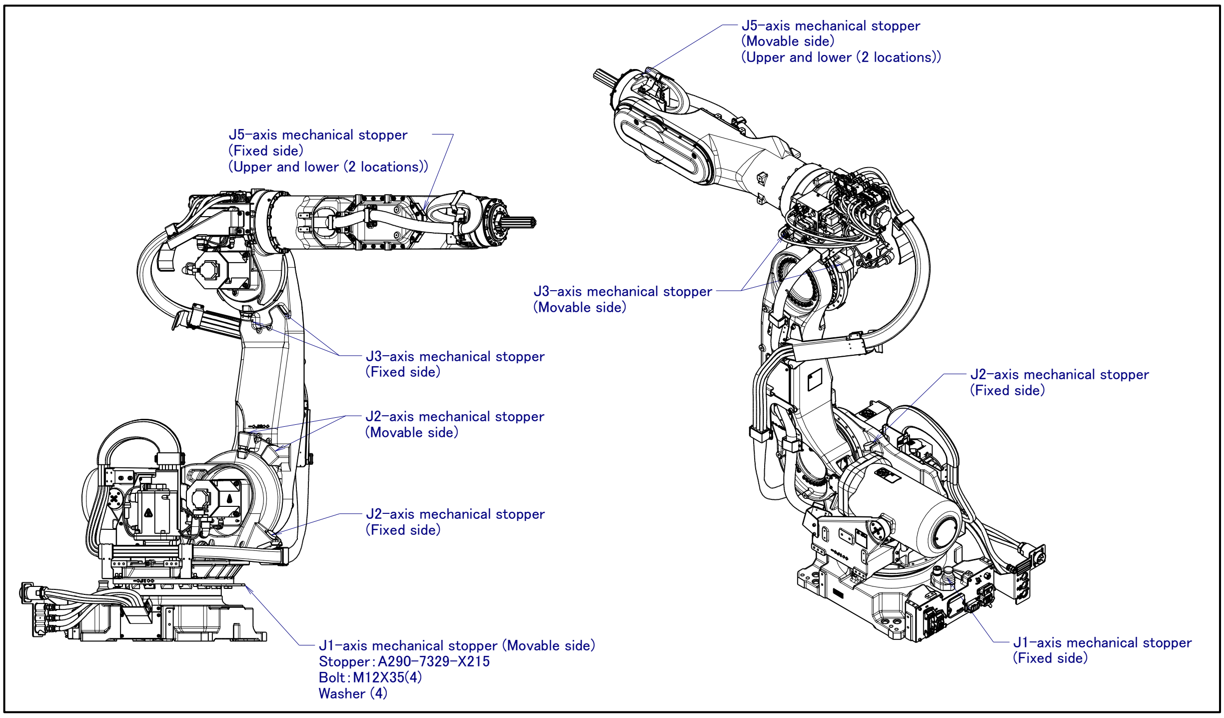


Fig. 3.3 (c) Position of mechanical stopper (R-2000*i*B/210FS/220US)

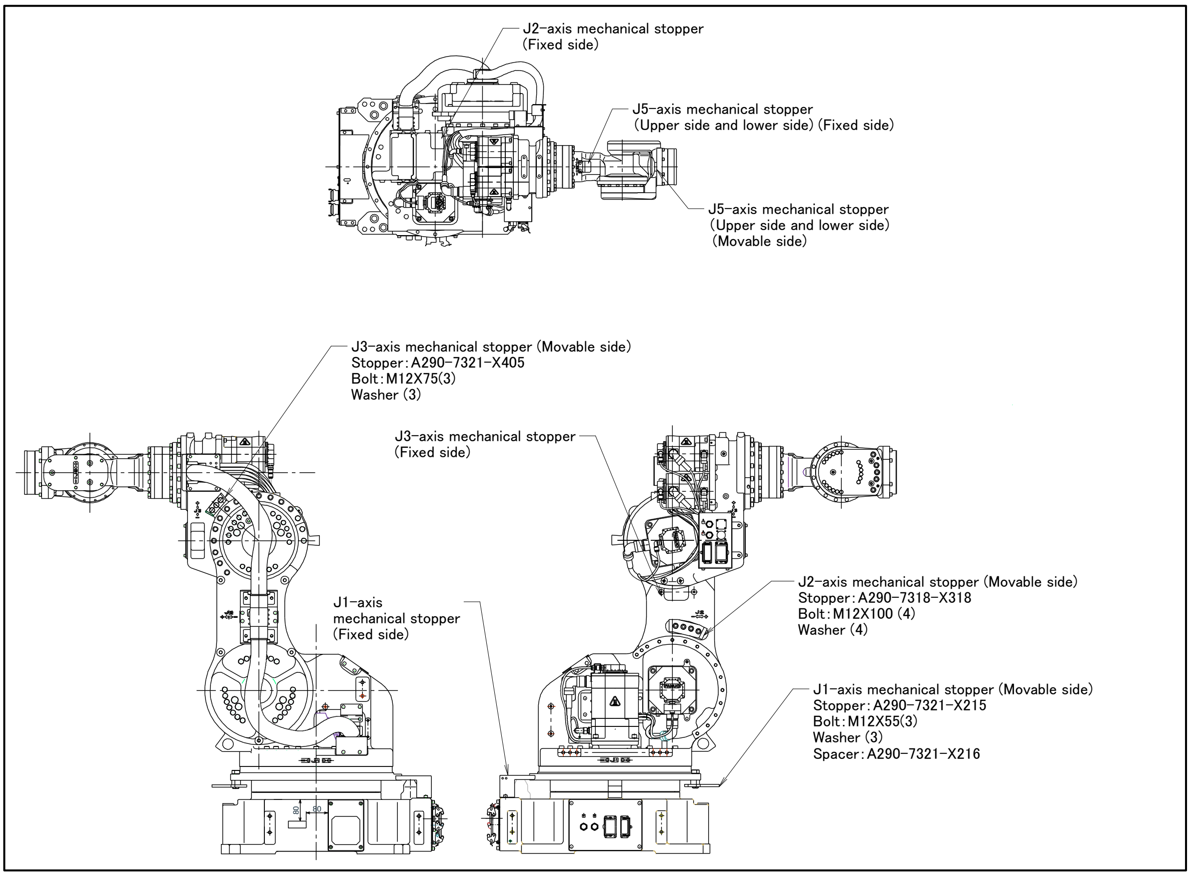


Fig. 3.3 (d) Position of mechanical stopper (R-2000*i*B/165CF)

Fig.3.3 (e) to (r) show the zero point and motion limit, LS detection position, and maximum stopping distance (stopping distance in condition of max.speed and max.load) of each axis.
R-2000*i*B/210WE does not support limit switch option.

* The motion range can be changed. For information on how to change the motion range, see Chapter 6, "AXIS LIMIT SETUP".

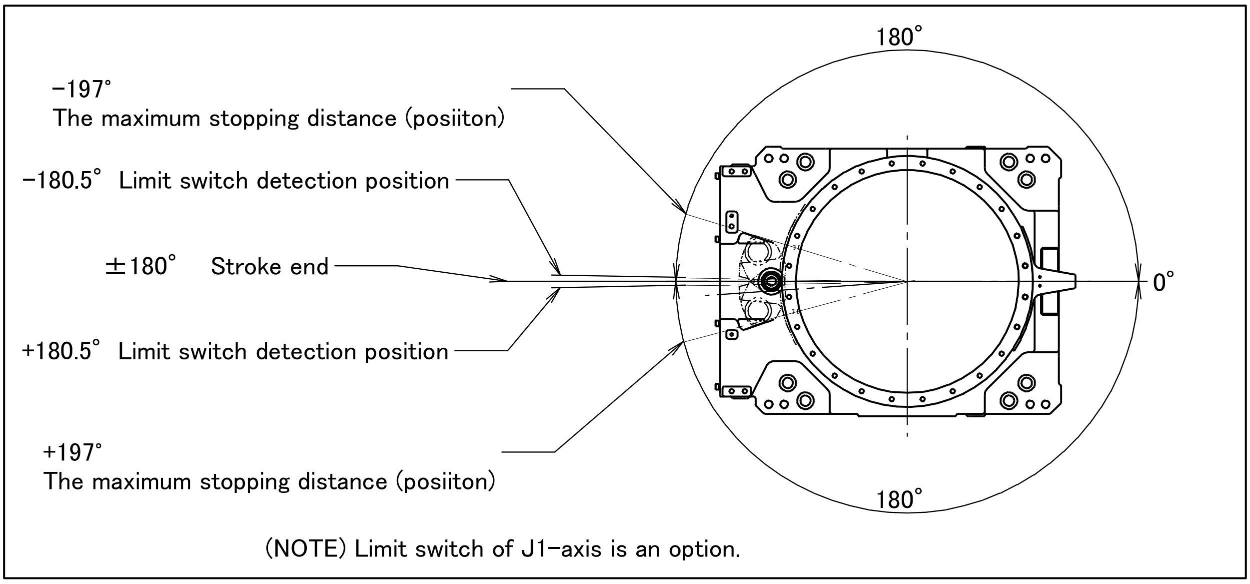


Fig. 3.3 (e) J1-axis motion limit

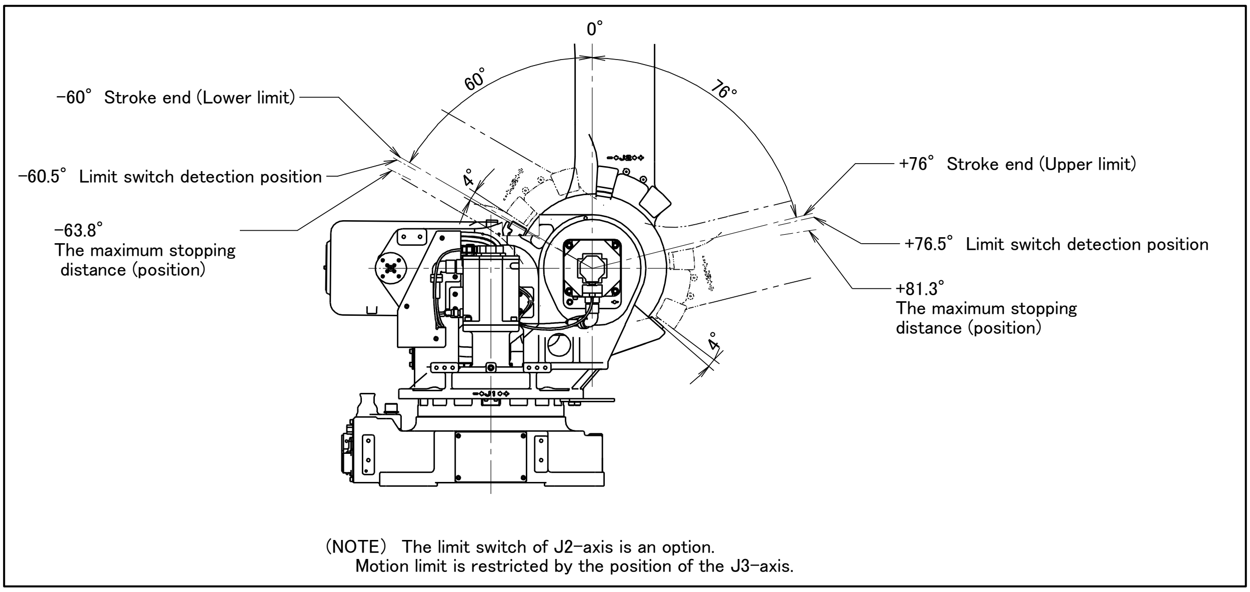


Fig. 3.3 (f) J2-axis motion limit
(R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U/210FS/220US)

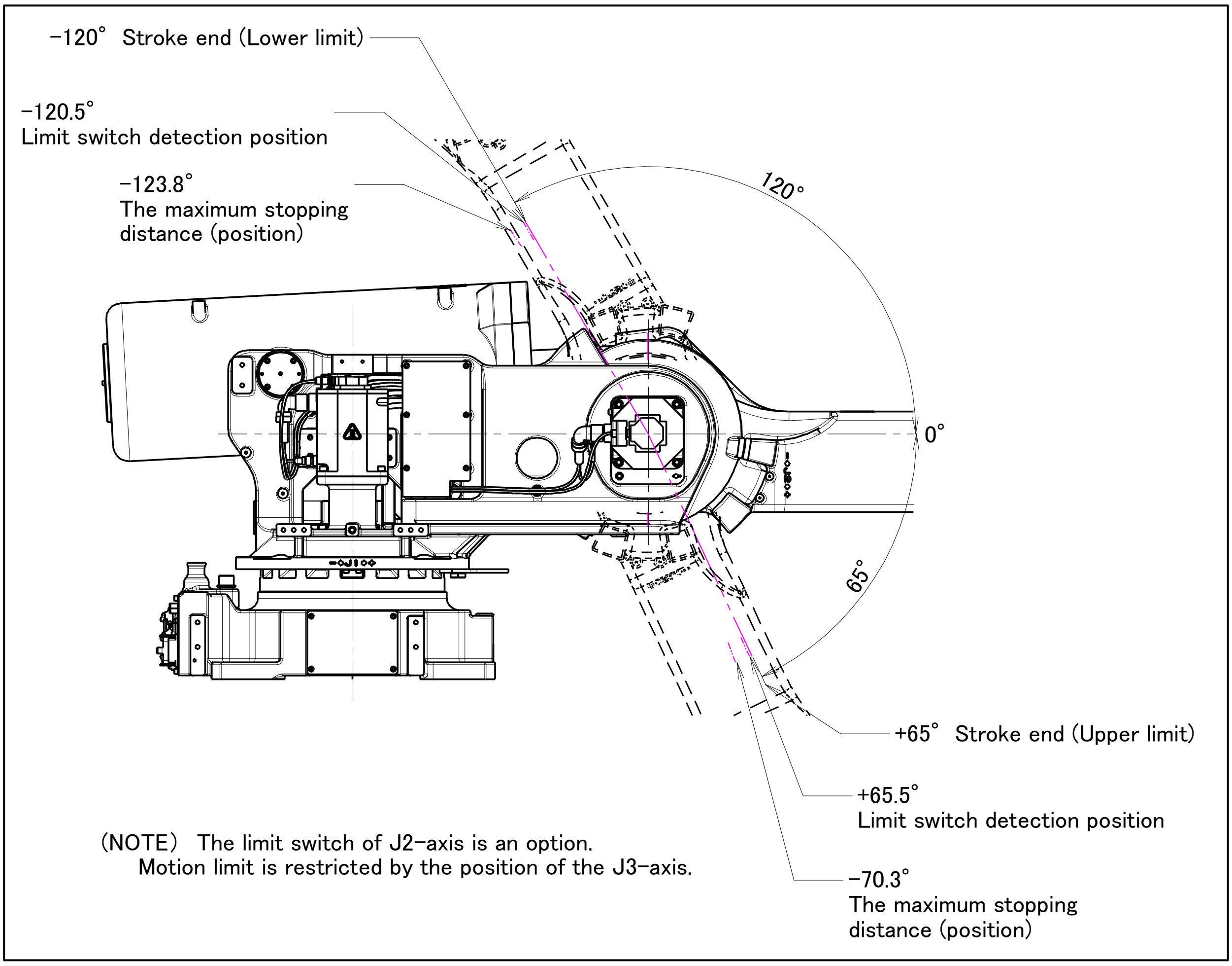


Fig. 3.3 (g) J2-axis motion limit (R-2000*i*B/165R/200R/100P)

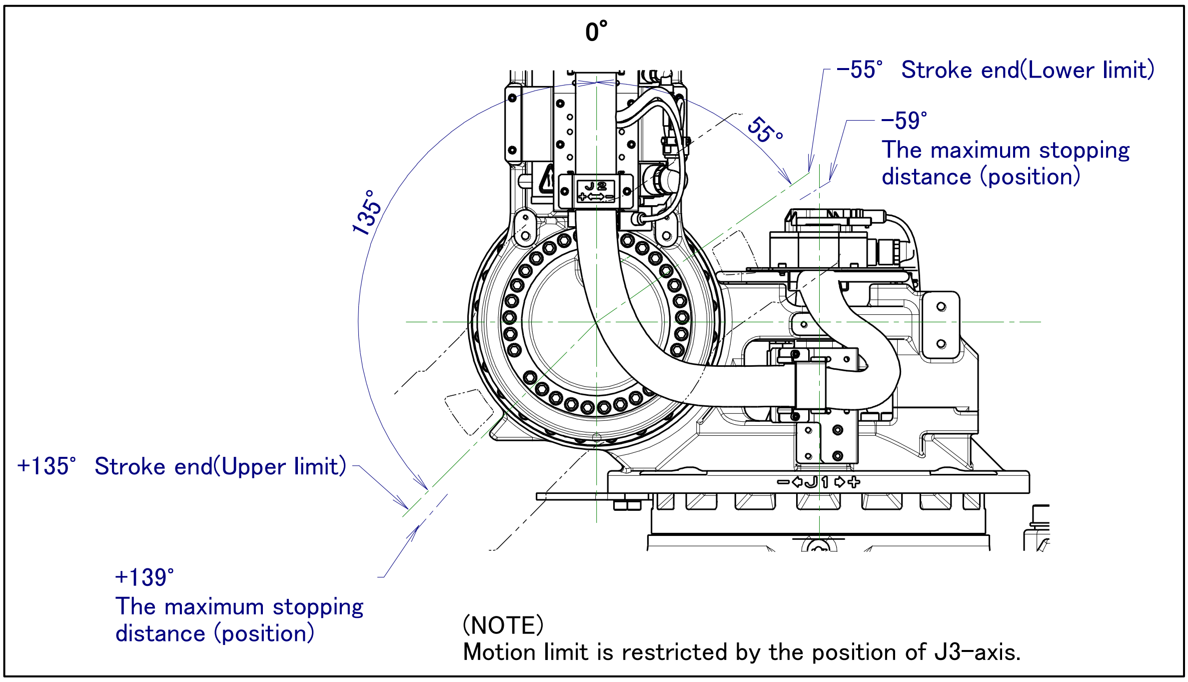


Fig. 3.3 (h) J2-axis motion limit (R-2000*i*B/170CF)

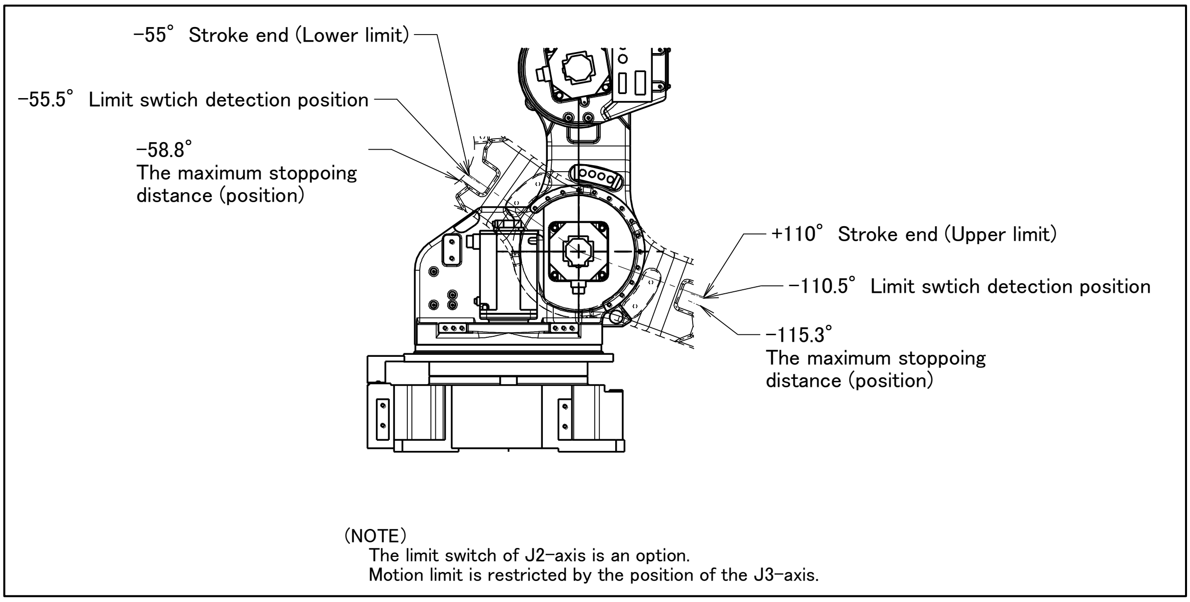


Fig. 3.3 (i) J2-axis motion limit (R-2000*i*B/165CF)

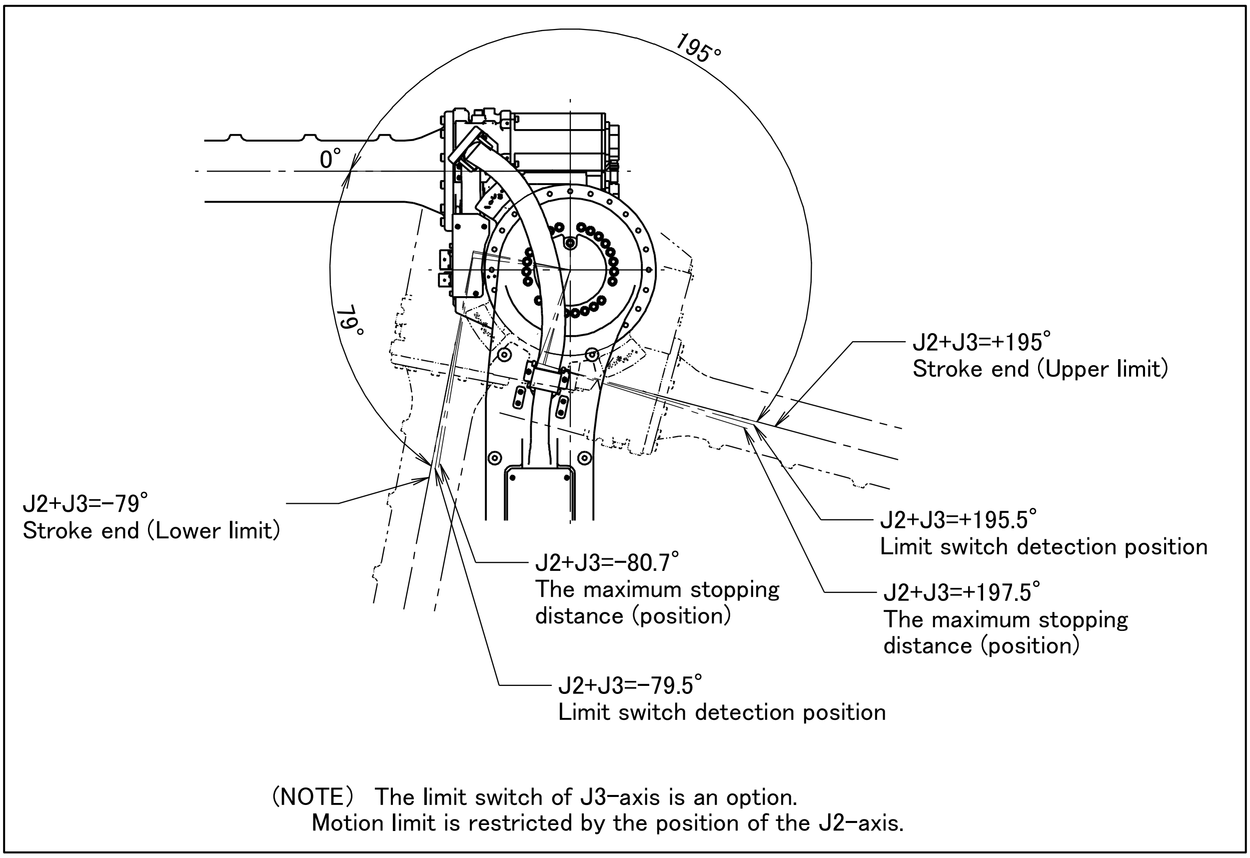


Fig. 3.3 (j) J3-axis motion limit
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U)

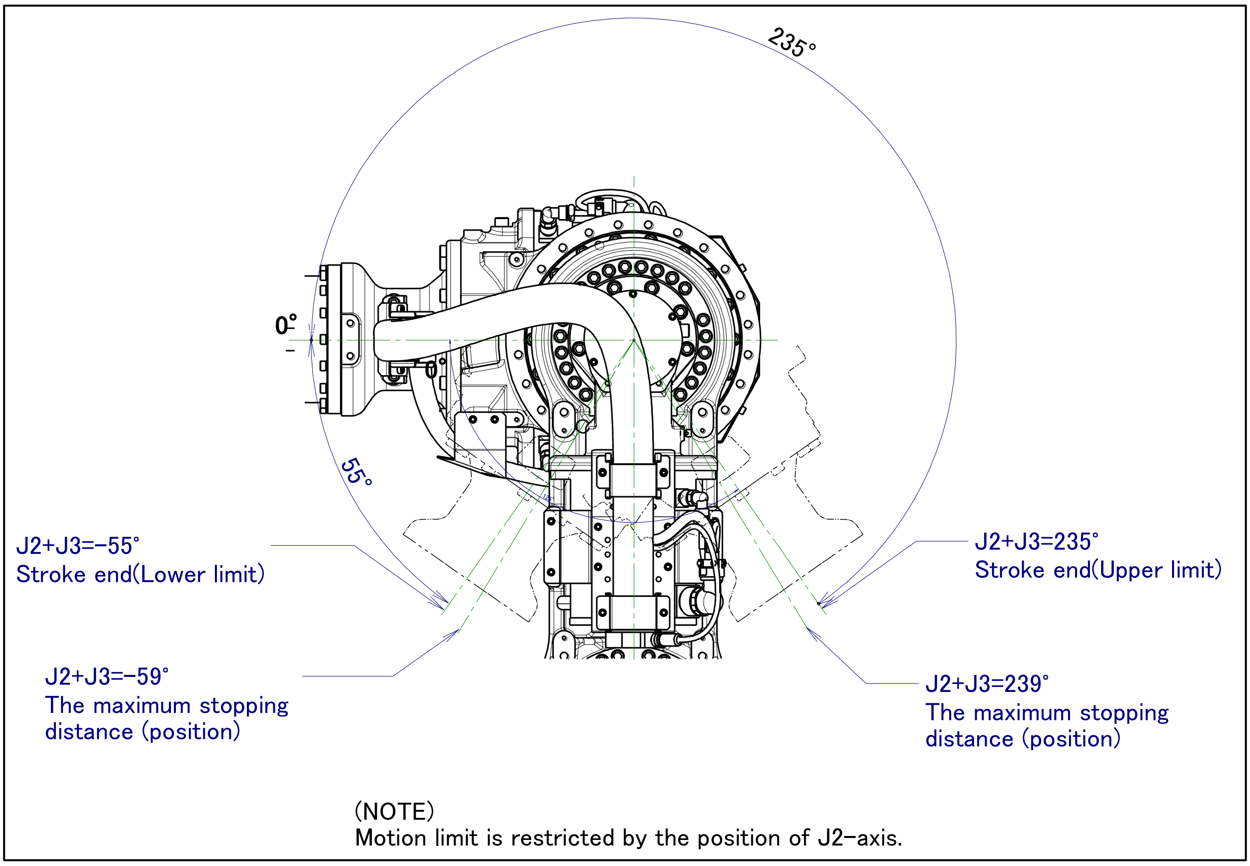


Fig. 3.3 (k) J3-axis motion limit (R-2000*i*B/170CF)

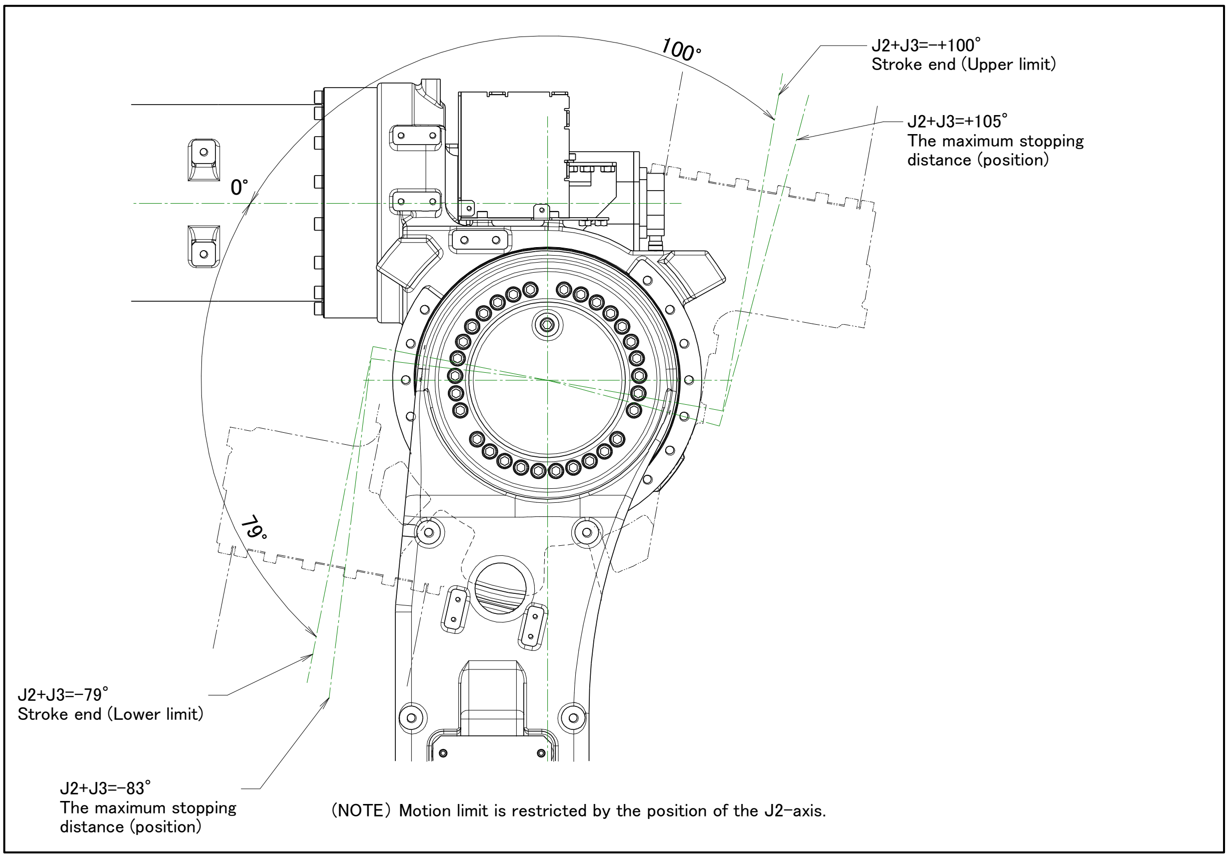


Fig. 3.3 (l) J3-axis motion limit (R-2000*i*B/210FS/220US)

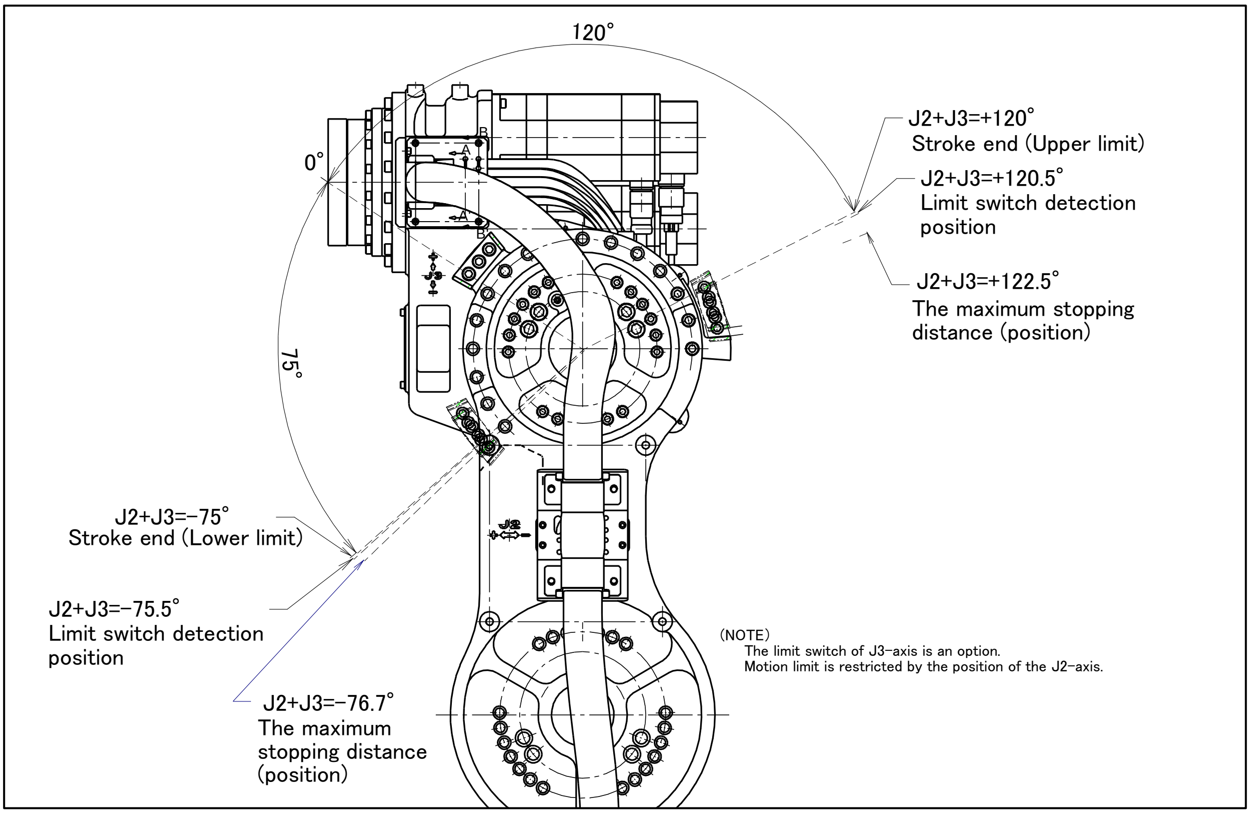


Fig. 3.3 (m) J3-axis motion limit (R-2000*i*B/165CF)

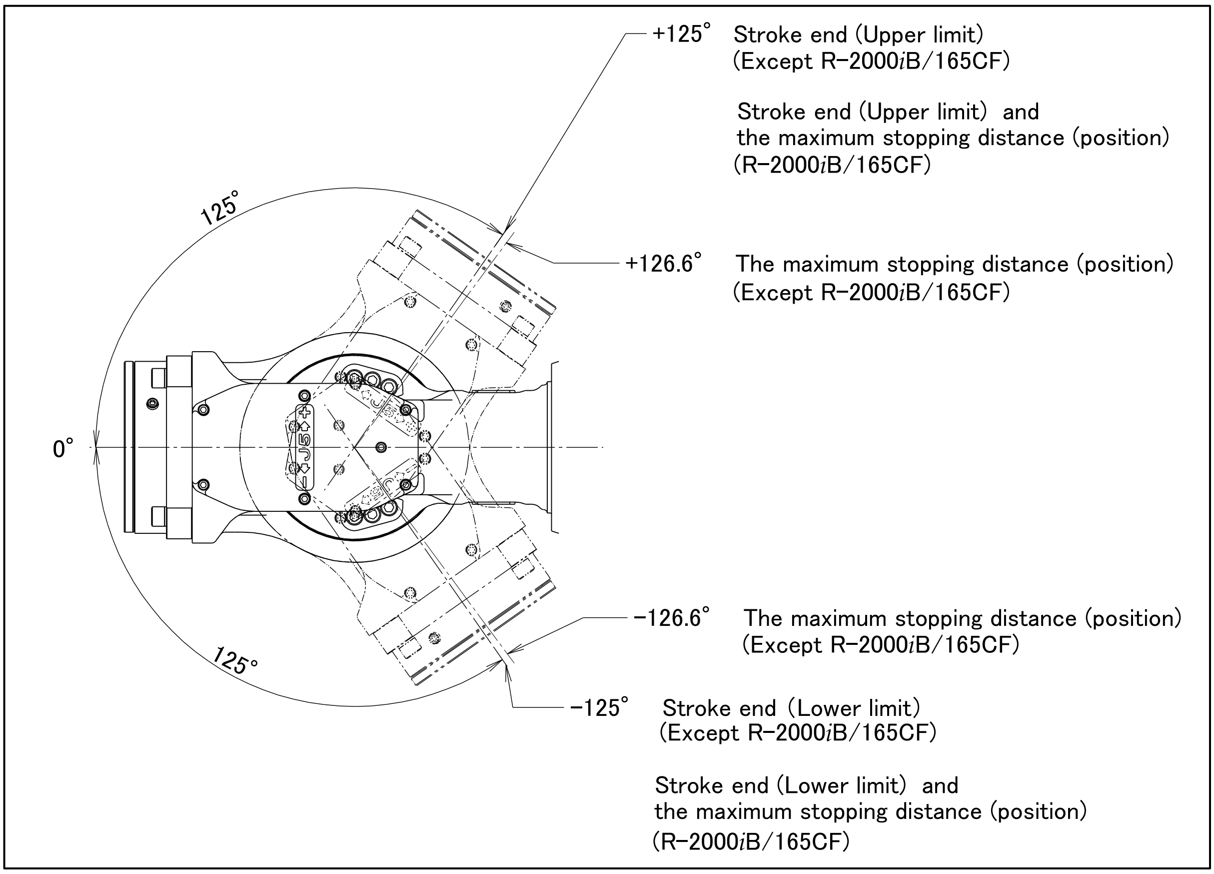
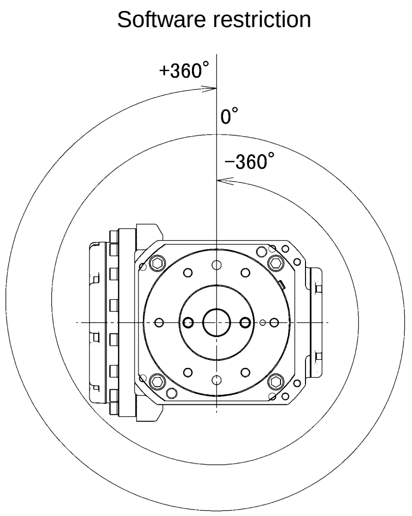
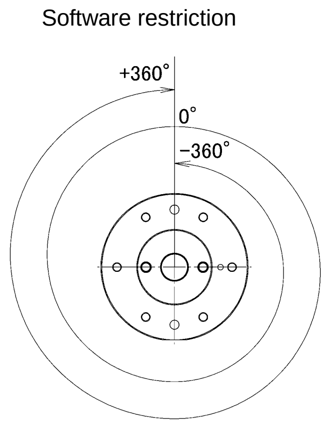


Fig. 3.3 (n) J5-axis motion limit (It is J4-axis for R-2000*i*B/100H)



(NOTE)
J4-axis does not have the limit switch
and the mechanical stopper.



(NOTE)
J6-axis does not have the limit switch
and the mechanical stopper.

Fig. 3.3 (o) J4-axis motion limit (except R-2000*i*B/100H/210FS/220US)

Fig. 3.3 (p) J6-axis motion limit (It is J5-axis for R-2000*i*B/100H except 210FS/220US)

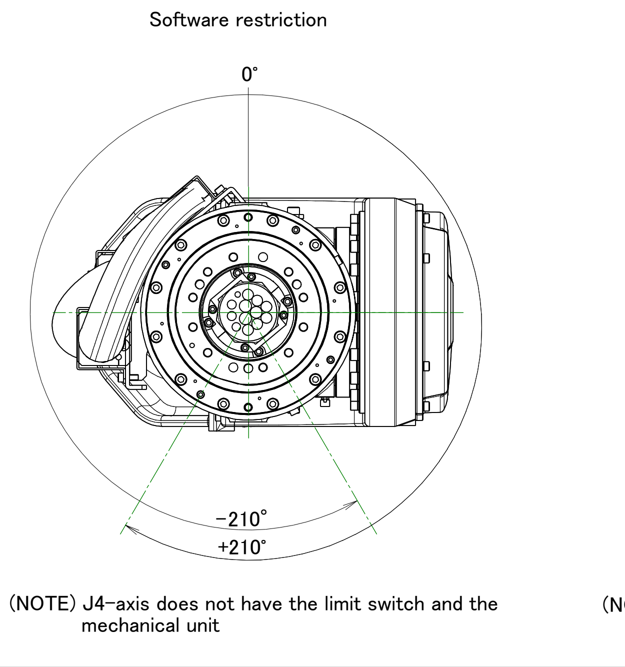


Fig. 3.3 (q) J4-axis motion limit
(R-2000*i*B/210FS/220US)

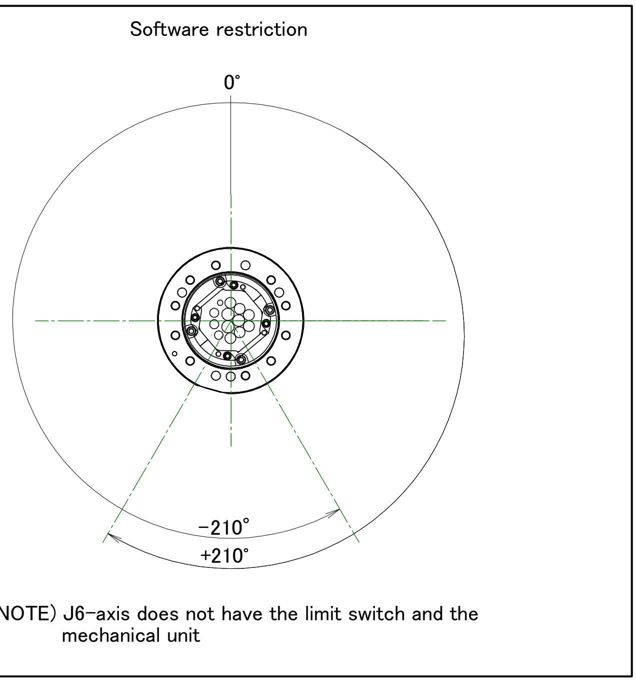


Fig. 3.3 (r) J6-axis motion limit
(R-2000*i*B/210FS/220US)

3.4 WRIST LOAD CONDITIONS

Fig. 3.4 (a) to (ad) are diagrams showing the allowable load that can be applied to the wrist section.

- Apply a load within the region indicated in the graph.
- Apply the conditions of the allowable load moment and the allowable load inertia. See Section 3.1 about the allowable load moment and the allowable load inertia.
- See Section 4.1 about mounting of end effector.

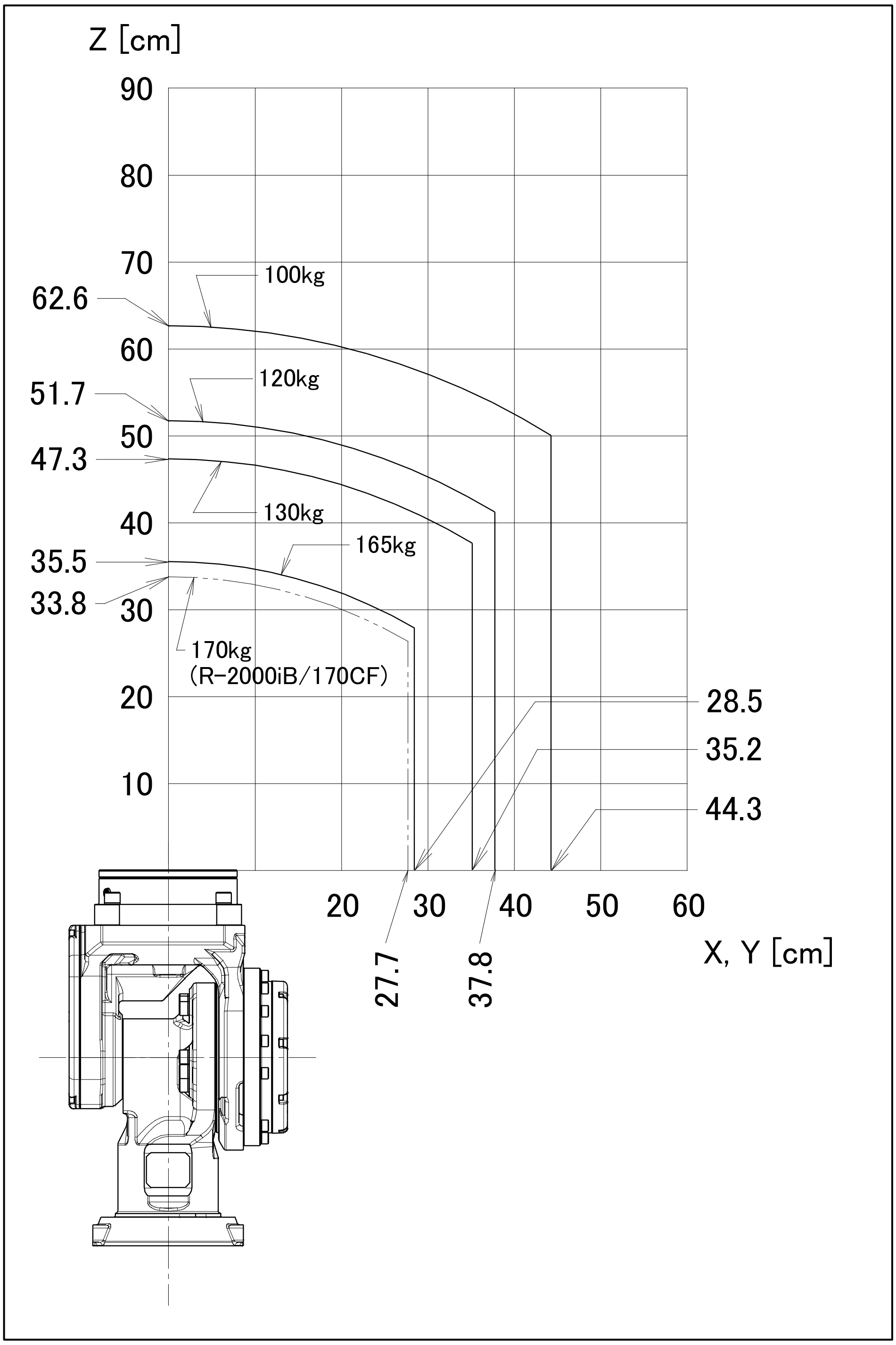


Fig. 3.4 (a) Wrist load diagram (ISO flange) (R-2000*i*B/165F/165R/170CF)

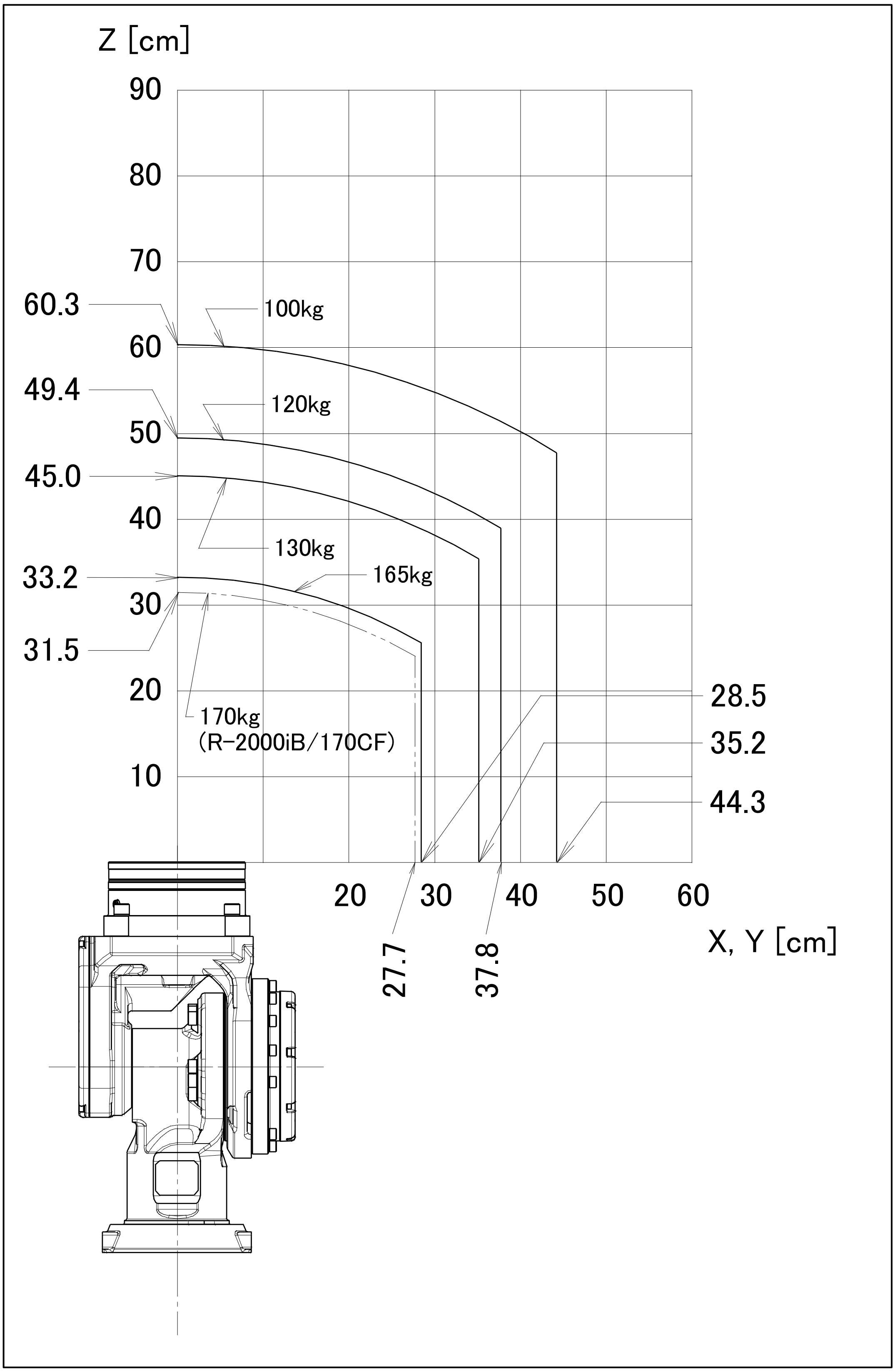


Fig. 3.4 (b) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/165F/165R/170CF)

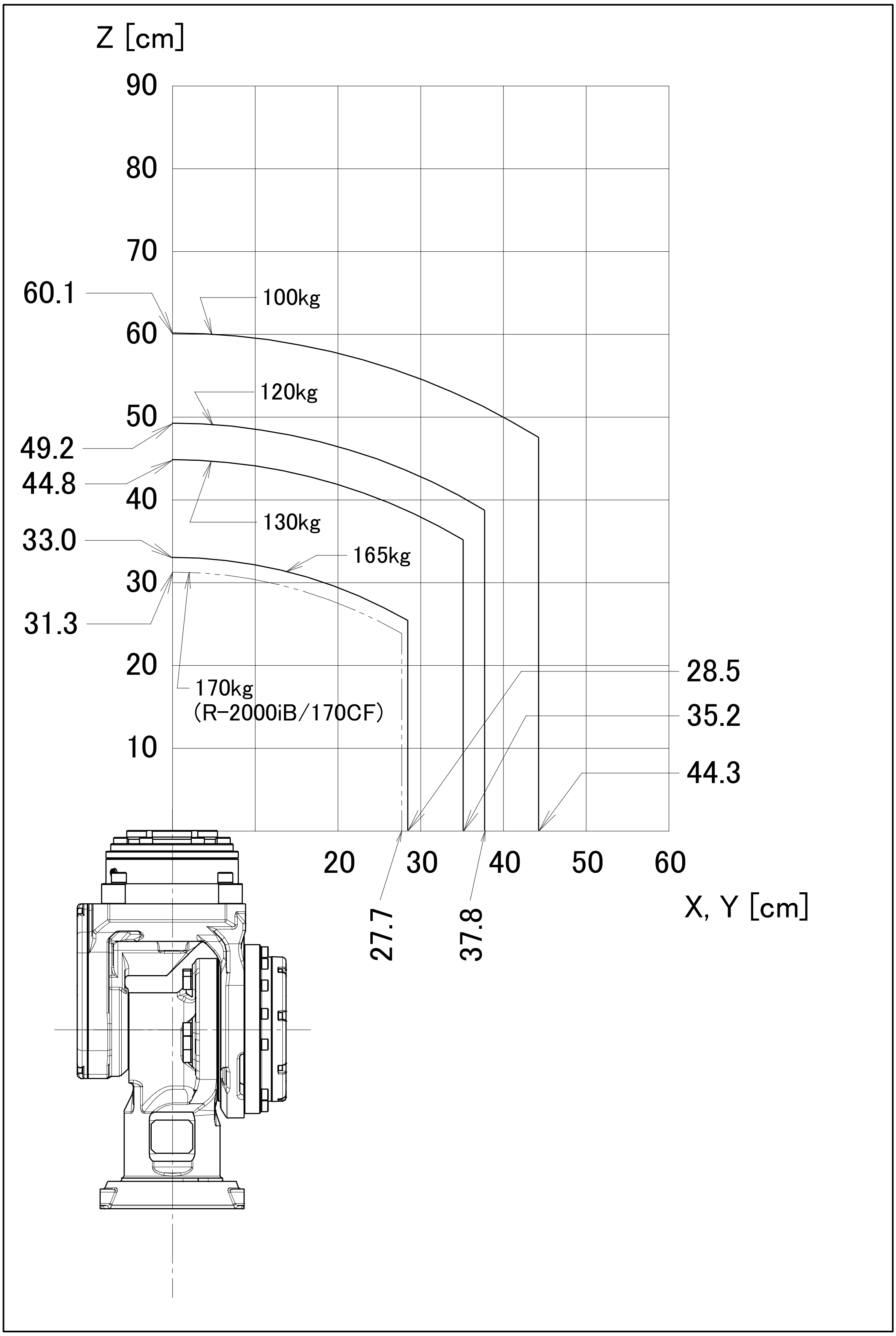


Fig. 3.4 (c) Wrist load diagram (FANUC / special flange) (R-2000*i*B/165F/165R/170CF)

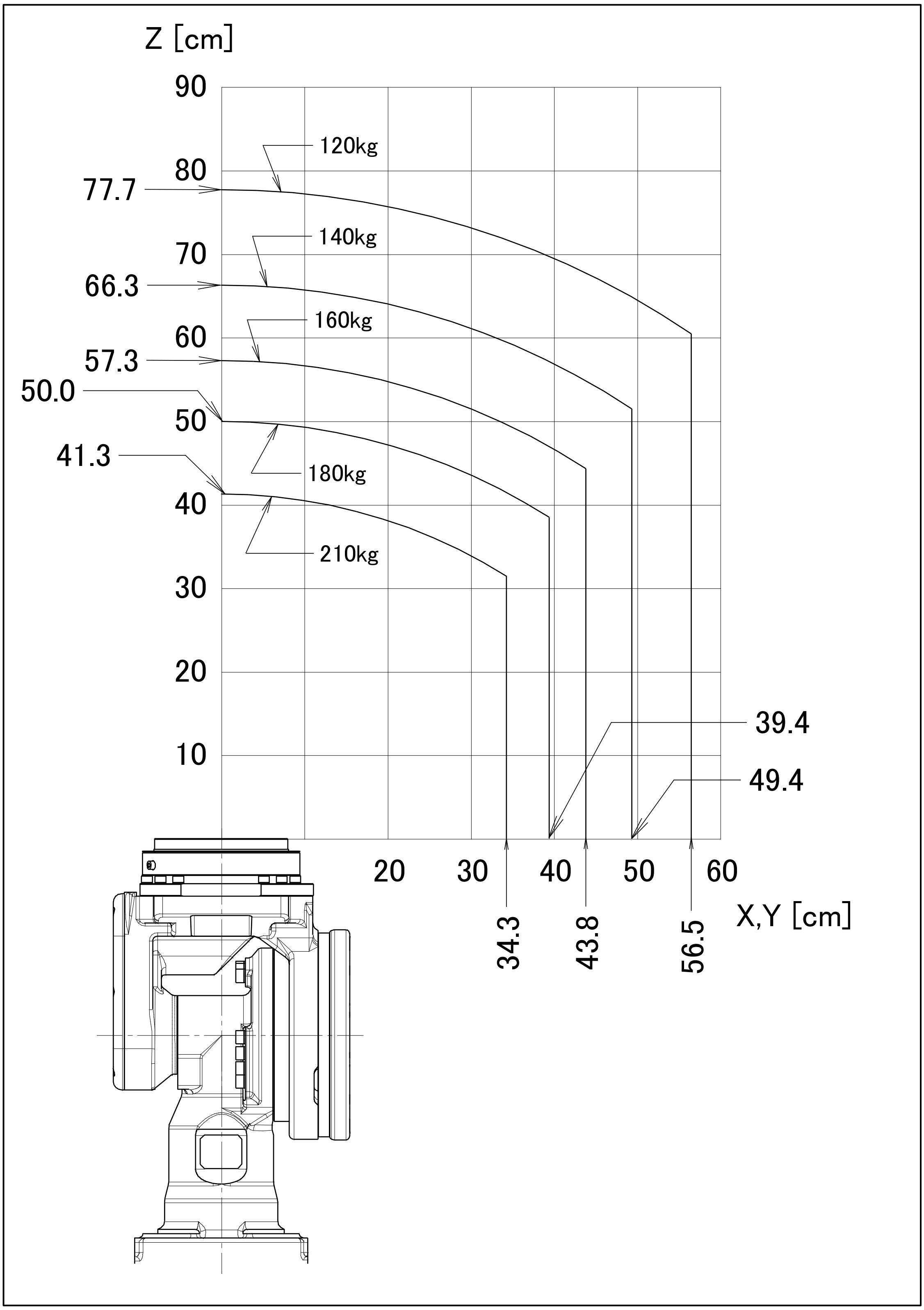


Fig. 3.4 (d) Wrist load diagram (ISO flange) (R-2000*i*B/210F/200R/210WE)

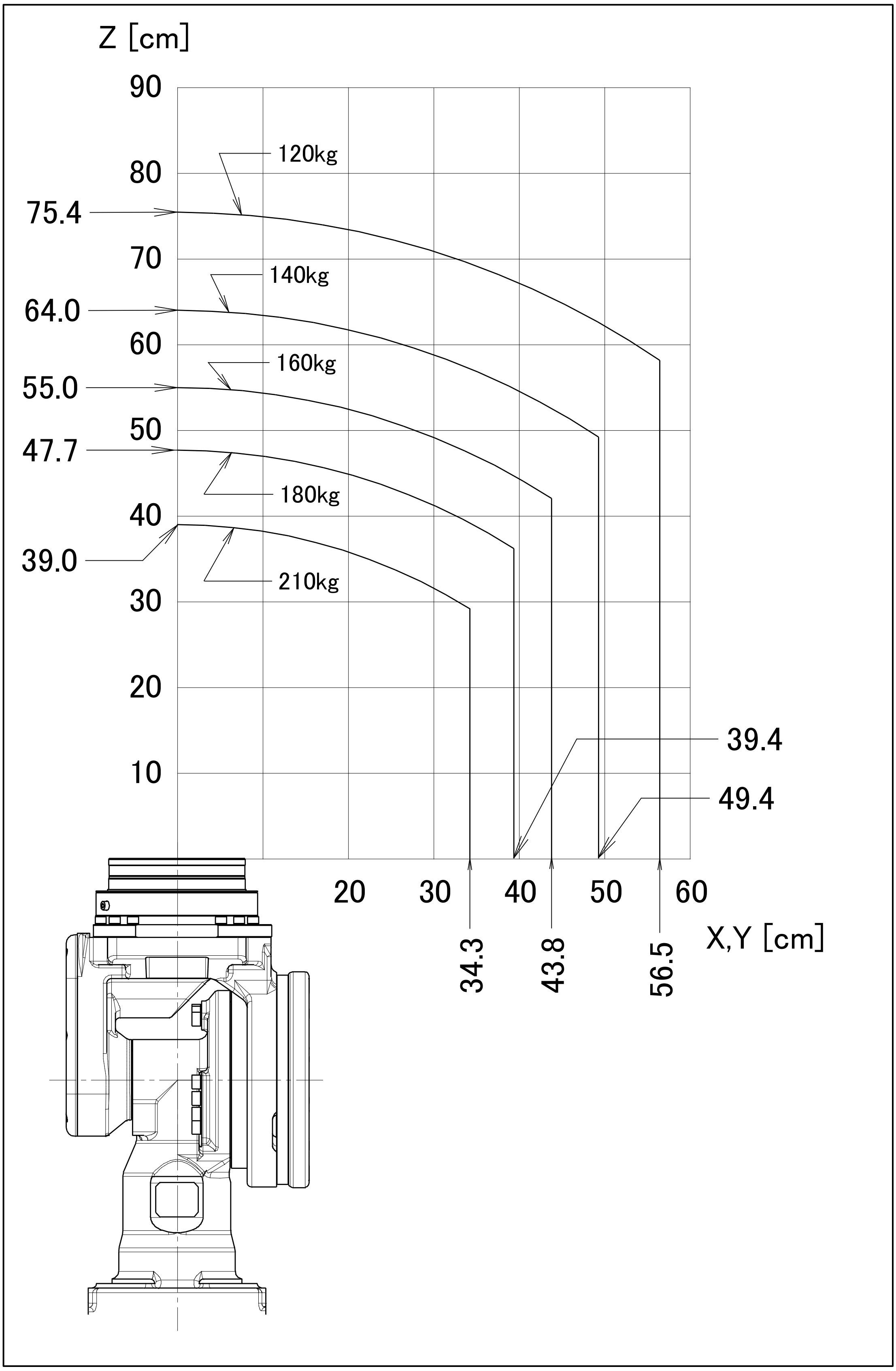


Fig. 3.4 (e) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/210F/200R)

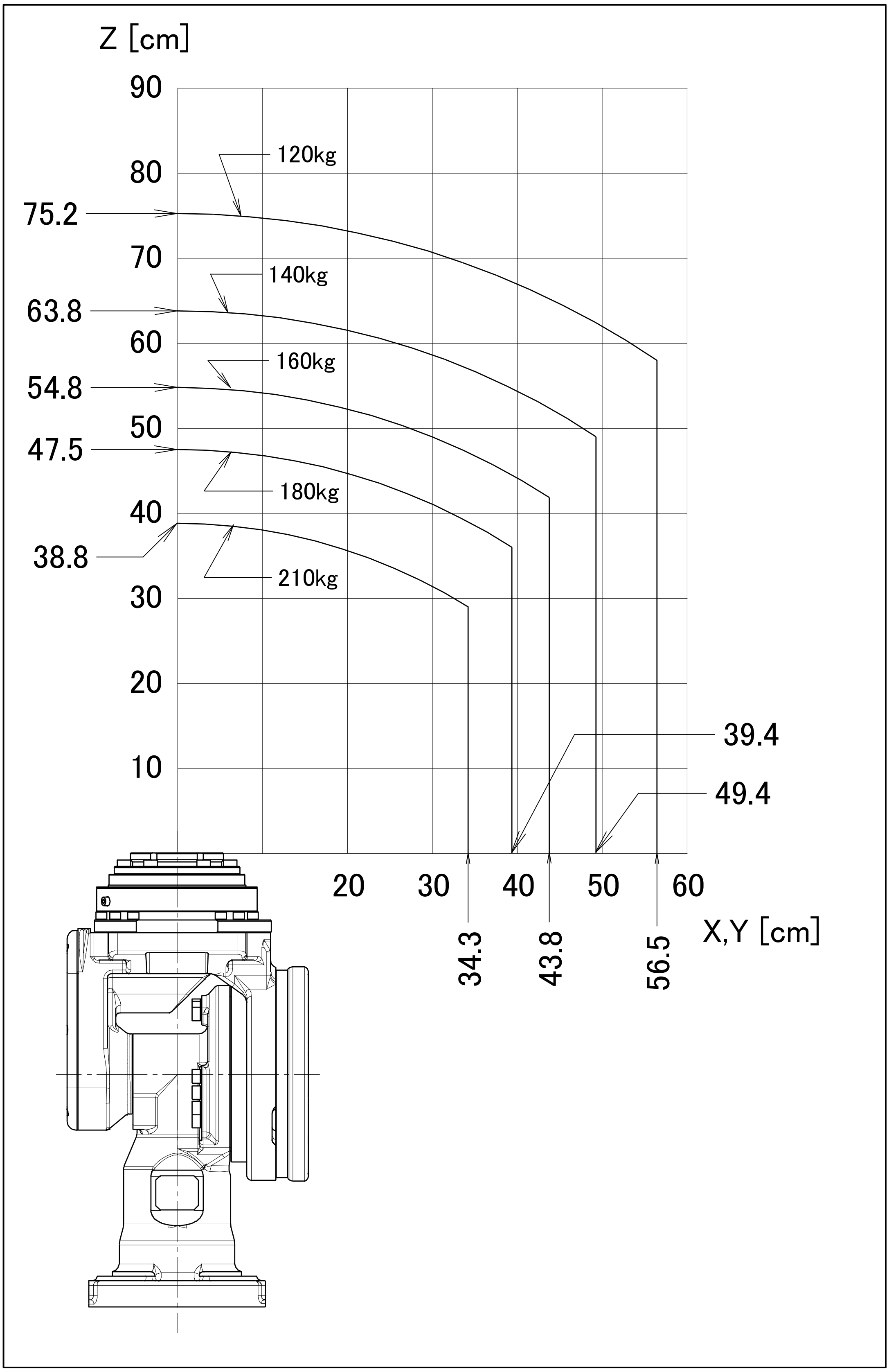


Fig. 3.4 (f) Wrist load diagram (FANUC / special flange) (R-2000*i*B/210F/200R)

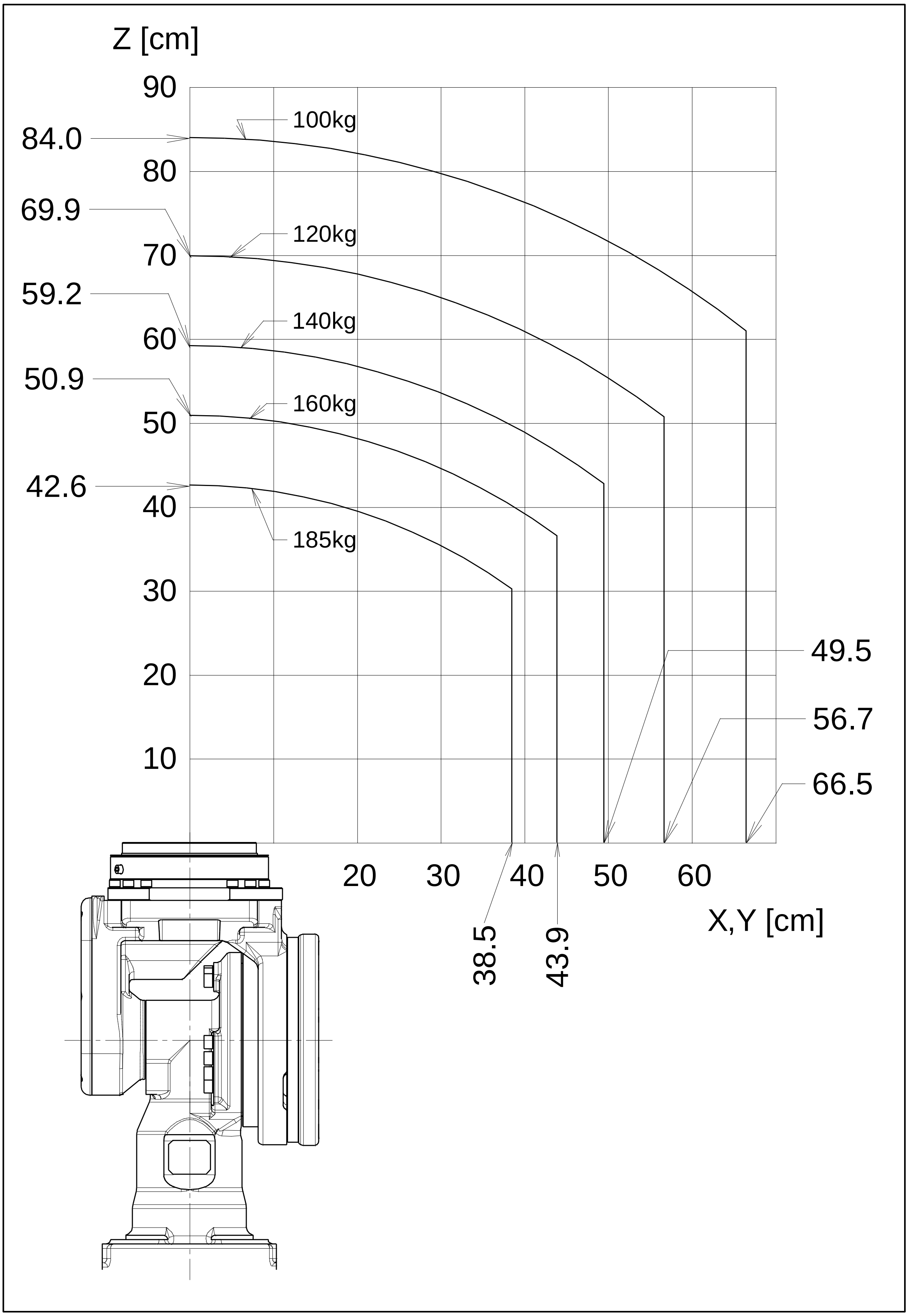


Fig. 3.4 (g) Wrist load diagram (ISO flange) (R-2000*i*B/185L)

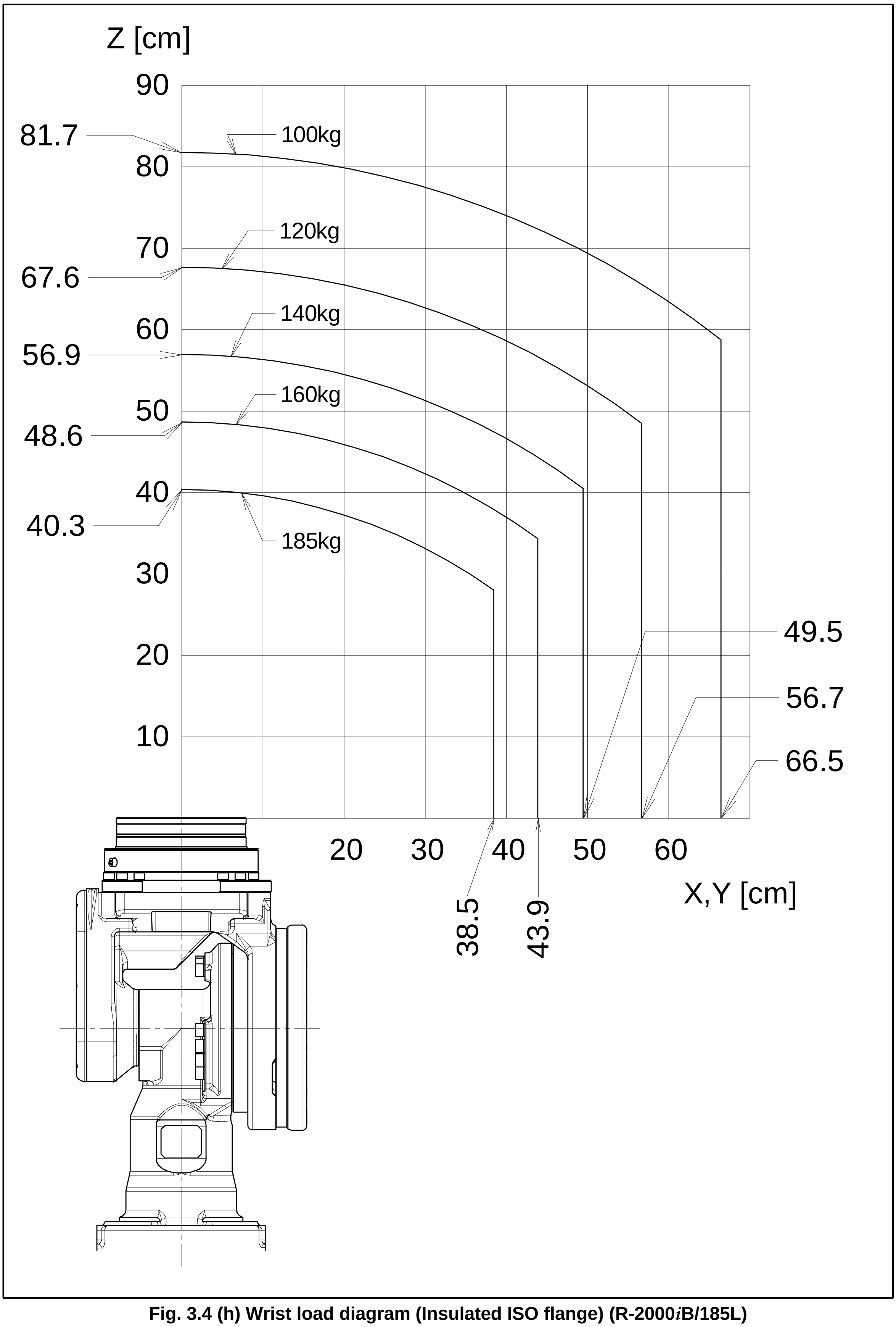


Fig. 3.4 (h) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/185L)

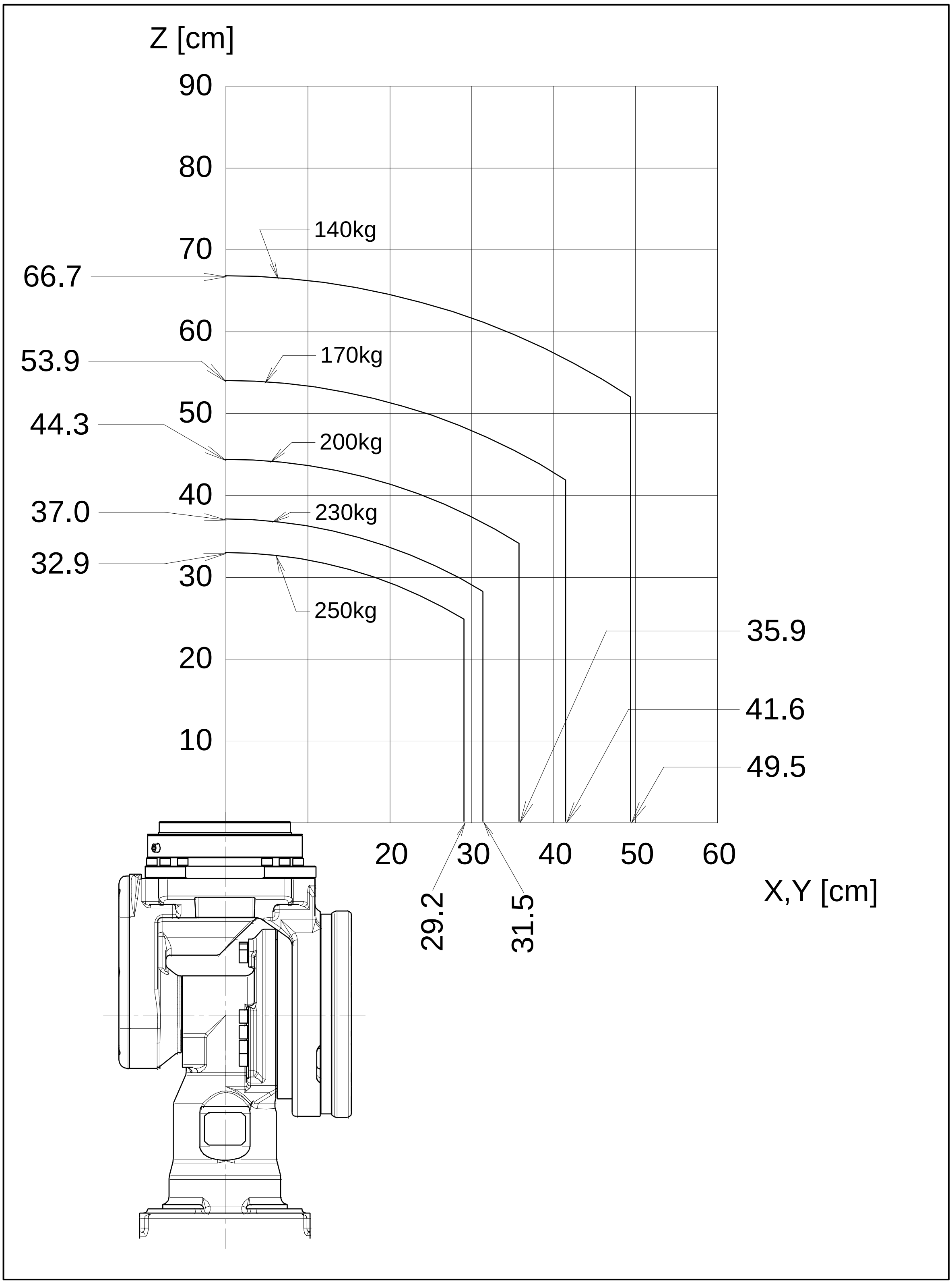


Fig. 3.4 (i) Wrist load diagram (ISO flange) (R-2000*i*B/250F)

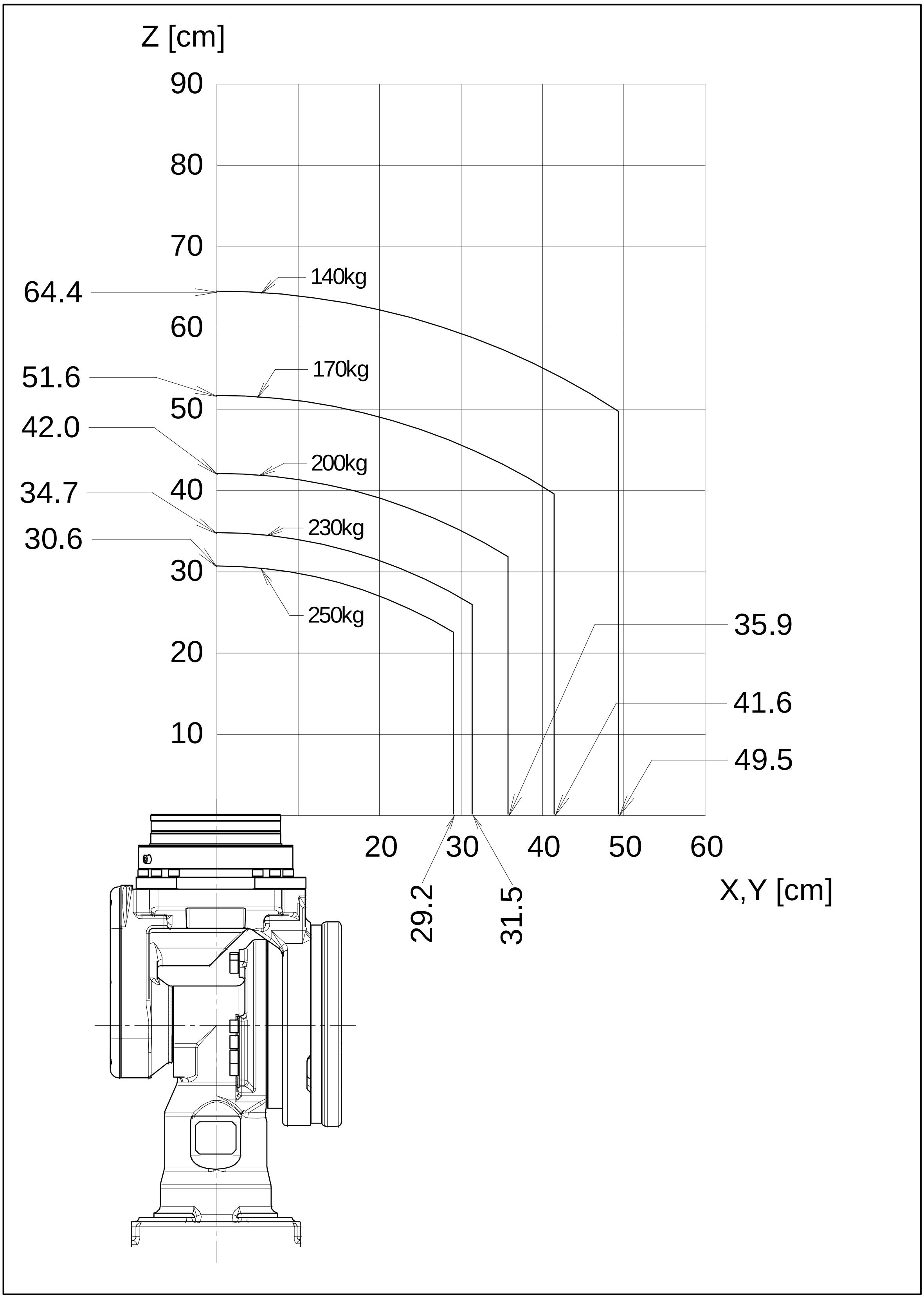


Fig. 3.4 (j) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/250F)

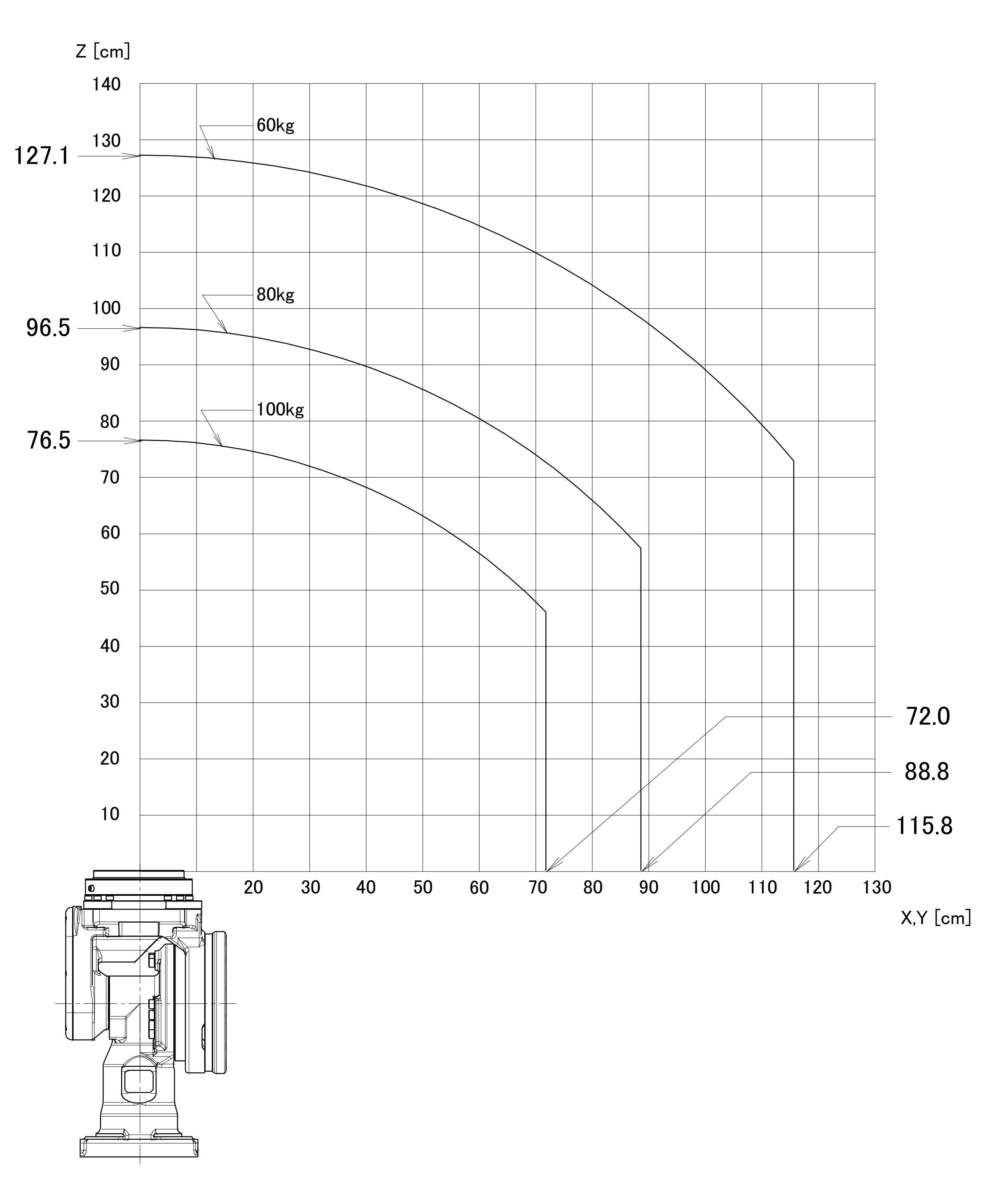


Fig. 3.4 (k) Wrist load diagram (ISO flange) (R-2000*i*B/100P)

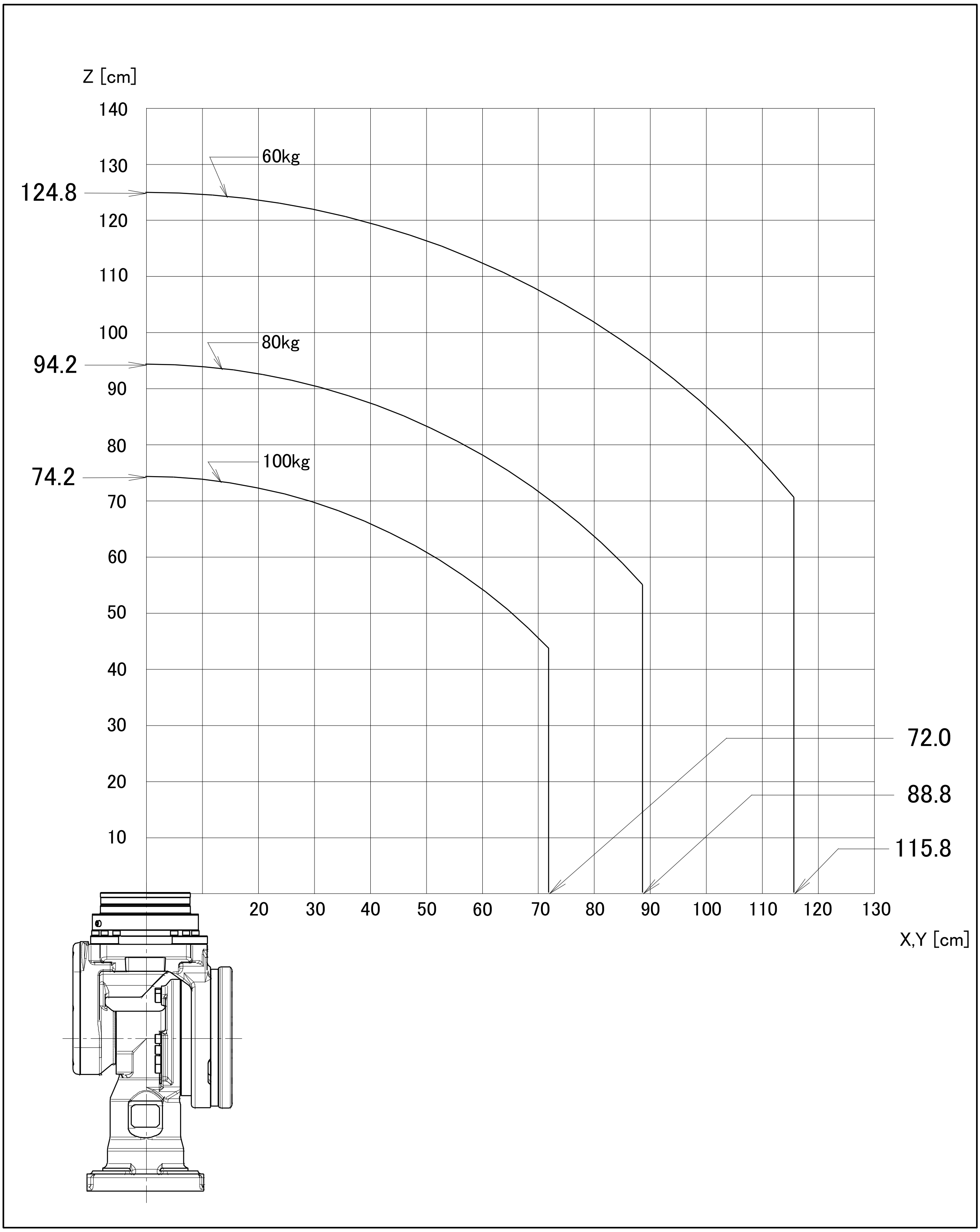


Fig. 3.4 (l) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/100P)

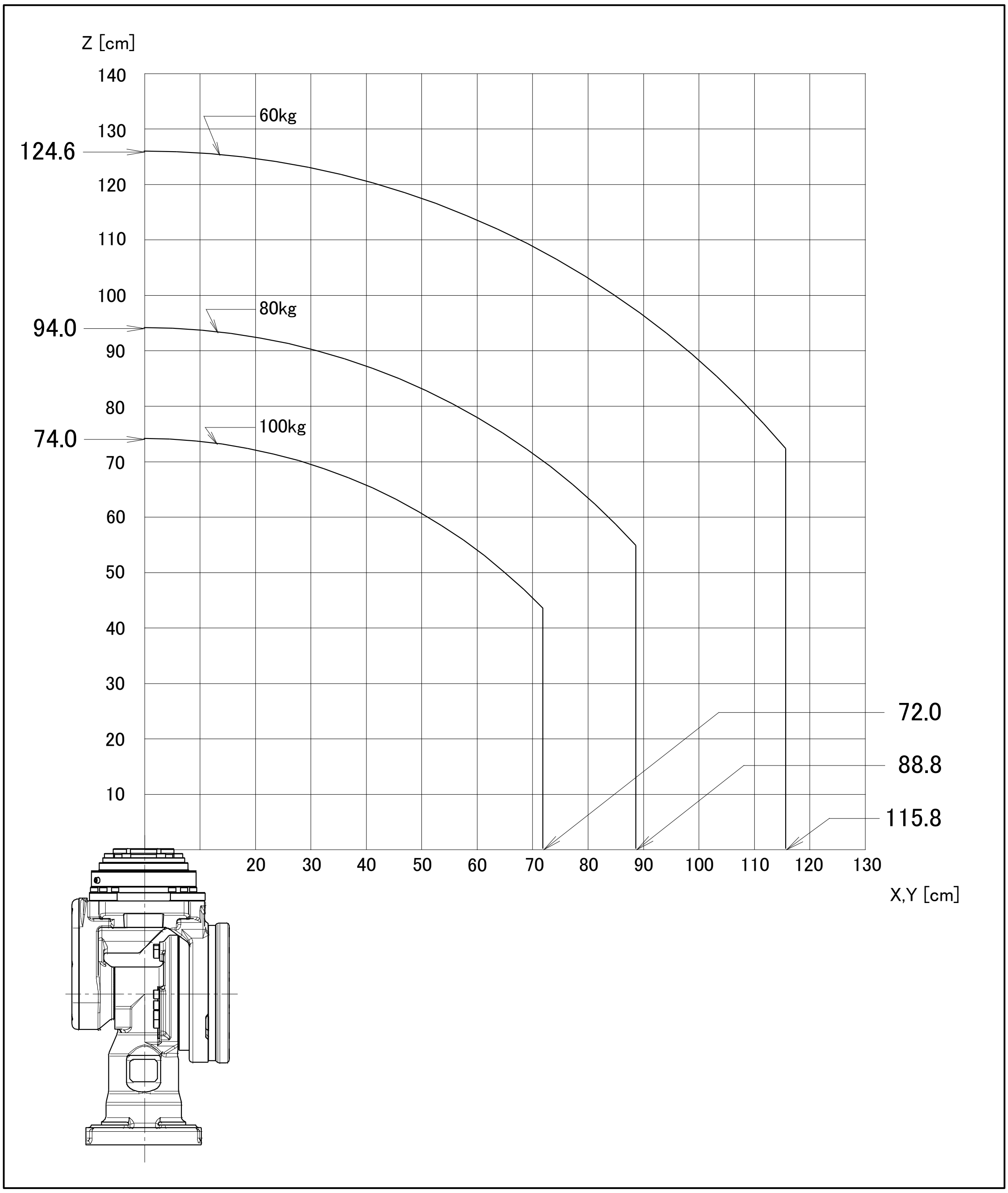


Fig. 3.4 (m) Wrist load diagram (FANUC/Special flange) (R-2000*i*B/100P)

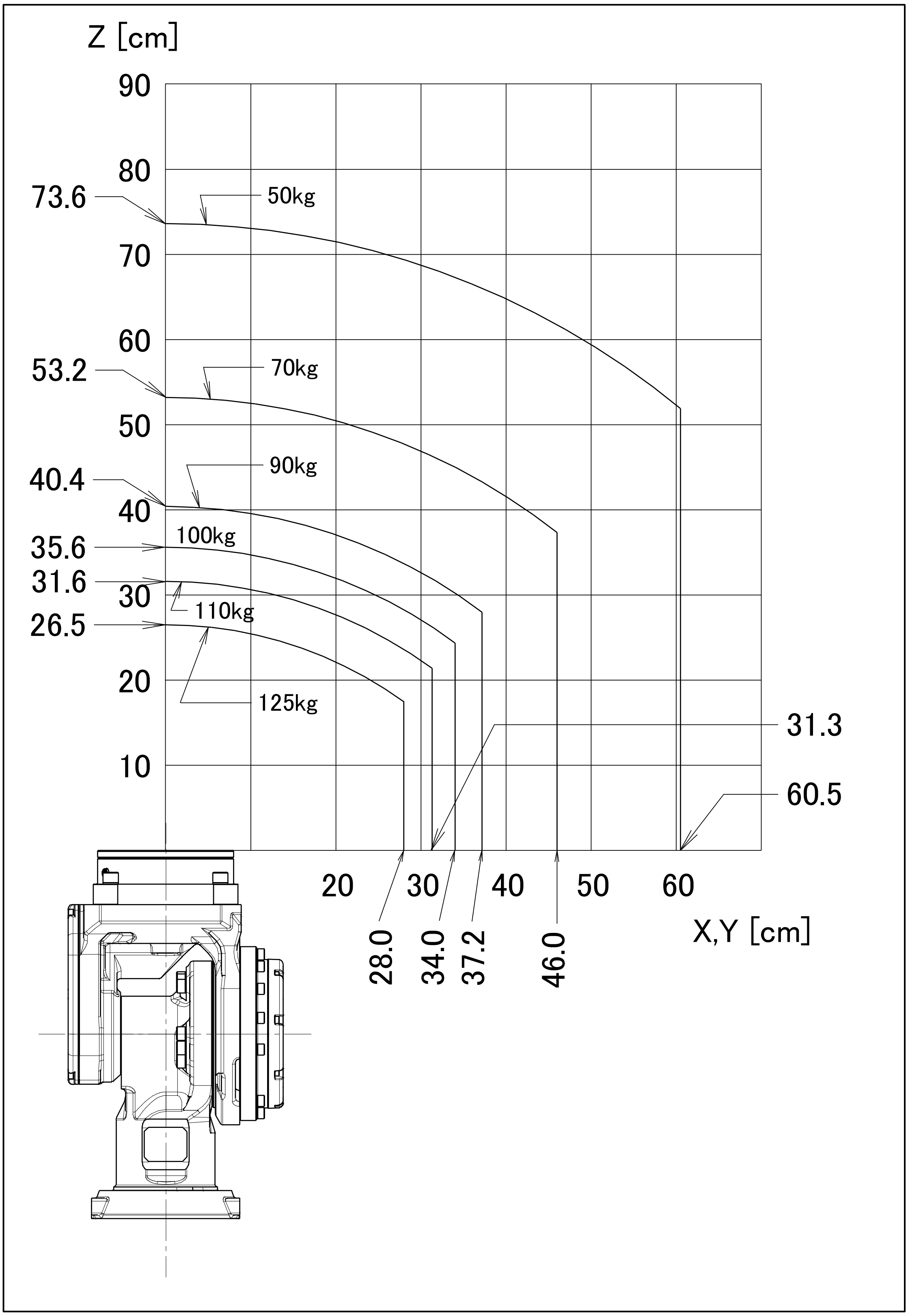


Fig. 3.4 (n) Wrist load diagram (ISO flange) (R-2000*i*B/125L)

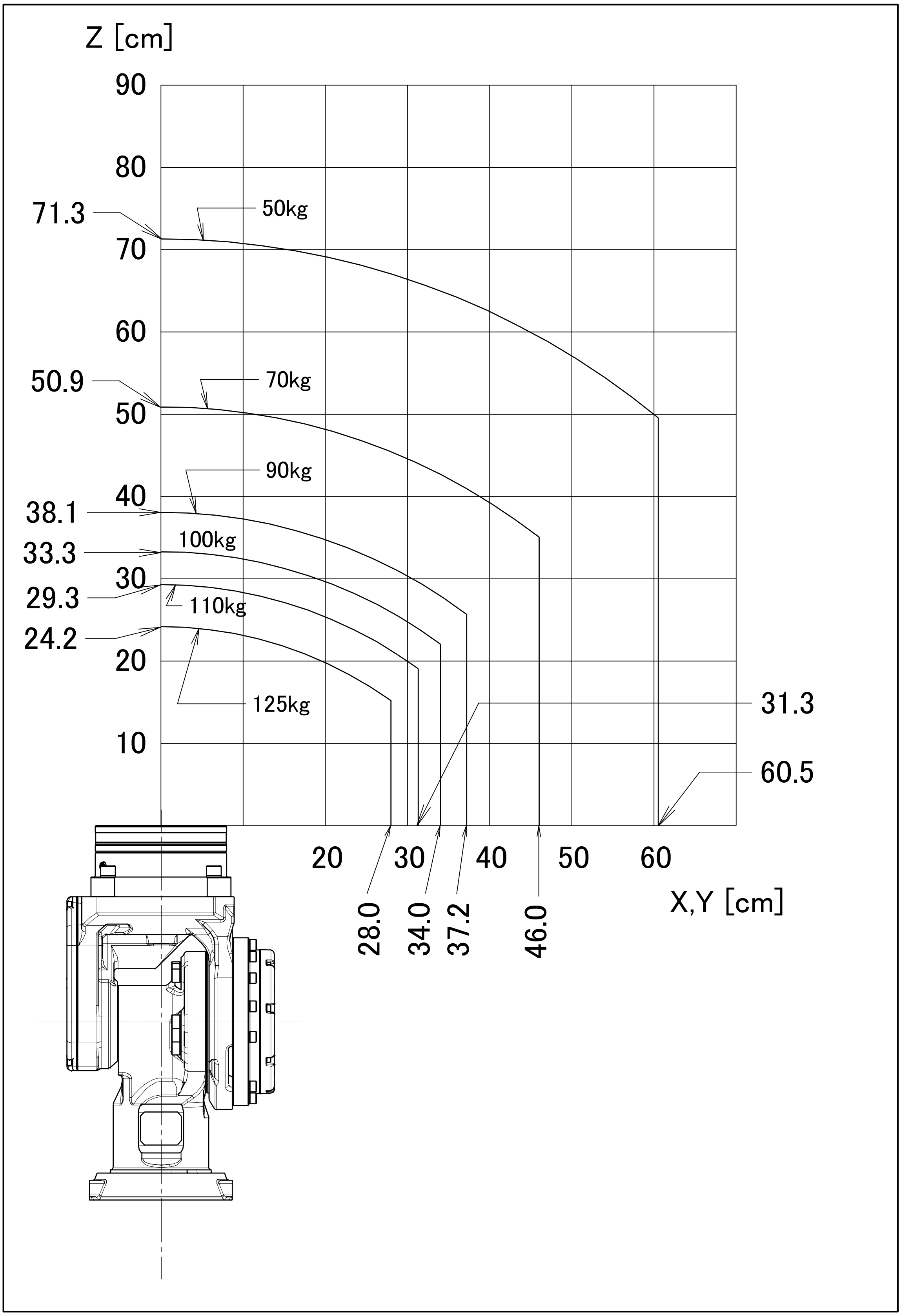


Fig. 3.4 (o) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/125L)

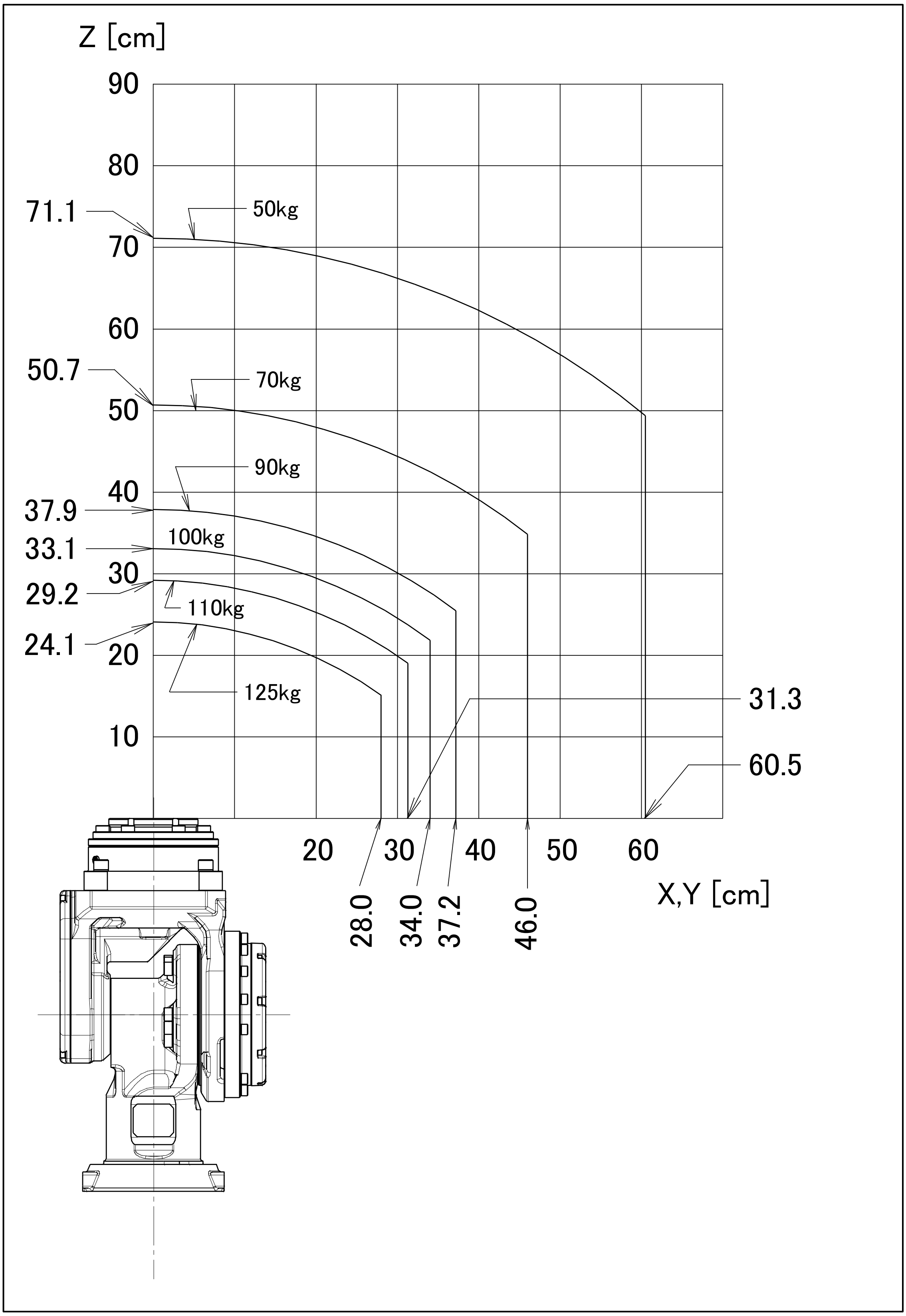


Fig. 3.4 (p) Wrist load diagram (FANUC / special flange) (R-2000*i*B/125L)

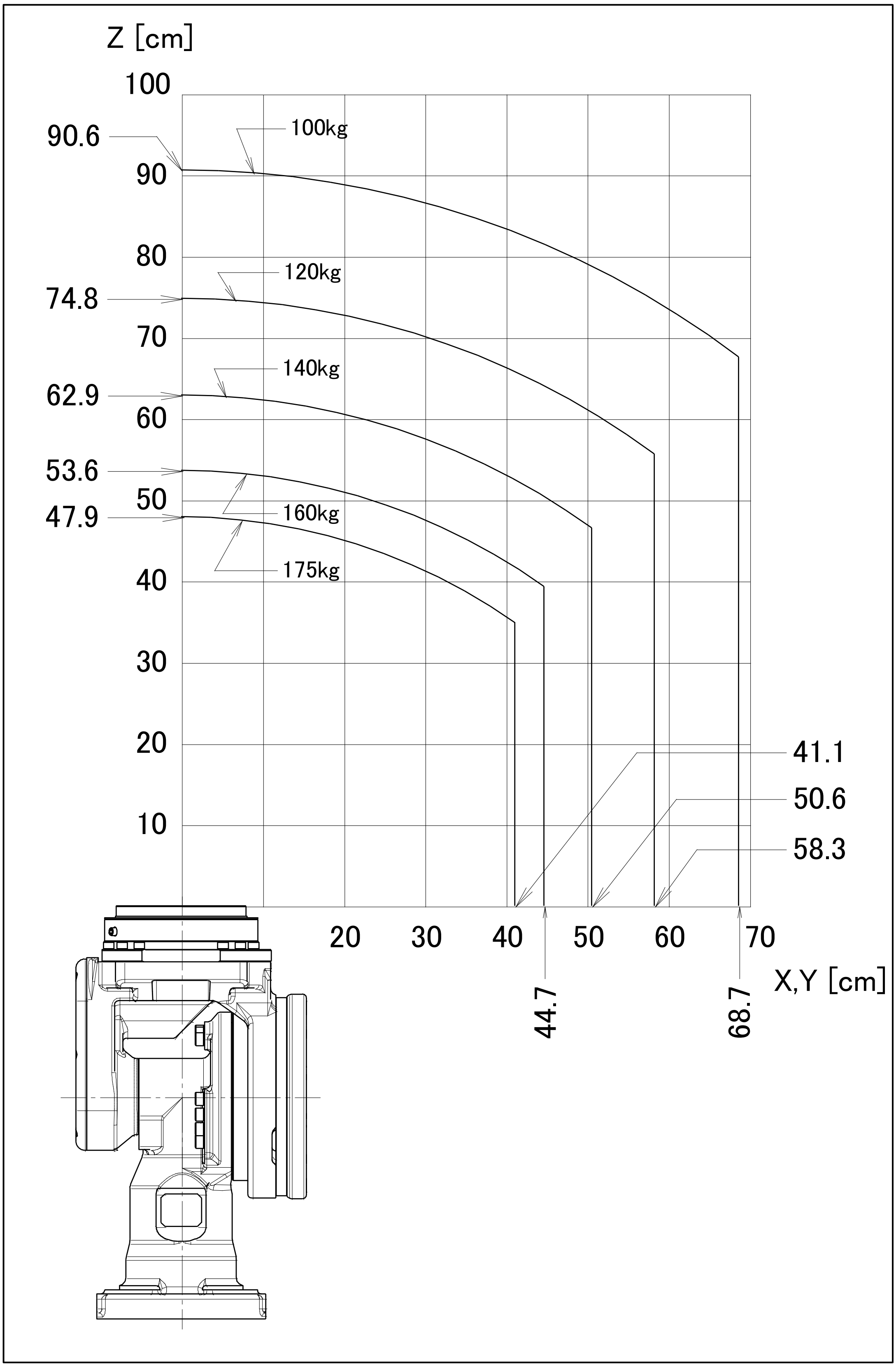


Fig. 3.4 (q) Wrist load diagram (ISO flange) (R-2000*i*B/175L)

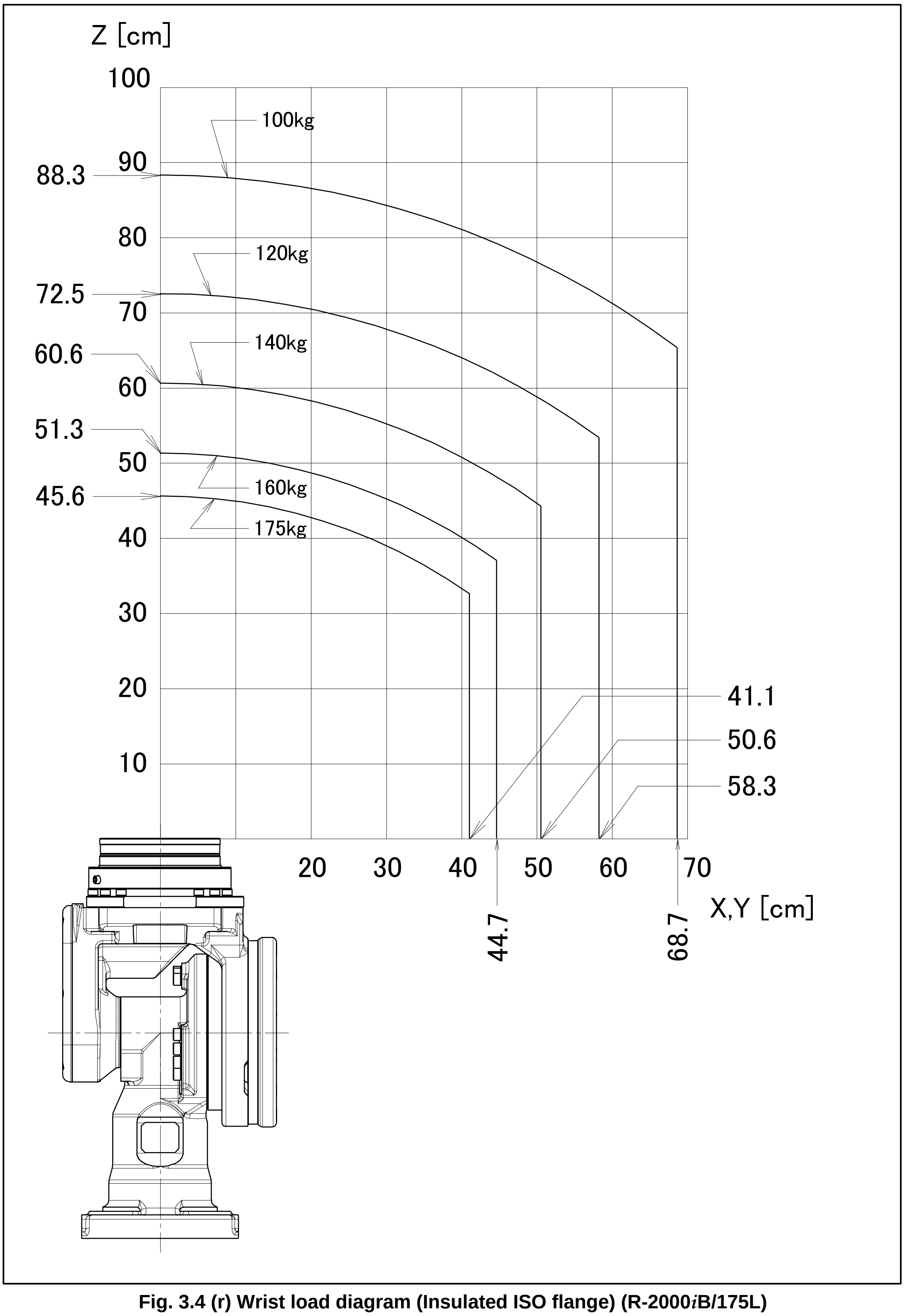


Fig. 3.4 (r) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/175L)

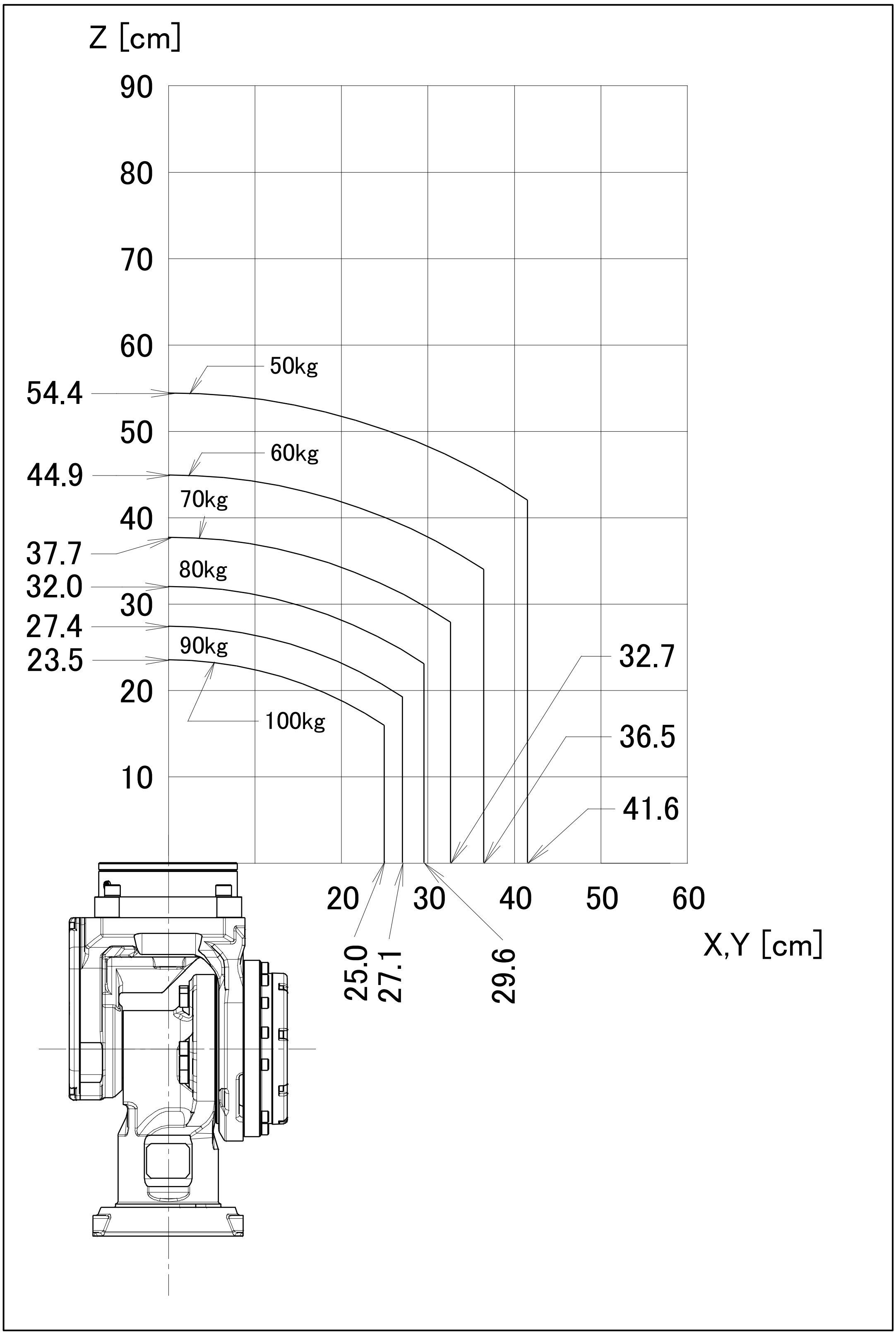


Fig. 3.4 (s) Wrist load diagram (ISO flange) (R-2000*i*B/100H)

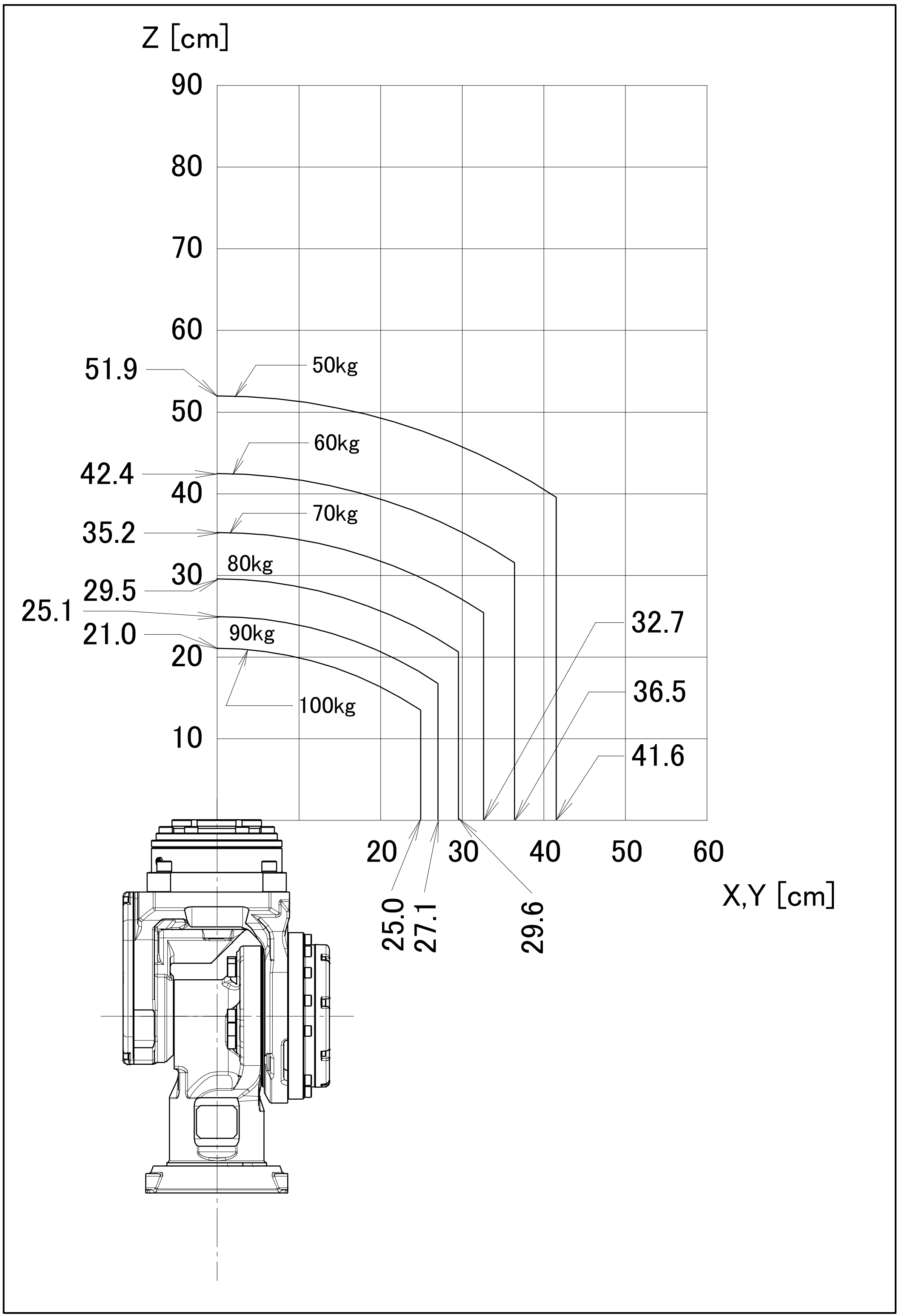


Fig. 3.4 (t) Wrist load diagram (FANUC/Special flange) (R-2000*i*B/100H)

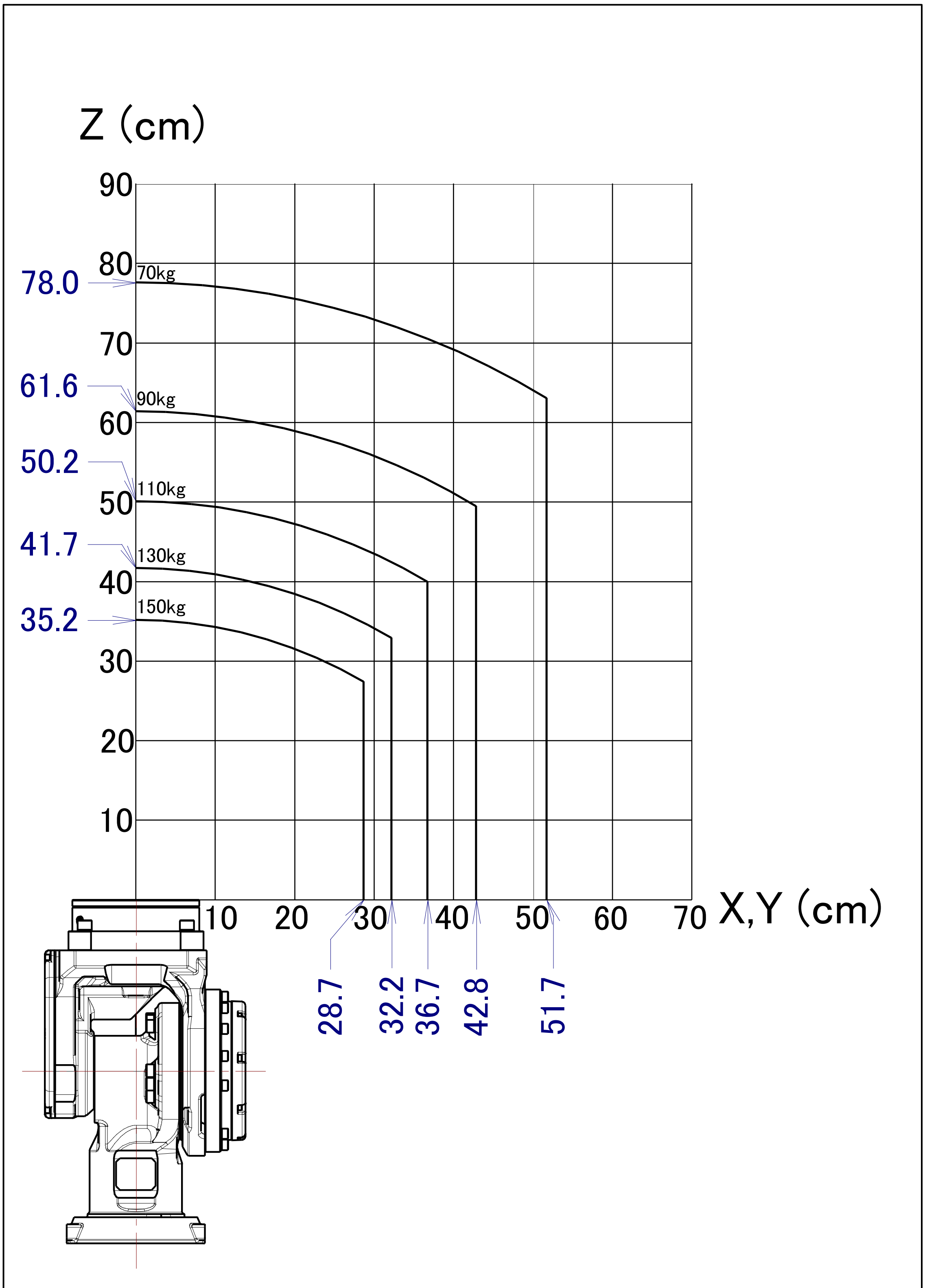


Fig. 3.4 (u) Wrist load diagram (ISO flange) (R-2000*i*B/150U)

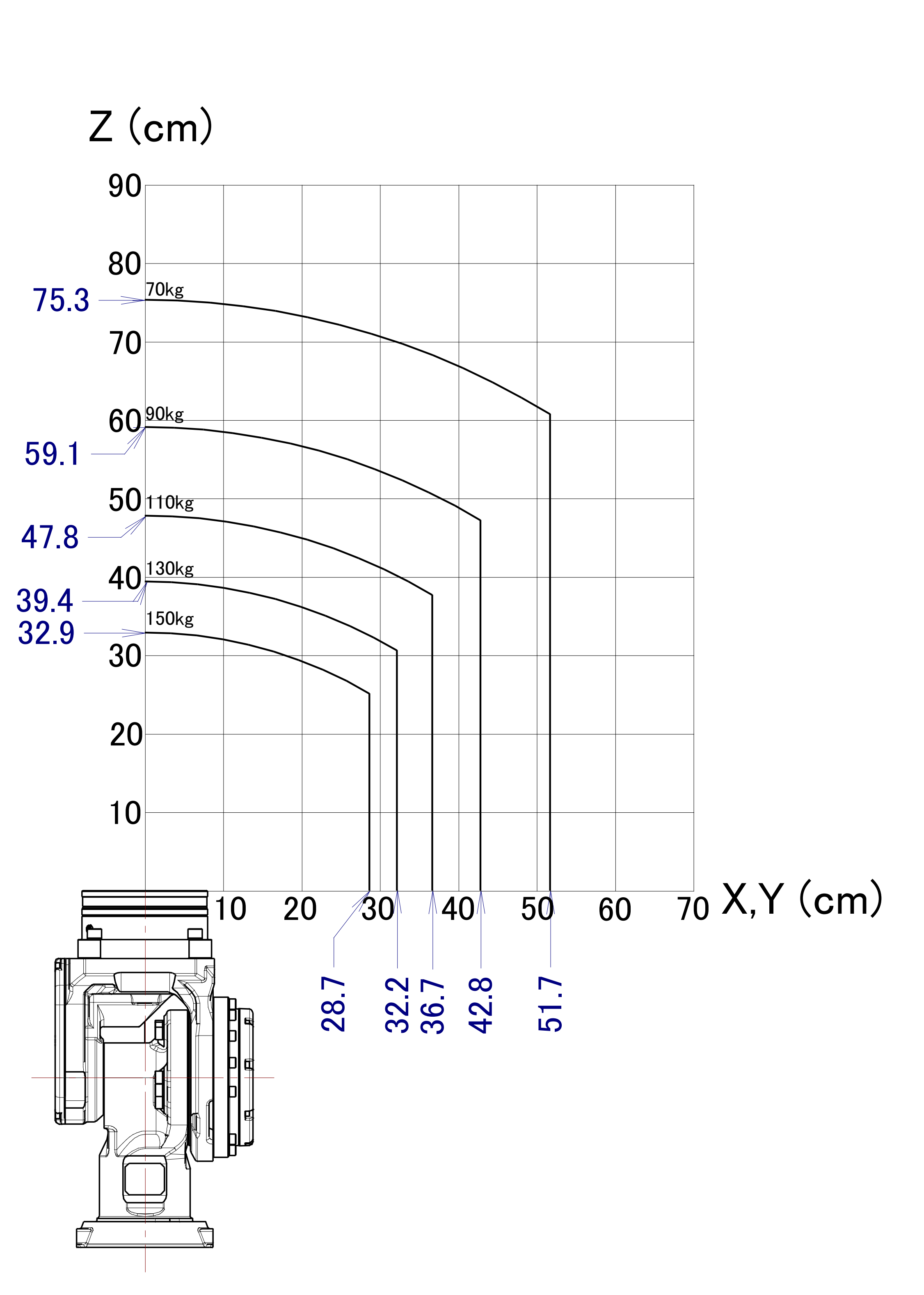


Fig. 3.4 (v) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/150U)

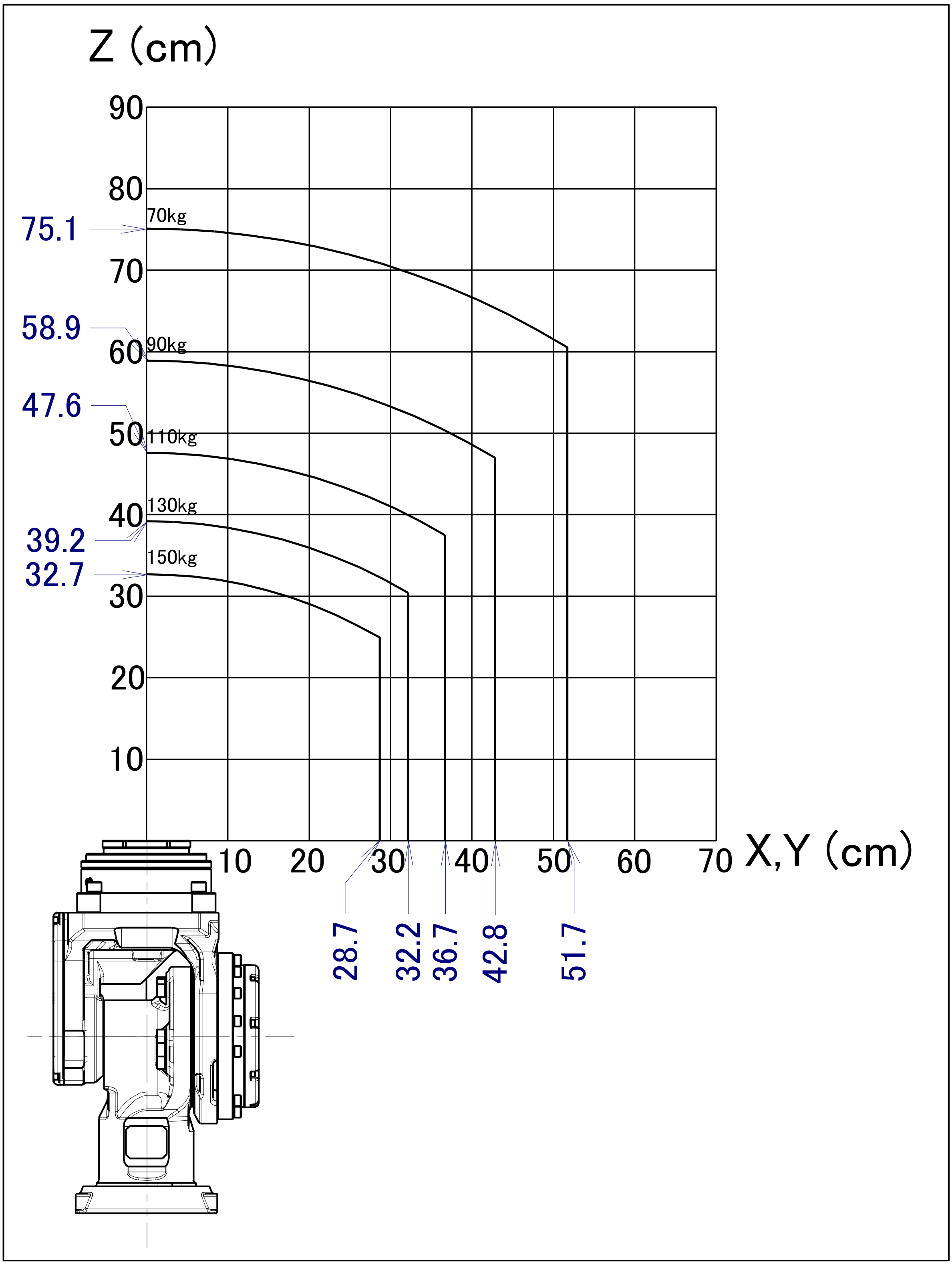


Fig. 3.4 (w) Wrist load diagram (FANUC/Special flange) (R-2000*i*B/150U)

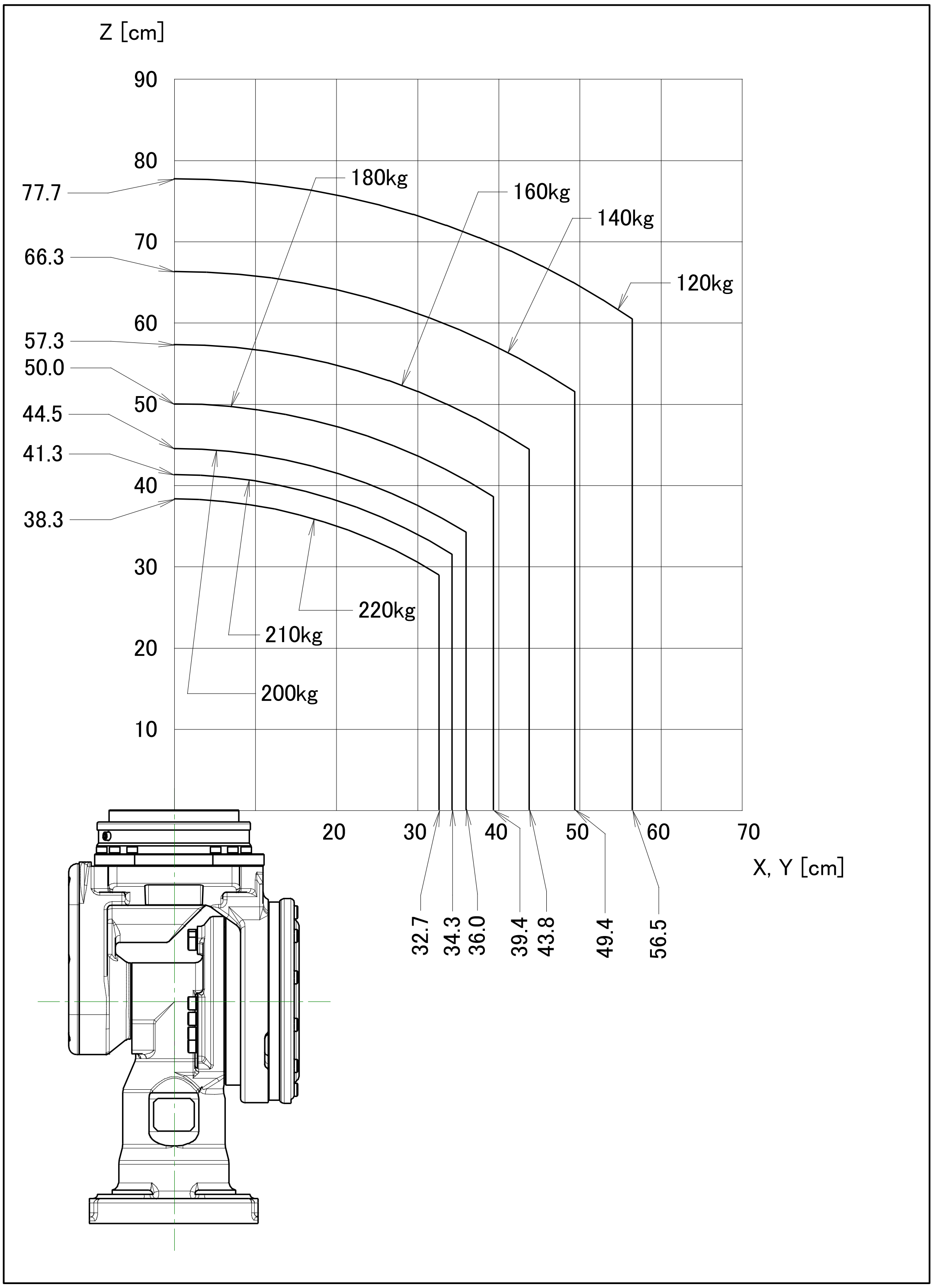


Fig. 3.4 (x) Wrist load diagram (ISO flange) (R-2000*i*B/220U)

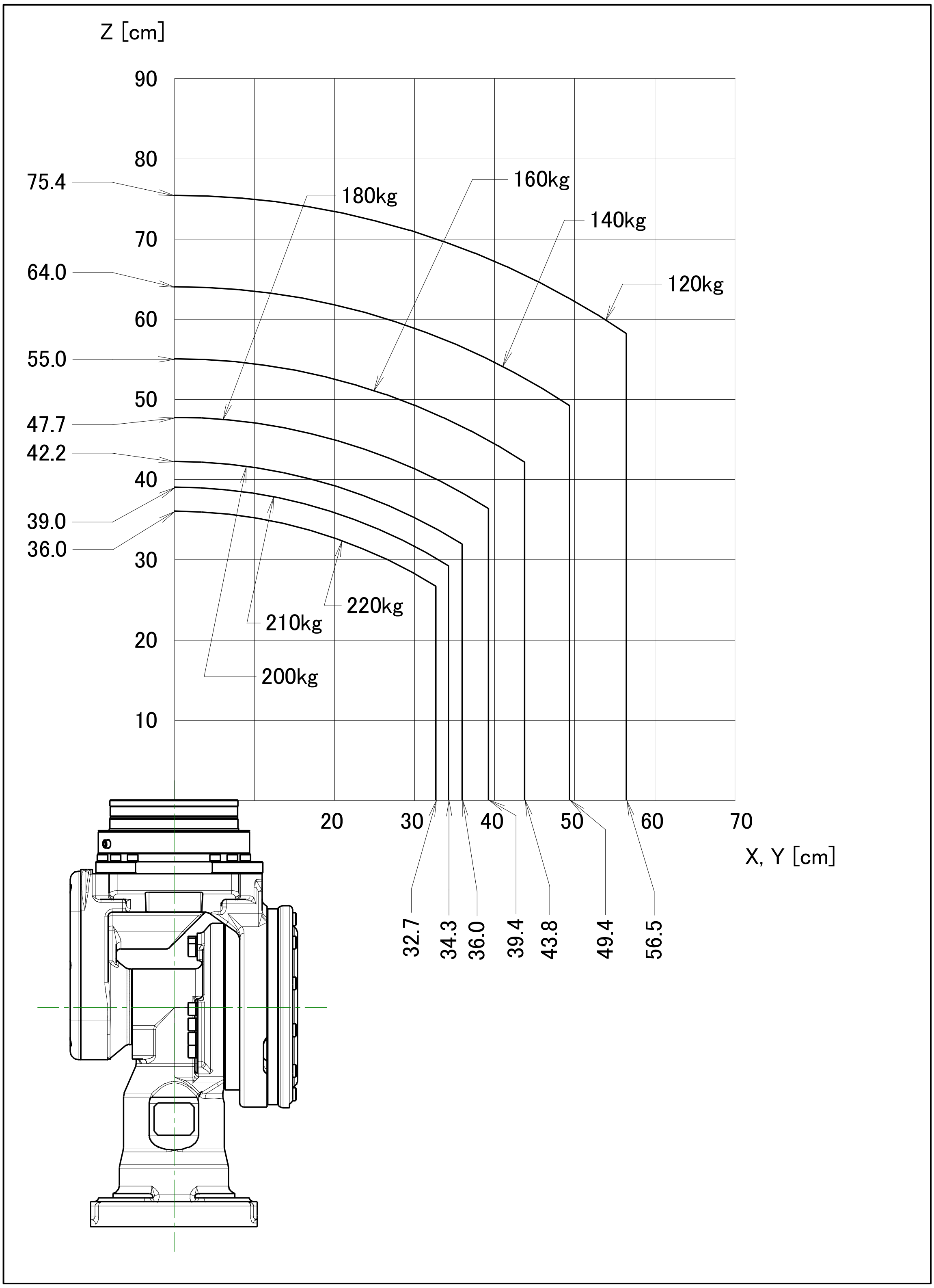


Fig. 3.4 (y) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/220U)

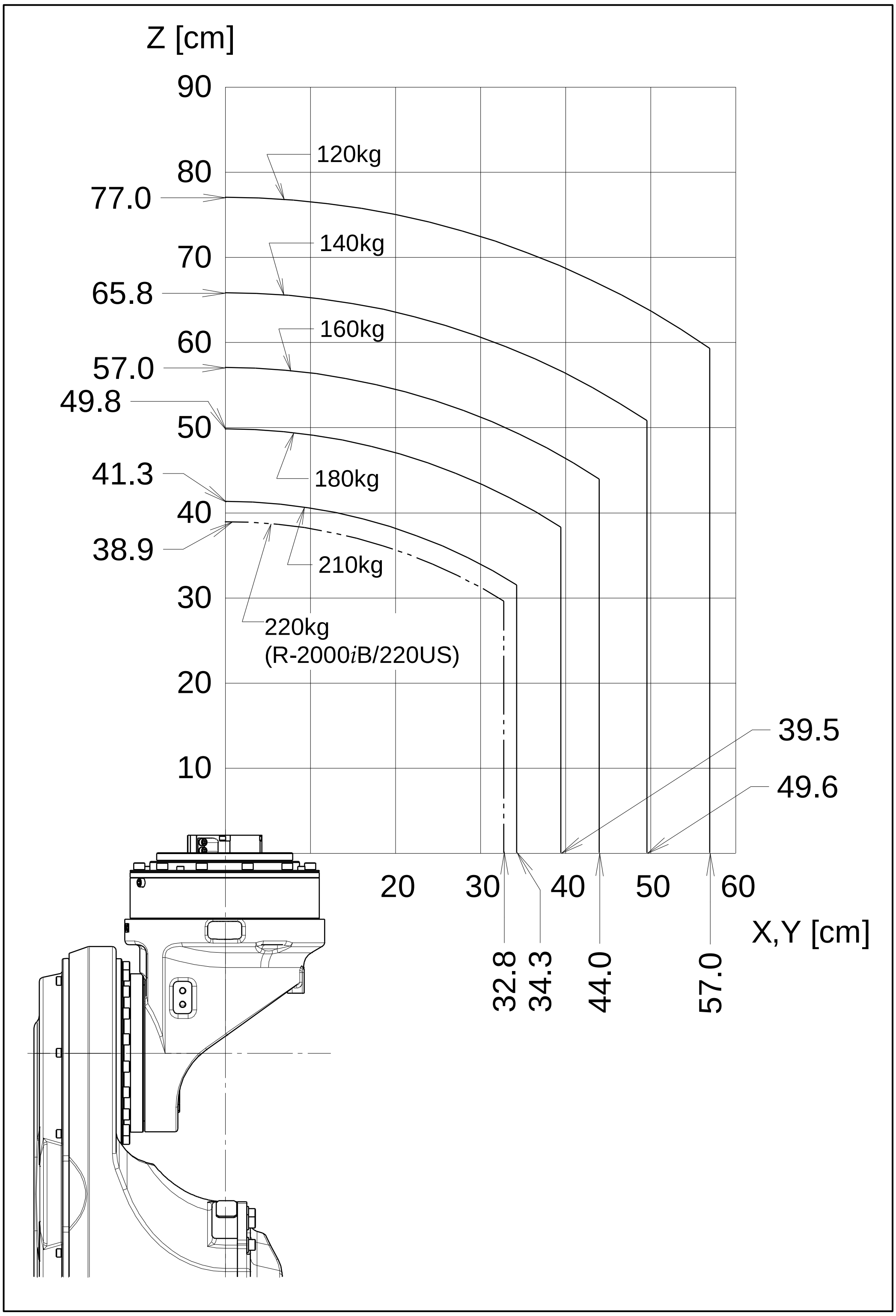


Fig. 3.4 (z) Wrist load diagram (ISO flange) (R-2000*i*B/210FS/220US)

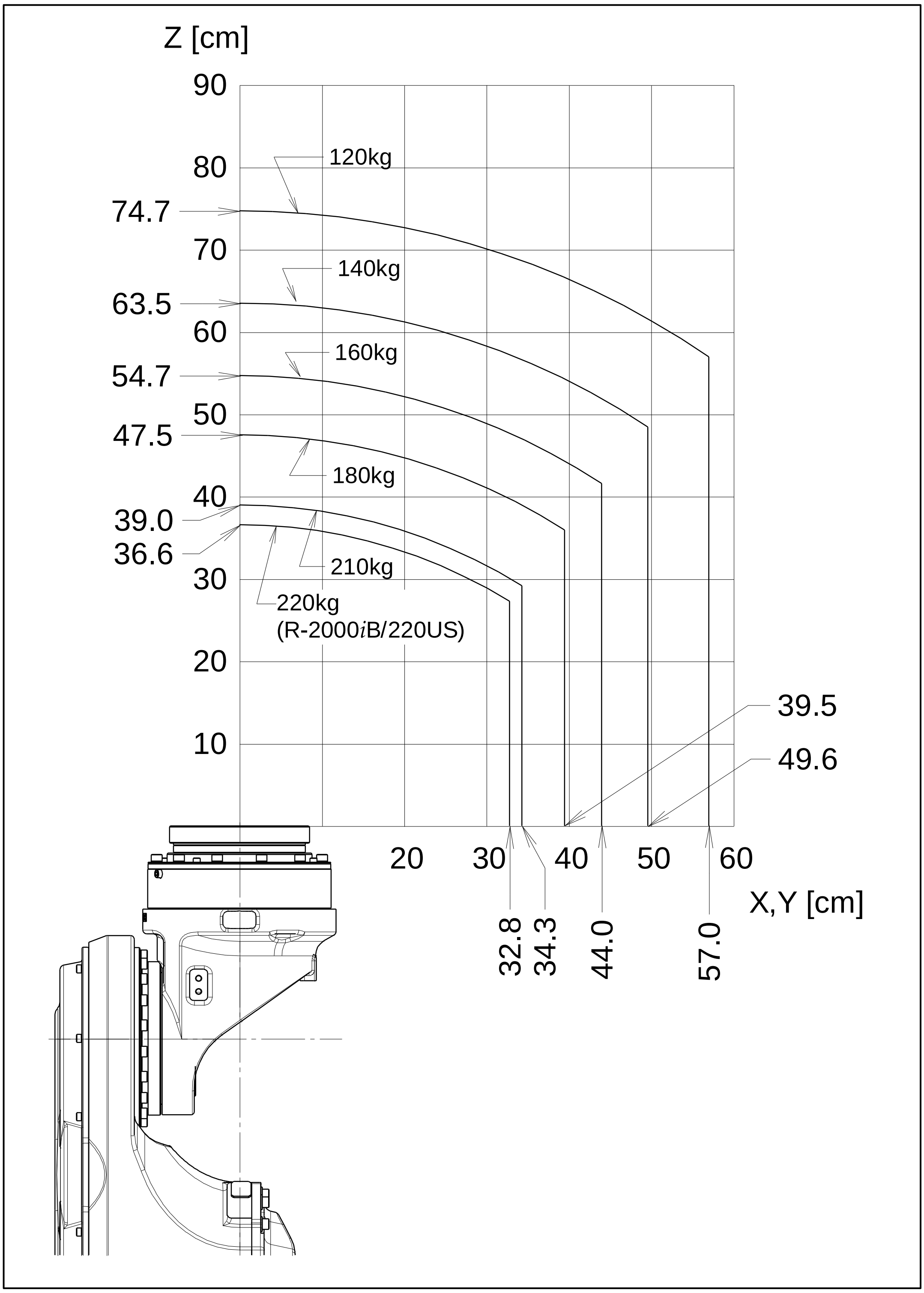


Fig. 3.4 (aa) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/210FS/220US)

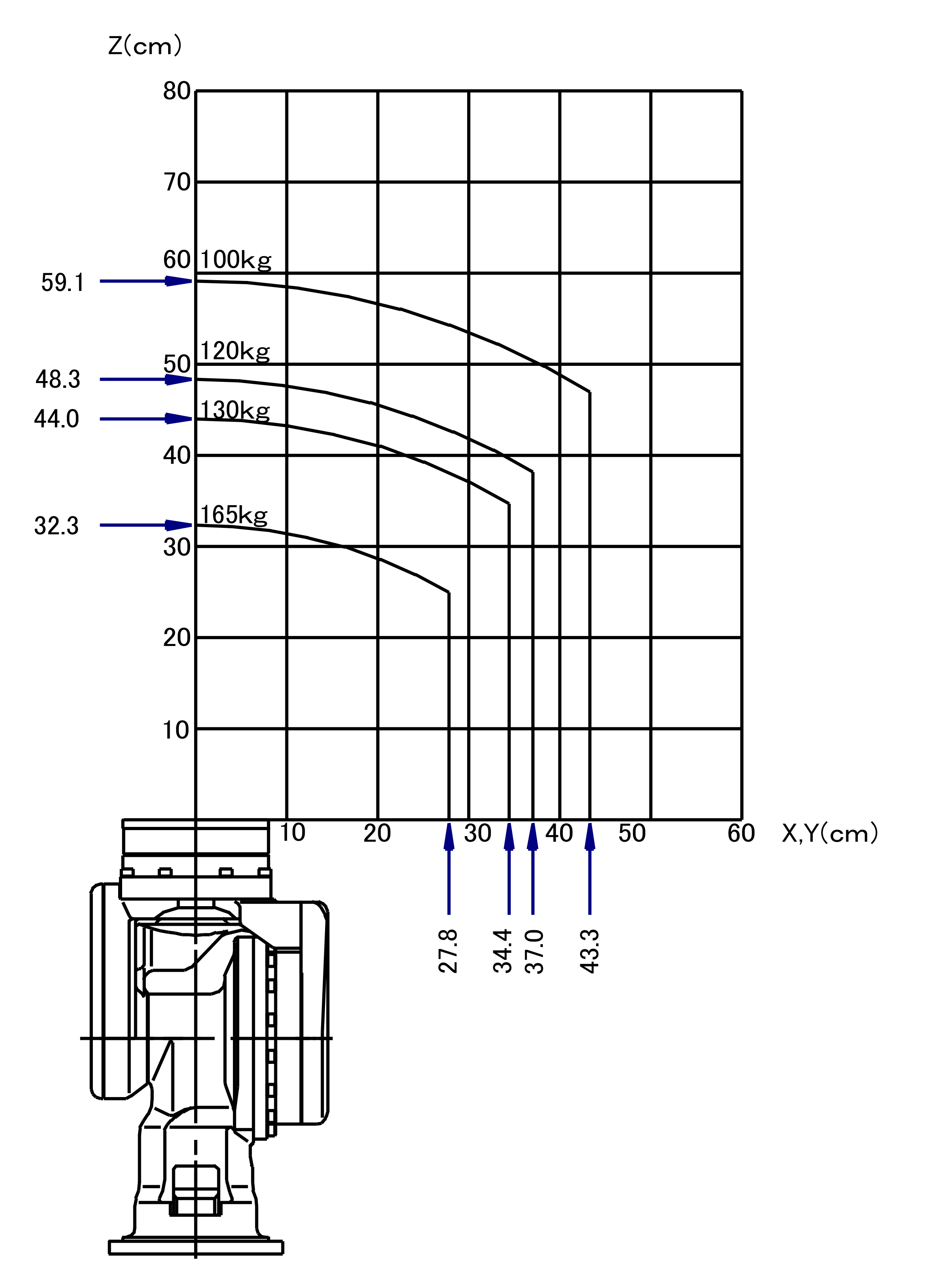


Fig. 3.4 (ab) Wrist load diagram (ISO flange) (R-2000*i*B/165CF)

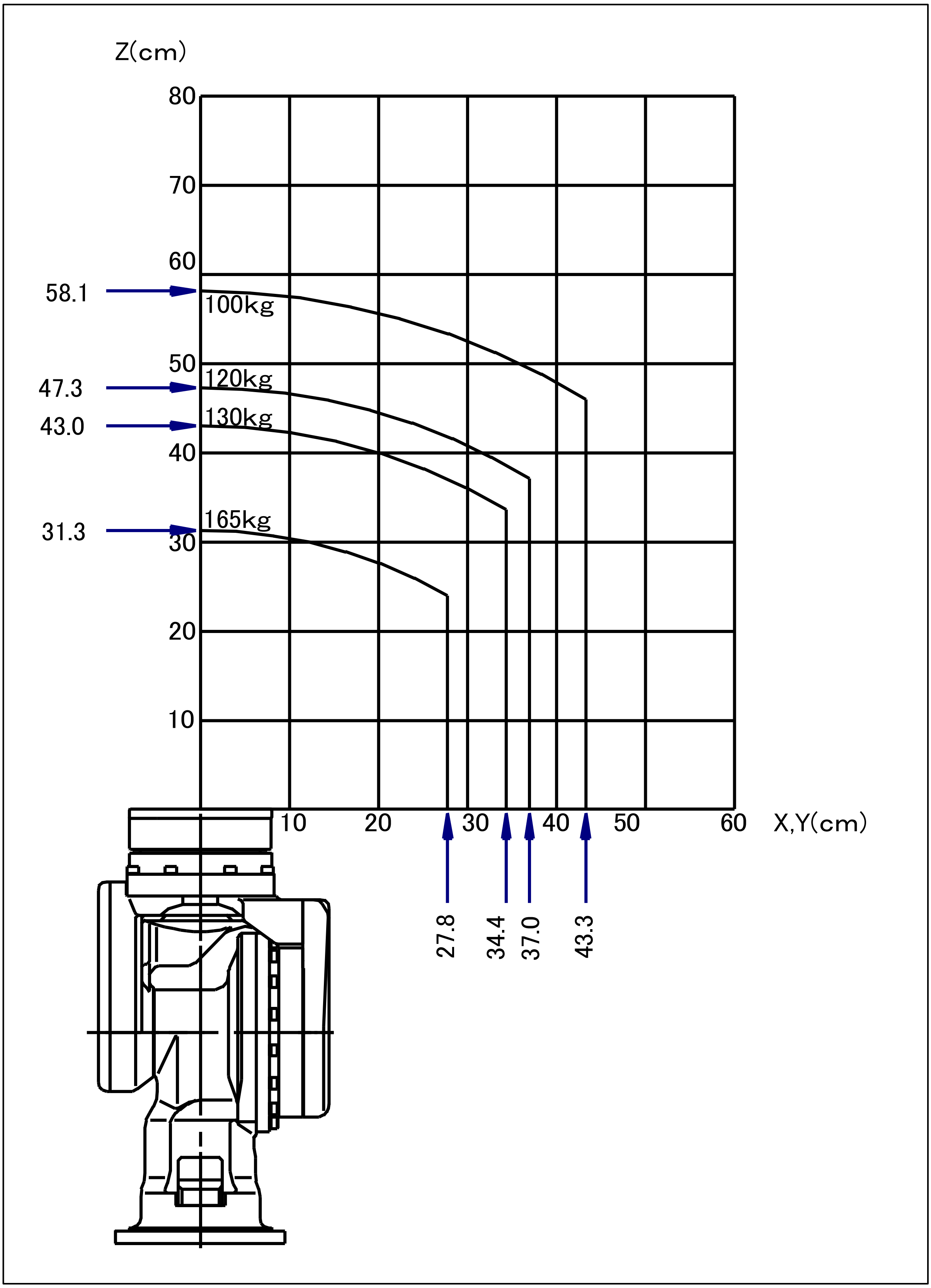


Fig. 3.4 (ac) Wrist load diagram (Insulated ISO flange) (R-2000*i*B/165CF)

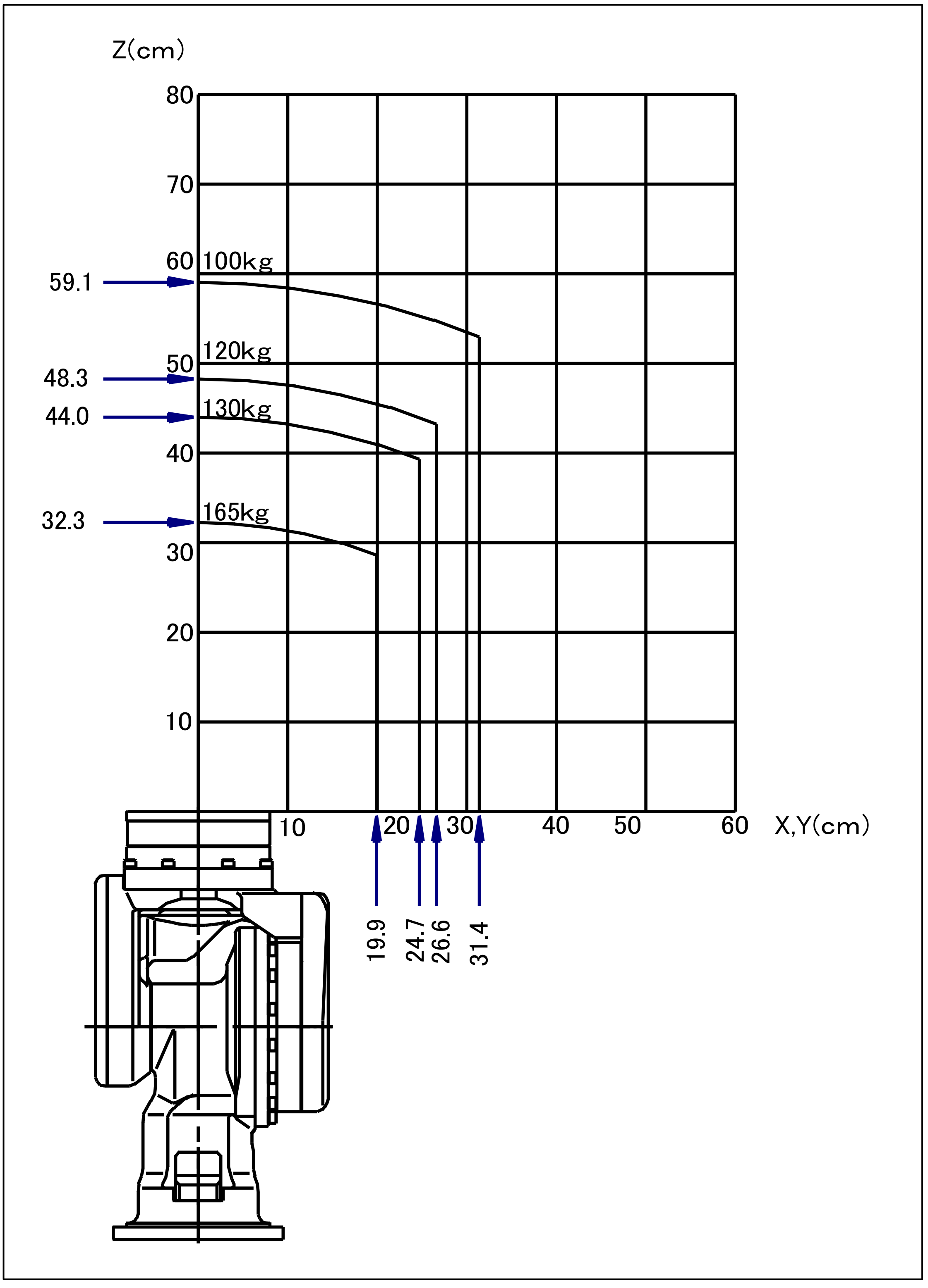


Fig. 3.4 (ad) Wrist load diagram (FANUC/special flange) (R-2000*i*B/165CF)

3.5 LOAD CONDITIONS ON J2 BASE, J3 ARM AND J3 CASING

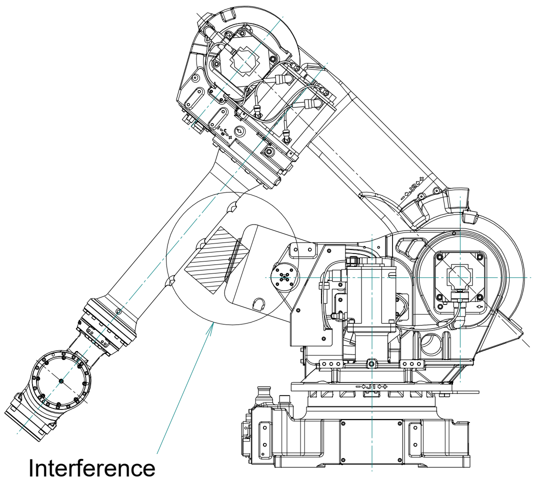
Table 3.5 (a) and Fig. 3.5 (a) to (j) show J2 base, J3 arm and J3 casing load condition.

Table 3.5 (a) J2 base / J3 arm /J3 casing load condition

	J2 base	J3 arm	J3 casing	Figure
R-2000*i*B/165F/210F/250F/210WE	O	O	X	Fig. 3.5 (a)
R-2000*i*B/185L	O	X	O	Fig. 3.5 (b)
R-2000*i*B/165R/100P	O	X	O	Fig. 3.5 (c)
R-2000*i*B/200R	O	X	X	Fig. 3.5 (d)
R-2000*i*B/170CF	O	X	O	Fig. 3.5 (e)
R-2000*i*B/125L/175L	O	O	X	Fig. 3.5 (f)
R-2000*i*B/100H	O	X	X	Fig. 3.5 (g)
R-2000*i*B/150U/220U	X	O	X	Fig. 3.5 (h)
R-2000*i*B/210FS	O	X	X	Fig. 3.5 (i)
R-2000*i*B/220US	X	X	X	-
R-2000*i*B/165CF	O	X	O	Fig. 3.5 (j)

⚠ **CAUTION**

Take great care to avoid the load on the J3 arm from interfering with the J2 balancer during backflip operation of the J3 arm.



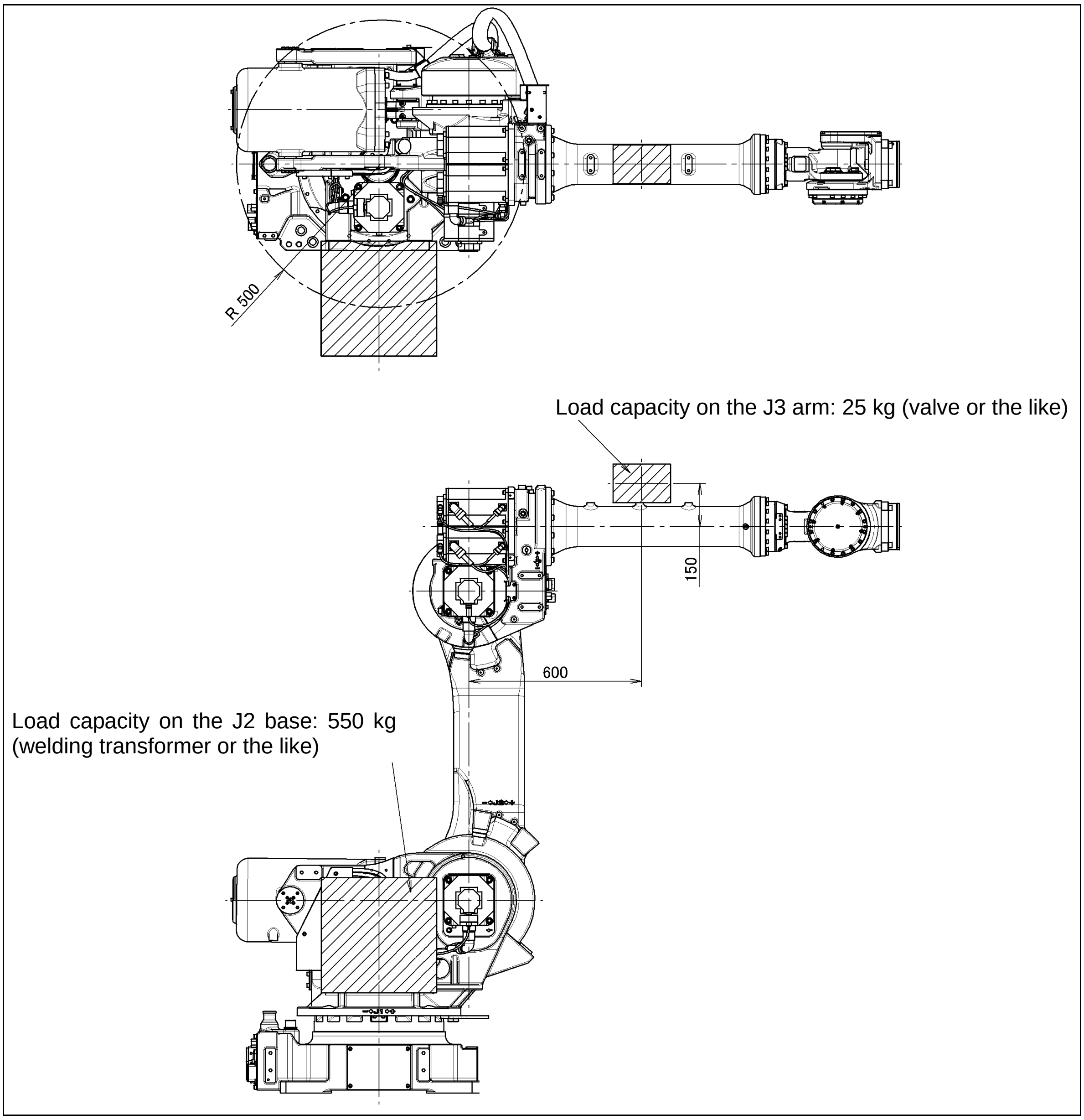


Fig. 3.5 (a) J2 base / J3 arm load condition (R-2000*i*B/165F/210F/250F/210WE)

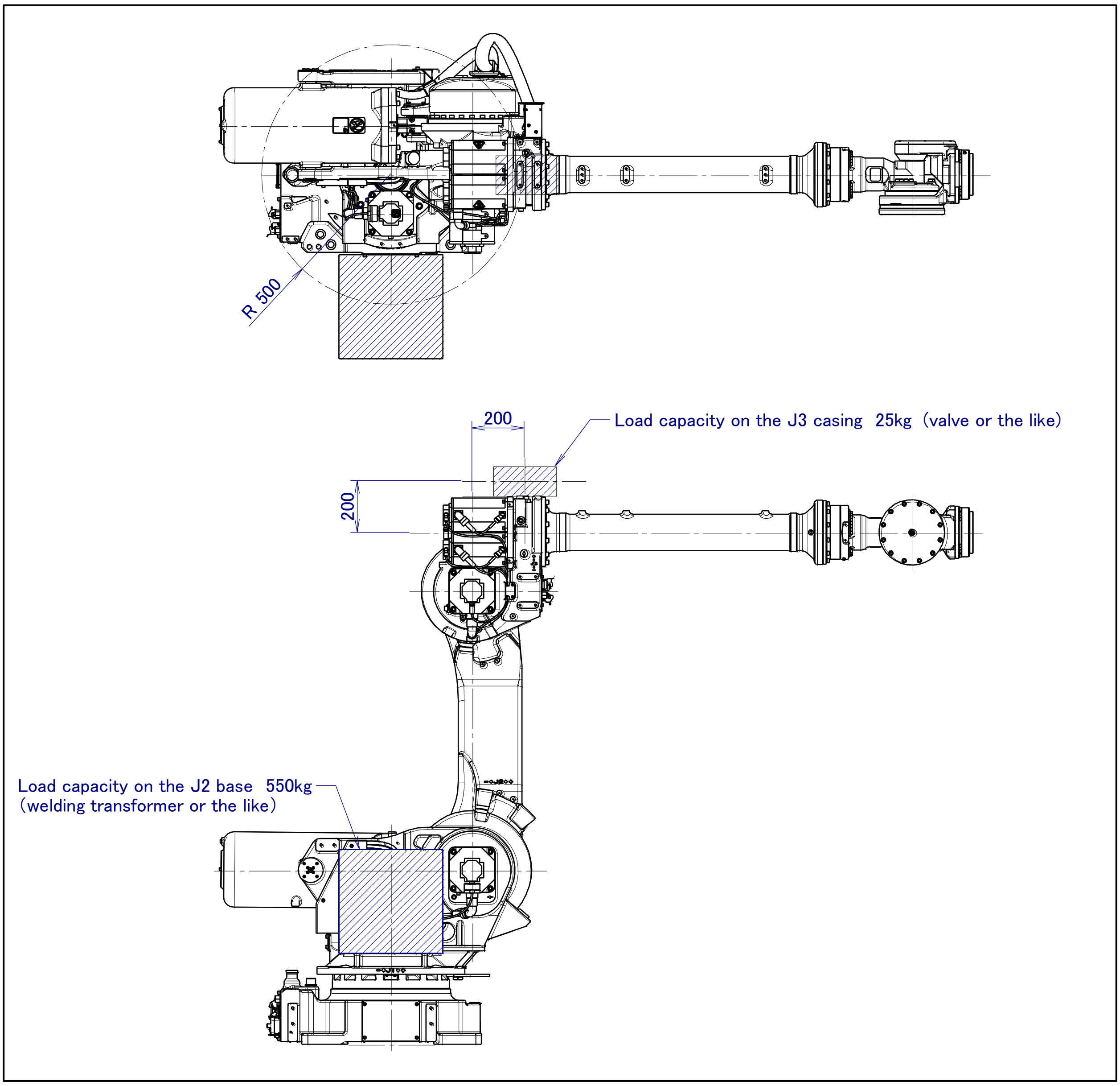


Fig. 3.5 (b) J2 base / J3 casing load condition (R-2000*i*B/185L)

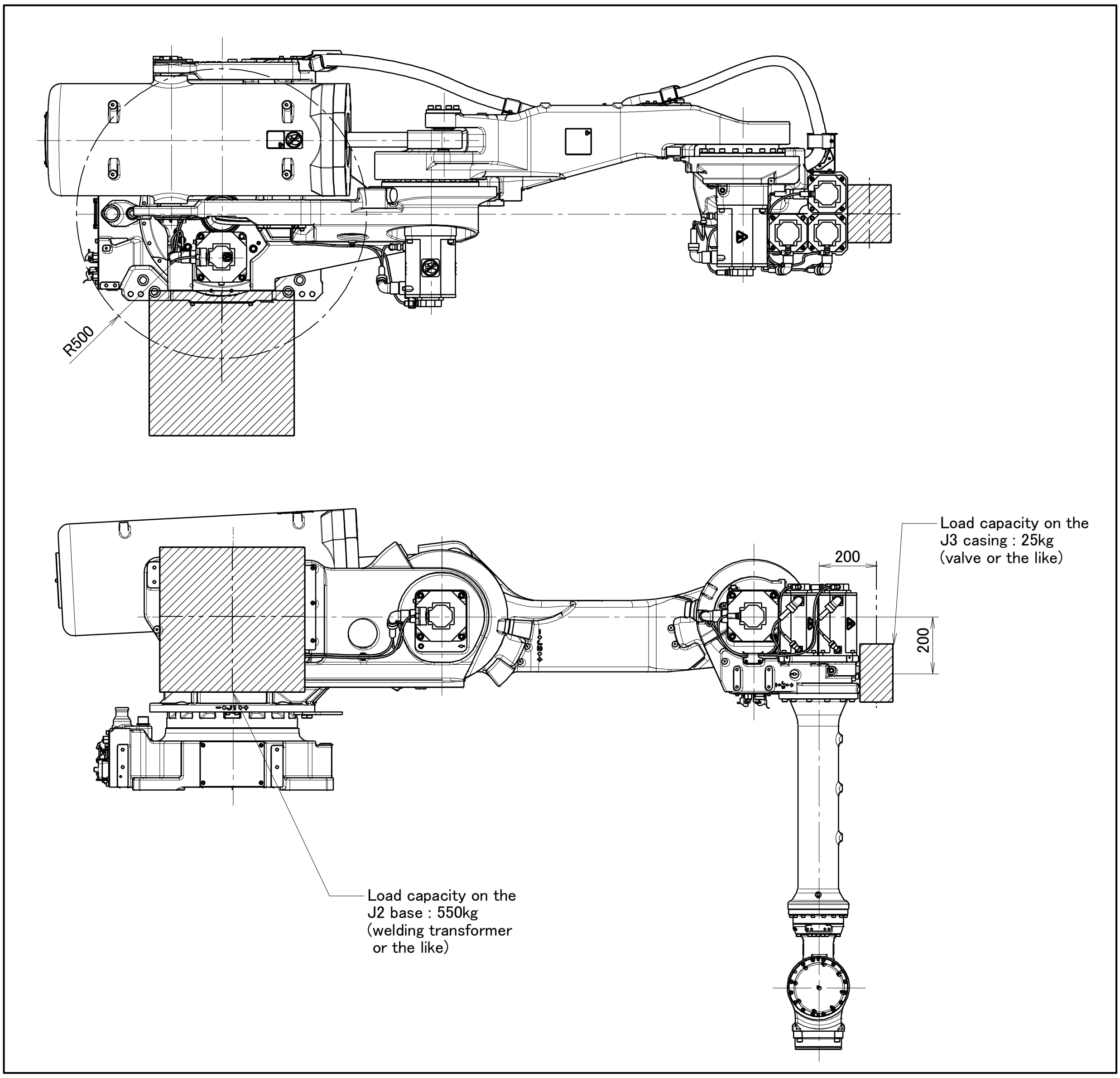


Fig. 3.5 (c) J2 base / J3 casing load condition (R-2000*i*B/165R/100P)

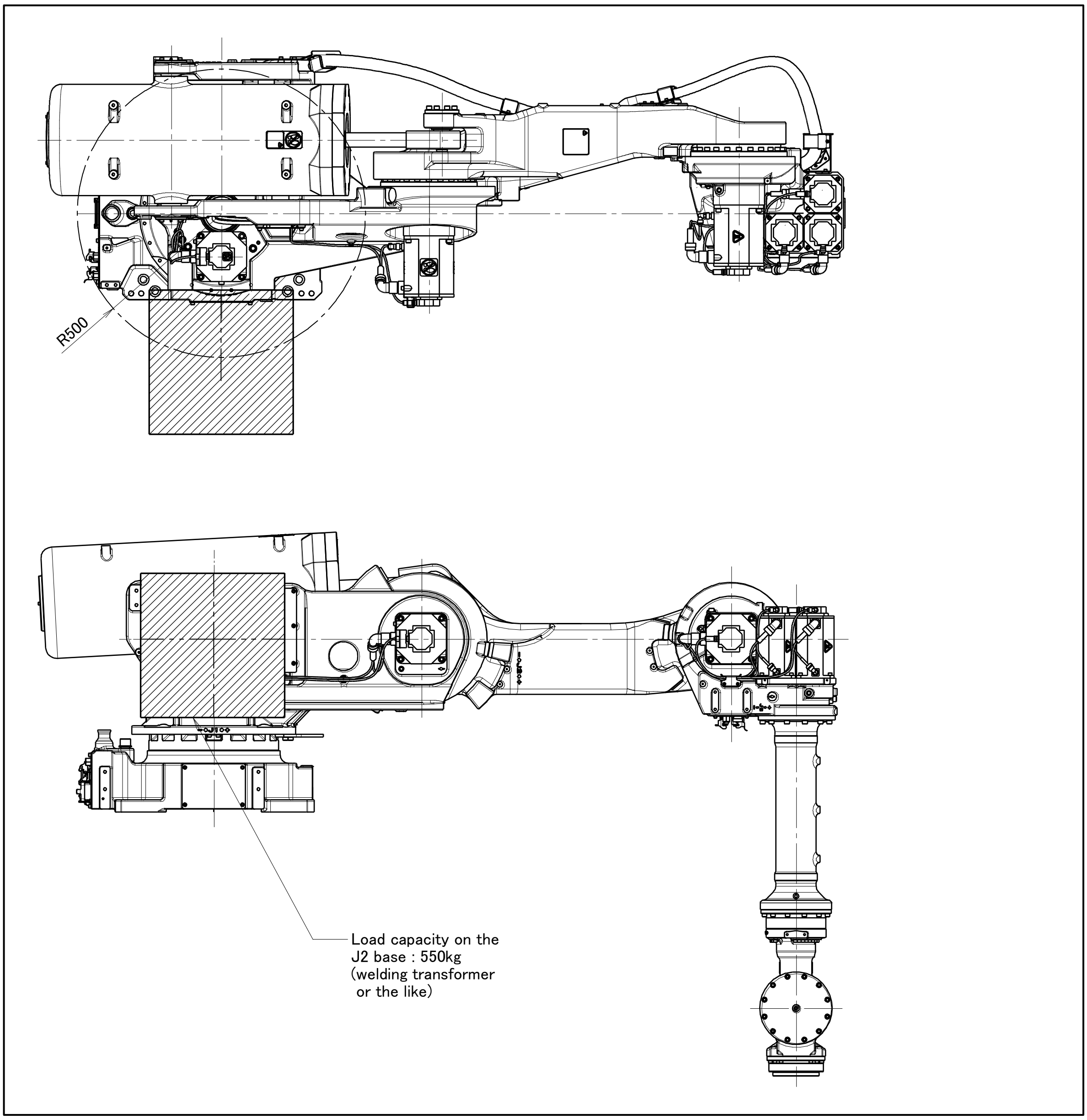


Fig. 3.5 (d) J2 base load condition (R-2000*i*B/200R)

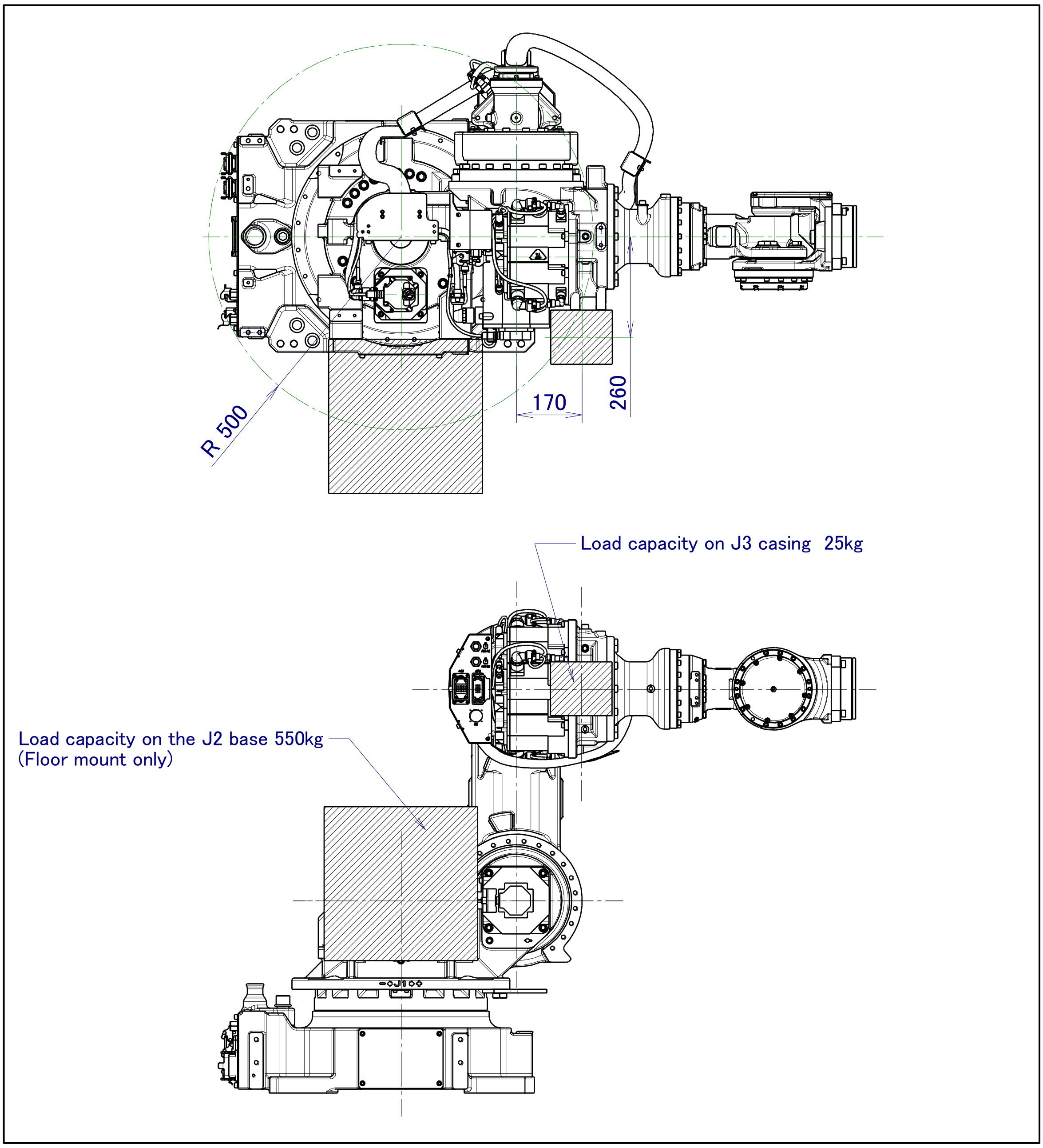


Fig. 3.5 (e) J2 base / J3 casing load condition (R-2000*i*B/170CF)

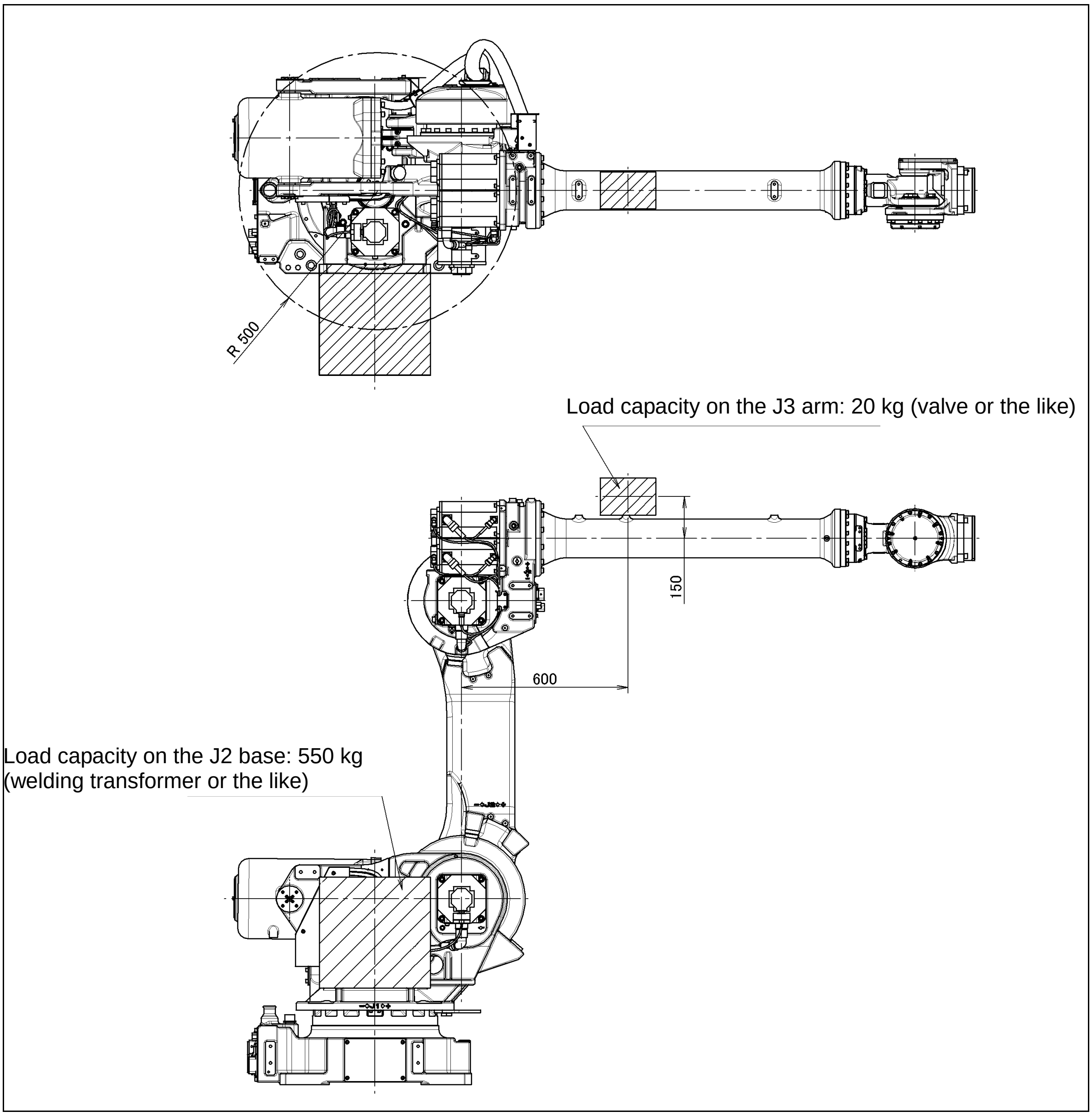


Fig. 3.5 (f) J2 base / J3 arm load condition(R-2000*i*B/125L/175L)

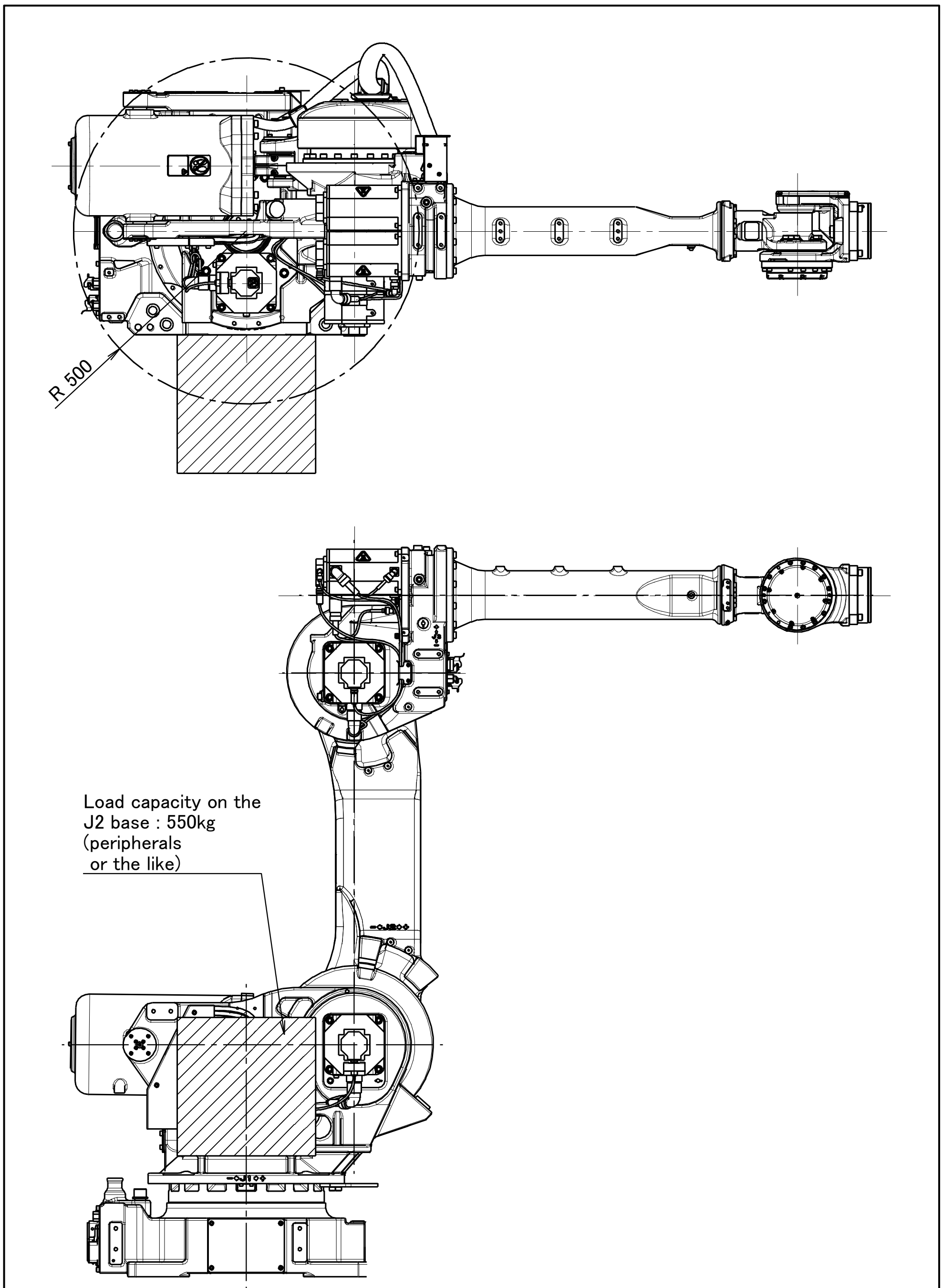


Fig. 3.5 (g) J2 base load condition (R-2000*i*B/100H)

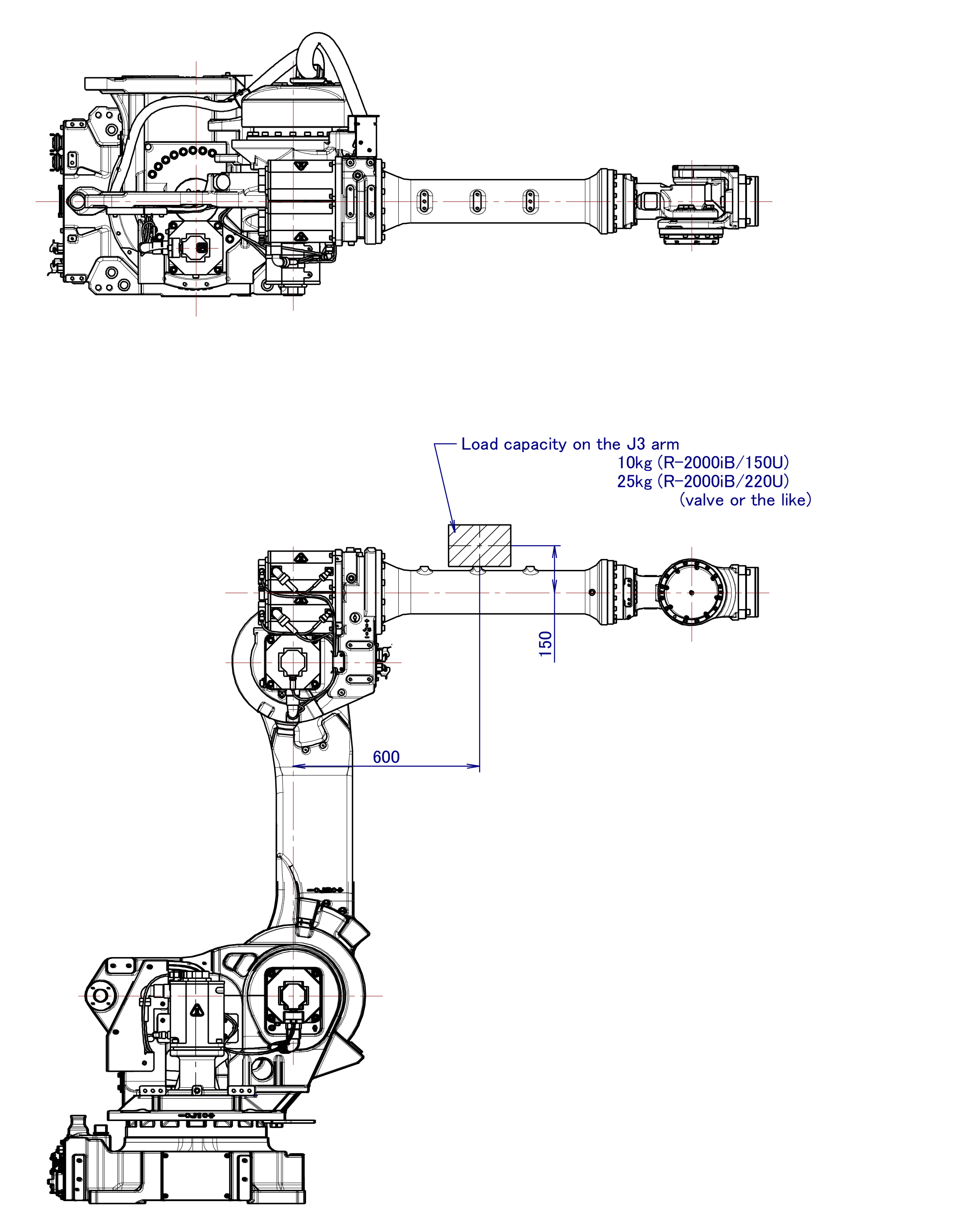


Fig. 3.5 (h) J3 arm load condition (R-2000*i*B/150U/220U)

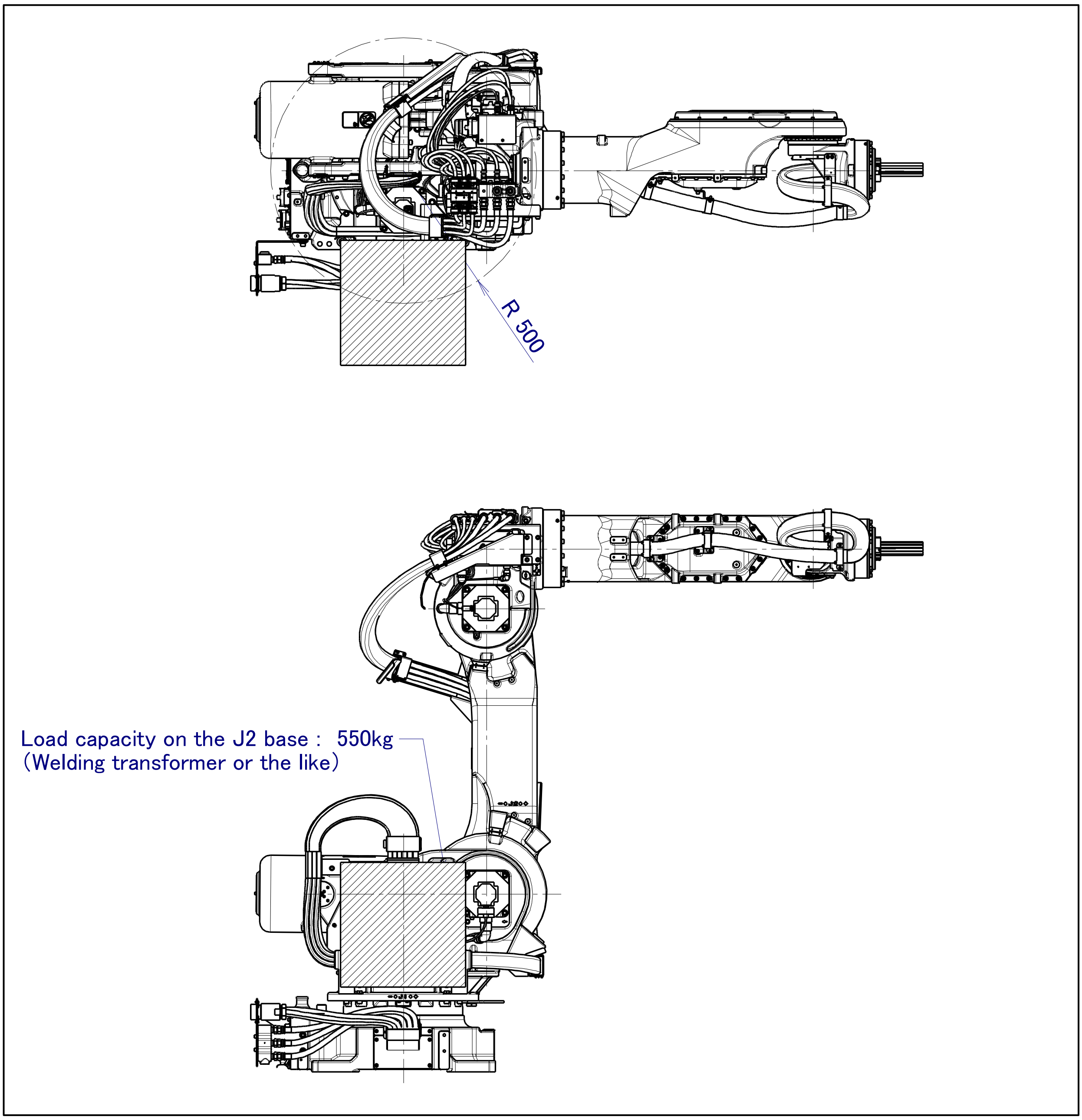


Fig. 3.5 (i) J2 base load condition (R-2000*i*B/210FS)

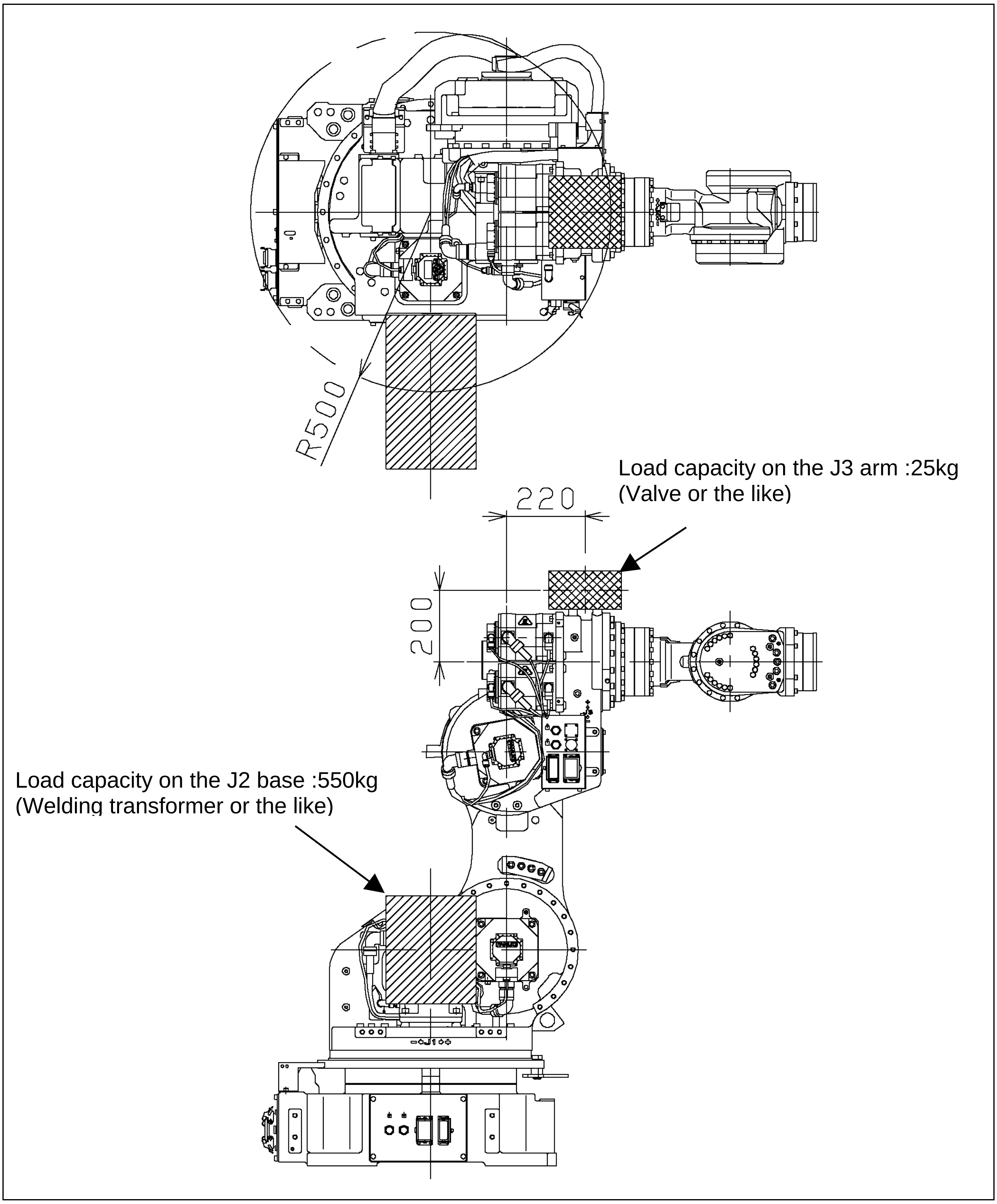


Fig. 3.5 (j) J2 base / J3 casing load condition (R-2000*i*B/165CF)

3.6 ATTENTION ABOUT 210WE

1. The liquids below cannot be applied because they may cause deterioration or corrosion of the rubber parts (such as gasket, oil seals, and O-rings) used in the robot. (As exception to this only liquids tested and approved by FANUC can be used with the robot.)
   (a) Organic solvent
   (b) Chlorine- or gasoline-based cutting fluid
   (c) Amine-based cleaning fluid
   (d) Liquid or solution that includes a corrosive such as an acid or alkali or causes rust
   (e) Some other liquid or solution to which nitrile rubber (NBR) does not have resistance

2. When the robot is used in an environment where a liquid such as water is dashed over the robot, great attention should be given to drainage under the J1 base.
   A failure may be caused if the J1 base is kept immersed in water due to poor drainage.

3. Replace gaskets by new one when it is removed when replacing part and check.
4. Don’t use unconfirmed liquid for cutting fluid and cleaning fluid.

Liquid model name	Manufacturer name	Permissible concentration
QUAKERCLEAN 624JBS	Quaker Chemical Corporation	5.0% Diluted to 20 parts of water
QUAKERCLEAN 624CP	Quaker Chemical Corporation	5.0% Diluted to 20 parts of water
HOUGHTO CLEAN 130F	HOUGHTON BRASIL LTDA.	5.0% Diluted to 20 parts of water

5. Note that applying a cleaning liquid not included in the specification or one beyond its permissible concentration or temperature even if it is included in the specification to the robot may results in serious damage to the robot.
6. Be sure to perform air purge by regulated pressure.(See Section 5.4.) Please do the air purge whenever the robot is stopping or the power supply is cut. The air purge stop causes the flood and the be dewy in the mechanism. Don’t apply factory air without any filter. Remove water and oil in compressed air using air purge kit (option).
7. Robot cannot be used in the condition that cleaning fluid splash on the robot.
8. Do not use the robot immersed in water, neither temporary nor permanent. Robot must not be wet permanently.

4 EQUIPMENT INSTALLATION TO THE ROBOT

4.1 END EFFECTOR INSTALLATION TO WRIST

Fig. 4.1 (b) to (m) show the figures for installing end effectors on the wrist. To fasten the end effector, first position it with two pin holes at G using fitting A or B, then lock it using screws at D. Select screws and positioning pins of a length that matches the depth of the tapped holes and pin holes. Fasten the bolt for fixing the end effector with following torque.

73.5±3.4Nm (750±35kgfcm)

Generally, the ISO flange is specified as the end effector mounting face. When using the insulated ISO flange, FANUC flange, or special flange, however, the corresponding adaptor needs to be attached.
For details on attaching the adaptors, see Section 4.2.

> ⚠ **CAUTION**
> 1. Notice the tooling coupling depth to wrist flange should be shorter than the flange coupling length.
> 2. When a FANUC flange or special flange is used, be sure to use ten bolts to install an end effector. (Except R-2000*i*B/165CF)
> 3. For the R-2000*i*B/210F/185L/250F/200R/100P/210WE/175L/220U/210FS /220US it is desirable to attach the end effector with 10 bolts.
> 4. In case of R-2000*i*B/210F/185L/250F/200R/100P/210WE/175L/220U/210FS/220US, please pay special attention when mounting peripheral equipment to J6. Such equipment must not get in touch with the protection metal plate for the oil seal (located at the wrist flange root side, as shown in Fig. 4.1 (a)). Indeed, if force is applied to this equipment and consequently the protection metal plate is moved, this may cause damage to the oil seal, as well as J6 axis calibration may become impossible.

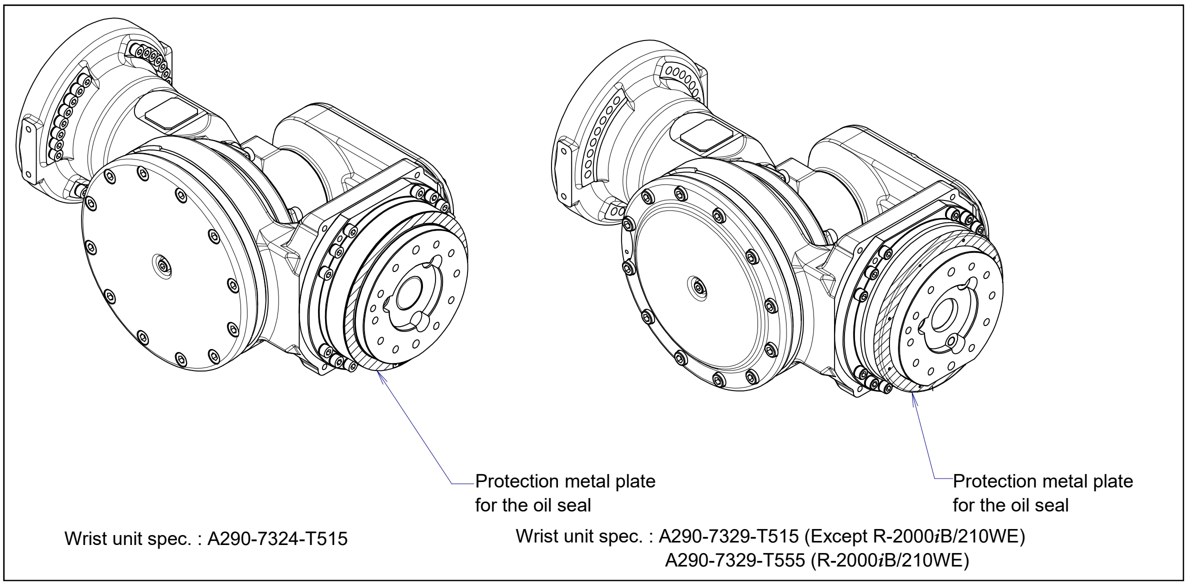


Fig. 4.1 (a) Protection metal plate for oil seal

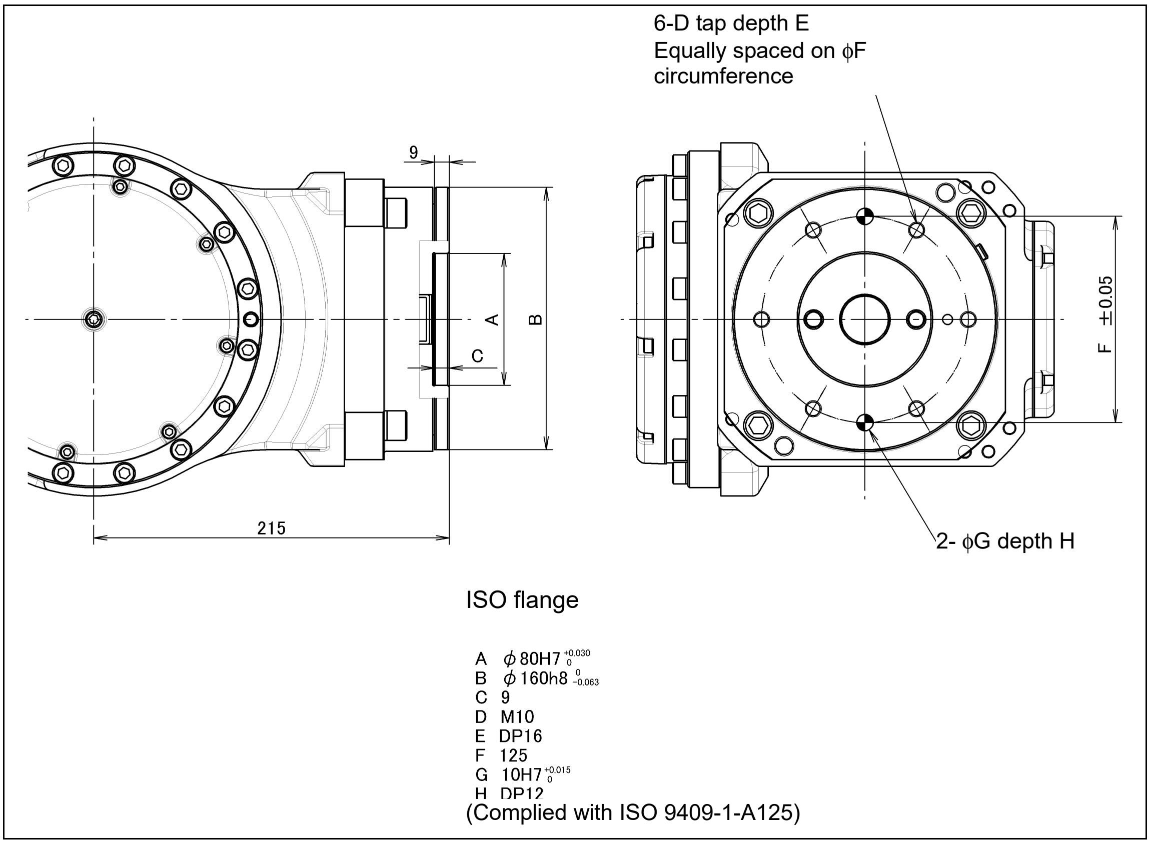


Fig. 4.1 (b) End effector mounting face (ISO flange) (R-2000*i*B/165F/165R/170CF/125L/100H/150U)

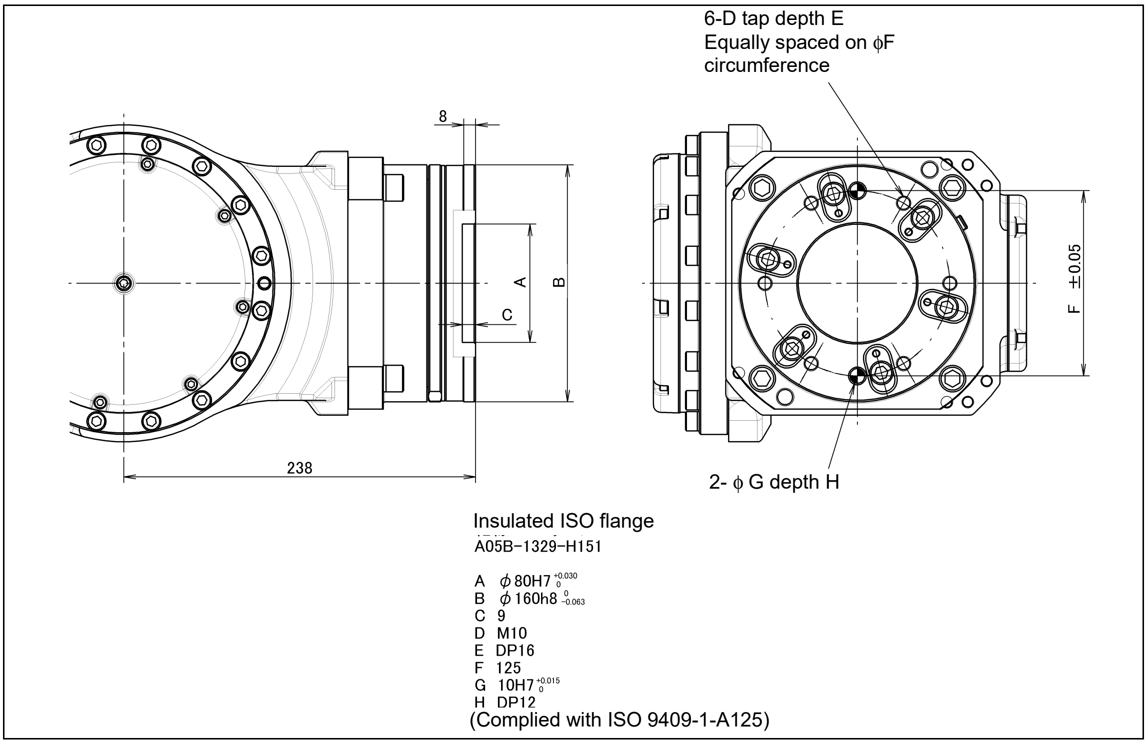
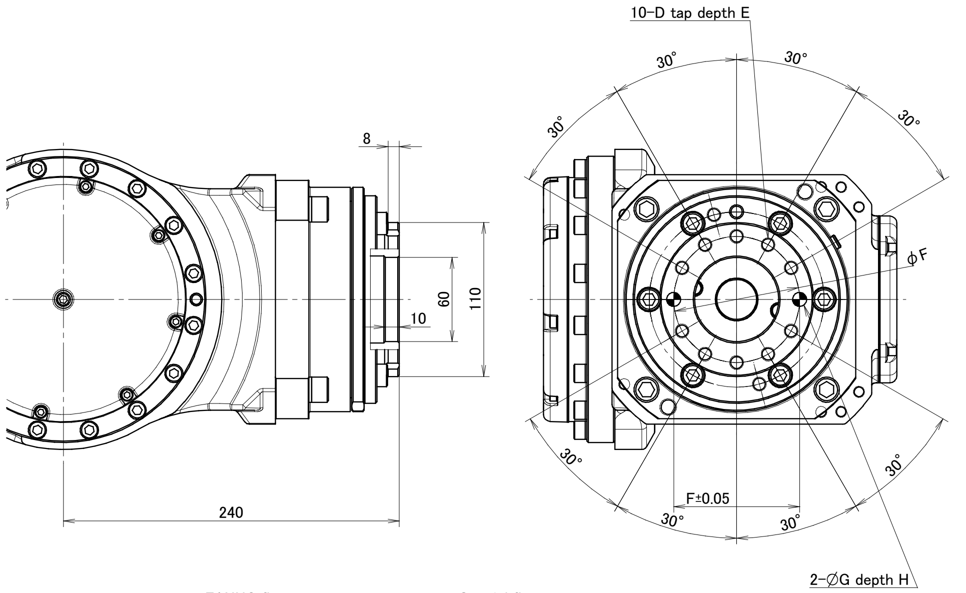


Fig. 4.1 (c) End effector mounting face (Insulated ISO flange) (R-2000*i*B/165F/165R/170CF/125L/150U)



FANUC flange
A05B-1329-K051

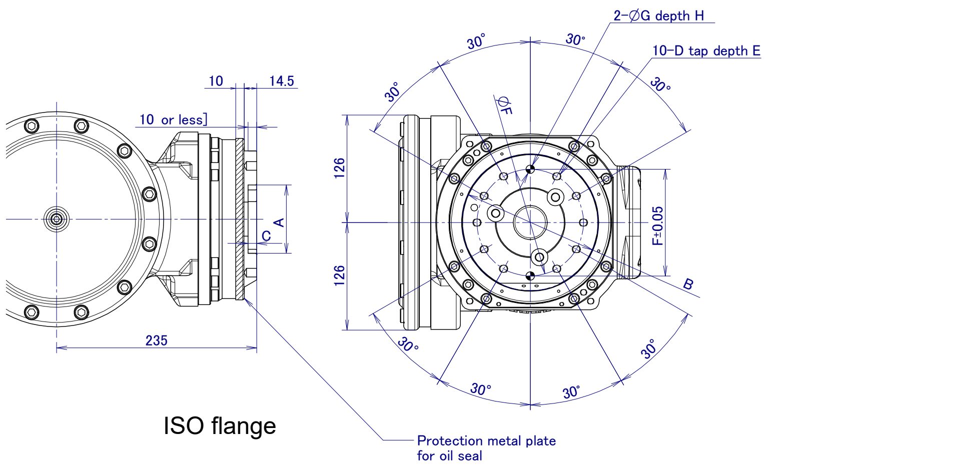
A ϕ60H7 $^{+0.030}_{0}$
B ϕ110h7 $^{0}_{-0.035}$
C 10
D M10
E DP16
F 90
G 10H7 $^{+0.015}_{0}$
H DP12

Special flange
A05B-1329-K052

A ϕ76G7 $^{+0.040}_{+0.010}$
B ϕ108f8 $^{-0.036}_{-0.090}$
C 11
D M10
E DP16
F 92
G 9H7 $^{+0.015}_{0}$
H DP12

Fig. 4.1 (d) End effector mounting face (FANUC／special flange) (R-2000*i*B/165F/165R/170CF/125L/100H/150U)

> ⚠ **CAUTION**
> When a FANUC flange or special flange is used, be sure to use ten bolts to install an end effector.

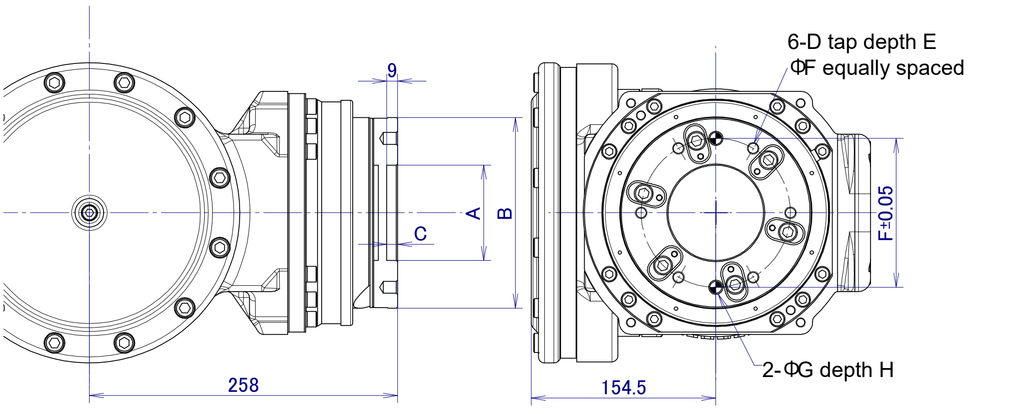


ISO flange

A ϕ80H7 $^{+0.030}_{0}$
B ϕ160h8 $^{0}_{-0.063}$
C 10
D M10
E DP18
F 125
G 10H7 $^{+0.015}_{0}$
H DP12
(Complied with ISO 9409-1-A125)

Fig. 4.1 (e) End effector mounting face (ISO flange) (R-2000*i*B/210F/185L/250F/200R/100P/175L/220U)

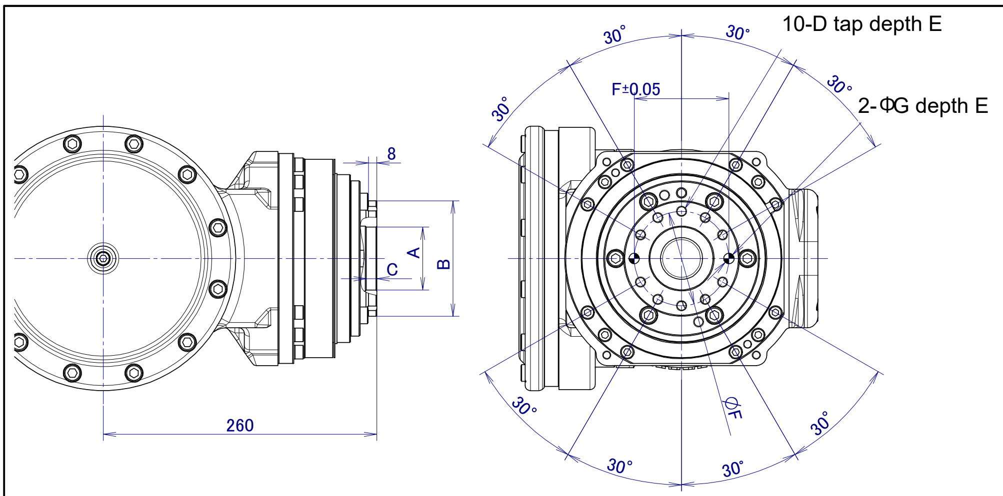
> ⚠ **CAUTION**
> When R-2000*i*B/210F/185L/250F/200R/100P/175L is specified, use ten bolts to install an end effector, if possible.



Insulated flange
A05B-1329-H151

A ϕ 80H7 $^{+0.030}_{0}$
B ϕ 160h8 $^{0}_{-0.063}$
C 10
D M10
E DP16
F 125
G 10H7 $^{+0.015}_{0}$
H DP12
(Complied with ISO 9409-1-A125)

Fig. 4.1 (f) End effector mounting face (Insulated ISO flange) (R-2000*i*B/210F/185L/250F/200R/100P/175L/220U)



FANUC flange
A05B-1329-K051

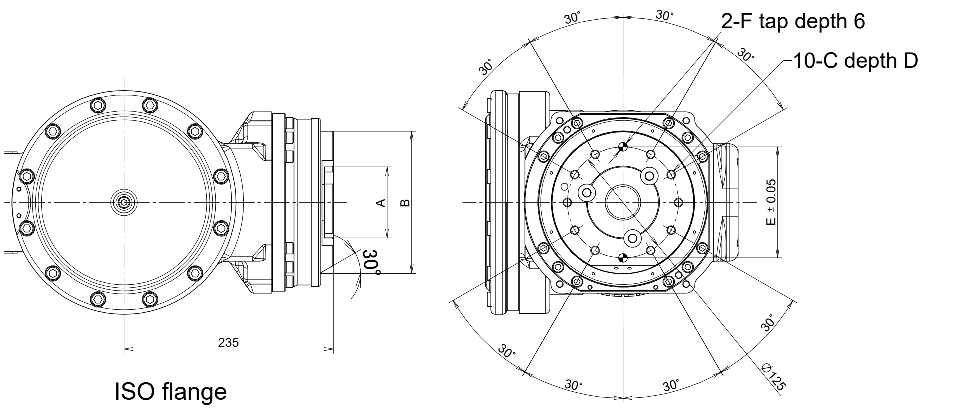
A ϕ 60H7 $^{+0.030}_{0}$
B ϕ 110h7 $^{0}_{-0.035}$
C 10
D M10
E DP16
F 90
G 10H7 $^{+0.015}_{0}$
H DP12

Special flange
A05B-1329-K052

A ϕ 76G7 $^{+0.040}_{+0.010}$
B ϕ 108f8 $^{-0.036}_{-0.090}$
C 11
D M10
E DP16
F 92
G 9H7 $^{+0.015}_{0}$
H DP12

Fig. 4.1 (g) End effector mounting face (FANUC／Special flange) (R-2000*i*B/210F/200R)

> ⚠ **CAUTION**
> When a FANUC flange or special flange is used, use ten bolts to install an end effector, if possible.

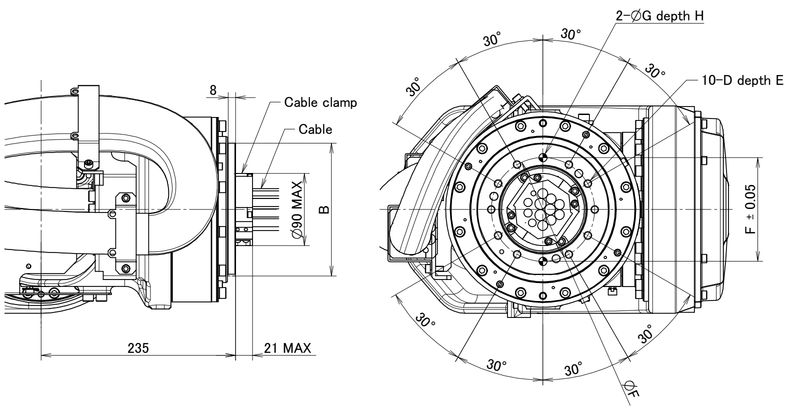


ISO flange

A ϕ80
B ϕ160
C M10
D DP16
E 125
F $10H7\ ^{+0.015}_{0}$
G DP12
(Complied with ISO 9409-1-A125)

Fig. 4.1 (h) End effector mounting face (ISO flange) (R-2000*i*B/210WE)

> ⚠ **CAUTION**
> In case of R-2000*i*B/210WE, it is impossible to use fitness portion of inside diameter and outside diameter. Please use locating pin for mounting of end effector.



ISO flange

A —
B $\varnothing 160h8\ ^{0}_{-0.063}$
C —
D M10
E DP16
F 125
G $10H7\ ^{+0.015}_{0}$
H DP12
(Complied with ISO 9409-1-A125)

Fig. 4.1 (i) End effector mounting face (ISO flange) (R-2000*i*B/210FS/220US)

> ⚠ **CAUTION**
> It is necessary to prepare hollow diameter larger than ϕ90 and work space for the tool side to form and replace cables.

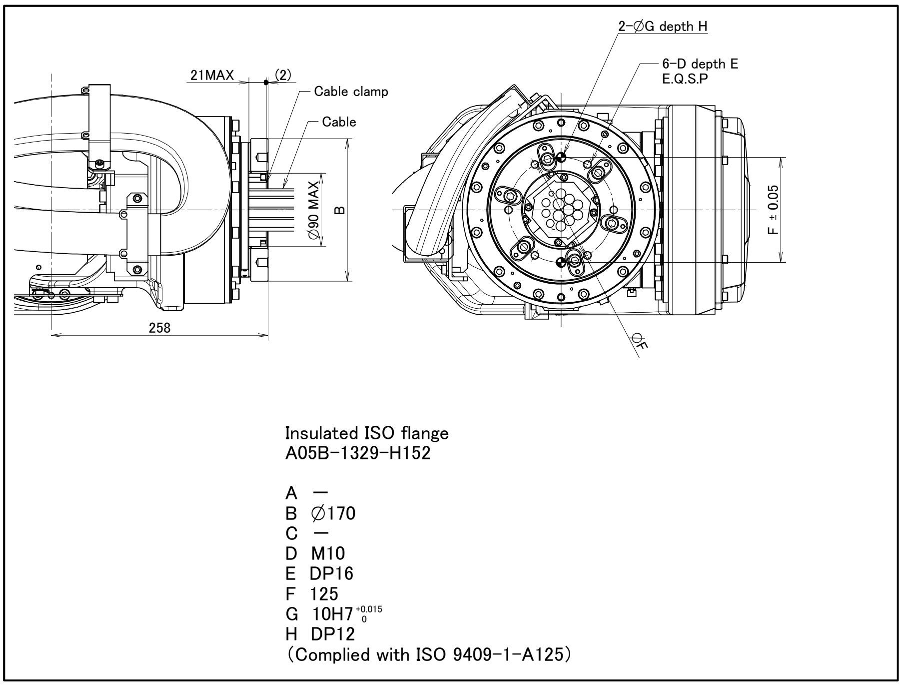


Fig. 4.1 (j) End effector mounting face (Insulated ISO flange) (R-2000*i*B/210FS/220US)

> ⚠ **CAUTION**
> It is necessary to prepare hollow diameter larger than ϕ60 and forming cable space for the tool side.
> It is necessary to prepare hollow diameter larger than ϕ90 and work space for the tool side to replace cables without removing the tool.

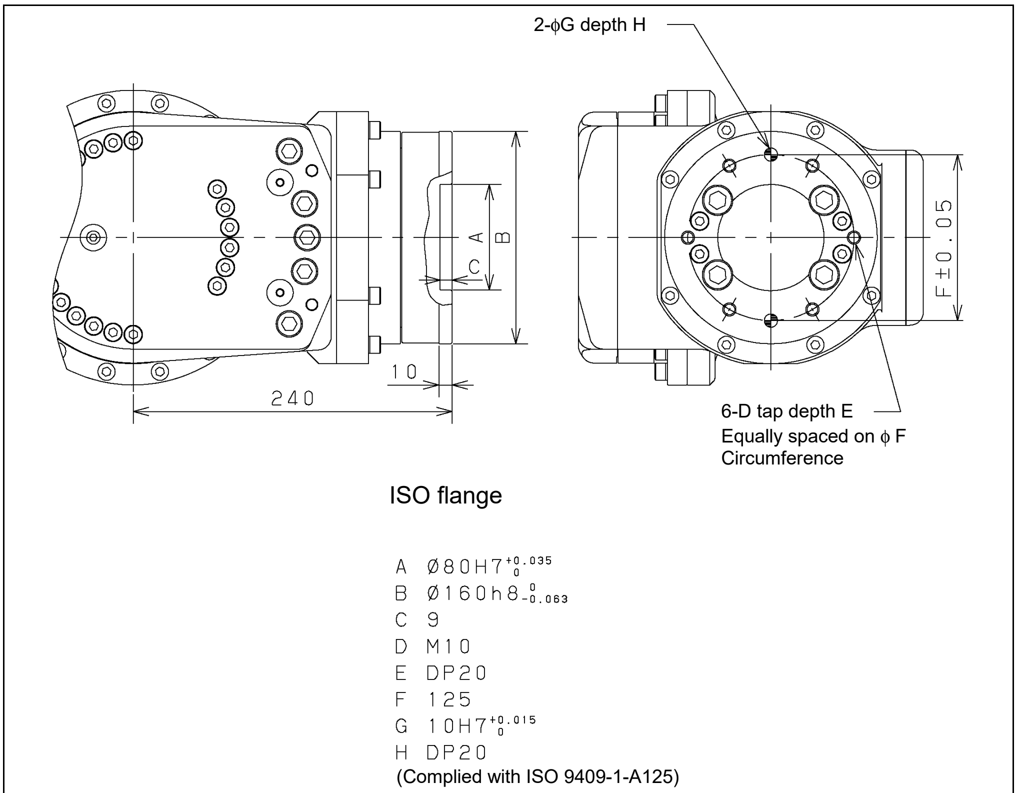
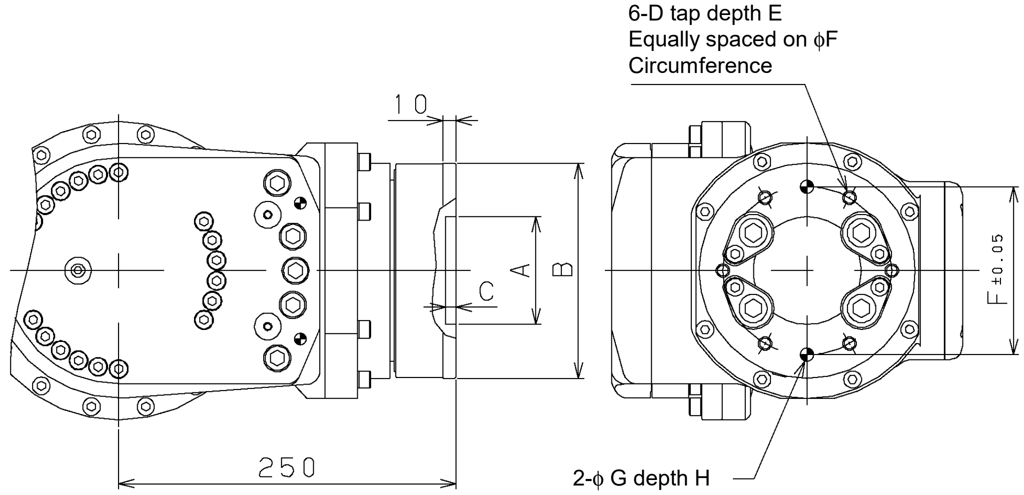


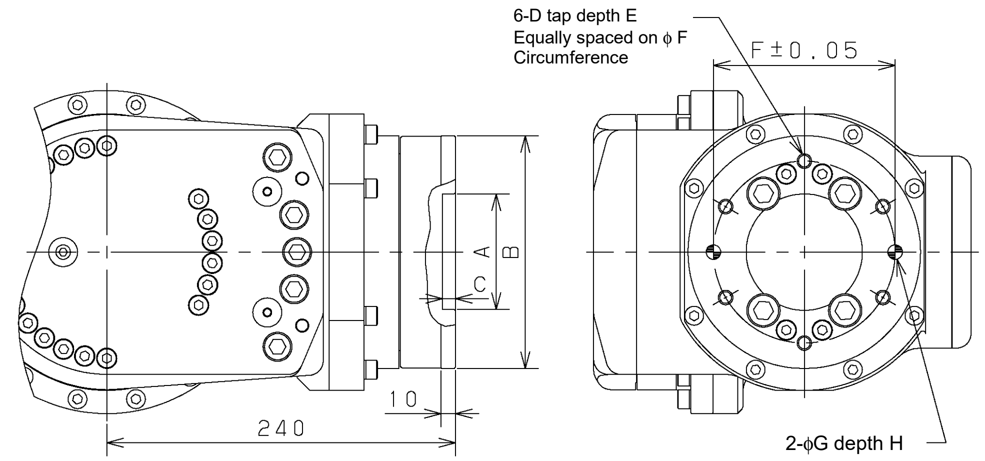
Fig. 4.1 (k) End effector mounting face (ISO flange) (R-2000*i*B/165CF)



Insulated ISO flange
A05B-1321-H153

A $\varnothing 80H7^{+0.030}_{0}$
B $\varnothing 160h8^{0}_{-0.063}$
C 8
D M10
E DP20
F 125
G $10H7^{+0.015}_{0}$
H DP20
(Complied with ISO 9409-1-A125)

Fig. 4.1 (l) End effector mounting face (Insulated ISO flange) (R-2000*i*B/165CF)



FANUC flange	Special flange
A05B-1321-H051	A05B-1321-H052
A $\varnothing 60H7^{+0.030}_{0}$	A $\varnothing 76G7^{+0.040}_{+0.010}$
B $\varnothing 110h7^{0}_{-0.035}$	B $\varnothing 108f8^{-0.036}_{-0.090}$
C 6	C 10
D M10	D M10
E DP20	E DP20
F 90	F 92
G $10H7^{+0.015}_{0}$	G $9H7^{+0.015}_{0}$
H DP20	H DP20

Fig. 4.1 (m) End effector mounting face (FANUC / special flange) (R-2000*i*B/165CF)

4.2 INSTALLING A FANUC/SPECIAL FLANGE ADAPTER (R-2000*i*B/165F/210F/165R/200R/100P/170CF/125L/100H/150U)

Fig. 4.2 (a) shows the method of installing a FANUC flange adapter and special flange adapter.

1 Press the pin into the adapter. At this time, apply LOCTITE 601 to the fitting surface.
2 Attach the adapter to the robot by using six M10 x 20 bolts. At this time, apply LOCTITE 263 to the screw, and tighten the screw by the following torque.

73.5±3.4 Nm (750±35kgfcm)

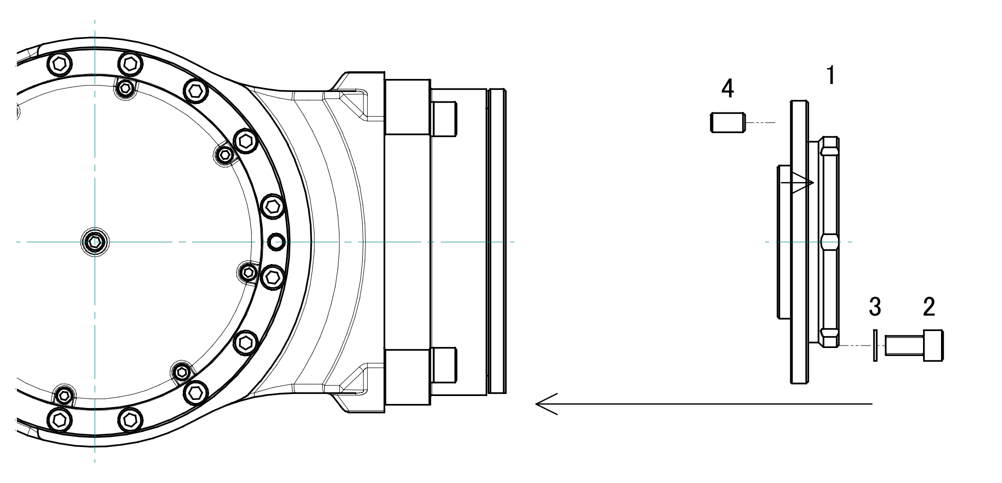


Fig. 4.2 (a) Installing a FANUC/Special flange adapter (R-2000*i*B/165F/210F/165R/200R/100P/170CF/125L/100H/150U)

	Name	Specifications	Q'ty	LOCTITE	Torque N-m (kgf cm)
1	ADAPTER	A290-7324-X551 (FANUC) A290-7324-X552 (SPECIAL)	1		
2	BOLT	A6-BA-10X20	6	LT263	73.5±3.4 (750±35)
3	WASHER	A97L-0001-0823#M10H	6		
4	PIN	JB-PH-H7A-10X18S45C	1	LT601	

4.3 EQUIPMENT MOUNTING FACE

As shown in Fig. 4.3 (a) to (l), tapped holes are provided to install equipment to the robot.

> ⚠ **CAUTION**
> 1 Never perform additional machining operations such as drilling or tapping on the robot body. This can seriously affect the safety and functions of the robot.
> 2 Note that the use of a tapped hole not shown in the following figure is not assured. Please do not tighten both with the tightening bolts used for mechanical unit.
> 3 Equipment should be installed so that mechanical unit cable does not interfere. If equipment interfere, the mechanical unit cable might be disconnected, and unexpected troubles might occur.
> 4 When using a user tap shown in Fig. 4.3 (a) to (l), keep the center of gravity position of the equipment according to Section 3.5.

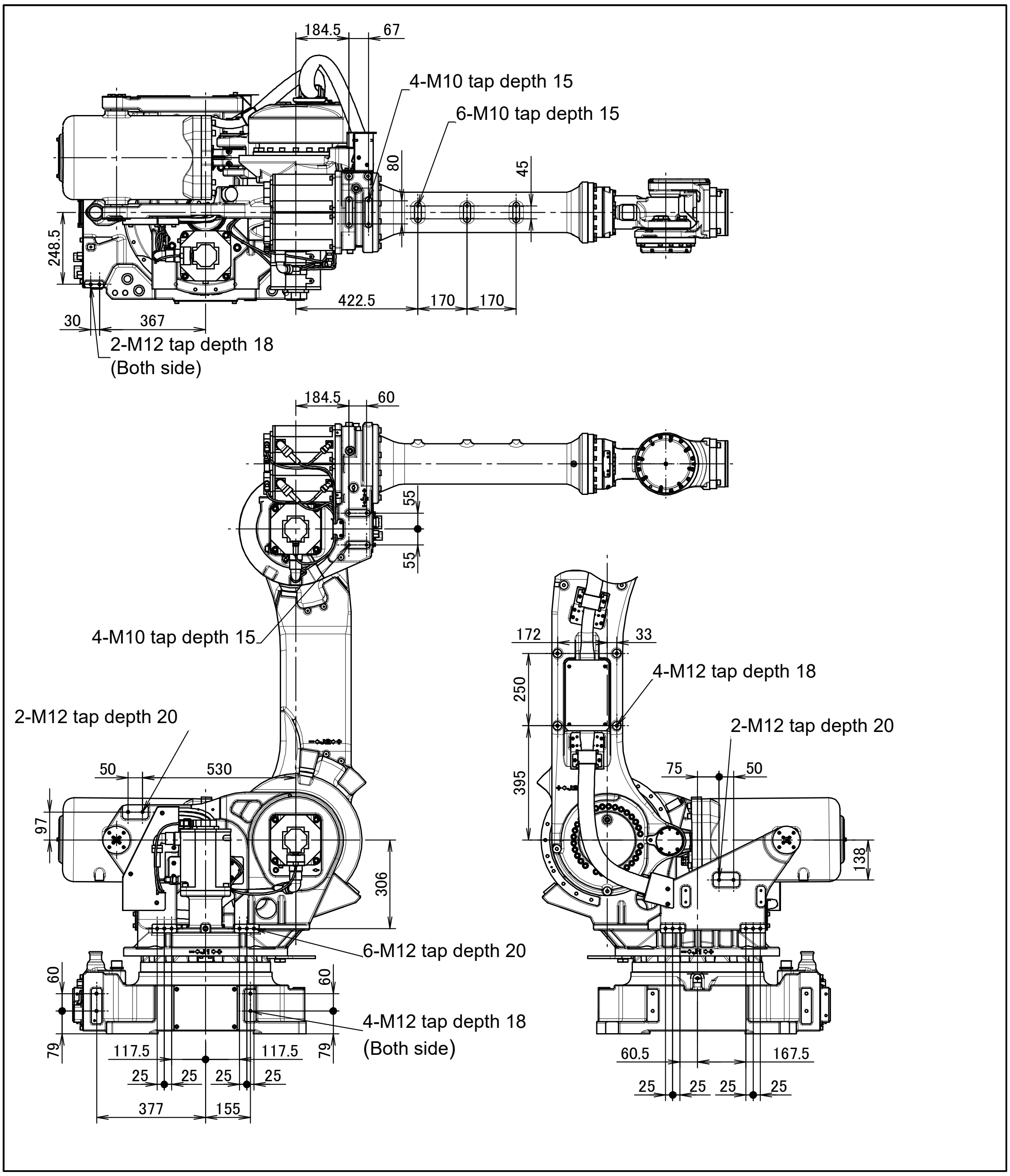


Fig. 4.3 (a) Equipment mounting faces (R-2000*i*B/165F/210F/250F/150U/220U)

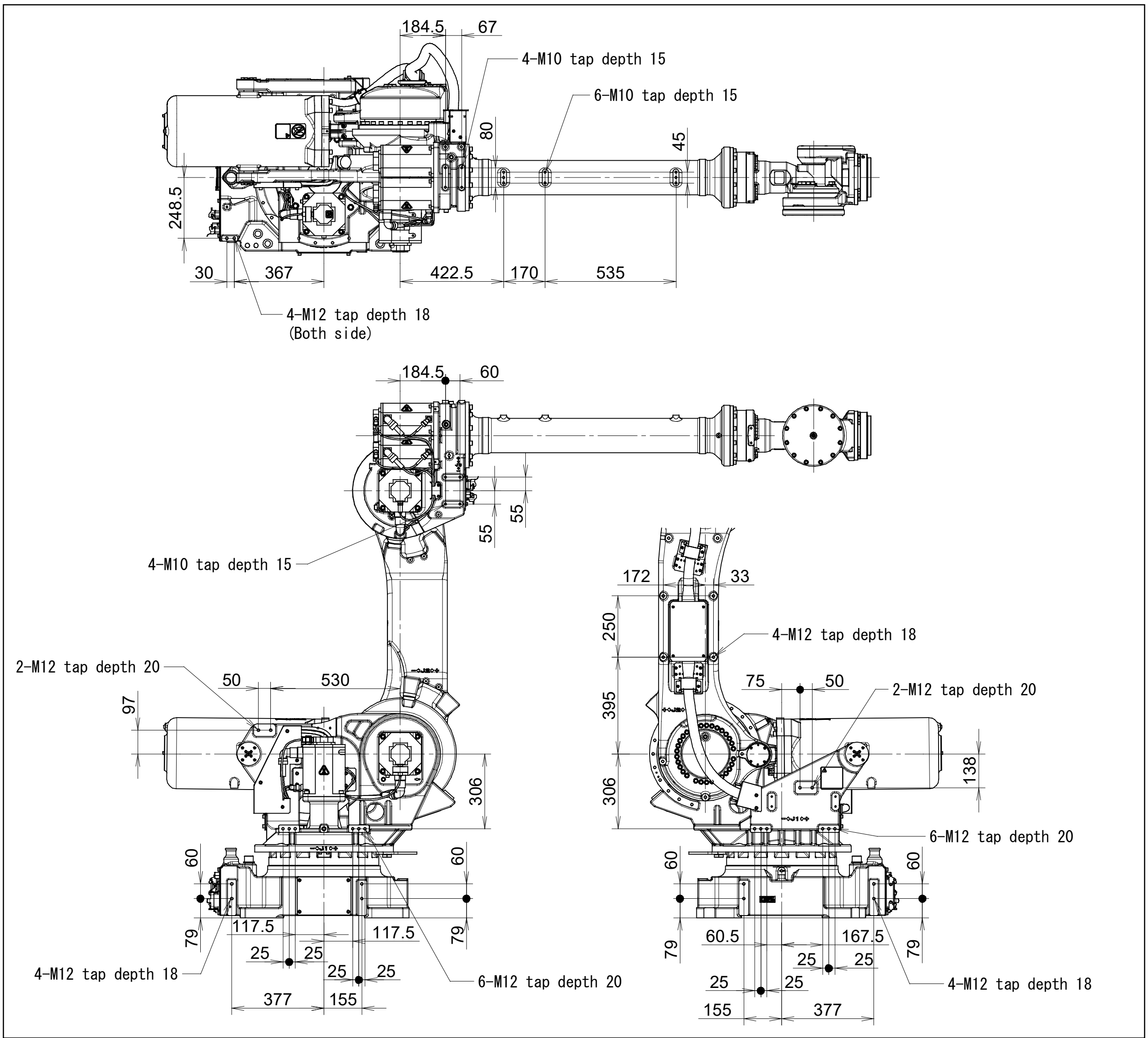


Fig. 4.3 (b) Equipment mounting faces (R-2000*i*B/185L)

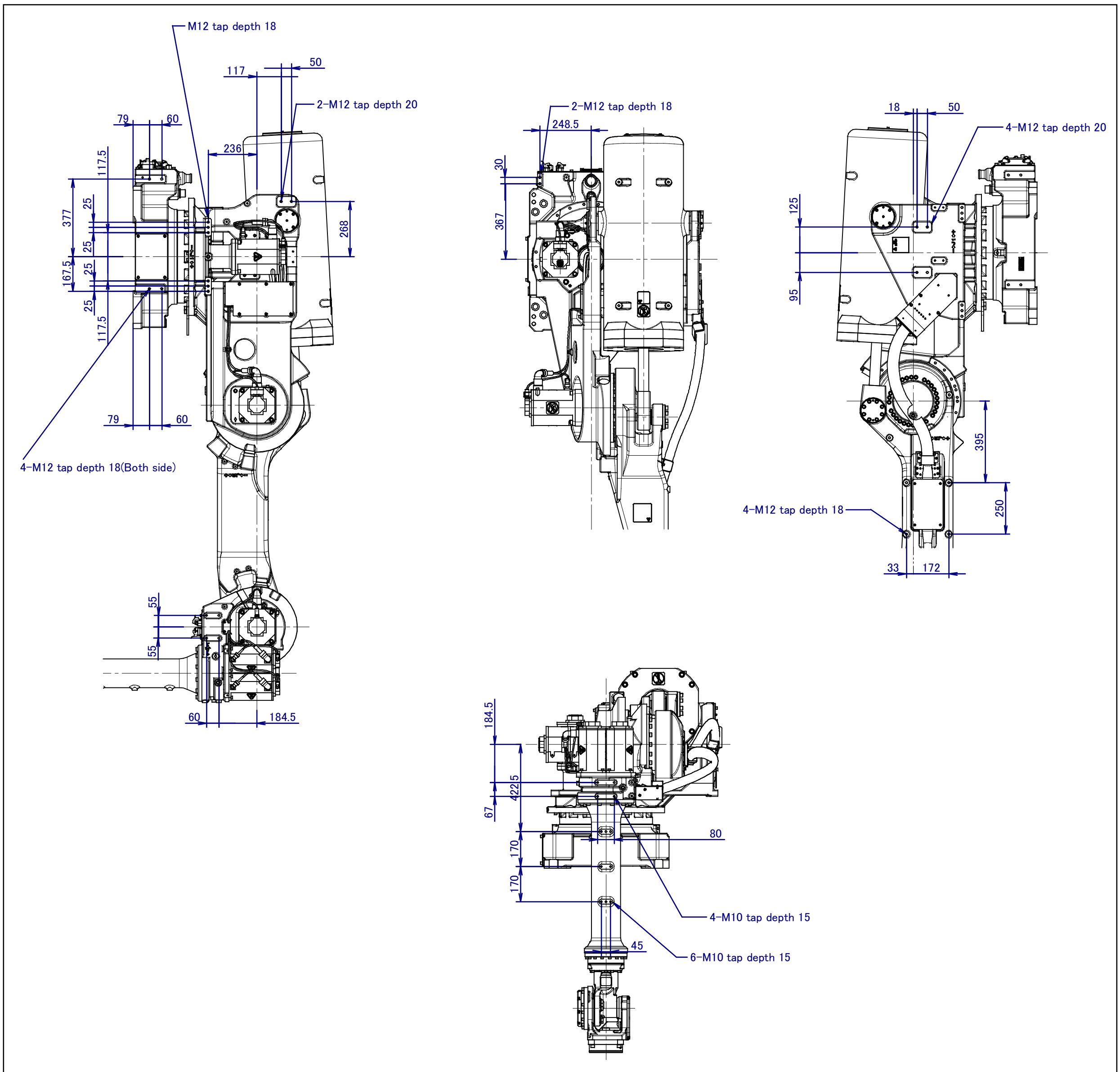


Fig. 4.3 (c) Equipment mounting faces (R-2000*i*B/165R)

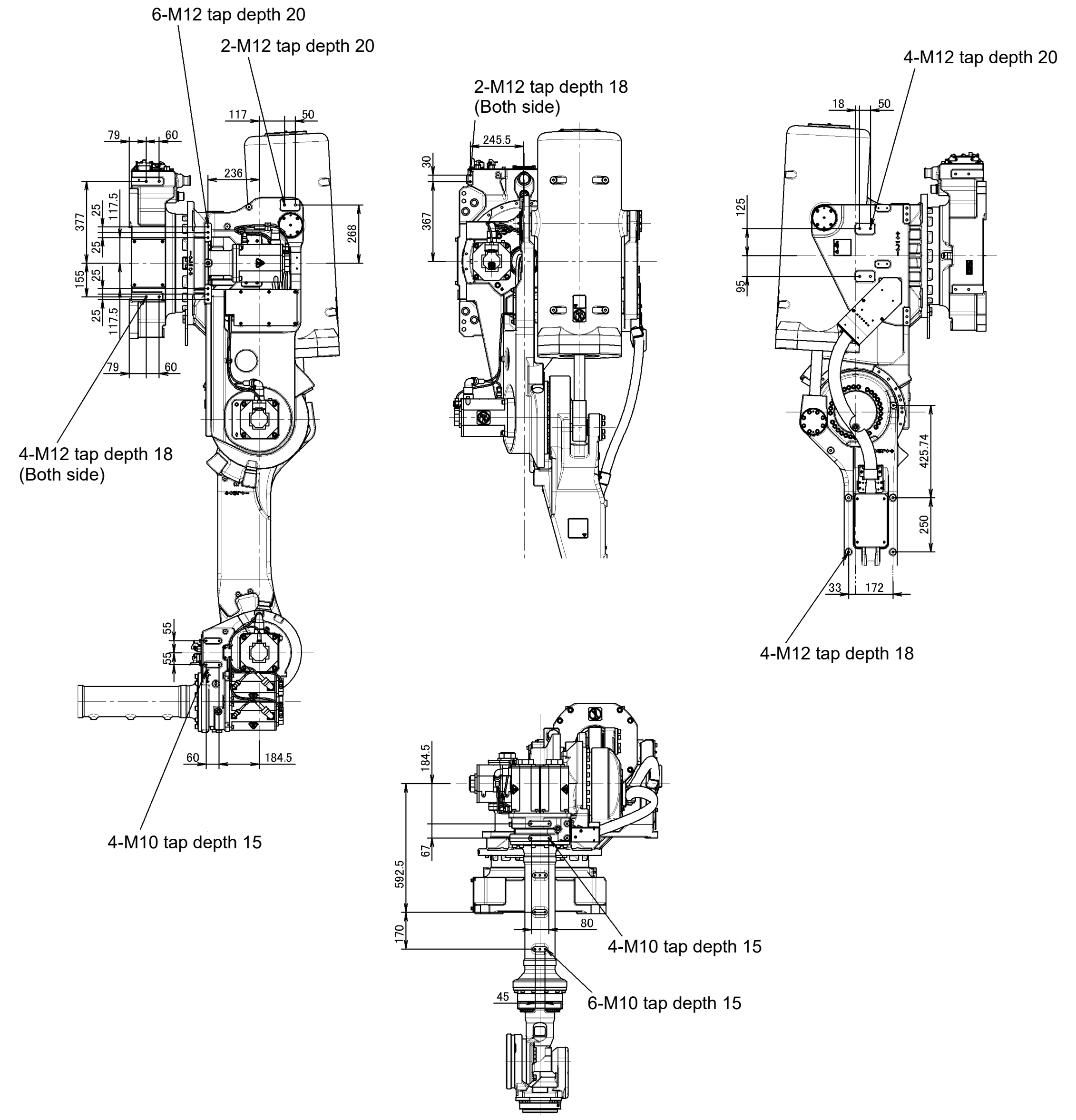


Fig. 4.3 (d) Equipment mounting faces (R-2000*i*B/200R)

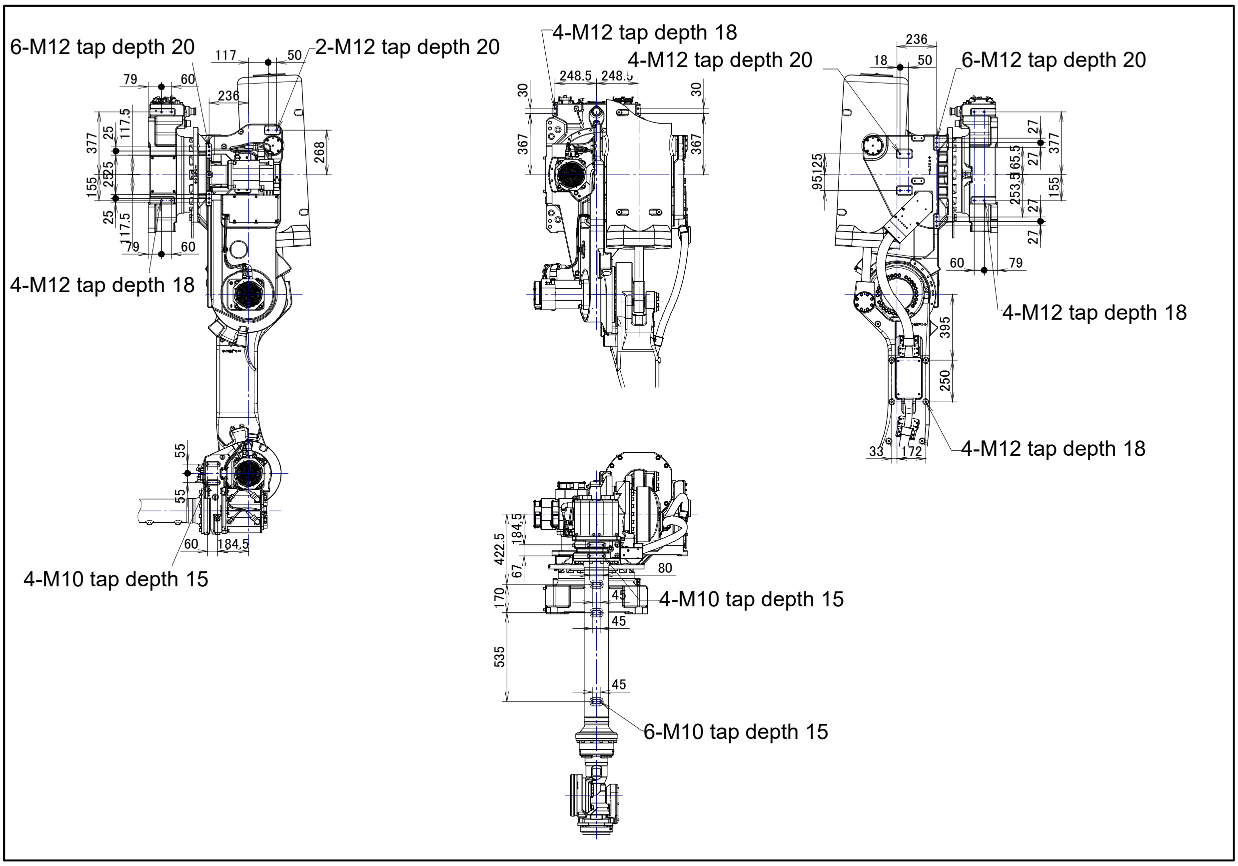


Fig. 4.3 (e) Equipment mounting faces (R-2000*i*B/100P)

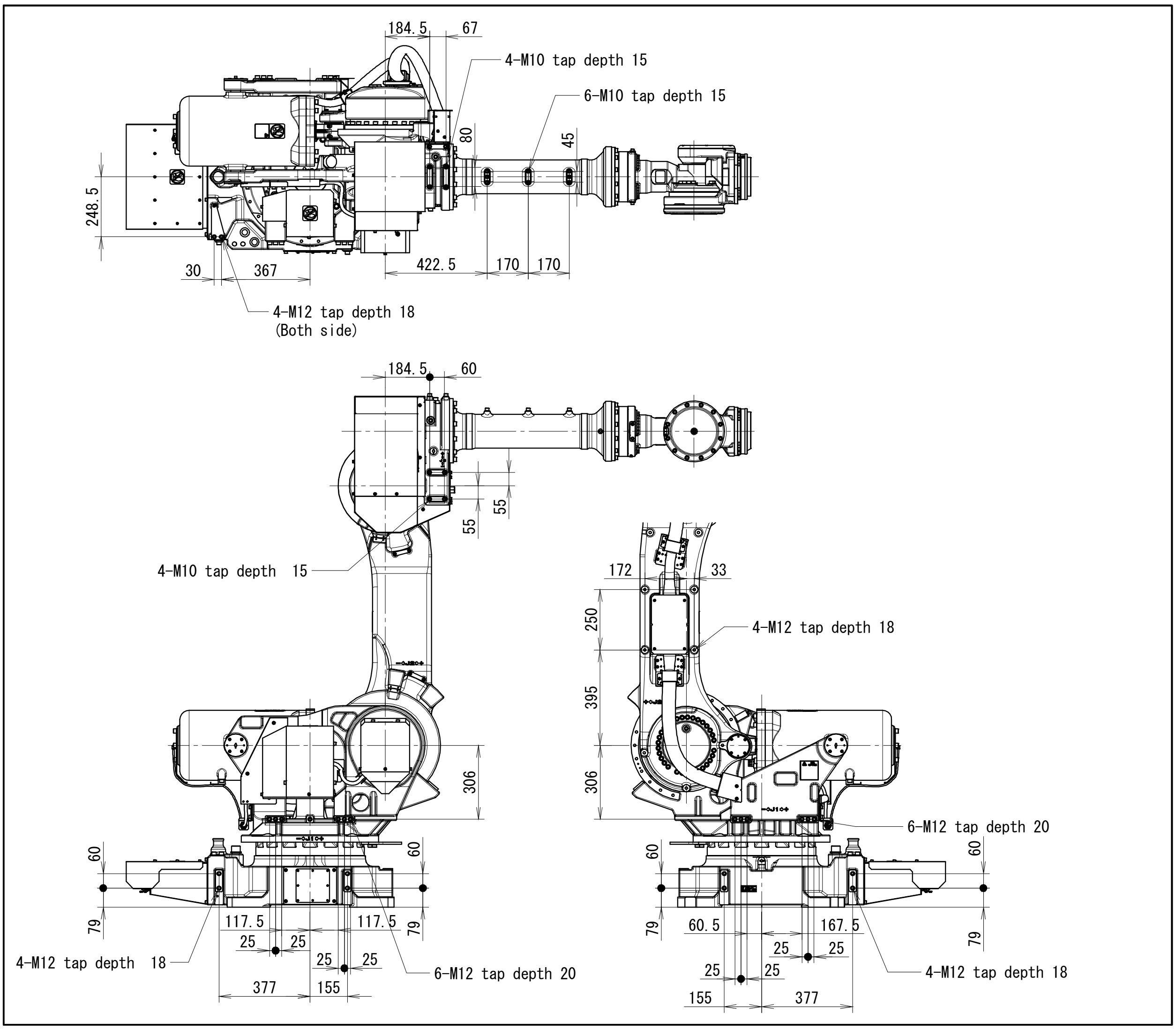


Fig. 4.3 (f) Equipment mounting faces (R-2000*i*B/210WE)

> ⚠ **CAUTION**
> In case of R-2000*i*B/210WE, All of the above mentioned taps for the equipment are protected by antirust treatment or metal plate when robot is shipped. If these taps are used, be sure to perform antirust treatment or attach metal plate which is installed when robot is shipped again to prevent rust.

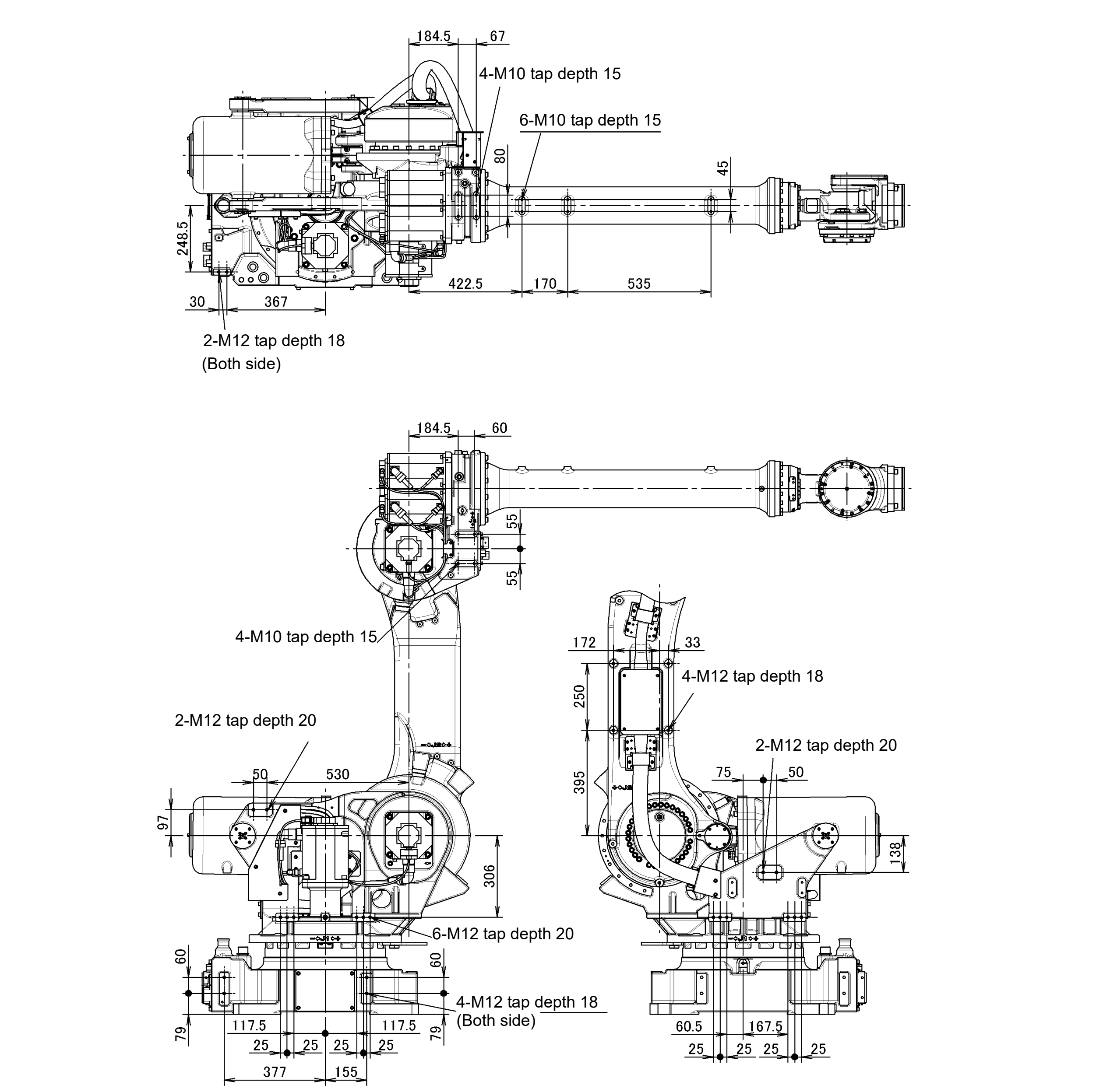


Fig. 4.3 (g) Equipment mounting faces (R-2000*i*B/125L)

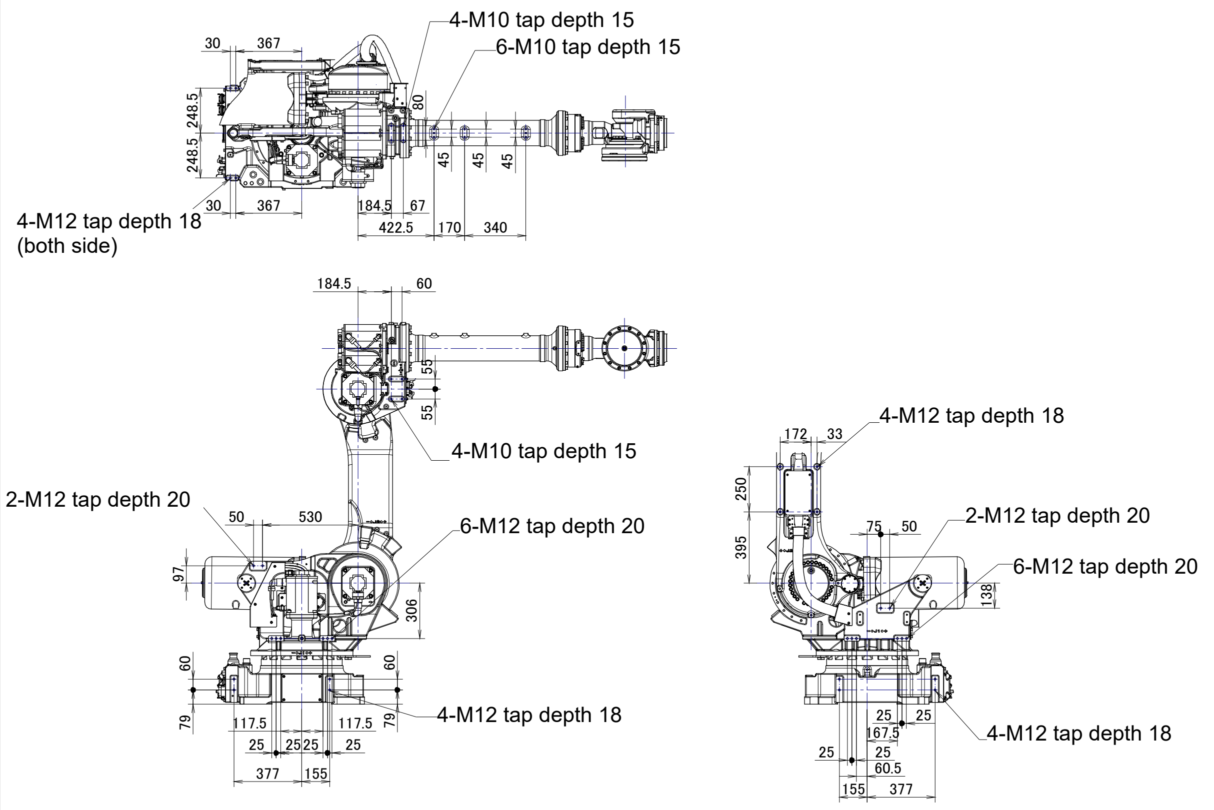


Fig. 4.3 (h) Equipment mounting faces(R-2000*i*B/175L)

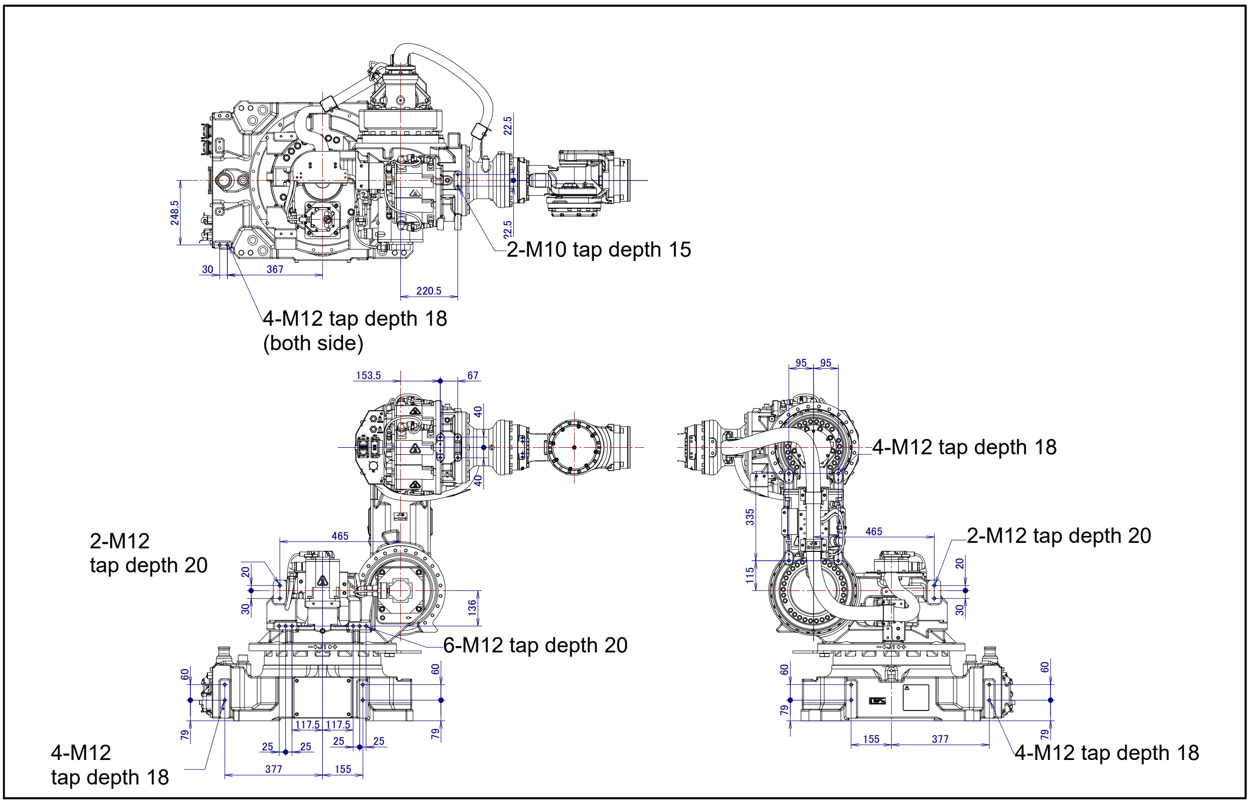


Fig. 4.3 (i) Equipment mounting faces (R-2000*i*B/170CF)

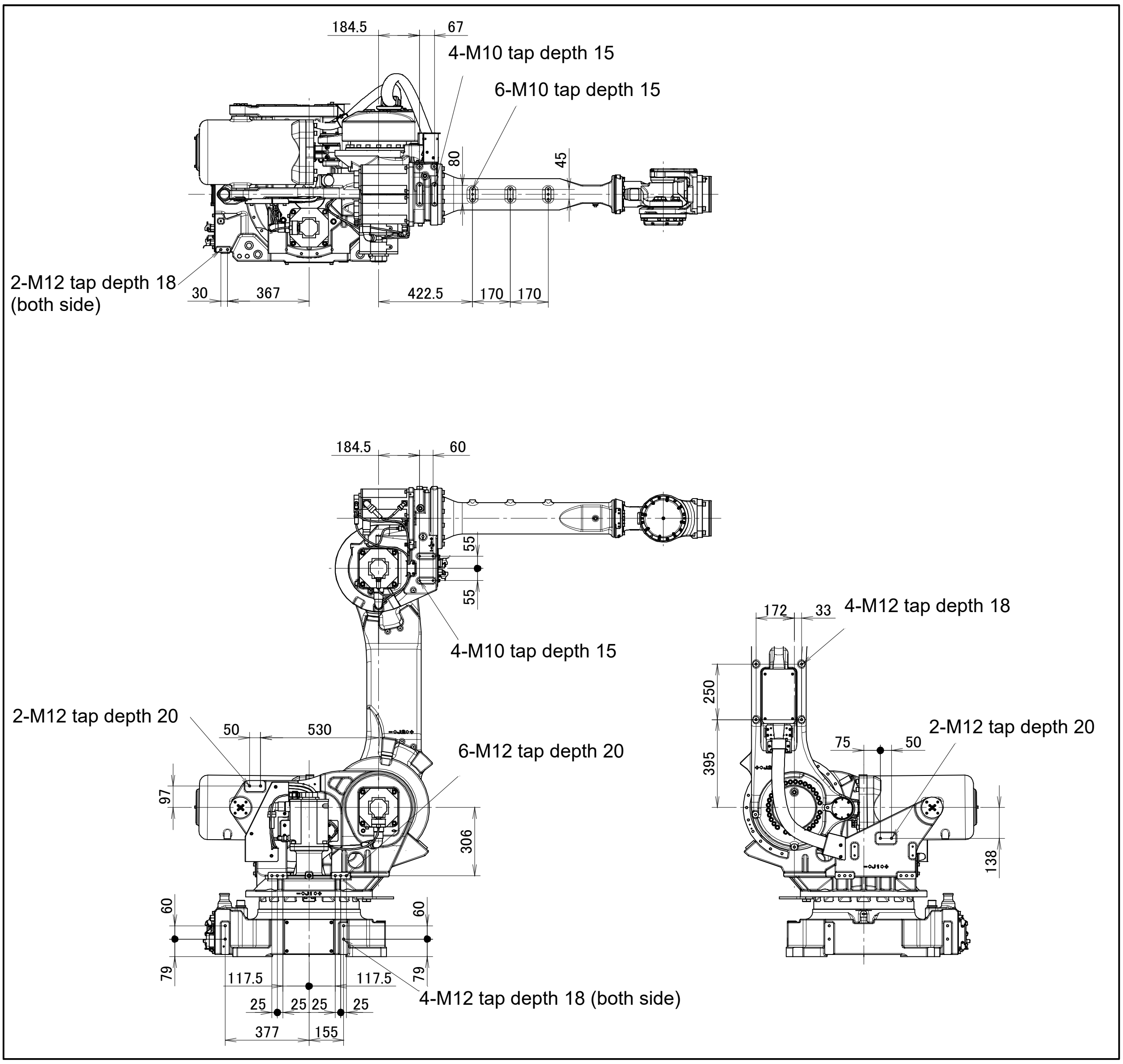


Fig. 4.3 (j) Equipment mounting faces (R-2000*i*B/100H)

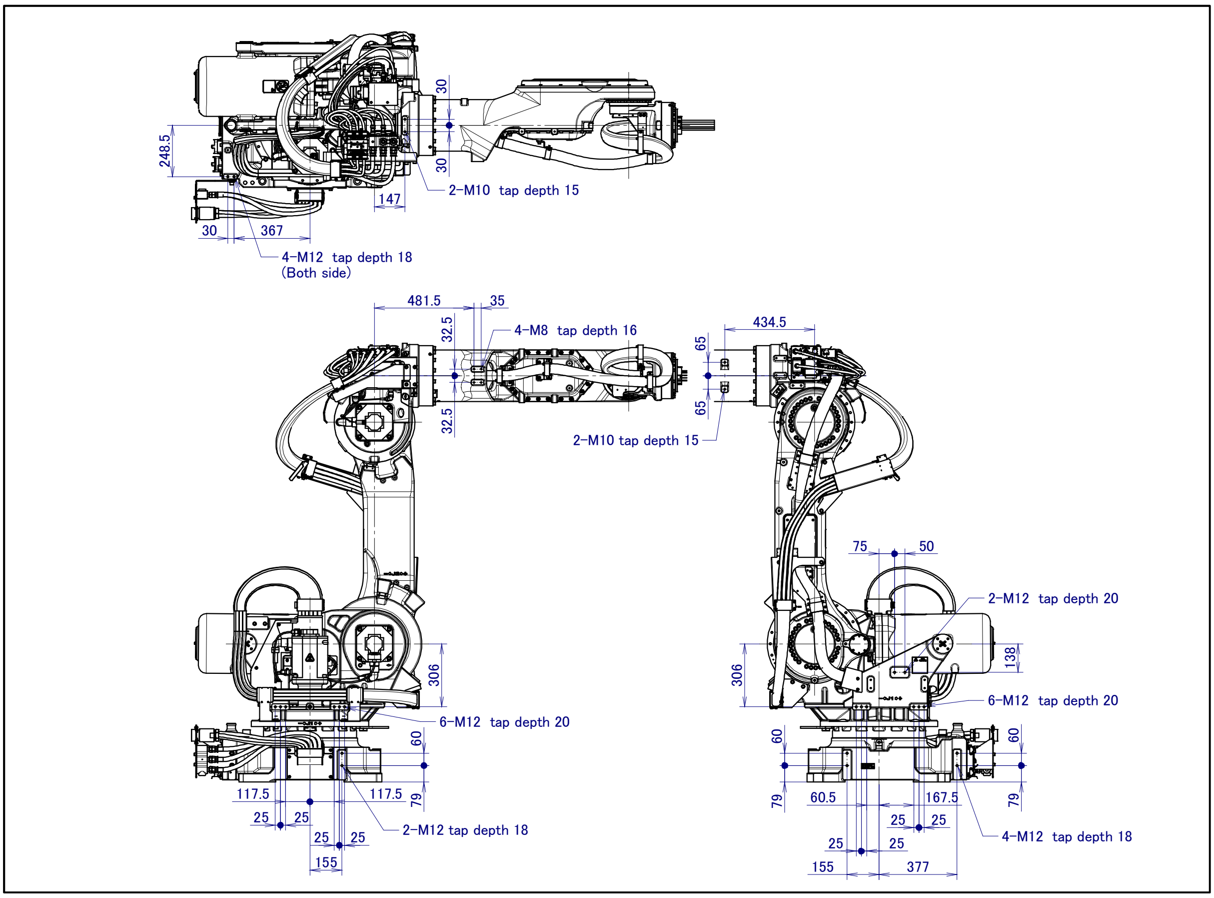


Fig. 4.3 (k) Equipment mounting faces(R-2000*i*B/210FS/220US)

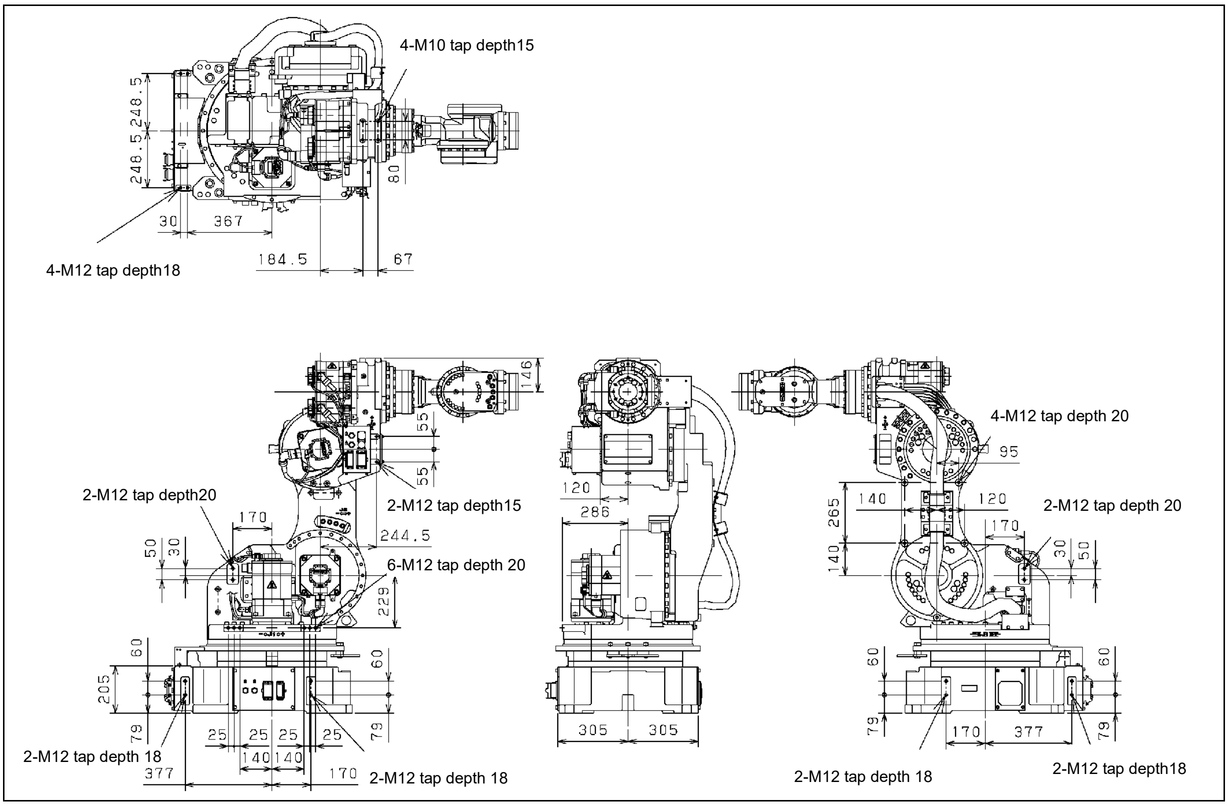


Fig. 4.3 (l) Equipment mounting faces (R-2000*i*B/165CF)

4.4 LOAD SETTING

> ⚠ **CAUTION**
> 1 Set load condition parameter before operating the robot. Do not operate the robot in over payload reduction. Don't exceed allowable payload including connection cables and its swing. Otherwise troubles such as degradation of reducer life may occur. Don't exceed allowable payload including connection cables and its swing.
> 2 WHEN PERFORMING LOAD ESTIMATION AFTER PARTS REPLACEMENT
> If wrist axes (J5/J6-axis) motors or reducers are replaced, estimation accuracy may go down. Perform the calibration for load estimation before performing load estimation. Refer to below.
> Section 9.15 "LOAD ESTIMATION" in R-30*i*A Controller Spot tool+ OPERATOR'S MANUAL (B-83124EN-1).
> Section 9.15 "LOAD ESTIMATION" in R-30*i*A Controller Handling tool OPERATOR'S MANUAL (B-83124EN-2).
> Section 9.15 "LOAD ESTIMATION" in R-30*i*A Controller Dispense tool OPERATOR'S MANUAL (B-83124EN-4).
> Chapter 9 "LOAD ESTIMATION" in R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus Controller Optional Function OPERATOR'S MANUAL (B-83284EN-2).

The operation motion performance screens include the MOTION PERFORMANCE screen, MOTION PAYLOAD SET screen, and payload information and equipment information on the robot.

1 Press the [MENU] key to display the screen menu.
2 Select "6 SYSTEM" on the next page.
3 Press the F1 ([TYPE]) key to display screen switch menu.
4 Select "Motion" The MOTION PERFORMANCE screen will be displayed.

```
MOTION PERFORMANCE                    JOINT 10%
   Group1
No.  PAYLOAD[kg]         Comment
 1          165.00    [                  ]
 2            0.00    [                  ]
 3            0.00    [                  ]
 4            0.00    [                  ]
 5            0.00    [                  ]
 6            0.00    [                  ]
 7            0.00    [                  ]
 8            0.00    [                  ]
 9            0.00    [                  ]
10            0.00    [                  ]

  Active PAYLOAD number =0
[ TYPE]  GROUP  DETAIL  ARMLOAD  SETIND >
```

5 Ten different pieces of payload information can be set using condition No. 1 to 10 on this screen. Place the cursor on one of the numbers, and press F3 (DETAIL). The MOTION PAYLOAD SET screen will be displayed.

```
MOTION/PAYLOAD SET                      JOINT 10%

   Group 1
 1 Schedule No[          1]:[Comment            ]
 2 PAYLOAD                    [kg]          165.00
 3 PAYLOAD CENTER  X [cm]                   -28.53
 4 PAYLOAD CENTER  Y [cm]                     0.00
 5 PAYLOAD CENTER  Z [cm]                    27.78
 6 PAYLOAD INERTIA X [kgfcms^2]              56.84
 7 PAYLOAD INERTIA Y [kgfcms^2]              59.39
 8 PAYLOAD INERTIA Z [kgfcms^2]              15.10

 [TYPE] GROUP NUMBER    DEFAULT    HELP
```

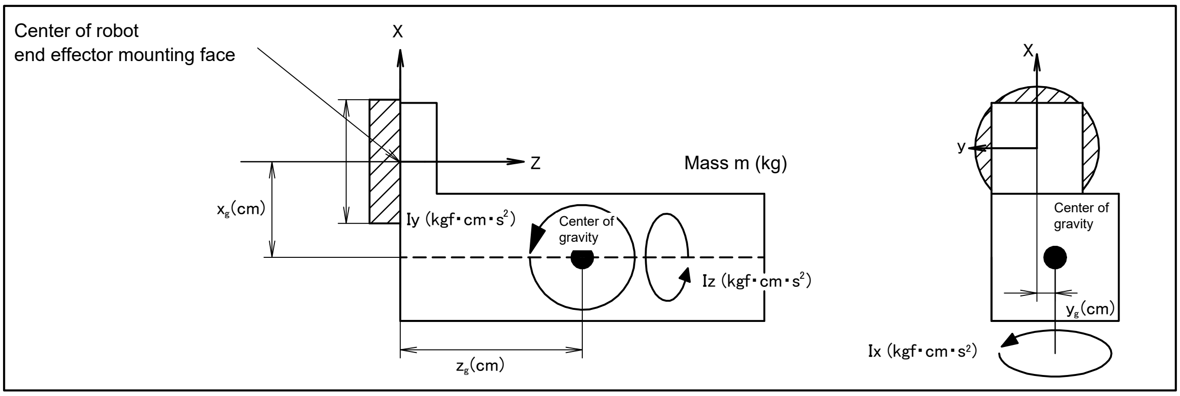


Fig. 4.4 (a) Standard tool coordinate

6 Set the payload, gravity center position, and inertia around the gravity center on the MOTION PAYLOAD SET screen. The X, Y, and Z directions displayed on this screen correspond to the respective standard tool coordinates (with no tool coordinate system set up). When values are entered, the following message appears: "Path and Cycletime will change. Set it?" Respond to the message with F4 ([YES]) or F5 ([NO]).

7 Pressing F3 ([NUMBER]) will bring you to the MOTION PAYLOAD SET screen for another condition number. For a multigroup system, pressing F2 ([GROUP]) will bring you to the MOTION PAYLOAD SET screen for another group

8 Press [PREV] key to return to the MOTION PERFORMANCE screen. Press F5 ([SETIND]), and enter the desired payload setting condition number.

9 On the MOTION PERFORMANCE screen, press F4 ([ARMLOAD]) to display the MOTION ARMLOAD SET screen.

```
MOTION/ARMLOAD SET                 JOINT    100%

    Group 1
 1   ARM LOAD AXIS #1 [kg]           550.00
 2   ARM LOAD AXIS #1 [kg]           550.00

 [   TYPE   ]      GROUP            DEFAULT    HELP
```

10 Specify the weight of the load on the J2 base and J3 arm as follows:
ARMLOAD AXIS #1[kg] : Weight of the load on the J2 base
ARMLOAD AXIS #3[kg] : Weight of the load on the J3 arm (or J3 casing)
The following message appears: "Path and Cycletime will change. Set it?" Respond to the message with F4 ([YES]) or F5 ([NO]). Once the arm payload is set up, the settings are completed by switching the power off and on again.

4.5 INERTIA LOAD SETTING

For the R-2000*i*B/165F/210F/185L/250F/210WE, there are two parameter settings depending on the magnitude of load inertia. (By default, the parameter settings for the standard inertia mode are made.)

<table>
<tr><th colspan="3"></th><th>Standard inertia mode</th><th>High inertia mode</th></tr>
<tr><td rowspan="6">Wrist unit allowable load inertia</td><td rowspan="2">J4-axis</td><td>165F</td><td>78.4kg·m^2
(800kgf·cm·s^2)</td><td>117.6kg·m^2
(1200kgf·cm·s^2)</td></tr>
<tr><td>210F/185L/250F/210WE</td><td>141.1kg·m^2
(1440kgf·cm·s^2)</td><td>225.4kg·m^2
(2300kgf·cm·s^2)</td></tr>
<tr><td rowspan="2">J5-axis</td><td>165F</td><td>78.4kg·m^2
(800kgf·cm·s^2)</td><td>117.6kg·m^2
(1200kgf·cm·s^2)</td></tr>
<tr><td>210F/185L/250F/210WE</td><td>141.1kg·m^2
(1440kgf·cm·s^2)</td><td>225.4kg·m^2
(2300kgf·cm·s^2)</td></tr>
<tr><td rowspan="2">J6-axis</td><td>165F</td><td>40.2kg·m^2
(410kgf·cm·s^2)</td><td>98kg·m^2
(1000kgf·cm·s^2)</td></tr>
<tr><td>210F/185L/250F/210WE</td><td>78.4kg·m^2
(800kgf·cm·s^2)</td><td>196kg·m^2
(2000kgf·cm·s^2)</td></tr>
</table>

R-2000*i*B/165F/210F/250F/210WE do not support high inertia depending on version of software.
R-2000*i*B/185L do not support standard inertia depending on version of software.
Refer to Table 4.5 (a) to (d).

Table 4.5 (a) Support for R-2000*i*B/165F high inertia mode

Software series	**V7.10P (7DA0)**	**V7.20P (7DA1)**		**V7.30P or later (7DA3)**
Software edition	-	Edition 21 or earlier	Edition 22 or later	-
When solution arm is not selected	Not supported (*2)	Not supported (*2)	Supported (*1)	Supported (*1)
When solution arm is selected	Not supported (*2)	Not supported (*2)	Not Supported (*2)	Not supported (*2)

Table 4.5 (b) Support for R-2000*i*B/210F/210WE high inertia mode

Software series	**V7.10P (7DA0)**	**V7.20P (7DA1)**		**V7.30P or later (7DA3)**
Software edition	-	Edition 21 or earlier	Edition 22 or later	-
When solution arm is selected or not selected	Not supported (*2)	Not supported (*2)	Supported (*1)	Supported (*1)

R-2000*i*B/210WE does not support the solution arm.

Table 4.5 (c) Support for R-2000*i*B/250F high inertia mode

Software series	V7.50P (7DA5)		V7.70P (7DA7)
Software edition	Edition 04 or earlier	Edition 05 or later	-
	Not supported (*2)	Supported (*1)	Supported (*1)

Table 4.5 (d) Support for R-2000*i*B/185L standard inertia mode

Software series	V7.50P (7DA5)		V7.70P (7DA7)
Software edition	Edition 06 or earlier	Edition 07 or later	-
	Not supported (*3)	Supported (*1)	Supported (*1)

(*1) Both of the standard inertia mode and the high inertia mode are supported. The parameter is automatically set according to the load value set in Section 4.4.
(*2) The high inertia mode is not supported. Use a value within the range allowable in the standard inertia mode.
(*3) The standard inertia mode is not supported. Use a value within the range allowable in the high inertia mode.

⚠ **CAUTION**
Set the load inertia correctly as described in Section 4.4. When a workpiece with inertia exceeding the allowable inertia for the standard inertia mode is used in the standard inertia mode, components of the mechanical unit may be degraded earlier.

5 PIPING AND WIRING TO THE END EFFECTOR

⚠ **WARNING**

- Only use appropriately-specified mechanical unit cables.
- Do not add user cables or hoses inside of the mechanical unit.
- Please do not obstruct the movement of the mechanical unit when cables are added to outside of mechanical unit.
- Please do not perform remodeling (adding a protective cover, or secure an additional outside cable) that obstructs the behavior of the outcrop of the cable.
- When external equipment is installed in the robot, make sure that it does not interfere with other parts of the robot.
- Cut and discard any unnecessary length of wire strand of the end effector (hand) cable. Insulate the cable with seal tape. (See Fig. 5 (a))
- If you have end effector wiring and a process that develops static electricity, keep the end effector wiring as far away from the process as possible. If the end effector and process must remain close, be sure to insulate the cable.
- Be sure to seal the connectors of the user cable and terminal parts of all cables to prevent water from entering the mechanical unit. Also, attach the cover to the unused connector.
- Frequently check that connectors are tight and cable jackets are not damaged.
- When precautions are not followed, damage to cables might occur. Cable failure may result in incorrect function of end effector, robot faults, or damage to robot electrical hardware. In addition, electric shock could occur when touching the power cables.

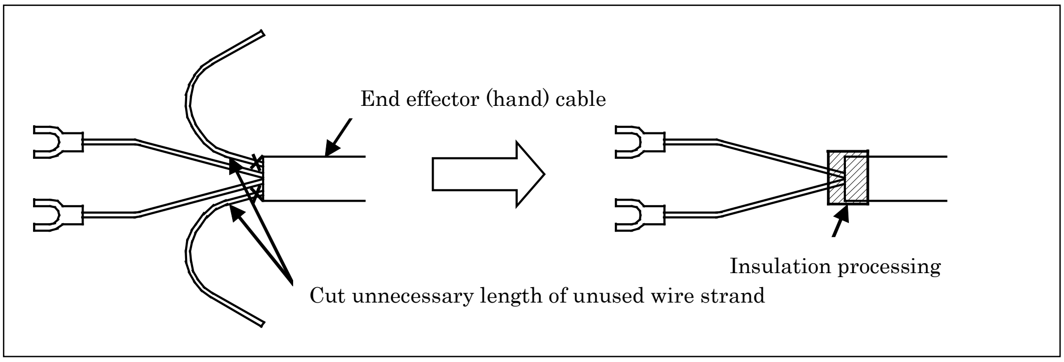


Fig. 5 (a) Treatment method of end effector (hand) cable

5.1 AIR SUPPLY (OPTION)

Robot has air inlets and air outlets openings on the back of the J1 base and the front or side of the J3 casing used to supply air pressure to the end effector. The connector is a Rc1/2 female (ISO).
Because coupling are not supplied, it will be necessary to prepare couplings which suit to the tube size.

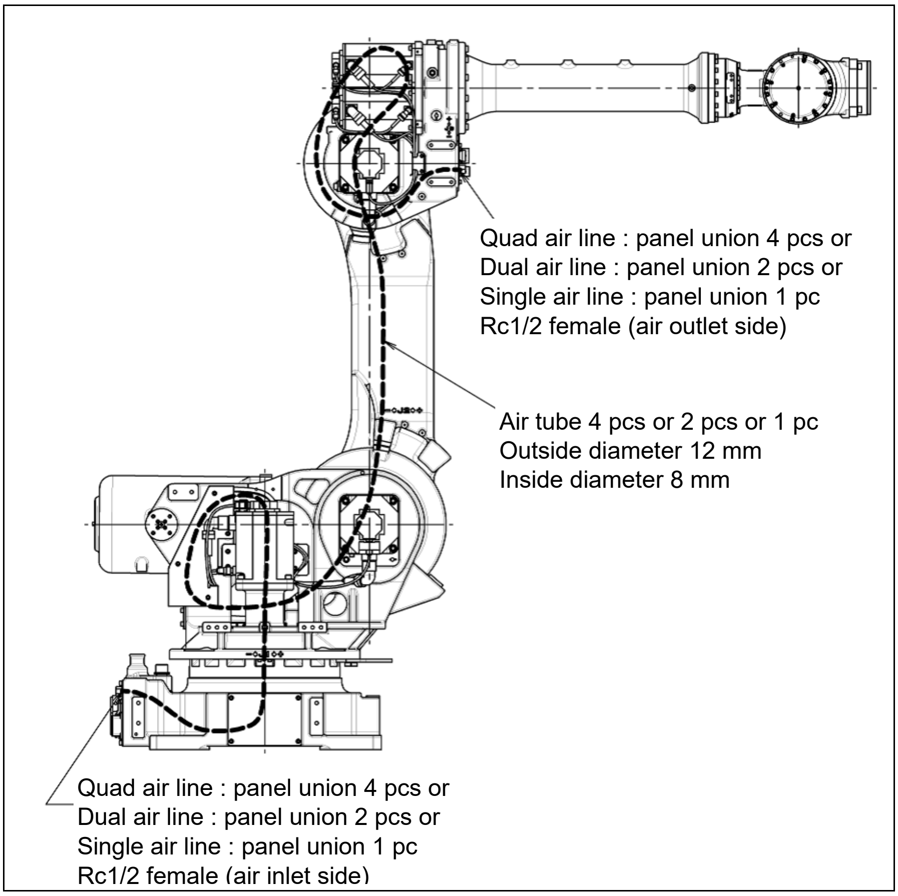


Fig. 5.1 (a) Air supply (option) (R-2000*i*B /165F/210F/185L/250F/125L/175L/100H/150U/220U)

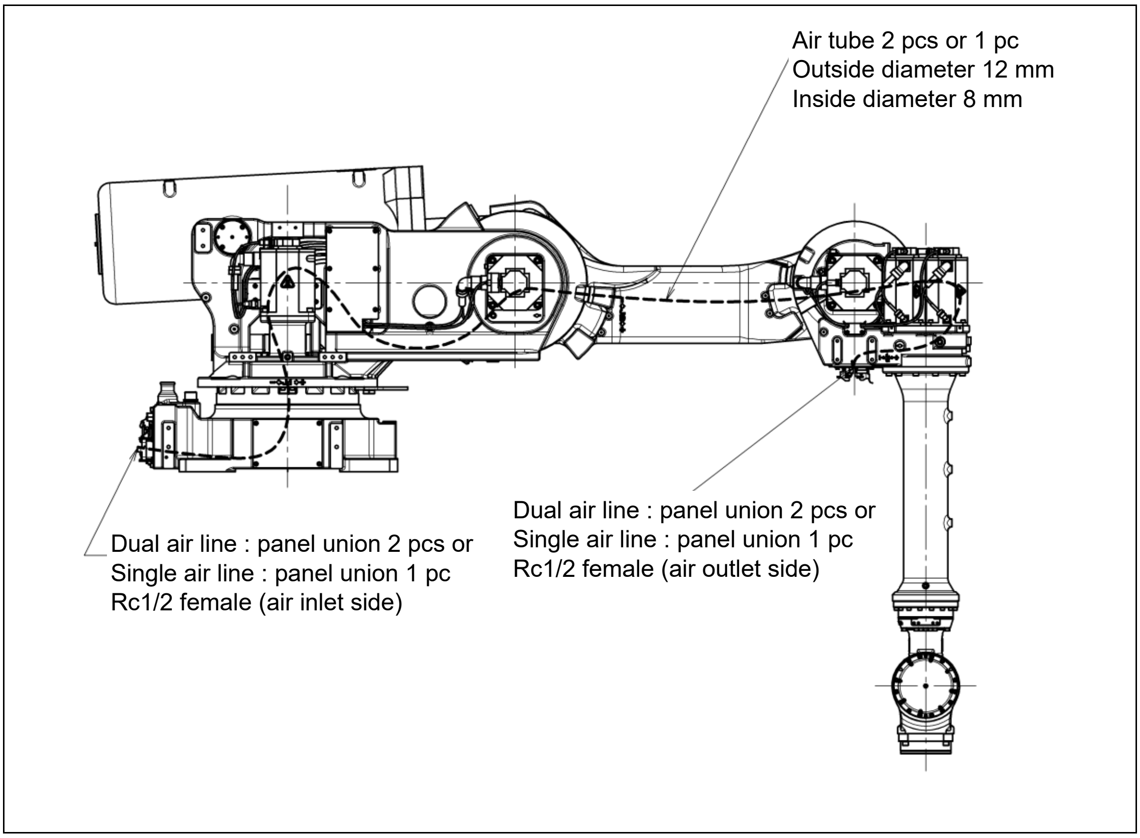


Fig. 5.1 (b) Air supply (option) (R-2000*i*B/165R/200R/100P)

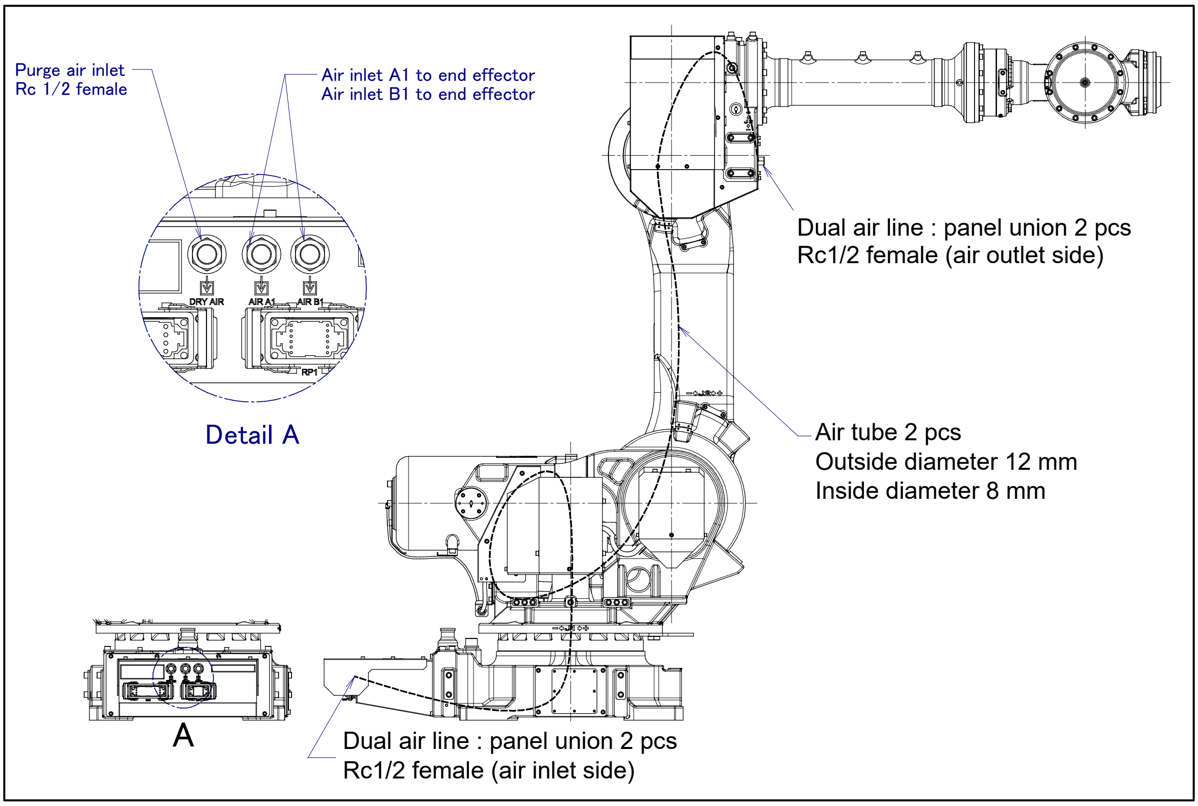


Fig. 5.1 (c) Air supply (option) (R-2000*i*B/210WE) (A05B-1329-B255)

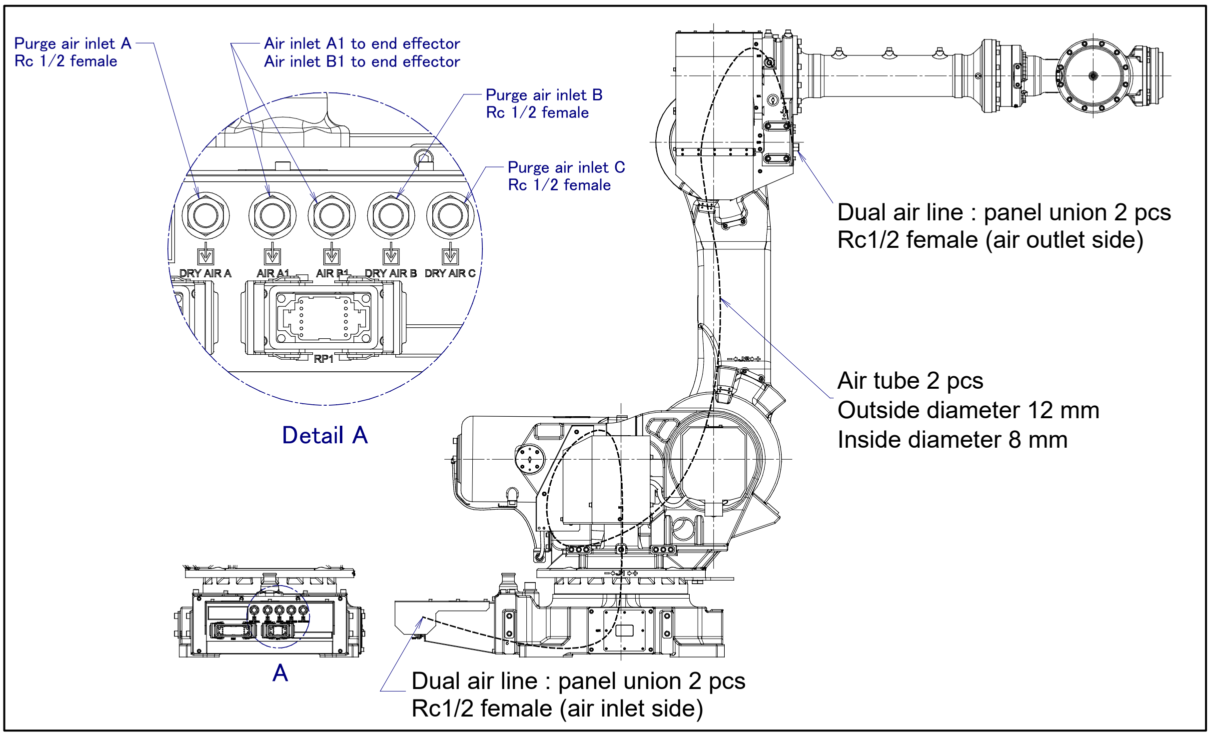


Fig. 5.1 (d) Air supply (option) (R-2000*i*B/210WE) (A05B-1329-B256)

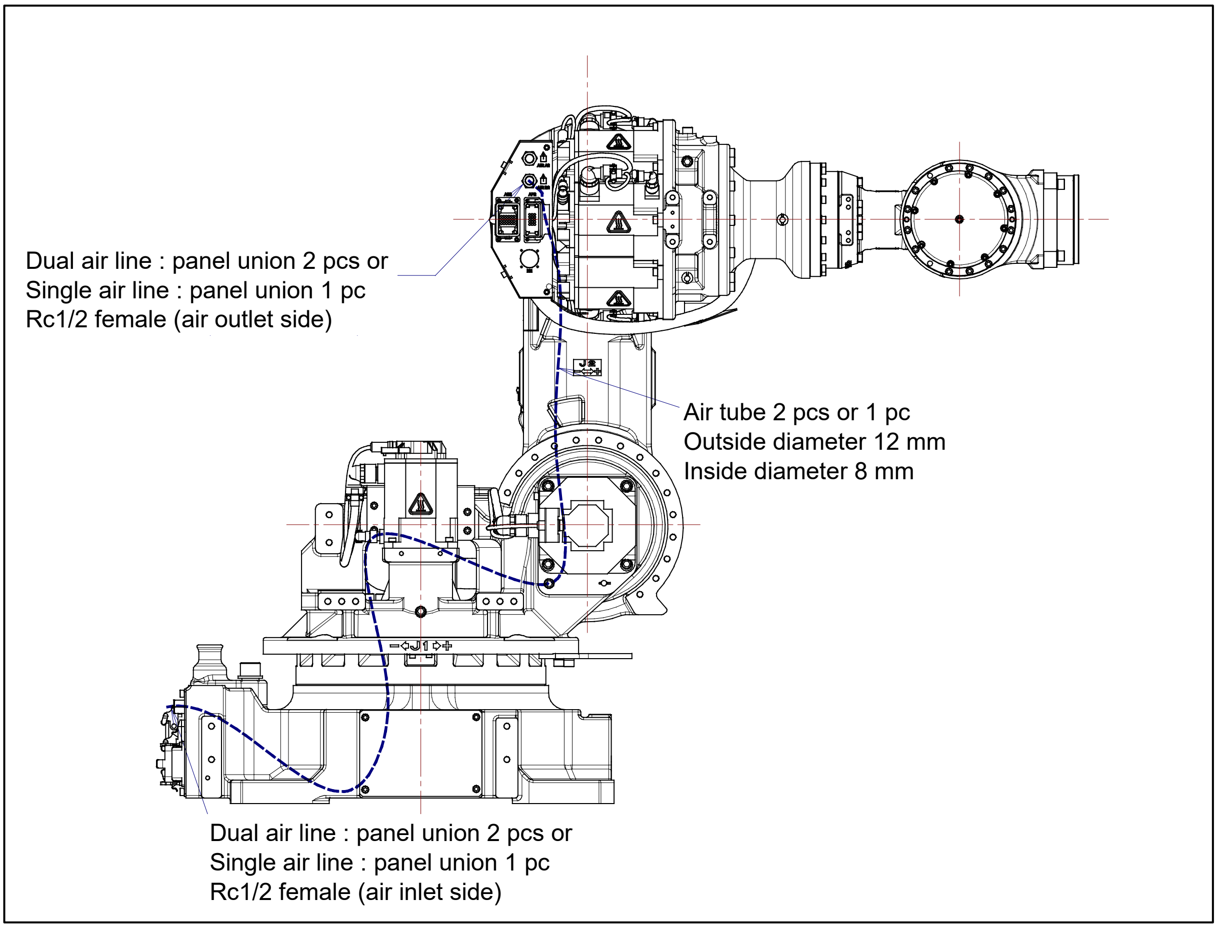


Fig. 5.1 (e) Air supply (option) (R-2000*i*B/170CF)

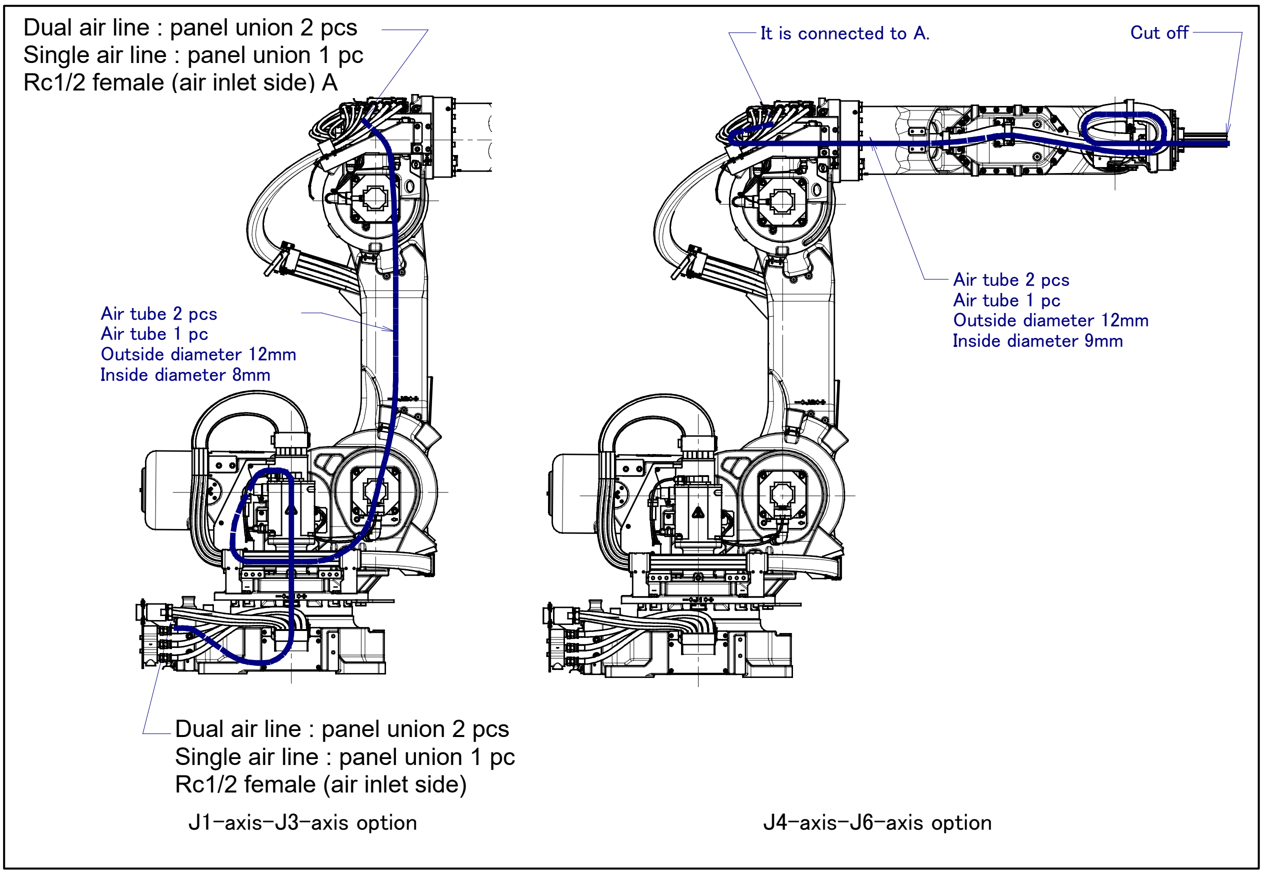


Fig. 5.1 (f) Air supply (option) (R-2000*i*B/210FS/220US)

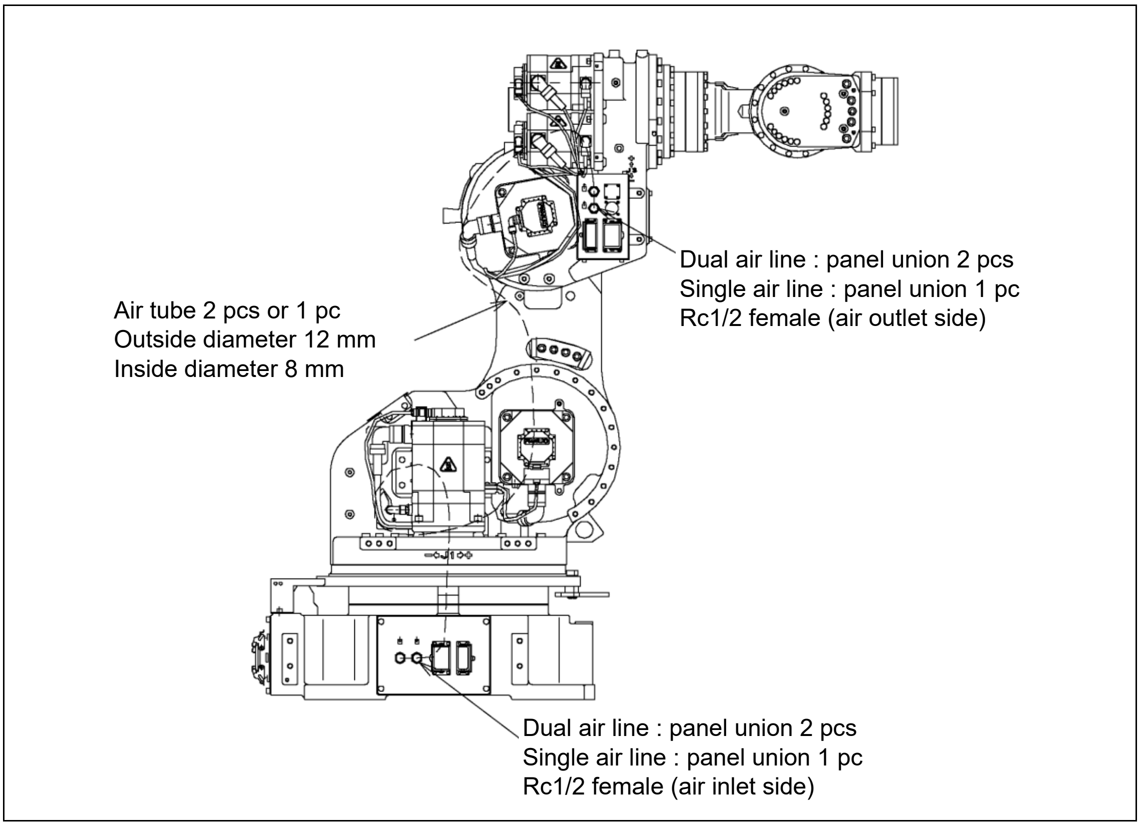


Fig. 5.1 (g) Air supply (option) (R-2000*i*B/165CF)

5.2 AIR PIPING (OPTION)

Fig. 5.2 (a) shows how to connect air hose to the robot. If the air control set is specified as an option, the air hose between the mechanical unit and the air control set is provided. Mount the air control set using the information in Fig. 5.2 (b). This is outside FANUC delivery scope.

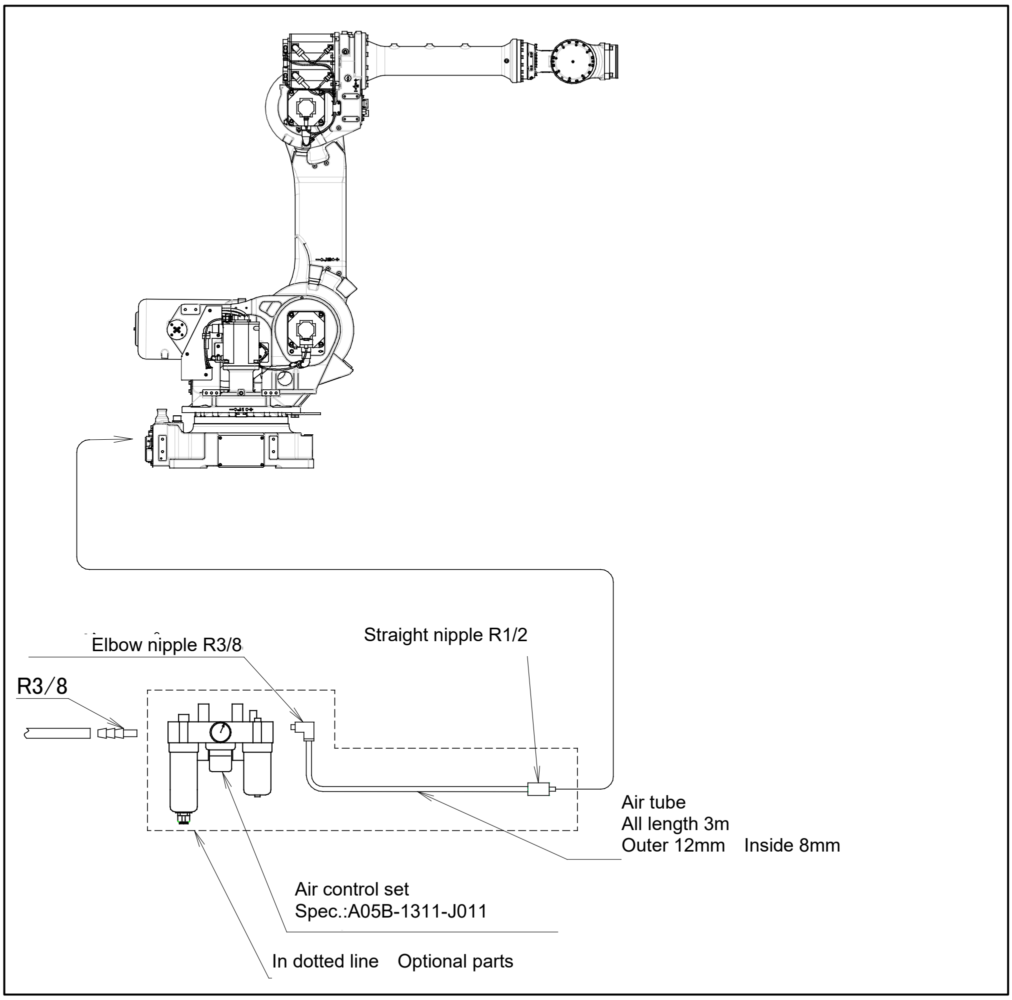


Fig. 5.2 (a) Air piping (option)

Air control set

Fill the lubricator having air control set to the specified level with turbine oil #90 to # 140. The machine tool builder is required to prepare mounting bolts. This is outside FANUC delivery scope.

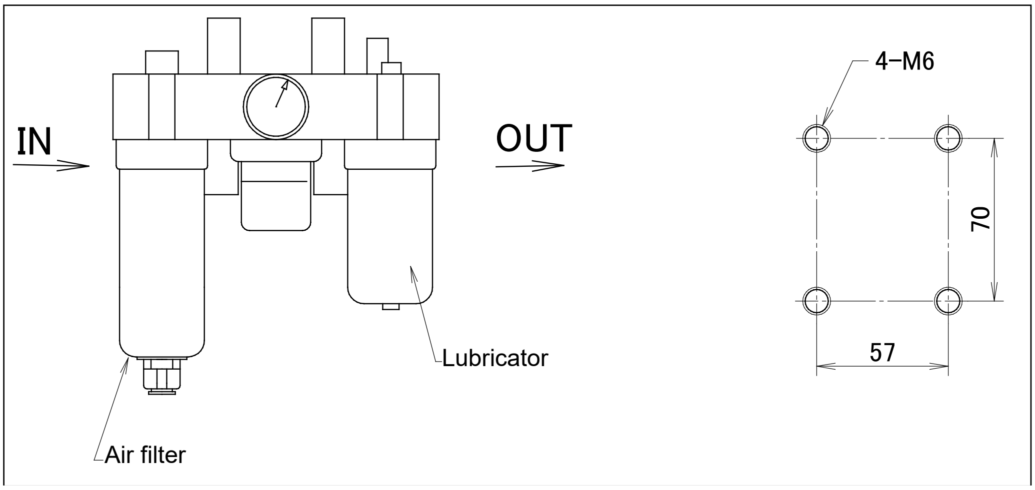


Fig. 5.2 (b) Air control set option (option)

NOTE
The capacity of the air control set is as follows. These values must not be exceeded.

Air pressure	Supply air pressure	0.49 to 0.69MPa (5 to 7kgf/cm^2), Setting: 0.49MPa (5kgf/cm^2)
	Amount of consumption	Maximum instantaneous amount 150Nl/min (0.15Nm^3/min)

5.3 INTERFACE FOR OPTION CABLE (OPTION)

Fig. 5.3 (a) to (e) show the position of the option cable interface. Fig. 5.3 (f) to (m) show the option cable interface.
EE interface (RI/RO), I/O Unit-MODEL B interface and user cable (signal lines, signal line usable to the force sensor, signal usable to force sensor and 3D Laser Vision sensor), user cable (power lines), DeviceNet cable (signal lines, power lines), additional axis motor cable (Pulsecoder line) ,additional axis motor cable(power and brake), 3DL sensor cable, camera cable and acceleration sensor cable are prepared as options.

NOTE

1 Each option cable is written as shown below on the connector panel.:
EE(RI/RO) interface : EE
I/O Unit Model B : I/O
User cable (signal) : AS
User cable (signal usable to force sensor) : ASH
User cable (signal usable to force sensor and 3D Laser Vision sensor) : ASi
User cable (power) : AP
DeviceNet cable (signal) : DS
DeviceNet cable (power) : DP
Additional axis motor cable (Pulsecoder) : ARP
Additional axis motor cable (power, brake line) : ARM
3DL sensor cable : SEN
Camera cable : CAM
Acceleration sensor cable : LVS

2 In case of R-2000*i*B/210WE, interface for option cable in this section cannot be used.

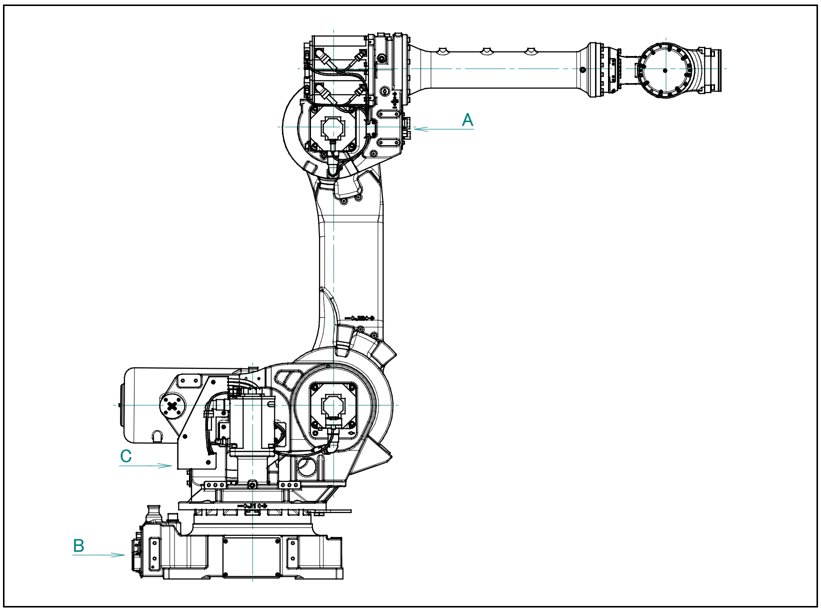


Fig. 5.3 (a) Position of interface for option cable (OPTION)
(R-2000*i*B/165F/210F/185L/250F/125L/175L/100H/150U/220U)

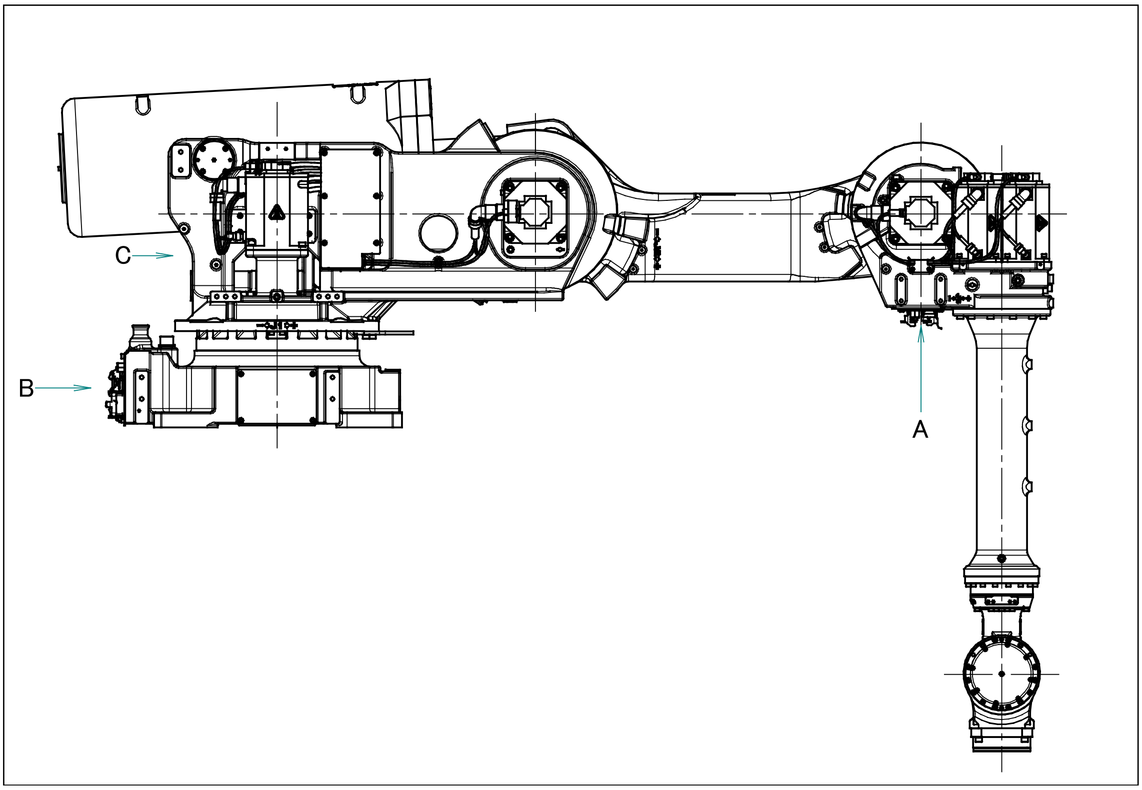


Fig. 5.3 (b) Position of interface for option cable (OPTION) (R-2000*i*B/165R/200R/100P)

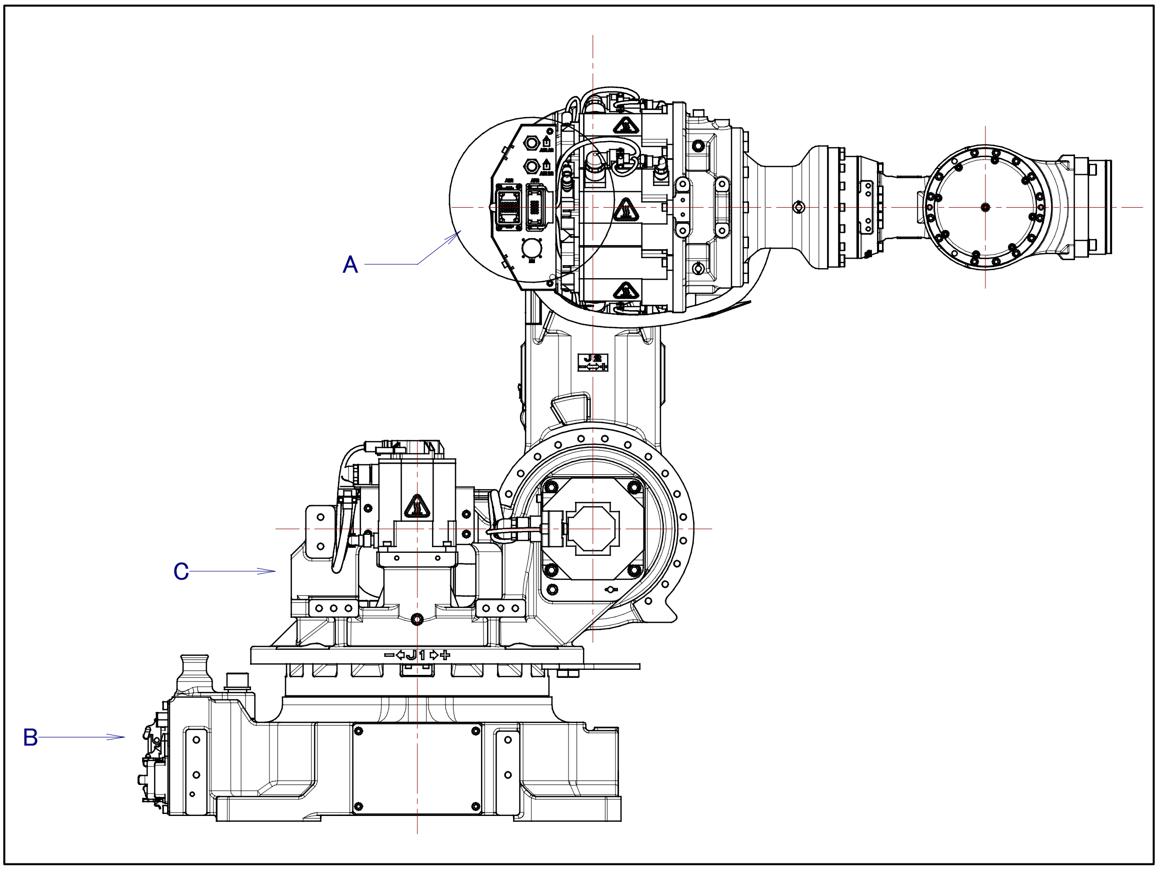


Fig. 5.3 (c) Position of interface for option cable (OPTION) (R-2000*i*B/170CF)

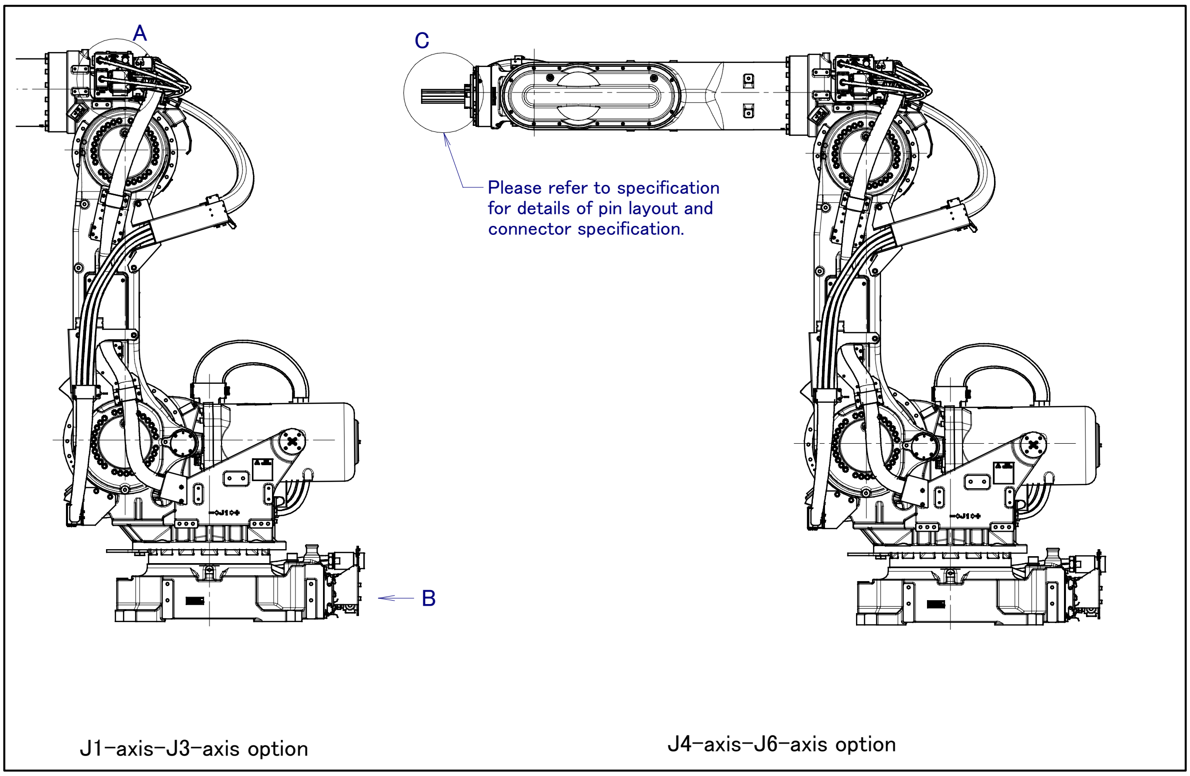


Fig. 5.3 (d) Position of interface for option cable (OPTION) (R-2000*i*B/210FS/220US)

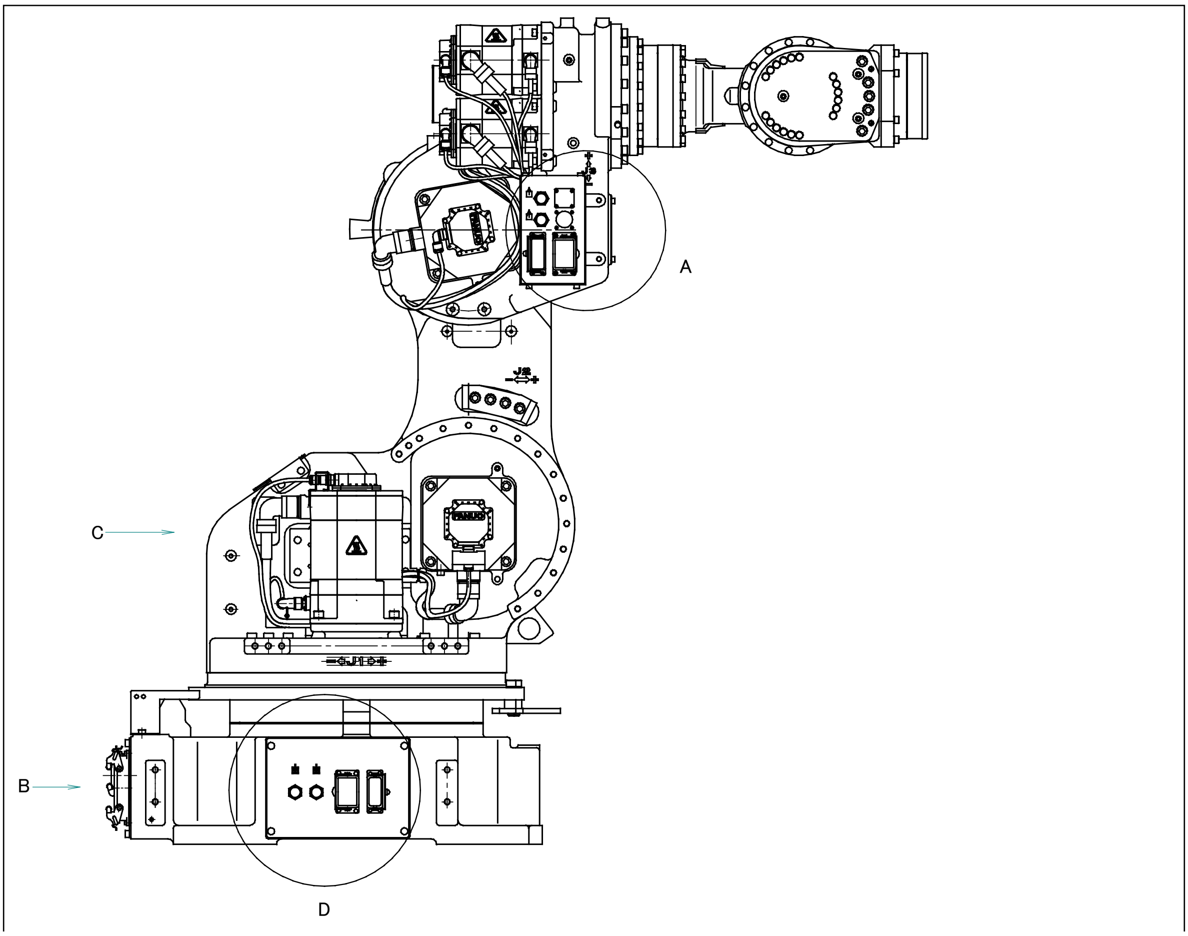
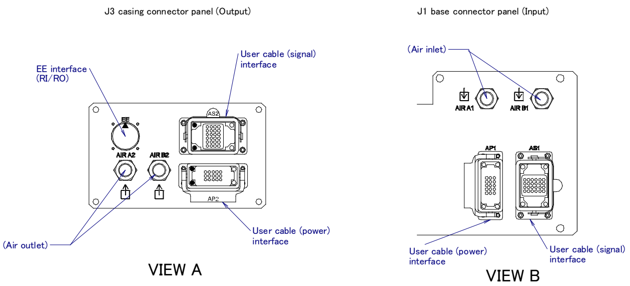
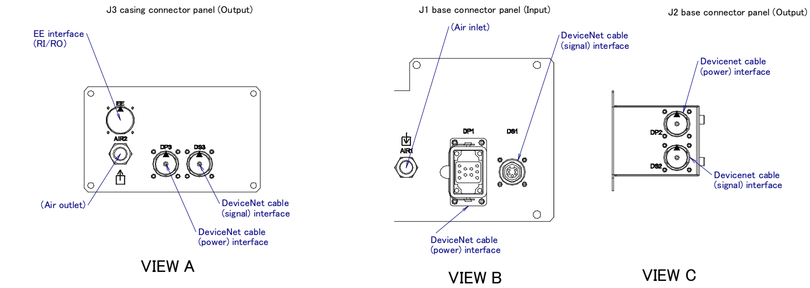


Fig. 5.3 (e) Position of interface for option cable (OPTION) (R-2000*i*B/165CF)



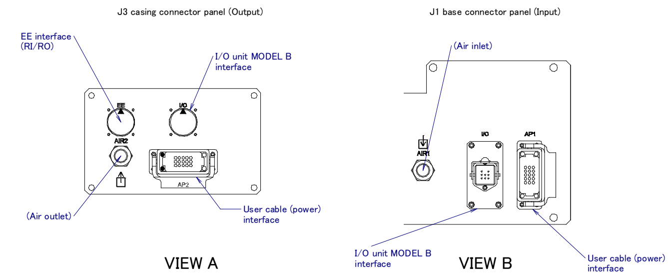
With user cable (signa/power)

Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U Standard:A05B-1329-H201/CE:A05B-1329-H501
R-2000*i*B/165R/200R Standard:A05B-1329-H301/CE:A05B-1329-H601
R-2000*i*B/100P Standard:A05B-1329-H901/CE:A05B-1329-H921
R-2000*i*B/100H Standard:A05B-1329-H211/CE:A05B-1329-H511
R-2000iB/220U CE:A05B-1329-H781



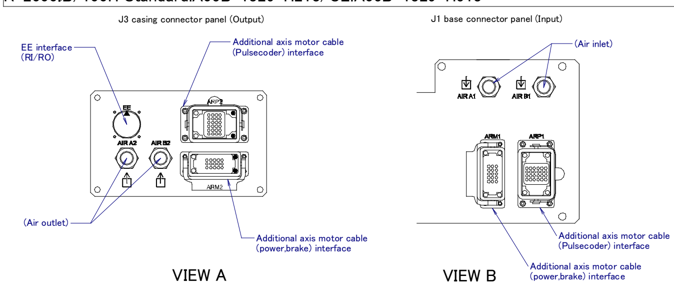
With DeviceNet cable (signal/power)

Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U Standard:A05B-1329-H202/CE:A05B-1329-H502
R-2000*i*B/165R/200R Standard:A05B-1329-H302/CE:A05B-1329-H602
R-2000*i*B/100P Stanadard:A05B-1329-H902/CE:A05B-1329-H922
R-2000*i*B/100H Stanadard:A05B-1329-H212/CE:A05B-1329-H512
R-2000*i*B/220U CE:A05B-1329-H782



With I/O unit MODEL B and user cable (power)

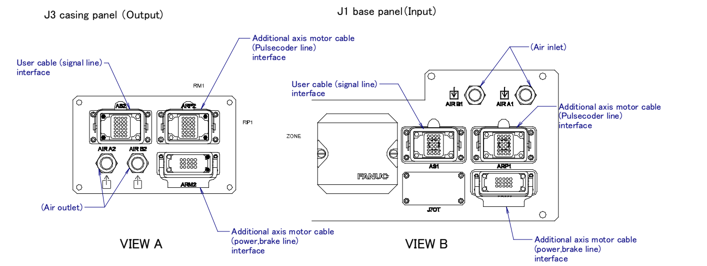
Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U Standard:A05B-1329-H203/CE:A05B-1329-H503
R-2000*i*B/165R/200R Standard:A05B-1329-H303/CE:A05B-1329-H603
R-2000*i*B/100P Standard:A05B-1329-H903/CE:A05B-1329-H923
R-2000*i*B/100H Standard:A05B-1329-H213/CE:A05B-1329-H513



Withd additional axis (1-axis) motor cable (Pulsecoder/power,brake)

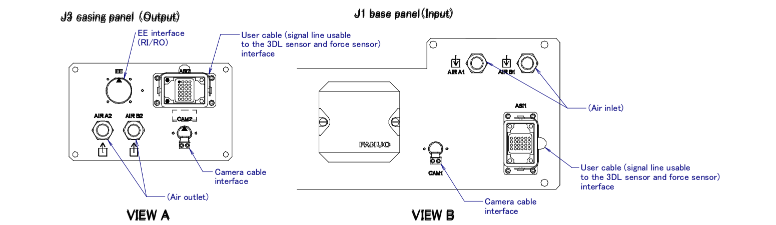
Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U Stanadard:A05B-1329-H204/CE:A05B-1329-H504
R-2000*i*B/165R/200R Standard:A05B-1329-H304/CE:A05B-1329-H604
R-2000*i*B/100P Standard:A05B-1329-H904/CE:A05B-1329-H924
R-2000*i*B/100H Standard:A05B-1329-H214/CE:A05B-1329-H514
R-2000*i*B/220U CE:A05B-1329-H784

Fig. 5.3 (f) Interface for option cable
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/125L/175L/100H/150U/220U)



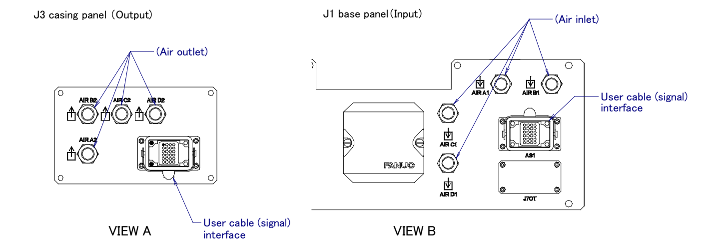
With user cable (signal line) and additional axis motor cable

Spec. of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H207
R-2000*i*B/165R/200R CE:A05B-1329-H307



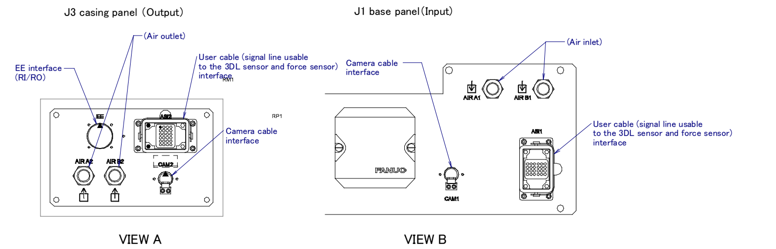
With user cable (sinagl line usable to the 3DL sensor and force sensor) and camera
(for iRVision camera package)

Spec of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H209
R-2000*i*B/165R/200R CE:A05B-1329-H309



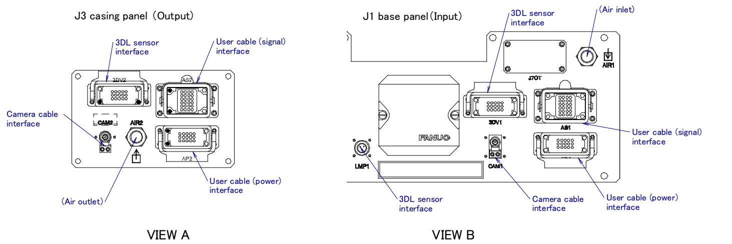
With user cable (signal) and AIRX4

Spec. of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U Standard:A05B-1329-H210



With camera cable (usable to force sensor and 3DL sensor)

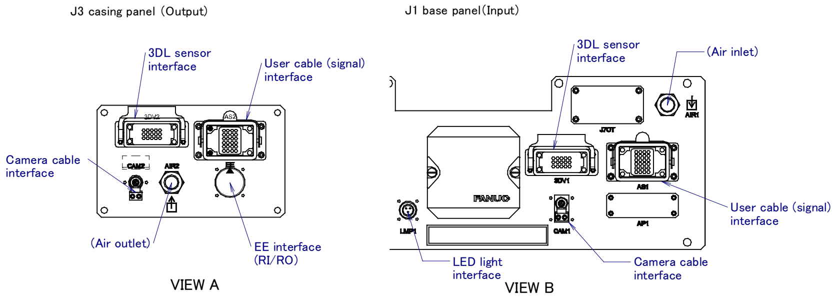
Spec. of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H215
R-2000*i*B/165R/200R CE:A05B-1329-H315



Withd 3DL sensor, camera,LED light and user cable (signal/power) and without EE(RI/RO)

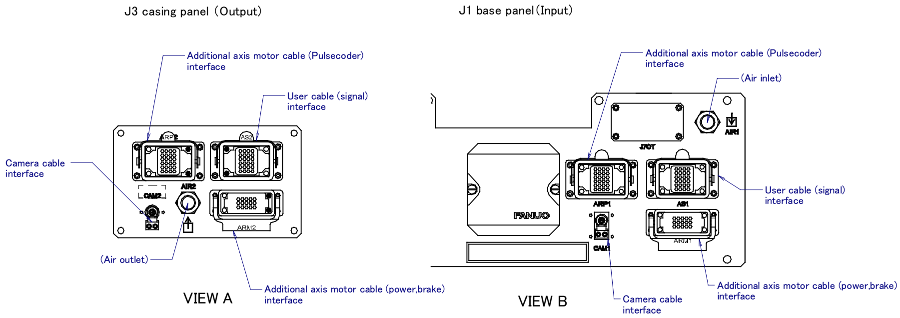
Spec of cables
R-2000*i*B/165F/185L/250F/210F/125L/175L/150U CE:A05B-1329-H801
R-2000*i*B/165R/200R CE:A05B-1329-H851

Fig. 5.3 (g) Interface for option cable (R-2000*i*B/165F/210F/185L/250F/165R/200R/125L/175L/150U)



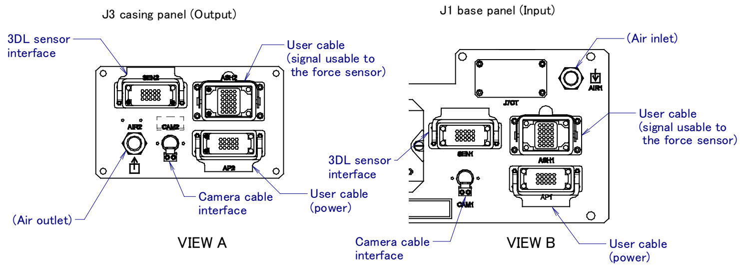
With 3DL sensor,camera,LED light and user cable (signal)

Spec of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H802
R-2000*i*B/165R/200R CE: A05B-1329-H852



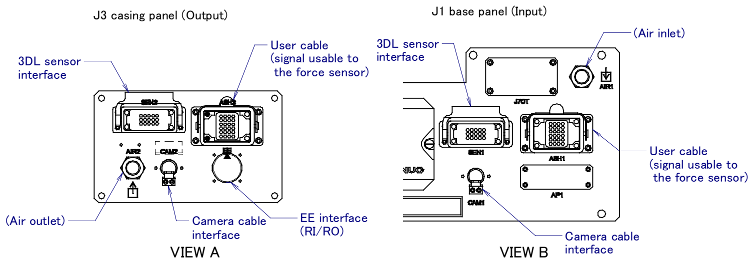
With additional axis (1-axis) motor cable,camera and user cable (signal) and without EE(RI/RO)

Spec of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H804



With user cable (signal usable to the force sensor/power) , 3DL sensora and camera and withouout EE(RI/RO)

Spec of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE: A05B-1329-H808
R-2000*i*B/165R/200R CE:A05B-1329-H858



With user cable (signal usable to the force senor), 3DL sensor and camera

Spec of cables
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H809
R-2000*i*B/165R/200R CE:A05B-1329-H859

Fig. 5.3 (h) Interface for option cable (R-2000*i*B/165F/210F/185L/250F/165R/200R/125L/175L/150U)

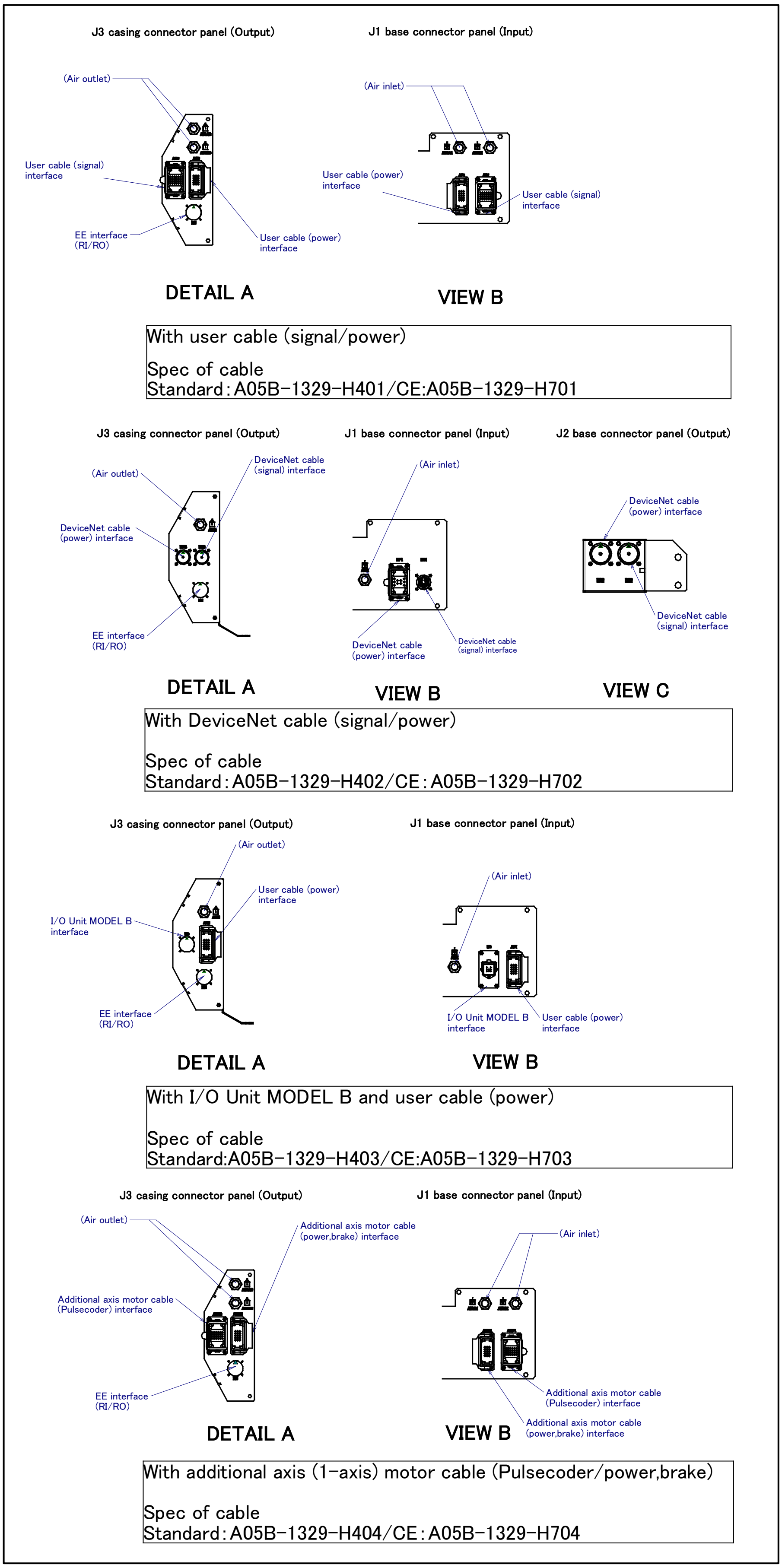
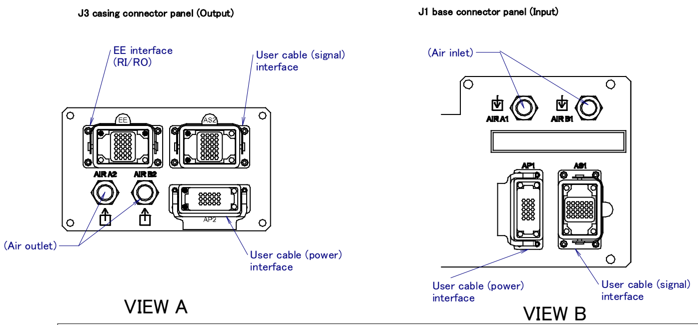
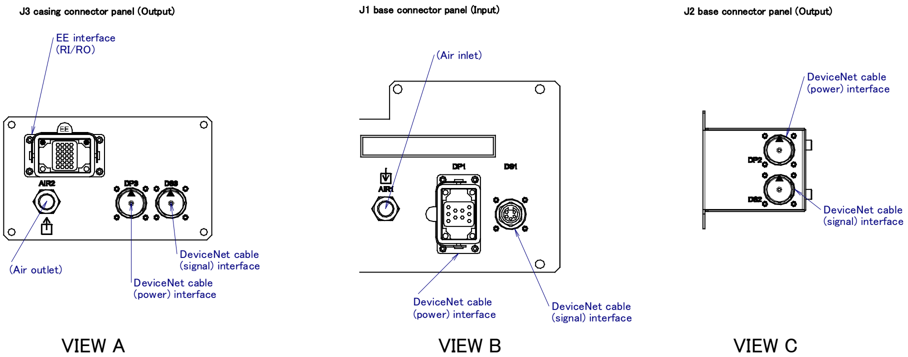


Fig. 5.3 (i) Interface for option cable (R-2000*i*B/170CF)



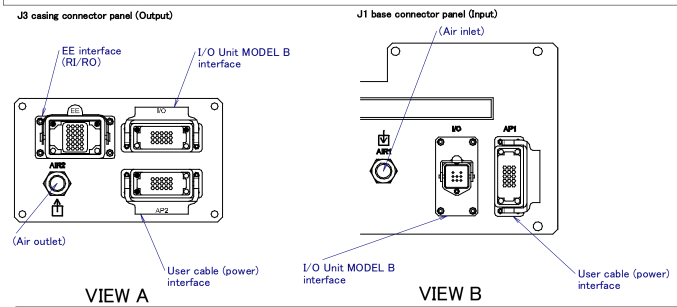
With user cable (signal/power)

Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H521
R-2000*i*B/165R/200R :A05B-1329-H621



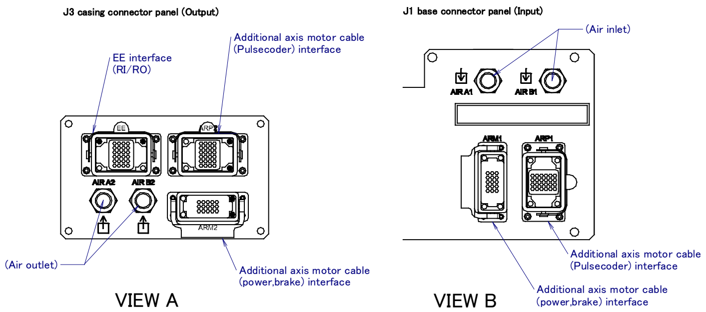
Withd DeviceNet cable (signal/power)

Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H522
R-2000*i*B/165R/200R CE:A05B-1329-H622



With I/O unit MODEL B and user cable (power)

Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H523
R-2000*i*B/165R/200R CE:A05B-1329-H623



With additional axis (1-axis) motor cable (Pulsecoder/power,brake)

Spec of cable
R-2000*i*B/165F/210F/185L/250F/125L/175L/150U CE:A05B-1329-H524
R-2000*i*B/165R/200R CE:A05B-1329-H624

Fig. 5.3 (j) Interface for option cable (R-2000*i*B/165F/210F/185L/250F/165R/200R/125L/175L/150U) (Severe dust/ liquid protection package)

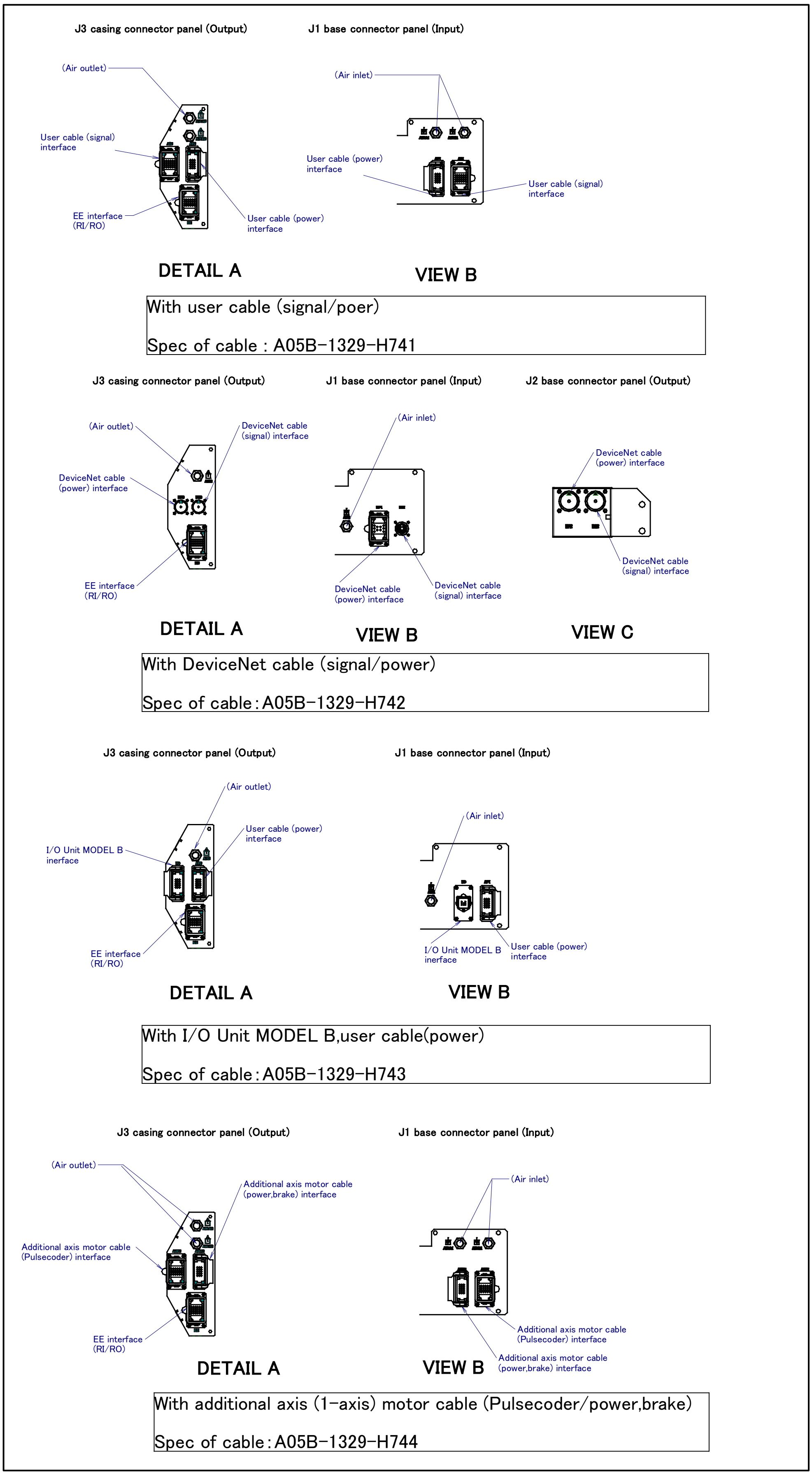
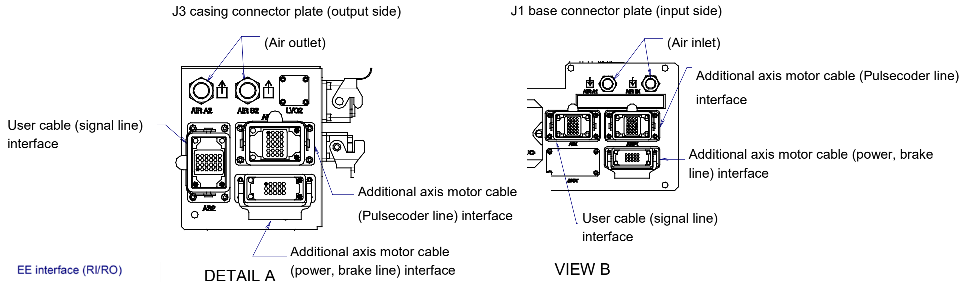
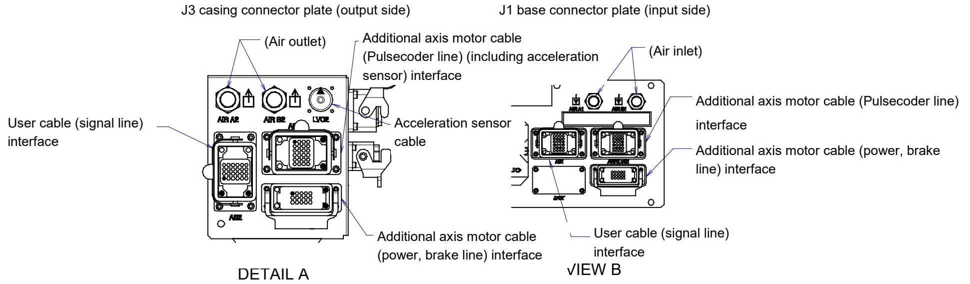


**Fig. 5.3 (k) Interface for option cable (R-2000*i*B/170CF)
(Severe dust/ liquid protection package)**



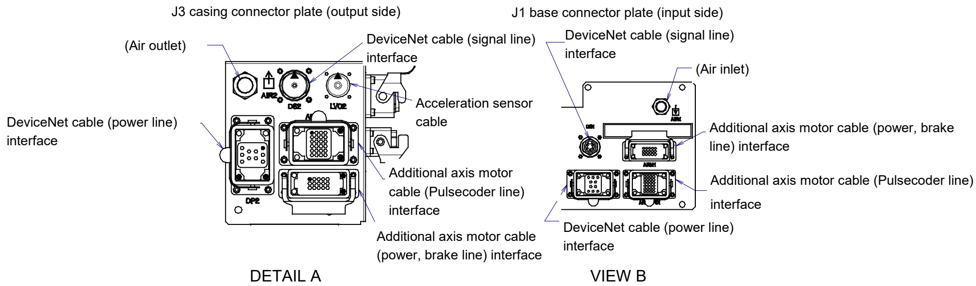
With additional axis (1-axis) motor cable (Pulsecoder line, power, brake line) and user cable (signal)

Cable spec.
R-2000*i*B/210FS : CE spec. A05B-1329-H762
R-2000*i*B/220US : CE spec. A05B-1329-H772



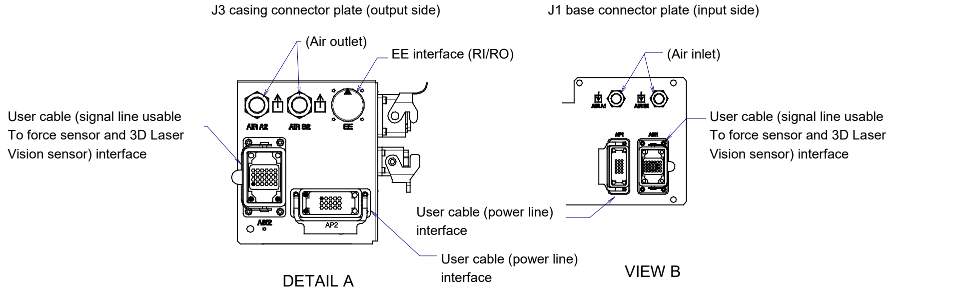
With additional axis (1-axis) motor cable (Pulsecoder line& acceleration sensor, power, brake line) and user cable (signal)

Cable spec.
R-2000*i*B/210FS : CE spec. A05B-1329-H763
R-2000*i*B/220US : CE spec. A05B-1329-H773



With additional axis (1-axis) motor cable (Pulsecoder line& acceleration sensor, power, brake line)
and DeviceNet cable (signal/power)

Cable spec.
R-2000*i*B/210FS : CE spec. A05B-1329-H766



With user cable (signal usable to force sensor and 3D Laser Vision sensor) and EE interface

Cable spec.
R-2000*i*B/210FS : CE spec. A05B-1329-H767

Fig. 5.3 (l) Interface for option cable(R-2000*i*B/210FS/220US)

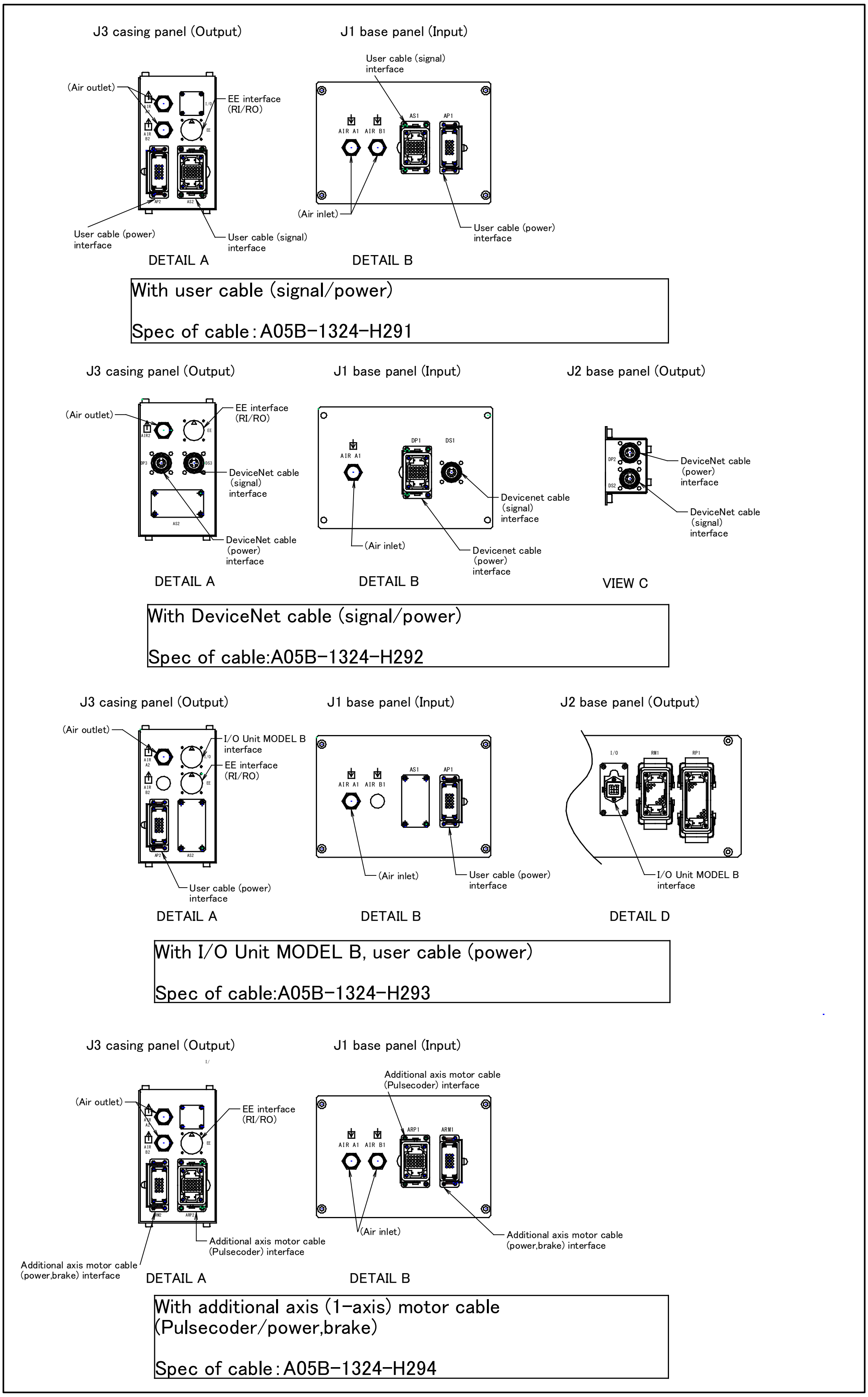


Fig. 5.3 (m) Interface for option cable (R-2000*i*B/165CF)

1 EE interface (RI/RO) (option) Fig. 5.3 (n) and Fig. 5.3 (o) show the pin layout for the EE interface (RI/RO). When severe dust/liquid protection package is specified, the connector has guide pins and bushes for preventing improper insertion. For cables prepared by the user, use these guide pins and bushes.

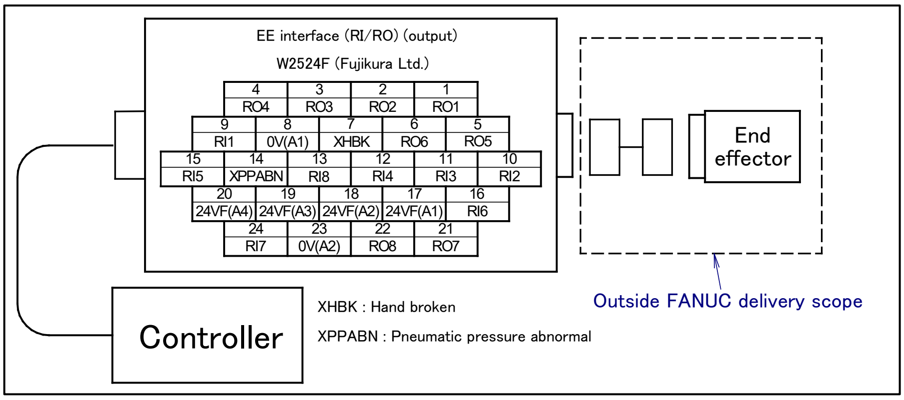


Fig. 5.3 (n) Pin layout for EE interface(RI/RO) (option)

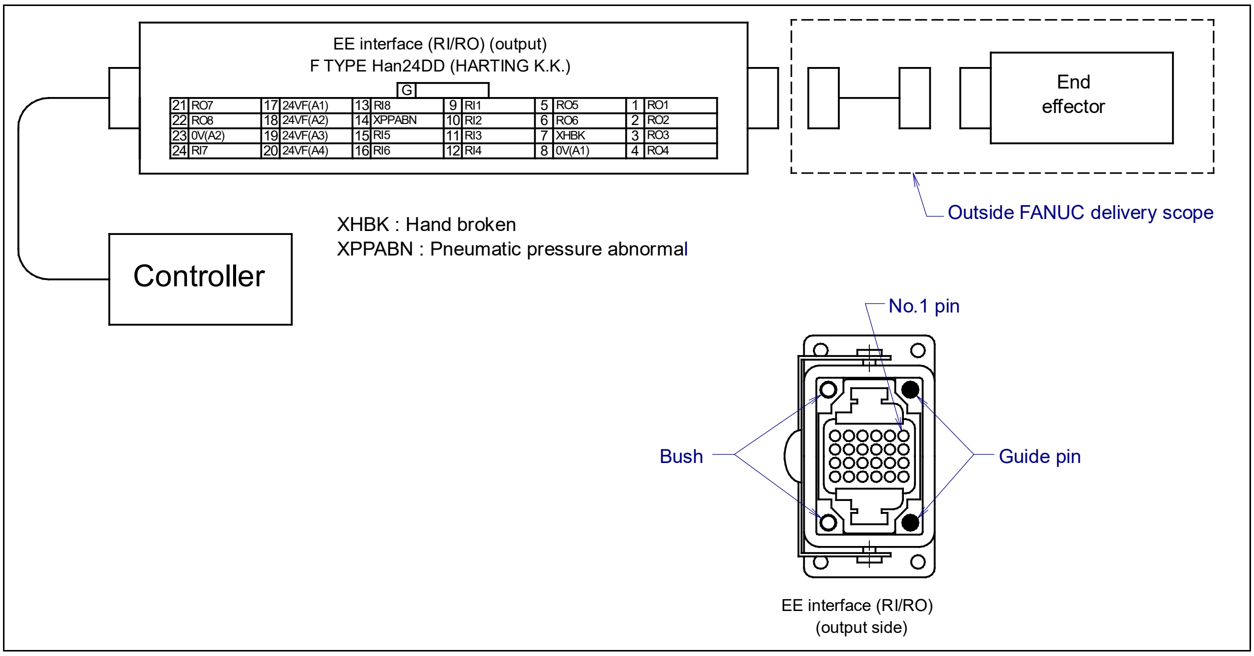


Fig. 5.3 (o) Pin layout for EE interface (RI/RO)(severe dust/liquid protection package) (option)

> ⚠ **CAUTION**
> For wiring of the peripheral device to the EE interface, refer to the ELECTRICAL CONNECSTIONS Chapter of CONTROLLER MAINTENANCE MANUAL, too.

2 I/O Unit-MODEL B interface (option)

Fig. 5.3 (p) and Fig. 5.3 (q) show the pin layout for the I/O Unit-MODEL B interface.

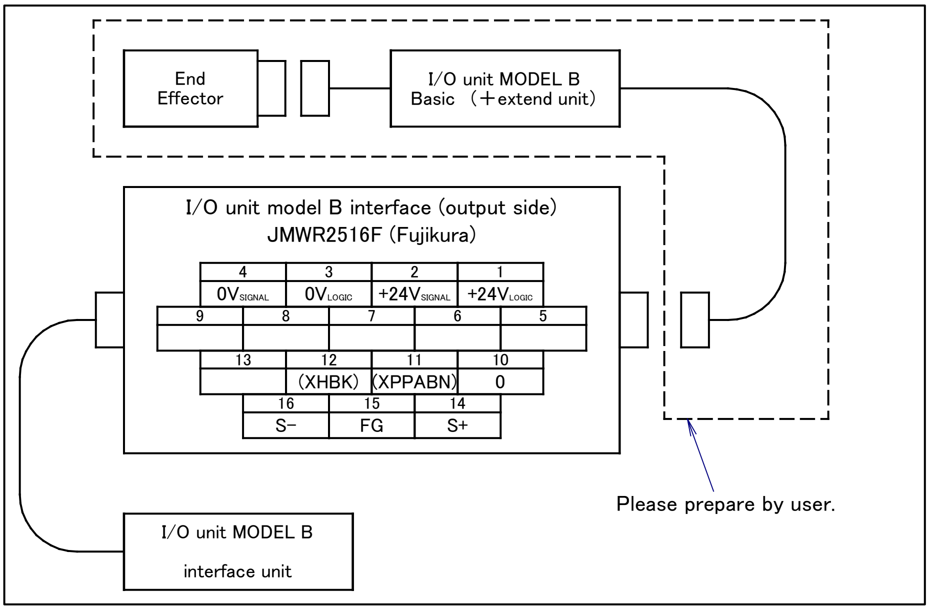


Fig. 5.3 (p) Pin layout for I/O Unit-MODEL B interface (option)

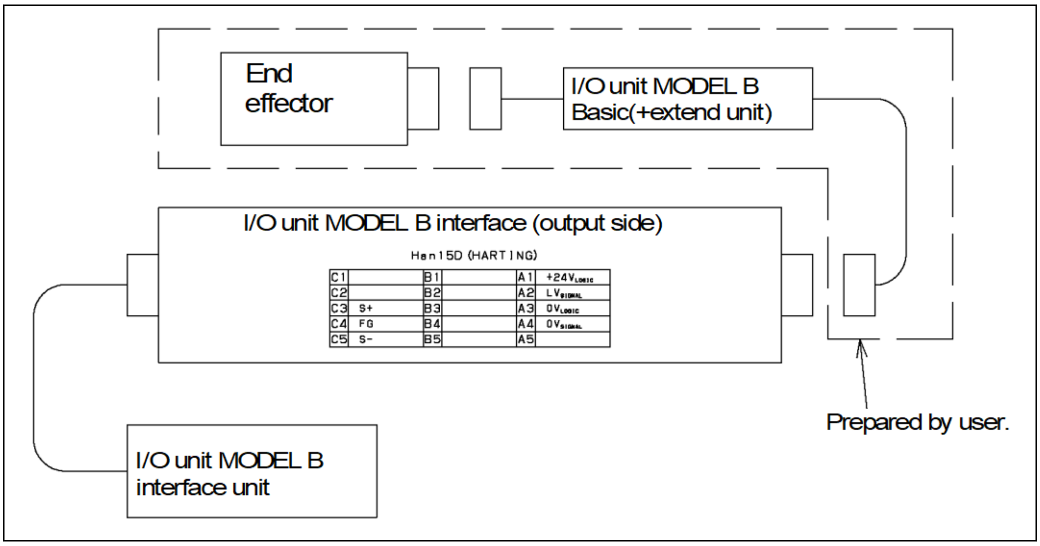


Fig. 5.3 (q) Pin layout for I/O Unit-MODEL B interface (severe dust/ liquid protection package) (option)

3 User cable (signal line) (AS) interface (option)
Fig. 5.3 (r) shows the pin layout for the user cable (signal line) (AS) interface.
The connector has a code pin for preventing improper insertion. The code pin is required for the cable which is prepared by the user.

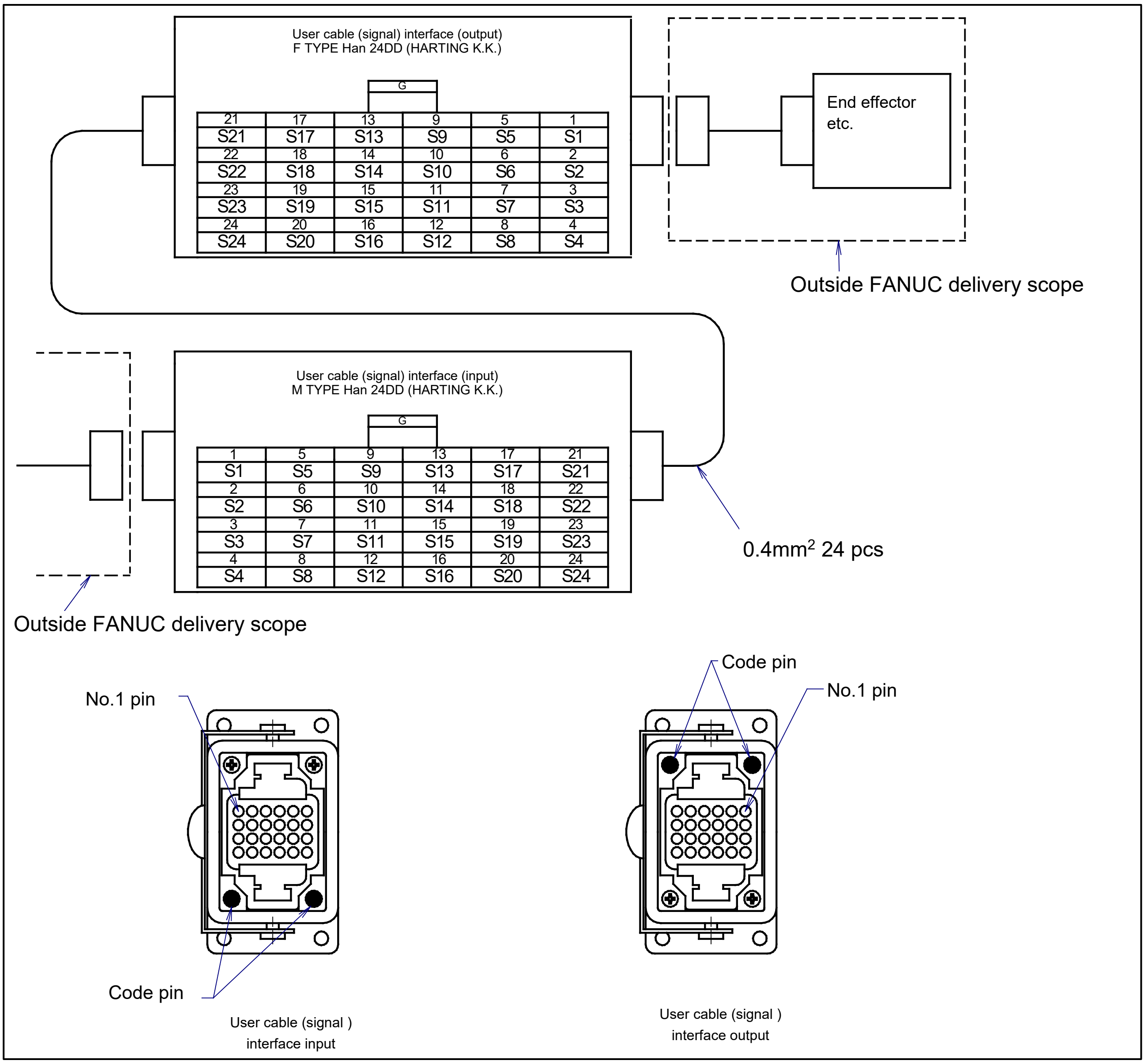


Fig. 5.3 (r) Pin layout for user cable (signal line) (AS) interface and code pin position (option)

4 User cable (signal line usable to force sensor and 3D Laser Vision sensor) (ASi) (ASH) Interface (option)
Fig. 5.3 (s) shows the pin layout for the user cable (signal line usable to force sensor and 3D Laser Vision sensor) interface.
The connector has a code pin for preventing improper insertion. The code pin is required for the cable which is prepared by the user.

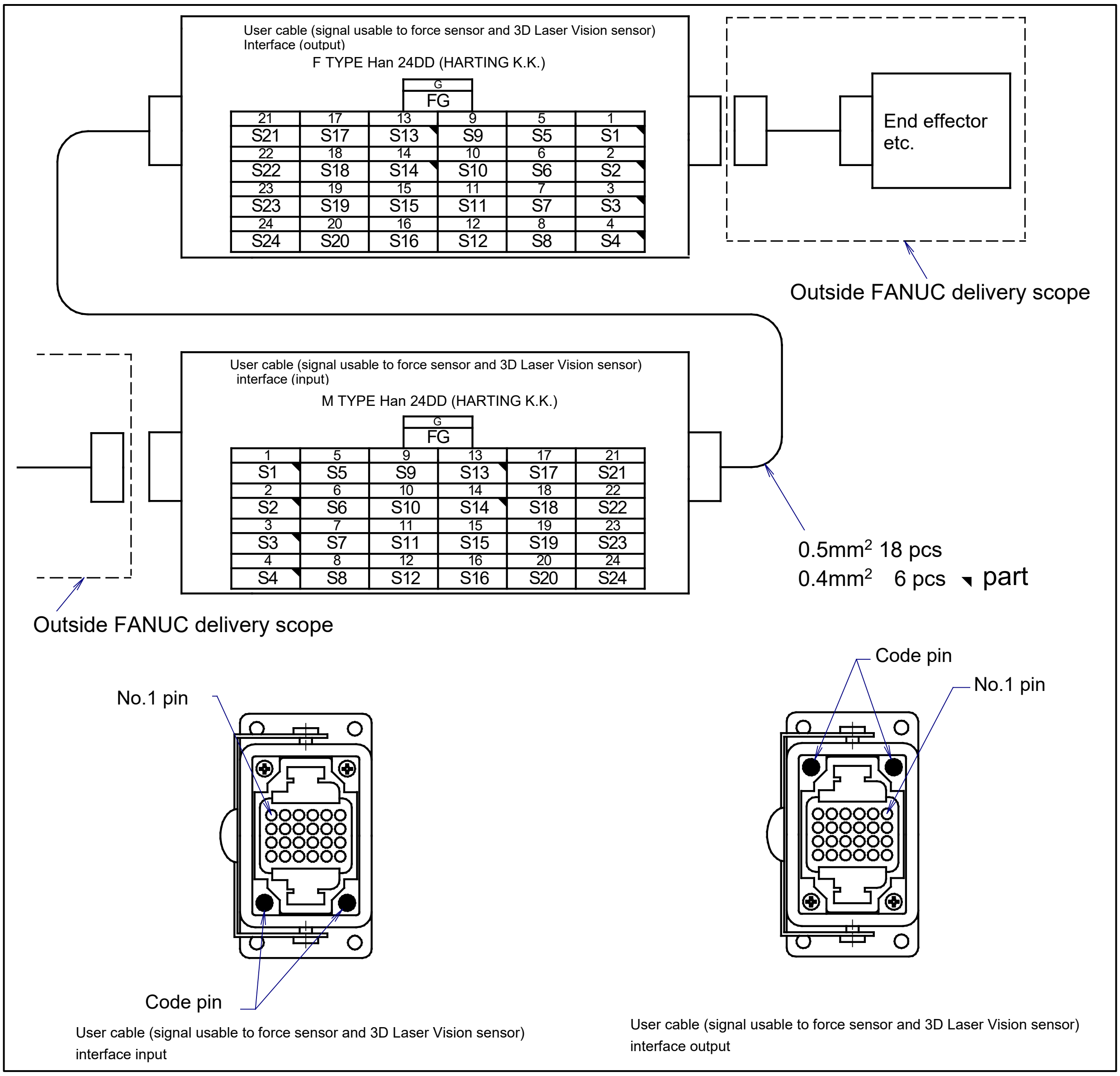


Fig. 5.3 (s) Pin layout for user cable (signal line usable to force sensor and 3D Laser Vision sensor) (ASi) (ASH) interface and code pin position (option)

5 User cable (power line) (AP) interface (option)
Fig. 5.3 (t) shows the pin layout for the user cable (power line) interface.
The connector has a code pin for preventing improper insertion. The code pin is required for the cable which is prepared by the user.

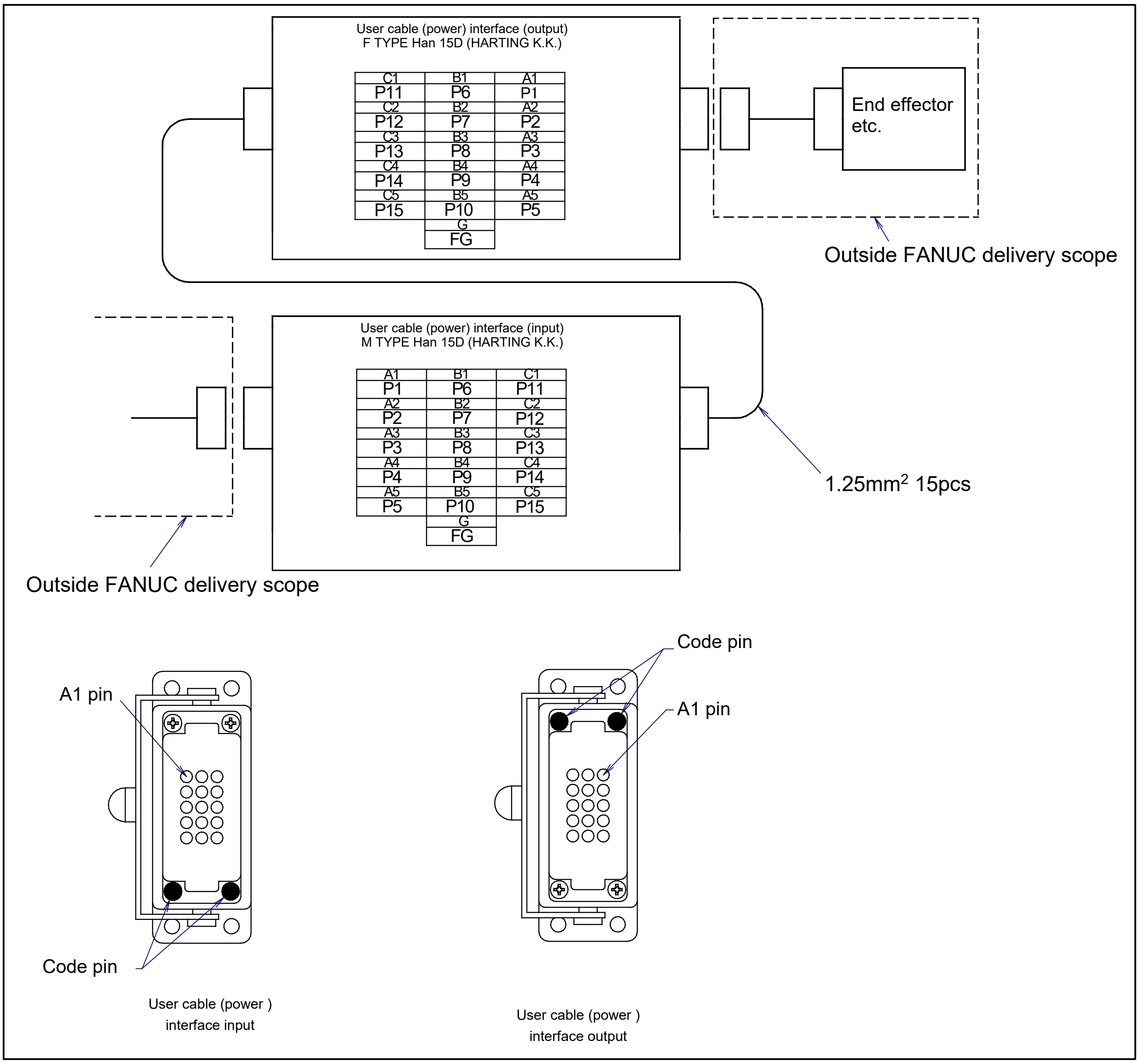


Fig. 5.3 (t) Pin layout for user cable (power line) (AP) interface and code pin position (option)

6 DeviceNet cable (signal line) (DS) interface (option)
Fig. 5.3 (u) shows the pin layout for the DeviceNet cable (signal line) interface.

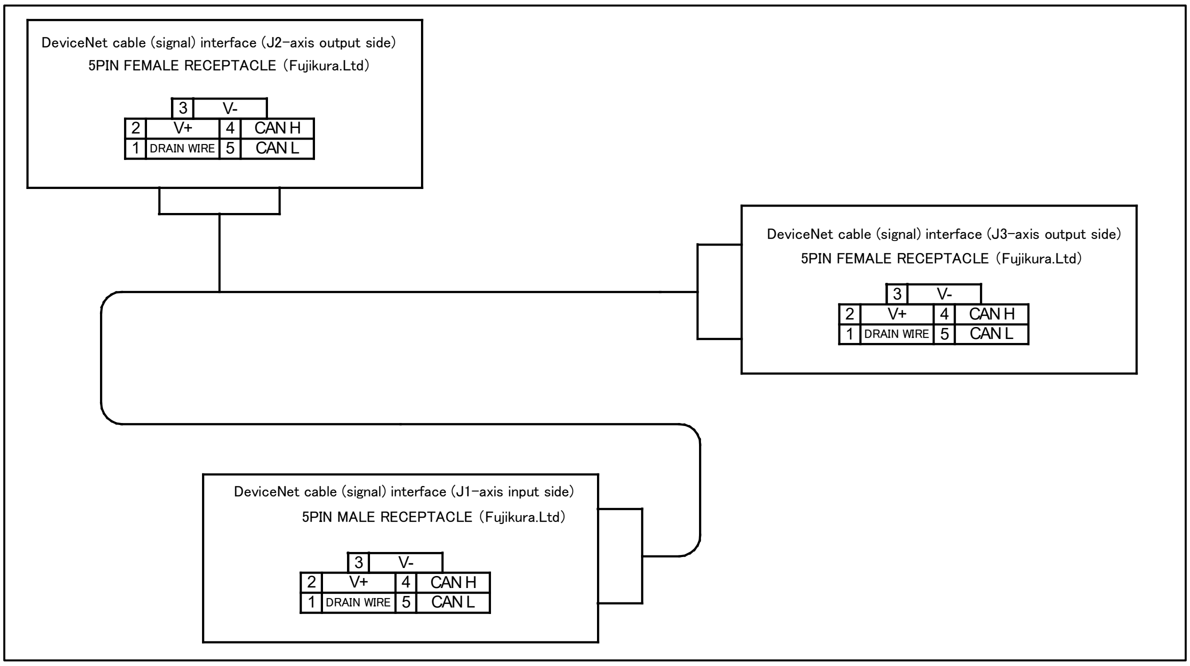


Fig. 5.3 (u) Pin layout for DeviceNet cable (signal line) (DS) interface (option)

7 DeviceNet cable (power line) (DP) interface (option) Fig. 5.3 (v) shows the pin layout for the DeviceNet cable (power line) interface.

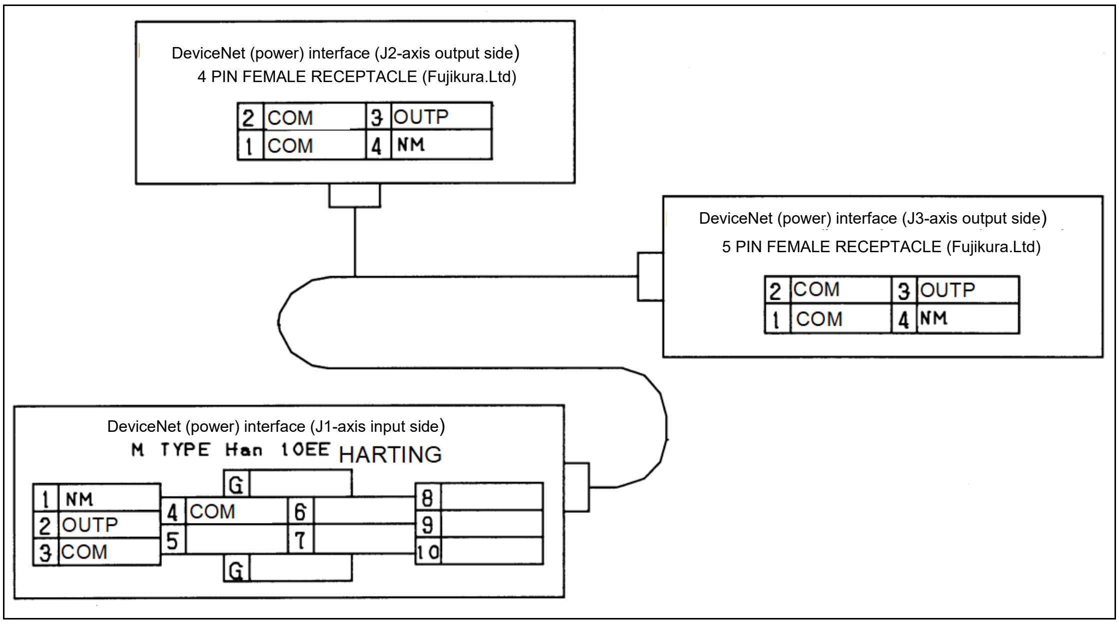


Fig. 5.3 (v) Pin layout for DeviceNet cable (power line) (DP) interface (option)

8 Additional axis motor cable (Pulsecoder cable) (ARP) interface (option)
Fig. 5.3 (w) shows the pin layout of the additional axis motor cable (Pulsecoder cable) interface.
The connector has a code pin for preventing improper insertion.

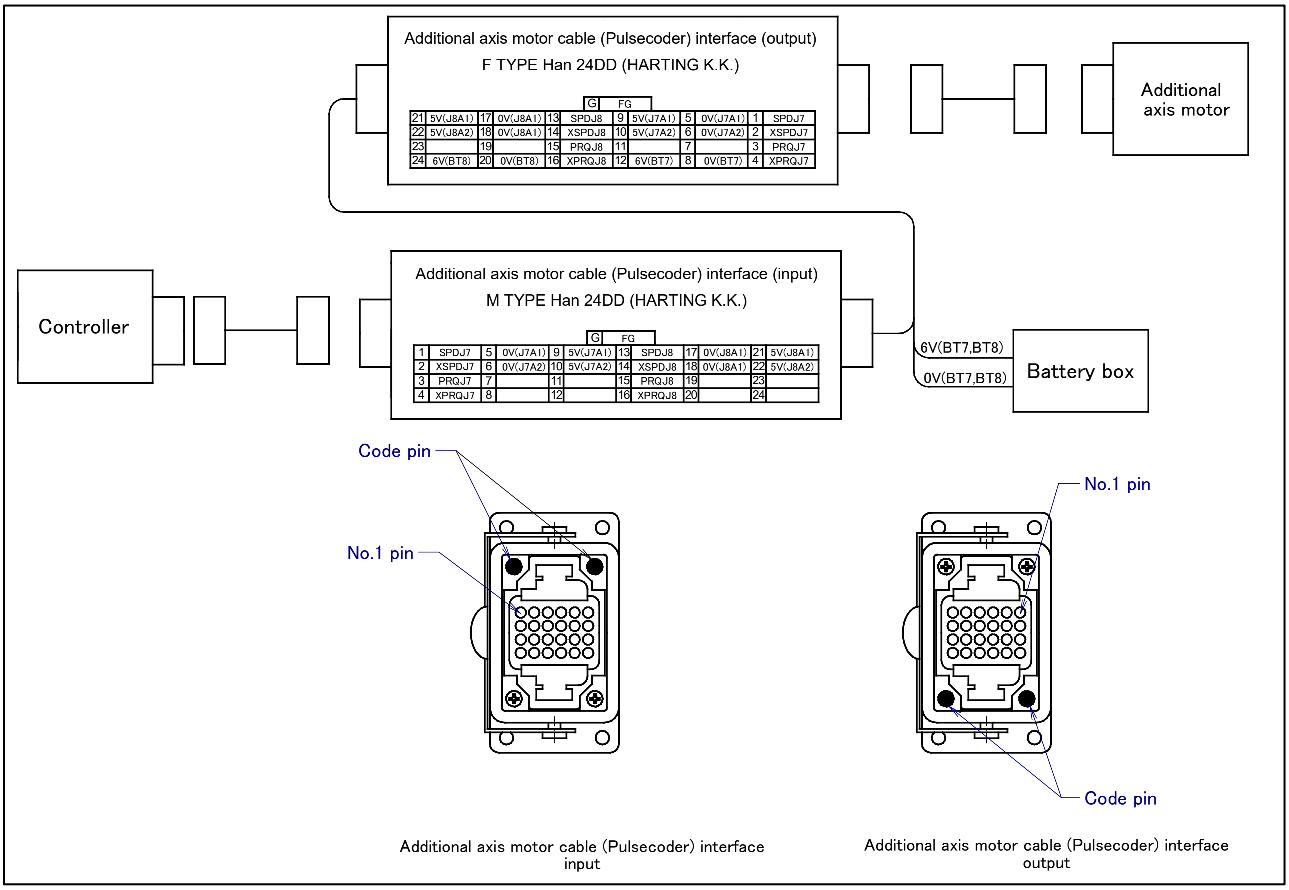


Fig. 5.3 (w) Pin layout for the additional axis motor cable (Pulsecoder cable) (ARP) interface and the code pin position (option)

> **NOTE**
> When the additional axis is 1-axis, “J8” pins do not exist.

Table 5.3 (a) Comparative table of signal line name according to the motor

ARP	α motor, β motor	α*i*, α*i* –B motor, β*i*, β*i*-B motor
SPD	SD	-
XSPD	*SD	-
PRQ	REQ	RD
XPRQ	*REQ	*RD

9 Additional axis motor cable (power and brake cables) (ARM) interface (option)
Fig. 5.3 (x) shows the pin layout of the additional axis motor cable (power and brake cables) interface. The connector has a code pin for preventing improper insertion.

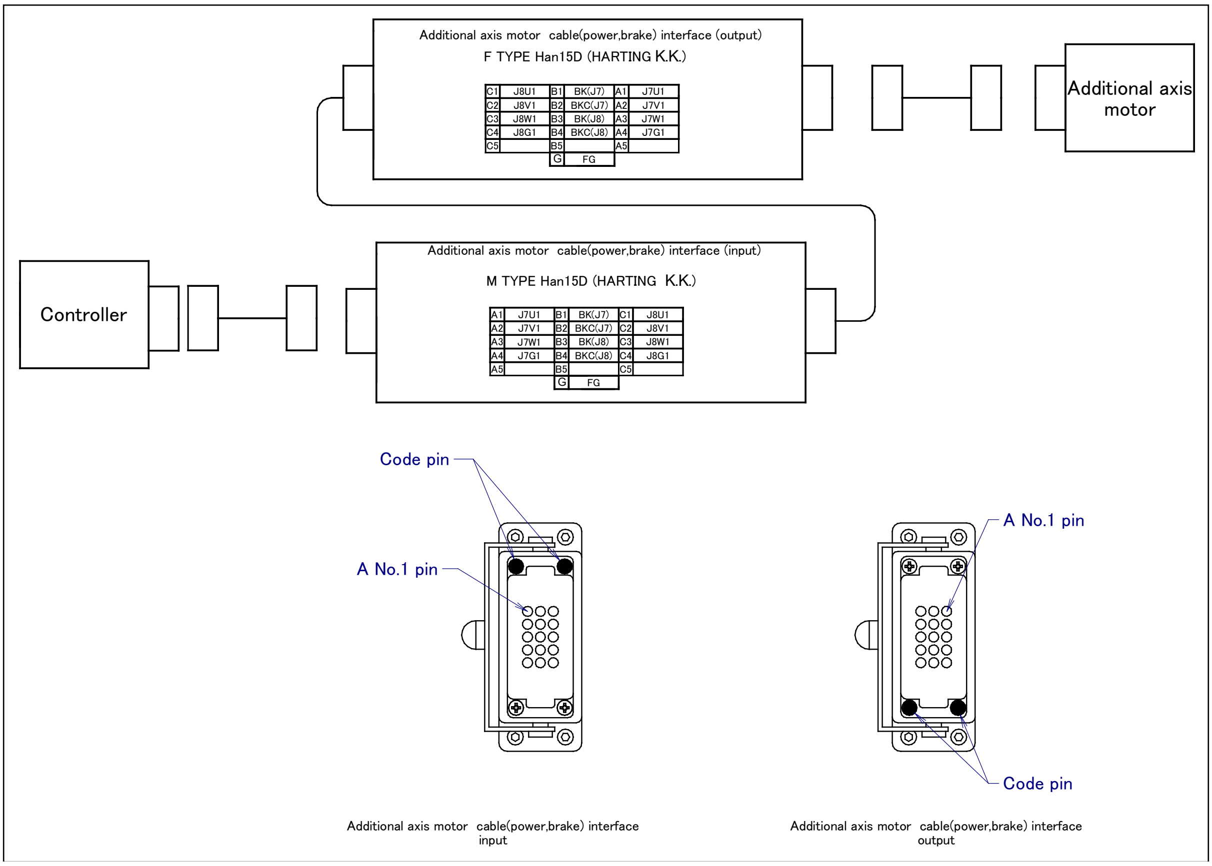


Fig. 5.3 (x) Pin layout of the additional axis motor cable (power and brake cables) (ARM) interface and layout position of the code pin (option)

Connector specifications

Table 5.3 (b) Connector specifications (mechanical unit side)

Cable	Input side (J1 base)		Output side (J3 casing)		Maker /dealer
EE(RI/RO)	———		JMWR2524F		Fujikura Ltd.
I/O	———		JMWR2516F		
LMP1	JMWR1303M		———		
AS ASH ASi	Housing Insert Contact Code pin	09 30 006 0301 09 16 024 3001 09 15 000 6103 09 30 000 9901	Housing Insert Contact Code pin	09 30 006 0301 09 16 024 3101 09 15 000 6203 09 30 000 9901	HARTING K.K.
AP	Housing Insert Contact Code pin	09 20 010 0301 09 21 015 3001 09 15 000 6101 09 30 000 9901	Housing Insert Contact Code pin	09 20 010 0301 09 21 015 3101 09 15 000 6201 09 30 000 9901	
EE(RI/RO) When a severe dust/liquid protection package is selected	———		Housing Insert Contact Guide pin Bush	09 30 006 0301 09 16 024 3101 09 15 000 6204 09 33 000 9908 09 33 000 9909	

Table 5.3 (c) Connector specifications (user side) (1/2)

Cable	Input side (J1 base)		Output side (J3 casing)		Maker /dealer
EE (RI/RO)	――――		JMSP2524M (*1) Straight JMLP2524M Angle		Fujikura Ltd.
I/O	――――		JMSP2516M (*2) Straight JMLP2516M Angle		
AS ASi	Hood (NOTE 2)	09 30 006 1540 Side entry 1541 0542 0543 ↓ 1440 Top entry 1441 0442 0443 ↓	Hood	←The same	HARTING K.K.
	Insert	09 16 024 3101	Insert	09 16 024 3001	
	Contact (NOTE 2)	09 15 000 6204 AWG 26-22 6203 AWG 20 6205 AWG 18 6202 AWG 18 6201 AWG 16 6206 AWG 14	Contact (NOTE 2)	09 15 000 6104 AWG 26-22 6103 AWG 20 6105 AWG 18 6102 AWG 18 6101 AWG 16 6106 AWG 14	
	Clamp (NOTE 2)	09 00 000 5083 5086 5090 5094 etc. Many other types are available	Clamp	← Same as left	
	Code pin	09 30 000 9901	Code pin	09 30 000 9901	
AP	Hood (NOTE 2)	09 20 010 1541 Side entry 0540 0541 ↓ 1440 Top entry 0440 0441 ↓	Hood	← Same as left	
	Insert	09 21 015 3101	Insert	09 21 015 3001	
	Contact (NOTE 2)	09 15 000 6204 AWG 26-22 6203 AWG 20 6205 AWG 18 6202 AWG 18 6201 AWG 16 6206 AWG 14	Contact (NOTE 2)	09 15 000 6104 AWG 26-22 6103 AWG 20 6105 AWG 18 6102 AWG 18 6101 AWG 16 6106 AWG 14	
	Clamp (NOTE 2)	09 00 000 5083 5086 5090 5094 etc. Many other types are available	Clamp	←Same as left	
	Code pin	09 30 000 9901	Code pin	09 30 000 9901	

Table 5.3 (d) Connector specifications (user side) (2/2)

Cable	Input side (J1 base)	Output side (J3 casing)		Maker /dealer
EE (RI /RO) (When a severe dust/liquid protection package is selected)	―――	Hood (NOTE 2)	<u>09 30 006 1540</u> Side entry 1541 0542 0543 1440(*3) Top entry 1441 0442 0443	HARTING K.K.
		Insert	<u>09 16 024 3001</u> (*4)	
		Contact (24 pcs)	<u>09 15 000 6104</u> (*5) AWG 26-22 6103 AWG 20 6105 AWG 18 6102 AWG 18 6101 AWG 16 6106 AWG 14	
		Clamp (NOTE 2)	<u>09 00 000 5085</u> (*6) 5086 5090 5094 Many other types are available	
		Guide pin (2 pcs)	<u>09 33 000 9908</u> (*7)	
		Bush (2 pcs)	<u>09 33 000 9909</u> (*8)	

NOTE 1

Underlined parts are attached. Below shows spec. to order in our company.
(*1)A63L-0001-0234#S2524M
(*2)A63L-0001-0234#S2516M
(*3)A63L-0001-0453#06B1440
(*4)A63L-0001-0453#24DDM
(*5)A63L-0001-0453#CA6104
(*6)A63L-0001-0453#A-152D
(*7)A63L-0001-0453#A-9908
(*8)A63L-0001-0453#A-9909

Table 5.3 (e) Connector specifications (DeviceNet cable, mechanical unit side)

Cable	Input side (J1 base)		Maker /dealer	Output side (J2 base)	Maker /dealer	Output side (J3 casing)	Maker /dealer
DS	CM03A-R5P-S-2		Fujikura Ltd.	CM03A-PR5S-S-2	Fujikura Ltd.	CM03A-PR5S-S-2	Fujikura Ltd.
DP	Housing Insert Contact	09 30 006 0301 09 32 010 3001 09 33 000 6104	HARTING K.K.	CM03A-PR4S-S-2	Fujikura Ltd.	CM03A-PR4S-S-2	Fujikura Ltd.

Table 5.3 (f) Connector specifications (DeviceNet cable, user side)

Cable	Input side (J1 base)		Maker /dealer	Output side (J2 base)	Output side (J3 casing)	Maker /dealer
DS	MINI connector for use on the device net 5-pin, FEMALE CM03-P5S		Fujikura Ltd.	MINI connector for use on the device net 5-pin, MALE CM03-J5P	MINI connector for use on the device net 5-pin, MALE CM03-J5P	Fujikura Ltd.
DP	Hood (NOTE 2)	09 30 006 1540 (Han 6E) Side entry 1541 0542 0543 1440 Top entry 1441 0442 0443	HARTING K.K.	MINI connector for use on the device net 4-pin, MALE CM03-J4P	MINI connector for use on the device net4-pin, MALE CM03-J4P	Fujikura Ltd.
	Insert	09 32 010 3101				
	Contact (NOTE 2)	09 33 000 6220 AWG20 6214 AWG18 6205 AWG18 6204 AWG16 6202 AWG14 6207 AWG12				
	Clamp (NOTE 2)	09 00 000 5083 5086 5090 5094 Many other types are available.				

Table 5.3 (g) Connector specifications (additional axis motor cable, mechanical unit side)

Cable	Input side (J1 base)		Output side (J3 casing)		Maker /dealer
ARP	Housing Insert Contact Code pin	09 30 006 0301 09 16 024 3001 09 15 000 6103 09 30 000 9901	Housing Insert Contact Code pin	09 30 006 0301 09 16 024 3101 09 15 000 6203 09 30 000 9901	HARTING K.K.
ARM	Housing Insert Contact Code pin	09 20 010 0301 09 21 015 3001 09 15 000 6101 09 30 000 9901	Housing Insert Contact Code pin	09 20 010 0301 09 21 015 3101 09 15 000 6201 09 30 000 9901	

Table 5.3 (h) Connector specifications (3DL sensor)

Cable	Input side (J1 base)	Output side (J3 casing)	Maker/ dealer
LMP1	JMWR1303M	———	Fujikura Ltd.

Table 5.3 (i) Connector specifications (3DL sensor)

Cable	Input side (J1 base)	Output side (J3 casing)	Maker/ dealer
LMP1	JMSP1303F Straight plug (FANUC specification A63L-0001-0234#S1303F) JMLP1303F Angle plug	———	Fujikura Ltd.

NOTE 2
For details, such as the dimensions, of the parts listed above, refer to the related catalogs offered by the respective manufactures, or contact your local FANUC representative.

5.4 INSTALLING THE AIR PURGE KIT

In case of R-2000*i*B/210WE, be sure to use air purge kit.
Air purge kit is preparatory as the option, and use it, please. Use the prepared air purge kit.
Set the air purge pressure to 20 kPa (0.02 MPa, 0.2 kgf/cm^2).

NOTE
1. Use a dedicated air pressure source for an air purge. Do not use the same air pressure source for both the air purge kit and others. Otherwise, the dryer capacity is exceeded and water or oil remains in air, causing serious damage to the robot.
2. After installing the robot, perform an air purge without fail. Even when the robot is not operated, an air purge is required if it is placed in an environment subject to water splash or high humidity such washing booth.

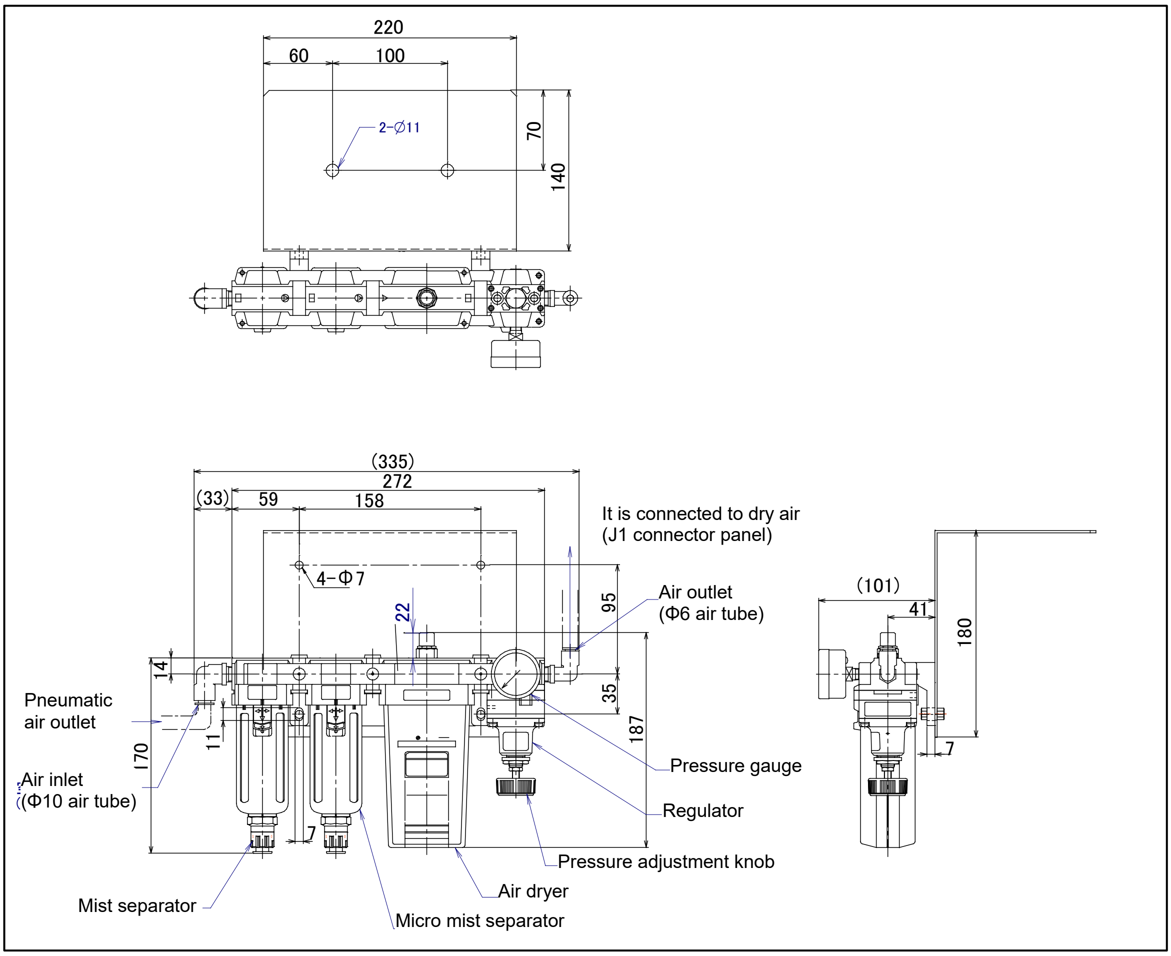


Fig. 5.4 (a) External dimensions of regulator kit for air purge

6 AXIS LIMITS SETUP

By setting the motion range of each axis, you can change the robot's motion range from the standard values. Changing the motion range of robot is effective under the following circumstances:

- Used motion range of robot is limited.
- There is an area where tool and peripheral devices interfere with robot.
- The length of cables and hoses attached for application is limited.

There are three methods as shown below to prevent the robot from going beyond the necessary motion range.

- Limit axis motion range by DCS (All axes (option))
- Limit axis motion range adjustable mechanical stopper (J1/J2/J3-axes (option))
- Limit axis motion range by adjustable mechanical stopper and switches (J1/J2/J3-axis (option))

⚠ **WARNING**

1 Changing the motion range of any axis affects the operation range of the robot. To avoid trouble, carefully consider a possible effect of the change to the movable range of each axis in advance. Otherwise, it is likely that an unexpected condition occurs; for example, an alarm may occur in a previous taught position.
2 For J1-axis, use adjustable mechanical stoppers, for J2/J3-axis, use the adjustable mechanical stoppers or DCS function so that damage to peripheral equipment and injuries to human bodies can be avoided.
3 Mechanical stoppers are physical obstacles. For J1 to J3 axis, it is possible to re-position the adjustable mechanical stoppers. But the robot cannot move beyond them. For J5 axis (J4-axis for R-2000*i*B/100H), the mechanical stoppers are fixed. For the J4 and J6 axes (J5-axis for R-2000*i*B/100H), only DCS-specified limits are available.
4 For changing J2 andJ3 axes interference angles, only adjustable mechanical stoppers are available; DCS-specified movable range cannot be changed.
5 Adjustable mechanical stoppers (J1, J2, and J3 axes) are deformed in a collision to stop the robot. Once a stopper is subject to a collision, it can no longer assure its original strength and, therefore, may not stop the robot. When this happens, replace it with a new one.

6.1 CHANGE AXIS LIMIT BY DCS (OPTION)

The robot motion can be restricted with DCS (Dual check safety) function by using the following software. For J2/J3-axis, the same effect as J1-axis adjustable mechanical stopper can be obtained.
The robot motion can be restricted at any angle and position if it is in robot motion area. DCS functions are certified to meet the requirements of International Standard ISO13849-1 and IEC61508 approved by notified body. If only the operating space is set using Joint Position Check, the robot stops after it goes beyond the workspace. When the motor power is shut down, the robot's momentum causes it to move some distance
before it completely stops. The actual "Robot Stop Position" will be beyond the workspace. To stop the robot within the robot workspace, use the DCS Stop Position Prediction function. The stop position prediction is disabled by default.

- DCS position/speed check function (J567)

As an example, we shows the procedure to set ±60° for J2-axis in here. Refer to R-30*i*B/R-30*i*B Mate /R-30*i*B Plus Controller Dual check safety function Operator's Manual (B-83184EN) or R-30*i*A/R-30*i*A Mate Controller Dual check safety function Operator's Manual (B-83104EN) for details of other setting, function and DCS stop position prediction.

Setting procedure

1. Press the [MENU] key to display the screen menu.
2. Press [0 NEXT] and press [6 SYSTEM].
3. Press the F1 ([TYPE]).
4. Select [DCS]. The following screen will be displayed.

```
                               AUTO
DCS                           JOINT 1%

  1  Joint position check
  2  Joint speed check:
  3  Cart. position check   OK
  4  Cart. speed check
  5  T1 mode speed check
  6  User model
  7  Tool frame
  8  User frame
  9  Stop position prediction

 [TYPE] APPLY DETAIL              UNDO
```

5. Move the cursor to [1 Joint position check], then press the [DETAIL].

```
                               AUTO
DCS                           JOINT 1%
  Join Position check
  No.          G  A  Status Comment
  1  DISABLE   1  1  ----   [          ]
  2  DISABLE   1  1  ----   [          ]
  3  DISABLE   1  1  ----   [          ]
  4  DISABLE   1  1  ----   [          ]
  5  DISABLE   1  1  ----   [          ]
  6  DISABLE   1  1  ----   [          ]
  7  DISABLE   1  1  ----   [          ]
  8  DISABLE   1  1  ----   [          ]
  9  DISABLE   1  1  ----   [          ]
  10 DISABLE   1  1  ----   [          ]

  [TYPE]      DETAIL
```

6 Move the cursor to [1], then press the [DETAIL].

```
                         AUTO
DCS                              JOINT 1%
 No.  1                  Status:
 1 Comment          [*********************]
 2 Enable/Disable                 DISABLE
 3 Group                              1
 4 Axis                               1
 5 Safe side:
   Position   (deg):
   Current:                       0.000
 6 Upper limit   :                0.000
 7 Lower limit   :                0.000
 8 Stop type:              Power-off stop

 [TYPE]  PREV  NEXT                UNDO
```

7 Move the cursor to [DISABLE], then press [CHOICE], set the status to [ENABLE].
8 Move the cursor to [Group], then input the robot group number, then press the [ENTER] key.
9 Move the cursor to [Axis], then input "2", then press the [ENTER] key.
10 Move the cursor to [Upper limit] right side, then input "60", then press the [ENTER] key.
11 Move the cursor to [Lower limit] right side, then input "-60", then press the [ENTER] key.

> ⚠ **WARNING**
> If only the operating space is set using Joint Position Check, the robot stops after it goes beyond the workspace. When the motor power is shut down, the robot's momentum causes it to move some distance before it completely stops. The actual "Robot Stop Position" will be beyond the workspace. To stop the robot within the robot workspace, use the DCS Stop Position Prediction function. The stop position prediction is disabled by default.

```
                         AUTO
DCS                              JOINT 1%
 No.  1                  Status:
 1 Comment          [*********************]
 2 Enable/Disable                  ENABLE
 3 Group                              1
 4 Axis                               2
 5 Safe side:
   Position   (deg):
   Current:                       0.000
 6 Upper limit   :              +30.000
 7 Lower limit   :              -30.000
 8 Stop type:              Power-off stop

 [TYPE]  PREV  NEXT                UNDO
```

12 Press the [PREV] key two times, back to the first screen.

```
                         AUTO
DCS                              JOINT 1%

 1   Joint position check   UNSF   CHGD
 2   Joint speed check:
 3   Cart. position check    OK
 4   Cart. speed check
 5   T1 mode speed check
 6   User model
 7   Tool frame
 8   User frame
 9   Stop position prediction

 [TYPE] APPLY DETAIL                UNDO
```

13 Press the [APPLY].

14 Input 4-digit password, then press the [ENTER] key. (Password default setting is “1111”.)
15 The following screen will be displayed, then press the [OK].

```
                              AUTO
DCS                           JOINT 1%
 Verify (diff)
 F Number :    F0000
 VERSION   :   HandlingTool
 $VERSION : V7.7097  9/1/2015
 DATE:   17-7-28    19:44
 DCS Version:  V2. 0. 11

 ---Joint Position Check-----------------
 No.             G  A  Status Comment
 1 EBABLE        1  2   CHGD [
 2 ENABLE        1  2   ---- [
 3 DISABLE       1  2   ---- [
               ALL     OK     QUIT
```

16 [CHGD] on the right side of [1 Joint position check] will change to [PEND].

```
                              AUTO
DCS                           JOINT 1%

 1   Joint position check   UNSF   PEND
 2   Joint speed check:
 3   Cart. position check    OK
 4   Cart. speed check
 5   T1 mode speed check
 6   User model
 7   Tool frame
 8   User frame
 9   Stop position prediction

 [TYPE] APPLY DETAIL                UNDO
```

17 Cycle the power of the controller in the cold start mode so the new settings are enabled.

> ⚠ **WARNING**
> You must cycle the power of the controller to enable the new setting. If you fail to do so, the robot does not work normally and it may injure personnel or damage the equipment.

6.2 ADJUSTABLE MECHANICAL STOPPER AND LIMIT SWITCH SETTING

For the J1, J2, and J3 axes, adjustable mechanical stopper (option) can be installed in addition to standard mechanical stopper. It is possible to re-position adjustable mechanical stoppers. The limit switch-based movable range can be changed by changing the dog positions. Change the position of the adjustable mechanical stoppers according to the desired movable range.

Table 6.2 (a) Motion range that can be set by the adjustable mechanical stopper and space between the upper and lower limits (R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U)

<table>
<tr><th colspan="2">Item</th><th>Settable motion range</th></tr>
<tr><td rowspan="3">J1 axis adjustable mechanical stopper, limit switch
(R-2000iB/210WE does not support limit switch)</td><td>Upper limit</td><td>Settable in steps of 7.5° in the range of -127.5° to +180°</td></tr>
<tr><td>Lower limit</td><td>Settable in steps of 7.5° in the range of -180° to +127.5°</td></tr>
<tr><td>Space between the upper and lower limits</td><td>A space of 52.5° or more is required.</td></tr>
<tr><td rowspan="3">J2 axis adjustable mechanical stopper</td><td>Upper limit</td><td>Settable in steps of 15° in the range of -45° to +60°. A fixed mechanical stopper is also provided at +76°. (+76° is upper limit of the standard motion range.)</td></tr>
<tr><td>Lower limit</td><td>Settable in steps of 15° in the range of -45° to +60°. A fixed mechanical stopper is also provided at the -60°. (-60° is lower limit of the standard motion range.)</td></tr>
<tr><td>Space between the upper and lower limits</td><td>A space of 15°or more is required.</td></tr>
<tr><td rowspan="3">J2 axis limit switch
(R-2000iB/210WE does not support limit switch)</td><td>Upper limit</td><td>Settable in steps of 15°in the range of -60° to +75°. Also settable to the upper limit +76°of the standard movable range.(When it is set to -60°, minus side dog cannot be set)</td></tr>
<tr><td>Lower limit</td><td>Settable in steps of 15°in the range of -60° to +75°. Also settable to the lower limit -60° of the standard movable range. (When it is set to -60°, plus side dog can not be set)</td></tr>
<tr><td>Space between the upper and lower limits</td><td>A space of 15°or more is required.</td></tr>
<tr><td rowspan="3">J3 axis (J2+J3) adjustable mechanical stopper</td><td>Upper limit</td><td>Settable in steps of 15° in the range of -45° to +180°. A fixed mechanical stopper is also provided at +195°. (+195° is upper limit of the standard motion range.)</td></tr>
<tr><td>Lower limit</td><td>Settable in steps of 15° in the range of -60° to +150°. A fixed mechanical stopper is also provided at the -79°. (-79° is lower limit of the standard motion range.)</td></tr>
<tr><td>Space between the upper and lower limits</td><td>A space of 30° or more is required.</td></tr>
<tr><td rowspan="3">J3 axis (J2+J3) limit switch
(R-2000iB/210WE does not support limit switch)</td><td>Upper limit</td><td>Settable in steps of 15° in the range of -75° to +195°. Also settable to the upper limit +195° of the standard movable range. .(When it is set to -75° or -60°, minus side dog can not be set)</td></tr>
<tr><td>Lower limit</td><td>Settable in steps of 15° in the range of -75° to +195°. Also settable to the lower limit -79° of the standard movable range. (When it is set to +180° or +195°, plus side dog can not be set)</td></tr>
<tr><td>Space between the upper and lower limits</td><td>A space of 30° or more is required.</td></tr>
</table>

Table 6.2 (b) Motion range that can be set by the adjustable mechanical stopper and space between the upper and lower limits (R-2000*i*B/165R/200R/100P)

Item		Settable motion range
J1 axis adjustable mechanical stopper, limit switch	Upper limit	Settable in steps of 7.5° in the range of -127.5° to +180°
	Lower limit	Settable in steps of 7.5° in the range of -180° to +127.5°
	Space between the upper and lower limits	A space of 52.5° or more is required.
J2 axis adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -105° to +45°. A fixed mechanical stopper is also provided at +65°. (+65° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -105° to +45°.A fixed mechanical stopper is also provided at the -120°. (-120° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 15°or more is required.
J2 axis limit switch	Upper limit	Settable in steps of 15°in the range of -120° to +60°. Also settable to the upper limit +65°of the standard movable range. (When it is set to –120°, minus side dog can not be set)
	Lower limit	Settable in steps of 15° in the range of -120° to +60°. Also settable to the lower limit -120° of the standard movable range. (When it is set to +60°, plus side dog can not be set)
	Space between the upper and lower limits	A space of 15°or more is required.
J3 axis (J2+J3) adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -45° to +180°. A fixed mechanical stopper is also provided at +195°. (+195° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -60° to +150°. A fixed mechanical stopper is also provided at the -79°. (-79° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 30° or more is required.
J3 axis (J2+J3) limit switch	Upper limit	Settable in steps of 15° in the range of -75° to +195°. Also settable to the upper limit +195° of the standard movable range. .(When it is set to –75°or –60°, minus side dog can not be set)
	Lower limit	Settable in steps of 15° in the range of -75° to +195°. Also settable to the lower limit -79° of the standard movable range. (When it is set to +180° or +195°, plus side dog can not be set)
	Space between the upper and lower limits	A space of 30° or more is required.

Table 6.2 (c) Motion range that can be set by the adjustable mechanical stopper and space between the upper and lower limits (R-2000*i*B/170CF)

Item		Settable motion range
J1 axis adjustable mechanical stopper, limit switch	Upper limit	Settable in steps of 7.5° in the range of -127.5° to +180°
	Lower limit	Settable in steps of 7.5° in the range of -180° to +127.5°
	Space between the upper and lower limits	A space of 52.5° or more is required.
J2 axis adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -45° to +120°. A fixed mechanical stopper is also provided at +135°. (+135° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -45° to +120°. A fixed mechanical stopper is also provided at the -55°. (-55° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 30° or more is required.
J2 axis limit switch	It doesn't correspond to R-2000*i*B/170CF	
J3 axis (J2+J3) adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -15° to +225°. A fixed mechanical stopper is also provided at +235°. (+235° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -45° to +195°. A fixed mechanical stopper is also provided at the -55°. (-55° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 30° or more is required.
J3 axis (J2+J3) limit switch	It doesn't correspond to R-2000*i*B/170CF	

Table 6.2 (d) Motion range that can be set by the adjustable mechanical stopper and space between the upper and lower limits (R-2000*i*B/210FS/220US)

Item		Settable motion range
J1 axis adjustable mechanical stopper, limit switch	Upper limit	Settable in steps of 7.5° in the range of -127.5° to +180°
	Lower limit	Settable in steps of 7.5° in the range of -180° to +127.5°
	Space between the upper and lower limits	A space of 52.5° or more is required.
J2 axis adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -45° to +60°. A fixed mechanical stopper is also provided at +76°. (+76° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -45° to +60°. A fixed mechanical stopper is also provided at the -60°. (-60° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 15°or more is required.
J2 axis limit switch	It doesn't correspond to R-2000*i*B/210FS/220US	
J3 axis (J2+J3) adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -45° to +90°. A fixed mechanical stopper is also provided at +100°. (+100° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -60° to +75°. A fixed mechanical stopper is also provided at the -79°. (-79° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 30° or more is required.
J3 axis (J2+J3) limit switch	It doesn't correspond to R-2000*i*B/210FS/220US	

Table 6.2 (e) Motion range that can be set by the adjustable mechanical stopper and space between the upper and lower limits (R-2000*i*B/165CF)

Item		Settable motion range
J1 axis adjustable mechanical stopper, limit switch	Upper limit	Settable in steps of 7.5° in the range of -127.5° to +180°
	Lower limit	Settable in steps of 7.5° in the range of -180° to +127.5°
	Space between the upper and lower limits	A space of 52.5° or more is required.
J2 axis adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -45° to +90°. A fixed mechanical stopper is also provided at +110°. (+110° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -30° to +105°. A fixed mechanical stopper is also provided at the -55°. (-55° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 30°or more is required.
J2 axis limit switch	Upper limit	Settable in steps of 15° in the range of -45° to +105°. Also settable to the upper limit +110°of the standard movable range.
	Lower limit	Settable in steps of 15°in the range of -45° to +105°. Also settable to the lower limit -55° of the standard movable range.
	Space between the upper and lower limits	A space of 30°or more is required.
J3 axis (J2+J3) adjustable mechanical stopper	Upper limit	Settable in steps of 15° in the range of -75° to +105°. A fixed mechanical stopper is also provided at +120°. (+120° is upper limit of the standard motion range.)
	Lower limit	Settable in steps of 15° in the range of -60° to +120°. A fixed mechanical stopper is also provided at the -75°. (-75° is lower limit of the standard motion range.)
	Space between the upper and lower limits	A space of 30° or more is required.
J3 axis (J2+J3) limit switch	Upper limit	Settable in steps of 15° in the range of -75° to +105°. Also settable to the upper limit +120° of the standard movable range.
	Lower limit	Settable in steps of 15° in the range of -60° to +120°. Also settable to the lower limit -75° of the standard movable range.
	Space between the upper and lower limits	A space of 15° or more is required.

NOTE

1 If the newly set operation range does not include 0°, you must change it by zero degree mastering so that 0° is included.
2 When adjustable mechanical stopper (option) is ordered, mounting bolt is attached.
3 When motion range is changed by adjustable mechanical stopper, be sure to set the motion range of soft same refer to Subsection 6.2.2.

6.2.1 Installing Adjustable Mechanical Stopper Option

Attach adjustable mechanical stoppers referring to Fig. 6.2.1 (a) to (o).

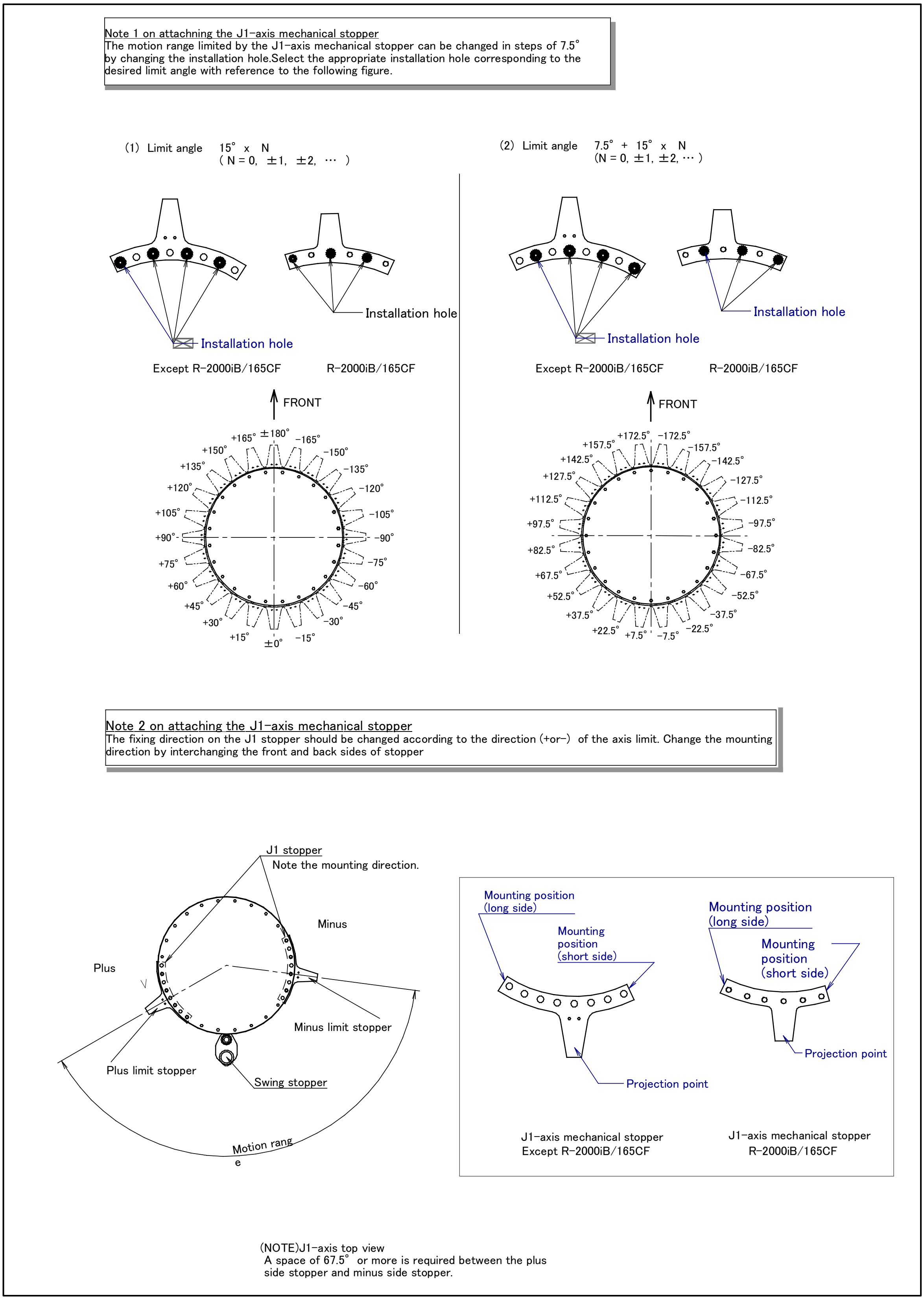


Fig. 6.2.1 (a) Mounting the J1-axis mechanical stopper

165F/210F/185L/250F/170CF/210WE/125L/175L/100H/150U/220U/210FS/220US	A290-7329-X215
165R/200R/100P	A290-7329-Y215
165CF	A290-7321-X215

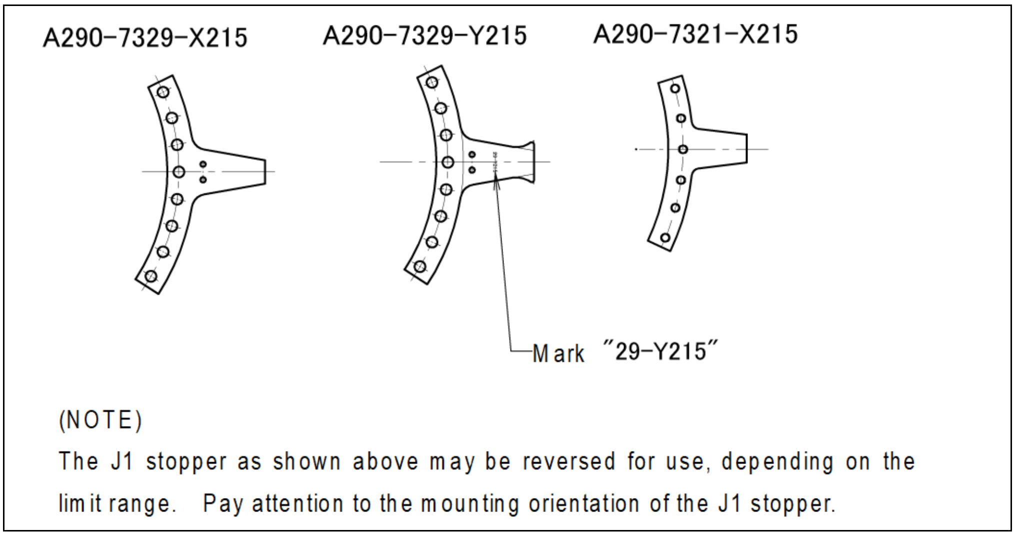


Fig. 6.2.1 (b) Mounting the J1-axis mechanical stopper
(Stopper part specifications corresponding to models)

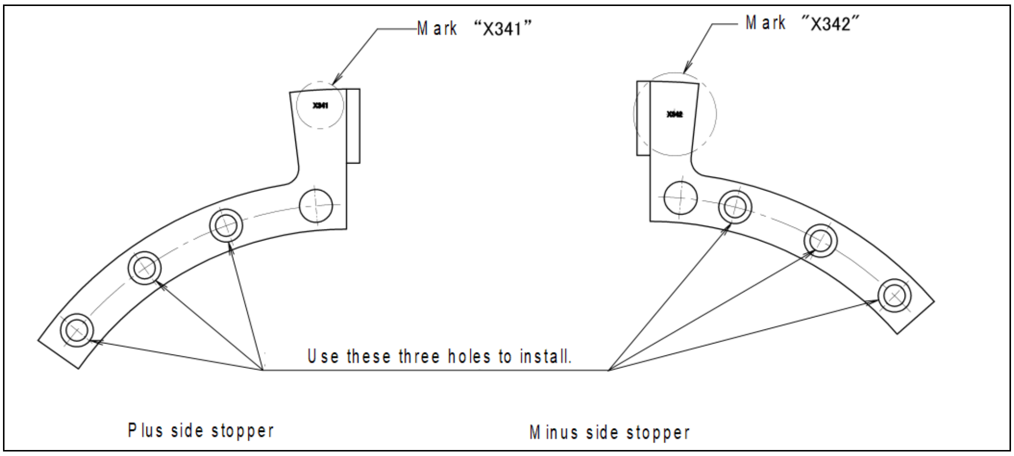
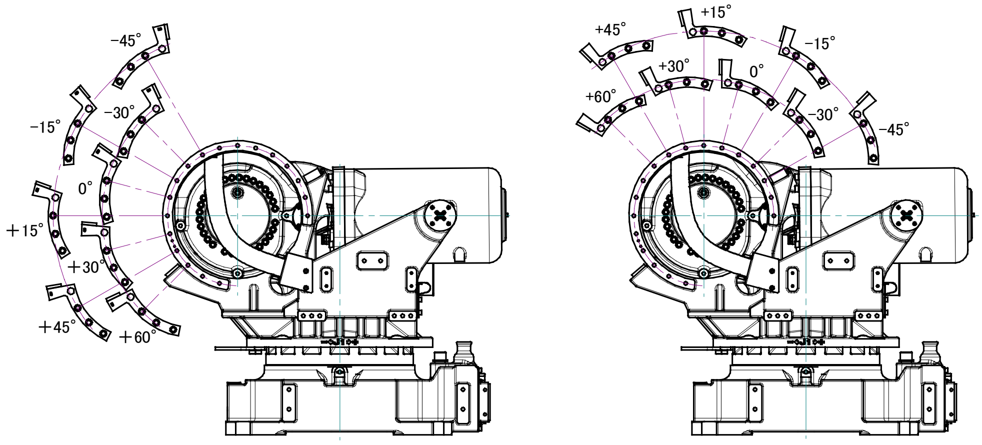


Fig. 6.2.1 (c) J2-axis mechanical stopper (option)
(R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U/210FS/220US)



Mounting position of plus side stopper

Mounting position of minus side stopper

(NOTE)
J2-axis left view
A space of 15° or more is required between the plus side stopper and minus side stopper.

Fig. 6.2.1 (d) Mounting the J2-axis mechanical stopper (R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U/210FS/220US)

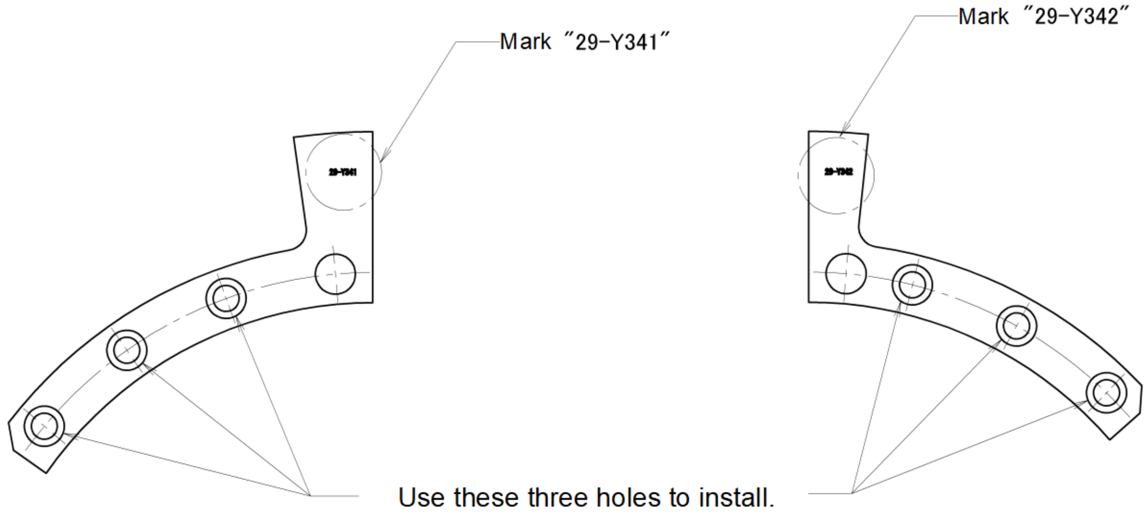
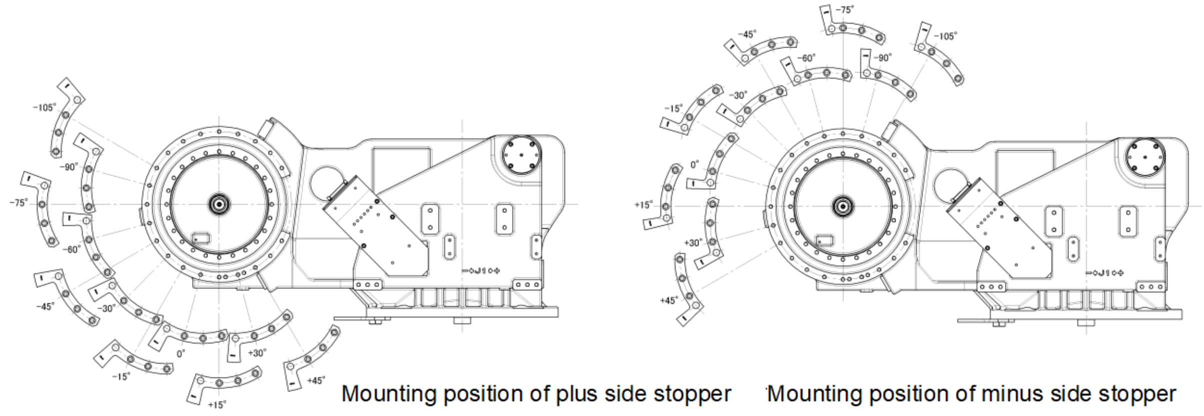


Fig. 6.2.1 (e) J2-axis mechanical stopper (option) (R-2000*i*B/165R/200R/100P)



(NOTE)
J2-axis left view
A space of 15° or more is required between the plus side stopper and minus side stopper.

Fig. 6.2.1 (f) Mounting the J2-axis mechanical stopper (R-2000*i*B/165R/200R/100P)

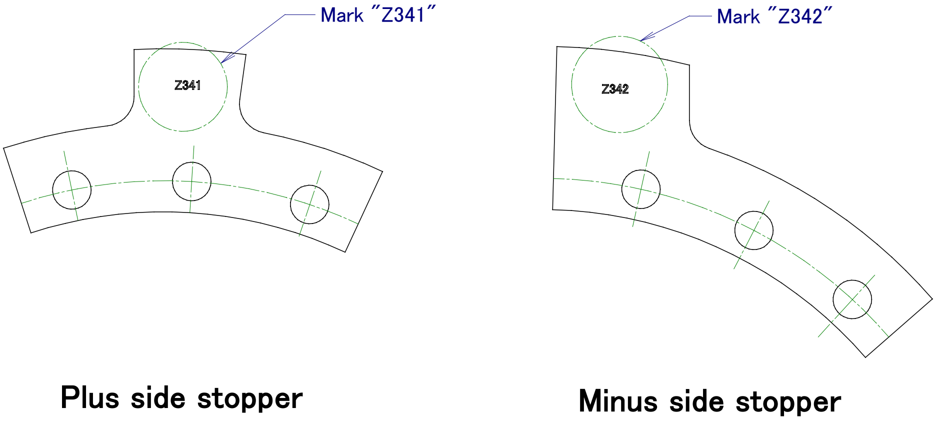
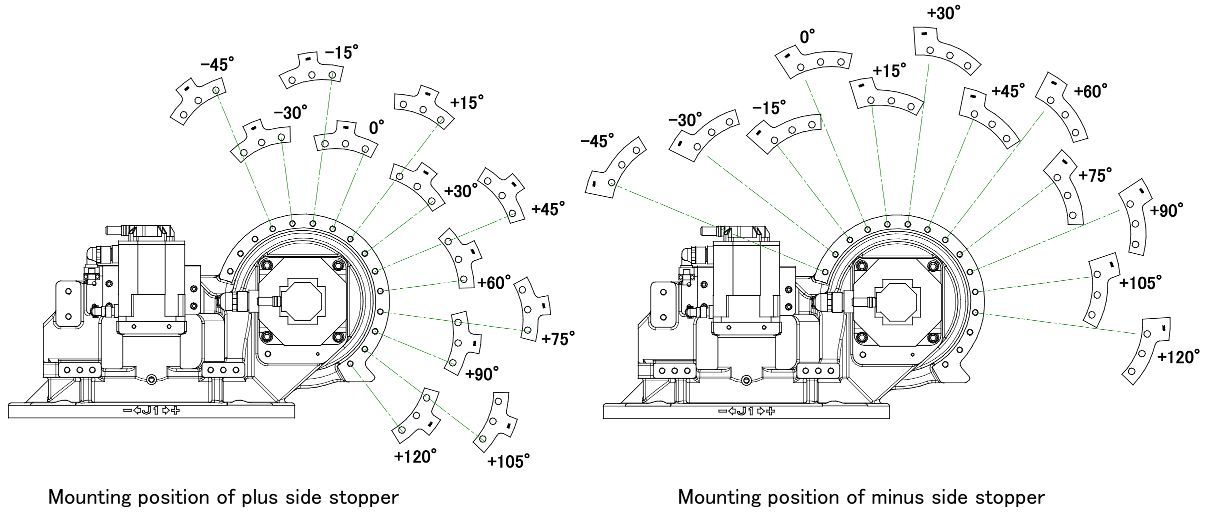
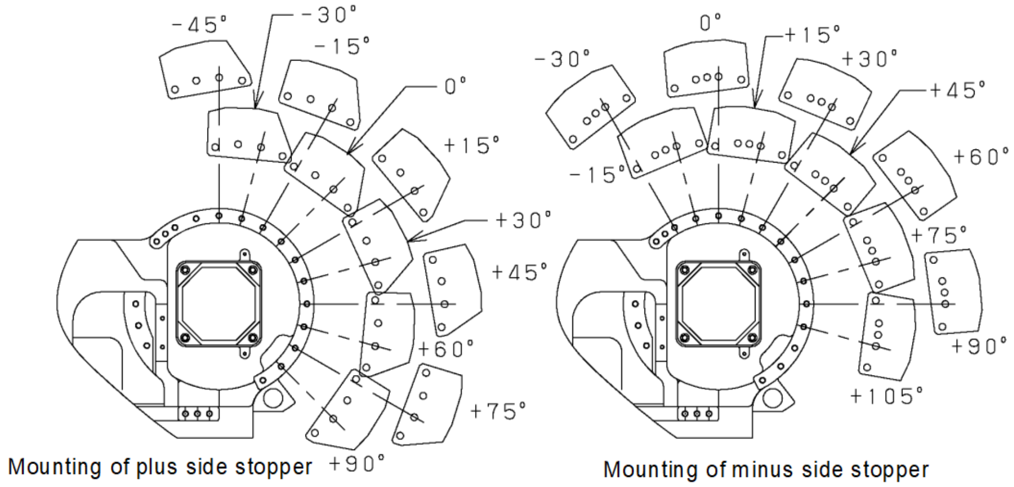


Fig. 6.2.1 (g) J2-axis mechanical stopper (option) (R-2000*i*B/170CF)



(NOTE)
J2-axis left view
A space of 30° or more is required between the plus side stopper and minus side stopper.

Fig. 6.2.1 (h) Mounting the J2-axis mechanical stopper (R-2000*i*B/170CF)



(NOTE) J2-axis right view

Fig. 6.2.1 (i) Mounting the J2-axis mechanical stopper (R-2000*i*B/165CF)

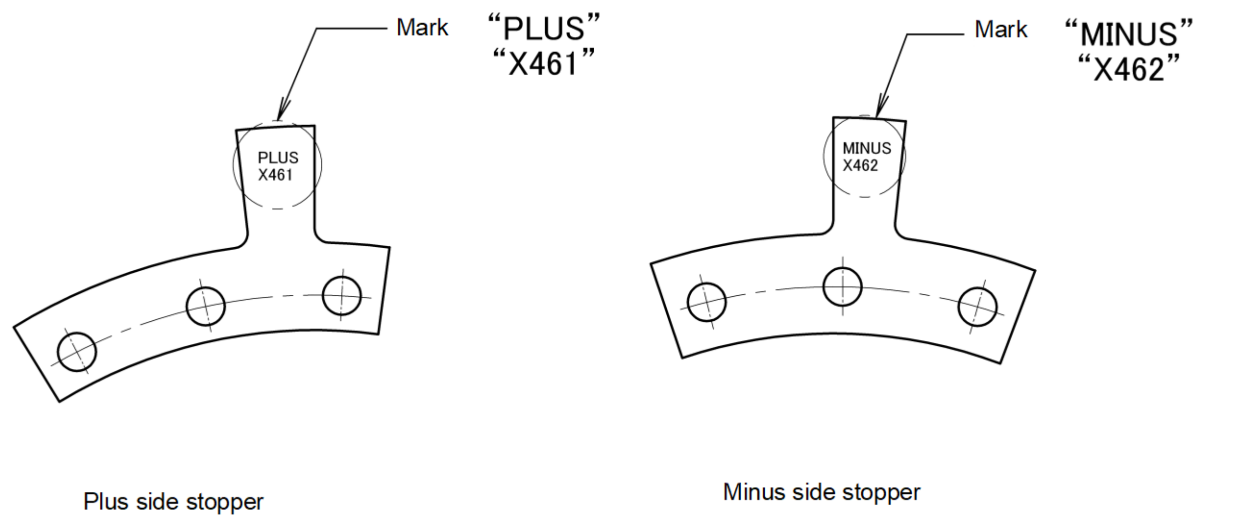
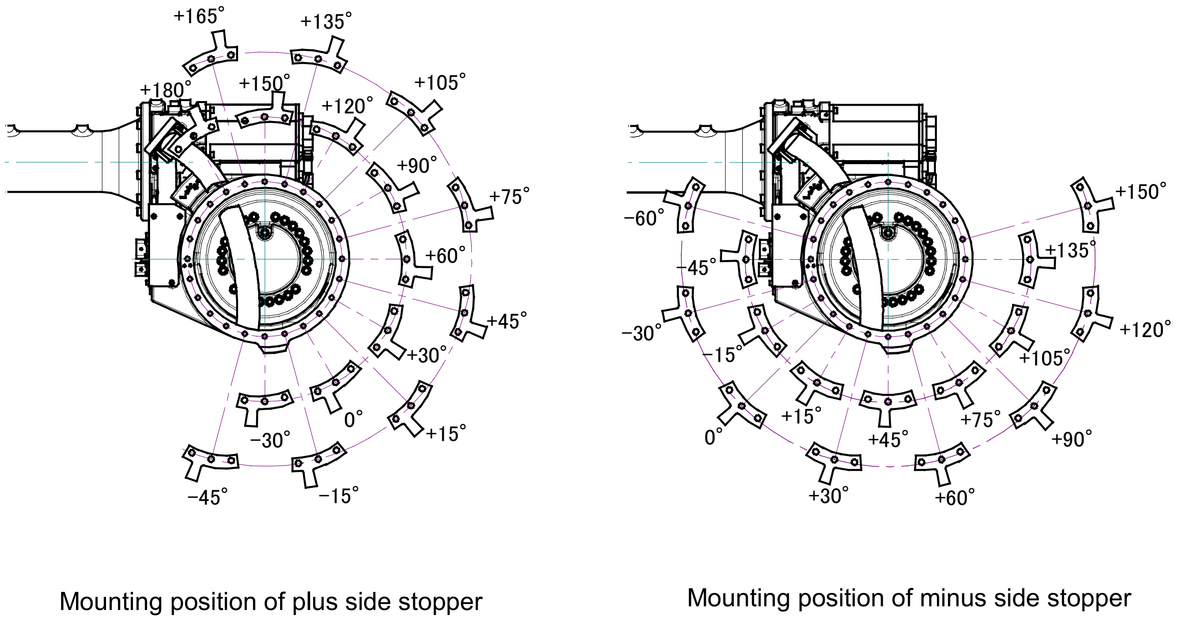


Fig. 6.2.1 (j) J3-axis mechanical stopper (option)
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U/210FS/220US)



(NOTE)
J3-axis left view
A space of 30° or more is required between the plus side stopper and minus side stopper.

Fig. 6.2.1 (k) Mounting the J3-axis mechanical stopper
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U)

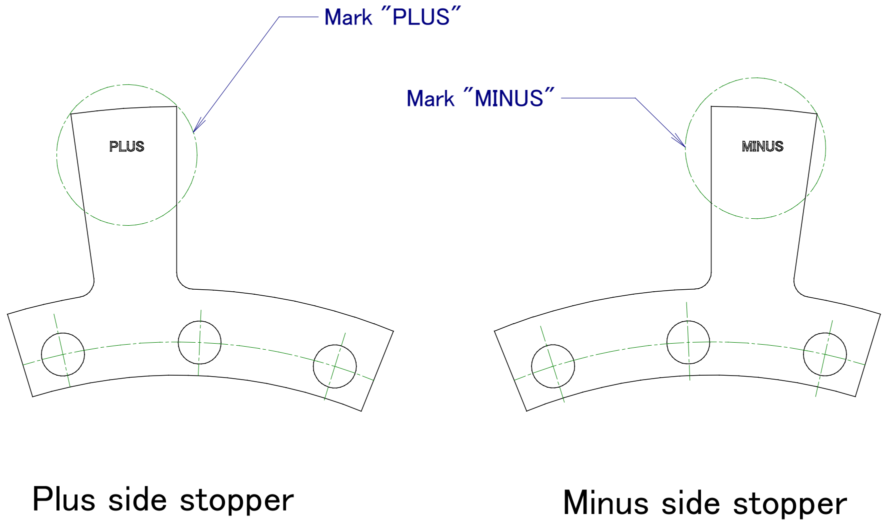
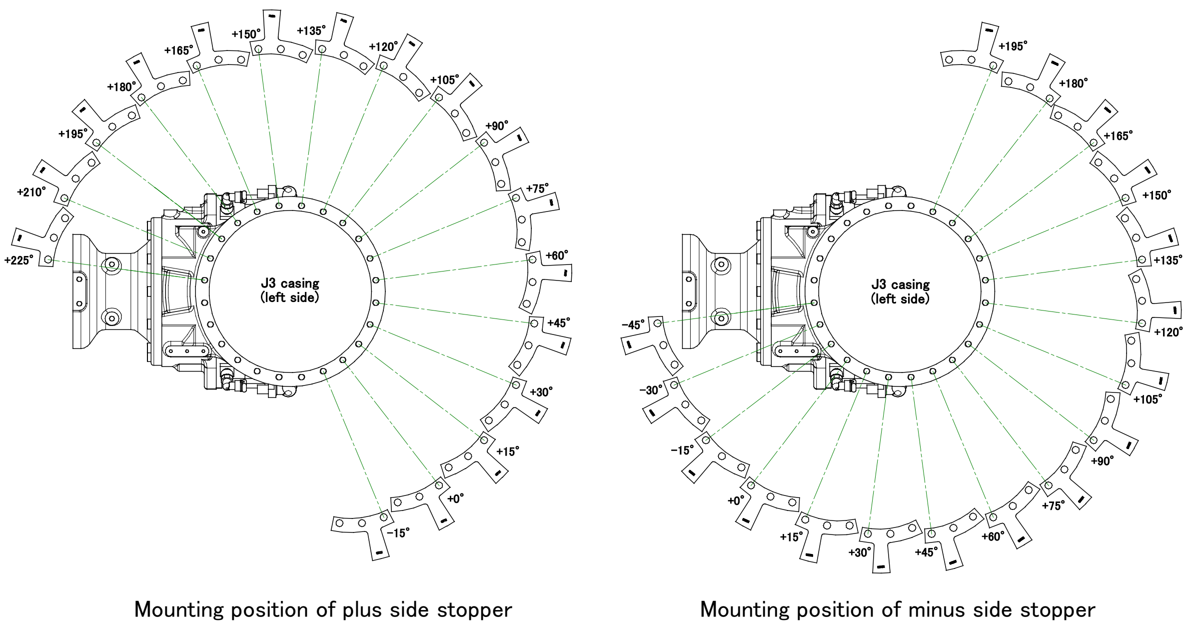
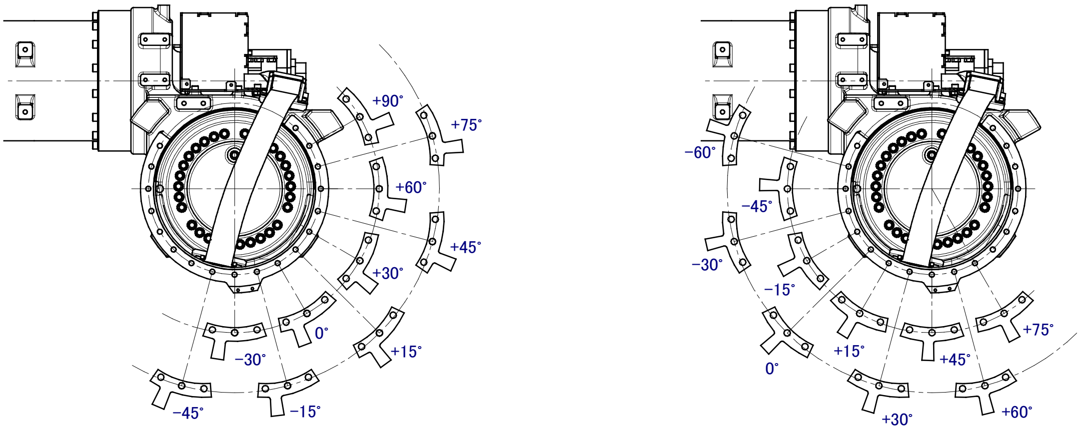


Fig. 6.2.1 (l) J3-axis mechanical stopper (option) (R-2000*i*B/170CF)



(NOTE)
J3-axis left view
A space of 30° or more is required between the plus side stopper and minus side stopper.

Fig. 6.2.1 (m) Mounting the J3-axis mechanical stopper (R-2000*i*B/170CF)

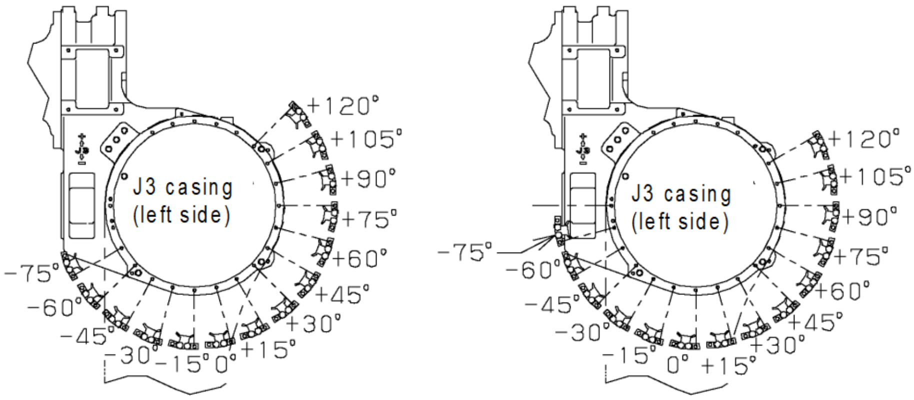


Mounting position of plus side stopper

Mounting position of minus side stopper

(NOTE)
J3-axis left view
A space of 30° or more is required between the plus side stopper and minus side stopper.

Fig. 6.2.1 (n) Mounting the J3-axis mechanical stopper (R-2000*i*B/210FS/220US)



Mounting of plus side dog

Mounting of minus side dog

(NOTE) J3-axis left view
A space of 15° or more is required between the plus side dog and minus side dog.

Fig. 6.2.1 (o) Mounting the J3-axis mechanical stopper (R-2000*i*B/165CF)

6.2.2 Changing the Parameter Setting

Setting procedure

1. Press the [MENU] key to display the screen menu.
2. Select [0 NEXT] and press [6 SYSTEM].
3. Press F1 [TYPE].
4. Select [Axis Limits]. The following screen will be displayed.

```
System Axis Limits                    JOINT 100%
   Group1                                   1/16
  AXIS    GROUP    LOWER     UPPER
  1         1     -180.00    180.00   deg
  2         1      -60.00     76.00   deg
  3         1     -132.00    230.00   deg
  4         1     -360.00    360.00   deg
  5         1     -125.00    125.00   deg
  6         1     -360.00    360.00   deg
  7         1        0.00      0.00   mm
  8         1        0.00      0.00   mm
  9         1        0.00      0.00   mm

[ TYPE]
```

NOTE
0.00 indicates the robot does not have these axes.

5. Move the cursor to the axis limit to be set. Type the new value using the numeric keys on the teach pendant. In this time, set the axial upper limit and the lower limit at the position same as adjustable mechanical stoppers are attached.

```
System Axis Limits                    JOINT 100%
   Group1                                   1/16
  AXIS    GROUP    LOWER     UPPER
  2         1      -60.00     76.00   deg

[ TYPE]
```

6. Turn off the controller and then turn it back on again in the cold start mode so the new information can be used.

⚠ WARNING
1. You must turn off the controller and then turn it back on to use the new information; otherwise, the old settings remain valid and could cause personnel injury or equipment damage.
2. After changing system variables, be sure to run the robot at a low speed and make sure that the robot stops at the ends of the stroke.
3. If a collision should occur, the adjustable mechanical stopper becomes deformed to absorb energy, so that the robot can stop safely. If the stopper is deformed by mistake, replace it.
4. Do not depend on parameter settings to control the motion range of your robot.

6.2.3 The Maximum Stopping Distance (Position) of Adjustable Mechanical Stopper

The adjustable mechanical stopper is a mechanism that can be adjusted in its position. The robot can work safely inside the adjusted motion range, up to the maximum range as shown in Table 6.2.3 (a) and Fig. 6.2.3 (a) to (c). A robot attempting to travel beyond this set range of motion, will be stopped by these stoppers, by collision; and therefore the robot will remain contained within the setup range.
Stopping the robot will cause the mechanical stopper to be "transformed" (permanently damaged). Be sure to replace the deformed stopper before using the robot again.

Table 6.2.3 (a) The maximum stopping distance(position) of adjustable mechanical stopper

	Plus side	Minus side
J1-axis	+17°	-17°
J2-axis	+12°	-12°
J3-axis	+7.6°	-6.8°

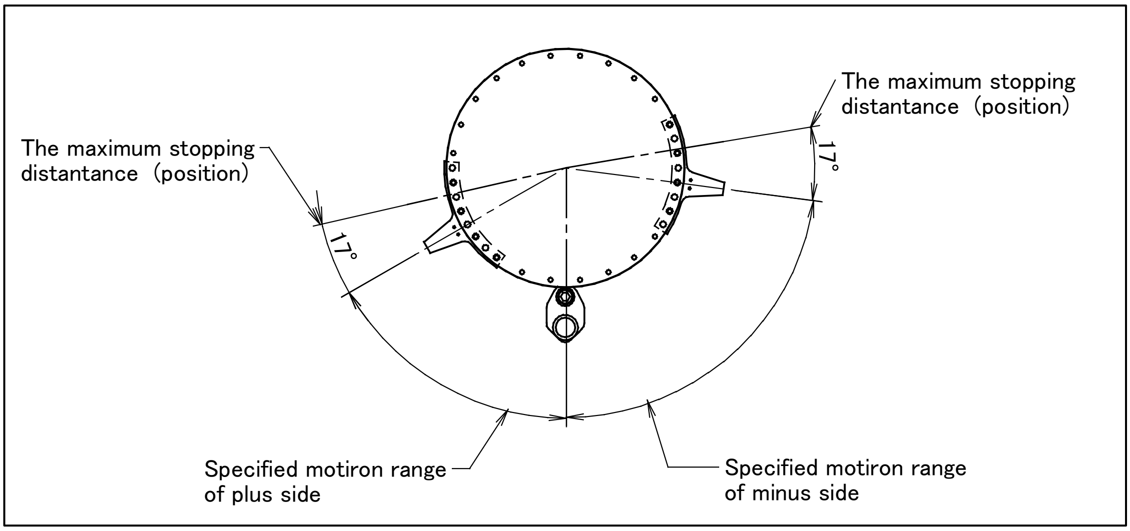


Fig. 6.2.3 (a) The maximum stopping distance of adustable mechanical stopper of J1-axis

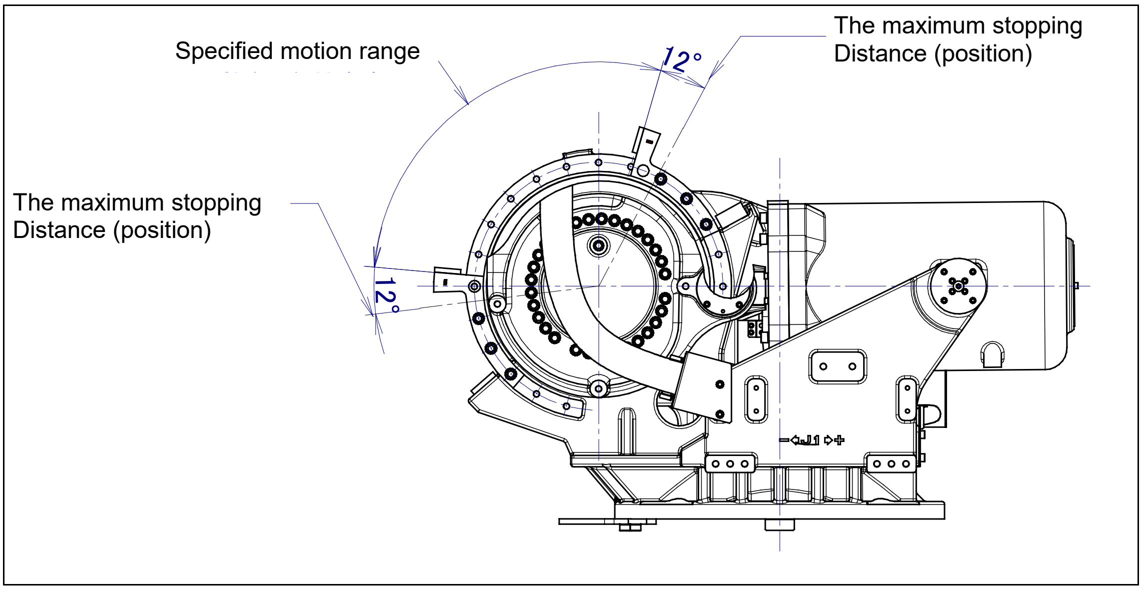


Fig. 6.2.3 (b) The maximum stopping distance of adjustable mechanical stopper of J2-axis

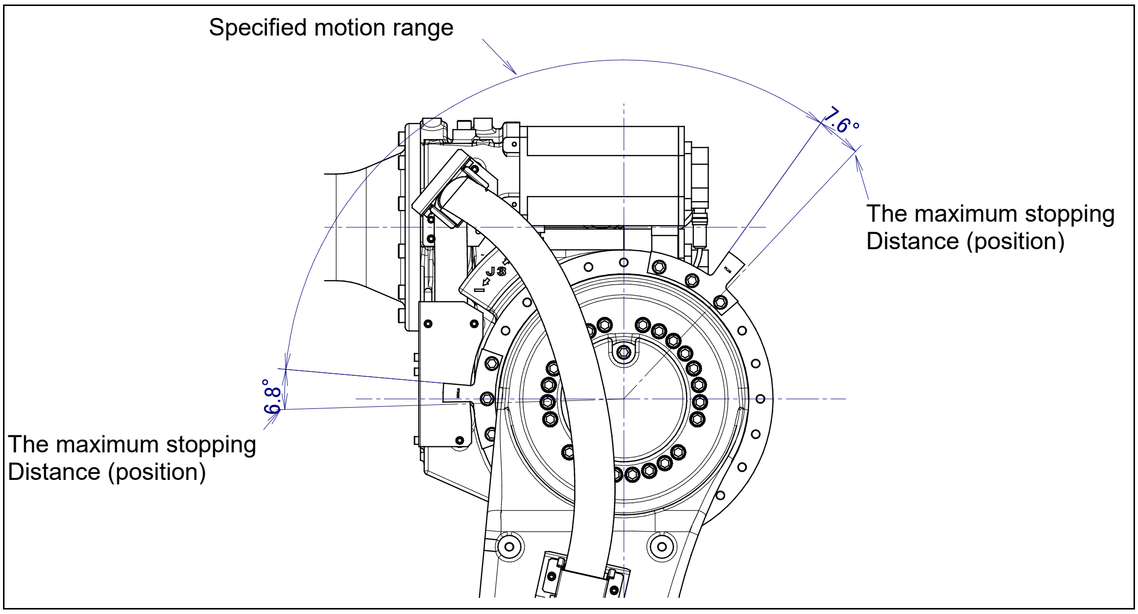
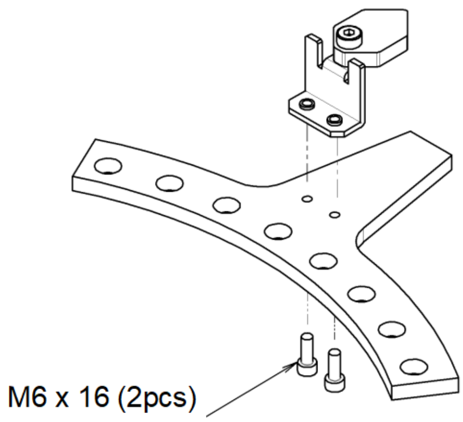


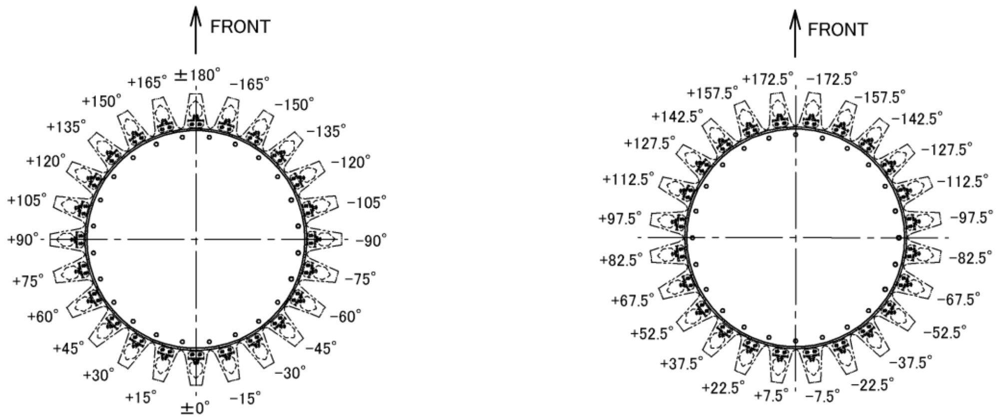
Fig. 6.2.3 (c) The maximum stopping distance of adjustable mechanical stopper of J3-axis

6.3 CHANGING THE MOTION RANGE BY THE LIMIT SWITCH (OPTION)

The limit switch is an over travel switch, which interrupts power to the servo motor and stops the robot when turned on. The limit switch is optionally provided for the J1-axis, J2-axis and J3-axis.
To change the motion range by the limit switch, move the dog. The following figure shows the relationship between the dog position and the motion range.
The dog of the J1-axis is placed in the same position as with the mechanical stopper.



The dog of the J1-axis is attached to the mechanical stopper.
In both plus and minus directions, mount the dog with the hole provided in the projection part of the mechanical stopper.

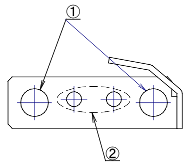


(NOTE)
This figure is drawn with the J1-axis viewed from above.
The dog of the J1-axis is placed in the same position as with the mechanical stopper.

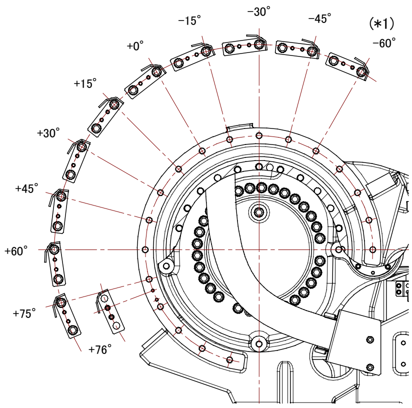
Fig. 6.3 (a) J1-axis dog position and motion range (option)

The mounting holes to be used in the minus side dog depend on the limitation angle.
Mount the dog as shown in the table below

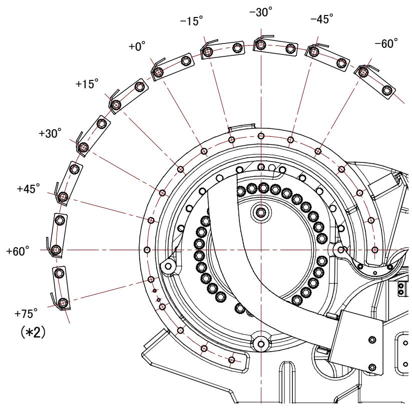
Plus side dog



Limitation angle	Dog mounting hole
−45° to +75°	Use holes ①
−76°	Use holes ②



Dog mounting position at plus side

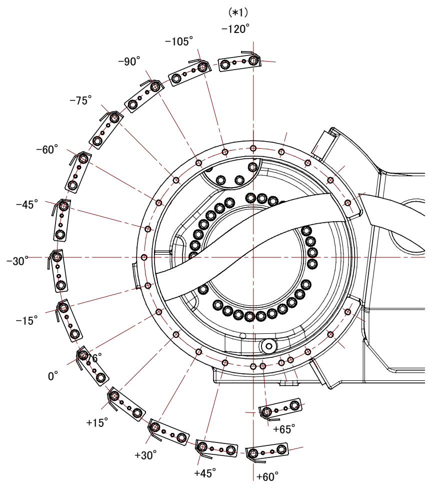


Dog mounting position at minus side

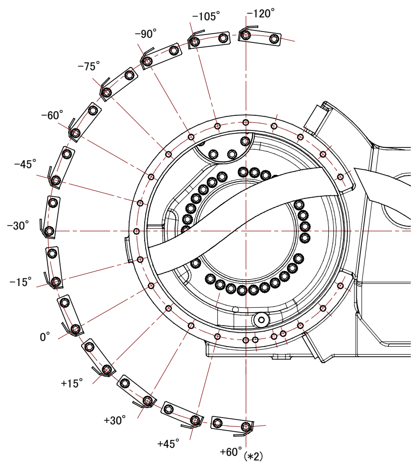
(∗1) When the plus side dog is installed to −60° , the minus side dog cannot be installed.
(∗2) When the minus side dog is installed to +75° , the plus side dog cannot be installed.

(NOTE)
J2−axis left view
A minimum space of 15° is required between the plus side dog and minus side dog

Fig. 6.3 (b) J2-axis dog position and motion range (option)
(R-2000*i*B/165F/210F/185L/250F/125L/175L/100H/150U/220U)



Dog mounting position at plus side

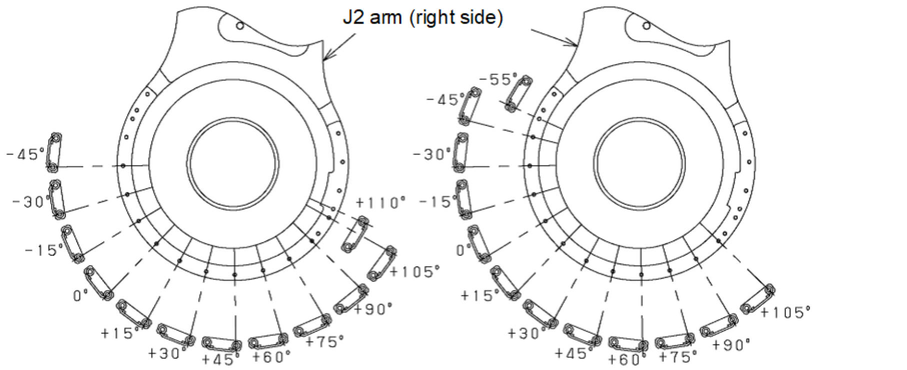


Dog mounting position at minus side

(∗1) When the plus side dog is installed to −120° , the minus side dog cannot be installed.
(∗2) When the minus side dog is installed to +60° , the plus side dog cannot be installed.

(NOTE)
J2−axis left view
A minimum space of 15° is required between the plus side dog and minus side dog

Fig. 6.3 (c) J2-axis Dog Position and Motion Range (option) (R-2000*i*B/165R/200R/100P)



Dog mounting position on plus side

Dog mounting position on minus side

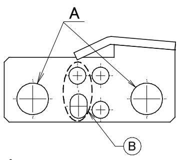
(NOTE) J2-axis right view

A space of 30° or more is required between the plus side dog and minus side dog.

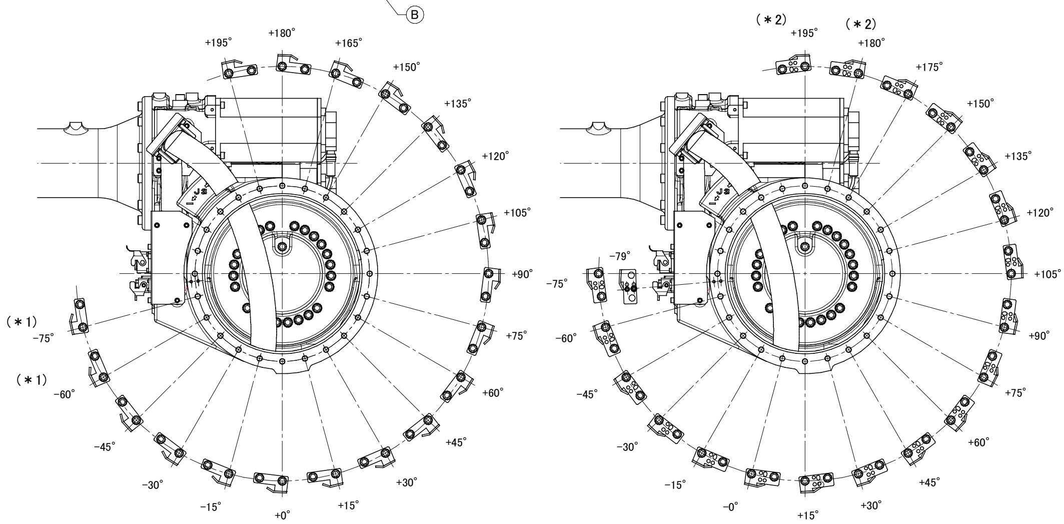
Fig. 6.3 (d) J2-axis dog position and Motion Range (option) (R-2000*i*B/165CF)

The mounting holes to be used in the minus side dog depend on the limitation angle.
Mount the dog as shown in the table below.

Minus side dog



Limitation angle	Dog mounting hole
−75° to +165°	Use holes A.
−79°	Use holes B.



Dog mounting position on plus side

Dog mounting position on minus side

(*1) When the plus side dog is installed to −75° or −60° , the minus side dog cannot be installed.
(*2) When the minus side dog is installed to +195° or +180° , the plus side dog cannot be installed.

(NOTE)
J3−axis left view
A space of 30° or more is required between the plus side dog and minus side dog.

Fig. 6.3 (e) J3-axis dog position and motion range (option)
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/125L/175L/100H/150U/220U)

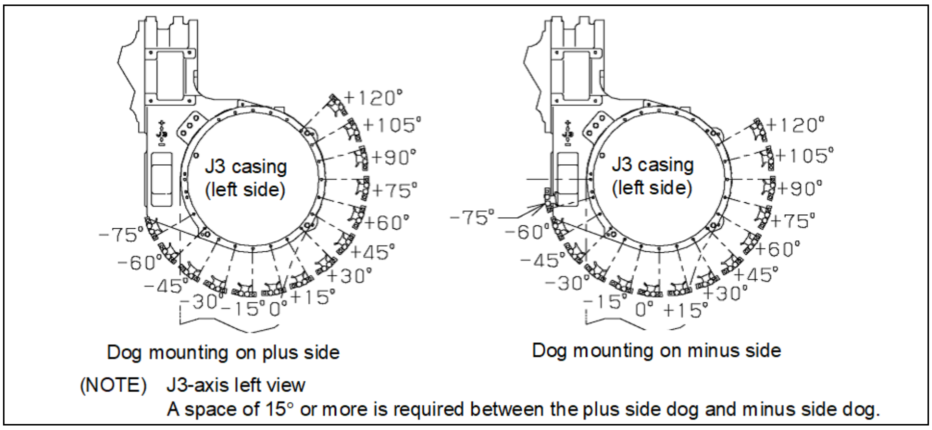


Fig. 6.3 (f) J3-axis dog position and motion range (option) (R-2000*i*B/165CF)

6.4 ADJUSTING LIMIT SWITCH (OPTION)

After the motion range is changed by the adjustable mechanical stopper and limit switch, be sure to make adjustment.

ADJUSTING PROCEDURE

1 Set the $MOR_GRP.$CAL_DONE system parameter to FALSE. This disables the stroke end specified by the software. As a result, the operator can rotate the robot by a jog feed which goes beyond the motion limit.

2 Loosen the following bolts that hold the limit switch.
J1-axis : M8 x 12 2 pcs M4 x 25 2 pcs
J2-axis : M6 x 10 2 pcs M4 x 25 2 pcs
J3-axis : M6 x 10 2 pcs M4 x 25 2 pcs

3 Move the limit switch so that the robot activates it at about 0.5° before the stroke end. Step on the dog, and position the limit switch in such a place that only one of the step-on allowance indication lines at the tip of the switch is hidden.

4 When the limit switch operates and detects overtravel (OT), the robot stops, and an error message, "OVERTRAVEL", is displayed. To restart the robot, hold on the SHIFT key and press the [RESET] key. Then, while holding on the [SHIFT] key, move the adjusting axis off the OT limit switch by jogging in joint mode.

5 Check that the robot also activates the limit switch when the robot is approx. 0.5° from the opposite stroke end in the same way as above. If the limit switch does not operate at the position, adjust the position of the switch again.

6 Set the $MOR_GRP.$CAL_DONE system parameter to TRUE.

7 Turn off the controller power, then turn it on again to restart the controller.

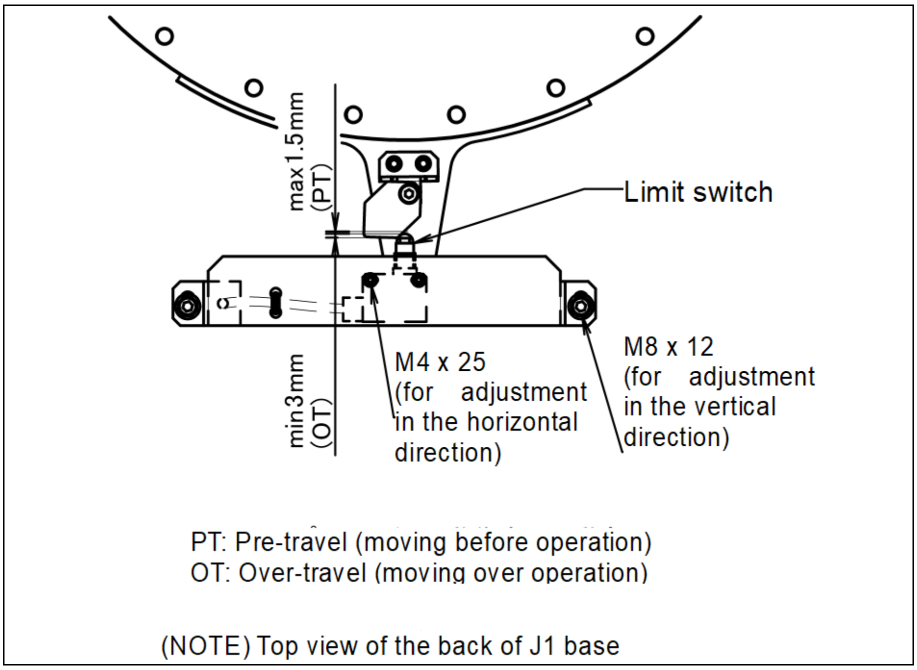


Fig. 6.4 (a) Adjusting J1-axis limit switch (option)
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/125L/175L/100H/150U/220U/210FS/220US)

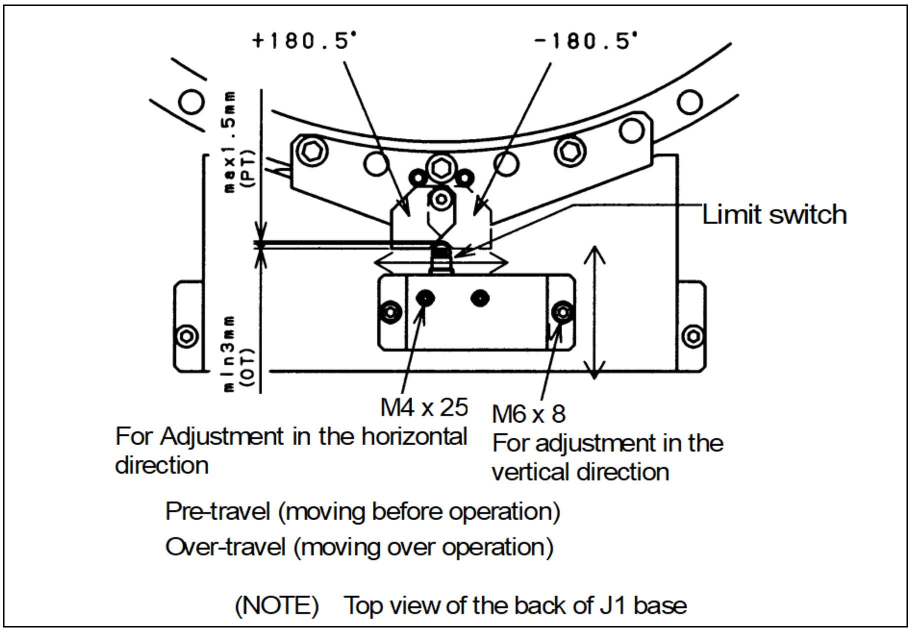


Fig. 6.4 (b) Adjusting J1-axis limit switch (option) (R-2000*i*B/165CF)

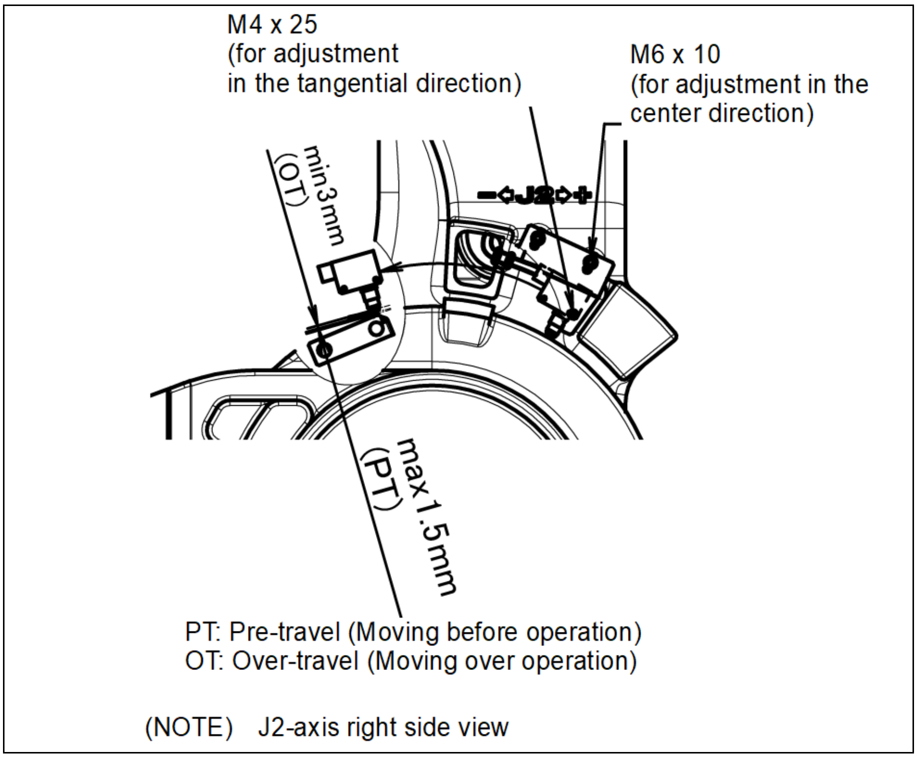


Fig. 6.4 (c) Adjusting J2-axis limit switch (option)
(R-2000*i*B/165F/210F/165R/185L/250F/200R/100P/125L/175L/100H/150U/220U)

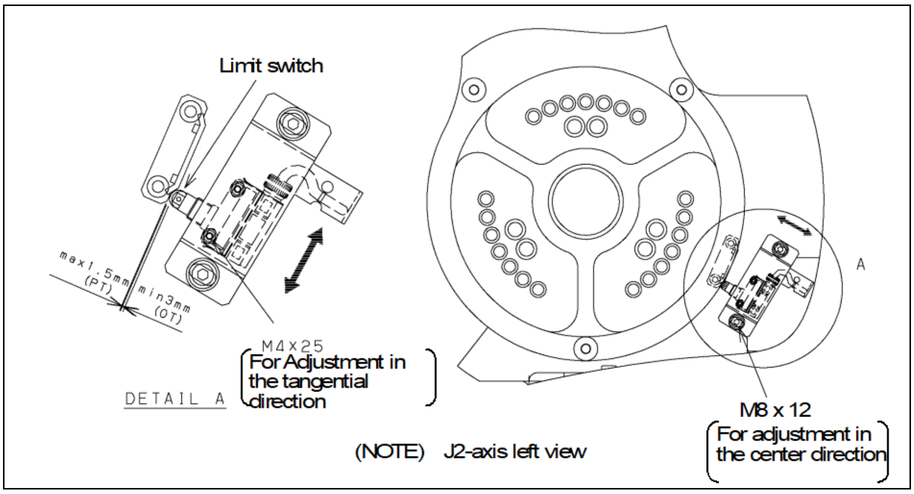


Fig. 6.4 (d) Adjusting J2-axis limit switch (option) (R-2000*i*B/165CF)

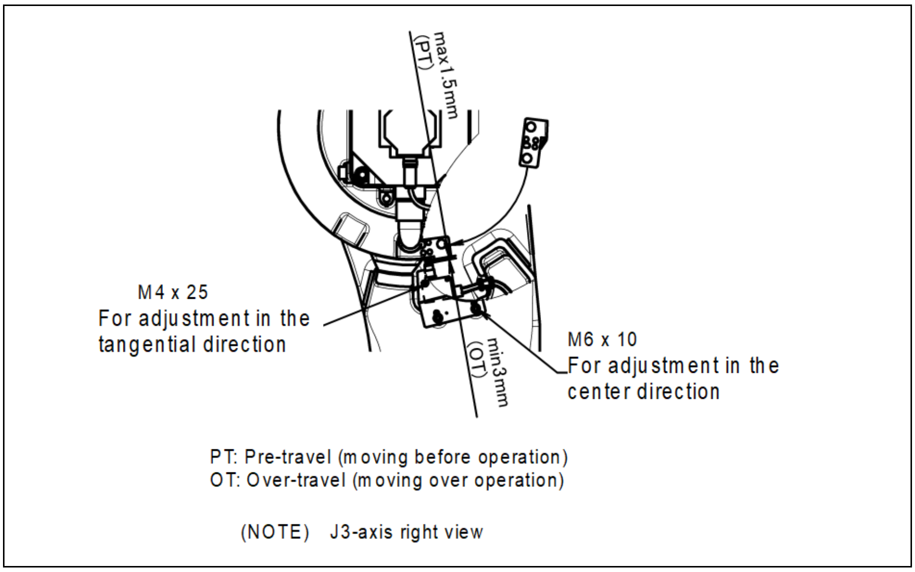


Fig. 6.4 (e) Adjusting J3-axis limit switch (option)
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/125L/175L/100H/150U/220U)

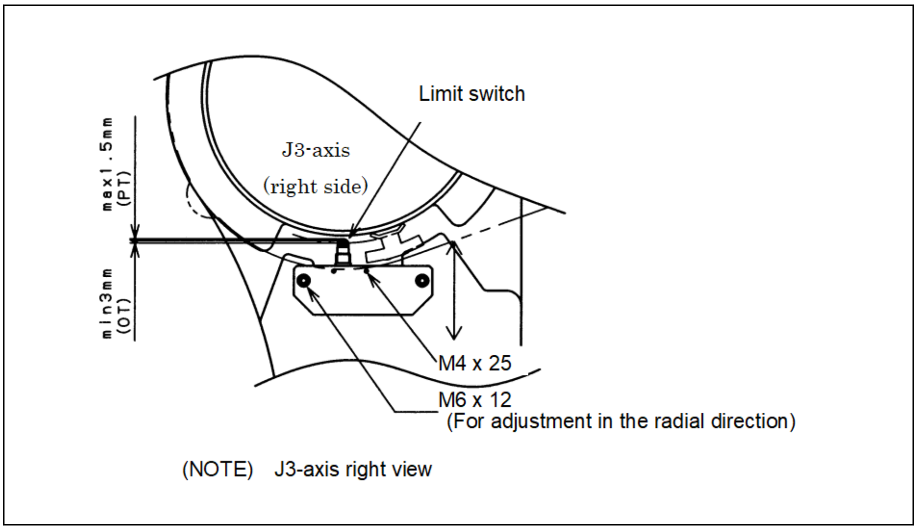


Fig. 6.4 (f) Adjusting J3-axis limit switch (option) (R-2000*i*B/165CF)

7 CHECKS AND MAINTENANCE

Optimum performance of the robot can be maintained by performing the checks and maintenance procedures presented in this chapter. (See APPENDIX A PERIODIC MAINTENANCE TABLE.)

NOTE

The periodic maintenance procedures described in this chapter assume that the FANUC robot is used for up to 3840 hours a year. In cases where robot use exceeds 3840 hours/year, adjust the given maintenance frequencies accordingly. The ratio of actual operating time/year vs. the 3840 hours/year should be used to calculate the new (higher) frequencies. For example, when using the robot 7680 hours a year with a recommended maintenance interval of 3 years or 11520 hours, use the following calculation to determine the maintenance frequency: 3 years / 2 = perform maintenance every 1.5 years.

7.1 CHECKS AND MAINTENANCE

7.1.1 Daily Checks

Clean each part, and visually check component parts for damage before daily system operation. Check the following items when necessary.

Check items	Check points and management
Oil seepage	Check to see if there is oil on the sealed part of each joint. If there is an oil seepage, clean it. **⇒"7.2.1 Confirmation of oil seepage"**
Air control set	(When air control set is used) **⇒"7.2.2 Confirmation of the Air Control Set or Air Purge Kit"**
Vibration, Abnormal noises	Check whether vibration or abnormal noises occur. When vibration or abnormal noises occur, perform measures referring to the following section: **⇒"9.1 TROUBLESHOOTING"(symptom：Vibration, Noise)**
Positioning accuracy	Check that the taught positions of the robot have not deviated from the previously taught positions. When the displacement occurs, perform the measures as described in the following section: **⇒"9.1 TROUBLESHOOTING "(symptom：Displacement)**
Peripheral equipment for proper operation	Check whether the peripheral equipment operates properly according to commands from the robot and the peripheral equipment.
Brakes for each axis	Check that the end effector drops 0.2 mm or less when servo power is turned off. If the end effector (hand) drops, perform the measures as described in the following section: **⇒"9.1 TROUBLESHOOTING "(symptom：Dropping axis)**
Warnings	Check whether unexpected warnings occur in the alarm screen on the teach pendant. If unexpected warnings occur, perform the measures as described in the following manual: **⇒"R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus CONTROLLER OPERATOR'S MANUAL (Alarm Code List)(B-83284EN-1) or R-30*i*A/R-30*i*A Mate CONTROLLER OPERATOR'S MANUAL (Alarm Code List)(B-83124EN-6)"**

7.1.2 Periodic Check and Maintenance

Check the following items at the intervals recommended below based on the period or the accumulated operating time, whichever comes first.

Check and maintenance intervals (Period, Accumulated operating time)							Check and maintenance item	Check points, management and maintenance method	Periodic maintenance table No.
1 month 320h	3 months 960h	1 year 3840h	1.5 years 5760h	2 years 7680h	3 years 11520h	4 years 15360h			
○ Only 1st check	○						Cleaning the controller ventilation system	Confirm that the controller ventilation system is not dusty. If dust has accumulated, remove it.	26
	○						Check for external damage or peeling paint	Check whether the robot has external damage or peeling paint due to contact with the peripheral equipment. If unintended contact has occurred, eliminate the cause. Also, if the external damage is serious, and causes a problem in which the robot will not operate, replace the damaged parts.	1
	○						Check damages of the cable protective sleeves	Check whether the cable protective sleeves of the mechanical unit cable have holes or tears. If damage is found, replace the cable protective sleeve. If the cable protective sleeve is damaged due to the interference with peripheral devices, eliminate the cause. ⇒**“7.2.3 Check the Mechanical Unit Cables and Connectors”**	2
	○						Check wear debris of the balancer and J1-axis swing stopper	Check whether wear debris is generated on the following parts. ・ Balancer rod, support part of in front and behind of the balancer ・ J1-axis swing stopper rotation part If serious wear occurs on the part that generated the wear debris, replace the part.	3
	○						Check for water (Except 210WE)	Check whether the robot is subjected to water or cutting oils. If water is found, remove the cause and wipe off the liquid.	4
	○ Only 1st check	○					Check for damages to the teach pendant cable, the operation box connection cable or the robot connection cable	Check whether the cables connected to the teach pendant, operation box and robot are unevenly twisted or damaged. If damage is found, replace the damaged cables.	27

Check and maintenance intervals (Period, Accumulated operating time)							Check and maintenance item	Check points, management and maintenance method	Periodic maintenance table No.
1 month 320h	3 months 960h	1 year 3840h	1.5 years 5760h	2 years 7680h	3 years 11520h	4 years 15360h			
	○ Only 1st check	○					Check for damage to the mechanical unit cable (movable part)	Observe the movable part of the mechanical unit cable, and check for damage. Also, check whether the cables are excessively bent or unevenly twisted. ⇒**"7.2.3 Check the Mechanical Unit Cables and Connectors"**	5
	○ Only 1st Check	○					Check for damage to the end effector (hand) connection cable	Check whether the end effector connection cables are unevenly twisted or damaged. If damage is found, replace the damaged cables.	6
	○ Only 1st check	○					Check the connection of each axis motor and other exposed connectors	Check the connection of each axis motor and other exposed connectors. ⇒**"7.2.3 Check the Mechanical Unit Cables and Connectors"**	7
	○ Only 1st check	○					Retightening the end effector mounting bolts	Retighten the end effector mounting bolts. Refer to the following section for tightening torque information: ⇒**"4.1 END EFFECTOR INSTALLATION TO WRIST"**	8
	○ Only 1st check	○					Retightening the external main bolts	Retighten the bolts which are installed, removed in the inspection, and exposed. Refer to the recommended bolt tightening torque guidelines at the end of the manual. Some bolts are attached with adhesive. If the bolts are tightened with torque greater than the recommended one, the adhesive might be removed. Therefore, follow the recommended bolt tightening torque guidelines when retightening the bolts.	9
	○ Only 1st check	○					Check the mechanical stopper and the adjustable mechanical stopper	Check that there is no evidence of a collision on the mechanical stopper, the adjustable mechanical stopper, and check the looseness of the stopper mounting bolts. Check that the J1-axis swing stopper rotates smoothly. ⇒**"7.2.4 Check of Fixed Mechanical Stopper and Adjustable Mechanical Stopper"**	10
	○ Only 1st check	○					Clean spatters, sawdust and dust	Check that spatters, sawdust, or dust does not exist on the robot main body. If dust has accumulated, remove it. Especially, clean the robot movable parts well (each joint, the balancer rod. the support part of in front and behind of the balancer, and the cable protective sleeves).	11

Check and maintenance intervals (Period, Accumulated operating time)							Check and maintenance item	Check points, management and maintenance method	Periodic maintenance table No.
1 month 320h	3 months 960h	1 year 3840h	1.5 years 5760h	2 years 7680h	3 years 11520h	4 years 15360h			
	○ Only 1st check	○					Check the operation of the cooling fan	(When cooling fans are installed on the each axis motor) Check whether the cooling fans are operating correctly. If the cooling fans do not operate, replace them.	12
		○					Greasing to the balancer bush	Supply grease to the balancer bush. For the 170CF/165CF/150U/220U/220US, no balancer is provided. **⇒"7.3.1 Greasing the Balancer Bush"**	13
			○				Replacing the mechanical unit batteries	Replace the mechanical unit batteries. Regardless of operating time, replace batteries at 1.5 years. **⇒"7.3.2 Replacing the Batteries"**	14
		○ (*)			○ (*)		Replacing the grease of each axis reducer	Replace the grease of each axis reducer (*) Periodic interval differs according to the model. Except 210WE : 3 years (11520 hours) 210WE : 1 year (3840 hours) **⇒"7.3.3 Replacing the Grease of the Drive Mechanism"**	15 to 21
	○ Only 1st check	○					Check the purge piping (210WE)	Confirm there is no breakage on purge piping. **⇒"7.2.5 Confirm There is No Breakage on Purge Piping"**	22
						○	Replacing the major axis solution arm cable (210FS/220US)	Replace the major axis solution arm cable Contact your local FANUC representative for information regarding replacing the cable.	23
				○			Replacing wrist integrated cable (210FS/220US)	Replace the wrist integrated cable. Contact your local FANUC representative for information regarding replacing the cable.	24
						○	Replacing the mechanical unit cable	Replace the mechanical unit cable. Contact your local FANUC representative for information regarding replacing the cable.	25
						○	Replacing the controller batteries	Replace the controller batteries. Regardless of operating time, replace batteries at 4 years. **⇒"Chapter 7 Replacing batteries of R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL(B-83195EN) or R-30*i*A CONTROLLER MAINTENANCE MANUAL (B-82595EN) or R-30*i*A CONTROLLER MAINTENANCE MANUAL(For Europe) (B-82595EN-1) or R-30*i*A CONTROLLER MAINTENANCE MANUAL(For RIA) (B-82595EN-2)"**	28

7.2 CHECK POINTS

7.2.1 Confirmation of Oil Seepage

Check items

Check to see whether there is an oil seepage on the rotating parts of each joint axis.

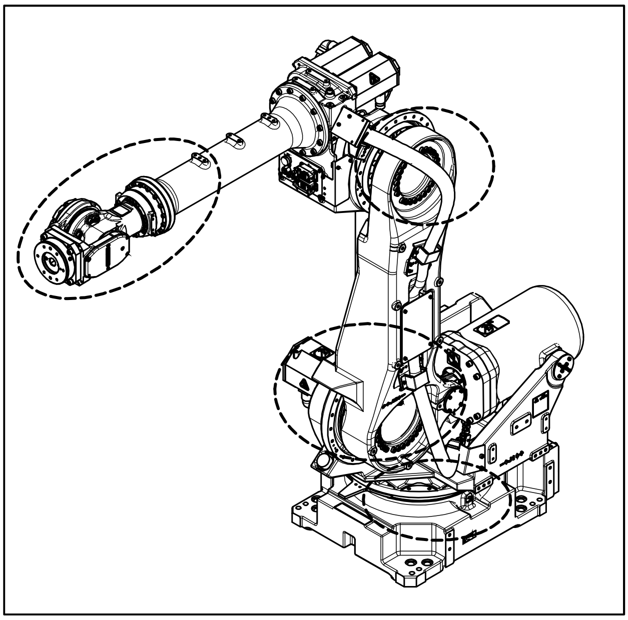


Fig. 7.2.1 (a) Check points of oil seepage

Management

- Oil might accumulate on the outside of the seal lip depending on the movement condition or environment of the axis. If the oil changes to a state of liquid, the oil might fall depending on the axis movement. To prevent oil spots, be sure to wipe away any accumulated oil under the axis components before you operate the robot.
- Also, drive mechanisms might become hot and the internal pressure of the grease bath might rise by frequent repetitive movement and use in high temperature environments. In these cases, normal internal pressure can be achieved by venting the grease outlet. (When opening the grease outlet, refer to Subsection 7.3.3 and ensure that grease is not expelled onto the machine or tooling.)

> ⚠ **WARNING**
> Hot grease might eject suddenly when you open the grease outlet. Attach bags for collecting grease, and use appropriate protective equipment such as heat-resistant gloves, protective glasses, a face shield, or a body suit if necessary.

- If you must wipe oil frequently, and opening the grease outlet does not stop the seepage perform the measures below.

  ⇒"9.1 TROUBLESHOOTING "(Symptom：Grease leakage)

7.2.2 Confirmation of the Air Control Set or Air Purge Kit

When an air control set or air purge kit is used, check the items below.

Item	Check items		Check points
1	In case of air control set	Air pressure	Check air pressure using the pressure gauge on the air control set as shown in Fig. 7.2.2 (a). If it does not meet the specified pressure of 0.49 to 0.69 MPa (5-7 kgf/cm^2), adjust it using the regulator pressure-setting handle.
2		Lubricator oil mist quantity	Check the number of oil drops during operation. If it does not meet the specified value (1 drop/10-20 sec), adjust it using the handle for lubricator adjustment. The lubricator becomes empty in about 10 to 20 days under normal operation.
3		Lubricator oil level	Check to see that the lubricator level is within the specified level.
4		Leakage from hose	Check the joints, tubes, etc. for leaks. Retighten the joints or replace parts, as required.
5		Drain	Check the drain and empty it. When the quantity of liquid in the drain is excessive, examine the setting of the air dryer on the air supply side.
6	In case of air purge kit	Supply pressure	Check the supply pressure using the air purge kit shown in Fig. 7.2.2 (b). If it does not meet the specified pressure of 20 KPa (0.2kgf/cm^2), adjust it using the regulator pressure setting handle.
7		Dryer	Check whether the color of the dew point checker is blue. When it is not blue, identify the cause and replace the dryer. Maintenance for air purge kit, refer to the operator's manual attached kit.
8		Drain	Check the drain and empty it. When the quantity of liquid in the drain is excessive, examine the setting of the air dryer on the air supply side.

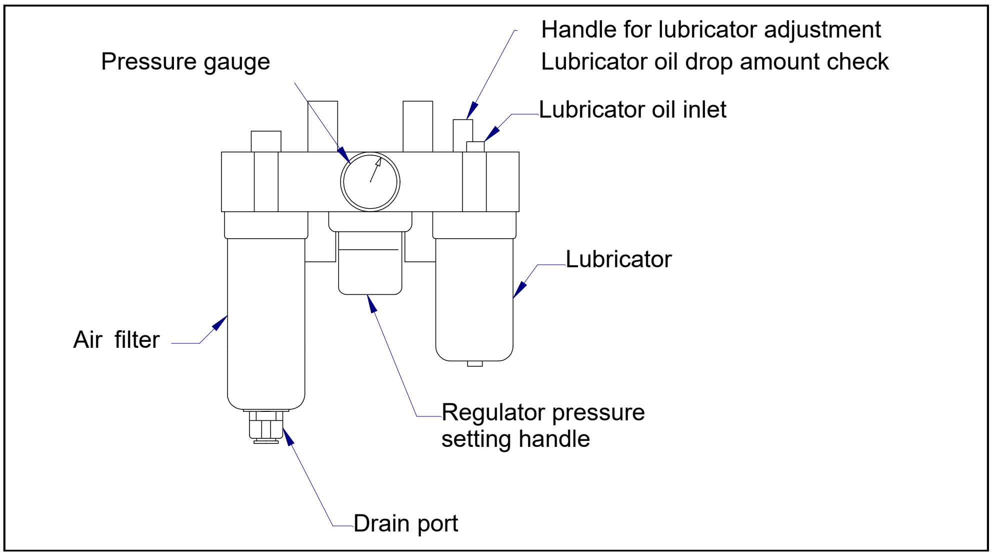


Fig. 7.2.2 (a) Air control set (option)

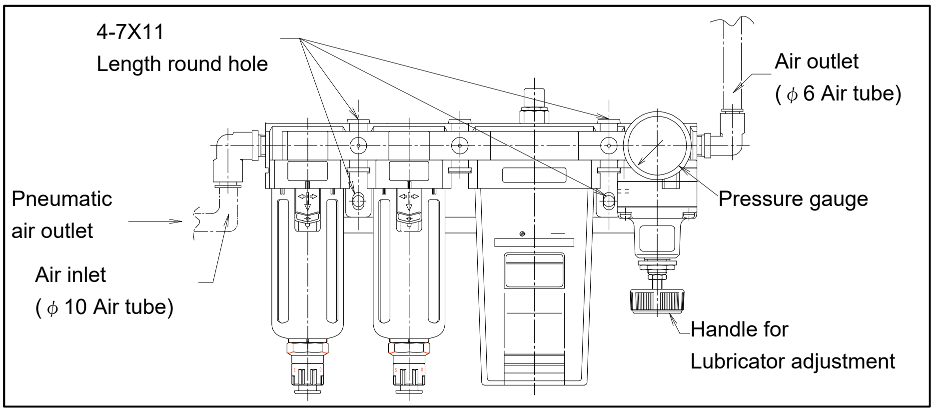


Fig. 7.2.2 (b) Air purge kit (option)

7.2.3 Check the Mechanical Unit Cables and Connectors

Check points of the mechanical unit cables

Fixed part cables can interfere with the J1, J2, and J3 movable parts and peripheral equipment

* For the J1-axis, inspect the cables from above the J2 base and from the side by removing the metal plate on the side of the J1 base.

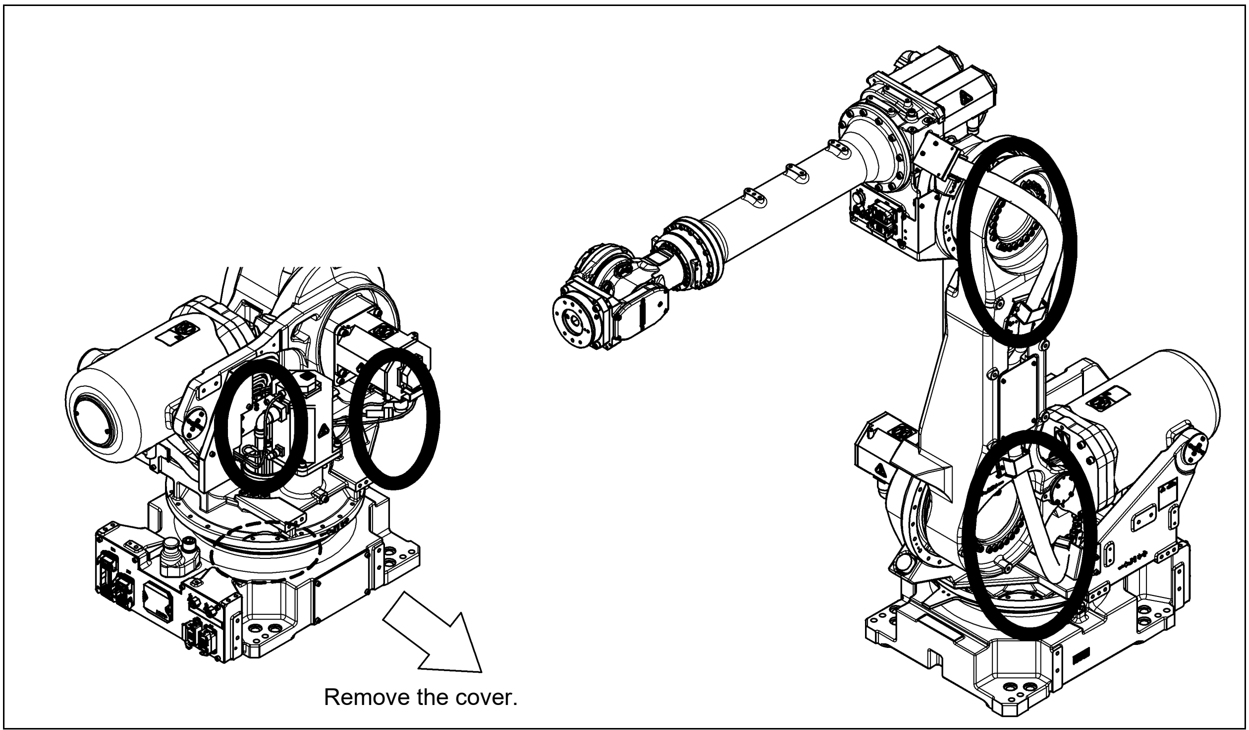


Fig. 7.2.3 (a) Check points of the mechanical unit cables

Check items

＜Cable protective sleeve＞

- Check that no holes or tears exist on the cable protective sleeves.
- If there is damage as shown in Fig.7.2.3 (b), replace the cable protective sleeves.

Fig. 7.2.3 (b) Damage on the cable protective sleeve

＜Cables＞

- Check that there is no wear or damage on the cable jacket.
- If the inside wire strands are exposed due to wear or damage, replace the cables.

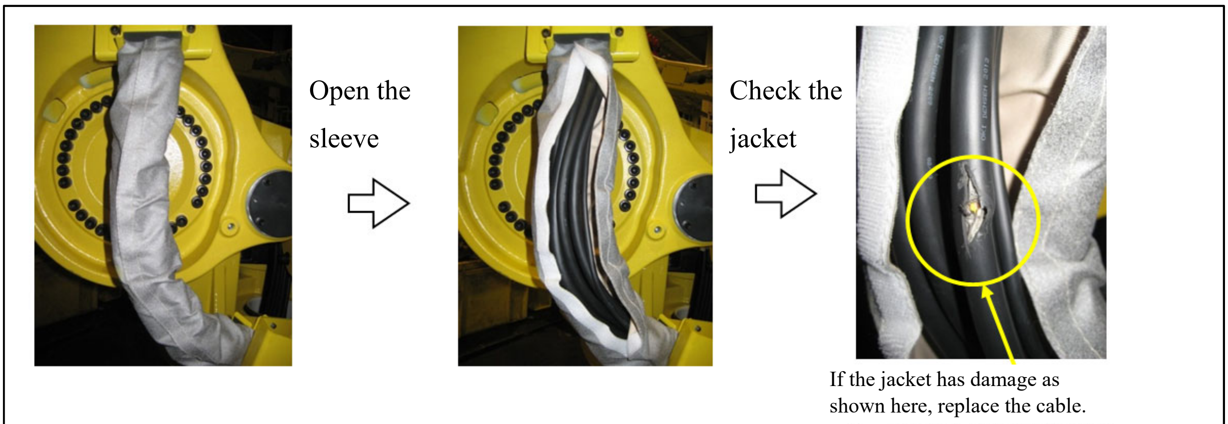


Fig. 7.2.3 (c) Cable check method

Inspection points of the connectors

- Power/brake connectors of the motor exposed externally
- Robot connection cables, earth terminal and user cables

Check items

- Circular connector: Check the connector for tightness by turning it manually.
- Square connector: Check the connector for engagement of its lever.
- Earth terminal: Check the terminal for tightness.

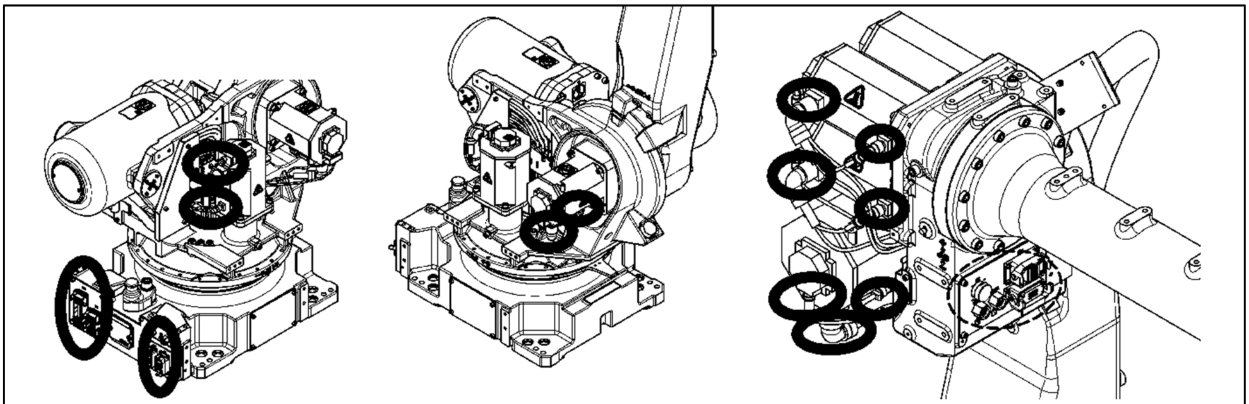


Fig. 7.2.3 (d) Connector Inspection points

7.2.4 Check of Fixed Mechanical Stopper and Adjustable Mechanical Stopper

- Check that there is no evidence of a collision on the mechanical stopper and the adjustable mechanical stopper. If there is evidence of a collision on the stopper, replace the parts.
- Check the tightness of the stopper mounting bolts. If they are loose, retighten them.
  Be sure to check the tightness of the mounting bolts of the J1-axis swing stopper.
- Check that the J1-axis swing stopper rotates smoothly.
- Refer to Section 6.2 of the operator's manual for details regarding the adjustable mechanical stopper.

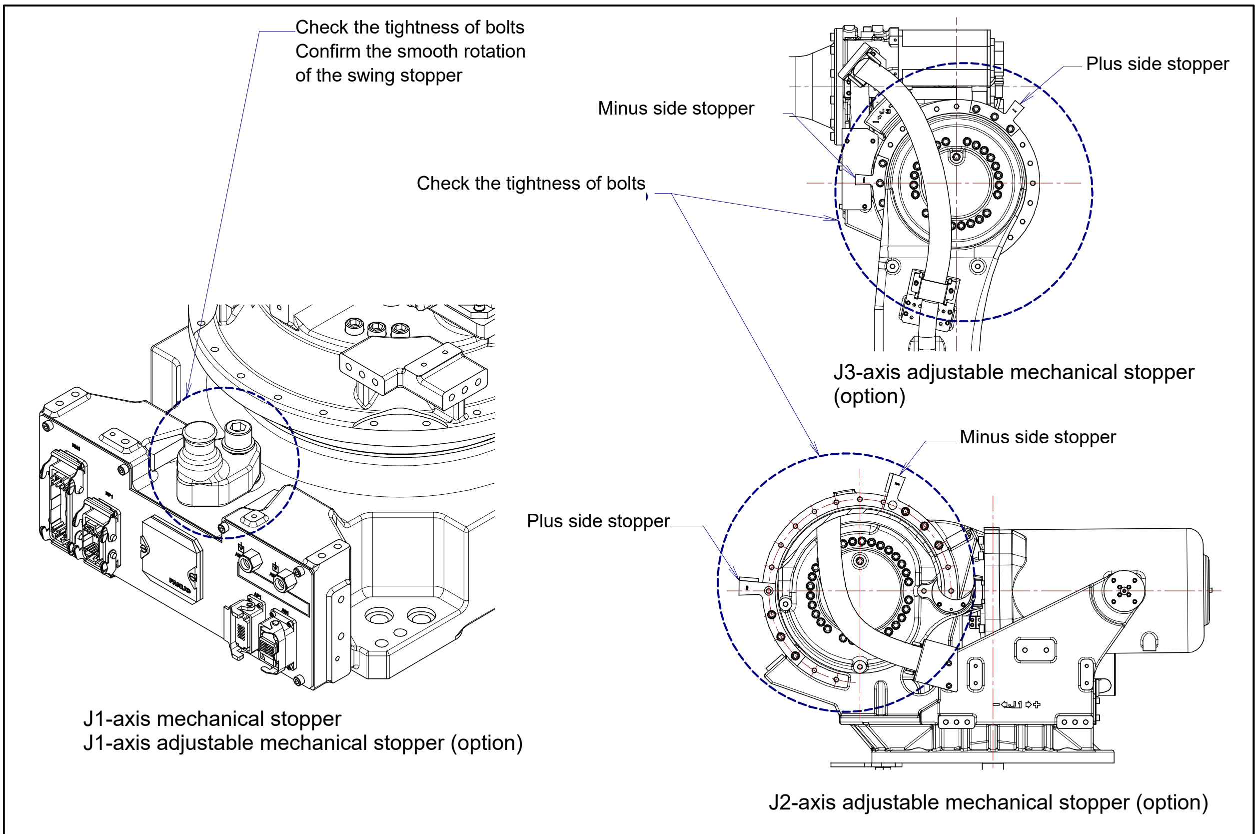


Fig. 7.2.4 (a) Check of fixed mechanical stopper and adjustable mechanical stopper

7.2.5 Confirm the Purge Piping (For R-2000*i*B/210WE)

Confirm there is no breakage on purge piping.

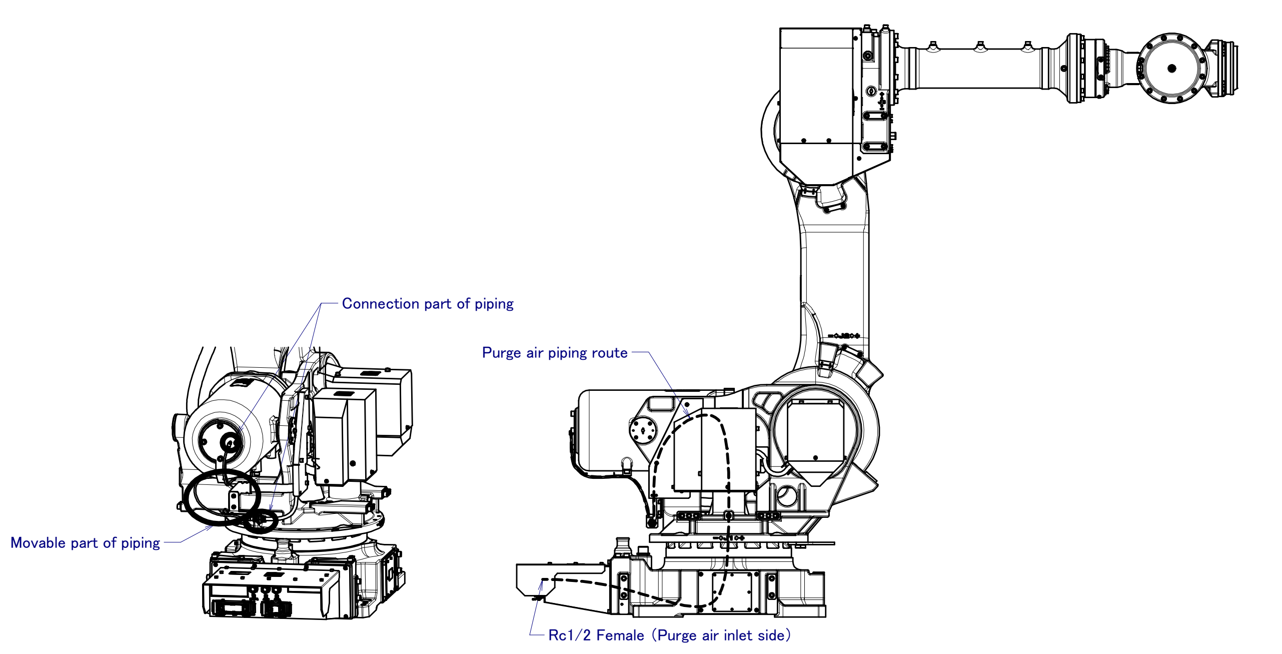


Fig. 7.2.5 (a) Confirming the purge piping (R-2000*i*B/210WE) (A05B-1329-B255)

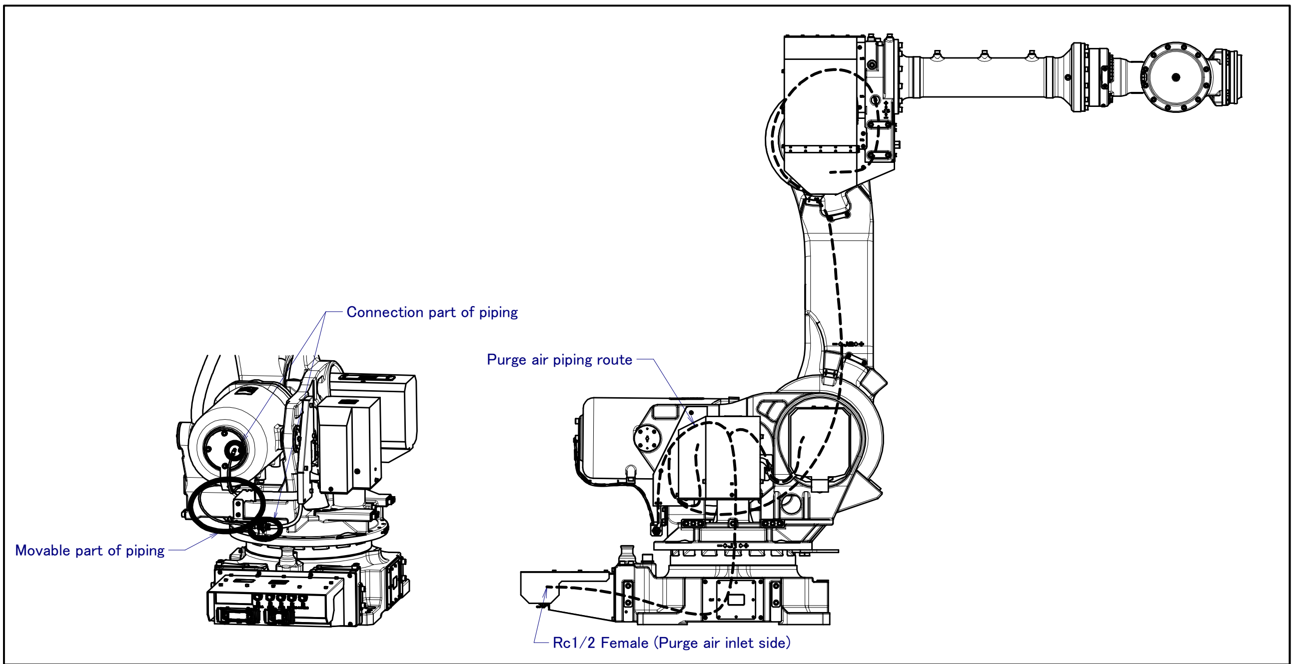


Fig. 7.2.5 (b) Confirming the purge piping (R-2000*i*B/210WE) (A05B-1329-B256)

7.3 MAINTENANCE

7.3.1 Greasing the Balancer Bush (1 year (3840 hours) Periodic Maintenance)

The installation environment of the robot is bad, however, greasing needs to be made as appropriate. If water splashes on the robot, supply grease immediately. Fig. 7.3.1 (a) shows the greasing points of the balancer bush. Be sure to grease the balancer bush at specified intervals as shown in Tables 7.3.1 (a) and 7.3.1 (b).

Table 7.3.1 (a) Greasing the balancer bush

Recommended grease	Amount of grease	Greasing interval
Shell Lubricants Shell Alvania grease S2 Specification: A98L-0004-0602#CTG	10 ml for each (two points)	1 year or every 3840 hours of accumulated operating time

Table 7.3.1 (b) Grease alternative to Alvania GREASE S2

Maker	Grease name
Exxon Mobil	Mobilux EP2
ENEOS	Multinoc 2
ENEOS	Epinoc grease AP(N)2
Idemitsu Kosan Co., Ltd.	Eponex grease No. 2
Cosmo Oil Co., Ltd.	Dynamax No. 2
Shell Lubricant	Shell Gadus S2 V100 2

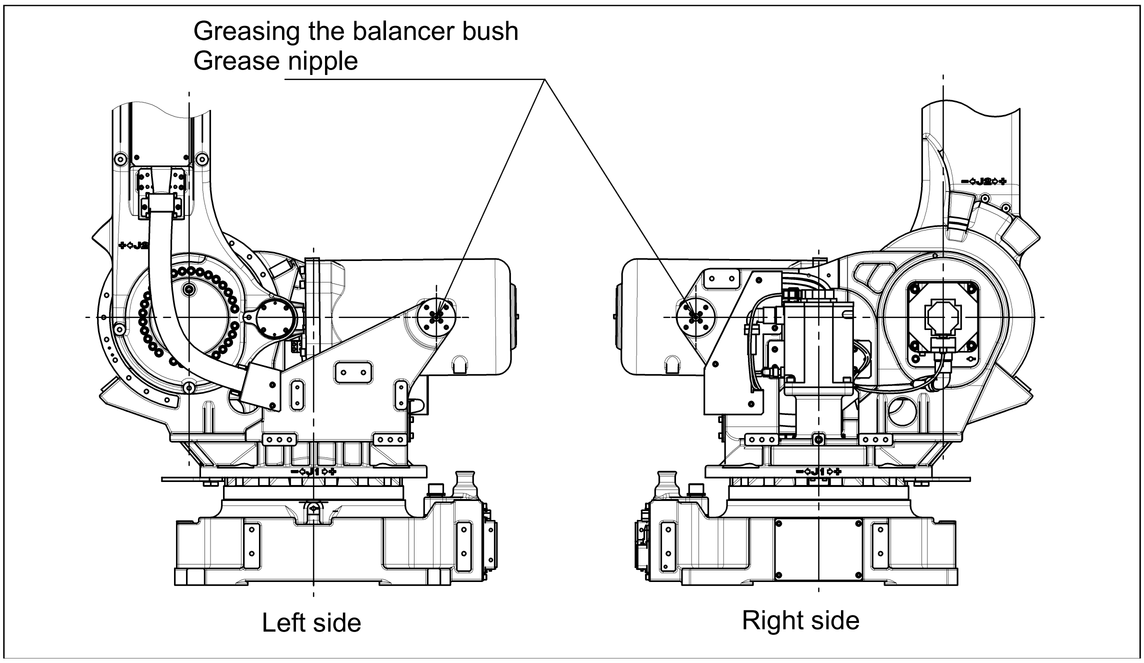


Fig. 7.3.1 (a) Balancer bush greasing points
(R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/210FS)

NOTE
For the R-2000*i*B/170CF/150U/220U/220US/165CF, no balancer is provided.

7.3.2 Replacing the Batteries (1.5 Year Periodic Maintenance)

The position data of each axis is preserved by the backup batteries. The batteries need to be replaced every 1.5 year. Also use the following procedure to replace when the backup battery voltage drop alarm occurs.

Procedure of replacing the battery

1 Keep the power on. Press the EMERGENCY STOP button to stop the robot motion.

> ⚠ **CAUTION**
> Be sure to keep the power supply turning on. Replacing the batteries with the power supply turned off causes all current position data to be lost. Therefore, mastering will be required again.

2 Remove the battery case cap. (Fig. 7.3.2 (a), (b) and (d))
3 Take out the old batteries from the battery case.
4 Insert new batteries into the battery case while observing their correct orientation.
5 Close the battery case cap.

> ⚠ **CAUTION**
> 1 When using a robot with the severe dust/liquid protection option, remove the cover from the battery case as shown in Fig.7.3.2 (c) to replace the battery. After replacing the battery, reinstall the cover. At this time, please be sure to replace gasket with new one for severe dust/liquid protection.
> 2 In case of 210WE, remove J1 base side cover and replace the battery referring to Fig.7.3.2 (d). After replacing the battery, reinstall the cover. In this time, replace gasket by new one for sealing up characteristics of battery store space.

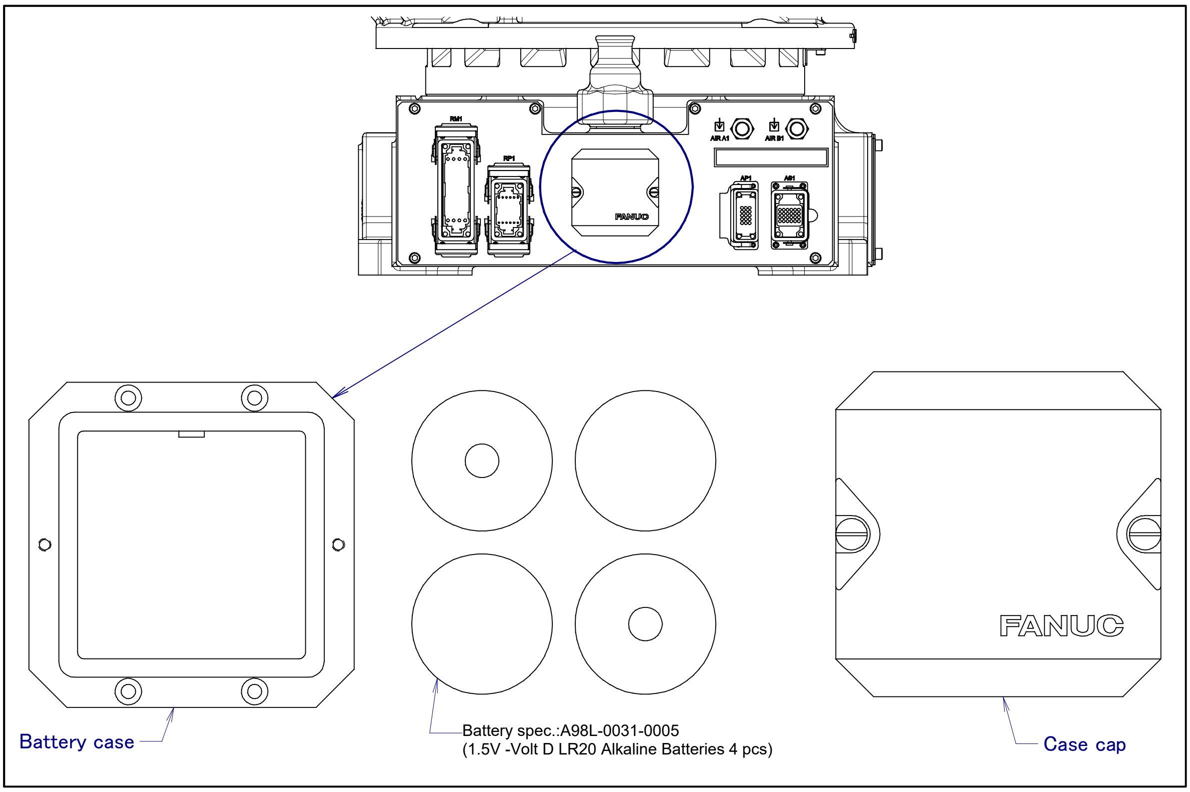


Fig. 7.3.2 (a) Replacing the battery (R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/100H/150U/220U/210FS/220US)

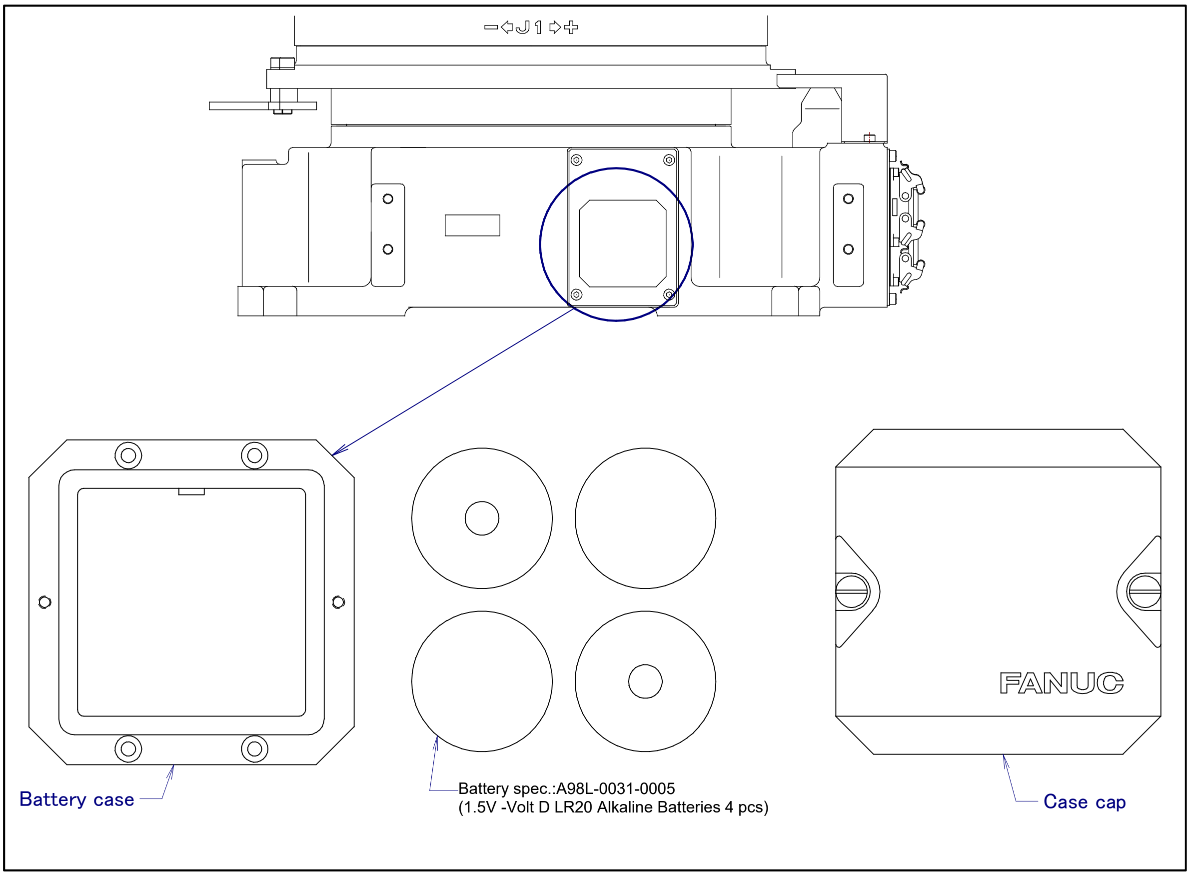


Fig. 7.3.2 (b) Replacing the battery (R-2000*i*B/165CF)

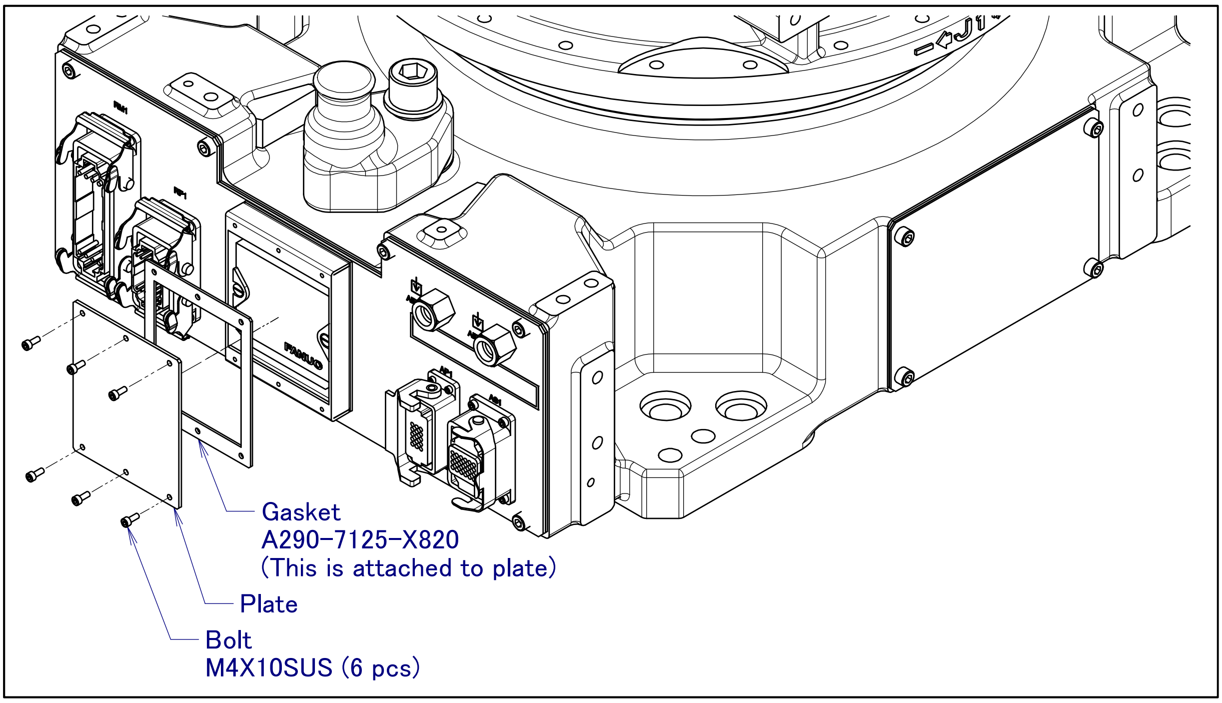


Fig. 7.3.2 (c) Removing the battery cover plate (When severe dust/liquid protection is specified.) (R-2000*i*B/165F/210F/185L/250F/165R/200R/170CF/125L/175L/150U)

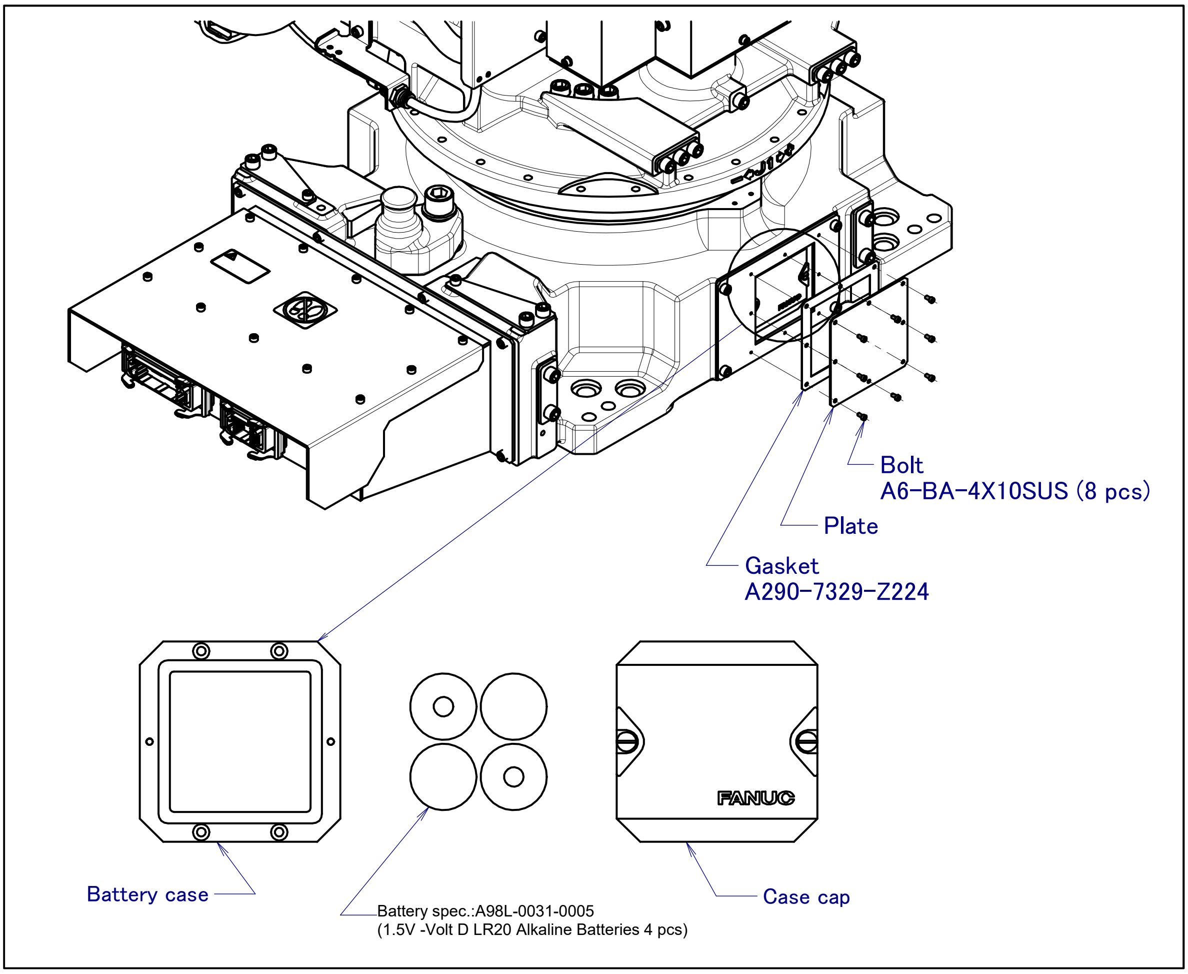


Fig. 7.3.2 (d) Replacing the battery (R-2000*i*B/210WE)

7.3.3 Replacing the Grease of the Drive Mechanism (3 years (11520 hours) Periodic Maintenance or 1 year (3840 hours) Periodic Maintenance)

According to below, replace the grease of the reducers of J1, J2, and J3 axes, the J4-axis gearbox, and the wrist at the intervals based on every 3 years or 11520 hours (every 1 year or 3840 hours for 210WE), whichever comes first. See table 7.3.3 (a), (b) for the grease name and the quantity.

Table 7.3.3 (a) Grease for 3-years (11520 hours) periodical replacement

Models	Grease supplying position	Quantity	Gun tip pressure	Grease name
R-2000*i*B/165F R-2000*i*B/165R R-2000*i*B/125L R-2000*i*B/150U	J1-axis reducer	4900g (5500ml)	0.15MPa or less (NOTE)	Spec : A98L-0040-0174
	J2-axis reducer	3100g (3500ml)		
	J3-axis reducer	2200g (2500ml)		
	J4-axis gearbox	1700g (1900ml)		
	wrist 1	2100g (2400ml)		
	wrist 2	700g (800ml)		
R-2000*i*B/210F R-2000*i*B/185L R-2000*i*B/250F R-2000*i*B/200R R-2000*i*B/175L R-2000*i*B/220U	J1-axis reducer	4900g (5500ml)		
	J2-axis reducer	3100g (3500ml)		
	J3-axis reducer	2350g (2640ml)		
	J4-axis gearbox	1700g (1900ml)		
	wrist 1	3400g (3800ml)		
	wrist 2	1000g (1100ml)		
R-2000*i*B/100P	J1-axis reducer	4900g (5500ml)		
	J2-axis reducer	3100g (3500ml)		
	J3-axis reducer	2200g (2500ml)		
	J4-axis gearbox	1700g (1900ml)		
	wrist 1	3400g (3800ml)		
	wrist 2	1000g (1100ml)		
R-2000*i*B/170CF	J1-axis reducer	4700g (5300ml)		
	J2-axis reducer	2400g (2700ml)		
	J3-axis reducer	2400g (2700ml)		
	J3-axis gearbox	300g (340ml)		
	J4-axis gearbox	1900g (2100ml)		
	wrist 1	2100g (2400ml)		
	wrist 2	700g (800ml)		
R-2000*i*B/100H	J1-axis reducer	4900g (5500ml)		
	J2-axis reducer	3100g (3500ml)		
	J3-axis reducer	2200g (2500ml)		
	J4-axis gearbox	1700g (1900ml)		
	wrist 1	1400g (1600ml)		
	wrist 2	700g (800ml)		
R-2000*i*B/210FS R-2000*i*B/220US	J1-axis reducer	4900g (5500ml)		
	J2-axis reducer	3100g (3500ml)		
	J3-axis reducer	2350g (2640ml)		
	J4-axis gearbox	1700g (1890ml)		
	wrist 1	2500g (2780ml)		
	wrist 2	500g (560ml)		
R-2000*i*B/165CF	J1-axis gearbox	3600g (4100ml)		
	J2-axis gearbox	2300g (2600ml)		
	J3-axis gearbox	1400g (1600ml)		
	J4-axis gearbox wrist 1	3400g (3950ml)		
	wrist 2	350g (400ml)		

Table 7.3.3 (b) Grease for 1-year (3840 hours) periodical replacement

Models	Greasing	Quantity	Gun tip pressure	Grease name
R-2000*i*B/210WE	J1-axis reducer	4900g (5500ml)	0.15MPa or less (NOTE)	Spec : A98L-0040-0174
	J2-axis reducer	3100g (3500ml)		
	J3-axis reducer	2350g (2640ml)		
	J4-axis gearbox	1700g (1900ml)		
	wrist 1	3400g (3800ml)		
	wrist 2	1000g (1100ml)		

NOTE

When a manual pump is used for greasing, the standard rate is two pumping cycles per three seconds.
In case of 150U/220U/220US upside-down mount J1-J3-axis reducer, the standard rate is one pumping cycles per two seconds.

⚠ WARNING

Hot grease might eject suddenly when you open the grease outlet. Attach bags for collecting grease, and use appropriate protective equipment such as heat-resistant gloves, protective glasses, a face shield, or a body suit if necessary.

For grease replacement or replenishment, use the posture indicated below.

Table 7.3.3 (c) Postures for greasing (floor mount)
(R-2000*i*B/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U/210FS/220US/165CF)

Supply position	Posture					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary
J2-axis reducer		0°				
J3-axis reducer		0°	0°			
J4-axis gearbox		Arbitrary	0°			
Wrist			0°	0°	0°	0°

Table 7.3.3 (d) Postures for greasing (upside-down mount) (R-2000*i*B/150U/220U/220US)

Supply position	Posture					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary
J2-axis reducer		0°				
J3-axis reducer		0°	-35°			
J4-axis gearbox		Arbitrary	180°			
Wrist			0°	0°	0°	0°

Table 7.3.3 (e) Postures for greasing (R-2000*i*B/165R/200R/100P)

Supply position	Posture					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary
J2-axis reducer		-90°				
J3-axis reducer		-90°	90°			
J4-axis gearbox		Arbitrary	90°			
Wrist			90°	0°	0°	0°

Table 7.3.3 (f) Postures for greasing (R-2000*i*B/170CF)

Supply position	Posture					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary
J2-axis reducer		0°				
J3-axis reducer		0°	0°			
J3-axis gearbox		0°	0°			
J4-axis gearbox		Arbitrary	0°			
Wrist			0°	0°	0°	0°

Grease replacement procedure of the J1, J2, J3-axis reducer and J3-axis gearbox

1. Move the robot to the greasing posture described in Table 7.3.3 (c) to (f).
2. Turn off the controller power.
3. Remove the seal bolt from grease outlet. (Fig.7.3.3 (a) to 7.3.3 (f))
4. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet.
5. Release remaining pressure using the procedure given in Subsection 7.3.4.
6. In case of 150U/220U/220US upside-down mount, pull out about 400 to 500ml grease from the J2-axis.

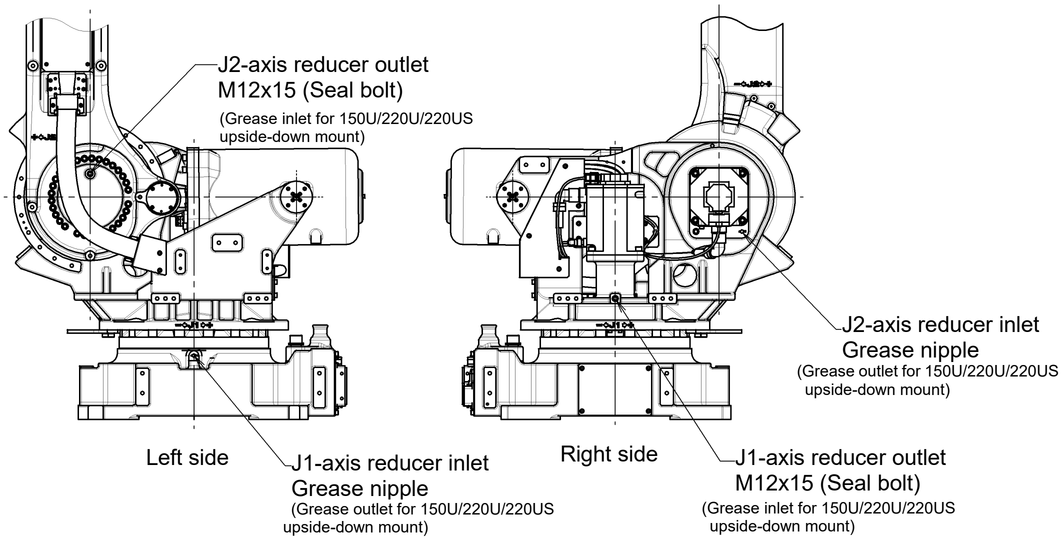


Fig. 7.3.3 (a) Replacing grease of the J1/J2-axis reducer (R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U/210FS/220US)

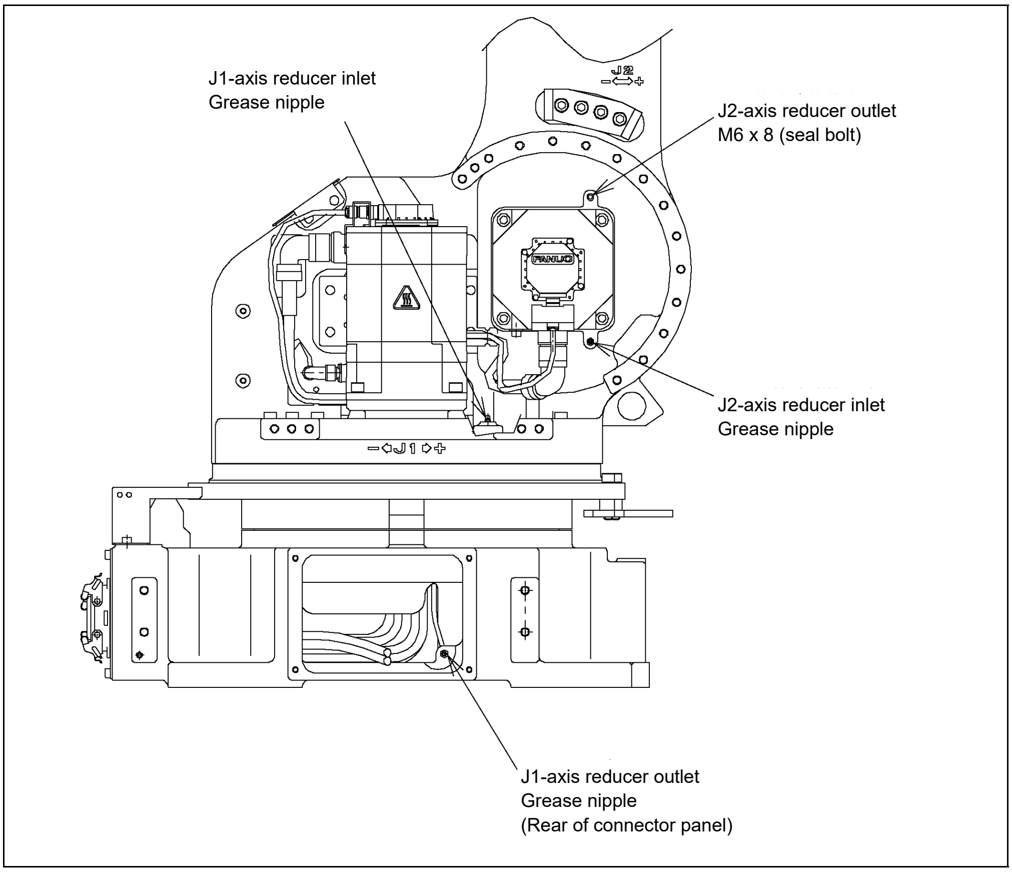


Fig. 7.3.3 (b) Replacing grease of the J1/J2-axis reducer (R-2000*i*B/165CF)

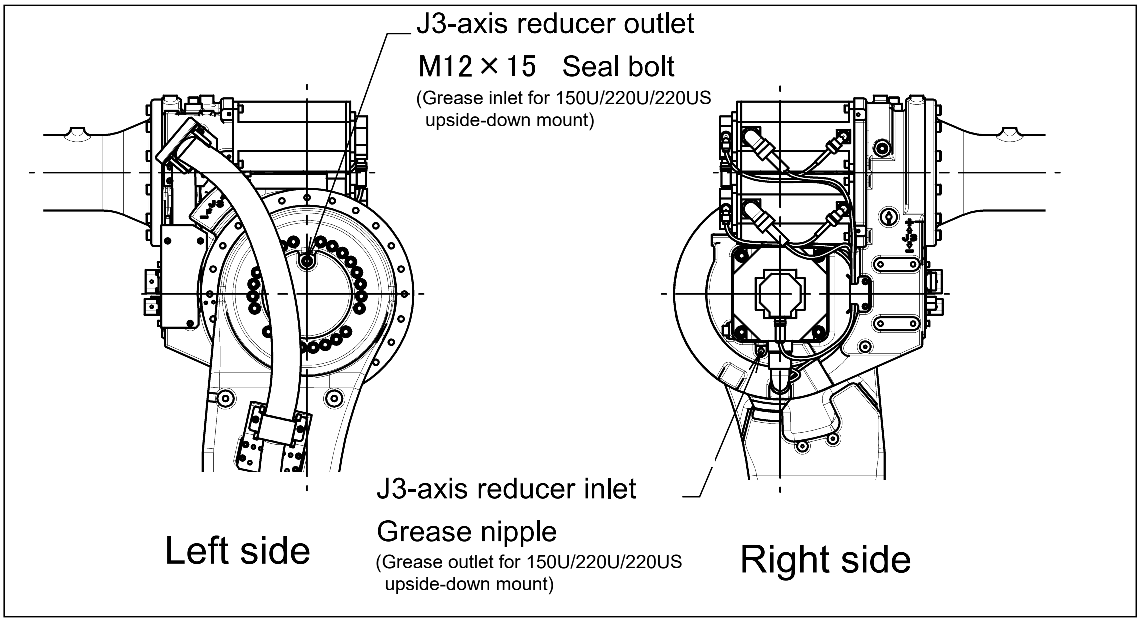


Fig. 7.3.3 (c) Replacing grease of the J3-axis reducer (R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U)

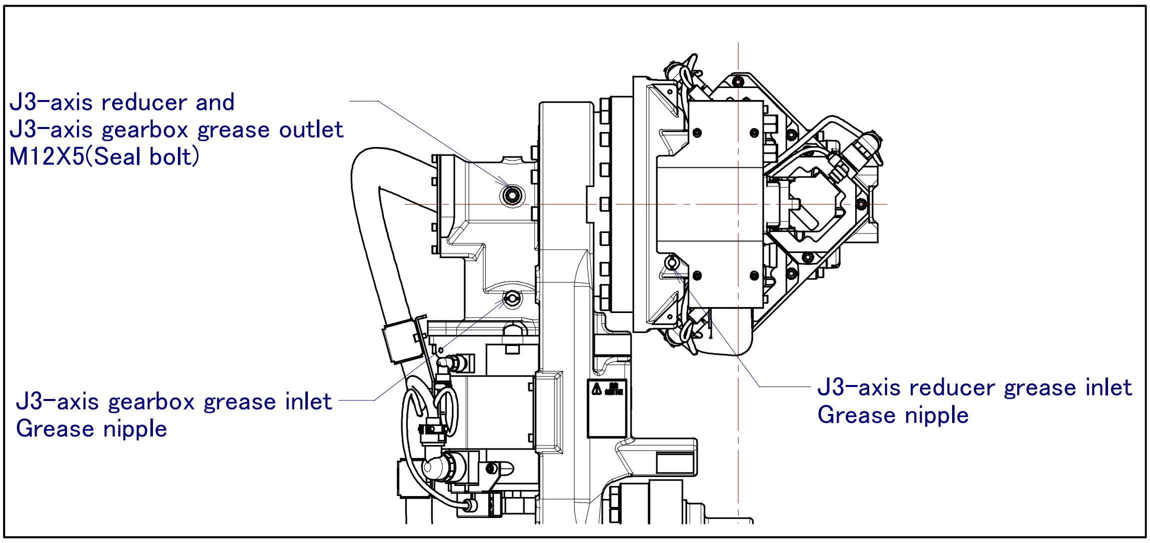


Fig. 7.3.3 (d) Replacing grease of the J3-axis reducer and J3-axis gearbox (R-2000*i*B/170CF)

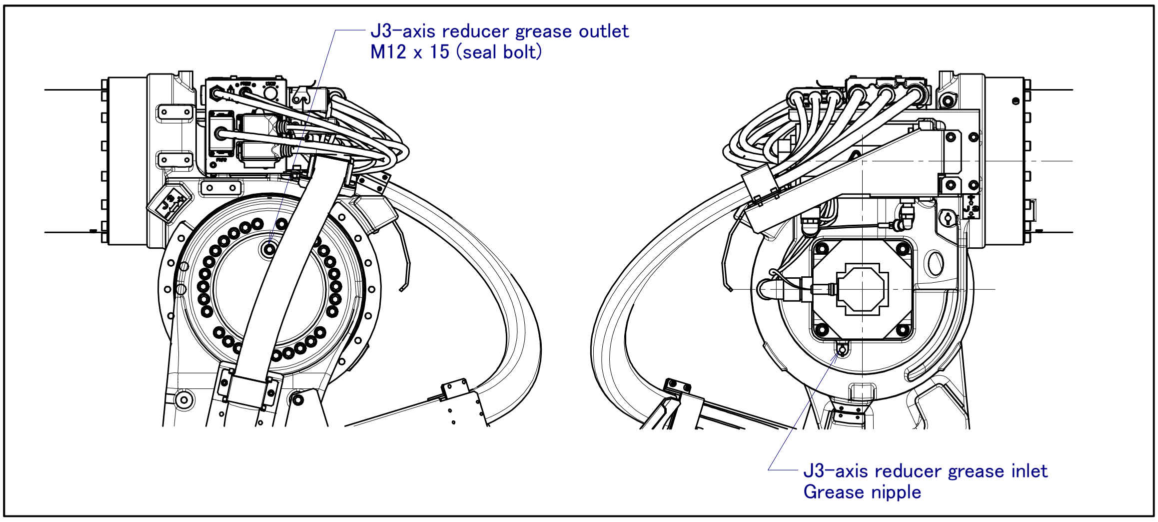


Fig. 7.3.3 (e) Replacing grease of the J3-axis reducer (R-2000*i*B/210FS/220US)

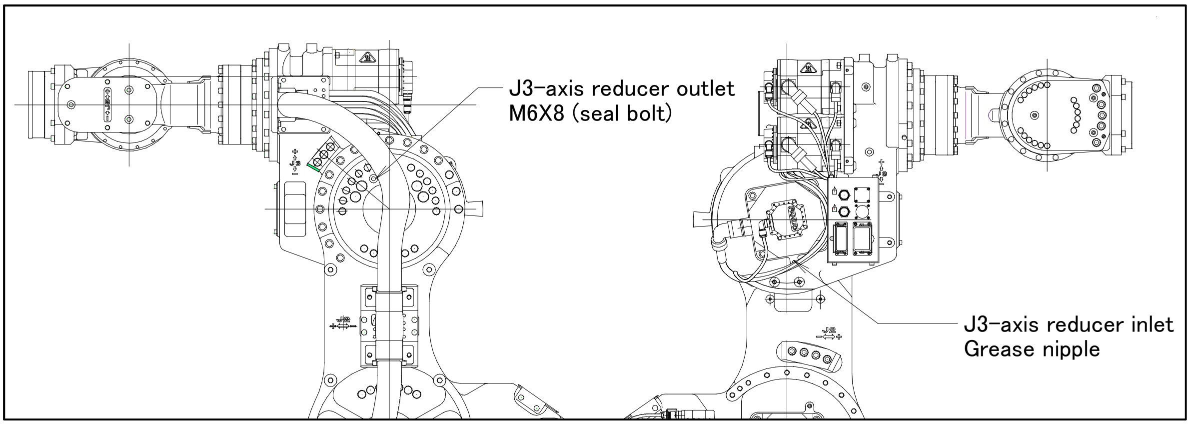


Fig. 7.3.3 (f) Replacing grease of the J3-axis reducer (R-2000*i*B/165CF)

Grease Replacement Procedure for the J4-axis gearbox (R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U)

1 Move the robot to the greasing posture described in Table 7.3.3 (c) to (f).
2 Turn off the controller power.
3 Remove the seal bolt from the grease outlet and the air inlet. (Fig. 7.3.3 (g))
4 Supply new grease until new grease is output from the grease outlet.
5 Release remaining pressure using the procedure given in Subsection 7.3.4.

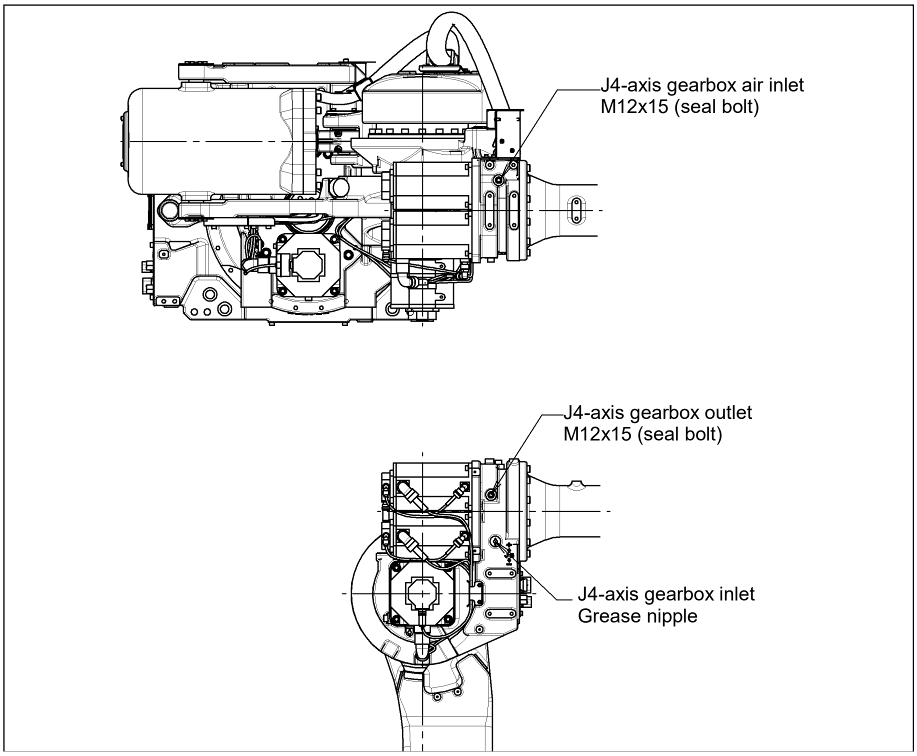


Fig. 7.3.3 (g) Replacing grease of the J4-axis gearbox (R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U)

Grease Replacement Procedure for the J4-axis gearbox (R-2000*i*B/210FS/220US/165CF)

1 Move the robot to the greasing posture described in Table 7.3.3 (c), (d).
2 Turn off the controller power.
3 Remove the seal bolt from the grease outlet. (Fig. 7.3.3 (h), (i))
4 Supply new grease until new grease is output from the grease outlet.
5 Release remaining pressure using the procedure given in Subsection 7.3.4.

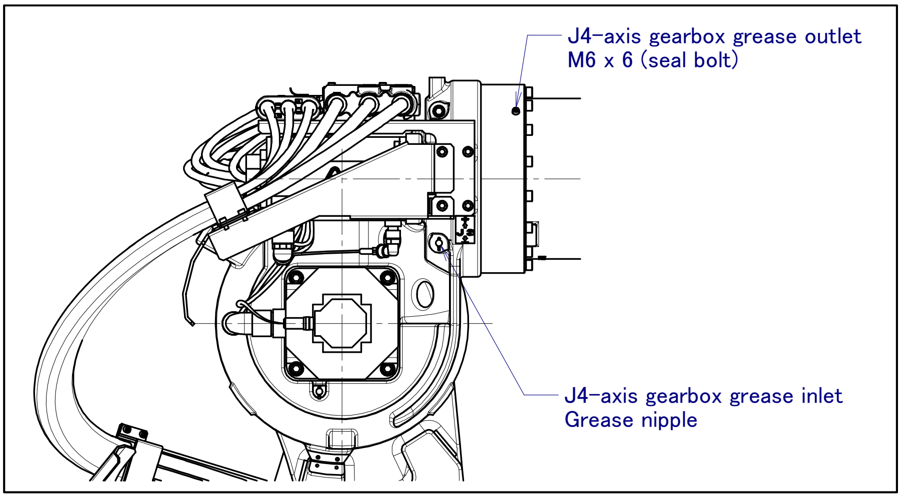


Fig. 7.3.3 (h) Grease replacement for the J4-axis gearbox (R-2000*i*B/210FS/220US)

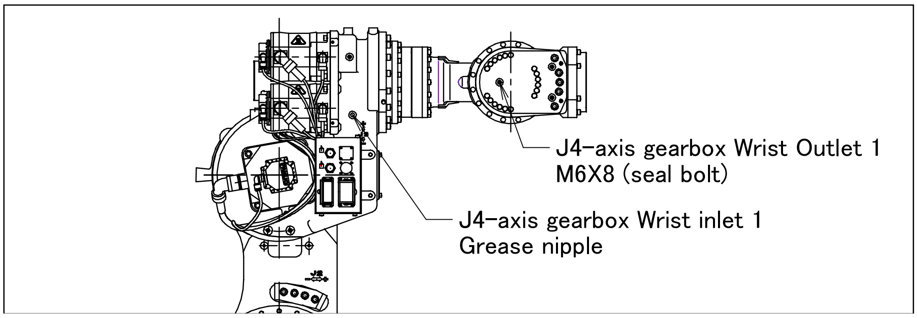


Fig. 7.3.3 (i) Grease replacement for the J4-axis gearbox (R-2000*i*B/165CF)

Grease Replacement Procedure for the Wrist (R-2000*i*B/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L / 100H/150U/220U)

1 Move the robot to the greasing posture described in Table 7.3.3 (c) to (f).
2 Turn off the controller power.
3 Remove the sealant plug of wrist grease outlet 1 (Figs. 7.3.3 (j) and 7.3.3 (k)).
4 Supply grease to the wrist grease inlet until new grease outputs from wrist grease outlet 1.
5 Attach the sealant plug to wrist grease outlet 1.
6 Next, remove the sealant plug (or the seal bolt for the 210F/185L/250F/200R/100P/210WE/175L /220U) of wrist grease outlet 2.
7 Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2.
8 Release remaining pressure using the procedure given in Subsection 7.3.4.

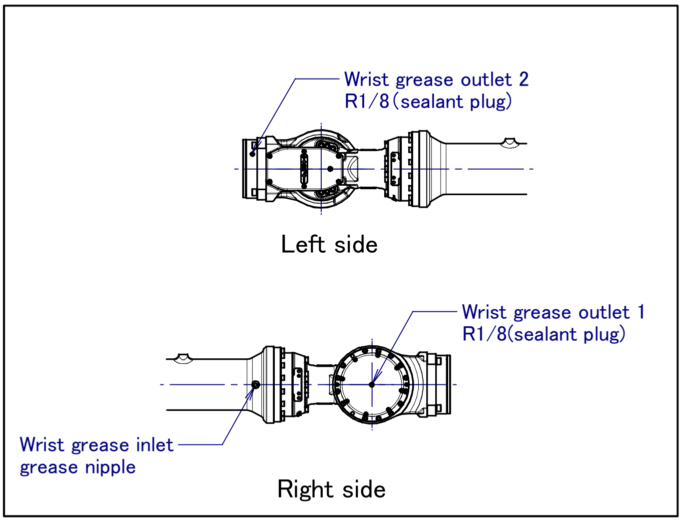


Fig. 7.3.3 (j) Replacing grease of the wrist (R-2000*i*B/165F/165R/170CF/125L/100H/150U)

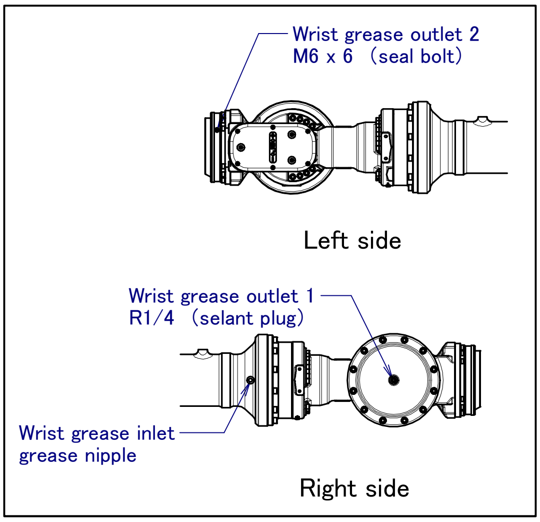


Fig. 7.3.3 (k) Replacing grease of the wrist (R-2000*i*B/210F/185L/250F/200R/100P/210WE/175L/220U)

Grease Replacement Procedure for the Wrist (R-2000*i*B/210FS/220US)

1. Move the robot to the greasing posture described in Table 7.3.3 (c).
2. Turn off the controller power.
3. Remove the seal bolt of wrist grease outlet 1 (Figs. 7.3.3 (l)).
4. Supply grease to the wrist grease inlet 1 until new grease outputs from wrist grease outlet 1.
5. Attach the seal bolt to wrist grease outlet 1.
6. Next, remove the seal bolt of wrist grease outlet 2.
7. Supply new grease through the wrist grease inlet 2 until new grease is output from wrist grease outlet 2.
8. Release remaining pressure using the procedure given in Subsection 7.3.4.

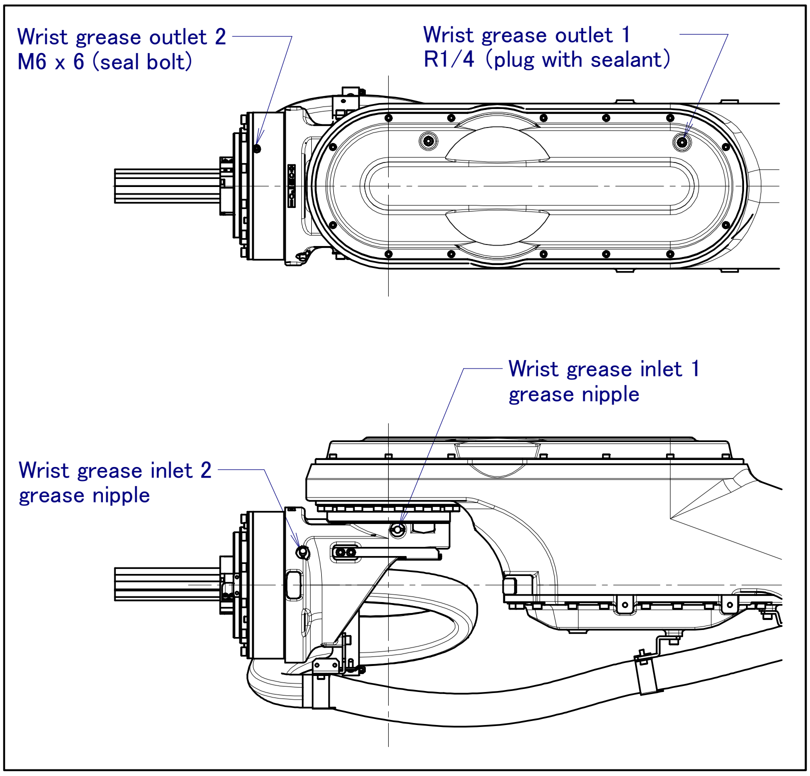


Fig. 7.3.3 (l) Replacing grease of the wrist (R-2000*i*B/210FS/220US)

Grease Replacement Procedure for the Wrist (R-2000*i*B/165CF)

1 Move the robot to the greasing posture described in Table 7.3.3 (c).
2 Turn off the controller power.
3 Remove the sealant plug of wrist grease outlet 1.
4 Supply grease to the wrist grease inlet until new grease outputs from wrist grease outlet 1.
5 Attach the seal bolt to wrist grease outlet 1. When reusing the seal bolt, be sure to seal it with seal tape.
6 Remove the seal bolt from wrist grease outlet 2.
7 Supply new grease through wrist grease inlet 2 until the new grease is forced out of wrist grease outlet 2.
8 Release remaining pressure using the procedure given in Subsection 7.3.4.

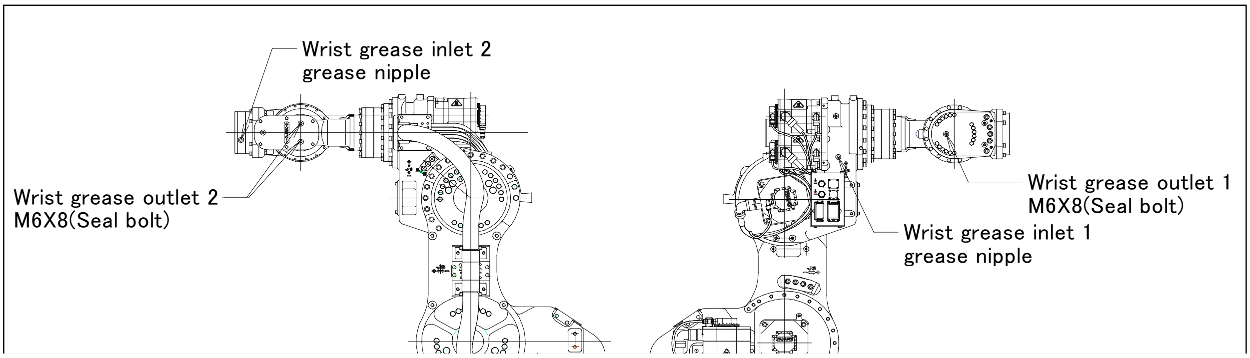


Fig. 7.3.3 (m) Replacing grease of the wrist (R-2000*i*B/165CF)

> ⚠ **CAUTION**
> Failure to follow proper greasing procedures may cause a sudden increase of the grease bath internal pressure and damage to the seal. This could lead to grease leakage and abnormal operation. When greasing, observe the following cautions.
> 1 Before starting to grease, remove the plug or bolt from the grease outlet to allow the grease to come out.
> 2 Supply grease slowly, using a manual pump.
> 3 Whenever possible, avoid using an air pump, which is powered by the factory air supply.
> If the use of an air pump is unavoidable, supply grease with the pump at a pressure lower than or equal to the gun tip pressure (see Table 7.3.3 (a), (b)).
> 4 Use specified grease. Use of non-approved grease may damage the reducer or lead to other problems.
> 5 After greasing, release remaining pressure from the grease bath using the procedure given in Subsection 7.3.4, and then close the grease outlet.
> 6 To prevent an accident such as a fall or fire, remove all the excess grease from the floor and robot.

7.3.4 Procedure for Releasing Remaining Pressure from the Grease Bath

Release remaining pressure as described below.
Under the grease inlets and outlets, attach bags for collecting grease so that grease does not spatter when it comes out of the inlets or outlets.

Grease replacement position	Motion angle	OVR	Operating time	Open point
J1-axis reducer	80° or more	50%	20 minutes	A
J2-axis reducer	90° or more	50%	20 minutes	A
J3-axis reducer J3-axis gearbox	70° or more	50%	20 minutes	A
J4-axis gearbox (Except 210FS/220US)	J4: 60° or more J5:120° or more J6: 60° or more	100%	20 minutes	B
J4-axis gearbox (210FS/220US)	J4: 60° or more	100%	20 minutes	D
Wrist (Except 210FS/220US)	J4: 60° or more J5:120° or more J6: 60° or more	100%	10 minutes	C
Wrist (210FS/220US)	J5=±30° J6=±180°	50%⇒100% *	10 minutes	D

* If starting operation with OVR100%, grease is out rapidly. Increase override to from 50% to 100% gradually confirming the grease discharging speed.

In the case of A
Open the grease inlets and outlets and perform continuous operation.

In the case of B
Open the grease outlets only and perform continuous operation.

In the case of C
Open all of the grease inlets and outlets shown below and perform continuous operation.

In the case of D
Open the grease outlet and holes of Fig. 7.3.4 (c), (d) and perform continuous operation.

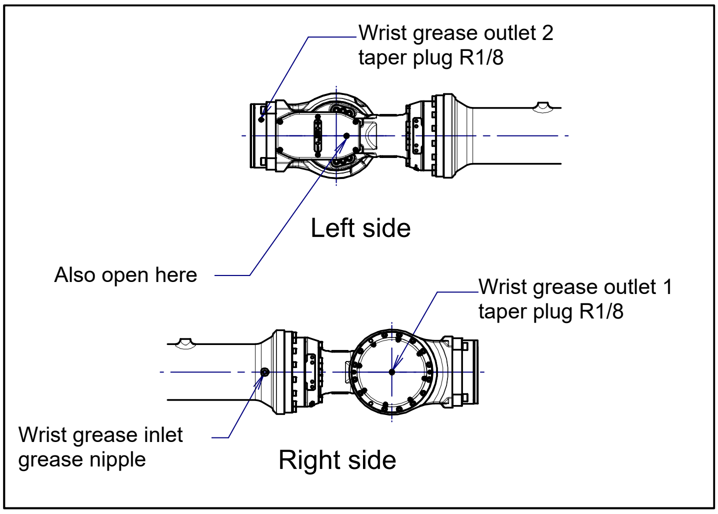


Fig. 7.3.4 (a) Open points for releasing remaining pressure from the wrist (R-2000*i*B/165F/165R/170CF/125L/100H/150U)

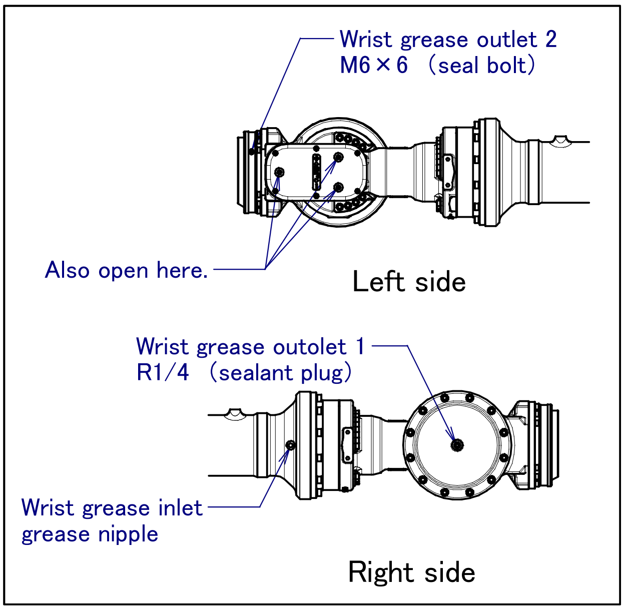


Fig. 7.3.4 (b) Open points for releasing remaining pressure from the wrist (R-2000*i*B/210F/185L/250F/200R/100P/210WE/175L/220U)

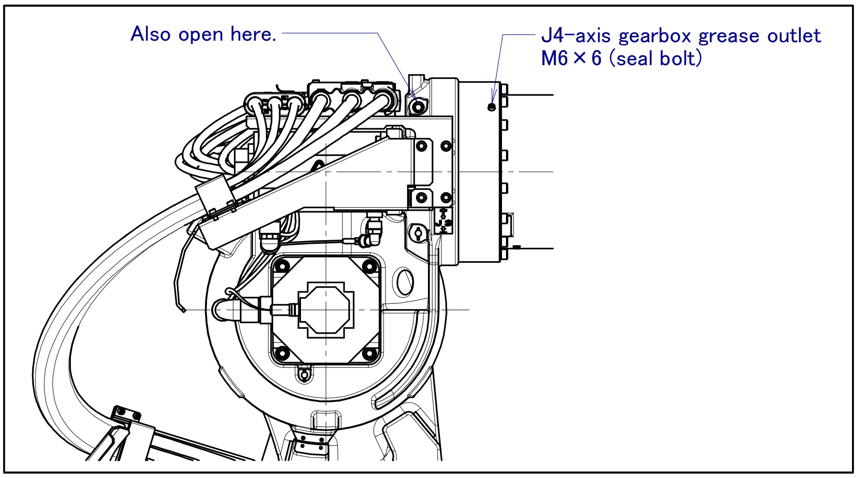


Fig. 7.3.4 (c) Open points for releasing remaining pressure from the J4-axis gearbox (R-2000*i*B/210FS/220US)

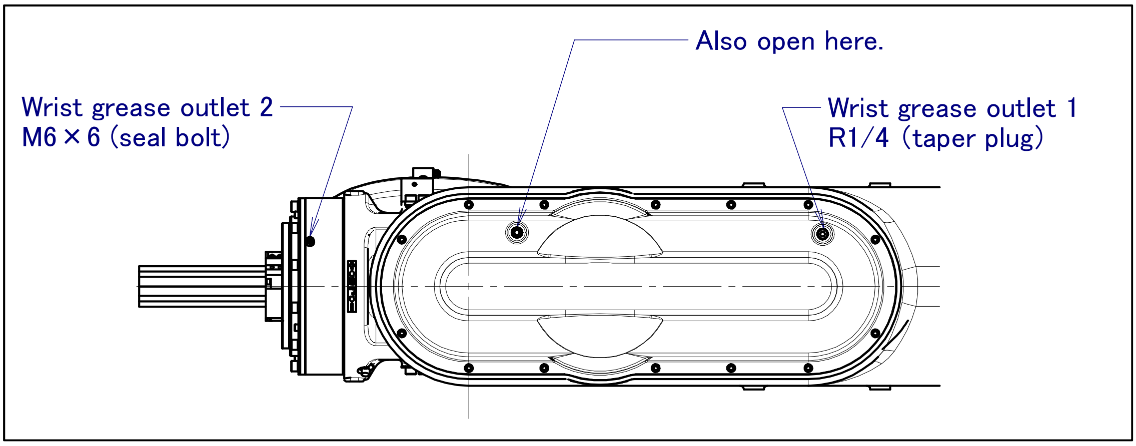


Fig. 7.3.4 (d) Open points for releasing remaining pressure from the wrist (R-2000*i*B/210FS/220US)

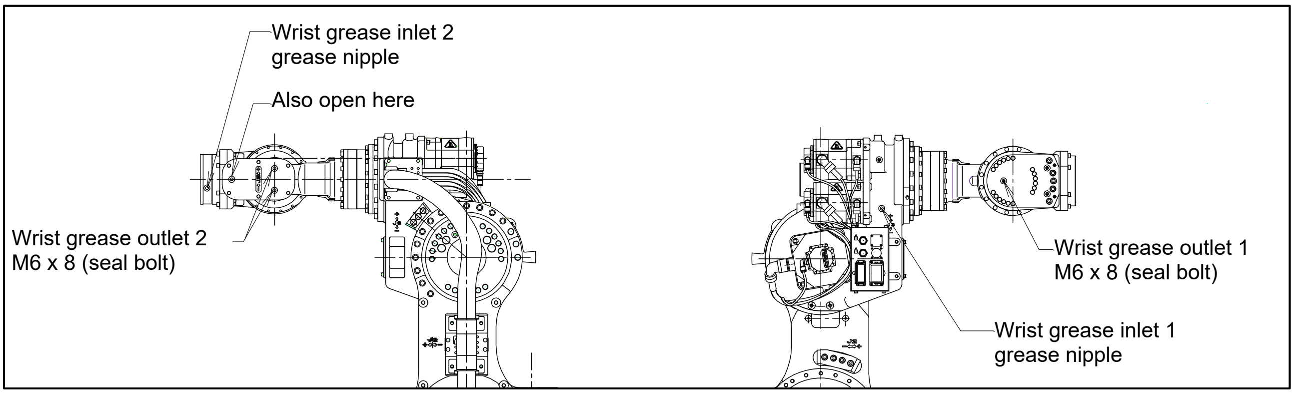


Fig. 7.3.4 (e) Open points for releasing remaining pressure from the wrist (R-2000*i*B/165CF)

If the above operation cannot be performed due to the environment of the robot, prolong the operating time so that an equivalent operation can be performed. (If only half of the predetermined motion angle can be set, perform an operation for a period of time twice as long as the specified time.) If you grease multiple axes, you can exercise multiple axes at the same time. After completion of the operation, attach the seal bolts and grease nipples to the grease inlets and outlets immediately. When reusing the seal bolts and grease nipples, be sure to seal them with seal tape.

7.4 STORAGE

When storing the robot, place it on a level surface with the same posture for transportation. (See Section 1.1.)

8 MASTERING

Mastering associates the angle of each robot axis with the pulse count value supplied from the absolute Pulsecoder connected to the corresponding axis motor. To be specific, mastering is an operation for obtaining the pulse count value; corresponding to the zero position.

> ⚠ **CAUTION**
> In case of performing mastering with gravity compensation (option) is enabled, if load setting (See Section 4.4) is not correct, it will influence the precision of the mastering.

8.1 OVERWVIEW

The current position of the robot is determined according to the pulse count value supplied from the Pulsecoder on each axis.
Mastering is factory-performed. It is unnecessary to perform mastering in daily operations. However, mastering is required under the following conditions:

- Motor replacement.
- Pulsecoder replacement
- Reducer replacement
- Cable replacement
- Batteries for pulse count backup in the mechanical unit have gone dead

> ⚠ **CAUTION**
> Robot data (including mastering data) and Pulsecoder data are backed up by their respective backup batteries. Data will be lost if the batteries die. Replace the batteries in the controller and mechanical units periodically. An alarm will alert you when battery voltage is low.

Types of Mastering

Table 8.1 (a) describes the following mastering methods. Note that "Quick Mastering for Single Axis" is not supported in software version 7DC2 (V8.20P) or earlier.

Table 8.1 (a) Types of mastering

Fixture position mastering	This is performed using a mastering fixture before the machine is shipped from the factory.
Zero-position mastering (witness mark mastering)	This is performed with all axes set at the 0-degree position. A zero-position mark (witness mark) is attached to each robot axis. This mastering is performed with all axes aligned to their respective witness marks.
Quick mastering	This is performed at a user-specified position. The corresponding count value is obtained from the rotation count of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost. (All axes at the same time)
Quick mastering for single axis	This is performed at a user-specified position for one axis. The corresponding count value is obtained from the rotation count of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost.
Single-axis mastering	This is performed for one axis at a time. The mastering position for each axis can be specified by the user. This is useful in performing mastering on a specific axis.

Vision axis mastering (option)	This is performed for one axis at a time with high precision by using vision. This is useful in performing mastering on a specific axis.
Mastering data entry	Mastering data is entered directly.

Once mastering is performed, you must carry out positioning (calibration). Positioning is an operation in which the controller reads the pulse count value to sense the current position of the robot.

This section describes zero-position mastering, quick mastering, single-axis mastering, vision axis mastering, and mastering data entry. For more detailed mastering (fixture position mastering), contact your local FANUC representative.

> ⚠ **CAUTION**
> 1 If mastering is performed incorrectly, the robot may behave unexpectedly. This is very dangerous. For the reason, the Master/Cal screen is designed to appear only when the $MASTER_ENB system variable is 1 or 2. After performing positioning, press the F5 ([DONE]) on the Master/Cal screen. The $MASTER_ENB system variable is reset to 0 automatically. And, the Master/Cal screen will disappear.
> 2 Before performing mastering, recommend to back up the current mastering data.

8.2 RESETTING ALARMS AND PREPARING FOR MASTERING

Before performing mastering because a motor has been replaced, it is necessary to release the relevant alarm and display the positioning menu.

Alarm displayed

"SRVO-062 BZAL" or "SRVO-075 Pulse not established"

Procedure

1 Display the positioning menu by following the steps 1 to 6.
   1 Press the [MENU] key to display the screen menu.
   2 Press [0 NEXT] and select [6 SYSTEM].
   3 Press F1 ([TYPE]), and select [Variable] from the menu.
   4 Place the cursor on $MASTER_ENB, then key in "1" and press the [ENTER] key.
   5 Press F1 ([TYPE]), and select [Master/Cal] from the menu.
   6 Select the desired mastering type from the [Master/Cal] menu.

2 To reset the "SRVO-062 BZAL" alarm, follow steps 1 to 5.
   1 Press the [MENU] key.
   2 Press [0 NEXT] and select [6 SYSTEM].
   3 Press F1 ([TYPE]), and select [Master/Cal] from the menu.
   4 Press F3 ([RES_PCA]), then press F4 ([YES]).
   5 Cycle power of the controller.

3 To reset the "SRVO-075 Pulse not established" alarm, follow the steps 1 to 2.
   1 After cycling controller power, the message "SRVO-075 Pulse not established" appears again.
   2 Move the axis for which the message mentioned above has appeared in either direction till the alarm disappears when you press the [RESET] key.

If "SRVO-062 BZAL" alarm or "SRVO-068 DTERR" alarm occurred, and you cannot release the alarm, Please check there is no faulty wiring or disconnected part.

8.3 ZERO POSITION MASTERING

Zero-position mastering (witness mark mastering) is performed with all axes set at the 0-degree position. A zero-position mark (witness mark) is attached to each robot axis.(Fig.8.3 (a) to (k)) This mastering is performed with all axes set at the 0-degree position using their respective witness marks.

Zero-position mastering involves a visual check, and might not be highly accurate. It should be used only as a quick-fix method.

Zero-position Mastering Procedure

1. Press the [MENU] key to display the screen menu.
2. Select [0 NEXT] and press [6 SYSTEM].
3. Press F1 [TYPE]. Then select [Variables] from the menu.
4. If $DMR_GRP [group].$GRAV_MAST=1, set the gravity compensation to enabled, if it is 0, set the gravity compensation to disabled. In addition release the brake control.

> **NOTE**
> Gravity compensation can be set to enabled/disabled by setting the system variables as follows:
> $PARAM_GROUP[group].$SV_DMY_LNK[8] : FALSE(disabled) or TRUE (enabled)
> Brake control can be released by setting the system variables as follows:
> $PARAM_GROUP.SV_OFF_ALL : FALSE (for all axes)
> $PARAM_GROUP.SV_OFF_ENB[*] : FALSE
> After changing the system variables, cycle power of the controller.
> (Mastering can be performed without setting of gravity compensation. However, it will affect precision.)

5. Press the [MENU] key to display the screen menu.
6. Select [0 NEXT] and press [6 SYSTEM].
7. Press F1 [TYPE], display the screen change menu.
8. Select [Master/Cal]. The positioning screen will be displayed.

```
SYSTEM Master/Cal          AUTO    JOINT 10 %
                            TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA              DONE
```

9 Jog the robot into a posture for mastering.
10 Select [2 ZERO POSITION MASTER]. Press F4 [YES].

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
 Robot Mastered! Mastering Data:
    <0> <11808249> <38767856>
    <9873638> <12200039> <2000319>
 [ TYPE ]   LOAD   RES_PCA              DONE
```

11 Select [7 CALIBRATE] and press F4 [YES]. Mastering will be performed automatically. Alternatively, turn off the controller power and on again.

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
 Robot Calibrated! Cur Jnt Ang(deg):
   <     0.0000> <     0.0000> <     0.0000>
   <     0.0000> <     0.0000> <     0.0000>
```

12 After positioning is completed, press F5 [DONE].

```
                 DONE
                 [F5]
```

13 Return the setting of the gravity compensation.
14 Return brake control to the original setting, and cycle power of the controller.

Table 8.3 (a) Posture with position marks (witness mark) aligned

Axis	Position
J1-axis	0 deg
J2-axis	0 deg
J3-axis	0 deg(NOTE) When J2-axis is 0 deg.
J4-axis	0 deg
J5-axis	0 deg
J6-axis	0 deg

> ⚠ **CAUTION**
> There is no J6-axis for R-2000*i*B/100H.

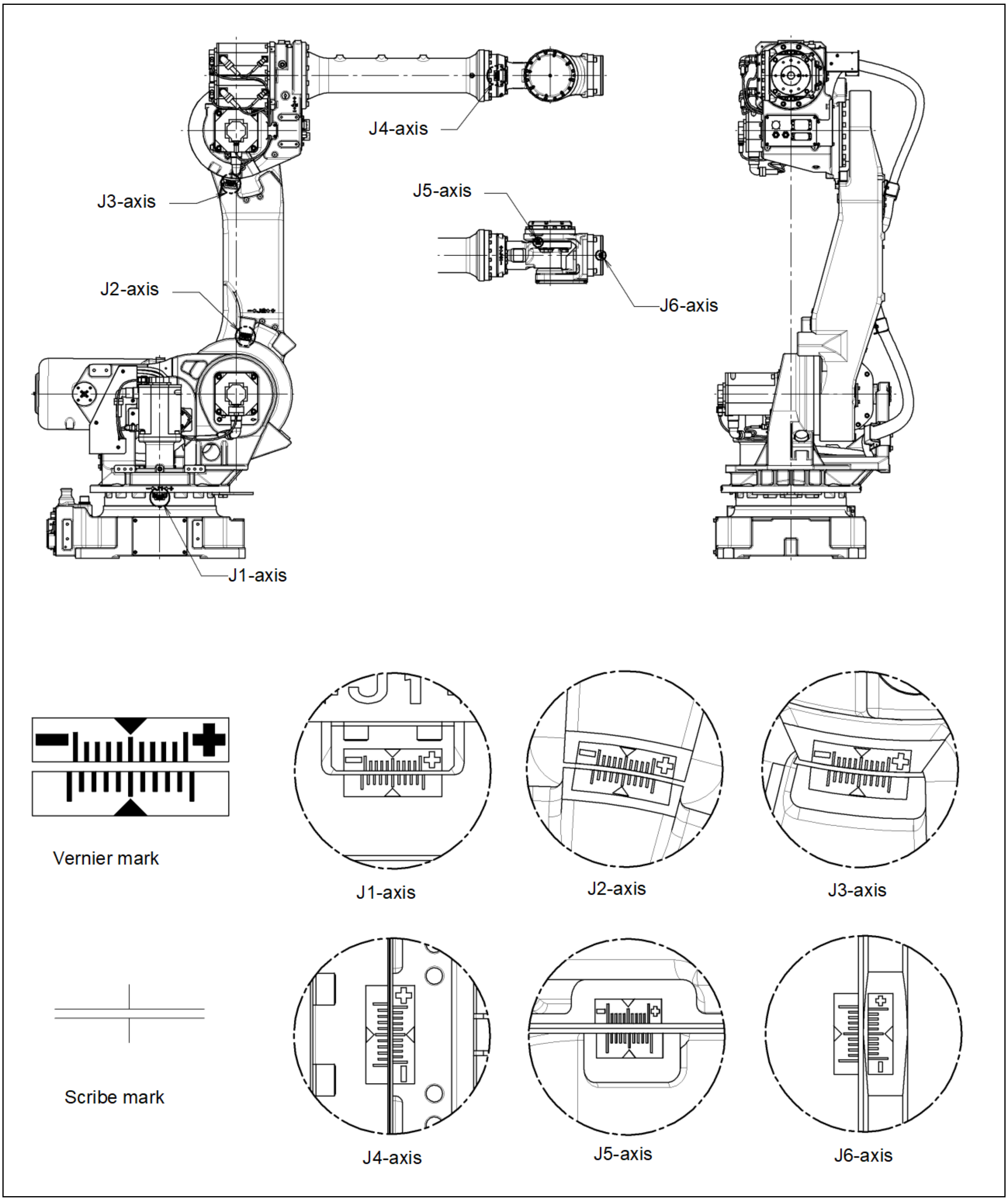


Fig. 8.3 (a) Zero-position mark (witness mark) for each axis (R-2000*i*B/165F/125L/150U)

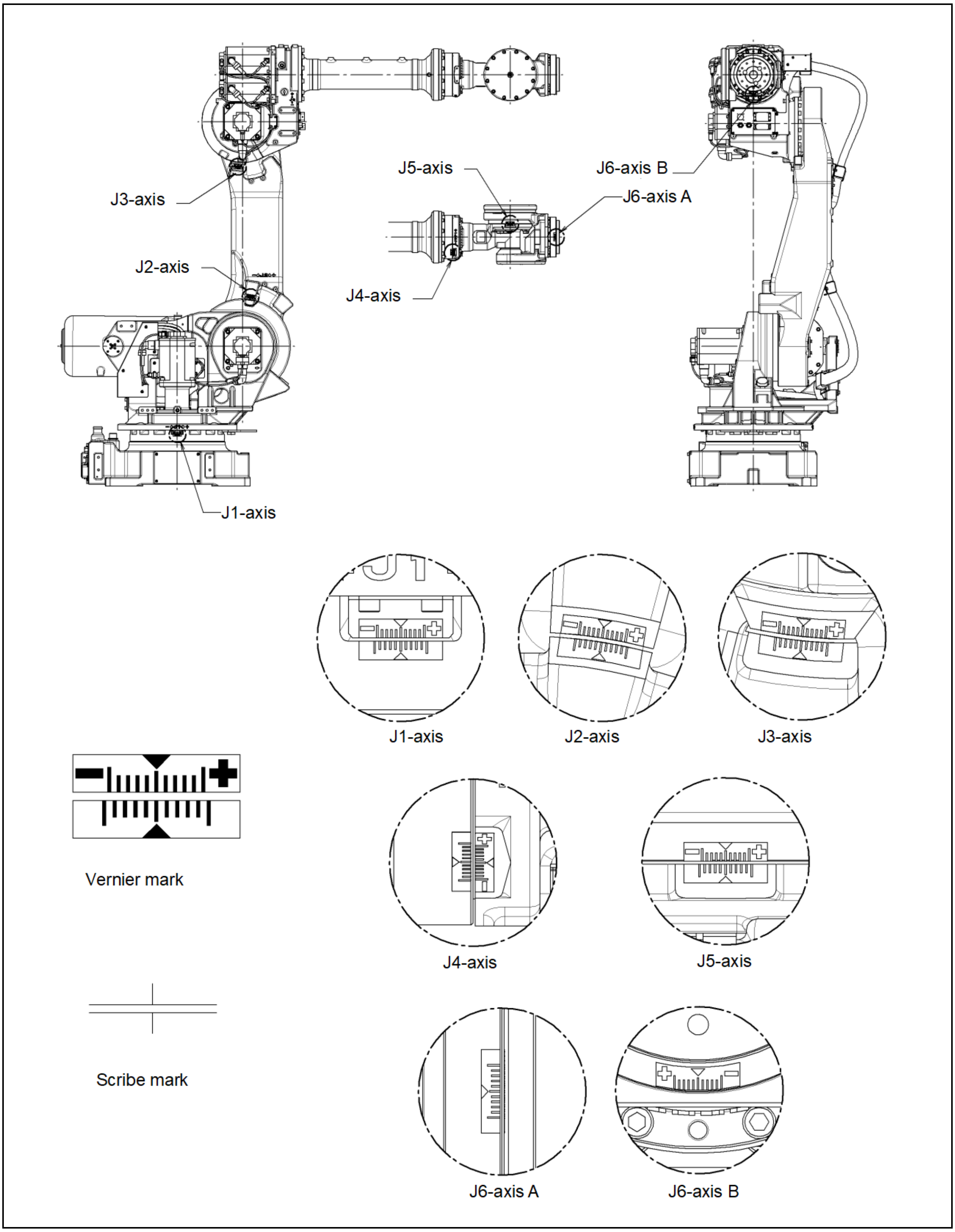


Fig. 8.3 (b) Zero-position mark (witness mark) for each axis (R-2000*i*B/210F/175L)

(*) Wrist unit and vernier mark for R-2000*i*B/210F/175L differ depend on production time of robot. Fig.8.3 (b) is in case of robot made before March, 2010. Refer to Fig.8.3 (c) about robot which are made after April, 2010.

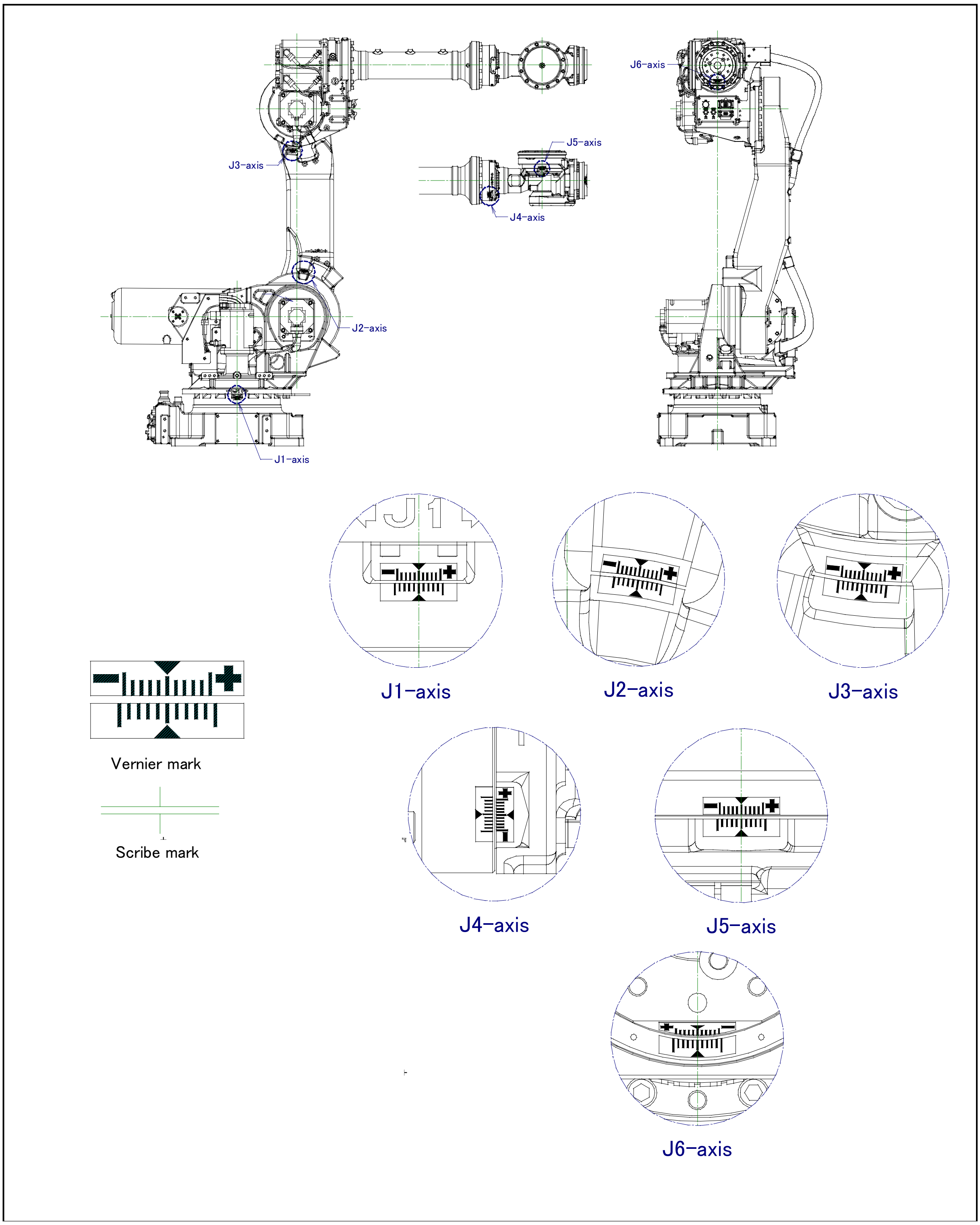


Fig. 8.3 (c) Zero-position mark (witness mark) for each axis (R-2000*i*B/210F/185L/250F/175L/220U)

(*) Wrist unit and vernier mark for R-2000*i*B/210F/175L differ depending on production time of robots. Fig.8.3 (c) is applicable in case of robots made after April, 2010. Refer to Fig.8.3 (b) about robots which were made before March, 2010.

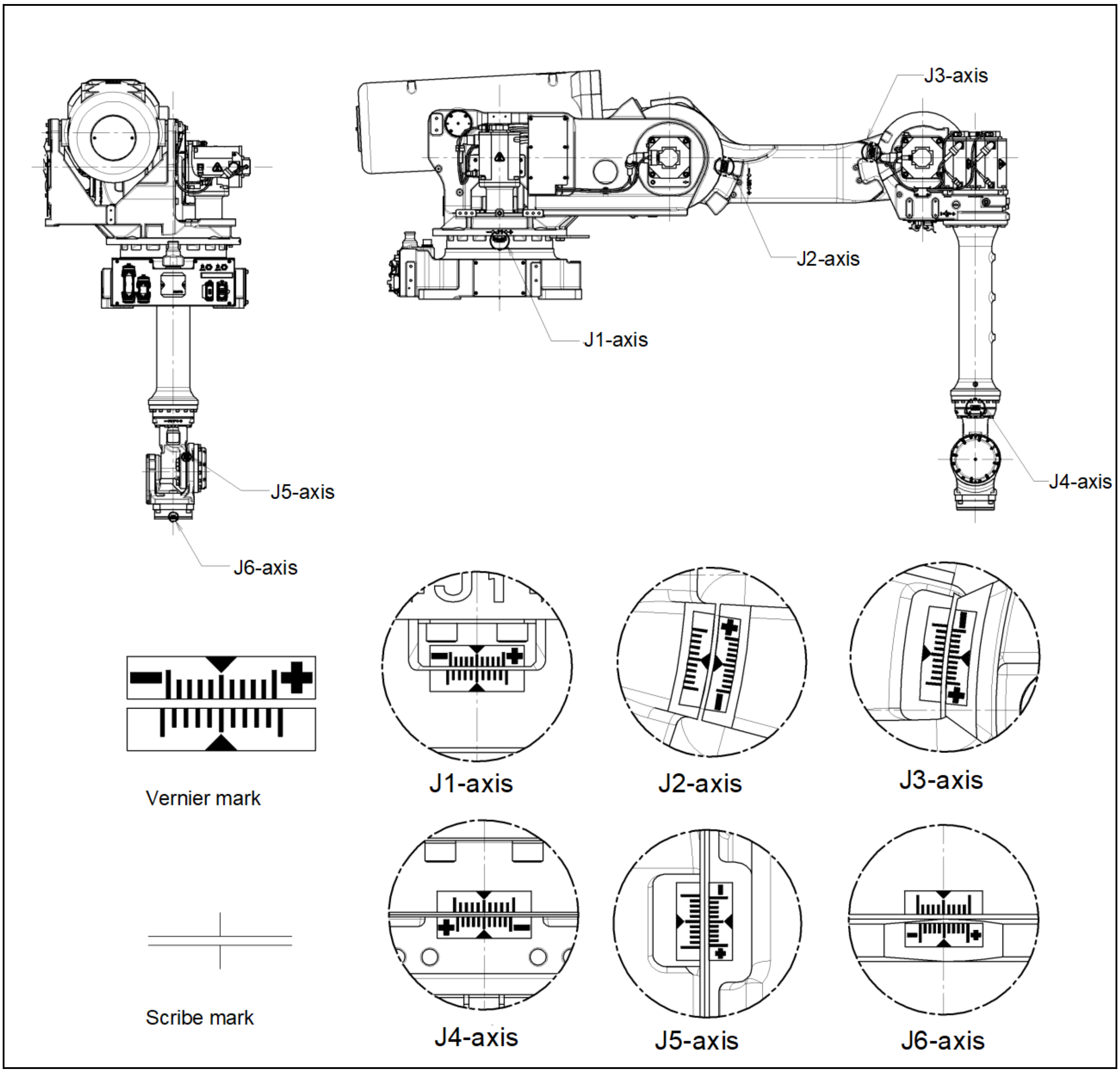


Fig. 8.3 (d) Zero-position mark (witness mark) for each axis (R-2000*i*B/165R)

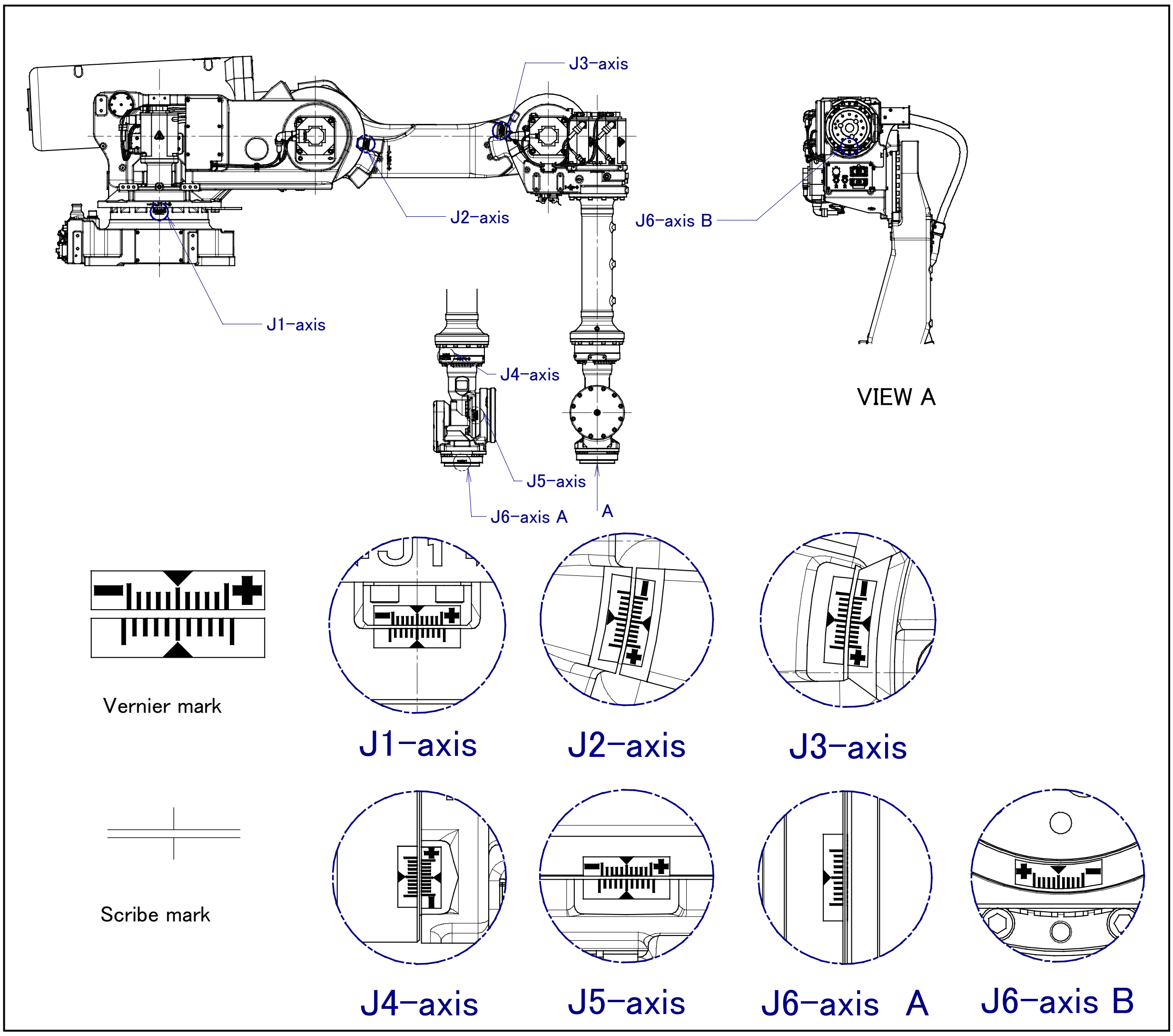


Fig. 8.3 (e) Zero-position mark (witness mark) for each axis (R-2000*i*B/200R/100P)

(*) Wrist unit and vernier mark for R-2000*i*B/200R/100P differ depending on production time of robots. Fig.8.3 (e) is applicable in case of robots made before March, 2010. Refer to Fig.8.3 (f) about robots which were made after April, 2010.

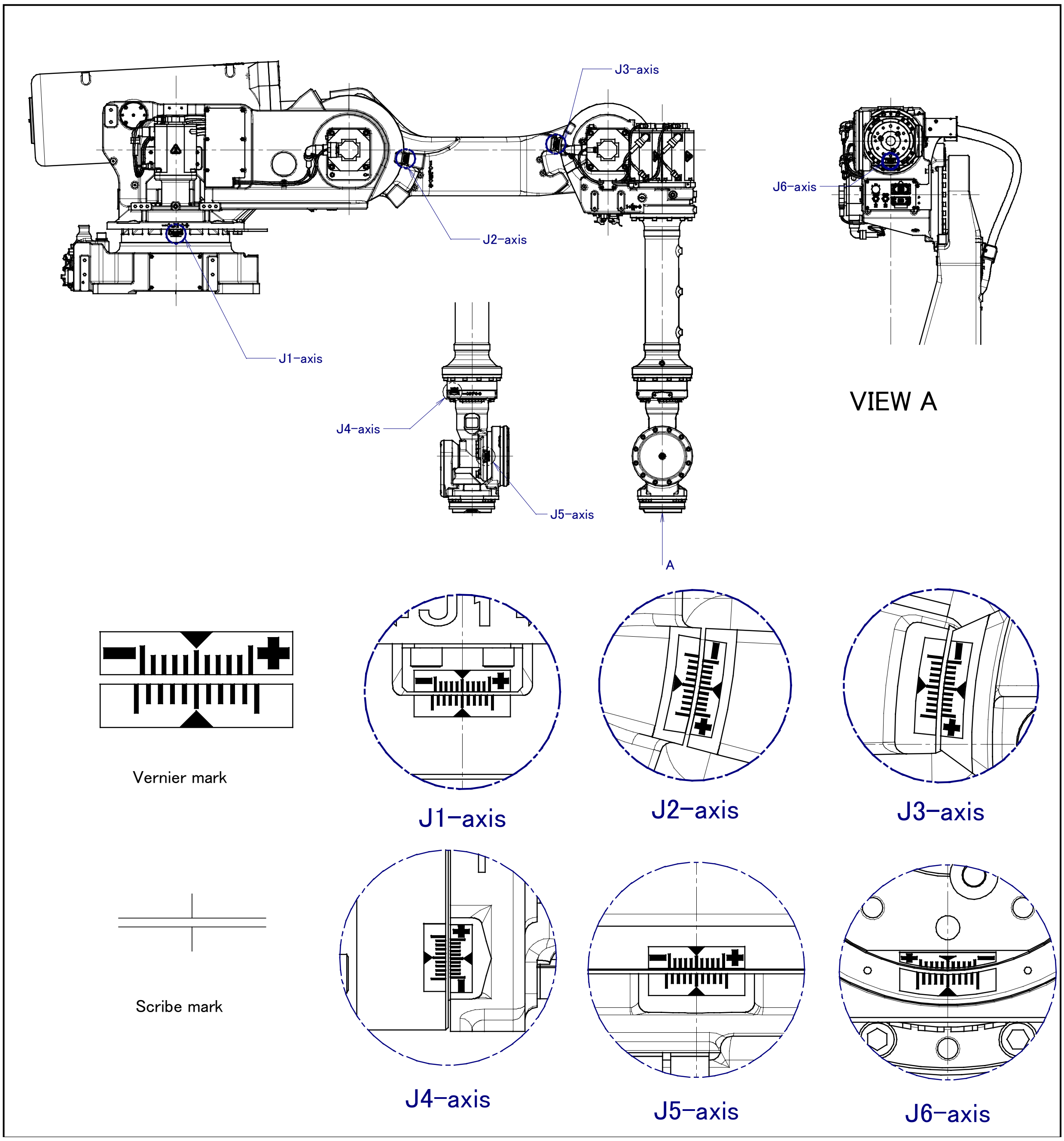


Fig. 8.3 (f) Zero-position mark (witness mark) for each axis (R-2000*i*B/200R/100P)

(*) Wrist unit and vernier mark for R-2000*i*B/200R/100P differ depending on production time of robots. Fig.8.3 (f) is applicable in case of robots made after April, 2010. Refer to Fig.8.3 (e) about robots which were made before March, 2010.

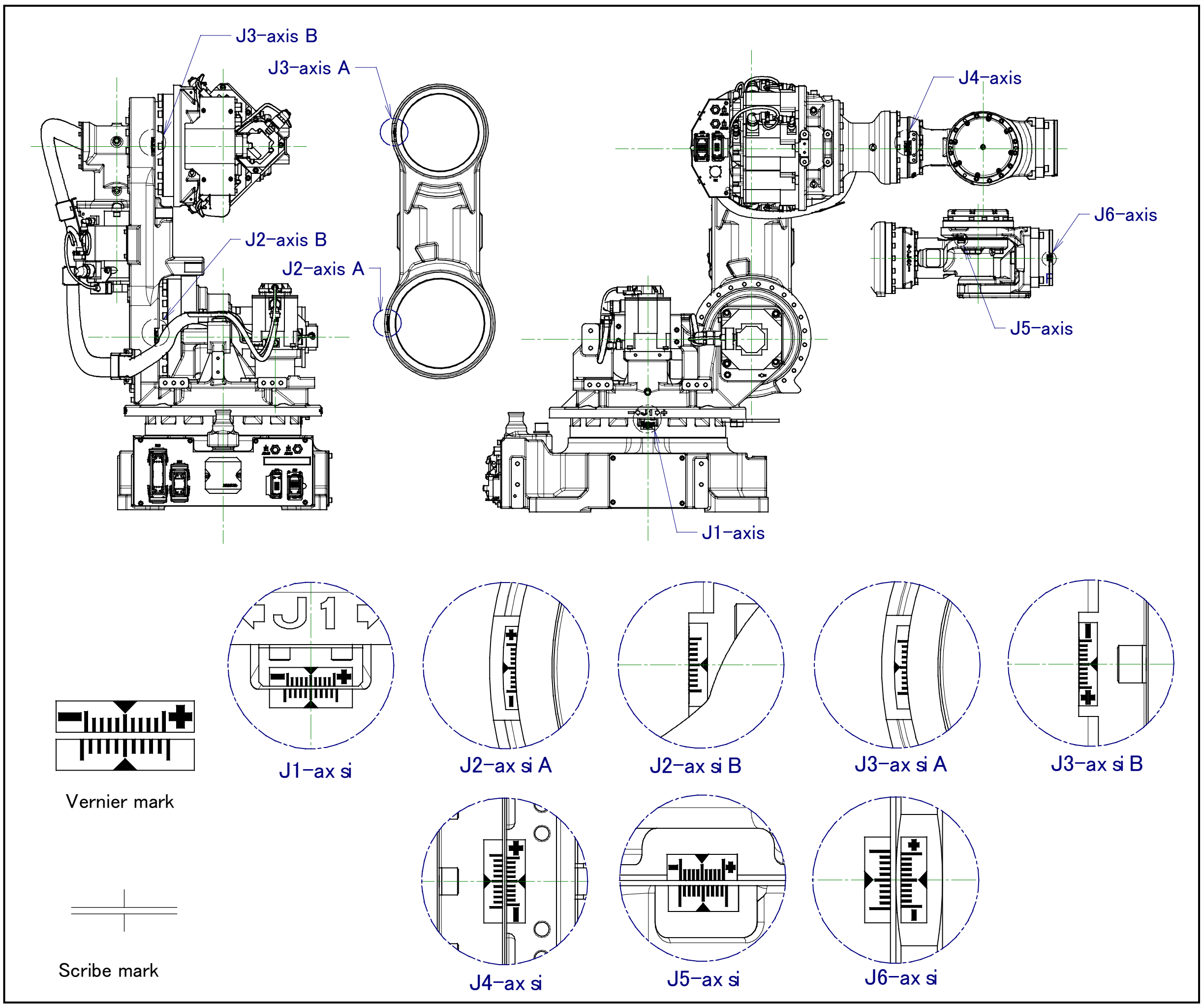


Fig. 8.3 (g) Zero-position mark (witness mark) for each axis (R-2000*i*B/170CF)

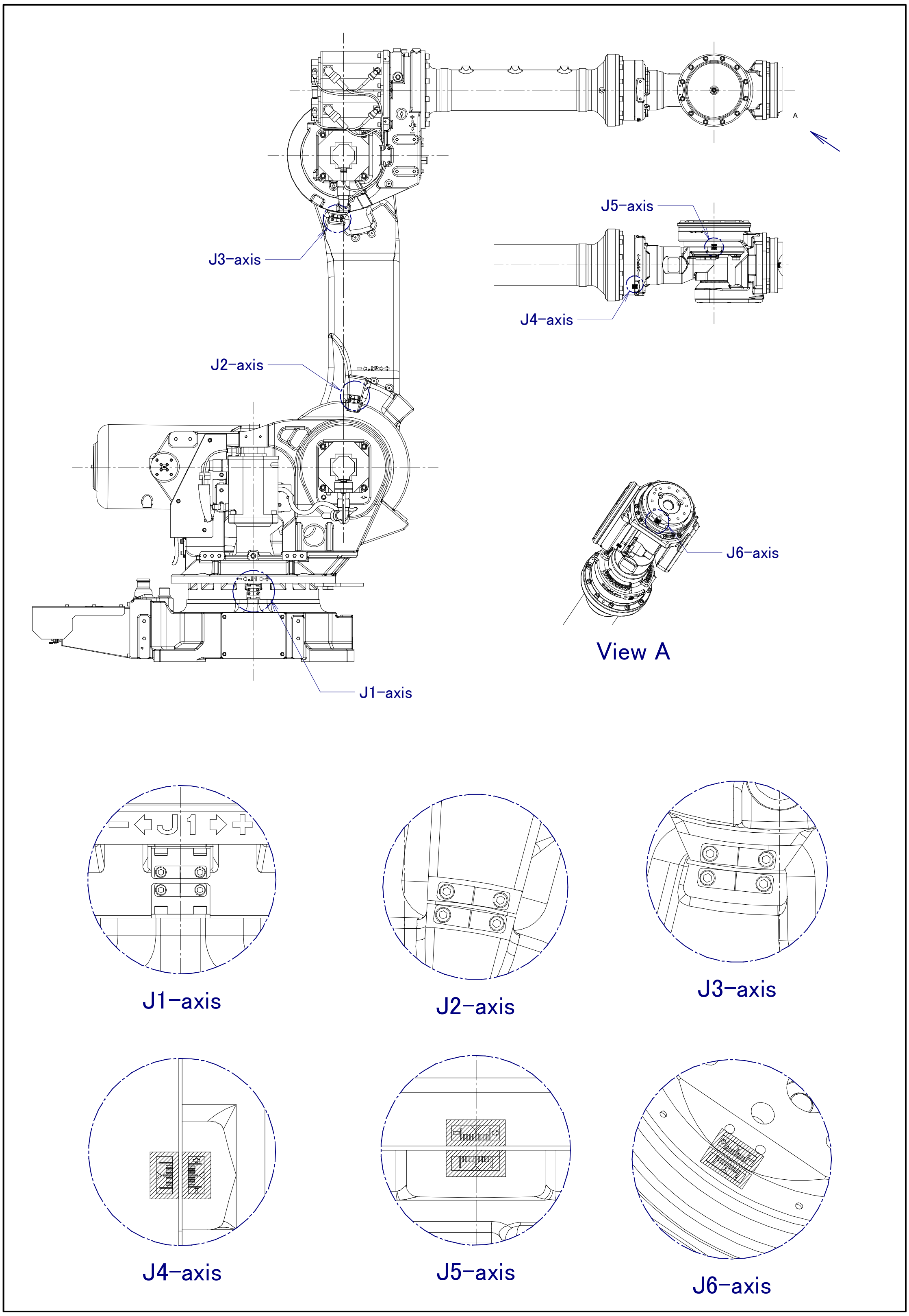


Fig. 8.3 (h) Zero-position mark (witness mark) for each axis (R-2000*i*B/210WE)

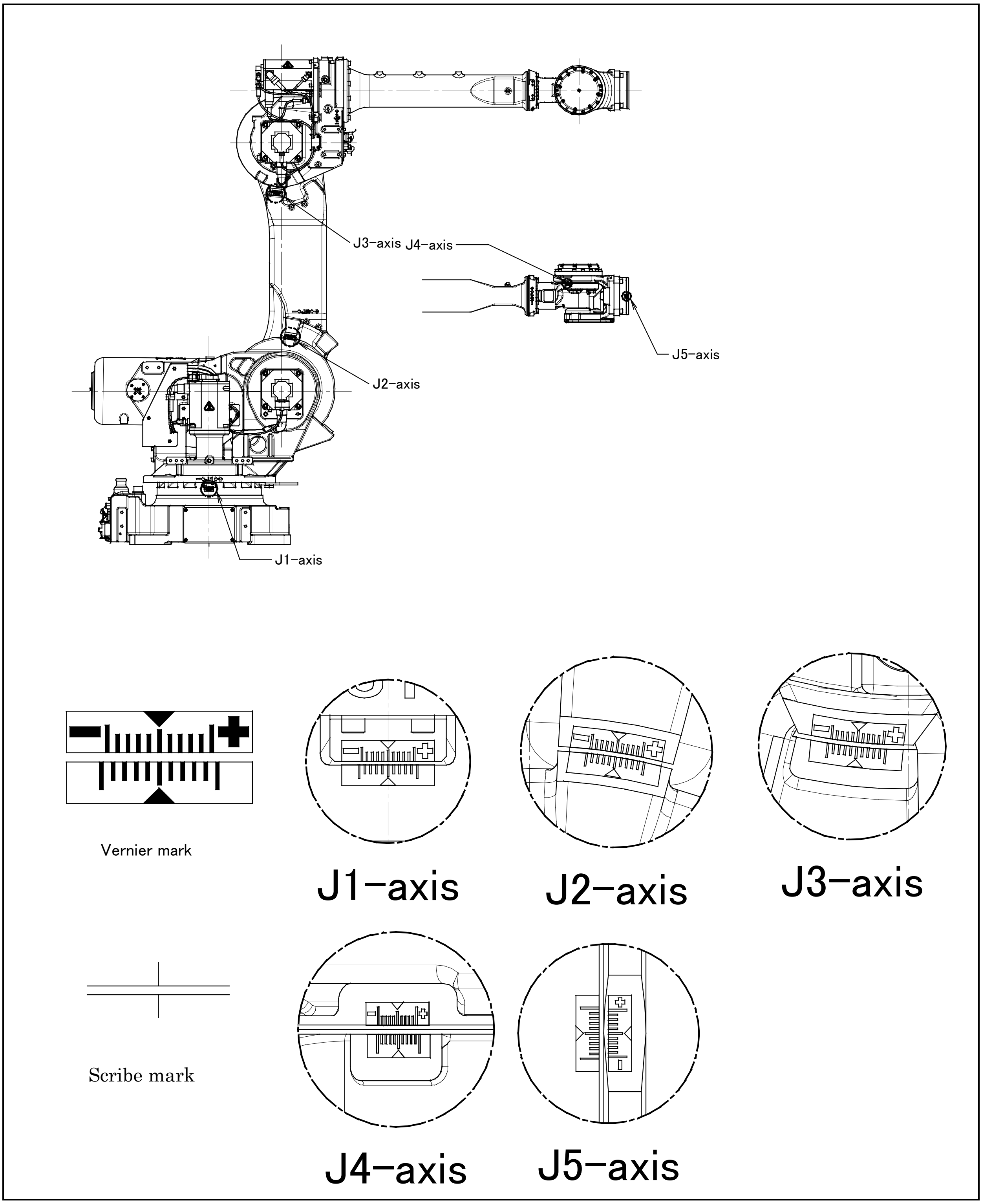


Fig. 8.3 (i) Zero-position mark (witness mark) for each axis (R-2000*i*B/100H)

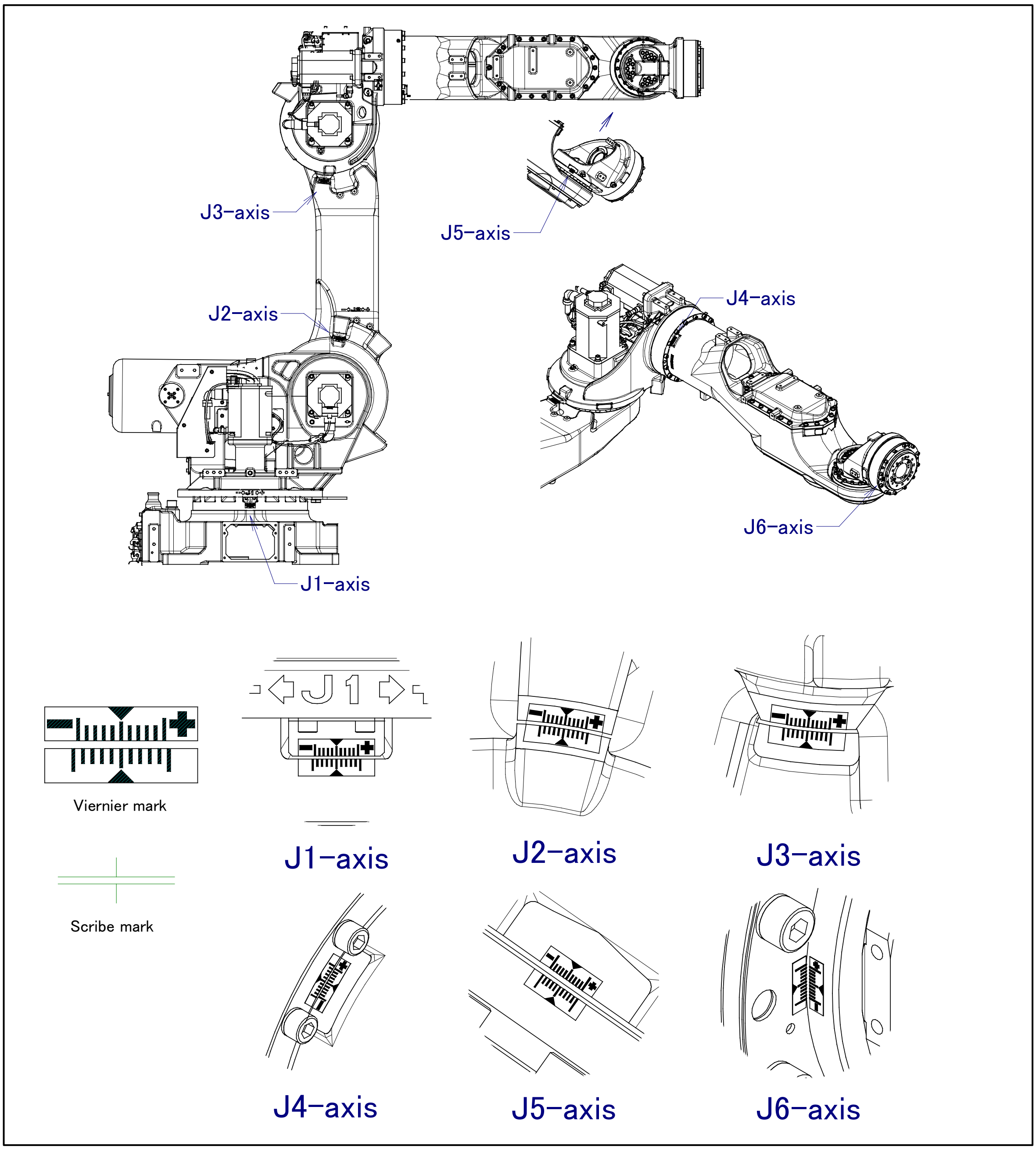


Fig. 8.3 (j) Zero-position mark (witness mark) for each axis (R-2000*i*B/210FS/220US)

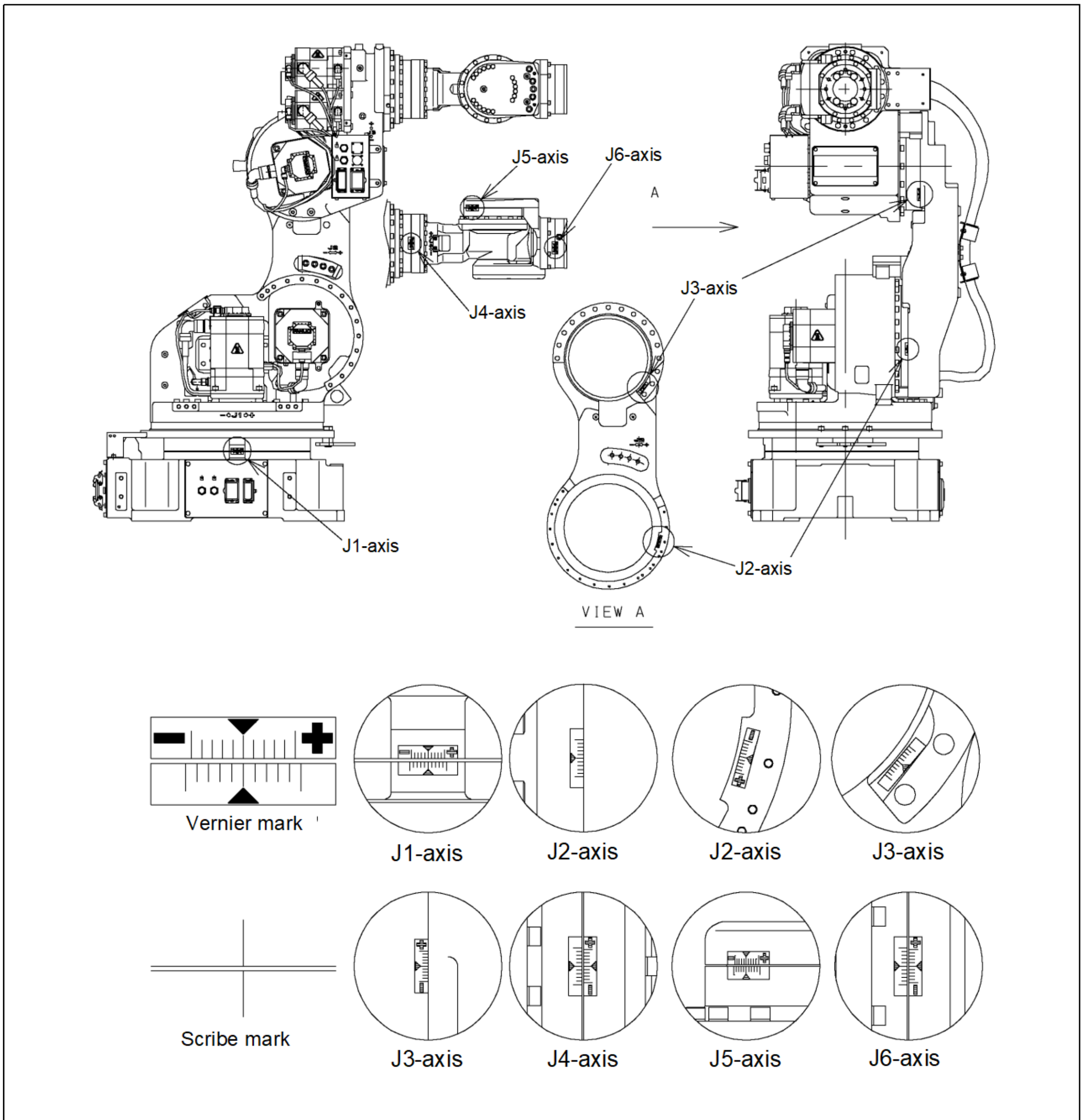


Fig. 8.3 (k) Zero-position mark (witness mark) for each axis (R-2000*i*B/165CF)

8.4 QUICK MASTERING

Quick mastering is performed at a user-specified position for each axis. The pulse count value is obtained from the rotation times of the Pulsecoder connected to the corresponding motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost.

Quick mastering is factory-performed at the position indicated in Table 8.3 (a). If possible, do not change the setting.

If setting the robot at the position mentioned above is impossible, you must re-set the quick mastering reference position using the following method. (It would be convenient to put a mark that can work in place of the witness mark.)

> ⚠ **CAUTION**
> 1 Quick mastering can be used, if the pulse count value is lost, for example, because a low voltage has been detected on the backup battery for the pulse counter.
> 2 Quick mastering cannot be used, after the Pulsecoder is replaced or after the mastering data is lost from the robot controller.

Procedure for Recording the Quick Mastering Reference Position

1 Press the [MENU] key to display the screen menu.
2 Select [0 NEXT] and press [6 SYSTEM].
3 Press F1 [TYPE]. Then select [Variables] from the menu.
4 If $DMR_GRP [group].$GRAV_MAST=1, set the gravity compensation to enabled, if it is 0, set the gravity compensation to disabled. In addition release the brake control.

> **NOTE**
> Gravity compensation can be set to enabled/disabled by setting the system variables as follows:
> $PARAM_GROUP[group].$SV_DMY_LNK[8] : FALSE(disabled) or TRUE (enabled)
> Brake control can be released by setting the system variables as follows:
> $PARAM_GROUP.SV_OFF_ALL : FALSE (for all axes)
> $PARAM_GROUP.SV_OFF_ENB[*] : FALSE
> After changing the system variables, cycle power of the controller.
> (Mastering can be performed without setting of gravity compensation. However, it will affect precision.)

5 Select [6 SYSTEM].
6 Select [Master/Cal]. The positioning screen will be displayed.

```
SYSTEM Master/Cal          AUTO    JOINT 10 %
                                 TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
     Press 'ENTER' or number key to select.

 [ TYPE ]    LOAD    RES_PCA                DONE
```

7 Jog the robot to the quick mastering reference position.
8 Select [6 SET QUICK MASTER REF] and press F4 [YES]. Quick mastering reference position is saved.

```
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE

 [ TYPE ]                    YES     NO
```

F4

9 Return the setting of the gravity compensation.
10 Return brake control to the original setting, and cycle power of the controller.

> ⚠ **CAUTION**
> If the robot has lost mastering data due to mechanical disassembly or repair, you cannot perform this procedure. In this case, perform Fixture position mastering or Zero position mastering to restore mastering data.

Procedure of Quick Mastering

1 Press the [MENU] key to display the screen menu.
2 Select [0 NEXT] and press [6 SYSTEM].
3 Press F1 [TYPE]. Then select [Variables] from the menu.
4 If $DMR_GRP [group].$GRAV_MAST=1, set the gravity compensation to enabled, if it is 0, set the gravity compensation to disabled. In addition release the brake control.

> **NOTE**
> Gravity compensation can be set to enabled/disabled by setting the system variables as follows:
> $PARAM_GROUP[group].$SV_DMY_LNK[8] : FALSE(disabled) or TRUE (enabled)
> Brake control can be released by setting the system variables as follows:
> $PARAM_GROUP.SV_OFF_ALL : FALSE (for all axes)
> $PARAM_GROUP.SV_OFF_ENB[*] : FALSE
> After changing the system variables, cycle power of the controller.
> (Mastering can be performed without setting of gravity compensation. However, it will affect precision.)

5 Display the Master/Cal screen.

```
SYSTEM Master/Cal          AUTO    JOINT 10 %
                           TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
   Robot Not Mastered!

Quick master? [NO]
```

6 Jog the robot to the quick mastering reference position.
7 Move the cursor to [3 QUICK MASTER] and press the [ENTER] key. Press F4 [YES]. Quick mastering data is saved.

```
2 ZERO POSITION MASTER
3 QUICK MASTER
4 QUICK MASTER FOR SINGLE AXIS
```

F4

8 Select [7 CALIBRATE] and press the [ENTER] key. Calibration is executed. Calibration is executed by cycling power.
9 After completing the calibration, press F5 [DONE].

DONE

F5

10 Return the setting of the gravity compensation.
11 Return brake control to the original setting, and cycle power of the controller.

8.5 QUICK MASTERING FOR SINGLE AXIS

Quick mastering for a single axis is performed at a user-specified position for one axis. The pulse count value is obtained from the rotation times of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost.

Quick mastering is factory-performed at the position indicated in Table 8.3. If possible, do not change the setting.

If setting the robot at the position mentioned above is impossible, you must re-set the quick mastering reference position using the following method. (It would be convenient to set up a marker that can work in place of the witness mark.)

> ⚠ **CAUTION**
> 1 Quick mastering can be used, if the pulse count value is lost, for example, because a low voltage has been detected on the backup battery for the pulse counter.
> 2 Quick mastering cannot be used, after the Pulsecoder is replaced or after the mastering data is lost from the robot controller.

Procedure for Recording the Quick Mastering Reference Position

1 Press the [MENU] key to display the screen menu.
2 Select [0 NEXT] and press [6 SYSTEM].
3 Press F1 [TYPE]. Then select [Variables] from the menu.
4 If $DMR_GRP [group].$GRAV_MAST=1, set the gravity compensation to enabled, if it is 0, set the gravity compensation to disabled. In addition release the brake control.

> **NOTE**
> Gravity compensation can be set to enabled/disabled by setting the system variables as follows:
> $PARAM_GROUP[group].$SV_DMY_LNK[8] : FALSE(disabled) or TRUE (enabled)
> Brake control can be released by setting the system variables as follows:
> $PARAM_GROUP.SV_OFF_ALL : FALSE (for all axes)
> $PARAM_GROUP.SV_OFF_ENB[*] : FALSE
> After changing the system variables, cycle power of the controller.
> (Mastering can be performed without setting of gravity compensation. However, it will affect precision.)

5 Select [6 SYSTEM].
6 Select [Master/Cal]. The positioning screen will be displayed.

```
SYSTEM Master/Cal          AUTO    JOINT 10 %
                                   TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA              DONE
```

7 Jog the robot to the quick mastering reference position.
8 Select [6 SET QUICK MASTER REF] and press F4 [YES]. Quick mastering reference position is saved.

```
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE

 [ TYPE ]                 YES    NO
                           F4
```

9 Return the setting of the gravity compensation.
10 Return brake control to the original setting, and cycle power of the controller.

> ⚠ **CAUTION**
> If the robot has lost mastering data due to mechanical disassembly or repair, you cannot perform this procedure. In this case, perform Fixture position mastering or Zero position mastering to restore mastering data.

Procedure of Quick Mastering for single axis

1 Press the [MENU] key to display the screen menu.
2 Select [0 NEXT] and press [6 SYSTEM].
3 Press F1 [TYPE]. Then select [Variables] from the menu.
4 If $DMR_GRP [group].$GRAV_MAST=1, set the gravity compensation to enabled, if it is 0, set the gravity compensation to disabled. In addition release the brake control.

> **NOTE**
> Gravity compensation can be set to enabled/disabled by setting the system variables as follows:
> $PARAM_GROUP[group].$SV_DMY_LNK[8] : FALSE(disabled) or TRUE (enabled)
> Brake control can be released by setting the system variables as follows:
> $PARAM_GROUP.SV_OFF_ALL : FALSE (for all axes)
> $PARAM_GROUP.SV_OFF_ENB[*] : FALSE
> After changing the system variables, cycle power of the controller.
> (Mastering can be performed without setting of gravity compensation. However, it will affect precision.)

5 Display the Master/Cal screen.

```
SYSTEM Master/Cal          AUTO    JOINT 10 %
                            TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA            DONE
```

6 Select [4 QUICK MASTER FOR SINGLE AXIS]. You will see the quick master for single axis screen.

```
                              AUTO JOINT 1%
QUICK MASTER FOR SINGLE AXIS
                                              1/9
    ACTUAL   POS    (MSTR POS)    (SEL)    [ST]
J1          0.000   (      0.000)   (0)      [2]
J2          0.000   (      0.000)   (0)      [2]
J3          0.000   (      0.000)   (0)      [2]
J4          0.000   (      0.000)   (0)      [2]
J5          0.000   (      0.000)   (0)      [2]
J6          0.000   (      0.000)   (0)      [0]
E1          0.000   (      0.000)   (0)      [0]
E2          0.000   (      0.000)   (0)      [0]
E3          0.000   (      0.000)   (0)      [0]

                                            EXEC
```

7 Move the cursor to the (SEL] column for the unmastered axis and press the numeric key [1]. Setting of (SEL] is available for one or more axes.

```
                                 AUTO JOIN 1%
QUICK MASTER FOR SINGLE AXIS
                                              1/9
    ACTUAL   POS    (MSTR POS)    (SEL)    [ST]
J5          0.000   (      0.000)   (1)      [2]
J6          0.000   (      0.000)   (1)      [2]

                                           EXEC
```

8 Jog the robot to the quick mastering reference position.
9 Press F5 [EXEC]. Mastering is performed. So, (SEL] is reset to 0, and [ST] is re-set to 2.
10 Select [7 CALIBRATE] and press F4 [YES]. Calibration is executed. Calibration is executed by cycling power.
11 After completing the calibration, press F5 [DONE].

DONE

F5

12 Return the setting of the gravity compensation.
13 Return brake control to the original setting, and cycle power of the controller.

8.6 SINGLE AXIS MASTERING

Single axis mastering is performed for one axis at a time. The mastering position for each axis can be specified by the user.
Single axis mastering can be used, if mastering data for a specific axis is lost, for example, because a low voltage has been detected on the pulse counter backup battery or because the Pulsecoder has been replaced.

```
SINGLE AXIS MASTER            AUTO    JOINT 10%
                                          1/9
   ACTUAL   POS    (MSTR POS)    (SEL)    [ST]
J1          0.000    (      0.000)   (0)      [2]
J2          0.000    (      0.000)   (0)      [2]
J3          0.000    (      0.000)   (0)      [2]
J4          0.000    (      0.000)   (0)      [2]
J5          0.000    (      0.000)   (0)      [2]
J6          0.000    (      0.000)   (0)      [0]
E1          0.000    (      0.000)   (0)      [0]
E2          0.000    (      0.000)   (0)      [0]
E3          0.000    (      0.000)   (0)      [0]

                                          EXEC
```

Table 8.6 (a) Items set in single axis mastering

Item	Description
Current position (ACTUAL AXIS)	The current position of the robot is displayed for each axis in degree units.
Mastering position (MSTR POS)	A mastering position is specified for an axis to be subjected to single axis mastering. It would be convenient to set to it to the 0 degree position.
SEL	This item is set to 1 for an axis to be subjected to single axis mastering. Usually, it is 0.
ST	This item indicates whether single axis mastering has been completed for the corresponding axis. It cannot be changed directly by the user. The value of the item is reflected in $EACHMST_DON (1 to 9). 0 : Mastering data has been lost. Single axis mastering is necessary. 1 : Mastering data has been lost. (Mastering has been performed only for the other interactive axes.) Single axis mastering is necessary. 2 : Mastering has been completed.

Single axis mastering for interaction axis

When single axis mastering is done in interaction axis, the axis of the interaction pair is also influenced. Therefore, mastering of these interaction axes must be done at the same time. Interaction axis depends on the robot model. Following table shows the relation between robot model and interaction axis. For example, when robot model is R-2000*i*B/165F and J4 motor is changed, mastering of J5 and J6 should be done at the same time with J4. (Provided that if 7DC2 (V8.20P)/14 or later software version is installed, axis numbers which should be selected to do single axis mastering at the same time are displayed if these are not selected. In this case, it is unnecessary to refer to a following table.)

Table 8.6 (b) Relation between robot model and interaction axis

Robot model		Interaction axis
R-2000*i*B	/100P/125L/150U/165CF/165F/165R /170CF/175L/185L/200R/210F/210F220U/250F	・ J2/J3 ・ J4/J5/J6
	/100H	・ J2/J3 ・ J4/J5
	/210FS/220US	・ J2/J3 ・ J5/J6

Procedure of Single axis mastering

1 Press the [MENU] key to display the screen menu.
2 Select [0 NEXT] and press [6 SYSTEM].
3 Press F1 [TYPE]. Then select [Variables] from the menu.
4 If $DMR_GRP [group].$GRAV_MAST=1, set the gravity compensation to enabled, if it is 0, set the gravity compensation to disabled. In addition release the brake control.

> **NOTE**
> Gravity compensation can be set to enabled/disabled by setting the system variables as follows:
> $PARAM_GROUP[group].$SV_DMY_LNK[8] : FALSE(disabled) or TRUE (enabled)
> Brake control can be released by setting the system variables as follows:
> $PARAM_GROUP.SV_OFF_ALL : FALSE (for all axes)
> $PARAM_GROUP.SV_OFF_ENB[*] : FALSE
> After changing the system variables, cycle power of the controller.
> (Mastering can be performed without setting of gravity compensation. However, it will affect precision.)

5 Select [6 SYSTEM].
6 Select [Master/Cal]. The positioning screen will be displayed.

```
SYSTEM Master/Cal          AUTO    JOINT 10 %
                           TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA            DONE
```

7 Select [5 SINGLE AXIS MASTER]. The following screen will be displayed.

```
SINGLE AXIS MASTER              AUTO    JOINT 10%
                                              1/9
    ACTUAL   POS    (MSTR POS)    (SEL)    [ST]
J1         0.000    (     0.000)   (0)      [2]
J2         0.000    (     0.000)   (0)      [2]
J3         0.000    (     0.000)   (0)      [2]
J4         0.000    (     0.000)   (0)      [2]
J5         0.000    (     0.000)   (0)      [2]
J6         0.000    (     0.000)   (0)      [0]
E1         0.000    (     0.000)   (0)      [0]
E2         0.000    (     0.000)   (0)      [0]
E3         0.000    (     0.000)   (0)      [0]

                                            EXEC
```

8 Move the cursor to the [SEL] column for the unmastered axis and press the numeric key [1]. Setting of [SEL] is available for one or more axes.
9 Turn off brake control, then jog the robot to the mastering position.
10 Enter axis data for the mastering position.

11 Press F5 [EXEC]. Mastering is performed. So, [SEL] is reset to 0, and [ST] is re-set to 2 or 1.

```
SINGLE AXIS MASTER            AUTO     JOINT 10%
                                            6/9
     ACTUAL   POS      (MSTR POS)     (SEL)    [ST]
J1            0.000     (       0.000)    (0)      [2]
J2            0.000     (       0.000)    (0)      [2]
J3            0.000     (       0.000)    (0)      [2]
J4            0.000     (       0.000)    (0)      [2]
J5            0.000     (       0.000)    (0)      [2]
J6           90.000     (       0.000)    (1)      [0]
E1            0.000     (       0.000)    (0)      [0]
E2            0.000     (       0.000)    (0)      [0]
E3            0.000     (       0.000)    (0)      [0]

                                                   EXEC
```

12 When single axis mastering is completed, press the [PREV] key to resume the previous screen.

```
SYSTEM Master/Cal        AUTO    JOINT 10 %
                          TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA              DONE
```

13 Select [7 CALIBRATE], then press F4 [YES]. Positioning is performed. Alternatively, turn off the controller power and on again. Positioning is performed.

14 After positioning is completed, press F5 [DONE].

```
                 DONE
                  F5
```

15 Return the setting of the gravity compensation.

16 Return brake control to the original setting, and cycle power of the controller.

8.7 MASTERING DATA ENTRY

This function enables mastering data values to be assigned directly to a system variable. It can be used if mastering data has been lost but the pulse count is preserved.

Mastering data entry method

1 Press the [MENU] key, then press [0 NEXT] and select [6 SYSTEM].
2 Press F1 [TYPE]. Select [Variables]. The system variable screen appears.

```
SYSTEM Variables                 AUTO    JOINT 10%
                                             1/669
   1  $AAVM_GRP           AAVM_GRP_T
   2  $AAVM_WRK           AAVM_WRK_T
   3  $ABSPOS_GRP         ABSPOS_GRP_T
   4  $ACC_MAXLMT         0
   5  $ACC_MINLMT         0
   6  $ACC_PRE_EXE        0

     [ TYPE ]   DETAIL
```

3 Change the mastering data.
The mastering data is saved to the $DMR_GRP.$MASTER_COUN system variable.

```
SYSTEM Variables                 AUTO    JOINT 10%
                                             1/669
     135  $DMR_GRP          DMR_GRP_T
     136  $DMSW_CFG         DMSW_CFG_T

     [ TYPE ]
```

4 Select $DMR_GRP.

```
SYSTEM Variables                 AUTO    JOINT 10%
   $DMR_GRP                                    1/1
      1       [1]           DMR_GRP_T

     [ TYPE ]   DETAIL
```

```
SYSTEM Variables                 AUTO    JOINT 10%
   $DMR_GRP                                   1/29
      1  $MASTER_DONE       FALSE
      2  $OT_MINUS          [9] of BOOLEAN
      3  $OT_PLUS           [9] of BOOLEAN
      4  $NASTER_COUN       [9] of INTEGER
      5  $REF_DONE          FALSE
      6  $REF_POS           [9] of REAL

     [ TYPE ]                  TRUE      FALSE
```

5 Select $MASTER_COUN, and enter the mastering data you have recorded.

```
SYSTEM Variables                    AUTO     JOINT 10%
   $DMR_GRP[1].$MASTER_COUN               1/9
     1       [1]              95678329
     2       [2]              10223045
     3       [3]              3020442
     4       [4]              30405503
     5       [5]              20497709
     6       [6]              2039490
     7       [7]              0
     8       [8]              0
     9       [9]              0

       [ TYPE ]
```

6 Press the [PREV] key.
7 Set $MASTER_DONE to TRUE.

```
SYSTEM Variables                    AUTO     JOINT 10%
   $DMR_GRP                                1/29
     1  $MASTER_DONE         TRUE
     2  $OT_MINUS            [9] of BOOLEAN

       [ TYPE ]              TRUE      FALSE
```

8 Display the positioning screen, and select [6 CALIBRATE], then press F4 [YES].
9 After completing positioning, press F5 [DONE].

```
                DONE
          F5
```

8.8 VISION AXIS MASTERING (OPTION)

Single axis mastering can be performed with higher precision by using vision axis master. Target mark have cover plate as Fig. 8.8 (a), (b). Refer to Fig. 8.8 (c), (d) about target jig. Refer to VISION AXIS MASTER chapter of *i*RCalibration OPERATOR’S MANUAL (B-83724EN) about detail of vision axis master.
Refer to Table 8.8 about measurement position.

Table 8.8 (a) Measurement position for Vision Axis Mastering

Measured axis	posture					
	J1-axis	J2-axis	J3-axis	J4-axis	J5-axis	J6-axis
J1-axis	0°	Arbitrary				
J2-axis	Arbitrary	0°				
J3-axis	Arbitrary	0°				
J4-axis	Arbitrary		0°			
J5-axis	Arbitrary		0°			
J6-axis	Arbitrary		0°			

Reference data setting function is executed in the FANUC robot factory before shipping the robots.
There is not tool attached. However, the weight of a tool can cause an error in the reference data.
After a tool is attached, the reference data setting function should be performed and saved again.
In that case, perform single axis mastering at the same payload condition and measurement posture with resetting.

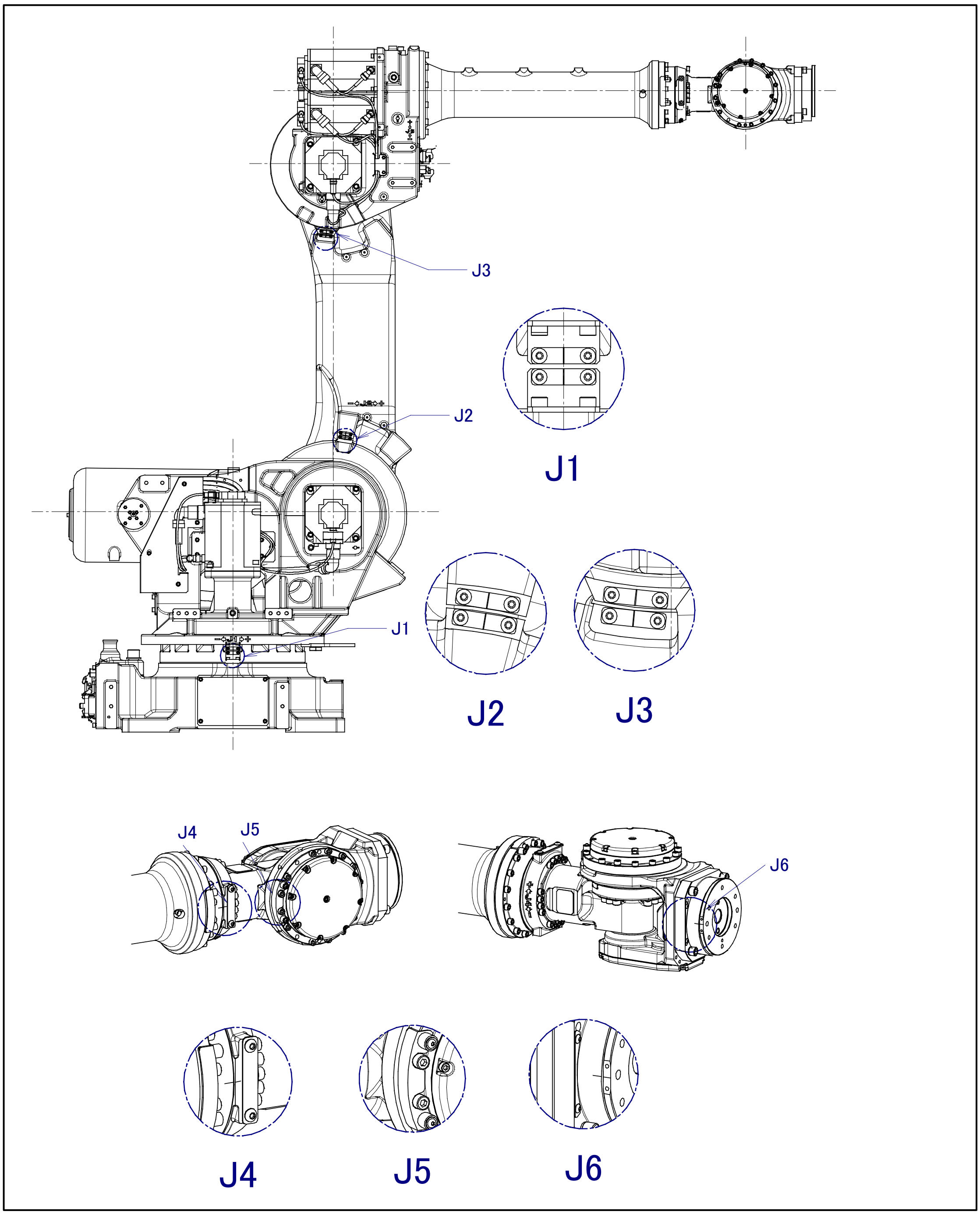


Fig. 8.8 (a) Target mark cover plate (R-2000*i*B/165F/165R/125L)

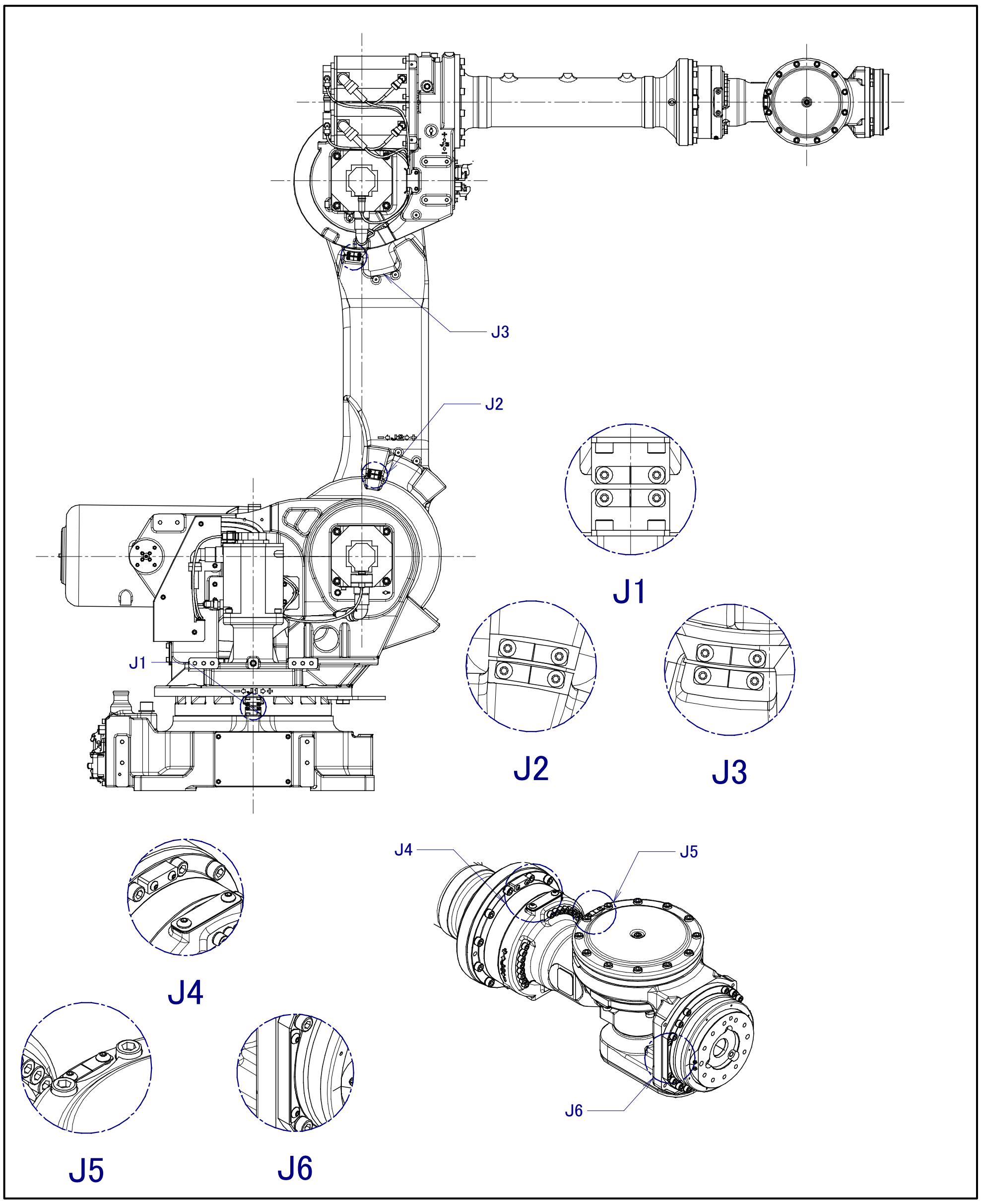


Fig. 8.8 (b) Target mark cover plate (R-2000*i*B/210F/185L/250F/200R/100P/175L/220U)

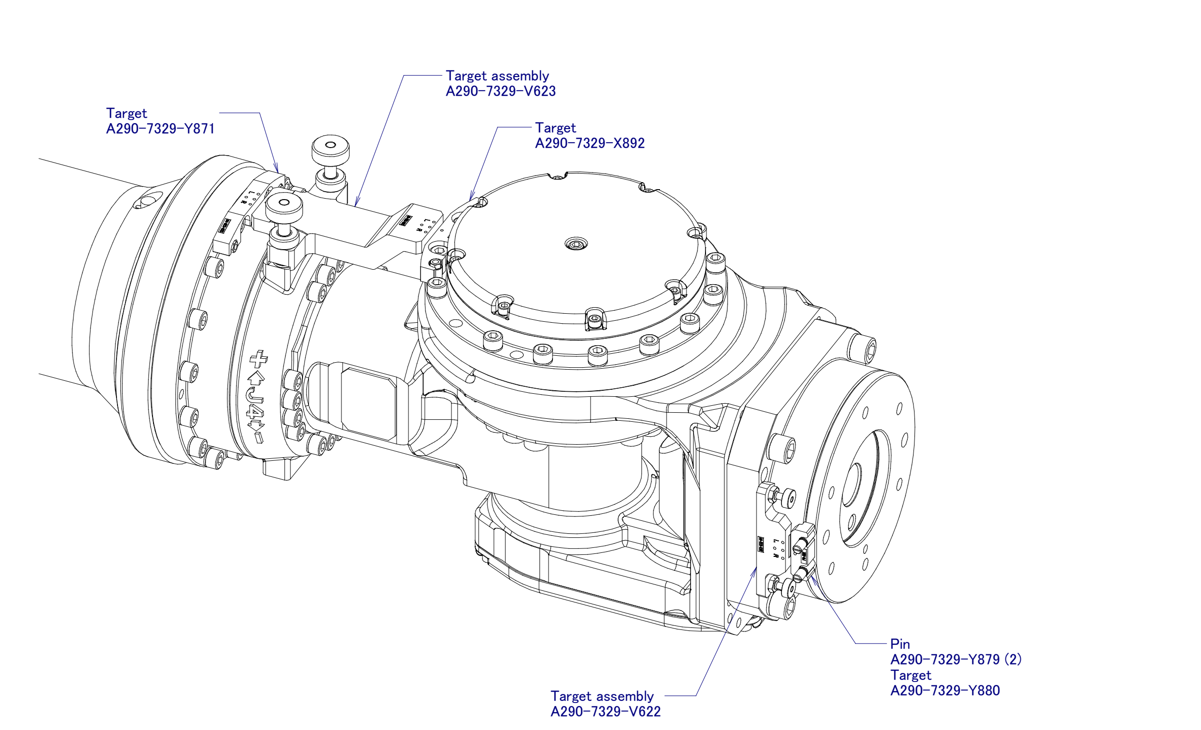


Fig. 8.8 (c) Target jig (R-2000*i*B/165F/165R/125L)

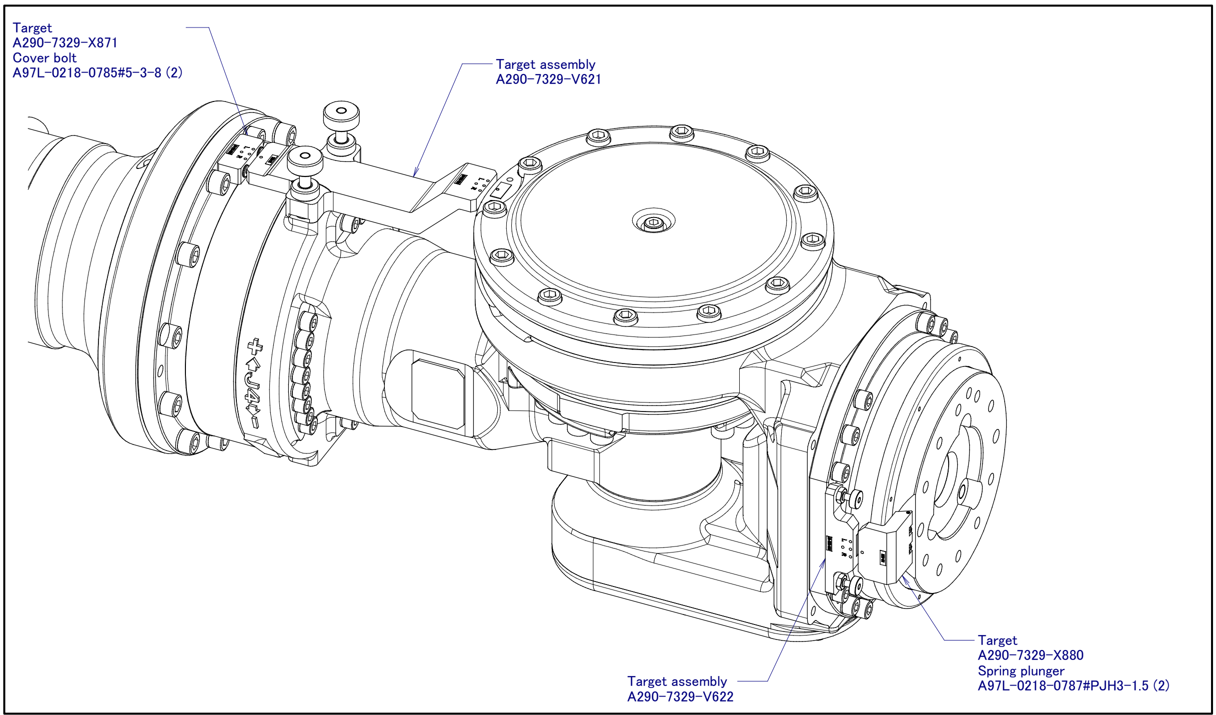


Fig. 8.8 (d) Target jig (R-2000*i*B/210F/185L/250F/200R/100P/175L/220U)

8.9 VERIFYING MASTERING

1 How to verify that the robot is mastered properly:
Usually, positioning is performed automatically when the power is turned on. To check whether mastering has been performed correctly, examine if the current displayed position meets the actual robot position by using the procedure described below:

(1) Reproduce a particular point in a program. Check whether the point agrees with the specified position.

(2) Set all axes of the robot to their 0-degree (0 rad) positions. Check that the zero-degree position marks indicated in Section 8.3 of OPERATOR'S MANUAL are aligned. There is no need to use a visual aid.
If the displayed and actual positions do not match, the counter value for a Pulsecoder may have been invalidated as a result of an alarm described in 2. Alternatively, the mastering data in system variable $DMR_GRP.$MASTER_COUN may have been overwritten as a result of an operation error or some other reason.
Compare the data with the values indicated on the supplied data sheet. This system variable is overwritten whenever mastering is performed. Whenever mastering is performed, record the value of the system variable on the data sheet.

2 Alarm type displayed during mastering and their solution method:

(1) BZAL alarm
This alarm is displayed if the Pulsecoder's backup battery voltage decreases to 0 V while the power to the controller is disconnected. Furthermore, if the Pulsecoder connector is removed for cable replacement, etc. this alarm is displayed as the voltage decreases to 0. Confirm if the alarm will disappear by performing a pulse reset (See Section 8.2.). Then, cycle power of the controller to check if the alarm disappears or not.
The battery may be drained if the alarm is still displayed. Perform a pulse reset, and turn off and on the controller power after replacing the battery. Note that, if this alarm is displayed, all the original data held by the Pulsecoder will be lost. Mastering is required.

(2) BLAL alarm
This alarm is displayed if the voltage of the Pulsecoder's backup battery has fallen to a level where backup is no longer possible. If this alarm is displayed, replace the battery with a new one immediately while keeping the power turned on. Check whether the current position data is valid, using the procedure described in 1.

(3) Alarm notification like CKAL, RCAL, PHAL, CSAL, DTERR, CRCERR, STBERR, and SPHAL may have trouble with Pulsecoder, contact your local FANUC representative.

9 TROUBLESHOOTING

The source of mechanical unit problems may be difficult to locate because of overlapping causes. Problems may become further complicated, if they are not corrected properly. Therefore, you must keep an accurate record of problems and take proper corrective actions.

9.1 TROUBLESHOOTING

Table 9.1 (a) shows the problems that may occur in the mechanical unit and their probable causes. If you cannot pinpoint the cause of a failure or which measures to take, contact your local FANUC representative. For troubleshooting except the mechanical unit, refer to “CONTROLLER MAINTENANCE MANUAL (B-83195EN etc.)” and Alarm Code List (B-83284EN-1).

Table 9.1 (a) Troubleshooting

Symptoms	Descriptions	Causes	Measures
Vibration Noise	- As the robot operates, its base plate lifts off the floor plate. - There is a gap between the base plate and the floor plate. - There is a crack in the weld that fastens the base plate to the floor plate.	[Base plate and floor plate fastening] - It is likely that the base plate is not securely fastened to the floor plate because of poor welding. - If the base plate is not securely fastened to the floor plate, it lifts as the robot operates, allowing the base and floor plates to strike each other which, in turn, leads to vibration.	- Re-weld the base plate to the floor plate. - If the weld is not strong enough, increase its width and length.
	- The J1 base lifts off the base plate as the robot operates. - There is a gap between the J1 base and base plate. - A J1 base retaining bolt is loose.	[J1 base fastening] - It is likely that the robot J1 base is not securely fastened to the base plate. - Probable causes are a loose bolt, an insufficient degree of surface flatness, or contamination caught between the base plate and floor plate. - If the robot is not securely fastened to the floor plate, the J1 base lift from the ground. Thus may cause the collision, and lead to vibration.	- If a bolt is loose, apply LOCTITE and tighten it to the appropriate torque. - Adjust the base plate surface flatness to within the specified tolerance. - If there is any contamination between the J1 base and base plate, eliminate them. - Apply adhesive between the J1 base and base plate.
	- The rack or floor plate vibrates during operation of the robot.	[Rack or floor] - It is likely that the rack or floor is not rigid enough. - If they are not rigid enough, counterforce deforms the rack or floor, and is responsible for the vibration.	- Reinforce the rack or floor to make it more rigid. - If reinforcing the rack or floor is impossible, modify the robot control program; doing so might reduce the vibration.

Symptoms	Descriptions	Causes	Measures
Vibration Noise (Continued)	- Vibration becomes more serious when the robot is in a specific posture. - If the operating speed of the robot is reduced, vibration stops. - Vibration is most noticeable when the robot is accelerating. - Vibration occurs when two or more axes operate at the same time.	[Overload] - It is likely that the load on the robot is heavier than the maximum rating. - It is likely that the robot control program is too demanding for the robot hardware. - It is likely that the ACCELERATION value is excessive.	- Check the maximum load that the robot can handle or not. If the robot is overloaded, reduce the load, or modify the robot control program. - Vibration in a specific portion can be reduced by modifying the robot control program while slowing the robot and reducing its acceleration (to minimize the influence on the entire cycle time).
	- Vibration or noise was first noticed after the robot collided with an object or the robot was overloaded for a long period. - The grease of the vibrating or noise occurring axis has not been replaced for a long period. - Cyclic vibration and noise occurs.	Broken gear, bearing, or reducer] - It is likely that the collision or overload applied an excessive force on the drive mechanism, thus damaging the geartooth surface or rolling surface of a bearing, or reducer. - It is likely that prolonged use of the robot while overloaded caused fretting of the gear tooth surface or rolling surface of a bearing, or reducer due to resulting metal fatigue. - It is likely that contamination which was caught in a gear, bearing, or within a reducer caused damage on the gear tooth surface or rolling surface of the bearing, or reducer. - It is likely that contamination which was caught in a gear, bearing, or within a reducer cause vibration. - It is likely that, because the grease has not been replenished for a long period, fretting occurred on the gear tooth surface or rolling surface of a bearing, or reducer due to metal fatigue.	- Operate each axis at individually to judge which axis has been vibrating. - Remove the motor, and replace the gear, the bearing, and the reducer. For the specification of parts and the procedure of replacement, contact your local FANUC representative. - Using the robot within its maximum rating prevents problems with the drive mechanism. - Specific type and period of grease change will prevent troubles.

Symptoms	Descriptions	Causes	Measures
Vibration Noise (Continued)	- The cause of problem cannot be identified from examination of the floor, rack, or mechanical unit.	[Controller, cable, and motor] - If a failure occurs in a controller circuit, preventing control commands from being supplied to the motor normally, or preventing motor information from being sent to the controller normally, vibration might occur. - Pulsecoder defect may be the cause of the vibration as the motor cannot propagate the accurate position to the controller. - If the motor becomes defective, vibration might occur because the motor cannot deliver its rated performance. - If a power line in a movable cable of the mechanical unit has an intermittent break, vibration might occur because the motor cannot accurately respond to commands. - If a Pulsecoder wire in a movable part of the mechanical unit has an intermittent break, vibration might occur because commands cannot be sent to the motor accurately. - If a robot connection cable has an intermittent break, vibration might occur. - If the power supply cable is about to be snapped, vibration might occur. - If the power source voltage drops below the rating, vibration might occur. - It may vibrate when an invalid value parameter was set.	- Refer to the Controller Maintenance Manual for troubleshooting related to the controller and amplifier. - Replace the motor of the axis that is vibrating, and check whether vibration still occurs. For the method of replacement, contact your local FANUC representative. - If vibration occurs only when the robot assumes a specific posture, it is likely that a cable in the mechanical unit is broken. - Shake the movable part cable while the robot is at rest, and check whether an alarm occurs. If an alarm or any other abnormal condition occurs, replace the mechanical unit cable. - Check whether the cable jacket of the robot connection cable is damaged. If so, replace the connection cable, and check whether vibration still occurs. - Check whether the power cable jacket is damaged. If so, replace the power cable, and check whether vibration still occurs. - Check that the robot is supplied with the rated voltage. - Check that the robot control parameter is set to a valid value. If it is set to an invalid value, correct it. Contact your local FANUC representative for further information if necessary.

Symptoms	Descriptions	Causes	Measures
Vibration Noise (Continued)	- There is some relationship between the vibration of the robot and the operation of a machine near the robot.	[Noise from Peripheral] - If the robot is not grounded properly, electrical noise is induced on the grounding wire, preventing commands from being transferred accurately, thus will lead to vibrate. - If the robot is grounded at an unsuitable point, its grounding potential becomes unstable, and noise is likely to be induced on the grounding line, thus will lead to vibrate.	- Connect the grounding wire firmly to ensure a reliable ground potential and prevent extraneous electrical noise.
	- There is an abnormal noise after replacing grease. - There is an abnormal noise after a long time. - There is an abnormal noise during operation at low speed.	- There may be an abnormal noise when using other than the specified grease. - Even for the specified grease, there may be an abnormal noise during operation at low speed immediately after replacement or after a long time.	- Use the specified grease. - When there is an abnormal noise even for specified grease, operate for one or two days on an experiment. Generally, an abnormal noise will disappear.
Rattling	- While the robot is not supplied with power, pushing it by hand wobbles part of the mechanical unit. - There is a gap on the mounting face of the mechanical unit.	[Mechanical unit mounting bolt] - It is likely that overloading or a collision has loosened a mounting bolt in the robot mechanical unit.	- Check the following retaining bolts tightness for each axis. If any of these bolts is loose, apply LOCTITE and bolt down with appropriate torque. - Motor retaining bolt - Reducer retaining bolt - Reducer shaft retaining bolt - Base retaining bolt - Arm retaining bolt - Casing retaining bolt - End effector retaining bolt

Symptoms	Descriptions	Causes	Measures
Motor overheating	- The motor overheated due to the temperature in the installation area rose. - After a cover was attached to the motor, the motor overheated. - After changing the Robot control program or the load, the motor overheat.	[Ambient temperature] - It is likely that the motor overheated along with the ambient temperature rose, and could not release heat. [Operating condition] - It is likely that the overcurrent above the specified permissive average current.	- Reducing the ambient temperature is the most effective means of preventing overheat. - Having the surroundings of the motor well ventilated enables the motor to release heat efficiently, thus preventing overheat. - If there is a source of heat near, it is advisable to install shielding to protect the motor from heat radiation. - Relaxing the robot control program and load condition is effective to reduce the average current. Thus, prevent overheat. - The teach pendant can monitor the average current. Check the average current when the robot control program launched.
	- After a robot control parameter (load setting etc.) was changed, the motor overheated.	[Parameter] - If data input for a workpiece is invalid, the robot cannot be accelerated or decelerated normally, so the average current increases, leading to overheat.	- As for load setting, Input an appropriate parameter referring to Section 4.4 of the operator’s manual.
	- Symptom other than stated above	[Mechanical unit problems] - It is likely that problems occurred in the mechanical unit drive mechanism, thus placing an excessive load on the motor. [Motor problems] - It is likely that motor brake failure locked on the break, and cause the motor overloaded. - It is likely that a failure of the motor prevented it from delivering its rated performance, thus causing an excessive current to flow into the motor. - It is likely that cooling fan is broken.	- Repair the mechanical unit referring to the above descriptions of vibration, noise, and rattling. - Check that, when the servo system is energized, the brake is released. If the brake remains applied to the motor all the time, replace the motor. - Judgment is possible if the average current decreased after replacing the motor, the former motor had been defected. - If the cooling fan is broken, replace it by new one.

Symptoms	Descriptions	Causes	Measures
Grease leakage	- Grease leaks from the mechanical unit.	[Poor sealing] - Probable causes are a crack in the casting, a damaged O-ring, a damaged oil seal, or a loose seal bolt. - The casting may crack with excessive force caused in collision. - An O-ring can be damaged if it is trapped or cut during disassembling or re-assembling. - An oil seal may be damaged if dust scratches the lip. - A loose seal bolt may allow grease to leak along the threads. - Problems with the grease nipple.	- If the casting cracks, sealant can be used as a quick-fix to prevent further grease leakage. However, the component must be replaced as soon as possible, as the crack will widen. - O-rings are used in the locations listed below. - Motor coupling section - Reducer (case and shaft) coupling section - Wrist coupling section - J3 arm coupling section - Inside the wrist - Oil seals are used in the locations stated below. - Inside the reducer - Inside the wrist - Seal bolts are used in the locations stated below. - Grease drain outlet - Replace the grease nipple.
Dropping axis	- An axis falls because the brake went out. - An axis falls in standstill.	[Brake drive relay and motor] - It is likely that brake drive relays are stuck to each other and keep the brake current flowing, thus preventing the brake from operating when the motor is reenergized. - It is likely that the brake shoe has worn out or the brake main body is damaged, preventing the brake from operating efficiently. - It is likely that oil or grease soak through the motor, causing the brake to slip.	- Check whether the brake drive relays stuck each other or not. If they are found to be stuck, replace the relay. - Replace the motor confirmed following symptoms. - Brake shoe is worn out - Brake main body is damaged - Oil soak through the motor

Symptoms	Descriptions	Causes	Measures
Displacement	- The robot operates at a point other than the taught position. - The repeatability is not within the tolerance.	[Mechanical unit problems] - If the repeatability is unstable, probable causes are a failure in the drive mechanism or a loose bolt, and so on. - If the repeatability is stable, it is likely that collision by an excessive load caused slip on the mounting face of each axis arm, and reducer. - It is likely that the Pulsecoder is abnormal.	- If the repeatability is unstable, repair the mechanical unit by referring to the above descriptions of vibration, noise, and rattling. - If the repeatability is stable, correct the taught program. Variation will not occur unless another collision occurs. - If the Pulsecoder is abnormal, replace the motor.
	- Displacement occurs only in a specific peripheral equipment.	[Peripheral equipment displacement] - It is likely that an external force was applied to the peripheral equipment, thus shifting its position relative to the robot.	- Correct the setting of the peripheral equipment position. - Correct the taught program.
	- Displacement occurred after a parameter was changed.	[Parameter] - It is likely that the mastering data was overwritten, and the origin had misaligned.	- Re-enter the previous optimal mastering data. - If optimal mastering data is unavailable, perform mastering again.

Symptoms	Descriptions	Causes	Measures
CLALM alarm occurred. Move error excess alarm occurred.	- Ambient temperature of the robot installation location is low, CLALM alarm is displayed on the teach pendant screen. - Ambient temperature of the robot installation position is low, "Move error excess" alarm is displayed on the teach pendant screen.	[Peripheral temperature] - When the robot is used in a low temperature environment that is near to 0ºC, or the robot is not operated for a long time in an environment that is less than 0ºC, there will be a large viscous resistance of the drive train immediately after starting which will cause the alarm.	- Perform a warm up operation or a low speed operation for several minutes.
	- After changing the motion program or the load condition, the CLALM alarm is displayed. - After changing the motion program or the load condition, the "Move error excess" alarm is displayed.	- It is likely that a robot collision occurred.	- If a robot collision has occurred, press the [RESET] key while pressing the [SHIFT] key. Then, jog the robot in the opposite direction while pressing the [SHIFT] key. - Check the motion program.
		[Overload] - It is likely that load exceeded the permissible value. - It is likely that the motion program is too severe for the robot. ・ Excessive motion due to a large "ACC (value)". ・ Tight motion such as reverse motion using "CNT". ・ Linear motion occurs near singularity point where axes revolve in high speed.	- Check the permissible value of the robot payload. If the load exceeds the permissible value, reduce the load or change the motion program. - Consider minimizing the cycle time by reducing the speed or acceleration, and changing the motion program. - Check that the load setting is performed correctly.
	- None of the symptoms stated above are the problem.	- It is likely the vibration occurred.	- Refer to the Symptoms: Vibration, Noise section of this troubleshooting for more information.
		- It is likely that rated voltage is not supplied due to the voltage drop.	- Check that the robot is supplied with the proper rated voltage.
		- Angle of robot mounting surface is not set correctly.	- According to Subsection 1.2.2, set the angle of robot mounting surface correctly.
BZAL alarm occurred	- BZAL is displayed on the teach pendant screen	- The voltage of the memory backup battery may be low. - The Pulsecoder cable may be broken.	- Replace the battery. - Replace the cable.

10 SEVERE DUST/LIQUID PROTECTION PACKAGE

10.1 SEVERE DUST/LIQUID PROTECTION PACKAGE(OPTION)

The package is intended to improve the Severe dust/Liquid protection characteristics of the robot so that it can be used in a severe environment.

NOTE
Contact your FANUC representative for confirmation that the Severe Dust/liquid protection package is suitable for your environment.

Model	Severe dust/liquid protection specification
R-2000*i*B/165F/125L	A05B-1329-J801
R-2000*i*B/210F/175L	A05B-1329-J802
R-2000*i*B/165R	A05B-1329-J803
R-2000*i*B/200R	A05B-1329-J804
R-2000*i*B/170CF	A05B-1329-J805
R-2000*i*B/185L/ 250F	A05B-1329-J806
R-2000*i*B/150U	A05B-1329-J807

10.2 CONFIGURATION OF THE SEVERE DUST/LIQUID PROTECTION PACKAGE

The following table lists the major differences between the R-2000*i*B standard specification and severe dust/liquid protection package.

	Standard specifications	Severe dust/liquid protection option	
	Entire mechanical unit	Main unit	J3 arm and wrist
Bolts	Black oxide finish steel bolt Black oxide finish washer	FR coating bolt Black chromate washer Stainless bolt Black oxide finish steel bolt	FR coating bolt Stainless bolt Black chromate washer
Covers		J1-axis motor cover J2-axis motor cover J3-axis motor covers (upper and lower) Battery box cover Cable cover in mechanical unit (for all exposed cables)	
J3 connector panel EE(RI/RO), I/O connectors	Non-waterproof connector	Waterproof connector	

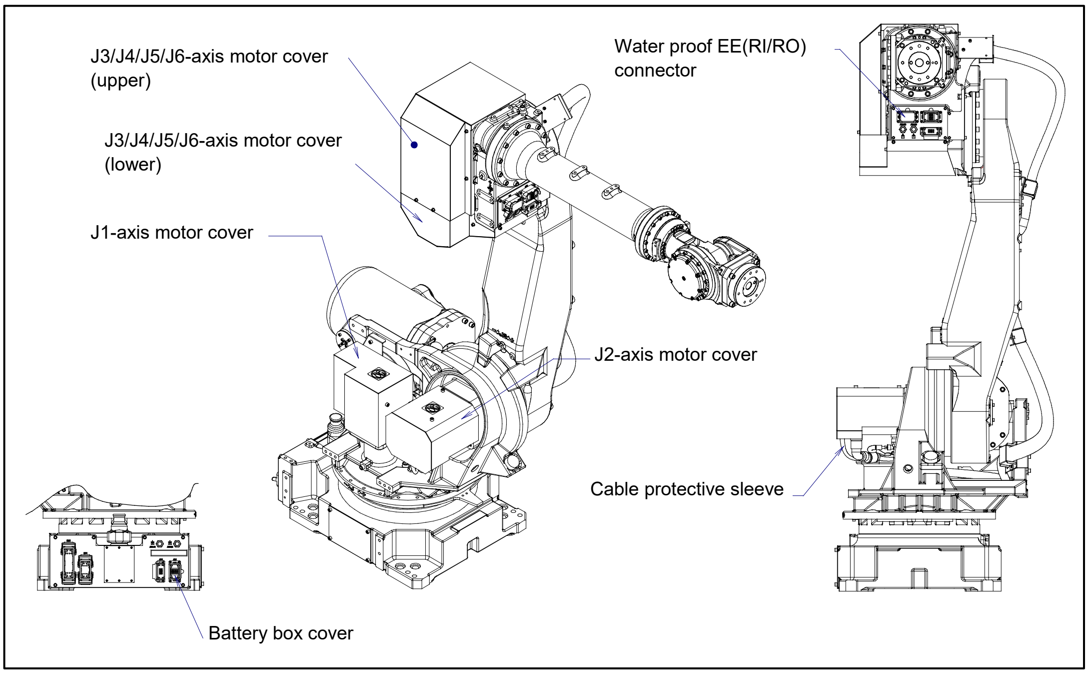


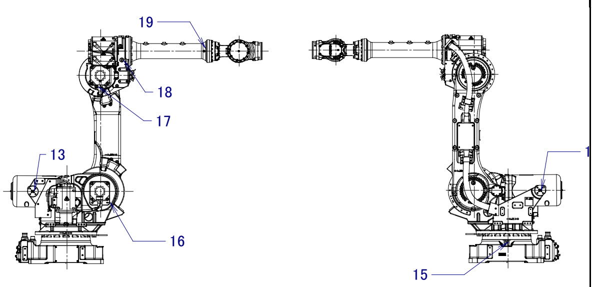
Fig. 10.2 (a) Configuration of the severe dust/liquid protection package

APPENDIX

A PERIODIC MAINTENANCE TABLE

FANUC Robot R-2000*i*B/165F/165R/125L/150U **Periodic Maintenance Table**

Items			Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the balancer and the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical unit cable (Damaged or twisted)	0.2H	–		○			○				○			
	6	Check the end effector (hand) cable	0.1H	–		○			○				○			
	7	Check the motor connector. (Loosening)	0.2H	–		○			○				○			
	8	Tighten the end effector bolt	0.2H	–		○			○				○			
	9	Tighten the cover and main bolt	2.0H	–		○			○				○			
	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
	11	Clean spatters, sawdust and dust	1.0H	–		○			○				○			
	12	Check the fan (option)	0.1H	–		○			○				○			
	13	Greasing to balancer bush *1	0.1H	10ml each					●				●			
	14	Replacing batteries *1 *3	0.1H	–							●					
	15	Replacing grease of J1-axis reducer *1	1.0H	5500ml												
	16	Replacing grease of J2-axis reducer *1	0.5H	3500ml												
	17	Replacing grease of J3-axis reducer *1	0.5H	2500ml												
	18	Replacing grease of J4-axis gearbox *1	0.5H	1900ml												
	19	Replacing grease of reducer (J5/J6-axis) for wrist axis *1	1.0H	3200ml												
	25	Replacing cable of mechanical unit *1	4.0H	–												
Controller	26	Cleaning the ventilator	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–		○			○				○			
	28	Replacing batteries *1 *3	0.1H	–												



Position of grease nipple

*1 For descriptions about the items marked with an asterisk (*), refer to this manual or "REPLACING UNITS Chapter of the following manuals.
R-30*i*A CONTROLLER MAINTENANCE MANUAL (Standard) (B-82595EN),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For Europe)(B-82595EN-1),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

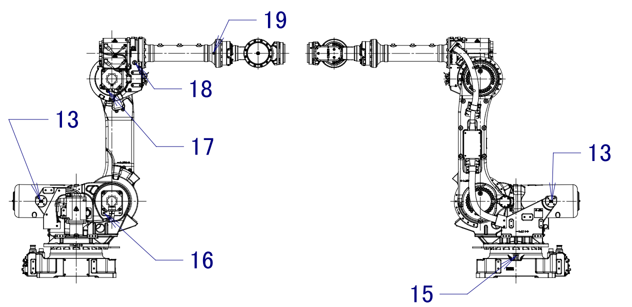
*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.
(NOTE) R-2000*i*B/150U has no balancer

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
○				○				○				○				○					12
●				●				●				●				●				Overhaul	13
●						●						●						●			14
●												●									15
●												●									16
●												●									17
●												●									18
●												●									19
				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/210F/185L/250F/200R/175L/220U **Periodic Maintenance Table**

Items		Accumulated operating time (H)	Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the balancer and the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical unit cable (Damaged or twisted)	0.2H	–		○			○				○			
	6	Check the end effector (hand) cable	0.1H	–		○			○				○			
	7	Check the motor connector. (Loosening)	0.2H	–		○			○				○			
	8	Tighten the end effector bolt	0.2H	–		○			○				○			
	9	Tighten the cover and main bolt	2.0H	–		○			○				○			
	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
	11	Clean spatters, sawdust and dust	1.0H	–		○			○				○			
	12	Check the fan (option)	0.1H	–		○			○				○			
	13	Greasing to balancer bush *1	0.1H	10cml each					●				●			
	14	Replacing batteries *1	0.1H	–							●					
	15	Replacing grease of J1-axis reducer *1	1.0H	5500ml												
	16	Replacing grease of J2-axis reducer *1	0.5H	3500ml												
	17	Replacing grease of J3-axis reducer *1	0.5H	2640ml												
	18	Replacing grease of J4-axis gearbox *1	0.5H	1900ml												
	19	Replacing grease of reducer (J5/J6-axis) for wrist axis *1	1.0H	4900ml												
	25	Replacing cable of mechanical unit *1	4.0H	–												
Controller	26	Cleaning the ventilator	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–		○			○				○			
	28	Replacing batteries *1 *3	0.1H	–												



Position of grease nipple

*1 For descriptions about the items marked with an asterisk (*), refer to this manual or "REPLACING UNITS Chapter of the following manuals.
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R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.
(NOTE) R-2000*i*B/220U has no balancer

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Overhaul	1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
○				○				○				○				○					12
●				●				●				●				●					13
●						●						●						●			14
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				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/210WE **Periodic Maintenance Table**

Items			Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
Mechanical unit	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
Mechanical unit	3	Check wear debris of the balancer and the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
Mechanical unit	5	Check the mechanical unit cable. (Damaged or twisted)	0.2H	–		○			○				○			
Mechanical unit	6	Check the end effector (hand) cable	0.1H	–		○			○				○			
Mechanical unit	7	Check the motor connector. (Loosening)	0.2H	–		○			○				○			
Mechanical unit	8	Tighten the end effector bolt.	0.2H	–		○			○				○			
Mechanical unit	9	Tighten the cover and main bolt.	2.0H	–		○			○				○			
Mechanical unit	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
Mechanical unit	11	Clean spatters, sawdust and dust	1.0H	–		○			○				○			
Mechanical unit	13	Greasing to balancer bush *1	0.1H	10cml each					●				●			
Mechanical unit	14	Replacing batteries *1 *3	0.1H	–							●					
Mechanical unit	15	Replacing grease of J1-axis reducer *1	1.0H	5500ml					●				●			
Mechanical unit	16	Replacing grease of J2-axis reducer *1	0.5H	3500ml					●				●			
Mechanical unit	17	Replacing grease of J3-axis reducer *1	0.5H	2640ml					●				●			
Mechanical unit	18	Replacing grease of J4-axis gearbox *1	0.5H	1900ml					●				●			
Mechanical unit	19	Replacing grease of reducer (J5/J6-axis) for wrist axis *1	1.0H	4900ml					●				●			
Mechanical unit																
Mechanical unit																
Mechanical unit	22	Check the purge air piping *1	0.1H	–		○			○				○			
Mechanical unit	25	Replacing cable of mechanical unit *1	4.0H	–												
Controller	26	Cleaning the ventilator	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
Controller	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–		○			○				○			
Controller	28	Replacing batteries *1 *3	0.1H	–												

*1 For descriptions about the items marked with an asterisk (*), refer to this manual or "REPLACING UNITS Chapter of the following manuals.
For descriptions about the items marked with an asterisk (*), refer to the following manuals.
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R-30*i*A CONTROLLER MAINTENANCE MANUAL (For Europe) (B-82595EN-1),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Overhaul	1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
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●				●				●				●				●					16
●				●				●				●				●					17
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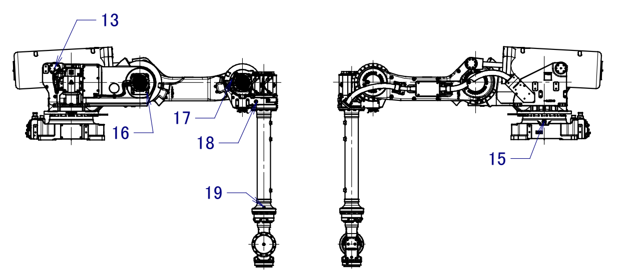
●				●				●				●				●					19
○				○				○				○				○					22
				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/100P **Periodic Maintenance Table**

Items		Accumulated operating time (H)	Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the balancer and the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical unit cable. (Damaged or twisted)	0.2H	–		○	○	○	○	○	○	○	○	○	○	○
	6	Check the end effector (hand) cable	0.1H	–		○			○				○			
	7	Check the motor connector. (Loosening)	0.2H	–		○			○				○			
	8	Tighten the end effector bolt	0.2H	–		○			○				○			
	9	Tighten the cover and main bolt.	2.0H	–		○			○				○			
	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
	11	Clean spatters, sawdust and dust	1.0H	–		○			○				○			
	12	Check the fan (option)	0.1H	–		○			○				○			
	13	Greasing to balancer bush *1	0.1H	10ml each					●				●			
	14	Replacing batteries *1 *3	0.1H	–							●					
	15	Replacing grease of J1-axis reducer *1	1.0H	5500ml												
	16	Replacing grease of J2-axis reducer *1	0.5H	3500ml												
	17	Replacing grease of J3-axis reducer *1	0.5H	2500ml												
	18	Replacing grease of J4-axis gearbox *1	0.5H	1900ml												
	19	Replacing grease of reducer (J5/J6-axis) for wrist axis *1	1.0H	4900ml												
	25	Replacing cable of mechanical unit *1	4.0H	–												
Controller	26	Cleaning the ventilator	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–		○			○				○			
	28	Replacing batteries *1 *3	0.1H	–												



Position of grease nipple

*1 For descriptions about the items marked with an asterisk (*), refer to this manual or "REPLACING UNITS Chapter of the following manuals.
For descriptions about the items marked with an asterisk (*), refer to the following manuals.
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R-30*i*A CONTROLLER MAINTENANCE MANUAL (For Europe) (B-82595EN-1),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Overhaul	1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
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●												●									15
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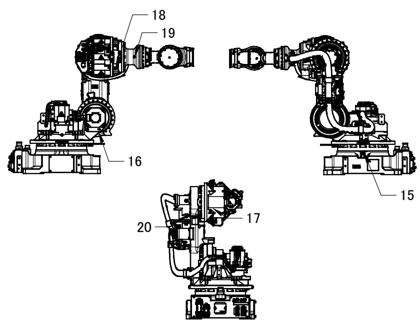
●												●									18
●												●									19
				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/170CF **Periodic Maintenance Table**

Items		Accumulated operating time (H)	Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical cable. (Damaged or twisted)	0.2H	–		○			○				○			
	6	Check the motor connector. (Loosening)	0.1H	–		○			○				○			
	7	Check the end effector (hand) cable	0.2H	–		○			○				○			
	8	Tighten the end effector bolt.	0.2H	–		○			○				○			
	9	Tighten the cover and main bolt.	2.0H	–		○			○				○			
	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
	11	Clean spatters, sawdust and dust	1.0H	–		○			○				○			
	14	Replacing batteries *1 *3	0.1H	–							●					
	15	Replacing grease of J1-axis reducer*1	1.0H	5300ml												
	16	Replacing grease of J2-axis reducer*1	0.5H	2700ml												
	17	Replacing grease of J3-axis reducer*1	0.5H	2700ml												
	18	Replacing grease of J4-axis gearbox*1	0.5H	2100ml												
	19	Replacing grease of reducer (J6-axis) for wrist axis*1	0.5H	3200ml												
	20	Replacing grease of J3-axis gearbox*1	0.5H	340ml												
	25	Replacing cable of mechanical unit *1	4.0H	–												
Controller	26	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
	27	Cleaning the ventilator	0.2H	–		○			○				○			
	28	Replacing batteries *1 *3	0.1H	–												



Position of grease nipple

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For descriptions about the items marked with an asterisk (*), refer to the following manuals.
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R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

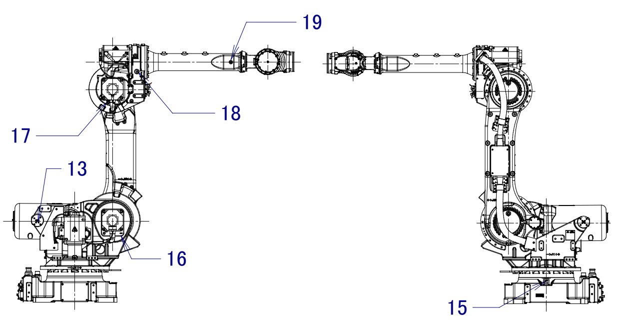
*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
●						●						●						●		Overhaul	14
●												●									15
●												●									16
●												●									17
●												●									18
●												●									19
●												●									20
				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/100H **Periodic Maintenance Table**

Items		Accumulated operating time (H)	Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	—		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	—		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the balancer and the J1-axis swing stopper	0.1H	—		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	—		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical cable. (Damaged or twisted)	0.2H	—		○			○				○			
	6	Check the end effector (hand) cable	0.1H	—		○			○				○			
	7	Check the motor connector. (Loosening).	0.2H	—		○			○				○			
	8	Tighten the end effector bolt.	0.2H	—		○			○				○			
	9	Tighten the cover and main bolt	2.0H	—		○			○				○			
	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	—		○			○				○			
	11	Clean spatters, sawdust and dust	1.0H	—		○			○				○			
	12	Check the fan (option)	0.1H	—		○			○				○			
	13	Greasing to balancer bush *1	0.1H	10cml each					●				●			
	14	Replacing batteries. *1 *3	0.1H	—							●					
	15	Replacing grease of J1-axis reducer*1	1.0H	5500ml												
	16	Replacing grease of J2-axis reducer*1	0.5H	3500ml												
	17	Replacing grease of J3-axis reducer*1	0.5H	2500ml												
	18	Replacing grease of J4-axis gearbox*1	0.5H	1900ml												
	19	Replacing grease of reducer (J4/J5-axis) for wrist axis*1	1.0H	2400ml												
	25	Replacing cable of mechanical unit *1	4.0H	—												
Controller	26	Cleaning the ventilator	0.2H	—	○	○	○	○	○	○	○	○	○	○	○	○
	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	—		○			○				○			
	28	Replacing batteries *1 *3	0.1H	—												



Position of grease nipple

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For descriptions about the items marked with an asterisk (*), refer to the following manuals.
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R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

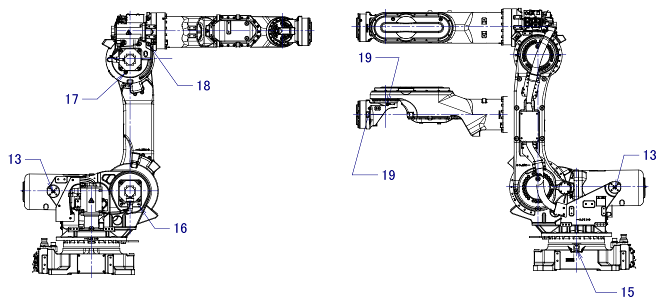
*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
○				○				○				○				○				Overhaul	12
●				●				●				●				●					13
●						●						●						●			14
●												●									15
●												●									16
●												●									17
●												●									18
●												●									19
				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/210FS/220US **Periodic Maintenance Table**

Items		Accumulated operating time (H)	Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the balancer and the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical cable. (Damaged or twisted)	0.2H	–		○			○				○			
	6	Check the end effector (hand) cable	0.1H	–		○			○				○			
	7	Check the motor connector. (Loosening)	0.2H	–		○			○				○			
	8	Tighten the end effector bolt.	0.2H	–		○			○				○			
	9	Tighten the cover and main bolt.	2.0H	–		○			○				○			
	10	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
	11	Clean spatters, sawdust and dust	1.0H	–		○			○				○			
	12	Check the fan (option)	0.1H			○			○				○			
	13	Greasing to balancer bush∗1	0.1H	10cml each					●				●			
	14	Replacing batteries ∗1 *3	0.1H	–							●					
	15	Replacing grease of J1-axis reducer∗1	1.0H	5500ml												
	16	Replacing grease of J2-axis reducer∗1	0.5H	3500ml												
	17	Replacing grease of J3-axis reducer∗1	0.5H	2640ml												
	18	Replacing grease of J4-axis gearbox∗1	0.5H	1890ml												
	19	Replacing grease of reducer (J5/J6-axis) for wrist axis∗1	1.0H	3340ml												
	23	Replacing basic axis solution Arm cable	2.0H													
	24	Replacing wrist integrated cable	2.0H										●			
	25	Replacing cable of mechanical unit ∗1	4.0H	–												
Controller	26	Cleaning the ventilator	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–		○			○				○			
	28	Replacing batteries *1 *3	0.1H	–												



Position of grease nipple

*1 For descriptions about the items marked with an asterisk (*), refer to this manual or "REPLACING UNITS Chapter of the following manuals.
For descriptions about the items marked with an asterisk (*), refer to the following manuals.
R-30*i*A CONTROLLER MAINTENANCE MANUAL (Standard) (B-82595EN),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For Europe) (B-82595EN-1),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2),
R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL (B-83195EN)

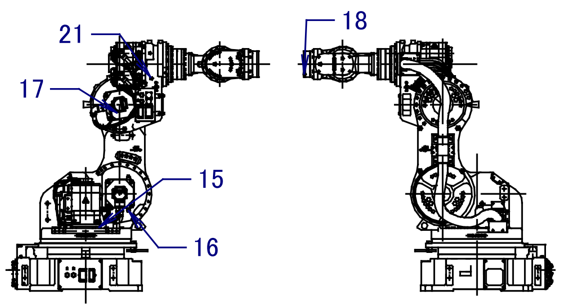
*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
○				○				○				○				○					7
○				○				○				○				○					8
○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
○				○				○				○				○					12
●				●				●				●				●				Overhaul	13
●						●						●						●			14
●												●									15
●												●									16
●												●									17
●												●									18
●												●									19
				●																	23
				●								●									24
				●																	25
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

FANUC Robot R-2000*i*B/165CF **Periodic Maintenance Table**

Items		Accumulated operating time (H)	Check time	Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check for external damage or peeling paint	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	2	Check damages of the cable protective sleeves	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	3	Check wear debris of the J1-axis swing stopper	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	4	Check for water	0.1H	–		○	○	○	○	○	○	○	○	○	○	○
	5	Check the mechanical cable. (Damaged or twisted)	0.2H	–		○			○				○			
	6	Check the motor connector. (Loosening)	0.2H	–		○			○				○			
	7	Tighten the end effector bolt.	0.2H	–		○			○				○			
	8	Tighten the cover and main bolt.	2.0H	–		○			○				○			
	9	Check the mechanical stopper and adjustable mechanical stopper	0.1H	–		○			○				○			
	10	Remove spatter and dust etc.	1.0H	–		○			○				○			
	11	Check the end effector (hand) cable	0.1H	–		○			○				○			
	14	Replacing batteries ∗1 *3	0.1H	–							●					
	15	Replacing grease of J1-axis reducer∗1	1.0H	4100ml												
	16	Replacing grease of J2-axis reducer∗1	0.5H	2600ml												
	17	Replacing grease of J3-axis reducer∗1	0.5H	1600ml												
	18	Replacing grease of wrist axis reducer (J6)∗1	1.0H	400ml												
	21	Replacing grease of J4-axis gearbox (J4/J5-axis) for wrist axis∗1	0.5H	3950ml												
	25	Replacing cable of mechanical unit ∗1	4.0H	–												
Controller	26	Cleaning the ventilator	0.2H	–	○	○	○	○	○	○	○	○	○	○	○	○
	27	Check the robot cable, teach pendant cable and robot connecting cable	0.2H	–		○			○				○			
	28	Replacing batteries *1 *3	0.1H	–												



Position of grease nipple

*1 For descriptions about the items marked with an asterisk (*), refer to this manual or "REPLACING UNITS Chapter of the following manuals.
For descriptions about the items marked with an asterisk (*), refer to the following manuals.
R-30*i*A CONTROLLER MAINTENANCE MANUAL (Standard) (B-82595EN),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For Europe) (B-82595EN-1),
R-30*i*A CONTROLLER MAINTENANCE MANUAL (For RIA) (B-82595EN-2)

*2 ●: Requires order of parts ○: Does not require order of parts

*3 Regardless of the operating time, replace the mechanical unit batteries at 1.5 year, replace controller batteries at 4 years.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 26880	27840	28800	29760	8 years 30720	Item
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		1
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		2
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		3
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		4
○				○				○				○				○					5
○				○				○				○				○					6
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○				○				○				○				○					9
○				○				○				○				○					10
○				○				○				○				○					11
●						●						●						●		Overhaul	14
●												●									15
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○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		26
○				○				○				○				○					27
				●																	28

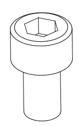
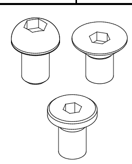
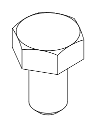
B STRENGTH OF BOLT AND BOLT TORQUE LIST

NOTE

When applying LOCTITE to a part, spread the LOCTITE on the entire length of the engaging part of the female thread. If applied to the male threads, poor adhesion can occur, potentially loosening the bolt. Clean the bolts and the threaded holes and wipe off any oil on the engaging section. Make sure that there is no solvent left in the threaded holes. When finished, remove all the excess LOCTITE when you are finished screwing the bolts into the threaded holes.

Use the following strength bolts. Comply with any bolt specification instructions.
Hexagon socket head bolt made of steel:
Size M22 or less: Tensile strength 1200N/mm^2 or more
Size M24 or more: Tensile strength 1000N/mm^2 or more
All size plated bolt: Tensile strength 1000N/mm^2 or more
Hexagon bolt, stainless bolt, special shape bolt (button bolt, low-head bolt, flush bolt .etc.)
Tensile strength 400N/mm^2 or more
Refer to the following tables if the bolts tightening torque is not specified.

Recommended bolt tightening torques **Unit: Nm**

Nominal diameter	Hexagon socket head bolt (steel)		Hexagon socket head bolt (stainless steel)		Hexagon socket head button bolt Hexagon socket head flush bolt Low-head bolt (steel)		Hexagon bolt (steel)	
	Tightening torque		Tightening torque		Tightening torque		Tightening torque	
	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit
M3	1.8	1.3	0.76	0.53	—	—	—	—
M4	4.0	2.8	1.8	1.3	1.8	1.3	1.7	1.2
M5	7.9	5.6	3.4	2.5	4.0	2.8	3.2	2.3
M6	14	9.6	5.8	4.1	7.9	5.6	5.5	3.8
M8	32	23	14	9.8	14	9.6	13	9.3
M10	66	46	27	19	32	23	26	19
M12	110	78	48	33	—	—	45	31
(M14)	180	130	76	53	—	—	73	51
M16	270	190	120	82	—	—	98	69
(M18)	380	260	160	110	—	—	140	96
M20	530	370	230	160	—	—	190	130
(M22)	730	510	—	—	—	—	—	—
M24	930	650	—	—	—	—	—	—
(M27)	1400	960	—	—	—	—	—	—
M30	1800	1300	—	—	—	—	—	—
M36	3200	2300	—	—	—	—	—	—
								

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REVISION RECORD

Edition	Date	Contents
14	Oct.,2022	• Change of the transport equipment • Addition of setting angle • Correction of errors
13	Oct.,2017	• Addition of R-30*i*B Plus Controller • Correction of errors
12	Oct.,2015	• Addition of R-2000*i*B/210WE (A05B-1329-B256) • Addition of note for severe dust/liquid performance • Addition of quick master for single axis • Correction of grease replacing procedure for R-2000*i*B/210FS,220US • Correction of errors
11	July,2012	• Addition of R-2000*i*B/210WE,210FS,220US • Addition of R-30*i*B Controller • Addition of Vision Axis Master • Correction of errors
10	Feb.,2011	• Addition of R-2000*i*B/220U • Correction of errors
09	Aug.,2010	• Addition of stop type of robot • Addition of stopping time and distance when controlled stop is executed • Correction of errors
08	Jun.,2009	• Addition of R-2000*i*B/185L/250F • Addition data of max stopping distance (position) • Change figure of transportation of crane • Correction of errors
07	Mar.,2008	• Addition of R-2000*i*B/170CF/150U • Change the coordinate system wrist payload diagram • Correction of errors
06	Dec, 2007	• Addition of a note on safety • Addition of notes on transportation with an end effector attached • Addition of notes on transport equipment of the J2 base type for floor-mount robots
05	Jul, 2007	• Addition of the R-2000*i*B/100H • Addition of the R-2000*i*B/165F, 210F with high inertia mode. • Correction of errors
04	May, 2007	• Change the name of controller (from R-J3*i*C to R-30*i*A) • Addition description about J2 base type transport equipment option for rack mount type robot • Correction of errors
03	Dec, 2006	• Addition of the R-2000*i*B/100P/175L • Correction of errors • Change the manufacture name of Daiichi Denshi Kogyo K.K to Fujikura Ltd.
02	Sep, 2006	• Addition of R-2000*i*B/165R, 200R, and 165CF • Change of the alarm release method • Addition of the procedure for releasing the remaining pressure in the grease • Modification to the troubleshooting table • Addition of descriptions about a severe dust/liquid protection package
01	Apr, 2006	

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