

## Aqua EXO™ Underwater Exothermic Cutting Rods



### CAUTION

**Only qualified divers, trained for underwater burning should operate underwater burning equipment. Please read the following references as well as your companies safety policy.**

- 1.) Consensus Standard for Commercial Diving Operations, Association of Diving Contractors, Houston, Texas
- 2.) 46 CFR 197.200, U.S. Coast Guard Commercial Diving Regulations
- 3.) 29 CFR 1910 Sub-part "T", OSHA Diving Regulations
- 4.) S0300-BB-MAN-010 U.S. Navy Underwater Cutting and Welding Manual
- 5.) NAVSHIPS 0994-001-9010, U.S. Navy Diving Manual
- 6.) ANSI Z49, 1 Safety in Welding and Cutting

### WARNING

**All Oxy lance burning products are cleaned for Oxygen service and packaged to prevent contamination from oils and grease. Avoid storing burning rods where they could become contaminated. Clean contaminated rods and burning equipment prior to use.**

### RECOMMENDED SAFETY INSTRUCTIONS FOR YOUR COMPANY

- 1.) All equipment should be inspected and in good condition prior to operation.
- 2.) Never allow oil, grease, or flammable substances to come in contact with cutting equipment.
- 3.) The operator should understand all safety precautions concerning the use of oxygen.
- 4.) Electrical shock can cause death or injury. Insure equipment is properly installed and operated.
- 5.) Never let the diver/burner become part of the electrical circuit.

### CAUTION

**UNDERWATER BURNING PRODUCES A COMBIANTION OF UN-BURNED OXYGEN AND HYDROGEN GAS. WHEN TRAPPED IN A CONFINED AREA THIS WILL PRODUCE EXPLOSIONS.**



639 Manhattan Blvd.  
Harvey, LA 70058 USA  
TEL: (504) 362-8124  
FAX: (504) 362-3600  
[www.aquaairind.com](http://www.aquaairind.com)  
EMAIL [sales@aquairind.com](mailto:sales@aquairind.com)

## **WARNING**

Never burn where there is a pressure differential situation either blowing out or sucking in prior to burning on any structure or pipeline. You must insure that there are no hydro carbons present that can cause an explosion.

## **Recommended burning on oil platforms and pipelines**

It is recommended that when there is doubt of the contents behind the area of the burn, you **MUST** drill an inspection hole prior to Oxy-Arc burning. **DO NOT BURN ON PIPELINES WITHOUT CONFIRMING THAT THE LINE CONTAINS NOTHING FLAMMABLE AND THAT THE LINE IS FLOODED WITH WATER.**

When burning on members or jacket legs **ALWAYS** drill a hole and allow the pressure to equalize prior to burning. **YOUR FINGERS OR HAND CAN BE SUCKED IN THE HOLE, RESULTING IN SERIOUS INJURY OR DEATH. USE CAUTION WHEN DRILLING THE HOLE.**

## **BURNING BELOW THE MUDLINE**

When burning below the mudline it is best to jet and airlift or pump the mud from behind the cut to prevent Oxygen and Hydrogen from being trapped in the mud. **OXYGEN AND HYDROGEN TRAPPED IN THE MUD CAN RESULT IN AN EXPLOSION.** If the mud cannot be removed it is best to leave it packed tight and use the same cutting techniques as for concrete filled piles.

## **CONCRETE FILLED PILES**

**VERTICAL CUTS:** The tip of the rod should be pointed slightly up and then drag the rod downward. This will prevent O<sub>2</sub> and hydrogen from being forced into pockets in the concrete ahead of the cut.

**CIRCUMFERENTIAL CUTS:** **NEVER** cut in a straight line around the pile. Make an angle or miter cut starting at a high point and progressing in a downward direction (1 to 2 inches down per foot of circumference). Cut one half of the pile in this manner and stop. Go back to the starting point and cut the other half of the pile in the same downward manner. **ALWAYS** point the rod tip away from the diver and drag the rod towards the diver (away from the kerf). Using the above techniques will allow gas bubbles to escape in a natural upward direction, and the drag method will prevent gas bubbles from being forced into void areas.

## **SHIPS AND BARGES**

Extreme caution should be used for burning projects on ships and barges. We can only cover the obvious in this safety data sheet. Before undertaking major projects, a study of the ship should be performed by experts in the salvage business and all divers should be made aware of all hazards that may be encountered. The following is a list of hazards that will always be present:

### **Fuel Tanks and Cargo Holds**

Never burn into an area that contains fuel. Never burn into cargo holds that contain flammable or explosive materials.

### **Hulls, Double Bottoms, and Double Patches**

Be aware, there are many areas in ship hulls where Oxygen and Hydrogen can become trapped. Insure these areas are properly vented. Again on vertical cuts, work from the top down. Insure that all void areas are flooded prior to burning



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## OPERATING INSTRUCTIONS

Equipment required:

- 1.) Underwater Burning Torch.
- 2.) High pressure, high volume Oxygen regulator, and sufficient Oxygen supply
- 3.) Knife switch, either single or double pole
- 4.) Ground lead with a ground clamp that will insure solid contact. (Preferably a screw type or welded on ground plate.)
- 5.) Direct Current Welding machine that is capable of 250 amps or a 12 volt auto battery. (See the manual on your machine for duty cycle rating). **A.C. WELDING MACHINES ARE NOT RECOMMENDED FOR UNDERWATER USE.**

## SETTING UP EQUIPMENT

- 1.) Place Oxygen supply in a location which will prevent damage to the Oxy-Arc supply hoses. Insure all regulators, supply hoses, torches, and electrodes are free of oil and grease or other materials that are flammable. Insure all cylinders are properly secured (ready for Sea).
- 2.) Adjust regulator for the depth and thickness of material to be cut. (See recommended O<sub>2</sub> pressure table).
- 3.) Check entire burning system for O<sub>2</sub> leaks using leak check.
- 4.) For single pole knife switch; Run jumper lead from the NEGATIVE terminal of the welding machine (or negative post of battery to the knife switch. **\*\*See Caution (NOTE: POLARITY IS NOT CRITICAL WHEN CUTTING WITH THE POWER OFF).**
- 5.) The knife switch should be located on the dive station so that it can be operated by the person operating the divers radio.
- 6.) Attach ground lead to POSITIVE terminal of welding machine (or positive terminal of battery). Check machine polarity selector switch to ensure it is set for STRAIGHT POLARITY. (If there is no switch just remember the word PIG...Positive Is Ground). (NOTE: POLARITY IS NOT CRITICAL WHEN CUTTING WITH THE POWER OFF).
- 7.) A polarity test can be performed by taking a bucket (plastic is recommend) and filling it with water. With a burning rod in the holder, submerge ground and burning rod in the water. Maintaining a separation of 2 inches, call for knife switch hot. If the polarity is correct a stream of hydrogen bubbles will rise from the tip of the burning rod.

## **\*\*CAUTION**

Most knife switches and welding lead lugs are made of copper. Insure that these are clean and free of corrosion. Where the welding lead lug attaches to the knife switch or the welding machine, put the lug in direct contact with the base of the terminal. If spacers are required to help tighten the lug, put them on top. Steel spacers between two copper plates can create arcing, and resistance causing problems with current flow to the cutting rod.



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## UNDERWATER BURNING WITH EXOTHERMIC CUTTING RODS

- 1.) The diver should attach the ground to the work as near as possible to the cut. The ground should be situated so the diver WILL NOT be in a position between the ground and the area where he will be burning.
- 2.) When the diver is in the position and ready to begin cutting he will direct the topside crew to MAKE IT HOT. After electrode is burning the diver can choose to cut with the knife switch hot or cold. IF cutting with power on use STRAIGHT PRIORITY.
- 3.) When cutting without power exothermic rods will consume slower, however, cutting speed may be reduced.
- 4.) For increased production, it is recommended that the surface be free of heavy oxidation, barnacles, or any other material that will reduce or prevent proper electrical conduction.

**WARNING:** Never leave the knife switch hot when not actually burning. Bubbles that form in the torch head and the burning rod are hydrogen and can explode. Prior to making the knife switch hot, purge the torch and rod with oxygen to insure that no hydrogen is present. Leaving the knife switch cold will also reduce corrosion damage to the torch.

## BATTERY CAUTION

When igniting electrodes with a battery make the knife switch cold after electrode is ignited. Battery will discharge rapidly if power is left on.

## OXYGEN PRESSURE AND AMPERAGE SETTINGS

Material Thickness	Oxygen Pressure	Amperage
1/8" to 3/8"	40 to 50 PSI	150 to 250
1/2" to 3/4"	50 to 70 PSI	150 to 250
1" to 1 1/2"	70 to 90 PSI	150 to 250
1 3/4" and over	90 to 110 PSI	150 to 250

To insure adequate O<sub>2</sub> flow we recommend 3/8" I.D. hose for the entire length of your Oxy Arc.

## AMPERAGE/VOLTAGE VERSUS CABLE LENGTH

The amperage and open circuit voltage settings on the welding machine will depend on the length of the Oxy-Arc system, and the size of the welding lead in the system.

When selecting the welding lead to be used for the Oxy-Arc system, you must measure the total length of the Oxy-Arc, the jumper lead from the machine to the knife switch, and the ground lead. This is the total length of the electrical circuit.

**EXAMPLE:** A 350 foot Oxy-Arc, with a 50 foot jumper from the machine to the knife switch, and a 200 foot ground, has a total circuit length of 600 feet. In this case using 3/0 (000) cable, to maintain 300 amps at the electrode, the welding machine settings would need to be increased by 28 amps, and the open circuit voltage by 14 volts. The amperage drop would be 28 amps (2 amps per 50 feet of cable) and 14 volts (2 volts per 50 feet of cable) and 14 volts (2 volts per 100 feet) at 300 amps for 600 feet.

**(REFERENCE AMPERAGE CHART)**



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A common practice, that creates problems for the diver, is to have an Oxy-Arc with 3/0 (000) welding lead, and then use 2/0 (00) for the jumper, and the ground. Another bad practice is to use old damaged welding lead for the ground lead because, "IT'S JUST A GROUND". Every piece of cable in the circuit needs to be the same size, and should be good quality cable, free of damage. All splices must be tight and water proof. The number of splices should be kept to a minimum.

The knife switch has to be well maintained. This includes removing all corrosion from the contact surfaces (blade), and from the base where the lead lugs attach. Do not use steel washers between the lugs on the lead and the knife switch. If spacers are required, put them on top of the cable lug.

**ANY DEFECT IN THE ELECTRICAL CIRCUIT IS A POTENTIAL FOR AN INCREASE IN RESISTANCE, SHORT CIRCUITING, AND LOSS OF AMPERAGE TO THE ELECTRODE. DEFECTS CAN RESULT IN INJURY AND/OR POOR PERFORMANCE.**

#### **AMPERAGE/VOLTAGE LOSS CHART**

To maintain 300 amps at the electrode, increase the machine amperage by the following amounts for the combined length of the burning circuit indicated.

#### **OXYGEN PRESSURE AND AMPERAGE SETTINGS**

Lead, Jumper, & Ground	100 Feet	150 Feet	200 Feet	300 Feet	400 Feet
1/0 (0) Cable	+ 10 AMPS	+ 14 AMPS	Not Recommended for These Lengths		
2/0 (00) Cable	+ 2 AMPS	+ 4 AMPS	+ 8 AMPS	Not Recommended	
3/0 (000) Cable	+ 0 AMPS	+ 0 AMPS	+ 4 AMPS	+ 12 AMPS	+ 20 AMPS

For lengths beyond 400 feet add 4 amps per 100 feet of cable. If problems are encountered at long lengths increase cable size to 4/0 (0000) cable, or double the cable (2 leads, 2 grounds, and 2 jumpers or 2/0 (00) or 3/0 (000) cable). These amp settings are figured on cable in like new condition with a minimum of splice connections. Older cable may have more resistance.

#### **Problem Areas and Locating Them**

When problems occur with the power to the torch, look for these defects.

Holes in the insulation. If they are in the water, or have been in the water, holes in the welding lead will bleed a red oxide color that will look like paint on the lead.

Run your hand along the lead. Hot spots in the insulation indicate a break or partial break in the lead. The heat is the result of resistance, or arcing between broken wires.

While the knife switch is hot, look for arcing them from the lead to the deck. This is a common problem that happens when old welding lead gets used for jumper leads. If you have Amp or Volt meters on the machine, and the Volt meter is reading zero, and the Amp meter is reading high or pegged, the hot lead is short circuited (grounded out).



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Inspect all splices to insure they are tight and waterproof.

Check connections at the machine and the knife switch.

Check the entire length of the jumper lead and the Oxy-Arc to insure that neither is grounded out.

<b>Trouble Shooting Guide</b>		
<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Weak Arc	Welder Idling	Increase RPM's to the correct setting for welding burning
	Battery Low	Charge Battery
	Lead/Ground Loose	Clean lugs and re-tighten connections
	Knife Switch	Clean lugs and knife switch, re-tighten connections
	Improper Ground	Inspect ground, make sure it is on clean metal and it is tight
	Loose/Broken Splices	Inspect and repair any damaged splices
	Broken Lead/Ground	Inspect lead/ground and repair as required
Difficult to Start	Low Oxygen Pressure	Increase oxygen pressure or change cylinder
Rod Burning	Machine Setting Low	Increase amp/volt settings to compensate for circuit length
	Damaged Lead	Inspect leads to insure they are not damaged and are water tight
	Loose Ground	Insure that the ground is tight and on clean metal
Electrode Burns too Fast	Amperage Set too High	Adjust welding machine to proper amperage setting
	Polarity Reversed	Insure that the system is set for straight polarity
	High Oxygen Pressure	Adjust pressure for the proper thickness and depth
Electrode Welds, Not Burns	Low Oxygen Pressure	Check Oxygen supply to insure there is adequate Oxygen Check torch for obstructions in the hose and the electrode Insure that the pressure setting is corrected for the material/depth
Electrical Shock	Damaged Lead/Ground	Inspect all leads for holes, cuts, or abrasions and repair
	Position of Ground	Insure that the diver is not between the work and the ground
	Improper Polarity	Insure that the system is set for straight polarity