MFGR. NO. 1387

NWSA 360
DATE: July 25,1988
REPLACES: January 15,1988

Arcair®

HAND TORCH INSTRUCTION MANUAL

K-4000® K-3 TRI-ARC• ARKY• II H-3

SETTING UP EQUIPMENT

I. ATTACHING CONCENTRIC CABLE TO TORCH

A. Remove Valve and Bonnet Assembly from Torch with the Spanner Wrench provided.

B. Remove Torch Handle by pulling straight back away from Torch Body.

NOTE: *The K3 and Tri-Arc Torches, have a screw which is found below the Valve Spool Assembly. Insert a straight blade screwdriver through the hole and turn the screw in a clockwise motion. This must be done before the handle can be pulled away from the torch body.*

The H-Model Torch, the Lever must be removed and the Upper Arm pulled away from the Torch before the Handle can be removed.

C. Insert Cable into smaller (round) end of the Torch Handle and draw it through the Handle.

D. Remove plastic cap from the Male Cable Connector. (Only on K-3, Arky II, H-3 and Tri-Arc Torch Cables.)

E. Screw the Cable Connector on to the Torch Body. NOTE: *The K4000 Torch Cable has a 360° Swivel Female Cable Connector. THIS CONNECTION MUST BE WRENCH TIGHT.*

F. Slide the Torch Handle to its original position on the Torch Body.

NOTE: *The Spring and Spring Insulator on the H-Model must be placed in position and the Upper Arm slid in place before the Handle can be put on.*

G. Insert the Valve and Bonnet Assembly and tighten with the Spanner Wrench.

NOTE: *Turn the screw, located below the Valve Spool on K3 and Tri-Arc Torches, in a counterclockwise motion until tight.*

II. ATTACHING POWER & AIR TO CABLE

A. Retract Insulating Boot by pulling the Boot back over the Cable, exposing power and air connections.

B. Connect shop air supply to the threaded Female Connector. *MAKE THIS CONNECTION WRENCH TIGHT.*

C. Connect the cable(s) from the power supply to the Concentric Cable connector lug. *ENSURE THE CABLES ARE OF ADEQUATE SIZE TO CARRY THE CURRENT, ELIMINATING POSSIBLE OVERHEATING OF THE POWER CABLES AND CONCENTRIC CABLE ASSEMBLY.* Refer to Table 2.

D. Return Insulating Boot to original position, over air connector and lug, producing a safe insulated power / air / cable joint assembly.

IMPORTANT: Be sure that all connections are tightened properly.

STARTING CONDITIONS

I. SELECTION OF POWER SUPPLY

A. The selection of the power supply should be based upon the type and diameter of the electrode being used to ensure proper operation of the process. Refer to Table 1.

B. The power supply cables should be connected to the Torch and work piece to obtain DC Electrode Positive (Reverse Polarity).

NOTE: There are some materials that require the Torch to be operated on DC Electrode Negative (Straight Polarity). Refer to Technique for Specific Material for further information.

II. OPERATION

A. Turn on the power supply. Set current or voltage for the size of carbon electrode being used.

B. Insert the Electrode in the Torch by pressing the lever downward. Be sure that the three air holes located in the torch head are pointing towards the tip of the electrode. The air should pass between the electrode and the work piece while gouging. When using jointed carbons, place the female portion of the electrode into the torch first.

C. Place the Electrode so that no more than 7" (178mm) of electrode protrudes. Be sure that the electrode is seated properly in the head.

D. Turn on compressed air by depressing "on-off" button on the Valve Bonnet.

WARNING

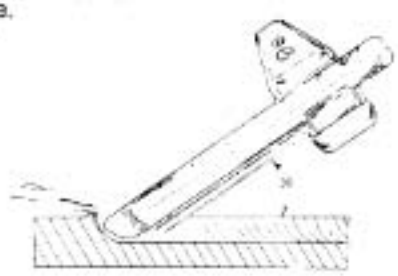
When using any air carbon arc torch, protect yourself and others. SMOKE AND GASES can be dangerous to your health. NOISE can damage hearing. ARC RAYS AND SPATTER can burn eyes and skin. ELECTRIC SHOCK can kill. KEEP YOUR HEAD OUT OF THE SMOKE. WEAR EAR, EYE AND BODY PROTECTION. USE TORCHES ONLY WITH COMPRESSED AIR. For additional information see American Welding Society Publication Z49.1-1967, "Standard Safety in Welding and Cutting" and OSHA Section 1910.95, "Permissible Noise Levels".

OPERATING TECHNIQUES

GOUGING...

Be sure the air is on. Hold the torch so that the electrode slopes back from the direction of travel with the air blast behind the tip of the electrode. The proper torch angle to work is 35°. The depth and contour of the groove produced are controlled by the electrode diameter and travel speed. Groove depths greater than 1-1/2 times the diameter must be made in multi-passes. The width of the groove is determined by the electrode diameter used and is usually 1/8" (3.2mm) wider than the diameter. A wider groove may be made with a small electrode by oscillating the electrode in a weaving motion.

Travel speed determines the depth of the gouge. The faster the travel speed, the shallower the gouge. A slow travel speed will produce a deeper gouge.



Strike an arc by touching the electrode to the work. Do not draw the electrode back once the arc is struck. A short arc must be maintained by progressing in the direction of the cut fast enough to keep up with the metal removal. The steadiness of the progression controls the smoothness of the resulting surface.

FLAT POSITION

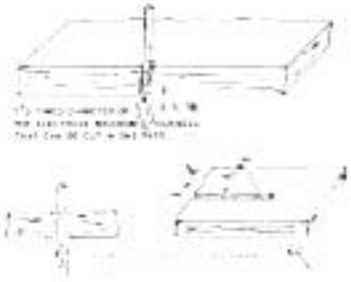
Hold the torch as shown and gouge in a downward direction. This permits the natural pull of gravity to help you.

VERTICAL POSITION

Horizontal and overhead gouging techniques are the same as the flat and vertical. Hold torch at sufficient angle to avoid molten metal dripping on operator's glove.

CUTTING...

In general, the technique for this operation is the same as for gouging, except that the electrode is held at a steeper angle and is directed at a point that will permit the tip of the electrode to pierce the material being cut. Remember that the depth of cut should be no more than 1-1/2 times the electrode diameter. For thicker materials, the technique used for cutting should be a sawing motion. Move the arc up and down through the material.



FLUSHING...

To remove excess metal such as pads, bosses, riser stubs, hardfacing, etc., weave from side to side in a forward direction with a washing motion to the depth desired. The Flat Copper-clad electrode may be used for this application if desirable. A 35° electrode angle is recommended.

BEVELING...

Beveling may be done in two ways: Holding the torch as in detail "a" and drawing it smoothly along the edge being sure the air blast is between the electrode and the surface of the material; or for light plates hold the electrode as in detail "b". A straight edge may be used in this application.

DETAIL A

DETAIL B

TABLE 1 - SUGGESTED CURRENT RANGES FOR COMMONLY USED ELECTRODE TYPES AND SIZES

Electrode Diameter		DC Electrode With DCEP		AC Electrode With AC		AC Electrode With DCEN	
in.	mm	Minimum Amps	Maximum Amps	Minimum Amps	Maximum Amps	Minimum Amps	Maximum Amps
1/8	3.2	30	60				
5/32	4.0	90	150				
3/16	4.8	200	250	200	250	150	180
1/4	6.4	300	400	300	400	200	250
5/16	7.9	350	450				
3/8	9.5	450	600	350	450	300	400
1/2	12.7	800	1000				
5/8	15.88	1000	1250				
3/4	19.05	1250	1600				
1	25.4	1600	2200				
3/8 FLAT	9.5	250	450				
5/8 FLAT	15.88	300	500				

TABLE 2 : RECOMMENDED NUMBER AND SIZE OF WELDING LEADS FOR VARIOUS CURRENTS(1,2) AND LENGTHS(3,4)

Current	25ft(7m)		50ft(15m)		100ft(30m)		150ft(46m)		200ft(61m)		250ft(76m)	
Amps	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
100	1	4	1	3	1	2	1	1/0	1	2/0	1	4/0
200	1	3	1	2	1	1/0	1	3/0	1	3/0	3	3/0
300	1	2	1	2	1	3/0	2	2/0	2	4/0	4	4/0
400	1	2	1	1/0	1	4/0	2	4/0	3	4/0	5	4/0
500	1	1	1	2/0	2	2/0	2	4/0	4	4/0		
600	1	1	1	3/0	2	3/0	2	4/0	5	4/0		
800	1	1/0	2	2/0	2	4/0	4	4/0				
1000	1	2/0	1	4/0	3	3/0	5	4/0				
1200	1	3/0	2	4/0	3	4/0						
1400	1	4/0	2	4/0	4	3/0						
1600(5)	2	3/0	4	3/0	4	4/0						
1800	2	4/0	4	4/0								
2000(6)	3	4/0	5	4/0								

1. Recommendations based on 4V, DC drop/100 ft.
2. For AC use next heavier size of cable.
3. Length given is one half the sum of the electrode and ground leads.
4. Inadequate grounding causes cable overheating; at least 1 in. ^{2} (645mm^2) of contact per 1000 amps.
5. Over 16000 amps, a heavy duty air cooled concentric cable should be used.
6. Over 2000 amps, a heavy duty water cooled cable should be used.

TROUBLE SHOOTING

The air carbon-arc cutting process is not complicated to use, but sometimes problems do arise. Some common problems and their solutions are listed below:

Problem	Cause/Solution
Large free carbon deposit at the beginning of the groove.	The cutter either neglected to turn on the air jet before striking the arc, or the torch was positioned improperly. The air should be turned on before striking the arc and should flow between the electrode and the work.
An unsteady arc, causing the cutter to use a slow travel speed even on shallow grooves.	Not enough amperage for the electrode diameter (see Table 1). While the lowest recommended amperage may be enough, it requires greater cutter skill. A mid range amperage is better. If the desired amperage cannot be obtained from the available power source, use the next smaller diameter electrode or parallel two or more welding power supplies.
Erratic groove with the arc wandering from side to side and with the electrode heating up rapidly.	The process was apparently used with DCEN (electrode negative). Direct current electrodes should be used with DCEP on all metals, except for a few copper alloys such as Superston and Nialite.
Intermittent arc action resulting in an irregular groove surface.	The travel speed was too slow in manual gouging. The cutter probably set his hand on other work for balance as shielded metal-arc welders do. Since the speed of air carbon-arc gouging is much faster than shielded metal-arc welding, friction between the gloved hand and the work may cause a jerky forward motion. This motion causes the gap between the electrode and workpiece to become to large to maintain the arc. The cutting operator should stand comfortably so his arms move freely and his gloves do not drag on the workpiece.
Carbon deposits at varying groove intervals.	The electrode has shorted out on the work. In manual gouging, this condition is caused by using excessive travel speed for the amperage available and for the depth of the groove being made.
Slag adhering to the edges of the groove.	Slag ejection was inadequate. For adequate slag ejection, keep a proper air pressure and flow rate (cfm). Air pressure; between 80 and 100 psi (550-690 kPa), may not effectively eject all of the slag if the volume is insufficient. To deliver adequate volume, the air hose feeding the concentric cable assembly should have a minimum ID of 3/8 in. (9.5 mm) for manual torches. Ensure the air jet is directed parallel to the gouge area. Do not favor one side unless you want to minimize slag from adhering to one side of the cut.

TABLE 3 - RECOMMENDED MINIMUM AIR REQUIREMENTS

	Air Pressure(1)		Air Consumpt.		Recommended Compressor Rating Intermittent Use		Continuous Use		ASME Receiver Size	
Type of Torch	psi	Kpa	cfm	L/min	hp	kW	hp	kW	gal	lit.
Arky II (2)	40	280	8	227	.5	0.4	1.5	1.1	60	227
K4000 & K3 & H3 (2)	80	550	25	708	5	3.7	7.5	5.6	80	303
Tri-Arc (3)	80	550	33	934	7.5	5.6	10	7.5	80	303

1. Pressure while torch is in operation.
2. Accommodates flat electrodes. (K4000 & Arky II)
3. Generally considered a foundry torch.
4. Use only clean compressed air - NEVER USE OXYGEN

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TABLE 4 - INCHES OF GROOVE PER ELECTRODE

GROOVE DEPTH		JOINTED ELECTRODES			POINTED ELECTRODES					
in.	mm	5/16x14 8mm x 36.8cm	3/8x17 9.5mm x 43.2cm	1/2x17 13mm x 43.2cm	5/32x12 4mm x 30.5cm	3/16x12 5mm x 30.5cm	1/4x12 6.5mm x 30.5cm	5/16x12 8mm x 30.5cm	3/8x12 9.5mm x 30.5cm	1/2x14 13mm x 35.6cm
1/8	3.2	NR	NR	NR	18" 45.7cm	36" 91cm	65" 165cm	NR	NR	NR
5/32	4.0	125" 317.5cm	NR	NR	4" 10cm	20" 50.8cm	48" 122cm	70" 177.8cm	NR	NR
3/16	5.0	112" 284cm	206" 523cm	NR	NR	12" 30.5cm	35" 89cm	59" 150cm	89" 226cm	NR
1/4	6.5	96" 243.8cm	150" 381cm	260" 660cm	NR	9" 22.9cm	26" 66cm	48" 122cm	76" 193cm	112" 284.5cm
5/16	8.0	85" 216cm	122" 309.8cm	188" 477.5cm	NR	5"/2P 12.7cm	20" 50.8cm	40" 101.6cm	66" 167.6cm	100" 254cm
3/8	9.5	76" 193cm	103" 261.6cm	157" 398.8cm	NR	3"/2P 7.6cm	15"/2P 38cm	33" 83.8cm	55" 139.7cm	76" 193cm
1/2	12.7	64"/2P 162.6cm	82" 208cm	121" 307cm	NR	NR	6"/2P 15cm	22"/2P 55.9cm	40" 101.6cm	68" 172.7cm
5/8	15.9	46"/2P 116.8cm	75"/2P 190.5cm	102" 259cm	NR	NR	NR	12"/2P 30.5cm	26"/2P 66cm	53" 134.6cm
3/4	19.0	NR	57"/2P 144.8cm	90" 228.6cm	NR	NR	NR	NR	12"/2P 30.5cm	43" 109cm
7/8	22.0	NR	NR	80" 203cm	NR	NR	NR	NR	NR	35"/2P 89cm
1	25.0	NR	NR	72" 182.9cm	NR	NR	NR	NR	NR	29"/2P 73.7cm

All figures derived from gouging mild steel under laboratory conditions. Field results may vary due to type of metal, nature of power source, compressed air supply, operator experience and other parameters.

NR = Not Recommended
2P = 2 Passes

TECHNIQUES FOR SPECIFIC MATERIALS

CARBON STEEL...

This material can be easily cut or gouged using the techniques discussed on page 2. DC EP (Reverse Polarity) is recommended.

STAINLESS STEEL...

These alloys can be easily cut or gouged using the same technique as on carbon steel.

ALUMINUM...

The electrode stickout should be no more than 3" (7.62cm). Be careful not to touch the electrode to the work surface as a carbon deposit will occur. The finish of the groove/cut will require a stainless steel brush to remove the black residue from the area. Recommend using DC Copperclad electrodes on DCEP (Reverse Polarity).

GRAY, DUCTILE & MALLEABLE IRON...

These materials require a special operating procedure when attempting to gouge with AAC. It is recommended that current range for gouging be 1000 amperes or higher. Request Form No. 89-310-091 & 89-310-092 for further details.

COPPER BASE ALLOYS...

Heat dissipation due to high conductivity of these materials makes them more difficult to cut or gouge than carbon steel. Pre-heating of the material will reduce heat loss and increase cutting and gouging speeds. Use either AC or DC Copperclad electrodes on straight polarity.

HIGH NICKEL ALLOYS...

These materials are more difficult to cut cleanly than carbon or stainless steel. AC Copperclad electrodes are recommended when cutting or gouging these materials. Some grinding will be necessary if a smooth surface is required.

MAGNESIUM...

Cuts readily using the same technique as for carbon steel. Travel speed will be somewhat faster.

PREVENTIVE MAINTENANCE

Be sure all threaded connections are tight to prevent arcing of the threads and loss of current.

Wire brush the Torch Head occasionally to maintain a bright surface and to avoid poor contact and minute arcing.

Do not allow incandescent end of Electrode to touch Torch Handle and or the Concentric Cable Assembly.

When insulators are damaged, replace them before further damage occurs to the Torch Head, Body and Upper Arm.

Inspect the O-Rings on the Valve Bonnet and lubricate or replace when necessary.

Treat Torch as a tool. Don't hammer with it or toss it on the floor.

METAL REMOVED PER ELECTRODE

DIAMETER (INCH) DIAMETER (MM)	1/2" 12.70	5/8" 15.88	3/4" 19.05
14" JOINTED (LBS.) 14" JOINTED (KG.)	5.0 2.26	10.00 4.54	14.35 6.51
17" JOINTED (LBS.) 17" JOINTED (KG.)	6.09 2.76	12.12 5.50	17.43 7.91

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Form No. 89-250-049 Printed in U.S.A.

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