FANUC Robot series

R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus CONTROLLER

ARC Welding Power Supply Option (LINCOLN/FANUC Welding Power Supply)

OPERATOR'S MANUAL

B-83614EN-1/06

- **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 “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. Works carried out in the safeguarded space include transportation, installation, teaching, adjustment, and maintenance.
- To work inside the safeguarded space, the person must be trained on proper robot operation.

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

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

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

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

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

2 DEFINITION OF SAFETY NOTATIONS

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

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

PREFACE

Prior to the use of the arc welding robot package FANUC Robot welding power supply option, this chapter provides an introduction to this manual and describes safety precautions.
Before using the robot, be sure to read and understand this documentation.

About this manual

The arc welding package " FANUC R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus Controller arc welding power supply option Operator's Manual" describes how to operate a welding machine incorporating a robot and controller.
This manual provides descriptions of the models indicated in the table below, and uses the abbreviations of the model names below in the text.
If you use ROBOWELD 100*i*C series , ROBOWELD 120*i*C series. Please refer to description about ARC Mate 100*i*C series, ARC Mate 120*i*C series.

Model name	Abbreviation for each	Abbreviation
FANUC Robot ARC Mate 0*i*B	ARC Mate 0*i*B	
FANUC Robot ARC Mate 100*i*C	ARC Mate 100*i*C	ARC Mate 100*i*C series
FANUC Robot ARC Mate 100*i*C/6L	ARC Mate 100*i*C/6L	
FANUC Robot ARC Mate 100*i*C/12	ARC Mate 100*i*C/12	
FANUC Robot ARC Mate 100*i*C/7L	ARC Mate 100*i*C/7L	
FANUC Robot ARC Mate 120*i*C	ARC Mate 120*i*C	ARC Mate 120*i*C series
FANUC Robot ARC Mate 120*i*C/10L	ARC Mate 120*i*C/10L	
FANUC Robot ARC Mate 120*i*C/12L	ARC Mate 120*i*C/12L	
FANUC Robot ARC Mate 50*i*D	ARC Mate 50*i*D	ARC Mate 50*i*D series
FANUC Robot ARC Mate 50*i*D/7L	ARC Mate 50*i*D/7L	
FANUC Robot ARC Mate 100*i*D	ARC Mate 100*i*D	ARC Mate 100*i*D series
FANUC Robot ARC Mate 100*i*D/10L	ARC Mate 100*i*D/10L	
FANUC Robot ARC Mate 100*i*D/8L	ARC Mate 100*i*D/8L	
FANUC Robot ARC Mate 120*i*D	ARC Mate 120*i*D	ARC Mate 120*i*D series
FANUC Robot ARC Mate 120*i*D/12L	ARC Mate 120*i*D/12L	

NOTE
Some models does not support FANUC welding power supply.

Definition of SAFETY

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warning and Caution according to their bearing on safety.
Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

Serious injuries mentioned below are those injuries that have after-effects and those that require hospitalization or reception of long-term hospital treatment as outpatients, such as loss of eyesight, wounds, burns (high-temperature and low-temperature burns), electric shocks, fractures, and poisoning. Medium troubles and minor injuries are those wounds, burns, electric shocks, and so forth that do not require hospitalization or reception of long-term hospital treatment as outpatients. Equipment damages refer to property damages and extended damages related to device damages.

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.

- Check this manual thoroughly, and keep it handy for the future reference.

SAFETY PRECAUTIONS

⚠**WARNING**
- Before using this machine, read this operator's manual thoroughly to use the machine correctly.
- The precautions in this manual are presented so that you can use the equipment safely and that injuries and damages to you and other people can be prevented.
- This equipment is designed and manufactured with sufficient consideration given to safety. When using the equipment, observe the precautions described in this operator's manual. Disregarding these precautions can cause serious accidents resulting in a human injury or death.

General precautions

⚠**WARNING**
- Observe the laws and your company's standards when performing power supply construction on the input side, selection of an installation place, handling and storing of high-pressure gas, piping, storing of welded products, waste disposal, and so forth.
- A person who uses a heart pace maker must keep away from the operating welding machine unless he or she gets permission from the doctor. When powered, the welding machine generates a magnetic field which affects pace maker operation adversely.
- For safety, installation, inspection, and repair of this equipment must be done by qualified persons or those who are familiar with the welding machine.
- For safety, operation of this equipment must be performed by those who are familiar with this operator's manual and have knowledge and skill to operate this equipment safely.
- Do not use this equipment for purposes other than welding.

Precautions relating to maintenance

⚠**WARNING**

When performing maintenance work, turn off the power to the robot and system where possible. If the power is on, some maintenance operations present a danger of electric shock. As necessary, provide a lock not to prevent other persons from turning on the power. If you have to perform maintenance work with the power on, press the emergency stop button where possible.

⚠CAUTION
The following parts will heat, so care must be taken. If you have to touch such a part when it is hot, prepare protectors such as heat-resistant gloves.
- Servo motor
- Inside of the controller
- Welding torch

⚠CAUTION
When replacing parts, be careful not to let dust and dirt enter the inside of the robot.

Electric shock

⚠WARNING
- Do not touch any charged part.
- Grounding the case of the welding power supply, a base metal, and a jig electrically connected to the base metal, and so forth must be performed according to the law (the electric facility engineering standard) by a person qualified as an electrician.
- Before starting maintenance and inspection, be sure to turn off the switch of the power panel (the power supply of the factory). The capacitor may be charged even after the input power supply is turned off, so wait at least five minutes.
- Do not use cables with insufficient capacities, damaged cables, and cables of which conductors are exposed.
- Cable connection parts must be tightened securely then insulated.
- Do not use the machine with the case or cover of the welding power supply left removed.
- Do not use broken or wet gloves.
- Maintenance and inspection must be performed periodically, and any damaged parts must be repaired before the use of the machine.

Weld fumes and gases

⚠WARNING
- In places defined by the laws (the labor safety and health regulation and the regulation for preventing anoxia and so forth), provide sufficient ventilation or use a device such as an air respirator to prevent gas poisoning and suffocation.
- To prevent dust troubles and poisoning due to fumes and so forth, use a local exhaust system defined by the laws (the labor safety and health regulation and the regulation for preventing dust troubles) or a respiratory protector.
- Carbon dioxide gas and other gases that are heavier than air stay in a bottom part. Therefore, when performing robot welding operation in the bottom part or a narrow place, provide sufficient ventilation, or use an air respirator.
- Do not perform robot welding near the places where degreasing, cleaning, and spraying are performed. Otherwise, toxic gas may be generated in such environments.
- When welding coated steel, be sure to provide sufficient ventilation or use a respiratory protector. Welding coated steel generates toxic gas or fumes.

Prevention of fires and explosions

⚠WARNING

- A base metal immediately after spattering or cutting is heated and can cause a fire.
- A portion where a cable is connected incompletely or an incomplete contact in the current path on the base metal side such as a steel frame can be heated when the power is on, which can cause a fire.
- Generating arc in a container of a combustible substance such as gasoline can cause explosion.
- Get rid of any combustible substance so that a spatter does not splash over the substance. If a combustible substance cannot be removed, cover the substance with a non-combustible cover.
- Do not perform welding near the presence of a combustible gas.
- Cable connection parts must be tightened securely and insulated.
- The cable should be connected on the base metal side as close as possible to the portion to be welded.
- Install a fire extinguisher near the welding place in preparation for emergency.

Arc light, spatter, and noise

⚠CAUTION

- The arc light can cause eye inflammation or skin burning.
- Splashing a spatter and slag can cause eye injury or burning.
- Noise can cause abnormality in hearing.
- When supervising welding work, wear safety glasses that provide sufficient glare protection or wear a safety mask for welding.
- Wear safety glasses to protect the eyes from spatter and slag.
- Wear protectors such as leather gloves for welding, long-sleeved clothes, foot covers, and a leather apron.
- Install a safety curtain around the welding place to prevent the arc light from reaching the eyes of other persons.
- If the noise level is high, use a noise protector.

Gas cylinder and gas regulator

⚠CAUTION

- If the gas cylinder falls, an accident can be caused, resulting in a human injury or death.
- High-pressure gas is encapsulated in the gas cylinder. Therefore, incorrect handling of the gas cylinder can cause high-pressure gas to blow out, which can lead to an accident resulting in a human injury or death.
- When handling the gas cylinder, observe the law and the in-house standard.
- Use the gas flow rate controller supplied by FANUC or recommended by FANUC.
- Before using the gas flow rate controller, read the relevant operator's manual and observe the precautions described in the manual.
- Secure the gas cylinder on a dedicated gas cylinder stand.
- Do not subject the gas cylinder to a high-temperature environment.
- When opening the valve of the gas cylinder, keep your face away from the outlet.
- Whenever the gas cylinder is not in use, be sure to mount the protection cap on the cylinder.

Welding wire

⚠CAUTION
The wire can protrude suddenly from the tip of the welding torch, which can result in an eye, face, or body injury.
- Do not perform inching with your eyes or face close to the tip of the welding torch. Should the wire protrude unexpectedly, the wire can injure the eyes, face, or body.

SAFETY MEASURES

Safety precautions

Unlike ordinary automatic machines, robots have arms and wrists which can be moved. This means that robots can adopt any posture quite easily, but it also means that they are quite dangerous. Usually, a robot and peripheral equipment make up an automatic system.
Therefore, the user of the robot must take safety precautions for the entire system. The safety precautions are described below.

Safety precautions for installation and layout

- Use signals such as warning lamps to indicate that the robot is in operation.

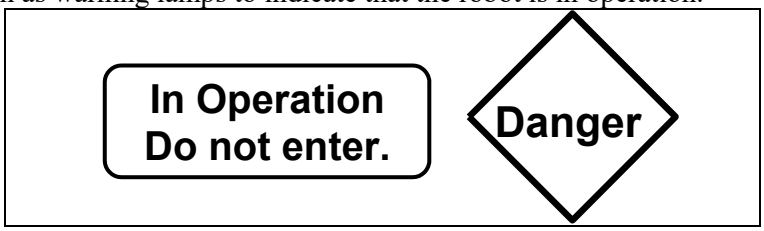

Fig. 1 Example of Alarm indications

- Install a safety fence with a safety door so that a worker can enter the inside of the fence only by opening the door, and opening the door causes the robot to stop.

NOTE
The controller brings the robot to a deceleration stop when the safe speed (*SFSPD) input signal is turned off.

- Install the safety fence so that it encloses the robot operation area completely. Install the controller outside the safety fence.

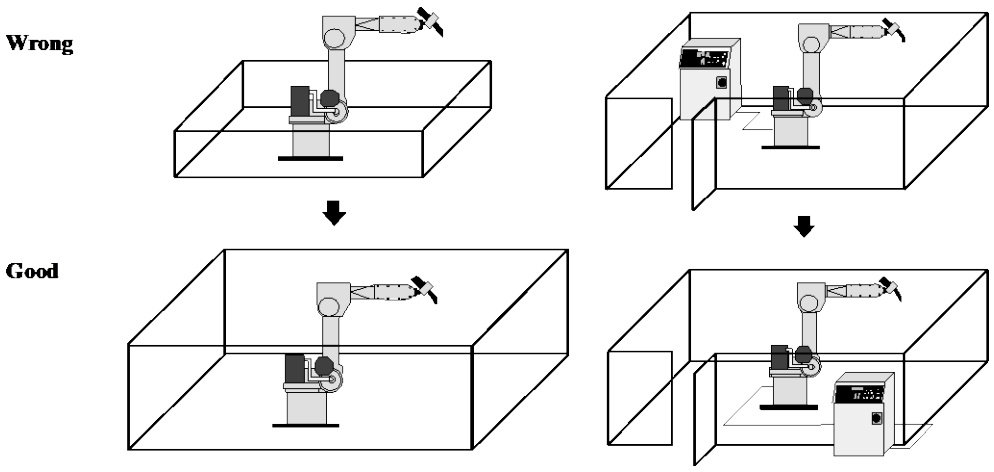

Fig. 2 Safety fence

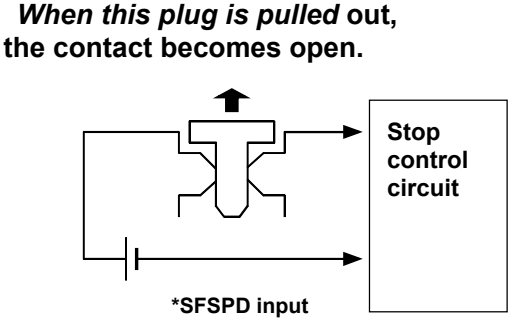

Fig. 3 Safety plug

- Install an emergency stop button in a place that allows the operator to press it immediately.

NOTE
Upon receiving the emergency stop signal, the controller brings the robot to an emergency stop.

Safety precautions for system design

- Install a safety joint between the robot's joints forming a tool so that if an abnormal external force is applied to the robot the safety joint breaks and the robot stops.

NOTE
When the hand break (XHBK) input signal is turned off, the controller brings the robot to an emergency stop.

- Ground all peripheral units properly.
- When an available operating area is smaller than the maximum operating area of the robot, the operating area can be specified by parameters.
- The robot can receive several types of external interlock signals.
  By sending the operating status of a peripheral unit to the robot, robot operation can be suspended or stopped.
- Install a lock as required so that only authorized workers can turn on the power.

NOTE
A padlock can be installed on the circuit breaker of the controller door to prevent the power from being turned on by an unauthorized person.

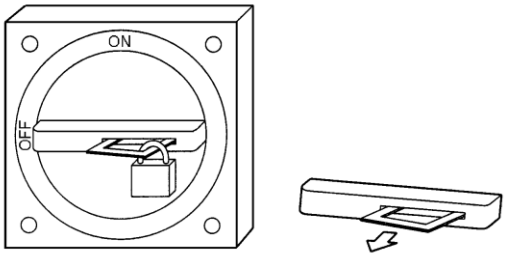

Fig. 4 Locking the circuit breaker

Safety precautions for inspection and maintenance

- Before starting inspection and maintenance, turn off the power to the controller whenever possible. Lock the circuit breaker or place a guard to prevent an unauthorized person from turning on the power.
- Before disconnecting the pneumatic system, release the supply pressure.
- Before making an electrical check that requires no robot operation, press the emergency stop button.
- When making an inspection that requires robot operation, carefully observe the motion of the robot so that the emergency stop button can be immediately pressed whenever required.

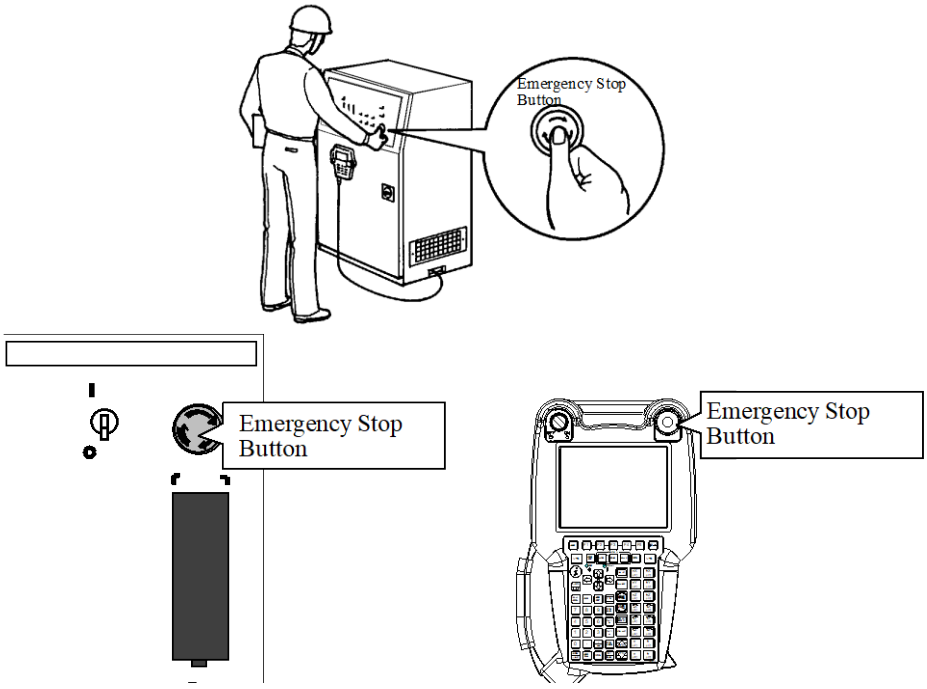

Fig. 5 Emergency stop button

Safety precautions for transportation

- Before lifting the robot with a crane or carrying the robot with a forklift, firmly secure the robot to the crane or forklift.
- Carefully inspect the carrier (crane forklift, etc.) and also carefully inspect the grips of the product.

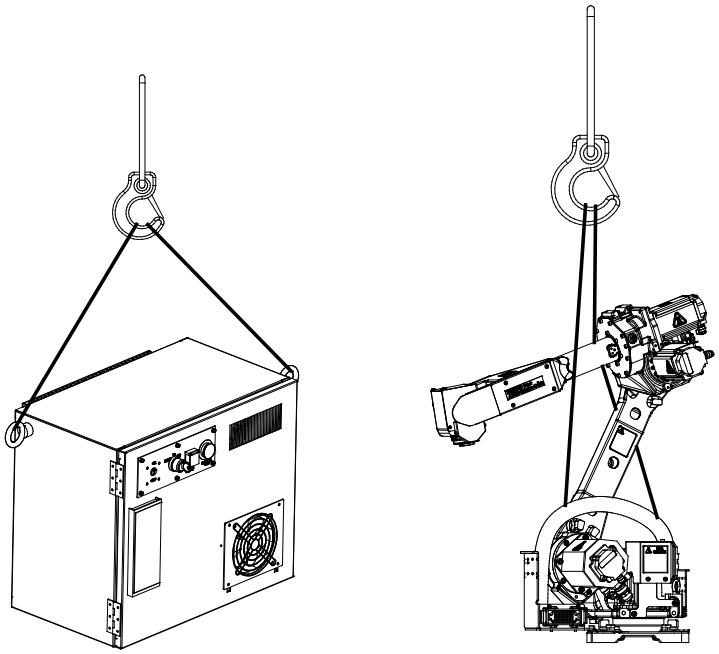

Fig. 6 Transportation of robot

Safety precautions for operation

- All robot system users are requested to attend FANUC training courses to acquire sufficient knowledge about the safety precautions and robot functions.
- Before working within the operating area of the robot -even when the robot is not running-, turn off the power to the robot or the press the emergency stop button. In addition, place a guard, warning sign, or other provision to prevent an unauthorized person from entering the operating area of the robot or activating the robot using the operator's panel or some other device.
- While working in the operating area of the robot, for example, to teach the robot a program, place a guard so that the robot can be immediately stopped in an emergency.

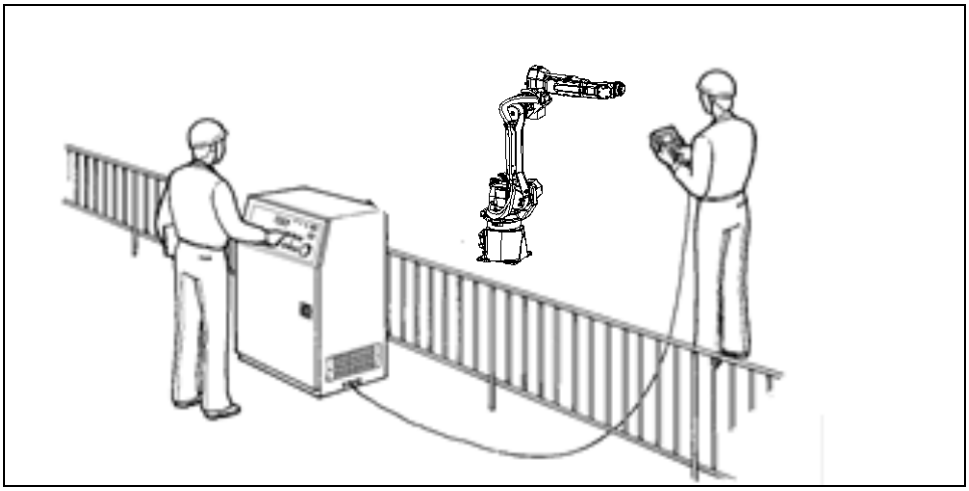

Fig. 7 Additional worker to watch for danger

Table 1 Safety precautions

Operator	Workshop	Transportation and installation
Avoid dangerous behavior. Wear safety clothes. Wear safety shoes and a helmet.	Keep the work environment neat, tidy, and clean. Provide a safety fence and warning indications. Provide ventilation. Never bring flammable materials into the workshop.	Keep the transportation path free of obstacles. When carrying the robot on a carrier such as a crane or forklift, ensure that the robot is firmly secured to the carrier. Allow sufficient clearance. Make connections properly.
Operation	**Maintenance・Check**	**Welding power supply・Torch**
Attend training classes. Master the operating procedures. Exclude unauthorized persons.	Perform repair work using FANUC products only. Before starting maintenance and inspection, turn off the power. Keep the controller door closed.	Check and maintain the cables. Check the pneumatic system. Insulate the robot from the welding gun. Provide a spatter shield. Check for cooling water leakage.

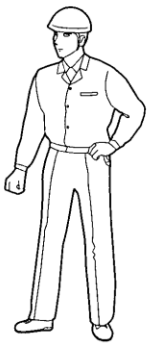

Fig. 8 Safety Clothes and Safety Helmet

- Before approaching the robot to teach a program to it, hold the teach pendant, press the deadman's switch, then turn on the teach pendant enable switch.

NOTE
The deadman's switch, if released when the teach pendant enable switch is on, brings the robot to an emergency stop.

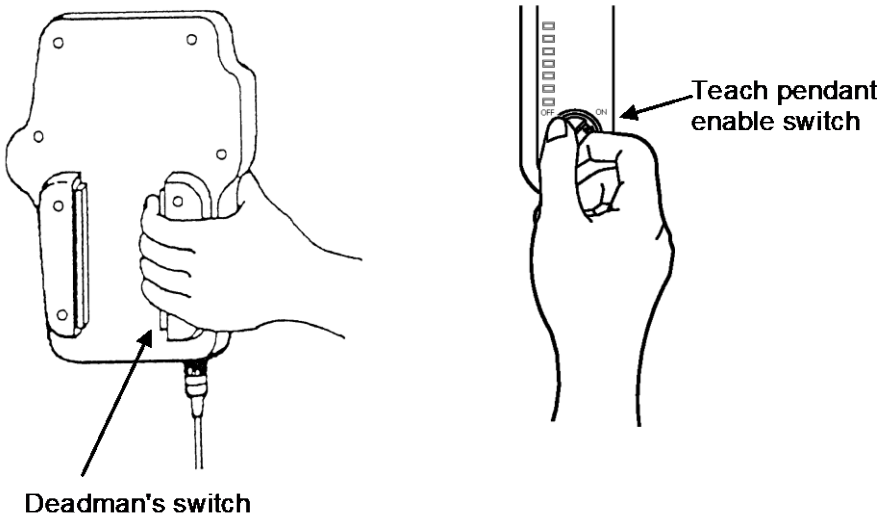

Fig. 9 Deadman's switch and Teach pendant enable switch

- Before starting to jog the robot, carefully observe the operation of the jog keys and the robot.
- During jogging, use a sufficiently low robot override speed.

RELATED MANUALS

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

Safety handbook **B-80687EN** All persons who use the FANUC Robot and system designer must read and understand thoroughly this handbook		Intended readers: Operator , system designer Topics: Safety items for robot system design, Operation, Maintenance
R-30*i*B, **R-30*i*B Mate** **R-30*i*B Plus** **R-30*i*B Mate Plus** **controller**	OPERATOR'S MANUAL (Basic Operation) **B-83284EN** OPERATOR'S MANUAL (Alarm Code List) **B-83284EN-1** OPERATOR'S MANUAL (Optional Function) **B-83284EN-2** ARC WELDING FUNCTION OPERATOR'S MANUAL **B-83284EN-3**	Intended readers : Operator, programmer, Teaching operator, Maintenance technician, System designer Topics : Robot functions, Operations, Programming, Setup, Interfaces, Alarms Use : Robot operation, Teaching, System design
	MAINTENANCE MANUAL **R-30*i*B/** **R-30*i*B Plus : B-83195EN** **R-30*i*B Mate** **R-30*i*B Mate Plus : B-83525EN**	Intended readers : Maintenance technician, System designer Topics : Installation, Start-up, Connection, Maintenance Use : Installation, Start-up, Connection, Maintenance
FANUC Robot **ARC Mate 0*i*B** **Mechanical unit**	OPERATOR'S MANUAL **B-83614EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
FANUC Robot **ARC Mate 100*i*C,** **M-10*i*A,** **ARC Mate 100*i*Ce,** **M-10*i*Ae,** **Mechanical unit**	OPERATOR'S MANUAL **B-82754EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
FANUC Robot **ARC Mate 100*i*C/12/7L/12S,** **M-10*i*A/12/7L/12S,** **Mechanical unit**	OPERATOR'S MANUAL **B-83654EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
FANUC Robot **ARC Mate 120*i*C,** **M-20*i*A** **Mechanical unit**	OPERATOR'S MANUAL **B-82874EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
FANUC Robot **LR Mate 200*i*D,** **ARC Mate 50*i*D** **Mechanical unit**	OPERATOR'S MANUAL **B-83494EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
FANUC Robot **ARC Mate 100*i*D,** **M-10*i*D** **Mechanical unit**	OPERATOR'S MANUAL **B-83944EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance

FANUC Robot ARC Mate 120*i*D, M-20*i*D Mechanical unit	OPERATOR'S MANUAL **B-84074EN**	Intended readers: System designer, Maintenance technician Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
Torch	Refer to manual of BINZEL .Ltd or MIZUHO (*)	
Welding power supply Wire feeder	Refer to manuals of LINCOLN for LINCOLN WELDING POWER SUPPLY (*) Refer to append manuals for FANUC WELDING POWER SUPPLY (*)	

(*) If there is indispensability, please make a demand in your local FANUC representative.

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Ⅰ LINCOLN WELDING POWER SUPPLY

1 OVERVIEW

This chapter describe the basic configuration and component of the robot with arc welding power supply option.

Organization of this chapter

- 1.1 Standard configuration
- 1.2 Option configuration

1.1 STANDARD CONFIGURATION

Robot with welding power supply consists of a robot mechanical section, controller, welding power supply, controller, wire feeder, welding torch, wire reel stand, and so forth.

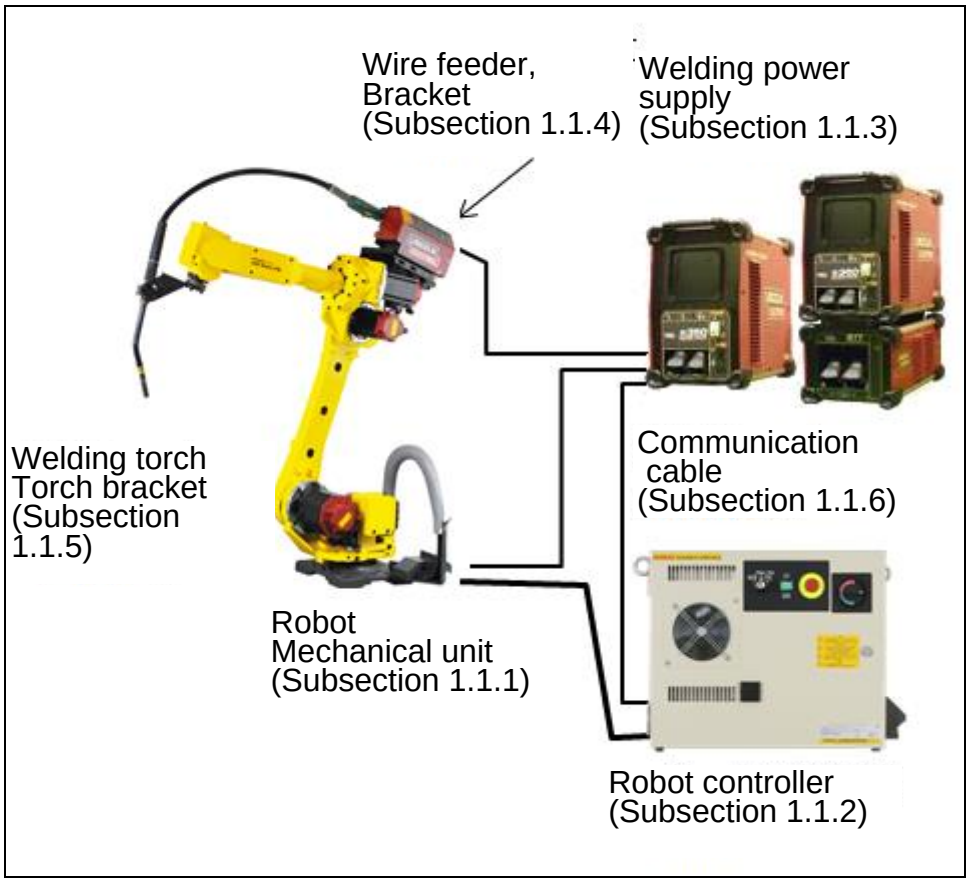


Fig. 1.1 (a) Configuration of robot with welding power supply option (except ARC Mate 50*i*D series)

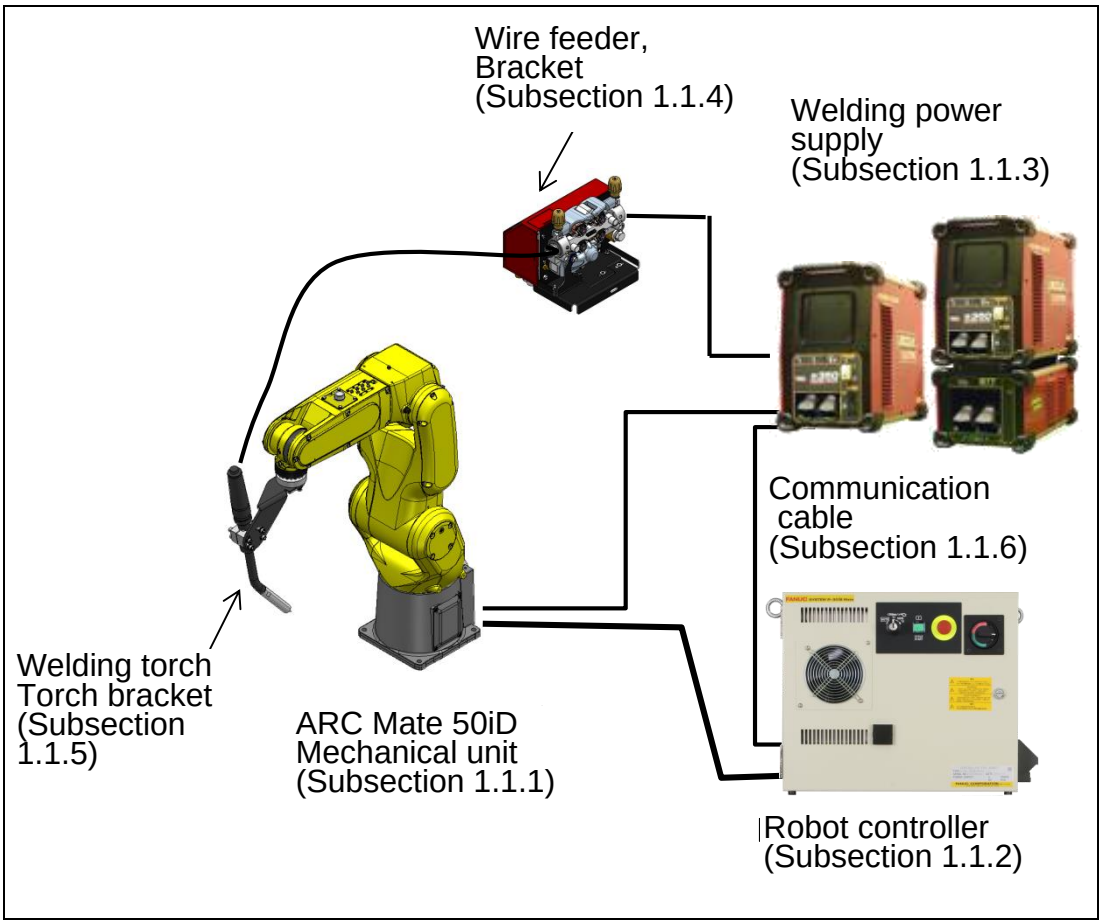


Fig. 1.1 (b) Configuration of robot with welding power supply option (ARC Mate 50*i*D series)

1.1.1 Robot Mechanical Unit Specification

Table 1.1.1 (a) Robot specifications (Note 1) (ARC Mate 0*i*B)

Item		Specification	
Model		ARC Mate 0*i*B	
Type		Articulated type	
Controlled axes (Note 2)		6-axes (J1, J2, J3, J4, J5, J6)	
Installation		Floor, Upside-down, Angle mount (Note 3)	
Motion range	J1-axis	Upper limit/Lower limit	120° (2.09rad)/-120° (-2.09rad) (with stopper) 180° (3.14rad)/-180° (-3.14rad) (without stopper)
	J2-axis	Upper limit/Lower limit	160° (2.79rad)/-90° (-1.57rad)
	J3-axis	Upper limit/Lower limit	275° (4.80rad)/-180° (-3.14rad)
	J4-axis	Upper limit/Lower limit	190° (3.31rad)/-190° (-3.31rad)
	J5-axis	Upper limit/Lower limit	140° (2.44rad)/-140° (-2.44rad)
	J6-axis	Upper limit/Lower limit	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 4)	J1-axis	225°/s(3.93rad/s)	
	J2-axis	215°/s(3.75rad/s)	
	J3-axis	225°/s(3.93rad/s)	
	J4-axis	425°/s(7.42rad/s)	
	J5-axis	425°/s(7.42rad/s)	
	J6-axis	625°/s(10.91rad/s)	
Maximum load	Wrist	3kg	
Allowable load moment at wrist	J4-axis	8.9 N·m	
	J5-axis	8.9 N·m	
	J6-axis	3.0 N·m	
Allowable load inertia at wrist	J4-axis	0.28 kg·m^2	
	J5-axis	0.28 kg·m^2	
	J6-axis	0.035 kg·m^2	
Repeatability		±0.08 mm	
Robot mass		99 kg (without pedestal) 145 kg (with pedestal)	
Acoustic noise level		Less than 70dB (Note 5)	
Installation environment		Ambient temperature: 0 to 45℃ (Note 6) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 7)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE for further evaluation before running production.
2 In case of using robot combined with aux. axis, please consult with your local FANUC representative.
3 In case of angle mount, motion range is restricted. Please contact your local FANUC representative for details.
4 During short distance motions, the axis speed may not reach the maximum value stated.
5 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
6 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
7 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

⚠ WARNING

1 Make welding torch less than allowable load moment at wrist and inertia.
If load exceeds allowable load, it may cause early breakage of mechanical unit.
2 When setting load to J3 casing orJ2 base, refer to mechanical unit operator's manual.
3 Use of this robot is strictly limited to arc welding applications.

Table 1.1.1 (b) Robot specifications (Note 1) (ARC Mate 100*i*C)

Item		Specification			
Model		ARC Mate 100*i*C			
Type		Articulated type			
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)			
Installation		Floor, Upside-down, Wall & Angle mount (Note 2)			
Load setting		3 kg (Standard welding torch) mode		6 kg (Standard inertia) mode	10 kg (High inertia) mode
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)		
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)		
	J3-axis	Upper limit /Lower limit	264.5° (4.61rad)/-180° (-3.14rad)		
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)		
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)	
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)	
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)	
Maximum speed (Note 3)	J1-axis	210°/s(3.67rad/s)			
	J2-axis	190°/s(3.32rad/s)			
	J3-axis	210°/s(3.67rad/s)			
	J4-axis	400°/s(6.98rad/s)			
	J5-axis	400°/s(6.98rad/s)			
	J6-axis	600°/s(10.47rad/s)			
Maximum load	At wrist (Note 4)	3 kg		6 kg	10 kg
	On J3 arm (Note 5)	12 kg			
Allowable load moment at wrist	J4-axis	7.7 N·m		15.7 N·m	22.0 N·m
	J5-axis	7.7 N·m		9.8 N·m	22.0 N·m
	J6-axis	0.2 N·m		5.9 N·m	9.8 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.63 kg·m^2	0.63 kg·m^2
	J5-axis	0.24 kg·m^2		0.22 kg·m^2	0.63 kg·m^2
	J6-axis	0.0027 kg·m^2		0.061 kg·m^2	0.15 kg·m^2
Repeatability		±0.08 mm			
Mass		130 kg			
Acoustic noise level		Less than 70dB (Note 6)			
Installation environment		Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)			

NOTE

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

2 There is not the limit in the motion range in all installation.

3 During short distance motions, the axis speed may not reach the maximum value stated.

4 When arc tool is specified, robot is shipped with 3kg payload setting.

5 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82754EN) in detail.

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

7 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.

8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (c) Robot specifications (Note 1) (ARC Mate 100*i*C/ 6L)

Item		Specification		
Model		ARC Mate 100*i*C/6L		
Type		Articulated type		
Controlled axes		6axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 2)		
Load setting		3 kg (Standard welding torch) mode	6 kg (Standard inertia) mode	
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267° (4.66rad)/-180° (-1.57rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 3)	J1-axis	210°/s(3.67rad/s)		
	J2-axis	190°/s(3.32rad/s)		
	J3-axis	210°/s(3.67rad/s)		
	J4-axis	400°/s(6.98rad/s)		
	J5-axis	400°/s(6.98rad/s)		
	J6-axis	600°/s(10.47rad/s)		
Maximum load	At wrist (Note 4)	3 kg	6 kg	
	On J3 arm (Note 5)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m	15.7 N·m	
	J5-axis	7.7 N·m	10.1N·m	
	J6-axis	0.2 N·m	5.9 N·m	
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2	0.63 kg·m^2	
	J5-axis	0.24 kg·m^2	0.38 kg·m^2	
	J6-axis	0.0027 kg·m^2	0.061 kg·m^2	
Repeatability		±0.08 mm		
Mass		135 kg		
Acoustic noise level		Less than 70dB (Note 6)		
Installation environment		Ambient temperature: 0 to 45°C (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)		

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 There is not the limit in the motion range in all installation.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 When arc tool is specified, robot is shipped with 3kg payload setting.
5 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82754EN) in detail.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
7 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (d) Specifications (Note 1) (ARC Mate 100*i*C/12)

Item		Specification		
Model		ARC Mate 100*i*C/12		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 2)		
Load setting		3 kg (Standard welding torch mode)		12 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267°(4.66rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 3)	J1-axis	230°/s(4.01rad/s)		
	J2-axis	225°/s(3.93rad/s)		
	J3-axis	230°/s(4.01rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist (Note 4)	3 kg		12 kg
	On J3 arm (Note 5)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		22.0 N·m
	J5-axis	7.7 N·m		22.0 N·m
	J6-axis	0.2 N·m		9.8 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.65 kg·m^2
	J5-axis	0.24 kg·m^2		0.65 kg·m^2
	J6-axis	0.0027 kg·m^2		0.17 kg·m^2
Repeatability		±0.08 mm		
3Mass		130 kg		
Acoustic noise level		Less than 70dB (Note 6)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)		

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 There is not the limit in the motion range in all installation.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 When arc tool is specified, robot is shipped with 3kg payload setting.
5 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) in detail.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
7 When robot is used in low temperature environment that is near to 0ºC, or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (e) Specifications (Note 1) (ARC Mate 100*i*C/7L)

Item		Specification		
Model		ARC Mate 100*i*C/7L		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 2)		
Load setting		3 kg (Standard welding torch mode)		7 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267°(4.66rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 3)	J1-axis	230°/s(4.01rad/s)		
	J2-axis	225°/s(3.93rad/s)		
	J3-axis	230°/s(4.01rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist (Note 4)	3 kg		7 kg
	On J3 arm (Note 5)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		15.7 N·m
	J5-axis	7.7 N·m		10.1 N·m
	J6-axis	0.2 N·m		5.9 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.63 kg·m^2
	J5-axis	0.24 kg·m^2		0.38 kg·m^2
	J6-axis	0.0027 kg·m^2		0.061 kg·m^2
Repeatability		±0.08 mm		
Mass		135 kg		
Acoustic noise level		Less than 70dB (Note 6)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)		

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 There is not the limit in the motion range in all installation.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 When arc tool is specified, robot is shipped with 3kg payload setting.
5 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) in detail.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
7 When robot is used in low temperature environment that is near to 0ºC, or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (f) Specifications (Note 1) (ARC Mate 120*i*C)

Item			Specification	
Model			ARC Mate 120*i*C	
Type			Articulated type	
Controlled axes			6 axes(J1, J2, J3, J4, J5, J6)	
Installation			Floor, (Upside-down, Wall & Angle mount) (NOTE 2)	
Load setting			3 kg mode (Standard welding torch mode)	20 kg mode (High inertia mode)
Motion range Upper limit /Lower limit	J1-axis		185° (3.23rad) / -185° (-3.23rad)	
	J2-axis		160° (2.79rad) / -100° (-1.75rad)	
	J3-axis		273° (4.77rad) / -185° (-3.23rad)	
	J4-axis		200° (3.49rad) / -200° (-3.49rad)	
	J5-axis	(NOTE 3)	140° (2.44rad) / -140° (-2.44rad)	
		(NOTE 4)	180° (3.14rad) / -180° (-3.14rad)	
	J6-axis	(NOTE 3)	270° (4.71rad) / -270° (-4.71rad)	
		(NOTE 4)	450° (7.85rad) / -450° (-7.85rad)	
Maximum speed (Note 5)	J1-axis		195°/s(3.40rad/s)	
	J2-axis		175°/s(3.05rad/s)	
	J3-axis		180°/s(3.14rad/s)	
	J4-axis		360°/s(6.28rad/s)	
	J5-axis		360°/s(6.28rad/s)	
	J6-axis		550°/s(9.60rad/s)	
Maximum load	At wrist (Note 6)		3kg	20kg
	On J3 arm (Note 7)		12kg	
Allowable load moment at wrist	J4-axis		7.7N・m	44N・m
	J5-axis		7.7N・m	44N・m
	J6-axis		0.22N・m	22N・m
Allowable load inertia at wrist	J4-axis		0.24kg・m^2	1.04kg・m^2
	J5-axis		0.24kg・m^2	1.04kg・m^2
	J6-axis		0.0027kg・m^2	0.28kg・m^2
Repeatability			±0.08 mm	
Robot mass			250kg	
Acoustic noise level			Less than 70dB (Note 8)	
Installation environment			Ambient temperature: 0 to 45℃ (Note 9) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 10)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), motion range will be limited only when high inertia mode. See Section 3.6.
3 The specification of “Cable integrated J3 Arm”.
4 The specification of "Conventional dress-out".
5 During short distance motions, the axis speed may not reach the maximum value stated.
6 When arc tool is specified, robot is shipped with 3kg payload setting.
7 Maximum load on J3 arm depends on load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR’S MANUAL (B-82874EN) in detail.
8 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
-Maximum load and speed
-Operating mode is AUTO
9 When robot is used in low temperature environment that is near to 0ºC, or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
10 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (g) Specifications (Note 1) (ARC Mate 120*i*C/12L)

Item			Specification	
Model			ARC Mate 120*i*C/12L	
Type			Articulated type	
Controlled axes			6 axes(J1, J2, J3, J4, J5, J6)	
Installation			Floor, (Upside-down, Wall & Angle mount) (Note 2)	
Load setting			3 kg mode (Standard welding torch mode)	12 kg mode (High inertia mode)
Motion range Upper limit /Lower limit	J1-axis		185° (3.23rad) / -185° (-3.23rad)	
	J2-axis		160° (2.79rad) / -100° (-1.75rad)	
	J3-axis		275.6° (4.81rad) / -185° (-3.23rad)	
	J4-axis		200° (3.49rad) / -200° (-3.49rad)	
	J5-axis	(NOTE 3)	140° (2.44rad) / -140° (-2.44rad)	
		(NOTE 4)	180° (3.14rad) / -180° (-3.14rad)	
	J6-axis	(NOTE 3)	270° (4.71rad) / -270° (-4.71rad)	
		(NOTE 4)	450° (7.85rad) / -450° (-7.85rad)	
Maximum speed (Note 5)	J1-axis		200°/s (3.49rad/sec)	
	J2-axis		175°/s (3.05rad/sec)	
	J3-axis		190°/s (3.32rad/sec)	
	J4-axis		430°/sec (7.50rad/sec)	
	J5-axis		430°/sec (7.50rad/sec)	
	J6-axis		630°/sec (11.00rad/sec)	
Maximum load	At wrist (Note 6)		3kg	12kg
	On J3 arm (Note 7)		12kg	
Allowable load moment at wrist	J4-axis		7.7N・m	22N・m
	J5-axis		7.7N・m	22N・m
	J6-axis		0.22N・m	9.8N・m
Allowable load inertia at wrist	J4-axis		0.24kg・m^2	0.65kg・m^2
	J5-axis		0.24kg・m^2	0.65kg・m^2
	J6-axis		0.0027kg・m^2	0.17kg・m^2
Repeatability			±0.08 mm	
Robot mass			250kg	
Acoustic noise level			Less than 70dB (Note 8)	
Installation environment			Ambient temperature: 0 to 45℃ (Note 9) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 10)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), motion range will be limited only when high inertia mode. See Section 3.6 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN) .
3 The specification of "Cable integrated J3 Arm".
4 The specification of "Conventional dress-out".
5 During short distance motions, the axis speed may not reach the maximum value stated.
6 When arc tool is specified, robot is shipped with 3kg payload setting.
7 Maximum load on J3 arm depends on load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN) in detail.
8 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
-Maximum load and speed
-Operating mode is AUTO
9 When robot is used in low temperature environment that is near to 0ºC, or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
10 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (h) Specifications (NOTE 1) (ARC Mate 50*i*D series)

Item		Specifications	
Model		ARC Mate 50*i*D	ARC Mate 50*i*D/7L
Type		Articulated Type	
Controlled axis		6-axis (J1, J2, J3, J4, J5, J6)	
Reach		717mm	911mm
Installation (NOTE 2)		Floor, Upside-down (Angle mount)	
Motion range (Max. speed) (NOTE 3)	J1-axis	340°/360° (option) (450°/s) 5.93rad/6.28rad (option) (7.85rad/s)	340°/360°(option) (370°/s) 5.93rad/6.28rad(option) (6.45rad/s)
	J2-axis	245° (380°/s) 4.28rad (6.63rad/s)	245° (310°/s) 4.28rad (5.41rad/s)
	J3-axis	420° (520°/s) 7.33rad (9.08rad/s)	430° (410°/s) 7.50rad (7.15rad/s)
	J4-axis	380° (550°/s) 6.63rad (9.60rad/s)	380° (550°/s) 6.63rad (9.60rad/s)
	J5-axis	250° (545°/s) 4.36rad (9.51rad/s)	250° (545°/s) 4.36rad (9.51rad/s)
	J6-axis	720° (1000°/s) 12.57rad (17.45rad/s)	720° (1000°/s) 12.57rad (17.45rad/s)
Max. load capacity (NOTE 4)	Wrist	7 kg	
Allowable load moment at wrist	J4-axis	16.6Nm	16.6Nm
	J5-axis	16.6Nm	16.6Nm
	J6-axis	9.4Nm	9.4Nm
Allowable load inertia at wrist	J4-axis	0.47 kg·m^2	0.47 kg·m^2
	J5-axis	0.47 kg·m^2	0.47 kg·m^2
	J6-axis	0.15kg·m^2	0.15kg·m^2
Drive method		Electric servo drive by AC servo motor	
Repeatability (NOTE 5)		±0.018mm	
Mass (NOTE 6)		25kg	27kg
Dust proof and drip proof mechanism (NOTE 7)		Conform to IP67 (Option :IP69K)	
Acoustic noise level		64.7dB.(NOTE 8)	
Installation environment		Ambient temperature: 0 - 45°C (NOTE 9) Ambient humidity: Normally 75%RH or less. No dew, nor frost allowed. Short time (within one month) Max 95%RH Height: Up to 1000 meters above the sea level required, no particular provision for posture. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 10)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), the J1 and J2 axis motion range will be limited.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 The all up weight including the equipment and connection cables and its swing must not exceed this value when you install the equipment.
5 Compliant with ISO9283.
6 It doesn't contain the mass of the control part.
7 The liquid that is the deterioration of the seal material such as Organic solvent, acid, alkali and chlorine system, cutting liquid cannot be use. (See Subsection 3.1.1 of the mechanical unit operator's manual (B-83494EN).)
8 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
9 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
10 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (i) Specifications (ARC Mate 100*i*D, ARC Mate 100*i*D/10L) (NOTE 1)

Item		Specification		
Model		ARC Mate 100*i*D		ARC Mate 100*i*D/10L
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount *Floor, Upside-down for 4 brake type(NOTE 2)		
Motion range	J1-axis	Upper limit /Lower limit	170°(2.97rad)/-170°(-2.97rad) 185°(3.23rad)/-185°(-3.23rad) (option)	
	J2-axis	Upper limit /Lower limit	145°(2.53rad)/ -90°(-1.57rad)	
	J3-axis	Upper limit /Lower limit	275°(4.80rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190°(3.31rad)/-190°(-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)
			Conventional dress out type	180°(3.14rad)/-180°(-3.14rad)
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)
			Conventional dress out type	450°(7.85rad)/-450°(-7.85rad)
Maximum speed (NOTE 3)	J1-axis	260°/s(4.54rad/s)		
	J2-axis	240°/s(4.19rad/s)		
	J3-axis	260°/s(4.54rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	450°/s(7.85rad/s)		
	J6-axis	720°/s(12.57rad/s)		
Maximum load	At wrist	12 kg		10 kg
	On J3 arm (NOTE 4)	12 kg		10 kg
Allowable load moment at wrist	J4-axis	26.0 N·m		22.0 N·m
	J5-axis	26.0 N·m		22.0 N·m
	J6-axis	11.0 N·m		9.8 N·m
Allowable load inertia at wrist	J4-axis	0.90 kg·m^2		0.65 kg·m^2
	J5-axis	0.90 kg·m^2		0.65 kg·m^2
	J6-axis	0.30 kg·m^2		0.17 kg·m^2
Repeatability (NOTE 5)		±0.02 mm		±0.03 mm
Mass		145 kg		150kg
Acoustic noise level		57.4dB (NOTE 6)		
Installation environment		Ambient temperature: 0 to 45℃ (NOTE 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 8)		

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-83944EN)
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-83944EN) for detail.
5 Compliant with ISO9283.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

7 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (j) Specifications (ARC Mate 100*i*D/8L/16S) (NOTE 1)

Item		Specification			
Model		ARC Mate 100*i*D/8L		ARC Mate 100*i*D/16S	
Type		Articulated type			
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)			
Installation		Floor, Upside-down, Wall & Angle mount (NOTE 2)			
Motion range	J1-axis	Upper limit /Lower limit	170°(2.97rad)/-170°(-2.97rad) 185°(3.23rad)/-185°(-3.23rad) (option)		
	J2-axis	Upper limit /Lower limit	145°(2.53rad)/ -90°(-1.57rad)		
	J3-axis	Upper limit /Lower limit	275°(4.80rad)/-180°(-3.14rad)		
	J4-axis	Upper limit /Lower limit	190°(3.31rad)/-190°(-3.31rad)		
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)	
			Conventional dress out type	180°(3.14rad)/-180°(-3.14rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)	
			Conventional dress out type	450°(7.85rad)/-450°(-7.85rad)	
Maximum speed (NOTE 3)	J1-axis	210°/s (3.66rad/s)		290°/s (5.06rad/s)	
	J2-axis	210°/s (3.66rad/s)		270°/s (4.71rad/s)	
	J3-axis	220°/s (4.62rad/s)		270°/s (4.71rad/s)	
	J4-axis	430°/s (6.98rad/s)		430°/s (7.50rad/s)	
	J5-axis	450°/s (7.33rad/s)		450°/s (7.85rad/s)	
	J6-axis	720°/s(12.57rad/s)		730°/s(12.74rad/s)	
Maximum load	At wrist	8 kg		16 kg	
	On J3 arm (NOTE 4)	12 kg		12 kg	
Allowable load moment at wrist	J4-axis	16.1 N·m		26.0 N·m	
	J5-axis	16.1 N·m		26.0 N·m	
	J6-axis	5.9 N·m		11.0 N·m	
Allowable load inertia at wrist	J4-axis	0.63 kg·m^2		0.90 kg·m^2	
	J5-axis	0.63 kg·m^2		0.90 kg·m^2	
	J6-axis	0.061 kg·m^2		0.30 kg·m^2	
Repeatability (NOTE 5)		±0.03 mm		±0.02 mm	
Mass		180 kg		145kg	
Acoustic noise level		57.4dB (NOTE 6)			
Installation environment		Ambient temperature: 0 to 45℃ (NOTE 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 8)			

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-83944EN).
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-83944EN) for detail.
5 Compliant with ISO9283.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

7 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (k) Specifications (ARC Mate 120*i*D, ARC Mate 120*i*D/12L)(NOTE 1) (1/1)

Item		Specification			
Model		ARC Mate 120*i*D			ARC Mate 120*i*D/12L
Type		Articulated type			
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)			
Installation(NOTE 2)		Floor, Upside-down, Wall & Angle mount			
Motion range	J1-axis	Upper limit /Lower limit	170°(2.97rad) /-170°(-2.97rad) 185°(3.23rad) /-185°(-3.23rad) (option)		
	J2-axis	Upper limit /Lower limit	160°(2.79rad)/ -100°(-1.74rad)		
	J3-axis	Upper limit /Lower limit	268.4°(4.68rad)/-190°(-3.32rad)		
	J4-axis	Upper limit /Lower limit	200°(3.49rad) /-200°(-3.49rad)		
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)	
			Conventional dress out type	180°(3.14rad)/-180°(-3.14rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)	
			Conventional dress out type	450°(7.85rad)/-450°(-7.85rad)	
Max motion speed (NOTE 3)	J1-axis	210°/s (3.67rad/s)			210°/s (3.67rad/s)
	J2-axis	210°/s (3.67rad/s)			210°/s (3.67rad/s)
	J3-axis	265°/s (4.63rad/s)			265°/s (4.63rad/s)
	J4-axis	420°/s (7.33rad/s)			420°/s (7.33rad/s)
	J5-axis	420°/s (7.33rad/s)			450°/s (7.85rad/s)
	J6-axis	720°/s(12.57rad/s)			720°/s(12.57rad/s)
Maximum load	At wrist	25 kg			12 kg
	On J3 arm (NOTE 4)	40 kg			36 kg
Allowable load moment at wrist	J4-axis	52.0 N·m			22.0 N·m
	J5-axis	52.0 N·m			22.0 N·m
	J6-axis	32.0 N·m			9.8 N·m
Allowable load inertia at wrist	J4-axis	2.40 kg·m^2			0.65 kg·m^2
	J5-axis	2.40 kg·m^2			0.65 kg·m^2
	J6-axis	1.20 kg·m^2			0.17 kg·m^2
Repeatability (NOTE 5)		±0.02 mm			±0.03 mm
Mass		250kg			
Acoustic noise level		67.8dB (NOTE 6)			
Installation environment		Ambient temperature: 0 to 45℃ (NOTE 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 8)			

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 In case of ARC Mate 120*i*D, M-20*i*D/25, when the Wall & Angle mount is specified, the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-84074EN) .
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-84074EN) for detail.
5 Compliant with ISO9283.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
7 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

1.1.2 Robot Controller

Table 1.1.2 (a) Controller specification (R-30*i*B/R-30*i*B Plus Controller)

Item	Model	Specification/condition
Rated Voltage	All models	Trans. Type E:380-415, 440-500, 500-575VAC(*1) Trans. Type D:380-400, 200-230VAC 50/60Hz 3phases (*1) In case of NRTL controller with UL/CSA breaker (600V Rating), 500-575VAC tap can be used.
Tolerant fluctuation	All models	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power supply capacity	ARC Mate 120*i*C	3kVA
	ARC Mate 100*i*C	2kVA
Average power consumption	ARC Mate100*i*C,ARC Mate 120*i*C	1kW
Permissible ambient temperature	All models	Operating 0°C to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	All models	Normal: 75%RH or less, no condensation Short period(less than 1 month): 95%RH or less, no condensation
Surrounding gas	All models	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, and/of salt).
Installation category	All models	Installation categoryⅢ, Pollution degree 3, IEC60664-1 and IEC61010-1
Vibration acceleration	All models	4.9m/s^2 (0.5G) or less. When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	All models	Operating:Up to 1,000m above sea level Non-operating:Up to 12,000m above sea level
Ionized and non-ionized radiation	All models	A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller	A-cabinet	120kg
	B-cabinet	180kg
Degree of protection	A-cabinet	IP54
	B-cabinet	
	Teach pendant	

NOTE

The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.
If the acceleration/deceleration override greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.
In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.

NOTE
In case of CE controller

R-30*i*B controller is a group 1, class A product according to IEC55011.

This means that this product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection / analysis purpose and that it is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

There may be potential difficulties in ensuring electromagnetic compatibility in environments other than industrial, due to conducted as well as radiated disturbances.

This product must not be used in residual areas.

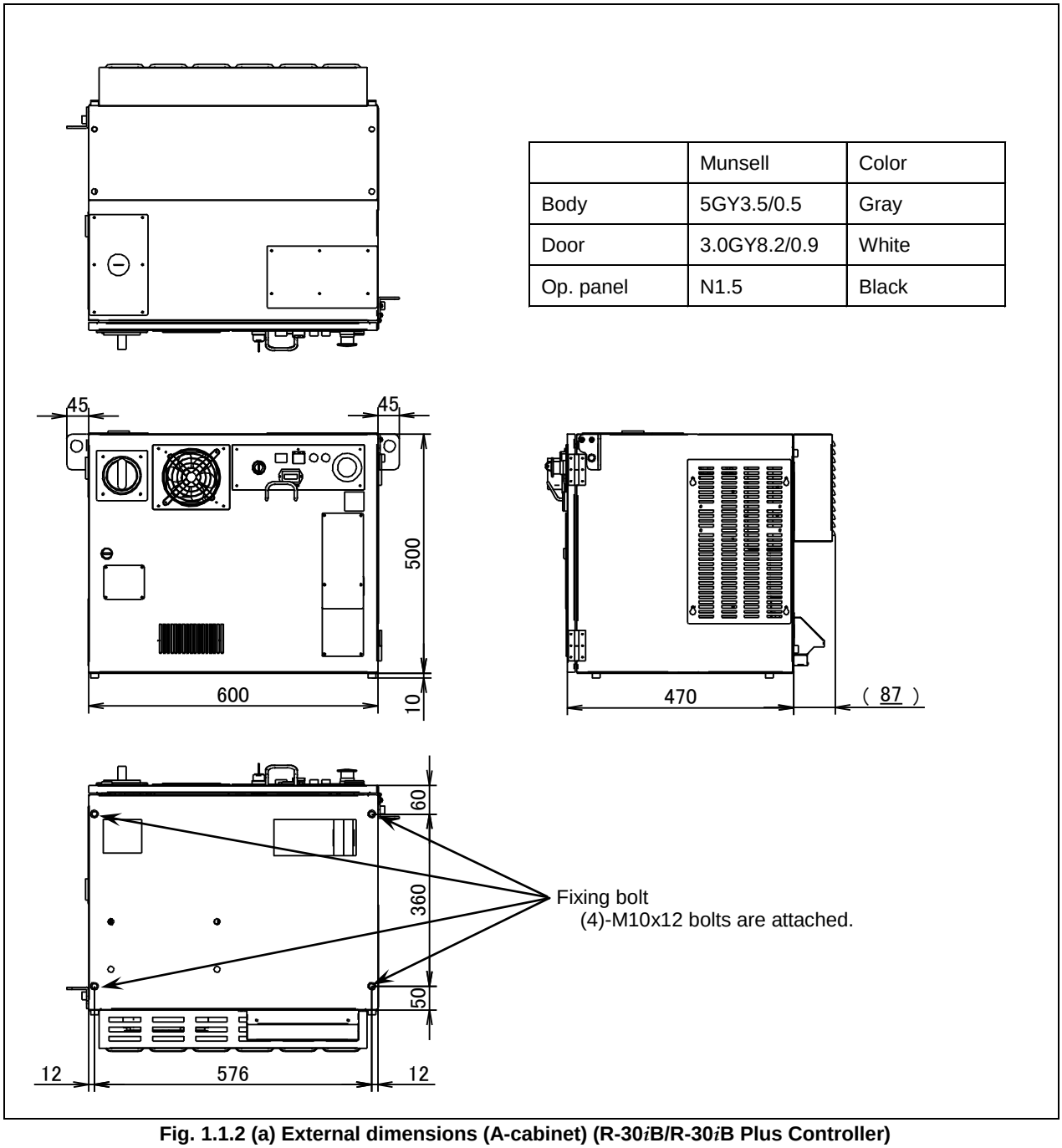
This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Table 1.1.2 (b) Controller specification (R-30*i*B Mate/R-30*i*B Mate Plus Controller)

Item	Specification/condition
Rated Voltage	200-230VAC +10% -15% single phase
	200-230VAC 50/60Hz 3 phase
Tolerant fluctuation	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power supply capacity	2.0KVA
Average power consumption	1.0KW
Permissible ambient temperature	Operating 0℃ to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	Normal: 75%RH or less, no condensation Short period (less than 1 month): 95%RH or less, no condensation
Surrounding gas	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, salt, etc.).
Installation Category	Installation Category Ⅱ, Pollution Degree 3, IEC60664-1 and IEC61010-1
Vibration	Vibration acceleration : 4.9m/s^2 (0.5G) or less When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	Operating: Up to 1000m Non-operating: Up to 12000m
Ionized and non-ionized radiation	A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller	40kg
Degree of protection	IP54

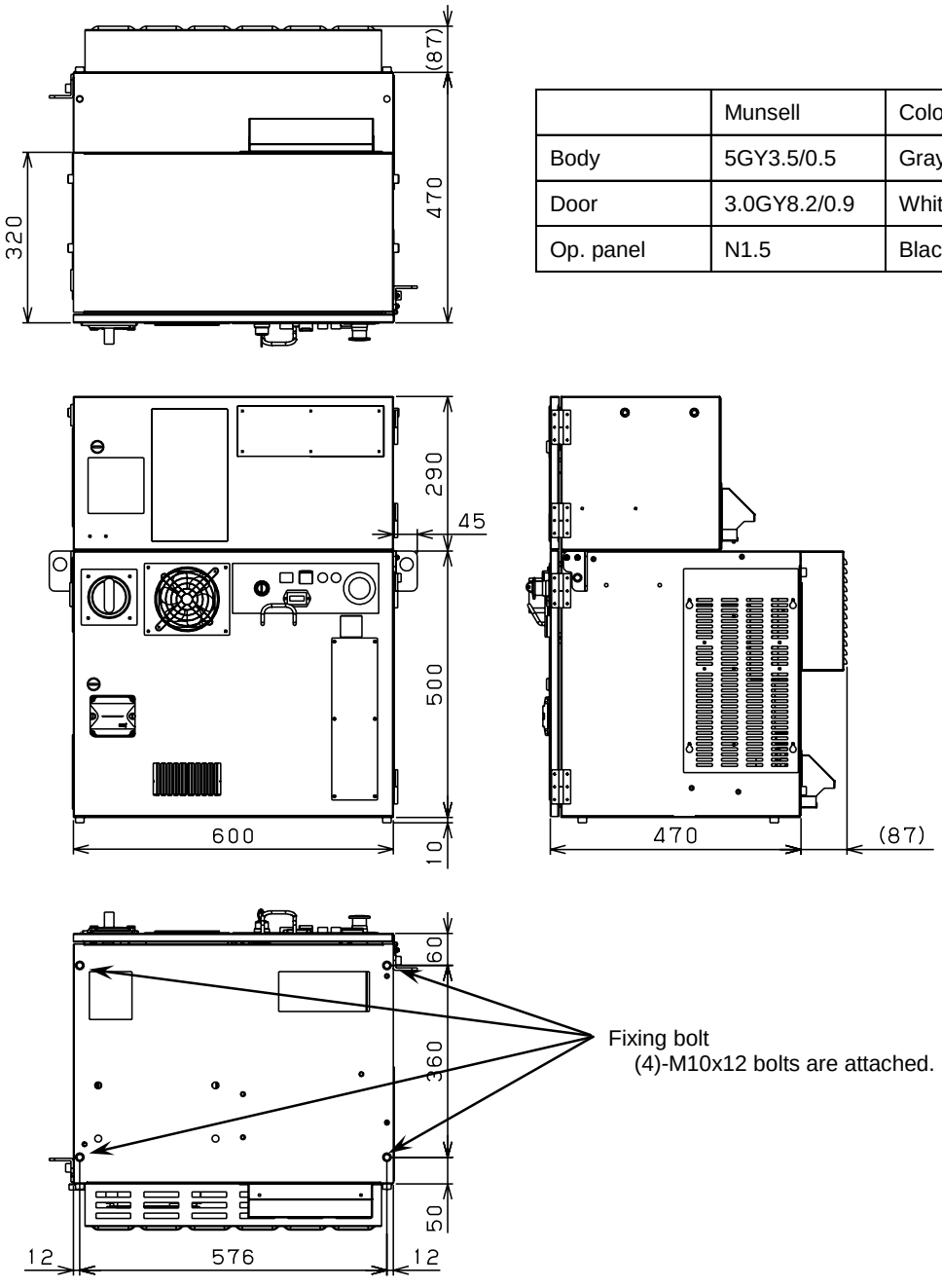
NOTE

1 The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.
If the acceleration/deceleration override greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.
In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.



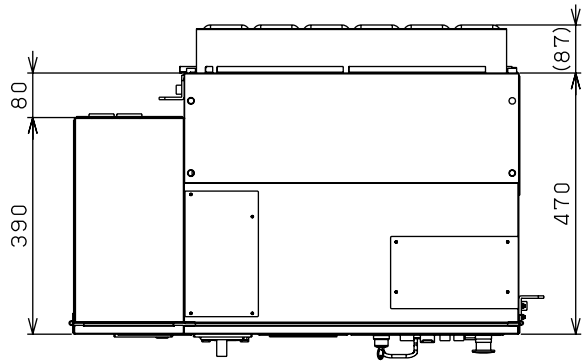
	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

Fig. 1.1.2 (a) External dimensions (A-cabinet) (R-30*i*B/R-30*i*B Plus Controller)

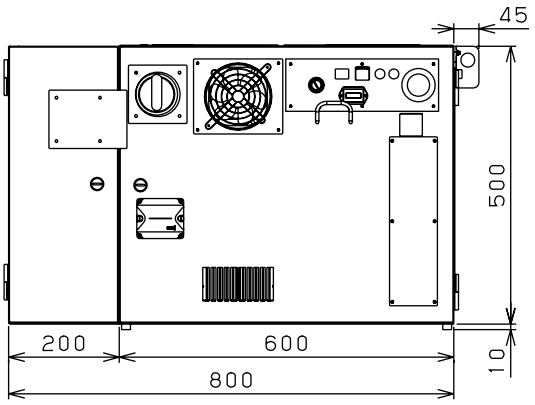


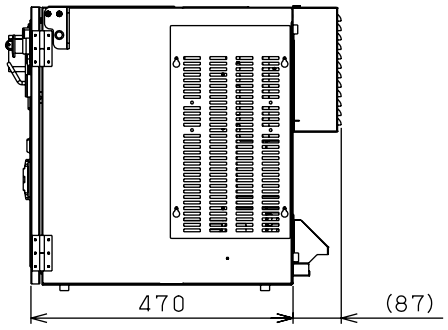
	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

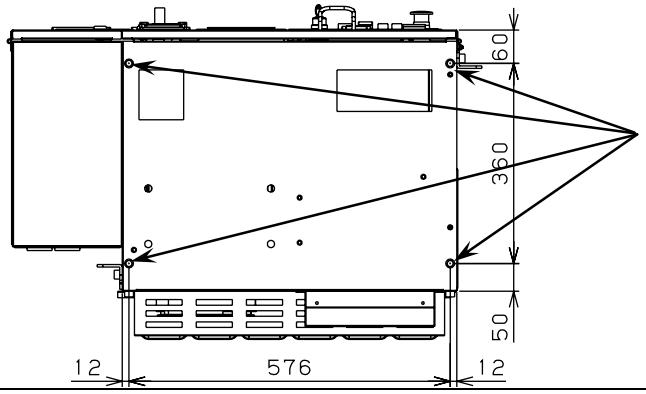
Fig. 1.1.2 (b) External dimensions (A-cabinet with Top box) (R-30*i*B/R-30*i*B Plus Controller)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

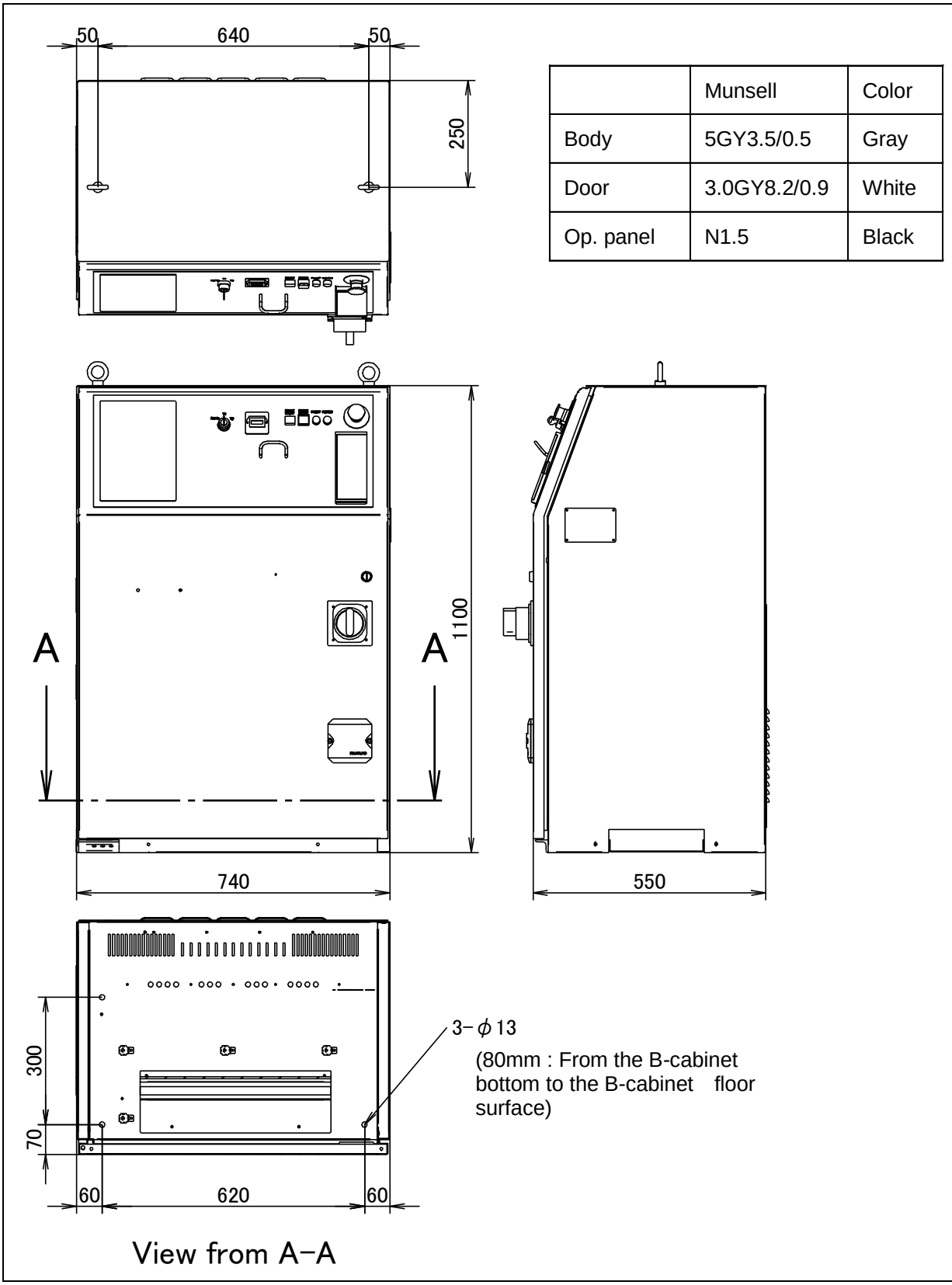






Fixing bolt
(4)-M10x12 bolts are attached.

Fig. 1.1.2 (c) External dimensions (A-cabinet with Side box) (R-30*i*B/R-30*i*B Plus Controller)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

Fig. 1.1.2 (d) External dimensions (B-cabinet) (R-30*i*B/R-30*i*B Plus Controller)

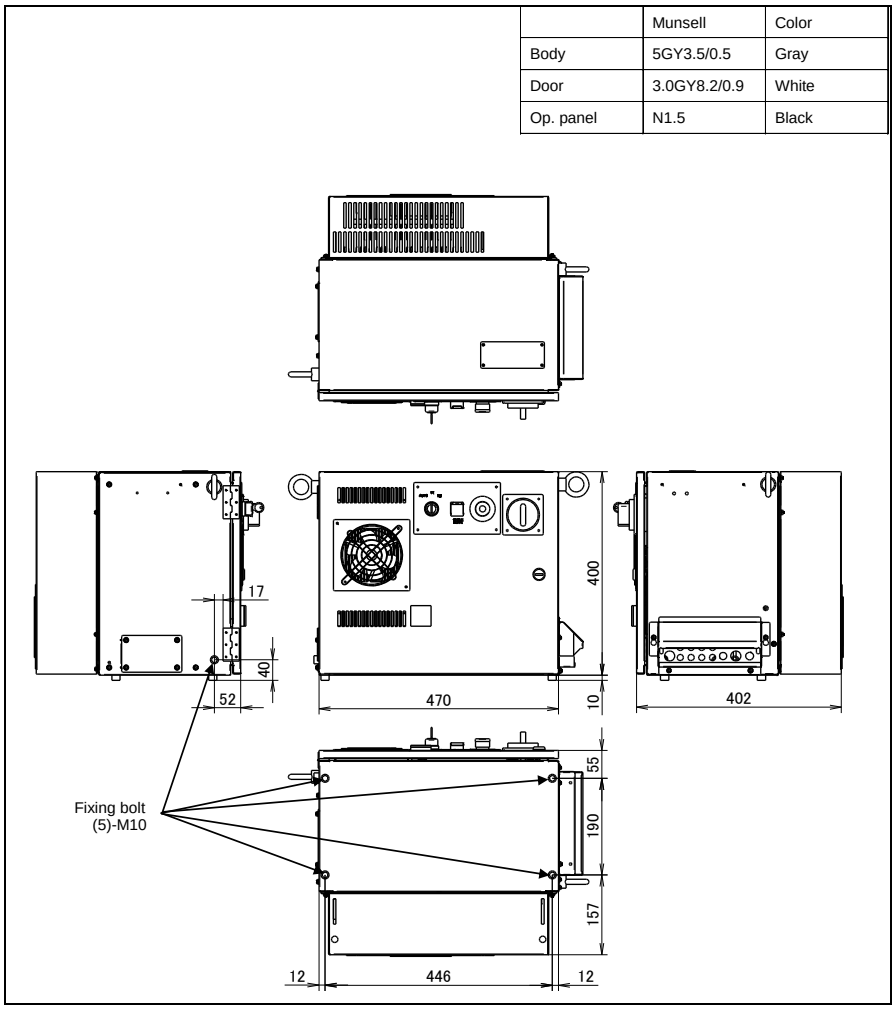


Fig. 1.1.2 (e) Controller external dimensions (R-30*i*B Mate Controller)

1.1.3 Welding Power Supply

Table 1.1.3 (a) Specification of welding power supply (Power Wave R350, Power Wave S350)

Item	Specifications
Specification of welding power supply	Main body A05B-1291-H141（Power Wave R350） A05B-1291-H943（Power Wave S350） STT module : A05B-1291-H142 Advanced module : A05B-1291-H146
Type	CO2/MAG/MIG/Pulsed
Rated input voltage	AC 208V.230V,380-415V,460V or 575V 3φ
Input frequency	50/60Hz
Rated input power	17.0kVA
Output current	DC 5 - 350A
Output voltage	DC 14V to 38V
Rated duty	100% at 300A (Complied with IEC60974-1)
Mass	Mass : 39kg STT module : 21kg Advanced module: 32kg

Refer to Chapter 11 for details of Expansion module (STT module & Advanced module).

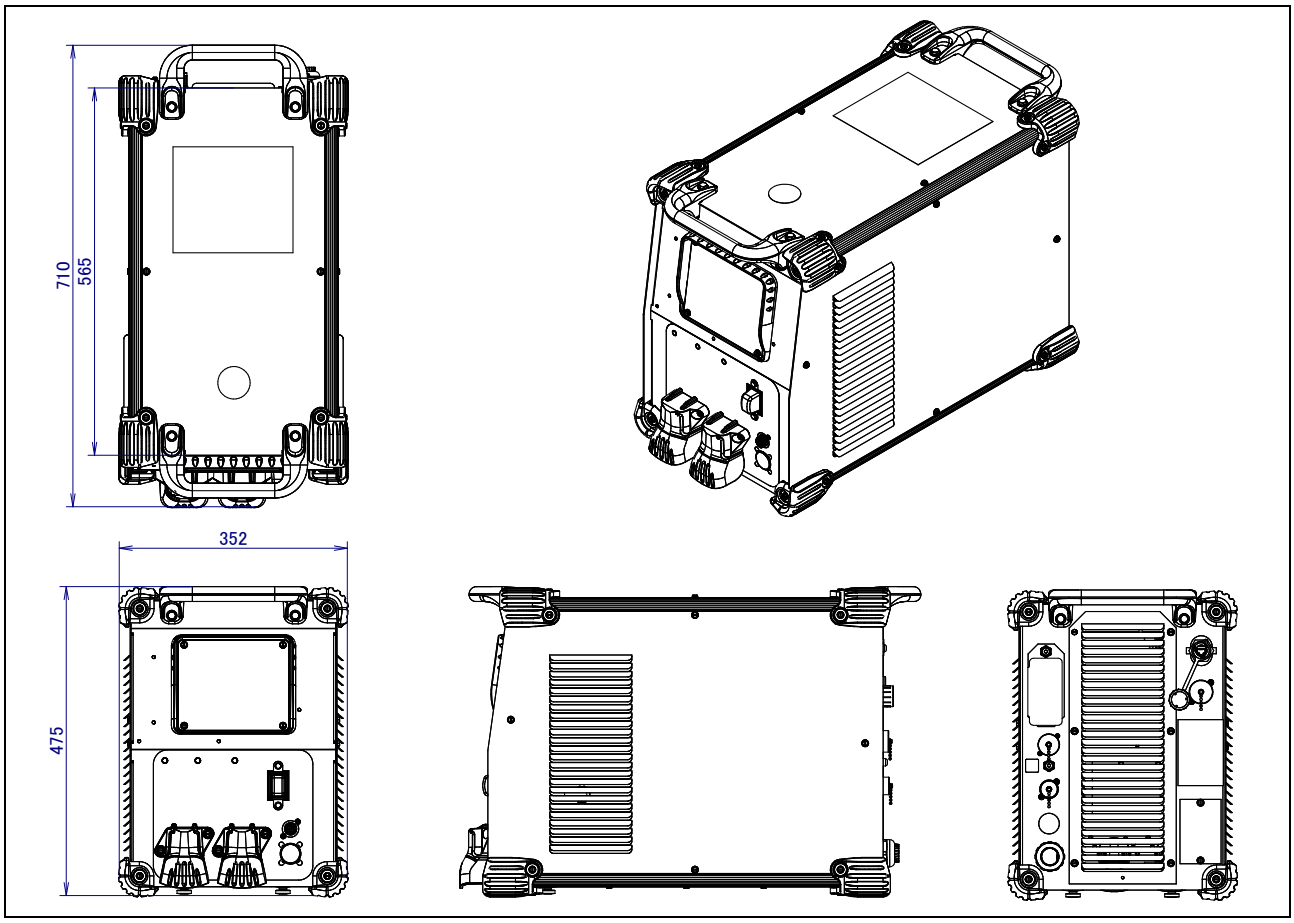


Fig. 1.1.3 (a) External dimensions of Power Wave R350

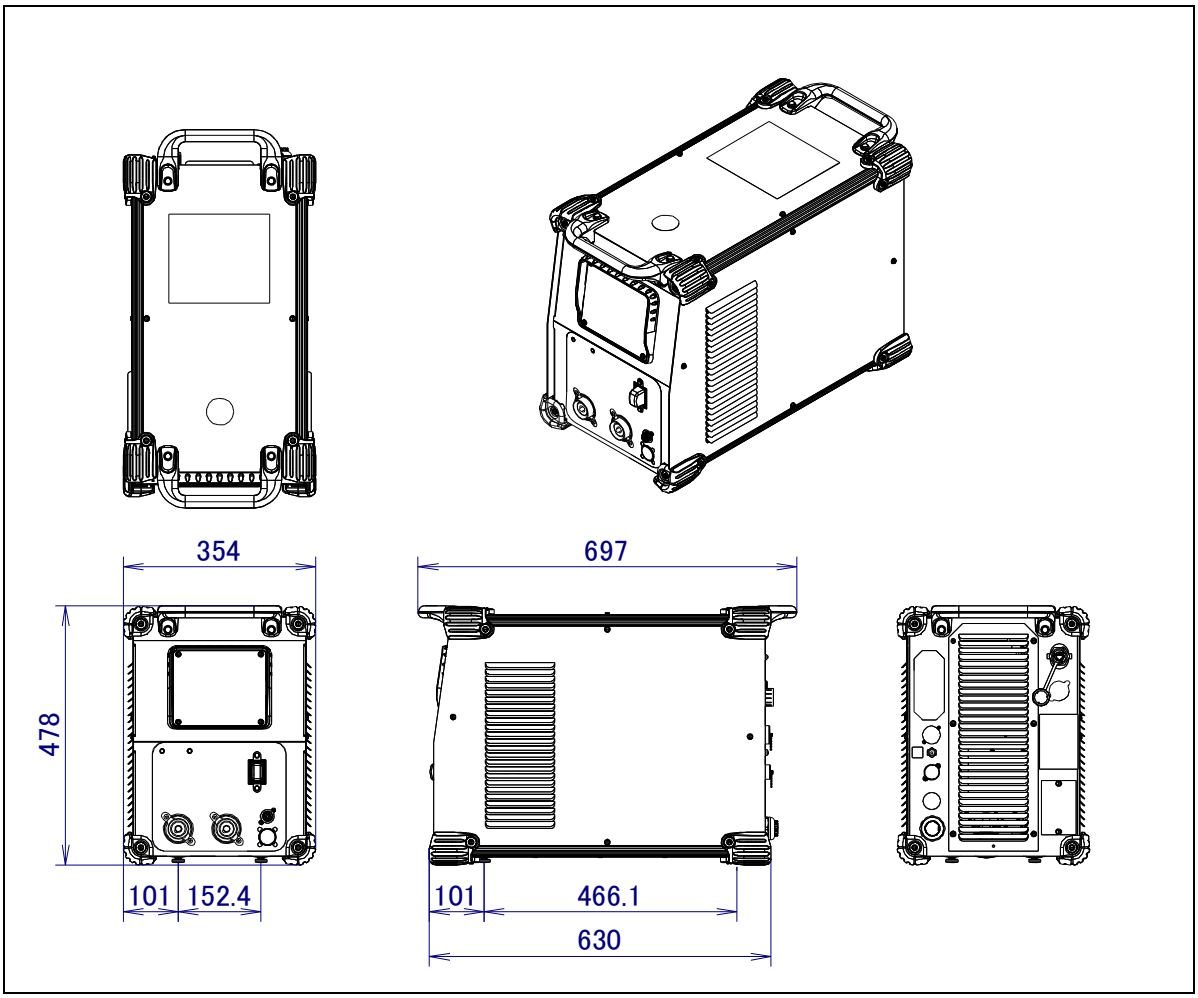


Fig. 1.1.3 (b) External dimensions of Power Wave S350

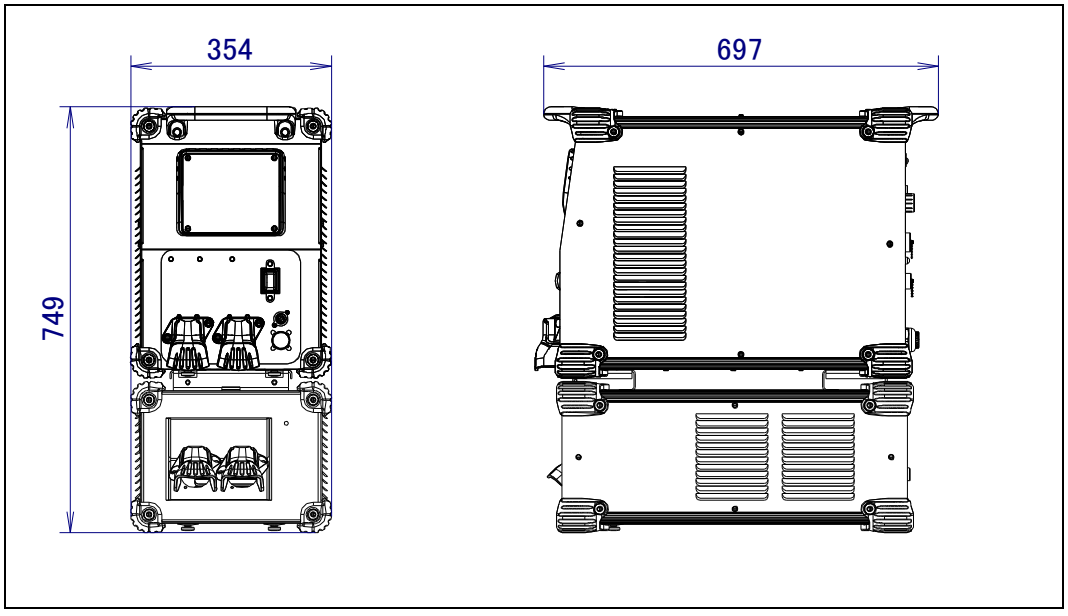


Fig. 1.1.3 (c) External dimensions of Power Wave R350, Power Wave S350+Expansion module (Figure is an example of the STT module)

Table 1.1.3 (b) Specification of welding power supply (Power Wave R500)

Item	Specifications
Specification of welding power supply	Main body : A05B-1291-H947 STT module : A05B-1291-H142 Advanced module: A05B-1291-H146
Type	CO2/MAG/MIG/Pulsed
Rated input voltage	AC 208V.230V,380-415V,460V/575V (3ϕ)
Input frequency	50/60Hz
Rated input power	20.5kVA
Output current	DC 5A to 550A
Output voltage	DC 14V to 47V
Rated duty	100% at 450A (Complied with IEC60974-1)
Mass	Main body : 68kg STT module : 21kg Advanced module: 32kg

Refer to Chapter 11 for details of Expansion module (STT module & Advanced module).

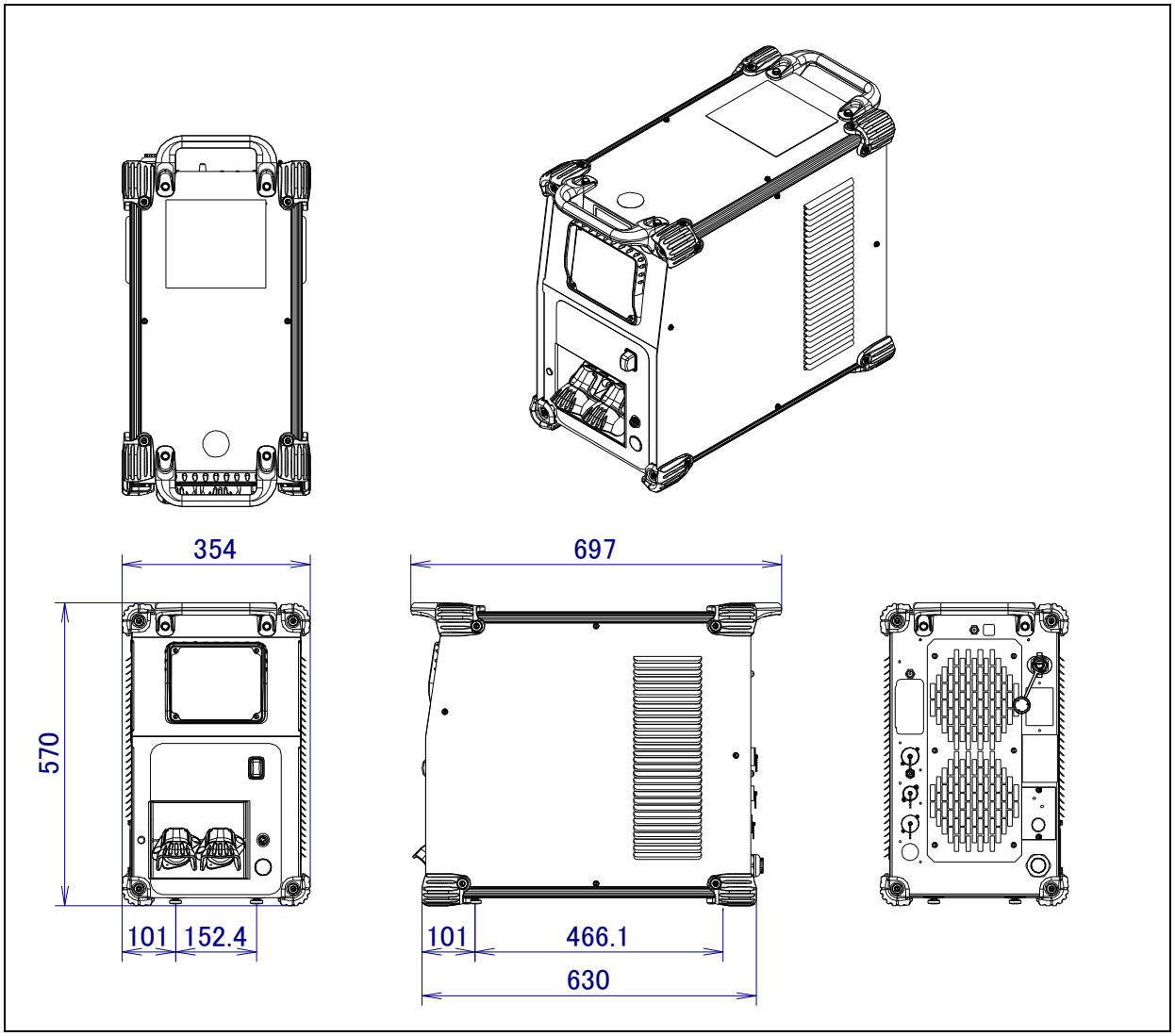


Fig. 1.1.3 (d) External dimensions of Power Wave R500

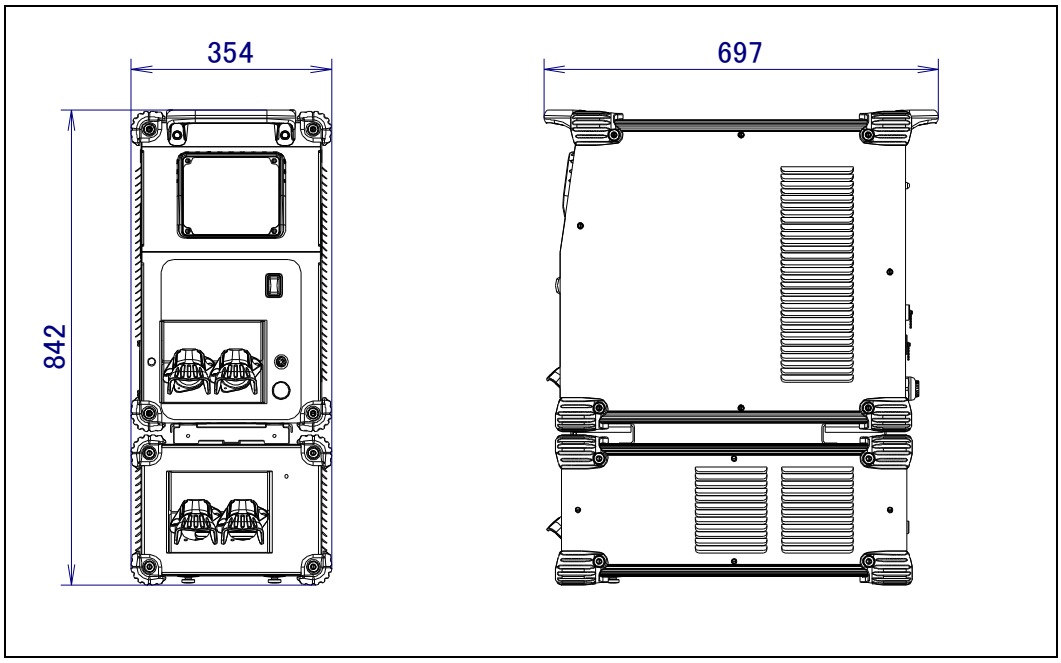


Fig. 1.1.3 (e) Power Wave R500 & Expansion module (Figure is STT module)

Table 1.1.3 (c) Specification of Power Wave i400

Item	Specifications
Type	CO2/MAG/MIG/Pulse MAG/Pulse MIG
Rated input voltage	AC 200V 3 ϕ or AC 400V 3 ϕ
Input frequency	50/60Hz
Rated input power	17.0kVA
Output current	DC 10A - 420A
Output voltage	DC 14V - 38V
Rated duty	100% at 350A (Complied with IEC60974-1)
Mass	85.5kg (200V) /95kg (400V)

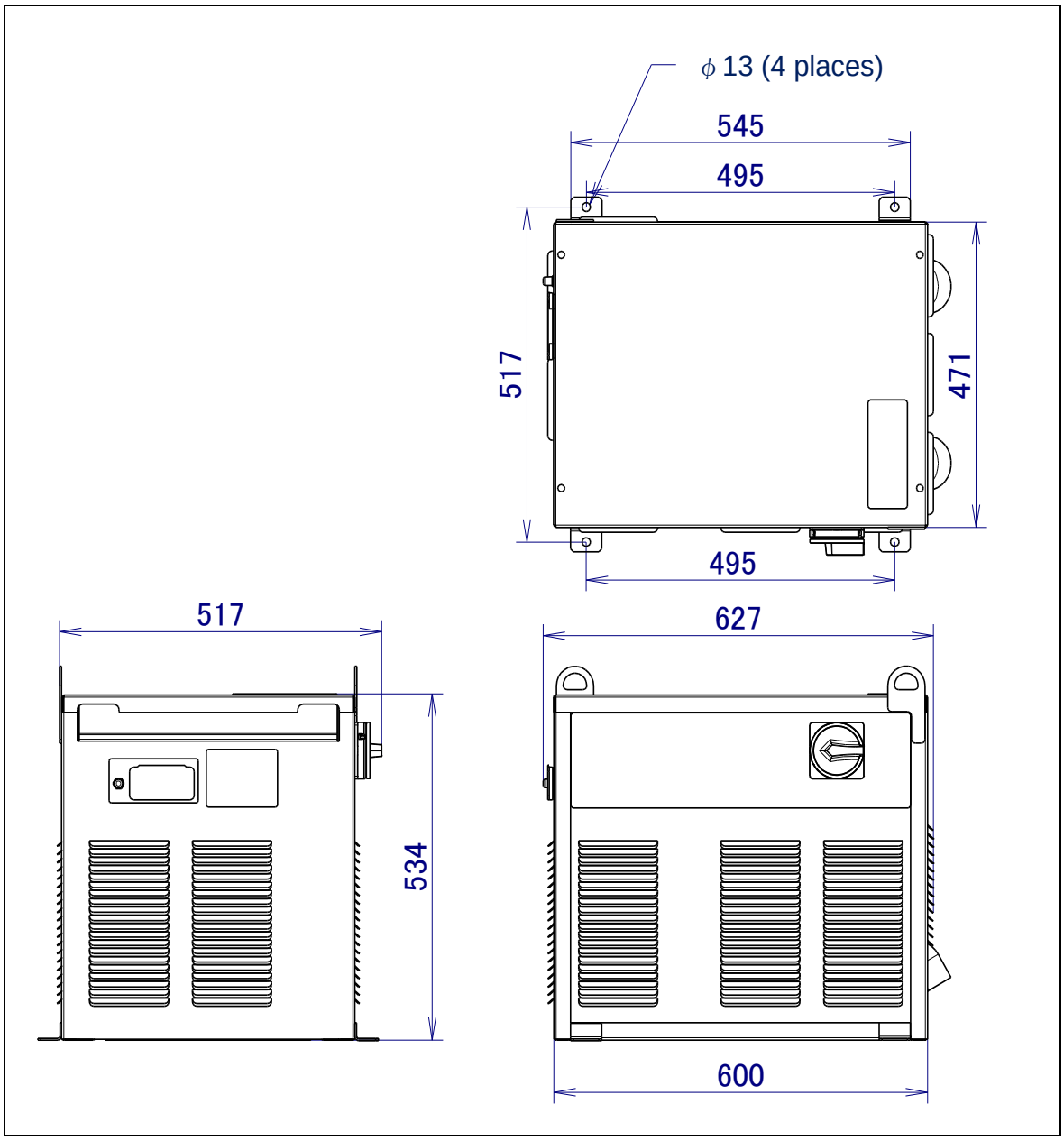


Fig. 1.1.3 (f) External dimensions of Power Wave i400

Table 1.1.3 (d) Specification of Power Wave 455M/STT

Item	Specifications
Type	CO2/MAG/MIG/Pulse MAG/Pulse MIG
Rated input voltage	AC208/230/460/575V, 3φ
Input frequency	50/60Hz
Rated input power	19.0kVA
Output current	DC5A- 570A
Output voltage	DC5V - 55V
Rated duty	100% at 400A (Complied with IEC60974-1)
Mass	133kg

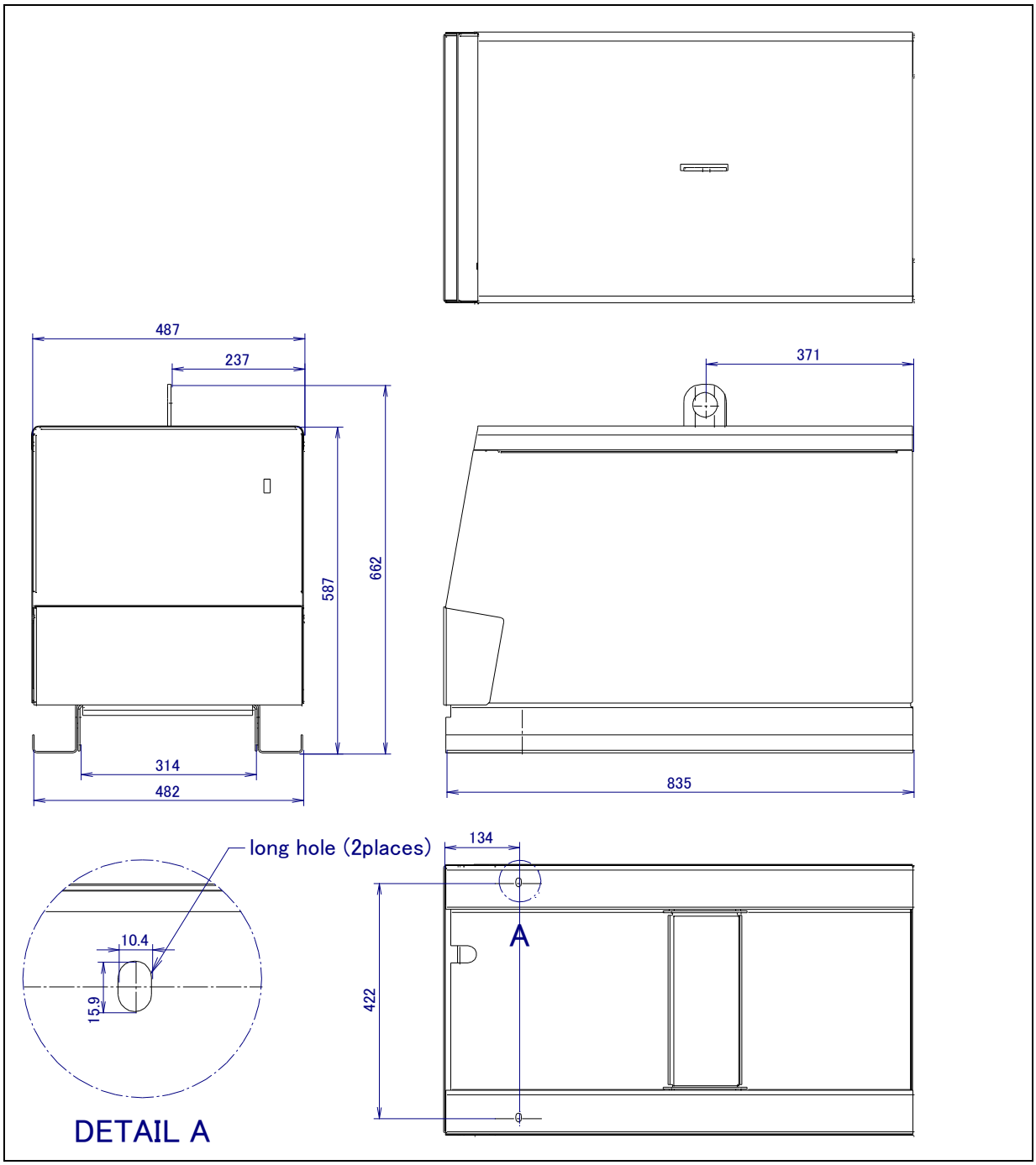


Fig. 1.1.3 (g) External dimensions of Power Wave 455M/STT

Table 1.1.3 (e) Specification of Lincoln welding power supply (Power Wave R450)

Item	Specifications
Specification of welding power supply	Main body : A05B-1291-H147（Power Wave R450）
Type	MAG / TIG / Flux-Cored /High Performance Pulse Modes for Steel / Stainless Steel / Aluminum / Nickel
Rated input voltage	AC 208V, 230V, 380-415V, 460V or 575V 3φ
Input frequency	50/60Hz
Rated input power	80 / 73 / 41 / 37 / 29 A (40%Duty) 60 / 54 / 31 / 27 / 21 A (100%Duty)
Output current	550 A (40%Duty), 450 A (100%Duty)
Output voltage	41.5 V (MAG, 40%Duty), 36.5 V (MAG, 100%Duty) 32.0 V (TIG, 40%Duty), 28.0V (TIG, 100%Duty)
Rated duty	100% at 450A (Complied with IEC60974-1)
Mass	Main body :68kg

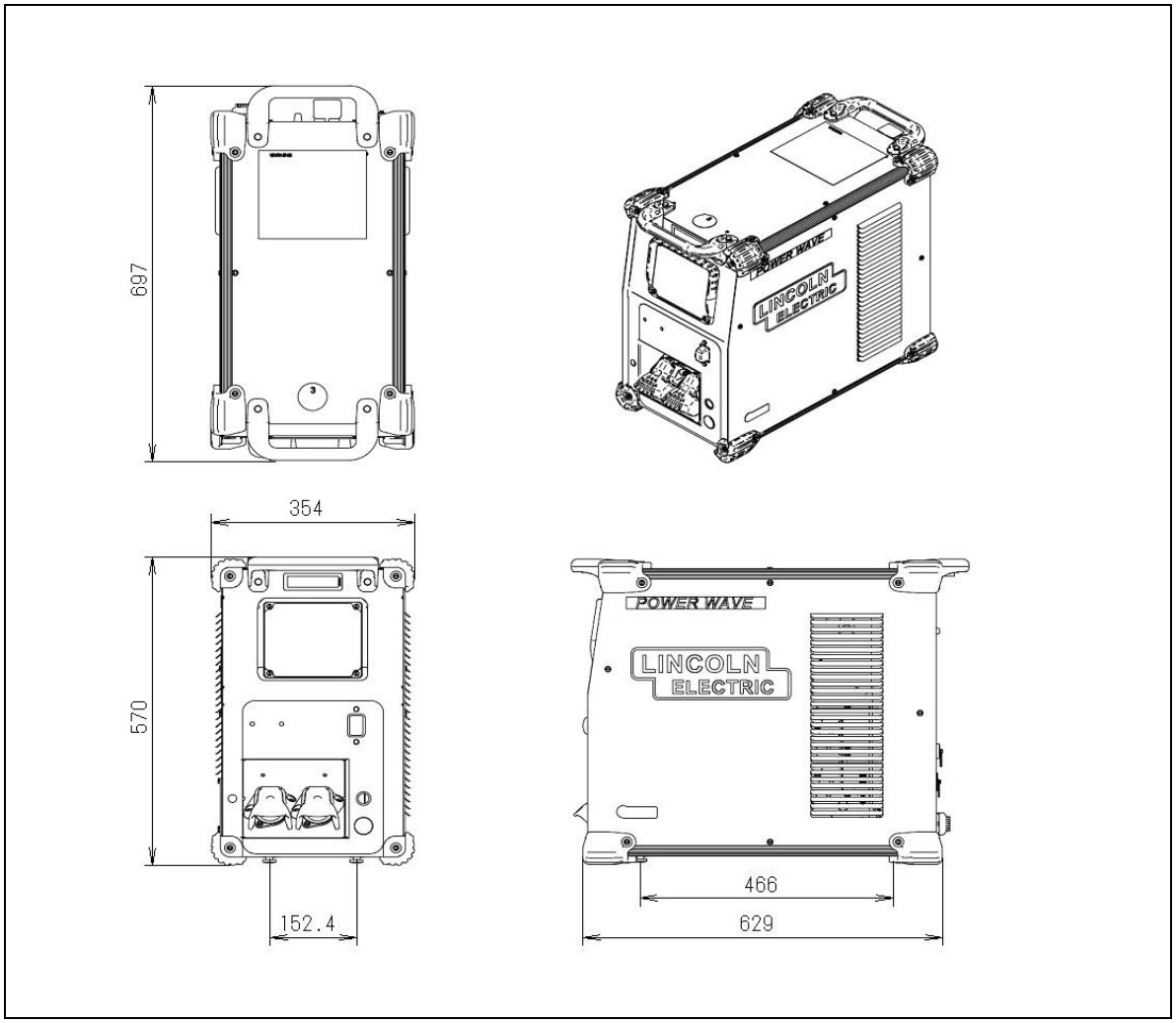


Fig. 1.1.3 (h) External dimensions of the Power Wave R450

Table 1.1.3 (e) Specification of Lincoln welding power supply (Power Wave J350)の定格仕様

Item	Specifications
Specification of welding power supply	Main body : A05B-1291-H149（Power Wave J350）
Type	MAG / TIG / Flux-Cored /High Performance Pulse Modes for Steel / Stainless Steel / Aluminum / Nickel
Rated input voltage	200/230V (3φ)
Input frequency	50/60Hz
Rated input power	40/37A
Output current	350A (100%Duty)
Output voltage	31.5 V (GMAW, 100%Duty), 34 V (SMAW, 100%Duty) 24.0 V (GTAW-DC, 100%Duty)
Rated duty	100% at 350A (Complied with IEC60974-1)
Mass	Main body :68kg

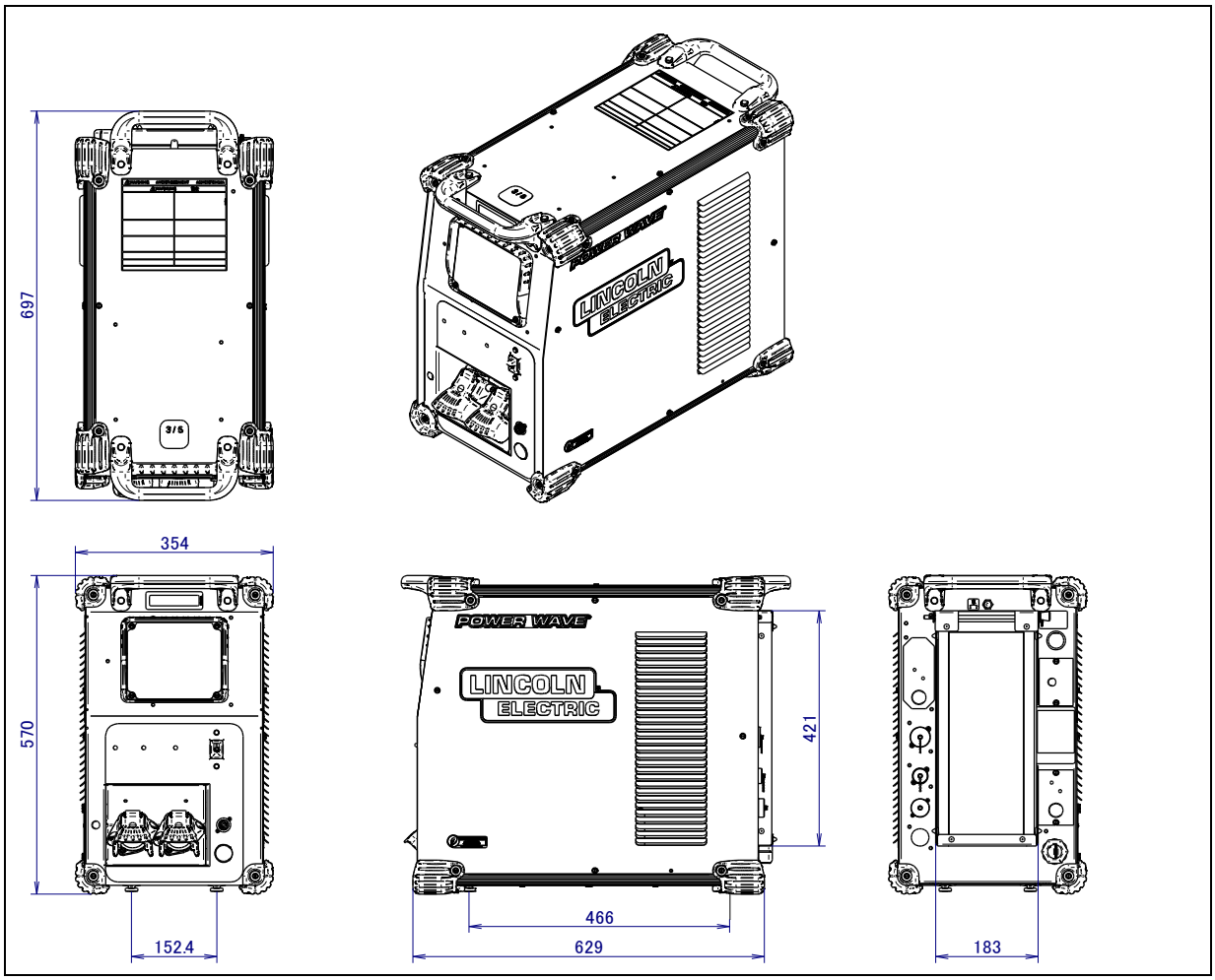


Fig. 1.1.3 (i) External dimensions of the Power Wave J350

If there is a risk of the mine dust and sputtering are scattered, set welding power supply on a stand of around 30cm to prevent absorb them.
Please refer to Setup section of welding power supply manual.

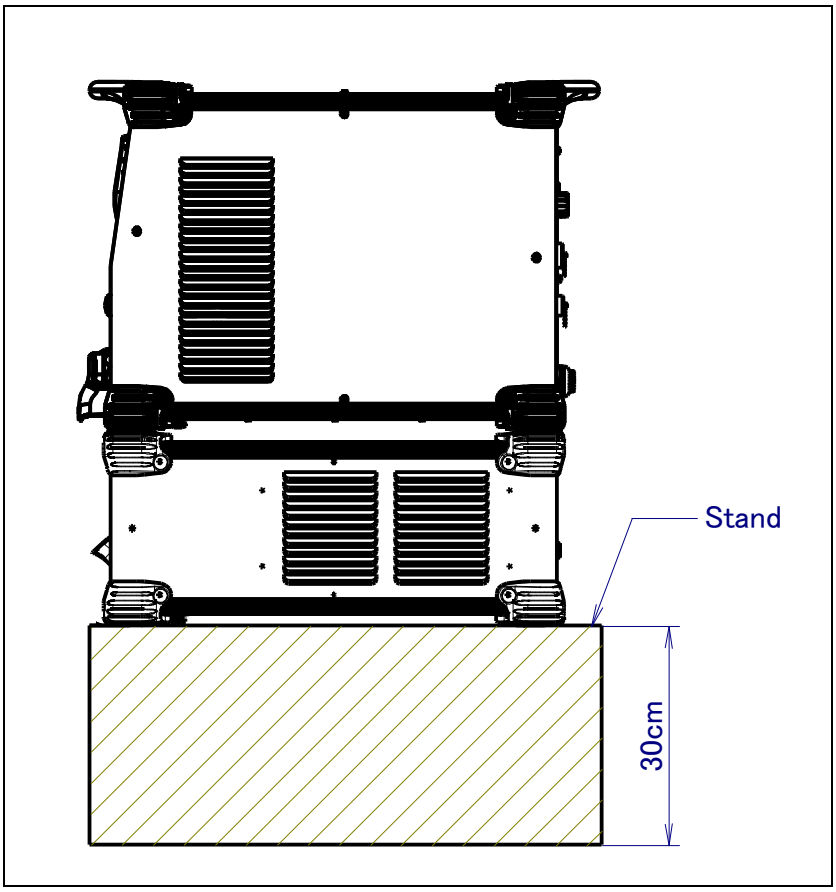


Fig. 1.1.3 (j) Quantity advance of welding power supply

Transportation method of welding power supply

When transporting welding power supply only, Use hand referring to Fig. 1.1.3 (k).When transporting Power Wave R350, Power Wave i400 welding power supply integrated controller, refer to Fig. 1.1.3 (l).

> ⚠ **WARNING**
> When transporting Power Wave R350 or Power Wave S350 or Power Wave R500, be sure to transport it with two people.

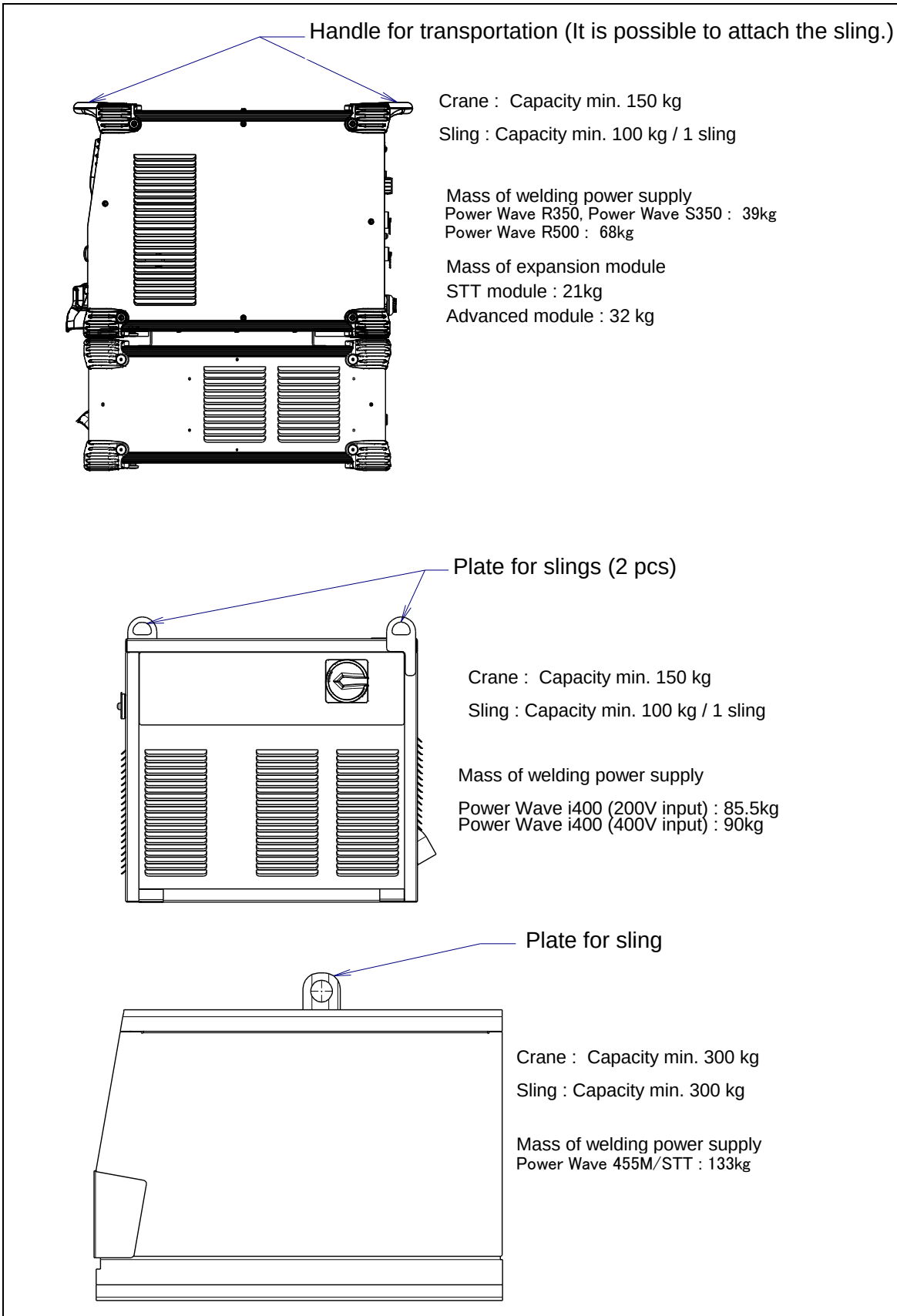


Fig. 1.1.3 (k) Transportation of welding power supply

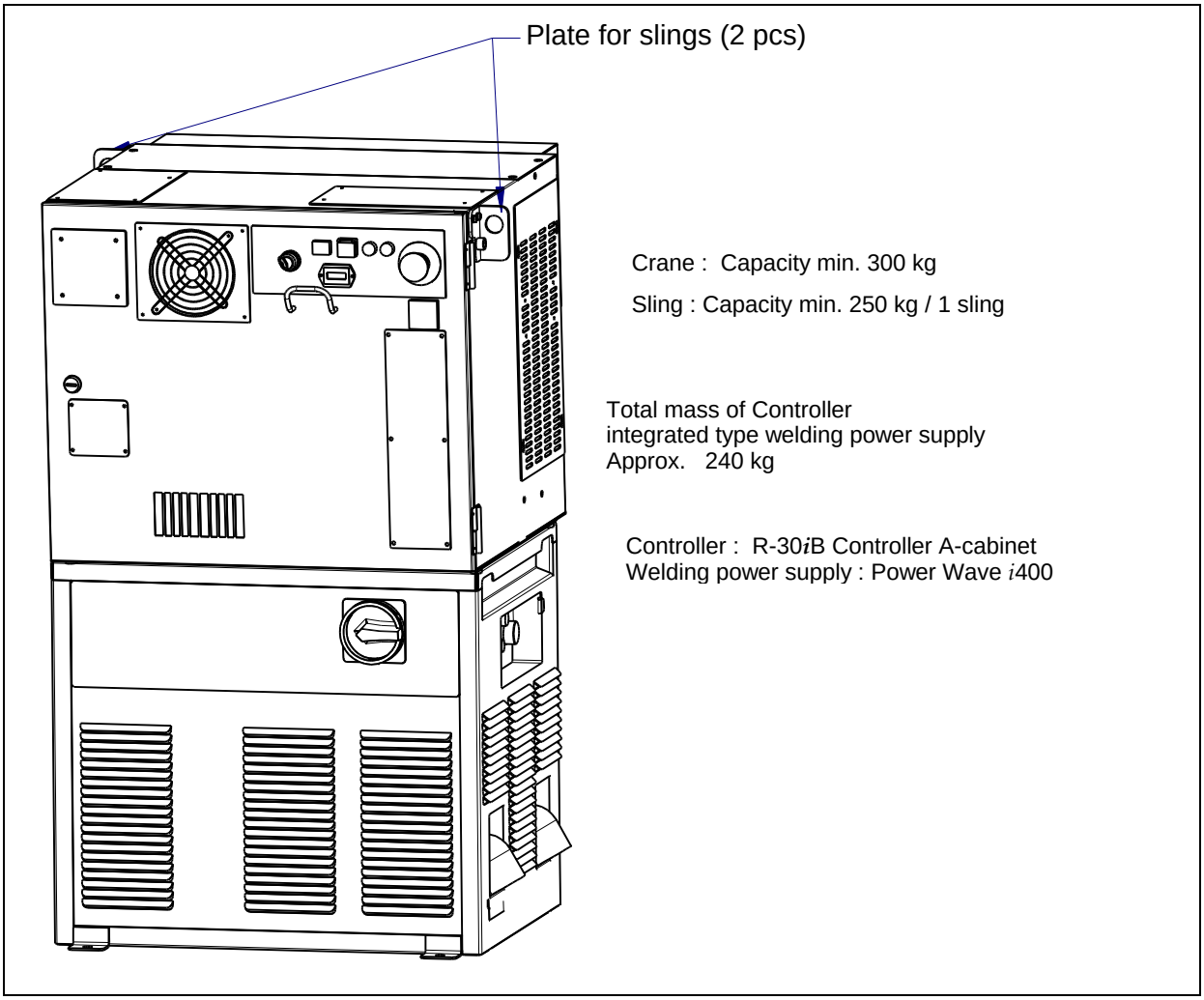


Fig. 1.1.3 (l) Transportation of Power Wave i400 welding power supply integrated type controller

Welding power supply (Power Wave R350, Power Wave S350, Power Wave R500, Power Wave R450, Power Wave J350) and STT module fixed method

Welding power supply (Power Wave R350, Power Wave S350, Power Wave R500) and STT module have metal fitting for mounting to connect them to other module in its bottom. Connect them by picking the metal fitting for mounting up to the metal fitting of connected module on the top surface.
Likewise, welding power supply or module can be fixed by installing metal fitting to welding power supply or module mounting trestle.

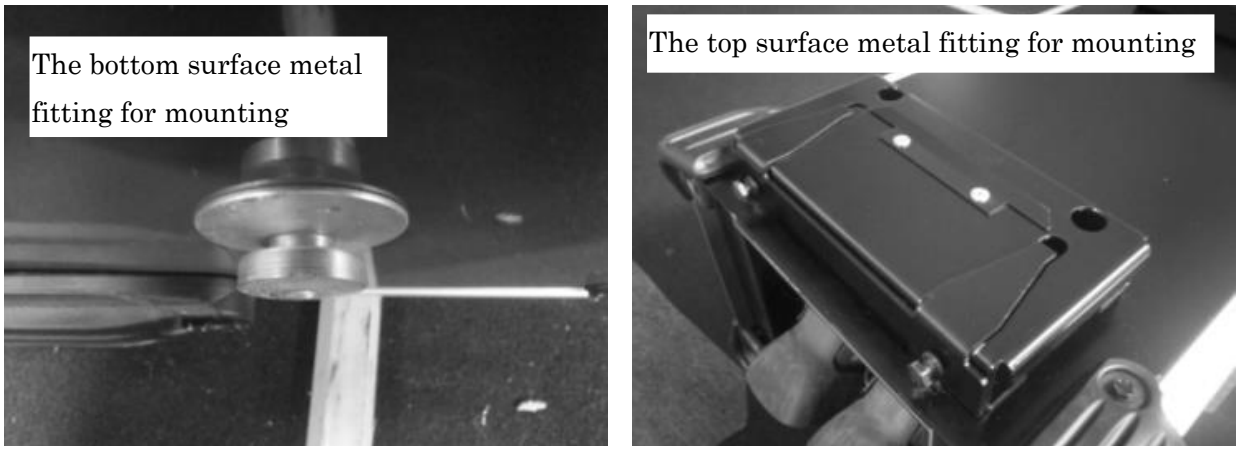
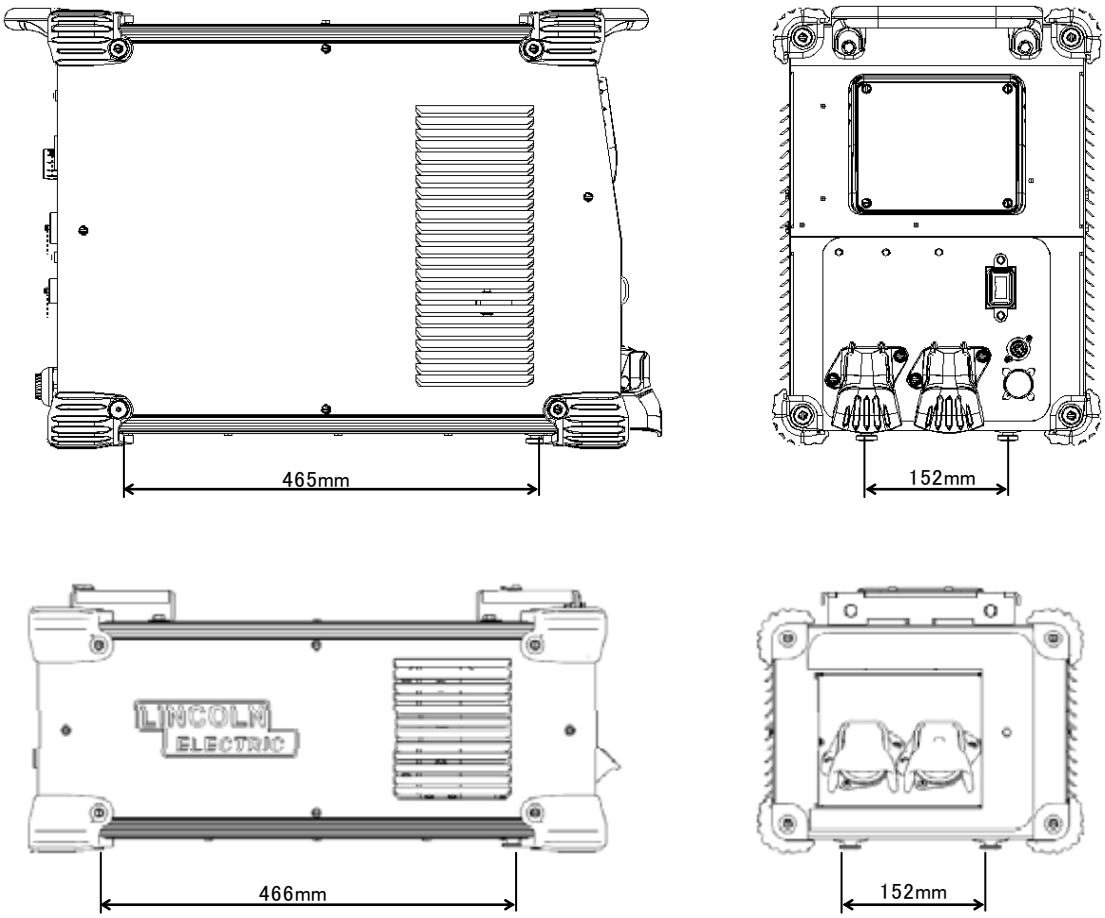


Fig. 1.1.3 (m) Metal fitting for mounting

Install metal fitting to trestle side referring to the figure below, pick the metal fitting of welding power supply or STT module bottom surface and fix them.

Metal fitting for mounting outer dimensions



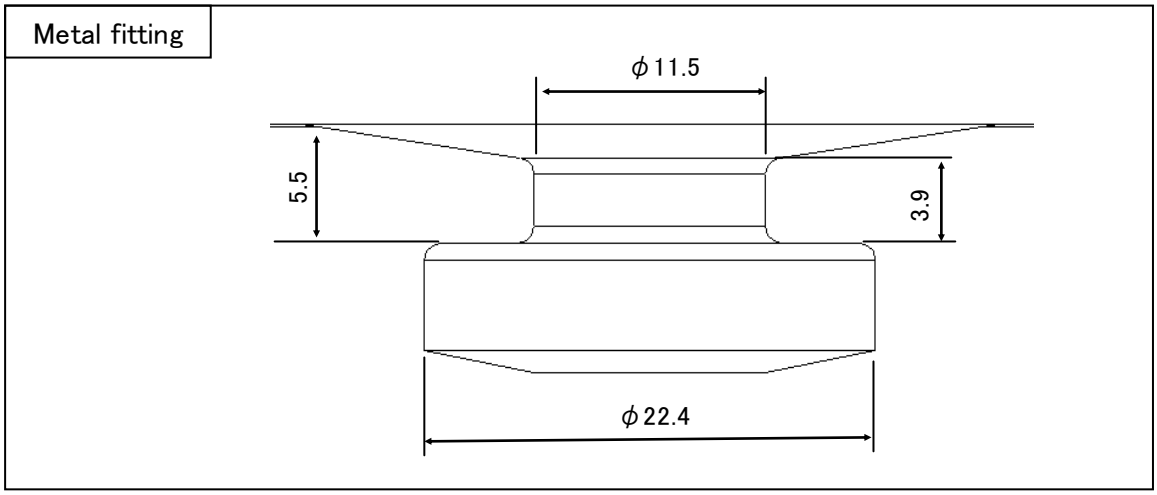


Fig. 1.1.3 (n) Metal fitting for mounting

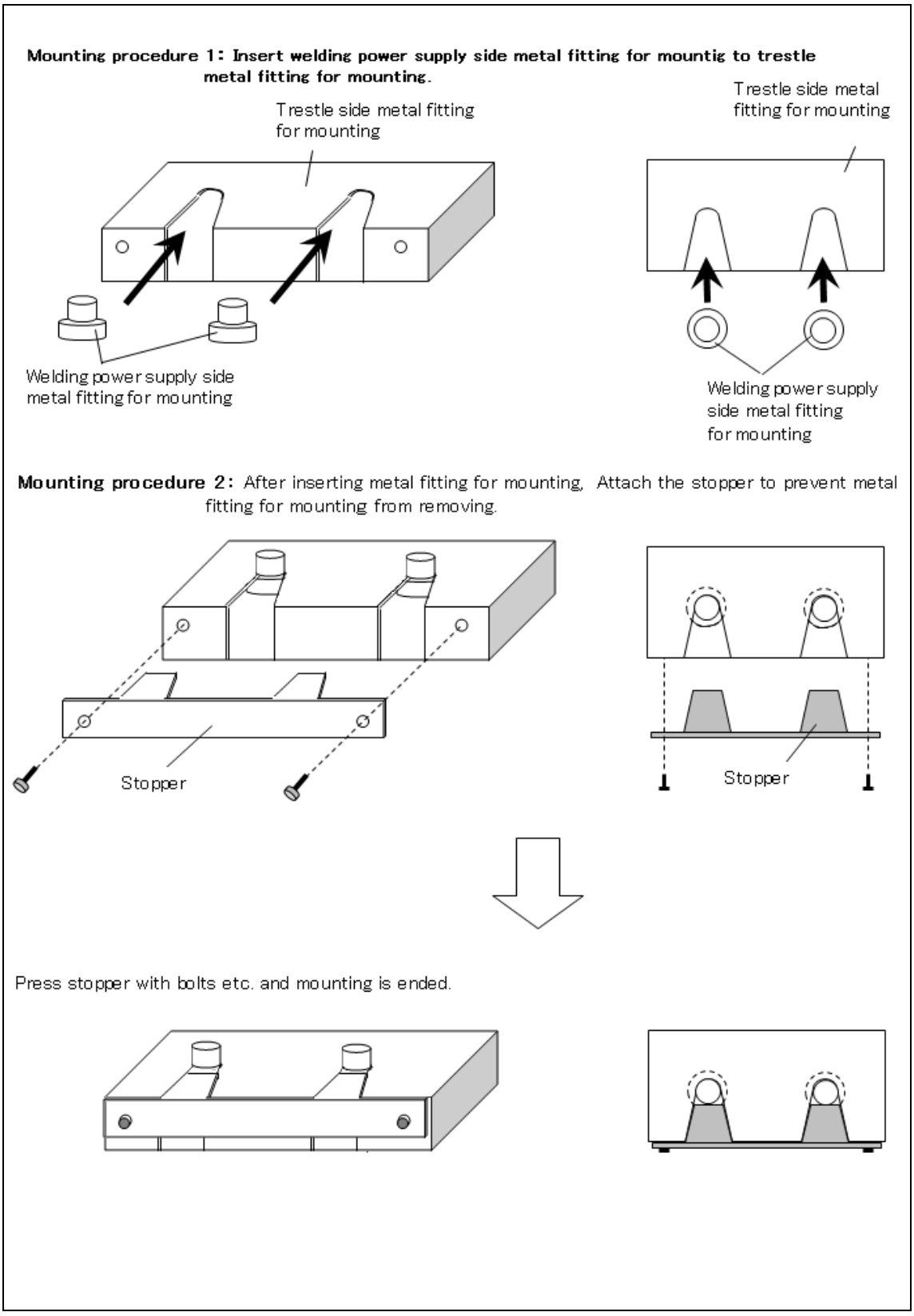


Fig. 1.1.3 (o) Fixed method

1.1.4 Wire Feeder

Table 1.1.4 (a) Wire feeder (AutoDrive 4R100)

Specification	A05B-1291-H203 (ARC Mate 100*i*C series) A05B-1296-H201 (ARC Mate 100*i*D series)
Drive roll	4 drive roll
Mass	6kg
Electrode wire	Steel or stainless Φ0.9,1.0,1.2

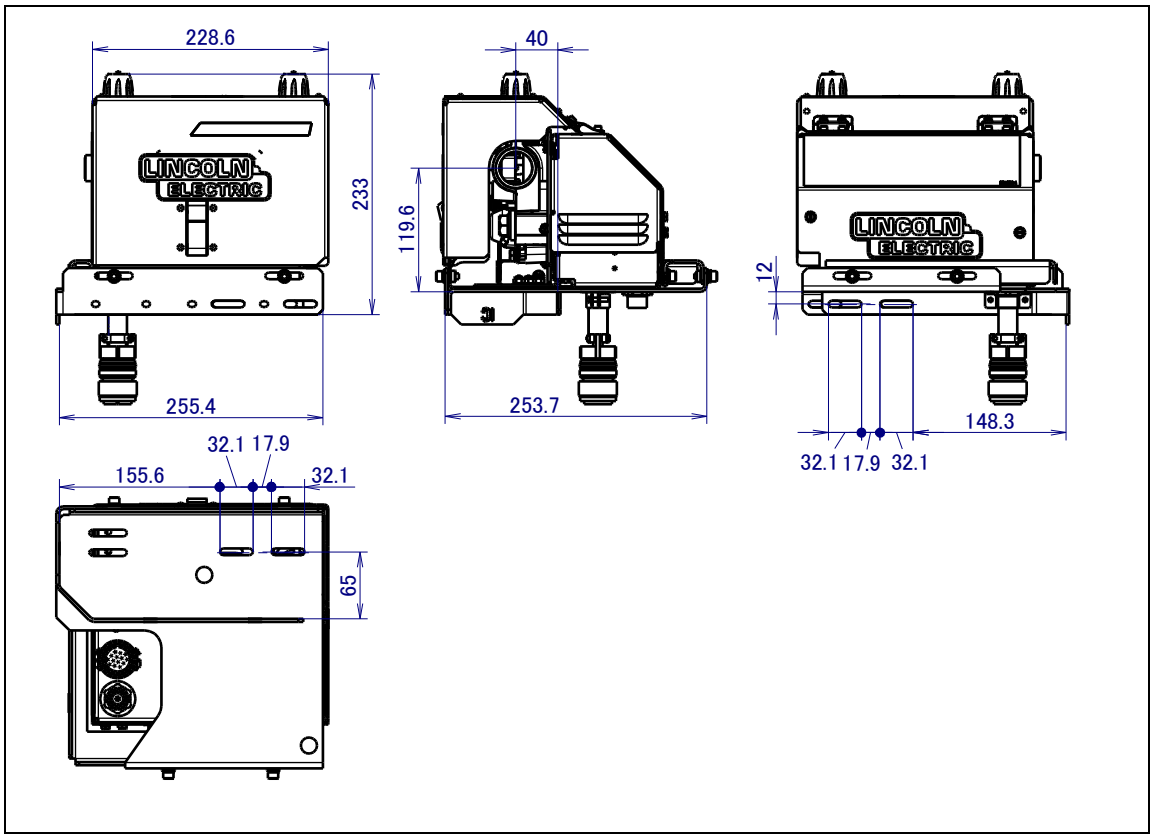


Fig. 1.1.4 (a) Wire feeder external dimensions (A05B-1291-H203)

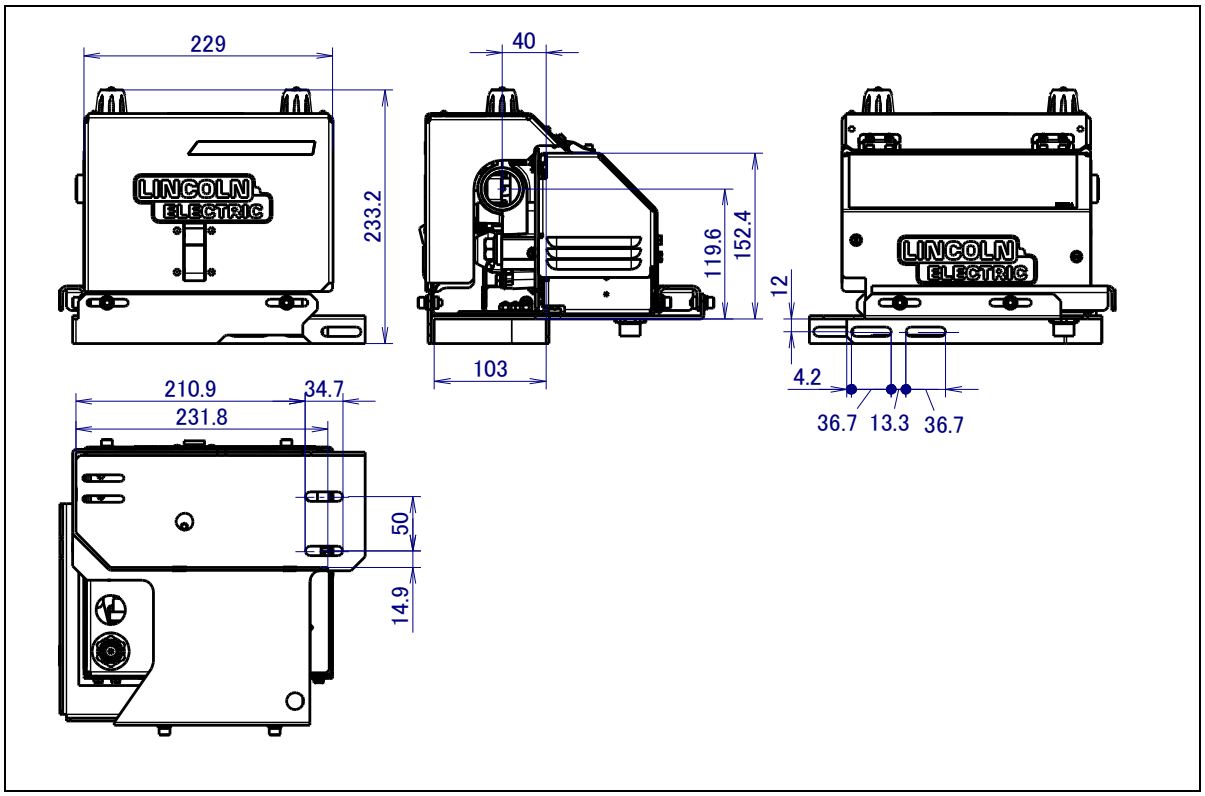


Fig. 1.1.4 (b) Wire feeder external dimensions (A05B-1291-H201)

Table 1.1.4 (b) Specification of wire feeder (AutoDrive 4R220)

Item	Specifications
Specification	A05B-1291-H204(ARC Mate 100*i*C series) A05B-1296-H202 (ARC Mate 100*i*D series)
Drive roll	4 drive roll
Mass	9.5kg
Electrode wire	Steel or stainless ϕ0.9 - 2.0

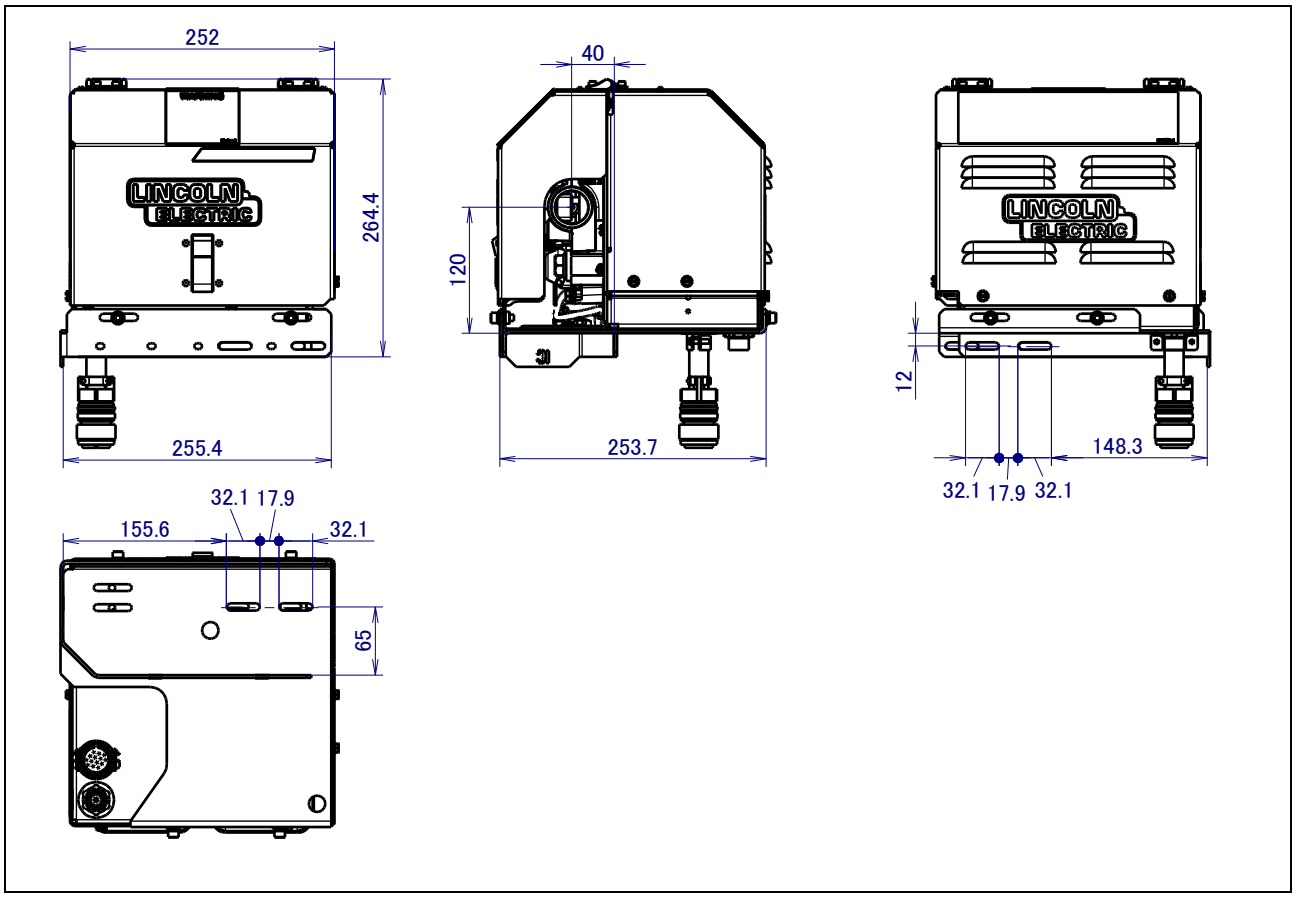


Fig. 1.1.4 (c) Wire feeder external dimensions (A05B-1291-H204)

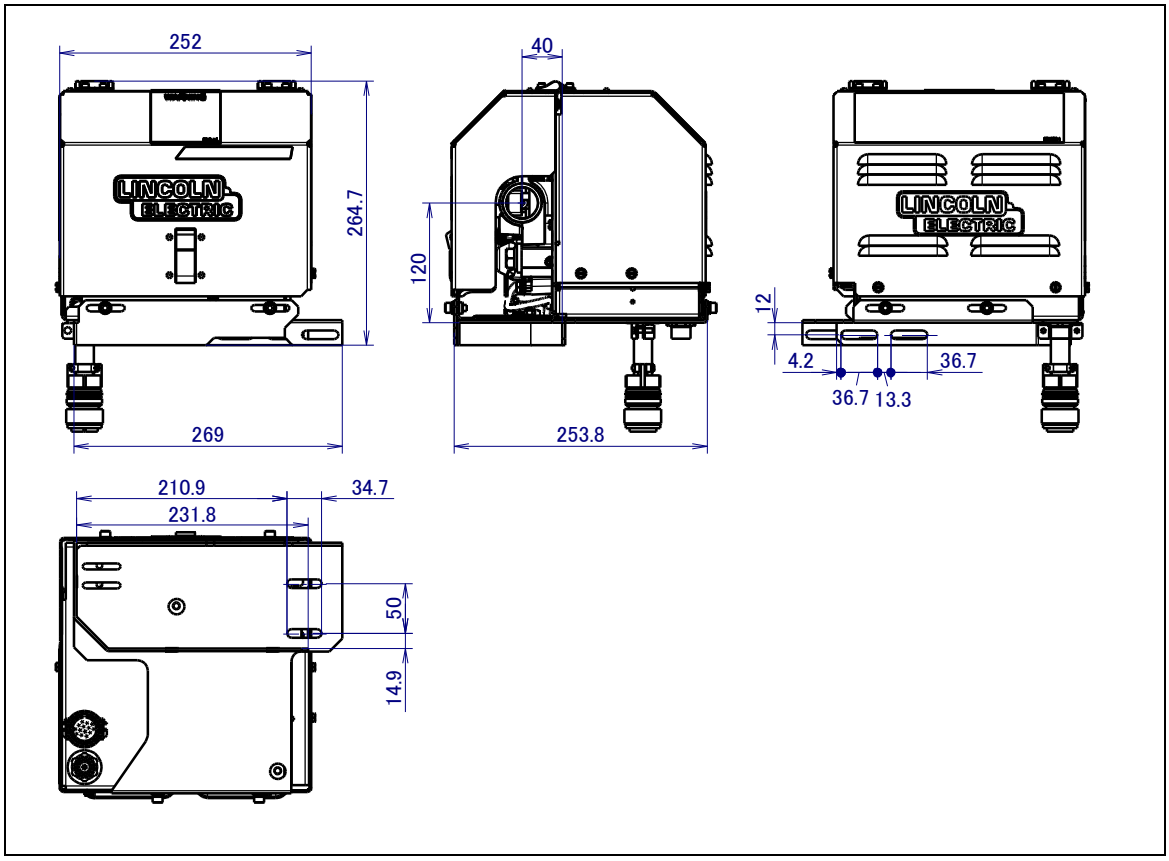


Fig. 1.1.4 (d) Wire feeder external dimensions (A05B-1296-H202)

Specification of drive rolls are below.

Table 1.1.4 (c) Specification of drive roll

	Specifications	Model
Drive roll for 4 rolls Iron ϕ0.9mm	A05B-1291-H251 (*)	ARC Mate 0*i*B ARC Mate 100*i*C series ARC Mate 120*i*C series
Drive roll for 4 rolls Iron ϕ1.2mm	A05B-1291-H252 (*)	
Drive roll for 4 rolls Iron ϕ1.0mm	A05B-1291-H254 (*)	

(*) Four drive rolls make a set.

Specification of wire feeders are below.

Table 1.1.4 (d) Wire feeder bracket

	Specifications
Wire feeder bracket	A05B-1223-J601

*ARC Mate 100*i*C series, ARC Mate 120*i*C series does not need the wire feeder bracket.

1.1.5 Welding Torch and Torch Bracket

Table 1.1.5 (a) Welding torch (1/5) (ARC Mate 0*i*B)

	Specifications
TORCH MADE BY MIZUHO (air cooling) (torch cable length 1100mm)	A05B-1223-H301
BINZEL BIROB 350GC-30L (air cooling) (torch cable 1100mm)	A05B-1223-H311
TORCH MADE BY MIZUHO (air cooling) (torch cable length 1230mm)	A05B-1291-H302
BINZEL ABIROB 350GC-30L (air cooling) (torch cable 1230mm)	A05B-1291-H347

Table 1.1.5 (b) Welding torch (2/5) (ARC Mate 100*i*C series)

	Spec	Model
BINZEL 350GC-30S (air cooling)(Standard torch)	A05B-1291-H301	ARC Mate 100*i*C, ARC Mate 100*i*C/12
BINZEL 350GC-30L (air cooling)(Long torch)	A05B-1291-H303	
BINZEL 350GC-30S (air cooling)(Standard torch for Asia)	A05B-1291-H305	
BINZEL 350GC-30L (air cooling) (Long torch for Asia)	A05B-1291-H307	
BINZEL ABIROB W500-35 (water cooling)	A05B-1291-H311	
BINZEL ABIROB A360-35	A05B-1291-H321	
Tregaskiss	A05B-1291-H331	
BINZEL 350GC-30L (Conventional dress out)	A05B-1291-H343	
BINZEL 350GC-30S (air cooling) (with wire clamp)(Standard torch)	A05B-1291-H351	
BINZEL 350GC-30L (air cooling) (with wire clamp)(Long torch)	A05B-1291-H353	
BINZEL ABIROB W500-35 (water cooling) (with wire clamp)	A05B-1291-H371	
BINZEL 350GC-30S (air cooling)(Standard torch)	A05B-1291-H302	ARC Mate 100*i*C/6L, ARC Mate 100*i*C/7L
BINZEL 350GC-30L (air cooling)(Long torch)	A05B-1291-H304	
BINZEL 350GC-30S (air cooling)(Standard torch for Asia)	A05B-1291-H306	
BINZEL 350GC-30L (air cooling) (Long torch for Asia)	A05B-1291-H308	
BINZEL ABIROB W500-35(water cooling)	A05B-1291-H312	
BINZEL ABIROB A360-35	A05B-1291-H322	
BINZEL 350GC-30L (Conventional dress out)	A05B-1291-H344	
BINZEL 350GC-30S (air cooling) (with wire clamp)(Standard torch)	A05B-1291-H352	
BINZEL 350GC-30L (air cooling) (with wire clamp)(Long torch)	A05B-1291-H354	
BINZEL ABIROB W500-35 (water cooling) (with wire clamp)	A05B-1291-H372	

	Spec	Model
BINZEL 350GC-30S (air cooling)(Standard torch for Asia)	A05B-1291-H309	ARC Mate 100*i*C/8L
BINZEL 350GC-30L (air cooling) (Long torch for Asia)	A05B-1291-H310	
BINZEL ABIROB W500-35 (water cooling)	A05B-1291-H313	
BINZEL ABIROB A360-35	A05B-1291-H323	
BINZEL 350GC-30S (air cooling) (with wire clamp)(Standard torch)	A05B-1291-H359	
BINZEL 350GC-30L (air cooling) (with wire clamp)(Long torch)	A05B-1291-H360	
BINZEL ABIROB W500-35(water cooling)(with wire clamp)	A05B-1291-H377	

Table 1.1.5 (c) Welding torch (3/5) (ARC Mate 120*i*C series)

	Spec.	Model
BINZEL 350GC-30S (air cooling)(Standard torch)	A05B-1292-H301	ARC Mate 120*i*C
BINZEL 350GC-30L (air cooling)(Long torch)	A05B-1292-H303	
BINZEL 350GC-30S (air cooling)(Standard torch for Asia)	A05B-1292-H305	
BINZEL 350GC-30L (air cooling)(Long torch for Asia)	A05B-1292-H307	
BINZEL ABIROB W500-35(water cooling)	A05B-1292-H311	
BINZEL ABIROB A360-35	A05B-1292-H321	
Tregaskiss	A05B-1292-H331	
BINZEL 350GC-30S (air cooling) (with wire clamp)(Standard torch)	A05B-1292-H351	
BINZEL 350GC-30L (air cooling) (with wire clamp)(Long torch)	A05B-1292-H353	
BINZEL 350GC-30S (air cooling)(Standard torch)	A05B-1292-H302	ARC Mate 120*i*C/10L ARC Mate 120*i*C /12L
BINZEL 350GC-30L (air cooling)(Long torch)	A05B-1292-H304	
BINZEL 350GC-30S (air cooling)(Standard torch for Asia)	A05B-1292-H306	
BINZEL 350GC-30L (air cooling)(Long torch for Asia)	A05B-1292-H308	
BINZEL ABIROB W500-35(water cooling)	A05B-1291-H312	
BINZEL ABIROB A360-35	A05B-1292-H322	
Tregaskiss	A05B-1292-H332	
BINZEL 350GC-30S (air cooling) (with wire clamp)(Standard torch)	A05B-1292-H352	
BINZEL 350GC-30L (air cooling) (with wire clamp)(Long torch)	A05B-1292-H354	
BINZEL ABIROB W500-35 (water cooling) (with wire clamp)	A05B-1291-H372	

Table 1.1.5 (d) Welding torch (4/5) (ARC Mate 50*i*D series)

	Spec.	Model
BINZEL ABIROB 350GC-30L (air cooling/long torch)	A05B-1292-H343	ARC Mate 50*i*D series

Table 1.1.5 (e) Welding torch (5/5) (ARC Mate 100*i*D, 120*i*D series)

	Spec.	Model
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#12LL	ARC Mate 100*i*D
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#12LL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#12L	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#12L	
BINZELABIROB iSTM mini G500-35	A05B-1296-H308#12L	
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#LGLL	ARC Mate 100*i*D/10L, ARC Mate 120*i*D
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#LGLL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#LGL	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#LGL	
Tregaskiss TA-3 (air cooling) (short torch)	A05B-1296-H331#LGLS	
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#ELLL	ARC Mate 100*i*D/8L
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#ELLL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#ELL	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#ELL	
Tregaskiss TA-3 (air cooling) (short torch)	A05B-1296-H331#ELLS	
BINZELABIROB 350GC-30S (air cooling) (Standard torch for Asia)	A05B-1291-H309	ARC Mate 120*i*D/12L
BINZELABIROB 350GC-30L (air cooling) (Long torch for Asia)	A05B-1291-H310	
BINZELABIROB W500-35 (water cooling)	A05B-1291-H313	
BINZELABIROB A360-35	A05B-1291-H323	

TCP and payload setting of torch is below.

Table 1.1 5 (f) TCP and payload setting of torch (Common to MIZUHO AND BINZEL) (ARC Mate 0*i*B)

		Standard torch	Long torch	
TCP(*)	X	0	0	[mm]
	Y	0	0	[mm]
	Z	361	461	[mm]
	W	180	180	[deg]
	P	-40.7	-40.7	[deg]
	R	0	0	[deg]
PAYLOAD		2.2	2.5	[kg]
PAYLOAD CENTERY	X	16.66	15.06	[cm]
	Y	2.45	-2.22	[cm]
	Z	12.98	15.58	[cm]
PAYLOAD INERTIA	Ix	0.14	0.26	[kgf·cm·s^2]
	Iy	0.18	0.30	[kgf·cm·s^2]
	Iz	0.05	0.06	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	[kg]

(*)Above-mentioned TCP is the one of 15mm in the wire thrusting out length.

Table 1.1.5 (g) TCP and payload setting of torch (ARC Mate *i*C series) (1/2)

		ABIROB 350GC-30S (*2)	ABIROB 350GC-30L (*2)	ABIROB 350GC-30S for Asia	ABIROB 350GC-30L for Asia	
		Standard torch	Long torch	Standard torch	Long torch	
TCP (*1)	X	-84.5	-84.5	-84.5	-84.5	[mm]
	Y	0	0	0	0	[mm]
	Z	362	440.7	362	440.7	[mm]
	W	180	180	180	180	[deg]
	P	-30	-30	-30	-30	[deg]
	R	0	0	0	0	[deg]
PAYLOAD		1.94	2.04	1.61	1.71	[kg]
PAYLOAD CENTER	X	-0.7	-0.7	-0.7	-0.7	[cm]
	Y	-0.3	-0.3	-0.3	-0.3	[cm]
	Z	16.7	16.7	16.7	16.7	[cm]
PAYLOAD INERTIA	Ix	0.35	0.35	0.35	0.35	[kgf·cm·s^2]
	Iy	0.35	0.35	0.35	0.35	[kgf·cm·s^2]
	Iz	0.026	0.026	0.026	0.026	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	7	7	[kg]

(*1)Above-mentioned TCP is the one of 15mm in the wire thrusting out length.
(*2)Including torches with wire clamp.

Table 1.1.5 (h) TCP and payload setting of torch (ARC Mate *i*C series) (2/2)

		ABIROB W500-35 (*2)	ABIROB A360-35	
TCP (*1)	X	-90.6	-91.4	[mm]
	Y	0	0	[mm]
	Z	401.9	403.7	[mm]
	W	180	180	[deg]
	P	-35	-35	[deg]
	R	0	0	[deg]
PAYLOAD		2.32	1.82	[kg]
PAYLOAD CENTER	X	-0.7	-0.7	[cm]
	Y	-0.3	-0.3	[cm]
	Z	16.7	16.7	[cm]
PAYLOAD INERTIA	Ix	0.35	0.35	[kgf·cm·s^2]
	Iy	0.35	0.35	[kgf·cm·s^2]
	Iz	0.026	0.026	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	[kg]

(*1)Above-mentioned TCP is the one of 15mm in the wire thrusting out length.
(*2)Including torches with wire clamp.

Table 1.1.5 (f) TCP and payload setting of torch (ARC Mate *i*D series) (1/2)

		ABIROB G350-30 (*2)	ABIROB W500-35	ABIROB W500-35 (with wire clamp)	
		Long torch	Standard torch	Standard torch	
TCP (*1)	X	-92.1	-91.4	-91.4	[mm]
	Y	0	0	0	[mm]
	Z	415.2	392.6	412.6	[mm]
	W	180	180	180	[deg]
	P	-30	-35	-35	[deg]
	R	0	0	0	[deg]
PAYLOAD		1.29	1.79	2.42	[kg]
PAYLOAD CENTER	X	-0.81	-0.84	-0.65	[cm]
	Y	0	0	-0.3	[cm]
	Z	15.9	16.5	16.4	[cm]
PAYLOAD INERTIA	Ix	0.15	0.16	0.2	[kgf·cm·s^2]
	Iy	0.15	0.17	0.21	[kgf·cm·s^2]
	Iz	0.01	0.013	0.015	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	7	[kg]

(*1)Above-mentioned TCP is the one of 15mm in the wire thrusting out length.
(*2)Including torches with wire clamp.

Table 1.1.5 (g) TCP and payload setting of torch (ARC Mate *i*C series) (2/2)

		ABIROB G500-35	Tregaskiss TA3	
		Standard torch	Short torch	
TCP (*1)	X	-81.9	-100	[mm]
	Y	0	0	[mm]
	Z	345	413	[mm]
	W	180	180	[deg]
	P	-35	-45	[deg]
	R	0	0	[deg]
PAYLOAD		1.74	2.4	[kg]
PAYLOAD CENTER	X	0.9	-0.6	[cm]
	Y	0	0	[cm]
	Z	21.3	13.9	[cm]
PAYLOAD INERTIA	Ix	0.35	0.25	[kgf·cm·s^2]
	Iy	0.35	0.26	[kgf·cm·s^2]
	Iz	0.026	0.016	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	[kg]

(*1)Above-mentioned TCP is the one of 15mm in the wire thrusting out length.
(*2)Including torches with wire clamp.

1.1.6 Communication Cable Specifications

Table 1.1.6 (a) Communication cables

	Specifications	Model
Integration kit	A05B-2601-J310	Power Waver *i*400
Ethernet cable 3.0m	A05B-2512-J280	Power Waver *i*400
Ethernet cable 7.6m	A05B-2512-J281	Power Waver R350 Power Waver S350
Ethernet cable14.0m	A05B-2512-J282	Power Waver R500
ArcLink cable 7.6m	A05B-1291-H571	Power Wave 455M/STT

1.2 OPTION CONSTITUTION

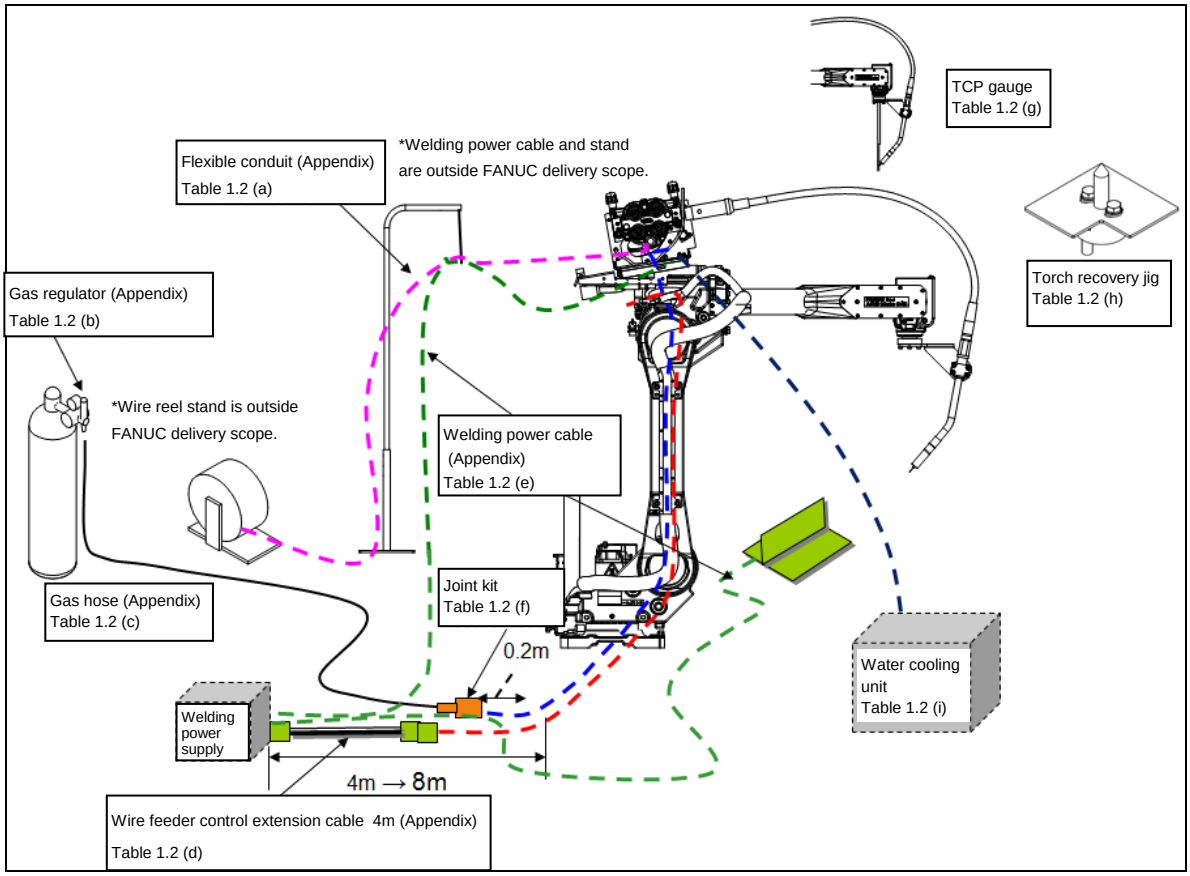


Fig. 1.2 (a) Option constitution

Table 1.2 (a) Flexible conduit specifications

	Specifications	Model
FLEXIBLE CONDUIT 4.5m	A05B-1291-H401 (*1)	All models
	A05B-1291-H411 (*2)	
FLEXIBLE CONDUIT 7.6m	A05B-1291-H402 (*1)	
	A05B-1291-H412 (*2)	
FLEXIBLE CONDUIT 3.0m	A05B-1291-H413 (*2)	

(*1) This is heavy-duty conduit. (It is impossible to adjust the length.)
(*2) This is light weight and variable-length conduit.

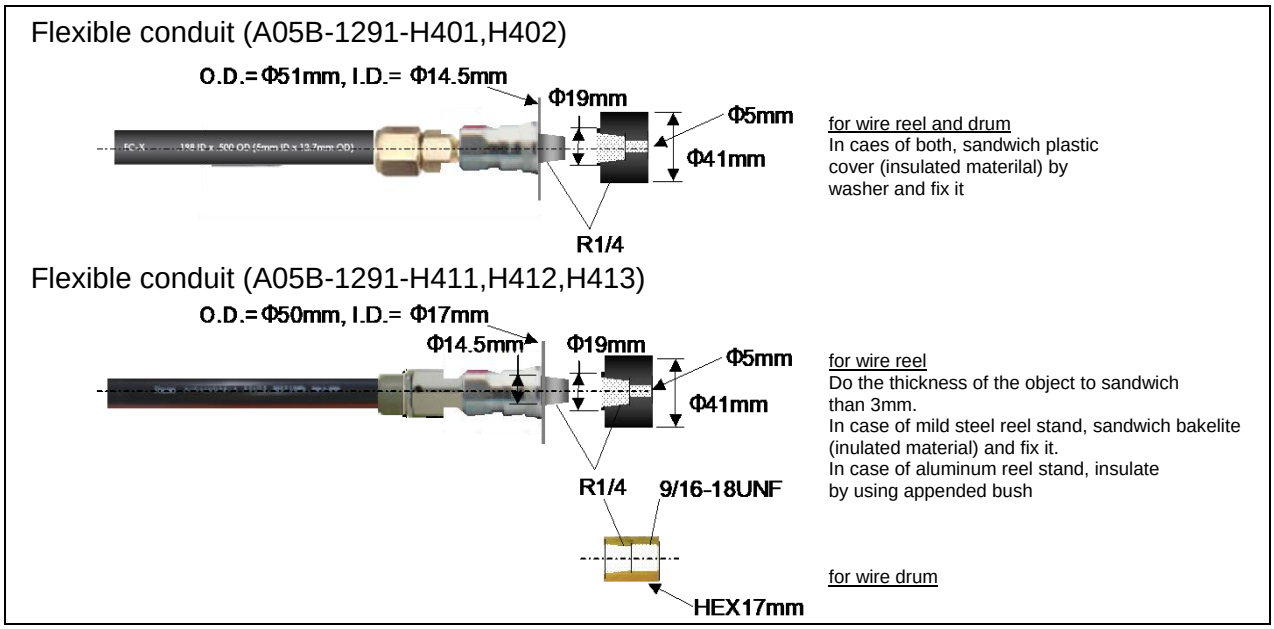


Fig. 1.2 (b) External dimension of flexible conduit

> ⚠ **CAUTION**
> When using attached washers of flexible conduit (A05B-1291-H411,H412,H413), be sure to stack 2 pcs.

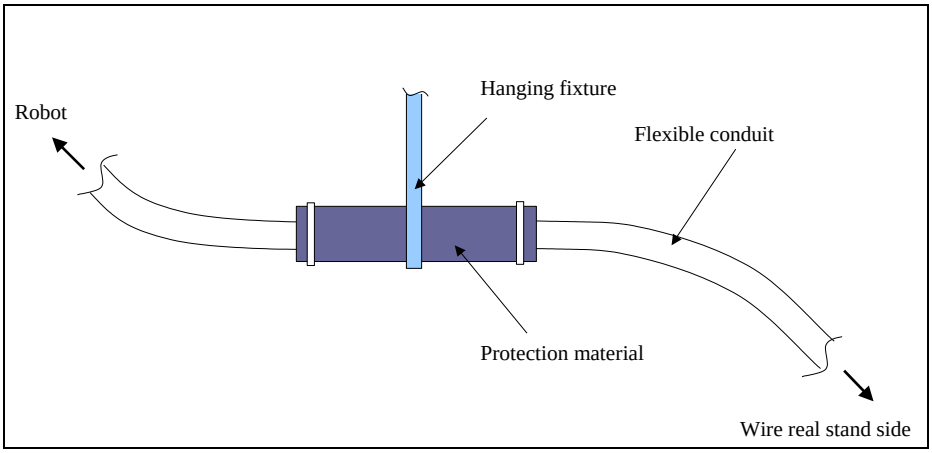


Fig. 1.2 (c) Hanging method of flexible conduit

Table 1.2 (b) Specification of regulator

Specifications		**A05B-1291-J101**
Maker		**Yutaka.LTD**
Decompression method		**Two step decompression method**
Basic performance	Inlet pressure gauge	0 to 25Mpa
	Inlet pressure	Ar, MAG: 0 to 14.8MPa CO2: 0 to 12MPa
	Measurement flow quantity range	1 to 25L/min
	Safety valve	20Mpa or more
	Regulated pressure	0.25MPa
Coupling	Inlet	W22-14 (R)
	Outlet	Φ8.5 hose mouth
Heating device performance	Voltage	100V
	Heating capacity	200W
	Power source code	2P(2m)

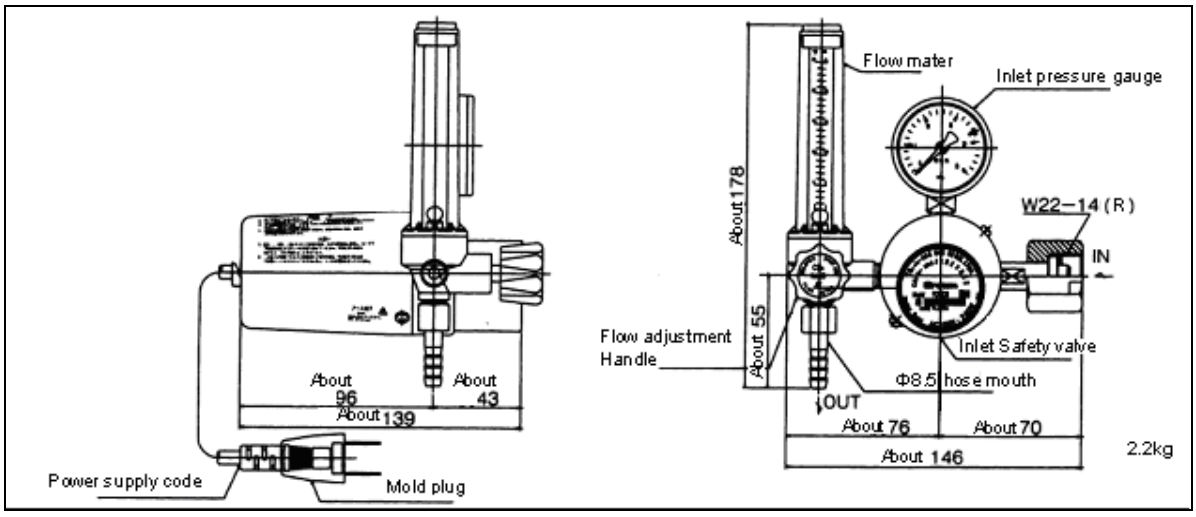


Fig. 1.2 (d) Regulator external dimensions (A05B-1291-J101)

Table 1.2 (c) Gas hose specifications

	Specifications
Gas hose 10m	A05B-1291-J151
Gas hose 15m	A05B-1291-J152
Gas hose 20m	A05B-1291-J153
Gas hose 25m	A05B-1291-J154

Table 1.2 (d) Wire feeder control extension cable (common to all models)

	Specifications
Wire feeder control extension cable	A05B-1223-K751

Table 1.2 (e) Welding power cables specifications (common to all models)

	Specifications
Welding power cable(not for movable part) 38SQ 6m	A05B-1223-K701
Welding power cable(not for movable part) 38SQ 10m	A05B-1223-K702
Welding power cable(not for movable part) 38SQ 15m	A05B-1223-K703
Welding power cable(not for movable part) 38SQ 20m	A05B-1223-K704
Welding power cable(not for movable part) 60SQ 5m	A05B-1291-H711
Welding power cable(not for movable part) 60SQ 10m	A05B-1291-H712
Welding power cable(not for movable part) 60SQ 15m	A05B-1291-H713
Welding power cable(not for movable part) 60SQ 20m	A05B-1291-H714

(*) When 2 welding power supplies are used in system, be sure to separate each power cable when forming them.

⚠ WARNING

1 These cables cannot be used for the moving part such as the cable carriers. (Except for movable) Please contact FANUC beforehand when the application such as the cable carriers to the moving part is necessary.
Please insulate the seam of the sheath and the terminal of the welding power cable firmly. There is danger of breaking the robot when the seam touches the robot.

2 Please consider covering the cable with the rubber mule for protection etc. when hanging it with the balance device etc. that set up the cable in the surrounding for the welding outside so that it plans, the limited part is bound in the cable tie etc., and power should not concentrate on a specific part.

Table 1.2 (f) Joint kit (ARC Mate 0*i*B)

	Specifications
Joint kit (For gas piping and air piping)	A05B-1223-K801

Table 1.2 (g) TCP gauge

	Specifications
TCP gauge	A05B-1223-J057

Using method of TCP gauge

Remove 2 bolts from torch cable bracket and attach TCP gauge.
In the state that a wire protrude from torch cable 15mm, confirm TCP gage center line matches wire tip position.

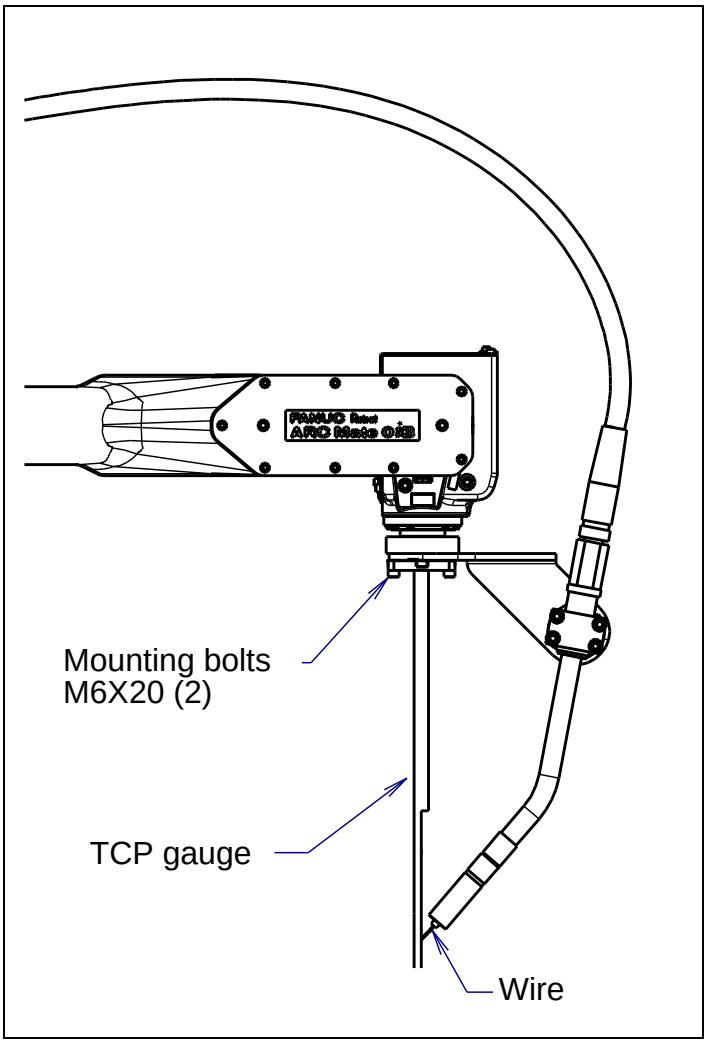


Fig. 1.2 (e) TCP gauge

Table 1.2 (h) High speed torch recovery jig

	Specifications
High speed torch recovery jig	A05B-1210-J056
High speed torch recovery jig (compact type)	A05B-1221-J056

Table 1.2 (i) Water cooling unit

Items	Specifications
Specifications	A05B-1291-J703 A05B-1291-J704
Heat exchanger	3-rows
Input power supply	230VAC 50/60Hz. (A05B-1291-J703) 115VAC 50/60Hz. (A05B1291-J704)
Cooling capacity Q=1L/min at 25℃ Cooling	1250W with H_2O
	1050W with BTC-15
Delivery height	Approx. 35m 230V
Maximum flow rate	7L/min
Maximum pressure	0.35MPa
Pump type	Vortex pump
Tank capacity	6.0L
Cooling water	BTC-15
Protection class	IP23 (Indoor use only)
External dimensions	690mm(L)X250mm(W)X340mm(H)
Mass	16.7kg
Maker type	850.1051.JF (A05B-1291-J703) 850.1052.JF (A05B-1291-J704)

Additional axis option

If additional axis cabinet (option) is added to R-30*i*B/R-30*i*B Mate controller, it supports additional axis positioner

- Each of 1 of FANUC standard 1-axis/2-axes positioner (option)
- If using positioner designed by customer, 1-axis motor drive by 80A amplifier or less

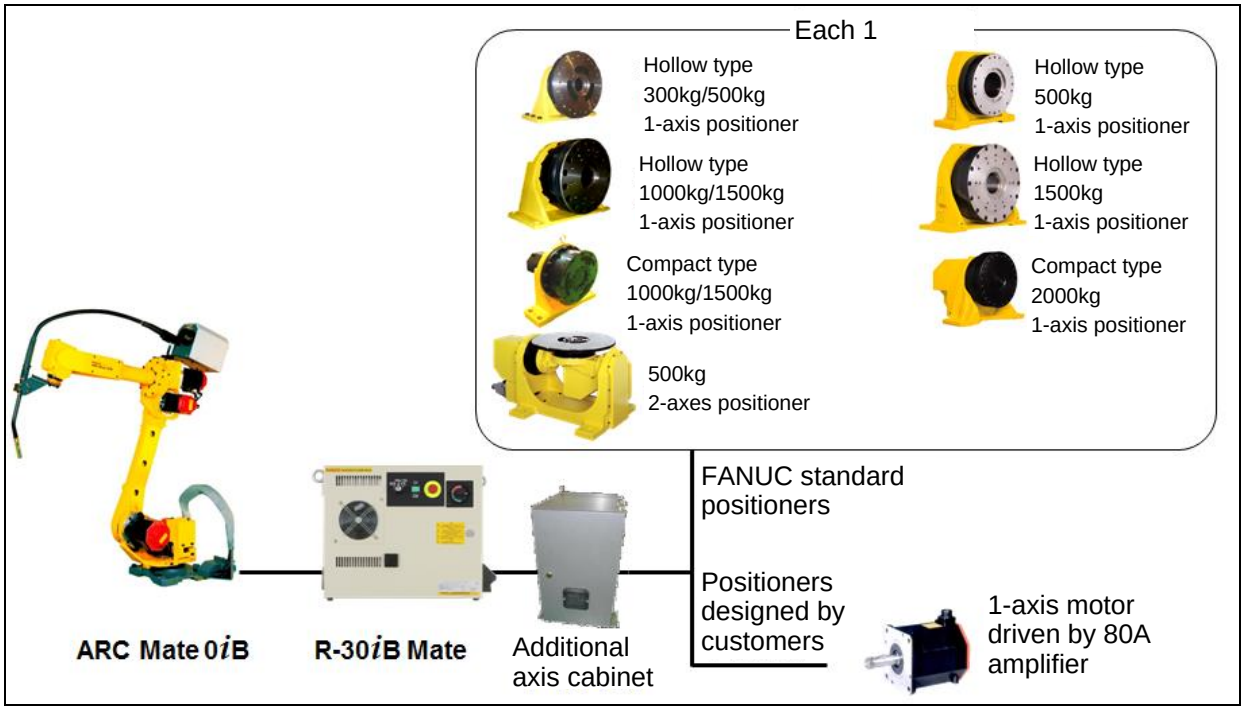


Fig. 1.2 (f) Additional axis option constitution (ARC Mate 0*i*B)

NOTE
In case of ARC Mate 0*i*B, it is possible to use positioner X2 configuration only when positioner is horizontal axis turn and each positioner does not move at the same time. (Positioner is restricted to the above mentioned positioner.)

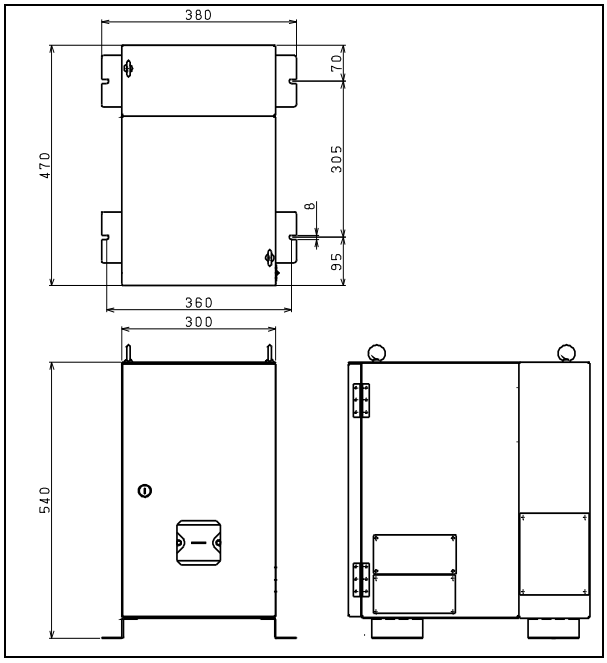
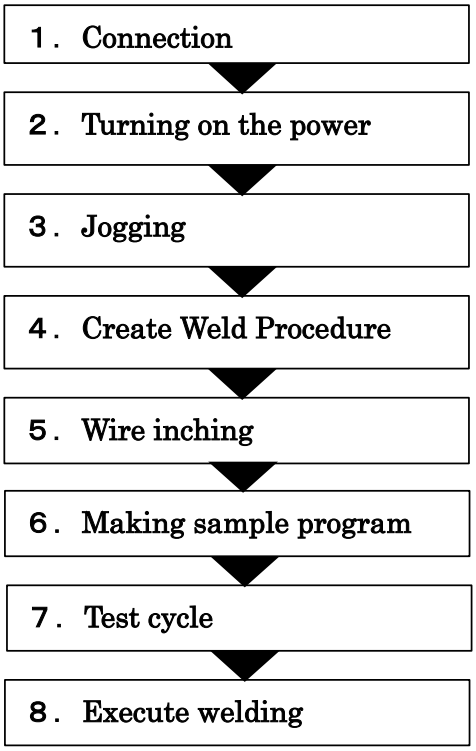


Fig. 1.2 (g) Additional axis cabinet external dimensions

2 BASIC OPERATION (QUICK REFERENCE)

2.1 OVERVIEW



This chapter describe the basic operation from installing the robot to performing arc welding for customers who are not familiar with FANUC arc welding robot operation.

Please refer to Chapter “3 BASIC OPERATION” to “12 Power Wave i400 & Power Wave 455M/STT CONNECTION” and CONTROLLER Arc Welding Function OPERATOR’S MANUAL (B-83284EN-3) for more details of arc welding robot operation method.

2.2 CONNECTION

Fig. 2.2 (a), (b) show connection contents of a robot, a controller and welding power supply.
Refer to Subsection 2.2.1 to 2.2.5 for details.

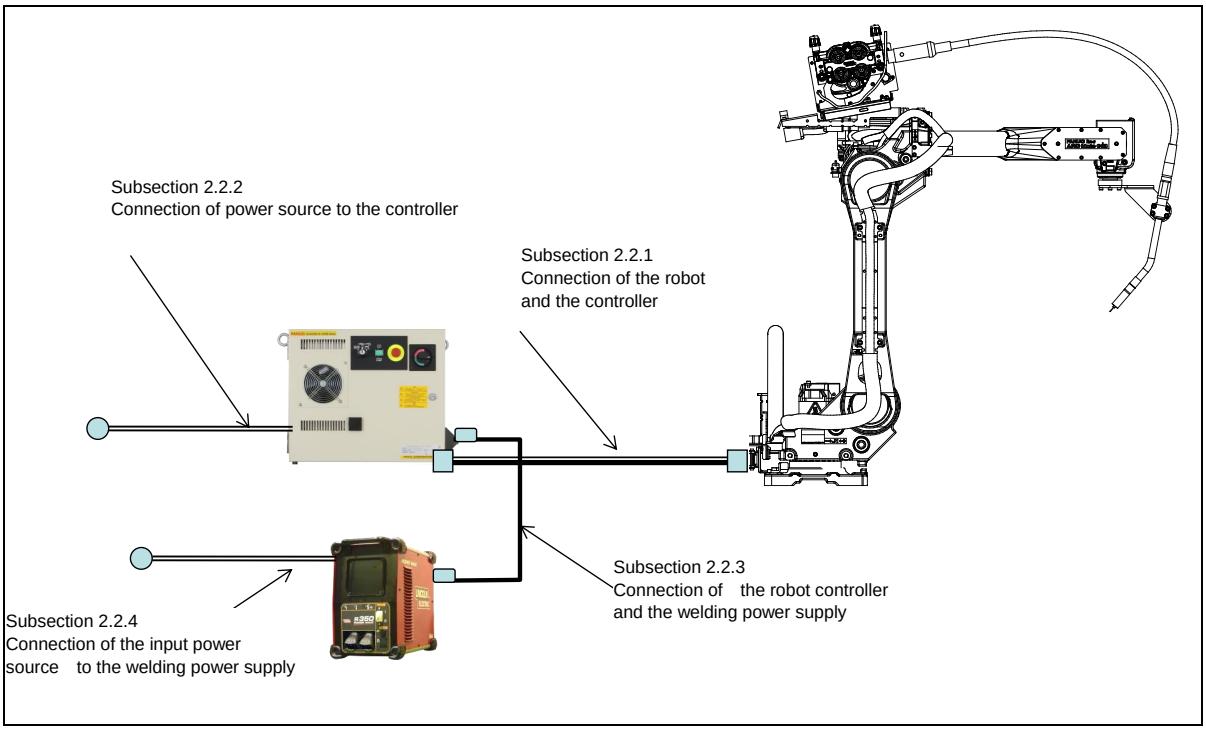


Fig. 2.2 (a) Connection contents (1/2)

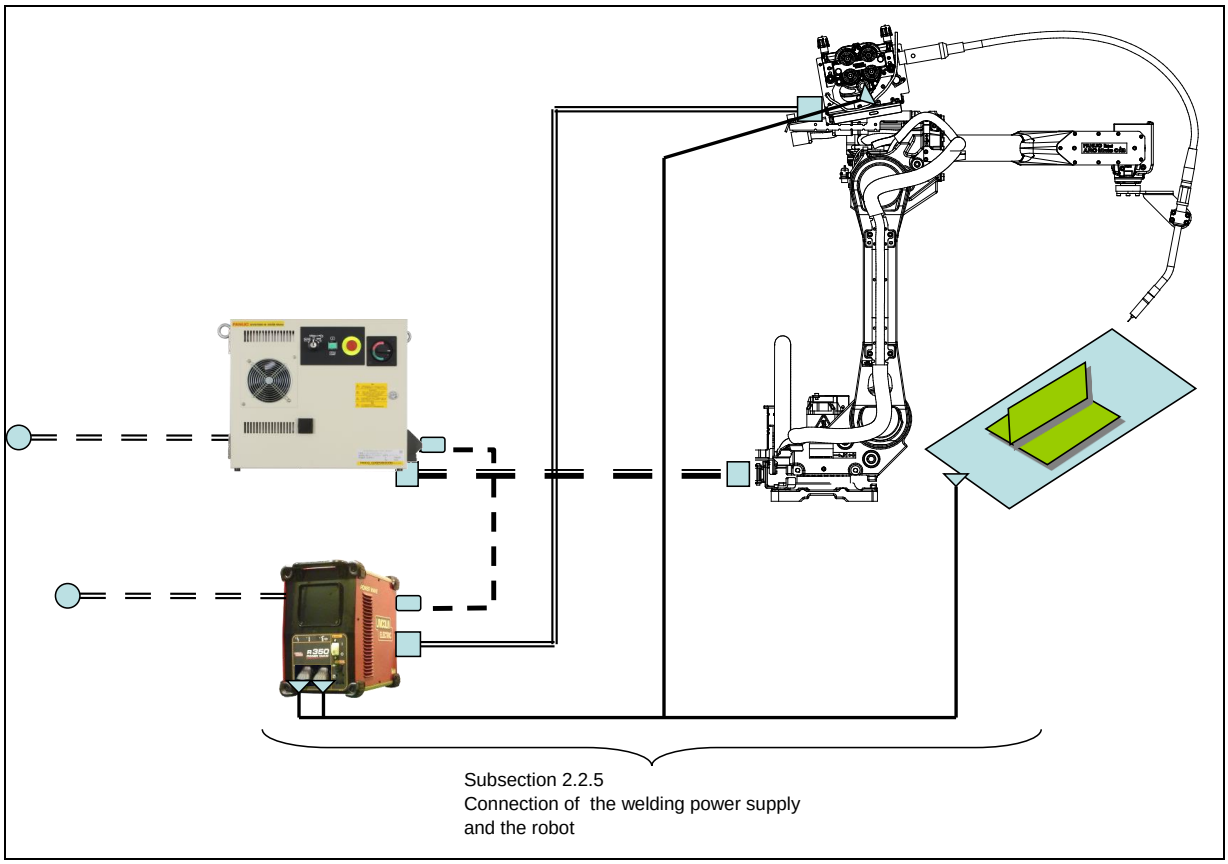


Fig. 2.2 (b) Connection contents (2/2)

2.2.1 Connection of Robot and Controller

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

> ⚠ **CAUTION**
> 1 Before connecting the cables, be sure to turn off the controller power.
> 2 Don't use 10m or longer coiled cable without untying. The long coiled cable will heat and damage itself.

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

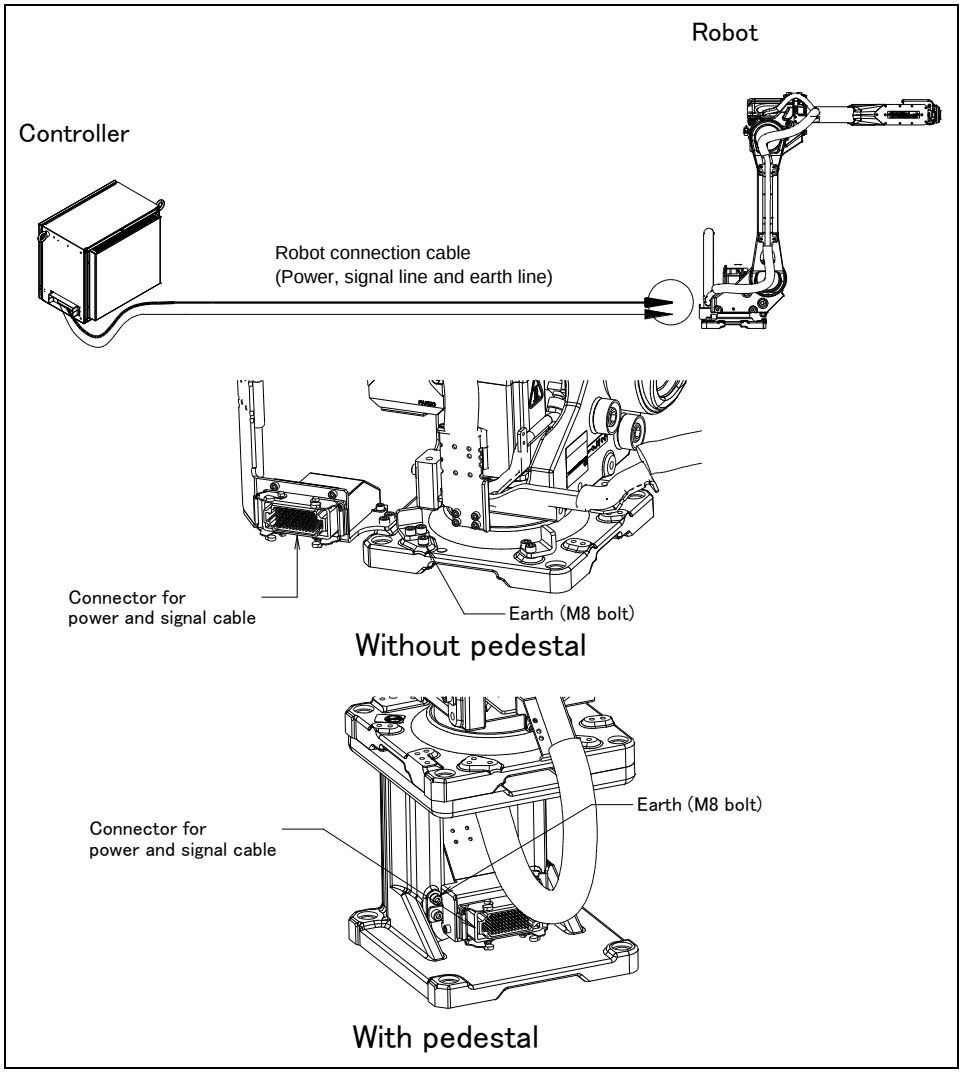


Fig. 2.2.1 (a) Cable connection figure (ARC Mate 0*i*B)

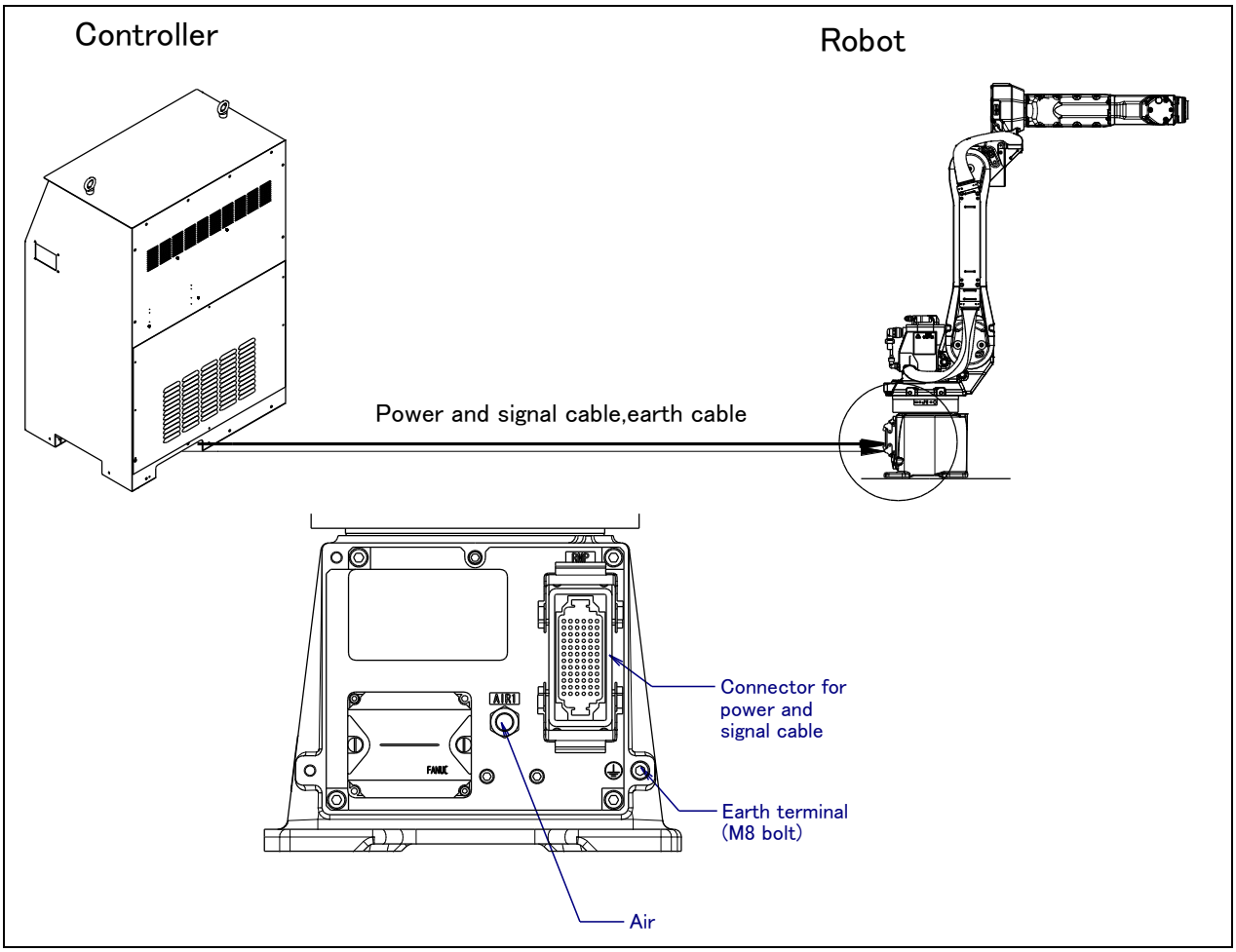


Fig. 2.2.1 (b) Cable connection figure (ARC Mate 100*i*C series, ARC Mate 120*i*C series)

2.2.2 Connection of Input Power Supply to Controller

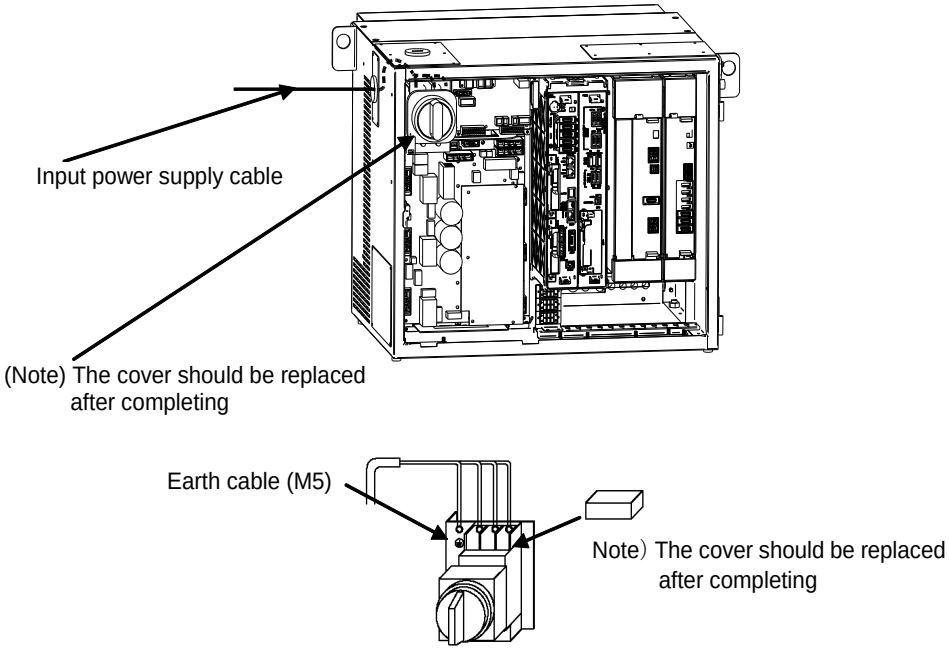
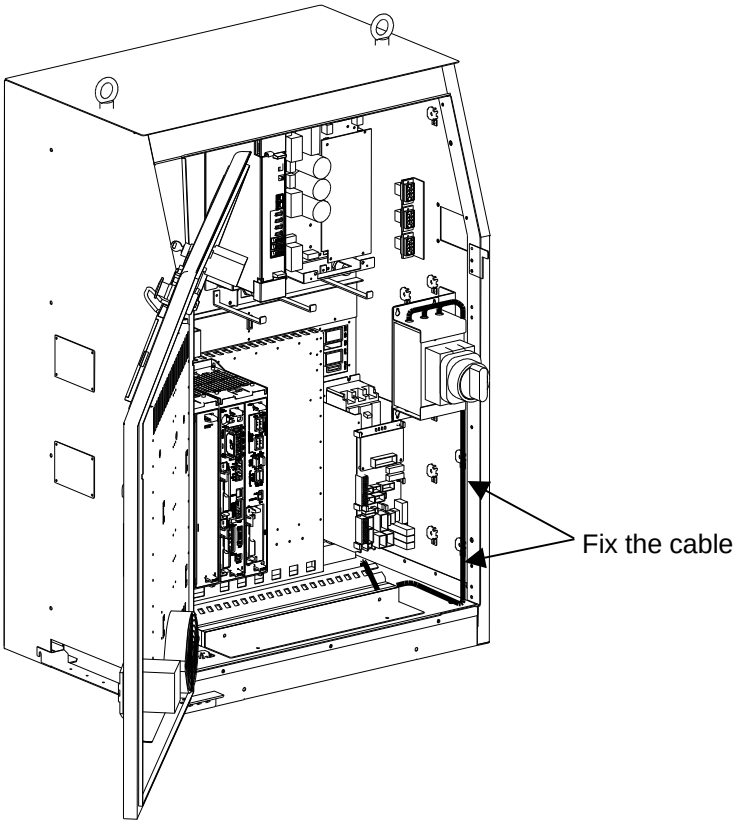


Fig. 2.2.2 (a) Connecting the input power cable (R-30*i*B Controller, A-cabinet)

⚠ WARNING
The cover for primly terminal of main breaker should be replaced after completing.



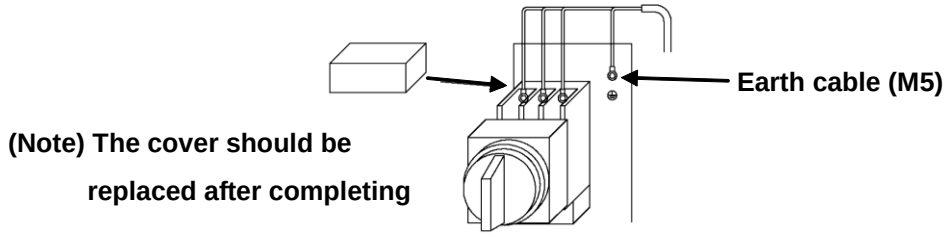


Fig. 2.2.2 (b) Connecting the input power cable (R-30*i*B Controller, B-cabinet)

⚠ WARNING
The cover for primly terminal of main breaker should be replaced after completing.

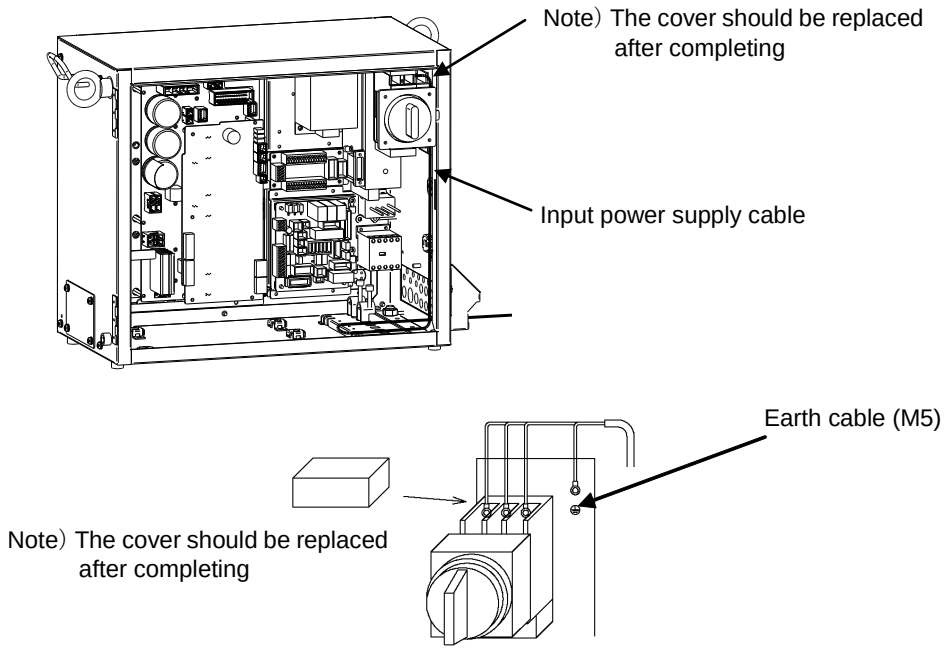


Fig. 2.2.2 (c) Connecting the input power cable (R-30*i*B Mate Controller)

NOTE
Use the wire which size is from AWG14 (2mm^2) to AWG10 (5.5mm^2) for input power supply cable and earth cable.

2.2.3 Connection of Controller and Welding Power Supply

Power Wave R350, Power Wave S350, Power Wave R500

Connect controller and welding power supply using Ethernet cable.
Ethernet cable is connected to controller when they are shipped from the factory.

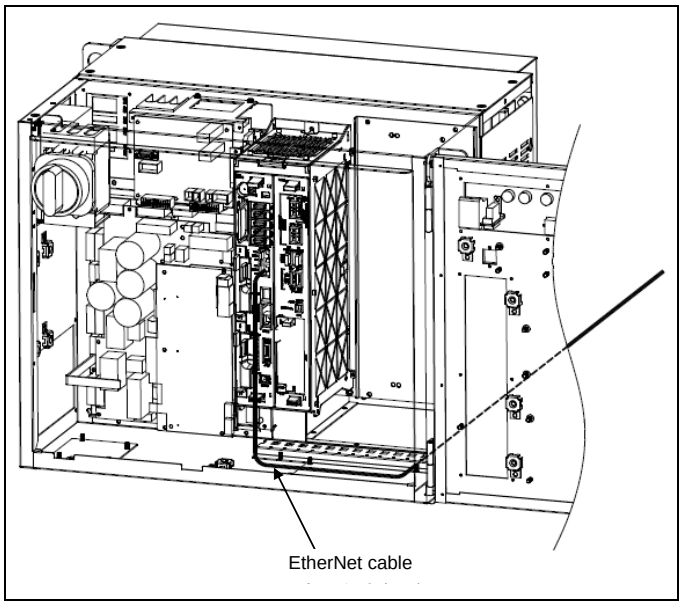


Fig. 2.2.3 (a) Connection of EtherNet cable (R-30*i*B/R-30*i*B Plus controller A-cabinet)

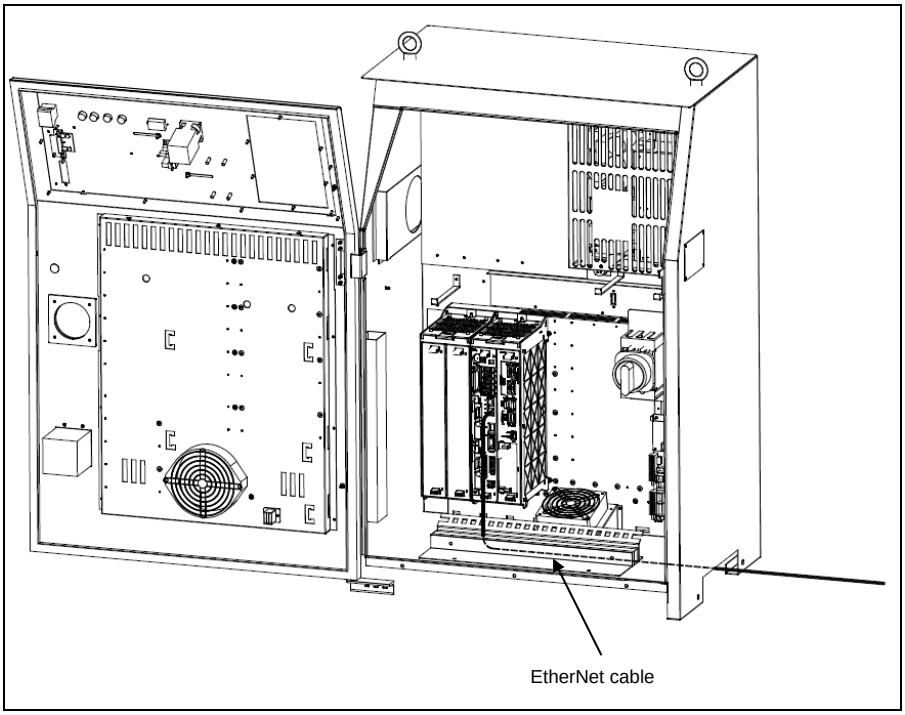


Fig. 2.2.3 (b) Connection of EtherNet cable (R-30*i*B/R-30*i*B Plus controller B-cabinet)

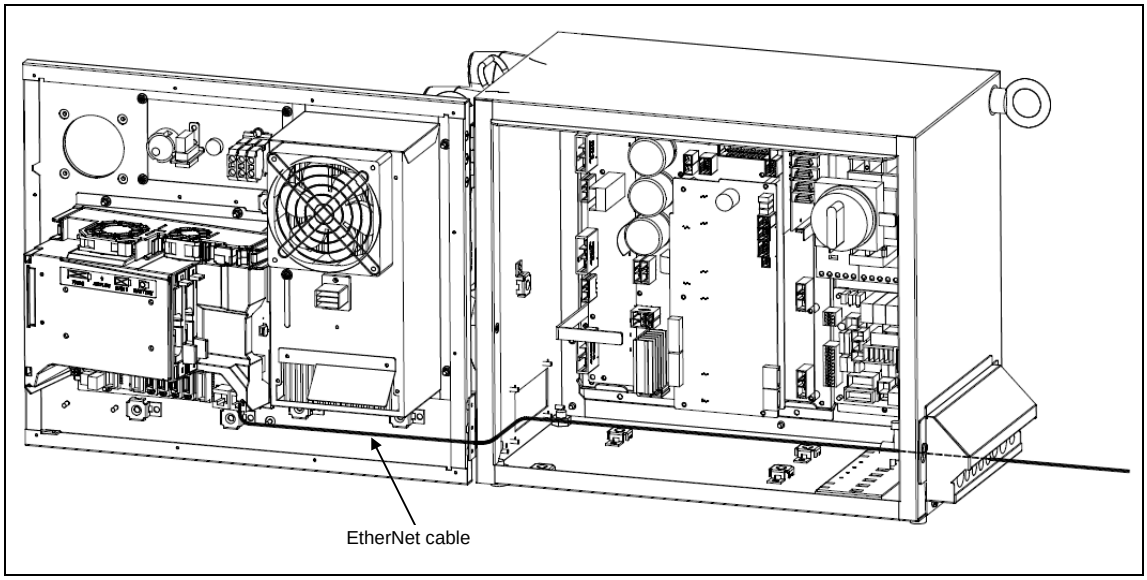


Fig. 2.2.3 (c) Connection of EtherNet cable (R-30*i*B Mate/R-30*i*B Mate Plus controller)

The port number for inserting Ethernet cable becomes followings corresponding to the number of ports on robot controller.

- Robot controller has only CD38A port :Connect the cable to CD38A
- Robot controller has CD38A and CD38B ports : Connect the cable to CD38B

The Ethernet cable must be fastened by a cable clamp to prevent tension being applied to the modular connector (RJ-45) that connects the cable to the controller even if the Ethernet cable is pulled directly. This clamp is also used to ground the cable shield.

Connect this cable to welding power supply backside.

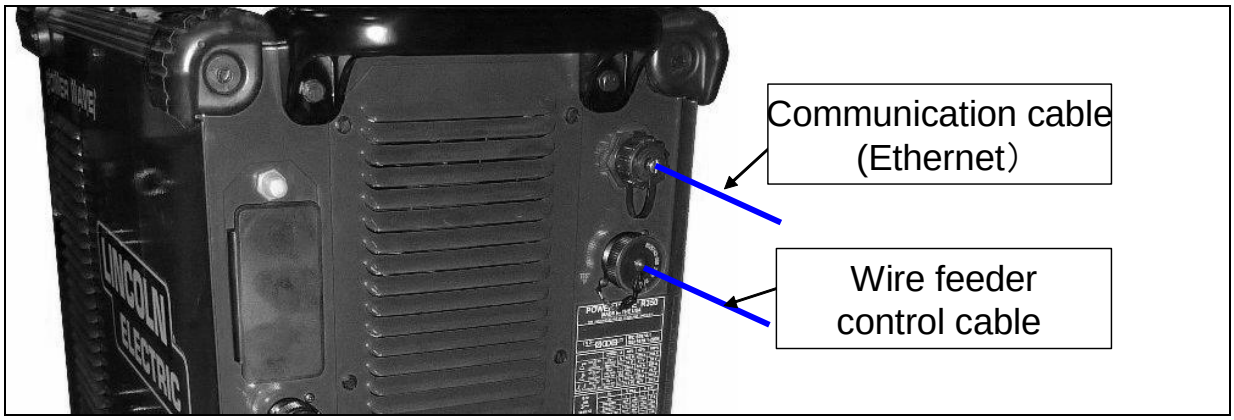


Fig. 2.2.3 (d) Connection of Ethernet cable (welding power supply Power Wave R350, Power Wave S350)

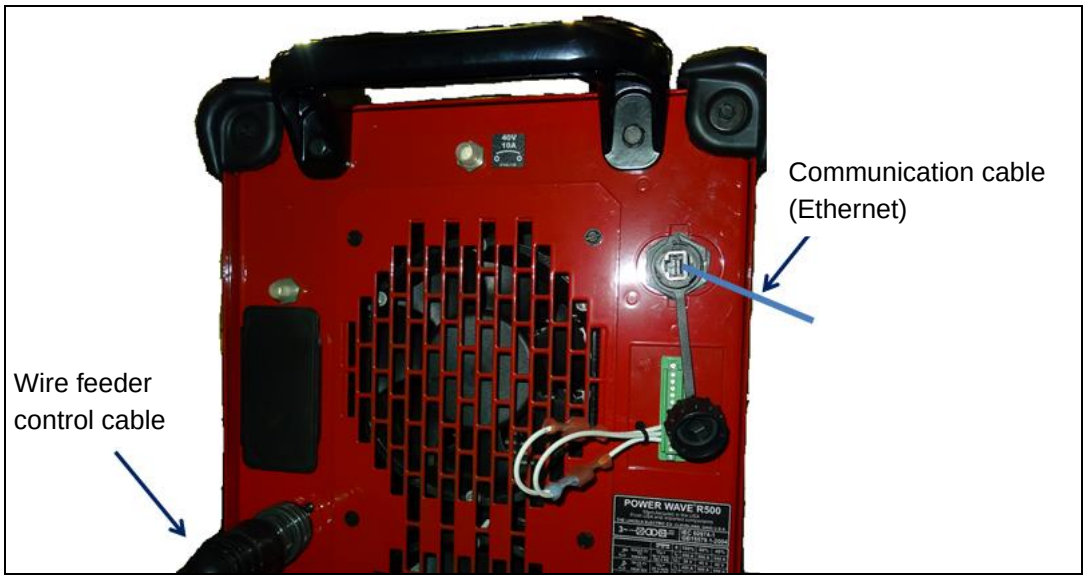


Fig. 2.2.3 (e) Connection of Ethernet cable (welding power supply Power Wave R500)

If controlling multiple welding power supplies with a robot controller, adopt a switching hub.
For R-30*i*B Controller: Connect CD38B and the switching hub, then connect the switching hub and each welding power supply.

For R-30*i*B Mate Controller

- If robot controller has only CD38A port, connect the cable to CD38A and the switching hub, then connect it to the switching hub and each welding power supply.
- If robot controller has CD38A and CD38B ports, connect the cable to CD38B and the switching hub, then connect it to the switching hub and each welding power supply.

If multiple welding power supplies are controlled, other robot software setup is required. About the detail, please refer to Section 10.4 “INITIAL SETTING WHEN MULTIPLE WELDING POWER SUPPLIES ARE CONNECTED”.

⚠ WARNING
When Lincoln welding power supply and robot controller is connected via Ethernet cable, you must not connect through the network in operation. If the connection is established through the network in operation, the performance of welding power supply is not guaranteed. Additionally, It may have a bad influence against the traffic on the network in operation.

Power Wave i400, Power Wave 455M/STT

Refer to Chapter 12.

If multiple welding power supplies are controlled, other robot software setup is required. Additionally, if Power Wave 455M/STT is connected, the setup of DIP switch on DeviceNet board is also required. About the detail, please refer to Section 10.4 “INITIAL SETTING WHEN MULTIPLE WELDING POWER SUPPLIES ARE CONNECTED”.

2.2.4 Connection of Input Power Supply to Welding Power Supply

Power Wave R350, Power Wave S350

1 Remove upper both side cover and side panel. (It is similar when Expansion module is specified.)

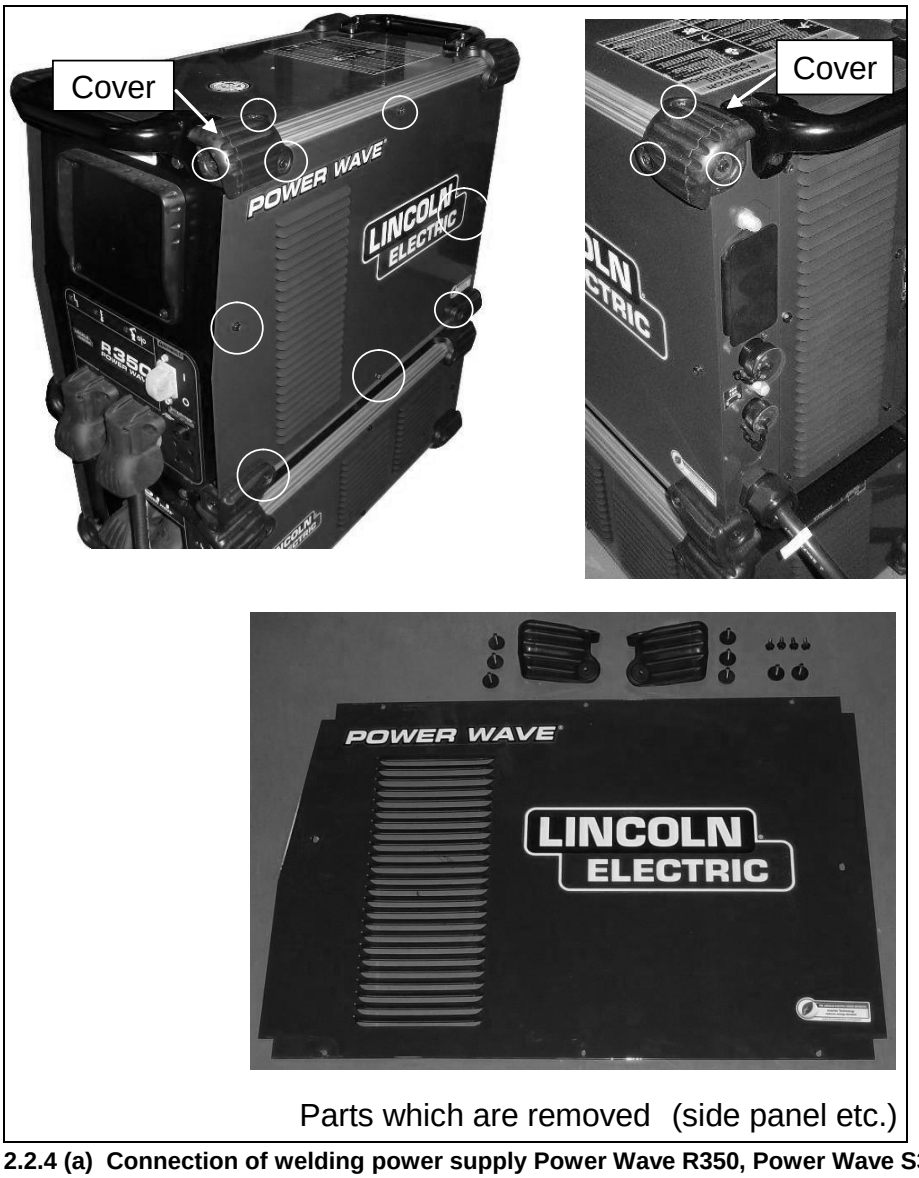


Fig. 2.2.4 (a) Connection of welding power supply Power Wave R350, Power Wave S350

2 Connect primary power supply cable and put side panel back. (It is similar when Expansion module is specified.)

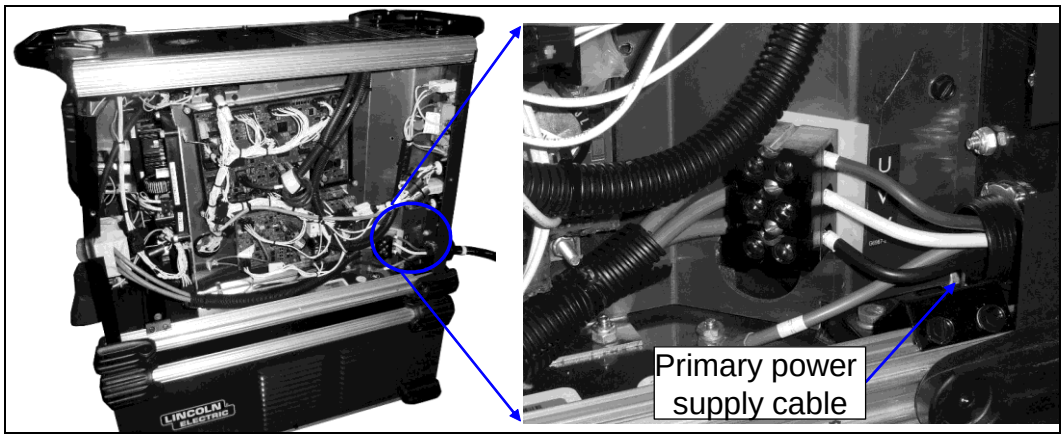


Fig. 2.2.4 (b) Connection of welding power supply Power Wave R350, Power Wave S350

Power Wave R500

1 Remove the lower left of the side panel. (It is similar when Expansion module is specified.)
2 Connect the primary power supply cable, attach the side panel to the original position. (It is similar when Expansion module is specified.)

Fig. 2.2.4 (c) Connection of welding power supply Power Wave R500

Power Wave i400
Power Wave 455M/STT

Refer to Chapter 12.

2.2.5 Connection of Welding Power Supply and Robot

Power Wave R350, Power Wave S350, Power Wave R500

1. Connect welding power cable (+), (-) , wire feeder control cable and communication cable to welding power supply referring to Fig. 2.2.5 (a) to (d). When cover is attached, remove it and perform procedure below.

Fig. 2.2.5 (a) Connection of welding power supply Power Wave R350, Power Wave S350 (1/2)

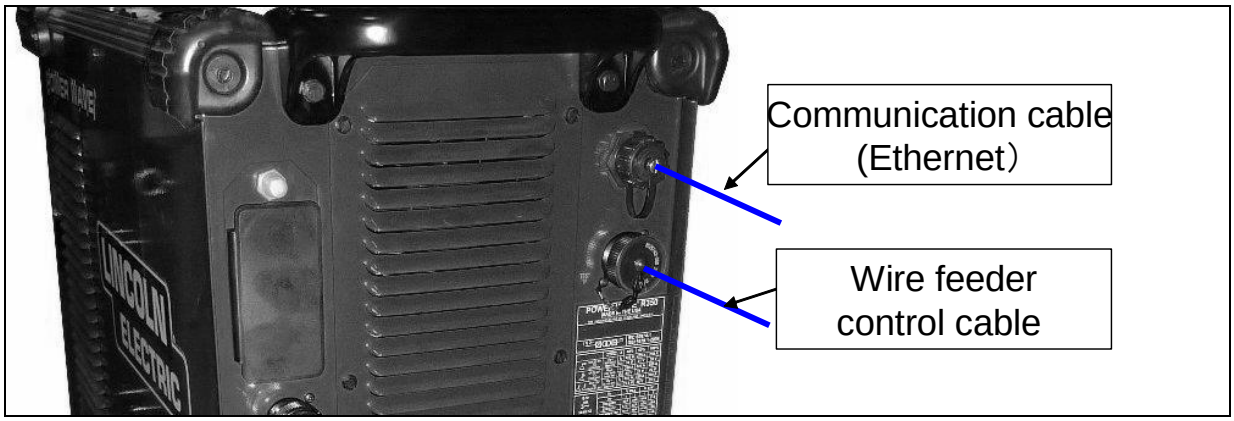


Fig. 2.2.5 (b) Connection of welding power supply Power Wave R350, Power Wave S350 (2/2)

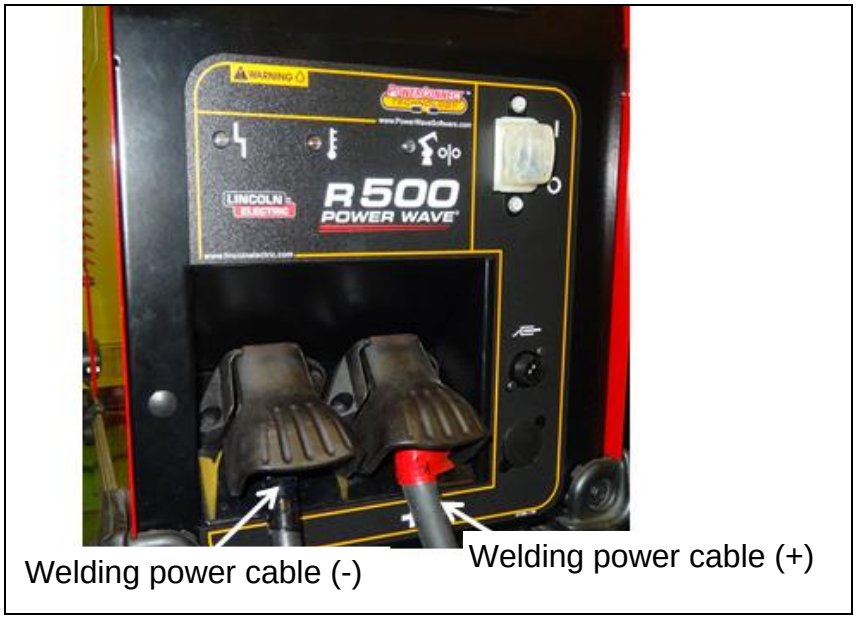


Fig. 2.2.5 (c) Connection of welding power supply Power Wave R500 (1/2)

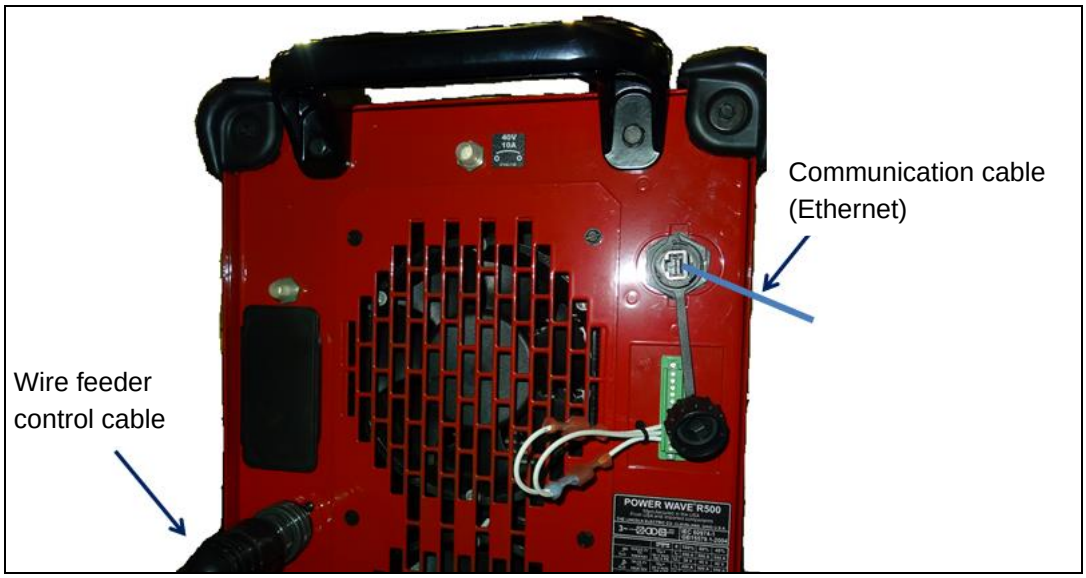


Fig. 2.2.5 (d) Connection of welding power supply Power Wave R500 (2/2)

Power Wave i400
Power Wave 455M/STT

Refer to Chapter 12.

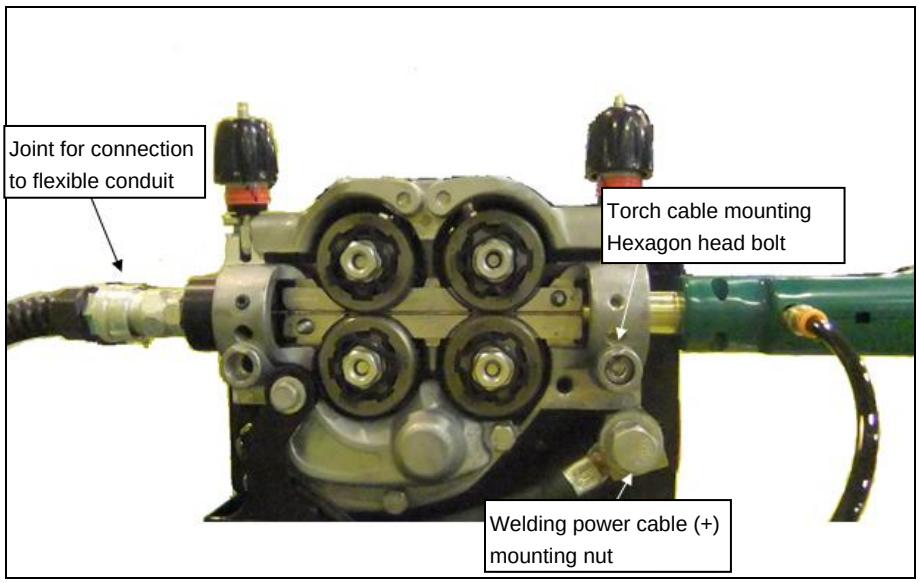


Fig. 2.2.5 (e) Connection to wire feeder

Connection of torch cable

Connect torch cable to wire feeder and tighten hexagon hole bolt with hexagon wrench of Fig. 2.2.5 (e) which is appendix of wire feeder.

Connection of flexible conduit

Connect flexible conduit to wire feeder using joint part of Fig. 2.2.5 (e) .

Connection of welding power cable

Tighten the nut of Fig. 2.2.5 (e) and fix welding power cable.

2.2.6 Piping of Robot

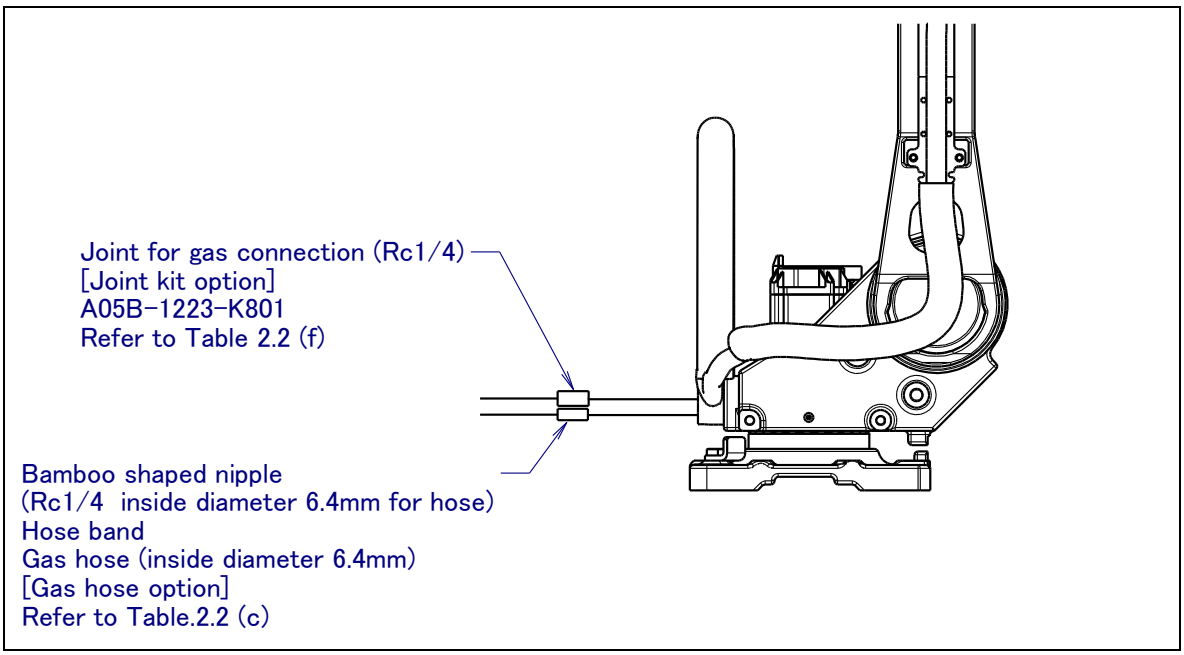
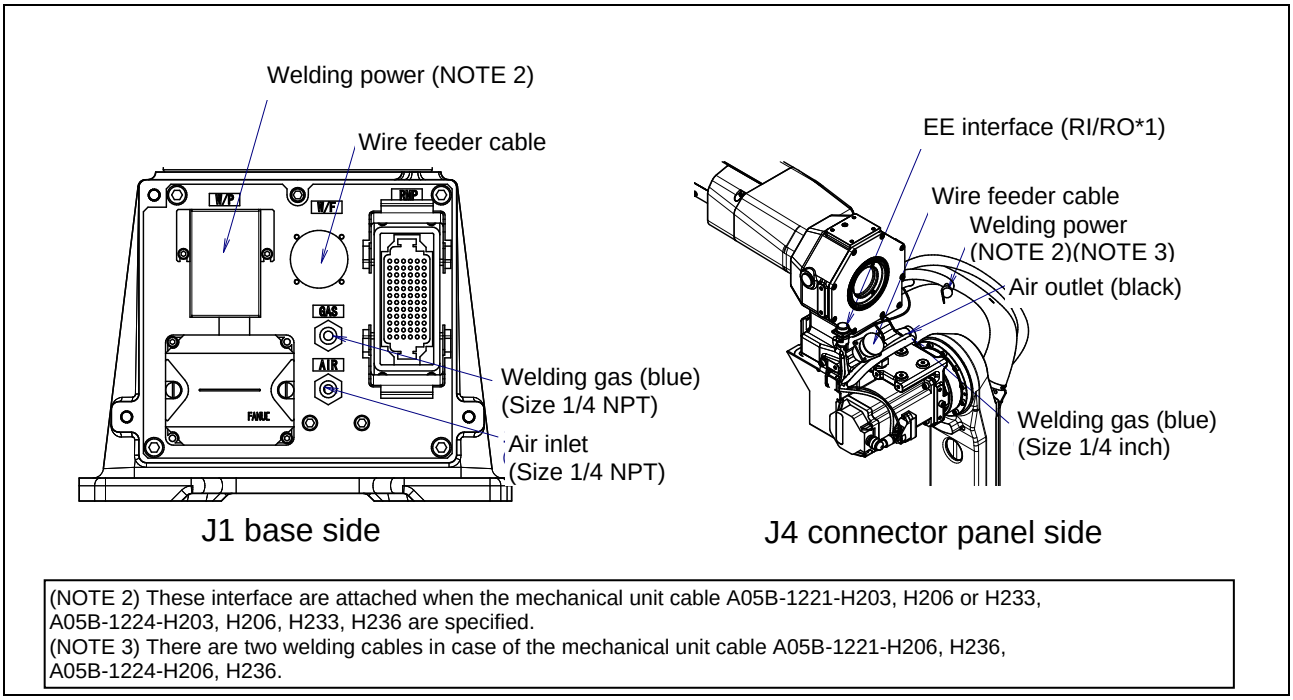


Fig. 2.2.6 (a) Piping of robot (ARC Mate 0*i*B)

Gas hose is blue. Air hose is black.
(*) Form the cable so that welding power cable does not touch metal plate etc.



(NOTE 2) These interface are attached when the mechanical unit cable A05B-1221-H203, H206 or H233, A05B-1224-H203, H206, H233, H236 are specified.
(NOTE 3) There are two welding cables in case of the mechanical unit cable A05B-1221-H206, H236, A05B-1224-H206, H236.

Fig. 2.2.6 (b) Connection interface of ARC Mate 100*i*C, ARC Mate 100*i*C/6L/7L/12

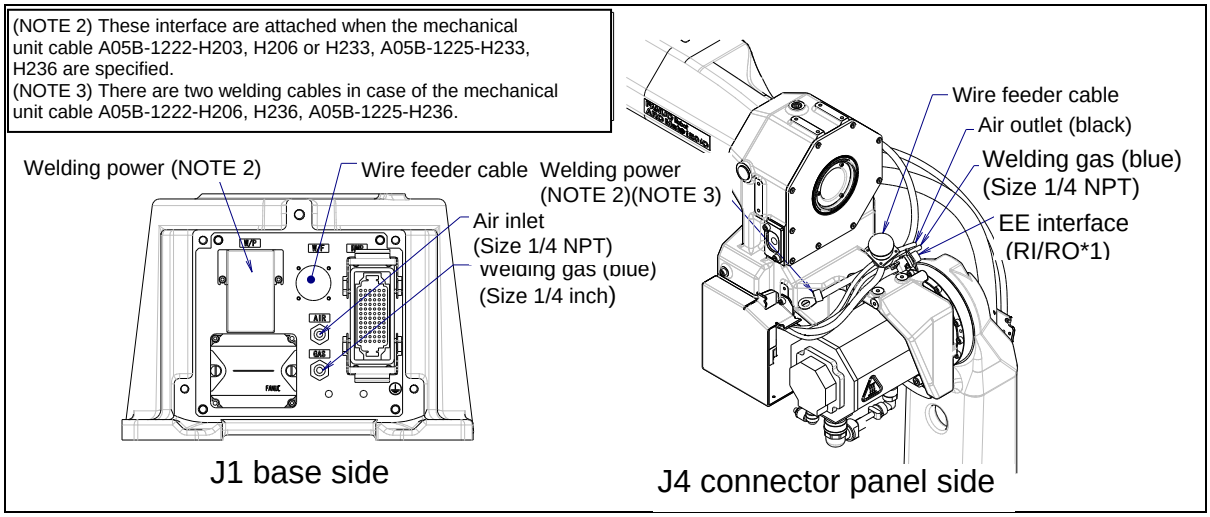


Fig. 2.2.6 (c) Connection interface of ARC Mate 120*i*C, ARC Mate 120*i*C/10L/12L

NOTE
Rated current of welding cable of A05B-1221-H203,H233,A05B-1222-H203,H233,A05B-1224-H203,H233,A05B-1225-H233 is 190A. (Ambient temperature: 40°C)
Rated current of welding cable of A05B-1221-H206,H236 and A05B-1221-H206,H236,A05B-1222-H206,H236,A05B-1225-H236A is 300A. (Ambient temperature: 40°C)
Form the cable so that welding power cable does not touch metal plate etc.

2.3 TURNING ON THE POWER

When connection is completed, turn on the robot controller and welding power supply. Dozens of seconds later, communication connection between robot controller and welding power supply is completed, and it becomes possible to perform the operation of welding power supply from robot controller.
Turn them on according to Procedure 2-3.

Air outlet (black)

Procedure 2-3 Turning on the power

Step

1 Before turning on the power, Check working area such as robot, controller and processing cells. Confirm that the all safety devices work correctly, and working area for worker is safe.
2 Turn on the robot controller.

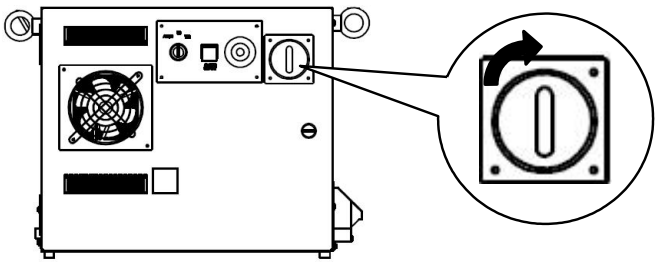


Fig. 2.3 (a) Turning on the robot controller

3 Turn on the welding power supply.

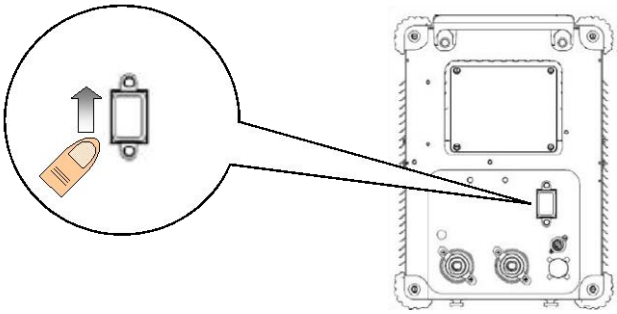


Fig. 2.3 (b) Turning on the welding power supply

4 Normally, “ARC-051 Weld EQ1 ONLINE: ArcLink“ will be displayed on upper part of the screen of the teach pendant when approximately 40 seconds pass after completion of turning on the welding power supply.

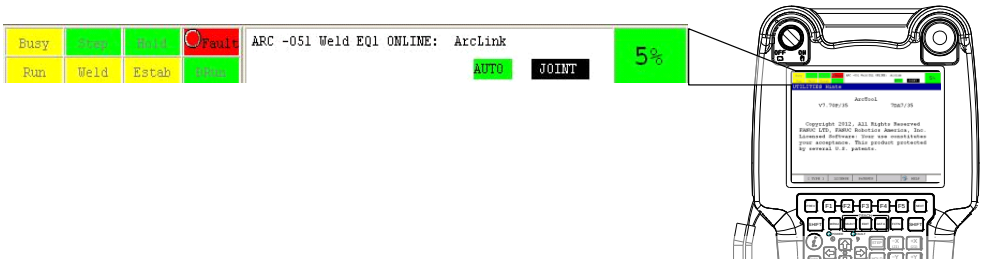


Fig. 2.3 (c) Indication of the connection completion of welding power supply and robot controller

5 If “ARC-051“ is not displayed on upper part of the screen of the teach pendant, and “ARC-045 Weld EQ Device is OFFLINE” will be displayed, confirm whether connection does not have problems referring to Chapter 6 “TROUBLESHOOTING”.

> ⚠ **WARNING**
> Please cancel turning on power when you found some kind of abnormality or potential danger element. It might cause a serious accident when turning on the power by insufficient check.

2.4 MOVING THE ROBOT MANUALLY (JOGGING)

Jogging is an operation to move the robot to an arbitrary position by manipulating keys on the teach pendant. During program teaching, the positions of the robot are recorded by actually moving the robot.

> **NOTE**
> This chapter explains minimum jogging operation to move a robot.
> Please refer to Subsection 5.2.3 of OPERATOR’S MANUAL (Basic Operation) (B-83284EN) for more details of jogging operation.

Procedure 2-4 Jogging

Step

1 If robot controller has 3 mode switch, insert key and change switch to T1 mode.
Turn on the teach pendant switch.

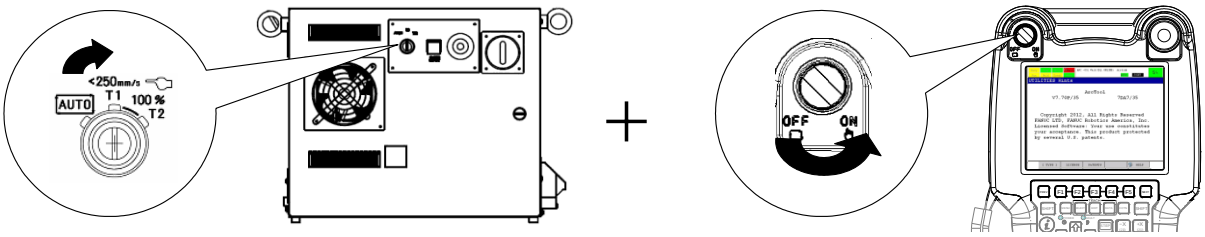


Fig. 2.4 (a) Setting of 3 mode switch and teach pendant switch

2 Decide the kind of the jogging. Kind of jobs are shown in Fig. 2.4 (b). Change jogging variation by pressing manual-feed coordinate system key on teach pendant. You can confirm the present jogging by screen of Fig. 2.4 (c).

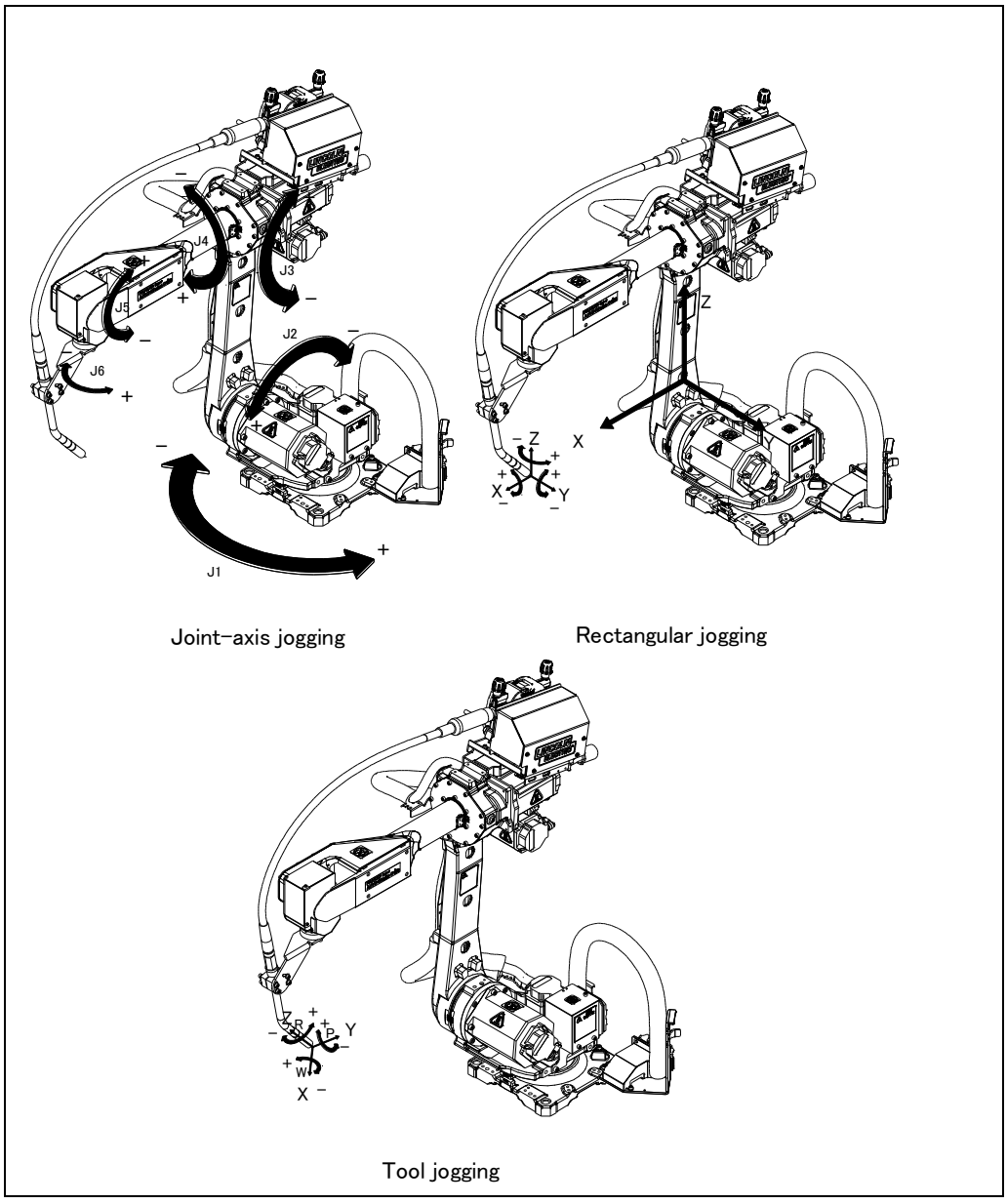


Fig. 2.4 (b) The kind of jogging

Table 2.4 (a) Jog modes (manual feed coordinate system)

Jog modes	Description
Joint jog	Directs the robot axes (joint axes) by manipulating corresponding keys on the teach pendant.
Cartesian jog	Moves the robot rectilinearly along the axes of a Cartesian coordinate system (jogging coordinate system or user coordinate system). Rotation can also be performed to change the tool posture. **The jogging coordinate system** is a Cartesian coordinate system set specifically for jogging. **The user coordinate system** is a Cartesian coordinate system set in the work space.
Tool jog	Moves the robot rectilinearly along the axes of the current tool coordinate system. Rotation can also be performed to change the tool posture. The tool coordinate system is a Cartesian coordinate system set to match the orientation of the tool.

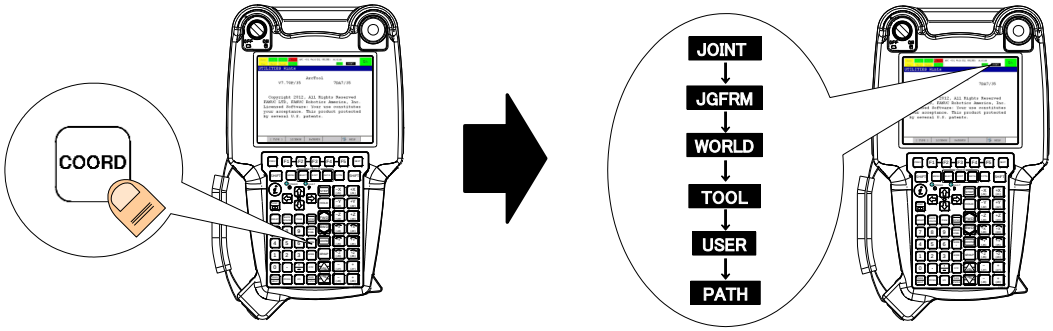


Fig.2.4 (c) Change of jogging variation by manual-feed coordinate system key

3 Press override key on teach pendant, and decide robot motion speed.
The amount of change of the value becomes large by pressing the [SHIFT] key and override key together. Please refer to Table 2.4 (b) for details.

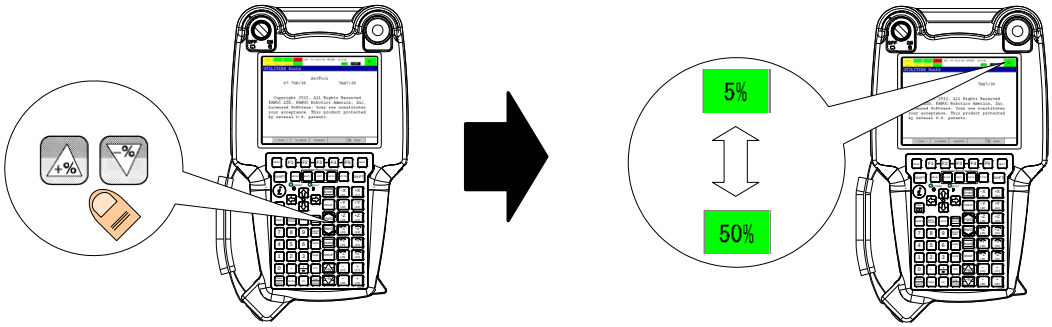


Fig.2.4 (d) Operation of override key

Table 2.4 (b) The change of the value when override key is pressed

Override key	VFINE → FINE → 1% → 5% → 100% Steps of 1% Steps of 5%
Shift ＋ Override key	VFINE → FINE → 5% → 25% → 50% → 100%

4 Grasp the teach pendant and press deadman switch. Afterward, keep the deadman switch on while performing a jogging. When an alarm occurs, press [RESET] key and release the alarm.

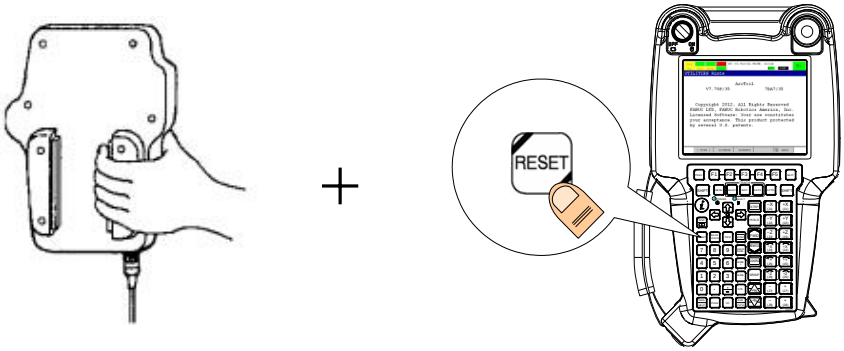


Fig. 2.4 (e) Operation of deadman switch and alarm release key

5 Execute a jogging. When the [SHIFT] key and jog key are pressed, the robot moves to the direction decided by jog mode and jog key.

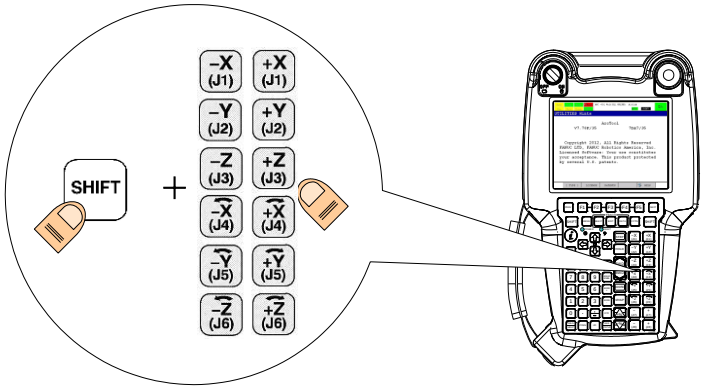


Fig. 2.4 (f) Operation of jog key

> ⚠ **WARNING**
> At the beginning of operation, please set the value of the override in low speed (10% around). If the robot speed is fast, you cannot deal with an emergency. In addition, please confirm that no person is in the work area when you start to move a robot.

2.5 CREATING WELD PROCEDURES

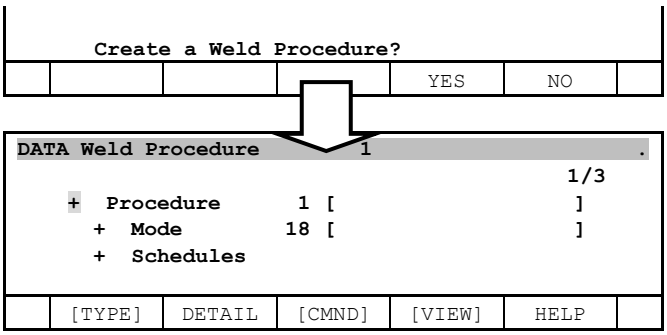
Arc welding robot manages weld setups (weld schedules, etc.) by the data units called “Weld Procedures”. On the other hand, multiple of appropriate weld control methods for the combination of wire material, wire diameter, Gas type and pulse weld are registered as “Process Mode”, and users can perform the welding with appropriate weld control method each time by selecting “Process Mode” number.
At least one Weld Procedure is necessary for performing wire inching and for specifying arc weld schedule explained later. This section explains the creating process of Weld Procedure and the allocation process between Process Mode and Weld Procedure easily.

NOTE
This section only explains the basic operation (creating new Weld Procedure) for performing arc welding. About details of Weld Procedures (the method for preparing multiple Weld Procedures, the general method for assigning Process Mode, etc.), please refer to Section 3.3, “OPERATION OF WELD PROCEDURE AND PROCESS MODE”.

Procedure 2-5 Creating Weld Procedure

Step

1 Press the [DATA] key and display DATA Weld Procedure screen. When there is no Weld Procedure, the message “Create a Weld Procedure?” will be displayed on the lower position of the screen. Press F4 “YES” and create a new Weld Procedure. Then, Weld Procedure DATA screen will be displayed.



2 Next, move the cursor on the line of Mode number, and specify a Process Mode number. A process for welding is decided by this Process Mode number. In this example, no-pulse welding is performed. Search the Process Mode number from Table 2.5 according to the used wire material, wire diameter and gas type. Then, input the number (in this example, “20”) by numerical keys on Teach Pendant, and press ENTER key. Specified Process Mode number is applied to Weld Procedure.

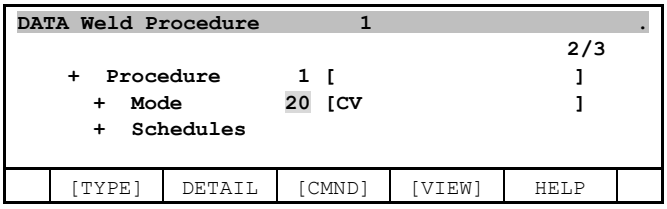


Table 2.5 (a) Main Process Modes

Wire Material	Wire Diameter	Gas Type	Process Mode Number
Steel	1.2mm	CO2	20
Steel	1.2mm	MAG	21
Steel	1.0mm	CO2	10
Steel	1.0mm	MAG	11

NOTE
If there is no appropriate type on the table, perform Process Mode Search referring to Procedure 4-3-2 “Assignment of process mode number by searching“, or search Process Mode number from the table on Chapter 9 “Process Mode” and perform Procedure 4-3-1 “Assignment of process mode number by direct input”.

2.6 WIRE INCHING

It is possible to perform wire inching/retract by key operations on Teach Pendant. By this operation, you can pass a wire through a conduit or can adjust wire stickout. Please refer to the following Procedure 2-6.

Procedure 2-6 Manual Wire Inching

Step

1 Press the [WIRE+] key on Teach Pendant. Wire is fed while pressing the key.

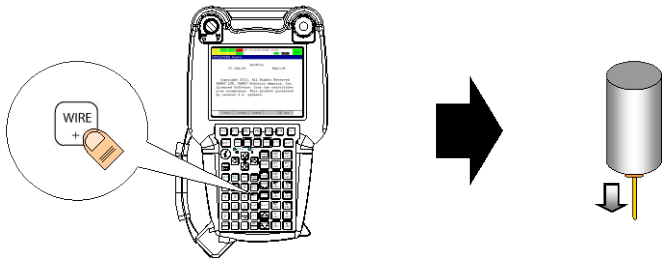


Fig. 2.6 (a) Wire Inching

2 Press the [WIRE-] key on Teach Pendant. Wire is retracted while pressing the key.

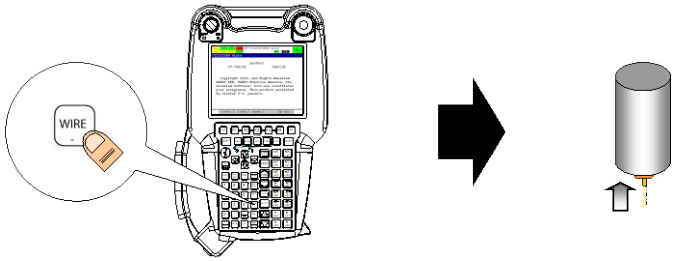


Fig. 2.6 (b) Wire Retract

3 Press the [WIRE+] key while pressing the [SHIFT] key on Teach Pendant. Wire is fed with low speed for 2 seconds since pressing the [WIRE+] key. After 2 seconds since pressing the [WIRE+] key, wire feed speed becomes high.

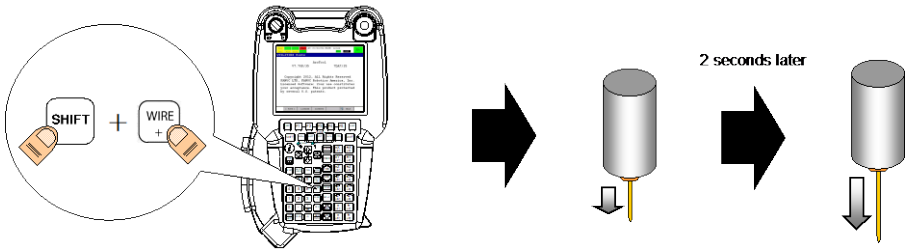


Fig. 2.6 (c) High Speed Wire Inching

⚠ CAUTION
1 When Lincoln weld power supply is connected, wire inching is not available if available Process Mode is not assigned to Weld Procedure. Please perform wire inching after assigning available Process Mode.
2 Do not perform wire inching when wire is stuck to the tip, or when wire is clogged up.

2.7 CREATING MOTION PROGRAM

Next, create a program for arc welding. As an easier arc welding program, the creating procedure of a sample program of arc welding for a lap joint like the following is explained. In this section, the creation of robot motion part of the program is explained. Move the robot manually referring Section 2.4, and save 5 positions of the right figure of Fig. 2.7 (a) to the motion program. Please refer to Procedure 2-7.

```
ARC_WELD                                    7/7
  1:J  P[1] 10% CNT100          Move to reference position
  2:L  P[2] 100mm/sec CNT100    Move to approach position
  3:L  P[3] 100mm/sec FINE      Move to Weld Start position
  4:L  P[4] 60cm/min FINE       Move to Weld End position
  5:L  P[5] 100mm/sec CNT100    Move to escape position
  6:J  P[1] 10% FINE            Return to reference position
[End]
```

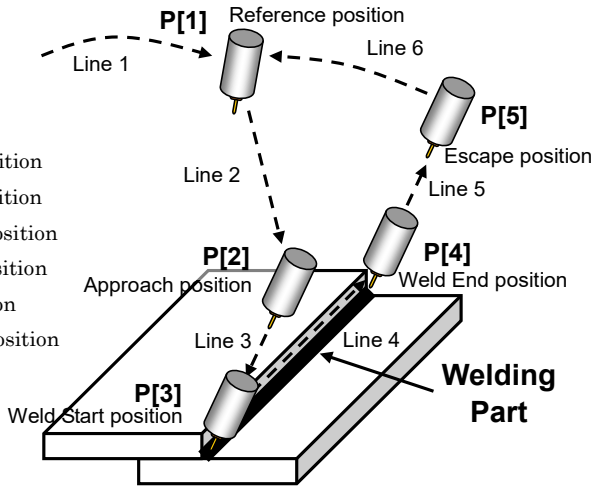


Fig. 2.7 (a) Sample Program

NOTE
This section explains the basic operation for creating sample program. If you would like to know more details about program edit, please refer to Section 3.2 “EDITING OPERATION OF PROGRAM”.

Procedure 2-7 Creating Motion Program

Step

1 Set a workpiece for arc welding on the place electrified to the weld power cable (-). In this timing, Please fix the workpiece tightly to prevent a gap during the program creation.
2 Adjust the wire stickout by wire inching operation. Recommended stickout is “12mm” for 1.0mm wire diameter, or “15mm” for 1.2mm wire diameter.

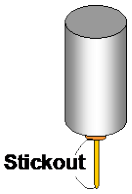
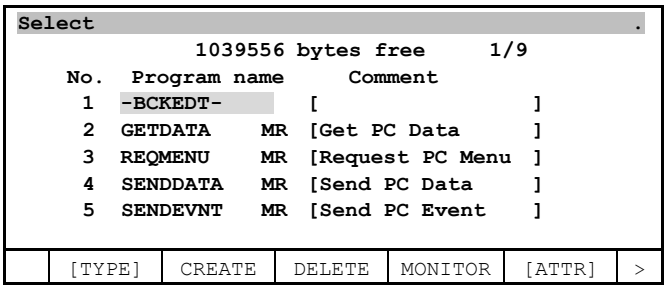
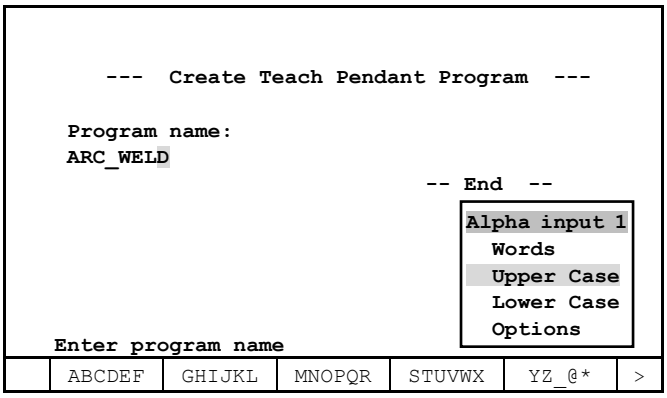


Fig. 2.7 (b) Adjustment of Wire Stickout

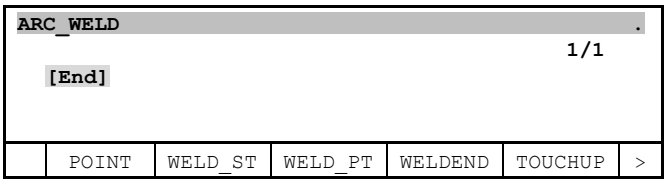
3 Press the [MENU] key on a teach pendant. Following Program List screen will be displayed.



4 Press F2[CREATE] key. A screen for entering program name will be displayed. Additionally, a list of [Alpha input 1] will be displayed at the lower left. In this operation example, define the sample program name as “ARC_WELD”. Move the cursor on “Upper Case” and enter the program name by using F1-F5 function keys.

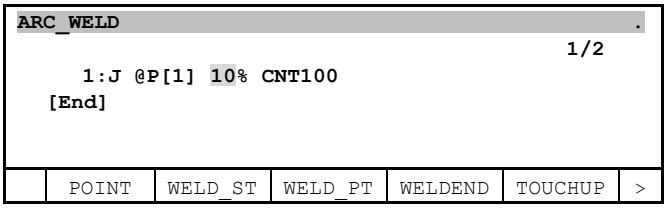


5 After finishing the input of program name, press the [ENTER] key. After that, press F3[EDIT] and complete the input of program name. The screen will be automatically moved to Program Edit screen.



6 Move the robot on the reference position by jogging. Any places are allowed if there is no obstacle between this position and Weld Start position.

7 Teach a motion instruction for moving to the reference position. Press F1[POINT] when the cursor is placed on [End]. Select “2 J P[] 100% CNT100” from a displayed list. Next, move the cursor on a value “100” in 100%, and then enter “10” by numerical keys, and press the [ENTER] key.



8 Jog the robot to an appropriate posture for welding, and then jog the robot to the position that is diagonally upper 100mm away from Weld Start position (approach position).

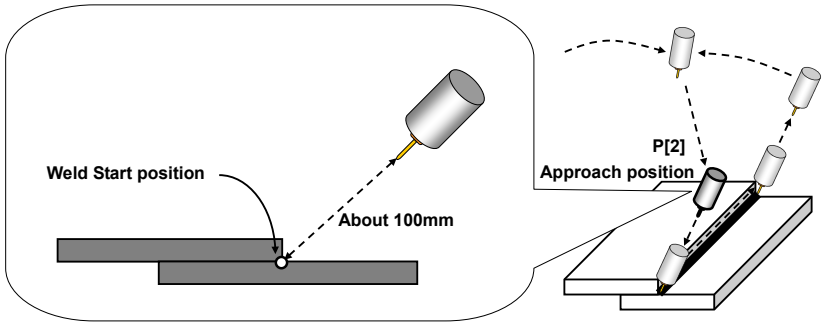
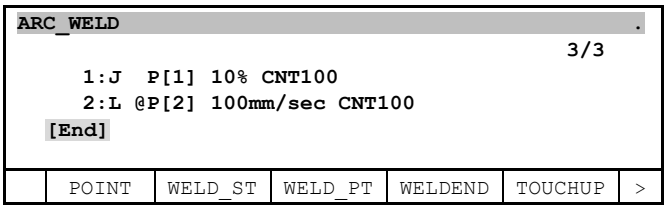


Fig. 2.7 (c) Jog to Approach Position

9 Teach a motion instruction for moving to the approach position. Press F1[POINT] when the cursor is placed on [End]. Select "4 L P[] 100mm/sec CNT100" from a displayed list.



10 Jog the robot to Weld Start position.

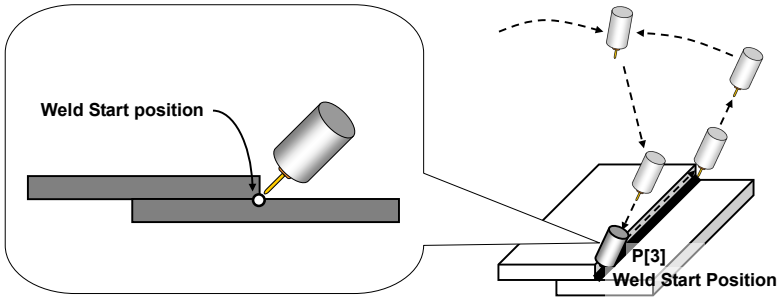
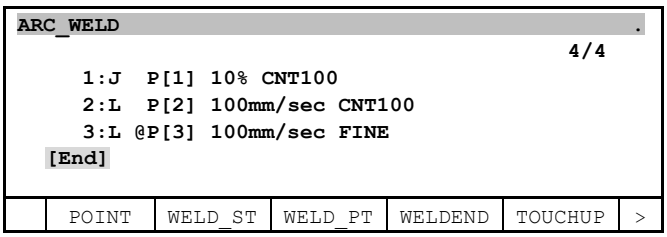


Fig. 2.7 (d) Jog to Weld Start Position

11 Teach a motion instruction for moving to Weld Start position. Press F1[POINT] when the cursor is placed on [End]. Select "3 L P[] 100mm/sec FINE" from a displayed list.



12 Jog the robot to Weld End position.

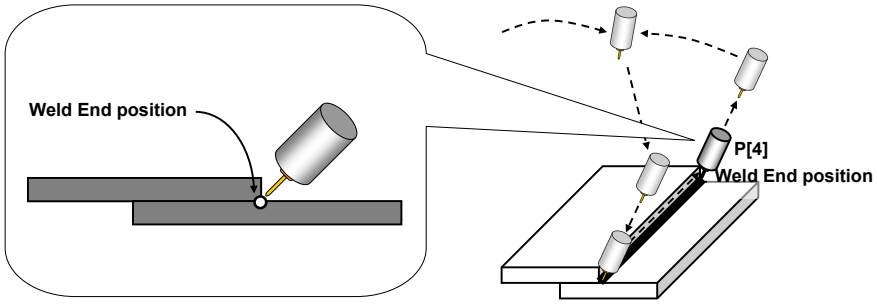
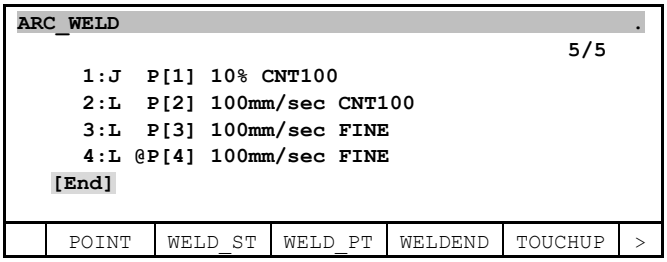
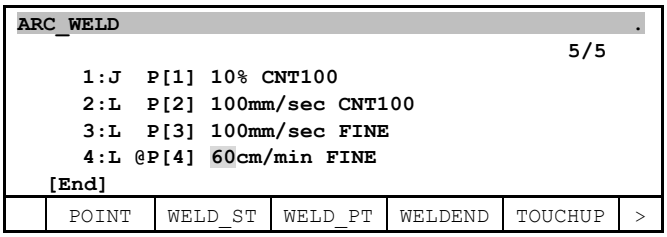


Fig. 2.7 (e) Jog to Weld End Position

13 Teach a motion instruction for moving to Weld End position. Press F1[POINT] when the cursor is placed on [End]. Select "3 L P[] 100mm/sec FINE" from a displayed list.



14 Next, input weld speed. The motion speed on the motion instruction for moving from Weld Start position to Weld End position becomes weld speed. Move the cursor on "100" value and press F4[CHOICE] key. Select "cm/min" from the displayed list. Then, enter "60" by numerical keys.



15 Jog the robot to the position that is diagonally upper 100mm away from Weld End position (escape position).

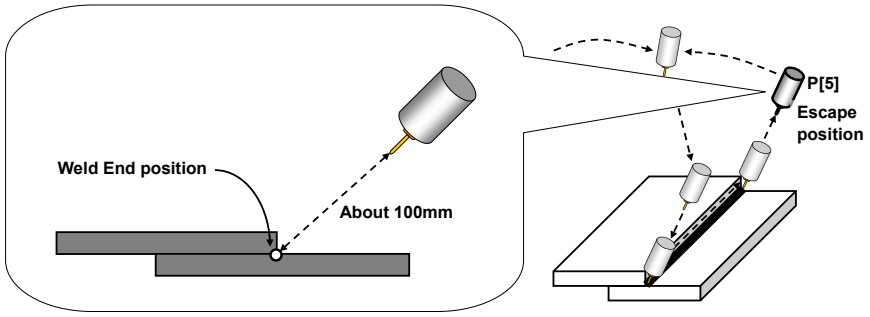
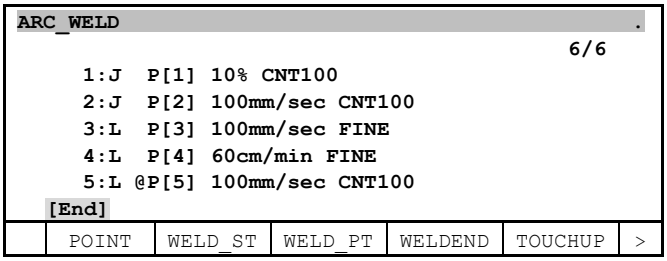
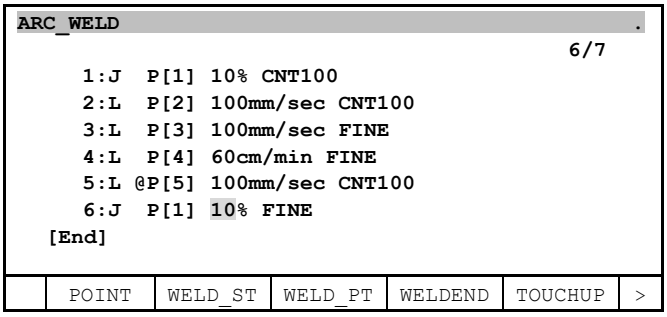


Fig. 2.7 (f) Jog to Escape Position

16 Teach a motion instruction for moving to the escape position. Press F1[POINT] when the cursor is placed on [End]. Select “4 L P[] 100mm/sec CNT100” from a displayed list.



17 Teach a motion instruction for returning to the reference position. Press F1[POINT] when the cursor is placed on [End]. Select “1 J P[] 100% FINE” from a displayed list. Next, move the cursor on a value “6” in P[6] and input “1” by numerical key, and press ENTER key. Move the cursor on a value “100” in 100% and input “10” by numerical keys, and then press ENTER key.



NOTE

This section explains one operation example for creating easy sample program. However, you can create a sample program even if you do not follow the operation in this section. About details of program edit, please refer to Section 5.4 in OPERATOR’S MANUAL (Basic Operation) (B-83284EN).

2.8 SPECIFY ARC WELD SCHEDULE

It is impossible to achieve arc welding by only the motion program created on Section 2.7. For achieving arc welding, it is necessary to specify an arc weld schedule by using Weld Procedure created on Section 2.5, and also necessary to specify this schedule on Weld Start and Weld End instructions.
Arc welding robot performs arc welding on the section between Weld Start and Weld End instructions.

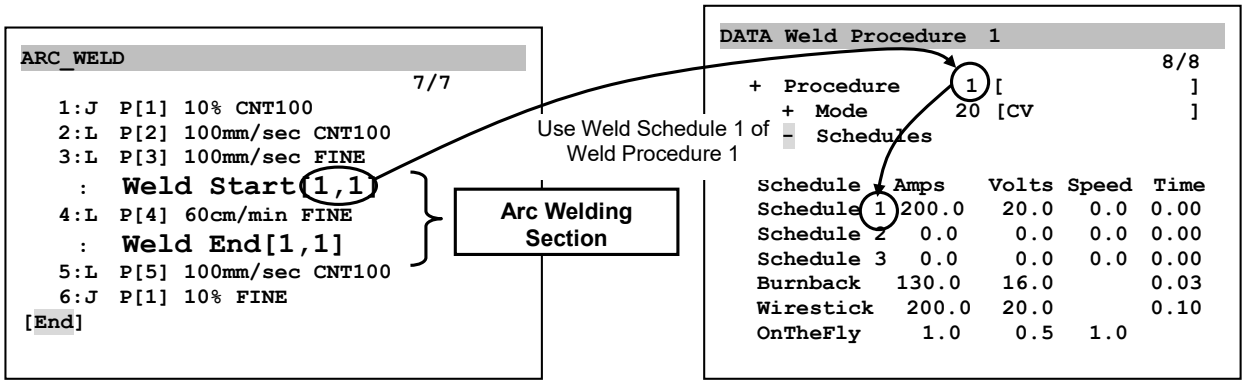


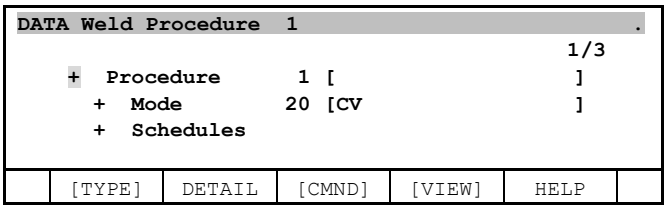
Fig. 2.8 (a) Relationship between Sample Program and Arc Weld Schedule

NOTE
This section explains the basic operation for operating arc weld instructions. If you would like to know more details about arc weld instructions, please refer to Section 3.5 “TEACHING AND EDITING OF ARC WELD INSTRUCTION”.

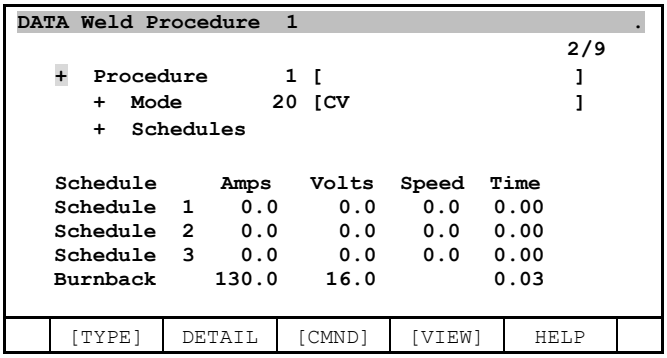
Procedure 2-8 Specify Arc Weld Schedule

Step

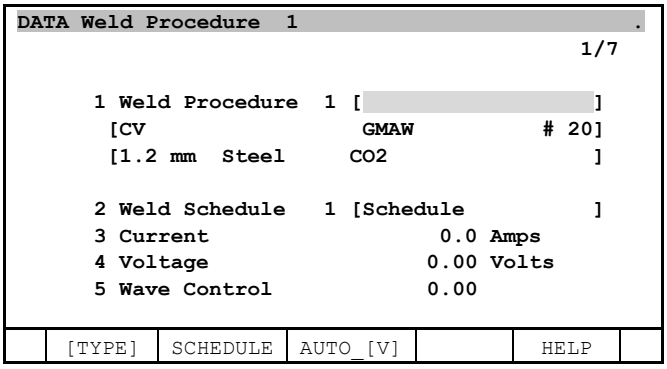
1 Press the [DATA] key and display Weld Procedures screen.



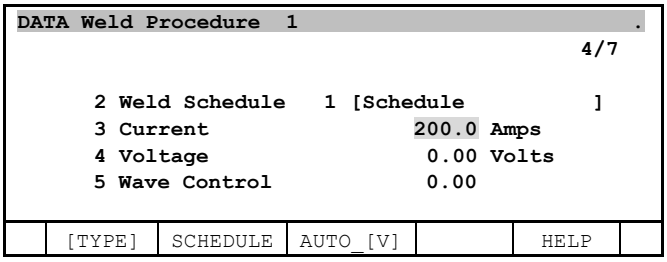
2 Move the cursor on “+” at the left of “Schedules” and press ENTER key. A list of weld schedules will be displayed.



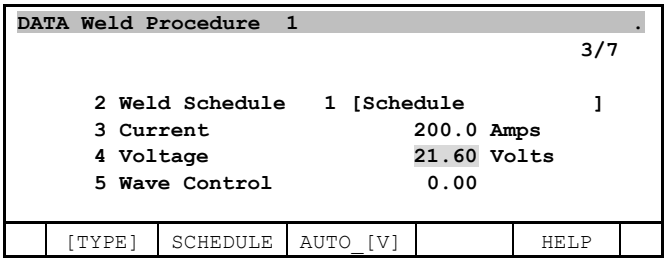
3 Move the cursor on unused weld schedule (in this example, Weld Schedule 1), and press F2[DETAIL]. Detail screen for the weld schedule will be displayed.



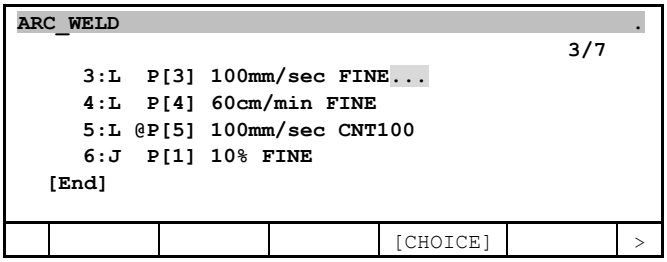
4 In this example, specify the current “200A” as the weld schedule. Move the cursor on the line of “Current” and input “200” by numerical keys, and then press the [ENTER] key.



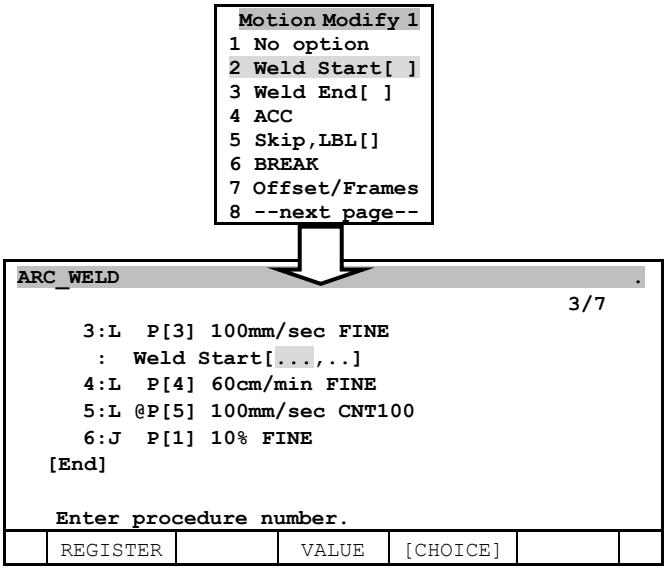
5 Next, input voltage. Move the cursor on the line of “Voltage” and press F3[AUTO_[V]]. Then, the message “Reset recommended voltage. Are you OK ?” will be displayed on the prompt line. When F4[YES] is pressed, recommended voltage for the preset current is automatically set. In this stage, the preparation of weld schedule was completed.



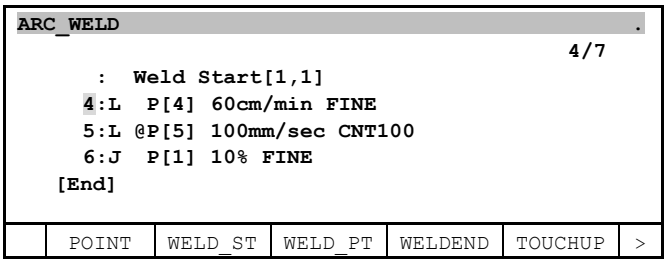
6 Display the edit screen of the motion program created on Procedure 2-7. Press the [EDIT] key, or press SELECT key and select the sample program name which was set by Step 4 in Procedure 2-7 (in this example, ARC_WELD). Then, move the cursor on a blank part just behind “FINE” on line 3.



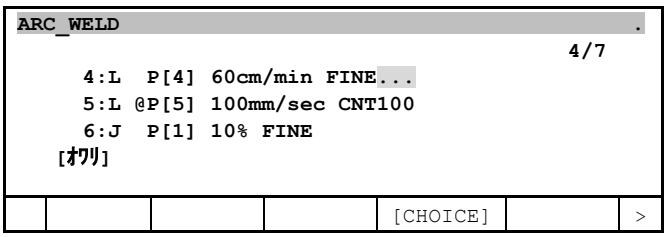
7 Press F4[CHOICE]. The list of additional motion instructions are displayed. Select “Weld Start[]” from the list. Weld Start instruction is taught at the last of line 3.



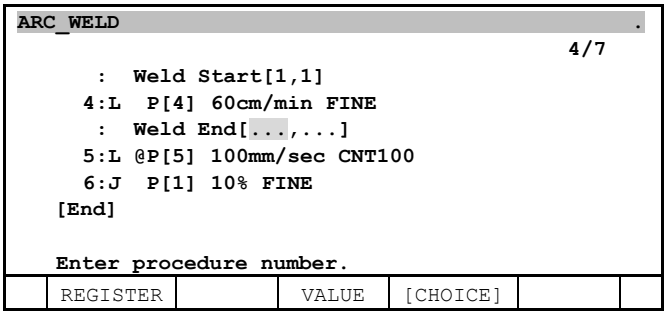
8 Input the Weld Procedure number (in this example, 1) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 4 (in this example, 1) to the second argument.



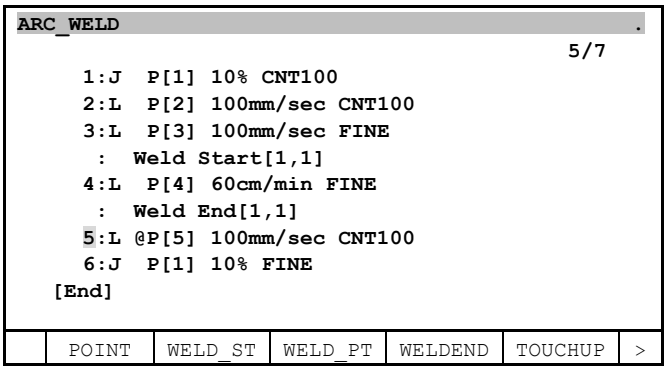
9 Next, move the cursor on a blank part just behind “FINE” on line 4.



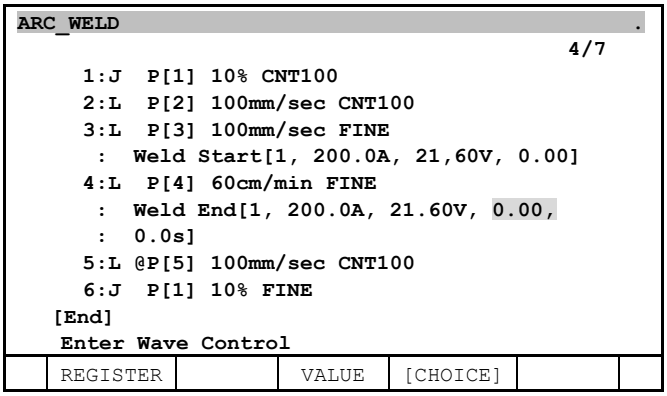
10 Press F4[CHOICE]. The list of additional motion instructions will be displayed. Select “Weld End[]” from the list. Weld End instruction is taught at the last of line 4.



11 Input the Weld Procedure number (in this example, 1) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 4 (in this example, 1) to the second argument. In this stage, sample program for arc welding was completed.



12 You can directly specify command voltage and current parameters for arc weld schedule in Weld Start/Weld End instructions on Program Edit screen. Move the cursor on the argument part in Weld Start instruction and press F3[DIRECT]. It becomes possible to input parameters like voltage and current to Weld Start instruction directly. In this example, same values with Step 5 and 6 are specified. Then, specify same values to Weld End instruction, too.



NOTE

The operation procedure in this section assumes the status just after factory shipment. If Weld Procedures or weld schedules have already been set, please perform the copy of Weld Procedure (refer to Section 4.3) or use unused weld schedule for preventing the change of existing setup.

2.9 MANUAL OPERATION FOR WELDING

As preparations for arc welding, following weld-related manual operations are required.

- Gas Check
- Switching Weld Enabled/Disabled

Gas Check

Open the valve for shield gas and check a gas pressure and a gas flow before performing arc welding.

Procedure 2-9 (a) Manual gas check

Step

1 Press the [GAS/STATUS] key once while pressing the [SHIFT] key on Teach Pendant. Gas is left out from the top of the torch. 5 seconds have passed, the gas flow stops automatically.

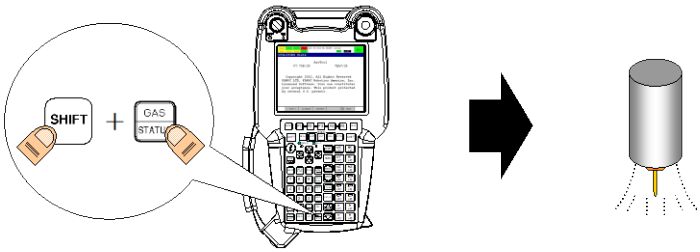


Fig. 2.9 (a) Gas Check by Gas Purge Key Operation

2 During the gas flow, you can also stop the gas flow manually by pressing the [GAS/STATUS] and the [SHIFT] key simultaneously again before passing Gas Purge Time.

3 If you would like to change the gas purge time from 5 seconds, please perform the following steps. Press the [MENU] key and select “6 SETUP”. Then, press F1[TYPE] and select “Weld System”. Weld System Setup screen will be displayed.

```
SETUP Weld System                                    .
                                                1/19
        NAME                          VALUE
   Monitoring Functions
     1 Arc loss:                      ENABLED
     2 Gas shortage:                  DISABLED
     3 Wire shortage:                 DISABLED
     4 Wire stick:                    ENABLED
     5 Power supply failure:          ENABLED

 |  [TYPE]  |  |  | ENABLED | DISABLED |  |
```

4 Move the cursor below on the screen, and move the cursor on “Gas Purge Time”. Then, input appropriate time by numerical keys and press the [ENTER] key.

```
SETUP Weld System                                    .
                                                19/19
    15 Weld from teach pendant: ENABLED
    16 Remote gas purge:        DISABLED
    17 Remote wire inch:        DISABLED
    18 Gas purge key:           ENABLED.
    19 Gas purge time:          20   sec

 |  [TYPE]  |  |  | ENABLED | DISABLED |  |
```

Switching Weld Enabled/Disabled

Arc welding can be performed with Weld Enabled status when arc weld instruction is executed. On the other hand, arc welding is never performed with Weld Disabled status even when arc weld instruction is executed. Switching operation of Weld Enabled/Disabled is achieved by the following procedure.

Procedure 2-9 (b) Switching Weld Enabled/Disabled

Step

1 Press the [WELD ENBL] key while pressing [SHIFT] key on Teach Pendant. “Weld” software LED on Teach Pendant is switched to yellow and green alternately.

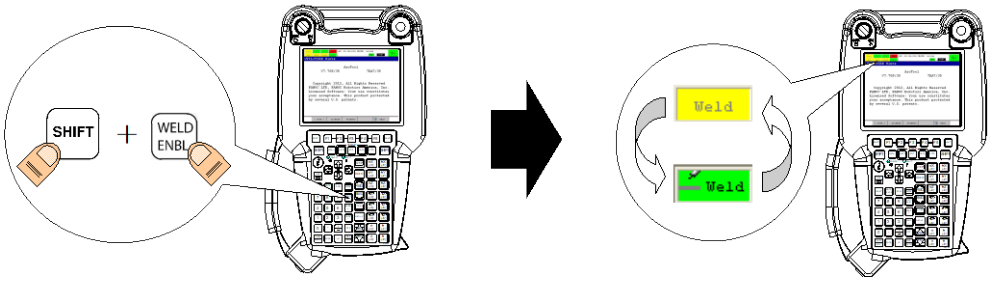


Fig. 2.9 (b) Switching Operation of Weld Enabled/Disabled by WELD ENBL Key

2 When “Weld” software LED is yellow, arc welding is not performed even if arc weld instruction is executed. When “Weld” software LED is green, arc welding is performed if arc weld instruction is executed.

2.10 TEST OPERATION

Before performing arc welding, test operation is required for the motion check of created program. Test operation has step operation and continuous operation. Normally, step operation is performed first, and then continuous operation is performed next.

Procedure 2-10 (a) Step Operation

Step

1 Grasp Teach Pendant, press dead man switch and turn the Enable switch on Teach Pendant ON.

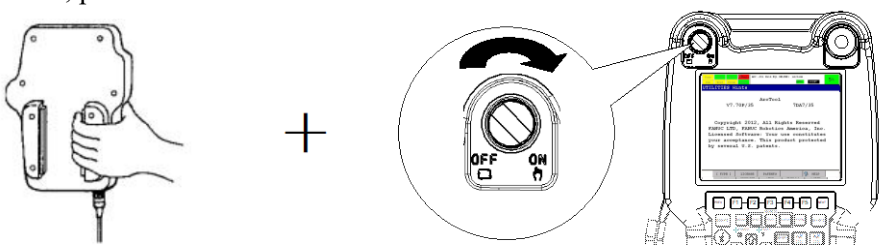


Fig. 2.10 (a) Operation of Dead Man Switch and Teach Pendant Enable Switch

2 Set the robot speed during program execution by override keys.

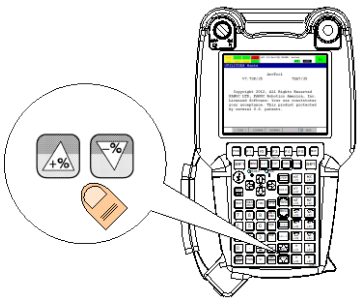
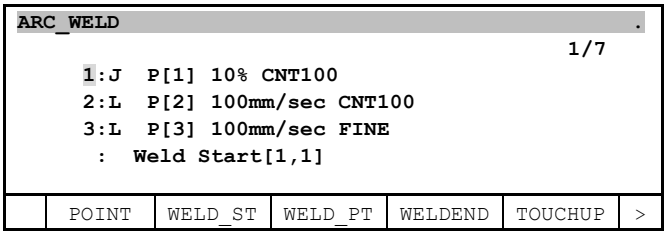


Fig. 2.10 (b) Setup of Override

> ⚠ **WARNING**
> Please set the value of the override in low speed (10% around). If the speed of the robot is fast, you cannot deal with an emergency.

3 Display the edit screen of the arc welding program created by Procedure 2-7. Press EDIT key, or press SELECT key and select the sample program name which was set by Step 4 in Procedure 2-7 (in this example, ARC_WELD). Then, move the cursor on the top of line 1.



4 Press STEP key and set “Step” software LED on Teach Pendant to yellow status.

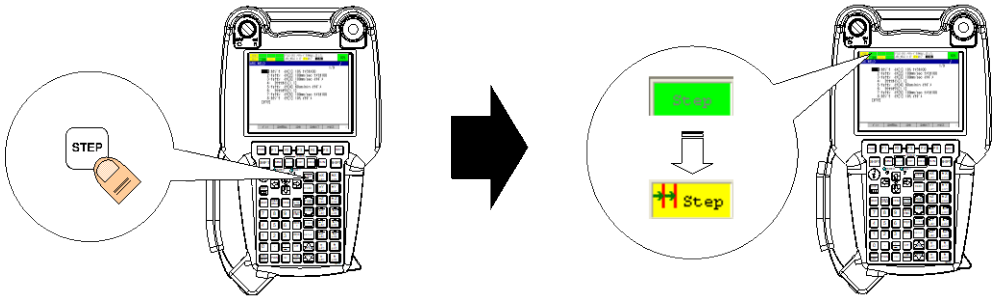


Fig. 2.10 (c) Switch to Step Mode

> ⚠ **WARNING**
> Program instructions will be executed and the robot will move by the next step. The robot may perform unexpected motion by program contents. Please check that there is no person in the working area and please check there is no needless equipment sufficiently. Additionally, during next or later steps, if you would like to pause the program before the program execution completes, please release the [SHIFT] key or dead man switch, or please press HOLD key or Emergency Stop button.

5 Start the program execution. Press the [FWD] key while pressing the [SHIFT] key. After the robot starts to move, release only FWD key, but keep the [SHIFT] key pressed. The robot stops after the robot arrives at the taught position of line 1. The cursor on Teach Pendant moves on the line 2 of the program.

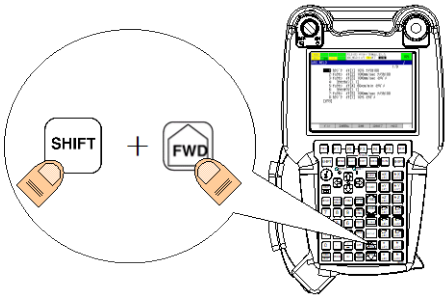


Fig. 2.10 (d) Step Operation of Program

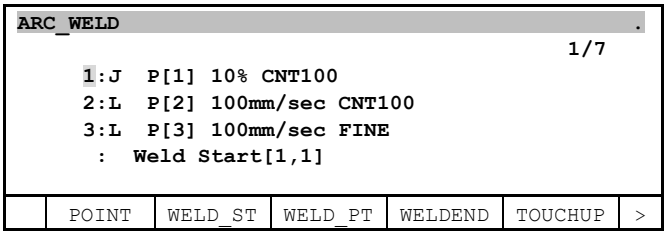
6 When FWD key is pressed while pressing the [SHIFT] key again, the execution of line 2 on the program is started. Please check the motion path of the robot by repeating the operation

NOTE
Arc weld instructions are never executed during Step Operation. Therefore, arc welding is not performed even with Weld Enabled status.

Procedure 2-10 (b) Continuous Operation

Step

1 Move the cursor on the top of line 1.



2 Set continuous operation mode. Press the [STEP] key and set “Step” software LED on Teach Pendant to green status.

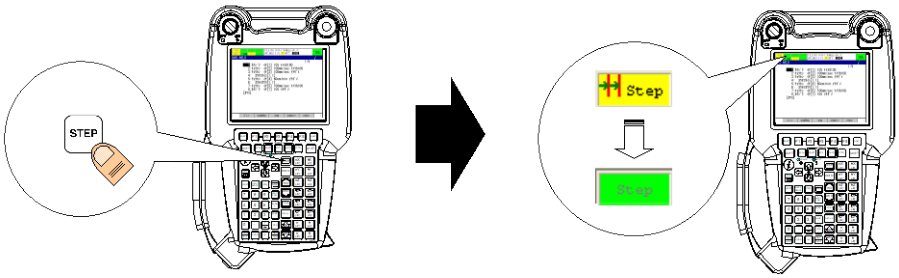


Fig. 2.10 (e) Switch to Continuous Operation Mode

3 Set Weld Disabled status. Press the [WELD ENBL] key and set “Weld” software LED on Teach Pendant to yellow status.

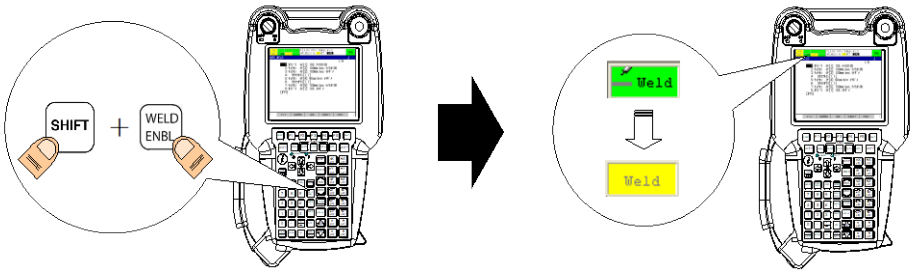


Fig. 2.10 (f) Switch to Weld Disabled

4 Set the robot speed during program execution by override keys.

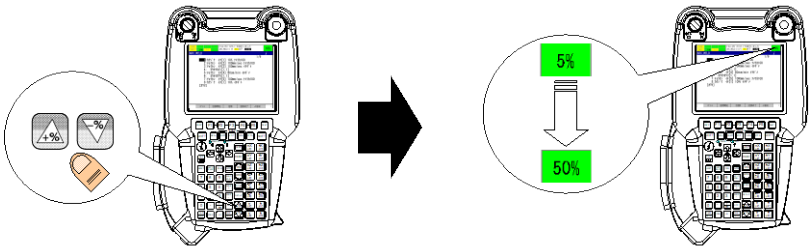


Fig. 2.10 (g) Setup of Override

5 Start the program execution. Press FWD key while pressing the [SHIFT] key. After the robot starts to move, release only [FWD] key, but keep the [SHIFT] key pressed. The program is continuously executed to the last line without stop. This is the different point between continuous operation and step operation.

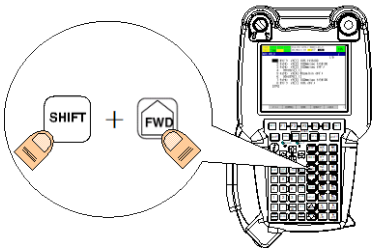


Fig. 2.10 (h) Continuous Execution of Program

2.11 EXECUTION OF WELD PROGRAM

For executing arc welding, the program must be executed with Weld Enabled status, 100% override and continuous operation. Please refer to the following Procedure 2-11.

Procedure 2-11 Execution of Weld Program

Step

1 Set Weld Enabled status. Press the [WELD ENBL] key and set “Weld” software LED on Teach Pendant to green status.

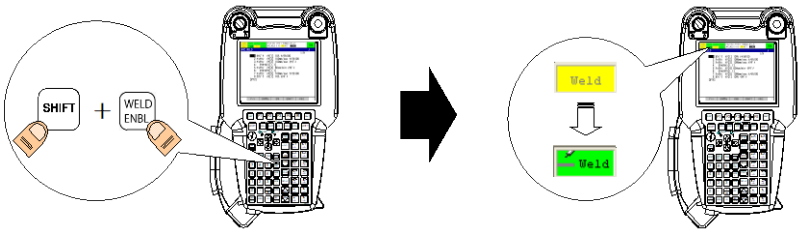


Fig. 2.11 (a) Switch to Weld Enabled

2 Set 100% override by override key.

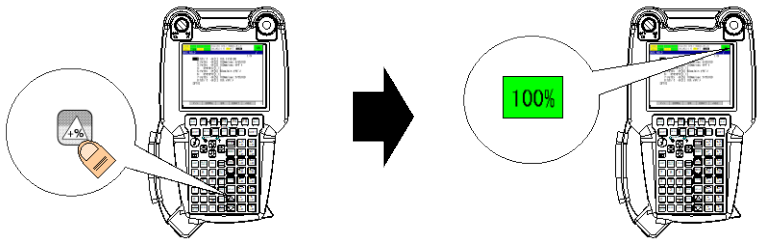


Fig. 2.11 (b) Set 100% Override

3 Move the cursor on the top of line 1 and then perform the program execution.

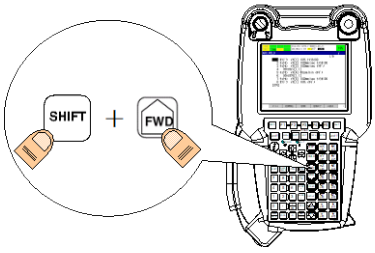


Fig. 2.11 (c) Continuous Operation of Weld Program

4 Arc welding is performed when the motion instruction that is put between Weld Start and Weld End instructions is executed.

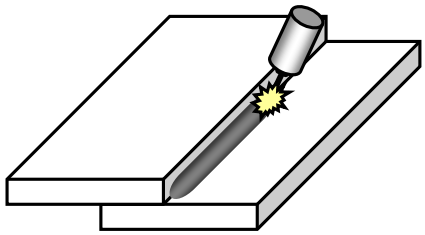


Fig. 2.11 (d) Execution of Arc Welding

NOTE

1 If Weld Start instruction is executed without 100% override, “ARC-033 Override must be 100% to weld” alarm is posted and the program pauses. In this case, please change override to 100% and then perform program execution again.
2 If arc is not generated at Weld Start position, “ARC-013 Arc Start failed” alarm is posted and the program pauses. Then, please investigate the cause of arc failure referring to Chapter 6 “TROUBLE SHOOTING”.

3 BASIC OPERATION

This Chapter describe about robot basic operation except contents which are already described in Chapter 2 “QUICK REFERENCE”.

3.1 SETTING OPERATION OF ArcLink I/O

Robot controller and LINCOLN welding power supply perform digital communication by special communication method called “ArcLink”.

The assignment of Arclink signals must be set correctly. When the assignment is incorrect, welding can not be executed correctly. Normally, no setting is required because the Arclink I/O is automatically set at the first communication between the robot controller and the welder.

Please take care not to assign the Arclink I/O incorrectly when the Arclink I/O assignment is changed. Also, please take care it when the Arclink I/O assignment is shifted after adding other communication board (DeviceNet board, CC-Link board etc.).
This section explains the procedure to confirm the correct assignment of Arclink I/O and the procedure to change the assignment of Arclink I/O.

3.1.1 Detail of ArcLink I/O

The state of each Arclink I/O signals can be confirmed in the Weld I/O screen. And the assignment range of Arclink I/O can be confirmed / modified on the Digital I/O screen because the Digital I/O signals are used for Arclink I/O.
Normally, the assignment range of Arclink I/O is automatically set. Though the Arclink I/O is assigned in the range of [21-36] in the Fig. 3.1.1 (b), the assignment range is changed corresponding to the configuration of the I/O hardware. As the result, the assignment range is different in every case.

List of Arclink signals

(MENU key → I/O → Weld → Pressing the F3:IN/OUT key for switching the screen IN or OUT)

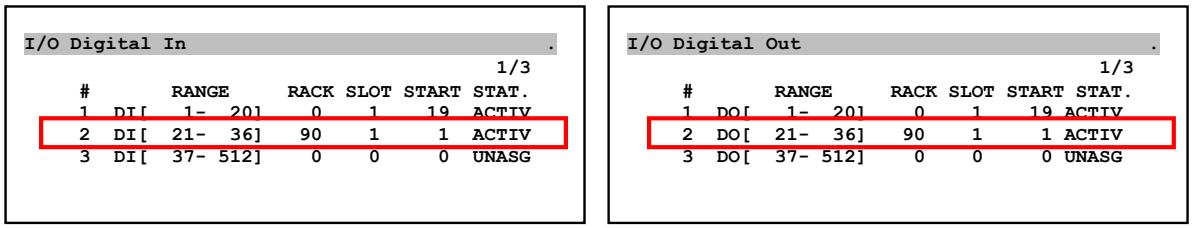
```
I/O Weld In                                          .
                                                  1/10
          WELD SIGNAL     TYPE #  SIM STATUS
       1[Current        ] AI[   1] U   0.0
       2[Voltage        ] AI[   2] U   0.0
       3[Wire Feed      ] AI[   3] U   0.0

       4[Arc detect     ] DI[  21] U OFF
       5[Gas fault      ] DI[  23] U OFF
       6[Wire fault     ] DI[  24] U OFF
       7[Water fault    ] DI[  25] U OFF
       8[Power fault    ] DI[  26] U OFF
       9[Wirestick      ] DI[  27] U OFF

      10[Arc enable     ]  *[****] * ***
```

```
I/O Weld Out                                         .
                                                  1/14
          WELD SIGNAL     TYPE # SIM STATUS
       1[Current        ] AO[   1] U   0.0
       2[Voltage        ] AO[   2] U   0.0
       3[Wave Control   ] AO[   3] U   0.0

       4[Weld start     ] DO[  21] U OFF
       5[Gas start      ] DO[  22] U OFF
       6[Inch forward   ] DO[  24] U OFF
       7[Inch backward  ] DO[  25] U OFF
       8[Feed forward   ] DO[  26] U OFF
       9[Feed backward  ] DO[  27] U OFF

      10[Wirestick alarm]  *[****] * ***
      11[Proc select 1  ]  *[****] * ***
      12[Proc select 2  ]  *[****] * ***
      13[Proc select 3  ]  *[****] * ***
      14[Weld EQ ready  ]  *[****] * ***
```

Fig. 3.1.1 (a) Weld I/O screen

Assignment range of Arclink I/O

(MENU key → I/O → Digital → F2:CONFIG key → Press F3:IN/OUT key for switching the screen IN or OUT)



I/O Digital In 1/3

#	RANGE	RACK	SLOT	START	STAT.
1	DI[1- 20]	0	1	19	ACTIV
2	DI[21- 36]	90	1	1	ACTIV
3	DI[37- 512]	0	0	0	UNASG

I/O Digital Out 1/3

#	RANGE	RACK	SLOT	START	STAT.
1	DO[1- 20]	0	1	19	ACTIV
2	DO[21- 36]	90	1	1	ACTIV
3	DO[37- 512]	0	0	0	UNASG

Fig. 3.1.1 (b) Digital I/O assignment screen

> ⚠ **CAUTION**
> Do not change weld I/O signal to SIM mode. If arc welding is executed with SIM mode of weld I/O signal, there is a case that the welding is not performed correctly.

> **NOTE**
> Such WI / WO signals are not used because ArcLink is digital communication. Actually, analog signals are not used. Though [AI] and [AO] are displayed in the Weld In/Out screen, those are common notation with the conventional welder.

3.1.2 Confirm the Correct Assignment Range of ArcLink I/O

At the stage of the system start-up, there are opportunities that the I/O assignment is changed or communication board is newly added. At that time, there is a risk that the assignment of Arclink I/O is deleted or the Arclink I/O is assigned incorrectly. Therefore, please confirm whether the Arclink I/O is assigned correctly. When the Arclink I/O is assigned incorrectly, it is impossible to weld.

Procedure 3-1-2 Confirm the assignment range of Arclink I/O

Step

1 Press the [MENU] key and select [I/O].
2 Press F1 [TYPE] and select [Digital].
3 Press the F2[CONFIG]. Assignment screen will be displayed.
4 Confirm the signals assigned to RACK 90 on both IN and OUT screens.

5 Please confirm that the signals assigned to RACK 90 are such as the following [Example of correct assignment]. That means, there are 16 points at the RANGE field (it is not necessary to start from 153), SLOT number is 1, START number is 1.
Please confirm that assignment is not such as the following [Example of wrong assignment 1, 2].

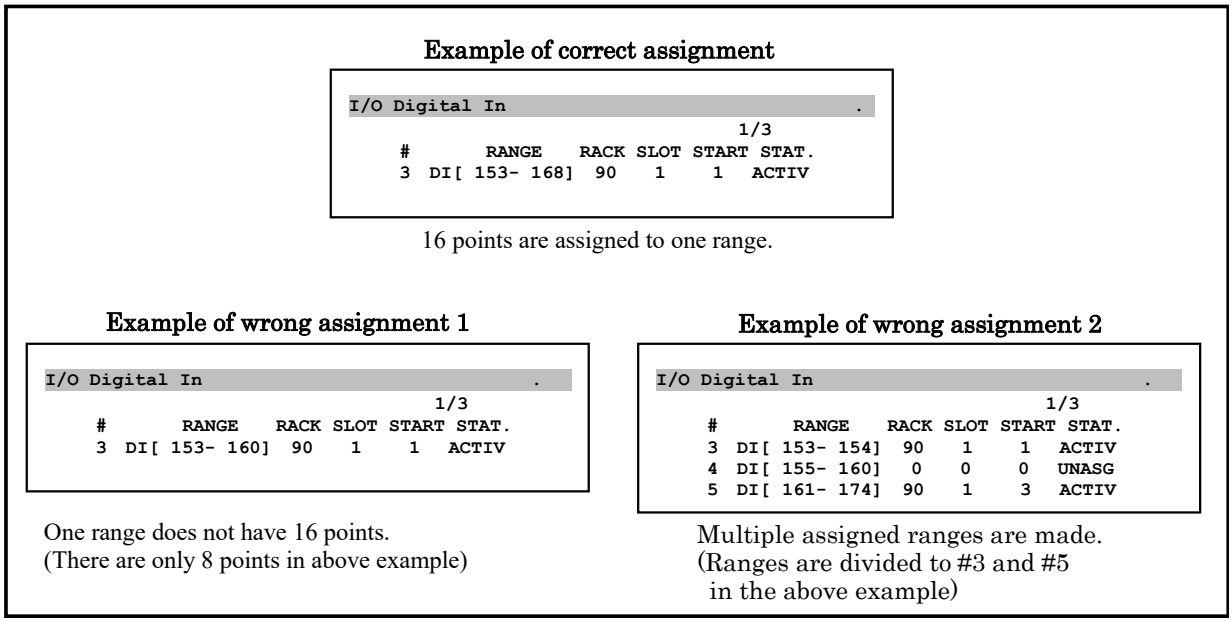


Fig. 3.1.2 (a) Correct assignment and Wrong assignment

6 If there is not signal assigned to RACK 90 or wrong assignment is executed, please execute the [Procedure to change the assignment of Arclink I/O] in next section. After that, please execute this procedure again.

NOTE
This procedure is assumed that the system has only one weld equipment. If your system has two or more weld equipment, SLOT is 2 in the second weld equipment. RACK and START number are the same as the first weld equipment. That means, RACK is 90, START is 1. It is necessary to assign another RANGE besides the assignment of first weld equipment.

3.1.3 Procedure to Change the Assignment of ArcLink I/O

ArcLink I/O is automatically assigned to vacant range concerning to the hardware configuration at the first Cold Start timing. Therefore, for example, if DO [1] – DO [16] are not used by other hardware, ArcLink I/O is assigned to DO [1] – DO [16].
There is a case that the user would like to use DI [1] and DO [1] as the start number for other hardware (Process I/O Board, DeviceNet, CC Link, etc.). Then, if ArcLink I/O has already assigned from DI [1], please change the I/O number by the following procedure.

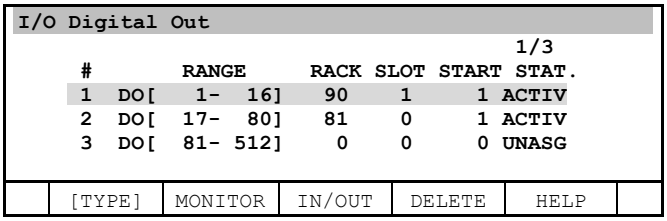
Procedure 3-1-3 Change the assignment of Arclink I/O

Condition

- Weld equipment power supplies are ON.
- "ARC-051 Weld EQi ONLINE: ArcLink" will be displayed after Cold Start (If the message is not displayed on the top of the Teach Pendant, please confirm it by Alarm History screen).
- System variable of $IO_AUTO_CFG is set to TRUE (This is standard setting).

Step

1 Press the [MENU] key and select [5 I/O].
2 Press F1[TYPE] and select [Digital]. I/O Digital Output screen will be displayed.
3 Press F2[ASSIGN]. The following screen will be displayed. In this screen, ArcLink I/O (Rack 90) has already been assigned to DO[1] – DO[16].



4 Move the cursor on the line for output signals to which rack 90 are assigned (In above example screen, it is DO [1 - 16]), and press F4[DELETE]. The assignment of ArcLink I/O is deleted.
5 During this state, change the range, rack, and slot and start number for I/O hardware which you would like to change the assignment to desirable values. (Please perform assignment change according to each I/O hardware manuals.)
6 Check that the DO status of changed I/O hardware becomes [PEND]. If the status is [INVAL], range, rack or slot number etc. may have incorrect setting. Please check and correct.
7 Perform cycle power of the robot controller.
8 ArcLink I/O is automatically assigned to a vacant range of I/O.
9 Please perform similar settings (Step 1 - 7) in Digital Input screen (you can switch the display by pressing F3[IN/OUT] key when Digital Output screen is displayed.).

> ⚠ **CAUTION**
> If you already set $IO_AUTO_CFG to FALSE manually, automatic assignment of ArcLink I/O is not performed. For ArcLink I/O assignment, it is necessary to set $IO_AUTO_CFG to TRUE.

3.2 EDITING OPERATION OF PROGRAM

This section explains the basic editing operation of program.

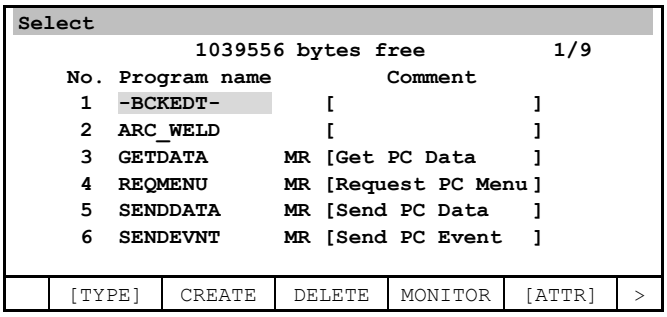
3.2.1 Selecting and Editing of Program

About the method for creating new program, procedure 2-7 “Creating Motion Program” explains. This Subsection explains the procedure for selecting and editing the program that already exists.

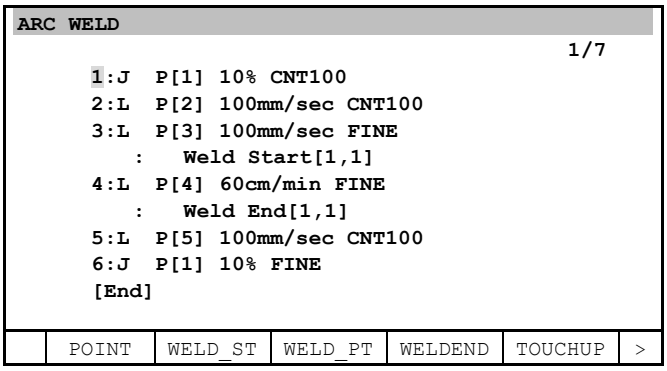
Procedure 3-2-1 Selecting and editing of program

Step

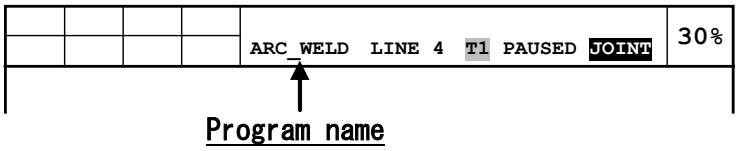
1 Select a program on the program selection screen.
Press the [MENU] key and select [SELECT] from the displayed menu. Or, press [SELECT] key.
Program selection screen will be displayed.



2　Move the cursor on the program that you would like to select and press the [ENTER] key. The program will be selected and the edit screen for this program will be displayed.



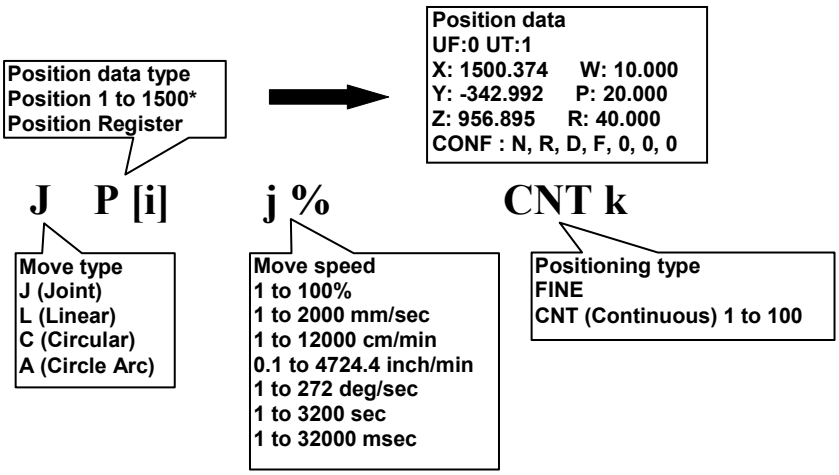
3　The program name of currently selected can be confirmed at status line that is in the window at the top of the teach pendant. So the selected program can be confirmed even if another screen is displayed.



4　Press the [MENU] key and select the [EDIT] from the displayed menu if you would like to display the program edit screen for currently selected. Or, press the [EDIT] key.

3.2.2 Editing of Motion Instruction

About the teaching of motion instruction, procedure 2-7 “Creating Motion Program” explains. This Subsection explains the procedure for editing the motion instruction that is already taught.
Motion instruction is composed of move type and position data type, move speed, positioning type (Refer to Fig. 3.2.2(a)). Procedure 3-2-2 explains about the editing method of those four compositions.



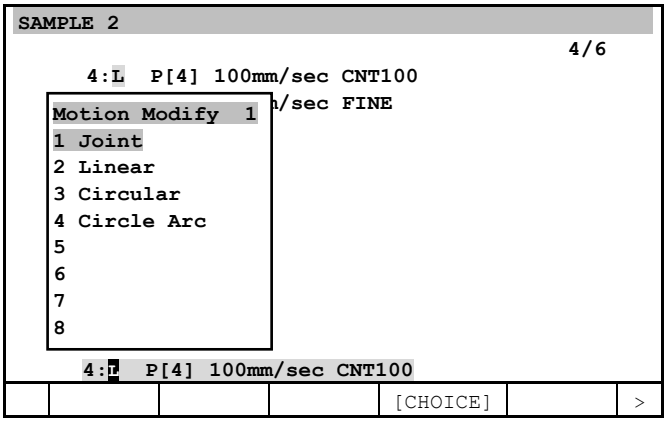
*** A position number can be as large as memory allows.**
The maximum move speed differs according to robot model.

Fig. 3.2.2 (a) Composition of motion instruction

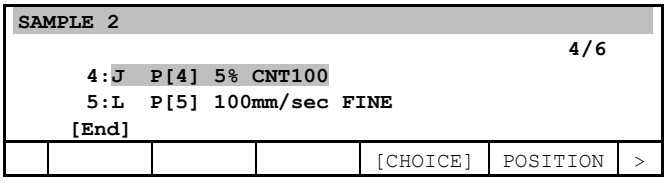
Procedure 3-2-2 Editing of motion instruction

Step

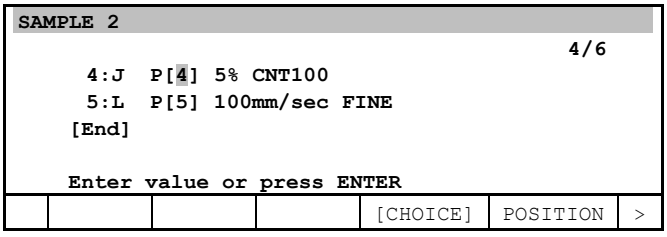
1 In case of changing move type, move the cursor to move type and press F4[CHOICE]. Sub menu for selecting move type will be displayed.



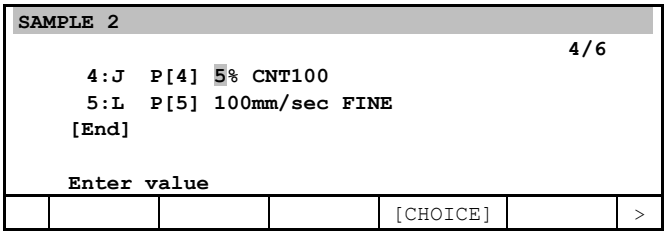
2 When the move type is selected from the sub menu, move type is changed. If it is changed, move speed and its unit are also changed according to the move type.



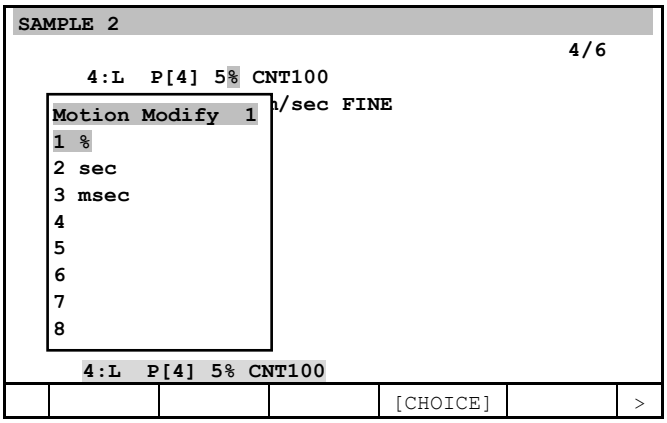
3 In case of changing position data number, move the cursor to the position data number and input new position data number.



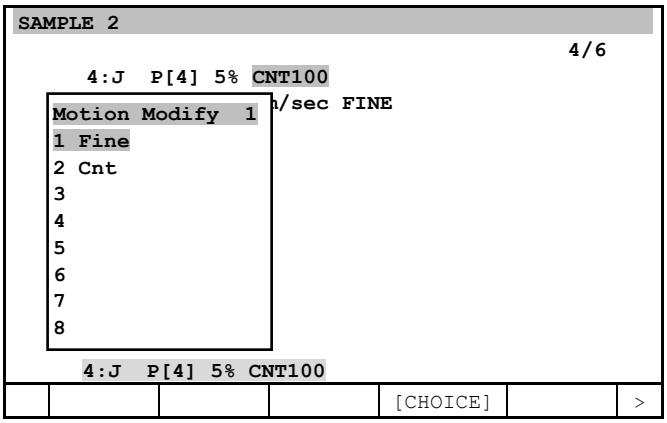
4 In case of changing move speed, move the cursor to move speed and input new value.



5 In case of changing the unit of move speed, move the cursor to move speed and press F4 [CHOICE]. Sub menu for selecting the unit will be displayed. Select new unit from the sub menu. If it is changed, the value of move speed is automatically converted to new unit.



6 In case of changing the positioning type, move the cursor to positioning type and press F4 [CHOICE]. Sub menu for selecting positioning type will be displayed. Select new positioning type from the sub menu.



7 If “Cnt” is selected as the positioning type, move the cursor to the value field of positioning type and input new value.

```
SAMPLE 2                                          4/6
     4:J  P[4] 5% CNT30
     5:L  P[5] 100mm/sec FINE
    [End]

    Enter value
|  |  |  |  | [CHOICE] |  | > |
```

3.2.3 Correcting a Position

If the robot does not track the ideal path, it is necessary to modify the position that is taught by motion instruction. Operator can touch-up the position data in motion instruction after moving the robot to the position that should be corrected by jog feed. Please refer to procedure 3-2-3 (a).
Operator can confirm the taught position data in motion instruction. Operator can also modify the taught position data by changing the position number in motion instruction. Please refer to procedure 3-2-3 (b).

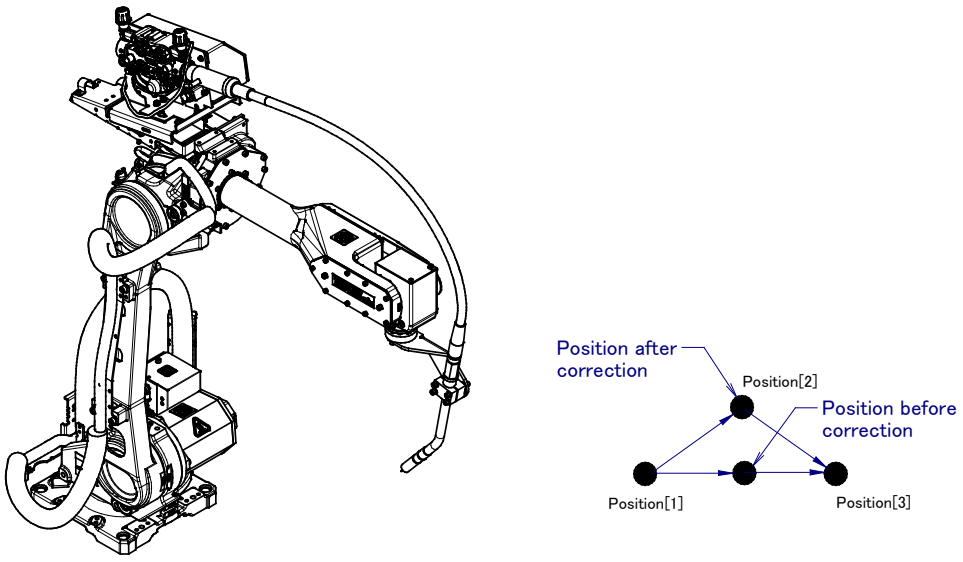


Fig. 3.2.3 (a) Correcting a position

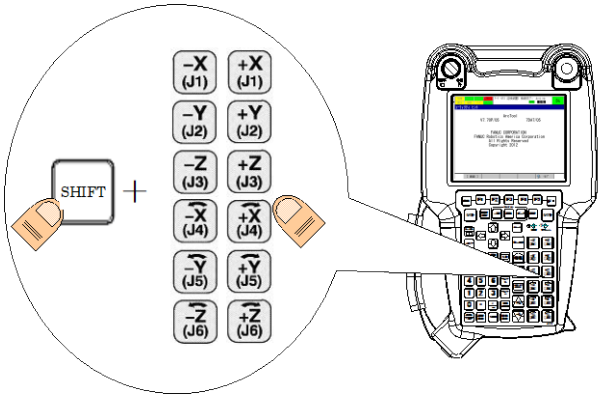
Procedure 3-2-3 (a) Correcting a position

Step

1 Move the cursor to the beginning of motion instruction line that you would like to correct.

```
SAMPLE 3                                          3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
    [End]

|  | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | > |
```

2 Move the robot TCP to the desired position by jog feed operation.



3 Press F5[TOUCHUP] with holding the [SHIFT] key. The position data in the motion instruction of current cursor position (it is P[3] in the following example screen) is modified to the current robot TCP position.

```
SAMPLE 3                                        3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L @P[3] 100mm/sec FINE
    [End]

 | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

Procedure 3-2-3 (b) Confirm position data and Change position data number

Step

1 Move the cursor to the position data number.

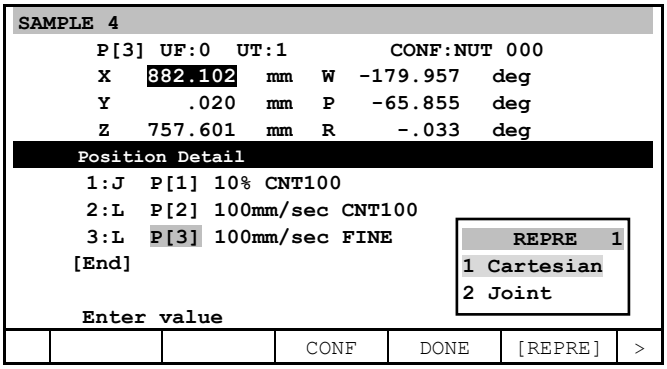
```
SAMPLE 4                                        3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
    [End]

 |  |  |  | [CHOICE] | POSITION | >
```

2 Press F5[POSITION] key. Sub menu for position data will be displayed. In standard, the position will be displayed based on the cartesian coordinate system (world coordinate system).

```
SAMPLE 4
      P[3] UF:0  UT:1         CONF:NUT 000
       X   882.102   mm   W  -179.957   deg
       Y      .020   mm   P   -65.855   deg
       Z   757.601   mm   R     -.033   deg
    Position Detail
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
    [End]

     Enter value
 |  |  | CONF | DONE | [REPRE] | >
```

3 Move the cursor to desired coordinate position data and input the desired value with numeric key. After that, press the [ENTER] key.

4 It is possible to change the format of position data. Press F5[REPRE] and select the desired format. For example, display changes as follows when the format of position data is changed from “Cartesian” to “Joint”.



5 When the confirmation / changing position data ends, press F4[DONE]. Display is returned to program edit screen.

3.2.4 Edit by Using Program Edit Instructions

It is possible to modify / edit the program efficiently by using the program edit instructions. Kind of those are shown in following Table 3.2.4 (a). In those instructions, “Insert” and “Delete”, “Copy” are often used. So those are explained in procedure 3-2-4 (a) – (c).

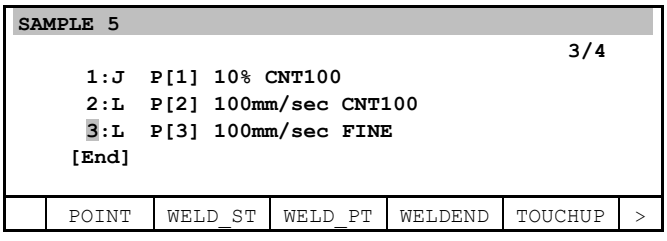
Table 3.2.4 (a) Kind of program edit instructions

Insert	Inserts blank lines, the number of which is specified, between the existing lines of a program.
Delete	Deletes a series of instructions from a program.
Copy	Copies a series of instructions and inserts the instruction range into another location in the program.
Find	A specified element of a program instruction is found.
Replace	Replaces an item of the specified program instruction with another item.
Renumber	Renumbers the position number in ascending order.

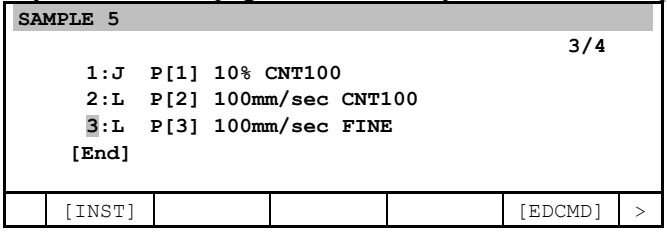
Procedure 3-2-4 (a) Insert blank lines

Step

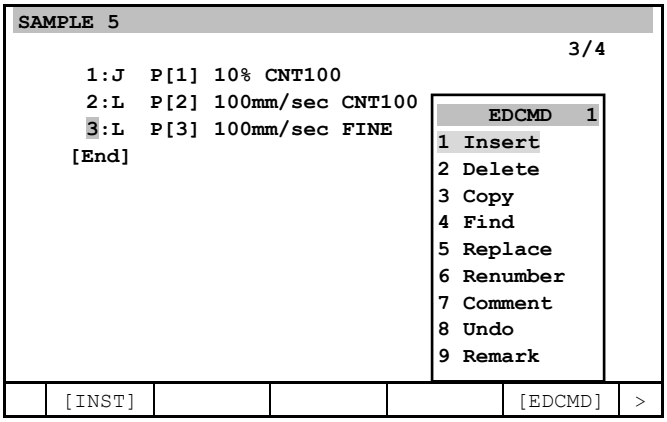
1 Move the cursor to the head of line where you would like to insert blank lines.



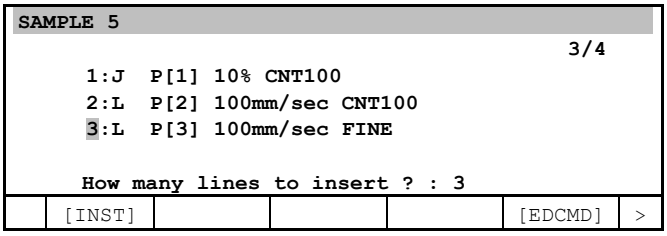
2 Press the [NEXT] key then the next page of function key menu will be displayed.



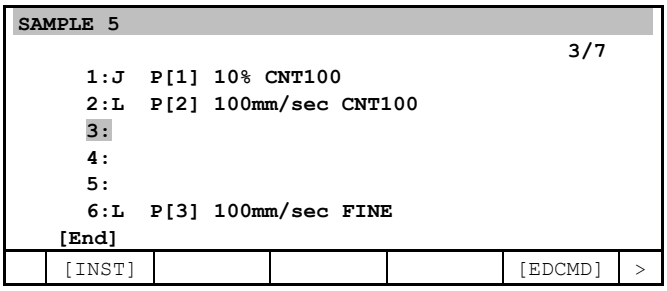
3 Press F5[EDCMD], then the EDCMD menu will displayed.



4 Select “Insert” from the displayed menu. Input the number of lines to insert by numeric key and press the [ENTER] key.



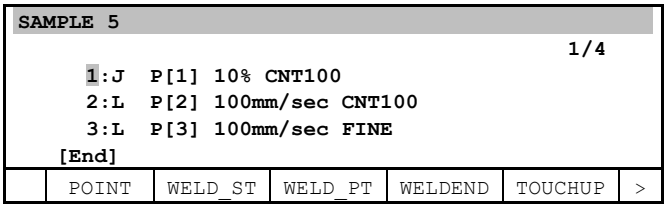
5 The number of specified blank lines are added to specified cursor position.



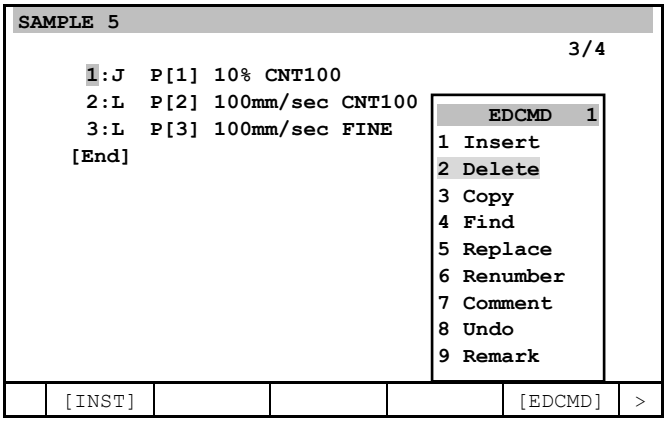
Procedure 3-2-4 (b) Delete lines

Step

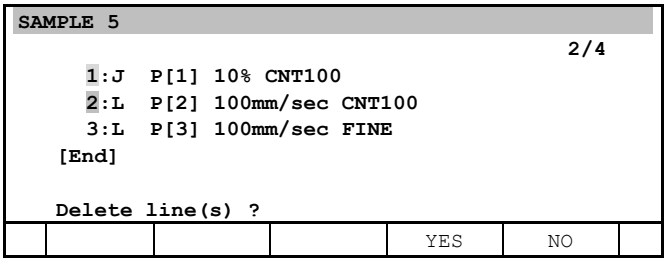
1 Move the cursor to the head of line where you would like to delete lines.



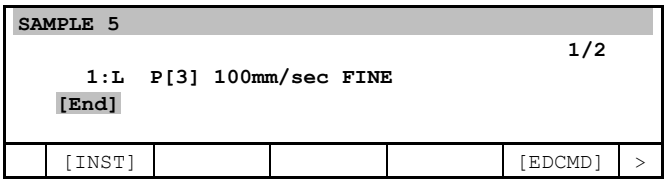
2 Perform the step 2 and 3 in procedure 3-2-4 (a) then the EDCMD menu will be displayed.



3 Select “Delete” from the displayed menu. Press the F4[YES] after specifying the delete range by using cursor keys (up / down arrow keys).



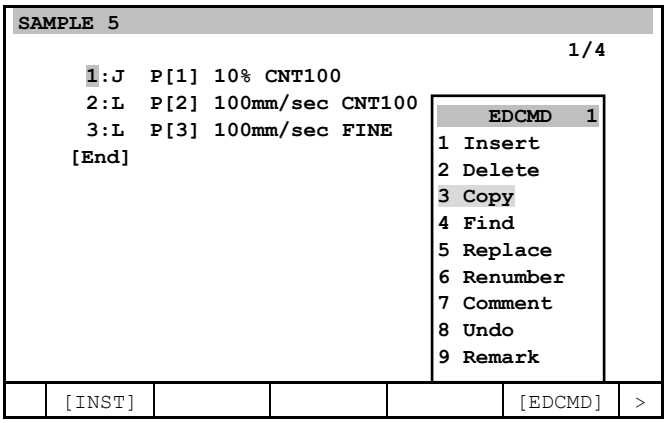
4 The specified range of lines are deleted.



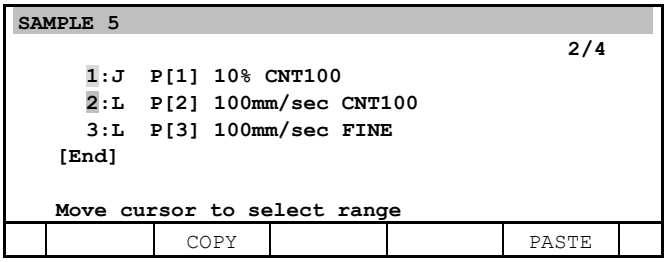
Procedure 3-2-4 (c) Copy lines

Step

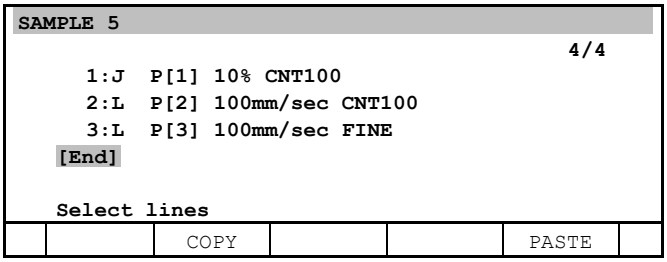
1 Perform the step 2 and 3 in procedure 3-2-4 (a) then the EDCMD menu will be displayed. Select “Copy” from the displayed menu.



2 The message of "Select lines" will be displayed at prompt lines. Press F2[COPY] after moving the cursor to beginning of copy range.
3 The message of "Move cursor to select range" will be displayed at prompt lines. Press F2[COPY] after moving the cursor to ending of copy range. The specified range of program lines is stored to the internal memory.



4 Press F5[PASTE] after moving the cursor to the position where you would like to paste.



5 The message of "Pate before this line?" will be displayed at prompt line. Select the copy mode by pressing F2 or F3 or F4 key. Program lines stored by step 3 and 4 are inserted. About the copy mode, please refer to the following table.

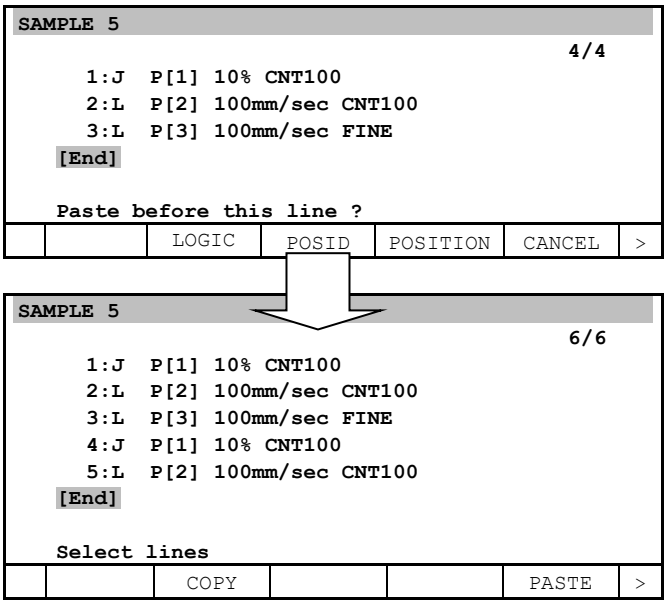


Table 3.2.4 (b) Kind of program edit instructions

F2 LOGIC	The position number of pasted motion instruction becomes "..."(initial state).
F3 POSID	The position number of pasted motion instruction succeeds the position number of copied motion instruction.
F4 POSITION	The position number of pasted motion instruction becomes unused position number.

3.3 OPERATION OF WELD PROCEDURE AND PROCESS MODE

3.3.1 About Weld Procedure and Process Mode

Arc welding power supply can use different output characteristics to wire diameter, wire material, gas type and weld method, and it has the database of the most suitable output characteristic for each combination. The database of output characteristic can be changed for each weld point. Therefore, you can select the most suitable characteristic for each point and then execute welding.
For switching the database of output characteristics for arc welding power supply during welding, it is necessary for arc welding robot to specify “This combination is used for this weld point”.
Between arc welding robot – welding power supply, the relevance of each combination is done by specifying the number called “Process Mode”.
Process Mode number cannot be specified on arc weld instruction directly. Therefore, one “Process Mode” is assigned to one “Weld Procedure”. Then Weld Procedure which is assigned the desired Process Mode is specified on arc weld instruction, and it is possible to achieve the switching of output characteristic from arc welding robot to arc welding power supply.

NOTE
It is necessary to select Process Mode number whose wire diameter, wire material and gas type are suitable for using ones.

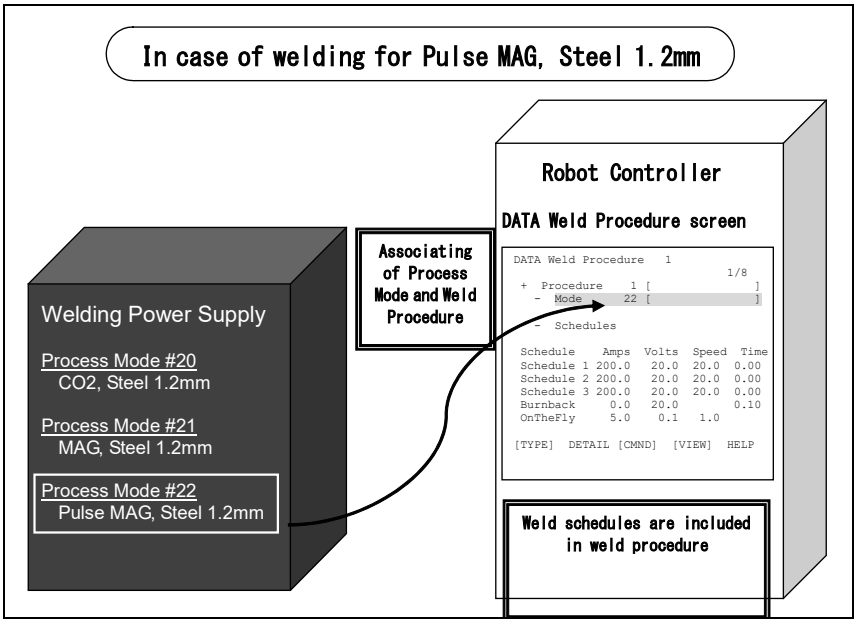


Fig. 3.3.1 (a) Process Mode and Weld Procedure

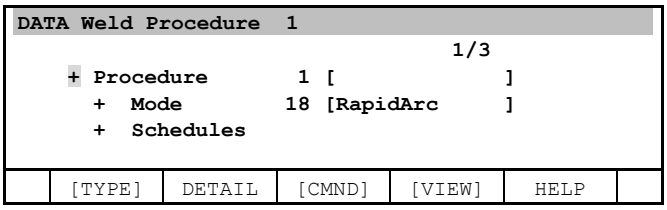
3.3.2 Operation of Weld Procedure

“Weld Procedure” has “Weld Schedule”, and also setups which decide welding sequence. When this weld procedure number is specified on arc weld instruction, weld process on the point where the instruction is taught is decided.
One weld procedure has multiple weld schedules. It is possible to create weld procedure up to 20. Additionally, one weld procedure can have weld schedules up to 32.
The new creation method of the first weld procedure is explained by Procedure 2-5. So Procedure 3-3-2 explains the creation method of the second or later weld procedures. Please refer to Section 3.5 of Arc Welding Function OPERATOR’S MANUAL (B-83284EN-3) for other operations for weld procedures.

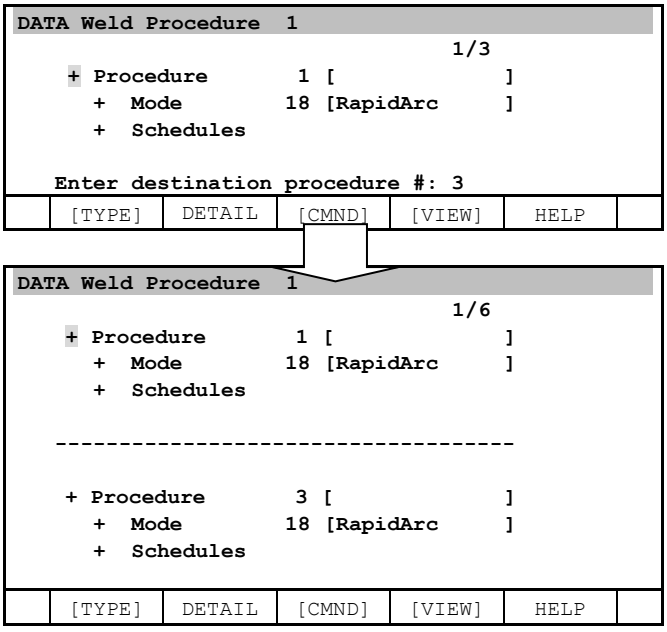
Procedure 3-3-2 Copy weld procedure

Step

1 Press the [MENU] key and select [0 -- NEXT--].
2 Select [3. DATA].
3 Press F1[TYPE] key and select [Weld Procedure]. Following screen will be displayed.



4 In case of creating another weld procedure, it is achieved by copying the existing weld procedure. Press F3[CMND] and select [Copy WP].
5 The message of "Enter destination procedure #:" will be displayed at prompt line. Please input the weld procedure number that you would like to create. The message of "Copy procedure i to procedure j" will be displayed. Then, press F4[YES].



3.3.3 In case of Process Mode Number is Known

When the process mode number that you would like to use is known, it is possible to input the process mode number directly in the DATA Weld Procedure screen (refer to Procedure 3-3-1). Or, it is possible to perform this method after checking the process mode number that you would like to use by referring "CHAPTER9 PROCESS MODE".

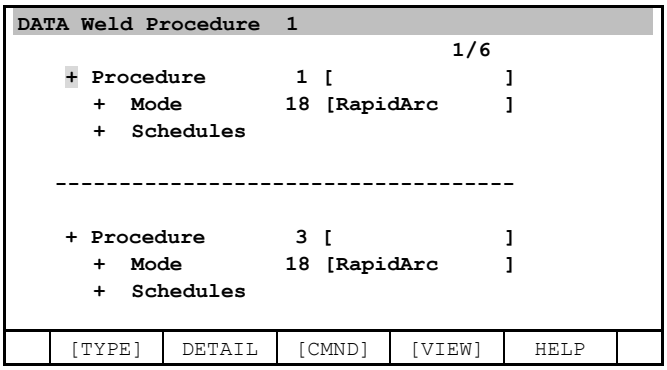
Procedure 3-3-3 Assignment of process mode number by direct input

Condition

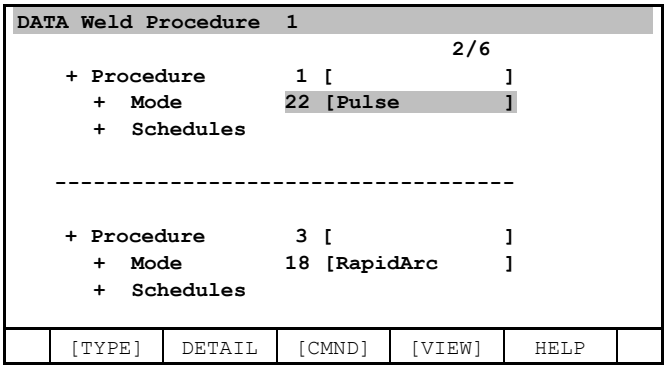
- The power supply of weld equipment is ON.
- After the power supply ON, the message of "ARC-051 Weld EQi ONLINE: ArcLink" is posted (If this message is not displayed on the top of the Teach Pendant, please confirm it by Alarm History screen.).

Step

1 Perform the step 1 - 3 in Procedure 3-3-2 then DATA Weld Procedure screen will be displayed.



2 Move the cursor to “Mode” line in the desired weld procedure and input the process mode number that you would like to use. The comment of specified “Mode” line is updated to the content that corresponds to the inputted process mode number. Please confirm the content whether it is correct or not. If it does not exist in the weld equipment, the value of “Mode” is returned to the original value.



NOTE

In case of Lincoln welding power supply, setup of process mode cannot be done and the message “ARC-094 Cannot select Mode: EQi offline” (i is an weld equipment number) is displayed if the communication of arc welding power supply is not ONLINE status. In this case, please establish the communication with Lincoln welding power supply and then try the procedure again.

3.3.4 In case of Process Mode Number is Unknown

When the process mode number that you would like to use is unknown, it is necessary to find the process mode number by using the information of welding methods and wire diameter, etc. Process mode number is founded by accessing to the process mode data base in weld equipment.

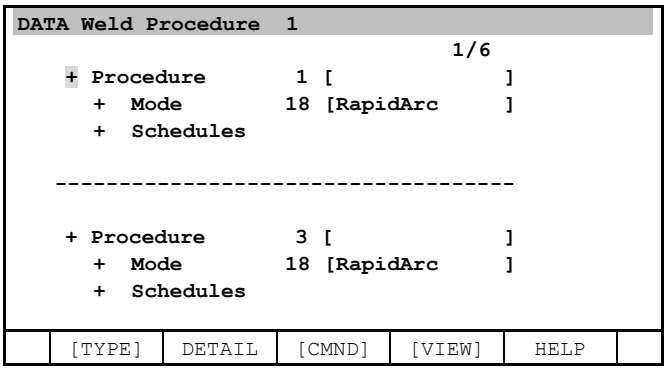
Procedure 3-3-4 Assignment of process mode number by searching

Condition

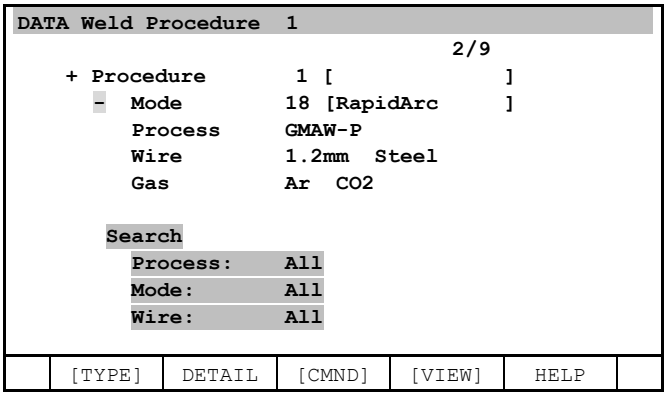
- The power supply of weld equipment is ON.
- After the power supply ON, the message of “ARC-051 Weld EQi ONLINE: ArcLink” is posted (If this message is not displayed on the top of the Teach Pendant, please confirm it by Alarm History screen.).

Step

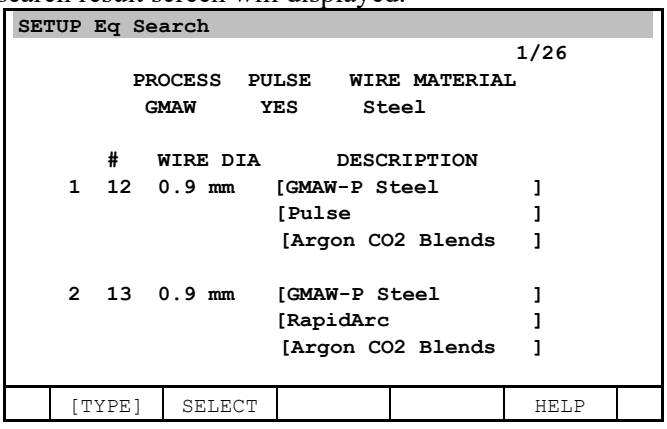
1 Perform the step 1 - 3 in Procedure 3-3-2 then DATA Weld Procedure screen will be displayed.



2 Move the cursor to "+" in the head of "Mode" line and press ENTER key. Following "Search" setting items are displayed.



3 Set "Process", "Mode" and "Wire" items. Press F3[CMND] and select [Search] from the displayed menu. Following search result screen will displayed.



4 This screen is scrollable by using cursor key (up / down arrow key). When the founded process mode exists over 30, it is possible to display the search result since 30 process modes by pressing F3[MORE] key.

5 Move the cursor to desired process mode number and press F2[SELECT]. When you would like to exit from this screen without selecting process mode, please press PREV key.

NOTE
In case of Lincoln welding power supply, setup of process mode cannot be done and the message “ARC-094 Cannot select Mode: EQi offline” (i is an weld equipment number) is displayed if the communication of arc welding power supply is not ONLINE status.

3.4 WELDING PARAMETERS OF LINCOLN WELDING POWER SUPPLY

In this section, welding parameters in weld schedule are explained.
In Lincoln welding power supply, welding parameters are changed by “Weld Process” which is associated with process mode. Additionally, it is possible to switch the setup of voltage/trim command forms or wire feed speed/current command forms.
First, weld processes mainly used on Lincoln welding power supply are explained and then examples of welding parameters for each setup are shown.

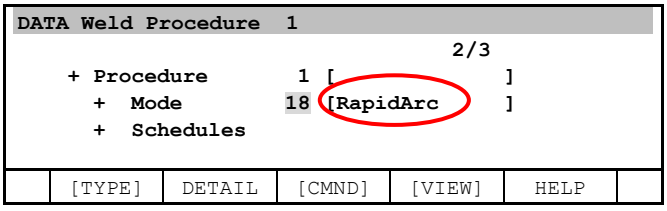
3.4.1 Weld Processes for Lincoln Welding Power Supply

Lincoln welding power supply supports variable weld processes. Main weld processes are shown below.

Table 3.4.1 (a) Weld Processes for Lincoln welding power supply

Weld Process	Explanation
CV	General constant voltage weld process.
Pulse	General pulse weld process.
Rapid Arc	Weld process suitable for high-speed welding.
Non-Synergic STT	Weld process for very low spatter. Weld parameters become special form. Sense lead cable (voltage detection cable) is required because weld current is finely controlled by feedback voltage. Additionally, special module is also required.
Rapid X	Weld process for achieving low spatter on high-speed welding. Sense lead cable (voltage detection cable) is required because weld current is finely controlled by feedback voltage. Additionally, special module is also required.

These weld processes are selected by process mode number. Please refer to Chapter 10 for process mode list of Lincoln welding power supply.
You can confirm weld process for each process mode on the following weld procedure screen.



3.4.2 General Command Form

Welding parameters for CV, Pulse, Rapid Arc and Rapid X weld processes become the following structure generally.

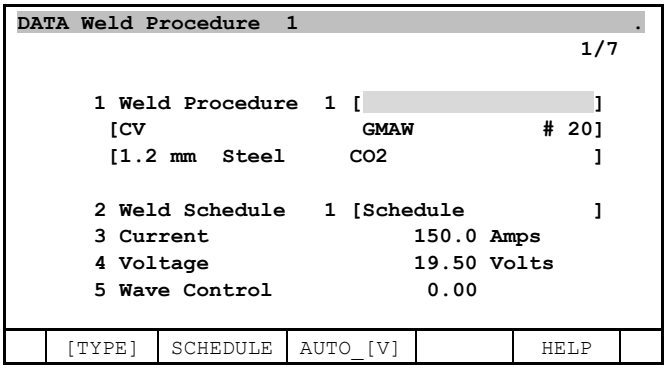


Table 3.4.2 (b) Welding parameters for general command form

Welding parameter	Explanation
Current	This welding parameter decides welding current. Unit is A (Amps).
Voltage	This welding parameter decides welding voltage. Unit is V (volts).
Wave Control	This welding parameter set the status of arc from soft to hard. Basic value is 0. When this value is changed to positive side, arc becomes hard. When this value is changed to negative side, arc becomes soft. You can adjust this value from -10 to +10.

NOTE
Power Wave 455M/STT cannot support Current command. Therefore, when Power Wave 455M/STT is connected, 1st welding parameter becomes wire feed speed command.

3.4.3 Synergic Voltage Command Form

Lincoln welding power supply can use synergic voltage command except CV mode. In synergic voltage command form, a standard voltage is automatically decided by current command value.
Please refer to Procedure 3-4-3 for switching command form to synergic voltage.

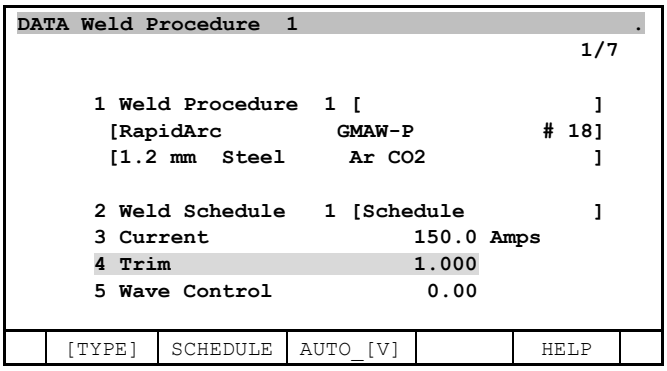


Table 3.4.3 (a) Welding parameters for synergic voltage command form

Welding parameter	Explanation
Current	This welding parameter decides welding current. Unit is A (Amps).
Trim	When this value is set to 1, standard voltage is output. You can adjust this value from 0.5 to 1.5.

Welding parameter	Explanation
Wave Control	This welding parameter set the status of arc from soft to hard. Basic value is 0. When this value is changed to positive side, arc becomes hard. When this value is changed to negative side, arc becomes soft. You can adjust this value from -10 to +10.

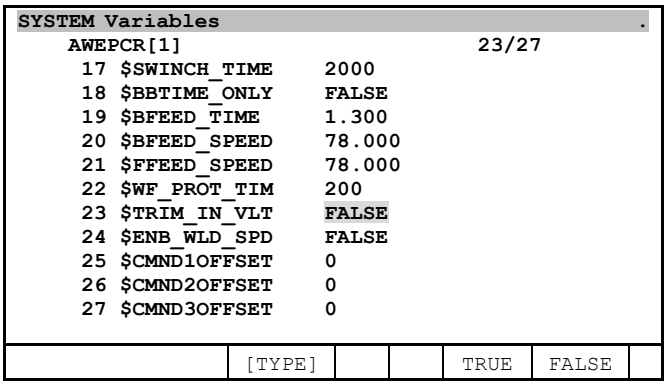
Procedure 3-4-3 Changing Trim/Voltage command forms

Condition

- Lincoln Asia package is installed
- Robot controller and Lincoln welding power supply are correctly connected with LAN cable and communication has been established
- The power of robot controller and welding power supply are both turned on.

Step

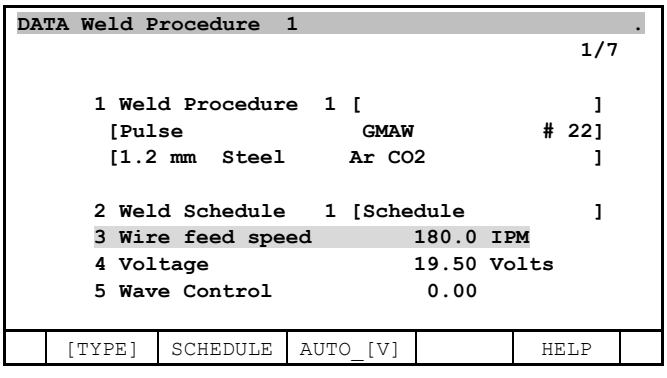
1 Press the [MENU] key and select the [6 System].
2 Press F1[TYPE]key and select [Variables].
3 Move the cursor to “AWEPCR_T” of the $AWEPCR line and press [ENTER] key. On the next screen, match the cursor to “AWEPCR_T” and press the [ENTER] key.
4 If you change the command form to synergic voltage, move the cursor on “TRUE” of “$TRIM_IN_VLT” line and then press F5[FALSE] key. If you change it to individual voltage, press F4[TRUE] key.



5 Cycle power of welding power supply or robot controller. After the communication is established, check the weld procedure which is assigned the process mode except CV, and check 2nd welding parameter is changed to “Trim”.

3.4.4 Wire Feed Speed Command Form

Lincoln welding power supply can change “Current” command to “Wire feed speed” command. In this case, welding current is changed by wire feed speed.



The procedure from current command to wire feed speed command is shown below.

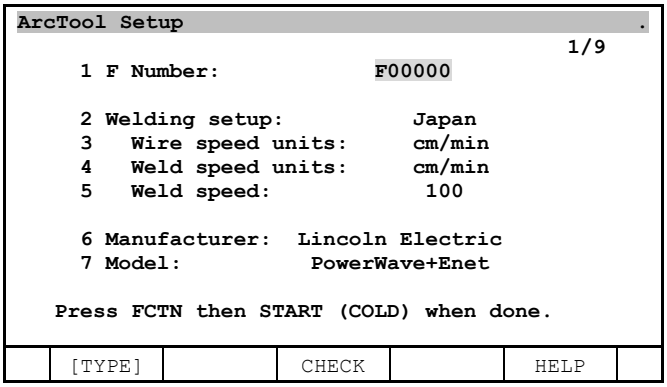
Procedure 3-4-4 Changing Current/Wire feed speed command forms

Condition

- Lincoln Asia package is installed
- Robot controller and Lincoln welding power supply are correctly connected with LAN cable and communication has been established
- The power of robot controller and welding power supply are both turned on.

Step

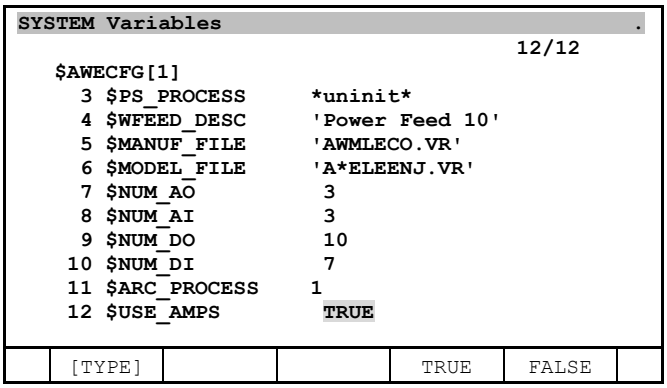
1 Perform Controlled Start. ArcTool Setup screen will be displayed.



2 Press the [MENU] key and select the [4 Variables].

3 Move the cursor to “AWECFG_T” of the $AWECFG line and press the [ENTER] key. On the next screen, move the cursor to “AWECFG_T” and press the [ENTER] key.

4 Move the cursor to “TRUE” of the $USE_AMPS line and press F5[FALSE].



5 Perform Cold Start. After the communication is established, check the weld procedure and check 1st welding parameter is changed to “Wire feed speed”.

NOTE
When Power Wave 455M/STT is connected, only wire feed speed command form can be used. Therefore, this change cannot be done.

3.4.5 Non-Synergic STT

When process mode of Non-Synergic STT is selected, special welding parameters are displayed.

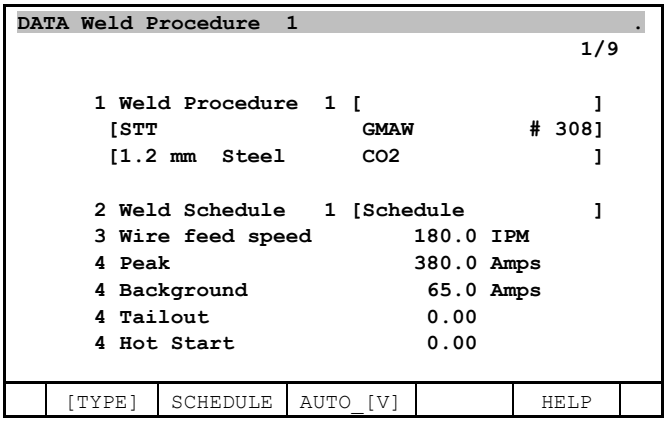


Table 3.4.5 (a) Welding parameters for synergic voltage command form

Welding parameter	Explanation
Wire feed speed	This welding parameter decides wire feed speed.
Peak	This welding parameter decides peak current.
Background	This welding parameter decides base current.
Tailout	This welding parameter adjusts the current wave form while transferring from peak current to base current. Heat input can be controlled by this parameter.
Hot Start	This welding parameter adjusts the time while transferring from arc start wave form to STT wave form. Output time of arc start wave form becomes longer when this value increases.

NOTE
Non-Synergic STT mode is designed based on wire feed speed command form. Therefore, current command form must be changed to wire feed speed command before using this mode. Please refer to Procedure 4-4-4 for switching command form and then use the mode.

3.5 TEACHING AND EDITING OF ARC WELD INSTRUCTION

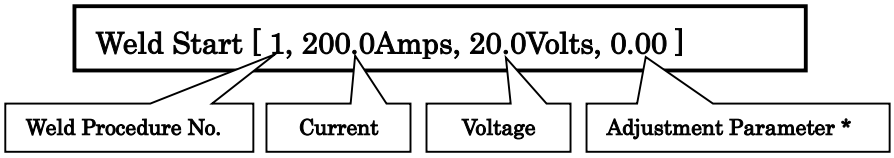
Arc weld instruction performs the arc welding start / end. Though the Procedure 2-8 explains briefly about teaching of arc weld instruction, this section explains it in detail.

3.5.1 Arc Weld Start Instruction

The arc weld start instruction requests to start an arc welding. Once arc welding has started, welding pass becomes the robot movement path. The welding is continued until requesting the arc weld end instruction. There are two methods in arc weld start instruction. One is arc indirect instruction, two is arc direct instruction.
Following shows the example of those two instructions.

Schedule number specified (Arc indirect instruction)

Schedule directly specified (Arc direct instruction)

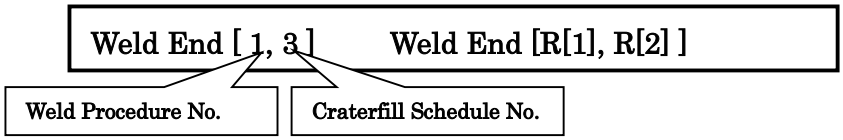


* The command value such as [Wave control] enters to the adjustment parameter.

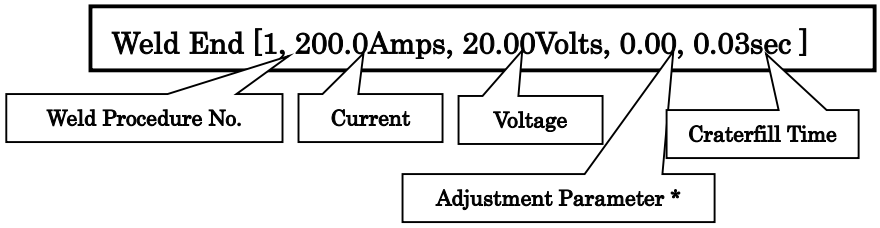
3.5.2 Arc Weld End Instruction

The arc welding end instruction requests to end an arc welding. When an arc welding ends, the craterfill is performed. The craterfill schedule is specified in this instruction. Craterfill is a function to avoid the crater hole generation due to a rapid voltage decrease.
In the craterfill schedule, it is necessary to specify craterfill time in addition to various command values. If you do not perform the craterfill, set the craterfill time to 0sec. There are two methods in arc weld end instruction well as arc weld start instruction.

Schedule number specified (Arc indirect instruction)



Schedule directly specified (Arc direct instruction)



* The command value such as [Wave control] enters to the adjustment parameter.

NOTE
1 In case of schedule directly specified, all commands are cleared to 0 when the weld procedure number is changed (This is measures to prevent original commands from becoming outside the range that is for the weld procedure after changed). Please always set each commands after setting the weld procedure number.
2 The number/kinds of command parameters are changed according to the specified process mode number. Therefore, you may not see the above explanation.

3.5.3 Note while Teaching Arc Weld Instruction

- Please use the FINE motion when robot moves to arc welding start position.
- Please use the linear or circular, C-circular with CNT motion when robot moves to pass point during arc welding.
- Please use the linear or circular, C-circular with FINE motion when robot moves to arc welding end position.
- Please set torch to appropriate angle against welding object.
- Please use the appropriate welding schedule.
- Do not execute arc weld start instruction on condition that welding wire touches to the welding object. It may cause the welding trouble. Welding wire should not touch to the welding object at arc start point. In case of those touching, please confirm stick out length at last arc end point, etc.

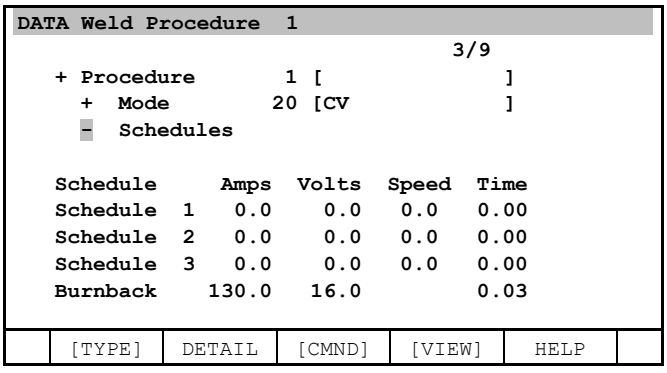
3.5.4 Teaching of Arc Indirect Instruction

Arc indirect instruction performs the welding according to the specified weld schedule that is set in weld procedure. The weld schedule must be set beforehand at weld procedure screen. It is necessary to specify the weld procedure number and schedule number in the use of arc indirect instruction.
In the weld procedure screen, please set the process mode number at first. Next, please set each weld command values (Amps, Volts, etc.).
Teaching procedure is shown in Procedure 3-5-4.

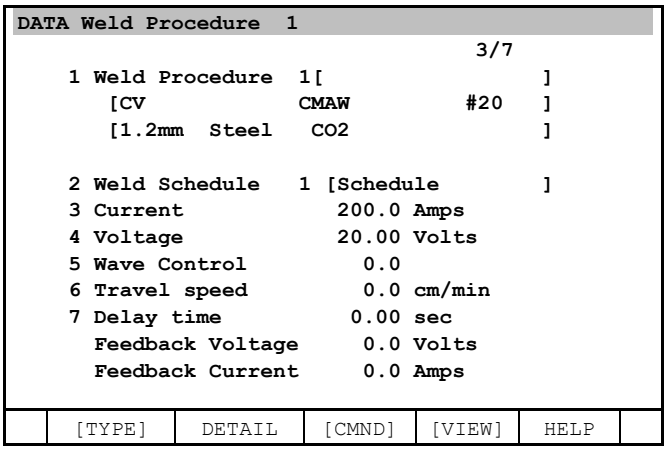
Procedure 3-5-4 Teaching of arc indirect instruction

Step

1 Press the [MENU] key and select [0 -- NEXT --]. Select [3 DATA].
2 Press the F1 [TYPE] key and select [Weld Procedure]. Then, Weld Procedure screen will be displayed.
3 Move the cursor to “Schedules” included in weld procedure used by arc indirect instruction. Press F2 [DETAIL] or the [ENTER] key. Weld schedule list will be displayed as the followings.



4 Move the cursor to schedule that you would like to use and press F2 [DETAIL]. The following screen will be displayed.



5 Input commands (current, voltage, etc.). The maximum and minimum values of each parameter are different according to the selected process mode.
6 Input the weld schedule number to the arc indirect instruction in the TP program.

NOTE
In Lincoln welding power supply, maximum and minimum values for each welding parameter is changed by process mode number. Even if the value is in range with some process mode, this may become out of range after changing process mode number. Therefore, please confirm the value of each welding parameters after changing process mode number.

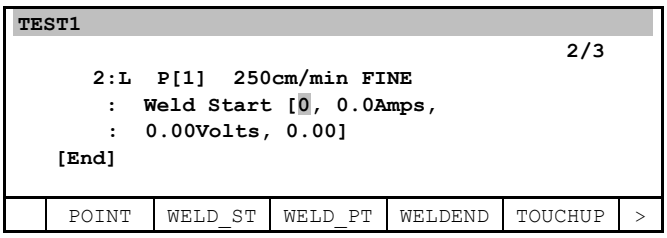
3.5.5 Teaching of Arc Direct Instruction

In arc direct instruction, you specify the weld procedure number and each command (current, voltage, etc.) directly in TP program.
Teaching procedure is shown in Procedure 3-5-5.

Procedure 3-5-5 Teaching of Arc direct instruction

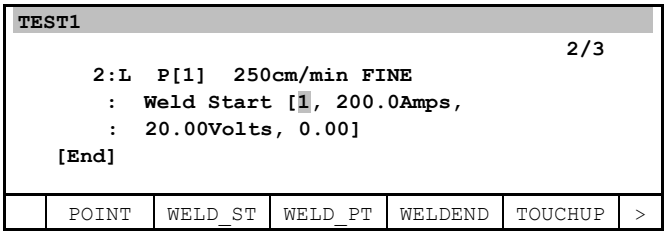
Step

1 Teach the arc weld instruction in TP program. Move the cursor to inside "[]" of the arc weld instruction and press F3 [VALUE] key. Arc direct instruction will be displayed.



2 Move the cursor to the first parameter and input the weld procedure number here.

3 After inputting the weld procedure number, input commands (current, voltage, etc.). The maximum value and the minimum value of each parameter are different in each process mode.



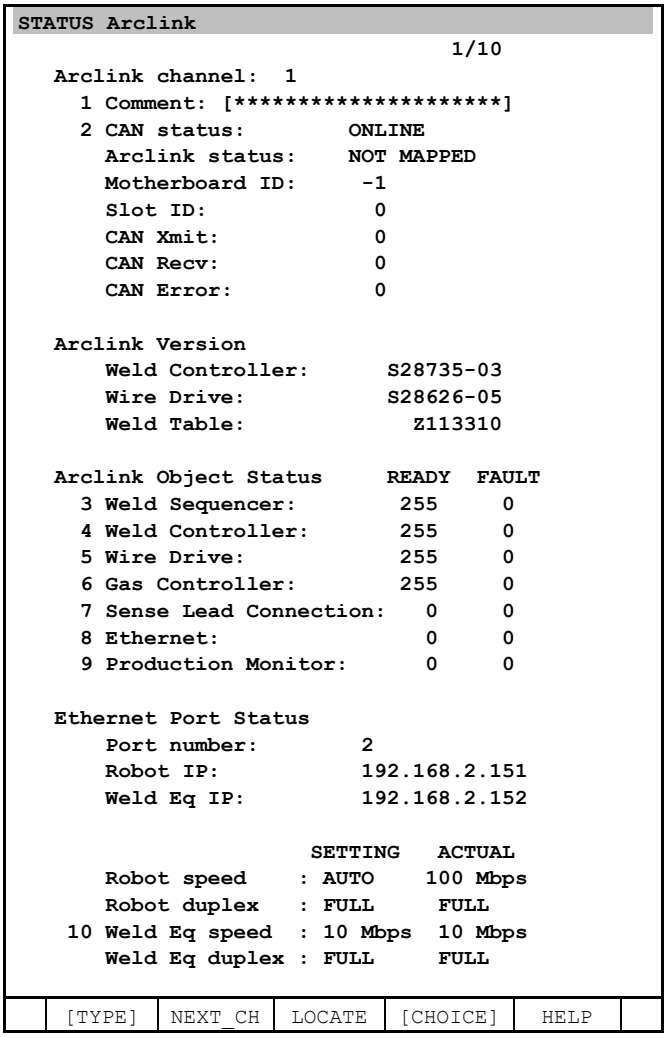
NOTE

1 The input parameters (EX: current, voltage, etc.) are reset to 0 when you change the weld procedure number. Please input the weld procedure number first before inputting commands for each parameter.

2 In Lincoln welding power supply, maximum and minimum values for each welding parameter is changed by process mode number. Even if the value is in range with some process mode, this may become out of range after changing process mode number. Therefore, please confirm the value of each welding parameters after changing process mode number.

3.6 STATUS OF ARCLINK

ArcLink Status screen shows the communication status of the ArcLink. In this screen, detailed information (CAN status, firmware version of weld equipment, weld table version, ArcLink object status, etc.) is displayed. Status of Ethernet communication is also displayed when the weld equipment is PowerWave R350, S350, R450, R500 or *i*400. The method of operating the ArcLink Status screen is shown in Procedure 3-6.



Procedure 3-6 Operation of ArcLink status screen

Step

1 Press the [MENU] key and press 0. Then, select [4 STATUS].
2 Press F1[TYPE] key and select [ArcLink]. ArcLink Status screen will be displayed.
3 When the display of [CAN status] is [ONLINE], the communication between the robot controller and the weld equipment is correct. When it is [OFFLINE], the communication is not established by some reasons such as no power supply of the weld equipment. When the communication error occurs, this field shows [ERROR].
4 When this screen is displayed before establishing a communication, there are some items that are not displayed. In this case, please press F3[LOCATE] key after establishing a communication. The display will be updated and all items will be displayed.

4 ARC WELDING FUNCTIONS

This chapter describes about setting operation of functions related to arc welding depending on using situation (when starting arc welding, when finishing arc welding and others.)

4.1 OPERATION OF ARC WELDING START TIMING

Functions related to arc welding start timing are follow.

- Adjustment of wire feed speed at arc generation timing (Strike wire feed speed function)
- Gas control just before weld start (Gas purge/ Gas pre flow function)
- Adjustment of weld schedule at weld start position (Runin function)
- Retry after weld start failed (Repeat touch retry function, Scratch start function)

This section explains overview and using method of these functions.

4.1.1 Adjustment of Wire Feed Speed at Arc Generation Timing

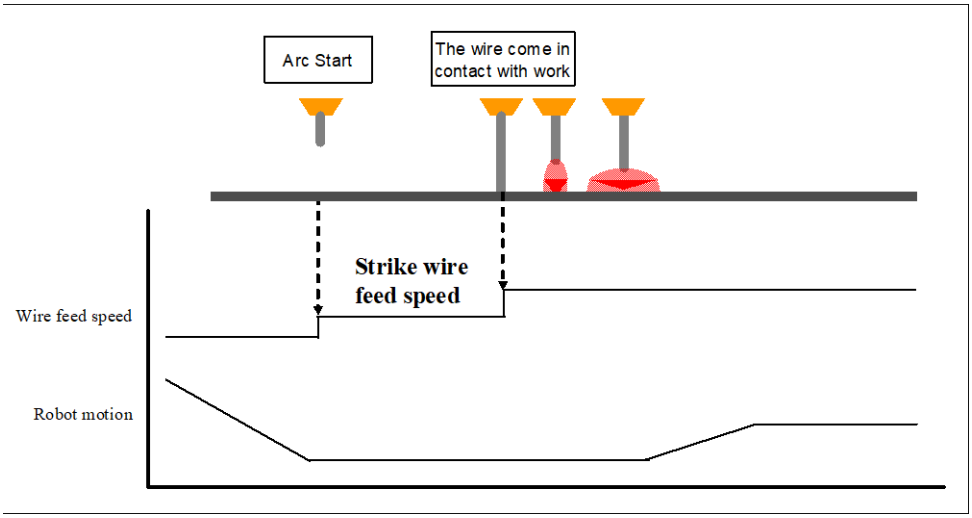


Fig. 4.1.1 (a) Strike wire feed speed

Strike Wire Feed Speed

Strike wire feed speed is the wire feed speed from the beginning of the execution of the arc start instruction to the contact of the wire to work (refer to Fig.4.1.1 (a)). Normally, it is not necessary to change strike wire feed speed from a standard value (125cm/min). Lincoln welding power supply can adjust the strike wire feed speed when users do not obtain arc start with enough quality.

Strike wire feed speed can be defined in each weld procedure. This content is the bottom of a weld procedure screen.

```
DATA Weld Procedure         1                           .
                                                1/8
   -  Procedure             1 [                 ]
      Weld equipment        1
      Manufacturer:         Lincoln Electric
      Model:                PowerWave+Enet
      File name:            AWE1WP01
      Schedules:            3

      Runin :                        ENABLED
      Burnback:                      ENABLED
      Wirestick reset:      3        ENABLED

      Gas purge:                  0.35  sec
      Gas preflow                 0.00  sec
      Gas postflow:               0.00  sec
      Strike wire feed speed       125  cm/min

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

4.1.2 Gas Control just before Weld Start

There are two functions for executing gas control just before weld start: Gas Purge function and Gas Preflow function.

Gas Purge Function

Gas purge function improves arc start quality without increasing cycle times by starting gas flowing before robot arrives arc start position and still be moving. Only the additional motion instruction type weld instructions support the function.

Gas Preflow Function

On the other hand, gas preflow function also improves quality by starting gas flowing during assigned time after robot arrived. The additional motion instruction type and single type weld instructions support the function but the cycle time increases preflow time.

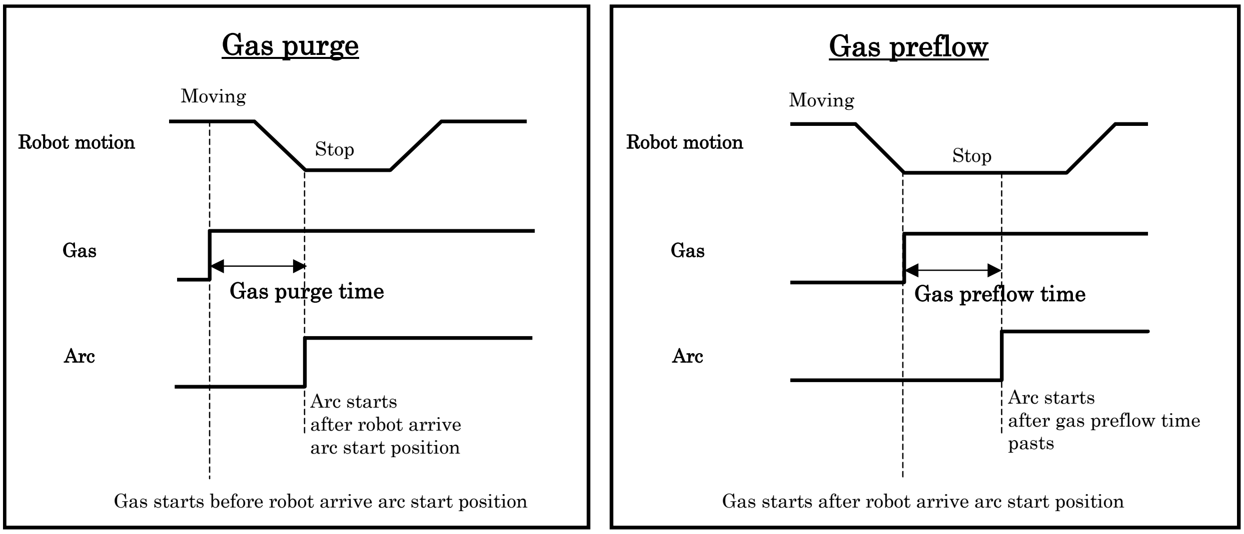


Fig. 4.1.2 (a) Timing chart of gas purge and gas preflow

Gas purge time and gas preflow time are setup in each weld procedure. When a time is zero, the corresponding function becomes disabled.
In standard is that gas purge time is 0.35 sec and gas preflow time is 0 sec, so gas purge function is executed every additional motion instruction type weld instruction and gas preflow function is never executed without setup the time manually.

```
Data Weld Procedure                                    .
                                            1/8
   -  Procedure               1 [                ]
      Weld equipment          1
      Manufacturer:           Lincoln Electric
      Model:                  PowerWave+Enet
      File name:              AWE1WP01
      Schedules:              3

      Runin :                         ENABLED
      Burnback:                       ENABLED
      Wirestick reset:        3       ENABLED

      Gas purge:                   0.35  sec
      Gas preflow                  0.00  sec
      Gas postflow:                0.00  sec
      Strike wire feed speed        125  cm/min

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

> **⚠NOTE**
> 1 When gas purge time is longer than the moving time of the weld start added motion instruction, gas purge is executed during the moving time.
> 2 Both of gas purge time and gas preflow time setup in a weld procedure, both of the function are executed when the weld procedure is selected.

4.1.3 Adjustment of Weld Schedule at Weld Start Position

Runin Function

Runin function requests specified welding commands with the torch stops at the weld start position. This function is used for arc start executes smoothly by requested different current/voltage commands from welding. Command values and delay time for runin can be specified on each weld procedure.

In standard is that the function is disabled, when you would like to use it, set up the configurations with Procedure 4-1-3.

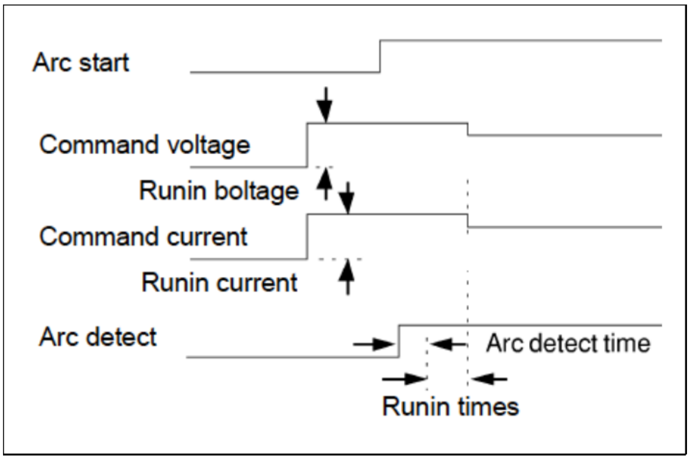


Fig. 4.1.3 (a) Runin function

Procedure 4-1-3 Setup of Runin Function

Step

1 Press the [DATA] key and press F1[TYPE] and select “Weld Procedure”. Weld Procedure data screen will be displayed.

2 Move cursor to “Procedure” you would like to use and press F2 “DETAIL”. The following screen will be displayed.

```
DATA Weld Procedure         1                          .
                                        1/8
   -  Procedure            1 [                ]
      Weld equipment       1
      Manufacturer:        Lincoln Electric
      Model:               PowerWave+Enet
      File name:           AWE1WP01
      Schedules:           3

      Runin :                       ENABLED
      Burnback:                     ENABLED
      Wirestick reset:     3        ENABLED
   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

3 Move the cursor to [Runin]. If it needs to be enabled, press F4 [ENABLED]. If it needs to be disabled it, press F5 [DISABLED].

```
DATA Weld Procedure        1                           .
                                        1/8
   -  Procedure            1 [                ]
      Weld equipment       1
      Manufacturer:        Lincoln Electric
      Model:               PowerWave+Enet
      File name:           AWE1WP01
      Schedules:           3

      Runin :                       ENABLED
      Burnback:                     ENABLED
      Wirestick reset:     3        ENABLED
   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

4 Next, setup Runin schedule. Move cursor on “Schedules” in the weld procedure and press F2 [DETAIL]. The following screen will be displayed.

```
DATA Weld Procedure          1                         .
                                          1/10
  + Procedure               1 [             ]
     +  Mode               22 [Pulse         ]
     -  Schedules
 Schedule #    Amps   Volts    Speed     Time
 Runin        200.0    20.0              0.00
 Schedule  1  200.0    20.0     20.0     0.00
 Schedule  2  200.0    20.0     20.0     0.00
 Schedule  3  200.0    20.0     20.0     0.00
 Burnback     130.0    16.0              0.10
 Wirestick    200.0     0.0              0.10
 OnTheFly       5.0     0.1      1.0

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

5 Move cursor to the schedule of Runin and change the command value if necessary.

⚠CAUTION
1 Even if the runin is enable, runin is not executed when “Delay Time” is 0sec.
2 When you set the Runin enable and Delay Time, it is applied to all the welding parts where the corresponding process selection number is used. When both the Runin applying part and the Runin not applying part exists for one process mode, please assign the process mode number to two process selection number. One side set the Delay Time and the other side does not set the Delay Time.

4.1.4 Retry after Weld Start Failed

There are two functions to retry weld start after weld start failed: Repeat Touch Retry Function and Scratch Start Function.

Repeat Touch Retry Function

When arc is not generated at arc weld start instruction, Repeat Touch Retry Function retry start of welding at the same position (weld start position) by the motion of the Figure below. If arc is not generated after this motion, Scratch Start function works.

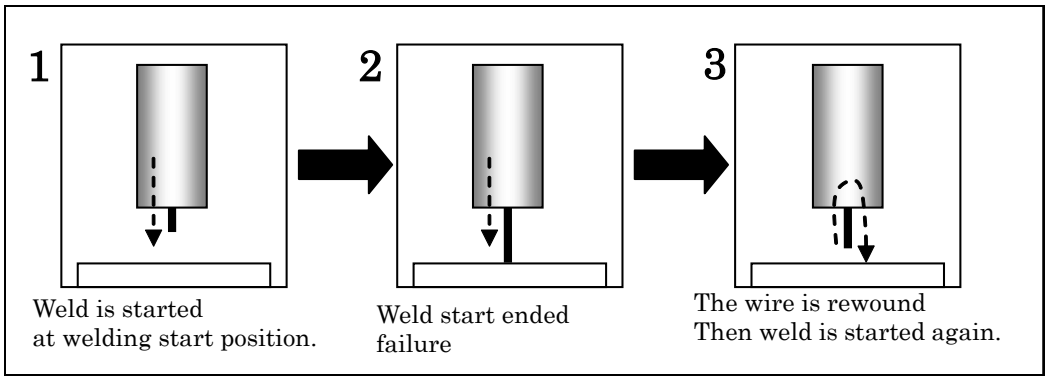


Fig. 4.1.4 (a) Repeat Touch Retry Function

In standard, Repeat Touch Retry is enabled and retry count is 2 The following procedure 4-1-4 (a) shows the setup procedure of Repeat Touch Retry function.

Operation 4-1-4 (a) Setup of Repeat Touch Retry Function

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below and the following screen will be displayed.

```
SETUP Weld System                                    .
                                                10/22
    Scratch Start Function
     10 Scratch Start:           ENABLED
     11 Distance:                5    mm
     12 Return to start speed:   100  mm/s
     13 Retry count:             1
    Repeat Touch Retry Function
     14 Repeat Touch Retry:      ENABLED
     15 Retry count:             2

 | [TYPE] |  |  | ENABLED | DISABLED |  |
```

3 Move the cursor to [14 Repeat Touch Retry]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].

4　Change the value of [Retry count] if necessary.

Scratch Start Function

When arc is not generated at arc weld start instruction, scratch start function is performed (refer to Fig. 4.1.4(b)). The top of the wire moves from arc start position to next target position by specified distance. When arc generates during this process, the top of the wire returns to welding starting position at once and the welding program is continued.

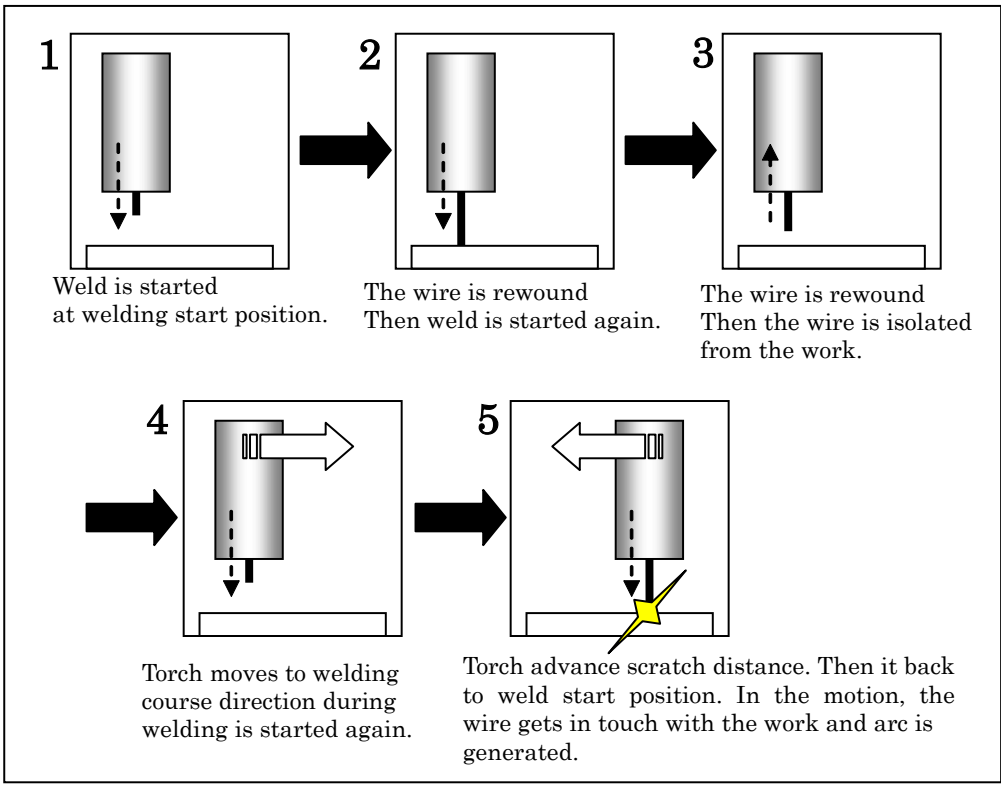


Fig. 4.1.4 (b) Scratch start function

Scratch start has the following three setting items.

Scratch return speed

This is the returning speed from the arc generating position during scratch motion. When this value is too low, some holes are generated at work since heat gain increases by the arc output during returning motion. So please set this value to high as much as possible.
When robot approach change rapidly in the motion like a circular motion, robot cannot reach the speed; for example, when robot approach changes rapidly, the scratch return speed may become 30 mm/sec even if the command is 100 mm/sec.

Scratch distance

This is the maximum distance that robot moves during scratch motion. When the arc does not generate even if the top of the wire moves by this distance, alarm is generated. When this value is too long, the area of heat insertion becomes large. So please set this value to short as much as possible.

Retry count

Specify the number of times of Scratch Return.
In the standard is that scratch start is enabled, scratch distance is 5 mm and scratch return speed is 100 mm/sec. Retry count is 1. Those settings support various welding from thin metal welding to heavy welding.
The following procedure 4-1-4 (b) shows the setup procedure of scratch start function.

Procedure 4-1-4 (b) Setup of Scratch Start Function

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below and the following screen will be displayed.

```
SETUP Weld System                                    .
                                                10/22
Weld Restart Function
  7 Return to path:                 ENABLED
  8 Overlap distance:               0     mm
  9 Return to path speed:           200   mm/s
Scratch Start Function
 10 Scratch start:                  ENABLED
 11 Distance                        5     mm
 12 Return to start speed:          100   mm/s
 13 Retry count:                    1
|  | [TYPE] |  |  |  | HELP |  |
```

3 Move the cursor to [10 Scratch start]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4 Change the value of [Distance] , [Return to start speed] and [Retry count] if necessary.

> ⚠**CAUTION**
> When the scratch start is executed in circular or circle arc motion, scratch return motion becomes linear motion. Please set [distance] to short because there is a possibility that the torch interferes with work in circular motion.

4.2 FUNCTION OF ARC WELDING END TIMING

Functions related to arc welding end timing are follows.

- Treatment of the top of wire at weld end timing (Wire burnback function)
- Check and reset of wire stick (Wire stick detect/reset function)
- Gas control at weld end timing (Gas end flow / post flow functions)

This section explains overview and using method of these functions.

4.2.1 Treatment of the Top of Wire at Weld End Timing

Generally at weld end timing, stuck of wire and the workpiece should be prevented and the shape of the top of wire should be adjusted for preventing the arc start failure at the next weld start position by executing wire burnback process. If wire burnback process is not done properly, the top of the wire will be stuck to a workpiece at weld ending or the head of wire becomes spherically and creates an bad influence to the next welding.

Stable wire burnback — The sphere is small

Unstable wire burnback — The sphere is big

Fig. 4.2.1 (a) Effect of wire burn back

Lincoln welding power supply requires that arc welding robot commands wire burnback process. When Lincoln welding power supply is connected, wire burnback function becomes ENABLED as default.

Therefore, wire burnback is always done at weld end timing. The following values are factory default values of wire burnback.

- Current:130A
- Voltage:16V
- Delay time:0.03 sec

When you do not obtain the enough burnback quality by the above-mentioned standard value, please bring the command values (voltage, current, WFS and Trim) close to the weld schedule value in arc welding. When the amount of burn is too large, please shorten the delay time.
The confirmation of wire burnback is enabled or not is described in Procedure 4-2-1 (a). The adjustment of it is described in Procedure 4-2-1 (b).

NOTE
Normally, do not set burnback to disabled and the process time to zero. If the process isn't executed, wire may burst.

Procedure 4-2-1 (a) Confirmation of wire burnback is enabled/disabled

Step

1 Press the [DATA] key and press F1[TYPE] and select "Weld Procedure".
2 Move cursor to "Procedure" you would like to use and press F2 "DETAIL". The following screen will be displayed.

```
Data Weld Procedure       1                          .
                                              1/8
  -  Procedure            1 [                 ]
     Weld equipment       1
     Manufacturer:        Lincoln Electric
     Model:               PowerWave+Enet
     File name:           AWE1WP01
     Schedules:           3

     Runin :                       DISABLED
     Burnback:                     ENABLED
     Wirestick reset:     3        ENABLED
   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

3 Check "Burnback" is enabled. If it is disabled, move cursor on the it and press F4 "ENABLED".

Procedure 4-2-1 (b) Adjustment of wire burnback schedule

Step

1 Press the [DATA] key and press F1[TYPE] and select "Weld Procedure".
2 Move cursor on "Schedules" in the weld procedure. and press F2 [DETAIL]. The following screen will be displayed.

```
DATA Weld Procedure                                  .
                                               1/10
  +  Mode                 22 [Pulse          ]
  -  Schedules
 Schedule #    Amps   Volts    Speed     Time
 Schedule  1   200.0   20.0     20.0     0.00
 Schedule  2   200.0   20.0     20.0     0.00
 Schedule  3   200.0   20.0     20.0     0.00
 Burnback      130.0   16.0              0.10
 Wirestick     200.0   20.0              0.10

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

3 Change the command in "Burnback" if necessary.

4.2.2 Check and Reset of Wire Stick

At weld end timing, there is a case to stuck the wire to workpiece by welding situation. For confirming the situation, Wire Stick Detect Function can be used. Additionally, Wire Stick Reset Function can cut the wire off by burning forcibly when wire is stuck.

Wire Stick Detect Function

Wire Stick Detect Function is the function that a weld equipment judges whether the wire is fixed or not during arc end (the timing of the execution of Arc End instruction, or pause the program during welding).

When the robot is moved even if a wire have stuck, the weld torch or a fixture may be bent. To prevent it, Wire Stick Reset is executed automatically or the following alarm occurs when wire stick is detected.

ARC-011 STOP.L Wire stick, not reset

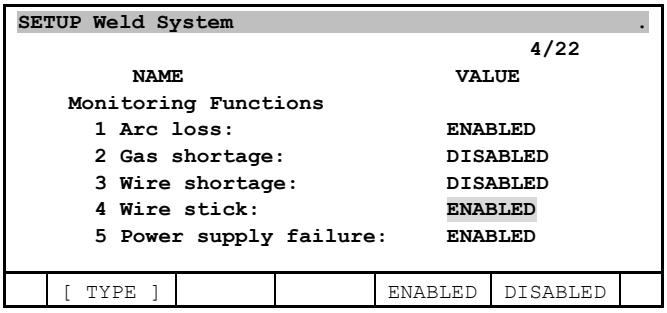
The function becomes ENABLED as default.

Procedure 4-2-2 (a) shows how to change the enabling/disabling Wire Stick Detect Function.

Procedure 4-2-2 (a) Enabled/Disabled wire stick detect function

Step

1 Press the [MENU] key. and select “6. SETUP”.
2 Press F1[TYPE] key and select “1,. Weld System”. the following screen will be displayed.



3 Move the cursor on “4. Wire stick”, when it becomes enabled, press F4 “ENABLED”, on the other hand, when it becomes disabled, press F5 “DISABLED”

Auto Wire Stick Reset Function

If a wire stick occurs at the end of welding, this function burns off the stick by applying a voltage for a fraction of a second.

You can set the total number of wire stick reset tries, commanded parameters and processing time to output. If a wire stick is detected again after wire stick reset, a wire stick reset is repeated. As a result, if wire stick is reset, the program execution is continued. After a wire stick reset is repeated a specified number of reset tries, if a wire stick is still detected, a weld alarm is posted and a robot motion is stopped.

ARC-012 STOP.L Wire stick reset(s) failed

The relation between Wire Stick Detect Function and Auto Wire Stick Reset Function are described in Fig. 4.2.2 (a). The setup procedure for Auto Wire Stick Reset Function is described in Procedure 4-2-2 (b).

The function becomes ENABLED as default. But when wire stick detect function is disabled, the function is never operated even if it is enabled.
Both of enable/disable the function and schedule are setup in each weld procedure.

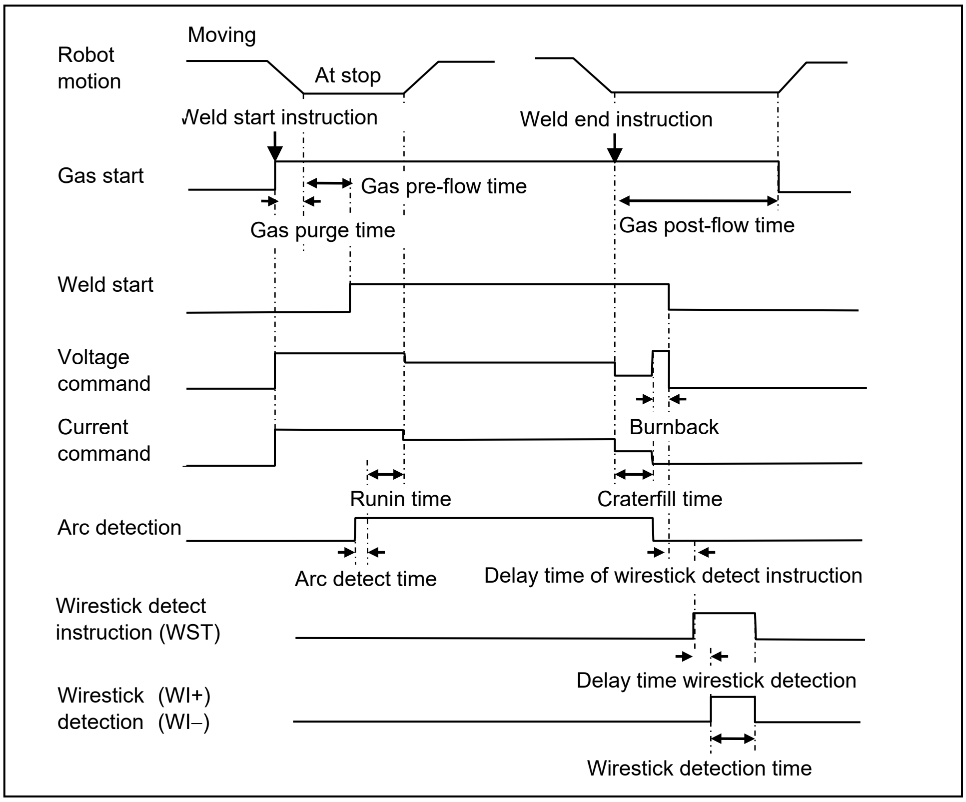


Fig. 4.2.2 (a) Wire stick detect and reset sequence

Procedure 4-2-2 (b) Setup Auto Wire Stick Reset Function

Condition

- Wire stick detect function is enabled.

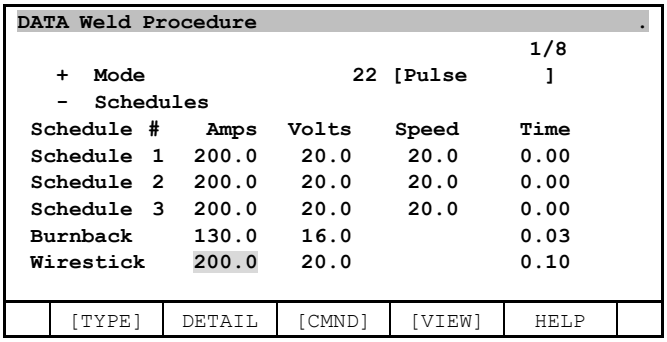
Step

1 Press the [DATA] key and press F1[TYPE] and select "Weld Procedure". Weld Procedure data screen will be displayed.
2 Move cursor to "Procedure" you would like to use and press F2 "DETAIL".
3 Move the cursor on "Wire stick reset", when it becomes enabled, press F4 "ENABLED", on the other hand, when it becomes disabled , press F5 "DISABLED"

```
DATA Weld Procedure          1                        .
                                            1/8
  -  Procedure               1 [                ]
     Weld equipment          1
     Manufacturer:           Lincoln Electric
     Model:                  PowerWave+Enet
     File name:              AWE1WP01
     Schedules:              3

     Runin :                     ENABLED
     Burnback:                   ENABLED
     Wirestick reset:        3   ENABLED
   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

4 The left content of enabled/disable of the function is setup the retry count of the function. it retry for up to 3 times.

5 Next, setup wirestick reset schedule. Move cursor on “Schedules” in the weld procedure and press F2 [DETAIL]. The following screen will be displayed.



6 Move the cursor on Wirestick in the schedules and change the command if necessary.

Treatment of Wire Stick State

When a wire sticks, Wire Stick Reset (Weld Equipment Setup Screen) is performed. But there is a case that wire still sticks after Auto Wire Stick Reset. Then, ARC-012 is posted.

When wire has still stuck after pressed [RESET] key, the following alarm occurs. The severity of the alarm is STOP.L, so you cannot perform program execution during wire stick.

ARC-030 STOP.L Wire stick is still detected

In this case, it is necessary to cut the wire by yourself. After you cut the wire, press [RESET] key and check that ARC-030 doesn’t occur.

Since the robot position is too difficult for cutting the wire, please jog the robot to refer to the following procedure.

Procedure 4-2-2 (c) Wire Cutting after Jogging a Robot

Step

1 Change 3 Mode Switch to T1 or T2.
2 Change a Teach Pendant Switch to ON.
3 **Press the [RESET] key while pressing the [SHIFT] key.** The severity of ARC-030 alarm changes from STOP.L to WARN. As a result, you can jog a robot.
4 Set a low speed override and carefully jog a robot. Then, cut the wire.
5 After cutting the wire, **once press the [RESET] key.** At the timing, wire stick detect is performed again and alarm is reset.

NOTE
You can jog a robot during wire stick state, but you cannot execute/resume a program. If you resume a program when the severity of ARC-030 is WARN, “INTP-106 Continue request failed” is posted.

External Output of Wire Stick Alarm

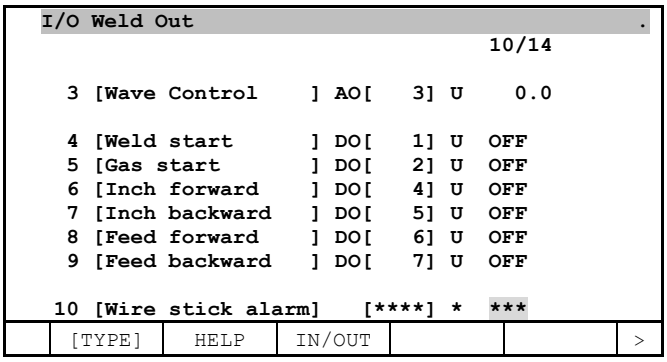
It is possible to output the wire stick state by Wire Stick Alarm Output Signal.
Wire Stick Alarm Output Signal is continued to output while the wire sticks (Wire Stick Detect Input Signal is ON) with Wire Stick Detect Function ENABLED (Weld System Setup Screen). If Auto Wire Stick Reset Function is ENABLED (Weld Equipment Setup Screen), the signal is output after wire stick reset and wire stick is still detected.

About the assignment of Wire Stick Alarm Output Signal, refer to Procedure 4-2-2 (d).

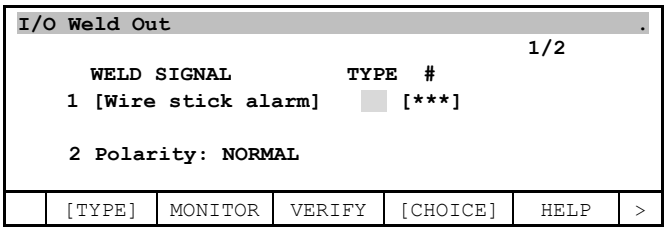
Procedure 4-2-2 (d)　Assignment of wire stick alarm output signal

Step

1 Press the [MENU] key and select ”5 I/O”. and Press F1[TYPE] key and select”Weld”. Either Weld Input screen or Output screen will be displayed.
2 When Weld Input screen is displayed, press F3 “IN/OUT”.
3 Move cursor on “Wire stick alarm”.



4 Press the [NEXT] key and F3 “Config”, the following screen will be displayed.



5 Select signal type and number.
6 Press F3 “VERIFY” after press F2 “MONITOR” to check selected signal whether exists or not.
7 Cycle power the controller. After reboot it, selected signal is assigned as wire stick alarm output signal.

4.2.3 Gas Control at Weld End Timing

At the weld end timing, gas flow continues automatically until all the weld end processes (burnback, wire stick detect, reset, etc.) are finished. This is called “Gas End Flow”. The time of gas end flow becomes the time of both burnback and wire stick detect/reset processes, but the time for wire stick detect process is changed by the wire stick status. Therefore, gas end flow time never becomes constant.

After craterfill process, if you always would like to perform gas flow with the constant time over gas end flow time on the weld end point, you can use gas post flow function. Gas post flow function can be used by setting gas post flow time.

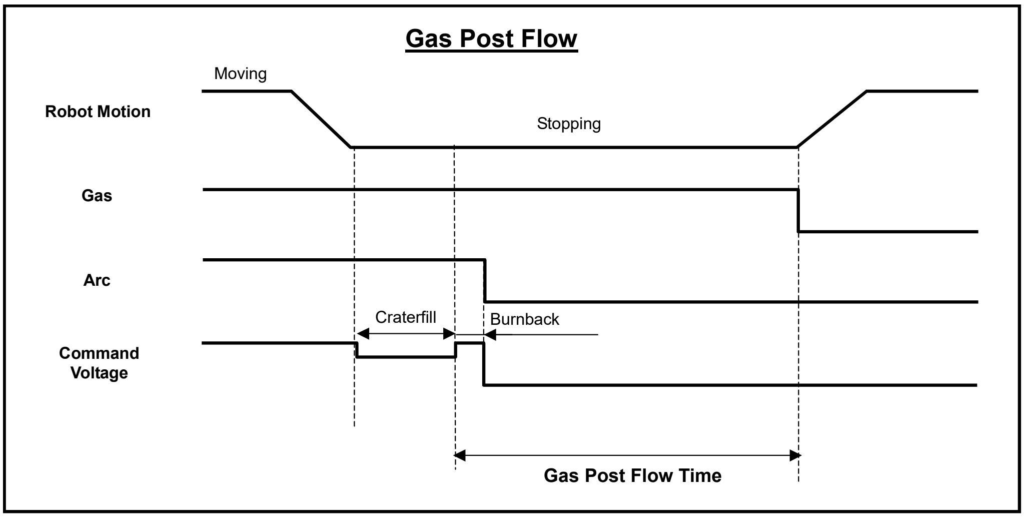


Fig. 4.2.3 (a) Timing Chart of Gas Post Flow

Robot stops until finishing gas post flow, so the setup of gas post flow time influences the cycle time. As Fig 4.2.3 (a), the count of gas post flow time starts just after craterfill process is completed, so burnback time and wire stick detect/reset time (gas end flow time) are included in gas post flow time. As a result, gas flow stops and robot moves to the next motion after finishing the longer process between gas end flow and gas post flow.

Gas post flow function is applied when the weld procedure which sets the gas post flow time is specified on Weld End instruction. When 0 sec is specified as gas post flow time, this function becomes disabled. 0 sec is specified as default, so normally gas end flow is applied.
Gas post flow can be used with both additional-motion instruction or single instruction of Weld Start instruction.

```
Data Weld Procedure                                 .
                                              1/8
   -  Procedure              1 [                  ]
      Weld equipment         1
      Manufacturer:          Lincoln Electric
      Model:                 PowerWave+Enet
      File name:             AWE1WP01
      Schedules:             3

      Runin :                    ENABLED
      Burnback:                  ENABLED
      Wirestick reset:       3   ENABLED

      Gas purge:                  0.35  sec
      Gas preflow                 0.00  sec
      Gas postflow:               0.00  sec
      Strike wire feed speed       125  cm/min

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

4.3 OTHER FUNCTION RELATED TO ARC WELDING

This section describes several useful functions supporting arc welding with robots.

- Auto recovery to pause position (Return to Path Function)
- Gas control by external devices (Remote Gas Purge Function)
- Wire feed control by external devices (Remote Wire Inching Function)
- Monitoring Functions
- Weld External Output Function
- Used Wire Estimation
- Torch Guard Function
- Auto recovery of TCP gap (Torch Mate Function)
- Arc Abnormal Monitor Function
- Arc Welding Analogue Meter Displaying Function
- Touch Sensing Function

4.3.1 Auto Recovery to Pause Position

Return to Path Function (Original Path Resume Function) enables the weld from a breakpoint if the weld motion is interrupted by HOLD or Alarm and then the robot is move away. First, a robot moves to a breakpoint without welding and then restarts welding from the point by resuming a program. For resuming a welding from a breakpoint, you need to set a weld to ENABLED.

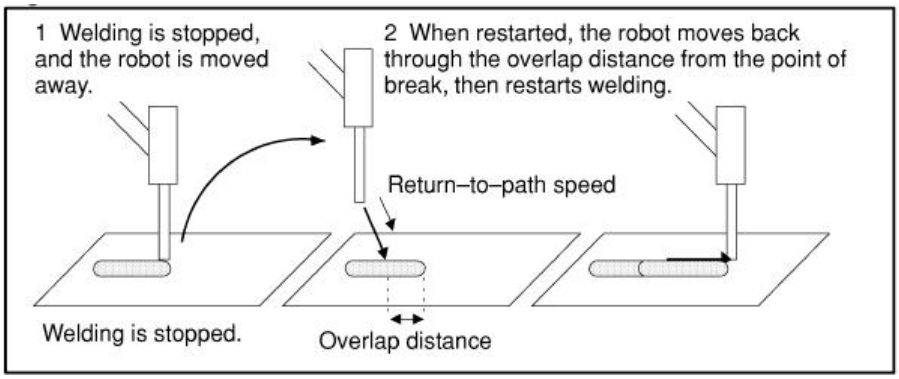


Fig. 4.3.1 (a) Return to path function

Additionally, when a program is stopped without welding and robot moves to away, robot moves to break point at first and restart the program.
The following two setting items are prepared for Return to Path Function.

Overlap Distance

When directed to restart, the robot moves back from the breakpoint through the overlap distance, then restarts welding. This is intended to prevent the sequence of beads from being out. If the specified overlap distance extends beyond the previous teaching point, the actual overlap distance is limited to within that teaching point.

Return to Path Speed

Specifies the return-to-path speed at which the robot moves to the breakpoint when restarted.

In the standard is that return to path function is enabled, Overlap distance is 0 mm and Return to path speed 200 mm/sec. normally, please use it with enabled.

⚠CAUTION
1 In the case of this function DISABLE, welding is restarted from current position when JOG operation is executed during welding. The welding pass becomes from current position to the next target position. So please set this function enable normally.
2 When operator restarts the program after robot is moved by JOG at HOLD for avoiding interference with work, welding restarting position is the position that HOLD is executed. So robot returns the HOLD position. To avoid this problem, please do the backward execution momentarily at the JOG position.

NOTE
Overlap distance is used only when a program is stopped during welding motion. When robot restart with weld disabled or the program is stopped without welding, the distance is ignored.

Following procedure 4-3-1 shows the setup procedure for return to pass function.

Procedure 4-3-1 Setup of Return to Pass Function

Step
1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below. The following screen will be displayed.

```
SETUP Weld System                                    .
                                                 7/22
  Weld Restart Function
  7 Return to path:                 ENABLED
  8 Overlap distance:               0     mm
  9 Return to path speed:           200   mm/s
Scratch Start Function
 10 Scratch start:                  ENABLED
 11 Distance                        5     mm
 12 Return to start speed:          100   mm/s

[TYPE]                                        HELP
```

3 Move the cursor to [7 Return to path]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4 Please change the value of [Overlap distance] and [Return to path speed] if necessary.

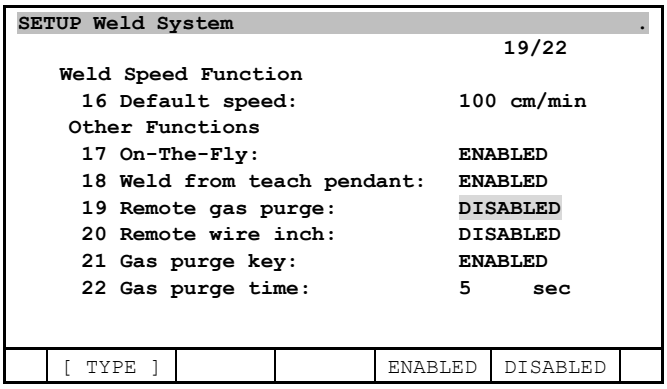
4.3.2 Gas Control by External Devices

Remote Gas Purge Function
Remote gas purge function is the function to execute the gas purge by the external input signal. When you use this function, gas check can be executed without teach pendant.

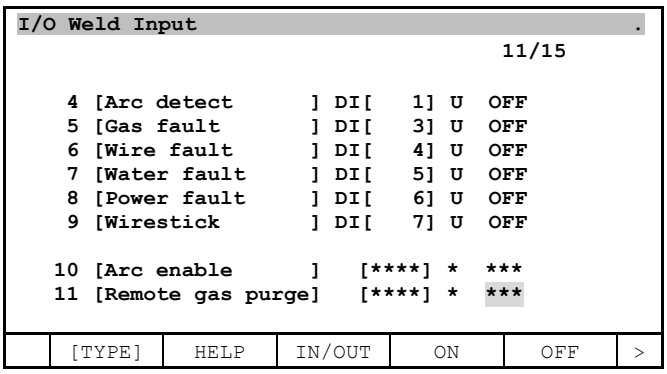
If you would like to use this function, please execute the following setting procedure.

Procedure 4-3-2 Setup Remote Gas Purge Function

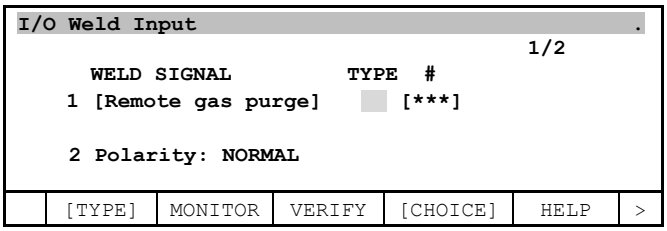
Step
1 Press the [MENU] key and select [6 SETUP]. Then press F1[TYPE] key and select “Weld System”, Weld System Setup screen will be displayed. Move a cursor to the bottom and then the following screen will be displayed.



2 Move cursor on “Remote gas purge”, when it needs to be enabled, press F4 “ENABLED” when it needs to be disabled press F5 “DISABLED”.
3 Next, assign the input signal. Press [MENU] key and select “5 I/O” and Press F1[TYPE] key and select “Weld”. Either Weld Input screen or Weld Output screen will be displayed.
4 When Weld Output screen will be displayed, press F3[IN/OUT] and change to Weld Input screen.



5 “Remote gas purge” signal will be appeared at the bottom of Weld Input screen only when remote gas purge function is enabled at step 2 in the procedure
6 Move cursor on “Remote gas purge” and press [NEXT] key and F3 “Config”, the following screen will be displayed.



7 Select signal type and number.
8 Press F3 “VERIFY” after press F2 “MONITOR” to check selected signal whether exists or not.
9 Cycle power the controller. After reboot it, selected signal is assigned as remote gas purge output signal.
10 When a signal is input through the signal assigned as remote gas purge signal (remote gas purge input signal becomes ON), robot request gas output signal and gas purge will be performed.

4.3.3 Wire Feed Control by External Devices

Remote Wire Inching Function

Remote wire inching function is the function to execute the wire inching (forward / backward) by the external input signal. When you use this function, wire inching can be executed without teach pendant.

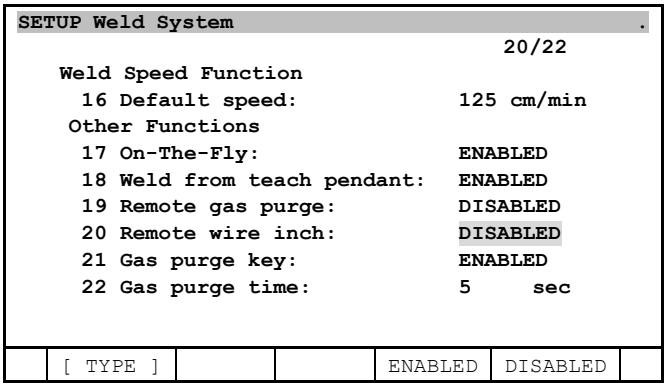
Remote wire inching speed and manual wire inching (using teach pendant) speed can be independently set.

If you would like to use this function, please execute the following setting procedure.

Procedure 4-3-3 Setup Remote Wire Inching Function

Step

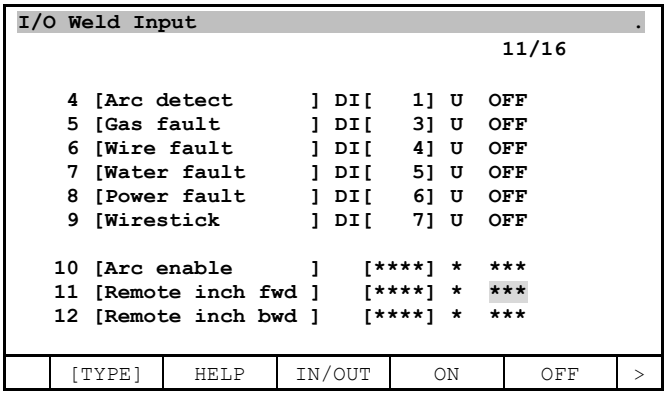
1 Press the [MENU] key and select “6. Setup”. and press F1[TYPE] key and select “Weld System”, Weld System Setup screen will be displayed. Move a cursor to the bottom and then the following screen will be displayed.



2 Move cursor on “Remote wire inching”, when it needs to be enabled, press F4 “ENABLED” when it needs to be disabled press F5 “DISABLED”.

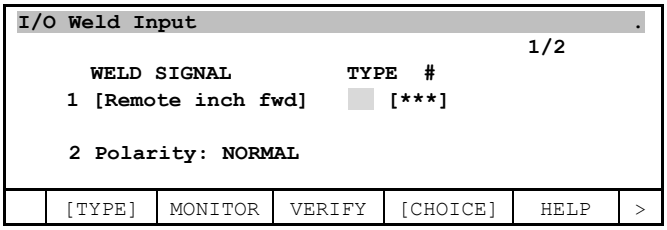
3 Next, assign the input signal. Press [MENU] key and select “5 I/O” and Press F1[TYPE] key and select “Weld”. Either Weld Input screen or Weld Output screen will be displayed.

4 When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.



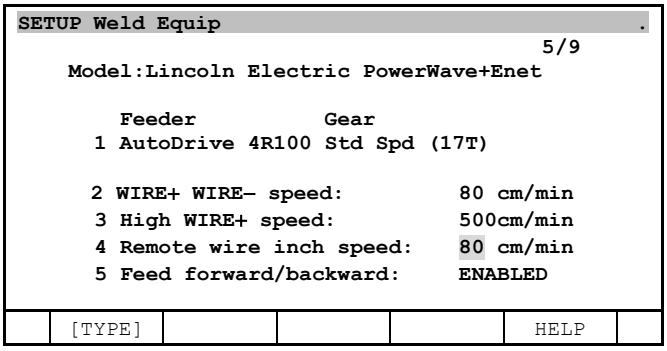
5 “Remote inch fwd” and “Remote inch bwd” signals will be appeared at the bottom of Weld Input screen only when remote gas purge function is enabled at step 2 in the procedure.

6 Move cursor on “Remote inch fwd” and press NEXT key and F3 “Config”, the following screen will be displayed.



7 Select signal type and number.

8 Press F3 “VERIFY” after press F2 “MONITOR” to check selected signal whether exists or not.
9 Assign “Remote inc bwd” with same steps (Refer to step.6 to 8)
10 Cycle power the controller. After cycle power, selected signal is newly assigned.
11 At last, setup remote wire feed speed. Press the [MENU] key and select “6. Setup” and press F1[TYPE] key and select “Weld Equip”. Weld Equipment Setup screen will be displayed.



12 “Remote wire inch speed” will be appeared below on “High Wire+ speed” only when remote wire inching function is enabled. Input the speed of remote wire inching.
13 When “Remote inch fwd” signal becomes ON, wire feeding to forward, on the other hand, “Remote inch bwd” signal becomes ON, wire feeding to backward.

4.3.4 Monitoring Functions

These functions are for monitoring abnormal state during arc welding. Monitoring functions have following six functions.

- Arc Loss Detect
- Gas Shortage Detect
- Wire Shortage Detect
- Wire Stick Detect
- Power Supply Failure Detect
- Coolant Shortage Detect

Subsection 4.2.2 describes wire stick detect function more detailed, please see the subsection about it.

Arc Loss Detect

The function posts an alarm and stops the welding and robot motion if the arc is lost during the fixed time of the welding.

Enabled/Disabled this function is set by Weld System Setup Screen. Allowance time of arc loss is defined on Weld Equipment Setup screen. If the arc detect signal is not returned over the time, the following alarm occurs and the welding and robot motion are stopped.

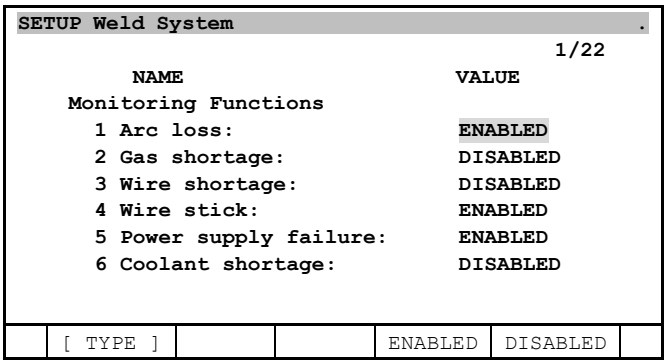
“ARC-018 Lost arc detect”

In the standard in that this function is enabled. Normally, please use it with enabled.

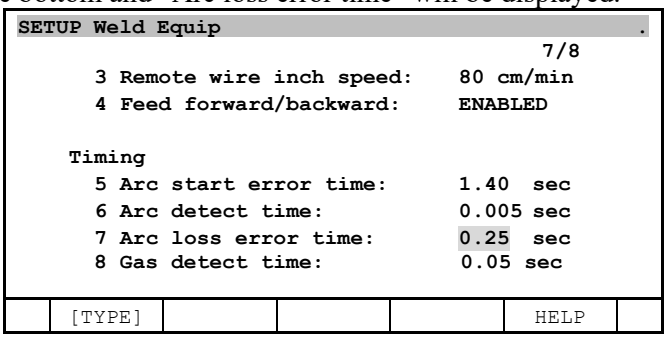
Procedure 4-3-4 (a) Setup Arc Loss Detect

Step

1 Press the [MENU] key and select “6. SETUP”.
2 Press F1[TYPE] key and select “Weld System”. The following screen will be displayed.



3 Move cursor on “Arc Loss”. When it needs to be enabled, press F4 “ENABLED” when it needs to be disabled press F5 “DISABLED”.
4 When the function becomes enabled in step 3, setup arc error detect time.
Press F1[TYPE] key and select “Weld Equip”. Weld Equipment Setup screen will be displayed.
5 Move cursor to the bottom and “Arc loss error time” will be displayed.



6 In the standard is that the time is 0.25 sec, change the command if necessary.
7 The status of arc loss can output other devices through digital output, for more details , please see Subsection 4.3.5 Weld external output function.

Power Supply Failure Detect

Power Supply Failure Detect signal will become ON if internal of weld equipment is abnormal. If the welding is requested when the input signal is ON, or if the signal becomes ON during welding, the following alarm occurs and the welding and robot motion are stopped.

“ARC-008 Power supply fault”

If the input signal is ON, please specify the cause by using “6.3 REMEDY FOR TROUBLES”.
In the standard in that this function is enabled. Normally, please use it with enabled.

Gas, Wire, Coolant Shortage Detect

these functions are not supported as default. Therefore, they are DISABLED as factory default. If you use these functions, please prepare and mount the sensors yourself and operate Procedure 4-3-4 (b). (FANUC does not prepare these sensors.)
When gas/wire/coolant supply become abnormal, sensors detect it and send some signals to the robot controller. The robot controller is monitoring them and when it receives the signals, the following alarms occurs, and the welding and robot motion are stopped.

- **Gas Shortage Detect --- “ARC-005 Gas fault”**
- **Wire Shortage Detect --- “ARC-006 Wire fault”**
- **Coolant Shortage Detect --- “ARC-007 Water fault”**

Enabled/disabled the functions are set on Weld System Setup screen. Next, the assignment of input signals from sensors to the robot controller is required.

Gas shortage detect function has the setup item "Gas Shortage Detect Time". Normally, this delay time exists since robot controller outputs gas signal and gas valve opens until gas arrives to the sensor for gas shortage detect. "Gas Shortage Detect Time" allows the delay time. If the alarm signal is input after the delay time passed, a weld alarm occurs. You should set appropriate value to Gas Shortage Detect Time according to your gas system structure.

> ⚠**CAUTION**
> 1 If Gas Shortage Detect Function becomes ENABLED, the delay time for Gas Shortage Detect Time is generated at arc start timing. Therefore, the cycle time is also increased. Do not set Gas Detect Function to ENABLED if you do not use the sensor for gas shortage detect.
> 2 If Gas Shortage Detect Time is too short, "ARC-005 Gas fault" might occur at every arc start timing. If so, set it longer time.

Procedure 4-3-4 (b) Setup of Gas, Wire, Coolant Shortage Detect Function

Step

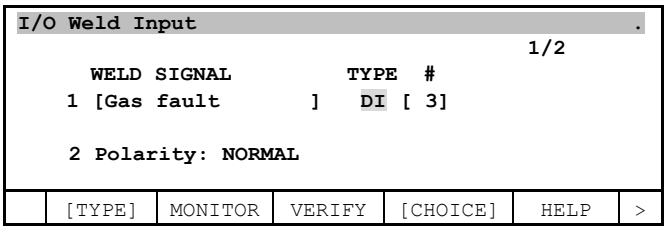
1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] and select [Weld System]. The following screen will be displayed.

```
SETUP Weld System                                          .
                                                     2/22
          NAME                          VALUE
    Monitoring Functions
      1 Arc loss:                       ENABLED
      2 Gas shortage:                   DISABLED
      3 Wire shortage:                  DISABLED
      4 Wire stick:                     ENABLED
      5 Power supply failure:           ENABLED
      6 Coolant shortage:               DISABLED

   [ TYPE ]                    ENABLED  DISABLED
```

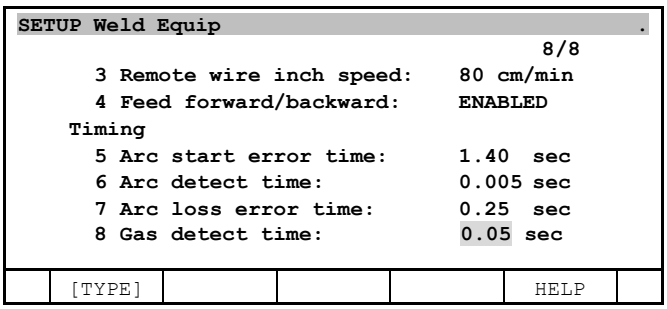
3 Move the cursor on the item, which you would like to set. If you set the function to ENABLED, press F4 "ENABLED". If you set the function to DISABLED, press F5 [DISABLED].
4 Next, assign the input signals. Press [MENU] key and select "5 I/O" and press F1[TYPE] key and select "Weld". Either Weld Input screen or Weld Output screen will be displayed.
5 When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.

```
I/O Weld Input                                             .
                                                 5/16

    4 [Arc detect      ] DI[   1] U  OFF
    5 [Gas fault       ] DI[   3] U  OFF
    6 [Wire fault      ] DI[   4] U  OFF
    7 [Water fault     ] DI[   5] U  OFF
    8 [Power fault     ] DI[   6] U  OFF
    9 [Wirestick       ] DI[   7] U  OFF

   10 [Arc enable      ]   [****] *  ***

   [TYPE]    HELP    IN/OUT    ON    OFF    >
```

6 Move the cursor on Gas Alarm, Wire Alarm or Coolant Alarm. Then, Press [NEXT] key and press F3[CONFIG]. The following screen will be displayed. (Following screen is the example of Gas Alarm.)



7 Select the port type and port number for the input signal from the sensor.
8 Check the existence of the selected signal by F3 [VERIFY], and press F2 [MONITOR].
9 Cycle power the controller. After reboot it, the selected signal is newly assigned.
10 If Gas Shortage Detected Function is set, you must also set Gas Shortage Detect Function. Please also carry out Step 11 or later
11 Press the [MENU] key and select [6 SETUP]. Press F1 [TYPE] and Select [Weld Equip].
12 Move the cursor to below. [Gas detect time] will be displayed. Input the desired value to this item.



13 You can output the gas, wire and coolant shortage state to external as digital signal. Please refer to [External Output Function for Weld Signals] and setup on the next subsection.

4.3.5 Weld External Output Function

Weld external output function is a function to output various signals that relate to the welding to an outside device such as PLC. The screen to set this function is shown below. Table 4.3.5 (a) shows setup items on this screen and the explanation. Setup procedure of this function is shown in Procedure 4-3-5 (a).

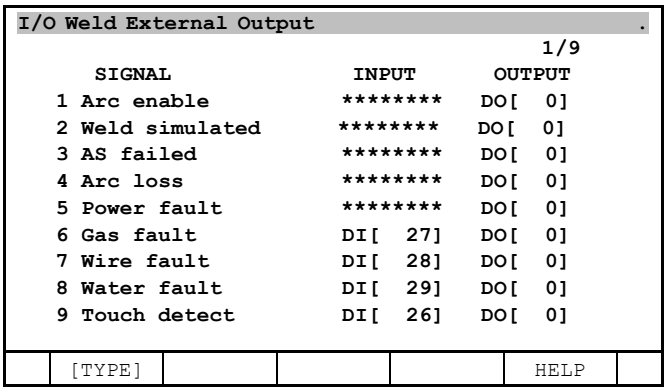


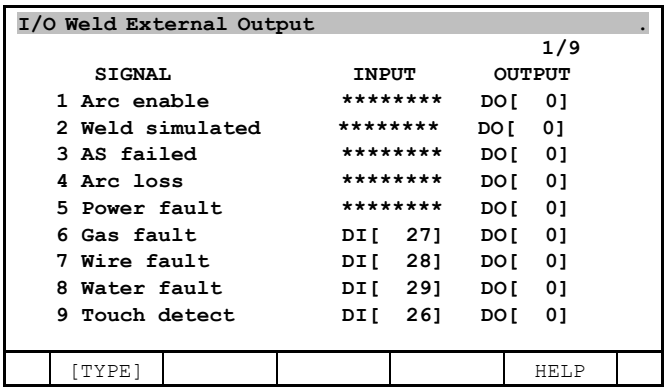
Table 4.3.5 (a) weld signals and the explanation

Signal	Explanation
Arc enable	This signal is output when weld enable. This signal is turned ON/OFF according to the state (weld enable/disable of each equipment). The state of weld enable/disable is displayed on the TEST CYCLE Arc screen.
Weld Simulated	This signal is output when weld simulated mode is enabled. Regarding to the details of weld simulated mode, please refer to Section 5.7 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).
AS failed	This signal is output when Arc Start fails. When this signal is ON, an alarm of **[ARC-013 Arc Start failed]** generates at the same time. When this alarm is reset, this signal is OFF.
Arc loss	This signal is output when the Arc loss generates. When this signal is ON, an alarm of **[ARC-018 Lost arc detect]** generates at the same time. When this alarm is reset, this signal is OFF.
Power fault	This signal is output when it is impossible to communicate with the weld equipment. Moreover, this signal is also output when ArcTool software detects the abnormal state in the weld equipment. This signal is output until [ARC-051 Weld EQi ONLINE: ArcLink] is displayed after turning on the power supply.
Gas fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Gas fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Gas shortage] on the SETUP weld system screen.(If the signal is valid and becomes ON, ARC-003 or ARC-005 alarm occurs as conventionally.)
Wire fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Wire fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Wire shortage] on the SETUP weld system screen. (If the signal is valid and becomes ON, ARC-006 alarm occurs as conventionally.)
Water fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Water fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Coolant shortage] on the SETUP weld system screen. (If the signal is valid and becomes ON, ARC-007 alarm occurs as conventionally.)
Touch detect	Touch detect signal is output when the wire contact with a work. This signal is output according to the state of the Touch sensing input signal. The signal is used for touch sensing function and torch mate function. **Reference:** The Touch sensing input signal turns ON in the state of Touch sensing output signal is ON when the wire contact with a work.

Procedure 4-3-5 (a) Setup of Weld external output function

Step

1 Press the [MENU] key then screen menu will be displayed.
2 Select the “5 I/O”.
3 Press the F1 [TYPE] and select “Weld Ext DO”. Following screen will be displayed.



4 Set the external output signal corresponding to each usage. When you set OUTPUT to 0, the output signal is invalid. When the specified value has already been used as weld input, [This NO. is already used as Weld Output] is displayed, back to before editing. When the specified value does not exist, [Port assignment is invalid] is displayed, back to before editing.

> **⚠CAUTION**
> In Step 4, the setting of the specified output signal is reflected at once. Therefore, there is a possibility that the signal is immediately turned on after this setting. Please confirm the number well before setting up it.

5 Concerning to [Gas fault], [Wire fault] and [Water fault], it requests to assign the signal of external sensor to weld I/O input. Please refer to Procedure 4-3-4 (b) about the method to assign.

Output weld equipment ready to weld signal

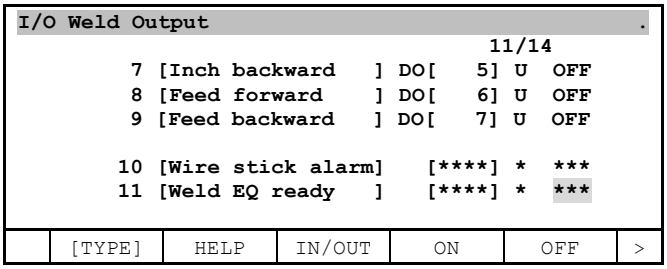
In addition to preceding signals, the output signal announcing that the weld equipment ready to weld to external device is provided.
At start up the controller and weld equipment 30 to 40 sec is required to establish connecting to weld equipment. This signal becomes ON after the establishment of communication. Since external devices checks robot can weld or not through the signal, users can check right and wrong of operations related to weld equipment and starting welding program on external devices.
This signal is displayed on Weld Output screen not Weld External Output screen. Procedure 4-3-5(b) describes the assignment of the signal.

Procedure 4-3-5 (b) Assignment weld equipment ready to weld signal

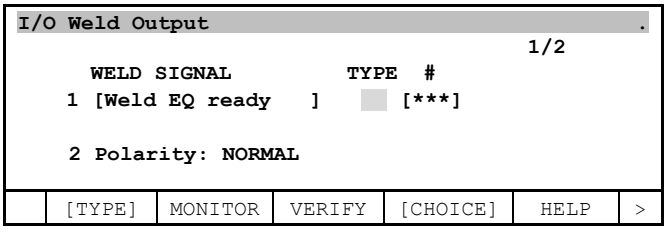
Step

1 Press the [MENU] key then screen menu will be displayed.
2 Select “5 I/O”.
3 Press F1[TYPE] key and select “Weld”. Weld Input screen or Weld Output screen will be displayed.

4　When Weld Input screen is displayed, press F3[IN/OUT] and change to Weld Output screen.



5　Move the cursor on “Weld EQ ready”, press NEXT key and press F3”CONFIG”. The following screen will be displayed.



6　Select the port type and port number for the input signal from the sensor.
7　Check the existence of the selected signal by F3 [VERIFY], and press F2 [MONITOR].
8　Cycle power the controller. After reboot it, the selected signal will be newly assigned.

4.3.6　Used Wire Estimation Function

Used wire estimation function derives the weight of used wire during welding continually and the remnant of the wire. This function also has alarm occurrence when the remnant is less than a threshold value, the supplementation of wire becomes rising efficiency.
This function supports only Power Wave R350, S350, R450 or R500.

Wire Information Screen

Wire information screen shows the remnant of wire and setup the material of wire etc. The method to display the screen is shown in Procedure 4-3-6 (a).
To calculate the used wire, please perform Procedure 4-3-6 (b) first.

Procedure 4-3-6 (a)　Display wire information screen

1　Show menu by pressed the [MENU] key.
2　Select “NEXT”.
3　Select “STATUS”.
4　Show Menu by pressed F1[TYPE].
5　Select “Wire”, then the following screen is appeared.

Wire information screen

```
STATUS Wire

      Current weight:            30.0 kg
  1   Warning weight:             5.0 kg
  2   Initial weight:            50.0 kg

  3   Warning signal:       DO[  1] S OFF

  4   Wire Diameter:              1.200mm
  5   Wire Material:              Steel
  6   Wire Density:               7.850 g/cm3
      …
 [TYPE]  RESET  kg/lb        HELP
```

Table 4.3.6 (a) The descriptions of the contents on wire information screen

Items	Description
Current weight	The weight of remaining wire.
Warning weight	Specify remaining weight for posting warning. When current weight is less than the value, An alarm occurs and the output specified at “Warning signal” becomes ON.
Initial weight	Specify the unused weight.
Warning signal	Specify the output that becomes ON when current weight is less than warning weight. Support DO and RO.
Wire diameter	Wire diameter used on the selected process mode is set.
Wire material	Specify the material of using wire. If steel, stainless or aluminum is used, select the material in the list. Otherwise, select “User defined” in the list and set wire density manually.
Wire density	When you select “User defined” on Wire material item, specify the density of wire manually. Otherwise, the proper value is automatically set according to wire material.

Procedure 4-3-6 (b) Setup Wire information

1 Select the units of weigh ant length by pressed F3 “kg/lb”. The following two types are supported.
- Weight : kg, Length : cm
- Weight : lb, Length : In

2 Move cursor to “Initial weight” and input the wire weight at unused.

3 Move cursor to “Wire material” and press F4[CHOICE], the following menu appears. Select the material of the wire in the menu, If there are no material in the menu, select “User defined”.

```
                  1
1 User defined
2 Steel
3 Stainless
4 Alum 4043
5 Alum 5356
```

4 If “User defined” is selected at step 4, The value of “Wire density” is initialized, specify the material of wire. Otherwise, the standard value of density of the selected material is setup automatically.

5 After any configurations have been setup, press F2 “RESET”.

NOTE
Wire diameter of current using weld mode uses as “Wire diameter” in the screen automatically.

If you would like to monitor warning wire, please perform the following procedure.

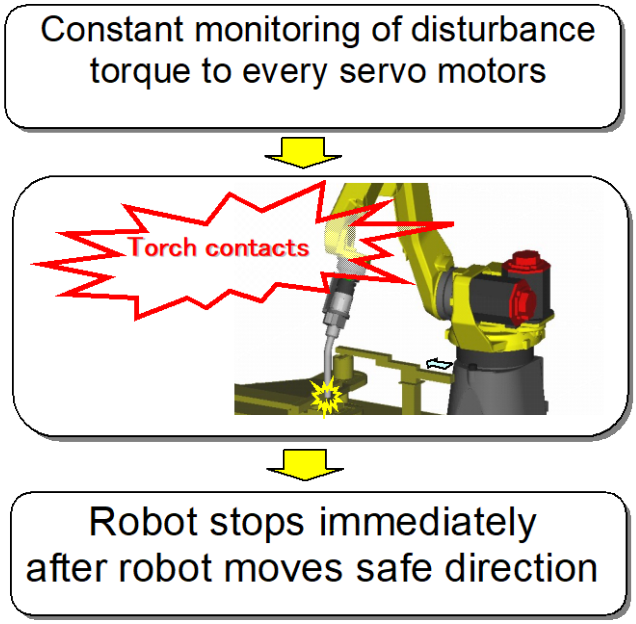
Procedure 4-3-6 (c)　Setup Warning wire information

Step

1　Move cursor on “Warning weight” and input threshold value.
2　Move cursor on “Warning signal” and select output port type and index.
3　When current wire weight is less than warning wire weight and warning signal becomes ON, press F2 “Reset” on the screen after complemented wire. Warning signal becomes OFF.

NOTE
Users cannot change warning weight when current wire weight is less than warning weight.

4.3.7　Torch Guard Function



Torch guard function avoid TCP(Tool Center Point) error with reducing damage to robot at torch interference by stopping robot motion immediately. Since TCP error doesn’t occur, even if an unexpected robot contact is occurs, the function provides to avoid time-consuming operation; re-setup TCP and re-teach weld program etc.

Since the contact is detected through constant monitoring of disturbance torques for every servo motors, the function detect contacts without additional sensor; shock sensor etc. and the robot stops after it moves to minimize disturbance torques, the damage to torch will be minimized.
This function can detect the contact between jig etc. and not torch but mechanical section of robot.

In the standard is that the function is enabled and it isn’t required some setting

4.3.8 Auto Recovery of TCP Gap

Torch Mate Function

Torch mate function detects and recoveries TCP(Tool Center Point) error with executing macro program for a few seconds. This function minimizes restoration time from abnormal status, since the function avoid re-teach weld program even if TCP error occurs.

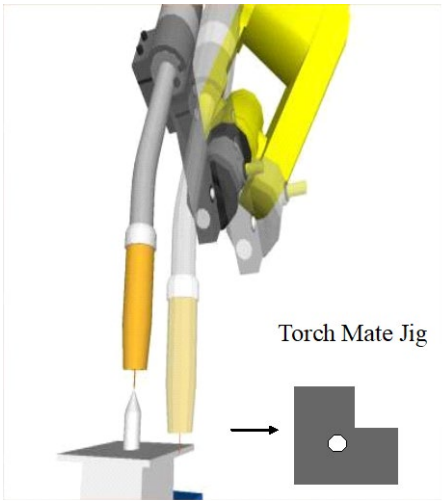


Fig. 4.3.8 (a) Torch Mate Function

Torch Mate function requires special software and hardware. The software has been installed, so, it isn't required an arrangement.
At hardware, torch mate jig and touch sensor circuit; detect to the wire touch the torch mate jig are required. Lincoln welding power supply has touch sensor circuit as standard, so it isn't required an arrangement.

About details of approach in the use of torch mate function, refer to Chapter 12 in Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).

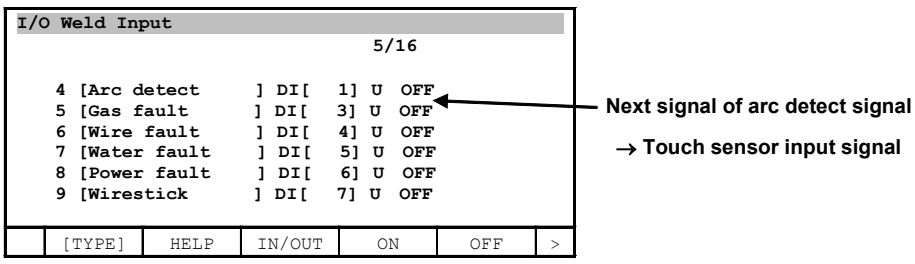
Assignment of I/O for Torch Mate Function

To use touch sensor circuit on Lincoln welding power supply for Torch Mate function, specify the port number of I/O of Torch Mate function on Torch Mate setup screen after confirming them on Weld I/O screen with Procedure 4-3-8.

Procedure 4-3-8 Confirm port numbers of touch sensor circuit

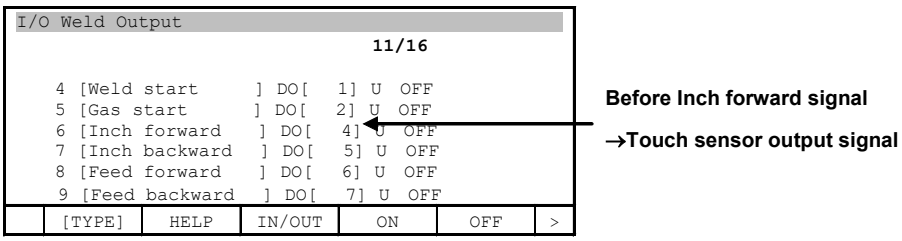
Step

1 Press the [MENU] key and select "5. I/O", and press F1[TYPE] key and select "Weld". Weld Input screen or Weld Output screen will be displayed.
2 When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.
3 Touch sensor input signal is the next port of arc detect signal; The following example, DI[2] is touch sensor input signal.



4　Press F3[IN/OUT] and change to Weld Input screen. Each analog and digital outputs are assigned correctly.

5　The port will be not used between gas start signal and inching forward signal. This signal will be corresponding to touch sensor output signal; In the following example, DO[3] becomes touch sensor output signal.



6　To use torch mate function, setup port number of the I/O in torch mate setup screen.
To use touch sensor function, setup port number on touch sensor I/O screen.

4.3.9　Arc Abnormal Monitor Function (Option)

Normally, when some bad conditions occur during arc welding, an operator needs to stand near the system, needs to check the weld conditions by an analog meter etc. ,and needs to chase the root cause.
Arc Abnormal Monitor Function monitors the actual current and voltage during arc welding, and it can inform the operator that some bad weldings occurred quickly by some alarms and output signals when these values exceed the thresholds (it is possible to stop the running program by alarms). This function makes the root cause analysis of the bad welding easier.
Additionally, Arc Weld Log function is included in Arc Abnormal Monitor Function. The function can save the actual current and voltage in output device for each weld bead, and it can also display graphs such as Fig. 4.3.9 (b) on Teach Pendant.

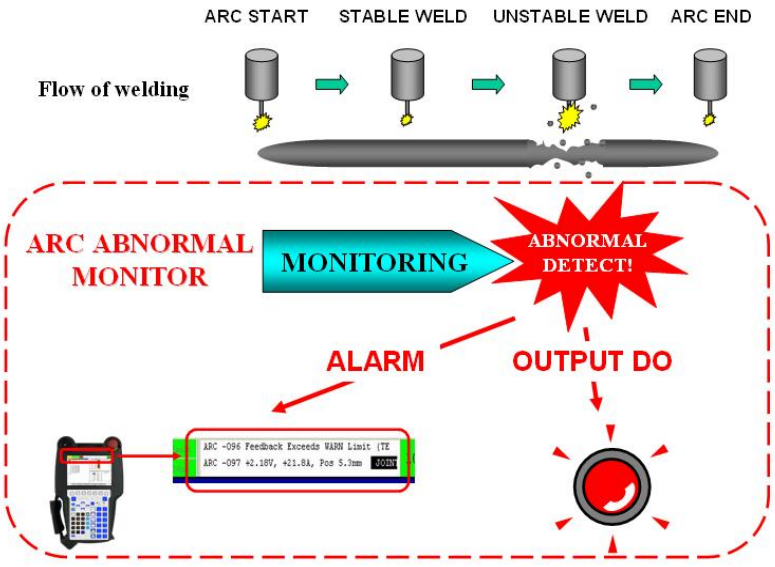


Fig. 4.3.9 (a) Outline of arc abnormal monitor function

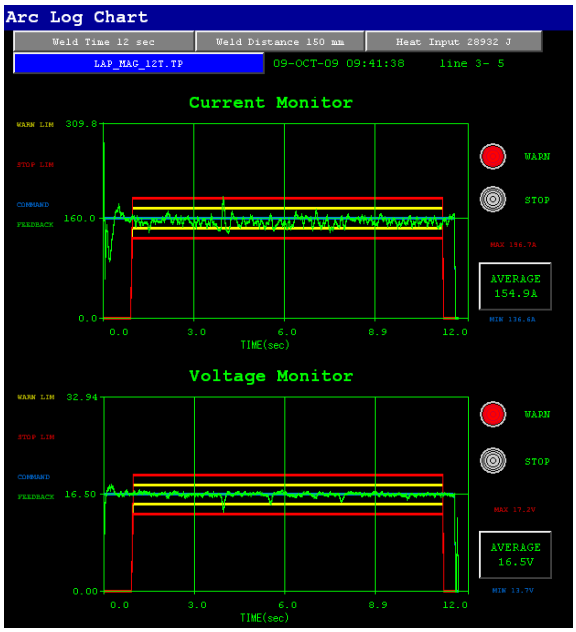


Fig. 4.3.9 (b) Arc weld log – chart function

Arc abnormal monitor function is an optional function. Detail of this function is written in Chapter 19 Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3). Please refer to it.

4.3.10 Arc Welding Analogue Meter Displaying Function (Option)

Arc welding analogue meter function is the graphical user interface of displaying welding command/feedback voltage and current.

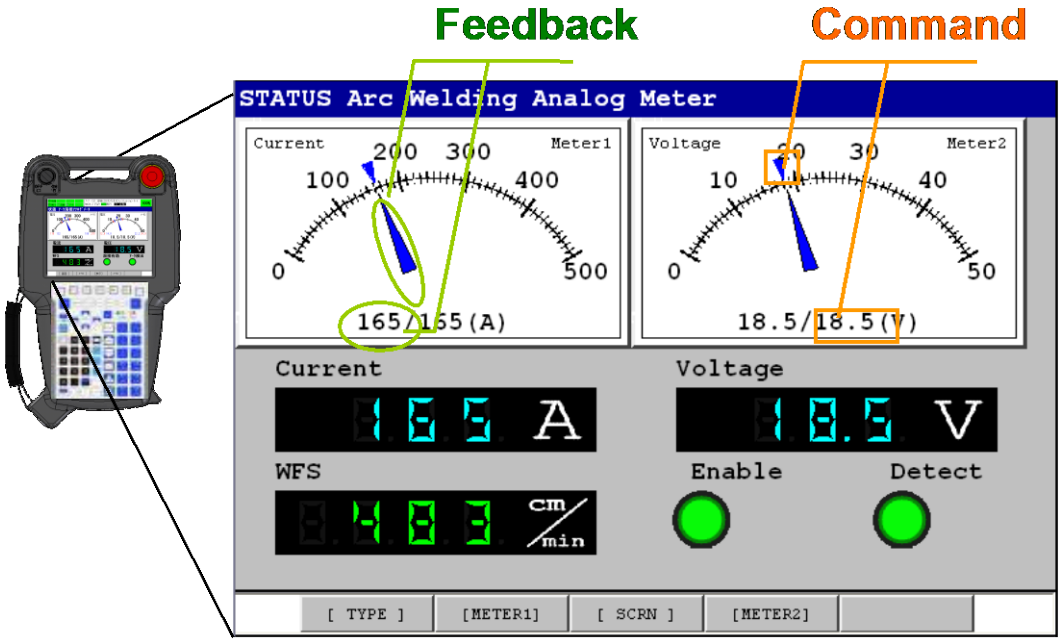


Fig. 4.3.10 (a) Arc Welding Analogue Meter Displaying Function

The UIF displays not only the contents on arc welding status screen but also the following contents.

- Show Current/Voltage/Wire feed speed as analog meter format.
- Average of welding voltage, current and wire feed speed per a welding
- The name of currently-running TP program
- The line number of the latest arc start instruction in currently-running TP program
- Currently using weld mode
- Weld distance and welding speed
- Arc on time per a welding

Arc welding analogue meter displaying function is an optional function. Detail of this function is written in Chapter 18 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).Please refer to it.

4.3.11 Touch Sensing (Option)

Touch sensing allows the robot to change a path automatically to compensate for object displacement. Touch sensing consists of two phases: Search Motion phase and Touch Offset phase.

Search Motion

Search Motion can detect the current position of workpiece.

- Move touch sensor part (on arc welding robot, the top of wire = TCP) toward the workpiece using pre-defined robot motion, speed, and direction.
- Use an input signal to indicate that the robot has come into the contact with the object.
- Store the found location of the workpiece, or position offset information, in position registers.

The example of search motion is shown below.

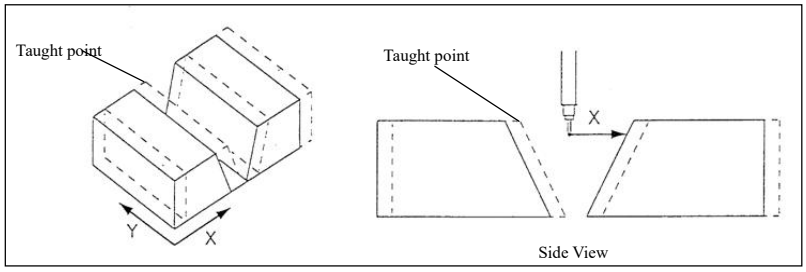


Fig. 4.3.11 (a) Search motion for detecting shift of X direction

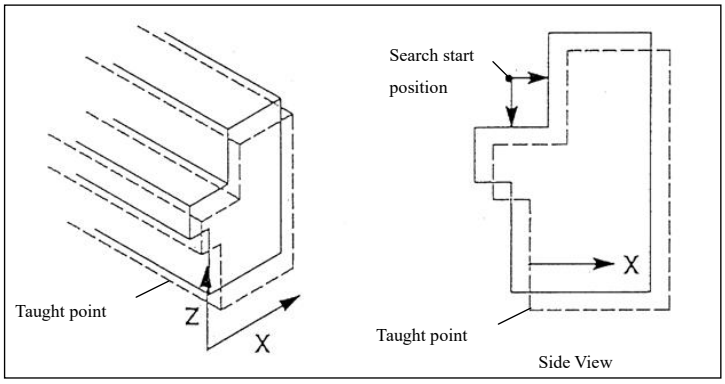


Fig. 4.3.11 (b) Search motion for detecting shift of X, Z directions

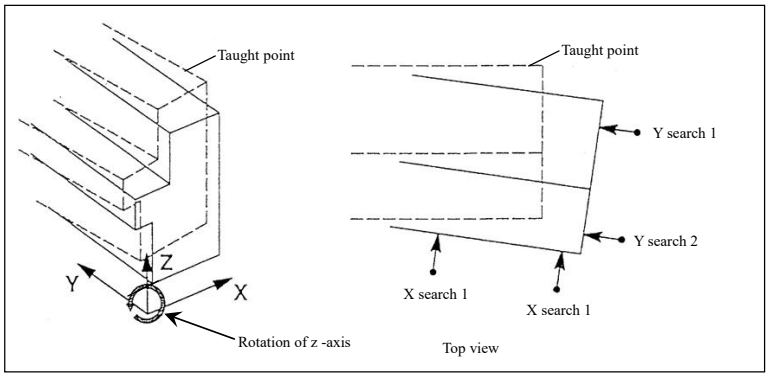


Fig. 4.3.11 (c) Search motion for detecting shift of X, Y directions and Z rotation

Touch Offset

Shift one or more teaching positions in your welding program by using the stored position the stored position offset information.

Touch sensing is an optional function. Detail of this function is written in Chapter 39 of Optional Function OPERATOR'S MANUAL (B-83284EN-2) Please refer to it.

Assignment Torch sensor I/O

To use touch sensor circuit on Lincoln welding power supply for touch sensing function, specify touch sensor I/O port numbers on torch sensing I/O setup screen after confirming them on Weld I/O screen with Procedure 4-3-8.

NOTE
I/O port numbers of touch sensor is depended on assignment range of Arclink I/O. Be sure to confirm torch sensor port number with Procedure 4-3-8 and setup touch sensing I/O.

5 CHECKS AND MAINTENANCE

This chapter describes the method of routine and periodic inspection and maintenance of the welding power supply section of robot welding power supply option.

- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 0*i*B operator’s manual”. (B-83614EN)
- ARC Mate 100*i*C, M-10*i*A, ARC Mate 100*i*Ce, M-10*i*AMechanical unit operator’s manual (B-82754EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 100*i*C/12/7L/12S, M-10iA/12/7L/12S operator’s manual”. (B-83654EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 120*i*C/M-20iA operator’s manual”. (B-82874EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 100*i*D/M-10iD operator’s manual”. (B-83944EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 120*i*D/M-20iD operator’s manual”. (B-84074EN)
- For the robot controller, refer to "R-30*i*B/R-30*i*B Plus controller Maintenance Manual". (B-83195EN)
- For the robot controller, refer to "R-30*i*B Mate R-30*i*B Mate Plus controller Maintenance Manual". (B-83525EN)

Organization of this chapter

- 5.1 ROUTINE INSPECTION
- 5.2 1-MONTH (320 HOURS) CHECKS
- 5.3 6-MONTH (1920 HOURS) CHECKS
- 5.4 1-YEAR (3840 HOURS) CHECKS
- 5.5 REPLACING CONSUMABLE
- 5.6 PROGRAM BACK-UP

5.1 ROUTINE INSPECTION

> **⚠WARNING**
> Before inspection, adjustment, and replacement, be sure to turn off the switch of the switch box and confirm safety at all times except when an inspection is required while the power is on.
> Otherwise, a serious accident resulting in an electrical shock or burn can occur.

To make full use of the welding machine and ensure safe operation in daily work, routine inspection is indispensable.
In routine inspection, check the components listed below, centering on the checking of the welding torch and wire feeder for worn, deformed, and clogged consumable parts. Replace or clean components as required.
For component replacement, be sure to use a component specified by FANUC in order to maintain the performance and functions.

5.1.1 Welding Power Supply

Component	Point of inspection	Remarks
Front	- Check that equipment is securely mounted. - Check that equipment (such as a switch) is not broken	If there is a problem, perform an internal inspection, additional tightening, part replacement, or other measures. Refer to the welding power supply for details.
Side	- Check that the "Input Voltage" switch is correctly set. - Check that equipment and terminal covers are securely mounted. - Check that the rotation sound of the cooling fan is normal and that cool air flows normally (from the rear to the front). (The cooling fan operates by internal temperature.)	
Peripheral	- Check that cases are securely mounted on the top board or other sections.	If it is loosened, perform additional tightening.
General	- Check that there is no visual sign of overheating such as discoloration. - Check the looseness of connector - Confirm the tightening of cable terminal connection part of secondary side - During power-on, Check that there is no abnormal vibrations or whines. Check that there is no abnormal smell.	If there is an abnormality, make an internal inspection.

Caution when abnormal is founded

Capacitor discharge procedure (Refer to welding power supply manual for details.)

Before inspection and maintenance, be sure to take enough time till discharge of capacitor completely finished. (this may take several minutes)

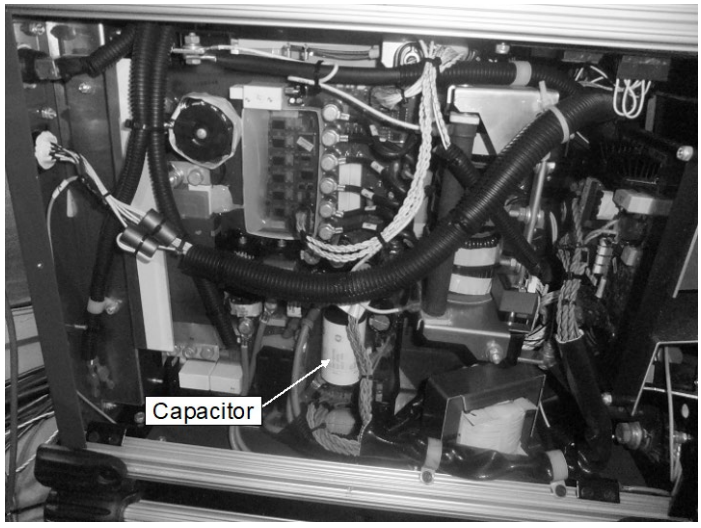
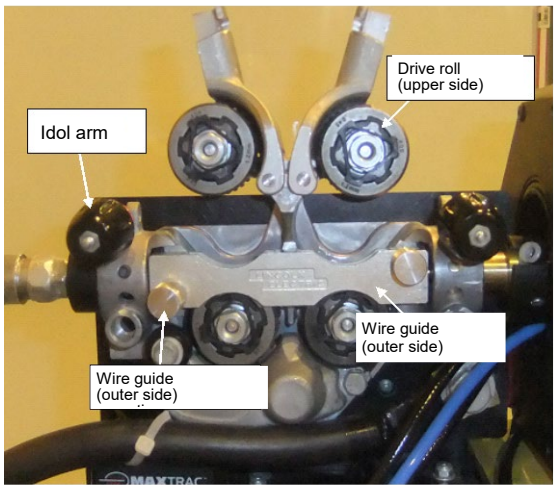
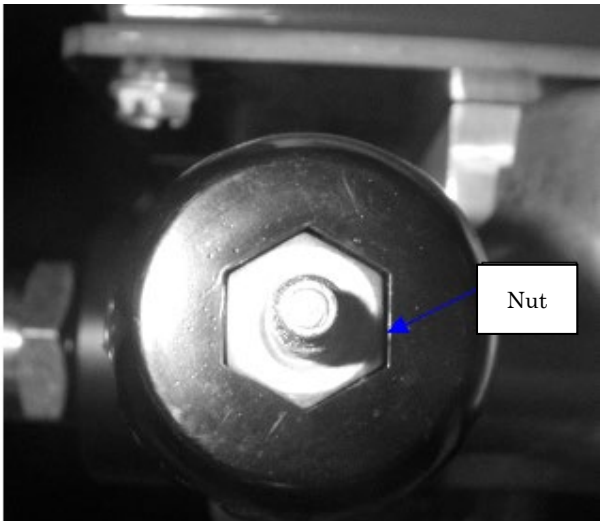


Fig. 5.1.1 (a) Capacitor discharge

5.1.2 Wire Feeder

Component	Point of inspection	Remarks
Idle arm	Check if the nut is tightened in the degree that does not slip. (In particular, wires of 1.2 mm ϕ and up must not be tightened excessively.)	Unstable wire feed and unstable arc operation can occur.
Drive roll (4 pcs)	Check the matching between the welding wire diameter and the nominal diameter of the feed roller. Check if the feed roller groove is clogged and if the cut groove is worn.	Wire chips can be generated, resulting in a clogged conduit tube and unstable arc operation. If any of these problems is found, replace them with a new articles.
General	Clean each parts. Check the looseness of bolts and other connection parts.	

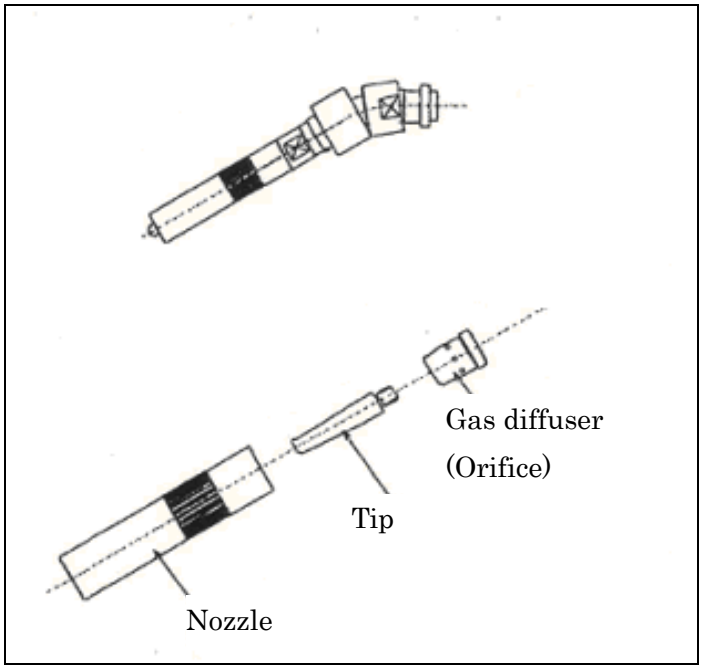




NOTE
There is a spring in the idle arm. If you remove the idle arm, remove it while putting nut of center of the idle arm.

5.1.3 Welding Torch

(Part constitution is different by a torch slightly.)



Component	Point of inspection	Remarks
Nozzle	Loose attachment and tip deformation	A blow hole can result.
	Sputter attachment	The torch can burn, or a blown hole can result. (The use of a sputter attachment protection agent is useful.) Clean frequently to prevent accumulation of spatter.
Tip	Loose attachment	The screws of the main torch body can be damaged.
	Tip damage, and hole wear and clogging	Unstable arc operation and intermittent stop of operation can occur.
Gas diffuser (Orifice)	Check if no gas diffuser is installed, the gas diffuser is cracked, the hole is clogged, or a gas diffuser of another supplier is installed.	A welding defect (such as a blow hole) can occur due to a gas shielding failure or the main torch body can burn (spark in the main body). Take necessary action.
General	- Check the looseness of bolts and other connection parts. - Perform air blow using dried air.	

5.1.4 Cable

Component	Point of inspection	Remarks
Torch cable	Check if the torch cable is not attached firmly to the mounting fixture. Check if the torch cable is bent excessively.	Wire feed can fail. The arc can flicker due to irregular wire feed, or unstable arc operation can occur. Ensure that the torch is extended straightly where possible.
Output side cable	Check if the cable insulator is worn or broken. Check if the cable joint is exposed (insulator is broken) or if the cable connection is loose (at the base metal connection point of the welding power supply terminal or between cables).	To ensure human safety and stable arc operation, conduct an inspection suitable for the status of the factory floor. ○ Make rough and simple checks in routine instruction. Make rough and simple checks in routine instruction. ○ Make detailed and through checks in periodic inspection.
Input side cable	Check if the cables on the input/output terminal on the input protective device of the switch box are loosely connected. Check if the fuse mounting section is not securely fastened. Check if the connections on the input terminal of the welding power supply are not securely fastened. Check if the cable insulator is worn, broken, or exposed in the input-side cabling.	
Ground wire	Check if the ground wire for welding power supply grounding is disconnected or loosely connected. Check if the ground wire for base metal grounding is disconnected or loosely connected.	To ensure safety against an unexpected leakage accident, be sure to perform routine inspection.
Confirm connection part of hose	Stop the main cylinder valve and confirm pressure go down.	
Confirm the installation place	Check there is combustibles or water and remove them.	

5.1.5 Welding Wire

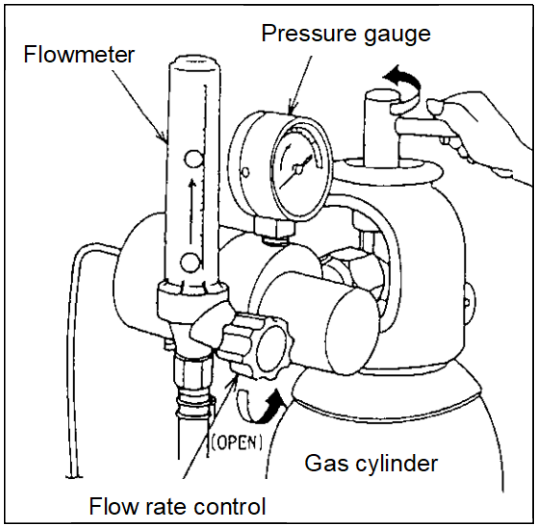
Point of inspection	Remarks
Confirm there is rust or oil, and remove them	

5.1.6 Checking Gas Flow Rate

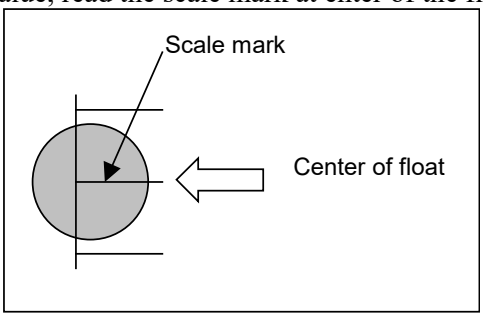
The gas flow rate is an important factor in ensuring stable arc welding. The gas flow rate can vary depending on the primary gas pressure. So, check the gas flow rate every day.

Use the procedure below when checking the gas flow rate.

1 When gas is not output, check that the specified gas pressure is observed.
   * The maximum input pressure of the gas controller is 11.8 MPa for CO_2 gas, and 15.7 MPa for argon gas and mixed gas (CO_2 + argon).
2 Make a gas check from the teach pendant. Refer to [Procedure 2-9(a) manual gas check] about this operation.
3 Meanwhile, read the value of the gas flow meter.
4 Check that the read value satisfies the specification. If the specification is not satisfied, adjust the flow rate control to set the specified flow rate.



* When reading a flow rate value, read the scale mark at enter of the float as shown below.



5.2 1-MONTH (320 HOURS) CHECKS

Item	Check items		Check points
1	Welding torch	Confirm the looseness of union nut (In case of BINZEL torch 350GC)	In case of BINZEL torch, remove insulated cap and rubber cover referring to Section 7.9 to 7.12 and confirm tightness of union nut. If it is loosen, retighten it with torque of 30Nm.

* Torch made by MIZUHO does not have a union nut.

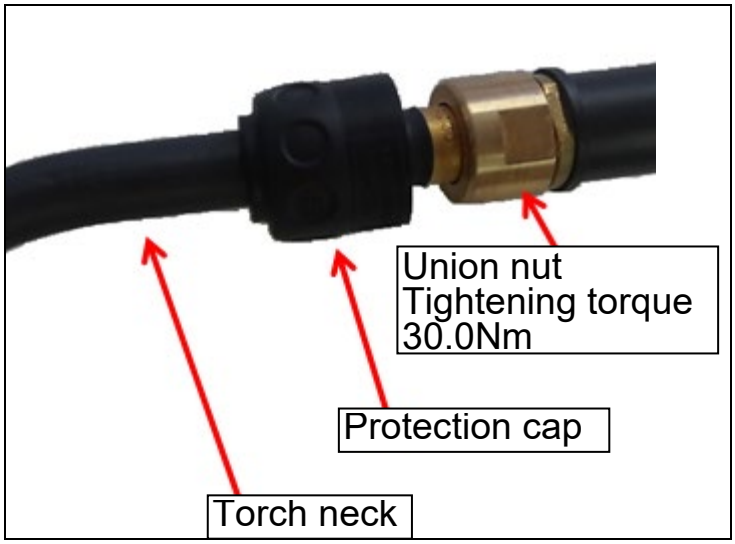


Fig. 5.2 (a) Check of the union nut (Figure is an example of ARC Mate 0*i*B BINZEL torch)

5.3 6-MONTH (1920 HOURS) CHECKS

Check the following items at the intervals based on every 6 months or 1920 hours, whichever comes first. Refer to maintenance and check parts of LINCOLN welding power supply manual.

Item	Check items		Check points
1	Welding power supply	Cleaning inside the welding power supply	Perform air blow using dried air. (Note)
2		Confirm the damage situation of fan	Confirm whether a fan is not damaged.
3		Check the allophone and vibration	Check there is allophone and vibration.
4	Wire feeder	Cleaning each parts	Perform air blow using dried air.
5		Check the tighten of bolts and other connection parts.	Check the looseness of torch mounting parts. and retighten the terminal of power supply parts.
6		Check the length of wire feeding	Check the length of inching is regulated degrees.
7		Check the gas valve	Check opening and shutting is normal And check whether there are not forwarding irregularities when opening and shutting is normal.
8		Replace the motor brush	Replace the motor brush after 6 months operation or 250 million times of welding start (which ever comes first). If the brush is shorter than 12.7mm, replace it.
9	Welding torch	Confirm tightness of union nut. (BINZEL torch only)	See Section 5.2.

(Note) Cleaning in the inside the welding power supply

Discharge capacitor before cleaning referring to Fig. 5.1.1(a).
Perform cleaning referring to welding power supply manual maintenance and check section.

Remove the both side panel and clean the inside.
Remove it using a cloth. and check whether the cable is not damaged.
Internal element have a capacitor (condensers). There might be the electric shock just after turning off power. So be careful.

Straight-head screwdriver (nominal 4.5x50) and box wrench (width across flats 8mm) are necessary to remove terminal of power cable.

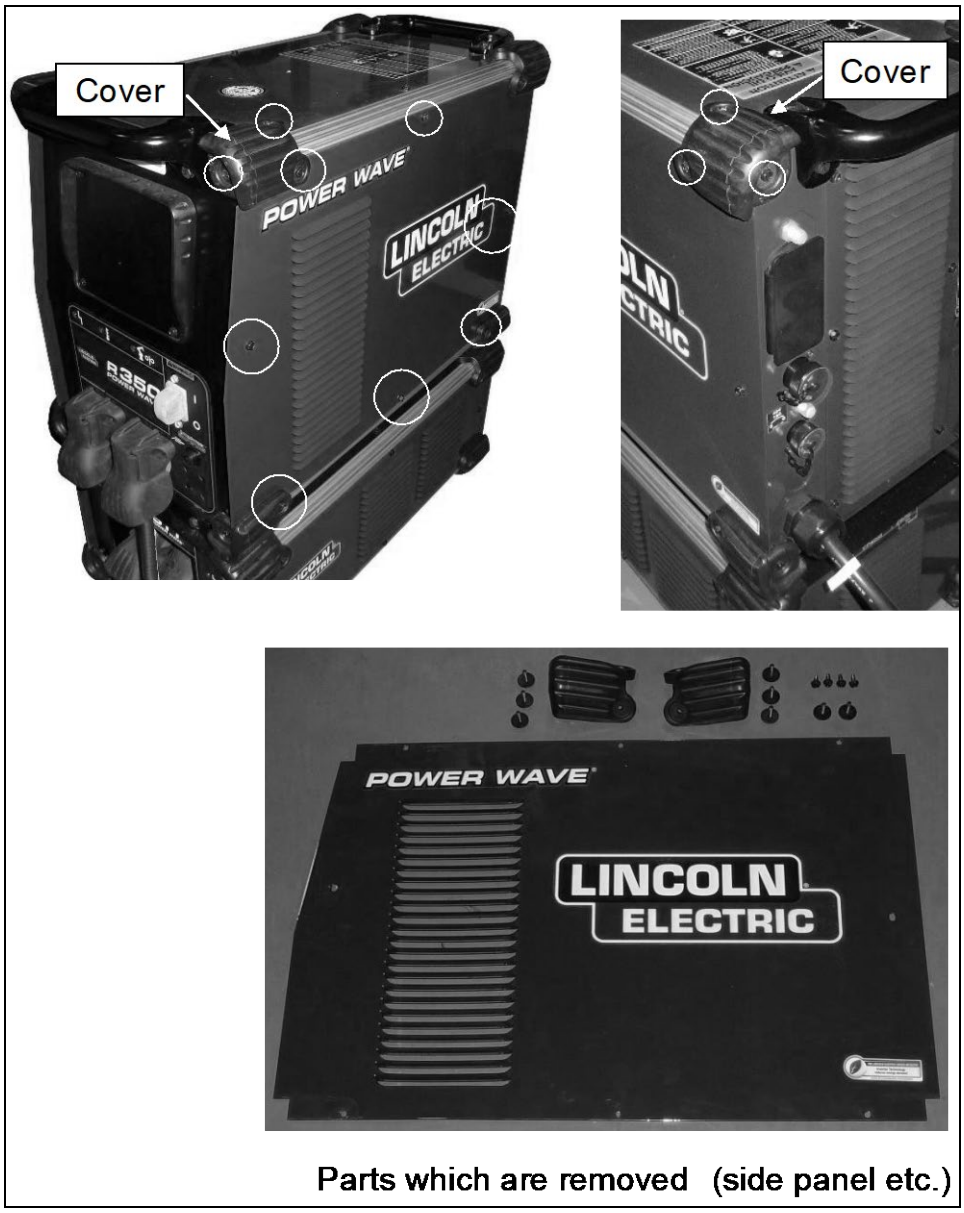


Fig. 5.3 (a) Cleaning of Power Wave R350, Power Wave S350

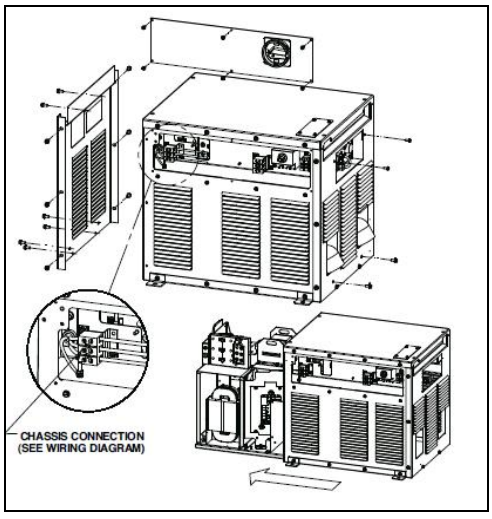


Fig. 5.3 (b) Cleaning of Power Wave i400

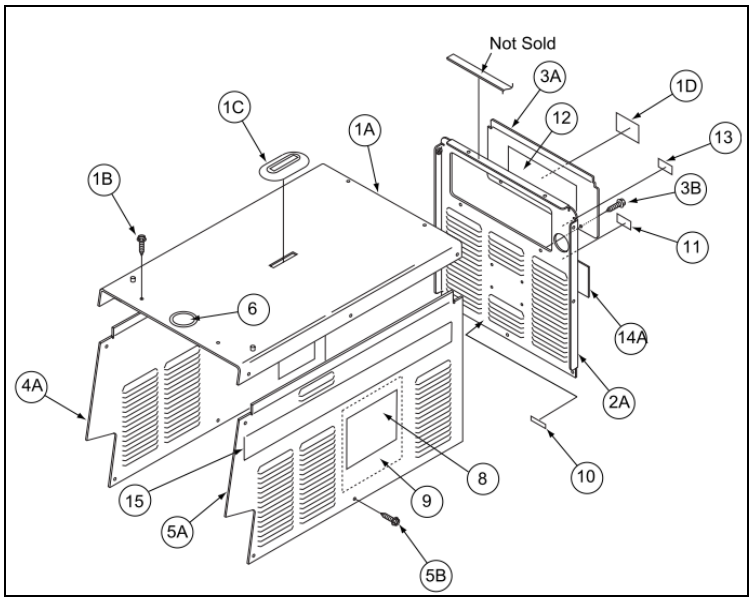


Fig. 5.3 (c) Cleaning of Power Wave 455M/STT

5.4 1-YEAR (3840 HOURS) CHECKS

Check the following items at the intervals based on every 1 year or 3840 hours, whichever comes first. Refer to maintenance and check parts of welding power supply manual.

Item	Check items		Check points
1	Welding power supply	Cleaning inside the welding power supply	See Section 5.3.
2		Confirm the damage situation of fan	See Section 5.3.
3		Check the allophone and vibration	See Section 5.3.
4	Wire feeder	Cleaning each parts	See Section 5.3.
5		Check the tighten of bolts and other connection parts.	See Section 5.3.
6		Check the length of wire feeding	See Section 5.3.
7		Check the gas valve	See Section 5.3.
8		Replace the motor brush	See Section 5.3.
9	Welding torch	Confirm looseness of union nut. (BINZEL torch only)	See Section 5.2.
10		Replacing torch cable (Including conduit)	Confirm whether it is not damaged. If it is damaged, replace it by new one. (See Chapter 7.)
11		Replacing liner	Confirm whether it is not damaged. If it is damaged, replace it to new one. (See Chapter 7.)
12	Around cable	Confirm reel side conduit.	Confirm whether it is not damaged. Check whether it is moderate length and bending radius is not to small.

5.5 REPLACING CONSUMABLES

⚠WARNING
Before inspection, adjustment, and replacement, be sure to turn off the switch of the switch box and confirm safety at all times except when an inspection is required while the power is on.
Otherwise, a serious accident resulting in an electrical shock or burn can occur.

This section describes how to replace consumables.
Use consumables supplied by FANUC at all times except wire and gas. Use special care when selecting a wire and gas.

5.5.1 Wire

1 When wire remains in the conduit, pull out the wire.
2 Detach the empty wire reel from the wire reel stand.
3 Attach a new wire reel.
4 Run the wire.

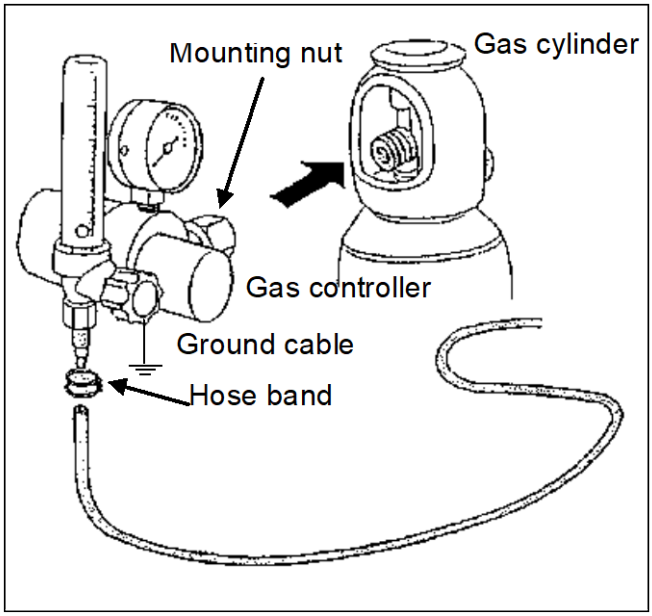
5.5.2 Gas

⚠WARNING
When handling a gas cylinder, observe the high-pressure gas regulation, and manage the gas cylinder according to the standard defined in your company. A gas cylinder contains high-pressure gas. If a gas cylinder is handled incorrectly, high-pressure gas can blow out, and can cause an accident resulting in a human injury or death. Be sure to observe the following items:

- When a gas cylinder falls, an accident resulting in a human injury or death can occur.
- Secure a gas cylinder to a dedicated cylinder stand. Be sure to secure a gas cylinder vertically. When using a gas cylinder, do not lay it.
- The internal pressure of a gas cylinder varies with temperature. If a gas cylinder is exposed to direct sunlight or placed close to a heat source, the internal pressure increases, and the safety valve of the gas cylinder can be actuated.
- Before mounting a gas controller onto the gas cylinder, check that a cylinder packing is inserted in the cylinder mounting nut of the gas controller. If no cylinder packing is inserted, be sure to insert a cylinder packing.
  When opening the valve of the gas cylinder, open the valve step by step until the valve is fully open.

1 Close the valve of the gas cylinder.
2 Detach the gas controller.
3 Replace the gas cylinder.
4 Mount the gas controller.
  Mount the gas controller onto the gas cylinder with a mounting nut. Tighten the nut sufficiently with a monkey wrench.
5 Open the valve of the gas cylinder.
6 Check the gas pressure and gas flow rate.

For gas check operation, see Subsection 5.1.6, " CHECKING GAS FLOW RATE ".



5.5.3 Nozzle

Before starting operation, make a check every day. Replace the nozzle if distorted.

1 Remove the nozzle.
2 Attach a new nozzle.

> ⚠**CAUTION**
> Remember to mount a gas diffuser.

5.5.4 Tip

Before starting operation, make a check every day. Replace the tip if its hole is enlarged.

1 Remove the nozzle.
2 Remove the tip.
3 Mount a new tip.

> **NOTE**
> Mount a tip that matches the diameter of wire used.

4 Mount a nozzle.

> **NOTE**
> Remember to mount a gas diffuser.

5.5.5 Liner

Clean the liner with an air blow at least once a week.
Replace the liner if it has lost elasticity or is broken.

1 Remove the welding torch from the wire feeder.
2 Replace liner with new one (See Section 7.6 and 7.7.)

NOTE
Mount a liner spring that matches the diameter of wire used.

3 Paying attention to the following, mount the welding torch onto the wire feeder:

- When mounting the welding torch onto the wire feeder, push the welding torch sufficiently up to the base. Otherwise, trouble such as gas leakage, wire distortion in the torch due to a caught wire, and feed failure can occur.

5.6 PROGRAM BACK-UP

Usually, programs are stored in the memory internal to the robot controller. Even when the power is turned off, this memory is powered by a battery so that information stored in the memory is not lost. However, it is recommended to back up programs stored in the memory, considering an accidental damage to the memory or battery life expiration. Moreover, when a modification is to be made to a taught program, it is recommended that the program be backed up before and after the modification. By backing up programs in this way, a program or position data lost by an incorrect operation can be restored.

You can use “Flash ATA memory Card”.

About backup, please refer to Subsection 6.3.4 Acquisition of All Backup, 6.3.5 Acquisition of Image Backup and Section 8.4 SAVING FILES in OPERATOR’S MANUAL (Basic Operation) (B-83284EN).

⚠CAUTION
Flash ATA memory card.
In order to protect against accidental loss of data from a flash ATA memory card, it is recommended to back up the files of the flash ATA memory card to another medium such as a memory card.

6 TROUBLE SHOOTING

6.1 TROUBLE SHOOTING ABOUT ALARM

This section describes about main cause of a displayed alarm / message and the measures related to welding power supply.

ARC -008 Weld power supply fault (###, i)

Cause: A problem generates in the welding power supply.

Remedy: Confrim whether other ARC alarms or LECO alarms are posted simultaneously or not. Then please contact your local FANUC representative.

ARC -022 Weld AO scaling limit used (###, i)

Cause: The warning message is posted when command values in weld schedules for arc instruction (or command values in direct arc instruction) become out of range. Then, command values are clamped by upper or lower limits.

Remedy: Set the command values within a range. The range for command values is different in each process mode. Therefore, if you change the assignment of Weld Procedure or process mode number, please confirm that the command values in arc instruction that uses the process mode number are not out of range. Additionally, please also confirm command values of weld processes (Burnback, Runin and Wirestick Reset) are not out of range. You can see the range for each process mode on Weld Procedure screen.

ARC-040 EQi Missing I/O: ###

Cause: When ArcLink I/O (weld I/O) is not allocated definitely, it occurs.

Remedy: 1 f the missing I/O name is "gas alarm", "wire alarm" or "coolant alarm", assign these signals by manual operation in reference to Subsection “4.3.4 Gas, Wire, Coolant Shortage Detect”. If you do not use these signals, please disable the detection function by “Procedure 4-3-4 (b) Setup of Gas, Wire, Coolant Shortage Detect Function”.

2 There is a case that only “ARC-204 Arclink ch i available” is posted but “ARC-051 Weld EQ i ONLINE: ArcLink” is not appeared with the generation of ARC-040 just after the communication establishment. In this case, $IO_AUTO_CFG may be set to FALSE. Please set $IO_AUTO_CFG to TRUE and cycle power of the robot controller. After that, ArcLink I/O will be automatically assigned and the communication will be established. If you would not like to perform auto assignment (you cannot set $IO_AUTO_CFG to TRUE) for I/O devices (DeviceNet, Profibus etc.), please contact FANUC.

3 Because communication establishment with the welding equipment is never performed, there is a possibility that ArcLink I/O is not allocated. In reference to Section 10.1 “WELDING POWER SUPPLY SELECT”, please perform communication establishment with the welding equipment.

ARC –045 Weld EQ is OFFLINE

Cause: A robot controller tried communication with the welding power supply, but this alarm is displayed when communication cannot be established. The first message becomes alarm handling, but becomes the warning message after having pushed the reset.
The arc welding cannot be carried out during message indication, but the operation of the robot is possible.

Remedy: Please confirm that the welding equipment is switched on.

1 Please confirm that the power of weld equipment is ON.

2 Please confirm that a communication cable is connected definitely. In the case of Power Wave
R350, please confirm that Ethernet cable is connected to the following port number.

- R-30*i*B Mate Controller only has one Ethernet port: **CD38A Port**
- R-30*i*B Mate Controller has two Ethernet ports: **CD38B Port**

3 When connection with the welding equipment cannot be performed in Power Wave R350 suddenly and cannot be restored, carry out F3 [CHECK] with a Controlled Start screen, and please reconnect it.

4 There is a possibility that choice of the welding equipment is not performed definitely. Please perform “Procedure 10-1 Welding power supply select” in Section 10.1 “WELDING POWER SUPPLY SELECT” to establish communication with the welding equipment.

5 With ArcLink Status screen, please confirm the state of ArcLink. In addition, in the case of Power Wave R350, please confirm the Ethernet Port Status (refer to “4.5 Status of ArcLink”). The Ethernet Port Status has to seem to become Fig.6.1 (a). When the SETTING states of speed or duplex are different from 6.1 (a) figures, please perform the two changes.

- Move the cursor on "10 Weld Eq speed" during communication establishment with the welding equipment, and press F4[CHOICE], and please choose "10Mbps". Just after the change, please perform cycle power of the weld equipment.
- With a system variable screen, please input "2" into $ENETMODE[i].$SPEED. (i becomes the port number displayed by an ArcLink Status screen). In addition, please set $ENETMODE[i].$FULL_DUPLEX to "TRUE". Just after the change, please cycle power of the robot controller.

```
STATUS Arclink
                                        10/10
Ethernet Port Status
    Port number:       1
    Robot IP:             192.168.2.151
    Weld Eq IP:           192.168.2.152

                       SETTING   ACTUAL
    Robot speed    :   AUTO       10 Mbps
    Robot duplex   :   FULL      FULL
 10 Weld Eq speed  :   10 Mbps    10 Mbps
    Weld Eq duplex :   FULL      FULL

[ TYPE ] NEXT_CH  LOCATE   ATTRIB   HELP
```

Fig. 6.1 (a) Ethernet port status

6 If the alarm still has been posted after performing above remedies, there is a possibility of the trouble of the control board on weld equipment. Please contact and ask FANUC to change the control board. If the weld equipment model is Power Wave R350, please operate the communication establishment procedure referring to Step 6 - Step15 on Section 7.1 after changing control board.
(Normally the work is completed by FANUC).

7 If you only would like to operate robot movement without arc welding, this message does not become the problem. Another alarm may appear when LED of "ALARM" turns on as well as this message being given when the reset is pushed. Confirm an alarm history screen and confirm the alarm, and please get rid of a cause.

ARC-046 Weld EQ communication error

Cause: There was a communication error detected between Arc Tool and the Weld Equipment.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to Subsection 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-046 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is impossible, please deal in reference to countermeasures to ARC-045.

3 Please confirm whether some errors of the welding power supply appears or not by referring to [6.3.2 Check of LED of Weld Equipment]. If some errors appear, please contact FANUC after checking an alarm number of the welding power supply. Additionally, please follow [6.3 REMEDY FOR TROUBLES].

ARC-047:Not allowed during a weld

Cause: The operation that cannot be performed during a stop at one time during welding or the welding was going to be performed.

Remedy: Operate it after a program is finished or forces it, and having been finished

ARC-049 Process i switch to j failed

Cause: The Reshuffling of the welding process is failed. The power of the welding power supply becomes OFF, or communication is not established.

Remedy: Confirm that the welding power supply is switched on, and establish communication.

ARC-050 Process i NOT found

Cause: A process mode allocated for Weld Procedure that appointed on a welding power supply was not found.

Remedy: Confirm whether a process mode allocated for Weld Procedure that appointed is a thing allocated definitely. In reference to 3-3-1 and 3-3-2 operation, allocate an appropriate process mode number for Weld Procedure. Even when Weld Procedure number is not set on arc direct type instruction, this alarm produces (when it is 0).

ARC-051 Weld EQ i ONLINE： ArcLink

Cause: It is the message which is displayed when the communication between a robot controller and a weld equipment are established.

Remedy: Because it is not an alarm, the remedy is unnecessary. A message disappears when reset is done.

ARC-059 Gas purge stopped

Cause: By the gas purge operation(pressing both the [SHIFT] key and the [STATUS] key), the following operations are executed in the state of gas ON. To prevent the gas being left ON, gas is automatically stopped when this alarm is generated.

- Start the program
- Teach Pendant disabled or switched to AUTO mode
- Changed the setting item of [Gas purge key] to DISABLED in the Weld System screen.

Remedy: Please do not execute the above operation while gas is ON by the gas purge operation. Please stop the gas flow before executing the above operation.

ARC-092 Weld Cmd error EQi (%d,%d)

Cause: An error occurred when sending the welding command to the power supply.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to Subsection 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-092 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is not possible, please deal in reference to countermeasures to ARC-045.

3 Please confirm whether some errors of the welding power supply appear or not by referring to [6.3.2 Check of LED of Weld Equipment]. If some errors appear, please contact to FANUC after checking an alarm number of the welding power supply. Additionally, please follow [6.3 REMEDY FOR TROUBLES], and please report numbers in () on ARC-092 to your local FANUC representative.

ARC-093 Wire Feed Cmd error EQi (%d,%d)

Cause: An error occurred sending the command to the wire feeder.

Remedy: 1 Please confirm whether Strike Wire Feed Speed is the very limit value against the upper or lower limits or not. For checking the upper and lower limits, please input “0” as Strike Wire Feed Speed and push Enter key. After that, the upper and lower limits appear in () of the message like “Invalid area. (76.000, 999.000)”. If the setup value is the very limit, please adjust about +1 or -1.

2 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-093 is also resolved.

3 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is impossible, please deal in reference to countermeasures to ARC-045.

4 Please confirm whether some errors of the welding power supply appear or not referring to [6.3.2 Check of LED of Weld Equipment]. If some errors appear, please contact FANUC after checking an alarm number of the welding power supply. Additionally, please follow [6.3 REMEDY FOR TROUBLES], and please report numbers in () on ARC-093 to your local FANUC representative.

ARC-094 Can't enter mode, EQi is OFFLINE
ARC-094 Can't SEARCH, EQi is OFFLINE
ARC-094 Can't select mode, EQi is OFFLINE
ARC-094 Can't select feeder, EQi is OFFLINE
ARC-094 Can't select gear, EQi is OFFLINE
ARC-094 Can't inch wire, EQi is OFFLINE

Cause: Because Power Wave was in an off-line state, an alarm message was not able to perform described operation.

Remedy: Please operate it after establishing communication with the welding power supply. When communication establishment with the welding power supply is impossible, please deal in reference to measures to ARC-045.

ARC-134 EQ1 E8 PM missing machine option
ARC-134 EQ1 E9 PM missing robot option

Cause: The message is about Lincoln Production Monitor function.

Remedy: Lincoln Production Monitor function is not supported now. There is no problem when this message appears. There is no need to remedy.

ARC-200 Arclink ch i heartbeat timeout

Cause: ArcLink bus master did not respond to a heartbeat request within the maximum time period.

Remedy: Check ArcLink connections and the weld controller devices that are on the ArcLink network.

ARC-201 WARN Arclink ch i obj #j no resp

Cause: The message appears when the response from the weld equipment is not arrived (or late) in ArcLink communication.

Remedy: If the message appears frequently, please perform the Remedy 5 of ARC-045. If the symptom is not recovered, please contact FANUC.

ARC-202 Arclink ch i obj #j error resp

Cause: A device on ArcLink sent unexpected error response to a request message.

Remedy: Please cycle power of both the robot controller and the weld equipment, and then try again.

ARC-203 Arclink ch i reset by master

Cause: The ArcLink connection between the robot controller and the weld equipment is reset if the other PC try to connect to the weld equipment while the connection between the robot controller and the weld equipment is established. After that, the communication between the PC and the weld equipment is established.

Remedy: You cannot operate the weld equipment from the robot controller until finishing the connection between the PC and the weld equipment. If you do not request the reset, please check the ArcLink connections.

ARC-204 WARN Arclink ch i available

Cause: When it has access to a robot controller and communication with the weld equipment, the message is displayed just before ARC-051.

Remedy: When ARC-051 appears just after that, there is no problem. The remedy is unnecessary. When ARC-051 is not displayed after the message, please refer to Remedy 2 of ARC -040. If the alarm is not solved, please contact FANUC.

ARC-205 Arclink ch i h/s event lost

Cause: The high speed event message expected during welding failed to arrive in time.

Remedy: The ArcLink network is automatically reset. If this error persists, it indicates a problem with the settings of the communications network, noise, or communication devices. Please perform the following remedies.

1 Perform “Remedy 5” for ARC-045. Please check whether the status of Ethernet port is correct.
2 Check whether Ethernet cable is correctly connected to a connector. Additionally, check that Ethernet cable is away from power cables. If they are touched or closed, please change the cabling and separate them.
3 If the communication is not solved after the above remedies, there is a possibility that one of communication devices has a trouble. The Ethernet cable, the main board on the robot controller, and the communication board on the weld equipment sequentially.

ARC-206 Arclink ch i too many errors

Cause: The ArcLink interface detected too many errors on the network.

Remedy: Please perform the remedy for ARC-205.

ARC-207:Arclink ch i no bus power

Cause: When an error in conjunction with plural ArcLink occurred on a CAN bus network, this alarm is displayed. It becomes the cause that poor noise and communication is important. This alarm is also displayed when the power of DeviceNet board for ArcLink communication is not supplied.

Remedy: Confirm the connection situation of ArcLink network, a communications cable.

ARC-208 Arclink ch i no nodes on bus

Cause: ArcLink interface is not detecting any other devices on ArcLink network.

Remedy: Check ArcLink cable connections and make sure that the welding equipment is also connected and powered on.

ARC-209 Arclink ch i bus errors
Cause: ArcLink interface is detecting errors on the network.
Remedy: Please perform the remedy for ARC-205.

ARC-210 Arclink ch i network flooded
Cause: ArcLink interface is unable to send messages due to too much traffic on the network.
Remedy: Cycle power on the robot controller and weld controller.

ARC-211 Arclink ch i comm error j
Cause: ArcLink interface has detected a fatal error condition.
Remedy: Check ArcLink cable connections and make sure that the welding equipment is also connected and cycle power, and then try again.

ARC-212 Arclink ch i CAN-Enet conflict
Cause: On the channel that has the setting for the connection by Ethernet (ArcLink XT), the setting for the connection by DeviceNet board (ArcLink) is also detected.
Remedy: Change the channel for Ethernet, or change the channel for DeviceNet board by DIP switches, and avoid the mixed traffics on one channel.

ARC-213 XXX: Invalid Arclink I/O EQi
Cause: The assignment of ArcLink I/O is wrong.
Remedy: Check ArcLink I/O assignment on DI/DO assignment screen or AI/AO assignment screen referring to Section 3.1. If you only would like to jog or run programs without arc welding before solving this alarm, turn the weld equipment off.

6.2 TROUBLE SHOOTING AGAINST SITUATIONS

Table 6.2 (a) Trouble shooting against some situations

No.	Problems	Cause	Remedy
1	Wire inching is not performed.	A robot controller and the communication establishment of the welding power supply are not done	Please confirm whether the welding power supply is switched on. Please confirm whether a robot controller is connected to a welding power supply definitely. In reference to "WELDING POWER SUPPLY SELECT " of Section 10.1 and please perform communication establishment setting again.
		A welding mode available for a welding process choosing is not assigned now (a welding mode becomes 0)	In reference to “OPERATION OF WELD PROCEDURE” of Section 3.3.2, please assign the welding mode to a welding process.
		An idle arm does not go up	Put up an idle arm.
2	Wire feed is not stable (Wire feeding speed is too fast or there is allophone while wire feeding)	Choice of wire feeder is not correct	In reference to "Setting of wire feeder" of Chapter 10.3, please choose wire feeder.
		There is a problem to idle arm or drive roll.	In reference to "wire feeder" of Subsection 5.1.2, please perform maintenance check of wire feeder.
		There is the slack in the joint of the blowtorch cable	Please confirm whether the slack does not occur in a joint with the blowtorch cable installation metal fittings.

No.	Problems	Cause	Remedy
3	A gas purge (a gas check) is not possible by manual operation	A robot controller and the communication establishment of the welding power supply are not done	Please confirm whether the welding power supply is switched on. Please confirm whether a robot controller is connected to a welding power supply definitely. In reference to " Weld Equipment Select " of Chapter 10.1, please perform communication establishment setting again.
		The valve of the gas cylinder, a gas adjustment knob do not open.	In reference to “Checking Gas Flow Rate" of Subsection 5.1.6, please confirm the gas flow quantity.
		$AWELEWC[eq].$USR_DEF_DO (eq is a weld equipment number) is set to “2”.	Please set $AWELEWC[eq].$USR_DEF_DO to “0” and cycle power the controller. If gas start signal of ArcLink I/O signals described in “Detail of ArcLink I/O” of Subsection 3.1.1 is changed, this system variable is changed to “2”.
4	There is much sputtering at the time of the arc start	A welding process choosing, a welding mode are wrong	In reference to “OPERATION OF WELD PROCEDURE” of Subsection 3.3.2 or “TEACHING AND EDITING OF ARC WELD INSTRUCTION” of Section 3.5, select the proper weld data or weld mode number for the Arc Instruction.
		Stick out is not reasonable.	Confirm stick out of the welding program inside, and revise it
		A ball of the wire tip that you had at the time of the welding end just before that is big	Adjust the burnback schedule referring to “4.2.1 Treatment of the Top of Wire at Weld End Timing”.
5	There is much spattering at the time of the welding or an arc is unstable or is poor in welding	Gas flow quantity is insufficient (or do not appear)	Perform a gas check in reference to “Checking Gas Flow Rate of Subsection 5.1.6, and please confirm that gas appears definitely.
		A welding process choosing, a welding mode are wrong	In reference to “OPERATION OF WELD PROCEDURE” of Subsection 3.3.2 or “TEACHING AND EDITING OF ARC WELD INSTRUCTION” of Section 3.5, select the proper weld data or weld mode number for the Arc Instruction.
		Stick out is not reasonable.	Confirm stick out of the welding program inside, and revise it
		There is a problem to welding torch	Please perform maintenance check of the welding torch in reference to "5.1.3 welding torch".
		Wire feeding is unstable	Carry out No. 2 remedy.
		Others	Refer to 4 of Appendix A.2.
6	At the time of the arc end, a wire explodes.	Wire burnback/retract becomes invalid	Please refer to “4.2.1 Wire Burnback” and set wire burnback function to ENABLED.
7	A ball of the wire tip to have after the arc end is big	Burnback schedule is not reasonable.	Adjust the burnback schedule referring to “4.2.1 Wire Burnback”.
8	DI that you would like to use, a number of the DO are used for weld I/O (ArcLink I/O).	I/O number you would like to use is assigned to Arc-link I/O by automatic Arc-link assign function.	In reference to "3.1 ArcLink I/O", revise a layout of arc link I/O.
9	LED on welding power supply has blinked in red.	An error occurs in the welding power supply inside	Please perform “6.3.2 Check of LED of Weld Equipment”. If the problem is not recovered after cycle power of the weld equipment, please perform “6.3 REMEDY FOR TROUBLES” as possible as you can. Then, please contact FANUC.
10	The Power Lamp is not Turned on.	Power is not supplied correctly.	Check if power is fed correctly. If the power lamp is not turned on when power is fed correctly, contact FANUC.

No.	Problems	Cause	Remedy
11	The Wire is Deposited onto the Base Metal.		Cut wire of deposited part referring to 「4.2.2. Treatment of Wire Stick State」. There is the automatic stick reset function to prevent deposit of the wire. See 「4.2.2 Auto Wire Stick Reset Function」about this function.
12	The Robot Collided with a Fixture		Recover it according to the procedure below/. 1 Stop the motion of the robot by pressing the emergency stop button, then enter within the safety fence. 2 Correct the cause of collision. 3 Exit from within the safety fence. 4 Reset the emergency stop button. 5 Reset the system error. 6 Restart the robot.
13	The Emergency Stop Button was Pressed during Operation.		Recover it according to the procedure below/. 1 Reset the emergency stop button. 2 Reset the system error. 3 Restart the robot.

6.3 REMEDY FOR TROUBLES

We gathered up the contents which would like you to do when the following troubles occurred.
- A robot and a welding power supply do not communicate
- Welding is not possible (it stops by alarm etc.)
- Wire inching, a gas check are not possible
- Welding source's LED has blinked in red

In this case, please operate the following because the identification of the cause is difficult only for the symptom mentioned above.

Confirming procedure
1 The confirmation of the alarm history
2 In condition confirmation of the LED of the welding power supply
3 Get ARCLINK.DG
4 Get all back up
5 Get image back up (If possible)

6.3.1 Confirmation of the Alarm History

Open alarm history screen, Confirm whether arc alarm, LECO alarm are given.
Please contact us when alarm is given what kind of turn alarm is given with.
Please take the confirmation method of the alarm history in the following procedures.

1 Press the [MENU] key, select [4 alarm].
2 Active alarm screen will be displayed. Press F3[history] key.
3 Alarm history screen will be displayed.
4 Press F1[TYPE] and select [application]. Only an arc-related alarm history will be displayed.
5 Please confirm whether LECO alarm is not given. In addition, please confirm arc alarm (The part which ARC-045, ARC-200, ARC-051 form a line, and appears is normal.)
6 After the confirmation, press F1[SCREEN] and select [alarm] , return it to an original state

6.3.2 Check of LED of Weld Equipment

Please confirm a lighting state of two LED on the panel of the welding power supply. An alarm occurs in a welding power supply when it flashes on and off in red.

Please count the blinking number of times of the red LED of the welding power supply.

(Example 1)

Green → Red (Three times of continuation) → Some light out → **red (one time)**

In this case alarm number is “31”.

(Example 2)

Green → Red (Three times of continuation) → Some light out → **red (one time)** → **Green** → **Red (Three times of continuation)** →Some light out → **Red (Two times of continuation)**

In this case alarm “31” and alarm “32” occurs at the same time.

6.3.3 Acquisition of ARCLINK.DG

When Lincoln welding power supply is connected, backup data concerning the ArcLink communication can be acquired. Normally, it is not necessary to acquire ARCLINK.DG, but there is a case to acquire this data for maintaining the system.

You can save ARCLINK.DG to external devices automatically by the operation of “6.3.4 Acquisition of All Backup”. The sample contents of ARCLINK.DG are followings.

```
F Number: F00000
VERSION : ArcTool
$VERSION: V7.3059      05/16/2007
DATE:     20-AUG-07 18:54

ArcLink Diagnostics

ArcLink Channel: 0 Bus Available: 1

Weld Sequencer Event Log
Num Cd(h) dd-mm-yy  hh:mm:ss Data(h)
  1   11  20-08-07  18:23:23   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  2   11  20-08-07  18:21:57   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  3   11  20-08-07  16:47:06   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  4   11  20-08-07  16:45:39   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  5   11  20-08-07  16:29:07   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  6   11  20-08-07  16:24:19   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  7   11  20-08-07  16:10:38   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  8   11  20-08-07  16:04:46   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
  9   11  20-08-07  16:01:20   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
 10   11  20-08-07  15:59:32   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
 11   11  20-08-07  15:58:18   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
 12   11  20-08-07  15:56:37   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
 13   11  20-08-07  15:27:01   0  5 11 13 = LECO- 17 Action db failed (5,17,19)
 14   11  20-08-07  15:21:25   0  5 11 13 = LECO- 17 Action db failed (5,17,19)

Weld Sequencer Attributes
Num Attrib  (hex) Type  Name                                  Value
  1      1      1   14  "Vendor Name                        " = "The Lincoln Electric Co."
  2      2      2   14  "Module Model Number                " = "i400"
  3      3      3   14  "Module Model Name                  " = "PowerSource Controller"
  4      4      4   11  "Class ID                           " = 0
  5      5      5   14  "Class Name                         " = "Weld Sequencer"
```

Fig. 6.3.3 (a) Sample of ARCLINK.DG

6.3.4 Acquisition of All Backup

Next, acquire all back up.

Operation 6-3-4 is procedure of back up.

Procedure 6-3-4 Acquisition of all backup

Step

1 Please insert an empty memory card or USB memory in a robot controller.
2 Select「7 FILE」.
3 Press F5[UTIL] and select [Set Device] .In case of memory card, select [MC],In case of USB memory ,select [UDI].
4 Select F4[BACKUP] and select [All of above]. When the message “Delete XXXX before backup files?” is displayed, please select “YES”.
5 When backup is completed, press F5[UTIL] and select [Set Device]. then correct it at an original.

6.3.5 Acquisition of Image Backup

If possible, acquire image backup.
Please do not perform this during robot operation.

Operation 6-3-5 is procedure of image back up.

Procedure 6-3-5 Acquisition of all Image backup

Step

1 Please insert an empty memory card or USB memory in a robot controller.
2 Select [7 FILE].
3 Press F5[UTIL] and select [Set Device] .In case of memory card, select [MC],In case of USB memory ,select [UDI].
4 Select F4[BACKUP] and select [Image].
5 The message “Please cycle power.” is displayed. Please cycle power of the robot controller.
6 When you turn the robot controller ON, image back up is started.
7 When backup is completed, If the massage “Image backup completed successfully.” is displayed, the image backup was successfully obtained.
8 Press F5[UTIL] , select [Select Device] then correct it at an original device.

7 REPLACING UNITS

This chapter describes the method of replacing each unit.

> ⚠ **WARNING**
> Before replacing units, be sure to turn off the main power and pull the cable plug out the socket.
> When replacing a unit, ensure a safe state where peripheral equipment is not operating.

*For the robot mechanical unit, contact your local FANUC representative about replacing

*For the robot controller, refer to the following maintenance manual.
FANUC Robot series R-30*i*B/R-30*i*B Plus controller (RIA) maintenance manual B-83195EN
FANUC Robot series R-30*i*B Mate/R-30*i*B Mate Plus controller (RIA) maintenance manual B-83525EN

Organization of this chapter:
- 7.1, 7.2 Welding power supply
- 7.3 to 7.5 Torch cable
- 7.6, 7.7 Liner
- 7.8 Drive roll, wire guide
- 7.9 to 7.12 Torch neck
- 7.13, 7.14 Wire feeder

After replacing a part, be sure to check the corresponding item(s).
The table below indicates replacement parts and the corresponding check items. Make checks according to the table below.

Replacement part	Check item
Torch cable	(a) Liner replacement (b) Wire feed capability
Liner Drive roll Wire guide	(a) Wire feed capability

7.1 REPLACING THE WELDING POWER SUPPLY (Power Wave J350, Power Wave R350, Power Wave S350, Power Wave R500，Power Wave R450)

1 Turn off the controller power.
2 Remove welding power cable (+),(-), wire feeder control cable and communication cable from welding power supply referring to Fig. 7.1 (a) to (c).

Fig. 7.1 (a) Connection of welding power supply

Fig. 7.1 (b) Connection of welding power supply Power Wave R350, Power Wave S350

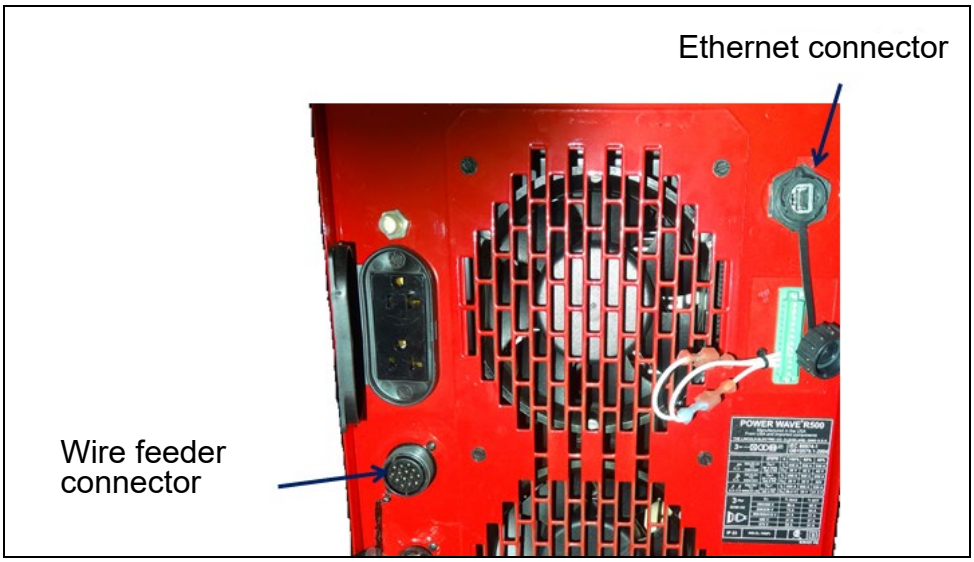


Fig. 7.1 (c) Connection of welding power supply (Power Wave J350, Power Wave R500, Power Wave R450)

3 In case of Power Wave R350, Power Wave S350, remove both upper side cover and side face panel.
In case of Power Wave 500, remove four screws. (It is similar when STT module is specified.)

Fig. 7.1 (d) Cover of the welding power supply (Power Wave R350, Power Wave S350)

Fig. 7.1 (e) Cover of the welding power supply (Power Wave J350, Power Wave R500, Power Wave R450)

4 Remove primary power supply cable and put side face panel back. (It is similar at Expansion module is specified.)

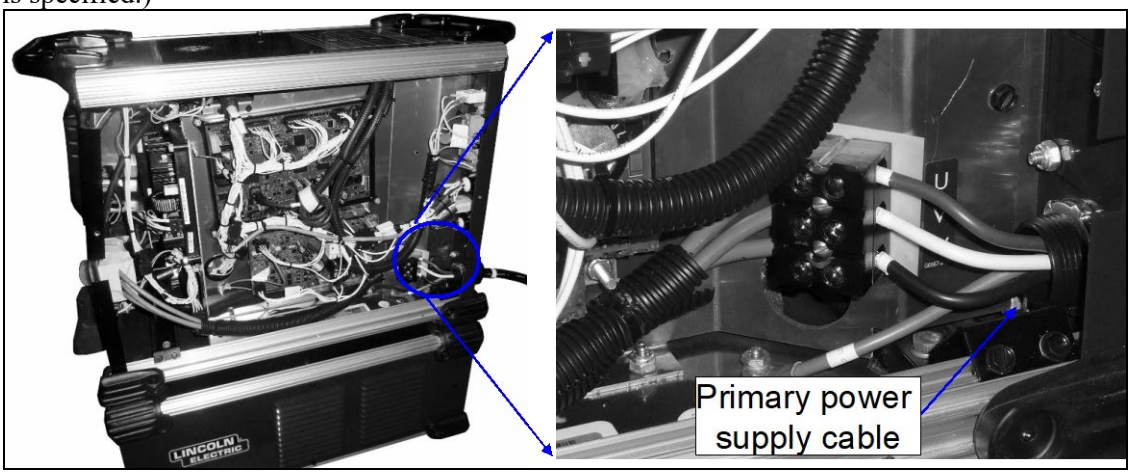


Fig. 7.1 (f) Primary power supply cable of welding power supply Power Wave R350 and Power Wave S350

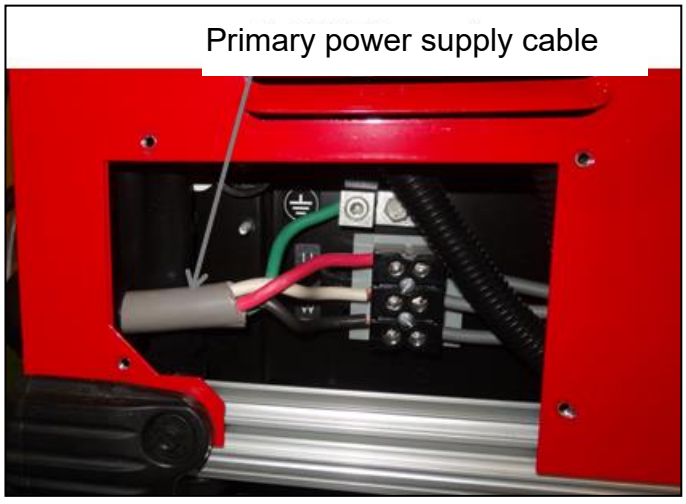
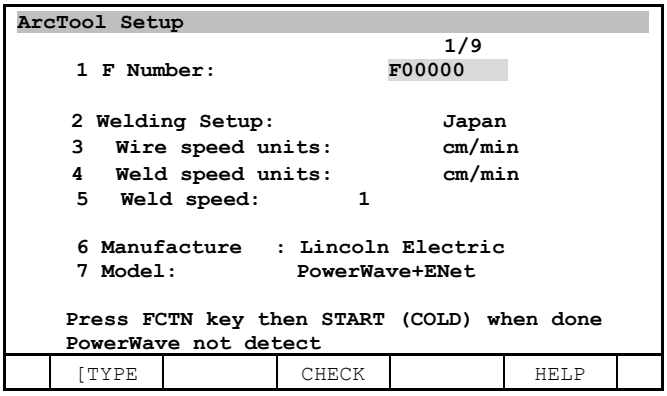


Fig. 7.1 (g) Primary power supply cable of welding power supply Power Wave J350, Power Wave R500, Power Wave R450

5 Replace old welding power supply by new one. For its assembly, please apply the steps above in reversed sequence.

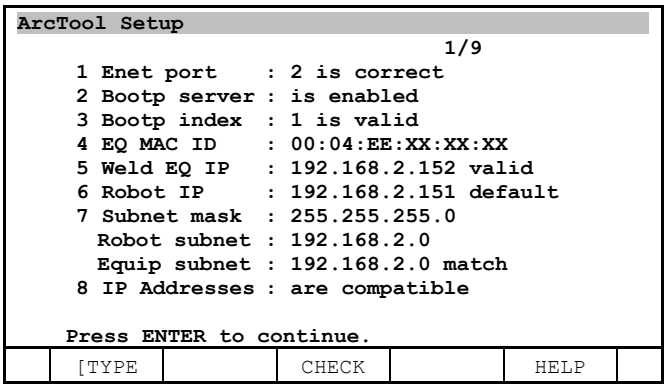
6 Next, perform communication establishment of replaced welding power supply and robot controller. Turn on the robot controller during pressing the [PREV] key and the [NEXT] key of the teach pendant. Controlled start is performed.

7 After controlled start, ARC TOOL setup screen as below starts up.

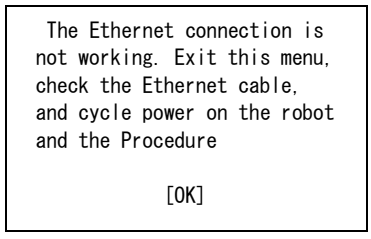


8 Since, connection between controller and new weld equipment isn't established, the message "PowerWave not detect" is displayed. Press F3 "CHECK" key.

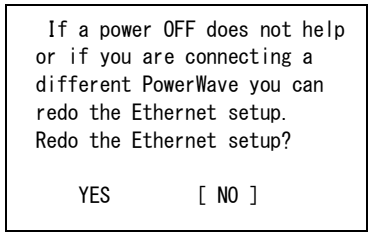
9 Configurations to connect older weld equipment are displayed and a message "Press ENTER to continue" is displayed. Press the [ENTER] key.



10 Next, controller try to connect new weld equipment based on older weld equipment configuration and will fail to connect. The following message box will be appeared, press the [ENTER] key.



11 Next, the following message box is appeared. In this message box, it requires to operation to establish to connect with new PowerWave. Press [PREV] key to move cursor on "YES" and press the [ENTER] key.



12 Message box as below is opened. Confirm Ethernet cable connection is correct and PowerWave power supply is turned ON, then press the [ENTER] key.

```
 To setup PowerWave+Ehernet
the Ethernet cable must be
connected and the PowerWave
must be ON.

          [ OK ]
```

13 Communication establishment with replace welding power supply is performed.
14 When communication becomes established, a message “PowerWave detects” will be displayed. Press the [FCTN] key and select “START(COLD)” to perform cold start.
15 After cold start is complete set correct wire feeder referring to Setting of wire feeder of Section 10.4.

> ⚠ **CAUTION**
> When firmware version or weld table version isn’t same between older weld equipment and new weld equipment, different welding result may occur even if same weld condition is used since, firmware or weld table are incompatible.
> If firmware version or weld table version isn’t same as older weld equipment, please let us. To confirm the versions, please see Arclink Status screen(Section 4.6).

When expansion module is specified

1 Refer to Chapter 12 about Expansion module replacing method. When using a Expansion module, connect sense lead of Fig. 7.1 (h). Be sure to connect this cable, too.

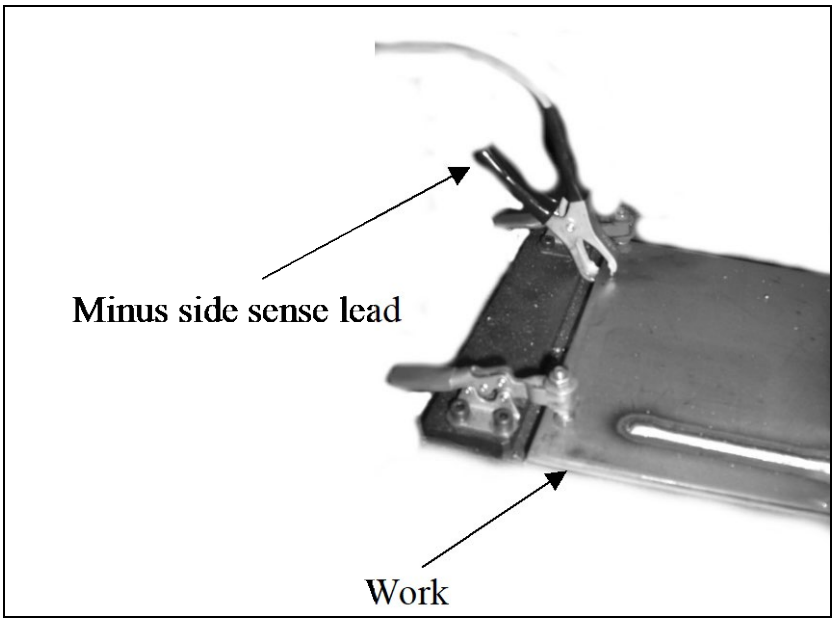


Fig. 7.1 (h) Connection of welding power supply and expansion module

7.2 REPLACING THE WELDING POWER SUPPLY (Power Wave *i*400)

In the following, it explains the welding power supply integrated controller of Power Wave *i*400.

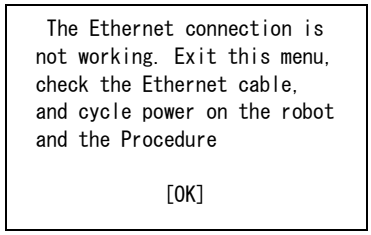
1 Open the door of the controller.
2 Remove the connector of the cable, which is connected to CD38B referring to Fig. 7.2 (a).
3 Remove the cover of the right side of the bottom, then remove the nuts which fix the unification kit referring Fig. 7.2 (b).
4 Pull out the cable to the controller side.
5 Remove sheet metal of upper side of welding power supply referring to Fig. 7.2 (c).
6 Remove the terminal of cable of U1, V1, W1 and G in upper right of welding power supply referring to Fig. 7.2 (d).
7 Pull out the cable which is removed procedure 6 from the outside of controller.
8 Remove the bolt which is fixation of welding power supply to controller and hang the controller by crane referring to Fig. 7.2 (b), (e).
9 Attach new welding power supply by opposite procedure.
10 Then, operate the communication establishment procedure after replacement. Turn ON the controller with [PREV] and [NEXT] key pressed. Controlled start is performed.
11 After controlled start, ARC TOOL setup screen as below starts up.

```
ArcTool Setup
                                    1/9
     1 F Number:                 F00000

     2 Welding Setup:                Japan
     3   Wire speed units:           cm/min
     4   Weld speed units:           cm/min
     5   Weld speed:         1

     6 Manufacture   : Lincoln Electric
     7 Model:          PowerWave+ENet

    Press FCTN key then START (COLD) when done
    PowerWave not detect
|  | [TYPE |  | CHECK |  | HELP |  |
```

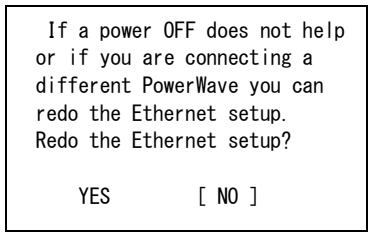
12 Since, connection between controller and new weld equipment isn't established, the message "PowerWave not detect" is displayed. Press F3 "CHECK" key.
13 Configurations to connect older weld equipment are displayed and a message "Press ENTER to continue" is displayed. Press the [ENTER] key.

```
ArcTool Setup
                                    1/9
     1 Enet port    : 2 is correct
     2 Bootp server : is enabled
     3 Bootp index  : 1 is valid
     4 EQ MAC ID    : 00:04:EE:XX:XX:XX
     5 Weld EQ IP   : 192.168.2.152 valid
     6 Robot IP     : 192.168.2.151 default
     7 Subnet mask  : 255.255.255.0
       Robot subnet : 192.168.2.0
       Equip subnet : 192.168.2.0 match
     8 IP Addresses : are compatible

    Press ENTER to continue.
|  | [TYPE |  | CHECK |  | HELP |  |
```

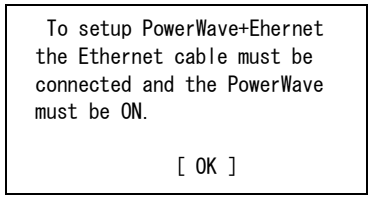
14 Next, controller try to connect new weld equipment based on older weld equipment configuration and will fail to connect. The following message box will be appeared, press the [ENTER] key.



15 Next, the following message box is appeared. In this message box, it requires to operation to establish to connect with new PowerWave. Press the [PREV] key to move cursor on “YES” and press the [ENTER] key.



16 Message box as below is opened. Confirm Ethernet cable connection is correct and PowerWave power supply is turned ON, then press the [ENTER] key.



17 Communication establishment with replace welding power supply is performed.
18 When communication becomes established, a message “PowerWave detects” will be displayed. Press the [FCTN] key and select “START(COLD)” to perform cold start.
19 After cold start is complete set correct wire feeder referring to Setting of wire feeder of Section 10.3.

⚠ CAUTION
When firmware version or weld table version isn’t same between older weld equipment and new weld equipment, different welding result may occur even if same weld condition is used since, firmware or weld table are incompatible.
If firmware version or weld table version isn’t same as older weld equipment, please let us. To confirm the versions, please see ArcLink Status screen(Section 3.6).

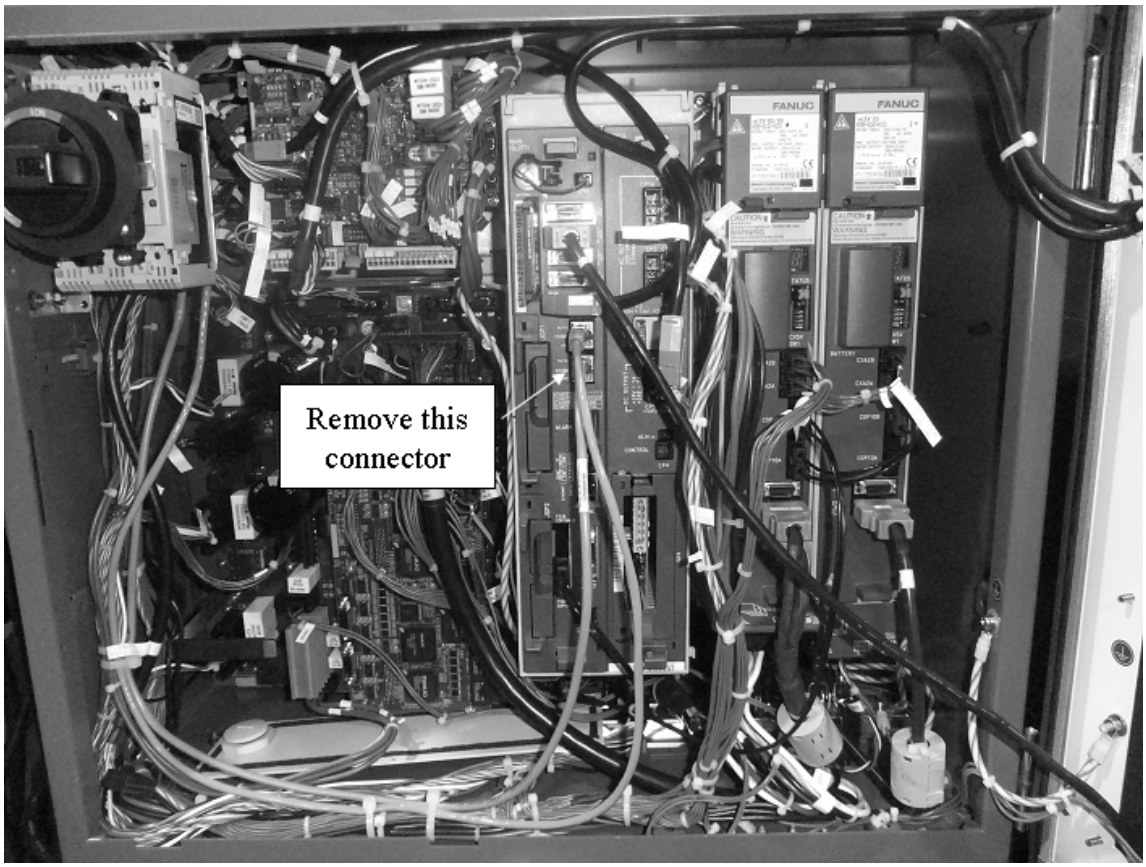


Fig. 7.2 (a) Remove the connector of main board (R-30*i*B Controller A cabinet)

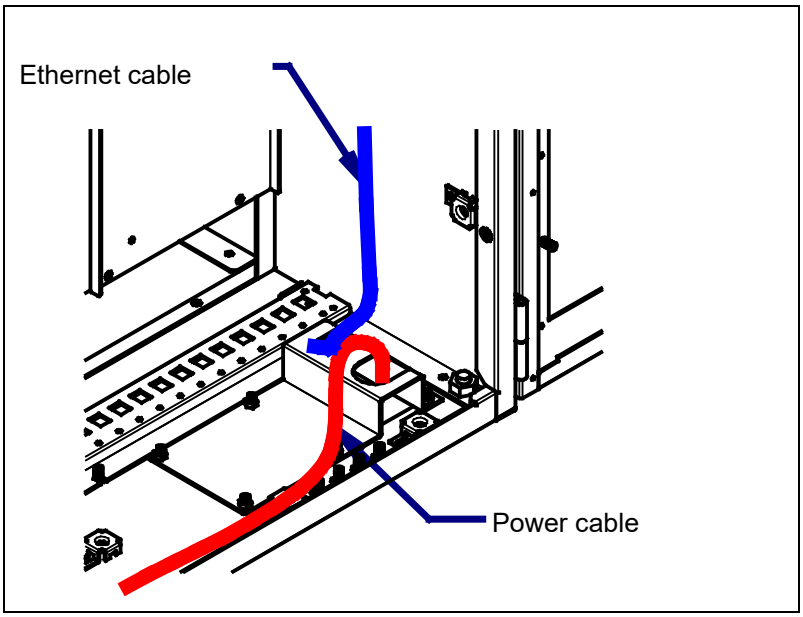


Fig. 7.2 (b) Remove cable fixation sheet metal and welding power supply fixation bolt

Fig. 7.2 (c) Remove cover of welding power supply

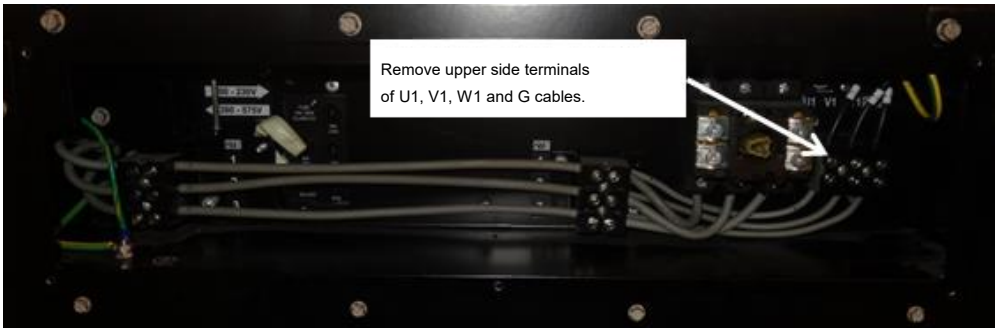


Fig. 7.2 (d) Remove terminal of welding power supply

Fig. 7.2 (e) Remove fixation bolt of welding power supply

7.3 REPLACING THE TORCH CABLE (ARC Mate 0*i*B)

1 Remove the wire guide of the wire feeder.

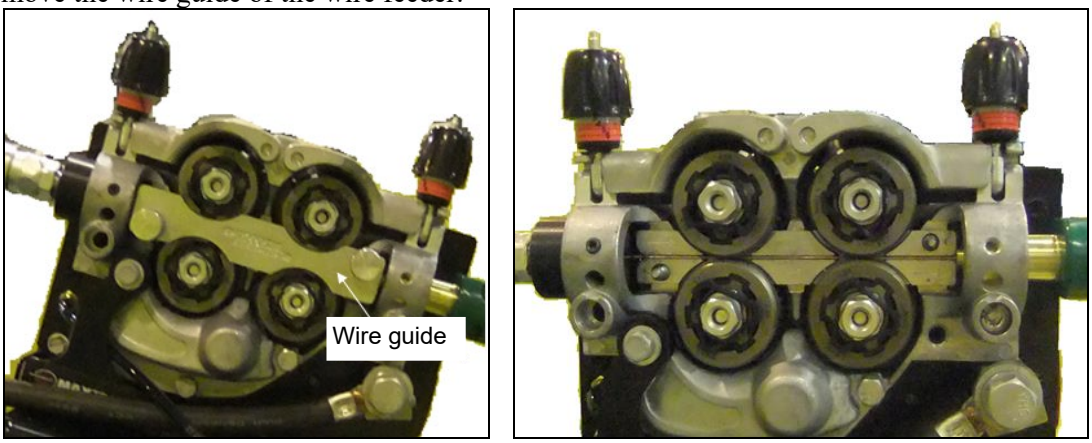


Fig. 7.3 (a) Replacing the torch cable

2 Take down the idle arm below, lift the drive roll (upper side) to upper side.
3 Remove the gas hose from the joint.
4 Loosen the hexagon hole bolt with a hexagon wrench which is appendix of wire feeder.
5 Pull out torch cable from the wire feeder.

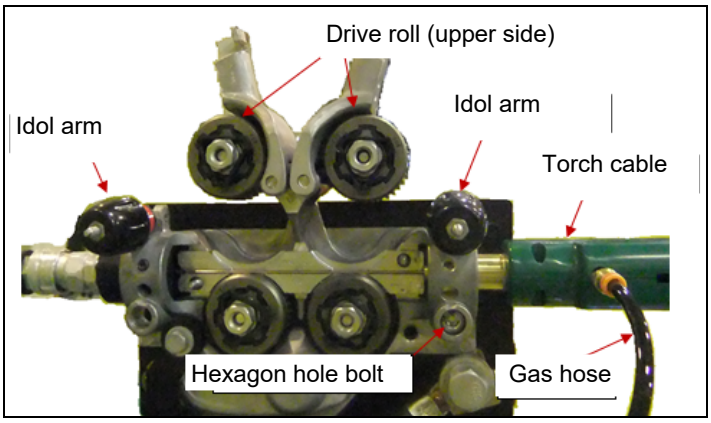


Fig. 7.3 (b) Replacing the torch cable

6 Remove the torch bracket mounting bolts.
7 Replace old torch cable by new one. For its assembly, please apply the steps above in reversed sequence.
8 Pull the wire. In this time, tip may be caught on the wire, so remove tip from torch in advance and pull wire through torch to torch tip. Afterwards attach the tip to the torch.

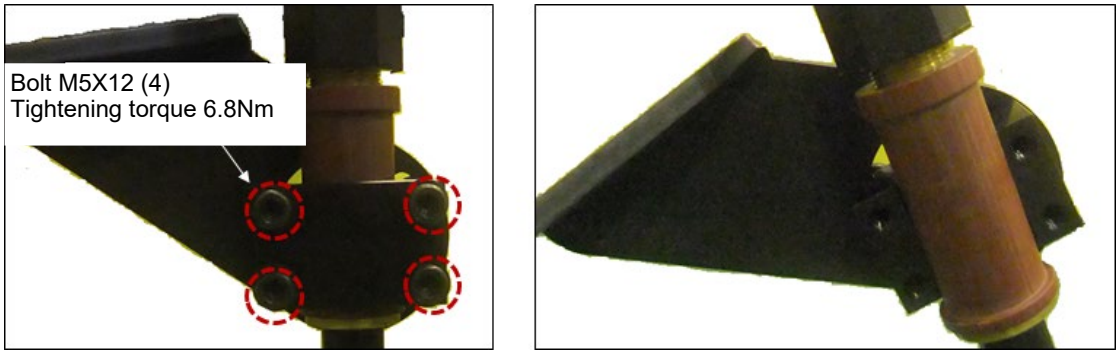


Fig. 7.3 (c) Replacing the torch cable

7.4 REPLACING TORCH CABLE (ARC Mate *i*C series) (WHEN USING TORCH CABLE CHANGING TOOL (RECOMMENDED))

1 Move the robot posture to J4=J5=J6=0°, The J1-J3 axis is not cared about by arbitrary posture.
2 Confirm the gas hose and the water cooling hoses arrange as Fig. 7.4 (a). In addition, remove the torch cable from the conduit and confirm grease is applied on the hoses and does not occur interference of the hoses.

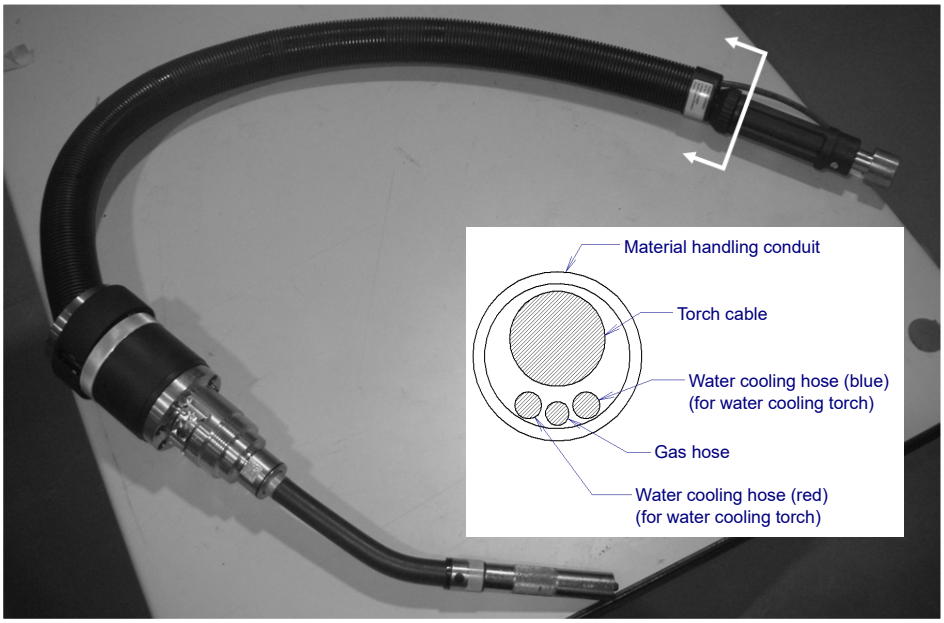


Fig. 7.4 (a) Torch appearance (Section view is seen from the arrow direction)

3 Remove the flexible conduit of wire feeder, cut the wire. Pull out the wire from the tip point after it supplies it until the wire cannot be sent. (Please do not remove the torch neck.)

4 Remove the conduit cover of J3 arm referring to Fig. 7.4 (b).

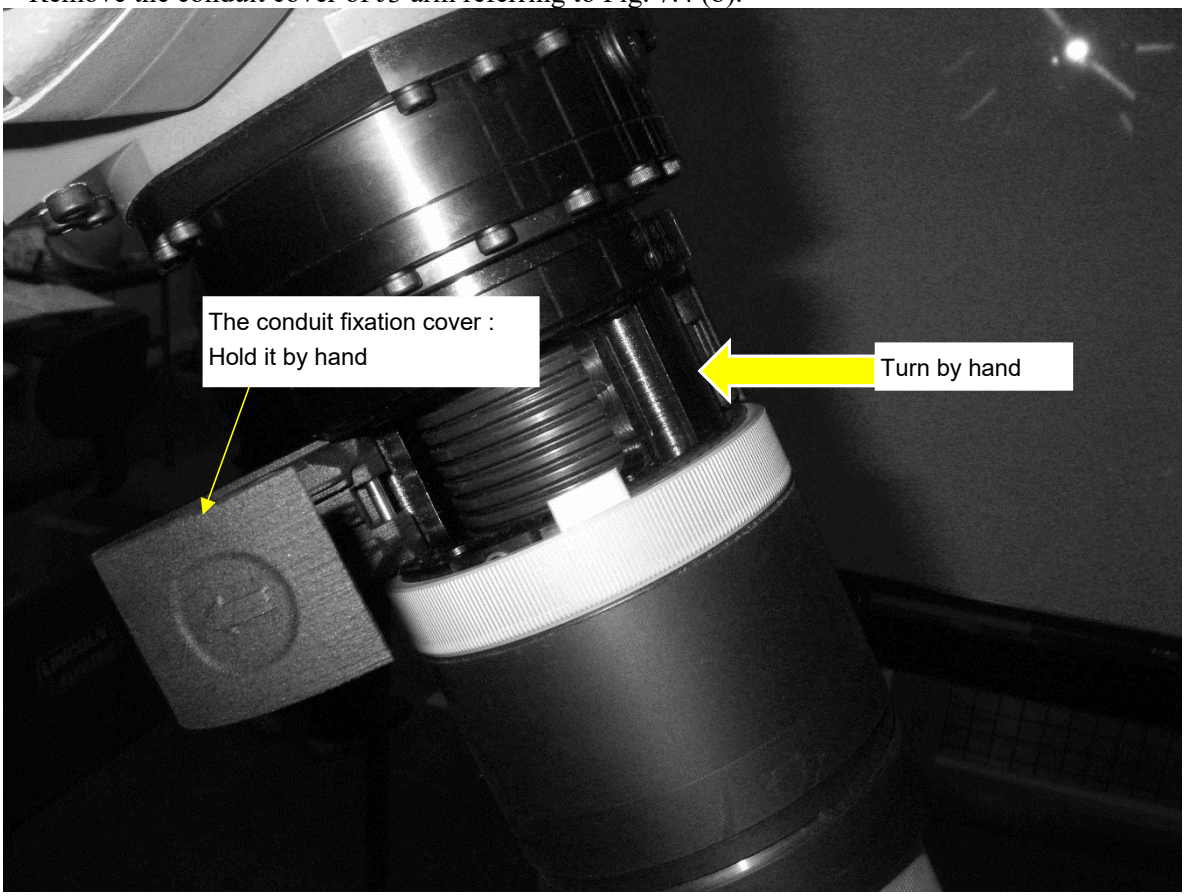


Fig. 7.4 (b) Remove conduit

5 Loosen the fixation two bolt of torch side referring to Fig.7.4 (c).

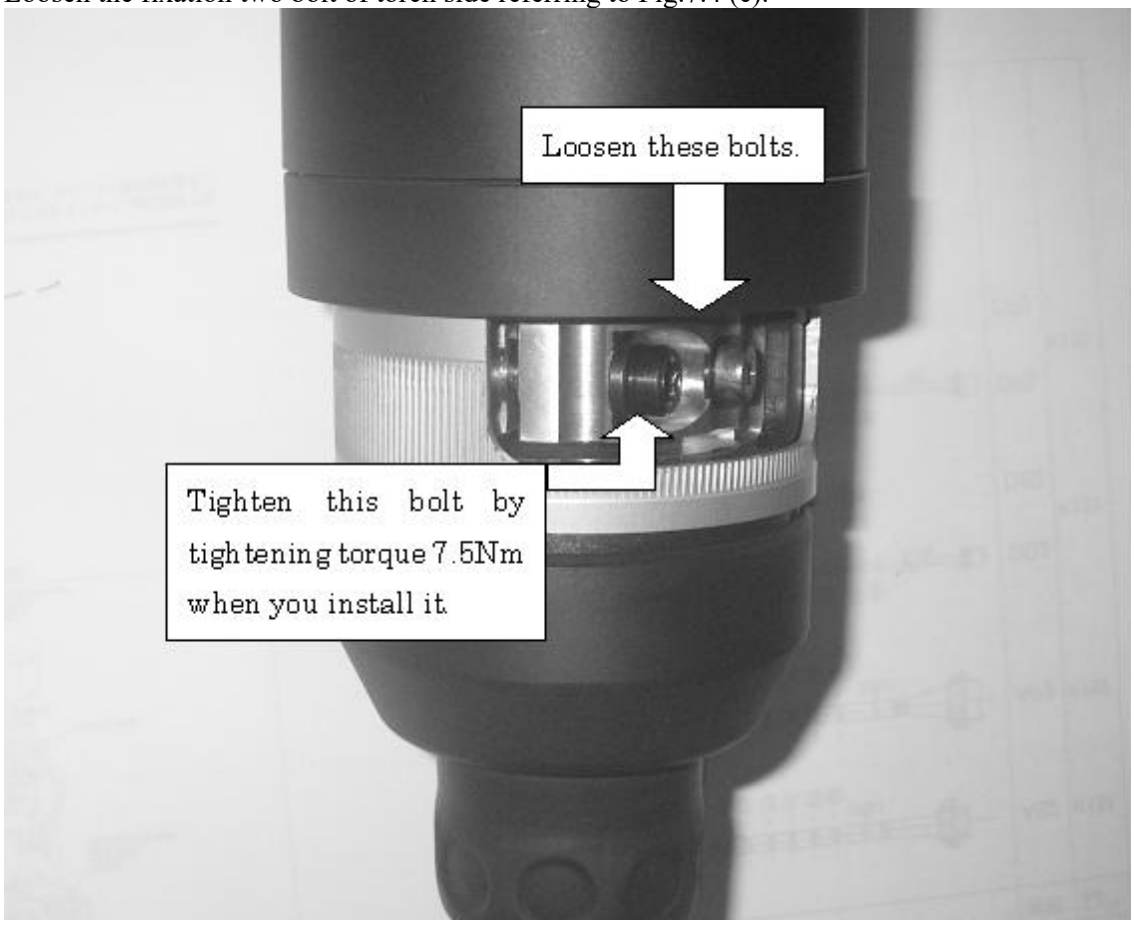


Fig. 7.4 (c) Fixation bolt of torch side

6 Remove torch cable from torch adapter (Fig. 7.4 (d).)

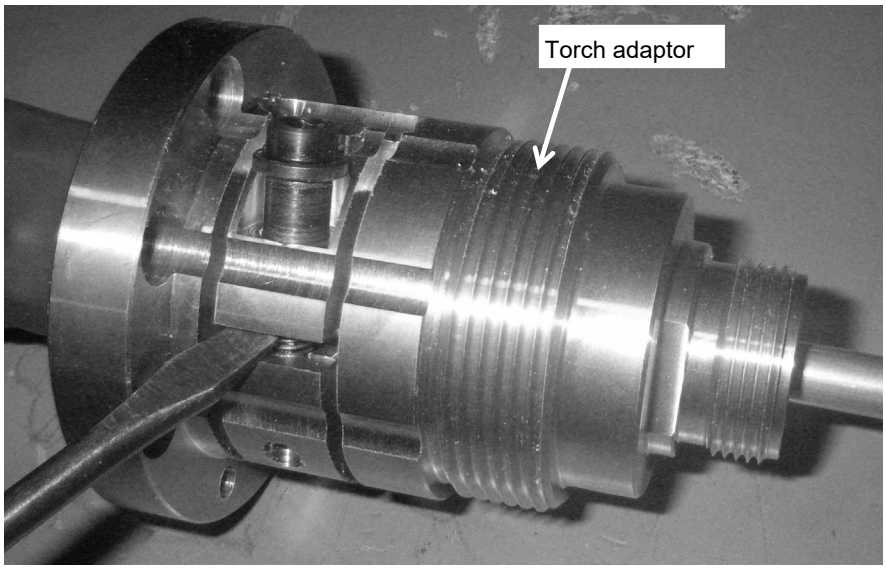


Fig. 7.4 (d) Groove of torch adapter

7 Loosen the bolt with hexagon hole of wire feeder referring to Fig. 7.4 (e).

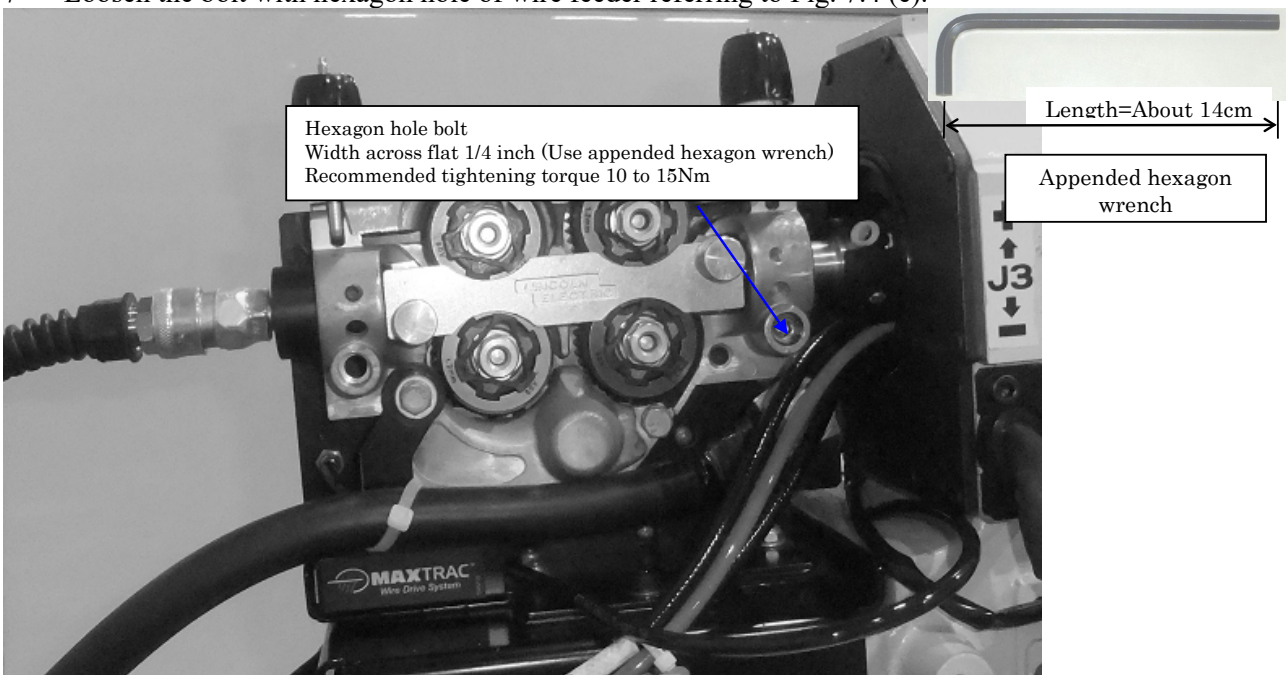


Fig. 7.4 (e) Remove the thumbscrews of wire feeder

8 Pull out the torch cable from the J3 arm part with Conduit to torch side.
9 Insert a new torch cable in the J3 arm part.
10 Match tip of metal of torch to the keyway and insert it into torch adapter.
11 Confirm the bottom of tip of metal of torch cable has stuck to the face of torch adapter. (refer to Fig. 7.4 (f)) When the torch cable doesn't enter easily, it becomes easy if a straight-head screwdriver is inserted in the groove, and the groove is expanded. (See Fig. 7.4 (d))

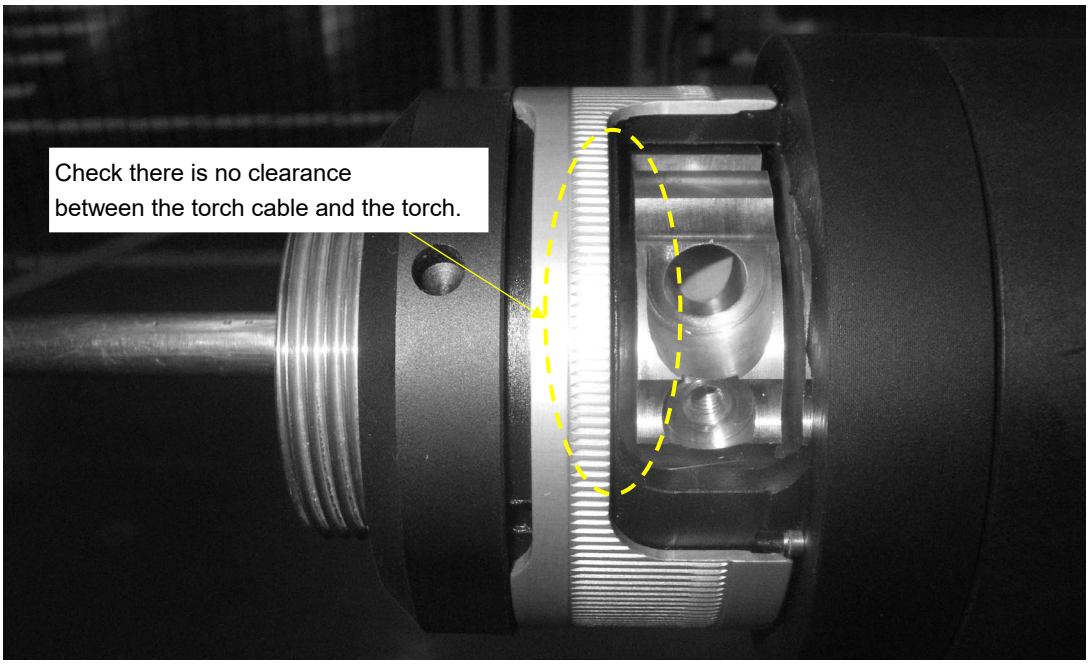


Fig. 7.4 (f) Confirming of no clearance of torch cable

12 Shut up a conduit till it do not move towards the torch neck, and lock a conduit fixation cover

13 According to Subsection 7.7, insert new liner to torch cable and tighten liner suppression nut. Adjust the length of liner.

14 Loosen a fixed bolt of the wire feeder to the torch cable to become parallel to wire feeder, insert torch cable all the way and tighten the bolt which is inside the wire feeder with wrench (1/4in) which is appended to wire feeder. (Recommended tightening torque 10 to 15 Nm) (See Fig. 7.4 (e).) This part is thumb screw depending on the time of shipment. In this case, tighten it with torque of 10Nm. (See Fig. 7.4 (g).)

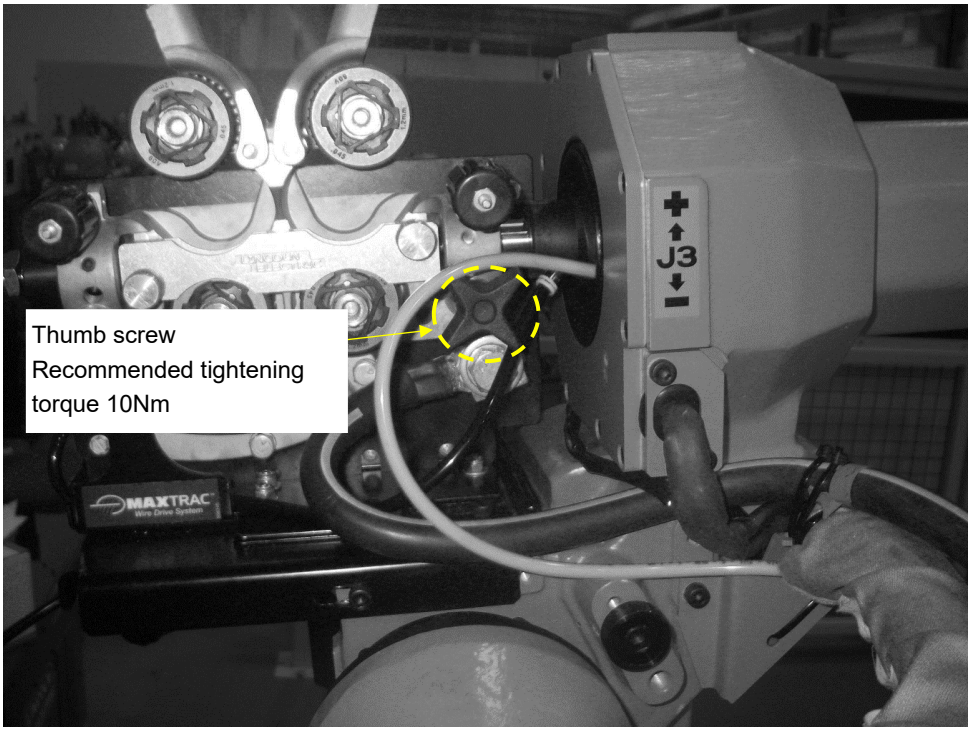


Fig. 7.4 (g) Remove the thumbscrews of wire feeder

15 Form the gas hose and water cooling hoses referring to Fig. 7.4 (h) ,Fig.7.4 (i). At this chance, be careful to prevent the interference of the hoses. Rotate the gas hose and water cooling torch 90° around the torch cable as shown in Fig. 7.4 (h). Locate it in the lower side of the torch cable (In case of floor mount） , Push it 20mm into the conduit, then fix it with cable ties referring to Fig. 7.4 (i).

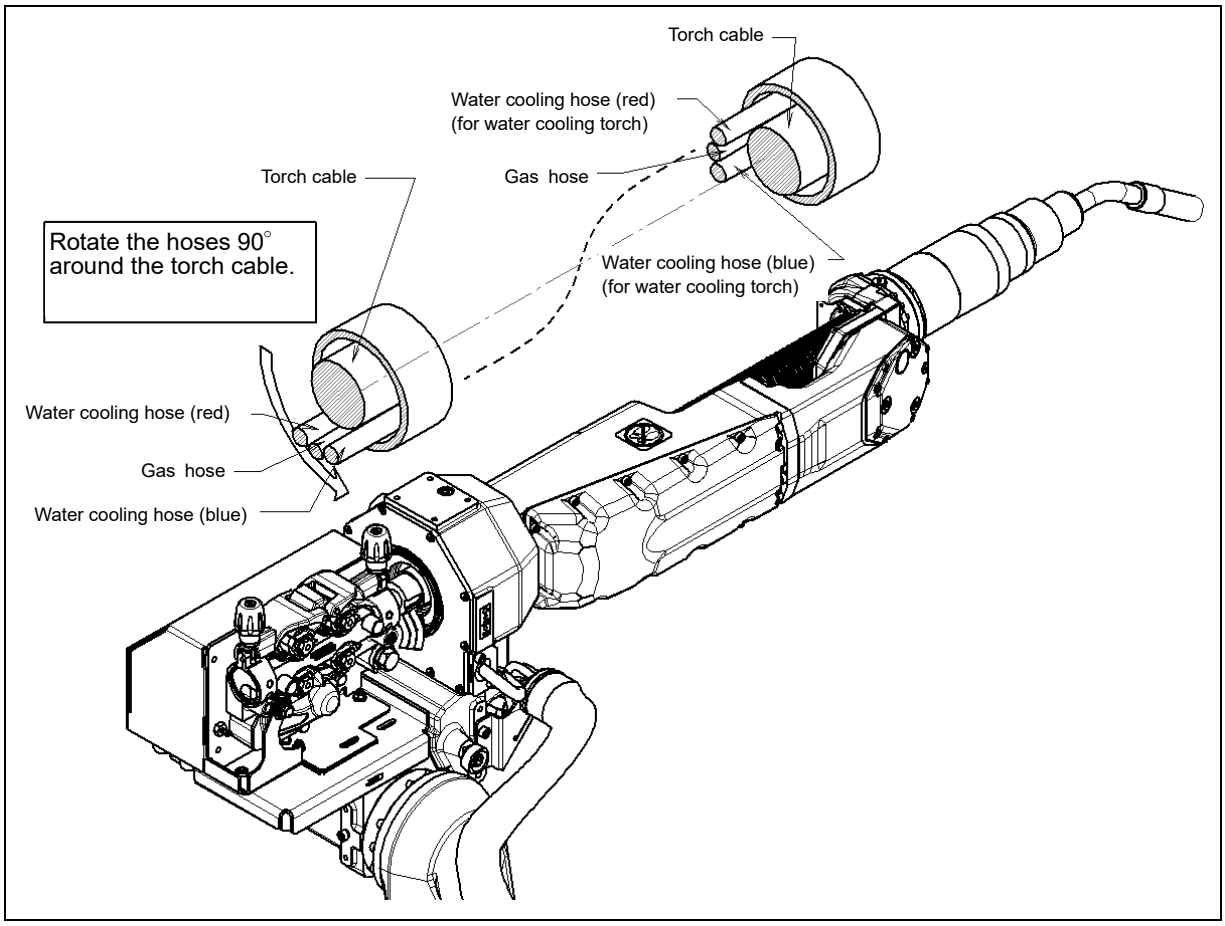


Fig. 7.4 (h) Arrangement of the cables and hoses

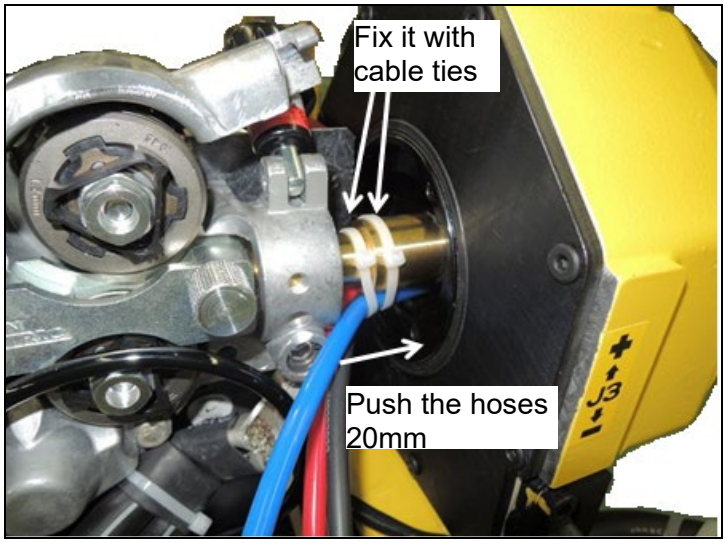


Fig. 7.4 (i) Forming of hoses

16 Attach fixation 2 bolts of torch side referring to Fig. 7.4 (c).Tighten black bolt with torque of 7.5Nm.

17 Firmly push Conduit all the way into the interior before applying the Conduit fixation cover, and install the cover that fixes Conduit referring to Fig. 7.4 (b).
18 Lift the roll, insert wire and restore them.
19 Adjust the length of the liner referring to Section 7.7.

Judgment of torch cable length

Confirm torch cable come out is less or equal to 10mm.
If it exceeds 10mm, pull out wire feeder to a direction apart from the robot and adjust it.

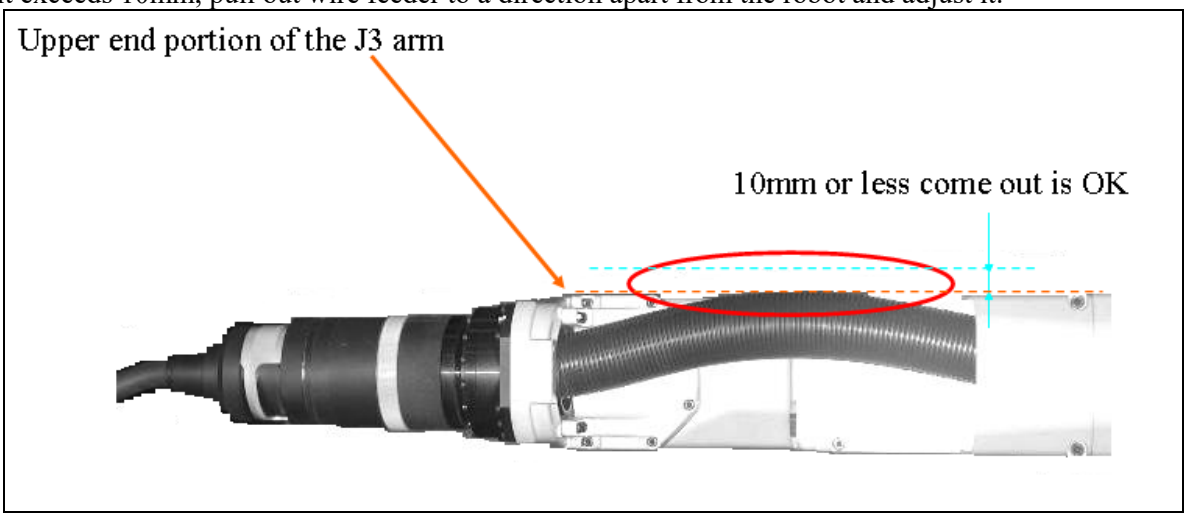


Fig. 7.4 (j) Judgment of torch cable length

7.5 REPLACING TORCH CABLE (ARC Mate *i*C series) (WHEN NOT USING TORCH CABLE CHANGING TOOL)

1 Move the robot posture to J4=J5=J6=0°, The J1-J3 axis is not cared about by arbitrary posture.
2 Confirm the gas hose and the water cooling hoses arrange as Fig. 7.5 (a). In addition, remove the torch cable from the conduit and confirm grease is applied on the hoses and does not occur interference of the hoses.

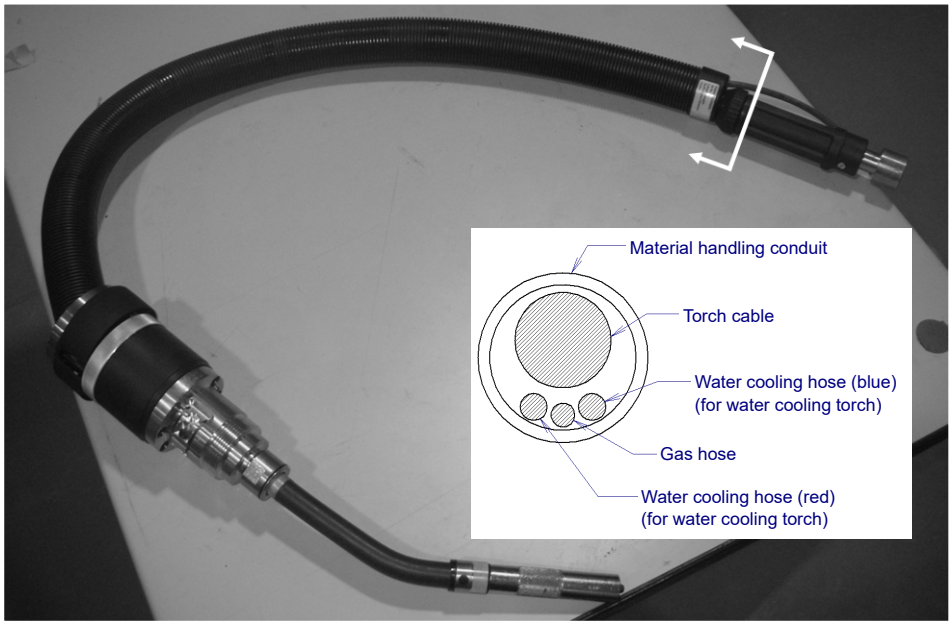


Fig. 7.5 (a) Torch appearance (Section view is seen from the arrow direction)

3 Remove the flexible conduit of wire feeder, cut the wire. Pull out the wire from the tip point after it supplies it until the wire cannot be sent.

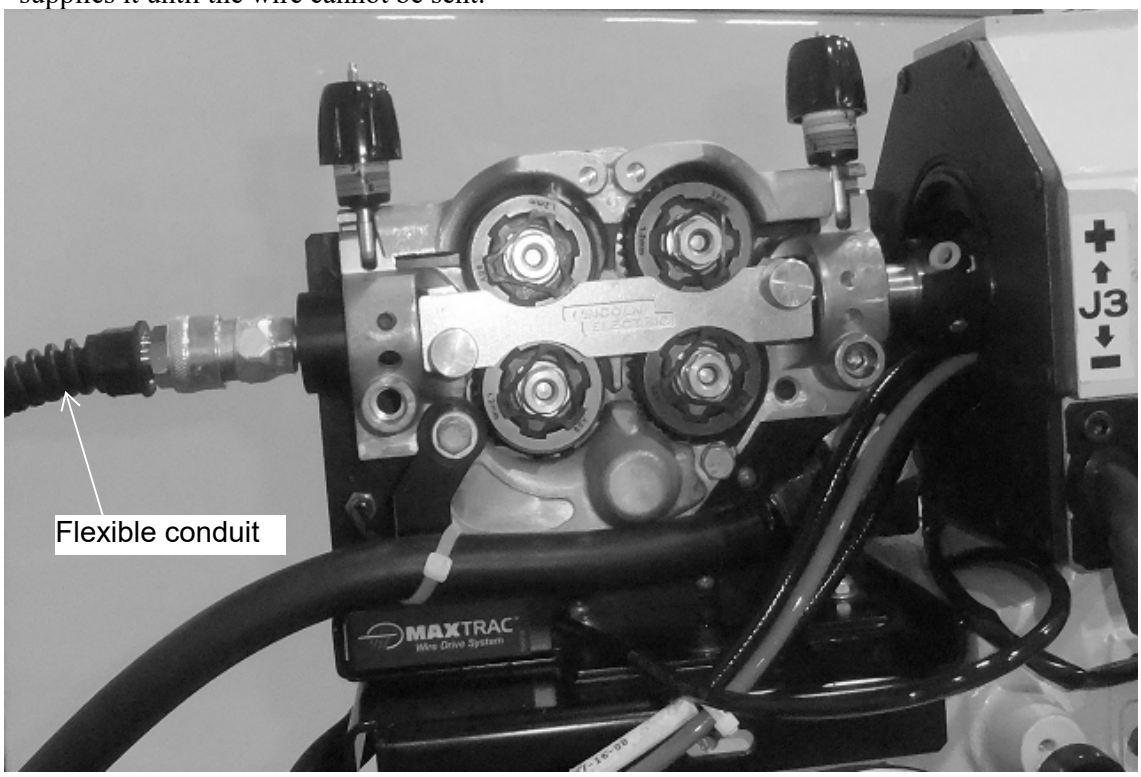


Fig. 7.5 (b) Remove flexible conduit

4 Remove the torch neck referring to Section 7.10 to 7.12.
5 Remove the conduit cover of J3 arm referring to Fig. 7.5 (c).

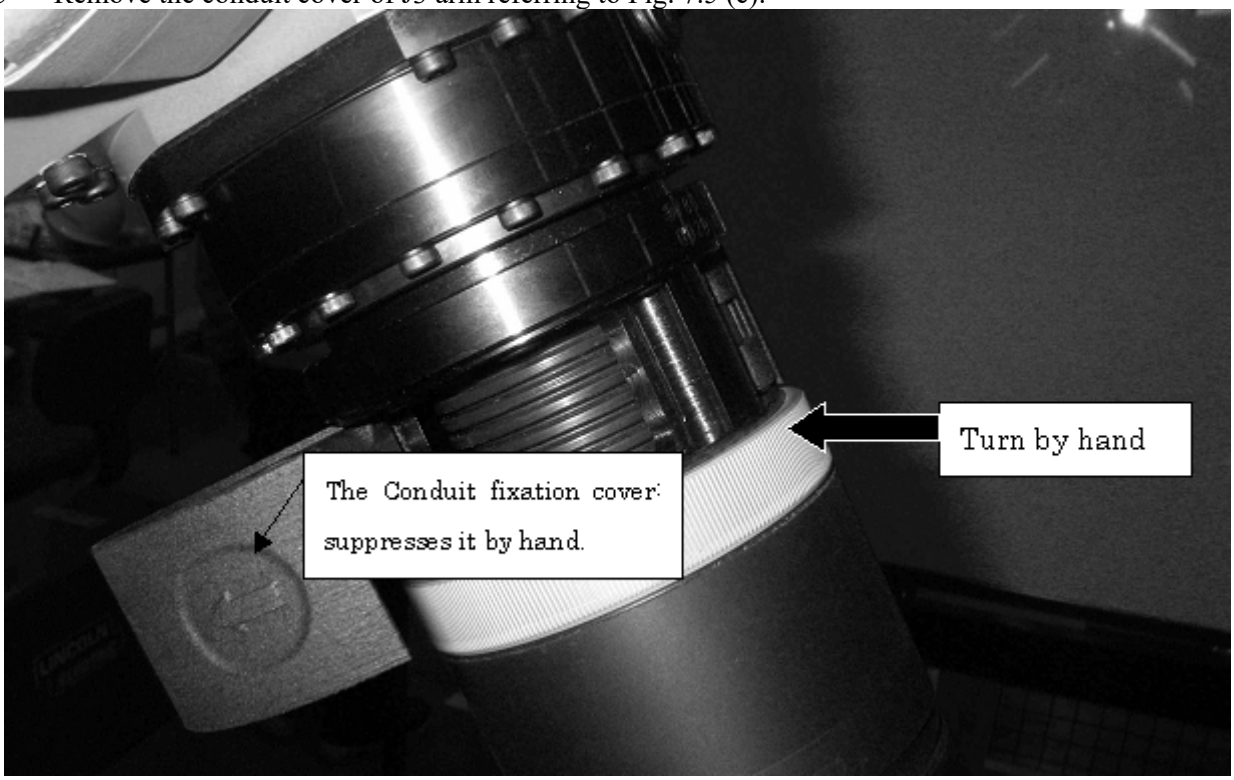


Fig. 7.5 (c) Remove conduit

6 Loosen the fixation two bolt of torch side referring to Fig. 7.5 (d).

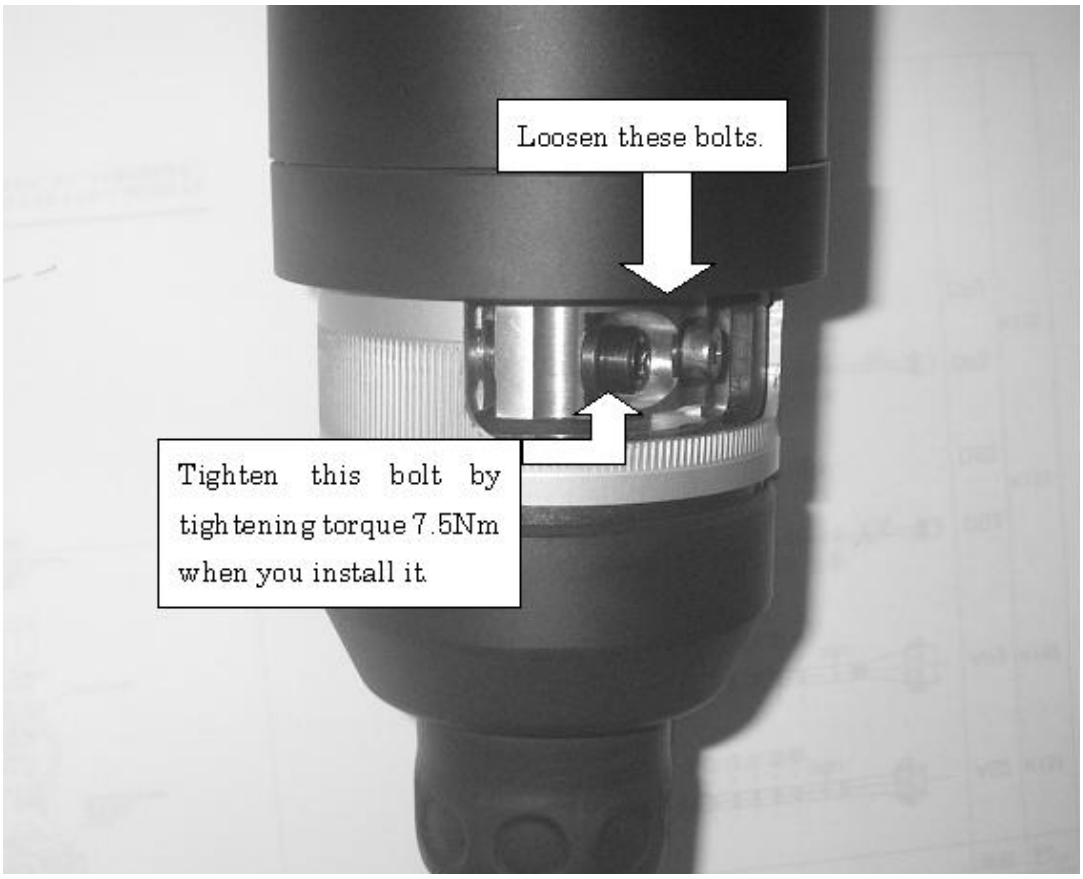


Fig. 7.5 (d) Fixation bolt of torch side

7 Remove torch cable from torch adapter (Fig. 7.5 (e).)

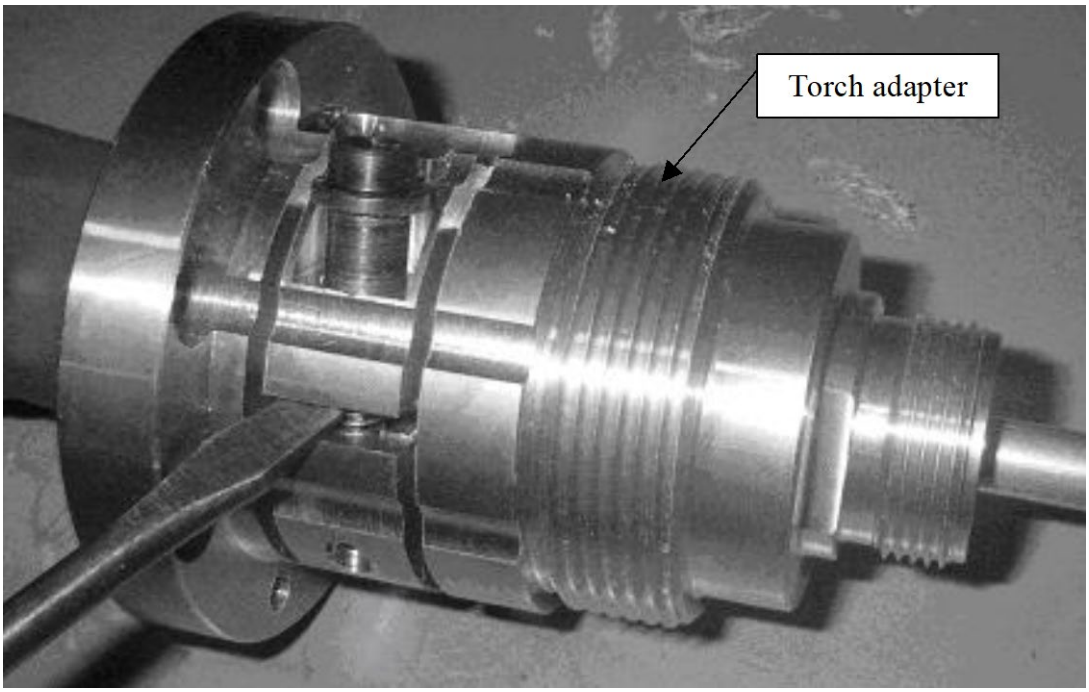


Fig. 7.5 (e) Groove of torch adapter

8 Loosen the bolt with hexagon hole of wire feeder referring to Fig. 7.5 (f).

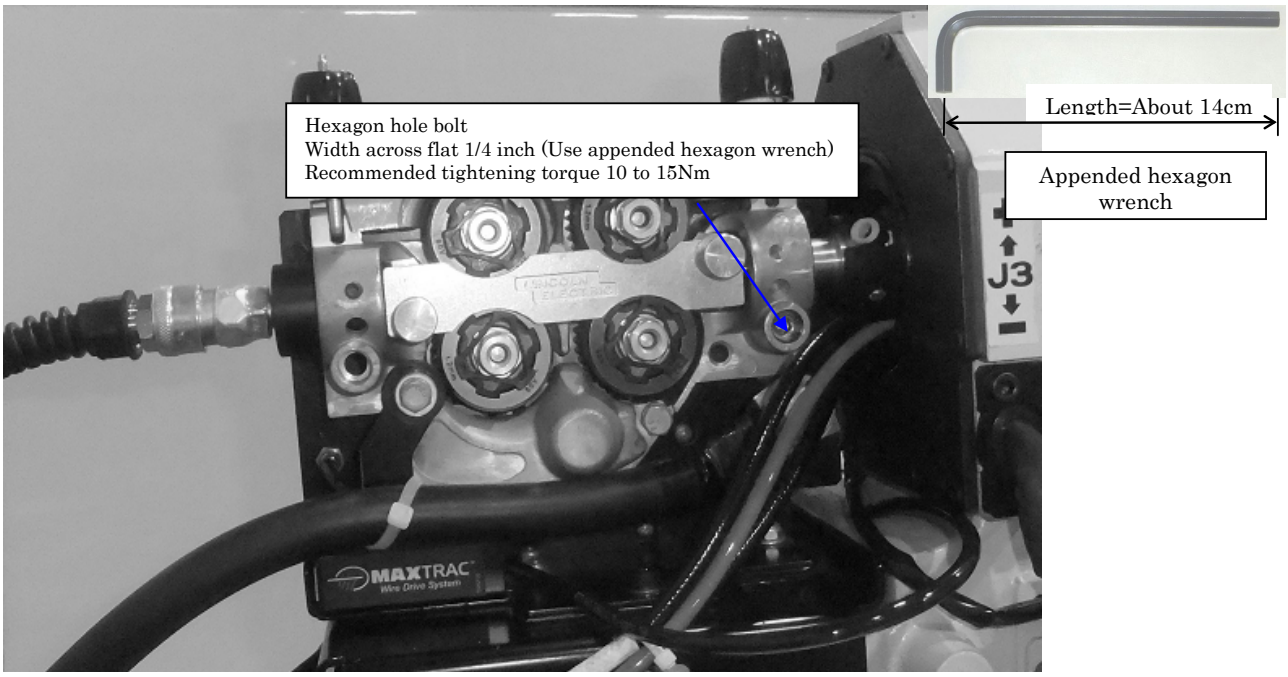


Fig. 7.5 (f) Remove the thumbscrews of wire feeder

9 Pull out the torch cable from the J3 arm part with Conduit to torch side.
10 Insert a new torch cable in the J3 arm part.
11 Insert torch cable changing tool (A05B-1291-K001) referring to Fig. 7.5 (g), (h).

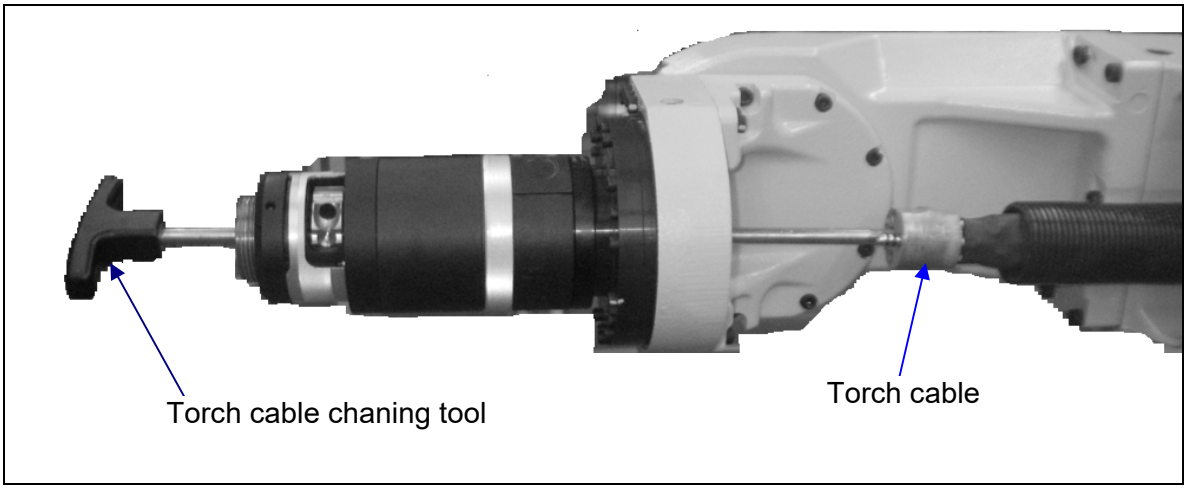


Fig. 7.5 (g) Attach torch cable changing tool

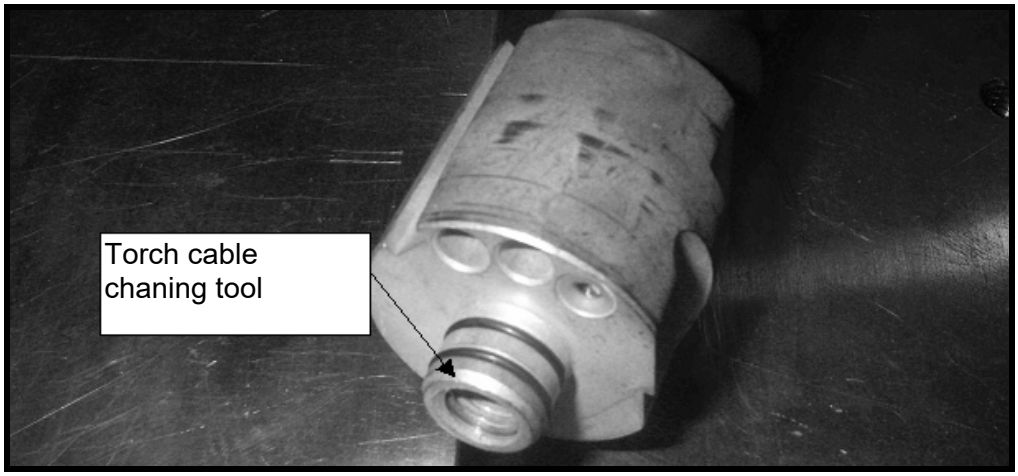


Fig. 7.5 (h) Torch cable changing tool attaching position

12 Match tip of metal of torch to the keyway and insert it into torch adapter.
13 Confirm the bottom of tip of metal of torch cable has stuck to the face of torch adapter. When the torch cable doesn't enter easily, it becomes easy if a straight-head screwdriver is inserted in the groove, and the groove is expanded. (See Fig. 7.5 (i))

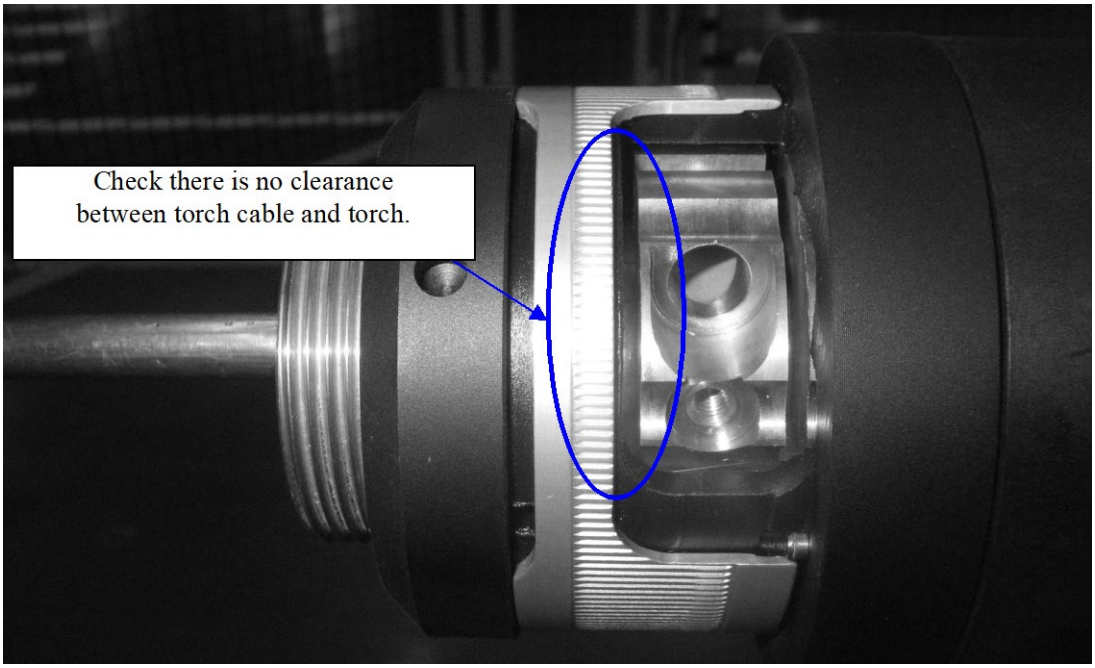


Fig. 7.5 (i) Confirming of no clearance of torch cable

14 Shut up a conduit till it do not move towards the torch neck, and lock a conduit fixation cover
15 Attach the torch neck referring to Section 7.10 to 7.12. Recommended tightening torque for the nut is 30Nm.
16 According to Section 7.7, insert new liner to torch cable and tighten liner suppression nut. Adjust the length of liner.
17 Loosen a fixed bolt of the wire feeder to the torch cable to become parallel to wire feeder, insert torch cable to a deep corner and tighten the bolt which is inside the wire feeder with wrench (1/4in) which is appended to wire feeder. (Recommended tightening torque 10 to 15 Nm)(refer to Fig. 7.5 (f)) This part is thumb screw depending on the time of shipment. In this case, tighten it with torque of 10Nm. (See Fig. 7.5 (j).)

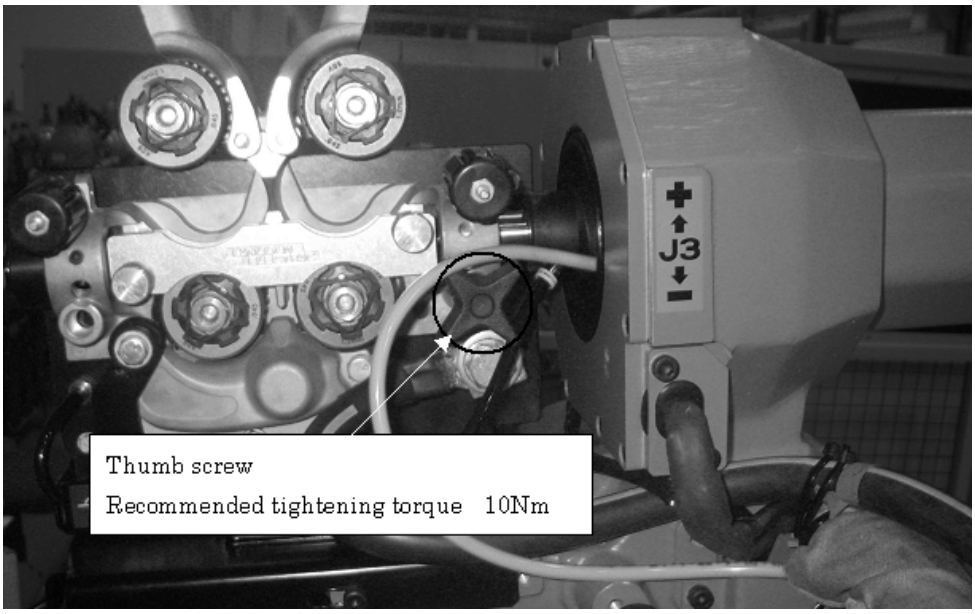


Fig. 7.5 (j) Remove the thumbscrews of wire feeder

18 Form the gas hose and water cooling hoses referring to Fig. 7.5 (k) , Fig. 7.5 (l). At this chance, be careful to prevent the interference of the hoses. Rotate the gas hose and water cooling torch 90° around the torch cable as shown in Fig. 7.5 (k). Locate it in the lower side of the torch cable (In case of floor mount） , Push it 20mm into the conduit, then fix it with cable ties referring to Fig. 7.5 (k).

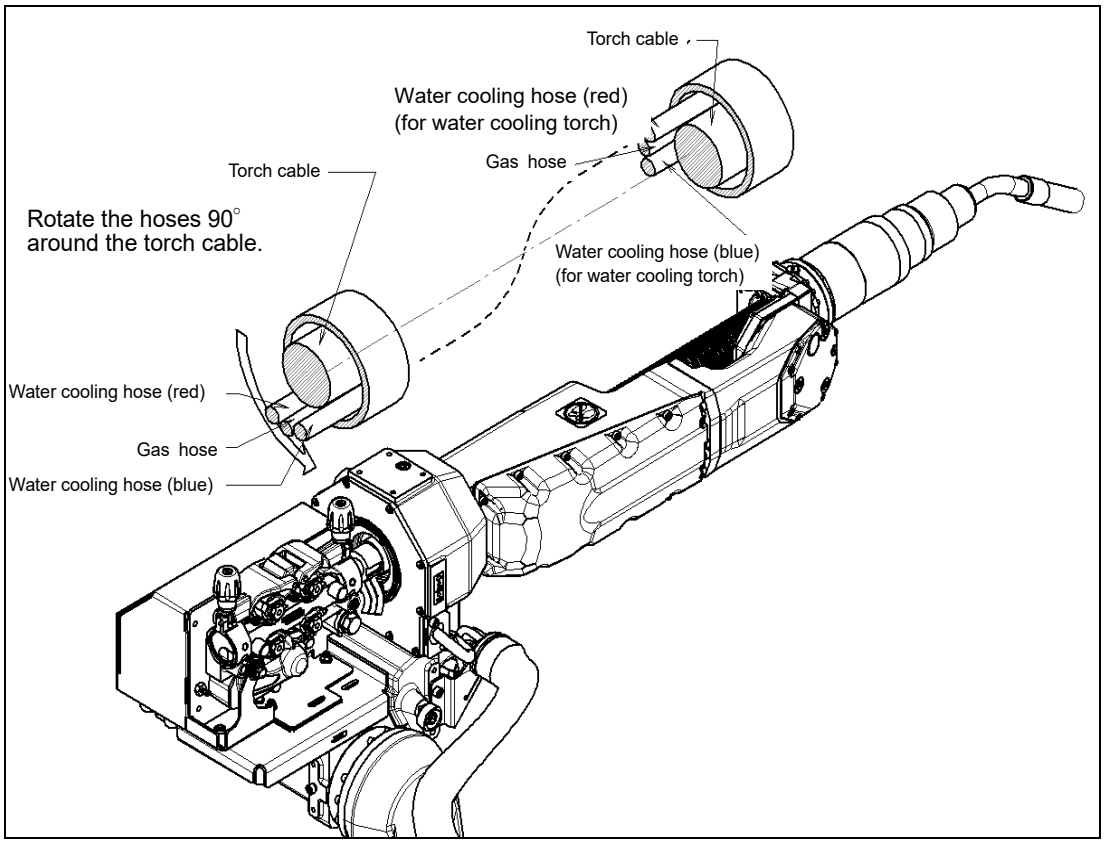


Fig. 7.5 (k) Arrangement of the cables and hoses

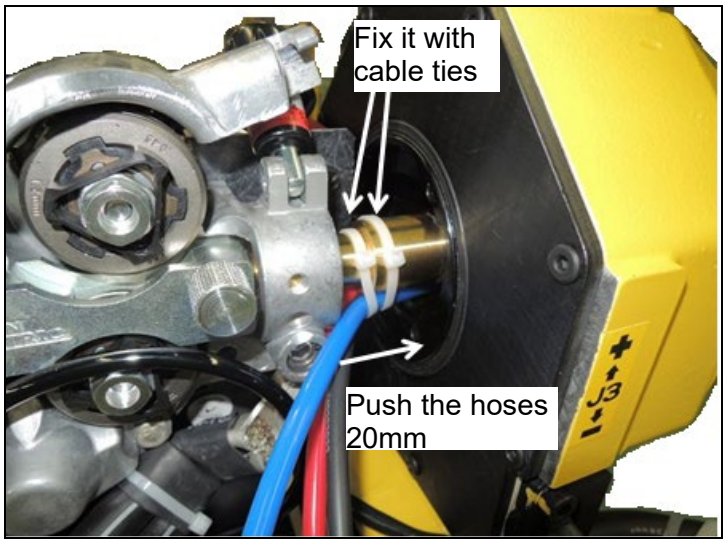


Fig. 7.5 (l) Forming of hoses

19 Attach fixation 2 bolts of torch side referring to Fig. 7.5 (d). Tighten black bolt with torque of 7.5Nm.
20 Firmly push Conduit into the interior before applying the Conduit fixation cover, and install the cover that fixes Conduit referring to Fig. 7.5 (c).
21 Lift the roll, insert wire and restore them.
22 Adjust the length of the liner referring to Section 7.7.

Judgment of torch cable length

Confirm torch cable come out is less or equal to 10mm.
If it exceeds 10mm, pull out wire feeder to a direction apart from the robot and adjust it.

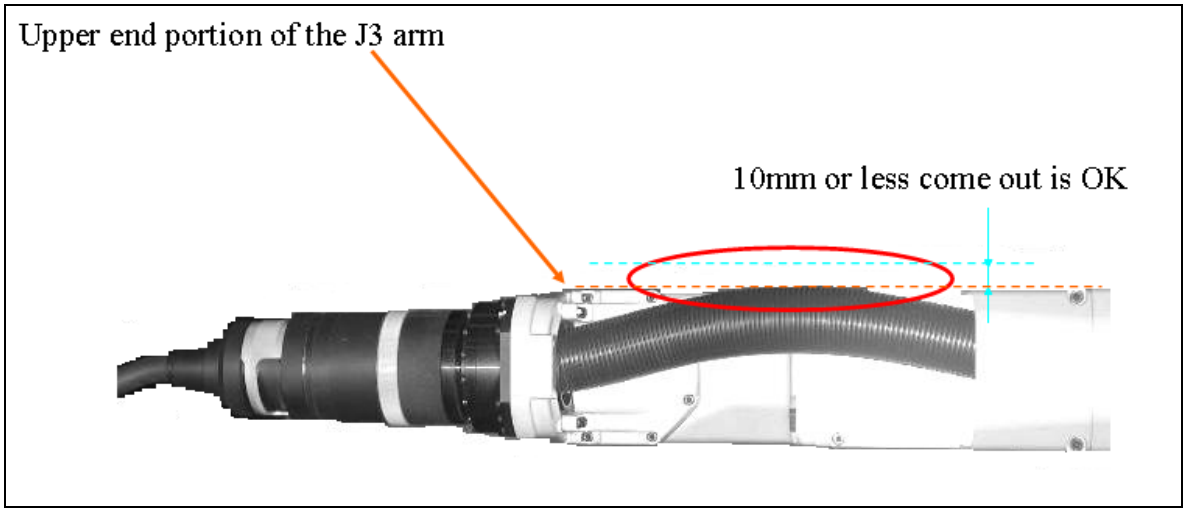


Fig. 7.5 (m) Judgment of torch cable length

7.6 REPLACING THE LINER (ARC Mate 0*i*B)

1 Remove the wire guide of wire feeder.

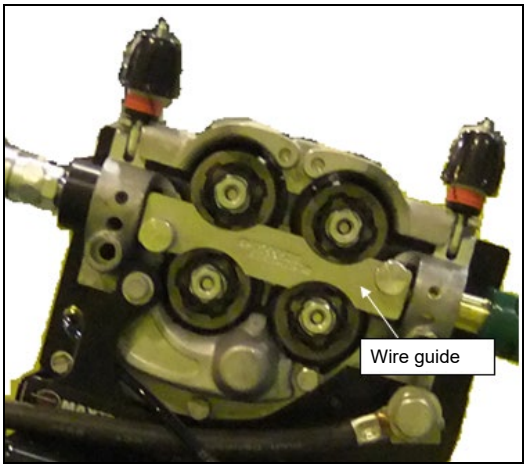


Fig. 7.6 (a) Replacing the liner

2 Take down the idle arm below, lift the drive roll (upper side) to upper side.

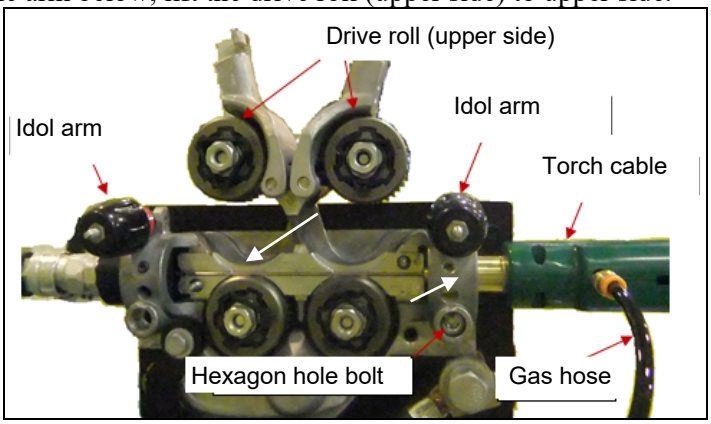


Fig. 7.6 (b) Replacing the liner

3 Remove gas hose form joint.
4 Loosen it with hexagon wrench which is appendix of wire feeder.
5 Pull out torch cable from wire feeder.
6 Loosen torch cable tip nu and remove it.

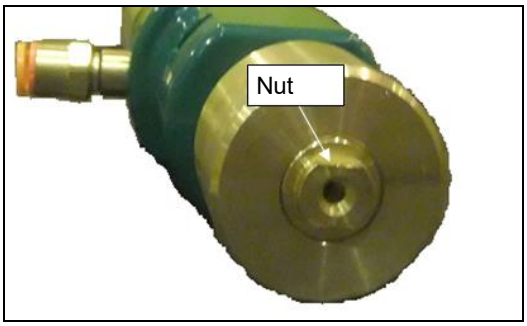


Fig. 7.6 (c) Replacing the liner

7 Remove nozzle, gas diffuser (orifice), tip, insulation cylinder (insulator) and tip body in this turn from torch tip.

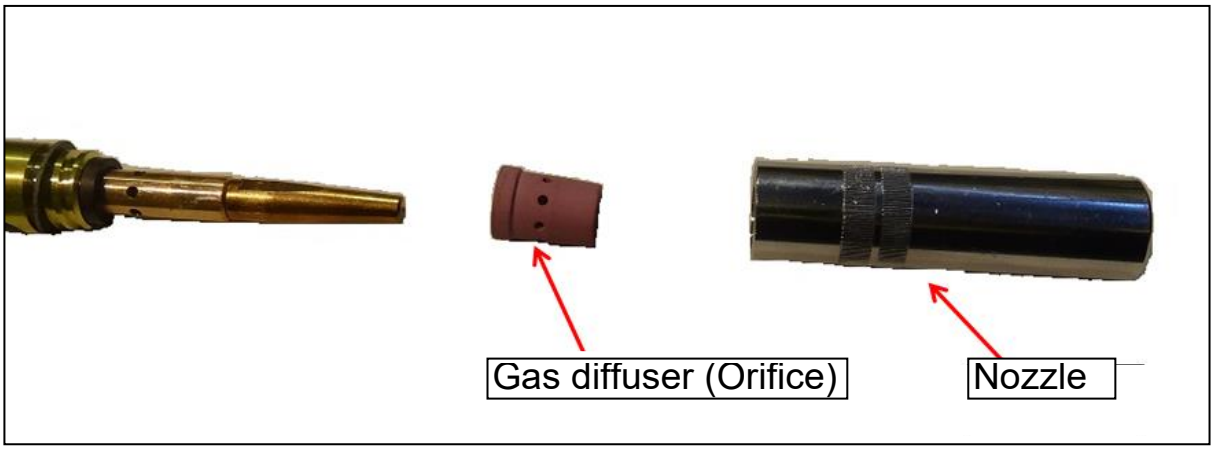


Fig. 7.6 (d) Replacing the liner

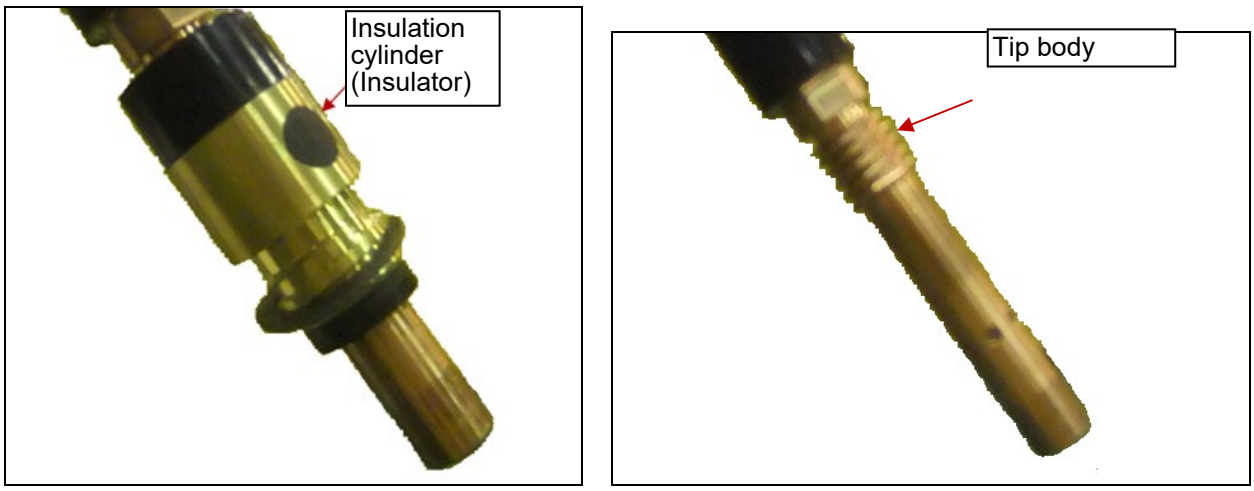


Fig. 7.6 (e) Replacing the liner

8 Liner can be seen from torch tip, so push it to wire feeder side.
9 Pull out liner from wire feeder side.

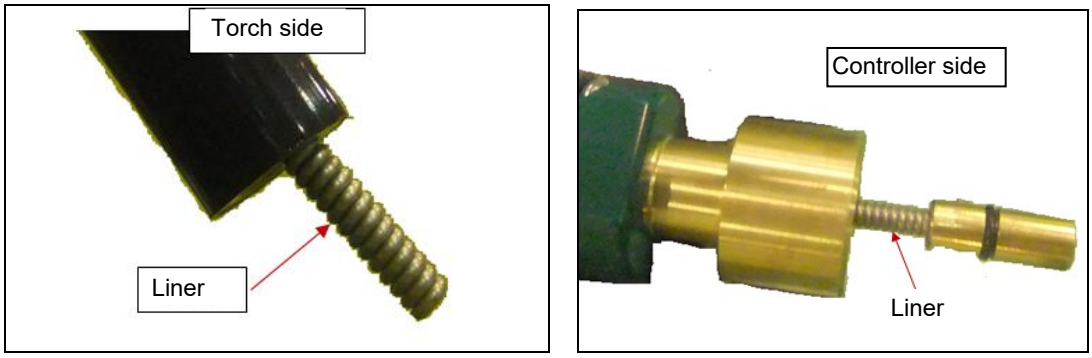


Fig. 7.6 (f) Replacing the liner

10 Replace the liner to new one and insert it.
11 Attach torch cable nut.
12 Attach torch cable to wire feeder.
13 Attach tip body and insulation cylinder (insulator).
14 Run the wire to the wire feeder groove, send it until it is seen from torch side.
15 Attach the tip and tighten it with a spanner.
16 Attach nozzle and gas diffuser (orifice).

7.7 REPLACING THE LINER (ARC Mate *i*C series)

1 Move the robot posture to J4=0°, J5=-90°, J6=0°. The J1-J3 axis is not cared about by arbitrary posture. And turn off the controller power and welding power supply.
2 Cut the wire around the roller of wire feeder, pull out the wire from the tip point.
3 Remove nozzle, gas diffuser and welding tip. At this time, pay attention not to drop and destroy gas diffuser from nozzle. (See Subsection 6.1.3 about each part.)
4 Loosen the bolt with the hexagon hole of wire feeder, and pull out torch cable from wire feeder.
5 Pull out the torch cable from the hole of J4-axis hollow parts of J3 arm to wrist side.
6 Loosen the liner hold by the monkey spanner and remove it. (See Fig. 7.7 (a))
7 Pull out the liner from torch cable.
8 Insert liner to torch cable, and temporally tighten the liner suppression nut.
9 Cut the liner in the tip holder point.(See Fig. 7.7 (b))
10 If torch cable is not new one, pull out the liner from the torch cable again and cut about 8-10mm from the point further.
11 Peel off the liner hull (orange) from the point part to about 250mm. (See Fig. 7.7 (c))
12 Remove burr, etc. of cutting part. (Apply roundness.)
13 Insert liner to torch cable again, and tighten the liner suppression nut firmly.
14 Insert torch cable to J4-axis hollow part and insert torch into the interior while pushing bolt with the hexagon hole of wire feeder and tighten it ,and attach torch cable to wire feeder.
15 Turn on the controller power then feed the wire to check that the wire is fed through the torch tip. Next, operate the robot slowly to check that no problem is found.

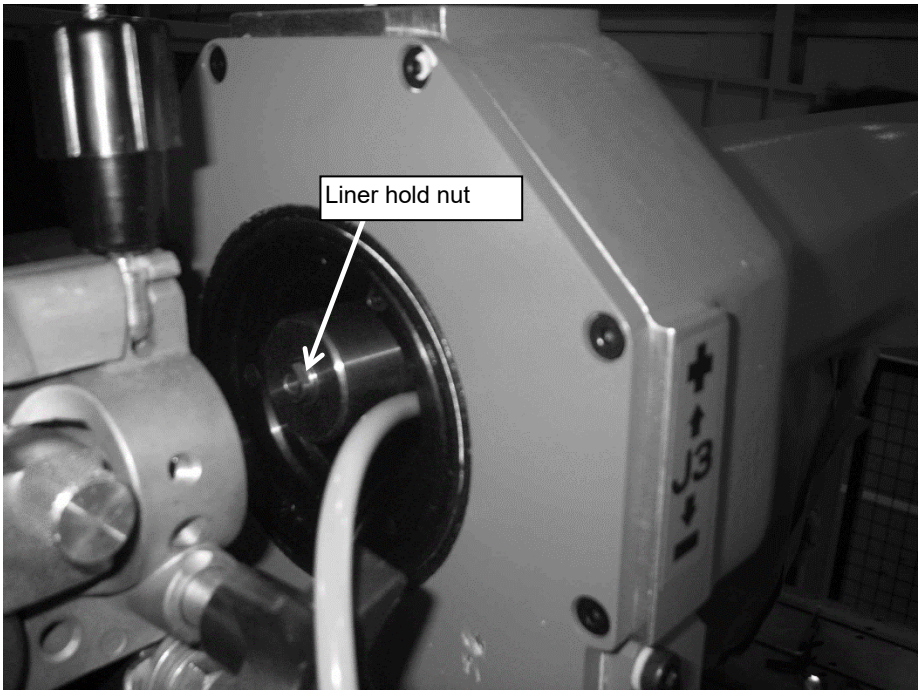


Fig. 7.7 (a) Liner suppression nut

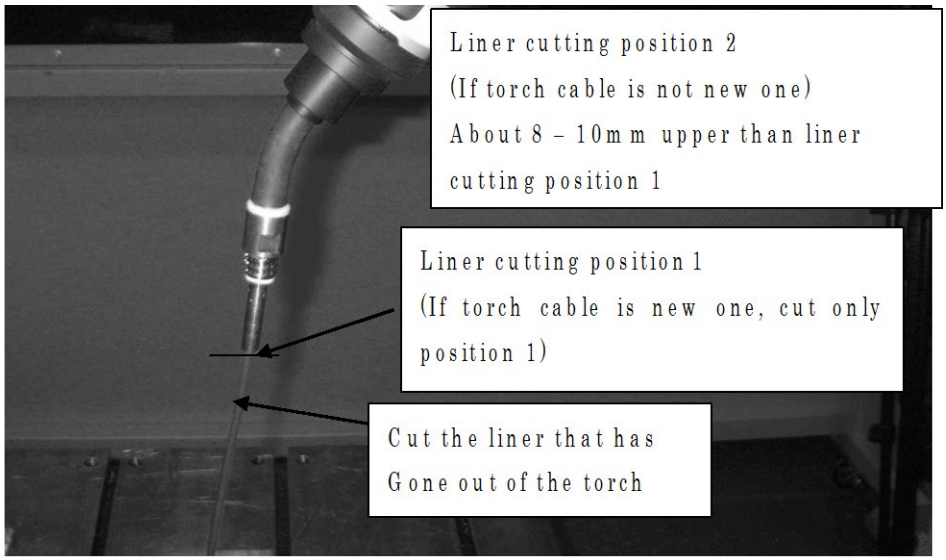


Fig. 7.7 (b) Cutting liner

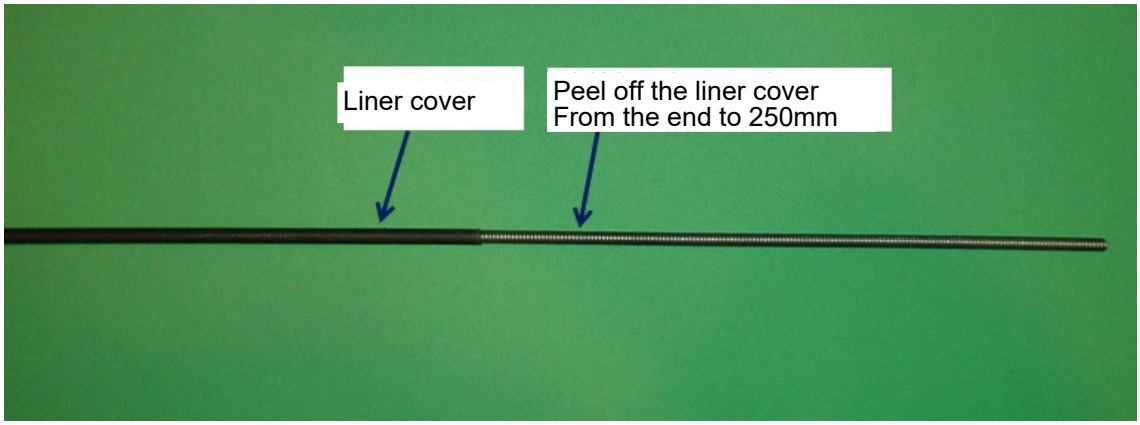


Fig. 7.7 (c) Peeling off the line cover

7.8 REPLACING DRIVE ROLL AND WIRE GUIDE

This chapter indicates procedure of replacing both of drive roll and wire guide (inside).

1 Loosen the screw in two places of the wire guide (outside) and remove wire guide (outside)
2 Knock down the idle arm below, and lift the drive roll of upper side.(See Fig. 7.8 (a))
3 Turn a triangular ring that is attached to the drive roll by hand and adjust it as unlocked.(See Fig. 7.8 (b))
4 Remove the drive roll.
5 Remove wire guide (inside) after removing the 4 drive rolls.
6 Replace old drive roll and wire guide (inside) by new articles. For its assembly, please apply the steps above in reversed sequence. Pay attention to the direction of wire guide (inside) (See Fig. 7.8 (c)) Turn at the same time and install two screws when you install the wire guide (outside).

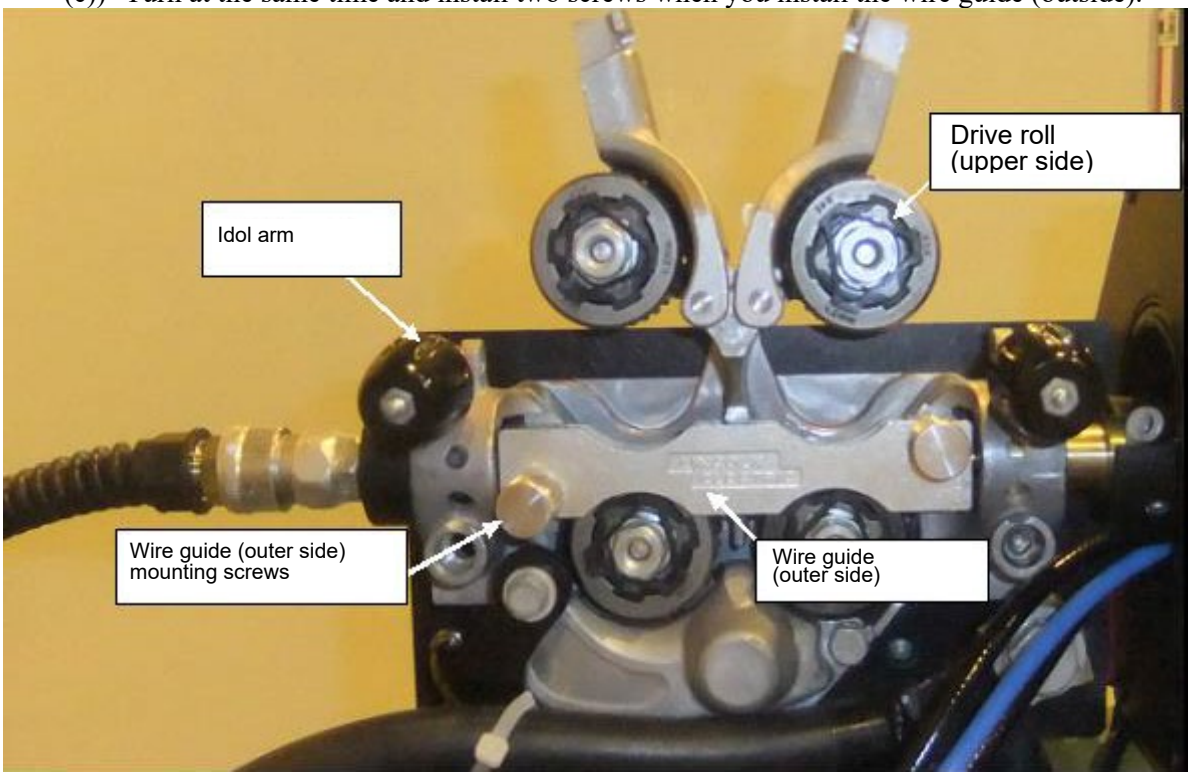


Fig. 7.8 (a) Lifting the drive roll

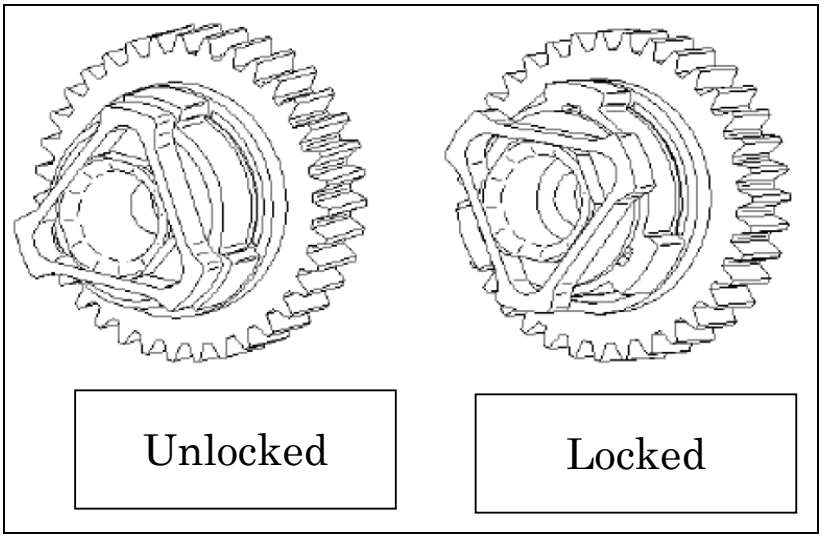


Fig. 7.8 (b) Releasing lock of the drive roll

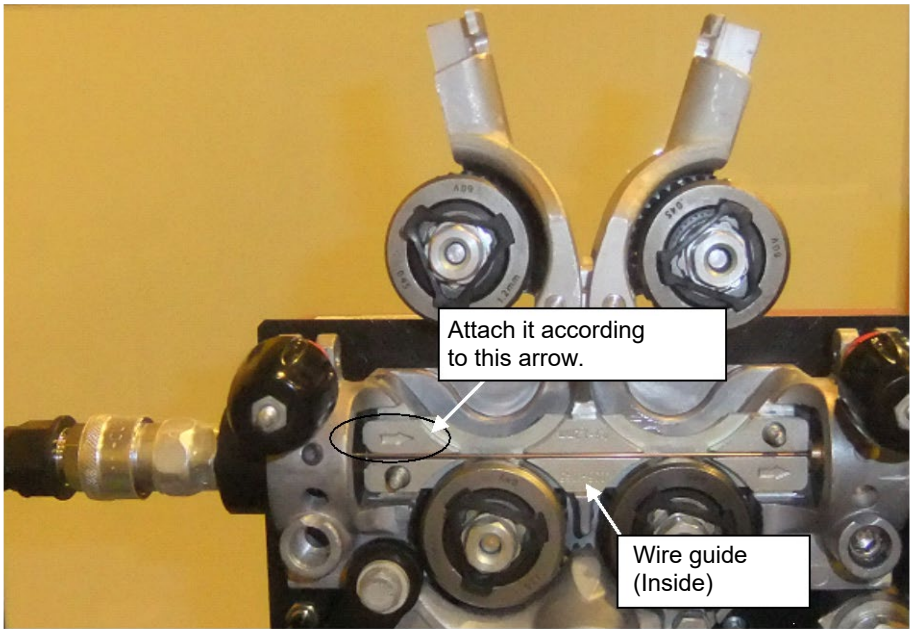


Fig. 7.8 (c) Wire guide (inside)

7.9 REPLACING THE TORCH NECK (BINZEL TORCH for ARC Mate 0*i*B)

When torch neck is broken, it is necessary to replace it.
In this case, there is a possibility that TCP must be set again using torch recovery etc.
In case of BINZEL torch neck, replace it by the procedure below.
In case of MIZUHO torch, the replacing only torch neck is impossible, so replace whole torch cable.

1 Remove the nozzle. (refer to Fig. 7.9 (a))
2 Loosen insulation cylinder screw with a monkey spanner and remove it. (See Fig. 7.9 (b).)
3 Loosen the tip holder screw with a monkey spanner and remove it. (See Fig. 7.9 (b))
4 Turn insulation cap by hand and remove it. (See Fig. 7.9 (c).)
5 Loosen the union nut with a monkey spanner, remove torch neck, then replace it to new one.(See Fig. 7.9 (c).) Tighten union nut with regulated torque.
* Attach the insulation cap. (See Fig. 7.9 (c).)
6 Attach the tip holder.(See Fig. 7.9 (b).)
7 Attach insulation cylinder. (See Fig. 7.9 (b).)
8 Attach the nozzle. (See Fig. 7.9 (a))

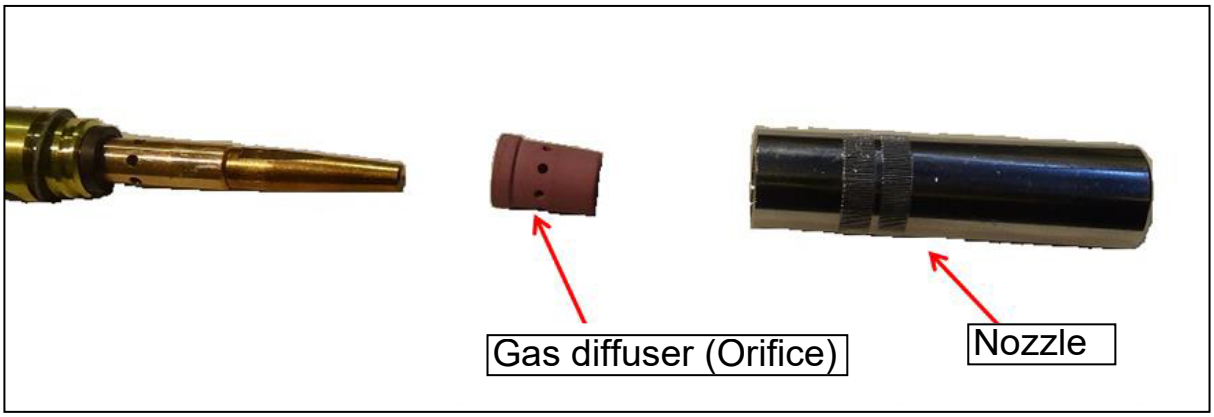


Fig. 7.9 (a) Removing the gas diffuser and the nozzle

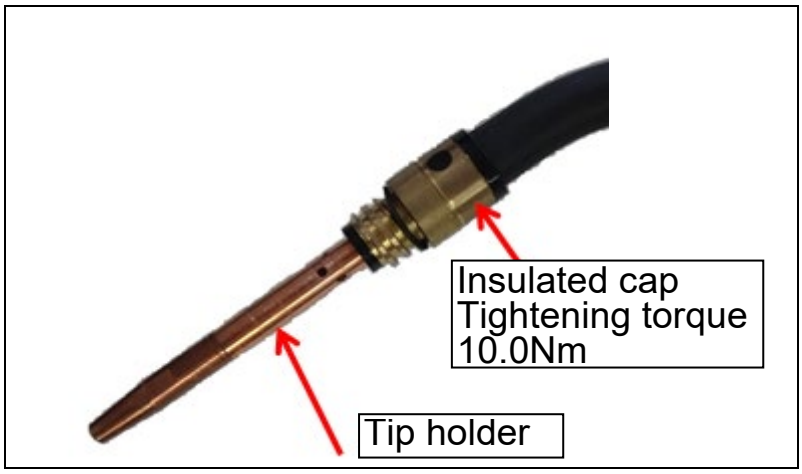


Fig. 7.9 (b) Removing the tip holder

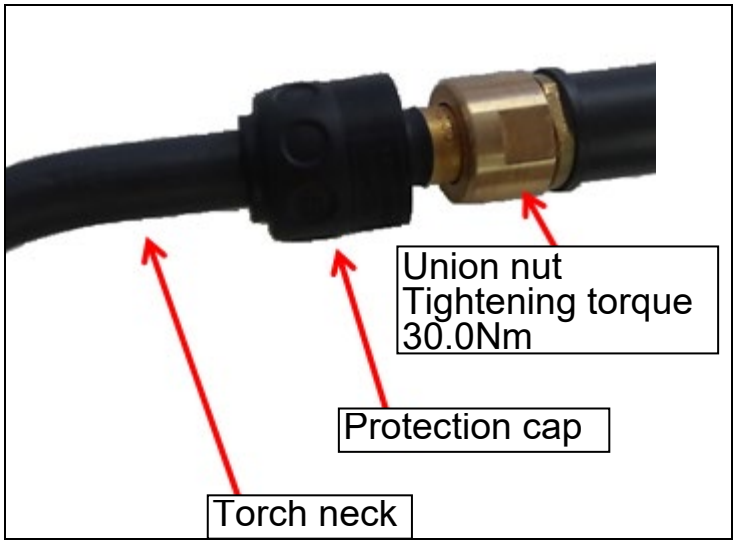


Fig. 7.9 (c) Removing the insulation cap

7.10 REPLACING THE TORCH NECK (BINZEL AIR COOLING TORCH 350GC ARC Mate *i*C series)

When torch neck is broken, it is necessary to replace it.
In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1 Remove the nozzle. (Refer to Fig. 7.10 (a))
2 Loosen the screws of the insulation cylinder with a pliers and remove it. (Refer to Fig. 7.10 (b))
3 Loosen the screw of the tip holder with a spanner and remove it. (Refer to Fig. 7.10 (b))
4 Remove the protection cap. (Refer to Fig. 7.10 (c))
5 Loosen the union nut with a spanner, remove the torch neck, then replace by new one. (Refer to Fig. 7.10 (d)) Tighten the union nut with the regulated torque.
6 Attach the protection cap. (Refer to Fig. 7.10 (c))
7 Attach the tip holder. (Refer to Fig. 7.10 (b))
8 Attach the insulated cap. (Refer to Fig. 7.10 (b))
9 Attach the nozzle. (Refer to Fig. 7.10 (a))

Fig. 7.10 (a) Removing the nozzle

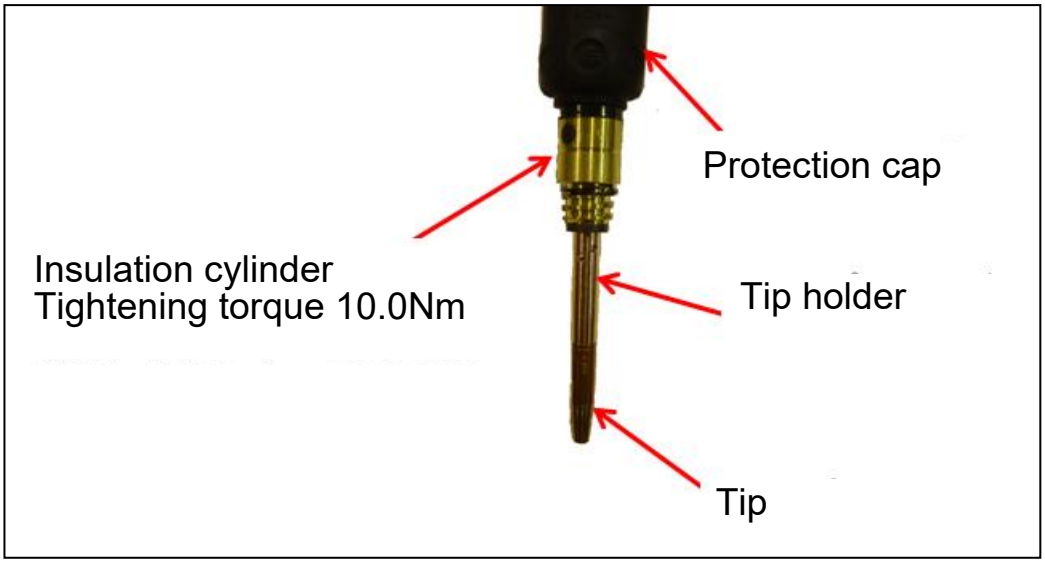


Fig. 7.10 (b) Removing the insulated cap and the tip holder

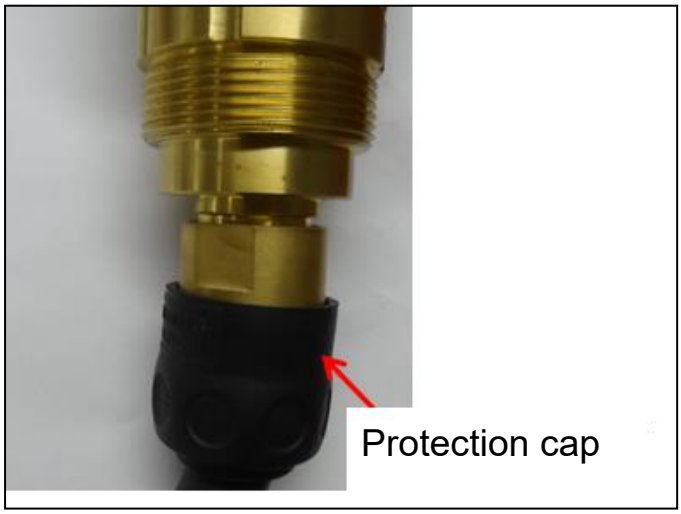


Fig. 7.10 (c) Removing the protection cap

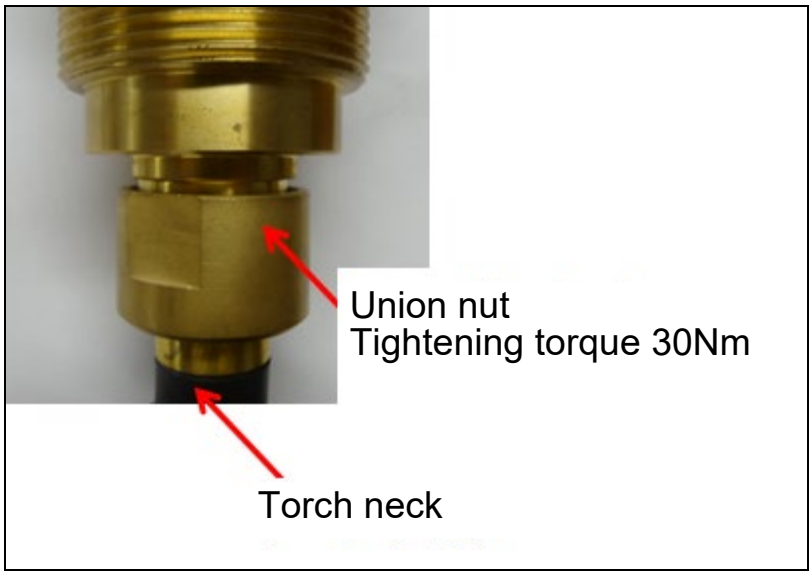


Fig. 7.10 (d) Removing the torch neck

7.11 REPLACING THE TORCH NECK (BINZEL TORCH W500 for ARC Mate *i*C series)

When torch neck is broken, it is necessary to replace it. In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1 Remove the nozzle. (Refer to Fig. 7.11 (a))
2 Loosen the screw of the tip holder with a spanner and remove it. (Refer to Fig. 7.11 (b))
4 Rotate the union nut to the arrow direction with hands and remove it. (Refer to Fig. 7.11 (c))
5 Remove the torch neck, then replace it with new one. Install the torch neck and wrist with no gap referring to the Fig. 7.11(d). Tighten the union nut.
7 Attach the tip holder. (Refer to Fig. 7.11 (b))
8 Attach the nozzle. (Refer to Fig. 7.11 (a))

Fig. 7.11 (a) Removing the nozzle

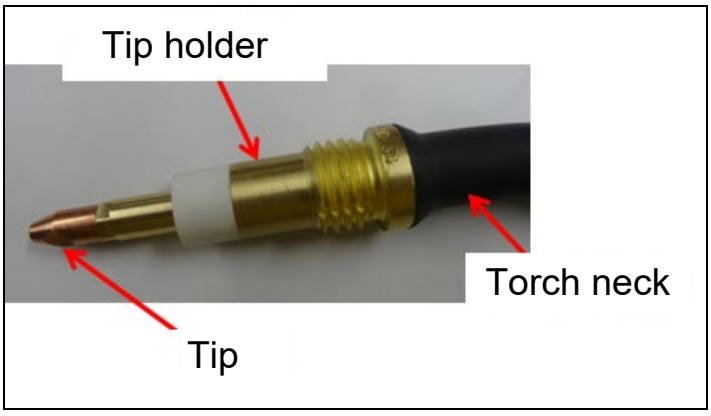


Fig. 7.11 (b) Removing the tip holder

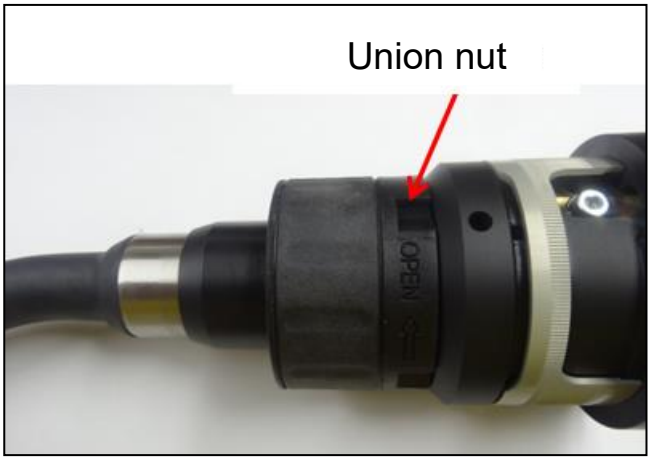


Fig. 7.11 (c) Removing the torch neck

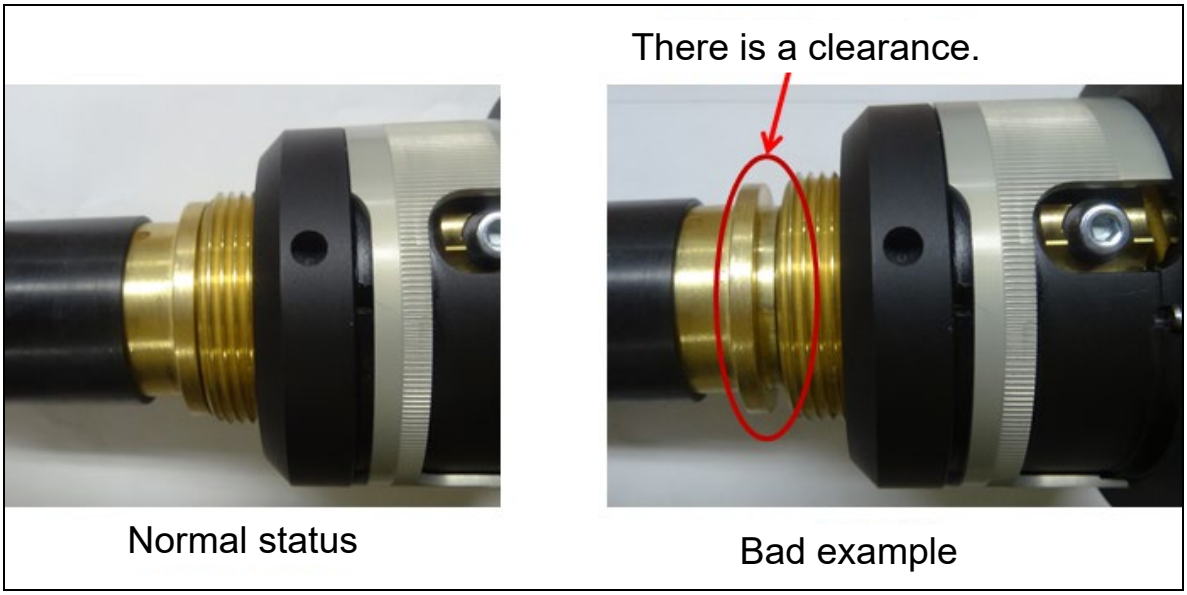


Fig. 7.11 (d) Check no gap of the torch neck

7.12 REPLACING THE TORCH NECK (BINZEL TORCH A360 for ARC Mate *i*C series)

When torch neck is broken, it is necessary to replace it. In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1 Remove the nozzle. (Refer to Fig. 7.12 (a))
2 Loosen the screw of the tip holder with a spanner and remove it. (Refer to Fig. 7.12 (b))
3 Loosen 2 screws with hexagon wrench. (Refer to Fig. 7.12 (c))
4 Remove the torch neck, and replace it with new one. (Refer to Fig. 7.12 (b)) Install the torch neck and wrist with no gap referring to the Fig. 7.12(d). Tighten 2 screws with a regulated torque.
5 Attach the tip holder. (Refer to Fig. 7.12 (b))
6 Attach the nozzle. (Refer to Fig. 7.12 (a))

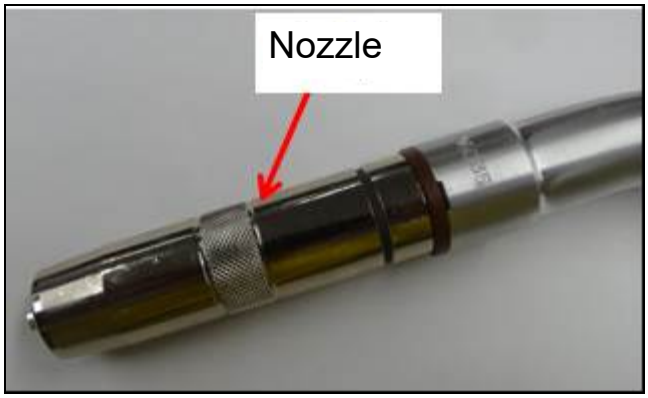


Fig. 7.12 (a) Removing the nozzle

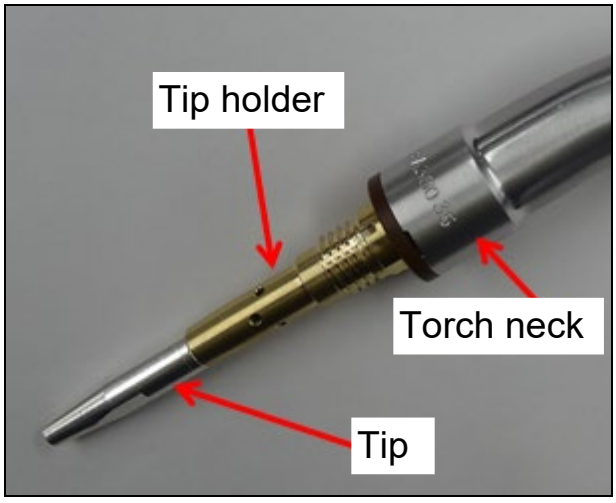


Fig. 7.12 (b) Removing the tip holder

Fig. 7.12 (c) Removing screws

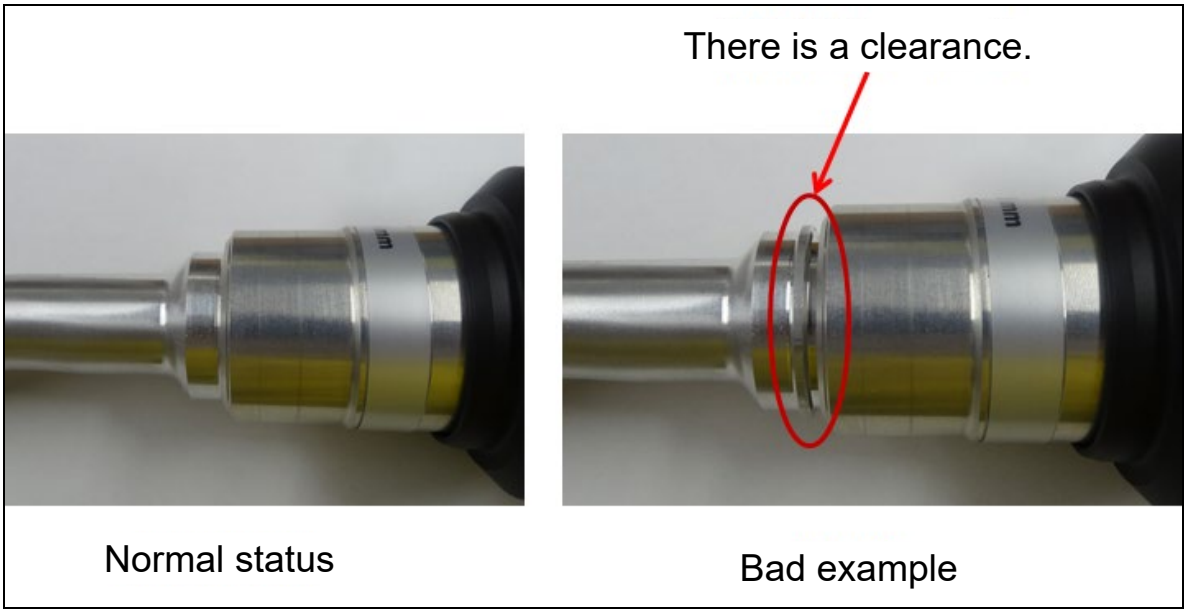


Fig. 7.12 (d) Check no gap of the torch neck

7.13 REPLACING THE WIRE FEEDER (AutoDrive 4R100)

1 When cover is attached, remove it and perform procedure below.
2 Loosen torch mounting hexagon bolt using a hexagon wrench which is appendix of wire feeder, then remove the torch from the wire feeder.
3 Remove gas hose of wire feeder side and torch side.
4 Remove the joint which connect flexible conduit to wire feeder.
5 Cut the wire, and pull out it from torch cable tip side.
6 Loosen welding power supply mounting nut and remove welding power cable.
7 Remove wire feeder mounting bolts.
8 Replace old wire feeder by new one. For its assembly, please apply the steps above in reversed sequence. For wire feeder mounting bolts, be sure to attach the side bolts of Fig. 7.13 (b) in the first.

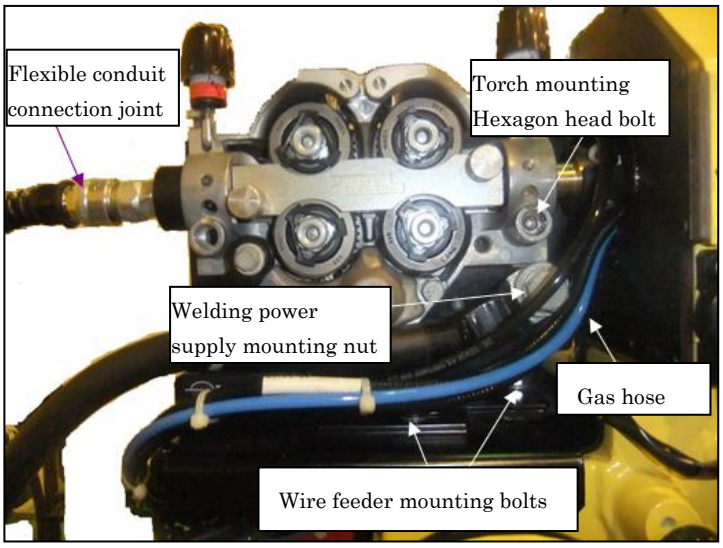


Fig. 7.13 (a) Replacing the wire feeder (1/2)

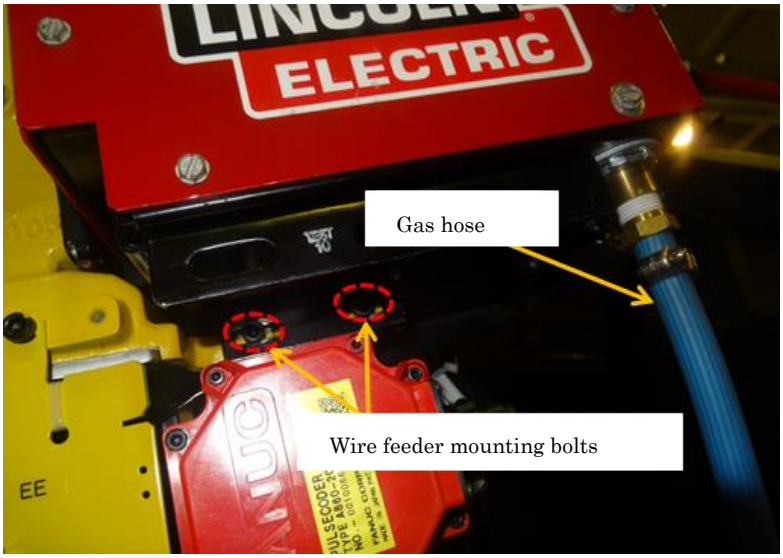


Fig. 7.13 (b) Replacing the wire feeder (2/2)

7.14 REPLACING THE WIRE FEEDER (AutoDrive 4R220)

1. Remove the wire feeder cover.
2. Loosen torch mounting hexagon bolt using a hexagon wrench which is appendix of wire feeder, then remove the torch from the wire feeder.
3. Remove the gas hoses of the wire feeder wide and the torch side.
4. Cut the joint which connect the flexible conduit to the wire feeder.
5. Cut the wire, and pull out it from torch cable tip side.
6. Loosen the welding power supply cable mounting nut, then remove the welding power supply cable.
7. Remove the wire feeder mounting bolts.
8. Replace old wire feeder by new one. For its assembly, please apply the steps above in reversed sequence.
9. Perform the wiring sot that it is does not installed on the robot body referring to Fig. 7.14 (d),(e).

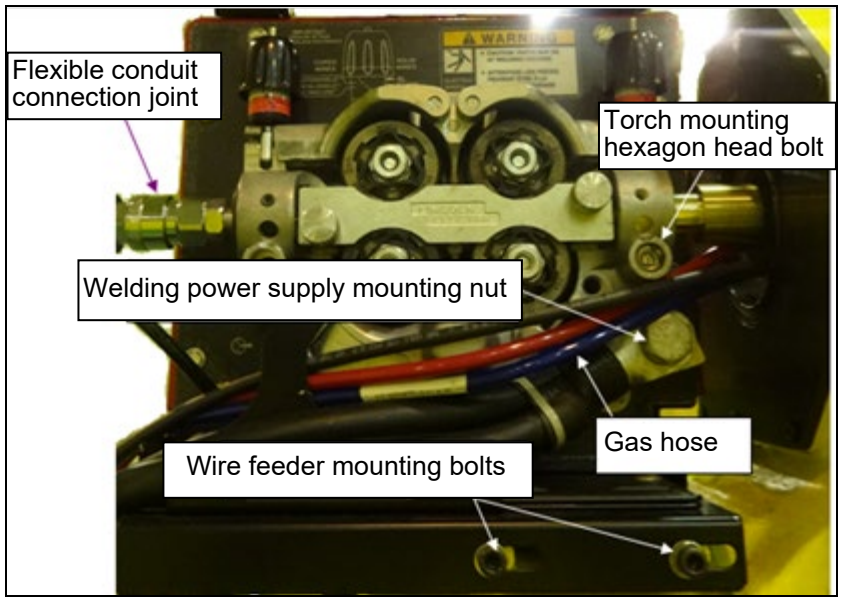


Fig. 7.14 (a) Replacing the wire feeder AutoDrive 4R220 (1/3)

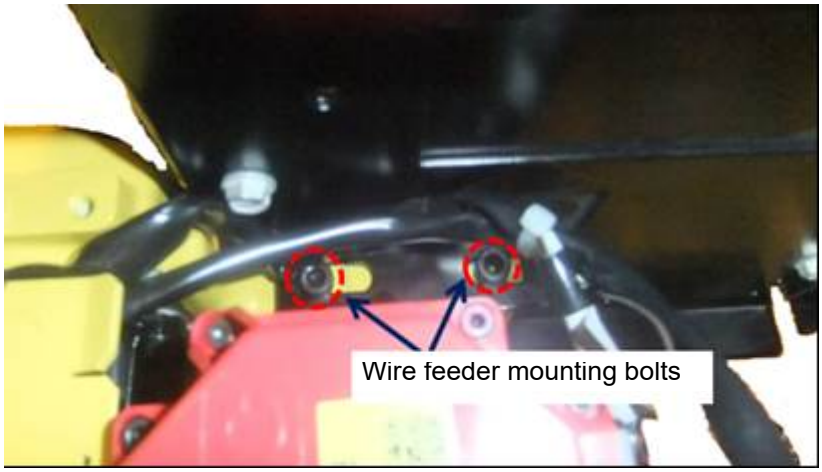


Fig. 7.14 (b) Replacing the wire feeder AutoDrive 4R220 (2/3)

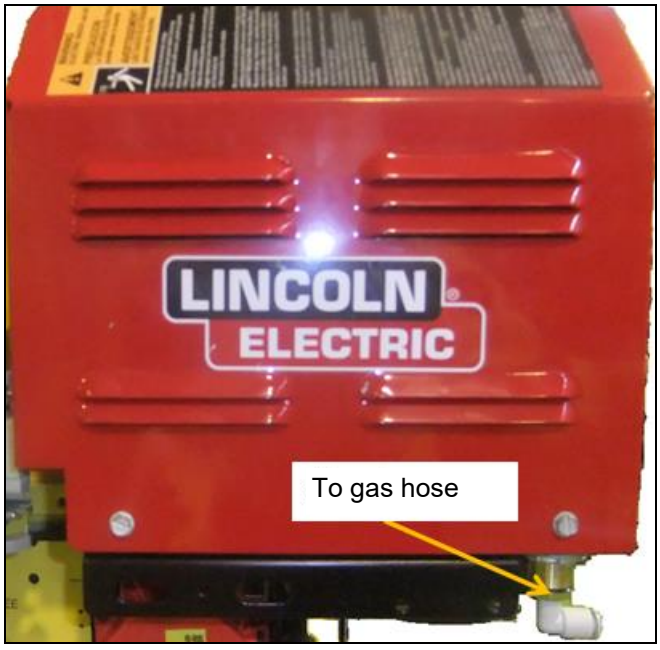


Fig. 7.14 (c) Replacing the wire feeder AutoDrive 4R220 (3/3)

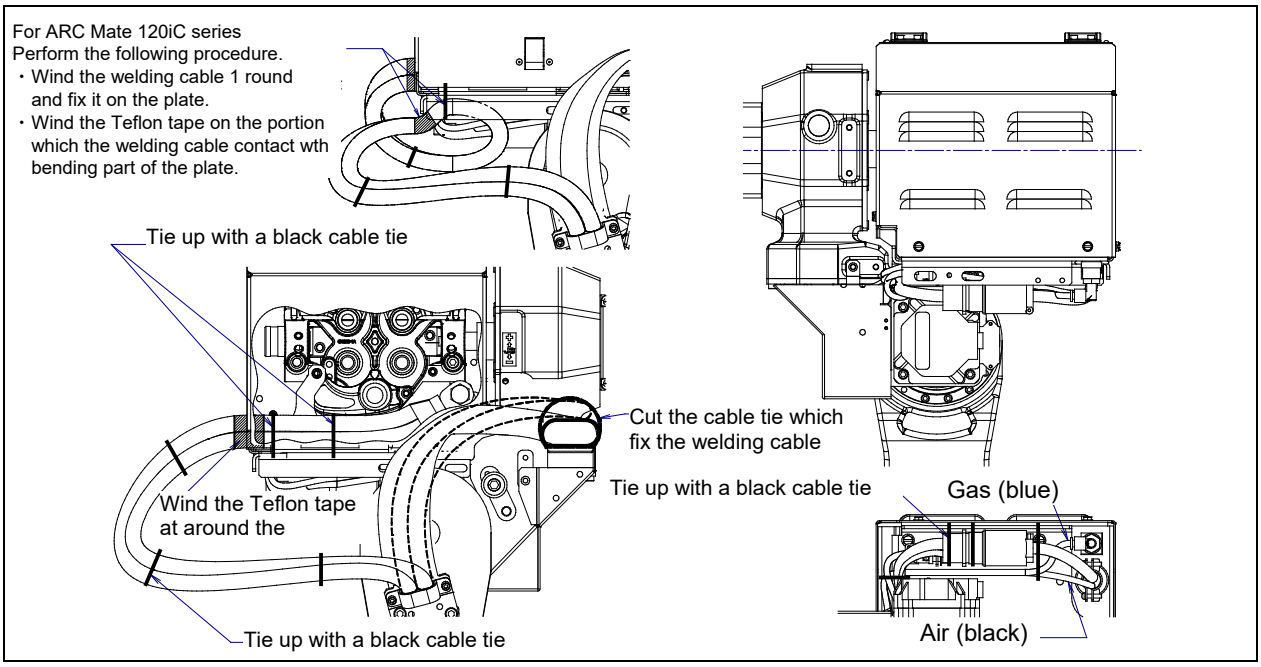


Fig. 7.14 (d) Wiring of the Wire Feeder AutoDrive 4R220 (1/2)

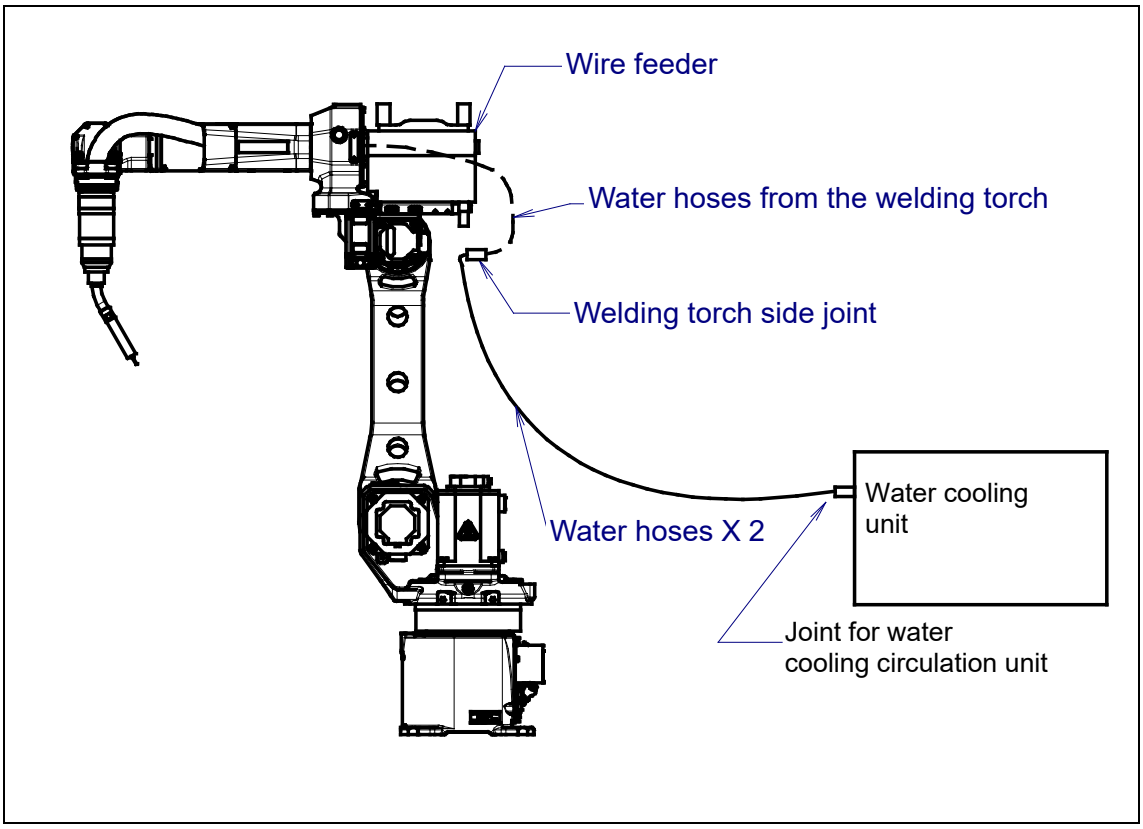


Fig. 7.14 (e) Wiring of the Wire Feeder AutoDrive 4R220 (2/2)

8 MAINTENANCE PARTS

When part unit is needed about welding power supply and welding torch, refer to this section.
Please inquire of our company about parts that not are described in this section.

Table 8 (a) Maintenance parts of torch made by MIZUHO (A05B-1223-H301,H302)

Maintenance parts specifications	Maintenance parts name	Spec. of MISUHO	Unit requirement	Remarks
A14L-0166-0801#1200016	CO2 TP	1200016	1	10 pcs/1 set
A14L-0166-0801#1200087	CO2 NOZZLE	1200087	1	5 pcs/ 1 set
A14L-0166-0801#141147	INSULATOR	141147	1	5 pcs/ 1 set
A14L-0166-0801#160022	ORIFICE	160022	1	10 pcs/1set
A14L-0166-0801#230153	TIP BODY	230153	1	
A14L-0166-0801#A15165-1	SPRING LINER	A15165-1	1	
A14L-0166-0801#A2	TORCH		1	
A14L-0166-0801#A23084	TORCH BODY	A23084	1	
A14L-0166-0801#A23086	POWER CABLE UNIT	A23086-2	1	Length 1100mm (for H301)
A14L-0166-0801#A23086-2	POWER CABLE UNIT	A23086-2	1	Length 1230mm (for H302)
A14L-0166-0801#KQ2H07M5	JOINT	KQ2H07M5	1	

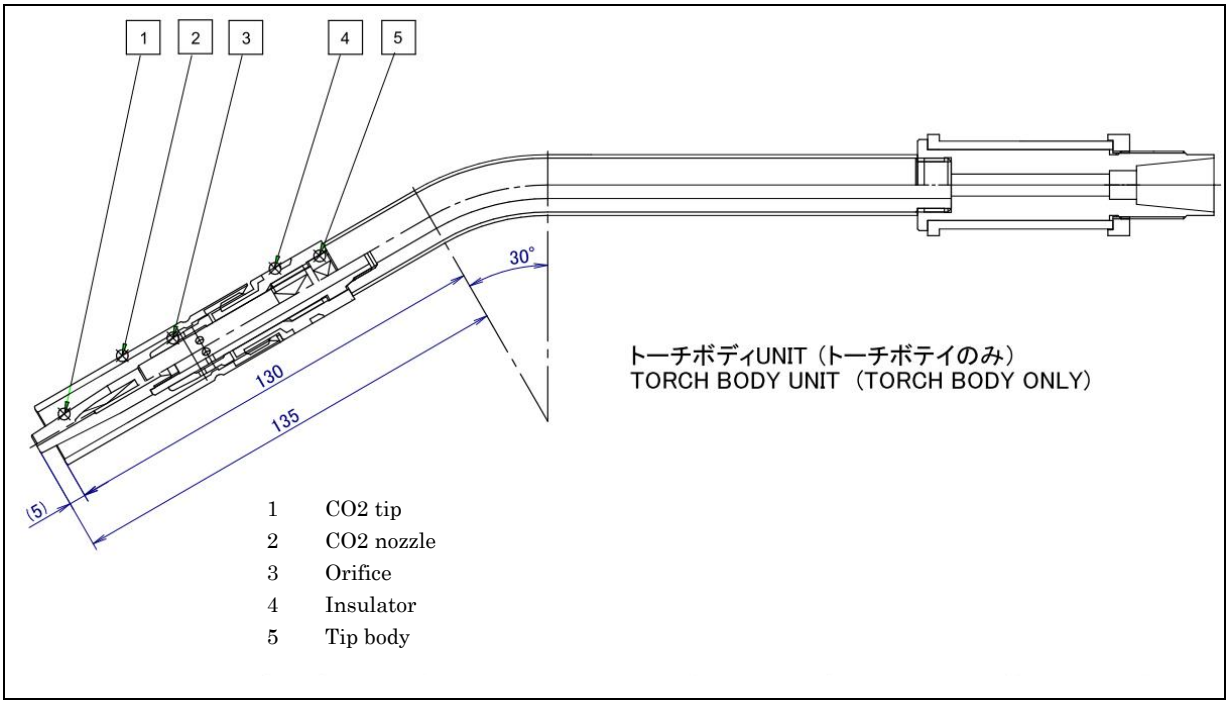
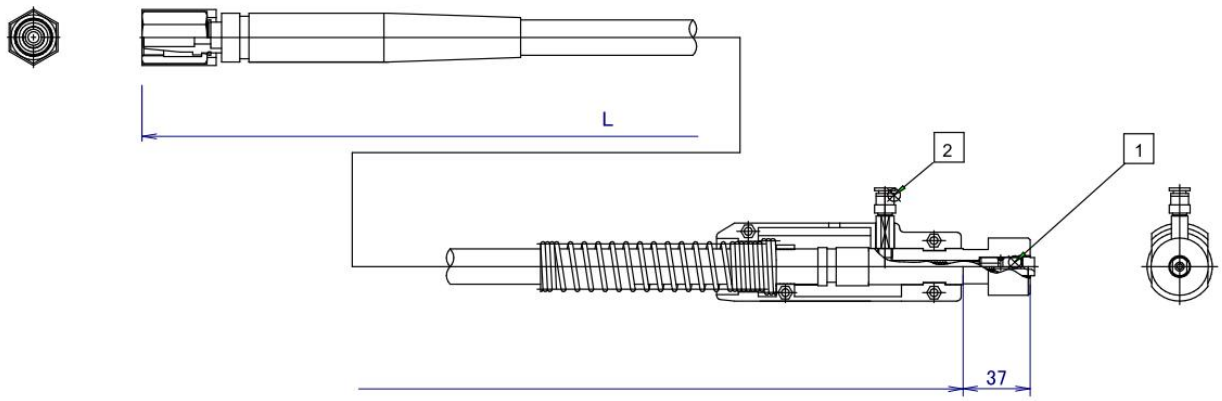


Fig. 8 (a) Torch made by MIZUHO (1/2)



パワーケーブルUNIT
POWER CABLE UNIT

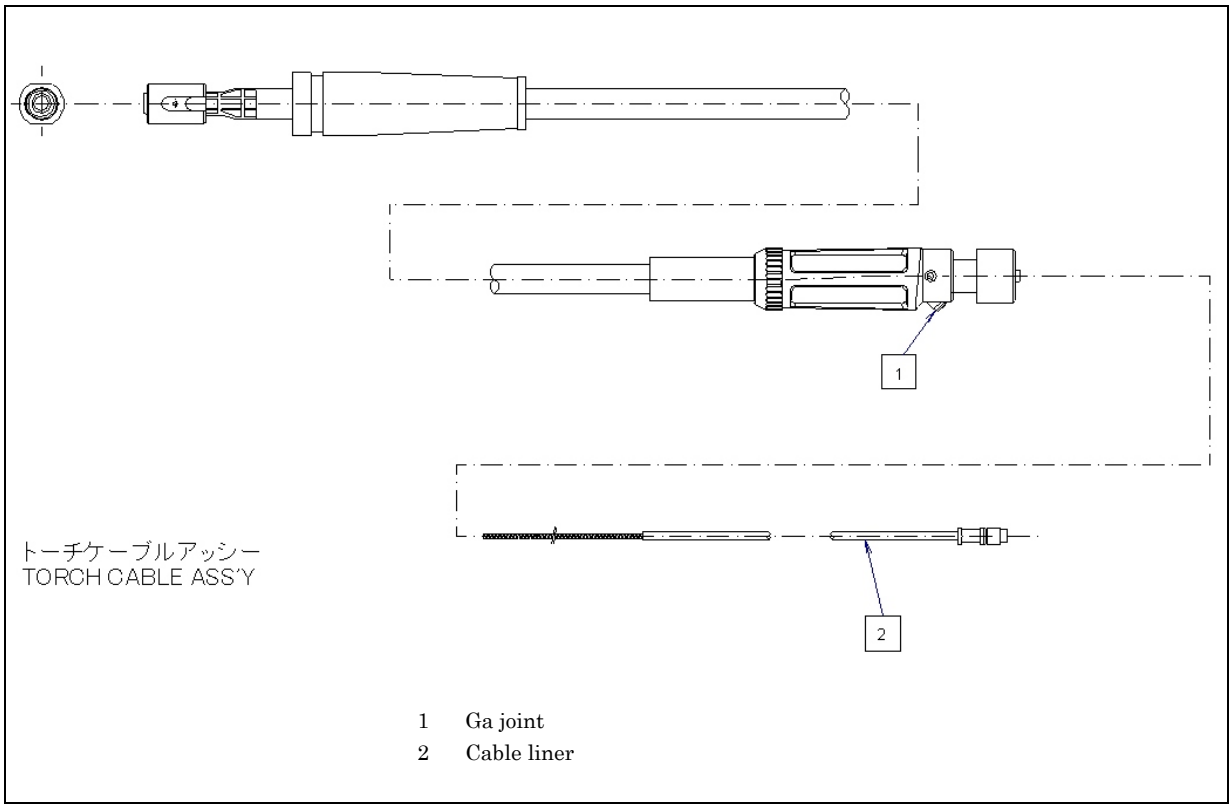
L: Cable length

1 Spring liner
2 One touch joint

Fig. 8 (b) Torch made by MIZUHO (2/2)

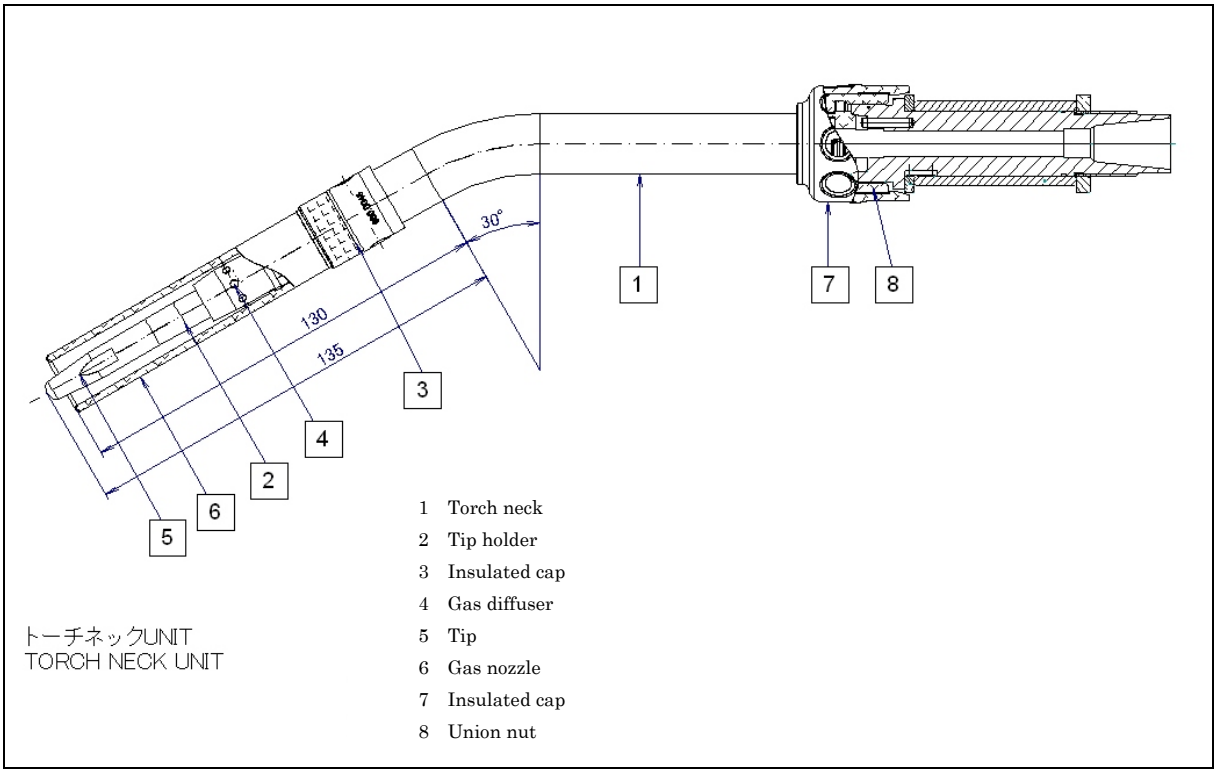
Table 8 (b) Maintenance part of torch made by BINZEL (A05B-1223-H311)

Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
A14L-0166-0301#124X0165	LINER	1	
A14L-0166-0301#140J4512	TIP	1	
A14L-0166-0301#142X0143	TIP HOLDER	1	
A14L-0166-0301#145XJ054	GAS NOZZLE	1	
A14L-0166-0301#980X0013	INSULATED CAP	1	
A14L-0166-0301#980X0014	UNION NUT	1	
A14L-0166-0301#980X0019	GAS DIFFUSER	1	
A14L-0166-0301#980X0028	TORCH NECK	1	
A14L-0166-0301#980X0142	INSULATED TUBE	1	
A14L-0166-0301#980XF113	TORCH NECK UNIT	1	
A14L-0166-0301#980XF201	GAS JONIT	1	
A14L-0166-0811	TORCH	1	ABIROB 350GC-30L
A14L-0166-0811#980XF308	TORCH CABLE ASSY	1	



1 Ga joint
2 Cable liner

Fig. 8 (c) Torch made by BINZEL (1/2)



1 Torch neck
2 Tip holder
3 Insulated cap
4 Gas diffuser
5 Tip
6 Gas nozzle
7 Insulated cap
8 Union nut

Fig. 8 (d) Torch made by BINZEL (2/2)

Table 8 (c) A05B-1291-H305,H306,H307,H308,H309,H310
A05B-1291-H305,H306,H307,H308
(ABIROB iSTM 350GC-30S, 350GC-30L by BINZEL)

Fig.No.	Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
—	A14L-0166-0305	350GC-30S torch set including the cable	1	ROBOWELD 100*i*C
—	A14L-0166-0306	350GC-30S torch set including the cable	1	ROBOWELD 100*i*C/6L
—	A14L-0166-0307	350GC-30L torch set including the cable	1	ROBOWELD 100*i*C
—	A14L-0166-0308	350GC-30L torch set including the cable	1	ROBOWELD 100*i*C/6L
—	A14L-0166-0309	350GC-30S torch set including the cable	1	ROBOWELD 100*i*C/8L
—	A14L-0166-0310	350GC-30Ltorch set including the cable	1	ROBOWELD 100*i*C/8L
—	A14L-0167-0305	350GC-30S torch set including the cable	1	ROBOWELD 120IC
—	A14L-0167-0306	350GC-30S torch set including the cable	1	ROBOWELD 120*i*C/10L
—	A14L-0167-0307	350GC-30L torch set including the cable	1	ROBOWELD 120*i*C
—	A14L-0167-0308	350GC-30L torch set including the cable	1	ROBOWELD 120*i*C/10L
A	A14L-0166-0301#980XF111	Torch neck finished product	1	350GC-30S(Tip L45 spec.)
*A	A14L-0166-0301#980XF112	Torch neck finished product	1	350GC-30S(Tip L40 spec.)
B	A14L-0166-0301#980XF113	Torch neck finished product	1	350GC-30L(Tip L45 spec.)
*B	A14L-0166-0301#980XF114	Torch neck finished product	1	350GC-30L(Tip L40 spec.)
1	A14L-0166-0301#980X0027	Torch neck simple substance	1	350GC-30S 30° short neck
1L	A14L-0166-0301#980X0028	Torch neck simple substance	1	350GC-30L 30° long neck
1-1	A14L-0166-0301#980X0013	Insulation cap	1 (5)	Rubber type
1-2	A14L-0166-0301#980X0014	Counter nut	1 (5)	
2	A14L-0166-0301#142X0143	Tip holder (S) L=92.5	1	Tip L=45
*2	A14L-0166-0301#142X0144	Tip holder (L) L=97.5	1	Tip L=40
3	A14L-0166-0301#980X0142	Insulation pipe (black)	1 (10)	Resin
4	A14L-0166-0301#980X0019	Gas diffuser pink	1 (10)	Ceramic
5	A14L-0166-0301#140X1357	Contact tip CuCrZr	1 (10)	L=45 φ1.2 M6
*5	A14L-0166-0301#147X1357	Contact tip CuCrZr	1 (10)	L=40 φ1.2 M6
*6-1	A14L-0166-0301#145X0558	Gas nozzle (taper) φ12 L=89.5	1 (10)	Cr plating spec.
6-2	A14L-0166-0301#145X0557	Gas nozzle (straight) φ15.6 L=89.5	1 (10)	Cr plating spec.
*6-2	A14L-0166-0301#145XJ054	Gas nozzle (straight) φ15.6 L=89.5	1 (10)	Non-spatter coating spec.
*6-3	A14L-0166-0301#145X0559	Gas nozzle(bottle) φ14 L=89.5	1 (10)	Cr plating spec.
*6-4	A14L-0166-0301#145X0573	Gas nozzle (taper) φ13 L=89.5	1 (10)	Cr plating spec.
7	A14L-0166-0301#780X3230	Robot mount	1	
8	A14L-0166-0305#780X9345	Insulation robot flange	1	100*i*C,120*i*C flange spec.
10	A14L-0166-0301#980X2112	Torch cable assembly L=0.85m	1	100*i*C/12 spec.
10	A14L-0166-0301#980X2131	Torch cable assembly L=1.07m	1	100*i*C/7L(100*i*C/6L) spec.
10	A14L-0166-0301#284X0721	Torch cable assembly L=1.29m	1	100*i*C/8L spec.
10	A14L-0166-0301#980X2147	Torch cable assembly L=1.05m	1	120*i*C spec.
10	A14L-0166-0301#980X2148	Torch cable assembly L=1.25m	1	120*i*C/12L(120*i*C/10L spec.)
10-1	A14L-0166-0301#331X9002	Liner mounting nut	1 (5)	
*10-2	A14L-0166-0301#980XF200	Gas fitting (black)	1 (5)	φ6
10-2	A14L-0166-0301#980XF201	Gas fitting (white)	1 (5)	φ1/4
10-3	A14L-0166-0301#980XF202	Air plug	1 (5)	φ6
11	A14L-0166-0301#124X0165	Cable liner(orange) for iron・SUS	1	φ1.0 - φ1.2 2.2m
*11	A14L-0166-0301#124XJ005	Cable liner (black) for iron・SUS	1	φ1.2 - φ1.6 2.2m
*11	A14L-0166-0301#124XJ006	Cable liner (blue) for iron・SUS	1	φ0.8 - 1.0 2.2m
12	A14L-0166-0301#980X2030	Cable replacing help tool	1	No description in Fig.

* are option.

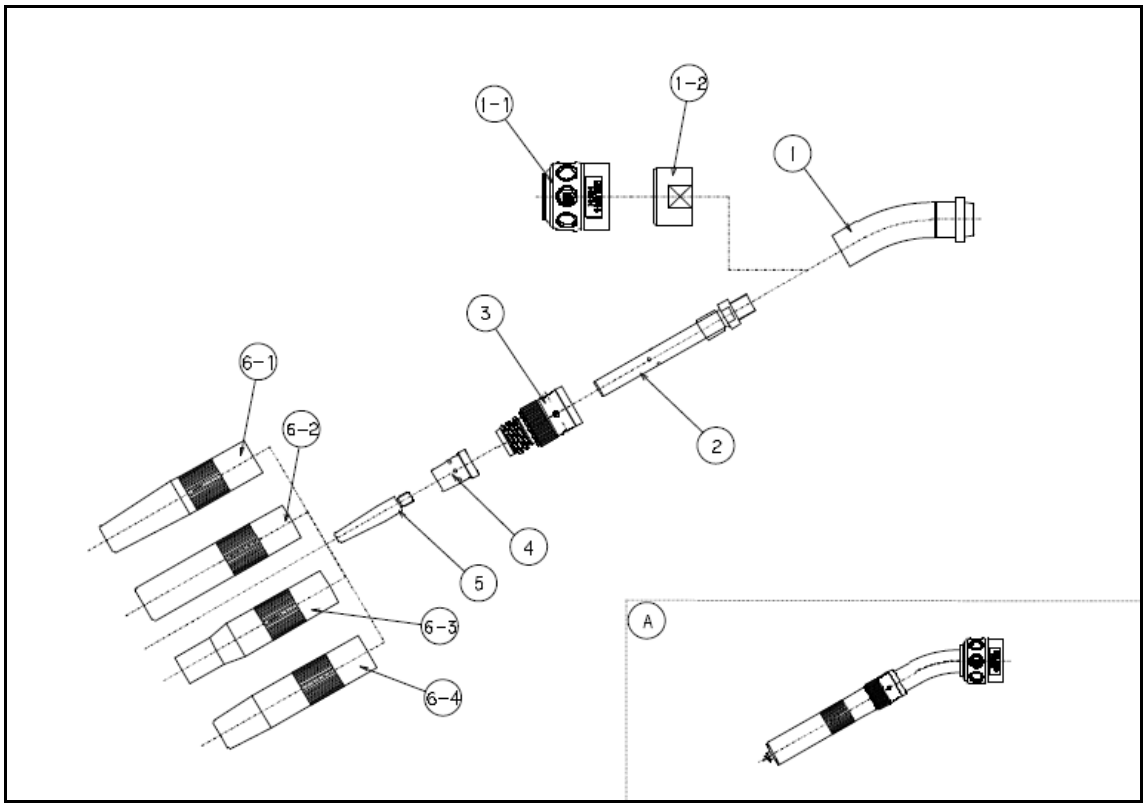


Fig. 8 (e) A05B-1291-H305,H306,H309
A05B-1292-H305,H306 component parts
(ABIROB iSTM 350GC-30S by BINZEL)

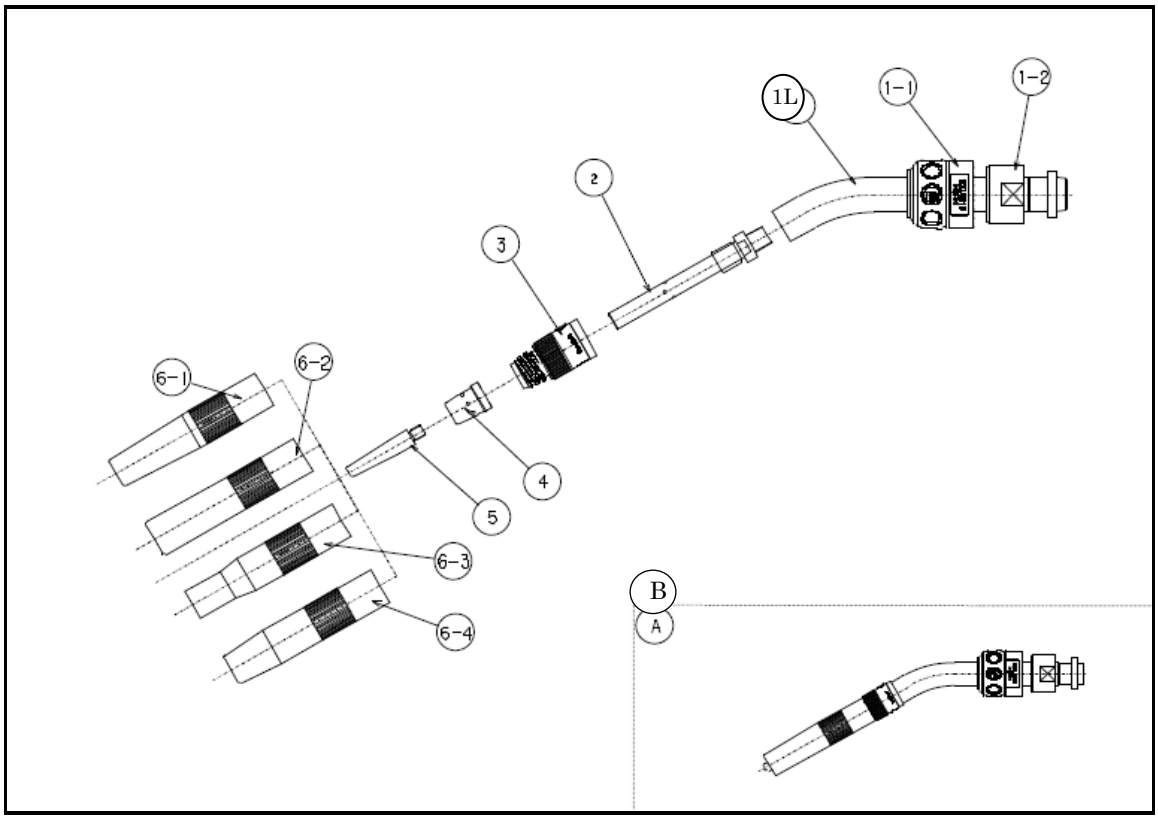


Fig.8 (f) A05B-1291-H307,H308,H310
A05B-1292-H307,H308 component parts
(ABIROB iSTM 350GC-30L by BINZEL)

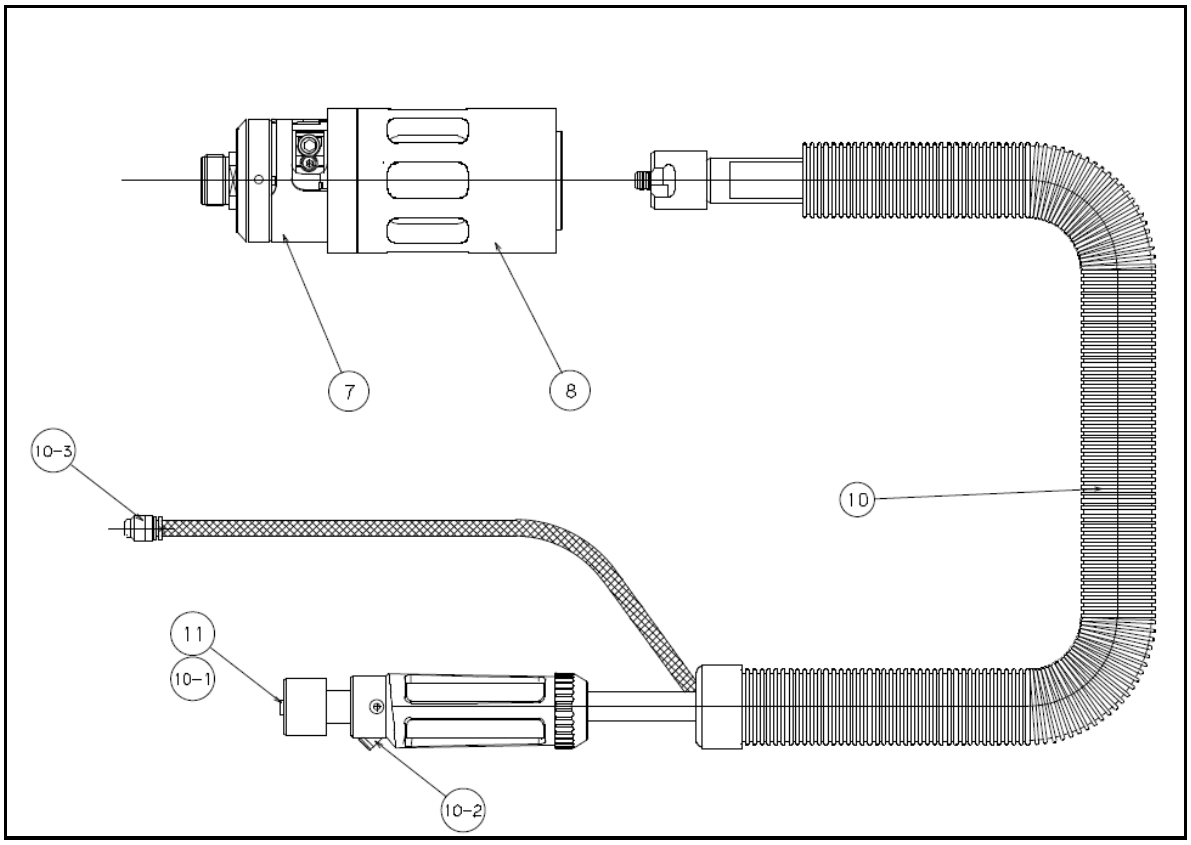


Fig. 8 (g) A05B-1291-H305,H306,H307,H308,H309,H310
A05B-1291-H305,H306,H307,H308 common component parts
(ABIROB iSTM 350GC-30S, 350GC-30L by BINZEL)

Table 8 (d) A05B-1296-H303,H304 series parts table
(ABIROB iSTM mini G350-30L by BINZEL)

Fig.No.	Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
—	A14L-0201-0303#12LL	G350-30L torch set including the torch cable	1	100*i*D spec.
—	A14L-0201-0303#LGLL	G350-30L torch set including the torch cable	1	100*i*D/10L,120*i*D spec.
—	A14L-0201-0303#ELLL	G350-30L torch set including the torch cable	1	100*i*D/8L spec.
—	A14L-0201-0303#HLLL	G350-30L torch set including the torch cable	1	120*i*D/12L spec.
—	A14L-0201-0304#12LL	G350-30L torch set including the torch cable with wire brake	1	100*i*Dspec.
—	A14L-0201-0304#LGLL	G350-30L torch set including the torch cable with wire brake	1	100*i*D/10L,120*i*D spec.
—	A14L-0201-0304#ELLL	G350-30L torch set including the torch cable with wire brake	1	100*i*D/8Lspec.
—	A14L-0201-0304#HLLL	G350-30L torch set including the torch cable with wire brake	1	120*i*D/12Lspec.
A	A14L-0201-0303#98002261	Torch neck finished product	1	G350-30L(Tip L=45spec.)
1	A14L-0201-0303#980X0226	Torch neck simple substance	1	
2	A14L-0166-0301#142X0143	Tip holder (S) L=92.5	1	Tip L=45
*2	A14L-0166-0301#142X0144	Tip holder (L) L=97.5	1	Tip L=40
3	A14L-0166-0301#980X0142	Insulation pipe (black)	1 (10)	Resin
4	A14L-0166-0301#980X0019	Gas diffuser pink	1 (10)	Ceramic
5	A14L-0201-0303#140J4512	Contact tip CuCrZr	1 (10)	L=45 ϕ1.2 M6
*5	A14L-0201-0303#140J4012	Contact tip CuCrZr	1 (10)	L=40 ϕ1.2 M6
*6-1	A14L-0166-0301#145X0558	Gas nozzle(taper) ϕ12 L=89.5	1 (10)	Cr plated spec.
6-2	A14L-0166-0301#145XJ054	Gas nozzle(straight) ϕ15.6 L=89.5	1 (10)	No spatter coating spec.
*6-3	A14L-0166-0301#145X0559	Gas nozzle(bottle) ϕ14 L=89.5	1 (10)	Cr plated spec.
*6-4	A14L-0166-0301#145X0573	Gas nozzle(taper) ϕ13 L=89.5	1 (10)	Cr plated spec.
7	A14L-0201-0304#149XJ490	Neck liner	1	ϕ1.0-ϕ1.2 L=270
8	A14L-0201-0303#780X3315	Insulation robot flange	1	100*i*D,120*i*D flange spec.
9	A14L-0201-0303#980X2548	Torch cable assembly L=0.86m	1	100*i*Dspec.
9	A14L-0201-0303#980X2550	Torch cable assembly L=1.06m	1	100*i*D/10L,120*i*D spec.
9	A14L-0201-0303#980X2649	Torch cable assembly L=1.26m	1	100*i*D/8L spec.
9	A14L-0201-0303#980X2652	Torch cable assembly L=1.495m	1	120*i*D/12L spec.
9	A14L-0201-0304#980X2540	Torch cable assembly L=0.86m with wire brake	1	100*i*Dspec.
9	A14L-0201-0304#980X2674	Torch cable assembly L=1.06m with wire brake	1	100*i*D/10L,120*i*D spec.
9	A14L-0201-0304#980X2676	Torch cable assembly L=1.26m with wire brake	1	100*i*D/8L spec.
9	A14L-0201-0304#980X2678	Torch cable assembly L=1.495m with wire brake	1	120*i*D/12L spec.
10	A14L-0166-0303#124X0256	Cable liner (black) for Iron・SUS	1	ϕ1.2 - 1.6 3.0m
*10	A14L-0166-0301#124XJ005	Cable liner (black) for Iron・SUS	1	ϕ1.2 - ϕ1.6 2.2m
*10	A14L-0166-0301#124XJ006	Cable liner (blue) for Iron・SUS	1	ϕ0.8 - ϕ1.0 2.2m
11	A14L-0201-0304#980X2459	Wire clamp unit	1	

* are options.

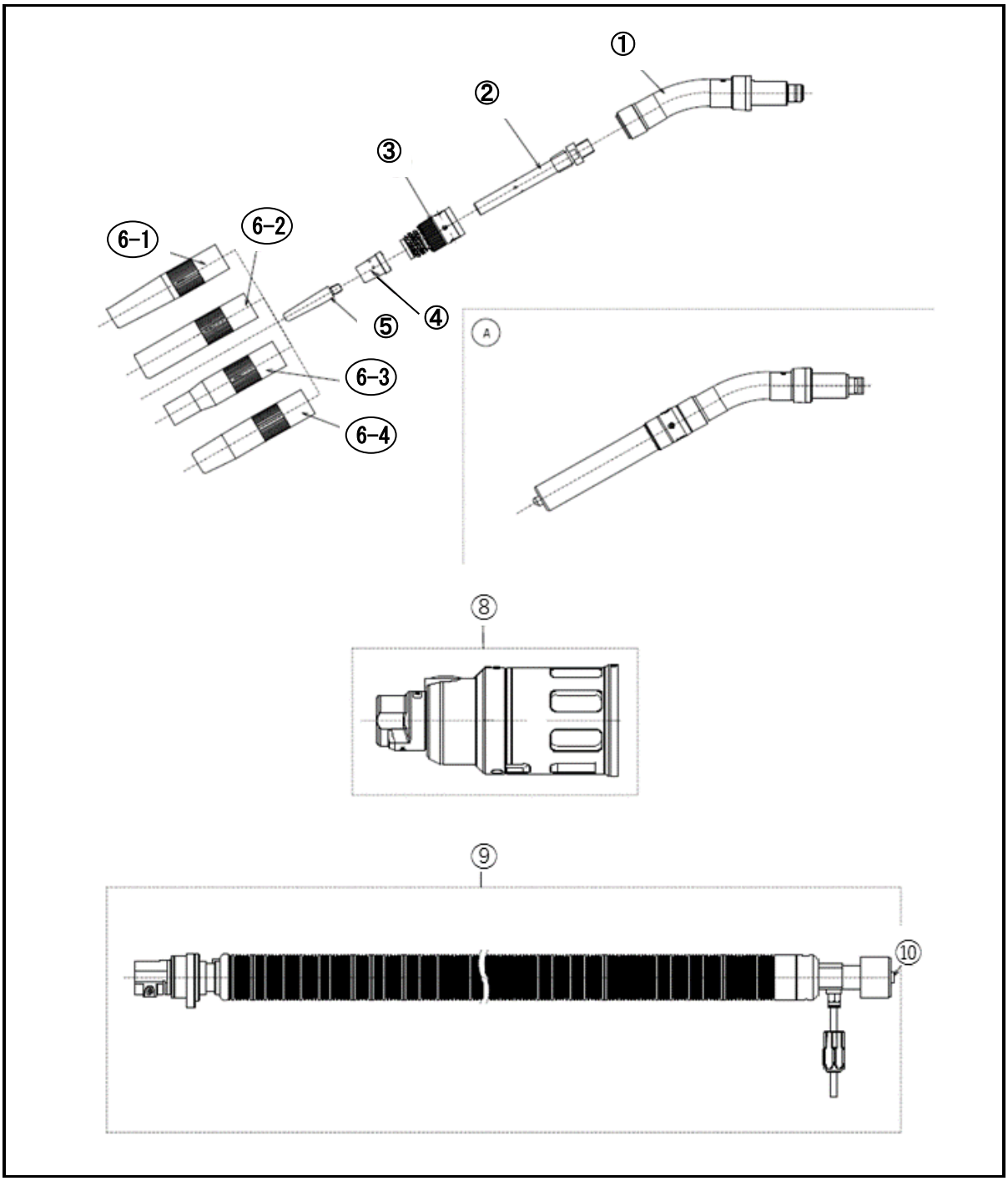


Fig.8 (h) A05B-1296-H303 series component parts
(ABIROB iSTM mini G350-30L by BINZEL)

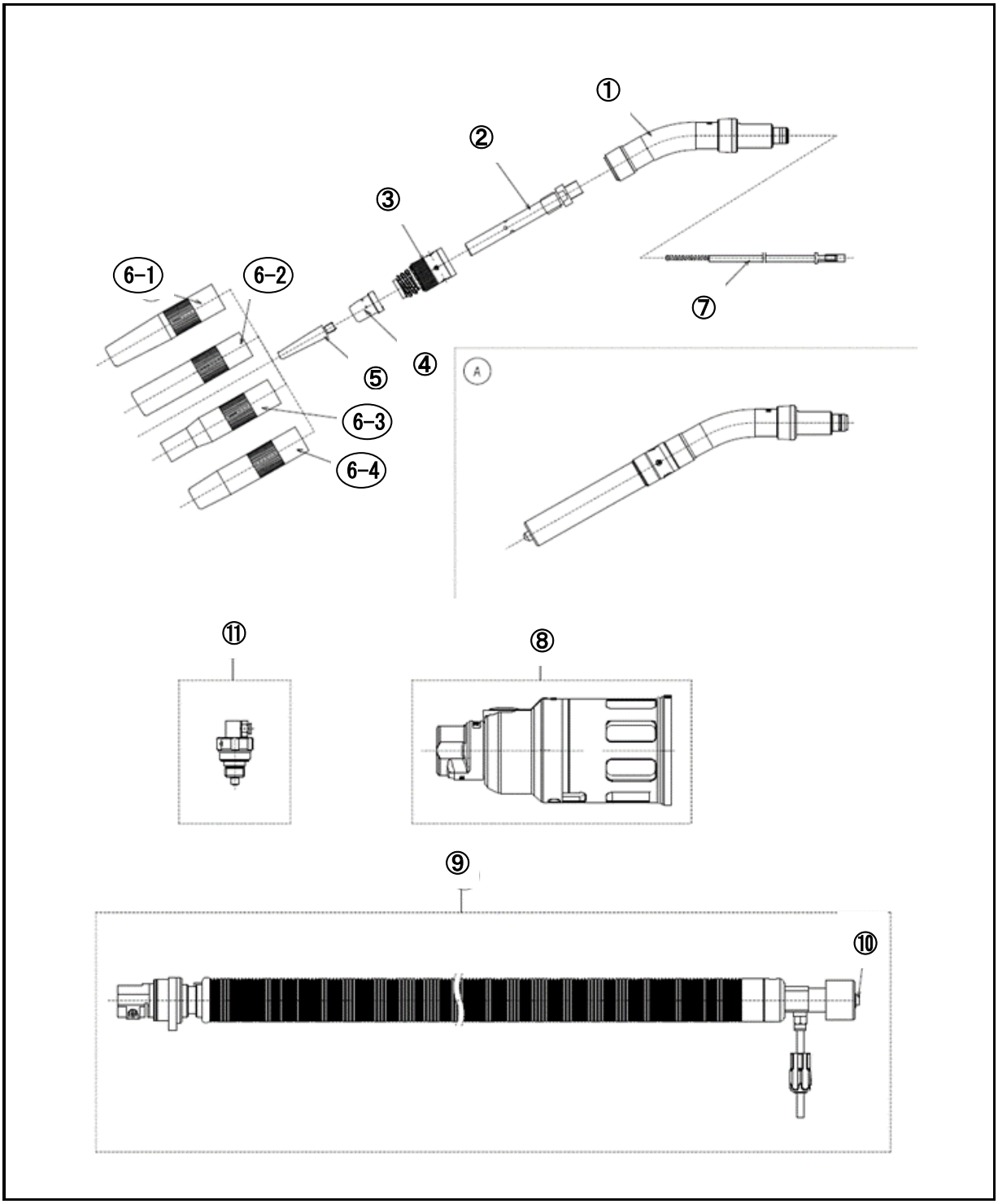


Fig.8 (i) A05B-1296-H304 series component parts
(ABIROB iSTM mini G350-30L with wire brake spec. for BINZEL)

Table 8 (e) A05B-1296-H305,H306 series parts table
(ABIROB iSTM mini W500-35 by BINZEL)

Fig.No.	Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
—	A14L-0201-0305#12L	W500-35 torch set including the torch cable	1	100*i*Dspec.
—	A14L-0201-0305#LGL	W500-35 torch set including the torch cable	1	100*i*D/10L,120*i*D spec.
—	A14L-0201-0305#ELL	W500-35 torch set including the torch cable	1	100*i*D/8L spec.
—	A14L-0201-0305#HLL	W500-35 torch set including the torch cable	1	120*i*D/12L spec.
—	A14L-0201-0306#12L	W500-35 torch set including the torch cable with wire brake	1	100*i*D spec.
—	A14L-0201-0306#LGL	W500-35 torch set including the torch cable with wire brake	1	100*i*D/10L,120*i*D spec.
—	A14L-0201-0306#ELL	W500-35 torch set including the torch cable with wire brake	1	100*i*D/8L spec.
—	A14L-0201-0306#HLL	W500-35 torch set including the torch cable with wire brake	1	120*i*D/12L spec.
1	A14L-0166-0311#782X0077	Torch neck simple substance	1	
2	A14L-0166-0311#142X0173	Tip holder (Ms)	1 (10)	L=40.9 M8
3	A14L-0166-0311#943XJ003	Gas diffuser Brown	1 (10)	
4	A14L-0166-0311#140X0445	Contact tip CuCrZr	1 (10)	L=30 ϕ1.2 M8
*4	A14L-0166-0311#140J3012	Contact tip CuCrZr	1 (10)	L=30 ϕ1.2 M8 Silver tungsten
*4	A14L-0166-0311#AGWX0445	Contact tip silver tungsten	1 (10)	L=30 ϕ1.2 M8
*5-1	A14L-0166-0311#145X0664	Gas nozzle (straight) ϕ20 L=87	1 (10)	Ni-Cr plated spec.
5-2	A14L-0166-0311#145X0665	Gas nozzle (taper) ϕ15.5 L=87	1 (10)	Ni-Cr plated spec.
*5-3	A14L-0166-0311#145X0629	Gas nozzle (straight) ϕ20 L=92	1 (10)	Ni-Cr plated spec.
*5-4	A14L-0166-0311#145X0714	Gas nozzle (taper) ϕ15.5 L=92	1 (10)	Ni-Cr plate spec. no description in Fig. and Table
6	A14L-0201-0306#149X0475	Water cooling neck liner	1	
7	A14L-0201-0303#780X3315	Insulation robot flange	1	100*i*D,120*i*D flange spec.
8	A14L-0201-0304#980X2459	Wire clamp unit	1	
9	A14L-0201-0305#980X2598	Torch cable assembly L=0.86m	1	100*i*D spec.
9	A14L-0201-0305#980X2599	Torch cable assembly L=1.06m	1	100*i*D/10L,120*i*D spec.
9	A14L-0201-0305#980X2684	Torch cable assembly L=1.26m	1	100*i*D/8L spec.
9	A14L-0201-0305#980X2686	Torch cable assembly L=1.495m	1	120*i*D/12L spec.
9	A14L-0201-0306#980X2632	Torch cable assembly L=0.86m with wire brake	1	100*i*Dspec.
9	A14L-0201-0306#980XZ573	Torch cable assembly L=1.06m with wire brake	1	100*i*D/10L,120*i*D spec.
9	A14L-0201-0306#980X2688	Torch cable assembly L=1.26m with wire brake	1	100*i*D/8Lspec.
9	A14L-0201-0306#980X2690	Torch cable assembly L=1.495m with wire brake	1	120*i*D/12L spec.
10	A14L-0166-0303#124X0256	Cable liner (black) for Iron・SUS	1	ϕ1.2 - ϕ1.6 3.0m
*10	A14L-0166-0301#124XJ005	Cable liner (black) for Iron・SUS	1	ϕ1.2 - ϕ1.6 2.2m
-	A14L-0166-0371#501X0195	Quick disconnector (female)	1	ϕ10 no description in Fig. and Table

* are options.

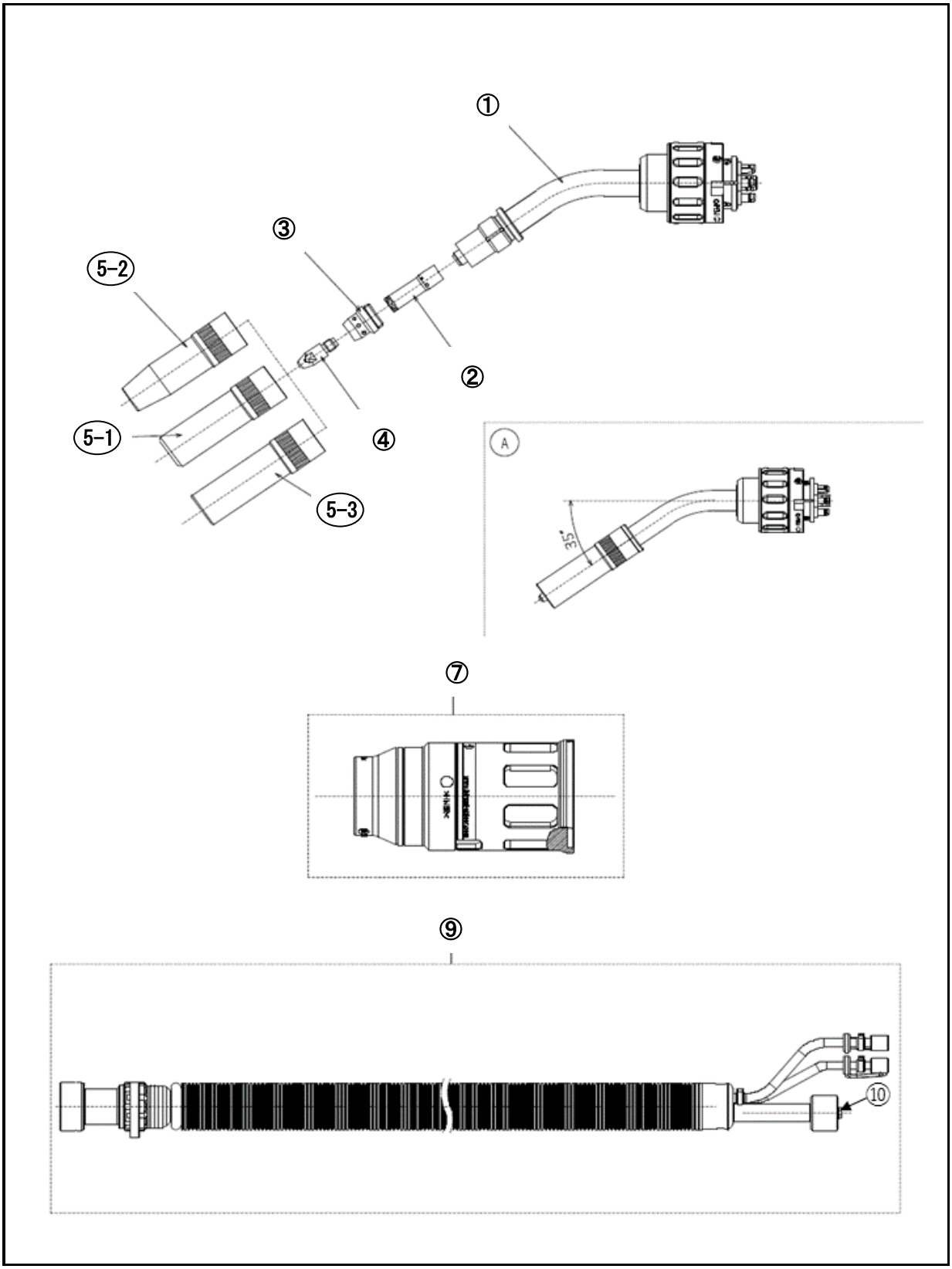


Fig.8 (j) A05B-1296-H305 series component parts
(ABIROB iSTM mini W500-35)

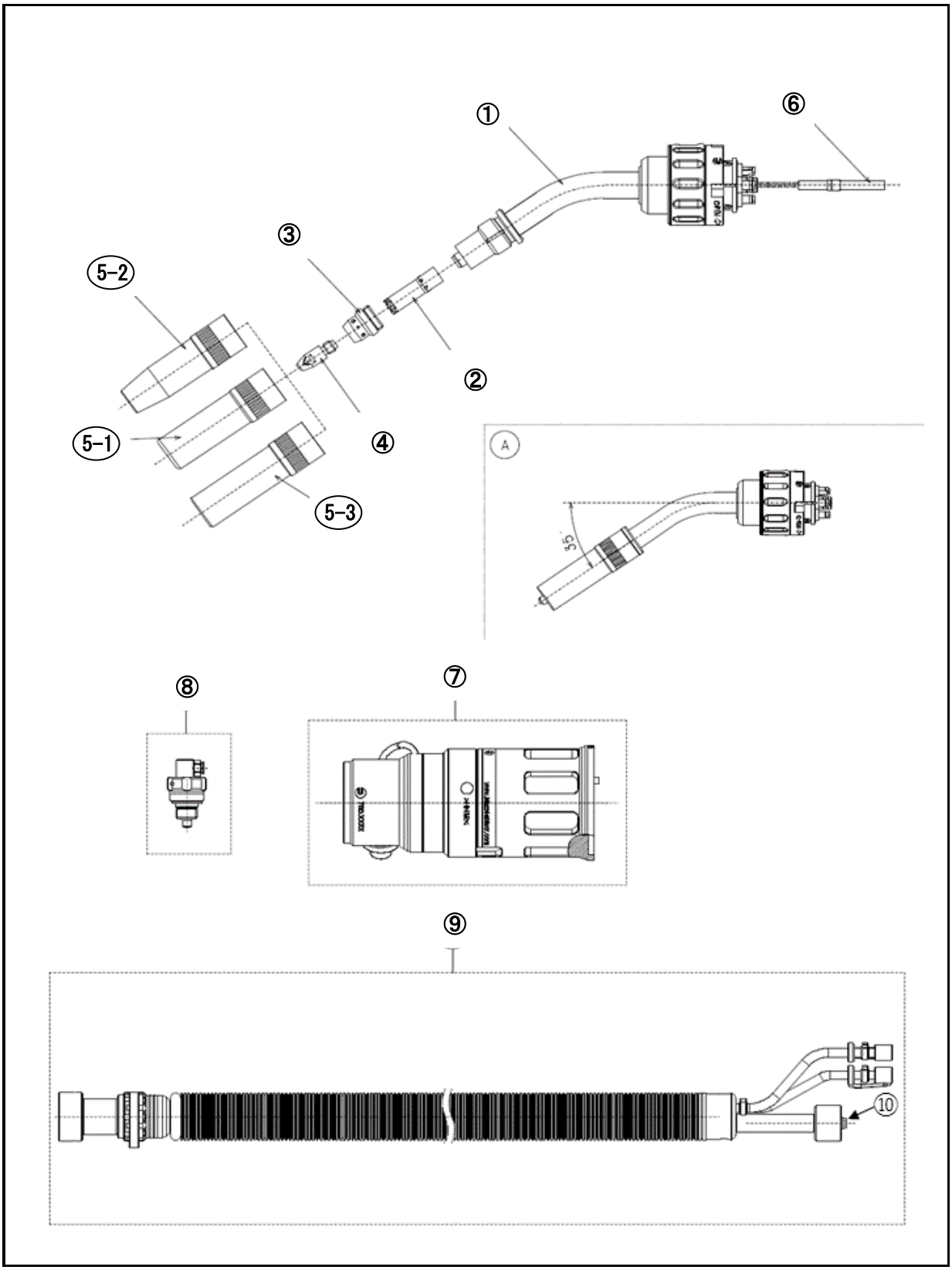


Fig.8 (k) A05B-1296-H306 series component parts
(ABIROB iSTM mini W500-35 with wire brake spec.)

Table 8 (f) Fig.8 (*) A05B-1296-H308 Series parts table
(ABIROB iSTM mini G500-35)

Fig.No.	Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
—	A14L-0201-0308#12L	G500-35 torch set including the torch cable	1	
1	A14L-0201-0308#980X0223	Torch neck simple substance	1	
2	A14L-0201-0308#142X0158	Tip holder	1 (5)	L=70 M8 brass
3	A14L-0166-0311#140X0445	Contact tip CuCrZr	1 (10)	L=30 ϕ1.2 M8
4	A14L-0201-0308#142X0581	Gas nozzle	5 (10)	ϕ16 L=77
8	A14L-0201-0303#780X3315	Robot flange	1	100*i*D spec.
9	A14L-0201-0308#980X2548	Torch cable assembly L=0.86m	1	100*i*D spec.
9	A14L-0201-0308#980X2551	Torch cable assembly L=1.06m	1	100*i*D/10L,120*i*D spec.
9	A14L-0201-0308#980X2676	Torch cable assembly L=1.26m	1	100*i*D/8L spec.
9	A14L-0201-0308#980X2652	Torch cable assembly L=1.495m	1	120*i*D/12L spec.
10	A14L-0166-0301#124XJ005	Cable liner (black) for Iron・SUS	1	ϕ1.2 to ϕ1.6 2.2m

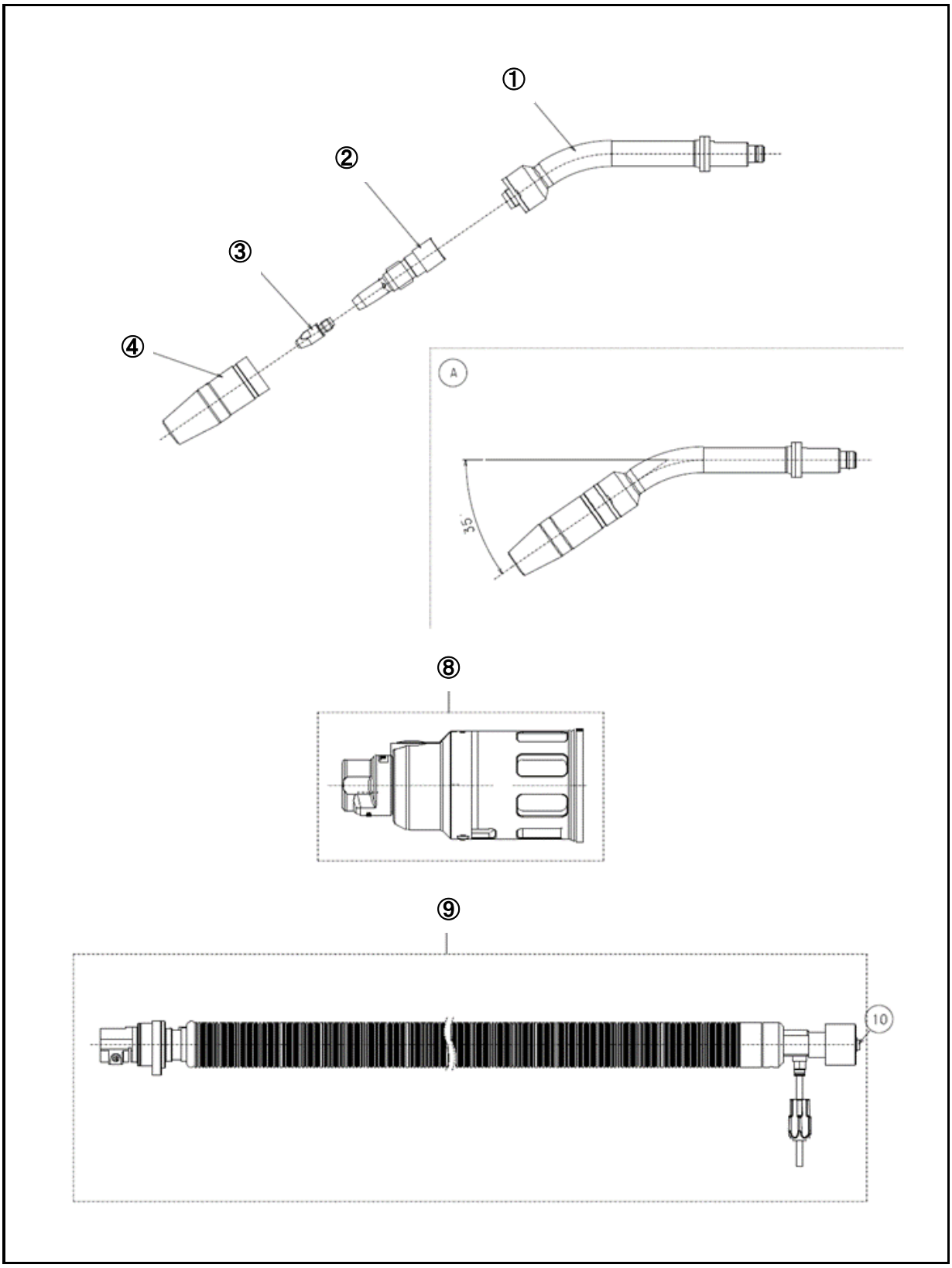


Fig.8 (l) A05B-1296-H308 series parts table
(ABIROB iSTM mini G500-35)

Table 8 (g) Maintenance parts of welding power supply Power Wave R350 (A05B-1291-H141)

Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
A14L-0166-0141 #E1X4A	Control Board	1	
A14L-0166-0141 #D1X13	Switch Board / Power Conversion Asbly	1	
A14L-0166-0141 #C1X16A	Input Board / PFC Control	1	
A14L-0166-0141 #E1X2A	40V DC Buss Board	1	
A14L-0166-0141 #H1X10B	Feedhead Bd.	1	
A14L-0166-0141#H1X10H	Voltage Sense Board	1	
A14L-0166-0141#G1X2A	Fan Asbly	3	

Table 8 (h) Maintenance parts of STT module (A05B-1291-H142)

Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
A14L-0166-0142 #E1X10B	Switchboard & Heatsink Assembly	1	
A14L-0166-0142 #E1X11B	Status Board Assembly.	1	
A14L-0166-0142 #9D	FAN Assembly	1	
A14L-0166-0142 #D1X3A	STT module mounting kit	1	

Table 8 (i) Parts for maintenance of welding power supply Power Wave *i*400 (200V) (A05B-1291-H101)

Spec of parts for maintenance	Name of parts for maintenance	Unit requirement	Remarks
A14L-0166-0101	Power wave *i*400	1	For 200V
A14L-0166-0101#F1X03A	Switch Board	1	
A14L-0166-0101#C1X12A	Aux. Transformer	1	
A14L-0166-0101#E1X02A	40V DC Bus Board	1	
A14L-0166-0101#G1X12A	Input Rectifier Module	1	
A14L-0166-0101#D1X02F	Ethernet Receptacle	1	
A14L-0166-0101#D1X02H	Ethernet Cable - 2ft	1	
A14L-0166-0101#E1X09A	Output Rectifier Assembly	1	
A14L-0166-0101#H1X15C	Switch - On/Off	1	
A14L-0166-0101#G1X03	Fan Blade	1	
A14L-0166-0101#G1X02A	Fan Motor	1	
A14L-0166-0101#E1X06	Capacitor - 40V Supply	1	
A14L-0166-0101#F1X15	Capacitor - Main	2	
A14L-0166-0101#G2X40	MOV Assembly - Input Rectifier	1	
A14L-0166-0101#C1X10A	Current Transducer	1	
A14L-0166-0101#H1X10B	Lift Hook	2	
A14L-0166-0101#E1X20A	Control Board Assembly	1	
A14L-0166-0101#C1X18C	Feed Head Board Assembly	1	
A14L-0166-0101#G1X20E	Fuse	1	
A14L-0166-0101#D1X02K	Circuit Breaker - 15A	2	
A14L-0166-0101#E1X04A	Thermostat - Bus Board	1	
A14L-0166-0101#E1X09G	Thermostat - Output Rectifier	1	
A14L-0166-0101#E1X03A	Diode Module	1	
A14L-0166-0101#G2X41	MOV Assembly - Input Rectifier	1	
A14L-0166-0101#C1	Inverter Chassis	1	
A14L-0166-0101#C1X04A	Choke Asbly.	1	
A14L-0166-0101#D1X02G	Ethernet Cover	1	
A14L-0166-0101#J1X03C	Terminal Block Assembly	4	

Table 8 (j) Parts for maintenance of welding power supply Power Wave *i*400 (400V) (A05B-1291-H102)

Spec of parts for maintenance	Name of parts for maintenance	Unit requirement	Remarks
A14L-0166-0101#F1X03A	Switch Board	1	
A14L-0166-0101#C1X12A	Aux. Transformer	1	
A14L-0166-0101#E1X02A	40V DC Bus Board	1	
A14L-0166-0101#G1X12A	Input Rectifier Module	1	
A14L-0166-0101#D1X02F	Ethernet Receptacle	1	
A14L-0166-0101#D1X02H	Ethernet Cable - 2ft	1	
A14L-0166-0101#E1X09A	Output Rectifier Assembly	1	
A14L-0166-0101#H1X15C	Switch - On/Off	1	
A14L-0166-0101#G1X03	Fan Blade	1	
A14L-0166-0101#G1X02A	Fan Motor	1	
A14L-0166-0101#E1X06	Capacitor - 40V Supply	1	
A14L-0166-0101#F1X15	Capacitor - Main	2	
A14L-0166-0101#G2X40	MOV Assembly - Input Rectifier	1	
A14L-0166-0101#C1X10A	Current Transducer	1	
A14L-0166-0101#H1X10B	Lift Hook	2	
A14L-0166-0101#E1X20A	Control Board Assembly	1	
A14L-0166-0101#C1X18C	Feed Head Board Assembly	1	
A14L-0166-0101#G1X20E	Fuse	1	
A14L-0166-0101#D1X02K	Circuit Breaker - 15A	2	
A14L-0166-0101#E1X04A	Thermostat - Bus Board	1	
A14L-0166-0101#E1X09G	Thermostat - Output Rectifier	1	
A14L-0166-0101#E1X03A	Diode Module	1	
A14L-0166-0101#G2X41	MOV Assembly - Input Rectifier	1	
A14L-0166-0101#C1	Inverter Chassis	1	
A14L-0166-0101#C1X04A	Choke Asbly.	1	
A14L-0166-0101#D1X02G	Ethernet Cover	1	
A14L-0166-0101#J1X03C	Terminal Block Assembly	4	

Table 8 (k) Parts for maintenance of welding power supply Power Wave J350 (A05B-1291-H149), Power Wave R500 (A05B-1291-H947) , Power Wave R450 (A05B-1291-H147)

Spec of parts for maintenance	Name of parts for maintenance	Unit requirement	Remarks
A14L-0166-0947#F1X10A	Control board	1	
A14L-0166-0947#D2X30A	Switch Board/ Power Conversion Asbly	1	
A14L-0166-0947#C1X16A	PFC Control Board	1	
A14L-0166-0947#D1X11A	40V DC Bus Board	1	
A14L-0166-0947#F1X12A	Feedhead Board	1	
A14L-0166-0947#F1X13B	Voltage Sense Board	1	
A14L-0166-0947#E1X2A	Fan Asbly	2	

Table 8 (l) Parts for maintenance for AutoDrive 4R100 (A05B-1291-H203,H213,A05B-1296-H201)

Item	Name of parts for maintenance	Specifications	Remarks
1	Gas Solenoid	A14L-0166-0201#C1X12A	
2	Cable Asbly.	A14L-0166-0201#C1X18	
3	TENSION ARM ASBLY	A14L-0166-0201#D1X02D	
4	MOTOR/GEARBOX ASSEMBLY	A14L-0166-0201#D1X04	
5	Motor brush	A14L-0166-0201#D1X04E	
6	RETAINER	A14L-0166-0201#D1X08	
7	WARE GUIDE ASBLY	A14L-0166-0201#D1X09	
8	LOCKING DRIVE HUB ASSEMBLY	A14L-0166-0201#D1X12	
9	Drive Rolls ϕ0.9mm	A05B-1291-H256	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.0mm	A05B-1291-H259	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.2mm	A05B-1291-H257	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.4mm	A05B-1291-H260	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.6mm	A05B-1291-H261	4 pcs set of wire feeder roll

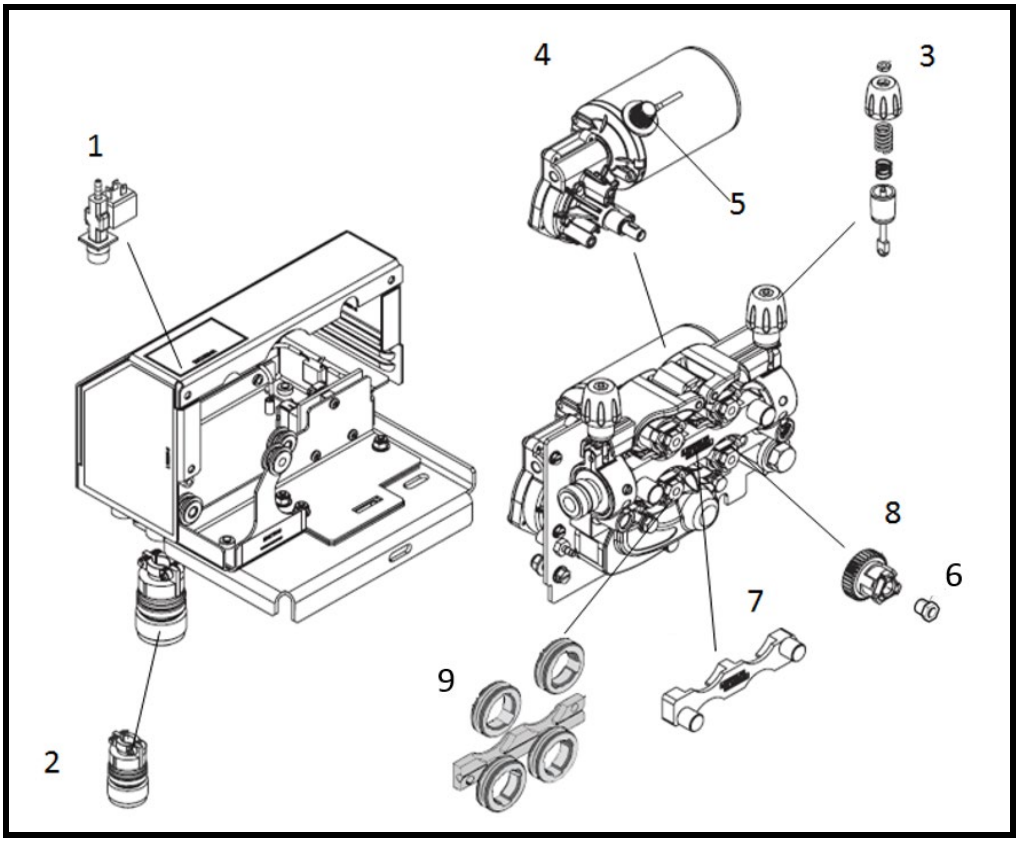


Fig. 8 (m) Wire feeder AutoDrive 4R100

Table 8 (j) Parts for maintenance fo AutoDrive 4R220 (A05B-1291-H204,A05B-1296-H202)

Item	Name of parts for maintenance	Specifications	Remarks
1	Gas Solenoid	A14L-0166-0201#C1X12A	
2	Cable Asbly.	A14L-0166-0201#C1X18	
3	TENSION ARM ASBLY	A14L-0166-0201#D1X02D	
4	RETAINER	A14L-0166-0201#D1X08	
5	WARE GUIDE ASBLY	A14L-0166-0201#D1X09	
6	LOCKING DRIVE HUB ASSEMBLY	A14L-0166-0201#D1X12	
7	Drive Rolls ϕ0.9mm	A05B-1291-H256	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.0mm	A05B-1291-H259	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.2mm	A05B-1291-H257	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.4mm	A05B-1291-H260	4 pcs set of wire feeder roll
	Drive Rolls ϕ1.6mm	A05B-1291-H261	4 pcs set of wire feeder roll

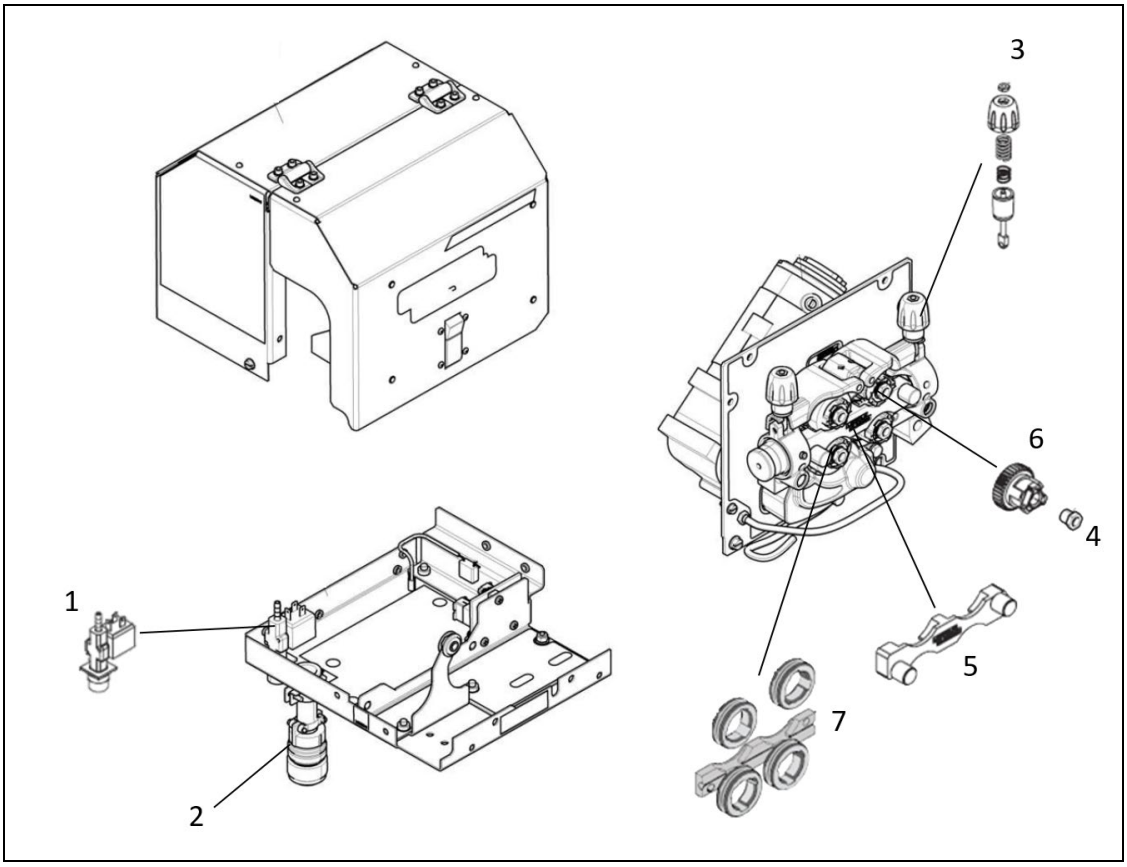


Fig. 8 (n) Wire feeder AutoDrive 4R220

9 PROCESS MODE

This chapter describes about available process modes of Lincoln welding power supply. Please refer to Section 3.3 “OPERATION OF WELD PROCEDURE AND PROCESS MODE” for the details of each process mode.

NOTE
Available process modes will be changed by the installed firmware version and weld table version in the welding power supply. Please use these lists as reference information.

9.1 POWER WAVE R350 / R450 PROCESS MODE LIST

Firmware Version : S28735-03
Weld Table Version : Z133310

Mode	Pulse/CV	Material	Diameter (mm)	CTWD (mm)	Gas
10	CV	Steel	1.0	12	100%CO2
11	CV	Steel	1.0	12	80%Ar 20%CO2
12	Pulse	Steel	1.0	12	80%Ar 20%CO2
13	Rapid Arc	Steel	1.0	12	80%Ar 20%CO2
18	Rapid Arc	Steel	1.2	15	80%Ar 20%CO2
20	CV	Steel	1.2	15	100%CO2
21	CV	Steel	1.2	15	80%Ar 20%CO2
22	Pulse	Steel	1.2	15	80%Ar 20%CO2
29	CV	Stainless	0.9	12	80%Ar 20%CO2
30	Pulse	Stainless	0.8	12	98%Ar 2%O2
31	CV	Stainless	1.0	12	98%Ar 2%O2
33	CV	Stainless	1.0	12	80%Ar 18%He 2%CO2
34	Pulse	Stainless	1.0	12	80%Ar 18%He 2%CO2
36	Pulse	Stainless	1.0	12	80%Ar 20%CO2
41	CV	Stainless	1.2	15	80%Ar 20%CO2
43	CV	Stainless	1.2	15	80%Ar 18%He 2%CO2
44	Pulse	Stainless	1.2	15	80%Ar 18%He 2%CO2
46	Pulse	Stainless	1.2	15	80%Ar 20%CO2
61	CV	Stainless	0.8	12	80%Ar 20%CO2
63	CV	Stainless	0.8	12	80%Ar 18%He 2%CO2
64	CV	Stainless	0.8	12	80%Ar 18%He 2%CO2
66	CV	Stainless	0.8	12	80%Ar 20%CO2
71	CV	Alumi 4043	1.2	15	100%Ar
72	Pulse	Alumi 4043	1.2	15	100%Ar
73	CV	Alumi 4043	1.6	18	100%Ar
74	Pulse	Alumi 4043	1.6	18	100%Ar
75	CV	Alumi 5356	1.2	15	100%Ar
76	Pulse	Alumi 5356	1.2	15	100%Ar
77	CV	Alumi 5356	1.6	18	100%Ar
78	Pulse	Alumi 5356	1.6	18	100%Ar
93	CV	Steel	0.8	12	100%CO2
94	CV	Steel	0.8	12	80%Ar 20%CO2
95	Pulse	Steel	0.8	12	80%Ar 20%CO2
151	CV	Alumi 5356	1.0	12	100%Ar

Mode	Pulse/CV	Material	Diameter (mm)	CTWD (mm)	Gas
152	Pulse	Alumi 5356	1.0	12	100%Ar
280	CV	Steel	0.9	12	100%CO2
281	CV	Steel	0.9	12	80%Ar 20%CO2
282	Pulse	Steel	0.9	12	80%Ar 20%CO2
283	Rapid Arc	Steel	0.9	12	80%Ar 20%CO2

You can use process modes in the following list only when STT module or Advanced module is connected to Power Wave R350 or R450.

Mode	Pulse/CV	Material	Diameter (mm)	CTWD (mm)	Gas
155	Rapid X	Steel	1.0	12	80%Ar 20%CO2
156	Rapid X	Steel	1.2	15	80%Ar 20%CO2
304	Non-synergic STT	Steel	0.9	12	100%CO2
305	Non-synergic STT	Steel	0.9	12	80%Ar 20%CO2
306	Non-synergic STT	Steel	1.0	12	100%CO2
307	Non-synergic STT	Steel	1.0	12	80%Ar 20%CO2
308	Non-synergic STT	Steel	1.2	15	100%CO2
309	Non-synergic STT	Steel	1.2	15	80%Ar 20%CO2
324	Synergic STT	Steel	0.9	12	100%CO2
325	Synergic STT	Steel	0.9	12	80%Ar 20%CO2
326	Synergic STT	Steel	1.0	12	100%CO2
327	Synergic STT	Steel	1.0	12	80%Ar 20%CO2
328	Synergic STT	Steel	1.2	15	100%CO2
329	Synergic STT	Steel	1.2	15	80%Ar 20%CO2
344	Non-synergic STT	Stainless	0.9	12	80%Ar 20%CO2
345	Non-synergic STT	Stainless	0.9	12	80%Ar 18%He 2%CO2
346	Non-synergic STT	Stainless	1.0	12	80%Ar 20%CO2
347	Non-synergic STT	Stainless	1.0	12	80%Ar 18%He 2%CO2
348	Non-synergic STT	Stainless	1.2	15	80%Ar 20%CO2
349	Non-synergic STT	Stainless	1.2	15	80%Ar 18%He 2%CO2
364	Synergic STT	Stainless	0.9	12	80%Ar 20%CO2
365	Synergic STT	Stainless	0.9	12	80%Ar 18%He 2%CO2
366	Synergic STT	Stainless	1.0	12	80%Ar 20%CO2
367	Synergic STT	Stainless	1.0	12	80%Ar 18%He 2%CO2
368	Synergic STT	Stainless	1.2	15	80%Ar 20%CO2
369	Synergic STT	Stainless	1.2	15	80%Ar 18%He 2%CO2

9.2 POWER WAVE *i*400 PROCESS MODE LIST

Firmware Version : S27271-15
Weld Table Version : Z123258

Process mode	Pulse/CV	Material	Diameter (mm)	CTWD (mm)	Gas
10	CV	steel	1.0	12	100%CO2
11	CV	steel	1.0	12	80%Ar 20%CO2
12	pulse	steel	1.0	12	80%Ar 20%CO2
13	Rapid Arc	steel	1.0	12	80%Ar 20%CO2
18	Rapid Arc	steel	1.2	15	80%Ar 20%CO2
20	CV	steel	1.2	15	100%CO2
21	CV	steel	1.2	15	80%Ar 20%CO2
22	pulse	steel	1.2	15	80%Ar 20%CO2
29	CV	stainless steel	0.9	12	98%Ar 2%O2
30	pulse	stainless steel	0.9	12	98%Ar 2%O2
31	CV	stainless steel	1.0	12	98%Ar 2%O2
32	pulse	stainless steel	1.0	12	98%Ar 2%O2
41	CV	stainless steel	1.2	15	98%Ar 2%O2
42	pulse	stainless steel	1.2	15	98%Ar 2%O2
93	CV	steel	0.8	12	100%CO2
94	CV	steel	0.8	12	80%Ar 20%CO2
138	CV	steel	0.9	12	100%CO2
139	CV	steel	0.9	12	80%Ar 20%CO2
140	pulse	steel	0.9	12	80%Ar 20%CO2
141	Rapid Arc	steel	0.9	12	80%Ar 20%CO2

10 INITIAL SETTING

This chapter describes “Weld equipment select”, “Setting of multi-process function”, “Setting of wire feeder” and “Changing command form of weld schedule” as initial setting of welding power supply. **These were already set when robot was shipped, so those settings are usually not required.**
Additionally, the required setup to control multiple welding power supplies by one robot controller is explained on Section 10.5.

10.1 WELDING POWER SUPPLY SELECT

If welding power supply is properly selected on ArcTool Setup screen, the communication between arc welding robot and welding power supply is never established and welding power supply cannot be controlled.
This operation is required only when the message of “ARC-045 Weld EQ is OFFLINE” keeps displaying.

Welding power supply select is performed in ArcTool Setup Screen after controlled start. The procedure is different by kind of welding power supply. If the welding power supply uses LAN cable to connect robot controller and welding power supply (Power Wave R350, S350, R450, R500 or *i*400), please refer to Procedure 10-1 (a). If the welding power supply is Power Wave 455M/STT, please refer to Procedure 10-1 (b).

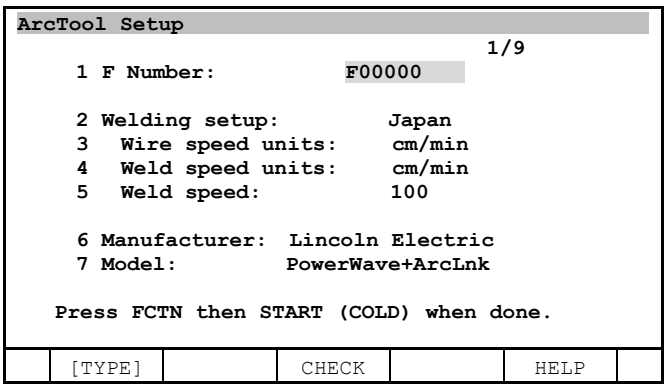
In Case of Power Wave R350, S350, R450, R500 or *i*400

In case of these welding power supply model, success/failure of the communication is displayed on the ArcTool Setup Screen. The method of the re-setting when the communication failed is also shown in Procedure 10-1 (a).

Procedure 10-1 (a) Welding power supply select (In case of Power Wave R350, S350, R450, R500 or *i*400)

Condition

- Lincoln Asia package is installed.
- LAN cable and robot controller are connected to the weld equipment correctly.
- The power supply of Robot controller and weld equipment are ON.
- Controlled Start has been performed and the following ArcTool Setup screen will be displayed.
- On ArcTool Setup screen, “Manufacturer” isn’t “Lincoln Electric” or “Model” isn’t “PowerWave + ENet”.

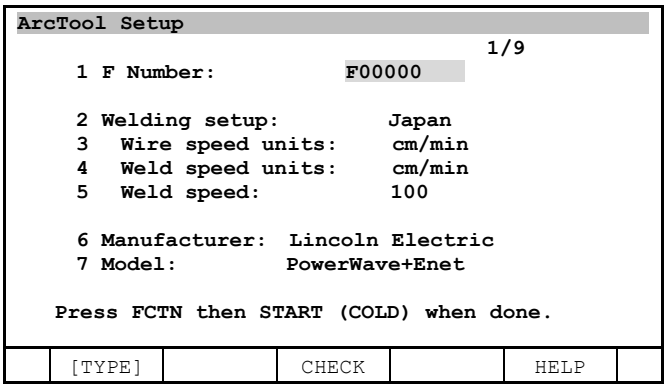


⚠CAUTION
If the item of [Manufacturer] has already been set to “Lincoln Electric”, do not change the item. Additionally, if the item of [Model] has already been set to “PowerWave + ENet”, do not change the item. If those items are changed and then performed Cold Start, ArcTool recognizes that the model of the weld equipment is changed, and the part of current settings about Arc Welding (Weld Schedules, etc.) will be lost.

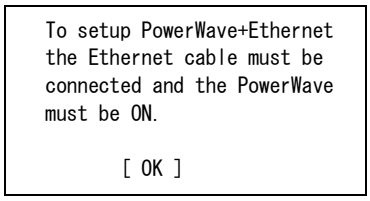
NOTE
[Welding setup] of the above-mentioned screen is not supported. It is not necessary to change this function from an initial value “Japan”.

Step

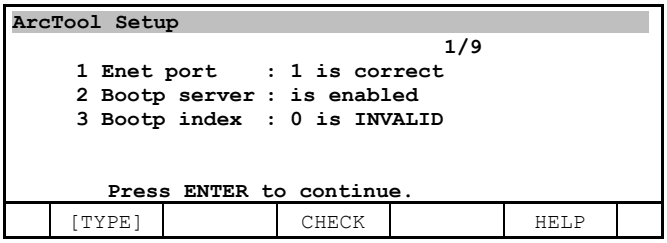
1 Move the cursor to the [Manufacturer:]. Press F4 [CHOICE] and select [Lincoln Electric].
2 Move the cursor to the [Model]. Press F4 [CHOICE] and select the [PowerWave+ENet].



3 After the step 2, the following screen is displayed. Press F3 [CHECK]. Press [ENTER] key.



4 Robot controller begins obtaining MAC address and assigning the IP address of weld equipment. When the assignment completes, [PowerWave detected] is displayed at the prompt line. If this message is displayed then next procedure jumps to step 12.
5 When the communication failed in step 4, [Checking for PowerWave] is displayed and countdown starts. When the communication doesn't establish during countdown, [PowerWave not detected] is displayed.
6 If you would like to try setup again after failing setup, press F3 [CHECK]. The following screen is displayed. Press the [ENTER] key.



7 The following message box is displayed. Select [YES].

```
The Ethernet setup is not
Complete.  It is best to
Redo the Ethernet setup.

Redo the Ethernet setup ?

      [YES]      [NO]
```

8 The following message box is displayed again. Please check the input power of weld equipment and the connection of Ethernet cable. If the power of weld equipment is not turned on, please turn it on and press the [ENTER] key.

```
To setup PowerWave+Ethernet
the Ethernet cable must be
connected and the PowerWave
must be ON.

        [ OK ]
```

9 When IP address assignment completes, the message [PowerWave detected] is displayed. If this message is displayed then next procedure jumps to step 12.

10 If the connection is not established, [PowerWave not detected] is displayed and then the following message box is displayed. Please execute cycle power of both weld equipment and robot controller.

```
The Ethernet connection is
not working. Exit this menu,
check the Ethernet cable,
and cycle power on the robot
and the PowerWave.

        [OK]
```

11 After robot controller completes the controlled start, [Setup incomplete, use CHECK] is displayed at the prompt line. Then, you can attempt to setup by pressing F3 [CHECK] key again. Please retry from Step 6.

12 If PowerWave is detected, press FCTN key and select [START (COLD)] and perform it.

13 After the Cold Start, ArcTool automatically tries to communicate with the weld equipment. After the Cold Start finishes and 10sec - 1min passes, the communication succeed if the following message is displayed on the upper side of the screen. After this message is displayed, it is possible to set and control the weld equipment by Teach Pendant. (“i” in the message is Weld Equipment Number.)

```
ARC-051 Weld EQ i ONLINE : ArcLink
```

14 If ARC-051 is not displayed at step 13 and ARC-045 keeps displaying, the communication fails. Major cause of communication failing is shown below.

- The power supply of weld equipment is turned off.
- The communication cable is not correctly connected.
- The setting of the welding equipment is not completed.

Please continue this procedure from step 6 in case of the power supply of weld equipment is turned on and this message keeps displaying. Please refer to Troubleshooting 6.1 for this message.

```
ARC-045 Weld EQ Device is OFFLINE
```

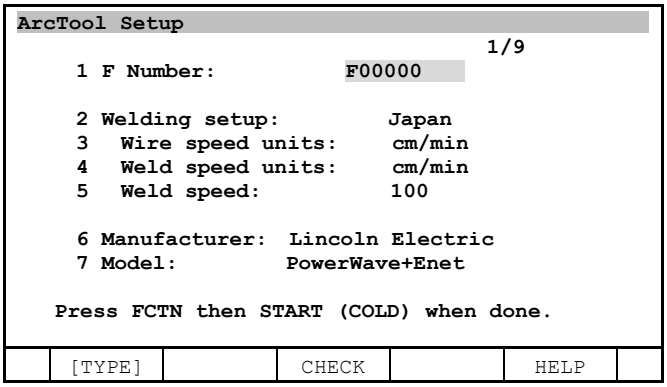
In Case of Power Wave 455M/STT

In case of Power Wave 455M/STT, procedure to select welding power supply becomes simple like general welding power supply model. The procedure is shown below.

Procedure 10-1 (b) Weld equipment select (In case of Power Wave 455M/STT)

Condition

- Lincoln Asia package for standard weld equipment is installed.
- Robot controller is connected to weld equipment correctly by DeviceNet board and ArcLink cable.
- Robot controller and weld equipment power supplies are ON.
- Controlled Start has been performed and the following ArcTool Setup screen is displayed.
- On ArcTool Setup screen, “Manufacturer” isn’t “Lincoln Electric” or “Model” isn’t “PowerWave + ArcLnk”.



⚠CAUTION

If the item of [Manufacturer] has already been set to “Lincoln Electric”, do not change the item. Additionally, if the item of [Model] has already been set to “PowerWave + ArcLnk”, do not change the item. If those items are changed and then performed Cold Start, ArcTool recognizes that the model of the weld equipment is changed, and the part of current settings about Arc Welding (Weld Schedules, etc.) will be lost.

NOTE

[Welding setup] of the above-mentioned screen is not supported. It is not necessary to change this function from an initial value “Japan”.

Step

1 Move the cursor to the [Manufacturer:]. Press F4 [CHOICE] and select [Lincoln Electric].
2 Move the cursor to the [Model]. Press F4 [CHOICE] and select the [PowerWave+ArcLink].
3 Press the [FCTN] key and select [START (COLD)] and perform it.
4 After Cold Start, ArcTool automatically tries to communicate with the weld equipment. After the Cold Start finishes and 10sec - 1min passes, the communication succeed if the following message is displayed on the upper side of the screen. After this message is displayed, it is possible to set and control the weld equipment by Teach Pendant. (“i” in the message is Weld Equipment Number.)

ARC-051 Weld EQ i ONLINE：ArcLink

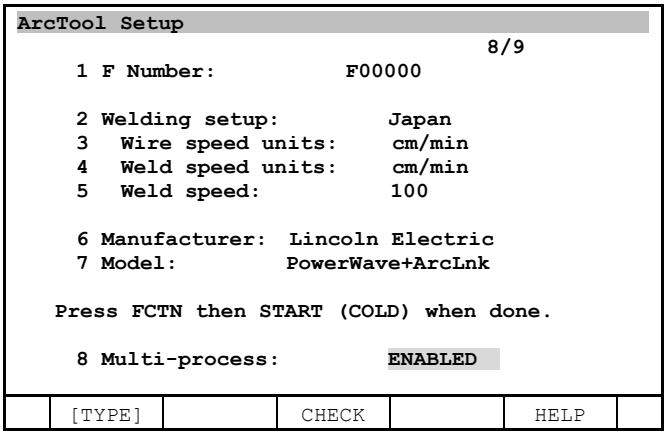
10.2 SETTING OF MULTI-PROCESS FUNCTION

When Lincoln welding power supply is connected, it is necessary to set multi-process function to enable. Setting of multi-process function is performed in ArcTool setup screen after Controlled Start. **This is already set when robot is shipped, so it is usually not required.**

Procedure 10-2 Setting of multi-process function

Condition

- ”PowerWave+ArcLnk” or “PowerWave+ENet” is selected as model of welding power supply
- ArcTool setup screen is displayed after performing Controlled Start.

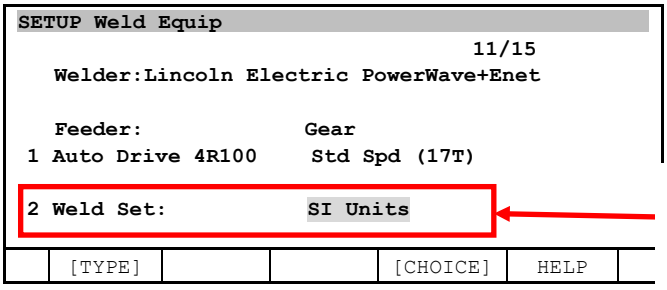


Step

1 Move the cursor to below and confirm multi-process is ENABLE. If multi-process is DISABLE, match the cursor to “multi-process” then press F4「ENABLE」key.
2 Press the [FCTN] key and select [START (COLD)] then perform it.

10.3 SETTING OF WELD SET

Some firmware versions of Lincoln welding power supply have multiple Weld Set in one welding power supply (S27271-20 or later for Power Wave *i*400, S28735-09 or later for Power Wave R350, S29514-08 or later for Power Wave R500, all versions for Power Wave R450).
If communication is established with the Lincoln welding power supply which has multiple Weld Set and the robot controller (software version is 7DC3P/23 or later), “Weld Set” item is displayed on weld equip setup screen, and it becomes possible o switch Weld Set.
This is already set when robot is shipped, so it is usually not required.



This is displayed only when welding power supply has multiple Weld Set

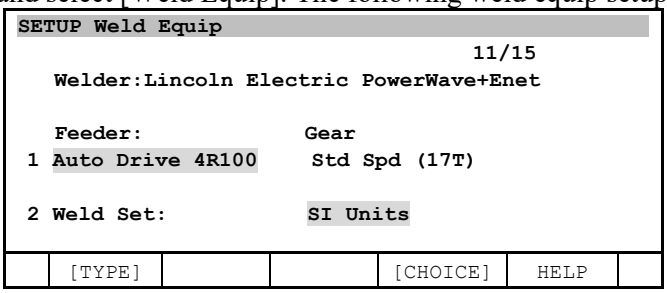
Table 10.3 (a) Selectable items of Weld Set

Selectable items	Contents
SI Units	When this item is selected, Weld Set which is adjusted for the wire diameter of “mm” unit is used. Normally, the wire of “mm” unit is used in Asia including Japan. If you do not need to select “Custom”, please select this item.
Imperial Units	When this item is selected, Weld Set which is adjusted for the wire diameter of “IPM” unit is used. Normally, the wire of “IPM” unit is used in North America.
Custom	This Weld Set includes weld modes (#155, #156, etc.) which are adjusted for special usage. This can be selected only in special firmware version. There is a case that this is selected when welding power supply is replaced.

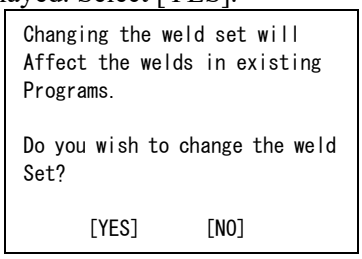
Procedure 10-3 Setting of Weld Set

Step

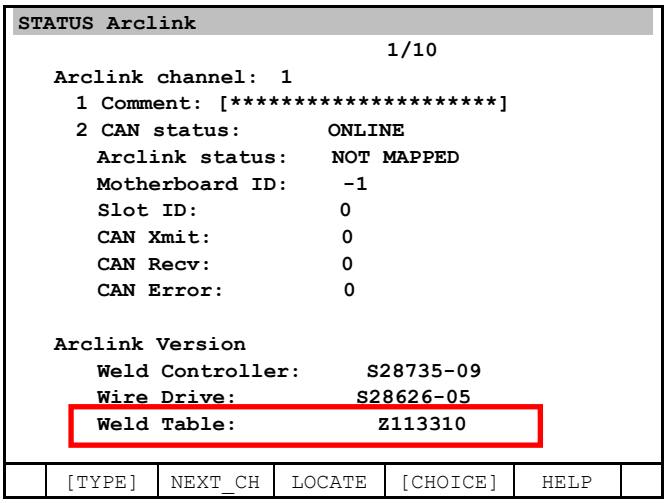
1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] and select [Weld Equip]. The following weld equip setup screen will be displayed.



3 Move the cursor to the item of Weld Set, and press F4 [CHOCE] key. If “Custom” is displayed as selectable item, select “Custom”. If “Custom” is not displayed, select “SI Units” or “Imperial Units” according to Table 10.3 (a).
4 Following message box is displayed. Select [YES].



5 “Reset Ei Arclink [NO]?” message will be displayed, then press F4 [Yes].
6 “Weld Table” item in ArcLink Status screen is changed according to the selection of Weld Set in this procedure. (Regarding to the display procedure for ArcLink Status screen, please refer to Procedure 3-6).



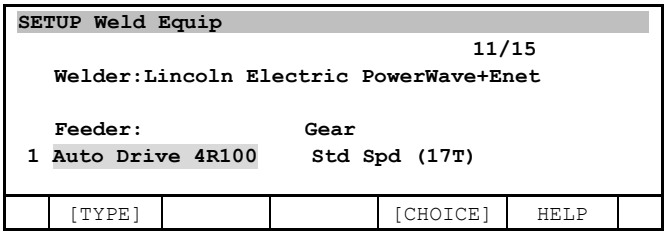
10.4 SETTING OF WIRE FEEDER

This section describes about setting of wire feeder. It is necessary to set appropriate wire feeder model correctly. If this setting is wrong, you cannot perform arc welding correctly.
This setting is already set when robot is shipped, so it is usually not required.

Procedure 10-4 Setting of wire feeder

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] and select [Weld Equip]. The following weld equip setup screen will be displayed.



3 Confirm whether wire feeder model name of weld equip setup screen accords with wire feeder model name which is real installed to robot. If they are not equal, press F4 [CHOCE] key and select wire feeder which is installed to robot. Then “Reset Ei Arclink [NO]?” message will be displayed, then press F4 [Yes].

NOTE
1 Setup information of wire feeder is saved by the weld equipment. Therefore, there is a possibility that the setup is different from previous one after the weld equipment unit is changed.
2 If item of wire feeder and gear are not displayed after establishment of communication is done, Select F1[TYPE] and select [Weld Equip] ,then display weld equip setting screen again.

10.5 INITIAL SETTING WHEN MULTIPLE WELDING POWER SUPPLIES ARE CONNECTED

Robot controller can control max four Lincoln welding power supplies simultaneously. The communication establishment procedure with first weld equipment has been already explained at Section 10.1. In this section explains the communication establishment procedure with second or later welding power supplies. This procedure is different from the model of welding power supply.

In Case of Power Wave R350, S350, R450, R500 or i400

Robot controller and Lincoln welding power supplies are connected by Ethernet cables via switching hub. Then, the execution of Procedure 10-5 (a) is needed.

Procedure 10-5 (a) Setting of 2nd or later welding power supplies (In case of Power Wave R350, S350, R450, R500 or i400)

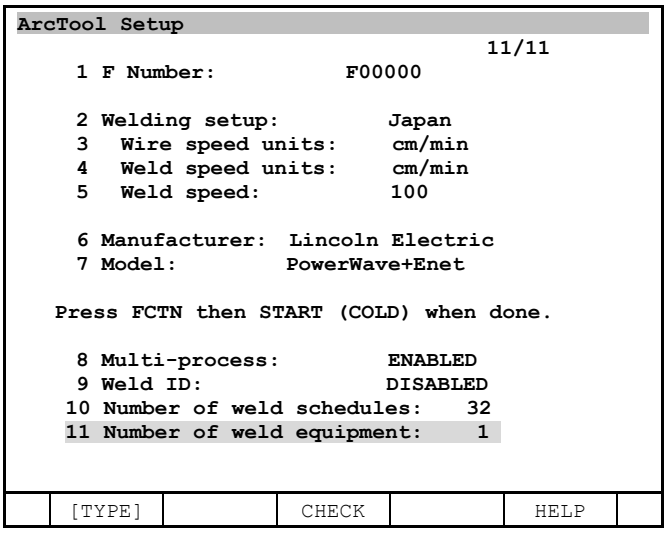
Condition

- Multi Equipment option (A05B-####-J617) is ordered.
- The connection to first weld equipment has already achieved. (Refer to Procedure 10.1 (a))
- The robot controller and the switching hub are connected by Ethernet cable, and switching hub and welding power supplies are connected by Ethernet cables.

Step

1 Turn off the robot controller and all of welding power supplies.

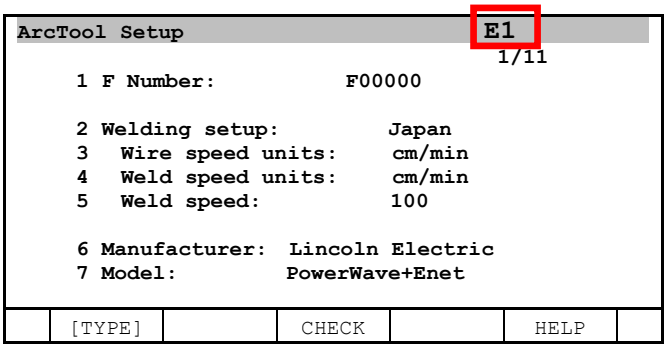
2 Turn on the robot controller with Controlled Start. Next, turn on only one welding power supply which you plan to connect now. Keep the power of other welding power supplies off.



3 After ArcTool Setup screen is displayed, mover the cursor on [Number of Equipments] and input the number of equipments (Max 4).

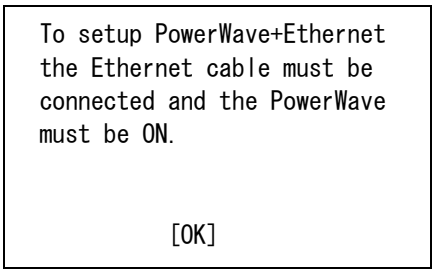
4 Execute cycle power of the robot controller (the weld equipment is still ON). The controller automatically turns on with Controlled Start.

5 Please check the equipment number on a right side of the top of the screen (EX: E1, E2, ...). The number is a present select number.



6 Window menu is displayed when the [SHIFT] key and [DISP] key are pressed simultaneously. Then, select [Display Equip] and select Equipment number which you want to set. For example, you want to set second weld equipment, please select [E2].

7 The following box is displayed. Press the [ENTER] key.



8 The controller starts the assignment of an IP address to the weld equipment. When the assignment is completed, “PowerWave detected” is displayed.

9 In Step 8, if weld equipment is detected, check the communication by pressing F3 [CHECK] key.

10 If PowerWave is not detected or CHECK is failed, turn both robot controller and weld equipment OFF, and execute F3 CHECK again after controller and weld equipment are turned ON. If the communication is not established, please refer to Section 10.1 or Chapter 6 “TROUBLE SHOOTING”.

11 If CHECK is succeeded, press the [FCTN] key, select [START (COLD)] and execute Cold Start.

12 The communication establishment is completed. If there are some weld equipments that have not established the communication yet, perform Step 1-2 and 5-11 again. (Then Step 3 and 4 are not required)

13 After the communication establishment for any equipment is completed, turn the all of equipments ON.

14 Window menu is displayed when [SHIFT] key and [DISP] key are pressed simultaneously. If you select [Display Equip], you can switch the weld equipment number for each ArcTool-related screen (EX: Weld Equipment Setup screen, Weld Procedure screen, etc). Please perform the setup for each weld equipment after selecting a weld equipment number.
If standard Teach Pendant is used, you can change a weld equipment number by pressing [FCTN] key and selecting [Change Equip].

⚠ WARNING
When Lincoln welding power supply and robot controller is connected via Ethernet cable, you must not connect through the network in operation. If the connection is established through the network in operation, the performance of welding power supply is not guaranteed. Additionally, It may have a bad influence against the traffic on the network in operation.

In Case of Power Wave 455M/STT

When multiple Power Wave 455M/STT are connected, DIP switch setting of DeviceNet board is also required in addition of software setting. Details are shown on Procedure 10-5 (b).

Procedure 10-5 (b) Setting of 2nd or later weld equipment (In case of Power Wave 455M/STT)

Condition

- Multi Equipment option (A05B-####-J617) is ordered.
- The connection to first welding power supply has already achieved. (Refer to Procedure 10.1 (b))

Step

1. Set the DIP switch of DeviceNet board referring to the following figure.
   (Board 1 means first welding power supply, Board 2 means second welding power supply.)

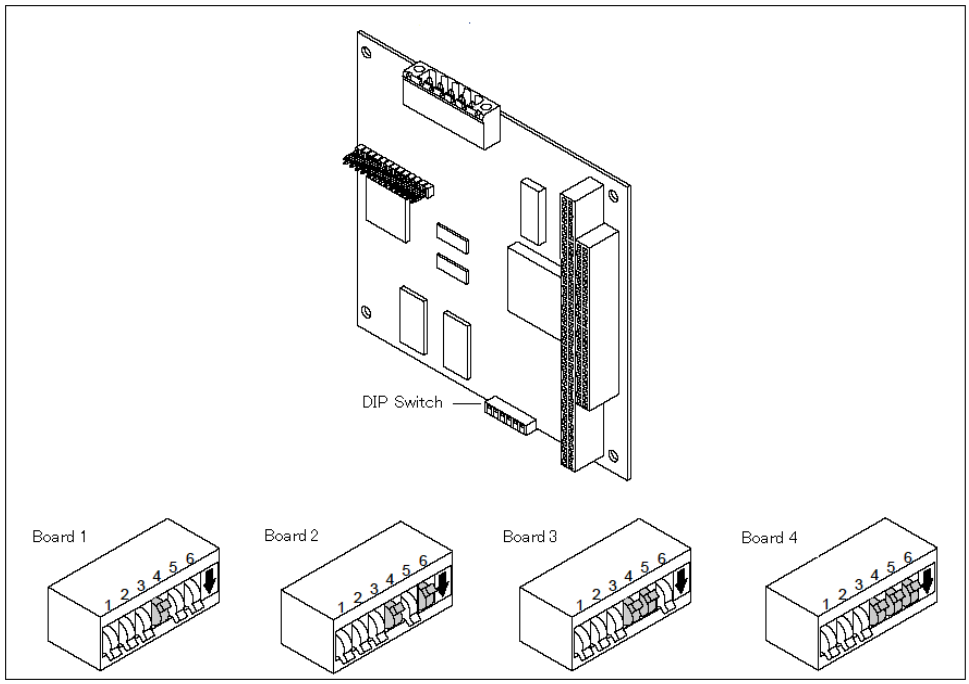
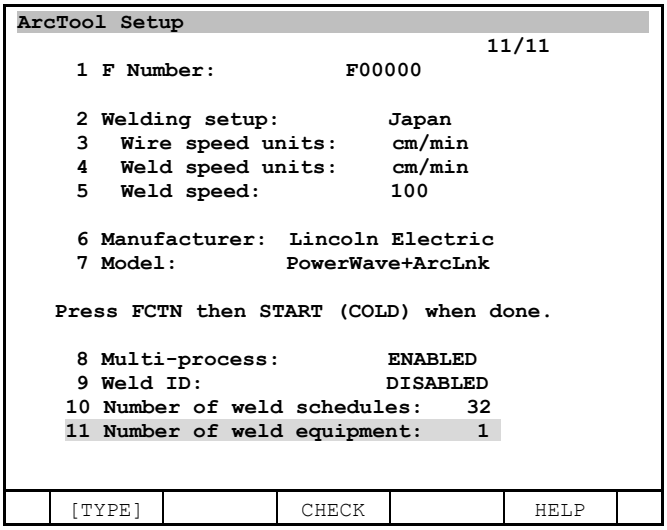


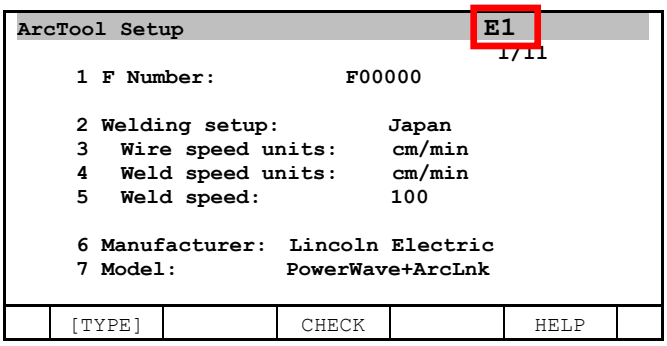
Fig. 10.5 (a) Setting of DIP switch for DN3 board

2 Mount the board whose DIP switch setup is finished to the robot controller and connect an ArcLink cable to the welding power supply.

3 Perform Controlled Start. The following screen will be displayed.



4 Move the cursor on [Number of weld equipments] and input the number of equipments (Max 4).
5 Perform cycle power of the robot controller. The controller automatically perform Controlled Start again.
6 After ArcTool Setup screen is displayed, please check the equipment No. on the top of a right side of the screen (EX: E1, E2, …). The number is the present select number.



7 Window menu is displayed when the [SHIFT] key and the [WINDOW] key are pressed simultaneously. Then, select [Display Equip] and select Equipment number which you want to set. For example, you want to set second weld equipment, please select [E2].
8 Execute Cold Start. You can switch the equipment number for screens (EX: Weld Equipment Setup screen, Weld Procedure screen, etc) by Step 7. After selecting an equipment number which you want to set, please perform a setup for each equipment.

Check method for Weld Equipment Number

If the model is Power Wave 455M/STT, you can check weld equipment numbers by confirming connections in Fig. 10.5 (a).

On the other hand, if the model is PowerWave R350, S350, R450, R500 or *i*400, you cannot check weld equipment numbers by connections. You can check weld equipment numbers by wire inching. Additionally, you can also check by ArcLink Status screen.

Procedure 10-5 (c) Check method for Weld Equipment Number

Condition

- Multi equipment setup has already finished.
- All of welding power supplies are turned ON.

Step

1 Press the [MENU] key and press “0” key. Then, select [4 STATUS].
2 Press F1 [TYPE] key and select [ArcLink]. ArcLink Status screen will be displayed.
3 Display ArcLink Status screen whose weld equipment number is that you want to check by referring to Step 6 of Procedure 3-6.
4 Press F3[LOCATE]. The LED of one of the weld equipment is flashed rapidly with green (about 1 second). This weld equipment has the equipment number in ArcLink Status screen.

11 EXPANSION MODULE

Use expansion module (STT module, advanced module) in combination with welding power supply Power Wave R350, Power Wave S350, Power Wave R500. Even when only the welding power supply is used, it is usable. Refer to Subsection 1.1.3 about welding power supply.

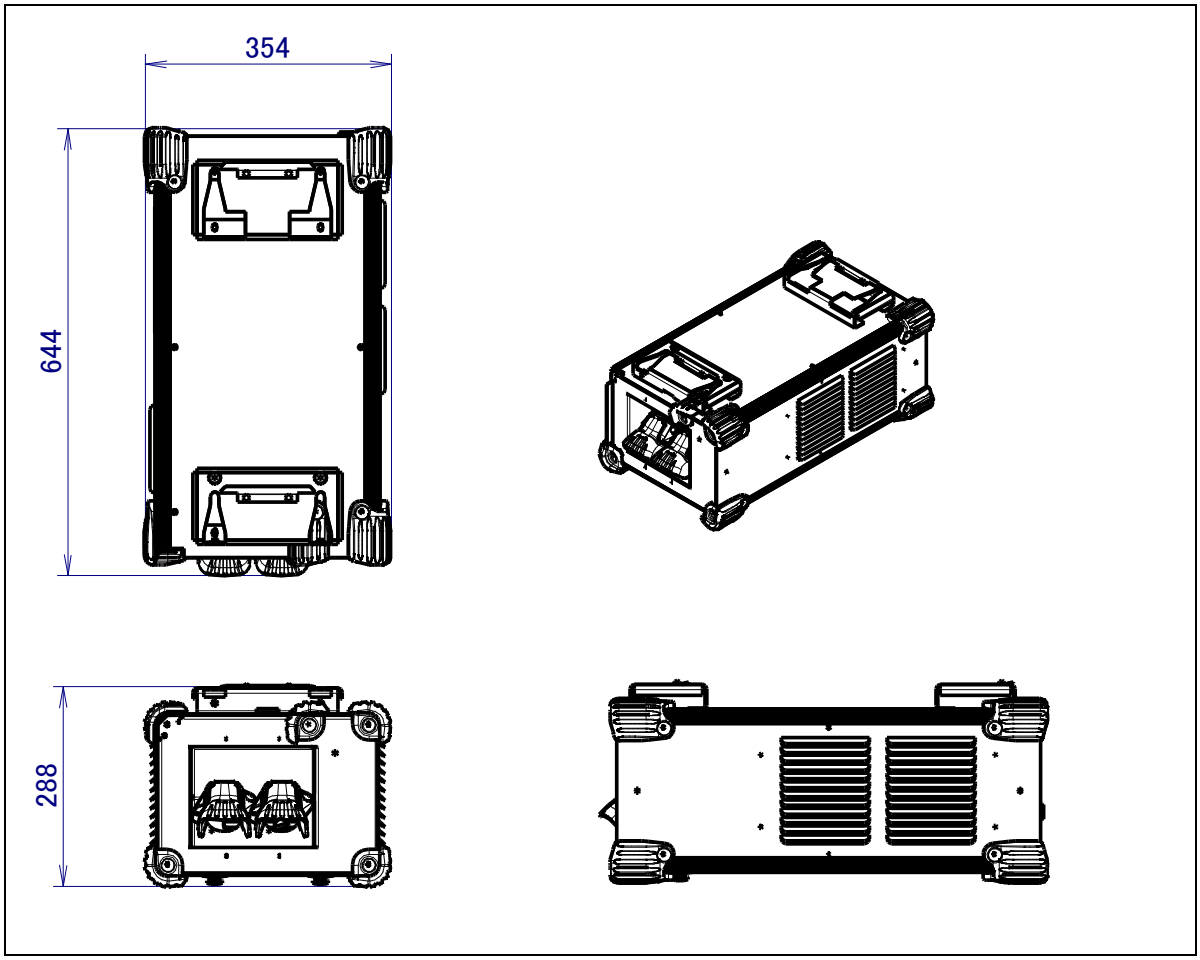


Fig. 11 (a) External dimensions of STT module

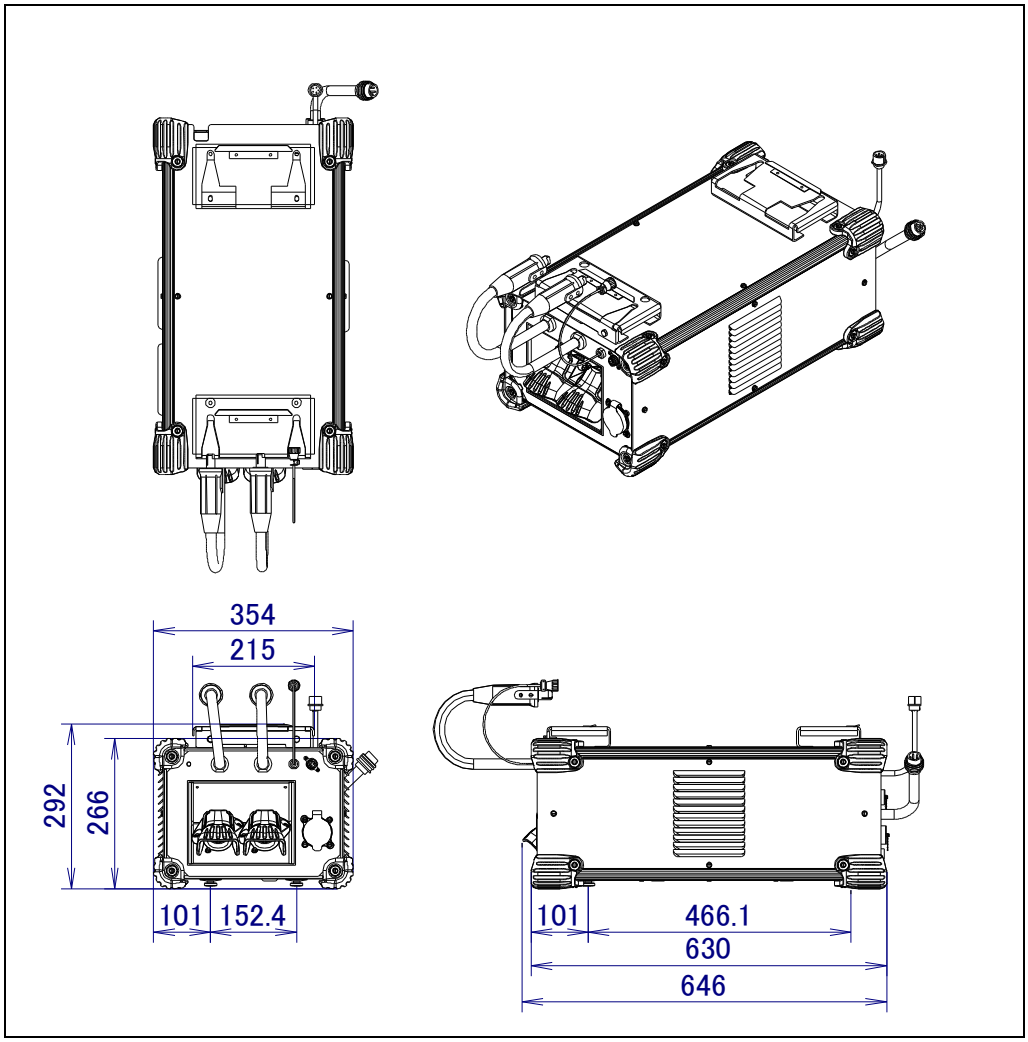


Fig. 11 (b) External dimensions of Advanced module

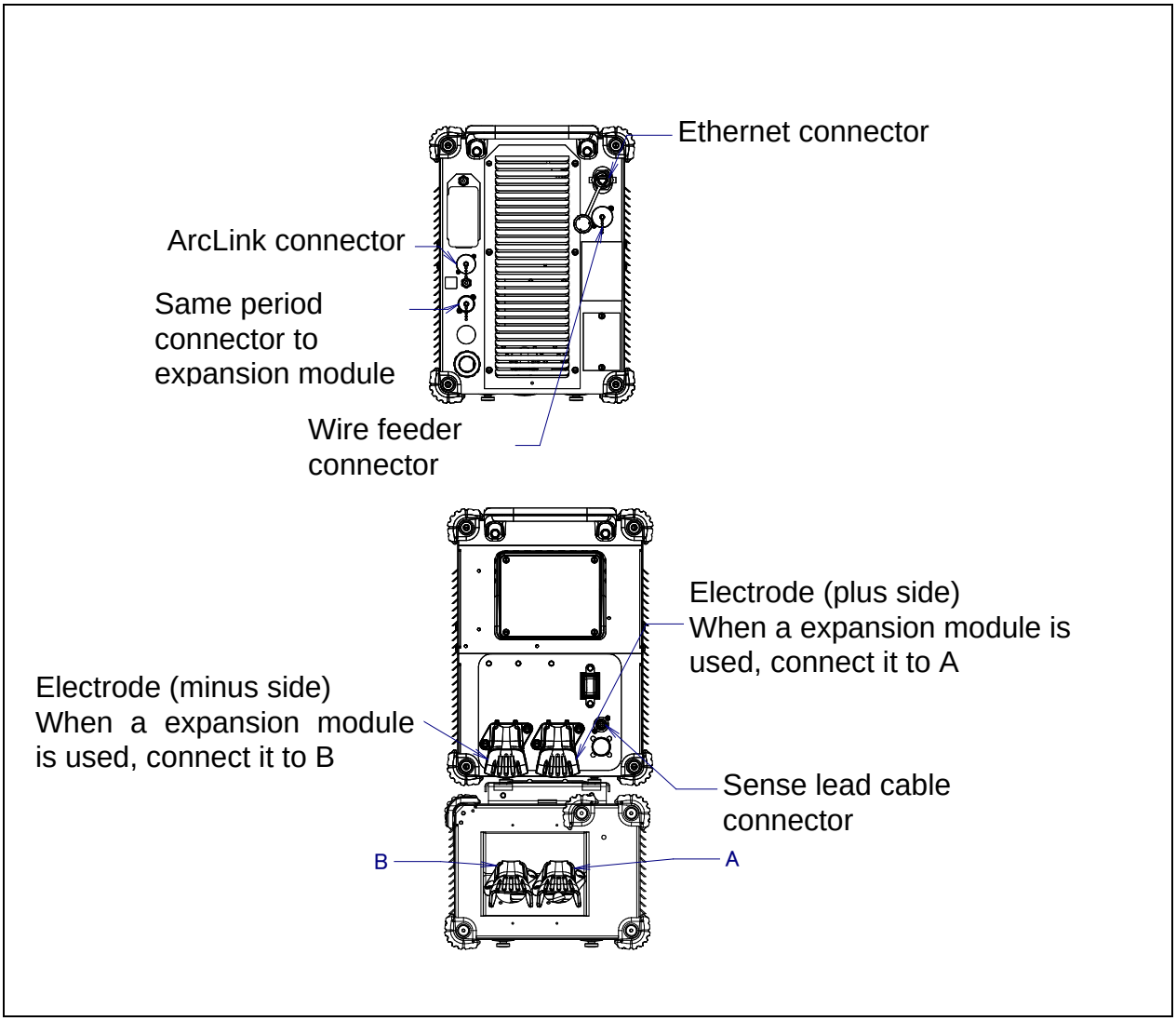


Fig. 11 (c) Welding power supply Power Wave R350 and Power Wave S350 connection interface

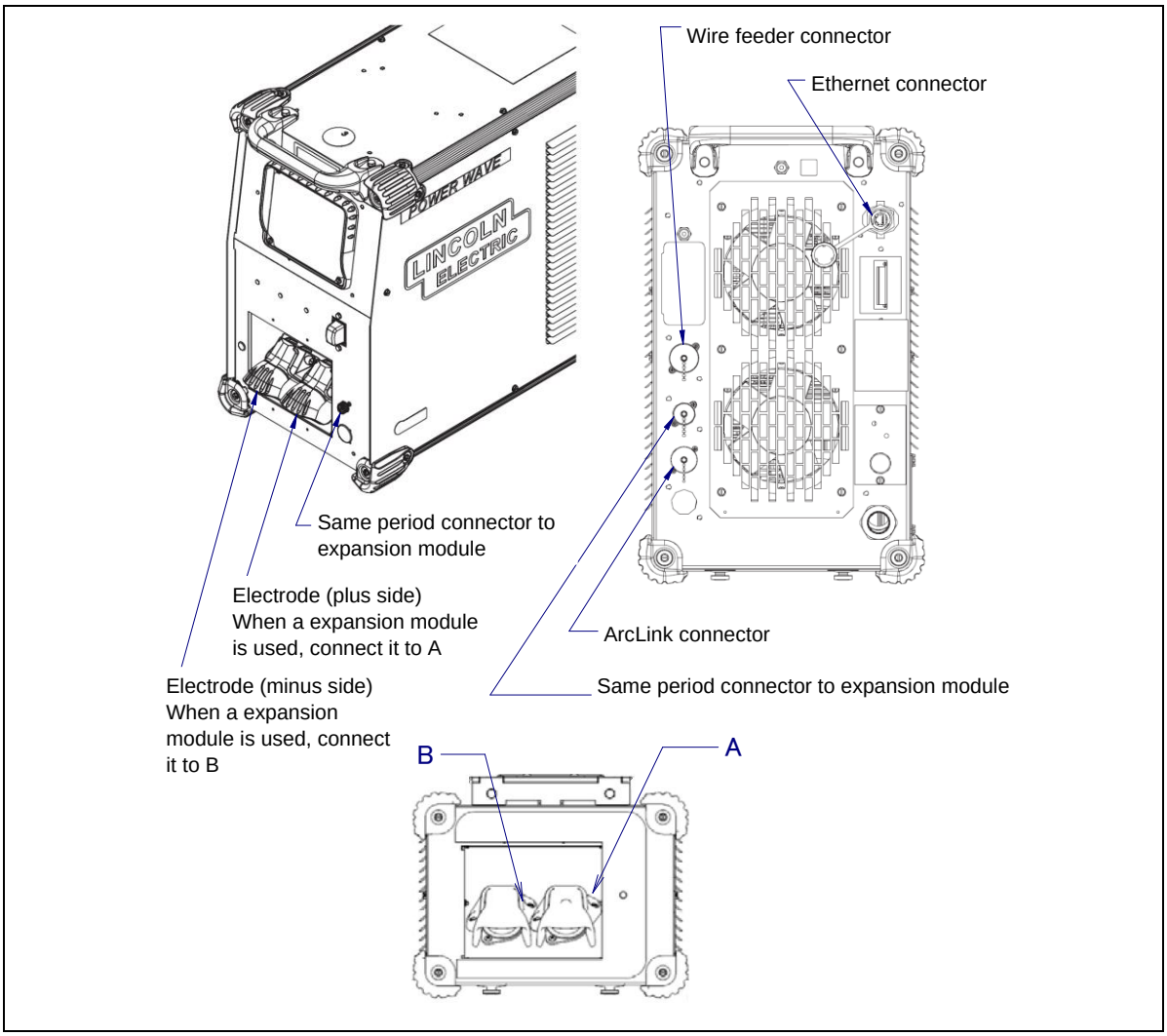


Fig. 11 (d) Welding power supply Power Wave R500 connection interface

Connection of Power Wave R350, Power Wave S350, Power Wave R500 with Expansion module

If Power Wave R350, Power Wave S350, Power Wave R500 and Expansion module are ordered at the same time, they are already combined when robot is shipped. So it is not necessary to perform procedure below.

1 Fix welding power supply main body on Expansion module. Remove metal plate of Expansion module and set welding power supply main body referring to Fig. 11 (e). Fix welding power supply main body with removed metal plate.

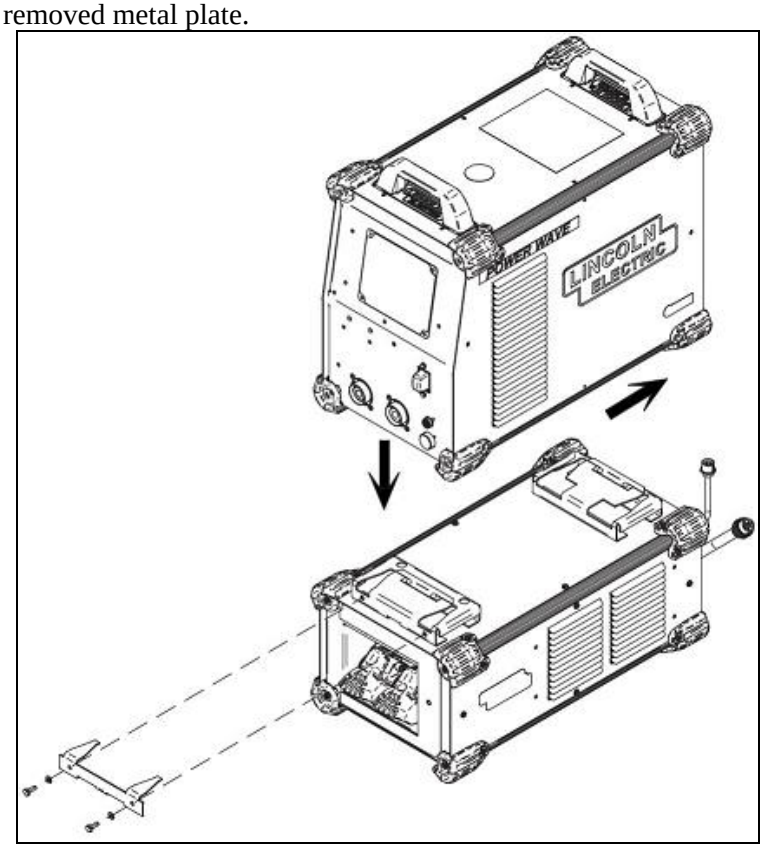


Fig. 11 (e) Connection of welding power supply Power Wave R350, Power Wave S350,Power Wave R500 and Expansion module (1/4)

2 Connect welding power cable (+), (-), wire feeder control cable and communication cable and sense lead to welding power supply referring to Fig. 11 (f), (g) and (h).

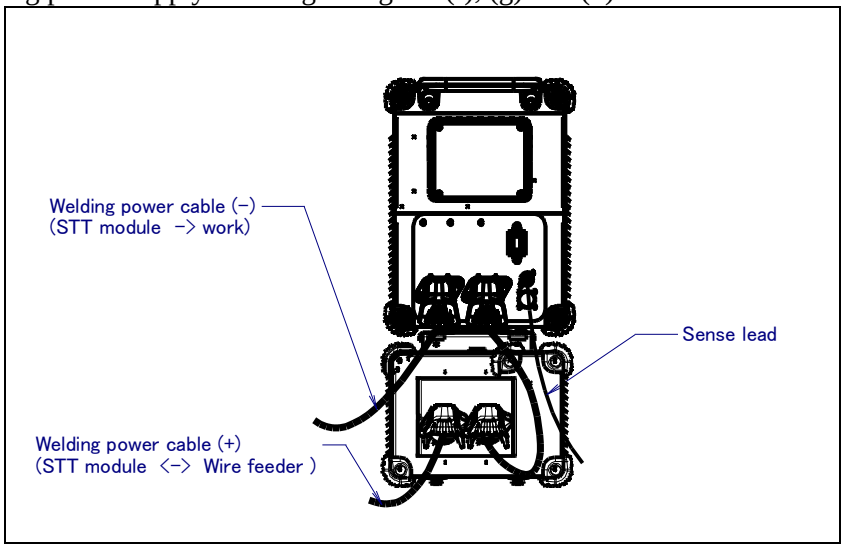


Fig. 11 (f) Connection of welding power supply Power Wave R350 and STT module (2/4)

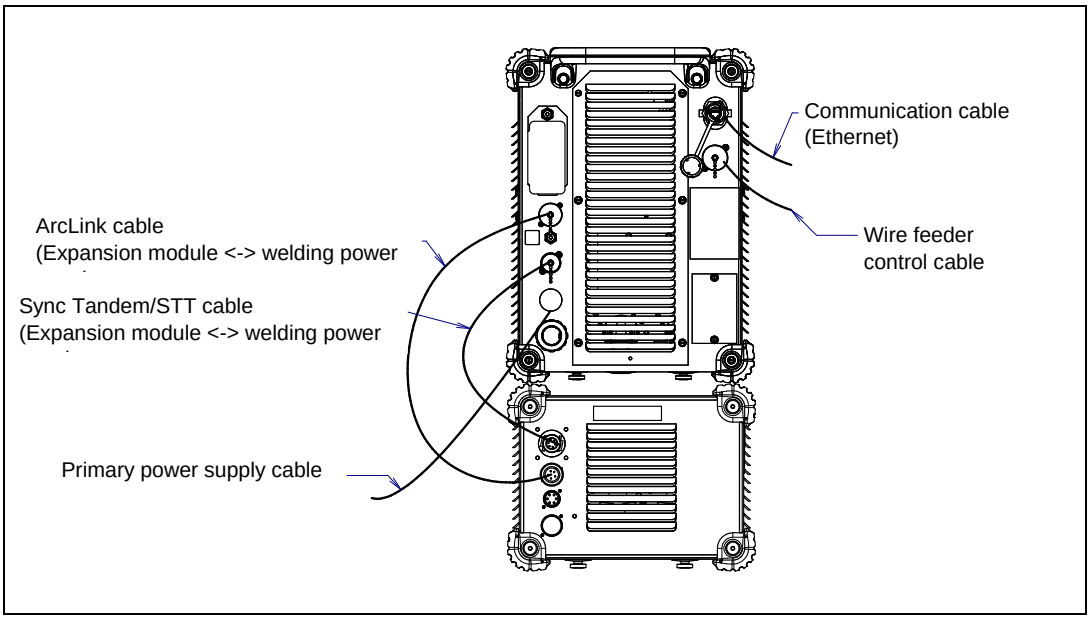


Fig. 11 (g) Connection of welding power supply Power Wave R350, Power Wave S350, Power Wave R500 and Expansion module (3/5) (STT module)

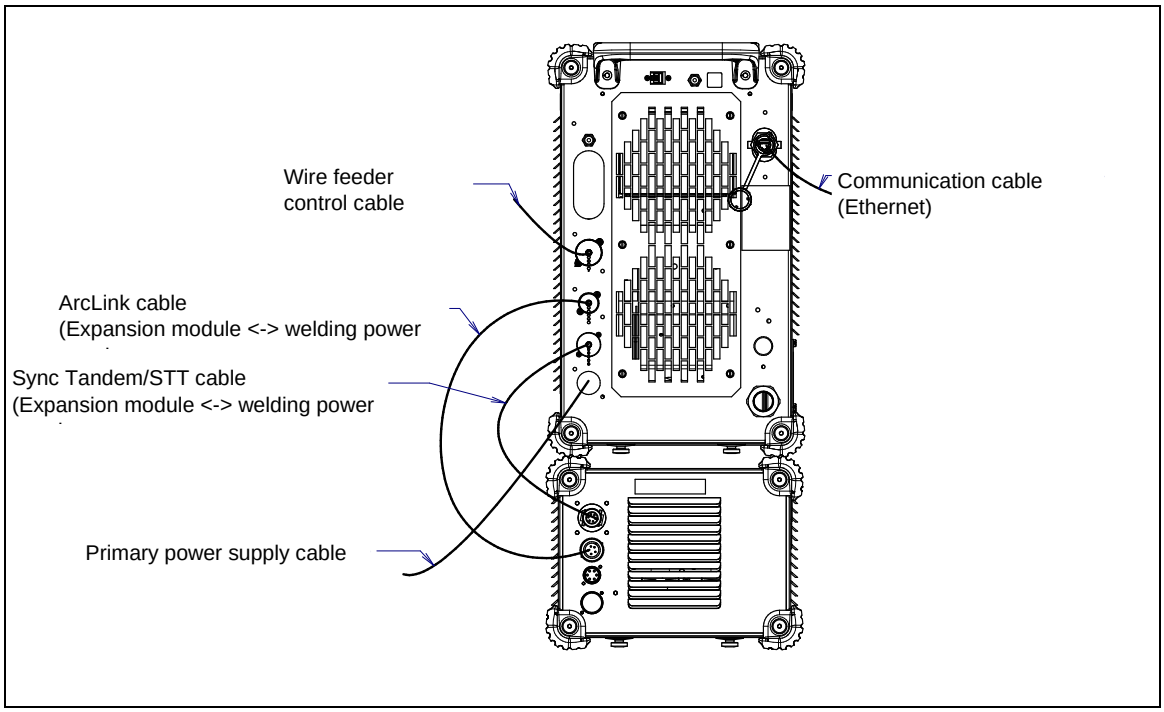


Fig. 11 (h) Connection of welding power supply Power Wave R350 and Expansion module (4/5) (Advanced module)

3 Put crocodile clip of minus side sense lead to energized part of fixture. (See Fig. 11 (i).)

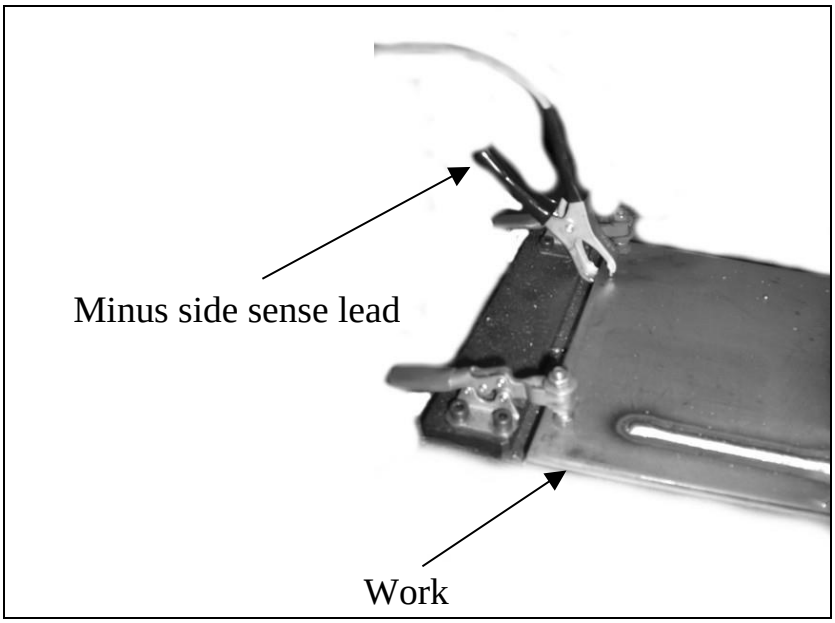


Fig. 11 (i) Connection of welding power supply Power Wave R350, Power Wave R500 and Expansion module (5/5)

Replacing method of welding power supply when Expansion module is specified

1 Replace the welding power supply and set the wire feeder. Refer to “7.1 Replacing welding power supply (Power Wave R350, Power Wave S350, Power Wave R500” for replacing the welding power supply. Refer to “10.3 SETTING OF WIRE FEEDER“ for the wire feeder setting.
2 Remove crocodile clip of sense lead from energized part of the fixture referring to Fig. 11 (i).
3 Remove welding power cable (+), (-) , wire feeder control cable, communication cable and sense lead from welding power supply referring to Fig. 11 (f),(g) and (h).
4 Remove metal plate on the Expansion module and remove welding power supply main body from the Expansion module. (See Fig. 11 (e).)

12 POWER WAVE i400 & POWER WAVE 455M/STT CONNECTION

12.1 CONNECTION OF Power Wave i400

A) Connection of remote type welding power supply

1 Connect LAN cable to main board. In case of R-30*i*B controller, connect LAN cable to Port2 (CD38B). (See Fig. 12.1 (a).) If the controller is R-30*i*B Mate, the port number for inserting Ethernet cable becomes followings corresponding to the number of ports.

- Controller has only one Ethernet port: Connect the cable to Port 1
- Controller has two Ethernet ports: Connect the cable to Port 2

Be sure to separate the LAN cable from 24V cable for emergency stop (red).

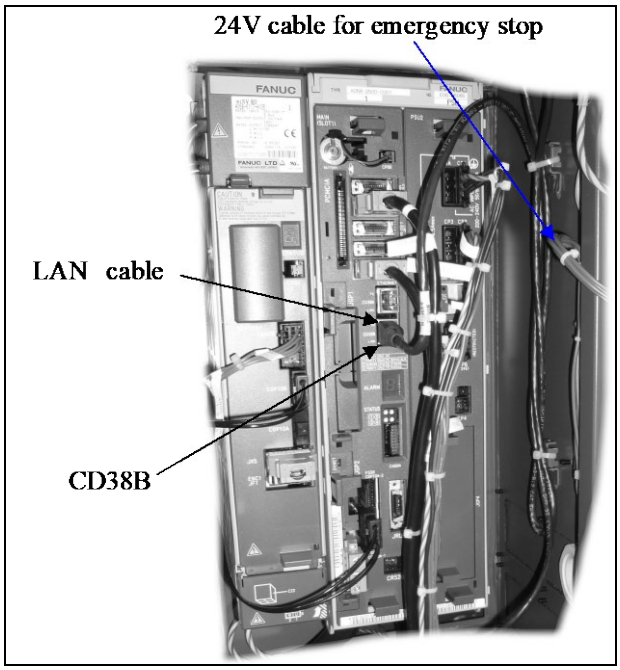


Fig. 12.1 (a) Connection of Power Wave i400 (1/7)

2 Connect LAN cable, wire feeder control cable and welding power cable (+)(-) to welding power supply referring to Fig. 12.1 (b).

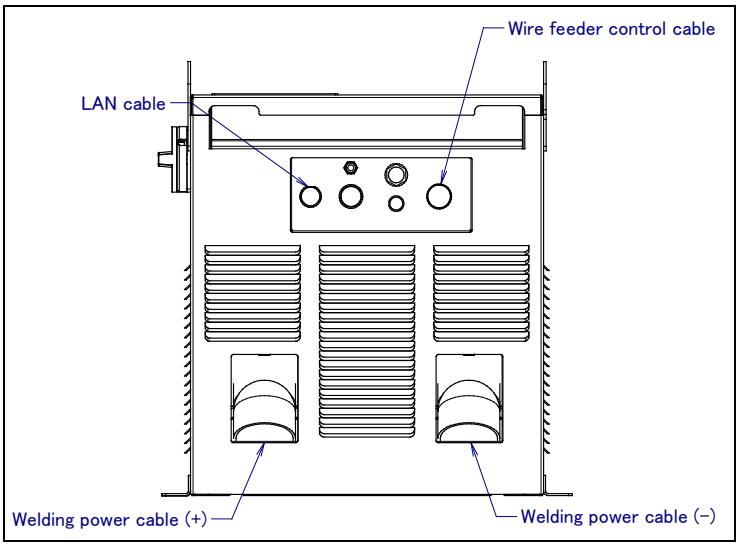


Fig. 12.1 (b) Connection of Power Wave i400 (2/7)

B) Connection of integrated type welding power supply

1 Remove four M10 bolts of under surface of controller referring to Fig.12.1 (c).

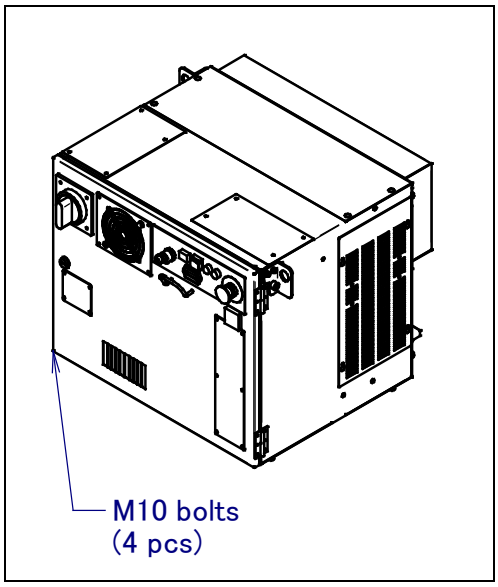


Fig. 12.1 (c) Connection of Power Wave i400 (3/7)

2 Remove hook (2 pcs) and cover A. (See Fig. 12.1 (d)). Fix bolt which fixed hook to original position.

3 Put controller on welding power supply and fix with M10 bolts which were removed in procedure 1.

4 Remove cover B. (See Fig. 12.1 (d).)

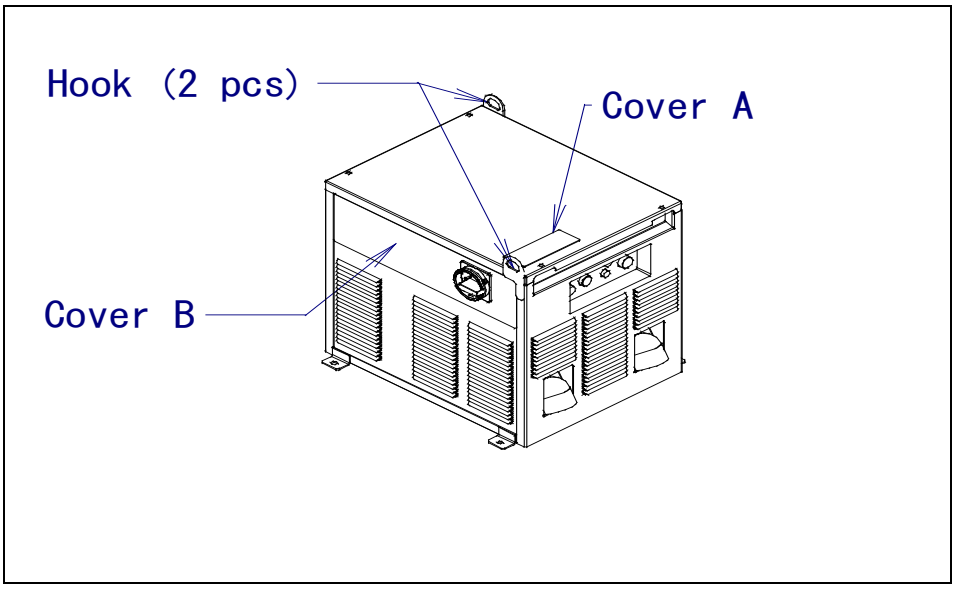


Fig. 12.1 (d) Connection of Power Wave i400 (4/7)

5 Put unified kit plate which is the right of the inside the controller and pass LAN cable and power cable. (See Fig. 12.1 (e).)
LAN cable can be passed only from welding power supply side.
6 Fix U, V and W earth of power cable to specified position.(See Fig. 12.1 (f).) Fix the cover B.
7 Connect LAN cable to main board. (See Fig. 12.1 (e).)
8 Forming power cable as route of Fig. 12.1 (e).

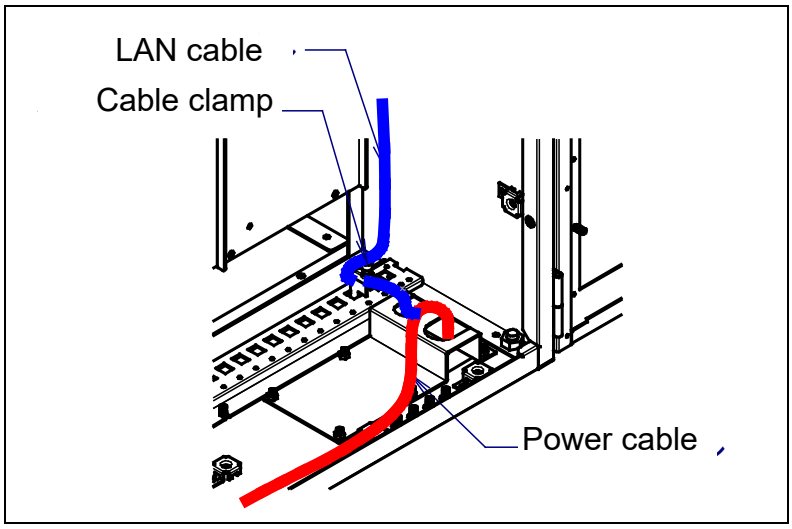


Fig. 12.1 (e) Connection of Power Wave i400 (5/7)

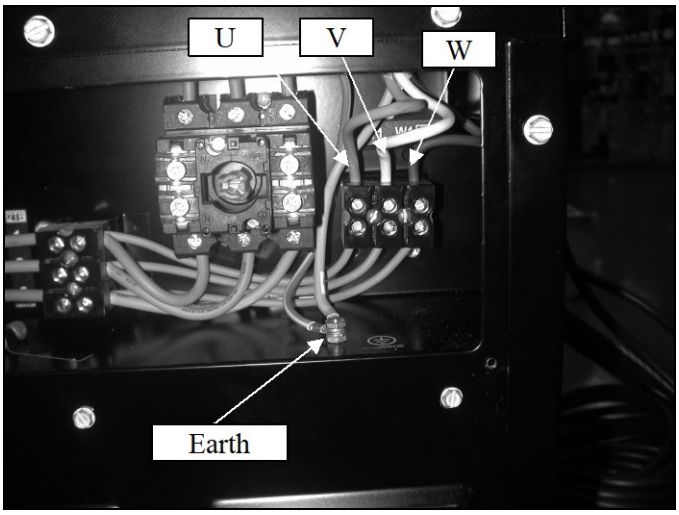


Fig. 12.1 (f) Connection of Power Wave i400 (6/7)

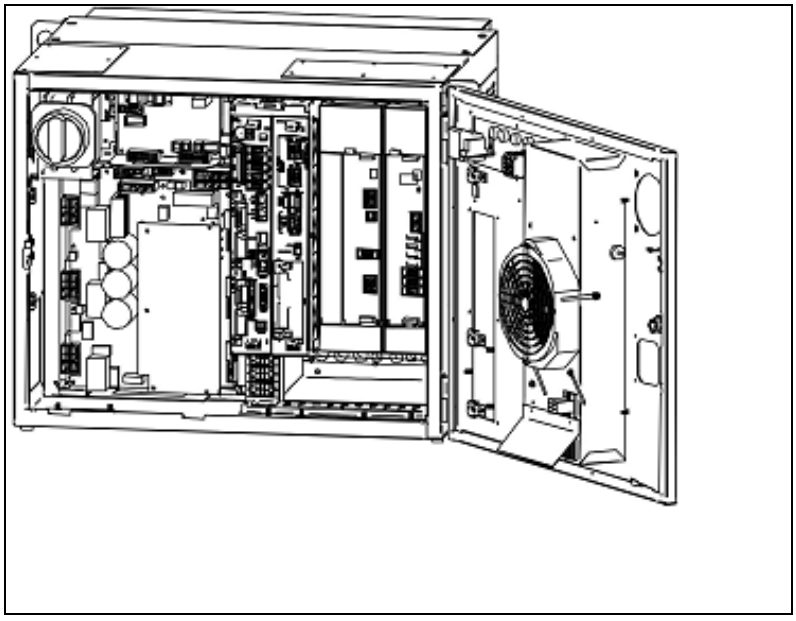


Fig. 12.1 (g) Connection of Power Wave i400 (7/7)

12.2 CONNECTION OF Power Wave 455M/STT

1 Connect welding power cable (+) , (-) , wire feeder control cable, communication cable and minus side sense lead to welding power supply referring to Fig. 12.2 (a).

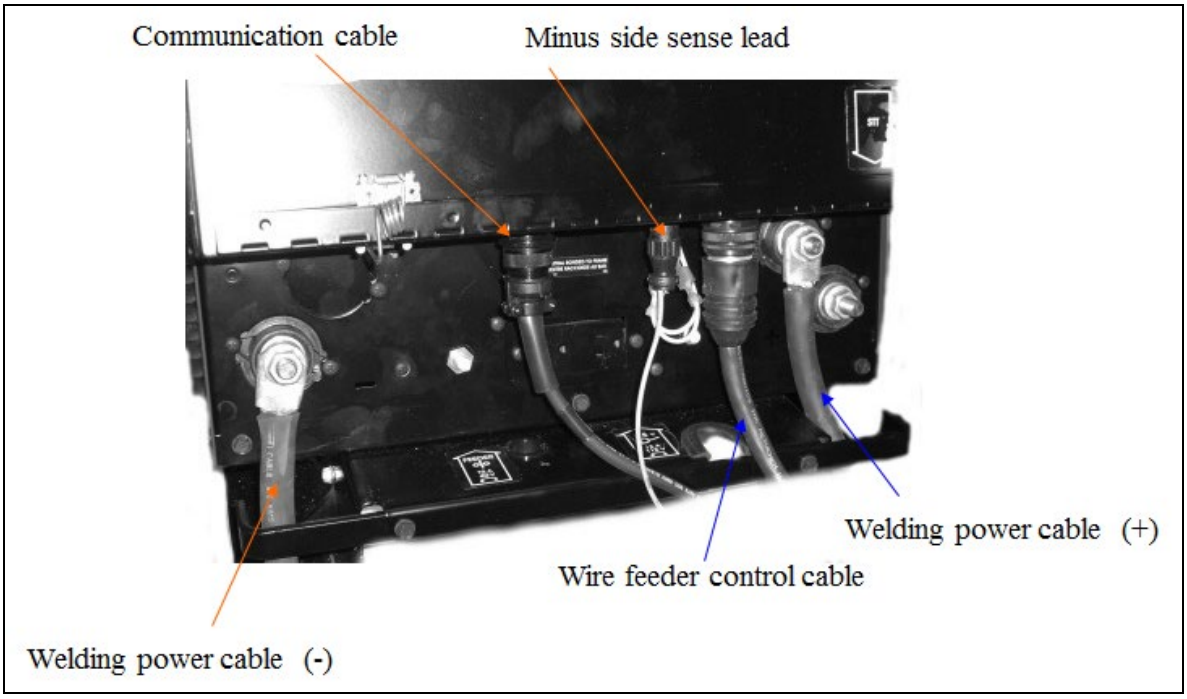


Fig. 12.2 (a) Connection of Power Wave 455M/STT (1/5)

2 Put crocodile clip of minus side sense lead to energized part of fixture. (See Fig. 12.2 (b).)

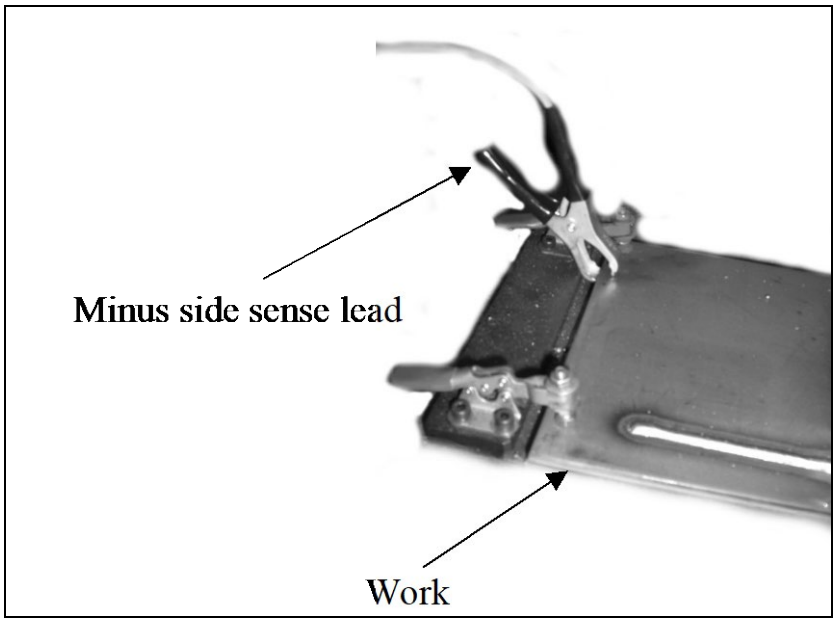


Fig. 12.2 (b) Connection of PowerWave 455M/STT (2/5)

3 Connect communication cable and 24V cable to Device Net connector referring to Fig. 12.2 (c).

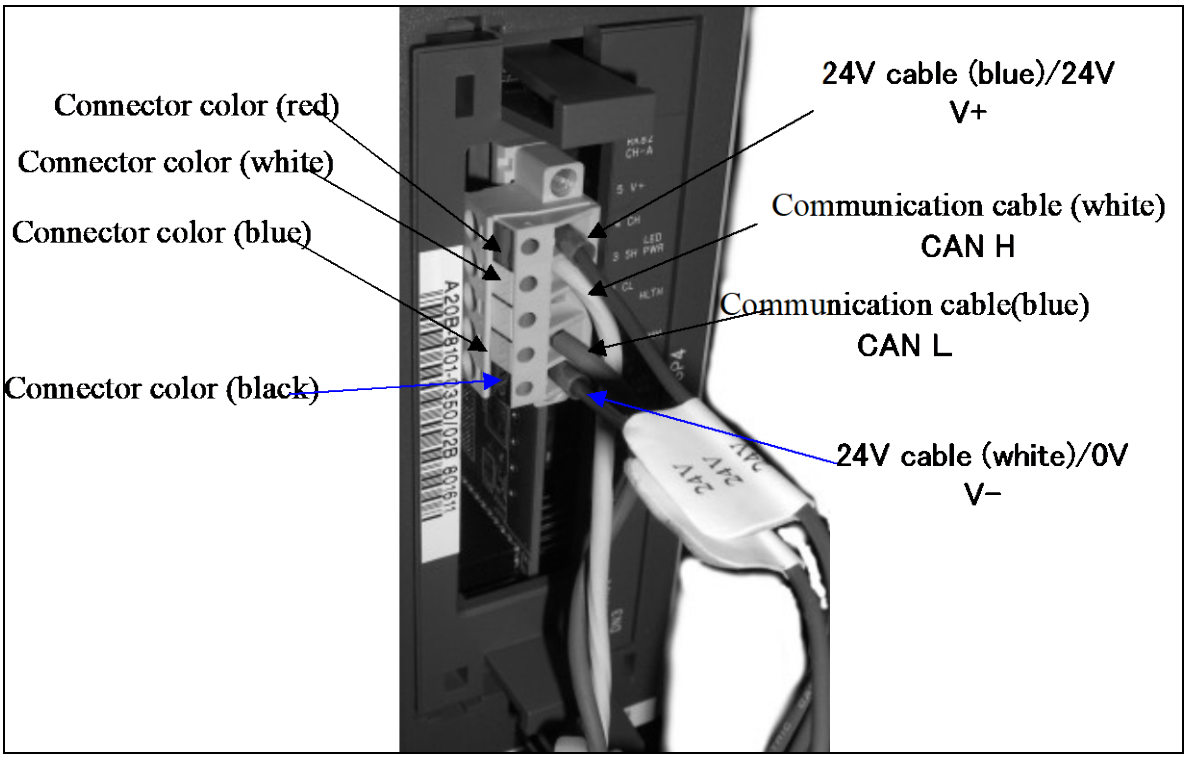


Fig. 12.2 (c) Connection of PowerWave 455M/STT (3/5)

4 Connect 24V cable referring to Fig. 12.2 (d).

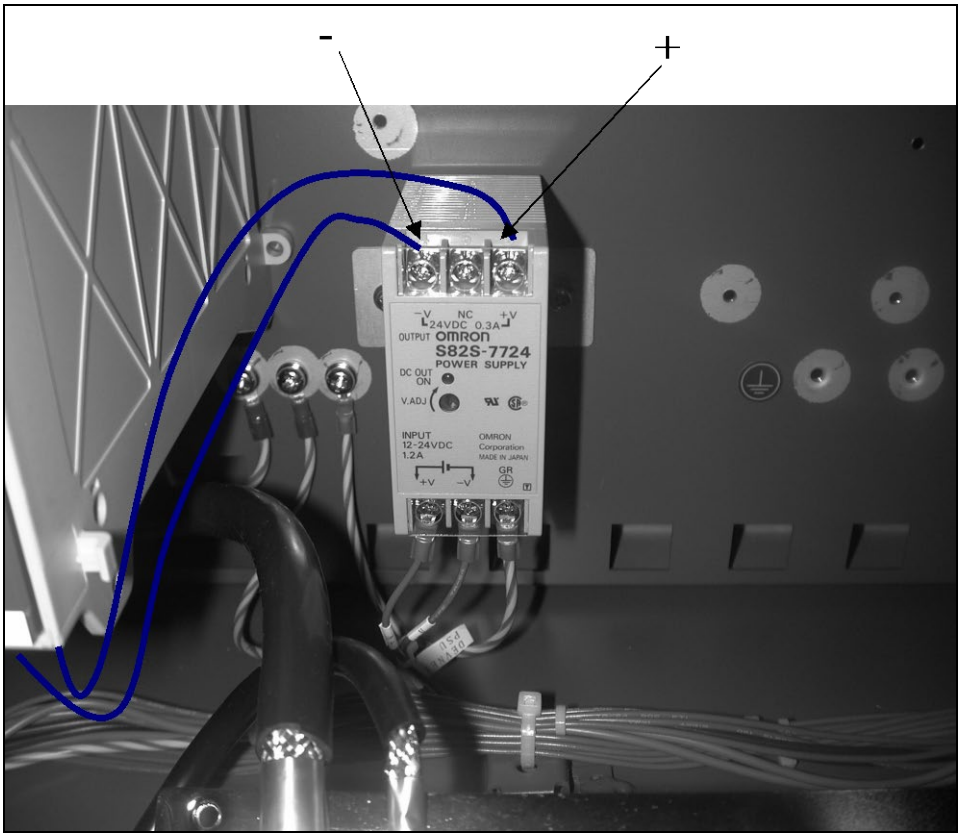


Fig. 12.2 (d) Connection of Power Wave 455M/STT (4/5)

5 When servo torch is specified, Connect rod terminal side of plus side sense lead to J2 base part of robot referring to Fig. 12.2 (e). (In case of normal wire feeder, plus side sense lead is included in wire feeder control cable.)

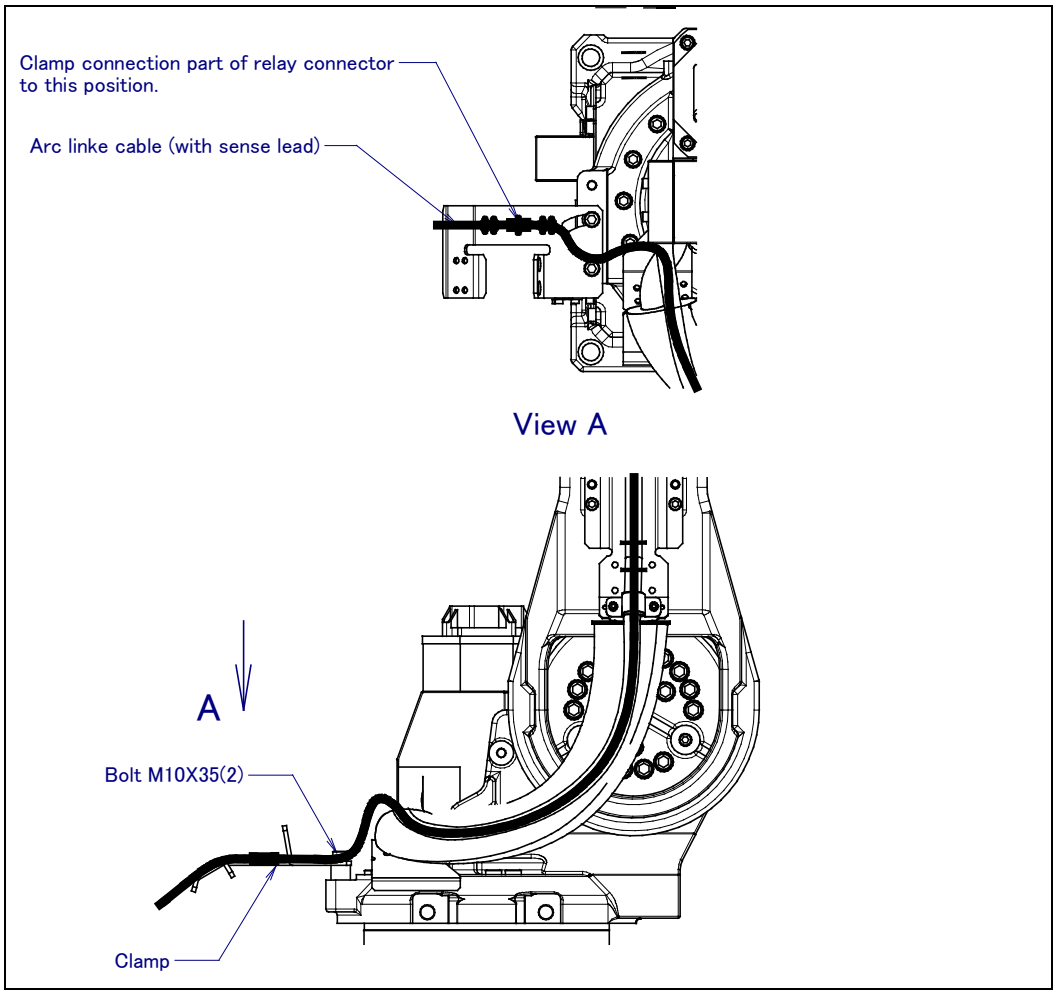


Fig. 12.2 (e) Connection of Power Wave 455M/STT (5/5)

Ⅱ FANUC WELDING POWER SUPPLY

1 OVERVIEW

This chapter describe the basic configuration and component of the robot with arc welding power supply option.

Organization of this chapter

- 1.1 Standard configuration
- 1.2 Option configuration

1.1 STANDARD CONFIGURATION

Robot with welding power supply consists of a robot mechanical section, controller, welding power supply, controller , wire feeder, welding torch, wire reel stand , and so forth.

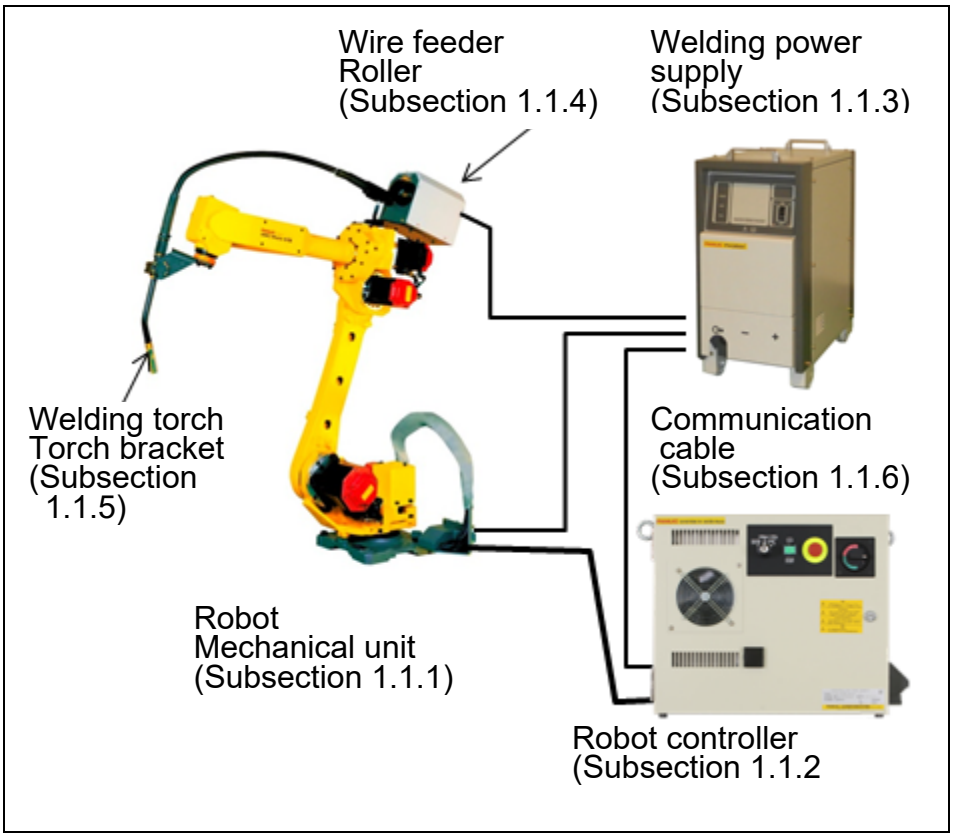


Fig. 1.1 (a) Configuration of robot with welding power supply option

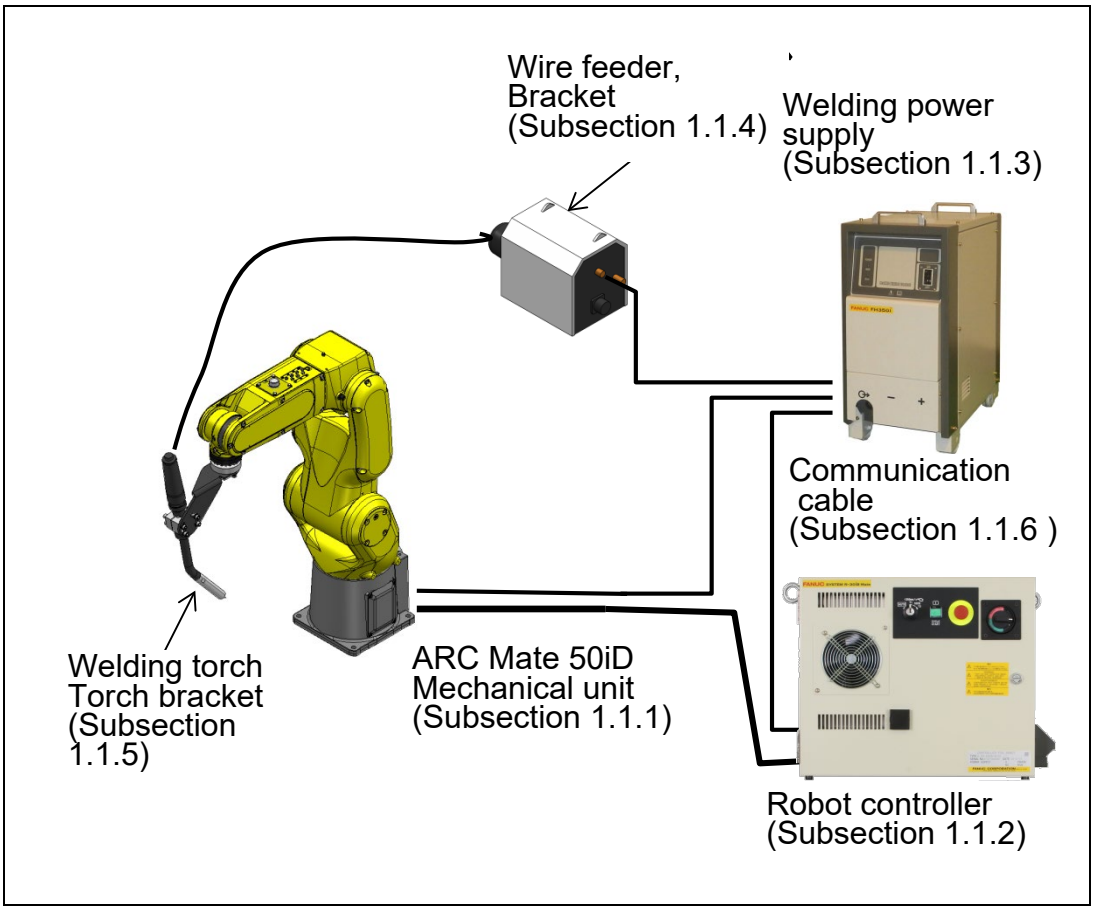


Fig. 1.1 (b) Configuration of robot with welding power supply option (ARC Mate 50*i*D series)

1.1.1 Mechanical Unit Specification

Table 1.1.1 (a) Robot specifications (Note 1) (ARC Mate 0*i*B)

Item		Specification	
Model		ARC Mate 0*i*B	
Type		Articulated type	
Controlled axes (Note 2)		6-axes (J1, J2, J3, J4, J5, J6)	
Installation		Floor, Upside-down, Angle mount (Note 3)	
Motion range	J1-axis	Upper limit/Lower limit	120° (2.09rad)/-120° (-2.09rad) (with stopper) 180° (3.14rad)/-180° (-3.14rad) (without stopper)
	J2-axis	Upper limit/Lower limit	160° (2.79rad)/-90° (-1.57rad)
	J3-axis	Upper limit/Lower limit	275° (4.80rad)/-180° (-3.14rad)
	J4-axis	Upper limit/Lower limit	190° (3.31rad)/-190° (-3.31rad)
	J5-axis	Upper limit/Lower limit	140° (2.44rad)/-140° (-2.44rad)
	J6-axis	Upper limit/Lower limit	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 4)	J1-axis	225°/s(3.93rad/s)	
	J2-axis	215°/s(3.75rad/s)	
	J3-axis	225°/s(3.93rad/s)	
	J4-axis	425°/s(7.42rad/s)	
	J5-axis	425°/s(7.42rad/s)	
	J6-axis	625°/s(10.91rad/s)	
Maximum load	Wrist	3kg	
Allowable load moment at wrist	J4-axis	8.9 N·m	
	J5-axis	8.9 N·m	
	J6-axis	3.0 N·m	
Allowable load inertia at wrist	J4-axis	0.28 kg·m^2	
	J5-axis	0.28 kg·m^2	
	J6-axis	0.035 kg·m^2	
Repeatability		±0.08 mm	
Robot mass		99 kg (without pedestal) 145 kg (with pedestal)	
Acoustic noise level		Less than 70dB (Note 5)	
Installation environment		Ambient temperature: 0 to 45℃ (Note 6) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 7)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE for further evaluation before running production.
2 In case of using robot combined with aux. axis, please consult with your local FANUC representative.
3 In case of angle mount, motion range is restricted. Please contact your local FANUC representative for details.
4 During short distance motions, the axis speed may not reach the maximum value stated.
5 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
6 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
7 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

⚠ WARNING

1 Make welding torch less than allowable load moment at wrist and inertia.
If load exceeds allowable load, it may cause early breakage of mechanical unit.
2 When setting load to J3 casing or J2 base, refer to mechanical unit operator's manual.
3 Use of this robot is strictly limited to arc welding applications.

Table 1.1.1 (b) Specifications (Note 1) (ARC Mate 100*i*C/12)

Item		Specification		
Model		ARC Mate 100*i*C/12		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 2)		
Load setting		3 kg (Standard welding torch mode)		12 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267°(4.66rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 3)	J1-axis	230°/s(4.01rad/s)		
	J2-axis	225°/s(3.93rad/s)		
	J3-axis	230°/s(4.01rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist (Note 4)	3 kg		12 kg
	On J3 arm (Note 5)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		22.0 N·m
	J5-axis	7.7 N·m		22.0 N·m
	J6-axis	0.2 N·m		9.8 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.65 kg·m^2
	J5-axis	0.24 kg·m^2		0.65 kg·m^2
	J6-axis	0.0027 kg·m^2		0.17 kg·m^2
Repeatability		±0.08 mm		
3Mass		130 kg		
Acoustic noise level		Less than 70dB (Note 6)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)		

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 There is not the limit in the motion range in all installation.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 When arc tool is specified, robot is shipped with 3kg payload setting.
5 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) in detail.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
7 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (c) Specifications (Note 1) (ARC Mate 100*i*C/7L)

Item		Specification		
Model		ARC Mate 100*i*C/7L		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 2)		
Load setting		3 kg (Standard welding torch mode)		7 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267°(4.66rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 3)	J1-axis	230°/s(4.01rad/s)		
	J2-axis	225°/s(3.93rad/s)		
	J3-axis	230°/s(4.01rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist (Note 4)	3 kg		7 kg
	On J3 arm (Note 5)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		15.7 N·m
	J5-axis	7.7 N·m		10.1 N·m
	J6-axis	0.2 N·m		5.9 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.63 kg·m^2
	J5-axis	0.24 kg·m^2		0.38 kg·m^2
	J6-axis	0.0027 kg·m^2		0.061 kg·m^2
Repeatability		±0.08 mm		
Mass		135 kg		
Acoustic noise level		Less than 70dB (Note 6)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)		

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 There is not the limit in the motion range in all installation.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 When arc tool is specified, robot is shipped with 3kg payload setting.
5 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) in detail.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
7 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (d) Specifications (Note 1) (ARC Mate 120*i*C)

Item			Specification	
Model			ARC Mate 120*i*C	
Type			Articulated type	
Controlled axes			6 axes(J1, J2, J3, J4, J5, J6)	
Installation			Floor, (Upside-down, Wall & Angle mount) (NOTE 2)	
Load setting			3 kg mode (Standard welding torch mode)	20 kg mode (High inertia mode)
Motion range Upper limit /Lower limit	J1-axis		185° (3.23rad) / -185° (-3.23rad)	
	J2-axis		160° (2.79rad) / -100° (-1.75rad)	
	J3-axis		273° (4.77rad) / -185° (-3.23rad)	
	J4-axis		200° (3.49rad) / -200° (-3.49rad)	
	J5-axis	(NOTE 3)	140° (2.44rad) / -140° (-2.44rad)	
		(NOTE 4)	180° (3.14rad) / -180° (-3.14rad)	
	J6-axis	(NOTE 3)	270° (4.71rad) / -270° (-4.71rad)	
		(NOTE 4)	450° (7.85rad) / -450° (-7.85rad)	
Maximum speed (Note 5)	J1-axis		195° /s(3.40rad/s)	
	J2-axis		175° /s(3.05rad/s)	
	J3-axis		180° /s(3.14rad/s)	
	J4-axis		360° /s(6.28rad/s)	
	J5-axis		360° /s(6.28rad/s)	
	J6-axis		550° /s(9.60rad/s)	
Maximum load	At wrist (Note 6)		3kg	20kg
	On J3 arm (Note 7)		12kg	
Allowable load moment at wrist	J4-axis		7.7N·m	44N·m
	J5-axis		7.7N·m	44N·m
	J6-axis		0.22N·m	22N·m
Allowable load inertia at wrist	J4-axis		0.24kg·m^2	1.04kg·m^2
	J5-axis		0.24kg·m^2	1.04kg·m^2
	J6-axis		0.0027kg·m^2	0.28kg·m^2
Repeatability			±0.08 mm	
Robot mass			250kg	
Acoustic noise level			Less than 70dB (Note 8)	
Installation environment			Ambient temperature: 0 to 45℃ (Note 9) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 10)	

NOTE
1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), motion range will be limited only when high inertia mode. See Section 3.6 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN).
3 The specification of "Cable integrated J3 Arm".
4 The specification of "Conventional dress-out".
5 During short distance motions, the axis speed may not reach the maximum value stated.
6 When arc tool is specified, robot is shipped with 3kg payload setting.
7 Maximum load on J3 arm depends on load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN) in detail.
8 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
-Maximum load and speed
-Operating mode is AUTO
9 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
10 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (e) Specifications (Note 1) (ARC Mate 120*i*C/12L)

Item			Specification	
Model			ARC Mate 120*i*C/12L	
Type			Articulated type	
Controlled axes			6 axes(J1, J2, J3, J4, J5, J6)	
Installation			Floor, (Upside-down, Wall & Angle mount) (Note 2)	
Load setting			3 kg mode (Standard welding torch mode)	12 kg mode (High inertia mode)
Motion range Upper limit /Lower limit	J1-axis		185° (3.23rad) / -185° (-3.23rad)	
	J2-axis		160° (2.79rad) / -100° (-1.75rad)	
	J3-axis		275.6° (4.81rad) / -185° (-3.23rad)	
	J4-axis		200° (3.49rad) / -200° (-3.49rad)	
	J5-axis	(NOTE 3)	140° (2.44rad) / -140° (-2.44rad)	
		(NOTE 4)	180° (3.14rad) / -180° (-3.14rad)	
	J6-axis	(NOTE 3)	270° (4.71rad) / -270° (-4.71rad)	
		(NOTE 4)	450° (7.85rad) / -450° (-7.85rad)	
Maximum speed (Note 5)	J1-axis		200°/s (3.49rad/sec)	
	J2-axis		175°/s (3.05rad/sec)	
	J3-axis		190°/s (3.32rad/sec)	
	J4-axis		430°/sec (7.50rad/sec)	
	J5-axis		430°/sec (7.50rad/sec)	
	J6-axis		630°/sec (11.00rad/sec)	
Maximum load	At wrist (Note 6)		3kg	12kg
	On J3 arm (Note 7)		12kg	
Allowable load moment at wrist	J4-axis		7.7N·m	22N·m
	J5-axis		7.7N·m	22N·m
	J6-axis		0.22N·m	9.8N·m
Allowable load inertia at wrist	J4-axis		0.24kg·m^2	0.65kg·m^2
	J5-axis		0.24kg·m^2	0.65kg·m^2
	J6-axis		0.0027kg·m^2	0.17kg·m^2
Repeatability			±0.08 mm	
Robot mass			250kg	
Acoustic noise level			Less than 70dB (Note 8)	
Installation environment			Ambient temperature: 0 to 45℃ (Note 9) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rhor less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 10)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), motion range will be limited only when high inertia mode. See Section 3.6 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN).
3 The specification of "Cable integrated J3 Arm".
4 The specification of "Conventional dress-out".
5 During short distance motions, the axis speed may not reach the maximum value stated.
6 When arc tool is specified, robot is shipped with 3kg payload setting.
7 Maximum load on J3 arm depends on load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN)in detail.
8 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
-Maximum load and speed
-Operating mode is AUTO
9 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
10 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (f) Specifications (NOTE 1) (ARC Mate 50*i*D series)

Item		Specifications	
Model		ARC Mate 50*i*D	ARC Mate 50*i*D/7L
Type		Articulated Type	
Controlled axis		6-axis (J1, J2, J3, J4, J5, J6)	
Reach		717mm	911mm
Installation (NOTE 2)		Floor, Upside-down (Angle mount)	
Motion range (Max. speed) (NOTE 3)	J1-axis	340°/360° (option) (450°/s) 5.93rad/6.28rad (option) (7.85rad/s)	340°/360°(option) (370°/s) 5.93rad/6.28rad(option) (6.45rad/s)
	J2-axis	245° (380°/s) 4.28rad (6.63rad/s)	245° (310°/s) 4.28rad (5.41rad/s)
	J3-axis	420° (520°/s) 7.33rad (9.08rad/s)	430° (410°/s) 7.50rad (7.15rad/s)
	J4-axis	380° (550°/s) 6.63rad (9.60rad/s)	380° (550°/s) 6.63rad (9.60rad/s)
	J5-axis	250° (545°/s) 4.36rad (9.51rad/s)	250° (545°/s) 4.36rad (9.51rad/s)
	J6-axis	720° (1000°/s) 12.57rad (17.45rad/s)	720° (1000°/s) 12.57rad (17.45rad/s)
Max. load capacity (NOTE 4)	Wrist	7 kg	
Allowable load moment at wrist	J4-axis	16.6Nm	16.6Nm
	J5-axis	16.6Nm	16.6Nm
	J6-axis	9.4Nm	9.4Nm
Allowable load inertia at wrist	J4-axis	0.47 kg·m^2	0.47 kg·m^2
	J5-axis	0.47 kg·m^2	0.47 kg·m^2
	J6-axis	0.15kg·m^2	0.15kg·m^2
Drive method		Electric servo drive by AC servo motor	
Repeatability (NOTE 5)		±0.018mm	
Mass (NOTE 6)		25kg	27kg
Dust proof and drip proof mechanism (NOTE 7)		Conform to IP67 (Option :IP69K)	
Acoustic noise level		64.7dB.(NOTE 8)	
Installation environment		Ambient temperature: 0 - 45°C (NOTE 9) Ambient humidity: Normally 75%RH or less. No dew, nor frost allowed. Short time (within one month) Max 95%RH Height: Up to 1000 meters above the sea level required, no particular provision for posture. Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 10)	

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), the J1 and J2 axis motion range will be limited.
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 The all up weight including the equipment and connection cables and its swing must not exceed this value when you install the equipment.
5 Compliant with ISO9283.
6 It doesn't contain the mass of the control part.
7 The liquid that is the deterioration of the seal material such as Organic solvent, acid, alkali and chlorine system, cutting liquid cannot be use. (See Subsection 3.1.1 of the mechanical unit operator's manual (B-83494EN).)
8 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO
9 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
10 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (g) Specifications (ARC Mate 100*i*D, ARC Mate 100*i*D/10L) (NOTE 1)

Item		Specification			
Model		ARC Mate 100*i*D		ARC Mate 100*i*D/10L	
Type		Articulated type			
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)			
Installation		Floor, Upside-down, Wall & Angle mount *Floor, Upside-down for 4 brake type(NOTE 2)			
Motion range	J1-axis	Upper limit /Lower limit	170°(2.97rad)/-170°(-2.97rad) 185°(3.23rad)/-185°(-3.23rad) (option)		
	J2-axis	Upper limit /Lower limit	145°(2.53rad)/ -90°(-1.57rad)		
	J3-axis	Upper limit /Lower limit	275°(4.80rad)/-180°(-3.14rad)		
	J4-axis	Upper limit /Lower limit	190°(3.31rad)/-190°(-3.31rad)		
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)	
			Conventional dress out type	180°(3.14rad)/-180°(-3.14rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)	
			Conventional dress out type	450°(7.85rad)/-450°(-7.85rad)	
Maximum speed (NOTE 4)	J1-axis	260°/s(4.54rad/s)			
	J2-axis	240°/s(4.19rad/s)			
	J3-axis	260°/s(4.54rad/s)			
	J4-axis	430°/s(7.50rad/s)			
	J5-axis	450°/s(7.85rad/s)			
	J6-axis	720°/s(12.57rad/s)			
Maximum load	At wrist	12 kg		10 kg	
	On J3 arm (NOTE 5)	12 kg		10 kg	
Allowable load moment at wrist	J4-axis	26.0 N·m		22.0 N·m	
	J5-axis	26.0 N·m		22.0 N·m	
	J6-axis	11.0 N·m		9.8 N·m	
Allowable load inertia at wrist	J4-axis	0.90 kg·m^2		0.65 kg·m^2	
	J5-axis	0.90 kg·m^2		0.65 kg·m^2	
	J6-axis	0.30 kg·m^2		0.17 kg·m^2	
Repeatability (NOTE 6)		±0.02 mm		±0.03 mm	
Mass		145 kg		150kg	
Acoustic noise level		57.4dB (NOTE 6)			
Installation environment		Ambient temperature: 0 to 45℃ (NOTE 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 8)			

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-83944EN)
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-83944EN) for detail.
5 Compliant with ISO9283.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

7 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (h) Specifications (ARC Mate 100*i*D/8L/16S) (NOTE 1)

Item		Specification			
Model		ARC Mate 100*i*D/8L		ARC Mate 100*i*D/16S	
Type		Articulated type			
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)			
Installation		Floor, Upside-down, Wall & Angle mount (NOTE 2)			
Motion range	J1-axis	Upper limit /Lower limit	170°(2.97rad)/-170°(-2.97rad) 185°(3.23rad)/-185°(-3.23rad) (option)		
	J2-axis	Upper limit /Lower limit	145°(2.53rad)/ -90°(-1.57rad)		
	J3-axis	Upper limit /Lower limit	275°(4.80rad)/-180°(-3.14rad)		
	J4-axis	Upper limit /Lower limit	190°(3.31rad)/-190°(-3.31rad)		
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)	
			Conventional dress out type	180°(3.14rad)/-180°(-3.14rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)	
			Conventional dress out type	450°(7.85rad)/-450°(-7.85rad)	
Maximum speed (NOTE 3)	J1-axis	210°/s (3.66rad/s)		290°/s (5.06rad/s)	
	J2-axis	210°/s (3.66rad/s)		270°/s (4.71rad/s)	
	J3-axis	220°/s (4.62rad/s)		270°/s (4.71rad/s)	
	J4-axis	430°/s (6.98rad/s)		430°/s (7.50rad/s)	
	J5-axis	450°/s (7.33rad/s)		450°/s (7.85rad/s)	
	J6-axis	720°/s(12.57rad/s)		730°/s(12.74rad/s)	
Maximum load	At wrist	8 kg		16 kg	
	On J3 arm (NOTE 4)	12 kg		12 kg	
Allowable load moment at wrist	J4-axis	16.1 N·m		26.0 N·m	
	J5-axis	16.1 N·m		26.0 N·m	
	J6-axis	5.9 N·m		11.0 N·m	
Allowable load inertia at wrist	J4-axis	0.63 kg·m^2		0.90 kg·m^2	
	J5-axis	0.63 kg·m^2		0.90 kg·m^2	
	J6-axis	0.061 kg·m^2		0.30 kg·m^2	
Repeatability (NOTE 5)		±0.03 mm		±0.02 mm	
Mass		180 kg		145kg	
Acoustic noise level		57.4dB (NOTE 6)			
Installation environment		Ambient temperature: 0 to 45℃ (NOTE 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 8)			

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 Under the installation condition within ( ), the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-83944EN).
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-83944EN)for detail.
5 Compliant with ISO9283.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

7 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

Table 1.1.1 (i) Specifications (ARC Mate 120*i*D, ARC Mate 120*i*D/12L)(NOTE 1) (1/1)

Item		Specification			
Model		ARC Mate 120*i*D			ARC Mate 120*i*D/12L
Type		Articulated type			
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)			
Installation(NOTE 2)		Floor, Upside-down, Wall & Angle mount			
Motion range	J1-axis	Upper limit /Lower limit	170°(2.97rad) /-170°(-2.97rad) 185°(3.23rad) /-185°(-3.23rad) (option)		
	J2-axis	Upper limit /Lower limit	160°(2.79rad)/ -100°(-1.74rad)		
	J3-axis	Upper limit /Lower limit	268.4°(4.68rad)/-190°(-3.32rad)		
	J4-axis	Upper limit /Lower limit	200°(3.49rad) /-200°(-3.49rad)		
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)	
			Conventional dress out type	180°(3.14rad)/-180°(-3.14rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)	
			Conventional dress out type	450°(7.85rad)/-450°(-7.85rad)	
Max motion speed (NOTE 3)	J1-axis	210°/s (3.67rad/s)			210°/s (3.67rad/s)
	J2-axis	210°/s (3.67rad/s)			210°/s (3.67rad/s)
	J3-axis	265°/s (4.63rad/s)			265°/s (4.63rad/s)
	J4-axis	420°/s (7.33rad/s)			420°/s (7.33rad/s)
	J5-axis	420°/s (7.33rad/s)			450°/s (7.85rad/s)
	J6-axis	720°/s(12.57rad/s)			720°/s(12.57rad/s)
Maximum load	At wrist	25 kg			12 kg
	On J3 arm (NOTE 4)	40 kg			36 kg
Allowable load moment at wrist	J4-axis	52.0 N·m			22.0 N·m
	J5-axis	52.0 N·m			22.0 N·m
	J6-axis	32.0 N·m			9.8 N·m
Allowable load inertia at wrist	J4-axis	2.40 kg·m^2			0.65 kg·m^2
	J5-axis	2.40 kg·m^2			0.65 kg·m^2
	J6-axis	1.20 kg·m^2			0.17 kg·m^2
Repeatability (NOTE 5)		±0.02 mm			±0.03 mm
Mass		250kg			
Acoustic noise level		67.8dB (NOTE 6)			
Installation environment		Ambient temperature: 0 to 45℃ (NOTE 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (NOTE 8)			

NOTE

1 Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.
2 In case of ARC Mate 120*i*D, M-20*i*D/25, when the Wall & Angle mount is specified, the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-84074EN) .
3 During short distance motions, the axis speed may not reach the maximum value stated.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-84074EN) for detail.
5 Compliant with ISO9283.
6 This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
- Maximum load and speed
- Operating mode is AUTO

7 When the robot is used in a low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.
8 Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other foreign materials.

1.1.2 Robot Controller

Table 1.1.2 (a) Controller specification (R-30*i*B/R-30*i*B Plus Controller)

Item	Model	Specification/condition
Rated Voltage	All models	Trans. Type E:380-415, 440-500, 500-575VAC(*1) Trans. Type D: 380-400,200-230VAC 50/60Hz 3phases (*1) In case of NRTL controller with UL/CSA breaker (600V Rating), 500-575VAC tap can be used.
Tolerant fluctuation	All models	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power source capacity	ARC Mate 120*i*C	3kVA
	ARC Mate 100*i*C	2kVA
Average power consumption	All models	1kW
Permissible ambient temperature	All models	Operating 0°C to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	All models	Normal: 75%RH or less, no condensation Short period(less than 1 month): 95%RH or less, no condensation
Surrounding gas	All models	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, and/of salt).
Installation category	All models	Installation categoryⅢ, Pollution degree 3, IEC60664-1 and IEC61010-1
Vibration acceleration	All models	4.9m/s^2 (0.5G) or less. When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	All models	Operating:Up to 1,000m above sea level Non-operating:Up to 12,000m above sea level
Ionized and non-ionized radiation	Common to all models	A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller	A-cabinet	120kg
	B-cabinet	180kg
Degree of protection	A-cabinet	IP54
	B-cabinet	
	Teach pendant	

NOTE

The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.

If the acceleration/deceleration override (ACC) greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.

In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.

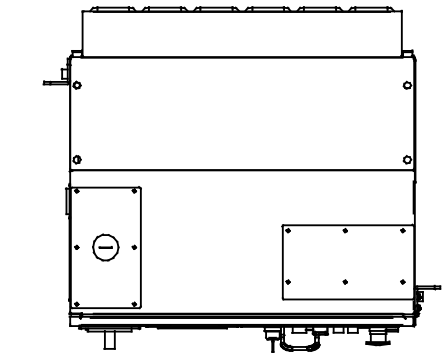
NOTE
In case of CE controller

R-30*i*B controller is a group 1, class A product according to IEC55011.
This means that this product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection / analysis purpose and that it is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
There may be potential difficulties in ensuring electromagnetic compatibility in environments other than industrial, due to conducted as well as radiated disturbances.
This product must not be used in residual areas.
This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

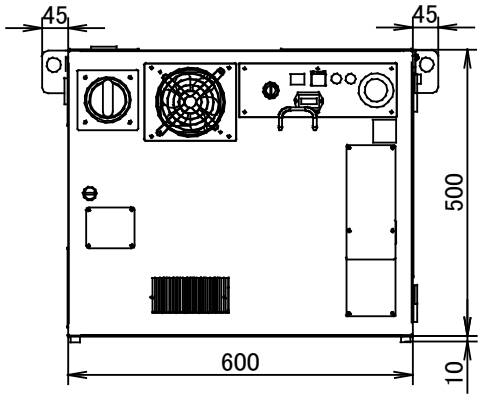
Table 1.1.2 (b) Controller specification (R-30*i*B Mate/R-30*i*B Mate Plus Controller)

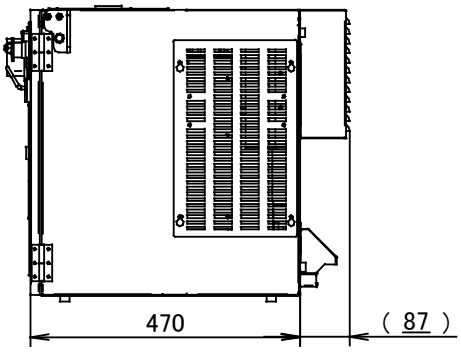
Item	Specification/condition
Rated Voltage	200-230VAC 50/60Hz Single Phase
	200-230VAC 50/60Hz 3 phase
Tolerant fluctuation	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power supply capacity	2.0KVA
Average power consumption	1.0KW
Permissible ambient temperature	Operating 0℃ to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	Normal: 75%RH or less, no condensation Short period (less than 1 month): 95%RH or less, no condensation
Surrounding gas	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, salt, etc.).
Installation Category	Installation Category Ⅱ, Pollution Degree 3, IEC60664-1 and IEC61010-1 (NOTE2)
Vibration	Vibration acceleration : 4.9m/s^2 (0.5G) or less When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	Operating: Up to 1000m Non-operating: Up to 12000m
Ionized and non-ionized radiation	A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller	40kg
Degree of protection	IP54

NOTE
1 The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.
If the acceleration/deceleration override (ACC) greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.
In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.
2 In case of connected with Input power supply of Installation category Ⅲ, set up isolated transformer between Input power supply and controller.



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black





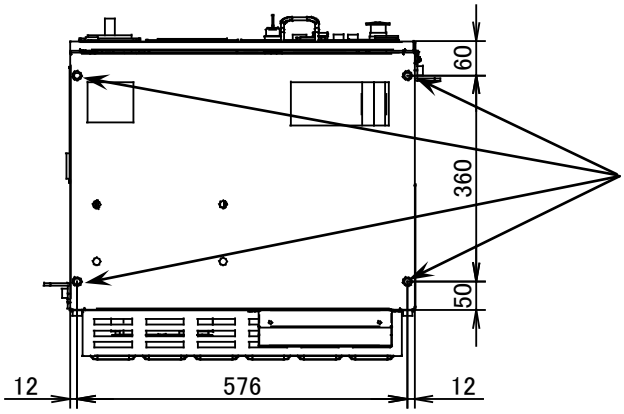
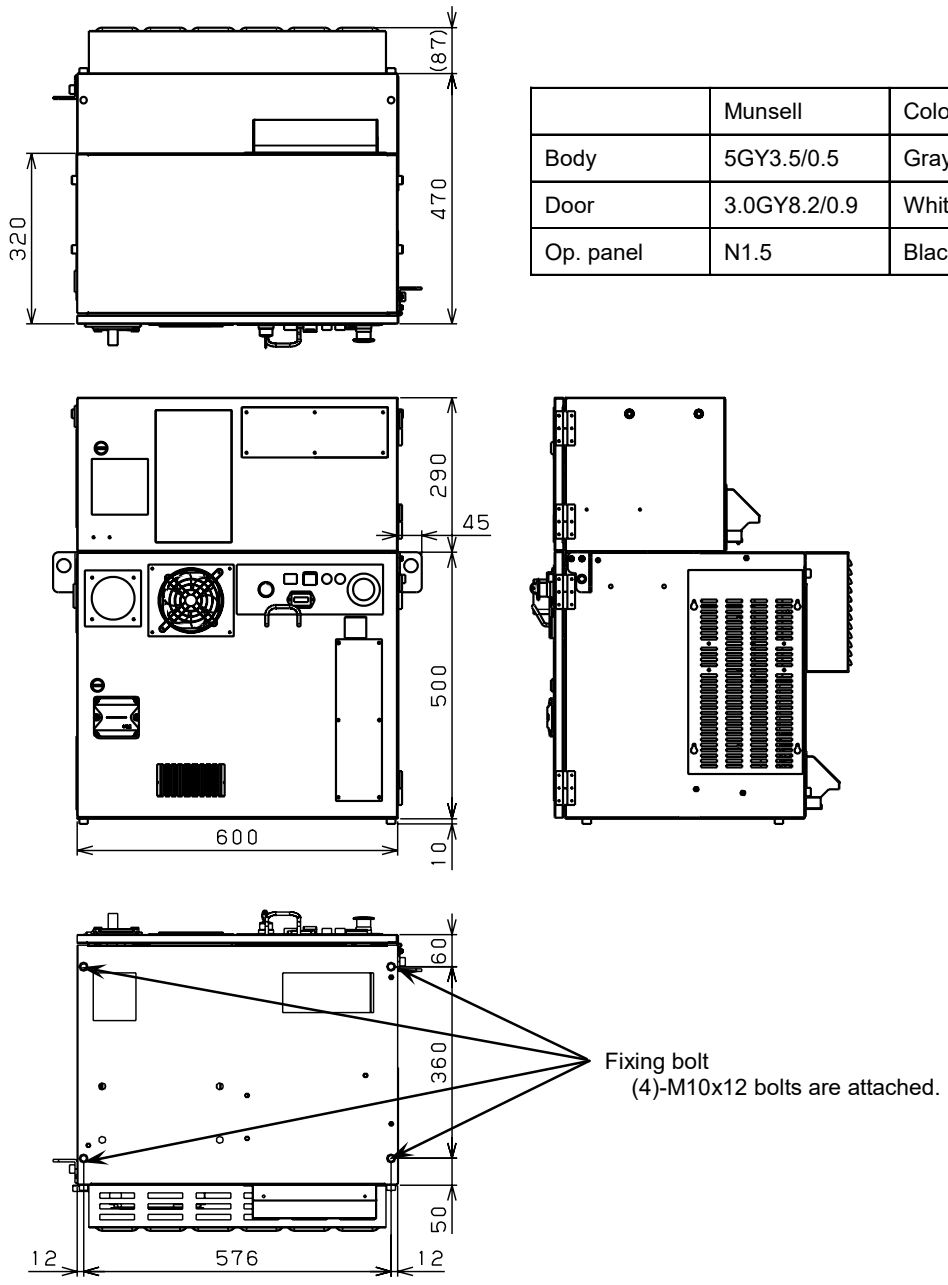
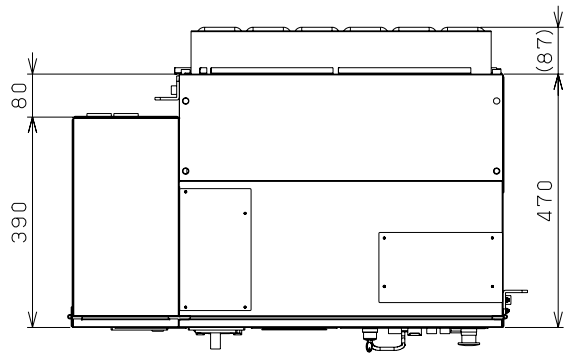


Fig. 1.1.2 (a) External dimensions (A-cabinet) (R-30*i*B/R-30*i*B Plus Controller)

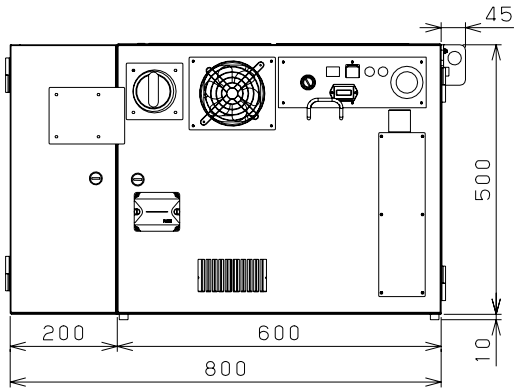


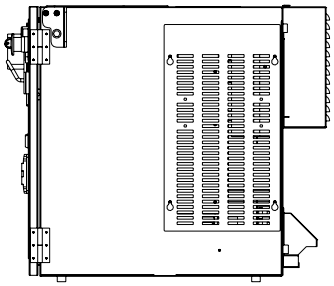
	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

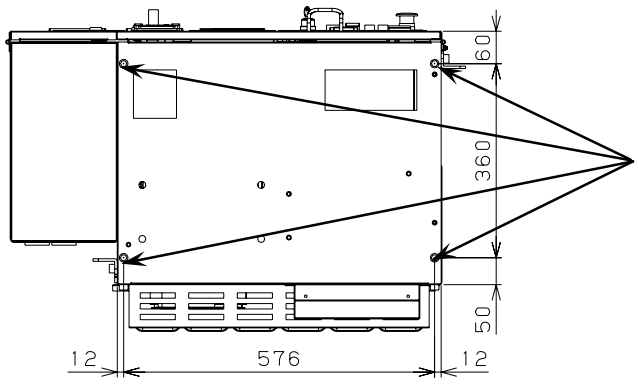
Fig. 1.1.2 (b) External dimensions (A-cabinet with Top box) (R-30*i*B/R-30*i*B Plus Controller)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

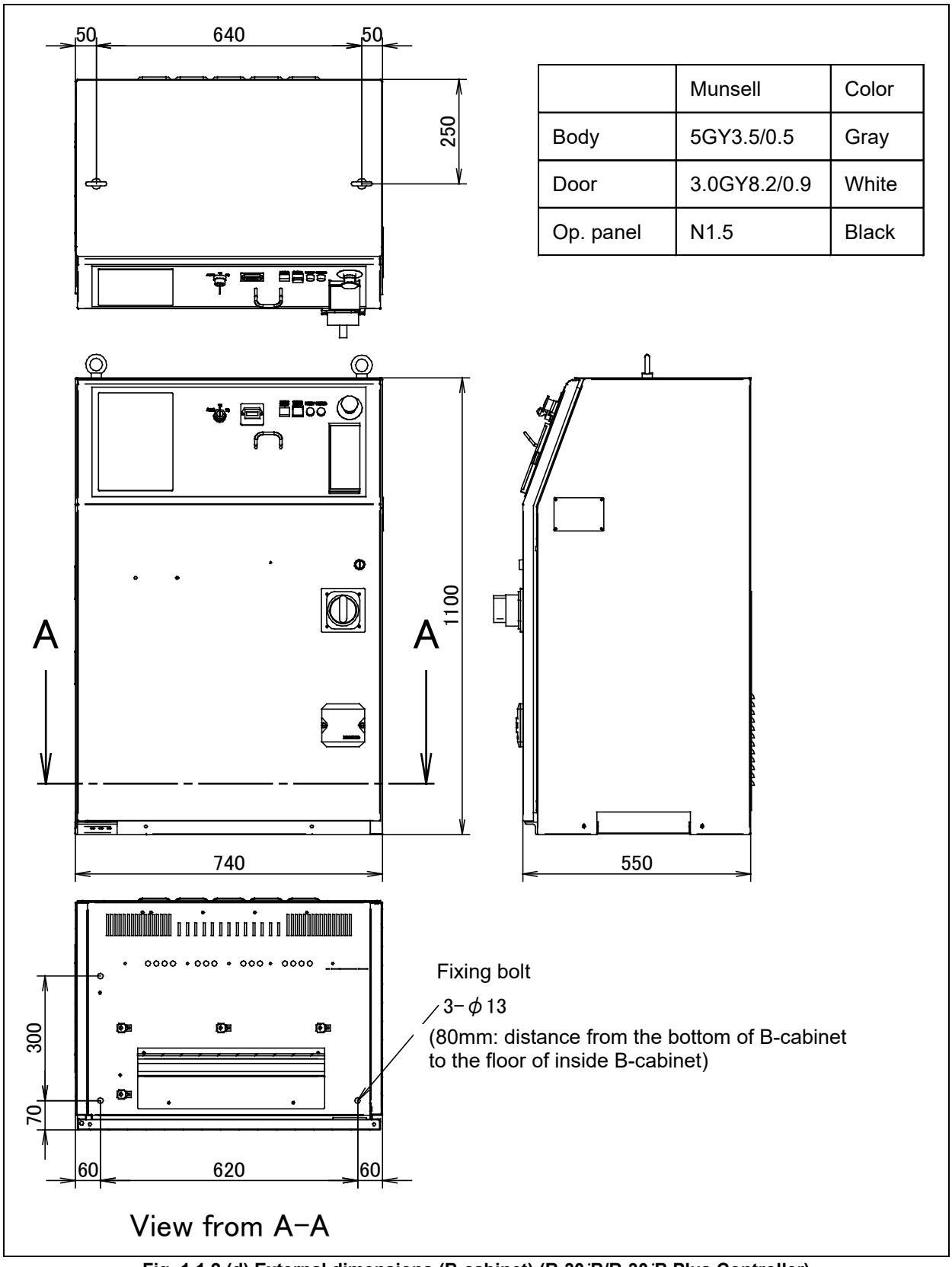






Fixing bolt
(4)-M10x12 bolts are attached.

Fig. 1.1.2 (c) External dimensions (A-cabinet with Side box) (R-30*i*B/R-30*i*B Plus Controller)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

Fig. 1.1.2 (d) External dimensions (B-cabinet) (R-30*i*B/R-30*i*B Plus Controller)

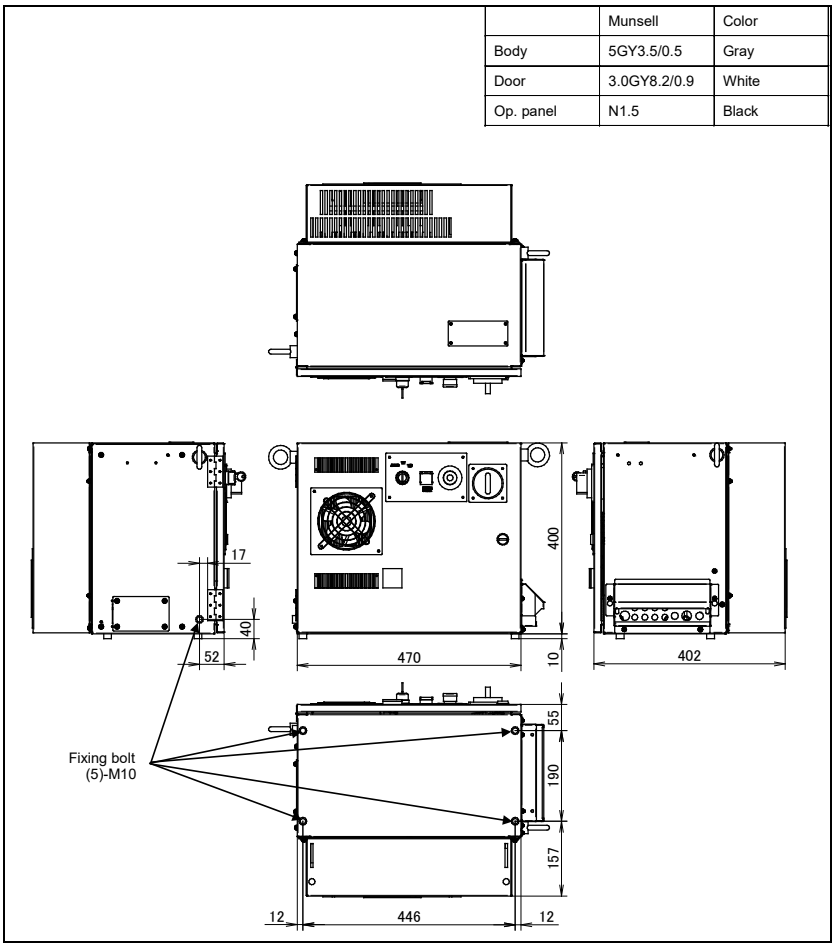


Fig. 1.1.2 (e) Controller external dimensions (R-30*i*B Mate Controller)

1.1.3 Welding Power Supply

Table 1.1.3 (a) Specification of welding power supply (FH350i)

Item	Specifications
Welding power supply spec.	A05B-1291-H151 (for DeviceNet communication specification) A05B-1291-H152 (for EtherNet communication specification)
Welding type	CV CO2/CV MAG SCMC CO2
Rated input voltage	200V±10% (3φ)
Input frequency	50/60Hz
Rated input power	16.0kVA, 15kW
Output current	DC 40A - 350A
Output voltage	DC 12V - 36V
Rated duty	60% at 350A, 100% at 270A, (complied with IEC60974-1)
Mass	58kg
External dimensions	W290mm x D540mm x H640mm

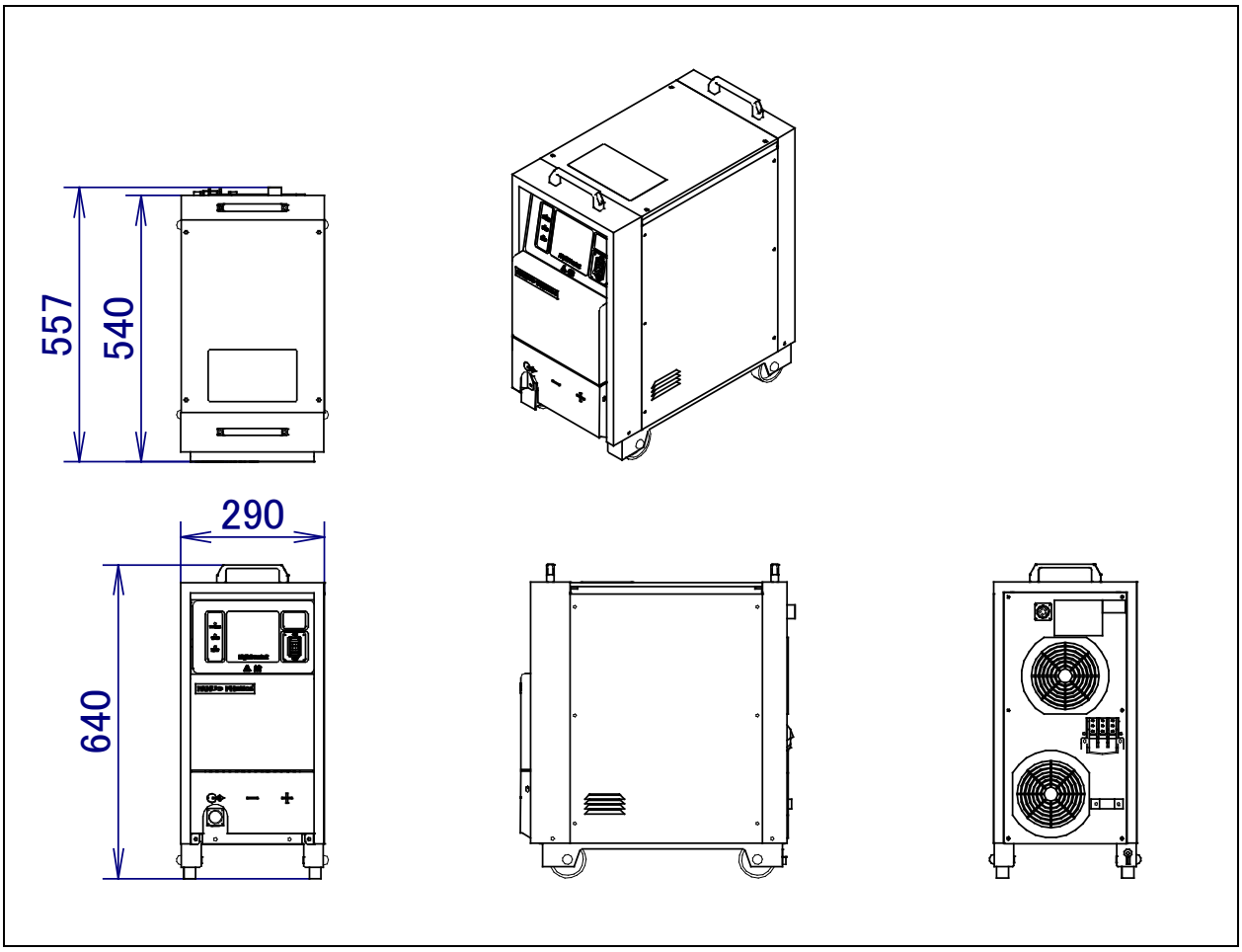


Fig. 1.1.3 (a) External dimensions of FH350i

Table 1.1.3 (b) Specification of welding power supply (FH350iP)

Item	Specifications
Welding power supply spec.	A05B-1291-H153 (for EtherNet communication specification)
Welding type	CV CO2/CV MAG SCMC CO2/SCMC MAG ZSCMC CO2/ZSCMC MAG PULSE MAG
Rated input voltage	200V±10% (3φ)
Input frequency	50/60Hz
Rated input power	19.0kVA, 15.8kW
Output current	DC 40A - 350A
Output voltage	DC 14V - 39V
Rated duty	60% at 350A, 100% at 270A, (complied with IEC60974-1)
Mass	70kg
External dimensions	W300mm x D650mm x H660mm

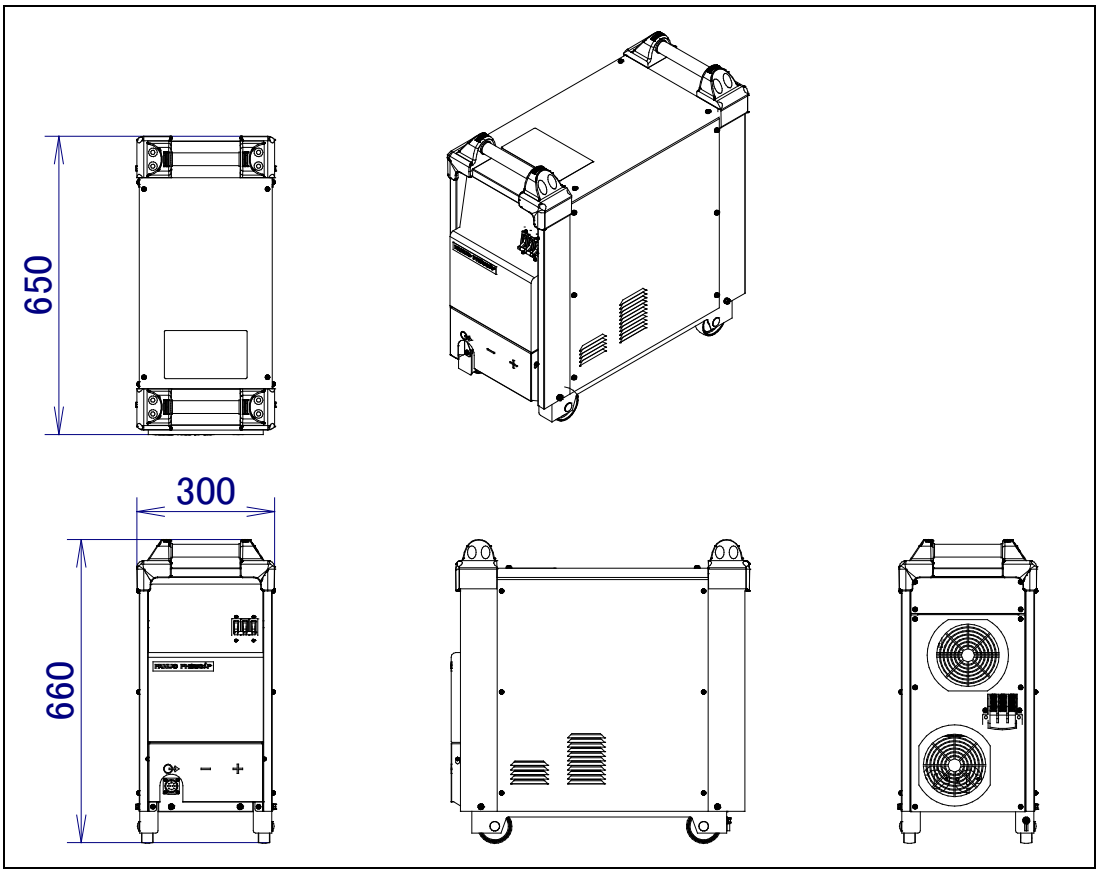


Fig. 1.1.3 (b) External dimensions of FH350iP

If there is a risk of the mine dust and sputtering are scattered, set welding power supply on a stand of around 30cm to prevent absorb them.
Please refer to Setup section of welding power supply manual.

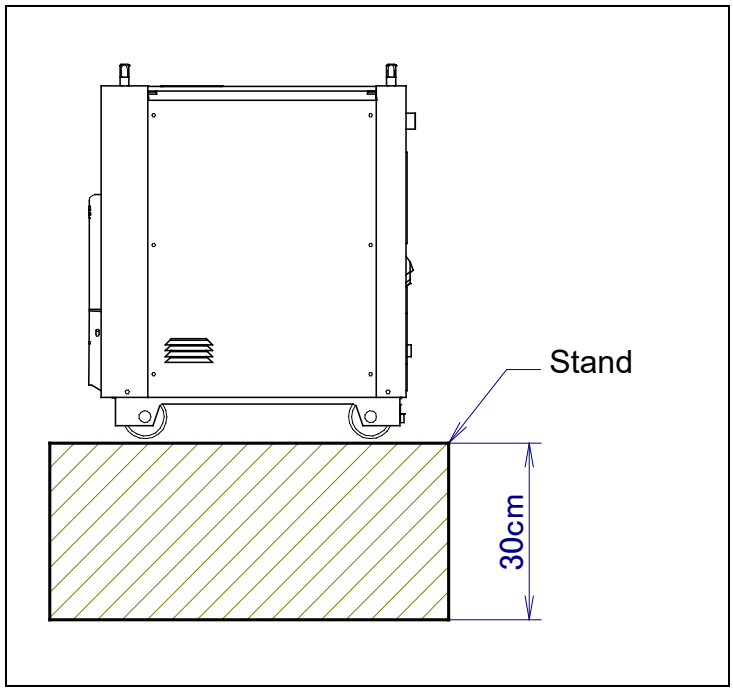


Fig. 1.1.3 (c) Quantity advance of welding power supply.

Transportation method of welding power supply

When transporting welding power supply only, use hand referring to Fig. 1.1.3 (d).

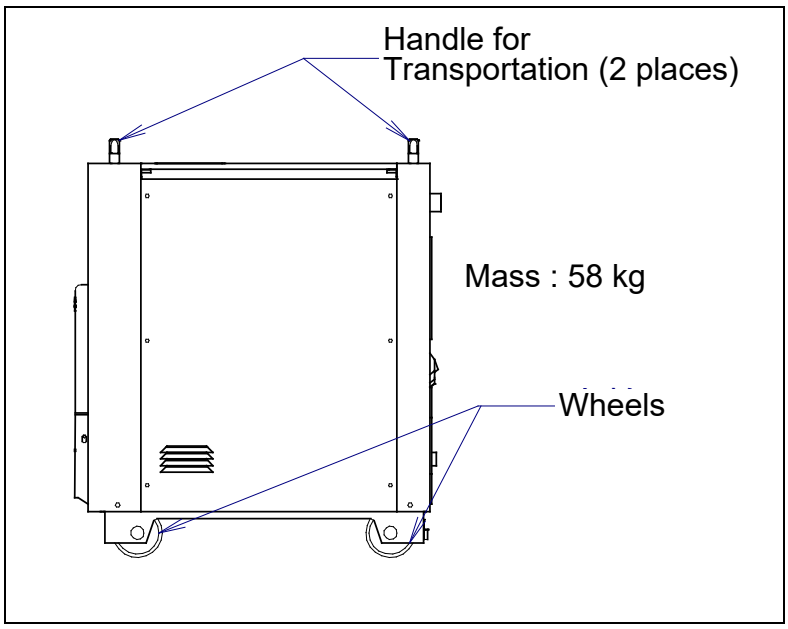


Fig. 1.1.3 (d) Transportation of welding power supply

1.1.4 Wire Feeder

Table 1.1.4 (a) Wire feeder(EF-R350FA)

Specification	A05B-1291-H205
Drive system	2 driving and 2 driven rolls
Roller type	0.9mm/1.2mm (when shipped)
Motor voltage / current	DC42V / 3.5A
Wire speed	1.0 to 18 m/min
Control system	Encoder pulse feed-back control
Gas valve	DC 24V Orifice 2.0mm, 0 to 5kgf/cm^2
Mass	5.8kg

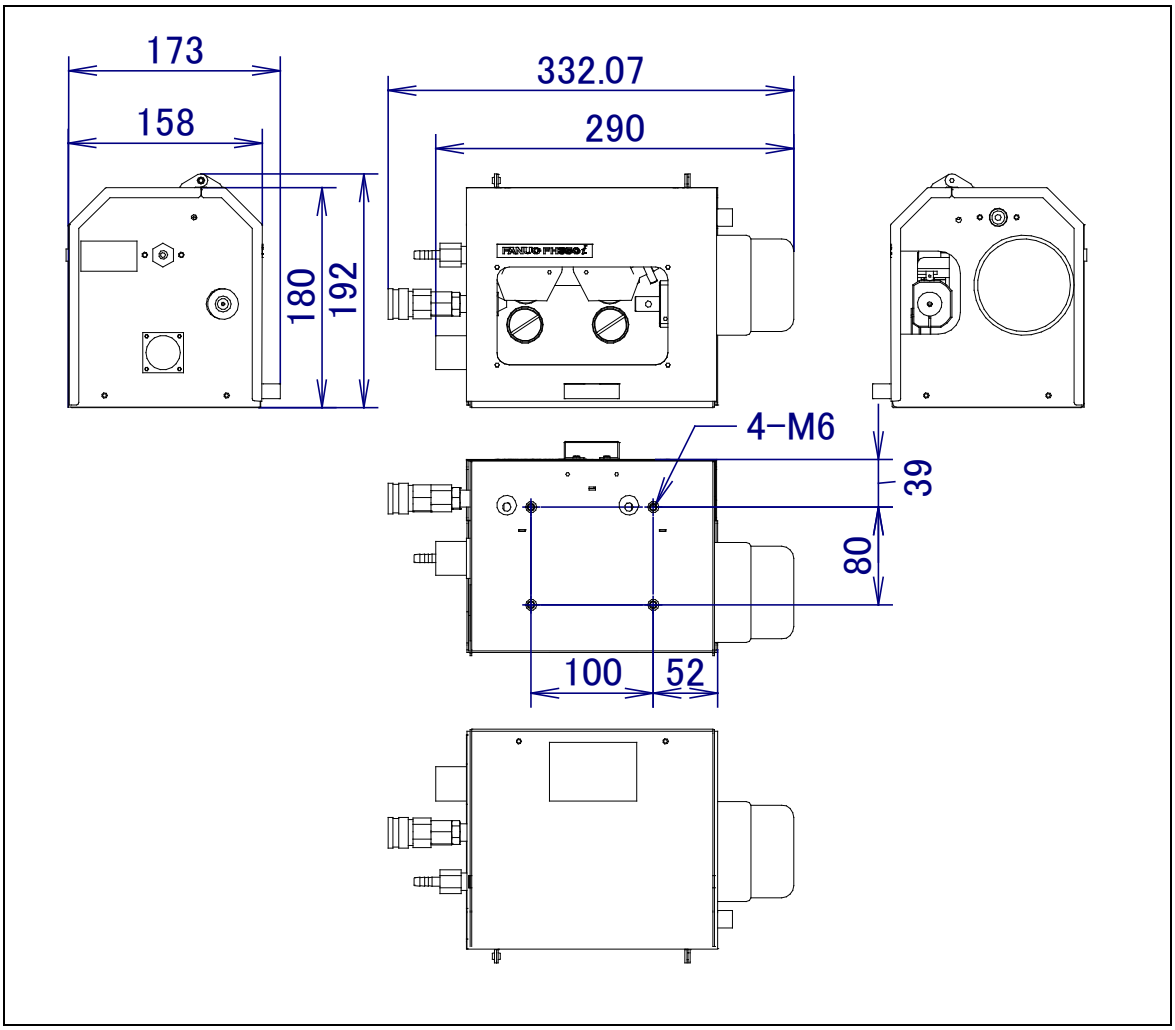


Fig. 1.1.4 (a) Wire feeder external dimensions (EF-R350FA)

Specification of drive rolls are below.

Table 1.1.4 (b) Specification of drive roll

	Specifications
Drive roll 0.9mm/1.2mm common 2 pcs /per 1 robot	A14L-0166-0205#WF2D1

1.1.5 Welding Torch, Torch Bracket

Table 1.1.5 (a) Welding torch

	Specifications	Models
BINZLE ABIROB 350GC-30S (air cooling/standard torch)	A05B-1291-H355	ARC Mate 100*i*C, ARC Mate 100*i*C/12
BINZLE ABIROB 350GC-30L (air cooling/long torch)	A05B-1291-H357	
BINZLE ABIROB 350GC-30S (air cooling/standard torch/for Asia)	A05B-1291-H365	
BINZLE ABIROB 350GC-30L (air cooling/long torch/for Asia)	A05B-1291-H367	
BINZEL ABIROB 350GC-30S (air cooling/standard torch)	A05B-1291-H356	ARC Mate 100*i*C/6L ARC Mate 100*i*C/7L
BINZEL ABIROB 350GC-30L (air cooling/long torch)	A05B-1291-H358	
BINZELABIROB 350GC-30S (air cooling/standard torch/for ASIA)	A05B-1291-H366	
BINZELABIROB 350GC-30L (air cooling/long torch/for ASIA)	A05B-1291-H368	
BINZELABIROB 350GC-30S (air cooling/standard torch/for ASIA)	A05B-1291-H369	ARC Mate 100*i*C/8L
BINZELABIROB 350GC-30L (air cooling/long torch/for ASIA)	A05B-1291-H370	
BINZELABIROB 350GC-30S (air cooling/standard torch)	A05B-1292-H355	ARC Mate 120iC
FH350i F-R35H torch (air cooling) (Torch cable length 1230mm)	A05B-1291-H321	ARC Mate 0*i*B
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#12HL	ARC Mate 100*i*D
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#12HL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#12H	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#12H	
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#LGHL	ARC Mate 100*i*D/10L, ARC Mate 120*i*D
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#LGHL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#LGH	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#LGH	
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#ELHL	ARC Mate 100*i*D/8L
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#ELHL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#ELH	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#ELH	
BINZELABIROB iSTM mini G350-30L (air cooling)	A05B-1296-H303#HLHL	ARC Mate 120*i*D/12L
BINZELABIROB iSTM mini G350-30L (air cooling) (with wire clamp)	A05B-1296-H304#HLHL	
BINZELABIROB iSTM mini W500-35 (water cooling)	A05B-1296-H305#HLH	
BINZELABIROB iSTM mini W500-35 (water cooling) (with wire clamp)	A05B-1296-H306#HLH	

TCP and payload setting of torch is below.

Table 1.1.5 (b) TCP and payload setting of torch (ARC Mate *i*C series)

		ABIROB 350GC-30S	ABIROB 350GC-30L	ABIROB 350GC-30S for ASIA	ABIROB 350GC-30L For ASIA	
		Standard torch	Long torch	Standard torch	Long torch	
TCP (*1)	X	-84.5	-84.5	-84.5	-84.5	[mm]
	Y	0	0	0	0	[mm]
	Z	362	440.7	362	440.7	[mm]
	W	180	180	180	180	[deg]
	P	-30	-30	-30	-30	[deg]
	R	0	0	0	0	[deg]
PAYLOAD		1.94	2.04	1.61	1.71	[kg]
PAYLOAD CENTER	X	-0.7	-0.7	-0.7	-0.7	[cm]
	Y	-0.3	-0.3	-0.3	-0.3	[cm]
	Z	16.7	16.7	16.7	16.7	[cm]
PAYLOAD INERTIA	Ix	0.35	0.35	0.35	0.35	[kgf·cm·s^2]
	Iy	0.35	0.35	0.35	0.35	[kgf·cm·s^2]
	Iz	0.026	0.026	0.026	0.026	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	7	7	[kg]

Above-mentioned TCP is the one of 15mm in the wire thrusting out length.

Table 1.1.5 (c) TCP and payload setting of torch (ARC Mate 0*i*B)

	F-R35H torch	F-35H torch (100mm extension)	
TCP X	0	0	[mm]
TCP Y	0	0	[mm]
TCP Z	361	461	[mm]
W	180	180	[deg]
P	-40.7	-40.7	[deg]
R	0	0	[deg]
PAYLOAD	2.26	2.62	[kg]
PAYLOAD CENTER X	12.28	10.09	[cm]
PAYLOAD CENTER Y	-1.26	-0.97	[cm]
PAYLOAD CENTER Z	4.95	14.61	[cm]
PAYLOAD INERTIA Ix	0.38	0.28	[kgf·cm·s^2]
PAYLOAD INERTIA Iy	0.43	0.38	[kgf·cm·s^2]
PAYLOAD INERTIA Iz	0.01	0.03	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 1)	0	0	
ARM LOAD AXIS (AXIS 3)	7	7	[kg]

Above-mentioned TCP is the one of 15mm in the wire thrusting out length.

Table 1.1.5 (d) TCP and payload setting of torch (ARC Mate *i*D series)

		ABIROB G350-30 (*2)	ABIROB W500-35	ABIROB W500-35 (with wire clamp)	
		Long torch	Standard torch	Standard torch	
TCP (*1)	X	-92.1	-91.4	-91.4	[mm]
	Y	0	0	0	[mm]
	Z	415.2	392.6	412.6	[mm]
	W	180	180	180	[deg]
	P	-30	-35	-35	[deg]
	R	0	0	0	[deg]
PAYLOAD		1.29	1.79	2.42	[kg]
PAYLOAD CENTER	X	-0.81	-0.84	-0.65	[cm]
	Y	0	0	-0.3	[cm]
	Z	15.9	16.5	16.4	[cm]
PAYLOAD INERTIA	Ix	0.15	0.16	0.2	[kgf·cm·s^2]
	Iy	0.15	0.17	0.21	[kgf·cm·s^2]
	Iz	0.01	0.013	0.015	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)		7	7	7	[kg]

(*1)Above-mentioned TCP is the one of 15mm in the wire thrusting out length.
(*2) Torches with the wire clamps are included.

1.1.6 Communication Cable Specifications

Table 1.1.6 (a) Communication cables

	Specification	Remarks
DeviceNet cable 7m	A05B-2512-J280	Made in Japan

1.2 OPTION CONSTITUTION

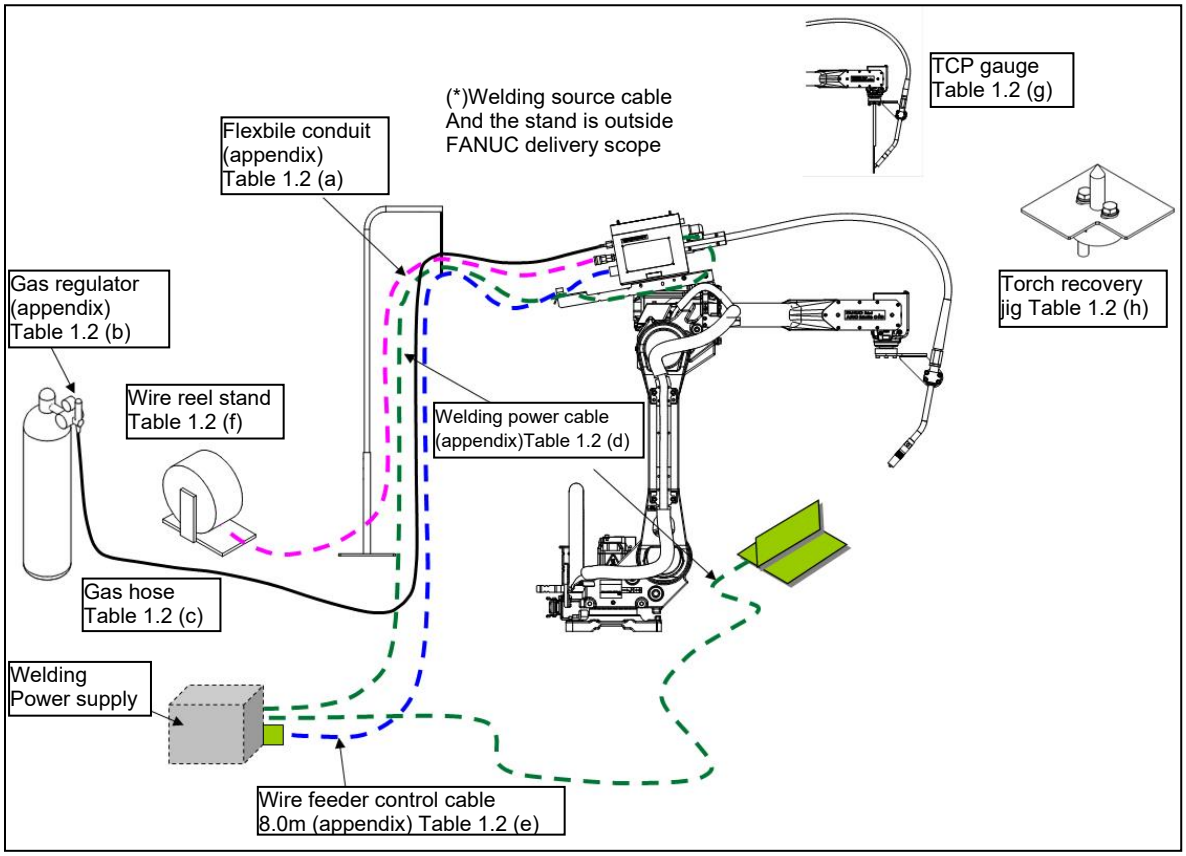


Fig. 1.2 (a) Option constitution

Table 1.2 (a) Flexible conduit specifications

	Specifications
Flexible conduit 4.6m	A05B-1291-H411
Flexible conduit 7.6m	A05B-1291-H412
Flexible conduit 3.0m	A05B-1291-H413

> ⚠ **CAUTION**
> At the air wiring part, separate the flexible conduit from the hose pack, make it the shortest.

Table 1.2 (b) Specification of regulator

Specifications		A05B-1291-J101
Maker		Yutaka.LTD
Decompression method		Two step decompression method
Basic performance	Inlet pressure gauge	0 to 25Mpa
	Inlet pressure	Ar, MAG: 0 to 14.8MPa CO2: 0 to 12MPa
	Measurement flow quantity range	1 to 25L/min
	Safety valve	20Mpa or more
	Regulated pressure	0.25MPa
Coupling	Inlet	W22-14 (R)
	Outlet	Φ8.5 hose mouth
Heating device performance	Voltage	100V
	Heating capacity	200W
	Power supply code	2P(2m)

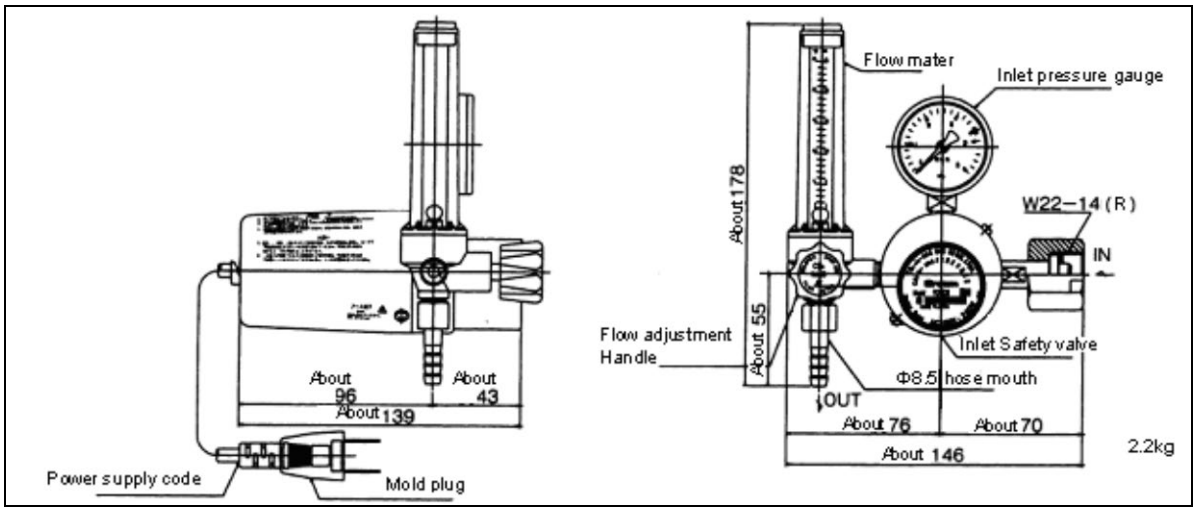


Fig. 1.2 (b) Regulator external dimensions (A05B-1291-J101)

Table 1.2 (c) Gas hose specifications

	Specifications
Gas hose 10m	A05B-1291-J151
Gas hose 15m	A05B-1291-J152
Gas hose 20m	A05B-1291-J153
Gas hose 25m	A05B-1291-J154

Table 1.2 (d) Welding power cables specifications

	Specifications
Welding power cable(not for movable part) 38SQ 6m	A05B-1223-K701
Welding power cable(not for movable part) 38SQ 10m	A05B-1223-K702
Welding power cable(not for movable part) 38SQ 15m	A05B-1223-K703
Welding power cable(not for movable part) 38SQ 20m	A05B-1223-K704
Welding power cable(not for movable part) 60SQ 5m	A05B-1291-H711
Welding power cable(not for movable part) 60SQ 10m	A05B-1291-H712
Welding power cable(not for movable part) 60SQ 15m	A05B-1291-H713
Welding power cable(not for movable part) 60SQ 20m	A05B-1291-H714

(*) When 2 welding power supplies are used in system, be sure to separate each power cable when forming them.

⚠ WARNING

1 These cables cannot be used for the moving part such as the cable carriers. (Except for movable) Please contact FANUC beforehand when the application such as the cable carriers to the moving part is necessary.
Please insulate the seam of the sheath and the terminal of the welding power cable firmly. There is danger of breaking the robot when the seam touches the robot.

2 Please consider covering the cable with the rubber mule for protection etc. when hanging it with the balance device etc. that set up the cable in the surrounding for the welding outside so that it plans, the limited part is bound in the cable tie etc., and power should not concentrate on a specific part.

Table 1.2 (e) Wire feeder control cable

	Specifications
Wire feeder control cable 8.0m	A05B-1291-H631

Table 1.2 (f) Wire reel stand

	Specifications
Wire reel stand (stationary)	A05B-1291-J203

Table 1.2 (g) TCP gauge

	Specifications
TCP gauge	A05B-1223-J057

Table 1.2 (h) High speed torch recovery fixture

	Specifications
High speed torch recovery fixture	A05B-1210-J056
High speed torch recovery fixture (compact type)	A05B-1221-J056

Using method of TCP gauge

Remove 2 bolts from torch cable bracket and attach TCP gauge.
In the state that a wire protrude from torch cable , confirm TCP gage center line matches wire tip position.

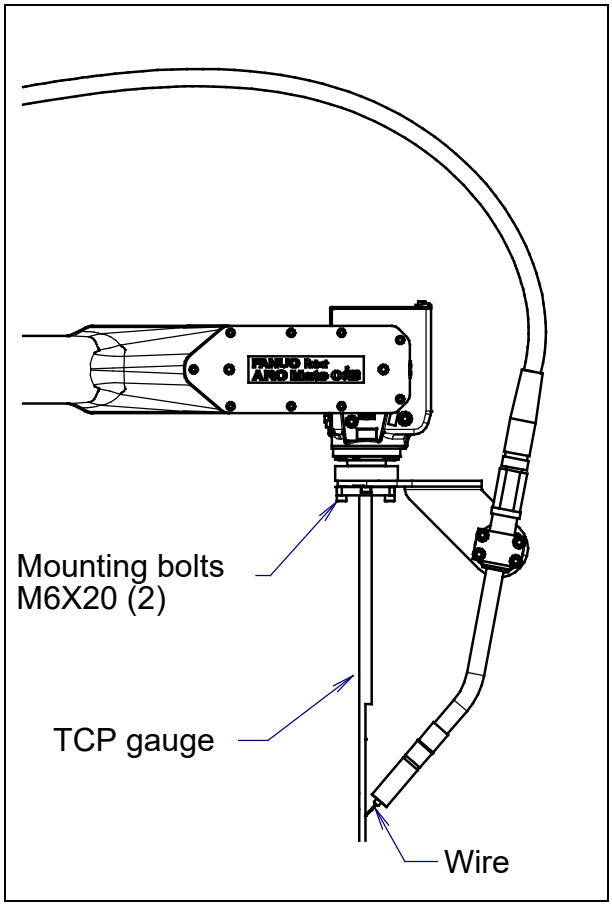


Fig. 1.2 (c) TCP gauge

Additional axis option

If additional axis cabinet (option) is added to R-30*i*B Mate controller, it supports additional axis positioner. ARC Mate 0*i*B has following limitations.

- Each of 1 of FANUC standard 1-axis/2-axes positioner (option)
- If using positioner designed by customer, 1-axis motor drive by 80A amplifier or less

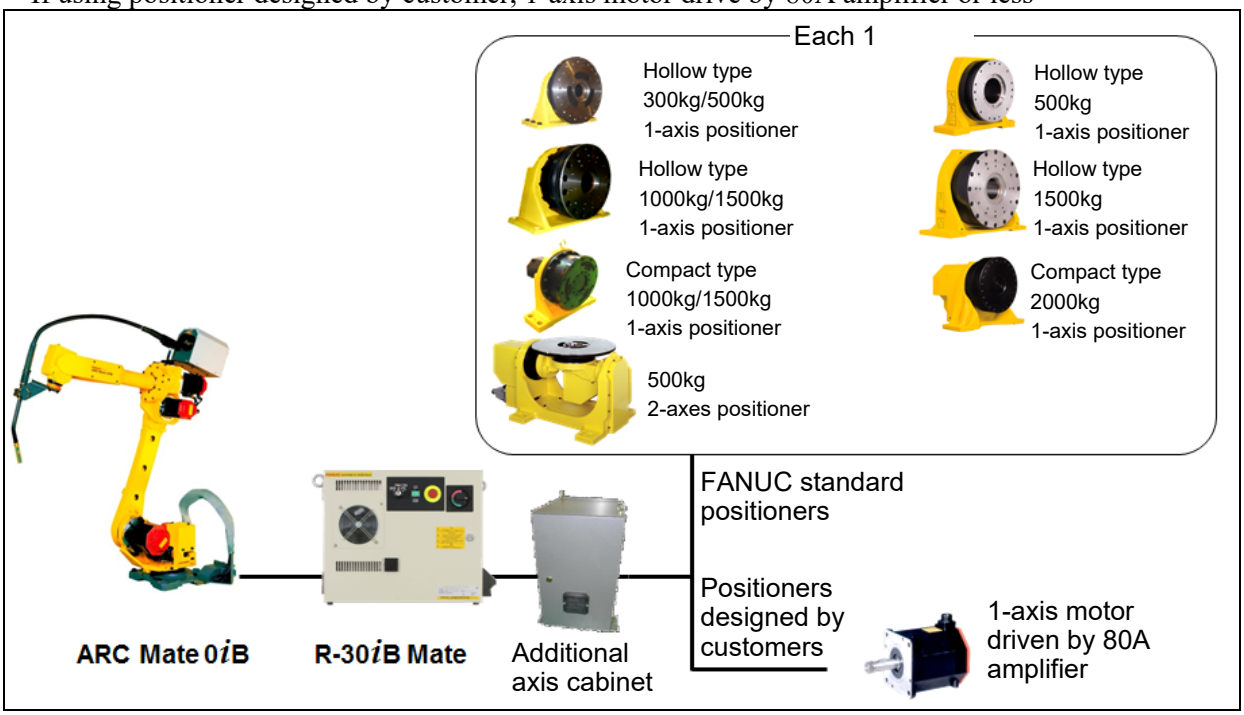


Fig. 1.2 (d) Additional axis option constitution

NOTE
It is possible to use positioner X2 configuration only when positioner is horizontal axis turn and each positioner does not move at the same time.
(Positioner is restricted to the above mentioned positioner.)

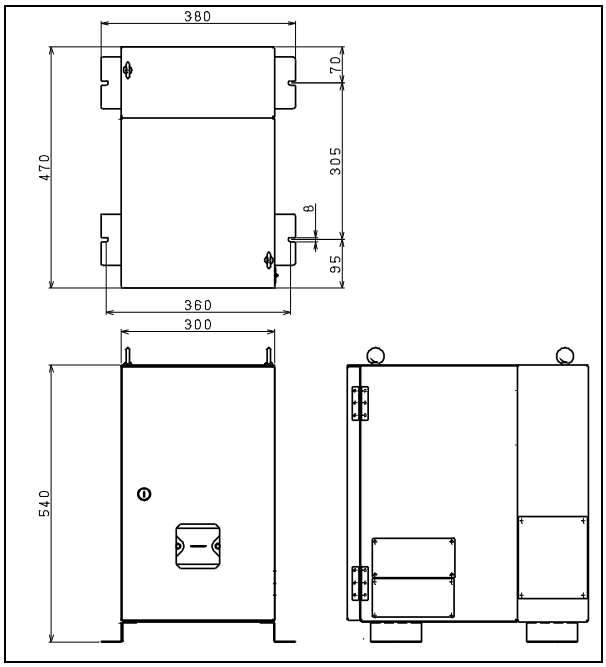
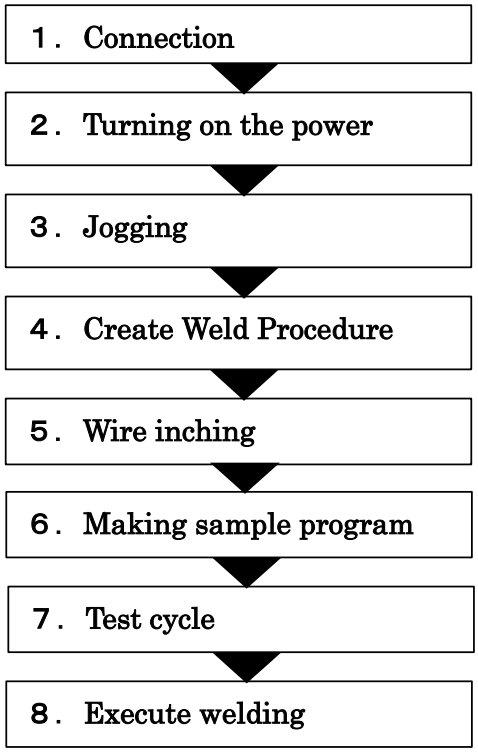


Fig. 1.2 (e) Additional axis cabinet external dimensions

2 BASIC OPERATION (QUICK REFERENCE)

2.1 OVERVIEW



This chapter describe the basic operation from installing the robot to performing arc welding for customers who are not familiar with FANUC arc welding robot operation.

Please refer to Chapter “3 BASIC OPERATION” to “10 INITIAL SETTING” and Arc Welding Function OPERATOR’S MANUAL (B-83284EN-3) for more details of arc welding robot operation method.

2.2 CONNECTION

Fig. 2.2 (a), (b) show connection contents of a robot, a controller and welding power supply.
Refer to Subsection 2.2.1 to 2.2.5 for details.

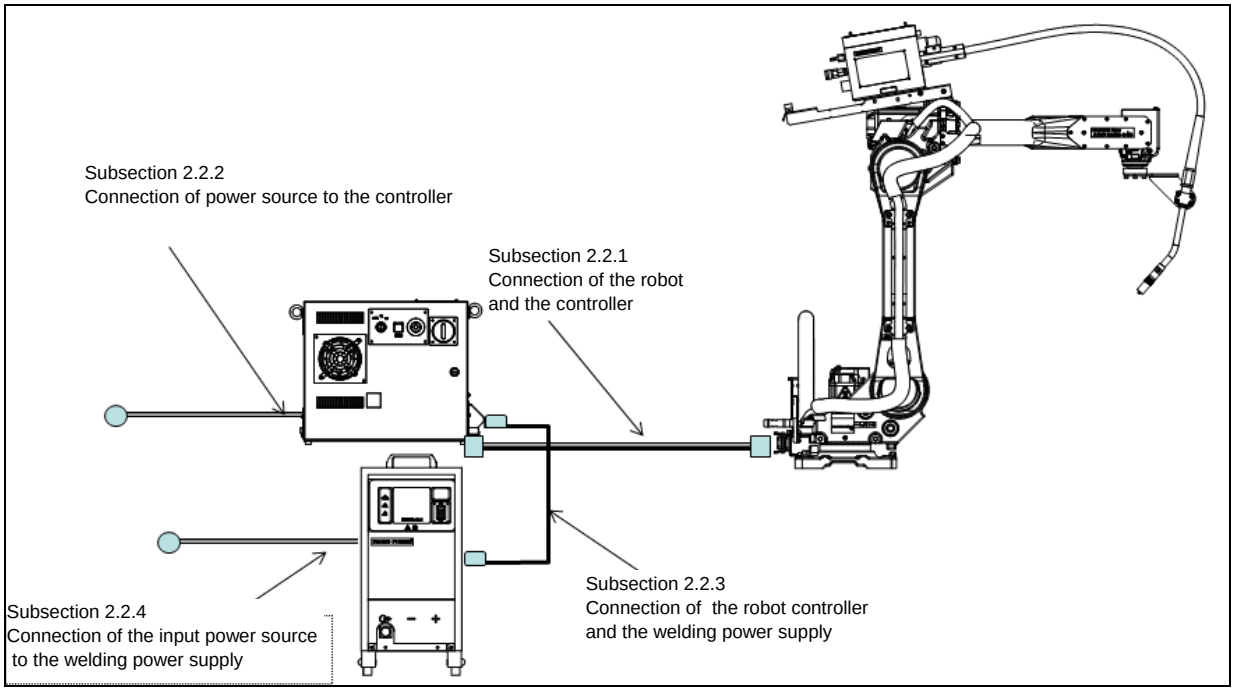


Fig. 2.2 (a) Connection contents (1/2)

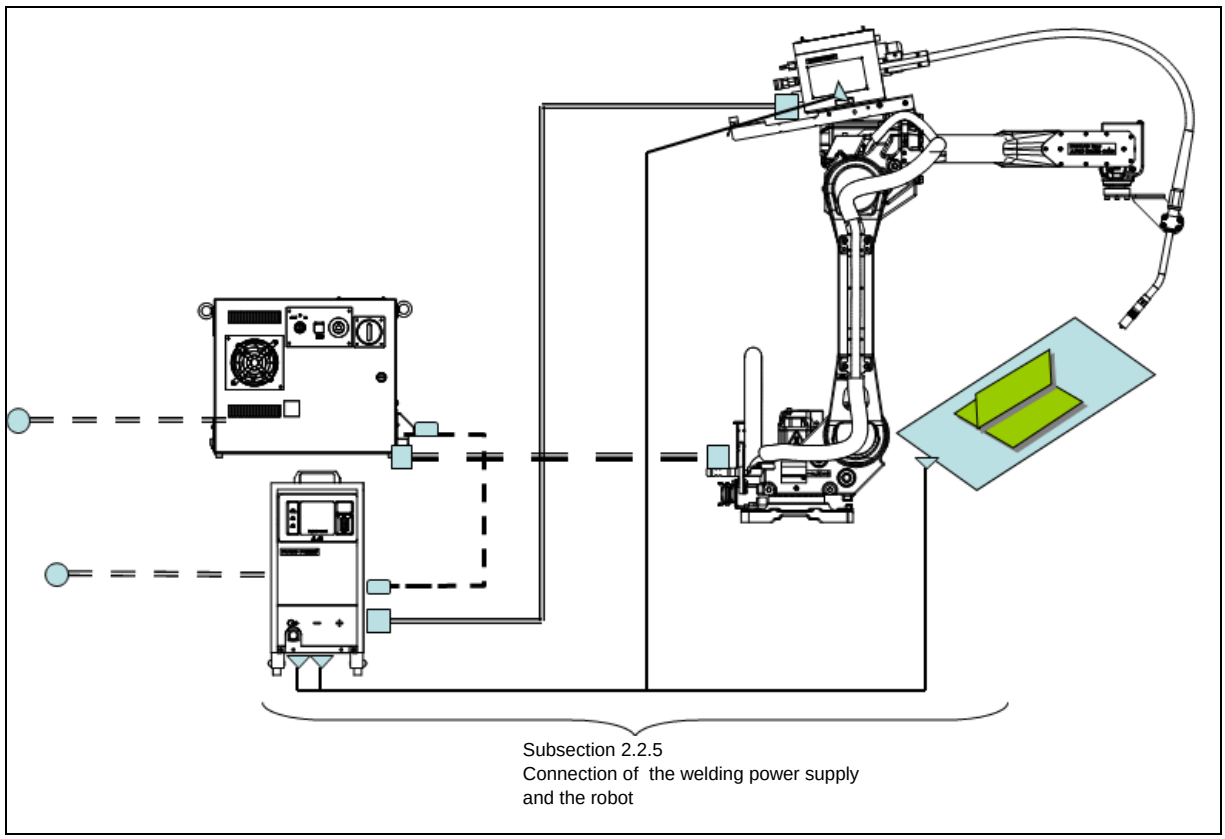


Fig. 2.2 (b) Connection contents (2/2)

2.2.1 Connection of Robot and Controller

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

> ⚠ **CAUTION**
> 1 Before connecting the cables, be sure to turn off the controller power.
> 2 Don't use 10m or longer coiled cable without untying. The long coiled cable will heat and damage itself.

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

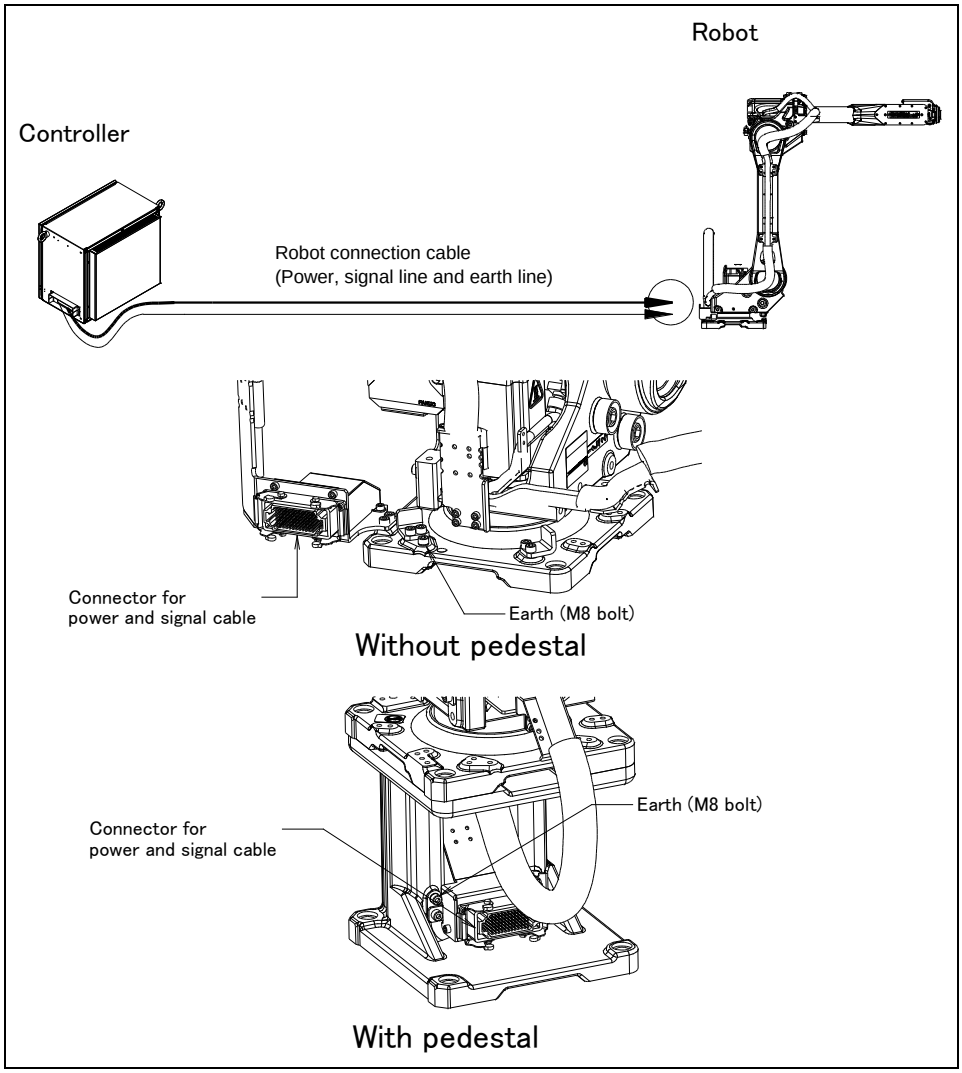


Fig. 2.2.1 (a) Cable connection figure (ARC Mate 0*i*B)

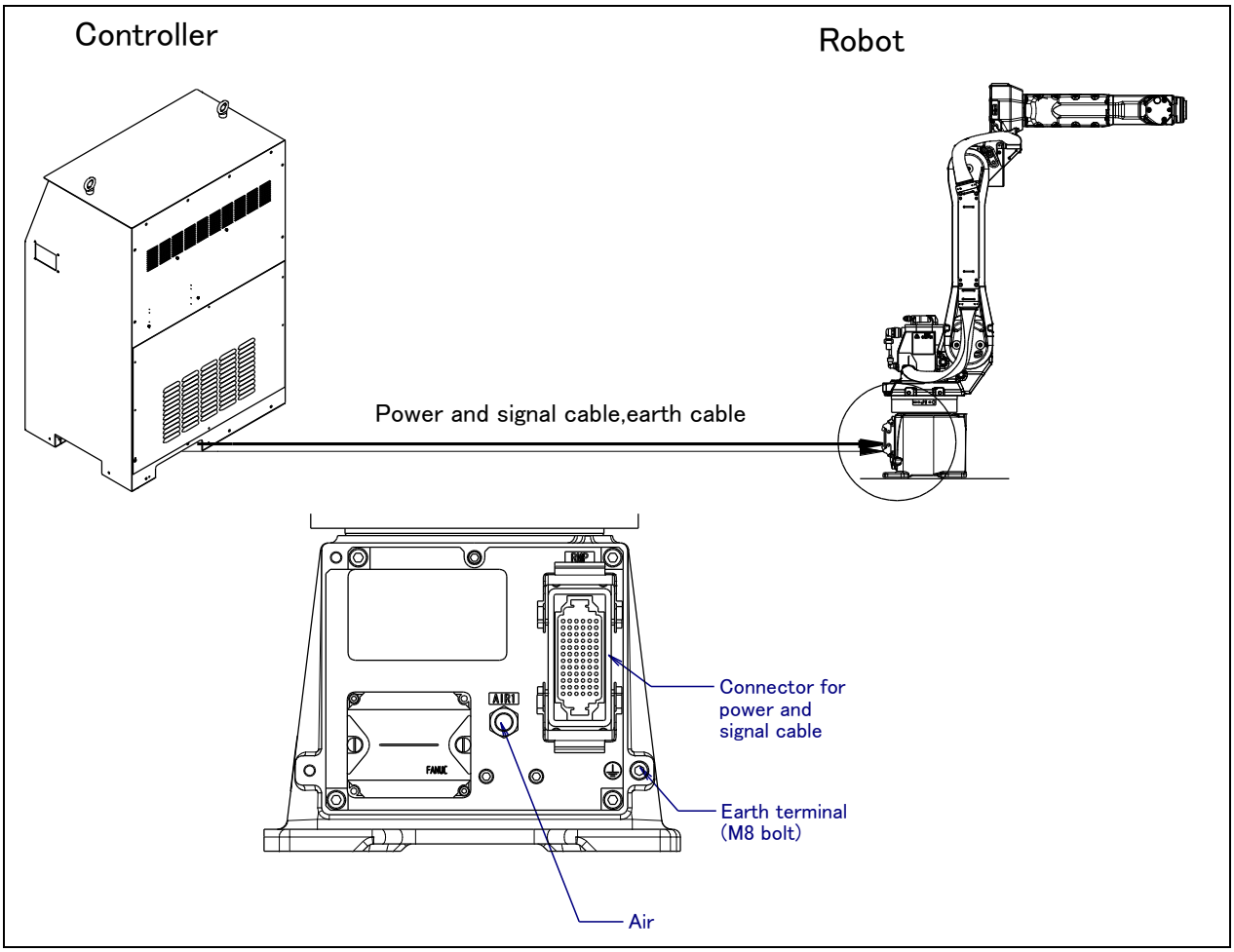


Fig. 2.2.1 (b) Cable connection figure (ARC Mate 100*i*C series, ARC Mate 120*i*C series)

2.2.2 Connection of Input Power Supply to Controller

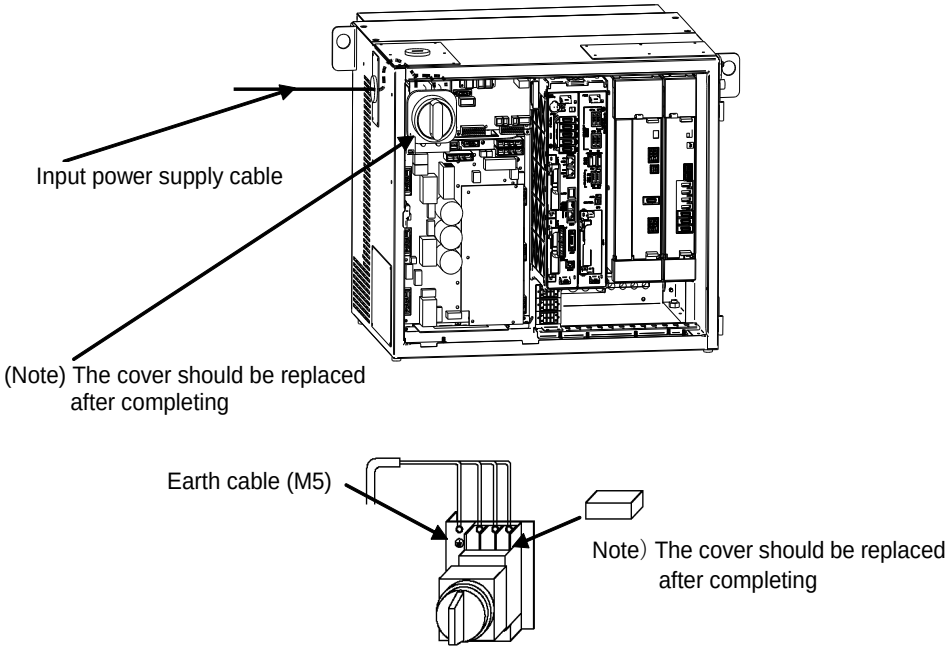
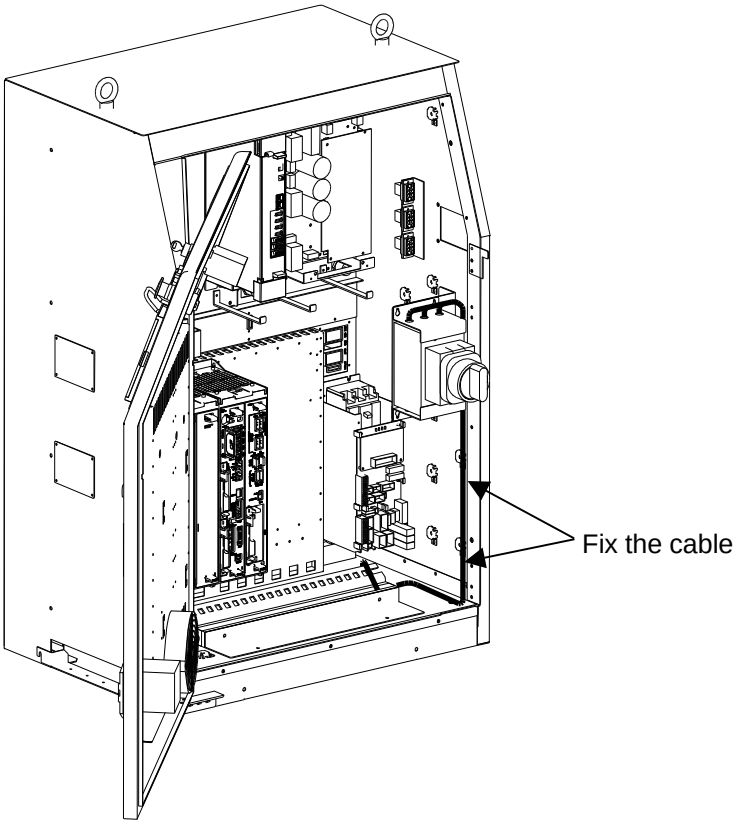


Fig. 2.2.2 (a) Connecting the input power cable (R-30*i*B Controller, A-cabinet)

⚠ WARNING
The cover for primly terminal of main breaker should be replaced after completing.



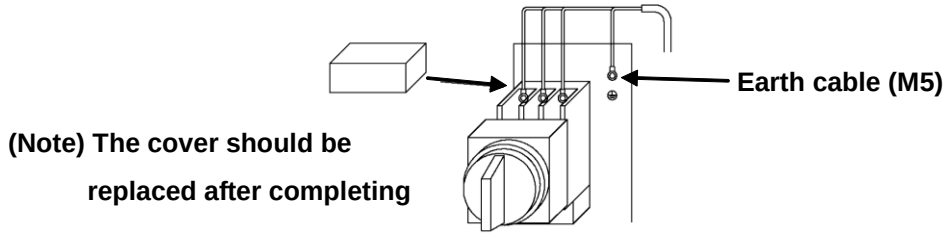


Fig. 2.2.2 (b) Connecting the input power cable (R-30*i*B Controller, B-cabinet)

⚠ WARNING
The cover for primly terminal of main breaker should be replaced after completing.

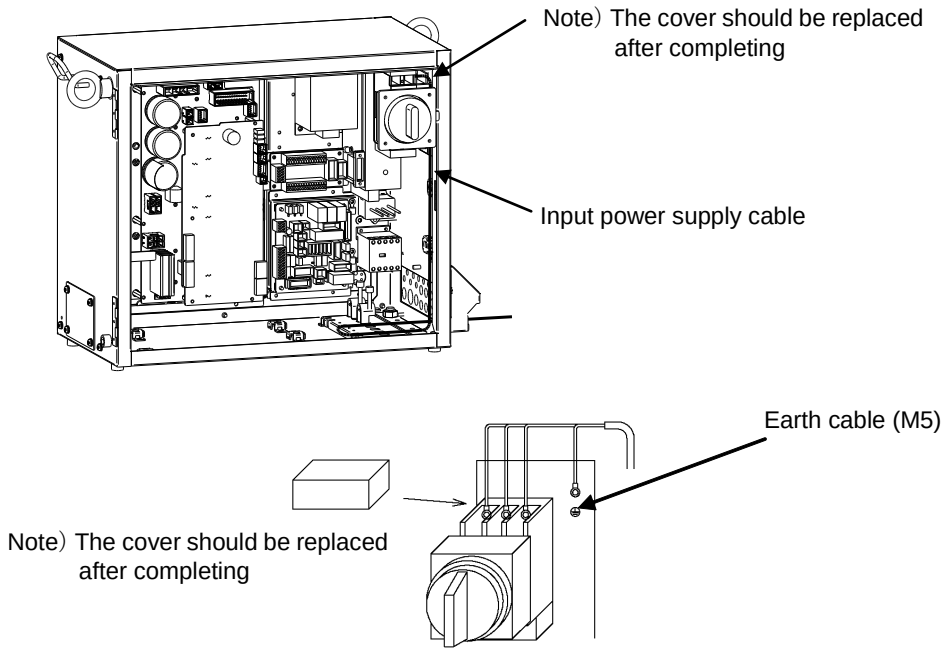


Fig. 2.2.2 (c) Connecting the input power cable (R-30*i*B Mate Controller)

NOTE
Use the wire which size is from AWG14 (2mm^2) to AWG10 (5.5mm^2) for input power supply cable and earth cable.

2.2.3 Connection of Controller and Welding Power Supply

FH350i (DeviceNet communication specification)

Connect controller and welding power supply using DeviceNet cable.
DeviceNet cable is connected to controller when they are shipped from the factory.

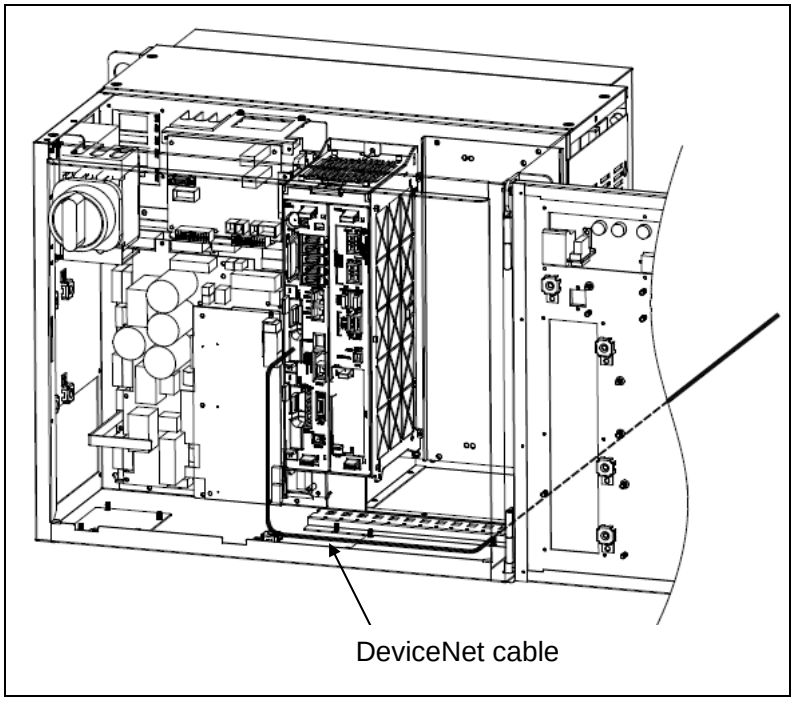


Fig. 2.2.3 (a) Connection of DeviceNet cable (R-30*i*B/R-30*i*B Plus controller, A-cabinet)

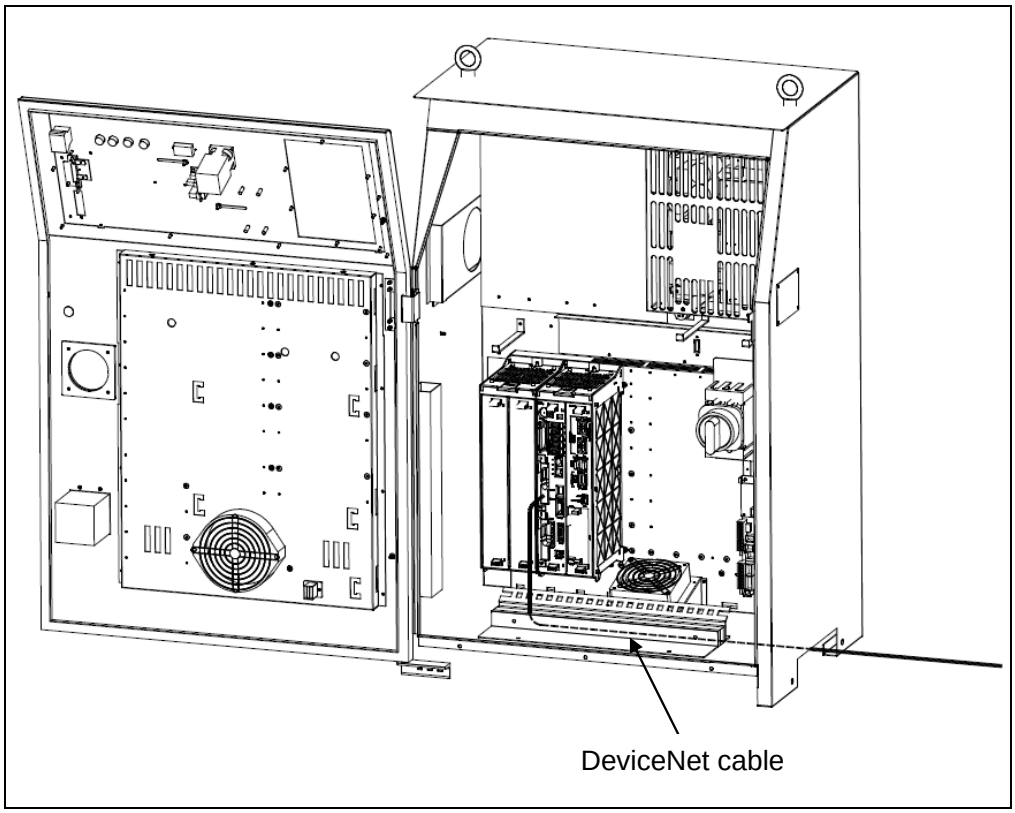


Fig. 2.2.3 (b) Connection of DeviceNet cable (R-30*i*B/R-30*i*B Plus controller, B-cabinet)

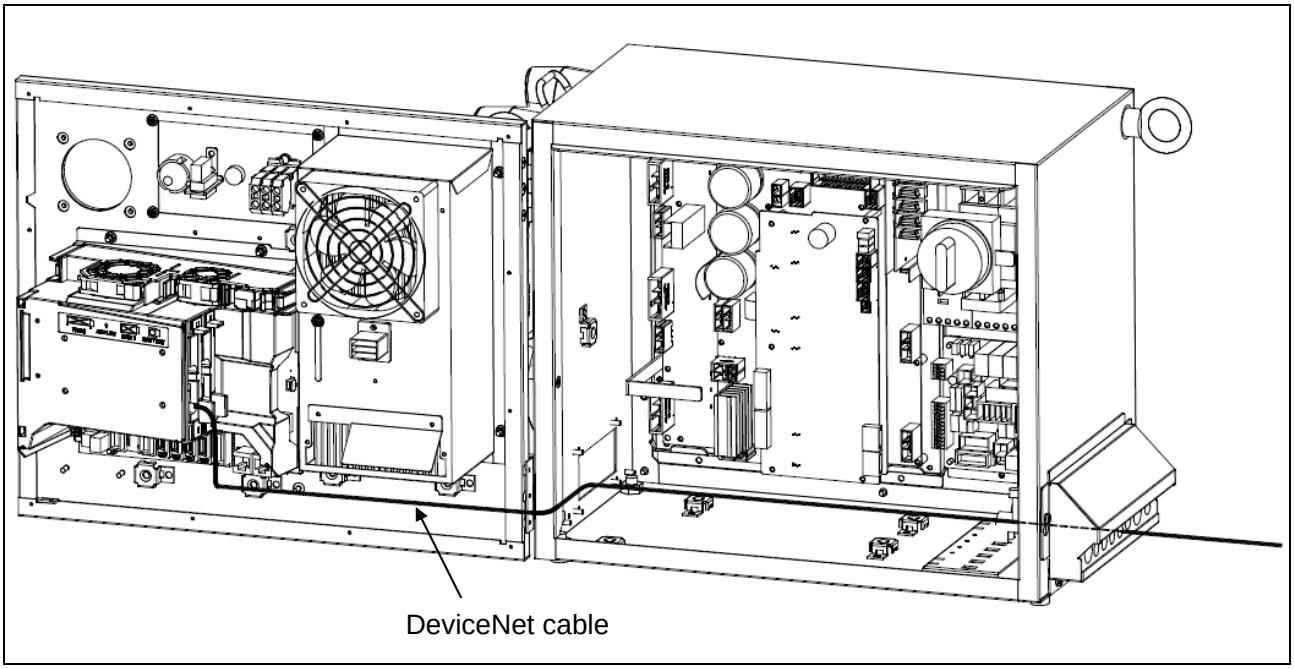


Fig. 2.2.3 (c) Connection of DeviceNet cable (R-30*i*B Mate/R-30*i*B Mate Plus controller)

Connect this cable to the welding power supply back side.

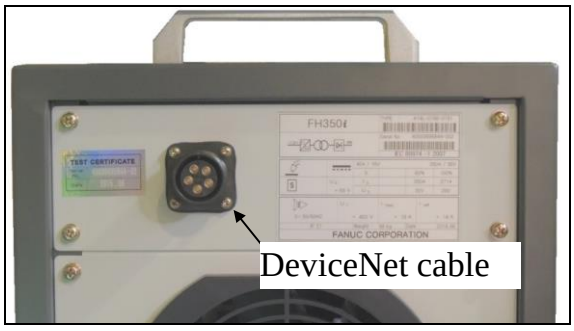


Fig. 2.2.3 (d) Connection of DeviceNet cable (Welding power supply FH350i)

FH350i (EtherNet communication specification), FH350iP

Connect controller and welding power supply using EtherNet cable.
EtherNet cable is connected to controller when they are shipped from the factory.

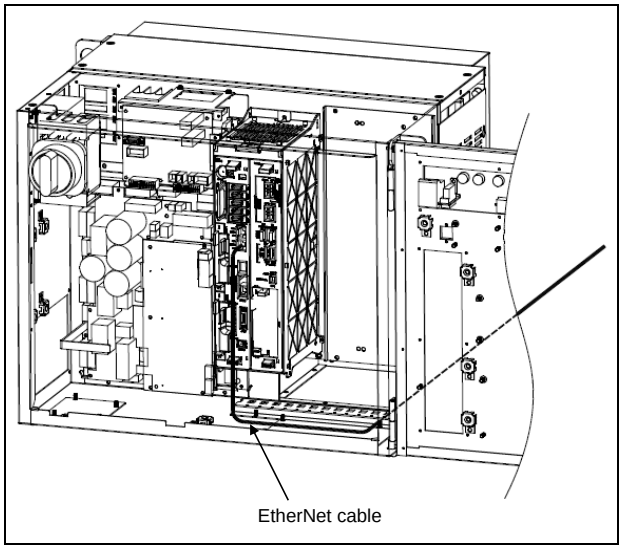


Fig. 2.2.3 (e) Connection of EtherNet cable (R-30*i*B/R-30*i*B Plus controller A-cabinet)

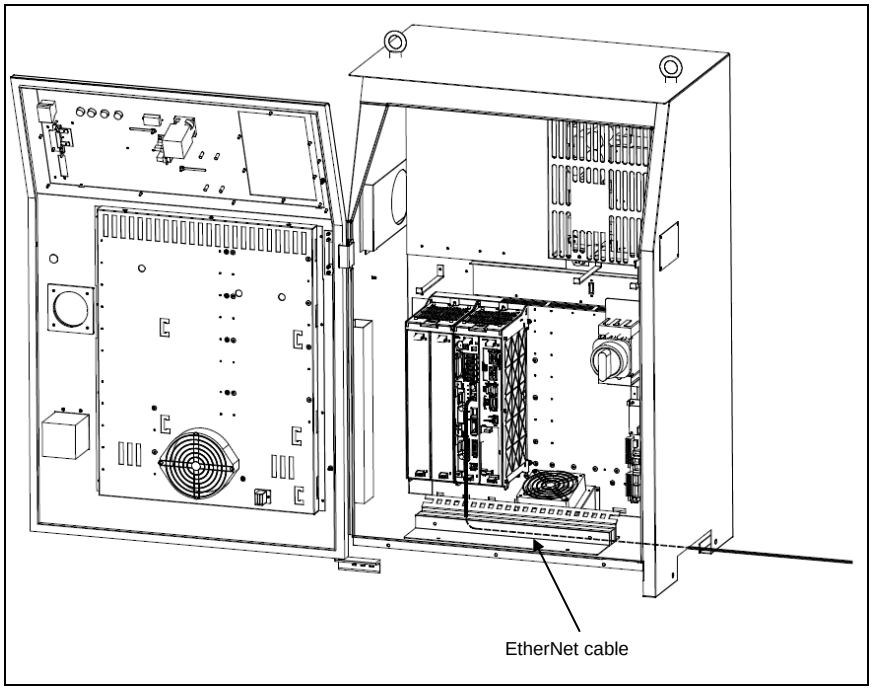


Fig. 2.2.3 (f) Connection of EtherNet cable (R-30*i*B/R-30*i*B Plus controller B-cabinet)

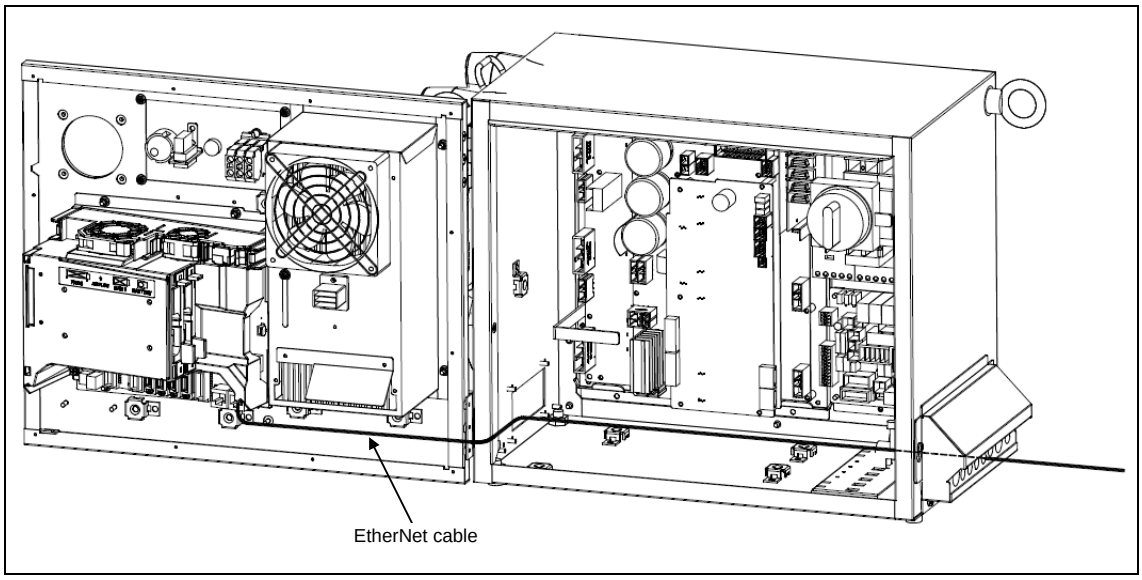


Fig. 2.2.3 (g) Connection of EtherNet cable (R-30*i*B Mate/R-30*i*B Mate Plus controller)

The port number for inserting Ethernet cable becomes followings corresponding to the number of ports on robot controller.

- Robot controller has only CD38A port: Connect the cable to CD38A
- Robot controller has CD38A and CD38B ports: Connect the cable to CD38B

The Ethernet cable must be fastened by a cable clamp to prevent tension being applied to the modular connector (RJ-45) that connects the cable to the controller even if the Ethernet cable is pulled directly. This clamp is also used to ground the cable shield.

Connect this cable to welding power supply backside.

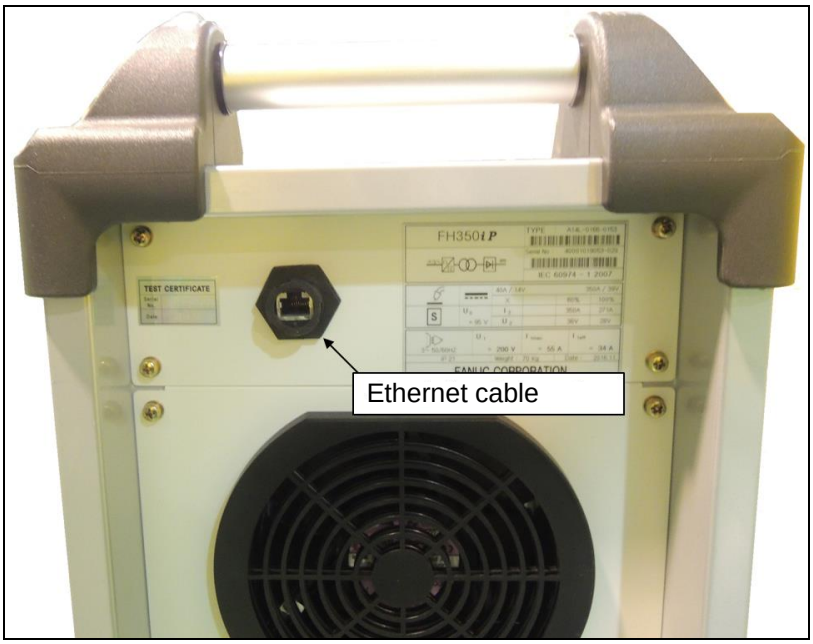


Fig. 2.2.3 (h) Connection of Ethernet cable (Welding power supply FH350i Ethernet specification, FH350iP)

2.2.4 Connection of Input Power Supply to Welding Power Supply

1. Connect the primary cable , then attach the cover.

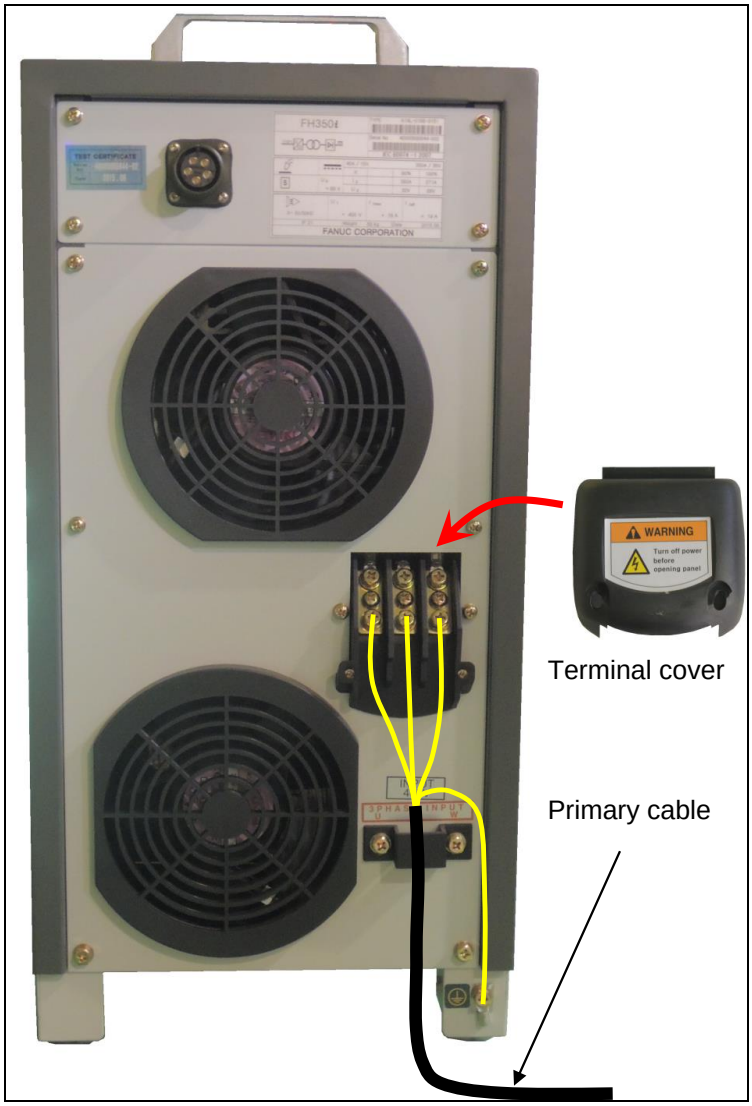


Fig. 2.2.4 (a) Connection of Welding power supply FH350i

2.2.5 Connection of Welding Power Supply and Robot

1 Connect welding power cable (+), (-) and the wire feeder control cable to the welding power supply referring to Fig .2.2.5 (a) and (b). Remove the cover before connecting them.

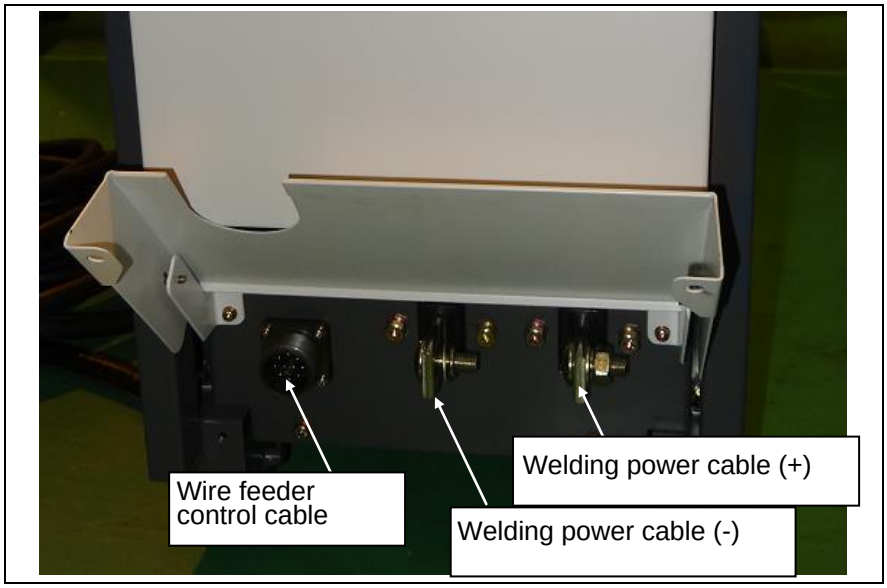


Fig. 2.2.5 (a) Connection of welding power supply FH350i (1/2)

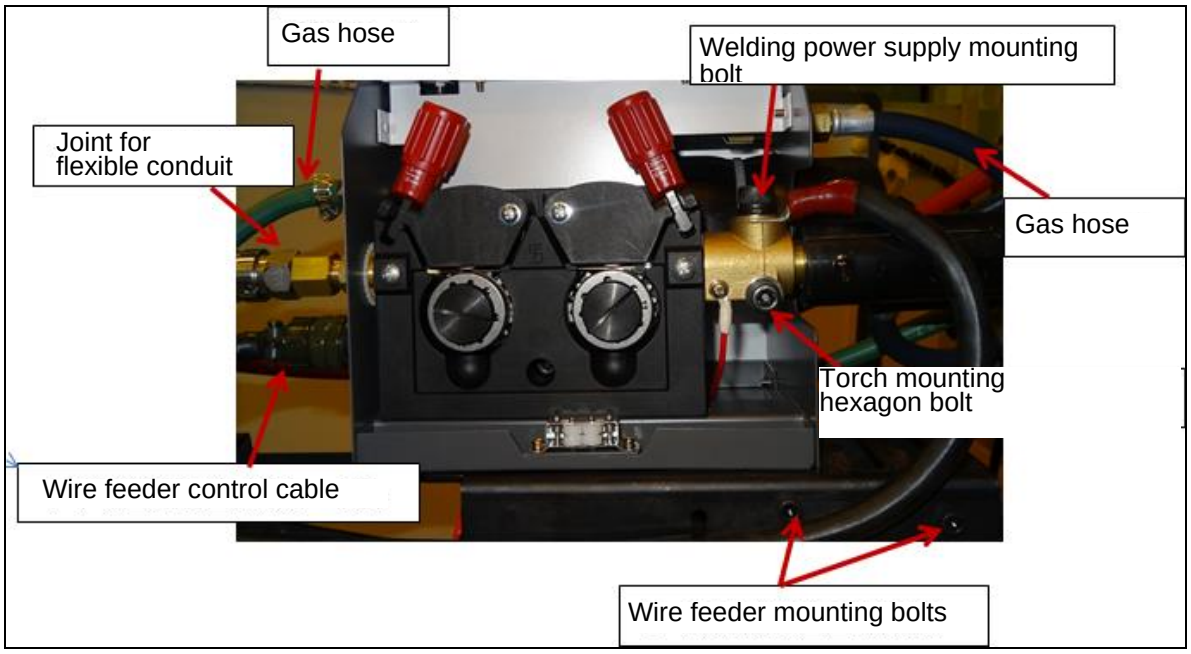


Fig. 2.2.5 (b) Connection to wire feeder

Connection of Flexible conduit

At the joint part as shown in Fig. 2.2.5 (b) connect the flexible conduit to the wire feeder.

Connection of welding power cable

Tighten the bolt as shown in Fig. 2.2.5 (b) , fix the welding power cable.

Connection of welding power cable

Connect the gas hose to the gas hose connection part as shown in Fig. 2.2.5 (b).

2.2.6 Cable Forming

Perform cable forming referring to the follow figure.

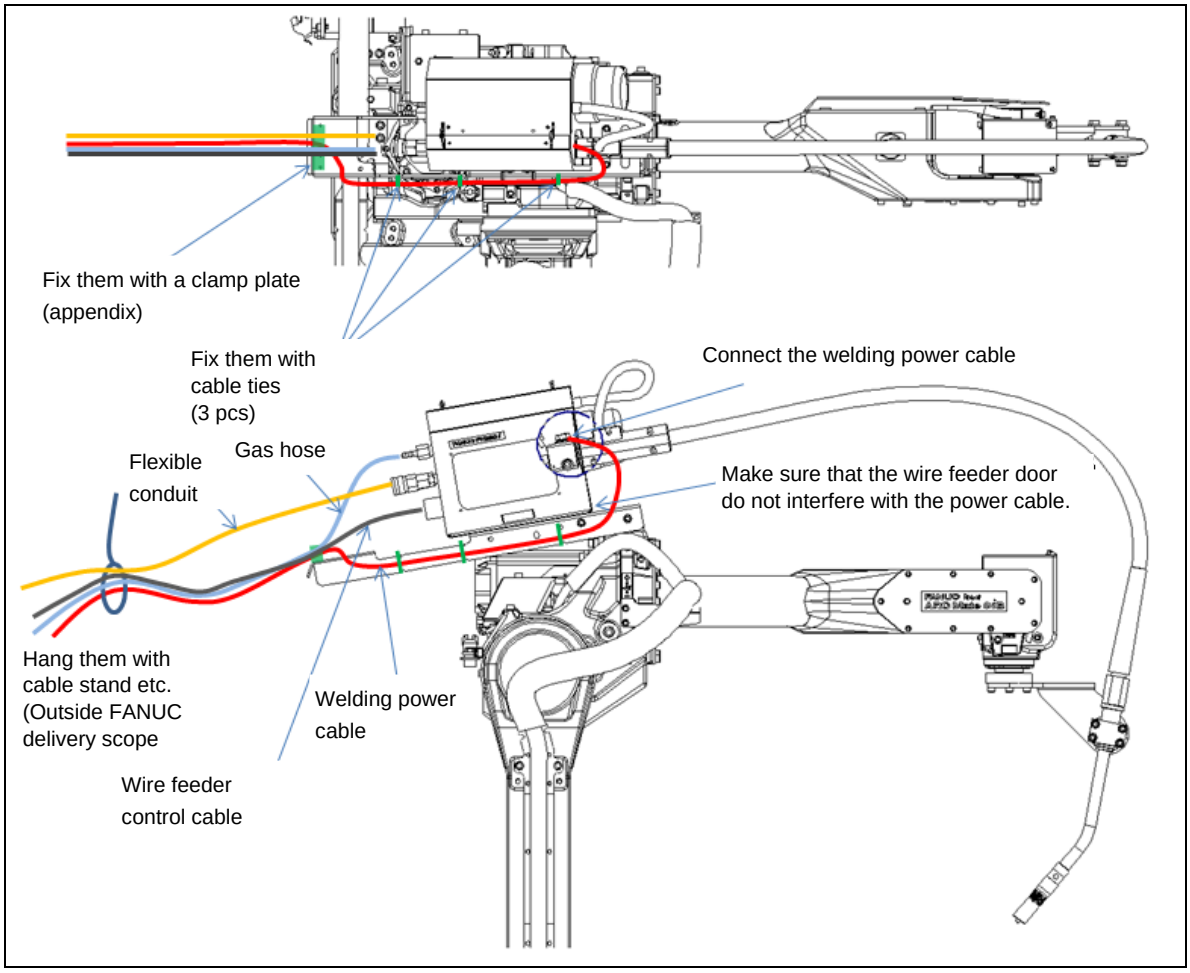


Fig. 2.2.6 (a) Cable forming example

2.3 TURNING ON THE POWER

When connection is completed, turn on the robot controller and welding power supply.
Dozens of seconds later, communication connection between robot controller and welding power supply is completed, and it becomes possible to perform the operation of welding power supply from robot controller.
Turn them on according to Procedure 2-3.

Procedure 2-3 Turning on the power

Step

1 Before turning on the power, Check working area such as robot, controller and processing cells. Confirm that the all safety devices work correctly, and working area for worker is safe.
2 Turn on the robot controller.

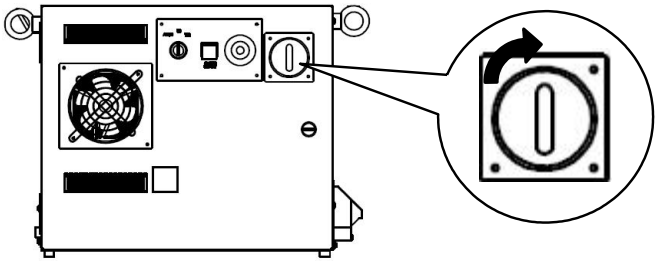


Fig. 2.3 (a) Turning on the robot controller

3 Turn on the welding power supply.

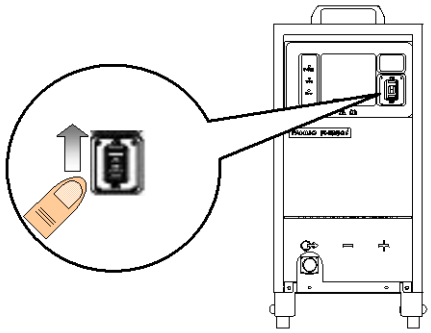


Fig. 2.3 (b) Turning on the welding power supply

4 Normally, “ARC-051 Weld EQ1 ONLINE: Ethenet/IP“ is displayed on upper part of the screen of the teach pendant when approximately dozens of seconds has passed since completion of turning on the welding power supply. (If the welding power supply is FH350i which is connected by DeviceNet cable, the message becomes “ARC-051 Weld EQ1 ONLINE: DeviceNet“.)

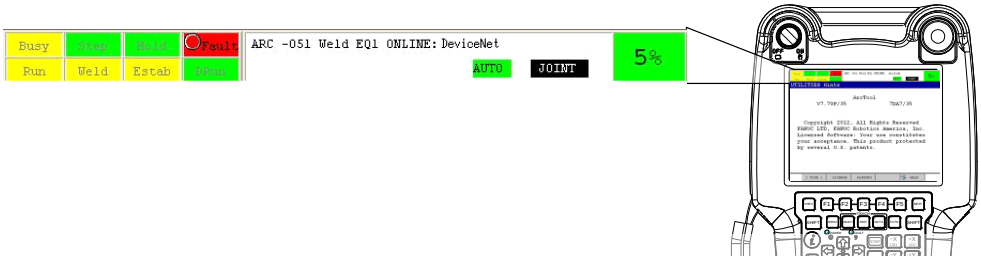


Fig. 2.3 (c) Indication of the connection completion of welding power supply and robot controller

5 If “ARC-051“ is not displayed on upper part of the screen of the teach pendant, and “ARC-045 Weld EQ Device is OFFLINE” is displayed, confirm whether connection does not have problems referring to Chapter 6 “TROUBLESHOOTING”.

> ⚠ **WARNING**
> Please cancel turning on power when you found some kind of abnormality or potential danger element. It might cause a serious accident when turning on the power by insufficient check.

2.4 MOVING THE ROBOT MANUALLY (JOGGING)

Jogging is an operation to move the robot to an arbitrary position by manipulating keys on the teach pendant. During program teaching, the positions of the robot are recorded by actually moving the robot.

> **NOTE**
> This chapter explains minimum jogging operation to move a robot.
> Please refer to Subsection 5.2.3 of OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for more details of jogging operation.

Procedure 2-4 Jogging

Step

1 If robot controller has 3 mode switch, insert key and change switch to T1 mode.
Turn on the teach pendant switch.

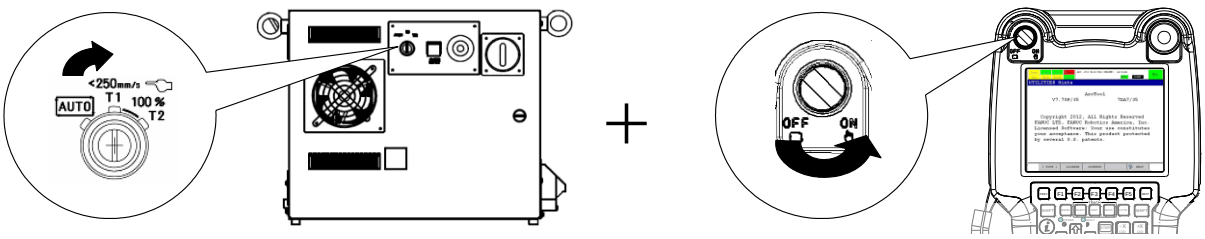


Fig. 2.4 (a) Setting of 3 mode switch and teach pendant switch

2 Decide the kind of the jogging. Kind of jobs are shown in Fig.2.4 (b). Change jogging variation by pressing manual-feed coordinate system key on teach pendant. You can confirm the present jogging by screen of Fig. 2.4 (c).

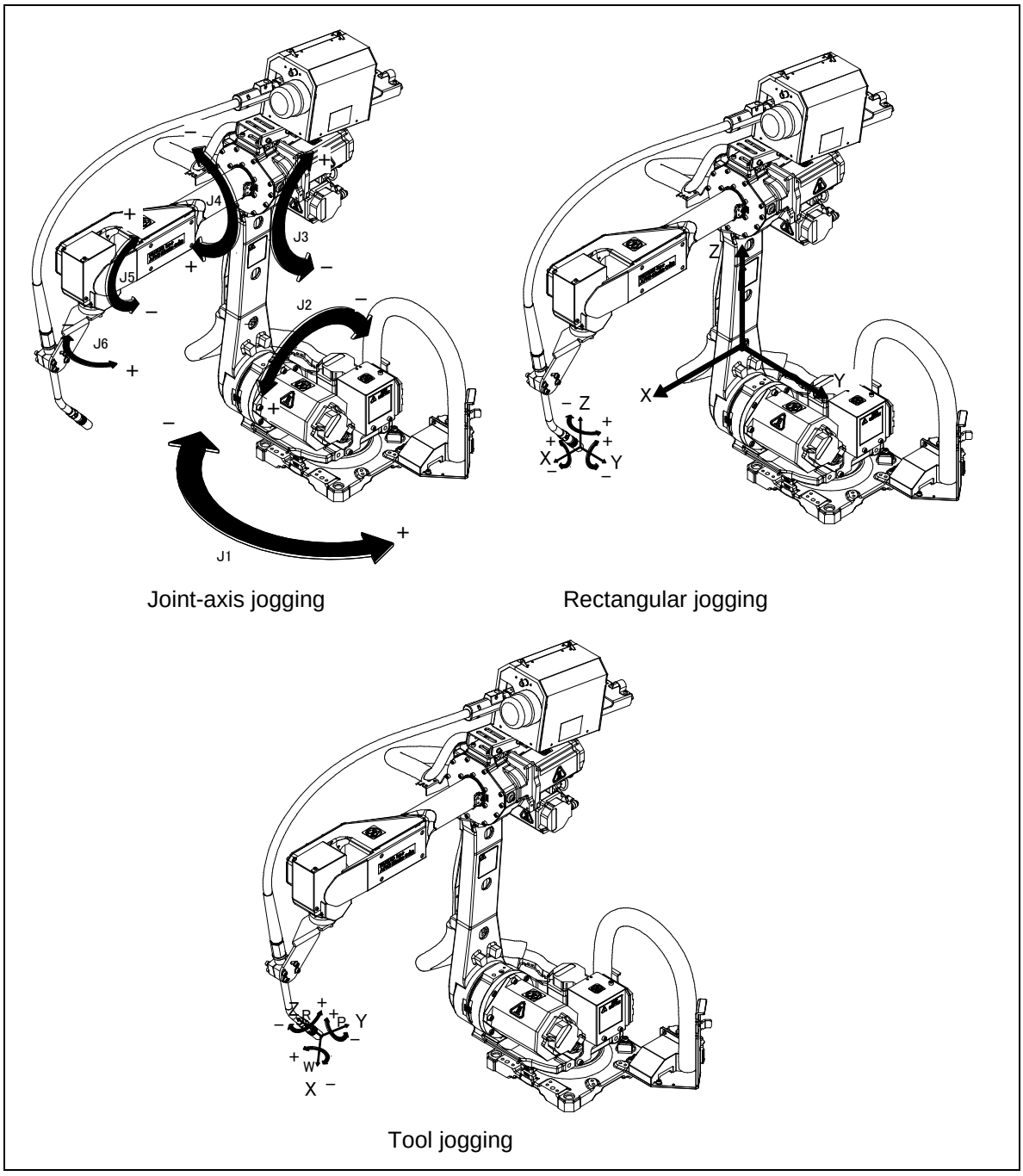


Fig. 2.4 (b) The kind of jogging

Table 2.4 (a) Jog modes (manual feed coordinate system)

Jog modes	Description
Joint jog	Directs the robot axes (joint axes) by manipulating corresponding keys on the teach pendant.
Cartesian jog	Moves the robot rectilinearly along the axes of a Cartesian coordinate system (jogging coordinate system or user coordinate system). Rotation can also be performed to change the tool posture. **The jogging coordinate system** is a Cartesian coordinate system set specifically for jogging. **The user coordinate system** is a Cartesian coordinate system set in the work space.
Tool jog	Moves the robot rectilinearly along the axes of the current tool coordinate system. Rotation can also be performed to change the tool posture. The tool coordinate system is a Cartesian coordinate system set to match the orientation of the tool.

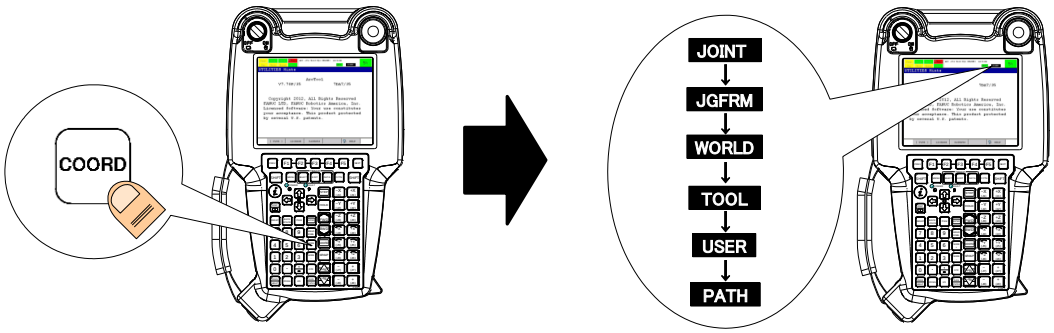


Fig. 2.4 (c) Change of jogging variation by manual-feed coordinate system key

3 Press override key on teach pendant, and decide robot motion speed.
The amount of change of the value becomes large by pressing the [SHIFT] key and override key together. Please refer to Table 2.4 (b) for details.

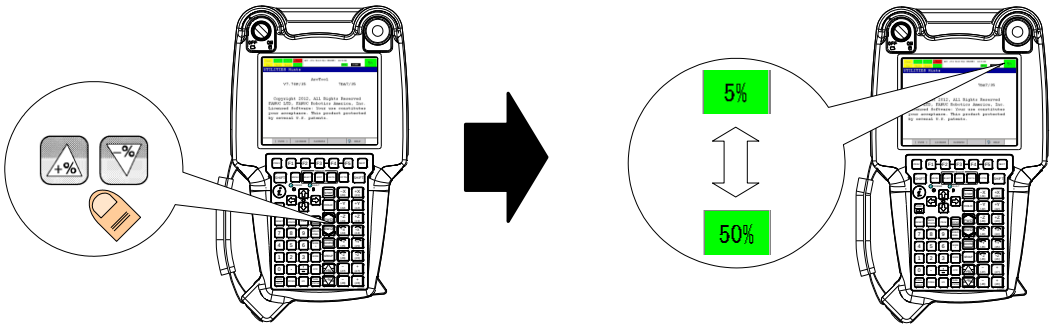


Fig. 2.4 (d) Operation of override key

Table 2.4 (b) The change of the value when override key is pressed

Override key	VFINE → FINE → 1% → 5% → 100% Steps of 1% Steps of 5%
Shift ＋ Override key	VFINE → FINE → 5% → 25% → 50% → 100%

4 Grasp the teach pendant and press deadman switch. Afterward, keep the deadman switch on while performing a jogging. When an alarm occurs, press alarm RESET key and release the alarm.

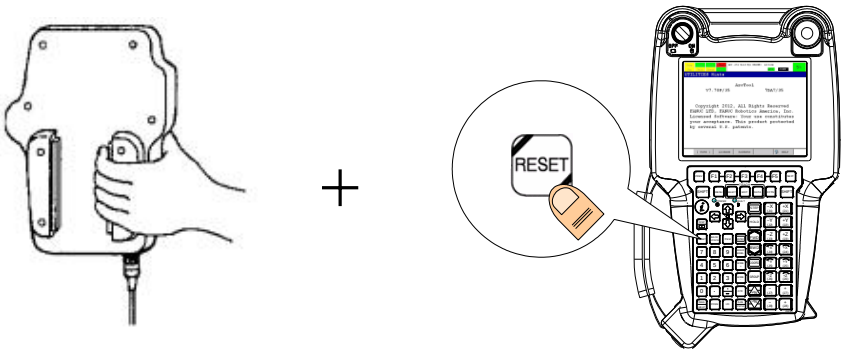


Fig. 2.4 (e) Operation of deadman switch and alarm release key

5 Execute a jogging. When the [SHIFT] key and jog key are pressed, the robot moves to the direction decided by jog mode and jog key.

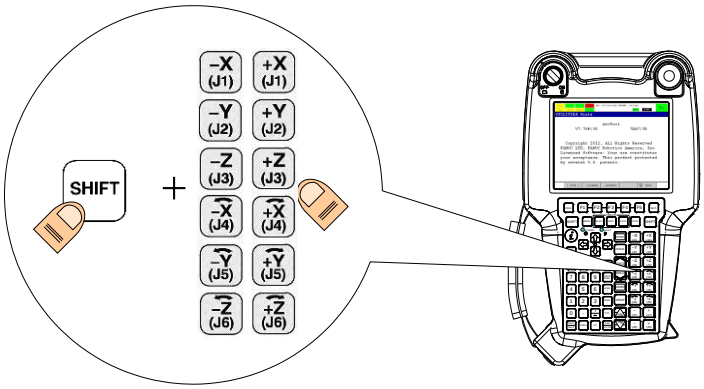


Fig. 2.4 (f) Operation of jog key

> ⚠ **WARNING**
> At the beginning of operation, please set the value of the override in low speed (10% around). If the robot speed is fast, you cannot deal with an emergency. In addition, please confirm that no person is in the work area when you start to move a robot.

2.5 CREATING WELD PROCEDURES

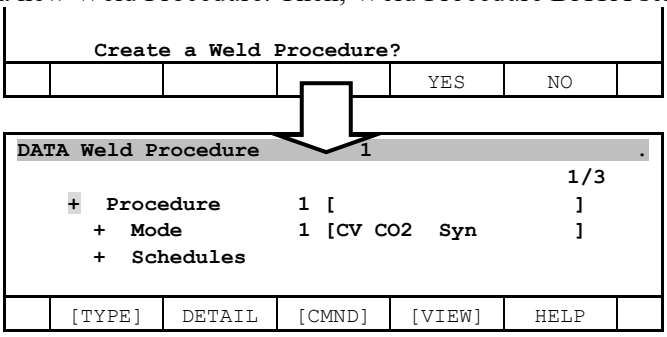
Arc welding robot manages weld setups (weld schedules, etc.) by the data units called “Weld Procedures”. On the other hand, multiple of appropriate weld control methods for the combination of wire material, wire diameter, Gas type and pulse weld are registered as “Process Mode”, and users can perform the welding with appropriate weld control method each time by selecting “Process Mode” number.
At least one Weld Procedure is necessary for performing wire inching and for specifying arc weld schedule explained later. This section explains the creating process of Weld Procedure and the allocation process between Process Mode and Weld Procedure easily.

NOTE
This section only explains the basic operation (creating new Weld Procedure) for performing arc welding. About details of Weld Procedures (the method for preparing multiple Weld Procedures, the general method for assigning Process Mode, etc.), please refer to Section 3.4, “OPERATION OF WELD PROCEDURE AND PROCESS MODE”.

Procedure 2-5 Creating Weld Procedure

Step

1 Press the [DATA] key and display DATA Weld Procedure screen. When there is no Weld Procedure, the message “Create a Weld Procedure?” is displayed on the lower position of the screen. Press F4 [YES] and create a new Weld Procedure. Then, Weld Procedure DATA screen is displayed.



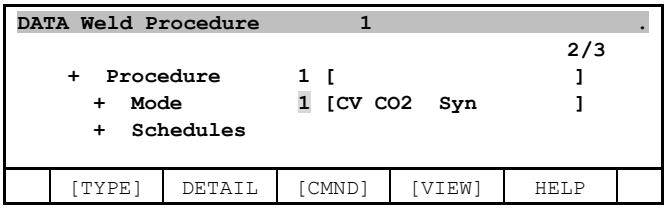
2 Next, Decide the Mode number. A process for welding is decided by this Process Mode number. In this example, CO2 welding is performed. Search the Process Mode number from Table 2.5 according to the used wire material, wire diameter and gas type.

Table 2.5 (a) Main Process Modes

Wire Material	Wire Diameter	Gas Type	Process Mode Number
Steel	1.2mm	CO2	**1**
Steel	1.2mm	MAG	**6**
Steel	1.0mm	CO2	**11**
Steel	1.0mm	MAG	**16**

NOTE
If there is no appropriate type on the table, perform Process Mode Search referring to Procedure 3-4-4 “Assignment of process mode number by searching“, or search Process Mode number from the table on Chapter 9. “Process Mode” and perform Procedure 3-4-3 “Assignment of process mode number by direct input”.

3 Move the cursor on the line of Mode number, and input the number which is decided in Step 2 (in this example, “1”) by numerical keys on Teach Pendant, and press [ENTER] key. If the number is already input, it is not necessary to change the number. After the input, yellow message box is displayed. Please select [YES] and [OK]. Specified Process Mode number is applied to Weld Procedure.



2.6 WIRE INCHING / RETRACT

It is possible to perform wire inching/retract by key operations on Teach Pendant. By this operation, you can pass a wire through a conduit or can adjust wire stickout. Please refer to the following Procedure 3-6.

Procedure 2-6 Manual Wire Inching

Step

1 Press the [WIRE+] key on Teach Pendant. Wire is fed while pressing the key.

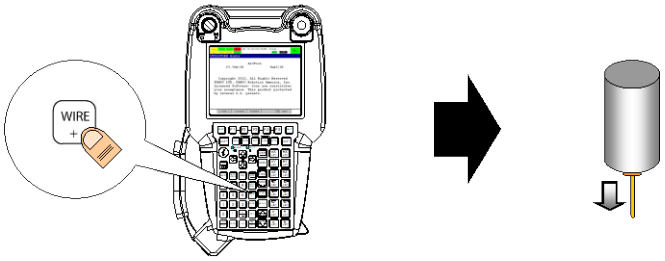


Fig. 2.6 (a) Wire Inching

2 Press the [WIRE-] key on Teach Pendant. Wire is retracted while pressing the key.

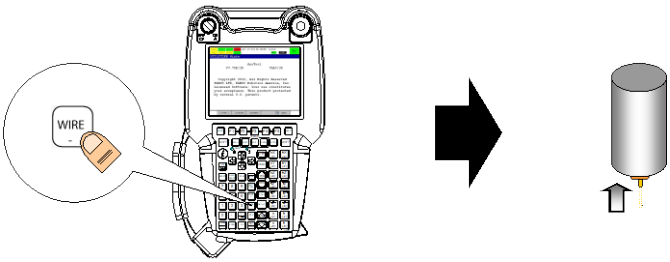


Fig. 2.6 (b) Wire Retract

3 Press the [WIRE+] key while pressing the [SHIFT] key on Teach Pendant. Wire is fed with low speed for 2 seconds since pressing the [WIRE+] key. After 2 seconds since pressing the [WIRE+] key, wire feed speed becomes high.

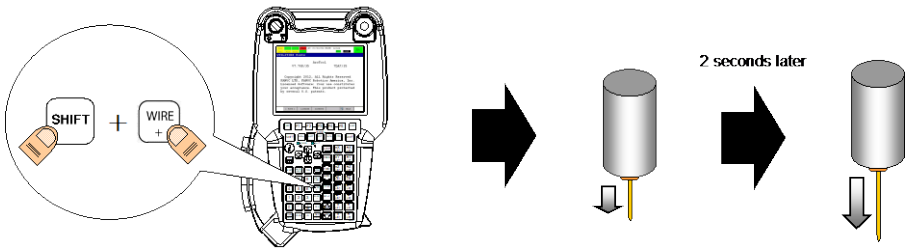


Fig. 2.6 (c) High Speed Wire Inching

> **⚠ CAUTION**
> Do not perform wire inching when wire is stuck to the tip, or when wire is clogged up.

2.7 CREATING MOTION PROGRAM

Next, create a program for arc welding. As an easier arc welding program, the creating procedure of a sample program of arc welding for a lap joint like the following is explained. In this section, the creation of robot motion part of the program is explained. Move the robot manually referring Section 2.4, and save 5 positions of the right figure of Fig. 2.7 (a) to the motion program. Please refer to Procedure 2-7.

```
ARC_WELD                                    7/7
   1:J  P[1] 10% CNT100          Move to reference position
   2:L  P[2] 100mm/sec CNT100    Move to approach position
   3:L  P[3] 100mm/sec FINE      Move to Weld Start position
   4:L  P[4] 60cm/min FINE       Move to Weld End position
   5:L  P[5] 100mm/sec CNT100    Move to escape position
   6:J  P[1] 10% FINE            Return to reference position
[End]
```

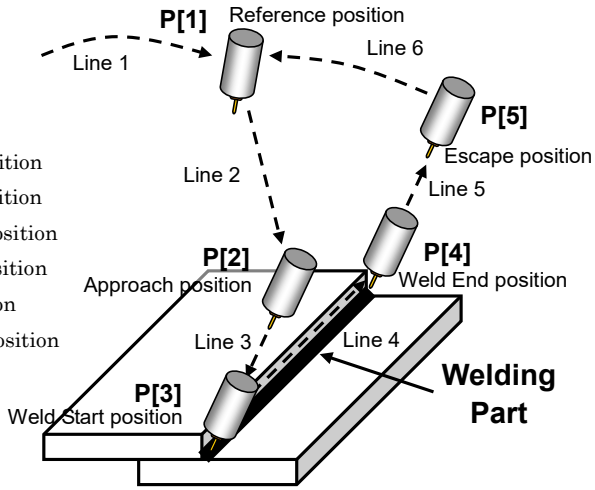


Fig. 2.7 (a) Sample Program

> **NOTE**
> This section explains the basic operation for creating sample program. If you would like to know more details about program edit, please refer to Section 3.3 “EDITING OPERATION OF PROGRAM”.

Procedure 2-7 Creating Motion Program

Step

1 Set a workpiece for arc welding on the place electrified to the weld power cable (-). In this timing, Please fix the workpiece tightly to prevent a gap during the program creation.

2 Adjust the wire stickout by wire inching operation. Recommended stickout is “12mm” for 1.0mm wire diameter, or “15mm” for 1.2mm wire diameter.

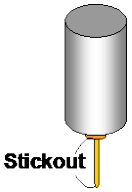
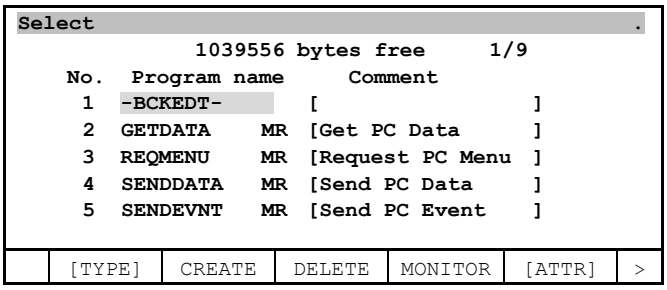
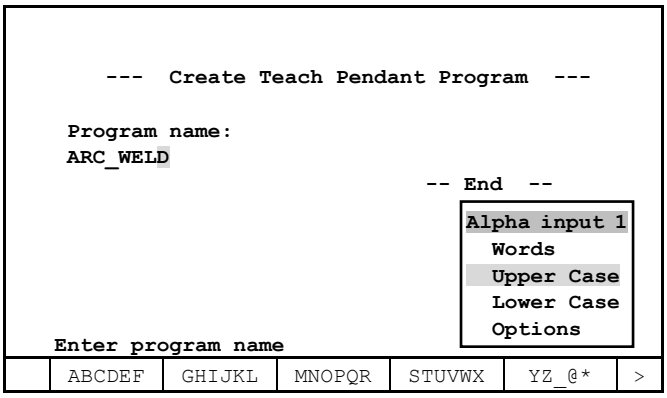


Fig. 2.7 (b) Adjustment of Wire Stickout

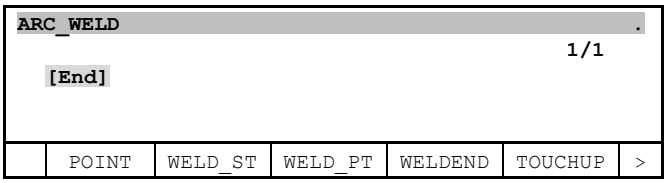
3 Press the [MENU] key on a teach pendant. Following Program List screen is displayed.



4 Press F2[CREATE] key. A screen for entering program name is displayed. Additionally, a list of [Alpha input 1] is displayed at the lower left. In this operation example, define the sample program name as “ARC_WELD”. Move the cursor on “Upper Case” and enter the program name by using F1-F5 function keys.

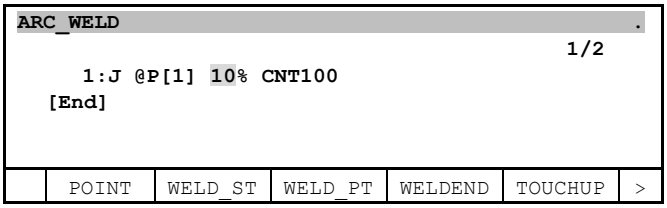


5 After finishing the input of program name, press the [ENTER] key. After that, press F3[EDIT] and complete the input of program name. The screen is automatically moved to Program Edit screen.



6 Move the robot on the reference position by jogging. Any places are allowed if there is no obstacle between this position and Weld Start position.

7 Teach a motion instruction for moving to the reference position. Press F1[POINT] when the cursor is placed on [End]. Select “2 J P[] 100% CNT100” from a displayed list. Next, move the cursor on a value “100” in 100%, and then enter “10” by numerical keys, and press ENTER key.



8 Jog the robot to an appropriate posture for welding, and then jog the robot to the position that is diagonally upper 100mm away from Weld Start position (approach position).

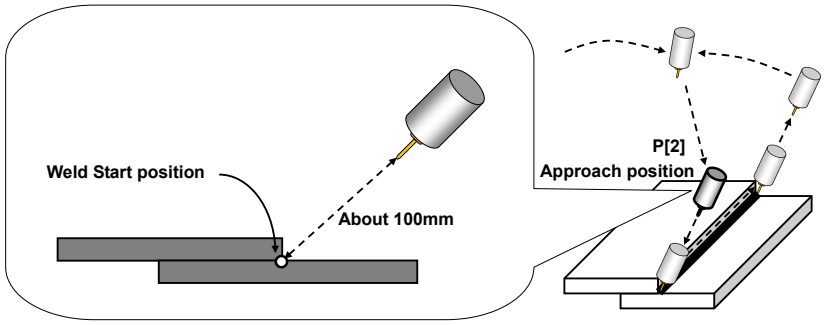
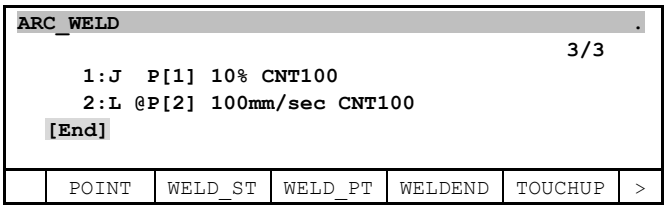


Fig. 2.7 (c) Jog to Approach Position

9 Teach a motion instruction for moving to the approach position. Press F1[POINT] when the cursor is placed on [End]. Select “4 L P[] 100mm/sec CNT100” from a displayed list.



10 Jog the robot to Weld Start position.

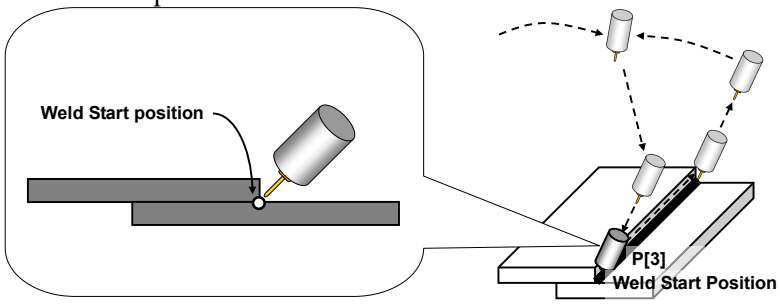
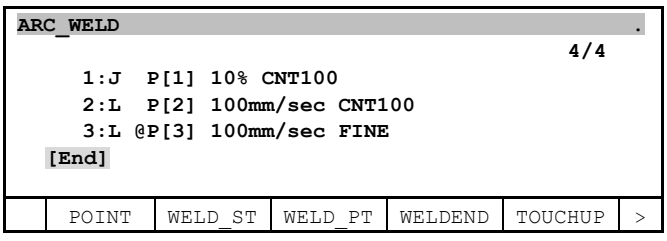


Fig. 2.7 (d) Jog to Weld Start Position

11 Teach a motion instruction for moving to Weld Start position. Press F1[POINT] when the cursor is placed on [End]. Select “3 L P[] 100mm/sec FINE” from a displayed list.



12 Jog the robot to Weld End position.

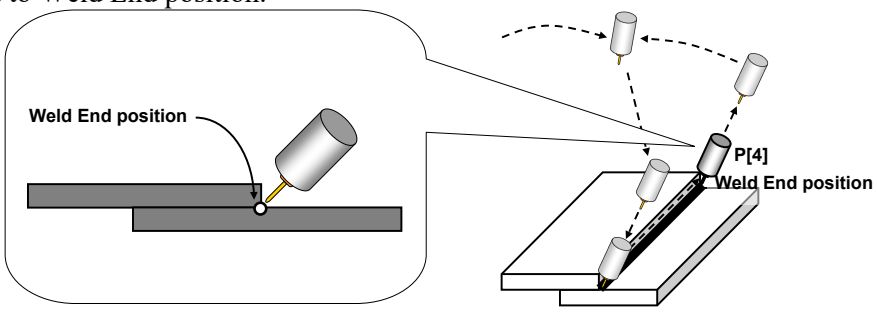


Fig. 2.7 (e) Jog to Weld End Position

13 Teach a motion instruction for moving to Weld End position. Press F1[POINT] when the cursor is placed on [End]. Select “3 L P[] 100mm/sec FINE” from a displayed list.

```
ARC_WELD                                                .
                                                      5/5
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
     4:L @P[4] 100mm/sec FINE
   [End]

   | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

14 Next, input weld speed. The motion speed on the motion instruction for moving from Weld Start position to Weld End position becomes weld speed. Move the cursor on “100” value and press F4[CHOICE] key. Select “cm/min” from the displayed list. Then, enter “60” by numerical keys.

```
ARC_WELD                                                .
                                                      5/5
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
     4:L @P[4] 60cm/min FINE
   [End]
   | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

15 Jog the robot to the position that is diagonally upper 100mm away from Weld End position (escape position).

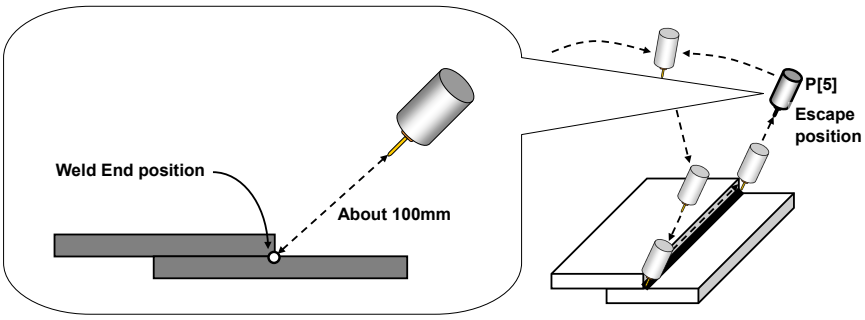


Fig. 2.7 (f) Jog to Escape Position

16 Teach a motion instruction for moving to the escape position. Press F1[POINT] when the cursor is placed on [End]. Select “4 L P[] 100mm/sec CNT100” from a displayed list.

```
ARC_WELD                                                .
                                                      6/6
     1:J  P[1] 10% CNT100
     2:J  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
     4:L  P[4] 60cm/min FINE
     5:L @P[5] 100mm/sec CNT100
   [End]
   | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

17 Teach a motion instruction for returning to the reference position. Press F1[POINT] when the cursor is placed on [End]. Select “1 J P[] 100% FINE” from a displayed list. Next, move the cursor on a value “6” in P[6] and input “1” by numerical key, and press the [ENTER] key. Move the cursor on a value “100” in 100% and input “10” by numerical keys, and then press the [ENTER] key.

```
ARC_WELD                                                    .
                                                        6/7
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
     4:L  P[4] 60cm/min FINE
     5:L @P[5] 100mm/sec CNT100
     6:J  P[1] 10% FINE
  [End]

   | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

NOTE
This section explains one operation example for creating easy sample program. However, you can create a sample program even if you do not follow the operation in this section. About details of program edit, please refer to Section 5.4 in OPERATOR'S MANUAL (Basic Operation) (B-83284EN).

2.8 SPECIFY ARC WELD SCHEDULE

It is impossible to achieve arc welding by only the motion program created on Section 2.7. For achieving arc welding, it is necessary to specify an arc weld schedule by using Weld Procedure created on Section 2.5, and also necessary to specify this schedule on Weld Start and Weld End instructions.
Arc welding robot performs arc welding on the section between Weld Start and Weld End instructions.

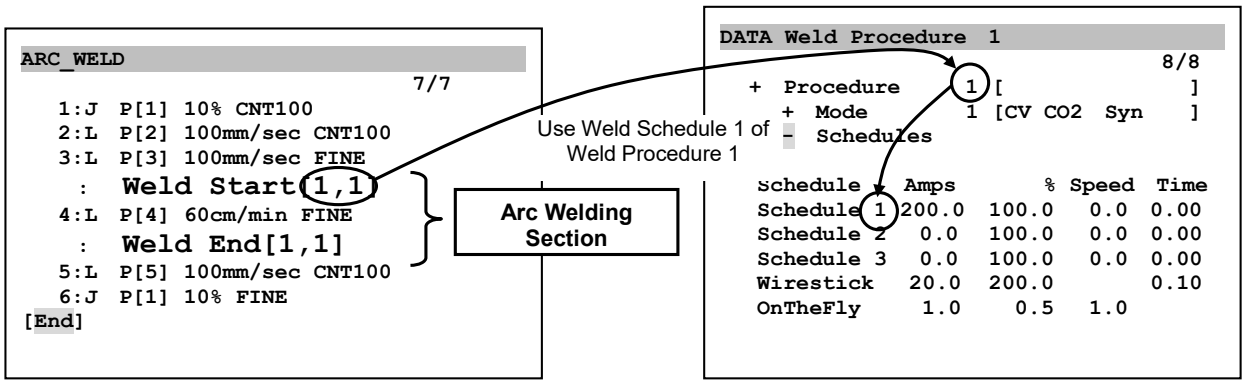


Fig. 2.8 (a) Relationship between Sample Program and Arc Weld Schedule

NOTE
This section explains the basic operation for operating arc weld instructions. If you would like to know more details about arc weld instructions, please refer to Section 3.6 "TEACHING AND EDITING OF ARC WELD INSTRUCTION".

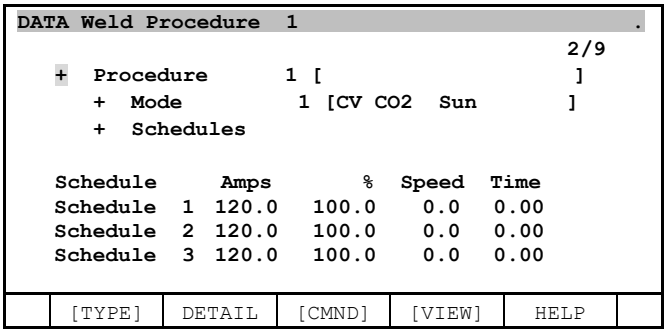
Procedure 2-8 Specify Arc Weld Schedule

Step

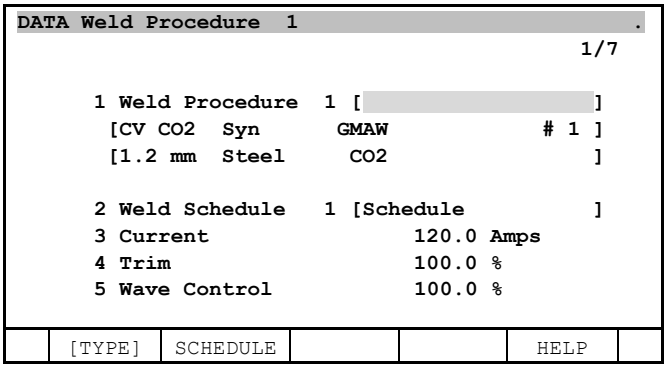
1 Press the [DATA] key and display Weld Procedures screen.

```
DATA Weld Procedure  1                                      .
                                                        1/3
   +  Procedure      1 [                                 ]
     +  Mode         1 [CV CO2  Syn                      ]
     +  Schedules

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

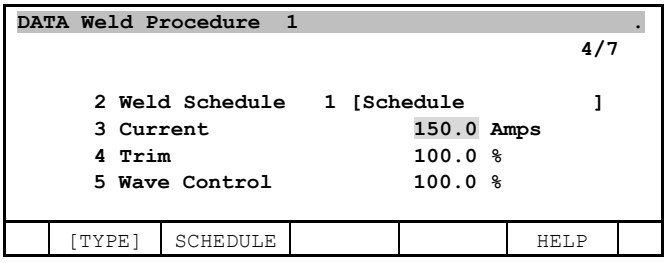
2 Move the cursor on "+" at the left of "Schedules" and press the [ENTER] key. A list of weld schedules is displayed.



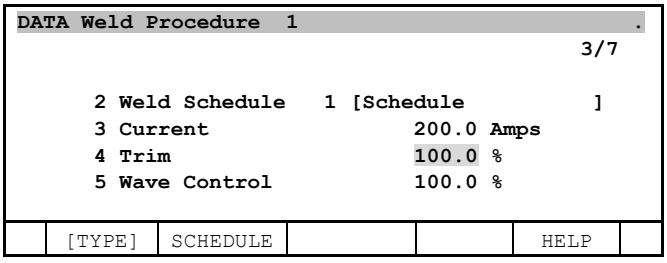
3 Move the cursor on unused weld schedule (in this example, Weld Schedule 1), and press F2[DETAIL]. Detail screen for the weld schedule is displayed.



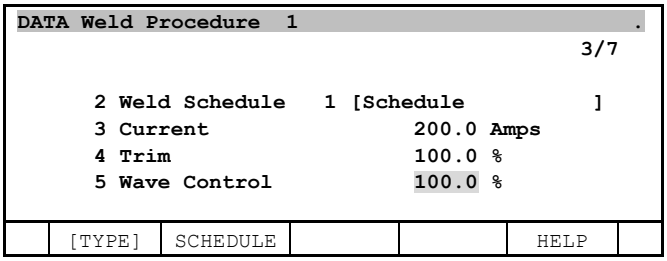
4 In this example, specify the current "150A" as the weld schedule. Move the cursor on the line of "Current" and input "150" by numerical keys, and then press the [ENTER] key.



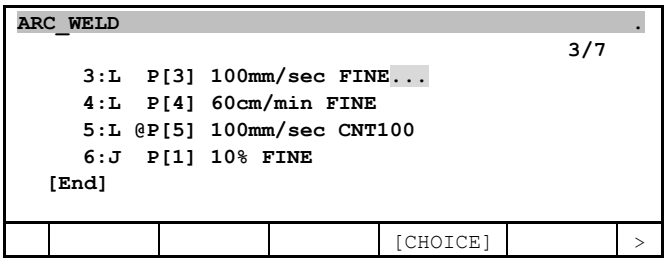
5 Next, input Trim. Move the cursor on the line of "Trim" and input "100". If it has already become 100%, no operation is required.



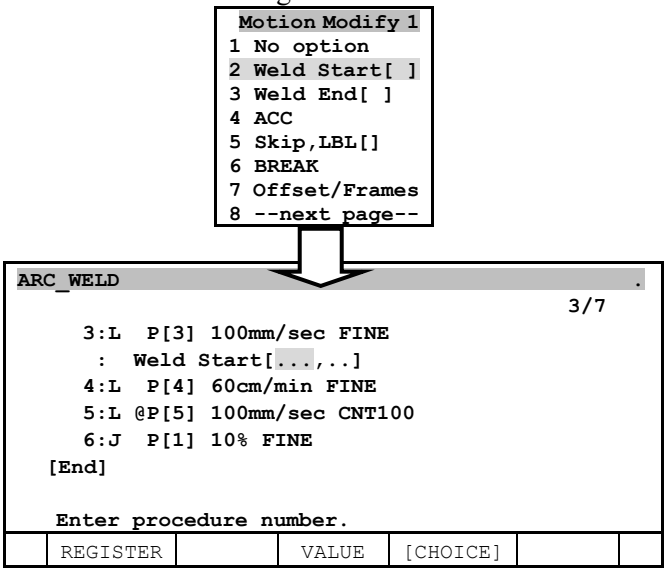
6 Next, input Wave Control. Move the cursor on the line of “Wave Control” and input “100”. If it has already become 100%, no operation is required.



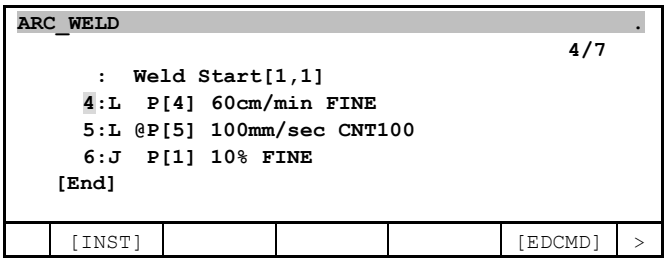
7 Display the edit screen of the motion program created on Procedure 2-7. Press EDIT key, or press the [SELECT] key and select the sample program name which was set by Step 4 in Procedure 2-7 (in this example, ARC_WELD). Then, move the cursor on a blank part just behind “FINE” on line 3.



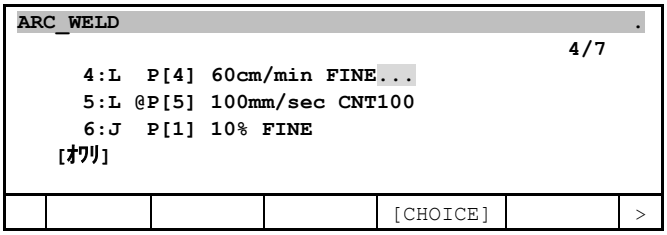
8 Press F4[CHOICE]. The list of additional motion instructions are displayed. Select “Weld Start[]” from the list. Weld Start instruction is taught at the last of line 3.



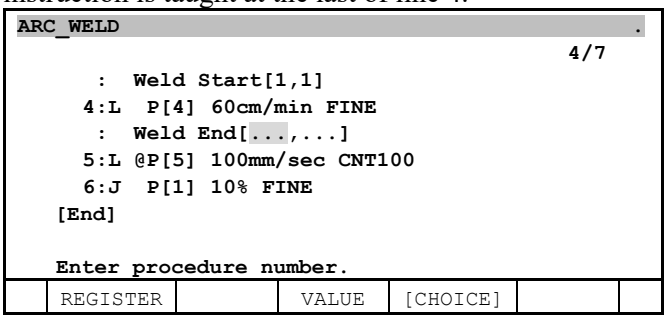
9 Input the Weld Procedure number (in this example, 1) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 4 (in this example, 1) to the second argument.



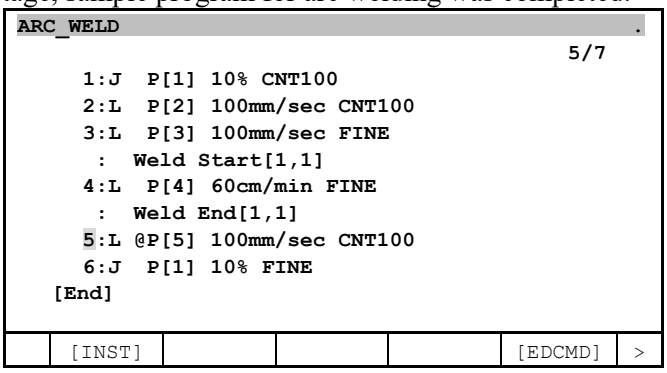
10 Next, move the cursor on a blank part just behind “FINE” on line 4.



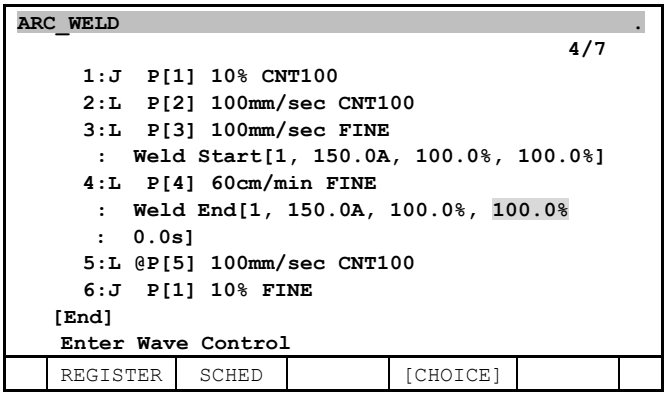
11 Press F4[CHOICE]. The list of additional motion instructions is displayed. Select “Weld End[]” from the list. Weld End instruction is taught at the last of line 4.



12 Input the Weld Procedure number (in this example, 1) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 4 (in this example, 1) to the second argument. In this stage, sample program for arc welding was completed.



13 You can directly specify command voltage and current parameters for arc weld schedule in Weld Start/Weld End instructions on Program Edit screen. Move the cursor on the argument part in Weld Start instruction and press F3[DIRECT]. It becomes possible to input parameters like voltage and current to Weld Start instruction directly. In this example, same values with Step 4, 5 and 6 are specified. Then, specify same values to Weld End instruction, too.



> **NOTE**
> The operation procedure in this section assumes the status just after factory shipment. If Weld Procedures or weld schedules have already been set, please perform the copy of Weld Procedure (refer to Section 3.4) or use unused weld schedule for preventing the change of existing setup.

2.9 MANUAL OPERATION FOR WELDING

As preparations for arc welding, following weld-related manual operations are required.

- Gas Check
- Switching Weld Enabled/Disabled

Gas Check

Open the valve for shield gas and check a gas pressure and a gas flow before performing arc welding.

Procedure 2-9 (a) Manual gas check

Step

1 Press the [GAS/STATUS] key once while pressing the [SHIFT] key on Teach Pendant. Gas is left out from the top of the torch. When 5 seconds have passed, the gas flow stops automatically.

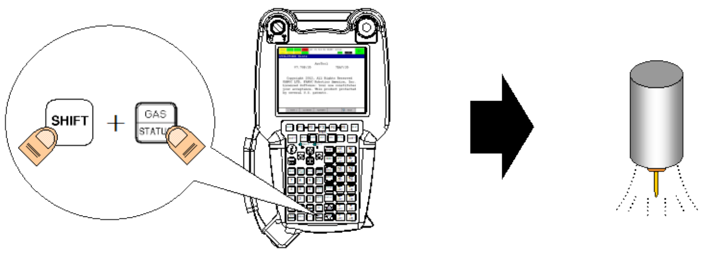


Fig. 2.9 (a) Gas Check by Gas Purge Key Operation

2 During the gas flow, you can also stop the gas flow manually by pressing the [GAS/STATUS] and the [SHIFT] key simultaneously again before passing Gas Purge Time.

3 If you would like to change the gas purge time from 5 seconds, please perform the following steps. Press [MENU] key and select “6 SETUP”. Then, press F1[TYPE] and select “Weld System”. Weld System Setup screen is displayed.

```
SETUP Weld System                                    .
                                               1/19
        NAME                      VALUE
   Monitoring Functions
     1 Arc loss:                  ENABLED
     2 Gas shortage:              DISABLED
     3 Wire shortage:             DISABLED
     4 Wire stick:                ENABLED
     5 Power supply failure:      ENABLED

   [TYPE]                         ENABLED  DISABLED
```

4 Move the cursor below on the screen, and move the cursor on “Gas Purge Time”. Then, input appropriate time by numerical keys and press the [ENTER] key.

```
SETUP Weld System                                        .
                                                    19/19
    15 Weld from teach pendant: ENABLED
    16 Remote gas purge:        DISABLED
    17 Remote wire inch:        DISABLED
    18 Gas purge key:           ENABLED.
    19 Gas purge time:          20   sec

 |  | [TYPE] |  |  | ENABLED | DISABLED |  |
```

Switching Weld Enabled/Disabled

Arc welding can be performed with Weld Enabled status when arc weld instruction is executed. On the other hand, arc welding is never performed with Weld Disabled status even when arc weld instruction is executed. Switching operation of Weld Enabled/Disabled is achieved by the following procedure.

Procedure 2-9 (b) Switching Weld Enabled/Disabled

Step

1 Press [WELD ENBL] key while pressing the [SHIFT] key on Teach Pendant. “Weld” software LED on Teach Pendant is switched to yellow and green alternately.

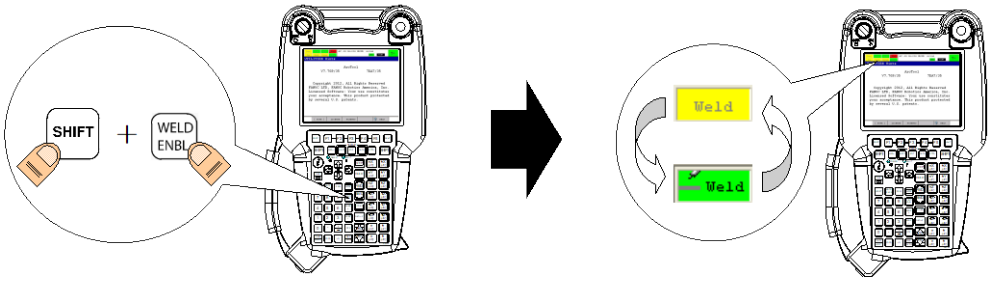


Fig. 2.9 (b) Switching Operation of Weld Enabled/Disabled by WELD ENBL Key

2 When “Weld” software LED is yellow, arc welding is not performed even if arc weld instruction is executed. When “Weld” software LED is green, arc welding is performed if arc weld instruction is executed.

2.10 TEST OPERATION

Before performing arc welding, test operation is required for the motion check of created program. Test operation has step operation and continuous operation. Normally, step operation is performed first, and then continuous operation is performed next.

Procedure 2-10 (a) Step Operation

Step

1 Grasp Teach Pendant, press dead man switch and turn the Enable switch on Teach Pendant ON.

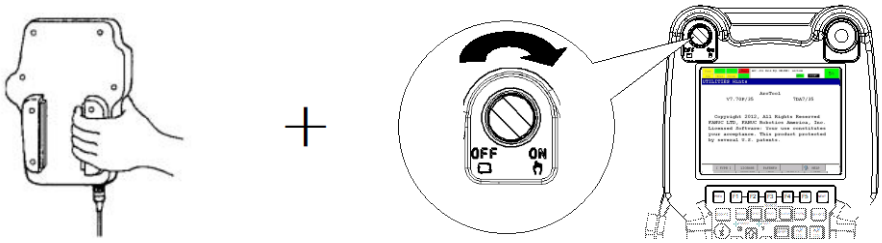


Fig. 2.10 (a) Operation of Dead Man Switch and Teach Pendant Enable Switch

2 Set the robot speed during program execution by override keys.

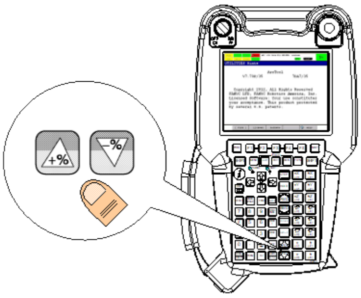


Fig. 2.10 (b) Setup of Override

> ⚠ **WARNING**
> Please set the value of the override in low speed (10% around). If the speed of the robot is fast, you cannot deal with an emergency.

3 Display the edit screen of the arc welding program created by Procedure 2-7. Press EDIT key, or press SELECT key and select the sample program name which was set by Step 4 in Procedure 2-7 (in this example, ARC_WELD). Then, move the cursor on the top of line 1.

```
ARC_WELD
                                        1/7
     1:J   P[1] 10% CNT100
     2:L   P[2] 100mm/sec CNT100
     3:L   P[3] 100mm/sec FINE
      :   Weld Start[1,1]

   [INST]                    [EDCMD]  >
```

4 Press STEP key and set "Step" software LED on Teach Pendant to yellow status.

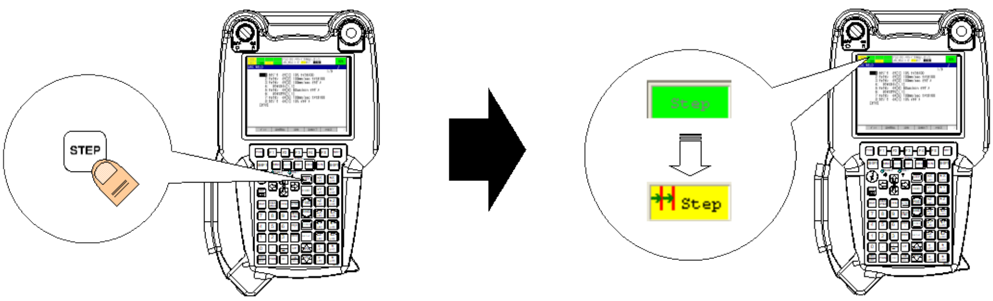


Fig. 2.10 (c) Switch to Step Mode

> ⚠ **WARNING**
> Program instructions will be executed and the robot will move by the next step. The robot may perform unexpected motion by program contents. Please check that there is no person in the working area and please check there is no needless equipment sufficiently. Additionally, during next or later steps, if you would like to pause the program before the program execution completes, please release the [SHIFT] key or dead man switch, or please press [HOLD] key or Emergency Stop button.

5 Start the program execution. Press the [FWD] key while pressing the [SHIFT] key. After the robot starts to move, release only the [FWD] key, but keep the [SHIFT] key pressed. The robot stops after the robot arrives at the taught position of line 1. The cursor on Teach Pendant moves on the line 2 of the program.

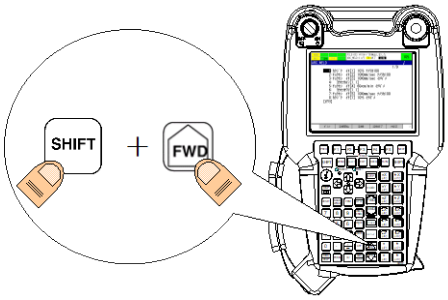


Fig. 2.10 (d) Step Operation of Program

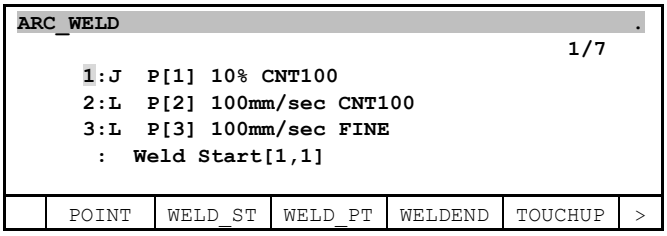
6 When the [FWD] key is pressed while pressing the [SHIFT] key again, the execution of line 2 on the program is started. Please check the motion path of the robot by repeating the operation.

NOTE
Arc weld instructions are never executed during Step Operation. Therefore, arc welding is not performed even with Weld Enabled status.

Procedure 2-10 (b) Continuous Operation

Step

1 Move the cursor on the top of line 1.



2 Set continuous operation mode. Press the [STEP] key and set “Step” software LED on Teach Pendant to green status.

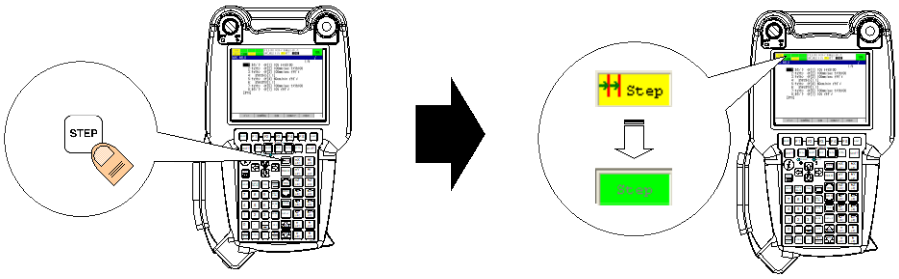


Fig. 2.10 (e) Switch to Continuous Operation Mode

3 Set Weld Disabled status. Press the [WELD ENBL] key and set “Weld” software LED on Teach Pendant to yellow status.

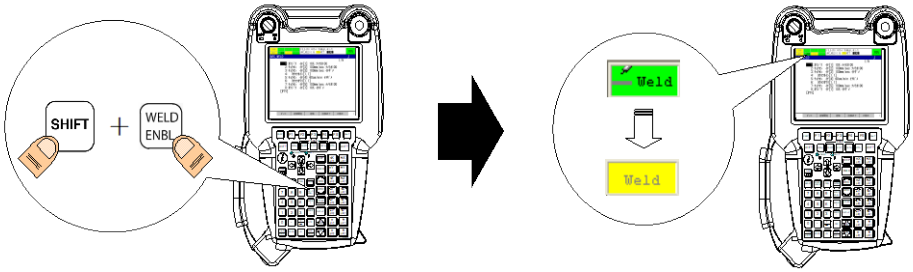


Fig. 2.10 (f) Switch to Weld Disabled

4 Set the robot speed during program execution by override keys.

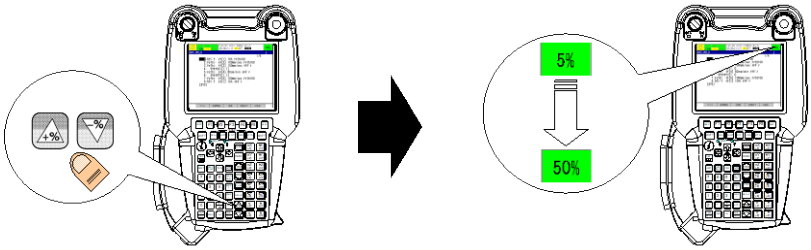


Fig. 2.10 (g) Setup of Override

5 Start the program execution. Press the [FWD] key while pressing the [SHIFT] key. After the robot starts to move, release only [FWD] key, but keep the [SHIFT] key pressed. The program is continuously executed to the last line without stop. This is the different point between continuous operation and step operation.

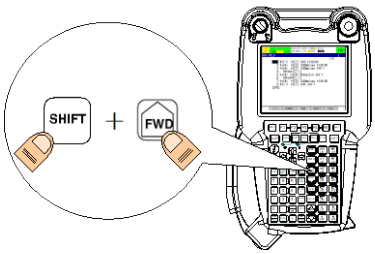


Fig. 2.10 (h) Continuous Execution of Program

2.11 EXECUTION OF WELD PROGRAM

For executing arc welding, the program must be executed with Weld Enabled status, 100% override and continuous operation. Please refer to the following Procedure 2-11.

Procedure 2-11 Execution of Weld Program

Step

1 Set Weld Enabled status. Press the [WELD ENBL] key and set “Weld” software LED on Teach Pendant to green status.

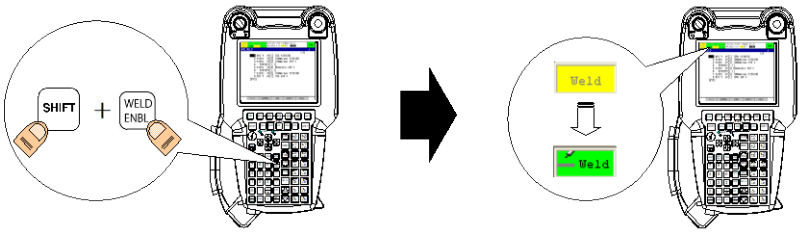


Fig. 2.11 (a) Switch to Weld Enabled

2 Set 100% override by override key.

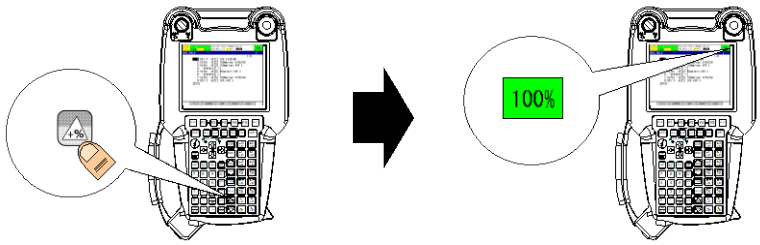


Fig. 2.11 (b) Set 100% Override

3 Move the cursor on the top of line 1 and then perform the program execution.

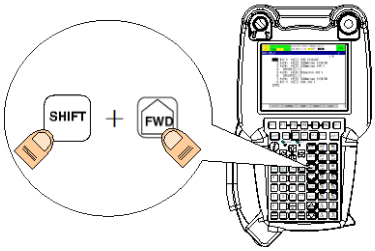


Fig. 2.11 (c) Continuous Operation of Weld Program

4 Arc welding is performed when the motion instruction that is put between Weld Start and Weld End instructions is executed.

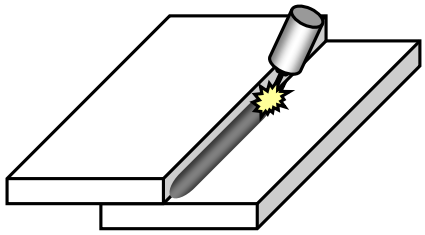


Fig. 2.11 (d) Execution of Arc Welding

NOTE
1 If Weld Start instruction is executed without 100% override, “ARC-033 Override must be 100% to weld” alarm is posted and the program pauses. In this case, please change override to 100% and then perform program execution again.
2 If arc is not generated at Weld Start position, “ARC-013 Arc Start failed” alarm is posted and the program pauses. Then, please investigate the cause of arc failure referring to Chapter 6 “TROUBLE SHOOTING”.

3 BASIC OPERATION

This Chapter describes about robot basic operation except contents which are already described in Chapter 2 “QUICK REFERENCE”.

3.1 SETTING OF I/O FOR FANUC WELDING POWER SUPPLY

Robot Controller and FANUC welding power supply perform digital communication by I/O of DeviceNet or EtherNet/IP.

Normally, communication with FANUC welding power supply requires no setting because the communication I/O is automatically set at the first communication between the robot controller and the welding power supply.
Please refer to this section if I/O assignment change is required by the addition of other communication board (DeviceNet board, CC-link board etc.) or the re-arrangement of I/O port numbers.

> ⚠ **WARNING**
> When wrong I/O assignment is done, FANUC welding power supply cannot be controlled properly. Additionally, welding cannot be executed correctly and the system might do unexpected behaviors by erroneous motions.

3.1.1 Default Setting of Communication I/O for FANUC Welding Power Supply

Following I/O signals are reserved for communication with FANUC welding power supply as default.

- Digital Output(DO):385 – 512 (Total 128 points)
- Digital Input(DI): 385 – 512 (Total 128 points)
- Group Output(GO): 51 – 58 (Total 8 points)
- Group Input(GI): 51 – 58 (Total 8 points)

The reserved I/O signals as above for FANUC welding power supply are called “Weld I/O”. These have some functions. The state of each Weld I/O signal can be confirmed in the Weld I/O screen. In default setting, the state of them is following.

List of I/O signals

(\[MENU\]key → I/O → Weld → Switch IN/OUT screens by F3:IN/OUT key)

I/O Weld In 1/10

	WELD SIGNAL	TYPE	#	SIM	STATUS
1	[Current]	GI[52]	U		0.0
2	[Voltage]	GI[53]	U		0.0
3	[Wire feed]	GI[54]	U		0.0
4	[Arc detect]	DI[386]	U		OFF
5	[Power fault]	GI[51]	U		0
6	[Wirestick]	DI[393]	U		OFF
7	[Gas fault]	[****]	*		***
8	[Wire fault]	[****]	*		***
9	[Water fault]	[****]	*		***
10	[Arc enable]	[****]	*		***

I/O Weld Out 1/11

	WELD SIGNAL	TYPE	#	SIM	STATUS
1	[Current]	GO[51]	U		0.0
2	[Trim]	GO[52]	U		0.0
3	[Wave control]	GO[53]	U		0.0
4	[Wire inch]	GO[51]	U		0.0
5	[Weld start]	DO[386]	U		OFF
6	[Gas start]	DO[390]	U		OFF
7	[Inch forward]	DD[391]	U		OFF
8	[Inch backward]	DO[389]	U		OFF
9	[Wire stick cmd]	DO[388]	U		OFF
10	[Wire stick alarm]	[****]	*		***
11	[Weld EQ ready]	[****]	*		***

Fig. 3.1.1 (a) Weld I/O screen for FANUC Welding Power Supply

> ⚠ **CAUTION**
> Do not change weld I/O signal to SIM mode. If arc welding is executed with SIM mode of weld I/O signal, there is a case that the welding is not performed correctly.

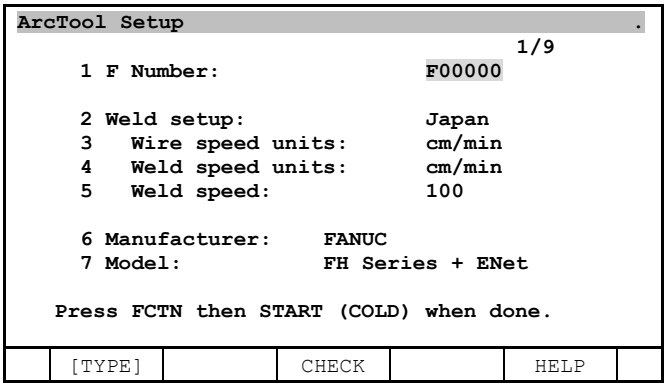
3.1.2 Change Communication DI/O Numbers for FANUC Welding Power Supply

Please follow Procedure 3-1-2 whenever you change the assignment of DI/O to communicate with FANUC welding power supply. Do not set on digital I/O screen directly.

Procedure 3-1-2 Change communication DI/O numbers for FANUC welding power supply

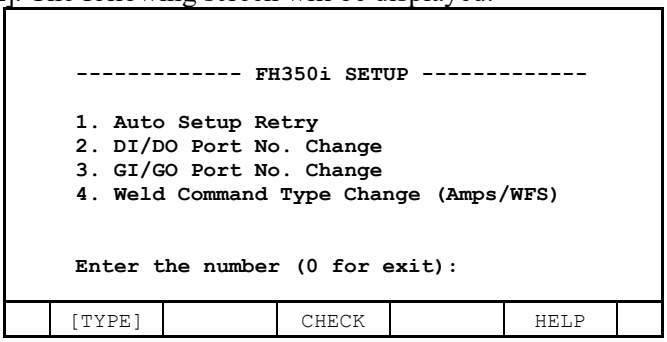
Condition

- Controlled Start has been performed and the following ArcTool Setup screen will be displayed.
- "FANUC" is set to Manufacturer, and "FH Series + DNet" or "FH Series + ENet" is set to Model.

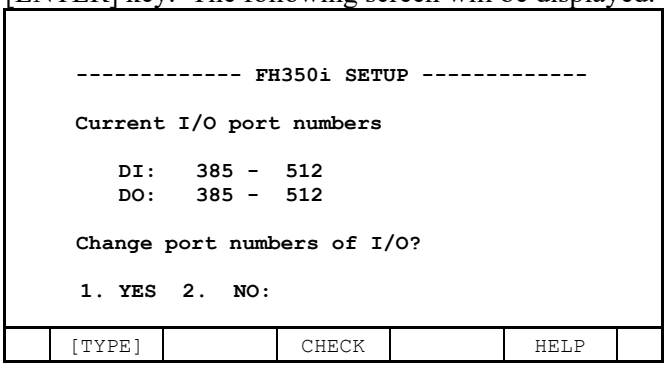


Step

1 Press F3 [CHECK]. The following screen will be displayed.



2 Input 2, and press [ENTER] key. The following screen will be displayed.



3 Input 1, and press [ENTER] key. The following screen will be displayed.

```
------------- FH350i SETUP -------------

 Enter the start point of DI/O.
DI/O range for continuous 128 points
is searched from input start point.

 Enter the number (0 for exit):

[TYPE]  CHECK  HELP
```

4 Input the start point of DI/O assignment, and press the [ENTER] key. If you would like to set 257 – 384 to port number to communicate with FANUC welding power supply, input “257” that is first number of region of assignment.

5 A number that has 128 free ports is searched from this or after this, and then assignment is done. Searched start point is displayed in the lower line.

```
------------- FH350i SETUP -------------

 Enter the start point of DI/O.
DI/O range for continuous 128 points
is searched from input start point.

Enter the number (0 for exit):  257
DI: Assignment is starting at 257
DO: Assignment is starting at 257

[TYPE]  CHECK  HELP
```

6 After “CHECK is complete.” is displayed, return to ArcTool setup screen automatically.

7 After COLD START, execute wire inching while weld I/O screen is displayed. Confirm that a signal of “Inch forward” is ON and wire inching is done. About the wire inching, please refer to “2.6 WIRE INCHING”.

8 As a result of searching, a following prompt box will be displayed if there is no region that is not able to assign. In this case, please change start point or increase max number of digital I/O signals ([MENU] – PROGRAM SETUP – Num. Dig. Ports). And then retry this procedure.

```
Sufficient digital IO ports
for weld EQ cannot be found.
Change the start point or
increase the maximum number
of digital IO ports and then
try to CHECK.
        [OK]
```

⚠ CAUTION
If you get to step 8, retry this procedure. If not retry, the control of welding power supply is wrong.

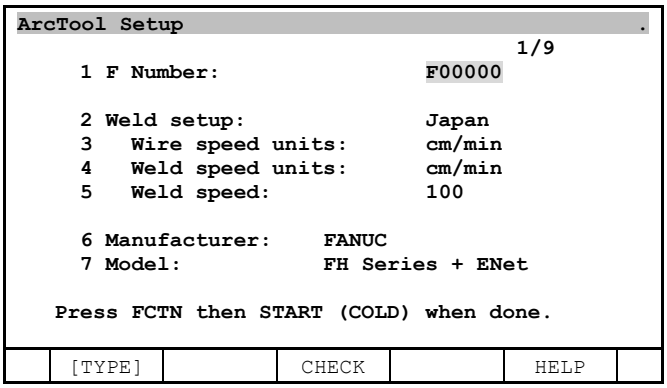
3.1.3 Change Communication GI/O Numbers for FANUC Welding Power Supply

Please follow Procedure 3-1-3 whenever you change the assignment of GI/O to communicate with FANUC welding power supply. Do not set on group I/O screen directly.

procedure 3-1-3 Change communication GI/O numbers for FANUC welding power supply

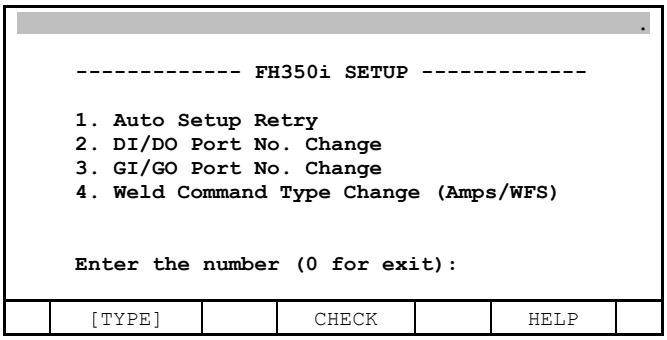
Condition

- Controlled Start has been performed and the following ArcTool Setup screen will be displayed.
- "FANUC" is set to Manufacturer, and "FH Series + DNet" or "FH Series + ENet" is set to Model.

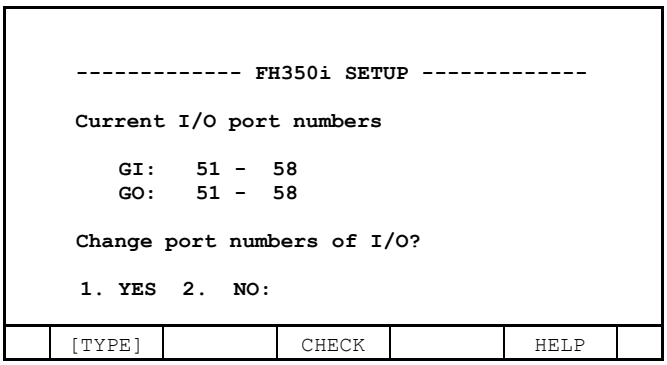


Step

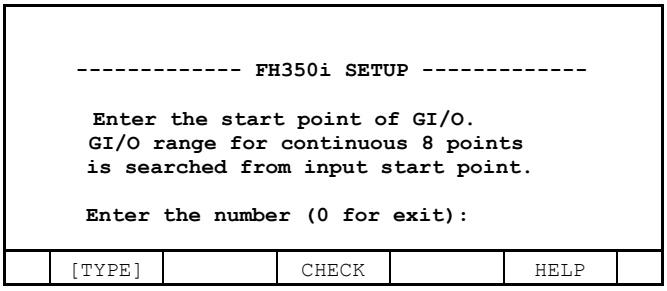
1 Press F3 [CHECK]. The following screen will be displayed.



2 Input 3, and press the [ENTER] key. The following screen will be displayed.

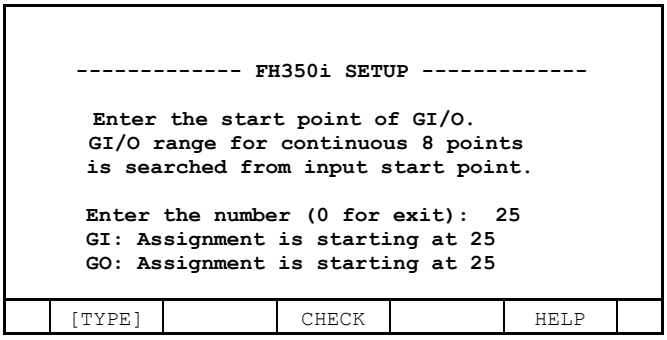


3 Input 1, and press [ENTER] key. The following screen will be displayed.



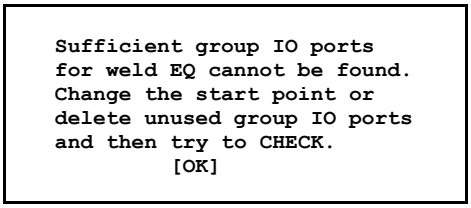
4 Input the start point of GI/O assignment, and press [ENTER] key. If you would like to set 25 – 32 to port number to communicate, input "25" that is first number of region of assignment.

5 A number that has 8 free ports is searched from this or after this, and then assignment is done. Searched start point is displayed in the lower line.



6 After "CHECK is complete." is displayed, return to ArcTool setup screen.

7 As a result of searching, a following prompt box will be displayed if there is no region that is not able to assign. In this case, please clear unnecessary ports or change start point. And then retry this procedure.



3.1.4 In Case of Assignment of Communication I/O is Incorrect

FANUC welding power supply cannot be controlled correctly if the relationship between DI/O(GI/O) and Weld I/O is disrupted by following operations.

- Assignment region for communication I/O is deleted on the configuration screen I/O Digital In or Out.
- Assignment region for communication I/O is deleted on the configuration screen I/O Group In or Out.
- Assignment region for communication I/O is deleted when "UOP auto assignment" is done on System/Config screen.

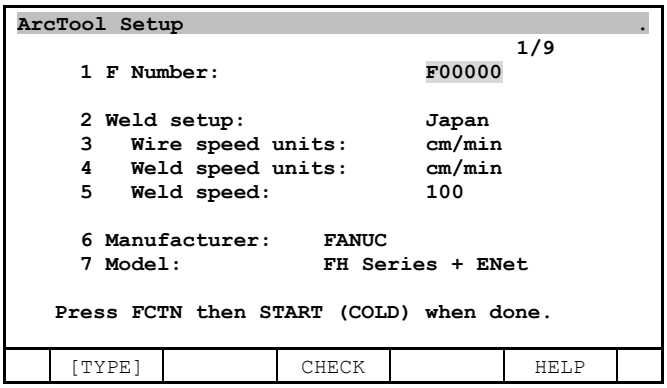
In these cases, the assignment of I/O for FANUC welding power supply can be recovered by executing Procedure 3-1-4 for setup of FANUC welding power supply.

> ⚠ **CAUTION**
> By this operation, some settings (Arc Start/End Adjust setup values, assignment of communication I/O and weld command form) return to default.
> Please take a note about above settings and restore this settings manually after recovery operations, if you need.

Procedure 3-1-4 Recover the assignment of communication I/O

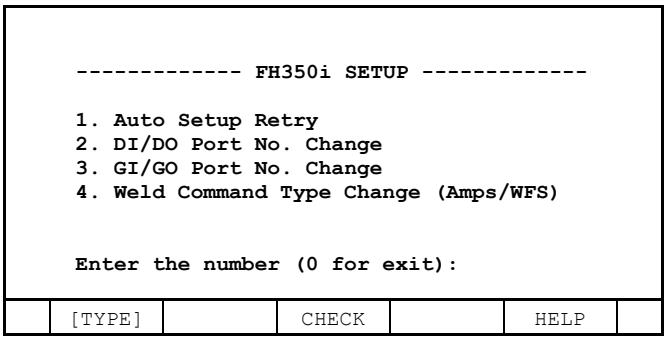
Condition

- Controlled Start has been performed and the following ArcTool Setup screen will be displayed.
- "FANUC" is set to Manufacturer, and "FH Series + DNet" or "FH Series + ENet" is set to Model.

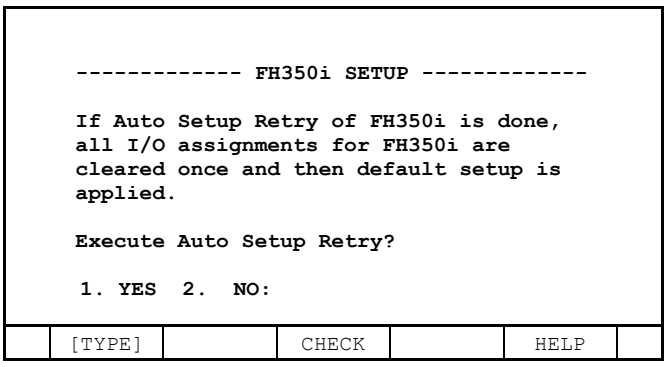


Step

1 Press F3 [CHECK]. The following screen will be displayed.



2 Input 1, and press the [ENTER] key. The following screen will be displayed.



3 Input 1, and press the [ENTER] key. Auto setup retry is executed. After "CHECK is complete." is displayed, return to ArcTool setup screen automatically.

3.2 JOG THE ROBOT WHILE DEVICENET IS OFFLINE

This section is the explanation only for the welding power supply model of "FH350i with DeviceNet connection".
Robot cannot be jogged if the power of the robot controller is turned ON during the power of FANUC welding power supply is OFF. In this case, a following alarm is posted and you cannot clear it by reset.

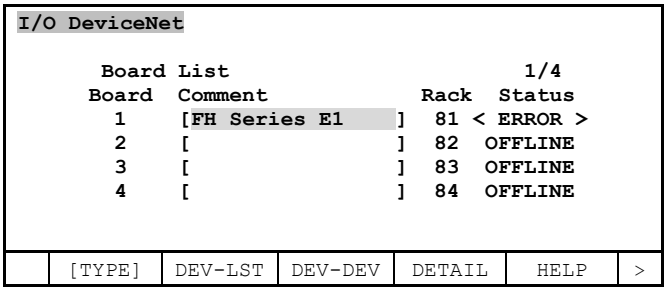
DNET-050 Board or network warning : Bd i (i is DeviceNet board number.)

You can allow to jog the robot if you would like to jog the robot while FANUC welding power supply cannot be turned ON or cannot be communicated. Please turn DeviceNet communication OFFLINE temporarily and prevent posting alarm.
See procedure 3-2.

Procedure 3-2 Switch ONLINE/OFFLINE of DeviceNet communication

Step

1 Press the [MENU] key and select [5 I/O].
2 Press F1[TYPE] and select [DeviceNet]. The following screen will be displayed.



3 Move the cursor on "FH Series Ei" (i is equipment number), press the [NEXT] key and then press F5[OFFLINE]. After a few moment, Status becomes "OFFLINE".
4 Press the [RESET] key and release DNET-050 alarm.
5 To revocer comunication with welding power supply after jogging the robot, press the [NEXT] key and F4[ONLINE].

> ⚠ **CAUTION**
> DeviceNet communication can be recovered only by resetting ONLINE manually if you set OFFLINE.
> Reset ONLINE to the communication with FANUC welding power supply properly before start welding if you set OFFLINE by above procedure.

3.3 EDITING OPERATION OF PROGRAM

This section explains the basic editing operation of program.

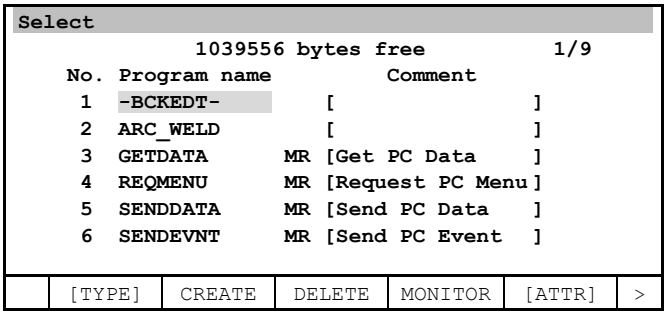
3.3.1 Selecting and Editing of Program

About the method for creating new program, procedure 3-7 “Creating Motion Program” explains. This Subsection explains the procedure for selecting and editing the program that already exists.

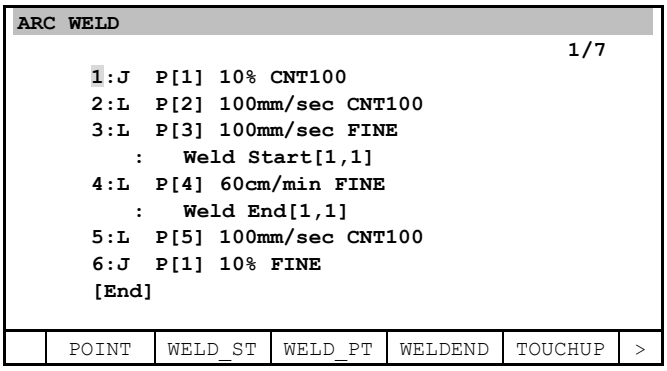
Procedure 3-3-1 Selecting and editing of program

Step

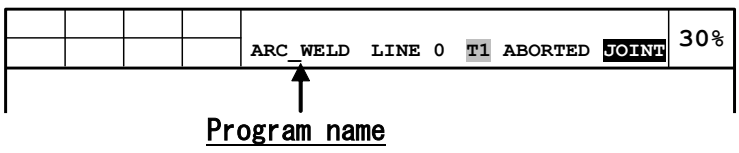
1 Select a program on the program selection screen.
Press the [MENU] key and select [SELECT] from the displayed menu. Or, press the [SELECT] key.
Program selection screen will be displayed.



2 Move the cursor on the program that you would like to select and press the [ENTER] key. The program will be selected and the edit screen for this program will be displayed.



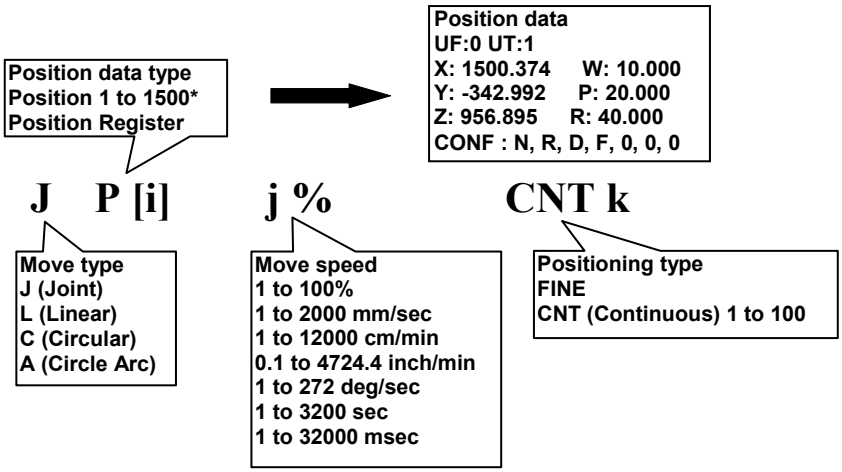
3 The program name of currently selected can be confirmed at status line that is in the window at the top of the teach pendant. So the selected program can be confirmed even if another screen is displayed.



4 Press the [MENU] key and select the [EDIT] from the displayed menu if you would like to display the program edit screen for currently selected. Or, press the [EDIT] key.

3.3.2 Editing of Motion Instruction

About the teaching of motion instruction, procedure 3-7 “Creating Motion Program” explains. This Subsection explains the procedure for editing the motion instruction that is already taught.
Motion instruction is composed of move type and position data type, move speed, positioning type (Refer to Fig. 3.3.2). Procedure 3-3-2 explains about the editing method of those four compositions.



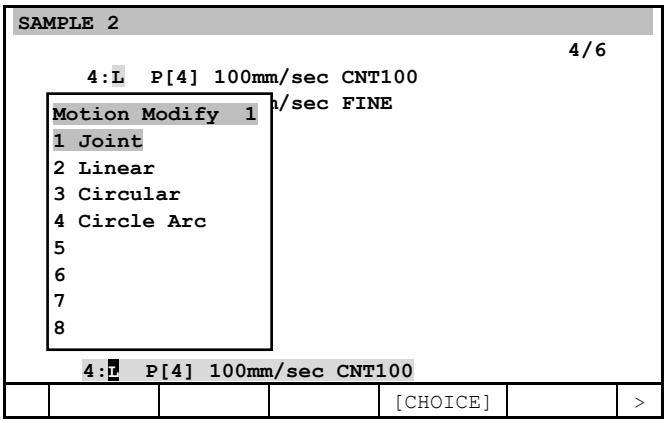
*** A position number can be as large as memory allows.**
The maximum move speed differs according to robot model.

Fig. 3.3.2 (a) Composition of motion instruction

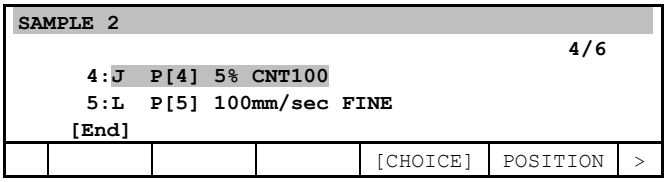
Procedure 3-3-2 Editing of motion instruction

Step

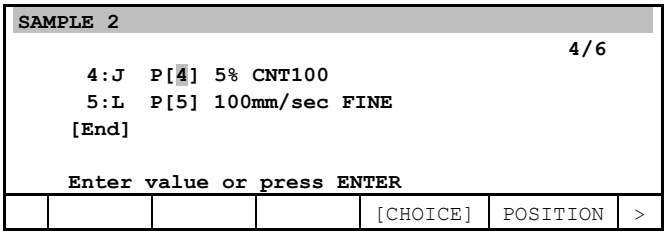
1 In case of changing move type, move the cursor to move type and press F4[CHOICE]. Sub menu for selecting move type will be displayed.



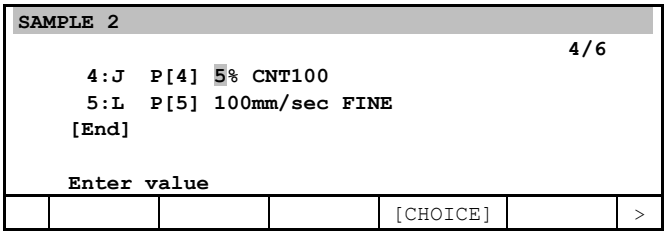
2 When the move type is selected from the sub menu, move type is changed. If it is changed, move speed and its unit are also changed according to the move type.



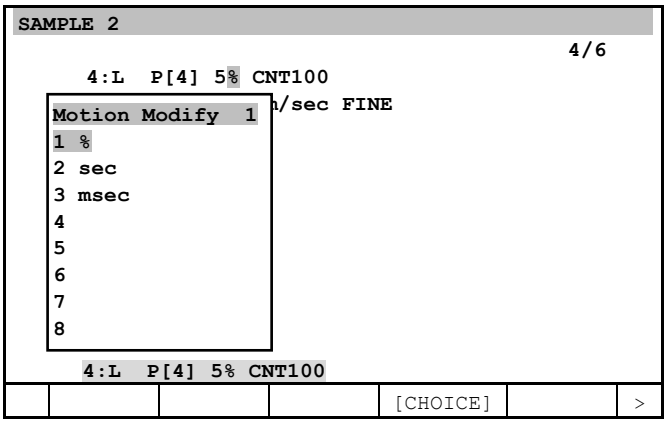
3 In case of changing position data number, move the cursor to the position data number and input new position data number.



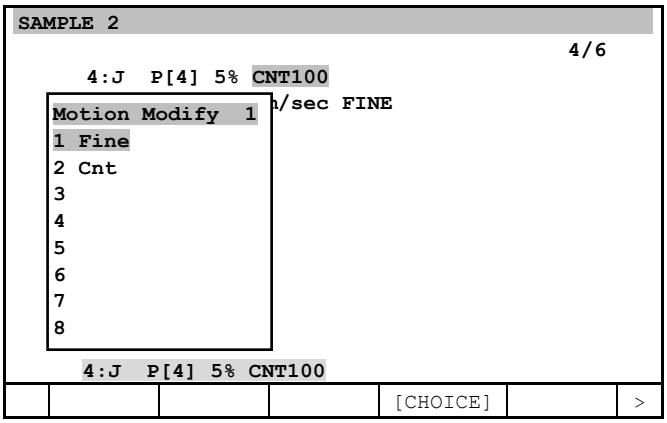
4 In case of changing move speed, move the cursor to move speed and input new value.



5 In case of changing the unit of move speed, move the cursor to move speed and press F4 [CHOICE]. Sub menu for selecting the unit will be displayed. Select new unit from the sub menu. If it is changed, the value of move speed is automatically converted to new unit.



6 In case of changing the positioning type, move the cursor to positioning type and press F4 [CHOICE]. Sub menu for selecting positioning type will be displayed. Select new positioning type from the sub menu.



7 If “Cnt” is selected as the positioning type, move the cursor to the value field of positioning type and input new value.

```
SAMPLE 2                                          4/6
     4:J  P[4] 5% CNT30
     5:L  P[5] 100mm/sec FINE
    [End]

    Enter value
[ ][ ][ ][ ][CHOICE][ ][>]
```

3.3.3 Correcting a Position

If the robot does not track the ideal path, it is necessary to modify the position that is taught by motion instruction. Operator can touch-up the position data in motion instruction after moving the robot to the position that should be corrected by jog feed. Please refer to procedure 3-3-3 (a).
Operator can confirm the taught position data in motion instruction. Operator can also modify the taught position data by changing the position number in motion instruction. Please refer to procedure 3-3-3 (b).

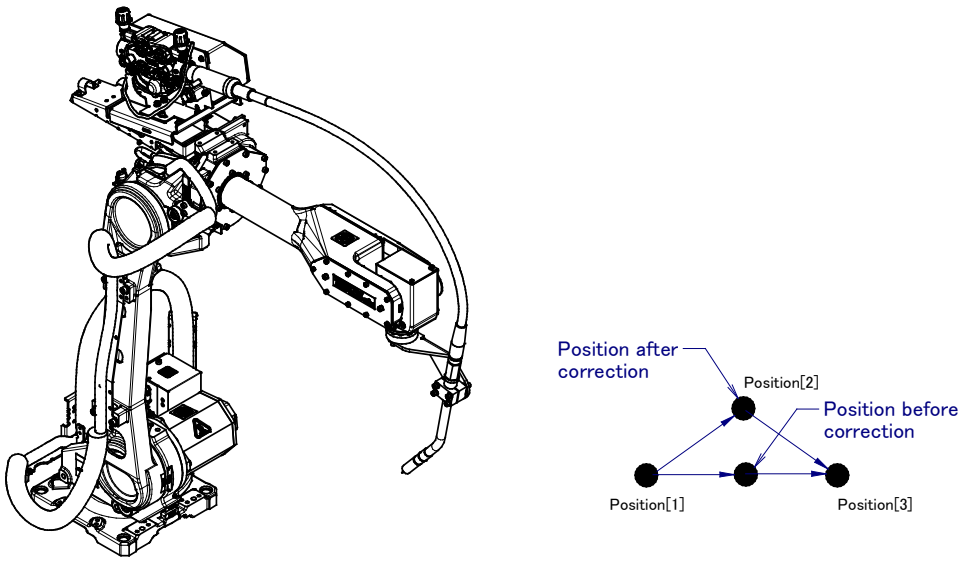


Fig. 3.3.3 (a) Correcting a position

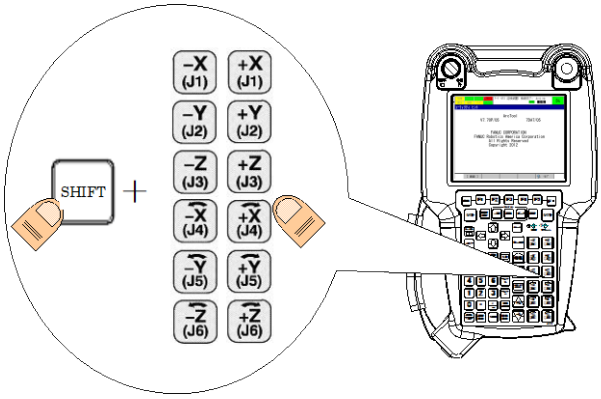
Procedure 3-3-3 (a) Correcting a position

Step

1 Move the cursor to the beginning of motion instruction line that you would like to correct.

```
SAMPLE 3                                          3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
    [End]

[ ][POINT][WELD_ST][WELD_PT][WELDEND][TOUCHUP][>]
```

2 Move the robot TCP to the desired position by jog feed operation.



3 Press F5[TOUCHUP] with holding the [SHIFT] key. The position data in the motion instruction of current cursor position (it is P[3] in the following example screen) is modified to the current robot TCP position.

```
SAMPLE 3                                        3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L @P[3] 100mm/sec FINE
    [End]

 | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

Procedure 3-3-3 (b) Confirm position data and Change position data number

Step

1 Move the cursor to the position data number.

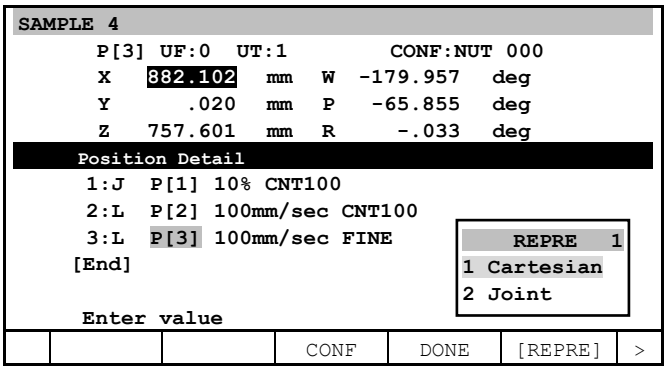
```
SAMPLE 4                                        3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
    [End]

 |  |  |  | [CHOICE] | POSITION | >
```

2 Press F5[POSITION] key. Sub menu for position data will be displayed. In standard, the position will be displayed based on the cartesian coordinate system (world coordinate system).

```
SAMPLE 4
      P[3] UF:0  UT:1         CONF:NUT 000
       X   882.102   mm   W  -179.957   deg
       Y      .020   mm   P   -65.855   deg
       Z   757.601   mm   R     -.033   deg
    Position Detail
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
    [End]

     Enter value
 |  |  |  | CONF | DONE | [REPRE] | >
```

3 Move the cursor to desired coordinate position data and input the desired value with numeric key. After that, press the [ENTER] key.

4 It is possible to change the format of position data. Press F5[REPRE] and select the desired format. For example, display changes as follows when the format of position data is changed from “Cartesian” to “Joint”.



5 When the confirmation / changing position data ends, press F4[DONE]. Display is returned to program edit screen.

3.3.4 Edit by Using Program Edit Instructions

It is possible to modify / edit the program efficiently by using the program edit instructions. Kind of those are shown in following Table 3-3-4 (a). In those instructions, “Insert” and “Delete”, “Copy” are often used. So those are explained in procedure 3-3-4 (a) – (c).

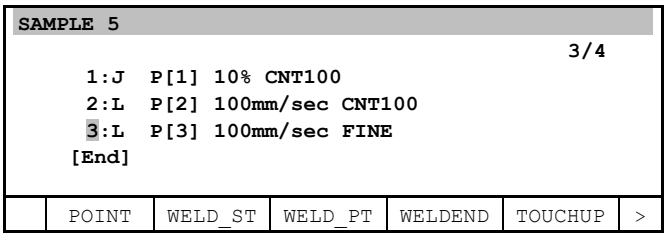
Table 3.3.4 (a) Kind of program edit instructions

Insert	Inserts blank lines, the number of which is specified, between the existing lines of a program.
Delete	Deletes a series of instructions from a program.
Copy	Copies a series of instructions and inserts the instruction range into another location in the program.
Find	A specified element of a program instruction is found.
Replace	Replaces an item of the specified program instruction with another item.
Renumber	Renumbers the position number in ascending order.

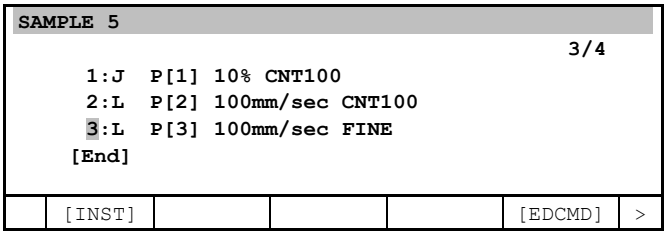
Procedure 3-3-4 (a) Insert blank lines

Step

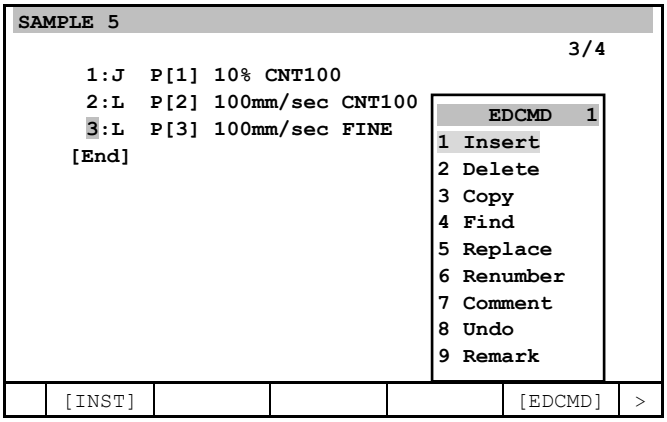
1 Move the cursor to the head of line where you would like to insert blank lines.



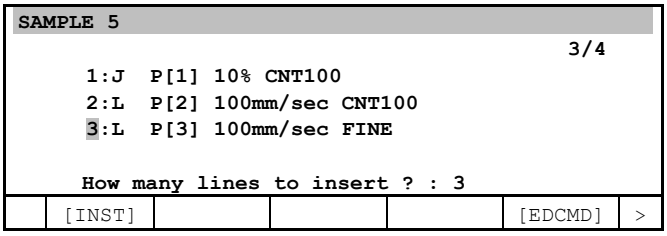
2 Press the [NEXT] key then the next page of function key menu will be displayed.



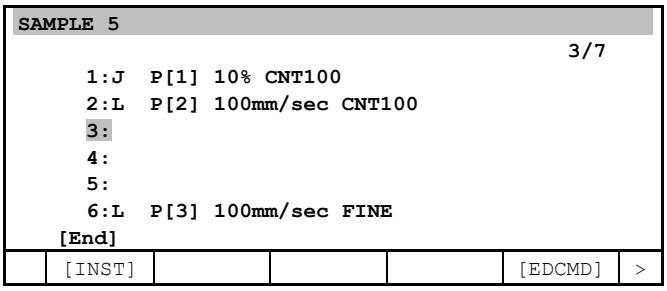
3 Press F5[EDCMD] then the EDCMD menu will be displayed.



4 Select “Insert” from the displayed menu. Input the number of lines to insert by numeric key and press the [ENTER] key.



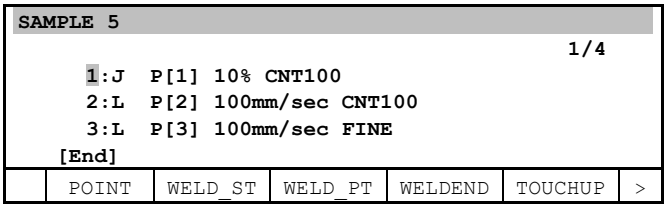
5 The number of specified blank lines are added to specified cursor position.



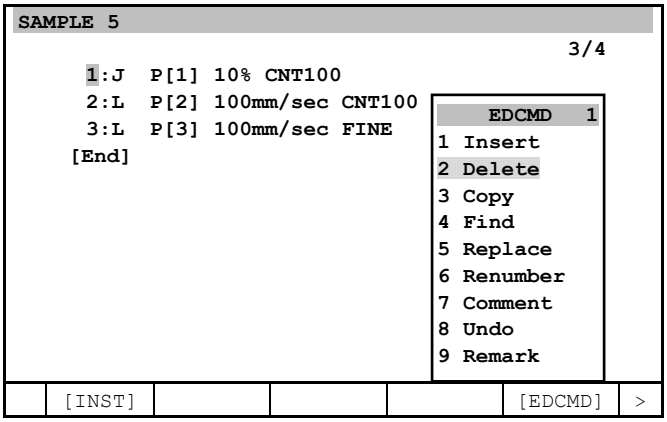
Procedure 3-3-4 (b) Delete lines

Step

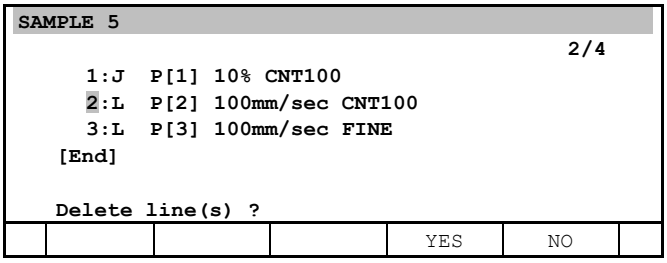
1 Move the cursor to the head of line where you would like to delete lines.



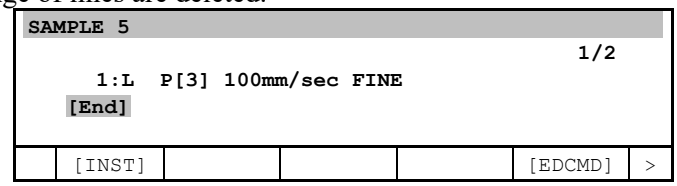
2 Perform the step 2 and 3 in procedure 4-2-4 (a) then the EDCMD menu will be displayed.



3 Select “Delete” from the displayed menu. Press the F4[YES] after specifying the delete range by using cursor keys (up / down arrow keys).



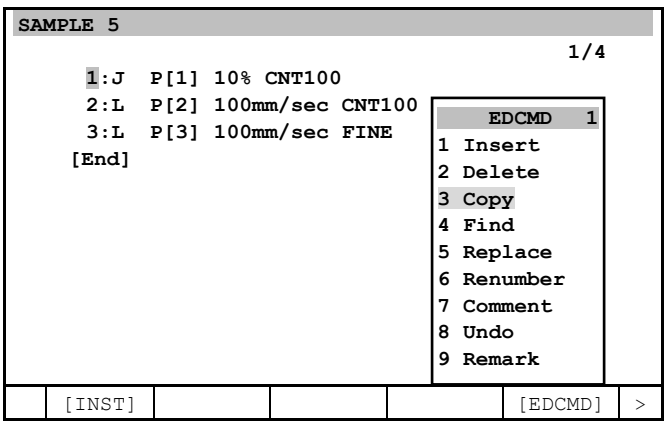
4 The specified range of lines are deleted.



Procedure 3-3-4 (c) Copy lines

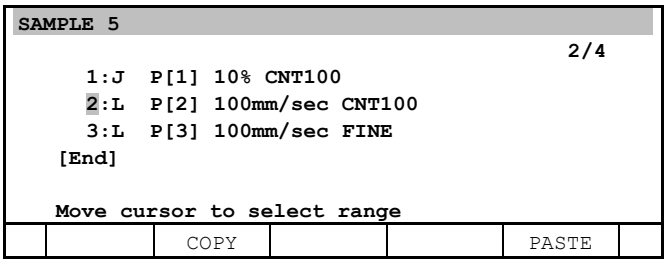
Step

1 Perform the step 2 and 3 in procedure 3-3-4 (a) then the EDCMD menu will be displayed. Select “Copy” from the displayed menu.

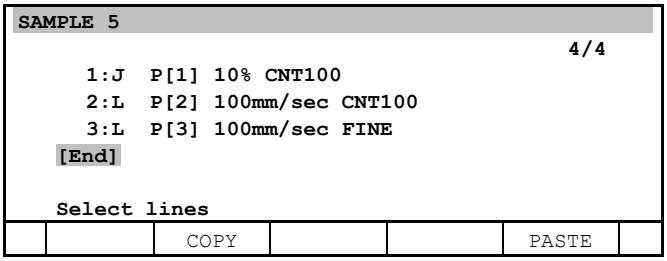


2 The message of “Select lines” will be displayed at prompt lines. Press F2[COPY] after moving the cursor to beginning of copy range.

3 The message of "Move cursor to select range" will be displayed at prompt lines. Press F2[COPY] after moving the cursor to ending of copy range. The specified range of program lines is stored to the internal memory.



4 Press F5[PASTE] after moving the cursor to the position where you would like to paste.



5 The message of "Pate before this line ?" will be displayed at prompt line. Select the copy mode by pressing F2 or F3 or F4 key. Program lines stored by step 3 and 4 are inserted. About the copy mode, please refer to the following table.

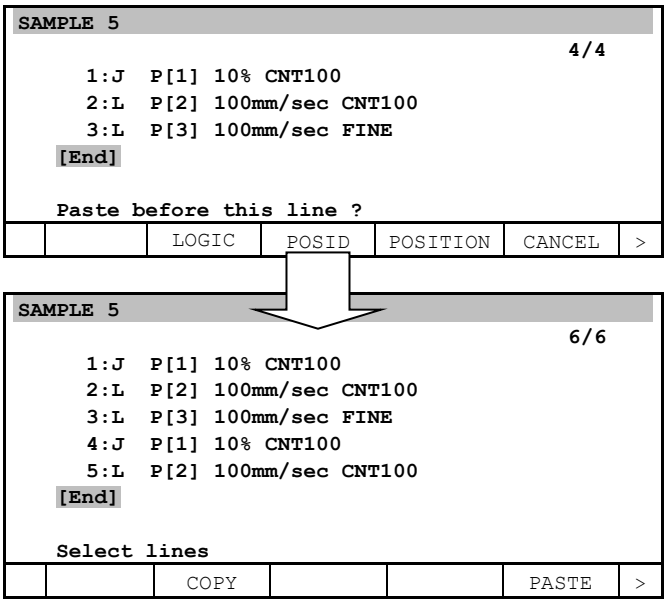


Table 3.3.4 (b) Kind of program edit instructions

F2 LOGIC	The position number of pasted motion instruction becomes "..."(initial state).
F3 POSID	The position number of pasted motion instruction succeeds the position number of copied motion instruction.
F4 POSITION	The position number of pasted motion instruction becomes unused position number.

3.4 OPERATION OF WELD PROCEDURE AND PROCESS MODE

3.4.1 About Weld Procedure and Process Mode

Arc welding power supply can use different output characteristics to wire diameter, wire material, gas type and weld method, and it has the database of the most suitable output characteristic for each combination. The database of output characteristic can be changed for each weld point. Therefore, you can select the most suitable characteristic for each point and then execute welding.
For switching the database of output characteristics for arc welding power supply during welding, it is necessary for arc welding robot to specify “This combination is used for this weld point”.
Between arc welding robot – welding power supply, the relevance of each combination is done by specifying the number called “Process Mode”.
Process Mode number cannot be specified on arc weld instruction directly. Therefore, one “Process Mode” is assigned to one “Weld Procedure”. Then Weld Procedure which is assigned the desired Process Mode is specified on arc weld instruction, and it is possible to achieve the switching of output characteristic from arc welding robot to arc welding power supply.

NOTE
It is necessary to select Process Mode number whose wire diameter, wire material and gas type are suitable for using ones.

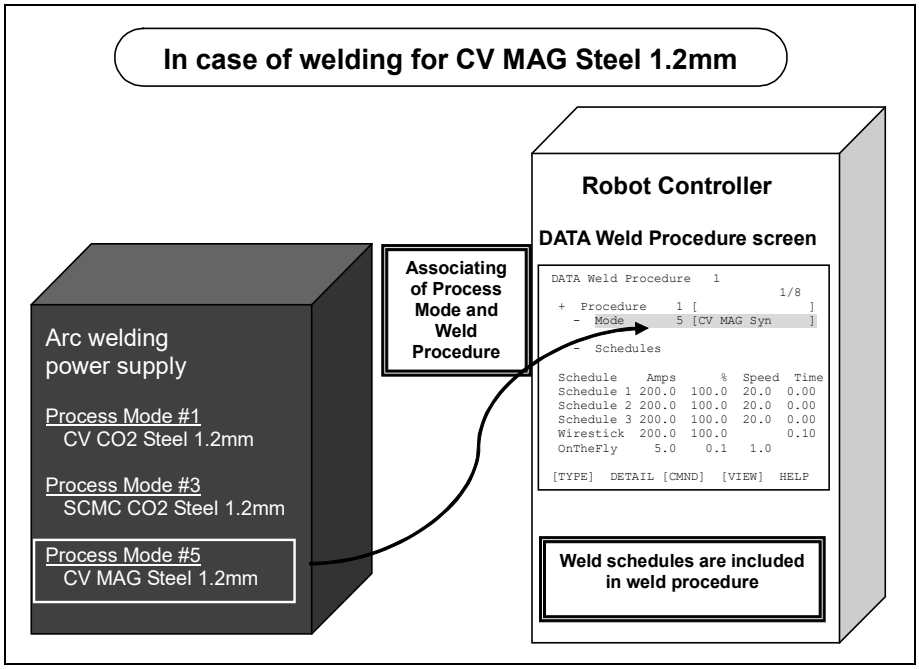


Fig. 3.4.1 (a) Process Mode and Weld Procedure

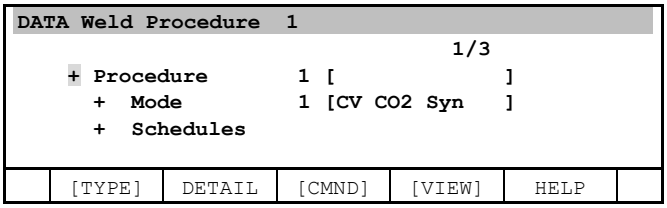
3.4.2 Operation of Weld Procedure

"Weld Procedure" has "Weld Schedule", and also setups which decide welding sequence. When this weld procedure number is specified on arc weld instruction, weld process on the point where the instruction is taught is decided.
One weld procedure has multiple weld schedules. It is possible to create weld procedure up to 20. Additionally, one weld procedure can have weld schedules up to 32.
The new creation method of the first weld procedure is explained by Procedure 3-5. So Procedure 3-4-2 explains the creation method of the second or later weld procedures. Please refer to Section 3.5 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3) for other operations for weld procedures.

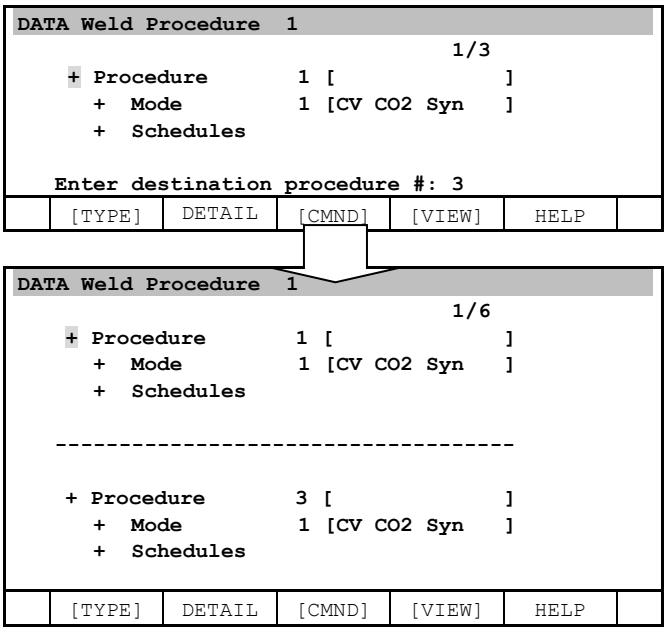
Procedure 3-4-2 Copy weld procedure

Step

1 Press the [MENU] key and select [0 -- NEXT--].
2 Select [3. DATA].
3 Press F1[TYPE] key and select [Weld Procedure]. Following screen will be displayed.



4 In case of creating another weld procedure, it is achieved by copying the existing weld procedure. Press F3[CMND] and select [Copy WP].
5 The message of "Enter destination procedure #:" will be displayed at prompt line. Please input the weld procedure number that you would like to create. The message of "Copy procedure i to procedure j" will be displayed. Then, press F4[YES].



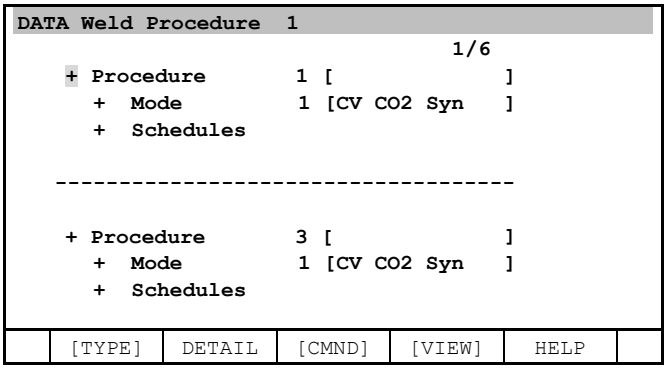
3.4.3 In case of Process Mode Number is Known

When the process mode number that you would like to use is known, it is possible to input the process mode number directly in the DATA Weld Procedure screen (refer to Procedure 3-4-3). Or, it is possible to perform this method after checking the process mode number that you would like to use by referring "Chapter 9 PROCESS MODE".

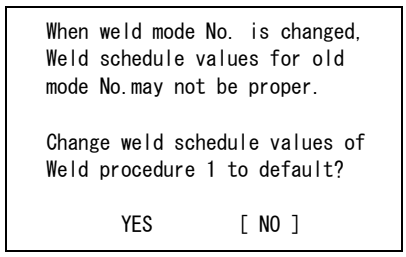
Procedure 3-4-3 Assignment of process mode number by direct input

Step

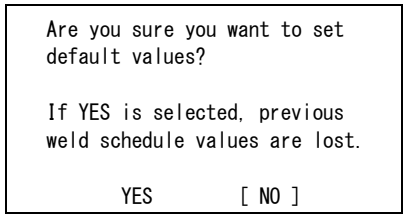
1 Perform the step 1 - 3 in Procedure 3-4-2. Then, DATA Weld Procedure screen will be displayed.



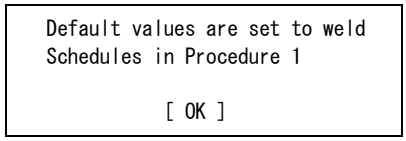
2 Move the cursor to "Mode" line in the desired weld procedure and input the process mode number that you would like to use. Following message box is displayed. If it is allowed to set default values to all weld schedules in the weld procedure, select [YES]. If you want to take the weld schedule values over, select [NO].



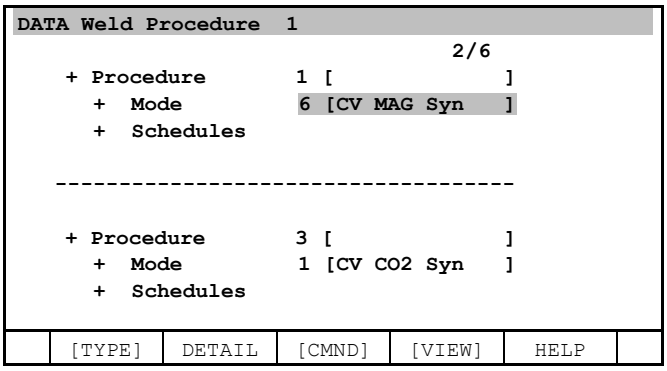
3 If [YES] was selected at Step 2, following message box is displayed for the confirmation. If there is not any problems for clearing to default values, select [YES] again.



4 If [YES] was selected at Step 3, following message box is displayed and weld schedule values of the weld procedure are cleared to default values.



5 The comment of specified “Mode” line is updated to the content that corresponds to the inputted process mode number. Please confirm the content whether it is correct or not. If it does not exist in the weld equipment, the value of “Mode” is returned to the original value.



NOTE
In case of changing from Synergic Voltage Command Form to Non-Synergic Voltage Command Form, or from Non-Synergic to Synergic, it is recommended to select [YES] in Step 2 and 3. If [NO] is selected, the value which may be out of range will remain as Voltage or Trim item, and you should change their values manually. Regarding to Synergic and Non-Synergic Voltage Command Form, please refer to Subsection 3.5.1 and 3.5.2.

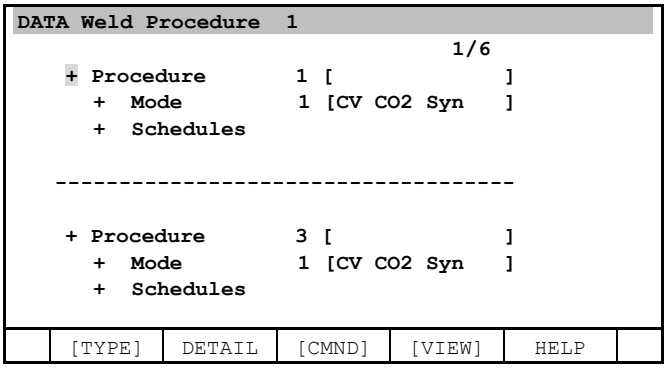
3.4.4 Select Process Mode

When the process mode number that you would like to use is unknown, it is necessary to find the process mode number by using the information of welding methods and wire diameter, etc. Process mode number is founded by accessing to the process mode data base in weld equipment.

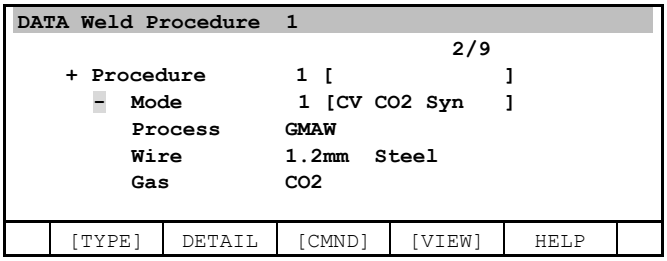
Procedure 3-4-4 Assignment of process mode number by searching

Step

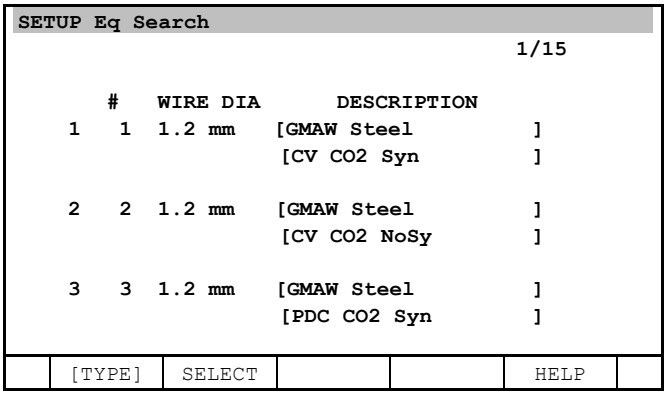
1 Perform the step 1 - 3 in Procedure 3-4-2. Then, DATA Weld Procedure screen will be displayed.



2 Move the cursor to "+" in the head of "Mode" line and press [ENTER] key. "Mode", "Wire" and "Gas" by current process mode are displayed.

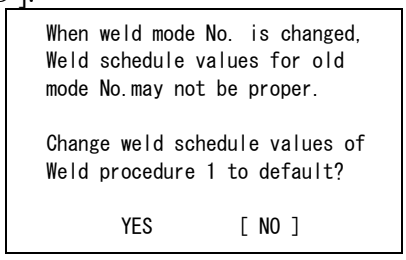


3 Press F3[CMND] and select [Search] from the displayed menu. Following search result screen will be displayed.

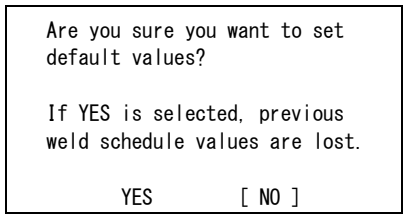


4 This screen is scrollable by using cursor key (up / down arrow key). Move the cursor to desired process mode number and press F2[SELECT]. When you would like to exit from this screen without selecting process mode, please press the [PREV] key.

5 If F2[SELECT] is pressed in Step 4, the following message box will be displayed. If it is allowed to set default values to all weld schedules in the weld procedure, select [YES]. If you want to take the weld schedule values over, select [NO].



6 If [YES] was selected at Step 2, the following message box will be displayed for the confirmation. If there is not any problems for clearing to default values, select [YES] again.



7 If [YES] was selected at Step 3, the following message box will be displayed and weld schedule values of the weld procedure are cleared to default values.

```
Default values are set to weld
Schedules in Procedure 1

            [ OK ]
```

> **NOTE**
> In case of changing from Synergic Voltage Command Form to Non-Synergic Voltage Command Form, or from Non-Synergic to Synergic, it is recommended to select [YES] in Step 5 and 6. If [NO] is selected, the value which may be out of range will remain as Voltage or Trim item, and you should change their values manually. Regarding to Synergic and Non-Synergic Voltage Command Form, please refer to Subsection 3.5.1 and 3.5.2.

3.5 PARAMETER OF WELD SCHEDULE

This section explains about weld parameters in weld schedule in detail.
In FANUC welding power supply, the command form for voltage differs from the process mode number. Examples of each case are as follows.

3.5.1 Synergic Voltage Command Form

If you set a process mode for synergic voltage command, weld parameters are as below. Synergic voltage mode is selected by setting once place digit of weld mode number to 1, 3 or 5.
In synergic voltage mode, standard voltage is selected from current by FANUC welding power supply automatically. Voltage can be adjusted by increase and decrease from standard voltage.

```
DATA Weld Procedure        1
                                        1/7

     1 Procedure      1 [                    ]
      [CV CO2 Syn       GMAW            #  1]
      [1.2 mm  Steel     CO2                ]

     2 Weld Schedule        1 [Schedule     ]
     3 Current                 120.0  Amps
     4 Trim                    100.0  %
     5 Wave Control            100.0  %

   [TYPE]  SCHEDULE                  HELP
```

Table 3.5.1 (a) Weld parameters of TRIM mode

Weld Parameter	Detail
Current	Set weld current. Unit is amperes (A).
Trim	When 100% is set, standard voltage is output in welding. This can be adjusted from 50% to 150% based on standard voltage.
Wave Control	Arc is set to soft or hard. 100% is standard. If this is increased, arc becomes hard. If this is decreased, arc becomes soft. This can be adjusted from 0% to 200%.

3.5.2 Non-Synergic Voltage Command Form

If you set a process mode for non-synergic voltage command, weld parameters are as below. Non-synergic voltage mode is selected by setting once place digit of weld mode number to 2 or 6.
In non-synergic voltage mode, command voltage can be set independently from current.

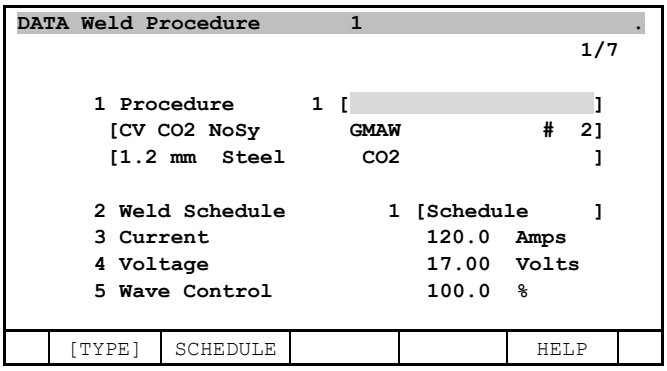


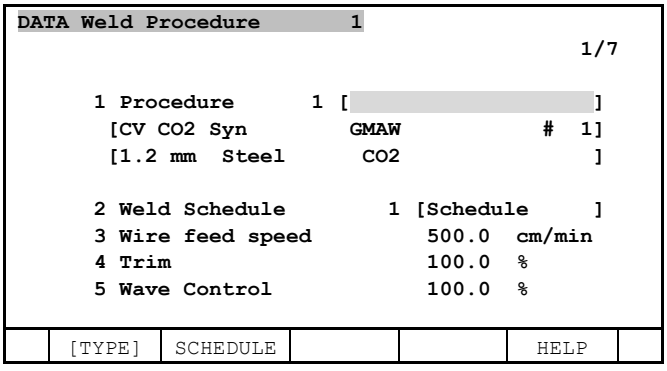
Table 3.5.2 (a) Weld parameters of Voltage mode

Weld Parameter	Detail
Current	Set weld current. Unit is amperes (A).
Voltage	Set weld voltage. Unit is volts (V).
Wave Control	Arc is set to soft or hard. 100% is standard. If this is increased, arc becomes hard. If this is decreased, arc becomes soft. This can be adjusted from 0% to 200%.

> ⚠ **WARNING**
> In FANUC welding power supply, if you switch synergic/non-synergic voltage by process mode, values of weld schedule and arc direct instruction are not changed. They are same as before change. For example, if Trim in weld schedule set 100% on non-synergic voltage command form, 100V is set to Voltage in weld schedule after synergic voltage command form is selected. In this case, max voltage is output while welding.
> Please make sure to reset all parameters of weld schedules and arc direct instructions if you change the command form

3.5.3 Wire Feed Speed Command Form

Wire feed speed (WFS) can be selected. “Current” is changed to “Wire feed speed”. In this setting, welding current is changed by wire feed speed.

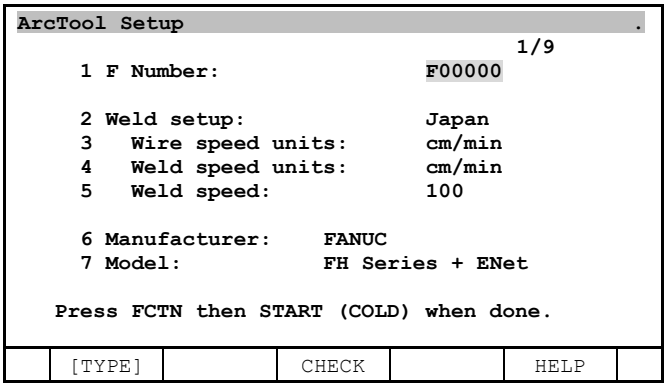


Switching of “Current” or “Wire feed speed” can be done on Controlled Start. See procedure 3-5-3.

Procedure 3-5-3 Change weld command form for FANUC welding power supply

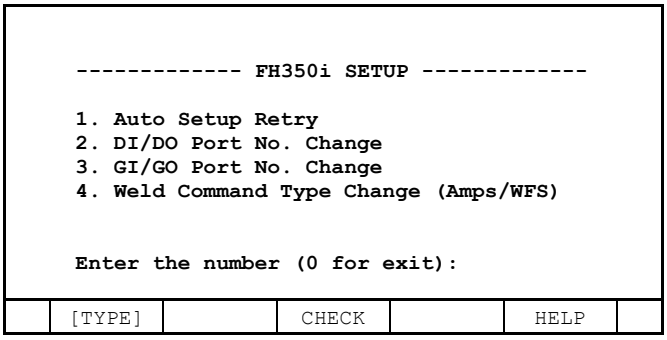
Condition

- Controlled Start has been performed and the following ArcTool Setup screen will be displayed.
- “FANUC” is set to Manufacturer, and “FH Series + DNet” or “FH Series + ENet” is set to Model.

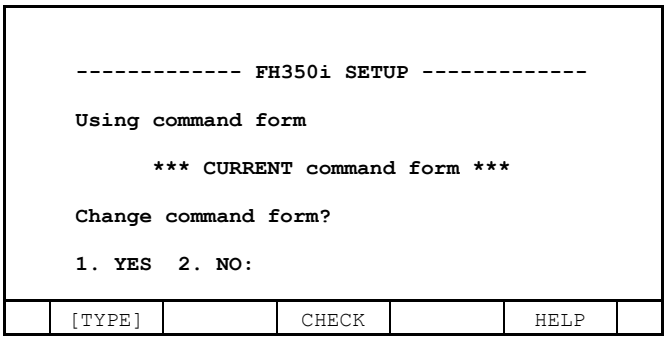


Step

1 Press F3 [CHECK]. The following screen will be displayed.

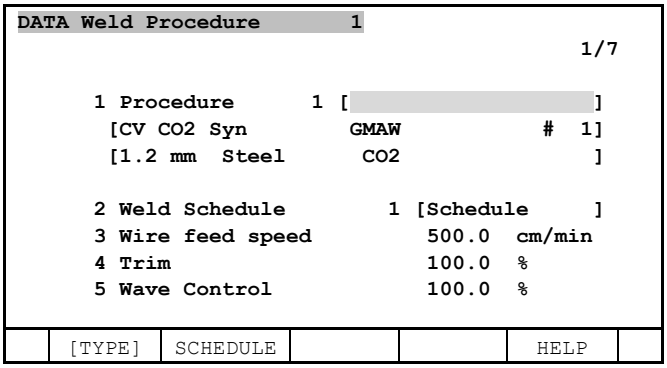


2 Input 4, and press the [ENTER] key. The following screen will be displayed.



3 Input 1, and press the [ENTER] key. After “CHECK is complete.” is displayed, return to ArcTool setup Screen automatically.

4 In Detail of weld schedule screen, confirm that the first weld parameter become “Wire feed speed”.



⚠ CAUTION
If you change the command form between current and wire feed speed, values of weld schedule and arc direct instruction are not changed. They are same as before change.
Please make sure to reset all parameters if you change the command form. If you do welding before reset, unexpected and abnormal schedule is used.

3.6 TEACHING AND EDITING OF ARC WELD INSTRUCTION

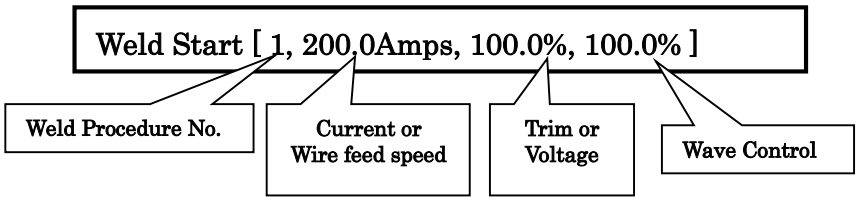
Arc weld instruction performs the arc welding start / end. Though the Procedure 3-8 explains briefly about teaching of arc weld instruction, this section explains it in detail.

3.6.1 Arc Weld Start Instruction

The arc weld start instruction requests to start an arc welding. Once arc welding has started, welding pass becomes the robot movement path. The welding is continued until requesting the arc weld end instruction. There are two methods in arc weld start instruction. One is arc indirect instruction, two is arc direct instruction.
Following shows the example of those two instructions.

Schedule number specified (Arc indirect instruction)

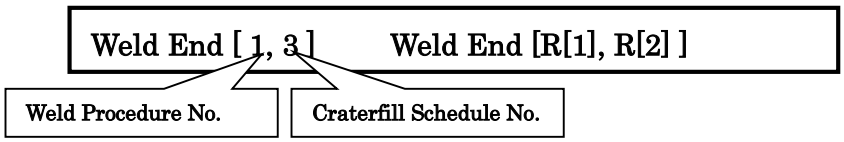
Schedule directly specified (Arc direct instruction)



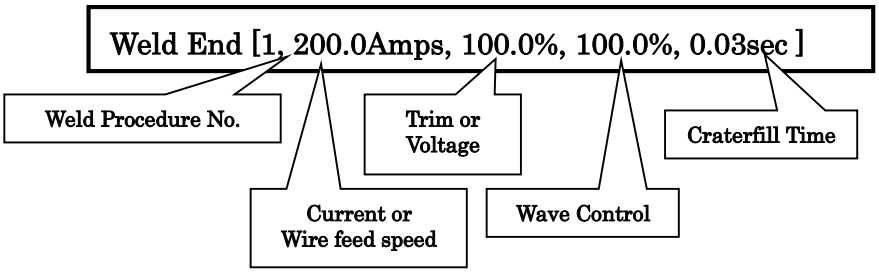
3.6.2 Arc Weld End Instruction

The arc welding end instruction requests to end an arc welding. When an arc welding ends, the craterfill is performed. The craterfill schedule is specified in this instruction. Craterfill is a function to avoid the crater hole generation due to a rapid voltage decrease.
In the craterfill schedule, it is necessary to specify craterfill time in addition to various command values. If you do not perform the craterfill, set the craterfill time to 0sec. There are two methods in arc weld end instruction well as arc weld start instruction.

Schedule number specified (Arc indirect instruction)



Schedule directly specified (Arc direct instruction)



NOTE
In case of schedule directly specified, all commands are cleared to 0 when the weld procedure number is changed (This is measures to prevent original commands from becoming outside the range that is for the weld procedure after changed). Please always set each commands after setting the weld procedure number.

3.6.3 Note while Teaching Arc Weld Instruction

- Please use the FINE motion when robot moves to arc welding start position.
- Please use the linear or circular, C-circular with CNT motion when robot moves to pass point during arc welding.
- Please use the linear or circular, C-circular with FINE motion when robot moves to arc welding end position.
- Please set torch to appropriate angle against welding object.
- Please use the appropriate welding schedule.
- Do not execute arc weld start instruction on condition that welding wire touches to the welding object. It may cause the welding trouble. Welding wire should not touch to the welding object at arc start point. In case of those touching, please confirm stick out length at last arc end point, etc.

3.6.4 Teaching of Arc Indirect Instruction

Arc indirect instruction performs the welding according to the specified weld schedule that is set in weld procedure. The weld schedule must be set beforehand at weld procedure screen. It is necessary to specify the weld procedure number and schedule number in the use of arc indirect instruction.
In the weld procedure screen, please set the process mode number at first. Next, please set each weld command values (Amps, Volts, etc.).
Teaching procedure is shown in Procedure 3-6-4.

Procedure 3-6-4 Teaching of arc indirect instruction

Step

1 Press the [MENU] key and select [0 -- NEXT --]. Select [3 DATA].
2 Press the F1 [TYPE] key and select [Weld Procedure]. Then, Weld Procedure screen will be displayed.
3 Move the cursor to “Schedules” included in weld procedure used by arc indirect instruction. Press F2 [DETAIL] or ENTER key. Weld schedule list will be displayed as the followings.

```
DATA Weld Procedure  1
                                        3/9
   + Procedure        1 [               ]
     +  Mode          1 [CV CO2 Syn     ]
     -  Schedules

   Schedule     Amps       %  Speed  Time
   Schedule  1 120.0  100.0   0.0   0.00
   Schedule  2 120.0  100.0   0.0   0.00
   Schedule  3 120.0  100.0   0.0   0.00

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

4 Move the cursor to schedule that you would like to use and press F2 [DETAIL]. The following screen will be displayed.

```
DATA Weld Procedure  1
                                      3/7
    1 Weld Procedure  1[                  ]
       [CV CO2 Syn    GMAW           #  1  ]
       [1.2mm  Steel   CO2                 ]

    2 Weld Schedule   1 [Schedule         ]
    3 Current             200.0 Amps
    4 Trim                100.0 %
    5 Wave Control        100.0 %
    6 Travel speed          0.0 cm/min
    7 Delay time            0.00 sec
      Feedback Voltage      0.0 Volts
      Feedback Current      0.0 Amps

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

5 Input commands (current, voltage, etc.).
6 Input the weld schedule number to the arc indirect instruction in the TP program.

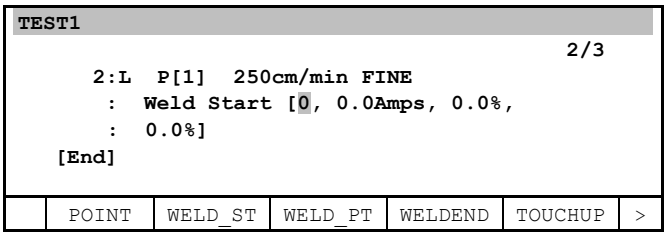
3.6.5 Teaching of Arc Direct Instruction

In arc direct instruction, you specify the weld procedure number and each command (current, voltage, etc.) directly in TP program.
Teaching procedure is shown in Procedure 3-6-5.

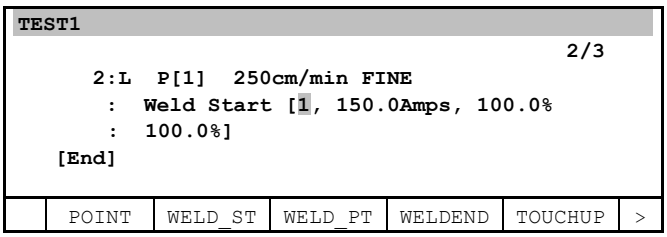
Procedure 3-6-5 Teaching of Arc direct instruction

Step

1 Teach the arc weld instruction in TP program. Move the cursor to inside “[]” of the arc weld instruction and press F3 [VALUE] key. Arc direct instruction will be displayed.



2 Move the cursor to the first parameter and input the weld procedure number here.
3 After inputting the weld procedure number, input current, trim (or voltage) or Wave Control values.



NOTE
1 If values of trim or wave control is 0, stable welding cannot be achieved. If you do not adjust these values, set 100% to their parameters.
2 The input parameters (EX: current, voltage, etc.) are reset to 0 when you change the weld procedure number. Be sure to input the weld procedure number first before inputting commands for each parameter.

3.7 ARC START/END ADJUST

FANUC welding power supply has adjust parameters for weld start and end processes.
Their default values are calibrated to produce best performance. If you need to change them, see Procedure 3-7.
They can be set on the following setup screen. After they are changed, all welding using FANUC welding power supply are used changed values. Therefore, please set and confirm carefully.

⚠ CAUTION
If parameters explained this section are wrong, the welding cannot be done in good. Please do not set drastic value.

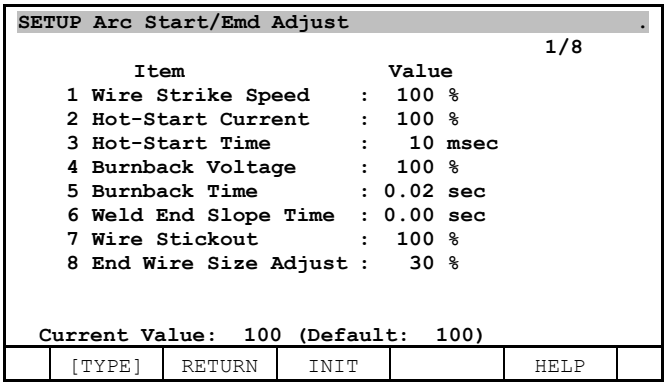


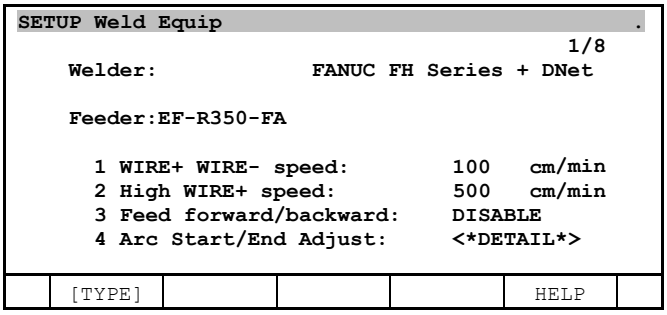
Table 3.7 (a) Parameters to adjust arc start/end

Item	Function	Detail
Wire Strike Speed	Adjust wire feed speed during occurring open circuit voltage after weld start ON. Default is 100%.	Following cases might be improved by adjusting. If continue unstable arc start, decrease this value from 100% and then slow WFS. If quick arc start is required by many consecutive weld lines, increase this value from 100% and then speed WFS.
Hot-Start Current	Adjust Hot-start current that is current right after weld start ON. Default is 100%	If continue unstable arc start, adjust this parameter. However, Wire strike speed is also changed if you make a major change.
Hot-Start Time	Adjust duration time of Hot-start current that is current right after weld start ON. Default is 10msec.	If continue unstable arc start, adjust this parameter. However, Wire strike speed is also changed if you make a major change.
Burnback Voltage	After weld end, output voltage for a constant time to prevent wirestick between wire and work. Adjust this voltage. Default is 100%.	By this adjustment, a state of Burnback process is settled. If voltage is too high, wire might stick to contact tip. Please make sure to confirm.
Burnback Time	Adjust time of Burnback process. Default is 0.02sec.	By this adjustment, a state of Burnback process is settled. If time is too long, wire might stick to contact tip. Please make sure to confirm.
Weld End Slope Time	Adjust time of weld end process.	Don’t change from 0sec normally.
Wire Stickout	This parameter has reference to Burnback process. Default is 100%.	Don’t change from 100% normally.
End Wire Size Adjust	Adjust size of ball created at tip of wire. Default is 30%.	By this adjustment, size of ball is changed.

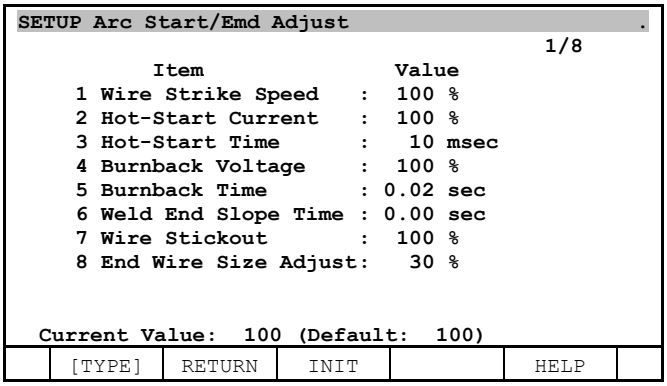
Procedure 3-7 Adjust arc start/end process

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] and select “Weld Equip”. SETUP Weld Equip screen will be displayed.



3 Move the cursor to ”*DETAIL*” of ”Arc Start/End Adjust”, and press [ENTER] key. SETUP Arc Start/End Adjust screen will be displayed.



4 Input any vale to each item, and press the [ENTER] key. If it is out of region of settable, maximum or minimum value is set.

5 As a result of adjustment, if the quality of welding deteriorates and you cannot recover, all parameter in this screen can be initialized. Press F3[INIT]. After the message “Is it OK to perform Initialization?” is displayed, press F4[YES] and execute initialize. After that, all parameters in this screen set default.

4 ARC WELDING FUNCTIONS

This chapter describes about setting operation of functions related to arc welding depending on using situation (when starting arc welding, when finishing arc welding and others.)

4.1 FUNCTION OF ARC WELDING START TIMING

Functions related to arc welding start timing are follow.

- Gas control just before weld start (Gas purge/ Gas pre flow function)
- Adjustment of weld schedule at weld start position (Runin function)
- Retry after weld start failed (Repeat touch retry function, Scratch start function)

This section explains overview and using method of these functions.

4.1.1 Gas Control just before Weld Start

There are two functions for executing gas control just before weld start: Gas Purge function and Gas Preflow function.

Gas Purge

Gas purge function improves arc start quality without increasing cycle times by starting gas flowing before robot arrives arc start position and still be moving. Only the additional motion instruction type weld instructions support the function.

Gas Preflow Function

On the other hand, gas preflow function also improves quality by starting gas flowing during assigned time after robot arrived. The additional motion instruction type and single type weld instructions support the function but the cycle time increases preflow time.

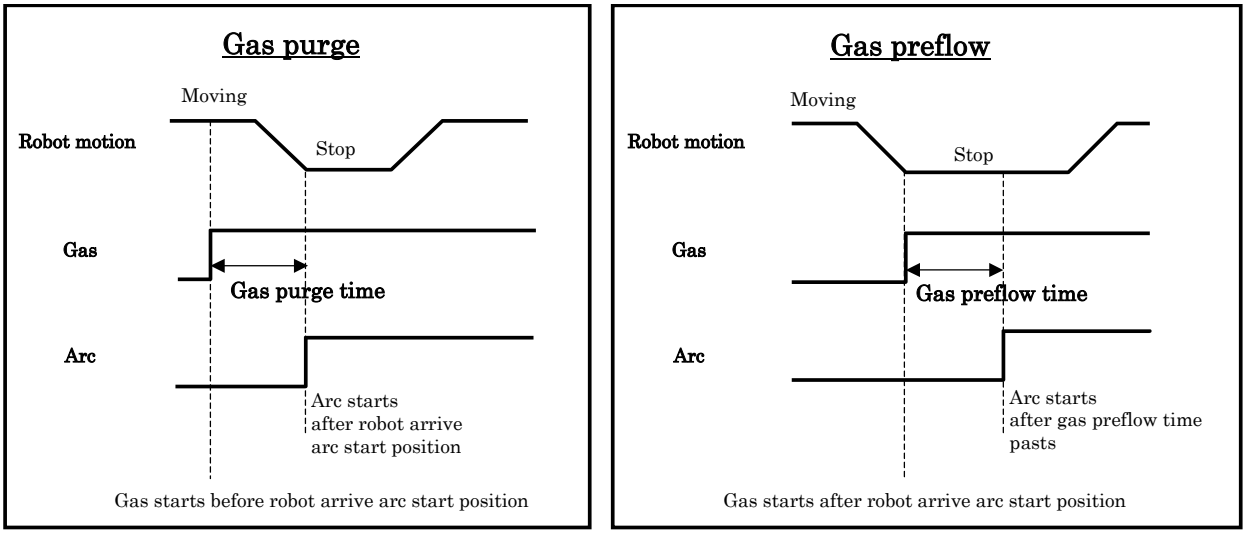


Fig. 4.1.1 (a) Timing chart of gas purge and gas preflow

Gas purge time and gas preflow time are setup in each weld procedure. When a time is zero, the corresponding function becomes disabled.
In standard is that gas purge time is 0.35 sec and gas preflow time is 0 sec, so gas purge function is executed every additional motion instruction type weld instruction and gas preflow function is never executed without setup the time manually.

```
DATA Weld Procedure         1                          .
                                                 1/8
   -  Procedure             1 [                   ]
      Weld equipment        1
      Manufacturer:         FANUC
      Model:                FH Series + Dnet
      File name:            AWE1WP01
      Schedules:            3

      Runin :                          ENABLED
      Burnback:                        ENABLED
      Wirestick reset:      3          ENABLED

      Gas purge:                    0.35  sec
      Gas preflow                   0.00  sec
      Gas postflow:                 0.00  sec

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

NOTE
1. When gas purge time is longer than the moving time of the weld start added motion instruction, gas purge is executed during the moving time.
2. Both of gas purge time and gas preflow time setup in a weld procedure, both of the function are executed when the weld procedure is selected.

4.1.2 Adjustment of Weld Schedule at Weld Start Position

Runin Function

Runin function requests specified welding commands with the torch stops at the arc start position. This function is used for arc start executes smoothly by requested different current/voltage commands from welding.
Command values and delay time for runin can be specified on each weld procedure.

In standard is that the function is disabled. If you would like to use it, set up the configurations with Procedure 4-1-2.

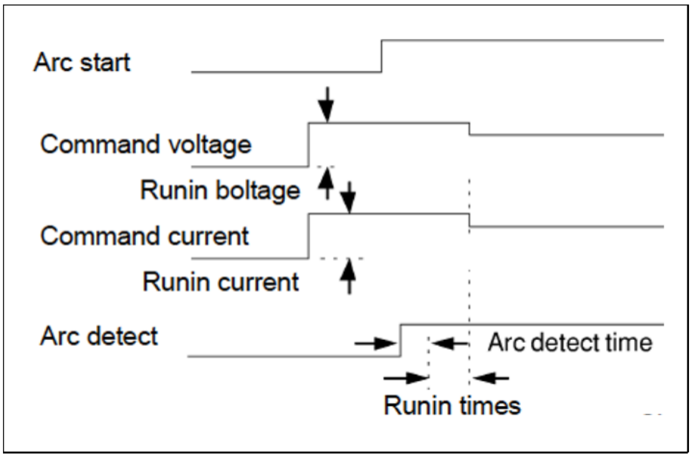


Fig. 4.1.2 (a) Runin function

Procedure 4-1-2 Setup of Runin Function

Step

1. Press the [DATA] key and press F1[TYPE] and select “Weld Procedure”. Weld Procedure data screen will be displayed.
2. Move cursor to “Procedure” you would like to use and press F2 [DETAIL]. The following screen will be displayed.

```
Data Weld Procedure                                      .
                                              1/8
   -  Procedure              1 [                ]
      Weld equipment         1
      Manufacturer:          FANUC
      Model:                 FH Series + Dnet
      File name:             AWE1WP01
      Schedules:             3

      Runin :                         DISABLED
      Burnback:                       DISABLED
      Wirestick reset:       3        ENABLED

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

3 Move the cursor to [Runin]. If it needs to be enabled, press F4 [ENABLED]. If it needs to be disabled it, press F5 [DISABLED].

```
Data Weld Procedure                                      .
                                              1/8
   -  Procedure              1 [                ]
      Weld equipment         1
      Manufacturer:          FANUC
      Model:                 FH Series + Dnet
      File name:             AWE1WP01
      Schedules:             3

      Runin :                         ENABLED
      Burnback:                       DISABLED
      Wirestick reset:       3        ENABLED

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

4 Next, setup Runin schedule. Move cursor on "Schedules" in the weld procedure and press F2 [DETAIL]. The following screen will be displayed.

```
DATA Weld Procedure         1                           .
                                              7/12
   +  Mode        1 [CV CO2 Syn         ]
   -  Schedule
   Schedule#  Amps       % SPEED  TIME
   Runin      200.0  100.0        0.00
   Schedule 1   0.0  100.0   0.0  0.00
   Schedule 2   0.0  100.0   0.0  0.00
   Schedule 3   0.0  100.0   0.0  0.00
   Burnback   200.0  100.0         0.1

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

5 Move cursor to the schedule of Runin and change the command value if necessary.

⚠CAUTION

1 Even if the runin is enable, runin is not executed when "Delay Time" is 0sec.
2 When you set the Runin enable and Delay Time, it is applied to all the welding parts where the corresponding process selection number is used. When both the Runin applying part and the Runin not applying part exists for one process mode, please assign the process mode number to two process selection number. One side set the Delay Time and the other side does not set the Delay Time.

4.1.3 Retry after Weld Start Failed

There are two functions to retry weld start after weld start failed: Repeat Touch Retry Function and Scratch Start Function.

Repeat Touch Retry Function

When arc is not generated at arc start instruction, Repeat Touch Retry Function retry start of welding at the same position (arc start position) by the motion of the Figure below. If arc is not generated after this motion, Scratch Start function of next Section works.

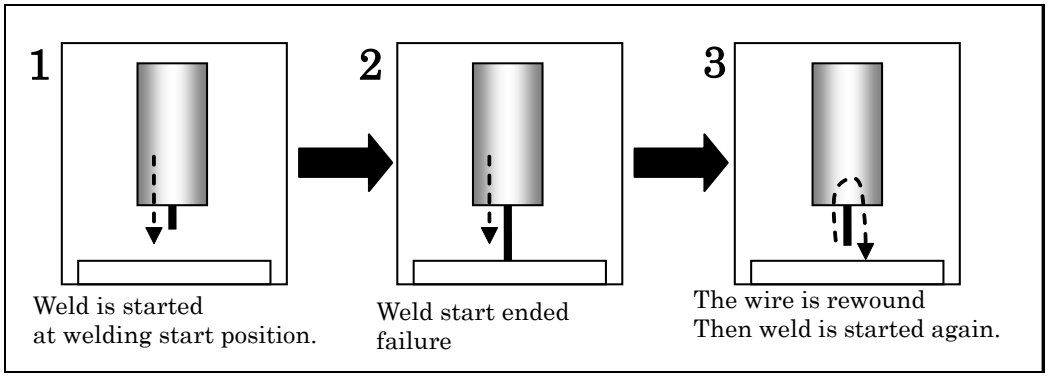


Fig. 4.1.3 (a) Repeat Touch Retry Function

In standard, Repeat Touch Retry is enabled and retry count is 2. The following procedure 4-1-3 (a) shows the setup procedure of Repeat Touch Retry function.

Operation 4-1-3 (a) Setup of Repeat Touch Retry Function

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below and the following screen will be displayed.

```
SETUP Weld System                                    .
                                                10/22
    Scratch Start Function
     10 Scratch Start:           ENABLED
     11 Distance:                5    mm
     12 Return to start speed:   100  mm/s
     13 Retry count:             1
    Repeat Touch Retry Function
     14 Repeat Touch Retry:      ENABLED
     15 Retry count:             2

 | [TYPE] |  |  | ENABLED | DISABLED |  |
```

3 Move the cursor to [14 Repeat Touch Retry]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4 Change the value of [Retry count] if necessary.

Scratch Start Function

When arc is not generated at arc start instruction, scratch start function is performed. The top of the wire moves from arc start position to next target position by specified distance. When arc generates during this process, the top of the wire returns to welding starting position at once and the welding program is continued.

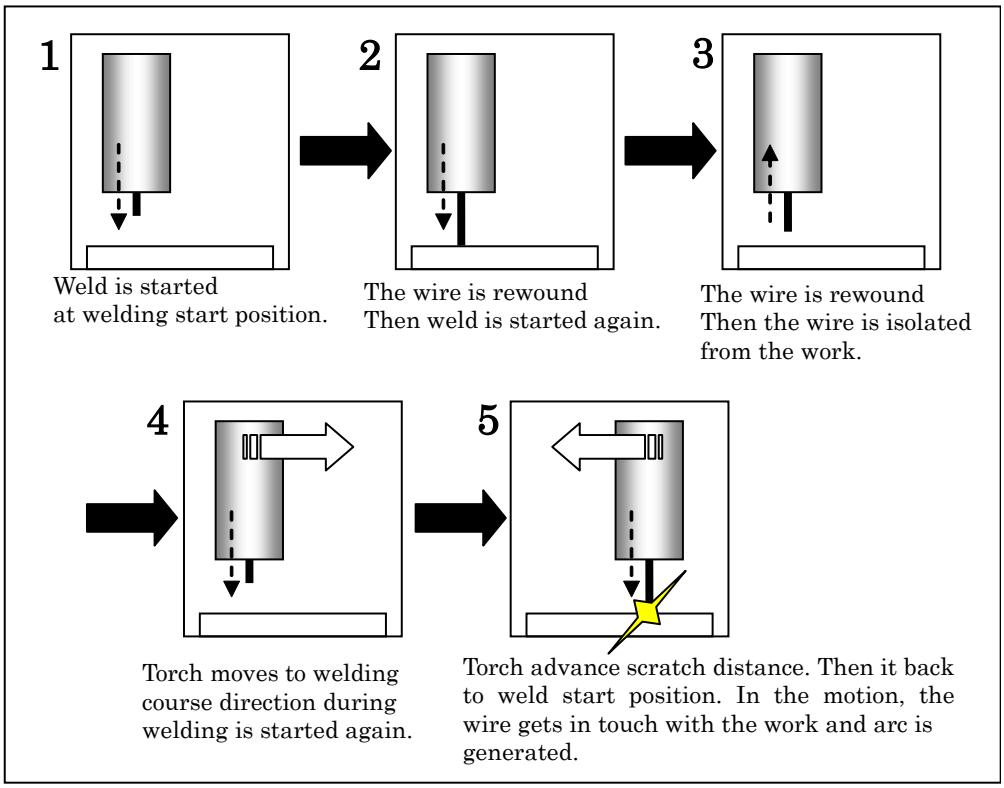


Fig. 4.1.3 (b) Scratch start function

Scratch start has the following three setting items.

Scratch return speed

This is the returning speed from the arc generating position during scratch motion. When this value is too low, some holes are generated at work since heat gain increases by the arc output during returning motion. So please set this value to high as much as possible.

When robot approach change rapidly in the motion like a circular motion, robot cannot reach the speed; for example, when robot approach changes rapidly, the scratch return speed may become 30 mm/sec even if the command is 100 mm/sec.

Scratch distance

This is the maximum distance that robot moves during scratch motion. When the arc does not generate even if the top of the wire moves by this distance, alarm is generated. When this value is too long, the area of heat insertion becomes large. So please set this value to short as much as possible.

Retry count

Specify the number of times of Scratch Return.

In the standard is that scratch start is enabled, scratch distance is 5 mm and scratch return speed is 100 mm/sec. Retry count is 1. Those settings support various welding from thin metal welding to heavy welding.

The following procedure 4-1-3 (b) shows the setup procedure of scratch start function.

Procedure 4-1-3(b) Setup of Scratch Start Function

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below and the following screen will be displayed.

```
SETUP Weld System                                        .
                                                    10/22
Weld Restart Function
  7 Return to path:                 ENABLED
  8 Overlap distance:               0     mm
  9 Return to path speed:           200   mm/s
Scratch Start Function
 10 Scratch start:                  ENABLED
 11 Distance                        5     mm
 12 Return to start speed:          100   mm/s
 13 Retry count:                    1
 [TYPE]                                        HELP
```

3 Move the cursor to [10 Scratch start]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4 Change the value of [Distance] , [Return to start speed] and [Retry count] if necessary.

> **⚠CAUTION**
> When the scratch start is executed in circular or circle arc motion, scratch return motion becomes linear motion. Please set [distance] to short because there is a possibility that the torch interferes with work in circular motion.

4.2 FUNCTION OF ARC WELDING END TIMING

Functions related to arc welding end timing are follows.

- Check and reset of wire stick (Wire stick detect/reset function)
- Gas control at weld end timing (Gas end flow / post flow functions)

This section explains overview and using method of these functions.

4.2.1 Check and Reset of Wire Stick

At weld end timing, there is a case to stuck the wire to workpiece by welding situation. For confirming the situation, Wire Stick Detect Function can be used. Additionally, Wire Stick Reset Function can cut the wire off by burning forcibly when wire is stuck.

Wire Stick Detect Function

Wire Stick Detect Function is the function that a weld equipment judges whether the wire is fixed or not during arc end (the timing of the execution of Arc End instruction, or pause the program during welding).

When the robot is moved even if a wire have stuck, the weld torch or a fixture may be bent. To prevent it, Wire Stick Reset is executed automatically or the following alarm occurs when wire stick is detected.

ARC-011 STOP.L Wire stick, not reset

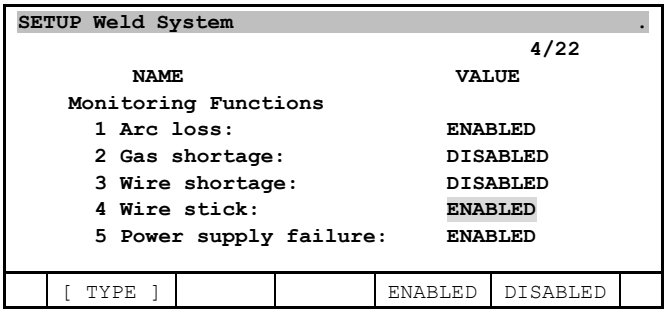
The function becomes ENABLED ss default.

Procedure 4-2-1 (a) shows how to change the enabling/disabling Wire Stick Detect Function.

Procedure 4-2-1 (a) Enabled/Disabled wire stick detect function

Step

1 Press the [MENU] key. and select “6. Setup”.
2 Press F1[TYPE] key and select “1,. Weld System”. the following screen will be displayed.



3 Move the cursor on “4. Wire stick”, when it becomes enabled, press F4 “ENABLED”, on the other hand, when it becomes disabled, press F5 “DISABLED”

Auto Wire Stick Reset Function

If a wire stick occurs at the end of welding, this function burns off the stick by applying a voltage for a fraction of a second.

You can set the total number of wire stick reset tries, commanded parameters and processing time to output. If a wire stick is detected again after wire stick reset, a wire stick reset is repeated. As a result, if wire stick is reset, the program execution is continued. After a wire stick reset is repeated a specified number of reset tries, if a wire stick is still detected, a weld alarm is posted and a robot motion is stopped.

ARC-012 STOP.L Wire stick reset(s) failed

The relation between Wire Stick Detect Function and Auto Wire Stick Reset Function are described in Fig. 4.2.1. The setup procedure for Auto Wire Stick Reset Function is described in Procedure 4-2-1 (b).

The function becomes ENABLED as default. But when wire stick detect function is disabled, the function is never operated even if it is enabled.
Both of enable/disable the function and schedule are setup in each weld procedure.

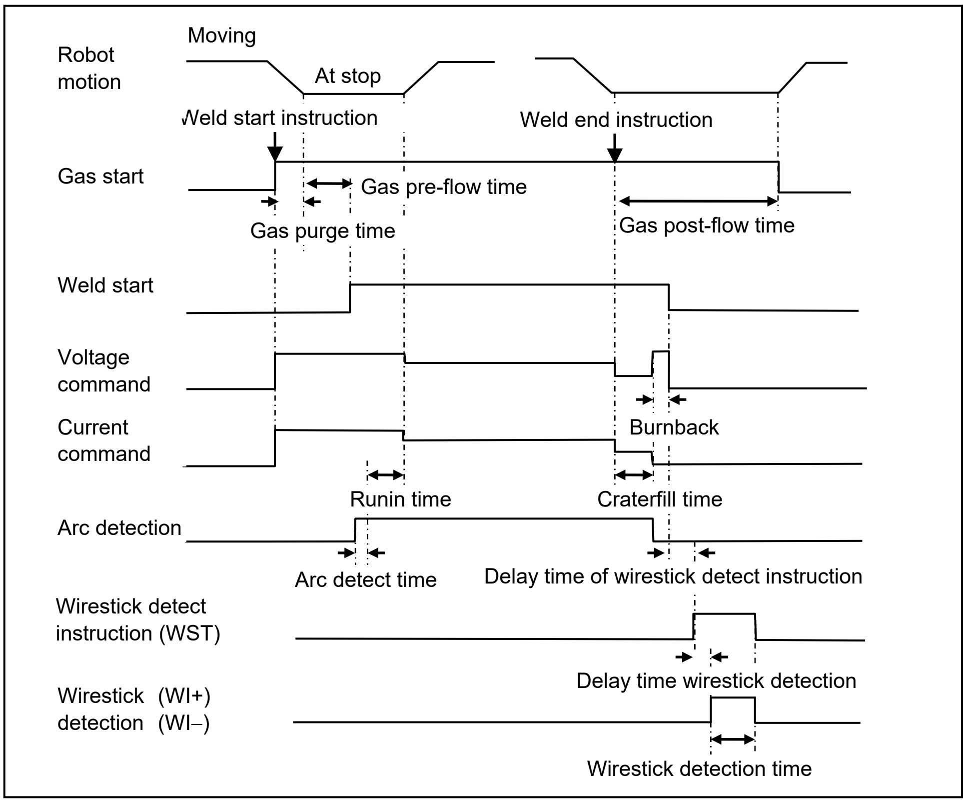


Fig. 4.2.1 (a) Wire stick detect and reset sequence

Procedure 4-2-1 (b) Setup Auto Wire Stick Reset Function

Condition

- Wire stick detect function is enabled.

Step

1. Press the [DATA] key and press F1[TYPE] and select "Weld Procedure". Weld Procedure data screen will be displayed.
2. Move cursor to "Procedure" you would like to use and press F2 "DETAIL".
3. Move the cursor on "Wire stick reset", when it becomes enabled, press F4 "ENABLED", on the other hand, when it becomes disabled , press F5 "DISABLED".

```
DATA Weld Procedure        1                          .
                                          1/8
  -  Procedure             1 [                ]
     Weld equipment        1
     Manufacturer:         FANUC
     Model:                FH Series + Dnet
     File name:            AWE1WP01
     Schedules:            3

     Runin :                   DISABLED
     Burnback:                 DISABLED
     Wirestick reset:      3   ENABLED

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

4. The left content of enabled/disable of the function is setup the retry count of the function. it retry for up to 3 times.

5 Next, setup wirestick reset schedule. Move cursor on “Schedules” in the weld procedure and press F2 [DETAIL]. The following screen will be displayed.

```
DATA Weld Procedure                                  .
                                              1/8
  +  Mode                  1 [CV CO2 Syn       ]
  -  Schedules
 Schedule #    Amps       %    Speed      Time
 Schedule  1  120.0   100.0     20.0      0.00
 Schedule  2  120.0   100.0     20.0      0.00
 Schedule  3  120.0   100.0     20.0      0.00
 Wirestick    200.0   100.0               0.10

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

6 Move the cursor on Wirestick in the schedules and change the command if necessary.

Treatment of Wire Stick State

When a wire sticks, Wire Stick Reset (Weld Equipment Setup Screen) is performed. But there is a case that wire still sticks after Auto Wire Stick Reset. Then, ARC-012 is posted.

When wire has still stuck after pressed alarm reset key, the following alarm occurs. The severity of the alarm is STOP.L, so you cannot perform program execution during wire stick.

ARC-030 STOP.L Wire stick is still detected

In this case, it is necessary to cut the wire by yourself. After you cut the wire, press alarm reset key and check that ARC-030 doesn’t occur.

Since the robot position is too difficult for cutting the wire, please jog the robot to refer to the following procedure.

Procedure 4-2-1 (c) Wire Cutting after Jogging a Robot

Step

1 Change 3 Mode Switch to T1 or T2.
2 Change a Teach Pendant Switch to ON.
3 **Press alarm reset key while pressing SHIFT key.** The severity of ARC-030 alarm changes from STOP.L to WARN. As a result, you can jog a robot.
4 Set a low speed override and carefully jog a robot. Then, cut the wire.
5 After cutting the wire, **once press alarm reset key.** At the timing, wire stick detect is performed again and alarm is reset.

NOTE
You can jog a robot during wire stick state, but you cannot execute/resume a program. If you resume a program when the severity of ARC-030 is WARN, “INTP-106 Continue request failed” is posted.

External Output of Wire Stick Alarm

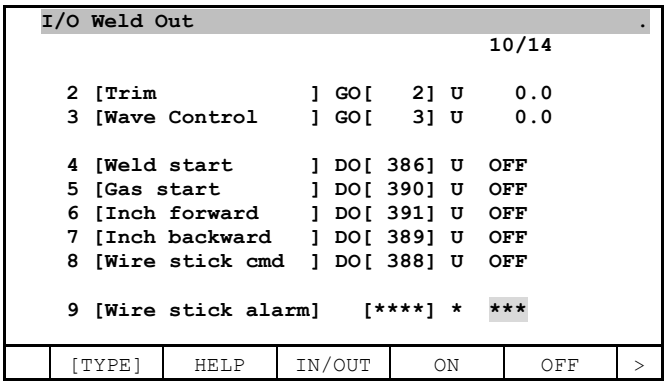
It is possible to output the wire stick state by Wire Stick Alarm Output Signal.
Wire Stick Alarm Output Signal is continued to output while the wire sticks (Wire Stick Detect Input Signal is ON) with Wire Stick Detect Function ENABLED (Weld System Setup Screen). If Auto Wire Stick Reset Function is ENABLED (Weld Equipment Setup Screen), the signal is output after wire stick reset and wire stick is still detected.

About the assignment of Wire Stick Alarm Output Signal, refer to Procedure 4-2-1 (d).

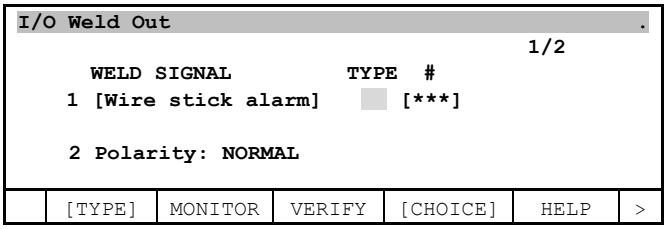
Procedure 4-2-1 (d) Assignment of wire stick alarm output signal

Step

1 Press the [MENU] key and select ”5 I/O”. and Press F1[TYPE] key and select ”Weld”. Either Weld Input screen or Output screen will be displayed.
2 When Weld Input screen is displayed, press F3 “IN/OUT”.
3 Move cursor on “Wire stick alarm”.



4 Press the [NEXT] key and F3 “Config”, the following screen will be displayed.



5 Select signal type and number.
6 Press F3 “VERIFY” after press F2 “MONITOR” to check selected signal whether exists or not.
7 Cycle power the controller. After reboot it, selected signal is assigned as wire stick alarm output signal.

4.2.2 Gas Control at Weld End Timing

At the weld end timing, gas flow continues automatically until all the weld end processes (burnback, wire stick detect, reset, etc.) are finished. This is called “Gas End Flow”. The time of gas end flow becomes the time of both burnback and wire stick detect/reset processes, but the time for wire stick detect process is changed by the wire stick status. Therefore, gas end flow time never becomes constant.

After craterfill process, if you always would like to perform gas flow with the constant time over gas end flow time on the weld end point, you can use gas post flow function. Gas post flow function can be used by setting gas post flow time.

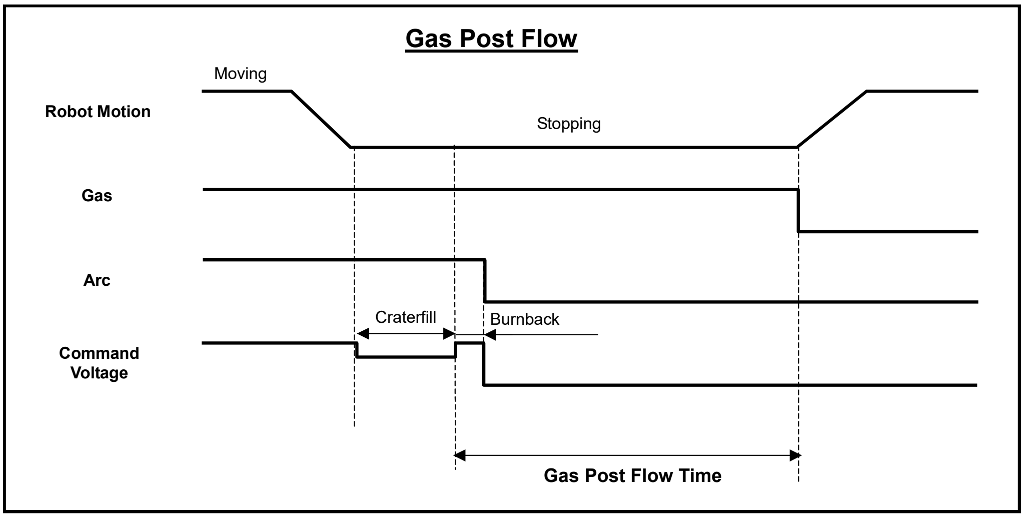


Fig. 4.2.2 (a) Timing Chart of Gas Post Flow

Robot stops until finishing gas post flow, so the setup of gas post flow time influences the cycle time. As Fig 4.2.2 (a) , the count of gas post flow time starts just after craterfill process is completed, so burnback time and wire stick detect/reset time (gas end flow time) are included in gas post flow time. As a result, gas flow stops and robot moves to the next motion after finishing the longer process between gas end flow and gas post flow.

Gas post flow function is applied when the weld procedure which sets the gas post flow time is specified on Weld End instruction. When 0 sec is specified as gas post flow time, this function becomes disabled. 0 sec is specified as default, so normally gas end flow is applied.
Gas post flow can be used with both additional-motion instruction or single instruction of Weld Start instruction.

```
Data Weld Procedure                                  .
                                            1/8
  -  Procedure              1 [                  ]
     Weld equipment         1
     Manufacturer:          FANUC
     Model:                 FH Series + Dnet
     File name:             AWE1WP01
     Schedules:             3

     Runin :                    ENABLED
     Burnback:                  DISABLED
     Wirestick reset:       3   ENABLED

     Gas purge:                  0.35  sec
     Gas preflow                 0.00  sec
     Gas postflow:               0.00  sec

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

4.3 OTHER FUNCTION RELATED TO ARC WELDING

This section describes several useful functions supporting arc welding with robots.

- Auto recovery to pause position (Return to Path Function)
- Gas control by external devices (Remote Gas Purge Function)
- Wire feed control by external devices (Remote Wire Inching Function)
- Monitoring Functions
- Weld External Output Function
- Torch Guard Function
- Auto recovery of TCP gap (Torch Mate Function)

- Arc Abnormal Monitor Function
- Arc Welding Analogue Meter Displaying Function
- Touch Sensing Function

4.3.1 Auto Recovery to Pause Position

Return to Path Function (Original Path Resume Function) enables the weld from a breakpoint if the weld motion is interrupted by HOLD or Alarm and then the robot is move away. First, a robot moves to a breakpoint without welding and then restarts welding from the point by resuming a program. For resuming a welding from a breakpoint, you need to set a weld to ENABLED.

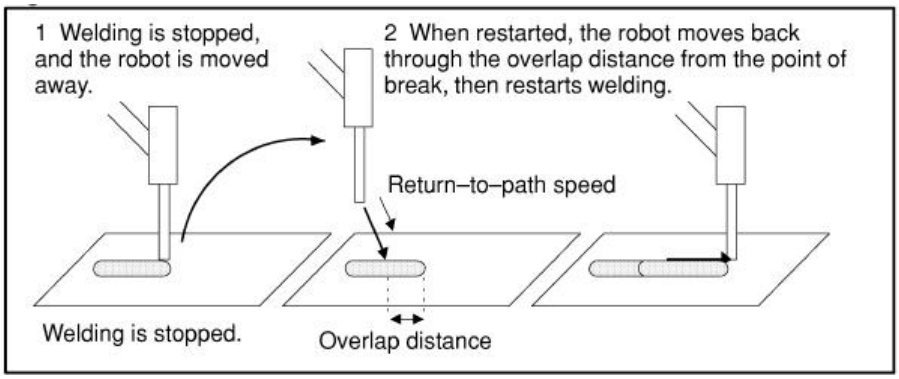


Fig. 4.3.1 (a) Return to path function

Additionally, when a program is stopped without welding and robot moves to away, robot moves to break point at first and restart the program.

The following two setting items are prepared for Return to Path Function.

Overlap Distance

When directed to restart, the robot moves back from the breakpoint through the overlap distance, then restarts welding. This is intended to prevent the sequence of beads from being out. If the specified overlap distance extends beyond the previous teaching point, the actual overlap distance is limited to within that teaching point.

Return to Path Speed

Specifies the return-to-path speed at which the robot moves to the breakpoint when restarted.

In the standard is that return to path function is enabled, Overlap distance is 0 mm and Return to path speed 200 mm/sec. Normally, please use it with enabled.

⚠CAUTION

1 In the case of this function DISABLE, welding is restarted from current position when JOG operation is executed during welding. The welding pass becomes from current position to the next target position. So please set this function enable normally.
2 When operator restarts the program after robot is moved by JOG at HOLD for avoiding interference with work, welding restarting position is the position that HOLD is executed. So robot returns the HOLD position. To avoid this problem, please do the backward execution momentarily at the JOG position.

NOTE
Overlap distance is used only when a program is stopped during welding motion. When robot restart with weld disabled or the program is stopped without welding, the distance is ignored.

Following procedure 4-3-1 shows the setup procedure for return to pass function.

Procedure 4-3-1 Setup of Return to Pass Function

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below. The following screen will be displayed.

```
SETUP Weld System                                    .
                                                 7/22
  Weld Restart Function
   7 Return to path:                 ENABLED
   8 Overlap distance:               0     mm
   9 Return to path speed:           200   mm/s
Scratch Start Function
  10 Scratch start:                  ENABLED
  11 Distance                        5     mm
  12 Return to start speed:          100   mm/s

 |  | [TYPE] |  |  |  | HELP |  |
```

3 Move the cursor to [7 Return to path]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4 Please change the value of [Overlap distance] and [Return to path speed] if necessary.

4.3.2 Gas Control by External Devices

Remote Gas Purge Function

Remote gas purge function is the function to execute the gas purge by the external input signal. When you use this function, gas check can be executed without teach pendant.

If you would like to use this function, please execute the following setting procedure.

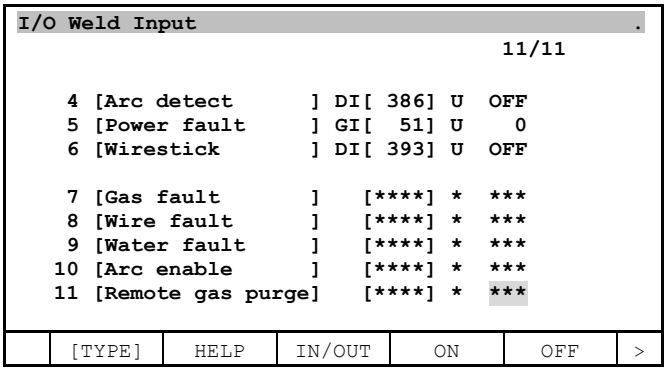
Procedure 4-3-2 Setup Remote Gas Purge Function

Step

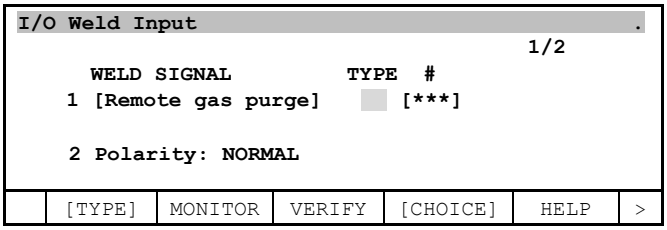
1 Press the [MENU] key and select “6. Setup”. and press F1[TYPE] key and select “Weld System”, Weld System Setup screen will be displayed. Move a cursor to the bottom and then the following screen will be displayed.

```
SETUP Weld System                                    .
                                                 19/22
   Weld Speed Function
     16 Default speed:               100 cm/min
    Other Functions
     17 On-The-Fly:                  ENABLED
     18 Weld from teach pendant:     ENABLED
     19 Remote gas purge:            DISABLED
     20 Remote wire inch:            DISABLED
     21 Gas purge key:               ENABLED
     22 Gas purge time:              5     sec

 |  | [ TYPE ] |  |  | ENABLED | DISABLED |  |
```

2 Move cursor on “Remote gas purge”, when it needs to be enabled, press F4 “ENABLED” when it needs to be disabled press F5 “DISABLED”.
3 Next, assign the input signal. Press the [MENU] key and select “5 I/O” and Press F1[TYPE] key and select “Weld”. Either Weld Input screen or Weld Output screen will be displayed.
4 When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.



5 “Remote gas purge” signal will be appeared at the bottom of Weld Input screen only when remote gas purge function is enabled at step 2 in the procedure
6 Move cursor on “Remote gas purge” and press the [NEXT] key and F3 “Config”, the following screen will be displayed.



7 Select signal type and number.
8 Press F3 “VERIFY” after press F2 “MONITOR” to check selected signal whether exists or not.
9 Cycle power the controller. After reboot it, selected signal is assigned as remote gas purge output signal.
10 When a signal is input through the signal assigned as remote gas purge signal (remote gas purge input signal becomes ON), robot request gas output signal and gas purge will be operated.

4.3.3 Wire Feed Control by External Devices

Remote Wire Inching Function

Remote wire inching function is the function to execute the wire inching (forward / backward) by the external input signal. When you use this function, wire inching can be executed without teach pendant.

Remote wire inching speed and manual wire inching (using teach pendant) speed can be independently set. If you would like to use this function, please execute the following setting procedure.

Procedure 4-3-3 Setup Remote Wire Inching Function

Step

1 Press [MENU] key and select “6. Setup”. and press F1[TYPE] key and select “Weld System”, Weld System Setup screen will be displayed. Move a cursor to the bottom and then the following screen will be displayed.

```
SETUP Weld System                                   .
                                             20/22
   Weld Speed Function
     16 Default speed:            125 cm/min
    Other Functions
     17 On-The-Fly:               ENABLED
     18 Weld from teach pendant:  ENABLED
     19 Remote gas purge:         DISABLED
     20 Remote wire inch:         DISABLED
     21 Gas purge key:            DISABLED
     22 Gas purge time:           5     sec

  [ TYPE ]            ENABLED  DISABLED
```

2 Move cursor on “Remote wire inching”, when it needs to be enabled, press F4 “ENABLED” when it needs to be disabled press F5 “DISABLED”.

3 Next, assign the input signal. Press [MENU] key and select “5 I/O” and Press F1[TYPE] key and select “Weld”. Either Weld Input screen or Weld Output screen will be displayed.

4 When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.

```
I/O Weld Input                                      .
                                             11/11

    4 [Arc detect      ] DI[ 386] U  OFF
    5 [Power fault     ] GI[  51] U    0
    6 [Wirestick       ] DI[ 393] U  OFF

    7 [Gas fault       ]   [****] *  ***
    8 [Wire fault      ]   [****] *  ***
    9 [Water fault     ]   [****] *  ***
   10 [Arc enable      ]   [****] *  ***
   11 [Remote inch fwd ]   [****] *  ***
   12 [Remote inch bwd ]   [****] *  ***

  [TYPE]  HELP  IN/OUT  ON  OFF  >
```

5 “Remote inch fwd” and “Remote inch bwd” signals will be appeared at the bottom of Weld Input screen only when remote gas purge function is enabled at step 2 in the procedure.

6 Move cursor on “Remote inch fwd” and press [NEXT] key and F3 “Config”, the following screen will be displayed.

```
I/O Weld Input                                      .
                                               1/2
     WELD SIGNAL          TYPE  #
    1 [Remote inch fwd]         [***]

    2 Polarity: NORMAL

  [TYPE]  MONITOR  VERIFY  [CHOICE]  HELP  >
```

7 Select signal type and number.

8 Press F3 “VERIFY” after press F2 “MONITOR” to check selected signal whether exists or not.

9 Assign “Remote inc bwd” with same steps (Refer to step.6 to 8)

10 Cycle power the controller. After cycle power, selected signal will be newly assigned.

11 At last, setup remote wire feed speed. Press [MENU] key and select “6. Setup” and press F1[TYPE] key and select “Weld Equip”. Weld Equipment Setup screen will be displayed.

```
SETUP Weld Equip                                    .
                                               4/9

      2 WIRE+ WIRE- speed:         80 cm/min
      3 High WIRE+ speed:          500cm/min
      4 Remote wire inch speed:    80 cm/min
      5 Feed forward/backward:     ENABLED

  [TYPE]                       HELP
```

12 "Remote wire inch speed" will be appeared below on "High Wire+ speed" only when remote wire inching function is enabled. Input the speed of remote wire inching.
13 When "Remote inch fwd" signal becomes ON, wire feeding to forward, on the other hand, "Remote inch bwd" signal becomes ON, wire feeding to backward.

4.3.4 Monitoring Functions

These functions are for monitoring abnormal state during arc welding. Monitoring functions have following six functions.

- Arc Loss Detect
- Gas Shortage Detect
- Wire Shortage Detect
- Wire Stick Detect
- Power Supply Failure Detect
- Coolant Shortage Detect

Subsection 4.2.1 describes wire stick detect function more detailed, please see the subsection about it.

Arc Loss Detect

The function posts an alarm and stops the welding and robot motion if the arc is lost during the fixed time of the welding.

Enabled/Disabled this function is set by Weld System Setup Screen. Allowance time of arc loss is defined on Weld Equipment Setup screen. If the arc detect signal is not returned over the time, the following alarm occurs and the welding and robot motion are stopped.

"ARC-018 Lost arc detect"

In the standard in that this function is enabled. Normally, please use it with enabled.

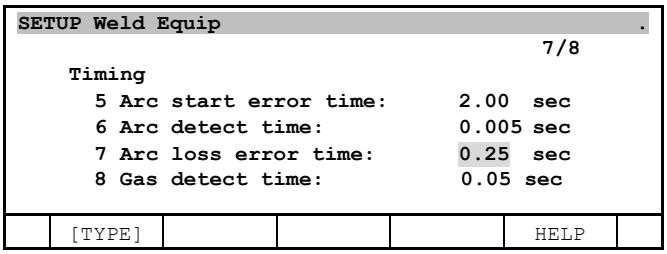
Procedure 4-3-4 (a) Setup Arc Loss Detect

Step

1 Press the [MENU] key and select "6. SETUP".
2 Press F1[TYPE] key and select "Weld System". The following screen will be displayed.

```
SETUP Weld System                                    .
                                                1/22
         NAME                         VALUE
    Monitoring Functions
      1 Arc loss:                     ENABLED
      2 Gas shortage:                 DISABLED
      3 Wire shortage:                DISABLED
      4 Wire stick:                   ENABLED
      5 Power supply failure:         ENABLED
      6 Coolant shortage:             DISABLED

   [ TYPE ]                    ENABLED   DISABLED
```

3 Move cursor on "Arc Loss". When it needs to be enabled, press F4 "ENABLED" when it needs to be disabled press F5 "DISABLED".
4 When the function becomes enabled in step 3, setup arc error detect time.
Press F1[TYPE] key and select "Weld Equip". Weld Equipment Setup screen will be displayed.
5 Move cursor to the bottom and "Arc loss error time" will be appeared.



6 In the standard is that the time is 0.25 sec, change the command if necessary.
7 The status of arc loss can output other devices through digital output, for more details , please see Subsection 4.3.5 Weld external output function.

Power Supply Failure Detect

Power Supply Failure Detect signal will become ON if internal of weld equipment is abnormal. If the welding is requested when the input signal is ON, or if the signal becomes ON during welding, the following alarm occurs and the welding and robot motion are stopped.

"ARC-008 Power supply fault"

If the input signal is ON, please specify the cause by using "6.3 REMEDY FOR TROUBLES".
In the standard in that this function is enabled. Normally, please use it with enabled.

Gas, Wire, Coolant Shortage Detect

These functions are not supported as default. Therefore, they are DISABLED as factory default. If you use these functions, please prepare and mount the sensors yourself and operate Procedure 4-3-4 (b). (FANUC does not prepare these sensors.)

When gas/wire/coolant supply become abnormal, sensors detect it and send some signals to the robot controller. The robot controller is monitoring them and when it receives the signals, the following alarms occurs, and the welding and robot motion are stopped.

- **Gas Shortage Detect --- "ARC-005 Gas fault"**
- **Wire Shortage Detect --- "ARC-006 Wire fault"**
- **Coolant Shortage Detect --- "ARC-007 Water fault"**

Enabled/disabled the functions are set on Weld System Setup screen. Next, the assignment of input signals from sensors to the robot controller is required.

Gas shortage detect function has the setup item "Gas Shortage Detect Time". Normally, this delay time exists since robot controller outputs gas signal and gas valve opens until gas arrives to the sensor for gas shortage detect. "Gas Shortage Detect Time" allows the delay time. If the alarm signal is input after the delay time passed, a weld alarm occurs. You should set appropriate value to Gas Shortage Detect Time according to your gas system structure.

⚠CAUTION
1 If Gas Shortage Detect Function becomes ENABLED, the delay time for Gas Shortage Detect Time is generated at arc start timing. Therefore, the cycle time is also increased. Do not set Gas Detect Function to ENABLED if you do not use the sensor for gas shortage detect.
2 If Gas Shortage Detect Time is too short, "ARC-005 Gas fault" might occur at every arc start timing. If so, set it longer time.

Procedure 4-3-4 (b) Setup of Gas, Wire, Coolant Shortage Detect Function

Step

1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] and select [Weld System]. The following screen will be displayed.

```
SETUP Weld System                                 .
                                            2/22
         NAME                         VALUE
    Monitoring Functions
      1 Arc loss:                     ENABLED
      2 Gas shortage:                 DISABLED
      3 Wire shortage:                DISABLED
      4 Wire stick:                   ENABLED
      5 Power supply failure:         ENABLED
      6 Coolant shortage:             DISABLED

   [ TYPE ]                     ENABLED  DISABLED
```

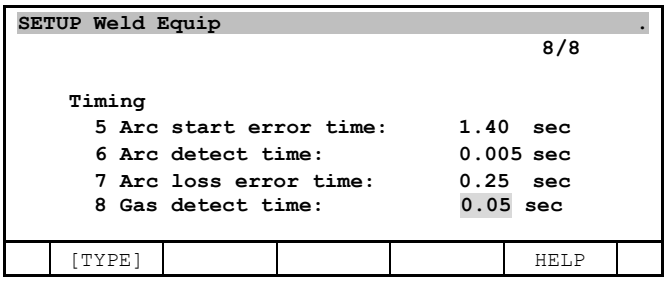
3 Move the cursor on the item, which you would like to set. If you set the function to ENABLED, press F4 “ENABLED”. If you set the function to DISABLED, press F5 [DISABLED].
4 Next, assign the input signals. Press [MENU] key and select “5 I/O” and press F1[TYPE] key and select “Weld”. Either Weld Input screen or Weld Output screen will be displayed.
5 When Weld Output screen will be displayed, press F3[IN/OUT] and change to Weld Input screen.

```
I/O Weld Input                                    .
                                         7/11

    4 [Arc detect      ] DI[ 386] U  OFF
    5 [Power fault     ] GI[  51] U    0
    6 [Wirestick       ] DI[ 393] U  OFF

    7 [Gas fault       ]   [****] *  ***
    8 [Wire fault      ]   [****] *  ***
    9 [Water fault     ]   [****] *  ***
   10 [Arc enable      ]   [****] *  ***

   [TYPE]   HELP   IN/OUT   ON   OFF   >
```

6 Move the cursor on Gas Alarm, Wire Alarm or Coolant Alarm. Then, Press the [NEXT] key and press F3[CONFIG]. The following screen will be displayed. (Following screen is the example of Gas Alarm.)

```
I/O Weld Input                                    .
                                          1/2
      WELD SIGNAL          TYPE  #
    1 [Gas fault       ]         [****]

    2 Polarity: NORMAL

   [TYPE]  MONITOR  VERIFY  [CHOICE]  HELP  >
```

7 Select the port type and port number for the input signal from the sensor.
8 Check the existence of the selected signal by F3 [VERIFY], and press F2 [MONITOR].
9 Cycle power the controller. After reboot it, the selected signal is newly assigned.
10 If Gas Shortage Detected Function is set, you must also set Gas Shortage Detect Function. Please also carry out Step 11 or later
11 Press [MENU] key and select [6 SETUP]. Press F1 [TYPE] and Select [Weld Equip].
12 Move the cursor to below. [Gas detect time] will be displayed. Input the desired value to this item.



13 You can output the gas, wire and coolant shortage state to external as digital signal. Please refer to [5.8 External Output Function for Weld Signals] and setup.

4.3.5 Weld External Output Function

Weld external output function is a function to output various signals that relate to the welding to an outside device such as PLC. The screen to set this function is shown below. Table 4.3.5 shows setup items on this screen and the explanation. Setup procedure of this function is shown in Procedure 4-3-5 (a).

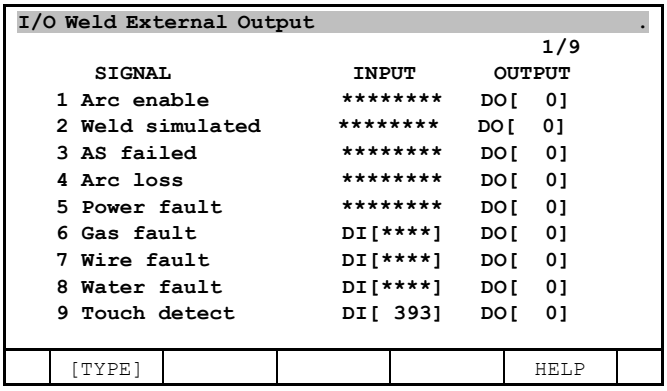


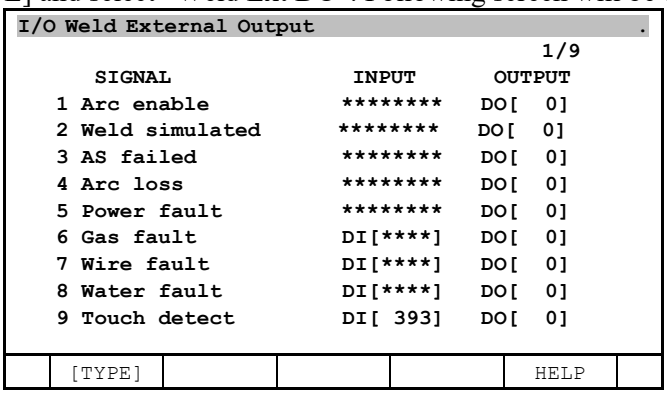
Table 4.3.5 (a) weld signals and the explanation

Signal	Explanation
Arc enable	This signal is output when weld enable. This signal is turned ON/OFF according to the state (weld enable/disable of each equipment). The state of weld enable/disable is displayed on the TEST CYCLE Arc screen.
Weld Simulated	This signal is output when weld simulated mode is enabled. Regarding to the details of weld simulated mode, please refer to Section 5.7 of R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus CONTROLLER Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).
AS failed	This signal is output when Arc Start fails. When this signal is ON, an alarm of **[ARC-013 Arc Start failed]** generates at the same time. When this alarm is reset, this signal is OFF.
Arc loss	This signal is output when the Arc loss generates. When this signal is ON, an alarm of **[ARC-018 Lost arc detect]** generates at the same time. When this alarm is reset, this signal is OFF.
Power fault	This signal is output when it is impossible to communicate with the weld equipment. Moreover, this signal is also output when ArcTool software detects the abnormal state in the weld equipment. This signal is output until [ARC-051 Weld EQi ONLINE: ArcLink] is displayed after turning on the power supply.
Gas fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Gas fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Gas shortage] on the SETUP weld system screen.(If the signal is valid and becomes ON, ARC-003 or ARC-005 alarm occurs as conventionally.)
Wire fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Wire fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Wire shortage] on the SETUP weld system screen. (If the signal is valid and becomes ON, ARC-006 alarm occurs as conventionally.)
Water fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Water fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Coolant shortage] on the SETUP weld system screen. (If the signal is valid and becomes ON, ARC-007 alarm occurs as conventionally.)
Touch detect	Touch detect signal is output when the wire contact with a work. This signal is output according to the state of the Touch sensing input signal. The signal is used for touch sensing function and torch mate function. **Reference:** The Touch sensing input signal turns ON in the state of Touch sensing output signal is ON when the wire contact with a work.

Procedure 4-3-5 (a) Setup of Weld external output function

Step

1 Press the [MENU] key then screen menu will be displayed.
2 Select the "5 I/O".
3 Press the F1 [TYPE] and select "Weld Ext DO". Following screen will be displayed.



4 Set the external output signal corresponding to each usage. When you set OUTPUT to 0, the output signal is invalid. When the specified value has already been used as weld input, [This NO. is already used as Weld Output] is displayed, back to before editing. When the specified value does not exist, [Port assignment is invalid] is displayed, back to before editing.

> **⚠CAUTION**
> In Step 4, the setting of the specified output signal is reflected at once. Therefore, there is a possibility that the signal is immediately turned on after this setting. Please confirm the number well before setting up it.

5 Concerning to [Gas fault], [Wire fault] and [Water fault], it requests to assign the signal of external sensor to weld I/O input. Please refer to Procedure 4-3-4 (b) about the method to assign.

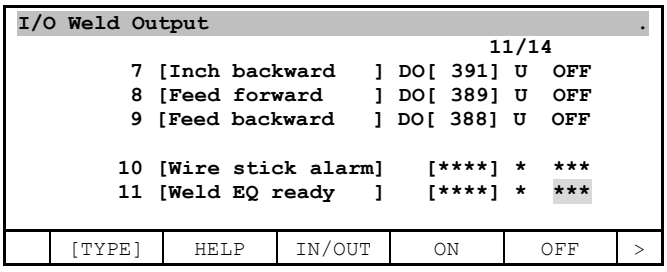
Output weld equipment ready to weld signal

In addition to preceding signals, the output signal announcing that the weld equipment ready to weld to external device is provided.
At start up the controller and weld equipment 30 to 40 sec is required to establish connecting to weld equipment. This signal becomes ON after the establishment of communication. Since external devices checks robot can weld or not through the signal, users can check right and wrong of operations related to weld equipment and starting welding program on external devices.
This signal is displayed on Weld Output screen not Weld External Output screen. Procedure 4-3-5(b) describes the assignment of the signal.

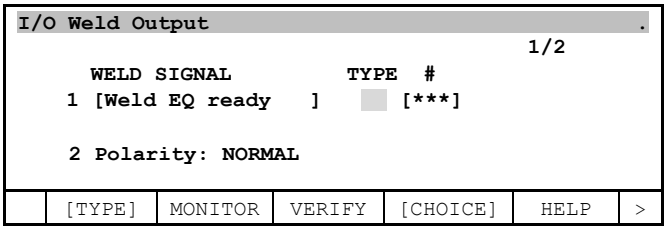
Procedure 4-3-5 (b) Assignment weld equipment ready to weld signal

Step

1 Press the [MENU] key then screen menu will be displayed.
2 Select “5 I/O”.
3 Press F1[TYPE] key and select “Weld”. Weld Input screen or Weld Output screen will be displayed.
4 When Weld Input screen is displayed, press F3[IN/OUT] and change to Weld Output screen.

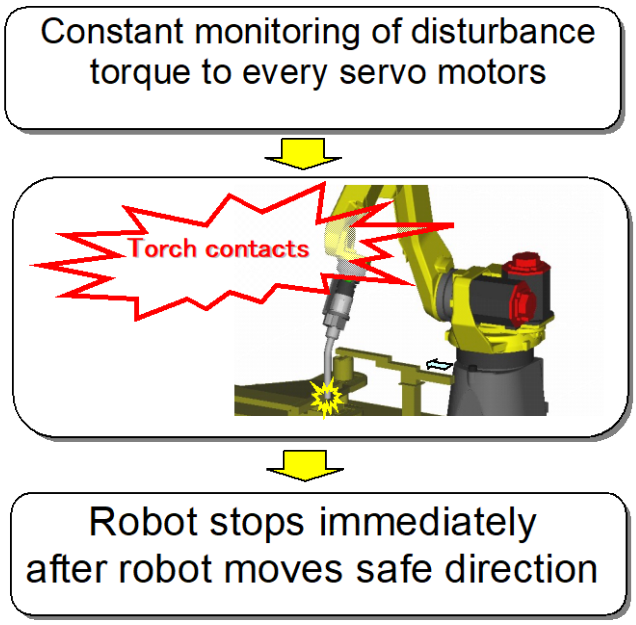


5 Move the cursor on “Weld EQ ready”, press the [NEXT] key and press F3”CONFIG”. The following screen will be displayed.



6 Select the port type and port number for the input signal from the sensor.
7 Check the existence of the selected signal by F3 [VERIFY], and press F2 [MONITOR].
8 Cycle power the controller. After reboot it, the selected signal is newly assigned.

4.3.6 Torch Guard Function



Torch guard function avoid TCP(Tool Center Point) error with reducing damage to robot at torch interference by stopping robot motion immediately. Since TCP error doesn't occur, even if an unexpected robot contact is occurs, the function provides to avoid time-consuming operation; re-setup TCP and re-teach weld program etc.
Since the contact is detected through constant monitoring of disturbance torques for every servo motors, the function detect contacts without additional sensor; shock sensor etc. and the robot stops after it moves to minimize disturbance torques, the damage to torch will be minimized.
This function can detect the contact between jig etc. and not torch but mechanical section of robot.

In the standard is that the function is enabled and it isn't required some setting

4.3.7 Auto Recovery of TCP Gap

Torch Mate Function

Torch mate function detects and recoveries TCP(Tool Center Point) error with executing macro program for a few seconds. This function minimizes restoration time from abnormal status, since the function avoid re-teach weld program even if TCP error occurs.

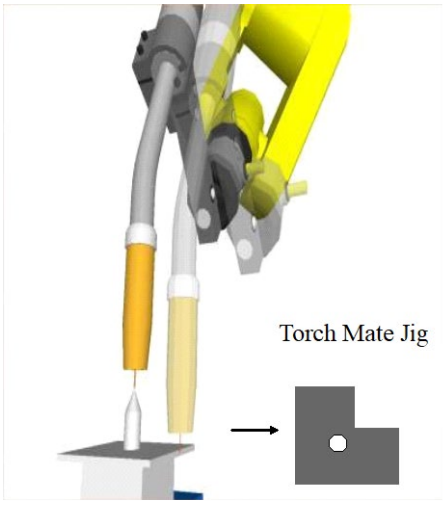


Fig. 4.3.7 (a) Torch Mate Function

Torch Mate function requires special software and hardware. The software has been installed, so it isn't required an arrangement.
At hardware, torch mate jig and touch sensor circuit; detect to the wire touch the torch mate jig are required.

FANUC welding power supply FH350i has wire stick detection circuit as default and it can be used for touch sensing, so it isn't required an arrangement.

About details of approach in the use of torch mate function, refer to Chapter 12 in R-30*i*B/ R-30*i*B Mate /R-30*i*B Plus/R-30*i*B Mate Plus CONTROLLER Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).

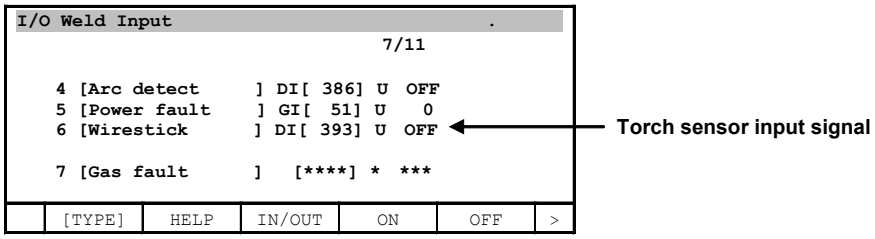
Assignment of I/O for Torch Mate Function

To use touch sensor circuit on welding power supply for Torch Mate function, specify the port number of I/O of Torch Mate function on Torch Mate setup screen after confirming them on Weld I/O screen with Procedure 4-3-7.

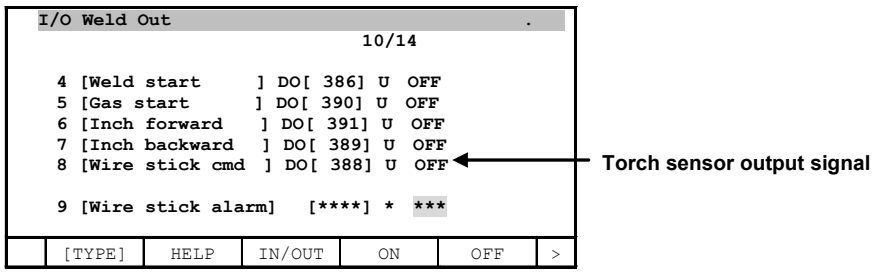
Procedure 4-3-7 Confirm port numbers of touch sensor circuit

Step

1 Press the [MENU] key and select "5. I/O", and press F1[TYPE] key and select "Weld". Weld Input screen or Weld Output screen will be displayed.
2 When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.
3 Port number of touch sensor input signal is equal to the one of "Wirestick". (The following example, DI[393] is touch sensor input signal.)



4 Press F3[IN/OUT] and change to Weld Input screen.
5 Port number of touch sensor output signal is equal to the one of "Wire stick cmd". (The following example, DO[388] is touch sensor input signal.)



6 To use torch mate function, setup port number of the I/O in torch mate setup screen.
To use touch sensor function, setup port number on touch sensor I/O screen.

4.3.8 Arc Abnormal Monitor Function (Option)

Normally, when some bad conditions occur during arc welding, an operator needs to stand near the system, needs to check the weld conditions by an analog meter etc. ,and needs to chase the root cause.
Arc Abnormal Monitor Function monitors the actual current and voltage during arc welding, and it can inform the operator that some bad weldings occurred quickly by some alarms and output signals when these values exceed the thresholds (it is possible to stop the running program by alarms). This function makes the root cause analysis of the bad welding easier.
Additionally, Arc Weld Log function is included in Arc Abnormal Monitor Function. The function can save the actual current and voltage in output device for each weld bead, and it can also display graphs such as Fig. 4.3.8 (b) on Teach Pendant.

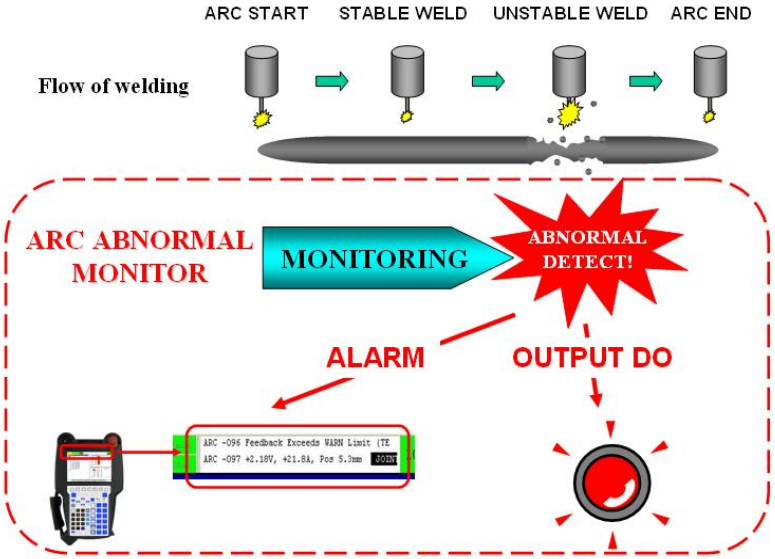


Fig. 4.3.8 (a) Outline of arc abnormal monitor function

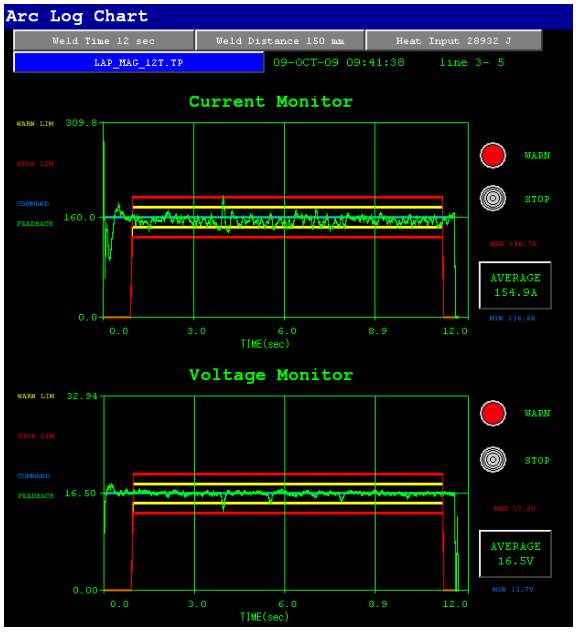


Fig. 4.3.8 (b) Arc weld log – chart function

Arc abnormal monitor function is an optional function. Detail of this function is written in Chapter 19 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3). Please refer to it.

4.3.9 Arc Welding Analogue Meter Displaying Function (Option)

Arc welding analogue meter function is the graphical user interface of displaying welding command/feedback voltage and current.

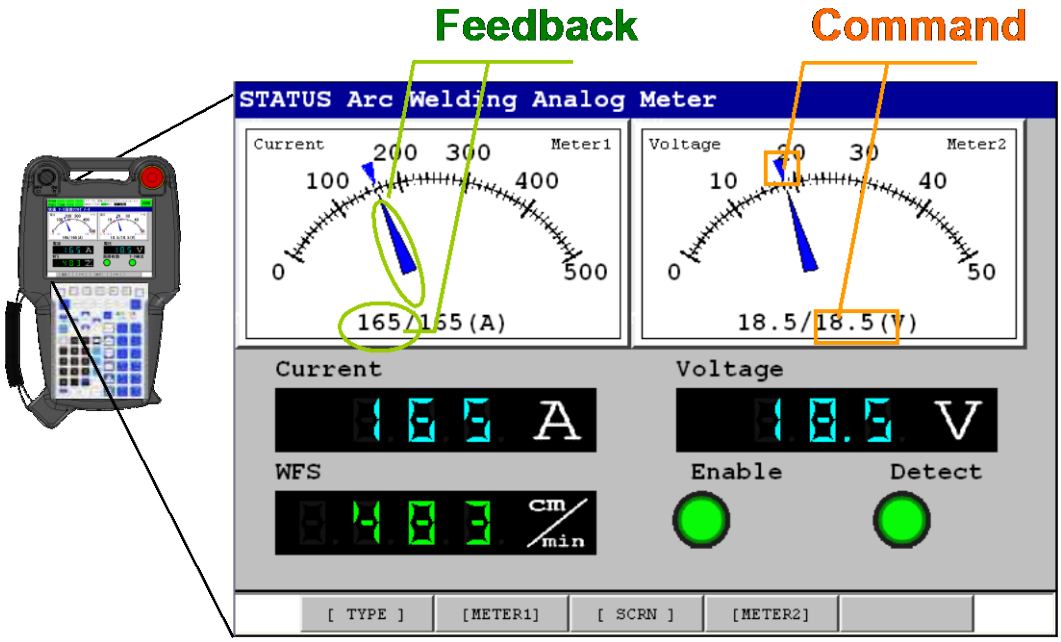


Fig. 4.3.9 (a) Arc Welding Analogue Meter Displaying Function

The UIF displays not only the contents on arc welding status screen but also the following contents.

- Show Current/Voltage/Wire feed speed as analog meter format.
- Average of welding voltage, current and wire feed speed per a welding
- The name of currently-running TP program
- The line number of the latest arc start instruction in currently-running TP program
- Currently using weld mode
- Weld distance and welding speed
- Arc on time per a welding

Arc welding analogue meter displaying function is an optional function. Detail of this function is written in Chapter 18 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).Please refer to it.

4.3.10 Touch Sensing (Option)

Touch sensing allows the robot to change a path automatically to compensate for object displacement.
Touch sensing consists of two phases: Search Motion phase and Touch Offset phase.

Search Motion

Search Motion can detect the current position of workpiece.

- Move touch sensor part (on arc welding robot, the top of wire = TCP) toward the workpiece using pre-defined robot motion, speed, and direction.
- Use an input signal to indicate that the robot has come into the contact with the object.
- Store the found location of the workpiece, or position offset information, in position registers.

The example of search motion is shown below.

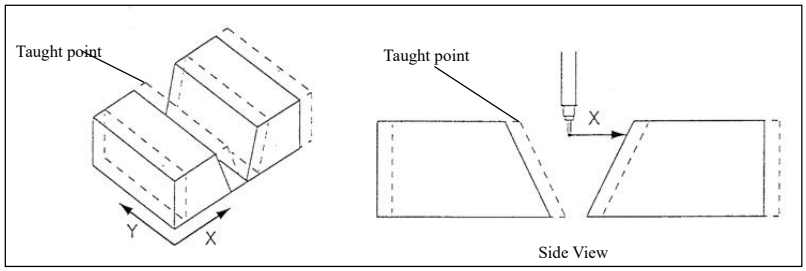


Fig. 4.3.10 (a) Search motion for detecting shift of X direction

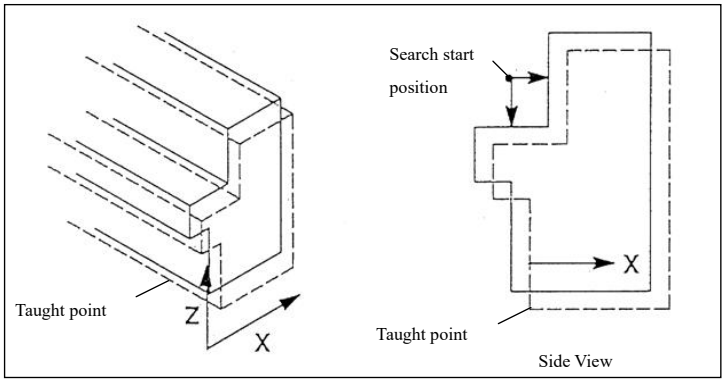


Fig. 4.3.10 (b) Search motion for detecting shift of X, Z directions

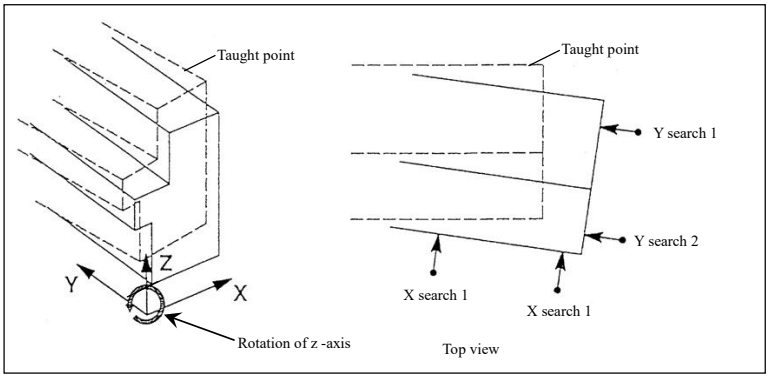


Fig. 4.3.10 (c) Search motion for detecting shift of X, Y directions and Z rotation

Touch Offset

Shift one or more teaching positions in your welding program by using the stored position the stored position offset information.

Touch sensing is an optional function. Detail of this function is written in Chapter 39 of Optional Function OPERATOR'S MANUAL (B-83284EN-2) Please refer to it.

Assignment Torch sensor I/O

To use touch sensor circuit on welding power supply for torch sensing function, specify touch sensor I/O port numbers on touch sensing I/O setup screen after confirming them on Weld I/O screen with Procedure 4-3-7.

NOTE
I/O port numbers of touch sensor is depended on assignment range of I/O. Be sure to confirm touch sensor port number with Procedure 4-3-7 and setup touch sensing I/O.

5 CHECKS AND MAINTENANCE

This chapter describes the method of routine and periodic inspection and maintenance of the welding power supply section of welding power supply option.

- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 0*i*B operator’s manual”. (B-83614EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 100*i*C/12/7L/12S, M-10iA/12/7L/12S operator’s manual”. (B-83654EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 120*i*C/M-20iA operator’s manual”. (B-82874EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 100*i*D/M-10iD operator’s manual”. (B-83944EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 120*i*D/M-20iD operator’s manual”. (B-84074EN)
- For the robot controller, refer to "R-30*i*B/R-30*i*B Plus controller Maintenance Manual". (B-83195EN)
- For the robot controller, refer to "R-30*i*B Matet/R-30*i*B Mate Plus controller Maintenance Manual". (B-83525EN)

Organization of this chapter

- 5.1 ROUTINE INSPECTION
- 5.2 1-MONTH (320 HOURS) CHECKS
- 5.3 6-MONTH (1920 HOURS) CHECKS
- 5.4 1-YEAR (3840 HOURS) CHECKS
- 5.5 REPLACING CONSUMABLE
- 5.6 PROGRAM BACK-UP

5.1 ROUTINE INSPECTION

> **⚠WARNING**
> Before inspection, adjustment, and replacement, be sure to turn off the switch of the switch box and confirm safety at all times except when an inspection is required while the power is on.
> Otherwise, a serious accident resulting in an electrical shock or burn can occur.

To make full use of the welding machine and ensure safe operation in daily work, routine inspection is indispensable.
In routine inspection, check the components listed below, centering on the checking of the welding torch and wire feeder for worn, deformed, and clogged consumable parts. Replace or clean components as required.
For component replacement, be sure to use a component specified by FANUC in order to maintain the performance and functions.

5.1.1 Welding Power Supply

Component	Point of inspection	Remarks
Front	- Check that equipment is securely mounted. - Check that equipment (such as a switch) is not broken	If there is a problem, perform an internal inspection, additional tightening, part replacement, or other measures. Refer to the welding power supply for details.
Side	- Check that the "Input Voltage" switch is correctly set. - Check that equipment and terminal covers are securely mounted. - Check that the rotation sound of the cooling fan is normal and that cool air flows normally (from the rear to the front). (The cooling fan operates by internal temperature.)	
Peripheral	- Check that cases are securely mounted on the top board or other sections.	If it is loosened, perform additional tightening.
General	- Check that there is no visual sign of overheating such as discoloration. - Check the looseness of connector - Confirm the tightening of cable terminal connection part of secondary side - During power-on, Check that there is no abnormal vibrations or whines. Check that there is no abnormal smell.	If there is an abnormality, make an internal inspection.

Caution when abnormal is founded

Capacitor discharge procedure (Refer to welding power supply manual for details.)

Before inspection and maintenance, be sure to take enough time till discharge of capacitor completely finished. (this may take several minutes)

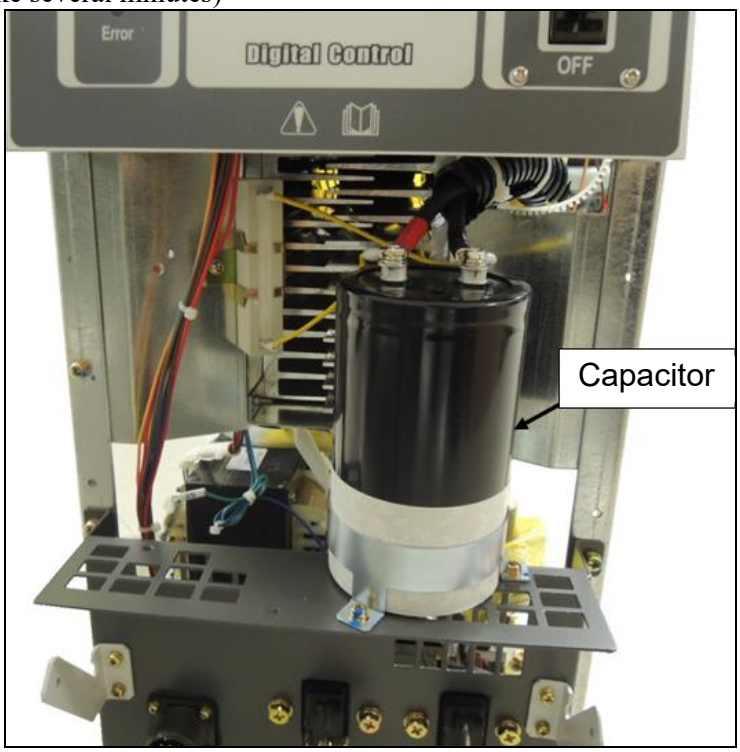
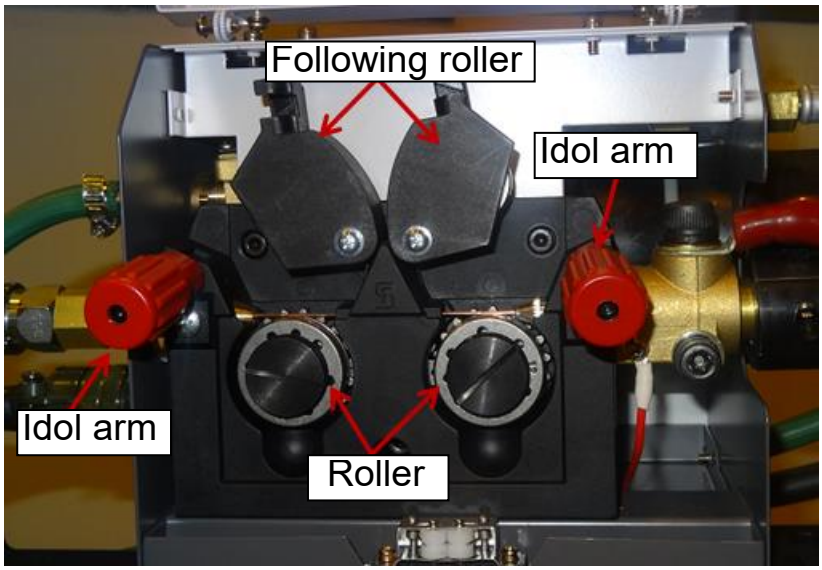


Fig. 5.1.1 (a) Capacitor discharge

5.1.2 Wire Feeder

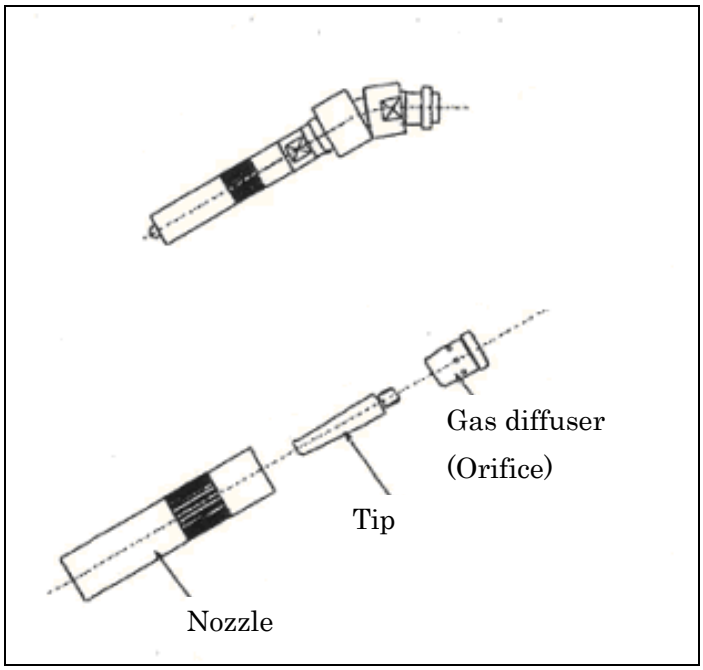
Component	Point of inspection	Remarks
Idle arm	Check if the nut is tightened in the degree that does not slip. (In particular, wires of 1.2 mm ϕ and up must not be tightened excessively.)	Unstable wire feed and unstable arc operation can occur.
Drive roll (2 pcs)	Check the matching between the welding wire diameter and the nominal diameter of the feed roller. Check if the feed roller groove is clogged and if the cut groove is worn.	Wire chips can be generated, resulting in a clogged conduit tube and unstable arc operation. If any of these problems is found, replace them with a new articles.
General	Clean each parts. Check the looseness of bolts and other connection parts.	

⚠ WARNING
The motor brush of the wire feeder cannot be replaced.



5.1.3 Welding Torch

(Part constitution is different by a torch slightly.)



Component	Point of inspection	Remarks
Nozzle	Loose attachment and tip deformation	A blow hole can result.
	Sputter attachment	The torch can burn, or a blown hole can result. (The use of a sputter attachment protection agent is useful.) Clean frequently to prevent accumulation of spatter.
Tip	Loose attachment	The screws of the main torch body can be damaged.
	Tip damage, and hole wear and clogging	Unstable arc operation and intermittent stop of operation can occur.
Gas diffuser (Orifice)	Check if no gas diffuser is installed, the gas diffuser is cracked, the hole is clogged, or a gas diffuser of another supplier is installed.	A welding defect (such as a blow hole) can occur due to a gas shielding failure or the main torch body can burn (spark in the main body). Take necessary action.
General	- Check the looseness of bolts and other connection parts. - Perform air blow using dried air.	

5.1.4 Cable

Cable Component	Point of inspection	Remarks
Torch cable	Check if the torch cable is not attached firmly to the mounting fixture. Check if the torch cable is bent excessively.	Wire feed can fail. The arc can flicker due to irregular wire feed, or unstable arc operation can occur. Ensure that the torch is extended straightly where possible.

Cable Component	Point of inspection	Remarks
Output side cable	Check if the cable insulator is worn or broken. Check if the cable joint is exposed (insulator is broken) or if the cable connection is loose (at the base metal connection point of the welding power supply terminal or between cables).	To ensure human safety and stable arc operation, conduct an inspection suitable for the status of the factory floor. ○ Make rough and simple checks in routine instruction. Make rough and simple checks in routine instruction. ○ Make detailed and through checks in periodic inspection.
Input side cable	Check if the cables on the input/output terminal on the input protective device of the switch box are loosely connected. Check if the fuse mounting section is not securely fastened. Check if the connections on the input terminal of the welding power supply are not securely fastened. Check if the cable insulator is worn, broken, or exposed in the input-side cabling.	
Ground wire	Check if the ground wire for welding power supply grounding is disconnected or loosely connected. Check if the ground wire for base metal grounding is disconnected or loosely connected.	To ensure safety against an unexpected leakage accident, be sure to perform routine inspection.
Confirm connection part of hose	Stop the main cylinder valve and confirm pressure go down.	
Confirm the installation place	Check there is combustibles or water and remove them.	

5.1.5 Welding Wire

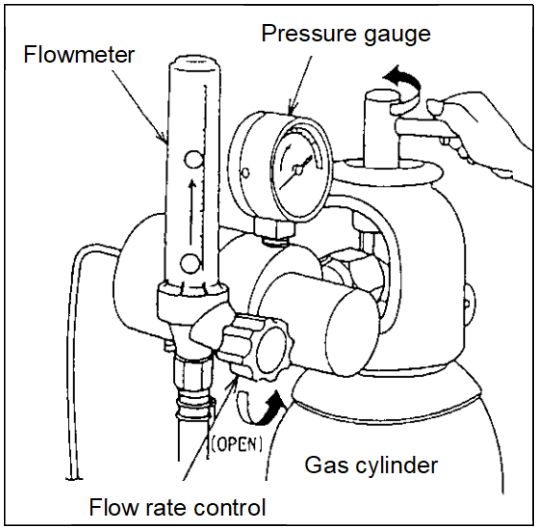
Point of inspection	Remarks
Confirm there is rust or oil, and remove them	

5.1.6 Checking Gas Flow Rate

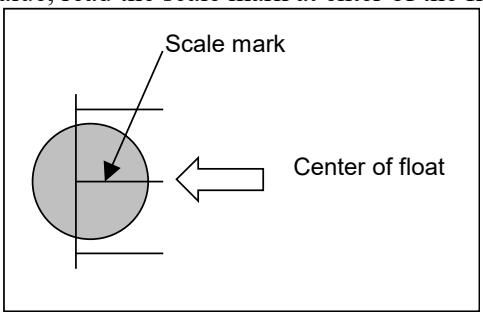
The gas flow rate is an important factor in ensuring stable arc welding. The gas flow rate can vary depending on the primary gas pressure. So, check the gas flow rate every day.

Use the procedure below when checking the gas flow rate.

1 When gas is not output, check that the specified gas pressure is observed.
   * The maximum input pressure of the gas controller is 11.8 MPa for CO_2 gas, and 15.7 MPa for argon gas and mixed gas (CO_2 + argon).
2 Make a gas check from the teach pendant. Refer to [Procedure 3-7 manual gas check] about this operation.
3 Meanwhile, read the value of the gas flow meter.
4 Check that the read value satisfies the specification. If the specification is not satisfied, adjust the flow rate control to set the specified flow rate.



* When reading a flow rate value, read the scale mark at enter of the float as shown below.



5.2 1-MONTH (320 HOURS) CHECKS

Item	Check items		Check points
1	Welding torch	Confirm the looseness of union nut (In case of BINZEL torch 350GC)	In case of BINZEL torch, remove insulated cap and rubber cover referring to Section 7.7 to 7.10 and confirm tightness of union nut. If it is loosen, retighten it with torque of 30Nm.

* Torch made by MIZIHO does not have a union nut.

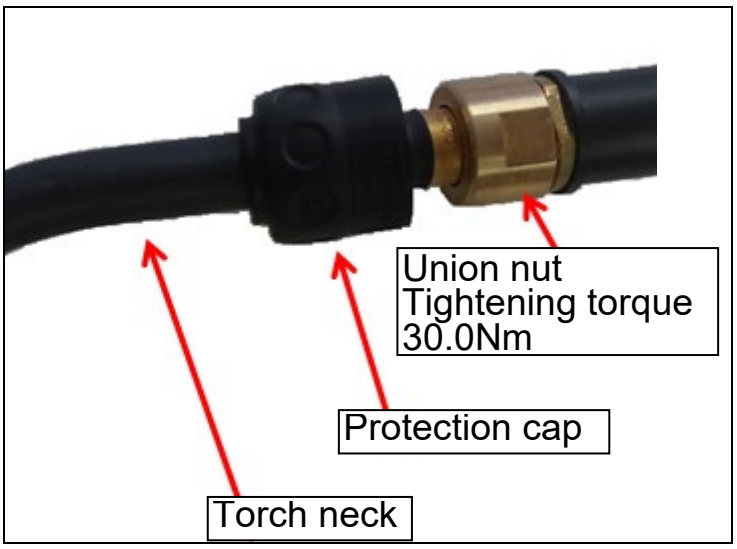


Fig. 5.2 (a) Check of the union nut (Figure is an example of ARC Mate 0*i*B BINZEL torch)

5.3 6-MONTH (1920 HOURS) CHECKS

Check the following items at the intervals based on every 6 months or 1920 hours, whichever comes first. Refer to maintenance and check parts of LINCOLN welding power supply manual.

Item	Check items		Check points
1	Welding power supply	Cleaning inside the welding power supply	Perform air blow using dried air. (Note)
2		Confirm the damage situation of fan	Confirm whether a fan is not damaged.
3		Check the allophone and vibration	Check there is allophone and vibration.
4	Wire feeder	Cleaning each parts	Perform air blow using dried air.
5		Check the tighten of bolts and other connection parts.	Check the looseness of torch mounting parts. and retighten the terminal of power source parts.
6		Check the length of wire feeding	Check the length of inching is regulated degrees.
7		Check the gas valve	Check opening and shutting is normal And check whether there are not forwarding irregularities when opening and shutting is normal.
8	Welding torch	Confirm tightness of union nut. (BINZEL torch only)	See Section 5.2.

（*It is impossible to replace the motor brush of FH350i.）

(Note) Cleaning in the inside the welding power supply

Discharge capacitor before cleaning referring to Fig. 5.1.1 (a).
Perform cleaning referring to welding power supply manual maintenance and check section.

Remove the both side panel and clean the inside.
Remove it using a cloth. and check whether the cable is not damaged.
Internal element have a capacitor (condensers). There might be the electric shock just after turning off power. So be careful.

Straight-head screwdriver (nominal 4.5x50) and box wrench (width across flats 8mm) are necessary to remove terminal of power cable.

Fig. 5.3 (a) Removing the cabinet panel

5.4 1-YEAR (3840 HOURS) CHECKS

Check the following items at the intervals based on every 1 year or 3840 hours, whichever comes first. Refer to maintenance and check parts of welding power supply manual.

Item	Check items		Check points
1	Welding power supply	Cleaning inside the welding power supply	See Section 5.3.
2		Confirm the damage situation of fan	See Section 5.3.
3		Check the allophone and vibration	See Section 5.3.
4	Wire feeder	Cleaning each parts	See Section 5.3.
5		Check the tighten of bolts and other connection parts.	See Section 5.3.
6		Check the length of wire feeding	See Section 5.3.
7		Check the gas valve	See Section 5.3.
8	Welding torch	Replacing torch cable (Including conduit)	Confirm whether it is not damaged. If it is damaged, replace it by new one. (See Chapter 7.)
9		Replacing liner	Confirm whether it is not damaged. If it is damaged, replace it to new one. (See Chapter 7.)
10	Around cable	Confirm reel side conduit.	Confirm whether it is not damaged. Check whether it is moderate length and bending radius is not to small.

5.5 REPLACING CONSUMABLES

> **⚠WARNING**
> Before inspection, adjustment, and replacement, be sure to turn off the switch of the switch box and confirm safety at all times except when an inspection is required while the power is on.
> Otherwise, a serious accident resulting in an electrical shock or burn can occur.

This section describes how to replace consumables.
Use consumables supplied by FANUC at all times except wire and gas. Use special care when selecting a wire and gas.

5.5.1 Wire

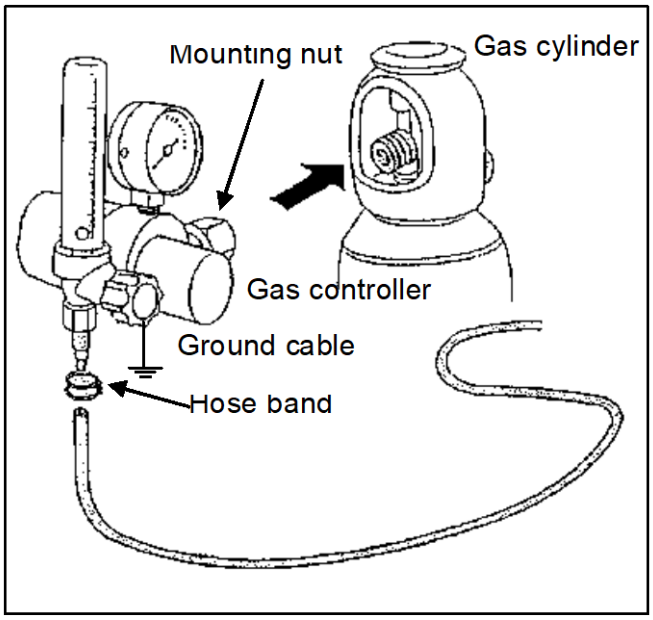
1 When wire remains in the conduit, pull out the wire.
2 Detach the empty wire reel from the wire reel stand.
3 Attach a new wire reel.
4 Run the wire.

5.5.2 Gas

> **⚠WARNING**
> When handling a gas cylinder, observe the high-pressure gas regulation, and manage the gas cylinder according to the standard defined in your company. A gas cylinder contains high-pressure gas. If a gas cylinder is handled incorrectly, high-pressure gas can blow out, and can cause an accident resulting in a human injury or death. Be sure to observe the following items:
> - When a gas cylinder falls, an accident resulting in a human injury or death can occur.
> - Secure a gas cylinder to a dedicated cylinder stand. Be sure to secure a gas cylinder vertically. When using a gas cylinder, do not lay it.
> - The internal pressure of a gas cylinder varies with temperature. If a gas cylinder is exposed to direct sunlight or placed close to a heat source, the internal pressure increases, and the safety valve of the gas cylinder can be actuated.
> - Before mounting a gas controller onto the gas cylinder, check that a cylinder packing is inserted in the cylinder mounting nut of the gas controller. If no cylinder packing is inserted, be sure to insert a cylinder packing.
>
> When opening the valve of the gas cylinder, open the valve step by step until the valve is fully open.

1 Close the valve of the gas cylinder.
2 Detach the gas controller.
3 Replace the gas cylinder.
4 Mount the gas controller.
Mount the gas controller onto the gas cylinder with a mounting nut. Tighten the nut sufficiently with a monkey wrench.
5 Open the valve of the gas cylinder.
6 Check the gas pressure and gas flow rate.

For gas check operation, see Subsection 5.1.6, " CHECKING GAS FLOW RATE ".



5.5.3 Nozzle

Before starting operation, make a check every day. Replace the nozzle if distorted.

1 Remove the nozzle.
2 Attach a new nozzle.

> **⚠CAUTION**
> Remember to mount a gas diffuser.

5.5.4 Tip

Before starting operation, make a check every day. Replace the tip if its hole is enlarged.

1 Remove the nozzle.
2 Remove the tip.
3 Mount a new tip.

> **NOTE**
> Mount a tip that matches the diameter of wire used.

4 Mount a nozzle.

> **NOTE**
> Remember to mount a gas diffuser.

5.5.5 Liner

Clean the liner with an air blow at least once a week.
Replace the liner if it has lost elasticity or is broken.

1 Remove the welding torch from the wire feeder.
2 Replace liner with new one (See Section 7.5.)

NOTE
Mount a liner spring that matches the diameter of wire used.

3 Paying attention to the following, mount the welding torch onto the wire feeder:

- When mounting the welding torch onto the wire feeder, push the welding torch sufficiently up to the base. Otherwise, trouble such as gas leakage, wire distortion in the torch due to a caught wire, and feed failure can occur.

5.6 PROGRAM BACK-UP

Usually, programs are stored in the memory internal to the robot controller. Even when the power is turned off, this memory is powered by a battery so that information stored in the memory is not lost. However, it is recommended to back up programs stored in the memory, considering an accidental damage to the memory or battery life expiration. Moreover, when a modification is to be made to a taught program, it is recommended that the program be backed up before and after the modification. By backing up programs in this way, a program or position data lost by an incorrect operation can be restored.

You can use “Flash ATA memory Card”.

About backup, please refer to Subsection 6.3.4 Acquisition of All Backup, 6.3.5 Acquisition of Image Backup and Section 8.4 SAVING FILES in OPERATOR’S MANUAL (Basic Operation) (B-83284EN).

⚠CAUTION
Flash ATA memory card.
In order to protect against accidental loss of data from a flash ATA memory card, it is recommended to back up the files of the flash ATA memory card to another medium such as a memory card.

6 TROUBLE SHOOTING

6.1 TROUBLE SHOOTING ABOUT ALARM

This section describes about main cause of a displayed alarm / message and the measures related to welding power supply.

ARC-008 Weld power supply fault (###, i)
Cause: A problem generates in the welding power supply.
Remedy: Please check the content of ARC-124 alarm which is posted simultaneously. Then please contact your local FANUC representative.

ARC-022:Weld AO scaling limit used (###, i)
Cause: The warning message is posted when command values in weld schedules for arc instruction (or command values in direct arc instruction) become out of range. Then, command values are clamped by upper or lower limits.
Remedy: Set the command values within a range. The range for command values is different in each process mode. Therefore, if you change the assignment of Weld Procedure or process mode number, please confirm that the command values in arc instruction that uses the process mode number are not out of range. Additionally, please also confirm command values of weld processes (Runin and Wirestick Reset) are not out of range. You can see the range for each process mode on Weld Procedure screen.

ARC-040 EQi Missing I/O: ###
Cause: When Weld I/O is not allocated definitely, it occurs.
Remedy: If the missing I/O name is "gas alarm", "wire alarm" or "coolant alarm", assign these signals by manual operation in reference to Subsection “4.3.4 Gas, Wire, Coolant Shortage Detect”. If you do not use these signals, please disable the detection function by “Procedure 4-3-4 (b) Setup of Gas, Wire, Coolant Shortage Detect Function”.

ARC-045 Weld EQ is OFFLINE
Cause: A robot controller tried communication with the welding power supply, but this alarm is displayed when communication cannot be established. The first message becomes alarm handling, but becomes the warning message after having pushed the reset.
Remedy: 1 Please confirm that the power of weld equipment is ON.
2 Please confirm that a communication cable is connected definitely.
3. Please confirm the status of DeviceNet Board referring Procedure 4-2. If “OFFLINE”, turn into “ONLINE”
4. Please confirm the setting of DIP switch on DeviceNet Board referring Appendix A in DeviceNet manual (B-82694EN). When FANUC welding power supply is used, board number is same as weld equip number. (Board number is always 1 except for multi equipment system.)
5. If this alarm is continuously posted, The assignment of I/O may be wrong. Please confirm assignment of I/O referring II Section 3.1.4 and recover the assignment of communication I/O.
6. If the phenomenon is not match to above 5 contents or above 5 contents are solved, and if some alarms related to DeviceNet generate, please execute the remedy for DeviceNet alarm by alarm according to the content of alarm code.

ARC-046 Weld EQ communication error

Cause: There was a communication error detected between Arc Tool and the welding power supply.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to Subsection 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-046 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is impossible, please deal in reference to countermeasures to ARC-045.

ARC-047:Not allowed during a weld

Cause: The operation that cannot be performed during a stop at one time during welding or the welding was going to be performed.

Remedy: Operate it after a program is finished or forces it, and having been finished

ARC-049 Process i switch to j failed

Cause: The Reshuffling of the welding process is failed. The power of the welding power supply becomes OFF, or communication is not established.

Remedy: Confirm that the welding power supply is switched on, and establish communication.

ARC-050 Process i NOT found

Cause: A process mode allocated for Weld Procedure that appointed on a welding power supply was not found.

Remedy: Confirm whether a process mode allocated for Weld Procedure that appointed is a thing allocated definitely. In reference to 4-4-3 and 4-4-4 operation, allocate an appropriate process mode number for Weld Procedure. Even when Weld Procedure number is not set on arc direct type instruction, this alarm produces (when it is 0).

ARC-051 Weld EQ i ONLINE：DeviceNet

Cause: It is the message which is displayed when the communication between a robot controller and a welding power supply are established.

Remedy: Because it is not an alarm, the remedy is unnecessary. A message disappears when reset is done.

ARC-059 Gas purge stopped

Cause: By the gas purge operation(pressing both [SHIFT] key and [STATUS] key), the following operations are executed in the state of gas ON. To prevent the gas being left ON, gas is automatically stopped when this alarm is generated.

- Start the program
- Teach Pendant disabled or switched to AUTO mode
- Changed the setting item of [Gas purge key] to DISABLED in the Weld System screen.

Remedy: Please do not execute the above operation while gas is ON by the gas purge operation. Please stop the gas flow before executing the above operation.

ARC-092 Weld Cmd error EQi (%d,%d)

Cause: An error occurred when sending the welding command to the power supply.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to Subsection 7.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-092 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is not possible, please deal in reference to countermeasures to ARC-045.

ARC-093 Wire Feed Cmd error EQi (%d,%d)

Cause: An error occurred sending the command to the wire feeder.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-093 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is impossible, please deal in reference to countermeasures to ARC-045.

ARC-124 EQ i E: j FH #####

Cause: An error occurred in FANUC welding power supply FH350i.

Remedy: Please confirm the number on “j” position and message on “#####” position. Then, please contact your local FANUC representative.

6.2 TROUBLE SHOOTING AGAINST SITUATIONS

Table 6.2 (a) Trouble shooting against some situations

No.	Problems	Cause	Remedy
1	Wire inching is not performed.	A robot controller and the communication establishment of the welding power supply are not done	Please confirm whether the welding power supply is switched on. Please confirm whether a robot controller is connected to a welding power supply definitely. If ARC-045 alarm is posted, please perform the remedy of ARC-045 in Section 6.1. In reference to " WELDING POWER SUPPLY SELECT" of Section 10.1, please perform communication establishment setting again.
		An idle arm does not go up	Put up an idle arm.
2	Wire feed is not stable (Wire feeding speed is too fast or there is allophone while wire feeding)	There is a problem to idle arm or drive roll.	In reference to "wire feeder" of Subsection 5.1.2, please perform maintenance check of wire feeder.
		There is the slack in the joint of the blowtorch cable	Please confirm whether the slack does not occur in a joint with the blowtorch cable installation metal fittings.
3	A gas purge (a gas check) is not possible by manual operation	A robot controller and the communication establishment of the welding power supply are not done	Please confirm whether the welding power supply is switched on. Please confirm whether a robot controller is connected to a welding power supply definitely. If ARC-045 alarm is posted, please perform the remedy of ARC-045 in Section 6.1. In reference to " WELDING POWER SUPPLY SELECT" of Section 10.1, please perform communication establishment setting again.
		The valve of the gas cylinder, a gas adjustment knob do not open.	In reference to “Checking Gas Flow Rate" of Subsection 5.1.6, please confirm the gas flow quantity.
4	There is much sputtering at the time of the arc start	A welding process choosing, a welding mode are wrong	In reference to “OPERATION OF WELD PROCEDURE AND PROCESS MODE” of Section 3.4 or “TEACHING AND EDITING OF ARC WELD INSTRUCTION” of Section 3.6, select the proper weld data or weld mode number for the Arc Instruction.
		Stick out is not reasonable.	Confirm stick out of the welding program inside, and revise it

No.	Problems	Cause	Remedy
5	There is much spattering at the time of the welding or an arc is unstable or is poor in welding	Gas flow quantity is insufficient (or do not appear)	Perform a gas check in reference to “Checking Gas Flow Rate of Subsection 5.1.6, and please confirm that gas appears definitely.
		A welding process choosing, a welding mode are wrong	In reference to “OPERATION OF WELD PROCEDURE” of Section 3.4 or “TEACHING AND EDITING OF ARC WELD INSTRUCTION” of Section 3.6, select the proper weld data or weld mode number for the Arc Instruction.
		Stick out is not reasonable.	Confirm stick out of the welding program inside, and revise it
		There is a problem to welding torch	Please perform maintenance check of the welding torch in reference to "5.1.3 welding torch".
		Wire feeding is unstable	Carry out No. 2 remedy.
		Others	Refer to 4 of Appendix A.2.
6	DI that you would like to use, a number of the DO are used for weld I/O (ArcLink I/O).	I/O number you would like to use is assigned to I/O by automatic I/O assignment function.	In reference to "3.1 SETTING OF I/O FOR FANUC WELDING POWER SUPPLY", revise a layout of communication I/O.
7	The Power Lamp is not Turned on.	Power is not supplied correctly.	Check if power is fed correctly. If the power lamp is not turned on when power is fed correctly, contact FANUC.
8	The Wire is Deposited onto the Base Metal.		Cut wire of deposited part referring to Subsection 4.2.1. There is the automatic stick reset function to prevent deposit of the wire. See Subsection 4.2.1 about this function.
9	The Robot Collided with a Fixture		Recover it according to the procedure below/. 1. Stop the motion of the robot by pressing the emergency stop button, then enter within the safety fence. 2. Correct the cause of collision. 3. Exit from within the safety fence. 4. Reset the emergency stop button. 5. Reset the system error. 6. Restart the robot.
10	The Emergency Stop Button was Pressed during Operation.		Recover it according to the procedure below/. 1. Reset the emergency stop button. 2. Reset the system error. 3. Restart the robot.

6.3 REMEDY FOR TROUBLES

We gathered up the contents which would like you to do when the following troubles occurred in a procedure.

・A robot and a welding power supply do not communicate
・Welding is not possible (it stops by alarm etc.)
・Wire inching, a gas check are not possible

In this case, please operate the following because the identification of the cause is difficult only for the symptom mentioned above.

Confirming procedure
1 The confirmation of the alarm history
2 Get all back up
3 Get image back up (If possible)

6.3.1 Confirmation of the Alarm History

Open alarm history screen, confirm whether arc alarm, LECO alarm are given.
Please contact us when alarm is given what kind of turn alarm is given with.
Please take the confirmation method of the alarm history in the following procedures.

1 Press the [MENU] key, select [4 alarm].
2 Active alarm screen will be displayed. Press F3[history] key.
3 Alarm history screen will be displayed.
4 Press F1[TYPE] and select [application]. Only an arc-related alarm history will be displayed.
5 Please confirm ARC alarms.
6 After the confirmation, press F1[SCREEN] and select [alarm] , return it to an original state

6.3.2 Acquisition of All Backup

Next, acquire all back up

Operation 6-3-2 is procedure of back up.

Procedure 6-3-2 Acquisition of all backup

Step
1 Please insert an empty memory card or USB memory in a robot controller.
2 Select「7 FILE」.
3 Press F5[UTIL] and select [Set Device] .In case of memory card, select [MC],In case of USB memory ,select [UDI].
4 Select F4[BACKUP] and select [All of above]. When the message “Delete XXXX before backup files?” is displayed, please select “YES”.
5 When backup is completed, press F5[UTIL] and select [Set Device]. then correct it at an original.

6.3.3 Acquisition of Image Backup

If possible, acquire image backup.
Please do not perform this during robot operation.

Operation 6-3-3 is procedure of image back up.

Procedure 6-3-3 Acquisition of all Image backup

Step

1 Please insert an empty memory card or USB memory in a robot controller.
2 Select [7 FILE].
3 Press F5[UTIL] and select [Set Device] .In case of memory card, select [MC],In case of USB memory ,select [UDI].
4 Select F4[BACKUP] and select [Image].
5 The message “Please cycle power.” is displayed. Please cycle power of the robot controller.
6 When you turn the robot controller ON, image back up is started.
7 When backup is completed, If the massage “Image backup completed successfully.” is displayed, the image backup was successfully obtained.
8 Press F5[UTIL], select [Select Device] then correct it at an original device.

7 REPLACING UNITS

This chapter describes the method of replacing each unit.

> ⚠ **WARNING**
> Before replacing a unit, be sure to turn off the main power and pull the cable plug out the socket.
> When replacing a unit, ensure a safe state where peripheral equipment is not operating.

*For the robot mechanical unit, contact your local FANUC representative about replacing

*For the robot controller, refer to the following maintenance manual.
FANUC Robot series R-30*i*B/R-30*i*B Plus controller maintenance manual B-83195EN
FANUC Robot series R-30*i*B Mate controller maintenance manual B-83525EN

Organization of this chapter:
- 7.1 Welding power supply
- 7.2 to 7.4 Torch cable
- 7.5 Liner
- 7.6 Drive roll, wire guide
- 7.7 to 7.10 Torch neck
- 7.11 Wire feeder

After replacing a part, be sure to check the corresponding item(s).
The table below indicates replacement parts and the corresponding check items. Make checks according to the table below.

Replacement part	Check item
Torch cable	(a) Liner replacement (b) Wire feed capability
Liner Drive roll Wire guide	(a) Wire feed capability

7.1 REPLACING THE WELDING POWER SUPPLY(FH350i, FH350iP)

1 Turn off controller power.
2 Remove welding power cable (+),(-), wire feeder control cable and communication cable from welding power supply referring to Fig. 7.1 (a), (b).

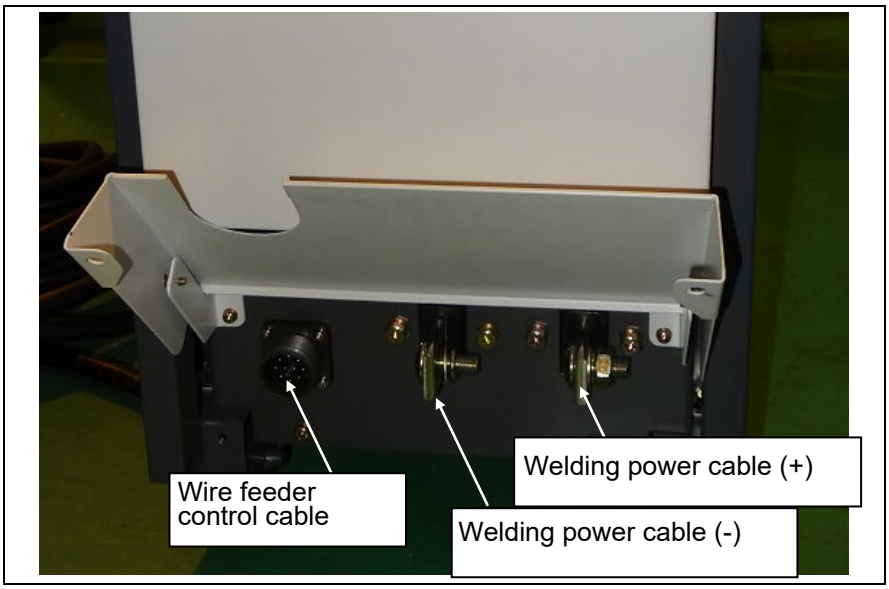


Fig. 7.1 (a) Connection of welding power supply FH350i, FH350iP (1/3)

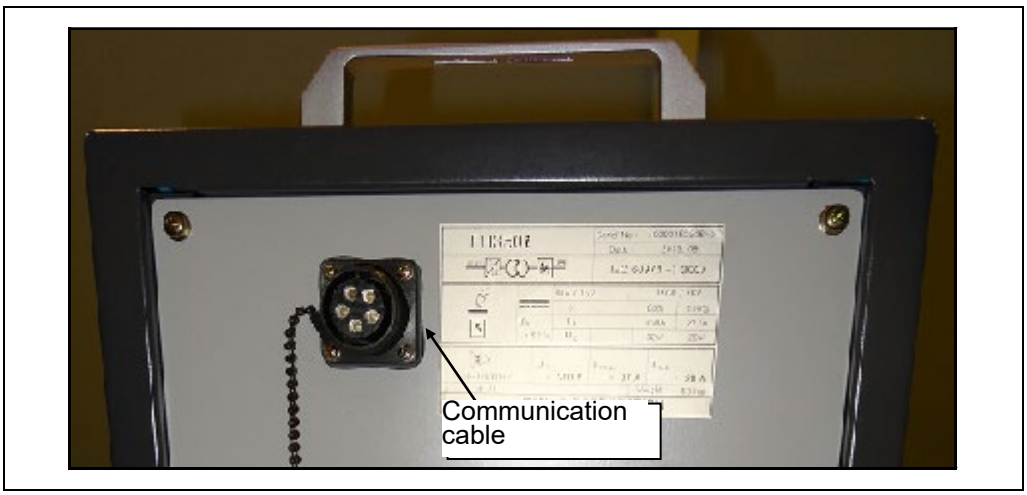


Fig. 7.1 (b) Connection of welding power supply FH350i, FH350iP (2/3)

3 Remove four screw and the primary cable referring to Fig. 7.1(c).

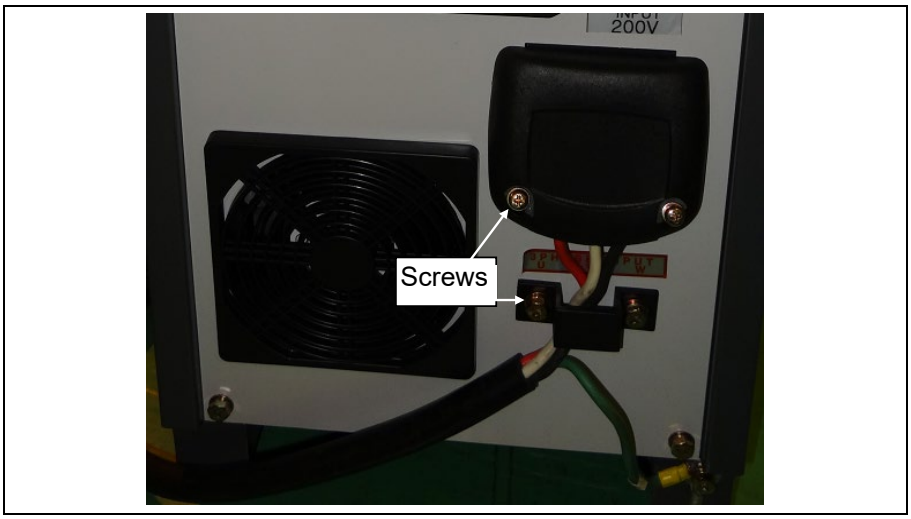


Fig. 7.1 (c) Connection of welding power supply FH350i, FH350iP (3/3)

4 Replace old welding power supply by new one. For its assembly, please apply the steps above in reversed sequence.

7.2 REPLACING THE TORCH CABLE (ARC Mate 0*i*B)

1 Lift down the idol arms.
2 Lift up the following rollers.
3 Pull out the wire from the wire feeder and the torch.

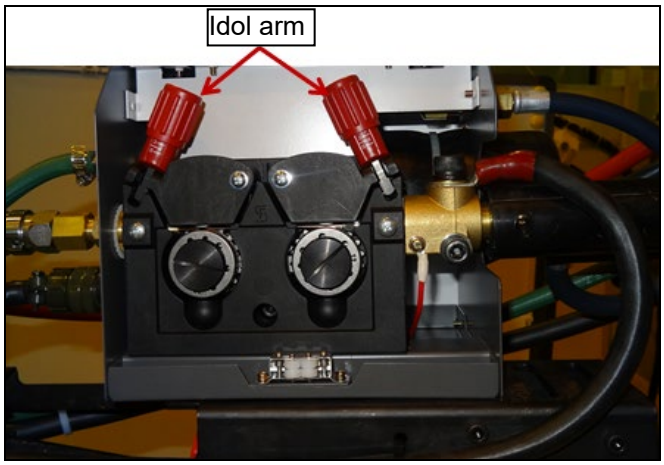


Fig. 7.2 (a) Replacing the torch cable

4 Remove the gas hose of the torch cable side from the joint.
5 Remove the torch mounting bolts of the wire feeder.
6 Pull out the torch cable from the wire feeder.

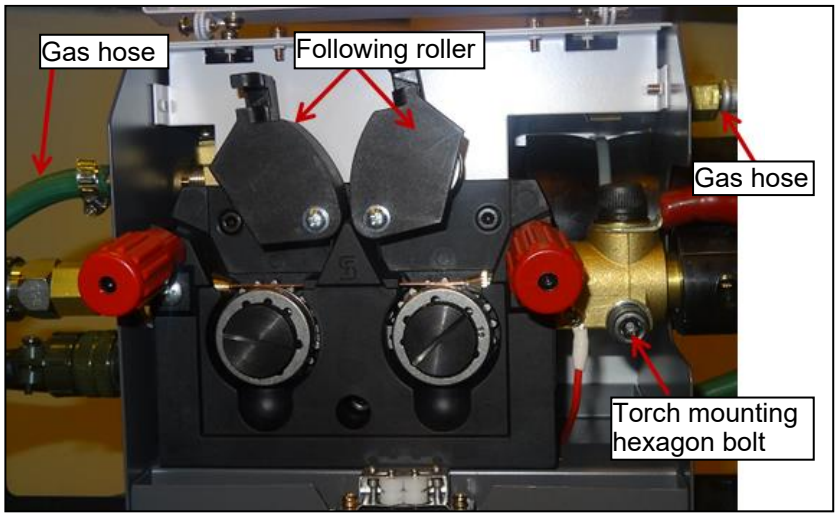


Fig. 7.2 (b) Replacing the torch cable

7 Remove the torch mounting bolt.
8 Replace old torch by new one. For its assembly, please apply the steps above in reversed sequence.
9 Pull the wire through the torch and the wire feeder. At this chance, tip may caught with the wire, so remove the tip from the torch in advance, then pull wire to the torch end. Then attach the tip on the torch.

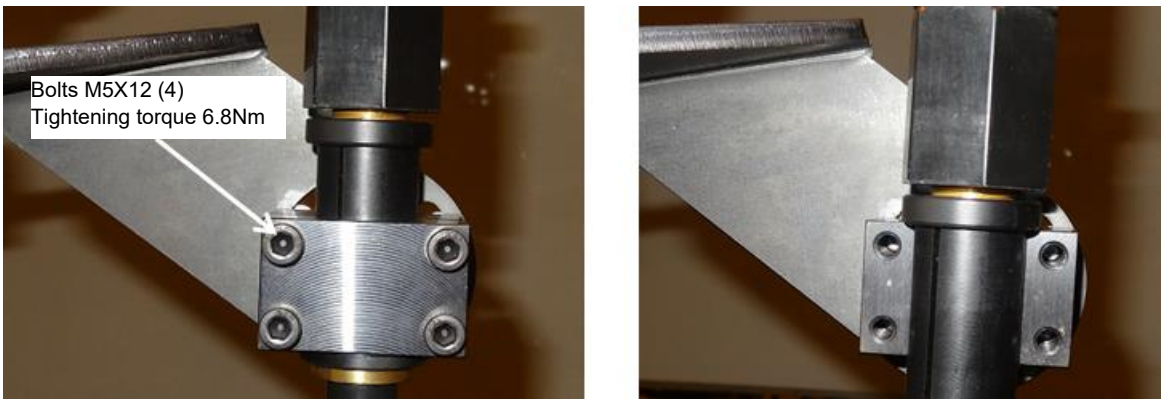


Fig. 7.2 (c) Replacing the torch cable

7.3 REPLACING TORCH CABLE (ARC Mate *i*C series)(WHEN USING TORCH CABLE CHANGING TOOL (RECOMMENDED))

1 Move the robot posture to J4=J5=J6=0°, The J1-J3 axis is not cared about by arbitrary posture.
2 Confirm the gas hose and the water cooling hoses arrange as Fig. 7.3 (a). In addition, remove the torch cable from the conduit and confirm grease is applied on the hoses and does not occur interference of the hoses.

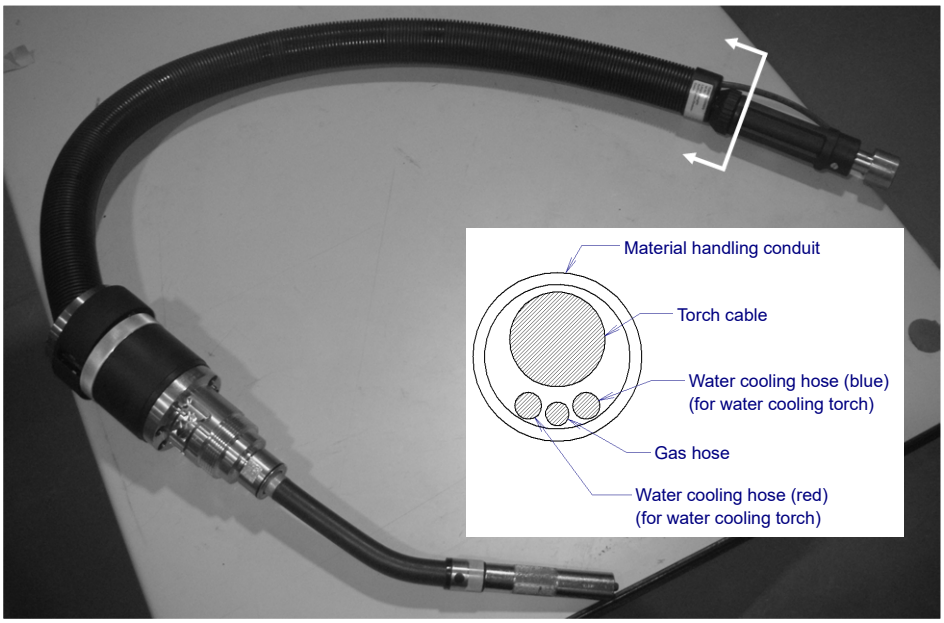


Fig. 7.3 (a) Torch appearance (Section view is seen from the arrow direction)

3 Remove the flexible conduit of wire feeder, cut the wire. Pull out the wire from the tip point after it supplies it until the wire cannot be sent.

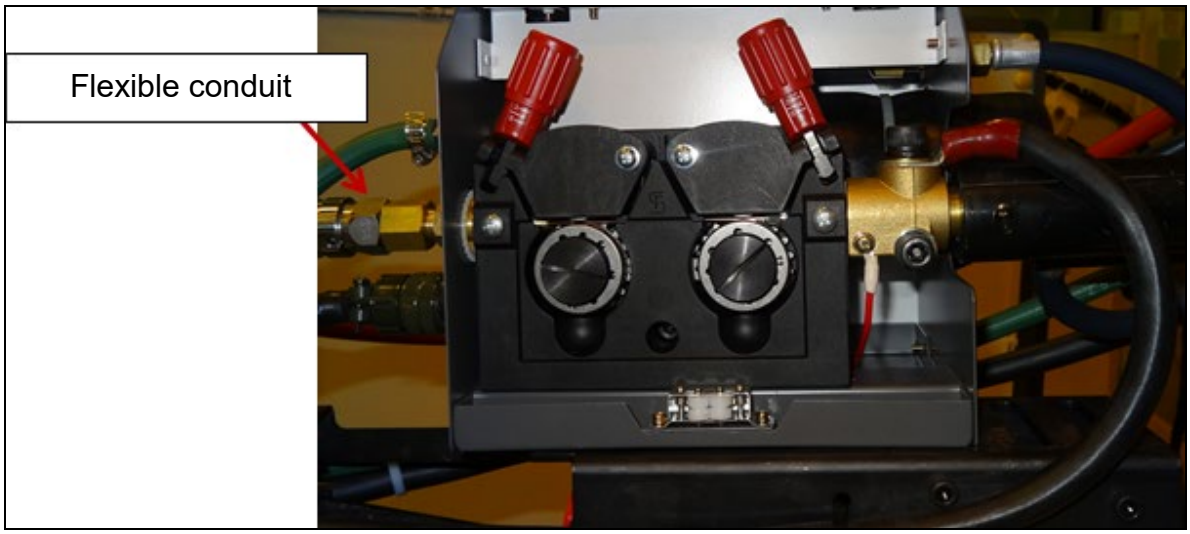


Fig. 7.3 (b) Remove flexible conduit

4 Remove torch neck referring to Section 7.8 to 7.10.
5 Remove the conduit cover of J3 arm referring to Fig. 7.3 (c).

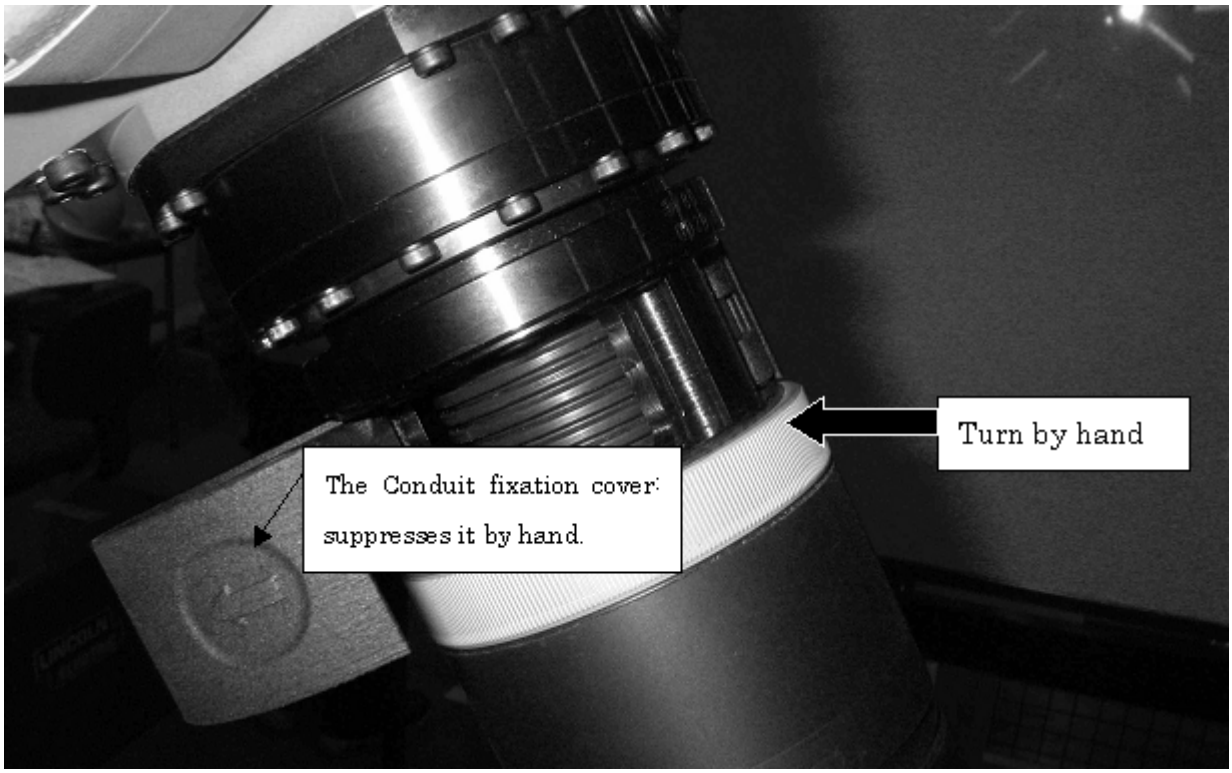


Fig. 7.3 (c) Remove conduit

6 Loosen the fixation two bolt of torch side referring to Fig. 7.3 (d).

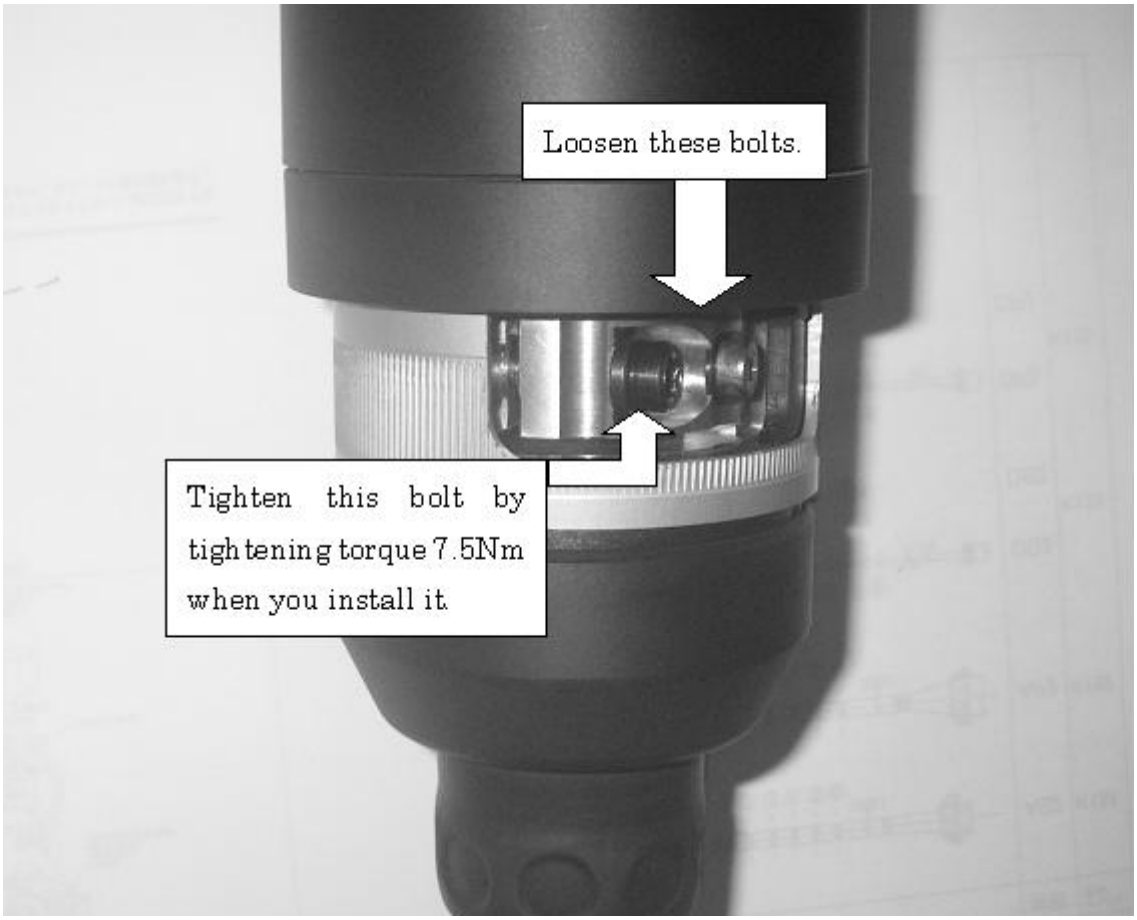


Fig. 7.3 (d) Fixation bolt of torch side

7 Remove torch cable from torch adapter (Fig. 7.3 (e).)

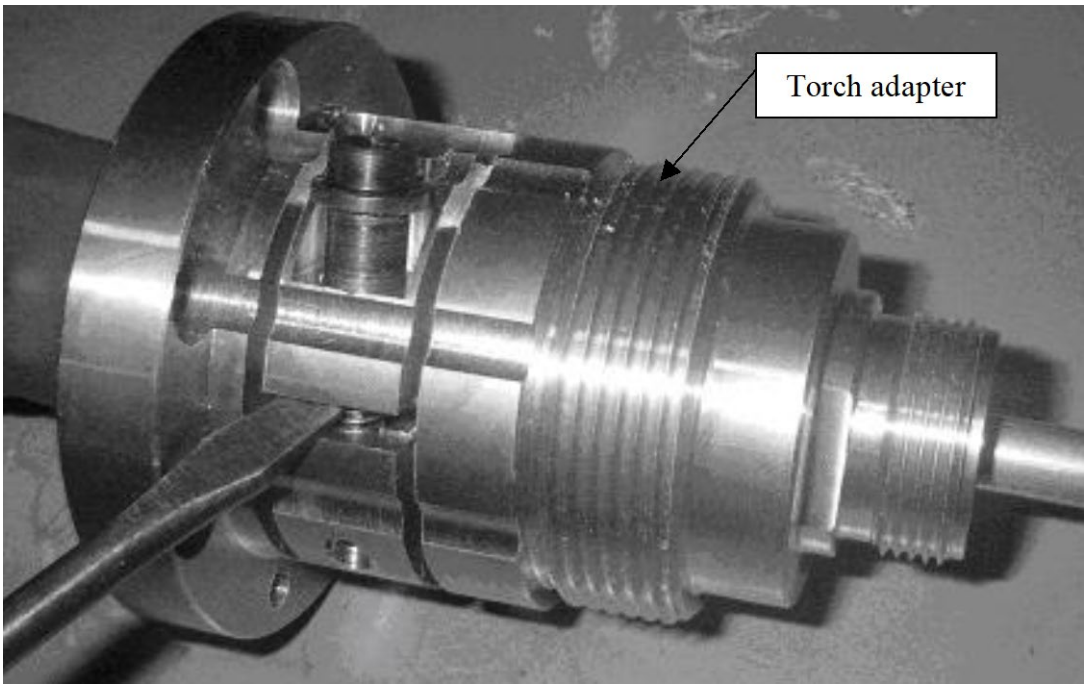


Fig. 7.3 (e) Groove of torch adapter

8 Loosen the bolt with hexagon hole of wire feeder referring to Fig. 7.3 (f).

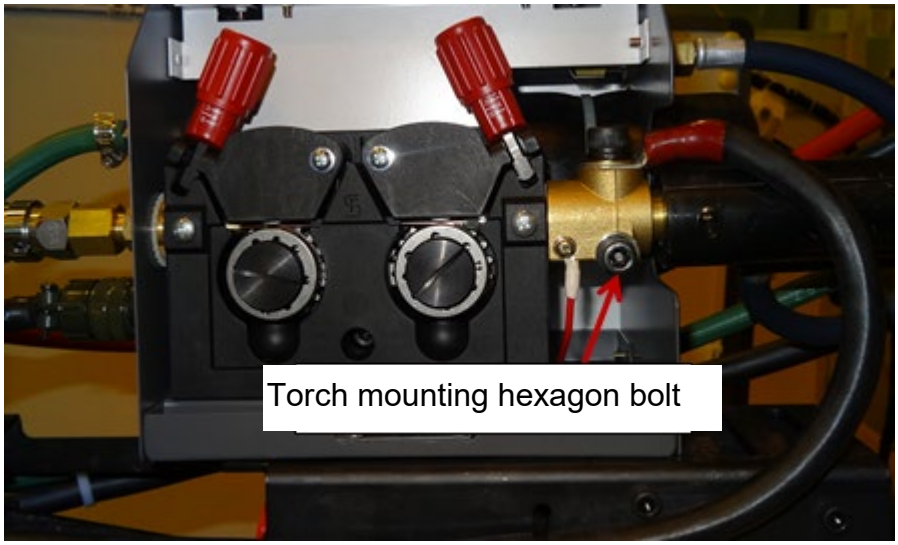


Fig. 7.3 (f) Remove the thumbscrews of wire feeder

9 Pull out the torch cable from the J3 arm part with Conduit to torch side.
10 Insert a new torch cable in the J3 arm part.
11 Insert torch cable changing tool referring to Fig. 7.3 (g),(h).

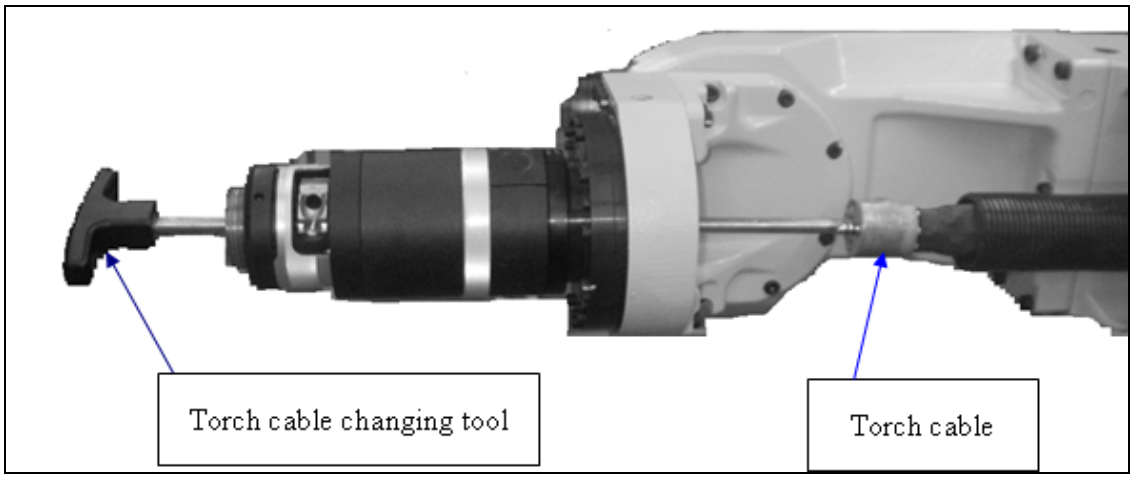


Fig. 7.3 (g) Installing of torch cable changing tool

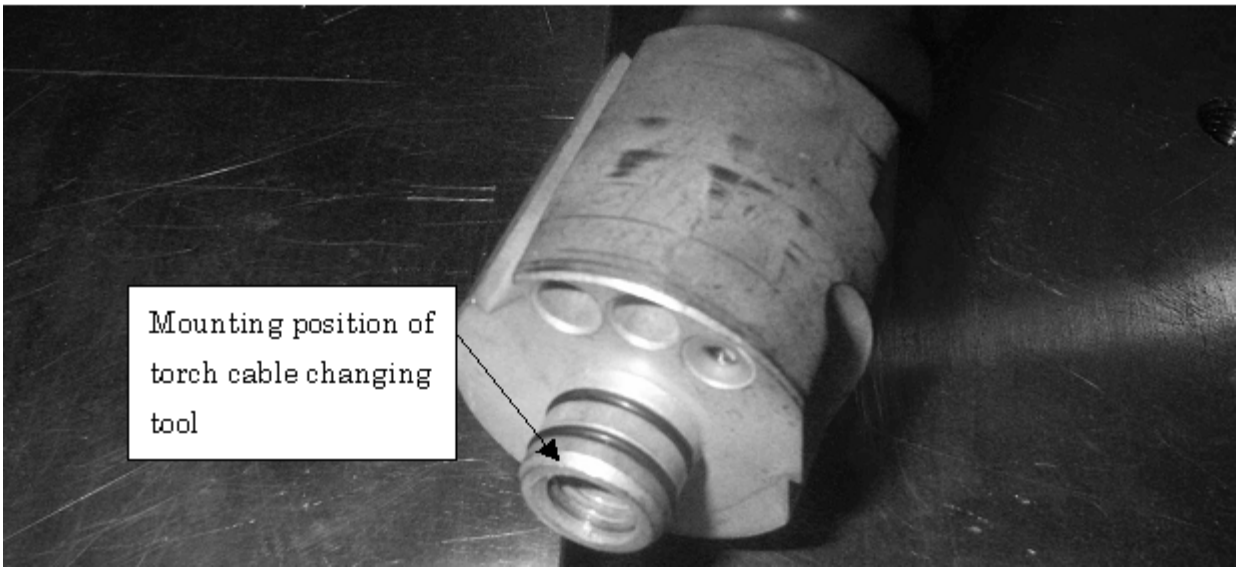


Fig. 7.3 (h) Mounting position of torch cable changing tool

12 Match tip of metal of torch to the keyway and insert it into torch adapter.
13 Confirm the bottom of tip of metal of torch cable has stuck to the face of torch adapter.(See Fig. 7.3 (e)) When the torch cable doesn't enter easily, it becomes easy if a straight-head screwdriver is inserted in the groove, and the groove is expanded. (See Fig. 7.3 (i))

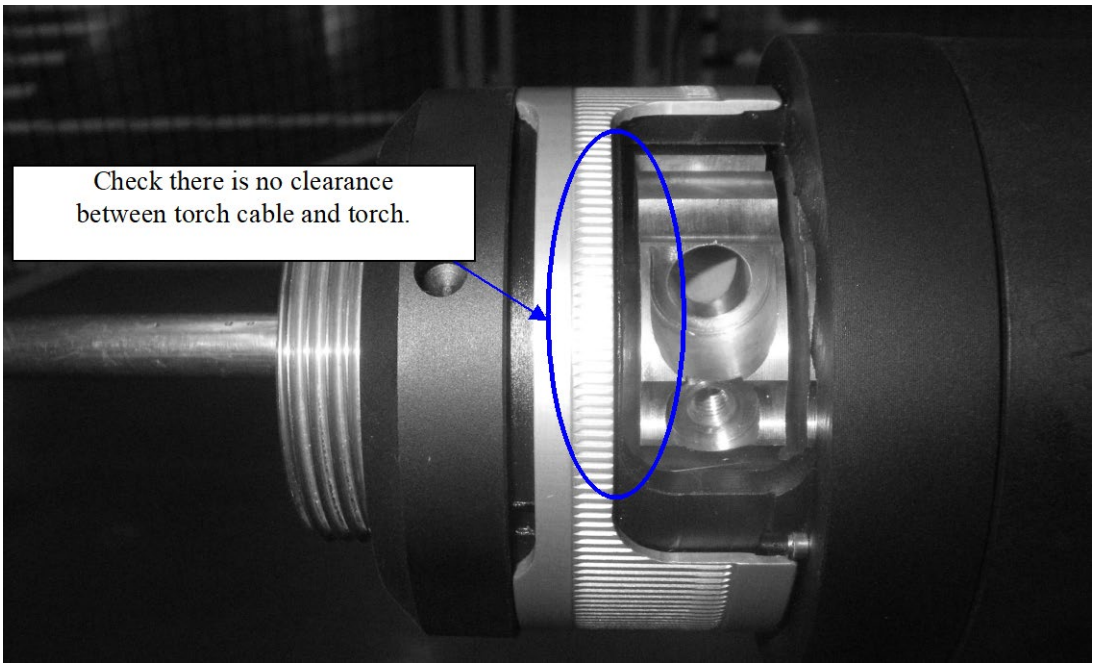


Fig. 7.3 (i) Confirming of no clearance of torch cable

14 Shut up a conduit till it do not move towards the torch neck, and lock a conduit fixation cover
15 Install torch neck referring to Section 7.8 to 7.10. Make aim of tightening torque of union nut 30Nm.
16 According to Subsection 7.5, insert new liner to torch cable and tighten liner suppression nut. Adjust the length of liner.
17 Loosen a fixed bolt of the wire feeder to the torch cable to become parallel to wire feeder, insert torch cable all the way, then tighten the hexagon bolt for torch. (See Fig.7.3 (j).)

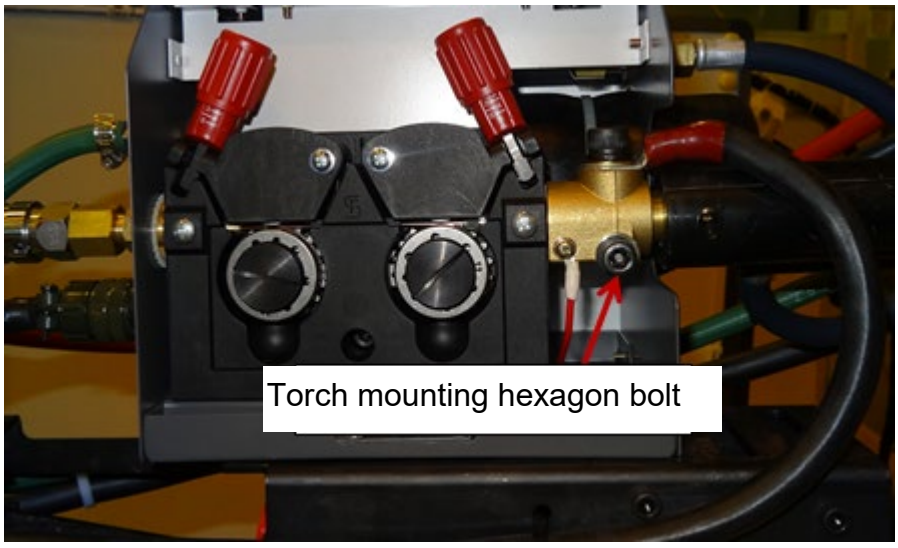


Fig. 7.3 (j) Remove the thumbscrews of wire feeder

18 Form the gas hose and water cooling hoses referring to Fig. 7.3 (k) . At this chance, be careful to prevent the interference of the hoses. Rotate the gas hose and water cooling torch 90° around the torch cable as shown in Fig. 7.3 (k). Locate it in the lower side of the torch cable (In case of floor mount）, Push it 20mm into the conduit, then fix it with cable ties referring to Fig. 7.3 (k).

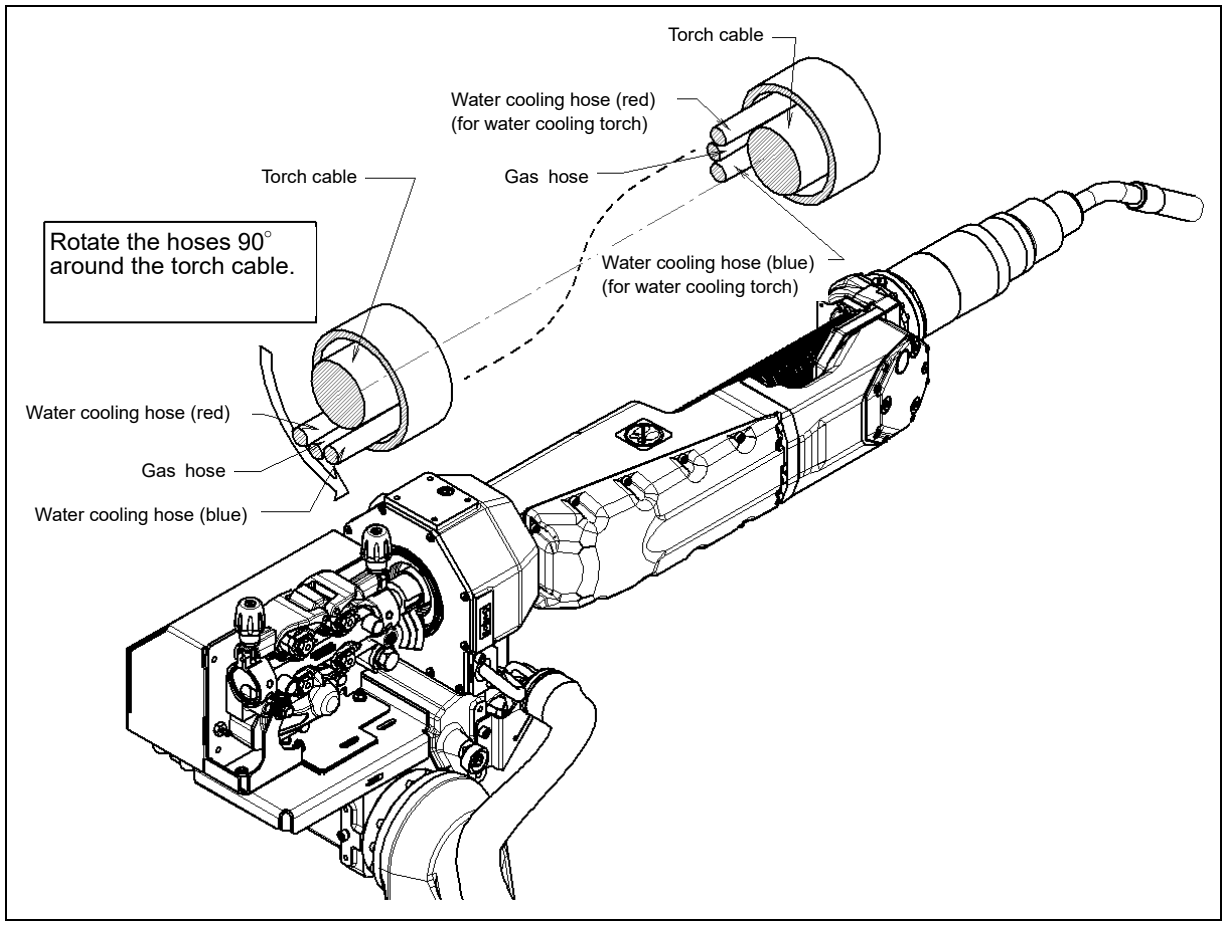


Fig. 7.3 (k) Arrangement of the cables and hoses

19 Attach fixation 2 bolts of torch side referring to Fig. 7.3 (d).Tighten black bolt with torque of 7.5Nm.

20 Firmly push Conduit all the way into the interior before applying the Conduit fixation cover, and install the cover that fixes Conduit referring to Fig. 7.3 (c).

21 Lift the roll, insert wire and restore them.

Judgment of torch cable length

Confirm torch cable come out is less or equal to 10mm.

If it exceeds 10mm, pull out wire feeder to a direction apart from the robot and adjust it.

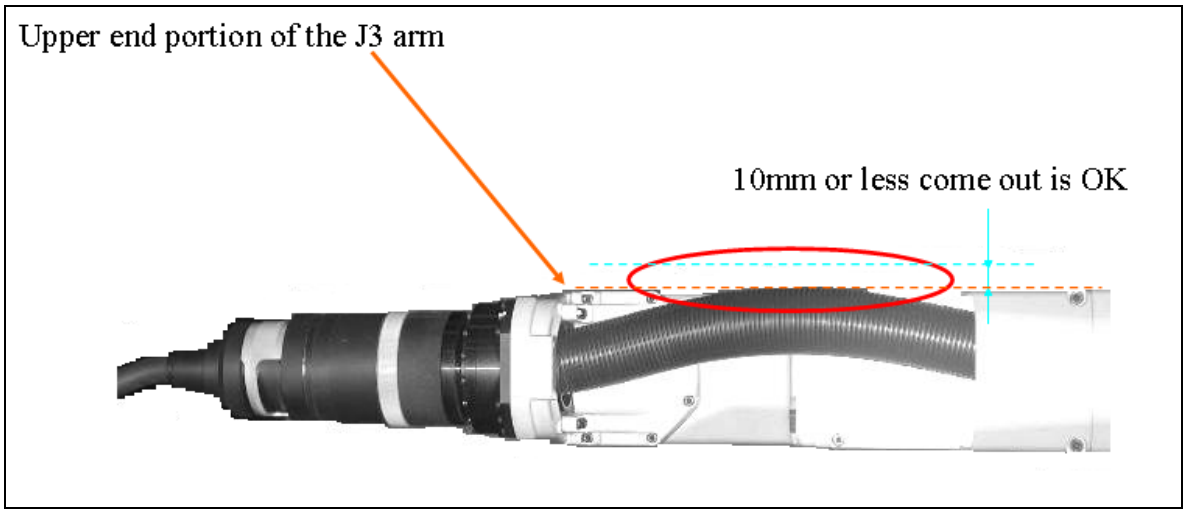


Fig. 7.3 (l) Judgment of torch cable length

7.4 REPLACING TORCH CABLE(ARC Mate *i*C series) (WHEN NOT USING TORCH CABLE CHANGING TOOL)

1 Move the robot posture to J4=J5=J6=0°, The J1-J3 axis is not cared about by arbitrary posture.
2 Confirm the gas hose and the water cooling hoses arrange as Fig. 7.4 (a). In addition, remove the torch cable from the conduit and confirm grease is applied on the hoses and does not occur interference of the hoses.

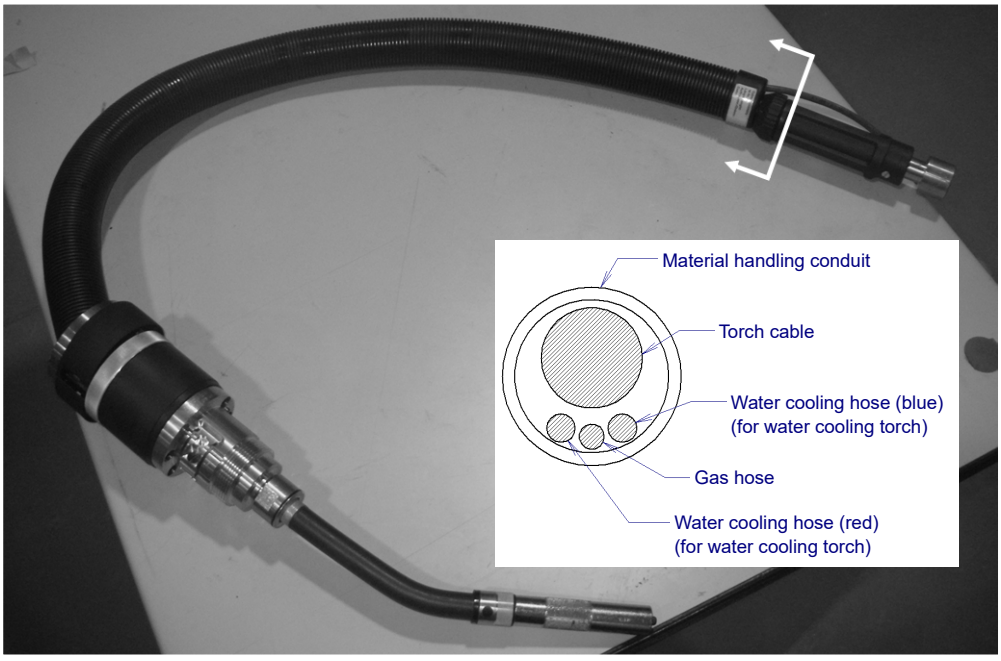


Fig. 7.4 (a) Torch appearance (Section view is seen from the arrow direction)

3 Remove the flexible conduit of wire feeder, cut the wire. Pull out the wire from the tip point after it supplies it until the wire cannot be sent. (It is not necessary to remove torch neck.)
4 Remove the conduit cover of J3 arm referring to Fig. 7.4 (b).

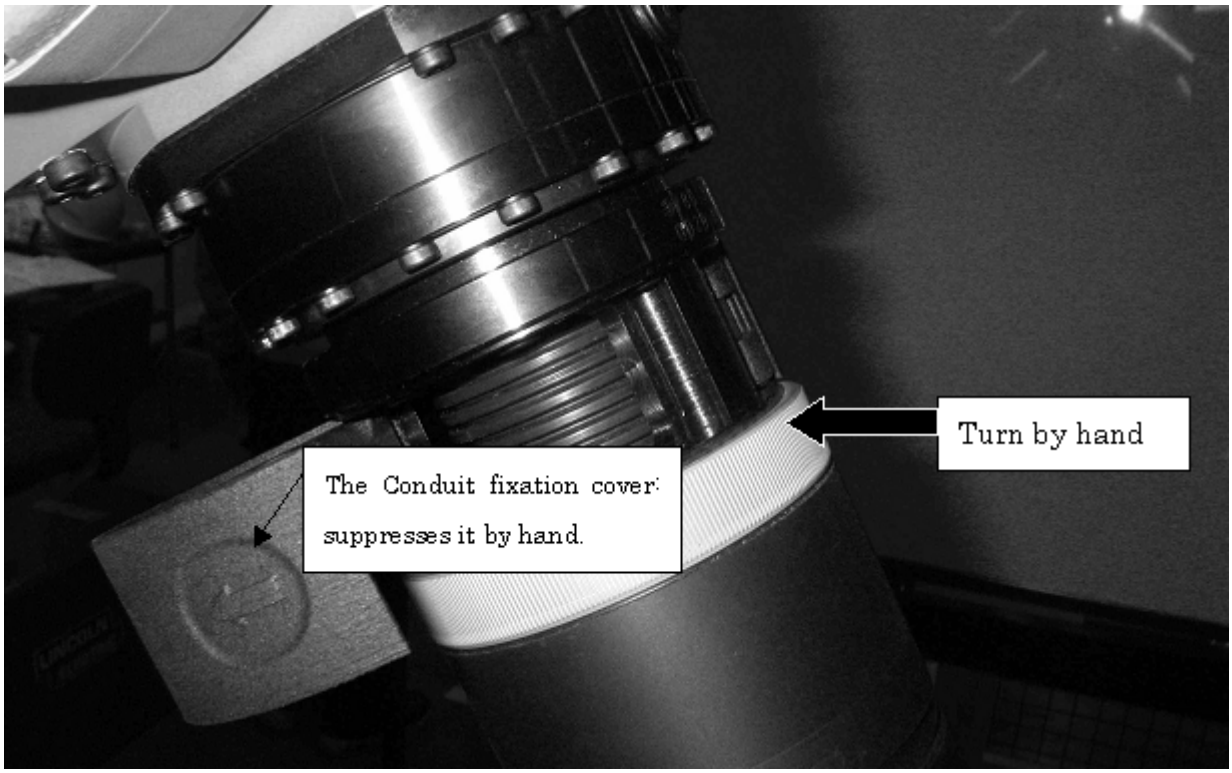


Fig. 7.4 (b) Remove conduit

5 Loosen the fixation two bolt of torch side referring to Fig. 7.4 (c).

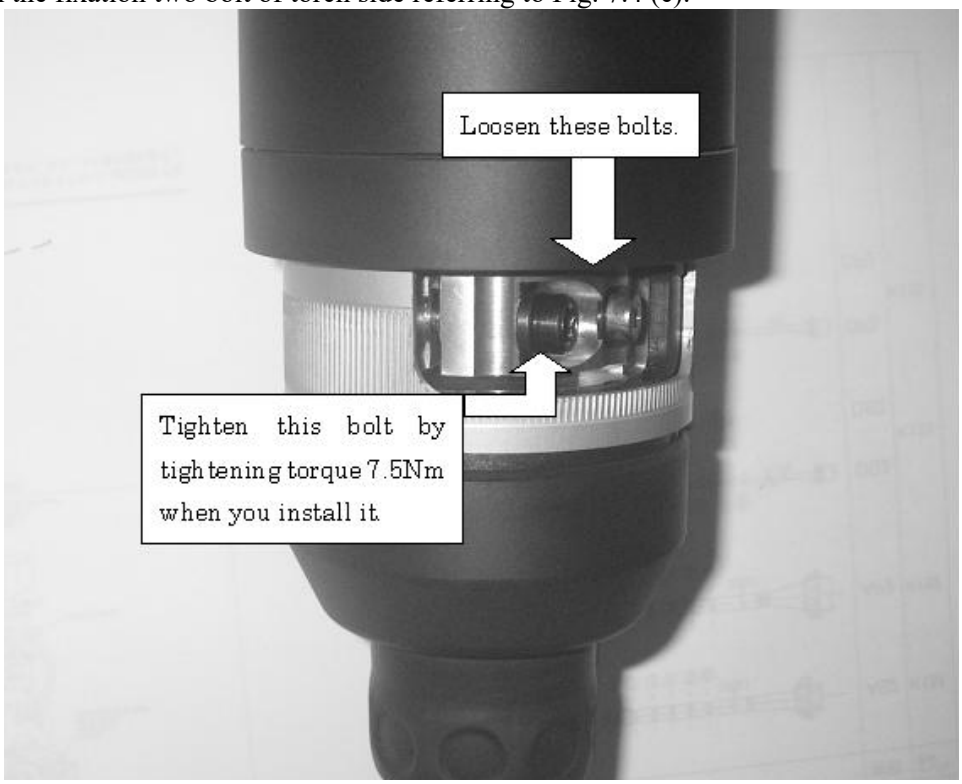


Fig. 7.4 (c) Fixation bolt of torch side

6 Remove torch cable from torch adapter (Fig. 7.4 (d).)

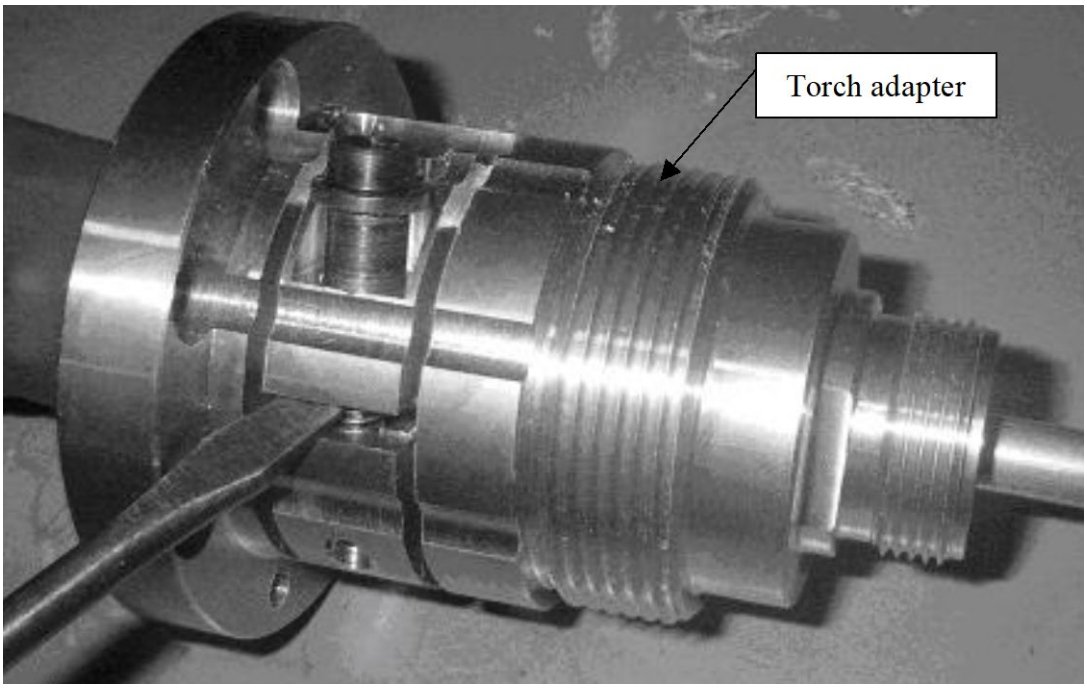


Fig. 7.4 (d) Groove of torch adapter

7 Loosen the bolt with hexagon hole of wire feeder referring to Fig. 7.4 (e).

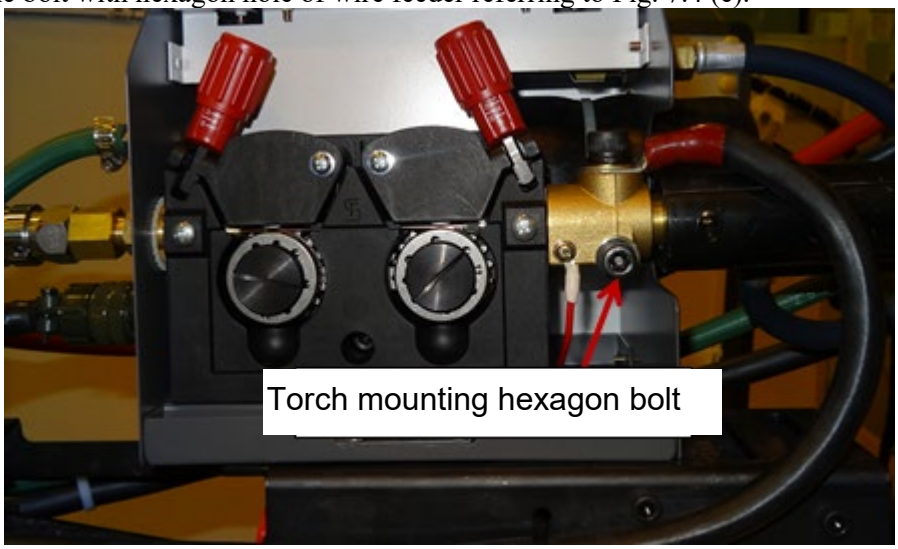


Fig. 7.4 (e) Remove the thumbscrews of wire feeder

8 Pull out the torch cable from the J3 arm part with Conduit to torch side.
9 Insert a new torch cable in the J3 arm part.
10 Match tip of metal of torch to the keyway and insert it into torch adapter.
11 Confirm the bottom of tip of metal of torch cable has stuck to the face of torch adapter. When the torch cable doesn't enter easily, it becomes easy if a straight-head screwdriver is inserted in the groove, and the groove is expanded. (See Fig. 7.4 (f))

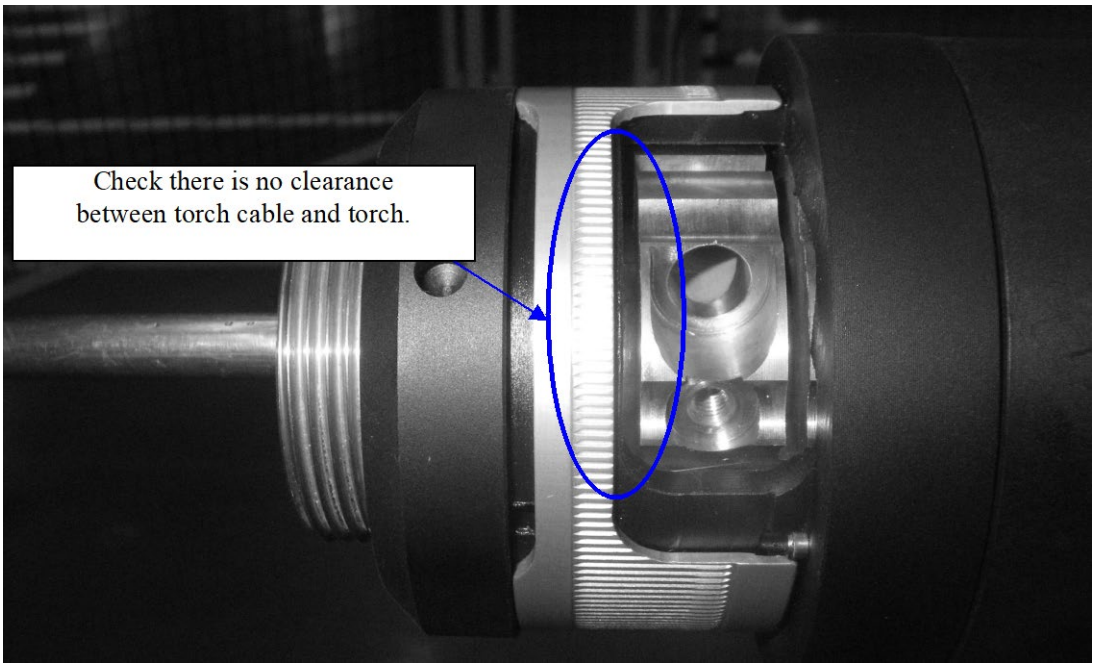


Fig. 7.4 (f) Confirming of no clearance of torch cable

12 Shut up a conduit till it do not move towards the torch neck, and lock a conduit fixation cover

13 According to Section 7.5, insert new liner to torch cable and tighten liner suppression nut. Adjust the length of liner.

14 Loosen a fixed bolt of the wire feeder to the torch cable to become parallel to wire feeder, insert torch cable all the way, then tighten the hexagon bolt for torch. (See Fig. 7.4 (g).)

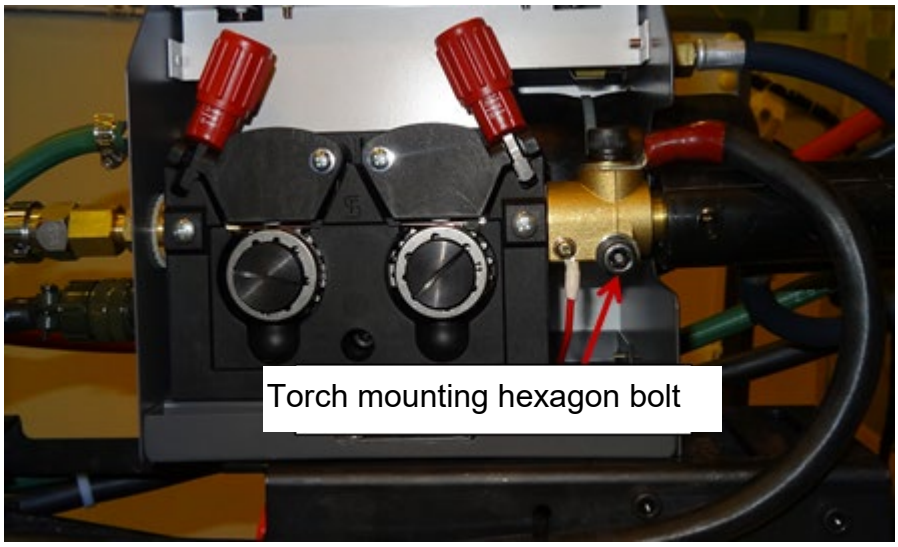


Fig. 7.4 (g) Remove the thumbscrews of wire feeder

15 Form the gas hose and water cooling hoses referring to Fig. 7.4 (h). At this chance, be careful to prevent the interference of the hoses. Rotate the gas hose and water cooling torch 90° around the torch cable as shown in Fig. 7.4 (h). Locate it in the lower side of the torch cable (In case of floor mount）, Push it 20mm into the conduit, then fix it with cable ties.

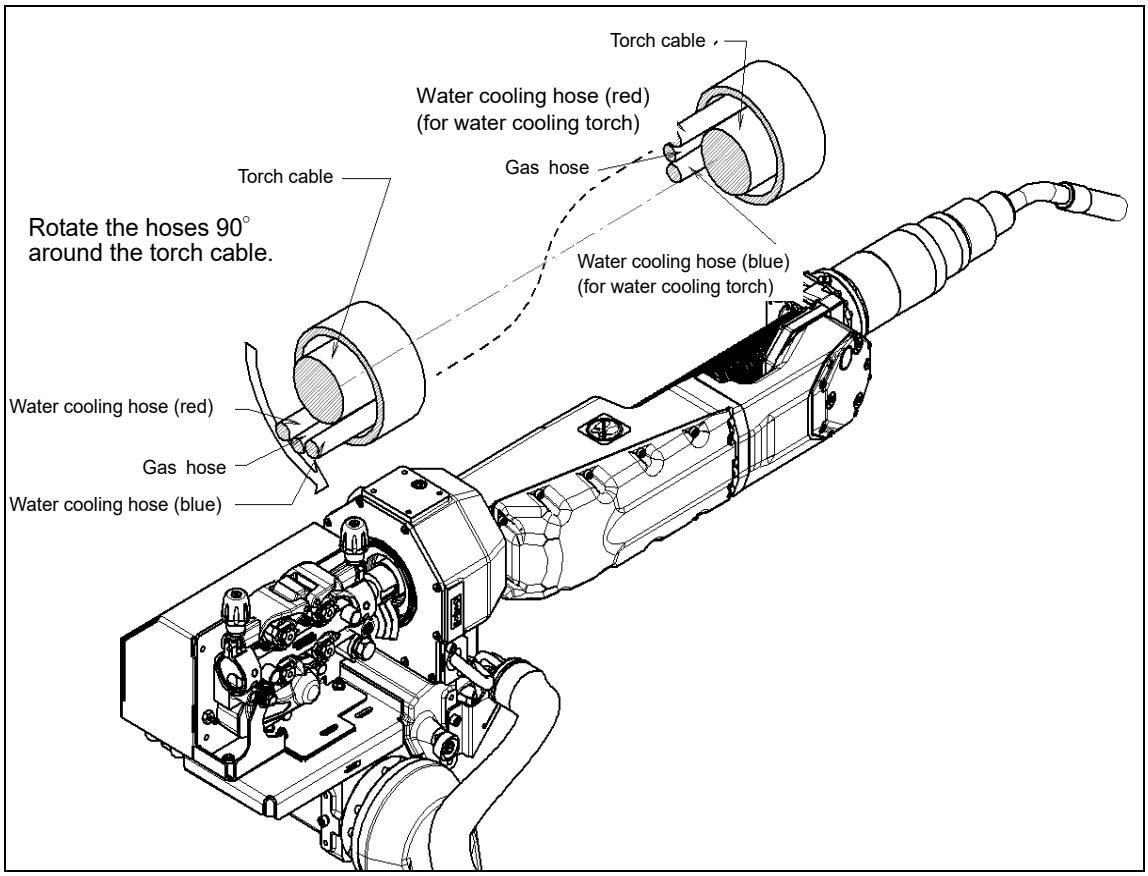


Fig. 7.4 (h) Arrangement of the cables and hoses

16 Attach fixation 2 bolts of torch side referring to Fig. 7.4 (c). Tighten black bolt with torque of 7.5Nm.
17 Firmly push Conduit into the interior before applying the Conduit fixation cover, and install the cover that fixes Conduit referring to Fig. 7.4 (b).
18 Lift the roll, insert wire and restore them.

Judgment of torch cable length

Confirm torch cable come out is less or equal to 10mm.
If it exceeds 10mm, pull out wire feeder to a direction apart from the robot and adjust it.

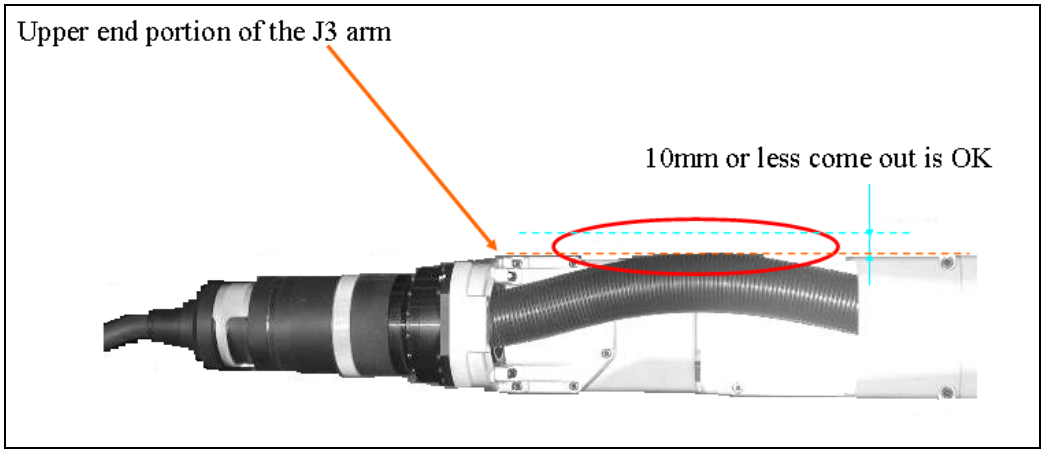


Fig. 7.4 (i) Judgment of torch cable length

7.5 REPLACING THE LINER

1 Lift down the idol arms.

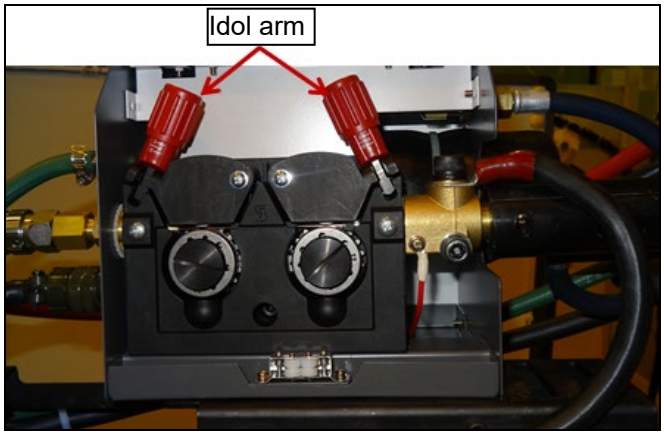


Fig. 7.5 (a) Replacing the liner

2 Lift up the following rollers.
3 Pull out the wire from the wire feeder and the torch.
4 Remove the gas hose of the torch cable side from the joint.
5 Remove the torch mounting bolt of the wire feeder.

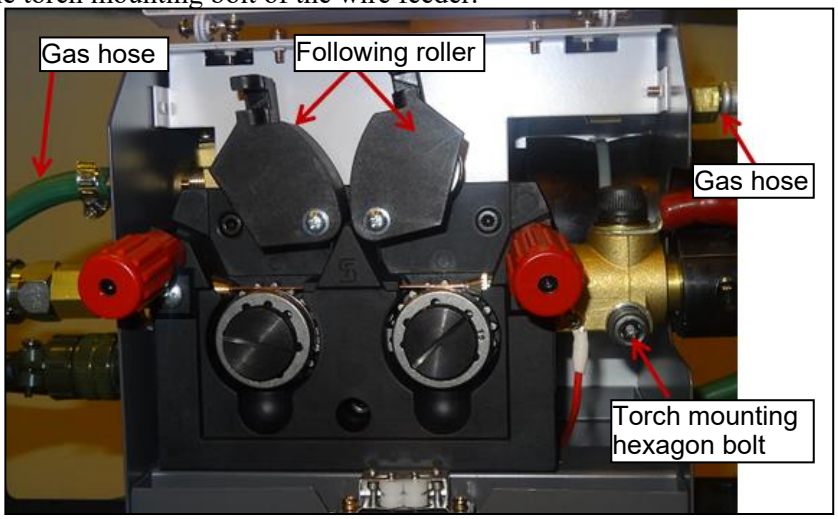


Fig. 7.5 (b) Replacing the liner

6 Pull out the torch cable from the wire feeder.
7 Pull out the liner from the wire feeder side torch cable end.

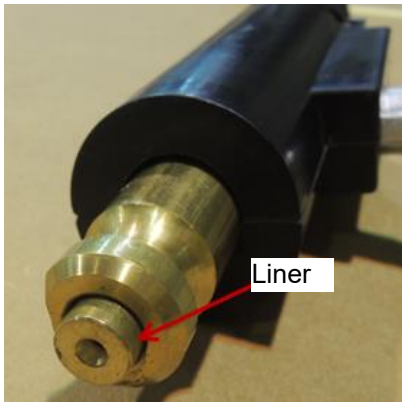


Fig. 7.5 (c) Replacing the liner

8 Replace old liner by new one. For its assembly, please apply the steps above in reversed sequence. (It is not necessary to adjust the liner length.)

7.6 REPLACING THE ROLLERS

Below shows the procedure for replacing the rollers.

1 Lift down the idol arms. (Refer to Fig. 7.6 (a).)
2 Lift up the following rollers.
3 Remove the roller mounting screws with a minus driver etc. (Refer to Fig. 7.6 (b))
4 Replace old rollers by new one. For its assembly, please apply the steps above in reversed sequence.

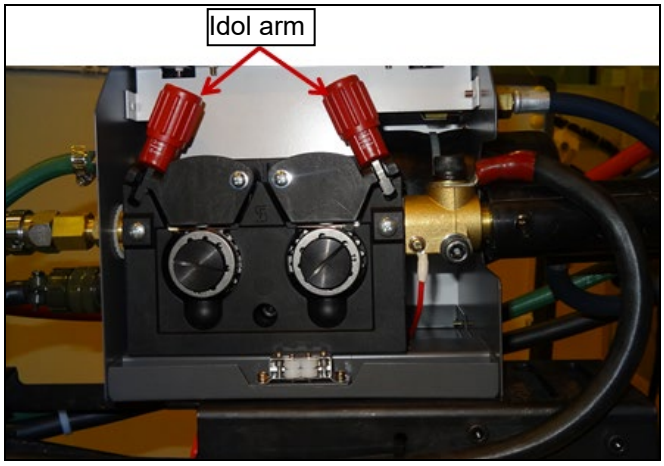


Fig. 7.6 (a) Replacing the rollers

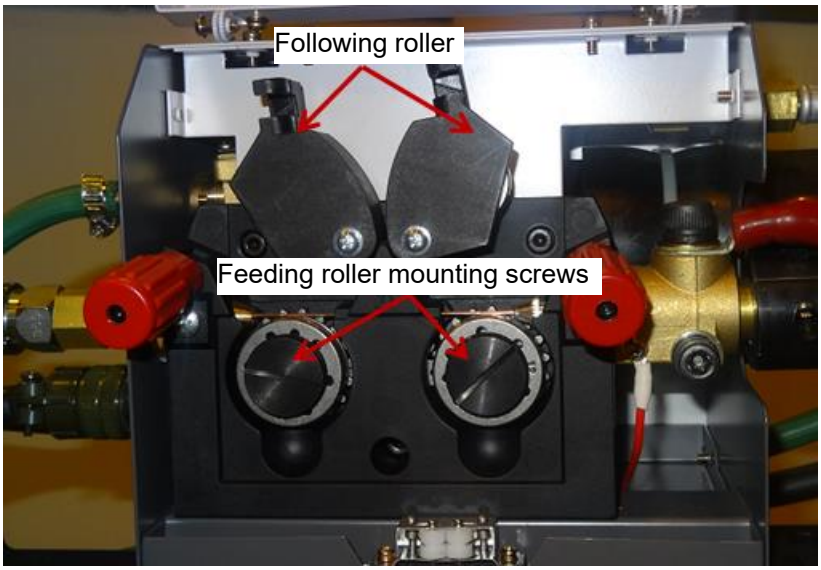


Fig. 7.6 (b) Replacing the rollers

7.7 REPLACING THE TORCH NECK (BINZEL TORCH for ARC Mate 0*i*B)

When torch neck is broken, it is necessary to replace it.
In this case, there is a possibility that TCP must be set again using torch recovery etc.
In case of BINZEL torch neck, replace it by the procedure below.
In case of MIZUHO torch, the replacing only torch neck is impossible, so replace whole torch cable.

1 Remove the nozzle. (refer to Fig. 7.7 (a))
2 Loosen insulation cylinder screw with a monkey spanner and remove it. (refer to Fig. 7.7 (b))
3 Loosen the tip holder screw with a monkey spanner and remove it. (See Fig. 7.7 (b))
4 Turn insulation cap by hand and remove it. (See Fig. 7.7 (c).)
5 Loosen the union nut with a monkey spanner, remove torch neck, then replace it to new one.(See Fig. 7.7 (d).) Tighten union nut with regulated torque.
* Attach the insulation cap. (See Fig. 7.7 (c).)
6 Attach the tip holder ,(See Fig. 7.7 (b).)
7 Attach insulation cylinder. (See Fig. 7.7 (b).)
8 Attach the nozzle. (refer to Fig. 7.7 (a))

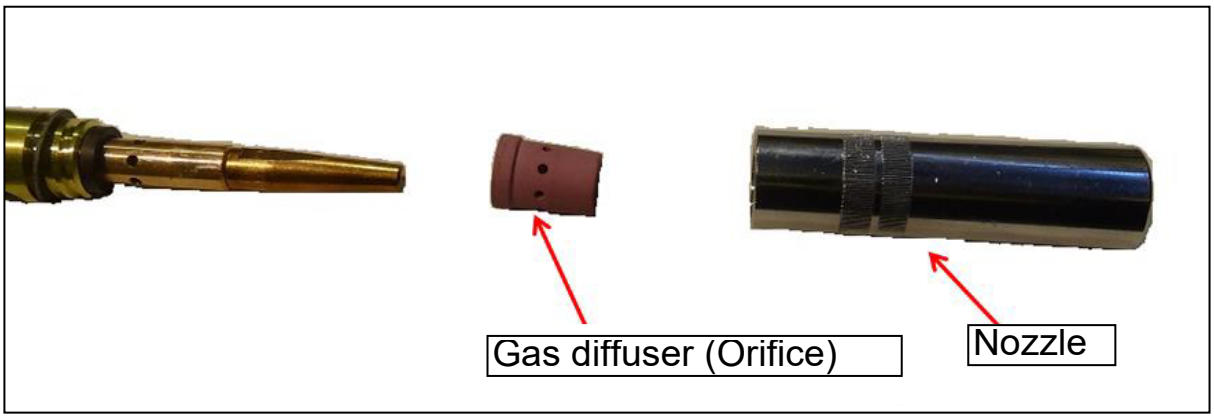


Fig. 7.7 (a) Removing the gas diffuser and the nozzle

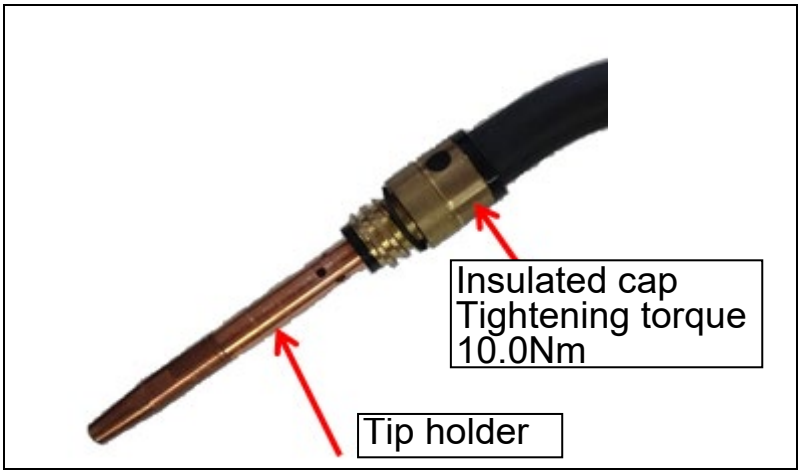


Fig. 7.7 (b) Removing the insulated cap and the tip holder

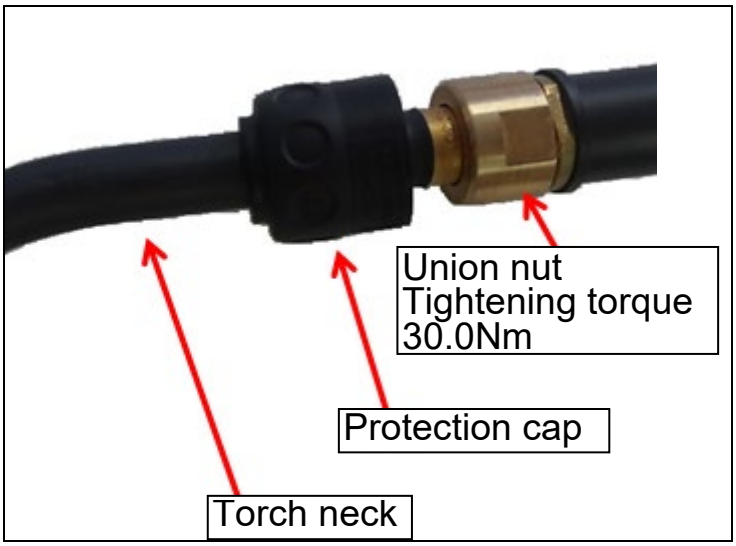


Fig. 7.7 (c) Removing the torch neck

7.8 REPLACING THE TORCH NECK (BINZEL AIR COOLING TORCH 350GC ARC Mate *i*C series)

When torch neck is broken, it is necessary to replace it.
In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1 Remove the nozzle. (Refer to Fig. 7.8 (a))
2 Loosen the screws of the insulation cylinder with a pliers and remove it. (Refer to Fig. 7.8 (b))
3 Loosen the screw of the tip holder with a spanner and remove it. (Refer to Fig. 7.8 (b))
4 Remove the protection cap. (Refer to Fig. 7.8 (c))
5 Loosen the union nut with a spanner, remove the torch neck, then replace by new one. (Refer to Fig. 7.8 (d)) Tighten the union nut with the regulated torque.
6 Attach the protection cap. (Refer to Fig. 7.8 (c))
7 Attach the tip holder. (Refer to Fig. 7.8 (b))
8 Attach the insulated cap. (Refer to Fig. 7.8 (b))
9 Attach the nozzle. (Refer to Fig. 7.8 (a))

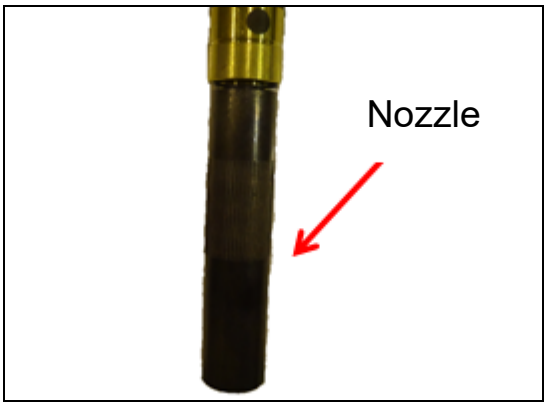


Fig. 7.8 (a) Removing the nozzle

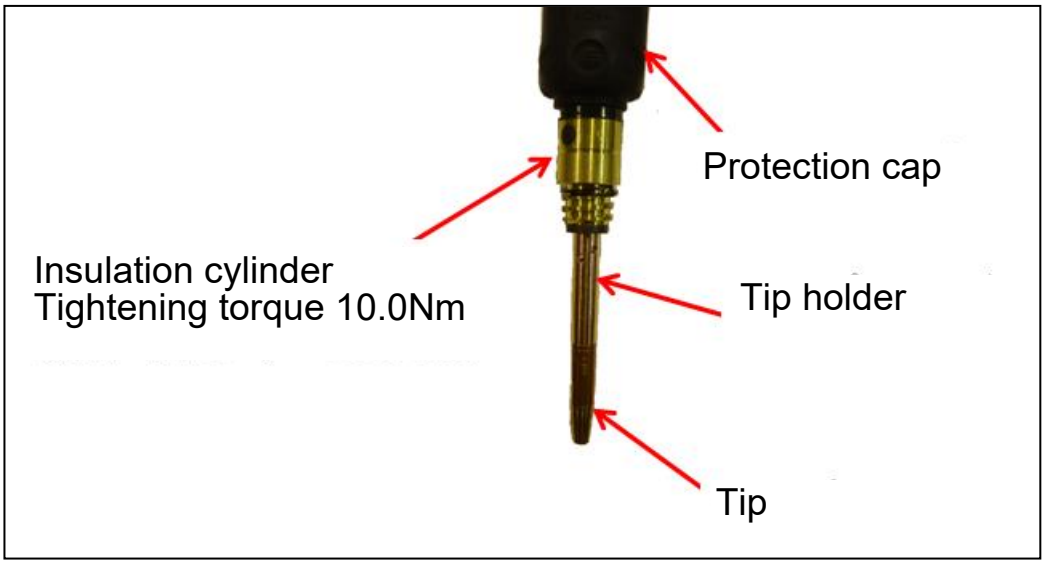


Fig. 7.8 (b) Removing the insulated cap and the tip holder

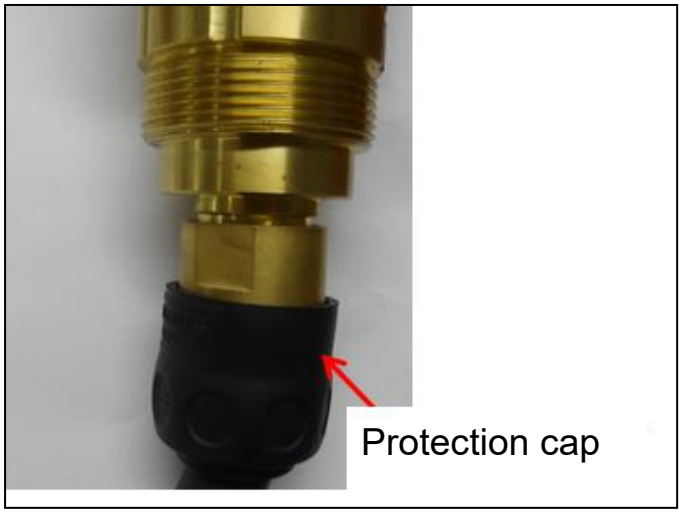


Fig. 7.8 (c) Removing the protection cap

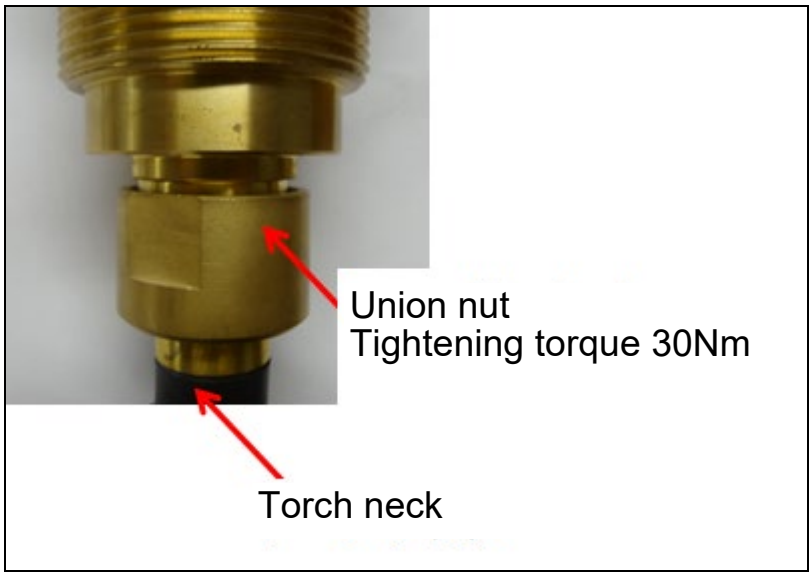


Fig. 7.8 (d) Removing the torch neck

7.9 REPLACING THE TORCH NECK (BINZEL TORCH W500 for ARC Mate *i*C series)

When torch neck is broken, it is necessary to replace it. In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1 Remove the nozzle. (Refer to Fig. 7.9 (a))
2 Loosen the screw of the tip holder with a spanner and remove it. (Refer to Fig. 7.9 (b))
3 Rotate the union nut to the arrow direction with hands and remove it. (Refer to Fig. 7.9 (c))
4 Remove the torch neck, then replace it with new one. Install the torch neck and wrist with no gap referring to the Fig. 7.9(d). Tighten the union nut.
5 Attach the tip holder. (Refer to Fig.7.9 (b))
6 Attach the nozzle. (Refer to Fig. 7.9 (a))

Fig. 7.9 (a) Removing the nozzle

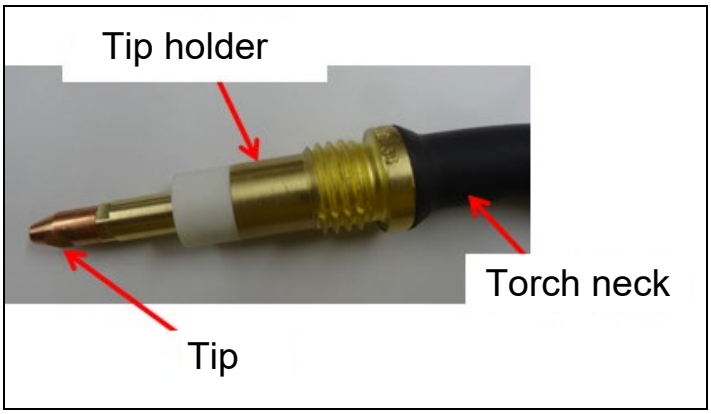


Fig. 7.9 (b) Removing the tip holder

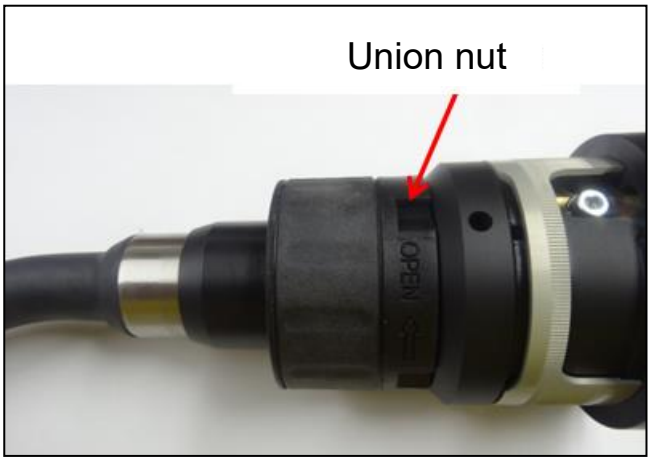


Fig. 7.9 (c) Removing the torch neck

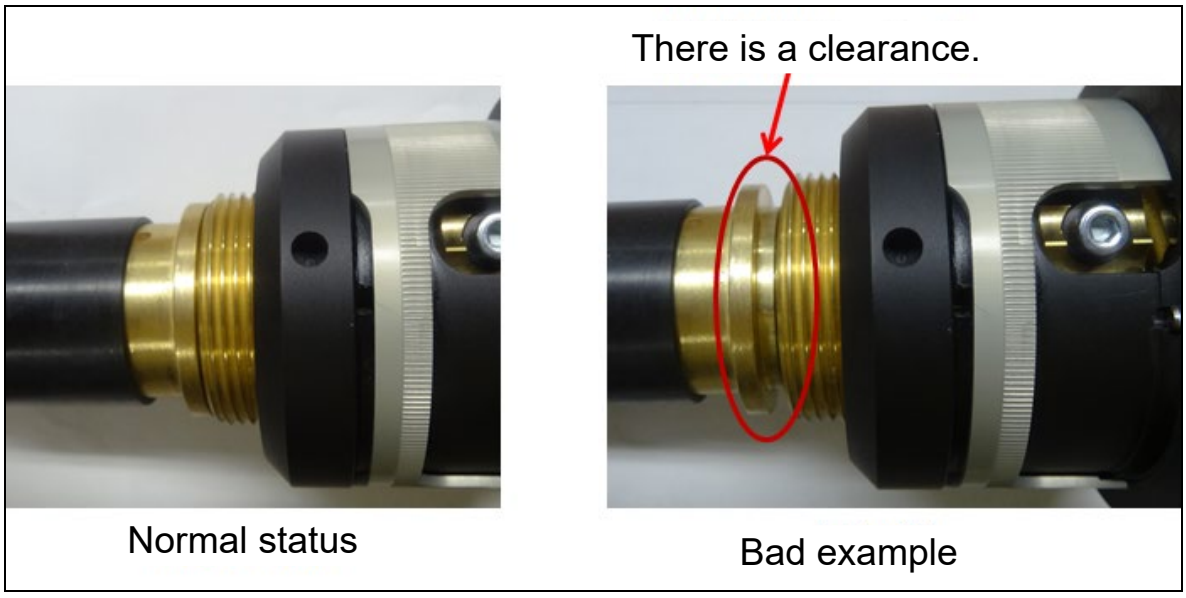


Fig. 7.9 (d) Check no gap of the torch neck

7.10 REPLACING THE TORCH NECK (BINZEL TORCH A360 for ARC Mate *i*C series)

When torch neck is broken, it is necessary to replace it. In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1 Remove the nozzle. (Refer to Fig. 7.10 (a))
2 Loosen the screw of the tip holder with a spanner and remove it. (Refer to Fig. 7.10 (b))
3 Loosen 2 screws with hexagon wrench. (Refer to Fig. 7.10 (c))
4 Remove the torch neck, and replace it with new one. (Refer to Fig. 7.10 (b)) Install the torch neck and wrist with no gap referring to the Fig. 7.10 (d). Tighten 2 screws with a regulated torque.
5 Attach the tip holder. (Refer to Fig. 7.10 (b))
6 Attach the nozzle. (Refer to Fig. 7.10 (a))

Fig. 7.10 (a) Removing the nozzle

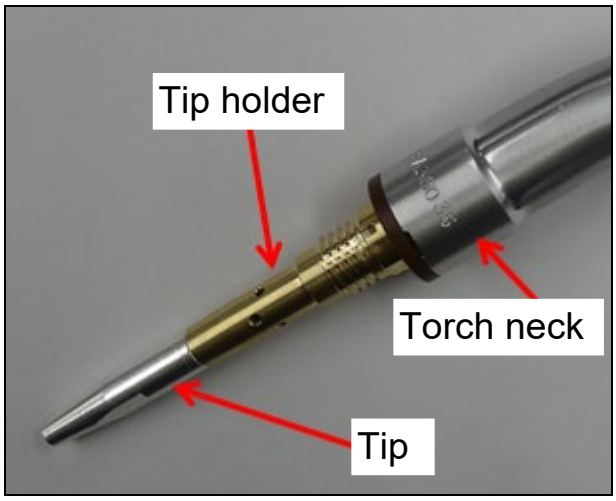


Fig. 7.10 (b) Removing the tip holder

Fig. 7.10 (c) Removing screws

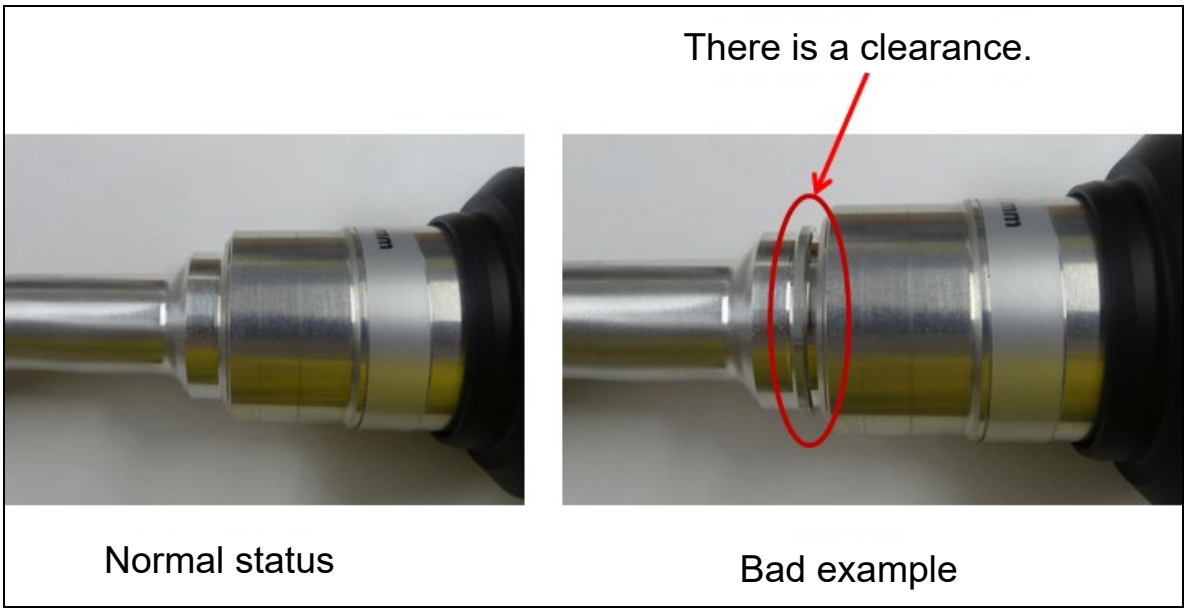


Fig. 7.10 (d) Check no gap of the torch neck

7.11 REPLACING THE WIRE FEEDER

1 Loosen the torch mounting hexagon bolt with a hexagon wrench, then remove the torch from the wire feeder.
2 Remove the gas hose of the wire feeder side and the torch side.
3 Remove the joint for connection of the flexible conduit to the wire feeder.
4 Cut the wire, then pull out it from the torch cable end side.
5 Loosen the welding power supply cable , he remove the welding power supply cable.
6 Remove the wire feeder control cable and the flexible conduit side gas hose.
7 Remove the wire feeder mounting bolts.
8 Replace old wire feeder by new one. For its assembly, please apply the steps above in reversed sequence.

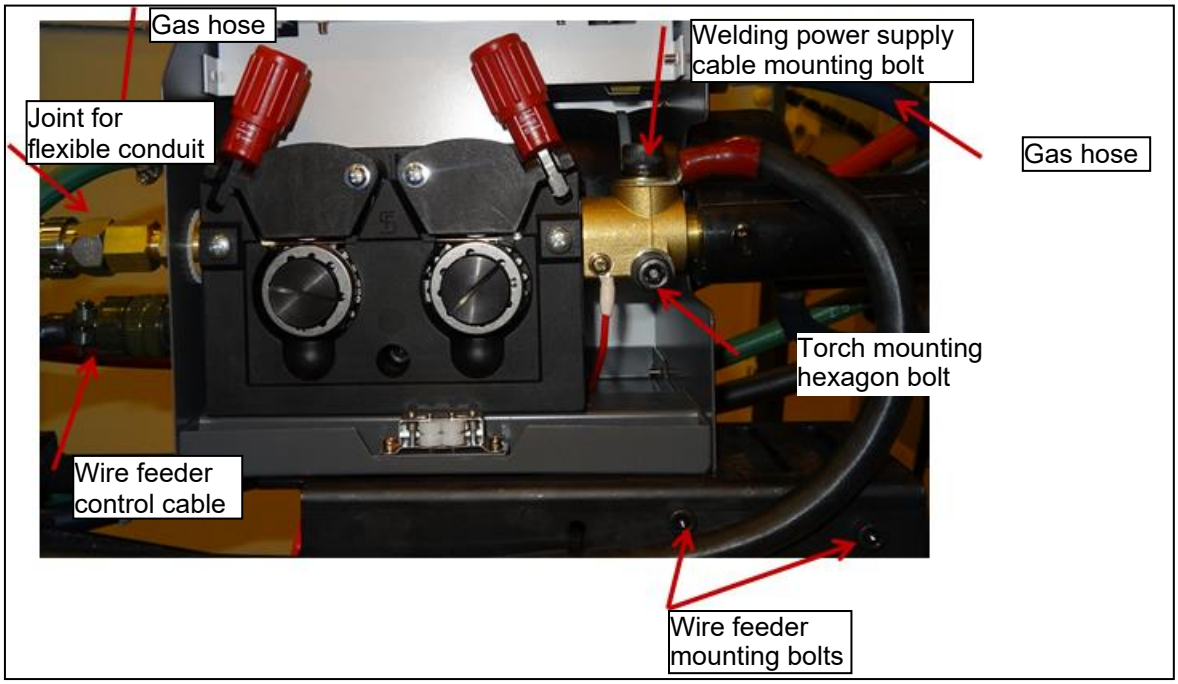


Fig. 7.11 (a) Replacing the wire feeder

8 MAINTENANCE PARTS

When part unit is needed about welding power supply and welding torch, refer to this section.
Please inquire of our company about parts that not are described in this section.

Table 8 (a) Maintenance parts of welding power supply FH350i (A05B-1291-H151)

Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
A14L-0166-0151#PR1	Printed circuit board	1	**PR1**
A14L-0166-0151#PR2	Printed circuit board	1	**PR2**
A14L-0166-0151#PR3	Printed circuit board	1	**PR3**
A14L-0166-0151#PR7	Printed circuit board	1	**PR7**
A14L-0166-0151#PR8	Printed circuit board	1	**PR8**
A14L-0166-0151#F1	Fuse	1	**F1**
A14L-0166-0151#FU1	Fuse	1	**FU1**
A14L-0166-0151#BAT	Battery		**CR2032**
A14L-0166-0151#FAN1X2	Cooling fan	1	**FAN1, FAN2**
A14L-0166-0151#Q1X2	IGBT MODULE	1	**2**

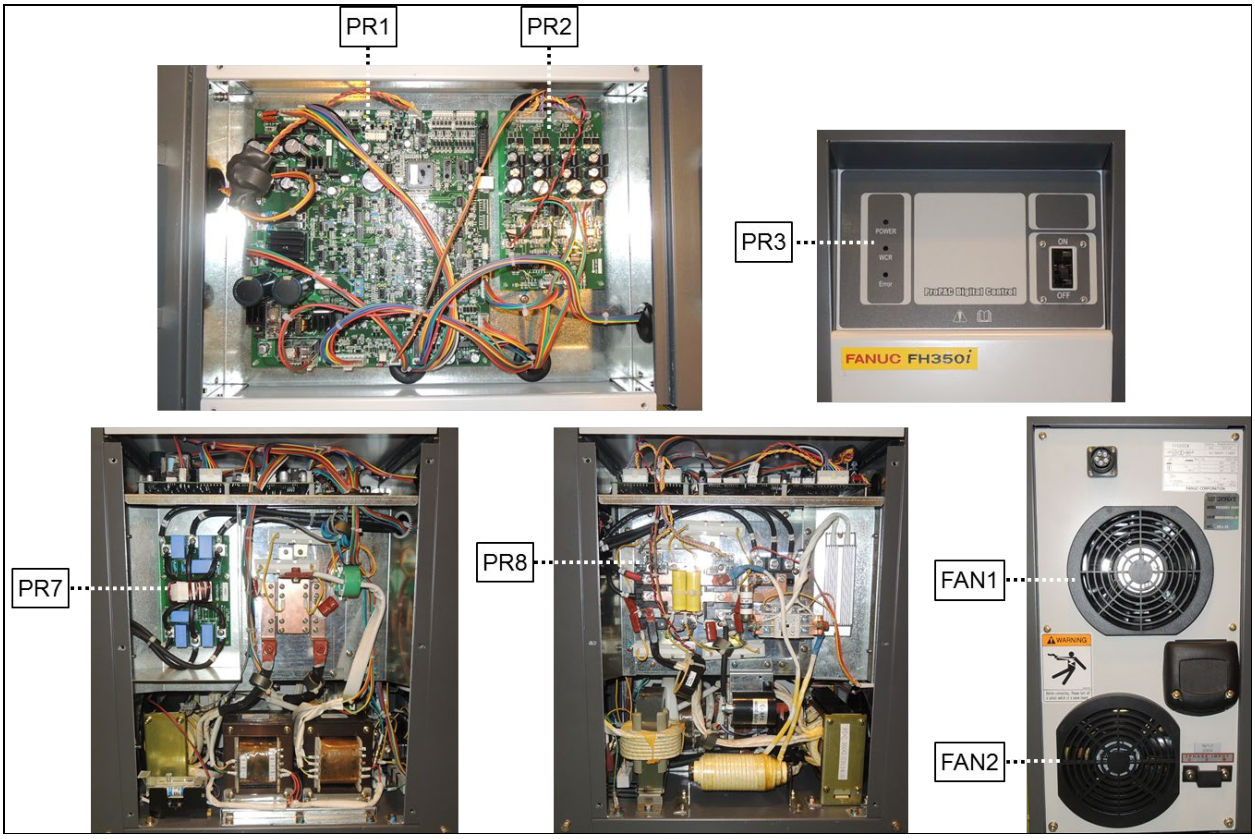


Fig. 8 (a) Welding power supply FH350i

Table 8 (b) Maintenance part for welding power supply FH350iP (A05B-1291-H153)

Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
A14L-0166-0151#F1	Fuse	1	**F1**
A14L-0166-0151#FU1	Fuse	1	**FU1**
A14L-0166-0153#FAN1X2	Cooling fan	2	**FAN1,2**
A14L-0166-0153#PR1	Printed circuit board	1	**PR1**
A14L-0166-0153#PR2	Printed circuit board	1	**PR2**
A14L-0166-0153#Q1X2X2V	IGBT MODULE	1	**Q1,Q2**
A14L-0166-0153#Q3X4	IGBT MODULE	1	**Q3,Q4**
A14L-0166-0153#Q5	IGBT MODULE	1	**Q5**

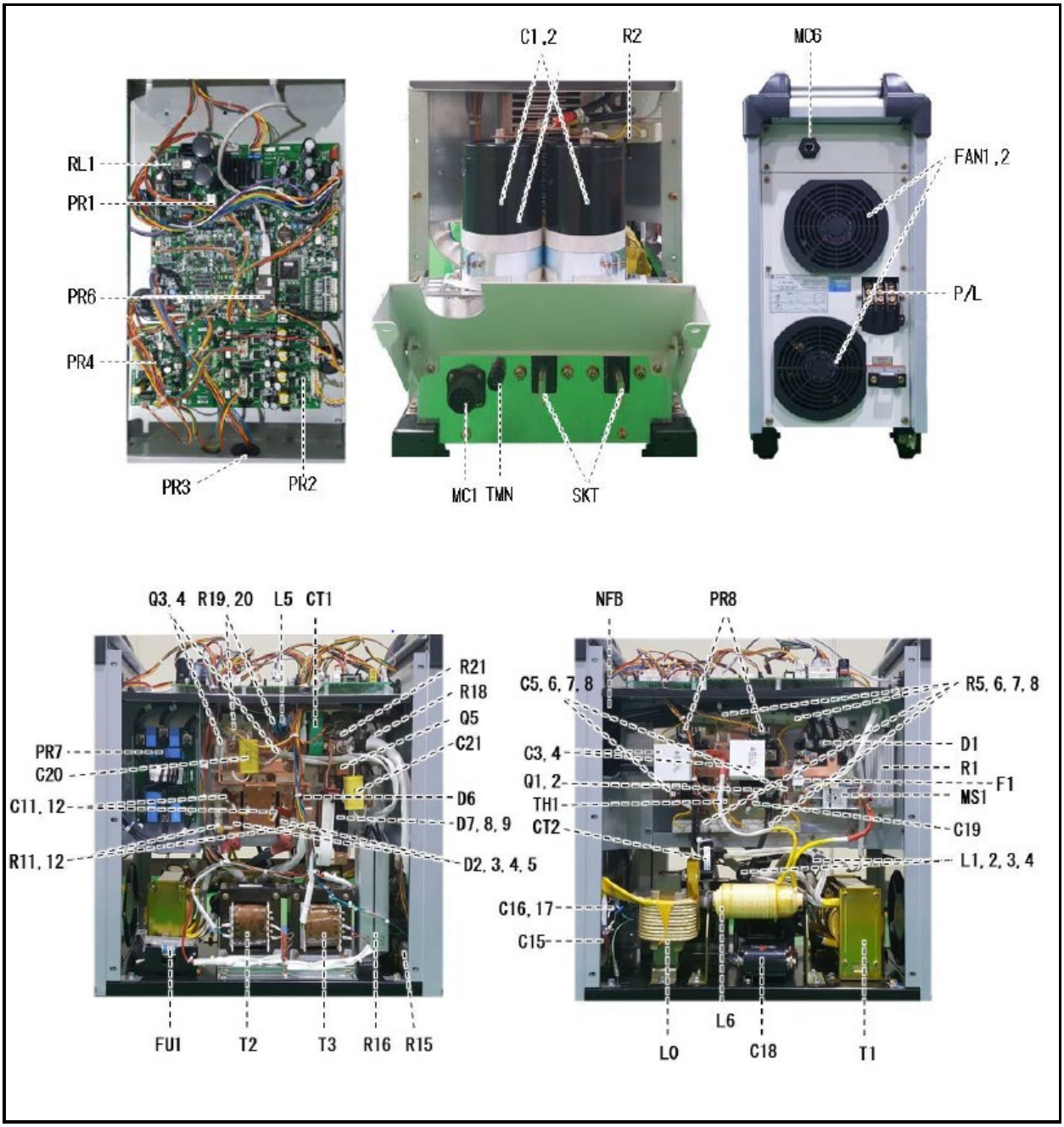


Fig. 8 (b) Welding power supply FH350iP

Table 8 (c) Maintenance parts of wire feeder EF-R350FA (A05B-1291-H205)

Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
A14L-0166-0205#WF1	Motor bracket	1	**1**
A14L-0166-0205#WF2D1	Roller （φ0.9/φ1.2）	2	**2D1**
A14L-0166-0205#WF2D2	Roller （φ1.0/φ1.2）	2	**2D2**
A14L-0166-0205#WF3	Torch adapter	1	**3**
A14L-0166-0205#WF4	Inlet guide	1	**4**
A14L-0166-0205#WF5	Nipple	1	**5**
A14L-0166-0205#WF6	Solenoid valve	1	**6**
A14L-0166-0205#WF7	Outlet guide	1	**7**
A14L-0166-0205#WF8	Roller mounting bolts	2	**8**
A14L-0166-0205#M	Motor	1	**M**
A14L-0166-0205#PR5	Printed circuit board	1	**PR5**

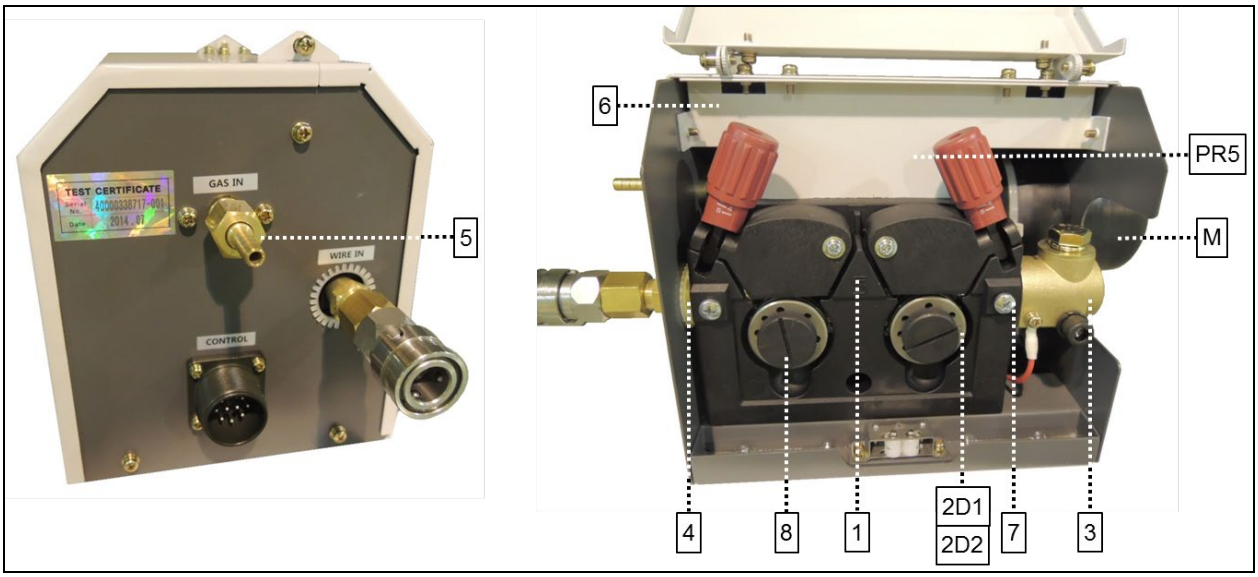


Fig. 8 (c) Wire feeder EF-R350FA

Table 8 (d) A05B-1296-H303,H304 series parts table
(ABIROB iSTM mini G350-30L by BINZEL)

Fig. No.	Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
—	A14L-0201-0303#12HL	G350-30L torch set including the cable	1	100*i*D/spec.
—	A14L-0201-0303#LGHL	G350-30L torch set including the cable	1	100*i*D/10L,120*i*Dspec.
—	A14L-0201-0303#ELHL	G350-30L torch set including the cable	1	100*i*D/8Lspec.
—	A14L-0201-0303#HLHL	G350-30L torch set including the cable	1	120*i*D/12Lspec.
—	A14L-0201-0304#12HL	G350-30L torch set including the cable with wire brake	1	100*i*Dspec.
—	A14L-0201-0304#LGHL	G350-30L torch set including the cable with wire brake	1	100*i*D/10L,120*i*Dspec.
—	A14L-0201-0304#ELHL	G350-30L torch set including the cable with wire brake	1	100*i*D/8Lspec.
—	A14L-0201-0304#HLHL	G350-30L torch set including the cable with wire brake	1	120*i*D/12Lspec.
A	A14L-0201-0303#98002261	Torch neck finished product	1	G350-30L(Tip L=45spec.)
1	A14L-0201-0303#980X0226	Torch neck simple substance	1	
2	A14L-0166-0301#142X0143	Tip holder (S) L=92.5	1	Tip L=45
*2	A14L-0166-0301#142X0144	Tip holder (L) L=97.5	1	Tip L=40
3	A14L-0166-0301#980X0142	Insulation pipe (black)	1(10)	Resin
4	A14L-0166-0301#980X0019	Gas diffuser pink	1(10)	Ceramic
5	A14L-0201-0303#140J4512	Contact tip CuCrZr	1(10)	L=45 ϕ1.2 M6
*5	A14L-0201-0303#140J4012	Contact tip CuCrZr	1(10)	L=40 ϕ1.2 M6
*6-1	A14L-0166-0301#145X0558	Gas nozzle (taper) ϕ12 L=89.5	1(10)	Cr plated spec.
6-2	A14L-0166-0301#145XJ054	Gas nozzle(straight) ϕ15.6 L=89.5	1(10)	Non-spatter coating spec.
*6-3	A14L-0166-0301#145X0559	Gas nozzle (bottle) ϕ14 L=89.5	1(10)	Cr plated spec.
*6-4	A14L-0166-0301#145X0573	Gas nozzle (taper) ϕ13 L=89.5	1(10)	Cr plated spec.
7	A14L-0201-0304#149XJ490	Neck liner	1	ϕ1.0-ϕ1.2 L=270
8	A14L-0201-0303#780X3315	Insulation robot flange	1	100*i*D,120*i*D flange spec.
9	A14L-0201-0303#980X2546	Torch cable assembly L=0.9m	1	100*i*Dspec.
9	A14L-0201-0303#980X2556	Torch cable assembly L=1.1m	1	100*i*D/10L,120*i*Dspec.
9	A14L-0201-0303#980X2658	Torch cable assembly L=1.3m	1	100*i*D/8Lspec.
9	A14L-0201-0303#980X2660	Torch cable assembly L=1.535m	1	120*i*D/12Lspec.
10	A14L-0166-0303#124X0256	Cable liner (black) for Iron・SUS	1	ϕ1.2 - ϕ1.6 3.0m
*10	A14L-0166-0301#124XJ005	Cable liner (black) for Iron・SUS	1	ϕ1.2 - ϕ1.6 2.2m
*10	A14L-0166-0301#124XJ006	Cable liner (blue) for Iron・SUS	1	ϕ0.8 - ϕ1.0 2.2m
11	A14L-0201-0304#980X2459	Wire clamp unit	1	

* are options.

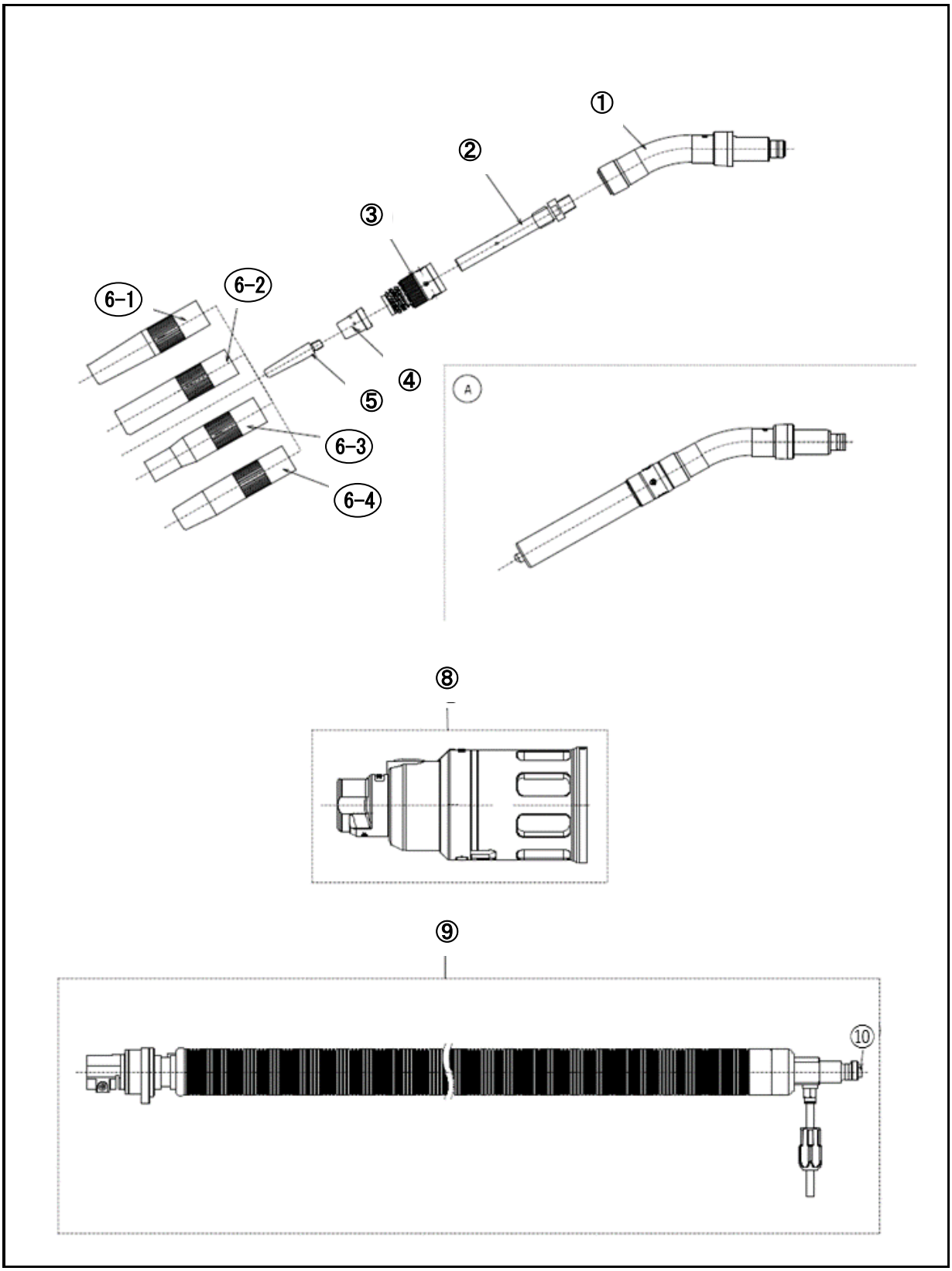


Fig. 8 (d) A05B-1296-H303 series component part
(ABIROB iSTM mini G350-30L by BINZEL)

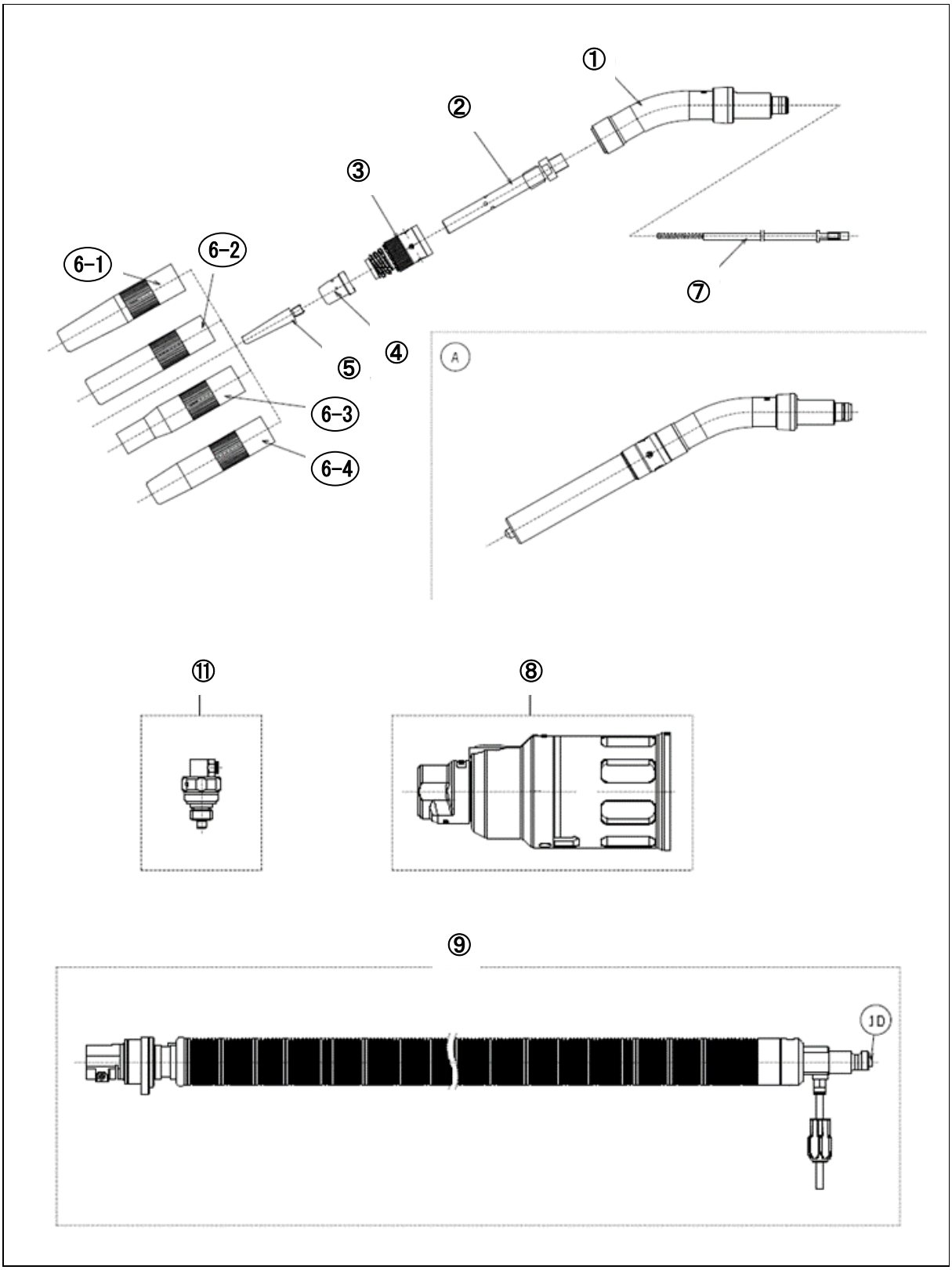


Fig. 8 (e) A05B-1296-H304 series component part
(ABIROB iSTM mini G350-30L by BINZEL)

Table 8 (e) A05B-1296-H305,H306 series parts table
(ABIROB iSTM mini W500-35 by BINZEL)

Fig. No.	Maintenance parts specifications	Maintenance parts name	Unit requirement	Remarks
—	A14L-0201-0305#12H	W500-35 torch set including the torch cable	1	100*i*D spec.
—	A14L-0201-0305#LGH	W500-35 torch set including the torch cable	1	100*i*D/10L,120*i*D spec.
—	A14L-0201-0305#ELH	W500-35 torch set including the torch cable	1	100*i*D/8L spec.
—	A14L-0201-0305#HLH	W500-35 torch set including the torch cable	1	120*i*D/12L spec.
—	A14L-0201-0306#12H	W500-35 torch set including the torch cable with wire brake	1	100*i*D spec.
—	A14L-0201-0306#LGH	W500-35 torch set including the torch cable with wire brake	1	100*i*D/10L,120*i*D spec.
—	A14L-0201-0306#ELH	W500-35 torch set including the torch cable with wire brake	1	100*i*D/8L spec.
—	A14L-0201-0306#HLH	W500-35 torch set including the torch cable with wire brake	1	120*i*D/12L spec.
1	A14L-0166-0311#782X0077	Torch neck simple substance	1	
2	A14L-0166-0311#142X0173	Tip holder (Ms)	1(10)	L=40.9 M8
3	A14L-0166-0311#943XJ003	Gas diffuser Brown	1(10)	
4	A14L-0166-0311#140X0445	Contact tip CuCrZr	1(10)	L=30 ϕ1.2 M8
*4	A14L-0166-0311#140J3012	Contact tip CuCrZr	1(10)	L=30 ϕ1.2 M8 silver plated
*4	A14L-0166-0311#AGWX0445	Contact tip silver tungsten	1(10)	L=30 ϕ1.2 M8
*5-1	A14L-0166-0311#145X0664	Gas nozzle (straight) ϕ20 L=87	1(10)	Ni-Cr plated spec.
5-2	A14L-0166-0311#145X0665	Gas nozzle (taper) ϕ15.5 L=87	1(10)	Ni-Cr plated spec.
*5-3	A14L-0166-0311#145X0629	Gas nozzle (straight) ϕ20 L=92	1(10)	Ni-Cr plated spec.
*5-4	A14L-0166-0311#145X0714	Gas nozzle (taper) ϕ15.5 L=92	1(10)	Ni-Cr plated spec. No description in Fig.
6	A14L-0201-0306#149X0475	Water cooling neck liner	1	
7	A14L-0201-0303#780X3315	Insulation robot flange	1	100*i*D,120*i*D flange spec.
8	A14L-0201-0304#980X2459	Wire clamp unit	1	
10	A14L-0166-0303#124X0256	Cable liner (black) For Iron・SUS	1	ϕ1.2 - ϕ1.6 3.0m
*10	A14L-0166-0301#124XJ005	Cable liner (black) For Iron・SUS	1	ϕ1.2 -ϕ1.6 2.2m
-	A14L-0166-0371#501X0195	Quick disconnector (female)	1	ϕ10 no description in Fig.

* are options.

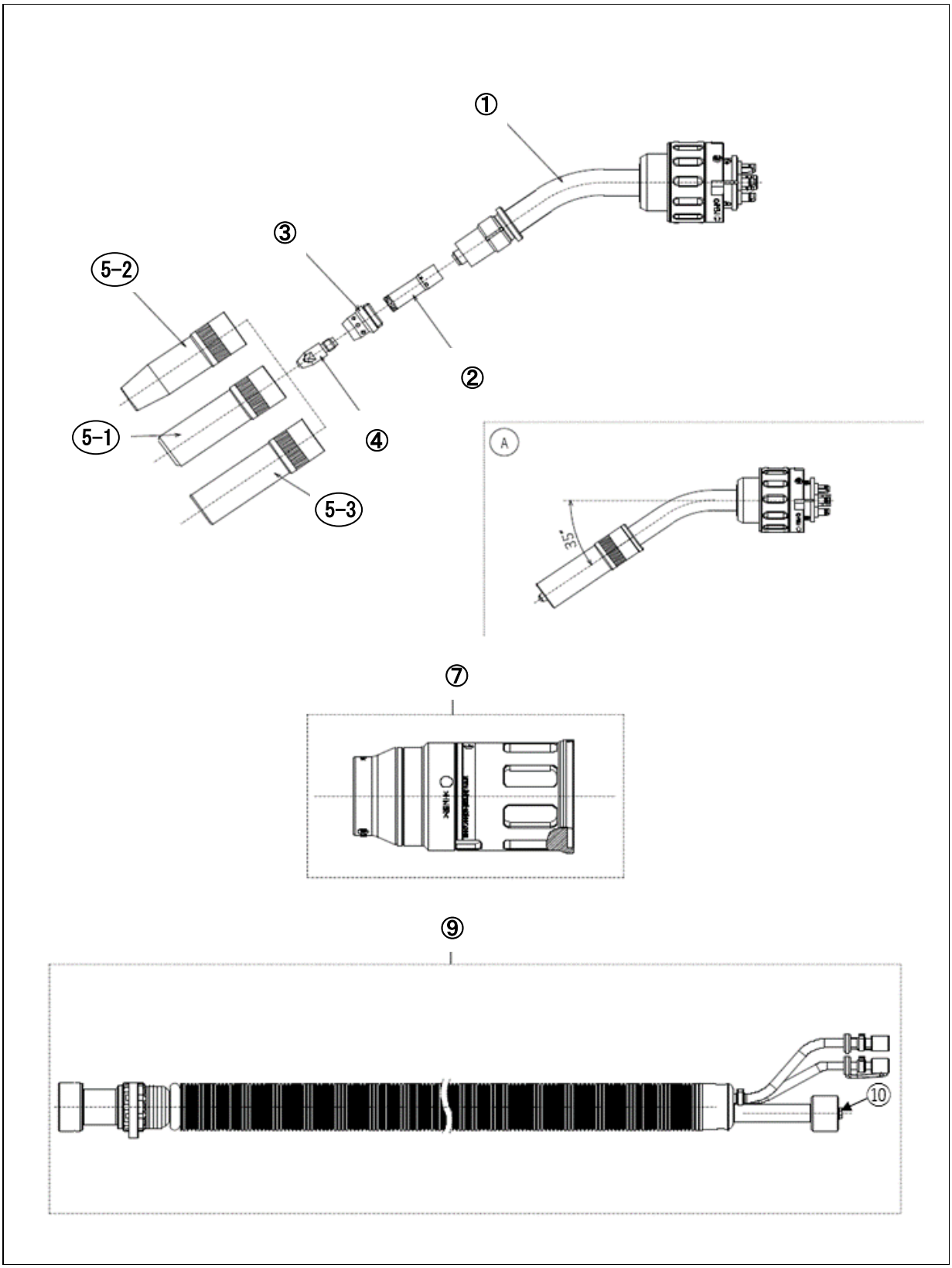


Fig. 8 (f) A05B-1296-H305 series component parts
(ABIROB iSTM mini W500-35)

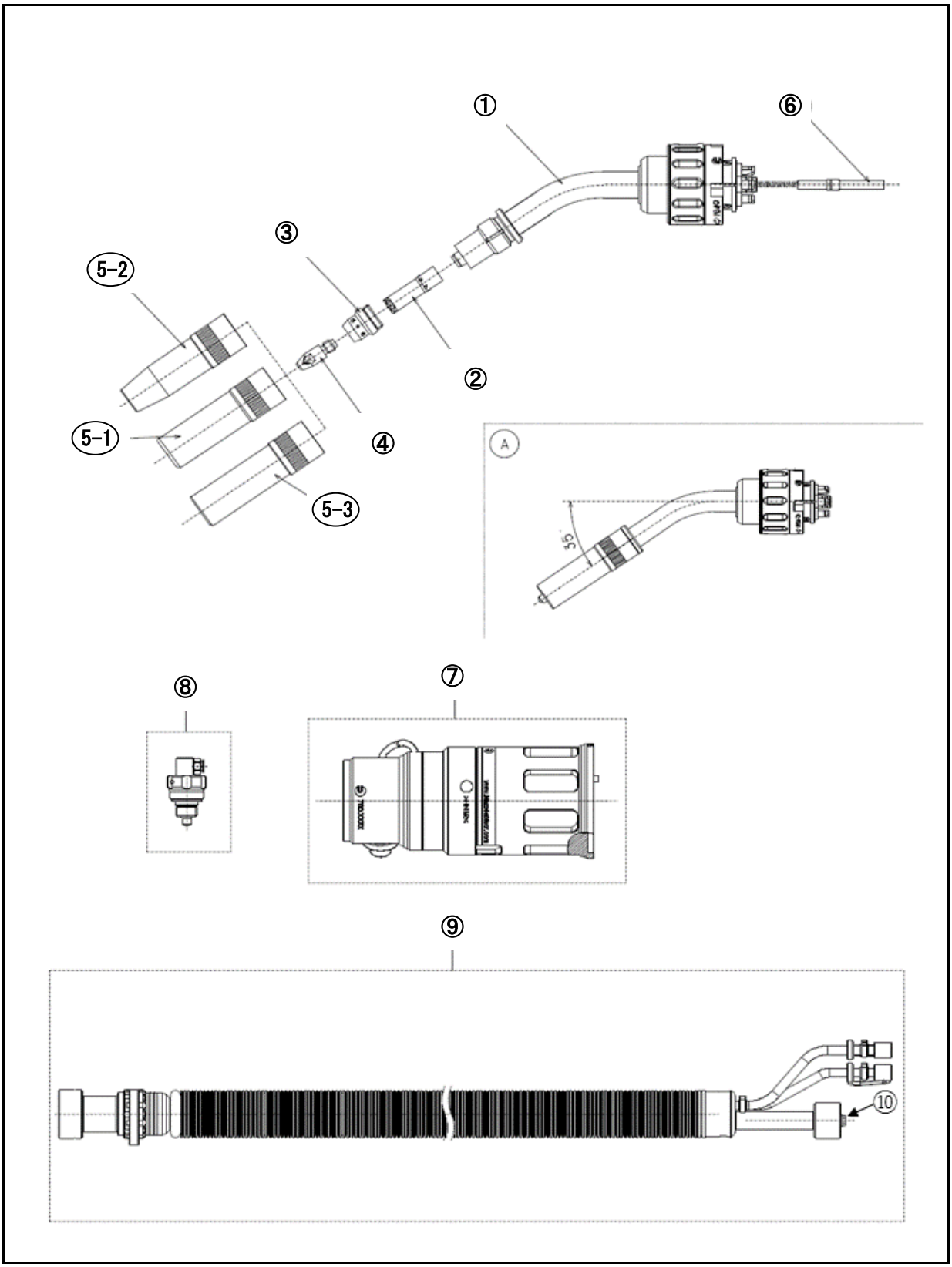


Fig. 8 (g) A05B-1296-H306 series component parts
(ABIROB iSTM mini W500-35 with wire brake spec.)

9 PROCESS MODE

This chapter describes about available process modes of FANUC welding power supply FH350i and FH350iP. About details of Process mode, please refer to Section 3.4 “OPERATION OF WELD PROCEDURE AND PROCESS MODE”.

NOTE
1 Available process modes will be changed by the installed firmware version and weld table version in the welding power supply. Please use these lists as reference information.
2 If unsupported weld mode number for the welding power supply model is selected, ARC-124 “EQi: E:97 FH Weld mode NOT found” error is posted.

9.1 FH350i PROCESS MODE LIST

Firmware Version： V5.25

Mode	Welding method	Material	Diameter (mm)	CTWD (mm)	Gas
1	CV Synergic	Steel	1.2	15	100%CO2
2	CV Non Synergic	Steel	1.2	15	100%CO2
3	SCMC Synergic	Steel	1.2	15	100%CO2
5	CV Synergic	Steel	1.2	15	80%Ar 20%CO2
6	CV Non Synergic	Steel	1.2	15	80%Ar 20%CO2
11	CV Synergic	Steel	1.0	12	100%CO2
12	CV Non Synergic	Steel	1.0	12	100%CO2
13	SCMC Synergic	Steel	1.0	12	100%CO2
15	CV Synergic	Steel	1.0	12	80%Ar 20%CO2
16	CV Non Synergic	Steel	1.0	12	80%Ar 20%CO2
21	CV Synergic	Steel	0.9	12	100%CO2
22	CV Non Synergic	Steel	0.9	12	100%CO2
23	SCMC Synergic	Steel	0.9	12	100%CO2
25	CV Synergic	Steel	0.9	12	80%Ar 20%CO2
26	CV Non Synergic	Steel	0.9	12	80%Ar 20%CO2
51	CV CV Synergic	Steel Flux	1.2	15	100%CO2
52	CV Non Synergic	Steel Flux	1.2	15	100%CO2

9.2 FH350iP PROCESS MODE LIST

Firmware Version： V7.32

Mode	Welding method	Material	Diameter (mm)	CTWD (mm)	Gas
1	CV Synergic	Steel	1.2	15	100%CO2
2	CV Non Synergic	Steel	1.2	15	100%CO2
3	SCMC Synergic	Steel	1.2	15	100%CO2
4	SCMC Non Synergic	Steel	1.2	15	100%CO2
5	CV Synergic	Steel	1.2	15	80%Ar 20%CO2
6	CV Non Synergic	Steel	1.2	15	80%Ar 20%CO2
7	SCMC Synergic	Steel	1.2	15	80%Ar 20%CO2
8	SCMC Non Synergic	Steel	1.2	15	80%Ar 20%CO2
11	CV Synergic	Steel	1.0	12	100%CO2

Mode	Welding method	Material	Diameter (mm)	CTWD (mm)	Gas
12	CV Non Synergic	Steel	1.0	12	100%CO2
13	SCMC Synergic	Steel	1.0	12	100%CO2
14	SCMC Non Synergic	Steel	1.0	12	100%CO2
15	CV Synergic	Steel	1.0	12	80%Ar 20%CO2
16	CV Non Synergic	Steel	1.0	12	80%Ar 20%CO2
17	SCMC Synergic	Steel	1.0	12	80%Ar 20%CO2
18	SCMC Non Synergic	Steel	1.0	12	80%Ar 20%CO2
21	CV Synergic	Steel	0.9	12	100%CO2
22	CV Non Synergic	Steel	0.9	12	100%CO2
23	SCMC Synergic	Steel	0.9	12	100%CO2
24	SCMC Non Synergic	Steel	0.9	12	100%CO2
25	CV Synergic	Steel	0.9	12	80%Ar 20%CO2
26	CV Non Synergic	Steel	0.9	12	80%Ar 20%CO2
27	SCMC Synergic	Steel	0.9	12	80%Ar 20%CO2
28	SCMC Non Synergic	Steel	0.9	12	80%Ar 20%CO2
51	CV Synergic	Steel Flux	1.2	15	100%CO2
52	CV Non Synergic	Steel Flux	1.2	15	100%CO2
103	ZSCMC Synergic	Steel	1.2	15	100%CO2
104	ZSCMC Non Synergic	Steel	1.2	15	100%CO2
105	PULSE Synergic	Steel	1.2	15	80%Ar 20%CO2
106	PULSE Non Synergic	Steel	1.2	15	80%Ar 20%CO2
107	ZSCMC Synergic	Steel	1.2	15	80%Ar 20%CO2
108	ZSCMC Non Synergic	Steel	1.2	15	80%Ar 20%CO2
113	ZSCMC Synergic	Steel	1.0	12	100%CO2
114	ZSCMC Non Synergic	Steel	1.0	12	100%CO2
117	ZSCMC Synergic	Steel	1.0	12	80%Ar 20%CO2
118	ZSCMC Non Synergic	Steel	1.0	12	80%Ar 20%CO2
301	PULSE Synergic	Stainless Austenite	1.2	15	98%Ar 2%O2
302	PULSE Non Synergic	Stainless Austenite	1.2	15	98%Ar 2%O2
501	PULSE Synergic	Stainless Ferrite	1.2	15	98%Ar 2%O2
502	PULSE Non Synergic	Stainless Ferrite	1.2	15	98%Ar 2%O2
551	PULSE Synergic	Stainless Ferrite Flux	1.2	15	98%Ar 2%O2
552	PULSE Non Synergic	Stainless Ferrite Flux	1.2	15	98%Ar 2%O2

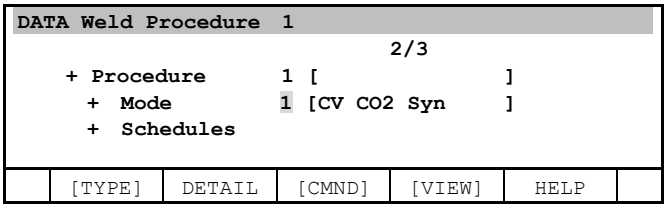
9.3 TEST MODE

In this section, the method to set arbitrary process mode to the robot controller as “Test Mode” is explained. The procedure is described in Procedure 9-3.

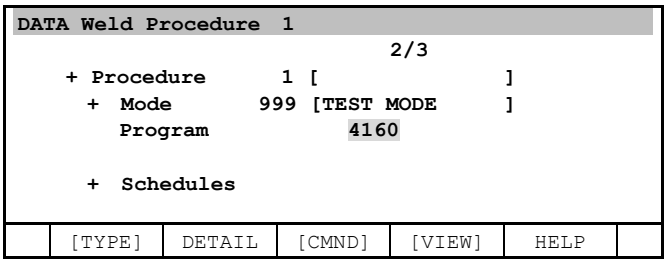
Procedure 9-3 Set process mode by test mode

Step

1. Press the [DATA] key. The following screen will be displayed.



2. Move the cursor to “Mode” number. If you would like to use Synergic Voltage Command Form for test mode, input “1” to Mode and then press the [ENTER] key. If you would like to use Non-Synergic Voltage Command Form for test mode, input “2” to Mode and then press ENTER key.
3. If you would like to initialize weld schedule on dialog screen, select “YES” twice. Otherwise, select “NO”.
4. Next, input “999” to Mode and press the [ENTER] key. Select “NO” on the displayed dialog box. “TEST MODE” will be displayed in the right frame.



5. Move the cursor to “Program” number and input a desired program number by referring to later description “Calculation of the program number”

Calculation of the program number

This explanation is about a way to calculate the program number in item 5 of procedure 9-3. The program number is a combination of diameter, material, gas and welding method. They are set by Hex number. The number should be converted to decimal number.

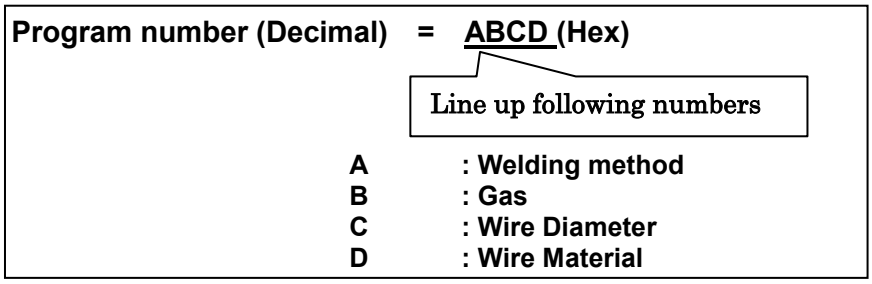


Table 9.3 (a) Setting Number for Program Number

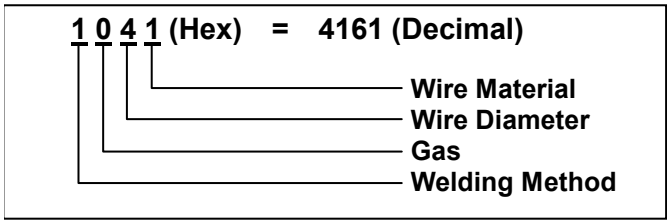
	A Welding Method	B Gas	C Wire Diameter (mm)	D Welding Material
0	SCMC	100%CO2	0.6	Steel Solid
1	CV	80%Ar 20%CO2	0.8	Steel Flux Cored
2	Pulse		0.9	Stainless Ferrite Flux
3	Z-SCMC	100%Ar	1.0	Stainless Ferrite
4			1.2	Stainless Austenite
5			1.4	
6			1.6	
7				
8				
9				

Example

Calculate the program number of following conditions.

- Welding Method = CV = 1
- Gas = 100% CO2 = 0
- Wire Diameter = 1.2mm = 4
- Wire Material = Steel Flux Cored = 1

Set above numbers as follow, and convert to decimal number.



10 INITIAL SETTING

This chapter describes “Weld equipment select” and “Setting of multi-process function” as initial setting of welding power supply. **These were already set when robot was shipped, so those settings are usually not required.**

10.1 WELDING POWER SUPPLY SELECT

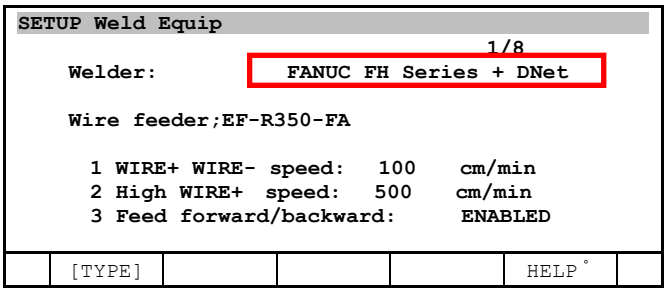
If appropriate welding equipment (welding power supply) is not selected, not only communication between arc welding robot and welding equipment cannot be performed, but also weld equipment cannot be controlled.
After you turn on the power supply of Robot controller and weld equipment, please wait a minute. **when the message of “ARC-045 Weld EQ is OFFLINE” keeps displaying,** Please refer to Procedure 10-1 (a) to confirm weld equipment select.

If wrong weld equipment is selected, selecting appropriate weld equipment is required. To select weld equipment, perform a Controlled start , then display arc tool setup screen. Perform the procedure 10-1 (b).

Procedure 10-1 (a) Confirm welding power supply select

Procedure

1 Confirm the communication type of FANUC welding power supply (DeviceNet or EtherNet/IP).
2 Press the [MENU] key and select[6 SETUP]
3 Press F1[TYPE] and select [Weld Equip]. The following weld equip set screen is displayed.



4 Please Confirm the correctness of the string of “Welder”. If communication type of FANUC welding power supply is DeviceNet, “FANUC FH Series + DNet” is correct setup. If communication type of FANUC welding power supply is EtherNet/IP, “FANUC FH Series + ENet” is correct setup.
5 If the string of “Welder” is not correct, please execute Procedure 10-1 (b).

Procedure 10-1 (b) Welding power supply select

Condition

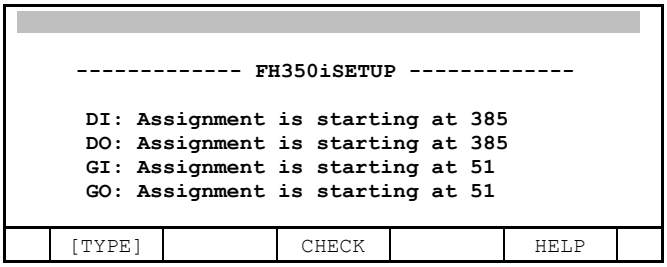
- FH Weld Equipment library is installed.
- Robot controller and weld machine are connected via communication cable (DeviceNet cable or Ethernet cable).
- ”Manufacture” is except “FANUC” in ArcTool Setup Menu.
- “Welder” is not correct for communication type of FANUC welding power supply in ArcTool Setup Menu.

⚠ CAUTION
Execute this procedure only when “Welder” setup is not correct after performing Procedure 10-1(a). If weld manufacture is changed and cold start in spite of correct setup status, controller recognizes weld machine model is changed and some settings of current ArcTool are lost.

NOTE
“Welding Setup” in the screen above is not supported. So it is not necessary to change from initial setting ”Japan”.

Procedure

1 Please set cursor to “Manufacture” and press F4 ”Choice”, choose “FANUC”.
2 Please set cursor to “Model” and press F4 ”Choice”, choose “FANUC FH Series + DNet”.
3 After model is changed to “FH Series + DNet”, following messages are displayed and ArcTool setup menu is displayed automatically.



4 Press FCTN key and select [START (COLD)] and perform it.

5 After Cold Start, ArcTool automatically tries to communicate with the weld equipment. After the Cold Start finishes and 10sec - 1min passes, the communication succeed if the following message is displayed on the upper side of the screen. After this message is displayed, it is possible to set and control the weld equipment by Teach Pendant. (“i” in the message is Weld Equipment Number.)

ARC-051 Weld EQ i ONLINE: DeviceNet
or
ARC-051 Weld EQ i ONLINE: EtherNet/IP

6 If ARC-051 is not displayed at step5 and ARC-045 keeps displaying, the communication fails. Major cause of communication failing is shown below.
- The power supply of weld equipment is turned off.
- The communication cable is not correctly connected.

In case of the power supply of weld equipment is turned on and this message keeps displaying. Please refer to Troubleshooting of Section 9.1for this message.

ARC-045 Weld EQ Device is OFFLINE

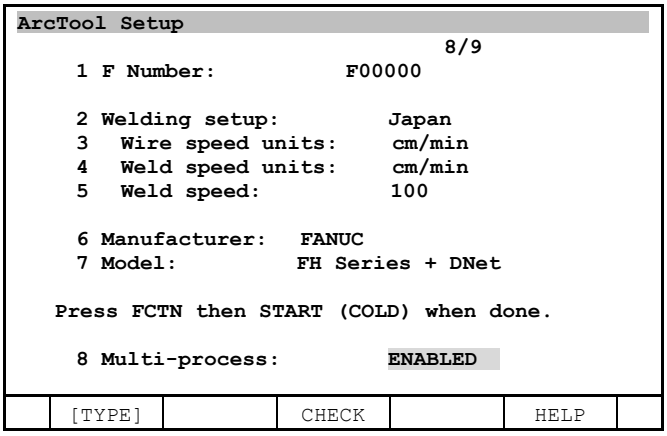
10.2 SETTING OF MULTI-PROCESS FUNCTION

When FANUC welding power supply is connected, it is necessary to set multi-process function to enable. Setting of multi-process function is performed in ArcTool setup screen after Controlled Start. **This is already set when robot is shipped, so it is usually not required.**

Procedure 10-2 Setting of multi-process function

Condition

- ArcTool setup screen is displayed after performing Controlled Start.



Step

1 Move the cursor to below and confirm multi-process is ENABLED. If multi-process is DISABLED, match the cursor to “multi-process” then press F4「ENABLED」key.
2 Press the [FCTN] key and select [START (COLD)] then perform it.

APPENDIX

A WELD CONDITION ADJUSTMENT

This chapter describes general adjustment method of welding condition, welding defects and countermeasure.

A.1 INFLUENCE BY ADJUSTMENT OF WELDING CONDITION

Table A.1.(a) describes the effect of weld schedule to bead appearance and Table A.1.(b) describes the effect of weld schedule to welding.

Table A.1 (a) Effect to appearance of each weld condition

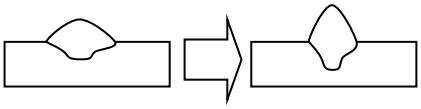
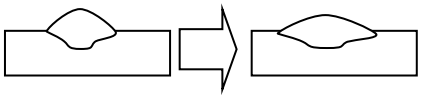
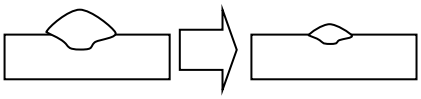
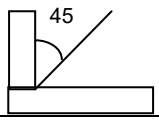
#	Factor	Change	Effect to bead	Notes
1	Weld current	Higher	Penetration becomes deeper Width of bead becomes wider Toe angle becomes smaller Less spatter	
2	Weld Voltage	Higher	Arc length becomes longer Penetration becomes shallower Width of bead becomes wider Convexity height becomes bigger spatter size becomes bigger	
3	Welding speed	Faster	Penetration becomes shallower Width of bead becomes narrower Toe angle becomes bigger Undercut may more occur	

Table A.1 (b) Effect to weld of each weld condition.

#	Factor	Change	Effect to weld	Notes
1	Wire size	Wider	More spatter Arc generation becomes unstable Penetration becomes shallower	Robots support 0.9, 1.0 1.2 mm
2	Contact tip distance	Longer	Less current Arc length becomes longer Penetration becomes shallower Arc generation becomes unstable	Suggested distance ϕ1.2 mm : 15 mm ϕ0.9, 1.0mm: 12 mm (enlarge 1mm → welding electric current descends 5 to 8A.)
3	Torch angle	Wider	Penetration becomes deeper Width of bead becomes narrower Toe angle becomes smaller	Common 45 degree 
4	Travel angle	Push/Pull	Pull angles are Penetration becomes deeper Width of bead becomes narrower Toe angle becomes smaller than push angle.	Push angle: Common attitude Pull angle Attitude for higher power Generally the angle it 10 to 20°
5	Gas	CO2/mixed	Mixed gas are Less spatter Arc generation becomes more stable bead becomes better in appearance Penetration becomes shallower than CO2 gas	CO2 gas: Cheaper and popular. Mixed gas More expensive Use for appearance and thin metal.

A.2 COUNTERMEASURE TO WELDING DEFECTS

Table A.2. (a) describes the problems and counter plan for bead appearance, Table A.2.(b) describes the problems and counter plan for gas and surface pores and Table A.2.(c) describes Problem and Cause and counter plan for unstable arc.

Table A.2 (a) Problems in appearance and counter plan

#	Problem in appearance	Counter plan
1	Unstable appearance	1 Correct a twist of conduit cable(Correct a twist of wire) 2 Change tip 3 Set contact tube distance shorter 4 Clean up groove face 5 Measure arc blow(Stable arc generation)
2	Convex bead or With of bead is narrow	1 Set weld voltage higher 2 Set wire size wider 3 Use weaving function(Set the width of bead wider) 4 Set welding speed slower
3	Short leg length	1 Set weld current higher 2 Set welding speed slower 3 Use weaving function(Set the width of bead wider) 4 Increase weld path
4	Different leg lengths (Bead falls Horizontal corner meat welding)	1. Move arc start position to vertical work side 2. Set torch angle wider 3. Set welding speed slower 4. Use weaving function(Set the width of bead wider) 5. Increase weld path 6. Set travel angle to push
5	Crater inferiority	1 Adjust crater-fill process schedule.
6	Burn-through	1 Set weld current lower. 2 Set welding speed slower 3 Use weaving function(Set the width of bead wider) 4. Set gaps of joint shorter
7	Penetration shortage	1 Set weld current higher 2 Set welding speed slower 3 Set travel angle to pull 4 Adjust arc start position 5 Change downward welding to upward welding
8	Undercut	1 Set weld current lower 2 Set weld voltage lower 3 Set welding speed slower 4 Set torch angle wider 5 Clean up groove face
9	Overlap	1 Set weld current higher 2 Set weld voltage higher 3 Set welding speed faster 4 Set contact tube distance shorter 5 Clean up groove face

#	Problem in appearance	Counter plan
10	Bead crack	There are various forms for bead crack, and the factors are different in each. Please review a welding condition because the following causes are thought about. a. Hot crack (Vertical crack and lateral crack on the bead surface) 1. Set wire feed speed or weld current lower 2. Set weld speed slower 3. Less heat input b. Cold crack (crack inside the bead and crack of heat-affected zone) 1. More heat input 2. More preheating and postheating 3. Clean up wire and work 4. Stable gas flow.

Table A.2 (b) Cause and counter plan for gas pore and surface pore

#	Cause	Counter plan
1	Dirt of work	Clean up oil, stain, paint, water and oxide scale on groove face completely
2	Dirt of wire	Use internal wire, since most outer wire will rust out
3	Dirt of nozzle	Remove spatter cohesion nozzle
4	Effect of wind	If welding part is exposed to wind, it may cause the disturbance of the shield gas, therefore air is involved to the arc and fusion zone. Increase gas flow Equip screen
5	Gas flow	Change gas cylinder when 1st pressure is less than 10 kg/cm2 Confirm heat equipped gas flow controller Confirm leak of gas hose and connection
6	Gas quality	Confirm whether the purpose of the gas is welding. Confirm mixture device
7	Contact tube distance	Adjust the distance
8	Weld schedule	Set weld current higher Set welding speed slower

Table A.2 (c) Problem and Cause and counter plan for unstable arc

#	Problem	Cause
1	Unstable wire feed	1 Wrong bore size of contact tip or attrition 2 Twist conduit cable. 3 Wire sniggles in the reel 4 Size of wire feed role is wrong Wire feed role is attrition Pressure to wire feed role is wrong. 5 Liner spring is clogging up
2	Unstable weld voltage	1 1st input of weld equipment is unstable 2 Connection of power cable is loose-knit 3 Contact tube distance is too long 4 Unstable wire feed. 5 Wire size is wrong for weld schedule.
3	Arc blow occurs	1 Earth connection is wrong. 2 Use tab board 3 Set the gap of joint narrower
4	Increase spatter	1 Wrong weld current and voltage 2 Wire size is too big 3 Torch angle is too wide 4 Arc blow occurs

B PERIODIC MAINTENANCE TABLE

Arc welding power supply option Periodic maintenance table

			Check times	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 year 7680	8640	9600	10560
Welding power supply	1	Cleaning inside the welding power supply	0.5H			○		○		○		○		○	
	2	Confirm the damage situation of fan	0.1H			○		○		○		○		○	
	3	Check the allophone and vibration	0.2H			○		○		○		○		○	
Wire feeder	4	Cleaning each parts	0.5H			○		○		○		○		○	
	5	Check the tighten of bolts and other connection parts.	0.1H			○		○		○		○		○	
	6	Check the length of wire feeding	0.1H			○		○		○		○		○	
	7	Check the gas valve	0.1H			○		○		○		○		○	
	8	Replace motor brush	0.5H			○		○		○		○		○	
Welding torch	9	Confirm looseness of union nut. (BINZEL torch only) (*2)	0.1H	○	○	○	○	○	○	○	○	○	○	○	○
	10	Replacing torch cable (Including conduit)	0.5H					●				●			
	11	Replacing liner	0.2H					●				●			
Around cable	12	Confirm the wire conduit	0.2H					○				○			

*1 Replace the motor brush after 6 months operation or 250 million times of welding start (which ever comes first). If the brush is shorter than 12.7mm, replace it.
*2 Perform check of confirm looseness of union nut at every 1 month.
*3 Refer to Chapter 5 about daily check and check items.
*4 ●: requires order of parts
○: doe not requires order of parts
*5 Be sure to refer to maintenance section of welding power supply manual.
*6 Be sure to refer to operator's manual about mechanical unit of robot.

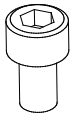
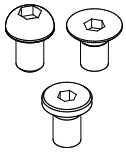
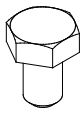
3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 23040	27840	28800	29760	Item
○		○		○		O		○		○		○		○		○		○		1
○		○		○		○		○		○		○		○		○		○		2
○		○		○		○		○		○		○		○		○		○		3
○		○		○		○		○		○		○		○		○		○		4
○		○		○		○		○		○		○		○		○		○		5
○		○		○		○		○		○		○		○		○		○		6
○		○		○		○		○		○		○		○		○		○		7
○		○		○		○		○		○		○		○		○		○		8
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	9
●				●				●				●				●				10
●				●				●				●				●				11
○				○				○				○				○				12

C 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 plating 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 are not specified.

Recommended bolt tightening torques **Unit: Nm**

Nominal diameter	Hexagon socket head bolt (steel)		Hexagon socket head bolt (stainless)		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	———	———	———	———	———	———
								

D TIG WELDING SPECIFICATION

D.1 OVERVIEW

This is the specification about TIG welding using FANUC Robot ARC Mate 100*i*C, 120*i*C（R-30*i*B, R-30*i*B Mate controller).
Executing following restriction, reconstruction and countermeasure that are countermeasures for TIG noise can do stable TIG welding.

D.2 CAUTION

Restriction

1) Specify the 10m length teach pendant cable.
2) Specify 3m or 7m for welding connection cable.
3) Specify 7m for the robot connection cable.

TIG welding modification items

TIG welding needs a welding modification and mechanical unit cable as below.

1 Mechanical unit TIG welding modification
   a) ARC Mate 100*i*C A05B-1221-J101, J102, J103
   b) ARC Mate 120*i*C A05B-1222-J101

2 Applied mechanical unit cables
   a) ARC Mate 100*i*C A05B-1224-H201, H231, H261
   b) ARC Mate 120*i*C A05B-1222-H201,1225-H231

In addition, use robot controller with insulation transformer. When the robot controller does not include insulation transformer, prepare the insulation transformer and connect the primary power to the robot controller through insulation transformer.

Countermeasure for TIG welding equipment side

1 Welding cable
   Use base metal cable that is over 38mm2 in order to prevent overheating of cable and to do proper welding. Strengthen the insulation effect of cables and prevent electric discharge among cables, robot body, iron plate fixing robot body and others.
   Refer to Fig. D.2 as examples.

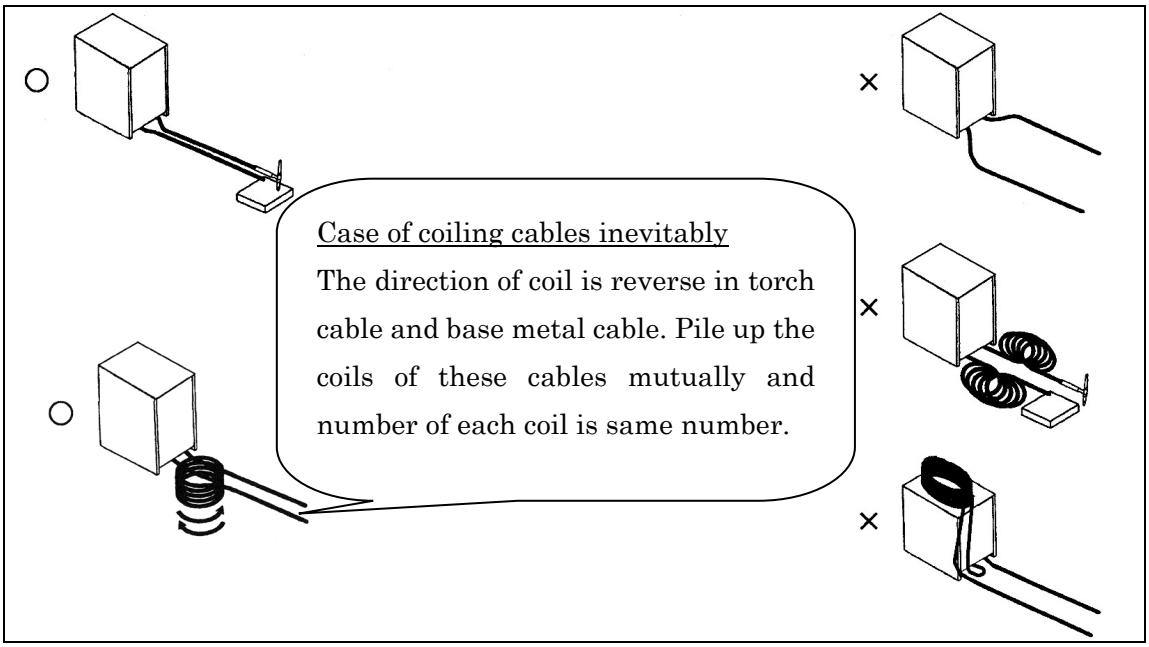


Fig. D.2 (a) Wiring example of the welding cable

2 Weld equipment connection cable
Keep this cable away from arc generating zone, torch cable, base metal cable, base metal ground cable, input power cable, ground cable and others to prevent the troubles by inserting high frequency noise.
Don't wire parallel to welding cable and robot connection cable as possible.

3 Ground cable
Connect one side of ground cable to ground terminal of welding machine and do class C or class D grounding to another side of ground cable.
Use ground cable which conductor size is more than one of input power cable (8 mm^2 is needed as the lowest one).
Grounding should be done by a person who has the license of electric engineering technician.
Don't connect ground cable to water pipe or steel frame of building because it is not enough ground.
Don't share grounds of welding machine and base metal with grounds of robot body, common base, jig and other welding machine.

Grounding		Applied class of machine and tool
Class C	Grounding resistance should be 100 Ω or less. (For low voltage electric circuit, if the purpose is constructing the equipment that cut off its circuit automatically within 0.5 seconds when ground fault generate in its circuit, grounding resistance should be 500 Ω or less.)	Below 300V and low voltage
Class D	Grounding resistance should be 10 Ω or less. (For low voltage electric circuit, if the purpose is constructing the equipment that cut off its circuit automatically within 0.5 seconds when ground fault generate in its circuit, grounding resistance should be 500 Ω or less.)	Over 300V and low voltage

（extract from "the interpretation of technical standard for electric equipment" Art. 19 and Art. 29）

4 Installation distance
Refer to Installation layout of Section D.3.

Others

1 Teach pendant and teach pendant cable
Keep teach pendant and teach pendant cable over 0.5m away from the object where welding electric current flow, such as welding cable, jig, iron plate used to fix the jig. High frequency noise with welding electric current may cause trouble, if it is inducted directly to teach pendant or teach pendant cable.

2 Ground cable
Provide ground cables of robot (ground cable between mechanical unit and controller is connected in standard specification), welding machine, wire feeder and others individually, which cables are over class D. Ground securely using ground cable that is designated by welding machine between welding machine and jig. Use attached four-core power cable (7m) to connect power and ground to robot controller.

3 Interface of USB and PCMCIA
It may become impossible to use the memory card, the sensor , PC etc, which use the USB or PCMCIA interface during the TIG welding due to noise.

4 Primary input wiring
Provide switch box of primary input for robot and welding machine individually.
In case of using some welding machines, provide switch box involving input protection equipment designated by each TIG welding machine individually.

5 Water cooling unit
Don’t set water cooling unit on the top panel of welding machine.

6 As a guide, the start relay of High frequency start unit must be replaced after 400 million times operation. Contact your local FANUC representative for replacement method.

7 Others
While TIG welding, close all doors and covers of robot controller and welding machine securely.
The way of connecting cables and the way of grounding affect the toughness for noise of welding machine. So, need to modify the way of connecting cables and grounding in case of generating gap of welding position or alarm.
High frequency noise of TIG welding may insert following near equipment, and cause electromagnetic trouble.
   a) input cable, output cable, telephone cable etc.
   b) radio, television etc.
   c) computer or other controller
   d) Detectors for industrial purpose or safety device
   e) pacemaker or hearing aid

In those cases, please follow the caution of the TIG welding equipment.

D.3 INSTALLATION LAYOUT

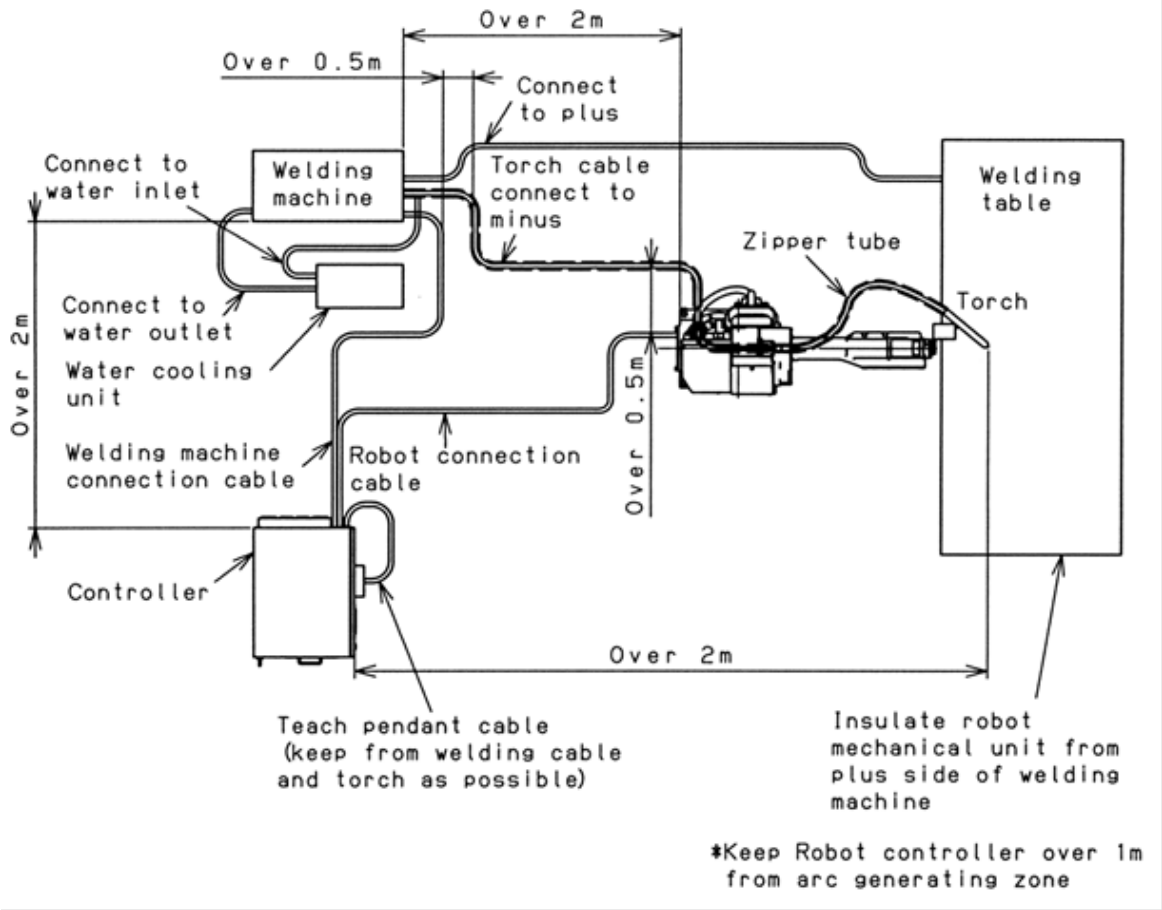


Fig. D.3 (a) Installation layout

The above notice of "Over 2m between Welding machine and Controller" does not needed for Lincoln PowerWave *i*400 that is integral type of Welding machine and Controller.

We recommend to connect the zipper tube of the torch cable to the earth of the high frequency unit of the welding machine or advanced module.

The way of grounding

Make grounding in referring following matters.

- Use ground cable which conductor size is over 8mm^2 as thick as possible and fix it securely.
- Construct a ground per a robot or a welding machine and not share with other equipment.
- Insulate robot mechanical unit from welding jig, welded work (plus side of welding machine) perfectly.
- Insulate welded work from jig body, auxiliary axis and robot common base. (insulation resistance should be over 1 MΩ.) and insulate from robot controller. (not turn on electricity) For inserting insulated material, use different bolts for insulated material mounting bolts and jig/outer axis/robot/robot controller mounting so that insulation is performed at the mounting part absolutely. Please contact your local FANUC representative for details.
- In case of using common base, construct ground that is beyond class D with cabtyre cable that is over 8 mm^2 for common base and jig body. Don't share this ground with ground of robot or welding machine.
- In case of setting robot mechanical unit or controller on the common base, insulate them from common base surely.

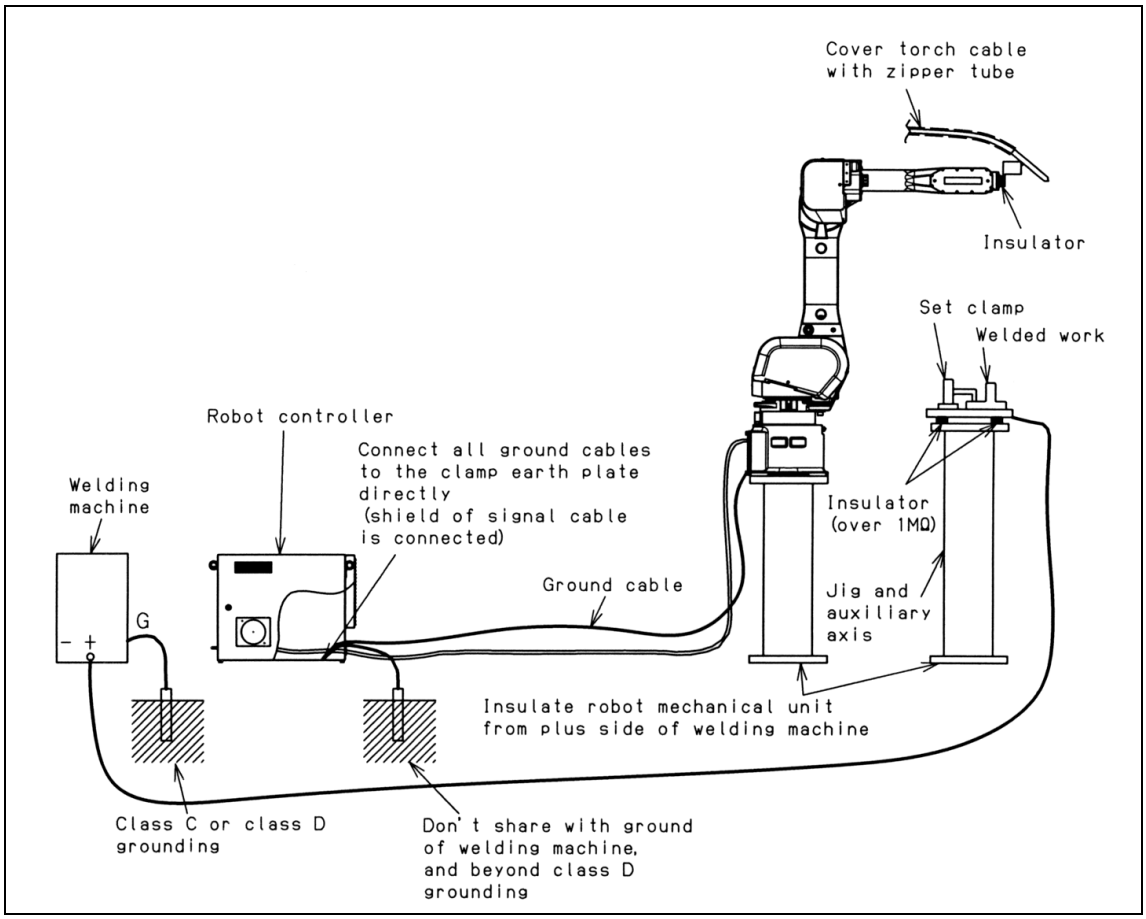


Fig. D.3 (b) Installation layout (good example)

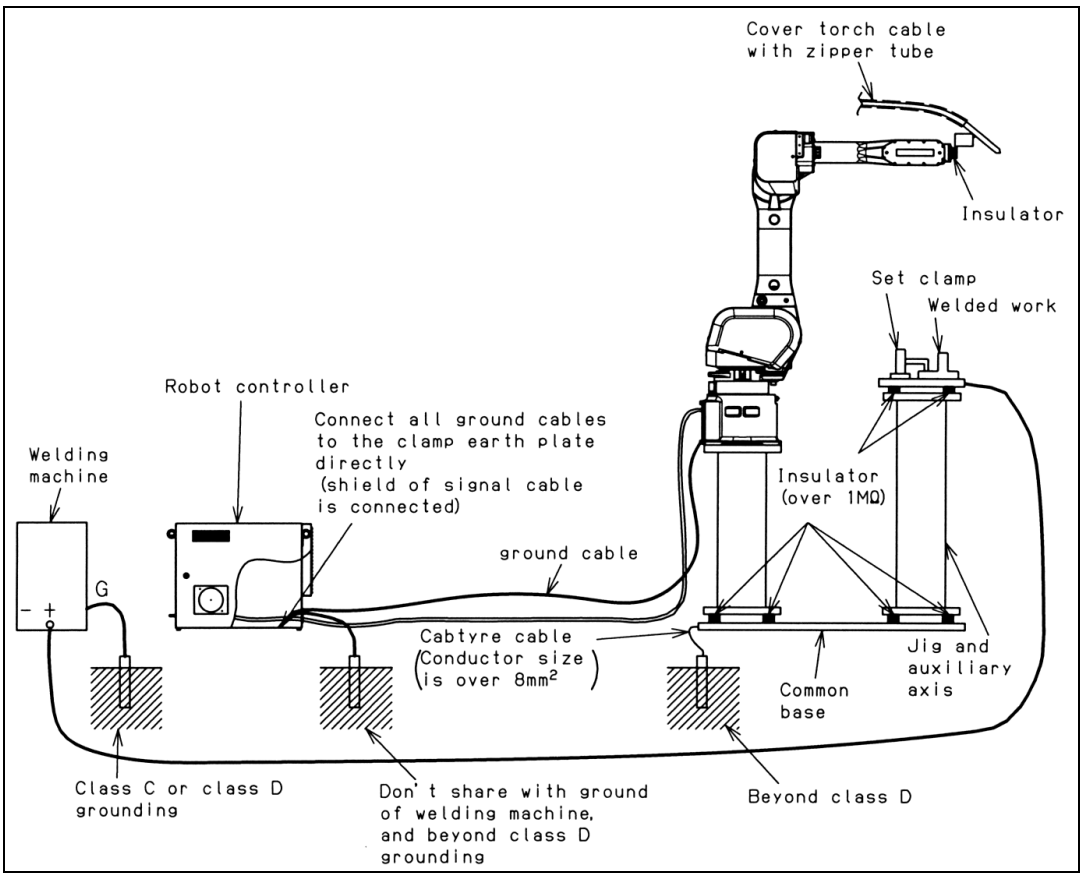


Fig. D.3 (c) Installation layout (good example (when a common base))

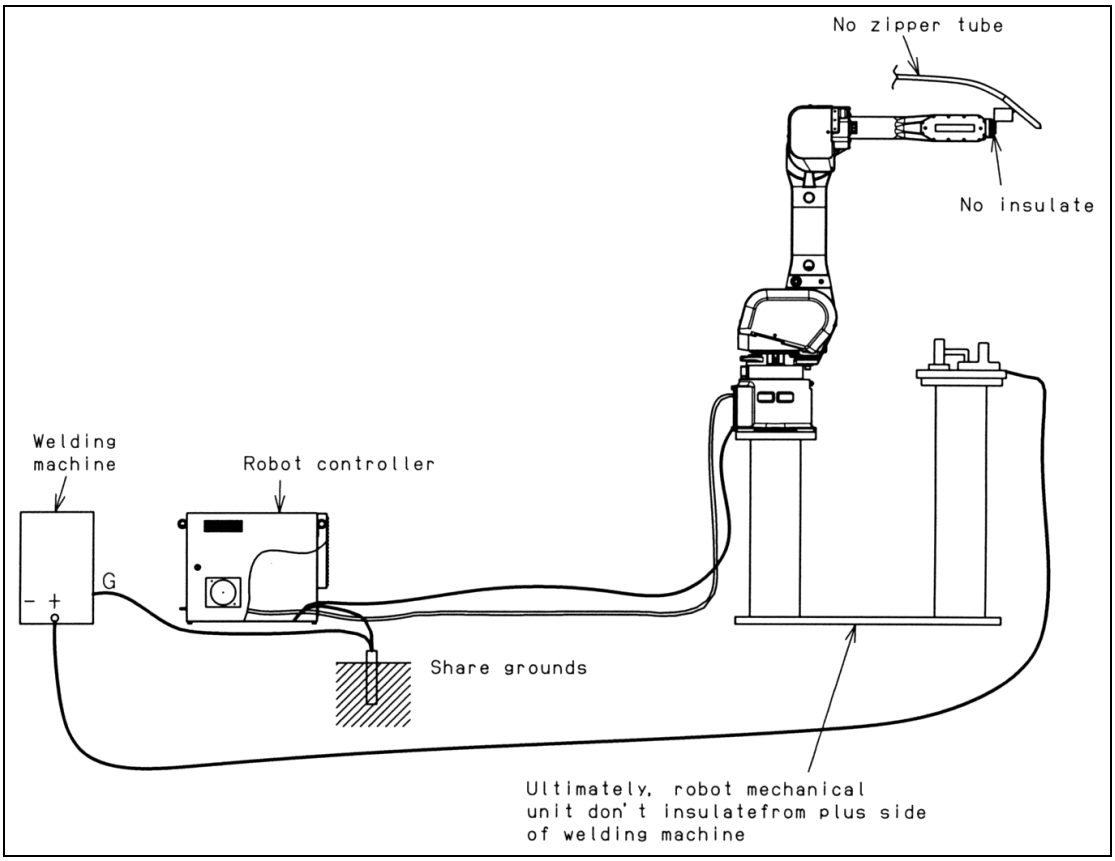


Fig. D.3 (d) Installation layout (bad example)

E SHUNT OPTION

Shunt is highly precise resistor which resistance is small made for the current measurements of the circuit which a severe electric current flowed through.

You can confirm welding electric current and voltage by teach pendant. If you use ammeter which is set outside, shunt option which output current is prepared. In this chapter, connecting method and how to put out current and voltage signal are shown.

Table E shows specification of shunt. For details, such as the dimensions, refer to catalog of Yamaki Electric Corporation.

Table E (a) Specification of shunt

Model	A rating electric current	A rating voltage descent	Maker / Dealer
YS-3-400A60mV-C1	400A * Please set the electric current turning on electricity to become less than 80% (less than 320A).	60mV	YAMAKI Electric Corporation

Fig E (b) and (c) show assembling method and caution.

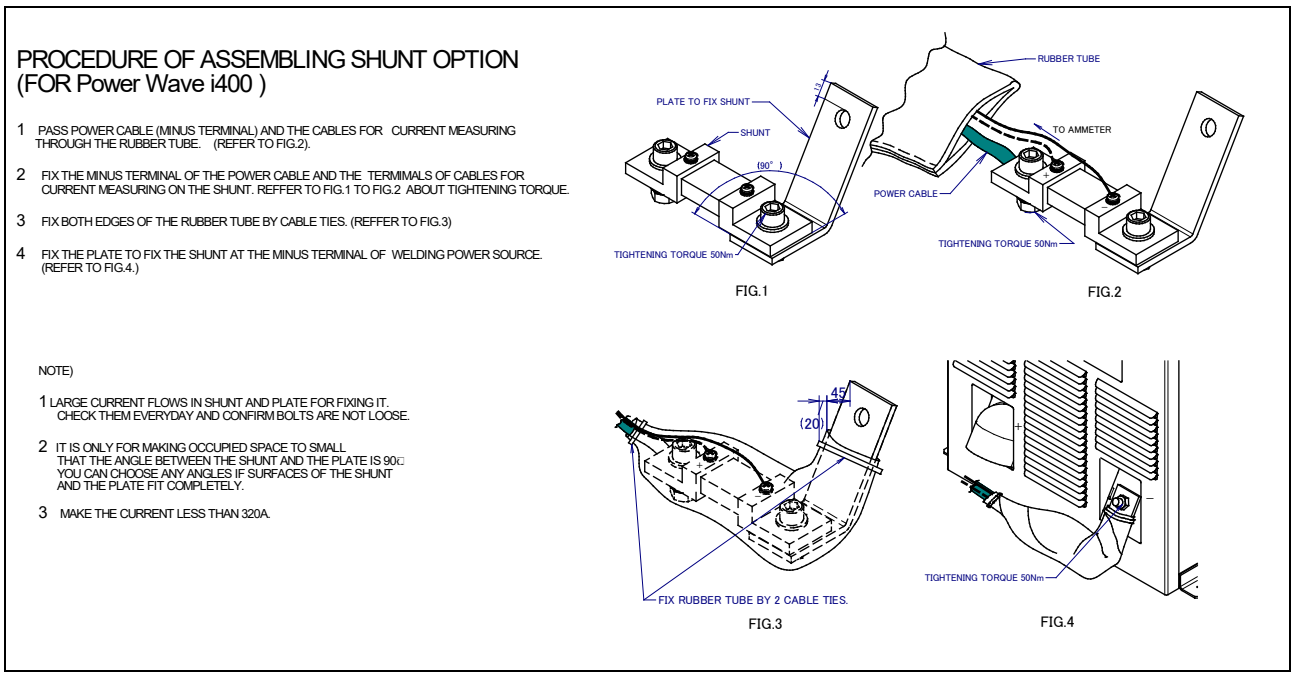


Fig. E (a) Procedure of assembling shunt option (Power Wave i400)

PROCEDURE OF ASSEMBLING SHUNT OPTION (FOR Power Wave 455M/STT)

1 PASS POWER CABLE (MINUS TERMINAL) AND THE CABLES FOR CURRENT MEASURING THROUGH THE RUBBER TUBE. (REFER TO FIG.2).

2 FIX THE MINUS TERMINAL OF THE POWER CABLE AND THE TERMIMALS OF CABLES FOR CURRENT MEASURING ON THE SHUNT. REFFER TO FIG.1 TO FI G.4 ABOUT TIGHTENING TORQUE.

3 FIX BOTH EDGES OF THE RUBBER TUBE BY CABLE TIES. (REFER TO FIG.3)

4 FIX THE PLATE TO FIX THE SHUNT AT THE MINUS TERMINAL OF WELDING POWER SOURCE. (REFER TO FIG.4.)

NOTE)

1 LARGE CURRENT FLOWS IN SHUNT AND PLATE FOR FIXING IT. CHECK THEM EVERYDAY AND CONFIRM BOLTS ARE NOT LOOSE.

2 IT IS ONLY FOR MAKING OCCUPIED SPACE TO SMALL. THAT THE ANGLE BETWEEN THE SHUNT AND THE PLATE IS 90□ YOU CAN CHOOSE ANY ANGLES IF SURFACES OF THE SHUNT AND THE PLATE FIT COMPLETELY.

3 MAKE THE CURRENT LESS THAN 320A.

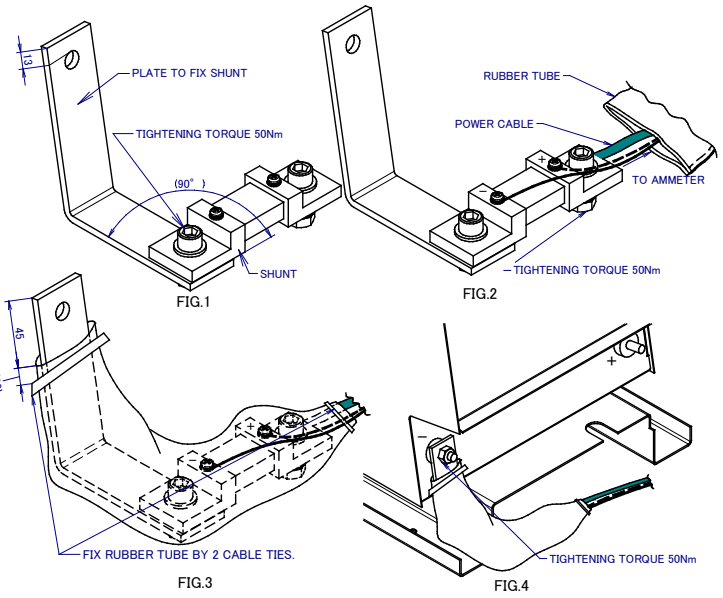


Fig. E (b) Procedure of assembling shunt option (Power Wave 455M/STT)

Fig, E(c),(d) show connection method of voltmeter.

CONNECTION METHOD OF VOLTMETER (FOR Power Wave i400)

1 FIX A TERMINAL OF CABLE FOR VOLTMETER AND PLUSE TERMINAL OF POWER CABLE TOGETHER AND CONNECT AN OTHER TERMINAL OF CABLE FOR VOLTMETER TO PLUSE TERMINAL OF VOLTMETER. (REFER TO FIG.1)

2 FIX A TERMINAL OF CABLE FOR VOLTMETER AND PLATE TO FIX SHUNT TOGETHER AT MINUS TERMINAL OF WELDING POWER SOURCE. CONNECT ANOTHER TERMINAL OF CABLE FOR VOLTMETER TO MINUS TERMINAL OF VOLTMETER.((REFFER TO FIG.1)

NOTE)

1 TAKE CABLES FOR VOLTMETER OFF CERTAINLY WHEN YOU DO NOT MEASURE VOLT. IF TERMINALS OF LEFT CABLES CONNECT, IT CAUSES A SHORT CIRCUIT. IT IS VERY DANGEROUS.

2 THE NO LOAD VOLTAGE of Power Wave 455M/STT IS 70VDC. USE APPROPRIATE VOLTMETER.

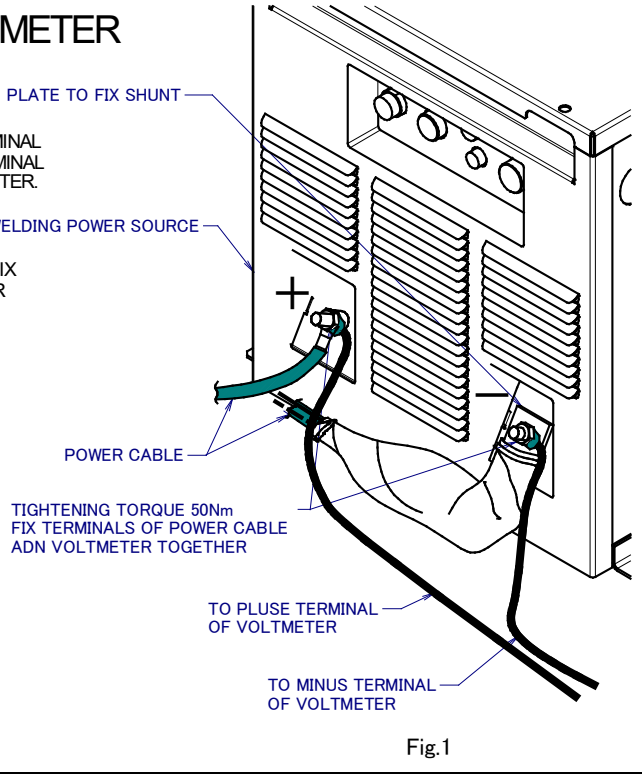


Fig. E (c) Connection method of voltmeter (Power Wave i400)

CONNECTION METHOD OF VOLTMETER (FOR Power Wave 455M/STT)

1 FIX A TERMINAL OF CABLE FOR VOLTMETER AND PLUSE TERMINAL OF POWER CABLE TOGETHER AND CONNECT ANOTHER TERMINAL OF CABLE FOR VOLTMETER TO PLUSE TERMINAL OF VOLTMETER.(REFER TO FIG.1)

2 FIX A TERMINAL OF CABLE FOR VOLTMETER AND PLATE TO FIX SHUNT TOGETHER AT MINUS TERMINAL OF WELDING POWER SOURCE. CONNECT ANOTHER TERMINAL OF CABLE FOR VOLTMETER TO MINUS TERMINAL OF VOLTMETER.(REFER TO FIG.1)

NOTE)

1 TAKE CABLES FOR VOLTMETER OFF CERTAINLY WHEN YOU DO NOT MEASURE VOLT. IF TERMINALS OF LEFT CABLES CONNECT, IT CAUSES A SHORT CIRCUIT. IT IS VERY DANGEROUS.

2 THE NO LOAD VOLTAGE of Power Wave 455M/STT IS 75VDC. USE APPROPRIATE VOLTMETER.

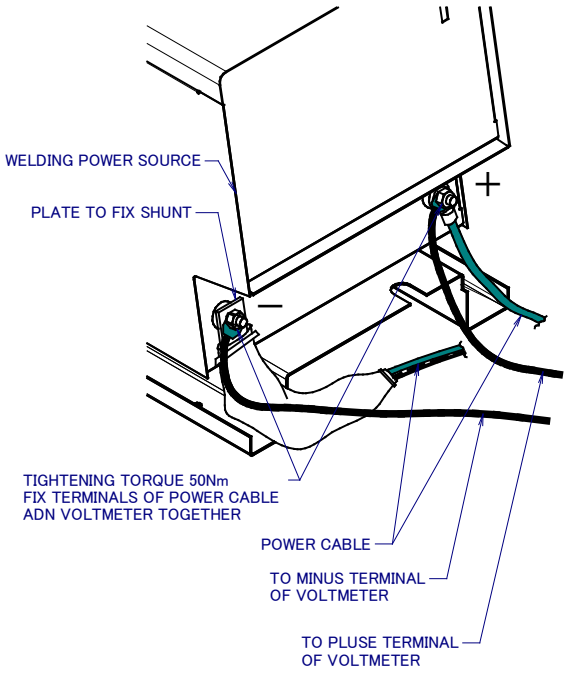


Fig.1

Fig. E (d) Connection method of voltmeter (Power Wave 455M/STT)

F CABLE FORMING ROUT FOR USING MULTI WELDING POWER SUPPLY

Bad example

In the following Fig. F (a) 1, 2, the welding power cables are installed parallel to the Voltage detection line, and then the noise breakout.

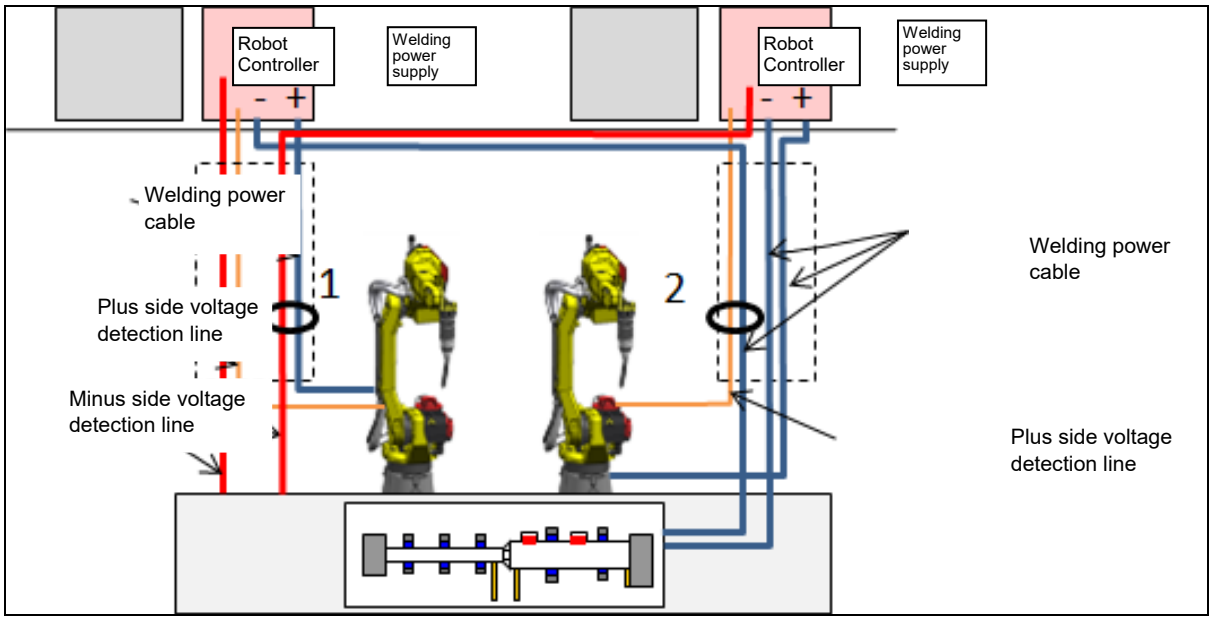


Fig. F (a) Bad wiring example

Good example

Wire each Welding power cable and Voltage detection line separately.
Locate the Welding power cable well away from the Voltage detection line, and the Welding power supply + and – abut.

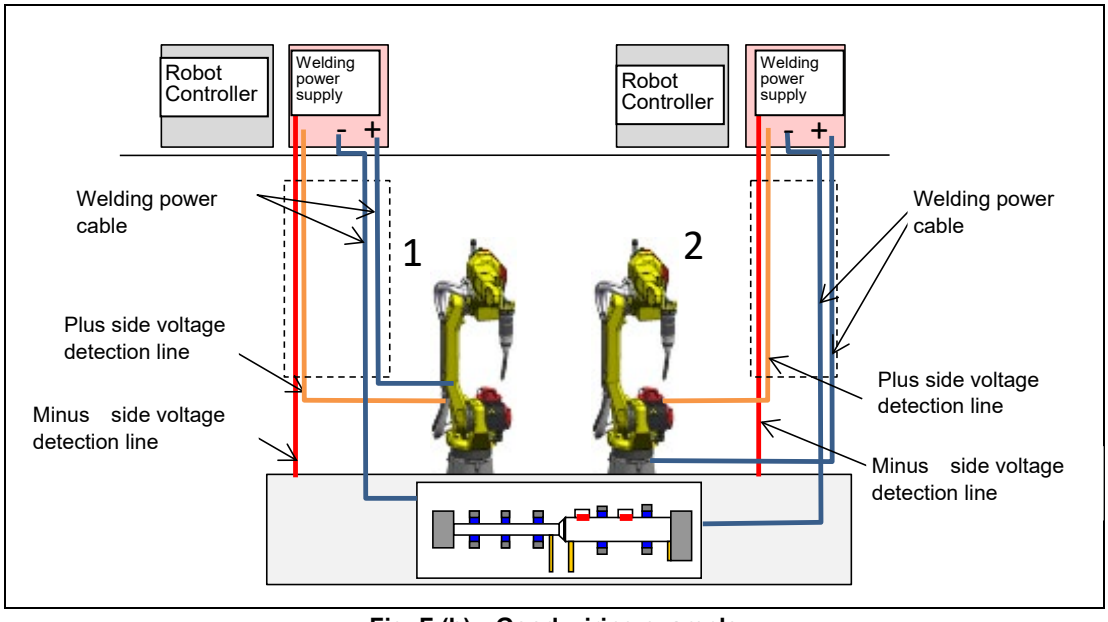


Fig. F (b) Good wiring example

G ABOUT BINZEL AIR COOLING TORCH

When a BINZEL air cooling torch is used, the current flowing through the torch cable must not exceed the range indicated by shading in Fig. G (a). When a current exceeding the permissible current level flows, ignition, electric shock, or shortened torch cable life can result. So, care should be taken. Please contact your local FANUC representative for information of water cooling toorchs and other torchs.

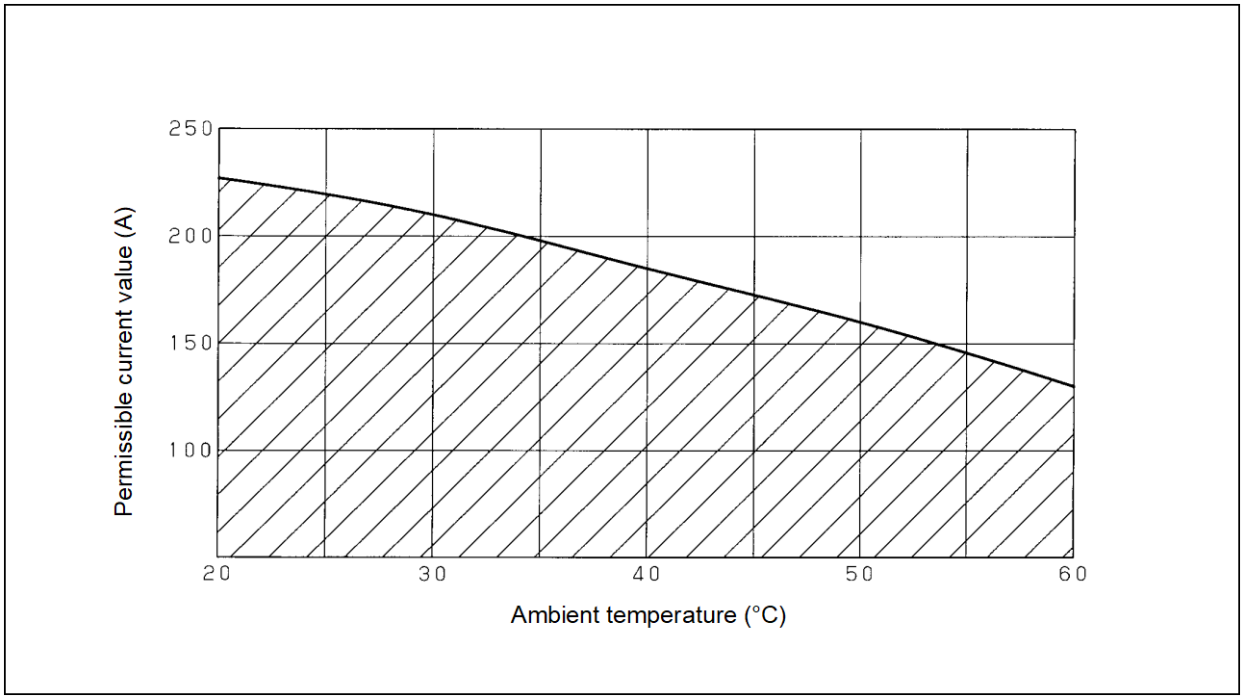


Fig. G (a) Relationship between ambient temperature and permissible current for the torch cable

⚠WARNING
When a current exceeding the permissible current level flows, ignition or electric shock can result. So, care should be taken.

When a BINZEL torch is used, the service factor (duty) of the torch cable must not exceed the range indicated by shading in Fig. G (b).
The service factor (duty) of the torch cable is calculated from the following expression:

Actual welding time/total operation time per cycle (cycle time) × 100 [%]

When a current exceeding the permissible current level flows, ignition, electric shock, or shortened torch cable life can result. So, care should be taken.

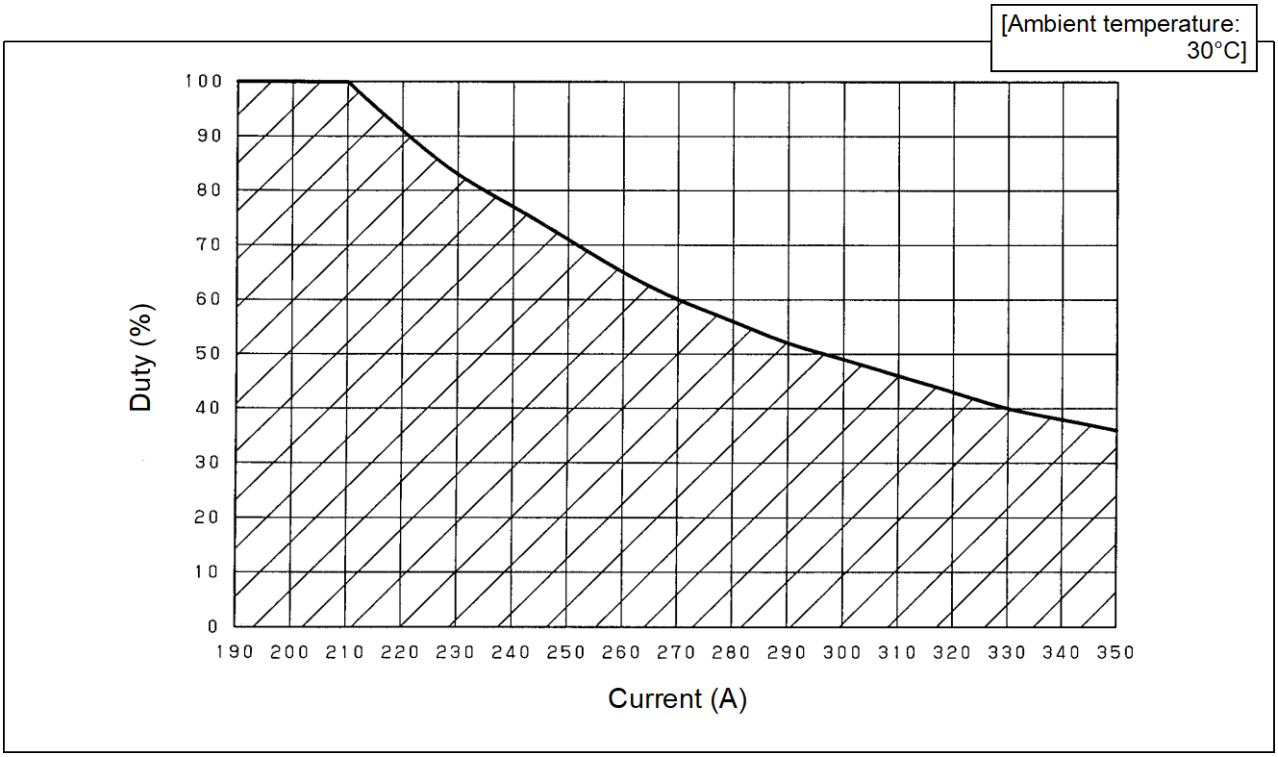


Fig. G (b) Relationship between current flowing through the torch cable and service factor (duty)

⚠WARNING
When a current exceeding the permissible current level flows, ignition or electric shock can result. So, care should be taken.

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REVISION RECORD

Edition	Date	Contents
06	Dec., 2021	・ Addition of Power Wave J350 ・ Correction of errors
05	Dec., 2020	・ Addition of Power Wave R450 ・ Updating of the maintenance parts lists ・ Correction of errors
04	Jun., 2017	・ Addition of R-30*i*B Plus, R-30*i*B Mate Plus Controller ・ Addition of FANUC welding power supply FH350i (FANUC communication specification) and FH350iP ・ Correction of errors
03	Jun., 2015	・ Addition of welding power supply Power Wave S350, FH350i, Power Wave R500, Power Wave *i*400 and Power Wave 455M/STT ・ Addition of robot ARC Mate *i*C series ・ Correction of errors
02		
01	Mar., 2014	

B-83614EN-1/06