FANUC Robot series

Servo Torch for ARC Mate *i*C series (Option)

OPERATOR'S MANUAL

B-83074EN/06

- **Original Instructions**

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

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

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

SAFETY PRECAUTIONS

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

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

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

1 PERSONNEL

Personnel can be classified as follows.

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

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

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

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

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

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

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

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

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

2 DEFINITION OF SAFETY NOTATIONS

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

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

TABLE OF CONTENTS

1 CONFIGURATION

For the structure of the mechanical unit of each robot, refer to the following robot maintenance manuals:

ARC Mate 100*i*C
: FANUC Robot ARC Mate 100*i*C, M-10*i*A, ARC Mate 100*i*Ce, M-10*i*Ae OPERATOR'S MANUAL (B–82754EN)
: FANUC Robot ARC Mate 100*i*C/12/7L/12S/8L, M-10iA/12/7L/12S/8L OPERATOR'S ANUAL (B–83654EN)

ARC Mate 120*i*C
: FANUC Robot ARC Mate 120*i*C, M-20*i*A OPERATOR'S MANUAL (B–82874EN)

Welding power supply
: Controller ARC Welding Power Supply Option (LINCOLN/FANUC welding power supply) OPERATOR'S MANUAL (B-83614EN-1)

1.1 BASIC SPECIFICATION

Specification and external dimension are shown below.

Table 1.1 (a) Specification (Servo torch for aluminum)

Wire size	φ1.2mm
Wire feeding speed	Max 35m/min
Welding currency	Max 500A

Table 1.1 (b) Specification (Servo torch for mild steel)

Wire size	φ0.9, φ1.0, φ1.2mm
Wire feeding speed	Max 35m/min
Welding currency	Max 500A

Table 1.1 (c) Specification (Servo torch for TIG)

Wire size	φ1.2mm
Wire feeding speed	Max 5m/min
Welding currency	Max 400A

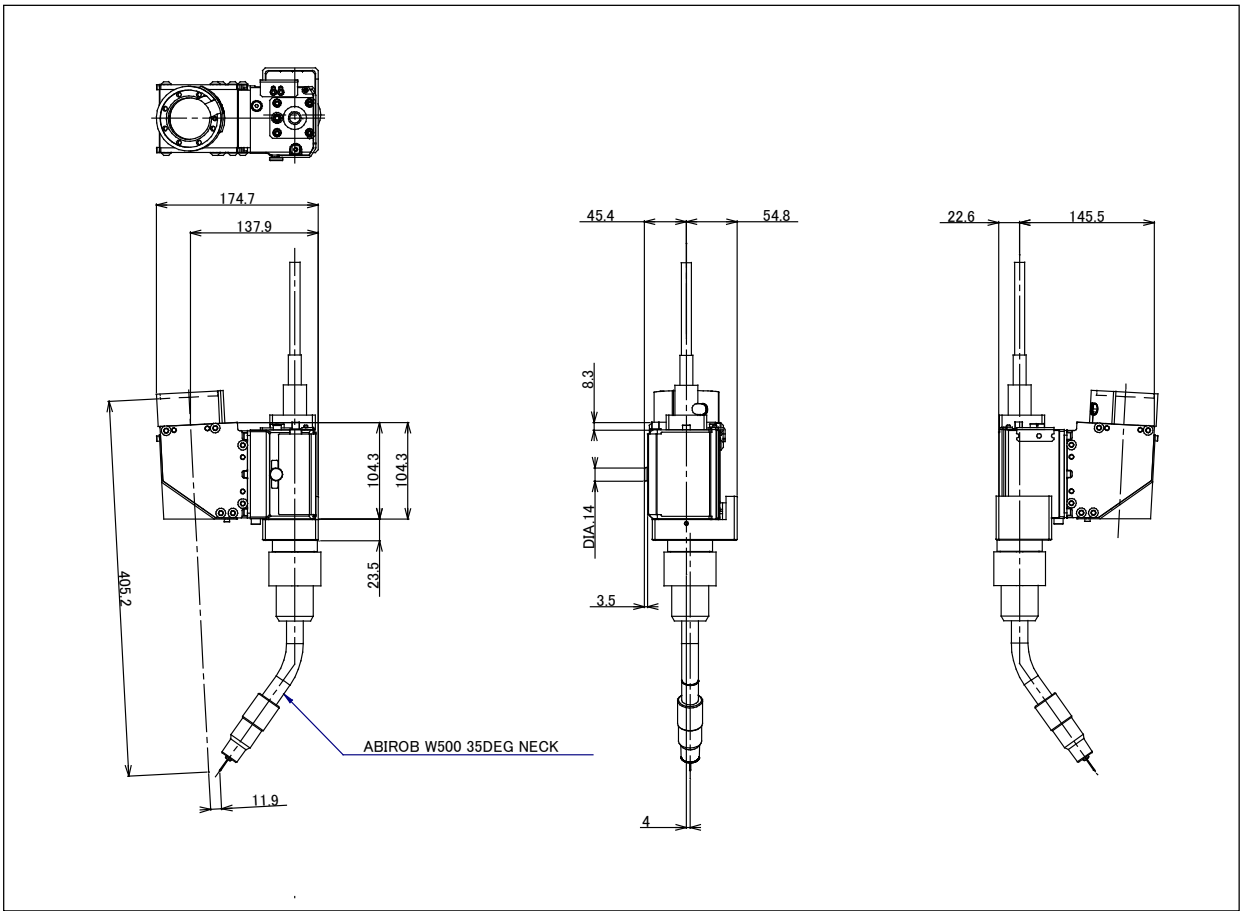
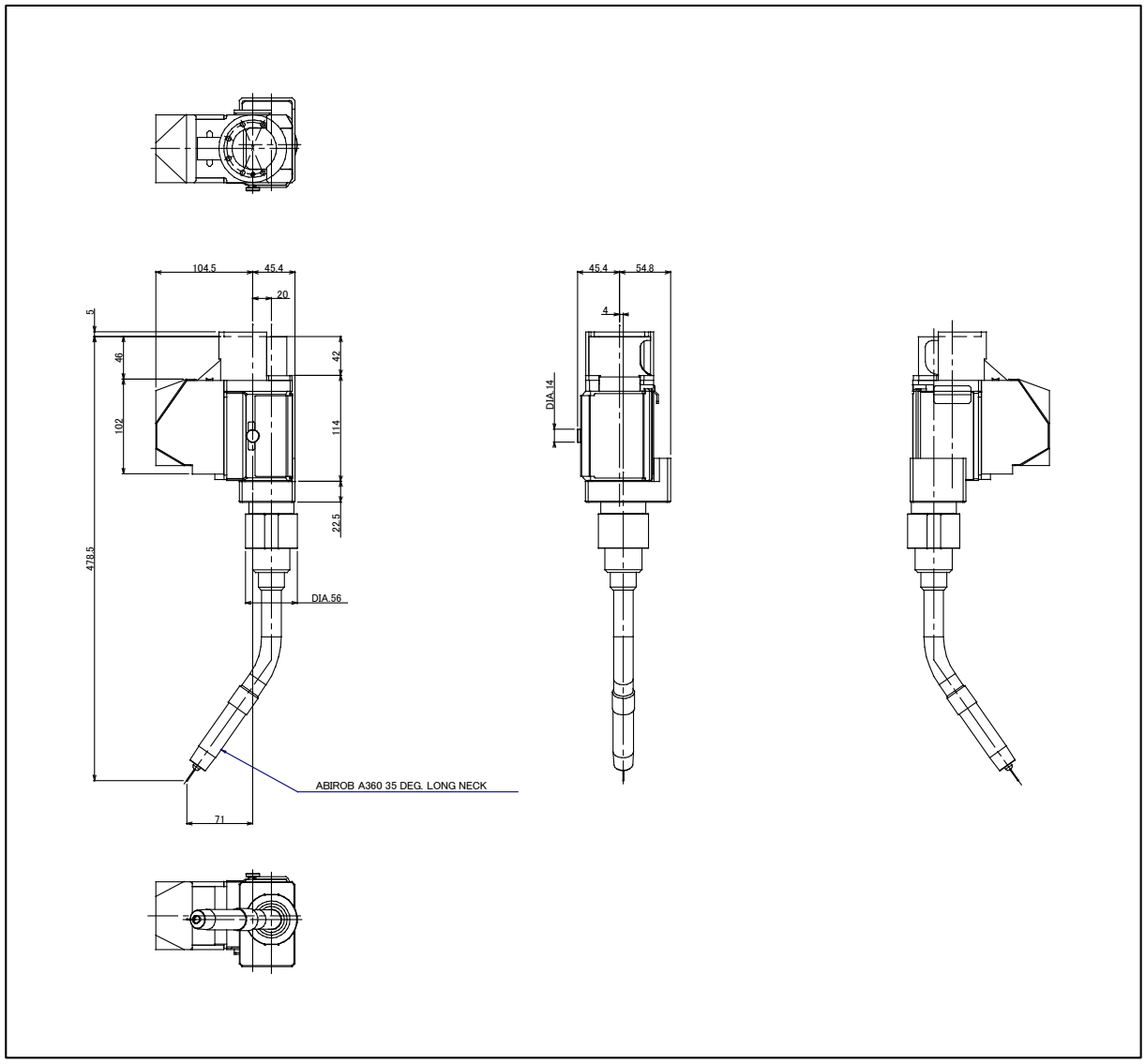


Fig. 1.1 (a) External dimension (Servo torch for aluminum)

Table 1.1 (d) Parameter for load setting

Item	For Aluminum	Unit
Payload	4.540	[kg]
X	6.692	[cm]
Y	-0.098	[cm]
Z	12.207	[cm]
Ix	0.273	[kgf･cm･s^2]
Iy	0.345	[kgf･cm･s^2]
Iz	0.111	[kgf･cm･s^2]

Please refer to Chapter 4 of each mechanical unit operator's manual about method of the load setting.

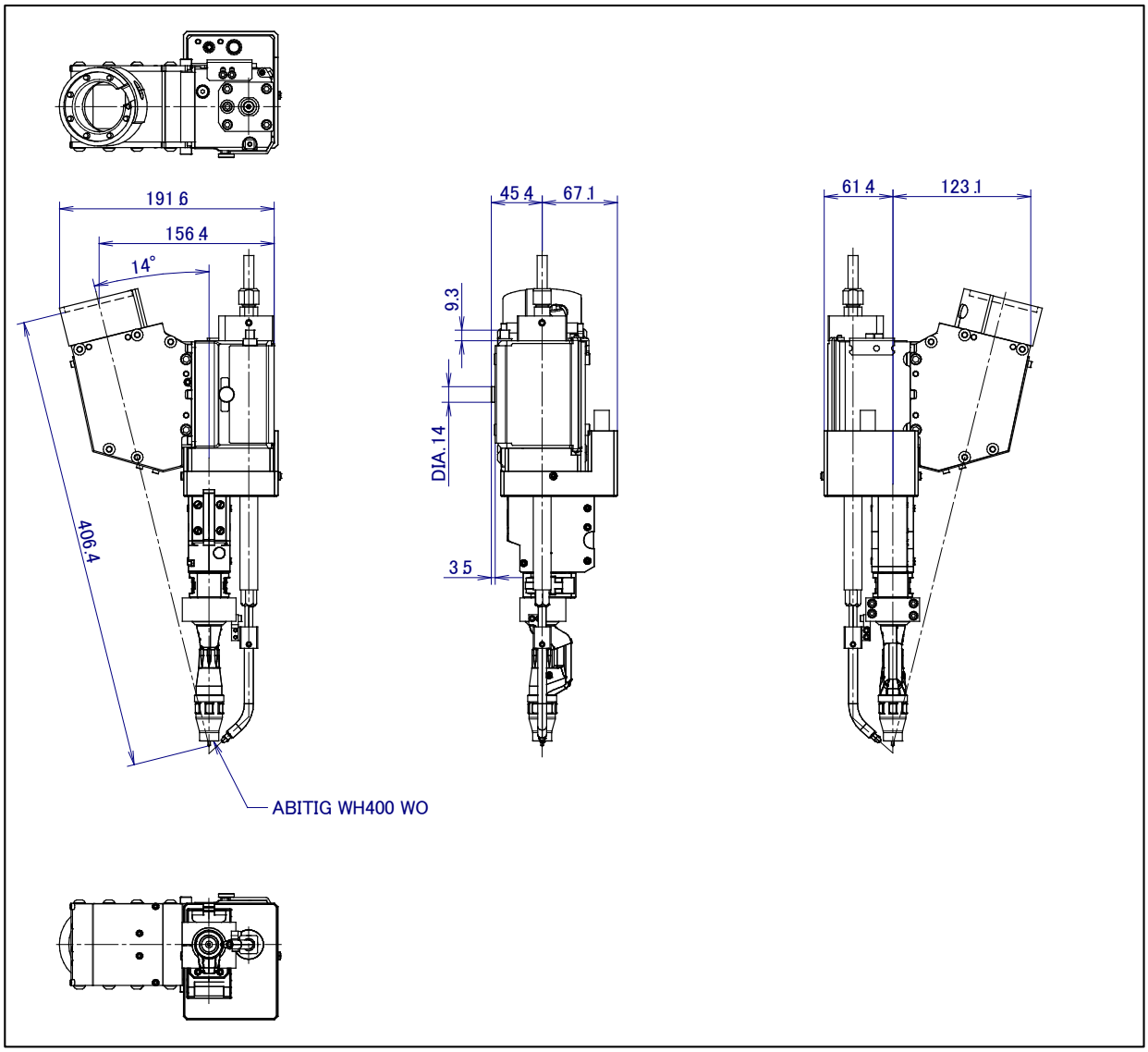


Fig, 1.1 (b) External dimension (Servo torch for mild steel)

Table 1.1 (e) Parameter for load setting

Item	For Mild steel	Unit
Payload	5.000	[kg]
X	-4.000	[cm]
Y	-0.021	[cm]
Z	13.000	[cm]
Ix	0.300	[kgf･cm･s^2]
Iy	0.375	[kgf･cm･s^2]
Iz	0.116	[kgf･cm･s^2]

Please refer to Chapter 4 of each mechanical unit operator's manual about method of the load setting.



Fig, 1.1 (c) External dimension (Servo torch for TIG)

Table 1.1 (f) Parameter for load setting

Item	For TIG	Unit
Payload	4.540	[kg]
X	6.692	[cm]
Y	-0.098	[cm]
Z	12.207	[cm]
Ix	0.273	[kgf･cm･s^2]
Iy	0.345	[kgf･cm･s^2]
Iz	0.111	[kgf･cm･s^2]

Please refer to Chapter 4 of each mechanical unit operator's manual about method of the load setting.

1.2 SYSTEM STRUCTURE

Fig. 1.2 (a) to (c) show the servo torch structure.

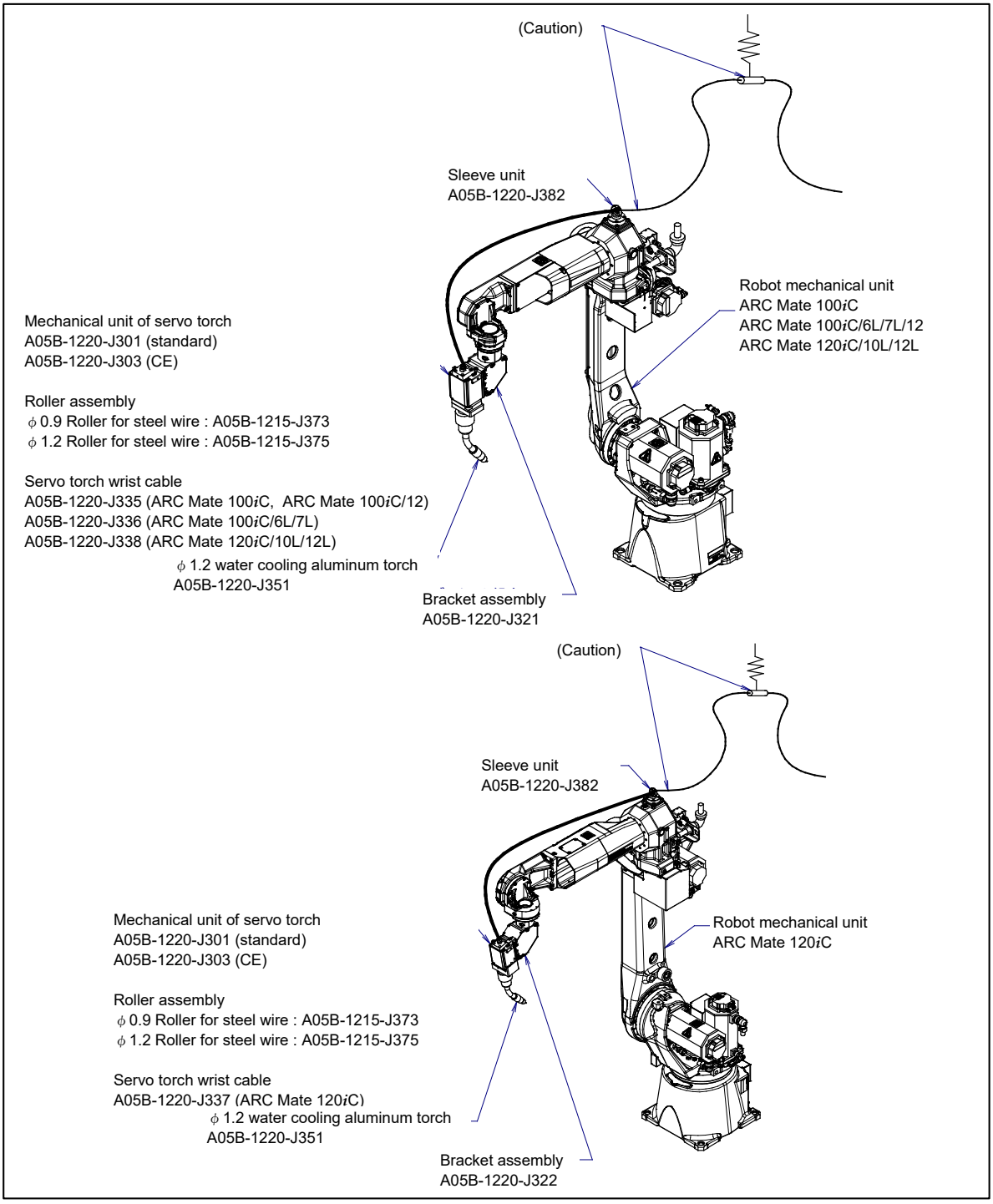


Fig. 1.2 (a) system structure (Servo torch for aluminum)

> ⚠ **CAUTION**
> Be sure to hang the flexible conduit. Make bend radius of back of wire feeder or around the hanging tool more than 400mm, maximize the bend radius of other parts, so that you can feed wire smoothly. Make length of flexible conduit less than 760mm.

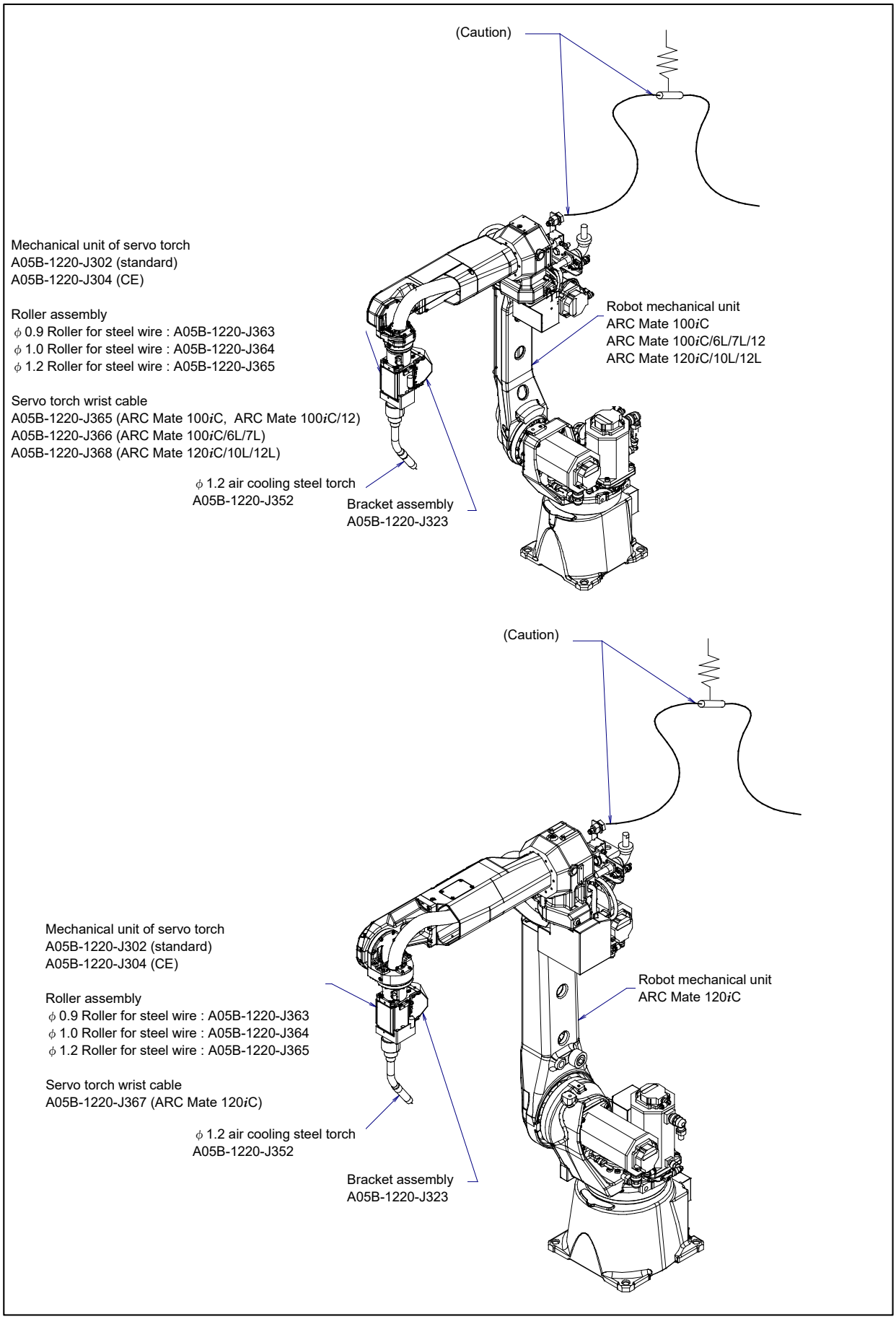


Fig. 1.2 (b) system structure (Servo torch for mild steel)

⚠ CAUTION

Be sure to hang the flexible conduit.
If it was not hanged, excessive load is applied onto the metal plate of J3 casing backside and it might be broken.
Make bend radius of back of wire feeder or around the hanging tool more than 400mm, maximize the bend radius of other parts, so that you can feed wire smoothly. Make length of flexible conduit less than 760mm.

NOTE

When servo torch is specified, allowable payload of robot is below.
ARC Mate 100*i*C/12, ARC Mate 120*i*C/12L : 12kg
ARC Mate 100*i*C, ARC Mate 100*i*C/10S, ARC Mate 120*i*C/10L : 10kg
ARC Mate 100*i*C/7L : 7kg
ARC Mate 100*i*C/6L : 6kg
ARC Mate 120*i*C : 20kg
Do not change the payload of robot which has servo torch because it may cause breakage.
(It is impossible to change allowable payload depend on the shipment time.)

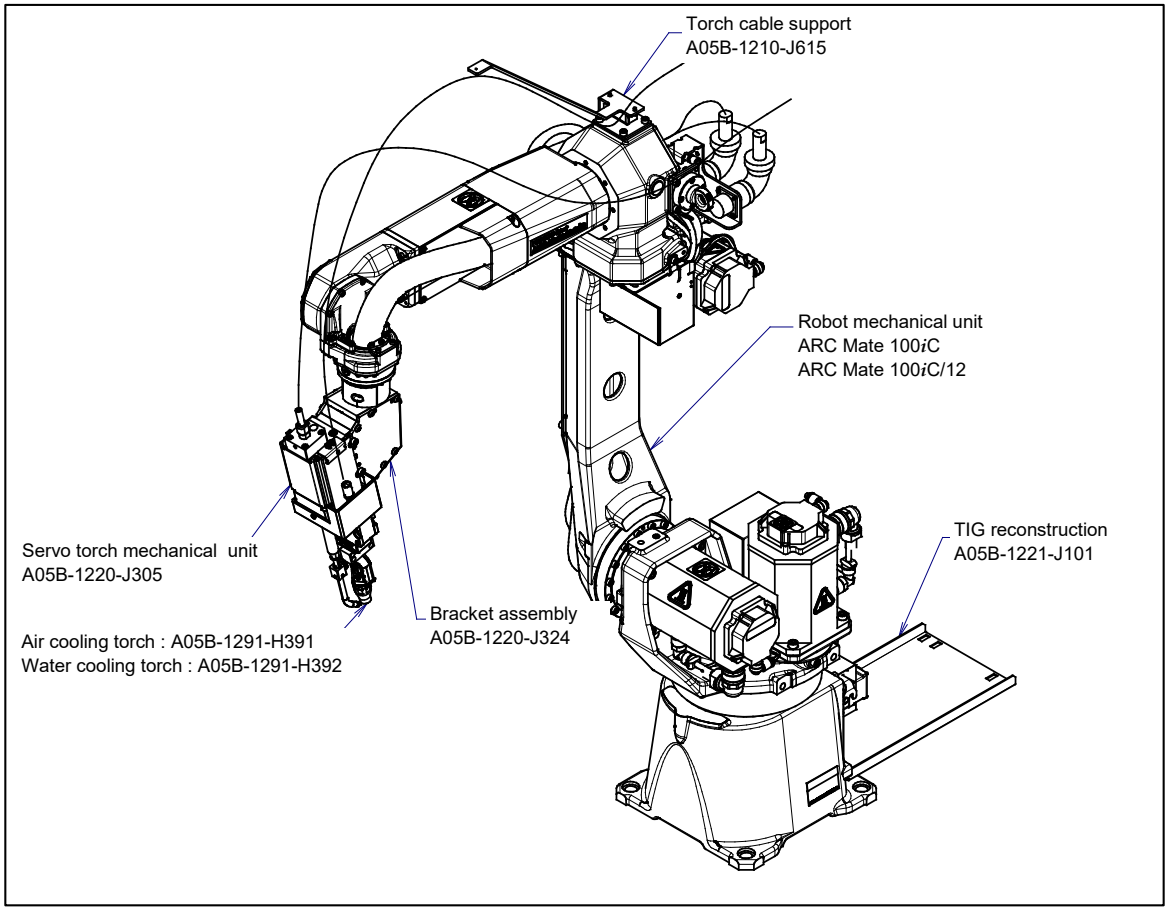


Fig. 1.2 (c) system structure (Servo torch for TIG)

1.3 STRUCTURE OF THE SERVO TORCH

Fig. 1.3 (a) shows the drive mechanism of the servo torch. The drive mechanism of the servo torch is such that the rotation of the AC servo motor is reduced using a gear to turn the wire feed rollers.

NOTE
You can setup Servo Torch axes in MAINTENANCE screen at controlled start status. Servo Torch axes are set as the axes of motion group 0.

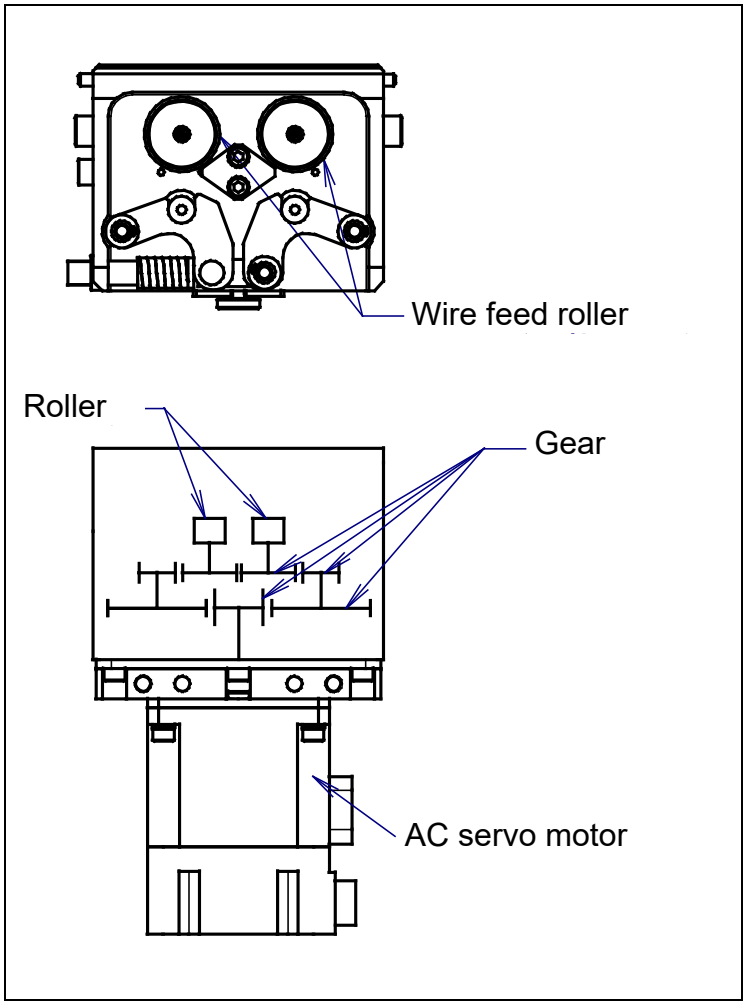


Fig. 1.3 (a) Servo torch drive mechanism

1.4 SENSE LEAD CABLE

Sense lead cable of the welding power supply is supplied to detect welding part voltage correctly.
For Power Wave R350, Power Wave R500, to use STT or Advanced module in welding, installing plus side and minus side are required.

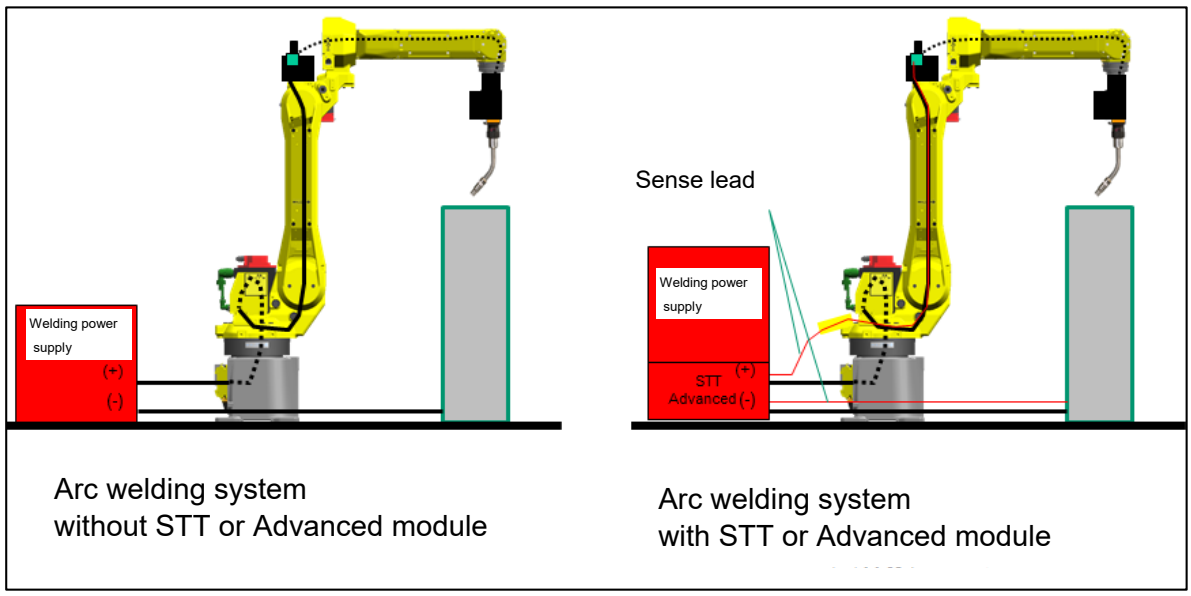


Fig. 1.4 (a) Installation of the sense lead cable

Below shows specifications of sense lead cable for servo torch.

Between welding power supply and robot mechanical unit
- A05B-1291-H582

For mechanical unit
- A05B-1220-J341 for ARC Mate 100*i*C series
- A05B-1220-J344 for ARC Mate 120*i*C series

1.5 AIR BLOW OPTION

To clean the spatters inside of the torch nozzle of servo torch, air blow option (A05B-1220-J390) is prepared. Fig. 1.5 (a) shows air blow option schematic. Air and gas are supplied from the J1 base backside. Refer to Section 2.2 for J1 base back side interface. To use this option, mechanical unit cable with RO X 2 is required.

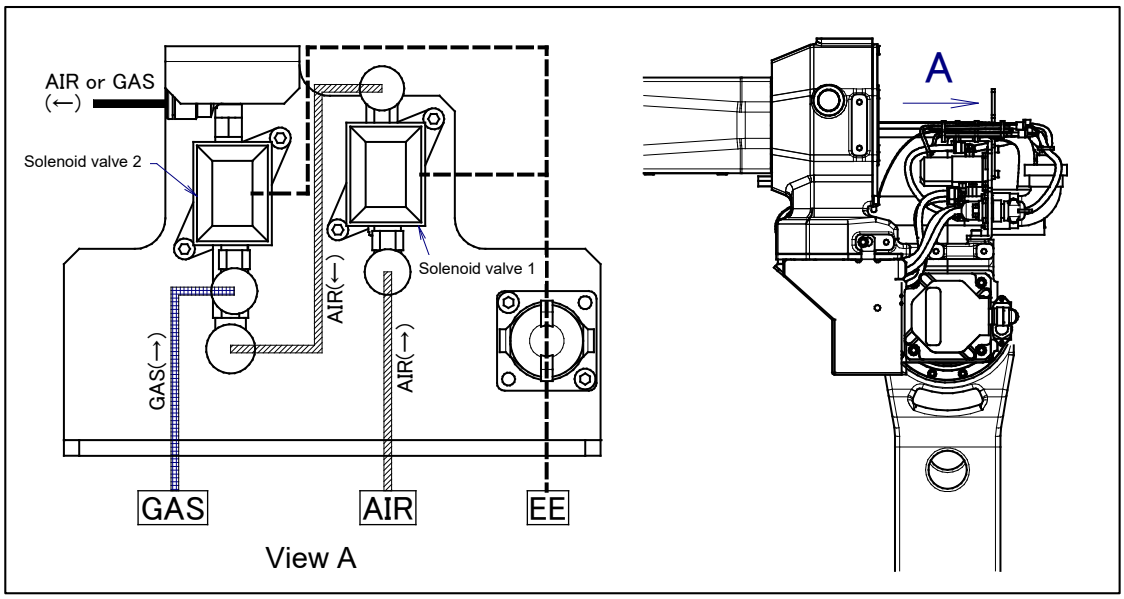


Fig. 1.5 (a) Air blow option schematic

Fig. 1.5 (b) shows circuit diagram.

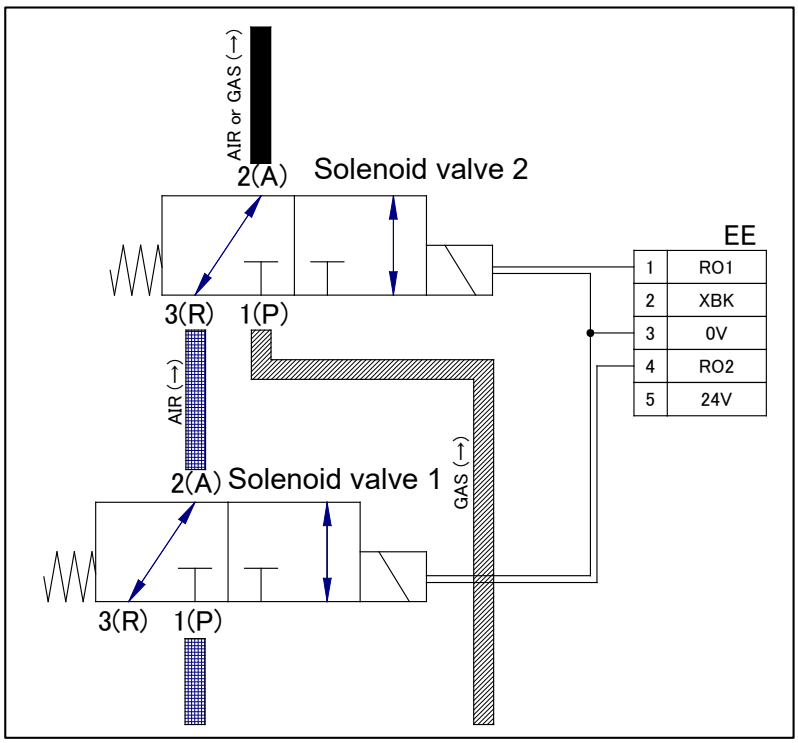


Fig. 1.5 (b) Air blow option circuit diagram.

2 INSTALLATION

When servo torch is shipped, you must attach feed roller and jamming roller. This chapter explains about the procedure.

2.1 ATTACHING ROLLER

(1) Replacing the feed rollers

1) Loosen the knob, open the cover, raise the adjusting bolts, then release the roller lever (2 places).
2) Remove the knurled nut while pressing the feed rollers.
3) Pull out the feed roller from the shaft.
4) Remove the feed roller on the opposite side in the same way.
5) Assemble new feed rollers by reversing the procedure above. Install feed rollers so that the spring pin stuck into the shaft sits in the groove on the bottom surface of each feed roller.

(2) Replacing the jamming roller

1) Loosen the knob, open the cover, raise the adjusting bolts, then release the roller lever (2 places).
2) Pull out the jamming roller from the roller lever (see the top of Fig. 2.1 (a)).
3) Pull out the pin stuck at the center of the jamming roller. and pull out the upper and lower bushings from the jamming roller,
4) Remove the opposite side in the same way.
5) For its assembly, please apply the steps above in reversed sequence.

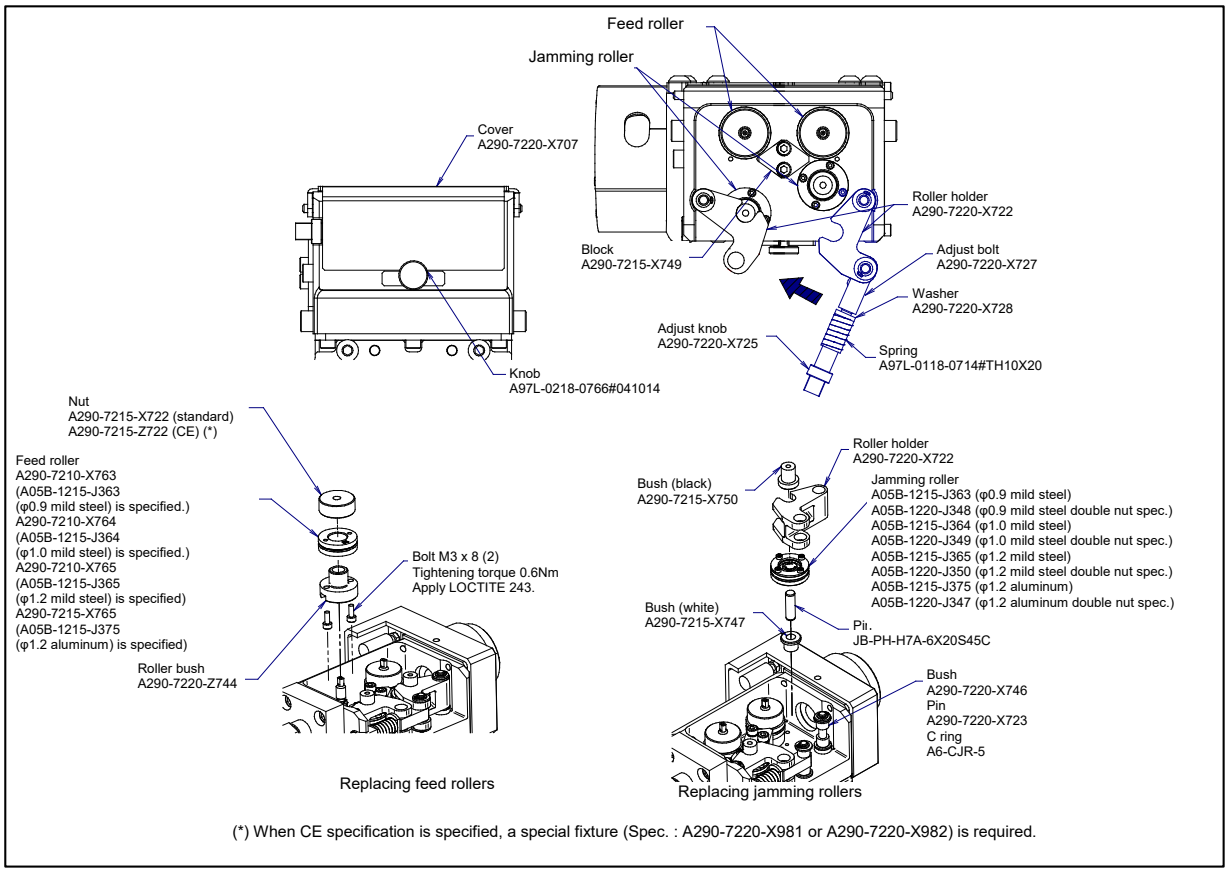


Fig. 2.1 (a) Attaching roller

When CE specification is specified, protector is attached around the feed roller.

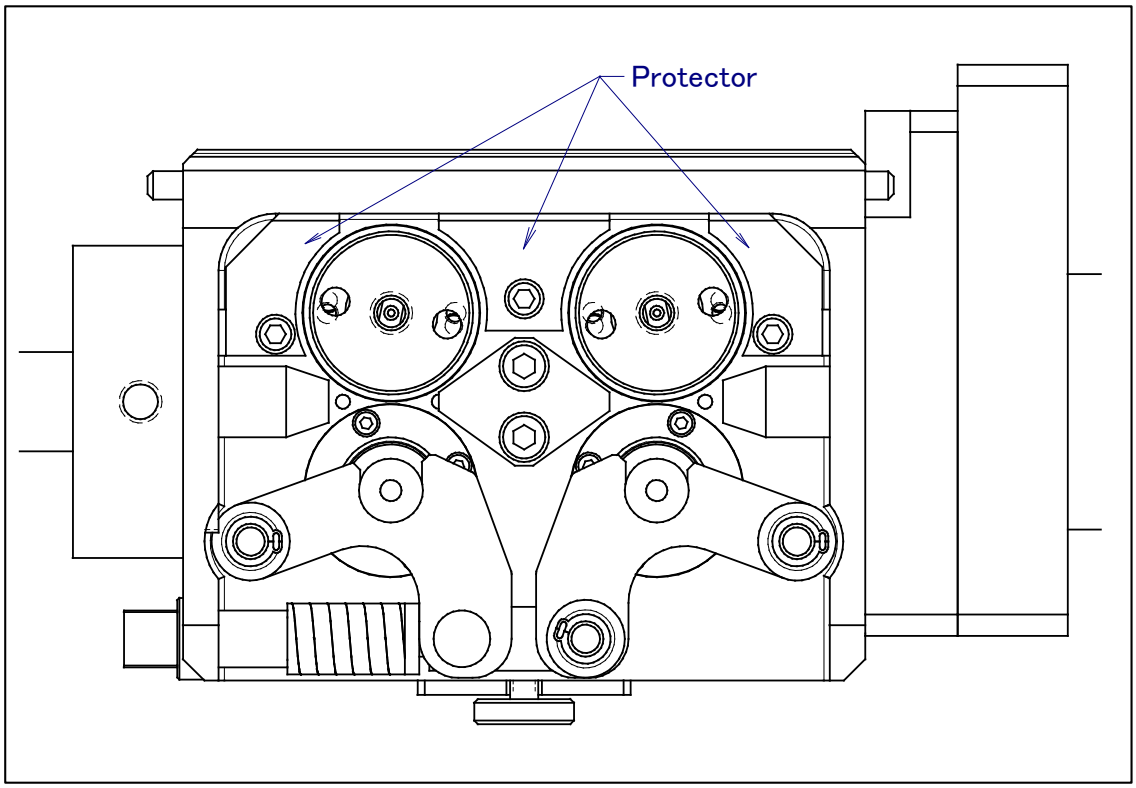


Fig. 2.1 (b) Protector (When CE specification is specified)

Fig.2.1 (c) shows method of using fixture (Spec: A290-7220-X981) to remove nut. It is necessary when CE specification is specified.

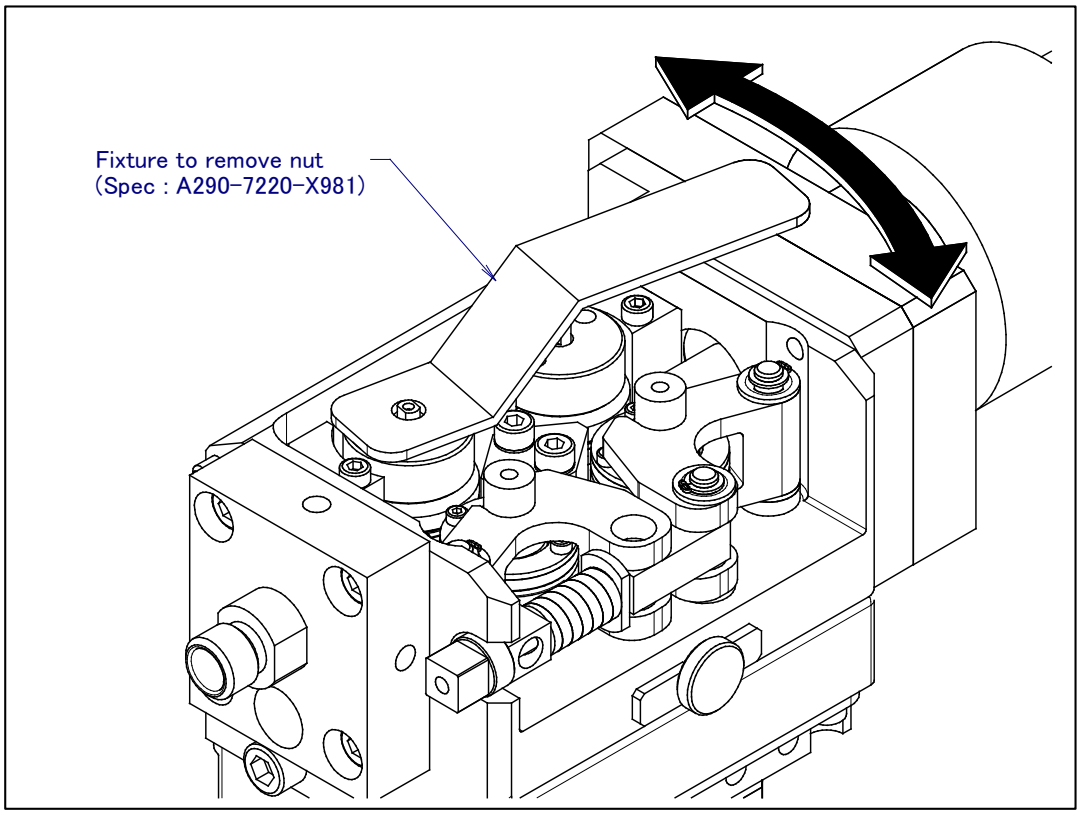


Fig. 2.1 (c) Fixture to remove nut (When CE specification is specified)

2.2 CABLE CONNECTION

Connect servo torch cable to J1 base of robot referring to Fig.2.2 (a) to (c).

> **⚠ CAUTION**
> When changing wire feeder made by LINCOLN by servo torch, do not use wire feeder control cable (between connector panel of robot main body and welding power supply). Be sure to use servo torch connection cable (between connector panel of robot main body and robot controller.
> If using wire feeder cable (between connector panel of robot main body and welding power supply) and turning on the power, it will cause breakdown of feeder head main board inside the welding power supply.

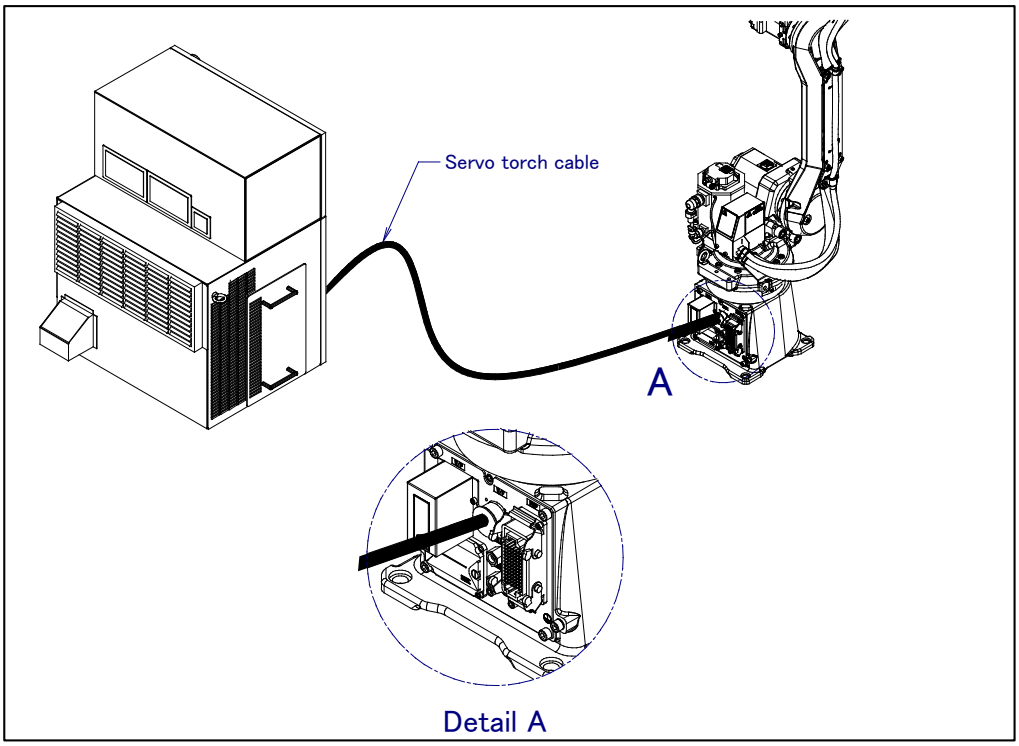


Fig. 2.2 (a) Cable connection

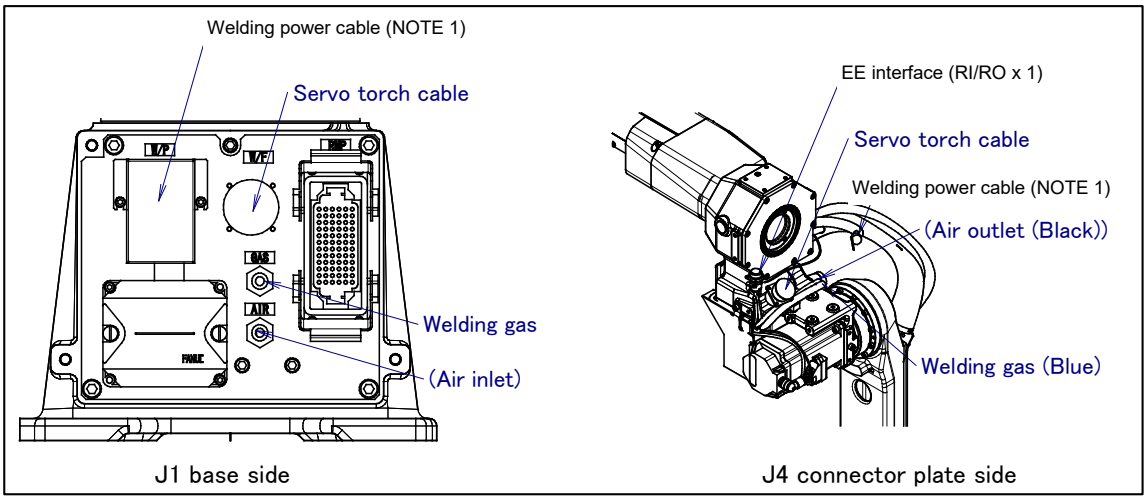


Fig. 2.2 (b) ARC Mate 100*i*C option cable interface
(A05B-1221-H202, H203, H206, H232, H233, H236, A05B-1224-H202, H203, H206, H232, H233, H236 are specified)

NOTE
1 These interfaces are attached only when A05B-1221-H203, H206, H233, H236, A05B-1224-H203, H206, H233, H236 are specified.
2 Tolerance electrical current of the welding power cable is 5A/mm^2.
Rated current of welding cable of A05B-1221-H203, H233 and A05B-1224-H203, H233 is 190A. (38mm^2 1 pcs)
Rated current of welding cable of A05B-1221-H206, H236 and A05B-1224-H206, H236 is 300A. (60mm^2 2 pcs)

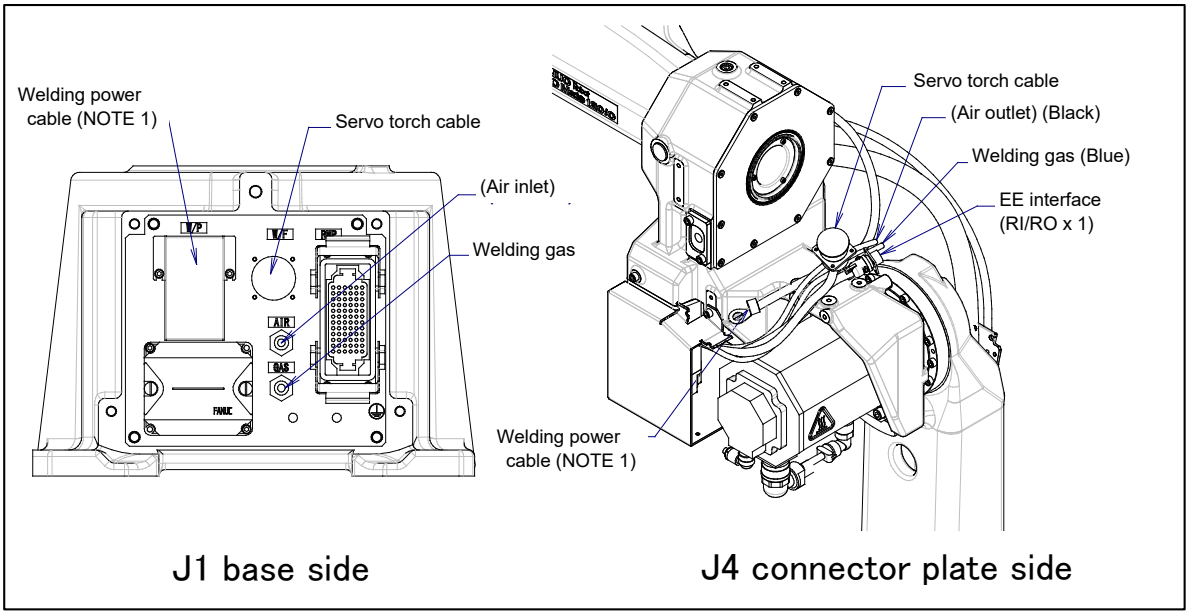


Fig. 2.2 (c) ARC Mate 120*i*C option cable interface
(A05B-1222-H202, H203, H206, H232, H233, H236, A05B-1225-H232, H233, H236 are specified)

NOTE
1 These interfaces are attached only when A05B-1222-H203, H206, H233, H236, A05B-1225-H233, H236 are specified.
2 Tolerance electrical current of the welding power cable is 5A/mm^2.
Rated current of welding cable of A05B-1222-H203, H233 and A05B-1225-H233 is 190A. (38mm^2 1 pcs)
Rated current of welding cable of A05B-1222-H206, H236 and A05B-1225-H236 is 300A. (60mm^2 2 pcs)

2.3 SERVO TORSH INSTLALLATION TO THE ROBOT

When the servo torch is not installed to the robot, install it to the robot according to Fig. 2.3. (a), (b).

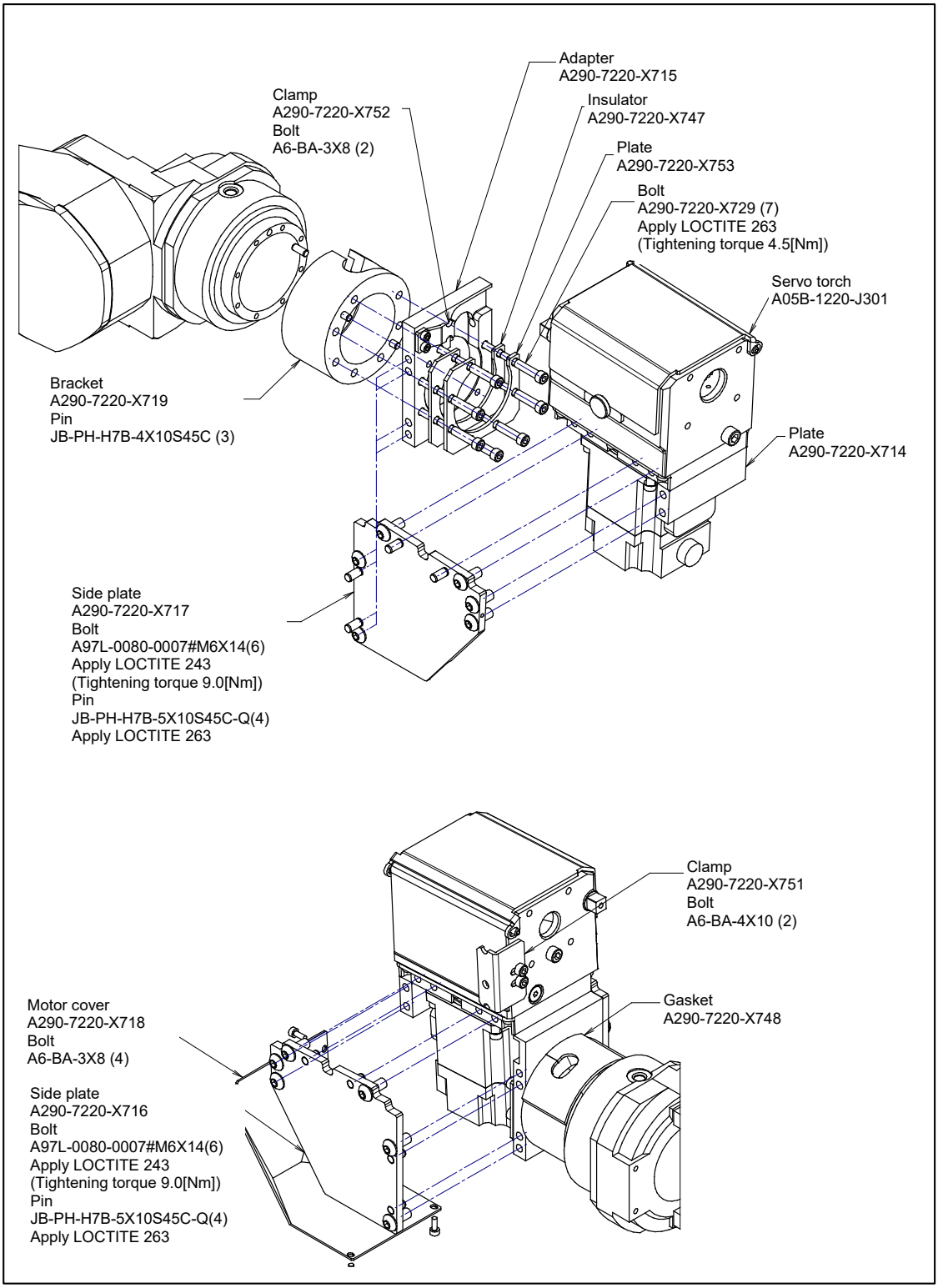


Fig. 2.3 (a) Servo torch for aluminum installation (Bracket assembly spec. A05B-1220-J321)

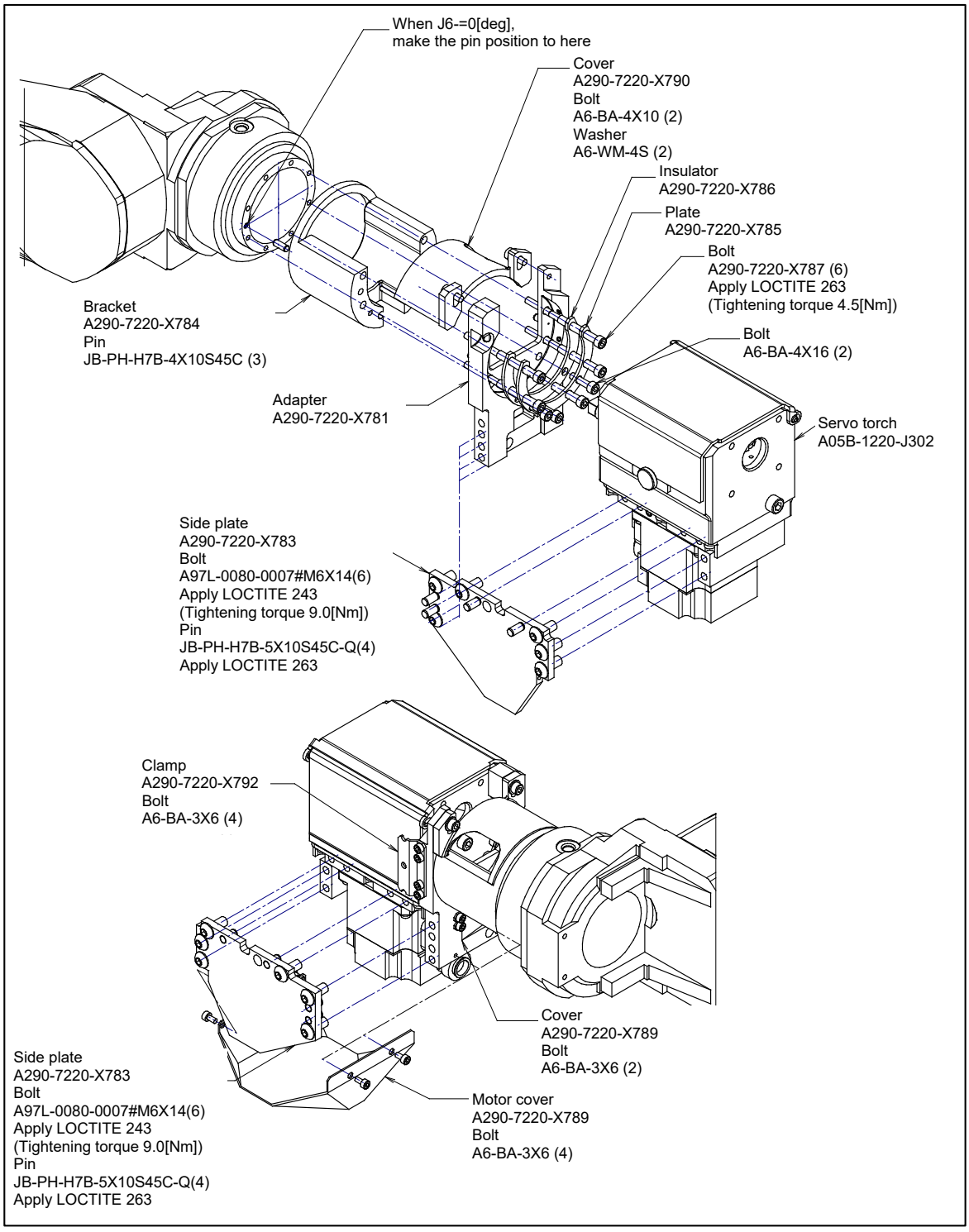


Fig. 2.3 (b) Servo torch for mild steel installation (Bracket assembly spec. A05B-1220-J323)

3 SOFTWARE SETUP

The Servo Torch is a mechanism which feeds welding wire by a servo motor. Servo Torch is controlled by Servo Torch control Software (Servo Torch Control function) on ArcTool software. Servo Torch Control function is supported in the Lincoln weld equipment configuration only.
Wire feeding by a servo motor always stabilize actual wire feed speed during welding and avoid influence of disturbance such as a bend of conduit tube by robot motion. This also enables high accuracy wire feeding. In case of aluminum welding, it is possible to stabilize the welding easily by using a heat wave function. About the heat wave function, please refer to the following manual according to your system.

R-30*i*B CONTROLLER : Chapter 10 in "R-30*i*B/R-30*i*B Mate/R-30*i*B Plus CONTROLLER Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3)"
R-30*i*A CONTROLLER : Section 13.20 in "R-30*i*A CONTROLLER ARC TOOL OPERATOR'S MANUAL (B-83124EN-3)"
R-30*i*A Mate CONTROLLER : Section 13.18 in "R-30*i*A Mate CONTROLLER LR ARC TOOL OPERATOR'S MANUAL (B-83134EN-2)"

Before using Servo Torch, "3.1 SETUP FOR SERVO TORCH" should be performed.

3.1 SETUP FOR SERVO TORCH

Following setups are required in order to use Servo Torch.
- Setup Servo Torch axis
- Setup in weld equipment setup screen
- Setup in Servo Torch setup screen

This section describes the details of these setups.

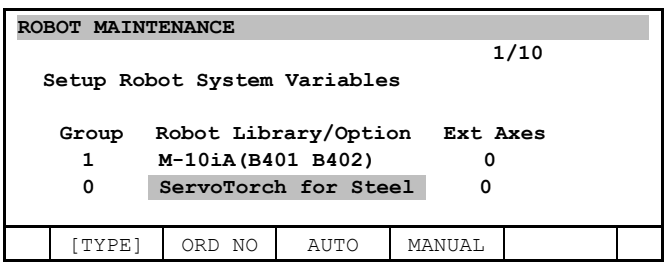
3.1.1 Setup Servo Torch Axis

You can setup Servo Torch axis in MAINTENANCE screen after controlled start. Servo Torch axis is set as the axis of motion group 0 (axis for no motion group).

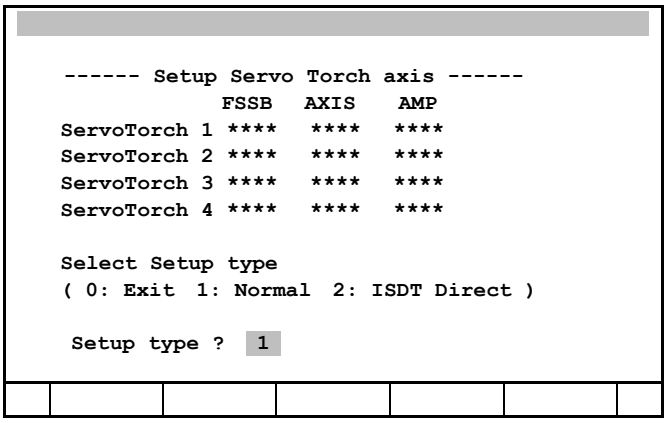
Procedure 3-1 Setup servo torch axis

Step

1 Turn on the controller with the [PREV] and the [NEXT] key pressed. Then select [3 Controlled start].
2 Press the [MENU] key and select [MAINTENANCE]. The following screen will be displayed.



3 Move the cursor to [ServoTorch for Steel] (or [ServoTorch for Alumi] in aluminum welding system) and press F4 [MANUAL]. Following screen is displayed. Select [1: Normal].



4 Input the number of Servo Torch axes. If only one ServoTorch is used, please enter 1. If two or more Servo Torches are used, please enter the number. The maximum number of Servo Torch axes is 4.

```
Enter number of axes (1 - 4)?:
```

5 Input the FSSB number for Servo Torch axis 1. It is necessary to input the appropriate FSSB number for Servo Torch axis corresponding to your hardware configuration. For more detail, please refer to the following manual according to your system.
R-30*i*B CONTROLLER : APPENDIX B.8 in "R-30*i*B/R-30*i*B Mate CONTROLLER OPERATOR'S MANUAL (Basic Operation) (B-83284EN)"
R-30*i*A CONTROLLER : APPENDIX C.8 in "R-30*i*A CONTROLLER ARC TOOL OPERATOR'S MANUAL (B-83124EN-3)"
R-30*i*A Mate CONTROLLER : APPENDIX B.7 in "R-30*i*A Mate CONTROLLER LR ARC TOOL OPERATOR'S MANUAL (B-83134EN-2)"

```
ServoTorch 1:
Enter FSSB number (1 - 3 or 5)?:
```

When the FSSB number for Servo Torch axis is 2, it is necessary to input the total number of axes used by FSSB 1.

```
Total number of axes on FSSB 1 ?:
(Current value = 6)
```

6 Input the hardware axis number.

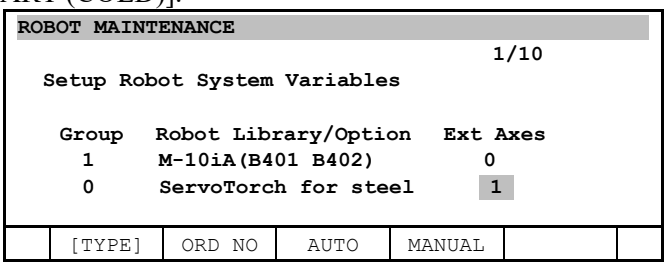
```
ServoTorch 1:
Enter hardware axis (1 - 32)?:
```

7 Input the amplifier number.

```
ServoTorch 1:
Enter amplifier number ?:
```

8 If the number of Servo Torch axes is set to 2 or more at step 4, questions of Step 5 - 7 are repeated for each Servo Torch. Please repeat the setup for each Servo Torch.

9 After a few seconds, the screen is returned to ROBOT MAINTENANCE screen. Check that the value of "Ext Axes" for [ServoTorch for Steel] (or [ServoTorch for Alumi] in aluminum welding system) matches with the number of Servo Torch axes (The following screen is the case that the number of Servo Torch is 1). According to this step, setting of Servo Torch axis is completed. Press FCTN key and select the [START (COLD)].



3.1.2 Setup in Weld Equipment Setup Screen

Wire type can be set in Weld equipment setup screen. In addition, Servo Torch setup screen is entered from this screen. Setting items and descriptions relates to Servo Torch are as following.

Table 3.1.2 (a) Setting items and descriptions relates to Servo Torch in Weld equipment setup screen

Item	Description
Wire size	Specifies diameter of welding wire. Cycle power is required to enable this changing.
Wire material	Specifies material of welding wire. Cycle power is required to enable this changing.
Servo Torch	Servo Torch setup screen is entered by pressing the [ENTER] key with the cursor located at 'DETAIL' of this item.

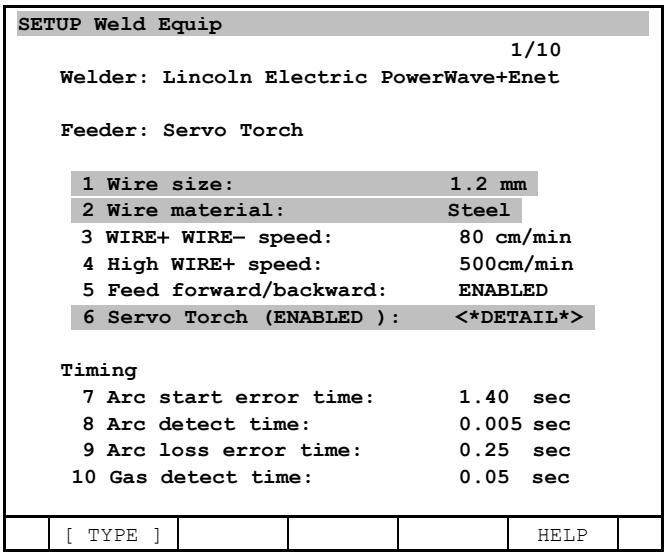
NOTE
Please set correct wire type. Otherwise correct wire feed speed is not issued at welding and welding is not performed correctly.

Procedure 3-2 Setup in weld equipment setup screen

Step

1 Press the [MENU] key and select [SETUP].

2 Press F1 [TYPE] and select [Weld Equip]. The following screen will be displayed.



3 Move the cursor to the item of [Wire size] or [Wire material]. Press F4 [CHOICE] and select desired items from displayed menu. When those settings are changed, please cycle power.
4 Move the cursor to [DETAIL] of the line of [Servo Torch] and press the [ENTER] key. Servo Torch setup screen is displayed. The next subsection explains items in Servo Torch setup screen.

3.1.3 Servo Torch Setup Screen

This screen is entered from Weld equipment setup screen.
Setting items and descriptions in this screen are as following.

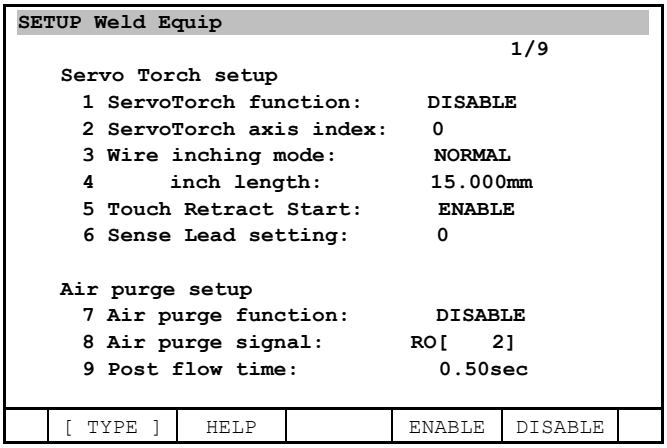
Table 3.1.3 (a) Setting items and descriptions in servo torch setup screen

Item	Description
ServoTorch function	Enable/Disable Servo Torch control function. Cycle power is required to enable this changing.
ServoTorch axis index	Specifies the Servo Torch axis index. Servo Torch axes are set as the axes of Group 0. The axis index to be specified is the index number of the axis in Group 0. If the index is set to 0, Servo Torch control function is disabled. Cycle power is required to enable this changing.
Wire inching mode	Specifies wire inching mode (NORMAL or CONSTANT).
Inch length (mm)	Specifies inching length in constant inching mode.
Touch Retract Start	This is enabled by default (This is defined as $SVT_CONFIG[Servo Torch axis index].$TCH_RET_ENA in system variable screen). This function is a function to reduce sputter at the arc start by generating an arc while retracting a wire after the wire touches to the work. For more detail, please refer to the Subsection 3.2.4.
Sense Lead setting	This must be set according to the sense lead connection and system configuration. If this setting is not correct, welding can not be performed correctly. This setting item is displayed in this screen at the V7.70 software or later. If this setting item is not displayed in your system, please change directly in system variable screen. This setting is defined by $AWELEWC[weld equipment number].$AO1_SEL. Cycle power of robot controller / weld equipment is required to enable this changing. In case of normal sense lead connection and system configuration, please refer to the following descriptions. • If your system does not use Servo Torch, it is not necessary to change this setting (the initial value is 0). • When the weld equipment is Lincoln PowerWave R350 or PowerWave R500, it is not necessary to change this setting from the default value. • When the weld equipment is Lincoln PowerWave 455M/STT, please set this to 3. • When the weld equipment is Lincoln PowerWave other than above-mentioned (ex: PowerWave i400), please set this to 2.
Air purge function	Enable/Disable air purge function.
Air purge signal	Specifies the kind of signal to control the solenoid valve for air purge. There is no need to change this setting for usual case. Please change this setting only when the wiring of the signal which controls the solenoid valve for air purge is different from standard specification. Default setting : Weld Eq.1 is RO[2], Weld Eq.2 is RO[10]
Post flow time (sec)	Specifies time between stopping Servo Torch and stopping air purge.

Procedure 3-3 Setup in servo torch setup screen

Step

1 Press the [MENU] key and select [SETUP].
2 Press F1 [TYPE] and select [Weld Equip] from the displayed menu.
3 Move the cursor to [DETAIL] in the line of [Servo Torch] and press the [ENTER] key. The following screen will be displayed.



4 Press F4 [ENABLE] after moving the cursor to [ServoTorch function]. And, input the appropriate Servo Torch axis number after moving the cursor to [ServoTorch axis index] (Normally, Servo Torch axis index number is 1 in the one Servo Torch configuration. In the two Servo Torch configuration, Servo Torch axis index 1 is for weld equipment 1 and Servo Torch axis index 2 is for weld equipment 2).
5 Input the appropriate number according to your configuration after moving the cursor to [Sense Lead setting].
6 Cycle power the robot controller and weld equipment (Setting in step 4 and 5 enables after cycle power).
7 If necessary, please execute the other settings in this screen. When the [PREV] key is pressed, displaying is return to Weld equipment setup screen from Servo Torch setup screen.

3.2 SERVO TORCH FUNCTION

3.2.1 Teaching of Arc Welding Instructions

Weld Start / End instructions are used as well as the not Servo Torch configuration.

3.2.2 Manual Wire Inching

Following two wire inching modes are prepared for Servo Torch.

- **Normal inching**
  Please hold the deadman switch and enable the teach pendant. And please switch to T1 or T2 mode. In that state, WIRE+ key or WIRE- key with holding SHIFT key on a teach pendant are used for feeding/retracting wire as well as an ordinary wire feeder. Wire feed speed is automatically changed to high speed when the feeding wire operation is executed over 2 sec.
- **Constant inching**
  Constant inching can be also executed according to the procedure of above Normal inching. However, inching speed is not changed to high speed. When wire inching is continued and wire is inched by specified length, wire inching is stopped automatically. The length to stop inching is specified in Servo Torch setup screen. If the keys are released before wire is inched by specified length, wire inching is stopped immediately.

NOTE
- Wire inching can be executed without SHIFT key in V7.50 software or later. However, inching speed is not changed to high speed with no SHIFT key inching.
- Remote wire inching can be performed only when the Servo Torch motor is activated as well as the manual wire inching.

3.2.3 Air Purge Function

Air purge function removes dust in Servo Torch wire feed mechanism by blowing high-pressured air. If the air purge option is attached to Servo Torch mechanism, air purge function enables following two operation.
- When the Servo Torch axis start moving, air purge starts.
- After the Servo Torch axis stops and the specified time (post flow time) passes, air purge stops.

Air purge is executed not only at welding but also at inching.
If Power Off stop is performed during air purge, post flow is not executed and air purge is stopped immediately.
Air purge can be executed manually in I/O screen by switching the status of the signal which is assigned as the air purge control signal.
When a RO or a DO is assigned as the air purge signal, a comment of "SVTorch air purge" is added for the signal in I/O screen.

Procedure 3-4 Manual execution of air purge

Condition
- The air purge option is attached to Servo Torch mechanism.
- Servo Torch control function is enabled.
- Air purge function is enabled.

Step
1 Press the [MENU] key and select [I/O].
2 Press F1 [TYPE] and select the screen corresponding to the type of the air purge control signal. This procedure explains the case that RO[2] is set as the air purge control signal (default setting). In this case, select the [Robot].
3 If the displayed screen is an input signal screen, press F3 [IN/OUT] to switch the screen into an output signal screen.
4 Move the cursor to the RO[2] and press F4[ON] or F5[OFF] to switch the status of the signal. If the status of the signal is ON, air purge is executed. If the status of the signal is OFF, air purge is stopped.

3.2.4 Touch Retract Start Function

3.2.4.1 Outline

Please refer to following figures about the outline of the touch retract start.
If the software is before 7DA7 (V7.70) series and improved touch retract start option (A05B-xxxx-J583) is not ordered, sequences of wire preheat and arc heat input (described in 3 and 6 in following figure) can not be executed. Even if the software is before 7DA7 (V7.70) series, improved touch retract start option enables those sequences. And, those are enable if the software is 7DC1 (V8.10) or later.

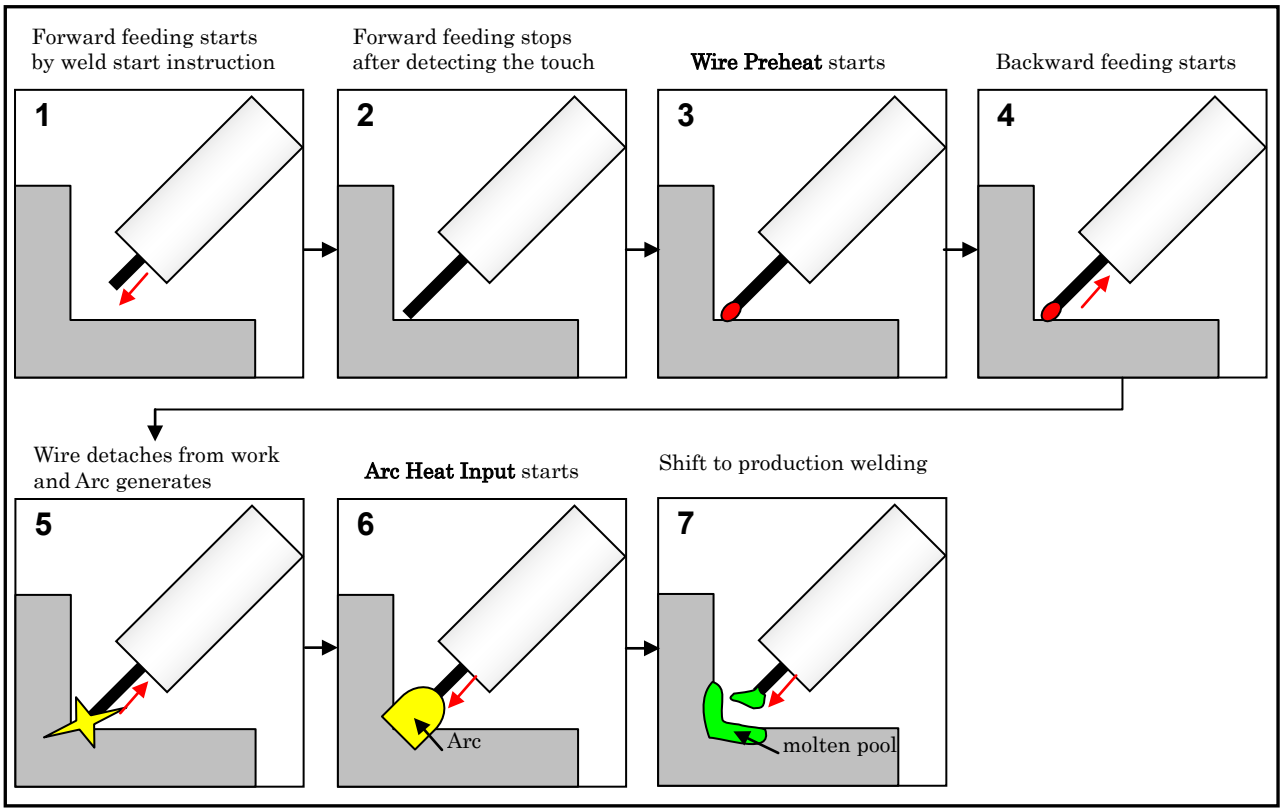


Fig. 3.2.4.1(a) Outline of touch retract start motion

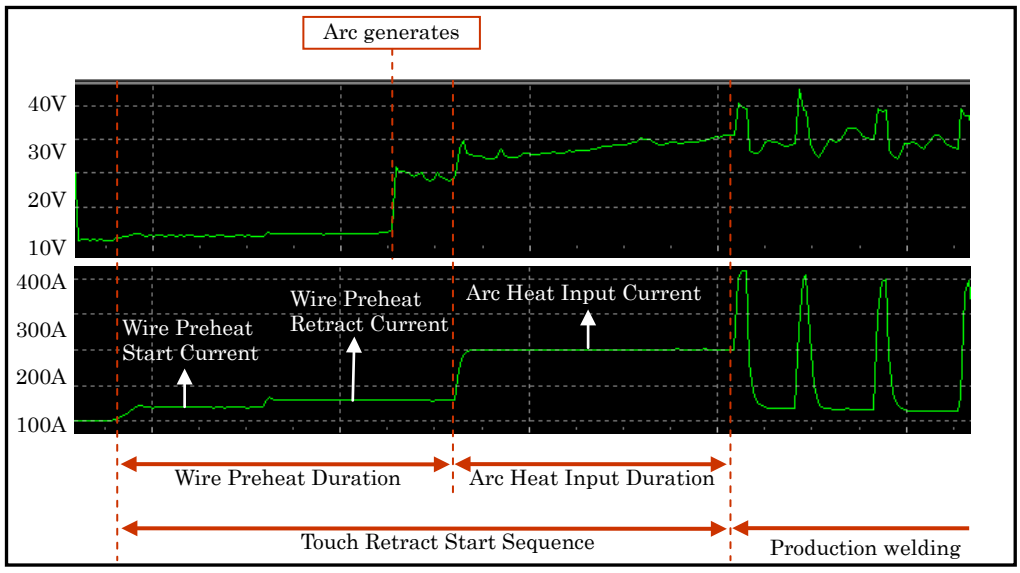


Fig. 3.2.4.1(b) Sample waveform of voltage/current during touch retract start

3.2.4.2 Setup touch retract start

Setting items and descriptions concerning to touch retract start are as following.

Table 3.2.4.2 (a) Setting items and descriptions for Touch Retract Start

Item	Description
TchRetract Sch (Touch Retract Mode)	First, please confirm that the setting of [Wire size] (this item exits in SETUP Weld Equip screen) is set correctly. Setting result of this item changes corresponding to the [Wire size]. This item has selection menus that are shown below. Please select the touch retract mode corresponding to welding wire material and welding process (CV, Pulse, etc.) that are used in your system. When this setting is done, all settings of touch retract start (wire preheat setting, arc heat input setting) are automatically set to the recommended value. Therefore, touch retract start setting is normally finished by this selection. It is possible to adjust each setting items if you are not satisfied with the performance of arc start by the recommended setting of touch retract start. Please note that the current settings are reset to recommended value when the touch retract mode is changed. ● **NO heating** (This is named [Initialize] in the 7DA7/14 or before) Touch retract start is executed with no wire preheat and no arc heat input. This mode ignores the wire preheat setting and arc heat input setting. ● **Steel -Pulse** (This is named [Pulse] in the 7DA7/18 or before) Recommended values for pulse welding with steel wire are automatically set. ● **Steel -Pulse(heat+)** (This is named [Pulse(heat+)] in the 7DA7/18 or before) Recommended values for pulse welding with steel wire are automatically set. And this mode increases the weld penetration around the weld start position. However, please note this mode has a tendency that the top of welding bead becomes big because the arc heat input duration is long. ● **Steel -STT** (This is named [STT welding] in the 7DA7/18 or before) Recommended values for STT welding with steel wire are automatically set. ● **Steel -CV** (This mode is not supported in the 7DA7 series or before) Recommended values for CV welding with steel wire are automatically set. ● **Aluminum -CV,Pulse** (This is named [Aluminum] in the 7DA7/18 or before) Recommended values for any welding with aluminum wire are automatically set. ● **Stainless -CV,Pulse** (This mode is supported in 7DA7/19 or later) Recommended values for any welding with stainless wire are automatically set. ● **For general use** (This mode is supported in 7DA7/19 or later) Please select this mode when the system executes the welding excluding above-mentioned touch retract modes. Recommended values for this mode are not prepared. So it is necessary to set all settings of touch retract start manually.
Wire Preheat Start Current (Amps)	This item specifies the 1st current command during wire preheat (Refer to Fig. 3.2.4.1(b)). If this item is not displayed in your software version, please set the value of $SVT_TRS[servo torch axis index].$TRS_CURR1 (unit : [Amps]) in system variables screen. In the case of aluminum welding, the tip of wire easily melts and wirestick occurs if a lot of wire preheat is executed. If it occurs, there is an adverse effect to the touch retract motion. So it is necessary to set this to low. In the aluminum welding, this is normally set to 10A - 40A. In the excluding the aluminum welding, this is normally set to 40A. In addition, it is impossible to specify the wire preheat start duration (The duration is always constant).

Item	Description
Wire Preheat Retract Current (Amps)	This item specifies the 2nd current command during wire preheat (Refer to Fig. 3.2.4.1(b)). There is an effect of promoting the tip of wire melt. If the tip of wire is not easily melts, metal transfer is not executed smoothly. As the result, spatter generates by thrusting the wire into the work. In the aluminum welding, this is normally set to 20A - 60A. In the excluding the aluminum welding, this is normally set to 60A - 200A.
Wire Preheat Time	This item specifies the 2nd current duration during wire preheat. This is normally set to 0.01sec – 0.1sec.
Wire Preheat WFS (Wire retract speed after the wire preheat)	When the tip of wire detaches from the work, arc generates. This item specifies the wire retract speed after the wire preheat ends. Unit is the same to wire speed units that system uses (this is defined at [Wire speed units] in controlled start screen). If this is too slow, spatter generates because the tip of molten wire touches to the work. If this is too fast, there is a possibility that the generated arc lost or wirestick at contact tip. Please set this speed as slow as possible in a range where the spatter is not generated. This is normally set to -100cm/min - -350cm/min.
Arc Heat Current (Amps)	This item specifies the current command during arc heat input. There is an effect that the surface of work melts by the arc heat input. It is possible to reduce the spatter because the tip of molten wire is adsorbed to the surface of molten work. Please note that it is necessary to adjust the [Arc heat WFS] (Wire Feed Speed during arc heat input) if this current is changed (Please refer to the following item of [Arc heat WFS]). This is normally set to 60A - 300A.
Arc Heat Time	This item specifies the duration of arc heat input. Arc Heat duration can not be adjusted to [Arc detect time] (this is defined in SETUP Weld Equip screen) or less. This is normally set to 0.005sec - 0.150sec.
Arc Heat WFS (Wire feed speed during arc heat input)	This item specifies the wire feed speed during arc heat input. Unit is the same to wire speed units that system uses (this is defined at [Wire speed units] in controlled start screen). It is necessary to setup arc heat input parameters (Amps, Time, this item) synthetically. When this speed is too slow compared with a certain arc heat input current, there is a possibility that the generated arc lost or wirestick at contact tip because of the wire burnback. Even if those problems are not generated, the bead shape around weld start position tends to become worse because the arc heat input sequence shifts to the production welding in the state of long arc length. When this speed is too fast compared with certain arc heat input current, there is a possibility that the generated arc lost or spatter generates because the wire thrusts into the work during arc heat input. It is necessary to adjust this speed for the maximum effect of arc heat input. That means, the tip of wire keeps the position as near as possible to the work in a range where the spatter is not generated. This is normally set to 200cm/min - 1000cm/min. Please note that the adjustment of this speed may ineffectual when the arc heat time is very short (for example, 0.005sec). Because the execution time of wire feed speed is also very short. In that case, it is necessary to adjust those parameters synthetically.

Before executing the following procedure 3-5 and 3-6, please confirm the top item name that is displayed at DATA menu (press F1[TYPE] key after pressing DATA key). If it is [Weld Sched], please execute the procedure 3-5. If it is [Weld Procedure], please execute the procedure 3-6.

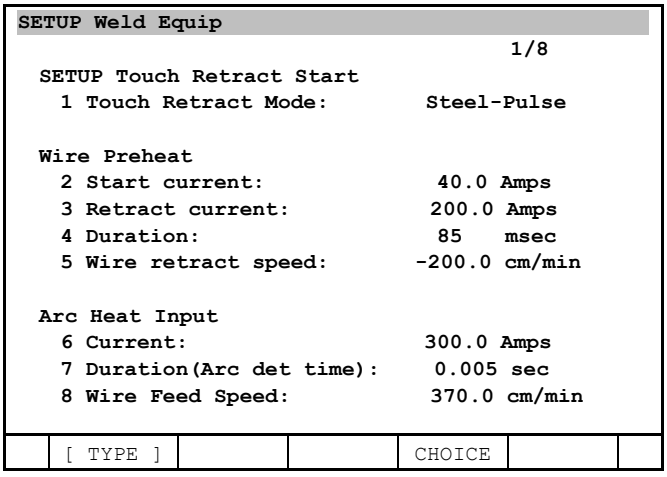
Procedure 3-5 SETUP Touch Retract Start (in the case of [Weld Sched])

Condition

- Initial setting of Servo Torch is already finished (Refer to Section 3.1)
- Improved Touch Retract Start option (A05B-XXXX-J583) is ordered if the software is 7DA7 series or before
- The firmware of Lincoln welder receives this function (welder has the welding mode 220)
- The communication between robot controller and Lincoln welder has been established

Step

1 Press the [MENU] key and select [SETUP].
2 Press F1 [TYPE] key and select [Weld Equip]. SETUP Weld Equip screen will be displayed.
3 Move the cursor to [Servo Torch] and press the [ENTER] key. SETUP Servo Torch screen will be displayed.
4 Move the cursor to [Touch Retract Start] and press F3[DETAIL]. Following screen will be displayed.



5 When the [Touch Retract Mode] is set, all settings are automatically set to the recommended value corresponding to the specified mode. So it is not necessary to set each touch retract settings. If you are not satisfied with the performance of recommended value or desired touch retract mode is not exists (in the case of [For general use] is selected), please adjust manually each touch retract settings. About the manual setting, please refer to the next subsection.

Procedure 3-6 SETUP Touch Retract Start (in the case of [Weld Procedure])

Condition

- Initial setting of Servo Torch is already finished (Refer to Section 3.1)
- Improved Touch Retract Start option (A05B-XXXX-J583) is ordered if the software is 7DA7 series or before
- The firmware of Lincoln welder receives this function (welder has the welding mode 220)
- The communication between robot controller and Lincoln welder has been established

Step

1 Press F1 [TYPE] key after pressing DATA key. Select [Weld Procedure] from the displayed menu. DATA Weld Procedure screen is displayed.

2 Move the cursor to [Procedure] that you would like to use and press [ENTER] key. Following screen is displayed. It is possible to setup enable/disable of touch retract start in each weld procedures. By the way, the setup enable/disable of touch retract start is also exists in SETUP Servo Torch screen (refer to step 1-3 in procedure 3-5), it defines enable/disable of touch retract start in the servo torch axis. If it disabled, touch retract start is disabled in all weld procedures that uses the servo torch axis (In the DATA Weld Procedure screen, the setting item of [Touch Retract] is not displayed).

```
DATA  Weld Procedure  1
                                    1/14
  - Procedure          1[              ]
     Weld equipment:  1
     Manufacturer:     Lincoln Electric
     Model:            PowerWave+Enet
     File name:        AWE1WP01
     Schedules:        3

     Touch Retract:          ENABLED
     Runin:                  DISABLED
     Burnback:               ENABLED
     Wirestick resets:   3   ENABLED
     Ramping:                DISABLED

     Gas purge:               0.35  sec
     Gas preflow:             0.00  sec
     Gas postflow:            0.00  sec
     Arc End pre-time:           0 msec
     Strike wire feed speed:  125cm/min

[ TYPE ] DETAIL [CMND] [VIEW] HELP
```

3 Confirm that the [Touch Retract] is enabled. If it is disabled, please enable it.

4 Move the cursor to [Schedules] and press the [ENTER] key. Following screen is displayed.

```
DATA  Weld Procedure  1
                                    3/13
  + Procedure          1[              ]
    + Mode            21[CV            ]
    - Schedules

  TchRetract Sch setup:  For general use

  TchRetract Sch #     Amps    Time     WFS
  Wire Preheat Start   40.0    ----     ---
  Wire Preheat         60.0    0.010  -200.0
  Arc heat             60.0    0.005   225.0

  Schedule      Amps   Volts  Speed  Time
  Sch      1    200.0  20.0   20.0   0.00
  Sch      2    200.0  20.0   20.0   0.00
  Sch      3    200.0  20.0   20.0   0.00

[ TYPE ] DETAIL [CMND] [VIEW] HELP
```

5 When the [TchRetract Sch setup] is set, all settings are automatically set to the recommended value corresponding to the specified touch retract mode. So it is not necessary to set each touch retract settings. If you are not satisfied with the performance of recommended value or desired [TchRetract Sch setup] is not exists (in the case of [For general use] is selected), please adjust manually each settings. About the manual setting, please refer to the next subsection.

3.2.4.3 Manual setup touch retract start

Please refer to the following procedure about the manual setup of touch retract start.

Procedure 3-7 Manual SETUP Touch Retract Start

Condition

- Though you set the touch retract mode and confirm the performance of touch retract with recommended parameters, you are not satisfied with it. Or, desired touch retract mode is not exists (in the case of [For general use] is selected). In those cases, please execute this procedure.
- Beforehand, please define the production weld schedule (It is not necessary to consider the spatter at the beginning of arc start). Please define the production weld schedule for desired weld penetration, desired beat shape, etc.
- Beforehand, please define the weld end schedule (craterfill and burnback). The tip of wire condition influences the phenomenon of arc generation by the touch retract start. Therefore, it is necessary to define the weld end schedule beforehand to stabilize the tip of wire condition at previous welding. The ideal condition is that the tip of wire is not a large globular more than the wire diameter.

Step

1 **This step checks whether the spatter is reduced or not when the amount of wire preheat is increased or decreased.**
If your system is aluminum welding, it is not necessary to execute this step (the reason is explained at the item of [Wire Preheat Start Current] and [Wire Preheat Retract Current] in Table 3.2.4.2 (a)).
First, please confirm the value of wire preheat duration. If the value is 10msec - 20msec, please change it to 30msec - 50msec. If this value is originally over 30msec, it is not necessary to change. After that, please confirm whether the spatter is reduced or not with changing the wire preheat retract current. In this confirmation, amount of this increment or decrement is about 20Amps. Normally, the confirmation range is from 60Amps to 200Amps. If the spatter is reduced, please find the best value of wire preheat retract current. Besides, there is no problem to shorten the wire preheat duration as long as the spatter is not generated. If the spatter generates yet, please proceed to step 2.

2 **This step checks whether the spatter is reduced or not when the wire retract speed is increased or decreased.**
Please confirm whether the spatter is reduced or not with changing the wire retract speed. In this confirmation, amount of this increment or decrement is about 10cm/min. If this is too slow, spatter generates because the tip of molten wire touches to the work. If this is too fast, there is a possibility that the generated arc lost or wirestick at contact tip. Please set this speed as slow as possible in a range where the spatter is not generated. Normally, the confirmation range is from -100cm/min to -350cm/min. If the spatter is reduced, please find the best value of wire retract speed. If the spatter generates yet, please proceed to step 3.

3 **This step checks whether the spatter is reduced or not when the wire feed speed during arc heat input is increased or decreased.**
This step adjusts the appropriate value of wire feed speed during arc heat input with keeping the recommended current that is defined by selecting touch retract mode. The appropriate value of wire feed speed exists responding to the arc heat input current. When the wire feed speed is too slow compared with certain arc heat input current, there is a possibility that the generated arc lost or wirestick at contact tip because of the wire burnback. Even if those problems are not generated, the bead shape around arc start position tends to become worse because the arc heat input sequence shifts to the production welding in the state of long arc length. When the wire feed speed is too fast compared with certain arc heat input current, there is a possibility that the generated arc lost or spatter generates because the wire thrusts into the work during arc heat input. It is necessary to adjust the wire feed speed during arc heat input for the maximum effect of arc heat input. That means, the tip of wire keeps the position as near as possible to the work in a range where the spatter is not generated. Normally, the confirmation range is from 200cm/min to 1000cm/min. Please note that the adjustment of the wire feed speed may ineffectual when the arc heat input duration is very short (For example, 0.005sec). Because the execution time of wire feed speed is also very short. In that case, it is necessary to adjust those parameters synthetically. If the spatter is reduced, please find the best value of wire feed speed. If the spatter generates yet, please proceed to step 4.

4 **This step checks whether the spatter is reduced or not when the amount of arc heat input current is increased or decreased.**
Please change the value of arc heat input current in the range of about ±50Amps from the recommended value. When the value of arc heat input current is changed, it is necessary to adjust the value of wire feed speed during arc heat input again (Please refer to step 3). If the spatter is reduced, please find the best value of arc heat input current / wire feed speed during arc heat input. If the spatter generates yet, please proceed to step 5.

5 **This step checks whether the spatter generates or not after the touch retract sequence.**
There is a possibility that the spatter generates after touch retract sequence even if no spatter generates during touch retract sequence. In this case, the robot begins the motion before the arc steadies. Please add the WAIT instruction (0.01sec - 0.1sec) at just behind the weld start instruction, and confirm whether the spatter is reduced or not. On the other hand, there is other method that uses runin schedule. If runin is enabled, runin sequence is executed after the touch retract sequence. After that, welding shifts to the production welding. It is possible to adjust the arc state arbitrarily after the touch retract sequence because runin schedule can be set to a special schedule independent of a production weld schedule. And, it is possible to increase/decrease the welding commands from runin schedule to production welding schedule smoothly by ramping function.
About the runin, please refer to the following manual according to your system.
R-30*i*B CONTROLLER: Subsection 3.5.5 in "R-30*i*B/R-30*i*B Mate/R-30*i*B Plus CONTROLLER Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3)"
R-30*i*A CONTROLLER: Subsection 12.1.7 in "R-30*i*A CONTROLLER ARC TOOL OPERATOR'S MANUAL (B-83124EN-3)"
R-30*i*A Mate CONTROLLER: Subsection 12.1.7 in "R-30*i*A Mate CONTROLLER LR ARC TOOL OPERATOR'S MANUAL (B-83134EN-2)"

About the ramping function, please refer to the following manual according to your system.
R-30*i*B CONTROLLER: Chapter 9 in "R-30*i*B/R-30*i*B Mate/R-30*i*B Plus CONTROLLER Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3)"
R-30*i*A CONTROLLER: Section 13.13 in "R-30*i*A CONTROLLER ARC TOOL OPERATOR'S MANUAL (B-83124EN-3)"
R-30*i*A Mate CONTROLLER: Section 13.13 in "R-30*i*A Mate CONTROLLER LR ARC TOOL OPERATOR'S MANUAL (B-83134EN-2)"

3.3 ATTENCTIONS AND LIMITATIONS FOR USE

- Wire type

This function supports following types of welding wire.

Wire material:
Steel, Steel (flux cored), Aluminum

Wire diameter:
0.6mm(steel), 0.9mm(steel), 1.0mm(steel), 1.2mm(steel, steel(flux cored), aluminum), 1.6mm(steel, aluminum)

- Recovery from alarms of 'Pulse mismatch', 'BZAL' and 'RCAL' (SRVO-038, 062, 063)

To recover from these alarm, for Servo Torch axes(Group:0), set sysvars of $IS_MCR.$SPC_RESET to TRUE and cycle power.

4 CHECKS AND MAINTENANCE

By performing preventive maintenance, the Servo Torch performance can be maintained. The preventive maintenance items and maintenance tools of servo torch are described below. For the preventive maintenance of the main unit of each servo torch model, refer to the following operator's manual:

ARC Mate 100*i*C
: FANUC Robot ARC Mate 100*i*C, M-10*i*A, ARC Mate 100*i*Ce, M-10*i*Ae OPERATOR'S MANUAL (B-82754EN)
: FANUC Robot ARC Mate 100*i*C/12/7L/12S/8L,M-10*i*A/12/7L/12S/8L OPERATOR'S MANUAL (B-83654EN)
ARC Mate 120*i*C
: FANUC Robot ARC Mate 120*i*C, M-20*i*A OPERATOR'S MANUAL (B–82874EN)
Welding power supply
: R-30*i*B/R-30*i*B Mate Controller ARC Welding Power Supply Option (LINCOLN/FANUC Welding Power Supply) OPERATOR'S MANUAL (B-83614EN-1)

4.1 DAILY CHECKS

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

NOTE
At the time of welding, be careful not to directly touch the high–temperature sections such as the nozzle, tip, and torch. Before replacing a component near the torch, turn off the power and confirm that the torch is cooled down.

Item	Check items	Check points and management
1	Cable abnormality	See Chapter 8.
2	Vibration, abnormal sound, and motor heat–up	Check if each axis is moving smoothly.
3	Secure and precise operation of peripheral equipment	Check if commands from the robot and peripheral equipment ensure secure and precise operation.
4	Tip	Replace the tip if its hole is enlarged or abnormal.
5	Nozzle	Replace the nozzle if it is deformed.
6	Liner	Check if powder is attached to the liner. If it is attached, clean the liner. (See Section 7.3.) Replace the liner if its inlet hole is enlarged. (See Section 7.1.)
7	Wire feed section	Open the cover of the wire feed section, then check if the wire is set correctly in the roller groove. Check also for dust. Remove dust if any.
8	Inlet guide liner (Servo torch for aluminum)	Confirm whether a blue resin part of the inlet guide liner is worn, and a wire is not about to short-circuit to a brass inlet guide. (See Fig. 4.1 (b).)
9	Neck liner	Check if powder is attached to the neck liner. If it is attached, clean the neck liner.
10	Torch power supply section	Check if the screws used to secure the crimp terminal are loose.
11	Torch assist gas supply section	Check if the piping for torch assist gas is attached to the joint correctly.
12	Torch cable connection section	Check if the screw of the torch cable connection section is loose.
13	Jamming roller	Check if jamming rollers are loosen.
14	Water cooling hose	Check if water leak from water hose.
15	Cleaning and checking each part	Clean each part (remove chips, etc.) and check component parts for cracks and flaws.

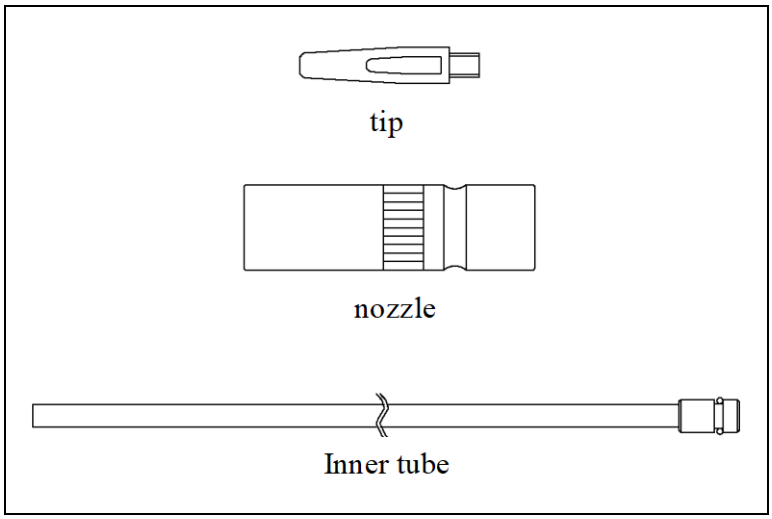


Fig. 4.1 (a) Daily checks

Note about aluminum welding

When the aluminum welding compares it with mild steel welding, there is the following characteristic.

- A melting point is low, in the case of a sheet, penetration is easy to occur.
- Specific heat, a thermal conductivity, fusion latent heat are big, and melting of the welding start department is insufficient. (It is necessary to supply much heat rapidly for welding.)
- Coefficient of thermal expansion is big, and transformation and residual stress are easy to occur in the weld.

Thus, it is necessary to warn the following points about the aluminum welding.

- Do not use rubber hose for shield gas piping (hose) to prevent moisture absorption.
- As for the execution environmental humidity, 80% please.
  When the humidity exceeds 80%, blowholes (an aluminum welding defect) suddenly increase.
- For the dew point management of the shielding gas, purge it before welding for 20 minutes, and please do below the dew point -45 degrees.
- Adjust the arc length appropriate, do not make it too long or too short.
- Make welding posture downward or direction long. Do not make it sideways-facing or an upswing.
- Make sealing up safekeeping by all means in order that a wire and the basic material prevent influence such as the moisture.
- Validate retract function and use heat wave function to raise welding stability margin. (Refer to Chapter 3.)

Fig. 4.1 (b) Inlet guide liner

4.2 PERIODIC CHECK AND MAINTENANCE

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

Check and maintenance intervals (Operation time, Operation accumulated time)					Check and maintenance items	Check points, management and maintenance methods	Periodic maintenance table No.
1 month 320h	3 months 960h	6 months 1920h	1 year 3840h	3 years 11520h			
○					Roller situation	Confirm whether there is abnormal abrasion. If trash is attached around, remove it.	1
○					Inlet guide liner replacement (Servo torch for aluminum)	Replace inlet guide liner.	2
	○ Only 1st check	○			Loose connector	Check if the motor connector and other connectors are loose.	3
	○ Only 1st check	○			Loose bolt	Check if the cover mounting bolt and external mounting bolts are loose.	4
	○ Only 1st check	○			Clean spatters, sawdust and dust	Remove spatter, dust, and so forth from the mechanical section.	5
	○ Only 1st check	○			Cleaning and replacement of the liner	See Chapter 8.	6
	○ Only 1st check	○			Neck liner replacement	See Chapter 8.	7
			○		Roller replacement	See Section 2.1.	8
			○		Flexible conduit replacement	See Section 8.5.	9
			○		Torch cable replacement	See Chapter 9.	10
				○	Replacement of the grease	See Chapter 5.	11

4.3 MAINTENANCE TOOLS

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

(1) Measuring instruments

Instruments	Condition	Applications
Dial gauge	1/100 mm	Measurement of positioning and backlash
Slide calipers	150 mm	

(2) Tools

Cross–head screwdrivers : Large, medium, and small sizes
Straight-head screwdrivers : Large, medium, and small sizes
Nut drivers : wide across flats 2.5,3,4,5,6,8,10,12 for replacing each part
Hex key set : wide across flats 2.5,3,4,5,6,8,10,12 for replacing each part
Torque wrench
Adjustable wrenches : Medium and small sizes
Pliers
Cutting pliers
Cutting nippers
Offset box end wrench
Grease gun
Gear puller
Separator
Flashlight

5 PERIODIC MAINTENANCE

Before greasing, be sure to turn off the controller power. Moreover, be sure to use the specified type of grease.

According to below, replace the grease of the gearbox in cycle that is shorter among every three years and 11520 hours by using the following procedures. See table 5 (a) for the grease name and the quantity for gearbox.

1 Remove the seal bolt from grease outlet.
2 Feed the grease specified in Table 5 (a) through the grease nipple. Feed grease until new grease is output after the old grease through the grease outlet. At this time, ensure that the amount of output grease equals the amount of new fed grease so that the grease path is not fully filled.
3 Check that grease output through the grease outlet has stopped. Then seal the removed seal bolt with sealing tape, and attach it to the grease inlet and outlet.

Table 5 (a) Grease name and amount to be replaced at regular intervals of three years (11520 hours)

Greasing points	Amount of grease to be applied	Gun tip pressure	Specified grease
Gearbox	50g	0.1MPa or less (NOTE)	(Specification: A98L-0040-0174)

NOTE
When using a hand pump, apply grease approximately once per two seconds.

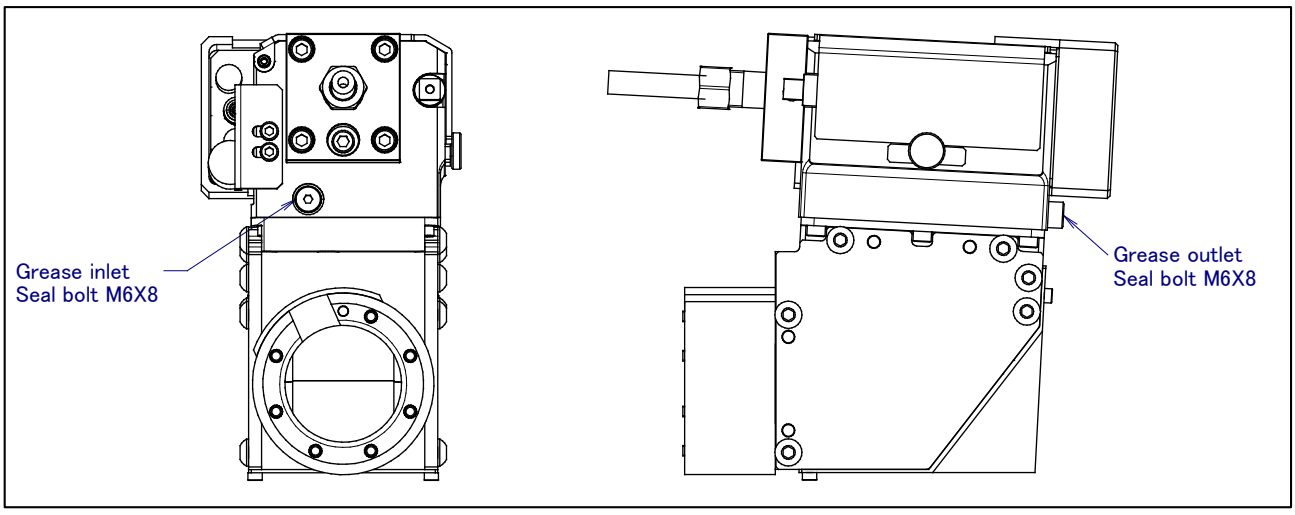


Fig. 5 (a) Greasing point (Servo torch for aluminum)

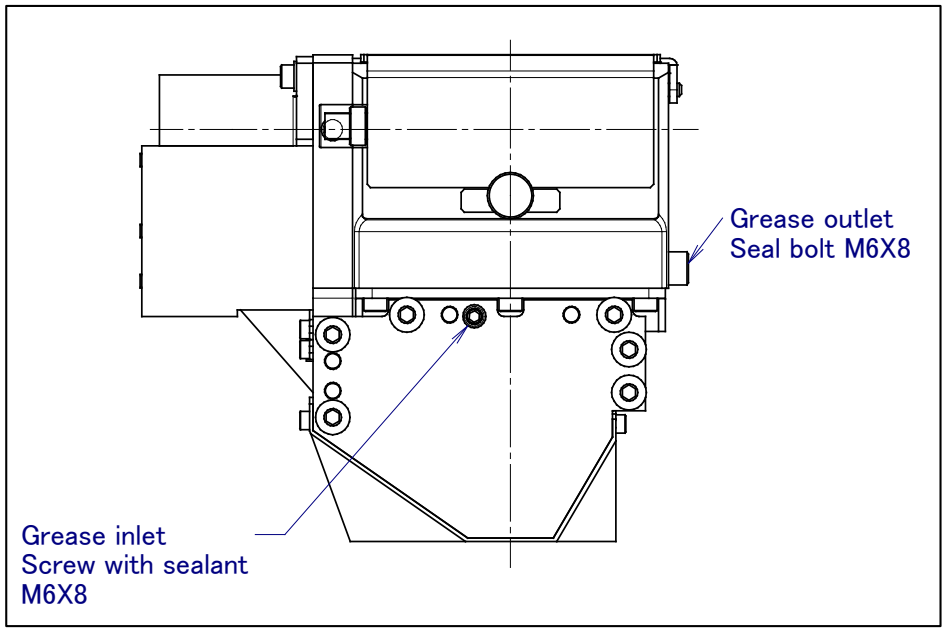


Fig. 5 (b) Greasing point (Servo torch for mild steel)

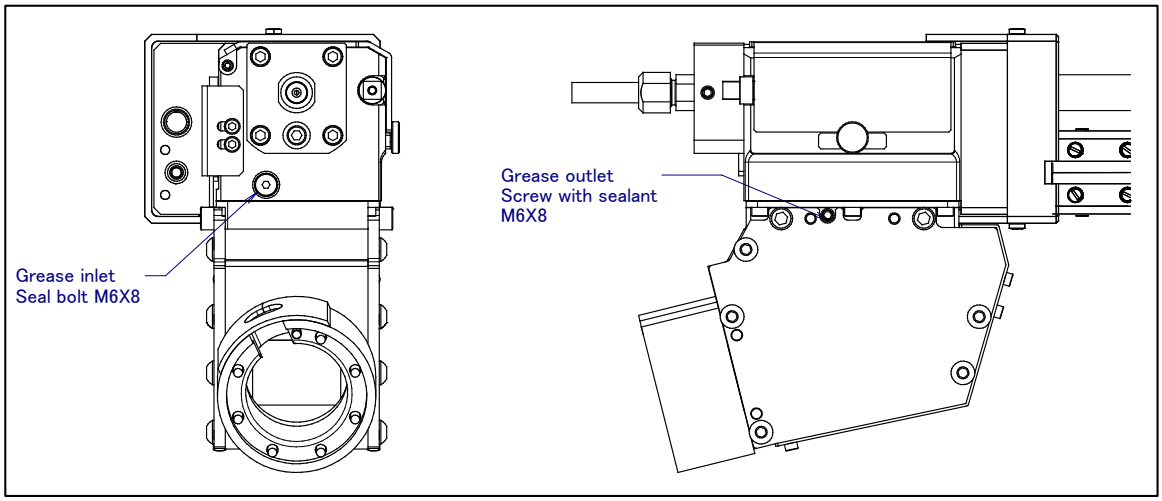


Fig. 5 (c) Greasing point (Servo torch for TIG)

⚠ CAUTION

Failure to follow proper lubrication procedures may cause the suddenly increase of the grease bath internal pressure and the damage to the seal, which could lead to grease leakage and abnormal operation. When greasing, observe the following cautions.

1 Before starting to grease, be sure to remove the seal bolt or screw with sealant from the grease outlet.
2 Supply grease slowly, using a manual pump.
3 Whenever possible, avoid using an air pump, which is powered by the factory air supply.
  If the use of an air pump is unavoidable, supply grease with the pump at a pressure lower than or equal to the gun tip pressure (see Table 5 (a)).
4 Use specified grease. Use of non-approved grease may damage the reducer or lead to other problems.
5 To prevent the accident like slipping, fire, remove all the excess grease from the floor and robot.

6 TROUBLESHOOTING

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. So, it is necessary to analyze the symptoms of the failure precisely so that the true cause can be found.

6.1 TROUBLESHOOTING

Table 6.1 (a) indicates troubleshooting for the servo torch. If the cause of a failure cannot be identified or action to be taken cannot be determined, contact your local FANUC representative.
For component replacement or adjustment for repair, see Chapter 7 and 8.

Table 6.1 (a) Troubleshooting

Symptom	Cause	Measure	Remark
Wire feed trouble	The roller jamming force is not adjusted.	Adjust the roller jamming force.	See Section 7.2.
	The roller groove is dirty.	Clean the roller groove.	See Section 8.2.
	The roller groove is worn.	Replace the roller.	See Section 2.1.
	An abnormal load is imposed on the wire reel.	Remove the load.	
	The wire conduit is twisted abnormally.	Correct the twist.	
	The roller diameter is incorrect.	Replace the roller with a roller whose diameter matches the wire diameter.	See Section 2.1.
Abnormal termination of reference position return operation	The external start signal is abnormal.	Make a check.	Contact your local FANUC representative.
	A parameter is specified incorrectly.	Correct the parameter.	Contact your local FANUC representative.
Incorrect positioning	Something hit the robot.	Correct the taught point.	
	The robot is not firmly fixed.	Fix it.	
	Peripheral equipment has shifted.	Fix it.	
	Incorrect parameter setting	Correct it.	Contact your local FANUC representative.
	Broken cable	Replace the cable.	See Chapter 9.
	Pulsecoder error	Replace the motor.	See Section 8.4 and 8.5.
	Backlash in the mechanical unit	If positioning pins are not installed, install then	
Vibration	The robot is not firmly fixed.	Fix it.	
	The floor is vibrating (especially when the robot is installed on the second floor or above).	Re–examine the location of installation.	
	Servo maladjustment	Adjust the servo section.	Contact your local FANUC representative.
	Broken cable	Replace the cable.	See Chapter 9.
	Robot not grounded	Ground the robot.	Refer to “Maintenance Manual for the Controller”.
	Defective motor	Replace the motor.	See Section 8.4 and 8.5.
	Defective axis printed–circuit board	Replace the axis printed–circuit board.	Refer to “Maintenance Manual for the Controller”.

Symptom	Cause	Measure	Remark
Vibration	Invalid time constant setting	Change the time constant.	Contact your local FANUC representative.
	Backlash in the mechanical unit — see the backlash or wobbling part.		
Backlash or wobbling	Loose screw or pin	Tighten it (and apply LOCTITE to it if specified so)	
	Worn bearing	Replace the bearing	Contact your local FANUC representative.
	Broken casting or other part	Replace the broken component.	Contact your local FANUC representative.
Abnormal heat generation	Worn bearing	Replace the bearing	Contact your local FANUC representative.
	Non–specified grease used	Replace the grease.	See Chapter 5.
	Invalid time constant setting	Change the time constant setting.	Contact your local FANUC representative.
Grease leakage	Deteriorated or broken O–ring, or oil seal	Replace the O–ring, or oil seal	Contact your local FANUC representative.
	Broken casting or other part	Replace the broken component.	Contact your local FANUC representative.
	Loose screw	Tighten it.	

7 ADJUSTMENT

The robot is shipped from the factory after each section of the mechanical unit is adjusted to the optimal state. Therefore, you do not need to make any adjustments when robot is delivered.
However, after using robot for a long time or replacing components, make adjustments according to the specifications in this chapter.

7.1 MASTERING

Mastering is an operation that matches the axis angle of each axis of the robot with the pulse count value of the absolute pulse coder connected to each axis motor. Specifically, this operation finds a pulse count value at the zero position. Perform mastering of the main robot unit and mastering of the servo torch separately.

7.1.1 Mastering of the Main Robot Unit

Before mastering of the main robot unit, the servo torch must be detached.
For the method of mastering of the main robot unit, refer to the operator's manual of the main robot unit.

7.1.2 Mastering of the Servo Torch

You do not have to perform mastering for servo torch.

7.2 ADJUSTING ROLLER JAMMING FORCE

With the servo torch, the force of the roller for nipping a wire is changed by adjusting the jamming force of the spring with an adjustment knob. Based on Table 7.2 (a) and (b), adjust the spring. Read the scale with respect to the right edge of the view port.

Table 7.2 (a) Value of scale and jamming force (Servo torch for aluminum/TIG)

Scale	Jamming force (kgf)
1	5.6
2	9.5
3	13.3
4	17.1
5	21.0

Table 7.2 (b) Value of scale and jamming force (Servo torch for mild steel)

Scale	Jamming force (kgf)
1	10.3
2	17.3
3	24.2
4	31.2
5	38.2

Table 7.2 (c) Spring adjustment

Wire diameter	Mark (from left edge)
0.8	3
0.9	3
1.0	3
1.2	3
1.6	3

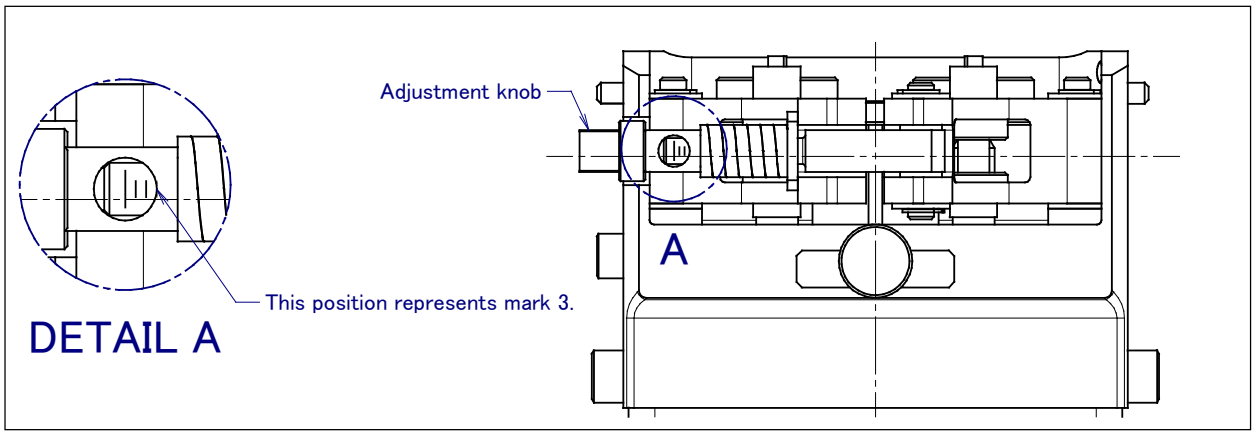


Fig.7.2 (a) Adjusting roller jamming force

When you pressurize jamming roller, First loosen looseness protection nut then pressurize jamming nut by rotating jamming nut. If you rotate only looseness protection nut and rotate with jamming, screw might be broken.

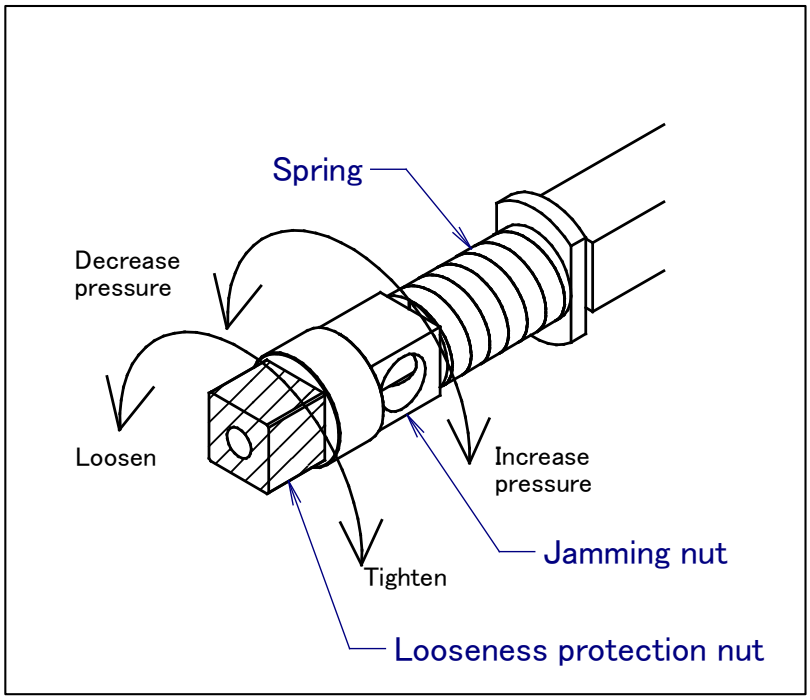


Fig.7.2 (b) Note when jam the roller

8 REPLACING PARTS

8.1 REPLACING THE TORCH

Replacement of Standard water–cooled torch (Torch for aluminum/mild steel)

1 Rotate root of torch counter clockwise by hand and remove torch from adapter.
2 Remove torch and clean the inner tube. When hole of entrance become large, replace neck liner. Length of neck liner is adjusted usually. Order spec. is A14L-0166-0321#783XFS01.

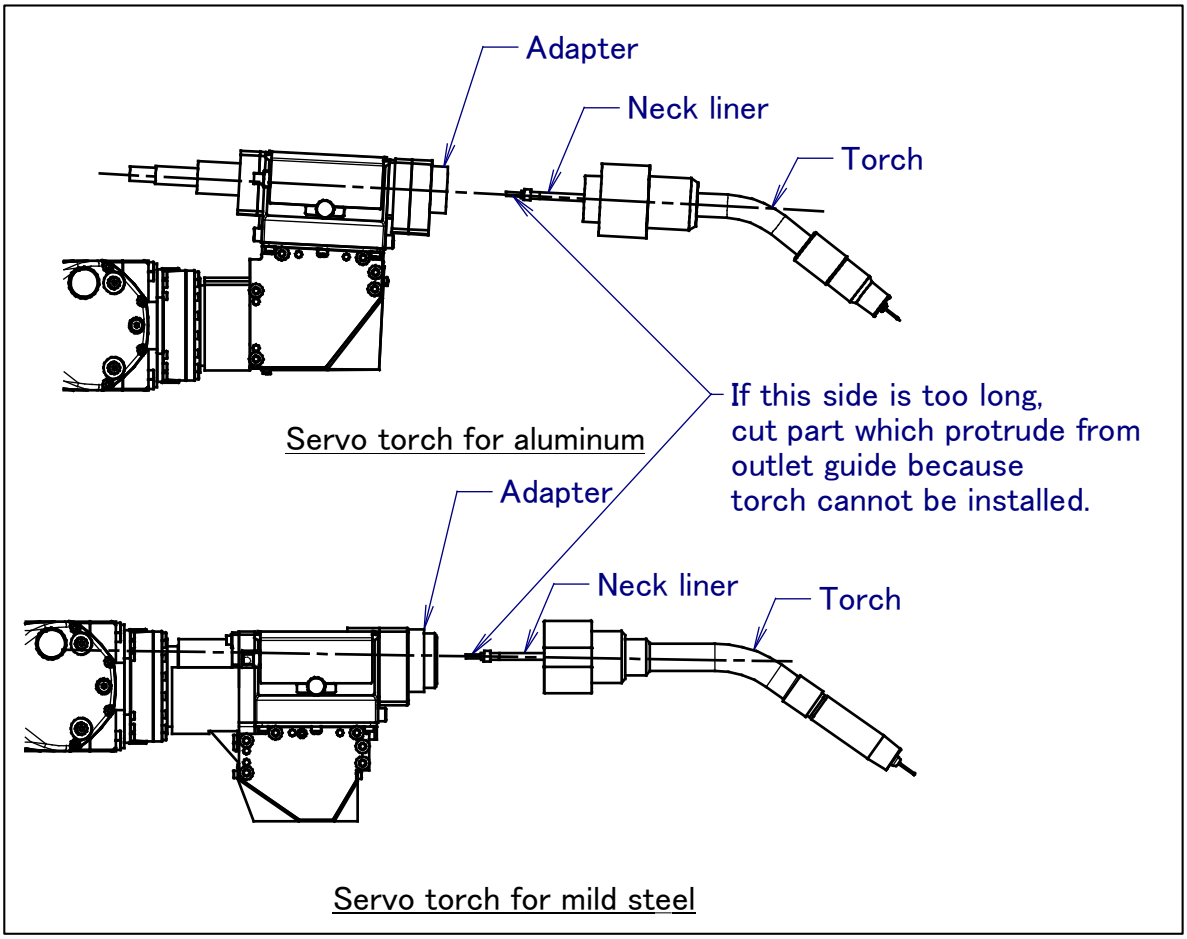


Fig. 8.1 (a) Replacing the torch (Servo torch for aluminum and mild steel)

Replacement of TIG torch neck

1 Remove bolts M3X8 (2pcs).
2 Loosen the nut of nozzle and remove the nozzle.
3 Remove the screw and remove the earth line and earth ring.
4 Knock over the lever and pull out torch from main body.
5 Replace torch neck by new one.
6 Assemble it. For its assembly, please apply the steps above in reversed sequence.
7 Adjust the nozzle position using nozzle position adjust screw and nut.

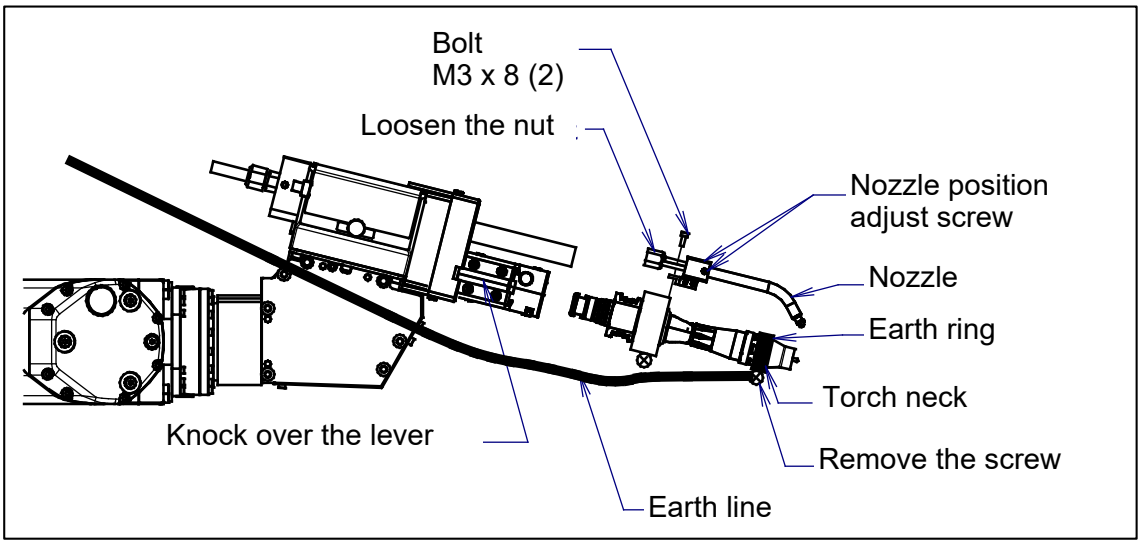


Fig. 8.1 (b) Replacing the torch (Servo torch for TIG)

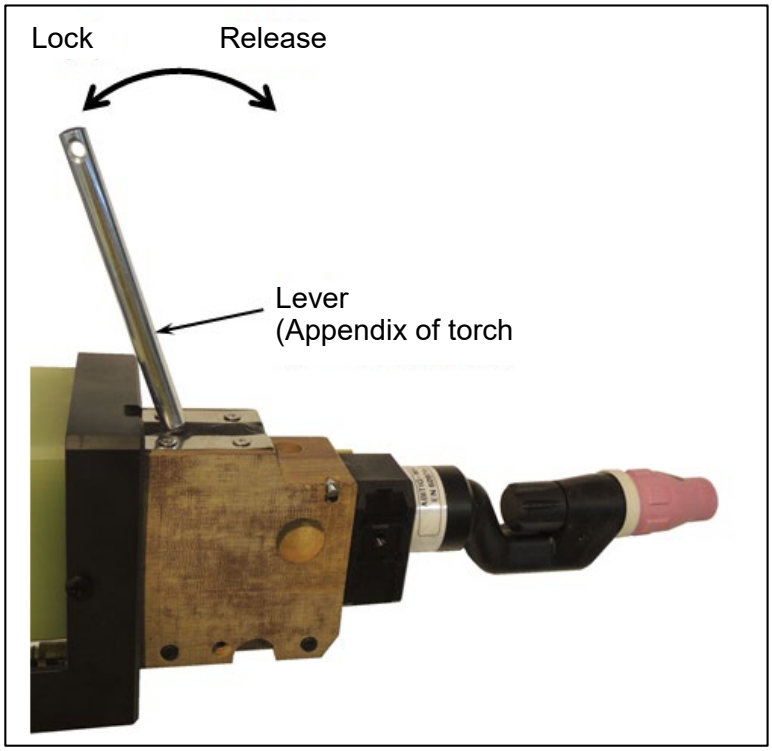


Fig. 8.1 (c) Lever for TIG torch

8.2 REPLACING THE ROLLER

Cleaning the feed rollers and jamming roller

1 Loosen the adjustment knob, then release the roller lever.
2 Clean off dust around the feed rollers and jamming roller.
3 Assemble the feed rollers and jamming roller by reversing the procedure above.

8.3 REPLACING THE MOTOR COVER

1 Remove the motor cover mounting M3 bolts (4pcs). In case of servo torch for TIG, remove plate mounting bolts (2 pcs), too.
2 Remove the motor cover.
3 Replace old motor cover by new one. For its assembly, please apply the steps above in reversed sequence.

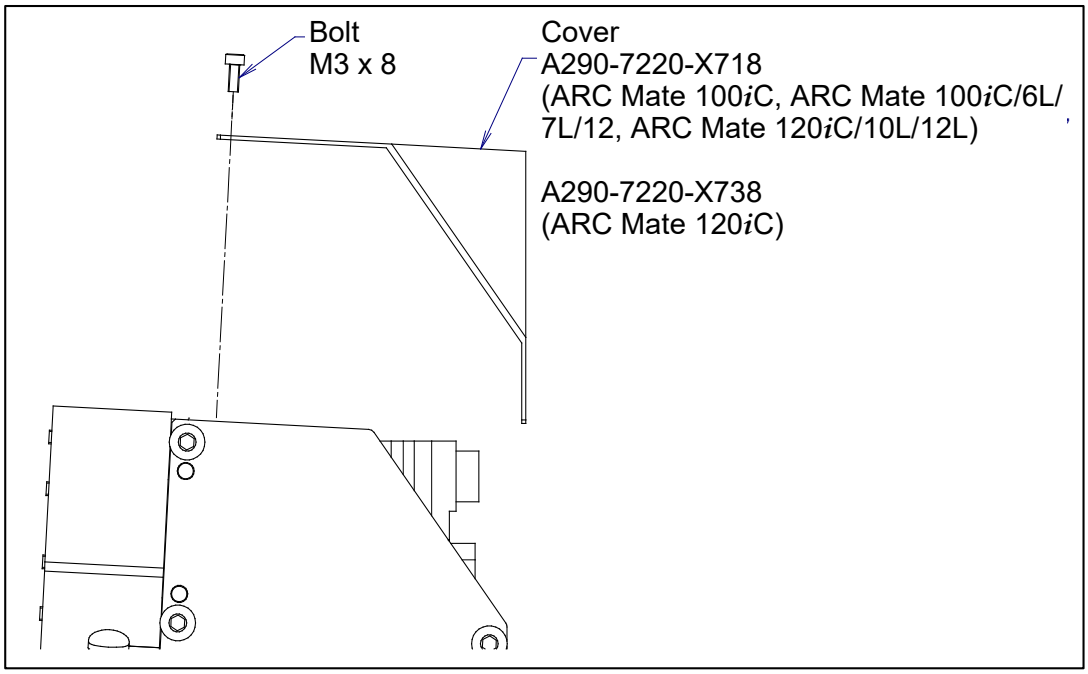


Fig. 8.3 (a) Replacing motor cover (Servo torch for aluminum)

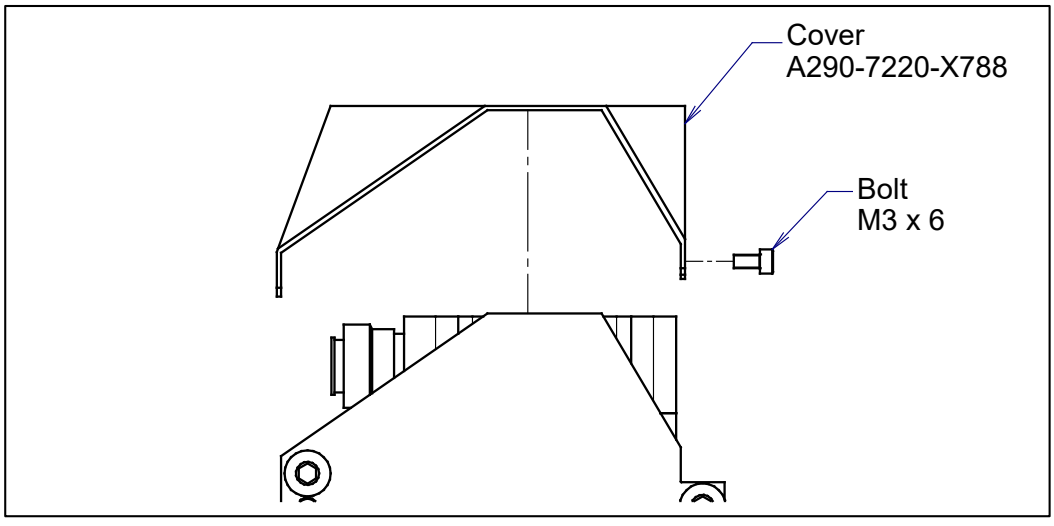


Fig. 8.3 (b) Replacing motor cover (Servo torch for mild steel)

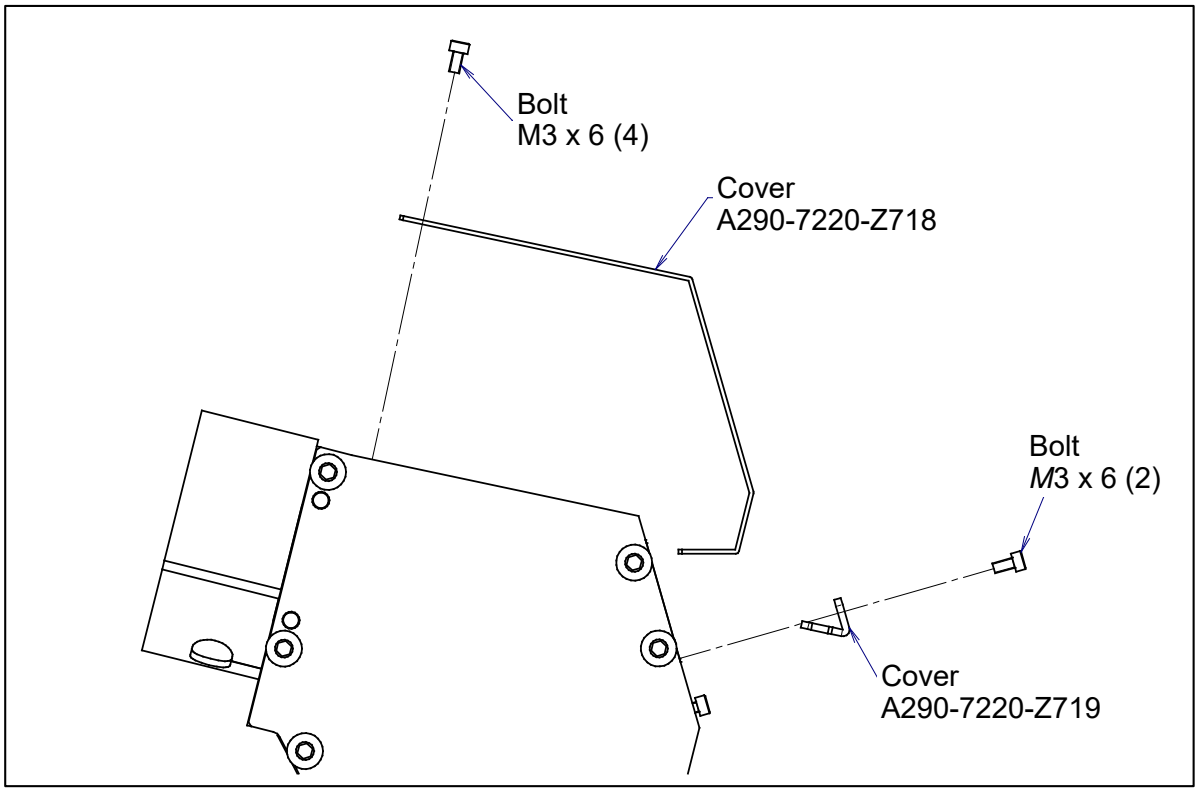


Fig. 8.3 (c) Replacing motor cover (Servo torch for TIG)

8.4 REPLACING THE MOTOR (SERVO TORCH FOR ALUMINUM/TIG) * CE SPECIFICATION COMMON

1 Move the robot to allow the motor to be pulled out in the upward direction, then turn off the power to the robot controller and welding machine.
2 Remove the motor cover (according to Section 8.3).
3 Remove the cover holding the cable, then detach the cable connected to the motor.
4 Remove the M4X18 bolts (4 pcs) used to secure the motor, then remove the motor.
5 Loosen the M3 bolt at the top of the shaft by referring to Fig.8.4 (a), and remove the gears and adapters.
Note) Do not forcibly remove the resin parts such as adapters. Otherwise, they would be damaged.
6 Attach a sort of the gear or adapter to the shaft of a new motor by reversing the procedure then secure the gear to the shaft with an M3 (1 pc) bolt to which LOCTITE 243 is applied.
7 Confirm O ring is in it, and Install motor with M4 x 18 bolts (4 pcs).
8 Install cover etc. For its assembly, please apply the steps above in reversed sequence.

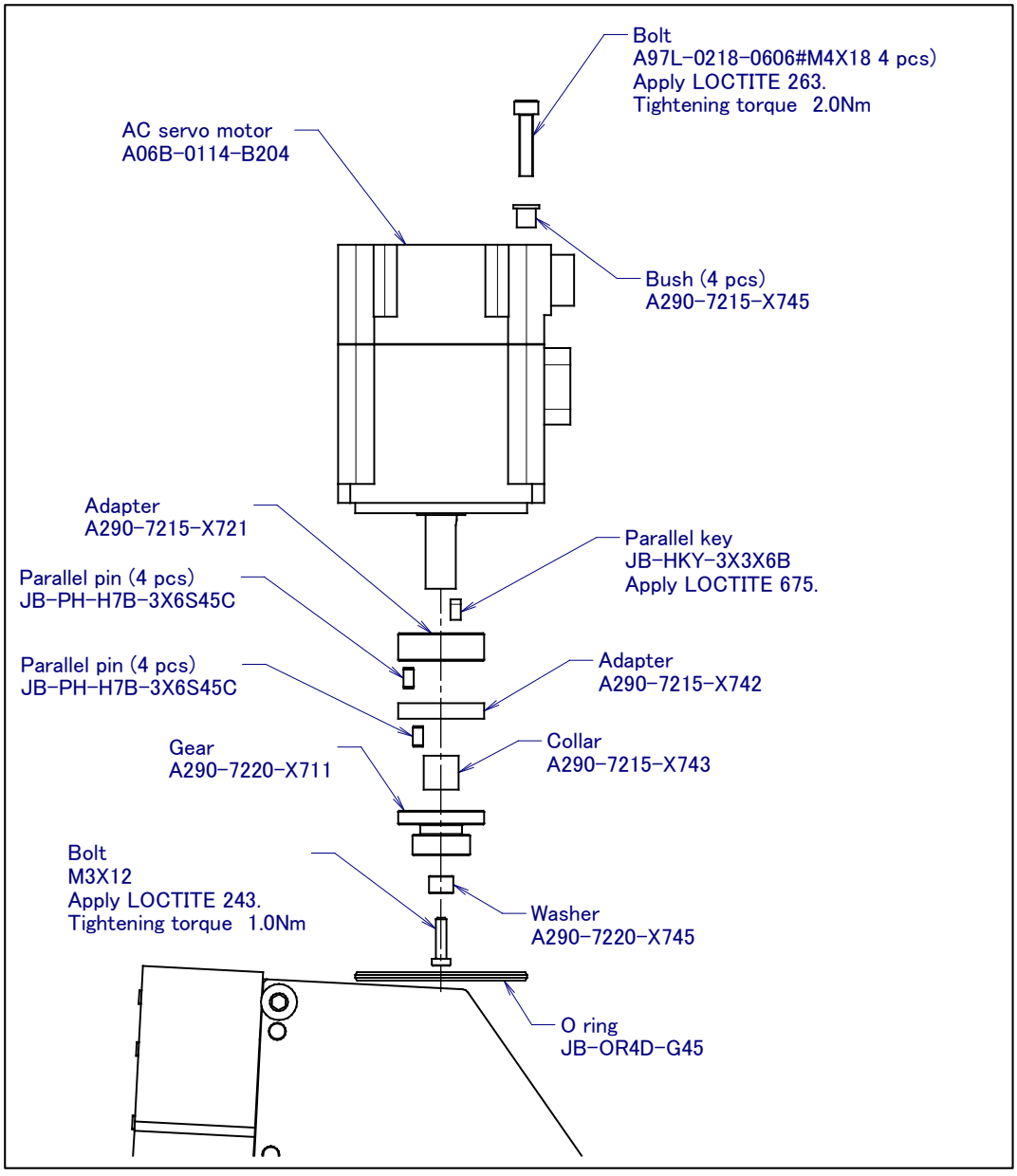


Fig. 8.4 (a) Replacing the motor (Servo torch for aluminum/TIG)

8.5 REPLACING THE MOTOR (SERVO TORCH FOR MILD STEEL) * CE SPECIFICATION COMMON

1 Move the robot to allow the motor to be pulled out in the upward direction, then turn off the power to the robot controller and welding machine.
2 Remove the motor cover (according to Section 8.3).
3 Remove the cover holding the cable, then detach the cable connected to the motor.
4 Remove the M3 x 14 bolts (4 pcs) used to secure the motor, then remove the motor. Be careful not to damage the oil seal. If oil seal is broken, replace it by new one.
5 Loosen the M3 bolt at the top of the shaft by referring to Fig. 8.5, and remove the gears and adapters.
Note) Do not forcibly remove the resin parts such as adapters. Otherwise, they would be damaged.
6 Attach a sort of the gear or adapter to the shaft of a new motor by reversing the procedure then secure the gear to the shaft with an M3 (1 pc) bolt to which LOCTITE 243 is applied.
7 Confirm O ring is in it, and install motor with M3 x14 bolts (4 pcs).
8 Install cover etc. For its assembly, please apply the steps above in reversed sequence. At this time, replace the gasket by new one.

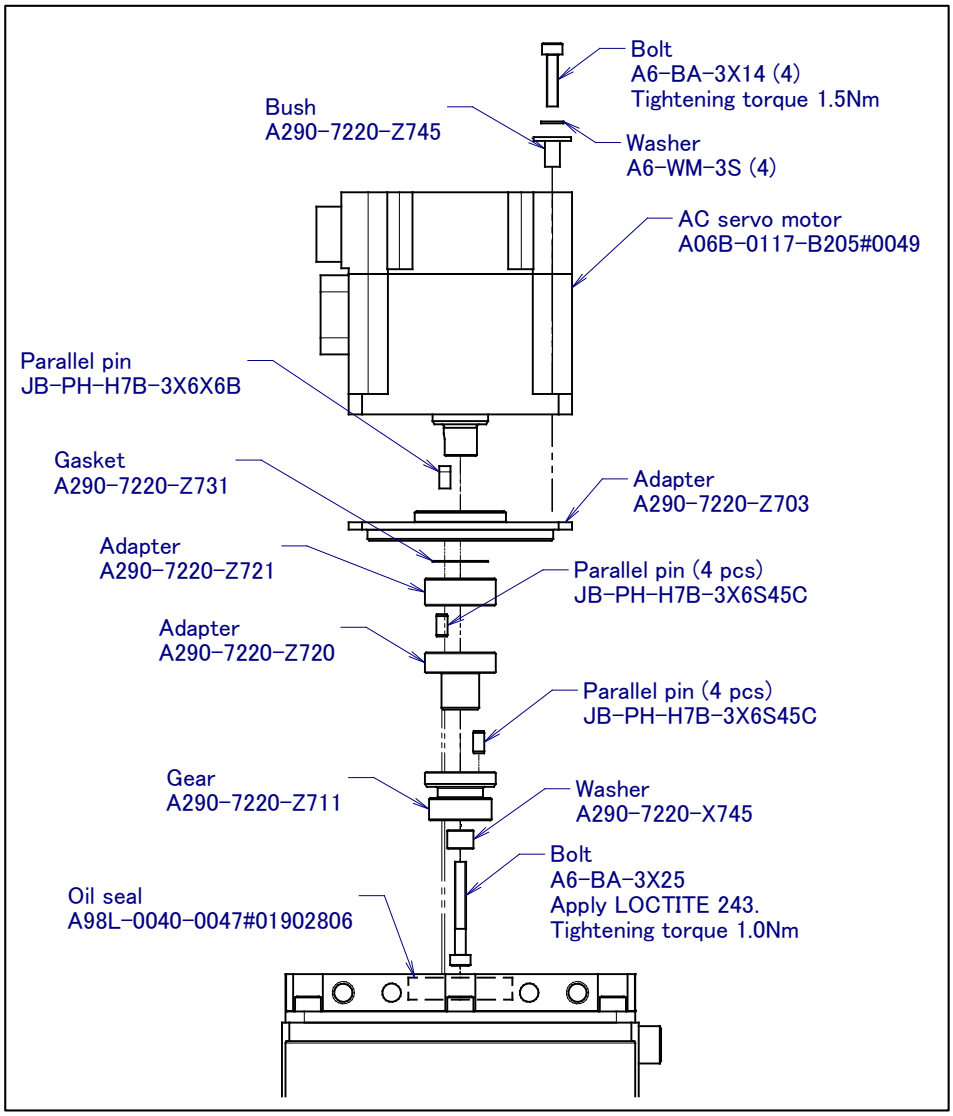


Fig. 8.5 (a) Replacing the motor (Servo torch for steel)

8.6 REPLACING THE FLEXIBLE CONDUIT AND LINER (SERVO TORCH FOR ALUMINUM)

1 Remove the cover of servo torch and move the roller lever and release the fixation of wire.
2 Remove wire from flexible conduit and servo torch to reel stand side.
3 Remove the nut of connection part to servo torch with a monkey spanner. And remove flexible conduit from servo torch. (See Fig. 8.6 (b).)
4 Remove the sleeve of the tip of conduit. (This procedure is when you replace sleeve.) (See Fig. 8.6 (c).)
5 Loosen adapter block mounting bolts and remove adapter block from servo torch. (See Fig. 8.6 (d).) (This procedure is when you replace inlet guide liner.)
6 Remove inlet guide liner from adapter block. (This procedure is when you replace inlet guide liner.) (See Fig. 8.6 (e).)
7 Remove the flexible conduit of reel stand. (See Fig. 8.6 (f).)
8 Remove connector from flexible conduit with a monkey spanner. Turn it in a course to unscrew it (See Fig. 8.6 (f).)
9 Insert sleeve which is removed in procedure 2 to flexible conduit. (This procedure is only when you replace sleeve.) (See Fig. 8.6 (c).)
10 Attach connector to flexible conduit of reel stand side. Install it with the point to tighten a nut. (See Fig. 8.6 (f).)
11 Insert wire to flexible conduit.
12 Cut the inlet guide liner so that it does not interfere roller referring to Fig. 8.6 (g).
13 Insert new inlet guide liner to adapter block and attach adapter block to main body of servo torch.
14 Open the cover of servo torch and insert wire to it.
15 Attach flexible conduit of torch side to adapter block. Tighten Nut with regulated torque of 15Nm. (See Fig. 8.6 (b))

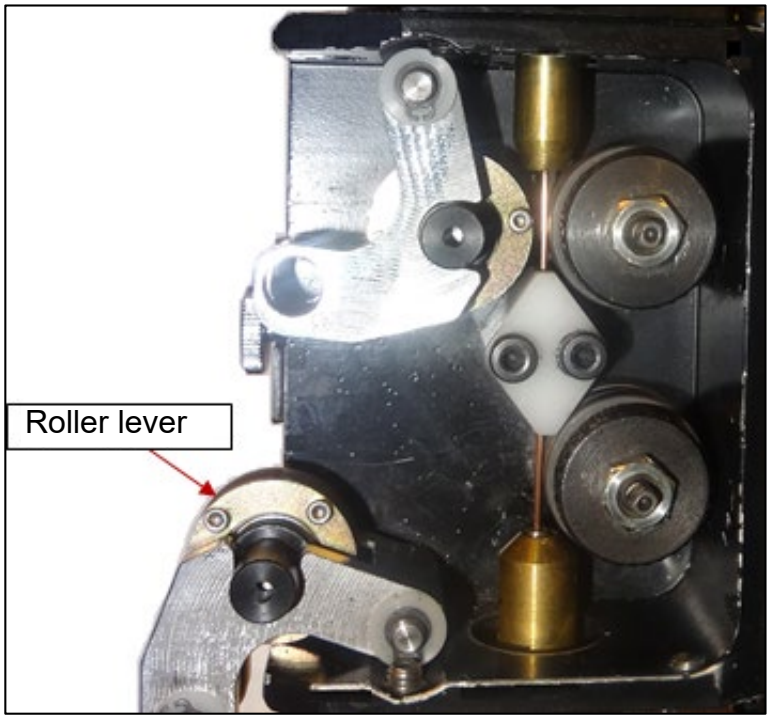


Fig. 8.6 (a) Roller lever of servo torch

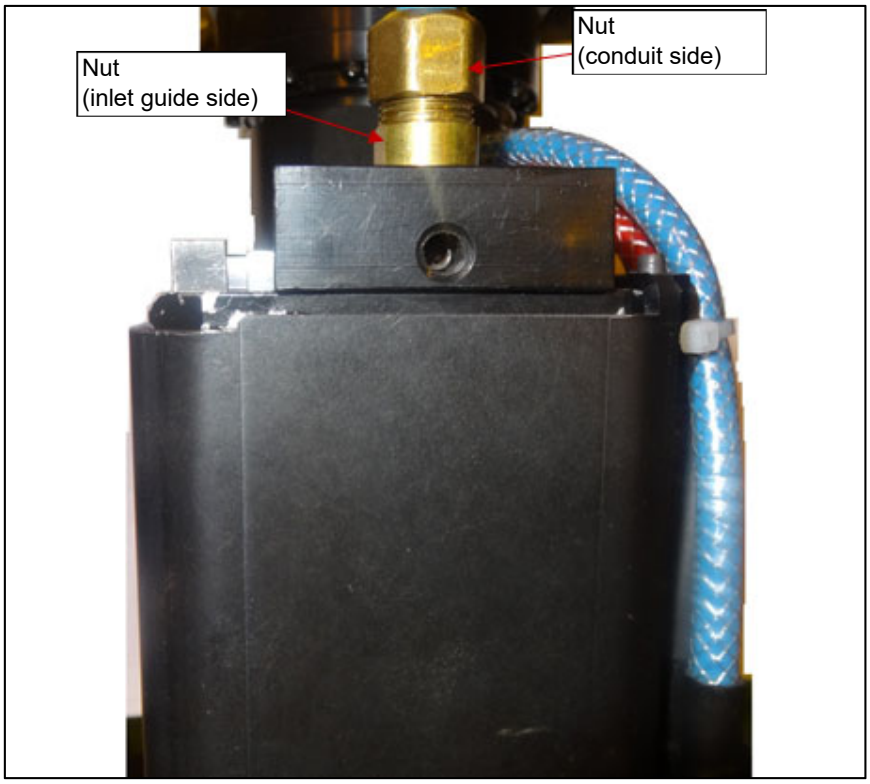


Fig. 8.6 (b) Nut of servo torch side

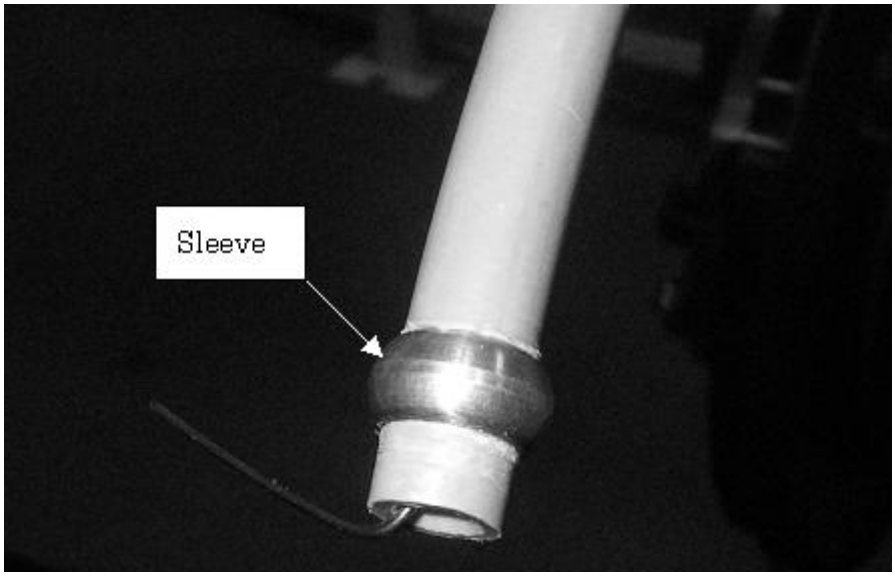


Fig. 8.6 (c) Sleeve of flexible conduit

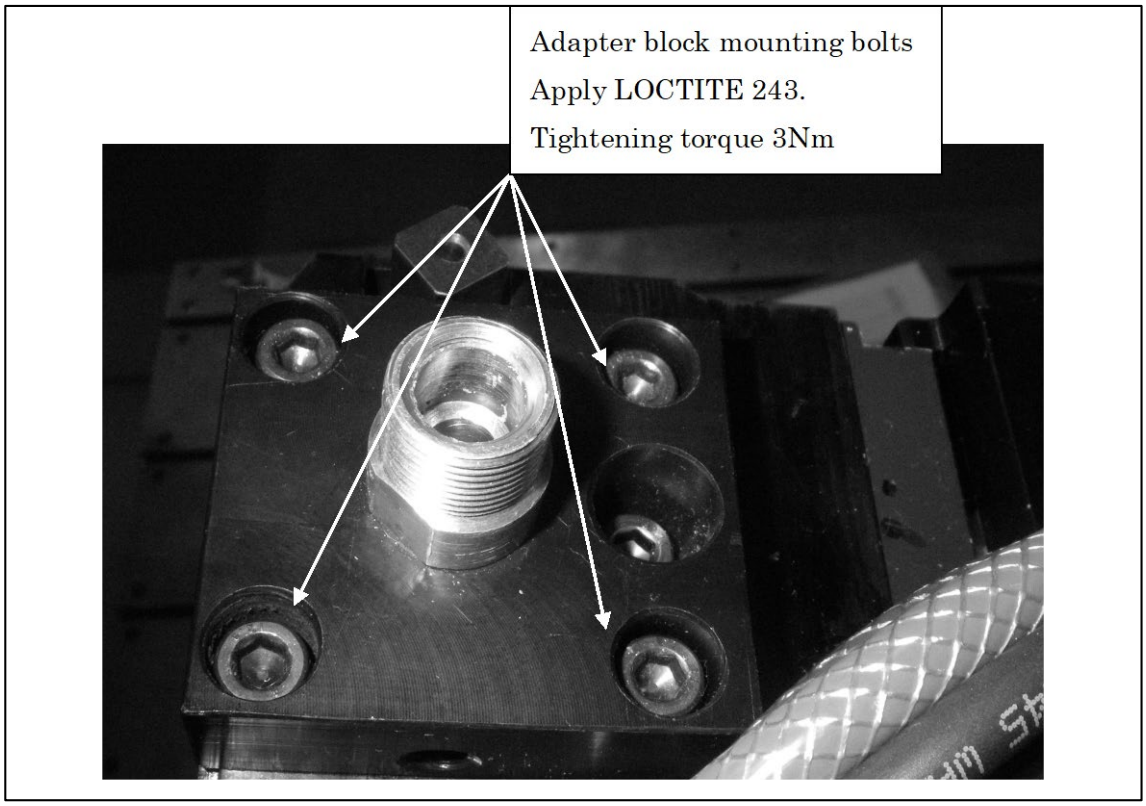


Fig. 8.6 (d) Adapter block mounting bolts

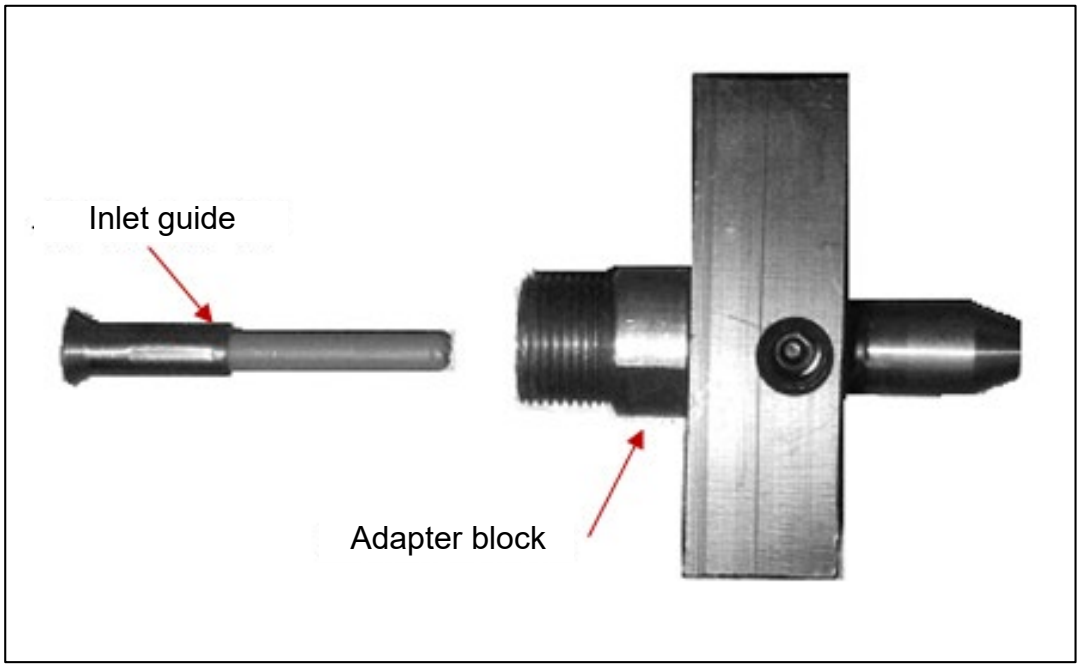


Fig. 8.6 (e) Liner

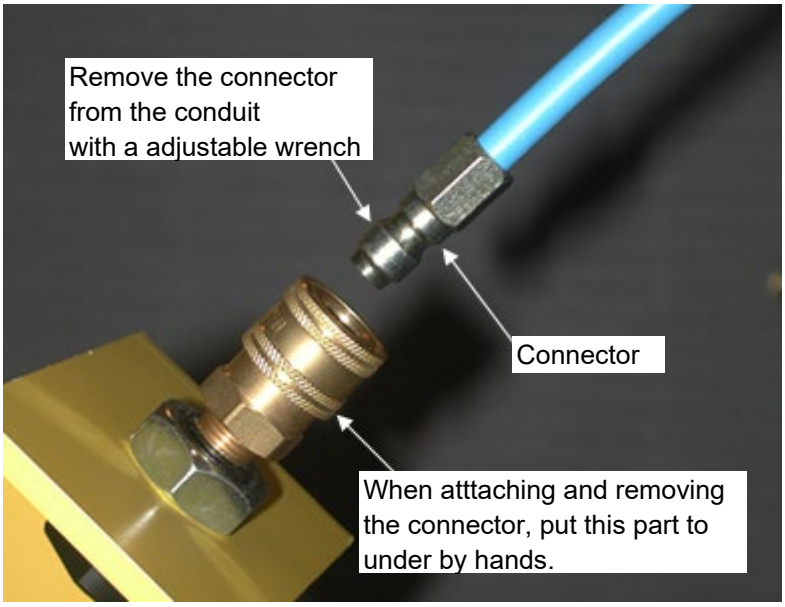


Fig. 8.6 (f) Connector of reel stand side

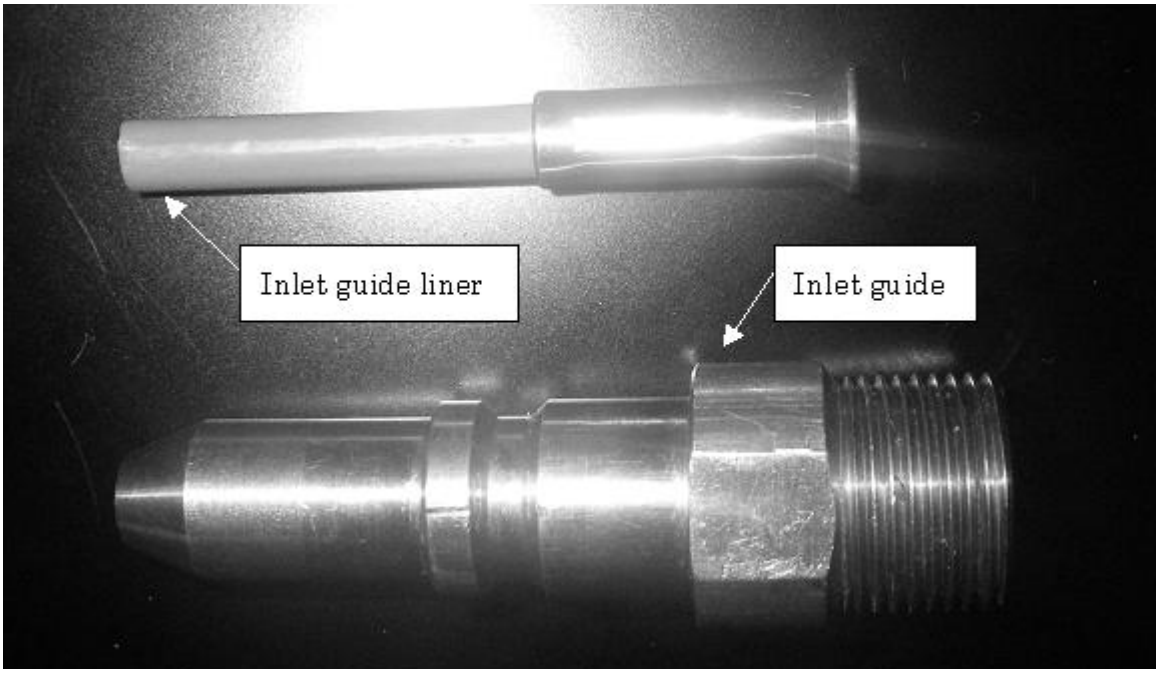


Fig. 8.6 (g) Cutting of liner

8.7 REPLACING THE FLEXIBLE CONDUIT AND LINER (SERVO TORCH FOR MILD STEEL)

Replacing the flexible conduit

1 Remove the rubber cap of servo torch and loosen hexagon nut referring to Fig.8.7 (a), (b).
2 Remove the coupling of back of J3 casing referring to Fig.8.7 (c).
3 Replace old flexible conduit by new one. For its assembly, please apply the steps above in reversed sequence.

Replacing liner

1 Remove the flexible conduit from one touch coupling of J3 casing back side referring to Fig.8.7 (c).
2 Pull out liner, replace it by new one. For its assembly, please apply the steps above in reversed sequence.

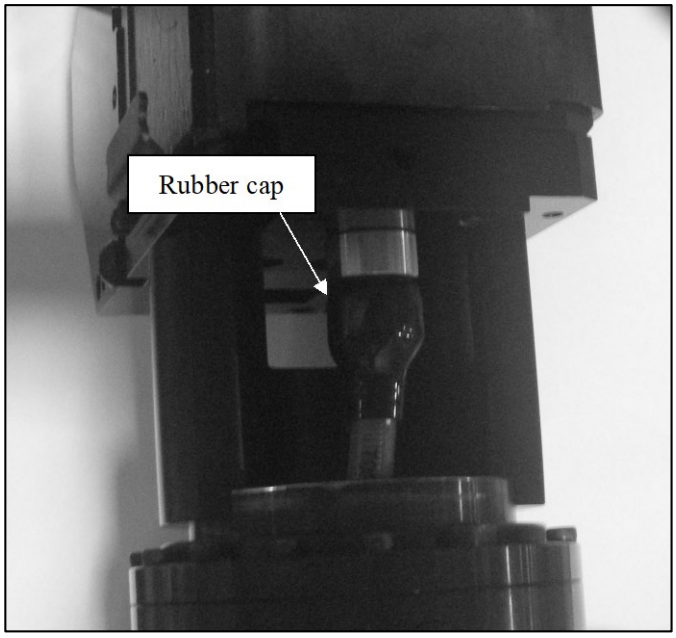


Fig. 8.7 (a) Replacing the flexible conduit and liner

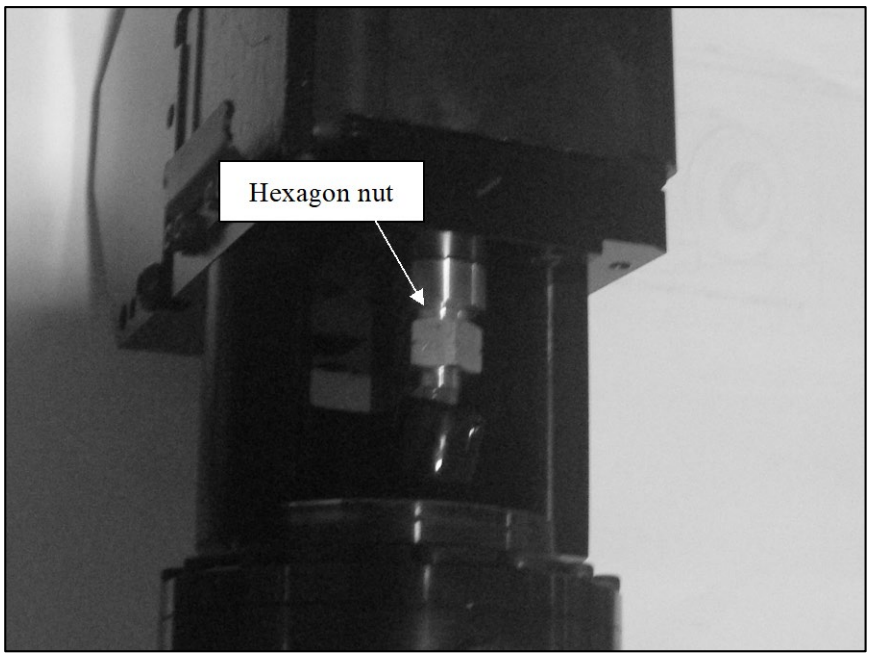


Fig. 8.7 (b) Replacing flexible conduit and liner

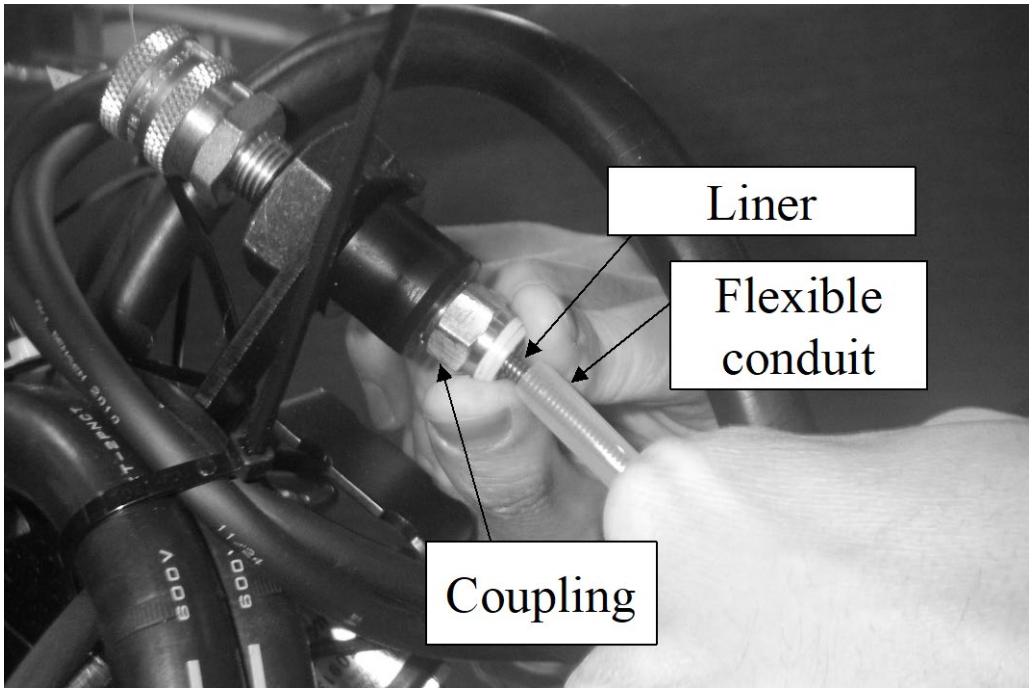


Fig. 8.7 (c) Replacing the flexible conduit

8.8 REPLACING THE FLEXIBLE CONDUIT AND LINER (Servo torch for TIG)

Replacing flexible conduit

1 Remove the nut of servo torch side and connector of wire reel stand.
2 Replace the flexible conduit by new one and assemble it. For its assembly, please apply the steps above in reversed sequence.

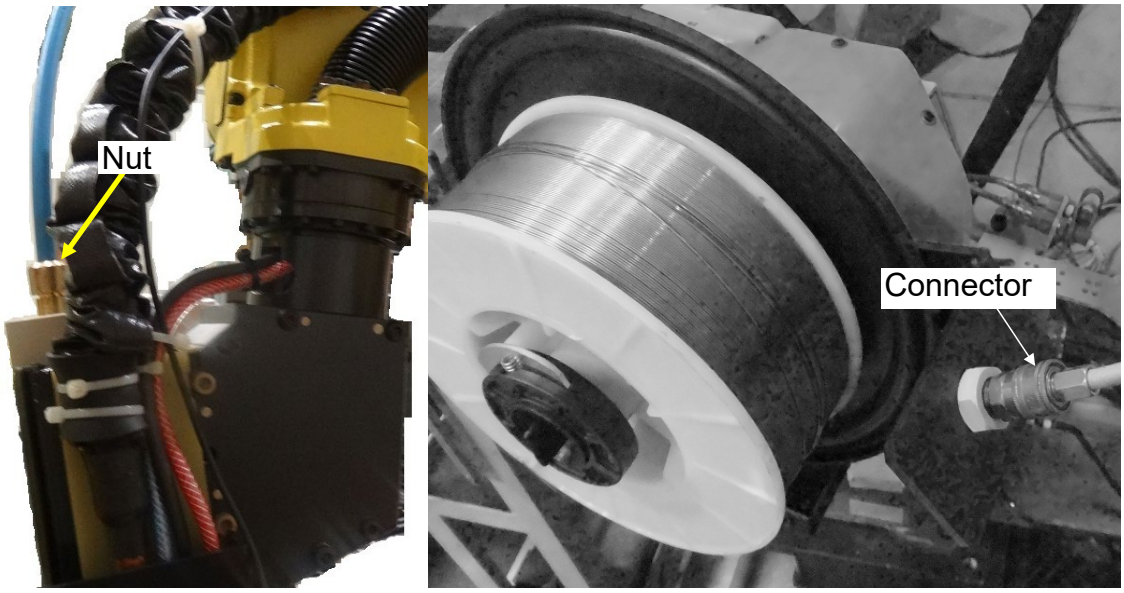


Fig. 8.8 (a) Replacing the flexible conduit

Replacing liner

1 Remove the hexagon bolt of Fig. 8.8 (b).
2 Remove the nut.
3 Remove parts which are below than nut from servo torch main body.
4 Replace liner by new one and assemble it. For its assembly, please apply the steps above in reversed sequence.

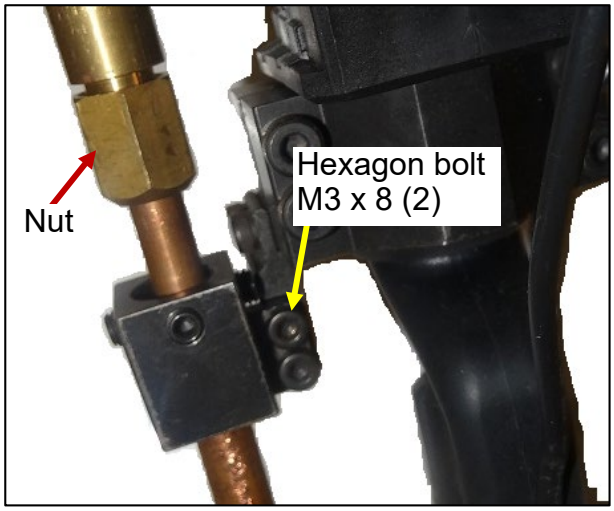


Fig. 8.8 (b) Replacing the liner (1/2)

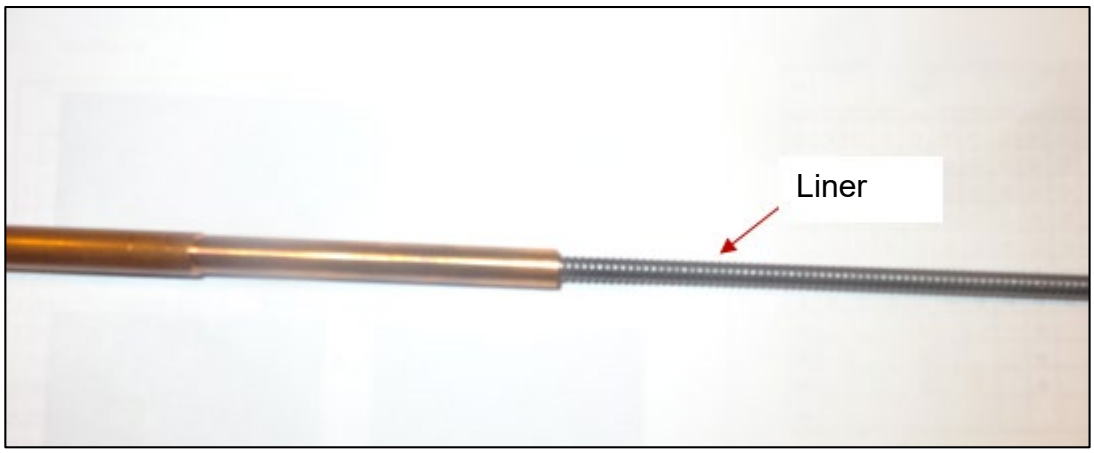


Fig. 8.8 (c) Replacing the liner (2/2)

9 CABLE REPLACEMENT

Replace the cablese at the intervals based on every 4 years or 15360 hours, whichever comes first. If a cable is broken or damaged, replace it according to the procedure described in this chapter.

Cautions in handling the Pulsecoder cable

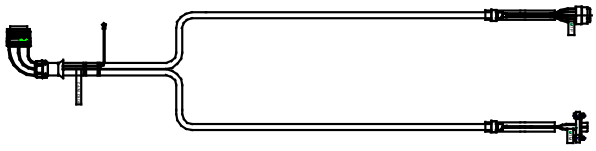
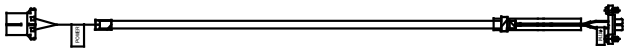
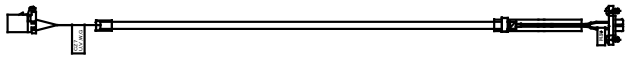
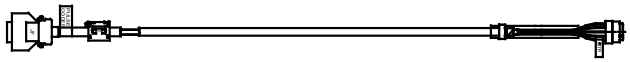
When transporting, installing, or maintaining the robot, do not detach the Pulsecoder cables carelessly. The cables are provided with the marking tie shown below. If you detached any cable with the marking tie, you need to perform mastering for the robot.
Do not detach any connector unless you replace a motor, Pulsecoder, gearbox or cable.

Fig. 9 (a) Wire mark

9.1 CABLE WIRING

Table 9.1 (a) is cable pattern diagram.

Table 9.1 (a) Cable pattern diagram

Stamp	Cable pattern diagram	Stamp	Cable No.
W/F 2		M7P M7M	K163
POWER		M7M	K181 K183
CZ7		M7M	K182 K184
PULSE CODER		M7P	K185

9.2 REPLACING CABLES

This section describes a procedure for replacing cables.
Contact FANUC about procedure for replacing mechanical unit cables of robot.

9.2.1 Replacing the Welding Power Cable * CE SPECIFICATION COMMON

1 Move the robot to the posture all axes are 0^{o}.
2 Turn off the controller power.
3 Remove 2 M4 x 10 bolts and remove conduit from wrist unit. (See Fig.9.2.1 (a).)
4 Remove the welding power cable. (See Fig.9.2.1 (f).)
5 Cut the cable tie of 2 locations which is back of J3 casing side. (See Fig.9.2.1 (c).)
6 Pull out cable to J3 casing side.
7 Remove connector of cable from plate (black color) of J3 casing side.
8 Replace old cable by new one. For its assembly, please apply the steps above in reversed sequence. At this chance, be careful not to make tension or slack to the cable. Refer to Fig.9.2.1 (c) to (g) about cable forming. We recommend using black cable ties which have high weatherability.

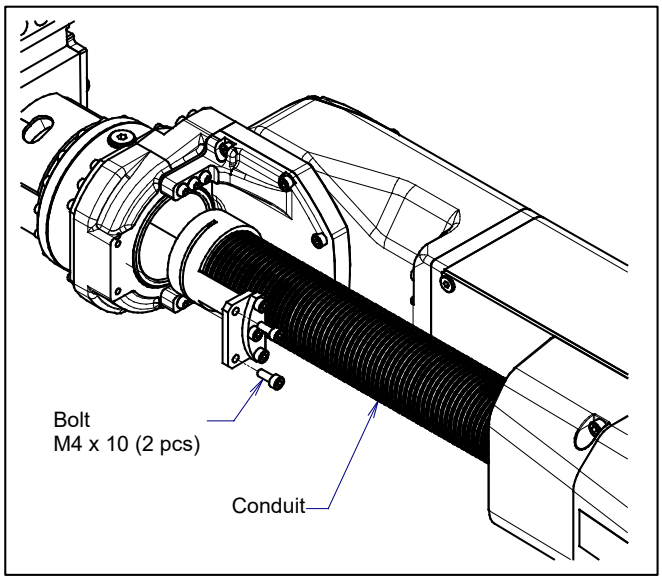


Fig. 9.2.1 (a) Removing the conduit

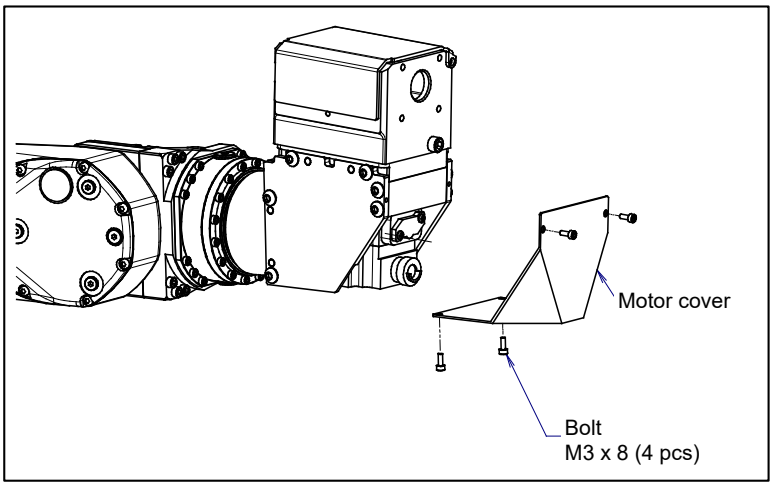


Fig. 9.2.1 (b) Removing the motor cover

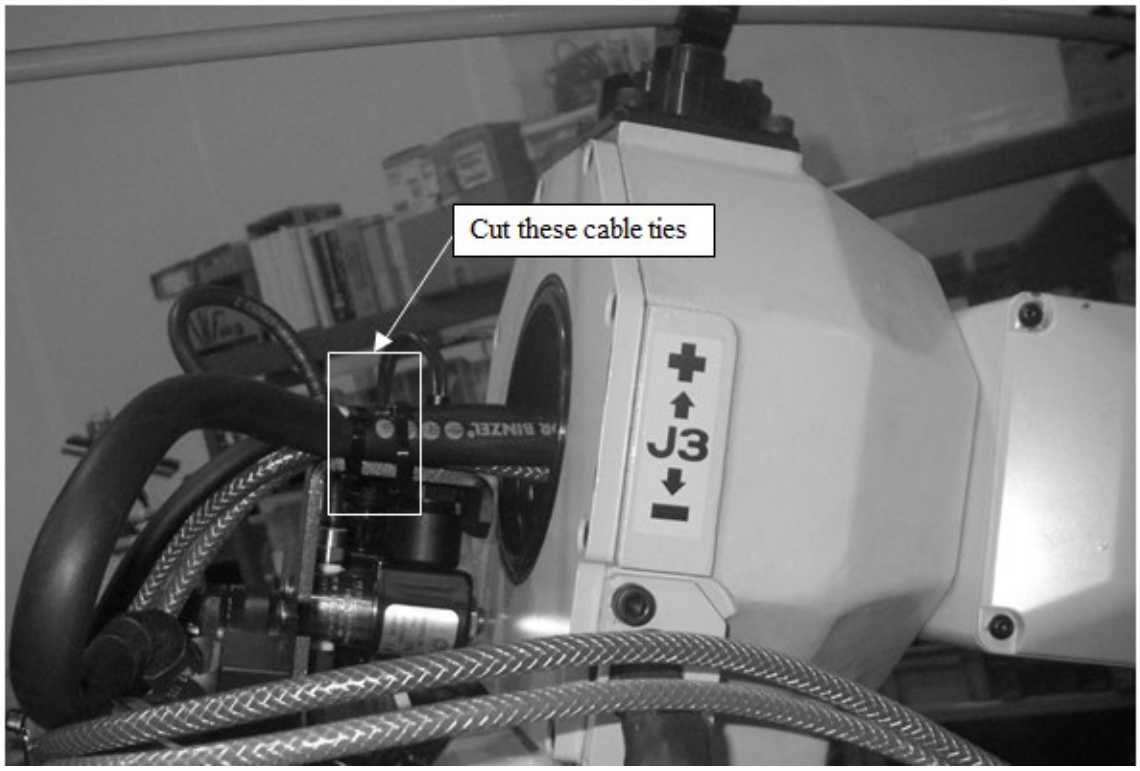


Fig. 9.2.1 (c) Cable tie of back of J3 casing

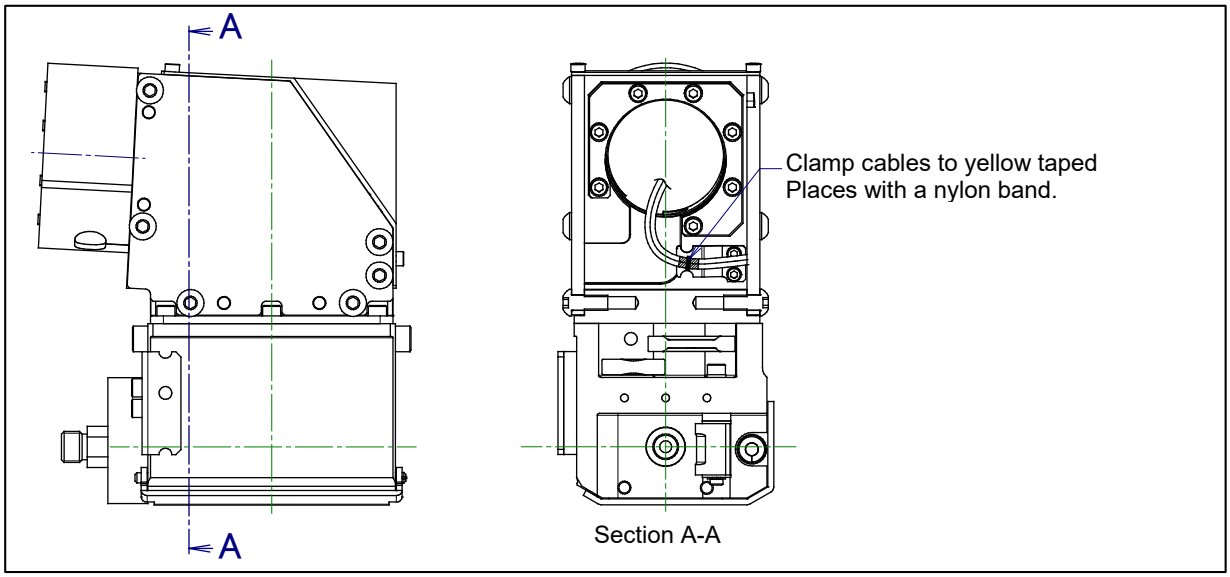


Fig. 9.2.1 (d) Forming cables to bracket (Servo torch for aluminum) (1/5)

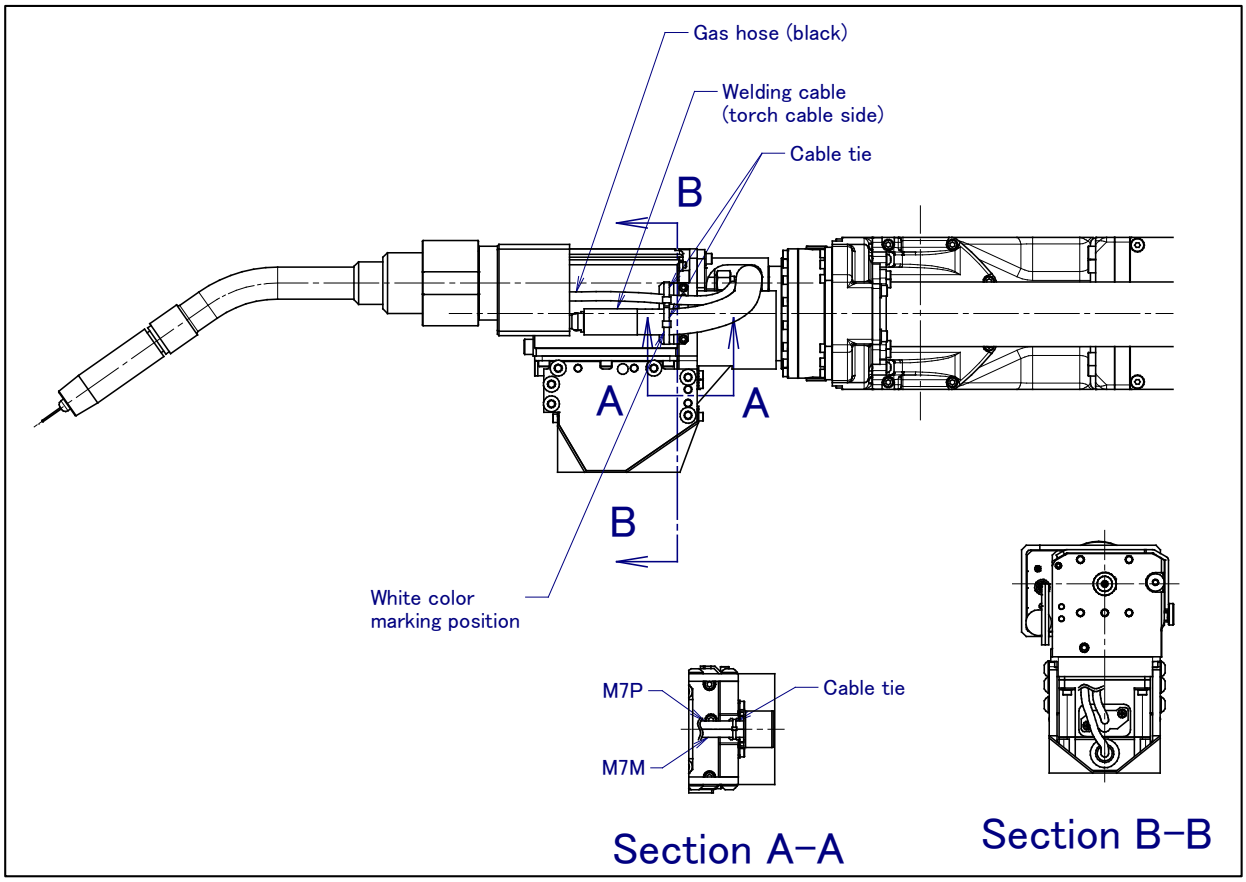


Fig. 9.2.1 (e) Forming cables to bracket (Servo torch for steel) (2/5)

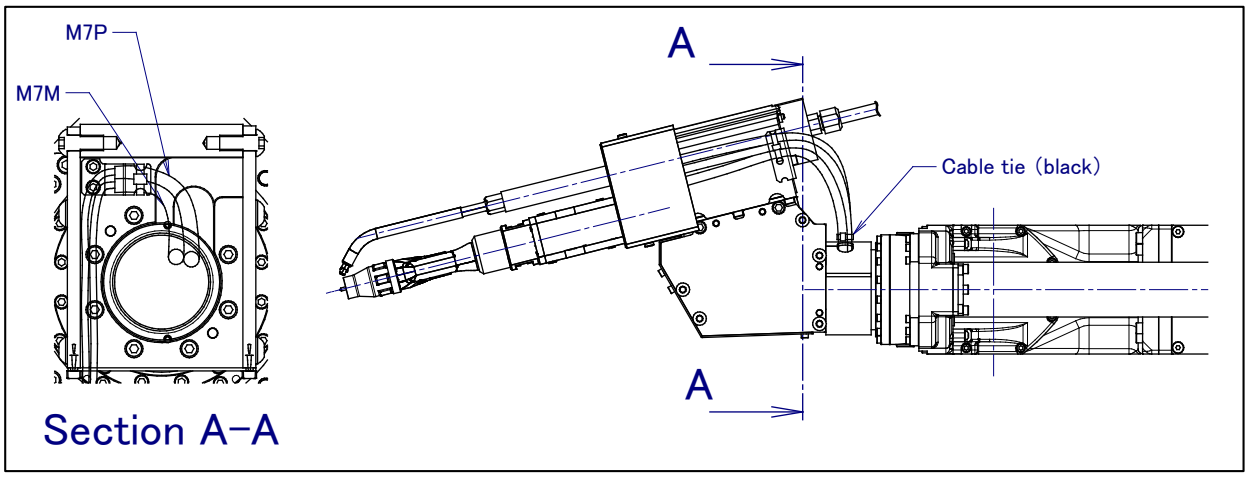


Fig. 9.2.1 (f) Forming cables to bracket (Servo torch for TIG) (3/5)

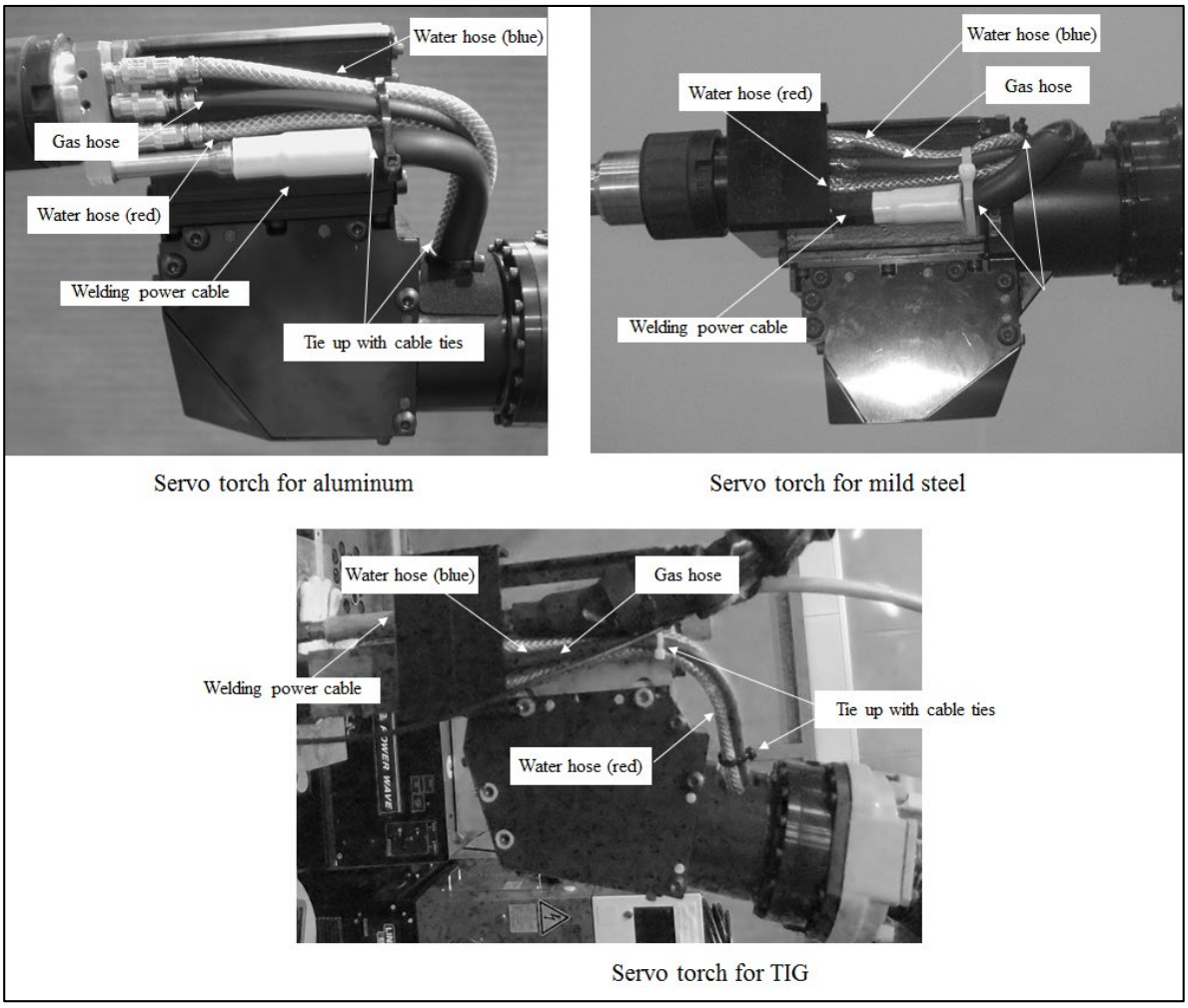


Fig. 9.2.1 (g) Forming cables to bracket (4/5)

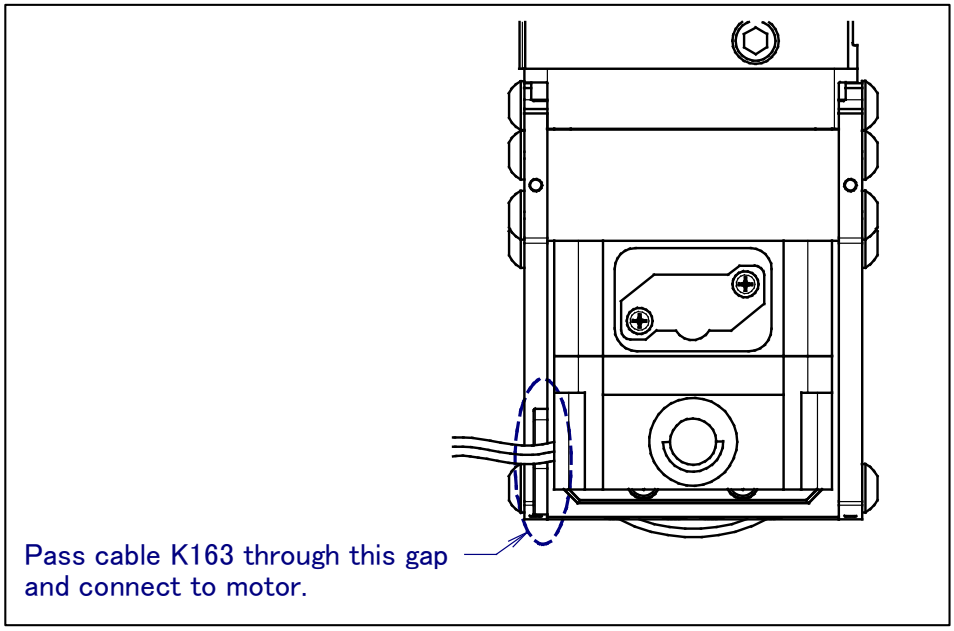


Fig. 9.2.1 (h) Forming cables to bracket (5/5)

9.2.2 Replacing the Motor Cable * CE SPECIFICATION COMMON

1 Move the robot to the posture all axes are 0^{o}.
2 Turn off the controller power.
3 Remove 2 M4X10 bolts and remove conduit from wrist unit.
4 Remove the motor cover. (See Fig. 9.2.1 (b).)
5 Remove the side plate. (See Fig. 9.2.2 (a) to (c).)
6 Remove the motor connector.
7 Cut the Cable tie of 2 locations referring to Fig. 9.2.1 (d) and (e).
8 Cover the connector in cloth or vinyl. (to make it easy to pass hollow part of wrist)
9 Pass cables through bracket and hollow part of wrist unit and pull it out to J3 arm side.
10 Cut the nylon band which is back J3 casing side.
11 Pull out cable to J3 casing side.
12 Remove connector of cable from plate (black color) of J3 casing side.
13 Replace old cable by new one. For its assembly, please apply the steps above in reversed sequence. At this chance, be careful not to make tension or slack to the cable. Push 15mm from the state that does not get loose, and fix it. Refer to Fig. 9.2.1 (c) to (g) about cable forming.

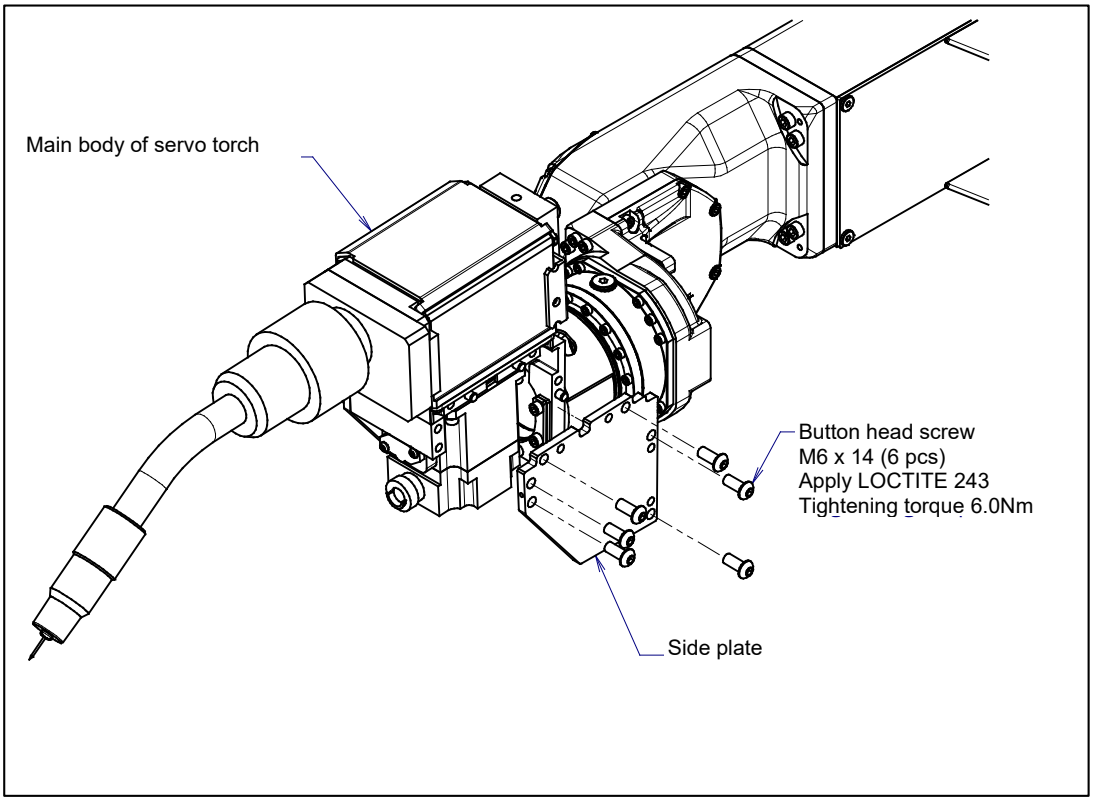


Fig. 9.2.2 (a) Removing the main body of servo torch and plate (Servo torch for aluminum)

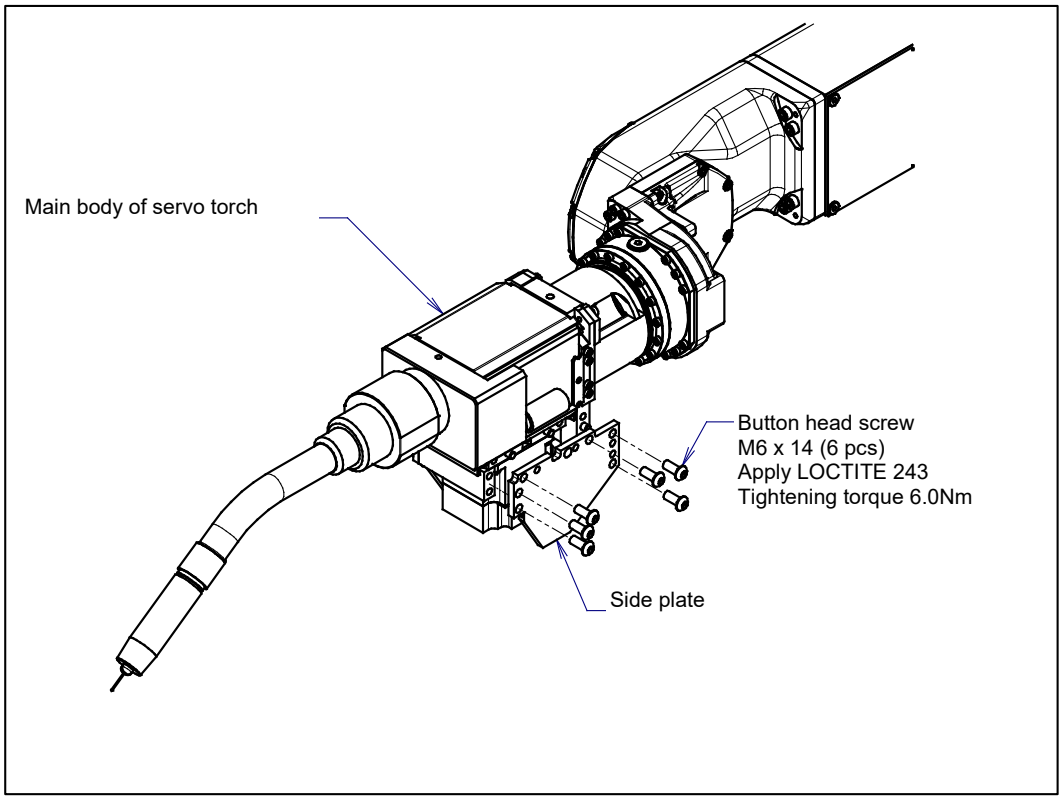


Fig.9.2.2 (b) Removing the main body of servo torch and plate (Servo torch for mild steel)

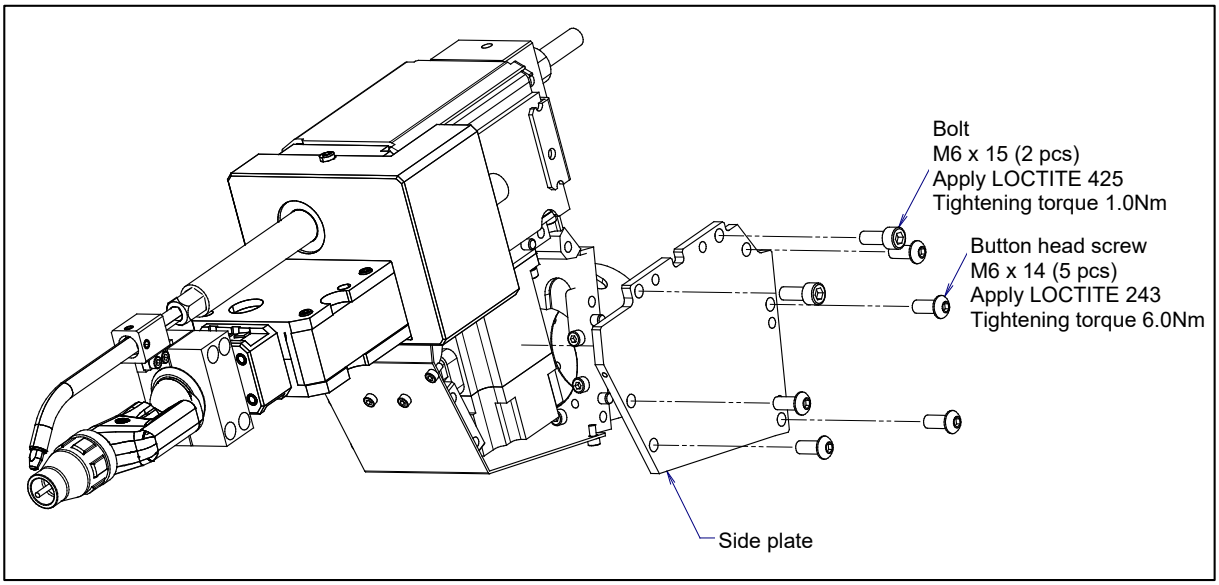


Fig.9.2.2 (c) Removing the main body of servo torch and plate (Servo torch for TIG)

APPENDIX

A MAINTENANCE PARTS

NOTE
Contact your local FANUC representative about maintenance parts of robot main body.

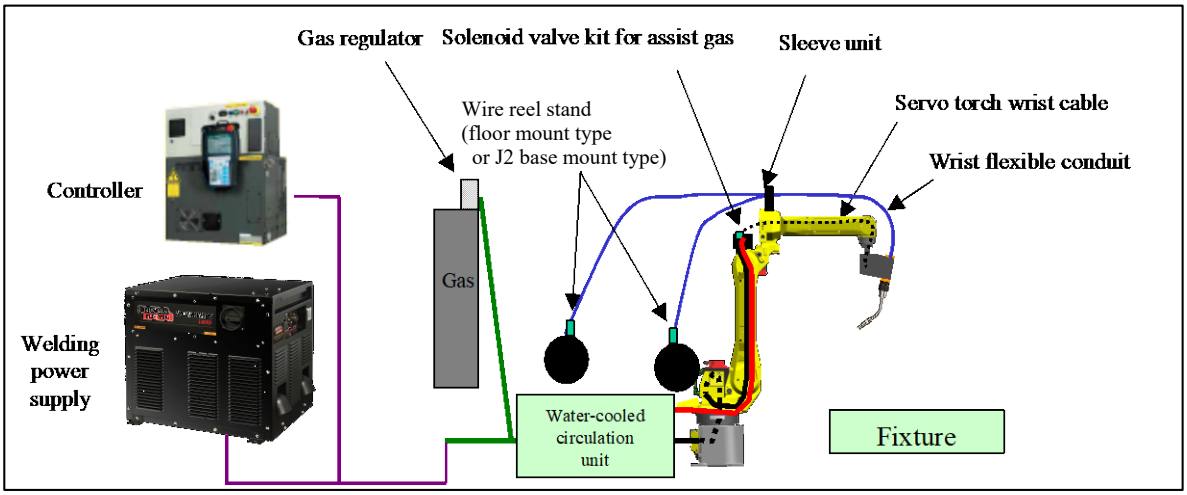


Fig. A (a) System constitution example (Servo torch for aluminum)

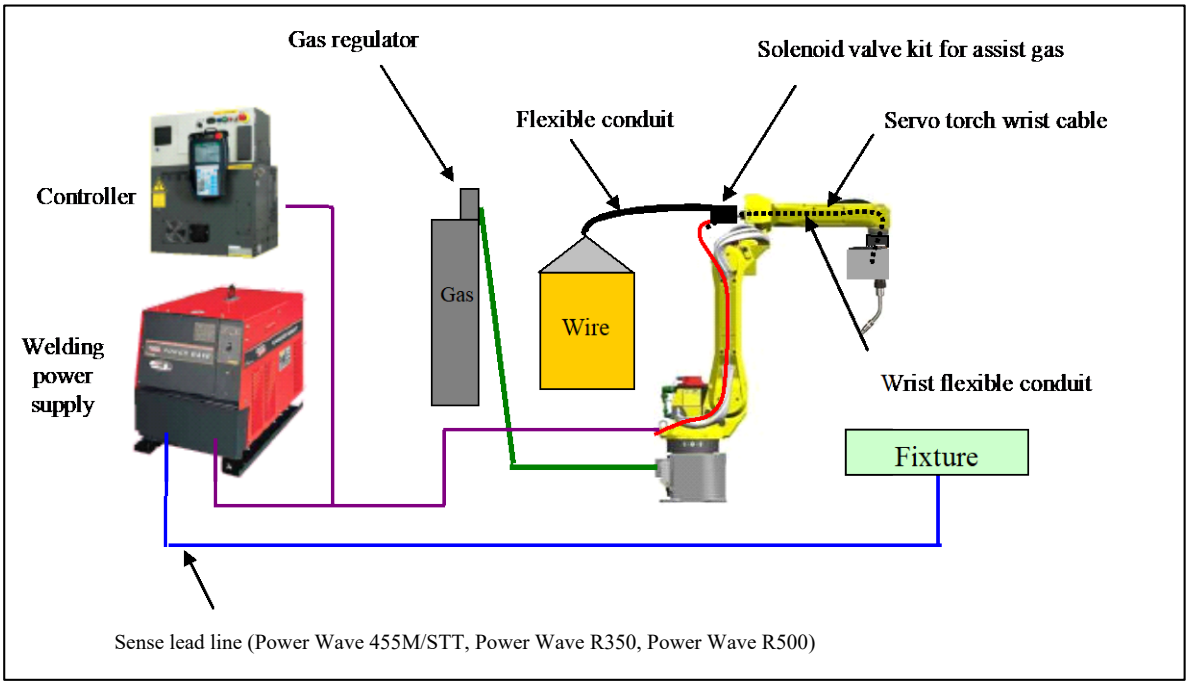


Fig. A (b) System constitution example (Servo torch for mild steel)

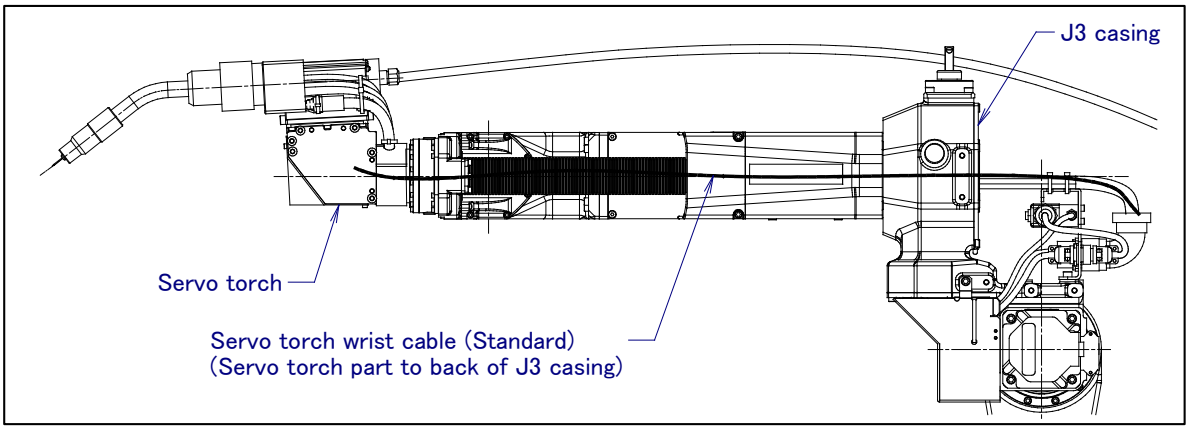


Fig. A (c) Cable mounting figure of servo torch wrist cable (In case of standard specification)

Figure is case of standard specification. Refer to operator's manual of mechanical unit about cable between J1 connector panel to J4 connector panel. In case of CE specification, servo cable is connected from controller to servo torch. The cable is laid in the outside of robot.

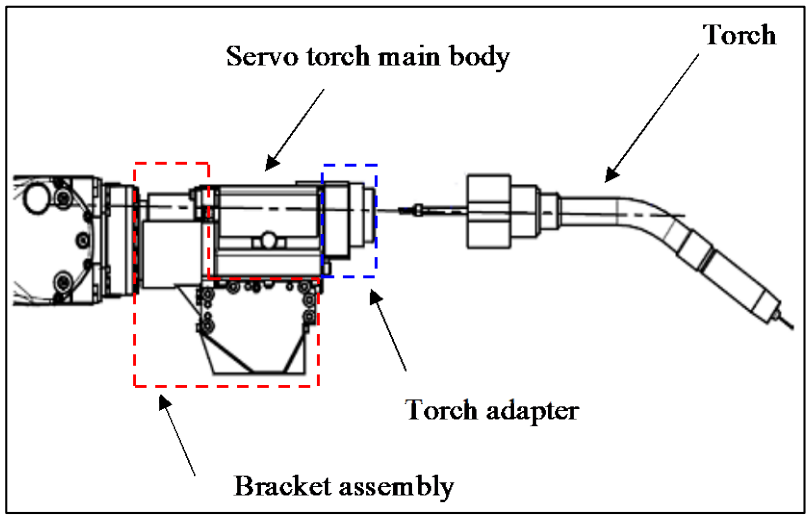


Fig. A (d) Mechanical unit of servo torch

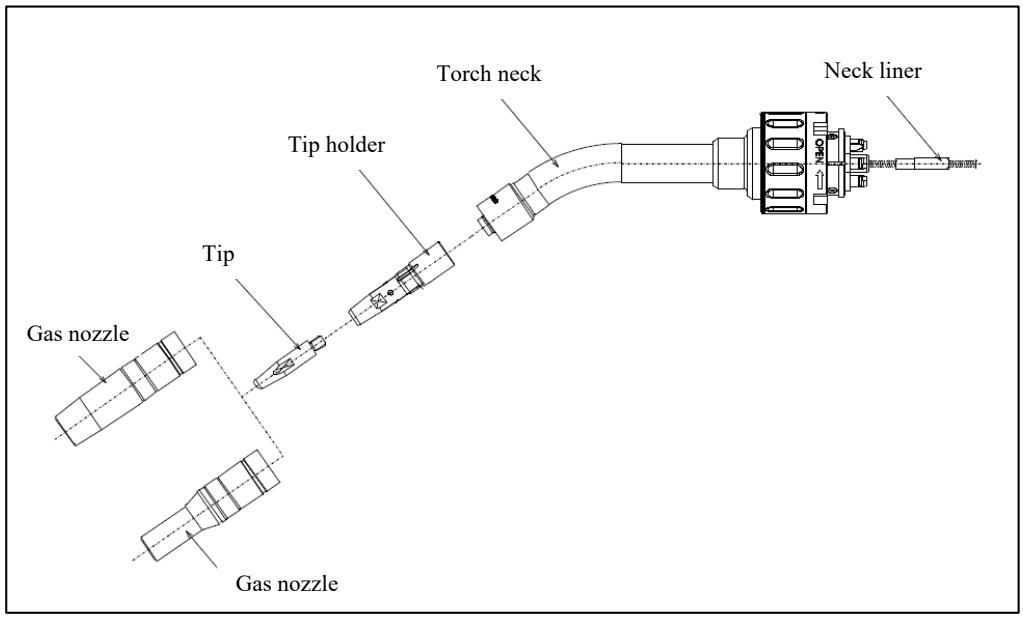


Fig. A (e) Parts of torch

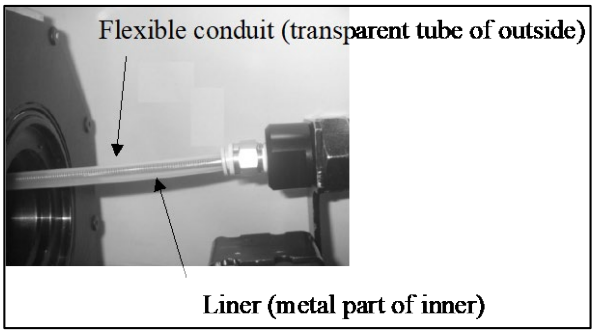


Fig. A (f) Flexible conduit and liner of servo torch for mild steel

A.1 SERVO TORCH FOR ALUMINUM

Table A.1 (a) Torch adapter assembly A05B-1220-J311 (Servo torch for aluminum)

Parts name	Specifications	Remarks
Torch adapter kit	A14L-0166-2311 (NOTE)	
Torch adapter insulator	A14L-0166-2311#783X9656	
Torch adapter cover	A14L-0166-2311#783X9655	

NOTE
Bar terminal connection type torch adapter is used for the unit made before Dec. 2013. Round terminal connection type torch adapter is used for the unit made later than it. (See Fig. A(g))
When replacing the torch adapter made after Dec. 2013, replace the servo torch wrist cable by round shape terminal, too.

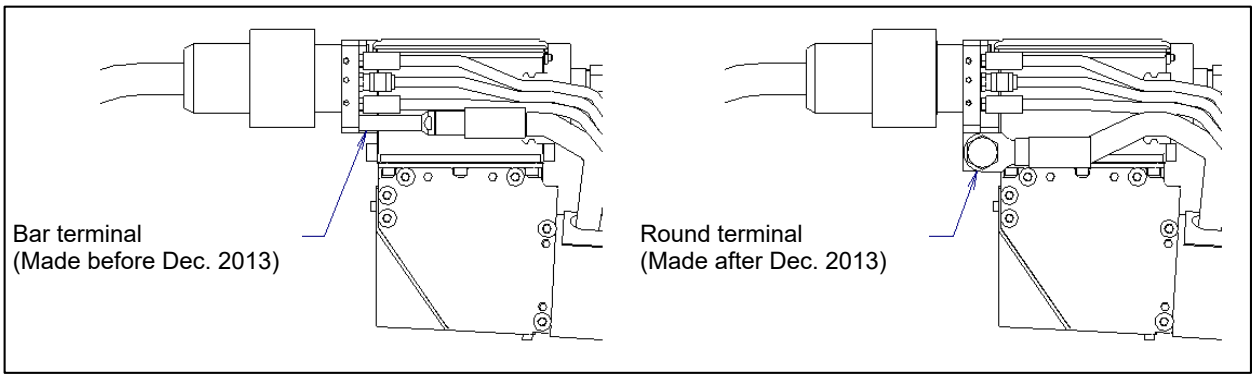


Fig. A.1 (a) Connection terminal of the torch adapter and the welding power cable

Table A.1 (b) Servo torch wrist cable A05B-1220-J335 (Standard ARC Mate 100*i*C, ARC Mate 100*i*C/12)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V335 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V345 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0062	Torch cable conduit (It is included in A290-7220-V335, V345)
Wrist cable K163	A660-4004-T972#L1R303	Wrist cable (It is included in A290-7220-V335, V345)

Table A.1 (c) Servo torch wrist cable A05B-1220-J336 (Standard ARC Mate 100*i*C/6L/7L)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V336 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V346 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0084	Torch cable conduit (It is included in A290-7220-V336, V346)
Wrist cable K163	A660-4004-T972#L1R543	Wrist cable (It is included in A290-7220-V336, V346)

Table A.1 (d) Servo torch wrist cable A05B-1220-J337 (Standard ARC Mate 120*i*C)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V337 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V347 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0087	Torch cable conduit (It is included in A290-7220-V337, V347)
Wrist cable K163	A660-4004-T972#L1R543	Wrist cable (It is included in A290-7220-V337, V347)

Table A.1 (e) Servo torch wrist cable A05B-1220-J338 (Standard ARC Mate 120*i*C/10L/12L)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V338 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V348 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0101	Torch cable conduit (It is included in A290-7220-V338, V348)
Wrist cable K163	A660-4004-T972#L1R703	Wrist cable (It is included in A290-7220-V338, V348)

NOTE
For the servo torch wrist cable, see Fig. A.1 (a), select the cable kit spec. which matches the torch adapter connection terminal.

Table A.1 (f) Servo torch cable (CE)

Cable No.	Specifications	Function	Applicable model
K181	A660-2007-T278	J7 power line	for aluminum for alpha *i* amplifier
K182	A660-2007-T279		for aluminum for beta *i* amplifier
K183	A660-2007-T280		for mild steel for alpha *i* amplifier
K184	A660-2007-T281		for mild steel for beta *i* amplifier
K185	A660-8017-T641	J7 signal line	All models for CE

Table A.1 (g) Roller for aluminum wire (Double nut Specifications) A05B-1220-J347

Parts name	Specifications	Remarks
ϕ1.2 Roller for aluminum wire	A05B-1220-J347	

(*) This specification is only for Japan.

Table A.1 (h) Roller for aluminum wire A05B-1215-J375

Parts name	Specifications	Remarks
ϕ1.2 Roller for aluminum wire	A05B-1215-J375	

Table A.1 (i) Servo torch mechanical section A05B-1220-J301, J303 (Servo torch for aluminum)

Parts name	Specifications	Remarks
Motor	A06B-0114-B204	J7-axis β*i*S0. 4/5000 (without brake)
Bush	A290-7215-X745	for mounting motor (4 pcs)
Adapter	A290-7215-X742	for motor shaft (bakelite)
Parallel key	JB-HKY-3X3X6B	for motor shaft
Parallel pin	JB-PH-H7B-3X6S45C	For connection of motor shaft and adapter (8 pcs)
Collar	A290-7215-X743	for motor shaft
Gear	A290-7220-X711	for motor shaft
Washer	A290-7220-X745	for motor shaft
O ring (fluorine)	JB-OR4D-G45	for motor shaft
Bolt	A97L-0218-0514#M3X12	
Adapter	A290-7220-X743	Between motor and drive unit assembly (bakelite)
Adjust bolt	A290-7220-X727	Jamming roller part
Grease	A98L-0040-0174#16KG	Refer to Chapter 5 for required quantity.

Table A.1 (j) Bracket assembly A05B-1220-J321 (Servo torch for aluminum)

Parts name	Specifications	Remarks
Motor cover	A290-7220-X718	
Insulator	A290-7220-X747	
Gasket	A290-7220-X748	
Parallel pin	JB-PH-H7B-4X10S45C	(3 pcs)
Parallel pin	JB-PH-H7B-5X10S45C-Q	(8 pcs)

Table A.1 (k) Bracket assembly A05B-1220-J322 (Servo torch for aluminum)

Parts name	Specifications	Remarks
Insulator	A290-7220-X747	

Table A.1 (l) Expendable supplies of water cooling aluminum torch A05B-1220-J351

Parts name	Specifications	Remarks
Torch neck kit (the whole)	A14L-0166-2351	
Torch neck	A14L-0166-0311#782X0077	
Tip holder	A14L-0166-0311#142X0117	
Gas diffuser	A14L-0166-2351#943XJ003	
Tip	A14L-0166-0311#140X0313	φ1.0mm
Tip	A14L-0166-0311#140X0442	φ1.2mm
Neck liner	A14L-0166-0311#783XFA01	
Gas nozzle	A14L-0166-0311#145X0553	

(*) Refer to Fig. A (e) about external figure of each part.

Be sure to apply grease of figure to O-ring of water cooling torch neck.
If grease is not applied, it may cause broken of O-ring. Use cotton swab of appendix to apply grease.

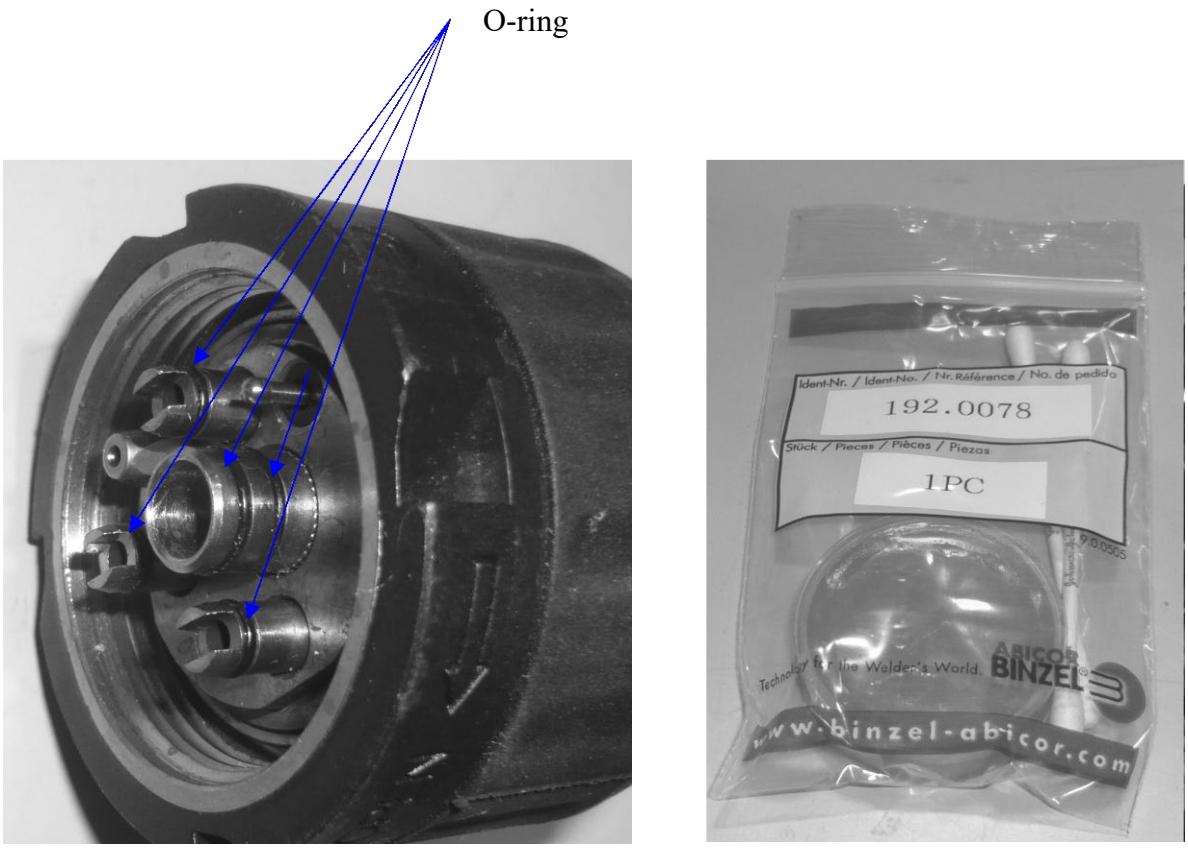


Fig. A.1 (b) Applying grease to O-ring of attached of water cooling torch

Table A.1 (m) Solenoid valve kit for assist gas A05B-1220-J381

Parts name	Specifications	Remarks
Solenoid valve kit for assist gas	A14L-0166-2381	

Table A.1 (n) Gas hose for servo torch for aluminum A05B-1220-J384

Parts name	Specifications	Remarks
Gas hose for argon gas 10m	A14L-0166-2384	

Table A.1 (o) Gas regulator for servo torch for aluminum A05B-1220-J383

Parts name	Specifications	Remarks
Gas regulator for argon gas	A14L-0166-2383	

Table A.1 (p) Flexible conduit for servo torch for aluminum A05B-1220-J393, J395, J397, J398

Parts name	Specifications	Remarks
Adapter kit	A14L-0166-2395#A-2LNIC-AK	
Inner liner	A14L-0166-2395#A-4L-H	
Threaded connector	A14L-0166-2395#A-16F-3	
Servo torch Flexible conduit ARC Mate 100*i*C for aluminum /2.5m	A14L-0166-2395#EC-3	
Servo torch Flexible conduit ARC Mate 100*i*C for aluminum /5m	A14L-0166-2393#EC-3	

Parts name	Specifications	Remarks
Servo torch Flexible conduit ARC Mate 120*i*C for aluminum /2.8m	A14L-0166-2397#EC-3	
Flexible conduit sleeve	A14L-0166-2395#EC-3RG	
Coupler	A14L-0166-2392#WWTT-DP	

A.2 Servo torch for mild steel

Table A.2 (a) Torch adapter assembly A05B-1220-J311 (servo torch for aluminum, servo torch for mild steel)

Parts name	Specifications	Remarks
Torch adapter kit	A14L-0166-2311 (NOTE)	
Torch adapter insulator	A14L-0166-2311#783X9656	
Torch adapter cover	A14L-0166-2311#783X9655	

NOTE
Bar terminal connection type torch adapter is used for robots which serial is R13Z02460 (Made in Dec. 2013) or before. Round terminal connection type torch adapter is used for robots which was made later than it. (See Fig. A.1 (a).) You cannot order bar terminal connection type torch adapter. Be careful.

Table A.2 (b) Servo torch wrist cable A05B-1220-J365 (Standard ARC Mate 100*i*C, ARC Mate 100*i*C/12)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V365 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V375 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0062	Torch cable conduit (It is included in A290-7220-V365, V375.)
Wrist cableK164	A660-4005-T072#L1R303	Wrist cable (It is included in A290-7220-V365, V375)
Wrist cableK165 (bar terminal connection type)	A660-8040-T037#L1R093 (NOTE	Welding power cable (It is included in A290-7220-V365)
Wrist cableK173 (round terminal connection type)	A660-8040-T041#L1R093 (NOTE)	Welding power cable (It is included in A290-7220-V375)

Table A.2 (c) Servo torch wrist cable A05B-1220-J366 (Standard ARC Mate 100*i*C/6L/7L)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V366 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V376 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0084	Torch cable conduit (It is included in A290-7220-V366, V376)
Wrist cable K164	A660-4005-T072#L1R543	Wrist cable (It is included in A290-7220-V366, V376)
Wrist cable K165 (bar terminal connection type)	A660-8040-T037#L1R313 (NOTE)	Welding power cable (It is included in A290-7220-V366)
Wrist cable K173 (round terminal connection type)	A660-8040-T041#L1R313 (NOTE)	Welding power cable (It is included in A290-7220-V376)

Table A.2 (d) Servo torch wrist cable A05B-1220-J367 (Standard ARC Mate 120*i*C)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V367 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V377 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0087	Torch cable conduit (It is included in A290-7220-V367, V377)
Wrist cable K164	A660-4005-T072#L1R543	Wrist cable (It is included in A290-7220-V367, V377)
Wrist cable K165 (bar terminal connection type)	A660-8040-T037#L1R313 (NOTE)	Welding power cable (It is included in A290-7220-V367)
Wrist cable K173 (round terminal connection type)	A660-8040-T041#L1R313 (NOTE)	Welding power cable (It is included in A290-7220-V377)

Table A.2 (e) Servo torch wrist cable A05B-1220-J368 (Standard ARC Mate 120*i*C/10L, 12L)

Parts name	Specifications	Remarks
Servo torch wrist cable (bar terminal connection type)	A290-7220-V368 (NOTE)	Torch cable kit (bar terminal connection type)
Servo torch wrist cable (round terminal connection type)	A290-7220-V378 (NOTE)	Torch cable kit (round terminal connection type)
Hand cable assembly	A97L-0118-0734#T36-0101	Torch cable conduit (It is included in A290-7220-V368,V378)
Wrist cable K164	A660-4005-T072#L1R703	Wrist cable (It is included in A290-7220-V368,V378)
Wrist cable K165 (bar terminal connection type)	A660-8040-T037#L1R493 (NOTE)	Welding power cable (It is included in A290-7220-V368)
Wrist cable K173 (round terminal connection type)	A660-8040-T041#L1R493 (NOTE)	Welding power cable (It is included in A290-7220-V378)

NOTE
For the servo torch wrist cable, select the cable kit spec. which match the torch adapter connection terminal. Refer to Fig. A.1 (a).

Table A.2 (f) Roller for mild steel wire (Double nut Specifications) A05B-1220-J348

Parts name	Specifications	Remarks
ϕ0.9 Roller for mild steel wire	A05B-1220-J348	

(*) This specification is only for Japan.

Table A.2 (g) Roller for mild steel wire (Double nut Specifications) A05B-1220-J349

Parts name	Specifications	Remarks
ϕ1.0 Roller for mild steel wire	A05B-1220-J349	

(*) This specification is only for Japan.

Table A.2 (h) Roller for mild steel wire (Double nut Specifications) A05B-1220-J350

Parts name	Specifications	Remarks
ϕ1.2 Roller for mild steel wire	A05B-1220-J350	

(*) This specification is only for Japan.

Table A.2 (i) Roller for mild steel wire A05B-1215-J363

Parts name	Specifications	Remarks
ϕ0.9 Roller for mild steel wire	A05B-1215-J363	

Table A.2 (j) Roller for mild steel wire A05B-1215-J365

Parts name	Specifications	Remarks
φ1.2 Roller for mild steel wire	A05B-1215-J365	

Table A.2 (k) Servo torch mechanical section A05B-1220-J302, J304 (Servo torch for mild steel)

Parts name	Specifications	Remarks
Motor	A06B-0117-B205#0049	J7-axis0 βiS0. 2/6000 (without brake) (Servo torch for aluminum)
Bush	A290-7215-X745	for mounting of motor (4 pcs)
Gear	A290-7220-Z711	for motor shaft
Adapter	A290-7220-Z720	for motor shaft
Gasket	A290-7220-Z731	for motor shaft
Bush	A290-7220-Z745	for motor shaft
Key	JB-HKY-3X3X6B	for motor shaft
Parallel pin	JB-PH-H7B-3X6S45C	For connection of motor shaft and adapter (8 pcs)
Adjust bolt	A290-7220-X727	Jamming roller part
Grease	A98L-0040-0174#16KG	Refer to Chapter 5 for required quantity.

Table A.2 (l) Bracket assembly A05B-1220-J323

Parts name	Specifications	Remarks
Insulator	A290-7220-X786	
Motor cover	A290-7220-X788	
Parallel pin	JB-PH-H7B-4X10S45C	(3 pcs)
Parallel pin	JB-PH-H7B-5X10S45C-Q	(8 pcs)

Table A.2 (m) air-cooling steel torch expendable supplies of A05B-1220-J352

Parts name	Specifications	Remarks
Torch neck kit (the whole)	A14L-0166-2352	
Torch neck	A14L-0166-0321#213X0141	
Tip holder	A14L-0166-2352#142X0177	
Tip	A14L-0166-0301#140JP009	φ0.9mm (10 pcs set)
Tip	A14L-0166-0301#140JP010	φ1.0mm (10 pcs set)
Tip	A14L-0166-0301#140JP005	φ1.2mm (10 pcs set)
Neck liner	A14L-0166-0321#783XFS01	
Gas nozzle	A14L-0166-2352#145X0615	

(*) Refer to Fig. A (e) about external figure of each part.

Table A.2 (n) Flexible conduit for servo torch for mild steel A05B-1220-J374 (ARC Mate 120*i*C/10L, 12L)

Parts name	Specifications	Remarks
Conduit	A14L-0166-2374#CONDUIT	
Liner	A14L-0166-2374#LINER	
Block	A14L-0166-2375#BLOCK	
Inlet	A14L-0166-2375#INLET	
Joint	A14L-0166-2375#JOINT	

Table A.2 (o) Flexible conduit for servo torch for mild steel A05B-1220-J375 (ARC Mate 100*i*C, ARC Mate 100*i*C/12)

Parts name	Specifications	Remarks
Conduit	A14L-0166-2375#CONDUIT	
Liner	A14L-0166-2375#LINER	
Block	A14L-0166-2375#BLOCK	
Inlet	A14L-0166-2375#INLET	
Joint	A14L-0166-2375#JOINT	

Table A.2 (p) Flexible conduit for servo torch for mild steel A05B-1220-J376 (ARC Mate 100*i*C/6L, 7L)

Parts name	Specifications	Remarks
Conduit	A14L-0166-2376#CONDUIT	
Liner	A14L-0166-2376#LINER	
Block	A14L-0166-2375#BLOCK	
Inlet	A14L-0166-2375#INLET	
Joint	A14L-0166-2375#JOINT	

Table A.2 (q) Flexible conduit for servo torch for mild steel A05B-1220-J377 (ARC Mate 120*i*C)

Parts name	Specifications	Remarks
Conduit	A14L-0166-2377#CONDUIT	
Liner	A14L-0166-2377#LINER	
Block	A14L-0166-2375#BLOCK	
Inlet	A14L-0166-2375#INLET	
Joint	A14L-0166-2375#JOINT	

A.2 (r) Flexible conduit for servo torch for mild steel A05B-1291-H411

Parts name	Specifications	Remarks
Flexible conduit 4.6m	A14L-0166-0411	

Table A.2 (s) Flexible conduit for servo torch for mild steel A05B-1291-H413

Parts name	Specifications	Remarks
Flexible conduit 3m	A14L-0166-0413	

Table A.2 (t) Flexible conduit for servo torch for mild steel A05B-1291-H414

Parts name	Specifications	Remarks
Flexible conduit 1.7m	A14L-0166-0414	

Table A.2 (u) Gas regulator A05B-1291-J101

Parts name	Specifications	Remarks
Standard (for gas cylinder)	A14L-0166-1101	

Table A.2 (v) Gas hose for servo torch for mild steel A05B-1291-J151, J152, J153,J154

Parts name	Specifications	Remarks
Gas hose 10m	A97L-0218-0112#L10R03	
Gas hose 15m	A97L-0218-0112#L15R03	
Gas hose 20m	A97L-0218-0112#L20R03	
Gas hose 25m	A97L-0218-0112#L25R03	

A.3 SERVO TORCH FOR TIG

Table A.3 (a) Mechanical unit of servo torch A05B-1220-J305 (Servo torch for TIG)

Parts name	Specifications	Remarks
Motor	A06B-0114-B204	J7-axis βiS0. 4/5000 (without brake)
Adapter	A290-7215-X721	for motor
Adapter	A290-7215-X742	for motor
Collar	A290-7215-X743	for motor
Bush	A290-7215-X745	for motor
Gear	A290-7220-X711	for motor shaft
Adjust bolt	A290-7220-X727	for motor shaft
Washer	A290-7220-X745	for motor
Roller bush	A290-7220-Z744	for roller
Bolt	A97L-0218-0514#M3X12	for roller cover
Cover knob	A97L-0218-0766#041014	Jamming roller part
Grease	A98L-0040-0174#16KG	Refer to Chapter 5 for required quantity.
Key	JB-HKY-3X3X6B	for motor
O ring	JB-OR4D-G45	for motor
Pin	JB-PH-H7B-3X6S45C	for motor

Table A.3 (b) Bracket assembly A05B-1220-J324 (Servo torch for TIG)

Parts name	Specifications	Remarks
Gasket	A290-7220-X748	
Motor cover	A290-7220-Z718	
Parallel pin	A290-7220-Z724	(4 pcs)
Parallel pin	JB-PH-H7B-4X10S45C	(3 pcs)
Parallel pin	JB-PH-H7B-5X10S45C-Q	(4 pcs)

Table A.3 (c) Torch A05B-1220-J354 (Servo torch for TIG)

Parts name	Specifications	Remarks
Torch	A14L-0166-2354	

B CIRCUIT DIAGRAM

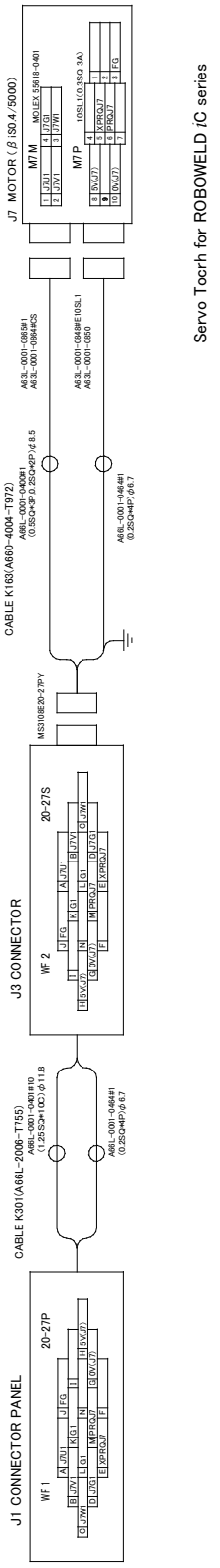


Fig.B (a) Circuit diagram (Servo torch for aluminum/TIG)

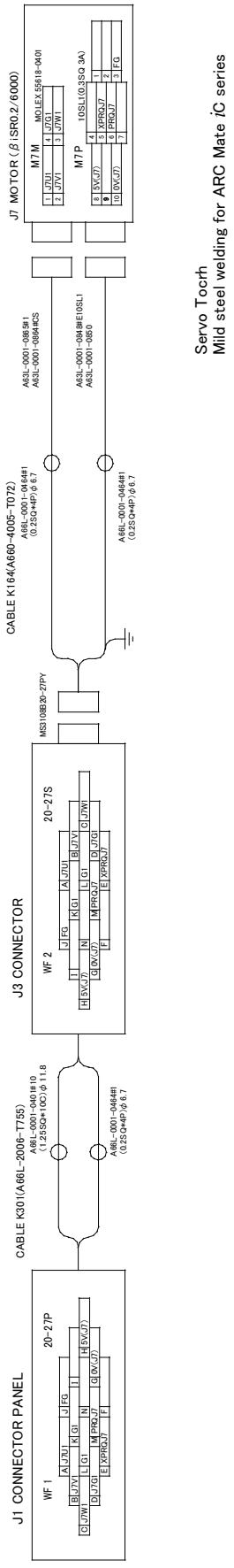


Fig.B (b) Circuit diagram (Servo torch for mild steel)

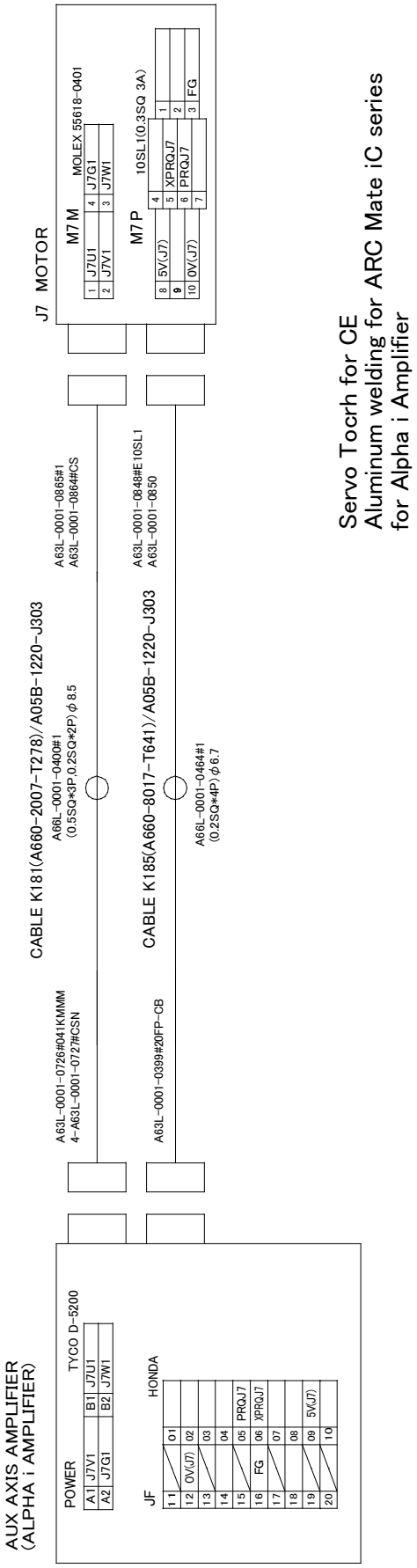


Fig.B (c) Circuit diagram (Servo torch for aluminum (CE) for alpha *i* amplifier)

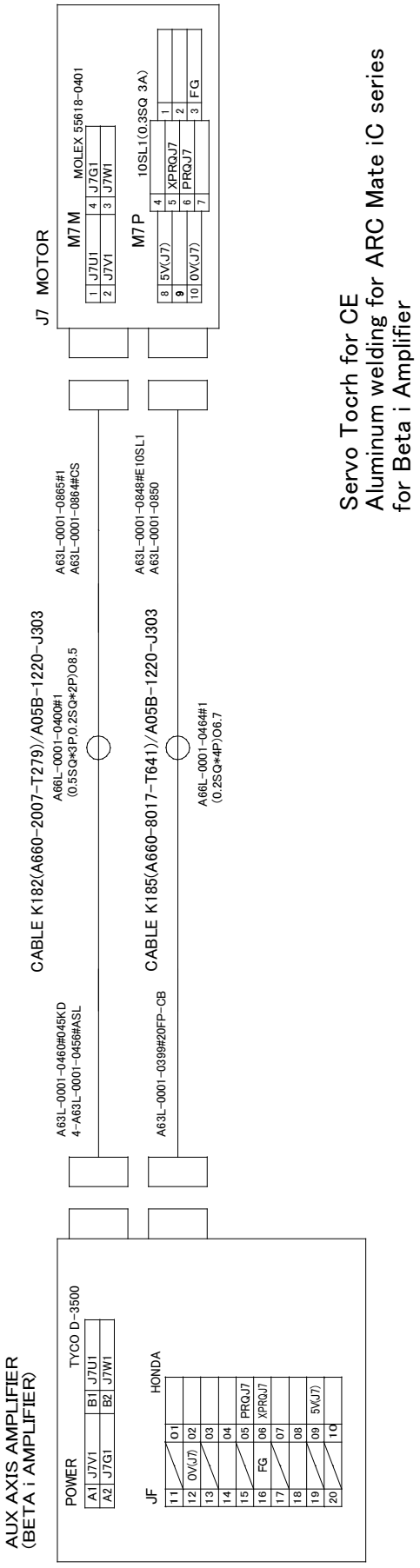


Fig.B (d) Circuit diagram (Servo torch for aluminum (CE) for beta *i* amplifier)

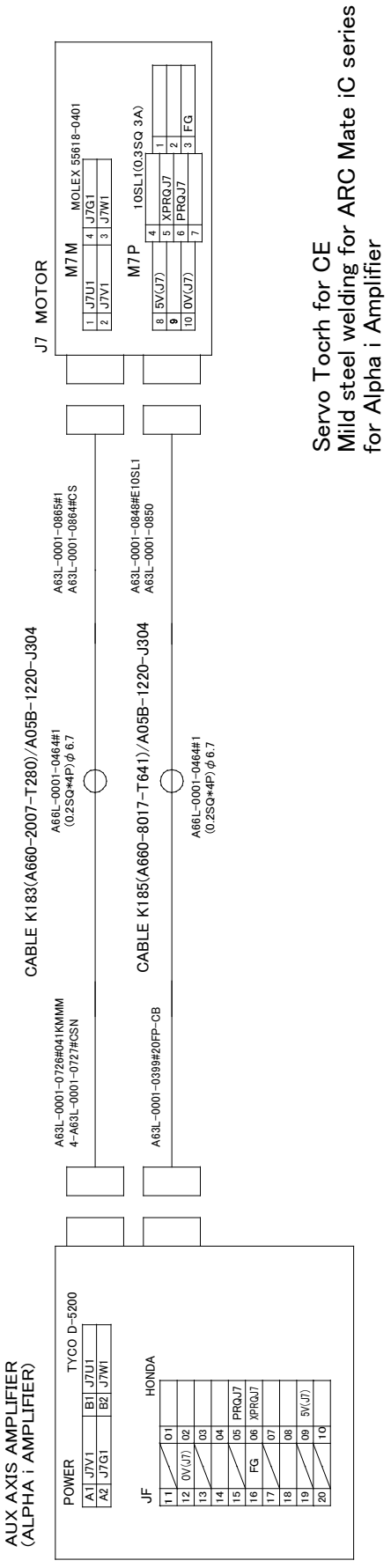


Fig.B (e) Circuit diagram (Servo torch for mild steel (CE) for alpha *i* amplifier)

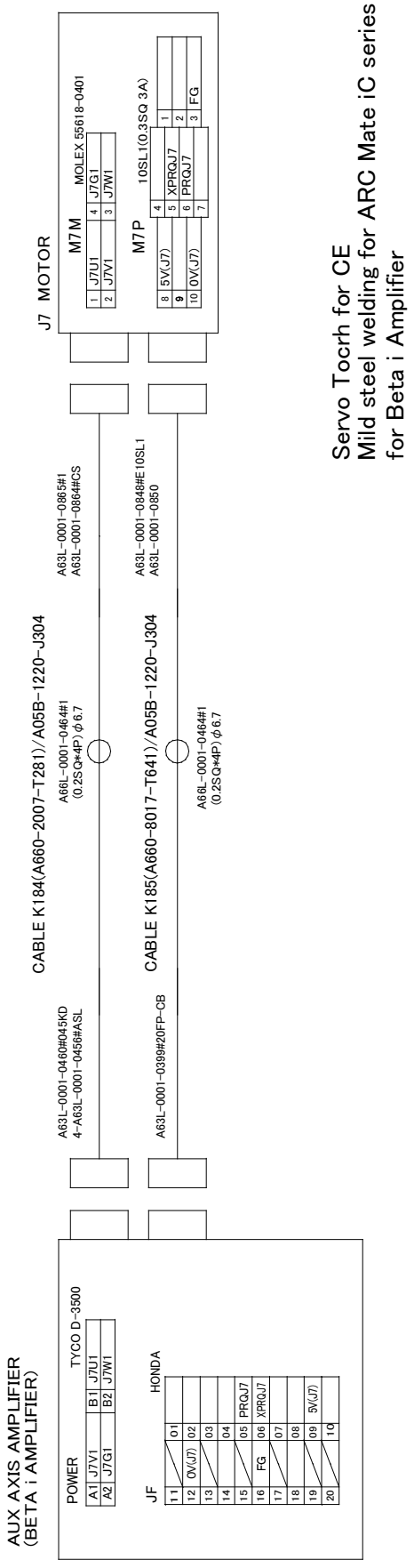


Fig.B (f) Circuit diagram (Servo torch for mild steel (CE) for beta *i* amplifier)

C PERIODIC MAINTENANCE TABLE

Servo torch **Periodic Maintenance Table**

		Check time	Grease amount	First check 320	3 months 920	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 years 7680	8640	9600	10560
1	Confirm the situation of roller (*1)	0.2H	—	○	○	○	○	○	○	○	○	○	○	○	○
2	Replacing inlet guide liner (Servo torch for aluminum)	0.1H	—	○	○	○	○	○	○	○	○	○	○	○	○
3	Check the motor and exposed connector. (Loosening)	0.1H	—		○	○	○	○	○	○	○	○	○	○	○
4	Tighten the cover and main bolt.	0.5H	—		○	○	○	○	○	○	○	○	○	○	○
5	Remove spatter, trash, dust etc.	0.1H	—		○	○	○	○	○	○	○	○	○	○	○
6	Cleaning and replacing liner	0.1H	—		○	●	○	●	○	●	○	●	○	●	○
7	Cleaning and replacing neck liner	0.1H	—		●	●	●	●	●	●	●	●	●	●	●
8	Replacing roller	0.5H	—					●				●			
9	Replacing flexible conduit	0.5H	—					●				●			
10	Replacing torch cable	1.0H	—					●				●			
11	Replacing grease	0.1H	50g												

*1 Confirm status of roller and replace inlet guide liner every months.
See Chapter 4 about daily check.

*2 ●: requires order of parts
○: does not require order 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
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D STRENGTH OF BOLT AND BOLT TORQUE LIST

NOTE

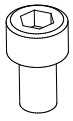
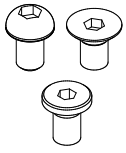
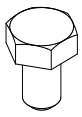
When applying LOCTITE to a part, spread the LOCTITE on the entire length of the engaging part of the female thread. If applied to the male threads, poor adhesion can occur, potentially loosening the bolt. Clean the bolts and the threaded holes and wipe off any oil on the engaging section. Make sure that there is no solvent left in the threaded holes. When finished, remove all the excess LOCTITE when you are finished screwing the bolts into the threaded holes.

Use the following strength bolts. Comply with any bolt specification instructions.
Hexagon socket head bolt made of steel:

Size M22 or less: Tensile strength 1200N/mm^2 or more
Size M24 or more: Tensile strength 1000N/mm^2 or more
All size plated bolt: Tensile strength 1000N/mm^2 or more

Hexagon bolt, stainless bolt, special shape bolt (button bolt, low-head bolt, flush bolt .etc.)
Tensile strength 400N/mm^2 or more
Refer to the following tables if the bolts tightening torque is not specified.

Recommended bolt tightening torques **Unit: Nm**

Nominal diameter	Hexagon socket head bolt (steel)		Hexagon socket head bolt (stainless steel)		Hexagon socket head button bolt Hexagon socket head flush bolt Low-head bolt (steel)		Hexagon bolt (steel)	
	Tightening torque		Tightening torque		Tightening torque		Tightening torque	
	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit
M3	1.8	1.3	0.76	0.53	———	———	———	———
M4	4.0	2.8	1.8	1.3	1.8	1.3	1.7	1.2
M5	7.9	5.6	3.4	2.5	4.0	2.8	3.2	2.3
M6	14	9.6	5.8	4.1	7.9	5.6	5.5	3.8
M8	32	23	14	9.8	14	9.6	13	9.3
M10	66	46	27	19	32	23	26	19
M12	110	78	48	33	———	———	45	31
(M14)	180	130	76	53	———	———	73	51
M16	270	190	120	82	———	———	98	69
(M18)	380	260	160	110	———	———	140	96
M20	530	370	230	160	———	———	190	130
(M22)	730	510	———	———	———	———	———	———
M24	930	650	———	———	———	———	———	———
(M27)	1400	960	———	———	———	———	———	———
M30	1800	1300	———	———	———	———	———	———
M36	3200	2300	———	———	———	———	———	———
								

INDEX

REVISION RECORD

Edition	Date	Contents
06	Apr., 2022	• Addition of servo torch installation procedure • Correction of errors
05	Jan., 2020	• Addition of the air blow • Correction of errors
04	Sep., 2015	• Correction of errors
03	Feb., 2013	• Addition of R-30*i*B controller • Addition of servo torch for TIG • Change of spare parts list • Addition of periodic maintenance table • Correction of errors
02	Nov., 2010	• Addition of servo torch for aluminum and CE specification
01	Mar., 2010	

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