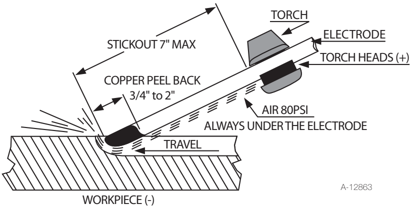
AIR CARBON-ARC DATA CARD

ARCAIR® AN ESAB® BRAND

TORCH AND ELECTRODE TYPES

TYPE	MODEL	ELECTRODE DIAMETER		TYPICAL APPLICATION
		INCHES	MM	
Medium-Duty	K3000™	5/32”, 3/16”, 1/4”, 5/16”, 3/8”, 3/8” FLATS, 5/8” FLATS	4.0, 4.8, 6.4, 7.9, 9.5, 9.5 FLATS, 15.9 FLATS	General repair and maintenance jobs in areas such as mining, construction, and all types of metal fabrication
Heavy-Duty	K4000®	5/32”, 3/16”, 1/4”, 5/16”, 3/8”, 1/2”, 3/8” FLATS, 5/8” FLATS	4.0, 4.8, 6.4, 7.9, 9.5, 12.7, 9.5 FLATS, 15.9 FLATS	Heavy-duty metal removal applications such as weld preparations in the pressure vessel shops and shipyards
Extra Heavy-Duty	K-5	5/16”, 3/8”, 1/2”, 5/8”, 5/8” HALF ROUND	7.9, 9.5, 12.7, 15.9, 15.9 HALF ROUND	Heavy-duty metal removal applications such as weld preparations, and defect removals in foundries
Foundry	TRI-ARC®	3/8”, 1/2”, 5/8”, 3/4”, 1”	9.5, 12.7, 15.9, 19.05, 25.4	General foundry work, padwashing, defects, nails, sprue, interior work



PRINCIPLES OF AIR CARBON ARC

SUGGESTED CURRENT RANGES FOR COMMONLY USED ELECTRODE TYPES AND SIZES

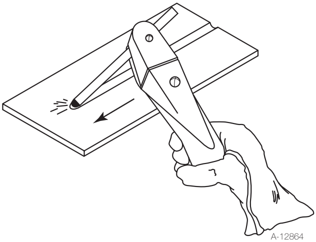
Electrode Diameter		DC Electrode with DCEP		AC Electrode with AC		AC Electrode with DCEN	
In	mm	Minimum Amps	Maximum Amps	Minimum Amps	Maximum Amps	Minimum Amps	Maximum Amps
1/8	3.2	60	90				
5/32	4.0	90	150				
3/16	4.8	200	250	200	250	150	180
1/4	6.4	300	400	300	400	200	250
5/16	7.9	350	450				
3/8	9.5	450	600	350	450	300	400
1/2	12.7	800	1000				
5/8	15.9	1000	1250				
3/4	19.1	1250	1600				
1	25.4	1600	2200				
3/8 FLAT	9.5	250	450				
5/8 FLAT	15.9	300	500				
5/8 HALF ROUND	15.9	600	800				

OPERATING TECHNIQUE

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 degrees. The depth and contour of the groove produced are controlled by the electrode diameter and travel speed. Groove depths greater than 1½ times the diameter must be made in multiple passes. The width of the groove is determined by the electrode diameter used and is usually ⅛" (3.2 mm) wider than the diameter. A wider groove may be made with a small electrode by oscillating the electrode in a weaving motion.

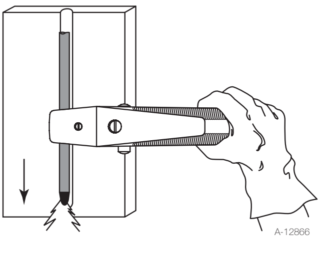
Travel speed determines the depth of the gouge. The faster the travel speed, the shallower the gouge. A slow travel speed will produce a deeper gouge.

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.



Horizontal Gouging Position

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

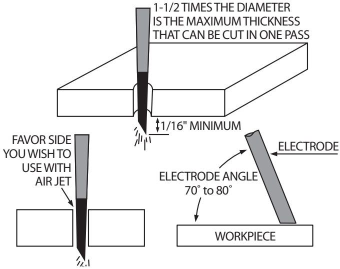


Vertical Gouging Position

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

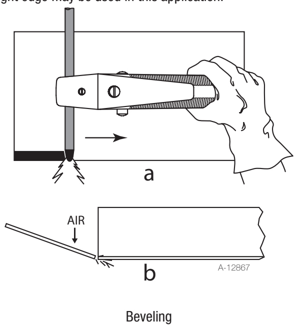
PAD WASHING To remove excess metal such as pads, bosses, riser stubs, hardfacing, etc., weave from side to side in a forward direction with a washing motion to the depth desired. The Flat Copperclad electrode may be used for this application if desirable. A 35 degree electrode angle is recommended.

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 1½ 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.



Use a 90 Degree Angle When Piercing Holes Only

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.



Beveling

TECHNIQUES FOR SPECIFIC MATERIALS

CARBON STEEL This material can be easily cut or gouged using the techniques discussed on page 2. DCEP (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" (7.62 cm). Be careful not to touch the electrode to the work surface as carbon deposits 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 CAC-A. It is recommended that current range for gouging be 1000 amperes or higher.

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.

TROUBLESHOOTING

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
An unsteady arc, causing the operator to use a slow travel speed even on shallow grooves.	Not enough amperage for the electrode diameter used. While the lowest recommended amperage may be enough, it requires greater operator 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 (electrode positive) 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 operator 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 workpiece may cause a jerky forward motion. This motion causes the gap between the electrode and workpiece to become too large to maintain the arc. The operator should stand comfortably so their arms move freely and their gloves do not drag on the workpiece.
In gouging, free carbon deposits at varying groove intervals; in padwashing, free carbon deposits at various spots on the washed surface.	The electrode has shorted out on the workpiece. In manual gouging, this condition is caused by a travel speed that is excessive for the amperage used and/or the depth of the groove being made. In mechanized operations, the condition is caused either by excessive travel speed or by using a flat-curve constant-voltage power source for a small diameter electrode 5⁄16 in. (7.9 10m). In padwashing, this shorting out is caused by holding the electrode at too small a push angle. Use an electrode-to-work angle of 15 to 70 degrees. A smaller angle increases the arcing area, reducing the current density; this reduction in arc-current density requires a great decrease in arc length, to the point of short circuiting. Keep a proper arc gap.
Irregular groove: too deep, then too shallow.	The operator was unsteady. The operator should assume a comfortable position when gouging.
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 inside diameter of ⅜ in. (9.5 10m) for manual torches. For automatic torches, the minimum hose ID should be ½ in. (12.7 mm). Be sure 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.

ELECTRODE TYPES

D.C. COPPERCLAD POINTED ELECTRODES A standard all-purpose gouging electrode. Controlled copper coating improves electrical conductivity, providing a more efficient, cooler operation and helps maintain electrode diameter at the point of the arc. Sizes available are: ⅛”, 5/32”, ¼”, 3/16”, 5/16”, ⅜”, in 12” (30.5 cm) lengths and ½” in 14” (35.6 cm) length.

D.C. JETROD® COPPERCLAD JOINTED ELECTRODES Eliminates stub loss and provides continuous electrode feed for automatic Arcair Torches. Machined at each end to provide male and female fittings. Sizes available: 5/16”, ⅜”, ½”, ⅝”, ¾”, in 14” (35.6 cm) lengths and ⅜”, ½” , ⅝”, ¾”, 1” in 17” (43.2 cm) lengths.

D.C. COPPERCLAD FLAT ELECTRODES Specially designed for close tolerance metal removal and scarfing applications. Excellent for removing weld crowns, repairing or making dies, removing temporary welded dogs and scarfing billets. Sizes available: ⅜” x 5/32” x 12” length and ⅝” x 3/16” x 12” length.

D.C. PLAIN General purpose electrodes used in similar applications as the Copperclad Electrodes. Used on such applications where copper is considered detrimental. Sizes available: 5/32”, 3/16”, ¼”, 5/16”, ⅜”, ½” and ⅝” in 12” lengths.

A.C. POINTED COPPERCLAD ELECTRODES Designed for use with A.C. power supplies. Rare earth materials is added to the electrodes to stabilize the arc thereby enhancing the operating characteristics. Sizes available: 3/16”, ¼” and ⅜” in 12” lengths.

INCHES OF GROOVE PER ELECTRODE

Groove Depth		Jointed Electrodes			Pointed Electrodes					
in.	mm	5/16 x 14 8mm x 36.6 cm	⅜ x 17 9.5 mm x 43.2 cm	½ x 17 13mm x 43.2 cm	5/32 x 12 4mm x 30.5 cm	3/16 x 12 5mm x 30.5 cm	¼ x 12 6.5 mm x 30.5 cm	5/16 x 12 8mm x 30.5 cm	⅜ x 12 9.5 mm x 30.5 cm	½ x 14 13mm x 35.6 cm
⅛	3.2	NR	NR	NR	65” 165 cm	70” 178 cm	81” 206 cm	NR	NR	NR
5/32	4.0	160” 406 cm	NR	NR	57” 145 cm	65” 165 cm	70” 178 cm	81” 206 cm	NR	NR
3/16	5.0	142” 361 cm	206” 523 cm	NR	NR	57” 145 cm	66” 168 cm	72” 183 cm	82” 208 cm	NR
¼	6.5	125” 318 cm	172” 437 cm	260” 660 cm	NR	46” 117 cm	58” 147 cm	66” 168 cm	72” 183 cm	112” 285 cm
5/16	8.0	112” 284 cm	150” 310 cm	188” 478 cm	NR	20”/2P 51 cm	46” 117 cm	58” 147 cm	67” 170 cm	100” 254 cm
⅜	9.5	84” 213 cm	136” 345 cm	157” 399 cm	NR	12”/2P 30 cm	24”/2P 61 cm	47” 119 cm	59” 150cm	88” 224 cm
½	12.7	72”/2P 183 cm	103” 262 cm	140” 356 cm	NR	NR	14”/2P 36 cm	26”/2P 66 cm	47” 11 cm	73” 185 cm
⅝	15.9	48”/2P 122 cm	75”/2P 191 cm	102” 259 cm	NR	NR	NR	16”/2P 41 cm	26”/2P 66 cm	57” 145 cm
¾	19.0	NR	57”/2P 145 cm	90” 229 cm	NR	NR	NR	NR	16”/2P 41 cm	43” 109 cm
⅞	22.0	NR	NR	80” 203 cm	NR	NR	NR	NR	NR	35”/2P 89 cm
1	25.0	NR	NR	72” 183 cm	NR	NR	NR	NR	NR	28”/2P 71 cm

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

NR = Not Recommended 2P = 2 Passes

A Global Cutting & Welding Market Leader™

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