AIR CARBON-ARC MANUAL GOUGING TORCHES

Operating Manual

English
Canadien Français
Americas Español

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WE APPRECIATE YOUR BUSINESS!

Congratulations on receiving your new Victor Arcair® product. We are proud to have you as our customer and will strive to provide you with the best service and support in the industry. This product is backed by our extensive warranty and world-wide service network.

We know you take pride in your work and we feel privileged to provide you with this high performance product that will help you get the job done.

For more than 60 years Victor Arcair® has provided quality products you can trust, when your reputation is on the line.

YOU ARE IN GOOD COMPANY!

Victor Arcair® is a Global Brand of Cutting Products for Victor Technologies™ Inc. We distinguish ourselves from our competition through market-leading innovation and truly dependable products that will stand the test of time.

We strive to enhance your productivity, efficiency and welding performance, enabling you to excel in your craft. We design products with the welder in mind delivering- advanced features, durability, ease of use and ergonomic comfort.

Above all, we are committed to a safer working environment within the welding industry. Your satisfaction with this product and its safe operation is our ultimate concern. Please take the time to read the entire manual, especially the Safety Precautions.

If you have any questions or concerns regarding your new Victor Arcair® product, please contact our friendly and knowledgeable Customer Service Team at:

1-800-462-2782 (USA) and 1-905-827-4515 (Canada), or visit us on the web at www.victortechologies.com/arcair
WARNINGS

Read and understand this entire Manual and your employer’s safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer’s best judgement, the Manufacturer assumes no liability for its use.

Operating Manual Guide Number: 89250012

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SECTION 1: INTRODUCTION

1.01 Air Carbon-Arc Cutting/Gouging

The air carbon-arc process (CAC-A) removes metal physically, not chemically as in oxy-fuel cutting (OFC). Gouging or cutting occurs when the intense heat of the arc between the carbon electrode and the workpiece melts part of the workpiece. Simultaneously, air passes through the arc quickly enough to blow the molten material away.

The air carbon-arc process does not require oxidation to maintain the cut, so it can gouge or cut metals that the OFC process cannot. Most common metals (e.g., carbon steel, stainless steel, many copper alloys and cast irons) can be cut using the air carbon-arc process. The metal removal rate depends on the melting rate and how efficiently the air jet removes molten metal. In the process, the air must lift the molten metal clear of the arc before the metal solidifies.

1.02 History

Air carbon-arc gouging began in the 1940’s, evolving from the existing carbon-arc cutting process. Myron Stepath, a welding engineer, developed air carbon-arc gouging to remove several hundred feet of flat, cracked, stainless steel weld.

Previously, carbon-arc cutting removed overhead and vertical defective welds and rivet heads. The carbon-arc melted the metal, then gravity moved the molten metal away.

Stepath reasoned that an air jet could provide the force to remove metal lying flat. So he tried a direct-current, electrode-negative carbon-arc with a second operator directing an air blast via air nozzle at the molten pool. However, this attempt was unsuccessful because the arc was less stable than a carbon-welding arc. So, Stepath tried a direct-current, electrode-positive arc, and the result was air carbon-arc gouging.

In 1948, Myron Stepath introduced the first air carbon-arc torch to the welding industry. In 1949, Stepath and two associates founded the Arcair® Company.

Two operators were no longer needed. The compressed air now passed through the torch and exited beneath the electrode. This new tool saved time on weld backgouging, crack removal, and weld defect repair on carbon, alloy, and stainless steel. Previously, these tasks were performed by grinding or chipping.

Today, the basic principle remains the same, but with improved equipment and an expanded number of applications.
1.03 Applications

The industry has enthusiastically adopted air carbon-arc gouging and found many uses for the process in metal fabrication and casting finishing, chemical and petroleum technology, construction, mining, general repair, and maintenance.

Victor® Arcair® Torches and Electrodes are used throughout the world, anywhere metal is gouged, grooved, severed, or removed from a surface.

The air carbon-arc process is flexible, efficient, and cost effective on practically any metal: carbon steel, stainless steel and other ferrous alloys; gray, malleable and ductile iron; aluminum; nickel; copper alloys and other nonferrous metals.

1.04 The "BEST" Just Got Better...

Victor® Arcair® is changing the game when it comes to the power and air connection design on their K-Series torch cable assemblies.

Since the invention of the air carbon-arc process in 1949, the torch and cable have always used a molded rubber "boot" to provide electrical protection for the power connection by preventing arcing against a grounded work surface. This boot design incorporates a large open rectangular end that allows the power cable and air hose space to connect to the torch cable. However, the boot can expose the power connection to the grounded work surface if it is not properly installed and kept in place over the connection.

Now, the improved boot design encapsulates the power/air connection, eliminating the chance of accidental arcing. It can accept one 4/0 welding cable from the power supply and one ¾” diameter air hose assembly that provides current and compressed air.

This new boot design is molded from a hard nylon reinforced fiber material that can withstand the abuse of everyday use in a fabrication shop.
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Safe practices in welding and cutting processes, such as air carbon-arc, are covered in ANSI Z49.1, “Safety in Welding and Cutting”, and ANSI 249.2, “Fire Prevention in Use of Welding and Cutting Processes.” Air carbon-arc operators and their supervisors should adhere to the safe practices discussed in these documents.

Other hazards in arc welding and cutting are briefly discussed in this section.

2.01 Proper Installation, Use, and Maintenance

Serious injury or death may result if gouging and cutting equipment is not properly installed, used, and maintained. Misuse of this equipment and other unsafe practices can be hazardous. The operator, supervisor, and helper must read and understand the following safety warnings and instructions before installing or using any air carbon-arc torch or equipment.

The gouging/cutting process is used in many potentially dangerous environments, such as elevated heights, areas with limited ventilation, close quarters, areas around water, hostile environments, etc. The operator must be aware of the dangers associated with working in these types of conditions. The operator must be trained in safe practices for his work environment and be under competent supervision.

It is essential that the operator, supervisor, and others in the work area be aware of the dangers of the air carbon-arc process. Training and proper supervision are important for a safe work place. Keep these instructions for future use. Additional recommended safety and operating information is referenced in each section.

2.02 Electrodes

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRIC SHOCK CAN CAUSE INJURY OR DEATH</td>
</tr>
</tbody>
</table>

Install and maintain equipment in accordance with the National Electrical Code (NFPA 70) and local codes. Do not service or repair equipment with power on. Do not operate equipment with protective insulators or covers removed. Service or repair to equipment must be done by qualified and/or trained personnel only. |
Keep carbon electrodes dry. If electrodes become damp, bake them for 10 hours at 300° F (176° C). Wet electrodes may shatter.

Do not touch electrically live parts. Do not touch an electrode with bare skin and electrical ground at the same time. Always wear dry welding gloves that are in good condition. Aluminized protective clothing can become part of the electrical path. Keep oxygen cylinders, chains, wire ropes, cranes, hoists, and elevators away from any part of the electrical circuit. Check all ground connections periodically to determine if they are mechanically strong and electrically adequate for the required current.

If you are engaged in alternating current gouging/cutting under wet conditions or warm surroundings where perspiration is a factor, use reliable automatic controls for reducing no load voltage to reduce shock hazard. When the gouging/cutting process requires values of open circuit voltages in alternating current machines higher than 80 volts, and direct current machines higher than 100 volts, take precautions, such as using adequate insulation, to prevent the operator from making accidental contact with the high voltage.

If you are going to suspend gouging for any substantial period of time, such as during lunch or overnight, remove all electrodes from the torch and put the torch in a safe location so that accidental contact cannot occur. Disconnect the torch from the power source when it is not in use. Never immerse air carbon-arc torches or electrodes in water.

2.03 Ventilation Hazards

WARNING
SMOKE, FUMES, AND GASES CAN BE DANGEROUS TO YOUR HEALTH

Keep smoke, fumes and gases from the breathing area. Fumes from the gouging process are of various types and strengths, depending on the kind of base metal being worked on. To ensure your safety, do not breathe these fumes. Ventilation must be adequate to remove smoke, fumes and gases during the operation to protect gouging operators and others in the area.

Vapors of chlorinated solvents can form the toxic gas phosgene when they are exposed to ultraviolet radiation from an electric arc. Remove all solvents, degreasers, and potential sources of these vapors from the operating area.

Fumes that are produced by cutting in particularly confined places can cause discomfort and physical harm if inhaled over an extended period of time. Provide adequate ventilation in the gouging/cutting area. Use air-supplied respirators if there is not enough ventilation to remove all fumes and gases. Never ventilate with oxygen, because oxygen supports and vigorously accelerates fire.
2.04 Personal Protective Equipment and Clothing

**WARNING**

**NOISE CAN DAMAGE HEARING**

Noise from the air carbon-arc process can damage your hearing. Operators and surrounding personnel must wear adequate protective hearing devices to ensure personal protection against noise when noise levels exceed OSHA standards.

<table>
<thead>
<tr>
<th>Duration Per Day (hours)</th>
<th>Sound Level (dBA*) Slow Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>1-1/2</td>
<td>102</td>
</tr>
<tr>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>1/4 or less</td>
<td>115</td>
</tr>
</tbody>
</table>

* dBA = decibels

**WARNING**

**ARC RAYS, HOT SLAG, AND SPARKS CAN INJURE EYES AND BURN SKIN**

The gouging/cutting process produces extreme localized heat and strong ultraviolet rays. Never attempt to gouge/cut without a welding helmet with the proper lens that complies with federal guidelines.

A number 12 to 14 shade filter lens provides the best protection against arc radiation. When in a confined area, prevent the reflected arc rays from entering around the helmet. Make sure others are protected from arc rays and sparks. Use approved shielding curtains and appropriate goggles to provide protection to others in the surrounding area and operators of nearby equipment.
Skin should also be protected from arc rays, heat and molten metal. Always wear protective gloves and clothing that will not allow skin to become exposed. Close all pockets and sew shut all cuffs. Wear leather aprons, sleeves, leggings, etc. for out-of-position gouging/cutting, or for heavy metal-removal operations using large electrodes. High top work shoes provide adequate protection from foot burns. Use leather spats for added protection. Do not use flammable hair preparations when gouging/cutting. Wear ear plugs to protect ears from sparks.

2.05 Shielding Booths

Where the work permits, the arc welder should be enclosed in an individual booth painted with a finish of low reflectivity—an important factor for absorbing ultraviolet radiations—such as zinc oxide and lamp black. The welder may also be enclosed in similarly painted noncombustible screens.

2.06 Fire and Burn Hazards

WARNING

WELDING SPARKS CAN CAUSE FIRES AND EXPLOSIONS.

Causes of fire and explosion include combustibles reached by the arc, flame, flying sparks, hot slag or heated materials. Remove combustibles from the work area and/or provide a fire watch. Avoid oily or greasy clothing as a spark may ignite them. Keep a fire extinguisher nearby, and know how to use it.

Be alert to the danger of conduction or radiation. For example, if you will be gouging/cutting on a metal wall, partition, ceiling or roof, take precautions to prevent combustibles from igniting on the other side. Do not gouge/cut containers that have held combustibles. Vent all hollow spaces, cavities and containers before gouging/cutting to permit air or gases to escape. Purging with inert gas is recommended.
### Table 2-1 - Recommended Minimum Air Requirements

<table>
<thead>
<tr>
<th>Type of Torch</th>
<th>Air Pressure¹ psi (kPA)</th>
<th>Air Consumption cfm (L/min.)</th>
<th>Recommended Compressor Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Intermittent Use hp (kW)</td>
<td>Continuous Use hp (kW)</td>
</tr>
<tr>
<td>Light Duty²</td>
<td>40 (280)</td>
<td>8 (227)</td>
<td>0.5 (0.4)</td>
</tr>
<tr>
<td>General Duty²</td>
<td>80 (550)</td>
<td>25 (708)</td>
<td>5 (3.7)</td>
</tr>
<tr>
<td>Multipurpose³</td>
<td>80 (303)</td>
<td>33 (934)</td>
<td>7.5 (5.6)</td>
</tr>
<tr>
<td>Automatic⁴</td>
<td>60 (414)</td>
<td>46 (1303)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

¹ Pressure while torch is in operation.
² Accommodates flat electrodes.
³ Generally considered a foundry torch.
⁴ Requires some kind of mechanical manipulation.

Use only compressed air. Using combustible compressed gases can cause explosions that may result in personal injury or death.

### 2.07 Safety and Operating References

2. ANSI Z49.1 “Safety In Welding and Cutting”
3. ANSI Z87.1 “Practice for Occupational and Educational Eye and Face Protection.”
5. AWS C5.3 “Recommended Practices for Air Carbon-Arc Gouging and Cutting.”
6. AWS F4.1 “Recommended Safe Practices for Welding and Cutting Containers.” The American Welding Society, 550 NW Lejeune RD., P.O. Box 351040, Miami FL. 33135
SECTION 3: HOW TO USE THIS MANUAL

To ensure safe operation, read the entire manual, including the chapters on safety instructions and warnings.

Throughout this manual, the words WARNING, CAUTION, and NOTE may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

![WARNING]

A WARNING GIVES INFORMATION REGARDING POSSIBLE PERSONAL INJURY.

![CAUTION]

A CAUTION refers to possible equipment damage.

![NOTE]

A NOTE offers helpful information concerning certain operating procedures.

3.01 Receipt of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the location in your area listed in the inside back cover of this manual. Include a full description of the parts in error.
SECTION 4: INSTALLATION

4.01 Installing the DC Welding Power Cable and Air Hose to the Power and Air Connector

Models Part No. 61-065-006, 61-065-007, 61-082-008 and 61-082-009

Follow these instructions to connect the DC Welding Power Cable and Compressed Air Line directly to the Power and Air Connector on the Torch Swivel Cable Assembly.

1. Remove the Torch and Cable Assembly from the carton and lay the assembly in a straight and untwisted position on a workbench or floor.

2. Position the molded boot so that you have access to the four (4) screws as shown in Figure 4-1.

3. Use a straight blade screwdriver to remove the four (4) screws. Lift the top half of the molded boot away from the assembly.
4. Using a ¼”-13 x 1” hex head bolt, position the bolt down so that its threads run through the crimped lug of the DC Welding Power Cable and through the Power and Air Connector on the Swivel Cable Assembly. The head of the bolt should be against the flat side of the crimped lug as shown in Figure 4-4.

5. Place a ½” lock washer over the bolt threads and begin to thread a ½”-13 nut down against the assembly.

6. Position the brass Power and Air Connector back into the bottom half of the boot.

7. Using your index finger to apply an upward force on the bolt, tighten the assembly down.
8. Lift the assembly away from the bottom half of the boot to securely fasten. Do not allow the crimped lug to move while doing this final tightening step.

![Figure 4-7](image1)

9. Thread the incoming Compressed Air Line with a 3/8” pipe threaded fitting into the Power and Air Connector. This connection should be wrench tight.

![Figure 4-8](image2)

10. Reposition the Cable Assembly with the DC Welding Power Cable and Air Hose back in place in the lower half of the boot.

![Figure 4-9](image3)
10. Reposition the top half of the boot in place and secure with the four (4) screws that were removed in step 3.

11. The assembly is now ready to be used in your metal removal application.

**4.02 Installing the DC Welding Power Cable with Twist Lock Power Connection and Air Hose to the Torch Swivel Cable Assembly**

**Models Part No. 61-065-002, 61-065-003, 61-082-006 and 61-082-007**

1. Remove the Torch and Cable Assembly from the carton and lay the assembly in a straight and untwisted position on a workbench or floor.

2. Remove the Twist Lock Connector attached to the Torch Swivel Cable Assembly. Follow these steps to connect the brass female connector to the DC Power Cable:
   
   a. Remove the cover screw holding the outer cover in place from the assembly.
   
   b. Trim the rear of the connector cover to fit the cable being used. NOTE: Do not over trim. The cover should fit snugly.
   
   c. Slip the cover over the cable.
   
   d. Trim the cable insulation back 1-7/8”, exposing the copper stranding.
   
   e. Loosen the ball-point screws and insert the copper cable into the cable hole of the brass connector half.
   
   f. Tighten the ball-point screws securely (150 – 250 in./lbs.) The heads of the screws should be flush with, or below, the connector body.
   
   g. Slip the connector cover over the brass body and install/tighten the cover screw. The screw fits into the second cover hole.

3. Thread the 3/8” pipe threaded fitting that is connected to the Air Hose coming out of the Torch Swivel Cable, into your shop air line. This connection should be wrench tight.
4.03 Connecting to DC or AC Welding Power Supplies

Gouging applications normally use three-phase welding power supplies with an open circuit voltage higher than 60 volts, to allow for any voltage drop in the circuit.

1. Connect the Welding Power Cable that is connected to the Torch Swivel Cable to the positive terminal on the power supply (DCEP or AC). Refer to Figure 4-11.

2. Connect the Welding Power Cable that is connected to the negative terminal on the power supply to the workpiece.

3. Turn on the power supply and air supply to the gouging torch and cable assembly.

4. Press down on the lever of the torch to insert the air carbon-arc electrode “carbon” into the torch. When using copper coated carbons, the bare carbon end should be down and away from the torch. This is where the arc will be struck between the carbon and workpiece. Refer to Figure 4-12.
5. Hold the electrode as shown in Figure 4-12, so that a maximum of 7” (178 mm) extends from the torch. This extension should be 3” (76.5 mm) for aluminum.

6. While the torch valve is open, adjust the air pressure at the torch to the normal pressures range between 80 psi (551.6 kPa) and 100 psi (690 kPa); higher pressures may be used, but they do not remove metal more efficiently.

7. Adjust the welding current (Constant Current) or voltage (Constant Voltage), depending on the type of power supply being used, to the suggested current range shown for the carbon diameter being used. Refer to Table 4-1.

Table 4-1 - Suggested Current Ranges (AMP) for Commonly Used Electrode Types and Sizes

<table>
<thead>
<tr>
<th>Electrode Diameter</th>
<th>DC Electrode DCEP</th>
<th>AC Electrode AC</th>
<th>AC Electrode DCEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>in (mm)</td>
<td>min - max</td>
<td>min - max</td>
<td>min - max</td>
</tr>
<tr>
<td>1/8 (3.2)</td>
<td>60 - 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/32 (4.0)</td>
<td>90 - 150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/16 (4.8)</td>
<td>200 - 250</td>
<td>200 - 250</td>
<td>150 - 180</td>
</tr>
<tr>
<td>1/4 (6.4)</td>
<td>300 - 400</td>
<td>300 - 400</td>
<td>200 - 250</td>
</tr>
<tr>
<td>5/16 (7.9)</td>
<td>350 - 450</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>3/8 (9.5)</td>
<td>450 - 600</td>
<td>350 - 450</td>
<td>300 - 400</td>
</tr>
<tr>
<td>1/2 (12.7)</td>
<td>800 - 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/8 (15.9)</td>
<td>1000 - 1250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4 (19.1)</td>
<td>1250 - 1600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (25.4)</td>
<td>1600 - 2200</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>3/8 (9.5) FLAT</td>
<td>250 - 450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/8 (9.5) FLAT</td>
<td>300 - 500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. Turn on the air jet before striking the arc. Hold the torch between a 45° - 60° work angle, so that the electrode slopes back from the direction of travel. The air jet sweeps between the electrode and workpiece, providing the force to remove all molten metal from the groove.

9. Lightly touch the electrode to the workpiece to establish the arc. Do not draw back the electrode once the arc is ignited. When the correct arc voltage is being maintained, the sound of the arc and the compressed air is loud. When the sound is muffled, the arc voltage is below the recommended operating conditions. Normal arc voltage with a handheld gouging torch is measured between 35 to 50 volts.

10. The groove’s depth is controlled by travel speed. Grooves up to 1” (25 mm) deep may be made. However, the deeper the groove, the more experienced the operator needs to be. Slow travel speeds produce deep grooves, and fast travel speeds produce shallow grooves. The width of the groove is determined by the size of the electrode used and is typically about 1/8” (3.2 mm) wider than the electrode’s diameter. A wider groove may be made with a small electrode by oscillating in a circular or weave motion.
## SECTION 5: TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large free-carbon deposit at the beginning of the groove.</td>
<td>1. The operator either neglected to turn on the air jet before striking the arc or the torch was located improperly. 2. Carbon rod not positioned properly in head assembly.</td>
<td>1. Turn on air before striking the arc and air should flow between the electrode and the workpiece. 2. Ensure carbon rod is seated in groove in torch head.</td>
</tr>
<tr>
<td>An unsteady arc, causing the operator to use a slow travel speed even on shallow grooves.</td>
<td>1. Not enough amperage for the electrode diameter used (see Table 2). While the lowest recommended amperage may be enough, it requires greater operator skill. A mid-range amperage is better.</td>
<td>1. 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.</td>
</tr>
<tr>
<td>Erratic groove with the arc wandering from side-to-side and with the electrode heating up rapidly.</td>
<td>1. The process used with DCEN (electrode negative).</td>
<td>1. Gouging process should be done with DCEP (Electrode positive) whenever possible. Direct current electrodes should be used with DCEP (electrode positive) on all metals, except for a few copper alloys such as Superston and Nialite.</td>
</tr>
<tr>
<td>Intermittent arc action resulting in an irregular groove surface.</td>
<td>1. The travel speed was too slow in manual gouging. The operator possibly set their hand on other work for balance, a tendency in shielded metal-arc welding. 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 thus causing the gap between the electrode and workpiece to become too large to maintain the arc. 2. Poor ground connection.</td>
<td>1. The operator should stand comfortably so their arms move freely and their gloves do not drag on the workpiece. If using mechanized equipment, check Table 4 (Page 4-24) for proper operating conditions. 2. Inspect ground clamps and lead(s) to ensure connection proper.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Solution</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>In gouging, free carbon deposits at varying groove intervals; in pad-washing, free carbon deposits at various spots on the washed surface.</td>
<td>1. A shorted electrode on the workpiece. In manual gouging, this is a result of excessive travel speed for the amperage used and for the depth of the groove being made. In mechanized operations, this is a result of excessive travel speed or using a flat-curve, constant-voltage power source for a small diameter electrode 5/16&quot; (7.9 mm). In padwashing, this is caused by holding the electrode at too small a push angle.</td>
<td>1. Use an electrode-to-work angle of 15° to 70°. 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 circuit. Keep a proper arc gap.</td>
</tr>
<tr>
<td>Irregular groove: too deep, then too shallow.</td>
<td>1. The operator was unsteady.</td>
<td>1. The operator should assume a comfortable position while gouging.</td>
</tr>
<tr>
<td>Slag adhering to the edges of the groove.</td>
<td>1. Slag ejection was inadequate. To resolve, 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.</td>
<td>1. To deliver adequate volume, the air hose feeding the concentric cable assembly needs a minimum hose ID of 3/8&quot; (9.5 mm) for manual torches. For automatic torches, the minimum hose ID should be 1/2&quot; (12.7 mm). Direct the air jet parallel to the gouge area. Do not favor one side unless operator wants to minimize slag from adhering to one side of the cut.</td>
</tr>
</tbody>
</table>
### TORCH REPLACEMENT PARTS LIST

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>K3000™</th>
<th>K4000®</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Insulators &amp; Screws</td>
<td>94-433-193</td>
<td>94-433-183</td>
</tr>
<tr>
<td>2</td>
<td>Lever &amp; Screw</td>
<td>94-476-080</td>
<td>94-476-066</td>
</tr>
<tr>
<td>3</td>
<td>Valve Bonnet</td>
<td>94-104-016</td>
<td>94-104-016</td>
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<tr>
<td>4</td>
<td>Bonnet Wrench</td>
<td>94-960-001</td>
<td>94-960-001</td>
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<tr>
<td>5</td>
<td>Bonnet Only</td>
<td>94-104-012</td>
<td>94-104-012</td>
</tr>
<tr>
<td>6</td>
<td>Spool &amp; O-Rings</td>
<td>94-801-011</td>
<td>94-801-011</td>
</tr>
<tr>
<td>7</td>
<td>O-Ring</td>
<td>94-710-036</td>
<td>94-710-036</td>
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<tr>
<td>8</td>
<td>Spool Only</td>
<td>94-801-010</td>
<td>94-801-010</td>
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<tr>
<td>9</td>
<td>Upper Arm</td>
<td>94-048-120</td>
<td>94-048-088</td>
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<tr>
<td>10</td>
<td>Head &amp; Screw</td>
<td>94-378-366</td>
<td>94-378-368</td>
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<tr>
<td>11</td>
<td>Torch Body</td>
<td>94-103-232</td>
<td>94-103-206</td>
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<tr>
<td>12</td>
<td>Hinge Pin</td>
<td>94-632-101</td>
<td>94-632-094</td>
</tr>
<tr>
<td>13</td>
<td>Spring</td>
<td>94-800-191</td>
<td>94-800-077</td>
</tr>
<tr>
<td>14</td>
<td>Handle</td>
<td>94-370-179</td>
<td>94-370-163</td>
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### CABLE REPLACEMENT PARTS LIST

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<th>Item</th>
<th>Description</th>
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<th>K4000®</th>
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<tbody>
<tr>
<td>7</td>
<td>7ft. (2.1M) Swivel Cable</td>
<td>70-088-107</td>
<td>70-084-207</td>
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<tr>
<td>8</td>
<td>10ft. (3M) Swivel Cable</td>
<td>70-088-110</td>
<td>70-084-210</td>
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<tr>
<td>1</td>
<td>Retainer Screw</td>
<td>94-695-054</td>
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</tr>
<tr>
<td>2</td>
<td>O-Ring</td>
<td>94-710-027</td>
<td>94-170-182 *</td>
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<tr>
<td>3</td>
<td>Connector</td>
<td>94-170-178</td>
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<tr>
<td>4</td>
<td>Spring Washer</td>
<td>94-940-104</td>
<td>94-940-104</td>
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<tr>
<td>5</td>
<td>Flat Washer</td>
<td>94-940-103</td>
<td>94-940-103</td>
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<td>6</td>
<td>Clamp (2 Required)</td>
<td>98-167-010</td>
<td>98-167-010</td>
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<tr>
<td>7</td>
<td>7ft. (2.1M) Conductor</td>
<td>96-130-314</td>
<td>96-130-263</td>
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<tr>
<td>8</td>
<td>10ft. (3M) Conductor</td>
<td>96-130-315</td>
<td>96-130-261</td>
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<tr>
<td>9</td>
<td>7ft. (2.1M) Cover</td>
<td>94-171-273</td>
<td>94-171-273</td>
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<tr>
<td>10</td>
<td>10ft. (3M) Cover</td>
<td>94-171-274</td>
<td>94-171-274</td>
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<tr>
<td>11</td>
<td>Molded Hard Boot with Screws</td>
<td>94-105-032</td>
<td>94-105-032</td>
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<td>12</td>
<td>Female Connector</td>
<td>94-170-150</td>
<td>94-170-150</td>
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</tbody>
</table>

* Includes Retainer Screw, O-Ring, and Connector
## POWER & AIR HOOK-UP KIT

### HOOK-UP KIT & PARTS LIST

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Cat No.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Complete Hook-Up Kit</td>
<td>94-463-046</td>
</tr>
<tr>
<td>1</td>
<td>Male Connector</td>
<td>94-170-184</td>
</tr>
<tr>
<td>2</td>
<td>Molded Hard Boot with Screws</td>
<td>94-105-031</td>
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<tr>
<td>3</td>
<td>4-WPC-R Connector</td>
<td>4WPC-R</td>
</tr>
<tr>
<td>4</td>
<td>Pigtail Air Supply Hose</td>
<td>94-396-205</td>
</tr>
</tbody>
</table>
STATEMENT OF WARRANTY

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