FLAME TECH®

PORTABLE TORCH KIT

OXYGEN-ACETYLENE

LIGHT / MEDIUM DUTY

WELDING, CUTTING & HEATING GUIDE

Setup and Safe Operating Procedures


CAUTION
FLAME TECH ALWAYS
RECOMMENDS USING
FLASH BACK ARRESTORS
(must purchase separately)

PLEASE READ THE FOLLOWING CAREFULLY

The parts diagram(s) in this manual are provided for reference 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. Flame Technologies and/or your distributor expressly state that all repairs and part 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 hereto.

FOREWORD

The equipment you have purchased was thoroughly tested and inspected when it left the factory. With reasonable care, and by following the instructions, 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 OR YOUR DISTRIBUTOR FOR CORRECT SIZE OF FLASHBACK ARRESTORS TO USE.

IMPORTANT

- Always wear safety goggles with tinted 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 in need of repair.
- Never use oxygen to blow debris off work area or clothing.
- Purge fuel gas and oxygen passages separately before lighting up the torch.
- Secure cylinders to a cart, wall or post to prevent them from falling.
- Always use reverse-flow check valves on torches and regulators. This reduces the possibility of mixing gases inside the regulators or hoses.
- Do not use oil or grease on the equipment. Oil and grease are easily ignited and burn violently in the presence of oxygen, which is under pressure.
- Empty cylinders should be kept in specified areas and clearly marked “Empty.”
- Before lighting the torch, follow all personal and equipment safety regulations.
- Flame Tech always recommends using flash back arrestors. (must purchase separately)

SAFETY SIGNS FOUND IN THIS MANUAL

Danger sign indicates a hazard that *will* cause death or serious injury if the dangerous situation is ignored.

Warning sign indicates a hazard that *could* cause death or serious injury if the warning is ignored.

Caution sign indicates a hazard that *may* cause minor or moderate injury if the caution is ignored. It also may indicate a hazard which will cause property damage, even if no one is injured.

Notice sign indicates any information pertaining to the product or its proper usage.

GENERAL SAFETY

Always keep an approved fire extinguisher accessible while performing oxy-fuel operations.

Never touch work pieces until completely cooled.

Keep work area well ventilated.

Flying sparks and hot metal can cause injury. Take necessary precautions to reduce the possibility of injury, such as protective clothing and shielding.

PROTECTIVE CLOTHING & SHIELDING

All persons operating this equipment or in the area, while this equipment is in use, must wear protective welding gear including:

- welding goggles/face shield/safety glasses (with side shield protection)
- flame resistant clothing
- leather welding gloves
- full foot protection

Oxy-fuel operations produce intense light, heat and ultraviolet (UV) rays. The intense light and UV rays can cause injury to eyes and skin. Eye protection must have a minimum shade of 5. Take all precautions to reduce the possibility of injury to eyes and skin.

Oxy-fuel operations cause sparks and heat metal to temperatures that can cause severe burns. Take necessary precautions to reduce the possibility of obtaining 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.

Wear ear plugs when welding or cutting overhead to prevent spatter or slag from falling into the ears.

Use flame resistant barriers as needed to protect others in the area from heat, sparks, intense light and ultraviolet rays.

OPERATIONAL HAZARDS

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

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

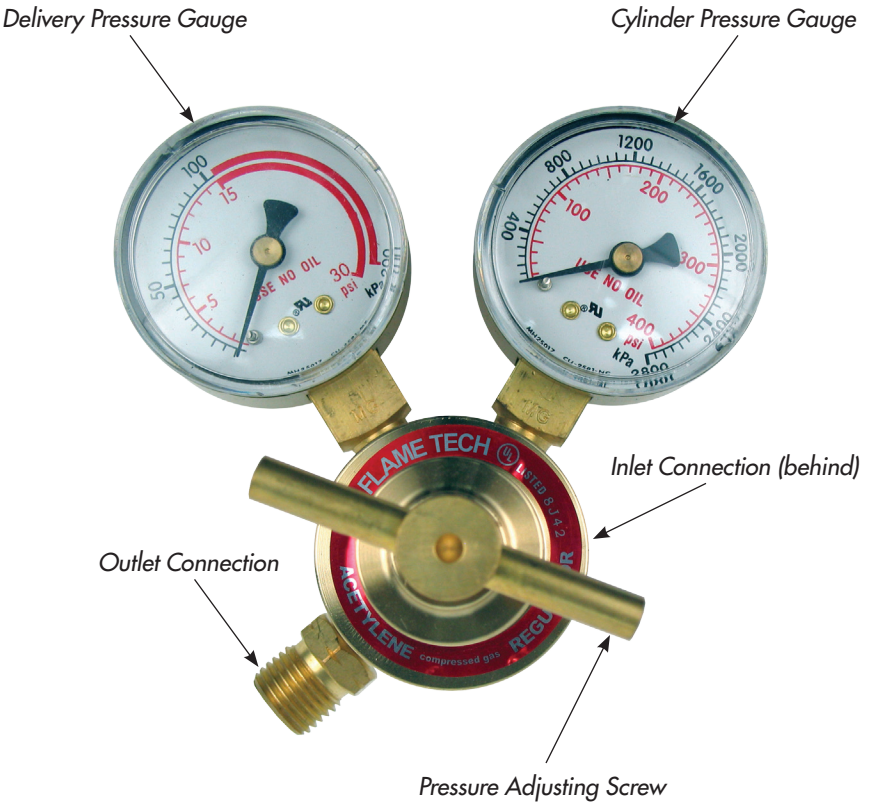
The following instructions apply to acetylene gas only. Contact your gas supplier for information about other fuel gases.

When the flame goes out with a loud pop, it's 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 the tip or (4) the tip is obstructed. If backfire occurs, shut off the torch handle valves (oxygen first) and fix the problem before relighting the torch.

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, valves functioning improperly or incorrect oxygen/acetylene pressure could lead to flashback. Be certain to find the cause before relighting the torch.

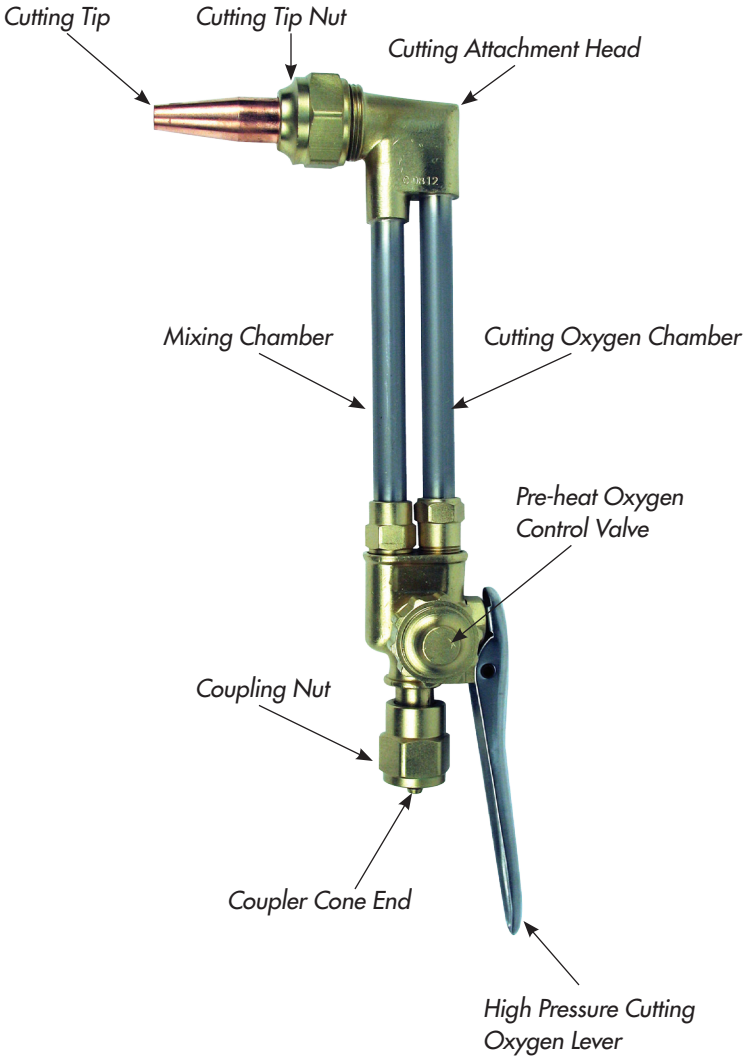
THE PARTS OF A REGULATOR

Regulators Included With This Kit
VLOR-18 (Light Duty Oxygen)
VLAR-18 (Light Duty Acetylene)



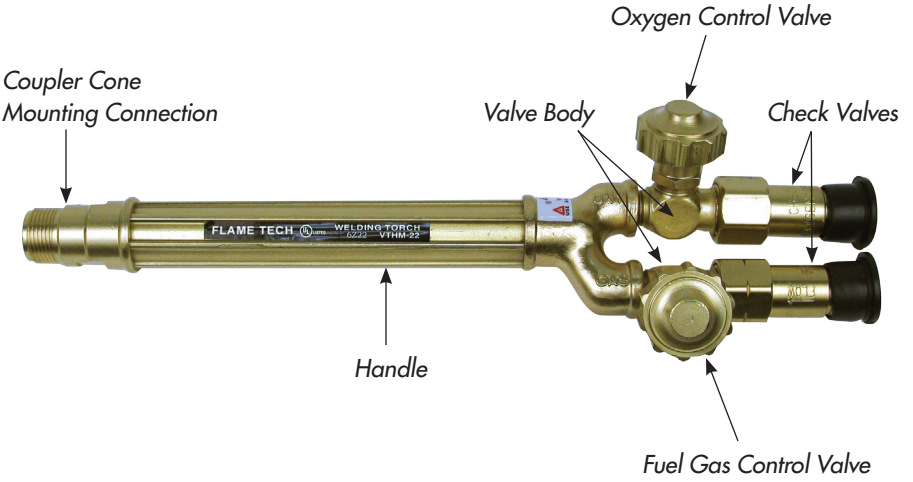
THE PARTS OF A CUTTING ATTACHMENT

Cutting Attachment Included With This Kit
VCAM-22



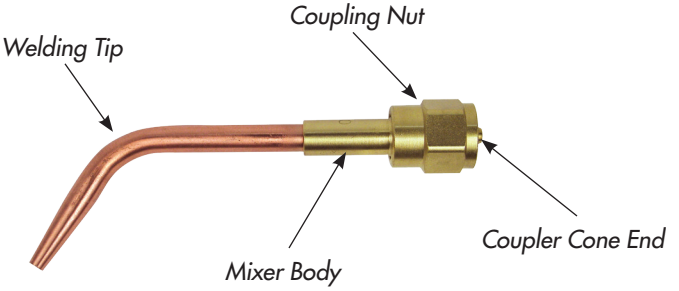
THE PARTS OF A WELDING TORCH HANDLE

Torch Handle Included With This Kit
VTHM-22



THE PARTS OF A MIXER AND WELDING TIP

Welding Nozzle & Mixer Included With This Kit
1-W-1



OXYGEN & ACETYLENE SET UP AND INSTRUCTION

Attaching the Regulators

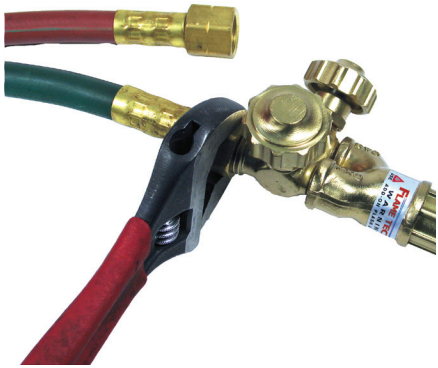
Open the cylinder valve slightly to blow out dirt, then close. Attach regulators to the cylinders and hoses to the regulators. Tighten all connections firmly with a wrench.

NOTE: The acetylene connections are left-hand threads. The oxygen connections are right-hand threads.

Do not force the regulators onto the incorrect cylinder type.

Attaching the Torch

Attach the acetylene hose (red) to the left-hand threaded torch valve marked "AC". Attach the oxygen hose (green) to the right-hand threaded torch valve marked "OX."



Do not force the hoses onto the incorrect valve. Shut both valves on the torch handle before opening either cylinder.

Opening the Cylinders

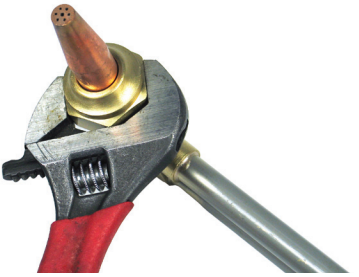
Be sure the adjusting screws of the regulators are free—that is, turned counter clockwise until loose. Completely open the oxygen and acetylene cylinder valves slowly.

Adjusting the Pressure

Turn the adjusting screw on each regulator clockwise 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 left in the cylinder. Proper outlet pressures are shown on the tip charts on page 10 for welding and page 13 for cutting.

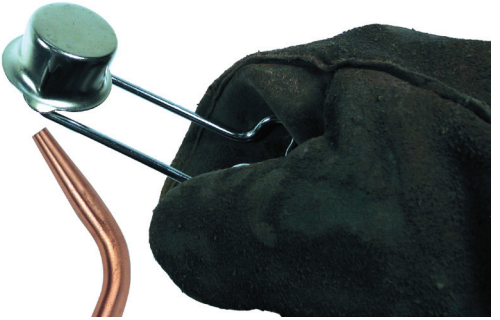
Installing the Cutting Tip

If you are cutting, remove the tip nut from the head of the cutting attachment. Place the appropriate tip into the nut, and then thread the nut back onto the cutting attachment head and tighten it firmly into place using a wrench to about fifteen (15) foot pounds.



Lighting the Torch

Open the fuel valve, on the cutting attachment, approximately one half turn and ignite the acetylene. Keep opening the fuel valve until the flame stops smoking excessively and the back of the flame leaves the end of the tip about 1/8", and then reduce the gas slightly to bring the flame back to the tip. Open the oxygen valve on the torch handle, 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."



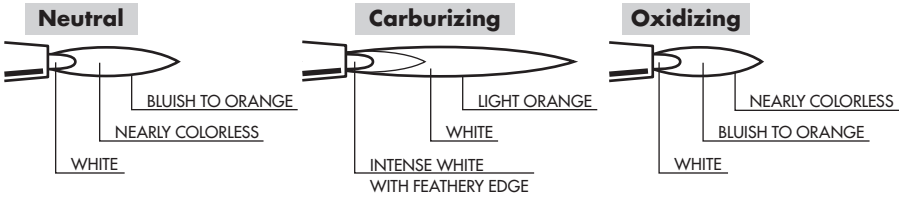
GAS WELDING PROCEDURES

Gas welding is a method of joining similar metal parts together by heating the adjacent surfaces, to the melting point, with an oxyacetylene flame, and then allowing the parts to fuse together. A filler metal is required on all materials 3/16" 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. When the beveled sides are joined, a filler rod of the same material is necessary.

The welding tip chart below shows the proper tip sizes and oxygen & acetylene pressures related to the size metal 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 of a flame burns the material, and too small of a flame is not big enough get the job done.

A neutral flame is used for almost all gas welding. The oxyacetylene 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. A carburizing flame is occasionally helpful when flame hardening or brazing.



WELDING RODS

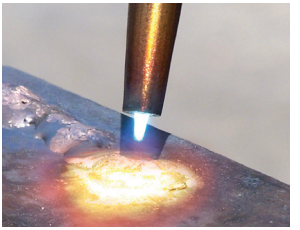
Rods are available for all types of welding, including mild steel, cast iron and aluminum, in the following sizes: 1/16", 3/32", 5/32", 3/16" and 1/4". The size needed will be determined by the type of weld, the thickness of the metal and the amount of filler metal required.

Metal Thickness (in.)	Tip Size	Rod Size	Oxygen Pressure (psi)	Acetylene Pressure (psi)
3/64	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

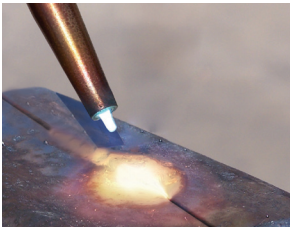
WELDING PRACTICES AND EXERCISES

Gas welding is not a difficult art. The following exercises are good practice and may help make subsequent welding jobs easier and of better quality.

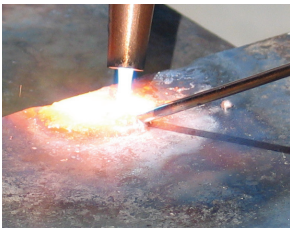
Exercise 1 Use a small welding tip and set proper pressures (see chart on page 10.) Point the flame directly on the material (1/8" steel stock is suggested) with the flame cone just above the metal's surface. When a puddle is formed, slowly move the torch back and forth to move the puddle across the metal. It is necessary to have good penetration, which comes from a deep puddle. When moving the puddle, it's helpful to lean the tip about 45° away from the direction you want the puddle to move.



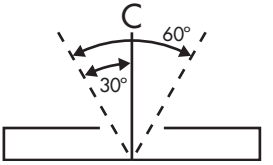
Exercise 2 Place two pieces of 1/8" steel together, as to the right. Make the puddle again, and then with a back and forth motion, move the puddle along the seam. Go slowly to get good penetration. This can be checked by turning the parts over after the melted metal has solidified. The penetration should be visible from the bottom side. Test the weld strength by attempting to tear the parts apart after they have cooled.



Repeat Exercise 2, but add a welding rod this time. While the flame is directed at metal to create a 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 has 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, a welding rod is necessary on all double joints. Once experienced, most welders prefer to use rods at all times, regardless of how thin the metal.



Metal 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 as filler metal on all welds made from beveled edges. Once the torch movement and puddle control are mastered, most welders can make vertical, horizontal or flat welds. Good quality welding is a skill that pays for itself.



BRAZE WELDING

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

The advantage of braze welding over gas welding is that it's the best way to join dissimilar metals or to 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 is not close. The metals must be cleaned well, and 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 not flow properly onto both pieces. Heat the rod by placing it in the flame, and then dip it into the can of flux. Notice that the heat causes flux to stick to the rod. If a pre-fluxed rod is used, the 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, and then melt the rod with the flame. The rod then flows over the heated area, bonding the metals 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 together tightly. Bronze bridges a gap much better than silver. Instead of putting the flux onto the silver rod, the joint 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's time to apply the silver. Silver melts as it's touched to the seam and flows over the fluxed area.

FLAME CUTTING

Flame cutting is a simple process that can be quickly mastered. Only steel can be cut with the oxyacetylene 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 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 (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. Steel thickness determines the proper tip size. Refer to the chart below for correct pressures and tip sizes.

TYPES 1-101 and 3-101 (Oxyacetylene)

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	.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	40-45	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"

GAS CUTTING PROCEDURES

After tightly securing the tip to the cutting torch, setting proper regulator pressure and obtaining a neutral flame:

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

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

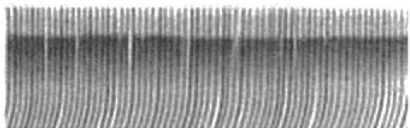
3. When the steel becomes red, slowly depress the cutting oxygen lever to release the oxygen stream to cut through the steel.

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

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

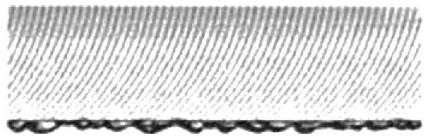
Too slow of a movement leaves a rounded top edge with slag sticking to the bottom of the metal.

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 the top edges.



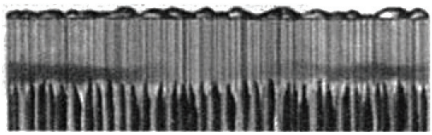
Perfect Cut

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



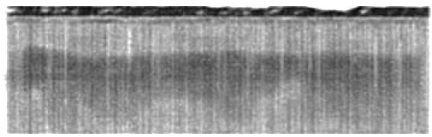
Extremely Fast

Not enough time is allowed for slag to blow out of the kerf.



Extremely Slow

Produces pressure marks which indicate too much oxygen for cutting conditions. The cut face is often slightly concave.



Too Hot Preheat

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

TROUBLESHOOTING CHART

Trouble	Probable Cause	Remedy
Welding Tip Popping	• Tip operating pressure is too low • Tip is too large • Too close to parts	• Increase pressure and consult appropriate tip chart for information • Use next smaller tip size • Move further from parts
Flames are not clearly defined, smooth or even	• Dirty tip	• Clean with tip cleaner or replace tip
Regulator not holding constant pressure	• Defective seat	• Replace regulator
Cutting tip popping	• Tip too loose • Nicked tip seat • Nicked torch seat	• Tighten tip nut with a wrench • Replace tip • Reseat torch
Leak around torch handle valve packing nut	• Valve packing nut is loose	• Tighten valve packing nut with a wrench
Gas is difficult to light	• Too much pressure	• Consult appropriate tip chart and adjust pressure
Flame changes while cutting	• Oxygen needle valve on torch handle is not open wide enough • Oxygen cylinder almost empty	• Open oxygen valve more • Replace cylinder with a full one

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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