WELDING, CUTTING & HEATING GUIDE

H SERIES

SET-UP AND SAFE OPERATING PROCEDURES

FLAME TECH

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IMPORTANT!

- Always wear safety goggles with filter lenses.
- Before starting work, always check for leaks by brushing a thick soap solution on all connections. Open valve and watch for bubbles to appear at points of leakage.
- Tighten loose connections with a wrench.
- Never use a flame to check for gas leaks.
- Do not use a hose that is worn, or any equipment that is need of repair.
- Never use Oxygen to blow off work or clothing.
- Purge Fuel Gas and Oxygen passages separately before lighting up.
- Secure cylinders to cart, wall or post to prevent them from falling.
- Always use reverse-flow check valves on torch and regulator. This reduces the possibility of mixing gases in the regulator or hoses.
- Do not use oil or grease on the equipment. Oil or grease is easily ignited and burns violently in the presence of oxygen under pressure.
- Empty cylinders should be kept in specified areas and clearly marked "Empty".

Please read the following carefully

The manufacturer and/or distributor has provided the parts diagram in this manual as a reference tool only. Neither the manufacturer nor distributor makes any representation or warranty of any kind to the buyer that he or she is qualified to make any repairs to the product. In fact, the manufacturer and/or distributor expressly states that all repairs and parts replacements should be undertaken by certified and licensed technicians and not by the buyer. The buyer assumes all risk and liability arising out of his or her repairs to the original product or replacement parts thereto; or, arising out of his or her installation of replacement parts thereto.

Foreword

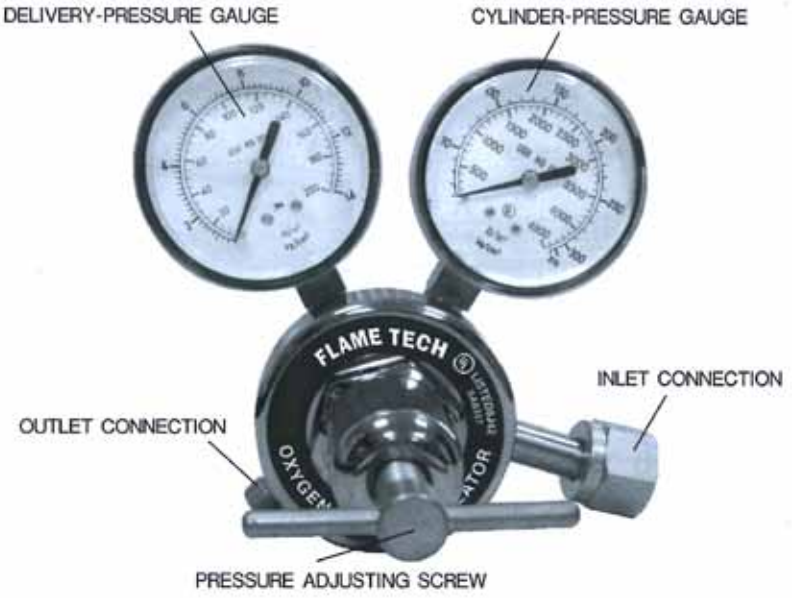
The equipment you have purchased was thoroughly tested and inspected when it left the factory. With reasonable care, and by following the instruction, it will give you many years of efficient, trouble-free service.

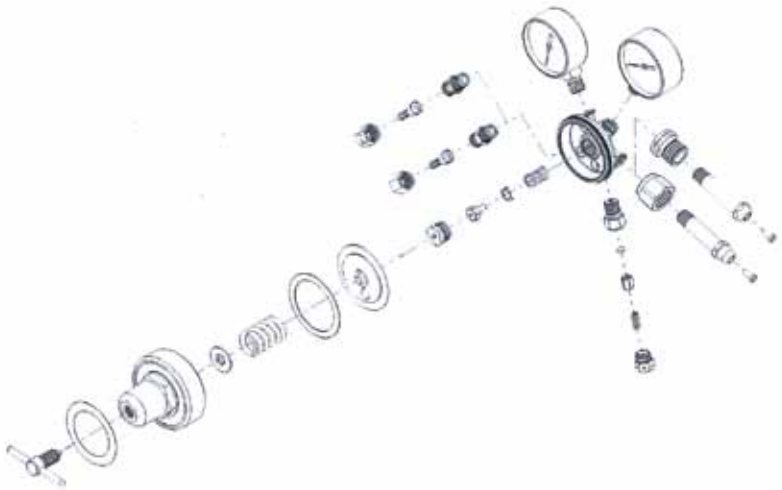
The instructions, applications and techniques described in this manual are designed to aid you in the basic principles of welding, flame cutting, brazing, silver soldering, heating and the safe use of gases, regulators and torches.

READ THIS BOOK THOROUGHLY AND FOLLOW INSTRUCTIONS!

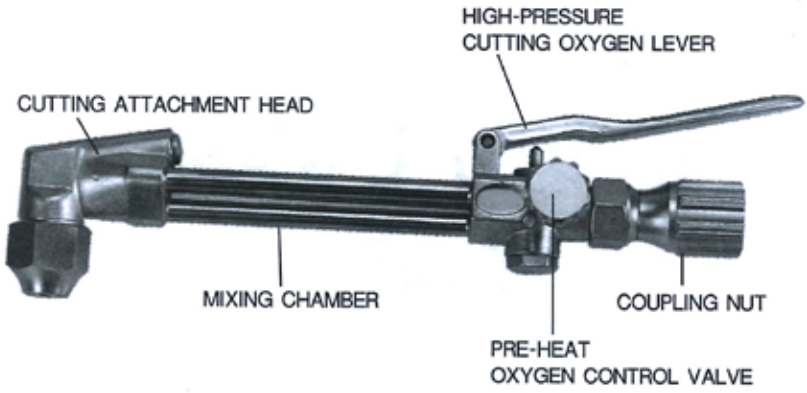
FAILURE TO USE OSHA RECOMMENDED FLASHBACK ARRESTORS COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH. CONTACT FLAME TECHNOLOGIES FOR CORRECT SIZE OF FLASHBACK ARRESTOR TO USE.

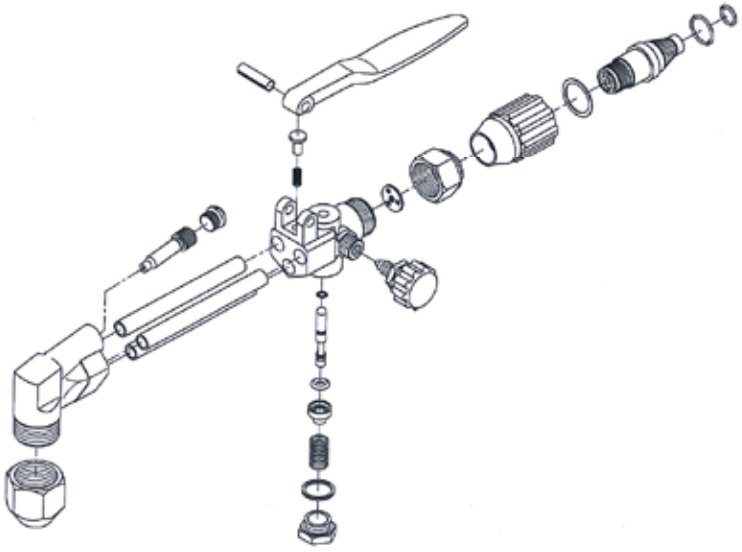
THE PARTS OF A REGULATOR



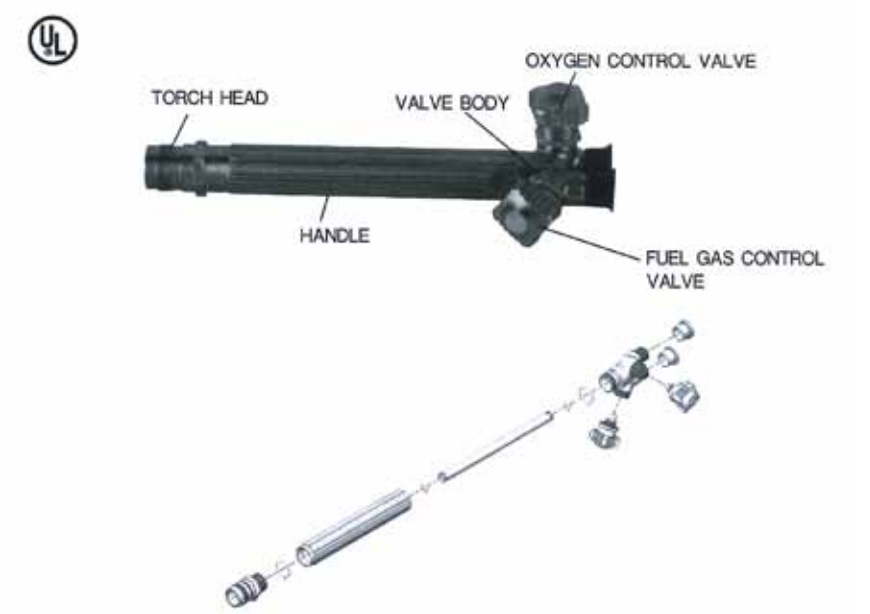


CUTTING ATTACHMENT WITH PRINCIPAL PARTS

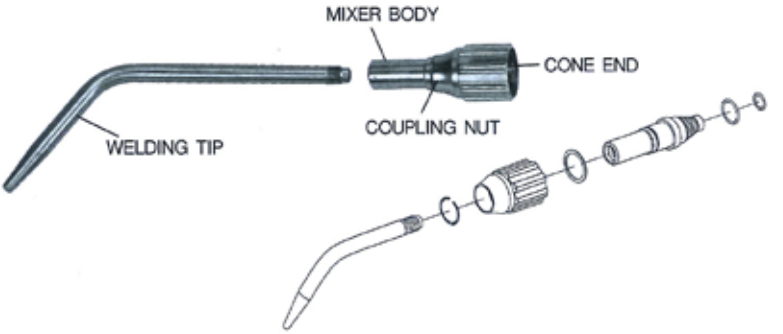




THE VARIOUS PARTS OF A WELDING TORCH HANDLE



MIXER & WELDING TIP WITH PRINCIPAL PARTS



OXYGEN AND ACETYLENE SET UP AND INSTRUCTIONS

Attaching the Regulators

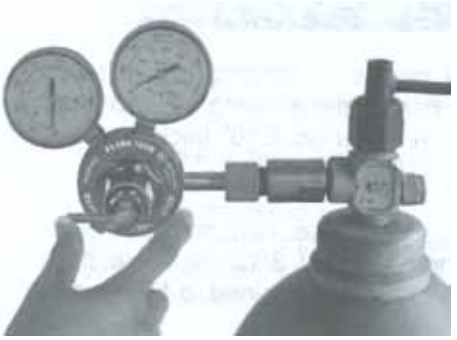
Open cylinder valve slightly to blow out dirt, then close. Attach regulators, tighten the connections firmly, attach the hoses to the regulators, and tighten. (NOTE: The acetylene hose connections are left hand threads, and the oxygen connections are right hand threads.)

Attaching the Torch

Attach the acetylene hose (RED) to torch valve marked "AC", note the left hand thread. Attach oxygen "OX", note right hand thread. Shut both valves on torch before opening cylinders.

Opening the Valves

Be sure adjusting keys of regulators are free – that is, turned counter clockwise until loose. Open oxygen tank valve and acetylene tank valve slowly.



Adjusting the Pressure

Screw the adjusting key on each regulator until the desired working pressure for each gas is reached. This is shown on the low pressure (left) gauge on each regulator. The high pressure (right) gauge indicates how much pressure is in the cylinder. Proper pressures are shown on the tip charts on page 11.

Installing the Cutting Tip

Remove the tip nut from cutting attachment. Place tip into the nut and then wind nut firmly into place using the wrench.

To Light the Torch

Open the torch fuel valve approximately one half turn and ignite the acetylene. Keep opening the torch fuel valve until the flame stops excessive smoking and leaves the end of the tip about 1/8", then reduce slightly to bring flame back to tip. Open the torch oxygen valve until a bright inner cone appears on the flame. The point at which the feathery edges of the flame disappear and a sharp inner cone is visible is called the "Neutral Flame".

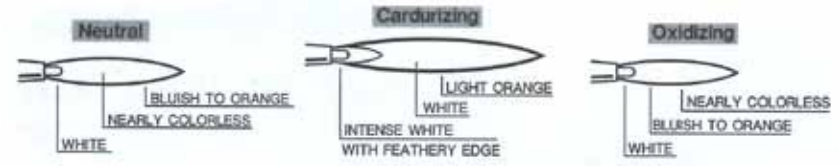
GAS WELDING PROCEDURES

Gas welding is a method of joining similar metals by heating the adjacent surfaces to the melting point with an oxy-acetylene flame, and allowing the two parts to fuse together, with a filler metal being required on materials 3/16" thick or more. The resulting weld is as strong as the parent metal.

All metal should be cleaned before welding. Oil, grease, rust, scale, or other impurities affect the weld quality, or tensile strength. Metal 3/16" or more thick should be beveled before welding, and when beveled sides are joined, a filler rod of the same material is necessary.

The welding tip chart on this page shows the proper tip sizes and oxygen and acetylene pressures related to the size material to be welded. The chart should serve as a handy guide to be referred to often. If too large a tip is used and the flame softened, the tip heats up unnecessarily and is often accompanied by a popping noise which splatters the weld puddle. Too hot a flame burns the steel, and too small a flame is not big enough to get the job done.

A neutral flame is used for almost all gas welding. The oxy-acetylene flame consumes all oxygen in the air around the welding area, which leaves an uncontaminated weld area and a weld of maximum strength. An oxidizing flame is rarely used, and a carburizing flame is occasionally helpful when flame hardening or brazing.



WELDING ROD

Available for all types of welding, including mild steel, cast iron, and aluminum, in the following sizes: 1/16", 3/32", 1/8", 5/32", 3/16", 1/4". The size needed will be determined by the type of weld, the thickness of the metal, and the amount of filler metal required.

THICKNESS OF METAL IN INCHES	SIZE OF TIPS	SIZE OF WELDING ROD	OXYGEN PRESSURE, P.S.I.	ACETYLENE PRESSURE, P.S.I.
1/64"	1	1/16"	4	4
1/16"	3	1/16"	5	5
3/32"	5	3/32"	9	7
1/8"	5	1/8"	9	7
3/16"	7	5/32"	12	9
1/4"-3/8"	9	3/16"-1/4"	14	10

WELDING-PRACTICES AND EXERCISES

Gas welding is not a difficult art. The following exercises of torch movement are good practice, and make subsequent welding easy.

Take a small welding tip and set proper pressures (see chart on page 8). Point the flame directly on the steel (1/8" stock recommended) with the flame cone just above the metal surface. When a puddle is formed, move the torch back and forth and move the puddle across the steel. Do this slowly. It is necessary to have good penetration, and this comes from a deep puddle. When moving the puddle, it is helpful to lean the tip about 45° away from the direction you want the puddle to move. Figure 1.

Place two pieces of 1/8" steel together as shown in Figure 2. Make the puddle again and with a back and forth torch motion, move the puddle along the seam. Go slowly to get good penetration. This can be checked by turning the parts over. The penetration should be visible from the bottom side. Test the weld strength by attempting to tear the parts apart.

Figure 1.

Figure 2.

Repeat Exercise 2, but add welding rod this time. While the flame is directed at the steel in order to form the puddle, put the rod into the flame. When it gets red, maintain this temperature by moving it in and out of the flame. Once the weld is started, dip the rod into the puddle. This builds up the weld so that the top is rounded instead of concave as when no rod was used. Remember, welding rod is necessary on all double joints and once the welder is experienced, he will prefer to use rod on all welds, regardless of how thin the steel. Figure 3.

Material 3/16" or thicker should be beveled before welding. A 30° bevel on each piece is best. This is necessary to obtain good penetration through the entire thickness. A rod is necessary filler metal on all welds made from beveled edges. Once the torch movement and puddle control are mastered, the welder can make vertical, horizontal or flat welds. He now has a tool that will repay its cost many times over. Figure 4.

Figure 3.

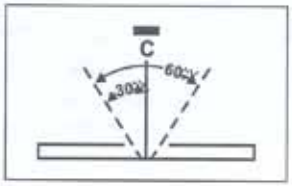


Figure 4.

BRAZE WELDING

Braze welding differs from gas welding because the two pieces of metal are not fused together. The brazing rod melts at a lower temperature than the parent metal, and the braze strength comes from the surface overlay of the brazing rod.

The advantage of the braze welding over gas welding is that it is the best way to join dissimilar metals, or repair cast iron. For instance, braze welding is the correct way to fix a pump water jacket. Almost any two metals can be joined, except aluminum and magnesium.

Braze welding is separated into two types, depending on the type of rod used. Bronze is less expensive than silver, and should be used when the fit between the two metals must be joined is not close. The metals must be well cleaned, then the flame is played onto them until they become a dull red color. Both pieces must be of equal temperature or the rod will flow to the hotter pieces. Heat the rod by placing it in the flame, then dip into the flux can. Notice that the heat causes the flux to stick to the rod. If a prefluxed rod is used, this heating and dipping step may be eliminated. Once the rod is fluxed, and the metals brought to the proper temperature, touch the rod to the joint, put the flame onto the rod, and melt it. The rod then melts and flows over the heated area, bonding the metal together. Abundant flux must be used. Without enough flux, the rod does not "stick" to the metals.

Silver brazing is a little faster than bronze brazing. This is because silver melts at a lower temperature, and less heat is required; however, the joint must fit tightly together. Bronze bridges a gap much better than silver. Instead of putting flux on the silver rod, the join should be painted with flux. The way to determine when the metals are at proper temperature is to watch the flux. When it bubbles, it is time to apply the silver. The silver melts as it is touched to the seam and flows over the fluxed area.

BRAZE WELDING

Flame cutting is a simple process that can be quickly mastered. Only steel can be cut with the oxy-acetylene method, since cast iron, stainless steel, aluminum, brass, and other ferrous metals do not burn the way steel does.

The way to cut steel is to heat it to its kindling temperature (a red color) and burn it rapidly with pure oxygen. A cutting torch provides both the preheat flames and pure oxygen cutting stream. Acetylene and oxygen are combined in the torch head, and burn at the torch tip with a 6000° flame; these are the preheat flames. The center hole in the cutting tip is the cutting oxygen hole, through which pure oxygen, which is not mixed with acetylene, flows to cut the steel after the metal is sufficiently preheated.

CUTTING TIPS

Cutting tips are available in a wide range of sizes, the proper size being determined by the steel thickness. Refer to the chart below for correct pressures and tip sizes.

TYPES 1-101, 3-1-1 (Oxy-Acetylene)

Metal Thickness	Tip Size	Cutting Oxygen		Pre-heat Oxygen* PSIG	Acetylene		Speed IPM	Kerf Width
		Pressure** PSIG	Flow ** SCFH		Pressure PSIG	Flow SCFH		
1/4"	00	20-25	30-35	3-5	3-5	6-11	20-30	0.05
1/2"	0	30-35	60-65	3-6	3-5	9-16	16-22	.06
3/4"	1	30-35	80-85	4-7	3-5	8-13	15-20	.07
1"	2	35-40	104-160	4-8	3-6	10-18	13-18	.09
2"	3	40-45	210-240	5-10	4-8	14-24	10-12	.11
3"	4	40-50	280-320	5-10	5-11	18-28	10-12	.12
4"	5	45-55	390-450	6-12	6-13	22-30	6-9	.15

CUTTING

Once the correct tip is tightly secured in the cutting torch, proper pressure set on the regulators, and adjusted to a neutral flame, follow these procedures to flame cut.

1. Before lighting, open oxygen needle valve on torch handle one full turn. Make all oxygen adjustments with needle valve on cutting attachment.

2. Move the flame to the edge of the steel and position the preheat cones just above the metal.

3. When the steel becomes red, slowly depress the cutting oxygen lever to release the oxygen stream to cut through the steel.

4. Slowly move the torch in the direction of the cut. The correct cutting speed is accompanied by a sputtering of sound, and a steady stream of sparks. This results in a clean, slag free cut with square top and bottom edges.

5. Too fast a movement does not allow enough time for the oxygen stream to cut all the way through the metal. Slag fills the kerf and the two pieces are not severed.

6. Too slow a movement leaves a rounded top edge with slag sticking to the bottom of the metal.

7. The size of the preheat flame determines how quickly the cut can be started. Often, a small preheat flame is desirable to conserve gases, and prevent melting of the top edges.

Perfect Cut

Shows regular surface with slightly sloping drag lines. Surface can be used for man purposes without machining.

Extremely Fast

Not enough time is allowed for slag to blow out of the kerf. Cut face is often slightly concave.

Extremely Slow

Produces pressure makes which indicate too much oxygen for cutting conditions.

Too Hot Preheat

Rounded top edge caused by too much preheat. Excess preheat does not increase cutting speed. It only wastes gases.

TROUBLE SHOOTING CHART

Trouble	Probable cause	Remedy
Welding Tip Popping	▪ Tip is operated at too low heat valve ▪ Tip too large ▪ Too close to work	▪ Increase pressure and constant appropriate tip chart ▪ Use next smaller size tip ▪ Move tip further from work area
Flames not clearly defined, smooth even	▪ Dirty tip	▪ Clean with tip cleaner or replace tip
Regulator not holding constant pressure	▪ Defective seat	▪ Return unit for replacement
Cutting Tip Popping	▪ Too loose ▪ Nicked seat	▪ Tighten tip nut ▪ Replace tip
Leak around needle valve	▪ Packing nut loose	▪ Snug packing nut
Difficult to light	▪ Too much pressure	▪ Constant appropriate tip chart
Flame change when cutting	▪ Oxygen needle valve on torch handle partly closed. ▪ Oxygen cylinder almost empty.	▪ Open Oxygen valve wide ▪ Replace cylinder with full one.

SAFETY GUIDELINES

⚠DANGER ***Danger means a hazard that will cause death or serious injury if the warning is ignored.***

⚠WARNING ***Warning means a hazard that could cause death or serious injury if warning is ignored.***

⚠CAUTION ***Caution means a hazard that may cause minor or moderate injury if the warning is ignored. It also may mean a hazard that will only cause damage to property.***

⚠NOTICE ***Notice means any information pertaining to the product or its proper usage.***

GENERAL SAFETY

⚠WARNING ***Always keep an approved fire extinguisher accessible while performing oxyfuel operations.***

⚠WARNING ***Flying sparks and hot metal can cause injury. Take necessary precautions to reduce the possibility of injury from flying sparks and hot metal.***

- Wear ANSI approved face shield or safety glasses with side shield protection when chipping or grinding metal parts.
- Wear ear plugs when welding overhead to prevent spatter or slag from falling into ears.

⚠WARNING ***Oxy-fuel operations produce intense light and heat and ultraviolet (UV) rays. The intense light and UV rays can cause injury to eyes and skin. Take all precautions described in this manual to reduce the possibility of injury to eyes and skin.***

- All persons operating this equipment or in the area while equipment is in use must wear protective welding gear including: welding goggles with a minimum shade 5, flame resistant clothing, leather welding gloves, and full foot protection.

⚠WARNING

Oxy-fuel operations cause sparks and heat metal to temperatures that can cause severe burns! Use protective gloves and clothing when performing any metal working operation. Take necessary precautions to reduce the possibility of skin and clothing burns.

- Keep all clothing and protective equipment free of oil and grease. These substances can ignite and will burn violently in the presence of pure oxygen.
- Make sure that all protected from heat, sparks, and ultraviolet rays. Use flame resistant barriers as needed.
- Never touch work pieces until completely cooled.

⚠WARNING

There must be two (2) O-rings on the cone end. The absence of either O-ring can lead to flashback within the torch handle or cutting attachment.

For cutting attachment, inspect the tapered seating surfaces on tip and in torch head. Have a qualified technician resurface the seat area if it has dents, burns or is burned. A poor seating surface may result in backfire or flashback.

OPERATION

⚠NOTICE

The following instructions are for acetylene gas use only. Contact your gas supplier for instructions on the use of other fuel gases.

⚠WARNING

Before lighting the torch, follow all personal and equipment safety regulations. Wear filtered protective eyewear (shade 5 minimum) to protect the eyes from heat, sparks and hazardous rays of light produced by the flame. Keep work area well ventilated.

BACKFIRE AND FLASHBACK

When the flame goes out with a loud pop, it is called a backfire. Backfire can be caused by (1) operating the torch at lower pressures than required for the tip used, (2) touching the tip against the work, (3) overheating tip, or (4) an obstruction in the tip. If backfire occurs, shut off the torch handle valves (oxygen first) and after remedying the cause, relight the torch.

A flashback is a condition that results when the flame flashes back into the torch and burns inside with a shrill hissing or squealing noise. If flashback occurs, close the torch handle valves (oxygen first), IMMEDIATELY. Flashback generally indicates a problem that should be fixed. A clogged tip, improper functioning of the valves, or incorrect acetylene/oxygen pressure could lead to flashback. Be certain to find the cause before relighting the torch.

NOTICE

Some parts and accessories manufactured by others may fit this brand cutting and welding apparatus. For your own protection, use only the apparatus accessories sold where you originally purchased this apparatus.

NOTES

WARRANTY

The Company warrants each new product or parts thereof to be free from defects in workmanship and material one year from the date of purchase by the user as a result of normal use and service. The Company will replace the part or parts so determined by it to be defective with new parts, at Company's cost and expense. This warranty is exclusive, and there are no other warranties or representations, expressed or implied.

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