# CENTURY® AC 120

#### Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT. And, most importantly, think before you act and be careful.



# **OPERATOR'S MANUAL**





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## **WARNING**

#### CALIFORNIA PROPOSITION 65 WARNINGS /

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.
KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.



# FOR ENGINE powered equipment.

 Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.



 Doperate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.



- 1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.
- 1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.
- 1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.



- 1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.



 To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



# ELECTRIC AND MAGNETIC FIELDS may be dangerous

- 2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines
- EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- Exposure to EMF fields in welding may have other health effects which are now not known.
- 2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
  - 2.d.1. Route the electrode and work cables together Secure them with tape when possible.
  - 2.d.2. Never coil the electrode lead around your body.
  - 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
  - 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
  - 2.d.5. Do not work next to welding power source.



#### **ELECTRIC SHOCK can**

#### kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".
- 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
- 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- 3.g. Never dip the electrode in water for cooling.
- 3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
- 3.j. Also see Items 6.c. and 8.



#### ARC RAYS can burn.

- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



# FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep

fumes and gases away from the breathing zone. When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.

- 5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.
- 5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.
- 5.f. Also see item 1.b.



# WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire.

Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.I. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.



# CYLINDER may explode if damaged.

- 7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
  - Away from areas where they may be struck or subjected to physical damage.
  - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.



# FOR ELECTRICALLY powered equipment.

- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to <a href="http://www.lincolnelectric.com/safety">http://www.lincolnelectric.com/safety</a> for additional safety information.

## PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

#### Sûreté Pour Soudage A L'Arc

- 1. Protegez-vous contre la secousse électrique:
  - a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
  - b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
  - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
  - d.Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
  - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
  - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.
- Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
- Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:
  - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
  - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
  - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
- 4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

- 5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.
- Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.
- Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.
- 8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.
- Assurer une ventilation suffisante dans la zone de soudage.
   Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.
- 10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.
- Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

## PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

- Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.
- 2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.
- Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.
- Garder tous les couvercles et dispositifs de sûreté à leur place.

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# Thank You-

for selecting one of our **QUALITY** products. We want you to take pride in operating this product ••• as much pride as we have in bringing this product to you!

#### **CUSTOMER ASSISTANCE POLICY**

The business of our company is manufacturing and selling high quality welding equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask us for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. We are not in a position to warrant or guarantee such advice, and assume no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

We are a responsive manufacturer, but the selection and use of specific products sold by us is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond our control affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change - This information is accurate to the best of our knowledge at the time of printing.

#### Please Examine Carton and Equipment For Damage Immediately

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, Claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

,
Product
Model Number
Code Number or Date Code (if available)
Serial Number (if available)
Date Purchased
Where Purchased
Whenever you request replacement parts or information on this equipment, always supply the information you have recorded above.

**Read this Operators Manual completely** before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. The level of seriousness to be applied to each is explained below:

### **A** WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life.

#### **A** CAUTION

This statement appears where the information **must** be followed to avoid **minor personal injury** or **damage to this equipment**.



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#### SAFETY

Read the entire manual before installing and operating the AC 120.

#### A WARNING



**ELECTRIC SHOCK can kill.** 

- Only qualified personnel should installation or operate this equipment.
- · Machine must be plugged into a receptacle which is grounded per any national, local or other applicable electrical codes.
- The AC 120 power switch is to be in the OFF ("O") position when connecting power cord to input power.
- · Do not touch electrically live parts or electrode with skin or wet clothing. Insulate yourself from work and ground.
- · Always wear dry insulating gloves.



**FUMES AND GASES can be dangerous.** 

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.



WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not weld on closed containers.



ARC RAYS can burn eyes and skin.

Wear eye, ear and body protection.

#### GENERAL DESCRIPTION

The AC 120 is composed of a single phase transformer and is suitable for welding in alternate current using stick electrodes (type 6013) with diameters from 1/16 to 5/64 in. The AC 120 is rated for a 20% duty cycle at a rated output of 55 amps. A 55A output can be drawn for 2 minutes out of each 10 minute period without overheating.

#### SELECT SUITABLE LOCATION

This machine can operate in harsh environments. However, it is important that simple preventative measures are followed to assure long life and reliable operation:

- This machine must be located where there is free circulation of clean air without restrictions for air movement to and from the air vents. Do not cover the machine with paper, cloth or rags when switched on.
- · Dirt and dust that can be drawn into the machine should be kept to a minimum.
- · Keep machine dry and do not place it on wet ground or in puddles. Do not use in wet or damp locations. Store indoors.

#### WARNING

Do not mount over combustible surfaces.

### **TECHNICAL SPECIFICATIONS**

INPUT – SINGLE PHASE ONLY			
Voltage/Frequency 120V/60Hz	I	Input Current 15 Amps @ Rated Output	
RATED OUTPUT			
Duty Cycle	<u>Amps</u>	<u>Volts</u>	
20%	55	27	

OUTPUT RANGE			
	Welding Current Range		
AC Output:		50-90 amps	
Maximum Open Circuit Voltage 37			

PHYSICAL DIMENSIONS			
<b>Height</b>	<u>Width</u>	<u>Depth</u>	Weight
11.00 in.	7.00 in.	11.00 in.	24.5 lbs.
280 mm	178 mm	280 mm	11 kg.

RECOMMENDED INPUT FUSE SIZES AND EXTENSION CORDS			
Breaker/Fuse Size	Input Amps	Power Cord	
20 Amp	15 - 20	15 Amp, 125V Three Prong Plug (NEMA Type 5-15P)	
Up to 25 Ft. (7.6 m):	Extension Cord	or #12 AWG	
Op to 23 Tt. (7.0 III).	Three Conductor #12 AWG (3.3 mm²) or Larger		
RECOMMENDED ELECTRODE & MATERIAL THICKNESS			
1/16" or 5/64" Fleetweld 37 (E6013)			



#### **IDENTIFY AND LOCATE COMPONENTS**

(See Figure A.1)

If you have not already done so, unpack the AC 120 from its carton and remove all packing material around the unit.

#### 1) INPUT CORD CONNECTION

This machine is intended to operate off a standard household type receptacle (20A, 120V, 60Hz, single phase, grounded). Refer to the Technical Specifications at the beginning of this manual. If connected to a circuit protected by fuses, use time delay fuses marked "D".

#### 2) WORK CLAMP

The work clamp and cable is attached to the welder at the factory. The work clamp must be directly connected to the workpiece or the work bench. Make sure the contact to the workpiece is adequate by avoiding painted or nonmetallic surfaces.

#### 3) ELECTRODE HOLDER

The Electrode holder and cable is attached to the welder at the factory. It has special contact jaws to grasp the bare part of the welding electrode.

#### 4) INSTRUCTION MANUAL

#### 5) POWER SWITCH

#### INPUT CONNECTIONS

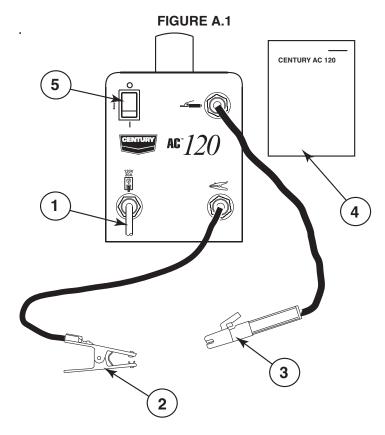
## CODE REQUIREMENTS FOR INPUT CONNECTIONS

#### **▲** WARNING

- This welding machine must be connected to a power supply in accordance with applicable electrical codes.
- If there is any question about the installation meeting applicable electrical code requirements, consult a qualified electrician.

Do not connect the AC 120 to an input power supply with a rated voltage that is greater than 125 volts.

Do not remove the power cord ground prong.



**CENTURY® AC 120** 



#### THERMAL PROTECTION

If the duty cycle is exceeded, a thermal protector will shut off the output until the machine cools to a reasonable operating temperature. The Power Switch will Illuminate if this condition occurs, which is an automatic function of the AC 120 and does not require user intervention. Output will resume once the machine cools.

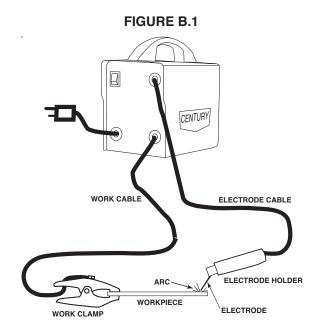
#### **MAKING A WELD**

(See Figure B.1)

Insert the bare part of the electrode into the electrode holder jaws and connect the work clamp to the welding piece. Make sure to have good electrical contact. Turn the AC 120 on. Lower Helmet or while holding shield in front of face strike the electrode work point on the workpiece as if striking a match. Do not hit the electrode on the workpiece, which will damage the stick electrode and make striking an arc difficult. Immediately after striking the arc try to maintain a distance from the workpiece that is equivalent to the diameter of the electrode used. Maintain this distance continually during the weld.

Refer to the "Learning to Weld" section in this manual for more information on:

- · How to correctly strike an arc.
- The correct welding position.
- · Proper travel speed.



Once the electrode is burned down turn the machine off and remove the stub by opening the jaws of the electrode holder and insert a new electrode. The welded work piece and electrode stub are hot after welding, allow time to cool down before touching or use pliers to move. Always make sure the AC 120 is turned off before setting down the Electrode Holder.

#### **ELECTRODE SELECTION**

For best results use genuine Lincoln Electric Fleetweld 37 electrodes in the 1/16" or 5/64" size. This is suitable for welding up to 14ga steel.

#### LEARNING TO WELD

The serviceability of a product or structure utilizing this type of information is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying this type of information. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements.

No one can learn to weld simply by reading about it. Skill comes only with practice. The following pages will help the inexperienced welder to understand welding and develop his skill.

#### The Arc-Welding Circuit

The operator's knowledge of arc welding must go beyond the arc itself. He must know how to control the arc, and this requires a knowledge of the welding circuit and the equipment that provides the electric current used in the arc. Figure B.1 is a diagram of the welding circuit. The circuit begins where the electrode cable is attached to the welding machine and ends where the work cable is attached to the welding machine. Current flows through the electrode cable to the electrode holder, through the holder to the electrode and across the arc. On the work side of the arc, the current flows through base metal to the work cable and back to the welding machine. The circuit must be complete for the current to flow. To weld, the work clamp must be tightly connected to clean base metal. Remove paint, rust, etc. as necessary to get a good connection. Connect the work clamp as close as possible to the area you wish to weld. Avoid allowing the welding circuit to pass through hinges, bearings, electronic components or similar devices that can be damaged.



#### **A** WARNING



**ELECTRIC SHOCK can kill.**Carefully review the ARC WELDING SAFETY PRECAUTIONS at the beginning of this manual.

The electric arc is made between the work and the tip end of a small metal wire, the electrode, which is clamped in a holder. A gap is made in the welding circuit (see Figure B.1) by holding the tip of the electrode.

Arc welding is a manual skill requiring a steady hand, good physical condition, and good eyesight. The operator controls the welding arc and, therefore, the quality of the weld made.

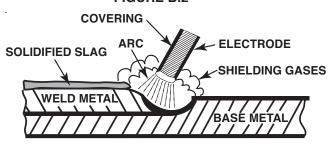
#### What Happens in the Arc?

**Figure B.2** illustrates the action that takes place in the electric arc. It closely resembles what is actually seen during welding.

The "arc stream" is seen in the middle of the picture. This is the electric arc created by the electric current flowing through the space between the end of the electrode and the work. The temperature of this arc is about 6000°F. (3315°C), which is more than enough to melt metal. The arc is very bright, as well as hot, and cannot be looked at with the naked eye without risking painful injury. A very dark lens, specifically designed for arc welding, must be used with a hand or face shield whenever viewing the arc.

The arc melts the base metal and actually digs into it, much as the water through a nozzle on a garden hose digs into the earth. The molten metal forms a pool or crater and tends to flow away from the arc. As it moves away from the arc, it cools and solidifies. A slag forms on top of the weld to protect it during cooling.

#### FIGURE B.2



The function of the covered electrode is much more than simply to carry current to the arc. The electrode is composed of a core of metal wire with an extruded chemical covering. The core wire melts in the arc and tiny droplets of molten metal shoot across the arc into the molten pool. The electrode provides additional filler metal for the joint to fill the groove or gap between the two pieces of the base metal. The covering also melts or burns in the arc. It has several functions. It makes the arc steadier, provides a shield of smoke-like gas around the arc to keep oxygen and nitrogen in the air away from the molten metal, and provides a flux for the molten pool. The flux picks up impurities and forms the protective slag.

Four simple manipulations are of prime importance. Without complete mastery of these four, further welding is more or less futile. With complete mastery of the four, welding will be easy.

#### 1. The Correct Welding Position

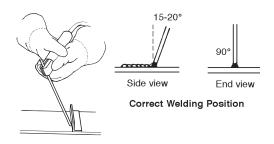
Beginners will find it easier to learn how to control the welding arc using the two-handed technique shown below. This requires the use of a **head-shield**.

- a. Hold the electrode holder in your right hand.
- **b.** Touch your left hand to the underside of your right.
- **c.** Put the left elbow against your left side. (For welding left-handed it is the opposite.)

If you are using a **hand shield**, hold the electrode holder in your right hand and the hand shield in your left. (For welding left-handed it is the opposite.)

Whenever possible, weld from left to right (if right-handed). This enables you to see clearly what you are doing. Hold the electrode at a slight angle as shown in **Figure B.3**.

#### FIGURE B.3



#### 2. The Correct Way to Strike an Arc

Be sure the work clamp makes good electrical contact to the work.



Lower your headshield or hold the hand shield in front of your face. Scratch the electrode slowly over the metal and you will see sparks flying. While scratching, lift the electrode 1/8" (3.2mm) and the arc is established.

**NOTE:** If you stop moving the electrode while scratching, the electrode will stick.

**NOTE:** Most beginners try to strike the arc by a fast jabbing motion down on the plate. Result: They either stick or their motion is so fast that they break the arc immediately.

#### 3. The Correct Arc Length

The arc length is the distance from the tip of the electrode core wire to the base metal.

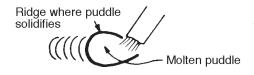
Once the arc has been established, maintaining the correct arc length becomes extremely important. The arc should be short, approximately 1/16 to 1/8" (1.6 to 3.2mm) long. As the electrode burns off the electrode must be fed to the work to maintain correct arc length.

The easiest way to tell whether the arc has the correct length is by listening to its sound. A nice, short arc has a distinctive, "crackling" sound, very much like eggs frying in a pan. The incorrect, long arc has a hollow, blowing or hissing sound.

#### 4. The Correct Welding Speed

The important thing to watch while welding is the puddle of molten metal right behind the arc. **Do NOT watch the arc** itself. It is the appearance of the puddle and the ridge where the molten puddle solidifies that indicate correct welding speed. The ridge should be approximately 3/8" (9.5mm) behind the electrode as shown in **Figure B.4**.

#### **FIGURE B.4**



Most beginners tend to weld too fast, resulting in a thin, uneven, "wormy" looking bead. They are not watching the molten metal.

**IMPORTANT:** For general welding it is not necessary to weave the arc; neither forwards and backwards nor sideways. Weld along at a steady pace. You will find it easier.

**NOTE:** When welding on thin plate, you will find that you will have to increase the welding speed, whereas when welding on heavy plate, it is necessary to go more slowly in order to get good penetration.

#### **COMMON METALS**

Most metals found around the home are low carbon steel, sometimes referred to as mild steel. Typical items made with this type of steel include most sheet metal, plate, pipe and rolled shapes such as channels and angle irons. This type of steel can usually be easily welded without special precautions.

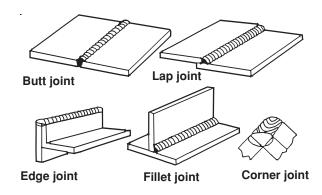
Regardless of the type of metal being welded, in order to get a quality weld, it is important that the metal is free of oil, paint, rust or other contaminants.

#### **Joint Types and Positions**

Five types of welding joints are: Butt joint, Fillet joint, Lap joint, Edge joint and Corner joint see **Figure B.5**.

Of these, the Butt joint and Fillet joint are the two most common welds.

#### **FIGURE B.5**

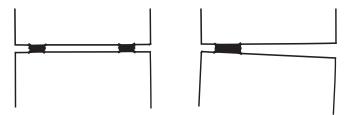


#### **Butt Joints**

Butt joints are the most widely used welds. Place two plates side by side.

Tack the plates at both ends, otherwise the heat will cause the plates to move apart. (See FIGURE B.6):

#### FIGURE B.6

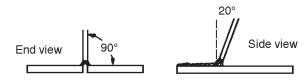




#### **Types of Butt Joint**

Now weld the two plates together. Weld from left to right (if right-handed). Point the electrode down in the crack between the two plates, keeping the electrode slightly tilted in the direction of travel. (See Figure B.7)

FIGURE B.7

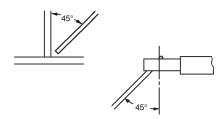


Watch the molten metal to be sure it distributes itself evenly on both edges and in between the plates.

#### **Fillet Joint**

When welding fillet joints, it is very important to hold the electrode at a 45° angle between the two sides, or the metal will not distribute itself evenly. (See Figure B.8)

FIGURE B.8



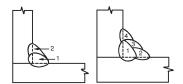
To make it easy to get the 45° angle, it is best to put the electrode in the holder at a 45° angle, as shown:

#### **Types of Fillet Joint**

#### **Multiple Pass Welds**

Make multiple pass horizontal fillets as shown in **figure B.9**. Put the first bead in the corner. Hold the electrode angle needed to deposit the filler beads as shown putting the final bead against the vertical plate. Make sure to remove the slag from the weld prior to making the next pass.

FIGURE B.9





#### HOW TO USE TROUBLESHOOTING GUIDE

#### WARNING

Service and Repair should only be performed by Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

#### Step 1. LOCATE PROBLEM (SYMPTOM).

Look under the column labeled "PROBLEM (SYMP-TOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting.

#### Step 2. POSSIBLE CAUSE.

The second column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

#### Step 3. RECOMMENDED COURSE OF ACTION

This column provides a course of action for the Possible Cause, generally it states to contact your local Authorized Field Service Facility.

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Authorized Field Service Facility.

## **A** CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.



## **TROUBLESHOOTING**

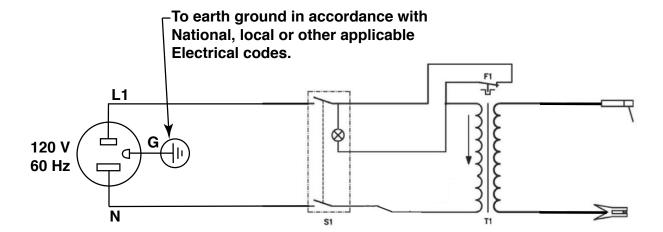
Observe all Safety Guidelines detailed throughout this manual

PROBLEMS	POSSIBLE	RECOMMENDED
(SYMPTOMS)	CAUSE	COURSE OF ACTION
Power source stops.	Thermal Overload Protection activated due to overload.	The Thermal Protection automatically resets when the transformer has cooled (approximately 15 minutes)
Power switch on but no weld current.	Bad connection between ground- clamp and workpiece.	Clean or wire brush the work surface.
Unstable arc.	Impurities on base metal.	Clean with wire brush.
Porous weld.	Dirty base metal.	Clean with wire brush.

# **A** CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.





NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.

WARNING	Do not touch electrically live parts or electrode with skin or wet clothing.     Insulate yourself from work and ground.	Keep flammable materials away.	Wear eye, ear and body protection.
AVISO DE PRECAUCION	<ul> <li>No toque las partes o los electrodos bajo carga con la piel o ropa moja- da.</li> <li>Aislese del trabajo y de la tierra.</li> </ul>	Mantenga el material combustible fuera del área de trabajo.	Protéjase los ojos, los oídos y el cuerpo.
ATTENTION	Ne laissez ni la peau ni des vête- ments mouillés entrer en contact avec des pièces sous tension.     Isolez-vous du travail et de la terre.	Gardez à l'écart de tout matériel inflammable.	Protégez vos yeux, vos oreilles et votre corps.
WARNUNG	Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung!     Isolieren Sie sich von den Elektroden und dem Erdboden!	Entfernen Sie brennbarres Material!	Tragen Sie Augen-, Ohren- und Kör- perschutz!
ATENÇÃO	<ul> <li>Não toque partes elétricas e electrodos com a pele ou roupa molhada.</li> <li>Isole-se da peça e terra.</li> </ul>	Mantenha inflamáveis bem guardados.	Use proteção para a vista, ouvido e corpo.
注意事項	● 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。 ● 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。	● 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。	● 目、耳及び身体に保護具をして下 さい。
Chinese	<ul><li>皮肤或濕衣物切勿接觸帶電部件及 銲條。</li><li>使你自己與地面和工件絶縁。</li></ul>	●把一切易燃物品移離工作場所。	●佩戴眼、耳及身體勞動保護用具。
Rorean 위험	● 전도체나 용접봉을 젖은 형겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	●인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic	<ul> <li>♦ لا تلمس الإجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء.</li> <li>♦ ضع عاز لا على جسمك خلال العمل.</li> </ul>	<ul> <li>ضع المواد القابلة للاشتعال في مكان بعيد.</li> </ul>	<ul> <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 ELEKTRO-DENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

	*		
Keep your head out of fumes.     Use ventilation or exhaust to remove fumes from breathing zone.	Turn power off before servicing.	Do not operate with panel open or guards off.	WARNING
Los humos fuera de la zona de respiración.     Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	Desconectar el cable de ali- mentación de poder de la máquina antes de iniciar cualquier servicio.	No operar con panel abierto o guardas quitadas.	AVISO DE PRECAUCION
<ul> <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>	Débranchez le courant avant l'entre- tien.	N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	ATTENTION
Vermeiden Sie das Einatmen von Schweibrauch! Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	WARNUNG
Mantenha seu rosto da fumaça.     Use ventilação e exhaustão para remover fumo da zona respiratória.	Não opere com as tampas removidas.     Desligue a corrente antes de fazer serviço.     Não toque as partes elétricas nuas.	Mantenha-se afastado das partes moventes.     Não opere com os paineis abertos ou guardas removidas.	ATENÇÃO
<ul><li>● ヒュームから頭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>	● 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 必ず切って下さい。	● パネルやカバーを取り外したまま で機械操作をしないで下さい。	注意事項
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	● 維修前切斷電源。	●儀表板打開或沒有安全罩時不準作 業。	Chinese <b>警</b>
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Rorean 위 험
<ul> <li>ابعد رأسك بعيداً عن الدخان.</li> <li>استعمل التهوية أو جهاز ضغط الدخان للخارج</li> <li>لكي تبعد الدخان عن المنطقة التي تتنفس فيها.</li> </ul>	<ul> <li>● اقطع التيار الكهربائي قبل القيام بأية صيانة.</li> </ul>	<ul> <li>♦ لا تشغل هذا الجهاز اذا كانت الإغطية الحديدية الواقية ليست عليه.</li> </ul>	تحذير

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

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説明以及應該使用的銀捍材料,並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀시의 작업자 안전수칙을 준수하시기 바랍니다.

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

