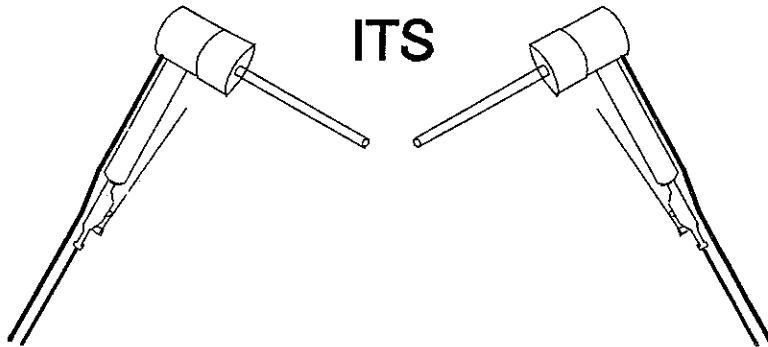


OCEANS TECHNOLOGY INC.

PRESENTS

ITS



OXY-ARC UNDERWATER BURNING CLASS

THE

DRAG METHOD

To

JOE SAVOIE

My Burning Instructor

John Carl Roat

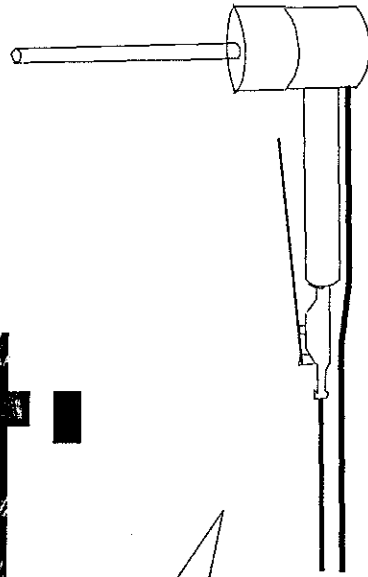
phone 504 340-4601

fax 504 340-4602

no

vent:

bang



**SAFETY BEGINS WITH
UNDERSTANDING THE
TOOLS YOU ARE USING
AND THEN USING THEM
PROPERLY.**

by
JOHN C ROAT

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APPENDIX " A "

TITLE

DRAWING #1 - PROPER VENT

DRAWING #2 - IMPROPER VENT

DRAWING #3 - BURNING GEAR SET UP

DRAWING #4- DRAG METHOD

DRAWING #5 - STARTING A NEW ROD

DRAWING #6 - ROD TRAVEL

DRAWING #7 - ENDING YOUR ROD TRAVEL

DRAWING #8 - HANGERS (Blow Backs)

DRAWING #9 - SHOCKING

DRAWING #10 - WINDOW

TIPS - CUTTING PADEYE HOLES

TIPS - REMOVING A SECTION OF PIPELINE

TIPS - BURNING GUIDE

CRAFTSWELD TORCH BREAKDOWN

BROCO TORCH BREAKDOWN

SEA TORCH BREAKDOWN

AQUA TECH TORCH BREAKDOWN

VIDEO LOG

TIME

SUBJECT DESCRIPTION

00:00 to 2 min 30 sec	INTRODUCTION
2 min 30 sec to 7 min	VENTING "The most important word in burning"
7 min to 16 min 15 sec	SELECTION OF THE PROPER EQUIPMENT
16 min 15 sec to 33 min 15 sec	EQUIPMENT INSPECTION, REPAIRING EQUIPMENT, BUILDING AND MAINTENANCE OF A BURNING RIG, WATERPROOF SPLICE EXOTHERMIC vs TUBULAR STEEL RODS
33 min 15 sec to 47 min	PROPER EQUIPMENT SET UP
47 min to 63 min 30 sec	DRY BURNING
63 min 30 sec to 77 min 30 sec	BURNING UNDERWATER
77 min 30 sec to 84 min	DEEP THOUGHTS

VENT

In the **OXY - ARC** underwater burning process you create hydrogen and oxygen, if these gases are allowed to build up you will have an explosion. If you **VENT** properly, an explosion will not happen.

THERE ARE ONLY TWO REASONS FOR AN EXPLOSION TO OCCUR

1. You have burned into a space containing an explosive substance.

Never burn into an area that may contain explosive substances, always drill or saw.

2. You did not **VENT** properly, you allow explosive gases that are created by the process of burning, to become trapped.

Any time you are burning you must make sure that the gases that are created, hydrogen and oxygen, cannot become trapped. They must escape to the surface. You do this by placing holes, vents, at the highest point that gas could be trapped, (see drawings #1 & #2).

Your safety depends on you understanding the burning process and thinking out each burning job before and during the work. The most important word in underwater burning is **VENT**. There is no excuse for an explosion, if you have one, you created it.

You must exercise **GREAT CAUTION** when venting a space that is at a lesser pressure than you. Make sure you, your hose and none of your equipment can become trapped by the suction created while the space equalizes, **THINK**.

WHY THE DRAG METHOD

If you drag the rod toward you, your helmet and body will not be in front of the cut. You must think of the cut you're making as a shaped charge, any explosion on the other side of the steel, will be focused out the cut. If your helmet or body is in front of the cut, that's where the explosion will be focused. One of the main advantages of the drag method is that it positions your helmet and body from being in front of the cut. The other advantage of the drag method is that you are able to burn by feel. This is necessary in no visibility situations.

The drag method will work with both the tubular steel and exothermic type burning rods. Each rod requires a different amount of penetration, angle and rate of travel. Each rod will also require different settings on the power source and oxygen supply.

With the drag method you should be pulling the rod toward your body, the tip of the rod, on the side you see, should be at least 1/16 (at most 1/8 inch) penetrating and hard against the steel. You should see no light where the rod is in contact with the steel. (see drawing #4)

To get a clear picture of what we are calling the Drag Method, get a burning rod, if you are left handed place your right shoulder against a wall, with you looking parallel to the wall. Place the torch end of the rod in your left hand, place the burning end of the rod against the wall as far from your body as you can reach, hold the rod lightly between the thumb and forefinger of your right hand, now slowly drag the rod toward your body. If you are right handed, reverse the process.

When burning, the rod is being consumed, so you must feed the rod in and travel at the same time. All movements need to be smooth and no faster than you can control. If you come out of the steel, make it cold and get back in good cut and start again. If you get too deep to travel, keep the rod tight against the steel and let it consume itself until travel resumes. Rod travel is fairly easy to learn with the dry burning method depicted in the video portion. What is harder to learn is how to start and finish a rod. Starts and finishes must be done at a slower rate and different angle than travel. Most hangers are left at rod changes, starts and finishes. (see drawings #5, #6 #7 & #8)

EXOTHERMIC RODS

An exothermic rod is a self consuming rod that once ignited does not require an electrical circuit to consume itself. One big advantage to burning exothermic rods, with the drag method, is it will teach you to burn by feel, not by sight. In a no visibility situation, this is critical. Even though exothermic rods will stay lit, if you can only burn by sight, when you cannot see you will have difficulty burning safely and efficiently.

The exothermic type rod burns a wider, more erratic cut and will work under conditions that a tubular steel rod will not.

ADVANTAGES OF EXOTHERMIC RODS

1. The rod does not require a constant or even flow of amperage. The leads may be smaller diameter, the welding machine doesn't have to put out as many amps. In short, your equipment does not have to be top of the line and in good repair.
2. The diver does not have to maintain contact with the steel for the rod to continue to consume itself. On such things as sheet pile this trait makes it very easy to wash out the knuckle area.
3. The steel does not require cleaning of growth to be burned. In some cases a light growth will help you control the rod. You will get more inches of burn per-rod on clean steel.
4. With visibility, an untrained burner can gouge out a burn.

DISADVANTAGES OF EXOTHERMIC RODS

1. The rod makes a wide erratic cut.
2. Exothermic rods consume more oxygen than tubular steel rods per-inch of steel cut.
3. All the heat is in the rod not in the steel, so inches of steel cut per-rod drop off dramatically in over 1 inch thick steel.

TUBULAR STEEL RODS

The tubular steel rod requires training and practice to use. The rod must be in contact with the steel to consume itself and the metal. In the hands of a trained diver with the proper equipment, the tubular steel rod will burn thick steel (**one inch and up**) further and faster than anything available .

ADVANTAGES OF TUBULAR STEEL RODS

1. Precision cuts can be made, load bearing surfaces, etc.. The kerf is narrow
2. More inches of cut per rod.
3. Less Oxygen consumed per inch of steel cut.
4. Will cut a wider range of steel thicknesses effectively.
5. Less bottom time for inches of steel cut.

DISADVANTAGES OF TUBULAR STEEL RODS

1. The tubular steel rods requires training and practice to be able to use effectively. The diver must maintain contact with the steel with the proper penetration, feed and travel of the rod.
2. To use effectively, the leads and equipment must be in good repair to a higher standard than normally found.
3. The rod requires a minimum of 300 evenly supplied amps at the torch head just to consume the rod. Amperage supplied to the torch head for 5/8" steel of 350 amps up to 550 amps for 2" steel.

POLARITY ?

There is a phenomena with D.C. welding machines called "Reverse Polarity". The polarity switch, or the lug connectors, will indicate the one polarity when actually the polarity is just the opposite. To always be sure of the polarity of a machine, use the bucket test. After setting up your burning system, insure the knife switch is in the open position, start your welding machine, place your ground clamp in a bucket of saltwater (if you are working in fresh water add salt), place a rod in the torch, put the tip of the rod in the water two inches from the ground, call "make it hot". When you have the correct polarity, electrode negative, a stream of small bubbles will come off the tip of the rod. If you have visibility you may check your polarity while in the water by holding the rod tip two inches from your grounded work and call "make it hot", again you will have a small stream of bubbles coming from the tip of the rod if your polarity is correct.

YOU AND THE GROUND

The ground cable is to be connected from the machine to the work, if you ground through the water, all the welds and bearings on your vessel will be eaten by electrolysis. The diver in this situation will have all the metal parts on his helmet eaten as well. During the burning process the power from the welding machine travels through the ground cable to the metal, from the metal to the tip of your rod. If you don't have a good ground you lose power and amperage. Do not get between your ground and your work, rod tip, you will become part of the circuit and that can be shocking. (see drawing #9)

EQUIPMENT

OXYGEN SUPPLY AND REGULATOR

The oxygen volume should be sufficient to complete the divers work, if the volume gets too low it will not drive the high flows required for burning, the divers first indication will be blow backs (**HANGERS, uncut steel**). Only top-side can keep an eye on the oxygen volume and flow.

The regulator must be of the high-flow type, it should deliver at least 70 cfm. A low-flow regulator will freeze up and deliver burst of oxygen, which will cause blow back (**HANGERS**).

All parts of the oxygen system must be free of oil, grease and any other foreign material that may cause an explosion.

The oxygen hose in a burning rig should have a burst pressure of 1000 psi and a inside diameter of 3/8 inch to deliver the volume.

When setting oxygen pressure for burning, add 5 to 10 psi for every 100 FT. of burning rig and 14.7 psi for every 33 FT. of depth.

KNIFE SWITCH

The knife switch should have a rating of at least 600 amps and be mounted on a non-conducting stand. Always connect the burning rig and the hot lead to the knife switch, never use the ground connected to the knife switch. (**see drawing # 3**)

The knife switch must be kept clean, it is part of the electrical circuit, all connections must be clean and tight, use a wire brush.

If the knife switch is mounted in a burning box or a closed space, snoop all oxygen connections, make sure there is no possibility of oxygen build up or leaks.

KNIFE SWITCH OPERATION

The diver should say "MAKE IT HOT", top side then says "MAKING IT HOT" and closes the knife switch. When the diver completes a rod or burn, he says "MAKE IT COLD", top side opens the switch and says "IT'S COLD".

You must always keep tight control of the knife switch, never allow it to be closed when the diver is not burning, this could cause injury to the diver or damage to the work sight. Never mount the switch in a way that it could fall closed.

WELDING MACHINE

Use only a D.C. welding generator for underwater cutting or welding. There is extreme danger with the use of A.C. current in the water.

The welding generator should be checked out by knowledgeable personnel before use, the commutators should be clean, brushes must not be excessively worn or short and slack brush rigging springs must be replaced. The oil, water or coolant and the fuel in the drive engine should be checked, before and after every use.

Select your machine by the amperage required at the torch head to burn the steel with the rod to be used. A high end machine will burn on the low end, a low end machine will not burn on the high end. On extended or critical burning jobs take a back up welding machine.

BURNING RIG CONSTRUCTION (600 Feet)

Equipment Needed:

1. 1200 feet of #4/0 cable
2. 630 feet Gates (100R3) 3/8 inside diameter diving hose or equivalent
3. 1 - Underwater Burning Torch
4. Four 4/0 welding cable lugs, deep barrel if possible
5. 1 - 12 in. C clamp
6. 2 - 1/2 in. or 5/8 in. brass nut and bolt sized for welding cable lugs
7. 16 - rolls silver tape
8. 2 - Lenz 3/8 in. female O² hose fittings (115R)

9. 1 - can Scotchkote electrical coating
10. 2 - rolls Scotch electrical tape 23
11. 1 - roll electrical tape

Burning Rig Construction Procedure

1. Divide the 1200 feet of #4/0 cable into two equal parts and "Figure-8" them down on the deck separately.
2. Cut back the rubber coating on both ends of each cable, exposing enough cable so that when you slide it into the welding cable lug, the rubber touches the bottom of the lug.
3. Crimp and/or solder the lugs to each end of both cables.
4. Connect the lug on the burning torch cable to the lug on the end of the 600 feet of #4/0 cable with a 1/2 in. or 5/8 in. brass nut and bolt. Cut excess of bolt flush with nut, tighten to the point of galling, **(all connections must be tight)**.
5. Coat this connection with Scotchkote electrical coating over the lugs and for 3 in. on either side of the cable on to the rubber insulation.
6. Cover area with Scotch electrical tape 23. Overlay each turn around the cable by half the width of the tape, making sure to pull the tape tight.
7. Repeat step (5) but take it 3 in. past each end of the taped area.
8. Repeat step (6).
9. Repeat step (5) but go 3 in. past the taped area.
10. Repeat step (6).
11. Repeat step (5), allowing it to become tacky and cover with four layers of regular electrical tape.

12. "Figure-8" the 630 feet of Gates 100R3 hose (diving hose) next to the 600 ft. of #4/0 cable with the burning torch at the end.
13. Cut 3 in. off each end of the Gates 100R3 hose. A clean cut, 90 degrees to the hose must be made.
14. Separate the Lenz 3/8 in. O² female hose fittings. Note that the main body which fits over the end of the hose has a left hand thread. Screw a main body on to each end of the hose, until seated.
15. Take a piece of tape and wrap it around the hose at the bottom of the main body. This will allow you to observe any crawl off the hose. (May move no more than 1/4 in.)
16. Put the main body in a vice to hold it in position. If no vice is available, use an adjustable wrench. Insert the internal part of the fitting into the end of the main body and screw clockwise until the thread catches. Use an open end or an adjustable wrench on the lock nut, and screw down until seated. (Check that the hose is not gouged and curled up on the inside).
17. Attach one end of the Gates 100R3 (diving hose) to the male 3/8 in. O² fitting on the end of the hose. Tighten firmly.
18. Begin taping the O² and #4/0 cables together just behind the Lenz fitting which is connected to the torch. Use 4 tight wraps of silver tape every 12 in. The last 30 feet of welding cable and the last 60 ft. of O² hose should not be taped.
19. Drill a hole in the center of the long arm of the 12 in. clamp, either 1/2 in. or 5/8 in.
20. Attach the clamp to the remaining 600 ft. of #4/0 cable. Tighten the 1/2 in. or 5/8 in. brass nut and bolt to the point of galling.
21. Water proof this connection with steps (5) to (11).

A burning rig of any size may be constructed with this plan by changing the cable, length, size and lug size.

BURNING RIG MAINTENANCE

1. Good maintenance begins with proper construction.
2. Have a storage place where all leads may be hung up and kept fairly dry. **(Plastic bag taped over torch head)**. Do not allow any equipment to be piled on top of the leads, torch or O² hose. Keep rods in a warm dry space. Keep high flow regulator exclusively for burning projects, make sure it is oxygen clean.
3. All leads **(hot leads, ground leads, torch leads, O² hose)** must be thoroughly checked before and after use.
4. Any damaged cable **(broken or smashed)** must be cut out and the cable spliced with #4/0 lugs then water proofed. **(Check steps #3 & # 5 to #11 in Burning Rig Construction Section)**. If the cable is not damaged but the insulation is cut, dry out the damaged area and waterproof with steps 5 to 11 of the Burning Rig Construction Section.
5. If the O² hose becomes damaged, **(cut, leaking or blown)**, cut out the damaged section and splice in a new hose using Lenz 3/8 in. female O² hose fittings **(115R)** and 3/8 in. male to male O² fittings. **(Check steps #13 to #16 in Burning Rig Construction Section)**.
6. The torch-head must be broken down after each dive and washed in fresh water and vinegar and then rinsed and dried.
 - Remove collect lock nut from torch head Check for any slag and wear.
 - Remove internal washer. Check for wear.
 - Remove flash arrester cartridge. Check for slag and burn-out.
 - Check inside the torch-head for slag.
 - Check the threads on the torch-head for wear and slag.
 - Check valve and trigger assembly for debris, leaks and tightness.
 - Reassemble and cover all exposed areas with Scotchkote.
7. Wire-brush the knife switch. Ensure that it makes a tight connection when closed.
6. Keep rods stored in a warm, dry place.

SET UP OF BURNING EQUIPMENT

1. **Check welding machine** for good brushes, clean armature, check water, good brush springs, fuel and oil.
2. **Check all leads**, hot lead, burning lead and ground. Insure no breaks in cable and no breaks in rubber coating. Insure all cables are same size as burning lead or larger. Inspect all waterproof splices. Clean all connection lugs.
3. **High flow O² regulator**, make sure it is O² clean, connect to bottles or banks of pure O². Attach O² hose of burning rig, charge rig to working pressure. Check all fittings in hose and torch for leaks (**leaks in torch can cause explosion**).
4. **Knife switch**: Insure knife is clean and not mounted in a closed space where there is a chance of O² build up. (**600 to 1000 amp switch**). Insure knife switch can not fall closed.
5. **Tubular Steel burning rods**, insure clean and that you can see a clear passage through rod. If rusted on either end, wire brush clean.
6. **Exothermic Rods**, Insure rod is free or rust on both ends. Check that the rod is the proper O.D. for the torch collect as their are 4 different size rods.
7. Connect hot lead to welding machine and knife switch. Connect ground to welding machine. Connect burning lead to knife switch. Insure that all connections are clean and tight. (**see drawing #3**). Set correct amperage, leave knife switch open.
8. **Check Polarity**: Put ground in bucket of salt water. Insert rod in torch. Make sure knife switch is open. Start machine, hold rod 2" from ground in bucket. Close knife switch. When you have proper polarity you will get a small stream of bubbles going from the rod to the ground, Open switch.

9. **Check System for Burning:** Attach ground to scrap metal (**you should wear welders mask and heavy gloves**). Set O² for at least 50 lbs. at torch. When ready close knife switch and burn at least one rod. This should be done at lower amp setting then used in the water, about 1/2 what you would use in the water or the thickness of steel being used to check torch.
10. **Spares:** Have extra rods standing by ready to go down the down line. Tape extra collet and washers 4 feet behind torch. Tie channel locks 10 feet behind torch.

SENDING DOWN AND RETRIEVING THE BURNING RIG

Never send a burning rig down without having the torch charged with enough O² to overcome bottom pressure. If at all possible hook your ground above water (burning on a structure, etc.) Keep your ground as short as possible. After torch and ground are on bottom, make sure that neither has any cable remaining coiled on deck or on hanger. This will cause a loss of amps by creating a coil, flake out remainder or drape over hand rail.

Never leave a burning rig hanging in the water when not in use for any length of time. The burning cable tends to soak up water and you want to stop the electrolysis as soon as possible. The same applies to the ground.

When burning is complete, check O² hose, burning rig and ground for damage as you retrieve them.

After torch is on surface, secure O² and bleed off torch. Soak complete torch in a 50/50 mixture of vinegar and fresh water. Once the torch is rinsed off dry it. Do not tighten collet unless you have a rod stub in it, you will distort the rose bud. Put torch in plastic bag to seal it from the weather.

EXOTHERMIC RODS

AMPERAGE & OXYGEN SETTINGS

O² and amperage settings for exothermic rods. All O² settings should be figured at the torch. Exothermic rods require 90 psi at the torch. You must add 5 to 10 PSI for every 100 ft of hose, for hose lose.

Exothermic rods require 150 amps at the rod.

<u>Length of Power Cable</u>		<u>Amperage Setting for Cable Size</u>		
<u>ft.</u>	<u>M</u>	<u>#1/0</u>	<u>#2/0</u>	<u>#3/0</u>
150	46	155	152	150
200	61	157	154	152
250	76	159	156	154
300	91	161	158	156
350	107	163	160	158
400	122	165	162	160
450	137	167	164	162
500	152	169	166	164

*The increase in amperage compensates for resistance losses.
For greater lead lengths, add 2 amperes per fifty feet to settings.

TUBULAR STEEL RODS **AMPERAGE & OXYGEN SETTINGS**

O² and amperage settings for tubular steel rods, flux coated. All O² settings should be figured at the torch. You must add 5 to 10 PSI for every 100 ft of hose, for hose lose.

2° leads will not carry the higher amperage settings, without over heating, with higher amperage settings leads should be #4/0.

It will take 300 amps at the torch head to consume a tubular steel rod.

650 amp welding machine at 1800 RPM for settings of 350 to 575:

<u>Thickness of Metal</u>	<u>Oxygen Setting Over Bottom Pressure</u>	<u>Amperage</u>
5/8" , 1/2"	70 to 80	350 to 360
3/4"	90 to 100	370 to 380
1"	90 to 100	380 to 390
1-1/4"	100 to 125	425 to 450
1-1/2"	125 to 150	460 to 480
1-3/4"	150 to 170	490 to 510
1-7/8"	150 to 170	510 to 525
2"	170	525 to 550

DEEP THOUGHTS

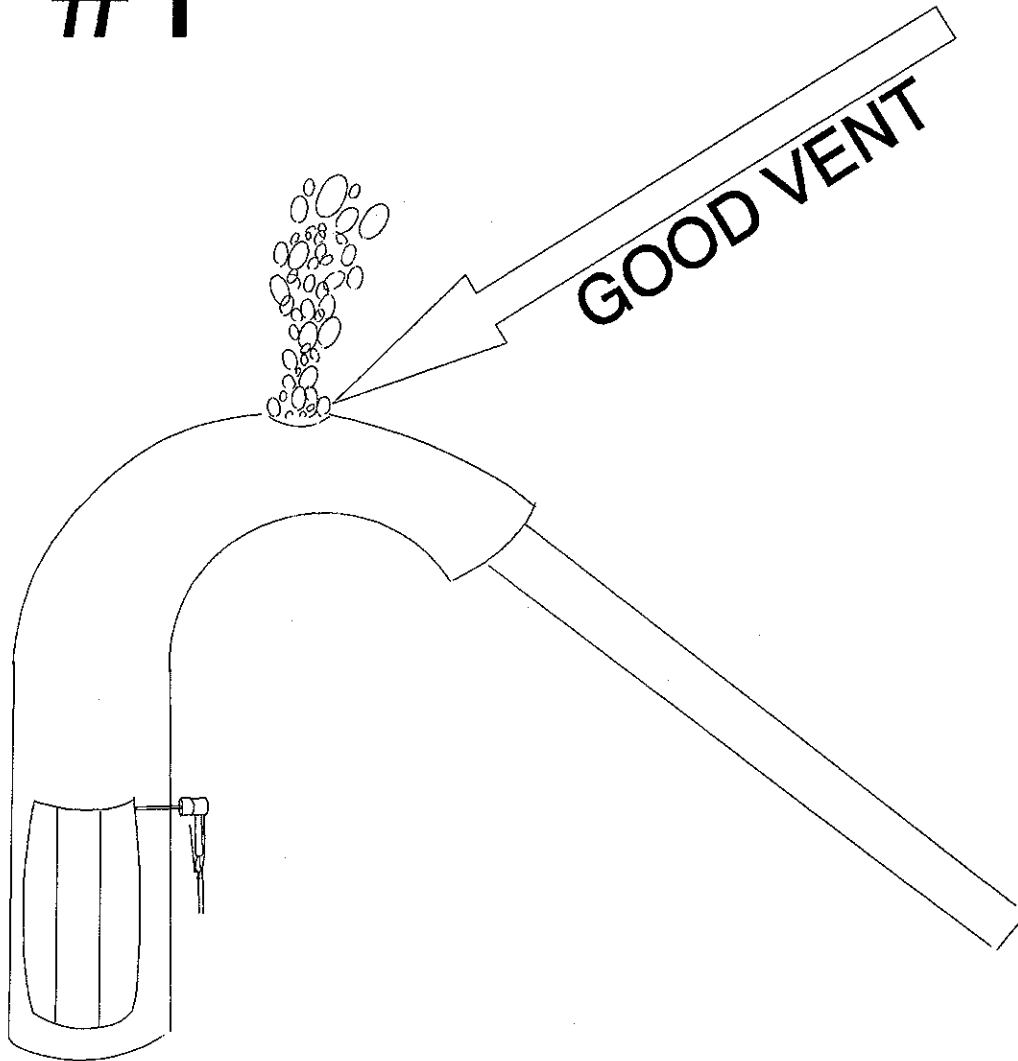
1. There is no great trick to **OXY-ARC Underwater Cutting**. The difference between a good burner and a bad burner is knowing what equipment to use for the job, how to set up and how to trouble shoot it. **PRACTICE, PRACTICE, PRACTICE** running rods, dry & wet.
2. **VENT!** the most important word in burning. More divers have been injured or killed from poor or no vent. Always make sure the gases can not build up. The process of **OXY-ARC** cutting creates **hydrogen**. **BANG!**
3. Burn only with **D.C.** current. **Never** use **A.C.** current, it can kill you.
4. Steel is often under great stress and can shift rapidly when cut, be out of the way.
5. Welding machines can switch polarity **never** believe the settings, use the **bucket test**.
6. Always have a clear understanding of what is to be burned. If you burn the wrong thing, there will be big trouble.
7. If you do not maintain it, it will not work. You only get a pay raise when your company makes a profit, gear is expensive, take care of it.
8. **Always** ground from the machine to the work. If you ground through the water, tugger wire, etc., you are eating up the vessel you work on.
9. When you dry burn, use a welders shield and hat with heavy leather gloves, coveralls and good boots under the leg of the coveralls. Have a fire watch with water and fire bottle.

APPENDIX "A"

Drawings

GOOD VENT

#1



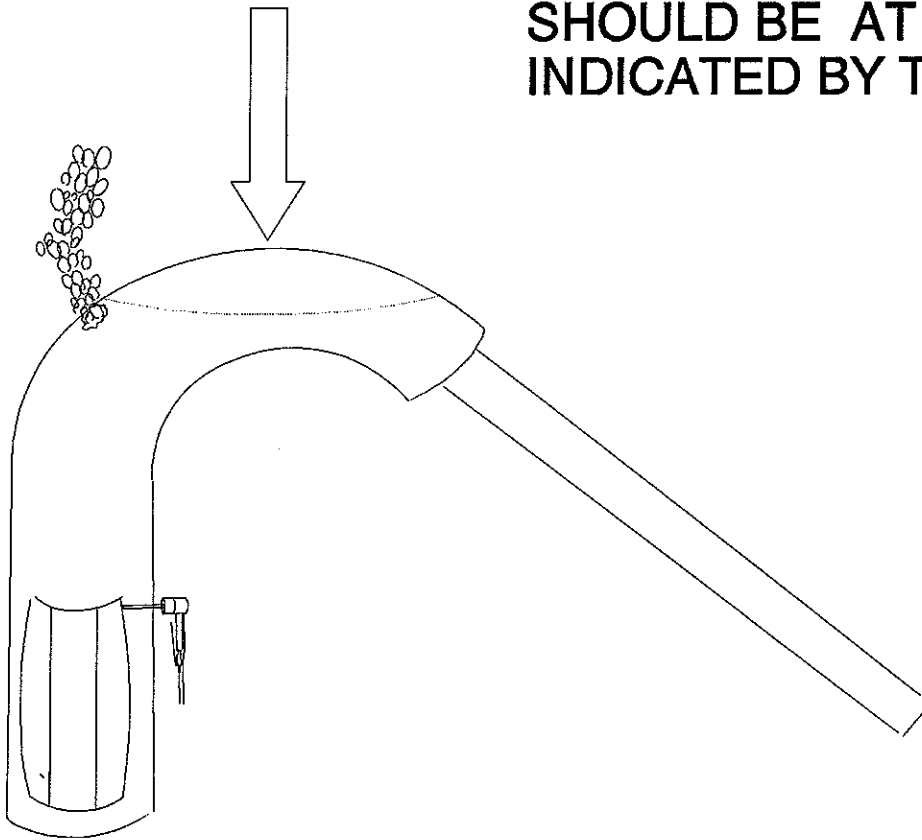
THIS IS A PROPER VENT. NOTE THE VENT IS AT THE HIGHEST POINT WHERE EXPLOSIVE GAS COULD BECOME TRAPPED.

BAD VENT

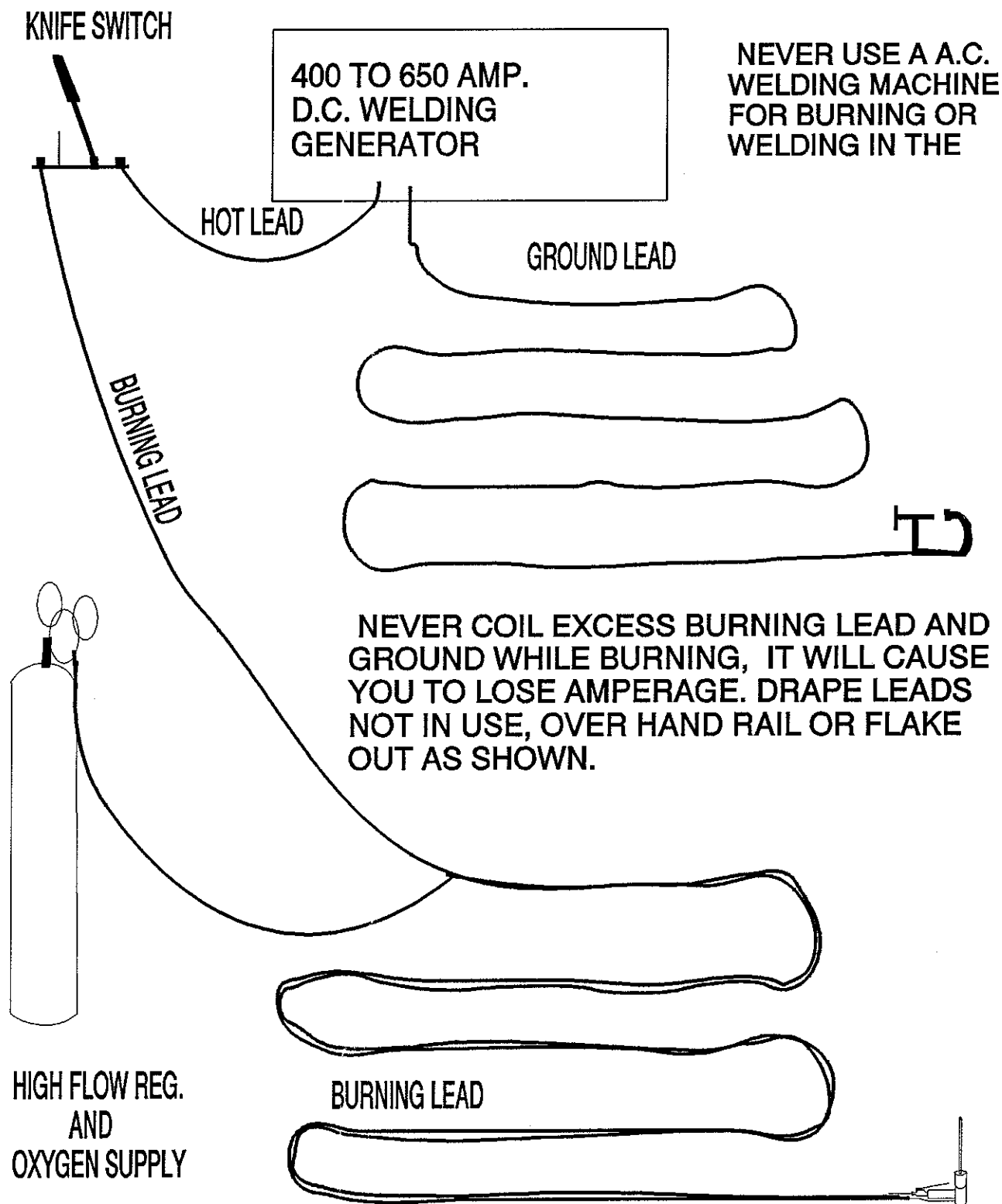
#2

THIS IS NOT A PROPER VENT
THE VENT SHOULD ALWAYS
BE AT THE HIGHEST POINT
POSSIBLE.

EXPLOSIVE GAS WILL
BECOME TRAPPED ABOVE
THE DOTTED LINE. THE VENT
SHOULD BE AT THE POINT
INDICATED BY THE ARROW.



BURNING GEAR SET-UP #3



#4 DRAG METHOD



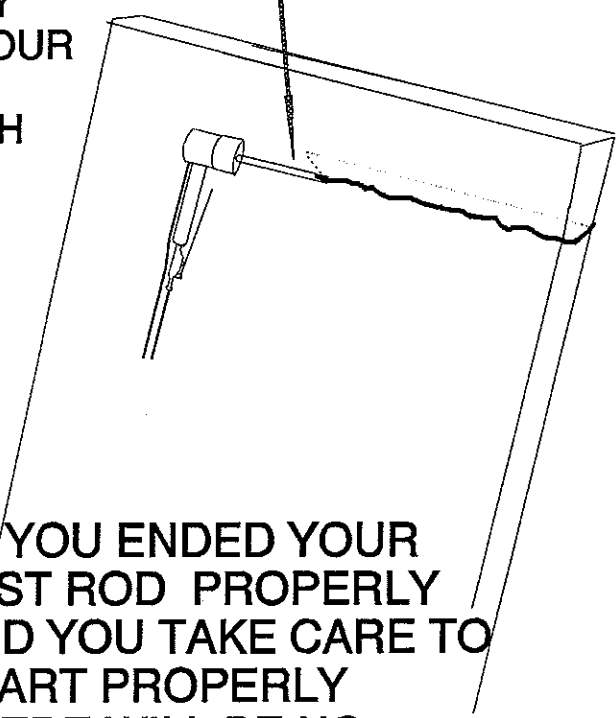
THE DRAG METHOD KEEPS YOUR BODY AND FACE FROM IN FRONT OF THE CUT . YOU PLACE YOUR SELF TO THE SIDE AND DRAG THE ROD TO YOU.

THIS REQUIRES YOU TO BURN BY FEEL NOT BY SIGHT.

#5 STARTING A NEW ROD

WHEN YOU BEGIN A ROD RUN, THE TIP OF THE ROD SHOULD BE POINTED IN THE DIRECTION YOU HAVE COME FROM. START THE OXYGEN FLOW THEN MAKE IT HOT, WHEN THE ROD LIGHTS UP GET IN A LITTLE TOO DEEP TO TRAVEL AND SLOWLY ROCK THE ROD TO YOUR ANGLE OF TRAVEL. ALWAYS MAKE SMOOTH EVEN MOVEMENTS

ARROW INDICATES THIN STEEL FOR ROD START

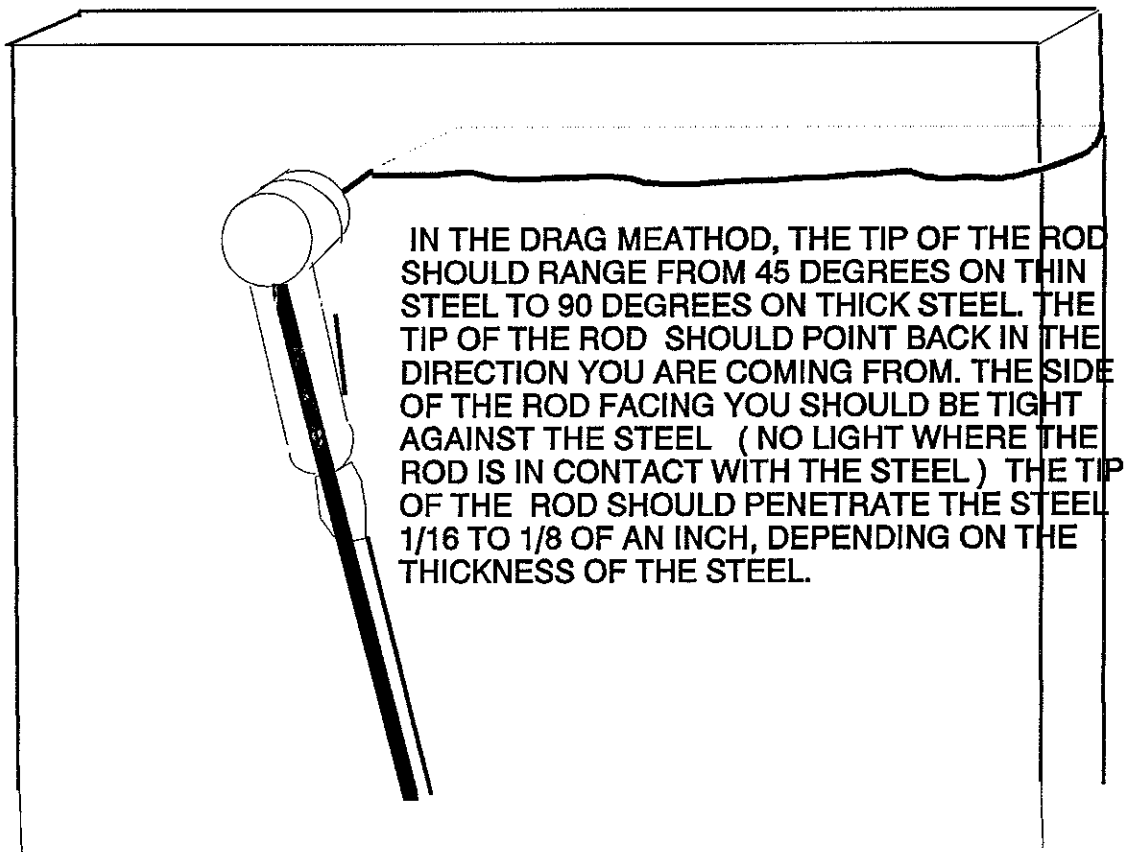


IF YOU ENDED YOUR LAST ROD PROPERLY AND YOU TAKE CARE TO START PROPERLY THERE WILL BE NO HANGERS AT YOUR ROD CHANGE

THIS METHOD WILL ALSO GIVE YOU MORE CONTROL STARTING A NEW CUT ON AN OPEN EDGE OR PUNCHING THROUGH STEEL.

ROD TRAVEL

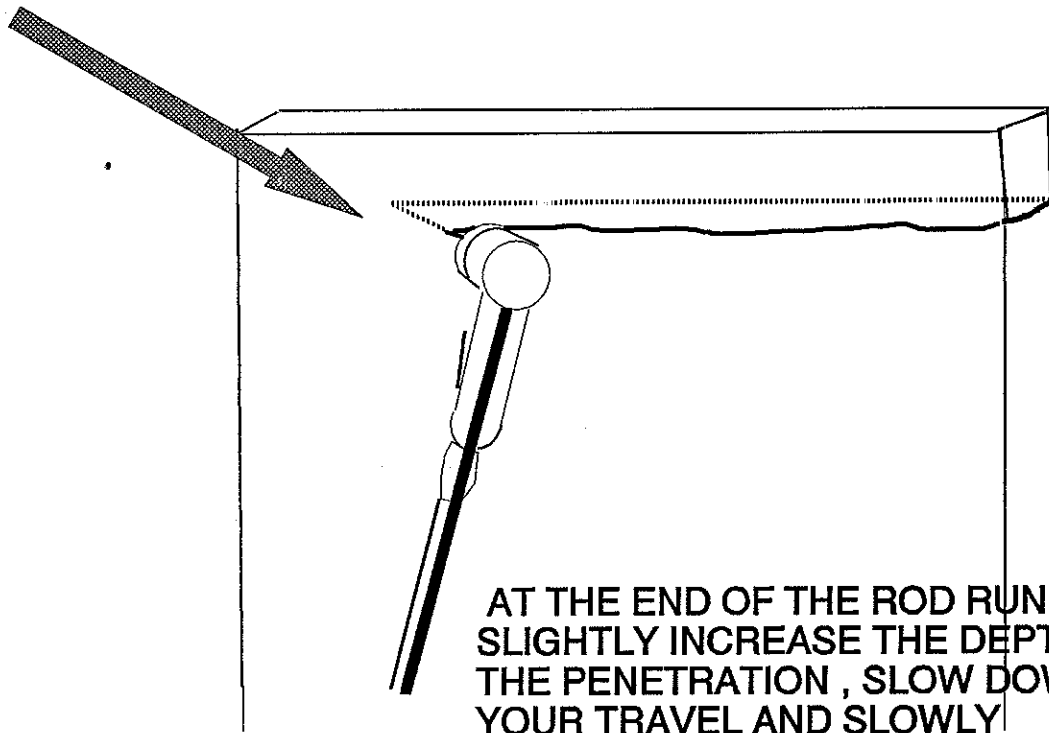
#6



ENDING YOUR ROD TRAVEL

#7

THE DOTTED LINE INDICATES THE BURN THROUGH THE STEEL. THE ARROW INDICATES THE THINNER SPOT FOR STARTING A NEW ROD.



AT THE END OF THE ROD RUN SLIGHTLY INCREASE THE DEPTH OF THE PENETRATION , SLOW DOWN YOUR TRAVEL AND SLOWLY ROCK THE ROD TIP IN THE DIRECTION YOU WERE TRAVELING. THIS WILL CREATE A THIN SPOT TO START YOUR NEXT ROD.

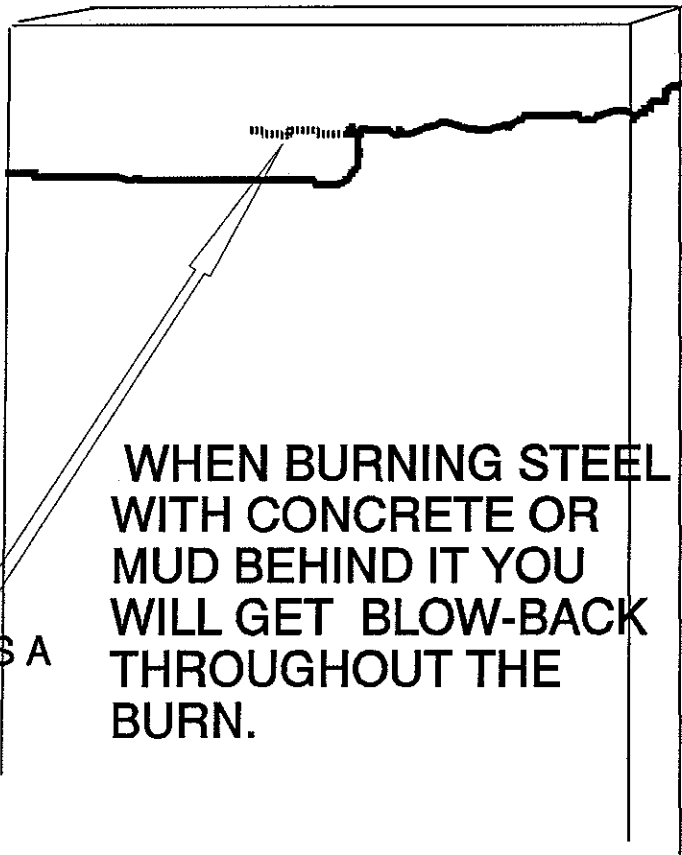
WITH DIVERS THAT CAN CONTROL A ROD, MOST HANGERS ARE LEFT AT THE ROD CHANGE. SMALL HANGERS AT EACH ROD CHANGE CAN KEEP A PIECE FROM COMING OFF CLEANLY

HANGERS (BLOW-BACKS)

#8

WHEN YOU GET A BLOW- BACK,
MOLTEN STEEL ON YOUR SIDE
OF THE CUT, YOU HAVE LEFT A
HANGER. DO NOT KEEP
BURNING, PULL OUT OF THE
STEEL, MAKE IT COLD. MOVE
BACK INTO GOOD CUT, MAKE IT
HOT, AND UNDERCUT THE
HANGER.

THE DOTTED LINE INDICATES A
HANGER (BLOW-BACK)



WHEN BURNING STEEL
WITH CONCRETE OR
MUD BEHIND IT YOU
WILL GET BLOW-BACK
THROUGHOUT THE
BURN.

SHOCKING

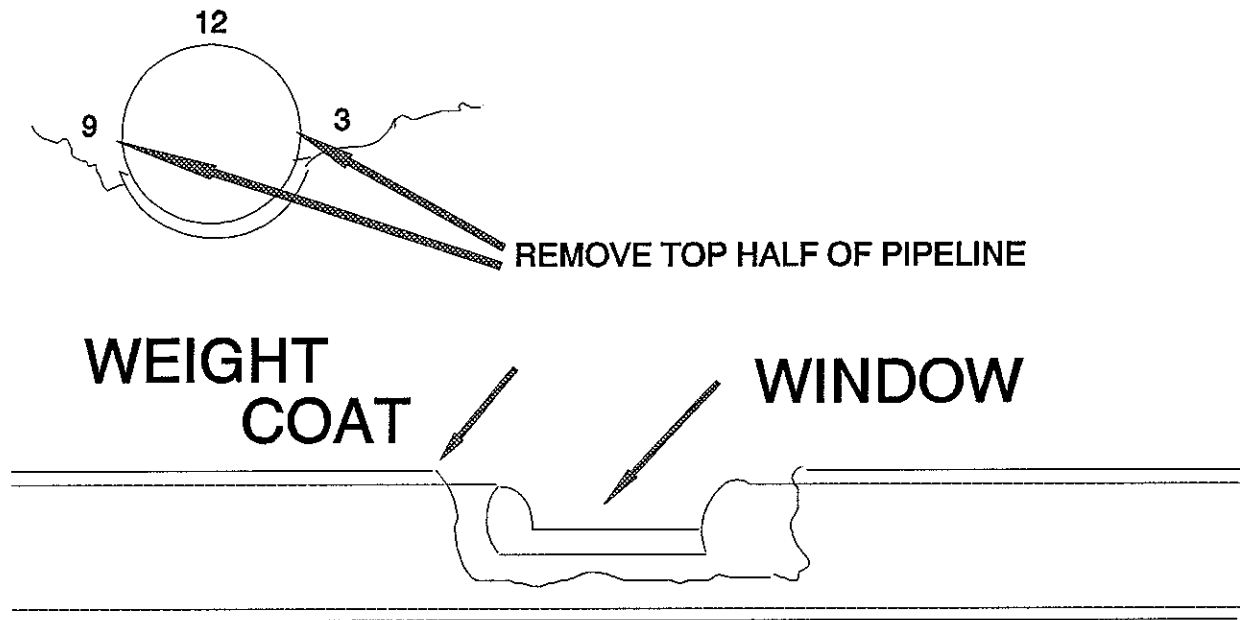
#9

GROUND SHOULD
BE LOCATED
HERE



DO NOT GET BETWEEN YOUR GROUND AND THE
TIP OF YOUR BURNING ROD. YOU WILL BECOME
PART OF THE CIRCUIT AND THAT CAN BE
SHOCKING. THE GROUND SHOULD BE WHERE THE
ARROW INDICATES (SEE DRAWING #4)

#10 WINDOW



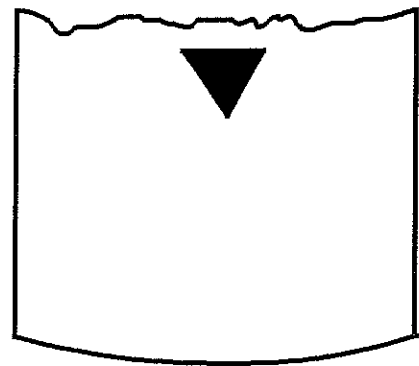
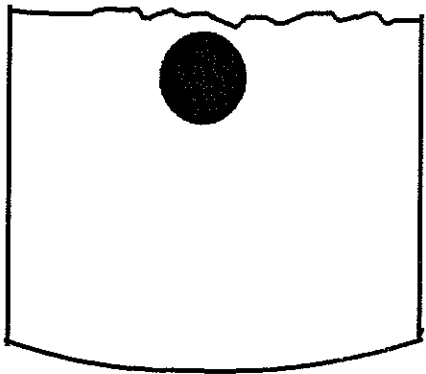
WHEN CUTTING A PIPELINE THAT IS NOT COMPLETELY FREE FROM THE BOTTOM, ALWAYS CLEAR THE COATING FROM THE PIPELINE AND CUT A WINDOW THAT IS AS BIG AS POSSIBLE. THE TOP HALF OF THE PIPELINE IS STRONGLY RECOMMENDED.

THIS WILL ALLOW YOU TO CUT OUT THE BOTTOM FROM THE INSIDE, WITHOUT PUTTING YOUR HAND AND ARM IN A CONFINED SPACE THAT MAY SHIFT WHEN THE CUT IS TIED IN.

BE SURE TO PLACE A VENT IN THE LINE AT 12 O'CLOCK BEFORE YOU BURN THE WINDOW, ALSO BE SURE THE LINE IS FLOODED. IF YOU ARE UNSURE DRILL OR SAW YOUR VENT.

TIPS

WHEN CUTTING HOLES FOR LIFT EYES A CIRCLE IS HARD TO CUT AND KEEP ENOUGH METAL OVER THE HOLE TO SUPPORT THE LIFT WEIGHT. IF YOU CUT A (V) YOU CAN MAKE A STRAIGHT CUT AT THE TOP AND ENSURE ENOUGH METAL TO SUPPORT THE

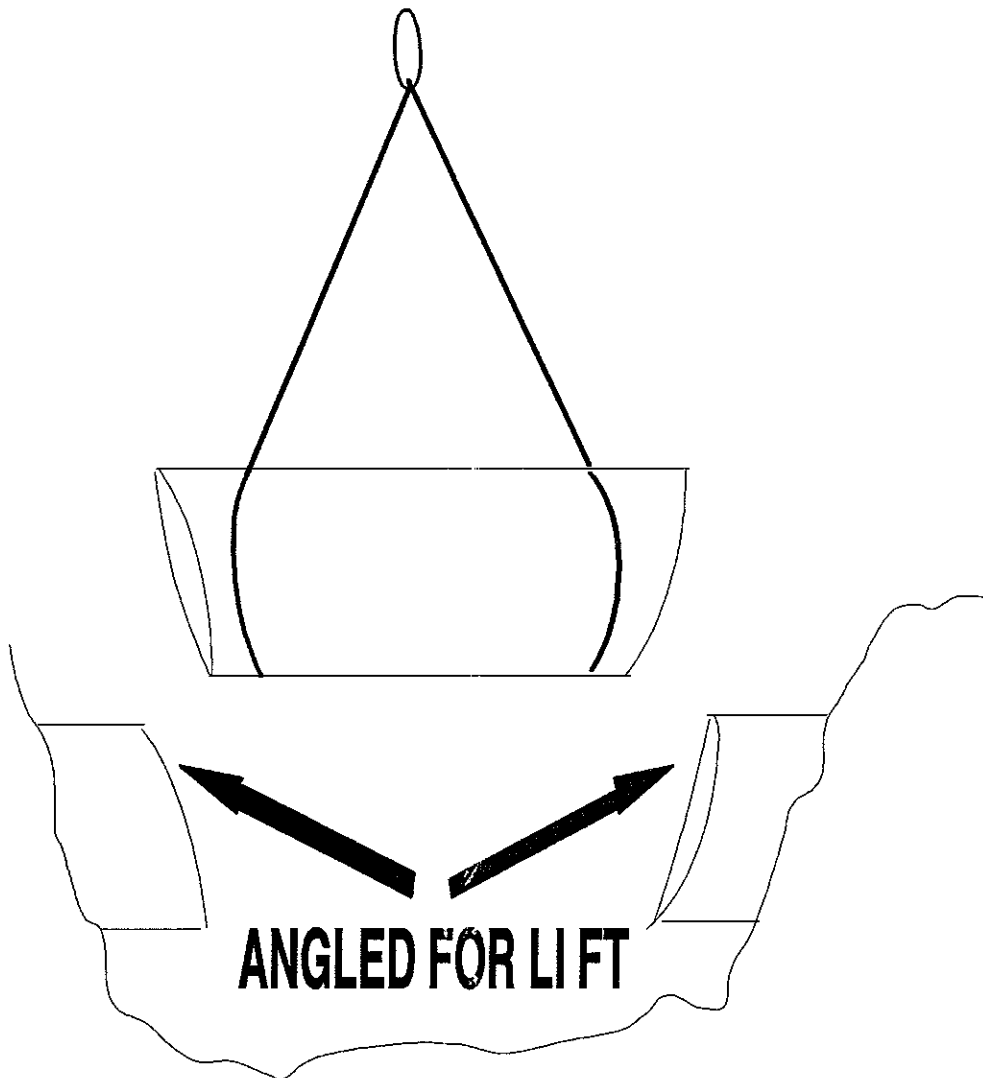


TIPS

WHEN REMOVING A SECTION OF A PIPELINE OR MEMBER, ALWAYS MAKE THE CUTS ON ANGLES THAT ALLOW THE SECTION TO BE REMOVED WITHOUT BECOMING JAMMED.

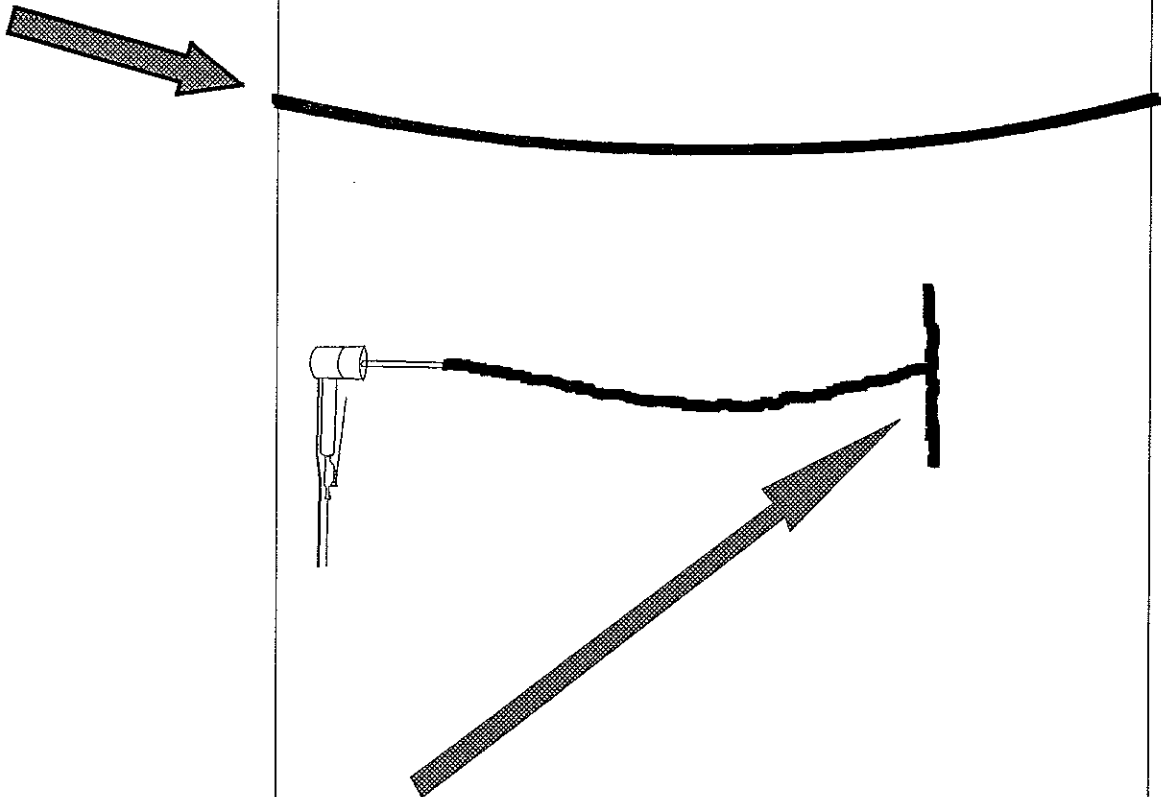
CHECK ARROWS, THESE CUTS ARE MADE TO LIFT THE PIECE OUT.

ALWAYS THINK, MAKE SURE THE LINE IS FLOODED. IF YOU ARE NOT SURE OF THE CONTENT OF THE PIPELINE MAKE YOUR VENT WITH A DRILL OR SAW.



TIPS

FOR PRECISE CUTS ,A
GUIDE MADE OF 1/2" THICK
BY 1" WIDE RUBBER
STRIPPING WILL ASSIST

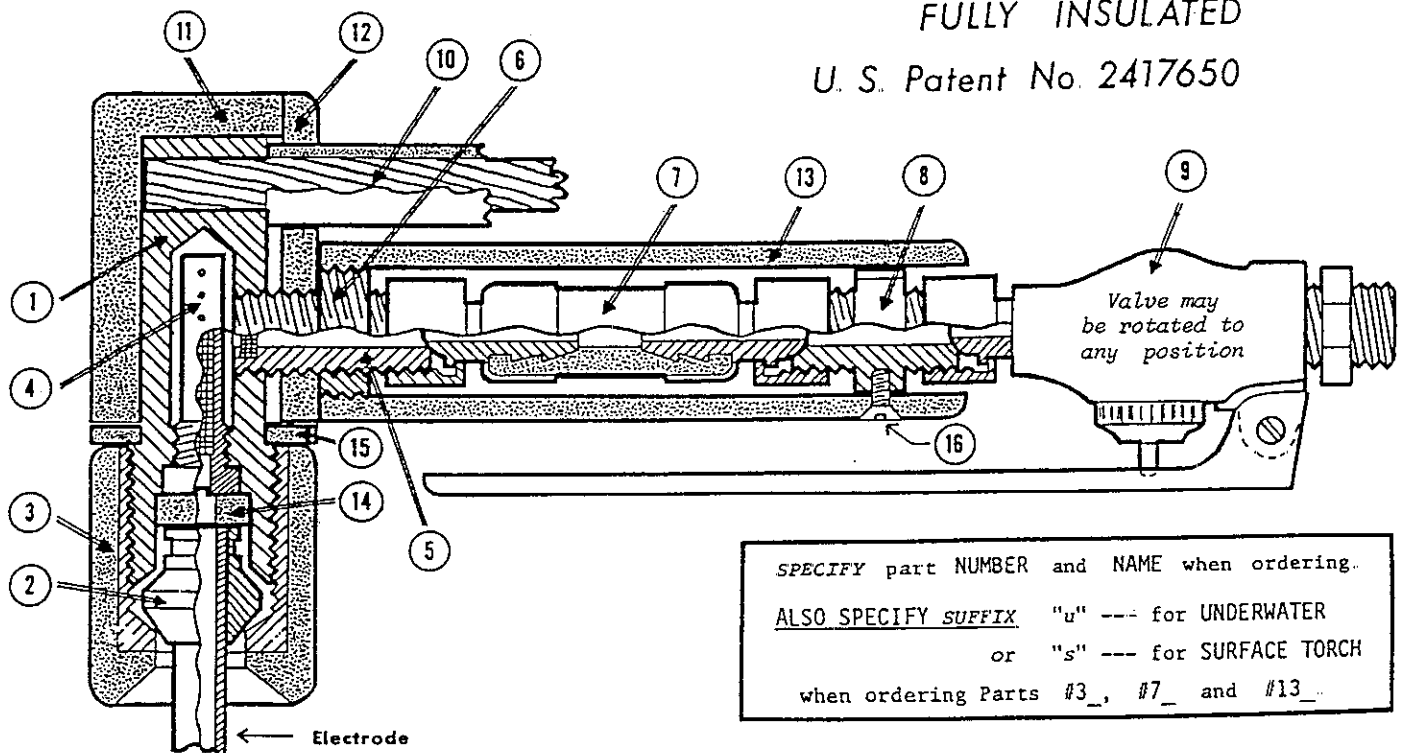


WHEN MAKING A CUT AROUND A PILE
OR PIPE WITHOUT A BURNING GUIDE,
START WITH A CUT THAT CROSSES
THE PLAIN OF YOUR INTENDED BURN.
THIS WILL MAKE YOUR TIE IN EASIER

Craftsweld Arc-Oxygen Cutting Torch

FULLY INSULATED

U. S. Patent No. 2417650



SPECIFY part NUMBER and NAME when ordering.

ALSO SPECIFY SUFFIX "u" --- for UNDERWATER
or "s" --- for SURFACE TORCH

when ordering Parts #3_, #7_ and #13_

PARTS LIST

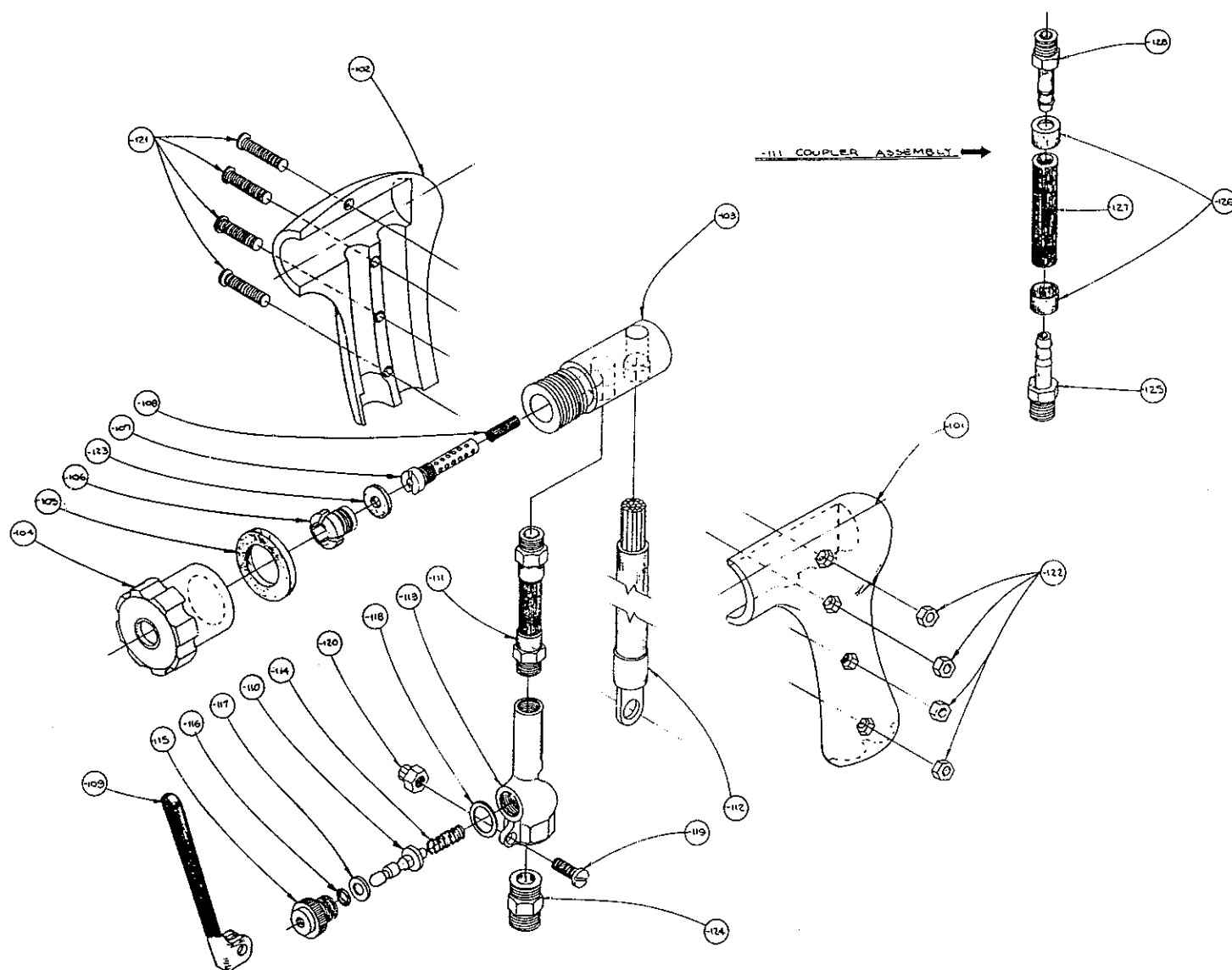
1. TORCH HEAD - one piece - bronze
- COLLETS - one piece - phosphor bronze
 - 2a. 5/16" for 5/16" Tubular Steel Electrodes...
 - 2b. 3/16" for 5/32" and 3/16" Welding Electrodes...
 - 2c. 9/16" for 1/2" Ceramic Electrodes.....
 - 2d. 3/8" supplied with large hole Part #14d....
- 3u. COLLET LOCKNUT - bronze - enclosed in a laminated thermoplastic jacket (for UA-10).
- 3s. SURFACE COLLET LOCKNUT - same as above, but with additional copper jacket to provide a slag shield for SC-10 Surface Torch
4. Removable FLASH ARRESTER CARTRIDGE - containing 3-ply roll of monel Screen.
 - 4a. SCREEN ONLY for above Cartridge.
5. INLET NIPPLE equipped with 2 monel screens.
6. INLET NIPPLE LOCKNUT - bronze
- 7u. INSULATOR COUPLER - for UA-10 Torch - with oxygen connections at each end
- 7s. SURFACE INSULATOR COUPLER (for SC-10 Torch)
8. BASE NIPPLE - bronze.
9. TRIGGER VALVE ASSEMBLY - complete - with oxygen fittings.
 - 9a. Valve GLAND - bronze
 - 9bc. Delrin VALVE STEM and "O"-RING Assembly. ("O"-Ring must be factory installed on Stem)
 - 9d. Valve SEAT
 - 9e. Valve SPRING
 - 9f. Valve TRIGGER with Nut and Bolt.
 - 9g. NUT and BOLT for Valve Trigger
 - 9h. Copper GASKET for Valve Gland.
- 10c. Replacement CABLE - oil resistant jacket - with standard LUG soldered on one end
- 10n. Replacement CABLE - as above, but one end has RAPID MALE COUPLING (only for UA-10-N).
11. INSULATOR JACKET - laminated thermoplastic.
12. BASE PLATE - laminated thermoplastic.
- 13u. TORCH HANDLE - laminated thermoplastic.
- 13s. SURFACE TORCH HANDLE - as above, but 9" long as required for Model SC-10 Surface Torch...
14. INTERNAL WASHER - neoprene, to seat electrode for oxygen flow
- 14d. Large Hole INTERNAL WASHER - for 3/8" electrodes requiring greater oxygen flow.
15. EXTERNAL WASHER - neoprene, to seal Locknut against Insulator Jacket.
16. HANDLE SCREW - flat head Stainless Steel.
- UA-SP-1. SPARE PARTS KIT for UA-10 UNDERWATER TORCH
1 each of Parts #2a, #4, #7u, #9bc, #9g, #15, #16 and 3 each Part #4a and 6 each Part #14...
- SC-SP-1. Same as above, but for SC-10 TORCH

FACTORY ASSEMBLIES

The following Factory Assemblies may be ordered to make field repairs. They consist of the parts indicated and are assembled and soldered as required. All other parts require only a screw driver or wrench

- A-17. Parts #1 and #5 factory assembled.
- A-18c. Parts #1, #5, #10c and #12 assembled
- A-18u. Parts #1, #5, #10u and #12 assembled

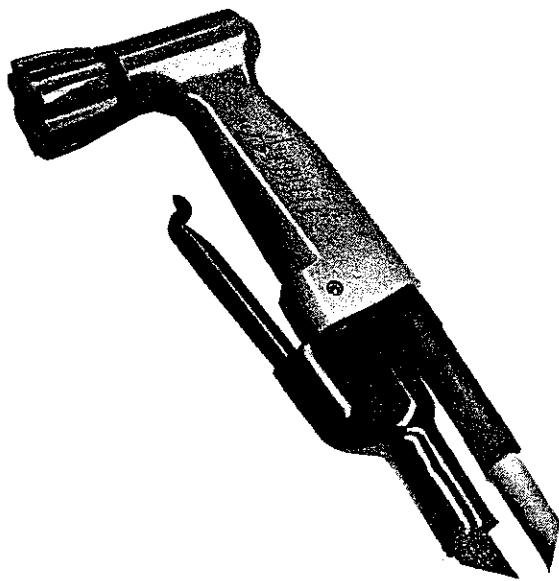
BROCO® BR-22 UNDERWATER OXYGEN-ARC CUTTING TORCH, ASSEMBLY



TORCH BREAKDOWN

no.	qty.	description	no.	qty.	description
128	1	CONNECTOR, BRASS (1/4" PIPE) HOSE	114	1	SPRING, VALVE STEM
127	1	HOSE, O ₂	113	1	CONTROL VALVE
126	2	FERRALS, K.K.	112	1	CABLE ASSEMBLY
125	1	CONNECTOR, DELRIN (1/8" PIPE) HOSE	111	1	ASSEMBLY, COUPLER
124	1	ADAPTER, OXYGEN HOSE	110	1	VALVE STEM, DELRIN
123	1	WASHER, NEOPRENE COLLET	109	1	LEVER, CONTROL VALVE
122	4	NUT, NYLON HANDLE	108	1	SCREEN, MONEL
121	4	SCREW, NYLON HANDLE	107	1	FLASH ARRESTOR
120	1	NUT, BRASS VALVE LEVER LOCK	106	1	COLLET
119	1	SCREW, BRASS VALVE LEVER	105	1	WASHER, COMPRESSION NEOPRENE
118	1	GASKET, COPPER	104	1	NUT, COLLET
117	1	WASHER, NEOPRENE VALVE STEM	103	1	HEAD, TORCH
116	1	"O"-RING, VALVE STEM	102	1	GRIP, HANDLE (RIGHT SIDE)
115	1	NUT, CONTROL VALVE	101	1	GRIP, HANDLE (LEFT SIDE)

SEA TORCH® COMBINATION TORCH



The torch has a spark arrestor located behind the collet chuck for safe operation. A ball check valve in the torch handle gives additional protection.

The torch comes with a 10 foot (3.05 m) cable which can be disconnected from the torch

COLLET CHANGES

Sea Torch Combination Torch, Catalog No. 14-050-124, has a 5/16" (7.9 mm) collet chuck for underwater cutting with Sea-Cut® or Tuff Cote® underwater electrodes. Sea Torch Combination Torch, Catalog No. 14-050-126, has a 3/8" (9.5 mm) collet chuck for underwater cutting with Sea-Jet® exothermic cutting electrodes.

To use the above torches for underwater welding, there are collet chucks available for use with the Sea-Weld® underwater wet welding electrodes.

FEATURES AND BENEFITS

The Sea Torch® is an improved underwater cutting and welding torch with a one piece body construction. It is fully insulated electrically for safety in normal operation. The torch is 8-3/4 inches (22.2 cm) long, weighs 4.5 pounds (2.04 kg) with cable, and is orange for high visibility to the diver. This torch can be used for oxygen-arc cutting and underwater welding.

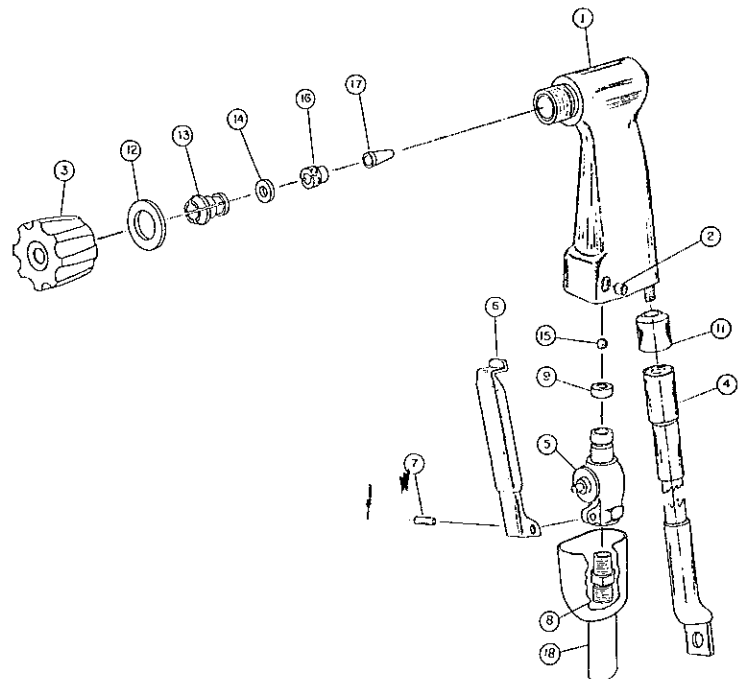
The one piece body prohibits oxygen leakage in the torch body, which can occur with torches having connections between the head and the handle.

The torch has a tapered collet which brings the bare surface of an electrode into contact for the entire length of the collet. This solid grip and increased contact area decreases the risk of arcing between the collet and the electrode and damaging the torch head.

It has a single external collet taper which forces the collet and electrode against a seal, ensuring a positive sealing of oxygen flow in that area.

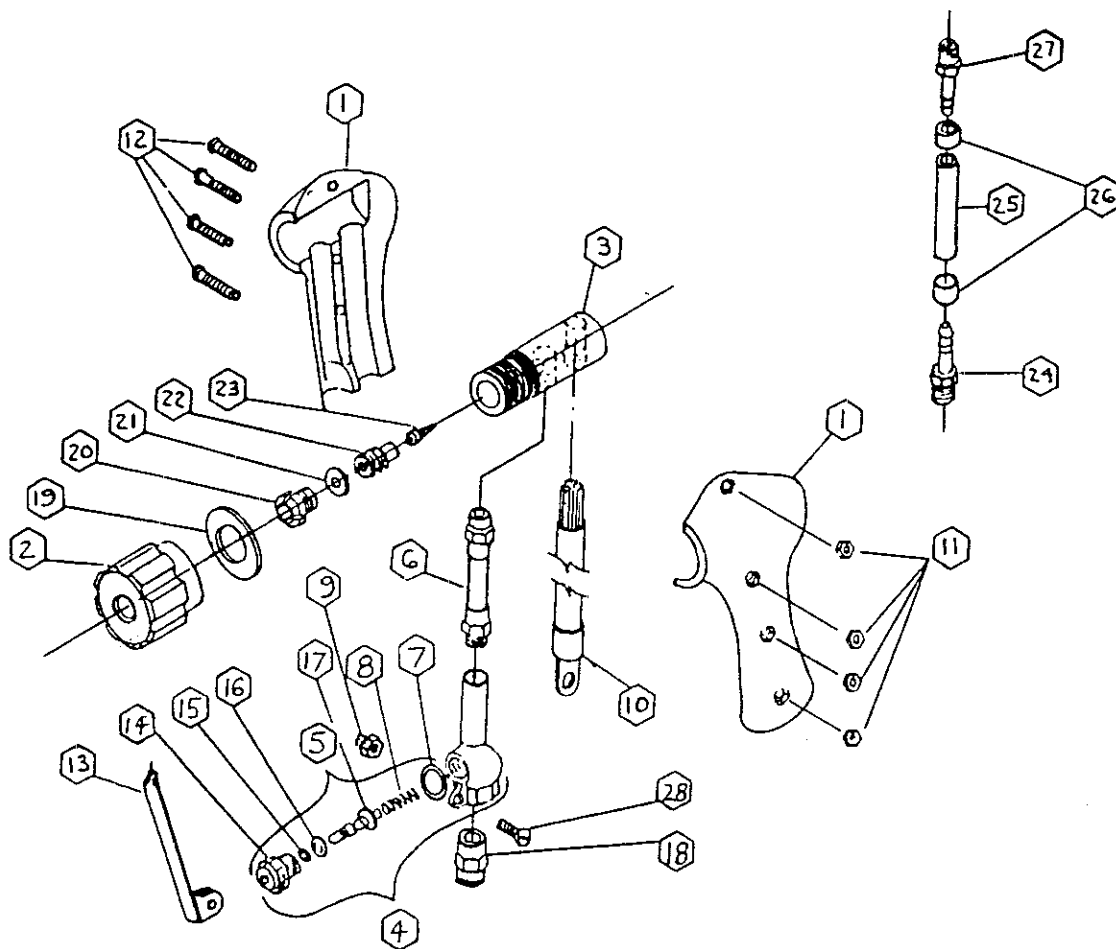
The oxygen path is metallic instead of plastic to avoid the possibility of damage by ignition of plastic.

By loosening two set screws, the oxygen valve and lever can be rotated to different positions to provide easier oxygen flow control for the diver.



REF. NO.	DESCRIPTION	CATALOG NO.	REF. NO.	DESCRIPTION	CATALOG NO.
	Sea Torch Complete (5/16" collet chuck)	14-050-124	12	Washer	94-840-097
	Sea Torch Complete (3/8" collet chuck)	14-050-126	13	1/8" Collet Chuck *	94-158-047
1	Sea Torch Handle	94-370-157		5/32" Collet Chuck *	94-158-042
2	Set Screw (2 req'd.)	97-373-001		3/16" Collet Chuck *	94-158-044
3	Molded Collet Ring Ass'y.	94-168-018		5/16" Collet Chuck	94-158-043
4	Cable Ass'y.	96-130-234		3/8" Collet Chuck	94-158-045
5	Oxygen Valve/Lever Ass'y	94-921-056	14	Washer	94-940-099
6	Oxygen Valve	94-921-057	15	Ball Check Valve	94-071-003
7	Valve Lever Ass'y	94-476-061	16	Blowback Retainer	94-695-037
8	Pin	98-718-057	17	Spark Arrestor	94-305-009
9	Adaptor	94-013-022	18	Valve Boot	94-105-013
10	Washer	94-940-098	NS	Loctite 242 (10 cc)	94-150-003
11	Cable Tip Insulator	94-433-177			
				NS = Not Shown	* = Optional

AQUA TECH Dive Center



• Oxy-Arc Torch Parts List •

	020-200-000	Aqua Tech Torch	15	021-200-015	"O" Ring, Valve Stem
			16	021-200-016	Washer, Neoprene
1	021-200-002	Handle (2 pc set)	17	021-200-017	Valve Stem, Deirin
2	021-200-002	Nut - Collet	18	021-200-018	Adapter, Brass O
3	021-200-003	Head - Torch	19	021-200-019	Washer Collet Nut
4	021-201-004	Valve Assembly	20	021-200-120	Collet, 3/8" (State rod size)
5	021-201-005	Bonnet & Stem Assembly	20	021-200-220	Collet, 5/16" (State rod size)
6	021-201-006	Hose Coupler Assembly	20	021-200-320	Collet, 1/4" (State rod size)
7	021-200-007	Gasket, Copper	20	021-200-420	Collet, 5/32" (State rod size)
8	021-200-008	Spring, Stem Return	21	021-200-021	Washer, Collet
9	021-200-009	Locknut, Lever	22	021-200-022	Retainer, Flash Screen
10	021-201-010	Cable, Assembly	23	021-200-023	Flash Screen, Sintered Bronze
11	021-200-011	Nut, Nylon (Set of 4)	24	021-200-024	Connector, Brass 1/8" Pipe-hose
12	021-200-012	Screw, Nylon (Set of 4)	25	021-200-025	Hose, 1/4" O
13	021-200-013	Lever, S/S Valve	26	021-200-026	Ferrules, KK Brass (Set of 2)
14	021-200-014	Bonnet Nut, Stem	27	021-200-027	Connector, Nylon 1/4" Pipe-hose