ARC

VOLTAGE

TORCH

HEIGHT

CONTROL

Operation Manual

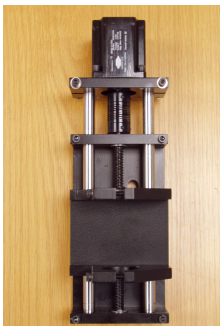
Table of Contents

ITEMS CHECK LIST

Your new Arc Voltage Torque Height Control, AVHC, system should include the following items. Please check each item has been included and free from damage.

NOTE: If any of the following items are missing please call 775-673-2200

(1) Arc Voltage Torch Height Control Box



(1) Lifter Station - Motor Preprogrammed from Factory

(1) Communications Cable

(1) Motor Cable

(1) Power Cord

WARNINGS

When working on or maintaining your plasma cutting system, be sure to disconnect all power sources. High voltages and amperages are present and can be fatal.

For arc voltage interface installation follow manufacturer's instructions carefully.

Be careful to check arc voltage polarity before connecting to the control console. Incorrect polarity can cause major damage to the control system and is not covered under warranty.

Always follow all plasma system manufacturers' safety precautions. These cautions also apply to the height controller system.

While the Torch height control can dramatically reduce the dependency of human intervention in the cutting process, never leave the machine unattended while cutting. Parts may "tip-up" after being cut and interfere with machine travel.

Plasma cutting systems produce high EMI (electromagnetic interference) which can cause unpredictable electronic system effects and operation. To reduce the potential of interference, always separate the control cables from the plasma torch cable by at least 6 inches where possible.

The work clamp, or ground wire, should always be attached to the material that you are cutting. This will ensure that the electricity needed to cut through the material is flowing from the Torch tip (Negative charge) to the work clamp (Positive charge) in a path of least resistance. NOTE: Attaching the work clamp to the table can cause this electricity to flow through other components of the table, such as the motors, and cause internal damage.

SYSTEM REQUIREMENTS

Your plasma system must have an available output for raw arc voltage. Raw arc voltage is equal to the actual cutting voltage and is not conditioned by a voltage divider to reduce the sensing voltage. If your system has a voltage divider or reduced sensing voltage, consult Torchmate to have your system calibrated to work with your plasma system. Use 18-20 gauge wire.

Your plasma system must have two wires that can be used to initiate plasma cutting by connecting these two wires together with either a switch or relay contact with a load no greater than 2 amps. The torch height control has a relay internally to accomplish this task. If your plasma requires more than a 2 amp signal, an external relay can be added. Consult Torchmate for details. You will need to supply a two conductor cable from the THC to the plasma unit. We recommend an 18 to 20 gauge wire for most systems.

Your CNC system must have an output relay that can be used to initiate the cutting sequence. A normally open contact rated at 1 amp that closes at the start of cut sequence will suffice. You will need to supply a two conductor cable from the relay to the THC (Torch height control) unit. We recommend an 18 to 20 gauge wire.

The construction of your cutting table will need to support the metal being cut sufficiently to avoid flexure when the torch contacts the material on initial approach height sensing. The Torch applies a load of 5-10 pounds of force to "feel" for the material. The table should support the material to avoid tipping the material over a support or over flexing the material. More details are given in the operation section of the manual.

PRINCIPLES OF OPERATION

It is important to understand how the system operates to avoid potential problems and to assist in diagnosing operational errors or failures.

The THC (Torch Height Control) system consists of two main components, the lifter station and the control console. There are two cables connecting the lifter station to the console and one power cord which supplies AC for the console. In addition you will install 3 two conductor cables that supply information to and from the THC system. The first cable from the CNC to the THC console tells the system to begin auto height sensing sequence and initiate the cut. The second cable supplies the arc voltage to the THC from the plasma power unit to determine the torch height while cutting. The third cable allows the THC to tell the plasma unit to fire the arc and stop the arc when the cut is complete.

Upon power up, the THC will raise the torch and establish the "home" position. You may use the up/dn switch to jog the torch up or down as desired.

Setting the auto / man (automatic / manual) switch to the manual position prevents cutting operation of the plasma. In the auto position, the THC will operate the plasma and height sense sequences.

When the CNC closes its' output contact to start the cut, the THC begins the initial height sensing sequence by sending the torch down to the metal surface. The torch will "feel" the metal by applying 5-10 pounds of force. When it senses that the torch has stopped moving, it reverses the motor and brings the torch back up to the preset pierce height. This height is adjusted by the "Pierce Height" knob on the front of the unit and can be set up to ½" from the metal surface. The THC then closes the plasma start output relay and tells the plasma to fire the arc.

After the arc is established, the THC will begin sensing and averaging the arc voltage. This voltage is compared to the "SET" voltage. The set voltage is adjusted on the front of the console by turning the "Set Volts" knob while observing the digital display. Note the selector switch must be in the "SET" position to read the voltage setting. The THC makes corrections to the torch height to maintain the arc voltage within 5 volts plus or minus. The set voltage may be changed while cutting to adjust torch height. In the "READ" selector position, the console will show the actual arc voltage.

At the end of cut, the CNC relay will open. This will signal the THC to stop the plasma and lift the torch back to the home position.

It should be noted that since many CNC systems do not accommodate an arc established input, no output has been provided. As a result, the CNC can only "assume" that the arc is established prior to machine motion. A standard 4.5 second delay has been programmed so that your CNC can always use the same start delay. Remember to program your system for approximately 5 seconds of delay after a start of cut command. A 2 second delay after end of cut will allow the torch to move away from the material before machine motion begins and avoid many "tip-up" parts.

INSTALLATION

Install the lifter station onto your Y axis carriage using two 5/16” or 3/8” bolts. Be sure that the bolt heads do not interfere with slide travel. (Fig. 1)

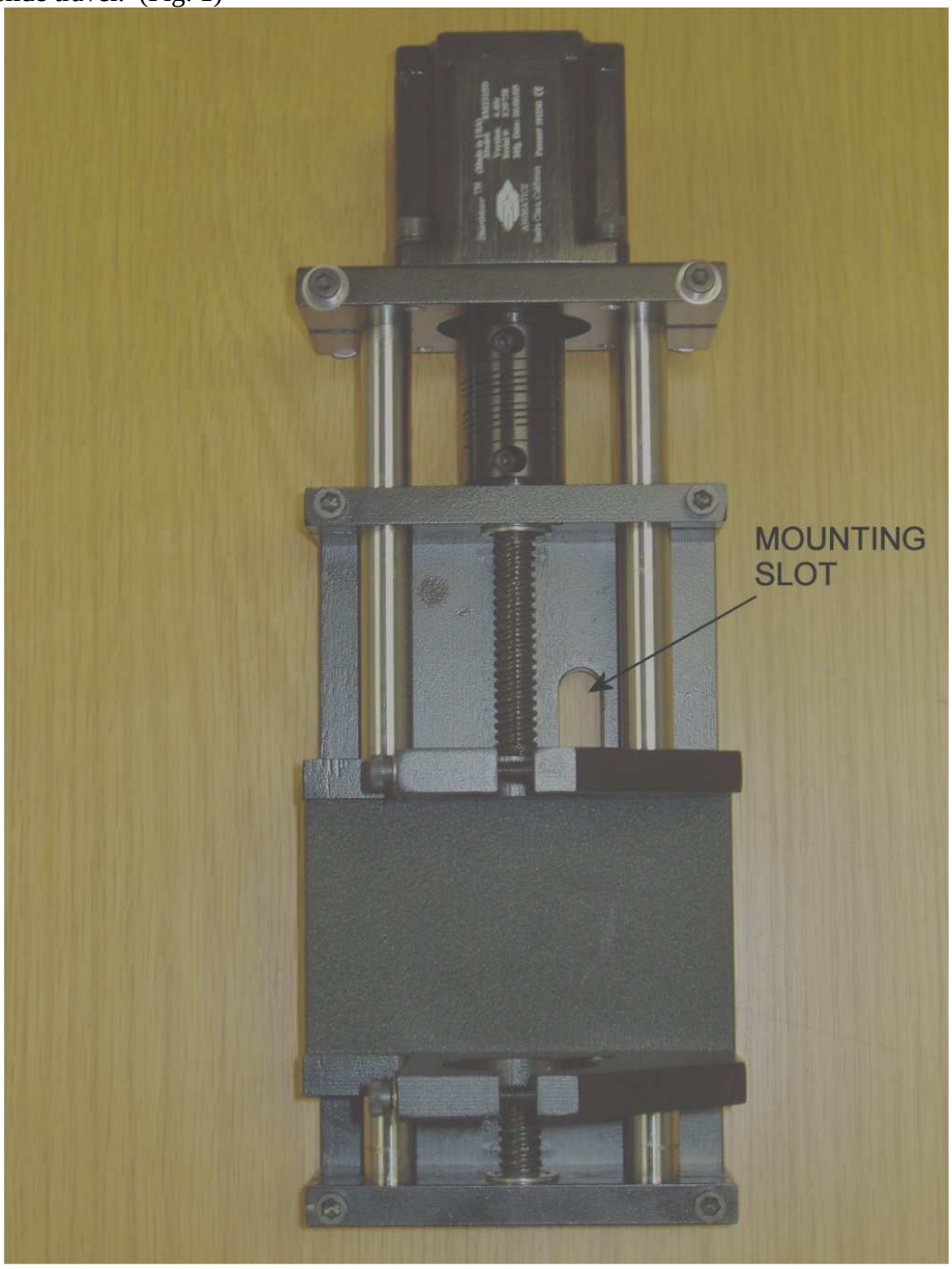
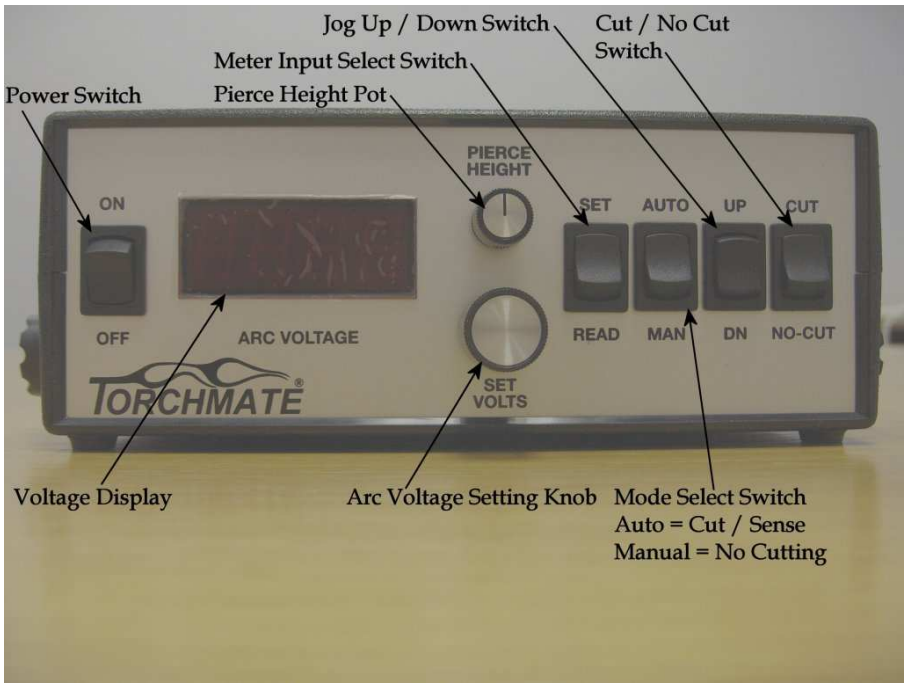
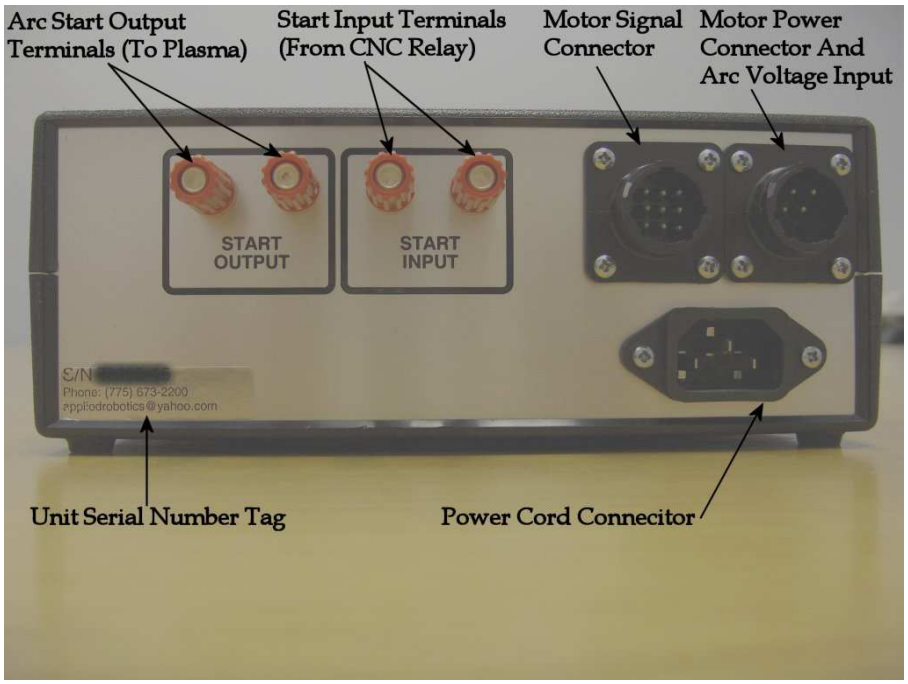


Figure 1

Attach the two lifter station cables to the lifter motor. Run the cables to the console and connect the round plugs to the back of the console. NOTE: To avoid unnecessary damage or stress to motor cables and connectors, leave a short cable loop coming off lifter station motor when routing cables back to console. If longer cables are required (30 ft supplied) contact Torchmate. Place the console where it can be accessible while cutting but away from metal splash when piercing. It is a good idea to place it in a cabinet with the CNC computer and monitor.



CONSOLE FRONT PANEL, Figure 2



CONSOLE REAR PANEL, Figure 3

Run a two conductor cable (18-20awg) -from the two terminals on the back of the unit marked “START INPUT” to the normally open contact of your CNC start relay. This contact will close when the start of a cut is encountered on your CNC system. See Fig 4. Polarity of this cable is not important.

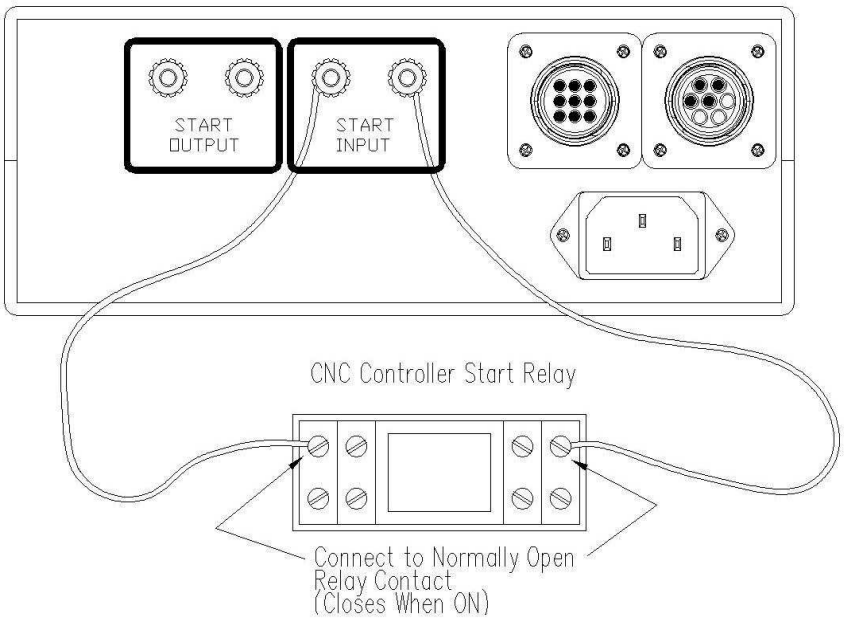


Figure 4

Connect the flying leads on the 20’ section of your “Motor Power Connector and Arc Voltage Input” (see fig. 3 on page 7) to your plasma power supply arc voltage output. POLARITY IS CRITICAL. (See Fig 5. Red is positive and black is negative). (See Warnings described on page 4 of this manual).

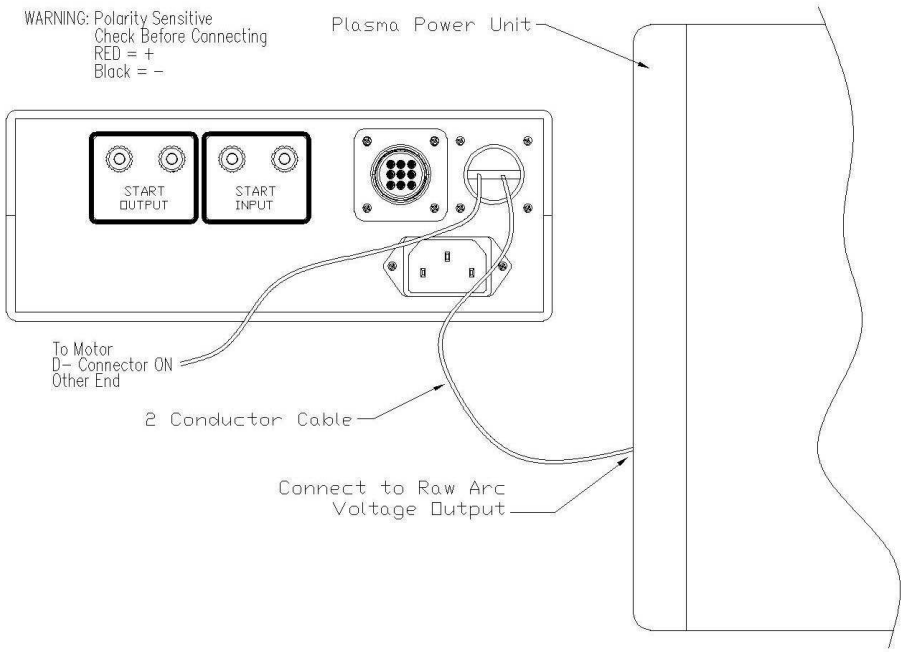


Figure 5

Run a two conductor cable (18-20awg) from the two terminals on the back of the console marked “START OUTPUT” to the plasma power supply start switch terminals or wires. See Fig 6. The Hypertherm Powermax 600, 900 and 1100 plasma cutters, have a short small diameter cable, about 12” in length, protruding from the large plasma torch plug. Cut the fitting off the end of this short cable and use only the Black and White wires. The remaining Green wire in this series of plasma cutters will not be used.

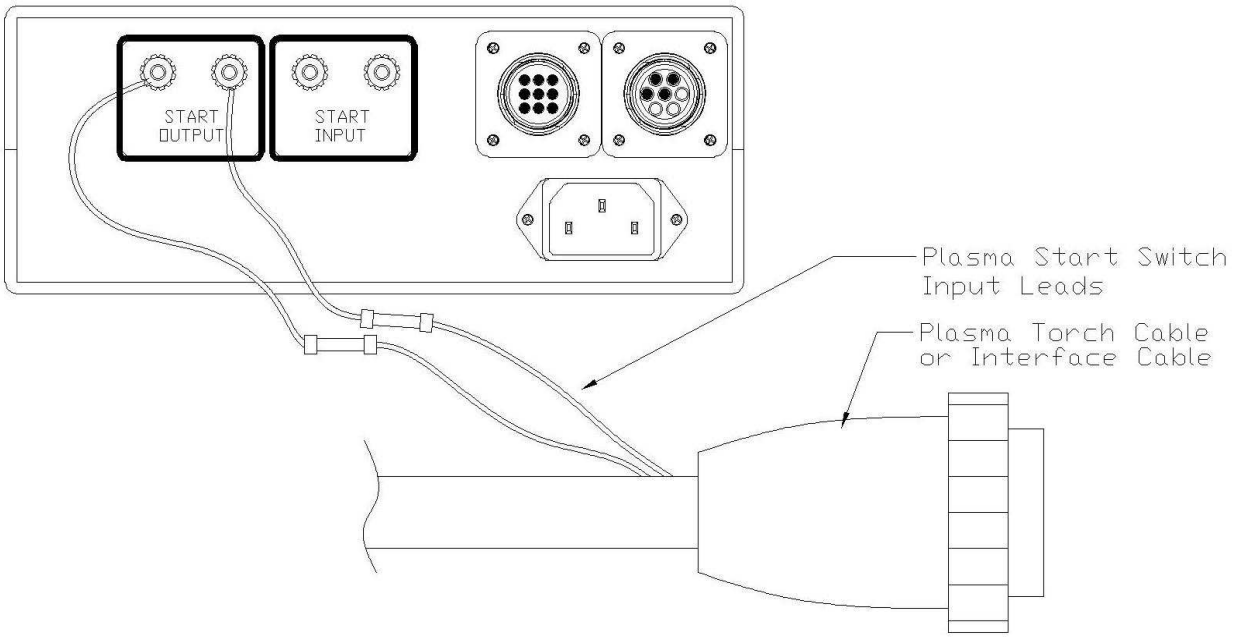


Figure 6

For Powermax 1000, 1250 and 1650 plasma cutters, Hypertherm makes an interface cable that connects to the back of the plasma cutter via an amphenol connector. This particular cable contains four wires. Of these four wires only the Green wire and one Black wire will be used. The correct Black wire, when touched with the Green wire, will fire the torch.

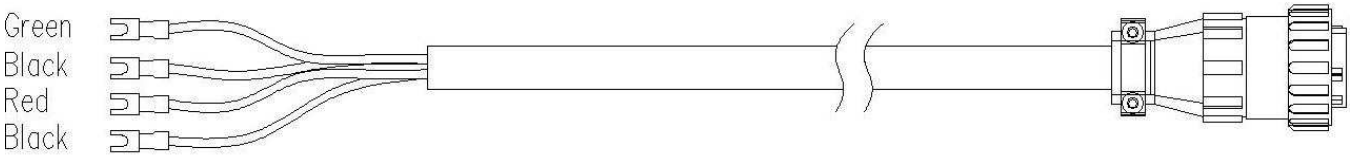


Figure 6B

Install the power cord. Turn on the power switch and manually jog the torch up and down to verify the required travel and connections.

CONNECTIONS

The numbered steps below correspond to the matching numbers in figure 7. While the components are laid out on the floor in figure 7 for clarity, you will obviously mount the lifter station and the control console in the final locations before connecting the cable.

1. Connect the 9 pin cable between the left AMP CPC receptacle on the back of the control console and the lower port on the lifter station motor.

2. Connect the 4 pin cable between the right AMP CPC receptacle on the back of the control console and the top port on the lifter station motor.

3. Connect the power cord to a 115 volt wall outlet.

4. The cable shown contains two wires that must be connected to an arc voltage take-off on your plasma cutter. It is critical that you get the polarity correct. The red wire is positive and black wire is negative. Failure to do this will damage your unit. Consult your plasma cutter owner's manual for information on locating the arc voltage take-off.

Note: The remaining plug on the short cable (5) is not used. It is used only for initial programming of the lifter station motor.

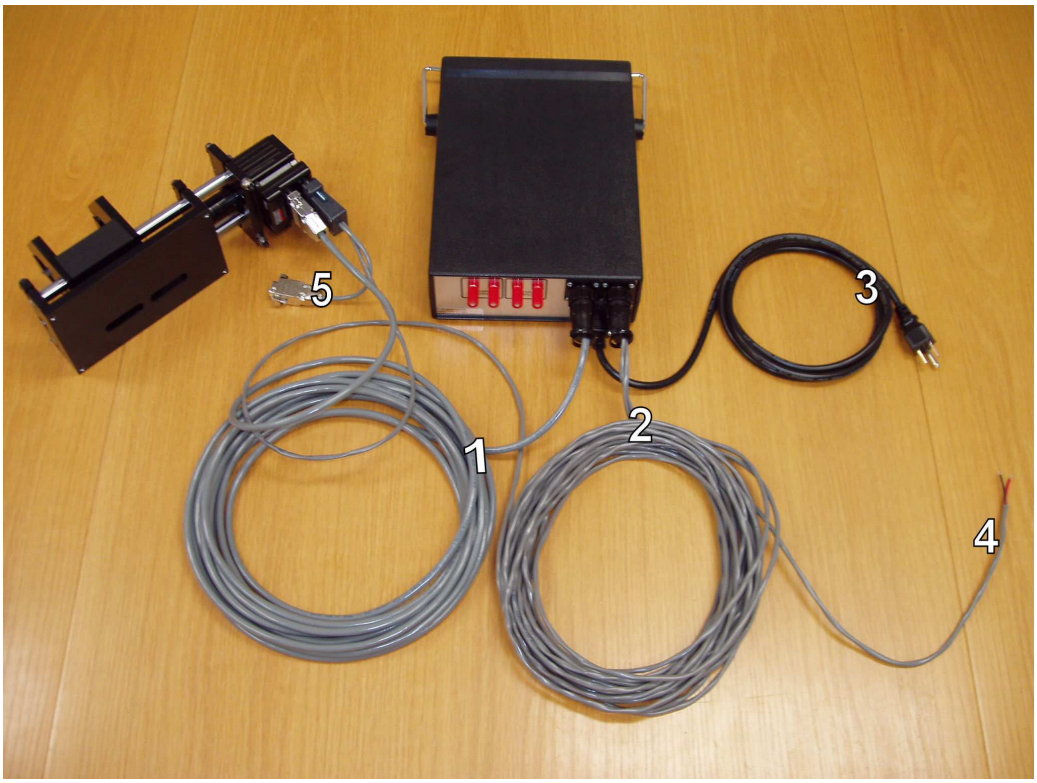


Figure 7

OPERATION

To begin with, place the material to be cut under the torch head or jog the machine to the start point. You may use the jog UP or DOWN switch to aid in alignment. On small or scrap pieces, be sure that the pierce points will be between table supports. If not, the initial height sensing can cause the material to flip up and drop off the supports. Also be sure that the support is sufficient to eliminate over flexing of the material. The initial sensing will place 5 to 10 pounds of pressure on the material with the torch head. This is equivalent to a hard press with your finger. If the material flexes and follows the torch back up, the pierce can splash molten metal back into the tip of the torch causing cut quality problems or shorting. This is generally only a problem on thin materials.

If you will be cutting thin materials, and flexure is consistent, you may adjust the pierce height as described below to accommodate this. If flexure is not consistent, you may want to use a plasma torch shield with stand off tabs. These are used on hand torches. Hypertherm part # 120601 can be used on Powermax 900 units. (Hyp # for 1100?) The additional tabs will allow material to exit out the sides when piercing, however a slightly higher arc voltage will be required to keep the tabs from contacting the plate.

SETTING ARC START DELAY

In order to allow the THC time to find the metal and pierce, you will need to add a time delay to the start sequence of your CNC software. Consult your software documentation on how to do this. Standard delay is 5 seconds. You may adjust this as required to obtain optimum operation. The transition from pierce to cut should be smooth. If the machine waits too long to start moving, reduce the delay. If the machine starts moving while or before piercing, increase the delay. If your software allows, also set a stop delay of about 2 seconds to allow the torch to move away from the metal before machine motion. This avoids hitting tip-up parts.

SETTING PIERCE HEIGHT

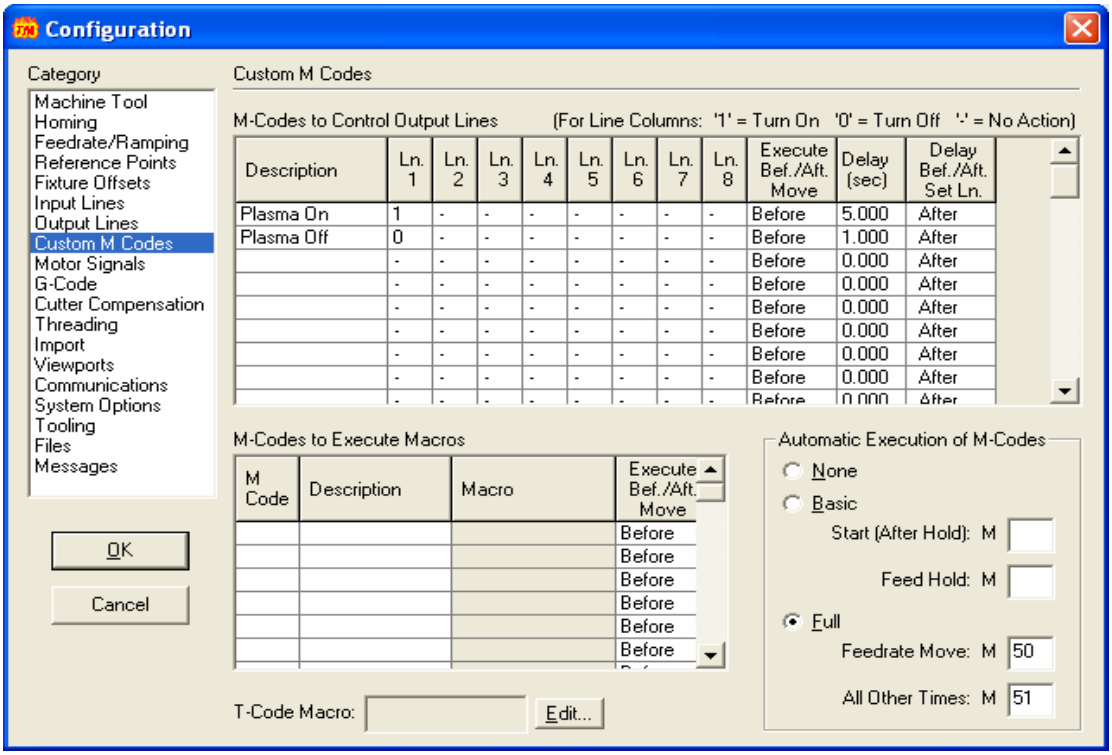
To test or set pierce height, leave plasma power supply OFF. Adjust the pierce height pot on the front of the unit starting at the mid point. Run a program or otherwise toggle the CNC output relay. The unit will sample the pot only once when it contacts the metal. Re-cycling and adjusting the pot a small amount each time will produce a stand off distance that is variable from 0 to ½". Recommended stand off is about 2X the desired cut height or about 3/16-1/4". This is not required to change unless the metal thickness changes dramatically or thin material flexing is being compensated. (Clockwise increases stand off distance).

SETTING THE DWELL TIMING

To set your Dwell Timing, click on the Configuration menu, and select Custom M Codes (or "M Code Definitions" on version 2.14 or later). Toward the top half of the page you will see the M Codes area. As you can see there are two fields for setting your dwell times, under the headings of M50 and M51. The delay times are shown at the right side of each column between before and after. This is where you may change the dwell timing for your machine.

Since you are using the height control unit to maintain the arc voltage during your cutting, you will want to start your M50 dwell at 5 seconds. This will allow enough time for the torch to lower to the material, sense it, back off to the Pierce Height, fire the pilot arc, penetrate the material and reach a stable voltage before the adjustment for voltage begins. The dwell time may need to be increased or decreased depending on the type of material, the thickness of the material, the program feed rate, and amount of amperage used. If you find that you are not getting the pierce quality you are looking for, it may be necessary to adjust your dwell timing. Start at 5 seconds, and then adjust the timing +/- 0.10 seconds depending on how the cut actually performs. Continue adjusting the dwell at .10 sec intervals until you achieve your desired pierce quality.

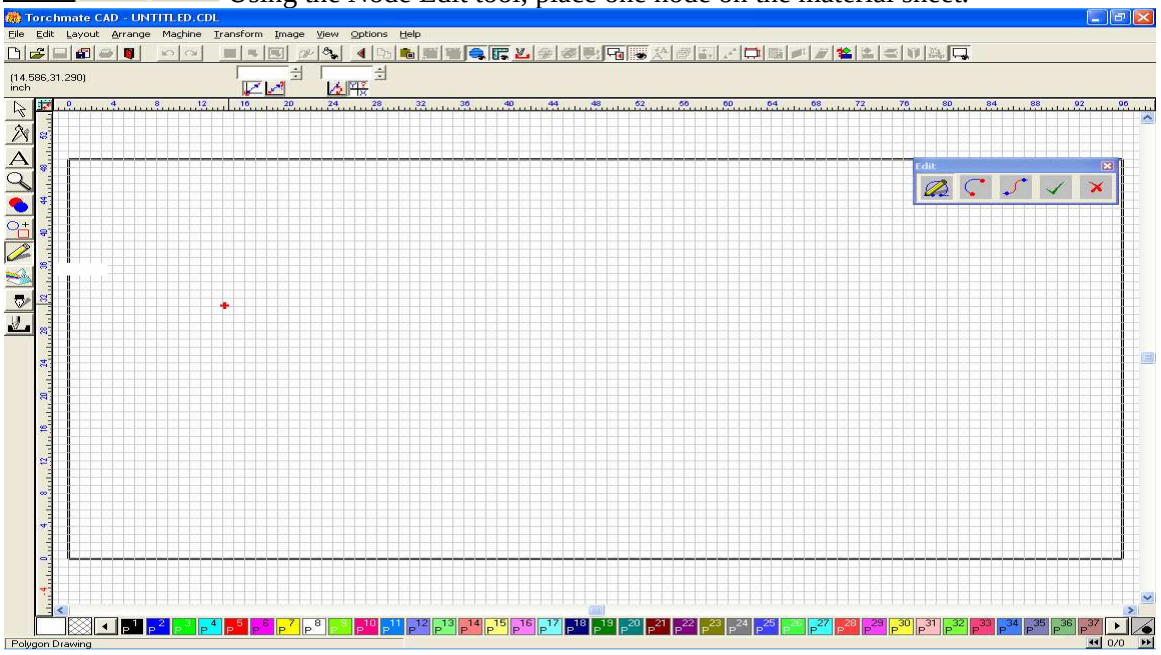
The M51 (Plasma Off) is the amount of time after the torch turns off that it will remain idle, while the compressed air cools off the tip of the torch, before moving to the next cut. This should be set to 1.5 seconds. If your plasma cutter has a low duty cycle rating it may be necessary to increase the timing to allow your plasma cutter more time to recover between cuts.



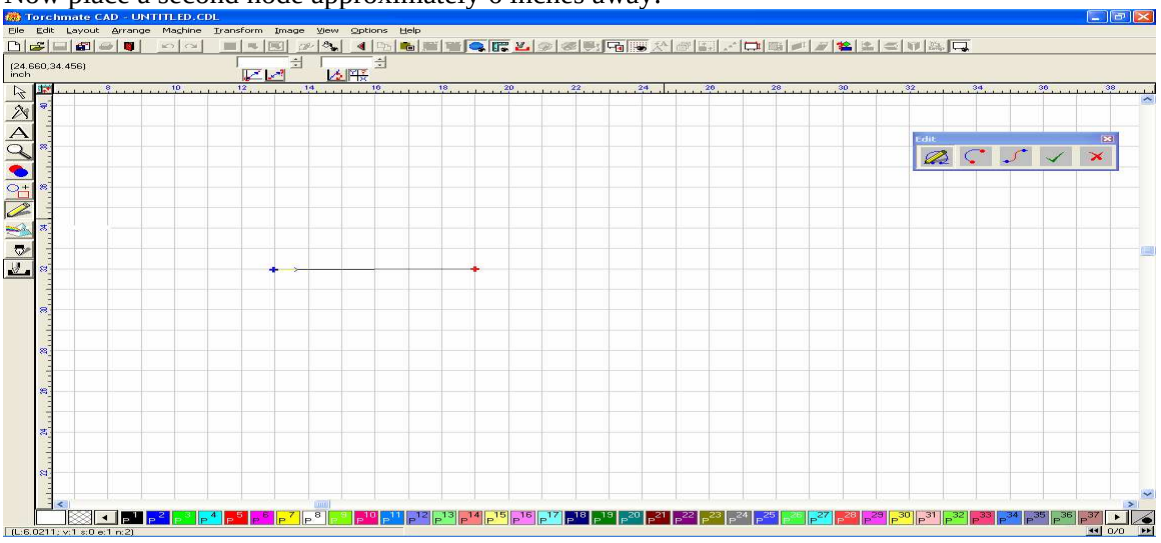
PRELIMINARY TEST CUTTING IN MANUAL MODE

With the Pierce Height and Dwell timing set, you can now utilize the manual mode of the controller to establish your arc voltage settings, by running a program with the torch on, and watching the LCD display on the Arc Height Control unit. Open your Torchmate Cad and create two parallel lines for test cutting.

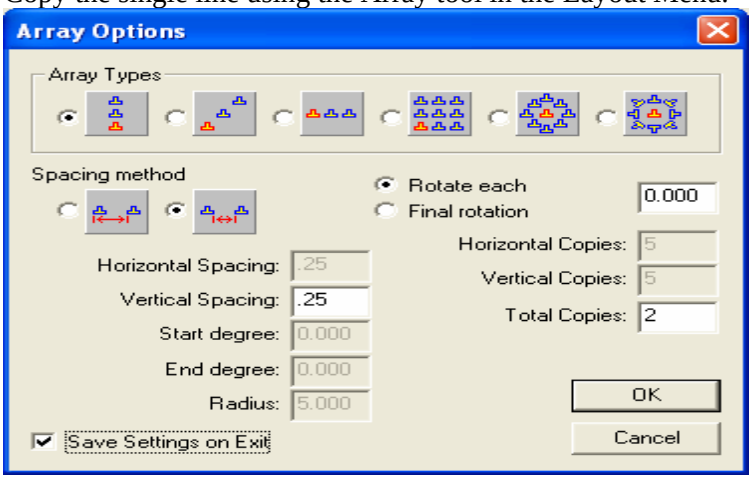
 Using the Node Edit tool, place one node on the material sheet.



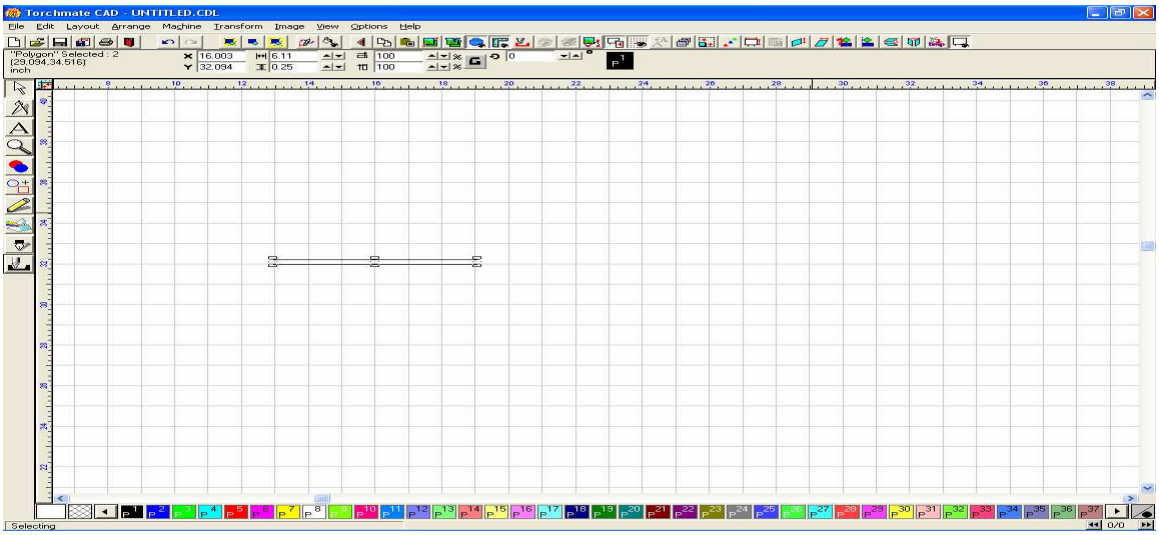
Now place a second node approximately 6 inches away.



Copy the single line using the Array tool in the Layout Menu.



Here you have two parallel lines, export them as a .dxf (Line) file to a folder on your hard drive. Import the dxf file to the driver software, and prepare the system for cutting.



When the initial cut begins, the torch will pierce the material then move along the cut path. While it is cutting, watch the LCD display for the voltage fluctuations, which will usually be somewhere between -60 to -200. Record the voltage range for each program cut in manual mode. The voltage reading, at which the torch settles and consistently runs, should be the appropriate initial setting for running the height control in Auto mode. After several Manual Mode tests have been conducted, run the same program again on fresh material. Flip the switch from Man to Auto, put the far left switch to Set, and then turn the large dial to the most consistent voltage setting that you recorded while in the manual mode. Push the switch to Read before running the program. The torch should now be able to cut your tool path without any fluctuation towards or away from the material. Be sure to record all setting adjustments you make, and the results of those changes, to help you determine if you are making steady progress towards you desired results.

Manual mode testing is essential in finding the consistent voltage that will allow the torch to stay at the necessary height above the material, and maintain it when the material rises from the resulting heat exchange during the cutting process. We recommend that you start with manual cutting whenever you are changing type, or thickness

of material. It is also recommended that you consult the manufacturer's Cut Chart for your plasma cutter, as it will help you to define the amount of amperage, air pressure, voltage, and cutting speeds to give you the best results possible.

SETTING CUT VOLTAGE

Move the front panel selector switch to the "SET" position and adjust to the desired arc voltage using the "ARC VOLTAGE" pot. This is a 10 turn pot that allows adjustment from 60-200 volts. A good starting point is about 130-135 volts. Your plasma unit user's guide may also have a chart of desired voltages for various materials and thicknesses. This value may be changed depending on gas pressure, arc amperage and feedrate but is a good starting guide. After adjusting, select "READ" to allow reading the actual voltage while cutting. When not cutting the readout will display 0-1 volt.

MANUAL / AUTOMATIC MODES

The position of the AUTO/MAN switch at the start of each cut will determine the operating mode.
In manual mode, the torch will find the plate and set pierce height as explained above, but no voltage sensing or automatic adjustments will be made. Only manual jog buttons will move the torch. At the end of cut, the plasma will go off and the torch will rise as normal.

If the AUTO/MAN switch is in the AUTO mode at the start of cut, the torch will proceed to find the plate for pierce height and after the arc starts will follow the plate based on the voltage setting. Switching to MAN during the auto cut freezes the height of the torch. No automatic or manual height adjustments are available at that time. Switching back to AUTO during this cut will resume auto height sensing.

In manual mode, the lost cut sensing is disabled to allow machines with constant pilot arcs to cut over holes or expanded metal.

NOTE: If the switch is in the MAN position, the SET voltage will be held at 0 volts. To SET the voltage, it will be necessary to put the switch in the AUTO mode.

CUT / NO-CUT SWITCH

The cut / no-cut settings allow for dry run operation. The switch simply interrupts the start output signal to your plasma unit. Generally the no-cut setting should be used with the unit in MANUAL mode to prevent torch movement while there is no arc voltage.

DIAGNOSTIC / PROGRAMMING CONNECTOR

A 9 pin RS232 connector is provided at the motor power connector. It is the short pig-tail with a 9 pin female connector. To utilize this you will need an appropriate serial cable. Contact Applied Robotics for information and instructions.

MANUFACTURE CUT CHARTS

These charts are located in the Operators Manual. Should you not be able to locate them, please contact Torchmate Technical Support or the Customer Technical Support provided by your plasma torch manufacturer.

WARRANTY

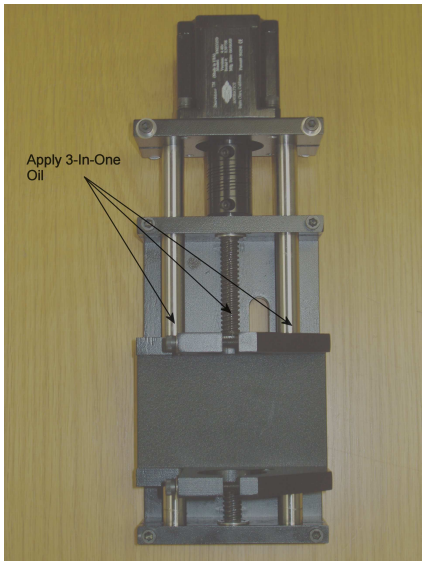
Warranty is limited to the torch height controller components only. Incidental damages or loss of income is not included. The THC system is warranted from defects in materials and workmanship for a period of one year from date of purchase. Failure to observe precautions mentioned above or unauthorized tampering voids warranty.

TECHNICAL SUPPORT

For 1st level technical support
Call 775-673-2200
Torchmate@yahoo.com
Applied Robotics, Inc.

MECHANICAL ASSEMBLY MAINTENANCE

In order to maintain proper operation of your AVHC mechanical assembly, 3 in 1 oil (or other light machine oil) should be applied to the drive screw and guide rails on a regular basis. The regularity of this maintenance will depend on your daily usage. **WARNING: DO NOT** use Grease or WD-40 in substitution for oil**.**



Whenever possible remove the consumable dust from the mechanical assembly of the height control. This works best with a compressed air nozzle.

ELECTRICAL SPECIFICATIONS

Input Power Requirements: 110VAC, 60 Hz, 1 amp

TROUBLESHOOTING

No Display

If you just powered on your Voltage Controller and show a blank display check LED's on Lifter Station Motor (located between motor connectors). Are either of the two LED's showing Red or Green?

No

1. Ensure Motor Power Cable (See Fig. 3 on page 7) is firmly connected to you're Voltage Controller and Lifter Station Motor.
2. Check the AC line cord is properly seated in the back panel of your console and electrical outlet.
3. Is AC power available at the electrical outlet?

If problem persists, contact Technical Support.

Yes

1. Ensure Motor Signal Cable (See Fig. 3 on page 7) is firmly connected to your Voltage Controller and Lifter Station Motor.

If problem persists, contact Technical Support.

Arc Voltage Errors

If the torch is diving into the material it could be that the arc voltage is set too low. The torch will automatically search for the voltage it has been set to maintain, thus it will look for it in the material or closer to the power source to maintain its voltage level. To correct this, increase the voltage setting 1 to 2 volts higher for starters, and continue to raise it if necessary.

If the Arc Voltage is set too high, the arc may actually spike up and stay further way from the material than normal, or may step upward, and will lose the arc altogether. The initial arc will penetrate the metal but it may not be able to maintain this high of a voltage setting, thus the AVHC inevitably moves too high off the material and the arc is lost and will rise to the top of its travel. To correct this, a decrease the voltage setting 1 to 2 volts lower to start, and continue to lower if necessary.

Make sure that the Raw Arc Voltage take-off wires are connected to the DC+ and DC – terminals inside your plasma cutter

If the Torch moves toward the material, touches it, then backs off, fires, pierces, then backs off in steps, loses arc but continues to follow program, check the fuse located on the left side panel of the height control unit. Push in on the small retaining cover with a small flathead screw driver, and turn to the left to release the fuse. This fuse is a 1 amp, 250 volt, slow-blow fuse, and can be found at Radioshack (part # 270-1063) or other electronics retailers. You can use up to a 5 amp fuse if the 1 amp fuse continues to blow. If the torch does not fire then check the fuse in the machine interface.

If problem persists, contact Technical Support.

Torch Misfires/Not Firing

Check the Compressor

The air pressure fed into your plasma cutter must be in the range of 90 to 120 psi in order to consistently create plasma in a given range of 65 to 90 psi. If you are using a compressor to supply air to more than one line at a time, be sure that it can maintain a level of pressure to allow all lines to consistently supplied, otherwise your tank may be draining faster than the compressor can recharge the holding tank. Consider switching to a dedicated tank for you plasma operation.

In the process of creating compressed air, water condensation collects in your holding tank. This condensation can also leak into the line supplying air to your plasma cutter. In most plasma torch systems, a water separator valve is utilized to allow the collection and drainage of excess condensation passing through the air line. Even with this preventive measure, condensation can still bleed into the torch line itself, and cause misfiring, or total system failures. To ensure that the excess condensation is removed, drain your holding tanks and water separator often, or whenever condensation is present. This will help to prevent Ignition failures.

Check the Consumables

In the torch head the electrode must move up and down freely for the torch to fire. The plasma unit looks for continuity between the electrode tip and nozzle before the torch will turn on the air and initiate the arc. The air forces the electrode up away from the nozzle to make electrical contact with another contact point in torch body permitting current flow to the electrode.

If there is slag or foreign matter keeping the electrode from making electrical contact with the nozzle when the air is off the plasma unit will alarm and not fire. The alarm will reset after 10 seconds. If the electrode cannot slide up freely and make electrical contact after the air is turned on, the torch will fire with a lowered amperage, or misfire completely.

The Retaining cap for the consumables and swirl ring should only be finger tight, if the cap is over tightened the electrode may not move freely enough to function properly.

If problem persists, contact Technical Support.

NOTES