WELDING HEAD

# MH-21AC/31AC

# OPERATION MANUAL

AMADA®

Y03M0830E-05

Thank you for purchasing our Welding Head **MH-21AC/31AC**.

- This operation manual explains its method of operation and precautions for use.
- Before using, read this operation manual carefully; after reading, save it in a proper place where you can easily access.

# Contents



This operation manual is common to both the **MH-21AC** and **MH-31AC**. The **MH-21AC** is used in the explanatory drawings.

# [1] For Correct Use

## Safety Precautions

**Before using, read "Safety precautions" carefully to understand the correct method of use.**

- These precautions are shown for safe use of our products and for prevention of damage or injury to operators or others. Be sure to read each of them, since all of them are important for safety.
- The meaning of the words and symbols is as follows:

**⚠ DANGER**

Denotes operations and practices that may imminently result in serious injury or loss of life if not correctly followed.

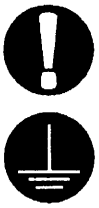
**⚠ WARNING**

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.

**⚠ CAUTION**

Denotes operations and practices that may result in personal injury or damage to the equipment if not correctly followed.

These symbols denote "prohibition". They are warnings about actions out of the scope of the warranty of the product.



These symbols denote actions which operators must take.

Each symbol with a triangle denotes that the content gives DANGER, WARNING or CAUTION to the operator.

**⚠ DANGER**

**Do not touch the inside of the Welding Head unnecessarily.**
You may receive an electric shock or be burned.
Do not touch the inside of the Welding Head other than for maintenance as described in the operation manual.

**Never disassemble, repair or modify the Welding Head.**
These actions can cause electric shock and fire. Do not do anything other than the maintenance described in the operation manual.

# ⚠ WARNING

**Do not put your hands between the electrodes.**
When welding, keep your fingers and hands away from the **electrodes**.

**Do not touch any welded part or electrodes during welding and just after welding is finished.**
The welded parts of a workpiece, **electrodes** and **arm** are very hot. Do not touch them; otherwise you may be burnt.

**Use proper tools (wire strippers, pressure wire connectors, etc.) for termination of the connecting cables.**
Do not cut the wire conductor. A flaw on it can cause fire and electric shock.

**Do not damage the power cable and connecting cables.**
Do not tread on, twist or tense any cable. The power cable and connecting cables may be broken, and that can cause electric shock and fire.

**Do not use a damaged power cable, connecting cable or plug.**
A damaged cable or a plug can cause electric shock, short circuits and fire. If any part needs to be repaired, consult us or your distributor.

**Connect the cables securely.**
Insecure connection of a cable can cause fire and electric shock.

**Stop the operation if any trouble occurs.**
Continuous operation after occurrence of a trouble such as burning smell, abnormal sound, abnormal heat, smoke, etc. can cause electric shock and fire. If such a trouble occurs, immediately consult us or your distributor.

**Persons with pacemakers must stay clear of the welding machine.**
A person who uses a pacemaker must not approach the welding machine or walk around the welding shop while the welding machine is in operation, without being permitted by his/her doctor. The welding machine generates a magnetic field and has effects on the operation of the pacemaker while it is turned on.

**Protective gear must be worn.**
Put on protective gear such as protective gloves, long-sleeve jacket, leather apron, etc. Spatter can burn the skin if they touch the skin.

**Wear protective glasses.**
If you look at the flash directly during welding, your eyes may be damaged. If any spatter gets in your eye, you may lose your eyesight.

# ⚠ CAUTION

**Use a power outlet of the correct voltage specially prepared for this Welding Head.**

If a power outlet other than the special one for this Welding Head is used, fire or electric shock may result.

**Keep the power plug clean and insert it all the way.**

If the plug is covered with dust or is not inserted completely, it will become hot and can cause a fire.

**When inserting or disconnecting the plug, hold the body.**

If the cable is pulled to disconnect the plug, it may be broken, and that can cause electric shock and fire.

**When leaving this Welding Head unused for a long time, disconnect the power plug from the power outlet.**

Deterioration of insulation can cause electric shock, leakage and fire.

**Do not splash water on the Welding Head.**

Water splashed over the electric parts, can cause electric shock and short circuits.

**Install the Welding Head on firm and level surface.**

If the Welding Head falls or drops, injury may result.

**Keep combustible matter away from the Welding Head.**

Spatter can ignite combustible matter. If it is impossible to remove all combustible matter, cover them with non-combustible material.

**Do not cover this Welding Head with a blanket, cloth, etc.**

Do not cover this Welding Head with a blanket, cloth, etc. while you are using it. The cover may be heated and burn.

**Keep a fire extinguisher nearby.**

Keep a fire extinguisher in the welding shop in case of fire.

**Maintain and inspect the Welding Head periodically.**

Maintain and inspect the Welding Head periodically, and repair any damage nearby before starting operation.

**Do not use this Welding Head for any purpose other than welding.**

Use of this Welding Head in a manner other than specified can cause electric shock and fire.

## Precautions for Handling

- Install this Welding Head securely not to fall on a firm and level surface.
- Do not install this Welding Head in the following places:

  Damp places (where humidity is 90% or higher), dusty places, places where chemicals are handled, places near a high-frequency noise source, hot or cold places (where temperatures are above 40°C or below 5°C), and places where water will be condensed.
- Use proper tools (wire strippers, pressure wire connector, etc.) for termination of the connecting cables, and take care not to damage the conductors.
- Clean the outside of the Welding Head with a soft, dry cloth or one wet with a little water. If it is very dirty, use diluted neutral detergent or alcohol. Do not use paint thinner, benzine, etc., since they can discolor or deform the Welding Head.
- Do not put anything other than a workpiece, e.g. a tool, a screw, etc., between the electrodes. It can cause serious trouble.
- Do not put a screw, a coin, etc., in the Welding Head, since they can cause a malfunction.
- Operate the Welding Head according to the method described in this operation manual.

# [2] Introduction

The MH-21AC/31AC precision Welding Heads have the following features:

- **Since the electrode force can be adjusted steplessly, the welding condition can be set finely.**
- **Since a stable electrode force is applied for each weld, constant weld quality can be obtained.**
- **Since the response (follow-up performance) to penetration is fast, explosive splashes and excessive surface indentation are not produced, and the workpiece surfaces are finished clean.**
- **The durable construction provides high reliability and stable weld quality.**
- **Since the positions of the electrodes can be changed freely, a workpiece of any shape can be welded.**

# [3] Specifications and Accessories

## Specifications

| Item | MH-21AC | MH-31AC |
|---|---|---|
| Electrode force | 19.6N – 137N (2 kgf – 14 kgf) (Stepless adjustment) | 49N – 274N (5 kgf – 28 kgf) (Stepless adjustment) |
| Type of forcing | Spring | Spring |
| Electrode diameter | ϕ6 | ϕ8 |
| Electrode stroke | 20 mm | 20 mm |
| Max. throat depth | 89 mm | 99 mm |
| Drive method of electrode | Foot pedal (MA-21) or air pressing unit (MK-105A) | Foot pedal (MA-21) or air pressing unit (MK-105A) |
| Welding current | 2000A (At duty cycle of 2%) (AC type and inverter type) | 3000A (At duty cycle of 2%) (AC type and inverter type) |
| Mass | 3.5 kg | 5.5 kg |
| Dimensions | See outline drawing. | See outline drawing. |

- The foot pedal (**MA-1**) and air pressing unit (**MK-105A**) are optional.
- For the relationship between the welding current and duty cycle, see graph "Welding Current vs. Duty Cycle" (Page 3-2).

## Accessories

Check that all of the following accessories are provided.

| Accessory name | MH-21AC | | MH-31AC | |
|---|---|---|---|---|
| Electrode | ϕ6 | 2 pcs. | ϕ8 | 2 pcs. |
| Hexagon socket head bolt | M8 x 40 | 2 pcs. | M8 x 40 | 2 pcs. |
| Plain washer | For M8 | 2 pcs. | For M8 | 2 pcs. |
| Spring washer | For M8 | 2 pcs. | For M8 | 2 pcs. |
| Hexagon wrench | For M6 (Nominal size: 5) | 1 pc. | For M6 (Nominal size: 5) | 1 pc. |
| Hexagon wrench | For M8 (Nominal size: 6) | 1 pc. | For M8 (Nominal size: 6) | 1 pc. |
| Operation manual | | 1 | | 1 |

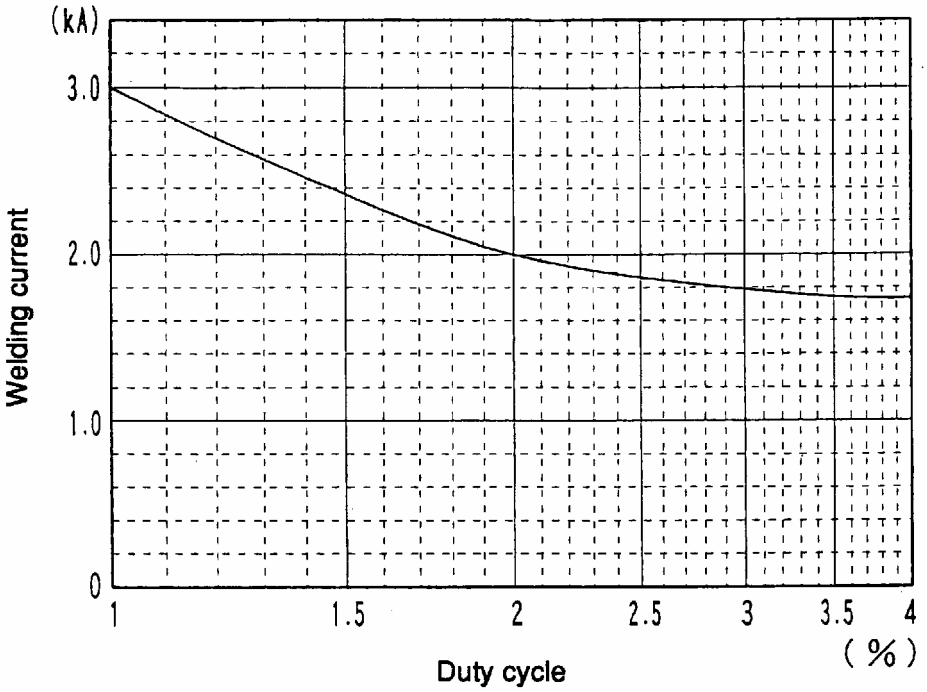
## Optional Arms

| Name | MH-21AC | MH-31AC |
|---|---|---|
| Arm for φ2 of electrode diameter | PC1173765 (1173765) | - |
| Arm for φ3 of electrode diameter | PC1173766 (1173766) | PC1176660 (1176660) |
| Arm for φ4 of electrode diameter | Z-01427-001 (1168665) | PC1176661 (1176661) |
| Arm for φ5 of electrode diameter | PC1173767 (1173767) | PC1176662 (1176662) |
| Arm for φ6 of electrode diameter | - | PC1176663 (1176663) |
| Arm for φ8 of electrode diameter | Z-01427-002 (1036898) | - |

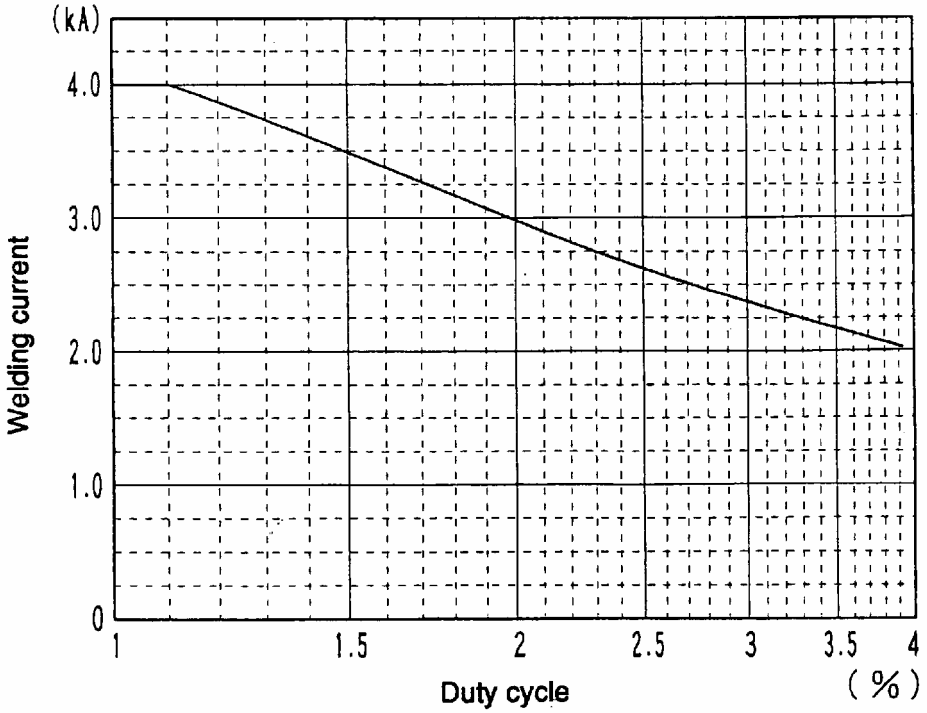
・Common to upper and lower arms. Two pieces are required when using the upper and lower sides.
・The electrode fixing screw is not attached to above optional parts.

## Welding Current vs. Duty Cycle

### MH-21AC




### MH-31AC



# [4] Name and Functions of Each Section

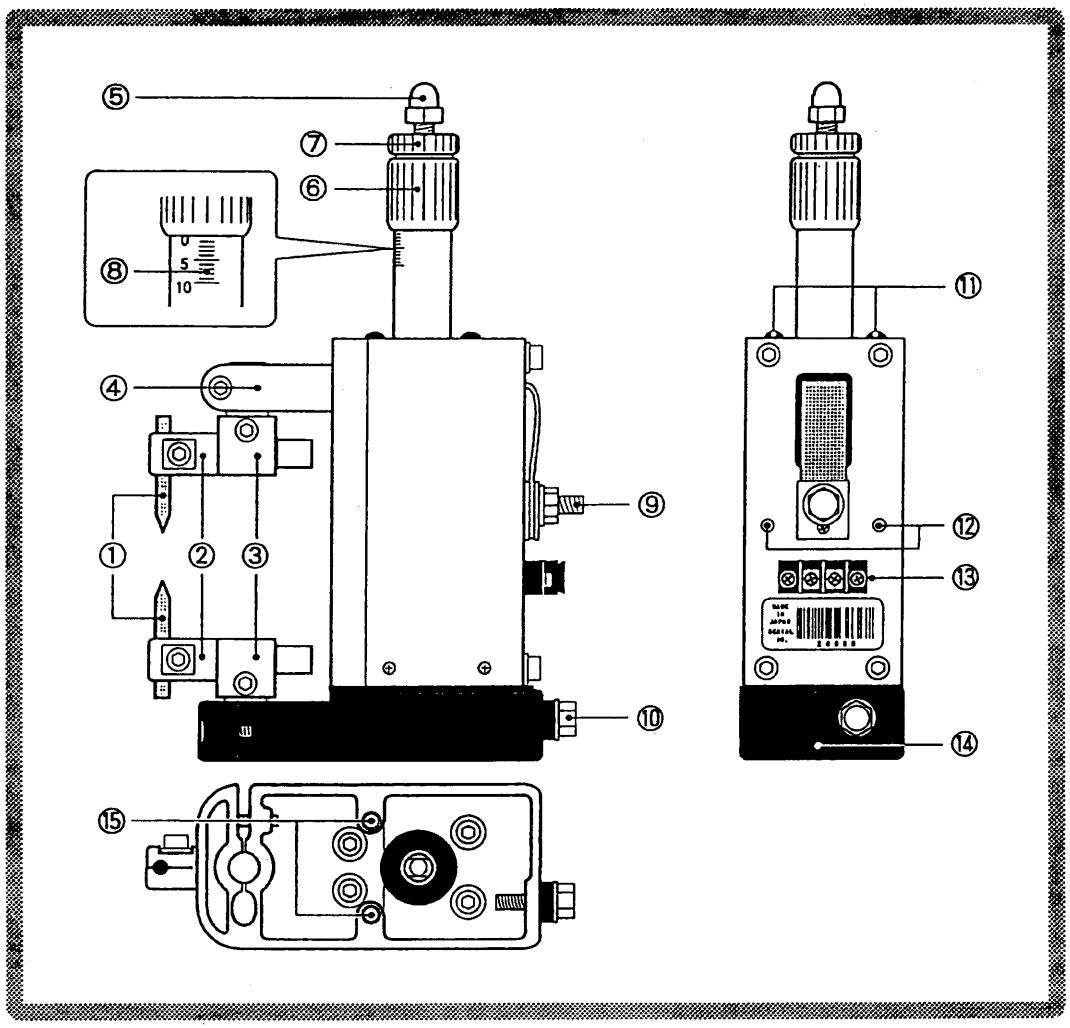



Fig. 4-1

① **Electrode** (Material: CrCu)
Electrode for spot welding.

② **Arm**
Holds the **Electrode.**

③ **Arm holder**
Holds the **Arm.**

④ **Upper holder**
Slides up and down as pressure is applied.

**CAUTION**

When operating, do not place any metallic items around the machine. If a screwdriver, a wire, etc. touches the metallic parts of ① – ④ during operation, it may be welded to the Welding Head.

⑤ **Cap nut**

When installing the air pressure unit, remove this nut.

⑥ **Force adjustment knob**

Used to adjust the force.

⑦ **Lock knob**

Secures the **Force adjustment knob**.

⑧ **Force indicator**

Used as a rough scale for force adjustment.

⑨ **Power supply terminal 1** (Thread size: M8)

Used to connect the secondary cable to supply the power to the upper electrode.

⑩ **Power supply terminal 2** (Thread size: M8)

Used to connect the secondary cable to supply the power to the lower electrode.

⑪ **Air pressure unit installing holes** (4 places)

These threaded holes are used to install the air pressure unit **MK-105A** (optional). Fit the rubber caps provided when they are not in use.
For the mounting method of the air pressure unit, see **[7] Installation of Optional Units** (Page 7-1).

⑫ **Cylinder drive unit installing holes**

These holes are used to install the cylinder drive unit **MK-106A** Series (optional).
For the mounting method of the cylinder drive unit, see **[7] Installation of Optional Units** (Page 7-5).

⑬ **Terminal block for start switch**

Used to connect the start cable of the welding controller. Has no polarity.
If the electrode force reaches the preselected value, the built-in microswitch closes.

⑭ **Base**

Used as the conductor to supply power to the lower electrode and as the base of the Welding Head.

**⚠ CAUTION**

The welding current flows through the **Base**. Do not place watches, tools, etc. around the **Base** during operation since they may be broken and may injure you.

⑮ **Base fixing screw holes** (Thread size: M8/Depth: 15 mm)

Used to secure the MH-21AC/31AC to a work stand.

**CAUTION**

The **Base** is made of brass. Since it is soft, take care not to damage the threads when removing and fitting the screws.

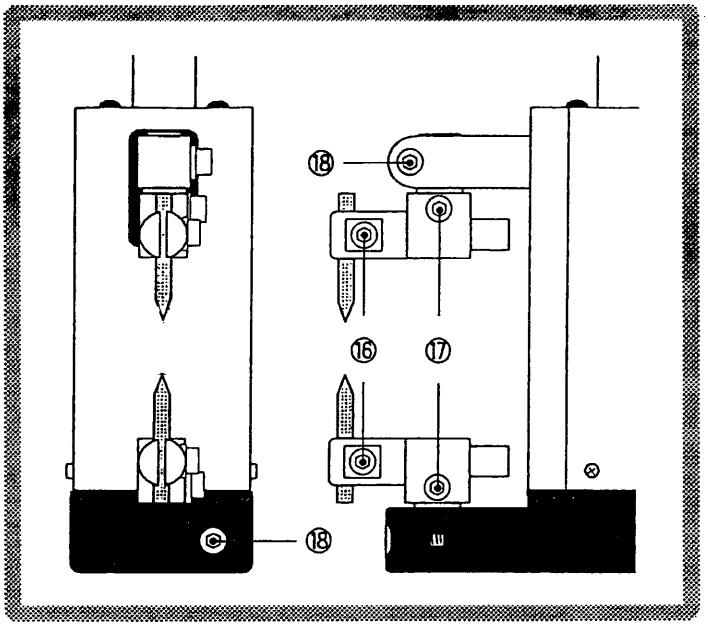



**Fig. 4-2**

⑯ **Electrode fixing screw**

Used to secure the **electrode**. Loosen this screw when replacing the electrode or adjusting its height.

⑰ **Arm fixing screw**

Used to secure the **Arm**. Loosen this screw when adjusting the length of the **Arm** or angle of the **Electrode**.

⑱ **Arm holder fixing screw**

Used to secure the **Arm holder**. Loosen this crew when adjusting the direction of the **Arm**.

# [5] Installation and Connection

Before using MH-21AC/31AC,install it according to the following procedures.

**(1) Determining where to install.**

**Determine where to install the MH-21AC/31AC, welding power supply and welding transformer, considering ease of operation.**

**(2) Drilling mounting holes.**

**Drill mounting holes on the work stand to secure the MH-21AC/31AC. When drilling, use the Hole drilling for installation of the Head (Page 5-3 – 5-4).**

**(3) Install the MH-21AC/31AC.**

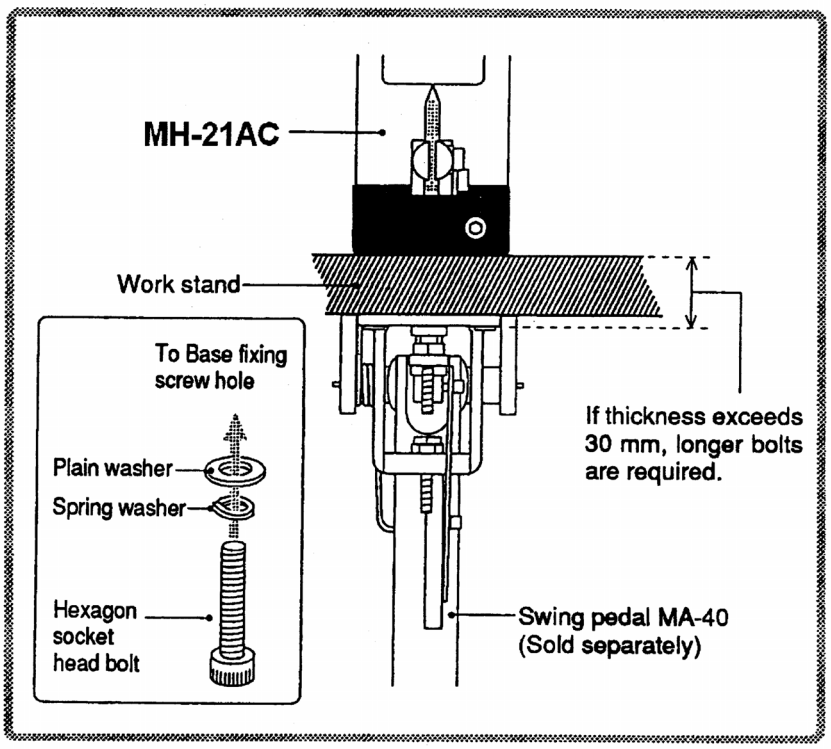



**Fig. 5-1**

**Install the MH-21AC/31AC to the work stand with the attached hexagon socket head bolts (M8 x 40), plain washers (For M8) and spring washers (For M8).**
**Use a tool suitable for the bolts to secure the head.**

**CAUTION**

**If the work stand top is thicker than 30 mm (including the thickness for our Swing pedal MA-40), prepare and use longer fixing bolts.**

### (4) Connecting to the welding controller and welding transformer

Connect the welding controller and welding transformer to the MH-21AC/31AC as shown in Fig. 5-2.

When connecting, use tools of correct sizes for the screws, nuts and bolts to secure cables.

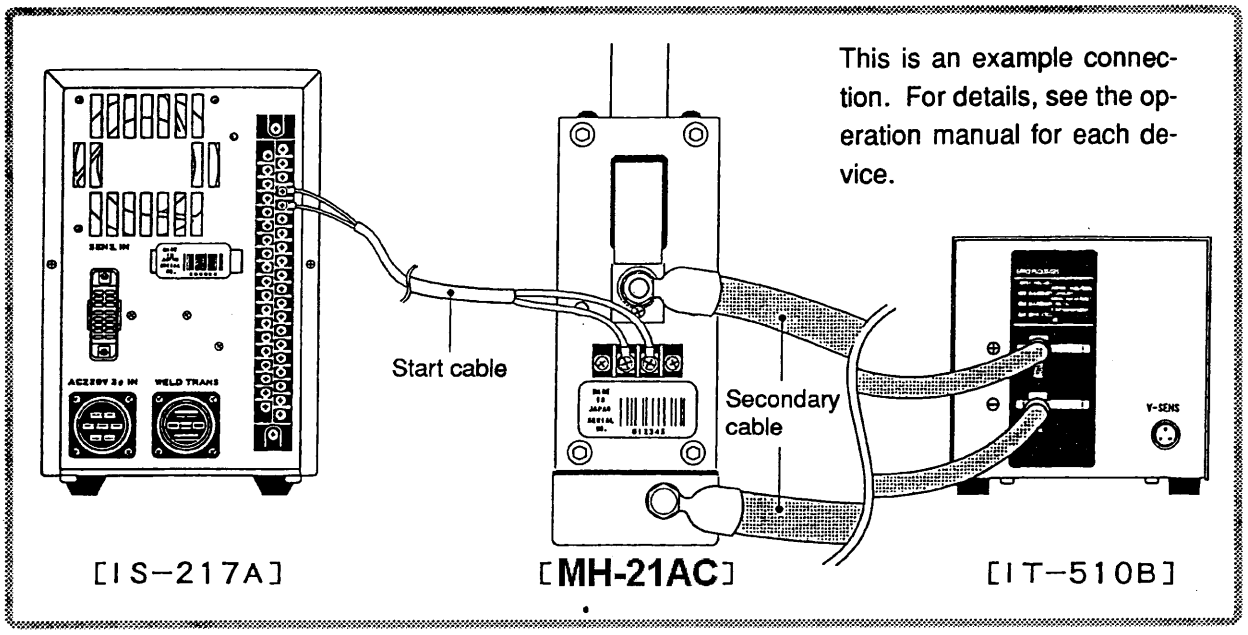
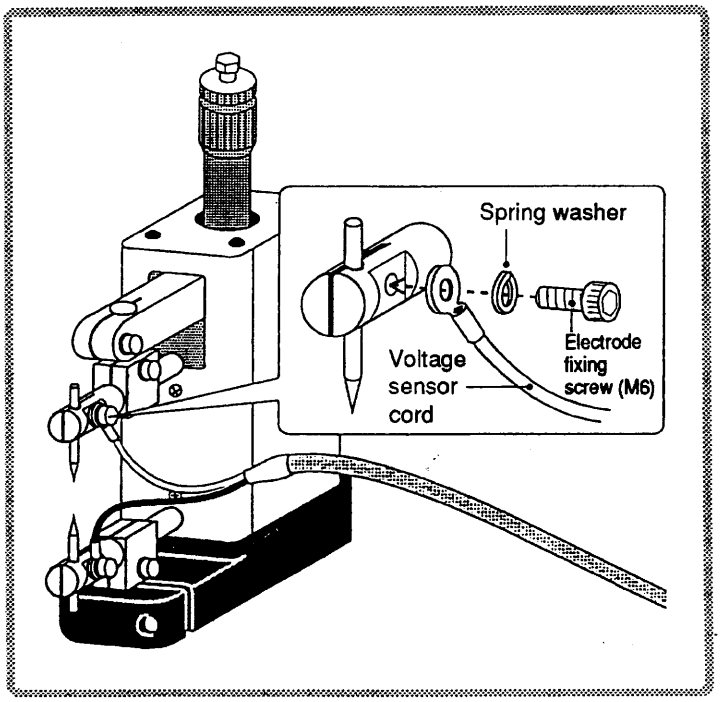



Fig. 5-2

**CAUTION**

The **Start cable** and **Secondary cable** are not attached to the MH-21AC/31AC. Customer is required to prepare them.

### (5) Connecting the Voltage sensor cord.

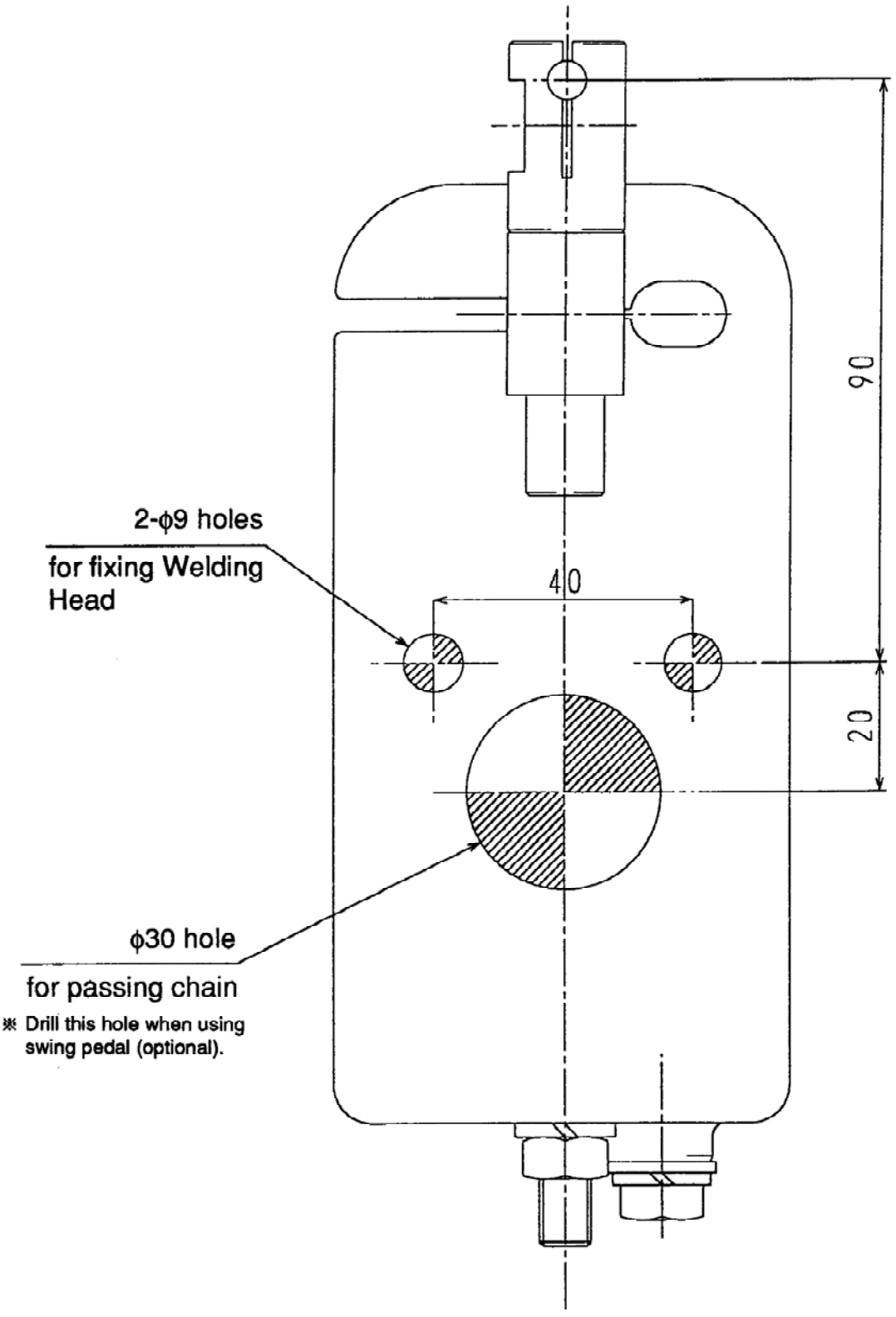



When using the voltage sensing function of an Inverter weld control, Weld checker, etc., connect the **Voltage sensor cord** to the **Electrode fixing screw** or tap the arm near the **electrode** and secure the voltage sensor cord with a screw.

Fig. 5-3

## Hole drilling for installation of head

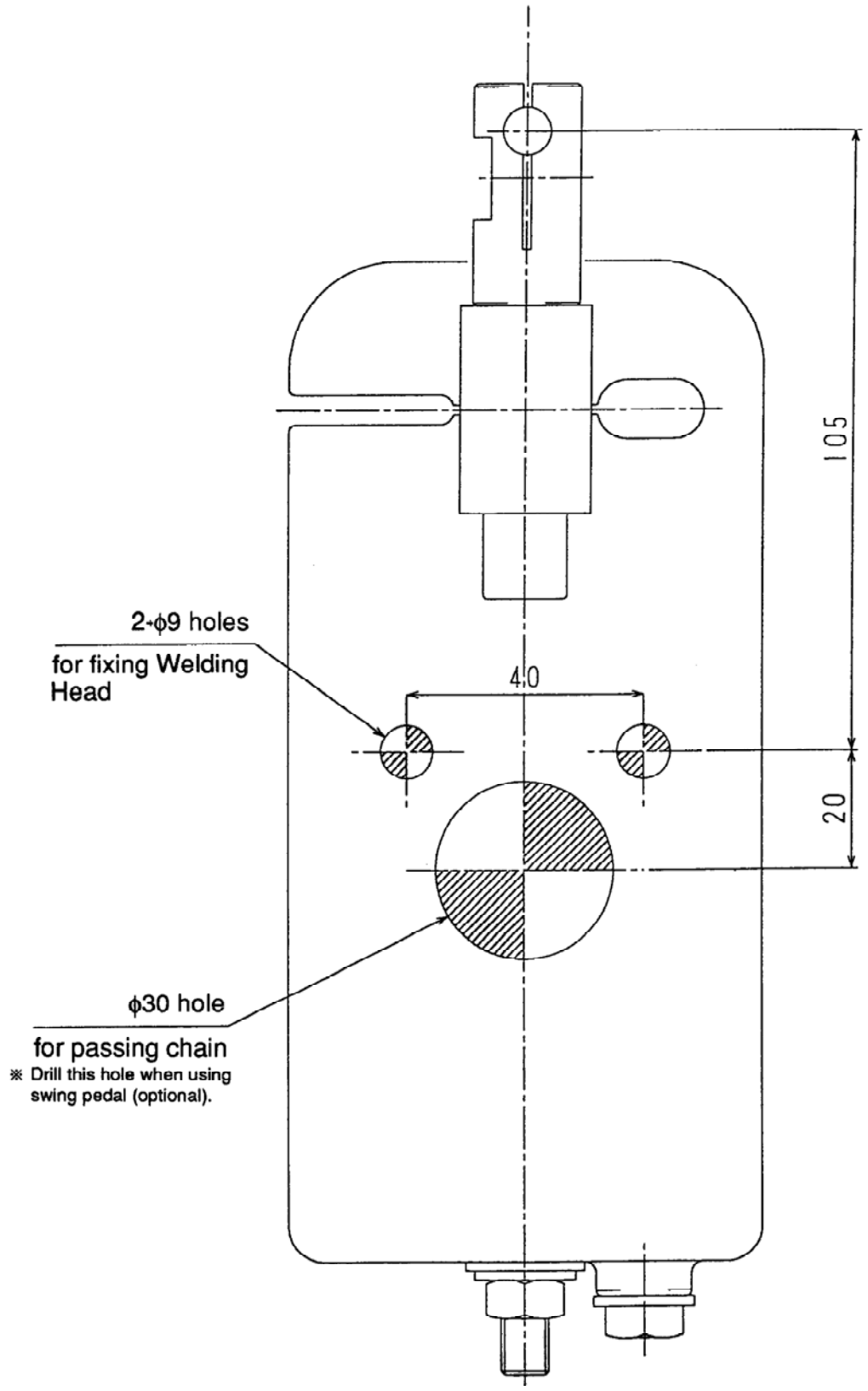
**MH-21AC**




(Unit: mm)

# Hole drilling for installation of head

**MH-31AC**




(Unit: mm)

# [6] User Maintenance

**CAUTION**

For the following work, use tools of correct sizes for the screws. After the adjustment, tighten the screws securely.

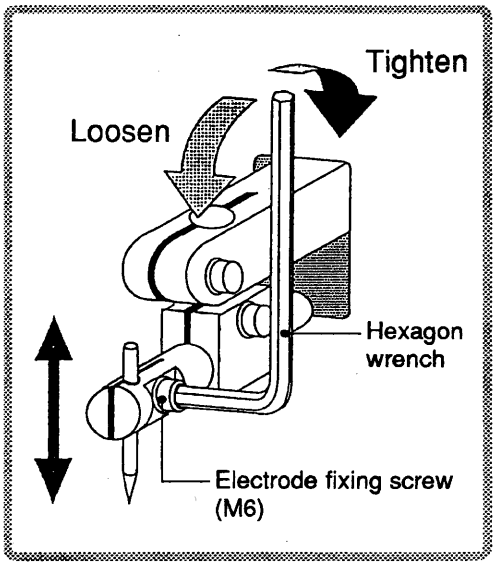



Fig. 6-1

**(1) Adjusting height of electrode and replacing electrode**

Loosen the **electrode fixing screw** with the attached hexagon wrench and adjust the height of the **electrode** (See Fig. 6-1).

When replacing the **electrode**, loosen the **electrode fixing screw** and pull the electrode up or down.

If the **electrode** cannot be pulled out easily, insert a blade-tip screwdriver or a flat plate in the slit of the **arm** to widen the slit as shown in Fig. 6-2.

After the work is finished, tighten the screw securely.

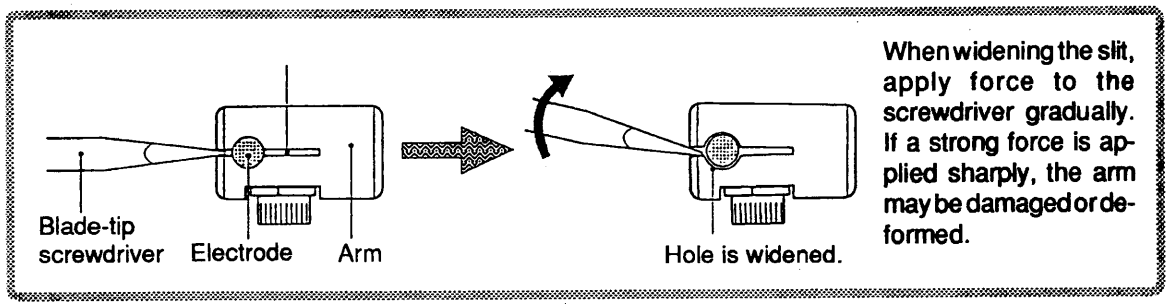



Fig. 6-2

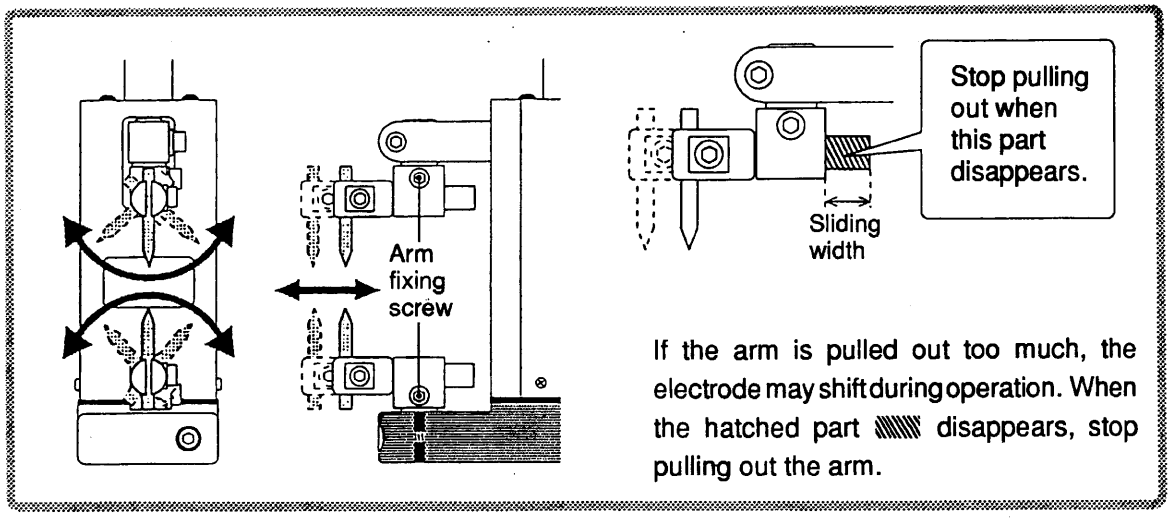



Fig. 6-3

**(2) Adjusting length of arm and angle of electrode**

Loosen the **arm fixing screw**, and adjust the length of the **arm** and the angle of the **electrode** as shown in Fig. 6-3.

**(3) Adjusting direction of arm**

Loosen the **arm holder fixing screw** of the **upper holder** and **base**, and adjust the direction of the **arm** (See Fig. 6-4).

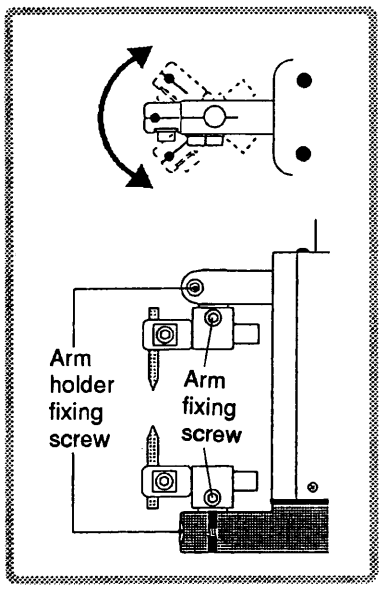



Fig. 6-4

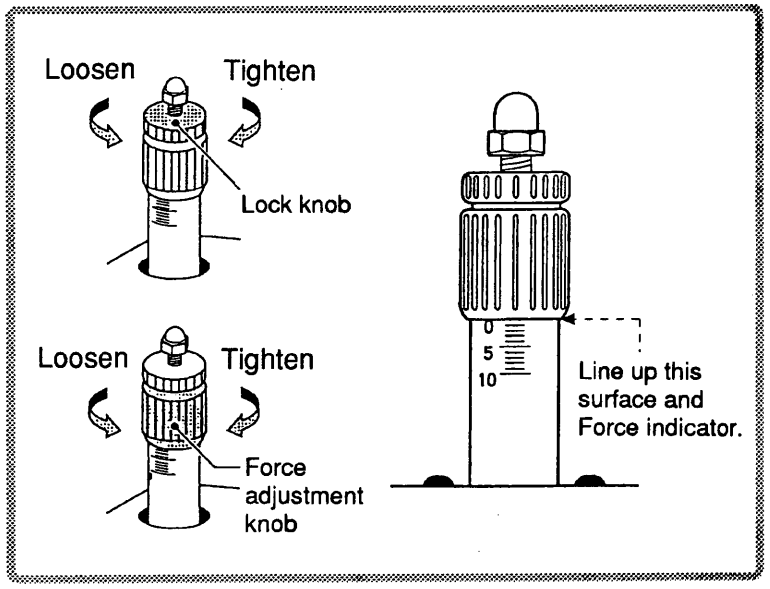



Fig. 6-5

**(4) Adjusting force** (See Fig. 6-5)

① Hold the **force adjustment knob** with the hand or pliers, and loosen the **lock knob** to unlock the **force adjustment knob**.

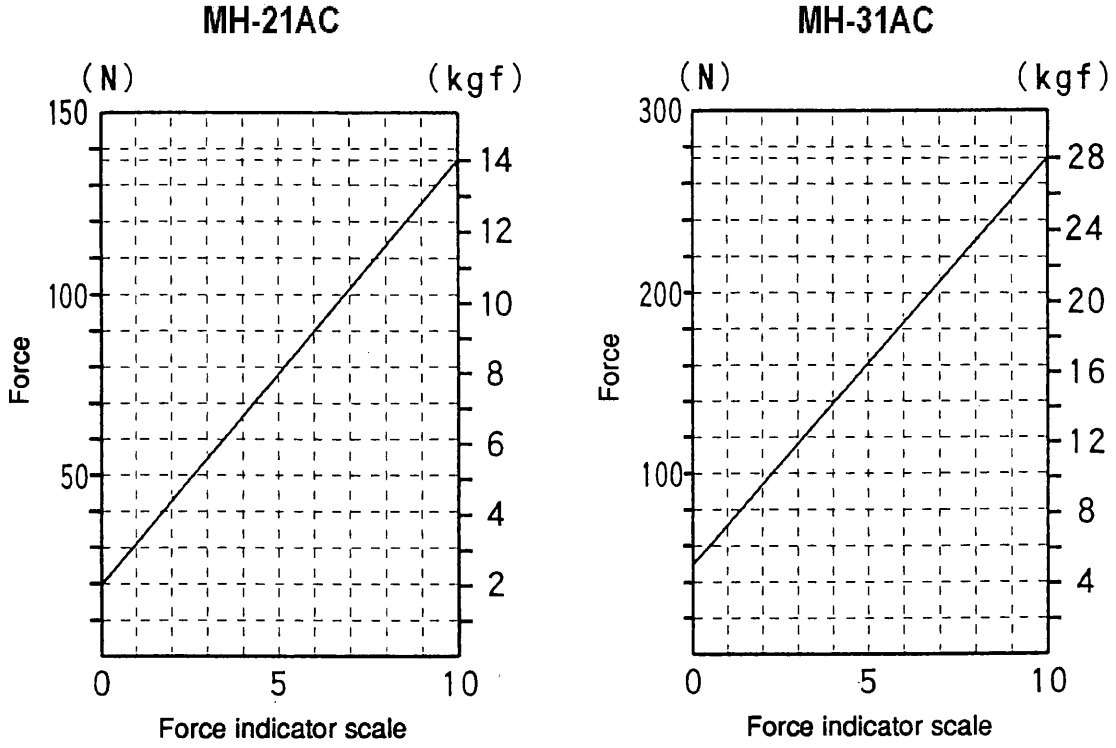
② Turn the **force adjustment knob** to obtain the necessary force. For the relationship between the **force indicator** scale and force, see the "Force conversion graph" (Page 6-3).

**CAUTION**

The Force conversion graph indicates the theoretical value. When measuring the actual force, use a pressure gauge or a spring balance.

③ Hold the **force adjustment knob** with the hand or pliers, and tighten the **lock knob** to lock the **force adjustment knob**.

## Force conversion graph




* Use these graphs for approximation.

# [7] Installation of Optional Units

The MH-21AC/31AC can be equipped with various optional units. Install them according to the following procedures.
For the specifications and detailed handling method of the optional units, see the respective operation manuals.

## (1) Installing air pressure unit

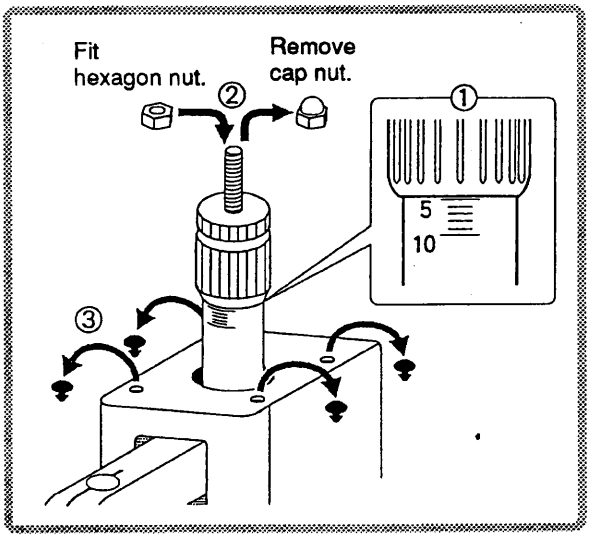



Fig. 7-1

① Set the **force adjustment knob** to "5" and lock it lightly with the **lock knob.**

② Remove the **cap nut** and fit the hexagon nut attached to the air pressure unit. Keep the **cap nut**. The size of the **cap nut** is M8 (Width across flats: 13 mm).

③ Remove the rubber caps (4 pieces) from the **air pressure unit installing holes**. They are inserted in the threaded holes. Do not turn them, rather pull them up.

④ Place the air pressure unit over the MH-21AC/31AC as shown in Fig. 7-2.

⑤ When the joint comes to just above the shaft, screw the joint in the shaft until the mounting surface of the air pressure unit touches the cover of the MH-21AC/31AC (See Fig. 7-3).

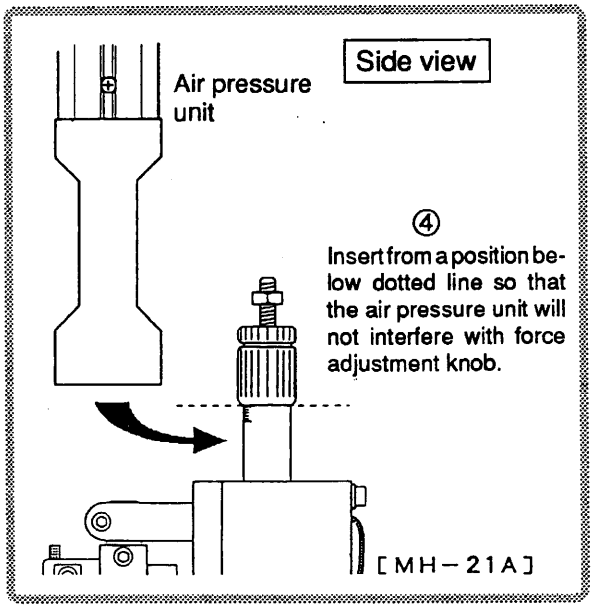



Fig. 7-2

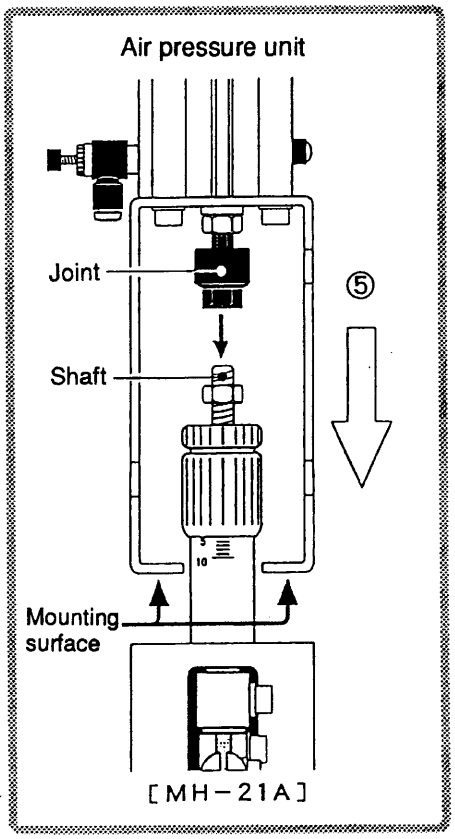
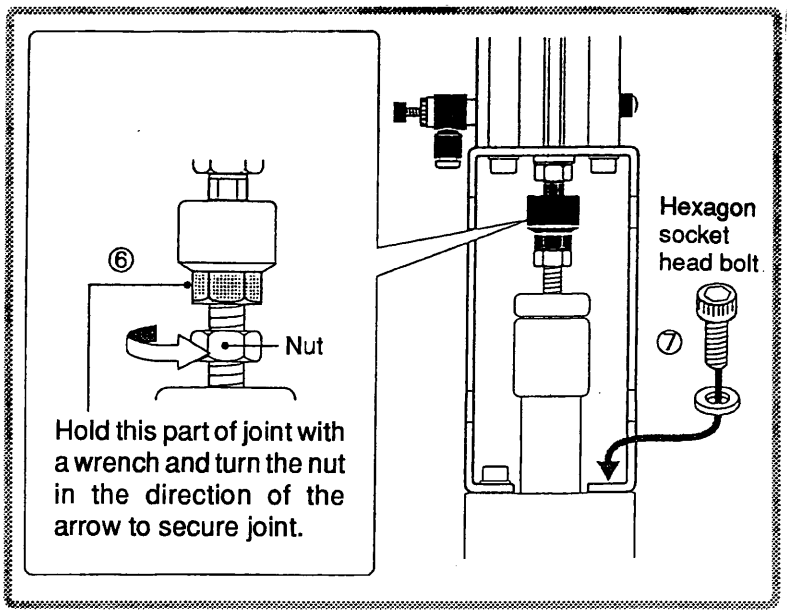



Fig. 7-3



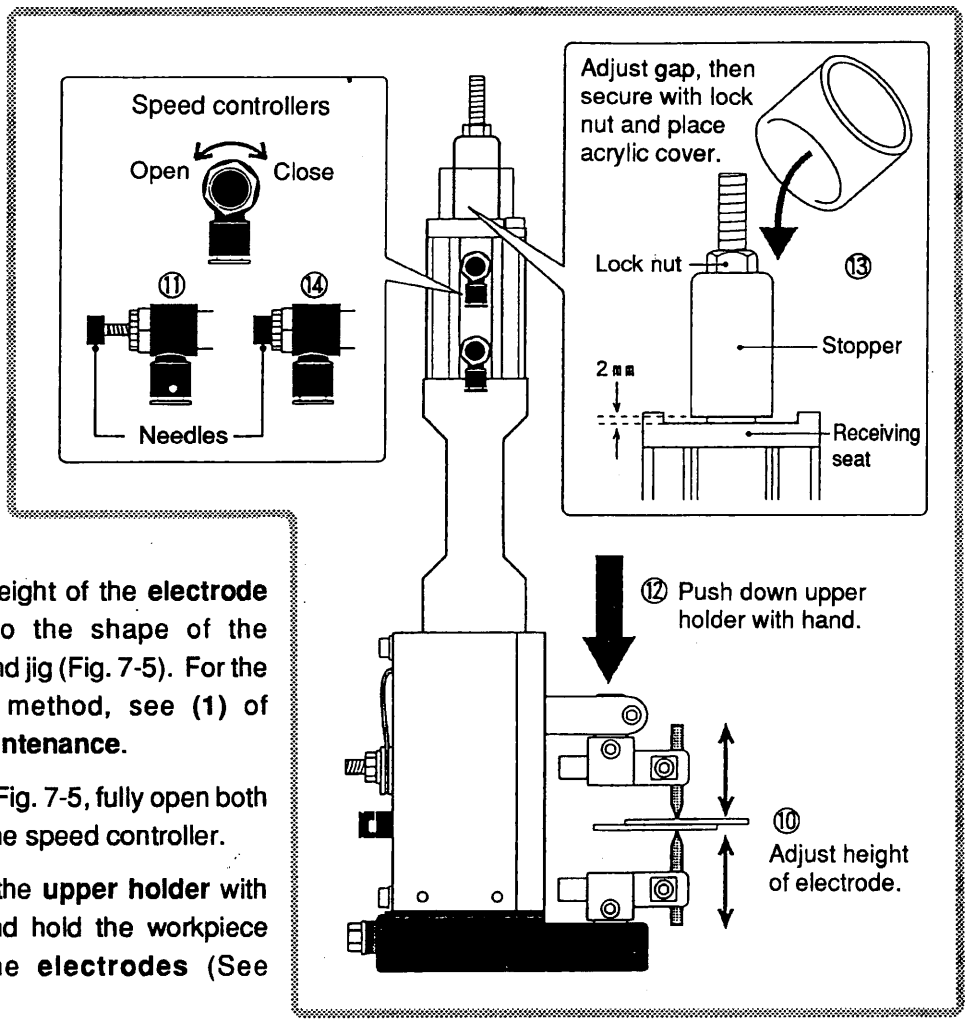

⑥ Referring to Fig. 7-4, secure the joint.

⑦ Secure the air pressure unit and MH-21AC/31AC lightly with the attached four hexagon-socket head bolts. Do not tighten those bolts too tightly (See Fig. 7-4).

⑧ Align the shaft with the air pressure unit.

⑨ Tighten the bolts, which were tightened lightly in ⑦, securely with a tool.

**Fig. 7-4**




⑩ Adjust the height of the **electrode** according to the shape of the workpiece and jig (Fig. 7-5). For the adjustment method, see **(1)** of **[6] User Maintenance.**

⑪ Referring to Fig. 7-5, fully open both needles of the speed controller.

⑫ Push down the **upper holder** with the hand and hold the workpiece between the **electrodes** (See Fig. 7-5).

**Fig. 7-5**

⑬ Turn the stopper to move it up and down so that the gap between the stopper and the receiving seat will be 2 mm.
After the adjustment, secure the stopper with the lock nut and place the acrylic cover (See Fig. 7-5).

⑭ After positioning the stopper, fully close both needles of the speed controller (See Fig. 7-5).
At this time, check that the upper **electrode** is up.

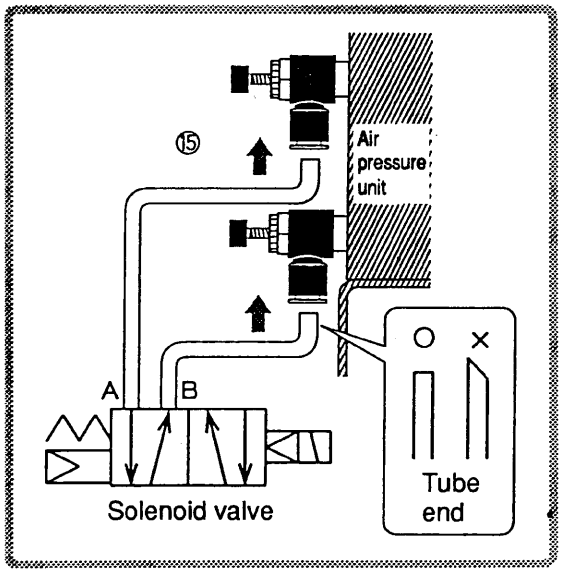



Fig. 7-6

⑮ Referring to Fig. 7-6, connect the tube to the speed controller.
When using cylinder drive unit **MK-106A**, connect port Ⓐ of the solenoid valve to the upper speed controller on the cylinder, and port Ⓑ to the lower speed controller on the cylinder (See page 7-5).
When using a solenoid valve other than the **MK-106A**, read the operation manual and specifications of that solenoid valve.

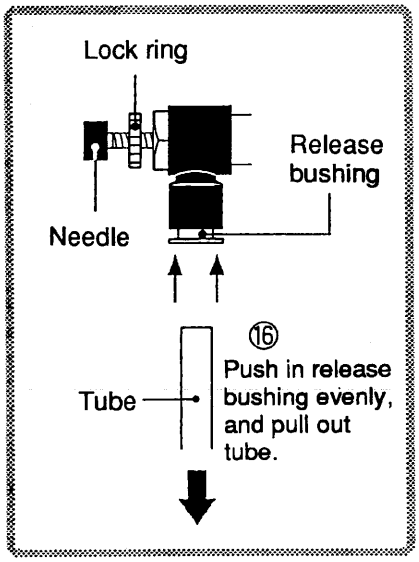



Fig. 7-7

⑯ Hold the tube securely and insert it slowly in the speed controller to the end. After inserting it, pull it lightly to check it does not come out.
If you have inserted a tube wrong, push in the release bushing evenly, then pull out the tube straight (See Fig. 7-7).

**CAUTION**

Cut the tube at right angles as shown in Fig. 7-6. If it is cut diagonally, cut it again correctly.

⑰ After connecting the tubes, open the main valve and adjust the pressure to 0.35 MPa (3.57 kgf/cm²) using a regulator.

⑱ Open the needles of the speed controllers and operate the solenoid valve for test runs. Adjust the moving up and down speeds of the electrode by opening and closing the needles (See the table at right).
After the adjustment, secure the needles with the lock rings (See Fig. 7-7).

| Needle | Moving up and down speed |
|---|---|
| Open | High |
| Close | Low |

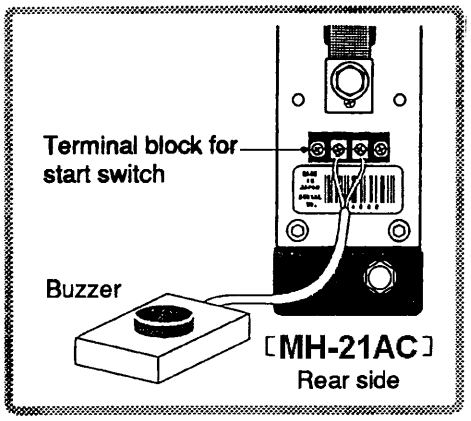



Fig. 7-8

⑲ Connect a buzzer or a tester to the terminal block on the rear side of MH-21AC/31AC (See Fig. 7-8). At this time, check that the buzzer does not sound (or the tester does not indicate current flow).

⑳ Set a workpiece between the electrodes and start test runs. Move the electrode up and down several times. If the buzzer sounds when the **electrodes** hold the workpiece between them, installing air pressure unit is completed.

If the buzzer does not sound, check that the gap between the stopper and receiving seat is 2 mm. If the buzzer still does not sound even when the gap is set to 2 mm, widen the gap by 0.5 – 1.0 mm.

**CAUTION**

When performing test runs, be sure to turn off the welding current. If a large current flows, the tips of the **electrodes** may be broken.

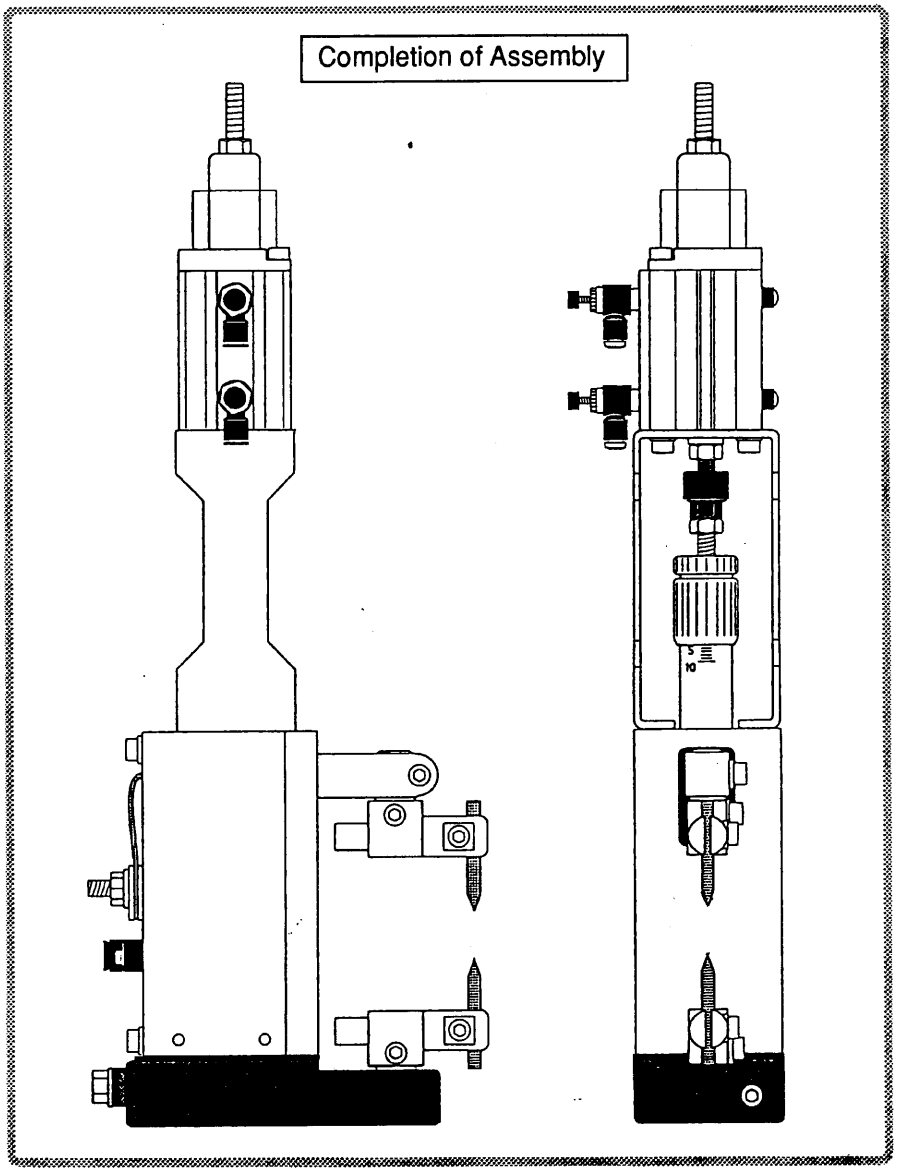



Fig. 7-9

## (2) Installing the cylinder drive unit MK-106A

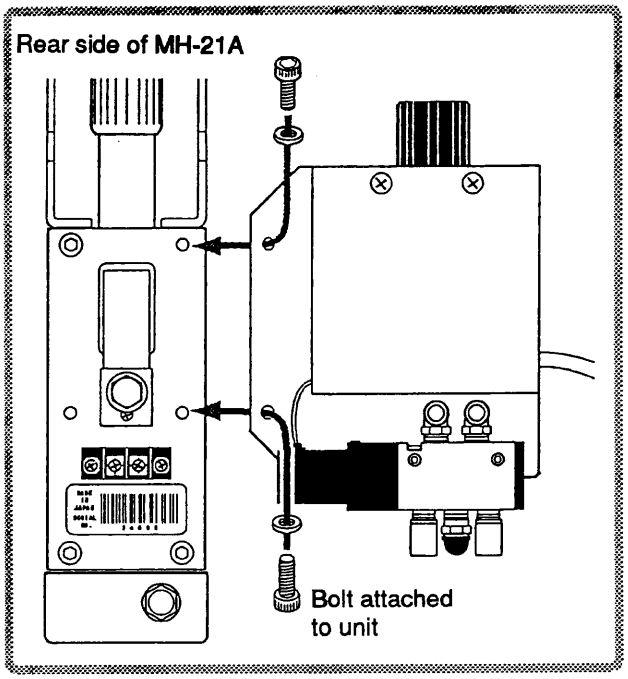



Fig. 7-10

① Remove the hexagon socket head bolt from the right upper corner of the rear side of the weld head.
Keep the removed bolt, since it will be used to install the cylinder drive unit.

② Install the cylinder drive unit to MH-21AC / 31AC.
Secure the unit with the bolt attached to it and the one removed in ① (See Fig. 7-10).

③ Referring to Fig. 7-11, connect ports Ⓐ and Ⓑ to the speed controllers using the attached tubes.
Hold the tube securely and insert it slowly in the speed controller to the end. After inserting it, pull it lightly to check that it does not come out.

| Solenoid valve port | Speed controller |
|---|---|
| Ⓐ | Upper position |
| Ⓑ | Lower position |

If you have inserted a tube wrong, push in the release bushing evenly, then pull out the tube straight (See Fig. 7-7, 7-11).

④ Connect the primary tube to the air intake adapter on the front side of the unit (See Fig. 7-12).

**CAUTION**

The tube for primary piping is not attached to the cylinder drive unit. Prepare a polyurethane tube having the outer diameter of 6 mm and inner diameter of 4 mm in advance.

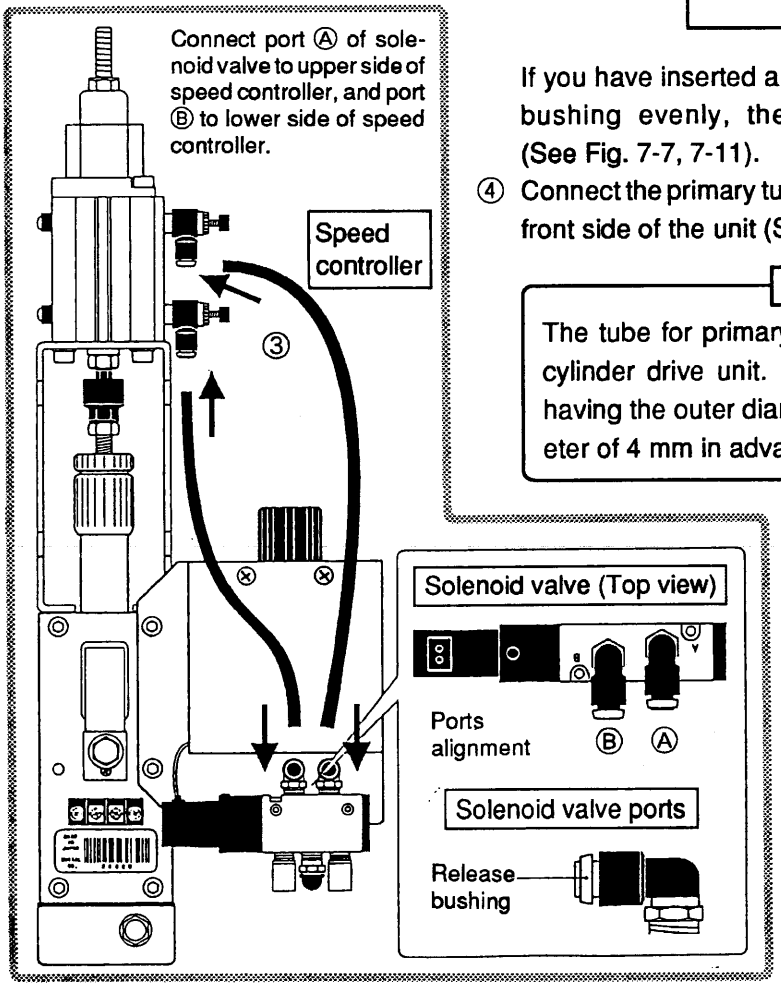



Fig. 7-11

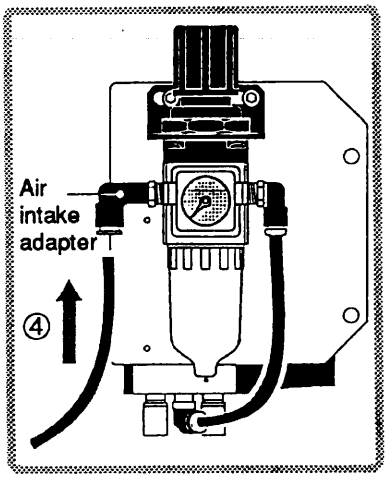



Fig. 7-12

⑤ After connecting the tubes, open the main valve and adjust the pressure to 0.35 MPa (3.57 kgf/cm²) using regulator.

| Needle | Moving up and down speed |
|---|---|
| Open | High |
| Close | Low |

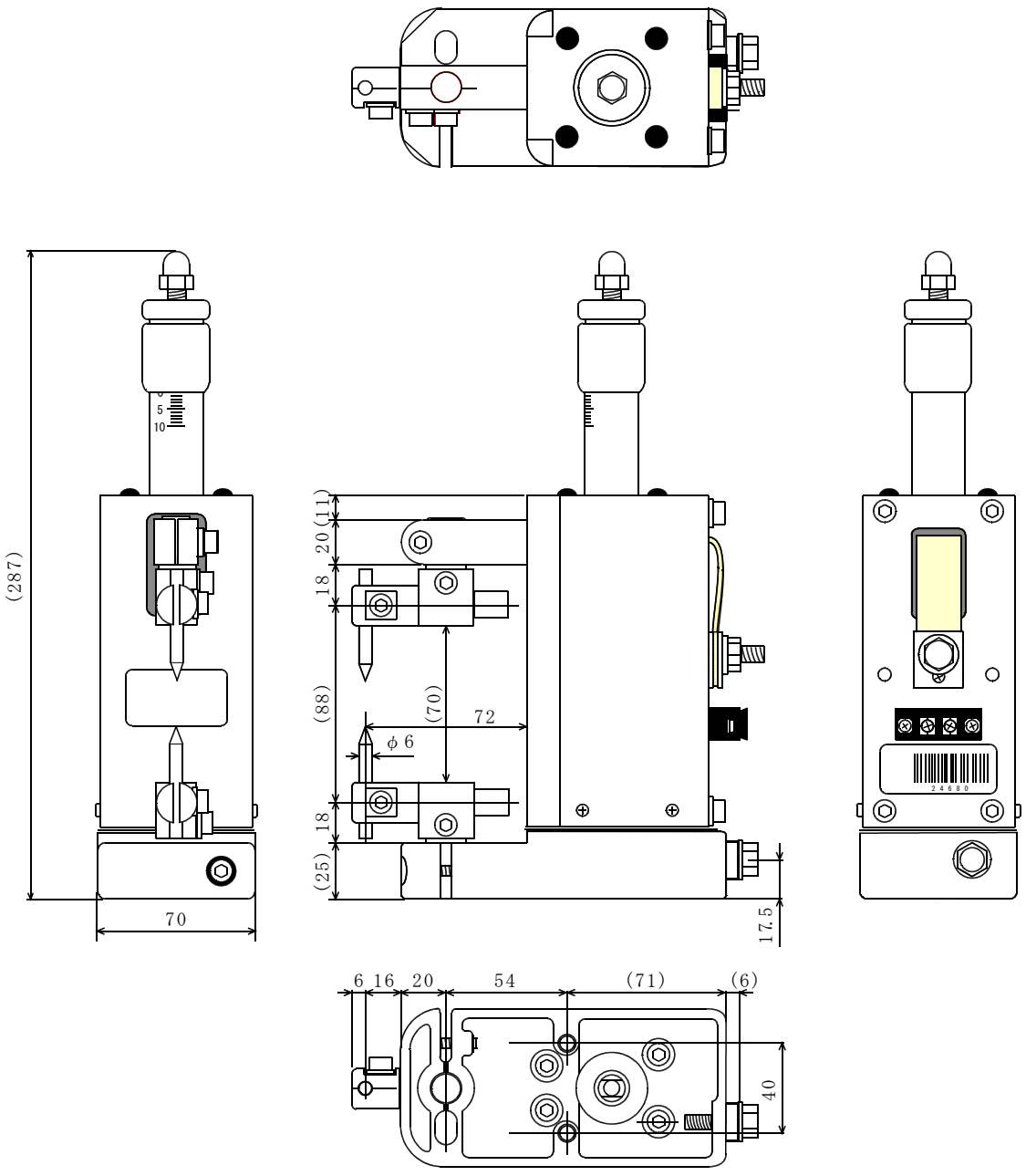
⑥ Open the needles of the speed controllers to operate the solenoid valve for test run. Adjust the moving up and down speed of the electrode with the needles (See the table at right).

After the adjustment, secure the needles with the lock rings (See Fig. 7-7).

The cylinder drive unit is now installed.

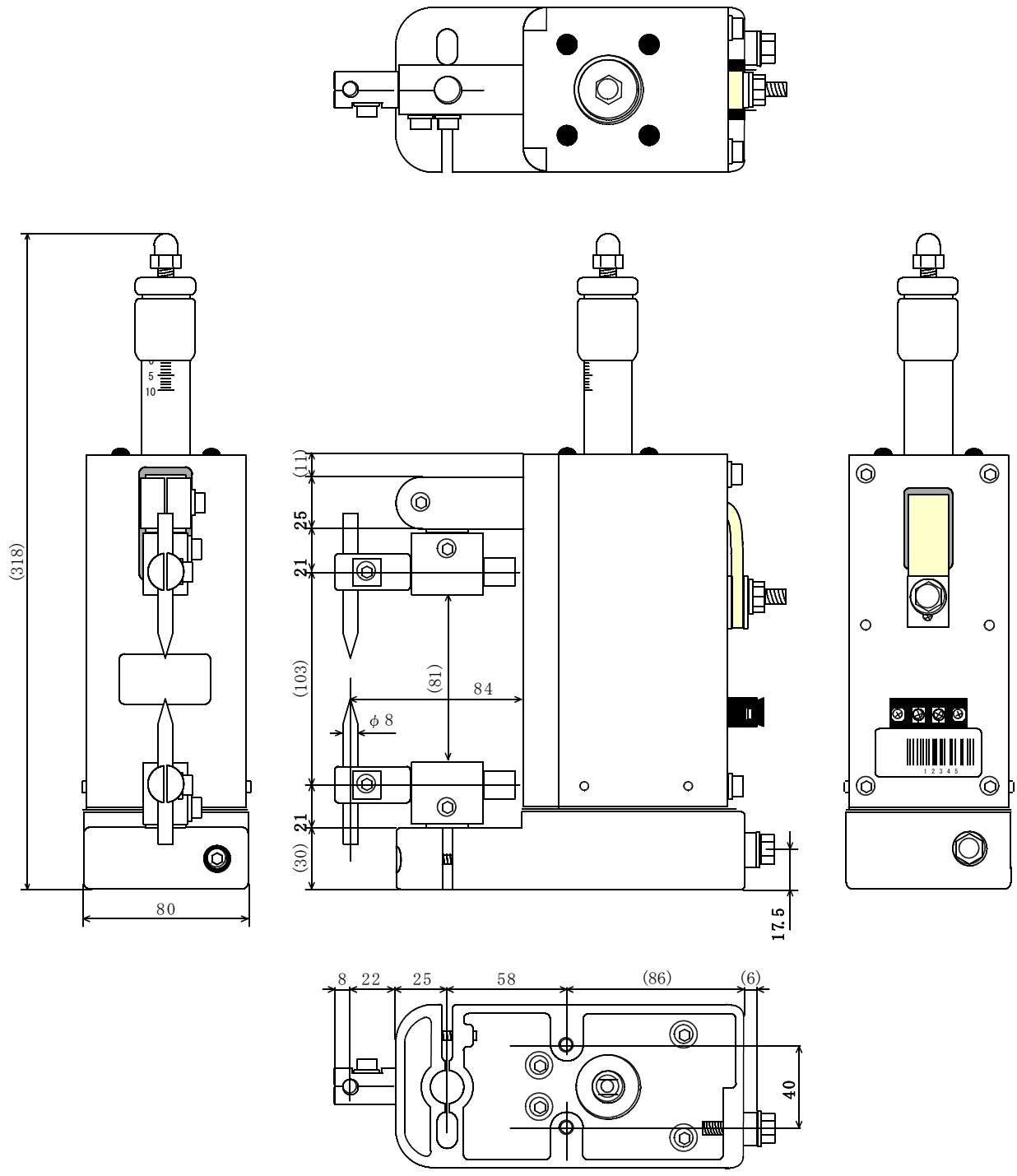
# [8] Outline Drawing

## MH-21AC




(Unit: mm)

# MH-31AC




(Unit: mm)