

**FANUC Robot LR Mate 200iC**

**MECHANICAL UNIT**

**MAINTENANCE MANUAL**

**B-82585EN/02**

Before using the Robot, be sure to read the "FANUC Robot Safety Manual (B-80687EN)" and understand the content.

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In this manual we have tried as much as possible to describe all the various matters. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities. Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

# 1

## SAFETY PRECAUTIONS

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For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral devices installed in a work cell.

In addition, refer to the “FANUC Robot SAFETY HANDBOOK (B-80687EN)”.

### 1.1 WORKING PERSON

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The personnel can be classified as follows.

**Operator:**

- Power ON/OFF for robot controller
- Start of robot program with operator's panel

**Programmer or teaching operator:**

- Operate for Robot
- Teaching inside safety fence

**Maintenance engineer:**

- Operate for Robot
- Teaching inside safety fence
- Maintenance (adjustment, replacement)

- An operator cannot work inside the safety fence.
- A programmer, Teaching operator and maintenance engineer can work inside the safety fence. The workings inside safety fence are lifting, setting, teaching, adjusting, maintenance, etc.
- To work inside the fence, the person must be trained for the robot.

Table 1 lists the workings of outside the fence. In this table, the symbol “O“ means the working allowed to be carried out by the personnel.

**Table 1 List of workings outside the fence**

	<b>Operator</b>	<b>Programmer or Teaching operator</b>	<b>Maintenance engineer</b>
Power ON/OFF for Robot controller	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Select operating mode (AUTO, T1, T2)		<input type="radio"/>	<input type="radio"/>
Select Remote/Local mode		<input type="radio"/>	<input type="radio"/>
Select robot program with teach pendant		<input type="radio"/>	<input type="radio"/>
Select robot program with external device		<input type="radio"/>	<input type="radio"/>
Start robot program with operator's panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Start robot program with teach pendant		<input type="radio"/>	<input type="radio"/>
Reset alarm with operator's panel		<input type="radio"/>	<input type="radio"/>
Reset alarm with teach pendant		<input type="radio"/>	<input type="radio"/>
Set data on the teach pendant	<input type="radio"/>	<input type="radio"/>	
Teaching with teach pendant	<input type="radio"/>	<input type="radio"/>	
Emergency stop with operator's panel		<input type="radio"/>	<input type="radio"/>
Emergency stop with teach pendant		<input type="radio"/>	<input type="radio"/>
Emergency stop with safety fence open		<input type="radio"/>	<input type="radio"/>
Maintain for operator's panel		<input type="radio"/>	
Maintain for teach pendant			<input type="radio"/>

In operating, programming and maintenance, the programmer, teaching operator and maintenance engineer take care of their safety using the following safety protectors, for example.

- Use adequate clothes, uniform, overall for operation
- Put on the safety shoes
- Use helmet

## 1.2 WORKING PERSON SAFETY

---

Working person safety is the primary safety consideration. Because it is very dangerous to enter the operating space of the robot during automatic operation, adequate safety precautions must be observed. The following lists the general safety precautions. Careful consideration must be made to ensure working person safety.

- (1) Have the robot system working person attend the training courses held by FANUC.

FANUC provides various training courses. Contact our sales office for details.

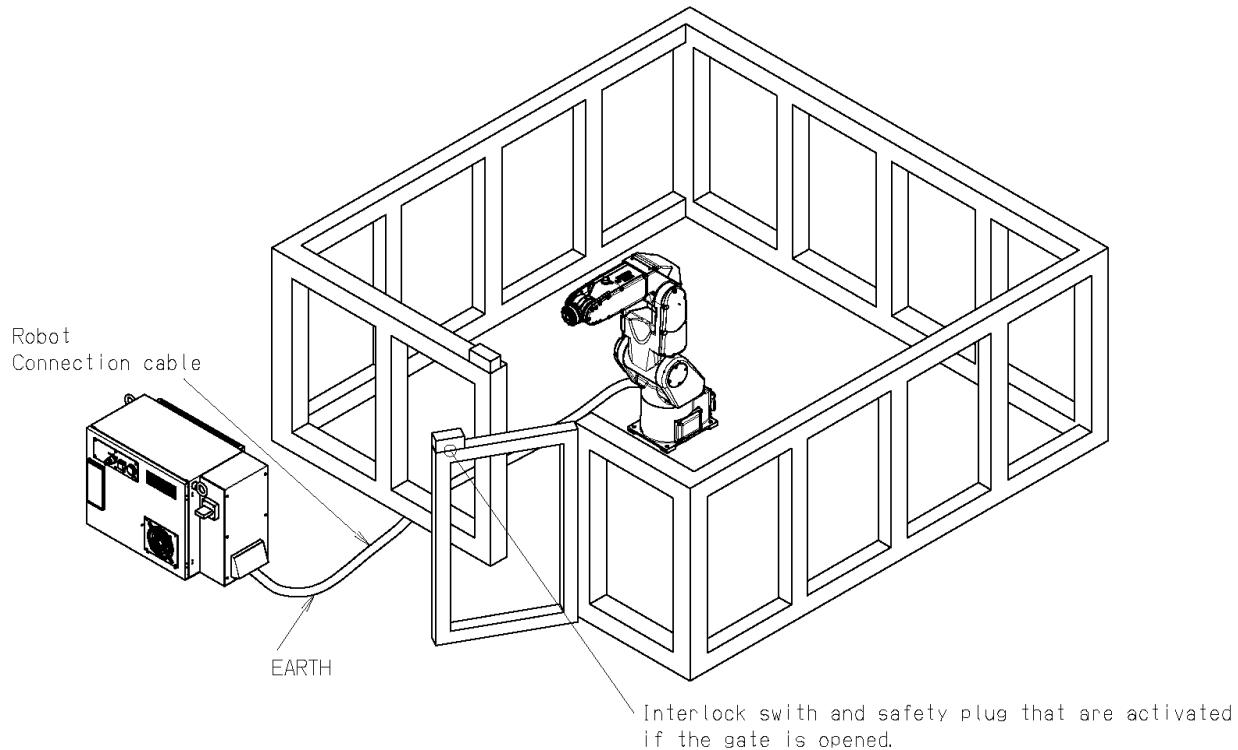
- (2) Even when the robot is stationary, it is possible that the robot is still in a ready to move state, and is waiting for a signal. In this state, the robot is regarded as still in motion. To ensure working person safety, provide the system with an alarm to indicate visually or aurally that the robot is in motion.
- (3) Install a safety fence with a gate so that no working person can enter the work area without passing through the gate. Install an interlock switch, a safety plug, and so forth in the safety gate so that the robot is stopped as the safety gate is opened.

The controller is designed to receive this interlock signal of the door switch. When the gate is opened and this signal received, the controller stops the robot in an emergency. For connection, see Fig.1.1.

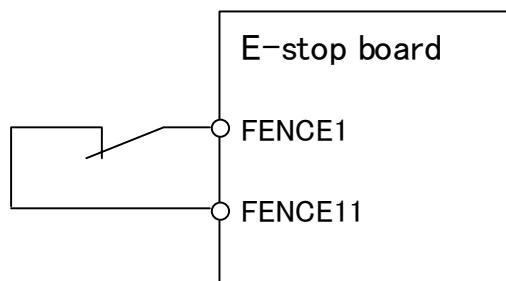
- (4) Provide the peripheral devices with appropriate grounding (Class A, Class B, Class C, and Class D).
- (5) Try to install the peripheral devices outside the work area.
- (6) Draw an outline on the floor, clearly indicating the range of the robot motion, including the tools such as a hand.
- (7) Install a mat switch or photoelectric switch on the floor with an interlock to a visual or aural alarm that stops the robot when a working person enters the work area.
- (8) If necessary, install a safety lock so that no one except the working person in charge can turn on the power of the robot.

The circuit breaker installed in the controller is designed to disable anyone from turning it on when it is locked with a padlock.

- (9) When adjusting each peripheral device independently, be sure to turn off the power of the robot.



**Fig.1.2 Safety fence and safety gate**



**NOTE**

Terminal FENCE1 and terminal FENCE11 are on the PC board in the E-stop unit.

**NOTE**

Please drop the power supply of the robot control system at once when the worker is placed by the robot by any chance or it is confined, push the robot arm directly, change posture, and liberate the worker.

## 1.2.1 General Person Safety

The general person is a person who operates the robot system. In this sense, a worker who operates power on/off of the robot system or the teach pendant is also a general person.

The general person can't operate inside a safety fence.

- (1) Operate the robot system at a location outside of the safety fence.
- (2) If it is not necessary for the robot to operate, turn off the power of the robot controller or press the EMERGENCY STOP button, and then proceed with necessary work.
- (3) Install an EMERGENCY STOP button within the general person's reach.

The robot controller is designed to be able to connect to an external EMERGENCY STOP button. With this connection, the controller stops the robot operation when the external EMERGENCY STOP button is pressed. See the diagram below for connection.

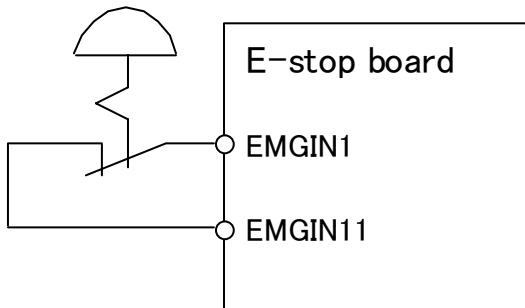


Fig.1.2.1 Circuit diagram for external emergency stop button

## 1.2.2 Safety of the Teaching Operator

While teaching the robot, it is necessary for the operator to enter the work area of the robot. It is particularly necessary to ensure the safety of the teaching operator.

- (1) Unless it is specifically necessary to enter the robot work area, carry out all tasks outside the area.
- (2) Before teaching the robot, check that the robot and its peripheral devices are all in the normal operating condition.
- (3) When entering the robot work area and teaching the robot, be sure to check the location and condition of the safety devices (such as the EMERGENCY STOP button and the DEADMAN switch on the teach pendant).
- (4) The teaching operator should pay careful attention so that no other workers enter the robot work area.

Our teach pendant is provided with a DEADMAN switch as well as an emergency stop button.

These button and switch function as follows:

- (1) Emergency stop button: Causes an emergency stop when pressed.
- (2) DEADMAN switch: Functions differently depending on the mode switch setting status.
  - (a) When the switch is set to the enable position:  
An emergency stop is made by releasing the DEADMAN switch.
  - (b) When the switch is set to the disable position:  
The DEADMAN switch is disabled.

The operator's intention of starting teaching is determined by the control unit through the dual operation of setting the teach pendant enable/disable switch to the enable position and pressing the DEADMAN switch. The operator should make sure that the robot can operate in such conditions and be responsible in carrying out tasks safely.

The teach pendant and peripheral device interface each send a robot start signal. However, the validity of each signal changes depending on the teach pendant enable switch and the remote condition of the software.

**Table 1.2.2(a) STANDARD**

Teach pendant enable switch	Software remote condition	Teach pendant	Peripheral device
On	Ignored	Allowed to start	Not allowed
Off	Local	Not allowed	Not allowed
	Remote	Not allowed	Allowed to start

**Table 1.2.2(b) CE/RIA**

<b>Mode</b>	<b>Teach pendant enable switch</b>	<b>Software remote condition</b>	<b>Teach pendant</b>	<b>Operator panel</b>	<b>Peripheral device</b>
AUTO mode	On	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed
	Off	Local	Not allowed	Allowed to start	Not allowed
		Remote	Not allowed	Not allowed	Allowed to start
T1, T2 mode	On	Local	Allowed to start	Not allowed	Not allowed
		Remote	Allowed to start	Not allowed	Not allowed
	Off	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed

- (5) (When CE or RIA specification is selected.) To start the system using the operator's panel, make certain that nobody is the robot work area and that there are no abnormal conditions in the robot work area.
- (6) When a program is completed, be sure to carry out a test run according to the procedure below.
  - (a) Run the program for at least one operation cycle in the single step mode at low speed.
  - (b) Run the program for at least one operation cycle in the continuous operation mode at low speed.
  - (c) Run the program for one operation cycle in the continuous operation mode at the intermediate speed and check that no abnormalities occur due to a delay in timing.
  - (d) Run the program for one operation cycle in the continuous operation mode at the normal operating speed and check that the system operates automatically without trouble.
  - (e) After checking the completeness of the program through the test run above, execute it in the automatic operation mode.
- (7) While operating the system in the automatic operation mode, the teaching operator should leave the robot work area.

### 1.2.3 Safety During Maintenance

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For the safety of maintenance personnel, pay utmost attention to the following.

- (1) During operation, never enter the robot work area.
- (2) Except when specifically necessary, turn off the power of the controller while carrying out maintenance. Lock the power switch, if necessary, so that no other person can turn it on.
- (3) If it becomes necessary to enter the robot operation range while the power is on, press the emergency stop button on the operator panel, or the teach pendant before entering the range. The maintenance personnel must indicate that maintenance work is in progress and be careful not to allow other people to operate the robot carelessly.
- (4) When disconnecting the pneumatic system, be sure to reduce the supply pressure.
- (5) Before the start of teaching, check that the robot and its peripheral devices are all in the normal operating condition.
- (6) Do not operate the robot in the automatic mode while anybody is in the robot work area.
- (7) When it is necessary to maintain the robot alongside a wall or instrument, or when multiple workers are working nearby, make certain that their escape path is not obstructed.
- (8) When a tool is mounted on the robot, or when any moving device other than the robot is installed, such as belt conveyor, pay careful attention to its motion.
- (9) If necessary, have trained worker who knows the robot system well stand beside the operator panel, and observe the operation. In case any danger arises, the worker should be ready to press the EMERGENCY STOP button at any time.
- (10) During replacing or reinstalling components, Take care not to let foreign matter enter the system.
- (11) When handling each unit or printed circuit board in the controller during inspection, turn off the circuit breaker to protect against electric shock.
- (12) When replacing parts, be sure to use those specified by FANUC. In particular, never use fuses or other parts of non-specified ratings. They may cause a fire or result in damage to the components in the controller.
- (13) When restarting the robot system after completing maintenance work, make sure in advance that there is no person in the work area and that the robot and the peripheral devices are not abnormal.

## **1.3 SAFETY OF THE TOOLS AND PERIPHERAL DEVICES**

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### **1.3.1 Precautions in Programming**

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- (1) Use a limit switch or other sensor to detect a dangerous condition and, if necessary, design the program to stop the robot when the sensor signal is received.
- (2) Design the program to stop the robot when an abnormal condition occurs in any other robots or peripheral devices, even though the robot itself is normal.
- (3) For a system in which the robot and its peripheral devices are in synchronous motion, particular care must be taken in programming so that they do not interfere with each other.
- (4) Provide a suitable interface between the robot and its peripheral devices so that the robot can detect the states of all devices in the system and can stop them according to their states.

### **1.3.2 Precautions for Mechanism**

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- (1) Keep the component cells of the robot system clean, and operate the robot in an environment free of grease, water, and dust.
- (2) Employ a limit switch or mechanical stopper to limit the robot motion so that the robot does not strike against its peripheral devices or tools.

## **1.4 SAFETY OF THE ROBOT MECHANISM**

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### **1.4.1 Precautions in Operation**

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- (1) When operating the robot in the jog mode, set it at an appropriate speed so that the operator can manage the robot in any eventuality.
- (2) Before pressing the jog key, be sure you know in advance what motion the robot will perform in the jog mode.

### **1.4.2 Precautions in Programming**

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- (1) When the work areas of robots overlap, make certain that the motions of the robots do not interfere with each other.
- (2) Be sure to specify the predetermined work origin in a motion program for the robot and program the motion so that it starts from the origin and terminates at the origin.  
Make it possible for the operator to easily distinguish at a glance that the robot motion has terminated.

### **1.4.3 Precautions for Mechanisms**

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- (1) Keep the work areas of the robot clean, and operate the robot in an environment free of grease, water, and dust.

## **1.5 SAFETY OF THE END EFFECTOR**

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### **1.5.1 Precautions in Programming**

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- (1) To control the pneumatic, hydraulic and electric actuators, carefully consider the necessary time delay after issuing each control command up to actual motion and ensure safe control.
- (2) Provide the end effector with a limit switch, and control the robot system by monitoring the state of the end effector.

## 1.6 WARNING LABEL

(1) Transportation attention label 1

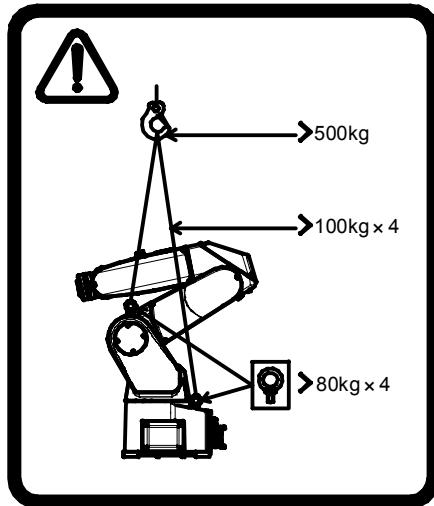


Fig. 1.6(a) Transportation attention label 1

### Description

- 1) Use a crane having a load capacity of 500 kg or greater.
- 2) Use at least four slings each having a withstand load of 980 N (100 kgf) or greater.
- 3) Use at least four eyebolts each having a withstand load of 784 N (80 kgf) or greater.

## (2) Transportation attention label 2

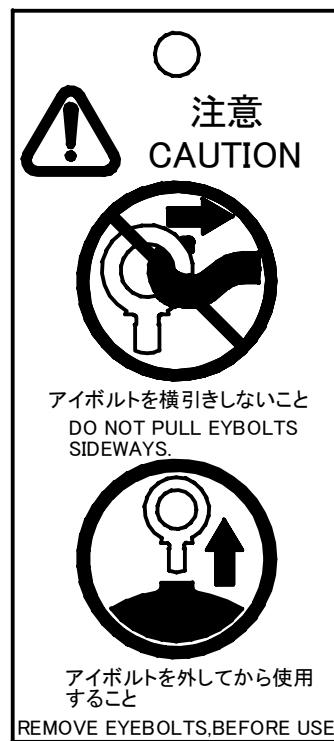


Fig.1.6 (b) Transportation attention label 2

### Description

Keep the following in mind about eyebolt.

- 1) Don't pull eyebolt side ways.
- 2) Remove eyebolt before use.

- (3) Greasing attention label (When grease applying kit: A05B-1139-K021 is specified.)

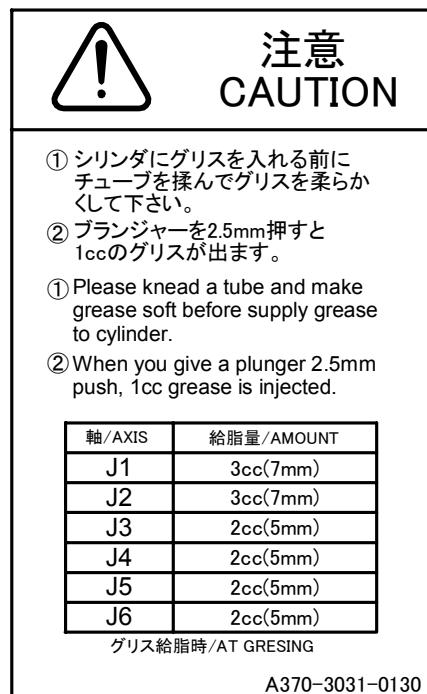


Fig.1.6(c) Greasing attention label

## Description

Keep the following in mind about grease applying kit.

- 1) Please knead a tube and make grease soft before supply grease to cylinder.
- 2) When you give a plunger 2.5mm push, 1ml grease is injected.

## (4) Range of motion and payload mark label

Below label is added when CE specification is specified.

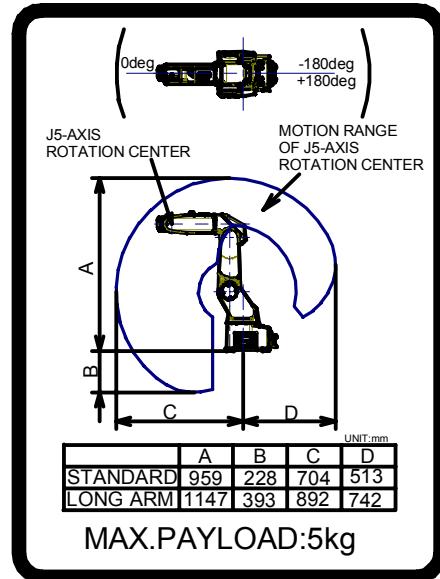


Fig.1.6 (d) Range of motion and payload mark label



# PREFACE

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This manual explains the maintenance and connection procedures for the mechanical units of the following robots:

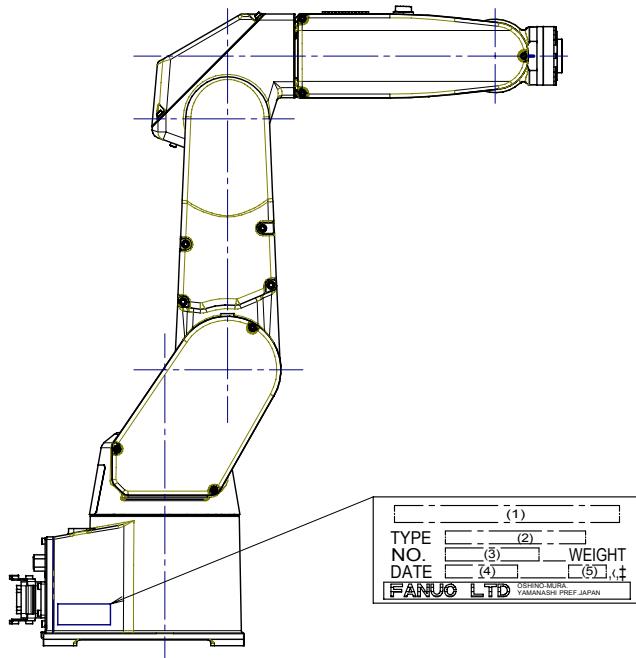
Model name	Mechanical unit specification No.	Maximum load	Remarks
FANUC Robot LR Mate 200iC	A05B-1139-B201	5kg	3-axes brake type Non-severe dust/liquid protection specification
FANUC Robot LR Mate 200iC	A05B-1139-B202		6-axes brake type Non-severe dust/liquid protection specification
FANUC Robot LR Mate 200iC	A05B-1139-B203		3-axes brake type severe dust/liquid protection specification
FANUC Robot LR Mate 200iC	A05B-1139-B204		6-axes brake type severe dust/liquid protection specification
FANUC Robot LR Mate 200iC/5L	A05B-1139-B211		6-axes brake type Non-severe dust/liquid protection specification
	A05B-1139-B212		6-axes brake type severe dust/liquid protection specification
FANUC Robot LR Mate 200iC/5LC	A05B-1139-B213		6-axes brake type Clean class 100 specification
FANUC Robot LR Mate 200iC/5C	A05B-1139-B221		6-axes brake type Clean class 100 specification
FANUC Robot LR Mate 200iC/5WP	A05B-1139-B231		6-axes brake type Washing specification
FANUC Robot LR Mate 200iC/5H	A05B-1139-B101		3-axes brake type Non-severe dust/liquid protection specification
FANUC Robot LR Mate 200iC/5H	A05B-1139-B102		5-axes brake type Non-severe dust/liquid protection specification
FANUC Robot LR Mate 200iC/5H	A05B-1139-B103		3-axes brake type severe dust/liquid protection specification
FANUC Robot LR Mate 200iC/5H	A05B-1139-B104		5-axes brake type severe dust/liquid protection specification

## NOTE

The following abbreviations are used herein.

- |          |                     |
|----------|---------------------|
| STANDARD | : LR Mate 200iC     |
| 5L       | : LR Mate 200iC/5L  |
| 5LC      | : LR Mate 200iC/5LC |
| 5C       | : LR Mate 200iC/5C  |
| 5WP      | : LR Mate 200iC/5WP |
| 5H       | : LR Mate 200iC/5H  |

The label stating the mechanical unit specification number is affixed in the position shown below. Before reading this manual, determine the specification number of the mechanical unit.

**TABLE 1 )**

CONTENTS	(1)	(2)	(3)	(4)	(5)
LETTERS	-	TYPE	No.	DATE	WEIGHT (Without controller)
FANUC Robot LR Mate 200iC	A05B-1139-B201	PRINT SERIAL NO.	PRINT PRODUCTION YEAR AND MONTH		27kg
	A05B-1139-B202				
	A05B-1139-B203				
	A05B-1139-B204				
	A05B-1139-B211			29kg	
	A05B-1139-B212				
	A05B-1139-B213				
	A05B-1139-B221				
	A05B-1139-B231				27kg
	A05B-1139-B101			26kg	
	A05B-1139-B102				
	A05B-1139-B103				
	A05B-1139-B104				

**Position of label indicating mechanical unit specification number**

**RELATED MANUALS**

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

Safety handbook B-80687EN All persons who use the FANUC Robot and system designer must read and understand thoroughly this handbook		Intended readers: All persons who use FANUC Robot, system designer Topics: Safety items for robot system design, operation, maintenance
R-30iA Mate controller	Operations manual  LR HANDLING TOOL B-82724EN-1	Intended readers: Operator, programmer, maintenance person, system designer Topics: Robot functions, operations, programming, setup, interfaces, alarms Use: Robot operation, teaching, system design
	Maintenance manual B-82725EN B-82725EN-1 (For Europe) B-82725EN-2 (For RIA)	Intended readers: Maintenance person, system designer Topics: Installation, connection to peripheral equipment, maintenance Use: Installation, start-up, connection, maintenance
Mechanical unit	Operator's manual FANUC Robot LR Mate 200iC B-82584EN	Intended readers: System designer, Maintenance person Topics: Installation, connection to controller, maintenance Use: Installation, start-up, connection, maintenance



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# 1

## CHECKS AND MAINTENANCE

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Optimum performance of the robot can be maintained by performing the periodic maintenance procedures presented in this chapter.  
(See the 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. When using the robot beyond this total operating time, correct the maintenance frequencies shown in this chapter by calculation in proportion to the difference between the actual operating time and 3840 hours/year.

## 1.1 DAILY CHECKS

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

### (1) Before turning on power

Item	Check items		Check points
1	When air control set is provided.	Air pressure	Check air pressure using the pressure gauge on the air regulator as shown in Fig.1.1. If it does not meet the specified pressure of 0.49MPa (5 kg/cm <sup>2</sup> ), adjust it using the regulator pressure setting handle.
2		Leakage from hose	Check the joints, tubes, etc. for leaks. Repair leaks, or replace parts, as required.
3	When air purge kit is provided.	Supply pressure	Check the supply pressure using the air purge kit shown in Fig.1.1 (b). If it does not meet the specified pressure of 10 KPa (0.1 kgf/cm <sup>2</sup> ), adjust it using the regulator pressure setting handle.
4		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.
5	Vibration, abnormal noises and motor heating		Check whether each axis moves smoothly
6	Changing repeatability		Check whether the stop positions of the robot have not deviated from the previous stop positions.
7	Peripheral devices for proper operation		Check whether the peripheral devices operate properly according to commands from robot.
8	Each axis brake		Refer to 3.2.
9	Cleaning and checking each part		Clean each part (remove chips, etc.) and check component parts for cracks and flaws.

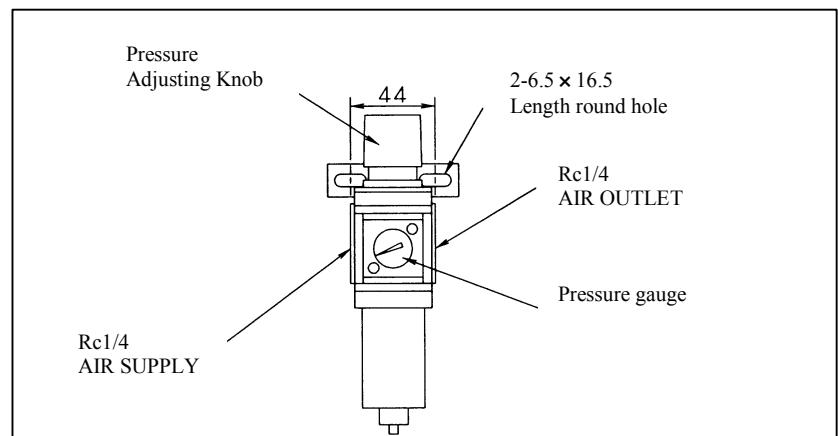


Fig.1.1(a) Air control set

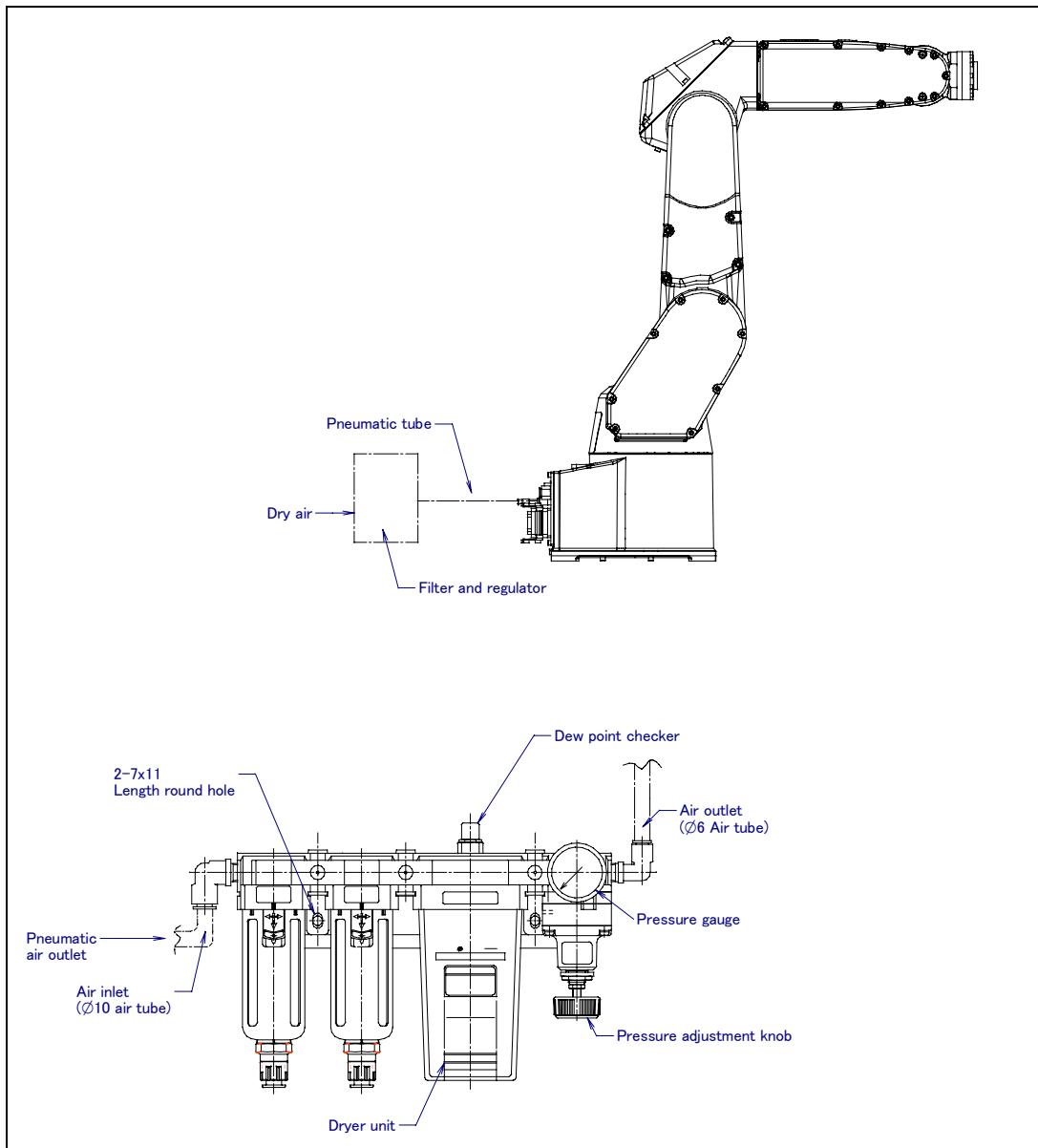


Fig.1.1(b) Air purge kit (option)

## (2) After turning on power

Item	Check items	Check points
1	Vibration, abnormal noises, and motor heating	Check whether the robot moves along and about the axes smoothly without unusual vibration or sounds. Also, check whether the temperatures of the motors are excessively high.
2	Changing repeatability	Check to see that the stop positions of the robot have not deviated from the previous stop positions.
3	Peripheral devices for proper operation	Check whether the peripheral devices operate properly according to commands from the robot.
4	Brakes for each axis	Check that the end effector drops within 2 mm when the power is cut.

**(Note 1) Cleaning**

- Necessary cleaning points, dust on the flat part, sedimentation of spatters

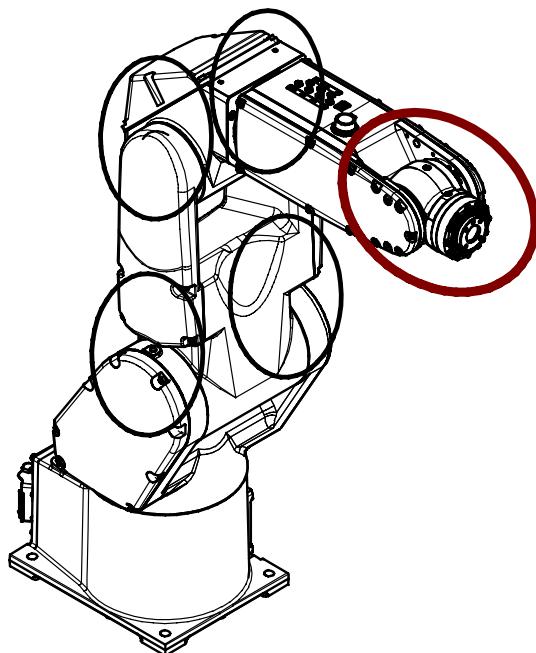
Clean sediments periodically.

In particular, clean the following points carefully.

Vicinity of the wrist axis and oil seal

→ If chippings or spatters are attached to the oil seal, an oil leak may be caused.

- Check if the vicinity of the necessary inspection points, wrist part, and J3 arm significantly wears due to rubbing against the welding cable or hand cable.
- Check if there is a trace of a collision around the hand.
- Check the reducer or grease bath for an oil leak.  
→ If oil can be found a day after wiping oil, an oil leak may be caused.



**Fig 1.1(c) Cleaning part**

## **1.2 First 1-Month (320 hours operating) Check**

---

Check the following items after the first one-month operation (or 320 hours operating)

First 1-month check

Item	Check items	Check points
1	Control unit cable and robot connecting cable	Check whether the cable connected to the teach pendant and robot is unevenly twisted.

## **1.3 3-month (960 hours) checks**

---

Check the following items once every three months (960 hours). Additional inspection areas and times should be added to the table according to the robot's working conditions, environment, etc.

(1) 3-month checks

Item	Check items	Check points
1	Control unit cable and robot connecting cable	(See Section 1.2)
2	Ventilation portion of control unit	If the ventilation portion of the control unit is dusty, turn off the power and clean the unit.
3	Cleaning and checking each part	(See Section 1.1)

Check the following items at the first quarterly inspection, then every year thereafter. (See the Section 1.4.)

(2) First quarterly inspection

Item	Check items	Check points
1	Connector used in mechanical unit	Check that the connectors of the connector panels are securely engaged. (NOTE2)
2	Further tightening external main bolts	Tighten the end-effector mounting bolts and external main bolts. (NOTE3)

**(NOTE 2) Inspection points of the connectors**

- Robot connection cables, earth terminal and user cables

**Check items**

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

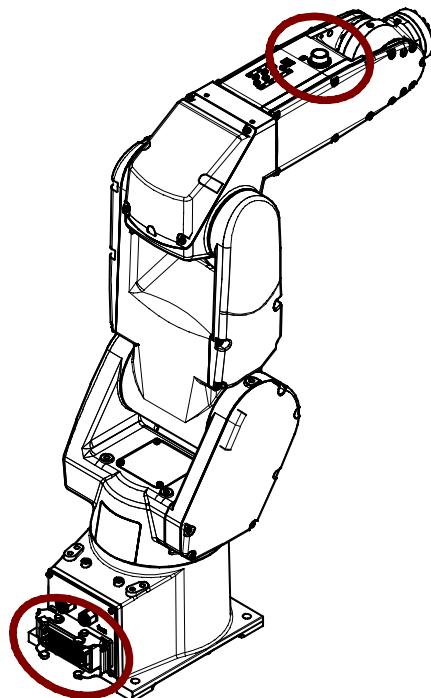


Fig 1.3 Check items of connector

**(NOTE 3) Points to be retightened**

- The end effector mounting bolts, robot installation bolts, and bolts to be removed for inspection need to be retightened.
- The bolts exposed to the outside of the robot need to be retightened.  
For the tightening torque, see the recommended bolt tightening torque shown in the Appendix.  
A loose prevention agent (adhesive) is applied to some bolts. If the bolts are tightened with greater than the recommended torque, the loose prevention agent may be removed. So, follow the recommended tightening torque when retightening them.

## **1.4 1-year (3,840 hours) checks**

---

Check the following items about once every year (3,840 hours).

Item	Check items	Check points
1	Tightness of major external bolts	(See Section 1.3)
2	Tightness of major external bolts	(See Section 1.3)
3	Battery (battery built-in type)	Replace battery in the mechanical unit. (See Section 2.1)

## **1.5 1.5-year (5,760 hours) checks**

---

Check the following items about once every year (5,760 hours).

Item	Check items	Check points
1	Battery (external battery type)	Replace battery in the mechanical unit. (See Section 2.1)

## 1.6 2-year (7,680 hours) checks (LR Mate 200iC /5WP) 4-year (15,360 hours) checks (LR Mate 200iC, LR Mate 200iC/5L , /5C, /5LC, /5H)

---

Check the following items in the cycle that is shorter among every four years and 15,360 hours.

Item	Check items	Check points
1	Greasing of reducers of each axis	<p>Specified grease Harmonic grease 4BNo.2 Spec:A98L-0040-0230#2KG</p> <p>Greasing kit (tube of grease plus injector) Spec:A05B-1139-K021</p> <p>Tube of grease (80 g) Spec:A05B-1139-K022</p> <p>Do not use Harmonic grease SK-3 or unspecified grease.</p>

## **1.7 MAINTENANCE TOOLS**

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The following tools and instruments are required for the maintenance procedures contained in this manual.

(a) Measuring instruments

Instrument	Specifications	Vendor	Manufacturer model No.	Application
Tension meter	A97L-0218-0700	Mitsuboshi Belting Ltd.	DOCTOR TENSION TYPE-	Adjustment of belt tension

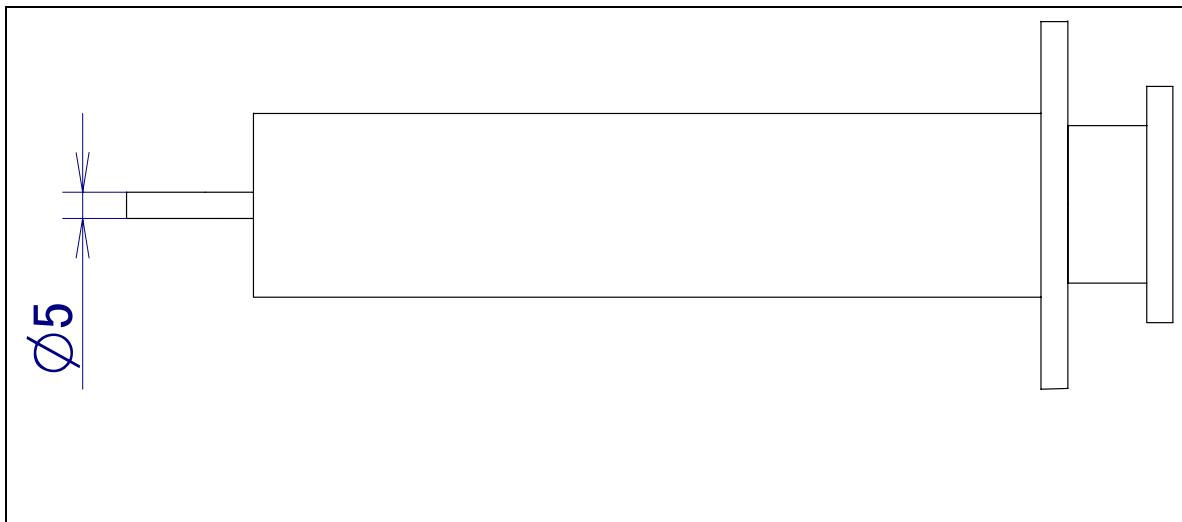
Instruments	Accuracy/Tolerance	Applications
Dialgauge accuracy	1/100 mm	Measurement of positioning and backlash
Slide calipers	150 mm	

(b) Tools

- • Torque wrench
  - Setting 5.6Nm(57kgfcm) M5
  - Setting 5.4Nm(55kgfcm) M4
  - Setting 4.5Nm(46kgfcm) M4
  - Setting 2.0Nm(20kgfcm) M3, M4
  - Setting 1.3Nm(13kgfcm) M3
- Cross tip (+) screwdrivers
  - Large, medium, and small sizes
- Flat tip (-) screwdrivers
  - Large, medium, and small sizes
- Box driver M2.5 to M6
- Hex-head wrench set M2.5 to M6
- Monkey wrench Middle, little
- Pincers
- Radio pincers
- Nippers
- Glasses wrench
- Pliers for C-retaining ring
- Loctite 242、262、518、638
- Grease applying kit A05B-1139-K021  
(It is options that grease (80g) for the grease greasing with the injection syringe and the tube makes a set.)
- grease in tube (80g) A05B-1139-K022

## 1.CHECKS AND MAINTENANCE

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**Fig 1.7 example of cylinder**

# **2**

## **PERIODIC MAINTENANCE**

---

## 2.1 REPLACING THE BATTERIES

### (1-YEAR CHECKS (battery built-in type))

### (1.5-YEAR CHECKS (external battery type))

The position data of each axis is preserved by the backup batteries. The batteries need to be replaced every 1 year in case of battery built-in J1 base type 1.5 years in case of external battery type. Also, use the following procedure to replace when the backup battery voltage drop alarm occurs.

#### Procedure of replacing the battery (battery built-in type)

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

##### **!CAUTION**

Replacing the batteries with the power supply turned off causes all current position data to be lost. Therefore, mastering will be required again.

- 2 When severe dust/liquid protection or 5LC,5WP,5C is selected, remove the battery case cap. (Fig. 2.1(a))
- 3 Loosen the plate screw, take out the lid of the battery box, and replace battery. Battery can be taken out by pulling the stick, which is center of the battery box.
- 4 Assemble them by the opposite procedure. Pay attention to the direction of batteries. Please exchange packing absolutely when severe dust/liquid protection specification or 5LC,5WP,5C is selected.

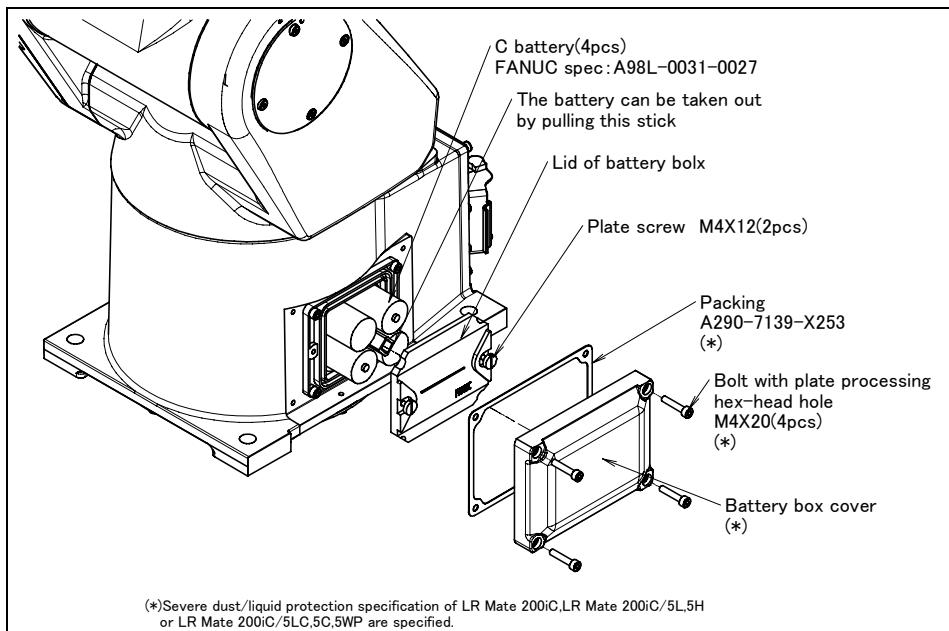


Fig.2.1 (a) Replacing the battery (battery built-in type)

## Procedure of replacing the battery (external battery type)

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

**! CAUTION**

Be sure to keep the power 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. 2.1(b))
- 3 Take out the old batteries from the battery case.
- 4 Insert new batteries into the battery case. Pay attention to the direction of batteries.
- 5 Close the battery case cap.

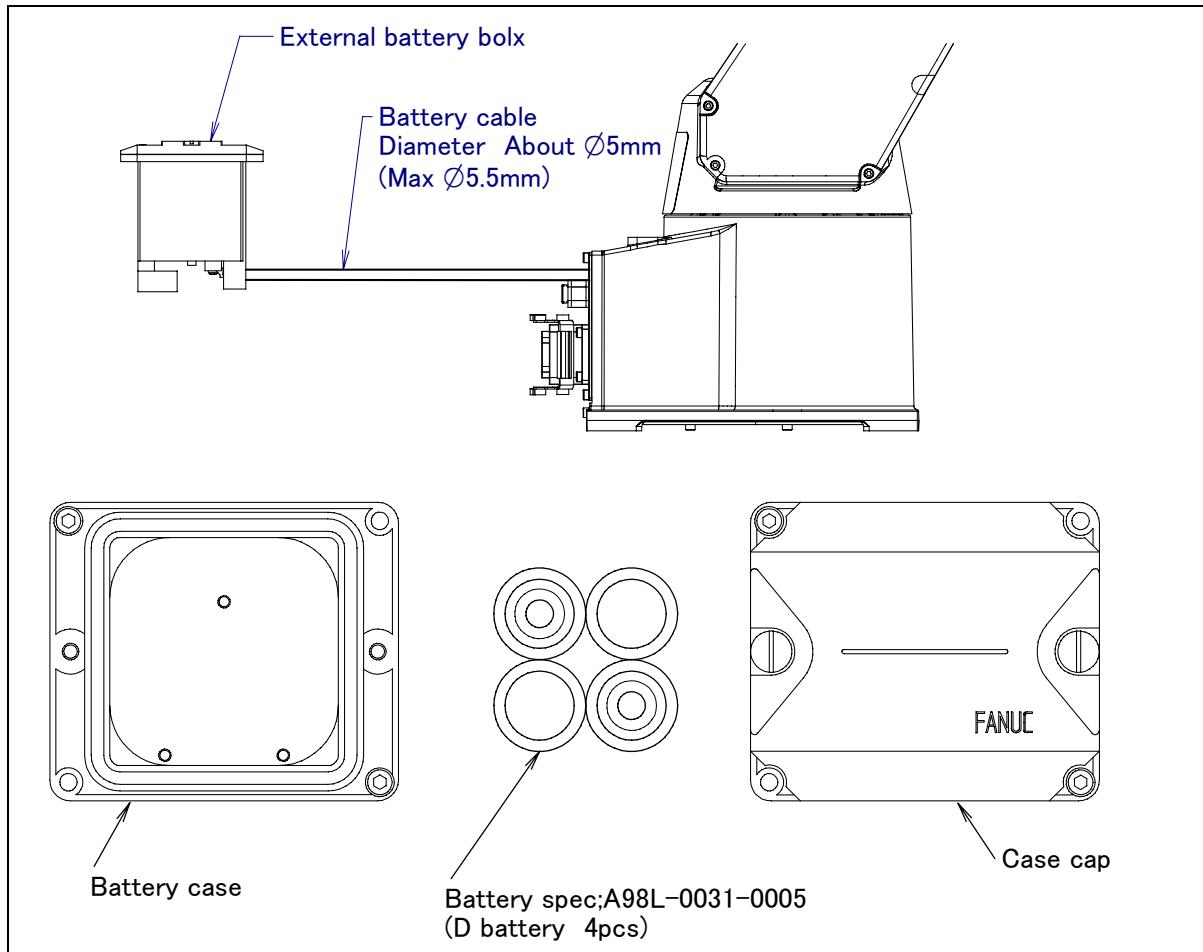
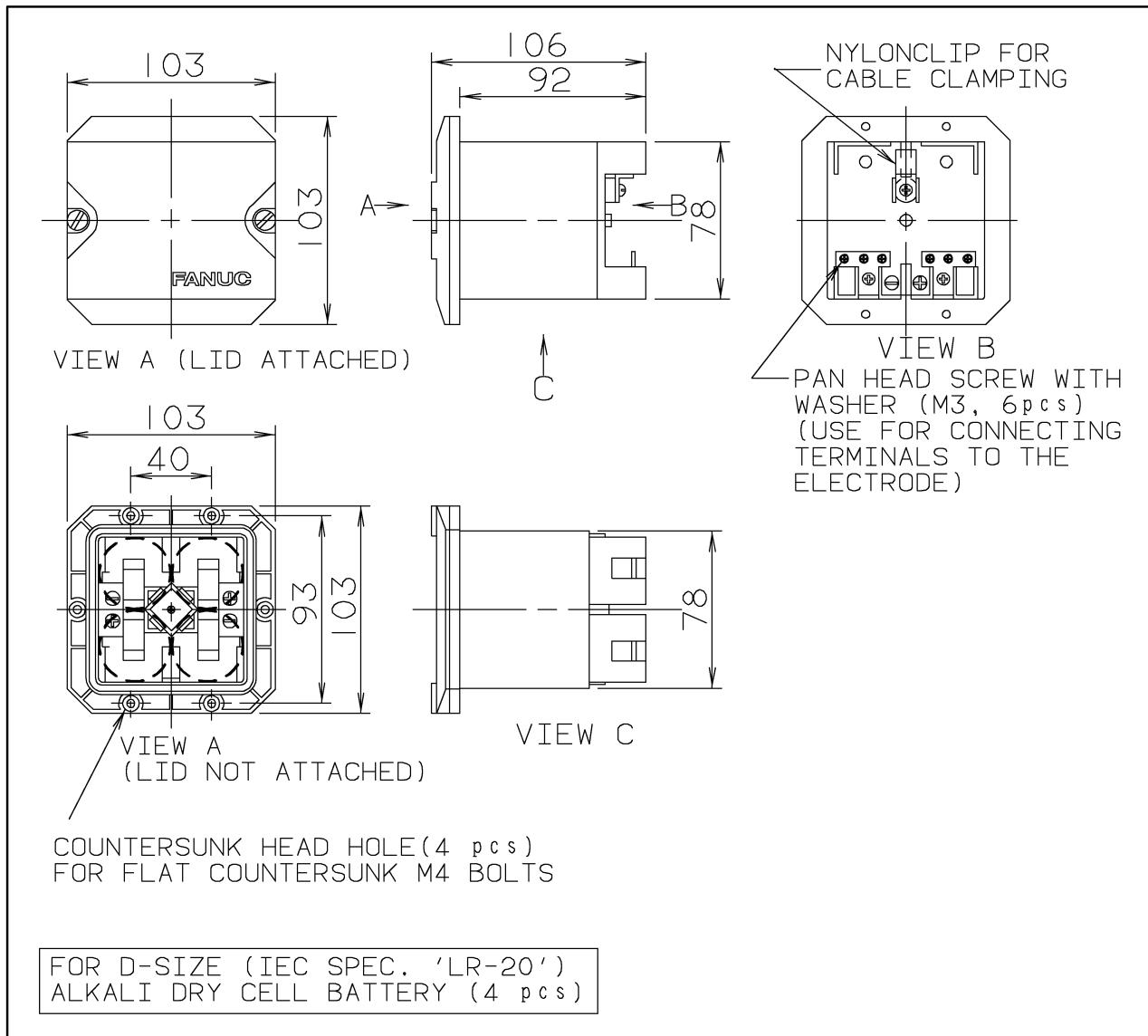


Fig.2.1 (b) Replacing the battery (external battery type)

Fig 2.1(c) shows the external size of external battery box.  
 When the battery box needs to be built into the control unit or other internal units, refer to the outer dimensions shown in Fig.2.1(c)  
 The battery box can be fixed by using M4 flat-head screws. (The bolts do not come with the system.)  
 A maximum of six terminals can be attached to the backplane of the battery box.



**Fig.2.1(c) Outer dimensions of the battery box**

## 2.2 REPLENISH THE GREASE OF THE DRIVE MECHANISM (4 years (11,520 hours) checks)

Replacing the grease of the reducers every four years or 15,360 hours by using the following procedures.

For the grease name and quantity, see the table 2.2 (a).

**Table 2.2 (a) Grease for 4-year periodical Replacement**

Greasing points	Greasing amount	Specified grease
J1-axis reducer	2.7g(3ml)	Harmonic grease 4BNo.2 Spec: A98L-0040-0230
J2-axis reducer	2.7g(3ml)	
J3-axis reducer	1.8g(2ml)	
J4-axis reducer	1.8g(2ml)	
J5-axis reducer	1.8g(2ml)	
J6-axis reducer	1.8g(2ml)	

For grease replacement, use the attitudes indicated below.

**Table 2.2 (b) Attitudes for greasing**

Supply position	Attitude					
	J1	J2	J3	J4	J5	J6
J1-axis reducer	-90°	90°				
J2-axis reducer						
J3-axis reducer						
J4-axis reducer	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary	Arbitrary
J5-axis reducer						
J6-axis reducer						

 **CAUTION**

The following maintenance kits are prepared for the grease greasing.

Greasing kit: A05B-1139-K021

(This a set of greasing syringe and grease in tube.)

Grease in tube: A05B-1139-K022

There is no J6-axis for LR Mate 200iC/5H

**⚠ NOTE**

If greasing is performed incorrectly, the internal pressure of the grease bath may suddenly increase, possibly causing damage to the seal, which would in turn lead to grease leakage and abnormal operation. When performing greasing, therefore, observe the following cautions.

- 1 In case of J1-axis and J3-axis, before starting to grease, open the grease outlet (remove the seal bolt from the grease outlet).
- 2 Use grease only of the specified type. Grease of a type other than that specified may damage the reducer or lead to other problems. Do no use Harmonic grease SK-3
- 3 To prevent accidents caused by slipping, completely remove any excess grease from the floor or robot.
- 4 Please fill a necessary amount to the injection syringe after softening grease in the tube massaging it by the hand when you use the grease greasing kit. Please install the nozzle in the point of the injection syringe. Please remove the nozzle and do the cap when you do not use the injection syringe.

## 2.2.1 Grease replacement procedure of the J1-axis reducer

- 1 Move the robot to the attitude of  $J1=-90^\circ$  and  $J2=90^\circ$ .
- 2 Turn off the power.
- 3 Remove the bolt/seal bolt (1) and cover U (2). In case of packing is attached, remove packing (3), too.
- 4 Remove seal bolt of two places refer to fig.2.2.1.
- 5 Supply regulated amount grease through the grease inlet by using injection syringe. Pay attention that grease inlet differs in case of floor mount and top mount. At this time, note that grease might come out from the side not used.
- 6 Assemble parts in the opposite procedure. In case of packing is attached, be sure to replace packing.

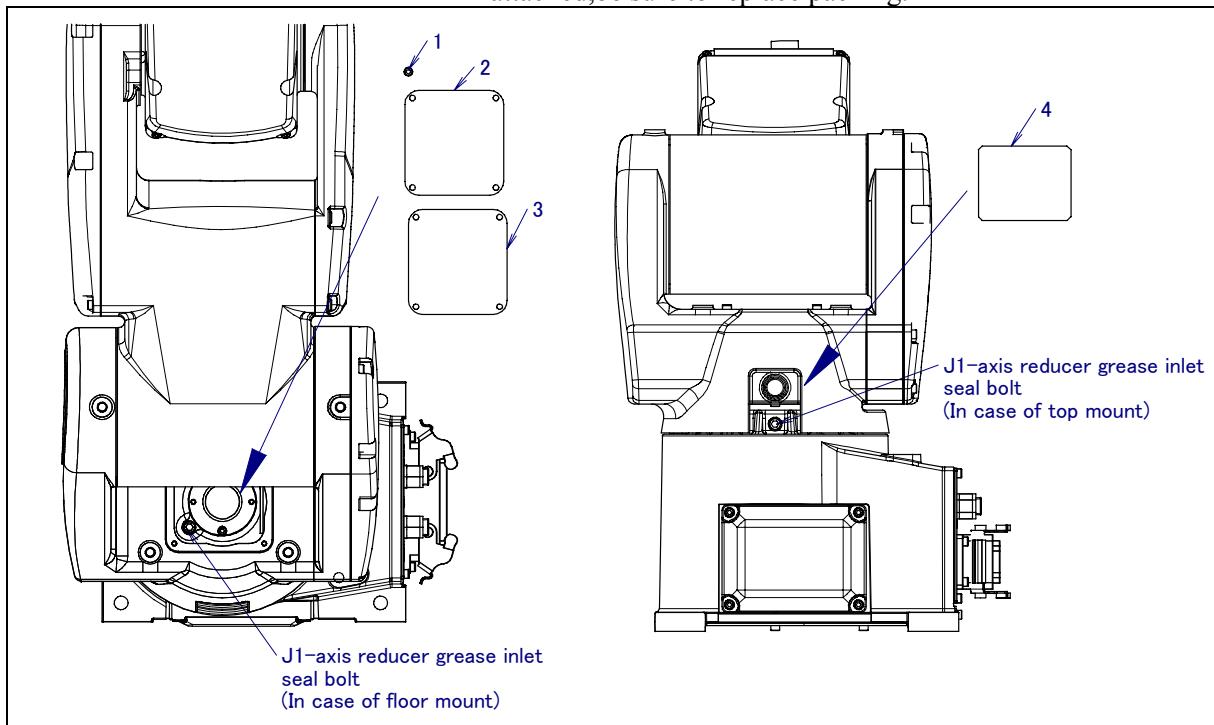


Fig. 2.2.1 Replacing grease of the J1-axis reducer

	Name	Specification	Amount	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-4X8	4		
	SEAL BOLT	A97L-0218-0496#M4X10BC(*1)	4		4.5 N·m (46kgf·cm)
	SEAL BOLT	A97L-0218-0496#M4X10EN(*2)	4		
2	COVER U	A290-7139-X332(*3)	1		
		A290-7139-Y332(*4)	1		
		A290-7139-Z332(*5)	1		
3	PACKING	A290-7139-X356 (*6)	1		
4	COVER	A290-7139-X347	1		

(\*1) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*2) When LR Mate 200iC/5LC,5WP 5C is specified.

(\*3) When LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*4) When LR Mate 200iC,LR Mate 200iC/5C,5LC is specified.

(\*5) When LR Mate 200iC,LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP 5C is specified.

## 2.2.2 Grease replacement procedure of the J2-axis reducer

- 1 Turn off the power.
- 2 Remove the seal bolt (1), (2) and remove cover S (3) and packing (4). Supply grease through the grease inlet by using injection syringe. Be sure to spread it to round in the gear because a regulated amount is a standard.
- 3 Attach cover S (3) and packing (4). In this time, note the installation phase. Be sure to replace packing. When reusing the seal bolt, be sure to seal it with seal tape.

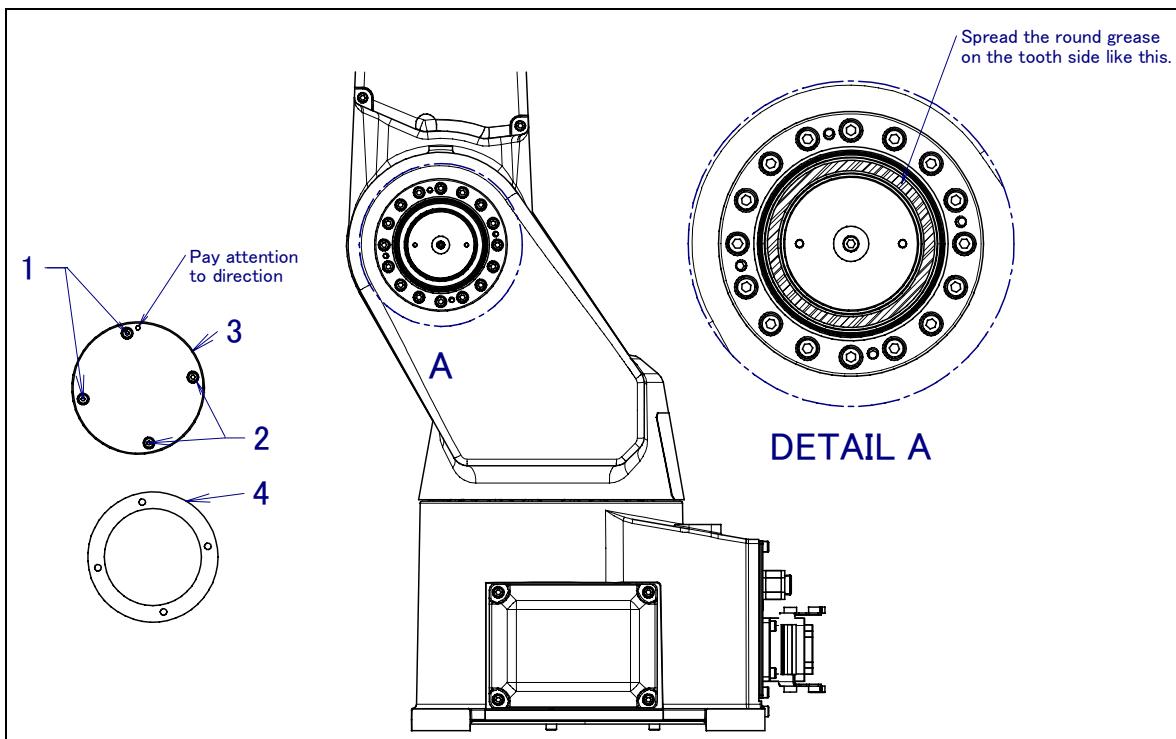


Fig. 2.2.2 Replacing grease of the J2-axis reducer

	Name	Specification	Amount	Loctite	Torque N·m (kgf·cm)
1	SEAL BOLT	A97L-0218-0738#040808BC(*1)	2		2.0 N·m (46kgf·cm)
	SEAL BOLT	A97L-0218-0738#040808EN(*2)	2		2.0 N·m (46kgf·cm)
2	SEAL BOLT	A97L-0218-0595#040808BC(*1)	2		2.0 N·m (46kgf·cm)
	SEAL BOLT	A97L-0218-0595#040808EN(*2)	2		2.0 N·m (46kgf·cm)
3	COVER S	A290-7139-X309	1		
4	PACKING	A290-7139-X351	1		

(\*1) When LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*2) When LR Mate 200iC/5LC,5WP,5C is specified.

## 2.2.3 Grease replacement procedure of the J3-axis reducer

- 1 Turn off the power.
- 2 Remove the bolt/seal bolt (1) and J2 arm cover (2). In case of packing is attached, remove packing (3), too.
- 3 Supply regulated amount grease through the grease inlet by using injection syringe. Please use arbitrary one as a greasing inlet.
- 4 Attach J2 arm cover. In case of packing is attached, be sure to replace packing of. When reusing the seal bolt, be sure to seal it with seal tape.

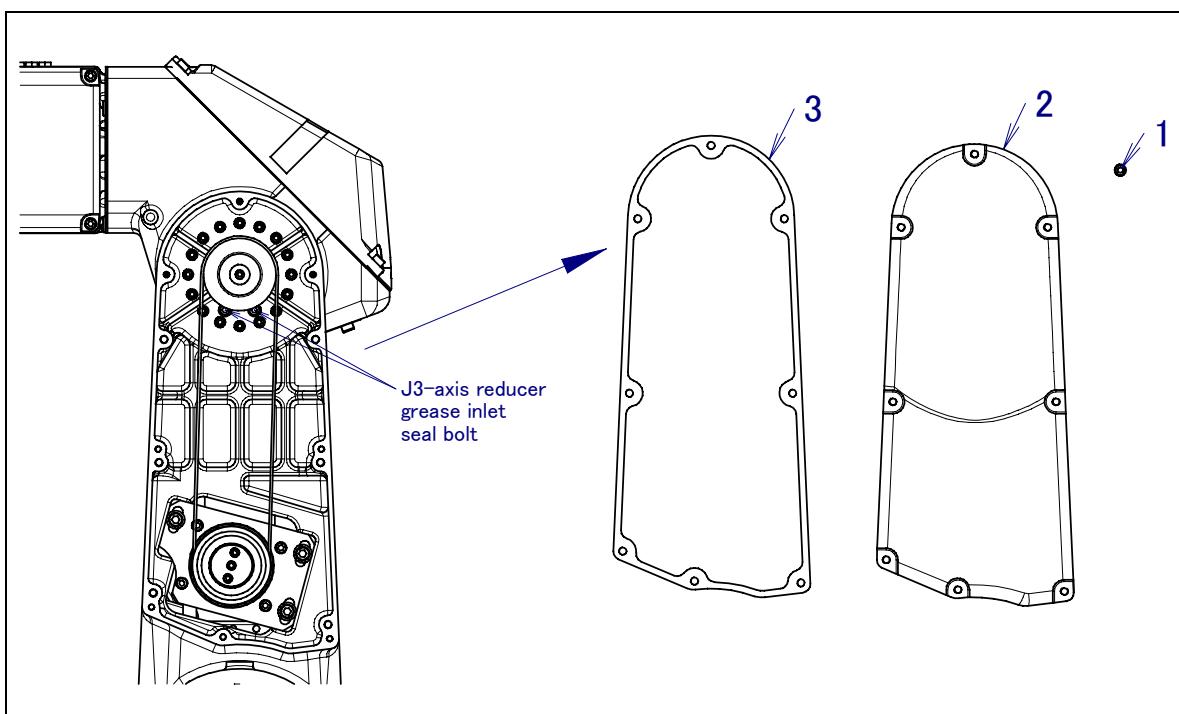


Fig. 2.2.3 Replacing grease of the J3-axis reducer

	Name	Specification	Amount	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4X10	3		2.0 N·m (20kgf·cm)
	SEAL BOLT	A97L-0218-0496#M4X12BC(*1)	8		4.5 N·m (46kgf·cm)
	SEAL BOLT	A97L-0218-0496#M4X12EN(*2)	8		4.5 N·m (46kgf·cm)
2	J2 ARM COVER	A290-7139-X306	1		
		A290-7139-X308 (*1)	1		
		A290-7139-Y308 (*3)	1		
		A290-7139-Z308 (*4)	1		
3	PACKING	A290-7139-X355 (*5)	1		

(\*1) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*2) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*3) When LR Mate 200iC/5LC,5C is specified.

(\*4) When LR Mate 200iC/5WP is specified.

(\*5) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

## 2.2.4 Grease replacement procedure of the J4-axis reducer

### NOTE

Fig. 2.2.4 is an example of standard type.  
In case of 5H type, read J5/J6 as J4/J5.

- 1 Turn off the power.
- 2 Remove the bolt/seal bolt (1) and J3 cover (2). In case of packing is attached, remove packing (3), too.
- 3 Supply regulated amount grease through the grease inlet by using injection syringe. Please note that grease might come out immediately after in the greasing or the greasing. Please note greasing excessively even in that case.
- 4 Attach J3 cover. In this time, be sure to replace packing . When reusing the seal bolt, be sure to seal it with seal tape.

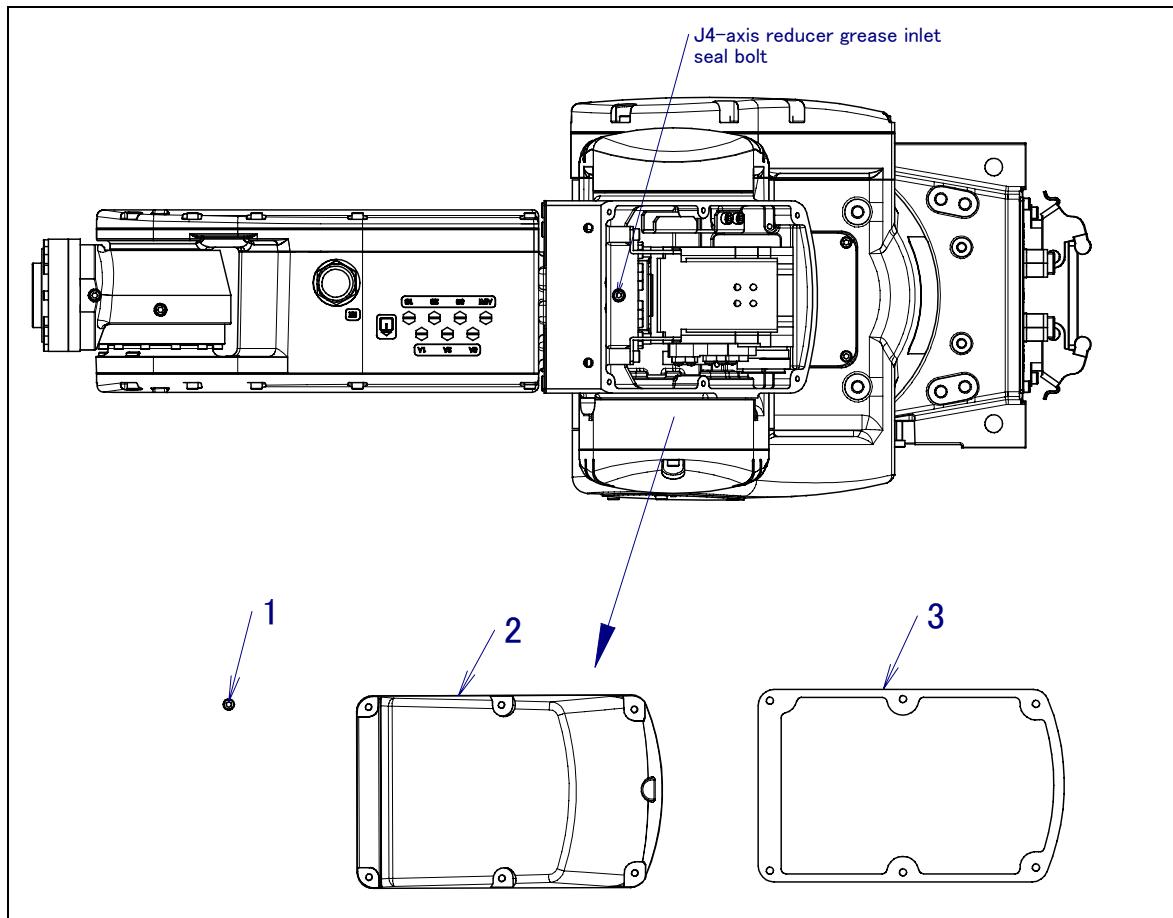


Fig. 2.2.4 Replacing grease of the J4-axis reducer (LR Mate 200iC)

	Name	Specification	Amount	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4X10	3		2.0 N·m (20kgf·cm)
	PLATED BOLT	A97L-0218-0496#M4X12BC(*1)	6		2.0 N·m (20kgf·cm)
	PLATED BOLT	A97L-0218-0496#M4X12EN(*2)	6		2.0 N·m (20kgf·cm)
2	J3 COVER	A290-7139-X404	1		
		A290-7139-X406 (*1)	1		
		A290-7139-Y406 (*3)	1		
		A290-7139-Z406 (*4)	1		
3	PACKING	A290-7139-X451 (*5)	1		

(\*1) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*2) When LR Mate 200iC/5LC,5WP 5C is specified.

(\*3) When LR Mate 200iC/5LC,5C is specified.

(\*4) When LR Mate 200iC/5WP is specified.

(\*5) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP 5C is specified.

## 2.2.5 Grease replacement procedure of the J5/J6-axis reducer

### NOTE

Fig. 2.2.5 is an example of standard type.  
In case of 5H type, read J5/J6 as J4/J5.

- 1 Turn off the power.
- 2 Supply regulated amount grease through the grease inlet by using injection syringe. Please note that grease might come out immediately after in the greasing or the greasing. Please note greasing excessively even in that case.

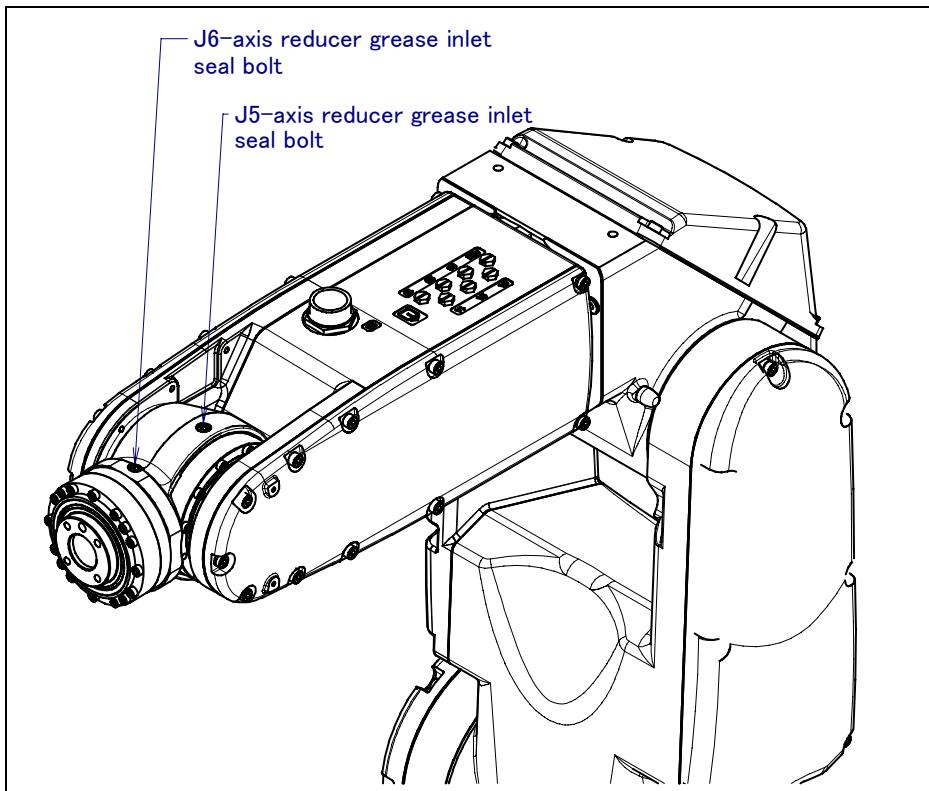


Fig. 2.2.5 Replacing grease of the J5/J6-axis reducer (LR Mate 200iC)  
Replacing grease of the J4/J5-axis reducer (LR Mate 200iC/5H)

# 3

## TROUBLESHOOTING

---

## **3.1      OVERVIEW**

---

The cause of a failure in the mechanical unit may be difficult to localize, because failures can arise from many interrelated factors. If you fail to take the correct measures, the failure may be aggravated. Therefore, it is necessary to analyze the symptoms of the failure precisely so that the true cause can be found.

## 3.2 FAILURES, CAUSES AND MEASURES

Table 3.2 lists the major failures that may occur in the mechanical unit and their probable causes. If you cannot pinpoint a failure cause or which measures to apply, contact FANUC.

**Table 3.2 (a) Failures, causes and measures**

Symptom	Description	Cause	Measure
Vibration Noise	<ul style="list-style-type: none"> <li>-The J1 base lifts off the floor plate as the robot operates.</li> <li>-There is a gap between the J1 base and floor plate.</li> <li>-A J1 base retaining bolt is loose.</li> </ul>	<ul style="list-style-type: none"> <li>[J1 base fastening]</li> <li>-It is likely that the robot J1 base is not securely fastened to the floor plate.</li> <li>-Probable causes are a loose bolt, an insufficient degree of surface flatness, or foreign material caught between the floor plate and floor plate.</li> <li>-If the robot is not securely fastened to the floor plate, the J1 base lifts the floor plate as the robot operates, allowing the base and floor plates to strike each other, which, in turn, leads to vibration.</li> </ul>	<ul style="list-style-type: none"> <li>-If a bolt is loose, apply Loctite and tighten it to the appropriate torque.</li> <li>-Adjust the floor plate surface flatness to within the specified tolerance.</li> <li>-If there is any foreign matter between the J1 base and floor plate, remove it.</li> </ul>
	<ul style="list-style-type: none"> <li>-Apply epoxy to the floor surface and re-install the plate.</li> </ul>	<ul style="list-style-type: none"> <li>[Rack or floor]</li> <li>-It is likely that the rack or floor is not sufficiently rigid.</li> <li>-If the rack or floor is not sufficiently rigid, reaction from the robot deforms the rack or floor, leading to vibration.</li> </ul>	<ul style="list-style-type: none"> <li>-Reinforce the rack or floor to make it more rigid.</li> <li>-If it is impossible to reinforce the rack or floor, modify the robot control program; doing so might reduce the amount of vibration.</li> </ul>
	<ul style="list-style-type: none"> <li>-Vibration becomes more serious when the robot adopts a specific posture.</li> <li>-If the operating speed of the robot is reduced, vibration stops.</li> <li>-Vibration is most noticeable when the robot is accelerating.</li> <li>-Vibration occurs when two or more axes operate at the same time.</li> </ul>	<ul style="list-style-type: none"> <li>[Overload]</li> <li>-It is likely that the load on the robot is greater than the maximum rating.</li> <li>-It is likely that the robot control program is too demanding for the robot hardware.</li> <li>-It is likely that the ACCELERATION value is excessive.</li> </ul>	<ul style="list-style-type: none"> <li>-Check the maximum load that the robot can handle once more. If the robot is found to be overloaded, reduce the load, or modify the robot control program.</li> <li>-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).</li> </ul>

### 3.TROUBLESHOOTING

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Symptom	Description	Cause	Measure
Vibration Noise (Continued)	-Vibration was first noticed after the robot collided with an object or the robot was overloaded for a long period. -The grease of the vibrating axis has not been exchanged for a long period.	[Broken gear, bearing, or reducer] - It is likely that collision or overload applied an excessive force on the drive mechanism, thus damaging the gear tooth 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 foreign matter 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, because the grease has not been changed for a long period, fretting occurred on the gear tooth surface or rolling surface of a bearing, or reducer due to metal fatigue.  These factors all generate cyclic vibration and noise.	-Operate one axis at a time to determine which axis is vibrating. -Remove the motor, and replace the gear, the bearing, and the reducer. For the spec. of parts and the method of replacement, contact FANUC. -Using the robot within its maximum rating prevents problems with the drive mechanism. -Regularly changing the grease with a specified type can help prevent problems.

**3.TROUBLESHOOTING**

<b>Symptom</b>	<b>Description</b>	<b>Cause</b>	<b>Measure</b>
Vibration Noise (Continued)	-The cause of problem cannot be identified from examination of the floor, rack, or mechanical section.	<p>[Controller, cable, and motor]</p> <p>-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.</p> <p>-If the pulse coder develops a fault, vibration might occur because information about the motor position cannot be transferred to the controller accurately.</p> <p>-If the motor becomes defective, vibration might occur because the motor cannot deliver its rated performance.</p> <p>-If a power line in a movable cable of the mechanical section has an intermittent break, vibration might occur because the motor cannot accurately respond to commands.</p> <p>-If a pulse coder wire in a movable part of the mechanical section has an intermittent break, vibration might occur because commands cannot be sent to the motor accurately.</p> <p>-If a connection cable between them has an intermittent break, vibration might occur.</p> <p>-If the power cable between them has an intermittent break, vibration might occur.</p> <p>-If the power source voltage drops below the rating, vibration might occur.</p> <p>-If a robot control parameter is set to an invalid value, vibration might occur.</p> <p>-There is a possibility that the belt has been damaged about the allophone of the axis of the belt drive.</p>	<p>-Refer to the Controller Maintenance Manual for troubleshooting related to the controller and amplifier.</p> <p>-Replace the pulse coder for the motor of the axis that is vibrating, and check whether the vibration still occurs.</p> <p>-Also, replace the motor of the axis that is vibrating, and check whether vibration still occurs. For the method of replacement, contact FANUC.</p> <p>-Check that the robot is supplied with the rated voltage.</p> <p>-Check whether the sheath of the power cord is damaged. If so, replace the power cord, and check whether vibration still occurs.</p> <p>-Check whether the sheath of the cable connecting the mechanical section and controller is damaged. If so, replace the connection cable, and check whether vibration still occurs.</p> <p>-If vibration occurs only when the robot assumes a specific posture, it is likely that a cable in the mechanical unit is broken.</p> <p>-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.</p> <p>-Check that the robot control parameter is set to a valid value. If it is set to an invalid value, correct it. Contact FANUC for further information if necessary.</p> <p>-Please exchange it if watching the cover is opened, an internal belt is confirmed, and damage is shown.</p>

### 3.TROUBLESHOOTING

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Symptom	Description	Cause	Measure
Vibration	-There is some relationship between the vibration of the robot and the operation of a machine near the robot.	[Noise from a nearby machine] -If the robot is not grounded properly, electrical noise is induced on the grounding wire, preventing commands from being transferred accurately, thus leading to vibration. -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 leading to vibration.	-Connect the grounding wire firmly to ensure a reliable ground potential and prevent extraneous electrical noise.
Rattling	-While the robot is not supplied with power, pushing it with the hand causes part of the mechanical unit to wobble. -There is a gap on the mounting face of the mechanical unit.	[Mechanical section coupling bolt] -It is likely that overloading or a collision has loosened a mounting bolt in the robot mechanical section.	-Check that the following bolts for each axis are tight. If any of these bolts is loose, apply Loctite and tighten it to the appropriate torque. -Motor retaining bolt -Reducer retaining bolt -Base retaining bolt -Arm retaining bolt -Casting retaining bolt -End effector retaining bolt
	-Backlash is greater than the tolerance stated in the applicable maintenance manual. (See Section 3.3.)	[Increase in backlash] -It is likely that excessive force applied to the drive mechanism, due to a collision or overloading, has broken a gear or the inside of the reducer, resulting in an increase in the amount of backlash. -It is likely that prolonged use has caused the tooth surfaces of a gear and the inside of the reducer to wear out, resulting in an increase in the amount of backlash. -It is likely that prolonged use without changing the grease has caused the tooth surfaces of a gear and the inside of the reducer to wear out, resulting in an increase in the amount of backlash.	-Operate one axis at a time to determine which axis has the increased backlash. -Remove the motor, and check whether any of its gears are broken. If any gear is broken, replace it. -Check whether any other gear of the drive mechanism is damage. If there is no damage gear, replace the reducer. -If the reducer is broken, or if a gear tooth is missing, replace the relevant component. Also, remove all the grease from the gear box and wash the inside of the gear box. -After replacing the gear or reducer, add an appropriate amount of grease. -Using the robot within its maximum rating prevents problems with the drive mechanism. -Regularly applying the grease with a specified type can help prevent problems.

Symptom	Description	Cause	Measure
Motor overheating	<ul style="list-style-type: none"> <li>-The ambient temperature of the installation location increases, causing the motor to overheat.</li> <li>-After the robot control program or the load was changed, the motor overheated.</li> </ul>	<p>[Ambient temperature]</p> <p>-It is likely that a rise in the ambient temperature prevented the motor from releasing heat efficiently, thus leading to overheating.</p> <p>[Operating condition]</p> <p>-It is likely that the robot was operated with the maximum average current exceeded.</p>	<ul style="list-style-type: none"> <li>-The teach pendant can be used to monitor the average current. Check the average current when the robot control program is running. The allowable average current is specified for the robot according to its ambient temperature. Contact FANUC for further information.</li> <li>-Relaxing the robot control program and conditions can reduce the average current, thus preventing overheating.</li> <li>-Reducing the ambient temperature is the most effective means of preventing overheating.</li> <li>-Having the surroundings of the robot well ventilated enables the robot to release heat efficiently, thus preventing overheating. Using a fan to direct air at the motor is also effective.</li> <li>-If there is a source of heat near the motor, it is advisable to install shielding to protect the motor from heat radiation.</li> </ul>
	<ul style="list-style-type: none"> <li>-After a control parameter was changed, the motor overheated.</li> </ul>	<p>[Parameter]</p> <p>-If data input for a workpiece is invalid, the robot cannot be accelerated or decelerated normally, so the average current increases, leading to overheating.</p>	<ul style="list-style-type: none"> <li>-Input an appropriate parameter as described in CONTROLLER OPERATOR'S MANUAL.</li> </ul>
	<ul style="list-style-type: none"> <li>-Symptom other than stated above</li> </ul>	<p>[Mechanical section problems]</p> <p>-It is likely that problems occurred in the mechanical unit drive mechanism, thus placing an excessive load on the motor.</p> <p>[Motor problems]</p> <p>-It is likely that a failure of the motor brake resulted in the motor running with the brake applied, thus placing an excessive load on the motor.</p> <p>-It is likely that a failure of the motor prevented it from delivering its rated performance, thus causing an excessive current to flow through the motor.</p>	<ul style="list-style-type: none"> <li>-Repair the mechanical unit while referring to the above descriptions of vibration, noise, and rattling.</li> <li>-Check that, when the servo system is energized, the brake is released.</li> <li>If the brake remains applied to the motor all the time, replace the motor.</li> <li>-If the average current falls after the motor is replaced, it indicates that the first motor was faulty.</li> </ul>

### 3.TROUBLESHOOTING

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Symptom	Description	Cause	Measure
Grease	-Grease is leaking from the mechanical unit.	<p>[Poor sealing]</p> <p>-Probable causes are a crack in the casting, a broken O-ring, a damaged oil seal, or a loose seal bolt.</p> <p>-A crack in a casting can occur due to excessive force that might be caused in collision.</p> <p>-An O-ring can be damaged if it is trapped or cut during disassembling or re-assembling.</p> <p>-An oil seal might be damaged if extraneous dust scratches the lip of the oil seal.</p> <p>-A loose seal bolt might allow grease to leak along the threads.</p>	<p>-If a crack develops in the casting, sealant can be used as a quick-fix to prevent further grease leakage. However, the component should be replaced as soon as possible, because the crack might extend.</p> <p>-O-rings are used in the locations listed below.</p> <ul style="list-style-type: none"> <li>-Motor coupling section</li> <li>-Reducer coupling section</li> <li>-Wrist coupling section</li> <li>-J3 arm coupling section</li> <li>-Inside the wrist</li> </ul> <p>-Oil seals are used in the locations stated below.</p> <ul style="list-style-type: none"> <li>-Inside the reducer</li> <li>-Inside the wrist</li> </ul> <p>-Seal bolts are used in the locations stated below.</p> <ul style="list-style-type: none"> <li>-Grease drain inlet and outlet</li> </ul>
Dropping axis	<p>-An axis drops because the brake does not function.</p> <p>-An axis drops gradually when it should be at rest.</p>	<p>[Brake drive relay and motor]</p> <p>-It is likely that brake drive relay contacts are stuck to each other to keep the brake current flowing, thus preventing the brake from operating when the motor is deenergized.</p> <p>-It is likely that the brake shoe has worn out or the brake main body is damaged, preventing the brake from operating efficiently.</p> <p>-It is likely that oil or grease has entered the motor, causing the brake to slip.</p>	<p>-Check whether the brake drive relay contacts are stuck to each other. If they are found to be stuck, replace the relay.</p> <p>-If the brake shoe is worn out, if the brake main body is damaged, or if oil or grease has entered the motor, replace the motor.</p>

Symptom	Description	Cause	Measure
Displacement	-The robot operates at a point other than the taught position. -The repeatability is not within the tolerance.	[Mechanical section problems] -If the repeatability is unstable, probable causes are a failure in the drive mechanism or a loose bolt. -If the repeatability becomes stable, it is likely that a collision imposed an excessive load, leading to slipping on the base surface or the mating surface of an arm or reducer. -It is likely that the pulse coder is abnormal.	-If the repeatability is unstable, repair the mechanical section 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 pulse coder is abnormal, replace the motor or the pulse coder.
	-Displacement occurs only in a specific peripheral unit.	[Peripheral unit displacement] -It is likely that an external force was applied to the peripheral unit, thus shifting its position relative to the robot.	-Correct the setting of the peripheral unit position. -Correct the taught program.
	-Displacement occurred after a parameter was changed.	[Parameter] -It is likely that the mastering data was rewritten in such a way that the robot origin was shifted.	-Re-enter the previous mastering data, which is known to be correct. -If correct mastering data is unavailable, perform mastering again.
BZAL alarm occurred	-BZAL is displayed on the controller screen	- It is likely that the voltage of the memory backup battery is low. - It is likely that the pulse coder cable is defected.	-Replace the battery. -Replace the cable.

**Table 3.2 (b) Allowable drops**

At power off	2 mm
At emergency stop	2 mm

**NOTE**

Each value indicates the amount by which an end effector mounting surface may fall.

## 3.3 BACKLASH MEASUREMENT

### Measurement method

- 1 Maintain the robot in a specified posture. (See Table 3.3.)
- 2 Apply positive and negative loads to each axis as shown in Fig.3.3 (a).
- 3 Remove the loads and measure the displacement.

Measure backlash by applying positive and negative loads to each axis three times. Average the values measured in the last two measurements for each axis, and use the averages as a measured backlash for the respective axes.

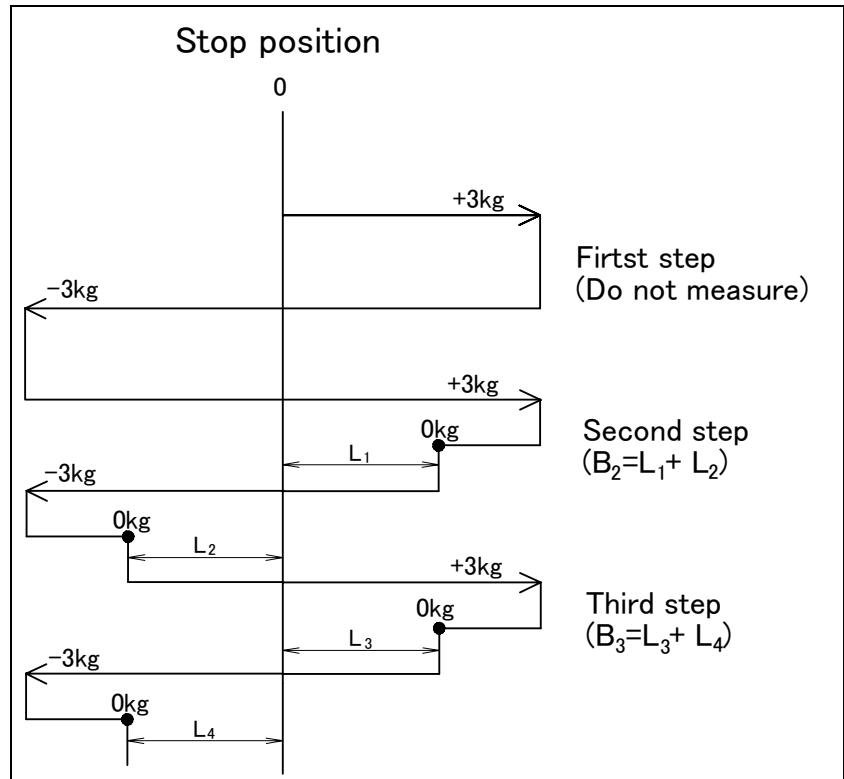


Fig. 3.3 (a) Backlash measurement method

Backlash B is calculated using the following expression:

$$B = \frac{B_2 + B_3}{2}$$

**Table 3.3(a) Backlash measurement posture, position and permissible value**

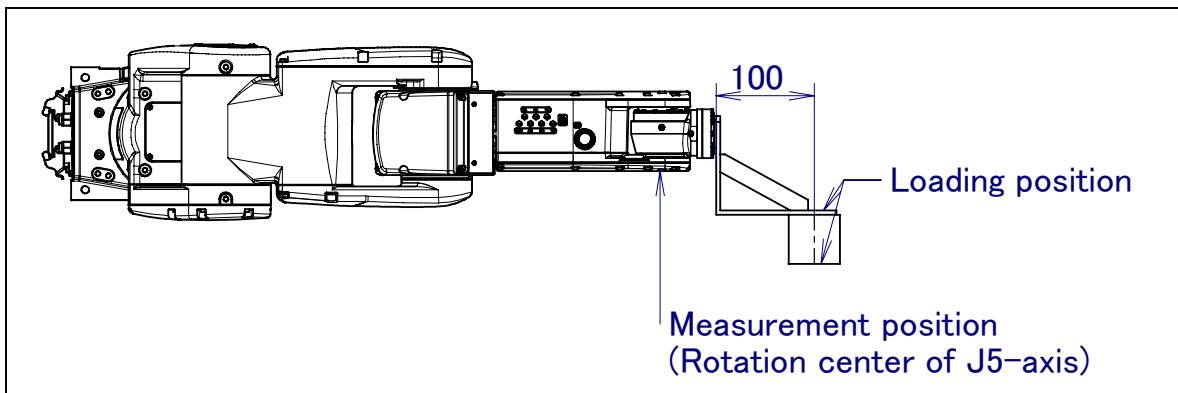
Measurement axis	J1-axis	J2-axis	J3-axis	J4-axis	J5-axis	J6-axis	Measurement position
J1-axis	Arbitrary	90°	0°	0°	0°	90°	Rotation center of J5-axis
J2-axis	Arbitrary	0°	90°	0°	0°	0°	Rotation center of J3-axis of J2 arm
J3-axis	Arbitrary	90°	-90°	0°	0°	180°	Rotation center of J5-axis
J4-axis	Arbitrary	0°	90°	0°	-90°	90°	100mm from rotation center of J4-axis
J5-axis	Arbitrary	90°	0°	0°	-90°	0° or 180°	206mm from rotation center of J5-axis
J6-axis	Arbitrary	90°	0°	0°	-90°	90° or -90°	100mm from rotation center of J6-axis

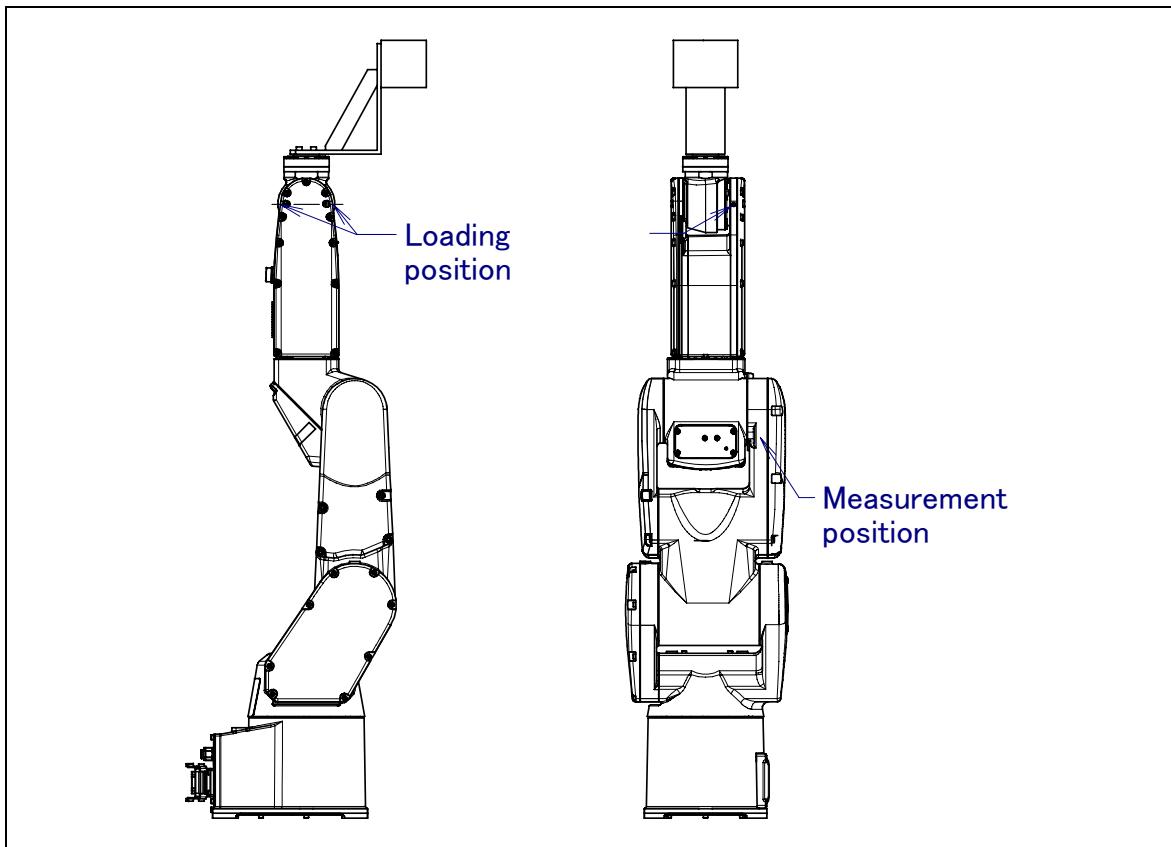
**Table 3.3(b) Distance at axis and measurement position and permissible value for backlash**

Measured axis	Distance at axis and measurement position (mm)		Permissible value (mm)	
	LR Mate 200iC, LR Mate 200iC/5C, 5WP,5H	LR Mate 200iC/5L,5LC	LR Mate 200iC, LR Mate 200iC/5C, 5WP,5H	LR Mate 200iC/5L,5LC
J1-axis	695	885	0.40	0.51
J2-axis	300	400	0.17	0.23
J3-axis	320	410	0.19	0.24
J4-axis	100	100	0.16	0.16
J5-axis	180	180	0.18	0.18
J6-axis	100	100	0.15	0.15

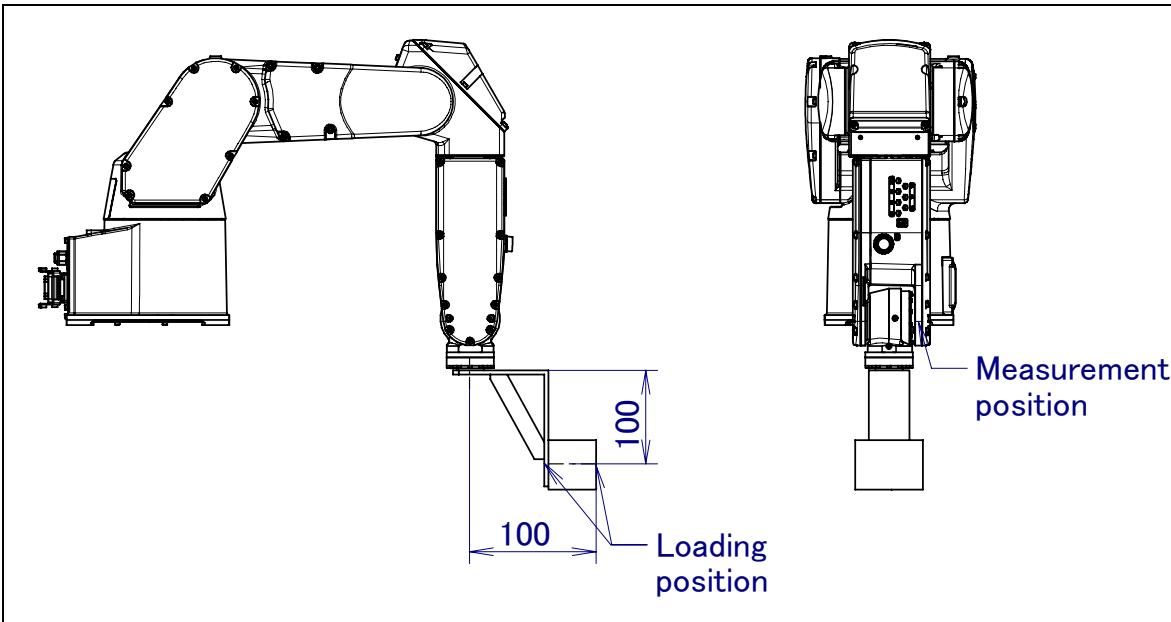
**NOTE**

In case of 5H type, read J5/J6 as J4/J5.

**Fig.3.3 (b) Backlash measurement position of J1-axis**



**Fig.3.3(c) Backlash measurement position of J2-axis**



**Fig.3.3 (d) Backlash measurement position of J3-axis**

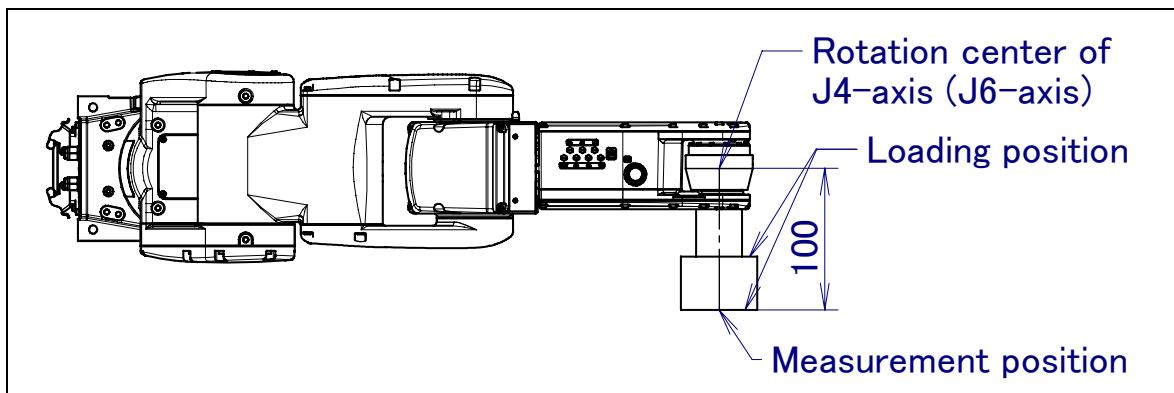


Fig.3.3 (e) Backlash measurement position of J4-axis

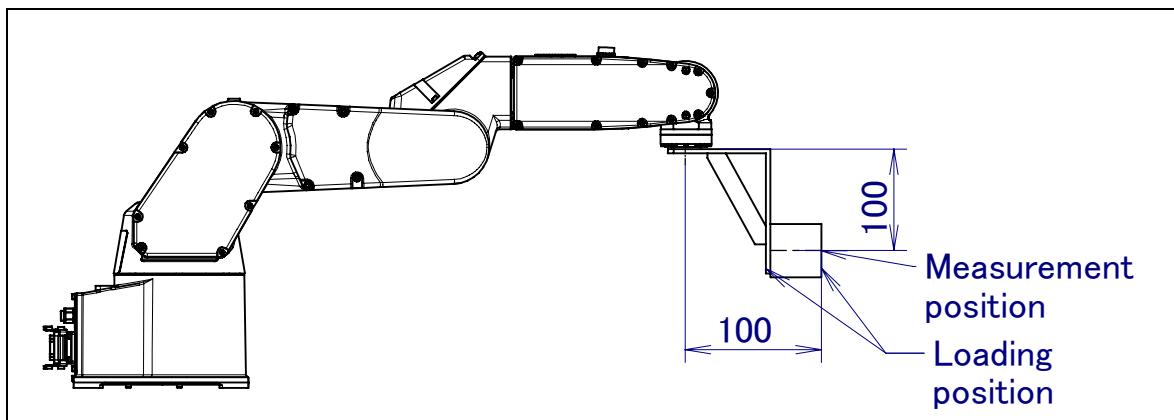


Fig.3.3 (f) Backlash measurement position of J5-axis

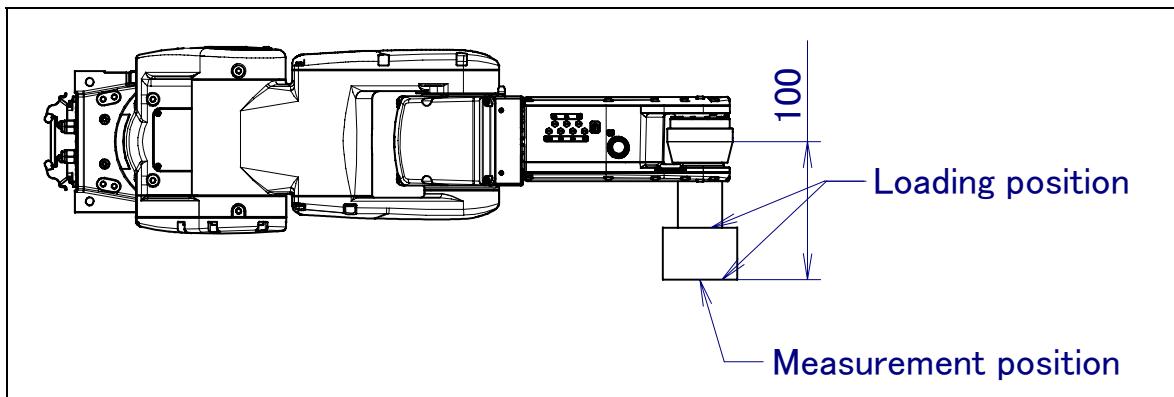


Fig.3.3 (g) Backlash measurement position of J6-axis

# 4 REPLACING PARTS

- When replacing a part, subsequent adjustment is required.
- When removing or mounting a motor, apply force in the direction of the shaft only. If excessive force is applied in any other direction, the motor and/or reducer may be damaged.
- If a motor and associated parts to be assembled incur a phase mismatch, assembly might prove impossible. Carefully check the state of the parts before removing them.
- Assemble a new O-ring and packing for seal securing after you exchange parts for spec of seal.

## ⚠ CAUTION

The packing must not be reused. To maintain dust and drip preventive effects, replace the old packing with new ones and then perform assembly.

- To secure the performance of the seal, replace seal bolt to new one after replacing parts as much as possible. If it is not possible to prepare it, peel off the sealant, spread Loctite on the internal thread, and recycle.

## NOTE

When applying Loctite to the important bolt tightening points, make sure that it is applied to the entire longitudinal portion in the engaging section of the female threads. If it is applied to the male threads, the bolts may be loosened because sufficient effects cannot be obtained. Remove the dust within the bolts and taps and wipe oil off the engaging section. Make sure that there is no solvent in the taps.

- When tightening a bolt, always observe the tightening torque, if specified those bolts for which no tightening torque is specified must be tightened according to the table of APPENDIX.
- Assemble the reducer to the vertical direction as much as possible when you assemble it.
- When installing bolt to reducer, make the applying order a corner and tighten uniformly.
- When applying Loctite 518 to reducer, pay attention Loctite doesn't enter inside the reducer.
- Spread it after softening grease mixing it when you do not softly spread grease easily.

**NOTE**

The following abbreviations are used herein.

STANDARD	: LR Mate 200 <i>i</i> C
5L	: LR Mate 200 <i>i</i> C/5L
5LC	: LR Mate 200 <i>i</i> C/5LC
5C	: LR Mate 200 <i>i</i> C/5C
5WP	: LR Mate 200 <i>i</i> C/5WP
5H	: LR Mate 200 <i>i</i> C/5H

## 4.1 FIGURE OF DRIVE MECHANISM

The drive mechanisms of each axis are shown in the following.

**!CAUTION**

When robot is 5H,please read J5/J6 as J4/J5.

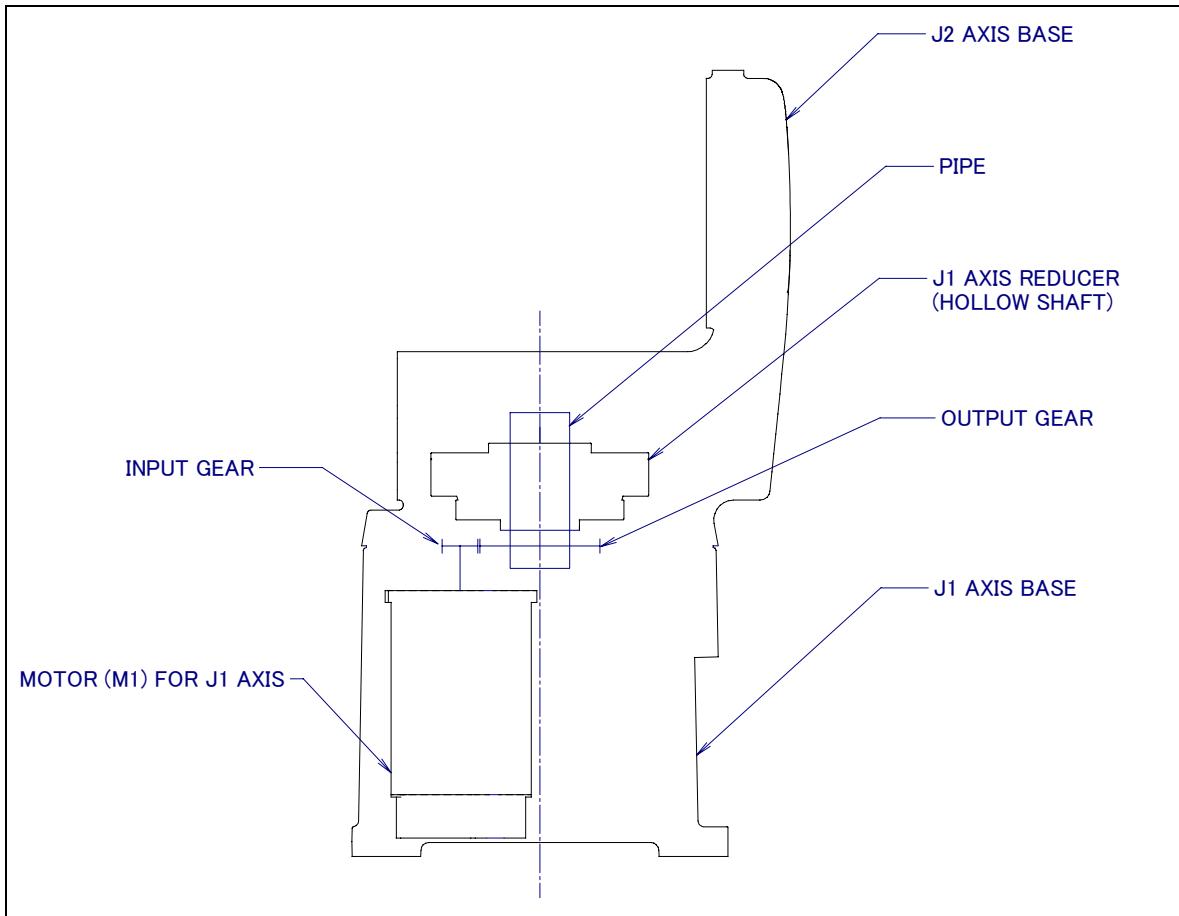


Fig. 4.1 (a) Drive mechanism of J1-axis

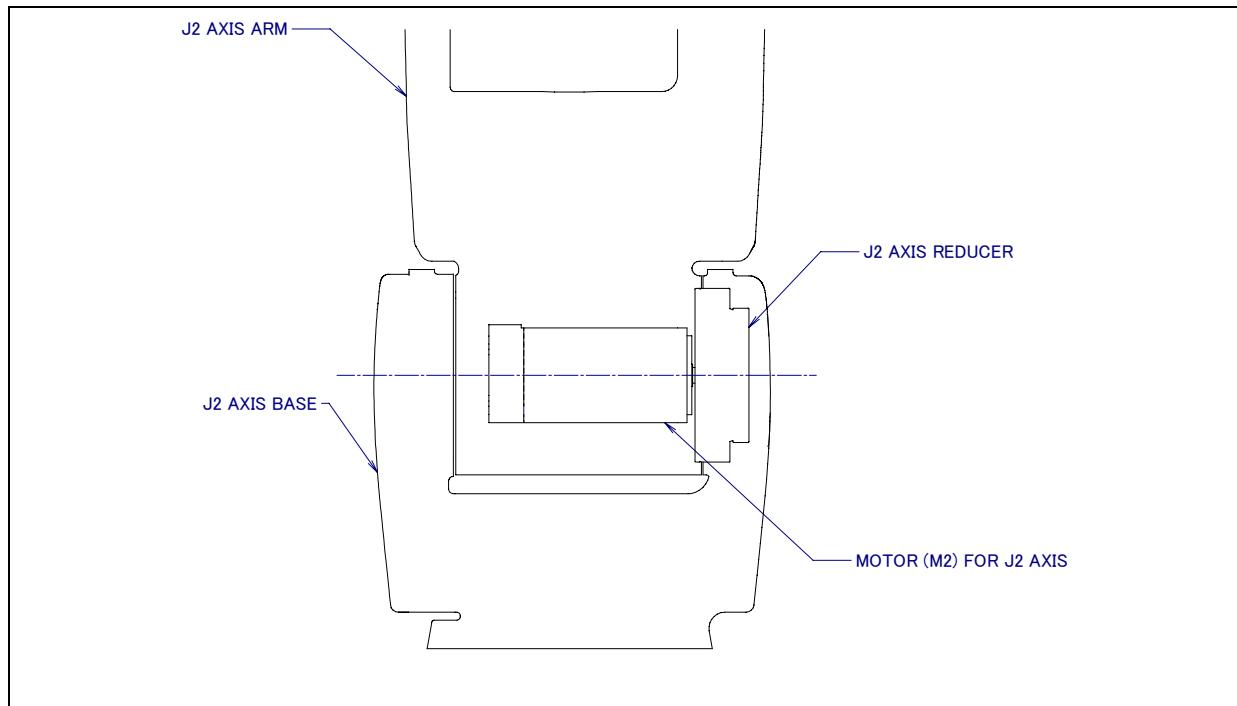


Fig. 4.1 (b) Drive mechanism of J2-axis

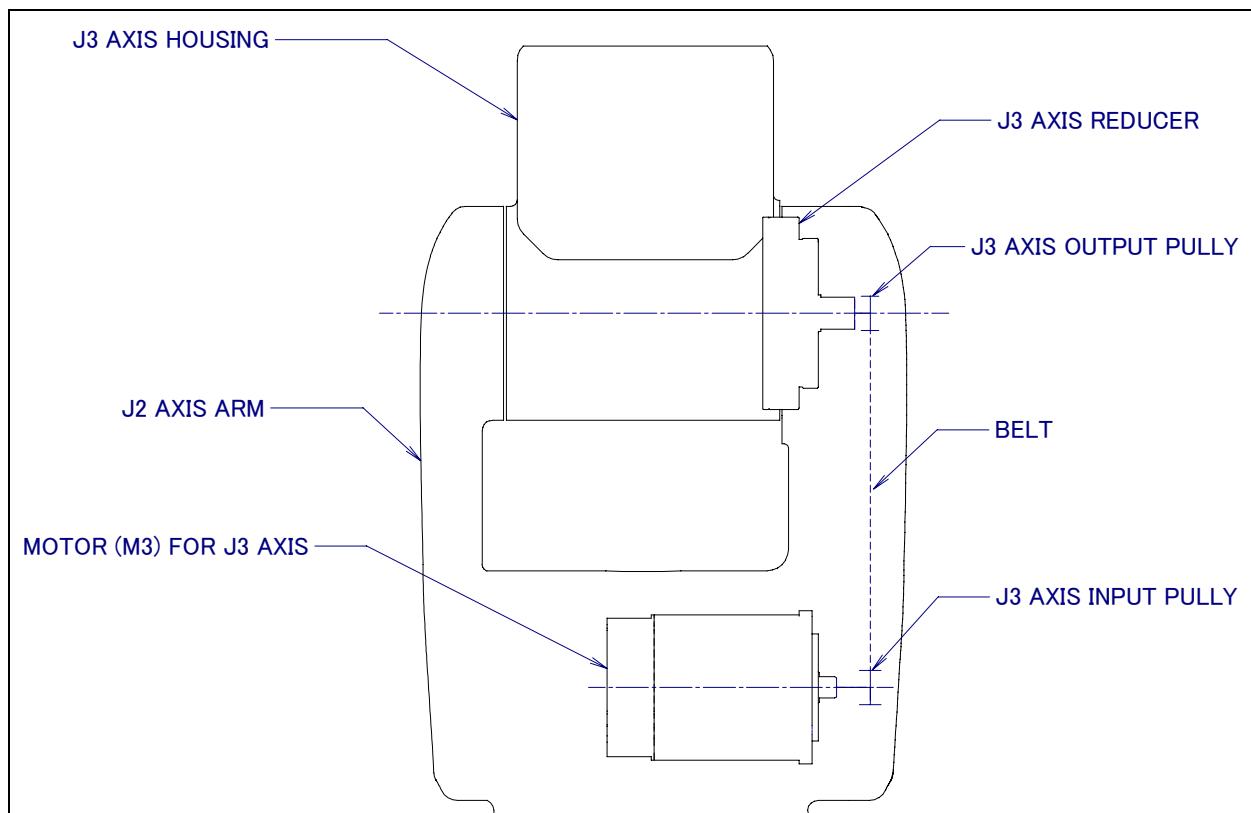
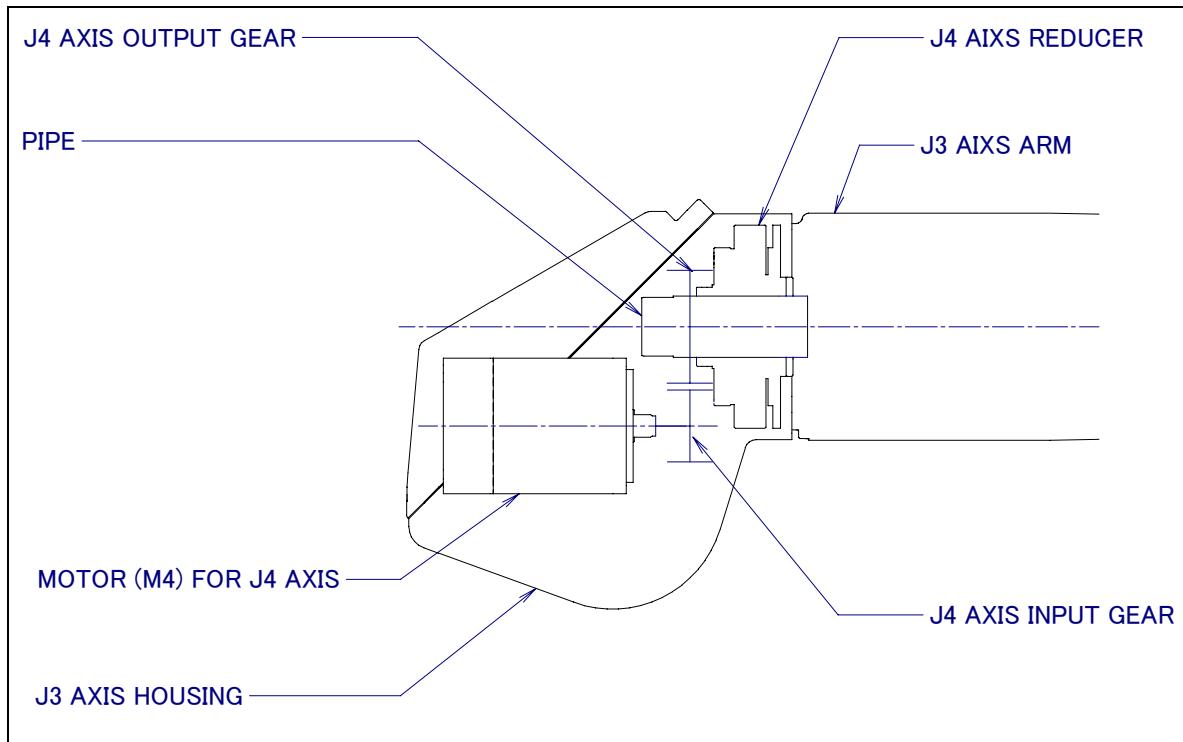


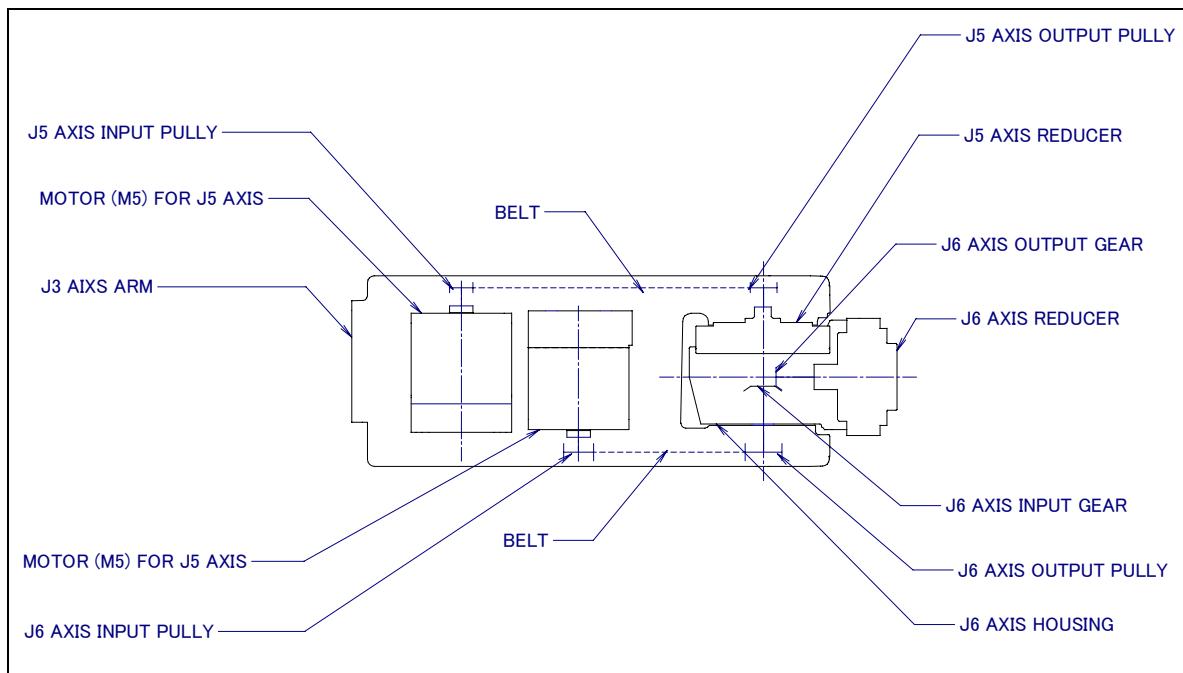
Fig. 4.1 (c) Drive mechanism of J3-axis

#### 4.REPLACING PARTS

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**Fig. 4.1 (d) Drive mechanism of J4-axis**



**Fig. 4.1 (e) Drive mechanism of J5/J6-axis**

## **4.2      REPLACING J1-AXIS MOTOR**

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### **Replacing procedure**

- 1    Move the robot posture to J1=90° and J2=-90°.
- 2    Remove robot from floor plate, and turn off the power of the controller.
- 3    Make it to posture in which the motor (2) can be removed.
- 4    When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L, 5H or LR Mate 200iC/5LC, 5WP, 5C is specified, remove plated bolt (12), cover B (11) and packing (13). (When not severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified, there are not.)
- 5    Remove bolt (1) and motor (2). In this time, note that there is a possibility that grease goes out.
- 6    Remove cable K101 from motor (1).
- 7    Wipe the grease of the gear off. In this time, pay attention not to damage the tooth side.
- 8    Remove O-ring (3) and seal bolt (4), and remove washer plate (5), gear (6), holder (7), O-ring (8) and key (9) sequentially.
- 9    Assemble it in the opposite procedure after exchanging Motor, packing and O-ring for the new article. In this time, pay attention to the following.
  - When motor is attached, confirm the thing that the oil seal is at the position, and note that the lip cannot be turned over.
  - Spread grease on surroundings about the gear.
- 10   Perform mastering (See subsection 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

## 4.REPLACING PARTS

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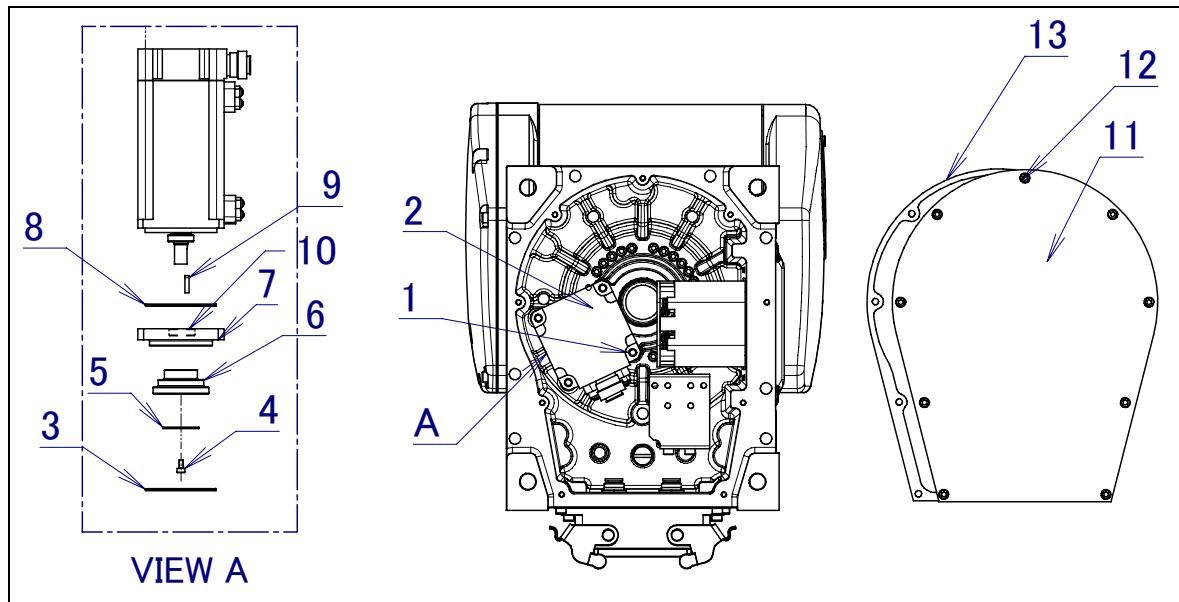


Fig. 4.2 Replacing J1-axis motor

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-5X20	4		
2	MOTOR	A06B-0116-B855#0048	1		
3	O-RING	A98L-0001-0347#S46	1		
4	SEAL BOLT	A97L-0218-0423#030606	3		1.3Nm (13kgfcm)
5	WASHER PLATE	A290-7139-X231	1		
6	GEAR J1-1	A290-7139-X211(*1) A290-7139-X213(*2)	1 1		
7	HOLDER	A290-7139-X221	1		
8	O-RING	A98L-0001-0347#S46	1		
9	KEY	JB-HKY-3X3X12B	1		
10	OIL SEAL	A98L-0040-0223#01001805	1		
11	COVER B	A290-7139-X233 (*3) A290-7139-Y233 (*4)	1 1		
12	PLATED BOLT	A97L-0218-0496#M4X8BC (*3) A97L-0218-0496#M4X8EN (*4)	9 9		4.5Nm (46kgfcm)
13	PACKING	A290-7139-X252 (*5)	1		

(\*1) When LR Mate 200iC,LR Mate 200iC/5C,5WP,5H is specified.

(\*2 )When LR Mate 200iC/5L,5LC is specified.

(\*3) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*4) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*5) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H

or LR Mate 200iC/5LC,5WP 5C is specified.

## 4.3 REPLACING J1-AXIS REDUCER

### Replacing procedure

- 1 Turn off the power of the controller.
- 2 Remove cover B (When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.) and J1 motor referring to 4.2. (The gear need not be removed.)
- 3 Remove bolt/plated bolt (5), J2 base cover (6) and sponge (7). When packing is attached, remove packing (19), too.
- 4 Remove the connector that relays cable K101 and cable K102, K103, K104, K105, K106, K107 and K108 referring to Fig.5.3.1 (b) in Section 5.
- 5 Remove bolt/seal bolt (1) and cover U (2). When packing is attached, remove packing (18), too.
- 6 Pull out cable K101 to the J1 base side. In this time, pull out the cable after it pushes into the pipe on the tip of the part of the relayed connector and it passes it. Do not pull it out forcibly with the relayed connector caught.
- 7 Remove bolt (3), (4) and remove J1 base (17) by using tap for pulled out. In this time, pay attention that there is a possibility that grease goes out. (Refer to Fig.4.3(d))
- 8 Wipe the grease of the gear (13) off. In this time, do not damage the tooth side.
- 9 Remove bolt/seal bolt (14) and reducer (10).
- 10 Remove seal bolt (12) and gear (13).
- 11 Assemble the gear (13) to wave generator (11) of the new reducer (10).
- 12 Keep the horizontal and install a new main body of the reducer in J2 base. In this time, put O-ring (8) without forgetting after it exchanges it for the new article.
- 13 Fill grease to the reducer. It is total 19ml greasing in inside of reducer, gear and bearing of wave generator.
- 14 When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified, spread the sealant on the reducer referring to Fig.4.3 (b).
- 15 Attach new wave generator (11) to the reducer. In this time, put wave washer (9) without forgetting.
- 16 Phase to reducer and assemble J1 base (17) referring to Fig.4.2(c). In this time, put O-ring (15) without forgetting. Assemble bolt (4) after previously assembling all bolt (3).
- 17 Put J1 motor, cable and cover in the reverse order of 2-6.

**CAUTION**

Do not apply grease to the O-ring (15). Otherwise, hardening of sealant is prevented, causing a grease leak.

- 18 Pass the cable K101 through J2 base side, and connect it with the relay connector. In this time, pull out the cable after it pushes into the pipe on the tip of the part of the relayed connector and it passes it. Do not pull it out forcibly with the relayed connector caught.
- 19 Attach J2 base cover (6) by bolt/plated bolt (5) after sponge (7) is attached inside of J2 base. When severe dust/liquid protection specification is specified, replace packing (19) to new one, and attach it.
- 20 Attach J1 motor referring to Section 4.2.
- 21 When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified, attach cover B.
- 22 Attach robot to floor plate.
- 23 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

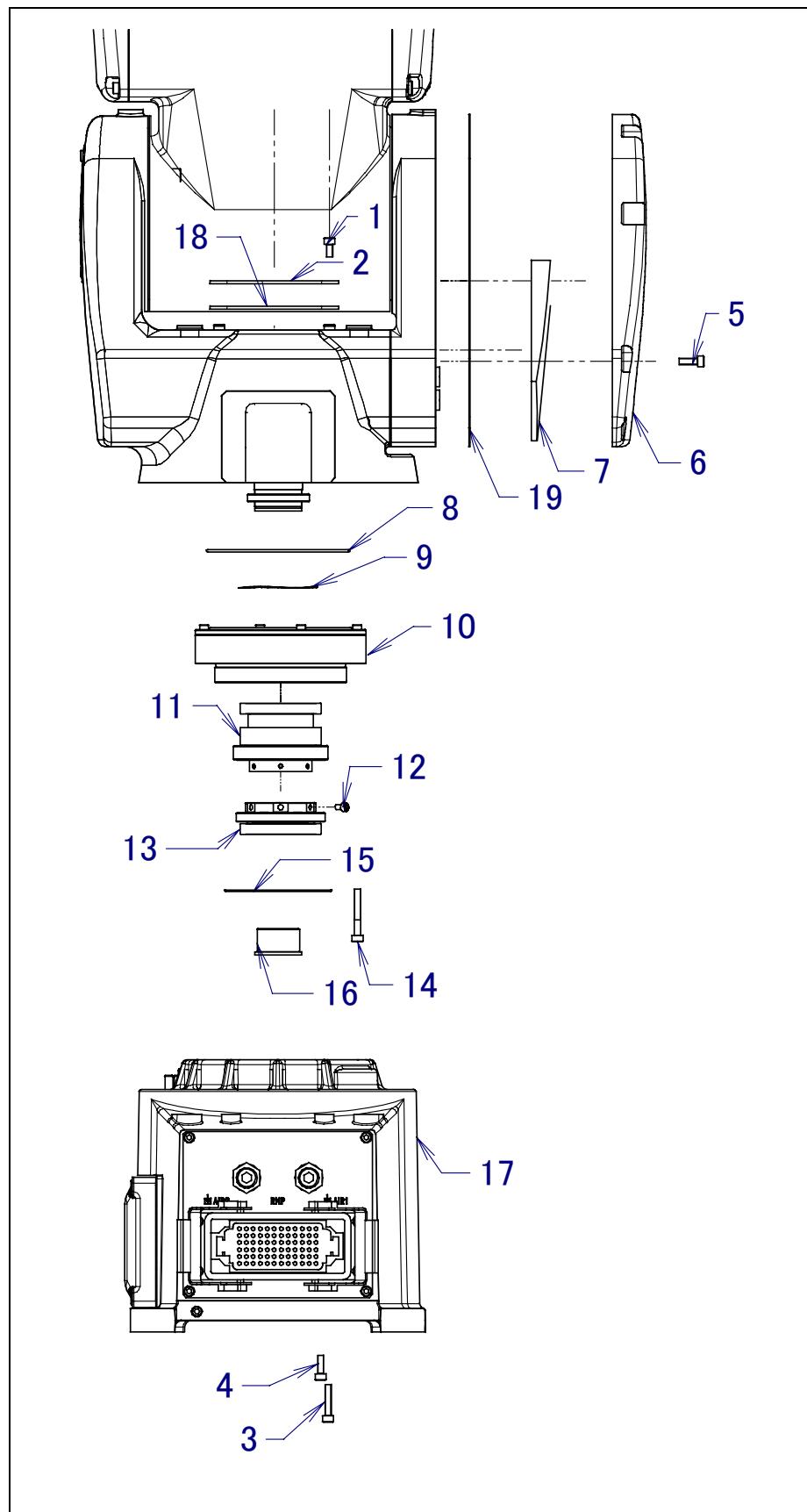


Fig. 4.3 (a) Replacing J1-axis reducer

## 4.REPLACING PARTS

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	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
	BOLT	A6-BA-4X8(*1)	4		
1	SEAL BOLT	A97L-0218-0546#040808BC(*2)	4		4.5Nm (46kgfcm)
	SEAL BOLT	A97L-0218-0546#040808EN(*3)	4		4.5Nm (46kgfcm)
2	COVER U	A290-7139-X332	1		
3	BOLT	A6-BA-4X12	7		4.5Nm (46kgfcm)
4	BOLT	A6-BA-4X20	9		4.5Nm (46kgfcm)
	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
5	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	8		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	8		4.5Nm (46kgfcm)
	J2 BASE COVER	A290-7139-X305(*1)	1		
6		A290-7139-X307 (*2)	1		
		A290-7139-Y307 (*5)	1		
		A290-7139-Z307 (*6)	1		
7	Sponge	A290-7139-X346	1		
8	O-RING	(Attached to J1 REDUCER)	1		
9	WAVE-WASHER	(Attached to J1 REDUCER)	1		
10	J1 REDUCER	A97L-0218-0812#80(*4)	1		
		A97L-0218-0812#80C(*3)	1		
11	WAVE GENERATOR	(Attached to J1 REDUCER)	1		
12	SEAL BOLT	A97L-0218-0423#030505	6		
13	GEAR J1-2	A290-7139-X212	1		
	BOLT	A6-BA-4X30(*1)	12		5.4Nm (55kgfcm)
14	SEAL BOLT	A97L-0218-0546#043016BC(*2)	12		5.4Nm (55kgfcm)
	SEAL BOLT	A97L-0218-0546#043016EN(*3)	12		5.4Nm (55kgfcm)
15	O-RING	(Attached to J1 REDUCER)	1		
16	J1 RING	A290-7139-X241	1		
	J1 BASE	A290-7139-X201(*4)	1		
17		A290-7139-Y201(*5)	1		
		A290-7139-Z201(*6)	1		
18	PACKING	A290-7139-X356 (*7)	1		
19	PACKING	A290-7139-X354 (*7)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*5) When LR Mate 200iC/5LC,5C is specified.

(\*6) When LR Mate 200iC/5WP is specified.

(\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

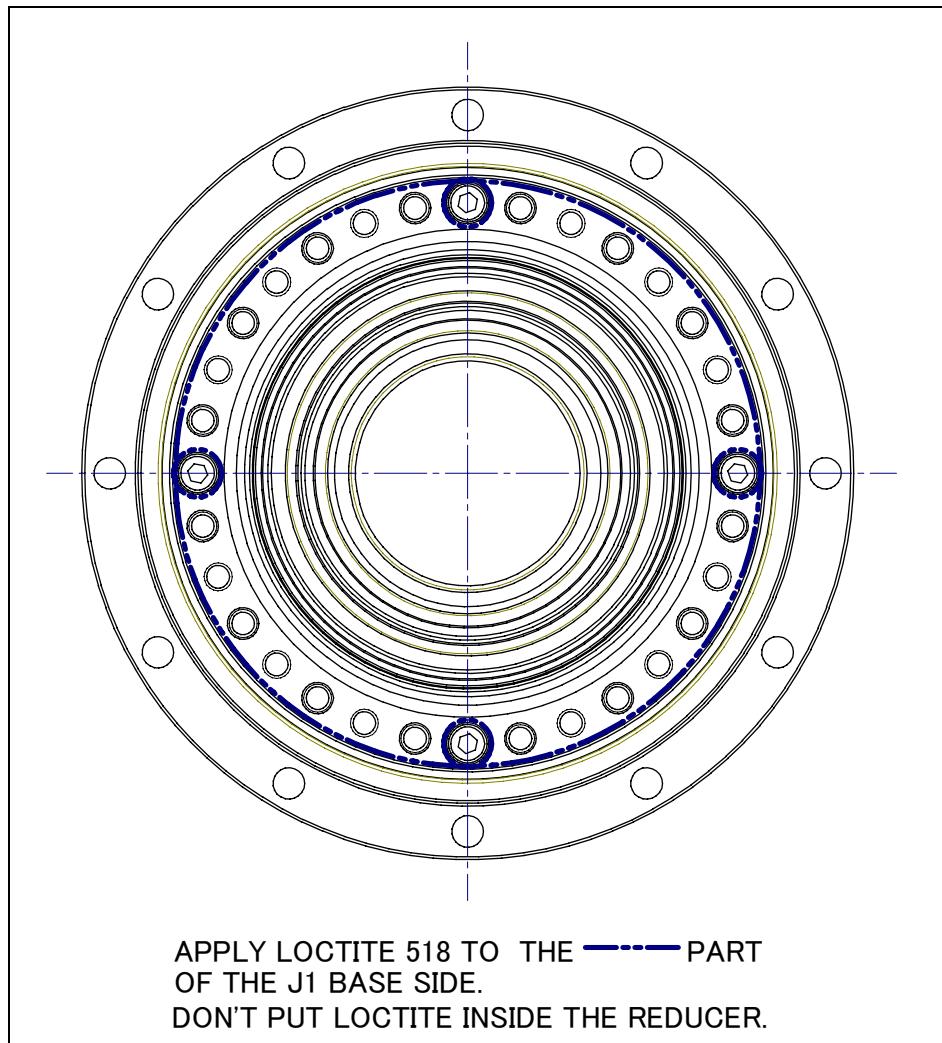


Fig. 4.3 (b) Range to J1-axis reducer of sealant spreading

(When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.)

#### 4.REPLACING PARTS

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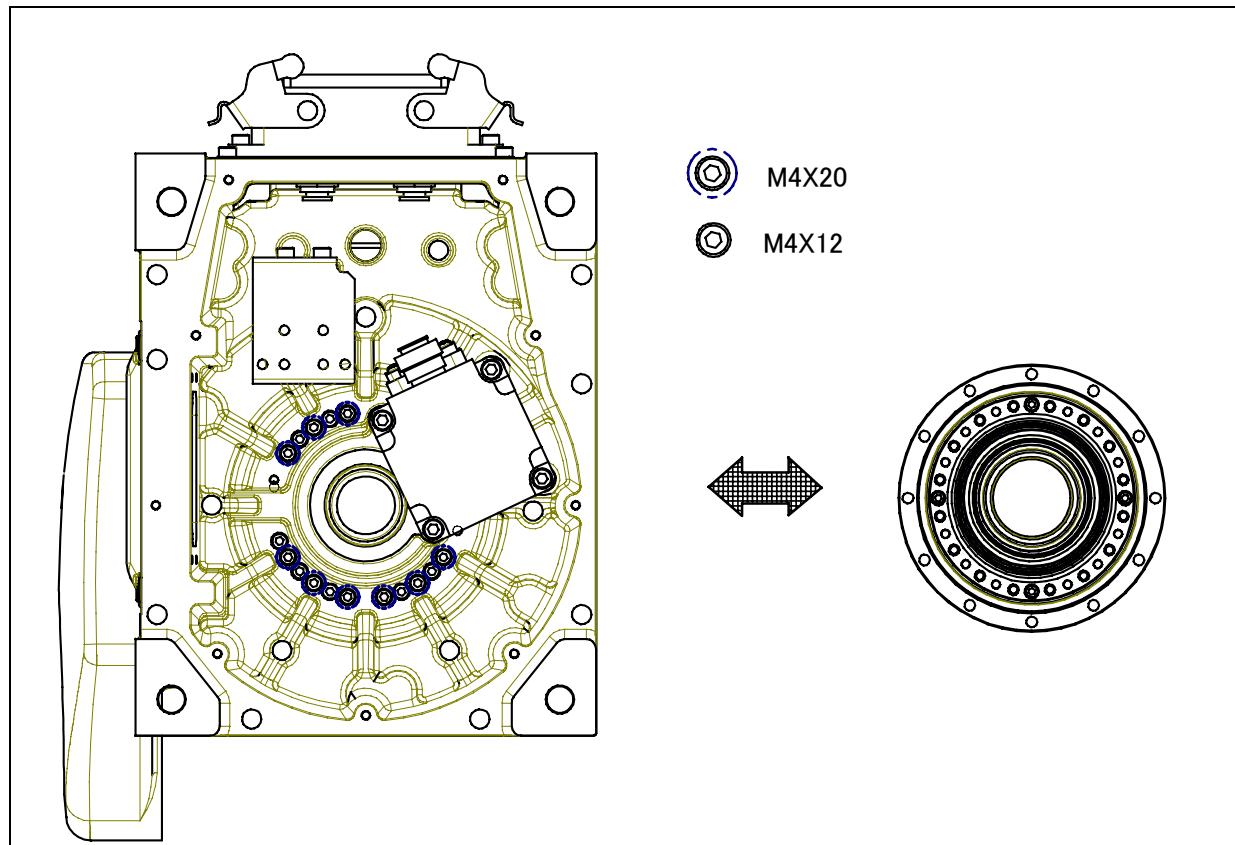


Fig. 4.3 (c) Assembled phase of J1-axis reducer

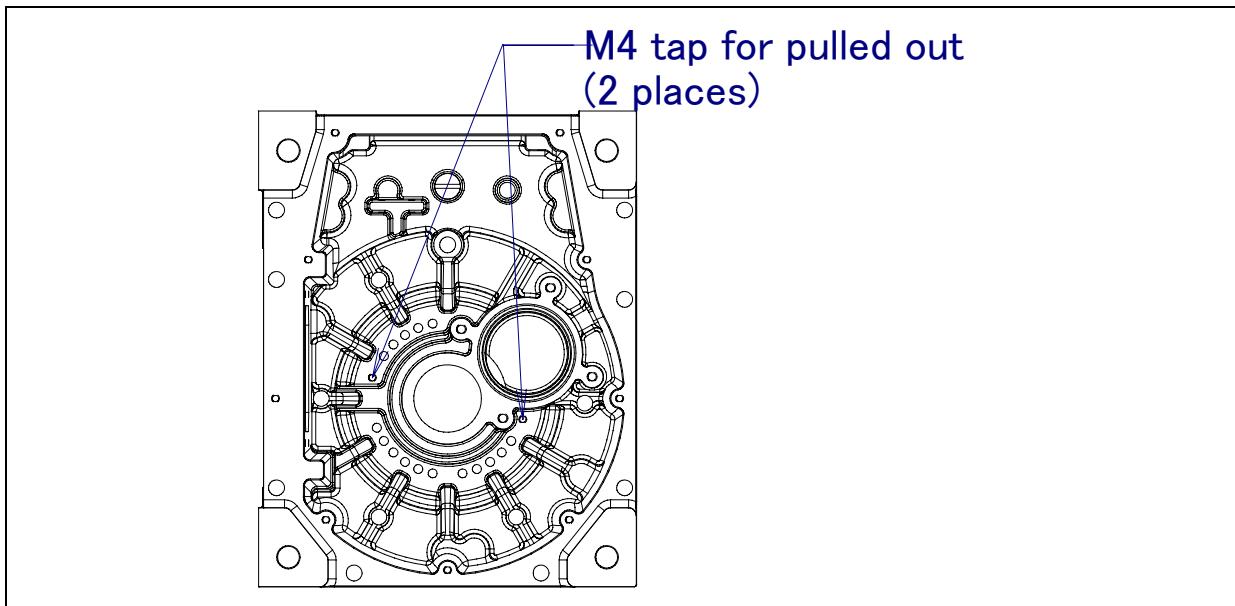


Fig. 4.3 (d) Position of taps for pulled out to remove J1 base.

## 4.4 REPLACING J2-AXIS MOTOR

### Replacing procedure

- 1 Turn off the power of the controller.
- 2 Remove bolt/plated bolt (1) and J2 base cover (2). When packing is attached, remove packing (19), too.
- 3 Remove sponge (3).
- 4 Cut the nylon band, which connect cable and clamp (5).
- 5 Remove the connector that relays cable K101 and cable K102, K103, K104, K105, K106, K107 and K108 referring to Fig.5.3.1 (b) in Section 5.
- 6 Remove bolt (4) and clamp (5).
- 7 Remove bolt (6) and support (7). When packing is attached, remove packing (20), too.
- 8 Remove seal bolt (8) and (9), cover S (10), packing (21). In this time, pay attention that there is a possibility that grease goes out.
- 9 Remove seal bolt (11), washer (12), wave generator (18), O-ring (17), key (16) and Motor (14) to which shaft (15) attaches.

#### ⚠ CAUTION

When the motor is removed, the arm moves downward by its weight. Hold the arm so that the arm does not collide with any other objects.

- 10 Remove cable K102 and K103 from motor (14).
- 11 Assemble it in the opposite procedure after exchanging Motor, O-ring, packing and shaft (15) for the new article. In this time, pay attention to the following.
  - Spread Loctite 638 referring to Fig.4.4(b) when you apply shaft(15).
  - Be sure to attach wave generator(18) after attaching motor(14). Spread grease inside of reducer.
  - Pay attention the phase when you apply the cover S (10) referring to Fig.4.4(c).
- 12 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

#### 4.REPLACING PARTS

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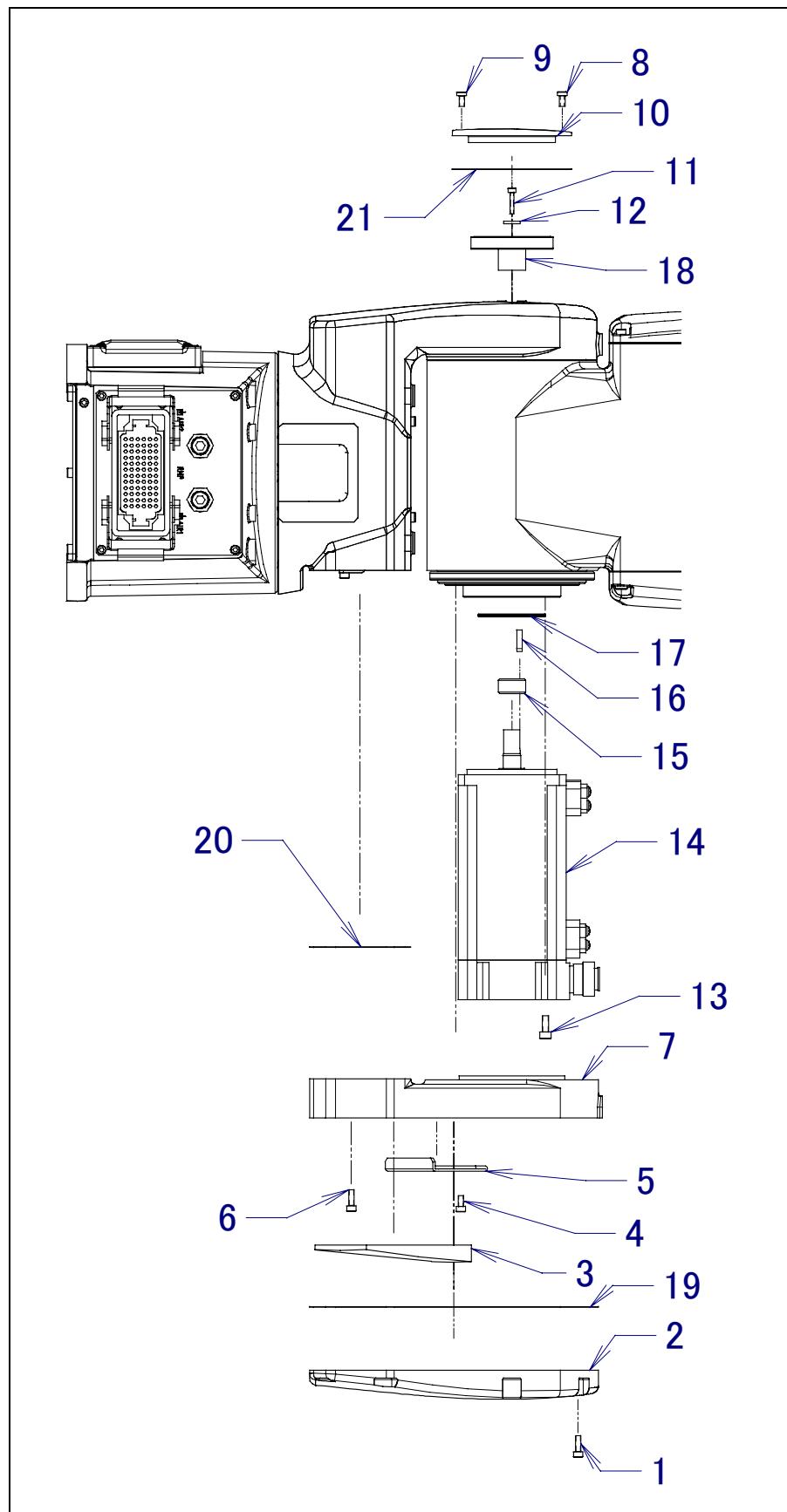


Fig. 4.4(a) Replacing J2-axis motor

	<b>Parts Name</b>	<b>Specifications</b>	<b>Number</b>	<b>Loctite</b>	<b>Torque N·m (kgf·cm)</b>
1	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	8		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	8		4.5Nm (46kgfcm)
2	J2 BASE COVER	A290-7139-X305(*1)	1		
		A290-7139-X307 (*2)	1		
		A290-7139-Y307 (*4)	1		
		A290-7139-Z307 (*5)	1		
3	Sponge	A290-7139-X346	1		
4	BOLT	A6-BA-4X8	2		
5	CLAMP J2-1	A290-7139-X333	1		
6	SEAL BOLT	A97L-0218-0423#041212	7		4.5Nm (46kgfcm)
7	SUPPORT	A290-7139-X303(*6)	1		
		A290-7139-Y303(*4)	1		
		A290-7139-Z303(*5)	1		
8	SEAL BOLT	A97L-0218-0595#040808BC(*6)	2		2.0Nm (20kgfcm)
	SEAL BOLT	A97L-0218-0595#040808EN(*3)	2		2.0Nm (20kgfcm)
9	SEAL BOLT	A97L-0218-0738#040808BC(*6)	2		2.0Nm (20kgfcm)
	SEAL BOLT	A97L-0218-0738#040808EN(*3)	2		2.0Nm (20kgfcm)
10	COVER S	A290-7139-X309(*6)	1		
		A290-7139-Y309(*4)	1		
		A290-7139-Z309(*5)	1		
11	SEAL BOLT	A97L-0218-0423#031616	1		1.3Nm (13kgfcm)
12	WASHER	A290-7210-X532	1		
13	SEAL BOLT	A97L-0218-0423#051212	4		
14	MOTOR	A06B-0116-B855#0048	1		
15	SHAFT	A290-7139-X322	1	LT638	
16	KEY	JB-HKY-3X3X12B	1		
17	O RING	JB-OR1A-G45	4		
18	WAVE GENERATOR	(Attached to J2 REDUCER)	1		
19	PACKING	A290-7139-X354 (*7)	1		
20	PACKING	A290-7139-X352 (*7)	1		
21	PACKING	A290-7139-X351	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

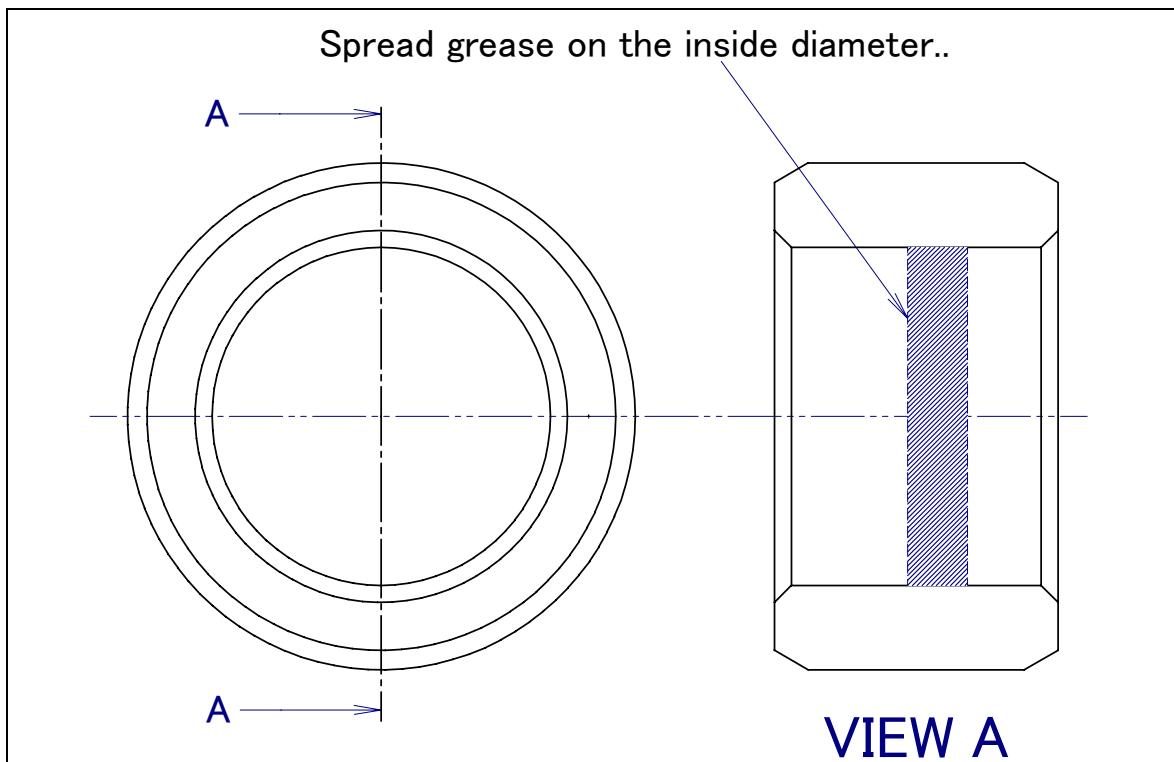


Fig. 4.4(b) Apply Loctite 638 to shaft

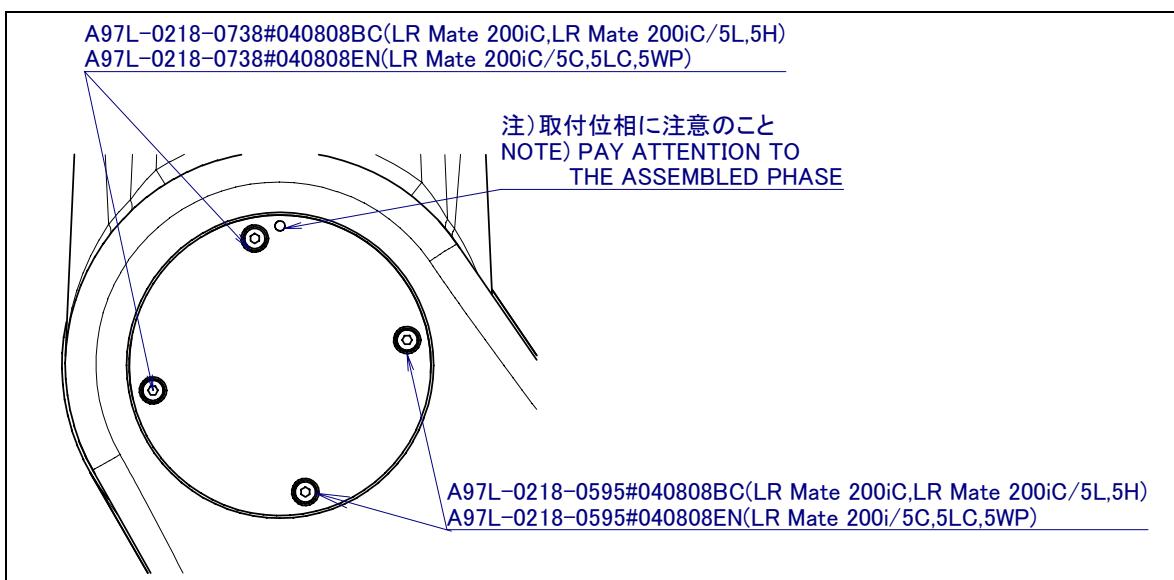


Fig. 4.4(c) Assembled phase of cover S and bolt

## 4.5 REPLACING J2-AXIS REDUCER

### Replacing procedure

- 1 Turn off the power of the controller.
- 2 Remove the robot from floor plate and knock down it sidewise.
- 3 Remove bolt/plated bolt (1), J2 base cover (2) and sponge (3). When packing is attached, remove packing (25), too.
- 4 Remove the connector that relays cable K101 and cable K102, K103, K104, K105, K106, K107 and K108 referring to Fig.5.3.1 (b) in Section 5.
- 5 Remove bolt (5) and clamp (4).
- 6 Cut the nylon band, which connect cable and clamp.
- 7 Remove bolt (6) and support (7). When severe dust/liquid protection specification is specified, remove packing (26), too.
- 8 Remove seal bolt (8) and (9), cover S (10) and packing (11). In this time, pay attention that there is a possibility that grease goes out.
- 9 Remove seal bolt (12), washer (13) and wave generator (14).
- 10 Remove seal bolt (19), motor (18) and O-ring (20), (21).
- 11 Remove bolt/seal bolt (15) and J2 arm (17) to which reducer (24) is attached.
- 12 Remove bolt (22) and remove reducer (24) from J2 arm (17).
- 13 Exchange reducer, O-ring, packing (when severe dust/liquid protection is specified) for new parts in the following order.
- 14 Attach new reducer to the J2 arm (17) by using bolt/seal bolt (22). When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified, spread the sealant on the reducer referring to Fig.4.5 (b).

**CAUTION**

Do not apply grease to the O-ring (23). Otherwise, hardening of sealant is prevented, causing a grease leak.

- 15 Attach J2 motor (18) to the J2 arm. Be sure to make the decelerator the horizontal about the procedure of 16 and 17.
- 16 Attach J2 base (16) to the reducer (24) by using bolt/seal bolt (22). In this time, put O-ring (23) without forgetting.
- 17 Fill grease to the reducer. It is total 26ml greasing in inside of reducer, gear and bearing of wave generator.
- 18 Attach wave generator (14) to the J2 base (16).
- 19 Attach cover S (10). In this time, pay attention to the phase referring to Fig.4.4(c).
- 20 Attach support (7) by using bolt (6). When packing is attached, be sure to replace packing (26) to new one and attach there.
- 21 Fix cable to the clamp (4) by using nylon band, attach support (7) by using bolt (5)

## 4.REPLACING PARTS

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- 22 Attach J2 base cover (2) by using bolt/plated bolt (1). In this time, put sponge (3) without forgetting, be sure to replace packing (25) to new one and attach there.
- 23 Attach robot to floor plate.
- 24 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

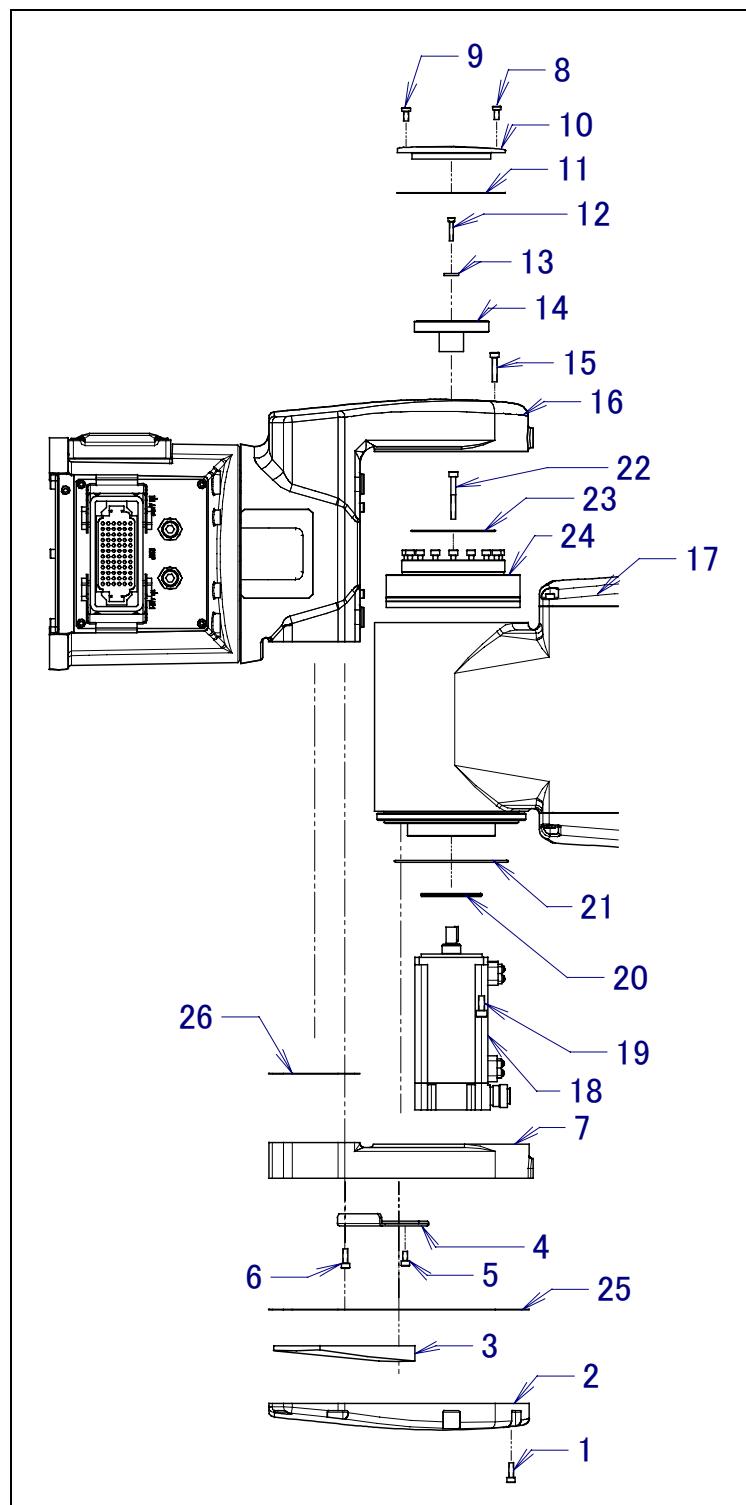


Fig. 4.5(a) Replacing J2-axis reducer

## 4.REPLACING PARTS

	<b>Parts Name</b>	<b>Specifications</b>	<b>Number</b>	<b>Loctite</b>	<b>Torque N·m (kgf·cm)</b>
1	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	8		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	8		4.5Nm (46kgfcm)
2	J2 BASE COVER	A290-7139-X305(*1)	1		
		A290-7139-X307 (*2)	1		
		A290-7139-Y307 (*4)	1		
		A290-7139-Z307 (*5)	1		
3	SPONGE	A290-7139-X346	1		
4	CLAMP J2-1	A290-7139-X333	1		
5	BOLT	A6-BA-4X8	2		
6	SEAL BOLT	A97L-0218-0423#041212	7		4.5Nm (46kgfcm)
7	SUPPORT	A290-7139-X303(*6)	1		
		A290-7139-Y303(*4)	1		
		A290-7139-Z303(*5)	1		
8	SEAL BOLT	A97L-0218-0595#040808BC(*6)	2		2.0Nm (20kgfcm)
	SEAL BOLT	A97L-0218-0595#040808EN(*3)	2		2.0Nm (20kgfcm)
9	SEAL BOLT	A97L-0218-0738#040808BC(*6)	2		2.0Nm (20kgfcm)
	SEAL BOLT	A97L-0218-0738#040808EN(*3)	2		2.0Nm (20kgfcm)
10	COVER S	A290-7139-X309(*6)	1		
		A290-7139-Y309(*4)	1		
		A290-7139-Z309(*5)	1		
11	PACKING	A290-7139-X351	1		
12	SEAL BOLT	A97L-0218-0423#031616	1		1.3Nm (13kgfcm)
13	WASHER	A290-7210-X532	1		
14	WAVE GENERATOR	(Attached to J2 REDUCER)	1		
15	BOLT	A6-BA-4X20	16		
16	J2 BASE	A290-7139-X301(*6)	1		
		A290-7139-Y301(*4)	1		
		A290-7139-Z301(*5)	1		
17	J2 ARM	A290-7139-X302 (*7)	1		
		A290-7139-X310 (*8)	1		
		A290-7139-Y302 (*9)	1		
		A290-7139-Y310 (*10)	1		
		A290-7139-Z302 (*5)	1		
18	MOTOR	A06B-0116-B855#0048	1		
19	SEAL BOLT	A97L-0218-0423#051212	4		
20	O RING	JB-OR1A-G45	1		
21	O RING	(Attached to J2 REDUCER)	1		
22	BOLT	A6-BA-4X35	12		5.4Nm (55kgfcm)
	SEAL BOLT	A97L-0218-0546#043516BC(*6)	12		5.4Nm (55kgfcm)
	SEAL BOLT	A97L-0218-0546#043516EN(*3)	12		5.4Nm (55kgfcm)
23	O RING	(Attached to J2 REDUCER)	1		
24	J2 REDUCER	A97L-0218-0813#120(*11)	1		
		A97L-0218-0813#120C(*3)	1		
25	PACKING	A290-7139-X354 (*11)	1		
26	PACKING	A290-7139-X352 (*11)	1		

## 4.REPLACING PARTS

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- (\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.
- (\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.
- (\*3) When LR Mate 200iC/5LC,5WP,5C is specified.
- (\*4) When LR Mate 200iC/5LC,5C is specified.
- (\*5) When LR Mate 200iC/5WP is specified.
- (\*6) When LR Mate 200iC, LR Mate 200iC/5H,5L is specified.
- (\*7) When LR Mate 200iC, LR Mate 200iC/5H is specified.
- (\*8) When LR Mate 200iC/5L is specified.
- (\*9) When LR Mate 200iC/5C is specified.
- (\*10) When LR Mate 200iC/5LC is specified.
- (\*11) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

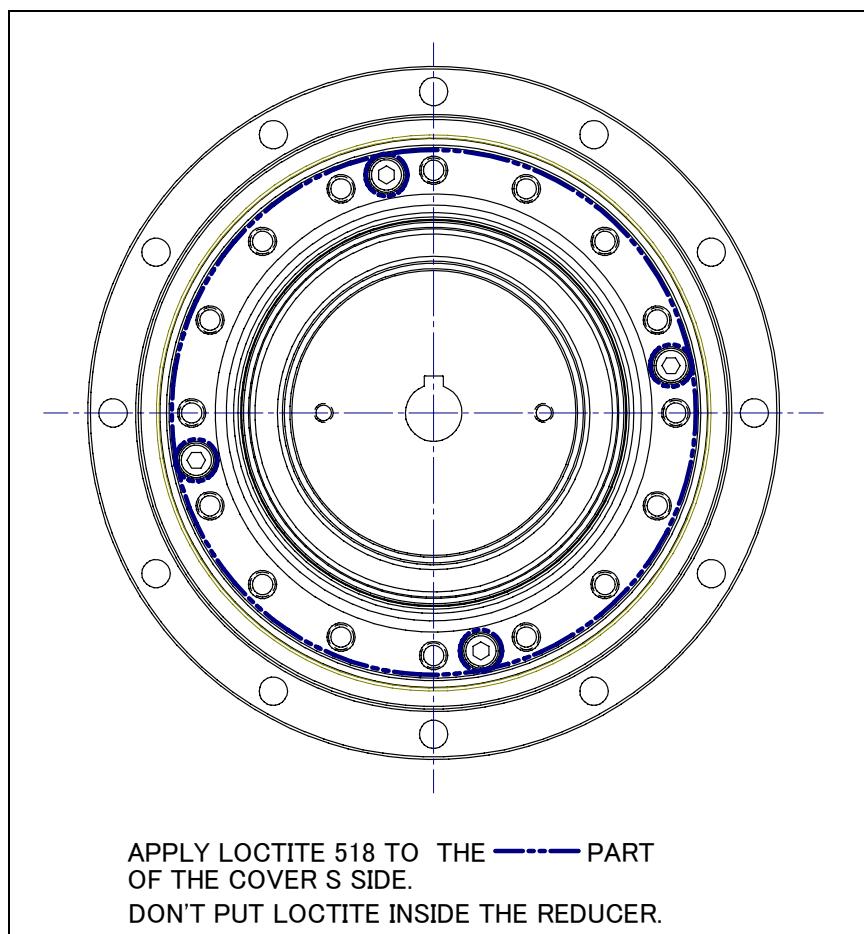


Fig. 4.5 (b) Range to J2-axis reducer of sealant spreading

(When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.)

## 4.6 REPLACING J3-AXIS MOTOR

### Replacing procedure

- 1 Turn off the power of the controller.
- 2 Remove bolt/plated bolt (3) and J2 arm cover (4). When packing is attached, remove packing (14), too.
- 3 Loosen a bolt (6) a little and lower the tension of the belt (5) and remove belt (5).

#### ⚠ CAUTION

When removing the belt, put the part beyond the J3 housing on a workbench to prevent the arm from dropping

- 4 According to Section 5.3.1, remove J2 base cover and relay of cable K101 and air tube. (Referring to Fig.5.3.1 (a), (b))
- 5 According to Section 5.3.1, remove clamp J2-1 and cut the nylon band, which connect cable and air tube to clamp. (Referring to Fig.5.3.1 (a), (b))
- 6 Remove seal bolt (1) and guide arm (2). Do not add power forcibly when you remove guide arm. When packing is attached, remove packing (13), too. Pay attention that the load doesn't rest upon cable and air tube so that an upper cable and the air tube may work from guide arm without removing.
- 7 Remove clamp J2-2 referring to Fig.5.3.2 (e) of Section 5.3.2. (It is not necessary to cut nylon band.)
- 8 Pull lower cable from guide arm from J2 base to guide arm. In this time, pull out the cable after it pushes into the robot on the tip of the part of the relayed connector and it passes it.
- 9 Remove bolt (12) and motor (11).
- 10 Remove seal bolt (7), washer plate (8) and pulley (9).
- 11 Remove cable K104 and K105 from motor (11).
- 12 Assemble it in the opposite procedure after exchanging Motor and packing for the new article. In this time, pay attention to the following.
  - Adjust the tension of the belt referring to Section 6.1 after the installation of the belt.
  - When installing guide arm, assemble it horizontally so as not to damage oil seal.
- 13 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

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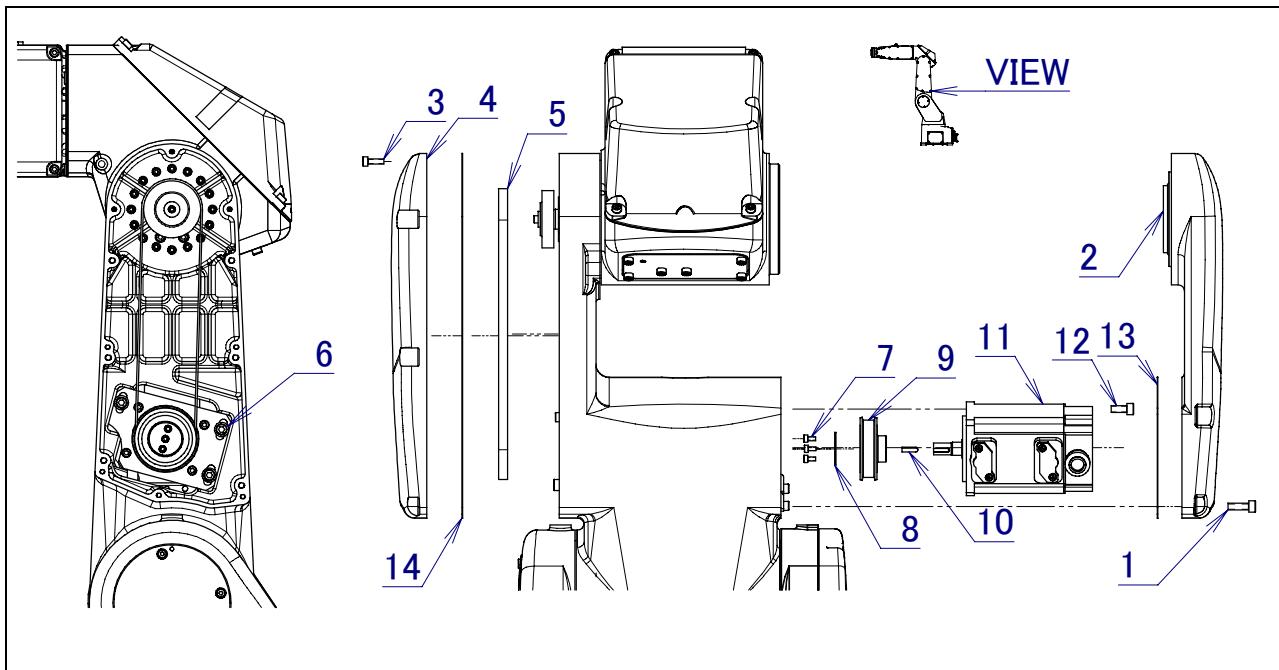


Fig. 4.6 Replacing J3-axis motor

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	SEAL BOLT	A97L-0218-0423#051616(*1)	4		5.6Nm (57kgfcm)
		A97L-0218-0546#051616BC(*2)	4		5.6Nm (57kgfcm)
		A97L-0218-0546#051616EN(*3)	4		5.6Nm (57kgfcm)
2	GUIDE ARM	A290-7139-X304	1		
3	BOLT	A97L-0218-0504#M4X10 (*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	8		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	8		4.5Nm (46kgfcm)
4	J2 ARM COVER	A290-7139-X306 (*4)	1		
		A290-7139-X308 (*2)	1		
		A290-7139-Y308 (*5)	1		
		A290-7139-Z308 (*6)	1		
5	BELT	A98L-0040-0190#007-098	1		
6	BOLT	A97L-0218-0504#M5X12	3		5.6Nm (57kgfcm)
7	SEAL BOLT	A97L-0218-0423#030606	3		
8	WASHER PLATE	A290-7139-X231	1		
9	PULLEY	A290-7139-X311	1		
10	KEY	JB-HKY-3X3X12B	1		
11	MOTOR	A06B-0115-B855#0048	1		
12	BOLT	A6-BA-5X12	4		
13	PACKING	A290-7139-X353 (*7)	1		
14	PACKING	A290-7139-X355 (*7)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC,LR Mate 200iC/5H,5L is specified

(\*5) When LR Mate 200iC/5LC,5C is specified.

(\*6) When LR Mate 200iC/5WP is specified.

(\*7) When severe dust/liquid protection specification of LR Mate 200iC,LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP 5C is specified.

## 4.7 REPLACING J3-AXIS REDUCER

### Replacing procedure

- 1 Turn off the power of the controller.
- 2 Remove guide arm referring to Section 4.6.
- 3 Remove J2 arm cover and belt referring to section 4.6.

#### **⚠ CAUTION**

When removing the belt, put the part beyond the J3 housing on a workbench to prevent the arm from dropping

- 4 Remove seal bolt (1), washer (2) and pulley (3).
- 5 Remove bolt (4) and J2 arm to which reducer (8) attach. Note that there is a possibility that grease goes out.
- 6 Remove bolt/seal bolt (6) and reducer (8).
- 7 Replace reducer to new one and install to J3 arm unit horizontally. In this time, put wave washer (10) and O-ring (9) without forgetting.
- 8 Fill grease to the reducer. It is total 10ml greasing in inside of reducer, gear and bearing of wave generator
- 9 Attach wave generator (7) to reducer.
- 10 When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified, spread sealant to the reducer referring to Fig.4.7 (b)
- 11 Attach J3 arm unit to which reducer attach to the J2 arm. In this time, put O-ring (11) without forgetting.

#### **⚠ CAUTION**

Do not apply grease to the O-ring (11). Otherwise, hardening of sealant is prevented, causing a grease leak.

- 12 Install pulley (3) and belt.
- 13 Adjust the tension of the belt referring to Section 6.1 after the installation of the belt.
- 14 Install J2 arm cover referring to Section 4.6.
- 15 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

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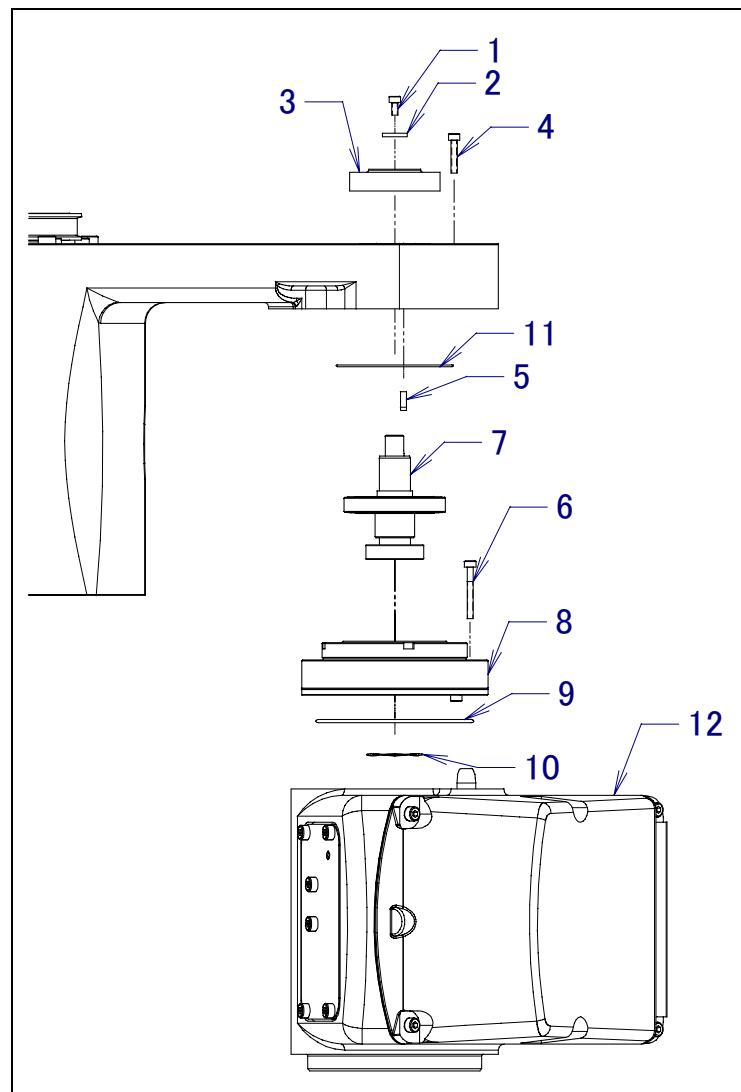


Fig. 4.7(a) Replacing J3-axis reducer

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	SEAL BOLT	A97L-0218-0423#030606	1		1.3Nm (13kgfcm)
2	WASHER	A290-7210-X532	1		
3	PULLEY	A290-7139-X312	1		
4	BOLT	A6-BA-3X16	16		2.0Nm (20kgfcm)
5	KEY	(Attached to J3 REDUCER)	1		
	BOLT	A6-BA-3X25(*1)	12		2.0Nm (20kgfcm)
6	SEAL BOLT	A97L-0218-0546#032504BC(*2)	12		2.0Nm (20kgfcm)
	SEAL BOLT	A97L-0218-0546#032504EN(*3)	12		2.0Nm (20kgfcm)
7	WAVE GENERATOR	(Attached to J3 REDUCER)	1		
8	J3 REDUCER	A97L-0218-0814#100 (*4)	1		
		A97L-0218-0814#100C (*3)	1		
9	O-RING	(Attached to J3 REDUCER)	1		
10	WAVE WASHER	(Attached to J3 REDUCER)	1		
11	O-RING	(Attached to J3 REDUCER)	1		
12	J3 HOUSING	A290-7139-X401 (*4)	1		
		A290-7139-Y401 (*5)	1		
		A290-7139-Z401 (*6)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC, LR Mate 200iC/5H,5L is specified

(\*5) When LR Mate 200iC/5LC,5C is specified.

(\*6) When LR Mate 200iC/5WP is specified.

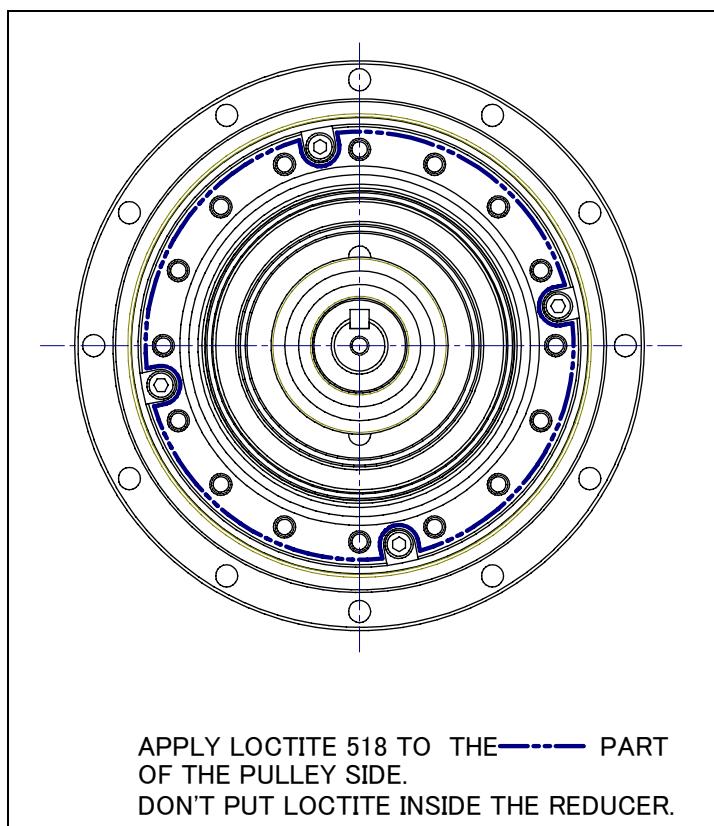


Fig. 4.7 (b) Range to J3-axis reducer of sealant spreading

(When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L or LR Mate 200iC/5C,5LC,5WP is specified)

## 4.8 REPLACING J4-AXIS MOTOR

### Replacing procedure

**!CAUTION**

This section is for standard type. This mechanical part does't exist in 5H. If you replace J4-axis motor of 5H, refer to Section 4.10

- 1 Turn off the power of the controller.
- 2 Remove bolt/plated bolt (1) and J3 cover (2). When packing is attached, remove packing (13), too.
- 3 Remove bolt (12), motor (11) and O-ring (3). Note that there is a possibility that grease goes out.

**!CAUTION**

When the motor is removed, the J3 arm can be rotated. Do as the J3arm is put on the stand so that the arm should not collide with surroundings.

- 4 Wipe the grease of the gear (6) off. In this time, pay attention not to damage the tooth side.
- 5 Remove cable K107 and K109 from motor (11).
- 6 Remove seal bolt (4), washer plate (5), gear (6), key (7), holder (8) and O-ring (9).
- 7 Assemble it in the opposite procedure after exchanging Motor-ring and packing for the new article.
  - Confirm the thing that the oil seal is at the position, and note that the lip cannot be turned over.
  - Spread grease on surroundings of the gear.
- 8 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

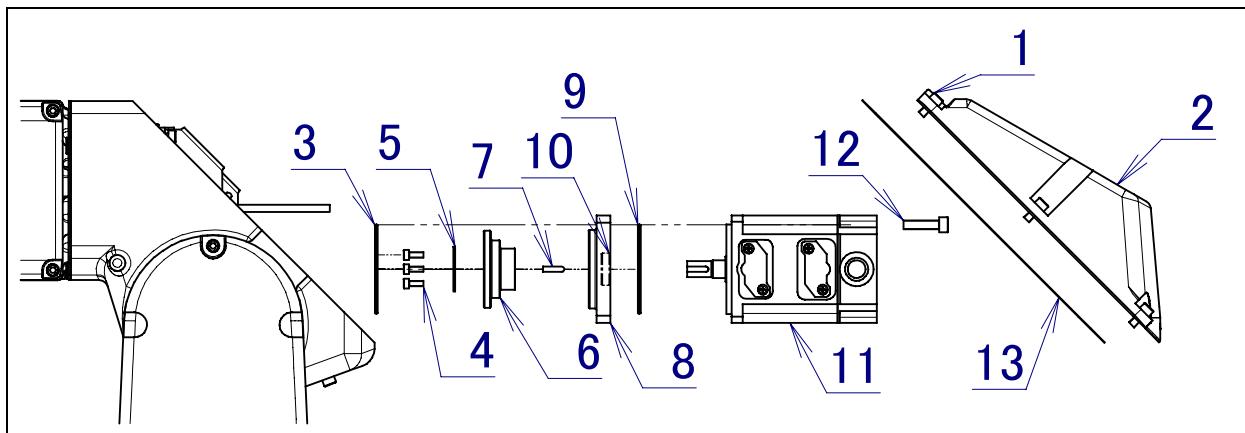


Fig. 4.8 Replacing J4-axis motor

	<b>Parts Name</b>	<b>Specifications</b>		<b>Number</b>	<b>Loctite</b>	<b>Torque N·m (kgf·cm)</b>
1	BOLT	A97L-0218-0504#M4X10 (*1)		4		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)		6		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)		6		2.0Nm (20kgfcm)
2	J3 COVER	A290-7139-X404 (*4)		1		
		A290-7139-X406 (*2)		1		
		A290-7139-Y406 (*5)		1		
		A290-7139-Z406 (*6)		1		
3	O-RING	A98L-0001-0347#S46		1		
4	SEAL BOLT	A97L-0218-0423#030606		3		1.3Nm (13kgfcm)
5	WASHER PLATE	A290-7139-X231		1		
6	GEAR J4-1	A290-7139-X411		1		
7	KEY	JB-HKY-3X3X12B		1		
8	HOLDER	A290-7139-X221		1		
9	O-RING	A98L-0001-0347#S46		1		
10	OIL SEAL	A98L-0040-0223#01001805		1		
11	MOTOR	No brake	A06B-0114-B205#0048	1		
12		With brake	A06B-0114-B855#0048			
13	BOLT	A6-BA-5X20		4		
	PACKING	A290-7139-X451 (*7)		1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC, LR Mate 200iC/5L is specified

(\*5) When LR Mate 200iC/5LC,5C is specified.

(\*6) When LR Mate 200iC/5WP is specified.

(\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L or LR Mate 200iC/5C,5LC,5WP is specified

## 4.9 REPLACING J4-AXIS REDUCER

### Replacing procedure

**!CAUTION**

This section is for standard type. This mechanical part does't exist in 5H. If you replace J4-axis reducer of 5H, refer to Section 4.11.

- 1 Turn off the power of the controller.
- 2 Remove J3 arm cover, relay connector and air tube referring to Section 4.10.
- 3 Remove J3 cover and cut the nylon band, which connect cable to clamp (2) referring to section 4.8.
- 4 Pull out the cable of the J3 arm to the J3 casing side through the pipe. In this time, pull out the cable after it pushes into the pipe on the tip of the part of the relayed connector and it passes it. Do not pull it out forcibly with the relayed connector caught.
- 5 Remove bolt (1) and clamp (2).
- 6 Remove bolt (3), (4) and J3 arm (13). Pay attention not to damage oil seal. Note that there is a possibility that grease goes out.
- 7 Wipe the grease of the gear (12) off. In this time, pay attention not to damage the tooth side.
- 8 Remove bolt/plated bolt (6) and reducer (10).
- 9 Remove seal bolt (5) and pipe (9).
- 10 Remove seal bolt (7) and gear (12).
- 11 Assemble it in the opposite procedure after exchanging reducer for the new article.
  - When installing reducer, spread grease on teeth of Wave generator, and install O-ring (11) without forgetting. (In case of J4-axis reducer, wave generator is assembled in reducer when it is shipped.) Also, pay attention to the phase of bolts referring to Fig.4.9(c).
  - Spread grease on surroundings of the gear.
  - When installing reducer to J3 casing apply bolt (3) after applying all bolt (4).
  - When installing J3 arm, confirm the thing that the oil seal (8) is at the position, and note that the lip cannot be turned over.
  - When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L or LR Mate 200iC/5C,5LC,5WP is specified, spread sealant to the each part referring to Fig.4.9 (b).

**!CAUTION**

Do not apply grease to the O-ring (11). Otherwise, hardening of sealant is prevented, causing a grease leak.

- 12 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

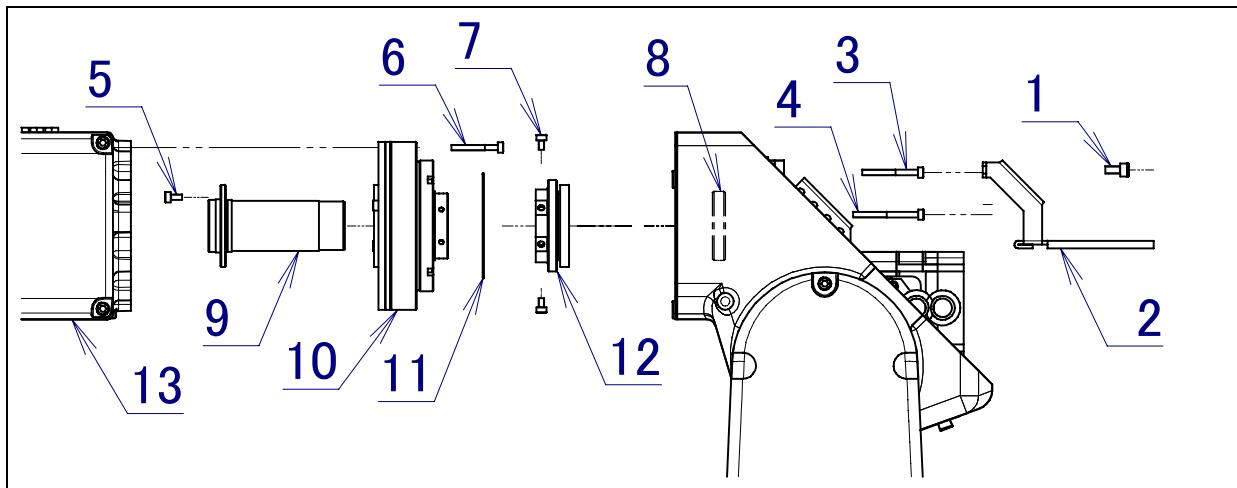


Fig. 4.9(a) Replacing J4-axis reducer

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-4X8	1		
2	CLAMP J4-1	A290-7139-X432	2		
3	BOLT	A6-BA-3X30	4		2.0Nm (20kgfcm)
4	BOLT	A6-BA-3X35	10		2.0Nm (20kgfcm)
5	SEAL BOLT	A97L-0218-0423#030606	4		1.3Nm (13kgfcm)
6	BOLT	A6-BA-3X25(*1)	9		2.0Nm (20kgfcm)
6	PLATED BOLT	A97L-0218-0496#M3X25BC (*2)	9		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M3X25EN (*3)	9		2.0Nm (20kgfcm)
7	SEAL BOLT	A97L-0218-0423#030505	6		1.3Nm (13kgfcm)
8	OIL SEAL	A98L-0040-0049#02603707	1		
9	PIPE	A290-7139-X421	1		
10	J4 REDUCER	A97L-0218-0815#80(*4)	1	LT518	
		A97L-0218-0815#80C(*3)	1	LT518	
11	O-RING	(Attached to J4 REDUCER)	1		
12	GEAR J4-2	A290-7139-X412	1		
13	J3 ARM 1	A290-7139-X402(*4)	1		
		A290-7139-Y402(*5)	1		
		A290-7139-Z402(*6)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC, LR Mate 200iC/5L is specified

(\*5) When LR Mate 200iC/5LC,5C is specified.

(\*6) When LR Mate 200iC/5WP is specified.

## 4.REPLACING PARTS

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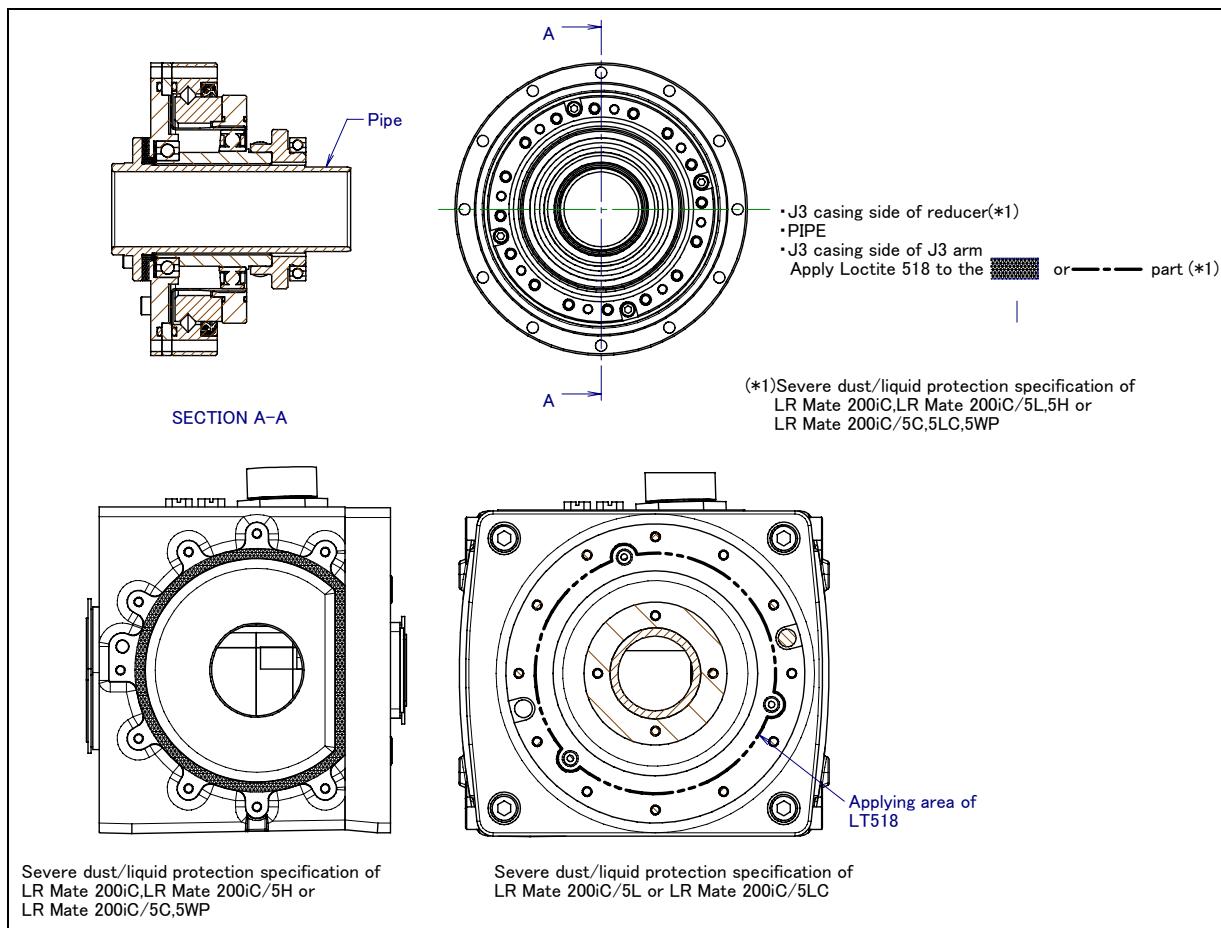


Fig. 4.9(b) Spread range of sealant

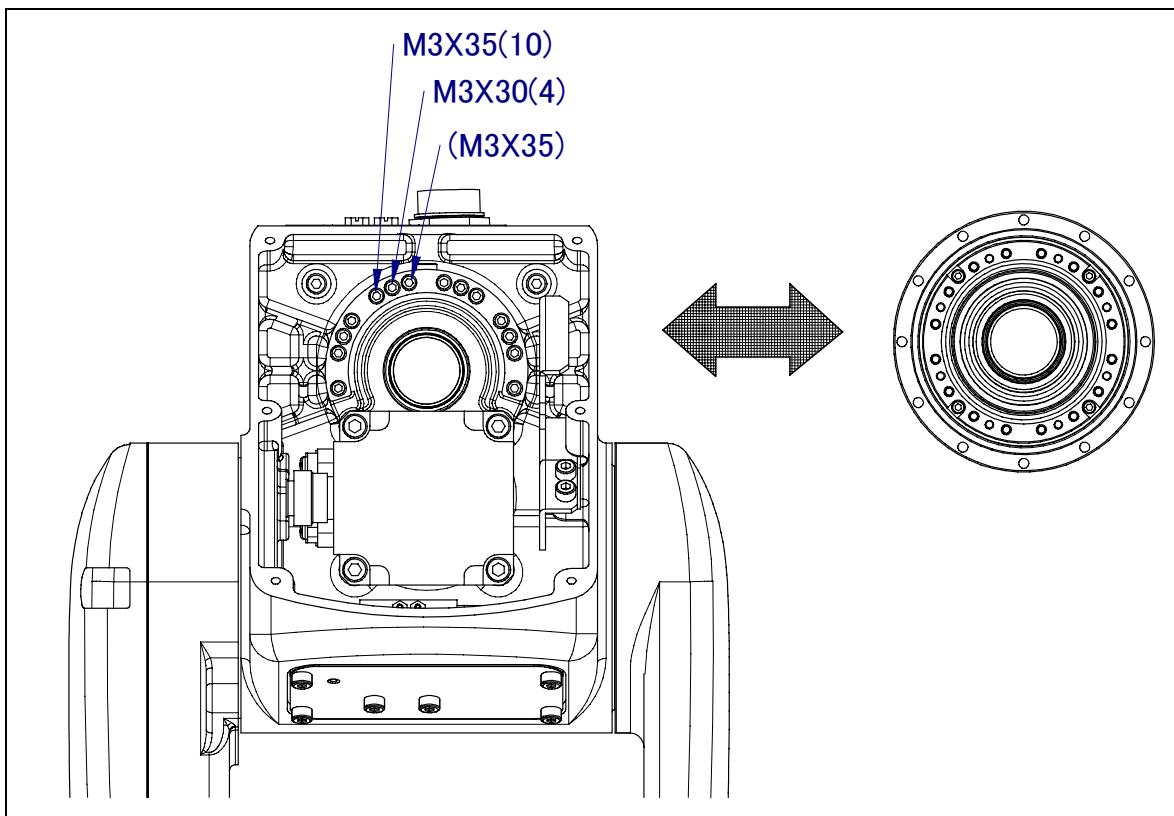


Fig. 4.9(c) Spread range of sealant

## 4.10 REPLACING J5-AXIS MOTOR

### Replacing procedure

#### !CAUTION

This mechanism becomes J4 axis in 5H. When you replace part of 5H, read J5/J6 as J4/J5.

- 1 Turn off the power of the controller.
- 2 Remove bolt/plated bolt (1) and J3 arm cover (2). When packing is attached, remove packing (12), too.
- 3 Remove bolt/plated bolt (3) and J3 arm cover (4). When packing is attached, remove packing (13), too.
- 4 Loosen a bolt (5) a little and lower the tension of the belt (6) and remove belt (6). Remove the bolt (14) when you do not remove the belt easily.
- 5 Pull cable from upper side of J5-axis motor and remove all relay connector.

#### !CAUTION

When the belt is removed, the wrist moves to bellow side. Do as the wrist is put on the stand so that the wrist should not collide with surroundings.

- 6 Remove bolt (5) and motor (11).
- 7 Remove cable K110, K111 from motor (11).
- 8 Remove seal bolt (7), washer (8), motor pulley (9) and key (10).
- 9 Assemble it in the opposite procedure after exchanging motor and packing for the new article.
  - Adjust the tension of the belt referring to Section 6.1 after the installation of the belt.
- 10 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.). In this time, perform not only J5-axis but also J6-axis.

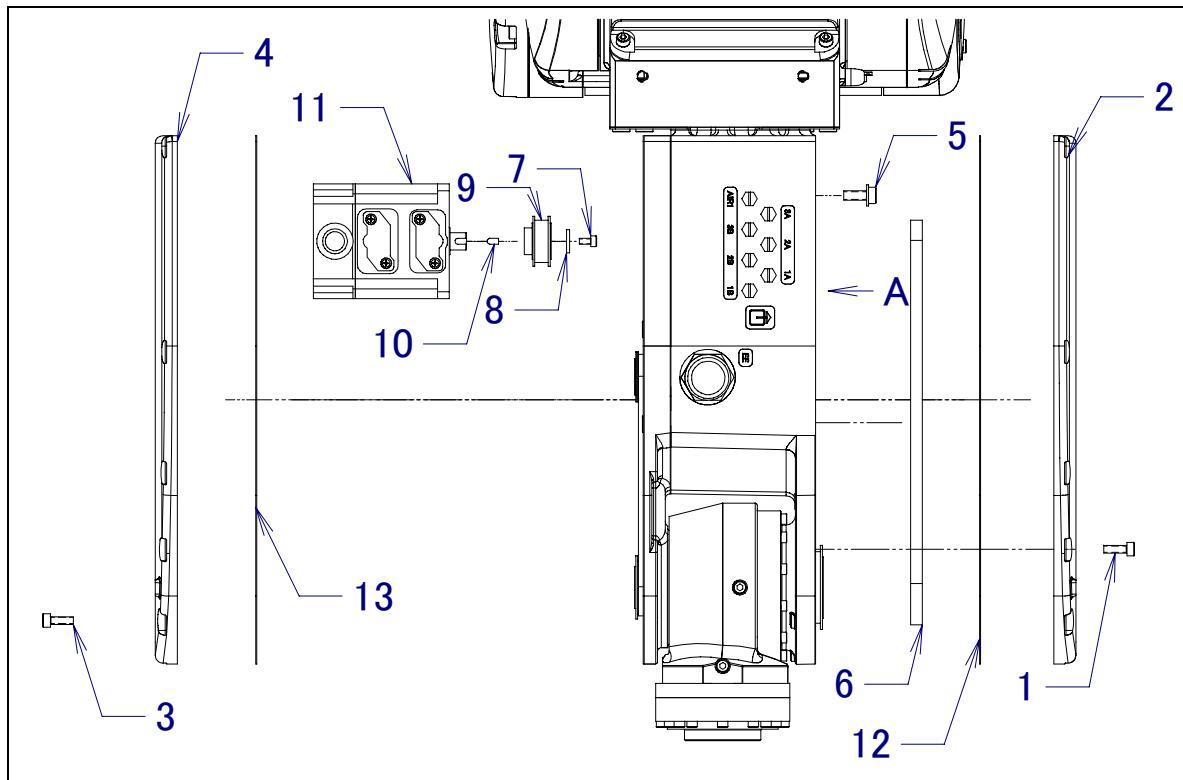
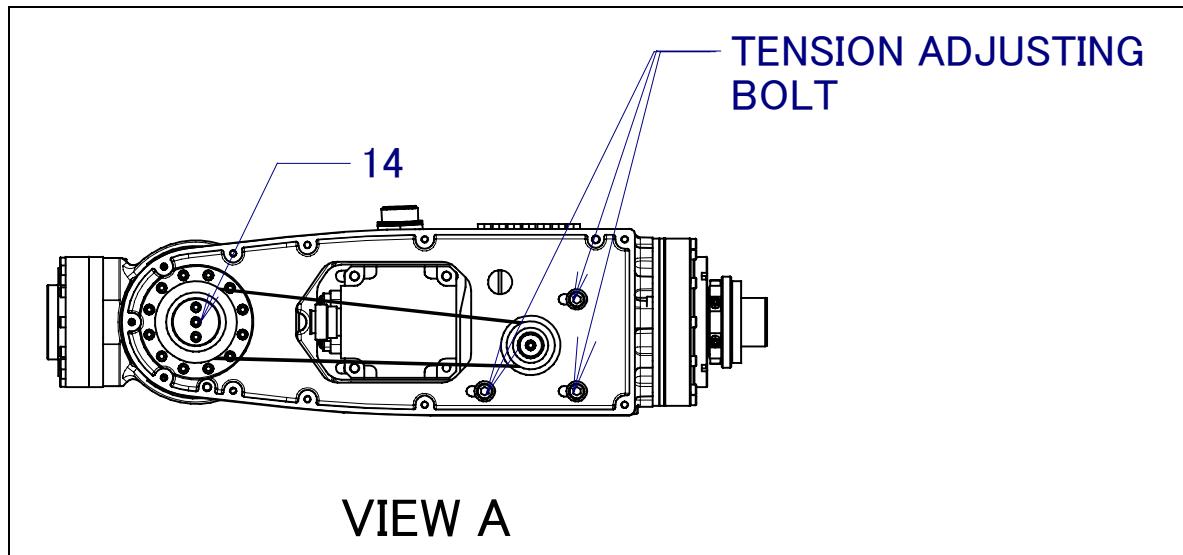


Fig. 4.10(a) Replacing J5-axis motor



VIEW A

Fig. 4.10(b) Replacing J5-axis motor

## 4.REPLACING PARTS

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	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	11		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	11		4.5Nm (46kgfcm)
2	J3 ARM COVER	A290-7139-X405(*1)	1		
		A290-7139-X407 (*2)	1		
		A290-7139-Y407 (*4)	1		
		A290-7139-Z407 (*5)	1		
3	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	11		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	11		4.5Nm (46kgfcm)
4	J3 ARM COVER	A290-7139-X405(*1)	1		
		A290-7139-X407 (*2)	1		
		A290-7139-Y407 (*4)	1		
		A290-7139-Z407 (*5)	1		
5	BOLT	A97L-0218-0504#M5X12	3		5.6Nm (57kgfcm)
6	BELT	A98L-0040-0227#006-152	1		
7	SEAL BOLT	A97L-0218-0423#030606	1		1.3Nm (13kgfcm)
8	WASHER	A290-7210-X532	1		
9	MOTOR PULLEY	A290-7139-X413	1		
10	KEY	JB-HKY-3X3X6B	1		
11	MOTOR	With brake A06B-0117-B855#0049	1		
		No brake A06B-0117-B205#0049	1		
12	PACKING	A290-7139-X454 (*6)	1		
13	PACKING	A290-7139-X454 (*6)	1		
14	BOLT	A97L-0218-0423#030606	3		1.3Nm (13kgfcm)

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L or LR Mate 200iC/5C,5LC,5WP is specified

## 4.11 REPLACING J5-AXIS REDUCER

### Replacing procedure

**!CAUTION**

This mechanism becomes J4 axis in 5H. When you replace part of 5H, read J5/J6 as J4/J5.

- 1 Turn off the power of the controller.
- 2 Remove both side of J3-arm cover referring to Section 4.10.
- 3 Remove belt (1) referring to Section 4.10.
- 4 Pull out cable from upper side of J5-axis motor and remove all relay of cable.

**!CAUTION**

When the belt is removed, the wrist moves to bellow side. Do as the wrist is put on the stand so that the wrist should not collide with surroundings.

- 5 Remove seal bolt (2), washer plate (3) and pulley (4)
- 6 Remove key (6) and bolt (7).
- 7 Remove seal bolt (8) and J3 arm (9). When severe dust/liquid protection specification is specified, remove packing (16), too. In this time, pay attention not to damage oil seal (5). Pay attention that there is a possibility that grease goes out, too.
- 8 Remove relay of cable K112, K113 and K106, K107.
- 9 Remove bolt/plated bolt (10) and remove reducer (13).
- 10 Replace reducer and packing to new one, and assemble robot by opposite procedure. In this time, pay attention below.
  - Fill grease to the reducer. It is total 7ml greasing in inside of reducer, gear and bearing of wave generator and install it horizontally. Install O-ring (11) and (14) and wave washer (15) without forgetting.
  - Apply grease to the lip of the Oil seal (5)
  - Adjust the tension of the belt referring to Section 6.1 after the installation of the belt.
  - When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L or LR Mate 200iC/5C,5LC,5WP is specified, spread sealant to the reducer referring to Fig.4.11 (b).

**!CAUTION**

Do not apply grease to the O-ring (11). Otherwise, hardening of sealant is prevented, causing a grease leak.

- 11 Perform mastering (See subsection 6.2 and refer to section 8 of OPERATOR'S MANUAL.). In this time, perform not only J5-axis but also J6-axis.

## 4.REPLACING PARTS

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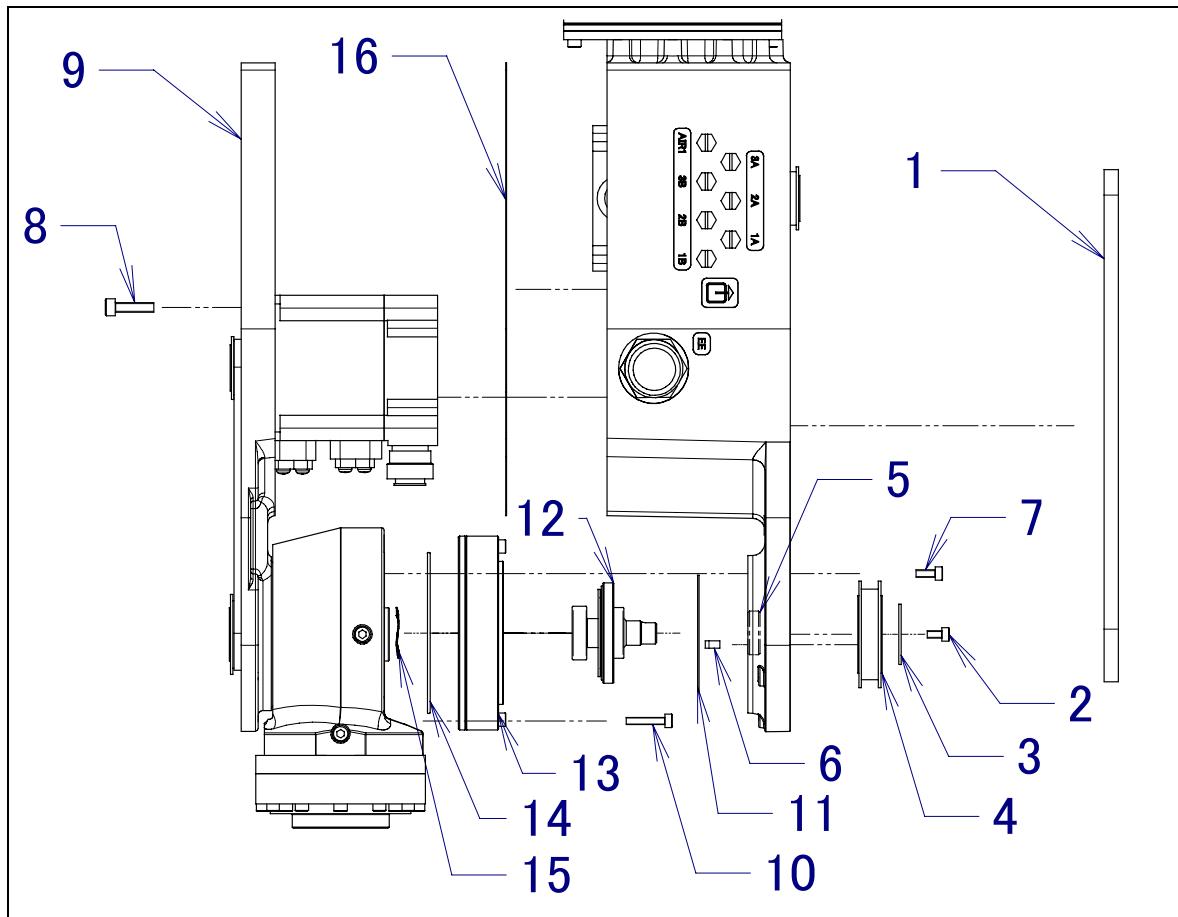


Fig. 4.11(a) Replacing J5-axis reducer

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BELT	A98L-0040-0227#006-152	1		
2	SEAL BOLT	A97L-0218-0423#030606	3		1.3Nm (13kgfcm)
3	WASHER PLATE	A290-7139-X231	1		
4	PULLEY	A290-7139-X414	1		
5	OIL SEAL	A98L-0040-0223#01001805	1		
6	KEY	JB-HKY-3X3X6B	1		
7	BOLT	A6-BA-3X8	12		2.0Nm (20kgfcm)
8	SEAL BOLT	A97L-0218-0423#041616	7		4.5Nm (46kgfcm)
9	J3 ARM 2	A290-7139-X403(*1) A290-7139-Y403(*2) A290-7139-Z403(*3)	1 1 1		
10	BOLT	A6-BA-3X22(*4)	9		2.0Nm (20kgfcm)
10	PLATED BOLT	A97L-0218-0496#M3X22BC (*5)	9		2.0Nm (20kgfcm)
10	PLATED BOLT	A97L-0218-0496#M3X22EN (*6)	9		2.0Nm (20kgfcm)
11	O-RING	(Attached to J5 REDUCER)	1		
12	WAVE GENERATOR	(Attached to J5 REDUCER)	1		
13	J5 REDUCER	A97L-0218-0816#50(*1) A97L-0218-0816#50C(*6)	1 1		
14	O-RING	(Attached to J5 REDUCER)	1		
15	WAVE WASHER	(Attached to J5 REDUCER)	1		
16	PACKING	A290-7139-X453 (*7)	1		

(\*1) When LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

- (\*2) When LR Mate 200iC/5LC,5C is specified.
- (\*3) When LR Mate 200iC/5WP is specified.
- (\*4) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H
- (\*5) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H
- (\*6) When LR Mate 200iC/5LC,5WP,5C is specified.
- (\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP 5C is specified.

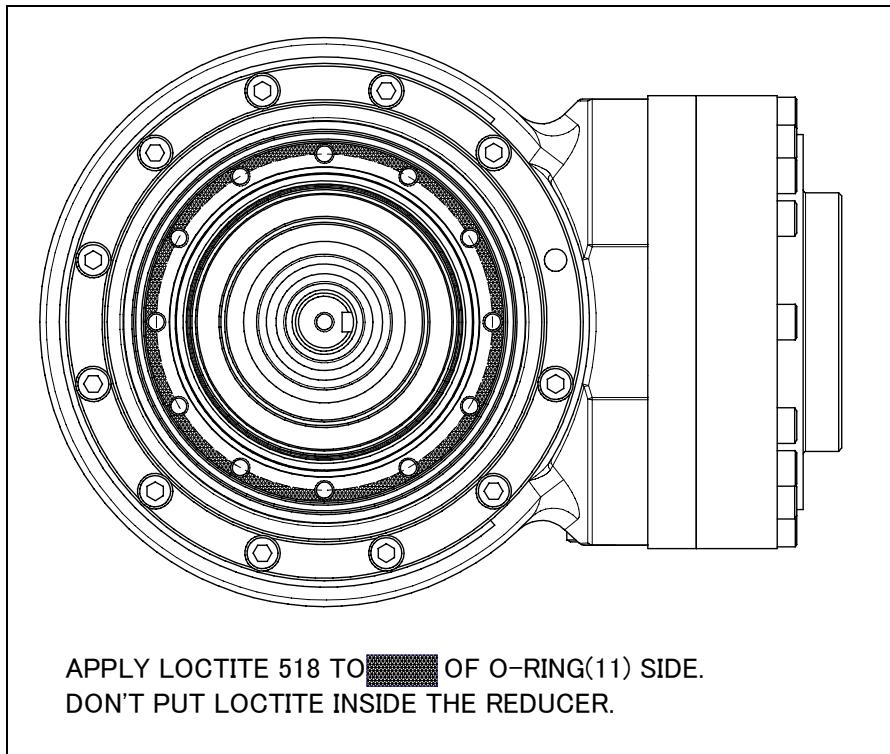


Fig. 4.11(b) Spread range of sealant to J5-reducer

(When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP 5C is specified.)

## 4.12 REPLACING J6-AXIS MOTOR

### Replacing procedure

**!CAUTION**

This mechanism becomes J5 axis in 5H. When you replace part of 5H, read J6 as J5.

- 1 Turn off the power of the controller.
- 2 Remove both side of J3 arm cover of J3 arm.
- 3 Loosen tension adjusting bolt and lower tension and remove belt (1) referring to Fig. 6.1.1(b). Loose the bolt (9) and remove pulley if it is difficult to remove the belt.

**!CAUTION**

When the belt (1) is removed, the wrist moves to bellow side. Do as the wrist is put on the stand so that the wrist should not collide with surroundings.

- 4 Loosen bolt (2) and lower tension and remove belt (3).

**!CAUTION**

When the belt (3) is removed, the wrist become rotatable. When end effector is attached, fix it so that the wrist should not collide with surroundings.

- 5 Remove bolt (2) motor (8).
- 6 Remove cable K112, K113 from motor (8).
- 7 Remove seal bolt (4), washer (5), motor pulley (6) and key (7).
- 8 Assemble it in the opposite procedure after exchanging motor and packing for the new article.
  - Adjust the tension of the belt referring to Section 6.1 after the installation of the belt
- 9 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.). In this time, perform not only J6-axis but also J5-axis.

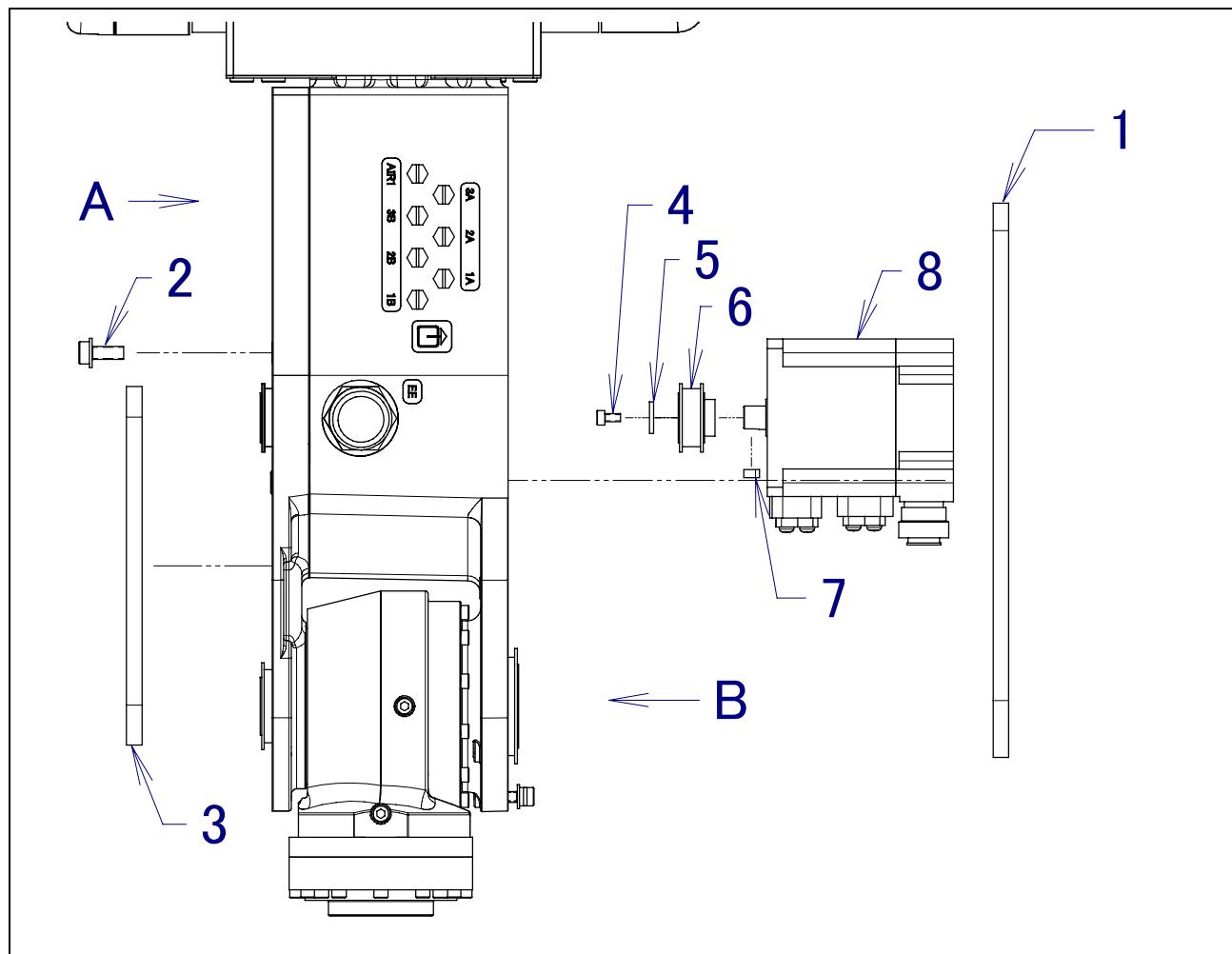


Fig. 4.12(a) Replacing J6-axis motor

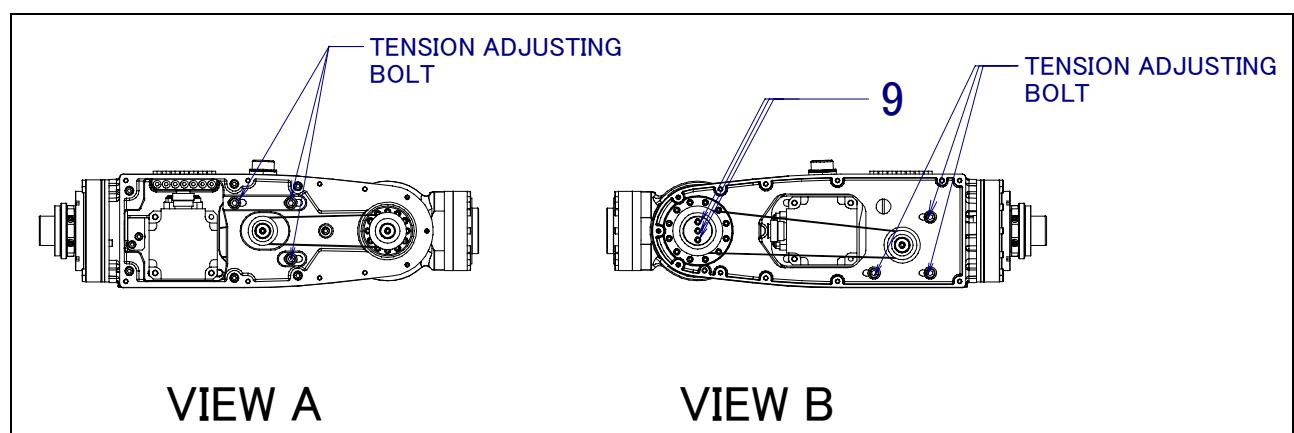


Fig. 4.12(b) Replacing J6-axis motor

#### 4.REPLACING PARTS

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	<b>Parts Name</b>	<b>Specifications</b>		<b>Number</b>	<b>Loctite</b>	<b>Torque N·m (kgf·cm)</b>
1	BELT	A98L-0040-0227#006-152		1		
2	FLANGE SOCKET BOLT	A97L-0218-0504#M5X12		3		
3	BELT	A98L-0040-0227#006-100		1		
4	SEAL BOLT	A97L-0218-0423#030606		1		1.3Nm (13kgfcm)
5	WASHER	A290-7210-X532		1		
6	MOTOR PULLEY	A290-7139-X413		1		
7	KEY	JB-HKY-3X3X6B		1		
8	MOTOR	No brake	A06B-0117-B205#0049	1		
		With brake	A06B-0117-B855#0049			
9	BOLT	A97L-0218-0423#030606		3		1.3Nm (13kgfcm)

## 4.13 REPLACING WRIST UNIT

### Replacing procedure

**!CAUTION**

If you replace unit of 5H, read J5/J6 as J4/J5.

- 1 Turn off the power of the controller.
- 2 Replacing both side of J3 arm cover of J3 arm referring to Section 4.10.
- 3 Remove belt (1), (8) referring to Section 4.12.

**!CAUTION**

When the belt (1), (8) is removed, the wrist moves to bellow side or rotate. Do as the wrist is put on the stand so that the wrist should not collide with surroundings.

- 4 Remove seal bolt (9), washer (10), pulley (11) and key (12).
- 5 Remove seal bolt (13) and J3 arm (14). When packing is attached, remove packing (21), too.
- 6 Remove relay of cable K112, K113 of J6-axis motor and cable K107 and K108.
- 7 Remove seal bolt (2), washer plate (3) and pulley (4)
- 8 Remove bolt (7), wrist unit (20) and key (5). In this time, pay attention not to damage oil seal. Pay attention that there is a possibility that grease goes out, too.
- 9 Remove bolt/plated bolt (19) and J5-axis reducer (16).
- 10 Replace wrist unit to new one and attach it. Attach reducer horizontally after apply greasing to gear of reducer. In this time, replace wave washer (15), O-ring (17), (18) without forgetting, too. Apply greasing to the lip of the oil seal (6).
- 11 Assemble it in the reverse order of 3-8.
- 12 Adjust belt referring to Section 6.1.
- 13 Install J3 arm cover.
- 14 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.). In this time, perform not only J6-axis but also J5-axis.

#### 4.REPLACING PARTS

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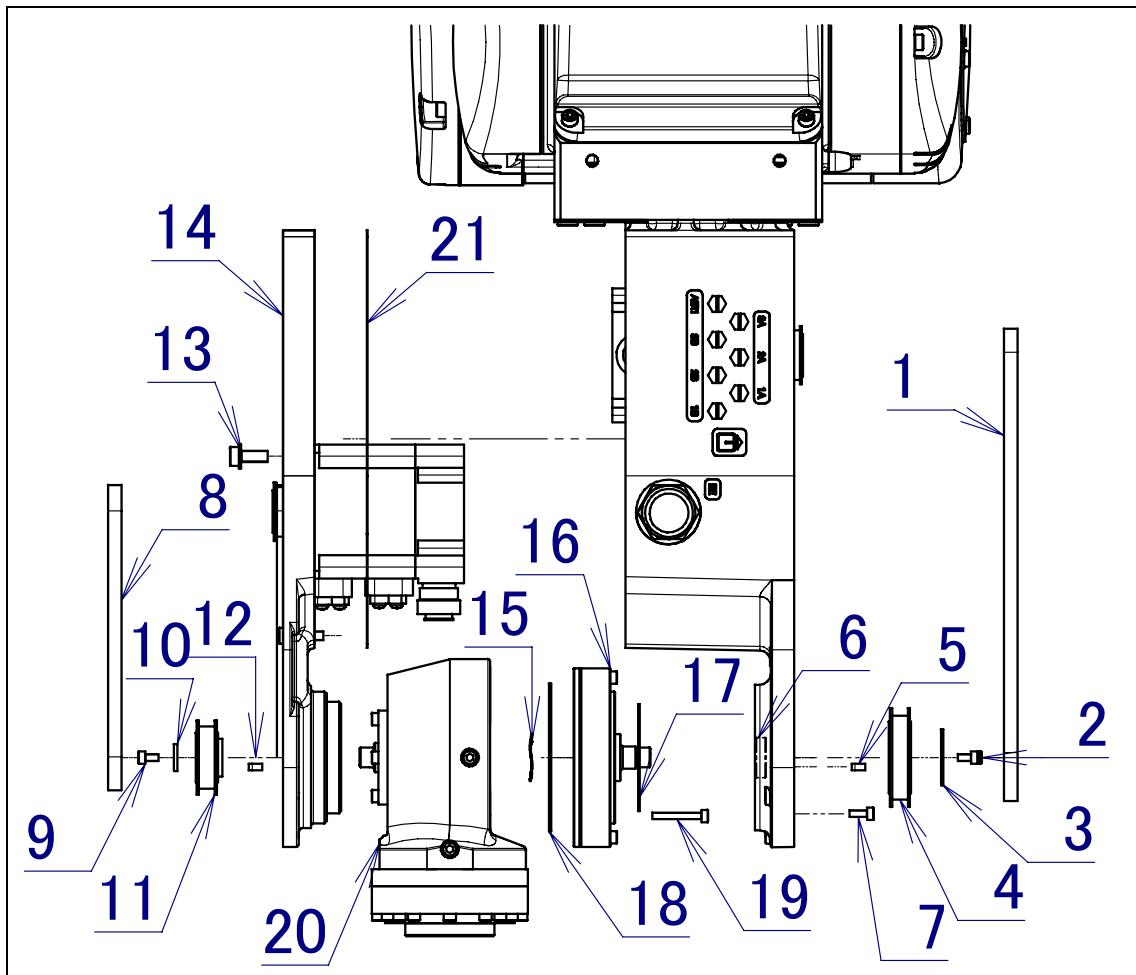


Fig. 4.13 Replacing wrist unit

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BELT	A98L-0040-0227#006-152	1		
2	SEAL BOLT	A97L-0218-0423#030606	3		1.3Nm (13kgfcm)
3	WASHER PLATE	A290-7139-X23 1	1		
4	PULLEY	A290-7139-X414	1		
5	KEY	JB-HKY-3X3X6B	1		
6	OIL SEAL	A98L-0040-0223#01001805	1		
7	BOLT	A6-BA-3X8	12		2.0Nm (20kgfcm)
8	BELT	A98L-0040-0227#006-100	1		
9	SEAL BOLT	A97L-0218-0423#030606	1		1.3Nm (13kgfcm)
10	WASHER	A290-7210-X532	1		
11	MOTOR PULLEY	A290-7139-X413	1		
12	KEY	JB-HKY-3X3X6B	1		
13	SEAL BOLT	A97L-0218-0423#041616	7		4.5Nm (46kgfcm)
14	J3 ARM 2	A290-7139-X403(*1)	1		
		A290-7139-Y403(*2)	1		
		A290-7139-Z403(*3)	1		
15	WAVE WASHER	(Attached to J5 REDUCER)	1		
16	J5 REDUCER	A97L-0218-0816#50(*1)	1		
		A97L-0218-0816#50C(*4)	1		
17	O-RING	(Attached to J5 REDUCER)	1		
18	O-RING	(Attached to J5 REDUCER)	1		
19	BOLT	A6-BA-3X22(*5)	9		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M3X22BC (*6)	9		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M3X22EN (*4)	9		2.0Nm (20kgfcm)
20	WRIST ASS'Y	A290-7139-V501(*5)	1		
		A290-7139-V502 (*6)	1		
		A290-7139-V521 (*2)	1		
		A290-7139-V531 (*3)	1		
21	PACKING	A290-7139-X453 (*7)	1		

(\*1) When LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2 )When LR Mate 200iC/5LC,5C is specified.

(\*3)When LR Mate 200iC/5WP is specified.

(\*4 )When LR Mate 200iC/5LC,5WP,5C is specified.

(\*5) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H

(\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP 5C is specified.

## 4.14 REPLACING J6-AXIS REDUCER

### Replacing procedure

**!CAUTION**

This mechanism becomes J5 axis in 5H. When you replace part of 5H, read J6 as J5.

- 1 Make to posture that J6 turns to the right under and turn off the power of the controller as shown in Fig.4.14 (a).
- 2 Remove bolt (1) and reducer.
- 3 Remove seal bolt (3), washer (4) and wave generator (5).
- 4 Remove O-ring (6).
- 5 Apply greasing to bearing of wave generator (5) to which attach new reducer and install to the robot.
- 6 Greasing total 6ml inside and gear of reducer (2) and wave generator by using the injection syringe.
- 7 Install new reducer (2) to the robot. In this time, replace O-ring (6) to new one, too.
- 8 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.). In this time, perform not only J6-axis but also J5-axis.

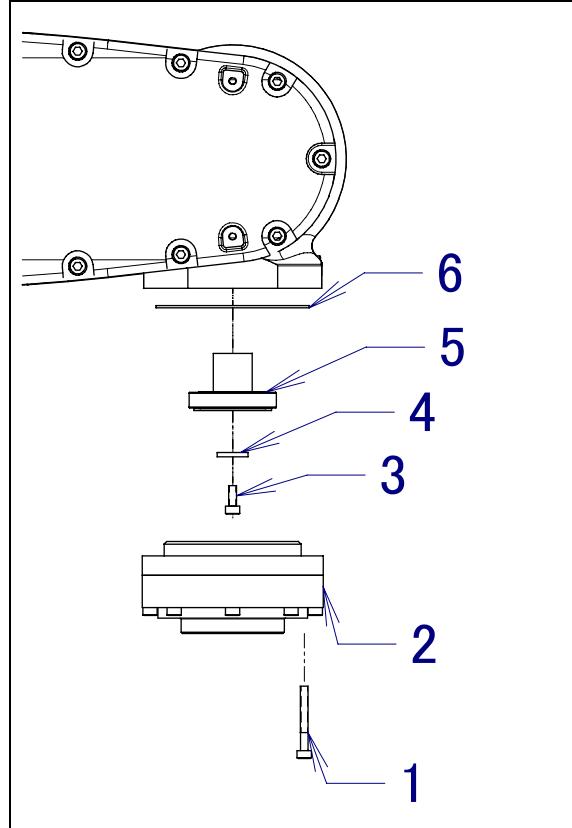


Fig. 4.14(a) Replacing J6-axis reducer

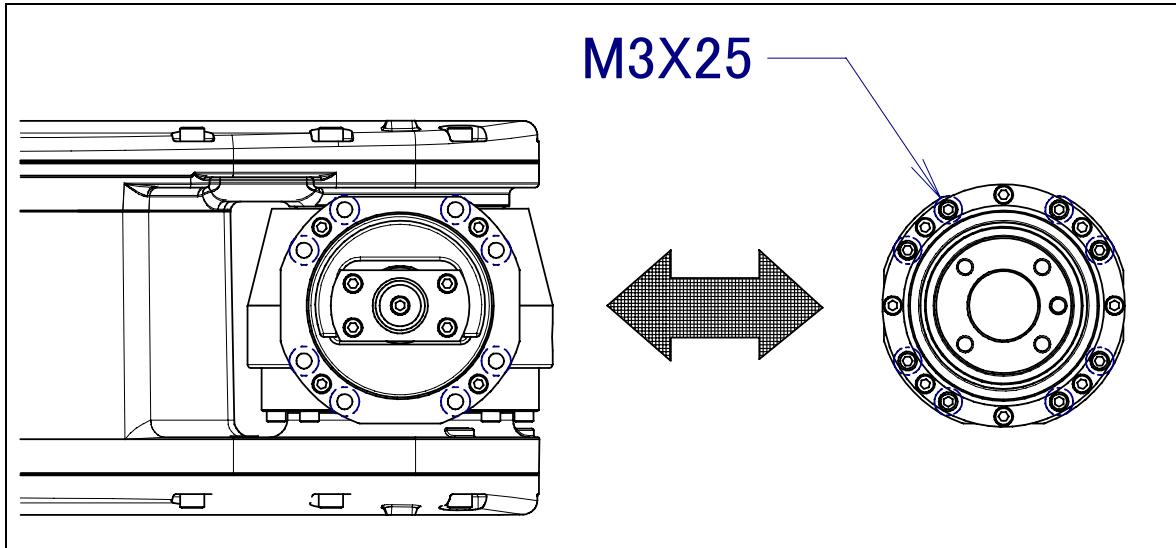


Fig. 4.14(b) Assembling phase of J6-axis reducer

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-3X25 (*1)	8		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M3X25BC (*2)	8		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M3X25EN (*3)	8		2.0Nm (20kgfcm)
2	REDUCER	A97L-0218-0817#50(*4)	1		
		A97L-0218-0817#50C(*3)	1		
3	SEAL BOLT	A97L-0218-0432#030808	1		1.3Nm (13kgfcm)
4	WASHER	A290-7210-X532	1		
5	WAVE GENERATOR	(ATTACHED TO J6 REDUCER)	1		
6	O RING	(ATTACHED TO J6 REDUCER)	1		2.0Nm (20kgfcm)

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP 5C is specified.

(\*4) When LR Mate 200iC, LR Mate 200iC/5H,5L is specified.

## 4.15 REPLACING J3 BELT

### Replacing procedure

- 1 Turn off the power of the controller.
- 2 Remove blot/plated bolt (1) and J2 arm cover (2). When packing is attached, remove packing (3), too.
- 3 Loosen tension adjusting bolt and lower tension and remove belt (4) referring to Fig.4.15.

**⚠ CAUTION**

When removing the belt, put the part beyond the J3 housing on a workbench to prevent the arm from dropping.

- 4 Replace belt and packing to new one and do the opposite procedure. In this time, pay attention below.
  - Adjust the tension of the belt referring to Section 6.1 after the installation of the belt.
- 5 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.).

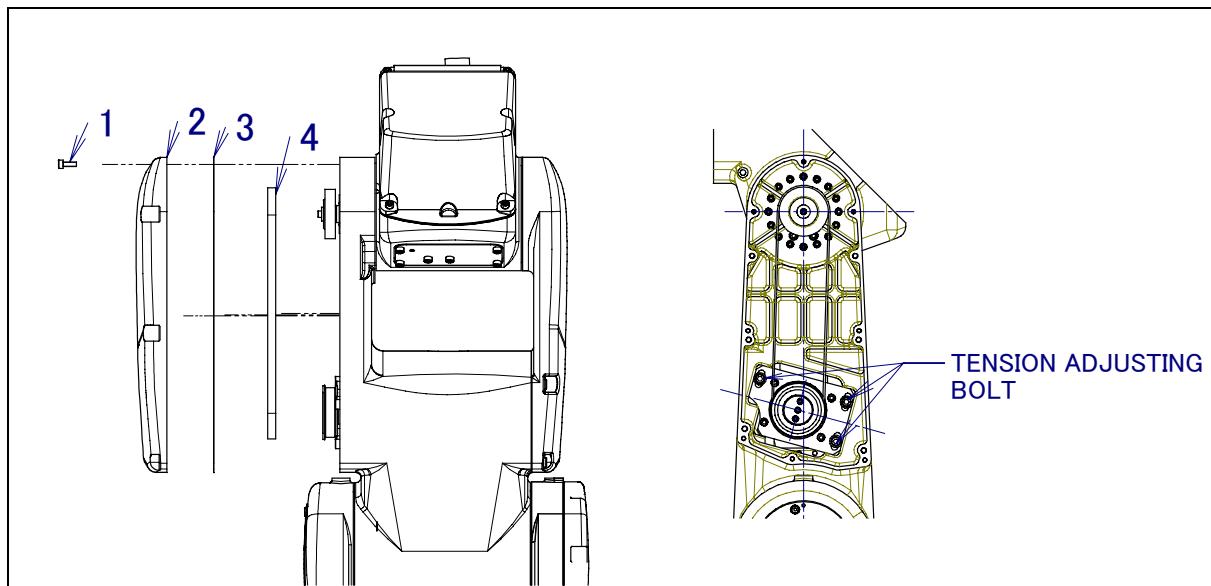


Fig. 4.15 Replacing J3 belt

	<b>Parts Name</b>	<b>Specifications</b>	<b>Number</b>	<b>Loctite</b>	<b>Torque N·m (kgf·cm)</b>
1	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	8		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	8		4.5Nm (46kgfcm)
2	J2 ARM COVER	A290-7139-X306(*1)	1		
		A290-7139-X308 (*2)	1		
		A290-7139-Y308 (*4)	1		
		A290-7139-Z308 (*5)	1		
3	PACKING	A290-7139-X355 (*6)	1		
4	BELT	A98L-0040-0190#007-098	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

## 4.16 REPLACING J5/J6 BELT

### Replacing procedure

**!CAUTION**

When replacing 5H,please read J5/J6 as J4/J5.

- 1 Turn off the power of the controller.
- 2 Remove bolt/plated bolt (1) and J3 arm cover (2). When packing is attached, remove packing (3), too.
- 3 Remove bolt/plated bolt (4) and J3 arm cover (5). When packing is attached, remove packing (6), too.
- 4 In case of replacing J5 belt, loosen tension adjusting bolt and lower tension and remove belt referring to Fig.6.1.1 (b).  
In case of replacing J6 belt, loosen tension adjusting bolt and lower tension and remove belt referring to Fig.6.1.1(c).

**!CAUTION**

When the belt (7) is removed, the wrist moves to bellow side or rotate. Do as the wrist is put on the stand so That the wrist should not collide with surroundings.

**!CAUTION**

When the belt (8) is removed, the wrist become rotatable, When end effector is attached, fix it so that the wrist should not collide with surroundings.

- 5 Replace belt and packing to new one and do the opposite procedure. In this time, pay attention below.
  - Adjust the tension of the belt referring to Section 6.1 after the installation of the belt.
- 6 Perform mastering (See sub section 6.2 and refer to section 8 of OPERATOR'S MANUAL.). When J5 belt is replaced, perform mastering not only J5-axis but also J6-axis.

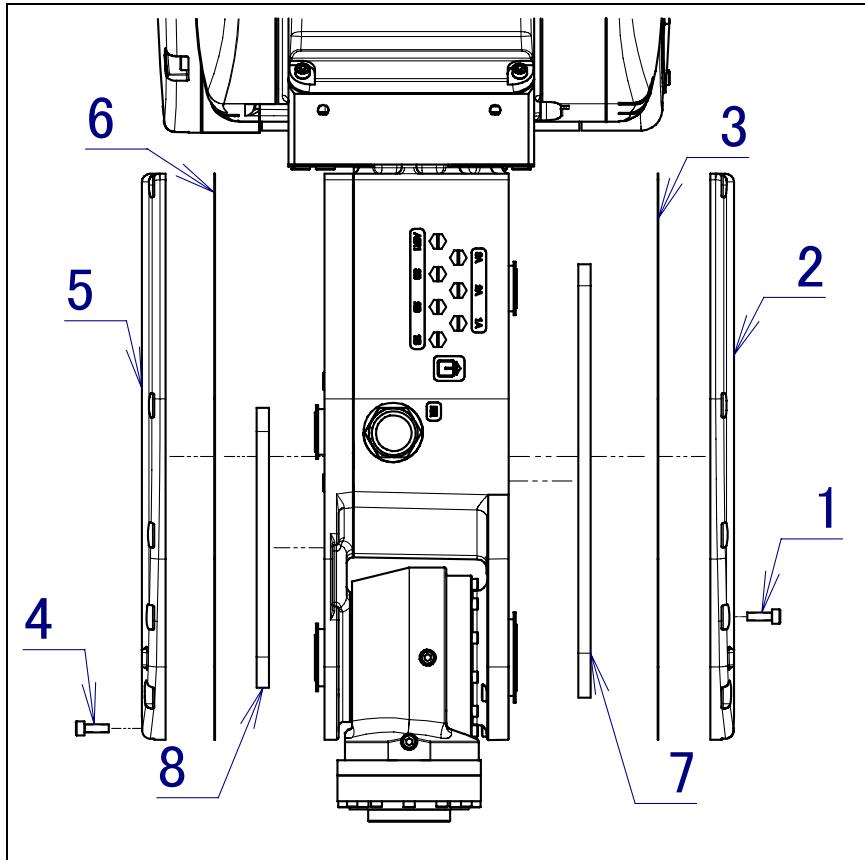


Fig. 4.16 Replacing J5/J6 belt

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	11		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	11		4.5Nm (46kgfcm)
2	J3 ARM COVER	A290-7139-X405(*1)	1		
		A290-7139-X407 (*2)	1		
		A290-7139-Y407 (*4)	1		
		A290-7139-Z407 (*5)	1		
3	PACKING	A290-7139-X454 (*6)	1		
4	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm (20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	11		4.5Nm (46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	11		4.5Nm (46kgfcm)
5	J3 ARM COVER	A290-7139-X405(*1)	1		
		A290-7139-X407 (*2)	1		
		A290-7139-Y407 (*4)	1		
		A290-7139-Z407 (*5)	1		
6	PACKING	A290-7139-X454 (*6)	1		
7	BELT	A98L-0040-0227#006-152	1		
8	BELT	A98L-0040-0227#006-100	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

## 4.17 REPLACING SOLENOID VALVE

### Replacing procedure

- 1 Make J3-axis to posture in which SV PLATE is removed easily.
- 2 Turn off the power of the controller.
- 3 Remove bolt (1), (3) and SV PLATE (2). When severe dust/liquid protection specification is specified, remove packing (5), too.
- 4 Remove relay of air tube and take solenoid valve out.
- 5 Replace solenoid valve and packing to new one, and do the opposite procedure.

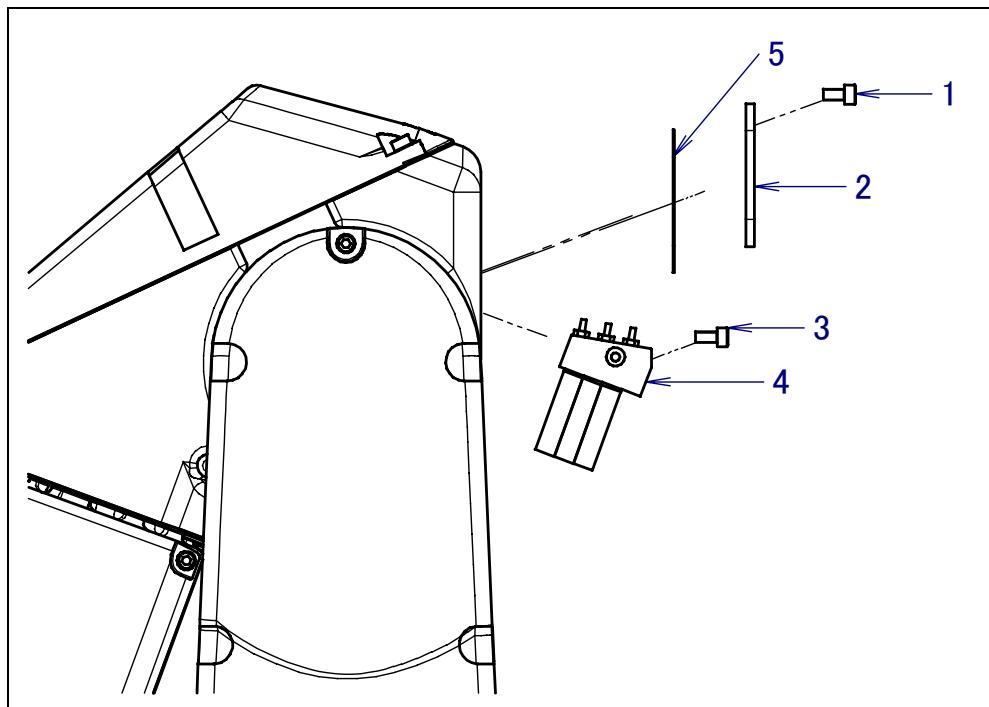


Fig. 4.17 Replacing Solenoid valve

	Parts Name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-4X8(*1)	4		
	PLATED BOLT	A97L-0218-0546#040808BC(*2)	4		
	PLATED BOLT	A97L-0218-0546#040808EN(*3)	4		
	PLATED BOLT	A97L-0218-0546#041010EN(*4)	4		
2	SV PLATE	A290-7139-X433	1		
		A290-7139-Y433(*3)	1		
		A290-7139-Z433(*4)	1		
3	BOLT	A6-BA-4X8(*1)	2		
	PLATED BOLT	A97L-0218-0546#040808BC(*2)	2		
	PLATED BOLT	A97L-0218-0546#040808EN(*3)	2		
	PLATED BOLT	A97L-0218-0546#041010EN(*4)	2		
4	SOL VALVE	A97L-0218-0113#D3R or A97L-0218-0113#D3 or A97L-0218-0113#D2 or A97L-0218-0113#D1	1		
5	PACKING	A290-7139-X452 (*5)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5C is specified.

(\*4) When LR Mate 200iC/5WP is specified.

(\*5) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

## 4.18 SEALANT APPLICATION

### Washing and degreasing the surfaces to be sealed

- 1 After dismounting the reducer from the arm, apply releasant (Loctite Gasket Remover) to the arm's surface from which the reducer was dismounted, then wait until the sealant (Loctite 518) becomes softened (for about 10 minutes). Remove the softened sealant from the surface using a spatula.
- 2 Blow air onto the surface to be sealed to remove dust from the tapped holes.
- 3 Sufficiently degrease the reducer's surface to be sealed and the arm's surface to be sealed, using a cloth dampened with alcohol.
- 4 Polish the arm's surface to be sealed with an oil stone, and degrease it with alcohol again.

**⚠ CAUTION**

Oil may drip from the inside of the reducer. After degreasing, make sure that no oil is dripping.

### Applying sealant

- 5 Make sure that the reducer and the arm is dry (with no alcohol remaining). If they are still wet with alcohol, wipe them dry.
- 6 Apply sealant (Loctite 518) to the surfaces.

**⚠ CAUTION**

The portions to which sealant is to be applied vary from one axis to another. See descriptions about reducer replacement for the relevant axes for details.

### Assembling

- 7 To prevent dust from sticking to the portions to which sealant was applied, mount the reducer as quickly as possible after sealant application. Be careful not to touch the applied sealant. If sealant was wiped off, apply again.
- 8 After mounting the reducer, fasten it with bolts and washers quickly so that the mated surfaces get closer.

# 5

## REPLACING CABLES

---

Replace the cables every four years (15,360 hours). When the cable is broken or damaged or shows signs of wear, replace it according to this chapter.

### **Precautions to be observed when handling the pulse coder cable**

The pulse coder cable is provided with a marking tie, as shown below, to warn against disconnecting the cable during transportation, installation, or maintenance.

If the cable with the marking tie is disconnected, mastering must be performed again. Therefore, do not disconnect the cable except when replacement of the motor, the pulse coder, the reducer, and the cable are necessary.



Fig. 5 marking label

## 5.1 CABLE WIRING

Followings are the routing of the robot cables.

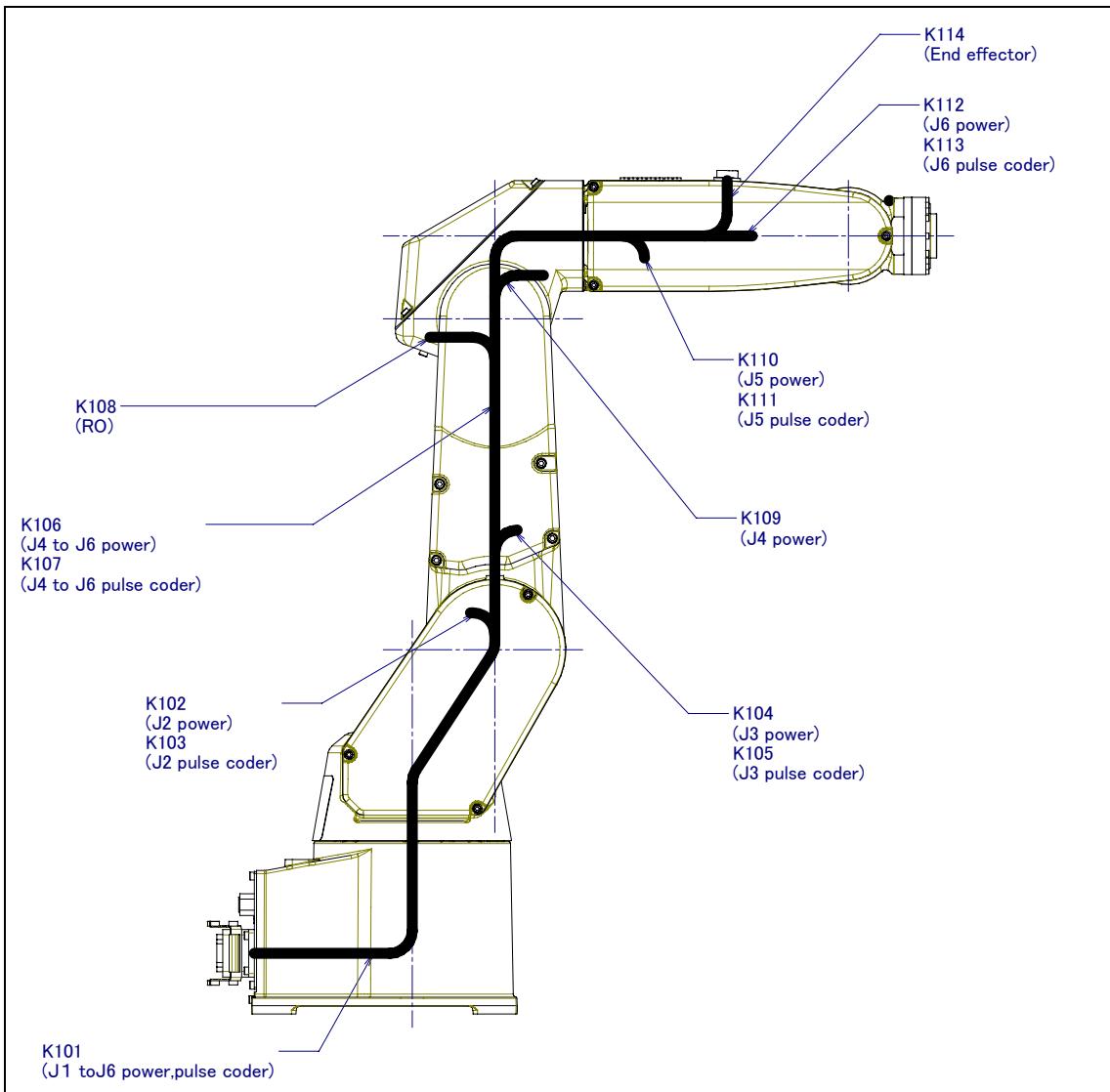


Fig.5.1 (a) Routing of the robot cables (LR Mate 200iC, LR Mate 200iC/5L, 5LC, 5C, 5WP,)

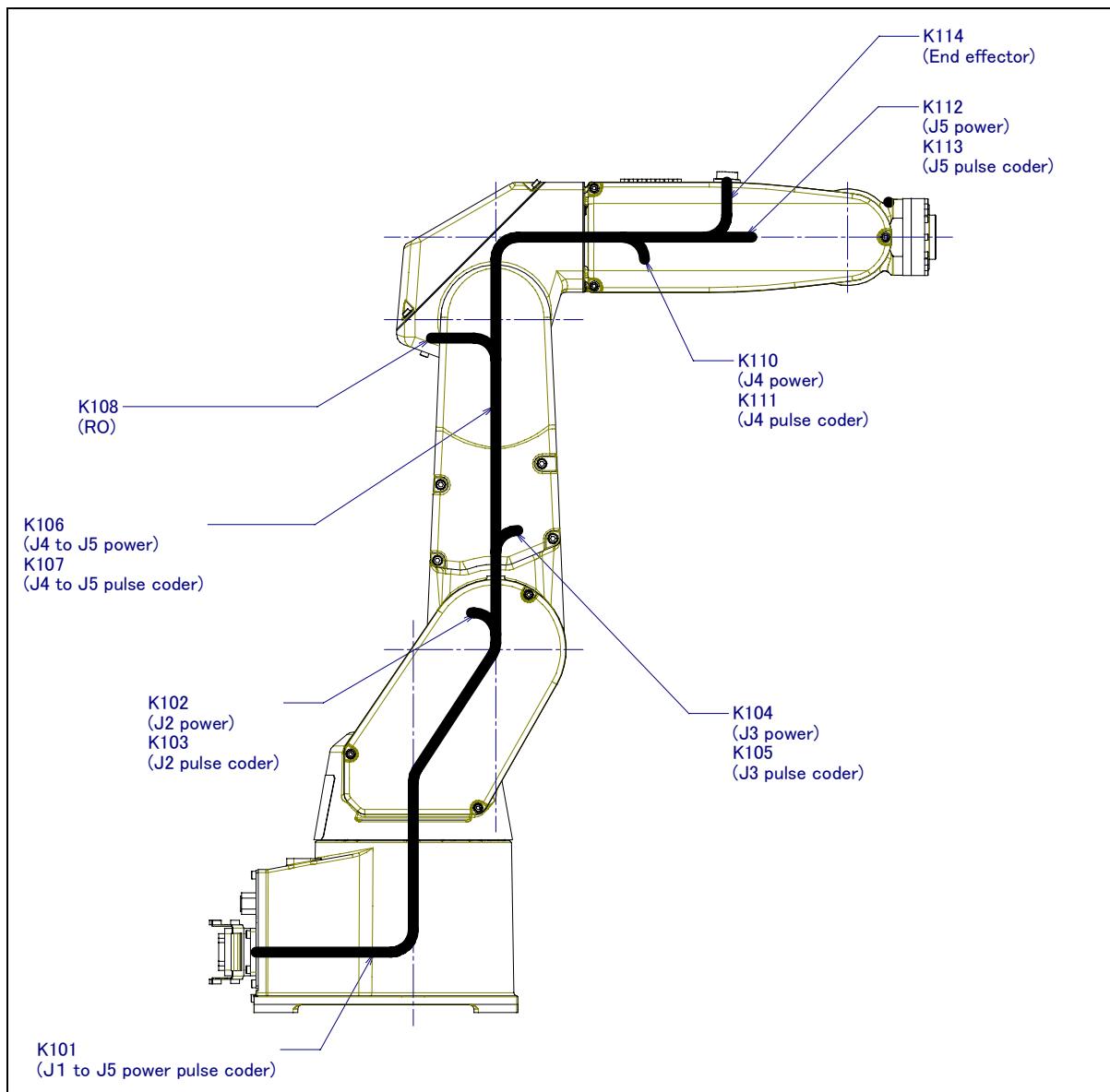
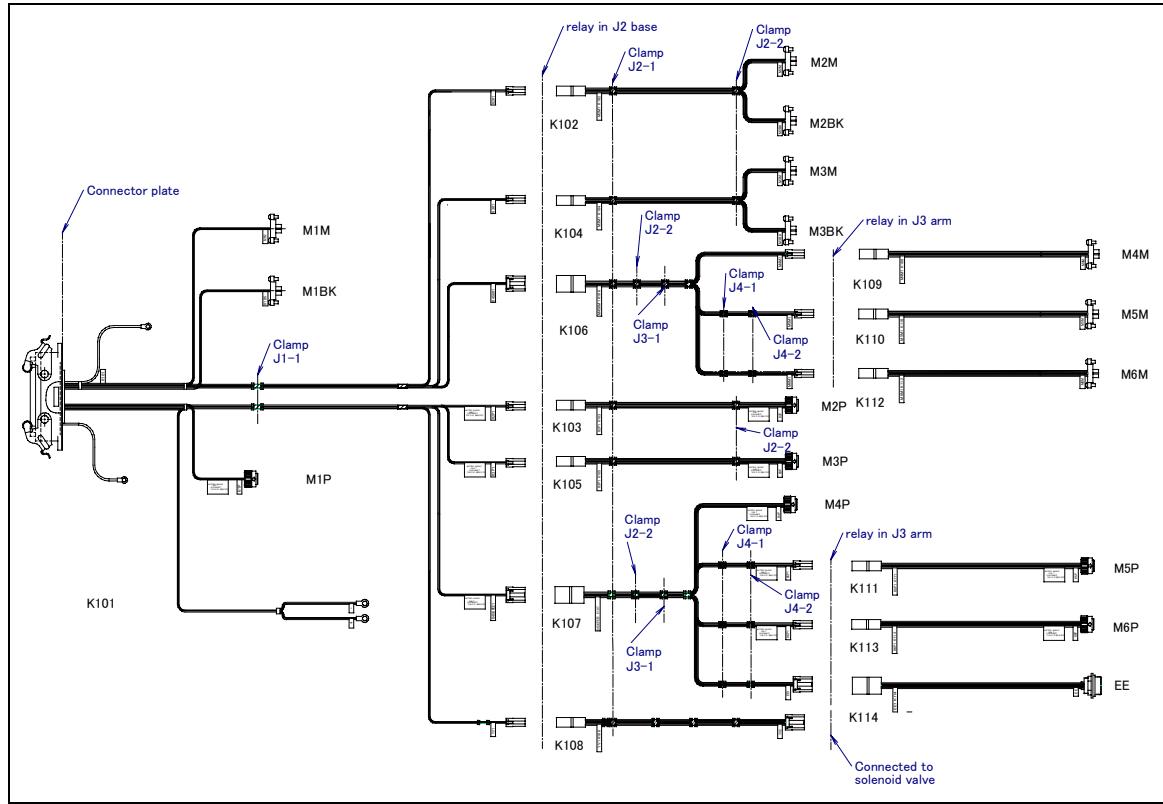
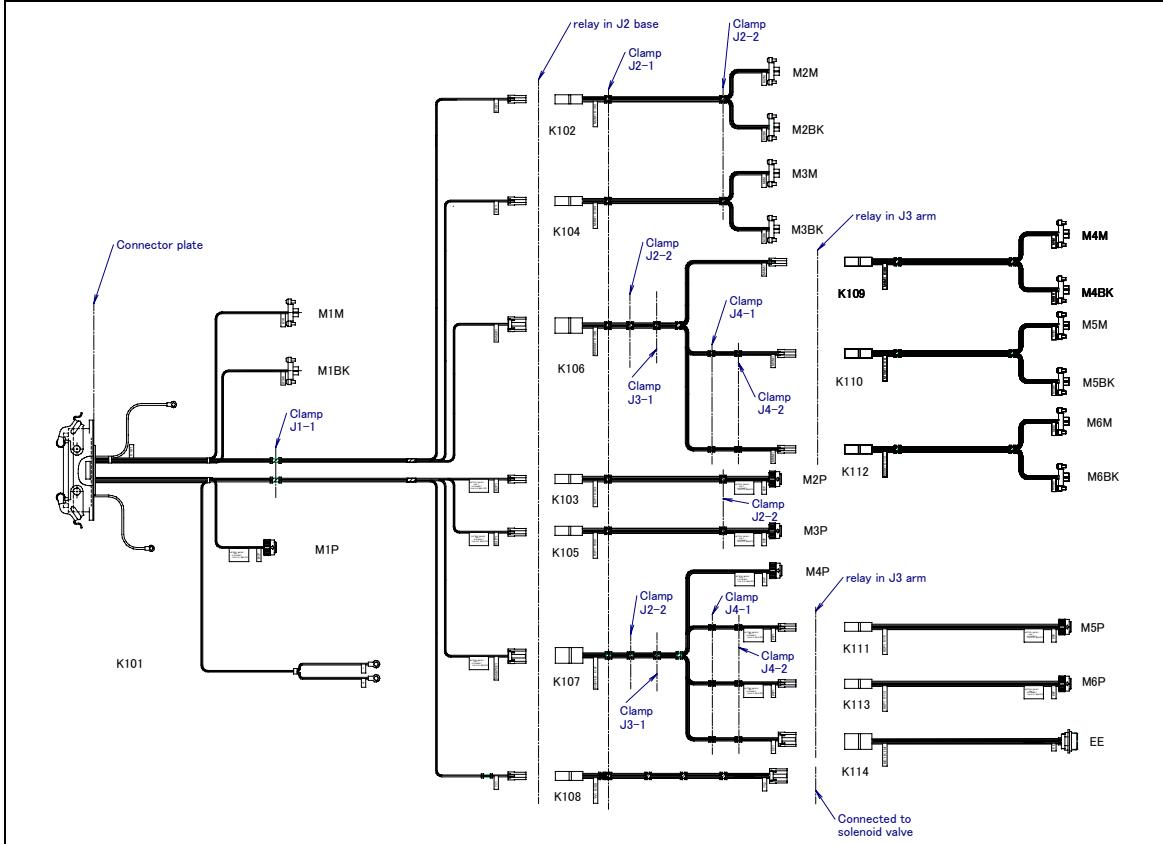


Fig. 5.1 (b) Routing of the robot cables (LR Mate 200iC/5H)

## 5.2 CABLE FORMING

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When replacing cables, clamp the cable at the position specified in Fig.5.2 (a) to (d) using a clamp or a nylon band. Otherwise, cables can be loosened or pulled by force to cause their disconnection. Refer to the Fig.5.2 (a) to (d) for the cable clamp.

**5.REPLACING CABLES****Fig.5.2 (a) Cable externals chart of Mechanical unit (LR Mate 200iC 3-axes brake type)****Fig.5.2 (b) Cable externals chart of Mechanical unit  
(LR Mate 200iC, LR Mate 200iC/5L,5LC,5C,5WP 6-axes brake type)**

## 5.REPLACING CABLES

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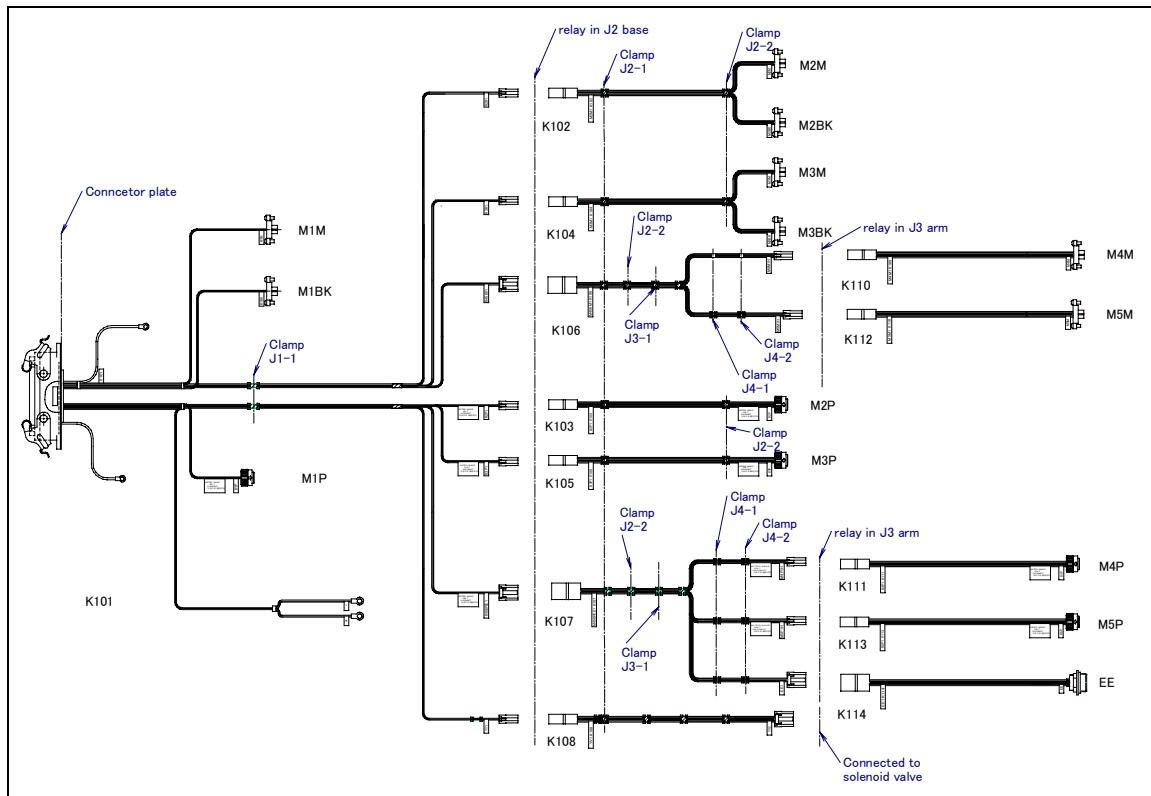


Fig.5.2(c) Cable externals chart of Mechanical unit (LR Mate 200iC/5H 3-axes brake type)

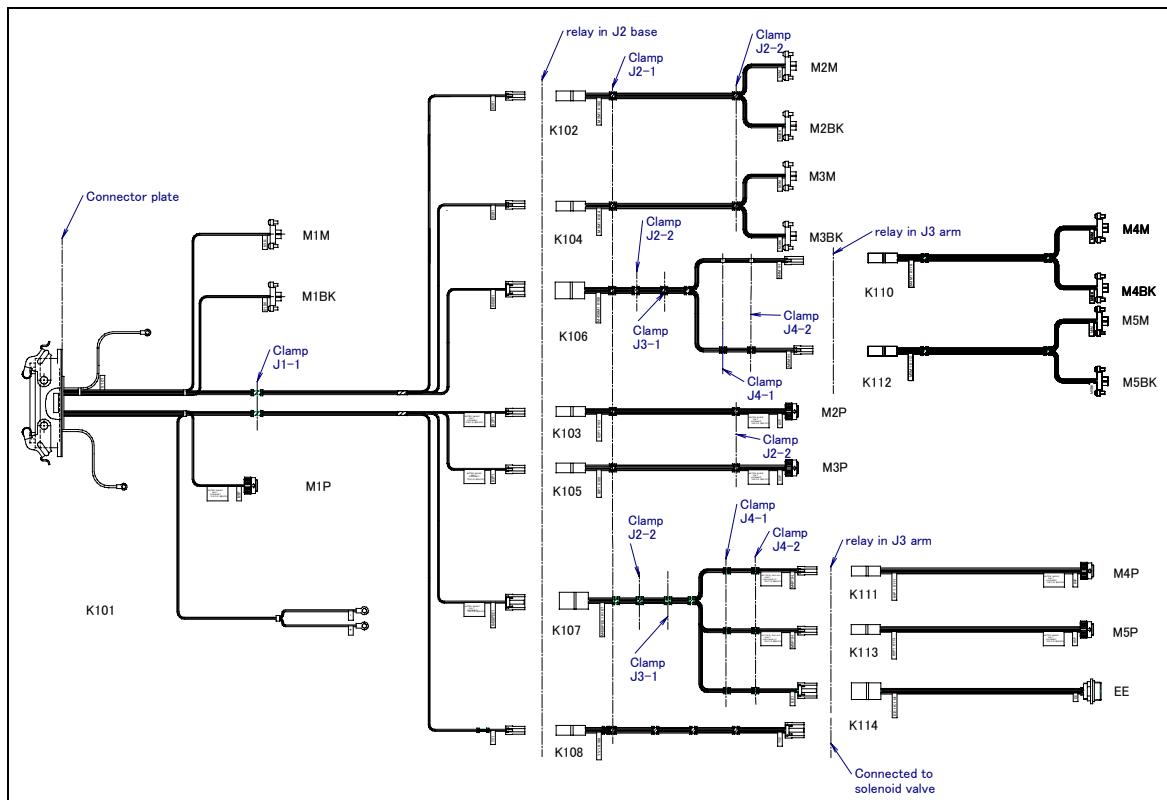


Fig.5.2 (d) Cable externals chart of Mechanical unit (LR Mate 200iC/5H 5-axes brake type)

## **5.3 CABLE AND AIR TUBE REPLACEMENT**

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This section describes a procedure for periodically replacing all the (full-option) mechanical unit cables.

See section 5.1 for the configuration of the mechanical unit cables.

It is necessary to perform after cable replacement. Refer to chapter 6 MASTERING or chapter 8 OPERATOR'S MANUAL in advance. (If pulse coder cable is not replaced, mastering is not necessary.)

### **5.3.1 REPLAING CABLE K101 and Air tube (Connector plate to J2 base)**

---

#### **Replacing procedure**

- 1 Turn off the power of the controller and remove cable of controller side from connector plate of back of J1-axis.
- 2 Remove robot from floor plate, knock down the robot sidewise.
- 3 Remove J2 base cover referring to Fig.5.3.1 (a).
- 4 Remove all relay of cable K102, K103, K104, K105, K106, K107, K108 and K101. Remove relay of air tube similarly.  
(In case of LR Mate 200iC/5C,5LC there are two white air tube and one black air tube, In case of other models there is one white air tube and one black air tube.)
- 5 Remove bolt (5) and cover U (6). When packing is attached, remove packing (7), too.
- 6 If necessary, remove cover B. (See Fig.5.3.1(c))
- 7 Cut the nylon band which connect cable and air tube to clamp J1-2.
- 8 Cut the nylon band of battery box terminal and remove cable.
- 9 Remove connector plate.
- 10 Pull cable and air tube in J2 base to J1 base side. In this time pull out the cable after it pushes into the pipe on the tip of the part of the relayed connector and it passes
- 11 Replace cable and air tube for the new article and assemble them by opposite procedure. When packing is attached, be sure to replace packing to new one.
- 12 Perform mastering (See section 6.2 and referring to chapter 8 of OPERATOR'S MANUAL.).

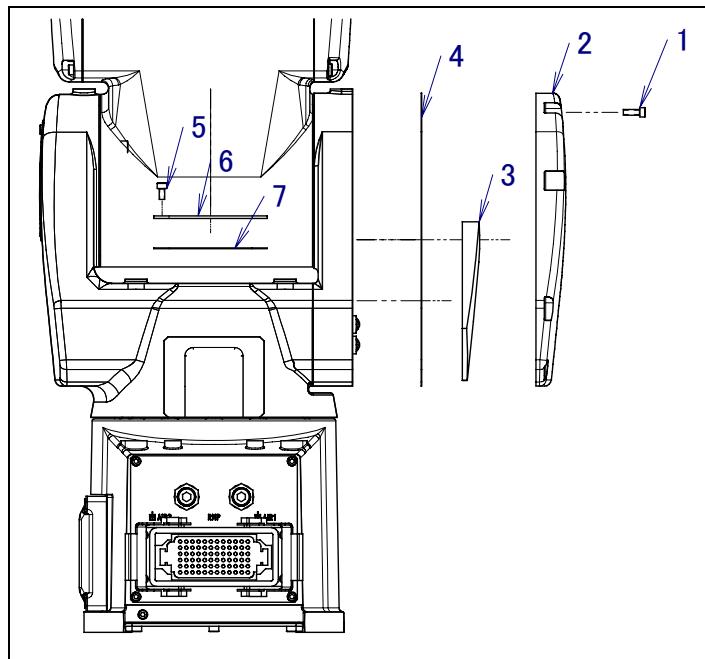


Fig.5.3.1 (a) Remove the J2 base cover

	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4X10(*1)	3		2.0Nm(20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	8		4.5Nm(46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	8		4.5Nm(46kgfcm)
2	J2 BASE COVER	A290-7139-X305(*1)	1		
		A290-7139-X307 (*2)	1		
		A290-7139-Y307 (*4)	1		
		A290-7139-Z307 (*5)	1		
3	Sponge	A290-7139-X346	1		
4	Packing	A290-7139-X354 (*6)	1		
5	BOLT	A6-BA-4X8(*1)	4		
		A97L-0218-0546#040808BC(*2)	4		
		A97L-0218-0546#040808EN(*3)	4		
6	COVER U	A290-7139-X332	1		
7	Packing	A290-7139-X356(*6)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

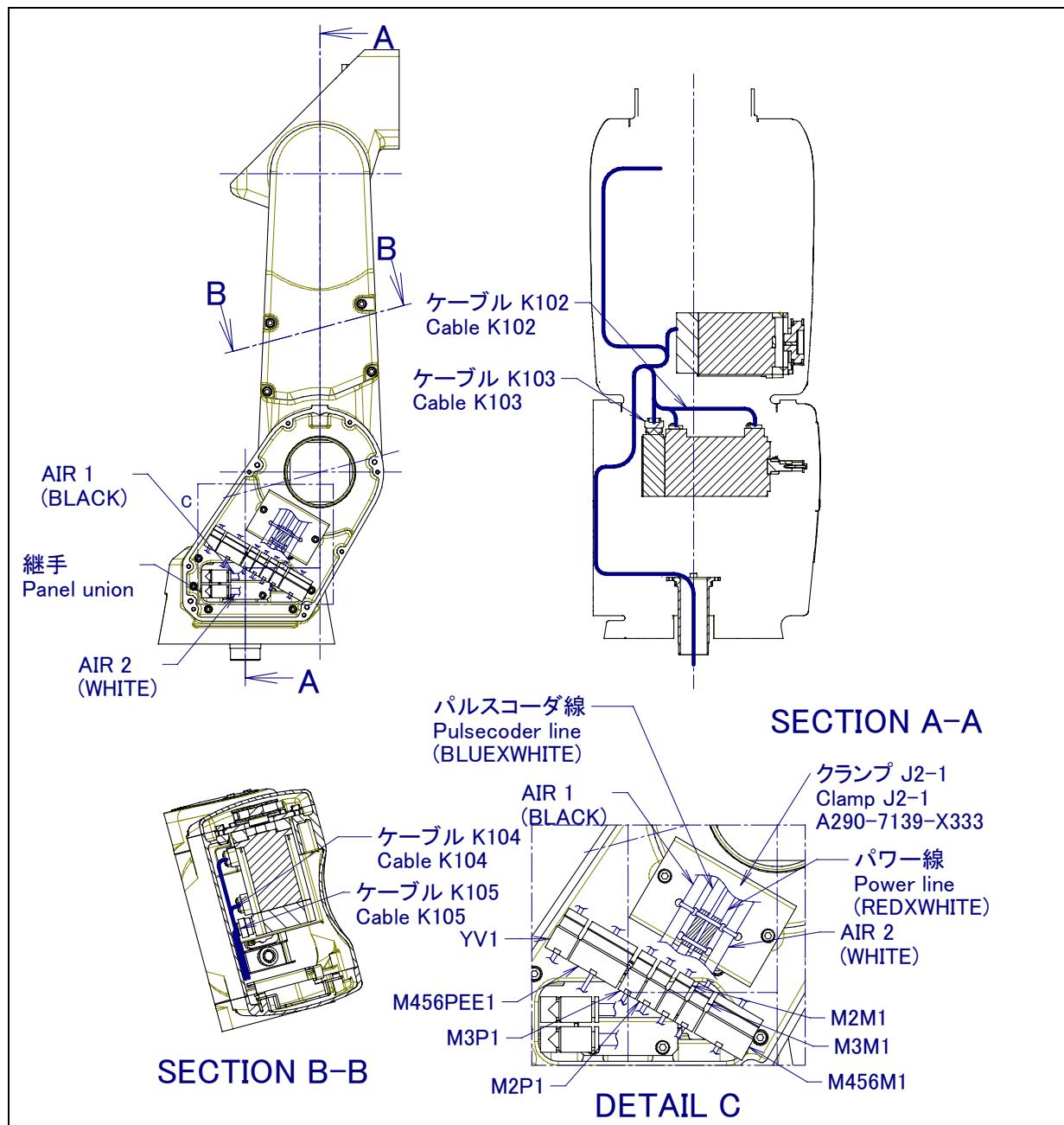


Fig.5.3.1 (b) Replace the cable in J2 base

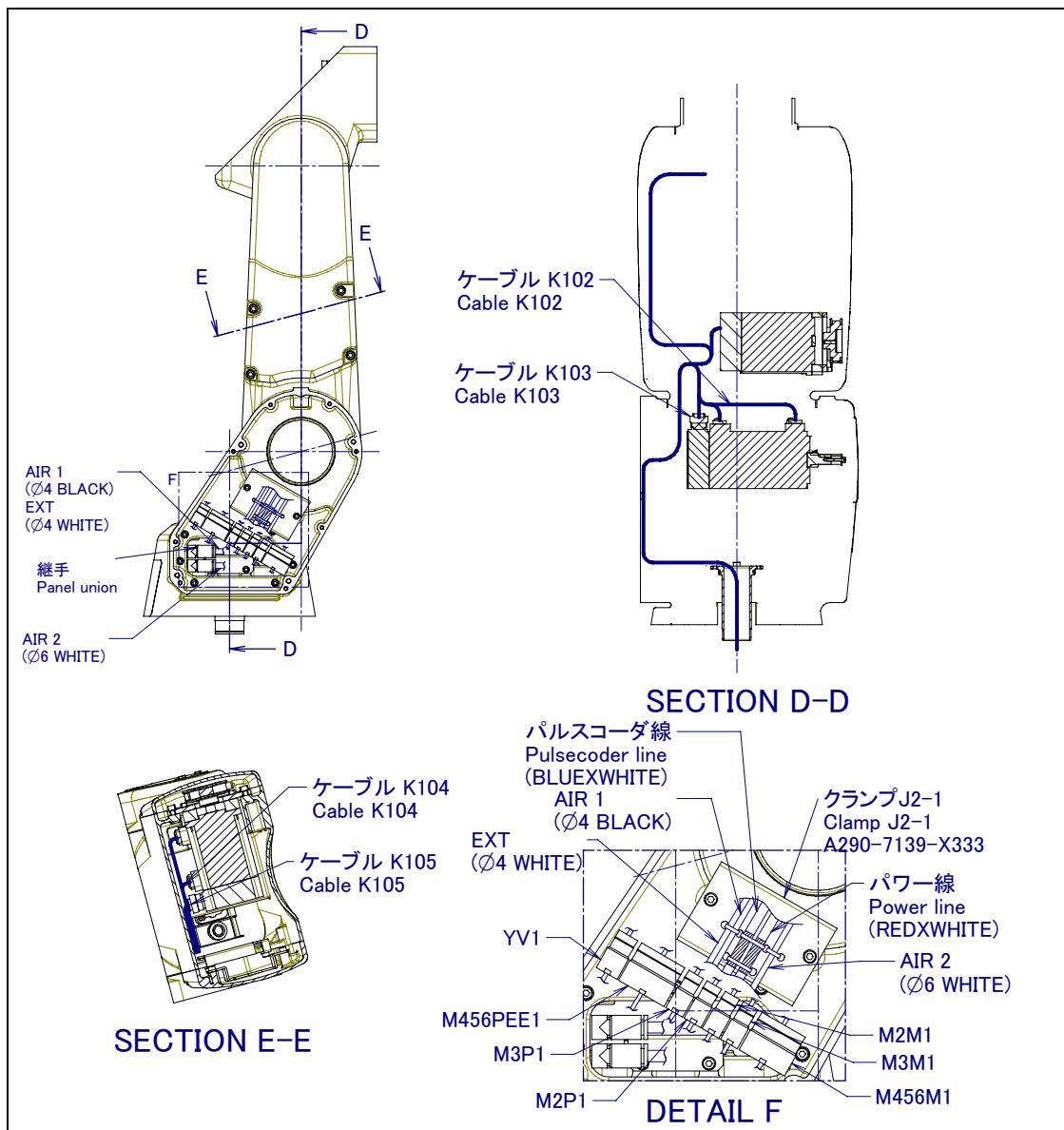
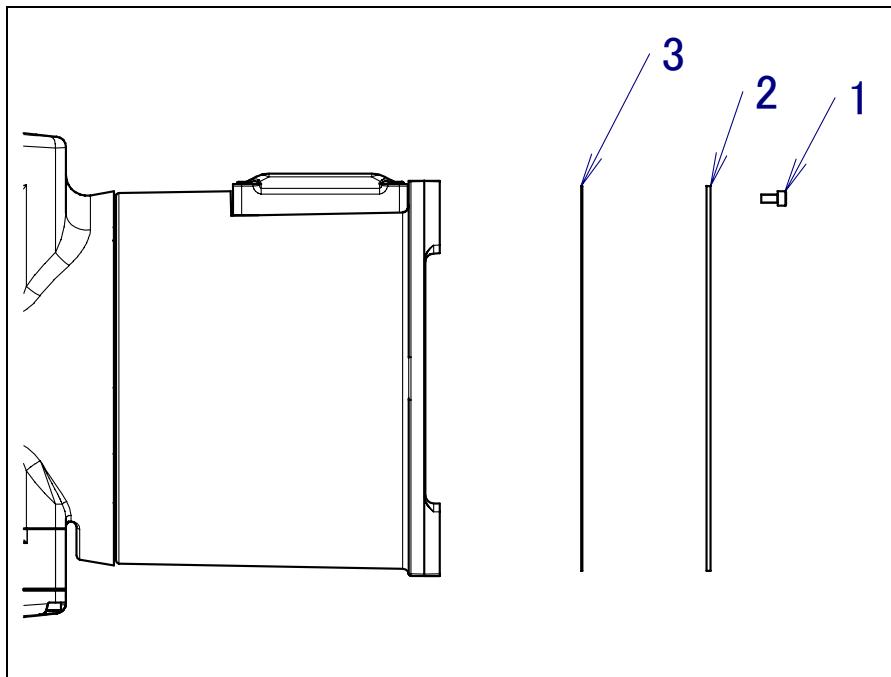


Fig.5.3.1 (c) Replace the cable in J2 base (LR Mate 200iC/5L,5LC)



**Fig.5.3.1(d) Remove the cover B (When only severe dust/liquid protection specification is specified)**

**When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.**

	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	PLATED BOLT	A97L-0218-0496#M4X8BC(*1)	9		4.5Nm(46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X8EN(*2)	9		4.5Nm(46kgfcm)
2	COVER B	A290-7139-X233(*1)	1		
		A290-7139-Y233(*2)	1		
3	PACKING	A290-7139-X252	1		

(\*1) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When LR Mate 200iC/5LC,5WP,5C is specified.

## 5.REPLACING CABLES

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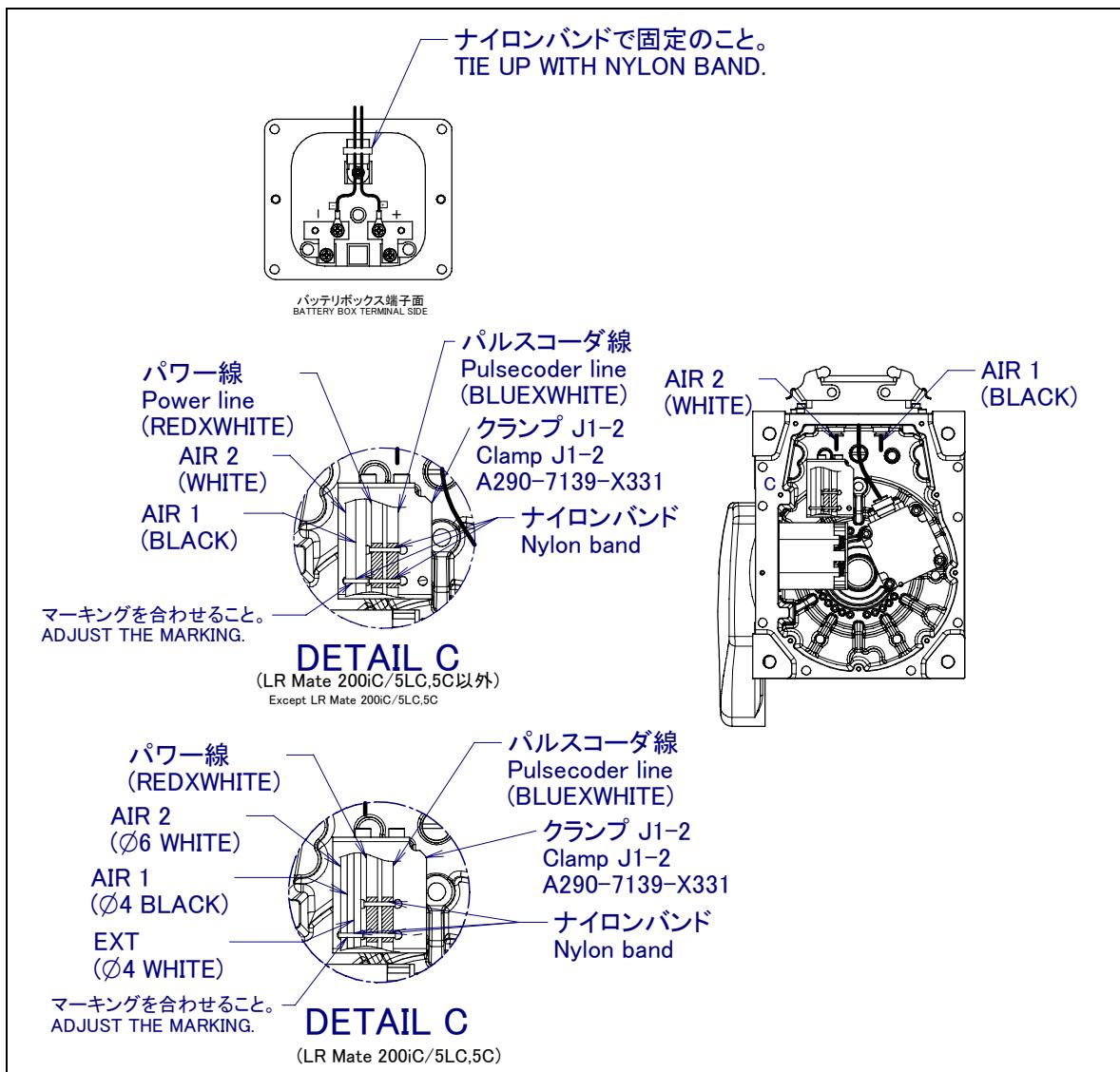


Fig.5.3.1 (e) Replace the cable in J1 base

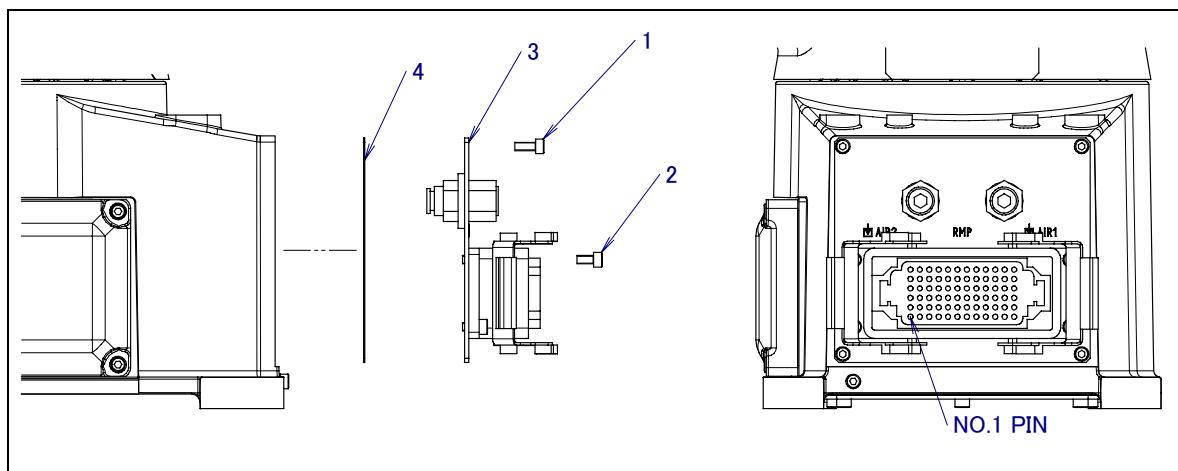


Fig.5.3.1 (f) Replace the parts of connector plate

	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-4X10(*1)	4		2.0Nm(20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X10BC (*2)	4		4.5Nm(46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X10EN (*3)	4		4.5Nm(46kgfcm)
2	BOLT	A6-BA-4X8	4	LT242	
3	CON.PLATE	A290-7139-X233(*4)	1		
		A290-7139-Y233(*3)	1		
4	PACKING	A290-7139-X251 (*5)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*5) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

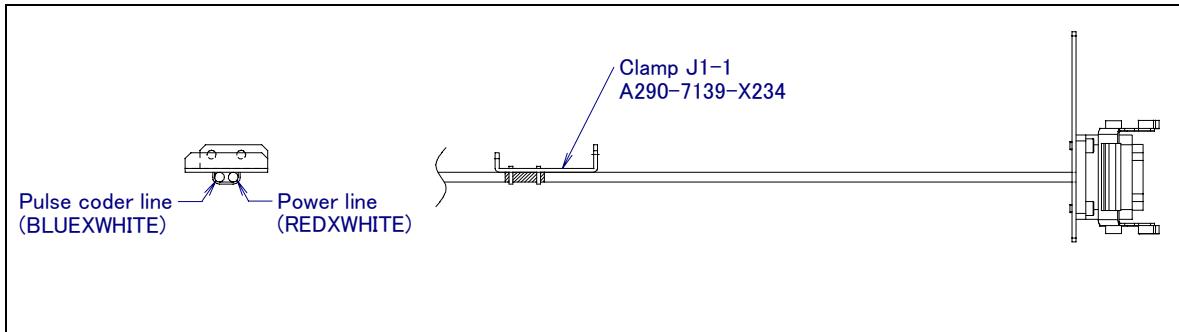


Fig.5.3.1 (g) Clamp of J1 base

### 5.3.2 REPLAING CABLE K106, K107, K108 and Air tube (J2 base to J3 casing)

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- 1 Turn off the power of the controller and remove cable of controller side from connector plate of back of J1-axis.
- 2 Remove the J3 arm cover which is in view of in front of the robot, it is left referring to Fig.5.3.2 (a).
- 3 When packing is attached, remove packing, too.
- 4 Drag cable to remove the relay easily.
- 5 Remove relay of K106 and K110, K112.  
Remove relay of K107 and K111, K113.
- 6 Cut the nylon band, which connect cable to clamp J4-2 referring to Fig.5.3.2 (b).
- 7 Remove J3 cover referring to Fig.5.3.2(c).
- 8 Remove air tube of six in diameter which color is black and white that has come from J2 base to J3 casing.
- 9 When packing is attached, remove packing, too.
- 10 Cut the nylon band, which connect cable to clamp J4-1 referring to Fig.5.3.2 (d).
- 11 Pull out the cable of the J3 arm to the J3 casing side. In this time, pull out the cable after it pushes into the pipe on the tip of the part of the relayed connector and it passes.
- 12 Remove relay of cable K106 and K109  
(In case of LR Mate 200iC/5H, there is no K109.)
- 13 Cut the nylon band, which connect cable to clamp J3-2 referring to Fig.5.3.2 (d).
- 14 Remove J2 base cover referring to Section 4.4.
- 15 When packing is attached, remove packing, too.
- 16 Cut the nylon band, which connect cable to clamp J2-2 referring to Fig.5.3.2 (e).
- 17 Remove relay to K101 and air tube.
- 18 Remove clamp J2-1 from J2 base referring to Fig.5.3.1 (b).
- 19 Remove guide arm.
- 20 When packing is attached, remove packing.
- 21 Remove clamp J3-1 from guide arm.
- 22 Drag the cable from the upper part and the lower side of the guide arm. In this time, drag it after it passes it on the tip of the part of the connector.
- 23 Cut the nylon band which connect cable and air tube to clamp J3-2 and sheet referring to Fig.5.3.2 (g) and (h).
- 24 Replace cable and air tube for the new article and assemble it by opposite procedure. When packing is attached, be sure to replace packing to new one.
- 25 Perform mastering (See section 6.2 and referring to chapter 8 of OPERATOR'S MANUAL.).

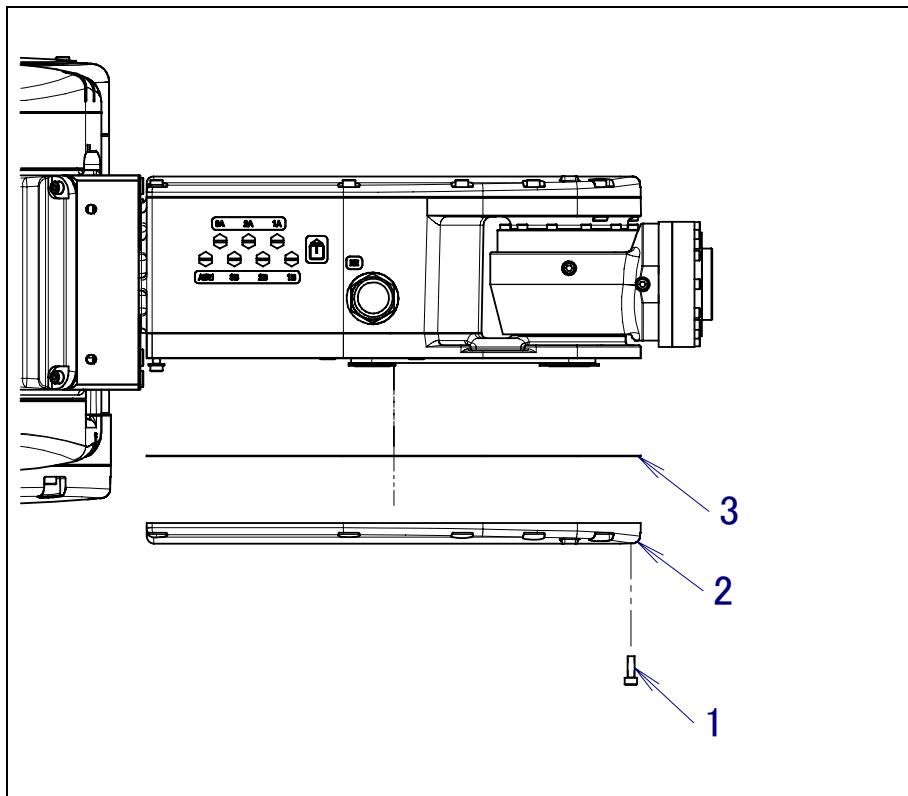


Fig.5.3.2 (a) Remove the J2 arm cover

	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4x10(*1)	3		2.0Nm(20kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12BC (*2)	11		4.5Nm(46kgfcm)
	PLATED BOLT	A97L-0218-0496#M4X12EN (*3)	11		4.5Nm(46kgfcm)
2	J3 ARM COVER	A290-7139-X405 (*1)	1		
		A290-7139-X407 (*2)	1		
		A290-7139-Y407 (*4)	1		
		A290-7139-Z407 (*5)	1		
3	PACKING	A290-7139-X454 (*6)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

## 5.REPLACING CABLES

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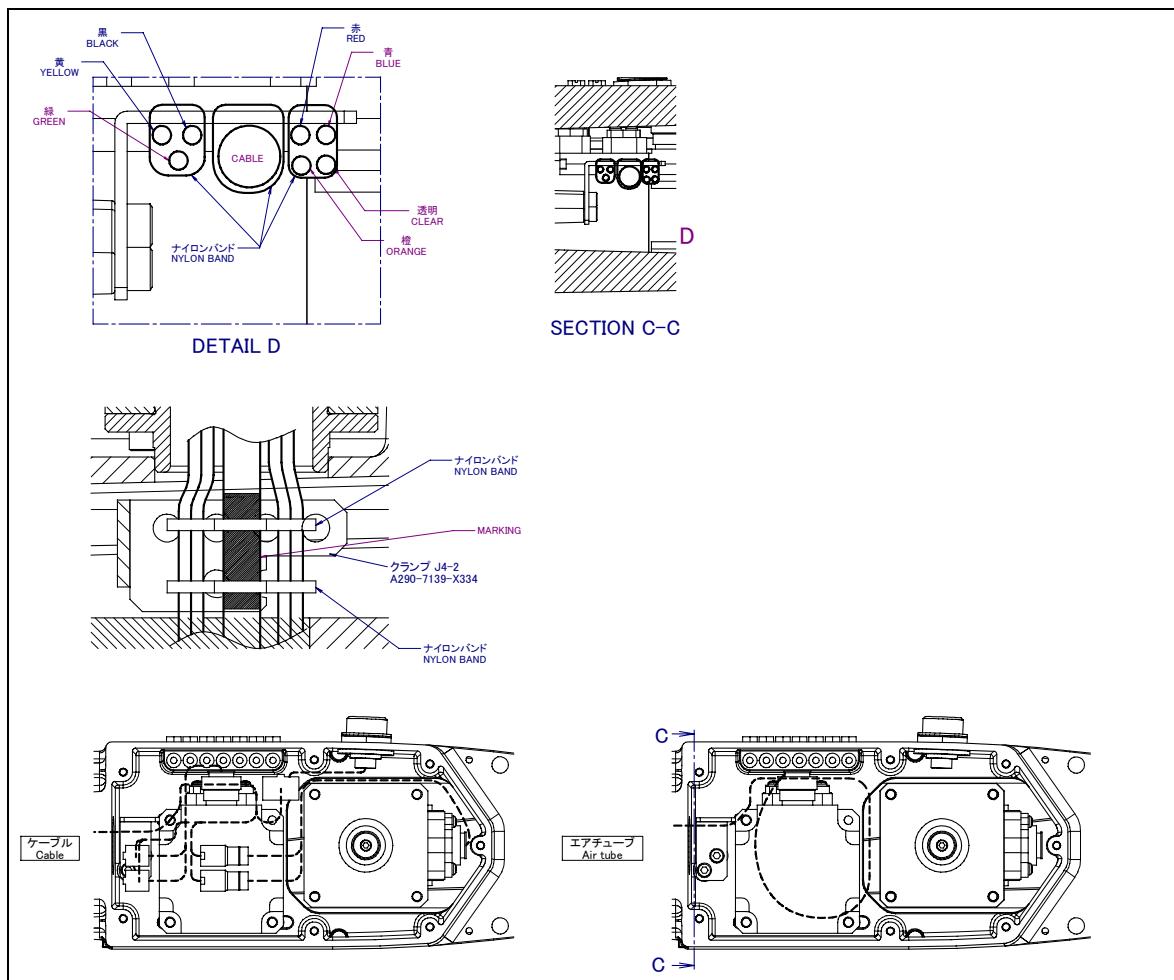


Fig.5.3.2 (b) Clamp of J3 arm part

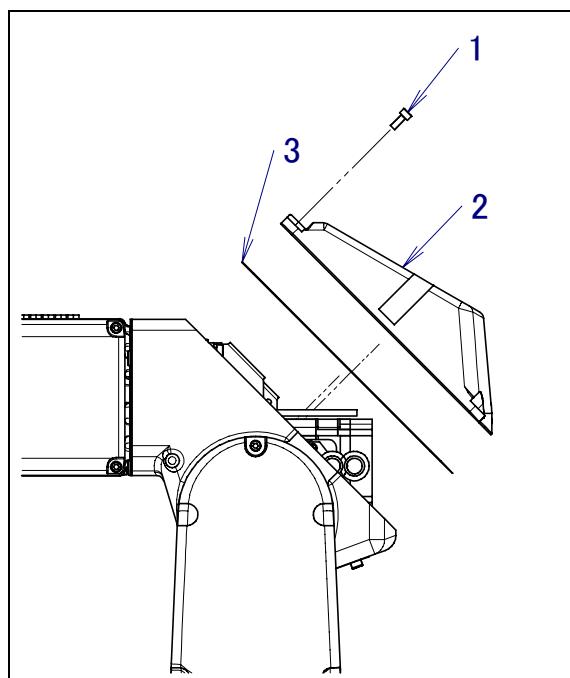


Fig.5.3.2(c) Remove the J3 cover

	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A97L-0218-0504#M4X10(*1)	4		2.0Nm(20kgfcm)
	PLATED BOLT	A97L-0218-0417#M4X12BC (*2)	6		4.5Nm(46kgfcm)
	PLATED BOLT	A97L-0218-0417#M4X12EN (*3)	6		4.5Nm(46kgfcm)
2	J3 COVER	A290-7139-X404 (*1)	1		
		A290-7139-X406 (*2)	1		
		A290-7139-Y406 (*4)	1		
		A290-7139-Z406 (*5)	1		
3	PACKING	A290-7139-X451 (*6)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC/5LC,5C is specified.

(\*5) When LR Mate 200iC/5WP is specified.

(\*6) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

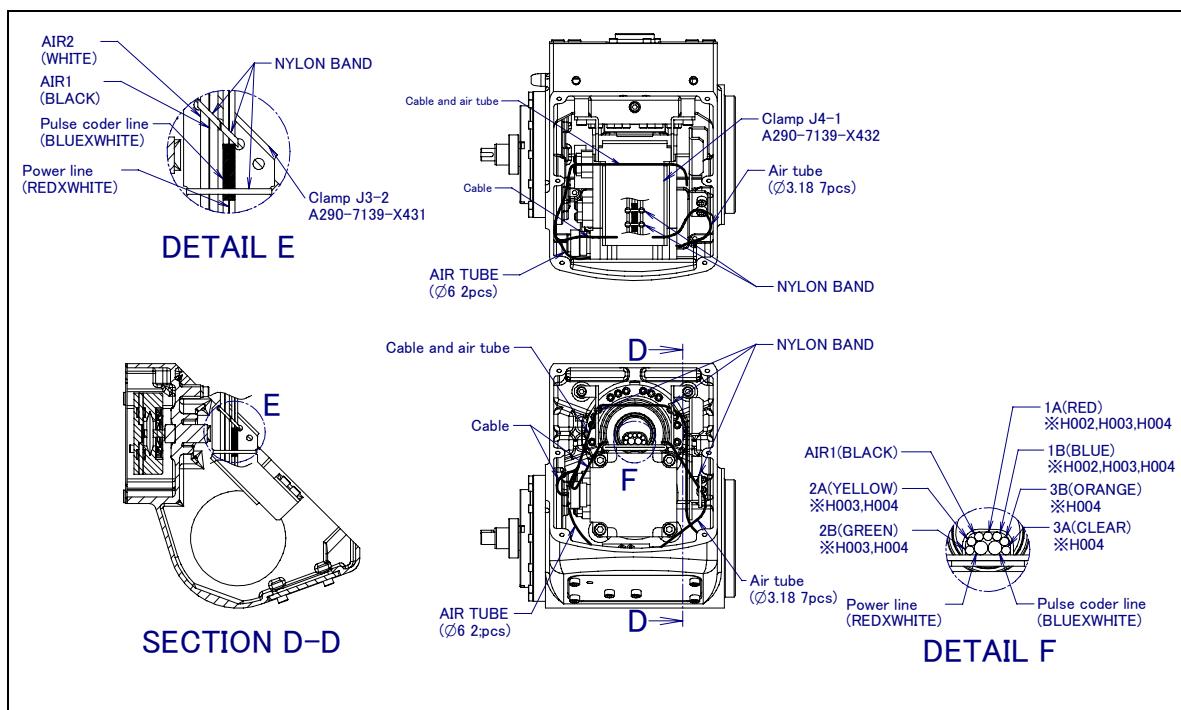


Fig.5.3.2 (d) Cable clamp in parts of J3 casing

## 5.REPLACING CABLES

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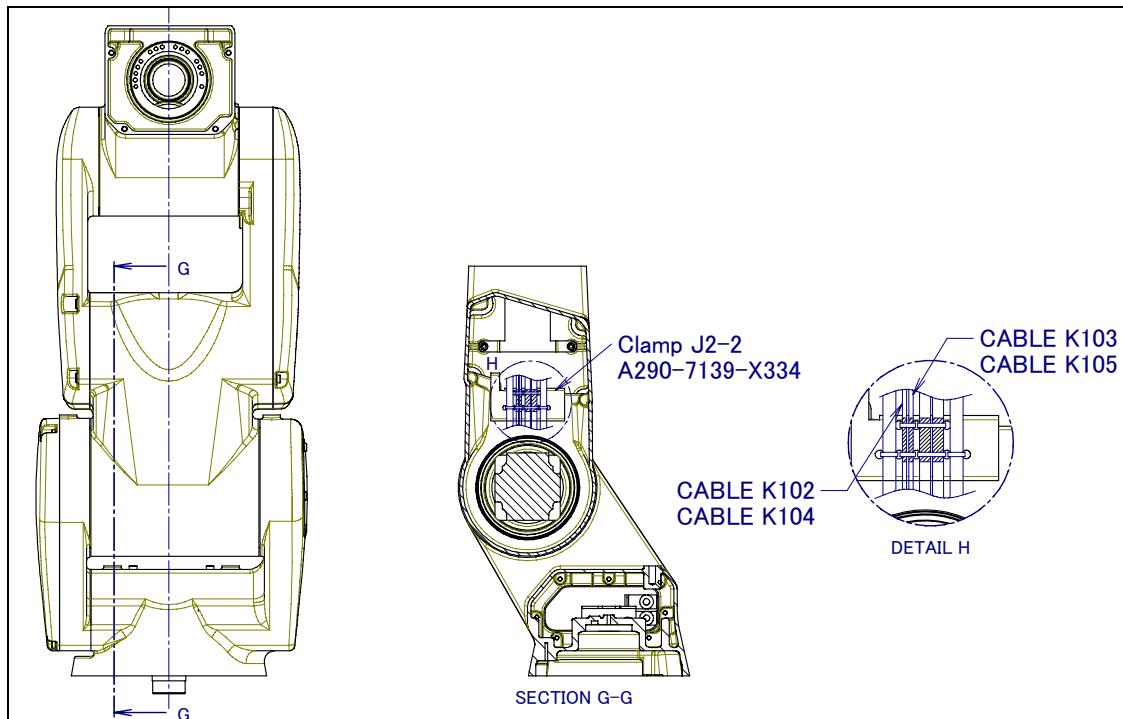


Fig.5.3.2 (e) Cable clamp in J3 casing part

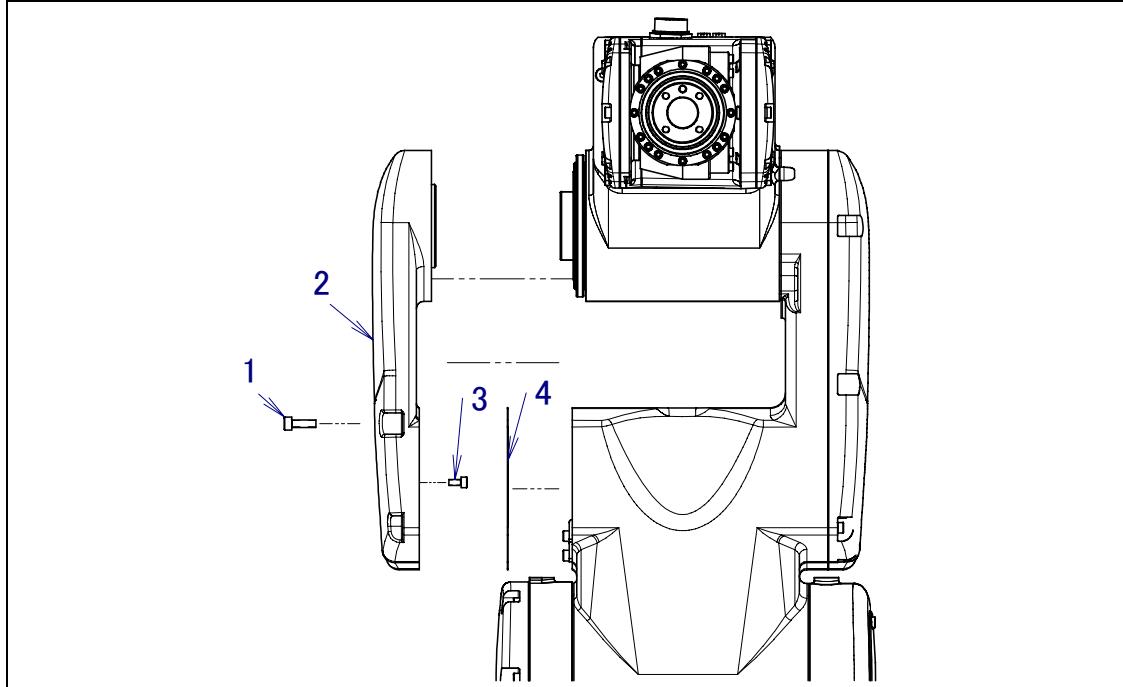


Fig.5.3.2 (f) Remove the guide arm

	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	SEAL BOLT	A97L-0218-0423#051616(*1)	4		5.6Nm(57kgfcm)
	SEAL BOLT	A97L-0218-0546#051616BC(*2)	4		5.6Nm(57kgfcm)
	SEAL BOLT	A97L-0218-0546#051616EN(*3)	4		5.6Nm(57kgfcm)
2	GUIDE ARM	A290-7139-X304(*4)	1		
		A290-7139-Y304(*5)	1		
		A290-7139-Z304(*6)	1		
3	BOLT	A6-BA-4X8	2		
4	PACKING	A290-7139-X353 (*7)	1		

- (\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.
- (\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.
- (\*3) When LR Mate 200iC/5LC,5WP,5C is specified.
- (\*4) When LR Mate 200iC, LR Mate 200iC/5L,5H is specified.
- (\*5) When LR Mate 200iC/5LC,5C is specified.
- (\*6) When LR Mate 200iC/5WP is specified.
- (\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

Table 5.3.2 Air tube

(*1)	H002,H003,H004,H005,H012,H013,H014,H017,H018,H022,H023,H032,H033 is specified
(*2)	H004,H005,H014,H015 is specified
(*3)	H003,H004,H005,H013,H014,H015,H018,H023,H024,H033 is specified

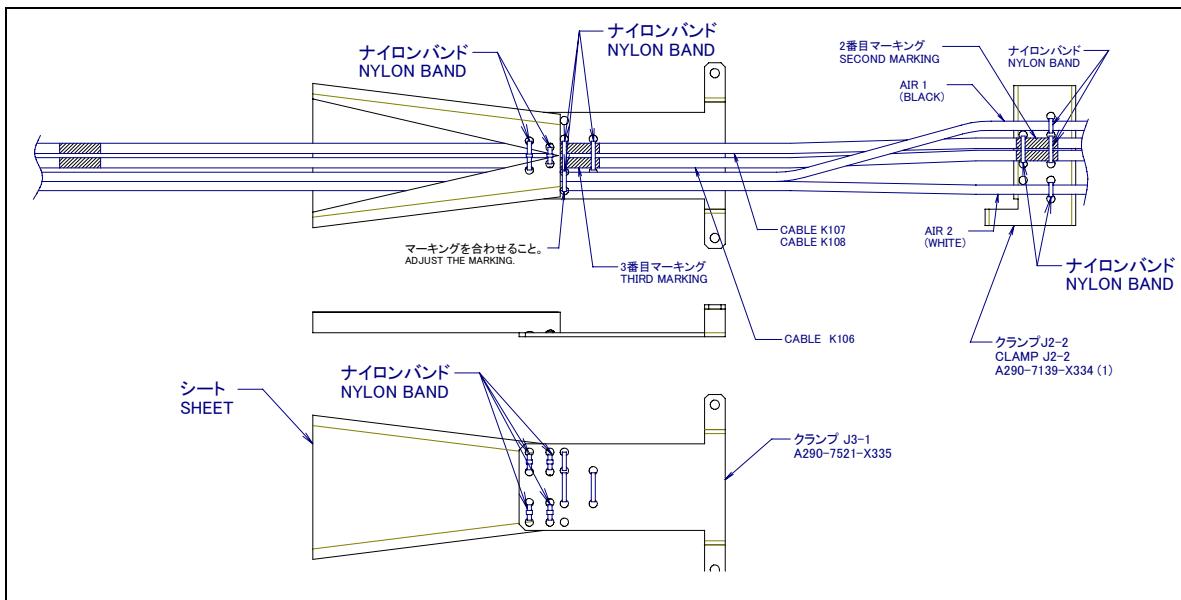


Fig.5.3.2 (g) Cable clamp inside the guide arm (LR Mate 200iC, LR Mate 200iC/5L,5WP,5H)

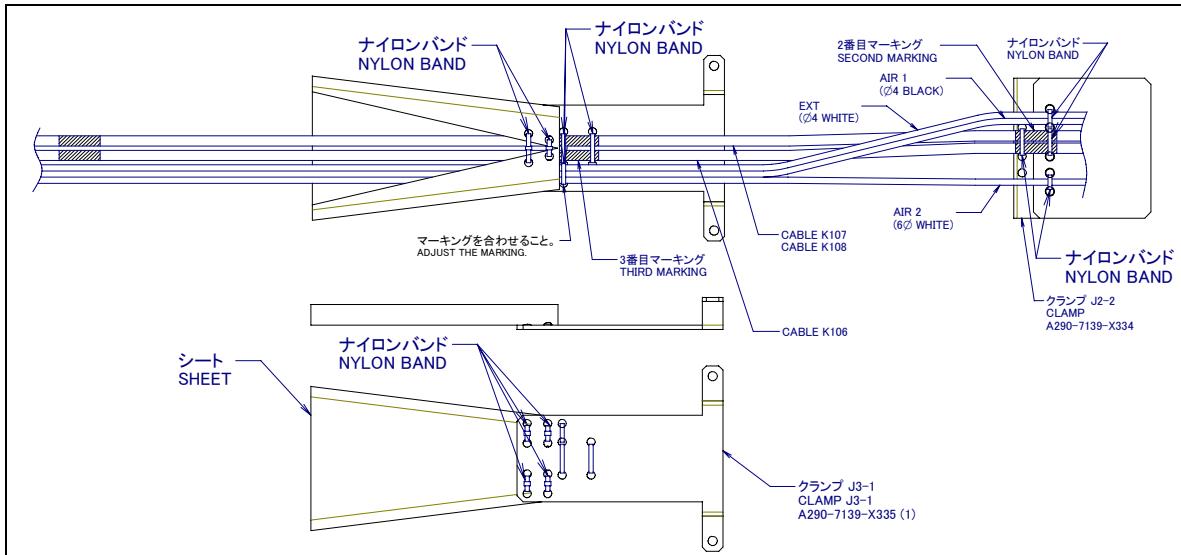


Fig.5.3.2 (h) Cable clamp inside the guide arm (LR Mate 200iC/5C,5LC)

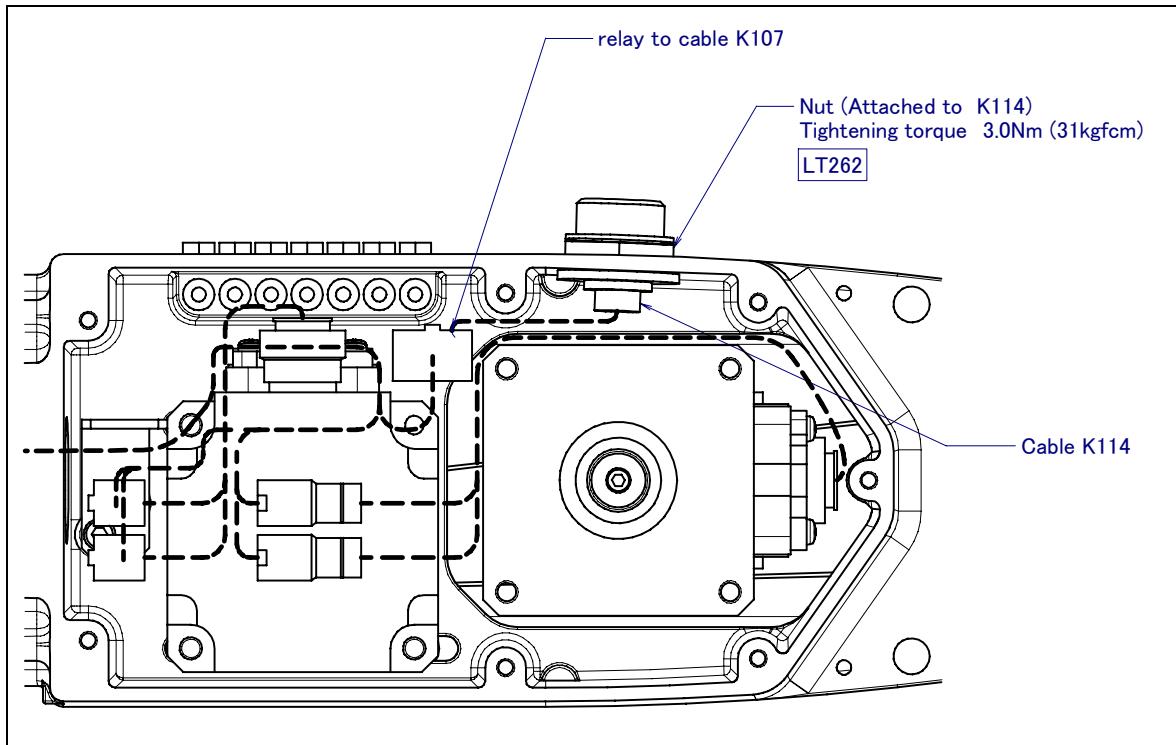
### 5.3.3 REPLAING CABLE K102, K103, K104, K105, K109, K110, K111, K112, K113

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- 1 Turn off the power of the controller.
- 2 (In case of except LR Mate 200iC/5H)  
In case of cable K102 and K103, remove J2-axis motor,  
In case of cable K104 and K105, remove J3-axis motor.  
In case of cable K109, remove J4-axis motor.  
In case of cable K110 or K111, remove J5-axis motor.  
In case of cable K112 or K113, remove J6-axis motor.  
See section 4 about replacing procedure of motor.  
(In case of LR Mate 200iC/5H)  
In case of cable K102 and K103 remove J2-axis motor,  
In case of cable K104 and K105, remove J3-axis motor.  
In case of cable K110 or K111, remove J4-axis motor.  
In case of cable K112 or K113, remove J5-axis motor.  
See section 4 about replacing procedure of motor.
- 3 Replace cable to new one and assemble it by opposite procedure.
- 4 Install motor referring to Section 4.
- 5 In case of replacing K103 or K104 or K105 or K109 or K111 or K112 or K113, perform mastering referring to section 6.2 or chapter 8 of Operator's manual.

### **5.3.4 REPLAING CABLE K104**

- 1 Turn off the power of the controller.
- 2 Remove J3 arm cover. (See Fig.5.3.2 (a))
- 3 Remove nut on J3 arm.
- 4 Remove relay of K107 and cable K114.
- 5 Replace cable to new one, and assemble it by opposite procedure.  
Spread Loctite referring to Fig.5.3.4 and tighten nut with the specified torque. When packing is attached, be sure to replace packing.



**Fig.5.3.4 Replace the cable K114**

### **5.3.5 REPLAING AIR TUBE**

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#### **Replacing procedure of air tube between connector plate to J2 base**

- 1 See section 5.3.1.

#### **Replacing procedure of air tube between J2 base to J3 casing**

- 1 See section 5.3.2.

#### **Replacing procedure of air tube between J3 casing to J3 arm**

- 1 Turn off the power of the controller.
- 2 Remove J3 arm cover. (See Fig.5.3.2 (a))
- 3 Remove air tube from panel union on J3 motor.
- 4 Cut the nylon band, which connects air tube to clamp J4-2.
- 5 Remove J3 cover. (See Fig.5.3.2(c))
- 6 Cut the nylon band, which connects air tube to clamp J4-1.
- 7 Remove the cover of solenoid valve (See Fig.5.3.5(h))
- 8 Drag air tube from the part removed by 7.
- 9 Replace air tube to new one, and install them by opposite procedure. When packing is attached , be sure to replace packing.

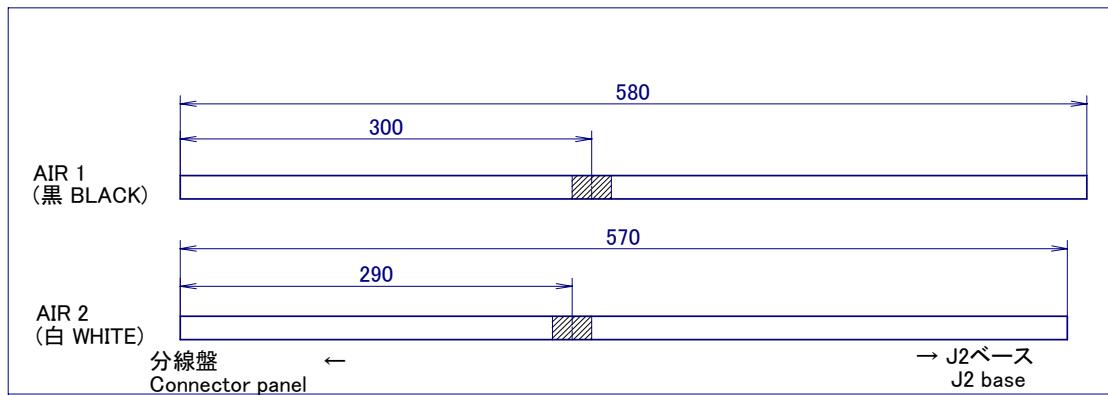


Fig.5.3.5 (a) Marking of air tube (connector plate to J2 base)( LR Mate 200iC, LR Mate 200iC/5L,5WP,5H)

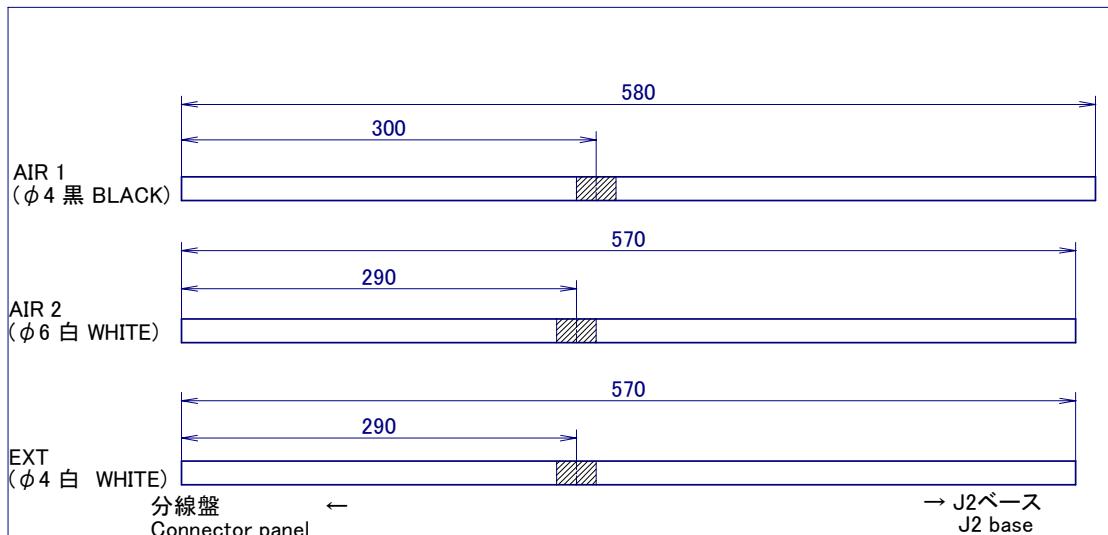


Fig.5.3.5 (b) Marking of air tube (connector plate to J2 base)(LR Mate 200iC/5C,5LC)

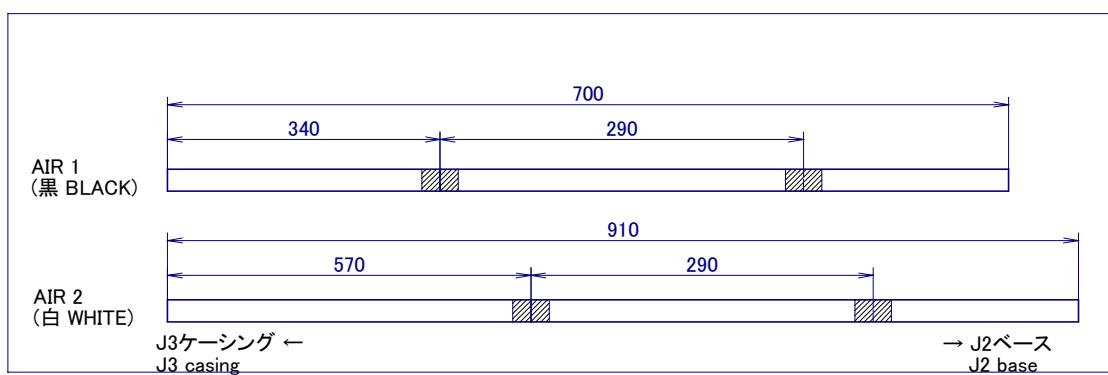


Fig.5.3.5 (c) Marking of air tube (J2 base to J3 casing) ( LR Mate 200iC, LR Mate 200iC/5WP,5H)

## 5.REPLACING CABLES

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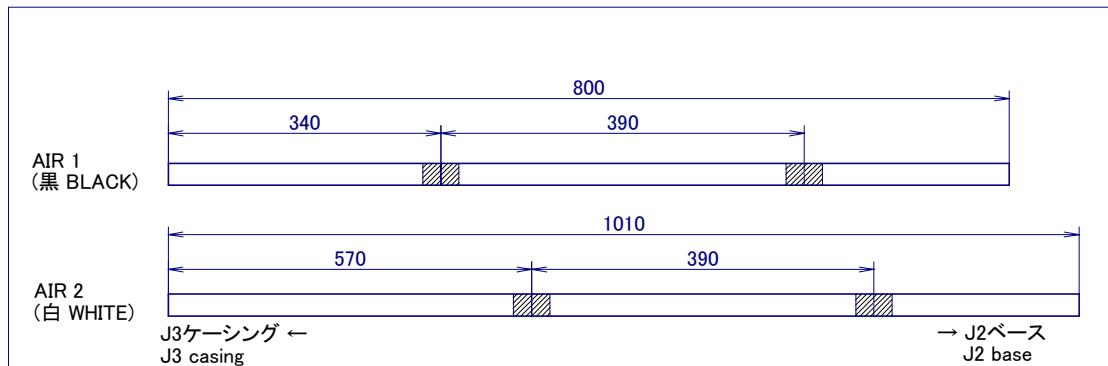


Fig.5.3.5 (d) Marking of air tube (J2 base to J3 casing) ( LR Mate 200iC/5L)

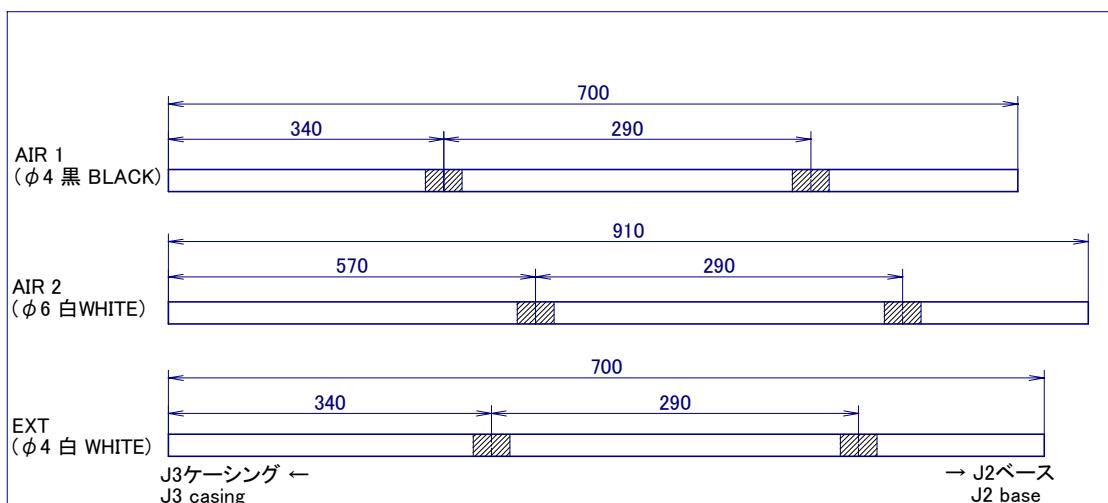


Fig.5.3.5 (e) Marking of air tube (J2 base to J3 casing) ( LR Mate 200iC/5C)

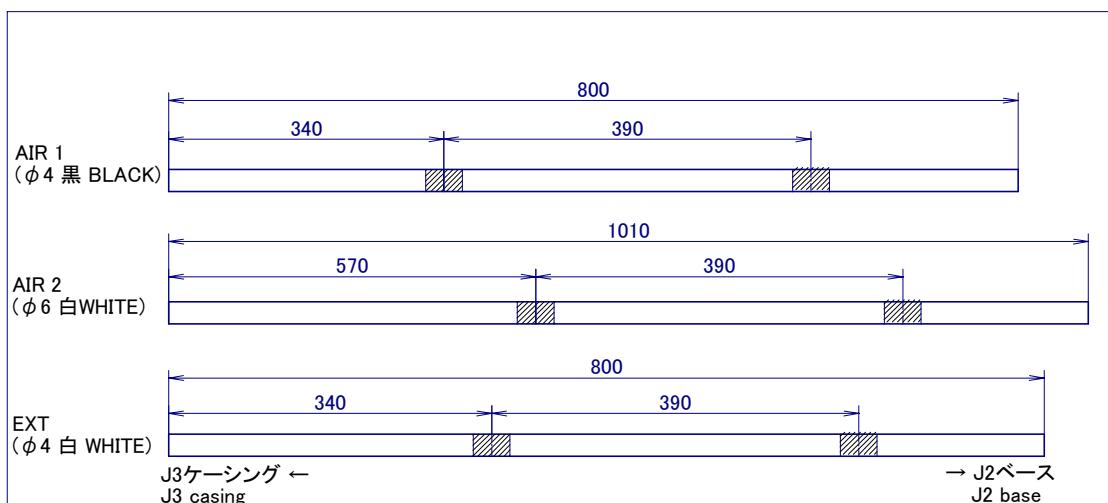


Fig.5.3.5 (f) Marking of air tube (J2 base to J3 casing) ( LR Mate 200iC/5LC)

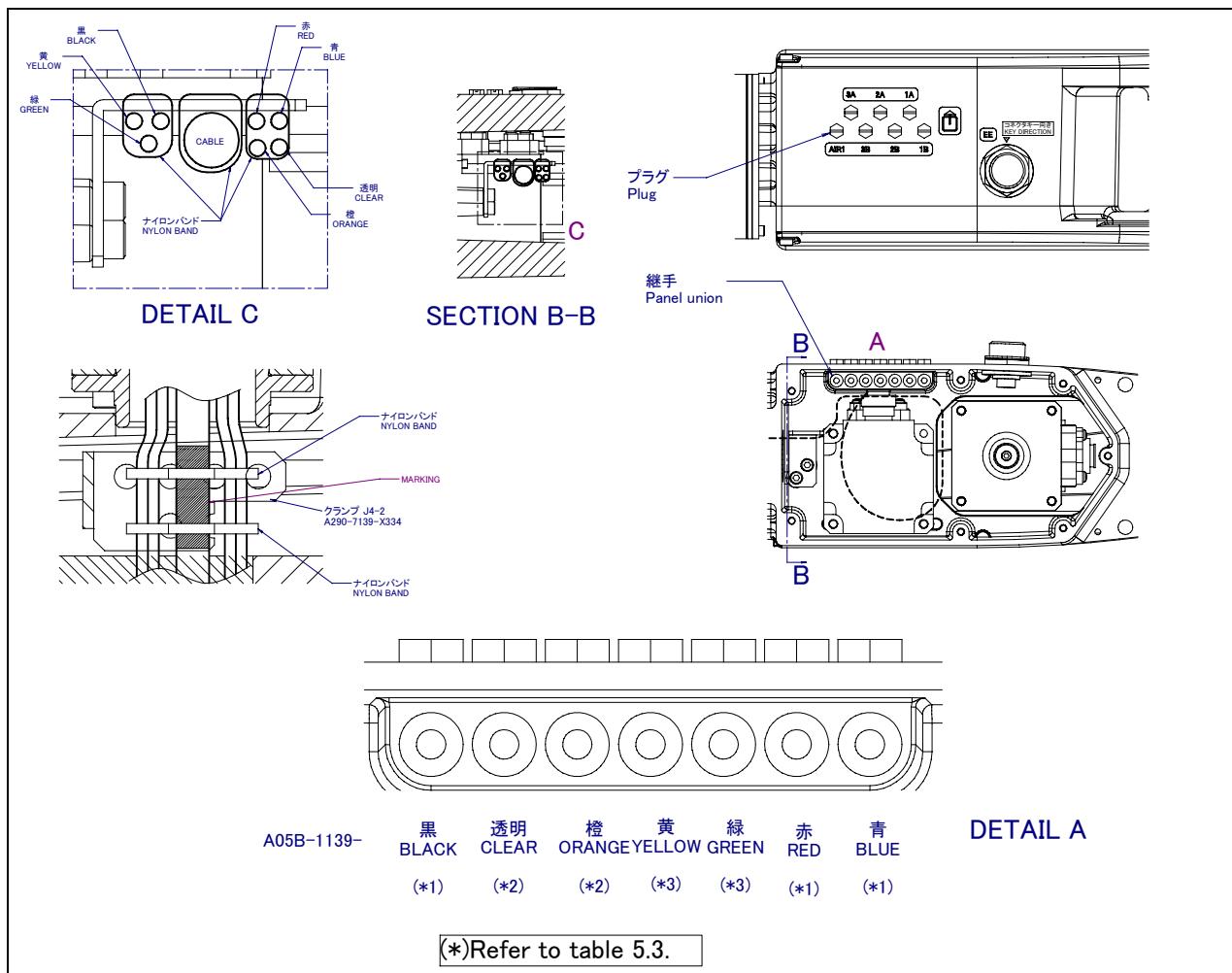


Fig.5.3.5(g) Remove the air tube in J3 arm

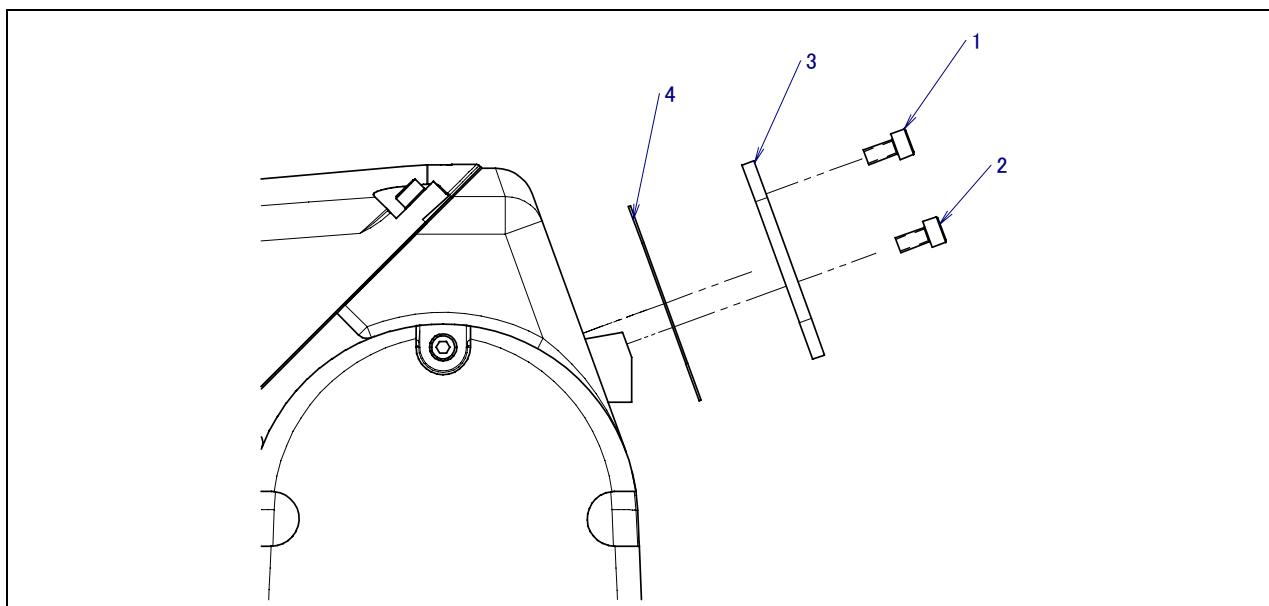


Fig.5.3.2 (h) Remove the cover of solenoid valve part

## 5.REPLACING CABLES

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	Parts name	Specifications	Number	Loctite	Torque N·m (kgf·cm)
1	BOLT	A6-BA-4X8(*1)	4		
	SEAL BOLT	A97L-0218-0546#040808BC(*2)	4		4.5Nm(46kgfcm)
	SEAL BOLT	A97L-0218-0546#040808EN(*3)	4		4.5Nm(46kgfcm)
2	BOLT	A6-BA-4X8(*1)	2		
	SEAL BOLT	A97L-0218-0546#040808BC(*2)	2		4.5Nm(46kgfcm)
	SEAL BOLT	A97L-0218-0546#040808EN(*3)	2		4.5Nm(46kgfcm)
3	SV PLATE	A290-7139-X433(*4)	1		
		A290-7139-Y433(*5)			
		A290-7139-Z433(*6)			
4	PACKING	A290-7139-X452 (*7)	1		

(\*1) When not severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*2) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H is specified.

(\*3) When LR Mate 200iC/5LC,5WP,5C is specified.

(\*4) When LR Mate 200iC,LR Mate 200iC/5L,5H is specified.

(\*5) When LR Mate 200iC/5LC,5C is specified.

(\*6) When LR Mate 200iC/5WP is specified.

(\*7) When severe dust/liquid protection specification of LR Mate 200iC, LR Mate 200iC/5L,5H or LR Mate 200iC/5LC,5WP,5C is specified.

## 5.REPLACING CABLES

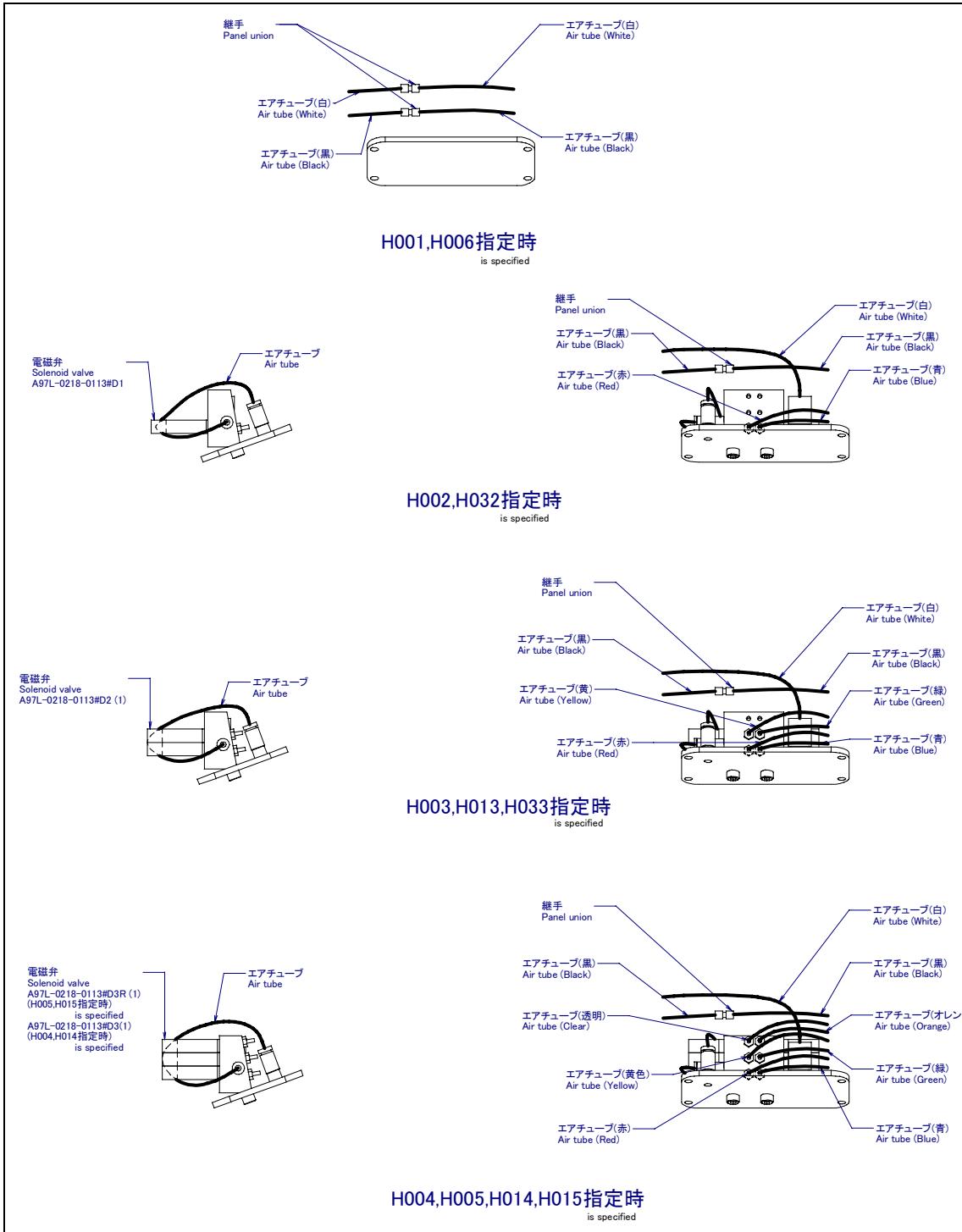


Fig.5.3.5 (i) Remove the air tube of solenoid valve part (LR Mate200iC, LR Mate200iC/5C,5WP,5H)

## 5.REPLACING CABLES

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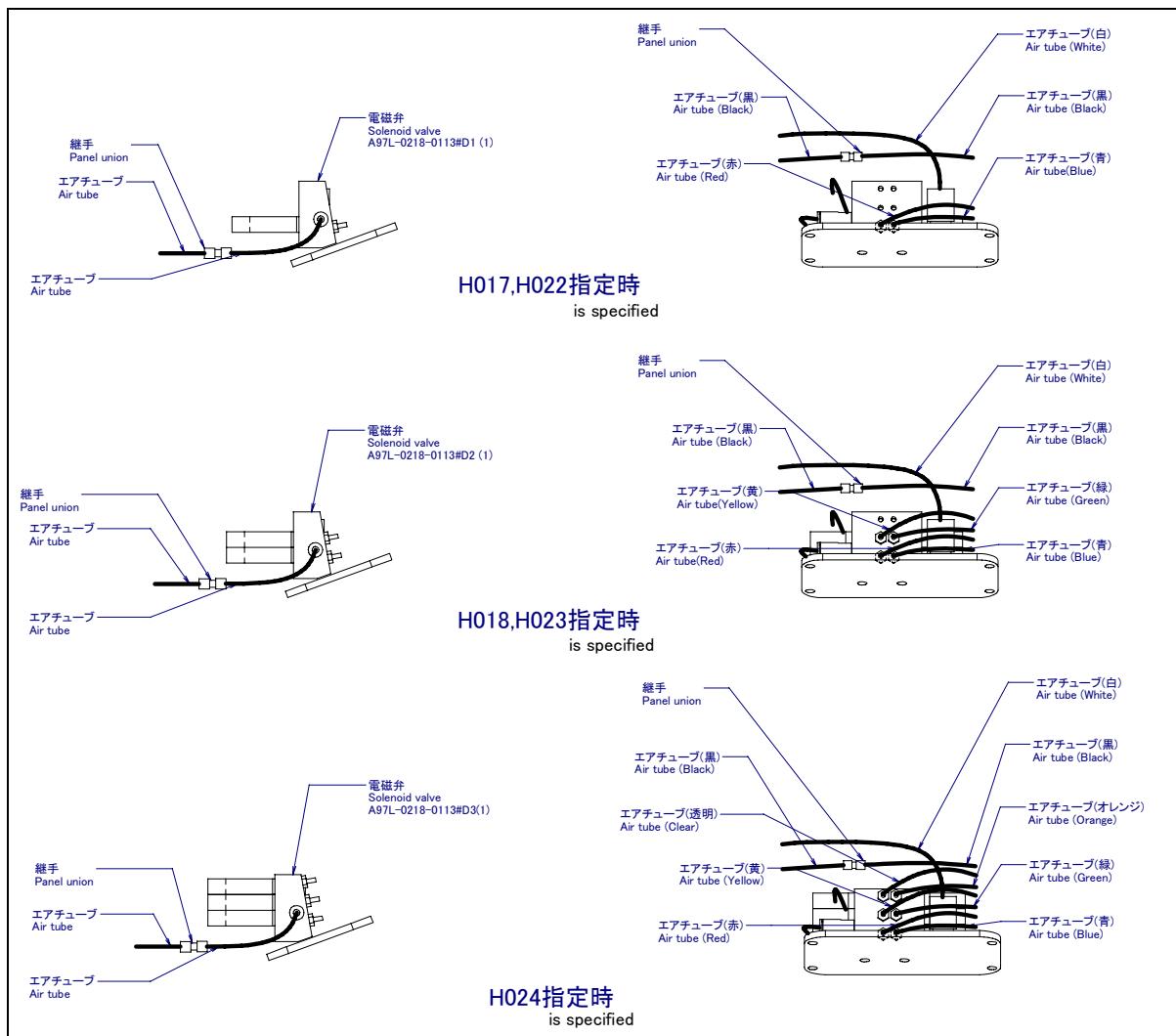


Fig.5.3.5 (j) Remove the air tube of solenoid valve part (LR Mate 200iC/5L,5LC)

# **6**

## **ADJUSTMENTS**

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Each part of the mechanical units of a robot is set to the best condition before the robot is shipped to the customer. The customer does not need to make adjustments on the robot when it is delivered.

## 6.1 ADJUSTING TENSION OF BELT

Please use the following tension meters for the tension adjustment of the belt.

Instrument	Specifications	Vendor	Manufacturer model No.	Application
Tension meter	A97L-0218-0700	Mitsubishi Belting Ltd.	DOCTOR TENSION TYPE-	Adjustment of belt tension

- 1 Move the robot posture to J2=0° and J3=0°.
- 2 Remove the bolt and arm cover (refer to Chapter 5).
- 3 When severe dust/liquid protection specification is selected, remove packing, too.
- 4 Adjust it so that it may loosen tension-adjusting bolts and the tension may reach a regulated value.
- 5 Attach arm cover. In case of severe dust/liquid protection specification, be sure to replace packing to new one. In this time, tighten the bolt with the specified torque.

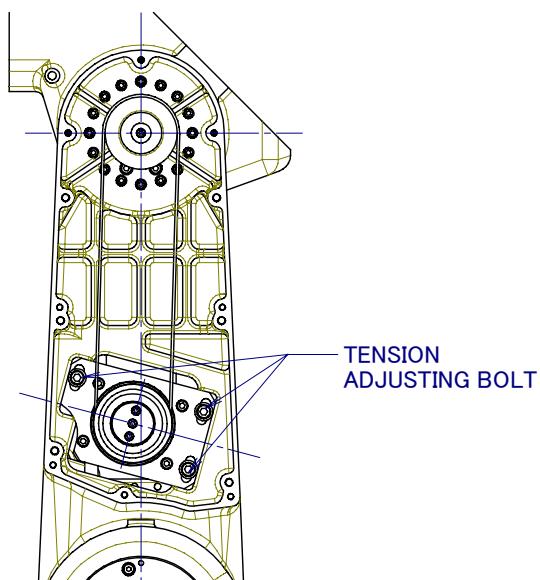


Fig. 6.1(a) Adjusting tension of J3 belt

Table. 6.1(a) Measurement condition of J3 belt

BELT TENSION	85 ± 5N
MASS	0.0367kg
WIDTH	7mm
SPAN	175mm

**⚠ NOTE**

This is example of LR Mate 200iC. In case of LR Mate 200iC/5H, please read J5/J6 as J4/J5.

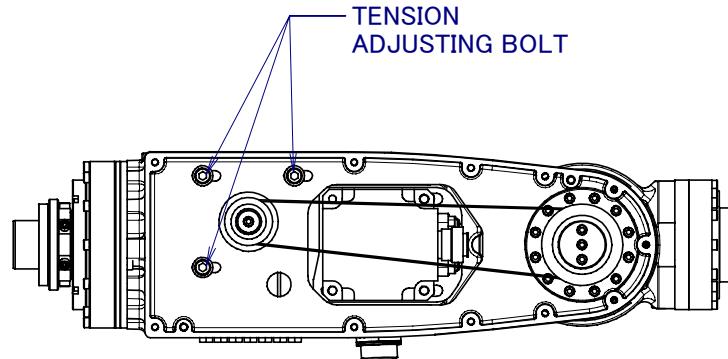


Fig. 6.1(b) Adjusting tension of J5 belt

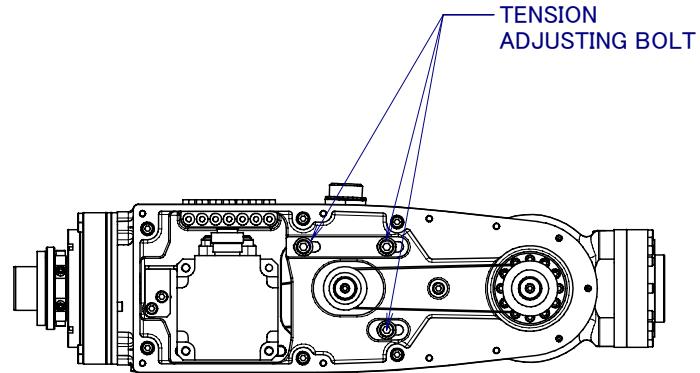


Fig. 6.1(c) Adjusting tension of J6 belt

Table 6.1(b) Measurement condition of J5 belt

BELT TENSION	$27.5 \pm 2.5\text{N}$
MASS	0.0171kg
WIDTH	6mm
SPAN	180mm

Table 6.1(c) Measurement condition of J6 belt

BELT TENSION	$27.5 \pm 2.5\text{N}$
MASS	0.0171kg
WIDTH	6mm
SPAN	110mm

## 6.2 MASTERING

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

The current position of the robot is determined according to the pulse count value supplied from the pulse coder on each axis.

Mastering is factory-performed. It is unnecessary to perform mastering in daily operations. However, mastering becomes necessary after:

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

 **NOTE**

Robot data (including mastering data) and pulse coder data are backed up by their respective backup batteries. Data will be lost if the batteries go dead. Replace the batteries in the control and mechanical units periodically. An alarm will be issued to warn the user of a low battery voltage.

### Mastering method

There are following five methods of mastering.

Fixture position mastering	This is performed using a mastering fixture before the machine is shipped from the factory.
Zero-position mastering (eye mark mastering)	This is performed with all axes set at the 0-degree position. A zero-position mark (eye mark) is attached to each robot axis. This mastering is performed with all axes aligned to their respective eye marks.
Simplified mastering	This is performed at a user-specified position. The corresponding count value is obtained from the rotation speed of the pulse coder connected to the relevant motor and the rotation angel within one rotation. Simplified mastering uses the fact that the absolute value of a rotation angel within one rotation will not be lost.
One-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.
Mastering data entry	Mastering data is entered directly.

This MAINTENANCE MANUAL describes fixture position mastering that is mainly required during replacement of parts. For other mastering methods, refer to OPERATOR'S MANUAL.

Once mastering is performed, it is necessary to carry out positioning, or calibration. Positioning is an operation in which the control unit reads the current pulse count value to sense the current position of the robot.

**⚠ NOTE**

If mastering is performed incorrectly, the robot may behave unexpectedly. This is very dangerous. Therefore, the positioning screen is designed to appear only when the \$MASTER\_ENB system variable is 1 or 2. After performing positioning, press F5 [DONE] on the positioning screen. The \$MASTER\_ENB system variable is reset to 0 automatically, thus hiding the positioning screen.

**⚠ CAUTION**

It is recommended that the current mastering data be backed up before mastering is performed.

## 6.2.1    RESETTING ALARMS AND PREPARING FOR MASTERING

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

### Alarm displayed

“Servo 062 BZAL” or “Servo 075 Pulse mismatch”

### Procedure

- 1    Display the positioning menu by following steps 1 to 6.
  - 1    Press the screen selection key.
  - 2    Press [0 NEXT] and Select [6 SYSTEM].
  - 3    Press F1 [TYPE], and select [SYSTEM Variable] from the menu.
  - 4    Place the cursor on \$MASTER\_ENB, then key in “1” and press [ENTER].
  - 5    Press F1 [TYPE], and select [Mater/Cal] from the menu.
  - 6    Select the desired mastering type from the [Master/Cal] menu.
  
- 2    To reset the “Servo 062 BZAL” alarm, follow steps 1 to 5.
  - 1    Press the screen selection key.
  - 2    Press [0 NEXT] and Select [6 SYSTEM].
  - 3    Press F1 [TYPE], and select [SYSTEM Variable] from the menu.
  - 4    Press the F3 RES\_PCA, then press F4 [TRUE].
  - 5    Switch the controller power off and on again.
  
- 3    To reset the “Servo 075 Pulse mismatch” alarm, follow steps 1 to 3.

- 1 When the controller power is switched on again, the message “Servo 075 Pulse mismatch” appears again.
- 2 Rotate the axis for which the message mentioned above has appeared through 10 degrees in either direction.
- 3 Press [FAULT RESET]. The alarm is reset.

## 6.2.2 FIXTURE POSITION MASTER

Fixture position mastering is performed using a mastering fixture. This mastering is carried out in the predetermined fixture position. Fixture position mastering is accurate because a dedicated mastering fixture is used.

When mastering the robot, arrange the robot to meet the following conditions.

- Make the robot mounting base horizontal within 1 mm.  
(Set the robot mounting face so that the levelness of the entire surface is 1 mm or less.)
- Remove the hand and other parts from the wrist.
- Set the robot in the condition protected from an external force.

### Assembling the fixture base

- 1 Assemble the fixture base as shown in Fig. 6.2.2 (a).

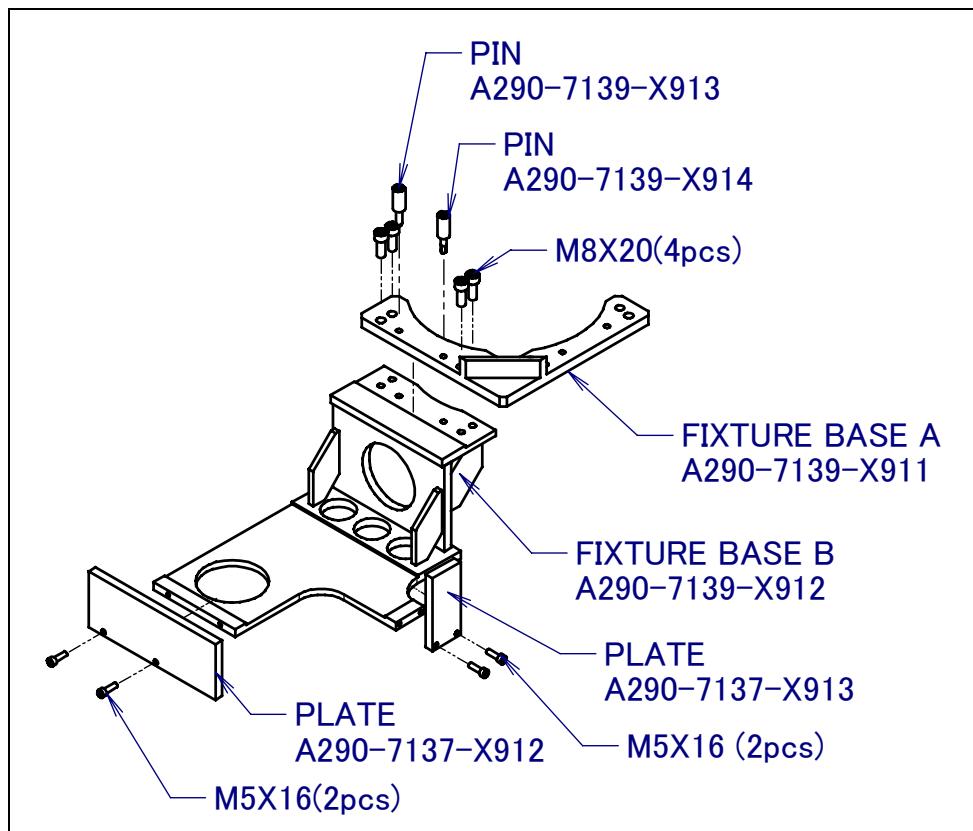


Fig. 6.2.2(a) Assembling the fixture base

- 2 Mount the fixture on the J1-axis base with bolts as shown in Fig.6.2.2 (b)

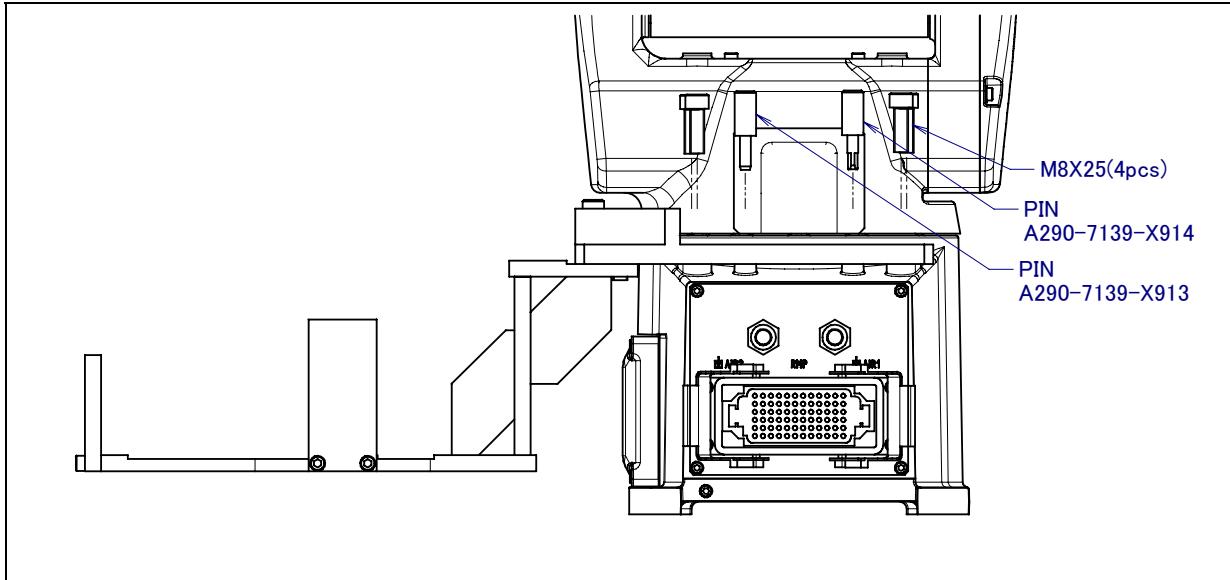


Fig. 6.2.2 (b) Mounting dial indicator

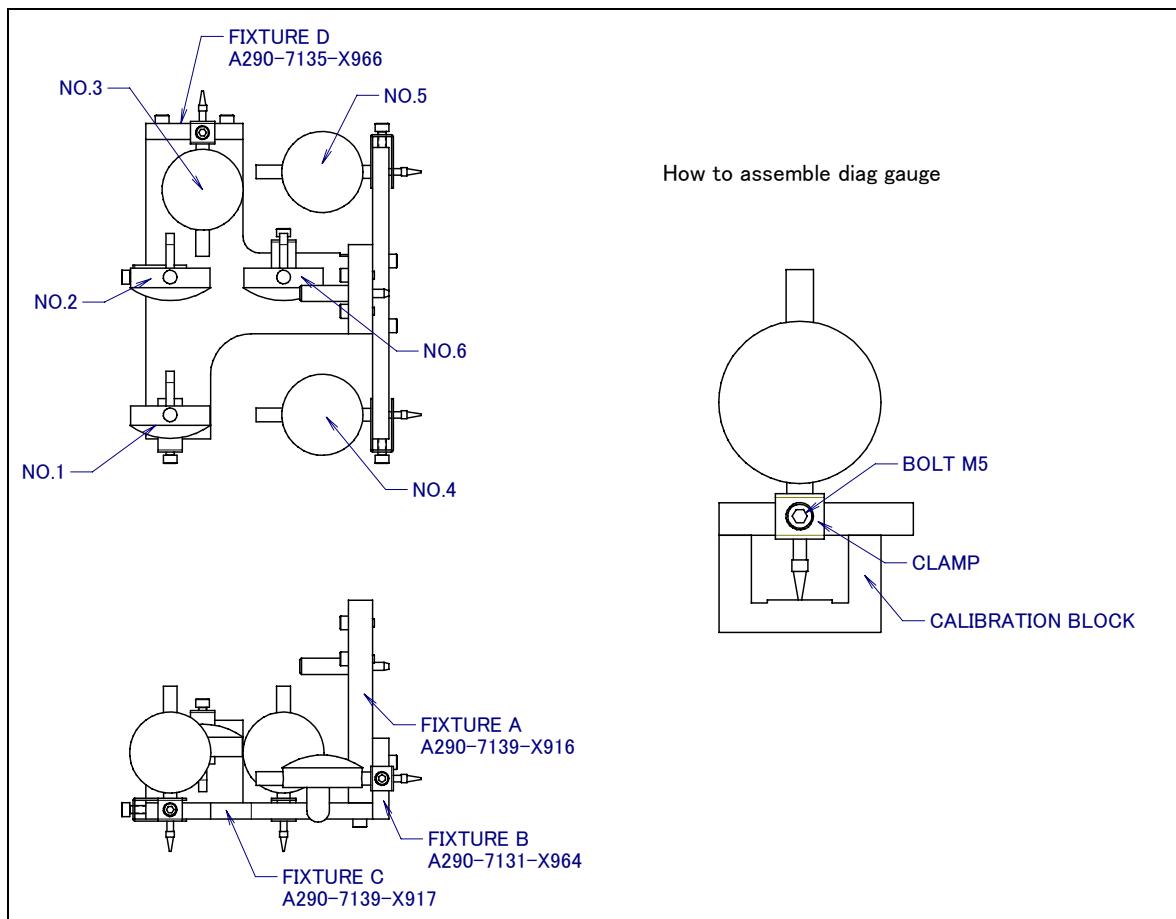
- 3 Mount the fixture to the wrist flange as shown Fig.6.2.2 (c). By using the calibration block, adjust the dial gage needle to 3.00 mm and fasten it with M-5 bolt. (In case of LR Mate 200iC/5H, the dial gage No.3 is not necessary to adjust.)

**NOTE**

The dial gage could be damaged if the bolt is fastened too tight.

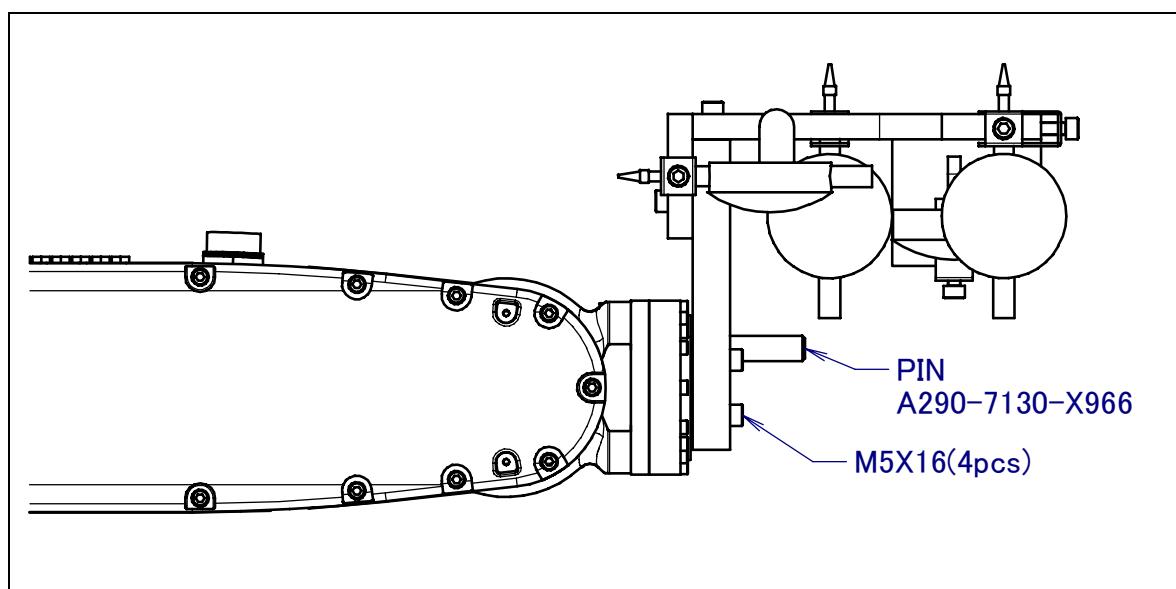
## 6.ADJUSTMENTS

B-82585EN/02



**Fig. 6.2.2 (c) Mounting the wrist fixture**

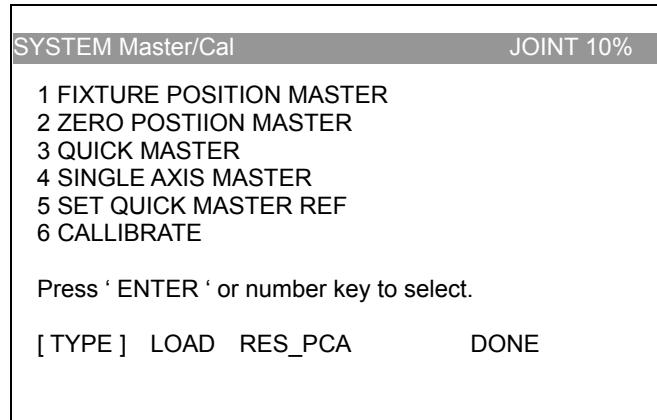
- 4 Assemble the fixture to the wrist flange as shown in Fig. 6.2.2 (d).



**Fig. 6.2.2 (d) Assembling the fixture to the wrist flange**

## Mastering

- 1 Press MENUS.
- 2 Press NEXT and select SYSTEM.
- 3 Press F1, [TYPE].
- 4 Select Mater/Cal.



- 5 Release brake control, and jog the robot into a posture for mastering.

### **⚠ NOTE**

Brake control can be released by setting the system variables as follows:

\$PARAM\_GROUP.\$SV\_OFF\_ALL: FALSE  
\$PARAM\_GROUP.\$SV\_OFF\_ENB[\*]: FALSE (for all axes)

After changing the system variables, switch the control unit power off and on again.

To prevent an error from occurring due to axis backlash at this time, ensure that the dial gage needle is adjusted to a specified position in the decreasing direction. If the needle is adjusted in the reverse direction, start all over again.

(In case of LR Mate 200iC, LR Mate 200iC/5L,5LC,5C,5WP)

- 1) Move the robot gradually so that dial gages No.1 through No. 6 shown in Fig.6.2.2 (c) touch the points indicated by arrows No. 1 through No. 6 shown in Fig.6.2.2 (e).
- 2) Move the J6 axis so that dial gages No.1 and No.2 indicate same value.
- 3) Set the corresponding value of dial gauges No.4 and No.5 and move the J1-axis and the J4-axis so that the dial gauge No.3 may show 3.00mm. When the value of dial gauge No.1 and No.2 deviates, modify it to make correspond.
- 4) Move the J2, J3, and J5 axes so that dial gages No.2, No.3 and No.4 indicate 3.00 mm.
- 5) After the operations above, check that all dial gages indicate 3.00 mm.

(In case of LR Mate 200iC/5H)

- 1) Move the robot gradually so that dial gages No.1, No.2, No.4, No.5 and No.6 shown in Fig.6.2.2 (c) touch the points indicated by arrows No.1, No.2, No.4, No.5 and No.6 shown in Fig.6.2.2 (e). (Dial gauge No.3 is not used.)
- 2) Move the J5 axis so that dial gages No.1 and No.2 indicate same value.
- 3) Move the J1 axis so that dial gages No.4 and No.5 indicate same value.
- 4) Move the J2, J3, and J4 axes so that dial gages No. 1, No.5, No.6 indicate 3.00 mm.
- 5) After the operations above, check that all dial gages indicate 3.00 mm.
- 6 Select “ 1 FIXTURE POSITION MASTER” and Press F4, YES. “MASTER POSITION” shown in Figs. 6.2.2(e) is set in this position.
- 7 Select “ 6 CALIBRATE “ and press F4, YES. Mastering will be performed. Alternatively, switch the power off and on again. Switching the power on always causes positioning to be performed.
- 8 After positioning is completed, press F5 [DONE].

**⚠WARNING**

Since the axis stroke is not checked during the mastering, be careful to stay clear of the robot motion.

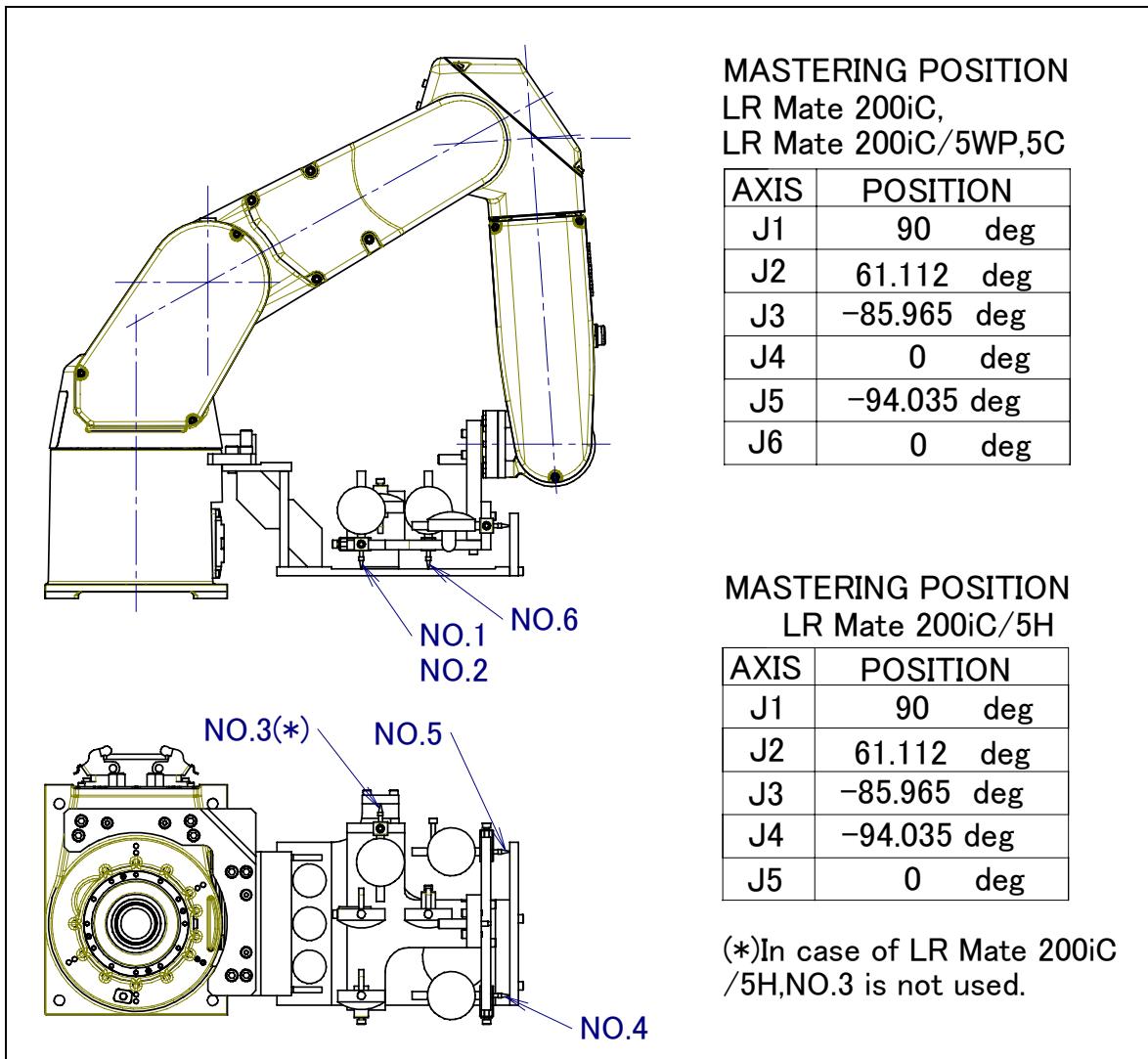


Fig. 6.2.2 (e) Mastering posture (LR Mate 200iC, LR Mate 200iC/5WP,5C)

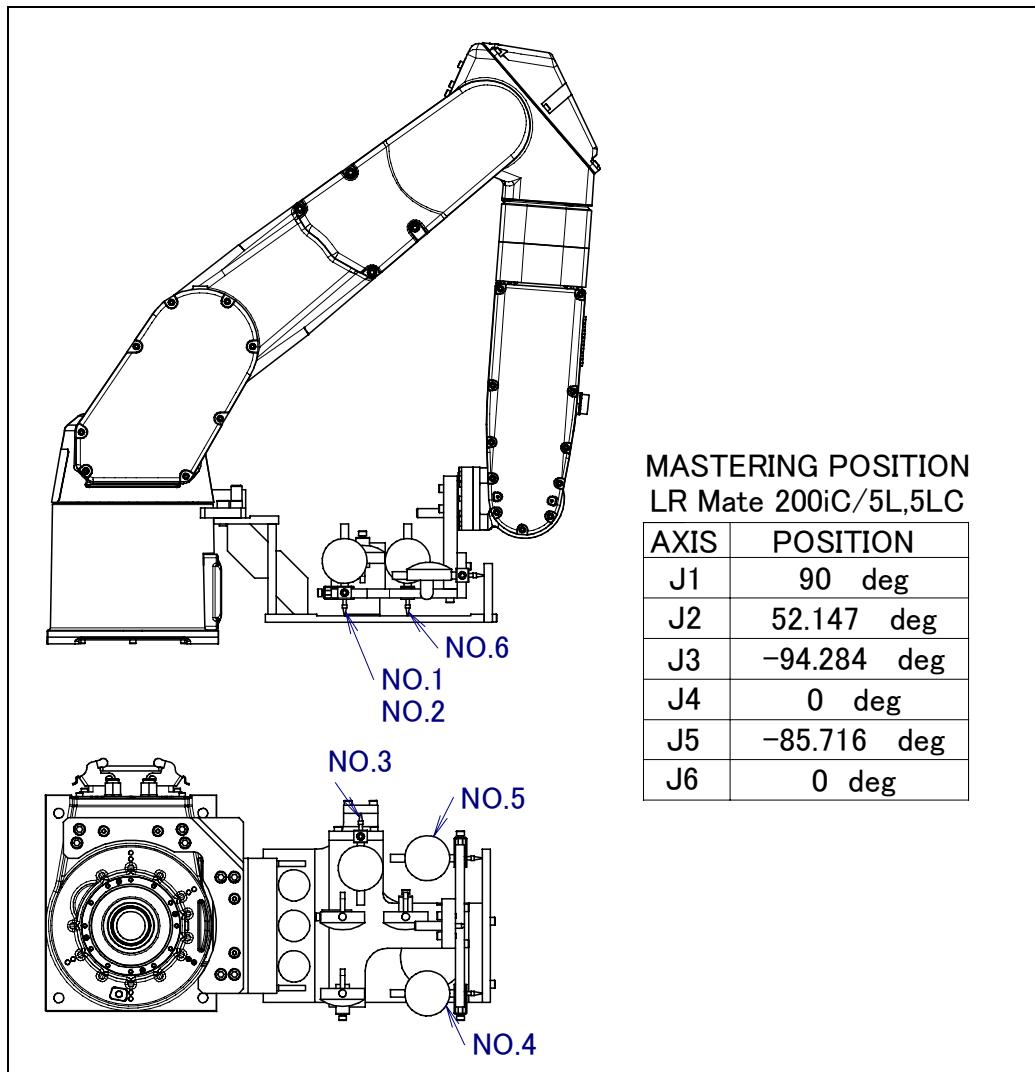


Fig. 6.2.2 (f) Mastering posture (LR Mate 200iC/5L,5LC)

# **APPENDIX**



# A

## SPARE PARTS LIST

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**Table A (a1) List of Basic cable (Specifications of Standard,5WP,5C)**

Name	Specifications	Remarks
K101	A660-8016-T285	RMP(Standard,5C)
	A660-8016-T495	RMP(5WP)
K102	A660-4004-T706	J2 power
K103	A660-2006-T657	J2 pulse coder
K104	A660-4004-T707	J3 power
K105	A660-2006-T658	J3 pulse coder
K106	A660-4004-T708	Relay of J4, J5, J6 power
K107	A660-4004-T709	J4 pulse coder
		Relay of J5, J6 pulse coder
		Relay of end effector
K108	A660-2006-T659	Relay of YV
K109	A660-2006-T660 (3-axis brake type)	J4 power
	A660-4004-T710 (6-axis brake type)	
K110	A660-2006-T661 (3-axis brake type)	J5 power
	A660-4004-T711 (6-axis brake type)	
K111	A660-2006-T662	J5 pulse coder
K112	A660-2006-T663 (3-axis brake type)	J6 power
	A660-4004-T712 (6-axis brake type)	
K113	A660-2006-T664	J6 pulse coder
K114	A660-2006-T665	End effector
K131	A660-8016-T498#L5R003	External battery cable (When external battery option is selected)

**Table A (a2) List of Basic cable (Specifications of 5L,5LC)**

Name	Specifications	Remarks
K101	A660-8016-T285	RMP
K102	A660-4004-T822	J2 power
K103	A660-2006-T789	J2 pulsecoder
K104	A660-4004-T823	J3 power
K105	A660-2006-T790	J3 pulsecoder
K106	A660-4004-T824	Relay of J4, J5, J6 power
K107	A660-4004-T825	J4 pulsecoder Relay of J5, J6 pulsecoder Relay of end effector
K108	A660-2006-T791	Relay of YV
K109	A660-2006-T710	J4 power
K110	A660-2006-T711	J5 power
K111	A660-2006-T662	J5 pulse coder
K112	A660-4004-T712	J6 power
K113	A660-2006-T664	J6 pulsecoder
K114	A660-2006-T665	End effector
K131	A660-8016-T498#L5R003	External battery cable (When external battery option is selected)

**Table A (a3) List of Basic cable (5H)**

Name	Specifications	Remarks
K101	A660-8016-T285	RMP
K102	A660-4004-T706	J2 power
K103	A660-2006-T657	J2 pulse coder
K104	A660-4004-T707	J3 power
K105	A660-2006-T658	J3 pulse coder
K106	A660-4004-T810	Relay of J4, J5 power
K107	A660-4004-T811	Relay of J4, J5 pulse coder Relay of end effector
K108	A660-2006-T659	Relay of YV
K110	A660-2006-T771 (3-axis brake type) A660-4004-T812 (5-axis brake type)	J4 power
K111	A660-2006-T772	J4 pulse coder
K112	A660-2006-T773 (3-axis brake type) A660-4004-T813 (5-axis brake type)	J5 power
K113	A660-2006-T774	J5 pulse coder
K114	A660-2006-T665	End effector
K131	A660-8016-T498#L5R003	External battery cable (When external battery option is selected)

**Table A (b1) Motor (Standard, 5L,5LC,5WP,5C)**

Name	Specifications	Remarks
βiSR1/6000	A06B-0116-B855#0048	J1, J2-axis
βiSR0.5/6000	A06B-0115-B855#0048	J3-axis
βiSR0.4/4000	A06B-0114-B205#0048	J4-axis (3-axis brake type)
βiSR0.4/4000	A06B-0114-B855#0048	J4-axis(6-axis brake type)
βiSR0.2/4000	A06B-0117-B205#0049	J5,J6-axis(3-axis brake type)
βiSR0.2/4000	A06B-0117-B855#0049	J5,J6-axis(6-axis brake type)

(\*) When J2-axis motor is replaced , please order shaft "A290-7139-X322" at the same time.

**Table A (b2) Motor (5H)**

Name	Specifications	Remarks
βiSR1/6000	A06B-0116-B855#0048	J1,J2-axis
βiSR0.5/6000	A06B-0115-B855#0048	J3-axis
βiSR0.2/4000	A06B-0117-B205#0049	J4,J5-axis(3-axis brake type)
βiSR0.2/4000	A06B-0117-B855#0049	J4,J5-axis(6-axis brake type)

(\*) When J2-axis motor is replaced , please order shaft "A290-7139-X322" at the same time.

**Table A (c) Reducer**

Name	Specifications	Remarks
Harmonic drive	A97L-0218-0812#80	J1-axis(Standard.5L,5H)
Harmonic drive	A97L-0218-0812#80C	J1-axis(5C,5LC,5WP)
Harmonic drive	A97L-0218-0813#120	J1-axis(Standard.5L,5H)
Harmonic drive	A97L-0218-0813#120C	J2-axis(5C,5LC,5WP)
Harmonic drive	A97L-0218-0814#100	J3-axis(Standard.5L,5H)
Harmonic drive	A97L-0218-0814#100C	J3-axis(5C,5LC,5WP)
Harmonic drive	A97L-0218-0815#80	J4-axis(Standard,5L)
Harmonic drive	A97L-0218-0815#80C	J4-axis(5C,5LC,5WP)
Harmonic drive	A97L-0218-0816#50	J5-axis(Standard.5L), J4-axis(5H)
Harmonic drive	A97L-0218-0816#50C	J5-axis(5C,5LC,5WP)
Harmonic drive	A97L-0218-0817#50	J6-axis(Standard.5L), J5-axis(5H)
Harmonic drive	A97L-0218-0817#50C	J6-axis(5C,5LC,5WP)

**NOTE**

When arranging in the reducer machine unit, the waving generator is built into the main body of the reducer machine beforehand as for J4-axis of Standard,5L,5LC,5WP or 5C reducer. As for other reducers, the waving generator is separated from the main body of the reducer machine.

**Table A (d) Gear**

Name	Specifications	Remarks
GEAR J1-1	A290-7139-X211	J1-axis(Standard,5WP,5C,5H)
	A290-7139-X213	J1-axis(5L,5LC)
GEAR J1-2	A290-7139-X212	J1-axis
GEAR J4-1	A290-7139-X411	J4-axis(Standard,5L,5LC,5WP,5C)
GEAR J4-2	A290-7139-X412	J4-axis(Standard,5L,5LC,5WP,5C)

**Table A (e) Pulley, shaft, key**

Name	Specifications	Remarks
Pulley	A290-7139-X311	J3-axis
Pulley	A290-7139-X312	J3-axis
Pulley	A290-7139-X414	J5-axis(Standard,5L,5LC,5WP,5C) J4-axis(5H)
Pulley	A290-7139-X415	J6-axis(Standard,5L,5LC,5WP,5C) J5-axis(5H)
Motor pulley	A290-7139-X413	J5,J6-axis(Standard,5L,5LC,5WP,5C) J4,J5-axis(5H)
Shaft	A290-7139-X322	J2-axis
Key	JB-HKY-3X3X12B	Motor, pulley, gear
Key	JB-HKY-3X3X6B	Motor, pulley, gear

**Table A (f) Bearing, belt**

Name	Specifications	Remarks
Bearing	A97L-0001-0192#08Z000A	J1-axis reducer
Bearing	A97L-0218-0596	J4-axis reducer(Standard.5L,5LC,5WP,5C)
Belt	A98L-0040-0190#007-098	J3-axis motor
Belt	A98L-0040-0227#006-100	J5-axis motor (Standard.5L,5LC,5WP,5C) J4-axis motor (5H)
Belt	A98L-0040-0227#006-152	J6-axis motor (Standard.5L,5LC,5WP,5C) J5-axis motor (5H)

**Table A (g) Packing(When severe dust/liquid protection specification of standard,5L,5H or 5WP,5C,5LC is specified)**

Name	Specifications	Remarks
Packing	A290-7139-X251	Connector plate
Packing	A290-7139-X252	Cover B
Packing	A290-7139-X253	Battery box
Packing (*)	A290-7139-X351	Cover S
Packing	A290-7139-X352	Support
Packing	A290-7139-X353	Guide arm
Packing	A290-7139-X354	J2 base cover
Packing	A290-7139-X355	J2 arm over
Packing	A290-7139-X356	Cover U
Packing	A290-7139-X451	J3 base cover
Packing	A290-7139-X452	SV plate
Packing	A290-7139-X453	J3 arm
Packing	A290-7139-X454	J3 arm cover (2pcs/1 machines)

(\*) This packing is attached when non-severe dust/liquid protection specification of Standard,5L,5H

**Table A (h) Oil seal, O-RING**

Name	Specifications	Remarks
Oil seal	A98L-0040-0223#01001805	J1, J4-axis motor (Standard,5L,5LC5WP,5C) J1-axis motor (5H)
Oil seal	A98L-0040-0049#02603707	J4-axis reducer (Standard,5L,5LC5WP,5C)
Oil seal	A98L-0040-0223#01001805	J5-axis reducer (Standard,5L,5LC5WP,5C) J4-axis reducer (5H)
O-RING	A98L-0001-0347#S46	J1, J4-axis motor (Standard,5L,5LC5WP,5C) J1-axis motor (5H)
O-RING	A98L-0001-0347#S35	J1-axis reducer
O-RING	JB-OR1A-G45	J2-axis motor

**Table A (i) Seal bolt**

Name	Specifications	Remarks
Seal bolt	A97L-0218-0423#030606	J 1, J3, J4, J5, J6-axis motor J2, J3, J5-axis reducer Wrist unit, J4 pipe
		J 1, J3, J4, J5-axis motor J2, J3, J4-axis reducer Wrist unit
Seal bolt	A97L-0218-0423#031616	J2-axis motor
Seal bolt	A97L-0218-0423#051212	J2-axis motor
Seal bolt	A97L-0218-0546#043016BC	J1-axis reducer(Standard,5L,5H Severe dust/liquid protection specification)
	A97L-0218-0546#043016EN	J1-axis reducer (5C,5LC,5WP)
Seal bolt	A97L-0218-0546#043516BC	J2-axis reducer(Standard,5L,5H Severe dust/liquid protection specification)
	A97L-0218-0546#043516EN	J2-axis reducer (5C,5LC,5WP)
Seal bolt	A97L-0218-0546#032504BC	J3-axis reducer(Standard,5L,5H Severe dust/liquid protection specification)
	A97L-0218-0546#032504EN	J3-axis reducer (5C,5LC,5WP)
Seal bolt	A97L-0218-0423#030505	GEAR J1-2, GEAR J4-2 (Standard,,5L,5LC,5WP,5C) GEAR J1-2 (Specifications of 5H)
Seal bolt	A97L-0218-0423#040808	J1 pipe
Seal bolt	A97L-0218-0423#041212	Support
Seal bolt	A97L-0218-0595#040808BC	Cover S(Standard,5L,5H)
	A97L-0218-0595#040808EN	Cover S (5C,5LC,5WP)
Seal bolt	A97L-0218-0738#040808BC	Cover S Standard,5L,5H)
	A97L-0218-0738#040808EN	Cover S (5C,5LC,5WP)
Seal bolt	A97L-0218-0423#051616	Guide arm
Seal bolt	A97L-0218-0546#051616BC	Guide arm(Standard,5L,5H Severe dust/liquid protection specification)
	A97L-0218-0546#051616EN	Guide arm(5C,5LC,5WP)
Seal bolt	A97L-0218-0423#041616	J3 arm cover
Seal bolt	A97L-0218-0546#040808BC	Cover U Standard,5L,5H Severe dust/liquid protection specification)
	A97L-0218-0546#040808EN	Cover U (5C,5LC,5WP)
Seal bolt	A97L-0218-0417#060606	J1 grease outlet
Seal bolt	A97L-0218-0417#040505	J3, J4, J5, J6 grease inlet (Standard,5L,5LC,5WP,5C) J3, J4, J5 grease inlet (5H) J3 grease outlet

**Table A (j) Spring pin, Stopper, Wrist unit, Sheet**

Name	Specifications	Remarks
Spring pin	A6-PS-5X18S	J3 Stopper
Stopper	A290-7139-X441	J3Stopper
Wrist unit	A290-7139-V501	J6-axis reducer is included (Standard,5L not severe dust/liquid protection specification) J5-axis reducer is included (5H not severe dust/liquid protection specification )
	A290-7139-V502	J6-axis reducer is included (Standard,5L severe dust/liquid protection specification) J5-axis reducer is included (5H severe dust/liquid protection specification )
	A290-7139-V521	J6-axis reducer is included (5C,5LC)
	A290-7139-V531	J6-axis reducer is included (5WP)
Sheet	A290-7139-X345	J2-axis motor(Standard,5WP,5C,5H)
	A290-7139-X349	J2-axis motor(5L,5LC)

**Table A (k) Air tube (Standard,5WP,5C,5H)**

Name	Specifications	Remarks
Air tube	A97L-0218-0114#ABL640R0	6mm BLACK AIR1 Connector plate to J2base
Air tube	A97L-0218-0010#AAL580R0	4mm BLACK AIR1 (5C) Connector plate to J2base
Air tube	A97L-0218-0114#BBL570R0	6mm WHITE AIR2 Connector plate to J2base
Air tube	A97L-0218-0010#BAL570R0	4mm WHITE EXT(5C) Connector plate to J2base
Air tube	A97L-0218-0114#ABL700R0	6mm BLACK AIR1 J2 base to J3 casing
Air tube	A97L-0218-0010#AAL700R0	4mm BLACK AIR1 (5C) J2 base to J3 casing
Air tube	A97L-0218-0114#BBL910R0	6mm WHITE AIR2 J2 base to J3 casing
Air tube	A97L-0218-0010#BAL700R0	4mm WHITE EXT(5C) J2 base to J3 casing
Air tube (H002,H003,H004,H005,H022, H023,H024,H032, H033 )	A97L-0218-0010#BAL150R0	4mm WHITE EXHAUST J3 casing
Air tube (H002,H003,H004,H005,H022, H023,H024,H032, H033 )	A97L-0218-0010#AFL855R0	3.18mm BLACK AIR1 J3 casing to J3 arm
Air tube (H002,H003,H004,H005,H022, H023,H024,H032,H033 )	A97L-0218-0010#CFL745R0	3.18mm RED A1 J3 casing to J3 arm
Air tube (H002,H003,H004,H005,H022, H023,H024,H032,H033 )	A97L-0218-0010#DFL745R0	3.18mm BLUE B1 J3 casing to J3 arm
Air tube (H003,H004,H005,H023,H024, H033 )	A97L-0218-0010#EFL745R0	3.18mm YELLOW A2 J3 casing to J3 arm
Air tube (H003,H004,H005,H023,H024, H033 )	A97L-0218-0010#FFL745R0	3.18mm GREEN B2 J3 casing to J3 arm
Air tube (H004,H005,H024 )	A97L-0218-0010#GFL745R0	3.18mm CLEAR A3 J3 casing to J3 arm
Air tube (H004,H005,H024 )	A97L-0218-0010#HFL745R0	3.18mm ORANGE B3 J3 casing to J3 arm

**Table A (k2) Air tube(5L,5LC)**

Name	Specifications	Remarks
Air tube	A97L-0218-0114#ABL580R0	6mm BLACK AIR1(5L) Connector plate ~ J2 base
Air tube	A97L-0218-0010#AAL580R0	4mm BLACK AIR1 (5C) Connector plate ~ J2 base
Air tube	A97L-0218-0114#BBL570R0	6mm WHITE AIR2 Connector plate ~ J2 base
Air tube	A97L-0218-0010#BAL570R0	4mm WHITE EXT(5C) Connector plate ~ J2 base
Air tube	A97L-0218-0114#ABL800R0	6mm BLACK AIR1(5L) J2 base ~ J3 casing
Air tube	A97L-0218-0010#AAL800R0	4mm BLACK AIR1(5C) J2 base ~ J3 casing
Air tube	A97L-0218-0114#BBL1R013	6mm WHITE AIR2 J2 base ~ J3 casing
Air tube	A97L-0218-0010#BAL800R0	4mm WHITE EXT(5C) J2 base ~ J3 casing
Air tube	A97L-0218-0010#BAL150R0	4mm WHITE EXHAUST J3 casing
Air tube ( H012,H013,H014,H015, H017,H018 )	A97L-0218-0010#AFL945R0	3.18mm BLACK AIR1 J3 casing to J3 arm
Air tube ( H012,H013,H014,H015, H017,H018 )	A97L-0218-0010#CFL835R0	3.18mm RED A1 J3 casing to J3 arm
Air tube ( H012,H013,H014,H015, H017,H018 )	A97L-0218-0010#DFL835R0	3.18mm BLUE B1 J3 casing to J3 arm
Air tube ( H013,H014,H015,H018 )	A97L-0218-0010#EFL835R0	3.18mm YELLOW A2 J3 casing to J3 arm
Air tube ( H013,H014,H015,H018 )	A97L-0218-0010#FFL835R0	3.18mm GREEN B2 J3 casing to J3 arm
Air tube ( H014,H015 )	A97L-0218-0010#GFL835R0	3.18mm CLEAR A3 J3 casing to J3 arm
Air tube ( H014,H015 )	A97L-0218-0010#HFL835R0	3.18mm ORANGE B3 J3 casing to J3 arm

**Table A (l) Solenoid valve (Either the following is installed by the option specification) (except H001,H006,H011 and H016)**

Name	Specifications	Remarks
Solenoid valve	A97L-0218-0113#D1	Double solenoidX1(2 positionX1)
Solenoid valve	A97L-0218-0113#D2	Double solenoidX2(2 positionX2)
Solenoid valve	A97L-0218-0113#D3	Double solenoidX3(2 positionX3)
Solenoid valve	A97L-0218-0113#D3R	Double solenoidX3 (2 positonX2, 3 positionX1)

**Table A (m) Battery**

Name	Specifications	Remarks
Battery	A98L-0031-0027	C battery/1.5V (When battery built-in option is selected)
Battery	A98L-0031-0005	D battery/1.5V (When external battery option is selected)

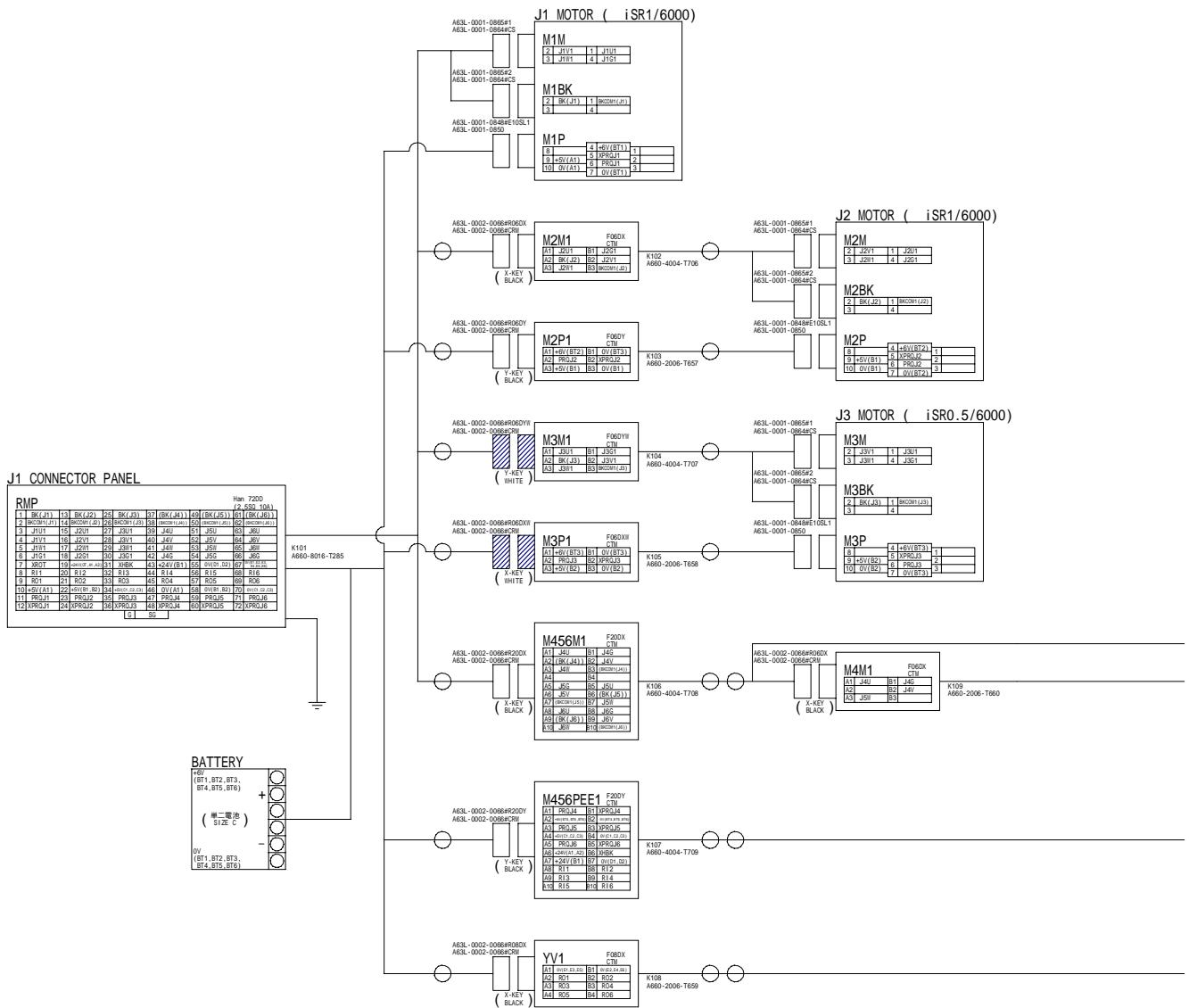
**Table A (n) Grease**

Name	Specifications	Remarks
Grease	A98L-0040-0230#2KG	Harmonic grease 4BNo.2

# B

## CIRCUIT DIAGRAM, AIR PRESSURE DIAGRM

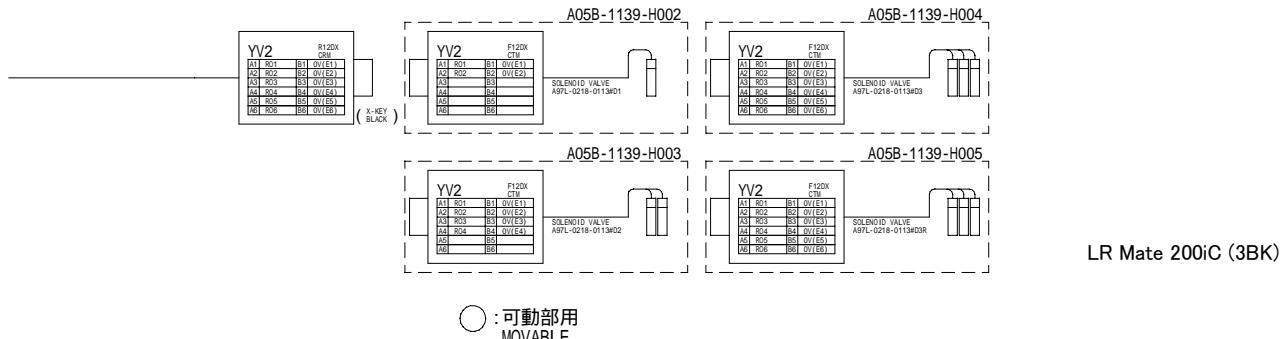
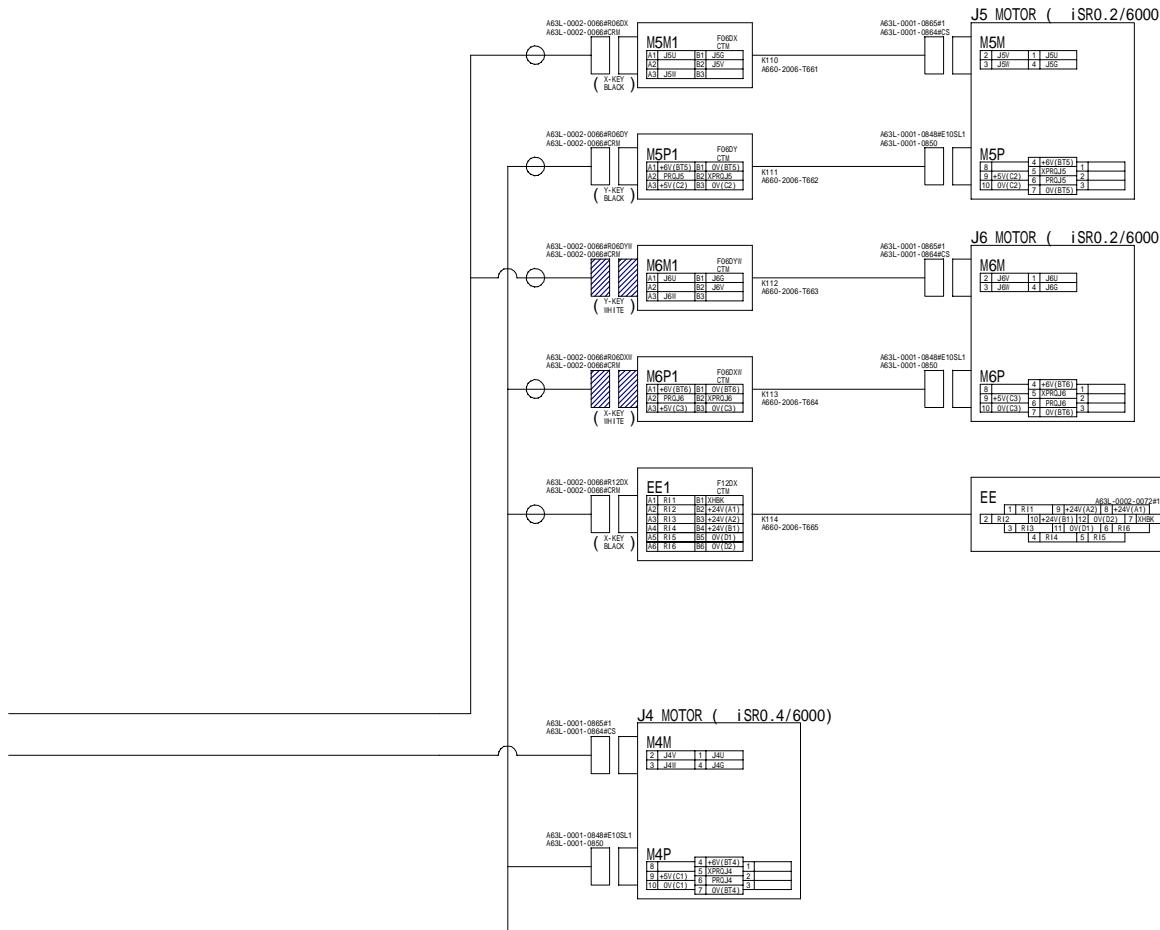
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注)  
NOTE)

1. (\*\*\*): 使用されていない信号。  
SIGNALS ARE NOT USED.
  2. オプション指定時は、A05C-1139-B202を参照。  
REFER TO A05C-1139-B202 IF SPECIFIED OPTIONS

**Fig. B (a) CIRCUIT DIAGRAM (LR Mate 200iC 3-axes brake type)**



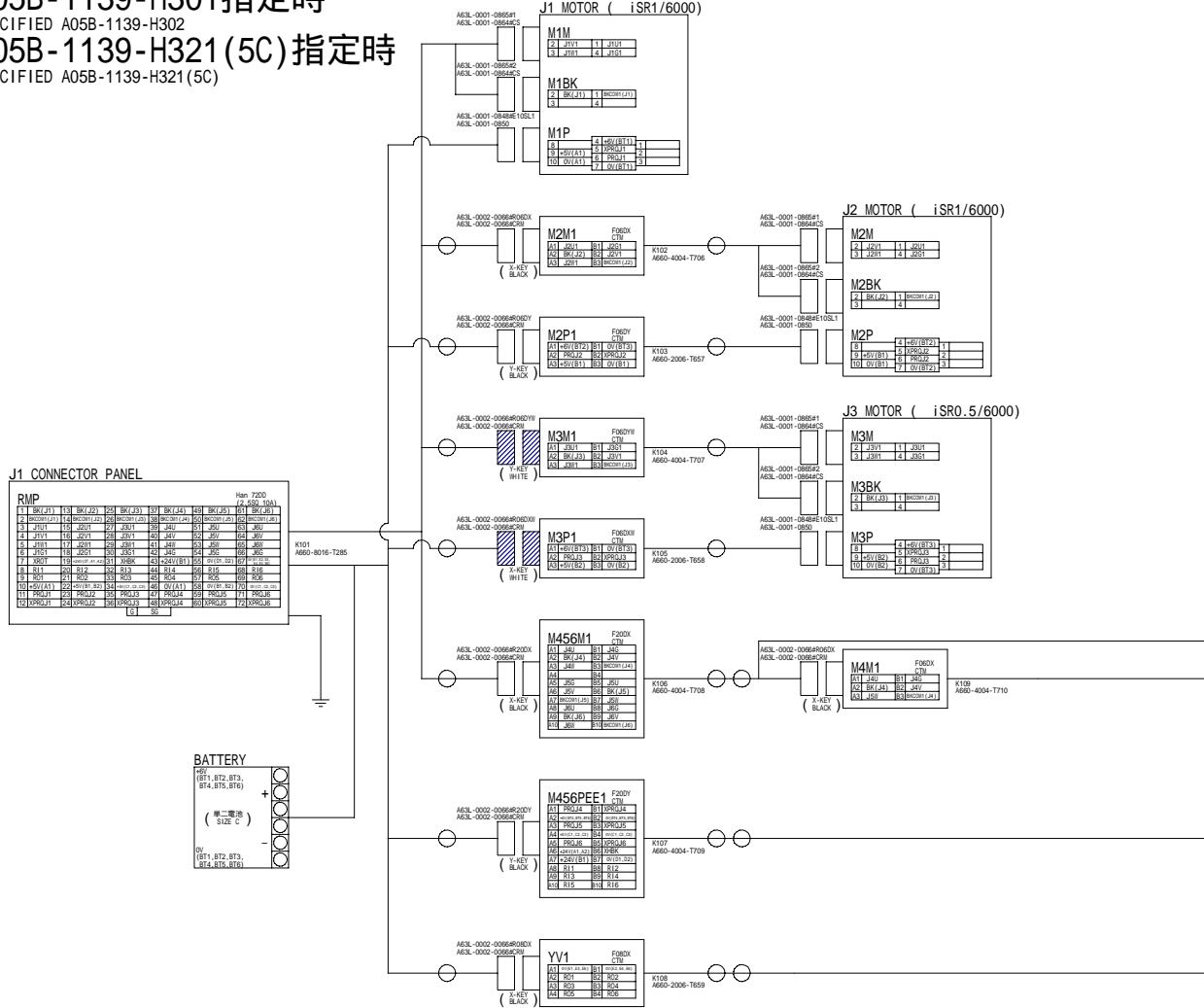
○ : 可動部用  
MOVABLE

A05B-1139-H301指定時

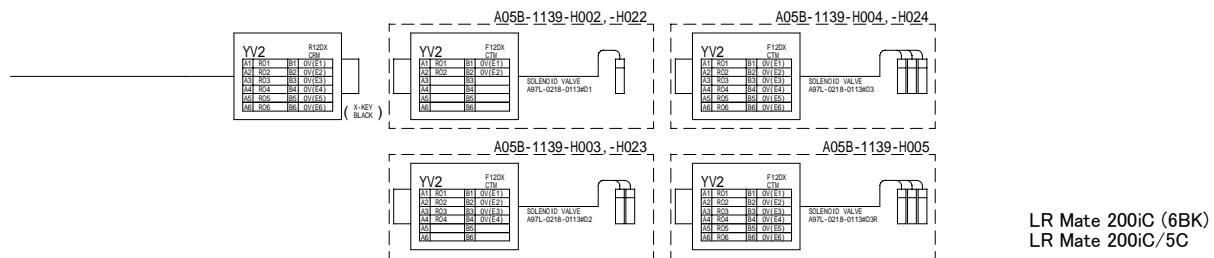
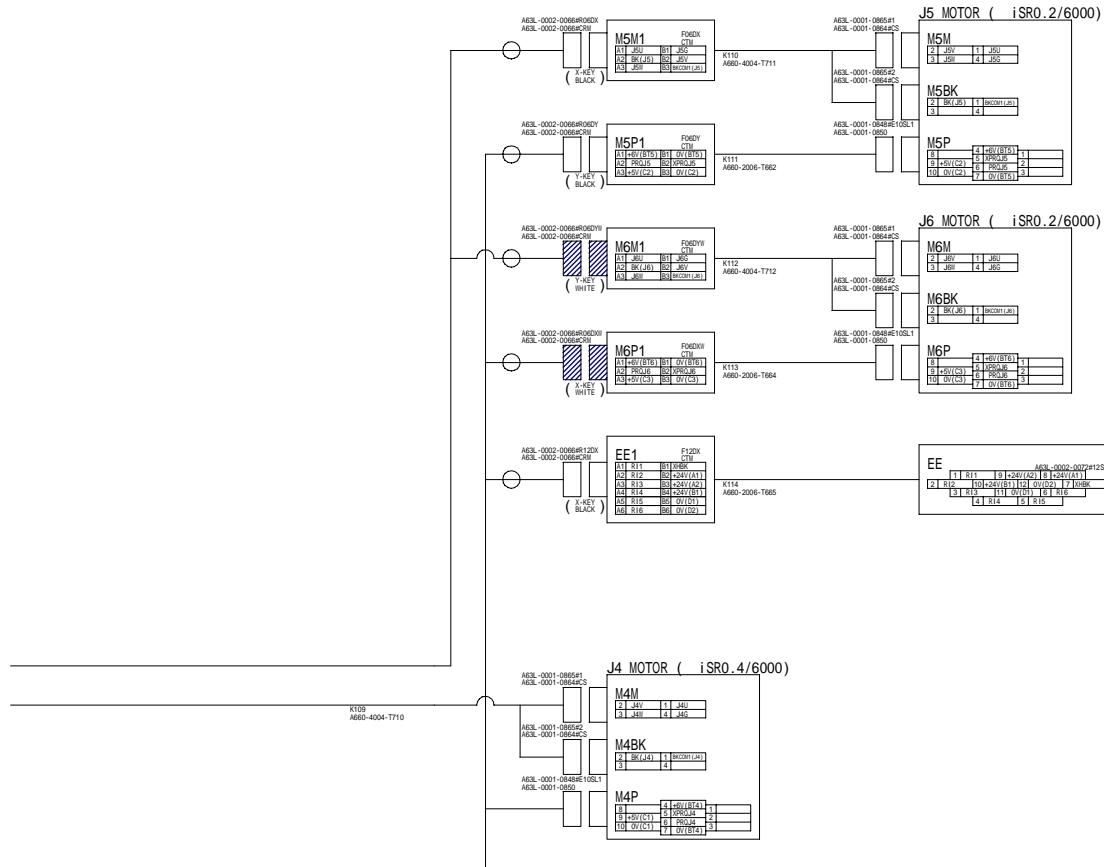
SPECIFIED A05B-1139-H302

A05B-1139-H321(5C) 指定時

SPECIFIED A05B-1139-H321(5C)



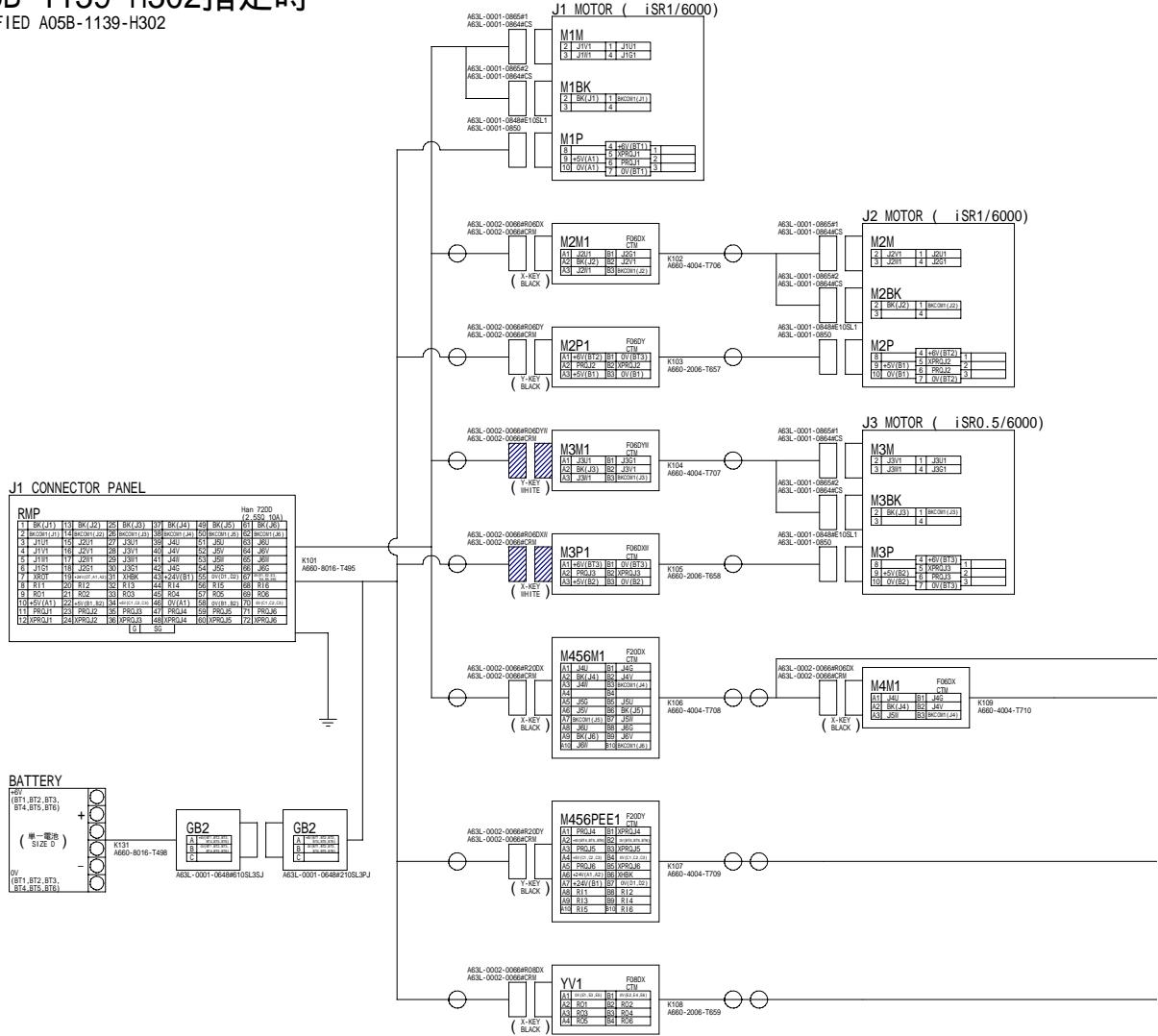
**Fig.B(b) Circuit diagram (LR Mate 200iC 6-axes brake type When H301 is specified)  
(LR Mate 200iC/5C When H321 is specified)**



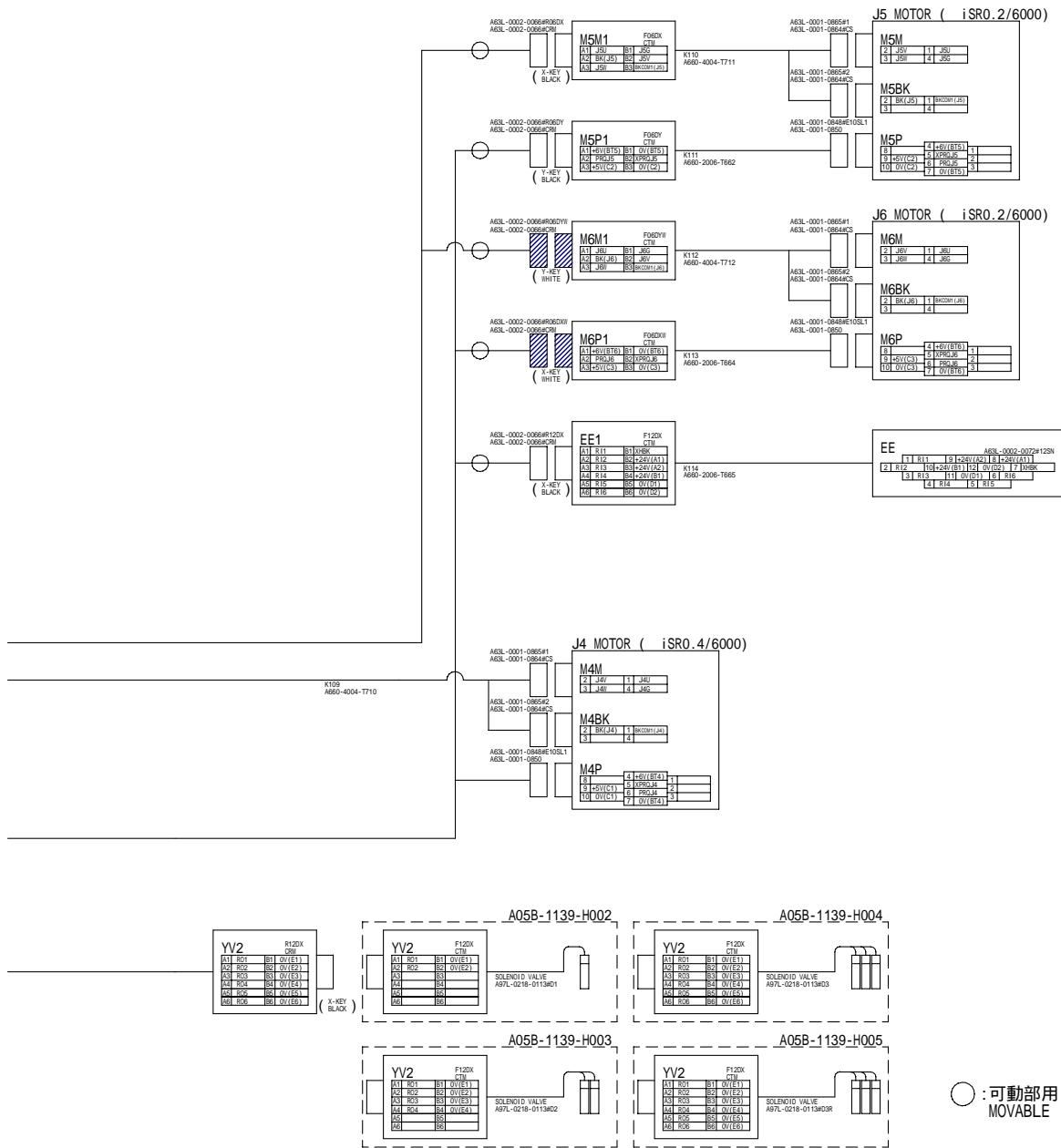
LR Mate 200iC (6BK)  
LR Mate 200iC/5C

A05B-1139-H302指定時

SPECIFIED A05B-1139-H302

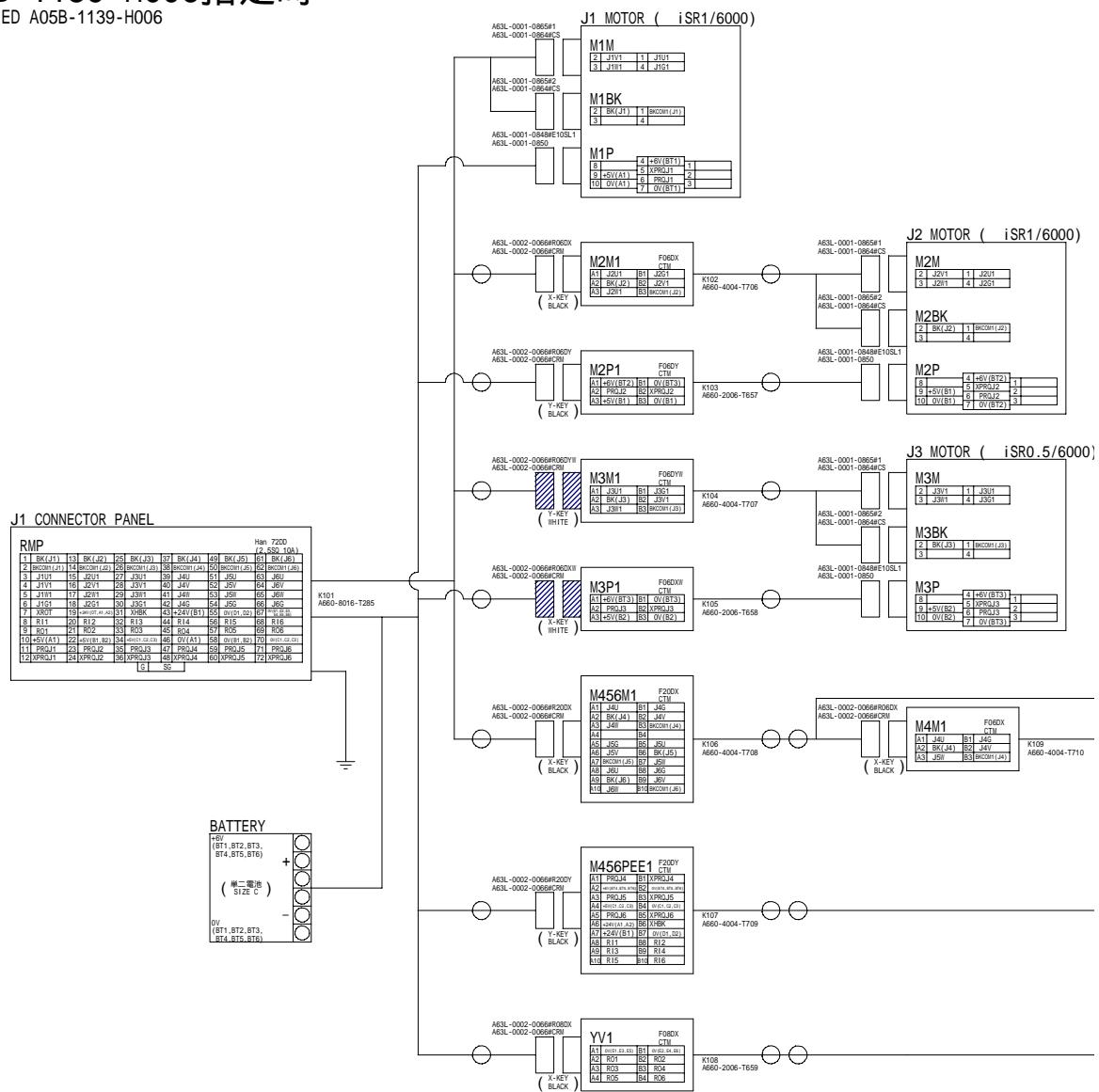


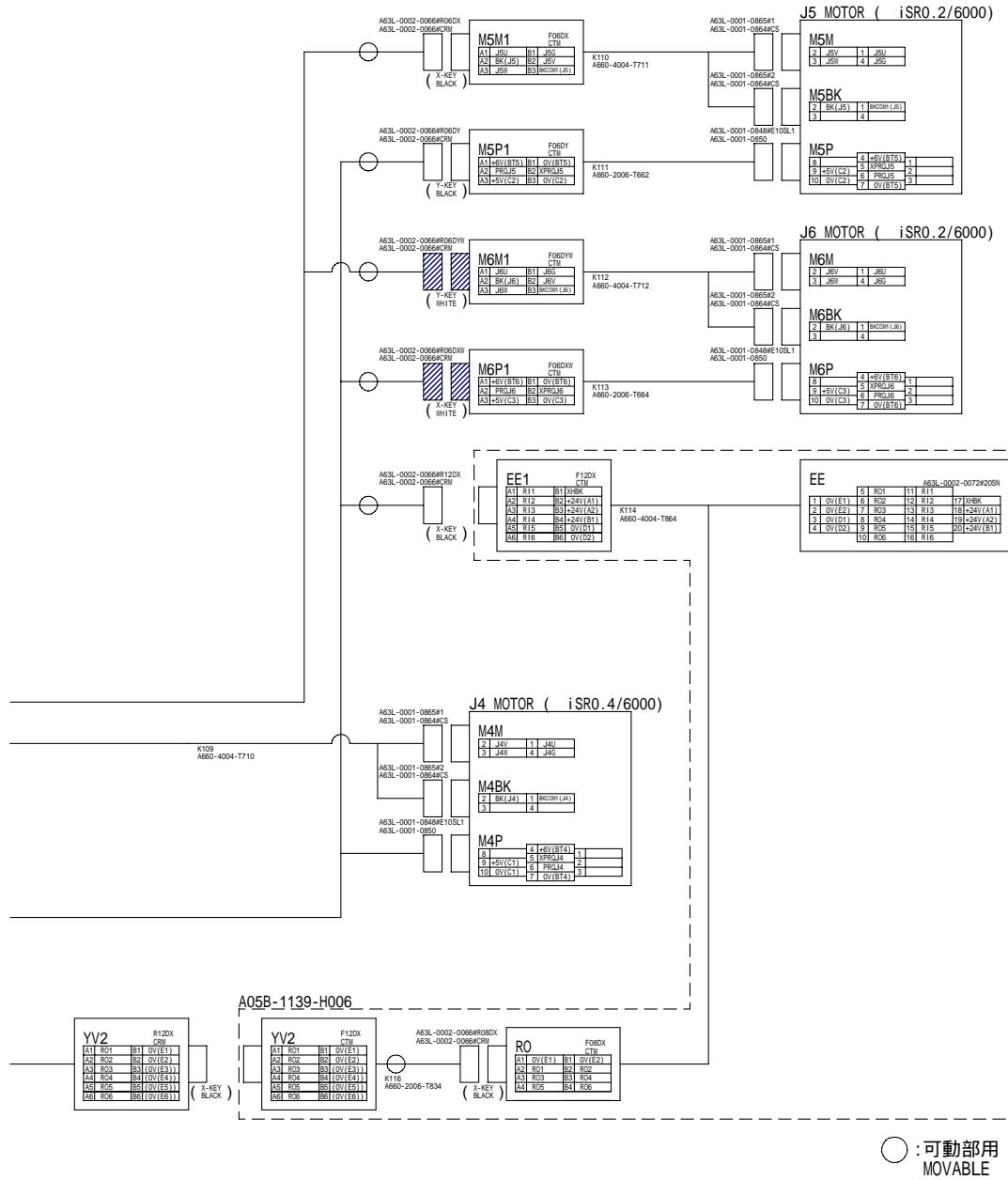
**Fig.B(c) Circuit diagram (LR Mate 200iC 6-axes brake type When H302 is specified)**

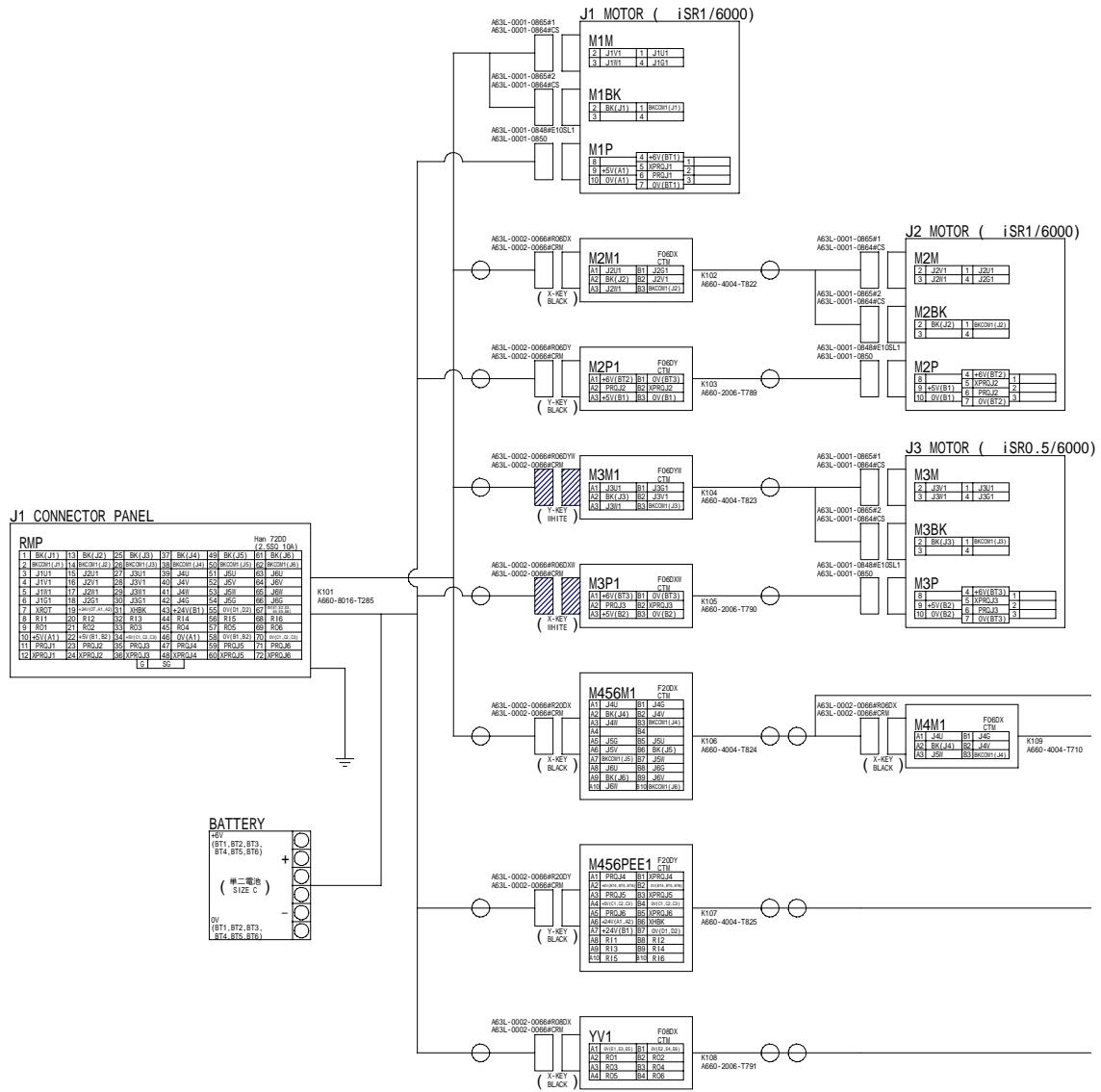


## A05B-1139-H006指定時

SPECIFIED A05B-1139-H006



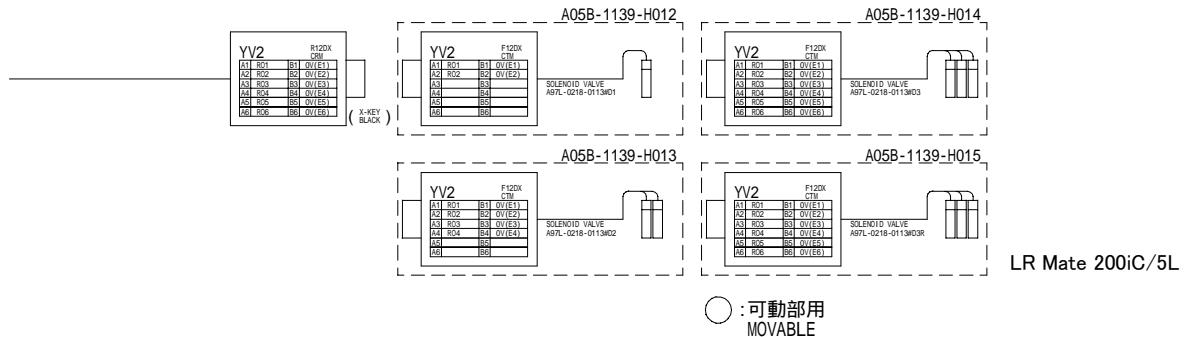
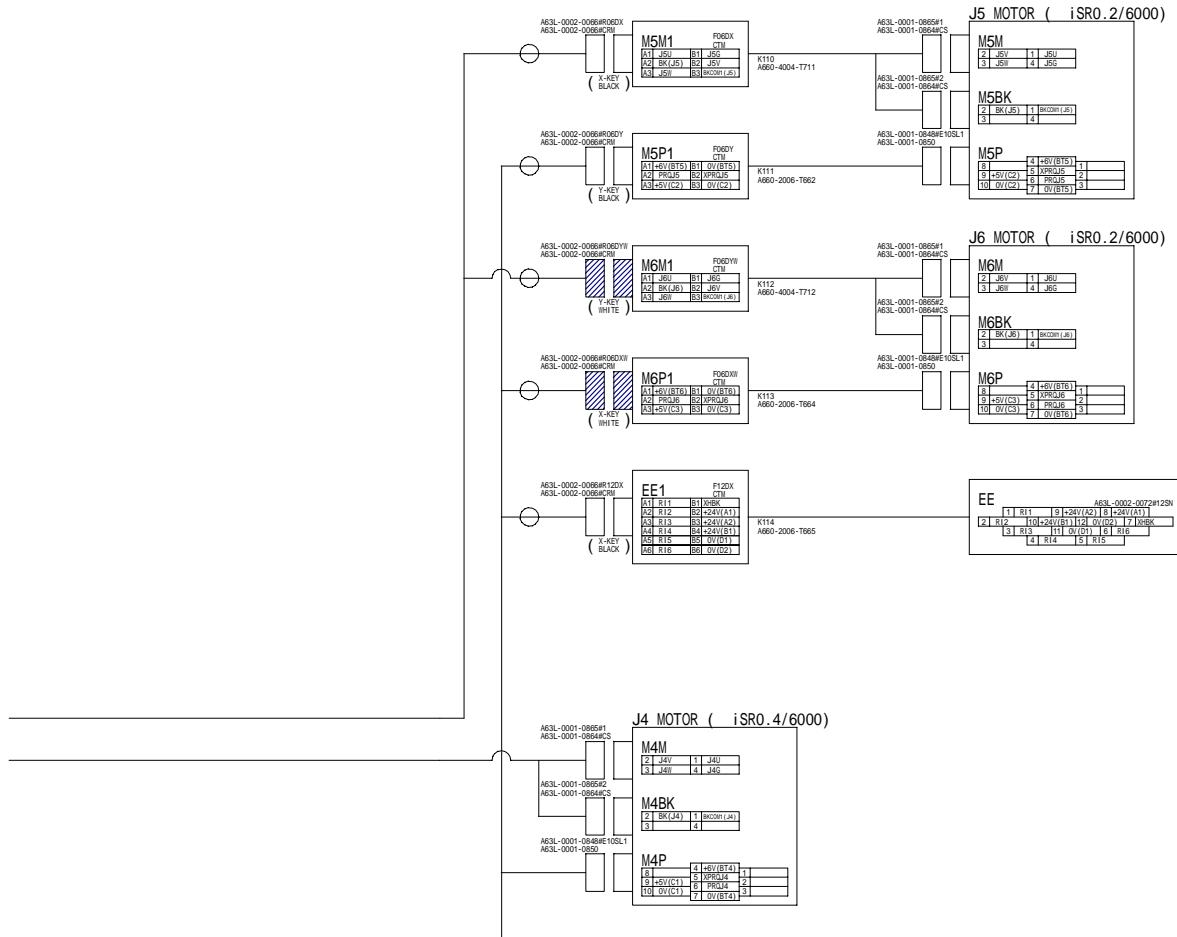




注)  
NOTE)

1. オプション指定時は、A05C-1139-B202を参照。  
REFER TO A05C-1139-B202 IF SPECIFIED OPTIONS.

**Fig.B(e) Circuit diagram (LR Mate 200iC/5L)**



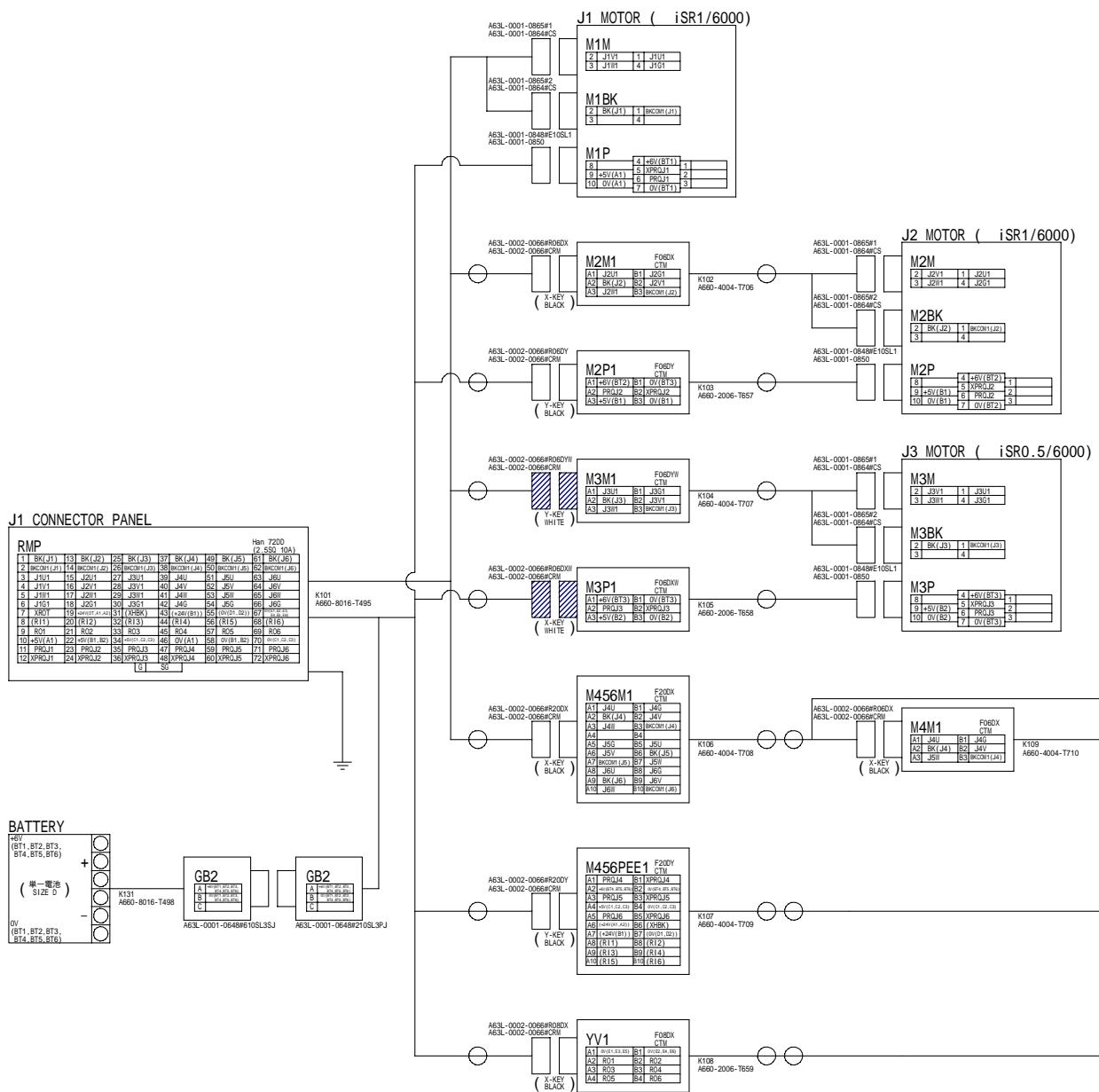
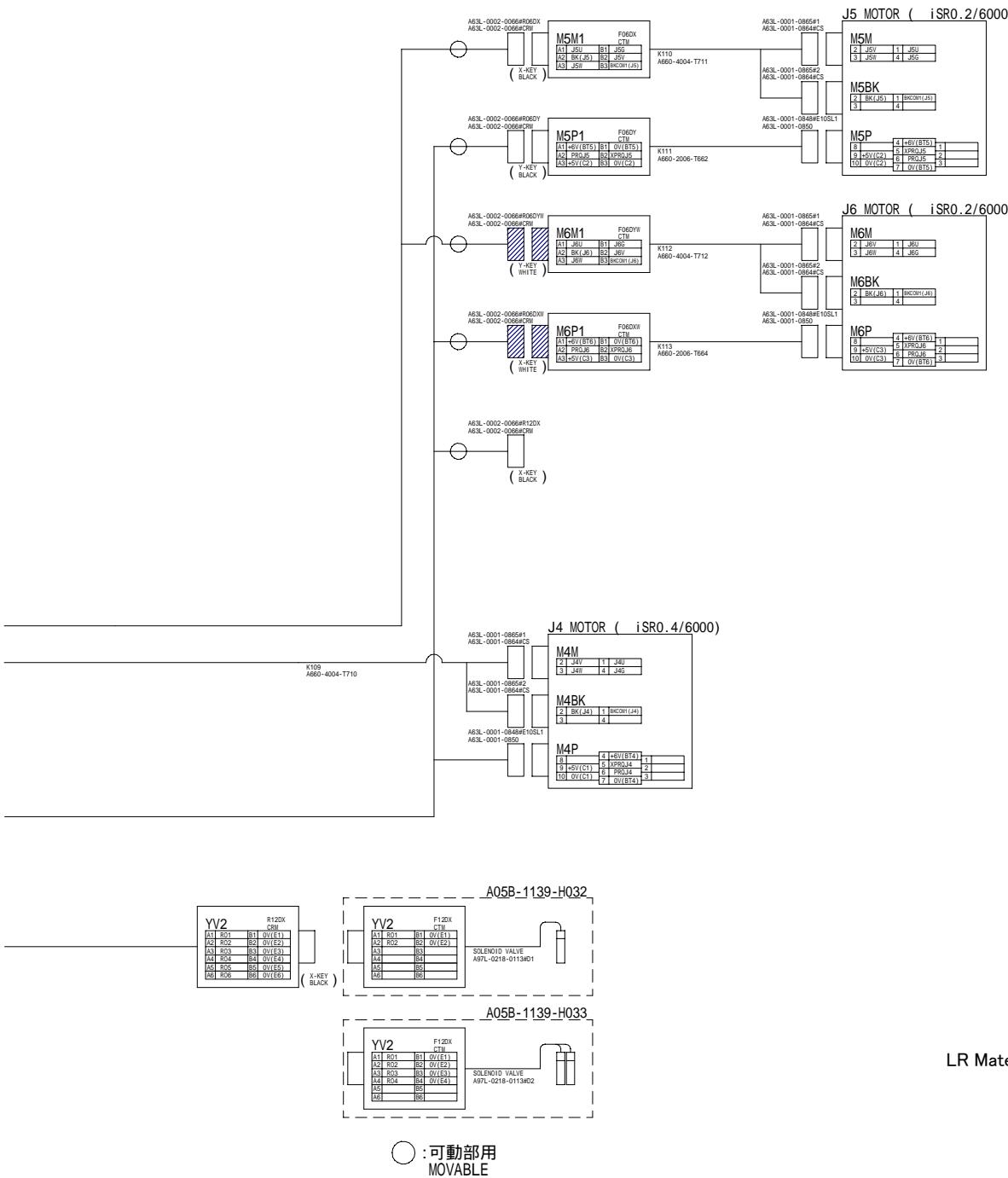
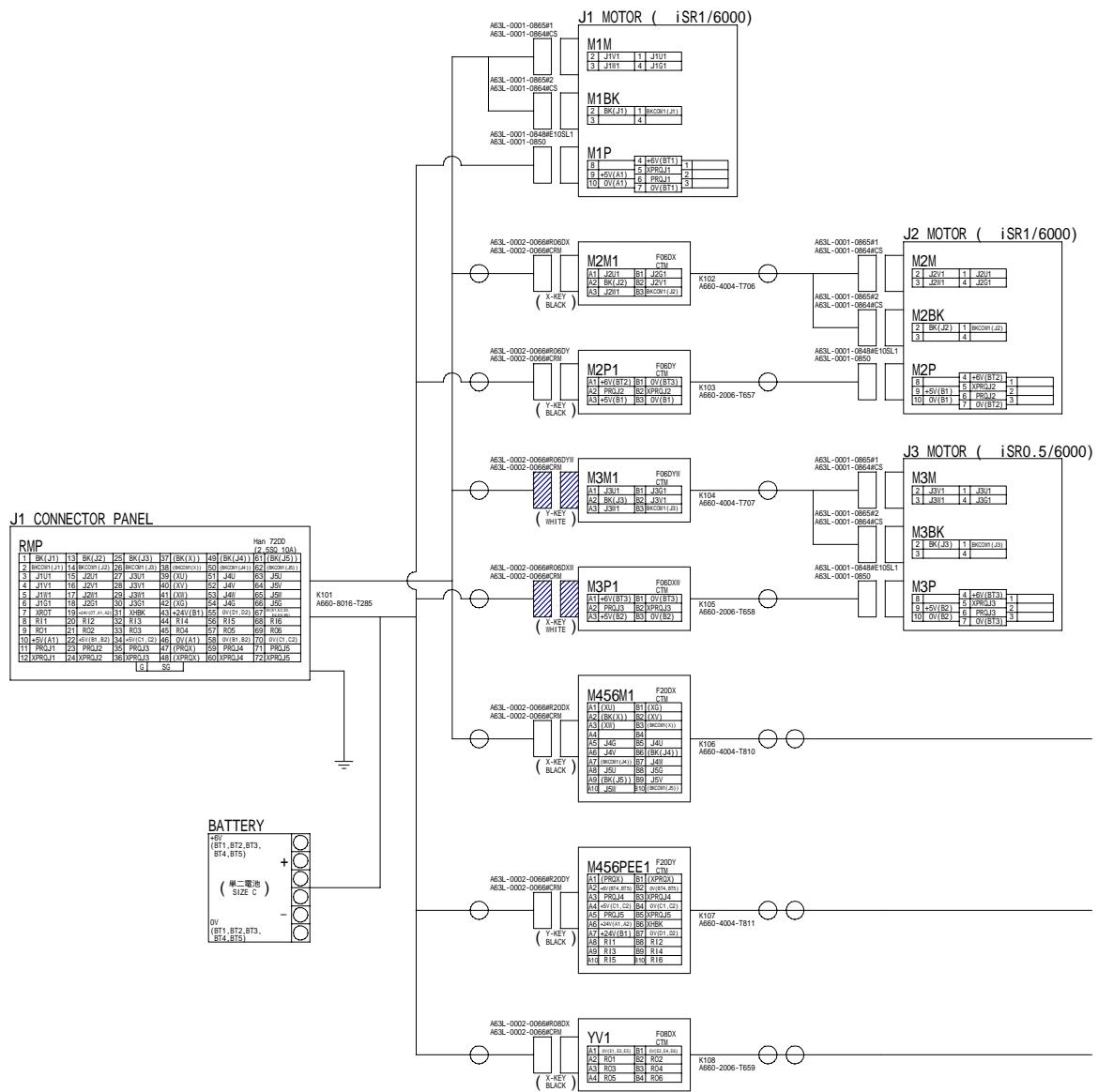


Fig.B(f) Circuit diagram (LR Mate 200iC/5WP)

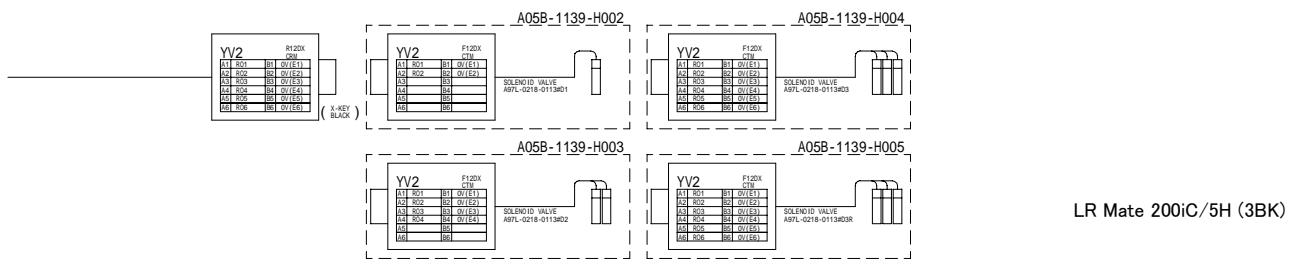
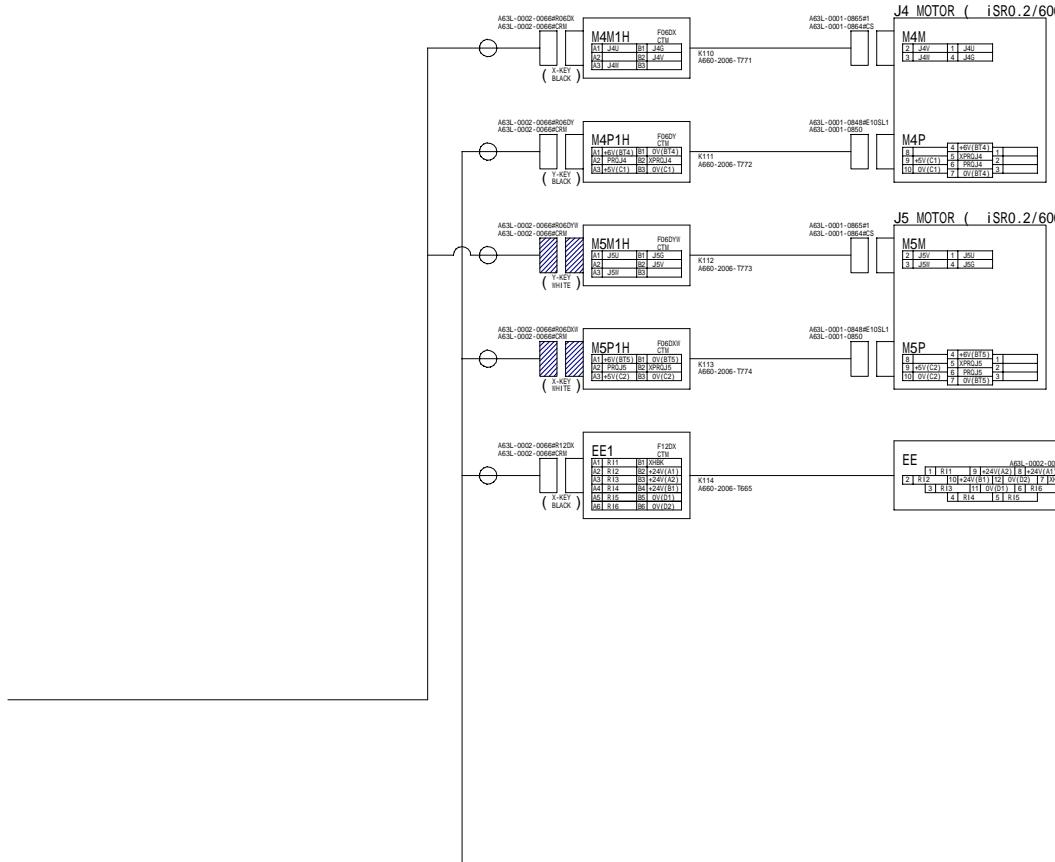




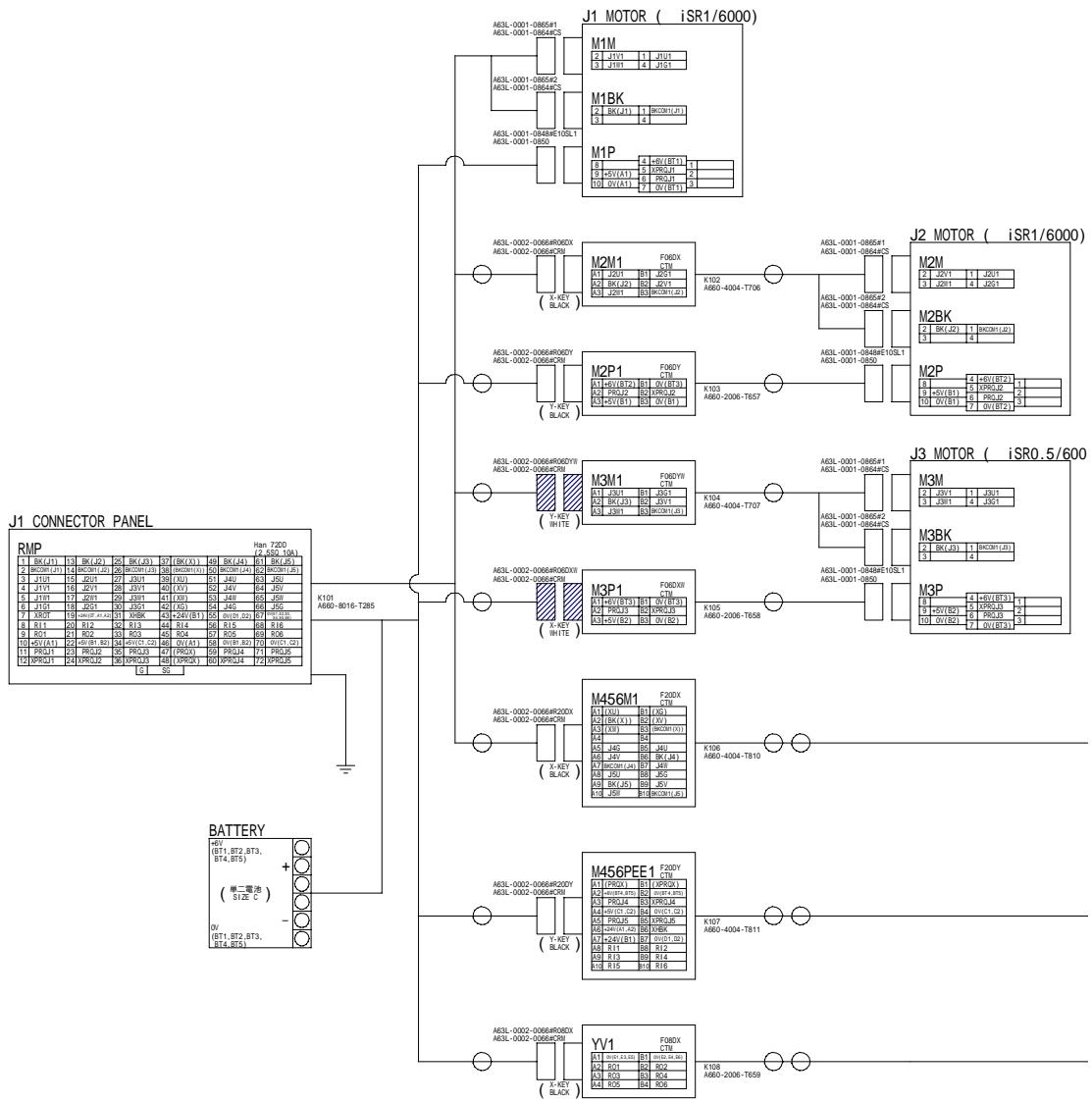
注)  
NOTE)

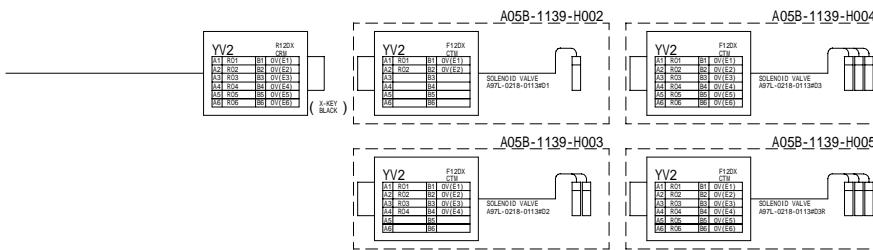
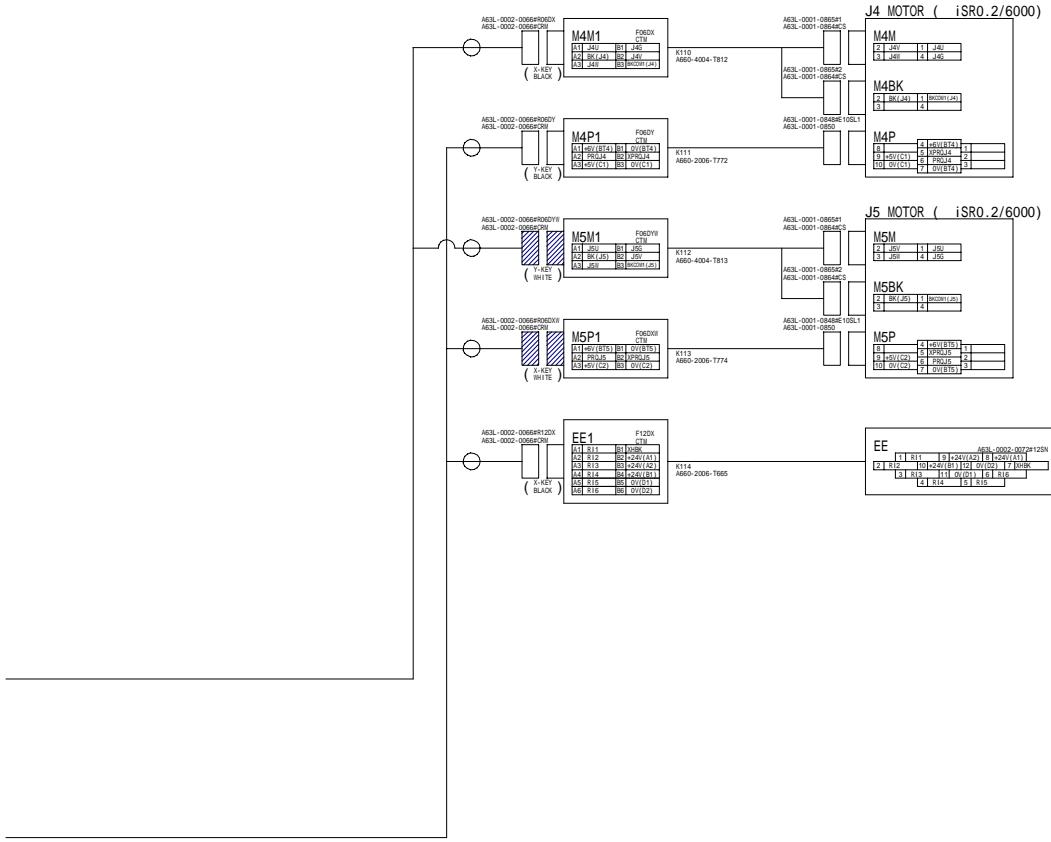
1. (\*\*\*): 使用されていない信号。  
SIGNALS ARE NOT USED.
2. オプション指定時は、A05C-1139-B202を参照。  
REFER TO A05C-1139-B202 IF SPECIFIED OPTIONS.

Fig. B(g) CIRCUIT DIAGRAM (LR Mate 200iC/5H 3-axes brake type)



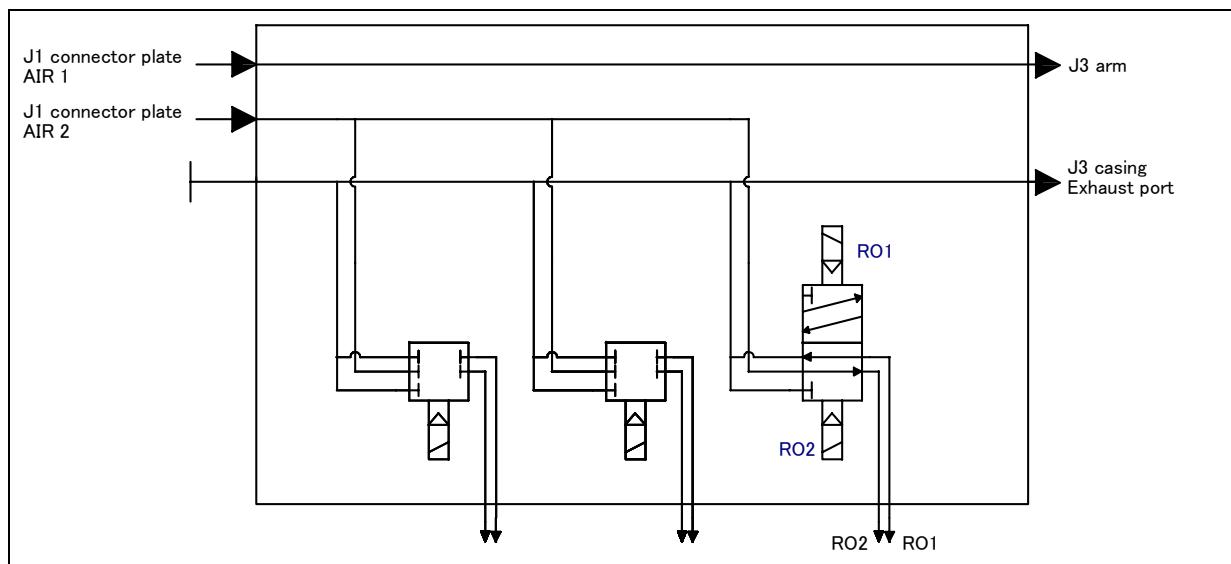
○ : 可動部用  
MOVABLE



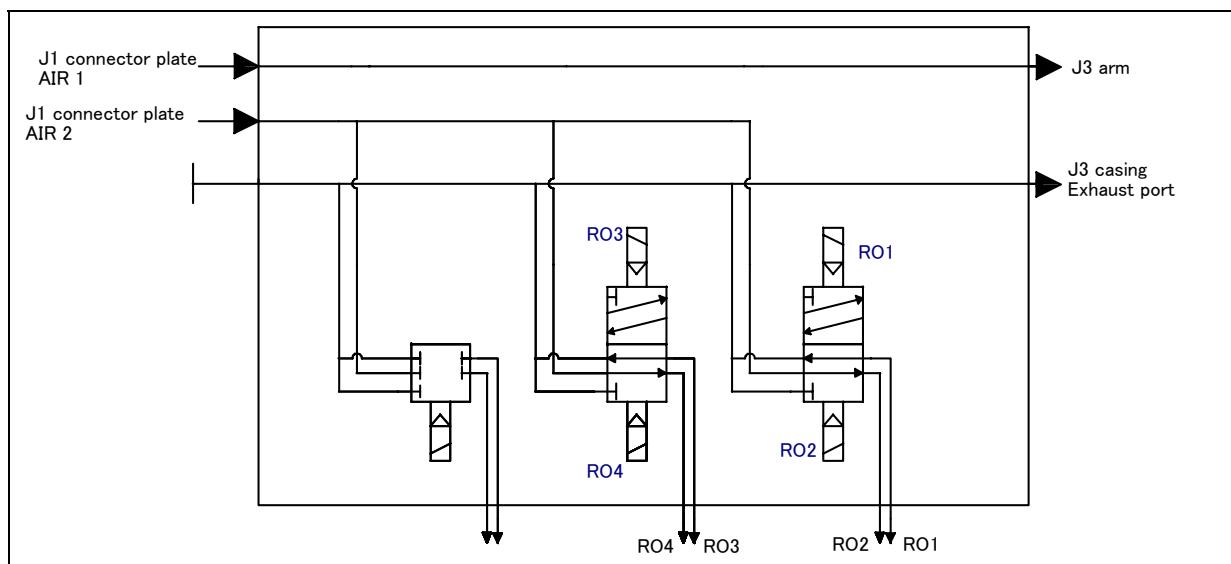


LR Mate 200iC/5H (5BK)

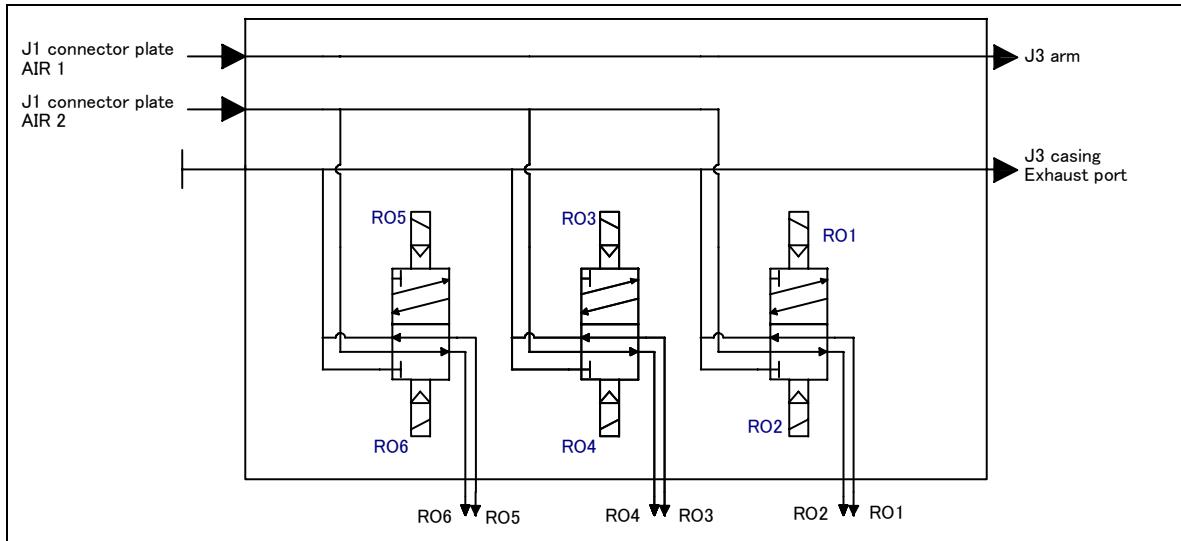
○ : 可動部  
MOVABLE



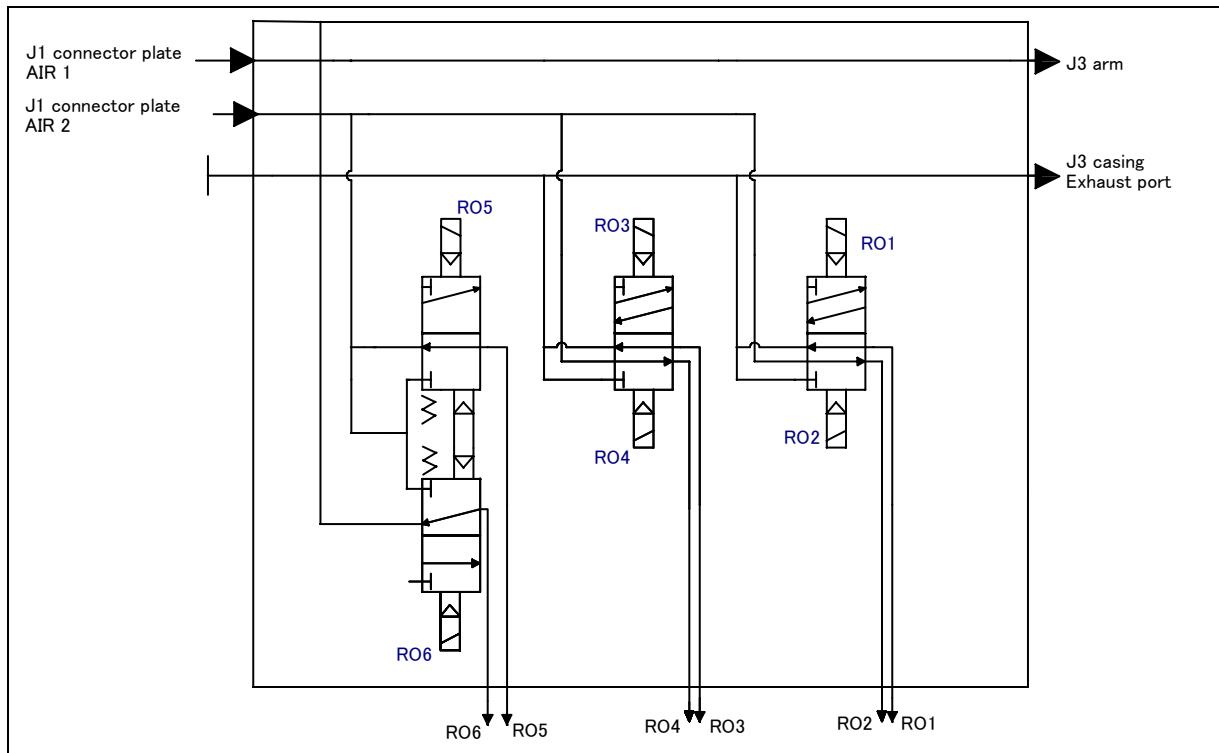
**Fig. B(i) Air pressure diagram  
(Double solenoid valve × 1 A05B-1139-H002,H012,H017,H022,H032 is specified)**



**Fig. B(j) Air pressure diagram  
(Double solenoid valve × 2 A05B-1139-H003,H013,H018,H023,H033 is specified)**



**Fig. B(k) Air pressure diagram**  
(Double solenoid valve × 3 A05B-1139-H004,H014,H024 is specified)



**Fig. B(l) Air pressure diagram**  
(Double solenoid valve × 3R A05B-1139-H005,H015 is specified)

# C

## PERIODIC MAINTENANCE TABLE

FANUC Robot LR Mate 200iC, LR Mate 200iC/5C, /5L, /5LC Periodic Maintenance Table

Items		Working time (H)	Check time	Oil Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 years 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check the exposed connector.(loosening)	0.2H	—		O			O				O			
	2	Tighten the end effector bolt.	0.2H	—		O			O				O			
	3	Tighten the cover and main bolt.	2.0H	—		O			O				O			
	4	Remove spatter and dust etc.	1.0H	—		O	O	O	O	O	O	O	O	O	O	O
	5	Replacing battery. (if built-in batteries are specified)	0.1H	—					●				●			
		Replacing battery. (if external batteries are specified)	0.1H								●					
	6	Greasing the reducers.	0.5H	14ml												
Control unit	7	Replacing cable of mechanical unit *1	4.0H	—												
	8	Check the robot cable and teach pendant cable	0.2H	—	O	O	O	O	O	O	O	O	O	O	O	O
	9	Cleaning the ventilator	0.2H	—		O	O	O	O	O	O	O	O	O	O	O
	10	Check the source voltage *1	0.2H	—		O		O		O		O		O		O
	11	Replacing battery *1	0.1H	—												

\*1 Refer to manual of controller.

\*2 ●: requires exchange of parts

O: does not require exchange of parts

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	
				●																	

FANUC Robot LR Mate 200iC/5WP

Periodic Maintenance Table

Items		Working time (H)	Check time	Oil Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 years 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Mechanical unit	1	Check the exposed connector.(loosening)	0.2H	—		○			○				○			
	2	Tighten the end effector bolt.	0.2H	—		○			○				○			
	3	Tighten the cover and main bolt.	2.0H	—		○			○				○			
	4	Remove spatter and dust etc.	1.0H	—		○	○	○	○	○	○	○	○	○	○	○
	5	Replacing battery.(external battery)	0.1H								●					
	6	Greasing the reducers.	0.5H	14ml								●				
	7	Replacing cable of mechanical unit *	4.0H	—												
Control unit	8	Check the robot cable and teach pendant cable	0.2H	—	○	○	○	○	○	○	○	○	○	○	○	○
	9	Cleaning the ventilator	0.2H	—		○	○	○	○	○	○	○	○	○	○	○
	10	Check the source voltage *1	0.2H	—			○		○		○		○		○	
	11	Replacing battery *1	0.1H	—												

\*1 Refer to manual of controller.

\*2 ●: requires exchange of parts

○: does not require exchange of parts

3 years 11520	12480	13440	14400	4 years 15360	Item
O				Overhaul	1
O					2
O					3
O	O	O	O		4
●					5
					6
					7
O	O	O	O		8
O	O	O	O		9
O		O			10
					11

FANUC Robot LR Mate 200iC/5H

Periodic Maintenance Table

Working time (H)		Check time	Oil Grease amount	First check 320	3 months 960	6 months 1920	9 months 2880	1 years 3840	4800	5760	6720	2 years 7680	8640	9600	10560
Items															
Mechanical unit	1	Check the exposed connector.(loosening)	0.2H	—	O			O				O			
	2	Tighten the end effector bolt.	0.2H	—	O			O				O			
	3	Tighten the cover and main bolt.	2.0H	—	O			O				O			
	4	Remove spatter and dust etc.	1.0H	—	O	O	O	O	O	O	O	O	O	O	O
	5	Replacing battery. (if built-in batteries are specified)	0.1H	—				●				●			
		Replacing battery. (if external batteries are specified)	0.1H							●					
	6	Greasing the reducers.	0.5H	12ml											
Control unit	7	Replacing cable of mechanical unit *	4.0H	—											
	8	Check the robot cable and teach pendant cable	0.2H	—	O	O	O	O	O	O	O	O	O	O	O
	9	Cleaning the ventilator	0.2H	—	O	O	O	O	O	O	O	O	O	O	O
	10	Check the source voltage *1	0.2H	—		O		O		O		O		O	
	11	Replacing battery *1	0.1H	—											

\*1 Refer to manual of controller.

\*2 ●: requires exchange of parts

O: does not require exchange of parts

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
O				O				O				O				O					Overhaul
O				O				O				O				O					
O				O				O				O				O					
O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
●				●				●				●				●					
●						●						●						●			
						●															
						●															
O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
O		O		O		O		O		O		O		O		O		O			
				●																	

# D

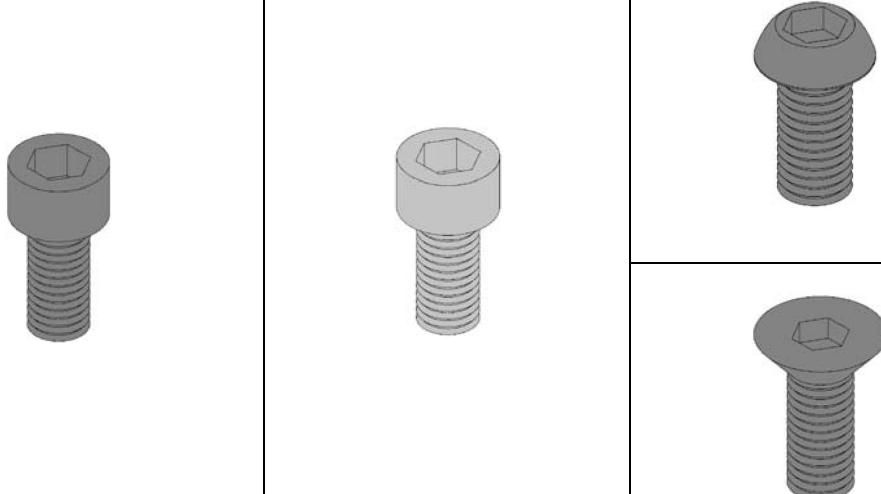
## MOUNTING BOLT TORQUE LIST

### NOTE

When applying Loctite to the important bolt tightening points, make sure that it is applied to the entire longitudinal portion in the engaging section of the female threads. If it is applied to the male threads, the bolts may be loosened because sufficient effects cannot be obtained. Remove the dust within the bolts and taps and wipe oil off the engaging section. Make sure that there is no solvent in the taps.

If no tightening torque is specified for a bolt, tighten it according to this table.

Recommended bolt tightening torques		Unit: Nm (kgf·cm)			
Nominal diameter	Hexagon socket head bolt (Steel in strength category 12.9)	Hexagon socket head bolt (stainless)		Hexagon socket head boss bolt Hexagon socket head flush bolt (steel in strength category 12.9)	
	Tightening torque	Tightening torque		Tightening torque	
	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit
M3	1.8(18)	1.3(13)	0.76(7.7)	0.53(5.4)	-
M4	4.0(41)	2.8(29)	1.8(18)	1.3(13)	1.8(18)
M5	7.9(81)	5.6(57)	3.4(35)	2.5(25)	4.0(41)
M6	14(140)	9.6(98)	5.8(60)	4.1(42)	7.9(81)
M8	32(330)	23(230)	14(145)	9.8(100)	14(140)
M10	66(670)	46(470)	27(280)	19(195)	32(330)
M12	110(1150)	78(800)	48(490)	33(340)	-
(M14)	180(1850)	130(1300)	76(780)	53(545)	-
M16	270(2800)	190(1900)	120 (1200)	82(840)	-
(M18)	380(3900)	260(2700)	160(1650)	110(1150)	-
M20	530(5400)	370(3800)	230(2300)	160(1600)	-
(M22)	730(7450)	510(5200)	-	-	-
M24	930(9500)	650(6600)	-	-	-
(M27)	1400(14000)	960(9800)	-	-	-
M30	1800(18500)	1300(13000)	-	-	-
M36	3200(33000)	2300(23000)	-	-	-





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## Revision Record

### FANUC Robot LR Mate 200iC MECHANICAL UNIT MAINTENANCE MANUAL (B-82585EN)

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02	Feb., 2008	<ul style="list-style-type: none"><li>• Addition of LR Mate 200iC/5L,5LC,5WP,5C</li><li>• Addition of Air pressure diagram</li><li>• Revice</li></ul>			
01	Nov., 2007	_____			
Edition	Date	Contents	Edition	Date	Contents

