



# CobraMig<sup>®</sup> 400P Pulsed Mig Welding Power Source

## Owner's Manual

Product:	CobraMig <sup>®</sup> 400P
Manual:	091 - 0603
Serial	07060001
Voltage Rating:	230/460 VAC
Revision:	B
Model Number:	186 - 004



Notice : Machine export to Europe

This product does not meet the requirements specified in the EC Directives which are the EU safety ordinance that was enforced starting on January 1, 1995. Please make sure that this product is not allowed to bring into the EU after January 1, 1995 as it is.

The same restriction is also applied to any country which has signed the EEA accord.



Please ask us before attempting to relocate or resell this product to or in any EU member country or any other country which has signed the EEA accord.

## TABLE OF CONTENTS


1. SAFETY INFORMATION.....	2
2. ARC WELDING SAFETY PRECAUTIONS.....	2
3. GENERAL NOTICE OF OPERATION.....	8
4. STANDARD COMPOSITION AND ACCESSORIES.....	9
5. FUNCTION OF EQUIPMENT.....	11
6. NECESSARY POWER SOURCE EQUIPMENT.....	12
7. TRANSPORT AND INSTALLATION.....	13
8. CONNECTION PROCEDURE AND GROUND FOR SAFETY USE.....	15
9. WELDING PREPARATION.....	18
10. OPERATION.....	28
11. APPLIED FUNCTION.....	46
12. MAINTENANCE AND TROUBLESHOOTING.....	51
13. PARTS LIST.....	59
14. SPECIFICATIONS.....	61
15. SERVICE AND SUPPORT.....	65

## 1. SAFETY INFORMATION



The following safety alert symbols and signal words are used throughout this manual to identify various hazards and special instructions.

 <b>WARNING</b>	<b>WARNING</b> gives information regarding possible personal injury or loss of life.
 <b>CAUTION</b>	<b>CAUTION</b> refers to minor personal injury or possible equipment damage.


## 2. ARC WELDING SAFETY PRECAUTIONS


 <b>WARNING</b>	
<b>ARC WELDING can be hazardous.</b>	
<b>1. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.</b> Be sure to: <ul style="list-style-type: none"><li>• Keep children away.</li><li>• Keep pacemaker wearers away until consulting a doctor.</li></ul>	
<b>2. Read and understand the summarized safety information given below and the original principal information that will be found in the PRINCIPAL SAFETY STANDARDS.</b>	
<b>3. Have only trained and experienced persons perform installation, operation, and maintenance of this equipment.</b>	
<b>4. Use only well maintained equipment. Repair or replace damaged parts at once.</b>	
<b>ARC WELDING is safe when precautions are taken.</b>	

## 2. ARC WELDING SAFETY PRECAUTIONS (continued)


	<p><b>ELECTRIC SHOCK can kill.</b></p>
<p>Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuits are electrically live whenever the output is on. The power line and internal circuits of this equipment are also live when the line disconnect switch is on. When arc welding all metal components in the torch and work circuits are electrically live.</p> <ol style="list-style-type: none"> <li>1. Do not touch live electrical parts.</li> <li>2. Wear dry insulating gloves and other body protection that are free of holes.</li> <li>3. Insulate yourself from work and ground using dry insulating mats or covers.</li> <li>4. Be sure to disconnect the line disconnect switch before installing, changing torch parts or maintaining this equipment.</li> <li>5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.</li> <li>6. Keep all panels and covers of this equipment securely in place.</li> <li>7. Do not use worn, damaged, undersized, or poorly spliced cables.</li> <li>8. Do not touch electrode and any metal object if POWER switch is ON.</li> <li>9. Do not wrap cables around your body.</li> <li>10. Turn off POWER switch when not in use.</li> </ol>	
	<p><b>ARC RAYS can burn eyes and skin: FLYING SPARKS AND HOT METAL can cause injury. NOISE can damage hearing.</b></p>
<p>Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin.</p> <p>Noise from some arc welding can damage hearing.</p> <ol style="list-style-type: none"> <li>1. Wear face shield with a proper shade of filter (See ANSI Z 49.1 listed in PRINCIPAL SAFETY STANDARDS) to protect your face and eyes when welding or watching a welder work.</li> <li>2. Wear approved safety goggles. Side shields recommended.</li> <li>3. Use protective screens or barriers to protect others from flash and glare: warn others not to look at the arc.</li> <li>4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.</li> <li>5. Use approved earplugs or earmuffs if noise level is high. Chipping and grinding can cause flying metal. As welds cool, they can throw off slag.</li> <li>6. Wear approved face shield or safety goggles. Side shields recommended.</li> <li>7. Wear proper body protection to protect skin.</li> </ol>	


## 2. ARC WELDING SAFETY PRECAUTIONS (continued)



	<b>WELDING</b> can cause fire and explosion.
<p>Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, spatter, hot base metal, and hot equipment can cause fire and explosion. Accidental contact of electrode or welding wire to metal object can cause sparks, overheating, or fire.</p> <ol style="list-style-type: none"><li>1. Protect yourself and others from flying sparks and hot metals.</li><li>2. Do not weld where flying sparks can strike flammable material.</li><li>3. Remove all flammables within 10m (33ft) of the welding arc. If this is not possible, tightly, cover them with approved covers.</li><li>4. Be alert that welding sparks and hot metals from welding can easily pass through cracks and openings into adjacent areas.</li><li>5. Watch for fire, and keep a fire extinguisher nearby.</li><li>6. Be aware that welding on a ceiling, floor, bulkhead, or partition can ignite a hidden fire.</li><li>7. Do not weld on closed containers such as tanks or drums.</li><li>8. Connect power cable for base metal as close to the welding area as possible to prevent the welding current from traveling along unknown paths and causing electric shock and fire hazards.</li><li>9. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.</li><li>10. Does not use the welding power source for other than arc welding.</li><li>11. Wear oil-free protective garments such as leather gloves, a heavy shirt, cuffless trousers, boots, and a cap.</li><li>12. A loose cable connection can cause sparks and excessive heating.</li><li>13. Tighten all cable connections.</li><li>14. When there is an electrical connection between a work piece and the frame of wire feeder or the wire reel stand, arc may be generated and cause damage by a fire if the wire contacts the frame or the work piece.</li></ol>	

	<b>FUMES AND GASES</b> can be hazardous to your health.
<p>Arc welding produce fumes and gases. Breathing these fumes and gases can be hazardous to your health.</p> <ol style="list-style-type: none"><li>1. Keep your head out of the fumes. Do not breathe the fumes.</li><li>2. Ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.</li><li>3. If ventilation is poor, use an approved air-supplied respirator.</li><li>4. Read the Material Safety Data Sheets (MSDS) and the manufacturer's instructions on metals, consumables, coatings, and cleaners.</li><li>5. Do not weld or cut in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.</li><li>6. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.</li></ol>	


## 2. ARC WELDING SAFETY PRECAUTIONS (continued)

	<p><b>CYLINDER</b> can explode if damaged.</p>
<p>A shielding gas cylinder contains high-pressure gas. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.</p> <ol style="list-style-type: none"> <li>1. Use only correct shielding gas cylinders, gas regulator, hoses, and fittings designed for the specific application; maintain them in good condition.</li> <li>2. Protect compressed gas cylinders from excessive heat, mechanical shock, and arcs.</li> <li>3. Keep the cylinder upright and securely chained to a stationary support or a rack to prevent falling or tipping.</li> <li>4. Keep cylinders away from any welding or other electrical circuit.</li> <li>5. Never touch cylinder with welding electrode.</li> <li>6. Read and follow instructions on compressed gas cylinders, associated equipment, and the CGA publication P-1 listed in <b>PRINCIPAL SAFETY STANDARDS</b>.</li> <li>7. Turn face away from valve outlet when opening cylinder valve.</li> <li>8. Keep protective cap in place over valve except when gas cylinder is in use or connected for use.</li> <li>9. Do not disassemble or repair the gas regulator except for the person authorized by the manufacturer of them.</li> </ol>	

 <b>CAUTION</b>	
<p>Be sure to observe the followings for preventing physical injuries, a fire and electric shock.</p>	
<p><b>Handling of plastic parts</b>          Front panel and the likes on this power source are made of polycarbonate.          Make sure to observe the following notice.</p> <ol style="list-style-type: none"> <li>(2) Do not apply external force and a shock to front panel and the likes. Otherwise it maybe broken and in trouble.</li> <li>(3) Polycarbonate can endure wiping off with water and alcohol in general but using at a sticking place with an organic solvent, chemicals, cutting oil and atmosphere such as composition oil, it gives bad influence to polycarbonate and it causes a crack (breaking) and a strength down.            If abnormality was discovered such as crack on the front panel, stop operating immediately and ask to repair and change.</li> </ol>	

		<p>Rotating parts may cause injuries. Be sure to observe the following.</p>
<p>If hands, fingers, hair or clothes are put near the fan's rotating parts or wire feeder's feed roll, injuries may occur.</p> <ol style="list-style-type: none"> <li>1. Do not use this equipment if the case and the cover are removed.</li> <li>2. When the case is removed for maintenance/inspection and repair, certified or experienced operators must perform the work. Erect a fence, etc. around this equipment to keep others away from it.</li> <li>3. Do not put hands, fingers, hair or clothes near the rotating fans or wire feed roll.</li> </ol>		

## 2. ARC WELDING SAFETY PRECAUTIONS (continued)

	<p><b>ARC WELDING</b> work areas are potentially hazardous.</p>
<p><b>FALLING</b> or <b>MOVING</b> machine can cause serious injury.</p> <ol style="list-style-type: none"><li>2. When hanging the welding power source by a crane, do not use the carrying handle.</li><li>3. Put the welding power source and wire feeder solidly on a flat surface.</li><li>4. Do not pull the welding power source across a floor laid with cables and hoses.</li><li>5. Do not put wire feeder on the welding power source.</li><li>6. Do not put the welding power source and wire feeder where they will pit or fall.</li></ol> <p><b>WELDING WIRE</b> can cause puncture wounds.</p> <ol style="list-style-type: none"><li>1. Do not press gun trigger until instructed to do so.</li><li>2. Do not point gun toward any part of the body, other people, or any metal when threading welding wire.</li></ol>	



## PRINCIPAL SAFETY STANDARDS

Arc welding equipment – Installation and use, Technical Specification IEC 62081, from International Electro technical Commission

Arc welding equipment Part 1: Welding power sources IEC 60974-1, from International Electro technical Commission

Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society.

Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office.

Recommended Practices for Plasma Arc Cutting, American Welding Society Standard AWS C5.2, from American Welding Society.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society.

National Electrical Code, NFPA Standard 70, from National Fire Protection Association.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association.

Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales.

Safe Practices For Occupation And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute.

Cutting And Welding Processes, NFPA Standard 51B, from National Fire Protection Association.

NOTE: The codes listed above may be improved or eliminated. Always refer to the updated codes.

M050906

### 3. GENERAL NOTICE OF OPERATION

#### 3.1 Rated Duty Cycle

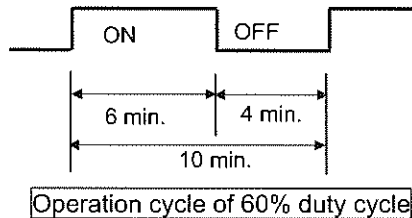
**⚠ CAUTION**

● Use this welding power source at or under the rated duty cycle. Exceeding the rated duty cycle limitation may result in damage to the welding machine.

- The rated duty cycle of the welding power source is the following:

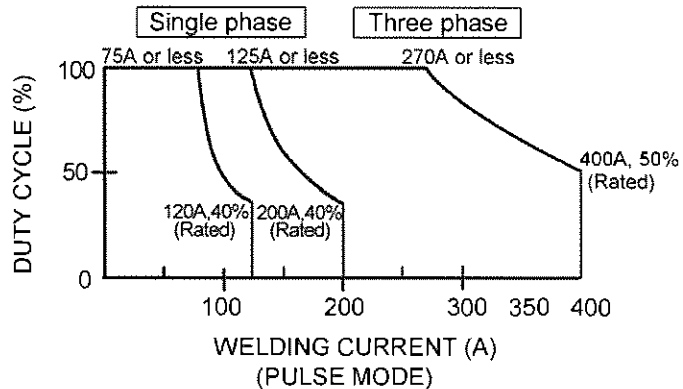
	Three phase (208/230/460V)		Single phase (208/230V)	
	For welding any alloys		For welding Aluminum with 3/64" wire or less	For welding with all other wires
Pulse mode	400A, 50%		200A, 40%	120A, 40%
DC mode	400A, 60%		250A, 40%	120A, 40%

- The duty cycle of 60% means the way the machine is rested for 4 minutes after 6 minutes of continuous welding at the rated current.

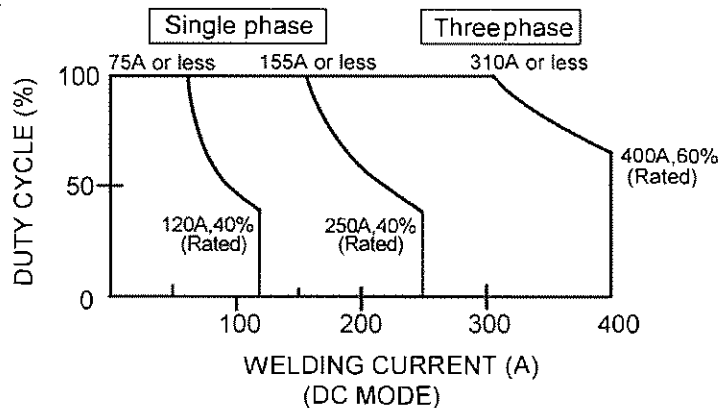


- Failure to observe duty cycle limitations may cause an excess of the tolerance of the temperature inside the welding machine. This may contribute to premature welding machine failure or product damage.

- The figure shown right indicates the relation between welding current and duty cycle. Use the welding machine within its usable range, following the duty cycle for the welding current.



- The duty cycle of the welding power source is also limited by the duty cycles of accessories combined with such as welding torches. Use the welding machine within the lowest rated duty cycle of the accessories.



#### 3.2 Applicable Welding Process and Wire Diameter

Refer to Section 10.1.1, "Setting of Welding Mode" for details of applicable welding method and wire diameter.

#### 3.3 Limitation of use

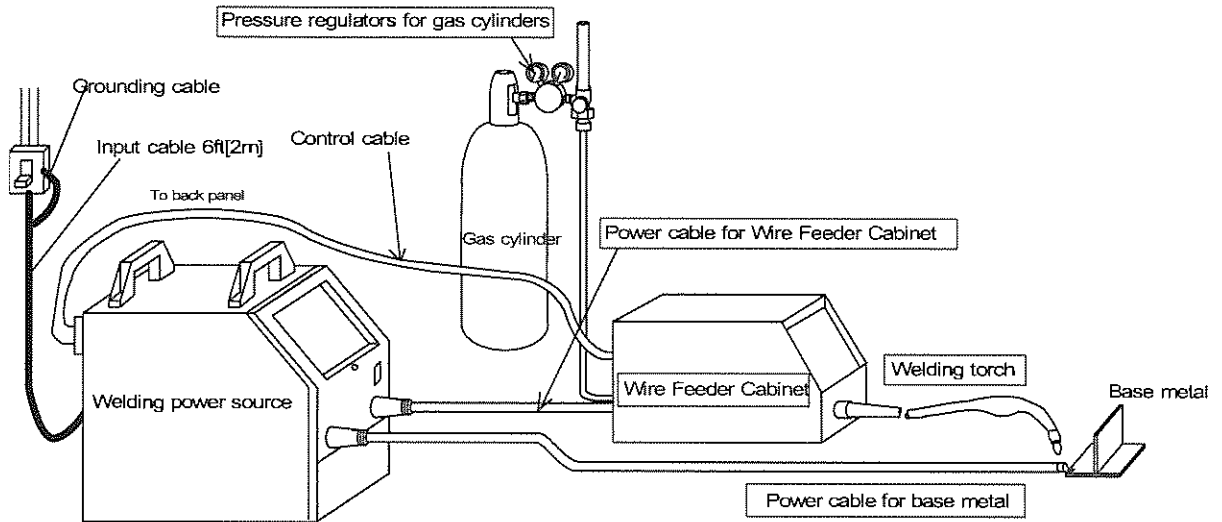
- Do not use this welding power source for pipe thawing.

## 4. STANDARD COMPOSITION AND ACCESSORIES

### 4.1 Standard Composition

- The parts names indicated in the boxes are standard parts. They are not supplied with this welding machine. Preparation of the standard parts except the welding power source is required to use the welding power source.
- Input cable and grounding cable  
For a switch box, the 6.5ft [2m] input and grounding cables are from the back panel of welding power source.

Input cable	AWG8 [8mm <sup>2</sup> ] with 10mmφ terminal x 3
Grounding cable	AWG8 [8mm <sup>2</sup> ] with 10mmφ terminal x 1



**NOTE:** Use power cable size as follows  
 Up to 33ft [10m]: AWG 2/0 [60mm<sup>2</sup>]  
 Up to 66ft [20m]: AWG 3/0 [80mm<sup>2</sup>]

**Ground a work piece if a local law requires.**

## 4. STANDARD COMPOSITION AND ACCESSORIES (continued)

### 4.2 Accessory

Make sure you have the item below before you start using the welding power source.

Description	Specification	Q'ty	Part number	Remarks
Power cable connector	DIX SKK 70	2	153-0755	For the power cable to welding power source

### 4.3 Preparation of consumables for welding

#### (1) Shield Gas

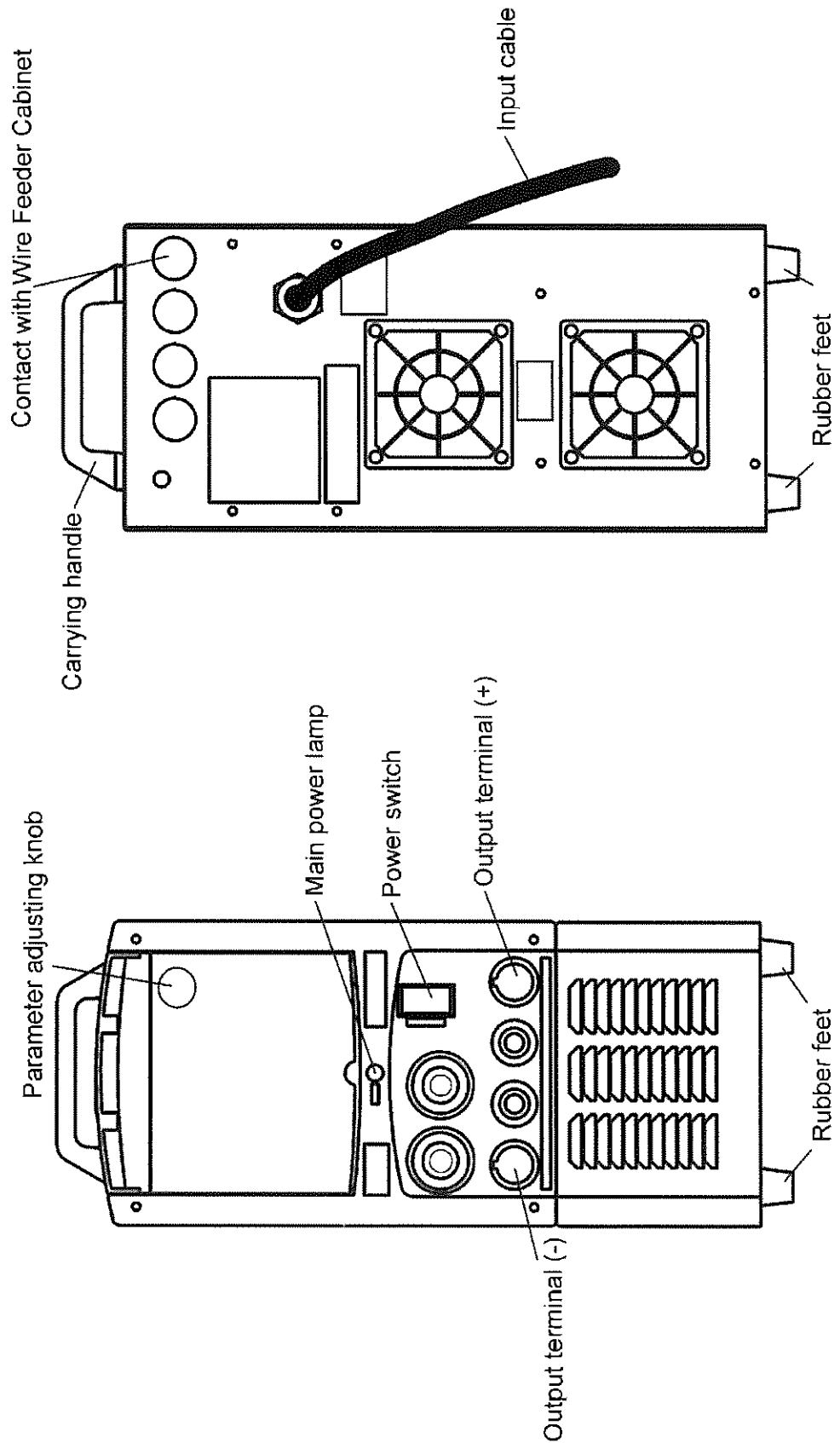
Use a suitable gas for welding method.

- Carbon dioxide gas (CO<sub>2</sub> gas)  
For welding (purity: 99.9% or more, moisture content: 0.002% or less)
- MAG gas  
80% argon (Ar) + 20% carbon dioxide gas (CO<sub>2</sub> gas)
- MIG gas for stainless steel without pulse  
90% helium (He) + 7.5% argon (Ar) + 2.5% oxygen (O<sub>2</sub>)
- MIG gas for stainless steel with pulse  
66% argon (Ar) + 33% helium (He) + 1% carbon dioxide gas (CO<sub>2</sub> gas)
- MIG gas for Aluminum  
Pure argon (Ar)

#### (2) Welding Wire


## 5. FUNCTION OF EQUIPMENT


### 5.1 Welding Power Source



## 6. NECESSARY POWER SOURCE EQUIPMENT

### 6.1 Welding Power Source Equipment (for commercial use)


 <b>WARNING</b>
● <b>When the welding machine is used in such a humid environment as construction site, on the steel plate, or on steel structure, install a leakage breaker.</b>

 <b>CAUTION</b>
● <b>Be sure to install a switch with fuse or a circuit breaker (for motor) to the input sides of each welding machine.</b>

#### Capacity of Necessary Power Source Utility

MODEL	Cobra Mig CM-400P
Power supply voltage	208/230/460V, Three phase 208/230V, Single phase The welding power source links the primary voltage automatically.
Tolerance range of fluctuation of power supply voltage	208/230/460V±10%, Three phase 208/230V±10%, Single phase
Installed capacity	24kVA or more
Capacity of switch/circuit breaker	70 A for 208/230V, 50A for 460V

### 6.2 Precautions for Use of the Engine Generator




 <b>CAUTION</b>
● <b>Use the auxiliary power of engine welder whose voltage waveform has been improved. Some of the engine welders have poor electricity, which may cause product damage. Contact an engine welder manufacturer for improvement of waveform.</b>

To prevent the engine generator or auxiliary power from being damaged, follow the instructions below.




- Set the output voltage of the engine generator to the voltage range between 230 and 240V at no-load welding operation. Setting to extremely high output voltage may result in product damage.
- Use the engine generator with a damper winding of which capacity is more than twice as much as the rated input of the welding machine. Generally, the recovery time of the engine generator's voltage for load change is slower than that of the commercial input power source, and if the engine generator does not have sufficient capacity, sudden current change such as arc start will occur. This may result in abnormal decrease in output current or arc loss. Ask an engine generator manufacturer for a damper winding.
- Do not combine more than two welding machines with an engine generator. The affect of each welding machine may cause easy loss of arc.

## 7. TRANSPORT AND INSTALLATION


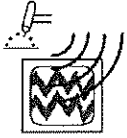
### 7.1 Transport


 <b>WARNING</b>	
<b>Follow the instructions below to avoid trouble and product damage when carrying the welding machine.</b>	
	<ul style="list-style-type: none"> <li>● Do not touch the charging parts inside or outside the welding machine.</li> <li>● Be sure to disconnect the line disconnect switch when carrying the welding machine.</li> </ul>
	<ul style="list-style-type: none"> <li>● When hanging the welding power source by a crane, do not use the carrying handle.</li> </ul>

### 7.2 Installation

 <b>WARNING</b>	
<b>When installing the welding machine, follow the instructions below to avoid a fire caused by welding and physical damages by fume gas.</b>	
	<ul style="list-style-type: none"> <li>● Do not place the welding machine near combustible materials and flammable gas.</li> <li>● Remove combustible materials to prevent dross coming into contact with combustible objects. If that not possible, cover them with noncombustible covers.</li> </ul>
	<ul style="list-style-type: none"> <li>● To avoid gas poisoning and danger of suffocation, wear a gas mask or adequately ventilate when the welding machine is used in the place regulated by a local law.</li> <li>● To prevent disorder or poisoning caused by fume, wear a gas mask or weld at a partial exhaust facility approved by the local regulation.</li> <li>● Adequately ventilate or wear a gas mask when using the welding machine in a tank, a boiler, a hold of a ship, because heavier gas such as carbon dioxide or argon gases are drifting there.</li> <li>● When using the welding machine at a narrow space, comply with a trained supervisor's directions. And be sure to wear a gas mask.</li> <li>● Do not operate the welding machine near the place where degreasing, cleansing, and spraying are performed. Otherwise, poisonous gas may be generated.</li> <li>● Be sure to wear a gas mask or adequately ventilate when welding a coating steel plate. (Poisonous gas and fume may be generated.)</li> </ul>


## 7. TRANSPORT AND INSTALLATION (continued)

 CAUTION	
	To prevent electromagnetic troubles, read the following. Also, if electromagnetic troubles occur, check the following again.
<p>Since large current abruptly flows inside the welding machine during welding, other machines near the welding power source may be troubled due to electromagnetic noise</p> <ul style="list-style-type: none"><li>● Do not ground the welding power source commonly with other machines.</li><li>● Close and fix all doors and covers of the welding machine.</li><li>● Do not use an unnecessarily long cable.</li><li>● Place a base metal cable and a torch side cable as closely as possible.</li></ul> <p>In the event of electromagnetic trouble, follow the instructions below.</p> <ul style="list-style-type: none"><li>● Change the installation place of the welding machine.</li><li>● Keep the machines which may be affected away as far from the welding machine, cables and welding site as possible.</li><li>● Add a noise filter to the input cables.</li><li>● Mount an input cable in the grounded metallic conduit.</li><li>● Shield the whole welding places from electromagnetic trouble. If electromagnetic troubles are still not solved after following the above instructions, consult your nearest DAIHEN dealer.</li></ul>	

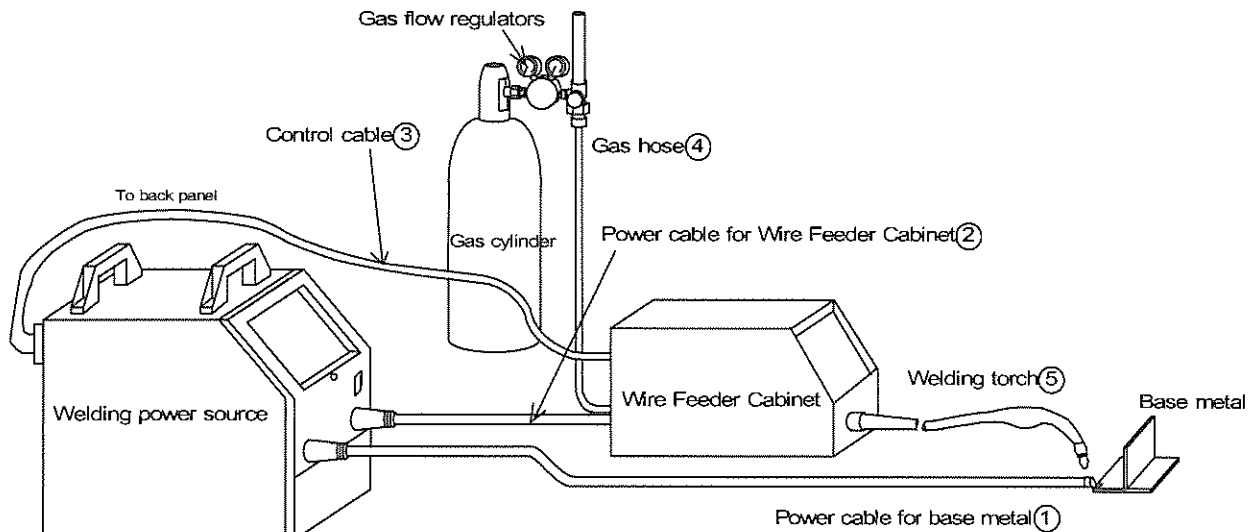
 CAUTION	
Follow the instructions below when selecting an installation place of the welding power source.	
<ul style="list-style-type: none"><li>● Do not install the welding power source in the place subject to direct sunlight and rain.</li><li>● Place the welding machine on a strong and stable surface.</li><li>● Install the welding machine in the place where the ambient temperature is between +14 °F and +104 °F [-10 °C and +40 °C].</li><li>● Do not install the welding machine in the place where metal material such as spatter enters the welding power source.</li><li>● Keep the install distance of 1ft [30 cm] between the welding power source and the wall or other welding power.</li><li>● Install a wind shield to protect arc from wind.</li><li>● Fix the gas cylinder to the stand only for gas cylinder.</li></ul>	



## 8. CONNECTION PROCEDURE AND GROUND FOR SAFETY USE

<b>⚠ WARNING</b>	
	Follow the instructions below to avoid electric shock.
<p>* Do not touch the charging parts, as this will result in fatal shock and severe burn.</p> <ul style="list-style-type: none"><li>● Do not touch the charging parts of the welding machine.</li><li>● Have a qualified electric engineer ground the case of the welding power source and the base metal or jig electrically connected, following a local law.</li><li>● With the line disconnect switch inside the switch box all turned off, ground and connect the welding machine.</li><li>● Do not use a cable with lack of capacity or a cable seriously damaged.</li><li>● Tighten and insulate the connections of cables.</li><li>● Surely attach the cover of the welding machine after connection of the cables.</li></ul>	

### 8.1 Connecting of the Welding Power Source





**Ground a work piece if a local law requires.**


Follow the steps below to attach the cables to the output connectors of the welding power source referring to the illustrations of "Connection of the Welding Power Source" on the previous page.

1. Connect the power cable for base metal between the base metal and "output terminal  $\ominus$ ".
2. Connect the power cable for Wire Feeder Cabinet between the back side of Wire Feeder Cabinet and "output terminal  $\oplus$ ".
3. Insert the control cable for Wire Feeder Cabinet into the socket for Wire Feeder Cabinet.
4. Attach the gas hose to the gas inlet on the Wire Feeder Cabinet.
5. Connect the welding torch to the Wire Feeder Cabinet.

## 8. CONNECTION PROCEDURE AND GROUND FOR SAFETY USE (continued)


### 8.2 Connecting of the Gas Hose

 <b>WARNING</b>	
	<ul style="list-style-type: none"><li>● You may suffer from danger of suffocation caused by lack of oxygen when shield gas keeps drifting in a closed place. Be sure to turn off the shield gas at the main when the welding power source is not in use.</li></ul>

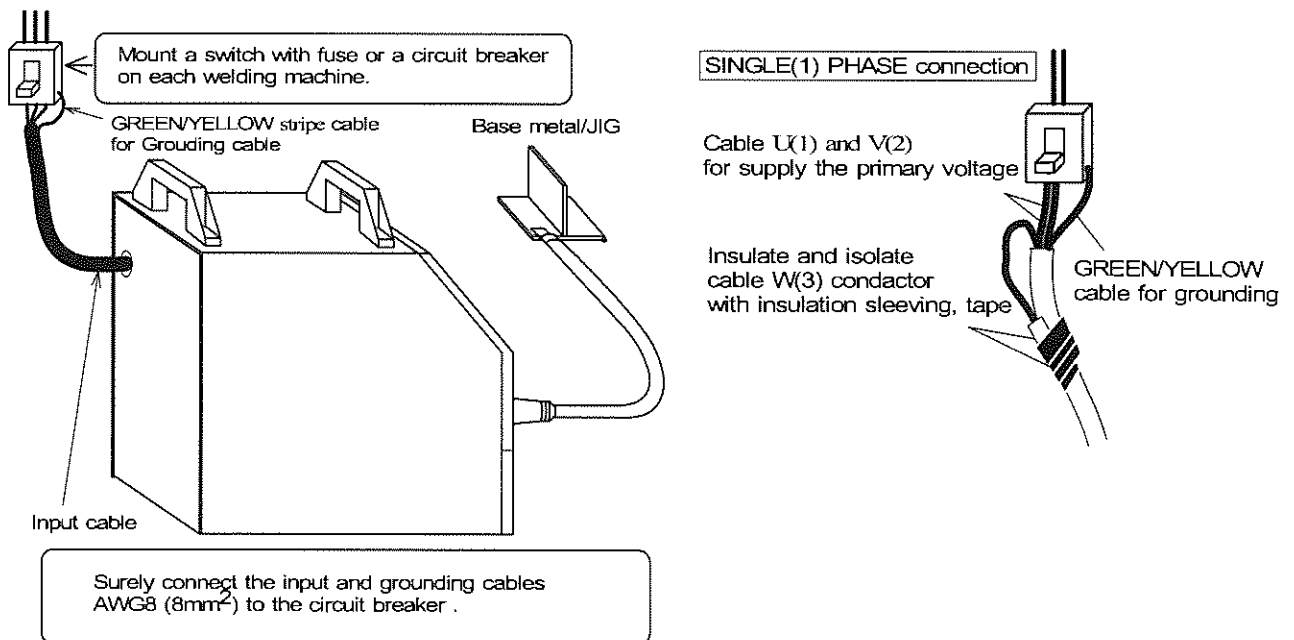
 <b>CAUTION</b>	
<ul style="list-style-type: none"><li>● Be sure to connect the gas hose after fixing to the stand, as physical injuries may result from falling down of gas cylinder.</li><li>● Attach a proper gas flow regulator to a gas cylinder. Failure to observe the demand may result in physical injuries. The gas flow regulator for high pressure gas must be used.</li></ul>	

1. Securely attach the gas hose to the gas inlet located on the rear side of the Wire Feeder Cabinet with a monkey wrench, etc.
2. Fix the nut for attaching gas cylinder to the gas cylinder with a monkey wrench, etc.
3. Securely attach the gas hose to the gas outlet with a monkey wrench, etc.

## 8. CONNECTION PROCEDURE AND GROUND FOR SAFETY USE (continued)

<b>⚠ WARNING</b>	
	Follow the instructions below to avoid electric shock.
<p>* Touching the charging parts may result in fatal electric shock and severe burn.</p> <ul style="list-style-type: none"> <li>● Do not touch the charging parts of the welding machine.</li> <li>● Have a qualified electric engineer ground the case of the welding power source and the base metal or jig electrically connected in accordance with a local law.</li> <li>● With the line disconnect switch in the switch box all touched off, ground and connect the welding machine.</li> </ul>	


<b>⚠ CAUTION</b>	
<ul style="list-style-type: none"> <li>● Be sure to install a switch with fuse or a circuit breaker (for motor) to the input sides of each welding machine.</li> </ul>	




<b>⚠ CAUTION</b>	
<p>Be sure to ground the case of the welding power source.          Use a grounding cable of which thickness is more than AWG8 [8mm<sup>2</sup>].</p>	
<ul style="list-style-type: none"> <li>● If the welding power source which is not grounded is used, voltage will be generated in the case through the capacitor between the welding power source input circuit and the case or floating capacity (electrostatic capacity naturally generated between the input conductor and the case metal). If you touch the case or the base metal, you may suffer from electric shock. Be sure to ground the case of the welding power source.</li> </ul>	

## 9. WELDING PREPERATION

### 9.1 Preparing the Protective Equipment

	<p>To protect you from gas generated from welding, fume, and lack of oxygen, wear protective equipment.</p>
<ul style="list-style-type: none"><li>● To avoid gas poisoning and danger of suffocation, wear a gas mask or adequately ventilate when the welding machine is used in the place regulated by a local law.</li><li>● To prevent disorder or poisoning caused by fume, wear a gas mask or weld at a partial exhaust facility approved by the local regulation.</li><li>● Adequately ventilate or wear a gas mask when using the welding machine in a tank, a boiler, a hold of a ship, because heavier gas such as carbon dioxide or argon gases are drifting</li><li>● When using the welding machine at a narrow space, comply with a trained supervisor's directions. And be sure to wear a gas mask.</li><li>● Do not operate the welding machine near the places where degreasing, cleansing, and spraying are performed. Otherwise, poisonous gas may be generated.</li><li>● Be sure to wear a gas mask or adequately ventilate when welding a coating steel plate. (Poisonous gas and fume may be generated.)</li></ul>	

**NOTE:** Install a windshield to protect arc from wind when using an electric fan for ventilation or when welding outdoors. Failure to observe the demand may result in poor welding.

<b>⚠ CAUTION</b>	
	<p>Use the protective equipment to protect you and other workers from arc rays, spattering dross, and noise from welding operation.</p>
<ul style="list-style-type: none"><li>● When performing or monitoring welding operation, wear an eye protector with a good light blocking effect or face shield.</li><li>● Wear protective glasses to protect your eyes from the spattering dross.</li><li>● Wear protective equipment such as protective gloves, long-sleeve clothes, leg covers, and leather apron.</li><li>● Install protective screens or barriers to protect the eyes of others in the work area from arc ray.</li><li>● Wear an ear protector when noise level is high.</li></ul>	

## 9. WELDING PREPARATION (continued)

### 9.2 Welding Conditions

When setting to the improper welding conditions, the following troubles will occur.

Cause	Trouble
Wire extension is too long.	<ul style="list-style-type: none"> <li>• Long Arc length</li> <li>• Wide bead width</li> <li>• Poor shield</li> </ul>
Wire extension is too short.	<ul style="list-style-type: none"> <li>• Short arc length</li> <li>• Easy generation of spatter</li> </ul>
Arc voltage is too high.	<ul style="list-style-type: none"> <li>• Long arc length</li> <li>• Wide bead width</li> <li>• Shallow penetration and flat bead</li> </ul>
Arc voltage is too low.	<ul style="list-style-type: none"> <li>• Stick to base metal and easy generation of spatter</li> <li>• Narrow bead width</li> <li>• Deep penetration and high excess metal</li> </ul>
Welding current is too high.	<ul style="list-style-type: none"> <li>• Wide bead width</li> <li>• Deep penetration and high excess metal</li> </ul>
Travel speed is too fast.	<ul style="list-style-type: none"> <li>• Narrow bead width</li> <li>• Shallow penetration and low excess metal</li> </ul>

The data in the tables below is only for reference. Please find the optimum welding conditions for weldment shape and welding position.

#### 9.2.1 Example CO<sub>2</sub> Welding Conditions

##### (1) Example Welding Conditions of Horizontal Fillet

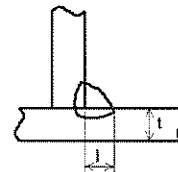


Plate thickness t ([mm])	Leg length l ([mm])	Wire diameter ([mm] φ)	Welding current (A)	Arc voltage (V)	Travel speed (IPM [cm/min])	CO <sub>2</sub> gas flow rate (CFM [ℓ/min])
18ga. [1.2]	0.10"-0.12" [2.5-3.0]	0.035" [0.9-1.0]	70-100	18-19	19.7-23.6 [50-60]	0.35-0.53 [10-15]
16ga. [1.6]	0.10"-0.12" [2.5-3.0]	0.035"-0.045" [0.9-1.2]	90-120	18-20	19.7-23.6 [50-60]	0.35-0.53 [10-15]
14ga. [2.0]	0.12"-0.14" [3.0-3.5]	0.035"-0.045" [0.9-1.2]	100-130	19-20	19.7-23.6 [50-60]	0.53-0.71 [15-20]
12ga. [2.3]	0.12"-0.14" [3.0-3.5]	0.035"-0.045" [0.9-1.2]	120-140	19-21	19.7-23.6 [50-60]	0.53-0.71 [15-20]
1/8" [3.2]	0.12"-0.16" [3.0-4.0]	0.035"-0.045" [0.9-1.2]	130-170	19-21	17.7-21.7 [45-55]	0.53-0.71 [15-20]
3/16" [4.5]	0.16"-0.18" [4.0-4.5]	0.045" [1.2]	190-230	22-24	17.7-21.7 [45-55]	0.53-0.71 [15-20]
1/4" [6.0]	0.20"-0.24" [5.0-6.0]	0.045" [1.2]	250-280	26-29	15.7-19.7 [40-50]	0.53-0.71 [15-20]
3/8" [9.0]	0.24"-0.28" [6.0-7.0]	0.045" [1.2]	280-300	29-32	13.8-15.7 [35-40]	0.53-0.71 [15-20]
1/2" [12.0]	0.28"-0.32" [7.0-8.0]	0.045" [1.2]	300-340	32-34	11.8-13.8 [30-35]	0.71-0.88 [20-25]

## 9. WELDING PREPARATION (continued)

### (2) Example Welding Conditions of Down Fillet

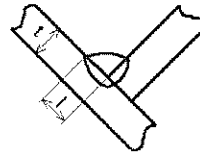


Plate thickness t ([mm])	Leg length l ([mm])	Wire diameter ([mm] φ)	Welding current (A)	Arc voltage (V)	Travel speed (IPM [cm/min])	CO <sub>2</sub> gas flow rate (CFM [ℓ/min])
18ga. [1.2]	0.10"-0.12" [2.5—3.0]	0.035" [0.9, 1.0]	70—100	18—19	19.7-23.6 [50—60]	0.35-0.53 [10—15]
16ga. [1.6]	0.10"-0.12" [2.5—3.0]	0.035"-0.045" [0.9—1.2]	90—120	18—20	19.7-23.6 [50—60]	0.35-0.53 [10—15]
14ga. [2.0]	0.12"-0.14" [3.0—3.5]	0.035"-0.045" [0.9—1.2]	100—130	19—20	19.7-23.6 [50—60]	0.53-0.71 [15—20]
12ga. [2.3]	0.12"-0.14" [3.0—3.5]	0.035"-0.045" [0.9—1.2]	120—140	19—21	19.7-23.6 [50—60]	0.53-0.71 [15—20]
1/8" [3.2]	0.12"-0.16" [3.0—4.0]	0.035"-0.045" [0.9—1.2]	130—170	20—22	17.7-21.7 [45—55]	0.53-0.71 [15—20]
3/16" [4.5]	0.16"-0.18" [4.0—4.5]	0.045" [1.2]	200—250	23—26	17.7-21.7 [45—55]	0.53-0.71 [15—20]
1/4" [6.0]	0.20"-0.24" [5.0—6.0]	0.045" [1.2]	280—300	29—32	15.7-19.7 [40—50]	0.53-0.71 [15—20]
3/8" [9.0]	0.24"-0.32" [6.0—8.0]	0.045" [1.2]	300—350	32—34	15.7-17.7 [40—45]	0.53-0.71 [15—20]
1/2" [12.0]	0.39"-0.47" [10.0—12.0]	0.045" [1.2]	320—350	33—36	9.8-13.8 [25—35]	0.71-0.88 [20—25]

### (3) Example Welding Conditions of I Shape Butt without Backing Plate

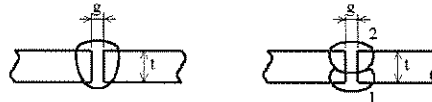
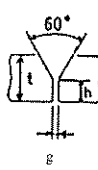
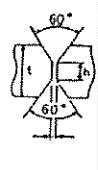




Plate thickness t ([mm])	Root gap g ([mm])	Wire diameter ([mm] φ)	Welding current (A)	Arc voltage (V)	Travel speed (IPM [cm/min])	CO <sub>2</sub> gas flow rate (CFM [ℓ/min])	Number of layers
18ga. [1.2]	0	0.035",0.040" [0.9, 1.0]	70—80	17—18	17.7-21.7 [45—55]	0.35 [10]	1
16ga. [1.6]	0	0.035",0.040" [0.9, 1.0]	80—100	18—19	17.7-21.7 [45—55]	0.35-0.53 [10—15]	1
14ga. [2.0]	0-0.02" [0—0.5]	0.035",0.040" [0.9, 1.0]	100—110	19—20	19.7-21.7 [50—55]	0.35-0.53 [10—15]	1
12ga. [2.3]	0.02"-0.04" [0.5—1.0]	0.035",0.040" [0.9, 1.0]	110—130	19—20	19.7-21.7 [50—55]	0.35-0.53 [10—15]	1
1/8" [3.2]	0.04"-0.05" [1.0—1.2]	0.035",0.040" [0.9, 1.0]	130—150	19—21	15.7-19.7 [40—50]	0.35-0.53 [10—15]	1
3/16" [4.5]	0.05"-0.06" [1.2—1.5]	0.045" [1.2]	150—170	21—23	15.7-19.7 [40—50]	0.35-0.53 [10—15]	1
1/4" [6.0]	0.05"-0.06" [1.2—1.5]	0.045" [1.2]	220—260	24—26	15.7-19.7 [40—50]	0.53-0.71 [15—20]	Front 1 Back 1
3/8" [9.0]	0.05"-0.06" [1.2—1.5]	0.045" [1.2]	320—340	32—34	17.7-21.7 [45—55]	0.53-0.71 [15—20]	Front 1 Back 1

## 9. WELDING PREPARATION (continued)

### (4) Example Welding Conditions of Single and Double Grooves

Plate thickness t ([mm])	Bevel shape	Root gap g ([mm])	Root face h ([mm])	Wire diameter ([mm] φ)	Welding current (A)	Arc voltage (V)	Travel speed (IPM [cm/min])	CO <sub>2</sub> gas flow rate (CFM [ℓ/min])	Number of layers	
1/2" [12.0]		0-0.02" [0-0.5]	0.16" -0.23" [4-6]	0.045" [1.2]	300-350	32-35	11.8-15.7 [30-40]	0.71-0.88 [20-25]	Front	
					300-350	32-35	17.7-19.7 [45-50]	0.71-0.88 [20-25]	Back	
				1/16" [1.6]	380-420	32-35	13.8-19.7 [35-50]	0.71-0.88 [20-25]	Front	
					380-420	32-35	17.7-19.7 [45-50]	0.71-0.88 [20-25]	Back	
5/8" [16.0]		0-0.02" [0-0.5]	0.16" -0.23" [4-6]	0.045" [1.2]	300-350	32-35	11.8-15.7 [30-40]	0.71-0.88 [20-25]	Front	
					300-350	32-35	17.7-19.7 [45-50]	0.71-0.88 [20-25]	Back	
				1/16" [1.6]	380-420	32-35	13.8-19.7 [35-50]	0.71-0.88 [20-25]	Front	
					380-420	32-35	17.7-19.7 [45-50]	0.71-0.88 [20-25]	Back	
5/8" [16]		0	0.16" -0.23" [4-6]	0.045" [1.2]	300-350	32-35	11.8-13.8 [30-35]	0.71-0.88 [20-25]	Front	
					300-350	32-35	11.8-13.8 [30-35]	0.71-0.88 [20-25]	Back	
				1/16" [1.6]	380-420	36-39	13.8-15.7 [35-40]	0.71-0.88 [20-25]	Front	
					380-420	36-39	13.8-15.7 [35-40]	0.71-0.88 [20-25]	Back	
3/4" [19]		0	0.20" -0.28" [5-7]	1/16" [1.6]	400-450	36-42	9.8-11.8 [25-30]	0.71-0.88 [20-25]	Front	
					400-450	36-42	9.8-11.8 [25-30]	0.71-0.88 [20-25]	Back	
1"				400-420	36-39	15.7-17.7 [40-45]	0.71-0.88 [20-25]	1	F	
				400-420	39-42	11.8-13.8 [30-35]	0.71-0.88 [20-25]	2	B	
1"	400-420	36-39	15.7-17.7 [40-45]	0.71-0.88 [20-25]	1	F				
	400-450	39-42	11.8-13.8 [30-35]	0.71-0.88 [20-25]	2	B				

## 9. WELDING PREPARATION (continued)

- Example Welding Conditions of Lap Fillet

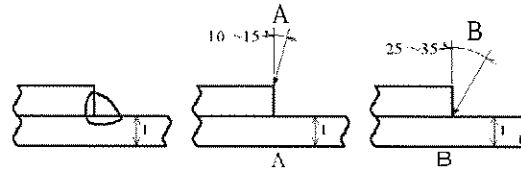
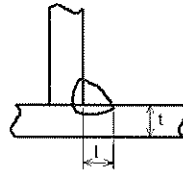


Plate thickness t ([mm])	Wire diameter ([mm] φ)	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])	Mark position	CO <sub>2</sub> gas flow rate (CFM [ℓ/min])
18ga. [1.2]	0.035"-0.040" [0.9-1.0]	80-100	18-19	17.7-21.7 [45-55]	A	0.35-0.53 [10-15]
16ga. [1.6]	0.035"-0.045" [0.9-1.2]	100-120	18-20	17.7-21.7 [45-55]	A	0.35-0.53 [10-15]
14ga. [2.0]	0.035"-0.045" [0.9-1.2]	100-130	18-20	17.7-21.7 [45-55]	A or B	0.53-0.71 [15-20]
12ga. [2.3]	0.035"-0.045" [0.9-1.2]	120-140	19-21	17.7-19.7 [45-50]	B	0.53-0.71 [15-20]
1/8" [3.2]	0.035"-0.045" [0.9-1.2]	130-160	19-22	17.7-19.7 [45-50]	B	0.53-0.71 [15-20]
3/16" [4.5]	0.045" [1.2]	150-200	21-24	15.7-17.7 [40-45]	B	0.53-0.71 [15-20]

### 9.2.2 Example Welding Conditions of Wire CO<sub>2</sub> with Flux

(1) Example Welding Conditions of Horizontal Fillet



Leg length ℓ ([mm])	Wire diameter ([mm] φ)	Welding current (A)	Arc voltage (V)	Travel speed (IPM [cm/min])
0.16" [4]	0.045" [1.2]	250	27	19.7 [50]
	0.052" [1.4]	330	29	39.4 [100]
	1/16" [1.6]	350	31	41.3 [105]
0.20" [5]	0.045" [1.2]	270	29	19.7 [50]
	0.052" [1.4]	330	30	35.4 [90]
	1/16" [1.6]	370	33	35.4 [90]
0.24" [6]	0.045" [1.2]	270	29	17.7 [45]
	0.052" [1.4]	330	31	31.5 [80]
	1/16" [1.6]	380	34	31.5 [80]
0.28" [7]	0.045" [1.2]	280	30	15.7 [40]
	0.052" [1.4]	350	32	19.7 [50]
	1/16" [1.6]	380	34	25.6 [65]
0.32" [8]	0.045" [1.2]	300	31	11.8 [30]
	0.052" [1.4]	350	33	17.7 [45]
	1/16" [1.6]	380	34	20.5 [52]
0.35" [9]	0.045" [1.2]	320	32	11.8 [30]
	0.052" [1.4]	350	34	15.7 [40]
	1/16" [1.6]	380	34	15.7 [40]



## 9. WELDING PREPARATION (continued)

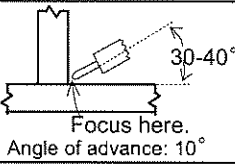
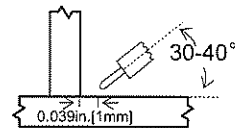
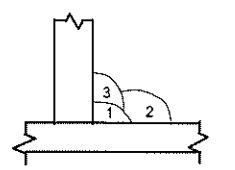
### 9.2.3 Example Welding Conditions of MAG Short Arc

Material: Soft steel, Gas: Mixture gas of Ar + CO<sub>2</sub> (0.35-0.53CFM [10–15 l/min])

Joint Geometry	Plate thickness t([mm])	Wire diameter ([mm]φ)	Gap ([mm])	Welding current (A)	Arc voltage (V)	Travel speed (IPM [cm/min])
Butt	20ga. [1.0]	0.030"-0.035" [0.8–1.0]	0	50–55	13–15	15.7-21.7 [40–55]
	18ga. [1.2]	0.030"-0.035" [0.8–1.0]	0	60–70	14–16	11.8-19.7 [30–50]
	16ga. [1.6]	0.030"-0.035" [0.8–1.0]	0	100–110	16–17	15.7-23.6 [40–60]
	12ga. [2.3]	0.035"-0.045" [1.0–1.2]	0-0.04" [0–1.0]	110-120	17–18	11.8-15.7 [30–40]
	1/8" [3.2]	0.035"-0.045" [1.0–1.2]	0.04"-0.06" [1.0–1.5]	120-140	17–19	9.8-11.8 [25–30]
	5/32" [4.0]	0.035"-0.045" [1.0–1.2]	0.06"-0.08" [1.5–2.0]	150-170	18–21	9.8-15.7 [25–40]

### 9.2.4 Example Welding Conditions of Pulse MAG

#### (1) Example Welding Conditions of Horizontal Fillet Welding

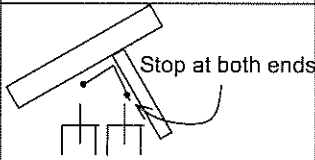
Plate thickness ([mm])	Leg length ([mm])	Aim angle and position	Number of layers	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])
1/8" [3.2]	0.12"-0.16" [3-4]	 <p>Focus here. Angle of advance: 10°</p>	1	150	26-27	23.6 [60]
3/16" [4.5]	0.20" [5.0]		1	170	26-27	15.7 [40]
1/4" [6.0]	0.24" [6.0]		1	200	27-28	15.7 [40]
5/32" [8.0]	0.32" [8.0]	 <p>0.039in. [1mm]</p>	1	250	29-30	13.8 [35]
1/2" [12.0]	0.39" [10.0]		1	180-200	25-27	17.7 [45]
			2	180-200	25-28	17.7 [45]
			3	180-200	25-28	17.7 [45]
5/8" [16.0]	0.47" [12.0]		1	220-230	25-28	17.7 [45]
			2	220-230	25-28	17.7 [45]
			3	210-230	25-28	17.7 [45]

## 9. WELDING PREPARATION (continued)

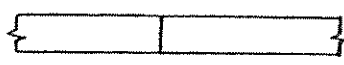

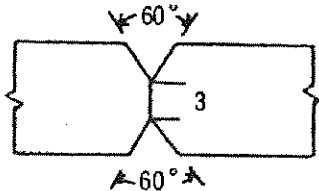
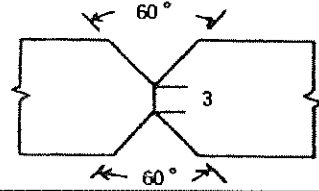
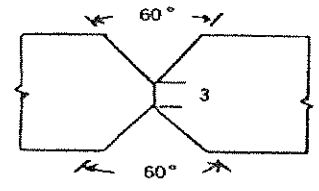
### (2) Example Welding Conditions of Downward Welding

Plate thickness t([mm])	Shape of joint weld	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])	Remarks
12ga. [2.3]	butt	100	22-23	2.3 [70]	Back bead appearance is good.
1/8" [3.2]	fillet	100	21-22	2.3 [70]	Leg length: 0.16"-0.20" [4 - 5mm], Throat depth: 0.10" [2.5mm]

### (3) Example Welding Conditions of Upward Welding

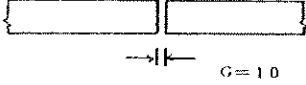
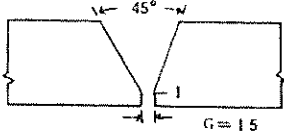
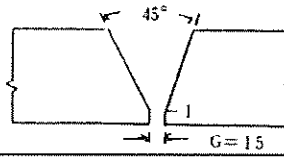
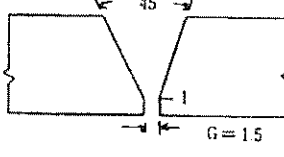
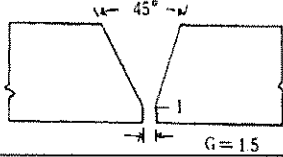
Plate thickness t ([mm])	Shape of joint weld	Welding current (A)	Welding voltage (V)	Remarks
1/2" [12.0]		100-110	20-21	Weaving Leg length: 0.39" [10.0mm]

### (4) Both Side Welding Conditions of (Semi-automatic)

Plate thickness ([mm])	Groove shape	Number of layers	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])
1/4" [6.0]		1	170	25-26	11.8 [30]
		2	180	26-27	11.8 [30]
3/8" [9.0]		1	270	29-30	11.8 [30]
		2	290	30-31	11.8 [30]
1/2" [12.0]		1	280	30-31	15.7 [40]
		2	330	33-34	15.7 [40]
3/4" [19.0]		Front 1	300	31-32	17.7 [45]
		Front 2	300	31-32	17.7 [45]
		Rear 1	340	32-33	17.7 [45]
		Rear 2	280	30-31	17.7 [45]
1" [25.0]		Front 1	300	31-32	17.7 [45]
		Front 2	320	32-33	17.7 [45]
		Front 3	320	32-33	17.7 [45]
		Rear 1	340	32-33	17.7 [45]
		Rear 2	320	32-33	17.7 [45]
		Rear 3	320	32-33	17.7 [45]

## 9. WELDING PREPARATION (continued)

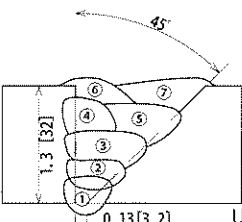
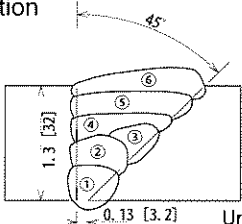
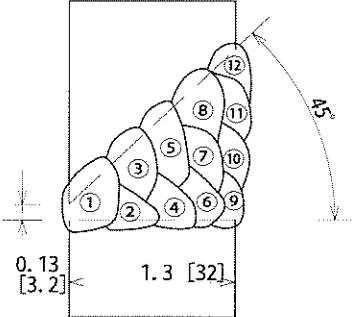
### (5) Example Welding Conditions of Single Side Welding Conditions (Automatic)

Plate thickness t([mm])	Groove shape	Number of layers	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])
1/8" [3.2]		1	140	24-25	19.7 [50]
1/4" [6.0]		1	130	23-24	9.8 [25]
		2	150	25-26	9.8 [25]
1/2" [12.0]		1	180	24-25	9.8 [25]
		2	290	30-32	9.8 [25]
1/2" [12.0]		1	180-190	24-25	9.8 [25]
		2	200	25-26	9.8 [25]
		3	200	26-27	9.8 [25]
3/4" [19.0]		1	180	24-25	9.8 [25]
		2	300	29-30	9.8 [25]
		3	300	29-30	9.8 [25]

Oscillation width: 0.05" [2 mm]  
Oscillation times: 120 times/min.

## 9. WELDING PREPARATION (continued)

### (6) Single Bevel Groove Penetration Welding Conditions (Semi-automatic)

Groove shape	Number of layers	Welding current (A)	Welding voltage (V)	Remark
<b>Flat position</b>  <p style="text-align: right;">Unit: in. [mm]</p>	1	100	20-21	Oscillation
	2	280	26-27	
	3	280	26-27	
	4	280	26-27	
	5	280	26-27	
	6	280	26-27	
	7	280	26-27	
<b>Vertical position</b>  <p style="text-align: right;">Unit: in. [mm]</p>	1	100	20-21	Oscillation
	2	130	21-22	
	3	130	21-22	
	4	130	21-22	
	5	130	21-22	
	6	120	19-20	
 <p style="text-align: right;">Unit: in. [mm]</p>	1	100-200	20-22	No oscillation
	2	200	24-25	
	3	200	24-25	
	4	200	24-25	
	5	200	24-25	
	6	200	24-25	
	7	200	24-25	
	8	200	24-25	
	9	180	24-25	
	10	180	24-25	
	11	180	24-25	
	12	180	24-25	

Wire diameter: 0.045" (1.2 mm)φ, Gas: 20% CO<sub>2</sub> + Ar

## 9. WELDING PREPARATION (continued)

### 9.2.5 Example Welding Conditions of Aluminum Pulse MIG

#### (1) Example Welding Conditions of I Shape Butt

Plate thickness ([mm])	Wire dia. ([mm] φ)	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])	Wire extension ([mm])	Gas flow rate (CFM [ℓ/min])
16ga. [1.5]	3/64" [1.2]	60-80	16-18	23.6-31.5 [60-80]	0.47"-0.59" [12-15]	0.71 [20]
14ga. [2.0]	3/64" [1.2]	70-80	17-18	15.7-19.7 [40-50]	0.59" [15]	0.71 [20]
1/8" [3.0]	3/64" [1.2]	80-100	17-18	15.7-19.7 [40-50]	0.59" [15]	0.71 [20]
5/32" [4.0]	3/64" [1.2]	90-120	18-21	15.7-19.7 [40-50]	0.59" [15]	0.71 [20]
1/4" [6.0]	3/64", 1/16" [1.2, .1.6]	150-180	20-23	15.7-19.7 [40-50]	0.59"-0.71" [15-18]	0.71 [20]

#### (2) Example Welding Conditions of Horizontal Fillet

Plate thickness ([mm])	Wire dia. ([mm] φ)	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])	Wire extension ([mm])	Gas flow rate (CFM [ℓ/min])
16ga. [1.5]	3/64" [1.2]	60-80	16-18	23.6 [60]	0.59" [15]	0.53-0.71 [15-20]
1/8" [3.0]	3/64" [1.2]	100-120	19-21	23.6 [60]	0.59" [15]	0.53-0.71 [15-20]
1/4" [6.0]	3/64", 1/16" [1.2, .1.6]	150-180	20-23	19.7-23.6 [50-60]	0.59" [15]	0.71 [20]

### 9.2.6 Example Short Welding Conditions of Aluminum MIG

#### (1) Example Short Welding Conditions of I Shape Butt

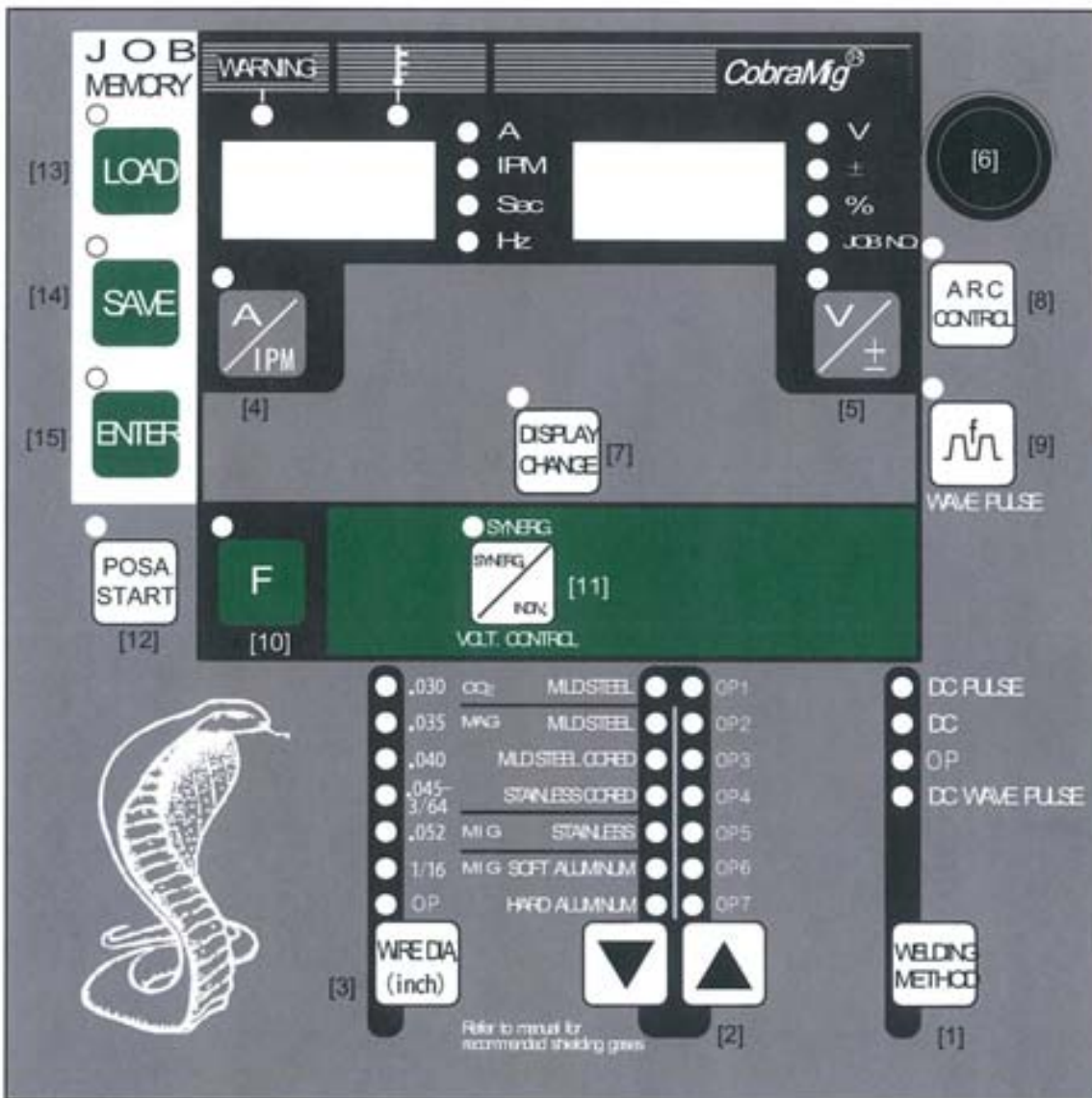
Plate thickness ([mm])	Wire dia. ([mm] φ)	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])	Wire extension ([mm])	Gas flow rate (CFM [ℓ/min])
1/8" [3.0]	3/64" [1.2]	120-140	20-22	23.6-31.5 [60-80]	0.59" [15]	0.71 [20]
5/32" [4.0]	3/64" [1.2]	150-170	22-24	23.6-31.5 [60-80]	0.59"-0.71" [15-18]	0.71 [20]
1/4" [6.0]	1/16" [1.6]	180-210	23-25	15.7-23.6 [40-60]	0.67"-0.79" [17-20]	0.71-0.88 [20-25]

#### (2) Example Short Welding Conditions of Horizontal Fillet

Plate thickness ([mm])	Wire dia. ([mm] φ)	Welding current (A)	Welding voltage (V)	Travel speed (IPM [cm/min])	Wire extension ([mm])	Gas flow rate (CFM [ℓ/min])
1/8" [3.0]	3/64" [1.2]	140-160	21-22	23.6-27.6 [60-70]	0.59" [15]	0.53-0.71 [15-20]
5/32" [4.0]	3/64" [1.2]	150-170	22-24	19.7-23.6 [50-60]	0.59"-0.71" [15-18]	0.53-0.71 [15-20]
1/4" [6.0]	1/16" [1.6]	200-230	23-25	19.7-25.6 [50-65]	0.67"-0.79" [17-20]	0.71-0.88 [20-25]

## 10. OPERATION

### 10. Front Panel



[1] WELDING METHOD key	[9] WAVE PULSE key
[2] WIRE/GAS selector keys	[10] F (FUNCTION) key
[3] WIRE DIA. (inch) key	[11] VOLT. CONTROL key
[4] A/IPM selector key	[12] POSA START key
[5] V/± selector key	[13] LOAD key
[6] Parameter adjusting knob	[14] SAVE key
[7] DISPLAY CHANGE key	[15] ENTER key
[8] ARC CONTROL key	

## 10. OPERATION (continued)

### CAUTION

- This welding machine should be operated by persons only after reading and understanding contents of this owner's manual and having knowledge and skills for handling the welding machine safely.
- Use this welding power source at or under the rated duty cycle. Exceeding the rated duty cycle limitation may result in damage to the welding machine.

When reading the operating instructions described below, unfold Page 64 so that you can read them confirming the location of the keys on the front panel.

### 10.1 Basic Settings

#### 10.1.1 Setting of Welding Mode

Choose the welding mode using the WELDING METHOD key [1], the WIRE/GAS selector keys [2], and the WIRE DIA (inch) key [3] in accord with the welding method and wire diameter used. The selectable welding modes are shown on the next page.

When setting the welding mode, select the welding method using the WELDING METHOD key [1] first. Once the welding method is set, the available wire diameters are automatically decided according to the welding method. Then, select wire/gas using the WIRE/GAS selector keys [2]. Finally, set the wire diameter with the WIRE DIA (inch) key [3].

For example, for welding power source, when selecting "WAVE PULSE" while setting "DC MILD STEEL SOLID CO<sub>2</sub> 0.035" [0.9mm]φ" with the WELDING METHOD key [1], the "MILD STEEL SOLID CO<sub>2</sub>" lamp blinks, which means the preset combination is incorrect. In that case, select material and gas again using the WIRE/GAS selector keys [2] or reset the welding method using the WELDING METHOD key [1]. Selecting the proper combination of material and gas can cancel the error and activate the welding power source.

Wrong combination of welding mode and wire diameter will cause "---" and "---" in the displays to blink, the LED lamps to light, and the welding power source to stop.

The following table shows the selections of wire diameter for setting current at aluminum welding. Refer to the table for selecting a wire.

Material	Wire dia. (mm)φ	Mode	Standard range of stable welding current
AL/MG (HARD) (A5183, A5356 etc.)	0.035" [1.0]	PULSE	50 - 100
		DC	50 - 100
	3/64" [1.2]	PULSE	50 - 200
		DC	50 - 200
AL/PURE(SOFT) (A4043 etc.)	1/16" [1.6]	PULSE	50 - 300
		DC	50 - 300
	3/64" [1.2]	PULSE	50 - 200
		DC	50 - 200
Welding current (A)			50 100 200 300 400

#### NOTE:

- The data shown above differ depending on actual welding conditions such as welding rate and welding position, etc.
- Observe the maximum current and the rated duty cycle. Optional accessories are necessary for some combinations of a torch and a Wire Feeder Cabinet.

### 10. OPERATION (continued)

Table of the Welding Mode

Welding method	Welding mode		WIRE DIA. ([mm])	CM-400P	Rated output		
	Type of wire	Gas			@1ph. 208/230V	@3ph.	
DC	MILD STEEL SOLID	CO <sub>2</sub>	.030" (0.8)	○	120 A	400A	
			.035" (0.9)	○			
			.040" (1.0)	○			
			.045" (1.2)	○			
DC	MILD STEEL SOLID	MAG (80%Ar+20%CO <sub>2</sub> )	.030" (0.8)	○			
			.035" (0.9)	○			
			.040" (1.0)	○			
			.045" (1.2)	○			
			.052" (1.4)	○			
DC PULSE	MILD STEEL SOLID	MAG (80%Ar+20%CO <sub>2</sub> )	.035" (0.9)	○			
			.040" (1.0)	○			
			.045" (1.2)	○			
			.052" (1.4)	○			
DC	STAINLESS STEEL SOLID	MIG (90%He+7.5%Ar +2.5%O <sub>2</sub> )	.030" (0.8)	○			
			.035" (0.9)	○			
			.040" (1.0)	○			
			.045" (1.2)	○			
DC PULSE	STAINLESS STEEL SOLID	MIG (66%Ar+33%He +1%CO <sub>2</sub> )	.035" (0.9)	○			
			.040" (1.0)	○			
			.045" (1.2)	○			
DC	MILD STEEL CORED	MAG (80%Ar+20%CO <sub>2</sub> )	.045" (1.2)	○			
	STAINLESS STEEL CORED	MAG (80%Ar+20%CO <sub>2</sub> )	.045" (1.2)	○			
DC	AL/PURE (SOFT ALUMINUM)	MIG (Ar)	.035" (0.9)	○	250 A		
			.040" (1.0)	○	120A		
			3/64" (1.2)	○	200 A		
			1/16" (1.6)	○	120A		
DC PULSE			.035" (0.9)	○	.035" (0.9)	○	200 A
					.040" (1.0)	○	120A
					3/64" (1.2)	○	200 A
					1/16" (1.6)	○	120A
DC WAVE PULSE			.035" (0.9)	○	.035" (0.9)	○	200 A
					.040" (1.0)	○	120A
					3/64" (1.2)	○	200 A
					1/16" (1.6)	○	120A
DC	AL/MG (HARD ALUMINUM)	MIG (Ar)	.035" (0.9)	○	250 A		
			.040" (1.0)	○	120A		
			3/64" (1.2)	○	200 A		
			1/16" (1.6)	○	120A		
DC PULSE			.035" (0.9)	○	.035" (0.9)	○	200 A
					.040" (1.0)	○	120A
					3/64" (1.2)	○	200 A
					1/16" (1.6)	○	120A
DC WAVE PULSE			.035" (0.9)	○	.035" (0.9)	○	200 A
					.040" (1.0)	○	200 A
					3/64" (1.2)	○	200 A
					1/16" (1.6)	○	120A



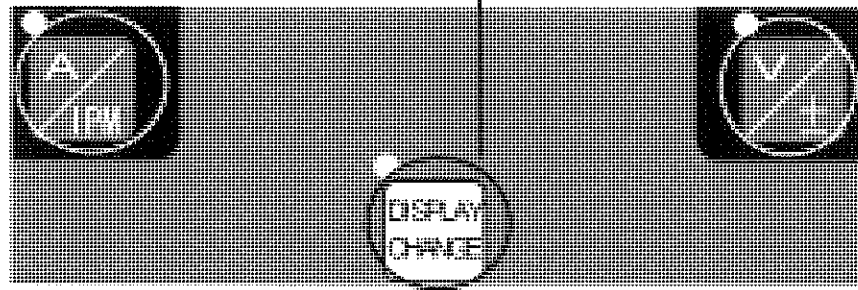
## 10. OPERATION (continued)

### 10.1.2 Setting the Parameter

Pressing the key while the A/IPM lamp (located at the upper left of the A/IPM selector key) is lit changes over displays of current setting and wire feed rate. Pressing the A/IPM selector key while the A/IPM lamp is not lit causes the A/IPM lamp to light.

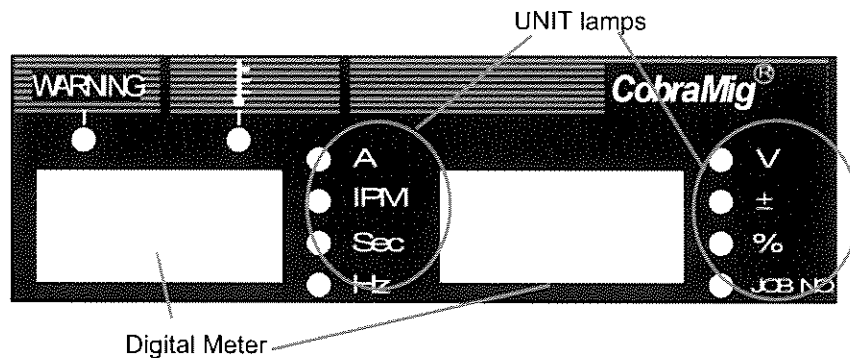
Pressing the key while the V/± lamp (located at the upper left of the V/± selector key) is lit changes over displays of current setting and wire feed rate. Pressing the V/± selector key while the V/± lamp is not lit causes the V/± lamp to light. While the V/± lamp is lit, welding voltage can be adjusted using the parameter adjusting knob [6].

Alternate display between output conditions and setting parameters



[Parameter selector]

Display in the displays are changed according to the parameters you select and the UNIT lamp of the parameter lights up.



[Parameter displays]

- When the wire feed speed is displayed, you may not set to the maximum feed speed depending on the welding mode settings (especially for large diameter). You are only allowed to set the wire feed rate to the value that can achieve the current setting determined by the rated output current.
- The values shown in the displays are not the actual data but the setting values of voltage, current, and wire feed speed. Use the values in the displays as approximates.

## 10. OPERATION (continued)

### 10.1.3 Adjusting Welding Voltage

Using the VOLT. CONTROL key [11] allows you to select one of the following voltage adjustment methods.

#### (1) Making the INDIVIDUAL Adjustment

The INDIVIDUAL adjustment can be achieved when the VOLT.CONTROL lamp (located at the upper left of the VOLT. CONTROL key [11]) is off. In the case of the INDIVIDUAL adjustment, welding current and welding voltage must be adjusted individually. When you want to set welding voltage, make sure that the VOLT. CONTROL lamp is lit, then adjust the welding voltage while turning the parameter adjusting knob [6]. When you want to set welding voltage, make sure that the VOLT. CONTROL lamp is lit, then set welding voltage while turning the parameter adjusting knob [6].

#### (2) Making the SYNERGIC Adjustment

The SYNERGIC adjustment can be achieved when the VOLT. CONTROL lamp (located at the upper left of VOLT. CONTROL key [11]) is on. For the SYNERGIC adjustment, the proper welding current for the current setting is automatically set. When the VOLT. CONTROL lamp is lit, welding voltage can be finely adjusted using the parameter adjusting knob [6]. In addition, it is also possible to change over the display setting in the right display using the V/± selector key [5]. The selectable display settings are the INDIVIDUAL mode (V) and the SYNERGIC mode (± adjustment) . In the SYNERGIC display mode, the standard value is 0. The setting range of welding voltage is 0 to ±30 .

**NOTE: Use of mixture gas other than the mixture ratio of the following gas may not properly adjust welding voltage at Synergic control, etc.**

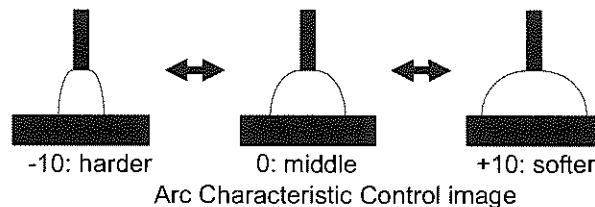
- Carbon dioxide gas (CO<sub>2</sub> gas)  
For welding (purity: 99.9% or more, moisture content: 0.002% or less)
- MAG gas  
80% argon (Ar) + 20% carbon dioxide gas (CO<sub>2</sub> gas)
- MIG gas for stainless steel without pulse  
90% helium (He) + 7.5% argon (Ar) + 2.5% oxygen (O<sub>2</sub>)
- MIG gas for stainless steel with pulse  
66% argon (Ar) + 33% helium (He) + 1% carbon dioxide gas (CO<sub>2</sub> gas)
- MIG gas for Aluminum  
Pure argon (Ar)

## 10. OPERATION (continued)

### 10.1.4 Arc Characteristics Function

When pressing the ARC CONTROL key [8], the ARC CONTROL lamp (located at the upper left of the ARC CONTROL key [8]) lights up, the setting value is displayed in the right display, and the V/± lamp lights up. At that condition, it is possible to set arc characteristics by using the parameter adjusting knob [6]. The setting range is 0 to ±10. Pressing the ARC CONTROL key [8] again or pressing the DISPLAY CHANGE key [7] returns to the previous parameter setting. In addition, it is also possible to change over the display to a current-related parameter by using the A/IPM selector key [4] and to a voltage-related parameter by using the V/± selector key [5].

The standard setting value of arc characteristic is 0. As the setting value of the arc characteristic is set in the negative direction (up to -10), arc condition becomes harder. (Similar to less inductance) As the setting value of the arc characteristic is set in the positive direction (up to 10), arc condition becomes softer (Similar to more inductance). When you use the welding power source in the low current range, set the setting value of the arc characteristic in the negative direction to obtain good welding results. When you use the welding machine in the high current range, set the setting value of the arc characteristic in the positive direction to obtain good welding results. If you can not obtain optimum arc condition due to use of the extension cables, set the setting value of the arc characteristic in the negative direction.

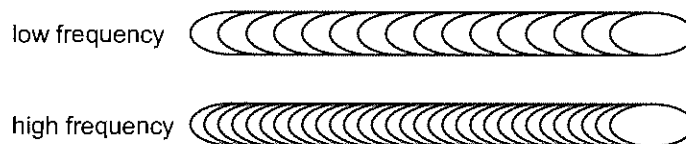


### 10.1.5 WAVE PULSE Function

In wave pulse welding, the ripple bead appearance is changed by applying two separate pulses cyclically at low frequency. This feature will also assist in welding joints that have some poor fit up or gaps. Although, the wave mode is usually most applicable for fully automatic welding, benefits are also achieved even in semi-automatic applications. Good bead appearances are obtained by setting the wave frequency to 5Hz or more even for semi-automatic.

When setting wave pulse frequency, select "DC WAVE PULSE" with the WELDING METHOD key [1]. Normally, the WELDING METHOD key does not function during pulse welding or no-pulse welding. When the WAVE PULSE key is pressed, the WAVE PULSE lamp (located at the upper left of the WAVE PULSE key) lights up, the setting value appears in the left display, the "Hz" LED lamp lights up. Under these conditions, wave pulse frequency can be adjusted while turning the parameter adjusting knob. The setting range of wave pulse frequency is 0.5 Hz to 32 Hz. Adjust wave pulse frequency until you can obtain the desired bead appearance.

When pressing the WAVE PULSE key or DISPLAY CHANGE key again, return to the last parameter that you have set. When changing the display to a current-related parameter, press the A/IPM selector key [4]. When changing the display to a volt-related parameter, press the V/± selector key [5].



#### NOTE:

- Wave pattern of the welding bead varies depending on the heat input during welding.
- When using annealed wire, bead surface may blacken somewhat if shorting occurs frequently during the welding operation.

## 10. OPERATION (continued)

### 10.1.6 Verifying the Parameters in the Displays

The displays on the front panel provides the following functions:

#### 1. Display of Parameter Setting Value

When setting to "parameter setting values display" mode during down period (excluding the result display period right after the completion of welding) and during welding, values of parameters under adjustment are displayed.

#### 2. Display of Output Current and Voltage During Welding

The parameters shown in the displays automatically change to average values of output current and output voltage according to the output conditions every about 0.5 second.

When you want to change the parameters during welding, switch to the "parameter setting values display" mode by using the DISPLAY CHANGE key [7]. When no welding operation is not carried out for about 5 seconds or the DISPLAY CHANGE key [7] is held down, the display mode automatically returns to the "output current and voltage display" mode. Refer to Section 10.1.7, "Using the Parameter Adjusting Knob" for the parameters that can be adjusted using the parameter adjusting knob [6] during welding.

#### 3. Display of Welding Results after Completion of Welding

Upon completion of welding, the average output current and voltage for last one second blink for about 5 seconds. Therefore, the operators can verify the welding conditions right after the completion of welding and can use them as approximates when adjusting the welding conditions. This display is cancelled by starting the next welding or by pressing any key on the front panel without waiting 5 seconds after the completion of welding. The result display time can be preset to F8 by using the F key [10]. The setting value is displayed in the left digital and the "sec" lamp lights up. The setting range of the result display time is 0 seconds to 60 seconds.

**NOTE: In the case where the less than one-second welding such as tack welding, etc. is performed, the correct results of the welding are not displayed.**

#### 4. Display of Error Message

If an error is detected in the power source of electric welding, an error number indicating error messages blinks. See Section 11.1, "Troubleshooting".

**NOTE: The average output values shown in the displays are processed by software and are not guaranteed as control data of measuring instruments.**

## 10. OPERATION (continued)

### 10.1.7 Using the Parameter Adjusting Knob

When adjusting parameters using the parameter adjusting knob [6] during welding, change over the display mode to the "parameter setting value display" mode by pressing the DISPLAY CHANGE key [7]. Pressing the ARC CONTROL key [8] after changing to the "parameter setting value display" mode adjusts the pulse arc characteristics. Pressing the WAVE PULSE key adjusts the wave frequency. In the "average parameter value display" mode, you can not adjust the parameter.

### 10.1.8 POSA START adjustment

When POSA START is ON, the welding power source provides the POSA START (wire slowdown at the start of welding). Default is ON. To alternate POSA START ON and OFF, press and hold the POSA START key [12] in 2 seconds. When POSA START is ON, POSA START LED is ON.

When tapping the POSA START key [12] during POSA START is ON, POSA START value adjustment mode will be activated. In this mode, POSA START LED is blinking and the value is indicated at the right side 7 segment LED. The adjustment range is from 0.0 to 8.0. The default value is 5.0. At the same time, the actual wire feed speed of POSA START is indicated at the left side 7 segment LED and "IPM" LED lamp lights up. The value can be adjusted by turning the adjustment knob[6]. When tapping the POSA START key [12] again, the adjustment mode is finished and the operation will go back as before.

## 10. OPERATION (continued)

### 10.2 Applied Settings

#### 10.2.1 Using Internal Function

- How To Use Internal Functions

- ① When holding down the F key [10] for a few seconds, the function number in the left-side display blinks, and the status of function assigned to the function number lights up and is displayed in the right-side display. Under this condition, a function number can be preset by using the parameter adjusting knob [6].



The number of function blinks.      The conditions of function lights.

A function number can be preset with the parameter adjusting knob [6]

The above example indicates that F19 is set to "on".

When pressing the F key [10] again after presetting the desired function number, the function number lights and the function conditions blinks. Under this condition, functions can be preset by using the parameter adjusting knob [6].



The number of function lights.      The condition of function blinks.

Conditions can be set while turning the parameter adjusting knob.

The above example indicates that F4 is set to "off".

- ② Pressing the F key [10] again causes the function number to light up and returns to the step ①. To cancel the function mode, hold down the F key [10] for a few seconds.

**NOTE:** In the function mode, no confirmation of the function is carried out when it is changed. Upon change of the setting by using the parameter adjusting knob [6], the change becomes valid. Therefore, before changing a function setting, carefully check to make sure that the correct function number is selected and that the proper setting value for the function number is set.

## 10. OPERATION (continued)

The following welding conditions can be adjusted by using the F key [10] and the parameter adjusting knob [6], **but only the welding conditions with\* next to the function numbers can be preset to the welding condition numbers.**

(1) Fine Adjustment of Anti-Stick (Burnback) Time: F1\*

Anti-stick (Burnback) time means the processing time to prevent electrode wire from fusing to base metal when welding is completed. Anti-stick (burnback) time is preset to proper conditions according to welding methods and wire diameters at shipment, but it can be finely adjusted by activating F1. The standard anti-stick (burnback) time is preset to "0", time decreases in the negative direction and increases in the positive direction. The fine adjustment range is 0 to  $\pm 50$  and the unit is 0.01 seconds.

Ex. 1) When the setting value of anti-stick (burnback) time is 25 seconds, add 0.25 second to the standard anti-stick (burnback) time.

Ex. 2) When the setting value of anti-stick (burnback) time is -10, subtract 0.1 second from the standard anti-stick (burnback) time.

(2) Fine Adjustment of Anti-stick (Burnback) Voltage: F2\*

Anti-stick (Burnback) voltage means the voltage which is output when processing is carried out to prevent electrode wire from fusing to base metal at the end of welding. Anti-stick (Burnback) voltage is preset to proper conditions according to welding methods and wire diameters at shipment, but it can be finely adjusted by activating F2. The standard anti-stick (burnback) voltage is preset to "0". When the voltage is set in the negative direction, it decreases. When the voltage is set in the positive direction, it increases. The fine adjustment range is 0 V to  $\pm 9.9$ V.

(3) Setting of Pre-flow Time: F6\*

Pre-flow time can be adjusted by F6 using F key [10]. The setting range is 0 to 10 seconds.

Depending on the gas solenoid control configuration of the Cobramatic, this time 'will be added' to the time set by the Cobramatic settings. This time can also be used 'in place of' the pre-flow time setting of the Cobramatic. Please reference Cobramatic owners manual for details.

(4) Setting of Result Display Holding Time: F8

After completion of welding, the average value of output current and output voltage for last one second blinks for about 5 seconds, but the result display holding time can be set by F8 using F key [10]. The setting range of result display holding time is 0 seconds to 60 seconds.

(5) Arc voltage direct detection ON/OFF selection: F12

When using an extension cable results in abnormal generation of spatter or when unstable welding is caused from malfunction of pulse weld, use a voltage detection cable for directly detecting arc voltage(-). When using a welding extension cable that is more than 100ft [30m] long, use an arc voltage direct detection cable. This direct connection will be necessary to sense precise welding voltage for stable welding. Connect between base metal and Wire Feeder Cabinet or the direct voltage detection (-) terminal inside the welding power source.

After connecting the voltage detection cable, activate the function of voltage direct detection by setting F12 to "on". The function is preset to "oFF" (invalid) at factory.

**NOTE: When using the equipment with such as brush for feeding parts like a turn table, connecting the voltage detection cable to the terminal for the base metal power cable after setting F12 to "on" is recommended.**

## 10. OPERATION (continued)

### (6) Fine Adjustment of Pulse Peak Current

The unit pulse conditions (pulse peak current/time and base current) at pulse welding is set properly according to welding method and wire diameter, but you can make the fine adjustment to obtain the optimum conditions of unit pulse according to the wire brand or welding position.

- The finely adjustable range of pulse peak current is 0 A to  $\pm 150$  A. The peak current is set by 1A.
- The finely adjustable range of pulse peak time is 0 ms to  $\pm 1.5$  ms. The pulse peak time is set by 0.1 ms.
- The fine adjustable range of base current is 0 A to  $\pm 60$ A. The base current is set by 1 A.

In function mode, when pressing the DISPLAY CHANGE key [7] during the fine adjustment of pulse width, the DISPLAY CHANGE lamp lights up (located at the upper left of the DISPLAY CHANGE key). Under this condition, you can switch the fine adjustment value shown in the right display to the modulus (the value which is subtracted or added the fine adjustment value from the standard value). When pressing the DISPLAY CHANGE key, you can return to the fine adjustment value display mode.

#### [Example of Fine Adjustment of the Unit Pulse Conditions]

When making a fine adjustment of the unit pulse conditions, adjust the pulse peak time first. Take longer fine adjustment time when large droplet and unstable arc (droplet transfer) occurs. Take shorter fine adjustment time when sharp tip of wire and extremely strong arc occurs. Adjust the pulse peak current following the same steps as pulse peak time adjustment.

#### [Precaution for the Fine Adjustment of the Unit Pulse Conditions]

Maximum pulse peak current which can be output varies depending on the type (capability) of welding machine or arc load. When the pulse peak current finely adjusted exceeds the maximum pulse peak current, the preset pulse peak current is not output.



## 10. OPERATION (continued)

**NOTE:** When the unit pulse conditions change significantly, there may be a possibility of difference between the preset current value and the output current and an impossibility of appropriate synergic fine adjustment.

(6-1) Fine adjustment of Pulse Peak Current : F13\*

The fine adjustment of pulse peak current can be achieved by activating F13 using the F key [10]. The value which is subtracted or added the fine adjusting value from the standard value of the pulse peak current is output. At the wave pulse welding, the high pulse condition (H. pulse) is adjusted.

(6-2) Fine Adjustment of the Pulse Peak Time: F14\*

The fine adjustment of pulse peak time can be achieved by activating F14 using the F key [10]. The value which is subtracted or added the fine adjusting value from the standard value of the pulse peak time is output. At the wave pulse welding, the high pulse condition (H pulse) is adjusted.

(6-3) Fine Adjustment of the Base Current: F15\*

Fine adjustment of base current can be achieved by activating F15 using the F key [10]. The value which is subtracted or added the fine adjusting value from the standard value of the base current is output.

(6-4) Fine Adjustment of L Pulse Peak Current: F16\*

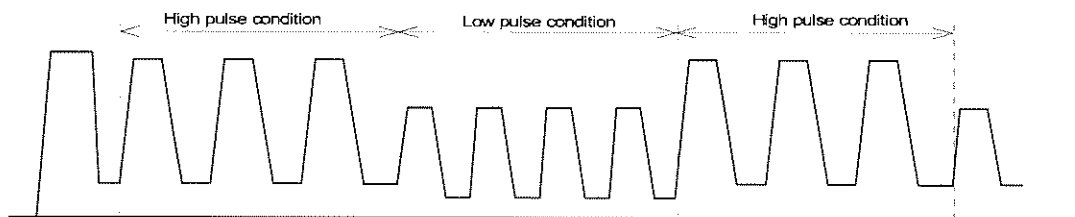
The fine adjustment of low pulse condition (L pulse) peak current at wave pulse welding can be achieved by activating F16 using the F key [10]. The value which is subtracted or added the fine adjusting value from the standard value of the L pulse peak current is output as L pulse peak current.

(6-5) Fine Adjustment of L Pulse Peak Time: F17\*

The fine adjustment of L pulse peak time of the second pulse condition at wave pulse welding can be achieved by activating F17 using the F key [10]. The value which is subtracted or added the fine adjusting value from the standard value of the L pulse peak time is output as L pulse peak time.

(6-6) Fine Adjustment of L Pulse Base Current: F18\*

The fine adjustment of the pulse base current of the second pulse condition at wave pulse welding can be achieved by activating F18 using the F key [10]. The value which is subtracted or added the fine adjusting value from the standard value of the L pulse peak current is output as L pulse peak current.



Example of current wave at wave pulse welding

## 10. OPERATION (continued)

### (7) Turbo Start ON/OFF Selection: F19

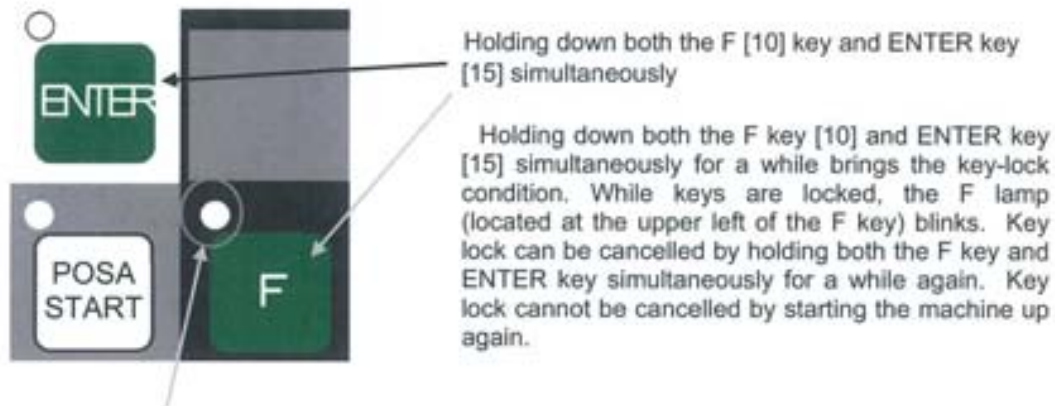
The welding power source has Turbo Start function by capacitor discharge, which enable you to obtain good welding start. At poor welding start with burnback, setting F19 to "oFF" deactivates the Turbo Start function. The function is preset to "on" (valid) at factory.

### (8) Keypad tone ON/OFF Selection: F20

Setting F20 to "oFF" deactivates key pad tone function. The volume of the key pad tone can not be adjusted.

### 10.2.2 Key Lock

Key lock is a function to prevent the welding conditions from being changed by accidentally operating keys and knobs on the front panel. Only the keys and parameter adjusting knobs which are used for changing each parameters and modes can be protected. However, the settings can be checked and confirmed by using the DISPLAY CHANGE key [7].



While keys are locked, the F lamp blinks

Even when the keys are locked, JOB MEMORY functions can be activated.

### 10.2.3 JOB MEMORY Function

The JOB MEMORY function enables welding conditions to be reproducible by storing the welding conditions in memory inside power source and by reading out the stored data at any time. The number of welding conditions that can be held in memory is up to 100.

#### **CAUTION**

- The welding conditions (electronic information) stored by this function are susceptible to occurrence of static electricity, impact, repair, etc., and there is a possibility that the storage contents may be changed or lost. BE SURE TO MAKE A COPY FOR IMPORTANT INFORMATION.
- We shall not assume any responsibility for any change or loss of electronic information resulting from repair, which you should note in advance.

Once the machine enters the memory mode and read-out mode, all the key operations are denied except the SAVE, LOAD, and ENTER keys. To exit the mode, press the LOAD key [13] if it is in the memory mode, and the SAVE key [14] if in the read-out mode. Memory can be copied to a different condition number after reading the welding conditions to be copied.

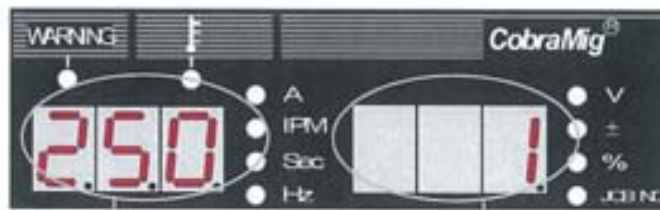
## 10. OPERATION (continued)

### ① SAVE Function

Welding conditions being currently in use are stored in the memory inside the welding power source.

#### • Holding the welding conditions in memory

- (1) When pressing the SAVE key [14], the machine enters memory mode, the SAVE lamp (located at the upper left of the SAVE key) lights up. See the following picture. In the right display, the condition number "1" blinks and the LED lamp of the welding condition number lights up. In the left display, the setting value of welding current preset to the condition number "1" appears. Under this condition, a condition number can be set while turning the parameter adjusting knob [6].



Welding Current setting value held in memory      Condition number blinks

In the event that any memory data is already preset to the condition number you selected, the WELDING METHOD lamp and etc. also light up. If no memory data is preset to the condition number you selected, "--" blinks in the left-side display. In this case, the system skips the parameter check condition of Step (2) and jumps to Step (3).



- (2) When pressing the ENTER key [15] after setting the condition number, the ENTER lamp blinks (located at the upper left of the key). Under this condition, you are allowed to confirm the setting value of the parameter preset to the condition number by using the DISPLAY CHANGE key [7]. The setting value of the parameter you selected blinks.

**NOTE:** In the save mode, you can not change the welding condition number or select any memory/readout mode. To reset the condition number, press the SAVE key [14], then return to the step (1). To quit the setting and exit from the memory mode, press the LOAD key [13].

- (3) Pressing the ENTER key [15] again holds the data in memory and allow you to exit from the memory mode.



## 10. OPERATION (continued)

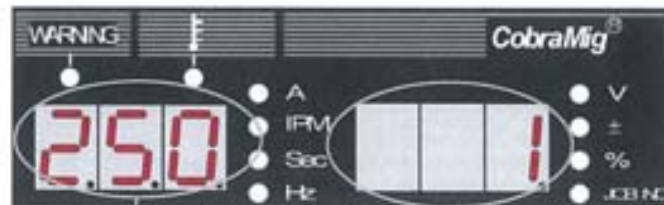
### ② LOAD Function

The welding conditions stored in memory are read out from the memory inside welding power source.

**NOTE: The welding conditions currently used can be overwritten with the welding conditions read out. When you want to save the welding conditions that have been used until now, preset the welding conditions to any condition number, then carry out readout.**

#### • Reading out the preset welding conditions

- (1) When pressing the LOAD key [13], the machine enters the readout mode. LOAD lamp (located at the upper left of the LOAD key) lights up. See the figure below. The condition number "1" in the right-side display blinks and the JOB No. LED lamp lights up. In the left-side display, the setting of welding current preset to condition number "1" lights up. Under this condition, a condition number can be set while turning the parameter adjusting knob [6].



In the event that any memory data is preset to the condition number you selected, the WELDING METHOD lamp and etc. also light up. When no memory data is preset to the condition number, "-" in the left-side display blinks. See the figure below.



- (2) When pressing the ENTER key [15] after setting the condition number, the ENTER lamp (located at the upper left of the key) blinks. Under this condition, you are allowed to confirm the setting of each parameter you want to read out by using the DISPLAY CHANGE key [7]. The setting of the parameter you selected blinks.

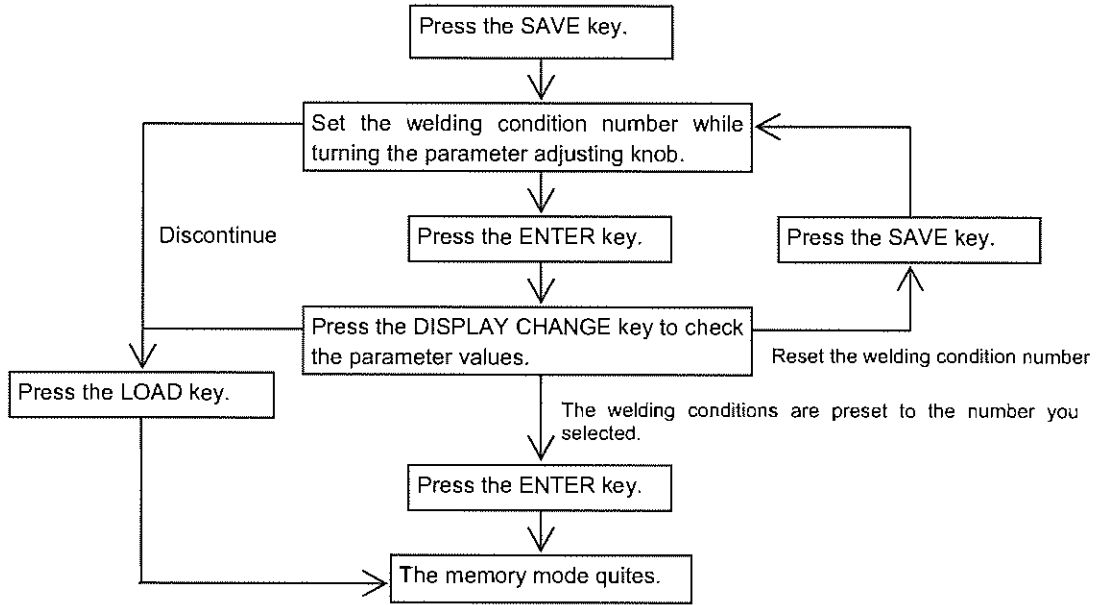
**NOTE: You are not allowed to change condition number or select a welding method, etc. To reset the condition number, press the SAVE key [14], then return to the step (1). To quit the setting and exit from the readout mode, press the SAVE key [14].**

- (3) When pressing the ENTER key [15] again, you can read out the preset welding conditions and the LOAD lamp continues to blink to represent the readout mode. During the readout mode, the welding conditions of both the wire feed speed (welding amperage) and the voltage can be adjusted by the Parameter adjusting knob [6] on the front panel of CM-400P, however the conditions can not be

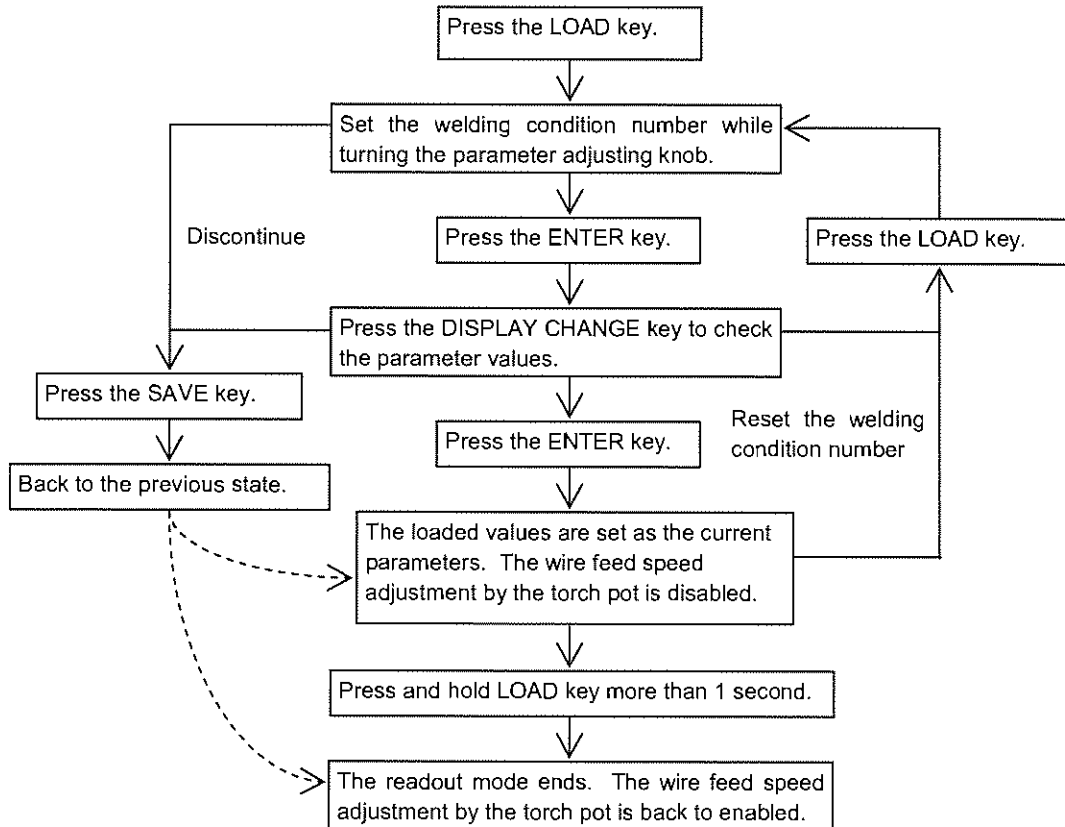
changed by the torch pot because it is disabled.

- (4) To exit the readout mode, press and hold the LOAD key [13] more than 1 second. The LOAD lamp turns off and the wire feed speed (welding amperage) can be changed by the torch pot back again.

• Operation flow in the memory mode



• Operation flow in the readout mode



## 10. OPERATION (continued)

### ③ Erasing the Welding Conditions

When you erase the welding conditions stored in memory, you can select either erasing all or erasing one.

#### • Erasing the welding conditions

- (1) Turn off the power switch and turn on the power switch with both the LOAD key [13] and SAVE key [14] pressed. Release the keys after tuning on the power switch, and then "dEL" appear in the left-side display. See the picture below.



"dEL" is displayed, which indicates the machine is in deletion mode

Condition number to be deleted blinks

- (2) Set the condition number to be deleted while turning the parameter adjusting knob [6]. When turning the knob counterclockwise, "ALL" appears in the right-side display as illustrated below and you can erase all the welding conditions.



"dEL" is displayed

"ALL" blinks

**NOTE:** When the welding conditions are deleted by selecting "ALL", welding conditions currently in use are also deleted. Consequently, all the parameters return to the initial settings.

- (3) Pressing the ENTER key [15] blinks "dEL". Confirm the condition number again and if you want to cancel erasing of the condition number, press any key other than the ENTER key [15] to return to step (2). To quit the delete mode, turn off the welding power source.
- (4) Pressing the ENTER key [15] again delete the welding condition preset to the condition number. When "End" is displayed after end of data deletion, turn off the power switch, then start up the welding machine.

**NOTE:** If you press the ENTER key twice in the deletion mode, you can not recover the erased welding conditions. When you attempt to delete a welding condition held in memory, make sure that the condition number you want to erase is surely selected.

## 10. OPERATION (continued)

### 10.2.4 Resetting to Initial Values

The welding conditions that are currently used (including the welding condition currently used) are all reset to initial values. To reset to initial values, turn off the power switch and then turn on the power switch with both the POSA START key [12] and the F key [10] held down. When "End"s appear in the displays after turning on the power switch, release the keys, turn off the power switch, then turn it on again. See the picture below.



See "SPECIFICATIONS" for initial values of each parameter and function.

### 10.2.5 Confirming software version

The version of software incorporated in the welding power source can be verified following these steps. Turn on the power switch with only the F key [10] held down. After powering the welding power source, the version number appears in the display.

- (Example)
- |                                    |  |
|------------------------------------|--|
| Right and left displays : "P30044" | ← Software number (P30044) is displayed.         |
| ↓ Press the F key [10].            |  |
| Left display : "001"               | ← Main software version (Ver. 001) is displayed. |
| Right display : "000"              | ← Sub software version is displayed.             |
| ↓ Press the F key [10].            |  |
| Left display : "- - -"             |  |
| Right display : "002"              | ← Combination is displayed.                      |
| ↓ Press the F key [10].            |  |
- The welding power source starts up as usual and gets ready to perform welding.

### 10.2.6 Automatic Stop of Fan



The cooling fan automatically stops in 10 minutes after welding is finished and automatically starts turning when welding is started. When powering the welding power source, the cooling fan is also turning but automatically stops in 10 minutes when no operation is carried out. Low speed fan rotation will work for 3 minutes every 20 minutes without weld.

### 10.2.7 Reduction of Fan Noise

When the welding power source is not temporarily in use, the rate of fan rotation decreases so that fan noise can reduce. This function works only for 250 A or less output current.

## 11. APPLIED FUNCTION

### 11.1 How to Solve an Error

 <b>WARNING</b>	
	Observe the following to prevent electrical shock.
<p><b>When touching charging parts, critical electric shock and burn may occur.</b></p> <ul style="list-style-type: none"> <li>● Do not touch charging parts inside or outside the welding machine.</li> <li>● Grounding to the case of the welding power source should be performed by persons qualified electric work and according to the laws and regulations in your area.</li> <li>● When touching the parts inside the welding power source, wait more than three minutes after powering off all input power supply by turning off the line disconnect switch in the switch box.</li> </ul>	

If an error occurs during use, an error code shown in the displays on the front panel blinks, then the welding power source stops automatically. In this case, check the errors in the following table.

No.	Displays on the front panel		Classification of errors
	Left	Right	
1	c o b	r A	Torch switch off state waiting
2	E -	1 0 0	Control power supply error
3	E -	1 1 5	Error in the 115V outlet circuit
4	E -	2 0 0	Primary / secondary current detection error
5	E -	2 1 0	Error in the voltage detection
6	E -	3 0 0	Thermal overload
7	E -	6 0 0	Battery low (warning)
8	E -	7 0 0	Output over current
9	E -	9 x x	Microcomputer error



## 11. APPLIED FUNCTION (continued)

### 1) cob rA Display

If "cob" and "rA" in the displays blink, it indicates the "Torch switch off state waiting".

When turning on the power switch, the displays on the front panel shows "cob" and "rA" for one second, then the welding power source becomes operable. But, if the torch switch remains on before turning on the power switch, the safety circuit will function, the welding power source will hold a halt condition, then the WARNING lamp and "cob" and "rA" shown in the displays will blink. In this case, turn off the torch switch to reset the safety circuit and make the welding power source operable.

### 2) E-100 Display

If "E-" and "100" the displays blink in, it indicates the "Control power supply error".

If there is an error in the control power source, the warning lamp will light up and "E-" and "100" in the displays will blink, then the welding power source will automatically stop. To cancel the error, start the machine up again.

### 3) E-115 Display

If "E-" and "115" in the displays blink, it indicates the "Error in 115V outlet circuit".

It means thermal overload of the 115V outlet circuit instead of the Wire Feeder Cabinet controller.

When "E-" and "115" are indicated in the displays, the welding power source will stop automatically.

### 4) E-200 Display

If "E-" and "200" in the displays blink, it indicates the "Primary/Secondary current detection error".

If an error is detected in the current detecting area, "E-" and "200" in the displays will blink and the welding power source will stop automatically. In this case, turn off the power switch, then turn it on again after making sure that CN8 and CN9 on the printed circuit board P10264U are surely connected.

### 5) E-210 Display

If "E-" and "210" in the displays blink, it indicates the "Error in the voltage detection wire".

If there is an error in the plus voltage detection line (+), the warning lamp will light up, "E-" and "210" in the displays will blink, then the welding power source will stop automatically. In this case, after checking to make sure that the Wire Feeder Cabinet control cable is not damaged and that CN6 and CN10 on the printed circuit board P10264T, CN23 and CN 24 on the printed circuit board P10264U, and CN 1 on the printed circuit board P10264X are surely connected, start the machine up again. And check the OCV at output terminal of welding power source.

### 6) E-300 Display

If "E-" and "300" in the displays blink, it indicates the "Thermal overload".

If the actual duty cycle exceeds the rated duty cycle of or temperature inside the welding power source increases, "E-" and "300" will blink and the welding power source will stop automatically. At this time, the temperature lamp also will be lit. In this case, wait more than 10 minutes with the power switch pressed and the fan turned. When restart welding, turn off the power switch and restore the system after lowering the duty cycle and the welding current. Such action will cancel the error. Repetitious welding without more than ten-minute rest may lead to damage to the welding machine. Refer to Section 3.1, "Rated Duty Cycle" for the rated duty cycle of the welding power source.

## 11. APPLIED FUNCTION (continued)

### 7) E-600 Display —Refer to section 11.2—

If "E-" and "600" in the displays blink, it indicates the "Battery low (warning)".

This welding power source uses batteries so that it can hold the welding conditions in memory even when no operation is carried out for long time. "E-" and "600" in the displays blink when the batteries get low. "E-" and "600" are displayed only when the front panel and the welding power source are temporarily not in use. To cancel the display of the error, press any key. Even when "E-" and "600" appear in the displays, welding can continued to be performed, **but when the batteries run down, the preset welding condition functions and the settings of functions are all erased. The last welding conditions before power is applied to the welding machine can not be stored. Each time power is applied to the equipment, all the parameters are reset to initial values.** Refer to Section 12.4, " Replacement of batteries" for details.

### 8) E-700 Display

If "E-" and "700" in the displays blink, it indicates the "Output overcurrent".



If an overcurrent or short circuit on the secondary output continues for more than one second during welding, the WARNING lamp lights up, "E-" and "700" in the display blinks, then the welding power source stops automatically. In this case, turn off the control power switch and check to make sure that the welding current does not exceed the rated output value, or that there is no short circuit on the output side such as a contact between the tip and the base metal, or a short circuit of the output cables.


### 9) E-9xx Display

If "E-" and "9xx" in the displays blink, it indicated the "Microcomputer error".

There could be an error in the built-in microcomputer, Please contact your dealer immediately. When contacting your dealer, you are required to provide the details of the problem you are facing.

## 11. APPLIED FUNCTION (continued)

 <b>WARNING</b>	
	Observe the following to prevent electrical shock.
<ul style="list-style-type: none"><li>● Do not touch charging parts inside or outside the welding machine.</li><li>● Grounding to the case of the welding power source should be performed by persons qualified electric work and according to the laws and regulations in your area.</li><li>● When touching the parts inside the welding power source, wait more than three minutes after powering off all input power supply by turning off the line disconnect switch in the switch box.</li></ul>	

 <b>CAUTION</b>	
<ul style="list-style-type: none"><li>● Try to move the control cable which is pulled out from the automatic connection terminal on the chassis farther away from the welding power cable or the torch cable when making an external connection. Otherwise, equipment failure may be caused by noise, etc., during welding operation.</li><li>● Pull out only the wiring on the printed circuit board to outside.</li></ul>	

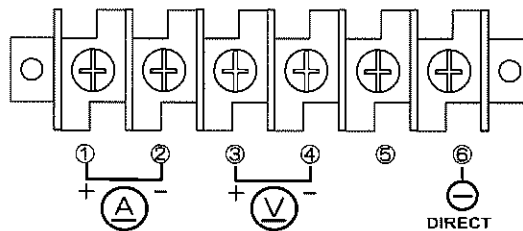
### 11.2 External Connection of Inside Terminal Block

When taking off the upper cover of the welding power source, you will find there is a 6P terminal block (TM6P) on the chassis.

Refer to Section 12, "Parts layout" for the locations of the terminal blocks.

**NOTE:** Wait more than three minutes after turning off the line disconnect switch or no-fuse breaker and the power switch on the front panel to remove the cover.

**NOTE:** Break the grommet with filter located on the rear side of the welding machine to lead in the external connecting wires. When leading in the external connection wires, do not touch the parts on the printed circuit board and the edges of the steel plate.



[6P terminal block]

## 11. APPLIED FUNCTION (continued)

6P terminal block (TM 6P)



Pin No.	Signal name	Function	
① <sup>+</sup> - ② <sup>-</sup>	AMMETER	Terminals for connecting an ammeter. Use the ammeter (400A/60mV, part number: 4403-057).	
③ <sup>+</sup> - ④ <sup>-</sup>	VOLTMETER	Terminals for connecting a voltmeter. Use the voltmeter (full scale 100V, part number: 4401-019).	*1
⑤	Unused		
⑥	Direct	When the welding cable is more than 100ft [30m] long, use this terminal pin to directly connect the voltage detection cable to base metal. Refer to Section 10.2.1 (5) "Arc Voltage Direct Detection ON/OFF Selection" for details of direct detection.	



Precaution for connection with terminals on the terminal block



The wires from the terminal blocks should be twisted for each signals to avoid accidental operation. Take care that the wires from the terminal blocks do not cross other signal wires from other welding power source.


**\*1 Be careful that no-load voltage (100V or less) is applied to between the terminals during welding.**

## 12. MAINTENANCE AND TROUBLESHOOTING

 <b>WARNING</b>	
	To avoid electric shock, follow the below instructions.
<ul style="list-style-type: none"><li>● Do not touch live electrical parts inside or outside the welding machine.</li><li>● Turn off all of the line disconnect switches before touching the parts inside the welding machine.</li><li>● Perform the maintenance checks periodically. If any damaged parts are found, only use the welding machine after troubleshooting or repairing.</li><li>● Only certified operators should maintain, inspect, or repair the welding machine.</li><li>● When carrying out the maintenance, wait more than three minutes after powering off all input power supply by turning off the line disconnect switch in the switch box. Capacitor may be discharging even after powering off all input power supply. Check to make sure that charging voltage does not exist before carrying out the maintenance.</li><li>● This welding power source uses a high-frequency inverter system, be careful of accidental connection of the line disconnect switch at input side.</li><li>● Have qualified operators or the persons familiar with this welding power source test withstand voltage. And install a protective wall around the welding machine to keep away others from the welding machine.</li></ul>	

 <b>CAUTION</b>	
	Rotating parts may cause injuries. Be sure to observe the following.
<ul style="list-style-type: none"><li>● Only certified operators should maintain, inspect, or repair the welding machine.</li><li>● Install a fence around the welding machine to keep others away from it.</li><li>● Do not put your hands, fingers, hair and clothes near the fans and wire feed roll rotating.</li></ul>	

 <b>CAUTION</b>	
	<ul style="list-style-type: none"><li>● Do not touch the parts for the main circuit which are located inside the power source, such as single-phase transformer, DC inductor, heat sink, etc. immediately after welding is performed, as the parts are extremely hot. Wait until the parts cool down, when touching. Failure to observe the demand may result in burn.</li></ul>

 <b>CAUTION</b>	
<ul style="list-style-type: none"><li>● The welding conditions (electronic information) stored using the JOB MEMORY keys are likely to be affected by occurrence of static electricity, and there is a possibility that the preset data contents may be changed or erased. We recommend taking notes of important data.</li><li>● We shall not assume any responsibility for any change or erase of the electronic information resulting from repair.</li></ul>	

## 12. MAINTENANCE AND TROUBLESHOOTING (continued)

### 12.1 Carrying out Maintenance on the Welding Power Source

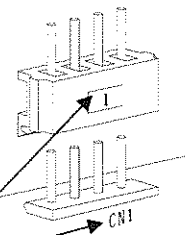
- (1) Periodical checking
- (2)

Periodically check the welding power source to ensure the safety of the equipment and the efficiency of work.

- Daily checking the followings:
  - No strange vibration, buzzing noise, and smell are generated from the welding power source.
  - No excessive heat is generated from the cable connections.
  - Fan functions properly when the power switch is turned on.
  - The switches properly function.
  - Connection and insulation of cables are surely made.
  - There are no break in cables.
  - Fluctuation of power source voltage is not large.
  - Case Earth is surely connected. (Disconnection of the Case Earth may result in failure or malfunction of the equipment.)
- Checking the followings each three to six months:
  - There is no damage inside the torch.
  - There are no loose connections or no poor contacts caused from rust, on input side of the welding power source and output side of the cables.
  - There is no trouble with insulation.
  - The welding power source is properly grounded.
  - Built-up dust on the transistor or the cold plate on the rectifier may affect the equipments. Take off the cover of the welding power source once a half year, then remove dust by blowing moisture-free compressed air on each part.
  - The dust protective filter located on the inlet of the fan does not clog, which may result in damage to the welding power source. Be sure to inspect it periodically.

### 12.2 Precaution for Replacement of the Printed Circuit Board



- Make sure that the connector number inscribed on the printed circuit board matches the number marked on the connector.
- Turn off the control power switch and line disconnect switch before carrying out maintenance on the welding power source, and wait three minutes until the capacitors inside the welding power source discharge.
- This welding power source uses a high-frequency inverter system, be careful of accidental connection of the line disconnect switch at input side.
- Surely connect the connectors until the connector clicks. Failure to do so may result in damage to the printed circuit board and the welding .
- With the connectors disconnected, do not turn on the power switch on the front panel.
- Do not use organic solvent such as thinner, trichloroethylene, gasoline, etc., to clean the plastic cover and carrying handle of the welding machine. Deformation and flaw may result from the adherence of the organic solvent.



**NOTE: Match the number on the printed circuit board with that on the connector.**

## 12. MAINTENANCE AND TROUBLESHOOTING (continued)

### 12.3 Insulation Resistance Test

 <b>WARNING</b>	
	<b>Observe the following to prevent an electrical shock.</b>
<b>When touching charging parts, a critical electric shock and burn may occur.</b>	
<b>● Have qualified operators or the persons familiar with this welding power source measure insulation resistance and test withstand voltage . And install a protective wall around the welding machine to keep away others from the welding machine. Check to make sure that charging voltage does not exist before carrying out the maintenance before carrying out measurement of insulation resistance and withstand voltage test.</b>	

When measuring insulation resistance and testing withstand voltage, follow the steps below. And, refer to the schematic diagram, parts layout, and parts list for maintenance.

1. Disconnect the grounding cable (wiring number: 80) from the earth.
2. Short-circuit on AC side and commutation side of DR1.
3. Short-circuit between TR1 (C1) and (E1), TR2(C2) and (E2), TR3(C2) and (E2), TR5(C2) and (E2), TR5(C1) and (E1).
4. Short-circuit between DR2 (Anode) and (Cathode), DR5 (Anode) and (Cathode).
5. The circuit protector is turned on.

Be sure to reconnect the cables after carrying out measurement of insulation resistance and withstand voltage test.

### 12.4 Replacement of Batteries

This welding power source uses lithium batteries to hold welding conditions in memory. The life of the batteries differs depending on the environments. "E-" and "600" shown in the displays on the front panel blinks when the batteries gets low. Replacement of the batteries every 5 years or so are recommended even when "E-" and "600" do not blink. Replace the batteries following the steps:

1. Turn off the line disconnect switch in the switch box or the no-fuse breaker and the power switch of the welding power source.
2. After more than three minutes, remove six screws that secure the front panel, and then pull the front panel out. Do not pull it forcibly. With the wiring inside the equipment disconnected, do not turn on the power switch. Failure to do so may result in damage to the welding power source.
3. Remove the connectors on the P.C.B.P10263R to replace the printed circuit board. Refer to the position for "Rear side of the front panel" in Section 12.7, " Parts List".
4. Insert the disconnected connectors into the P.C.B.P10263R.
5. Screw the front panel in position.

## 12. MAINTENANCE AND TROUBLESHOOTING (continued)

### 12.5 Troubleshooting

When an error code is displayed, refer to Section 11.1, "How To Solve an Error".

- Check the troubleshooting information listed below before contacting your dealer for service.

No.	Trouble	Cause	Solution	
1	The power switch on the front panel is tripped.	Never turn it on again. Contact your dealer.		
2	The main power lamp PL1 will not light.	When turning on the power switch, the displays light.	Trouble with PL1.	
		When turning on the power switch, nothing appears in the display.	The line disconnect switch in the switch box is not turned on.	Inspect the power box.
			The input cables are not surely attached.	Inspect the input cables.
3	When turning on the power switch, nothing appears in the display.	The main power lamp PL1 will not light.	Refer to No.2 in this list.	
		PL1 lights.	Shortage of the input voltage Trouble with the power circuit.	Check for proper input voltage. After inspecting PCB P10263Q and P10355X, replace them if necessary.
4	When turning on the power switch, the WARNING and TEMPERATURE lamps light up and an error code appears in the display,	Refer to Section 11.1, "How To Solve an Error".		
5	Shield gas is not generated when the torch switch is pressed.	The discharge valve of the gas cylinder is closed.	Open the valve.	
		Lack of gas pressure of the gas cylinder.	Check for proper gas pressure.	
		Trouble with the gas electromagnetic valve SOL.	Inspect the gas electromagnetic valve SOL.	
		Disconnection of the torch switch cable or incomplete insertion to receptacle.	Refer Cobramatic owners manual.	
6	Shield gas does not stop.	Trouble with the gas solenoid valve SOL	Check for operation of the gas solenoid valve of Wire Feeder Cabinet.	
7	When the torch switch is pressed, no-load voltage is not output but shield gas is generated.	Trouble with the inverter main circuit	Turn off the power switch, then contact your dealer.	
		Trouble with the control circuit	After inspecting PCBP30044P or P10352U replace it if necessary.	



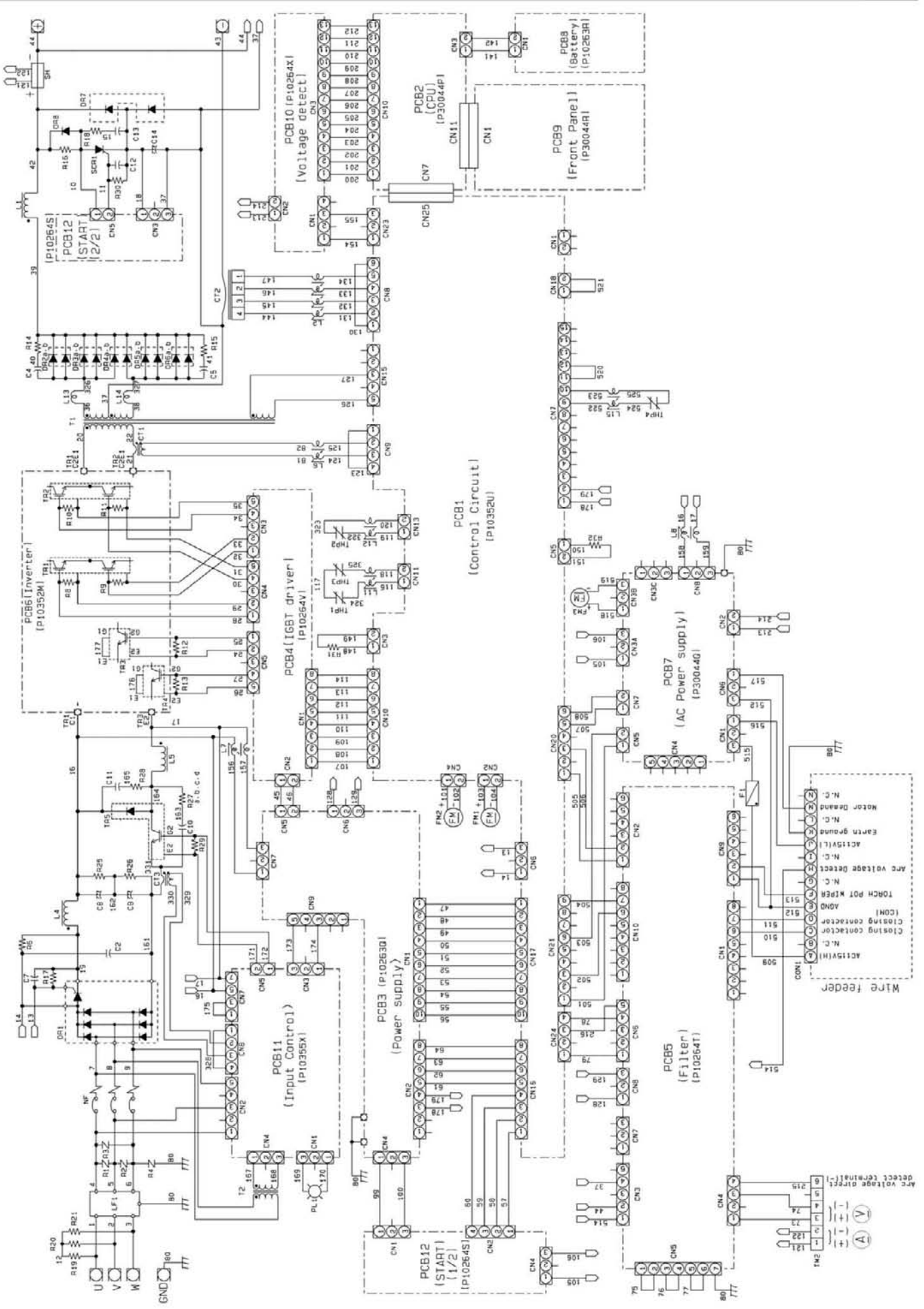
## 12. MAINTENANCE AND TROUBLESHOOTING (continued)

No.	Trouble	Cause	Solution
8	Current and voltage can not be set.	Trouble with the control circuit	After inspecting PCB P30044P or P10352U and replace it if necessary.
		Error in wire voltage detection	Inspect connections of CN23 and CN 24 on PCB P10352U or CN1 on PCB P10264X.
9	Wire is not fed.	Incomplete insertion or breaking of the control cable for Wire Feeder Cabinet	After inspecting the contacts of the plug and cable, replace them if necessary.
		Trouble with the motor control circuit	After inspecting PCB P30044Q, replace it if necessary.

This page is intentionally left blank.

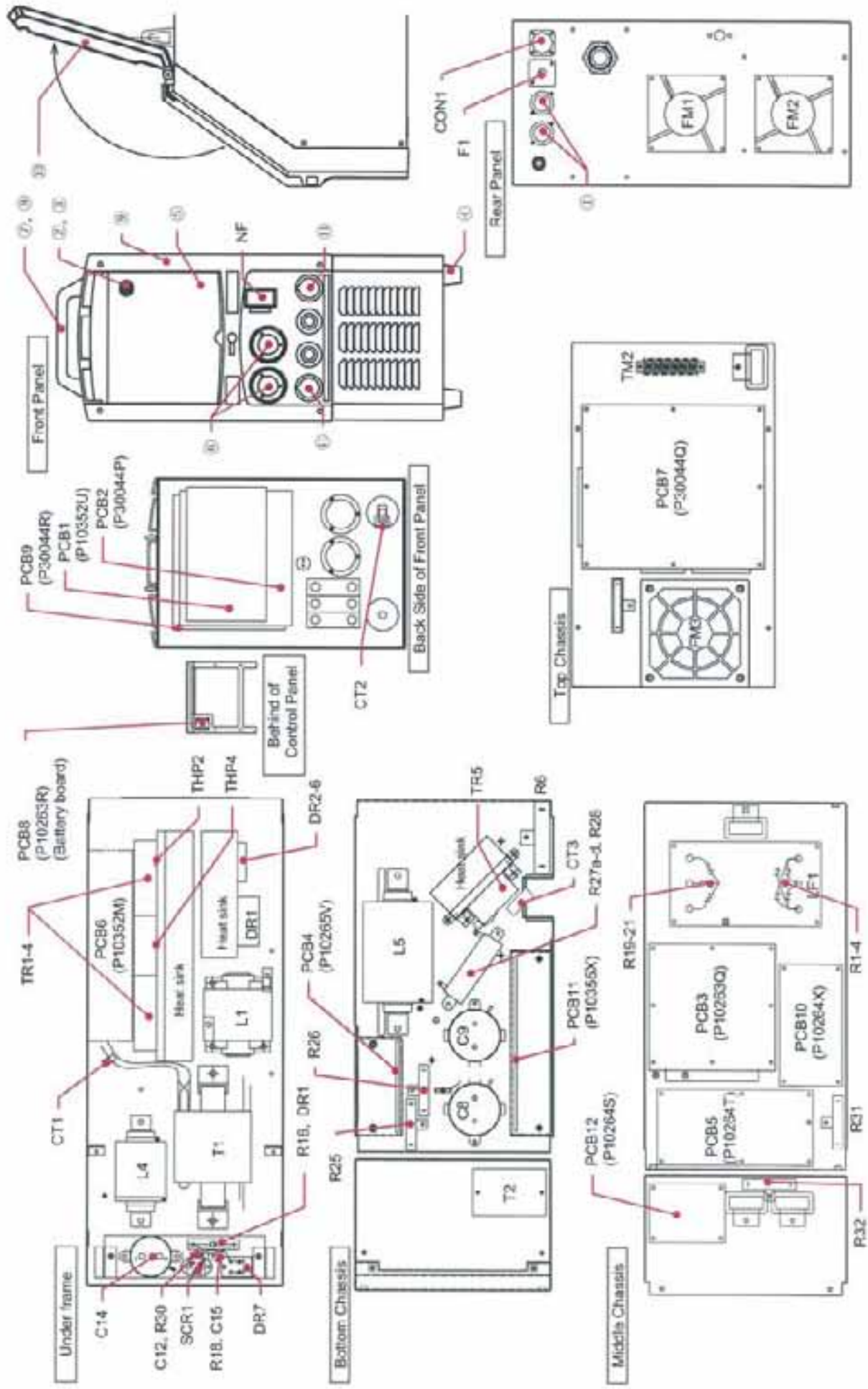
## 12. MAINTENANCE AND TROUBLESHOOTING (continued)

12.6 Schematic Diagram



12. MAINTENANCE AND TROUBLESHOOTING (continued)

12.7 Parts Layout



### 13. PARTS LIST

- Please contact your dealer to order parts. (See the back cover for telephone and fax numbers, and mailing addresses.)

Symbol	Part No.	Description	Specifications	Q'ty	Remarks
NF	4614-104	Circuit protector	119-0637(480V 75A)	1	
LF	4519-037	Line filter	FS5681-50-99	1	
PL1	4600-341	Pilot lamp	NPA10-2H-WS	1	
DR1	4531-717	Diode module	DFA150AA160	1	
DR2~7	4531-119	High speed diode module	DSEI 2×101-06A	6	
DR8	4531-505	Diode	S2L60	1	
TR1~4	4534-528	IGBT module	CM200DY-12NF	4	
TR5	4534-529	IGBT module	SKM300GAL128D	1	
SCR1	4530-412	Thyristor	SG25AA20	1	
CT1,3	100-0004	Current transformer	W-W03029A	2	
CT2	4406-009	Hole current detector	HA400S3EH	1	
T1	P10264B00	Inverter transformer	P10264B00	1	
T2	4810-351	Auxiliary transformer	W-W02921A	1	
L1	P10352B00	DC reactor	P10352B00	1	
L2,6,7,8, 13,14	4739-497	Ferrite core	E04RA400270150	6	
L4	P10322L00	Input reactor	P10322L00	1	
L5	P10352C00A	Choke coil	P10352C00	1	
L11,12,15	4739-543	Ferrite core	E04RA310190100	3	
THP1	4258-046	Thermostat	US-602AXTTL 120°C	1	
THP2,3	4614-057	Thermostat	67L080	2	
THP4	4258-033	Thermostat	67L070	1	
FM1,2	P30016L00	Fan	P30016L00	2	
FM3	100-0364	Fan	4710KL-05W-B50-B00	1	
SH	4403-116	Meter shunt	KY400A 400A/60mV	1	
TM1	Missing number				
TM2	4739-504	Terminal block	TB10-01 6P	1	
R1~4	100-0175	Surge absorber	ENE911D-14A	4	
R6	4509-819	Cement resistor	40SH 200ΩJ	1	
R8~13,17	4509-704	Carbon resistor	RD1/4W 1kΩJ	7	
R14,15	4509- 138	Metal film resistor	RNP-50SA 5ΩF	2	
R16	4509-916	Cement resistor	T20SH 2.2ΩJA	1	
R18	4509-107	Carbon resistor	RS2W 15ΩJ	1	
R19,20,21	4509-128	Metal oxide film resistor	RS2B 200kΩJ	3	
R23,24	Missing number				
R25,26	4509-883	Cement resistor	20SH 20kΩJ	2	
R27a~d	4504-321	Non-inductive resistor	NCRF22V 10Ω	4	
R28	4504-322	Non-inductive resistor	NCRF22V 20Ω	1	
R29,R30	4509-704	Carbon resistor	RD1/4W 1kΩJ	2	
R31,R32	4509-922	Cement resistor	20SH 10ΩJA	2	
C2	4518-530	Film capacitor	US16X154JAASA	1	
C4,C5	4518-542	Film capacitor	US20X472JAASA	2	
C7,C12	4518-402	Film capacitor	0.47μF 50V	2	
C8,C9	4511-344	Aluminum electrode capacitor	400LGSN33300MBD13	2	
C10	4518-533	Film capacitor	US20X473JAASA	1	

### 13. PARTS LIST (continued)

Symbol	Part No.	Description	Specifications	Q'ty	Remarks
C11	4518-528	Film capacitor	US20X103JAASA	1	
C13	4517-455	Ceramic capacitor	0.01 $\mu$ F 2kV	1	
C14	100-0177	Aluminum electrode capacitor	LWA2N601MSMAZO	1	
CON1	4731-076	Metal receptacle	MSB102A20-27S	1	
F1	100-0392	Fuse	0234005	1	
PCB1	P10352U00	Printed circuit board	P10352U00	1	
PCB2*	P30044P00	Printed circuit board	P30044P00	1	Refer to "NOTE" below.
PCB3	P10263Q00	Printed circuit board	P10263Q00	1	
PCB4	P10265V00	Printed circuit board	P10265V00	1	
PCB5	P10264T00	Printed circuit board	P10264T00	1	
PCB6	P10352M00	Printed circuit board	P10352M00	1	
PCB7	P30044Q00	Printed circuit board	P30044Q00	1	
PCB8	P10263R00	Printed circuit board	P10263R00	1	
PCB9	P30044R00	Printed circuit board	P10264R00	1	
PCB10	P10264X00	Printed circuit board	P10264X00	1	
PCB11	P10355X00	Printed circuit board	P10355X00	1	
PCB12	P10264S00	Printed circuit board	P10264S00	1	
①	4739-474	Grommet with film	W-W02805	2	
②	4735-038	Knob	K-100 22RSB	1	Adjusting knob
③	100-0400	Cap	K-100 22CSB	1	
④	4739-475	Rubber foot	C-30-RK-3220	4	
⑤	P30044W02	Control panel sheet	P30044W02	1	
⑥	100-0393	Blind bush	BB1187B	2	
⑦	P5801G03	Carrying Handle	P5801G03	2	
⑧	P10263G12	Bush	P10263G12	4	
⑨	P10264J01	Front cover	P10264J01	1	
⑩	P10263J02	Control panel cover	P10263J02	1	
⑪	4734-007	Machine socket	DIX BE 50/70	2	Output terminal
Plug for ⑪	4734-025	Power cable connector	DIX SKK 70	2	For 60mm <sup>2</sup> cable

**\*NOTE: When ordering a printed circuit board P30044P00, provide the software version on a label below a nameplate attached to the rear side of the welding power source.**

P30044 Ver. ###.###.000  
↑  
 Replace the ###.### with software version.

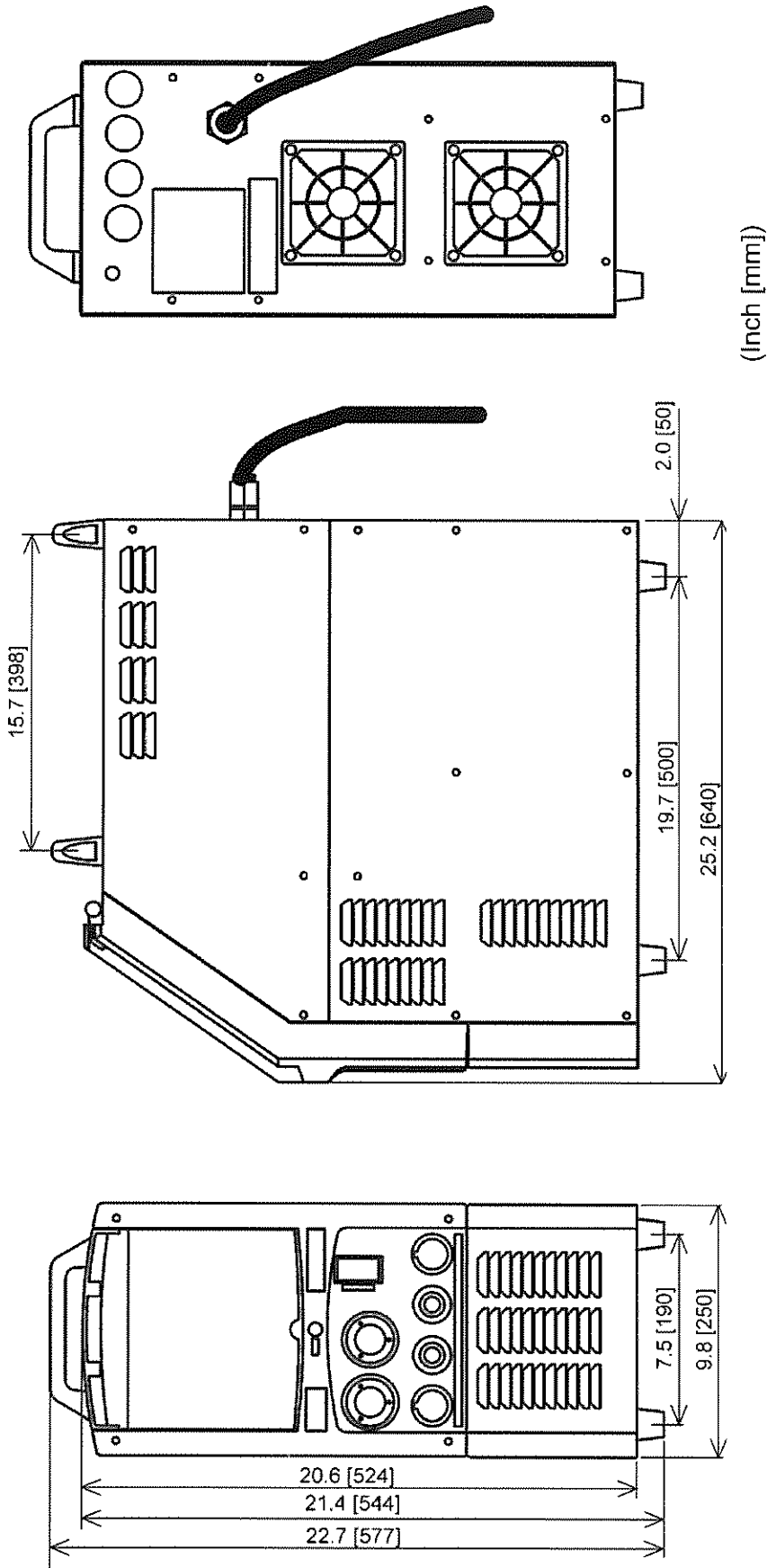
## 14. SPECIFICATIONS

### 14.1 Specifications

Specifications	Cobra Mig 400P					
Model	CM-400P					
	For welding any alloys			For welding Aluminum with 3/64" wire or less		
	Pulse	DC	Pulse	DC	Pulse	DC
Number of phase	Three (3)			Single (1)		
Rated frequency	50 / 60 Hz			50 / 60 Hz		
Rated input voltage	208 / 230V			208 / 230V		
Input voltage range	208 / 230V ± 10%			208 / 230V ± 10%		
Rated input power	21.4 kVA, 19.5 kW	17.9 kVA, 17.0 kW	23.6 kVA, 21.5 kW	18.5 kVA, 17.0 kW	11.3 kVA, 8.5 kW	7.3 kVA, 5.1 kW
	59.4 / 53.7A	49.7 / 45.0A	29.6A	23.2A	51.7 / 49.2A	35.3 / 29.6A
Rated input current	400A			250A		
Rated output current	34V			26.5V		
Rated load voltage	30 – 400A			30 – 250A		
Rated output current range	12 – 38V			12 – 31V		
Rated output voltage range	84 / 92V			84 / 92V		
Maximum no-load voltage	50%	60%	50%	60%	40%	
Rated duty cycle	100					
Number of welding condition	+320°F [+160°C]					
Temperature rise	+14 - +104°F [-10 - +40°C]					
Usable temperature range	20 – 80% (without dew condensation)					
Usable moisture range	+14 - +140°F [-10 - +60°C]					
Storage temperature range	20 – 80% (without dew condensation)					
Storage moisture range	9.8" x 25.2" x 21.4" [250mm x 640mm x 544mm] (without the carrying handle)					
External dimensions (W×D×H)	99.2 lb [45kg]					
Mass						

# 14. SPECIFICATIONS (continued)

## 14.2 External View





14. SPECIFICATIONS (continued)

● Initial Values and Setting Range of Parameter

Main condition	Initial value		Setting range
	Current	Voltage	
Main condition	20 A	20 - 400 A	
	10 V	10 - 45 V	
Wire diameter	0	-30 - 30	
POSA start	ON (5.0)	0.0 - 0.0	
Arc characteristic	0	-10 - 10	
Wave frequency	3 Hz	0.5 - 32 Hz	
JOB MEMORY numbers	1	1 - 150	

● Function

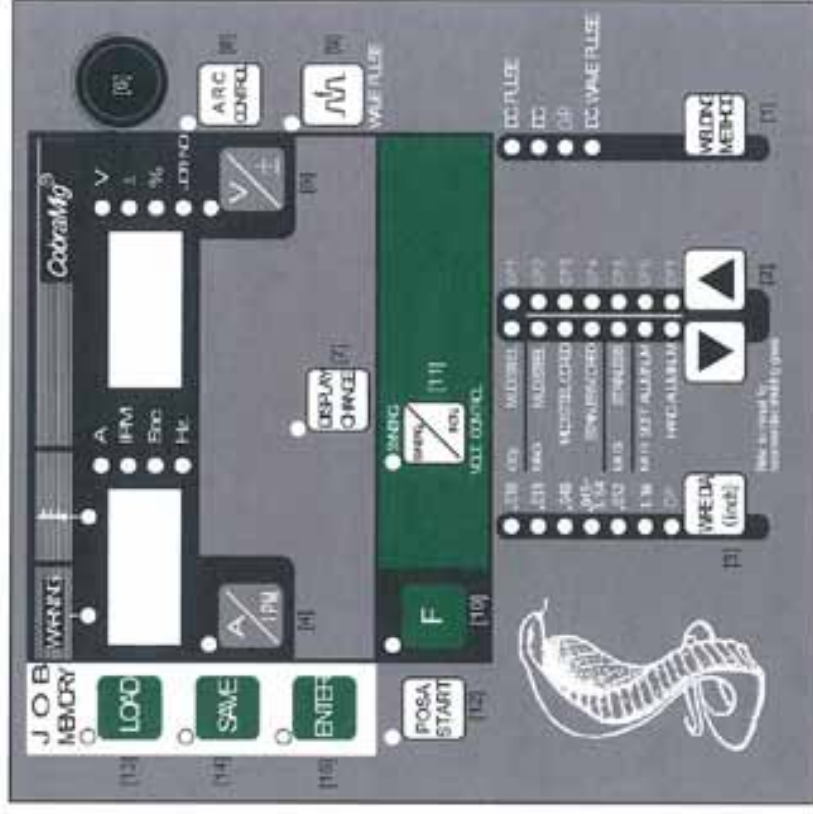
Welding method	Initial value	Setting item
Welding method	DC pulse	DC pulse / DC wave pulse
Wire/Gas	HARD ALUMINUM	MILD STEEL, CO-MILD STEEL, MAGNETALRESS CORELD MAGNETAL STEEL, CORED MAGNETALRESS STEEL, MIG, SOFT ALUMINUM MIG, HARD ALUMINUM MIG.
Wire diameter	0.045"	0.030" / 0.035" / 0.040" / 0.045" / 0.047" / 0.050" / 0.055" / 0.060" / 0.063" / 0.067" / 0.070" / 0.075" / 0.080" / 0.085" / 0.090" / 0.095" / 0.100"
Adjustment of welding voltage	SYNERGIC	SYNERGIC/ON/OFF/DUAL

● Internal Functions (Function) <Refer to Section 10.2.1, "Using of Internal Functions" >

Function	Initial value	Setting range
F1 Fine adjustment of anti-stick (backlash) time*	0	-500.50 second (down) - 500.50 second (up)
F2 Fine adjustment of anti-stick (backlash) voltage*	0.0	-9.9 - 9.9 V
F4 Setting of Pre-flow time	0.1	0 - 10.0 seconds
F8 Result display holding time	5	0 - 60 seconds
F12 Arc voltage direct selection ON/OFF selection	OFF	ON/DIRECT/OFF (TERMINAL)
F13 Fine adjustment of pulse peak current*	0	-150 A - 150 A
F14 Fine adjustment of pulse peak time*	0	-1.5 (ms) - 1.5 (ms)
F16 Fine adjustment of L pulse peak current*	0	-60 A - 60 A
F17 Fine adjustment of L pulse peak time*	0	-150 A - 150 A
F18 Fine adjustment of L pulse base current*	0	-1.5 (ms) - 1.5 (ms)
F19 Turbo Start ON/OFF selection	ON	ON (VALID) / OFF (INVALID)
P20 Keypad tone ON/OFF selection	ON	ON (VALID) / OFF (INVALID)

\*Welding conditions which can be preset to JOB MEMORY number.

Front Panel



[1] WELDING METHOD key	[9] WAVE PULSE key
[2] WIRE/GAS selector keys	[10] F (FUNCTION) key
[3] WIRE DIA. (inch) key	[11] VOLT. CONTROL key
[4] A/I/FM selector key	[12] POSA START key
[5] V/L selector key	[13] LOAD key
[6] Parameter adjusting knob	[14] SAVE key
[7] DISPLAY CHANGE key	[15] ENTER key
[8] ARC CONTROL key	

## 14. SPECIFICATIONS (continued)

### QUICK MANUAL

Refer to Section 10.1, "Basic Settings" and Section 10.2, "Applied Settings".

#### 1. Return Using the Welding Power Source

##### 1. Settings of Welding Method



Set a welding method, wire shield gas, then wire diameter by using the WELDING METHOD key, the WIRE GAS selector keys, and the WIRE DIA. (inch [mm]  $\phi$ ) key respectively.

##### 2. Settings of Functions



- For controlling voltage in the SYNERG. way, select "SYNERG." by pressing the VOLT. CONTROL key.

[SYNERGIC] VOLT. CONTROL lamp is on.  
[INDIVIDUAL] VOLT. CONTROL lamp is off.

##### 3. Settings of Parameter

Use the DISPLAY CHANGE key to select the parameter you want to set, then adjust it while turning the parameter adjusting knob.

When changing the parameter unit in the display, use the  $\frac{A}{V}$  or  $\frac{V}{A}$  selector key.



To adjust the desired arc characteristic (HARD/SOFT), after turning on the ARC CONTROL lamp by pressing the ARC CONTROL key, set the level of the arc characteristic.

[ON] ARC CONTROL lamp is on.  
[OFF] ARC CONTROL lamp is off.

When the desired bead appearance after turning on the WAVE PULSE lamp by pressing the WAVE PULSE key, set the wave pulse while turning the parameter adjusting knob.

[ON] WAVE PULSE lamp is on.  
[OFF] WAVE PULSE lamp is off.

#### NOTE:

- Turning the parameter adjusting knob clockwise increases the parameter. To decrease the parameter, turn the parameter adjusting knob counter-clockwise.

#### ① Protecting the Keys and Releasing the Key Protection



- Protecting of the keys

Hold down the ENTER key + the F key at a time for a few seconds. The F lamp starts blinking. Blinking of the F lamp means the welding machine is in the key protection mode.

- Releasing the key protection

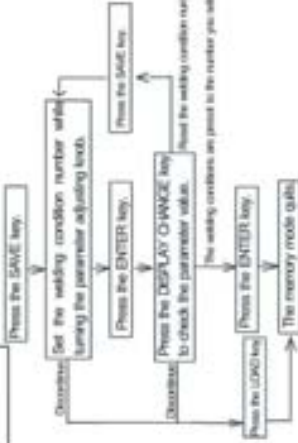
Hold down the ENTER key + the F key at a time for a few seconds. When the F lamp turns off, the key protection function is released.



#### ② Presetting the Welding Condition

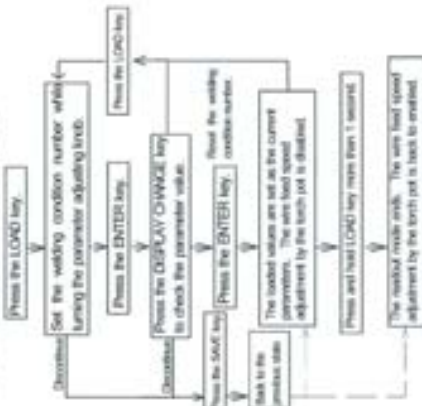


- Pressing the SAVE key enters the save mode. The preset welding condition number is displayed in the right display and the welding current is displayed in the left display.
- Preset the welding conditions to the desired numbers 0 - 100 while turning the parameter adjusting knob. When "..." is displayed in the left display, the number you selected is available. When "..." is not displayed in the left display, the number you selected is unavailable. In this case, select another number. Otherwise, the welding conditions preset to the number are erased and overwritten with the welding conditions you newly set.
- Press the ENTER key to check the parameter preset to the number.
- When pressing the ENTER key again, the welding conditions are set.



#### ③ Loading the Welding Conditions

- Pressing the LOAD key enter the load mode. The preset welding condition number is displayed in the right display and the welding current is displayed in the left display.
- Preset the welding conditions to the desired numbers. When "..." is displayed in the left display, no welding conditions are preset to the number you selected. When pressing the ENTER key [16] again, you can read out the preset welding conditions and the LOAD lamp continues to blink to represent the readout mode. During the readout mode, the welding conditions of both the wire feed speed (welding arrangement) and the voltage can be adjusted by the Parameter adjusting knob [8] on the front panel of CM-600P, however the conditions can not be changed by the torch pot because it is disabled.
- To exit the readout mode, press and hold the LOAD key [13] more than 1 second. The LOAD lamp turns off and the wire feed speed (welding arrangement) can be changed by the torch pot back again.



#### ⑤ Settings of the (Internal) Functions

- When holding down the F key for a few seconds, the function mode is activated. The function number blinks in the left display, the function status is displayed in the right display.
- Set the function number while turning the parameter adjusting knob.
- When pressing the F key, the function number lights up, then the function status blinks.
- Set the function status while turning the parameter adjusting knob.
- To cancel the function mode, hold down the F key for a few minutes.

## 15. SERVICE AND SUPPORT

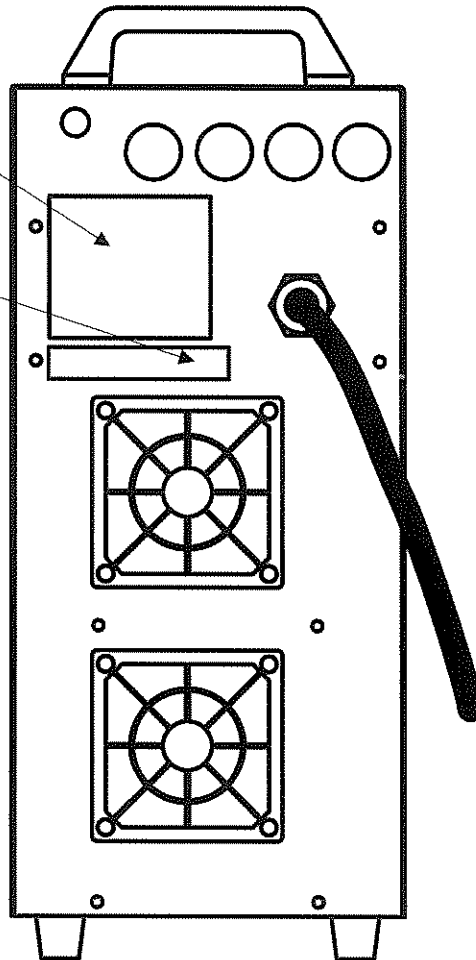
Please contact your local dealer for service. (See the back cover for telephone numbers, fax numbers, and mailing addresses.)

### NOTE:

- 1) See Section 12, "MAINTENANCE AND TROUBLESHOOTING" before contacting your dealer for service.
- 2) When contacting your dealer for service, you are required to provide the following information:
  - Address
  - Name
  - Telephone number
  - Product model
  - Manufacture year
  - Serial number
  - Software version number
  - Details of troubles

• MODEL: 186-004  
• DATE: 20XX  
• SERIAL NO.:XXXXXXXX

P30044 Ver ###.###.000



			
<b>WARNING</b>	<ul style="list-style-type: none"> <li>Do not touch electrically live parts or electrodes with skin or wet clothing.</li> <li>Insulate yourself from work and ground.</li> </ul>	<ul style="list-style-type: none"> <li>Keep flammable materials away.</li> </ul>	<ul style="list-style-type: none"> <li>Wear eye, ear and body protection.</li> </ul>
Spanish <b>AVISO DE PRECAUCION</b>	<ul style="list-style-type: none"> <li>No toque las partes o los electrodos bajo carga con la piel o ropa mojada.</li> <li>Aisle-se del trabajo y de la tierra.</li> </ul>	<ul style="list-style-type: none"> <li>Mantenga el material combustible fuera del área de trabajo.</li> </ul>	<ul style="list-style-type: none"> <li>Protéjase los ojos, los oídos y el cuerpo.</li> </ul>
French <b>ATTENTION</b>	<ul style="list-style-type: none"> <li>Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension.</li> <li>isolez-vous du travail et de la terre.</li> </ul>	<ul style="list-style-type: none"> <li>Gardez à l'écart de tout matériel inflammable.</li> </ul>	<ul style="list-style-type: none"> <li>Protégez vos yeux, vos oreilles et votre corps.</li> </ul>
German <b>WARNUNG</b>	<ul style="list-style-type: none"> <li>Berühren Sie keine stromführenden Teile oder Elektroden mit ihrem Körper oder feuchter Kleidung!</li> <li>Isolieren Sie sich von den Elektroden und dem Erdboden!</li> </ul>	<ul style="list-style-type: none"> <li>Entfernen Sie brennbares Material!</li> </ul>	<ul style="list-style-type: none"> <li>Tragen Sie Augen-, Ohren- und Körperschutz!</li> </ul>
Portuguese <b>ATENÇÃO</b>	<ul style="list-style-type: none"> <li>Não toque partes elétricas e electrodos com a pele ou roupa molhada.</li> <li>isole-se da peça e terra.</li> </ul>	<ul style="list-style-type: none"> <li>Mantenha inflamáveis bem guardados.</li> </ul>	<ul style="list-style-type: none"> <li>Use proteção para a vista, ouvidos e corpo.</li> </ul>
Japanese <b>注意事項</b>	<ul style="list-style-type: none"> <li>通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。</li> <li>施工物やアースから身体が絶縁されている様にして下さい。</li> </ul>	<ul style="list-style-type: none"> <li>燃えやすいものの側での溶接作業は絶対にしてはなりません。</li> </ul>	<ul style="list-style-type: none"> <li>目、耳及び身体に保護具をして下さい。</li> </ul>
Chinese <b>警告</b>	<ul style="list-style-type: none"> <li>皮肤或潮衣切勿与带电部件及焊条。</li> <li>使你自已与地面和工作绝缘。</li> </ul>	<ul style="list-style-type: none"> <li>把一切易燃物品移离工作场所。</li> </ul>	<ul style="list-style-type: none"> <li>佩戴眼、耳及身体劳动保护用具。</li> </ul>
Korean <b>위험</b>	<ul style="list-style-type: none"> <li>전도체나 용접봉을 젖은 옷감 또는 피부로 절대 접촉치 마십시오.</li> <li>모재와 접지를 접촉치 마십시오.</li> </ul>	<ul style="list-style-type: none"> <li>인화성 물질을 접근 시키지 마시오.</li> </ul>	<ul style="list-style-type: none"> <li>눈, 귀와 몸에 보호장구를 착용하십시오.</li> </ul>
Arabic <b>تحذير</b>	<ul style="list-style-type: none"> <li>لا تلمس الأجزاء التي يسي منها التيار الكهربائي أو الأقطاب بجهد الجسم أو بالملابس المبللة بالعام.</li> <li>ضع عزلا على جسمك خلال العمل.</li> </ul>	<ul style="list-style-type: none"> <li>ضع المواد القابلة للاحتراق في مكان بعيد.</li> </ul>	<ul style="list-style-type: none"> <li>ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.</li> </ul>

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
<ul style="list-style-type: none"> <li>● Keep your head out of fumes.</li> <li>● Use ventilation or exhaust to remove fumes from breathing zone.</li> </ul>	<ul style="list-style-type: none"> <li>● Turn power off before servicing.</li> </ul>	<ul style="list-style-type: none"> <li>● Do not operate with panel open or guards off.</li> </ul>	<b>WARNING</b>
<ul style="list-style-type: none"> <li>● Los humos fuera de la zona de respiración.</li> <li>● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.</li> </ul>	<ul style="list-style-type: none"> <li>● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.</li> </ul>	<ul style="list-style-type: none"> <li>● No operar con panel abierto o guardas quitadas.</li> </ul>	Spanish <b>AVISO DE PRECAUCION</b>
<ul style="list-style-type: none"> <li>● Gardez la tête à l'écart des fumées.</li> <li>● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.</li> </ul>	<ul style="list-style-type: none"> <li>● Débranchez le courant avant l'entretien.</li> </ul>	<ul style="list-style-type: none"> <li>● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.</li> </ul>	French <b>ATTENTION</b>
<ul style="list-style-type: none"> <li>● Vermeiden Sie das Einatmen von Schweißrauch!</li> <li>● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!</li> </ul>	<ul style="list-style-type: none"> <li>● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)</li> </ul>	<ul style="list-style-type: none"> <li>● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!</li> </ul>	German <b>WARNUNG</b>
<ul style="list-style-type: none"> <li>● Mantenha seu rosto da fumaça.</li> <li>● Use ventilação e exaustão para remover fumo da zona respiratória.</li> </ul>	<ul style="list-style-type: none"> <li>● Não opere com as tampas removidas.</li> <li>● Desligue a corrente antes de fazer serviço.</li> <li>● Não toque as partes elétricas nuas.</li> </ul>	<ul style="list-style-type: none"> <li>● Mantenha-se afastado das partes moventes.</li> <li>● Não opere com os painéis abertos ou guardas removidas.</li> </ul>	Portuguese <b>ATENÇÃO</b>
<ul style="list-style-type: none"> <li>● ヒュームから顔を離すようにして下さい。</li> <li>● 換気や排煙に十分留意して下さい。</li> </ul>	<ul style="list-style-type: none"> <li>● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切ってください。</li> </ul>	<ul style="list-style-type: none"> <li>● パネルやカバーを取り外したまま機械操作をしないで下さい。</li> </ul>	Japanese <b>注意事項</b>
<ul style="list-style-type: none"> <li>● 頭部遠離煙霧。</li> <li>● 在呼吸區使用通風或排風器除煙。</li> </ul>	<ul style="list-style-type: none"> <li>● 維修前切斷電源。</li> </ul>	<ul style="list-style-type: none"> <li>● 鐵要板打開或沒有安全罩時不準作業。</li> </ul>	Chinese <b>警告</b>
<ul style="list-style-type: none"> <li>● 얼굴로부터 용접가스를 멀리하십시오.</li> <li>● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거거나 통풍기를 사용하십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 보수전에 전원을 차단하십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 단열이 떨어진 상태로 작동하지 마십시오.</li> </ul>	Korean <b>위험</b>
<ul style="list-style-type: none"> <li>● بعد رأسك بعيداً عن الدخان.</li> <li>● استعمل التهوية أو جهاز ضبط الدخان للفراغ لكي تبعد الدخان عن المنطقة التي تتنفس فيها.</li> </ul>	<ul style="list-style-type: none"> <li>● قطع التيار الكهربائي قبل القيام بأية صيانة.</li> </ul>	<ul style="list-style-type: none"> <li>● لا تطلق هذا الجهاز إذا كانت الإسطوة الحديدية الواقية ليست عليه.</li> </ul>	Arabic <b>تحذير</b>

**LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGAADOR.**

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的說明以及應該使用的鍍焊材料，並請遵守貴方的有關勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها وتبع تعليمات الوقاية لصاحب العمل.



# LIMITED WARRANTY

Effective October 1, 2006

This warranty supersedes all previous MK Products warranties and is exclusive, with no other guarantees or warranties expressed or implied.

**LIMITED WARRANTY** - MK Products Inc., Irvine, California warrants that all new and unused equipment furnished by MK Products is free from defects in workmanship and material as of the time and place of delivery by MK Products. No warranty is made by MK Products with respect to trade accessories or other items manufactured by others. Such trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any.

MK Products' warranty does not apply to components having normal useful life of less than one (1) year, such as relay points, wire conduit, tungsten, and welding gun parts that come in contact with the welding wire, including gas cups, gas cup insulators, and contact tips where failure does not result from defect in workmanship or material.

MK Products shall, exclusively remedy the limited warranty or any duties with respect to the quality of goods, based upon the following options:

- (1) repair
- (2) replacement
- (3) where authorized in writing by MK Products, the reasonable cost of repair or replacement at our Irvine, California plant.

As a matter of general policy only, MK Products may honor an original user's warranty claims on warranted equipment in the event of failure resulting from a defect within the following periods from the date of delivery of equipment to the original user:

- 1. Power Supplies and Wire Feed Cabinets ..... **3 years**
- 2. Weldheads, Positioners, Prince XL and Prince XL Spool Guns, Python, CobraMAX, Cobra SX, Cobra MX ..... **1 year**
- 3. Sidewinder® Spool Gun, Prince SG Spool Guns, Modules ..... **180 days**
- 4. Repairs/Exchanges/Parts ..... **90 days**

Classification of any item into the foregoing categories shall be at the sole discretion of MK Products. Notification of any failure must be made in writing within 30 days of such failure.

A copy of the invoice showing the date of sale must accompany products returned for warranty repair or replacement.

All equipment returned to MK Products for service must be properly packaged to guard against damage from shipping. MK Products will not be responsible for any damages resulting from shipping.

Normal surface transportation charges (one way) for products returned for warranty repair or replacement will be borne by MK Products, except for products sold to foreign markets.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY, OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE, OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MK PRODUCTS, IS EXCLUDED AND DISCLAIMED BY MK PRODUCTS.

EXCEPT AS EXPRESSLY PROVIDED BY MK PRODUCTS IN WRITING, MK'S PRODUCTS ARE INTENDED FOR ULTIMATE PURCHASE BY COMMERCIAL/INDUSTRIAL USERS AND FOR OPERATION BY PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT AND NOT FOR CONSUMERS OR CONSUMER USE. MK PRODUCTS' WARRANTIES DO NOT EXTEND TO, AND NO RE-SELLER IS AUTHORIZED TO EXTEND MK PRODUCTS' WARRANTIES TO ANY CONSUMER.

USE OF OTHER THAN GENUINE MK PRODUCTS' CONSUMABLES, PARTS, AND ACCESSORIES MAY INVALIDATE YOUR PRODUCT WARRANTY.



16882 Armstrong Ave  
Irvine, CA 92606  
Tel (949) 863-1234  
Fax (949) 474-1428  
[www.mkproducts.com](http://www.mkproducts.com)



16882 Armstrong Ave.  
Irvine, California 92606  
Tel (949) 863-1234 Fax (949) 474-1428  
[www.mkproducts.com](http://www.mkproducts.com)