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 Standards 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
6.) ANSI Z49.1 Safety in Welding and Cutting

WARNING
All Oxylance 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 COMBINATION OF UN-BURNED OXYGEN AND HYDROGEN GAS. WHEN TRAPPED IN A CONFINED AREA THIS WILL PRODUCE EXPLOSIONS.

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 a 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 put a vent hole at the highest point where gases could collect. When burning in the Vertical plane ALWAYS start at the top and burn DOWN. This will allow the gasses to escape out of the kerf as well as the vent hole.

Where there is a pressure differential 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 O₂ 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 are 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 DOUBLER 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.

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. (Preferable 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 O2 pressure table)
3. Check entire burning system for O2 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. Attach to the receiver side of the switch. Attach the burning rig to the blade side of the 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 insure 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 recommended) 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.

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 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 POLARITY.
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

<table>
<thead>
<tr>
<th>Material Thickness</th>
<th>Oxygen Pressure</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot; to 3/8&quot;</td>
<td>40 to 50 PSI</td>
<td>150 to 250</td>
</tr>
<tr>
<td>3/8&quot; to 3/4&quot;</td>
<td>50 to 70 PSI</td>
<td>150 to 250</td>
</tr>
<tr>
<td>1&quot; to 1.5&quot;</td>
<td>70 to 90 PSI</td>
<td>150 to 250</td>
</tr>
<tr>
<td>1.75&quot; and over</td>
<td>90 to 110 PSI</td>
<td>150 to 250</td>
</tr>
</tbody>
</table>

To ensure adequate O₂ flow we recommend a 3/8" I.D. hose for the entire length of your Oxy-Arc.

AMPERAGE / VOLTAGE VRS. 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 100 feet) at 300 amps for 600 feet. (REFERENCE AMPERAGE CHART)

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 cable 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:

<table>
<thead>
<tr>
<th>Lead, Jumper &amp; Ground</th>
<th>100 Feet</th>
<th>150 Feet</th>
<th>200 Feet</th>
<th>300 Feet</th>
<th>400 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (0) Cable</td>
<td>+10 Amps</td>
<td>+14 Amps</td>
<td>NOT RECOMMENDED FOR THESE LENGTHS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/0 (00) Cable</td>
<td>+2 Amps</td>
<td>+4 Amps</td>
<td>+8 Amps</td>
<td>NOT RECOMMENDED</td>
<td></td>
</tr>
<tr>
<td>3/0 (000) Cable</td>
<td>+0 Amps</td>
<td>+0 Amps</td>
<td>+4 Amps</td>
<td>+12 Amps</td>
<td>+20 Amps</td>
</tr>
</tbody>
</table>

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, OF 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 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).
- Inspect all splices to ensure they are tight, and water proof.
- Check connections at the machine and the knife switch.
- Check the entire length of the jumper lead and the Oxy-Arc to ensure that neither is grounded out.
<table>
<thead>
<tr>
<th>TROUBLE SHOOTING GUIDE</th>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEAK ARC</td>
<td>Welder idling</td>
<td>Increase the R.P.M.’s to the correct setting for welding burning</td>
</tr>
<tr>
<td></td>
<td>Battery Low</td>
<td>Battery needs charging</td>
</tr>
<tr>
<td></td>
<td>Lead / ground loose</td>
<td>Clean lugs and re-tighten connections</td>
</tr>
<tr>
<td></td>
<td>Knife switch</td>
<td>Clean lugs and knife switch, re-tighten connections</td>
</tr>
<tr>
<td></td>
<td>Improper ground</td>
<td>Inspect ground, make sure it is on clean metal, and it is tight</td>
</tr>
<tr>
<td></td>
<td>Loose/Broken splices</td>
<td>Inspect and repair any damaged splices</td>
</tr>
<tr>
<td></td>
<td>Broken lead / ground</td>
<td>Inspect lead / ground and repair as required</td>
</tr>
<tr>
<td>DIFFICULT TO START</td>
<td>Low Oxygen pressure</td>
<td>Increase oxygen pressure or change cylinder</td>
</tr>
<tr>
<td>ROD BURNING</td>
<td>Machine setting low</td>
<td>Increase amp/volt settings to compensate for circuit length</td>
</tr>
<tr>
<td></td>
<td>Damaged lead</td>
<td>Inspect leads to insure they are not damaged and are water tight</td>
</tr>
<tr>
<td></td>
<td>Loose ground</td>
<td>Insure that the ground is tight and on clean metal</td>
</tr>
<tr>
<td>ELECTRODE BURNS TO FAST</td>
<td>Amperage set to high</td>
<td>Adjust welding machine to proper amperage setting</td>
</tr>
<tr>
<td></td>
<td>Polarity reversed</td>
<td>Insure that the system is set for straight polarity</td>
</tr>
<tr>
<td></td>
<td>High Oxygen pressure</td>
<td>Adjust pressure for the proper thickness and depth</td>
</tr>
<tr>
<td>ELECTRODE WELDS, NOT BURNS</td>
<td>Low Oxygen Pressure</td>
<td>Check O2 supply to insure there is adequate O2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check torch for obstructions in the hose and electrode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insure that the pressure setting is correct for the material/depth</td>
</tr>
<tr>
<td>ELECTRICAL SHOCK</td>
<td>Damaged lead/ground</td>
<td>Inspect all leads for holes, cuts, or abrasions, and repair</td>
</tr>
<tr>
<td></td>
<td>Position of ground</td>
<td>Insure that the diver is not between the work and the ground</td>
</tr>
<tr>
<td></td>
<td>Improper Polarity</td>
<td>Insure that the system is set for straight polarity</td>
</tr>
</tbody>
</table>

Refer to MSDS sheet for additional safety data.

For additional information, please contact:

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