Arcair®

Instruction Manual
For
SLICE Exothermic Cutting Equipment

FUNDAMENTALS OF THE PROCESS

Process Description

The SLICE Exothermic Cutting process uses an exothermic chemical reaction that burns, melts, or vaporizes most materials. The reaction begins with an electrical arc or alternate energy source that causes a steel cutting rod to burn. Oxygen flows through the center of the rod.

Because of the rod's design, the burning makes excess heat ("exo - thermic"). This heat cuts the workpiece. Once started, the burn will continue as long as oxygen flows through the rod. The heat created melts the material being cut. The velocity of oxygen through the rod blows the molten material away, creating the kerf or cut line.

This arc ignition process led to invention of the "oxy-arc" torch and design of equipment for underwater construction and salvage.

The electrical arc that starts the burn can be from a welding power source that delivers at least 100 amps, a 12-volt lead acid or similar low impedance battery. The cutting process can run without power, using the heat of the reaction only, or with power, cutting with an electrical arc from a welding power source providing more heat.

History

The exothermic cutting rod is a small "oxygen lance." It is a prime example of the combustion triangle, one side being fuel (the steel lance), the second the oxygen source (pure oxygen being forced through the lance), and the third the heat of combustion (some external source of heat). However, when the lance pierces a slag puddle, the puddle becomes the source of heat until the lance is withdrawn, at which time burning stops.

In 1888, a published paper described passing oxygen through a steel tube and heating the tube to a bright red. Heat resulted. In 1901, Ernst Henner filed a German patent on an early oxygen lance made of two concentric tubes. In 1902, documentation shows that the oxygen lance replaced oil and gas torches for opening furnace taps in steel blast furnaces. The oxygen lance has since been used to cut rocks and concrete structures. An example of this use is cutting up reinforced concrete structures such as bunker emplacements and tank traps built in Europe during World War II.

An ideal way to start the lance, workers found, was to use a welding power source on conductive material to strike an arc and start the burn. In construction this process worked well, even in mud and water.

Around 1940, the burning bar or exothermic lance was first marketed as a cutting tool. A flexible version made of an insulated cable was introduced around 1960. Not until the early 1980's were smaller burning bars designed for hand-torch use, above and below water. A one-piece unit now allows for adequate rod surface exposure to an oxygen supply for exothermic cutting. Arcair Company, a world leader in metal removal and cutting, sells this exothermic cutting equipment under the trade name SLICE.

PRINCIPLES OF OPERATION

General

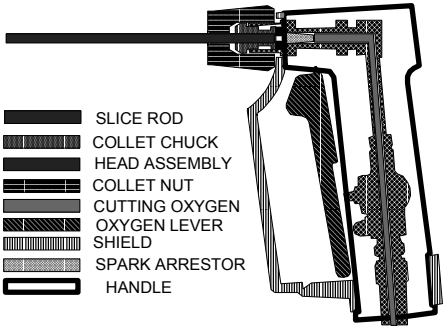
SLICE Exothermic Cutting uses heat from a chemical reaction between a consumable steel rod and oxygen flowing through the rod. Test data show that little or no oxygen remains. The oxygen not used in the reaction blows the molten material out of the cut area. This action creates the kerf that allows cut progression.

Exothermic cutting can be used with or without power. Without power, the heat from the reaction alone will make the cut. With power, an electrical arc from a welding power source increases the heat from the reaction. These differences will be discussed in detail later.

Both methods use the same consumable rod. This rod is inserted into the torch and locked into place. The oxygen lever on the torch is depressed and the arc, to start the burn, is established. Once the rod burn has begun, the rod tip should be placed at the cut area with slight contact between the tip of the rod and the work piece.

The burning rod tip must be kept in slight contact with the work piece to achieve the most efficient cut. Rods used in exothermic cutting can be consumed without any cutting taking place. Tip contact tells the operator that the most intense heat from the rod is in direct contact with the workpiece, ensuring the best cutting speeds.

FIGURE 1 How the Torch Works



Cutting Without Power

Cutting without power is cutting with the heat from the reaction between the rod and the oxygen. This type of cutting is done by igniting the rod off a spark supplied by a 12-volt battery or by a welding power source capable of delivering a 100-amp surge.

Once this spark has ignited the rod, the electrical path is broken and the heat of the reaction melts the material and cuts it.

Cutting without power can be done in remote areas. Bulky power sources and support equipment is not needed.

Cutting With Power

Cutting with power requires an electrical arc from a welding power supply and increases the heat created exothermically. Almost all constant-current welding power supplies can be used in powered exothermic cutting. Cutting with power is faster than cutting without power.

Constant-voltage power supplies should not be used with exothermic cutting equipment. When the exothermic cutting rod contacts the workpiece, the power supply is being dead shorted, causing maximum amperage output of the power supply. This surge can exceed the rated output of the machine and the recommended amperage for powered exothermic cutting.

Oxygen Supply

This cutting process uses standard industrial-grade oxygen to support the exothermic reaction and to remove molten metal. All SLICE equipment uses standard oxygen fittings. SLICE torches are equipped with 10 feet of 1/4" I.D. oxygen hose. The usual operating pressure is 80 psi. Applications such as cutting material sections 3" and thicker might require higher operating pressures. Pressures as low as 40 psi have been used to do jobs such as washing off rivet heads and scarfing out small cracks for repair.

The oxygen consumption rate for SLICE cutting rods at 80 psi is 7 to 7.5 cfm for the 1/4" diameter cutting rods and 12 to 13 cfm for the 3/8" diameter cutting rods. This rate will vary if a different operating pressure is used.

Compressed air should not be used for exothermic cutting. Compressed air does not contain enough oxygen to support the burn. Impurities in compressed air can damage or destroy the torch and components. Compressed air could cause serious injury to the operator. The torch could burn from the inside or even explode from the buildup of dirt from the compressed air in the oxygen-supply tube.

Cutting Rods

SLICE Cutting Rods are made of carbon steel. They are made by rolling a steel strip into a rod.

There are coated and uncoated cutting rods. The coating is made of arc stabilizers and a binder. There are several advantages to using the coated rods with power. Advantages are (1) more efficient cutting rates (more cut per inch of rod burnt and more cut per minute of burn time); (2) easier rod operation; and (3) protection from burning out on the side of the rod especially when piercing.

These SLICE cutting rods are available:

1/4" x 22" (6.4 mm X 558.8 mm) Standard size cutting rods used in a variety of jobs. This rod is recommended for all straight-line cutting and most general-cutting applications. It is available coated or uncoated.

1/4" x 44" (6.4 mm X 1117.6 mm) This rod is used when greater length is needed to reach the cutting area or when piercing holes in materials thicker than 18". 1/4" x 44" rods are available uncoated.

3/8" x 18" (9.5 mm X 457.2 mm) These rods are used for heavy piercing with a large bore. The 3/8" x 18" cutting rod comes coated or uncoated.

3/8" x 36" (9.5 mm X 914.4 mm) This rod is used when added length is needed to complete cutting. 3/8" x 36" cutting rods come uncoated only.

All SLICE cutting torches come ready to use the 1/4" diameter rods. Use of the 3/8" diameter rods requires the 3/8" adapter kit.

OPERATING TECHNIQUES

Cutting Without Power

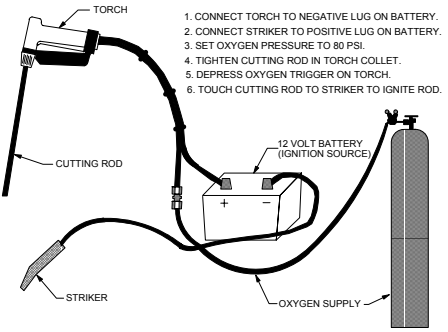
This is the most commonly used method of cutting with this type of equipment. To cut without power connect the torch to either terminal of a 12-volt battery or constant-current welding power source. Connect the striker or a strike plate to the other terminal. If using a welding power source, set output level for 100 amps. Turn on the oxygen supply and adjust the regulator to the proper working pressure. Insert the cutting rod into the collet and tighten the collet ring.

Tap the cutting rod on a hard, ungrounded surface to seat the rod in the torch. Depress the torch oxygen-valve lever and check for oxygen leaks around the collet ring. If oxygen is leaking, repeat the procedure until no oxygen is leaking.

Put the torch in one hand and striker in the other. Depress the oxygen lever and touch the cutting rod to the striker. As soon as the rod is ignited, remove the striker. Move the burning rod to the workpiece and begin cutting. The cutting rod should be held at a 45° to 80° drag angle from the workpiece surface. This angle depends on the thickness and type of material being cut. (See Section "Important Process Variables", Paragraph "Electrode-to-Work Angle")

As the cut progresses, slight contact should be made between the burning rod tip and the workpiece. This placement requires two motions: first, inward towards the workpiece as the rod is consumed, and second, in the direction of the cut. Since there is no electrical arc when cutting without power, wear at least a #5 shade lens for eye protection.

FIGURE 2 Cutting Without Power



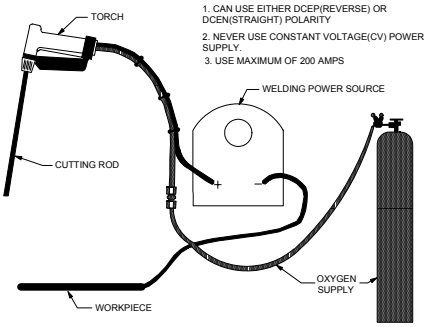
Cutting With Power

Cutting with power or an electric arc is done by connecting the torch to one terminal and connecting a welding ground clamp to the other terminal of a CC welding power source. The ground clamp is then attached to the workpiece. Unlike other processes, this process can use a welding power source set for DCEP (reverse polarity) or DCEN (straight polarity). AC (alternating current) power supplies can also be used without affecting cutting performance. Don't cut with power using a constant-potential power source.

Insert the cutting rod into the collet and tighten. Start the oxygen flow, touch the rod tip to the workpiece, and begin cutting. Again, as in cutting without power, the cutting rod should be held at a 45° to 80° drag angle from the workpiece surface. (See Section "Important Process Variables", Paragraph "Electrode-to-Work Angle") As the cut proceeds, make slight contact between the burning rod and the workpiece. This placement requires two motions: first, inward towards the workpiece as the rod is consumed and, second, in the

direction of cut. When cutting with power, the operator must use a protective lens shade #10 or higher to protect from arc flash.

FIGURE 3 Cutting With Power



Hole Piercing

Most piercing operations should be done without power. To pierce a hole, ignite the cutting rod as explained in the cutting-without-Power section. Move the burning rod to the pierce point and with the rod angled away from the operator, begin piercing the hole. Once the hole is under way, bring the cutting rod perpendicular to the surface of the workpiece. Keep the cutting rod deep enough in the hole to feel slight resistance from the non-molten material at the base of the hole. While the hole is being pierced, use a slight circular motion to keep the rod free of molten material coming out of the hole. During the piercing operation, the rod should be moved in and out of the hole occasionally to maintain an open path for the molten material.

During a piercing operation the molten material will be coming back up the rod. Wear proper clothing for protection from the molten spray. The torch should be held at arm's length to keep the operator as far away from the molten material as possible. To protect the operator and torch, an optional 6" collet extension and extension shield are available for the SLICE cutting torch.

Piercing in the flat position is more difficult than piercing horizontally. Progression while piercing flat will also be slower. (Example: Piercing a hole in a floor is more difficult and slower than piercing a hole in a wall.)

Cutting Copper and Copper Alloys

Because of the very rapid heat absorption of copper and its alloys, all cutting on these materials should be done with power. The maximum amperage to use with copper is 300 amperes. Copper quickly absorbs the heat created from the exothermic reaction, reducing the effectiveness of the cutting process. The heat is stronger when cutting with power, making it possible to cut some copper pieces. The larger the size of the part the more difficult it is to cut. A sawing motion into the cut kerf will speed cutting.

Piercing Copper and Copper Alloys

When piercing copper and its alloys, use power. Using power to pierce copper will cause extremely fast rod consumption. The higher the copper content of the part the harder the material is to cut. Brass, bronze and other alloys are slightly easier to cut, but these alloys should be cut using power, if possible.

EQUIPMENT SELECTION

SLICE Torch and Striker

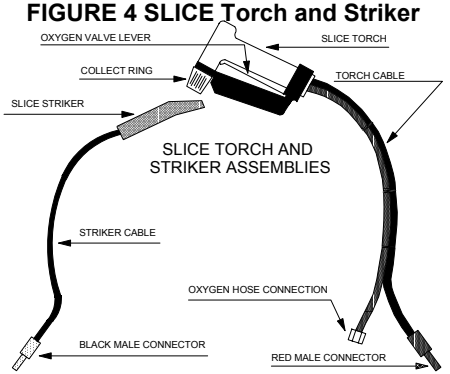
The SLICE Torch is a gun shaped tool that provides a means of gripping the rod and supplying the oxygen and power to the cutting rod. The basic torch comes complete with 10 feet of

power cable and oxygen hose. The power cable is of sufficient size to carry 200 amps in a power cutting operation. The oxygen hose comes with a standard size oxygen fitting and is ready to be connected to the user's oxygen regulator. This standard torch comes with a flexible hand shield that is easily replaceable if damaged. The SLICE Torch is molded from a glass reinforced thermoset plastic, which is rugged and will withstand the punishment of frequent everyday use.

To help reduce torch wear or damage when piercing, an optional 6" collet extension and 6" diameter extension shield is available. Also available is a 3/8" adapter kit consisting of a collet chuck, collet nut, washer, and flashback arrestor needed to adapt the torch for using the 3/8" diameter cutting rods.

To compliment the basic SLICE torch when cutting without power a SLICE Striker is also available. The striker is an insulated piece of copper plate with a serrated surface to provide a convenient means of igniting the cutting rod. By scratching the rod against the copper plate an arc is initiated and the cutting process begins. The SLICE striker also comes standard with a 10-foot cable.

FIGURE 4 SLICE Torch and Striker



Other Equipment

SLICE Cutting Equipment is also available in ready to go packages. Each pack is design to fit a specific need. The packs give the user all the exothermic cutting equipment he needs to compliment his shop or service vehicle.

These packs start with the very basic unit that includes; torch, striker and other support items in a handy toolbox. This type pack is just right for a service truck or for the welding jobber who has oxygen and an ignition source available.

A complete package is also available. The SLICE Pack Complete was designed for use in emergencies. All you need for cutting is available and ready for immediate use. This pack contains a 12-volt rechargeable battery for rod ignition. The carrying case has a compartment for a 40-cubic-foot oxygen bottle (supplied by the user).

The amount of burning this unit can do depends on the size of the oxygen supply. With a 40-cubic-foot oxygen bottle 8 to 10 rods can be burned, representing 5 to 7 minutes of cutting time.

Other packages are also available for both field use and inside a large factory. Each of these units is designed to fit a specific need.

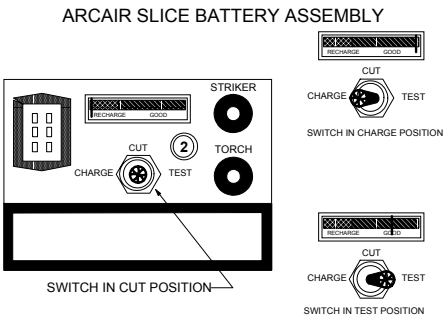
The Arcair Company has also developed specialty exothermic cutting units. They have developed a unit being called "PECU" or **P**ortable **E**xothermic **C**utting **U**nit that is being supplied to the U.S. Navy for use in damage control.

SLICE Pack Battery Box Assembly

Some packs include a 12-volt rechargeable battery. The battery and charging circuitry are enclosed in a protective case. Supplied with the battery box is a cord for recharging from a 120-volt AC outlet.

When using the battery supplied with this unit, the three-position switch on the face of the battery box must be in the "CUT" position when igniting the rod.
To check the charge on the battery, push the mode switch to the "TEST" position. The meter will register the charge level. The mode switch must be put in the "CHARGE" position when the battery is recharged.
The battery should be recharged when the indicator is close to or in the red zone of the meter. Recharge time depends on the level of battery's discharge level. A fully discharged battery will take 12 hours to recharge.

FIGURE 5 SLICE Battery Box Assembly



IMPORTANT PROCESS VARIABLES AND THEIR EFFECTS

Process Variables

Exothermic cutting is easier than most cutting processes to do. It can be done improperly though.
Variables can reduce the efficiency of this process, resulting in poor cutting. Major variables requiring attention are listed and discussed below.

Oxygen Pressure

The oxygen in this process maintains the exothermic burn and removes the molten material from the cut. 80 psi yields the most efficient cutting rates (amount of cut per inch of rod burned), on materials up to 3" thick. Using pressures less than 80 psi on such materials reduces cutting rates because there is not enough pressure to remove the molten material.
Using pressures under 80 psi is advantageous for scarfing. Lower pressures offer a more controllable scarfing action. With material thicker than 3", pressures over 80 psi can be used to give the oxygen enough velocity to blow away molten material at the bottom of the cut. Using higher pressures on thicker materials causes a more forceful oxygen jet and faster rod consumption. A sawing motion with 80 psi or a larger-diameter rod may help cut these materials more efficiently.
80 psi is the best pressure to use when piercing. To pierce, an operator should reduce the pressure slightly to control the distance the molten material travels. Once there is a hole, full pressure should be used. The operator can vary pressure by using the torch's oxygen lever. The only time pressures above 80 psi are used in piercing is when the thickness of the material - usually more than 12" - needs added pressure to blow the molten material out of the pierce hole.

Amperage

In exothermic cutting electrical current increases the heat from the reaction, allowing faster cutting. 200 amps yields the most efficient cutting rates with power. When cutting with power and using less than 200 amps, the amount of cut per minute will be lower. Amperage above 200 amps consumes the rod faster, reducing the cut per inch of rod burned.
Exothermic cutting equipment uses

around 200 amps. Exceeding this amperage could cause equipment damage.
When cutting without power, current from the battery ignites the rod. To ignite the rod a surge of at least 100 amps is needed. If the battery has not been properly charged it will not have enough amperage to ignite the cutting rod.

Travel Speed

This cutting rod will burn without an electrical arc, regardless of whether the user is cutting. Therefore, cut as fast as possible without losing the cut kerf. If the travel speed is too fast, the material will not be cut completely through and molten slag will be blown back from the workpiece.

Electrode-to-Work Angle

The electrode-to-work angle is the most forgiving process variable. However, use of an improper angle can cause reduced cutting efficiency. For most cutting jobs this angle is between 45° and 80°. The thicker the material the closer to the 80° angle the rod should be held. In almost all cutting the electrode-to-work angle is a drag angle. A drag angle is one in which the rod is held so the tip of the burning rod is away from the direction of travel. One exception is cutting sheet metal. Such cutting is usually faster and better controlled when the user keeps a 45° angle or slightly less and pushes the rod in the direction of cut. Aluminum, regardless of its thickness, requires a 70° to 80° drag angle.

SAFETY AND HEALTH

Introduction

SLICE Cutting Equipment uses industrial grade oxygen to produce its very effective cuts. Industrial standards associated with oxygen use, electrical equipment, cutting procedures and other safety precautions apply when using this equipment. This section highlights these procedures. Refer to ANSI/ASC "Safety in Welding and Cutting" safety standards (Z49.1-1983) or other prevailing standards for further details. SERIOUS INJURY OR DEATH
may result if exothermic cutting equipment is not properly installed, used and maintained. Misuse of this equipment and other unsafe practices can be hazardous. The operator, supervisor and helper must read and understand the following safety warnings and instructions before installing or using any cutting torch or equipment.
The exothermic cutting process is used in many potentially dangerous environments such as elevated heights, areas of limited ventilation, close quarters, in hostile environments, etc., and it is important that the operators are aware of the dangers associated in working in these types of conditions. Be certain that the operator(s) are trained in safe practices for the environments in which they are expected to work and are under competent supervision.
It is essential that the operator, supervisor and others in the work area are aware of the dangers of the exothermic cutting process. Training and proper supervision are important for a safe work place. Keep these instructions for future use. Additional recommended safety and operating information is referenced in each section.

ELECTRIC SHOCK CAN CAUSE INJURY OR DEATH

Install and maintain equipment in accordance with the National Electrical Code NFPA 70

and local codes. Do not service or repair equipment with power on. Do not operate equipment with protective insulators or covers removed. Service or repair to equipment must only be done by qualified, trained personnel. Do not contact electrically live parts. Do not touch electrode with bare skin and electrical ground at the same time. Always wear dry welding gloves in good condition. Aluminized protective clothing can become part of the electrical path. Keep oxygen cylinders, chains, wire ropes, cranes, hoists, and elevators away from any part of the electrical circuit. All ground connections must be checked periodically to determine that they are mechanically strong and electrically adequate for the required current.

Using alternating current is not recommended for exothermic cutting under wet conditions or warm surroundings where perspiration is a factor. Constant potential type power supplies shall not be used to supply current for exothermic cutting. It is not recommended to use an amperage output greater than 200 amps.

When cutting is to be suspended for any substantial period of time, such as during lunch or overnight, all rods should be removed from the torch and the torch carefully located so that accidental contact cannot occur. The torch must be disconnected from the power source when not in use. Never immerse exothermic cutting torches in water when cutting with an arc from a welding power supply. Whenever possible do not use electrical power to do exothermic cutting.

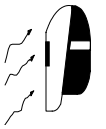
SEE SAFETY AND OPERATING REFERENCES 1 AND 2

SMOKE, FUMES AND GASES CAN BE DANGEROUS TO YOUR HEALTH

Keep smoke, fumes and gases from the breathing area. Fumes from the cutting process are of various types and strengths, depending on the kind of base metal being worked on. To ensure your safety, do not breathe these fumes. Ventilation must be adequate to remove smoke, fumes and gases to protect exothermic cutting operators and others in the area. Vapors of chlorinated solvents can form the toxic gas "Phosgene" when exposed to ultraviolet radiation from an electric arc. All solvents, degreasers and potential sources of these vapors must be removed from the work area

Fumes produced by cutting particularly in confined places can cause discomfort and physical harm if inhaled over an extended period of time. Provide adequate ventilation in the cutting area. Use air-supplied respirators if ventilation is not adequate to remove all fumes and gases. **Never ventilate with oxygen, because oxygen supports and vigorously accelerates fire.**

SEE SAFETY AND OPERATING REFERENCES 1, 2, 3, AND 4



ARC RAYS, HOT SLAG AND SPARKS CAN INJURE EYES AND BURN SKIN

This cutting process produces extreme localized heat, and can produce strong ultraviolet rays. Never attempt to cut without eye and face protection that complies with federal guidelines. A number 10 to 12 shade lens provides the best protection against arc radiation when using an electrical arc. A number 5-shade lens should be used when cutting without an electrical arc.

When in a confined area, prevent the reflected arc rays from entering around the helmet. Make sure others are protected from arc rays and sparks. Approved shielding curtains and appropriate goggles should be used to provide protection to others in the surrounding area and operators of nearby equipment.
Skin should also be protected from arc rays, heat, sparks and molten metal. Always wear protective gloves and clothing, which will not allow skin to become exposed. All pockets should be closed and cuffs sewn shut. Leather aprons, sleeves, leggings, etc. should be worn for out-of-position cutting. High top work shoes provide adequate protection from foot burns. For added protection use leather spats. Flammable hair preparations should not be used when cutting. Wear earplugs to protect ears from sparks.
SAFETY AND OPERATING REFERENCES 1, 2, AND 3.

WELDING SPARKS AND COMPRESSED GASES CAN CAUSE FIRES AND EXPLOSIONS

Causes of fire and explosion are; combustibles reached by the arc, flame, flying sparks, hot slag or heated materials. Remove combustibles from the work area and/or provide a fire watch. Avoid oily or greasy clothing as a spark may ignite them. Have a fire extinguisher nearby, and know how to use it. Be alert to the danger of conduction or radiation, for example if cutting is to be done on a metal wall, partition, ceiling or roof, precautions must be taken to prevent ignition of combustibles on the other side. Do not cut containers that have held combustibles. All hollow spaces, cavities and containers should be vented prior to cutting to permit the escape of air or gases. Purging with inert gas is recommended.
Exothermic cutting operations use oxygen, therefore all safety precautions concerning the use of oxygen must be observed. Oxygen itself is not flammable, however, the presence of pure oxygen will drastically increase the speed and force with which burning takes place. Always refer to oxygen by its full name "oxygen," and not by the word "air." Never allow oil, grease or other petroleum-based substances to come in contact with cylinder valves, regulators, hoses or any other part of the oxygen supply system. Do not let an arc, cutting rod or flame touch any part of the oxygen supply system. Chain or secure cylinders to an object such as a cylinder cart, wall, workbench, post, etc. When moving cylinders, always be certain that valve protection caps are securely in place. Never stand in front or behind a regulator when opening the cylinder valve. Always stand so the cylinder is between you and the regulator. Never use compressed air instead of oxygen. Keep oxygen cylinders away from electrical connections
SEE SAFETY AND OPERATING REFERENCES 1, 2, 5, AND 6.

SAFETY AND OPERATING REFERENCES

1. Code of Federal Regulations, (OSHA)
   Section 29 Part 1910.95, 101, 132, 133, 134, 139, 251, 252, 253, 254, AND 1000.
   U.S. Government Printing Office
   Washington, DC 20402
2. ANSI Z49.1 "Safety In Welding And Cutting."
3. ANSI Z87.1 "Practice for Occupational and Educational Eye and Face Protection
4. ANSI Z88.2 "Standard Practice for Respiratory Protection."

American National Standards Institute
1430 Broadway
New York, NY 10018.

5. AWS F4.1 "Recommended Safe Practices for Welding And Cutting Containers." The American Welding Society
550 NW Lejeune RD.
P.O.Box 351040
Miami FL. 33135
6. NFPA 51B "Fire Prevention in Cutting and Welding Processes." National Fire Protection Association
Battery Park
Quincy MA 02269
7. CSA Standard W117.2. "Safety in Welding, Cutting and Allied Processes"
Canadian Standards Association
178 Rexdale Blvd.
Rexdale, 0ntario, Canada
M9W 1R3

AREAS OF APPLICATION

Here is a partial list of uses for SLICE equipment.

Construction

Bridge repair. Cutting structural steel. Pierce and remove rivets and bolts without damaging surrounding material. Punch holes in concrete, crack rocks. Highway maintenance. Repair of highway guardrails. Cut reinforcing rods. Cut plaster or concrete insulated pipes. Repairs on heavy equipment. Removing old structural steel. Scrap clean up. Salvage work.

Plant Maintenance

Equipment/machinery repair. Remove headless bolts or frozen pins. Remove seized bearings. Plant renovation. Removing old piping systems. Punch lag holes to secure machinery. Repair machine bases. Remove old machinery. Cut up or repair storage tanks.

Heavy Equipment Maintenance

General maintenance (field or shop repairs). Repair buckets. Remove seized or worn pins. Cut worn or frayed control cables. Cut badly corroded material.

Foundry

Remove core sand trapped in holes of castings. Remove areas of imbedded sand. Cut gates, risers, fins from castings. Cut small multiple castings from runners. Cut through slag in furnace cleanup. Punch relief holes in molds. Cut up spilled materials for remelting. Cut up scrap castings. General plant maintenance.

Fire Service Rescue Departments

Rapid entry into buildings. Cut through steel doors, dead bolts, barred windows, overhead doors. Cut through debris (metal, concrete, plaster, rock) from building collapse. Rescue operations.

Police/Swat

Rapid entry into buildings. Cut through steel doors, dead bolts, barred windows, overhead doors. Rescue operations.

Railroad

Rail car repair and maintenance. Track maintenance/cut damaged sections of track. Repairs in remote yard locations. Remove old rail loading docks.

Mining

Equipment maintenance (field and shop repairs). Cut steel cables. Repair coal tipples. Belt repairs. Remove abandoned piping and railways. Piercing holes in rock to set blasting charges.

Metal Fabrication
Pierce starter holes in thick plates. Rough-cut pieces of material from large plates. Field construction.

Demolition
Cut through rebar. Pierce concrete. Remove rivets and frozen bolts. Cut steel imbedded in concrete. Equipment maintenance/repair. Cut corroded material.

Power Plants
General maintenance. Removal of piping. Cut out scrap feeder pans. Remove old grating covered with refractory. Remove old boilers. Remove or repair storage tanks.

Farming
General maintenance. Equipment/machinery repair. Repair stainless steel fertilizer tanks. Cut metal encrusted with rust and/or mud.

Scrap/Salvage Yards
Cut all types of scrap metal, including cast iron, stainless steel, and aluminum. Cut up scrap cars in remote areas of yard. Equipment maintenance. Cut badly corroded or crusted material.

TROUBLE SHOOTING
The SLICE Exothermic Cutting process is not complicated to use or maintain, but sometimes problems do arise. Some common problems and their solutions are listed below:

Problem:
Rod burns but with no cut progression.
Solution:
(1) To much gap between the burning rod tip and the workpiece. Must maintain slight pressure against workpiece.
(2) Travel speed too slow.
(3) Oxygen pressure too low.

Problem:
Molten material not being blown out of cut area.
Solution:
(1) Insufficient oxygen pressure being used.
(2) Rubber washer behind collet chuck worn and needs to be replaced.
(3) Travel speed too fast.

Problem:
Battery will only start a few rods before charge is depleted.
Solution:
(1) Battery was not given sufficient time to recharge.
(2) Three-position switch on battery box not put in the "CHARGE" position.
(3) Battery needs to be replaced.
(4) Battery left exposed to subfreezing temperatures.

Problem:
Torch shield is being burnt off around collet nut.
Solution:
(1) Rod is not properly seated in torch. Refer to section on operating techniques to properly seat rod.
(2) Collet extension not used when piercing holes.

Problem:
When piercing anything but copper and its alloys, the rod consumes extremely fast.
Solution:
(1) Operator is piercing with power. All piercing operations except ones on copper and its alloys should be done without power.

Problem:
Arced collet chuck and/or rod is burned off just outside of collet chuck.
Solution:
(1) Using a CP type welding power source.

Application Data

The following chart will help determine the best settings for a specific use. The chart is a result of extensive laboratory testing of the SLICE Equipment to determine the best cutting rates. Actual cutting results obtained in the field will vary due to conditions and to the experience of the user. The way you use SLICE Equipment will also cause your results to vary. For any use, you will need to adjust the settings. The following chart is presented only as a guide.

How To Use Chart

The data chart is simple to use. First, best cutting was achieved by using an oxygen pressure of 80 psi. Some uses may require higher or lower oxygen pressures. Minimum oxygen pressure to use with the SLICE Torch is 40 psi.; maximum pressure is 100 psi. Amperage over 200 amps does not improve cutting speed. The chart is divided first by metal type and thickness.

A) Find the right metal and thickness. For composites or unlisted metals, locate the listed type that most resembles the material to be cut.

NOTE: All these cutting values are based on 1/4" diameter flux-coated rods. Cutting rates with 1/4" bare rods will be slightly less than the values listed in the chart.

Cutting Rates

Material Type	Material Thickness		Length of Cut Per Inch Rod Used		Cutting Speed	
	Inches	mm	Inches	cm	In/Min	cm/Min
Carbon Steel	1/8	3.2	2.25	5.7	72	183
	¼	6.4	1.50	3.8	52	132
	3/8	9.5	1.38	3.5	42	106
	½	12.7	1.25	3.2	35	89
	¾	19.1	0.75	1.9	22	56
Stainless	1/8	3.2	2.00	5.1	65	165
	¼	6.4	1.13	2.9	36	91
Aluminum	¼	6.4	1.75	4.4	58	147
	3/8	9.5	1.25	3.2	38	97
	3/4	19.1	0.75	1.9	23	58

Sample Selections

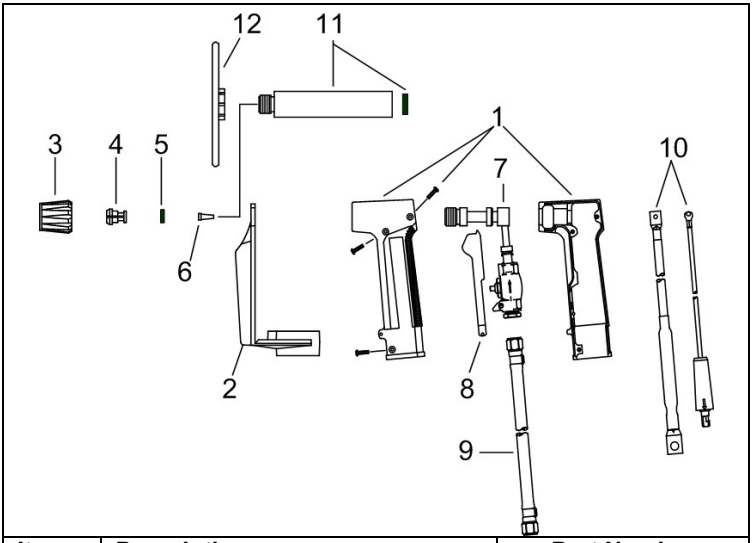
Cutting 3/8" (9.5 mm) aluminum with 1/4" fluxed rod: APPROX. cut/inch rod = 1.25 in. (3.2 cm) Amount of cut per rod = 19 usable inches (48.3 cm) of rod multiplied by 1.25 in. (3.2 cm) of cut/inch rod = 23.8 in. (60.5 cm) cut per rod used. APPROX. cut/min. arc time = 38 inches (97 cm).

Cutting 1/4" (6.4 mm) carbon steel with 1/4" fluxed rod: APPROX. cut/inch rod = 1.5 in. (3.8 cm) Amount of cut per rod = 19 usable inches (48.3 cm) of rod multiplied by 1.5 in. (3.8 cm) of cut/inch rod = 28.5 in. (72.4 cm) cut per rod used. APPROX. cut/min. arc time = 52 in. (132 cm).

Cutting rates in this chart were obtained using 80 PSI oxygen pressure and 1/4" x 22" cutting rods. These rates are averaged values based on multiple cutting tests. Actual cutting rates may vary due to parameters used and operator expertise.

Cutting Electrode Types							
Part Number	**Rod Diameter**	**Rod Length**	**Coated or Uncoated**	**Package Quantity**	**Optimum Oxygen Pressure**	**Oxygen Flow Rate**	**Rod Burn Time**
42-049-002	1/4"	22"	Coated	25	80	7.5 CFM	40 – 45 Seconds
42-049-003	1/4"	22"	Coated	100	80	7.5 CFM	40 – 45 Seconds
43-049-002	1/4"	22"	Uncoated	25	80	7.5 CFM	40 – 45 Seconds
43-049-003	1/4"	22"	Uncoated	100	80	7.5 CFM	40 – 45 Seconds
43-049-005	1/4"	44"	Uncoated	25	80	7.5 CFM	80 – 90 Seconds
42-049-005	3/8"	18"	Coated	50	80	12 CFM	30 – 35 Seconds
43-049-007	3/8"	18"	Uncoated	50	80	12 CFM	30 – 35 Seconds
43-049-009	3/8”	36"	Uncoated	25	80	12 CFM	60 – 70 Seconds

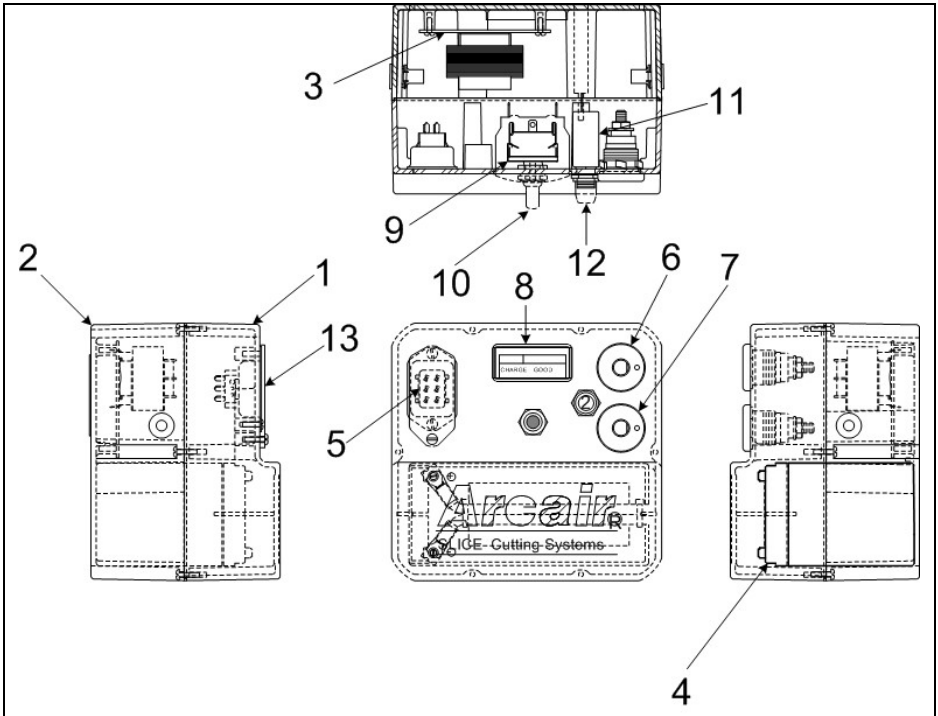
SLICE Cutting Torches					
	Cable Size	Power Cable Length	Oxygen Hose Length	Cutting With Power	Cutting Without Power
03-003-000	#1	10'	10'	Recommended	Can Be Used
03-003-001	#6	10’	10’	Limited Use Only	Recommended
03-003-006	#10	10'	10'	Not Recommended	Recommended



Item	Description	Part Number
	Torch	
1	Torch Handle Kit (with screws)	94-370-182
2	Shield	94-777-109
3	¼" Collet Nut	94-168-022
3	3/8" Collet Nut	94-168-024
4	¼" Collet Chuck	94-158-048
4	3/8" Collet Chuck	94-158-048
5	Seat Washer	94-940-109
6	Spark Arrestor	94-305-009
7	Head Assembly	94-378-338
8	Lever Assembly	94-476-082
9	Oxygen Hose	94-396-193
10	Torch Cable - #1	96-130-279
10	Torch Cable - #10	96-130-319
11	6" Extension	94-168-023
12	Extension Shield	94-777-111
	Striker	
NS	Striker Handle Kit	94-370-181
NS	Striker Bar	96-070-031
NS	Striker Cable	96-130-320

SLICE Accessories			
Description	**Part Number**	**Description**	**Part Number**
3/8" Rod Conversion Kit	94-463-032	55 Cu Ft. Oxygen Cylinder	94-208-002
3/8" Collet Chuck	94-158-045	Oxygen Cylinder Carry Case	94-134-046
SLICE Gloves	94-351-002	Torch Extension & Shield	94-287-013
Harness Assembly	94-463-042	Replacement 12-volt Battery	96-076-018
10' (3 m) Cable & Hose Extension	96-130-294	Battery Box Assembly	96-076-021
Preset Oxygen Regulator	94-698-084		

Slice Packs Parts Listings					
	Utility Pack	**Industrial Cart**	**Battery Pack**	**Cordless Striker Pack**	**Complete Pack**
Part Number	63-991-026	63-991-021	63-991-003	63-991-032	63-991-002
Tool Box, Case or Cart	94-134-049	N/A	94-134-047	94-134-047	94-134-034
Torch	03-003-001	03-003-001	03-003-006	N/A	03-003-006
Striker	72-012-002	72-012-002	72-012-002	72-012-002	72-012-002
Battery or Igniter	NONE	NONE	96-076-021	72-012-007	96-076-021
Torch Extension	94-168-023	94-168-023	94-168-023	94-168-023	94-168-023
Extension Shield	94-777-111	94-777-111	94-777-111	94-777-111	94-777-111
Red Battery Clamp	96-168-035	96-168-035	NONE	NONE	NONE
Black Battery Clamp	96-168-036	96-168-036	NONE	NONE	NONE
Instruction Manual	89-250-845	89-250-845	89-250-845	89-250-845	89-250-845
!/4” Cutting Rods	NONE	43-049-002	25 UNCOATED	25 UNCOATED	25 UNCOATED
Battery Charger or Cable	NONE	N/A	96-130-297	96-076-034	96-130-297
Oxygen Regulator	NONE	94-698-084	NONE	NONE	94-698-084
Oxygen Cylinder	NONE	NONE	NONE	NONE	94-208-002



Ref. No.	Description	Part Number
1	Front Half Battery Case	94-134-043
2	Back Half Battery Case	94-134-032
3	Circuit Board Assembly	96-162-752
4	Battery Assembly	96-076-018
5	6-Pin Male Connector	96-169-382
6	Red Female Panel Receptacle	96-169-374
7	Black Female Panel Receptacle	96-169-375
8	Meter	96-508-041
9	Toggle Switch	96-834-347
10	Toggle Switch Seal	94-766-052
11	Circuit Breaker	96-110-012
12	Circuit Breaker Seal	94-766-053
13	Connector Cover	94-171-285

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