LINCOLN ELECTRIC | **Cutting Systems**

Quick Start Cutting
with Arc Voltage Height Control

October 29, 2013

TORCHMATE®
A Lincoln Electric Company

VERNON TOOL

Table of Contents

Technical Support

Call, Fax, or Email

When building or maintaining a table, if a question or concern arises or a part is missing, please contact Torchmate technical support.

Technical support will also help you with operating the CNC system, and troubleshooting problems.

Technical support is available Monday through Friday from 6 AM to 4 PM (06:00 to 16:00) Pacific Time Zone.

TORCHMATE®
A Lincoln Electric Company

Toll Free: 1-866-571-1066

International: 775-673-2200

Fax: 775-673-2206

Email: support@torchmate.com

Call us for Consumables or visit our web store

www.TorchmateStore.com

Safety Information

Safety First

Torchmate and Lincoln Electric Cutting Systems equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part.

> ## WARNING
>
> **DO NOT INSTALL, OPERATE, OR RE-PAIR THIS EQUIP-MENT WITHOUT READING THE SAFE-TY WARNINGS CON-TAINED THROUGH-OUT THIS MANUAL.**
>
> **Think before you act— and be care-ful.**

Electric Shock

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJU-RY OR DEATH.

KEEP CHILDREN AWAY.

IF YOU WEAR A PACEMAKER, YOU SHOULD CONSULT WITH YOUR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safe-ty information it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Stan-dard W117.2.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDI-VIDUALS.

1. ELECTRIC SHOCK can kill.

    1.1 The electrode and work (or ground) circuits are electrically "hot" when the power source is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

    1.2 Disconnect the power source before performing any service or repairs. When the power source is operating, voltages in excess of 250 volts are produced. This creates the potential for serious electrical shock - possibly even fatal.

    1.3 Insulate yourself from work and ground using dry insulation. Wear dry gloves and clothing. Take extra care when the work place is moist or damp.

    1.4 Always be sure the work cable makes a good electrical connection with the metal being cut or gouged. The connection should be as close as possible to the area being cut or gouged.

    1.5 Ground the work or metal to be cut or gouged to a good electrical (earth) ground.

    1.6 Maintain the plasma torch, cable and work clamp in good, safe operating condition. Repair or replace all worn or damaged parts. Replace damaged insulation.

    1.7 Never dip the torch in water for cooling or plasma cut or gouge in or under water.

1.8 When working above floor level, protect yourself from a fall should you get a shock. Operate the pilot arc with caution. The pilot arc is capable of burning the operator, others or even piercing safety clothing.

1.9 Also see Items 4.3 and 6.

2. ARC RAYS can burn.

Arc Rays

2.1 Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultraviolet and infrared rays. These will damage your eyes and burn your skin if you are not properly protected.

2.2 Use safety glasses and a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when performing or observing plasma arc cutting or gouging. Glasses, head-shield, and filter lens should conform to ANSI Z87. I standards.

Arc Current	Minimum Shade No.	Suggested Shade No.
Less than 20A	4	4
20A-40A	5	5
40A-60A	6	6
60A-300A	8	9
300A-400A	9	12
400A-800A	10	14

2.3 Use suitable clothing including gloves made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

2.4 Protect other nearby personnel with suitable non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

3. FUMES AND GASES can be dangerous.

Fumes, Gases and Dust

3.1 Plasma cutting or gouging may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When cutting or gouging, keep your head out of the fumes. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone.

3.2 Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.

3.3 When plasma cutting or gouging on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required.

Safety First (continued)

3.4 Additional precautions are also required when cutting (zinc) galvanized steel or materials containing or coated with any of the following:

Antimony	Beryllium	Cobalt	Manganese	Selenium
Arsenic	Cadmium	Copper	Mercury	Silver
Barium	Chromium	Lead	Nickel	Vanadium

3.5 The operation of plasma cutting or gouging fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment, and the specific procedure and application involved. Worker exposure levels should be checked upon installation and periodically thereafter to be certain levels are within applicable OSHA PEL and ACGIH TLV limits. For information on how to test for fumes and gases in your work place, refer to publications section of this manual.

3.6 Do not use plasma cutting or gouging equipment in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products. Remove all sources of these vapors.

3.7 Gases used for plasma cutting and gouging can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

3.8 Read and understand the manufacturer's instructions for this equipment and follow your employer's safety practices.

3.9 This product, when used for cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects

3.10 Some dust created by routing, sawing, grinding, drilling, and other construction activities contains chemicals known to cause cancer, birth defects or other reproductive harm. Avoid prolonged contact with this dust. Wear protective clothing and wash exposed areas with soap and water. Allowing dust to get into your mouth, eyes, or lay on the skin may promote absorption of harmful chemicals.

Some examples of these chemicals are:

- Lead from lead-based paint.
- Crystalline silica from bricks and cement and other masonry products.
- Arsenic and chromium from chemically-treated lumber (CCA).

3.11 Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

4. Cutting flame and sparks can cause FIRE OR EXPLOSION.

Fire or Explosion

4.1 Fire and explosion can be caused by hot slag, sparks, oxygen fueled cutting flame, or the plasma arc.

4.2 Have a fire extinguisher readily available. Provide a fire watch when working in an area where fire hazards may exist.

4.3 When not cutting or gouging, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

4.4 Be sure there are no combustible or flammable materials in the workplace. Any material that cannot be removed must be protected.

4.4.1 Sparks and hot materials from cutting or gouging can easily go through small cracks and openings to adjacent areas.

4.4.2 Avoid cutting or gouging near hydraulic lines.

4.4.3 Do not cut or gouge tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned." For information purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

4.4.4 Vent hollow castings or containers before heating, cutting or gouging. They may explode.

4.5 Do not add fuel to engine driven equipment near an area where plasma cutting or gouging is being done.

4.6 Connect the work cable to the work as close to the cutting or gouging area as practical. Work cables connected to the building framework or other locations away from the cutting or gouging area increase the possibility of the current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

4.7 **Hydrogen** gas may be formed and trapped under aluminum work pieces when they are cut underwater or while using a water table. DO NOT cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.

4.8 Read and follow NFPA 51B " Standard for Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park,PO box 9101, Quincy, Ma 022690-9101.

Safety First (continued)

Cylinder Explosion

5.   CYLINDER may EXPLODE if damaged.

   5.1   Use only compressed gas cylinders containing the correct gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

   5.2   Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

   5.3   Cylinders should be located: • Away from areas where they may be struck or subjected to physical damage. • A safe distance from plasma cutting or gouging, arc welding operations and any other source of heat, sparks, or flame.

   5.4   Never allow any part of the electrode, torch or any other electrically "hot" parts to touch a cylinder.

   5.5   Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

   5.6   Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

   5.7   Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-l, "Precautions for Safe Handling of Compressed Gases in Cylinders,"available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

Electrical Power

6.   FOR ELECTRICALLY powered equipment.

   6.1   Turn off input power using the disconnect switch at the fuse box before working on the equipment.

   6.2   Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

   6.3   Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Plasma Arc

7.   PLASMA ARC can injure.

   7.1   Keep your body away from nozzle and plasma arc.

   7.2   Operate the pilot arc with caution. The pilot arc is capable of burning the operator, others or even piercing safety clothing.

8. ELECTRIC AND MAGNETIC FIELDS may be dangerous

Electric and Magnetic Fields

8.1 Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Cutting or gouging current creates EMF fields around torch cables and cutting machines.

8.2 EMF fields may interfere with some pacemakers, so operators having a pacemaker should consult their physician before cutting or gouging.

8.3 Exposure to EMF fields during cutting or gouging may have other health effects which are now not known.

8.4 All operators should use the following procedures in order to minimize exposure to EMF fields from the cutting or gouging circuit:

   8.4.1 Route the torch and work cables together - Secure them with tape when possible.

   8.4.2 Never coil the torch cable around your body.

   8.4.3 Do not place your body between the torch and work cables. If the torch cable is on your right side, the work cable should also be on your right side.

   8.4.4 Connect the work cable to the workpiece as close as possible to the area being cut or gouged.

   8.4.5 Do not work next to cutting power source.

9. AUTOMATIC OPERATION

Automatic Operation

9.1 Any CNC machine may begin to operate automatically without warning. Only a trained individual familiar with the software, machine, and computer system should operate this equipment.

9.2 Keep the immediate area around the CNC machine clear of materials that may cause interference. Keep area clear of bystanders.

9.3 All untrained persons should not work on or near a CNC machine. Do not leave the CNC machine unattended while power is on to any electronics.

10. NOISE

Noise

10.1 Noise can cause permanent hearing loss. CNC operation, plasma arc cutting, plate marking, routing, and drilling can cause noise levels that exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

   10.1.1 To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.

   10.1.2 Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.

10.2 For information on how to test for noise refer to the publications section of this manual.

Safety First (continued)

Heavy Parts

11. HEAVY PARTS

    11.1 Parts of CNC machines are heavy. Also, material you are cutting may be heavy. Use caution when lifting or moving them. To avoid injury, get someone to help you, or use a mechanical lifter. When using a mechanical lifter, follow all the manufacturer's safety guidelines.

    11.2 Review the Occupational Safety & Health Administration (OSHA) technical manual Sect. 7, Ch 1.5. See the publications section for additional information.

Flying Debris

12. FLYING DEBRIS

    12.1 Metal cutting and marking operations create waste that can fragment and fly. Make sure you have proper eye protection and that everyone close to the CNC operations has proper eye protection, too.

    12.2 Review the ANSI Z87.1 requirements. See the publications section for additional information.

Pinch & Crush Points

13. PINCH AND CRUSH POINTS

    13.1 Pinch and crush points are those normally moving parts of machinery, like CNC machines, that can pinch, capture, crush, or sever parts of your body. Be aware of hazardous pinch and crush points.

    13.2 Don't repair or adjust the machine with the controls on.

    13.3 When the end of a CNC machine's travel creates a "hard stop," it creates a crush point. Keep fingers and hands away from this.

    13.4 Do not stack or store any additional items in contact with the machine. These could create additional pinch or crush points, or could create a falling hazard.

Rotary Tools

14. SHARP ROTARY TOOLS

    14.1 Routing and drilling use high-speed rotating bits and cutters with sharp edges. Keep clear of bits when in use.

    14.2 Turn the router, spindle, or drill off when changing bits. Be careful of the sharp edges.

Hot Material

15. HOT MATERIALS

    15.1 Plasma cutting uses an electric arc that can reach temperatures of 45,000°F (25,000°C). Oxygen-fuel cutting flames can be up to 6,330°F (3,500°C). Any parts and scrap will be very hot after cutting. Use extreme care.

    15.2 Use tongs and wear protective gloves when handling recently cut material. Also, consider other devices for safe hot material handling.

    15.3 It is safest to let material cool completely before handling.

16. MECHANICAL DRIVES

16.1 High-speed mechanical drives made of gears, belts, and or drive screws are used by CNC machines. Keep clear of them during operation.

16.2 Do not attempt to service, adjust, or otherwise touch these components while the machine is on.

16.3 Secure loose clothing and cables to prevent entanglement.

17. AIR LINES UNDER PRESSURE

17.1 Some tools use compressed air or gases. Often flexible tubing (lines) bring the high-pressure air or gas to the machine. Inspect these lines periodically. Repair or replace damaged lines.

17.2 Hot sparks, flying debris, other objects, or vehicles can melt, burn, or puncture these lines. Check them for punctures, burns, or other damage or defects that could cause failure.

17.3 Check the routing of the lines to keep them away from traffic and from underfoot. Refer to the following standards or their latest revisions for more information:

- OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

- ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

- NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

- ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

- ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

- AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

- NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

- NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

- NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

- CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

- CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3

- NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103

- ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

Mechanical Drives

Pressurized Air Lines

Publications

Technical Support

Call, Fax, or Email

When building or maintaining a table, if a question or concern arises, or a part is missing, please contact Torchmate technical support.

Technical support will also help you with operating the CNC system,and troubleshooting problems.

Technical support is available Monday through Friday from 6 AM to 4 PM (06:00 to 16:00) Pacific Time Zone.

Toll Free: 1-866-571-1066

International: 775-673-2200

Fax: 775-673-2206

Email: support@torchmate.com

Call us for Consumables, or visit our web store

www.TorchmateStore.com

Identification and Wiring

Identify and name components

The Arc Voltage Height Control (AVHC) system consists of a number of components and a number of cables that electrically connect the components. The tables list these components and cables so that you may identify them for use in the steps that follow.

Components

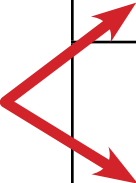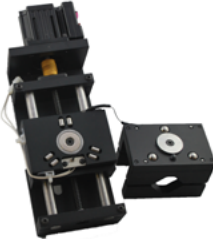| Component	Description
	Computer for use with Torchmate Driver software (Windows 7 or Windows 8)
	AVHC controller
	Compact CNC Controller (front and back)
	Pro-Series CNC Controllerge (front and back)
	Lifter station with magnetic breakaway
	Plasma cutter power supply

Depending on your CNC Cutting System model, you will have one of these two controller boxes, but not both.

Cable	Description
	CNC Interface cable (supplied with plasma cutter)
	CNC Input cable
	Raw arc voltage cable and Start cable (these two cables usually come packaged together)
	Lifter station motor cable
	Breakaway safety switch and pigtail cable, with extension cable

- Note: Some models of plasma cutter will include the raw arc voltage cable within the CNC Interface cable. Others will require that the cover of the plasma cutter be removed and the wire be attached to terminals inside the power supply.

Prepare cable ends

The AVHC Controller uses Phoenix-type (Euroblok) connectors. The connector has a removable terminal strip that is a press fit into the AVHC Controller. The individual wires must be prepared to ensure a good contact for the signal, and to eliminate stray wire strands that could cause short circuits.

Examine the Phoenix-type connectors

- Remove the larger Phoenix-type connector from the rear of the AVHC Controller. There is a larger one and a smaller one.

- In the illustration below, the top edge is the portion of the connector that press-fits into the AVHC Controller. The bottom edge contains ports for wire insertion.

How to connect a wire

- To insert a wire into the terminal strip:

  - Strip back the insulation about ¼"
  - Back out the screw for the insertion port by approximately 2 turns
  - Insert the wire. Be sure you have selected the correct insertion port.
  - Make sure that all strands are inside the insertion port. There should be no possibilit for the conductors from one wire to touch the conductors from another wire.
  - Make sure that the insulation will not interfere with the contacts closing on the wire
  - Tighten the screw to make a good electrical contact and to mechanically secure the wire.
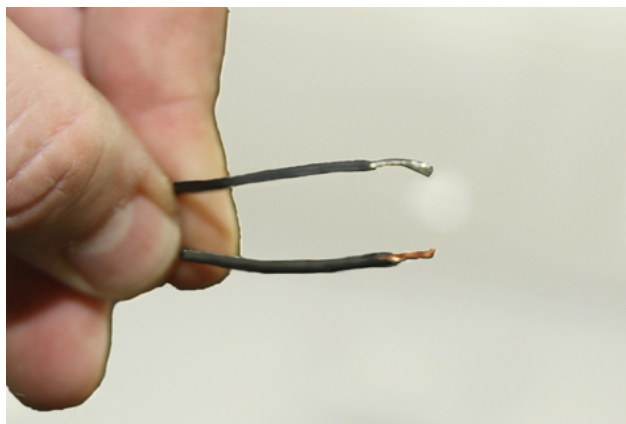
CNC Cable to Torch connection

The plasma torch power supply will typically include a CNC Interface cable for use in controlling the cutting process. The large round connector plugs into the power supply while the individual wires at the other end connect to the AVHC Control.

- The CNC Interface cable that came with your plasma power supply will have either two or three pairs of wires.

- If you have two pairs, they will typically be either color coded red / black and green / black (as shown), or they will have number tags indicating 12 and 14 as well as 3 and 4.

- If you have three pairs, they will be labeled START, OK, and VOLTAGE

This CNC Interface cable has two pairs of wires: red / black and green / black

Locate the CNC Interface cable

- Plug the large round connector into the plasma power supply, and secure it with the locking ring.

- The plasma power supplies from Lincoln Electric include the raw arc VOLTAGE wire pair in the CNC Interface cable, along with the other wire pairs. This is discussed later.

- The green & black / 3 & 4 / START wire pair signals the power supply to start a plasma arc. The AVHC label for this pair is "TORCH."

- The red & black / 12 & 14 / OK wire pair signals the AVHC that the plasma arc has reached the material being cut. The AVHC label for this pair is "OK TO MOVE."

Use a screwdriver to secure the green & black / 3 & 4 wire pair to the "TORCH" insertion port.
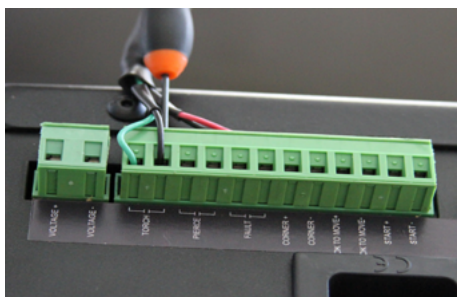
Similarly secure the red & black / 12 & 14 wire pair to the "OK TO MOVE" insertion port.
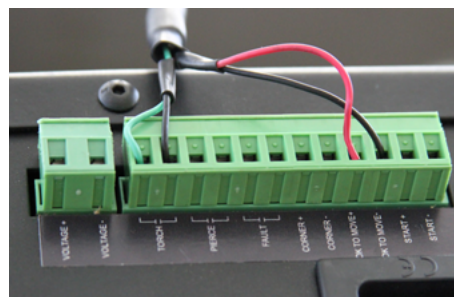
Input cable to AVHC connections

Although some CNC cutting systems come completely wired, others, like the kits or upgrades may require you to make connections to the input cable. Here is how that is done.

Identify the input cable wire pairs

- The input cable may come packaged by itself or with other cables (if it is not already installed).

- Find the cable that has a white Molex-type connector on one end. The connector will have sixteen connection points (two rows of eight connections). Five pairs of wires terminate in the molex connector.

- The other end of the five wire pairs terminate with female spade connectors (unless they have already been installed, it which case one or more pairs of wires may not include the spade connectors, using direct connections instead).
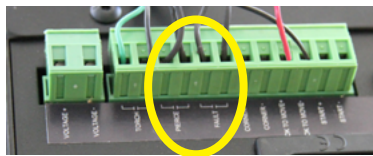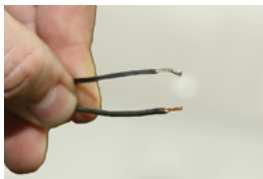
Prepare the cable ends and make the connections r

- Identify the number tags near the spade connector ends of the wires.

- For the pairs numbered 1 and 2, use a pair of wire cutter / strippers to remove the spade connectors and the insulation to expose ¼" of bare wire.

- Insert the wires from wire pair #1 into the AVHC connector labeled PIERCE. The signal from the AVHC controller on this wire tells the CNC Controller that the pierce is complete.

- Insert the wires from wire pair #2 into the connector labeled FAULT. This signal tells the CNC controller that the motor is not being detected or that the arc is not being detected as a voltage.

- Insert the molex-type connector into the input connector of the CNC Controller (only Compact CNC Controller illustrated). Click the protruding lock into place.

Input cable to safety breakaway connections

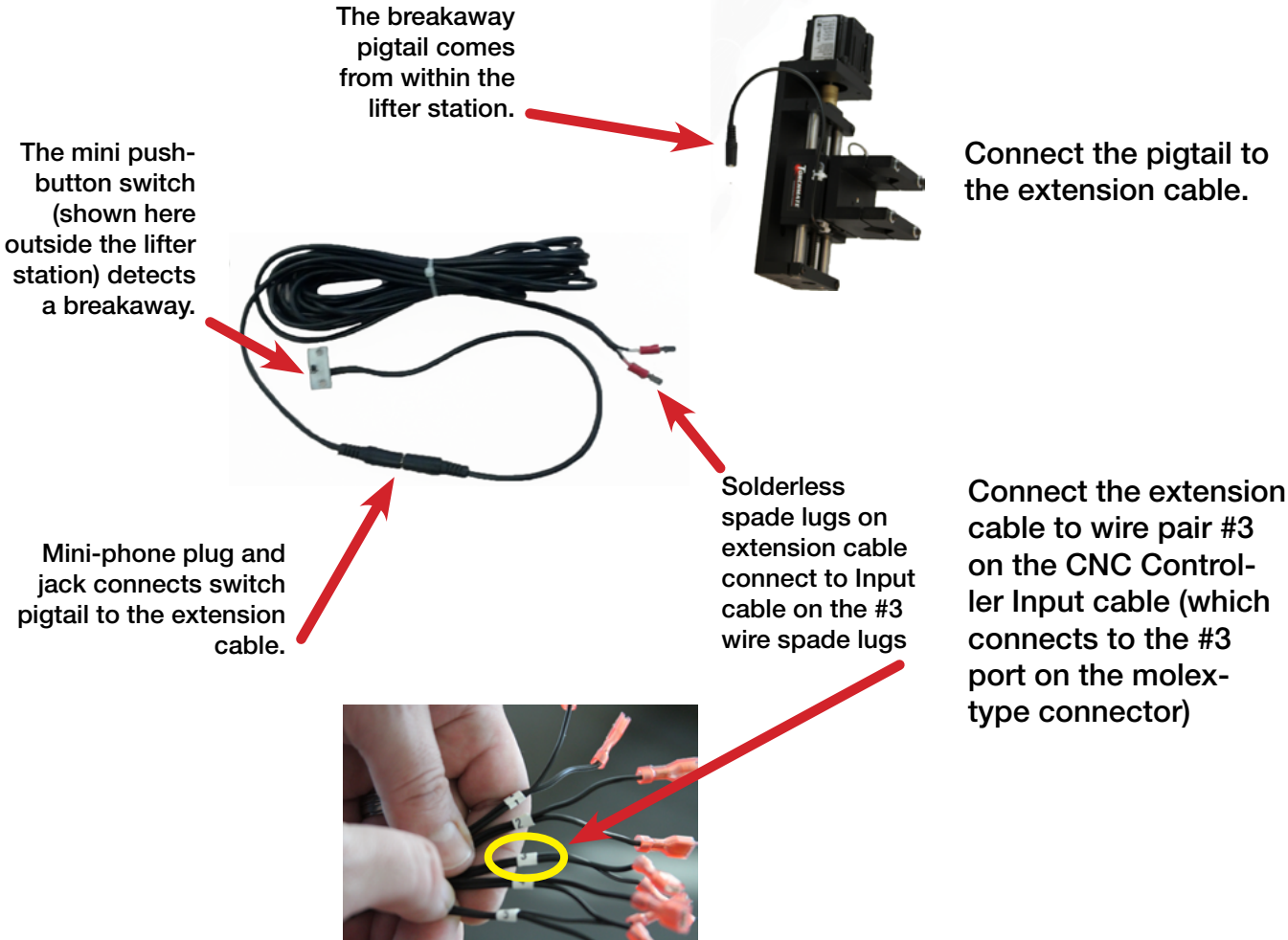More recent models of the AVHC lifter stations are equipped with a magnetic breakaway that can help avoid costly accidents. If something causes the torch to breakaway from its magnetic mounting, its switch opens. The CNC Controller senses this and stops the table's motors and turns off the plasma arc voltage. If not pre-wired, the cable will be added to the CNC input connector.

- If the breakaway-equipped lifter station was factory assembled, the breakaway cable will already be installed.

- If this installation uses a kit or a lifter station upgrade, you will get an extension cable with the lifter station. Connect the mini phone jack (like a stereo headphone jack) on one end of the extension cable to the breakaway switch pigtail near the lifter station.

- Run the extension cable from the lifter station (through the cable carrier, if installed) down to the CNC Controller.

- Connect the male spade connectors on the extension cable to the female #3 spade connectors on the input cable which should already be connected to the CNC Controller..

Locate the breakaway pigtail and extension cable

The breakaway pigtail comes from within the lifter station.

Connect the pigtail to the extension cable.

The mini push-button switch (shown here outside the lifter station) detects a breakaway.

Mini-phone plug and jack connects switch pigtail to the extension cable.

Solderless spade lugs on extension cable connect to Input cable on the #3 wire spade lugs

Connect the extension cable to wire pair #3 on the CNC Controller Input cable (which connects to the #3 port on the molex-type connector)

CNC start relay cable to AVHC

The CNC start cable runs from the CNC Controller's "RELAY" connector to the AVHC Controller's "START" connector. The two conductor cable will need both ends of both conductors stripped of insulation and inserted into the Phoenix-type connectors.

Locate and prepare the start relay cable

- The CNC Controller will produce a contact closure signal to the AVHC Controller on this wire when it begins a cut.

- The 10' start relay cable may be included in a package with a 25' arc voltage cable, or it may be packaged alone.

- The cable ends of both 18 AWG wires should be stripped back ¼".

Connect the wire ends
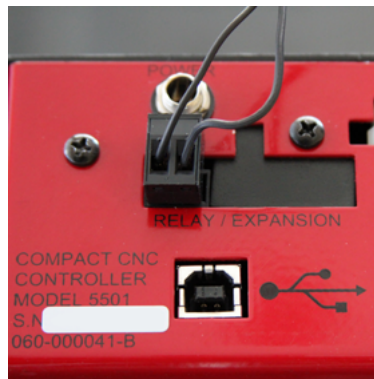
- Use a small screwdriver to loosen the screw terminals on the CNC Controller RELAY connector. Insert the stripped wire ends, and then tighten the screw terminals again, to make a good electrical contact and a physically strong connection.

- Check that the connector is fully inserted in its socket.
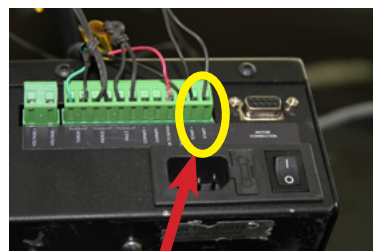
Use the START connectors (on the far right) on the AVHC Controller

- Continue using the screwdriver to terminate the other end of the wire to the AVHC Controller START connector.

- Although the START connectors are labeled with a plus (+) and a minus (-) terminal, there is no polarity requirement. Either wire can go to either terminal connector.

Raw plasma arc voltage to AVHC

The job of the AVHC Controller is to maintain a constant torch height or arc length over the material being cut, because that provides uniform quality cutting. It determines the torch height by measuring the voltage used to maintain the arc. The raw arc voltage cable carries this signal from the plasma cutter to the AVHC Controller.

- If a cable has not been pre-wired to the plasma cutter, use the raw arc voltage take off points inside the case.

- **CAUTION**: POTENTIAL SHOCK HAZARD. Never remove the cover when the plasma cutter is connected to power. Always unplug the power cable before working with the internal contacts for raw arc voltage.

- The Lincoln Electric plasma cutters provide a VOLTAGE wire in the CNC Interface Cable.

- For other systems, the 25' arc voltage cable may be included in a package with a 10' start relay cable, or it may be packaged alone.

- The cable ends of both 18 AWG wires should be stripped back ¼" (possibly more on the plasma cutter end).

- Your CNC Cutting System manual contains illustrations for different models of the connections that must be made at the plasma cutter's raw arc voltage terminals.

- Connect the other end of the wire to the VOLTAGE connectors on the AVHC Controller. Pay attention to polarity here.

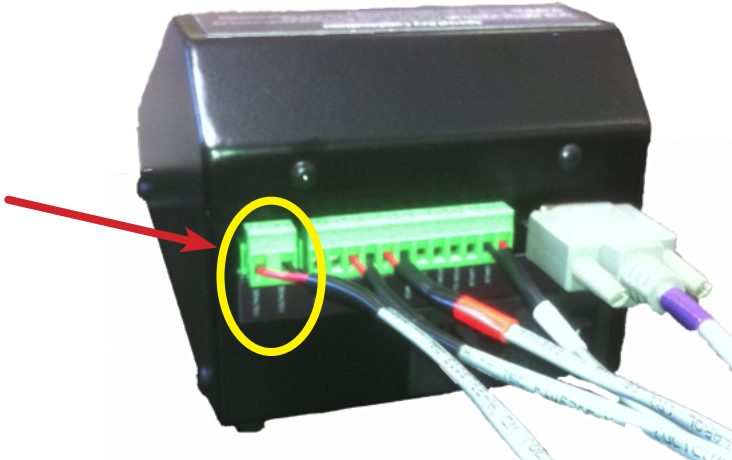Locate and prepare the raw arc voltage cable

Prepare the wire ends
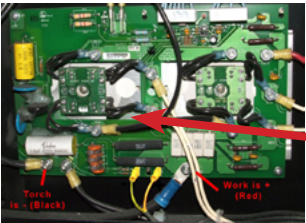
Sample raw arc voltage connection diagram from CNC cutting system manual. The connections are usually from the torch electrode and the work electrode

The connector for the raw arc voltage cable is separate and at far left

AVHC motor cable to lifter station motor

The AVHC Controller raises and lowers the torch by turning the lifter station lead screw with a "smart motor." The motor cable should be routed on the same path as the torch leads (through the cable carrier if present) from the torch to the AVHC Controller. However, keep the cable as far from the torch leads as possible to minimize interference.

Locate the motor cable.

- The motor cable has different kinds of D-connectors on each end.

- Both ends have screws that hold the cable into the equipment.

Connect the cable ends
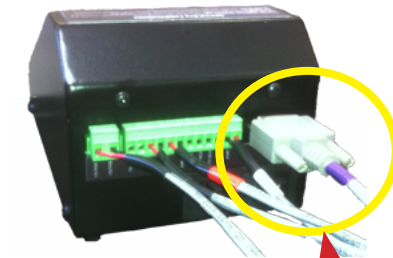
- Plug the nine-pin (DB-9) cable end into the connector on the AVHC Controller unit.
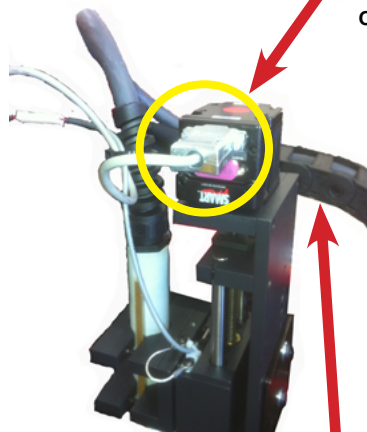
Plug these cable ends into the connectors

- The 7W2 Combo D-sub cable end has two large contacts in addition to five smaller contacts. Plug the cable end into the connector on the lifter station's SmartMotor.

- There are two cable sockets on the motor, but only the top one is used.

Route the motor cable through the cable carrier as far from the torch lead as possible

General Wiring Diagram

Review this diagram and ensure that all the connections are securely made, that all cables have been safely routed, and that signal cables have some distance of separation from the plasma power cable. Note that Lincoln Electric plasma cutters include the raw arc voltage cable with the other wires in the CNC Interface cable.

Plasma with Automatic Voltage Height Control

To Table Motors

Input Cable: Magnetic Breakaway Sensor(3)

[other lines reserved for optional limit switches]

AVHC Motor (top connector)

MOTOR CONNECTION

AVHC Controller

START -
START +
OK TO MOVE -
OK TO MOVE +
CORNER -
CORNER +
FAULT
PIERCE
TORCH
VOLTAGE -
VOLTAGE +

INPUTS 1-8
OUTPUTS 1-8
MOTOR SIGNALS

AXIS 4
AXIS 3
AXIS 2
AXIS 1

RELAY

Pro-Series CNC Controller

10' Input Cable: Pierce(1) and Fault(2)

TORCHMATE

Wires 12 & 14 on the Plasma Torch CNC Interface Cable, or the Red and Black Pair

Wires 3 & 4 on the Plasma Torch CNC Interface Cable, or the Green and Black Pair

Raw Arc Voltage on the Plasma Torch (See Section 3)

Technical Support

Call, Fax, or Email

When building or maintaining a table, if a question or concern arises, or a part is missing, please contact Torchmate technical support.

Technical support will also help you with operating the CNC system, and troubleshooting problems.

Technical support is available Monday through Friday from 6 AM to 4 PM (06:00 to 16:00) Pacific Time Zone..

TORCHMATE®

A Lincoln Electric Company

Toll Free: 1-866-571-1066

International: 775-673-2200

Fax: 775-673-2206

Email: support@torchmate.com

Call us for Consumables or visit our web store

www.TorchmateStore.com

Initial Setup and
Height Measurements

Inspect (and clean and oil) the lifter station

Take the time to inspect, clean, and lubricate the parts. Periodically, moving parts should be inspected for excessive wear. Bearings, precision shafts, and drive screws should all be free of built-up dirt and rust and lubricated with a light machine oil.

Inspect for wear

- The drive screw, its bronze nut, the precision linear shafts, and their sliding bearings can suffer wear over time, particularly in humid and dirty conditions. Excessive wear will reduce cut quality, so replacing worn components is recommended.

Inspect for dirt and rust

- Dirt and rust must be removed periodically for proper operation.
  - When beginning a cut the torch tip is lowered to touch the material, which is sensed as additional motor resistance. This allows proper setting of pierce and initial cut heights
  - However, dirt or rust can also cause additional motor resistance, which can interfere with the proper operation, and incorrect pierce and cut heights.
- At this step, perform a thorough cleaning that removes any built-up dirt or surface rust.
  - Use a synthetic scouring pad (such as Scotch Brite™) along with a penetrating solvent (such as WD-40™)
  - Remove all rust and solvent residue with absorbent towels
  - Lightly coat the cleaned surfaces with a few drops of light machine oil (such as 3-in-1™)
- When rust causes pitting that interferes with smooth motion, replace the rusted component.

If inspection reveals rust or wear, replace the components

If this rust has pitted the surface, replace the shaft

Check lifter station operation

Any stickiness, misalignment or binding in the motion of the lifter station will almost always result in significantly reduced cut quality. .By verifying smooth, even movement, you promote high, quality cutting that is reproducible and economical.

1. Check that the drive screw moves freely in the bronze nut. Add a drop of machine oil if any binding is found.

2. Check that the drive screw spins freely in the roller bearings (flanged or regular) in the top and bottom end plates.

3. Check the bolts that hold the bottom end plate to the base plate. See that they are tight.

4. Loosen the pinch bolts that hold the precision shafts between the top and bottom end plates. Center the shafts between the top and bottom end plates, then tighten the pinch bolts.

   • Avoid over-tightening these pinch bolts. Over-tightening could lead to mis-alignment and binding.

   • Lightly oil the precision shafts.

   • Check the freedom of movement of the carriage from top to bottom by rotating the drive shaft.

5. Check the four motor mounting bolts. They should be tight.

6. Check and tighten the two set screws on the spring coupler.

Check for smooth motion

Check for restricted movement. Rotate the end of the drive shaft or the spring coupler. It should move freely end-to-end.

Check for restriction to movement
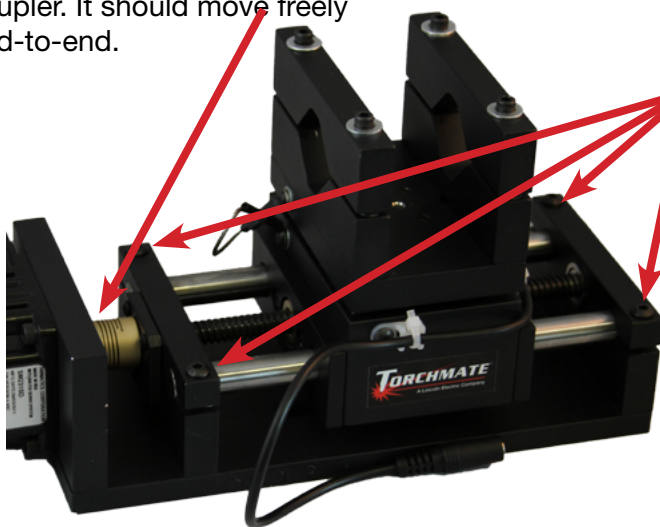
Do not make the pinch bolts too tight. This can force a shaft misalignment that can restrict carriage motion.

Test / adjust magnetic strength of breakaway

The magnetic force required to hold the breakaway carriage securely to the lifter station— yet allow it to easily detach during a collision—will be different for torches with different weights and cable configurations. An adjustment may be required to achieve a suitable magnetic strength level.

Test the strength

- After you mount your torch in the breakaway carrier, you can test the magnetic strength by simply breaking the torch away from the lifter station by gripping the torch on the bottom and pulling.

- You want a magnetic strength that:

  - Will allow easy breakaway in a collision

  - Securely hold the torch during normal operations without wobble or bounce

- If the strength is too low or too high, make the adjustment.

Adjust the strength

1. Loosen the three adjusting screws (on reverse side) by ¼ turn each.

2. Loosen the center screw in the hold ring by one to two full turns.

3. Adjust the three outer screws evenly, using quarter-turn increments.

   - Turn **clockwise** to **increase** the magnetic force (remember you have already made 1/4 counter-clockwise turn)

   - Turn **counter-clockwise** to **reduce** the magnetic force (remember you have already made 1/4 counter-clockwise turn)

4. Tighten the center screw and check that the hold ring is evenly spaced by the three adjusting screws.

5. Attach the breakaway and check breakaway force.
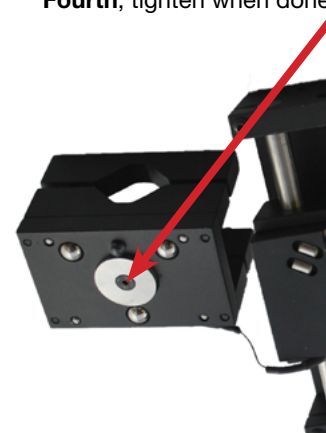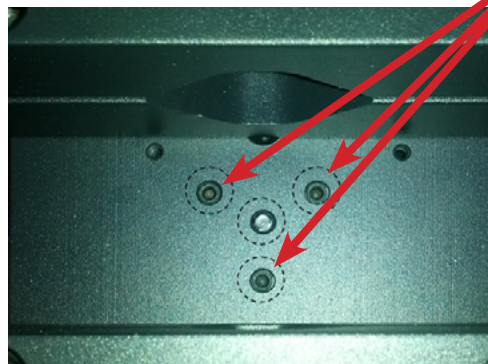
6. Repeat if necessary.

Where to adjust strength of magnet

First, loosen each of these three screws ¼ turn

Second, loosen center screw

Third, adjust "in" to increase or "out" to decrease force

Fourth, tighten when done

Connect extension cable and input cable

The lifter station upgrade with magnetic breakaway includes an extension cable with a mini-phone jack on one end, to connect to the magnetic breakaway sensor cable, and a set of spade lugs on the other end that connect to the CNC Control box input cable.

- If you have a cable carrier and /or a protective sheath for your cables, you will want to run the magnetic breakaway sensor cable extension through the carrier / sheath.

- Connect the mini-phone plug on the extension cable to the mini-phone jack on the lifter station. You should feel the connectors "click" together.

- Connect the spade lugs on the extension cable to the spade connectors on the CNC Control box input cable.

  - The spade connectors on the CNC Control box input cable are tagged with number tags. The usual practice is to use the #3 pair, however, using the Torchmate Driver software, any input pair can be configured.

  - The CNC Control box input cable comes with the AVHC Control box with the blue screen. If you have an AVHC Control box with a red screen, the CNC Control box input cable is a separately ordered item.

The extension cable connects with a mini-stereo phone jack
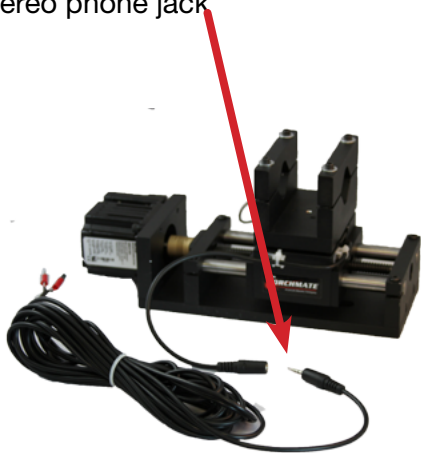
The CNC Control box input cable connects with the #3 set of spade lugs

Cables and connections

Torchmate Driver configuration

In addition to physically disconnecting the torch from the lifter station, the magnetic breakaway upgrade senses a physical breakaway with a normally-closed pushbutton switch and notifies the CNC Control box so that the plasma arc can be quickly stopped. This is configured in the Torchmate Driver software.

**Open the Torchmate Driver software**
- Launch the Torchmate Driver software.
- This is the Torchmate Driver icon that you can double-click on to launch the program.
- After connecting to the CNC Control box, use the menu for the following selection:
  Configuration > I/O > Input Lines ...

Use the Configuration menu
- On Line# 3, use the drop-down in the **Function** column to select **Feed Hold**. The Feed Hold setting stops the cut on breakaway, but does not reset the cut. After you correct the cause of the breakaway, you can restart the cut from where it stopped. If, instead, you select the **Safety** option, a breakaway event resets the cut to the beginning. (Note that "Red" screen AVHC Control boxes do not provide signals for input Line#s 1 and 2.)
- Change the description to something that indicates the breakaway fault. In the example, the description is **Break Away**.
- The **Wiring** column should indicate that the pushbutton is normally closed (**N.C.**).
- Other columns may be left with their default values.

Configure the input line
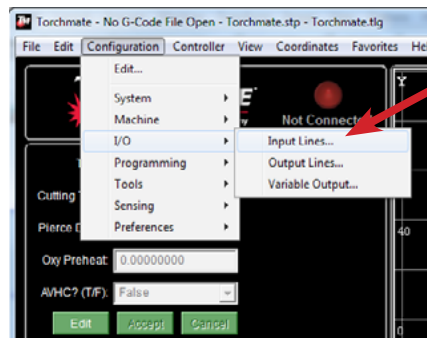
Select Input Lines

Set up the sensor

| Line #	Function	Location	Description	Wiring	Sensing Debounce (inches)
1	Control	N/A	Pierce Signal	N.O.	0.018300
2	Feed Hold	N/A	Fault Signal	N.O.	0.018300
3	Feed Hold	N/A	Break Away	N.C.	0.018300
4	Unused	N/A		N.C.	0.018300
5	Unused	N/A		N.C.	0.018300

Check / adjust pushbutton sensor activation

An adjustable set-screw keeps the pushbutton pressed (and normally-closed) when the magnetic torch holder is in its operating position. If the set-screw is extended too far, it could interfere with the complete attachment of the magnet. If the set-screw is retracted too far into the plate, the pushbutton may not close, causing the torch to fail to operate. This can be checked and adjusted with the help of the Torchmate Driver software.

• Launch the Torchmate Driver software.	**Open the Torchmate Driver software**
• After connecting to the CNC Control box, use the menu for the following selection: **Controller > Input Line Status ...**	
• With the magnetic torch holder in place, the button should be closed and the Status for Line 3 should be "green," and with the torch holder disconnected, it should be "red."	
• Adjust the position of the set-screw to achieve proper operation, then add a drop of blue thread-locking liquid to secure the set-screw.	**Adjust and lock the set-screw**
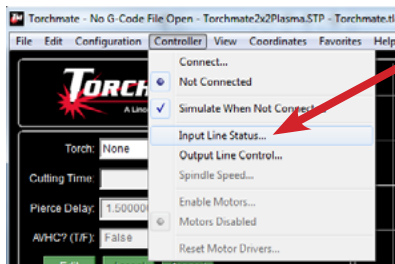
Input LIne Status

Select Input Line Status
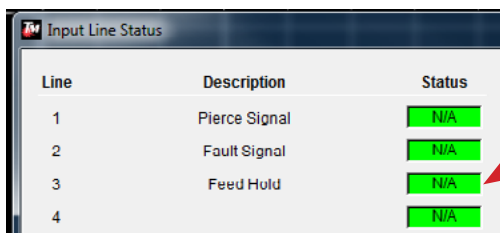
Where to adjust and lock the set-screw
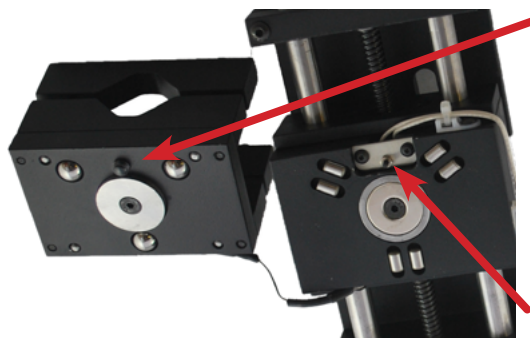
Inspect and adjust this set-screw, then secure it with a drop of blue thread locking fluid

Mini-pushbutton

Verify that status change is detected

Verify the push-button operation by manually breaking-away and restoring the torch holder

Power-up Controllers and Start Software

This Quick Start Guide is for use with a Torchmate CNC System that has already been assembled .configured, tested, and used. Use this guide if you have never made a cut on a Torchmate system before, or if you need to re-establish confidence in your procedures.

Turn on power to your CNC Controller

- You will have one of two CNC Controllers depending on the CNC cutting table model you have:

Compact CNC Controller for Growth Series tables

Pro CNC Controller for all other tables

- The power switch for each of these CNC Controllers is on the front.

- The power switch for the AVHC controller is on the back.

Turn on power to your AVHC Controller

Power switch

- Note: The 9-pin Motor Control cable has been removed for this photo to make the switch more visible, but you should leave your cable plugged in.

- Double-click the Torchmate 4 Driver Software (Black Icon).

- Click **Connect** to establish a connection with the CNC Controller (also referred to as the Signal Generator).
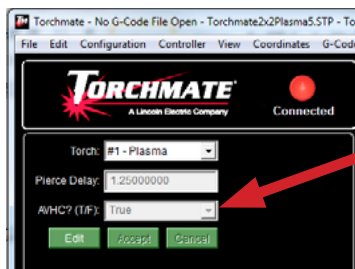

- Review the Safety Guidelines carefully. They are important. You must click **Agree** once you agree to the terms.

- You should now have access to the Torchmate Driver Software. Verify that your CNC Controller is connected by checking the status in the top-left corner of the screen:

- Click **Edit**, select **True**, and click **Accept** to set the **AVHC (T/F)** value.

True

Gather plasma cutter information

In plasma cutting, three settings control the quality of a cut: amperage, speed, and height. Amperage is selected first, then height, then speed, and changing one will change the subsequent settings. For each thickness and type of material the settings will be different. We start with looking up the amperage to use.
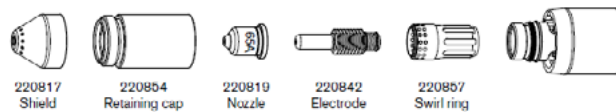
Decide which amperage fits your purpose

- For a given thickness and type of material, your plasma cutter may support different amperage settings. Generally, you can expect higher speed (and productivity) with a higher supported amperage, but finer quality (and lower speeds) with a lower supported amperage.

- Find the estimated cutting charts in the manual for your plasma cutter, . The cutting chart example below, which we will use as an example throughout this guide, is from a Hypertherm® Powermax 65/85 Manual. The chart is for 65 Amp / Mild Steel.

Check the cutting charts for your plasma power supply

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
	in	in	%	seconds	ipm	Volts	ipm	Volts
16GA				0.1	260	123	294	121
10GA					190	125	224	123
3/16 in		0.15	250	0.2	140	126	168	125
1/4 in				0.5	90	127	116	127
3/8 in	0.06			0.7	45	130	62	129
1/2 in		0.18	300	1.2	30	135	40	132
5/8 in		0.24	400	2.0	23	138	26	136
3/4 in					15	141	19	141
7/8 in		Edge Start			12	143	14	143
1 in					8	145	10	145

- The amperage rating on your nozzle has to correspond to the amperage on the cutting chart you are using. Unscrew the tip to check the amperage rating, which is etched or stamped onto the nozzle. The illustration below shows a nozzle rated at 65 Amps, which corresponds to our cutting chart.

Check your nozzle's amperage rating

| 220817 Shield | 220854 Retaining cap | 220819 Nozzle | 220842 Electrode | 220857 Swirl ring |

- The nozzle must be in good condition. If this is your first time cutting, and you are unsure of the condition of your consumables, you may want to re-assure yourself by using a new set of consumables. Consumables can be ordered from Torchmate's Technical Support staff or online from **www.TorchmateStore.com**.

Replace worn nozzles and electrodes

<div style="border:1px solid red">

TECHNICAL SUPPORT

Toll Free: 1-866-571-1066

International: 775-673-2200

Fax: 775-673-2206

Email: support@torchmate.com

</div>

- For setting-up your first cuts, select some material that will not easily flex and that is somewhere in the middle of the thicknesses listed on the cut chart. Let's say you want to perform the setup so that you can cut 1/4" plate using the example equipment and chart. In this case, you will note the following entries:

Example cut information

Cut Height (Torch-to-Work Distance)	0.06"
Pierce Height (Initial Pierce Height)	0.15"
Pierce Delay	0.5 seconds
Cut Speed (ipm)	90 inches per min.
Voltage	127 Volts

Set the Pierce Delay

With the 65 amp cut chart selected for our target material, we next set the Pierce delay and height. The AVHC Controller holds the torch at the Pierce Height briefly, during the pierce. The delay time is specified in the cut chart and it is set in the AVHC Controller

Verify the plasma cutter's "OK TO MOVE" connection

- For the AVHC Controller to be able to control the pierce delay, it must have a connection to the plasma cutter's "**OK TO MOVE**" input line, located on the cutter's CNC interface cable.

  - Refer to the previous page, [CNC Cable to Torch connection](#) to see how the "**OK TO MOVE**" line is connected.

- If your plasma cutter **does not** provide an "**OK TO MOVE**" connection, you can use an alternative configuration. Please call **Torchmate Technical Support** for more information on the alternative configuration.

- If your plasma cutter **does** provide the "**OK TO MOVE**" connection, proceed with the steps below:

Why a pierce delay is needed

- During normal cutting, after the plasma arc has been established, the high velocity and temperature of the plasma jet both melts and burns (oxidizes) the metal, and blows the molten metal and dross through and out the other side of the kerf.

- However, before this can happen, the material must be pierced all the way through (unless the cut is started on the edge of the material). During the piercing process, the torch is held stationary and molten metal and dross spatters back from the top of the material. This spatter can damage the torch shield and nozzle.

- To help avoid such damage, the torch is held at a greater distance above the material during pierce. This distance will be specified in a following step.

- Too short a delay means the torch will attempt to move and cut without the pierce being complete, while too long a delay means that material will continue to be removed around the pierce, so much so that the arc may be extinguished.

- For thicker material, the torch requires more time in the raised, stationary position to complete the pierce. Here, we will set the time delay that the torch spends in the pierce position.

- The blue-screen AVHC Controller displays it's **Main** screen when you turn it on. Note that the **CUT ON** light is off, so the torch will not accidentally start. During these initial setup steps, this light remains off.

- The Main screen shows:
    - **Current voltage**
    - **Set voltage**
    - Auto / manual mode as **Auto**
    - **Cut disabled** flashing

```
Current  Voltage:      0
Set  Voltage:        100
Auto       Cut  Disabled
Press  OK  to  Change
```

- Use the arrow keys to move though the screens until the **Setup Menu** screen appears. Press **OK** to enter the Setup Menu.

- Arrow down to the **Pierce Delay** screen.

- Press **OK** to enter the mode for changing the value.

```
Set  Pierce  Delay:
    .1


Press  OK  to  Change
```

- In our example from the cut chart, the delay is 0.5, so use the arrow keys on the AVHC controller to change the value to 0.5, then press **OK** to accept the value.

- The Pierce Delay is now set. Remember, you will usually be changing this value each time you select material that has a different cut chart.

- Arrow through the screens to the **Return to Main Menu** screen and press **OK**.

Measure the Pierce Height

Using the 65 amp cut chart for our selected ¼" steel material, we next set the torch heights. Because the Pierce Delay is so short, there's not time to get a measurement, so we will set the Pierce Height temporarily equal to the Cutting Height and then measure that.

Noting the Pierce Height on the AVHC Controller

- If you just performed the step of setting the **Pierce Delay**, you should be able to use the arrow keys to locate the **Pierce Height** screen.

  , and make a note of the current Pierce Height.

  ```
  Set   Pierce   Height:
   .14


  Press   OK   to   Change
  ```

  For our example, you will note the value 0.14.

Set Init Cut Height to match the Pierce Height

- The AVHC Lifter Station pauses at the Pierce Height before moving to the Init Cut Height, but the pause is not long enough to allow for making a measurement. To measure the Pierce Height, we will set the Init Cut Height to match the Pierce Height so that they can be measured together.

- Use the down arrow to select the **Init Cut Height** screen. Press **OK** to select **Change** mode. Use the up or down arrows to select the value you noted for Pierce Height (in our example, .14).

  ```
  Set   Init   Cut   Height:
   .14
  Press   OK   to   Accept
  Hold   OK   to   Cancel
  ```

Prepare for the simulated cut

- Position the ¼" plate under the torch. Make sure that nobody and no objects will be in the way when the torch drops toward the plate.

- On your Torchmate Driver Software screen, click the **AUX** button (bottom left of screen). The AUX panel shows one or more tool status buttons. The **Plasma Off** button should appear gray.

- Click on the **Plasma Off** button. This will change the button to from gray to a yellow **Plasma On** status button and the table will simulate a cut start without actually turning on the torch.
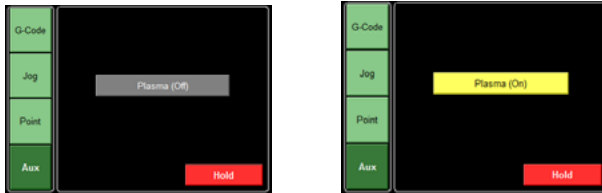
- The AVHC Lifter Station will move the torch down, sense the material with the torch tip, then stabilize at the Init Cut Height (which is also the Pierce Height).

- Measure the Pierce Height between the work material and the torch tip with a **Feeler Gauge**.

- For our example, lets say the measured Pierce Height/Cut Height is .10.

- *Note: AVHC settings on the blue screen are relative to the physical adjustment of the torch in the holder. As it's most often impractical to physically move the torch in its holder in hundredth-of-an-inch increments, and there will always be a small amount of play in the drive screw and nut, the indicated settings will almost always differ from the physical measurements. This is normal.*

Reset the Pierce Height and Cutting Height

If there is a difference between the Pierce Height from the cutting chart and what we have measured, we will adjust the AVHC settings to compensate for that difference. Then we will re-check the measurements.

Calculate the Adjusted Pierce Height

- In our example, the measured Pierce Height/Cut Height is 0.10. The cut chart specifies a Pierce Height of 0.15. The difference (+0.05) is how much we will change the AVHC settings for both Pierce Height and Init Cut Height. We will change them both because we want to re-measure to verify the Pierce Height before moving on to setting the Cut Height.

(Example)	Pierce Height	Adjusted Pierce Height
Cut Chart	0.15	
AVHC	0.14	(+0.05) = 0.19
Measured	0.10	(+0.05) = 0.15

Reset the Pierce Height and Init Cut Height

- Use the arrow key to select the Pierce Height screen and press OK to go into change mode. Use the arrows to change the height. Press OK to accept the change.

- In our example the change will be 0.05, from 0.14 to 0.19, because the measured Pierce Height is too low. We will also change the Init Cut Height to the matching value:

```
Set  Pierce  Height:
 .19
Press  OK  to  Accept
Hold  OK  to  Cancel
```

```
Set  Init  Cut  Height:
 .19
Press  OK  to  Accept
Hold  OK  to  Cancel
```

- *Note: AVHC settings on the blue screen are relative to the physical adjustment of the torch in the holder. As it's most often impractical to physically move the torch in its holder in hundredth-of-an-inch increments, and there will always be a small amount of play in the drive screw and nut, the indicated settings will almost always differ from the physical measurements. This is normal.*

- To have the torch move to the new value you entered, click on the Plasma ON status button (which retracts the torch) and again on the Plasma OFF status button. The torch should repeat moving the torch down, sensing the material, and rising and stabilizing at the Pierce Height / Init Cut Height.

Simulate cutting

- Use the **Feeler Gauge** to verify the measured Pierce Height matches the Cutting Chart value. In our case the measured value should be 0.15.

Measure to verify the Pierce Height

- If the measured height remains incorrect, repeat the steps starting at the top of this page.

Repeat if necessary

Reset the Cutting Height

Now that the Pierce Height is set, we will reset the Cutting Height using the previously measured values. Again, we will re-check the measurements.

Jog to and set the zero point

- In our example, the measured Cutting Height followed the Pierce Height and is now. 0.15. The cutting chart specifies a Cutting Height of 0.06. The difference (-0.09) is how much we will change the AVHC settings for the Init Cut Height.

(Example)	Cut Height	Adjusted Cut Height
Cut Chart	.06	
AVHC	.19	(−.09) = .10
Measured	.15	(−.09) = .06

Reset the Init Cut Height

- Use the arrow keys to select the Init Cut Height screen. Press OK to go into change mode. Use the arrows to change the height. Press OK to accept the change.

- In our example, we will change the entered value from 0.19 to 0.10. This reduction of 0.09 should change the measured Cut Height from 0.15 to 0.06. Press OK to accept the change.

```
Set   Init   Cut   Height:
  .10
Press   OK   to   Accept
Hold   OK   to   Cancel
```

- To have the torch move to the new value you entered, click on the Plasma ON status button (which retracts the torch) and again on the Plasma OFF status button. The torch should again move down, sense the material, briefly rise to the Pierce Height, and lower, stabilizing at the Init Cut Height.

Simulate cutting

- Use the **Feeler Gauge** to verify the measured Init Cut Height matches the Cutting Chart value. In our case the measured value should be 0.06.

Measure to verify the Init Cut Height

- If the measured height remains incorrect, repeat the steps starting at the top of this page.

Repeat if necessary

- At this point you should have setup the correct Init Cut Height and Pierce Height.

Technical Support

Call, Fax, or Email

When building or maintaining a table, if a question or concern arises, or a part is missing, please contact Torchmate technical support.

Technical support will also help you with operating the CNC system,and troubleshooting problems.

Technical support is available Monday through Friday from 6 AM to 4 PM (06:00 to 16:00) Pacific Time Zone.

Toll Free: 1-866-571-1066

International: 775-673-2200

Fax: 775-673-2206

Email: support@torchmate.com

Call us for Consumables   or visit our web store
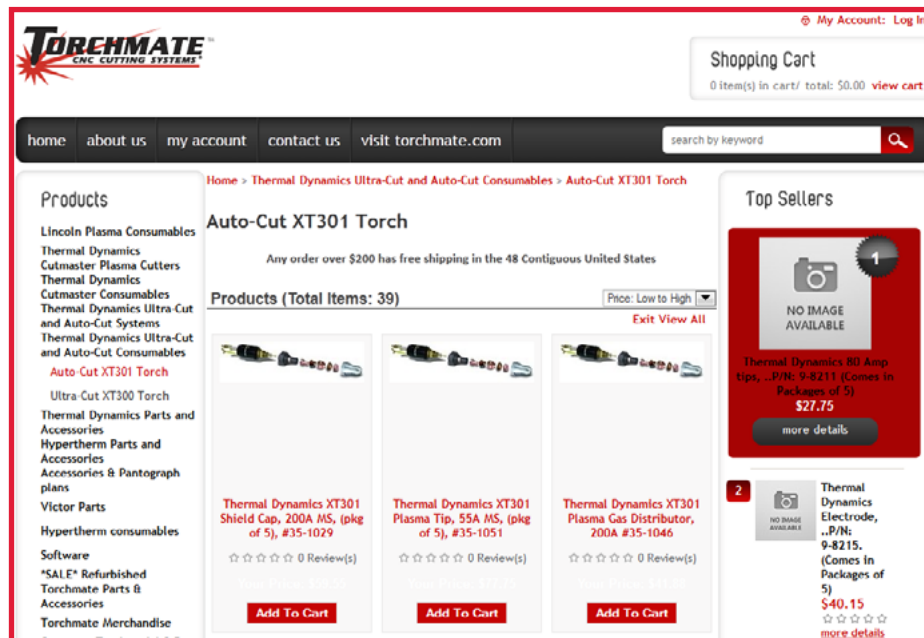
www.TorchmateStore.com

Test Cuts for Speed and Voltage

Prepare for the Speed Test

The amperage and height have now been setup. The next thing for us to find is the best speed to cut the selected material. We'll do this by producing a number of cuts at different speeds, so we need to setup for actual cutting.

Set Plasma Cutter Amperage
- Set the amperage on your plasma cutter according to the selected cut chart. The illustration below shows the amperage adjustment knob for the Hypertherm® Powermax 65/85 we have been using as our example, and with the power on, we would turn the adjustment knob until 65 was displayed for amperage on the status screen.
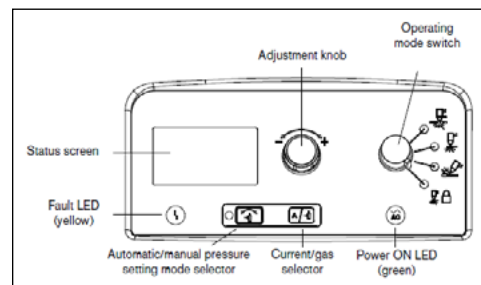
Replace worn nozzles and electrodes
- The electrode and nozzle need to be in good condition to get a test cut that provides useful information, check their conditions, and also verify that the amperage rating is the same as the amperage set on the plasma cutter. If the nozzle or electrode show significant wear, replace them before continuing with the test cut.
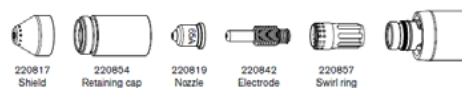
- IMPORTANT:
  Check that the **AUX** status button is showing **Plasma Off**.

Ensure Plasma is OFFI

- Arrow down on your AVHC Controller to the Auto /Manual screen. Press OK to enter change mode, then press an arrow key to select **Manual**. Click OK again and confirm the change to Manual mode.

Change AVHC mode to Manual


```
Select   Auto / Manual :
Manual

Press   OK   to   Change
```
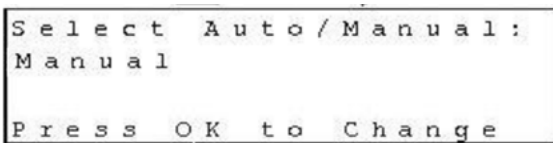
- Press the Up and Down arrow at the same time to return to the Main menu.

- Press and Hold the Cut Button on the AVHC until the Cut light is turned on.

Put the AVHC Controller into Cut mode
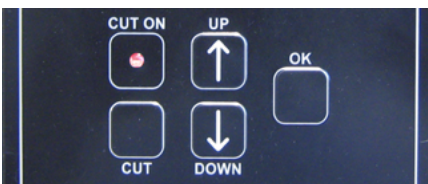
Load the Speed Test cut file

The Plasma Cutter is ready to cut and the AVHC Controller is ready to cut. We will now load a Speed Test file that will help us find the best cutting speed for our setup and our material.

**Load the Speed Test G-code File**

- On the Torchmate Driver Software Click on File → Open G Code.
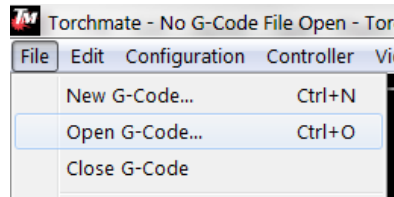
- If your sample cut material is 3/8" or less in thickness, you will open a file called: **Line speed 130-10**

- If the material is thicker than 3/8," open the file called: **Thick line speed test**.

- If you don't initially see the files, navigate to: **C:\Torchmate Data\G-Code.** Select the file and click **Open**.
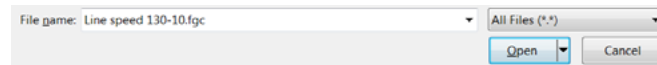

- The cutting path is displayed in red.
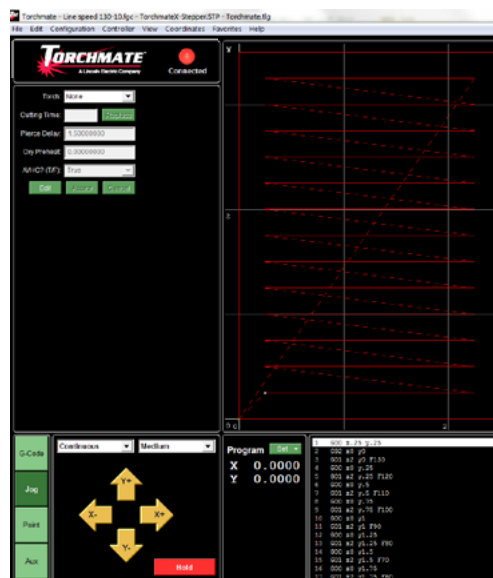
- To move the torch to the starting location point above your material (where X=0 and Y=0). select the **Jog** button, use the drop-down selections to control how the torch responds to the arrow buttons, then use the arrow buttons to move the torch.
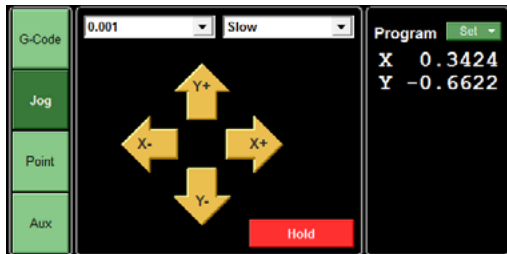
- To the right of the Jog arrow buttons, in the coordinates section, click the **SET** button, then select **Zero all**. This sets the coordinates to zero and the current torch position is now zero in the G-code file.
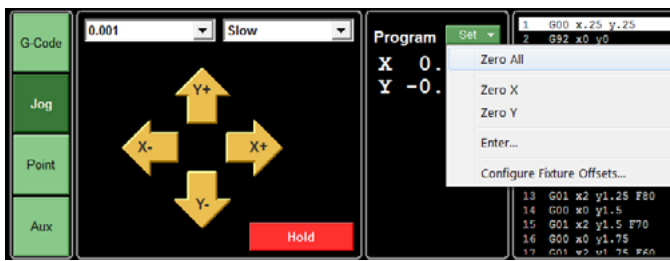
- The speed test is now ready to cut.

Cut the Speed Test

The Plasma Cutter is ready, the AVHC Controller is ready, the Speed Test file is loaded into the Torchmate Driver software. Performing the cut will now help us find the best cutting speed for our setup and our material.

Check the cut light
- Make sure that the Cut light is still lit on the AVHC Controller.

> ** Use proper eye protection if you look at the arc. **
>
> ** Check that the work (ground) clamp is attached to the material or cutting table at all times. **

Start the cut
- The machine is now ready to cut. Click the **G-Code** button. Click the **Start** button. The cutting process begins.
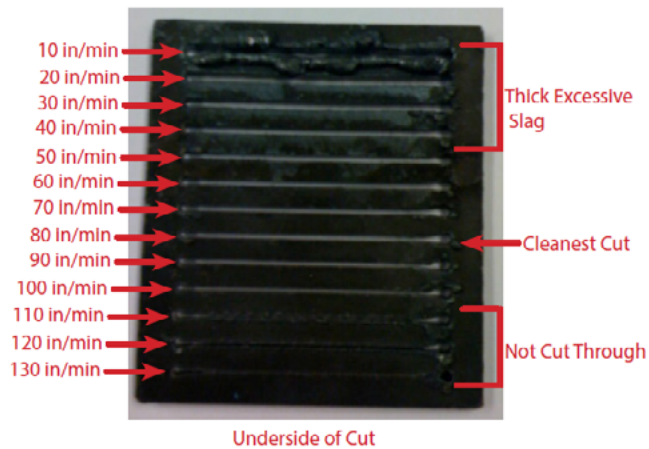

- When the machine finishes the cut, retrieve the cut part.

-

> ** Caution the cut material may be very hot **

- Inspect the cut piece to find the best cut and bevel quality.

10 in/min
20 in/min
30 in/min
40 in/min
50 in/min
60 in/min
70 in/min
80 in/min
90 in/min
100 in/min
110 in/min
120 in/min
130 in/min

Thick Excessive Slag

Cleanest Cut

Not Cut Through

Underside of Cut

- If you used the **Line Speed 130 – 10,** the fastest cut, 130 in/min was cut first at the bottom, and the speed of each higher line decreases in 10 in/min increments down to 10 in/min at the top.

- If you used the **Thick Line Speed Test,** the slowest cut, 10 in/min was cut first, and the speed of each line increases in 10 in/min increments up to 70 in/min at the top.

- Make a note of the best speed for the type and thickness of material you used. In our example photo, we select 80 in/min, which is close to the cutting table's 90 in/min.

- Some small variation can be expected due to differences in humidity, altitude and other factors.
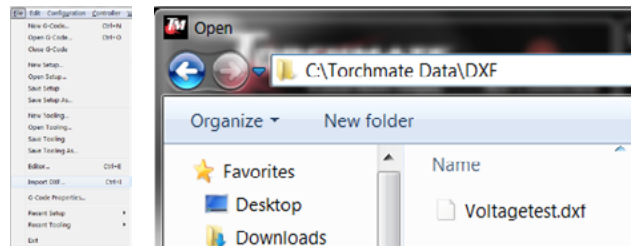
Set the best voltage

The AVHC Controller uses the voltage of the arc to maintain the height of the torch during cutting in Auto mode. This allows you to use the AVHC to make good quality cuts on material that is not perfectly flat. By measuring the voltage in Manual mode, you can specify the Set Voltage that will maintain the correct height during Auto mode cutting.
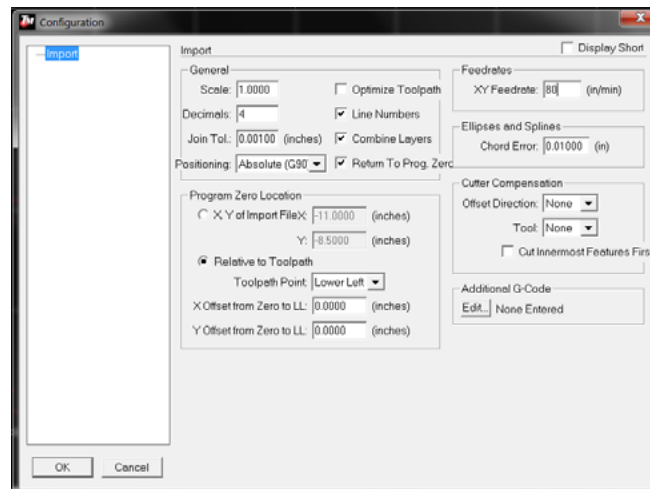
Start the Voltage Test

- To setup the AVHC Controller with the best Set Voltage, we will observe the actual voltage on a test cut and use that value.

- In the G-Code files in the speed test, the speed was already specified, but we want to set the best speed (which we just found) for this cut. When you import a DXF file, you can set the Feed Rate (speed) in a configuration window before you save the file as G-Code.

Import the Voltage Test DXF File

- Import **Voltagetest** from **C:\Torchmate Data\DXF**.

- You'll be asked for a filename to store the G-Code in. You can accept the suggested name of **Voltagetest** and the suggested location at **C:\Torchmate Data\G-Code**. The configuration screen appears.

- Set the **XY Feedrate** to the best quality speed found in the line speed test for the test cut material. Then click **OK**. In our example, we are using the 80 in/min speed from the speed test.

- The voltage test cuts two 6" lines just over an inch apart. As before, jog to a suitable location on your test material and zero the coordinates.

** Use proper eye protection if you look at the arc. **

** Check that the ground clamp is attached to the material or cutting table at all times. **

** Caution the cut material may be very hot **

- Click **Start** in the G-Code panel. As the torch cuts the lines, watch the Main screen of the AVHC Controller and note the Current Voltage on the main screen.

```
Current   Voltage:     126
Set   Voltage:         100
Manual      Cut   ENABLED
Press   OK   to   Change
```

- On flat material, the current voltage will hold fairly steady on one voltage. In our example, the voltage hovers around 126 volts. This is close to the voltage specified in the cut table (127 volts). Make note of this number.

- After the testing, change the Set Voltage to the value you noted. Set the mode to Auto, and press the Cut button on the AVHC Controller to disable cutting until you are ready to perform a suitable cut of your own design.

```
Current   Voltage:       0
Set   Voltage:         126
Auto        Cut   Disabled
Press   OK   to   Change
```

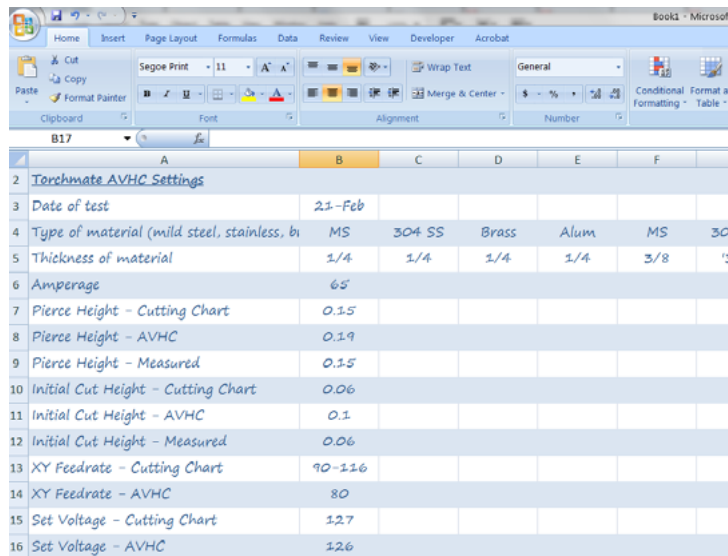# Begin a notebook and start cutting

The AVHC Controller and Plasma Cutter values you have determined through testing are valid for all cuts on any material of the tested type. For each different type and thickness of material you will cut, perform a similar set of tests. By writing down and keeping your test results, you will minimize the amount of re-testing you will need.

Congratulations!

- You have now determined the Initial Cut Height, Pierce Height, Arc Voltage, Feed rate, and Amperage. Using these values, you can cut any shape on the material you tested.

- You will make similar test cuts whenever you cut a different type or thickness of material.

Keep a notebook

- It will be a great help to keep a "cheat sheet" notebook or spreadsheet with all the test results for all the material and amperage selections you use. Keep a separate page for each test or make a table showing the :

  - Type of material (mild steel, stainless, brass, etc.)
  - Thickness of material
  - Amperage
  - Pierce Height
  - Initial Cut Height
  - XY Feedrate,
  - Set Voltage

- These values should not change until you pick a new type or thickness of material. Run a new set of tests for each new type or thickness.

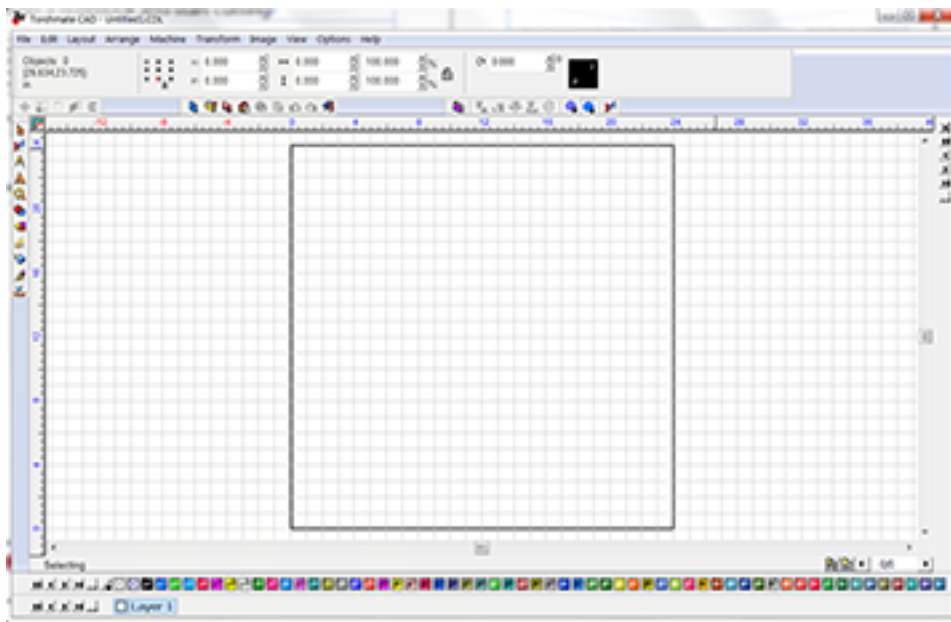|	A	B	C	D	E	F	G
2	Torchmate AVHC Settings						
3	Date of test	21-Feb					
4	Type of material (mild steel, stainless, br	MS	304 SS	Brass	Alum	MS	304
5	Thickness of material	1/4	1/4	1/4	1/4	3/8	'3.
6	Amperage	65					
7	Pierce Height – Cutting Chart	0.15					
8	Pierce Height – AVHC	0.19					
9	Pierce Height – Measured	0.15					
10	Initial Cut Height – Cutting Chart	0.06					
11	Initial Cut Height – AVHC	0.1					
12	Initial Cut Height – Measured	0.06					
13	XY Feedrate – Cutting Chart	90–116					
14	XY Feedrate – AVHC	80					
15	Set Voltage – Cutting Chart	127					
16	Set Voltage – AVHC	126					

- You can now import a DXF file for a part you want to cut or run additional tests (adding new "cheat sheets" to your notebook for additional material types, thicknesses and amperages.

- For each cut, you will:

  - Import a DXF file

  - Set the XY Feedrate

  - Check the Scale

  - Jog the torch to the X = 0, Y = 0 position

  - Select Program Set Zero All

  - Set the cut light on

  - Click the G-Code button

  - Click Start.

- To create new parts and to export their files in the DXF format, use the Torchmate CAD or Torchmate CAD-Lite. The instructions for using this software can be found here: **http://www.torchmatesupport.com/cad/**

Import and cut DXF files

Use Torchmate CAD or CAD-Lite to create new DXF files

Technical Support

Call, Fax, or Email

When building or maintaining a table, if a question or concern arises, or a part is missing, please contact Torchmate technical support.

Technical support will also help you with operating the CNC system,and troubleshooting problems.

Technical support is available Monday through Friday from 6 AM to 4 PM (06:00 to 16:00) Pacific Time Zone.

TORCHMATE®
A Lincoln Electric Company

Toll Free: 1-866-571-1066

International: 775-673-2200

Fax: 775-673-2206

Email: support@torchmate.com

Call us for Consumables, or visit our web store

www.TorchmateStore.com