



# ULTRA-CUT 100 XT™

## PLASMA CUTTING SYSTEM

### AUTOMATED GAS CONTROL

# Operating Manual



Revision: AF

Issue Date: January 6, 2015

Manual No.: 0-5303

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## **WARNINGS**

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

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

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Plasma Cutting Power Supply with Automated Gas Control, Ultra-Cut 100 XT™  
Operating Manual No. 0-5303

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**Record the following information for Warranty purposes:**

Where Purchased: \_\_\_\_\_

Purchase Date: \_\_\_\_\_

Power Supply Serial #: \_\_\_\_\_

Torch Serial #: \_\_\_\_\_

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# SECTION 1: GENERAL INFORMATION

## 1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

**NOTE**

*An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.*



**CAUTION**

*A procedure which, if not properly followed, may cause damage to the equipment.*



**WARNING**

*A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.*

## 1.02 Important Safety Precautions



**WARNINGS**

**OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.**

*Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.*

*To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.*



**GASES AND FUMES**

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

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

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.
- **WARNING:** This product contains chemicals, including lead, known to the State of California to cause birth defects and other reproductive harm. **Wash hands after handling.**



**ELECTRIC SHOCK**

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.

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- Extra care must be taken when the workplace is moist or damp.
- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.



### FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces 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.



### NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.



### PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.

- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

<u>Arc Current</u>	<u>Minimum Protective Shade No.</u>	<u>Suggested Shade No.</u>
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

\* These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.



### WARNING

**WARNING:** This product contains chemicals, including lead, known to the State of California to cause birth defects and other reproductive harm.  
***Wash hands after handling.***



### 1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. 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
4. 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
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. 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
7. 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
8. 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
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. 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
12. 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
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

## 1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

### NOTE

*Toute opération, procédure ou renseignement général sur lequel il importe d'insister davantage ou qui contribue à l'efficacité de fonctionnement du système.*



### ATTENTION

*Toute procédure pouvant résulter l'endommagement du matériel en cas de non-respect de la procédure en question.*



### AVERTISSEMENT

*Toute procédure pouvant provoquer des blessures de l'opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.*

## 1.05 Précautions De Sécurité Importantes



### AVERTISSEMENTS

**L'OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L'ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.**

*Coupant à l'arc au jet de plasma produit de l'énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d'un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé électronique. Ceux qui travail près d'une application à l'arc au jet de plasma devrait consulter leur membre professionnel de médication et le manufacturier de matériel de santé pour déterminer s'il existe des risques de santé.*

*Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d'éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d'utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.*



### FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.
- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain “MSDS”); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Éliminez toute source de telle fumée.
- **AVERTISSEMENT** : Ce produit contient des produits chimiques, notamment du plomb, reconnu par l'État de la Californie pour causer des malformations congénitales et d'autres dommages touchant le système reproductif. **Se laver les mains après manipulation.**



### CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce “sous tension” ou “vive”; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l’alimentation électrique avant tout travail d’entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l’arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l’arc en fournissant des cabines ou des écrans de protection.
- Utilisez la nuance de lentille qui est suggérée dans le recommandation qui suivent ANSI/ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggestée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

\* Ces valeurs s’appliquent ou l’arc actuel est observé clairement. L’expérience a démontré que les filtres moins foncés peuvent être utilisés quand l’arc est caché par moiceau de travail.



## INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l’arc de plasma. Le procédé à l’arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l’explosion de fumées inflammables.

- Soyez certain qu’aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu’il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d’incendie lors de tout travail dans une zone présentant des dangers d’incendie.
- Le gas hydrogène peut se former ou s’accumuler sous les pièces de travail en aluminium lorsqu’elles sont coupées sous l’eau ou sur une table d’eau. NE PAS couper les alliages en aluminium sous l’eau ou sur une table d’eau à moins que le gas hydrogène peut s’échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.



## RAYONS D’ARC DE PLASMA

Les rayons provenant de l’arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l’arc de plasma produit une lumière infra-rouge et des rayons ultra-violetes très forts. Ces rayons d’arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.



## BRUIT

Le bruit peut provoquer une perte permanente de l’ouïe. Les procédés de soudage à l’arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous devez vous protéger les oreilles contre les bruits forts afin d’éviter une perte permanente de l’ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d’assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l’article 1, page 5.



## AVERTISSEMENT

**AVERTISSEMENT** : Ce produit contient des produits chimiques, notamment du plomb, reconnu par l’État de Californie comme pouvant causer des malformations congénitales et d’autres troubles de la reproduction. **Se laver les mains après toute manipulation.**

## 1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMINATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3
13. Livret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103
14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX , disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

**1.07 Statement of Warranty**

**LIMITED WARRANTY:** Victor Thermal Dynamics® Corporation (hereinafter “Thermal”) warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal’s specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal’s sole option, of any components or parts of the product determined by Thermal to be defective.

**THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

**LIMITATION OF LIABILITY:** Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter “Purchaser”) for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

**THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.**

**THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.**

The limited warranty periods for this product shall be: A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with further limitations on such two (2) year period (see chart below).

	<b>Parts</b>	<b>Labor</b>
Auto-Cut XT™ and Ultra-Cut XT™ Power Supplies and Components	2 Years	1 Year
<b><u>Torch And Leads</u></b>		
XT™ / XT™-301 Torch (Excluding Consumable Parts)	1 Year	1 Year
<b><u>Repair/Replacement Parts</u></b>	90 Days	90 Days

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer’s risk and expense. This warranty supersedes all previous Thermal warranties.

Effective October 23, 2012

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## **SECTION 2: SPECIFICATIONS**

### **2.01 General Description Of The System**

A typical Ultra-Cut XT™ system configuration includes:

- One Power Supply
- Remote Arc Starter
- Gas Control - Digital manifold Control (DMC)
- Gas Control - Digital Pressure Control (DPC)
- Precision Plasma Cutting Torch
- Set Of Connecting Leads
- Torch Spare Parts Kit
- Touch Screen Control (TSC), Optional
- Heat Exchanger, Optional

The components are connected at installation.

### **2.02 Plasma Power Supply**

The power supply provides the necessary current for cutting operations. The power supply also monitors system performance, and cools and circulates the liquid coolant for the torch and leads.

### **2.03 Remote Arc Starter**

This unit produces a temporary HF pulse to start the pilot arc. The pilot arc creates a path for the main arc to transfer to the work. When the main arc is established, the pilot arc shuts off.

### **2.04 Gas Control Module**

This module allows remote setting of gas selection, pressures, and flows together with setting of cutting current.

### **2.05 Precision Plasma Cutting Torch**

The torch delivers the controlled current to the work through the main arc, causing the metal to be cut.

### **2.06 Specifications & Electrical Requirements**

<b>Ultra-Cut 100 XT™ Specifications &amp; Design Features</b>		
100 Amp System	Max OCV (U0)	425 vdc
	Minimum Output Current	5 Amps
	Max Output Current	100 Amps
	Output Voltage	60 - 180 vdc
	Duty Cycle Rating	100% @ 100A, 200V, (20kW),
	Ambient Temperature for Duty Cycle Rating	104F° (40°C)
	Operating range	14°F to 122°F (-10°C to + 50°C)
	Power Factor	0.94 @ 100 A DC Output
	Cooling	Coolant and Forced Air (Class F)

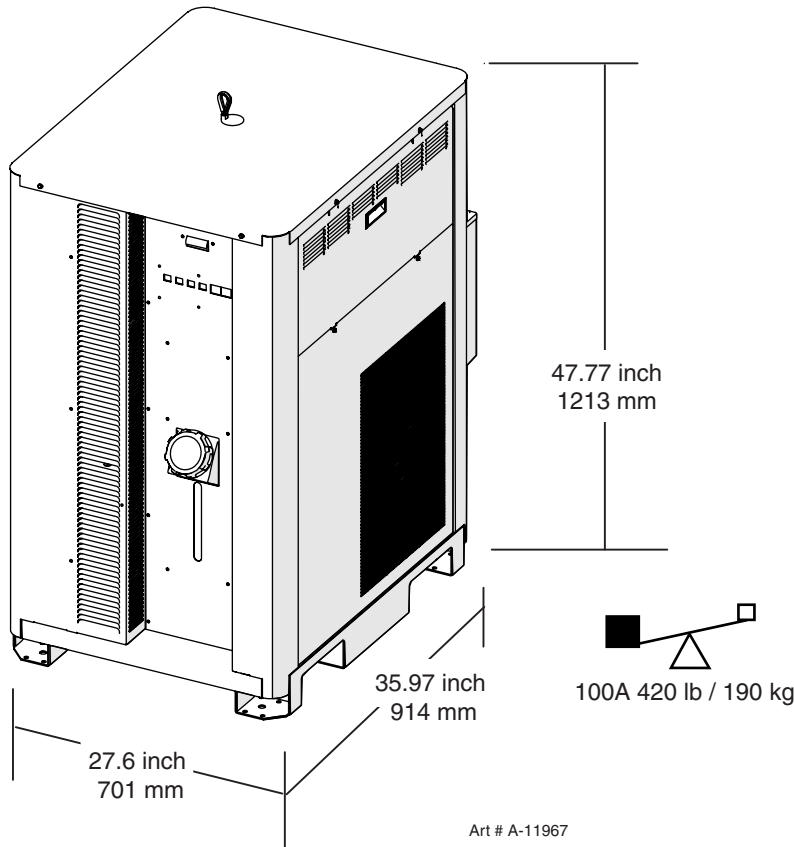
# ULTRA-CUT 100 XT

Ultra-Cut 100 XT™ Power Supply						
Input		Power Input	Current	Suggested Sizes (See Note)		
Voltage	Freq.	3-Ph	3-Ph	Fuse (Amps)	Wire (AWG)	Wire (mm <sup>2</sup> )
(Volts)	(Hz)	(kVA)	(Amps)	3-Ph	3-Ph	3-Ph
480	50/60	21	26	35-40	#12	4

## NOTE

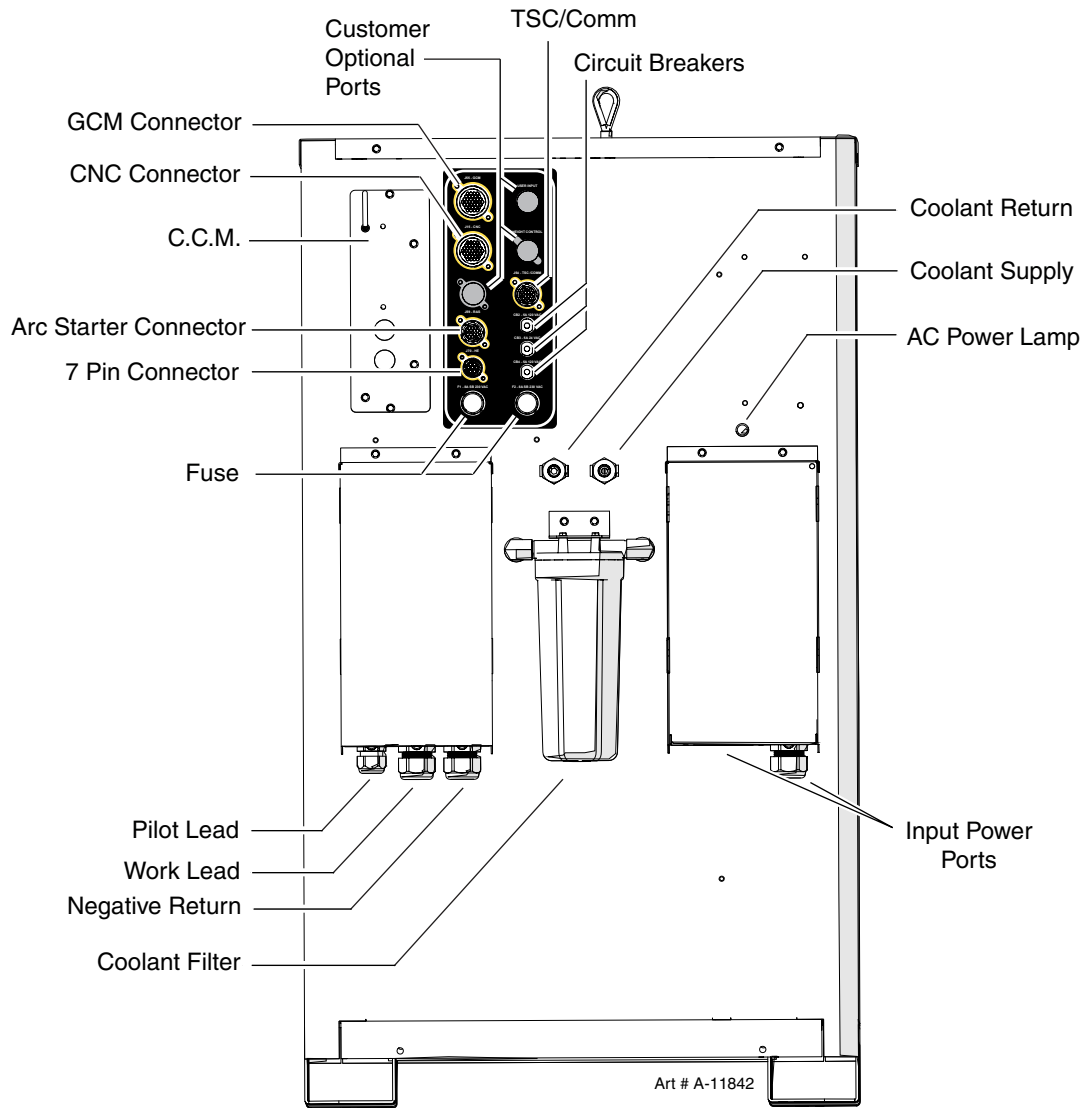
\* Suggested wire size based on United States NFPA 70 National Electrical Code 2011 edition published by the National Fire Prevention Association. Listings are from table 400.5(A)(2) for flexible cord of certain types rated for 75 deg C in ambient temperatures up to 30 deg C. Using wires of lower temperature rating or different insulation type may require larger wire size. De rate for higher ambient. These are suggestions only. Always refer to your local and national codes that apply to your region for final determination of correct wire type and size.

## 2.07 Power Supply Dimensions





**2.08 Power Supply Rear Panel Features**



# ULTRA-CUT 100 XT

## 2.09 Gas Requirements

The customer will provide all gases and pressure regulators. Gases must be of high quality. Pressure regulators shall be double stage and installed within 3 meters from the Gas Console.

Ultra-Cut 100 XT™ Power Supply: Gas Pressures, Flows, and Quality Requirements			
Gas	Quality	Minimum Pressure	Flow
O2 (Oxygen)	99.5% Purity (Liquid recommended)	120 psi 8.3 bar / 827 kPa	70 scfh (2000 l/h)
N2 (Nitrogen)	99.5% Purity (Liquid recommended) <1000 ppm O2, <32 ppm H2O)	120 psi 8.3 bar / 827 kPa	200 scfh (5700 l/h)
Compressed or Bottled Air	Clean, Dry, Free of Oil (see Note 1)	120 psi 8.3 bar / 827 kPa	250 scfh (7000 l/h)
H35 (Argon-Hydrogen) H35 = 35% Hydrogen, 65% Argon	99.995% Purity (gas recommended)	120 psi 8.3 bar / 827 kPa	90 scfh (2550 l/h)
Ar (Argon)	99.995% Purity (gas recommended)	120 psi 8.3 bar / 827 kPa	150 scfh (4200 l/h)
H2O (Water)	See Note 2	50 psi (3.5 bar)	10 gph (38 lph)

Note 1: The air source must be adequately filtered to remove all oil or grease. Oil or grease contamination from compressed or bottled air can cause fires in conjunction with oxygen.

For filtering, a coalescing filter able to filter to 0.01 microns should be placed as close as possible to the gas inlets on the Gas Control Module.

Note 2: The tap water source does not need to be deionized, but in water systems with extremely high mineral content a water softener is recommended. Tap water with high levels of particulate matter must be filtered.

Note 3: Water Pressure Regulator if needed can be purchased at local plumbing supply.

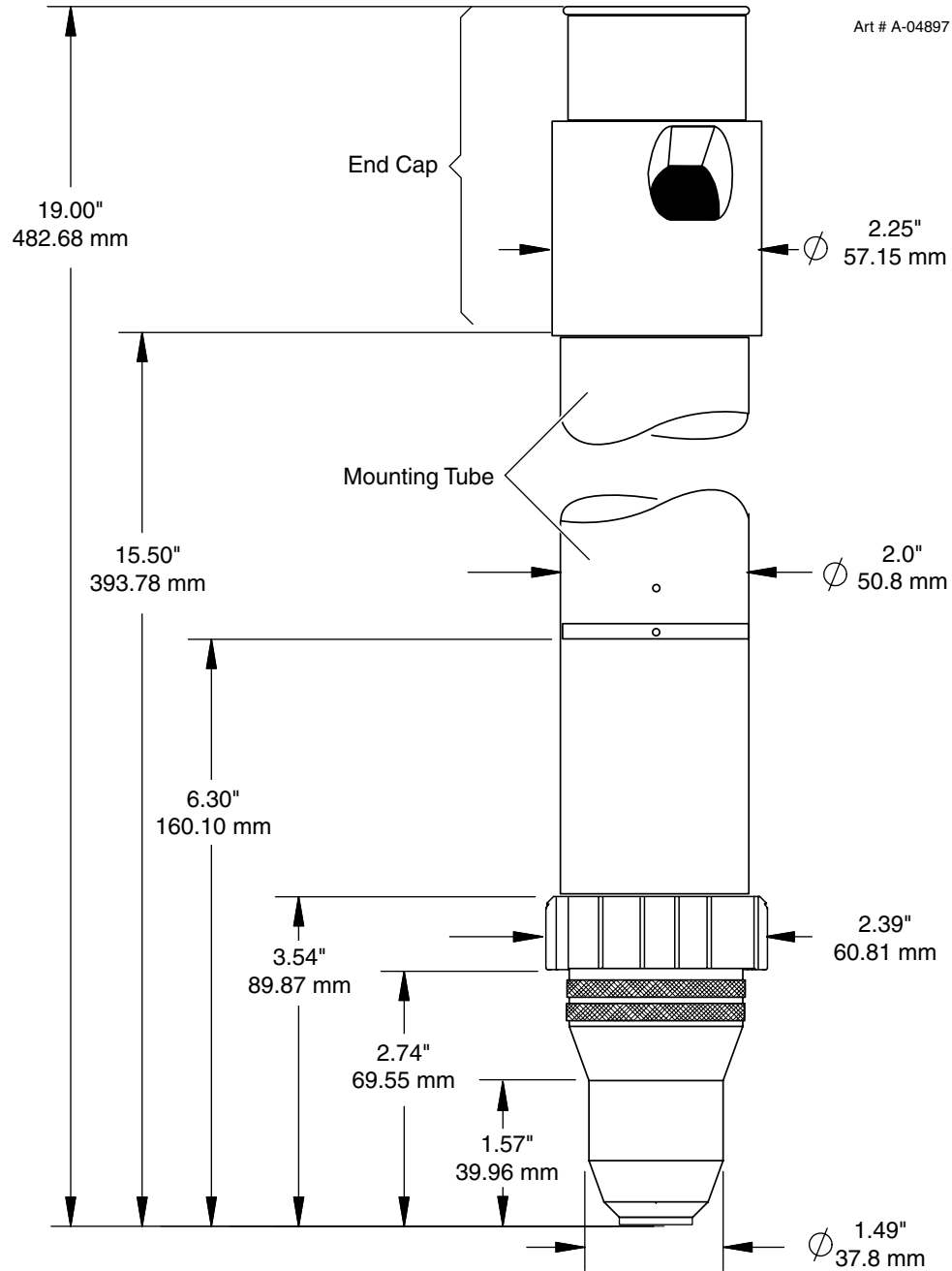
## 2.10 Gas Applications

MATERIAL	MILD STEEL			STAINLESS STEEL			ALUMINUM		
	GAS TYPE			GAS TYPE			GAS TYPE		
OPERATION	PREFLOW	PLASMA	SHIELD	PREFLOW	PLASMA	SHIELD	PREFLOW	PLASMA	SHIELD
30A Cut	Air	O <sub>2</sub>	O <sub>2</sub>	Air	Air	Air	Air	Air	Air
				N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O	N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O
50A Cut	Air	O <sub>2</sub>	Air	Air	Air	Air	Air	Air	Air
				N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O	N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O
70A Cut	Air	O <sub>2</sub>	Air	Air	Air	Air	Air	Air	Air
				N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O	N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O
100A Cut	Air	O <sub>2</sub>	Air	N <sub>2</sub>	H35	N <sub>2</sub>	N <sub>2</sub>	H35	N <sub>2</sub>
				N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O	N <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O
Marking	Air	Ar	Air/ O <sub>2</sub> *	Air/ N <sub>2</sub> *	Ar	Air/ N <sub>2</sub> / H <sub>2</sub> O	Air/ N <sub>2</sub> *	Ar	Air/ N <sub>2</sub> / H <sub>2</sub> O

\*Note: Depends on process used.

**2.11 XT Torch Specifications**

**A. Torch Dimensions**



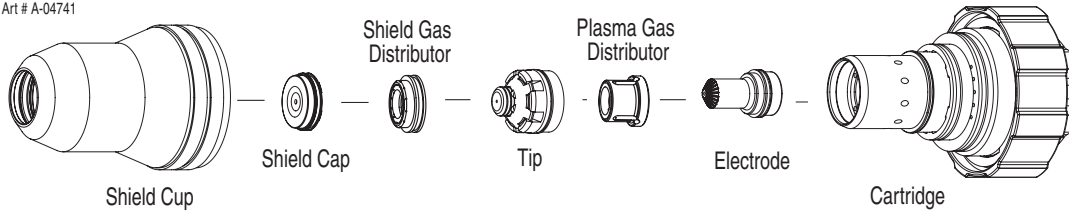
**B. Torch Leads Lengths**

Torch Lead Assembly	
Lengths	
Feet	Meters
10	3.05
15	4.6
25	7.6
50	15.2
75	22.9
100	30.4

# ULTRA-CUT 100 XT

## C. Torch Parts (Generic Parts Shown)

Art # A-04741



## D. Parts - In - Place (PIP)

The torch is designed for use with a power supply which senses coolant return flow to confirm that torch parts are in place. If coolant return flow to the power supply is absent or insufficient the power supply will not provide power to the torch. Coolant leakage from the torch also indicates that torch parts are absent or installed improperly.

## E. Type of Cooling

Combination of gas stream through torch and liquid cooling.

## F. XT Torch Data

XT™ Torch Ratings When used with Ultra-Cut 100 XT	
Ambient Temperature	104° F 40° C
Duty Cycle	100% @ 100 Amps
Maximum Current	100 Amps
Voltage (Vpeak)	500V
Arc Striking Voltage	10kV
Current	Up to 100 Amps, DC, Straight Polarity
XT® Torch Gas Specifications	
Plasma Gases:	Compressed Air, Oxygen, Nitrogen, H35
Shield Gases:	Compressed Air, Oxygen, Nitrogen, Water
Operating Pressure	125 psi ± 10 psi 8.6 bar ± 0.7 bar
Maximum Input Pressure	135 psi / 9.3 bar
Gas flow	10 - 250 scfh

## SECTION 3: INSTALLATION

### 3.01 Installation Requirements

#### Electric Supply

The electrical supply network, the gas and water supply system must meet local safety standards. This conformity shall be checked by qualified personnel.

Ultra-Cut 100 XT™ Power Supply						
Input		Power Input	Current	Suggested Sizes (See Note)		
Voltage	Freq.	3-Ph	3-Ph	Fuse (Amps)	Wire (AWG)	Wire (mm <sup>2</sup> )
(Volts)	(Hz)	(kVA)	(Amps)	3-Ph	3-Ph	3-Ph
480	50/60	21	26	35-40	#12	4

**NOTE**

*\* Suggested wire size based on United States NFPA 70 National Electrical Code 2011 edition published by the National Fire Prevention Association. Listings are from table 400.5(A)(2) for flexible cord of certain types rated for 75 deg C in ambient temperatures up to 30 deg C. Using wires of lower temperature rating or different insulation type may require larger wire size. Derate for higher ambient. These are suggestions only. Always refer to your local and national codes that apply to your region for final determination of correct wire type and size.*

#### Gas Supply

The customer must supply all gases and pressure regulators. Gases must be of high quality. Pressure regulators must be double-stage and installed as close as possible to the gas console. Contaminated gas can cause one or more of the following problems:

- Reduced cutting speed
- Poor cut quality
- Poor cutting precision
- Reduced consumables life.
- Oil or grease contamination from compressed or bottled air can cause fires in conjunction with oxygen.

#### Cooling System Requirements

Coolant must be added to the system on installation. The amount required varies with torch leads length.

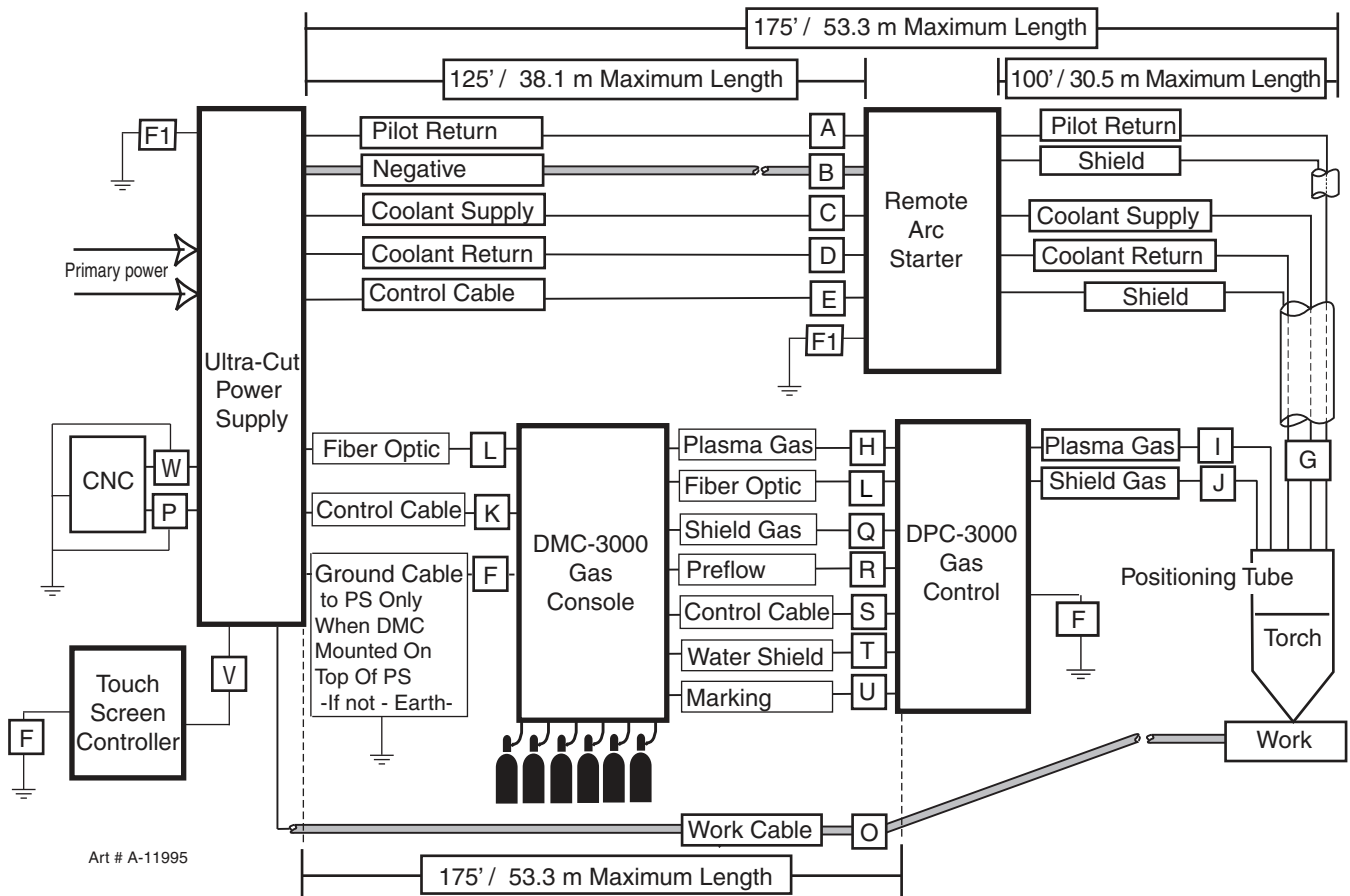
Victor Thermal Dynamics recommends the use of its coolants 7-3580 and 7-3581 (for low temperatures).

Coolant Capabilities		
Cat. Number and Mixture	Mixture	Protects To
7-3580 'Extra-Cool™'	25 / 75	10° F / -12° C
7-3581 'Ultra-Cool™'	50 / 50	-27° F / -33° C
7-3582 'Extreme Cool™'	Concentrate*	-76° F / -60° C
* For mixing with D-I Cool™ 7-3583		

# ULTRA-CUT 100 XT

## 3.02 System Layout

Refer to section 3.04 for ground connections and ground cables.

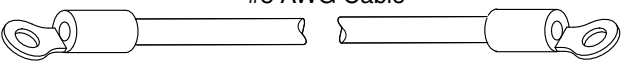


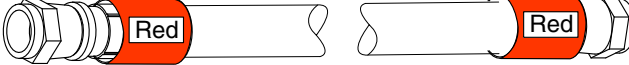
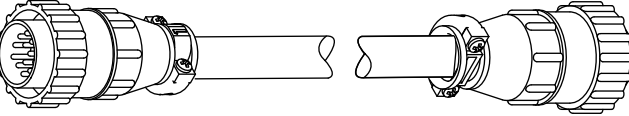

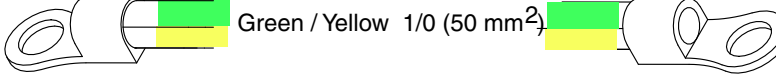
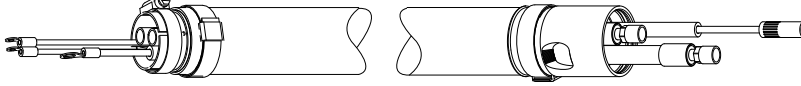


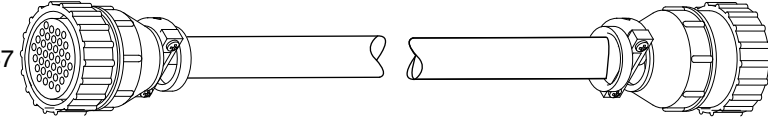
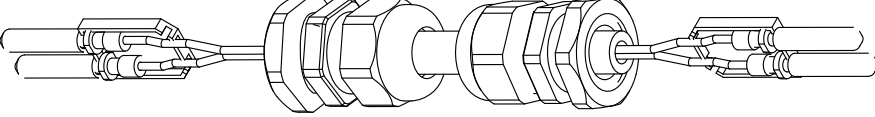
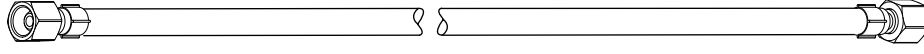
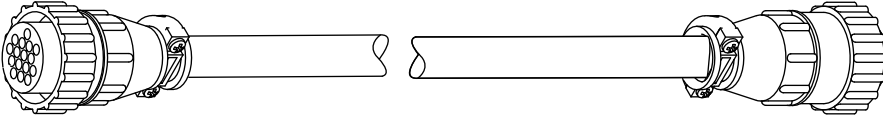
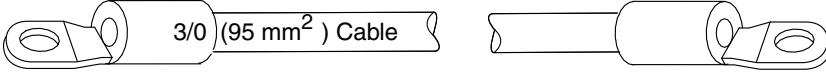
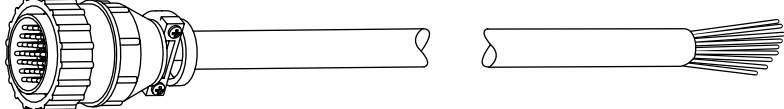


## 3.03 Recommended Gas Supply Hose

Item #	Qty	Description	Catalog #
1		3/8" Gray Synflex Hose. No fittings included. Catalog number per foot	9-3616

**3.04 Leads and Cables All Amperage**

Art # A-11997\_AB

- |                 |  |  |   |
|-----------------|--|--|---|
| A               | #8 AWG Cable                             |     | Pilot Return, Power Supply to Arc Starter   |
| B               | 3/0 AWG Cable (95 mm <sup>2</sup> )      |     | Negative Lead, Power Supply to Arc Starter  |
| C               |  |     | Coolant Supply Lead, Power Supply to Arc Starter                                      |
| D               |  |     | Coolant Return Lead, Power Supply to Arc Starter                                      |
| E,Y<br>14/7     |  |     | E - Control Cable, Power Supply to Arc Starter<br>Y - Control Cable to Heat Exchanger |
| F               | Green / Yellow # 4 AWG                   |    | Ground Cable  |
| F1              | Green / Yellow 1/0 (50 mm <sup>2</sup> ) |    | Ground Cable, Remote Arc Starter To Earth Ground                                      |
| G               |  |    | Shielded Torch Lead Assembly, Remote Arc Starter to Torch                             |
| I               |  |  | Plasma Gas Lead, Torch Valve to Torch   |
| J               |  |  | Shield Gas Lead, Torch Valve to Torch   |
| K<br>37         |  |  | Control Cable, Power Supply to Gas Control Module                                     |
| L               |  |  | Fiber Optic Cable, Power Supply to Gas Control Module                                 |
| H, Q,<br>R,T, U |  |  | For use with DFC-3000   |
| S,V<br>16 pin   |  |  | S - Control Cable, DMC-3000 to DPC-3000<br>V - TSC-3000 to PS                         |
| O               | 3/0 (95 mm <sup>2</sup> ) Cable          |  | Work Cable  |
| P,W<br>37/11    |  |  | CNC Cable (37 Wire)<br>W - CNC Communication Cable (11 Wire)                          |

## 3.05 Lift the Power Supply

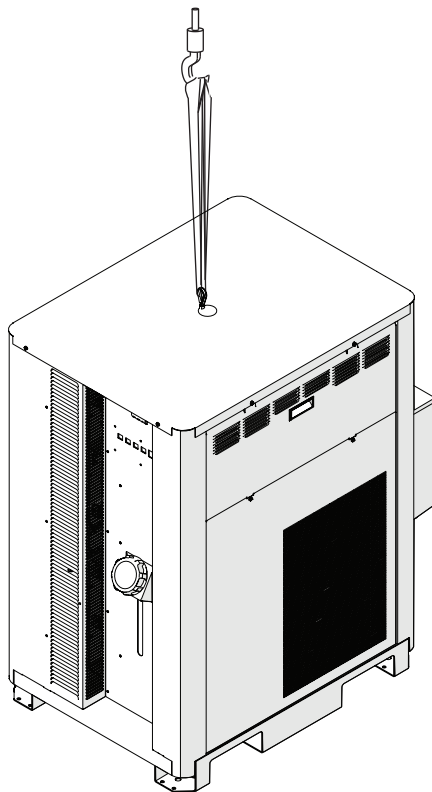


*Do not touch live electrical parts.*

*Disconnect input power conductors from de-energized supply line before moving unit.*

*FALLING EQUIPMENT can cause serious personal injury and equipment damage.*

Use a forklift, crane, or hoist to lift the unit off the shipping pallet as shown. Keep the power supply steady and vertical. Do not lift it any further than necessary to clear the shipping pallet. Ensure all panels and screws are secure prior to lifting.



Art # A-11531\_AC

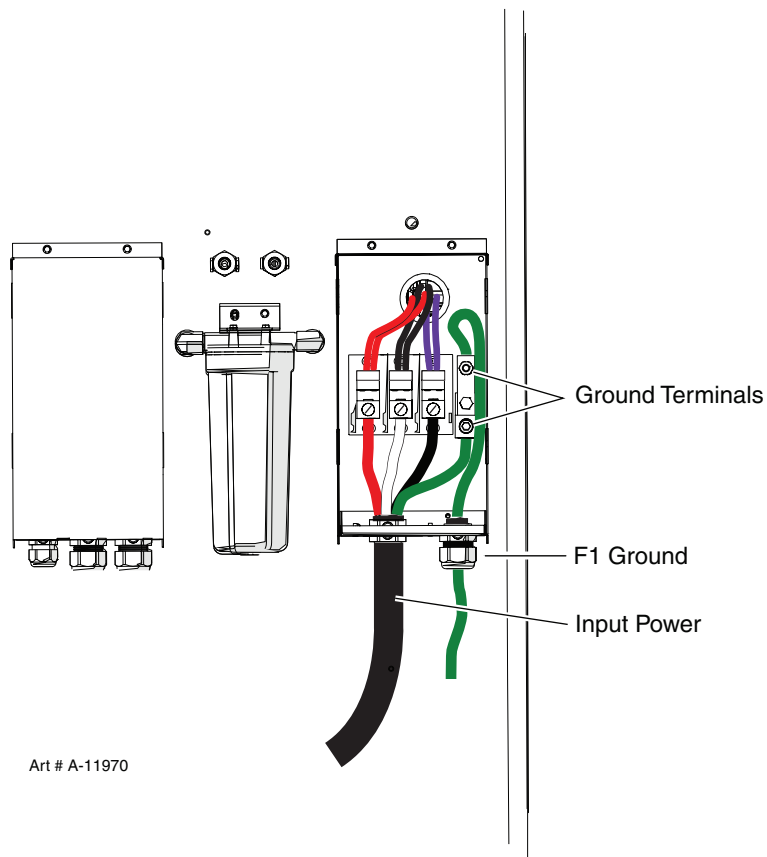
Set the power supply on a solid, level surface. The installer may fasten the power supply to the floor or a supporting fixture with hardware passing through the horizontal parts of the power supply feet.



### 3.06 Connect Input Power and Ground Cables

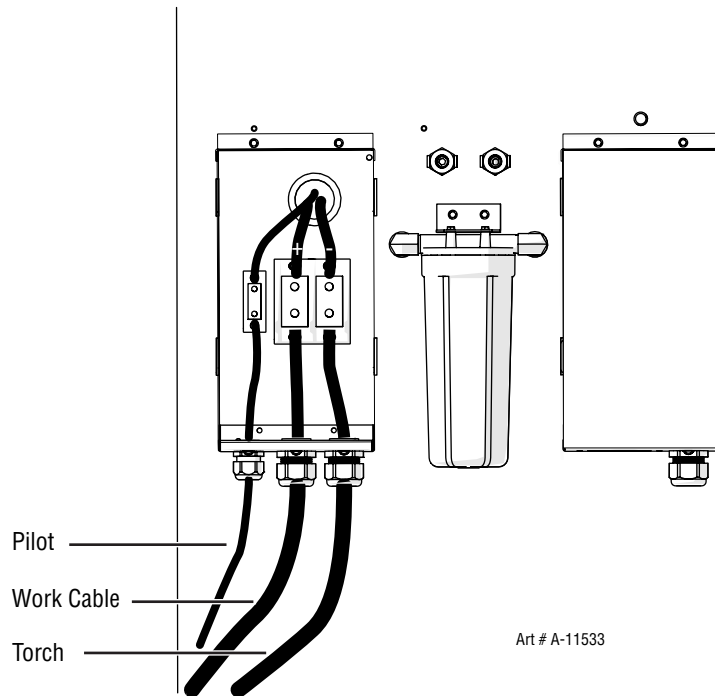
#### Connect Input Power and System Ground Cables

1. Remove the input power cover to the right of the coolant filter at the rear of the power supply. To do this remove the two screws then lift up and pull away.
2. Carefully cut back the outer sheath on the primary input power cable to expose the individual wires. Cut back the insulation on the individual wires. Route the cable upward through Input Power Port at the bottom of the panel. There are 2 extra plates included at the cable entrance. Discarding one or both allows changing the opening size for larger cable/strain relief.
3. Install stripped end of 3 phase wires into the terminal block L1, L2 and L3 and connect the individual cables as shown.
4. Connect the power cable ground wire to the ground terminal block.
5. Route a system ground cable (F1) through the last opening in the connections cover support panel next to the input power cable. Connect the cable to the ground terminal block on the power supply rear panel. Refer to the Ground Connections Section for full details and procedures on proper system grounding.



## 3.07 Connect Work Cable and Pilot and Negative Leads

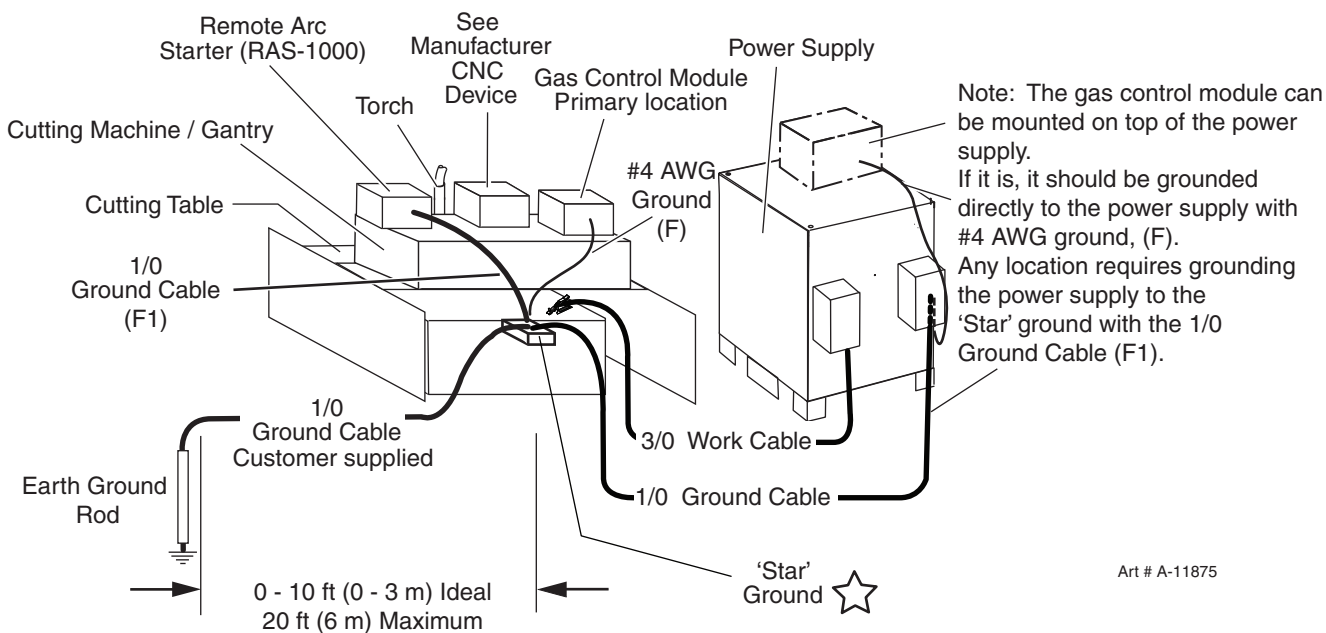
1. Remove the output power cover to the left of the coolant filter at the rear of the power supply. To do this remove the two screws then lift up and pull away.
2. Route the ends of the work cable, pilot and negative/torch leads upward through the leads strain relief at the bottom edge of the left rear panel.
3. Refer to the illustration. Connect the leads as shown. Tighten securely. Do not overtighten.



4. Reinstall the cover on the power supply. Snug the hardware securely by hand. Do not overtighten.

## 3.08 Ground Connections

### Star Ground on Cutting Table



**A. Electromagnetic Interference (EMI)**

Pilot arc starting generates a certain amount of electromagnetic interference (EMI), commonly called RF noise. This RF noise may interfere with other electronic equipment such as CNC controllers, remote controls, height controllers, etc. To minimize RF interference, follow these grounding procedures when installing mechanized systems:

**B. Grounding**

1. The preferred grounding arrangement is a single point or “Star” ground. The single point, usually on the cutting table, is connected with 1/0 AWG (European 50 mm<sup>2</sup>) or larger wire to a good earth ground (measuring less than 3 ohms; an ideal ground measures 1 ohm or less. Refer to paragraph ‘C’, Creating An Earth Ground. The ground rod must be placed as close as possible to the cutting table, ideally less than 10 ft (3.0 m), but no more than 20 ft (6.1 m) from the cutting table.

**NOTE**

*All ground wires should be as short as possible. Long wires will have increased resistance to RF frequencies. Smaller diameter wire has increased resistance to RF frequencies, so using a larger diameter wire is better.*

2. Grounding for components mounted on the cutting table (CNC controllers, height controllers, plasma remote controls, etc.) should follow the manufacturer’s recommendations for wire size, type, and connection point locations.

For Thermal Dynamics components (except Remote Arc Starter and Gas Control Module) it is recommended to use a minimum of 10 AWG (European 6 mm<sup>2</sup>) wire or flat copper braid with cross section equal to or greater than 10 AWG connected to the cutting table frame. The Remote Arc Starter uses 1/0 earth ground wire and the Gas Control Module should use minimum # 4 AWG wire. The connection point must be to clean bare metal; rust and paint make poor connections. For all components, wires larger than the recommended minimum can be used and may improve noise protection.

3. The cutting machine frame is then connected to the “Star” point using 1/0 AWG (European 50 mm<sup>2</sup>) or larger wire.
4. The plasma power supply work cable (see NOTE) is connected to the cutting table at the single point “Star” ground.

**NOTE**

*Do Not connect the work cable directly to the ground rod. Do not coil up excess ground or power cables. Cut to proper length and reterminate as needed.*

5. Make sure work cable and ground cables are properly connected. The work cable must have a solid connection to the cutting table. The work and ground connections must be free from rust, dirt, grease, oil and paint. If necessary grind or sand down to bare metal. Use lock washers to keep the connections tight. Using electrical joint compound to prevent corrosion is also recommended.
6. The plasma power supply chassis is connected to the power distribution system ground as required by electrical codes. If the plasma supply is close to the cutting table (see NOTE) a second ground rod is not usually needed, in fact it could be detrimental as it can set up ground loop currents that cause interference.

When the plasma power supply is far away from the ground rod and interference is experienced, it may help to install a second earth ground rod next to the plasma power supply. The plasma power supply chassis would then be connected to this ground rod.

**NOTE**

*It is recommended that the Plasma Power Supply be within 20 - 30 ft (6.1 – 9.1 m) of the cutting table, if possible.*

7. The plasma control cable should be shielded with the shield connected only at the cutting machine end. Connecting the shield at both ends will allow ground loop currents which may cause more interference than with no shield at all.

**Creating An Earth Ground**

1. To create a solid, low resistance, earth ground, drive a 1/2 in (12 mm) or greater diameter copper clad ground rod at least 6 - 8 ft (1.8 - 2.4 m) into the earth so that the rod contacts moist soil over most of its length. Depending on location, a greater depth may be required to obtain a low resistance ground (see NOTE). Ground rods, typically 10 ft (3.0 m) long, may be welded end to end for greater lengths. Locate the rod as close as possible to the work table. Install a ground wire, 1/0 AWG (European 50 mm<sup>2</sup>) or greater, between the ground rod and the star ground point on the cutting table.

**NOTE**

*Ideally, a properly installed ground rod will have a resistance of three ohms or less.*

## D. Low Cost Ground Rod Tester

1. A key component of reduced EMI is a good low resistance earth ground rod. There are several very expensive instruments to measure the ground but cost from several hundred to a few thousand dollars. Below is a low cost alternative which can be constructed by qualified personnel familiar with established electrical construction and safety practices. Previously suggested method using an incandescent light bulb will not work with GFCI outlets which are increasingly being used and the bulbs are becoming obsolete.
2. This method, as well as the light bulb method and some of the expensive instruments, assumes the utility ground is perfect, Zero ohms. It connects the rod being tested in series with the utility ground and measures the resistance of both in series. If the utility ground is not zero ohms, no matter how good your rod is, you won't get a low reading due the higher resistance of the utility ground. Fortunately this is rare. Also if your rod is right next to another earth grounded structure you may get a false lower reading of only resistance between that structure and your rod rather than to gnd.

### NOTE

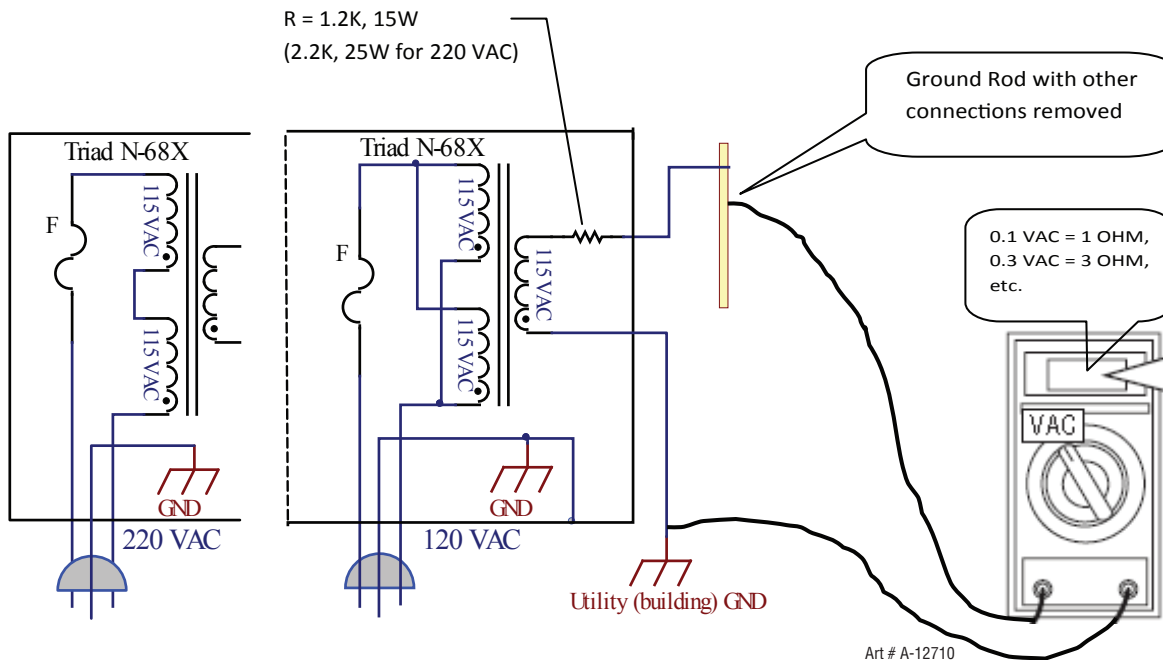
*In the United States most standard AC outlets are 120 VAC 60 Hz. Elsewhere most outlets are 220 VAC 50Hz.*

3. Obtain a transformer rated for at least 25 VA with primary voltage and frequency matching your standard outlets. The transformer should have an isolated secondary of either 220 VAC (220 -240 is OK) or 120 VAC (110-120 is OK) and be rated for at least 100 ma. The transformer could also have dual 115VAC primaries wired in series for 220V or in parallel for 120 VAC. An example is Triad N-68X, shown below, rated 50VA, 50/60 Hz.

Obtain a power resistor of either 1200 (1.2K) ohms, 15-25W min, if using a 120V secondary or 2200 (2.2K) ohms, 25 -30W for a 220V secondary.

4. Assemble the transformer and power resistor in a metal box. Connect a 3 wire (w/gnd) power cord with ground wire attached to the metal box for safety. If a plastic box is used instead, connect the transformer core and the resistor mounts to the power cord ground wire. There should be a fuse ¼ - ½ A, in series with the transformer primary. From the transformer secondary connect one wire to the utility safety ground. This could be the cutting table frame, the ground terminal of the 120 or 220 VAC outlet or the test box if grounded as indicated.

An excellent ground measures 1 ohm or less. Up to 3 ohms is often acceptable, higher reduces the effectiveness of the EMI suppression.



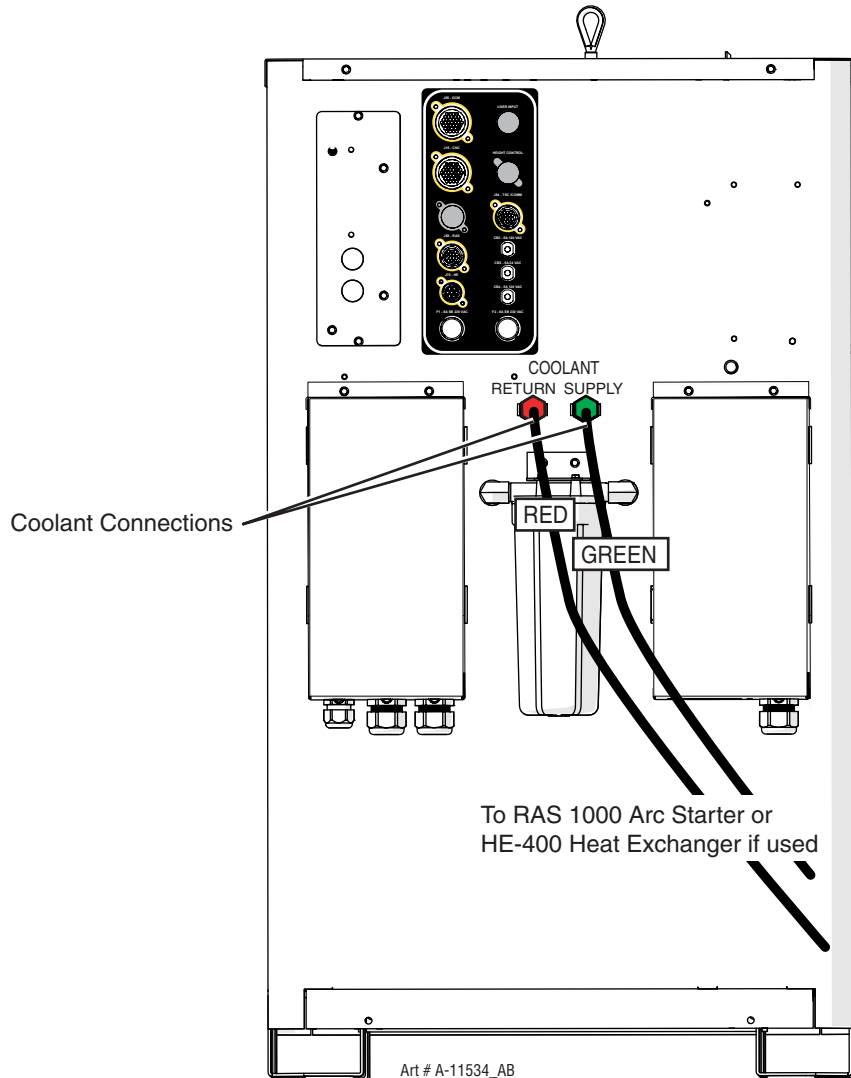
5. Increasing the ground rod length beyond 20 - 30 ft (6.1 – 9.1 m) does not generally increase the effectiveness of the ground rod. A larger diameter rod which has more surface area may help. Sometimes keeping the soil around the ground rod moist by continuously running a small amount of water into it will work. Adding salt to the soil by soaking it in salt water may also reduce its resistance. You may also try a chemical ground rod devise. When these methods are used, periodic checking of the ground resistance is required to make sure the ground is still good.

**E. Routing Of Torch Leads**

1. To minimize RF interference, position torch leads as far as possible from any CNC components, drive motors, control cables, or primary power lines. If cables have to pass over torch leads, do so at an angle. Do not run the plasma control or other control cables in parallel with the torch leads in power tracts.
2. Keep torch leads clean. Dirt and metal particles bleed off energy, which causes difficult starting and increased chance of RF interference.

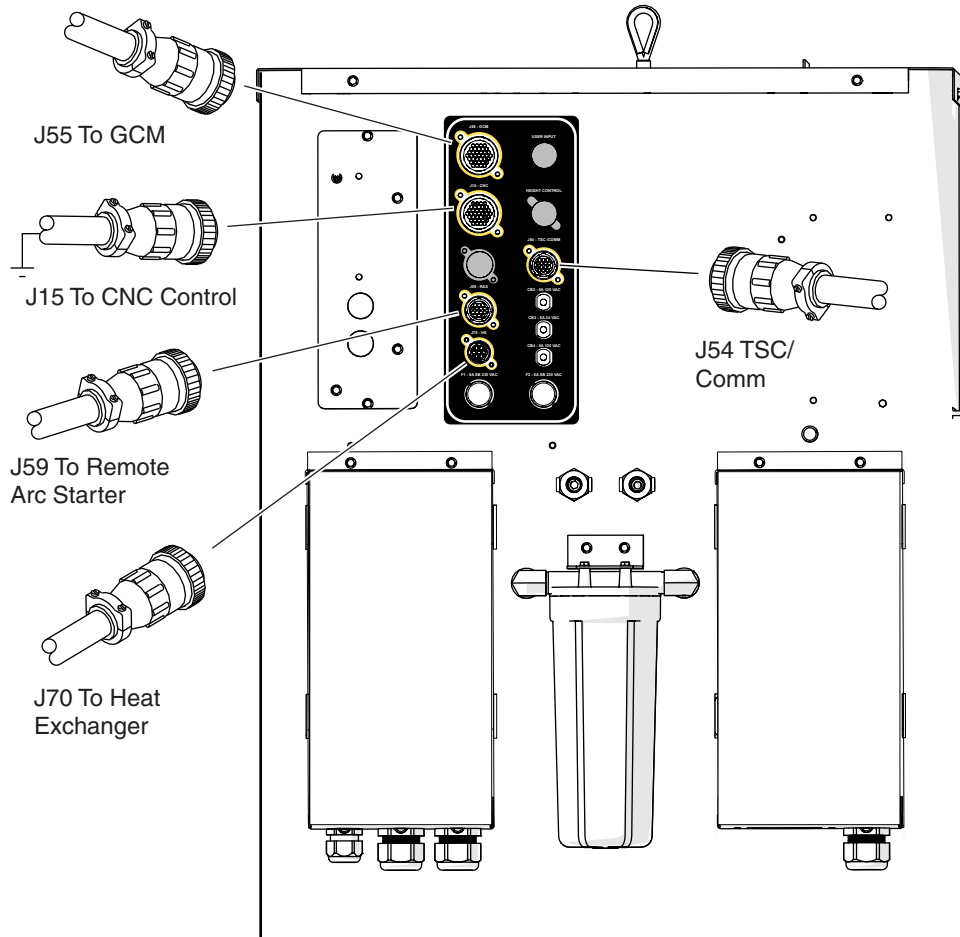
**3.09 Connect Coolant Leads**

1. Connect the color-coded coolant hoses to the coolant connections on the power supply rear panel. The supply line (out) is flagged green, the return line (in) is flagged red.



## 3.10 Connect Cables for CNC, Remote Arc Starter, DMC-3000 and HE 400

1. Connect one end of each cable to the power supply.
2. Connect the other end of the CNC cable to the CNC device.
3. The CNC cable shield must be attached to ground at the CNC end.



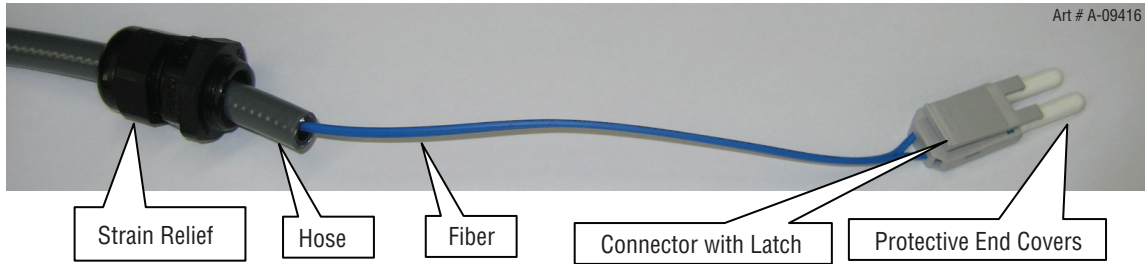
Art # A-11971

### 3.11 Handling and Installation of Fiber Optics

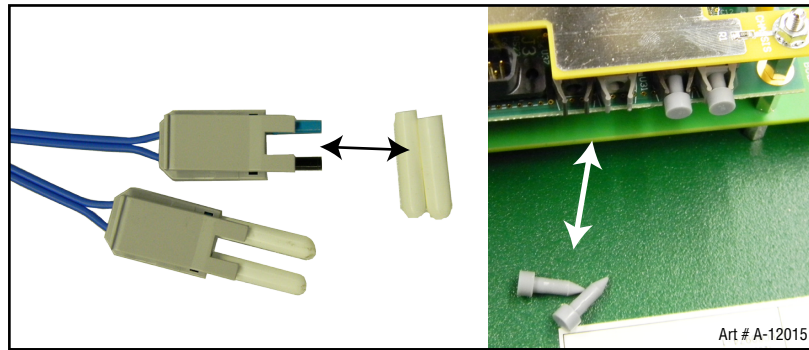
#### General Information

This kit is for proper handling and installation of Fiber Optic Cables used in Thermal Dynamics Ultra-Cut® and Auto-Cut O2® automated gas boxes and Gas Control Modules.

Fiber Optic cable is used in place of wire because it offers far superior immunity to electrical noise but it is more delicate and requires careful handling. With fiber optics, electrical signals are converted to light with a transmitter LED. The light passes down the fiber where it is converted back to an electrical signal at the receiver end. Any damage to the fiber from sharp bends or pulling that stretches the fiber can reduce its ability to transmit light. We run the fiber inside a hose for most of its length to protect it from abrasion, burning from hot metal or sharp bends but the ends are exposed and must be handled with care.



Remove fiber optic end covers and plugs.



*Disconnect primary power at the source.*

#### Avoid the following:

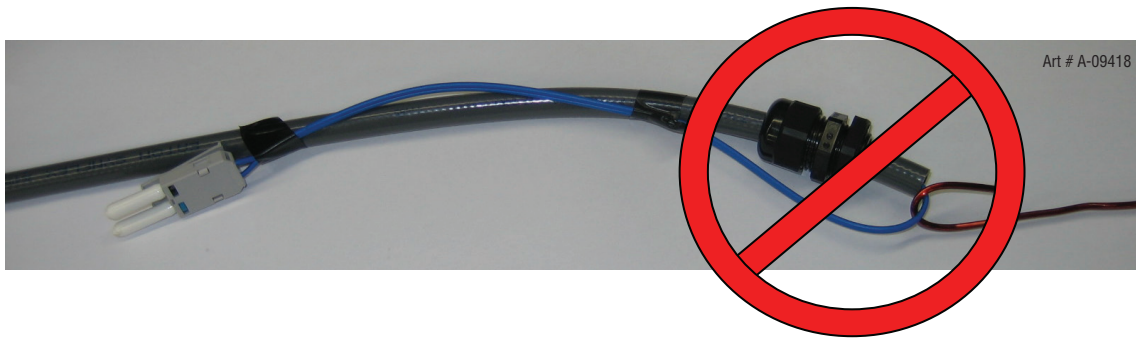
1. If you need to pull the cable through a power track do not fold the fiber back on itself making a sharp bend where it exits the hose.





## ULTRA-CUT 100 XT

2. Do not hook onto the fiber to pull on the cable.

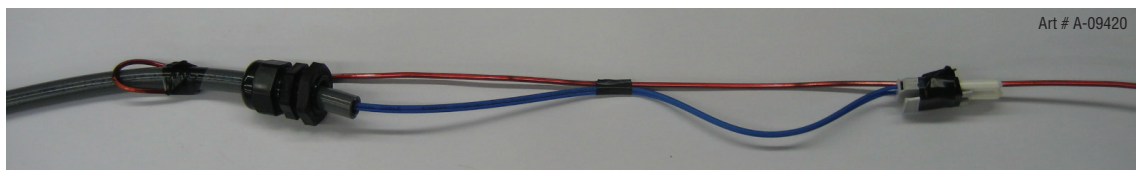


3. Once the fiber cable is installed in the CCM or gas control make sure the strain relief nut is securely tightened onto the hose so the hose can't pull out of it like this:



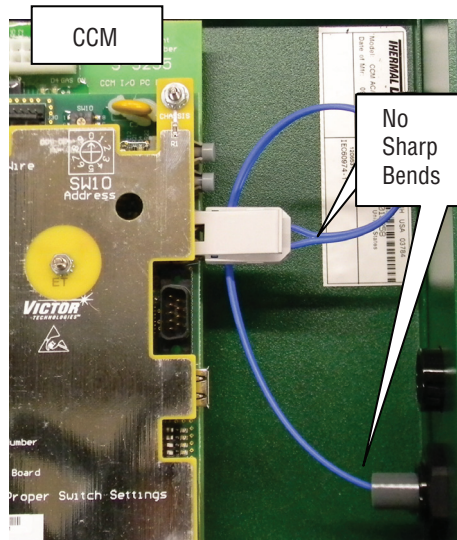
### Correct installation:

Correct way to pull the cable is to use a snake or a wire or another cable and attach it securely to the hose behind the strain relief. Then secure the fiber connector to the pulling device leaving some slack in the fiber. Keep the protective end covers on the fiber until you are ready to connect it to the PCB in the CCM or gas control.



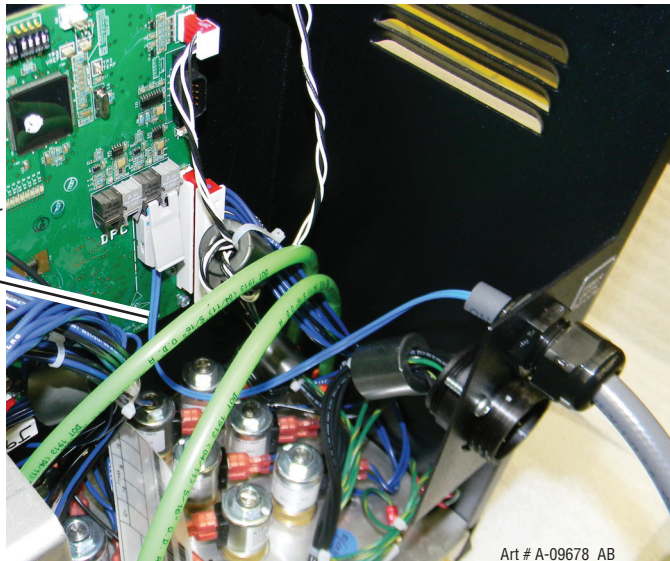


Correct installation in CCM or Gas Control leaves a loop of fiber so there is no stress on the fiber where it exits the connector or the hose.



Art # A-12014

Correct routing of fiber optic cable. No sharp bends going into connectors.

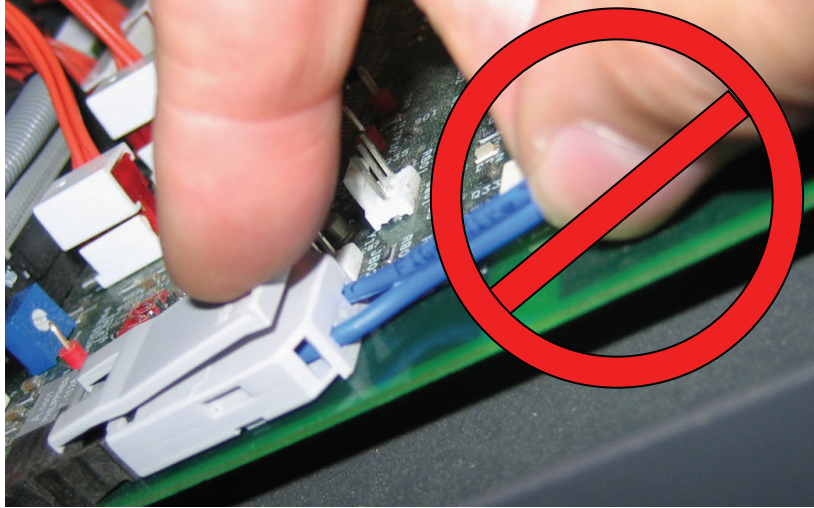


Art # A-09678\_AB

# ULTRA-CUT 100 XT

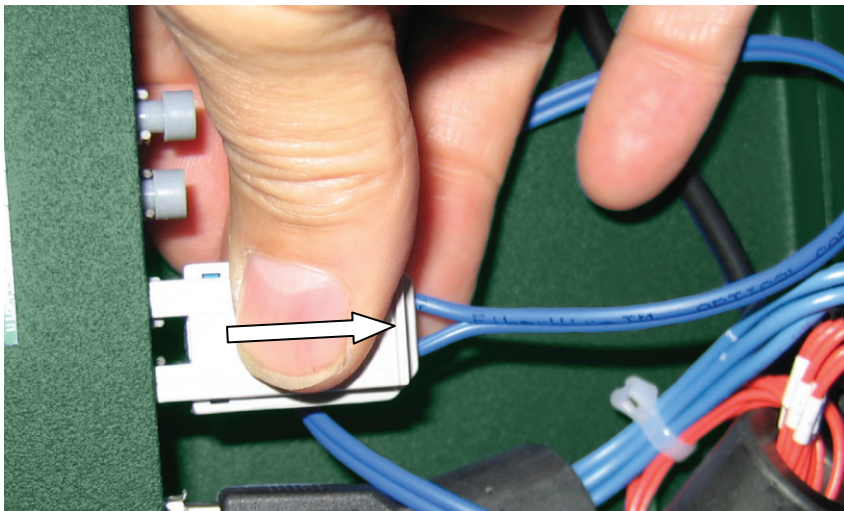
## Unplugging the fiber optic connector.

Do not pull on the fiber cable!



Art # A-09423

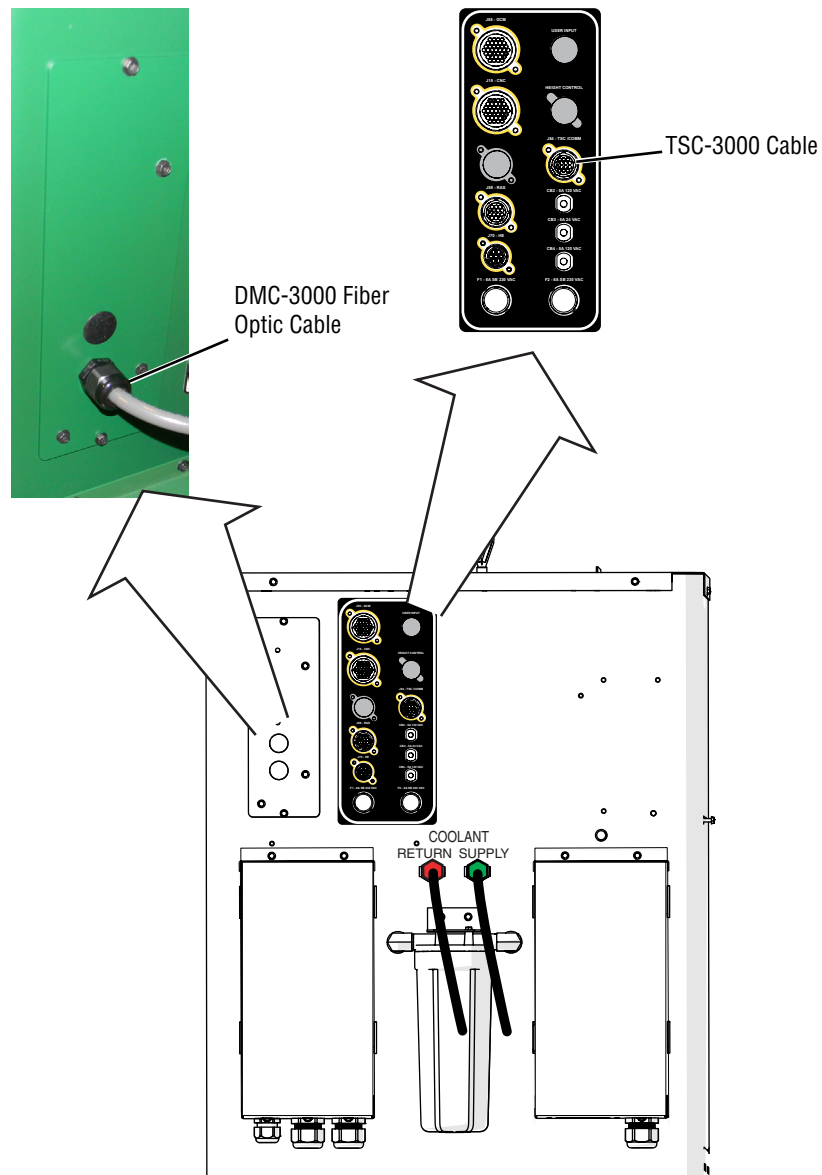
For the CCM grip the fiber connector front and back squeezing the latch lever and remove from the socket.



Art # A-09424\_AB

### 3.12 Connect DMC-3000 Fiber Optic Cable to CCM

1. Remove the bottom plastic plug in the CCM at the rear of the Power Supply.

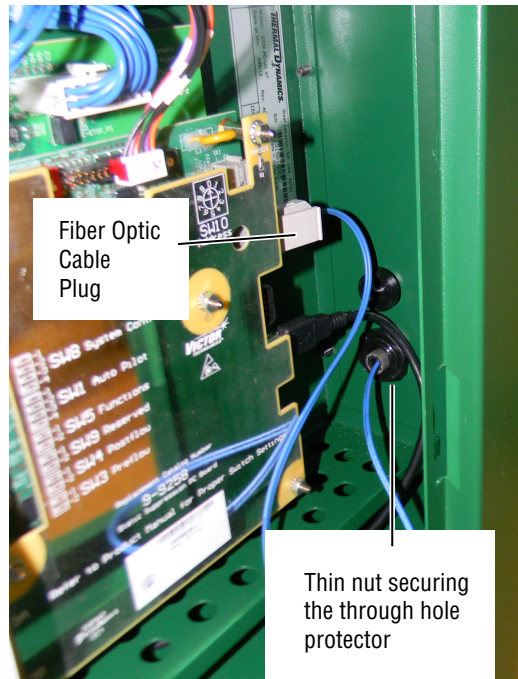




## CAUTION

*Avoid kinking, twisting, or bunching the fiber optic cable. The cable can be damaged by being forced into tight-radius turns.*

2. Remove outer thin nut from through hole protector at one end of Fiber Optic Cable (L) that connects between the CCM portion of the Power Supply and the DMC-3000.
3. Feed the Fiber Optic Cable plug and wires through the hole where the plastic plug was removed labeled GCM/DMC and slide the thin nut back over the Fiber Optic Cable.
4. Secure the thin nut on the through hole protector so both nut faces are tight against the sheet metal inside and out.
5. Plug the Fiber Optic Cable into the PCB as shown below. Make sure the locking tabs are engaged. Fiber Optic for the DMC-3000 goes into the lower pair of fiber optic receptacles (U31 & U37).



Art # A-11998

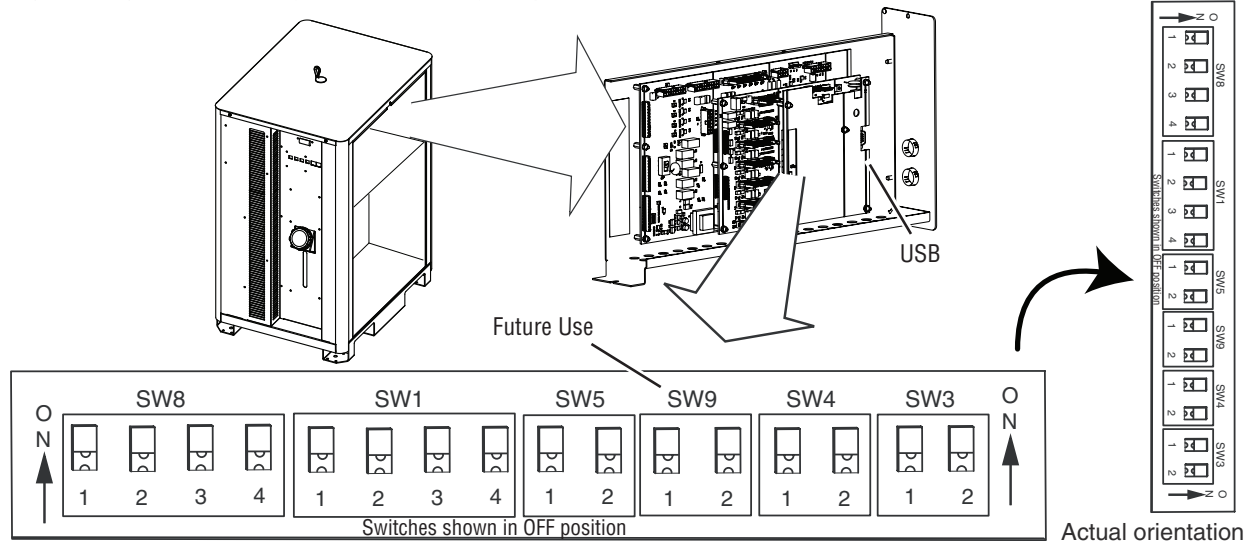
### 3.13 Set Switches on the Command - Control Module

Remove the power supply upper right side. Set switches on the CCM (Command-Control Module) per the illustrations. Switch settings and connection details are provided in the Appendix. Any changes made require a restart of the power supply.



**CAUTION**

Printed circuit boards in the Command - Control Module are static - sensitive. Discharge any built-up static charges in your body or surroundings before touching the printed circuit boards.



- SW 8-1: Pilot Time      1 = OFF = Short (85 ms.) (Factory default setting).  
                                 1 = ON = Long (3 s.)
- SW 8-2: Remote Current    1 = OFF = Disabled (Factory default setting).  
                                 1 = ON = (Remote Analog Current Control) Also set SW11 to "A" position
- \*SW 8-3: Auto Transfer Retry1 = OFF = Enabled Up to 3 tries (Factory default setting).  
                                 1 = ON = Disabled
- SW 8-4:                      OFF = Disabled (Factory default setting).  
                                 ON = Remote Marking SW Enabled at TB3-1&2

- SW-1-1: Auto Pilot Restart. 1 = ON = Auto Pilot Function enabled.  
                                 1 = OFF = Auto Pilot Function disabled (Factory default setting).
- SW-1-2: Pilot Delay      2 = OFF, 3 = OFF, 4 = OFF: 0 Seconds (Factory default setting).
- SW-1-3: Pilot Delay      2 = ON, 3 = OFF, 4 = OFF: 0.1 Seconds
- SW-1-4: Pilot Delay      2 = OFF, 3 = ON, 4 = OFF: 0.2 Seconds  
                                 2 = ON, 3 = ON, 4 = OFF: 0.4 Seconds  
                                 2 = OFF, 3 = OFF, 4 = ON: 0.8 Seconds  
                                 2 = ON, 3 = OFF, 4 = ON: 1.0 Seconds  
                                 2 = OFF, 3 = ON, 4 = ON: 1.5 Seconds  
                                 2 = ON, 3 = ON, 4 = ON: 2.0 Seconds

Active only when SW-1-1 is set to ON.

- SW-5-1: Tip Saver        Reserved for Factory use.
- SW-5-2: Off Plate        Reserved for Factory use.
- SW-4: Postflow Time    1 = OFF, 2 = OFF: 10 Seconds (Factory default setting).  
                                 1 = ON, 2 = OFF: 20 Seconds  
                                 1 = OFF, 2 = ON: 5 Seconds  
                                 1 = ON, 2 = ON: 0 Seconds
- SW-3: Gas Preflow Time 1 = Off, 2 = OFF: 3 seconds  
                                 1 = ON, 2 = OFF: 4 seconds  
                                 1 = OFF, 2 = ON: 6 seconds  
                                 1 = ON, 2 = ON: 8 seconds

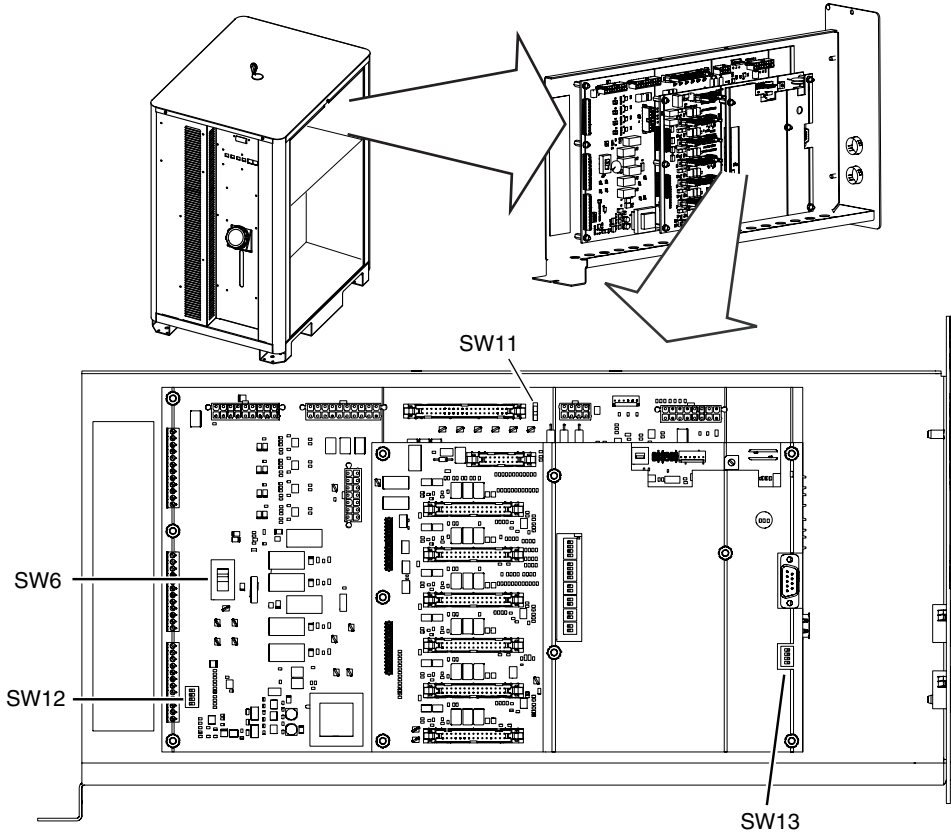
Art # A-11890\_AB





## CAUTION

Printed circuit boards in the Command - Control Module are static - sensitive. Discharge any built-up static charges in your body or surroundings before touching the printed circuit boards.

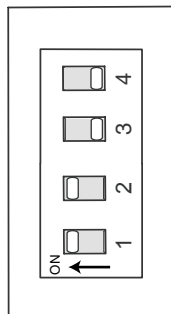


- SW-6: OK-to-Move: Contact closure, 120VAC @ 1A (Factory default setting) or DC Volts (16-18vdc @ up to 100 ma.)
- SW-11: Set "B" position, (up) for default
- SW-11: Set "A" position (down) for remote analog current control. SW-8-2 must be set to "ON".

SW-12-1/2/3/4: Divided Arc signal All = OFF = 50:1 (Factory default setting)

- 1 = ON = 16.6:1
  - 2 = ON = 30:1
  - 3 = ON = 40:1
  - 4 = ON = 25:1
- } Only 1 on at a time.

SW13: Ultra-Cut Switch positions



Art # A-12016\_AB

SW13 (Note positions 3-4 are not yet used)

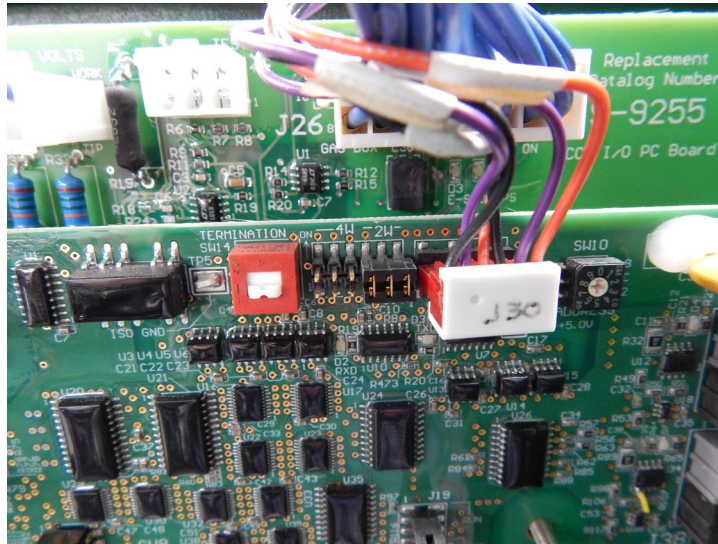
**2 - Wire and 4 - Wire settings**

When used with the TSC-3000 the plug should be in the 2 wire (2W) position shown below.

For other CNC controls using 4 wire communication such as the XT iCNC, place the jumper in the 4W position.

**NOTE**

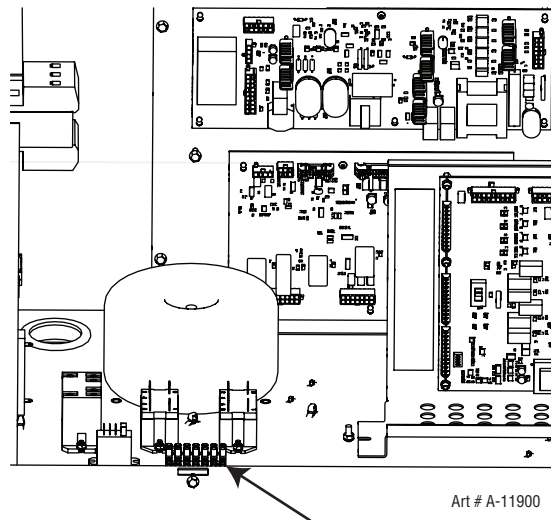
*Failure to set in the correct position will result in no communication with the device.*



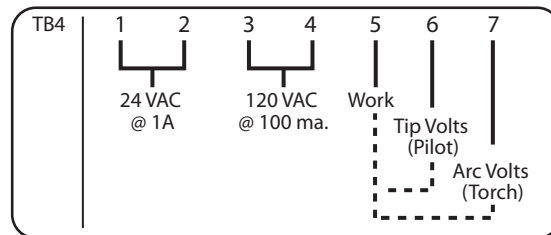
Art # 12322

**3.14 Height Control Connections**

The terminal strip provides connections to negative Arc Volts (Torch or electrode), Tip Volts (Pilot) and Work. These are for a height control that requires connection to the full non-divided arc voltage. Also available on the terminal strip are 120VAC and 24 VAC. The allowable current draw is 100ma @ 120VAC and 1Amp @ 24 VAC.



Art # A-11900



Art # A-11954

**NOTE**

*There are holes added in the rear panel for customer wiring. This, rather than the one in the CCM will be the preferred place for customer added wiring (and strain relief) for connections to height controls, etc..*

## 3.15 DMC-3000 Gas Manifold Control Installation

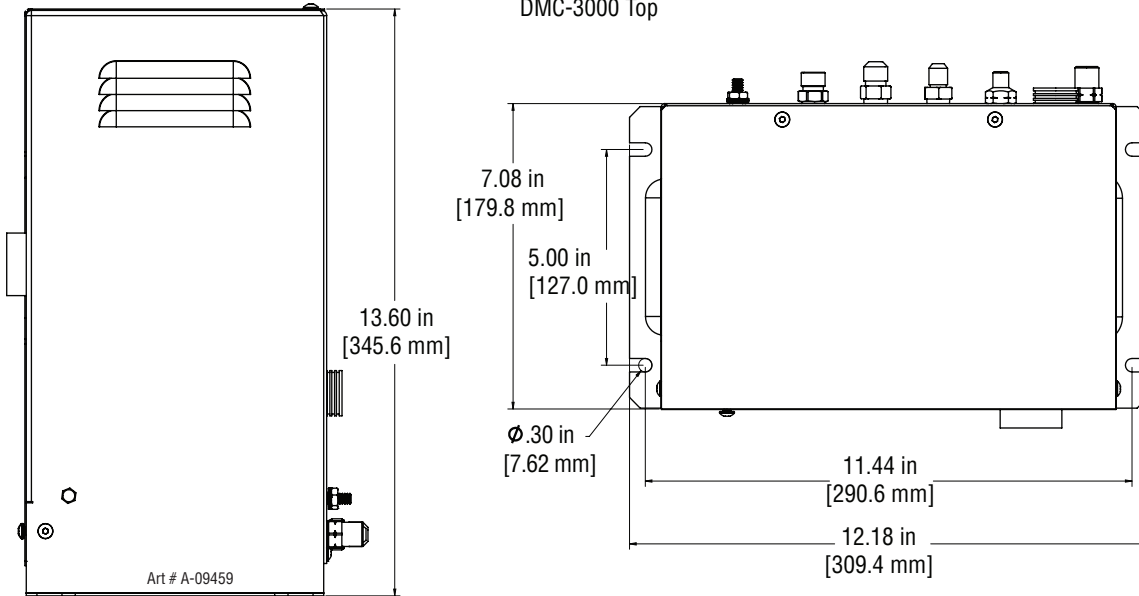
The DMC-3000 Gas Control must be installed in a suitable location where it is easily accessible to the system operator. The unit must be mounted to a flat horizontal surface. If the Module is mounted to any support subject to vibration or motion, the installer must fasten the module to the support securely.

The Module should be located as far away as possible from the Arc Starter due to possible electromagnetic interference. It is acceptable to locate the control cable in the same track as the cables from the Arc Starter and away from torch leads.

The Module includes feet which lift the bottom panel of the mounting surface. Louvers on the back panel of the module must remain unblocked, for the free passage of ventilating air.

### Mounting Dimensions

DMC-3000 Profile



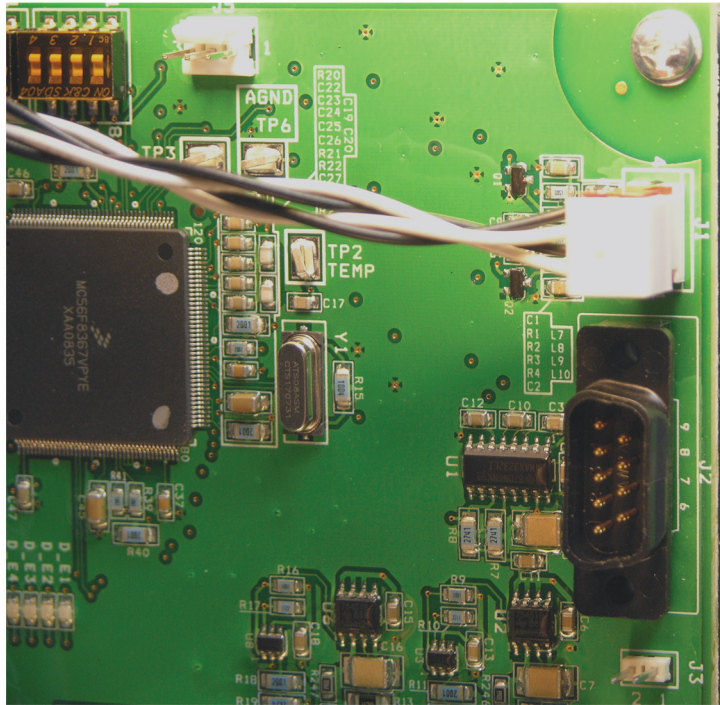
### Preparation

1. Remove the screws securing the Cover Panel to the Module.





- Carefully remove the cover from the module noting the attached wire harness that connects to J1. Remove the wire harness and then set the cover to the side.



Art # A-09140

- Attach all hoses and cables to the front of the DMC-3000 except the Fiber Optic cable which will be covered a little later. Avoid turning any fittings already mounted in the unit by placing a wrench on it before tightening the hose fitting to it.



Art # A-09141\_AB

**NOTE**

*Argon must be used for the “Marking” gas. If replacing existing fittings in the base, apply thread sealant to the fitting threads, according to manufacturer’s instructions. Do not use Teflon tape as a thread sealer, as small particles of the tape may break off and block the small air passages in the torch.*

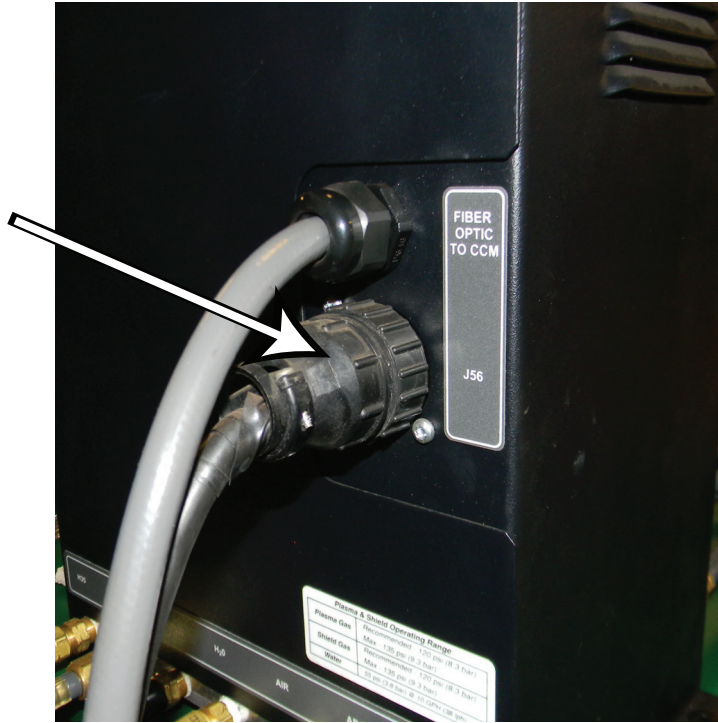
**NOTE**

*If you need to replace a gas or water fitting all inlets and outlets of the aluminum manifold are 1/4” NPT (United States National Pipe Thread) into which are screwed the various adapters.*

- Connect the ground cable to rear of DMC-3000 shown in previous illustration.

## ULTRA-CUT 100 XT

5. Connect Control cable from the Power Supply to J56 on the front of the DMC-3000 as shown below. The Fiber Optic cable will be covered a little later.



Art # A-09142\_AB

6. Install WMS Water Softener Kit in the line that feeds the inlet side of the DMC-3000. Mount the softener and bracket on the power supply where the provided 2' hose can reach to the DMC-3000. Mounting in another location is possible with a customer provided hose. Below is typical customer added hose and installation.



Art # A-09655

7. Make sure that the hose going to the DMC-3000 is connected to the port on the WMS Water Softener marked "OUT" and the incoming water supply connected to the port marked "IN". Do not mount over any electronics or outlets in case of leaks during operation or spills when changing the element at a later date.

### 3.16 DPC-3000 Gas Pressure Control Installation

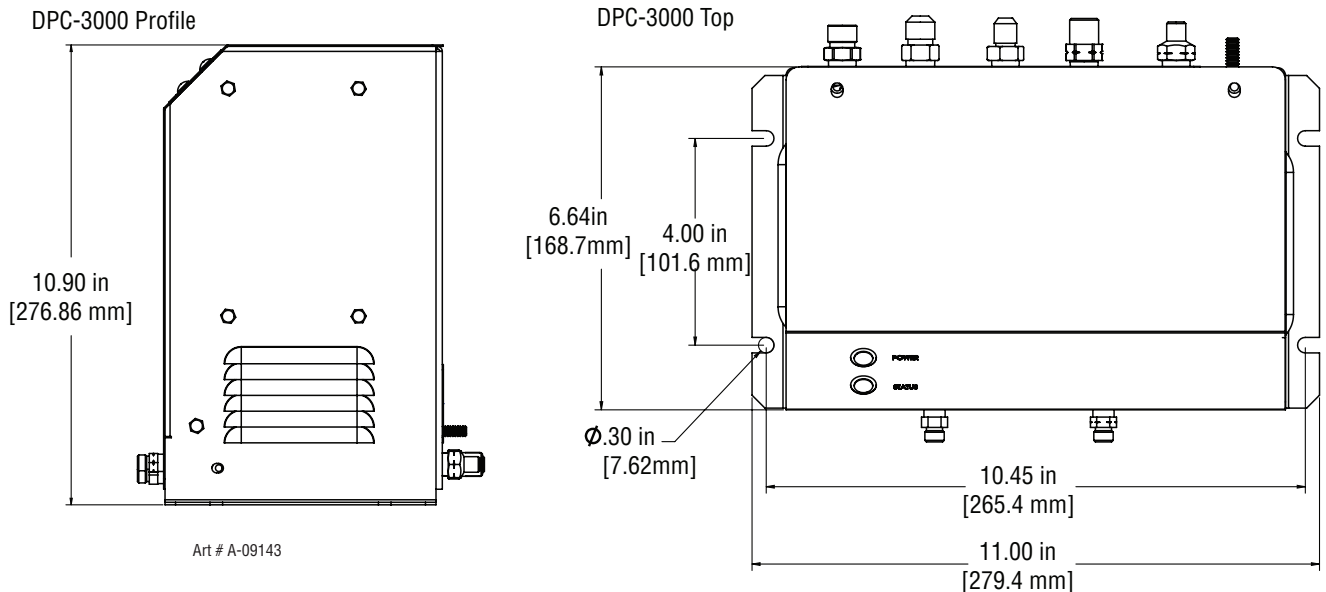
The DPC-3000 Gas Control must be installed in a suitable location close to the Torch such as the gantry. The unit must be mounted to a flat horizontal surface. If the Module is mounted to any support subject to vibration or motion, the installer must fasten the module to the support securely.

The Module should be located as far away as possible from the Arc Starter due to possible electromagnetic interference. It is acceptable to locate the control cable in the same track as the cables from the Arc Starter and away from torch leads.

The Module includes feet which lift the bottom panel off the mounting surface. Louvers on the back panel of the module must remain unblocked, for the free passage of ventilating air.

The Module also comes with non metallic isolation grommets for mounting. These must be used in all four mounting slots to raise the Module so there is no metal to metal contact between the Module and the mounting surface in order to reduce the chance of EMI interference.

#### Mounting Dimensions



#### Preparation

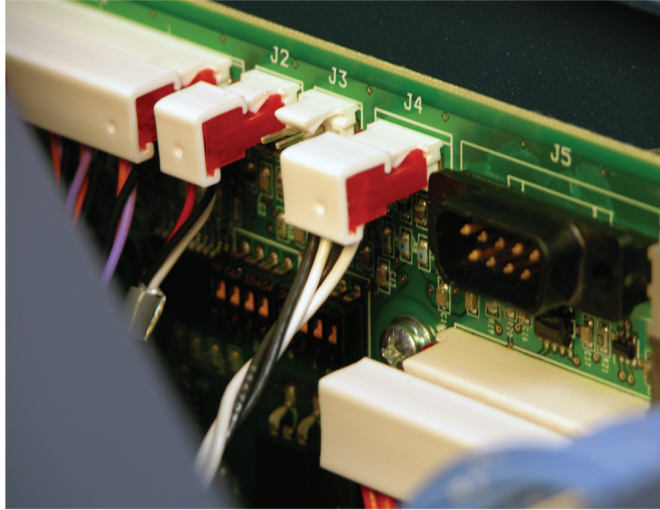
1. Remove the screws securing the Cover Panel to the Module.





## ULTRA-CUT 100 XT

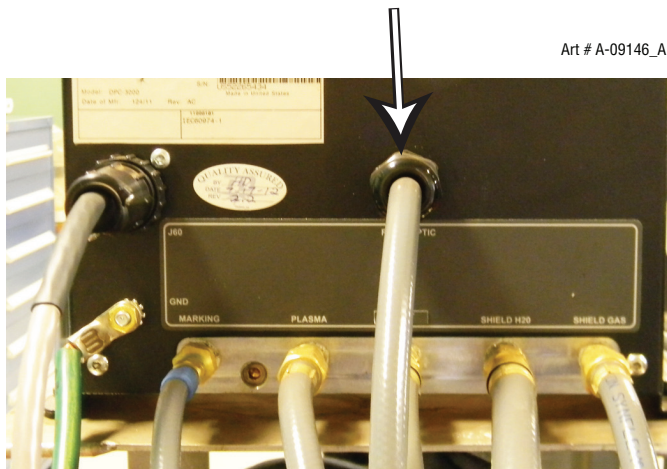
2. Carefully remove the cover from the module noting the attached wire harness that connects to J4. Remove the wire harness and then set the cover to the side.



Art # A-09145

3. Attach all hoses and cables to the back of the DPC-3000 except the Fiber Optic cable which will be covered a little later. Avoid turning any fittings already mounted in the unit by placing a wrench on it before tightening the hose fitting to it.

Do not connect Fiber Optic cable until later



Art # A-09146\_AB

4. Connect hoses from the front of the DMC-3000 where shown below to the torch.

**NOTE**

*One fitting with the notches is left hand thread and the other is standard right hand thread.*



## 3.17 Fiber Optic Cable Installation from CCM to DMC-3000



### CAUTION

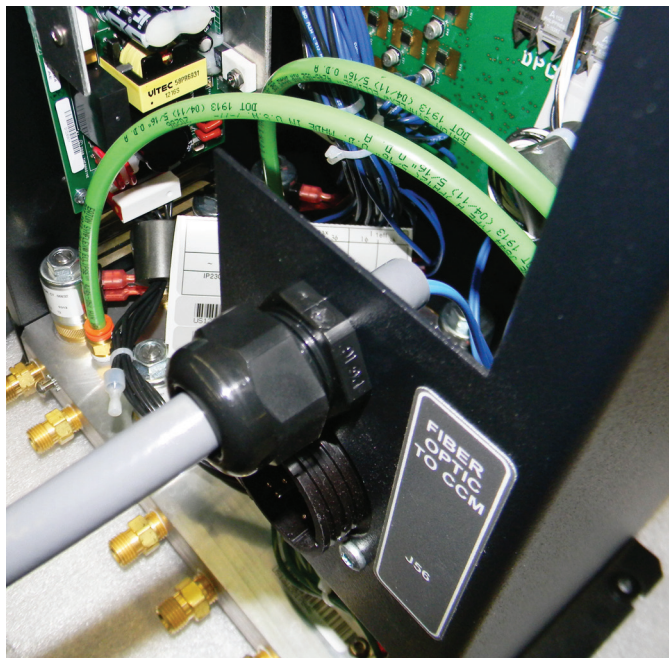
Avoid kinking, twisting, or bunching the fiber optic cable. The cable can be damaged by being forced into tight-radius turns. Review section 3.10 for proper handling and installation of fiber optic cable.

1. Remove outer thin nut from through hole protector at the end of Fiber Optic Cable (L) that is connected to the CCM.
2. Ensure that the cable is exposed beyond the through hole protector approximately 1" (as shown below) and secure by tightening the wide nut with the rounded end while holding the other nut in place. Normal hand tightening is not enough.
3. Feed the Fiber Optic Cable plug and wires through the hole where shown then slide the thin nut back over the Fiber Optic Cable.



Art # A-09148\_AB

4. Secure the thin nut on the through hole protector so both nut faces are tight against the sheet metal inside and out.

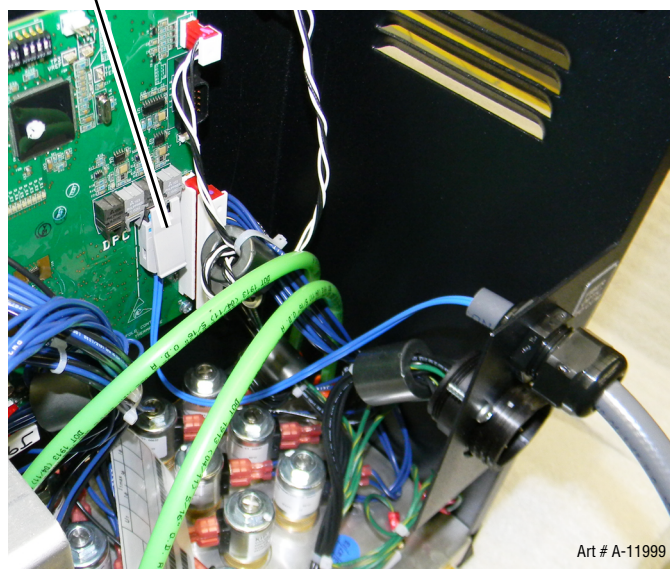


Art # A-09149\_AB



5. Plug the Fiber Optic Cable into the PCB as shown below. Make sure the locking tabs are engaged.

Fiber Optic Cable to/from  
CCM plugs in here



### 3.18 Fiber Optic Cable Installation From DMC-3000 to DPC-3000

1. Remove outer thin nuts from through hole protector at both ends of Fiber Optic Cable (L) that connects between the DCM-3000 and DPC-3000.

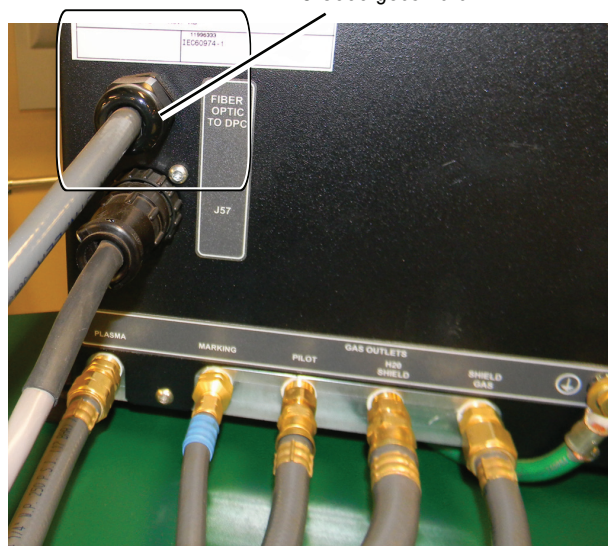


**CAUTION**

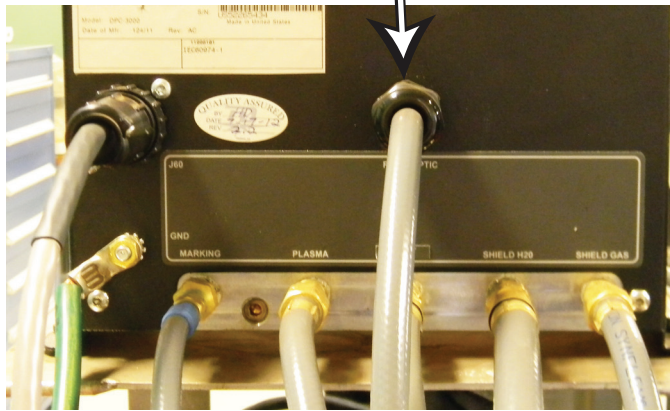
*Avoid kinking, twisting, or bunching the fiber optic cable. The cable can be damaged by being forced into tight-radius turns.*

2. Ensure that the outer protective hose/cable is exposed beyond the through hole protector approximately 1” and secure by tightening the wide nut with the rounded end while holding the other nut in place. Normal hand tightening is not enough.
3. Feed the Fiber Optic Cable plug and wires through the back of each module (DMC-DPC) where indicated and slide the thin nut back over the Fiber Optic Cable.

Fiber Optic for  
DMC-3000 goes here



Insert Fiber Optic cable here



Art # A-09153\_AB

4. Secure each of the thin nuts on the through hole protectors so both nut faces are tight against the sheet metal inside and out.
5. Plug the Fiber Optic Cable into the PCB as shown below for the DMC-3000. Make sure the locking tabs are engaged.

Plug Fiber Optic cable to/from DPC-3000 here

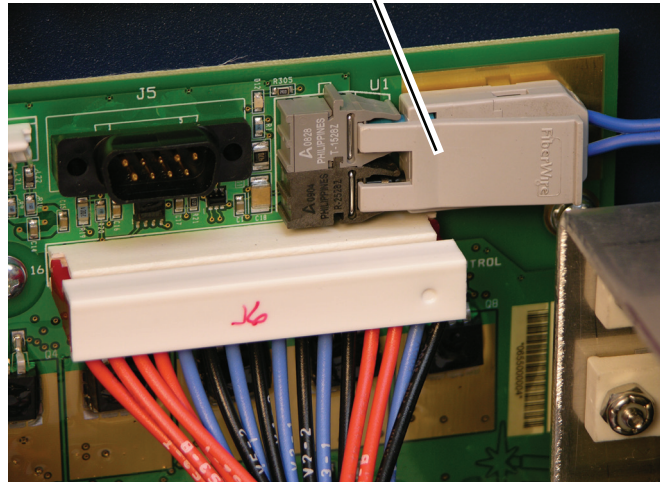


Art # A-09154



6. Plug the Fiber Optic Cable into the PCB as shown below for the DPC-3000. Make sure the locking tabs are engaged.

Fiber Optic to/from DMC-3000 plugs in here

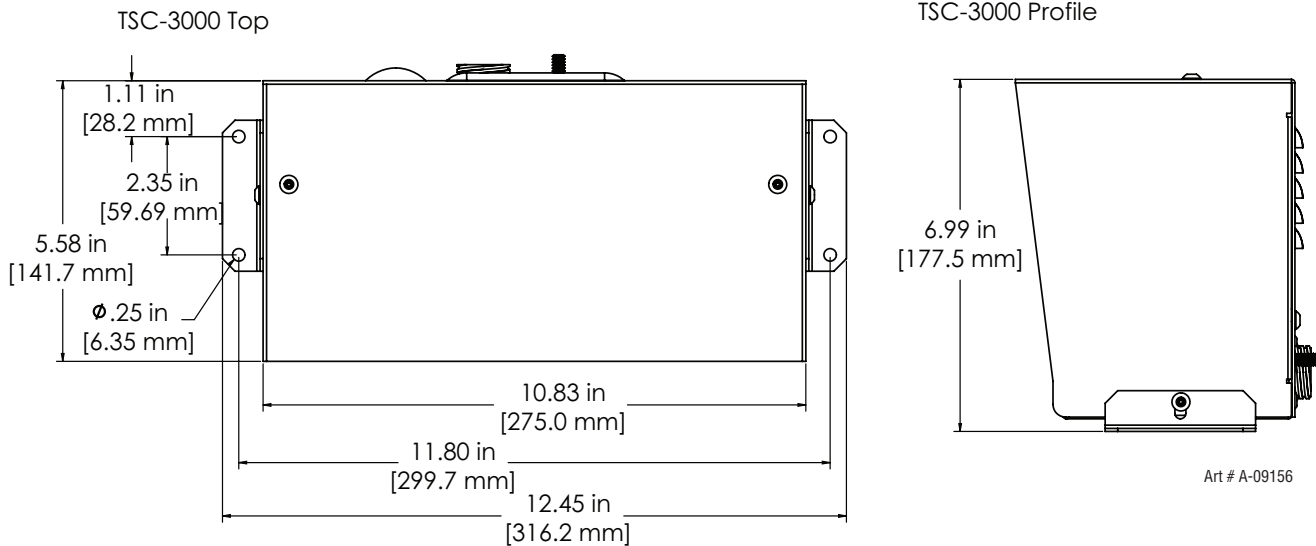


Art # A-09155

7. Reinstall the Cover Panels making sure the wire harnesses are attached.

## 3.19 Install TSC-3000 Touch Screen Control

### Mounting Dimensions

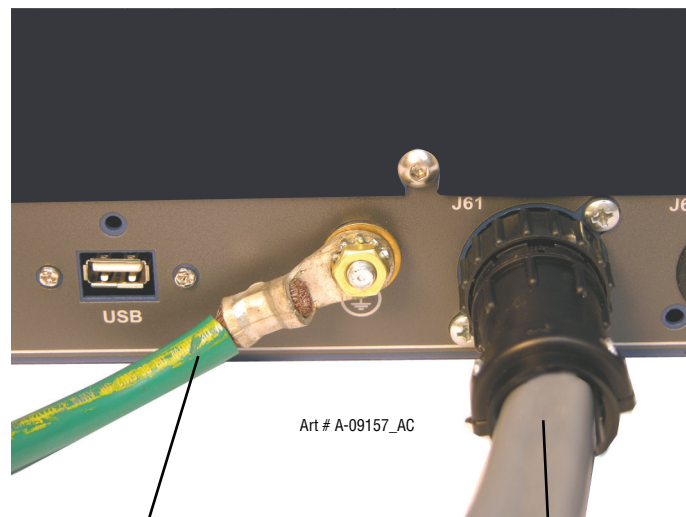


### Preparation

1. Select a clean, dry location with good ventilation and adequate working space around all components. Review the safety precautions in the front of this manual to be sure that the location meets all safety requirements. The TSC-3000 mounting brackets allow for mounting on or under a horizontal surface as well as left or right of a vertical surface. Choose which ever works best for protection against moving equipment and flying metal/cutting debris etc..
2. Once the unit has been secured to a flat surface, attach Communication cable ("V" which is already attached to J54 on the unit's rear panel done in sub section 3.10) and ground cable ("F") to the rear of the unit.

### NOTE

*Make sure the CCM CPU jumper is set to 2 Wire (2W) noted earlier in section 3.13 and in the Appendix.*



Ground Cable to/from  
"Star" ground on table

Communication Cable to/from  
CCM rear of power supply

### 3.20 Install Remote Arc Starter

#### Site Location

Select a clean, dry location with good ventilation and adequate working space around all components.

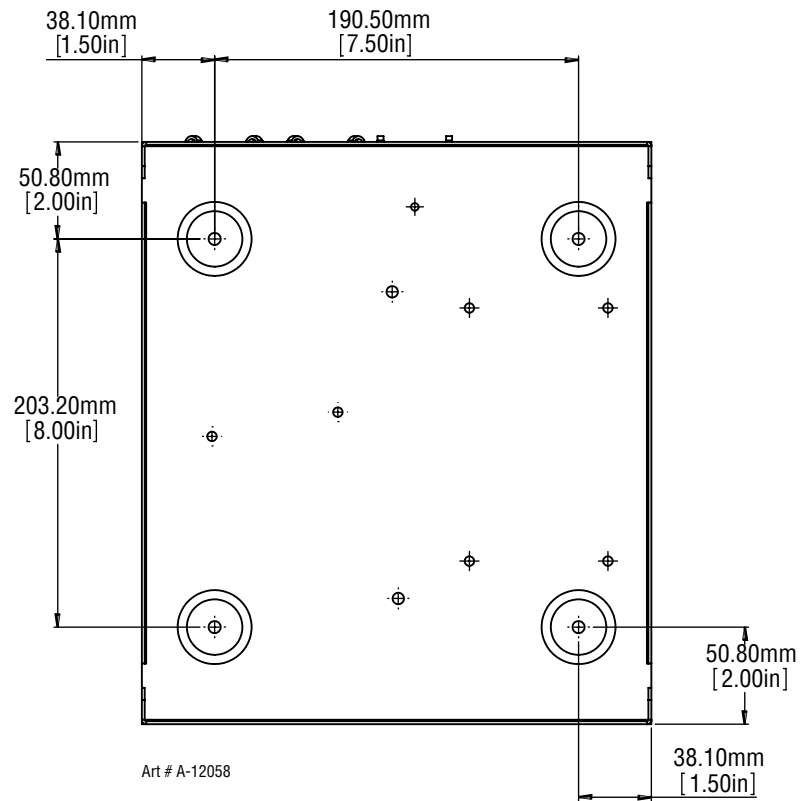
Review the safety precautions in the front of this manual to be sure that the location meets all safety requirements.

Interconnecting cables and hoses attach to the Arc Starter. There must be adequate space around the Arc Starter for these connections without excessive kinking or bending.

#### Mounting Dimensions

**NOTE**

*Height not shown is 7.375" ( 187mm )*



# ULTRA-CUT 100 XT

## Installation

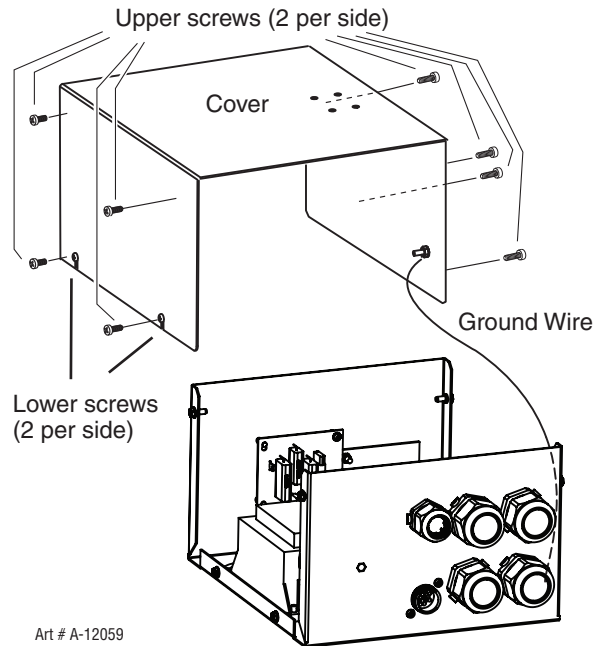
The Remote Arc Starter must be installed in a suitable location near the torch head. If the Arc Starter is mounted to a gantry or to any other support subject to motion or vibration, fasten the Arc Starter to the support securely.

1. Loosen, but do not remove, the lower screws securing the cover to the Arc Starter. Remove the upper screws securing the Cover Panel to the Arc Starter.

### NOTE

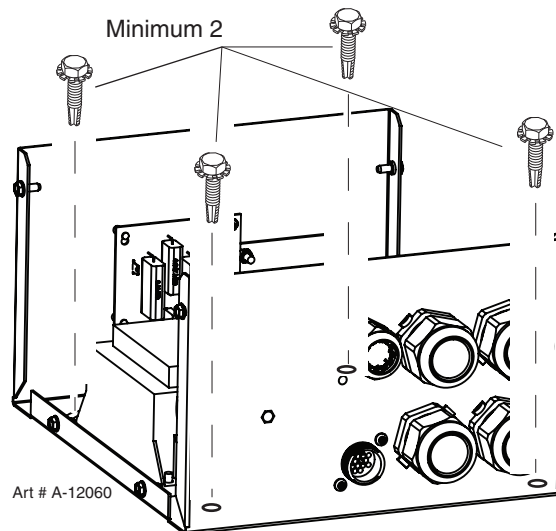
*A ground wire connects the cover to the Arc Starter base. This wire must remain in place.*

2. Remove the Cover Panel from the Arc Starter.



Cover Removal

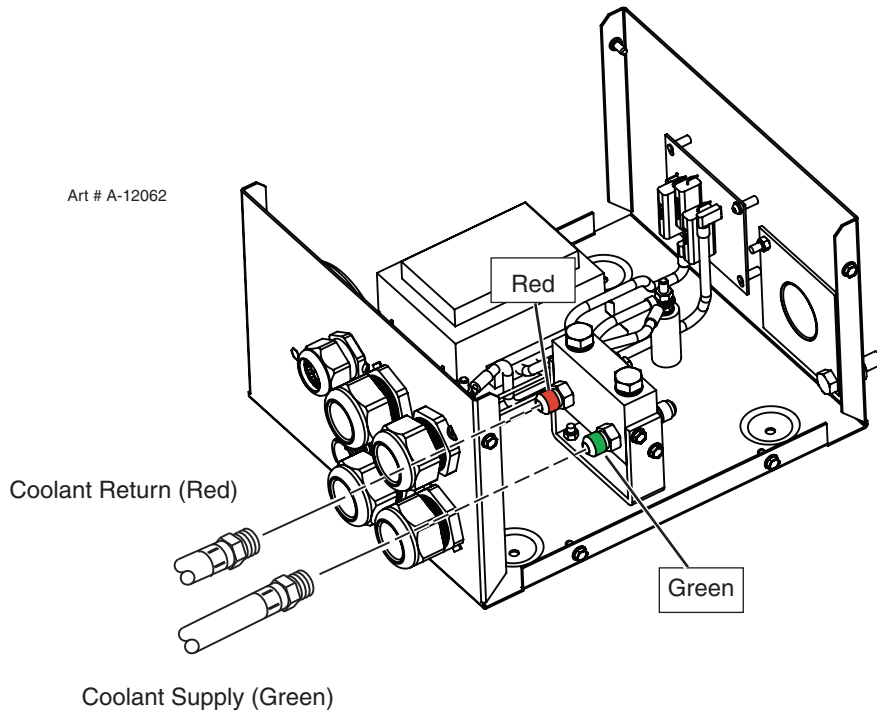
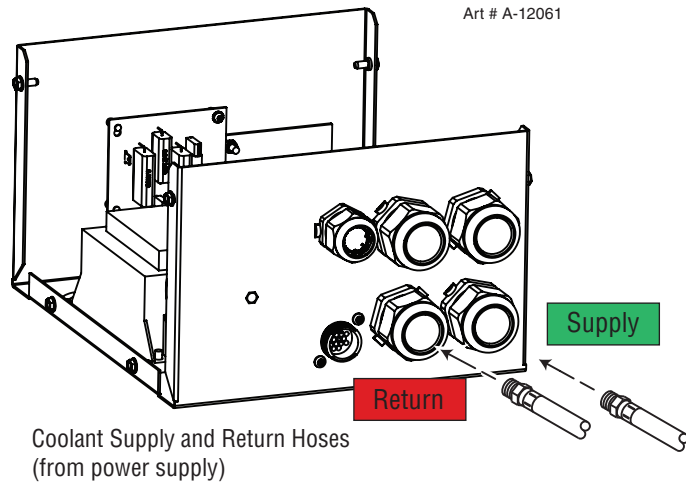
3. Position the Arc Starter on a flat, horizontal mounting surface.
4. Use pre-drilled holes in at least two of the feet on the bottom of the Arc Starter to secure the Arc Starter to the mounting surface.



**Input Connections**

1. Refer to the illustrations. Make the following input connections to the Arc Starter.

- Coolant Supply and Return Hoses (from HE-400 Heat Exchanger). Hoses and connectors are color-coded; Red for Return, Green for Supply.

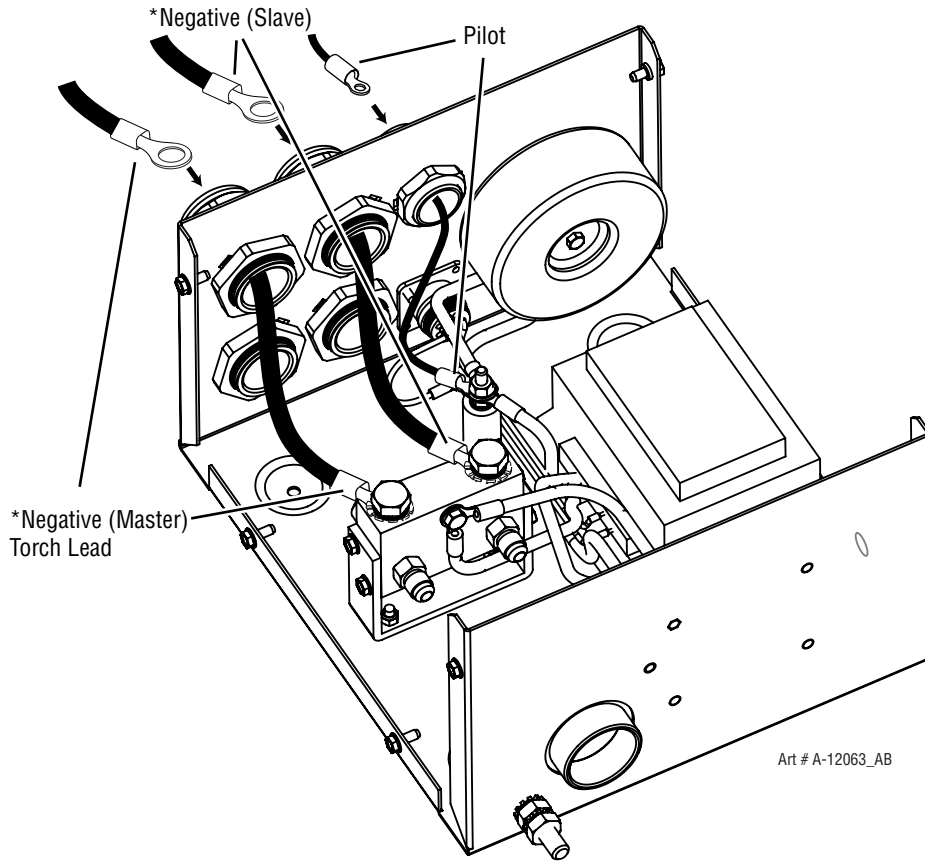


# ULTRA-CUT 100 XT

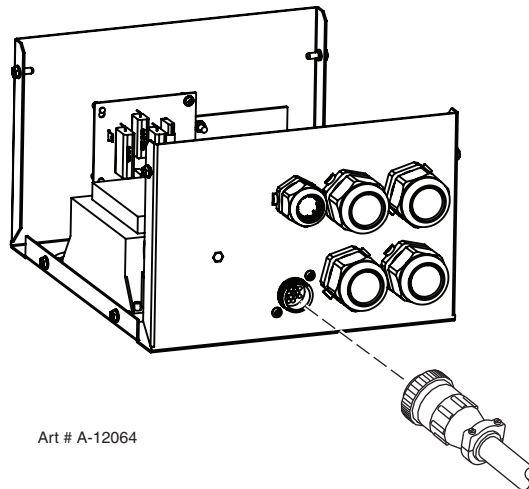
2. Refer to illustration. Connect the Pilot wire and Negative cables using a star washer on each.

## NOTE

\* Slave and Master refer to only those set ups using two power supplies in parrallel. Slave is not used in single system operations.



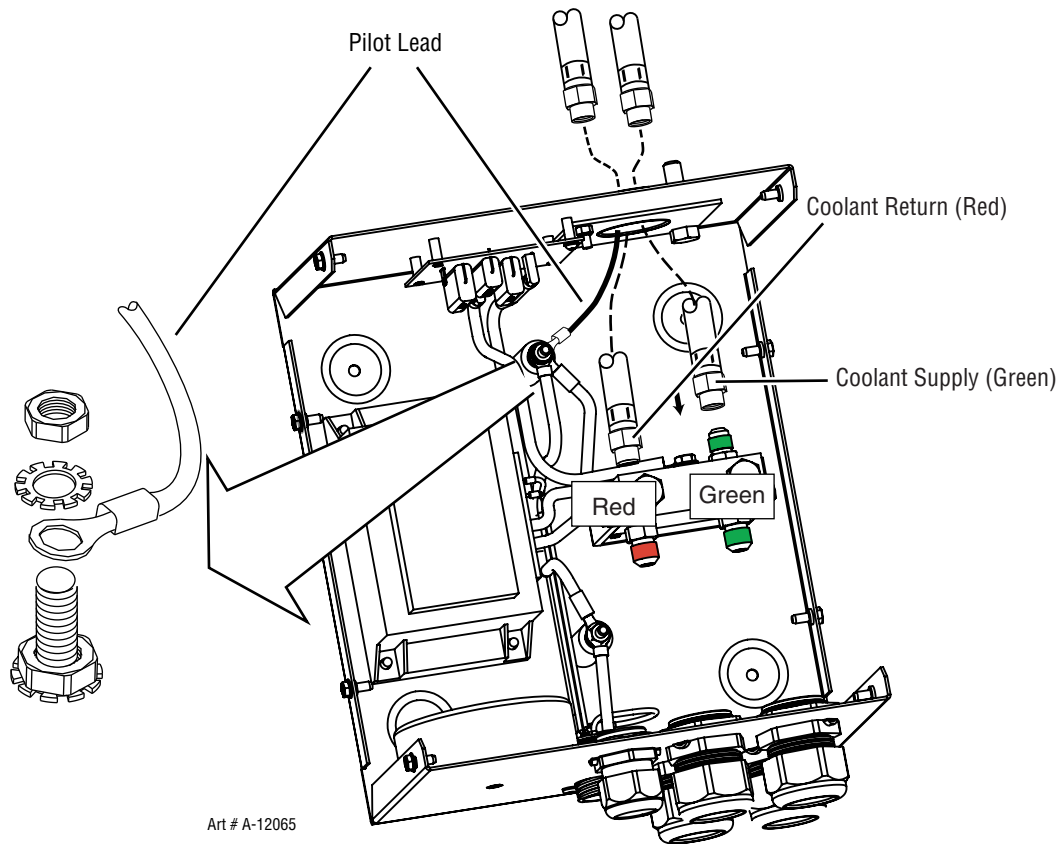
Negative Master, Negative Slave and Pilot Cables (from Power Supply )



Control Cable from Power Supply rear panel

**Output Connections**

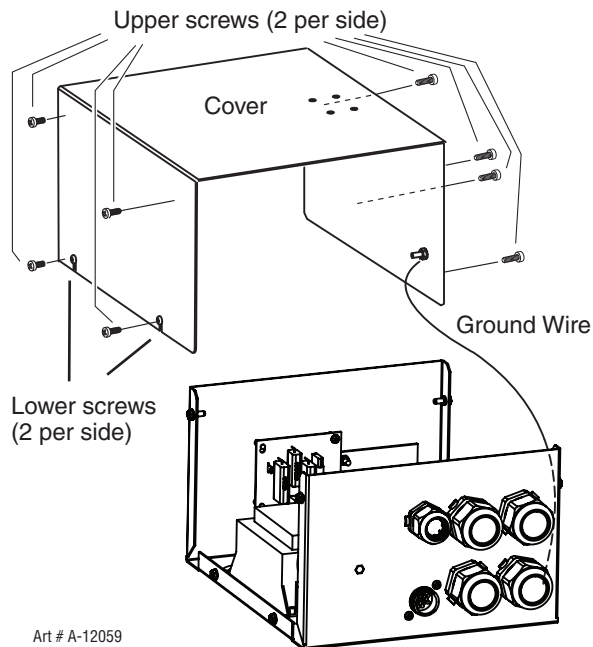
1. Refer to the illustrations. Make the following output connections to the Arc Starter.



Art # A-12065

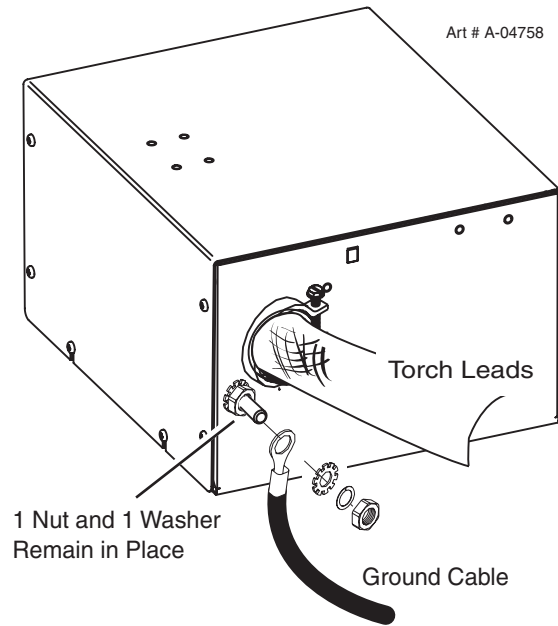
Pilot Return Cable, Coolant Supply and Return Hoses (from Torch)

2. Reinstall the Arc Starter Cover. Ensure that the ground wire is not crimped between the cover and the base.

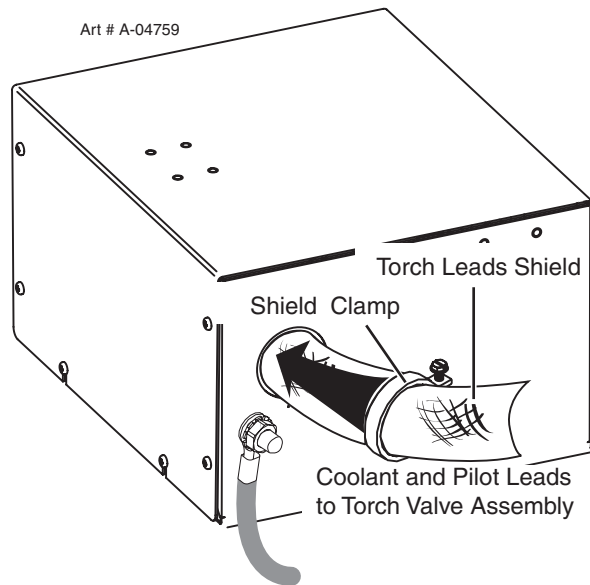


Art # A-12059

3. The Arc Starter must be grounded; the grounding terminal is marked  $\perp$ . Refer to the previous section for grounding details.



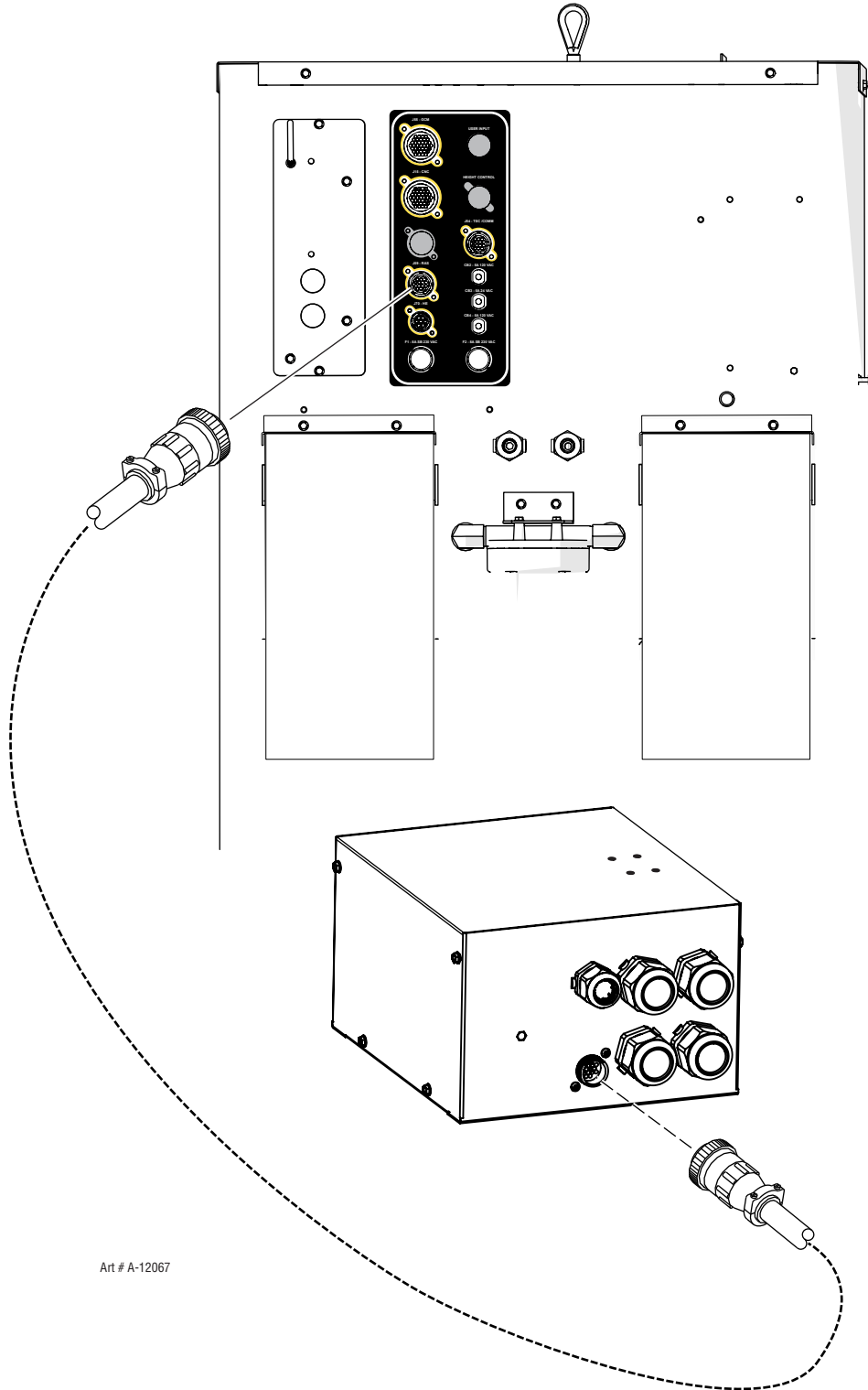
4. Use a clamp to secure the Torch Lead Shield braid brass ring to the port on the Remote Arc Starter as shown.





**Connect Control Cable**

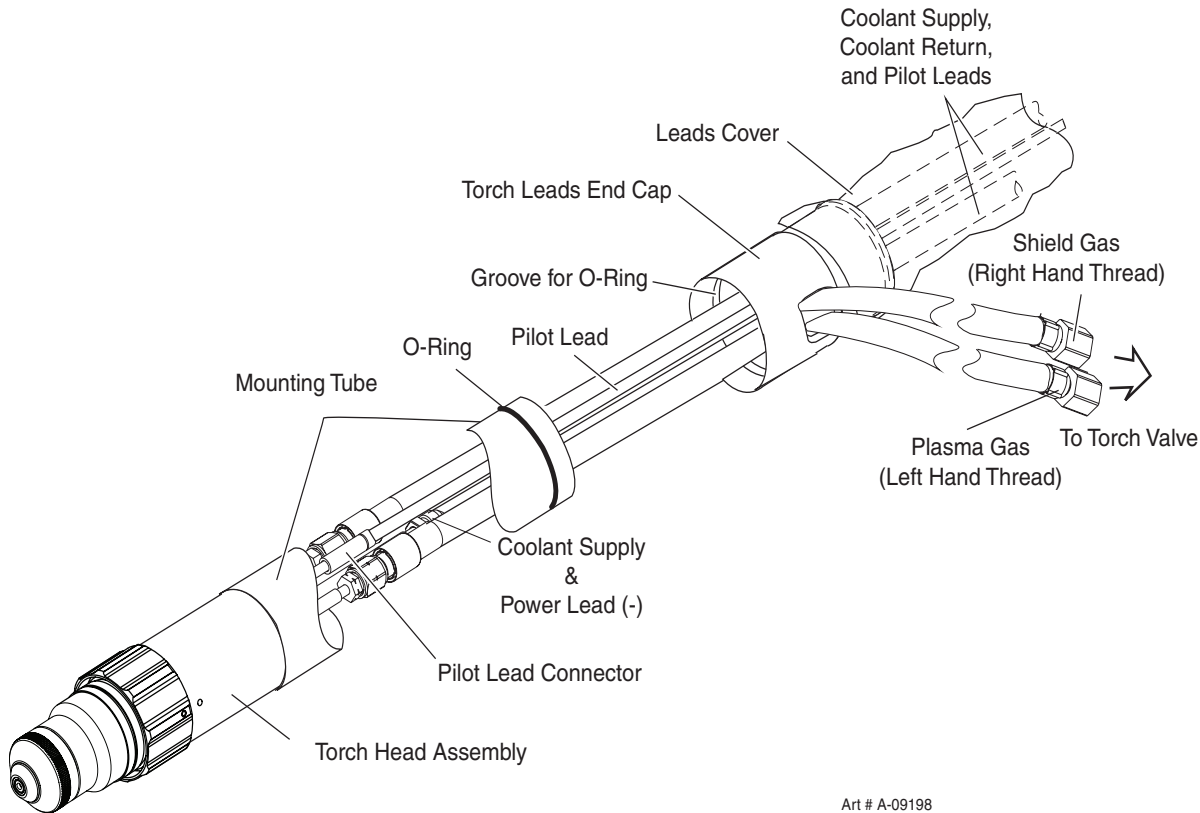
1. Connect the Remote Arc Starter cable to the Remote Arc Starter receptacle.



Art # A-12067

## 3.21 Connecting Torch

Connect the Torch as follows:



1. Lay out the torch leads on a clean, dry working surface.
2. Hold the Torch Leads End Cap stationary. Pull approximately 18" (0.5 m) of leads through the End Cap.
3. Remove and discard the protective end caps from the Mounting Tube.
4. Install the O-ring in the groove at the upper end of the Mounting Tube.
5. Install the Mounting Tube as follows:
  - a. Position the Mounting Tube at the end of the leads assemblies as shown.
  - b. Slide the Mounting Tube upward onto the leads assemblies.
  - c. Press the upper end of the Mounting Tube into the lower end of the Torch Leads End Cap. Ensure that the O-Ring on the Tube engages the mating groove inside the Torch Leads End Cap.
  - d. Ensure that the Mounting Tube is free to rotate within the Torch Leads End Cap.
6. Connect the gas and coolant leads to the Torch Head.
  - a. Coolant supply and return connections to the Torch Head are of different lengths.
  - b. Plasma and secondary gas connections to the Torch Head are threaded differently; the plasma gas connection is left-hand thread, the shield gas connection is right-hand thread.
  - c. Hold the Torch Head leads connectors stationary; turn the leads fittings with a wrench to secure the leads to the Torch Head. Do not overtighten.



### CAUTION

*The gas and coolant leads include compression fittings. Do not use sealant on these connections.*

*Slowly apply pressure to the gas lines. Check for leaks at all connections before continuing. If there are no leaks, shut off the gas supplies and continue with installation.*

7. Connect the pilot lead to the Torch Head. Press the two ends of the connector firmly together. Thread the plastic lead cover/connector onto the mating Torch Head connector.
8. Press the Torch Head Assembly upward to connect to the Mounting Tube. Pull the leads back as needed to ensure a proper fit through the Mounting Tube and Torch Leads End Cap. Hold the Torch Head Assembly stationary; rotate the Mounting Tube to thread it onto the Torch Head.



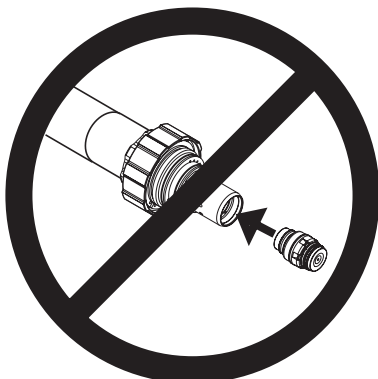
**CAUTION**

*Ensure that the leads do not twist within the mounting tube. Leads must lie as shown in the installation sketch.*

9. The lower end of the Mounting Tube includes four threaded holes. Install an Allen set screw in any of the threaded holes to secure the Torch Head Assembly to the Mounting Tube.
10. Install the appropriate consumable parts as shown on the following pages. The torch manual includes diagrams showing the correct parts to install, depending on the metal to be cut and the gases in use.

### 3.22 Install Consumable Torch Parts

Install the consumable parts as follows to ensure proper operation. These steps will help ensure that parts are seated correctly.

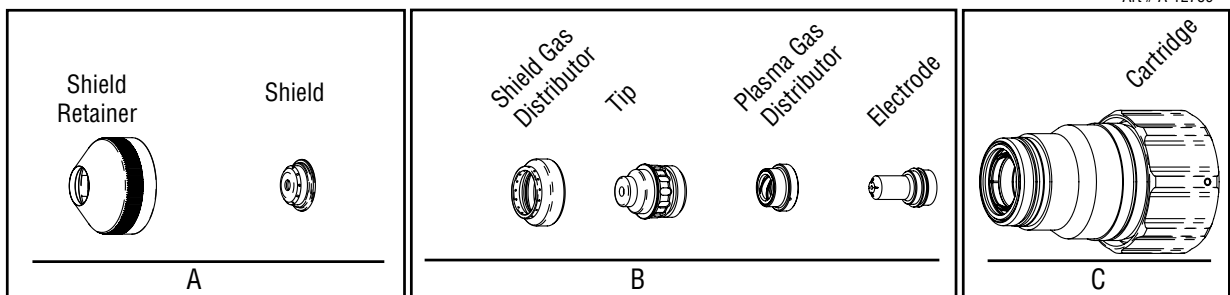


**WARNINGS**

Do not install consumables into the Cartridge while the Cartridge is attached to the Torch Head. Keep foreign materials out of the consumables and Cartridge. Handle all parts carefully to avoid damage, which may affect torch performance.

Art # A-03887

1. Check the appropriate cut chart for the right combination of parts for the cutting application.
2. For 200 Amp parts only, thread the Shield Retainer onto the Shield Cup.
3. Stack the consumable parts together.

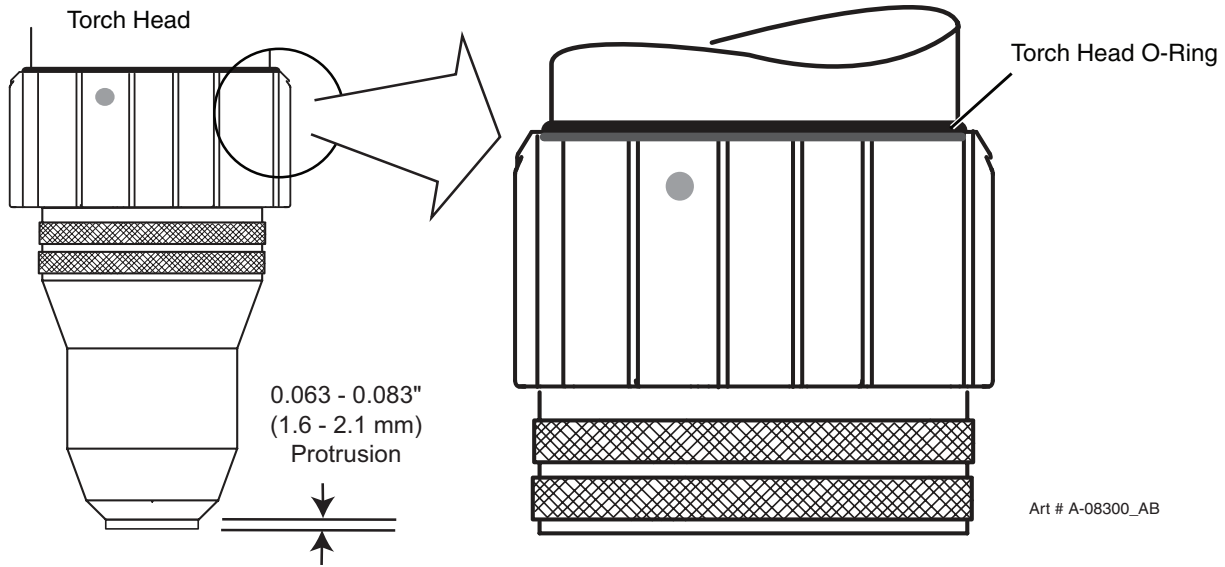


Art # A-12789

- 1 - Assemble "A" 200 A only.
- 2 - Assemble "B".
- 3 - Assemble "B" to "C".
- 4 - Assemble "A" to "B-C" assembly.

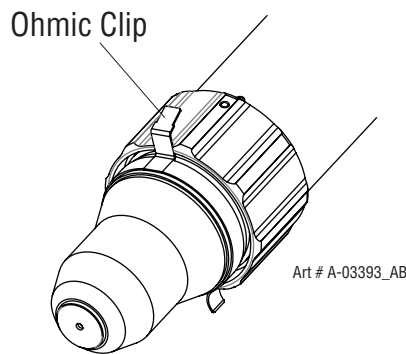
4. Insert the stack of consumable parts into the cartridge. Ensure that the large O-ring on the torch tip fits completely into the cartridge. If any part of the O-ring protrudes from the cartridge, the parts are not seated properly.
5. Use the cartridge tool to hold the cartridge assembly, while turning the shield cup (and shield retainer for 200 Amp parts) onto the cartridge assembly. For 300 Amp parts turn the shield retainer onto the shield cup now. When this group is fully assembled, the shield should protrude from the front of the shield cup or shield retainer. Without this protrusion the shield cup is not properly tightened onto the cartridge assembly.
6. Take the cartridge tool off the cartridge. Fit the cartridge assembly onto the torch head. The Speed Lok ring should click into place and the cartridge assembly should touch the large O-ring on the torch body.

# ULTRA-CUT 100 XT



Installing Assembled Cartridge Onto Torch Head

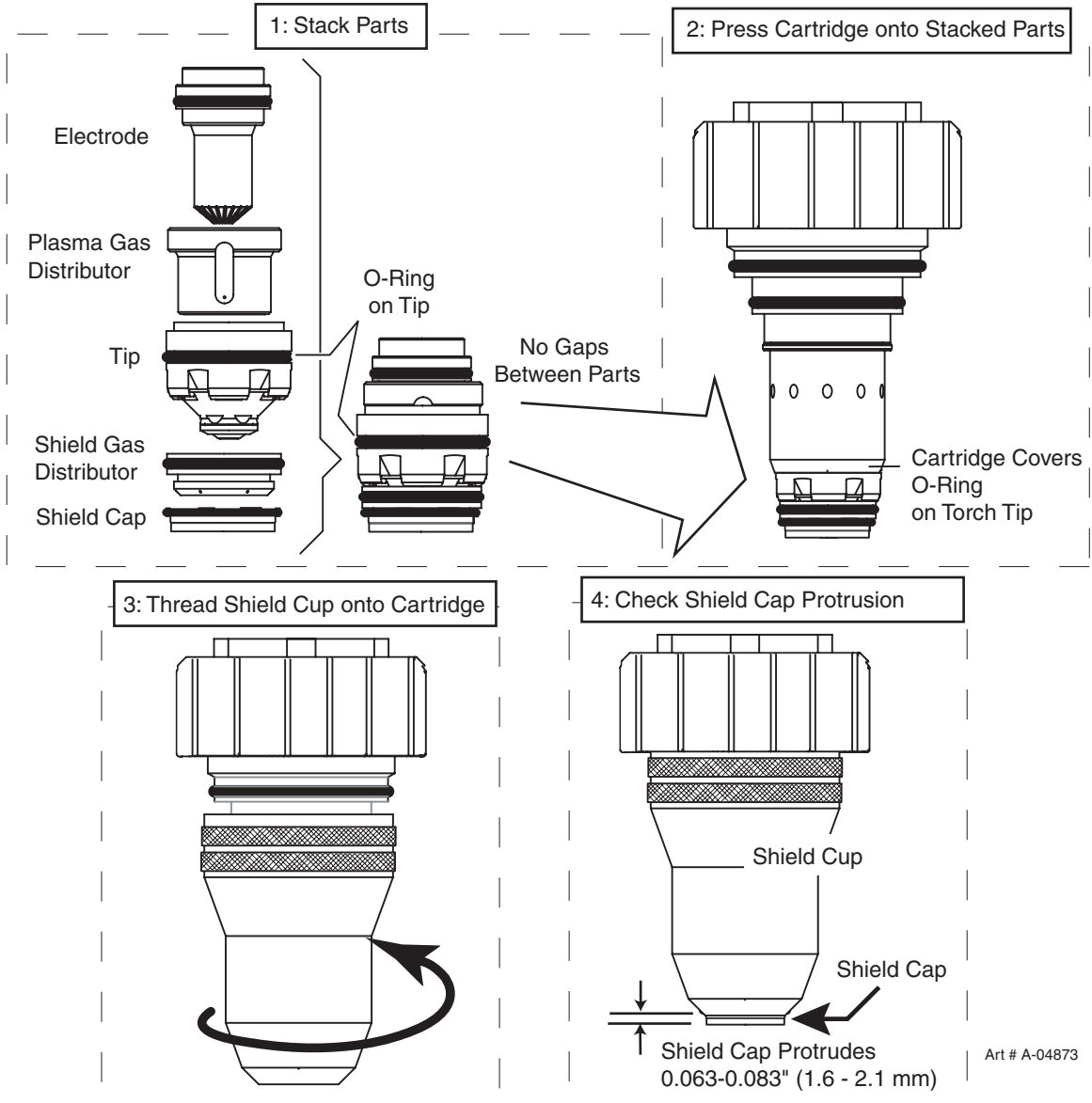
- Slide the ohmic clip over the shield cup if using ohmic torch height sensing.
- Connect the wire lead from the height finder to the ohmic clip if using ohmic torch height sensing.



## NOTE

*Ohmic height sensing is not recommended with water shield. Water on the plate interferes electrically with the ohmic sensing circuit.*

30 - 100 Amp Parts Assembly



Installing Assembled Cartridge Onto Torch Head

## 3.23 Voltage Divider for iHC Torch Height Control

For best plasma cutting performance it is necessary to maintain a constant height (standoff) above the metal while cutting. Cutting tables use a Torch Height Control (THC), also called a Z axis control, most of which use feedback from the arc voltage to control the height. Several of these, including the iHC, part of the Victor Technologies XT CNC Controller, come with a Voltage Divider Printed Circuit Board that has to be installed inside the plasma power supply to divide the high arc voltage down to lower levels for use with control circuits.

There is a space for mounting the V-D Board located on the upper portion of an internal vertical panel near the rear of the power supply. Predrilled holes for mounting the iHT V-D board as well as another popular height control are provided.

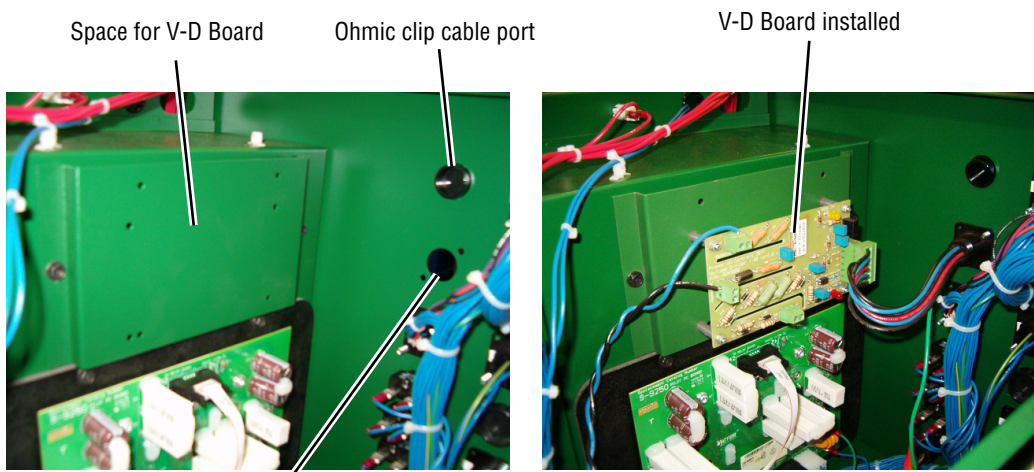


### CAUTION

*If using another board that doesn't align with the existing holes, remove the panel if possible before drilling. If not possible then every precaution must be taken to keep metal filings from being deposited inside the power supply.*

#### Install the V-D Board.

1. Locate the V-D Board which should be with the iCNC.
2. Inside the Power Supply, locate and remove the mounting panel's 2 screws and panel.
3. Install the V-D board standoffs and the V-D Board from the XT iCNC then reattach the panel with the 2 screws, securing the V-D board in place. If using another V-D Board, follow the instructions provided mounting it in this same location.



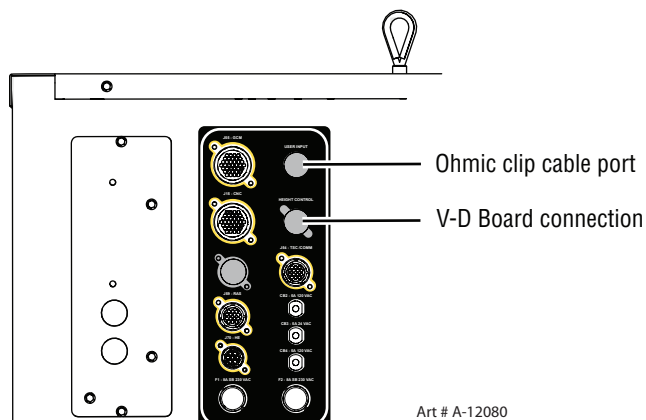
V-D Board connection

Art # A-12079

V-D Board shown with optional wire harness for iHC controller

#### Control Cable.

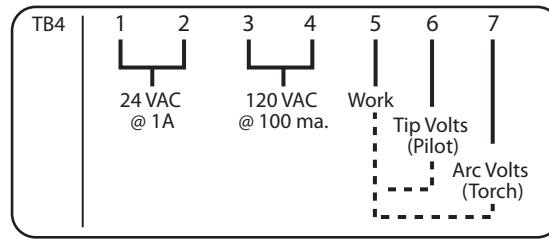
The iHC board can be supplied with a wire harness and connector (shown in previous image), to be installed in the rear panel hole labeled "Height Control". The connector mates with a cable from the iHC. For other height control V-D boards a strain relief can be installed in this hole for those cables. Refer to Appendix for wiring diagram.



Art # A-12080

**Arc Voltage Connections.**

The XT plasma supplies provide a terminal strip, TB4, on the right side ahead of the CCM module for connections to Arc V- (Torch); Tip V (Pilot); Arc V + (Work). If the V-D board requires separate power, 24 VAC and 120 VAC is available on the terminal strip TB4. Refer to the wiring diagram in the Appendix for more information.



Art # A-11954

**“Ohmic” or Shield (cup) cable.**

Some height controls including the iHC find the plate using an electrical or resistance measurement, thus “ohmic”, contact between the conductive end of the torch and the metal or “plate” being cut. A wire, usually a single highly flexible wire that withstands the reflective heat from the arc, is connected between the V-D board and the torch shield cup. The XT torch includes a metal spring clip which slips into a groove in the shield cup allowing easy removal for parts change. The Ohmic wire can be connected to this clip with a ¼” female push-on terminal.

Significant amounts of high frequency (HF) energy causing electromagnetic interference (EMI) can be conducted along this wire due to it’s close coupling to the torch. This is the reason for mounting the V-D board away from the CCM and close to the rear panel where the Ohmic wire does not need to pass near other sensitive electronics. It is especially recommended that the Ohmic wire not be routed near the CCM module or along the torch leads.

Refer to Appendix for wiring diagram.

**Ferrite cores.**

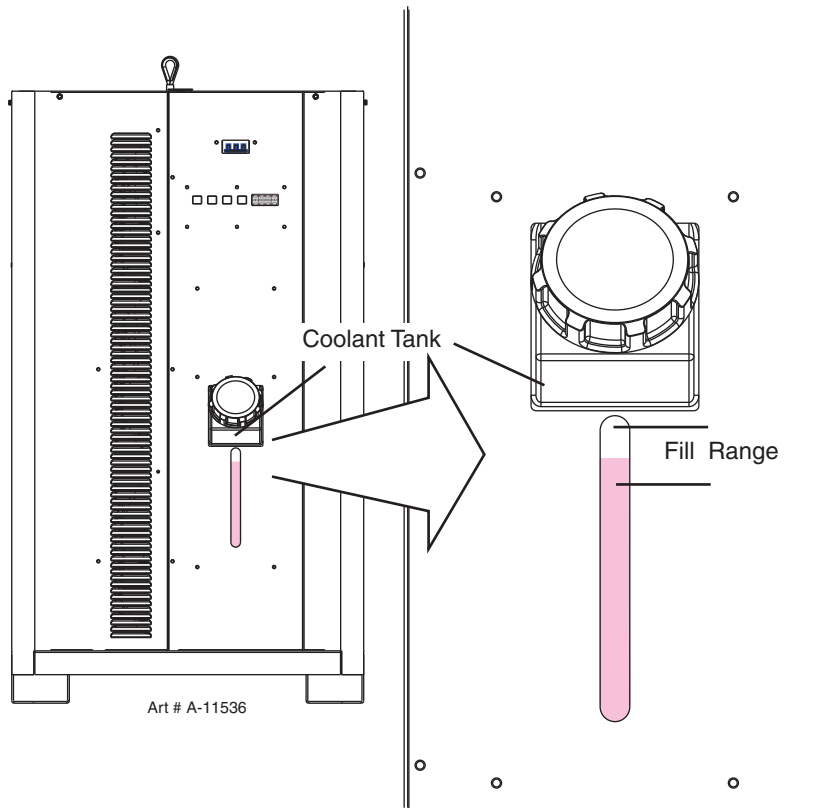
It is recommended that the Ohmic Sensing wire be wrapped through a ferrite core with several turns, at least 3 but more is better, to reduce the energy conducted to the V-D board and into the plasma supply. The ferrite core should be located on the wire where it enters the plasma supply. A second ferrite core added several feet (couple of meters) from the torch will further reduce the conducted EMI that may couple to other cable/wires and cause interference.

Refer to Appendix for wiring diagram.

**3.24 Complete the Installation**

1. Remove the cap from the coolant tank. Fill the coolant tank to the level shown, with Thermal Dynamics coolant. The coolant level is visible through the translucent coolant tank. The amount of coolant required varies with torch leads length.

Coolant Capabilities		
Cat. Number and Mixture	Mixture	Protects To
7-3580 ‘Extra-Cool™’	25 / 75	10° F / -12° C
7-3581 ‘Ultra-Cool™’	50 / 50	27° F / -33° C
7-3582 ‘Extreme Cool™’	Concentrate*	-65° F / -51° C
* For mixing with D-I Cool™ 7-3583		



2. After the complete system has been installed, check that the coolant has been pumped through the system as follows (see NOTE):

**NOTE**

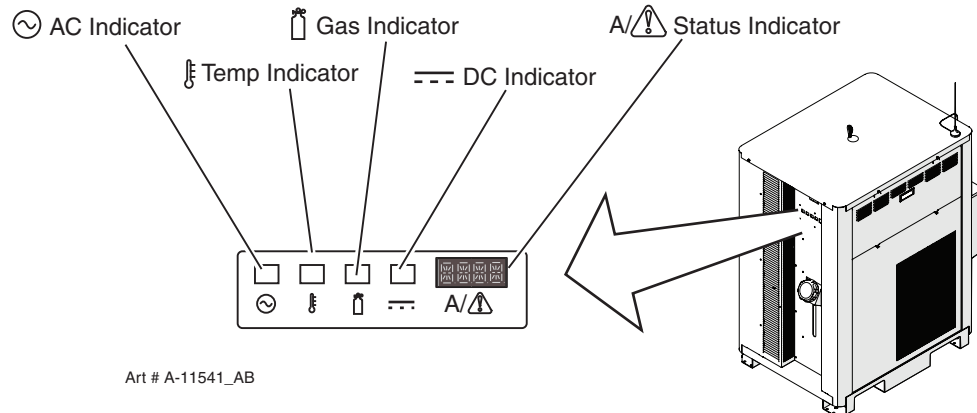
*Depending on the length of the torch leads, the system may require more coolant after turning the system ON for the first time.*

- a. Place the ON/OFF Switch to ON.
  - b. After about 4 minutes the system may shut down if the leads are not full of coolant.
  - c. Place the ON/OFF switch to OFF. Add more coolant if needed
  - d. After 10 seconds place the ON/OFF switch to ON again.
  - e. Repeat steps 'b' through 'd' until the system no longer shuts down. Depending on the length of the torch leads this sequence may need to be repeated.
  - f. After the system stays operational allow the pump to operate for ten minutes to properly purge any air from the coolant lines before using the system.
3. Refill the reservoir and reinstall the filler cap.
  4. Purge coolant from the torch before firing the torch. Ensure there are no leaks before use. If leaks are evident, consult the coolant leak troubleshooting guide in the maintenance section of this manual.



## SECTION 4: OPERATION

### 4.01 Power Supply Control Panel



Art # A-11541\_AB

#### AC Power Lamp

Indicates unit has passed the input power tests and AC power is being supplied to the inverter modules via the input contactor when the ON/OFF switch is in ON position.



**TEMP Lamp:** Normally OFF. Lamp will come ON when the internal temperature sensors detect temperatures above normal limits. Let the unit cool before continuing operation.



**GAS Lamp:** Flashing during start up gas purge/pump priming, then steady whenever gas is flowing. Indicates adequate gas pressure and coolant flow for operation.

**DC Lamp:** Indicates the power supply is generating output DC voltage.



**Status Indicator:** Shows CCM code version on start up followed by the Current Control setting and system status. Refer to Section 4.05 and Status Code Section for details.

#### Rear Panel AC Power Lamp

Indicates AC power is present inside the unit

### 4.02 System Operation

This section contains operating information which is specific to the power supply.



**WARNING**

*Review the safety precautions in Section 1.*

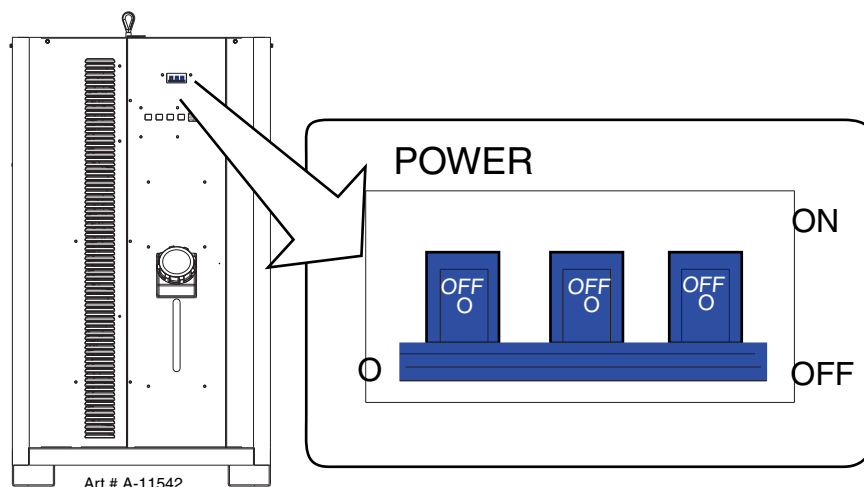
*If the power supply cord has a plug or is not permanently connected to power, be sure the power to the outlet is disconnected when inserting the plug into the outlet.*

*Disconnect primary power at the source before assembling or disassembling power supply, torch parts, or torch and leads assemblies, or adding coolant.*

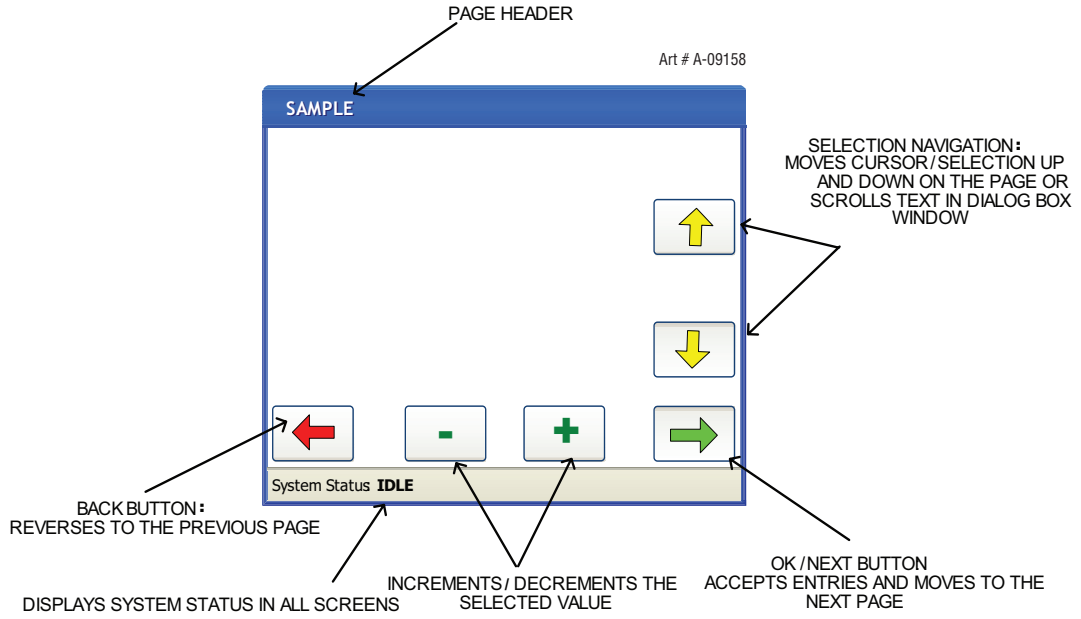
*It is not enough to simply move the ON/OFF switch on the unit to OFF position when cutting operations have been completed. Always open the power supply disconnect switch five minutes after the last cut is made.*

Prior to starting the system determine the process to be used. The process is determined by the type and thickness of the metal to be cut. Select and install the required consumables, connect the required gasses to the system.

1. Connect system to primary input power. An indicator will light on the rear panel when AC power is applied to the unit. Place the Plasma Enable Switch (TSC 3000; user installed Plasma Enable/E-Stop) in the "Enable" position
2. Turn ON/OFF switch to ON (up) position. System goes through the "Start up Sequence".
  - For about 10 seconds the decimal points of the 4 digit display blink from right to left.
  - Next the 4 rectangular LED indicators and the 4 status display digits illuminate all segments as a test.
  - Then for about 6 seconds the display shows the letter "C" (code) followed by the CCM code version. Example "C1.2.0". During this time various input voltage tests are being performed. If a fault is found its code is displayed and the start up sequence halts. Faults will show "E" or "L". If Plasma hasn't been Enabled by this point, E101 will be displayed and the startup sequence will not proceed.
  - The coolant pump starts, the Gas LED indicator blinks and the display shows "0" indicating no cutting process has been loaded.
  - o If the unit is disabled, Plasma Enable shut off, the pump doesn't start and display alternates between status code E101 and "0".
  - Assuming the unit is not disabled, as soon as adequate coolant flow is detected, usually in about 5 seconds, the Gas LED stops blinking and the contactors close and the AC LED Indicator lights.
  - o If there are bubbles in the coolant code E406 may be displayed alternating with "0" until the bubbles clear up. This is a warning and you can continue.
  - o If flow is not detected, the pump will run and the Gas LED blinks until flow is detected or for up to 4 minutes at which time the pump stops and the display shows E404 indicating proper coolant flow was not obtained.
  - Now select and load the cutting process using the TSC 3000 or the program included in the CNC control. Once the process is loaded a gas purge begins. Purge time varies with the torch lead length and the cutting process. See section 4.03 to 4.08 for details of using the TSC 3000 or the CNC manual for embedded programs. Also refer to section 4.09 for a more detailed Sequence of Operation.
  - During the gas purge the Gas LED will blink and the display will show E304 alternating with the cutting current indicating a gas purge is in progress. E304 goes away and the Gas LED stops blinking at the end of the gas purge. A purge is also initiated, with E304 and blinking Gas LED, when the unit is enabled following a disable. Does not require loading the process again.



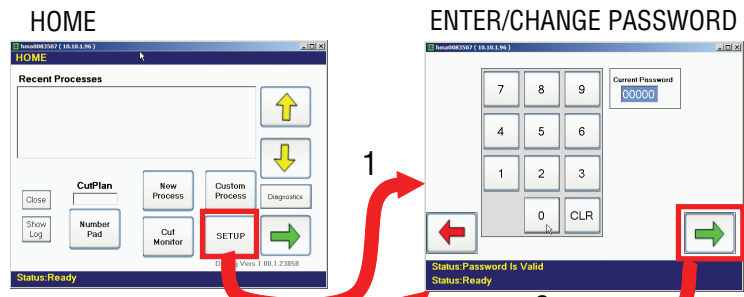
4.03 TSC-3000 Navigation Functions



## 4.04 TSC-3000 Initial Setup ONLY

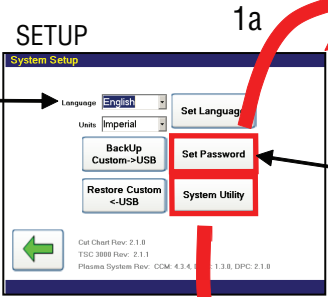
Initial steps required before First operation only. Note 400 Amp system requires a Height Controller with Elevation Height (EH) feature.

When power is turned on TSC 3000 goes to the Home screen. For new installation it is required to perform initial SETUP. Press SETUP button (1). Enter Initial default PASSWORD 00000 (2)



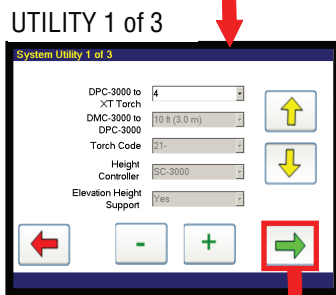
Select language and measurement units.

Enter SYSTEM UTILITY (3).



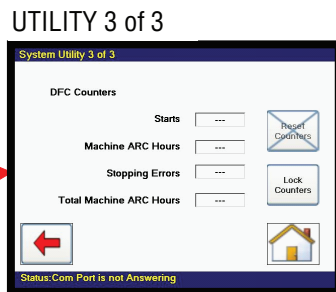
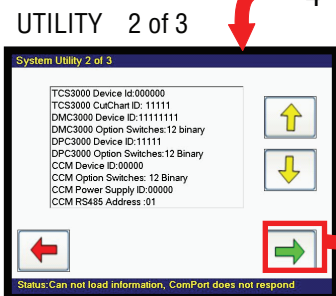
To change Password press SET PASSWORD enter new 5 digit password (1a). Press green arrow to accept new password and return to SETUP screen (2).

Enter XT lead (DPC to Torch); only 4' currently allowed. Enter DFC 3000 lead length (DMC to DPC);



Set Elevation Height Support to "Yes" if height control supports that feature. Elevation Height Feature is required for the Ultra-Cut 400

Utility Screen 2 is for information only. Displays Device and Cutchart IDs, setting of options switches etc.



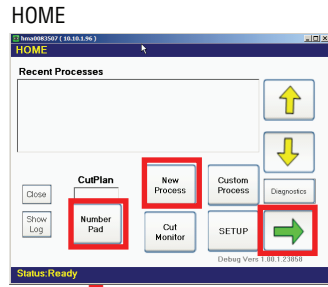
Utility screen 3 (5) allows viewing consumable statistics, Starts, Hours, Errors.

Return to Home Screen.

Art # A-09656

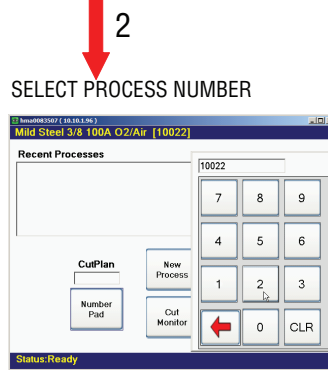
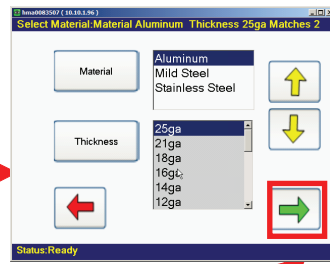
4.05 TSC-3000 Selecting New Process

Select new standard process by material; thickness; amperage (1) or enter process # using pop-up number pad (2).

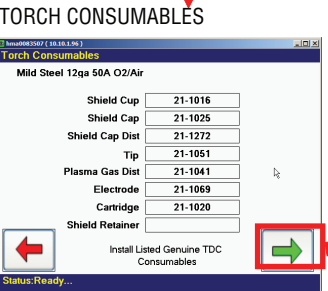
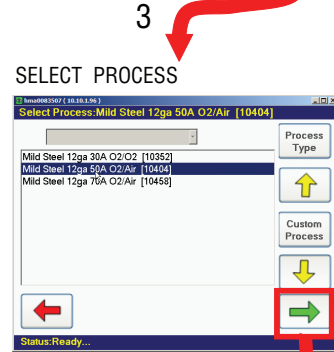


Material – Scroll to select,  
Thick ness – Scroll to select,  
Accept & advance (1).  
1

SELECT MATERIAL, THICKNESS

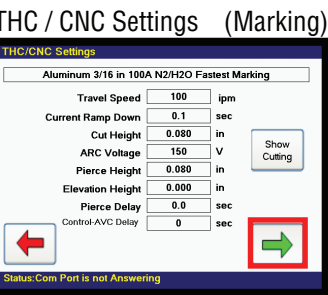
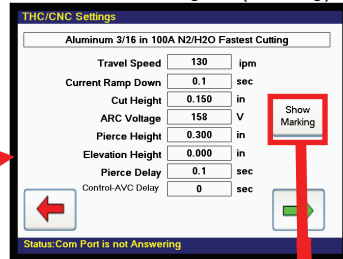


Select process by # (2) or by name (3).  
If by name, first select process type; best cut, fastest, MAX Pierce, etc.  
Then press  
To accept & advance to Torch Consumables. (4).  
4



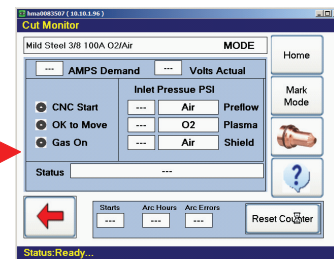
Confirm the listed torch consumables are installed in the torch.  
Go to THC / CNC settings for cutting (5).  
5

THC / CNC Settings (Cutting)



Toggle between Cut & Marking settings (6).  
Proceed to Process Monitor (7).  
7

PROCESS MONITOR



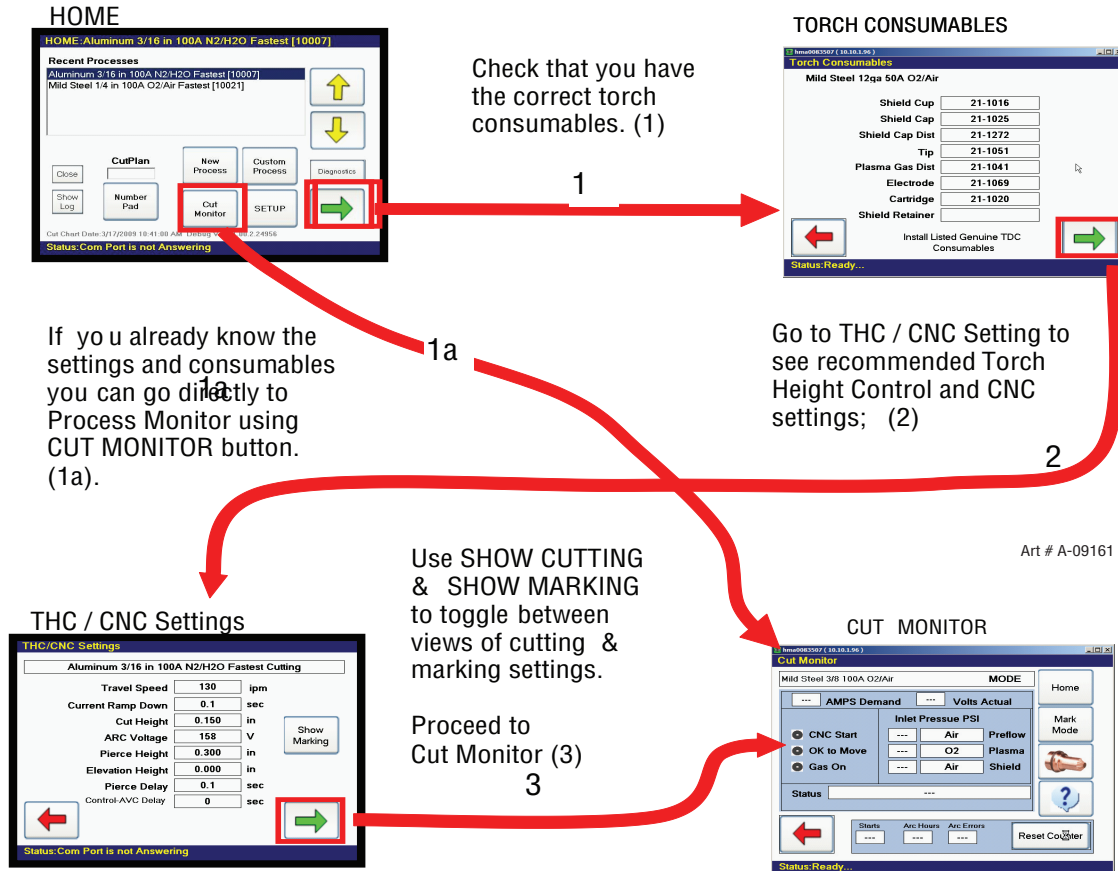
Now you are ready to start cutting. Displayed Amps Demand is the output current setting, not the actual current.

As soon as Start is applied Process Monitor shows output voltage, gas pressures, status of Start, OK to Move and Gas On signals. Here you can toggle between Plasma Marking with the selected consumables and cutting.

Art# A-09160

## 4.06 TSC-3000 Selecting Recently Used Process

Home screen shows some of the most recently used processes with the last one used highlighted. Select the highlighted process by pressing the Green arrow or scroll with up/down arrows to select another recent process then press the green arrow.



Now you are ready to start cutting. Displayed Amps Demand is the output current setting, not the actual current.

As soon as Start is applied Process Monitor shows output voltage, gas pressures, status of Start, OK to Move and Gas On signals. Here you can toggle between Plasma Marking with the selected consumables and cutting.

## 4.07 TSC-3000 Creating a Custom Process

Considerable effort has been made to define the best parameters for each cutting and marking process. However for various reasons, variations in material composition, variations in cutting table performance, user preferences, etc. you may desire to modify one or more processes. Or perhaps you want to keep the same cutting current and gas pressures but save different THC / CNC parameters such as cutting speed, arc voltage, pierce height, etc. That will still be treated as a custom process.

Creating a **Custom Process** starts with an existing standard process. From there you may adjust the cutting current and the gas pressures. It's up to you to determine and enter the correct values. There no limits in these values, if you change too far it may cause faults.

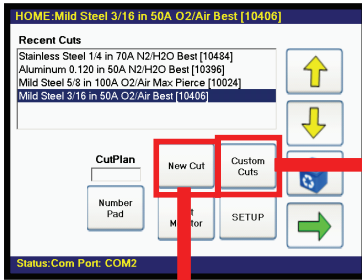
You may also change the values displayed on THC/CNC Settings screen. THC / CNC settings on the TSC-3000 at this time are for information only. They do not connect to the THC or CNC so do not automatically modify setting in those devices. Still, when you determine the correct values for your modified (custom) process you may want to record them here.

The custom process will have the same name as the standard base process but it will be automatically assigned a new number and the whole name and number will be in red text wherever it appears.

You cannot change the gas type. If you want a different gas types find a standard process that uses those types and edit it.

**First step** is to select a standard process. Usually you want a process that is for the same metal type and thickness that you want to cut. From the HOME screen you may select a recent process (sect 4.06, Selecting Recently Used Process) or a new process (sect 4.05, Selecting New Process).

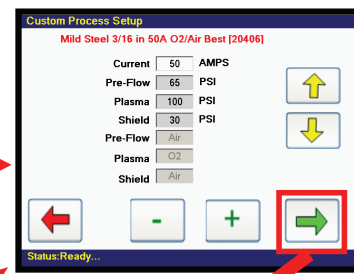
## HOME



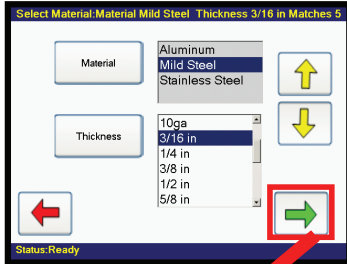
Customize Recent Cut.  
Highlight the process closest to what you want to use then press CUSTOM CUTS button.

Or  
Select NEW CUT then MATERIAL & THICKNESS.

## CUSTOM PROCESS SETUP



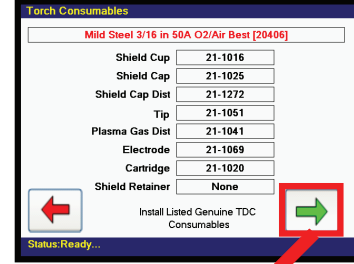
## SELECT MATERIAL/THICKNESS



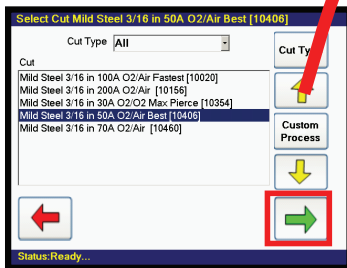
Select value to change using UP/DN arrows. Change value with +/- buttons.

Shows List of consumables to use.

## TORCH CONSUMABLES LIST



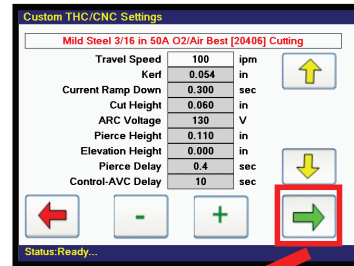
## SELECT CUT



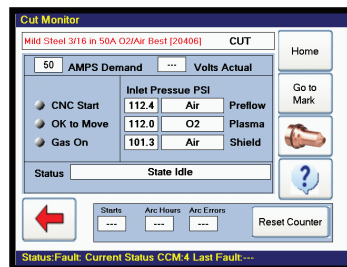
If the custom process requires different setting, speed, arc voltage, etc., edit it here.

Editing the THC / CNC SETTING is for reference only, does not change the actual THC or CNC setting. That must be done on the THC or CNC.

## CUSTOM THC/CNC SETTINGS



## CUT MONITOR



Art # A -09162

Going to the Cut Monitor loads the new custom process with its name/number in red. Following purging of the new process you are ready to cut. Your custom process will appear in the recent cuts menu in red.

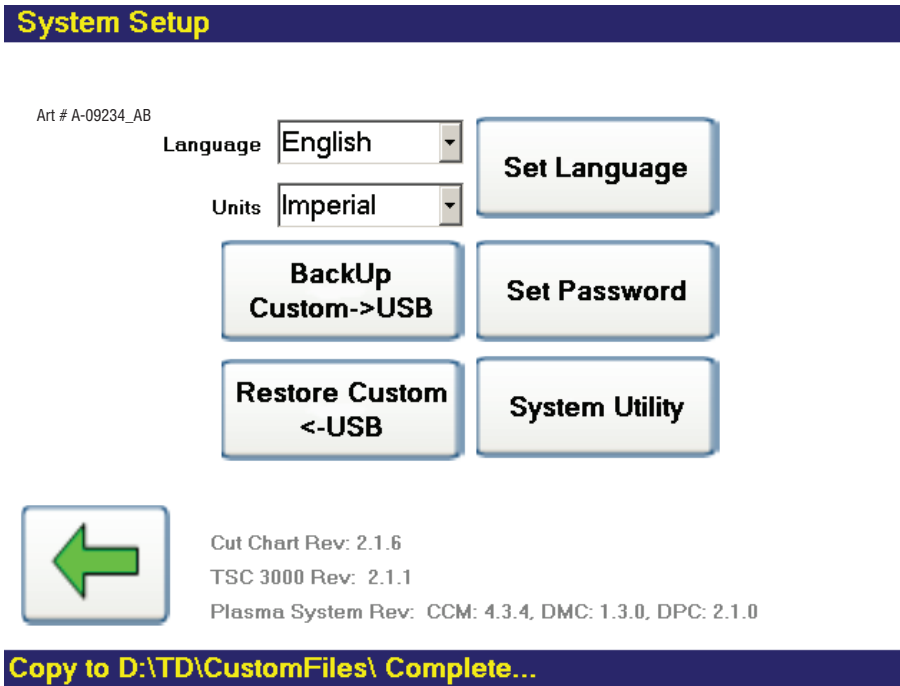


## 4.08 Back up and Restoration of Custom Processes.

Users can create their own custom cut processes. These can be lost by accidentally deleting them on the TDC 3000 or they can be over written when updating programs. They can also be lost if the DSC 3000 should be replaced. We recommend you back up your custom processes every time a new one is created. To back up you will need a USB Flash drive.

### Backing Up Custom Process:

1. For the remotely mounted DSC 3000 insert the flash drive in the USB connector on the back. If using the TSC 3000 mounted in the plasma supply front panel the USB connector is in the front under the clear plastic protective screen.
2. Go to the HOME screen. Select SETUP. Enter the 5 digit password (00000) unless you've changed it.
3. Press button "Back Up Custom>USB"
4. Very quickly, depending on how many custom processes there are, you should see along the bottom of the screen the message "Copy to D:\TD\CustomFiles\Complete" at which point you can remove the flash drive.



### Restoring Custom Processes:

During file backup (see previous process) a folder and sub folders called "TD" were placed on your flash drive. You should copy this folder with its subfolders to some secure place. Making more than one copy is advised. If the need arises to restore from this backup, place the entire TD folder in the root directory (not in another folder) on a USB flash drive and plug it into the USB port on the TDC 3000.

1. For the remotely mounted DSC 3000 insert the flash drive in the USB connector on the back. If using the TSC 3000 mounted in the plasma supply front panel the USB connector is in the front under the clear plastic protective screen.
2. Go to the HOME screen. Select SETUP. Enter the 5 digit password (00000) unless you've changed it.
3. Press the "Restore Custom <USB.

## System Setup

Art # A-09235\_AB

Language

Units



Cut Chart Rev: 2.1.6  
 TSC 3000 Rev: 2.1.1  
 Plasma System Rev: CCM: 4.3.4, DMC: 1.3.0, DPC: 2.1.0

## Copy to .\Files\Custom\ Complete...

- Shortly, almost instantly if only a few files, you should see at the bottom “Status: Copy to .\Files\Custom/Complete” then you can remove the USB flash drive.

### Renaming Custom Files

You cannot rename the files while on the TSC 3000 but once you backup a file on the flash drive you can use a computer to rename the file on the flash drive and perform the restore to put the renamed file back on the TSC 3000.

- Use Windows Explorer to find the folder **TD** in the root directory of the flash drive. Then find and open the folder **CustomFiles**. Here you will find all the custom processes saved.

Art # A-09236

Name	Size	Type	Date Modified
Aluminum 5mm 47A Air--Air Max Pierce [20392].cus	9 KB	CUS File	6/1/2009 11:40 AM
Mild Steel 5mm 47A O2--Air Best [20411].cus	9 KB	CUS File	6/1/2009 11:41 AM
Mild Steel 12mm 96A O2--Air Best [20031].cus	9 KB	CUS File	6/1/2009 11:40 AM

- Use Windows Rename to change the file name to whatever you want. **Do not change the file extension (.cus) or the file number in the brackets!** Suggest not making the name too long as the TSC 3000 screen is limited in the number characters on one line. Here I've renamed the top file.

Art # A-09237

Name	Size	Type	Date Modified
John Doe's Aluminum 5mm 47A Air--Air [20392].cus	9 KB	CUS File	6/1/2009 11:40 AM
Mild Steel 5mm 47A O2--Air Best [20411].cus	9 KB	CUS File	6/1/2009 11:41 AM
Mild Steel 12mm 96A O2--Air Best [20031].cus	9 KB	CUS File	6/1/2009 11:40 AM

- Now put the flash drive with the renamed file back into the TSC 3000 and perform the file restore.
- Go back to the Home screen. You will find your new file name (John Doe's) and the old name with the same file number [20392]. They are the same process, either one will work. You can delete the file with the old name if you don't want both of them showing.

## 4.09 Sequence of Operation

### Ultracut with DFC 3000 using TSC 3000

The purpose of this section is to explain the steps an operator should follow when using the DFC 3000 with the TSC 3000 touch screen control panel for a specific cutting process. Also included are steps to follow for changing torch consumables.

#### NOTE

*For units not using the TSC 3000 where control is embedded into the cutting table controller most of this sequence still applies except for the parts that are specific to the TSC 3000. For those sections refer to the cutting table controller documentation.*

#### NOTE

*When the TSC 3000 is installed, J14 on the CCM must be set for 2 Wire communication. For units not using a TSC 3000, determine if the communication requires 2 wire or 4 wire communication and set accordingly. The XT iCNC controller requires 4 wire setting. See section 3.13 and the Appendix.*

This assumes the system setup; language and units, lead lengths, etc., have already been performed by the installer and the system is confirmed as operational.

#### 1. Before Applying power:

- a) Ensure that the required gasses are connected to the DMC 3000 inlet and gasses are turned on and set for required inlet pressure.
- b) Ensure you have a torch cartridge with consumables installed on the torch.

If you don't know what consumables you need to use and need to select the cutting process in order to read the consumables list on the TSC 3000, you can start up with Plasma Disabled. In this case the operation sequence will skip to step 3.

- c) Set Plasma Enable SW on the TSC 3000 to Enabled.

#### 2. Turn on 3 phase power at the main disconnect (Plasma Enable on TSC 3000 on). Turn ON/OFF switch to the ON position (up). System will then go through the start up sequence.

- a) For about 10 seconds the decimal points of the 4 digit display blink from right to left.
- b) Next the 4 rectangular LED indicators and the 4 status display digits illuminate all segments as a test.
- c) Then for about 6 seconds the display shows the letter "C" (code) followed by the CCM code version. Example "C1.2.0". During this time various input voltage tests are being performed. If a fault is found its code is displayed and the start up sequence halts. Faults will show "E" or "L". If Plasma hasn't been Enabled by this point, E101 will be displayed. If disabled the pump will not start, the gas LED doesn't blink and the contactors don't close (steps d & e). However the events of steps f & g will continue and you can select and load the cutting process. Until the process is loaded, the display shows "0" indicating no process has been loaded. If a fault exists the display alternates between "0" and the fault code.
- d) The coolant pump starts and the Gas indicator blinks, and the display shows E304, while the cutting gasses are purged. Purge time varies with the torch lead length and the cutting process. See section 4.04 for setting lead length. When the gas purge ends the E304 goes away but the gas LED may continue blinking if the coolant flow hasn't been satisfied.
- e) Once coolant flow is detected, usually within 5 seconds after the pump starts, the input contactor(s) W1 (W2) close and the AC indicator lights.
- f) At the same time the DMC & DPC, both Green & Red LEDs, also blink their firmware version.
- g) Following the firmware version indication, while CCM establishes communication with the gas control (Step e.), the coolant pump and fans come on to "prime" the system. The "gas" indicator on the front panel blinks until correct coolant flow is detected. Normally this takes only a few seconds but can last up to 4 minutes if there is a problem. Should there be a problem with priming the coolant system, after 4 minutes the Status indicator will show code 404 and the pump will stop until you rectify the problem and recycle the power.

*If communication is not established in step g, the pump will not start and the gas indicator will not blink. The fault code E501 (DMC) or E301 (DPC) will be displayed.*

- h) Once communication with the DFC components is established the Green power indicator on both DMC & DPC will be on and their Red indicator will be off.
3. At power on while all the items in step 2 are going on the TSC 3000 has been starting up Windows XP™ which takes about 2 ¼ minutes. Another 15 sec the application starts and displays the HOME screen.
4. Now you must select the cutting (and plasma marking) process. Refer to sections 4.05, 4.06 and 4.07 for step by step instructions in selecting New, Recently Used or Creating Custom Processes.
5. During process selection you will come to the “Torch Consumables” screen. At this point if you have not installed correct consumables and “Plasma” is not already disabled, shut off (disable) the Plasma Enable SW. Install the consumables, Set the Plasma Enable SW to “Enable”.
  - a) Coolant Pump starts up to prime the torch cooling system. The “Gas” indicator on the front panel blinks until correct coolant flow is detected. Normally only a few seconds. See step 2 d and 2 e. for full details.
6. The next screen following Torch Consumables is a table of recommended CNC and THC (Torch Height Control) settings. You may toggle between cutting and marking settings using the “Show Marking / Show Cutting” button. Set your cutting table controller and height control to the recommended setting.
  - a) If you prefer other settings for cutting you can create a “Custom” process where you edit the cutting CNC/THC setting if you want. Currently, modifying the marking CNC/THC settings is not allowed. A custom process does not have to change the cutting current or gas pressures unless you want to. You can use customs to modify the recommended CNC/THC settings as well.
7. Continue the process selection until you reach the Cut Monitor screen. If you have not set the Plasma Enable SW to “Enable” do so now.
  - a) Purging of the gasses used for the selected process begins. Depending on your lead length and consumable type this can take some time. While the gas purge is being performed the display will show E304 and the Gas LED will blink. If the plasma was not enabled before this step the coolant pump will start and when the coolant flow is satisfied the contactors will turn on. Once the gas purge is finished E304 will go away and if the the coolant flow is OK the Gas LED stops blinking.

Purge times for different lead lengths have been set to allow time to fully pressurize the leads and to remove any coolant that gets into the consumables during a parts change. Make sure that during setup the correct lead length has been selected, the default time is for max lead length and may be longer than you require.
8. Once purge is complete you are ready to start cutting.
  - a) If marking is desired press button “Go to Marking”. The screen will show recommended CNC/THC setting. Green arrow takes you back to the Cut Monitor set up for Marking.
  - b) To return to cutting on the Cut Monitor press button “Got to Cutting”. Same as with the marking this takes you to the CNC/THC screen except this displays the cutting settings.
9. Upon applying CNC Start the fan(s) will come on and run during cutting and continue for 4 minutes after the last cut. Then both pump and fan(s) will shut off. With CNC Start the Gas LED will come on steady indicating gas should be flowing and gas preflow begins. Near the end of the preflow time the DC LED will come on indicating the inverters are enabled and we have DC Voltage at the output. At the end of the cut the Gas indicator remains one for the post flow time then goes out.
10. Changing torch consumables:

Following a consumables change or inspection the system will initiate a purge of the gas. This serves two purposes:

  - a) Remove the coolant that gets into the consumables when they have been removed.
  - b) If the gas type has changed “Purge” removes the old gas from the lines and replaces it with the new gas. If the gas type has changed from a fuel gas like H35 to an oxidizing gas like oxygen or air the purge inserts a buffer of inert gas, nitrogen, so the H35 and oxygen don't mix.

You can change consumables by removing power or using the “Plasma Disable” SW.

If you remove power the system does not remember what gasses were last used so you have to select the process again and it will do a complete purge including nitrogen buffer even if you do not change gas types.

With "Plasma Disable" the system remembers what was used last and does only the amount of purge necessary possibly saving time.

11. Use "Plasma Disable".

- a) You may use the Plasma Disable when removing the torch cartridge to change or inspect consumables. Plasma disable stops coolant pump, shuts off all gas solenoids, removes power from the inverter (power supply) and pilot circuits, inhibits the arc starter ignition (HF) circuit. It does not remove power from the TSC 3000 or the systems logic and communications circuits so you do not need to go through as long a power up process after replacing the consumables.
- b) If changing to a process with a different gas type you may want to select it before enabling the plasma otherwise it will start purging the old process and when you do select the new one it will purge again taking more time.
- c) If you are not changing gas type you may want to turn on the Enable first to start the purge while you enter the process.

12. Shutting off power.

- a) If you chose to shut off power for inspecting or changing consumables, or any other purpose, the system does not remember what you were doing last so you will have to go through the complete sequence from the beginning starting with step 1.

### **Operational Suggestions**

1. Wait four minutes before setting the ON/OFF switch to OFF after operation. This allows the cooling fans to remove operating heat from the power supply.
2. For maximum parts life, do not operate the pilot arc any longer than necessary.
3. Use care in handling torch leads and protect them from damage.
4. When using water as the shield note the following:
  - Use clean drinking quality tap water to help prevent particulate build-up within the system water shield plumbing.
  - Particulate contamination and build-up can cause reduced consumable parts life and premature torch failure.
  - A cartridge type particulate water filter may help achieve optimum cutting performance.

## 4.10 Gas Selection

### A. Plasma Gases

1. Air Plasma
  - Most often used on ferrous or carbon base materials for good quality at faster cutting speeds.
  - Air plasma is normally used with air shield.
  - Only clean, dry air is recommended for use as plasma gas. Any oil or moisture in the air supply will substantially reduce torch parts life.
  - Provides satisfactory results on nonferrous materials.
2. Argon/Hydrogen (H35) Plasma
  - Recommended for use on 3/4 in (19 mm) and thicker stainless steel. Recommended for 1/2 inch (12 mm) and thicker nonferrous materials. Ar/H2 is not normally used for thinner nonferrous materials because less expensive gases can achieve similar cut quality.
  - Poor cut quality on ferrous materials.
  - Provides faster cutting speeds and high cut quality on thicker materials to offset the higher cost.
  - A 65% argon / 35% hydrogen mixture should be used.
3. Oxygen (O2) Plasma
  - Oxygen is recommended for cutting ferrous materials.
  - Provides faster cutting speeds.
  - Provides very smooth finishes and minimizes nitride buildup on cut surface (nitride buildup can cause difficulties in producing high quality welds if not removed).
4. Nitrogen (N2) Plasma
  - Provides better cut quality on nonferrous materials such as stainless steel and aluminum.
  - Can be used in place of air plasma with air shield.
  - A good clean welding grade nitrogen should be used.
  - When used with a water mist secondary it produces superior cut speeds and cut quality on stainless steel and aluminum.
5. H17 Plasma (17.5% Hydrogen / 32.5% Argon / 50% Nitrogen)
  - Recommended for 1/2 inch (12 mm) and thicker nonferrous materials. H17 is not normally used for thinner nonferrous materials because less expensive gases can achieve similar cut quality.
  - Alternative to H35 Plasma. Yields slightly higher cut speeds and similar cut quality.
  - When using H17, the gas should be supplied to the gas supply port marked "H35".
  - Poor cut quality on ferrous materials.

### B. Shield Gases

1. Compressed Air Shield
  - Air shield is normally used when operating with air or oxygen plasma.
  - Improves cut quality on some ferrous materials.
  - Inexpensive - reduces operating costs.
2. Nitrogen (N2) Shield
  - Nitrogen shield is used with nitrogen (N2) or Ar/H2 (H35) plasma.
  - Provides smooth finishes on nonferrous materials.
  - May reduce smoke when used with Ar/H2 plasma.

### 3. Water Shield

- Normally used with nitrogen.
- Provides very smooth cut surface.
- Reduces smoke and heat input to the workpiece.
- Effective when used with N<sub>2</sub> up to 2 inch (50mm) maximum material thickness.
- Tap water provides low operating expense.

#### **Operational Suggestions**

1. Wait four minutes before setting the ON/OFF switch to OFF after operation. This allows the cooling fans to run to dissipate operating heat from the power supply.
2. For maximum parts life, do not operate the pilot arc any longer than necessary.
3. Use care in handling torch leads and protect them from damage.
4. When using water as the shield note the following:
  - Use clean drinking quality tap water to help prevent particulate build-up within the system water shield plumbing.
  - Particulate contamination and build-up can cause reduced consumable parts life and premature torch failure.
  - A cartridge type particulate water filter may help achieve optimum cutting performance.

## 4.11 CCM Status Codes

**NOTE**

See the Appendix for Advanced Troubleshooting

On start-up and during operation, the power supply control circuitry performs various tests. If the circuitry detects a condition requiring operator attention, the status display on the front panel shows a 3 digit number code preceded by either letter “E” (currently active fault) or letter “L” (last or latched fault) meaning a fault occurred during the process but is not currently active.

Some conditions can be active indefinitely, while others are momentary. The power supply latches momentary conditions; some momentary conditions can shut down the system. The indicator may show multiple conditions in sequence; it is important to recognize all possible conditions that may be displayed.

**NOTE**

There are no Group 5 (500) numbered status codes with the GCM 2010 system. These tables cover units up to 400A, Lower current units won't have all the inverter sections referred to in the Group 2. However codes for those sections should not appear.

CCM Status Code		
Group 1 -- Plasma Process		
Code	Message	Remedy / Comments
101	Plasma Disabled	Plasma Enable Off ; Disable activated on TSC3000 or GCM 2010 or external SW disabled (CNC); CCM TB1-1&2 jumper missing; 40 circuit ribbon cable from Relay PCB to CCM disconnected or defective;
102	Pilot Ignition Failure	Pilot did not start within 15 seconds. Torch consumable parts worn? Ensure correct process selected or manual setting including current control setting matches consumables; Plasma pressure too high; Defective Arc Starter; Defective Pilot PCB; defective Inverter section 1A. Ribbon cables reversed on INV1 sections 1A and 1B.
103	Lost Pilot	Pilot went out while Start active. Torch consumable parts worn? Ensure cut process or current control setting matches consumables; Plasma pressure too high;
104	Transfer Lost	Arc was transferred to work then went out while Start still active. Arc lost contact with work (run off edge, over hole, etc.); Standoff too high; Ensure cut process or manual settings (current control, gas pressures) matches consumables;
105	Not used	Reserved for legacy product
106	Pilot Timeout, no Transfer	Must transfer from Pilot to Cutting Arc in 0.085 seconds (SW8-1 OFF) or 3 sec. (SW8-1 ON). Standoff too high or void in work under torch; Wrong cut process selected or wrong manual settings (current control set too low or wrong gas pressure).
107	Not used	Reserved for legacy product
108	Tip to Electrode voltage fault.	Tip voltage too close to electrode voltage; Torch consumable parts worn out; Wrong consumables installed causing tip to electrode short; Wrong process selected or wrong manual setting of plasma gas or cutting current.; Leak in Plasma hose to torch; Defective Pilot PCB; Shorted torch body .
109	Part process not configured.	Applies only to DFC 3000 Auto Gas Control. Select and load a cutting process.
110	Not used	Reserved for legacy product



<b>CCM Status Code</b>		
<b>Group 2 -- Plasma Power Supply</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
201	Missing AC Phase	Blown wall fuse, Blown unit fuse F1 or F2 or rear panel, Bad power cable connection; Defective System Bias PCB.
202	Not used	Reserved for legacy product
203	Not used	Reserved for legacy product
204	Not used	Reserved for legacy product
205	DC Output Low	Less than 60 VDC; Negative lead short to work or ground; Defective inverter (output shorted); CCM voltage sense (J24) disconnected or wire broken; Defective CCM.
206	Not used	Reserved for legacy product
207	Unexpected current in work lead	Current above 8A in work lead prior to pilot ignition or transfer. Negative lead short to ground or arcstarter chassis; Defective HCT1 work lead current sensor; Defective Relay PCB.
208	Unexpected current in pilot circuit	Current above 6A in pilot circuit prior to ignition. Wrong or mismatched consumables causing tip - electrode short; Pilot lead shorted to negative in torch tube; Defective Relay PCB; Defective Pilot PCB; Possible shorted torch.
209	Not used	Reserved for legacy product
210	Work Current Too High	Work lead current detected greater than 16% above process setting. Possible defective HCT1 Work lead current sensor or Relay PCB; Defective CCM.
211	Work Current Too Low	Work current detected more than 16% below process setting. Possible defective HCT1 Work lead current sensor or Relay PCB; Possible defective pilot PCB (shorted IGBT);
212	Inverter 1A Output Current Low	Plasma work current low during cutting and attributed to Inverter Module 1 Section A output low; Inverter output disconnected; Possible defective ribbon cable; If problem persists replace Inverter Module 1
213	Inverter 1B Output Current Low	Plasma work current low during cutting and attributed to Inverter Module 1 Section B output low; Inverter output disconnected; Possible defective ribbon cable; If problem persists replace Inverter Module 1
214	Inverter 2A Output Current Low	Plasma work current low during cutting and attributed to Inverter Module 2 Section A output low; Inverter output disconnected; Possible defective ribbon cable; If problem persists replace Inverter Module 2
215	Inverter 2B Output Current Low	Plasma work current low during cutting and attributed to Inverter Module 2 Section B output low; Inverter output disconnected; Possible defective ribbon cable; If problem persists replace Inverter Module 2
216	Inverter 3A Output Current Low	Plasma work current low during cutting and attributed to Inverter Module 3 Section A output low; Inverter output disconnected; Possible defective ribbon cable; If problem persists replace Inverter Module 3
217	Inverter 3B Output Current Low	Plasma work current low during cutting and attributed to Inverter Module 3 Section B output low; Inverter output disconnected; Possible defective ribbon cable; If problem persists replace Inverter Module 2
218	Inverter 1A Output Current High	Plasma work current high during cutting and attributed to Inverter Module 1 Section A output high; If problem persists replace Inverter Module 1
219	Inverter 1B Output Current High	Plasma work current high during cutting and attributed to Inverter Module 1 Section B output high; If problem persists replace Inverter Module 1
220	Inverter 2A Output Current High	Plasma work current high during cutting and attributed to Inverter Module 2 Section A output high; If problem persists replace Inverter Module 2
221	Inverter 2B Output Current High	Plasma work current high during cutting and attributed to Inverter Module 2 Section B output high; If problem persists replace Inverter Module 2

<b>CCM Status Code</b>		
<b>Group 2 -- Plasma Power Supply</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
222	Inverter 3A Output Current High	Plasma work current high during cutting and attributed to Inverter Module 3 Section A output high; If problem persists replace Inverter Module 3
223	Inverter 3B Output Current High	Plasma work current high during cutting and attributed to Inverter Module 3 Section B output high; If problem persists replace Inverter Module 3
224	Inverter 1 Not Found	Inverter Module 1 Section A required for Piloting; Bad ribbon cable connection to CCM J31 to Inverter Module 1 Section A.
225	Inverter 1A Incompatible Revision	Unsupported Inverter Revision; Ribbon cable CCM J31 to Inverter Module 1 Section A damaged; CCM code version incompatible with Inverter revision or model
226	Inverter 1B Incompatible Revision	Unsupported Inverter Revision; Ribbon cable CCM J32 to Inverter Module 1 Section B damaged ; CCM code version incompatible with Inverter revision or model
227	Inverter 2A Incompatible Revision	Unsupported Inverter Revision; Ribbon cable CCM J33 to Inverter Module 2 Section A damaged; CCM code version incompatible with Inverter revision or model
228	Inverter 2B Incompatible Revision	Unsupported Inverter Revision; Ribbon cable CCM J34 to Inverter Module 2 Section B damaged; CCM code version incompatible with Inverter revision or model
229	Inverter 3A Incompatible Revision	Unsupported Inverter Revision; Ribbon cable CCM J35 to Inverter Module 3 Section A damaged; CCM code version incompatible with Inverter revision or model
230	Inverter 3B Incompatible Revision	Unsupported Inverter Revision; Ribbon cable CCM J36 to Inverter Module 3 Section B damaged; CCM code version incompatible with Inverter revision or model
231	Inverter 1A VAC Mismatch	Inverter AC Voltage rating incompatible with Power Supply voltage rating; Bad ribbon cable connection CCM J31 to Inverter Module 1 Section A; Wrong voltage Inverter Module 1 installed; Defective Inverter module
232	Inverter 1B VAC Mismatch	Inverter AC Voltage rating incompatible with Power Supply voltage rating; Bad ribbon cable connection CCM J32 to Inverter Module 1 Section B; Wrong voltage Inverter Module 1 installed; Defective Inverter module
233	Inverter 2A VAC Mismatch	Inverter AC Voltage rating incompatible with Power Supply voltage rating; Bad ribbon cable connection CCM J33 to Inverter Module 2 Section A; Wrong voltage Inverter Module 2 installed; Defective Inverter module
234	Inverter 2B VAC Mismatch	Inverter AC Voltage rating incompatible with Power Supply voltage rating; Bad ribbon cable connection CCM J34 to Inverter Module 2 Section B; Wrong voltage Inverter Module 2 installed; Defective Inverter module
235	Inverter 3A VAC Mismatch	Inverter AC Voltage rating incompatible with Power Supply voltage rating; Bad ribbon cable connection CCM J35 to Inverter Module 3 Section A; Wrong voltage Inverter Module 3 installed; Defective Inverter module
236	Inverter 3B VAC Mismatch	Inverter AC Voltage rating incompatible with Power Supply voltage rating; Bad ribbon cable connection CCM J36 to Inverter Module 3 Section B; Wrong voltage Inverter Module 3 installed; Defective Inverter module
237	Too Few Inverters Found	Two or more Inverter Sections required to operate; Ribbon cable from CCM to Inverter Section damaged or disconnected;
238	BIAS VAC Invalid	Invalid AC Voltage Selection; Damaged or loose connection at J61 of System Bias Supply; Defective System Bias PCB
239	AC Voltage High	System Bias PCB detected AC Voltage is higher than Power Supply rated Voltage; System Bias Supply J61 Voltage Selection connection damaged or disconnected; Defective System Bias PCB; Defective CCM
240	AC Voltage Low	System Bias PCB detected AC Voltage is lower than Power Supply rated Voltage; System Bias Supply J61 Voltage Selection connection damaged or disconnected; Defective System Bias PCB; Defective CCM

<b>CCM Status Code</b>		
<b>Group 2 -- Plasma Power Supply</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
241	Inverter 1A Input Voltage Error	Inverter Input Voltage fault; voltage out of range or missing phase at AC Input of Inverter Module 1 Section A; Poor AC Power Quality; Defective W1 contactor; Loose or open connection between input terminals and W1 contactor or contactor and input of Inverter Section; Defective Inverter module
242	Inverter 1B Input Voltage Error	Inverter Input Voltage fault; voltage out of range or missing phase at AC Input of Inverter Module 1 Section B; Poor AC Power Quality; Defective W1 contactor; Loose or open connection between input terminals and W1 contactor or contactor and input of Inverter Section; Defective Inverter module
243	Inverter 2A Input Voltage Error	Inverter Input Voltage fault; voltage out of range or missing phase at AC Input of Inverter Module 2 Section A; Poor AC Power Quality; Defective W1 contactor; Loose or open connection between input terminals and W1 contactor or contactor and input of Inverter Section; Defective Inverter module
244	Inverter 2B Input Voltage Error	Inverter Input Voltage fault; voltage out of range or missing phase at AC Input of Inverter Module 2 Section B; Poor AC Power Quality; Defective W2 contactor; Loose or open connection between input terminals and W2 contactor or contactor and input of Inverter Section; Defective Inverter module
245	Inverter 3A Input Voltage Error	Inverter Input Voltage fault; voltage out of range or missing phase at AC Input of Inverter Module 3 Section A; Poor AC Power Quality; Defective W2 contactor; Loose or open connection between input terminals and W2 contactor or contactor and input of Inverter Section; Defective Inverter module
246	Inverter 3B Input Voltage Error	Inverter Input Voltage fault; voltage out of range or missing phase at AC Input of Inverter Module 3 Section B; Poor AC Power Quality; Defective W2 contactor; Loose or open connection between input terminals and W2 contactor or contactor and input of Inverter Section; Defective Inverter module
247	Inverter 1A Circuit Fault	Inverter Module 1 Section A detected a circuit fault; Damaged Inverter Module 1
248	Inverter 1B Circuit Fault	Inverter Module 1 Section B detected a circuit fault; Damaged Inverter Module 1
249	Inverter 2A Circuit Fault	Inverter Module 2 Section A detected a circuit fault; Damaged Inverter Module 2
250	Inverter 2B Circuit Fault	Inverter Module 2 Section B detected a circuit fault; Damaged Inverter Module 2
251	Inverter 3A Circuit Fault	Inverter Module 3 Section A detected a circuit fault; Damaged Inverter Module 3
252	Inverter 3B Circuit Fault	Inverter Module 3 Section B detected a circuit fault; Damaged Inverter Module 3
253	Inverter 1A Over Temp	Inverter Module 1 Section A is over temperature; Operating with side panels removed, Check for restricted air flow, clogged radiator; Defective fan; If problem persists replace inverter module.
254	Inverter 1B Over Temp	Inverter Module 1 Section B is over temperature; Operating with side panels removed, Check for restricted air flow, clogged radiator; Defective fan; If problem persists replace inverter module.
255	Inverter 2A Over Temp	Inverter Module 2 Section A is over temperature; Operating with side panels removed, Check for restricted air flow, clogged radiator; Defective fan; If problem persists replace inverter module.
256	Inverter 2B Over Temp	Inverter Module 2 Section B is over temperature; Operating with side panels removed, Check for restricted air flow, clogged radiator; Defective fan; If problem persists replace inverter module.

CCM Status Code		
Group 2 -- Plasma Power Supply		
Code	Message	Remedy / Comments
257	Inverter 3A Over Temp	Inverter Module 3 Section A is over temperature; Operating with side panels removed, Check for restricted air flow, clogged radiator; Defective fan; If problem persists replace inverter module.
258	Inverter 3B Over Temp	Inverter Module 3 Section B is over temperature; Operating with side panels removed, Check for restricted air flow, clogged radiator; Defective fan; If problem persists replace inverter module.
259	Inverter 1A Over Temp Ambient	Inverter circuitry is over temperature likely cause is ambient greater than 40 deg C; Reduce power supply cutting Duty Cycle; Reduce ambient air temperature; Add auxiliary cooler.
260	Inverter 1B Over Temp Ambient	Inverter circuitry is over temperature likely cause is ambient greater than 40 deg C; Reduce power supply cutting Duty Cycle; Reduce ambient air temperature; Add auxiliary cooler.
261	Inverter 2A Over Temp Ambient	Inverter circuitry is over temperature likely cause is ambient greater than 40 deg C; Reduce power supply cutting Duty Cycle; Reduce ambient air temperature; Add auxiliary cooler.
262	Inverter 2B Over Temp Ambient	Inverter circuitry is over temperature likely cause is ambient greater than 40 deg C; Reduce power supply cutting Duty Cycle; Reduce ambient air temperature; Add auxiliary cooler.
263	Inverter 3A Over Temp Ambient	Inverter circuitry is over temperature likely cause is ambient greater than 40 deg C; Reduce power supply cutting Duty Cycle; Reduce ambient air temperature; Add auxiliary cooler.
264	Inverter 3B Over Temp Ambient	Inverter circuitry is over temperature likely cause is ambient greater than 40 deg C; Reduce power supply cutting Duty Cycle; Reduce ambient air temperature; Add auxiliary cooler.
265	Inverter 1A No Input Power	Inverter section may have no input power. Contactor W1 not closed; Defective contactor or CB4 tripped; Inverter section input not connected; Defective Inverter.
266	Inverter 1B No Input Power	Inverter section may have no input power. Contactor W1 not closed; Defective contactor or CB4 tripped; Inverter section input not connected; Defective Inverter.
267	Inverter 2A No Input Power	Inverter section may have no input power. Contactor W1 not closed; Defective contactor or CB4 tripped; Inverter section input not connected; Defective Inverter.
268	Inverter 2B No Input Power	Inverter section may have no input power. Contactor W2 not closed; Defective contactor or CB4 tripped; Inverter section input not connected; Defective Inverter.
269	Inverter 3A No Input Power	Inverter section may have no input power. Contactor W2 not closed; Defective contactor or CB4 tripped; Inverter section input not connected; Defective Inverter.
270	Inverter 3B No Input Power	Inverter section may have no input power. Contactor W2 not closed; Defective contactor or CB4 tripped; Inverter section input not connected; Defective Inverter.
271	Inverter ID reading fault	CCM found ID values inconsistant during reading. CCM to an Inverter section ribbon damaged or disconnected; Inproper ribbon cable routing.

<b>CCM Status Code</b>		
<b>Group 3 -- Gas Controller Status &amp; Protocol</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
301	Gas control communication fault	Problem with fiber optic cable to GCM 2010 or DMC or DPC; Dirt on fiber ends or in connectors; blow out with clean dry air. Fiber not locked into connector; Sharp bends in fiber cable; Fiber defective; GCM 2010 circuit board defect; DMC or DPC power supply defective; DMC or DPC circuit board defect
302	Gas Control reply fault	Problem with fiber optic cable to GCM 2010 or DMC or DPC; Dirt on fiber ends or in connectors; blow out with clean dry air. Fiber not locked into connector; Sharp bends in fiber cable; Fiber defective; GCM 2010 circuit board defect; DMC or DPC power supply defective; DMC or DPC circuit board defect
303	Gas Supply Pressure out of range.	GCM 2010 inlet plasma or shield pressure low or defective pressure sensors PS3 & PS4; Defective GCM 2010 PCB; For DFC 3000 see DPC for pressure faults.
304	Gas Control Purging	Normal following power up or returning from Plasma Disable. Wait for purge to finish.
305	Gas Control protocol error	Verify Firmware revision for compatibility with GCM 2010 or DMC and DPC
306	Not used	Reserved for other future use.
307	Gas Control sequencing error	Verify Firmware revision for compatibility with GCM 2010 or DMC and DPC
308	Gas Control Type Mismatch	Wrong CCM (Auto-Cut or Pak 200 type?) for Ultra-Cut; Install correct CCM
309	Gas Control command fault	Verify Firmware revision for compatibility with GCM 2010 or DMC and DPC; Electro-magnetic interference with Arc Starter; inspect grounding; bonding; and isolation
310 *	DPC fault	Check DPC status indicator for specific problem
311 *	DPC valve control fault	Check DPC status indicator for specific problem
312 *	DMC fault	Check DMC status indicator for specific problem
313 *	Gas Controller not configured.	DMC or DPC not configured for a process or locked; See DMC and DPC status
* Applies to DFC 3000 (Auto Gas) only		

<b>CCM Status Code</b>		
<b>Group 4 -- Torch Coolant System</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
401	Coolant Level low	Check coolant level, add as needed. Defective or disconnected level sensor.
402	Low coolant flow	Coolant flow as measured by flow switch FS1 is less than 0.7 gpm; Clogged filter; Restriction in torch lead or head; Wrong style consumables; broken or defective torch coolant tube/check valve; Defective pump or bypass valve.
403	Coolant overheated	Coolant supply temperature exceeded 75 degrees Celcius (167F). Operating with side panel loose or removed; Air flow blocked at air inlet or exit of power supply; Coolant fan failed; radiator fins clogged with dirt.
404	Coolant System not ready.	Proper coolant flow of 0.7 gpm as measured by flow switch FS1 was not obtained during up to 4 minutes of Priming. New installation can require additional Priming cycle(s) to fill hoses with coolant; cylce power to restart Priming; Coolant hoses or torch hoses reversed; Clogged coolant filter; Restriction in torch lead or head; Wrong style consumables; broken or defective torch coolant tube/check valve; Defective or disconnected FS1 flow SW; Defective pump or bypass valve.
405	Low Coolant Level Warning	Low coolant level during cut, does not stop cut. Add coolant as required.
406	Coolant Flow Low Warning.	This is a warning, does not stop system operation. Coolant flow rate lower than expected. Can be caused by gas bubbles being introduced into the coolant or wrong or mismatched or worn consumable parts; Failed seals in torch cartridge or torch body; Clogged coolant filter; Restriction in torch lead or head; defective or disconnected FL1 flow sensor.
407	Coolant overheated, high ambient.	Coolant supply temperature exceeded 75 degrees Celsius (167 Fahrenheit) likely cause ambient greater than 40 degrees Celsius (104 Fahrenheit); Reduce cutting duty cycle; Reduce ambient temperature; Add separate coolant cooler.

<b>CCM Status Code</b>		
<b>CCM-Group-5 Gas Controller Communication Port</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
501	CANBUS Acknowledge Fault	CCM to DMC Fiber-optic Control cable not connected, not properly connected or cable defective. DMC power supply or Control PCB defective. Defective CCM, replace.
502	CANBUS Off	Dirt on fiber ends or in connectors; blow out with clean dry air; Fiber not locked into connector; Sharp bends in fiber; Fiber defective
503	CANBUS Errors Warning	Dirt on fiber ends or in connectors; blow out with clean dry air; Fiber not locked into connector; Sharp bends in fiber; Fiber defective;
504	Reserved	No information available; Contact customer service



<b>CCM Status Code</b>		
<b>Group 6 -- CCM</b>		
<b>Code</b>	<b>Message</b>	<b>Remedy / Comments</b>
601	Analog Voltage Error	Defective CCM, replace.
602	ADC or DAC error	Defective CCM, replace.
603	Reserved	No information available; Contact customer service
604	Data Memory error	Defective CCM, replace.
605	Program memory fault	Defective CCM, replace.
606	+5V Logic supply low	Defective CCM, replace.
607	Processor over temperature	Reduce ambient temperature; Defective CCM; replace
608	5V supply for RS 485/422 communication low.	Defective CCM, replace.
609	Firmware Update Device Error	Defective CCM; replace
610	Firmware Update Protocol Error	Defective CCM; replace
611	USB Controller Fault	Defective CCM; replace
612	USB Power Fault	Faulty USB device plugged into USB port, remove; Defective CCM
613	USB Log Creation Fault	Unable to create Log file on USB Flash drive last firmware update attempt; Use different USB Flash Drive or Reformat
614	No USF File	File VTCCMFV.USF missing from Flash Drive; Add proper files to Flash Drive for Firmware Update; Use different USB Flash Drive or Reformat
615	No CCM Update File	CCM Firmware file specified in VTCCMFV.USF not found ; Add proper files to Flash Drive for Firmware updating
616	DPC Update Fault	Fault occurred attempting to update DPC firmware; Add proper files to USB Flash drive for Firmware updating; Refer to CCM_LOG.TXT on Flash Drive for details
617	DMC Update Fault	Fault occurred attempting to update DMC firmware; Add proper files to USB Flash drive for Firmware updating; Refer to CCM_LOG.TXT on Flash Drive for details
618	ADC Calibration Fault	Error too large calibrating ADC; Fault persists defective CCM;
619	Flow Switch Fault	Flow switch reporting coolant flow when pump off;
620	Non Volatile Memory Error	Non Volatile Memory Storage Corrupted and Erased; Fault persists defective CCM.

## 4.12 DMC-3000 Status Codes

### Status Code indicators:

1. At power up, RED & GREEN indicators flash program firmware revision number in a 2 digit code as explained below. Following the revision code
  2. Green indicator
    - On steady = OK, communication established.
    - Blinking = no communication established with CCM
  3. Red indicator
    - Off = Status OK
    - Rapid blinking = downloading new program
    - Blinking 2 digit code = Status (table below)

Status Indicators on the DMC & DPC modules flash a 2-part code. Both green and red flash the firmware version at power up. Only the red flashes for a fault.

First part of the code indicates a code group, the second part a particular condition within that group. DMC and DPM may flash codes at the same time and they may be different codes. For example, a power supply fault, such as 1-3, in the DMC could prevent communicating with the DPM so the DPC would flash one of its group 2 codes. You have to consider the codes in all the modules, CCM, DMC & DPC before determining which hardware has the fault.

The 2 digit code is separated by a 1.2 second space between digits and a 4 second space before the sequence repeats or flashes another code group. Codes displayed may be currently active or may represent a fault that shut the process down but is no longer active. If the fault that shut down the process is no longer active the first blink of the first digit is extra long.

Example: Indicator flashes 1 long followed by 3 shorter blinks the condition is in group 4. After 1.2 seconds delay, the indicator blinks 3 times; the condition code is 4-3 (the first long blink counts as part of the first digit), indicating the DMC has detected a DPC time-out error and it is not currently active. After a 4 second delay, the indicator repeats the sequence until the condition is corrected.

DMC Status Code Key		
Group 1 - DMC		
Code	Message	Cause/Remedy
1-1	Plasma Disabled	Enable Plasma; Defective DMC Power Supply (E-Stop relay)
1-2	24 VDC fault	Check /replace DMC power supply fuse (F2); Replace DMC Power Supply; Replace DMC control PCB
1-3	5 VDC fault	Check /replace DMC power supply; Replace DMC control PCB
1-4	No gas process selected	Select and send process from TSC 3000 or CNC;
1-5	DMC is locked	Process loading, wait until finished
1-6	Gas not Purged	DPC fault prevented purge from occurring, see DPC fault status
Group 2 - DPC Communication Port *		
2-1	DPC Acknowledge error	Check DMC to DPC fiber optic cable and connections; Dirty or defective fiber-optic;DPC power supply, fuse or Control PCB. DMC Control PCB
2-2	DPC Bus off error	Check DMC to DPC fiber optic cable and connections; Dirty or defective fiber-optic;DPC power supply, fuse or Control PCB. DMC Control PCB.
2-3	Reserved	No information available; Contact customer service



<b>Group 3 - CCM Communication Port *</b>		
3-1	CCM Acknowledge error	Check DMC to CCM fiber optic cable and connections; Dirty or defective fiber-optic; Replace DMC Control PCB; Replace CCM.
3-2	CCM Bus off error	Check DMC to CCM fiber optic cable and connections; Dirty or defective fiber-optic; Replace DMC Control PCB; Replace CCM.
3-3	Reserved	No information available; Contact customer service
<b>Group 4 - Gas Controller Status and Protocol Errors</b>		
4-1	CCM Connection loss	Loss of communication with either DPC or DMC; check for dirty or defective fiber optic to either DPC or CCM; See DPC and CCM status codes
4-2	CCM Timeout	Loss of communication with either DPC or DMC, check for dirty or defective fiber-optic to either DPC or CCM. See DPC and CCM status codes.
4-3	DPC Timeout	Loss of communication with DPC, check for dirty or defective fiber-optic to DPC. See DPC status code.
4-4	DPC error	Loss of communication with DPC, check for dirty or defective fiber-optic to DPC. See DPC status code.
4-5	Reserved	No information available; Contact customer service
4-6	Reserved	No information available; Contact customer service
<b>Group 5 - Shorted Solenoid Faults</b>		
5-1	Sol 1 – H35 Plasma	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-2	Sol 2 – Oxygen Plasma	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-3	Sol 3 – Air Plasma	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-4	Sol 4 – Nitrogen Plasma	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-5	Sol 5 – Aux Plasma	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-6	Sol 6 – Oxygen Shield	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-7	Sol 7 – Air Shield	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-8	Sol 8 – Nitrogen Shield	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-9	Sol 9 – H2O Shield	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-10	Sol 10 – Oxygen Preflow	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-11	Sol 11 – Air Preflow	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-12	Sol 12 – Nitrogen Preflow	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-13	Sol 13 – Argon Marking	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-14	Sol 14 – Air Marking	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
5-15	Sol 15 – Nitrogen Marking	Replace solenoid; Shorted wire harness; Defective DMC Control PCB
<p>* Communication faults shown on the DMC can be caused by the device on the other end of the communication line. Before assuming the DMC is at fault see if either the CCM or the DPC are showing any codes that might indicate they are at fault instead.</p>		

## 4.13 DPC-3000 Status Codes

DPC Status Code Key		
Group 1 - DPC		
Code	Message	Cause/Remedy
1-1	Plasma Disabled	Enable Plasma; DMC Power Supply input fuse F1 blown (no lights on DMC); Defective DMC Power Supply (E-Stop relay). Defective DPC Power Supply (E-Stop relay). Defective DPC control PCB
1-2	24 VDC fault	Check /replace DPC power supply output fuse (F2); Defective DPC power supply; Replace DPC control PCB
1-3	+12 VDC fault	Check /replace DPC power supply; Replace DPC control PCB
1-4	-12 VDC fault	Check /replace DPC power supply; Replace DPC control PCB
1-5	5 VDC fault	Check /replace DPC power supply; Replace DPC control PCB
1-6	Analog Reference fault	Replace DPC Control PCB
1-7	ADC voltage fault	Replace DPC Control PCB
1-8	Reserved	
1-9	Valve not configured	Resend process from TSC 3000 / CNC
1-10	DPC is locked	Process loading, wait until finished
Group 2 - Control Communication		
2-1	Acknowledge error	Fiber optic cable; DPC Control PCB
2-2	Timeout	Communication loss: Check DMC codes; if DMC 2-1 check DPC to DMC Fiber optic cable, DMC 4-2 check DMC to CCM fiber-optic cable.; DPC Control PCB; DMC Control PCB; CCM.
2-3	Protocol	Program firmware fault, consult factory
2-4	Bus off	Fiber optic cable; DPC Control PCB
2-5	Physical	Fiber optic cable; DPC Control PCB
Group 3 - Inlet Pressure Faults		
3-1	Plasma Gas High (>145 PSI)	Reduce pressure from gas supply; defective pressure sensor (PS4).
3-2	Pilot Gas High (>145 PSI)	Reduce pressure from gas supply; defective pressure sensor (PS3).
3-3	Shield Gas High (>145 PSI)	Reduce pressure from gas supply; defective pressure sensor (PS1).
3-4	Shield H2O High (>145 PSI)	Reduce pressure from gas supply; defective pressure sensor (PS2).
Group 4 - Proportional Valves & Solenoids Electrical Faults		
4-1	Plasma High (V5) shorted	Check for shorted wire harness; Replace valve
4-2	Plasma Low (V4) shorted	Check for shorted wire harness; Replace valve
4-3	Pilot (V3) shorted	Check for shorted wire harness; Replace valve
4-4	Shield Gas (V1) shorted	Check for shorted wire harness; Replace valve
4-5	Shield H2O (V2) shorted	Check for shorted wire harness; Replace valve
4-6	Vent (SOL2) shorted	Check for shorted wire harness; Replace valve
4-7	Cut (SOL3) shorted	Check for shorted wire harness; Replace valve
4-8	Mark (SOL1) shorted	Check for shorted wire harness; Replace valve
4-9	Vent (SOL2) open	Check for open connection; Replace valve.
4-10	Cut (SOL3) open	Check for open connection; Replace valve.
4-11	Mark (SOL1) open	Check for open connection; Replace valve.
Group 5 - Plasma High Proportional Valve (V5)		
5-1	Valve open	Check for open connection; Replace valve.
5-2	DPC inlet Supply pressure low	Raise plasma inlet pressure; check for DMC valve not open; restriction in gas supply / hoses.
5-3	Outlet pressure too low	Valve full open. Leak in plasma hose to torch; defective control valve (V5); defective pressure sensor (PS6); DPC Control PCB
5-4	Outlet pressure low	Tracking error Leak in plasma hose to torch; defective control valve (V5); defective pressure sensor (PS6); DPC Control PCB
5-5	Outlet pressure too high.	Valve at minimum setting. Restriction in plasma hose, torch, DPC manifold; defective control valve (V5); defective pressure sensor (PS6); DPC Control PCB

<b>DPC Status Code Key</b>		
<b>Code</b>	<b>Message</b>	<b>Cause/Remedy</b>
<b>Group 6 - Plasma Low Proportional Valve (V4)</b>		
6-1	Valve open	Check for open connection; Replace valve.
6-2	DPC inlet Supply pressure low	Raise plasma inlet pressure; check for DMC valve not open; restriction in gas supply/hoses.
6-3	Outlet pressure too low	Valve full open but pressure still too low. Leak in plasma hose to torch; Defective control valve (V4); Defective pressure sensor (PS6); DPC Control PCB
6-4	Outlet pressure low	Tracking error. Leak in plasma hose to torch; Defective control valve (V4); Defective pressure sensor (PS6); DPC Control PCB
6-5	Outlet pressure Too high	Valve at minimum setting but pressure still too high. Restriction in plasma hose to torch; torch or DPC manifold; Defective control valve (V4); Defective pressure sensor (PS6); DPC Control PCB
6-6	Outlet pressure high	Tracking error. Restriction in plasma hose; torch or DPC manifold; Defective control valve (V4); Defective pressure sensor (PS6); DPC Control PCB
<b>Group 7 - Pilot Proportional Valve (V3)</b>		
7-1	Valve open	Check for open connection; Replace valve.
7-2	DPC inlet Supply pressure low	Raise plasma inlet pressure; check for DMC valve not open; restriction in gas supply/hoses.
7-3	Outlet pressure too low	Valve full open but pressure still too low. Leak in plasma hose to torch; defective control valve; defective pressure sensor (PS6); DPC Control PCB
7-4	Outlet pressure low	Tracking error. Leak in plasma hose to torch; defective control valve; defective pressure sensor (PS6); DPC Control PCB
7-5	Outlet pressure Too high	Valve at minimum setting but pressure still too high. Restriction in plasma hose, torch, DPC manifold; defective control valve; defective pressure sensor (PS6); DPC Control PCB
7-6	Outlet pressure high	Tracking error. Restriction in plasma hose, torch, DPC manifold; defective control valve; defective pressure sensor (PS6); DPC Control PCB
<b>Group 8 - Shield Gas Proportional Valve (V1)</b>		
8-1	Valve open	Check for open connection; Replace valve.
8-2	DPC inlet Supply pressure low	Raise plasma inlet pressure; check for DMC valve not open; restriction in gas supply/hoses.
8-3	Outlet pressure too low	Valve full open but pressure still too low. Leak in plasma hose to torch; defective control valve; defective pressure sensor (PS5); DPC Control PCB
8-4	Outlet pressure low	Tracking error. Leak in plasma hose to torch; defective control valve; defective pressure sensor (PS5); DPC Control PCB
8-5	Outlet pressure Too high	Valve at minimum setting but pressure still too high. Restriction in plasma hose, torch, DPC manifold; defective control valve; defective pressure sensor (PS5); DPC Control PCB
8-6	Outlet pressure high	Tracking error. Restriction in plasma hose, torch, DPC manifold; defective control valve; defective pressure sensor (PS5); DPC Control PCB
<b>Group 9 - Shield H2O Proportional Valve (V2)</b>		
9-1	Valve open	Check for open connection; Replace valve.
9-2	DPC inlet Supply pressure low	Raise plasma inlet pressure; check for DMC valve not open; restriction in gas supply/hoses.
9-3	Outlet flow too low	Valve full on but pressure still too low. Leak in shield hose to torch; Defective control valve (V2); Defective pressure sensor (PS5) or flow sensor (FS-1) if equipped; DPC Control PCB
9-4	Outlet flow low	Tracking error, outlet pressure too low. Leak in shield hose to torch; Defective control valve (V2). Defective pressure sensor (PS5) or flow sensor (FS-1) if equipped; DPC Control PCB
9-5	Outlet flow Too high	Valve set to minimum but valve outlet pressure still too high. Mineral build up or other restriction in control valve (V2), DPC manifold, shield hose or torch; Defective control valve (V2)/ Defective pressure sensor (PS5) or flow sensor (FS-1) if equipped; DPC Control PCB
9-6	Outlet flow high	Tracking error, outlet pressure too high. Mineral build up or other restriction in control valve (V2), DPC manifold, shield hose or torch; Defective control valve (V2); Defective pressure sensor (PS5) or flow sensor (FS-1) if equipped; DPC Control PCB

**4.14 Remote Arc Starter Trouble Shooting**

<b>Arc Starter Trouble Shooting</b>			
<b>Symptom</b>	<b>Cause</b>	<b>Check</b>	<b>Remedy</b>
No Pilot ignition Neon indicator on Cap board lights but no ignition.	Pilot return wire not connected at torch head or broken in torch lead	Visual inspection, continuity check	Connect Wire or replace leads.
	Coolant has become conductive	Use conductivity meter	Flush system, replace coolant.
	High Frequency cap (C4 on Cap PCB) possibly open wires disconnected.	Use capacitance meter	Reconnect or replace.
	Negative supply cable not connected correctly	Visual inspection	Reconnect
	Pilot return wire not connected or loose in arcstarter.	Visual inspection	Connect Wire.
No Pilot ignition: Neon indicator not illuminated.	No 120V supply, CB4 of plasma rear panel tripped	Reset breaker, check for 120 VAC at the module's 115V terminals during ignition time.	Check for shorted cable, defective circuit breaker, shorted ignition module input. (see next symptom)
	Electronic Ignition module shorted input	Resistance measurement, good module measures about 45 ohms	Replace bad module
	No 120V supply, CB4 not tripped	check for 120 VAC at the plasma supply's rear panel connector J59-7 & 9 during ignition time.	120V present - open control cable, 120V not present - fault in plasma power supply
	Faulty Electronic Ignition module	Check for 120 VAC at the modules 115V terminals during pilot ignition time	If 120 VAC is present but neon not illuminated, module is defective, replace module
	Loose fitting(s)	Visual inspection	Tighten fittings.
Coolant Leaks	Damaged or punctured coolant line(s).	Visual inspection	Replace Coolant Lines
	Supply & return hose reversed	Visual Inspection of color-coded connections	Match coolant connection colors to arc starter fitting colors.
No cooling or insufficient cooling: No Coolant Flow	Blockage in supply/return hoses	Loosen fitting slightly and check for coolant flow	Flush system or replace blocked hose.
	Missing or loose ground connection	Visual inspection of ground wire to Arc Starter	Make or tighten connections to good ground.
Erratic System Behavior(EMI Interference	Torch Lead Shield not connected or loose. F1 gnd cable not connected.	Visual inspection of lead shield attachment to Arc Starter	Reconnect / tighten lead connectors.
	Cap board ground screw not tight or missing.	Visual inspection	Tighten or replace.
	Cap C5 or C7 (on Cap PCB) open or disconnected wires to Cap board.	Visual inspection / capacitor measurement	Replace PCB.

## SECTION 5: MAINTENANCE

### 5.01 General Maintenance

Perform the following checks periodically to ensure proper system performance.

Power Supply Maintenance Schedule
<b>Daily</b>
Check coolant level; add coolant as needed.
Check gas hose connections and pressures.
UC-AC Maintenance schedule
<b>Monthly</b>
Check cooling fan and radiator; clean as needed.
Check gas hoses for cracks, leaks, or abrasion. Replace as needed.
Check all electrical connections for cracks or abrasion. Replace as needed.
<b>Six Months</b>
Clean or replace external coolant filter.
Clean coolant tank.
Vacuum out any dust buildup inside power supply.

### 5.02 External Coolant Filter Cleaning Procedure

Periodic cleaning of the coolant filter ensures maximum coolant flow efficiency. Poor coolant flow causes inefficient torch parts cooling with consequent faster consumable wear.

Clean the coolant filter as follows:

1. Disconnect system from main input power.
2. Unscrew and remove the filter canister by hand. Large canister located at the back of the power supply. Be sure to keep the O-ring.
3. Inspect and replace filter as needed. Re-install the canister, tightening it **by hand**. Be sure the O-ring is in place.
4. Turn the system on and check for leaks.

### 5.03 Coolant Replacement Procedure

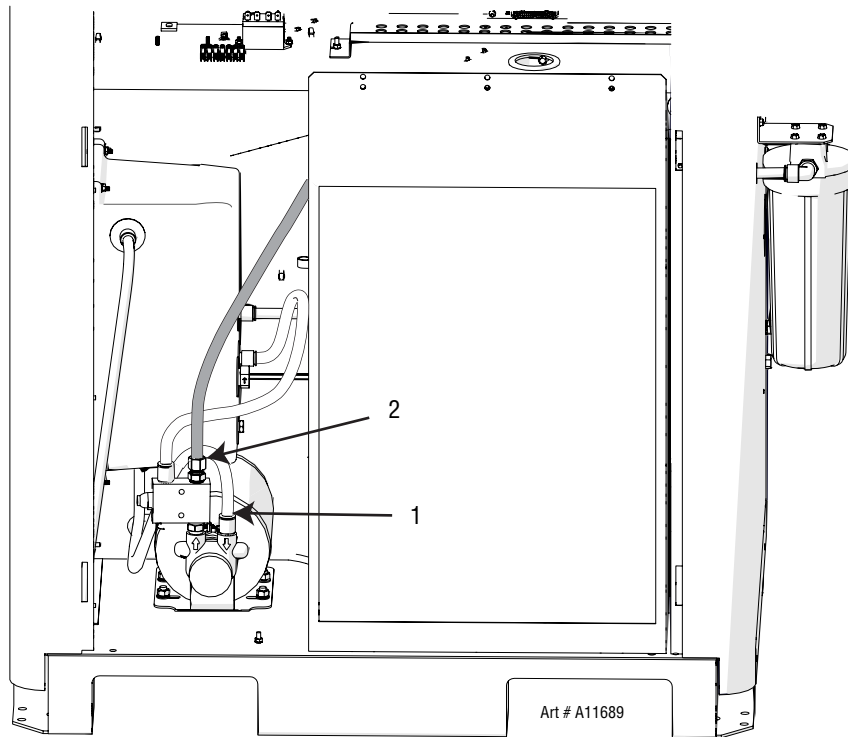
Replace coolant as follows:

1. Disconnect the system from main input power.
2. Remove the two right side panels.
3. Locate the coupling in the coolant line that comes from the bottom of the coolant tank, #1 in the following illustration. Disconnect the coolant line at this fitting and drain the coolant into a disposable container of sufficient size. Remember you will be draining more than the contents of the coolant reservoir.
4. Once coolant is draining, disconnect the gray hose coupling #2 in the illustration below. Allow excess coolant to drain, then apply a maximum of 5psi to clear the lines.



**CAUTION**

Applying more than 5 psi air pressure to the cooling system will result in damage. Extra caution must be used when performing this task.



5. Reconnect those two fittings and then remove the filter bowl from the canister at the rear of the power supply. Pour this remaining coolant into the container and replace the filter bowl.

**NOTE**

*If you also need to replace the coolant still in the leads, disconnect the leads from the power supply and manually drain them.*

6. Fill the tank with fresh coolant until the right level is reached checking for leaks.
7. Turn system on, let it run for a few minutes and check coolant level, refill as needed. Refer to Section 3:23 Complete the Installation on the procedure for this.
8. Install the side panels.

**SECTION 6: REPLACEMENT ASSEMBLIES & PARTS****6.01 Replacement Power Supply****Complete Unit / Component      Catalog Number**

Ultra-Cut 100 XT™ Power Supply, 480V +10 -15%      3-8116-2

Ultra-Cut 100 XT™ Power Supply, 480V +10 -15% with SL100 interface      3-8116-2T

Remote Arc Starter (RAS-1000 XT)      3-9130E

## OPTIONAL EQUIPMENT:

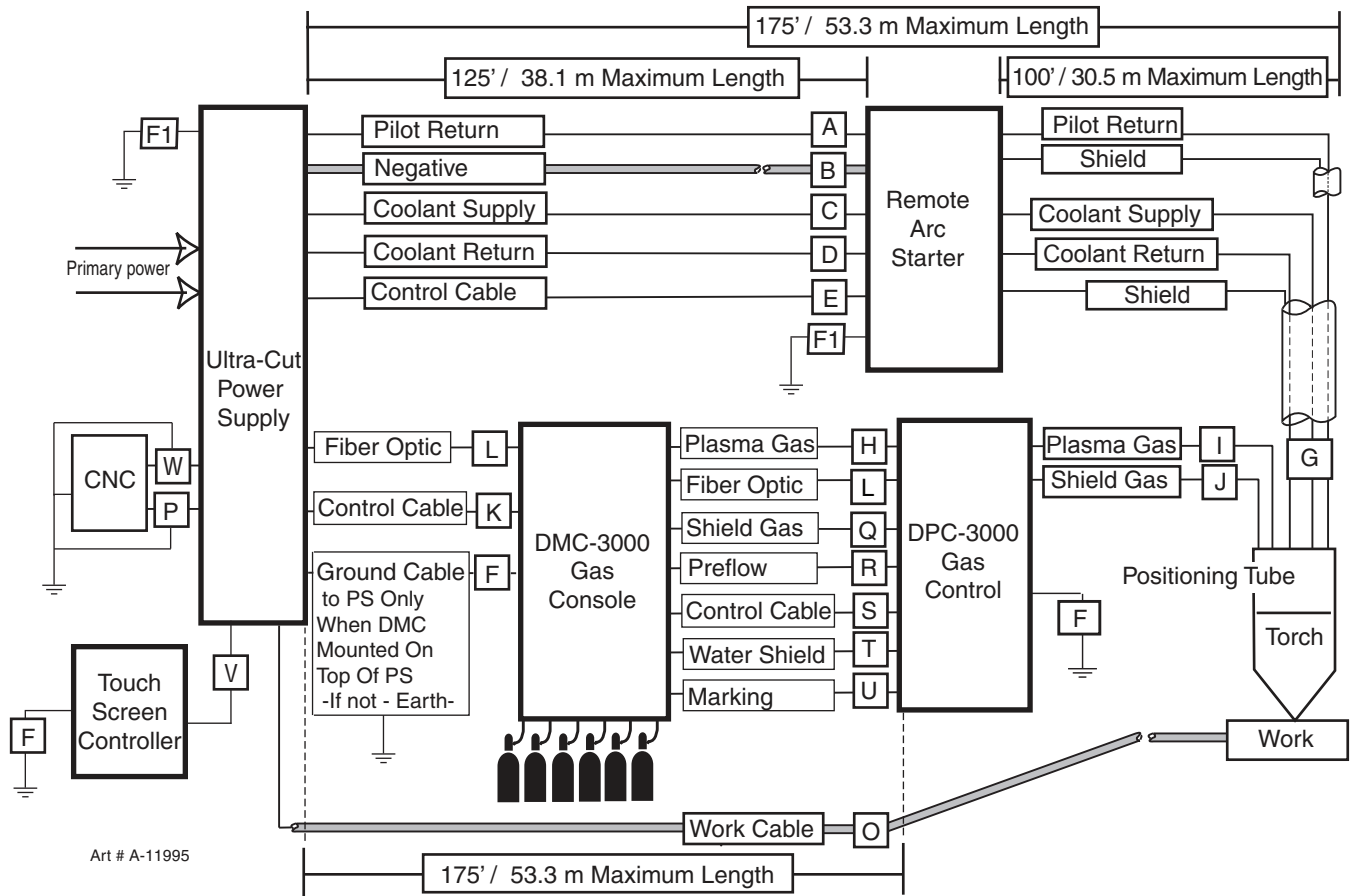
Wheel Kit      9-7378



# ULTRA-CUT 100 XT

## 6.02 System Layout

Refer to section 3.05 for ground connections and ground cables.





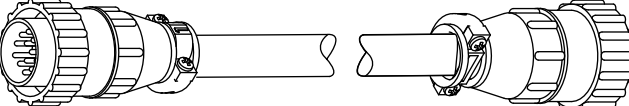
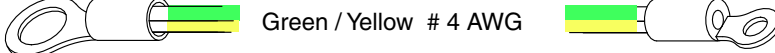
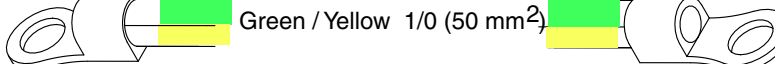
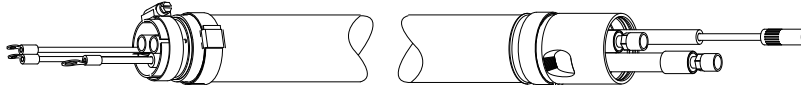


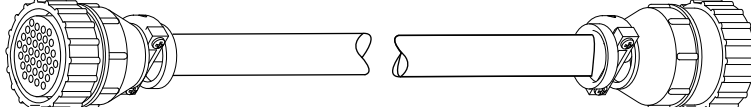
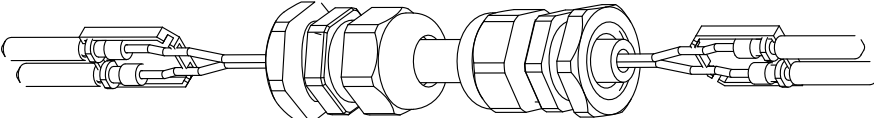
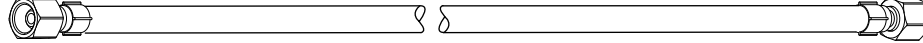
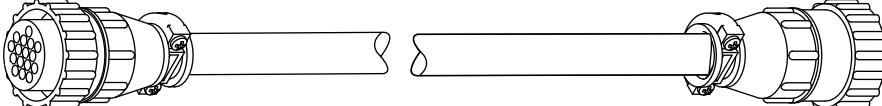
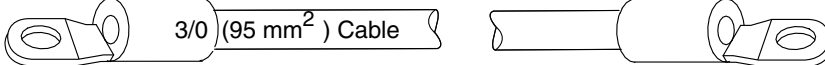
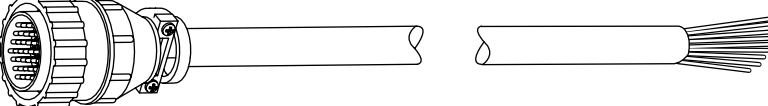


## 6.03 Recommended Gas Supply Hose

Item #	Qty	Description	Catalog #
	1	3/8" Gray Synflex Hose. No fittings included. Catalog number per foot	9-3616

**6.04 Leads And Cables All Amperages**

Art # A-11997\_AB

- |                  |  |  |   |
|------------------|--|--|---|
| A                | #8 AWG Cable                             |     | Pilot Return, Power Supply to Arc Starter   |
| B                | 3/0 AWG Cable (95 mm <sup>2</sup> )      |     | Negative Lead, Power Supply to Arc Starter  |
| C                |  |     | Coolant Supply Lead, Power Supply to Arc Starter                                      |
| D                |  |     | Coolant Return Lead, Power Supply to Arc Starter                                      |
| E, Y<br>14/7     |  |     | E - Control Cable, Power Supply to Arc Starter<br>Y - Control Cable to Heat Exchanger |
| F                | Green / Yellow # 4 AWG                   |    | Ground Cable  |
| F1               | Green / Yellow 1/0 (50 mm <sup>2</sup> ) |    | Ground Cable, Remote Arc Starter To Earth Ground                                      |
| G                |  |    | Shielded Torch Lead Assembly, Remote Arc Starter to Torch                             |
| I                |  |   | Plasma Gas Lead, Torch Valve to Torch   |
| J                |  |  | Shield Gas Lead, Torch Valve to Torch   |
| K<br>37          |  |  | Control Cable, Power Supply to Gas Control Module                                     |
| L                |  |  | Fiber Optic Cable, Power Supply to Gas Control Module                                 |
| H, Q,<br>R, T, U |  |  | For use with DFC-3000   |
| S, V<br>16 pin   |  |  | S - Control Cable, DMC-3000 to DPC-3000<br>V - TSC-3000 to PS                         |
| O                | 3/0 (95 mm <sup>2</sup> ) Cable          |  | Work Cable  |
| P, W<br>37/11    |  |  | CNC Cable (37 Wire)<br>W - CNC Communication Cable (11 Wire)                          |

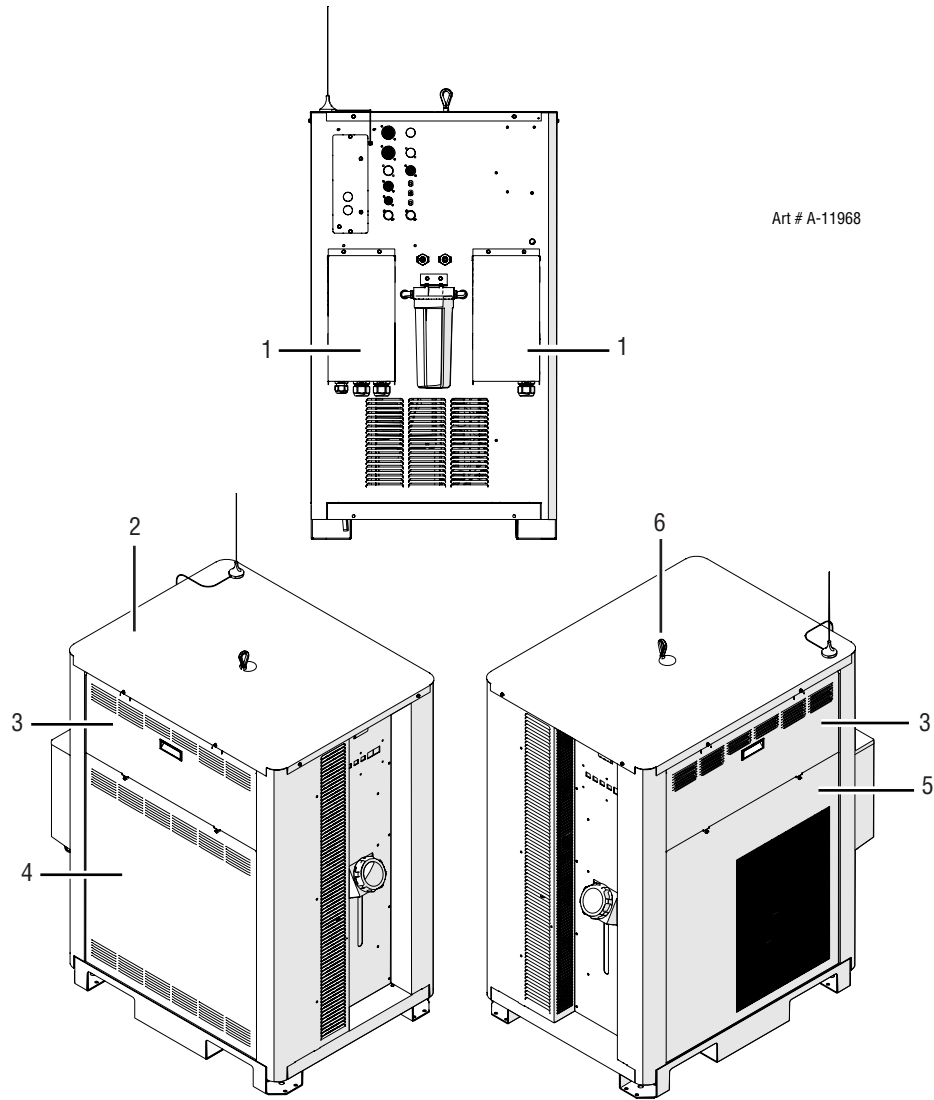
Key		Description		Leads Length																
				3 ft 1 m	4 ft 1.2 m	10 ft 3.05 m	15 ft 4.5 m	20 ft 6 m	25 ft 7.6 m	30 ft 9.1 m	35 ft 10.6 m	40 ft 12 m	50 ft 15.2 m	60 ft 18.3 m	75 ft 22.8 m	100 ft 30.5 m	125 ft 38.1 m	150 ft 45.7 m	175 ft 53.3 m	
A,B,C,D,E		Supply Lead Set (Note 1)	4-3096		4-3097	4-3098		4-3099		4-3100		4-3101	4-3105	4-3102	4-3103	4-3104				
A		Pilot Return Cable	9-4890	9-4891	9-4790		9-4791		9-9426		9-4792	4-3200	9-4793	9-4794	9-4796					
B		Negative Cable	9-7356	9-7357	9-7358		9-7359		9-7360		9-7361	4-3201	9-7362	9-7363	9-7364					
C		Hose, Coolant Supply	9-4886	9-4887	9-4780		9-4782	9-4783	9-4784	9-4785	9-4786	4-3202	9-4787	9-4788						
D		Hose, Coolant Return	9-4888	9-4889	9-4762		9-4764	9-4765	9-4766	9-4767	9-4768	4-3203	9-4769	9-4770						
E		Control Cable to Arc Starter	9-4941	9-4916	9-4917		9-4918				9-4942	4-3204	9-4943	9-4944	9-4922					
F		Ground Wire, PS to GCM	9-4923		9-4924		9-4925				9-4926		9-4927	9-4928	9-4929	9-4930				
F1		Ground Wire, Remote AS to Earth	9-4931		9-4932		9-4933				9-4934		9-4935	9-4936	9-4937	9-4938				
G		Assembly, Torch Lead		4-3053	4-3009	4-3010	4-3011	4-3012	4-3013	4-3014	4-3015	2-7017	4-3016	4-3017						
I		Plasma Lead	9-3333																	
J		Shield Lead	9-3334																	
K		Control Cable, PS to GCM	9-4907		9-4908		9-4909		9-9332		9-4910		9-4911	9-4912	9-4913	9-4914				
L		Control Cable Fiber Optic	9-4898		9-4899		9-4900		9-9335		9-4901		9-4902	9-4903	9-4904	9-4905	9-4906			
O		Work Cable			9-7350		9-7351				9-7352		9-7353							
P		Control Cable, CNC to PS					9-7368				9-7369		9-7370	9-7371	9-7372					
H,Q,R,T,U		Gas Lead Set (Note 2)		4-3035	4-3036		4-3037		4-3051		4-3038		4-3039	4-3040	4-3041	4-3042	4-3043			
H		Plasma Gas Hose		9-7103	9-7104		8-0149		9-7270		9-7271		9-7272	9-7273	9-7274	9-7275	9-7276			
Q		Shield Gas Hose		9-7277	9-7278		9-7279		9-7280		9-7281		9-7282	9-7283	9-7284	9-7285	9-7286			
R		Pilot Gas/Pre-Flow Hose		9-6956	9-6957		9-6959		9-6961		9-6963		9-6964	9-7080	9-7081	9-4876	9-4877			
S, V		Control Cable		9-7093	9-7094		9-7095		9-7096		9-7097		9-7098	9-7099	9-7100	9-7101	9-7102			
T		Water Shield		9-6985	9-6986		9-6988		9-6996		9-6992		9-6993	9-7073	9-7074	9-7075	9-7076			
U		Marking Cable		9-4725	9-4726	9-4727	9-4728	9-4729	9-4730	9-4731	9-4732		9-4733	9-4734	9-7077	9-7078	9-7079			
W		Communication Control Cable, CNC					9-8674				9-8675		9-8676	9-8677	9-8678	9-8679	9-8680			

NOTE 1: Supply lead sets include Pilot Return Cable, Negative Cable, Coolant Supply & Return Hoses and Control Cable.

NOTE 2: Gas lead sets include Plasma Gas Hose, Shield Gas Hose, Prewlow Gas Hose and Control Cable individually, not combined.

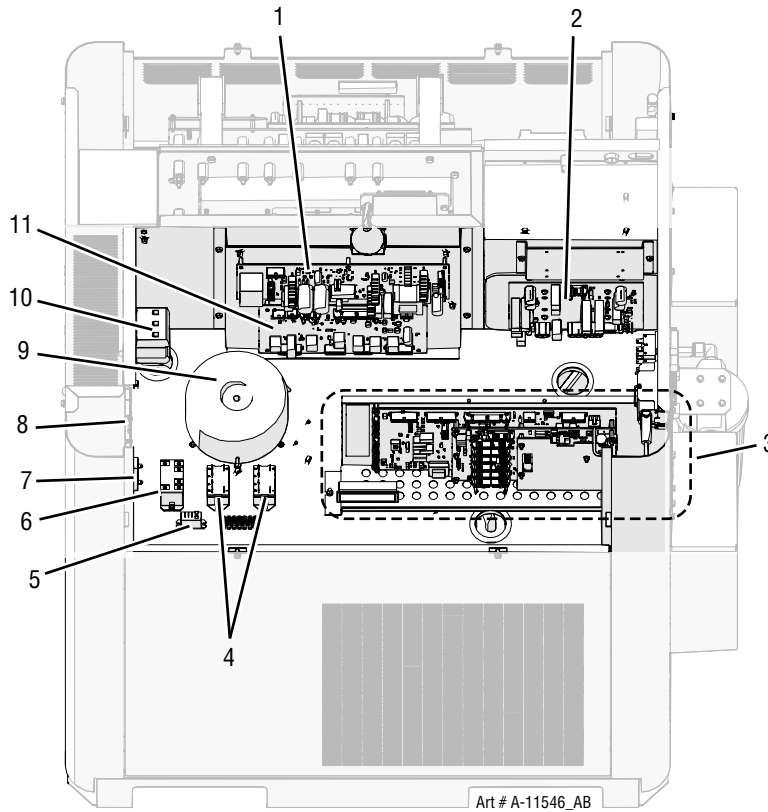
**6.05 Power Supply External Replacement Parts**

Item #	Qty	Description	Catalog #
1	1	Power and Leads Cable Cover	9-7346
2	1	Top Panel,	9-7300
3	1	Upper Side Covers	9-7301
4	1	Lower Left Side Panel	9-7304
5	1	Lower Right Side 100A/200A Panel	9-7302
6	1	Lifting Eye	9-9373



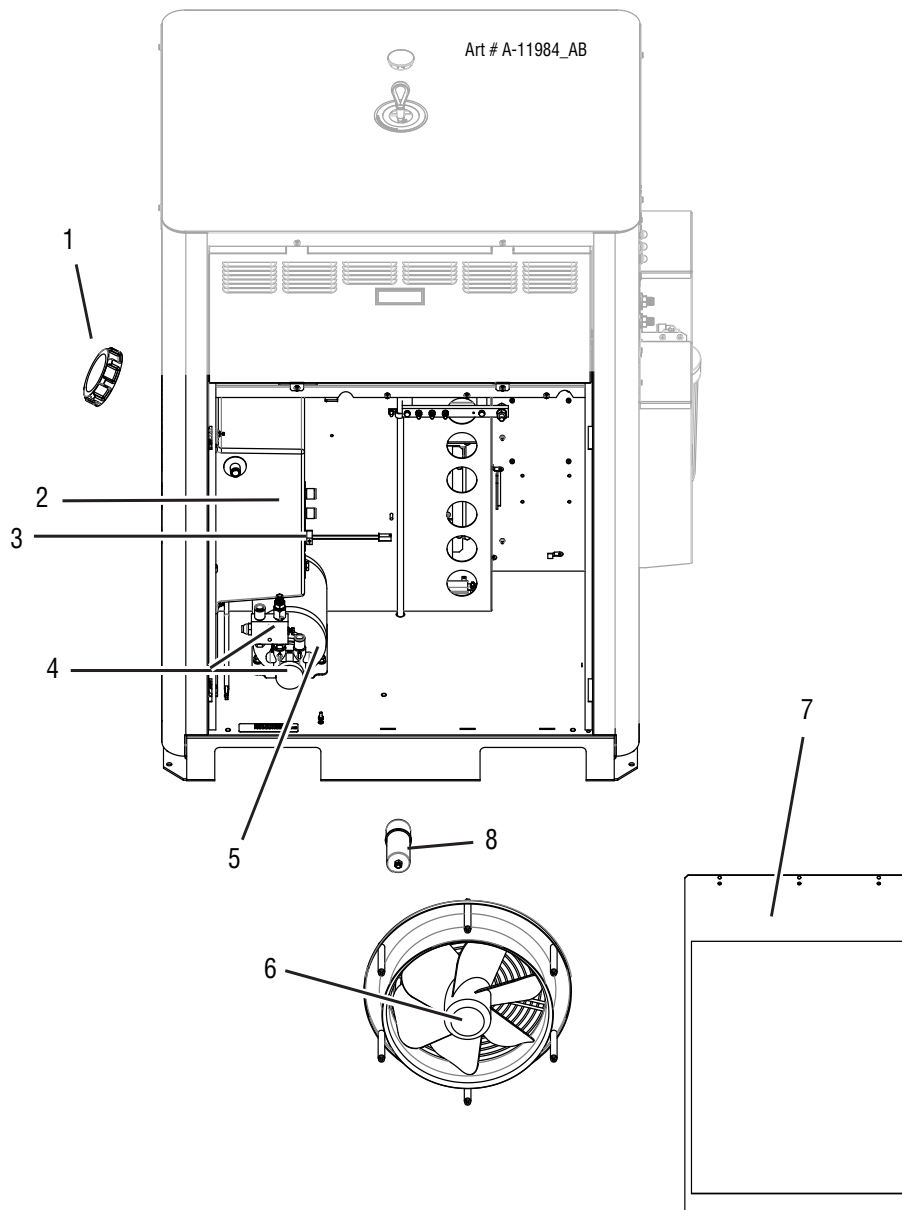
## 6.06 Power Supply Replacement Parts - Upper Right Side

Item #	Qty	Description	Ref. Des.	Catalog #
1	1	System Bias PCB		9-9253
2	1	Pilot PCB		9-9250
3	1	CCM Assembly		9-7335
4	1	Relays, Pump / Fan	MC3 / MC2	9-7314
5	1	Relay, Inrush Control	K1	9-7336
6	1	Relay, Inrush	MC1	9-7337
7	1	Resistor, Inrush	R2	9-7376
8	1	Display PCB		9-9252
9	1	Auxiliary Transformer	T1	9-7315
10	1	On/Off Switch Breaker	CB1	9-7316
11	1	Relay and Interface PCB		9-9251



**6.07 Power Supply Replacement Parts - Lower Right Side**

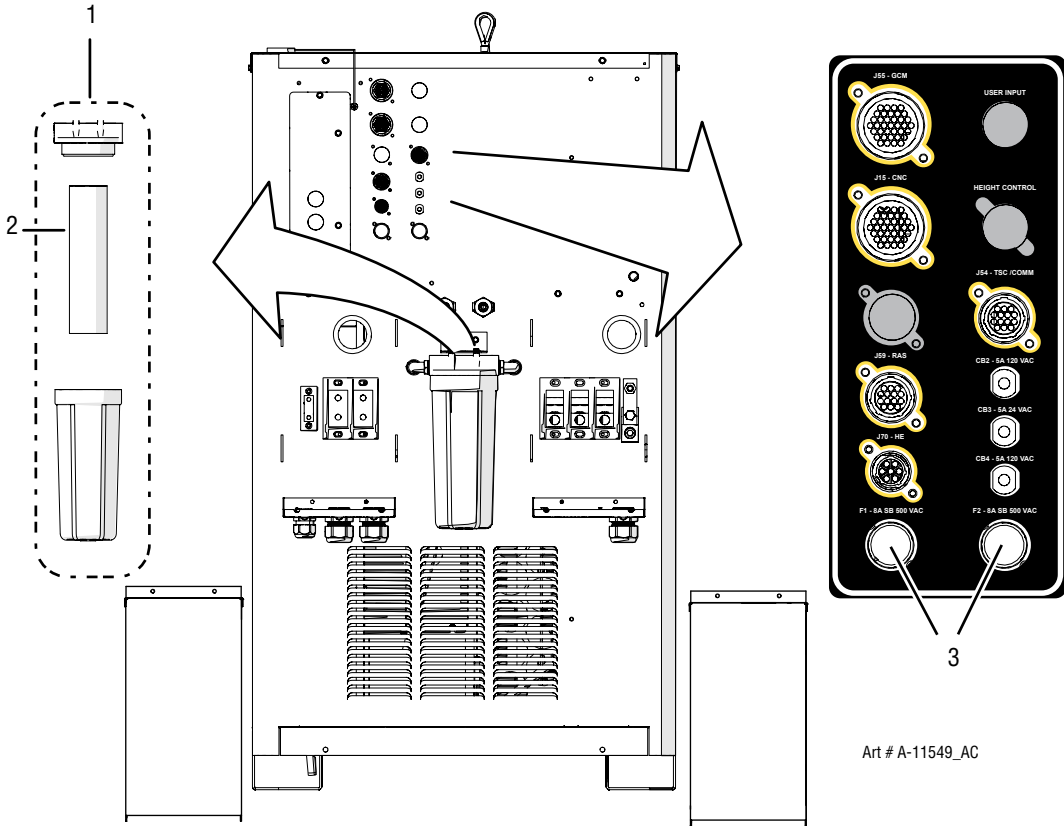
Item #	Qty	Description	Ref. Des.	Catalog #
1	1	Coolant Tank, Cap		8-5124
2	1	Coolant Tank		9-7306
3	1	Sensor, Coolant level		9-7307
4	1	Pump, Coolant, Assembly		9-7309
5	1	Motor, Pump		9-8166
6	1	Heat Exchanger Fan		9-7312
7	1	Radiator		9-7349
8	1	Flow, Switch (Not shown, behind cooling fans)	FS1	9-7310
9	1	Bubble (flow) Sensor (Not shown, behind cooling fans)	FL1	9-9297
10	1	Current Transducer, 300A (Not shown)	HCT1	W7005324



# ULTRA-CUT 100 XT

## 6.08 Power Supply Replacement Parts - Rear Panel

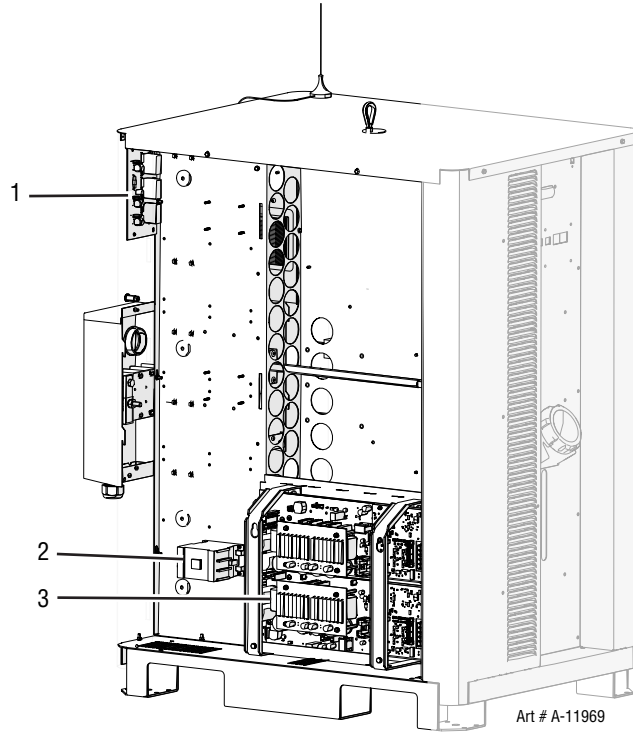
Item #	Qty	Description	Breaker Rating	Circuit Rating	Ref. Des.	Catalog #
1	1	Coolant Filter Assy				9-7320
2	1	Coolant Filter				9-7321
3	1	Fuse, 8A SB 500 VAC				9-7377





**6.09 Power Supply Replacement Parts - Left Side**

Item #	Qty	Description	Ref. Des.	Catalog #
1	1	AC Suppresion PCB		9-9254
2	1	Main Contactor	W1	9-7318
3	1	Inverter Module, Full 480 VAC		9-7330



## 6.10 DFC-3000 Automated Gas Control System Replacement Components

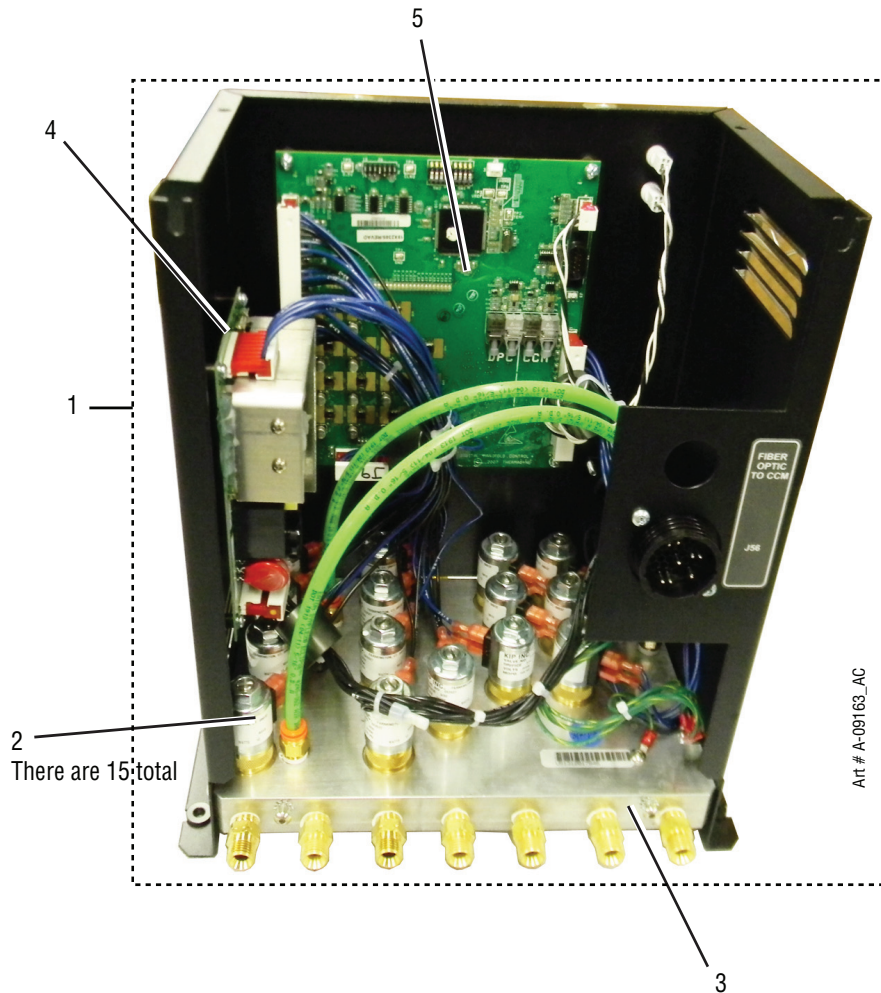
Item #	Qty	Description	Catalog #
1	1	Assy, DMC-3000, Demo	9-9491D
2	1	Assy, DPC-3000, Demo	9-9443D
3	1	Assy, TSC-3000, Remote, Demo	9-9490D



Art # A-09135\_AC

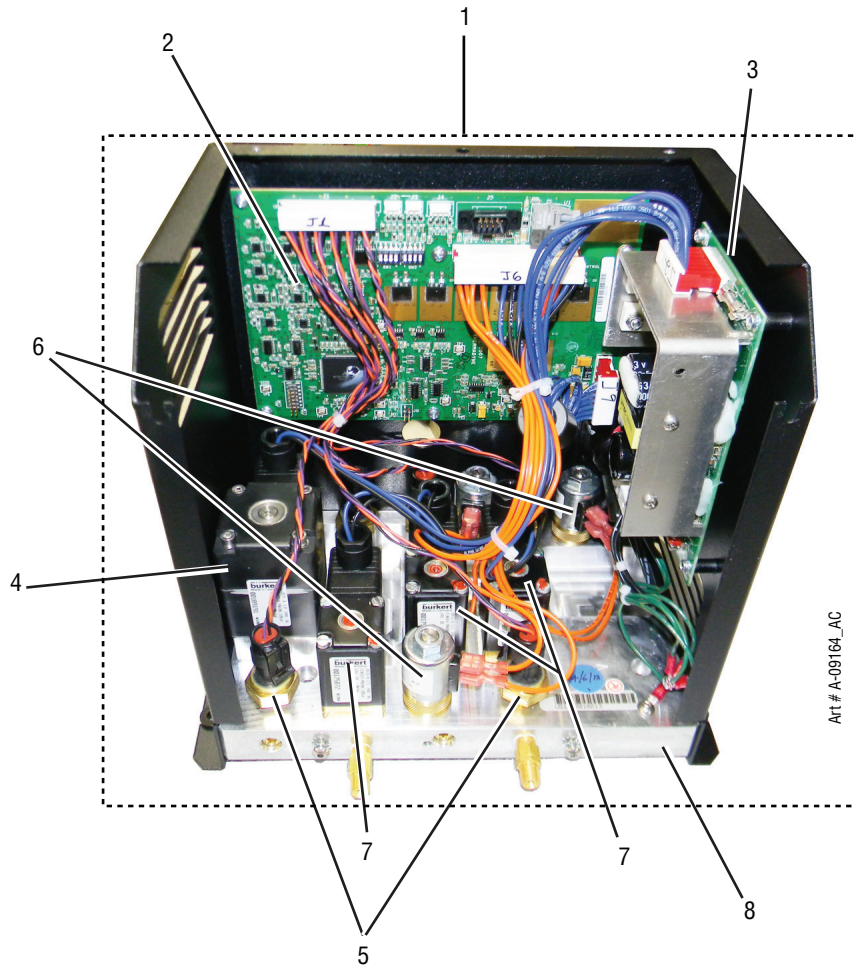
**6.11 DMC-3000 Gas Control Module Replacement Parts**

Item #	Qty	Description	Catalog #
1	1	DMC-3000 assembly	9-9491D
2	1	Solenoid	9-8264
3	1	Manifold subassembly (includes 15 of item 2)	9-7546
4	1	SMPS PCB	9-8263
5	1	Control PCB	9-7291
Not shown:			
6	1	WMS Water Softener Kit (includes the following items)	9-1068
7	1	WMS Replacement Filter Cartridge	9-1069
8	1	WMS Filter Housing	9-1070
9	1	WMS Filter Mounting Bracket	9-4523
10	1	WMS Filter Hose and Fitting Assembly	9-4524



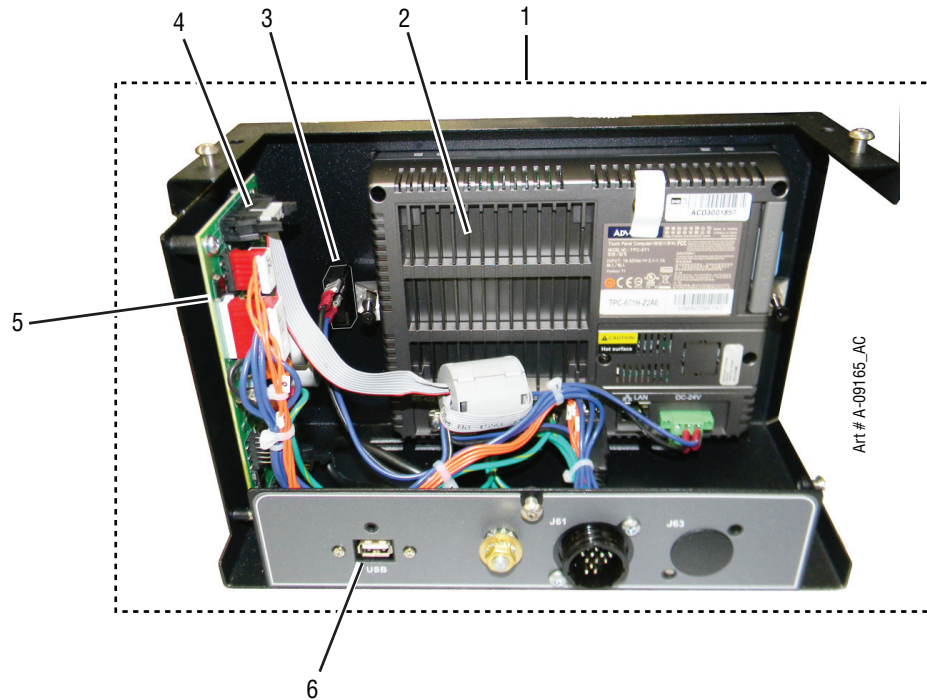
## 6.12 DPC-3000 Gas Control Module Replacement Parts

Item #	Qty	Description	Catalog #
1	1	Assy, DPC-3000, Demo	9-9443D
2	1	DPC-PCB	9-8262
3	1	SMPS PCB	9-8263
4	1	Shield Gas P Valve	9-8267
5	1	Sensor, Pressure, 1/8mnpt (six total)	9-8269
6	1	Solenoid	9-8264
7	1	Plasma Lo and Pre-Flow P Valve	9-8268
8	1	DPC Manifold Fully Assembled	9-7658



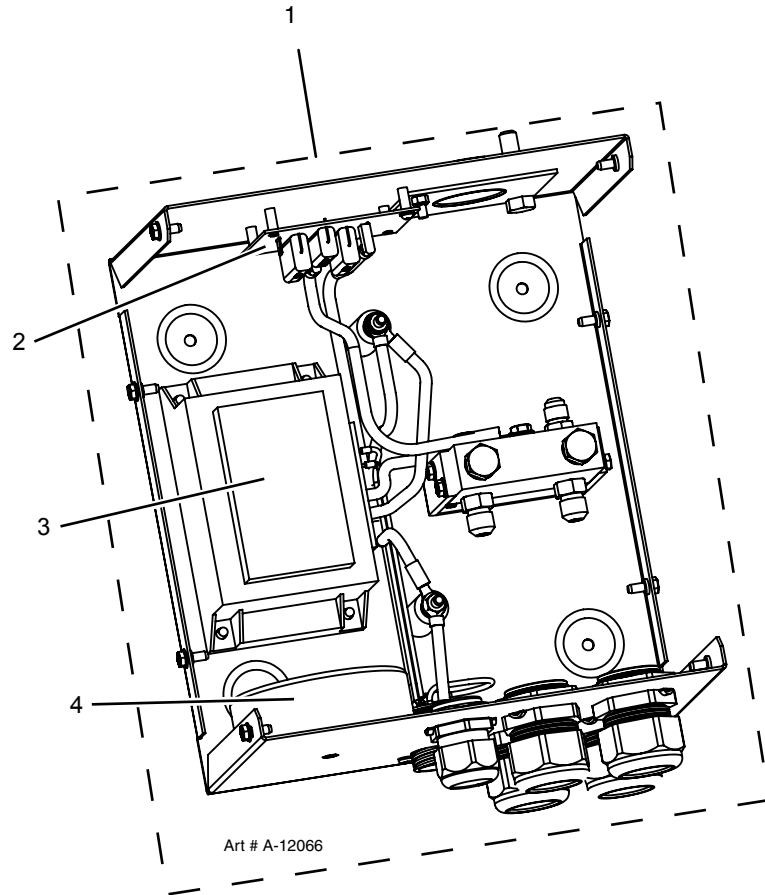
**6.13 TSC-3000 Touch Screen Control Remote and Internal Replacement Parts**

Item #	Qty	Description	Catalog #				
1	1	Assy, TSC-3000, Remote, Demo	9-9490D				
2	1	Touch Panel Computer	9-7543				
3	1	Switch, Rocker SPST	9-1042				
4	1	Ribbon Cable HMI to Interface PCB	N/A				
5	1	PCB	9-7547	6	1	USB Panel Mount Extension	9-7545
6	1	USB Panel Mount Extension	9-7545				



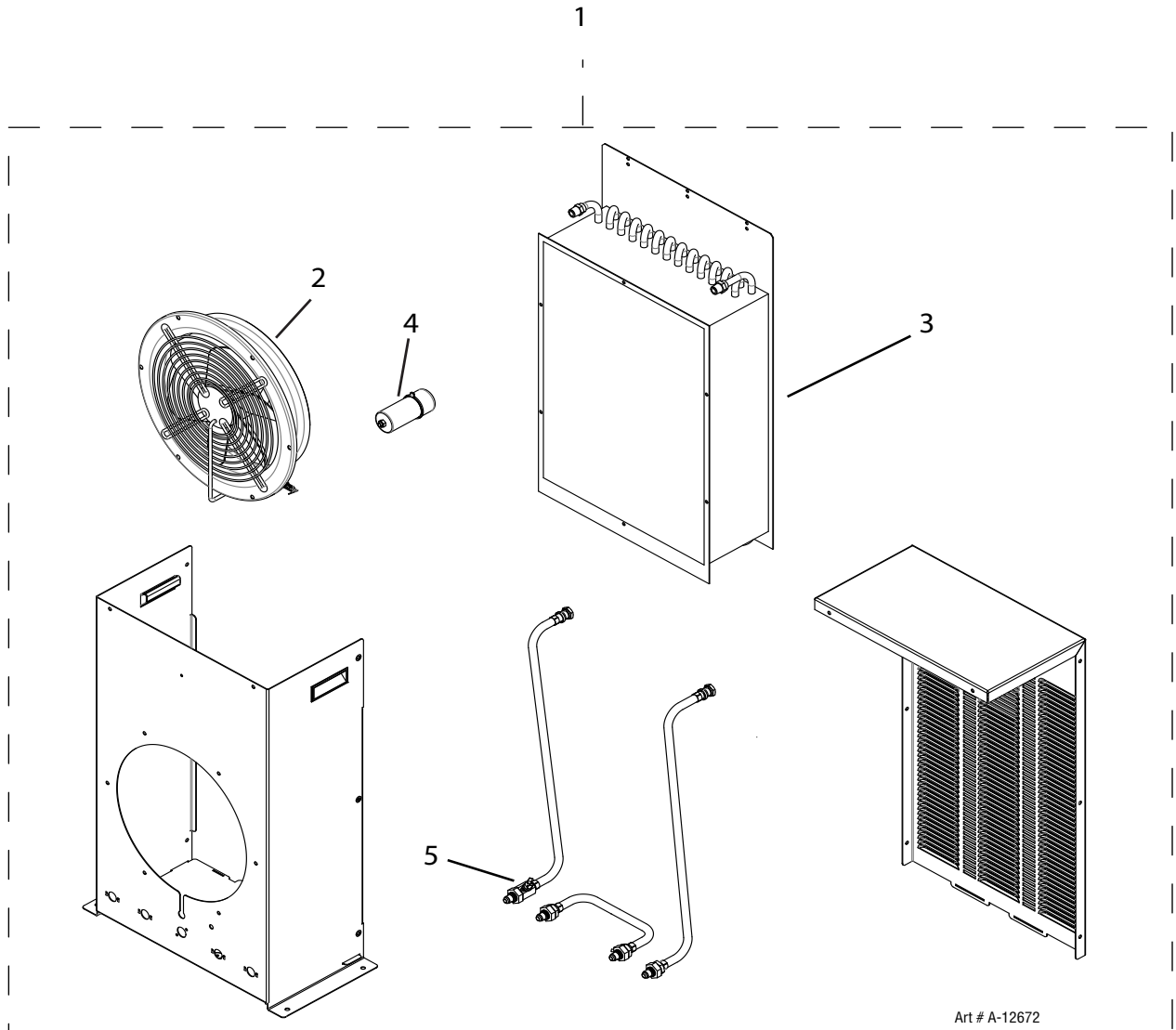
## 6.14 Remote Arc Starter (RAS-1000) Replacement Parts

Item #	Qty	Description	Catalog #
1	1	Complete RAS 1000 XT Assembly	3-9130E
2	1	Pilot Cap Assembly	9-9423
3	1	Electronic Ignition Module	9-7342
4	1	Toroidal Coil	9-7343



**6.15 Optional HE400XT Heat Exchanger - Replacement Parts**

Item #	Qty	Description	Catalog #
1	1	Assembly, HE400XT Heat Exchanger	9-9416
2	1	Fan	9-7348
3	1	Radiator	9-7349
4	1	Capacitor	9-1059
5	1	Thermal Switch	9-1448



Art # A-12672

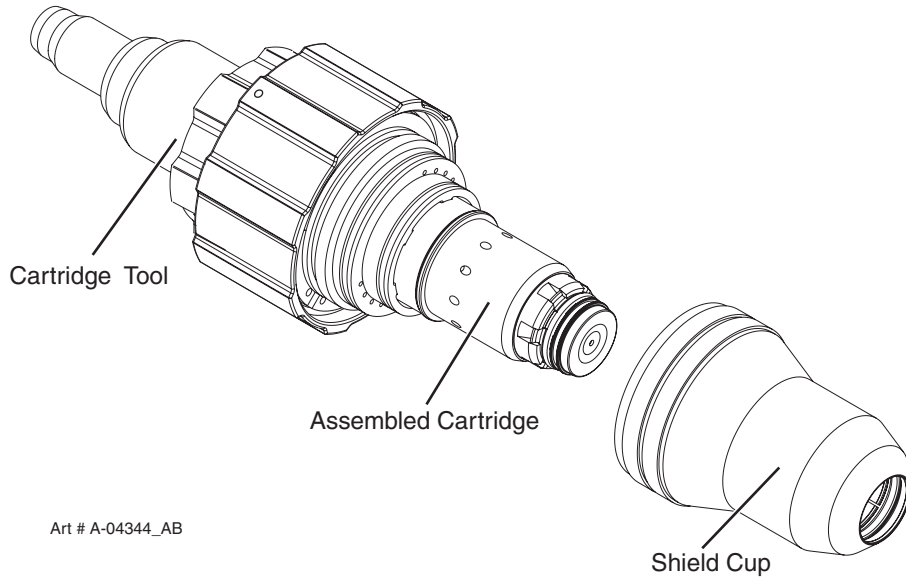


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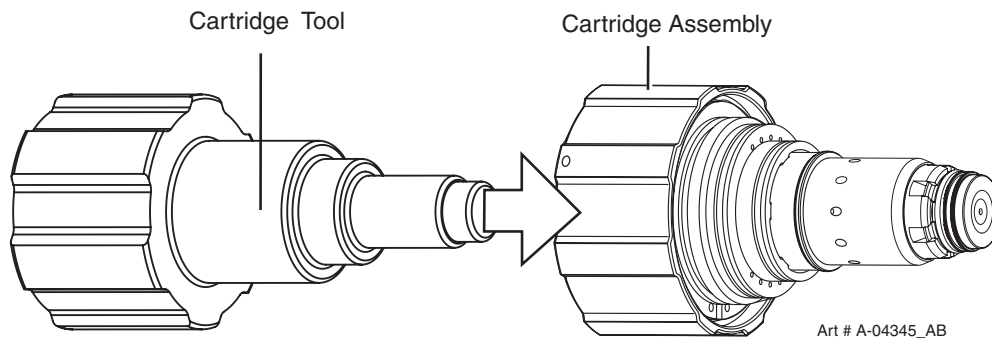
## SECTION 7: TORCH MAINTENANCE

### 7.01 Consumable Removal

1. Use the removal tool to hold the Shield Cup & Cartridge Assembly stationary. Turn the Shield Cup to remove it from the Cartridge Assembly.

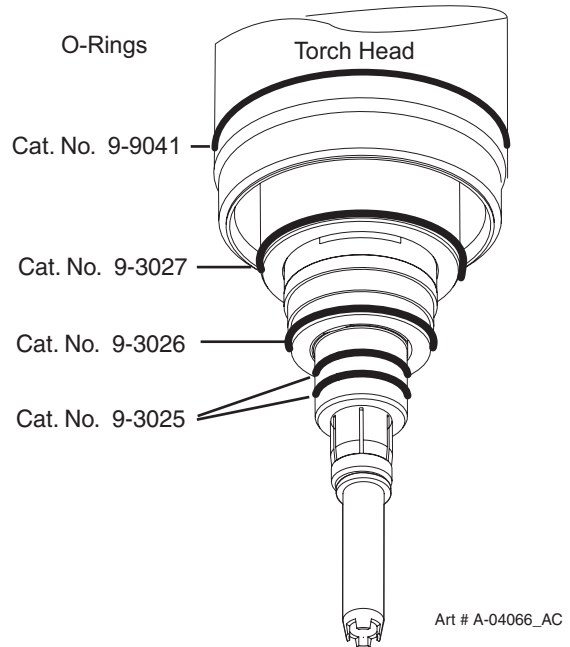
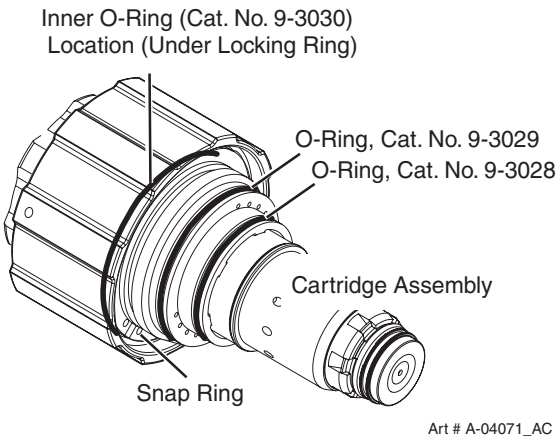


2. Take the Removal Tool off the back of the Cartridge Assembly Use the removal tool to push the consumable parts out of the Cartridge.



## 7.02 O-Ring Lubrication

Lubricate all three O-Rings on the Cartridge Assembly and all three O-Rings on the Torch Head periodically with O-Ring Lubricant supplied. Remove the snap ring on the cartridge assembly and slide the locking ring downward for access to the O-Ring under the locking ring.



### CAUTION

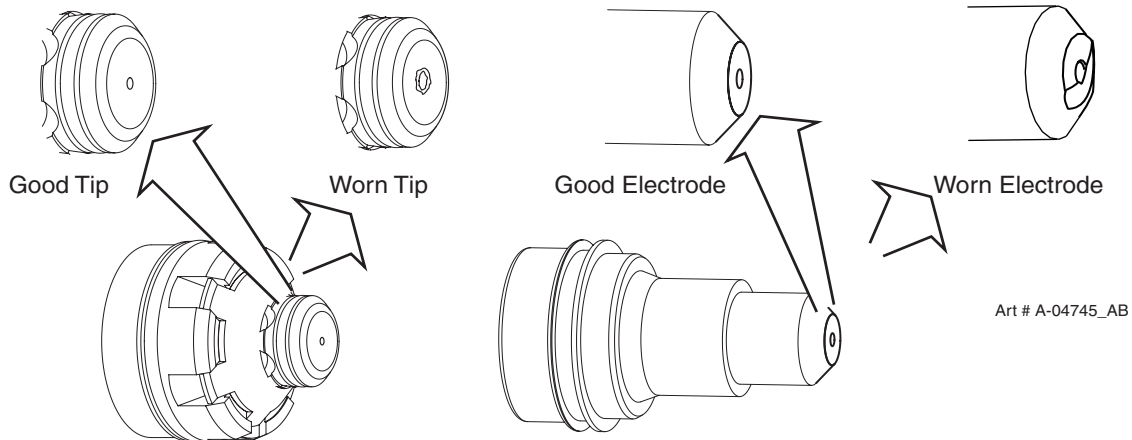
Use only Thermal Dynamics No. 9-4893 O-Ring Lubricant (Christo Lube MCG-129) with this torch part. Use of other lubricants may cause irreparable damage to the torch.

## 7.03 Parts Wear

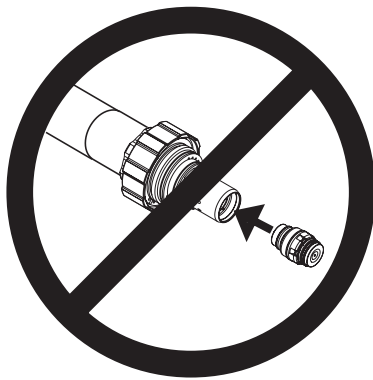
Replace the Gas Distributor if it is charred or cracked.

Replace the Gas Distributor if the flange is damaged in any way.

Replace the tip and/or electrode if they are worn.



7.04 Torch Consumables Installation

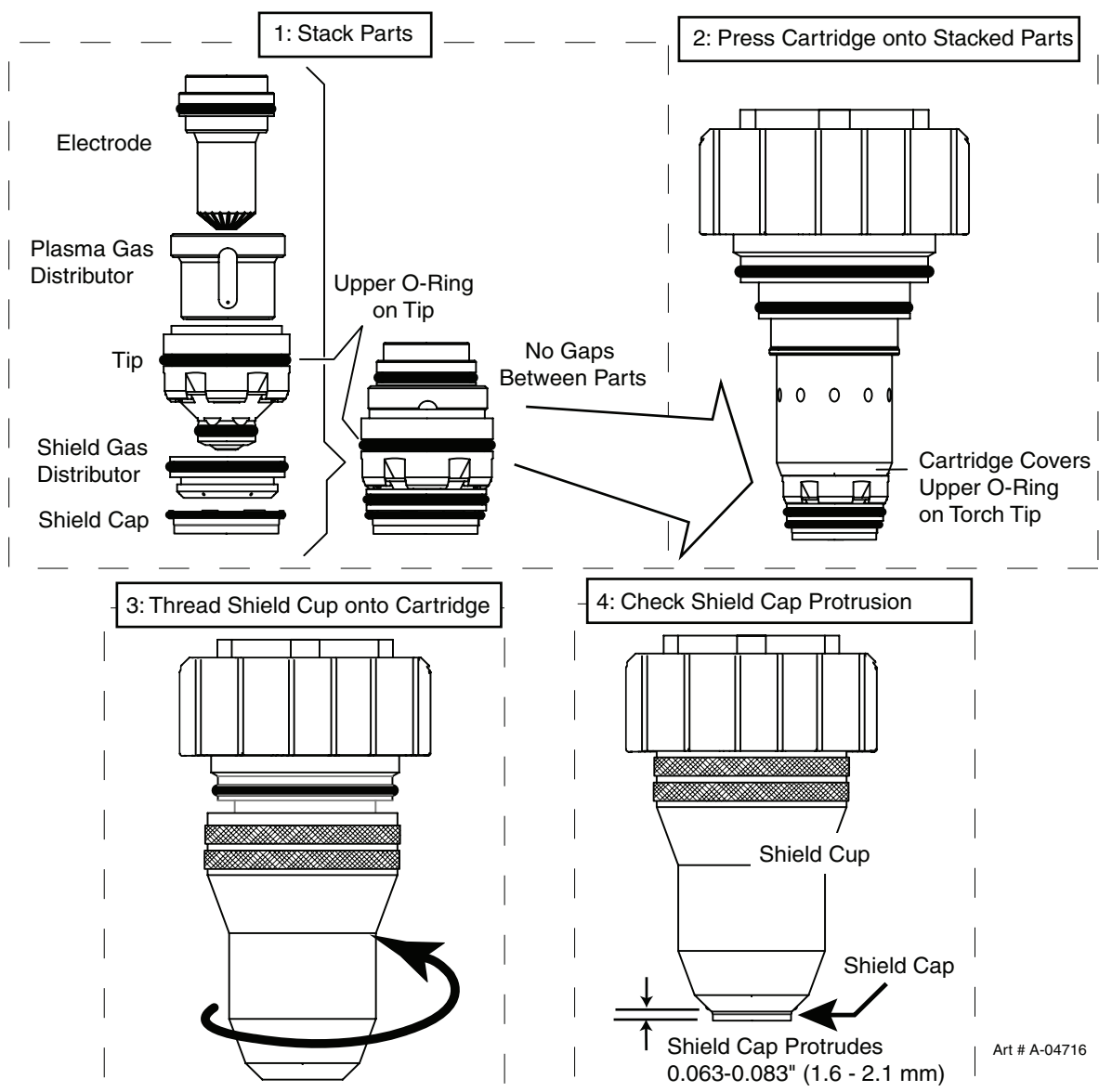


**WARNINGS**

Do not install consumables into the Cartridge while the Cartridge is attached to the Torch Head. Keep foreign materials out of the consumables and Cartridge. Handle all parts carefully to avoid damage, which may affect torch performance.

Art # A-03887

1. Install the consumables as follows:



Art # A-04716

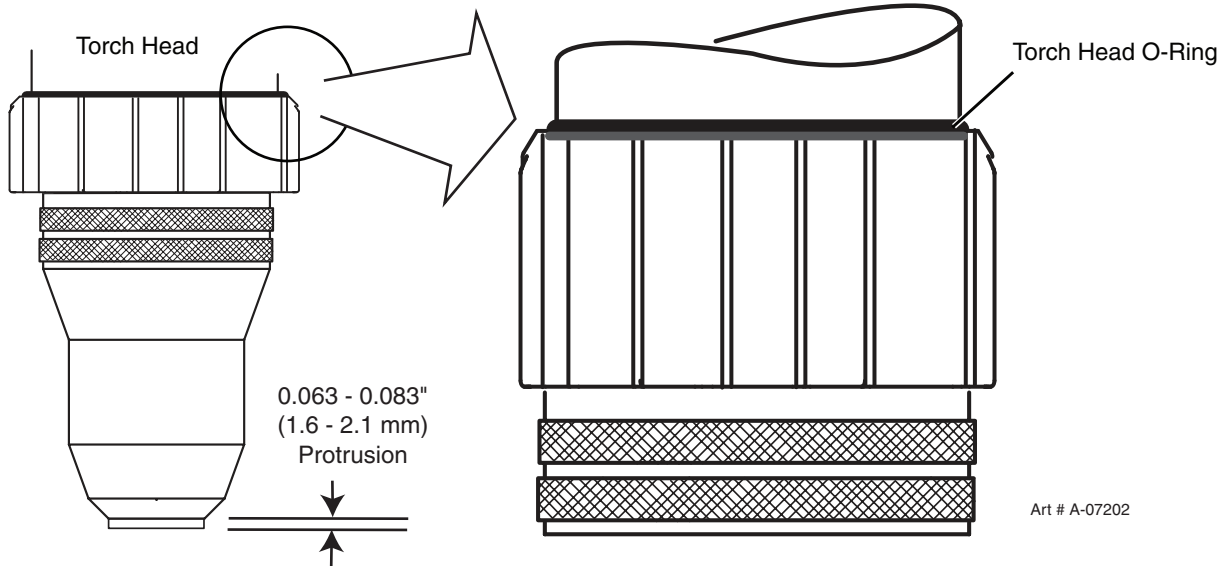
2. Remove the Removal Tool from the Cartridge and install the assembled Cartridge onto the Torch Head.



## CAUTION

The cartridge assembly must cover the O-Ring on the torch head.

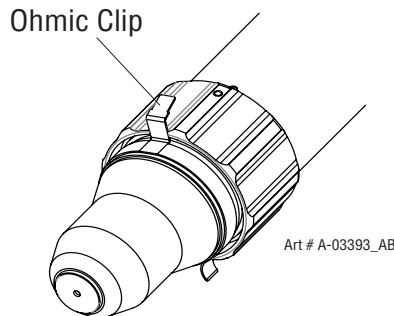
Do not force the cartridge if it will not tighten fully. Remove the cartridge assembly and gently clean the threads on the torch head with a wire brush. Apply oxygen-compatible lubricant (supplied with the torch) to the threads.



- Slide the ohmic clip over the shield cup if using ohmic torch height control sensing.

## NOTE

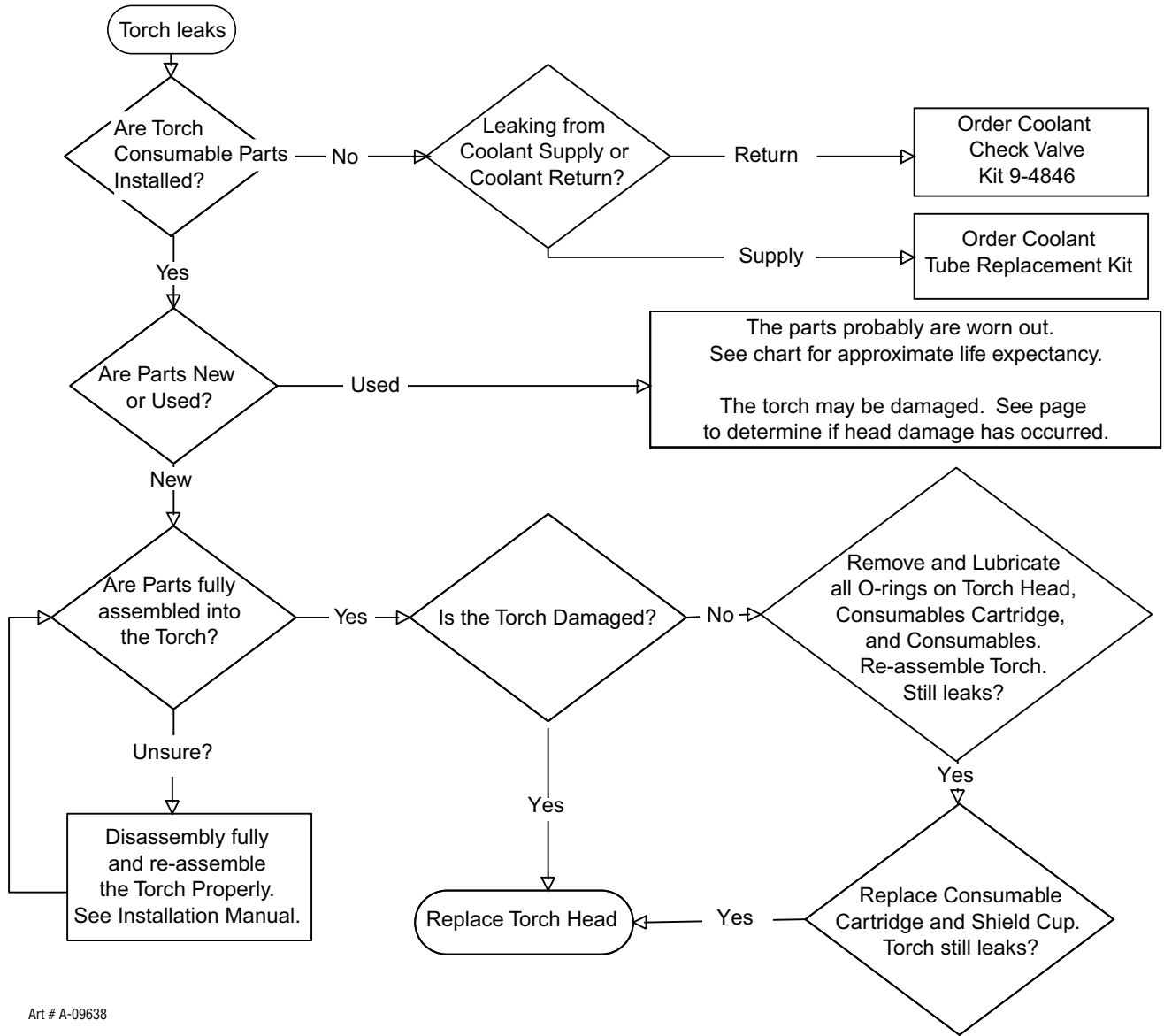
Ohmic height sensing is not recommended with water shield. Water on the plate interferes electrically with the ohmic sensing circuit.



- Connect the wire lead from the height finder to the ohmic clip.

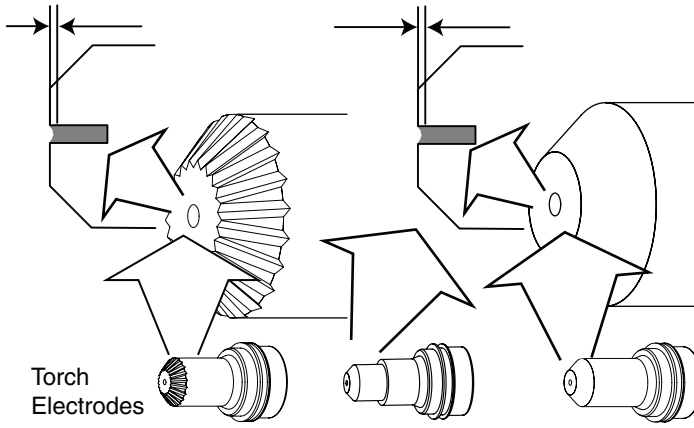
### 7.05 Coolant Leak Trouble-Shooting

Never operate the system if coolant leaks from the torch. A steady drip indicates that torch parts are damaged or installed improperly. Operating the system in this condition can damage the torch head. Refer to the following chart for guidance on coolant leakage from the torch head.



Art # A-09638

# ULTRA-CUT 100 XT

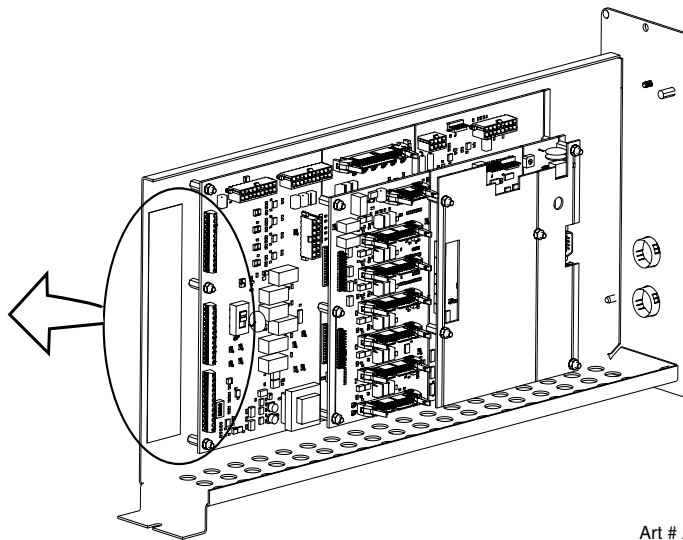
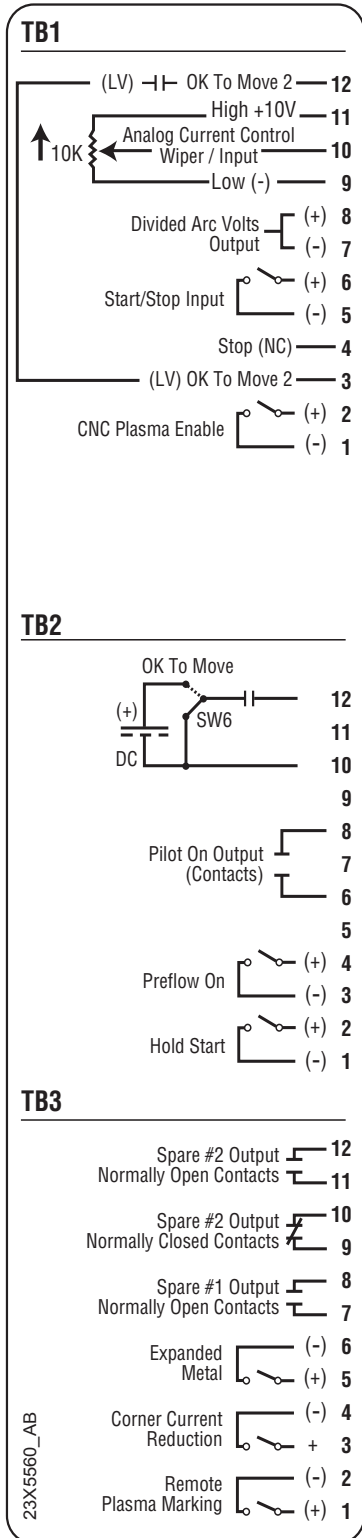


Art # A-09653

Amperage	Plasma Gas	Recommended Wear Depth for Electrode Replacement	
		Inch	mm
30	O2	0.04	1
	Air	0.04	1
	N2	0.04	1
50	O2	0.04	1
	Air	0.08	2
	N2	0.04	1
70	O2	0.04	1
	Air	0.08	2
	N2	0.04	1
100	O2	0.04	1
	H35	0.08	2
	N2	0.08	2



# APPENDIX 1: CNC - Control Module PCB Connections



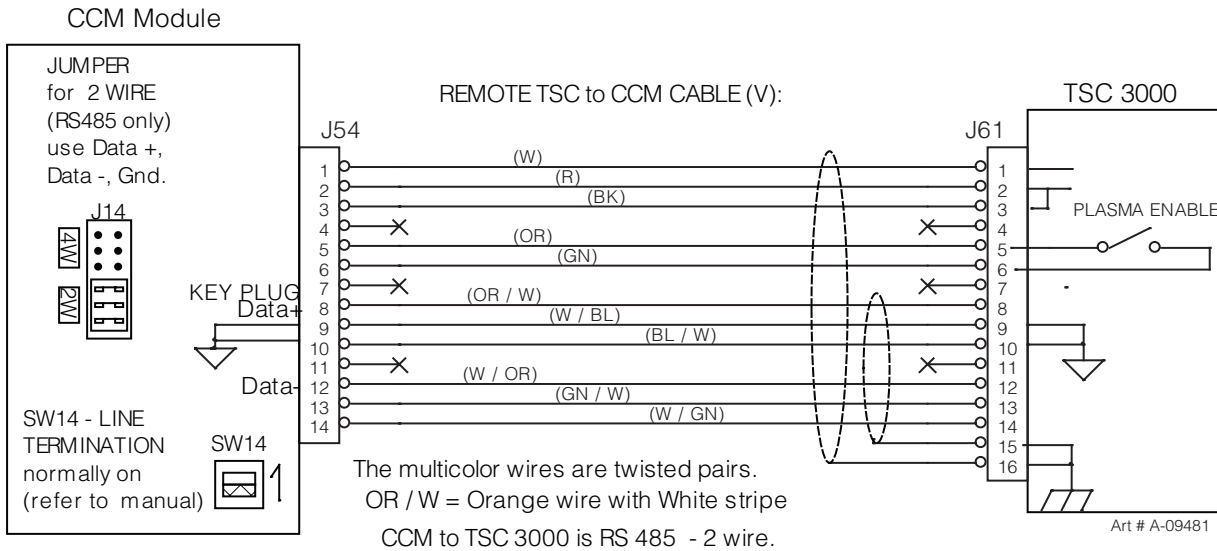
Art # A-11512\_AB

# APPENDIX 2: SERIAL COMMUNICATIONS

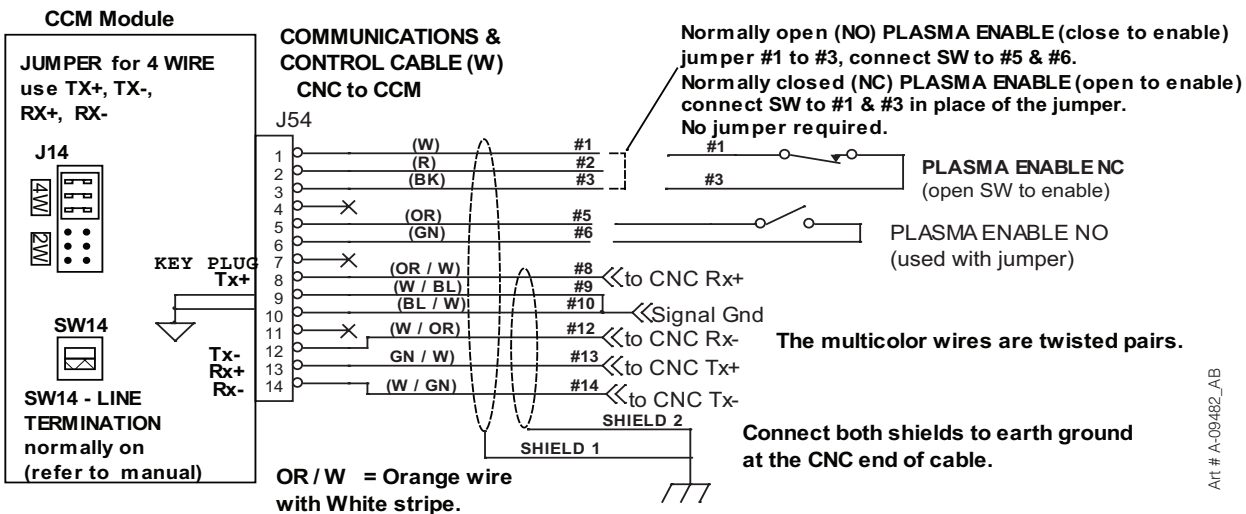
## A3.01 Cables and Switch Settings for 2 and 4 Wire

The CCM communicates with the TSC 3000 (touch screen HMI panel) using RS 485 (2 wire, half duplex). When a CNC controller is used in place of the TSC the CCM can be reconfigured for RS 422 (4 wire, half duplex) if supported by the CNC. RS 422 is normally full duplex but the CCM only supports half duplex. RS 232 is not directly supported. Converters are available from various sources to convert RS 232 to RS 485/422. When possible, the 4 wire configuration is recommended to use the 4 wire configuration when possible for easier troubleshooting. The serial communication port of the CCM is provided with 3KV isolation from the rest of the plasma supply circuitry.

### RS 485 wiring (2 wire, half duplex)



### RS 422 wiring (4 wire, half duplex) (also called RS 485 4 wire)



Recommend using the 4 wire when possible as it is easier to troubleshoot if there is a problem. Note that CCM Tx+ connects to CNC Rx+ and CCM TX- connects to CNC RX- for 4 wire half duplex. If using 2 wire RS 485 connect CCM Tx+ (also called D+ or Data +) to CNC Tx+ and CCM Tx- (also called D- or Data-) to CNC Tx-. The Rx wires are not used for 2 wire.

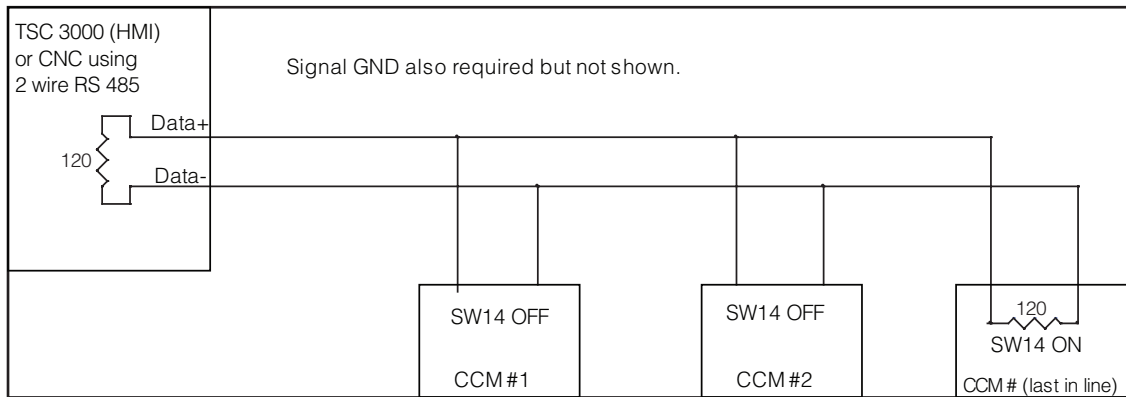
**Line termination:**

RS 485 and RS 422 are both “multi-drop protocols, that is there can be multiple devices on the same line. We do not currently support more than one CCM. Until we do line termination should always be ON.

For RS 485 it is recommended that the communication lines be terminated at each end with the line’s characteristic impedance. For RS 422 it is recommended the line be terminated at the receiver end.

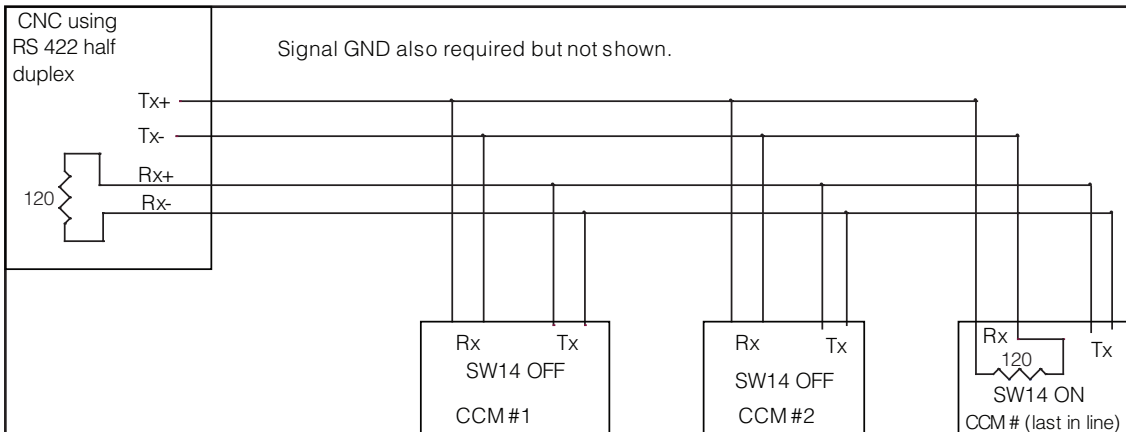
The CCM has a line termination switch SW14 whose default position is ON. For CCMs that are not at the end of the line (like CCM #1 & #2 below) switch off SW14.

**RS 485 with multiple CCMs:**



Art # A-09483

**RS 422 4 wire half duplex:**



Art # A-09484\_AB

**CCM Address:**

When more than one device is used in parallel on a serial communication line each has to have a unique address. The CCM has a switch SW10 to set the address of each CCM. The “0” factory setting is correct for system with one plasma (one CCM). We do not currently support CCMs in parallel. When that becomes available details for setting other addresses will be included in an updated manual explaining installation and set up of parallel systems.

**CNC functions**

CNC I/O circuits provide at least 1000V galvanic isolation from the plasma power supply.

While the CNC circuits are isolated from the power supply, many of the signal returns on J15 and TB1, TB2 & TB3 are common to each other. J15 pins 1, 4, 5, 10, 17, and TB1-1, 5, 7, 9, and TB2-1 & 3 are all common. J15 pin 12 and TB2-10 are also connected to the others when SW6 (OK to Move select) is set for voltage.

Rear Panel CNC Connector J15:

37 Circuit (Amp CPC) Remote Standard:

These are also duplicated on TB1, TB2 & TB3 use one or the other not both.

Chassis gnd (for SC-11 cable shield)	1
Start/Stop	3 (+); 4 (-)
Ok to Move (contacts or voltage 1)	12(-); 14 (+)
Divided Arc volts (selectable ratio 50:1; 40:1; 30:1; 16.6:1, 25:1)	5 (-); 6 (+)
PreFlow ON	7 (+); 9 (-)
Corner Current Reduction	10 (+); 11 (-)
Isolated Circuit Comm (for SC-11)	8
Chassis Gnd	13
Keying plug	15
Hold Start	16(+); 17 (-)
Plasma Mark	21 (+); 22 (-)
Cut Expanded Metal	23 (+); 24 (-)
CNC Plasma Enable <sup>2</sup>	25 (+); 26 (-)
Remote Analog Current Control <sup>3</sup>	29 (+); 30 (signal); 31 (-)
Stop (Latched) <sup>SW4</sup>	32 (+); 33 (-)(comm.)
Pilot is ON (contacts)	34; 35
Spare (contact)	36; 37

**Internal CNC connections. TB1, TB2 & TB3 on CCM module.**

Connections are provided on the CCM module TB1, TB2 & TB3 terminal blocks including most of the rear panel functions plus some additional features. All these signals are isolated from the plasma power supply but signals marked (comm.) and (-) are common to each other.

Users are expected to install their own CNC cable to these connections. Knockout hole is provided in rear panel of CCM module. User shall provide strain relief / cord grip for user installed cable.

**TB1**

<b>Function</b>	<b>Connection</b>
CNC Enable/Disable	TB1-2 (+), TB1-1(-)(comm.)
OK to Move <sup>2</sup>	TB1-3 & TB1-12 Contacts only, rated 1A @ 28 VAC/DC
Stop Latched (NC) <sup>4</sup>	TB1-4 (+) & TB1-5 (-) (comm.) used with Start Latched
Start/Stop Ret <sup>4</sup>	TB1-6 (+), TB1-5 (-) (comm.)
or Start Latched (NO) <sup>4</sup>	TB1-6 (+), TB1-5 (-) (comm.) used with Stop Latched
Divided Arc Voltage	TB1-8 (+), TB1-7 (-) comm.
Remote Analog Current Control	TB1-9 Analog Comm. (-) or 10K CC Pot low TB1-10 Analog in (+) or CC Pot Wiper TB1-11 10K CC Pot Hi (+10V @ 1 ma. Supply)

**TB2**

<b>Function</b>	<b>Connection</b>
Hold Start	TB2-2 (+), TB2-1 (-) (comm. )
Preflow ON	TB2-4 (+), TB2-3 (-) (comm.)
Pilot is ON (contacts)	TB2-6, TB2-8 rated 1A @ 120 VAC or 28 VDC
OK to Move (contacts or DC Volts) <sup>5</sup>	TB2-12 (+), TB2-10 (-)

**TB3**

<b>Function</b>	<b>Connection</b>
Plasma Marking	TB3-2(+), TB3-1(-) (comm.)
Corner Current Reduction	TB-4(+), TB3-3(-)(comm.)
Cut Expanded Metal	TB3-6(+), TB3-5(-)(comm.)
Spare NO Contact	TB3-7, TB3-8
Spare NC Contact	TB3-9, TB3-10
Spare NO Contact	TB3-11, TB3-12

<sup>1</sup>SW6 on CCM I/O PCB selects OK to Move for isolated contact closure or DC Volts (15-18V) at <100ma. When set for contacts, OK to Move circuit is rated for 120 VAC / 28 VDC

<sup>2</sup>Remove factory installed jumper from TB1-1 & 2 if using CNC Plasma Enable in J15.

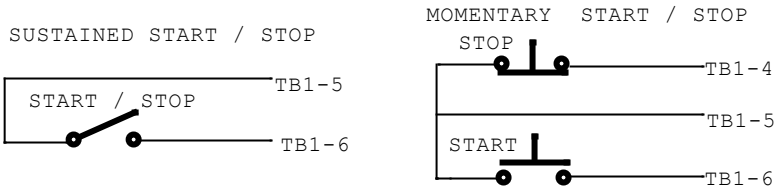
<sup>3-5</sup>See below.

## CNC Input / Output Descriptions

**E-Stop input**— Requires closed connection rated for 35ma. @ 20VDC for unit to operate. Factory installed jumper between TB1-1&2 must be removing when connecting user supplied E-Stop circuit.

**Start/Stop input**— Switch (momentary or sustained) rating 35ma. @ 20 VDC

Start / Stop circuit configurations. Momentary Start / Stop (Latched) is only available at TB1.



**Divided Arc Voltage output** — Arc Voltage signal is isolated from plasma supply, however (-) is common with other isolated CNC signals. Max Divided Arc Voltage signal level depends on actual arc voltage times divide ratio however can not exceed approximately 12 V.

**Analog Current Control input**— Analog Current Control includes analog isolation module, separate isolation module not usually required however it's low input is common with the other isolated CNC inputs. Scaling of Analog Current Control input is 0V = 0A, 10V. = MAX output and is linear in between. However MIN output is 5A. User is responsible for setting correct analog voltage to maintain at least 5A output. To use Analog Current Control on the I/O PCB set SW 11 to down position and on the CPU PCB set SW8-2 ON (up).

**Hold Start input**—Normally open, close to hold start. Circuit rating 10 ma. @ 20VDC. Delays pilot ignition, gas preflow continues. Used by some height controls to flow gas while finding height. Also used for synchronizing starts when multiple plasma supplies are used on same cutting table. User supplies circuit to keep Hold Start inputs active until all torches have found height. Used with CNC START. Apply START to begin gas flow. Same time apply HOLD to delay ignition until height is found. Remove HOLD to ignite pilot, initiate arc transfer.

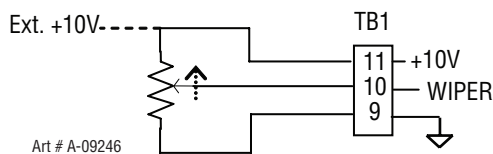
**Preflow On input**— Normally open, close to start preflow prior to normal START signal. Circuit rating 10 ma. @ 20VDC. Torch Height Controls (THC) normally issue START signal to plasma supply after torch height has been found. Then the plasma takes 1-2 seconds (or more) to perform preflow before igniting pilot. Some THCs have an output that can start preflow early during height finding saving 1-2 seconds on each cut. PREFLOW ON should remain active for at least 1 second after CNC START is applied. It is OK if it remains on until the end of the cut. Need to recycle it to begin a new preflow prior to applying START for the next cut.

**Pilot On output** – Relay contacts rated 1A @ 120 VAC / 28 VDC. Contacts close when pilot on. Can be wired parallel with Ok to Move contacts to start machine motion when pilot established. Used when starting over holes. Starting over holes requires setting SW8-1 ON (up) on the CPU PCB for extended pilot time. Using extended pilot time to start over holes or for cutting over holes will reduce parts life.

**OK to Move output** — Active when cutting arc is established, arc is transferred. Used to signal cutting table to start X-Y motion. Relay contacts rated 1A @ 120 VAC or 28 VDC when SW6 set for contacts. When SW6 is set for DCV, output supplies 15-18 VDC @ 100 ma. May be wired parallel with Pilot On to start cutting machine motion as soon as pilot established.

<sup>5</sup> **OK to Move2** – Provides a second set of N.O. contacts that close when arc transfer is detected. Contacts are rated for maximum of 24 VAC/DC @ 1A. Simplified CNC Circuit.

<sup>5</sup> **+10V @ 10ma. For Remote CC Pot** – Previously CCM versions if one wanted to use a potentiometer for the Remote Analog Current Control (CC) input an external 10 V supply was required for Pot High.. Now an isolated (from main plasma circuits) 10V supply is provided. Recommended value of the pot is 5K or 10K.



<sup>5</sup> **Plasma Marking Select (Remote)** – Plasma Marking, available only with DFC 3000, may be activated with a contact closure between TB3-1 & TB3-2 if SW8-4, DIP switch on the CPU board (smaller of the 2 CCM boards), is also on. Opening the connection between TB3-1 & TB3-2 switched back to normal cutting mode. For Ultracut power supplies It is OK to leave SW8-4 on whether you are marking or not.

**The following functions may not yet be available on your system. \***

**\*Corner Current Reduction (input)**--- When activated, normally from a table controller’s corner or height control inhibit signal, signaling that the cutting speed is being reduced to navigate a corner or small radius, the cutting current is reduced at a fixed rate to a predetermined level to provide an improved cut at the lower speed.

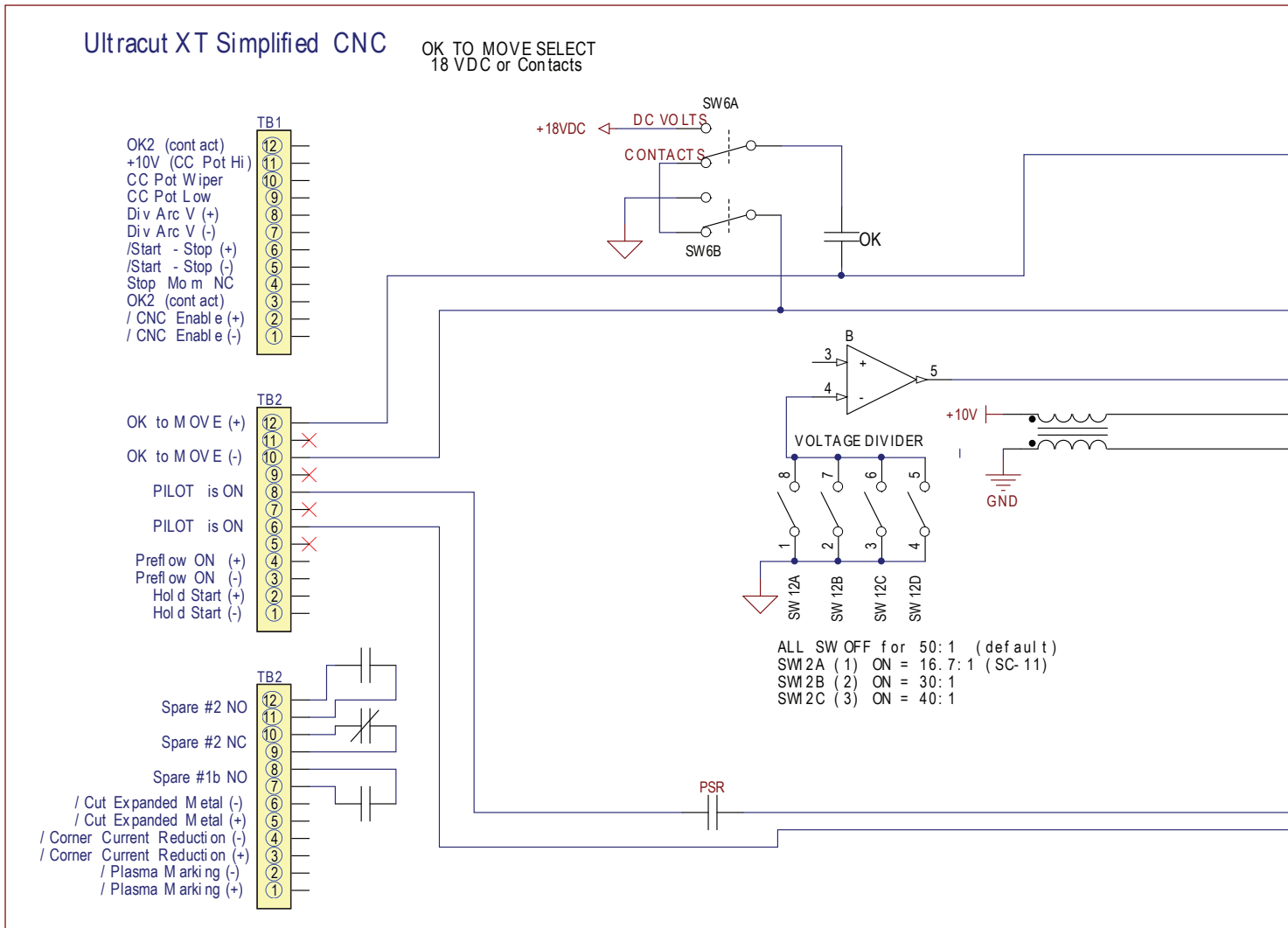
**\*Cut Expanded Metal (input)**---Normally the plasma supply is optimized for pierce cutting, high pierce height directly above the metal to be cut, short pilot time, etc. Activating this input adjusts the plasma supply to optimize it’s parameters for cutting expanded metal, perforated metal, running edge starting, etc. Among other changes the transfer height is reduced to same as cut height. In addition to activating the Cut Expanded Metal input CCM switch SW1-1 should be turned on automatically restart the pilot and SW8-1 set on for longer pilot time.



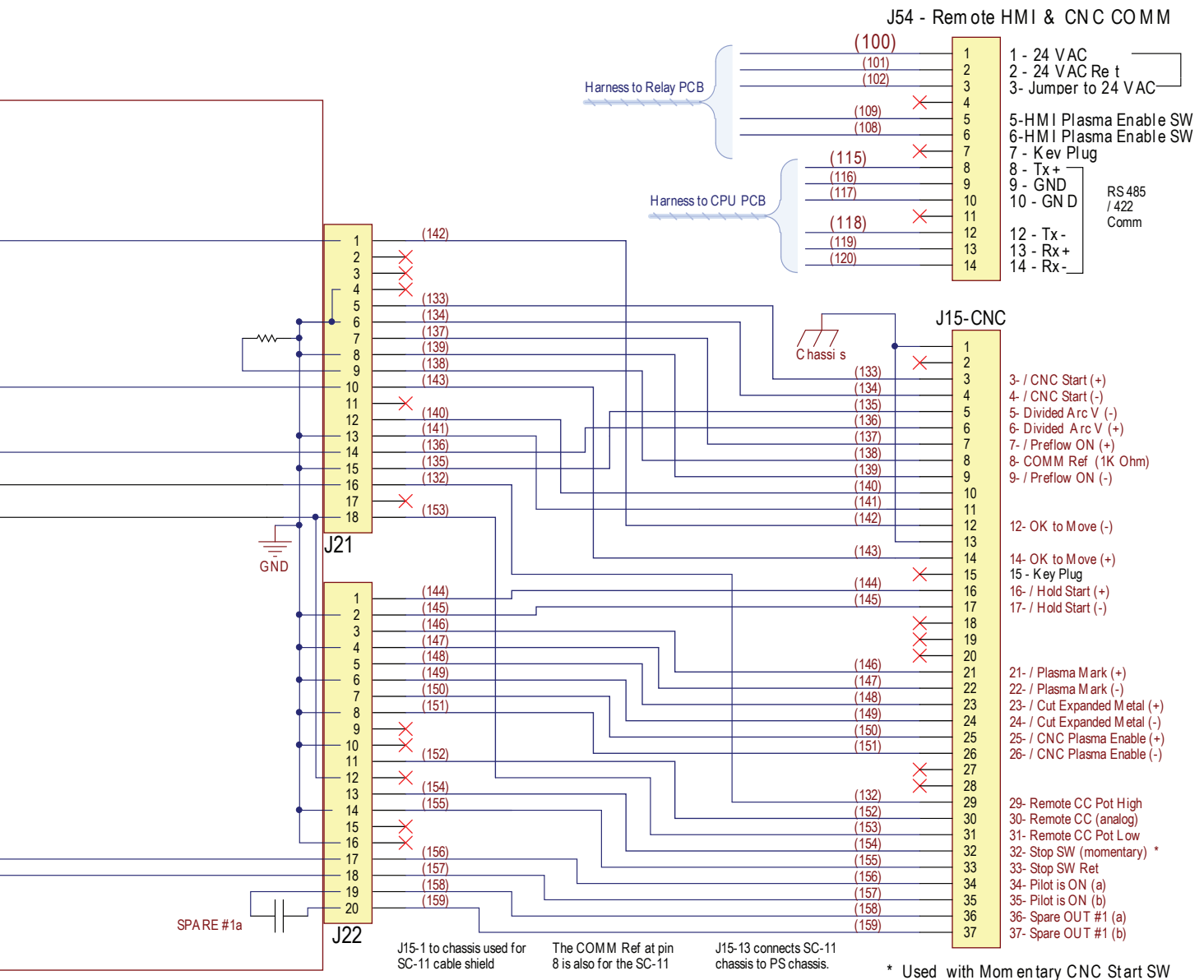
# ULTRA-CUT 100 XT

\*Spare contacts --- Not currently activated. Planned for future CCM code release.

## Simplified CNC Circuit



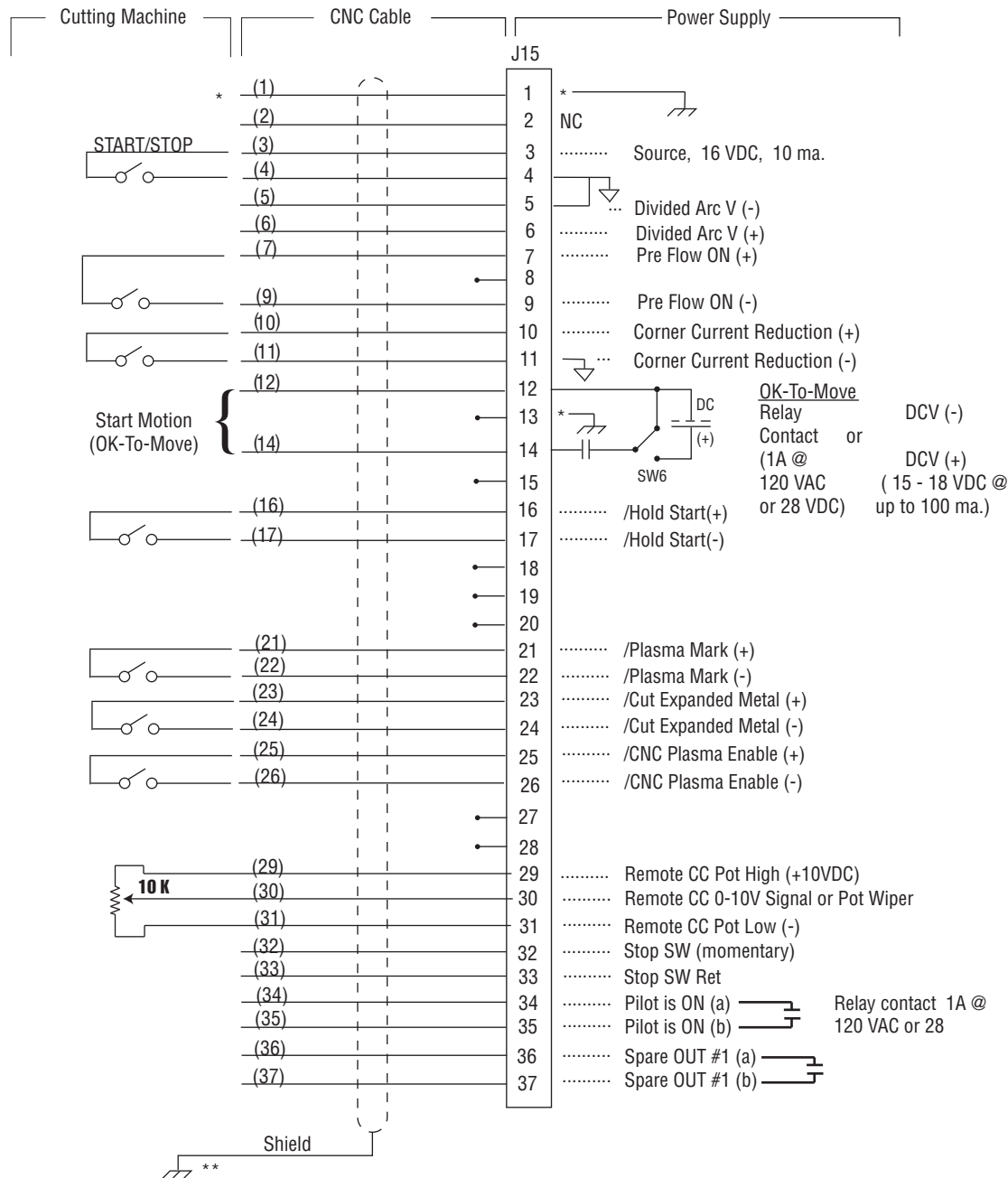
Art # A-11579

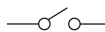


Art # A-11579

# ULTRA-CUT 100 XT

## CNC Connections



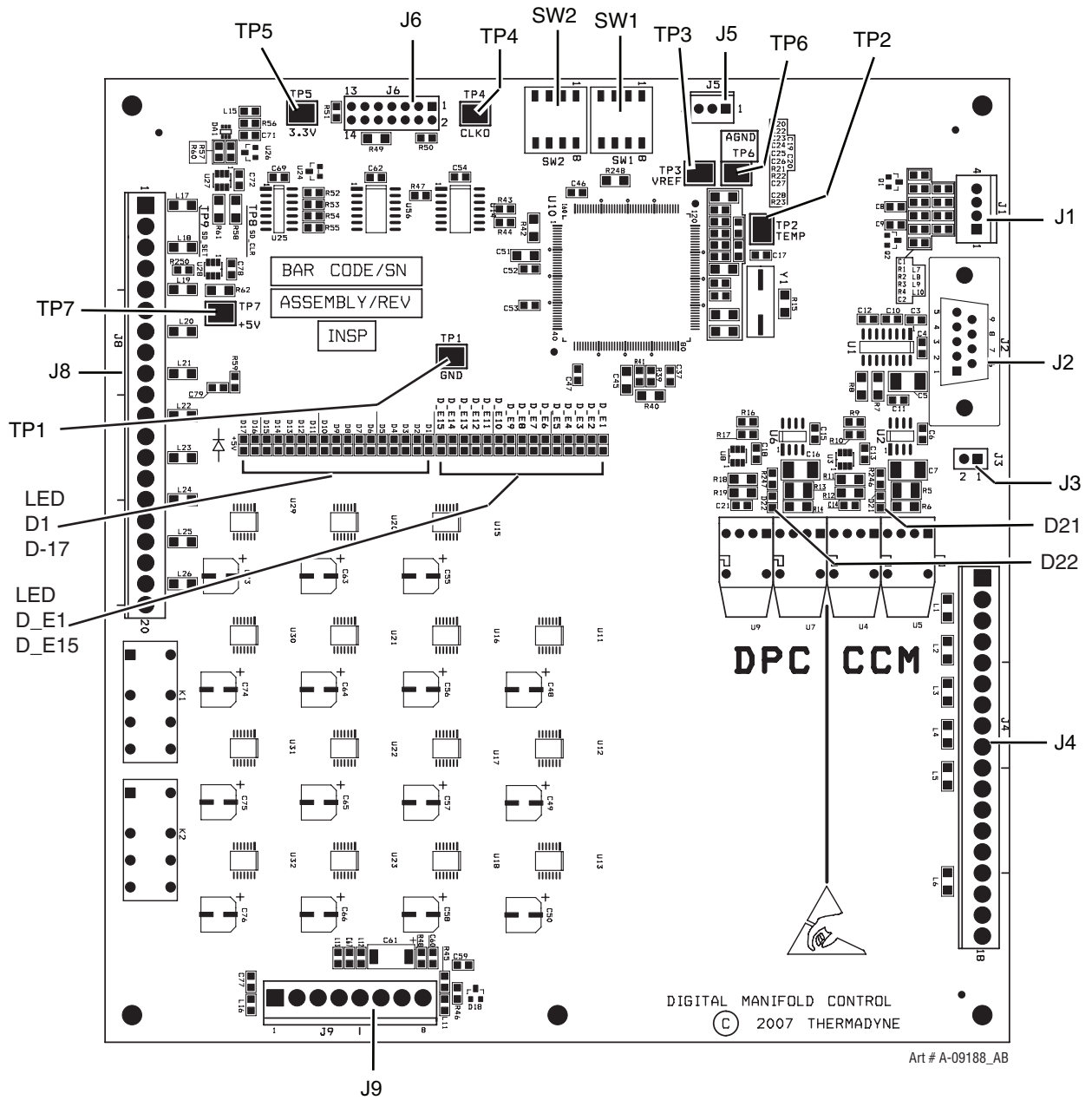

 Represents switch, relay, open collector transistor, etc.

\* Power Supply Gnd not used for CNC cable  
Do not connect wire #1 to anything.

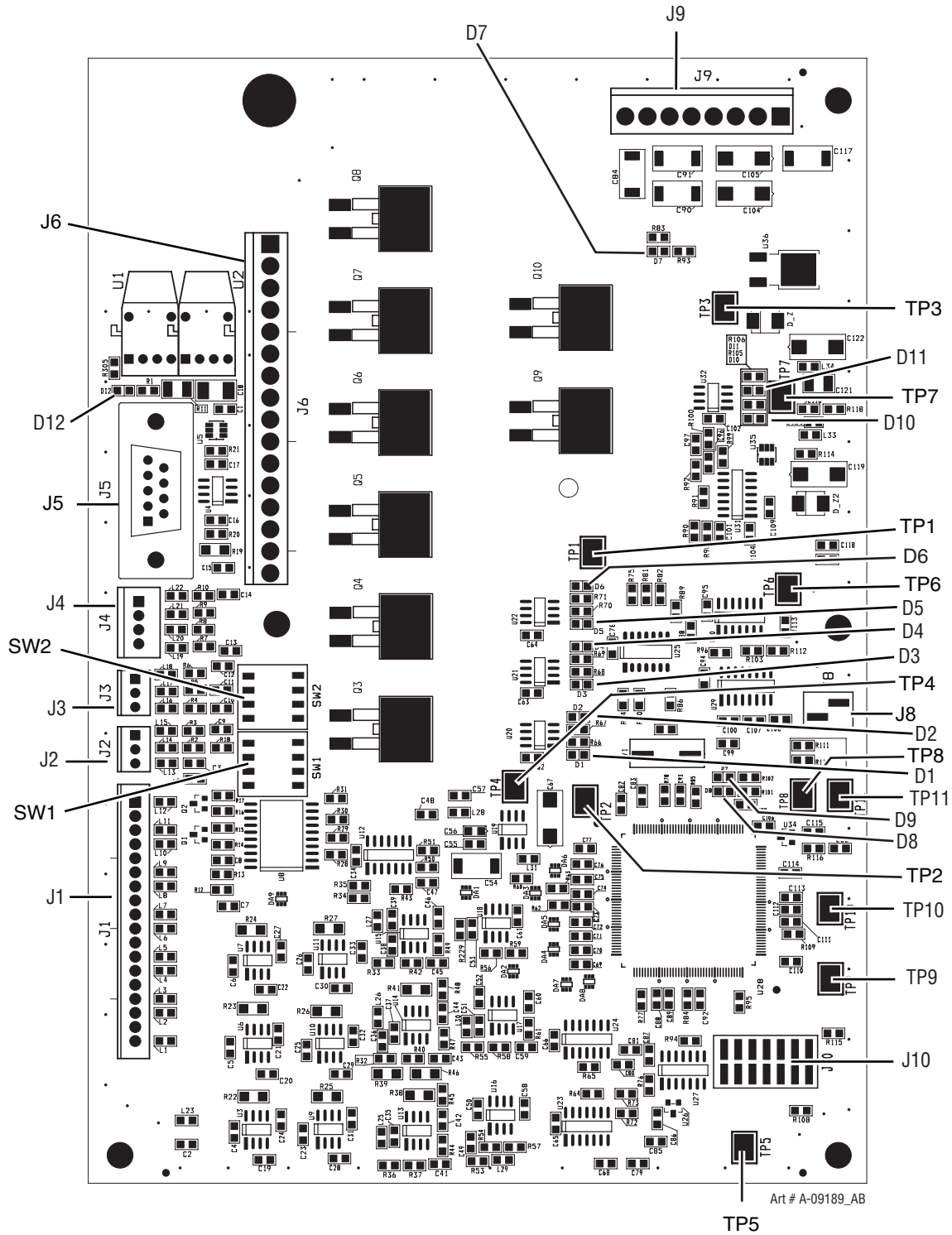
\*\* Cable Shield drain wire must be connected to ground at cutting machine.

Art # A-11901

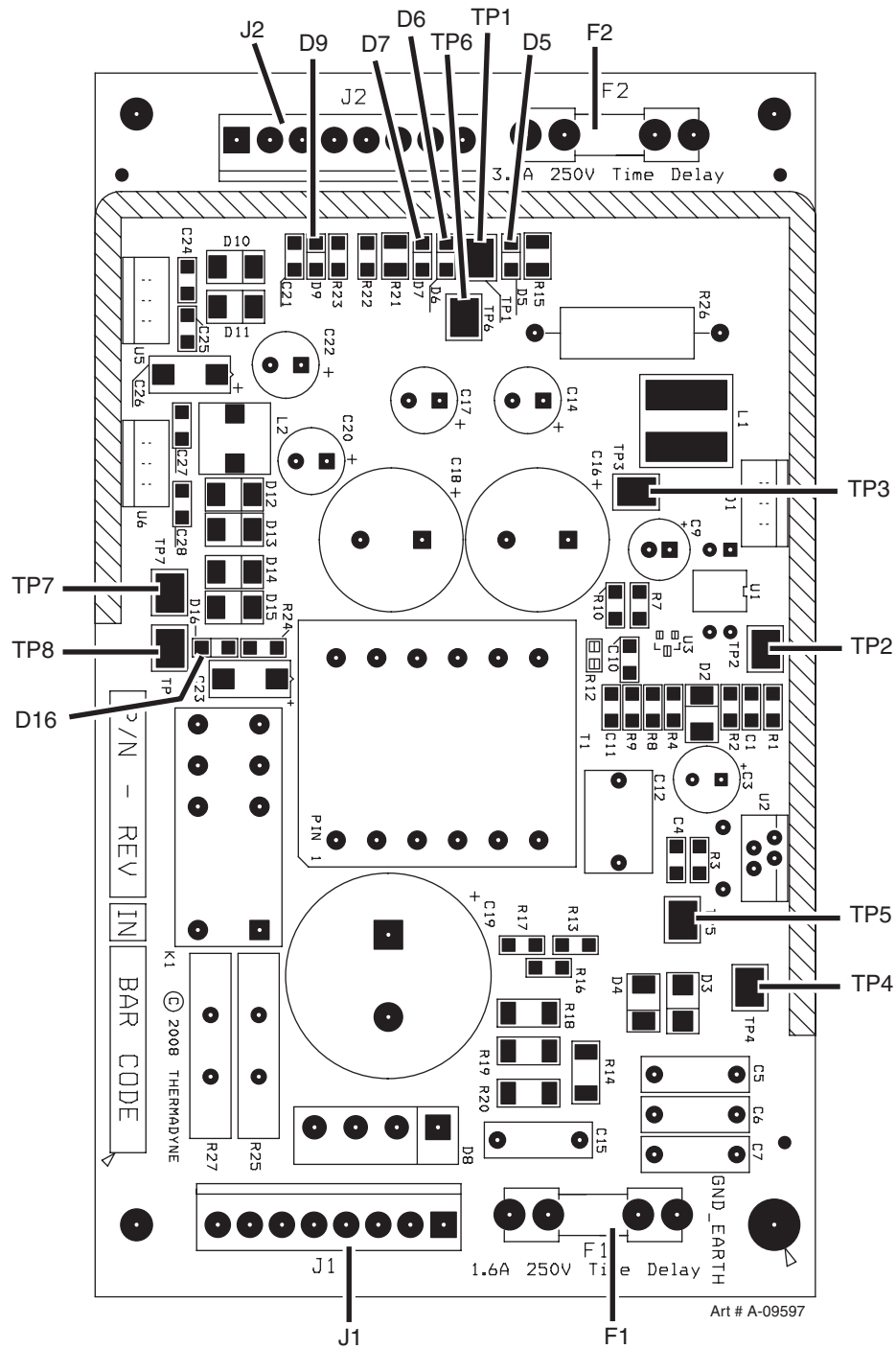
# APPENDIX 4: DMC-3000 Control PCB Layout



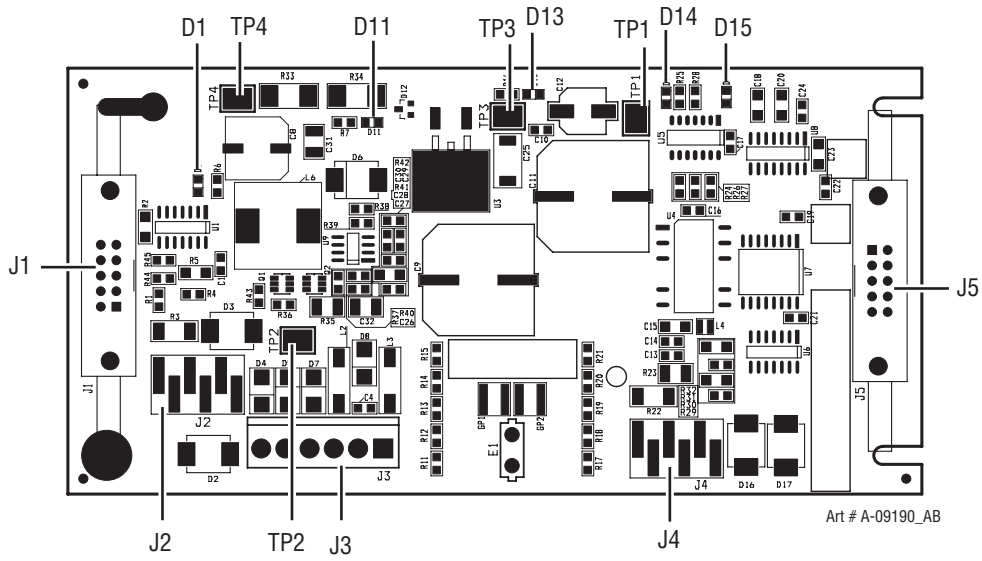
APPENDIX 5: DPC-3000 Control PCB Layout



# APPENDIX 6: DMC-3000 / DPC-3000 Power Supply PCB Layout



APPENDIX 7: TSC-3000 PCB Layout

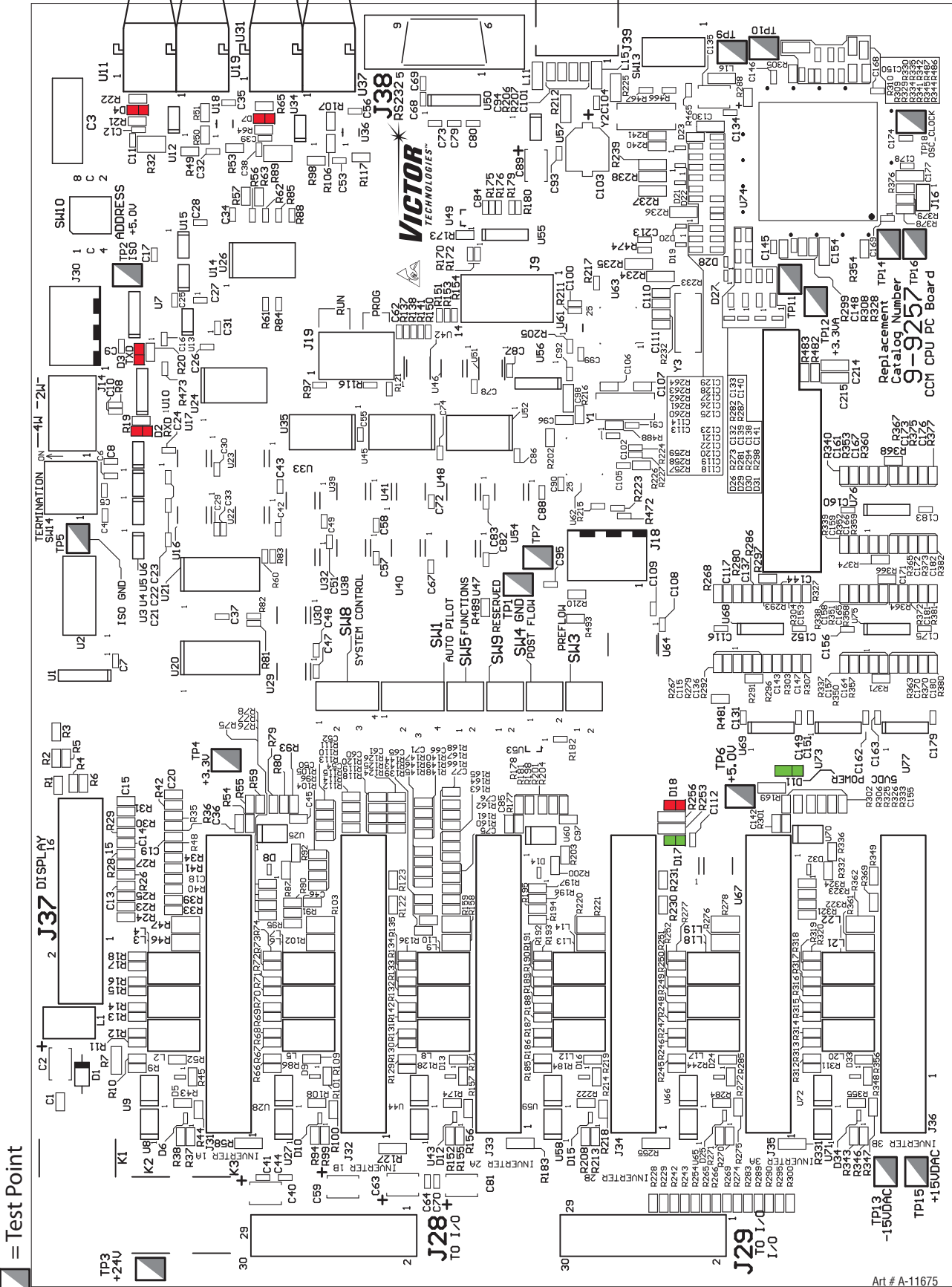




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APPENDIX 8: CCM CPU PCB Layout

▣ = Test Point



▣ = Test Point

Art # A-11675

**CCM CPU PCB****Test Points**

TP1GND  
TP2ISO +5.0V  
TP3+24V  
TP4+3.3V  
TP5ISO GND  
TP6+5.0V  
TP7TOTAL DEMAND 3.3V=400A  
TP9 /WR  
TP10 /RD  
TP11 CPU TEMP SENSE  
TP12 +3.3VA  
TP13 -15VDAC  
TP14 PC2  
TP15 +15VDAC  
TP16 CLKO  
TP18 OSC\_CLOCK

**LED Reference**

D2 Red RXD  
D3 Red TXD  
D4 Red Fiber Out 2  
D7 Red Fiber Out 1  
D11 Green Future Use  
D17Green Future Use



**CCM I/O PCB****Test Points**

TP1 GND  
TP2 /COOLANT FANS ON  
TP3 /TORCH PUMP ON  
TP4 LOW COOLANT FLOW (SW)  
TP5 COOLANT FLOW SIGNAL (PULSE)  
TP6 +15V ISOLATED  
TP7 -15V ISOLATED  
TP8 +18V ISOLATED  
TP9 ANALOG CURRENT CONTROL 0-3.3V  
TP10 GND ISOLATED  
TP11 /PILOT ENABLE  
TP12 +5VDC  
TP13 -15VDC  
TP14 +15VDC  
TP15 24VDC  
TP18 +5V ISOLATED  
TP19 WORK CURRENT

J23 RELAY - INTERFACE BOARD

J24 ARC / TIP VOLTS

J25 TEST

J26 GAS BOX

J28 TO CPU

J29 TO CPU

**LED Reference**

D2 Green PLASMA ENABLE  
D3 Green E-STOP\_PS  
D4 Green GAS ON  
D6 Green CNC START  
D8 Green HOLD START  
D12 Green PREFLOW ON  
D13 Green CSD  
D18 Green MARK  
D20 Green SPARE1  
D25 Green EXP METAL  
D33 Green OK TO MOVE  
D37 Green PSR  
D41 Green SPARE FIELD OUT 2  
D43 Green SPARE FIELD OUT 1

**J Connectors**

J21 BASIC CNC

J22 EXTENDED CNC



**Pilot PCB Test Points**

TP1GND

TP2PILOT GATE

TP3+5V

TP4TIP

**LED Reference**

D2        Green   PILOT ENABLE

D11       Green   +5V





**Relay and Interface PCB Test Points**

TP1GND

TP2-15V

TP3+5VDC

TP4+12V

TP5+24V

TP6+15V

TP7+5VDC

**LED Reference**

D2 Green 1 TORCH GAS ON

D7 Green PILOT ENABLE

D11 Green PILOT CURRENT DETECTED

D12Green WORK CURRENT DETECTED

D22Green CONTACTORS ON

D23Green RF ON

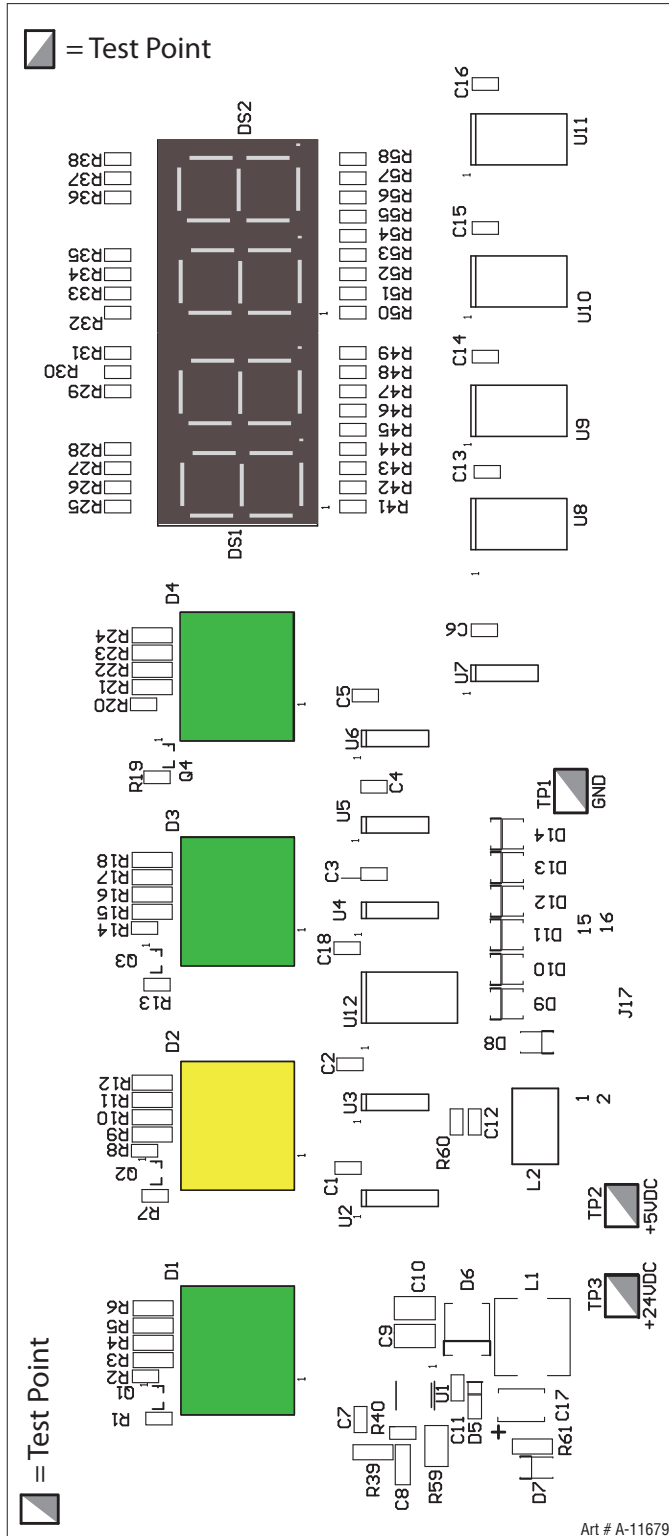
D24Green FANS ON

D25Green PLASMA ENABLED

D26Green 1 TORCH ON

D27Green TORCH COOLANT ON

# APPENDIX 12: Display PCB Layout



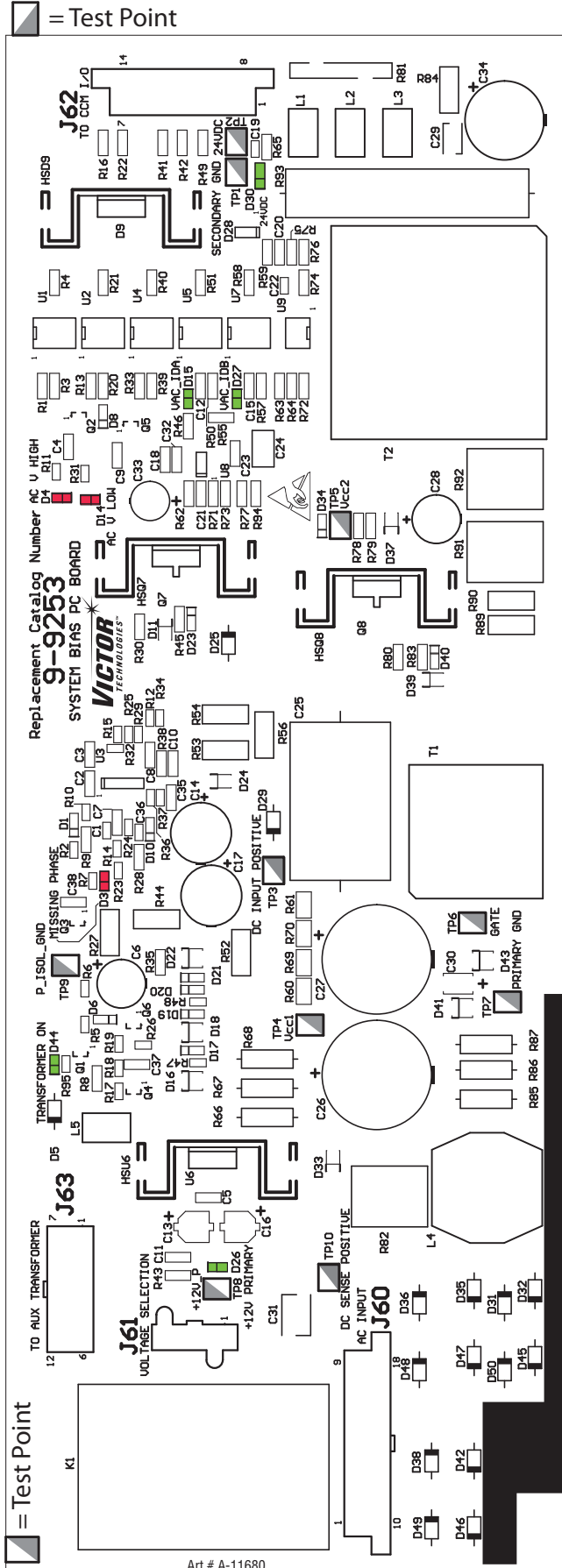
**Display PCB Test Points**

TP1GND

TP2+5VDC

TP3+24VDC

# APPENDIX 13: System Bias PCB Layout



Art # A-11680

**System Bias PCB Test Points**

TP1GND  
 TP224VDC  
 TP3DC INPUT POSITIVE  
 TP4Vcc1  
 TP5Vcc2  
 TP6GATE  
 TP7PRIMARY GND  
 TP8+12V PRIMARY  
 TP9P\_ISOL\_GND  
 TP10 DC SENSE POSITIVE

**LED Reference**

D3 Red MISSING PHASE  
 D4 Red AC V HIGH  
 D14Red AC V LOW  
 D15Green VAC\_IDA  
 D26Green +12V PRIMARY  
 D27Green VAC\_IDB  
 D30Green 24VDC  
 D44Green TRANSFORMER ON



**Main Inverter Bottom PCB Test Points**

TP1GND

TP2GATE 2A

TP3GATE 1A

TP4GATE 3A

TP5GATE 4A

TP6GATE 2B

TP7GATE 1B

TP8GATE 4B

TP9GATE 3B

TP10 +12VP

TP11 +12VDC

TP12 THERMISTOR SIDE A

TP13 THERMISTOR SIDE B

TP14 +5VDC

TP15 PGND

**LED Reference**

D3 Red CAP IMBALANCE

D4 Green READY





**Main Inverter Top PCB Test Points**

TP1GND

TP2GATE 2A

TP3GATE 1A

TP4GATE 3A

TP5GATE 4A

TP6GATE 2B

TP7GATE 1B

TP8GATE 4B

TP9GATE 3B

TP10 +12VP

TP11 +12VDC

TP12 THERMISTOR SIDE A

TP13 THERMISTOR SIDE B

TP14 +5VDC

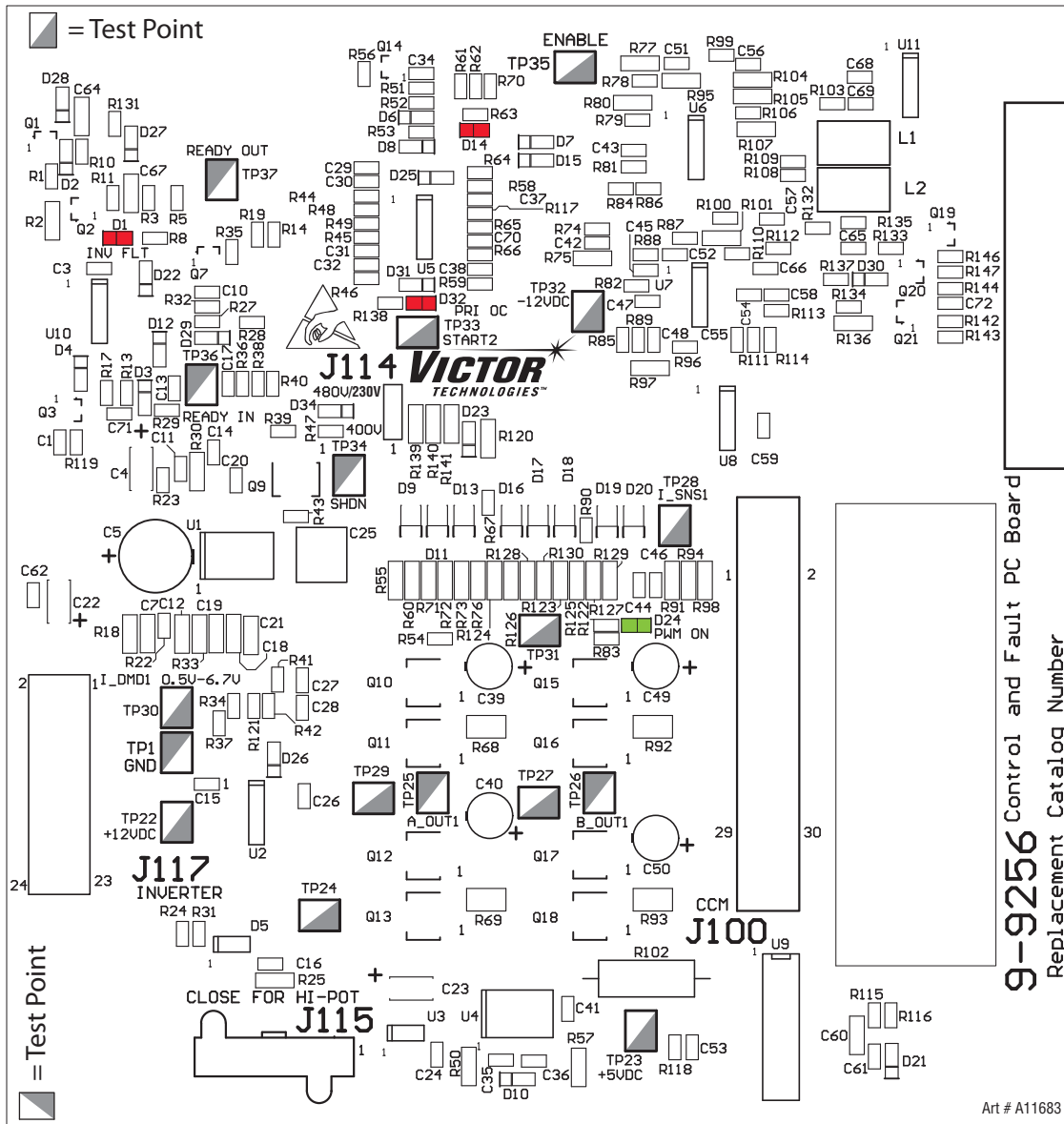
TP15 PGND

**LED Reference**

D3 Red CAP IMBALANCE

D4 Green READY

APPENDIX 16: Control and Fault PCB Layout



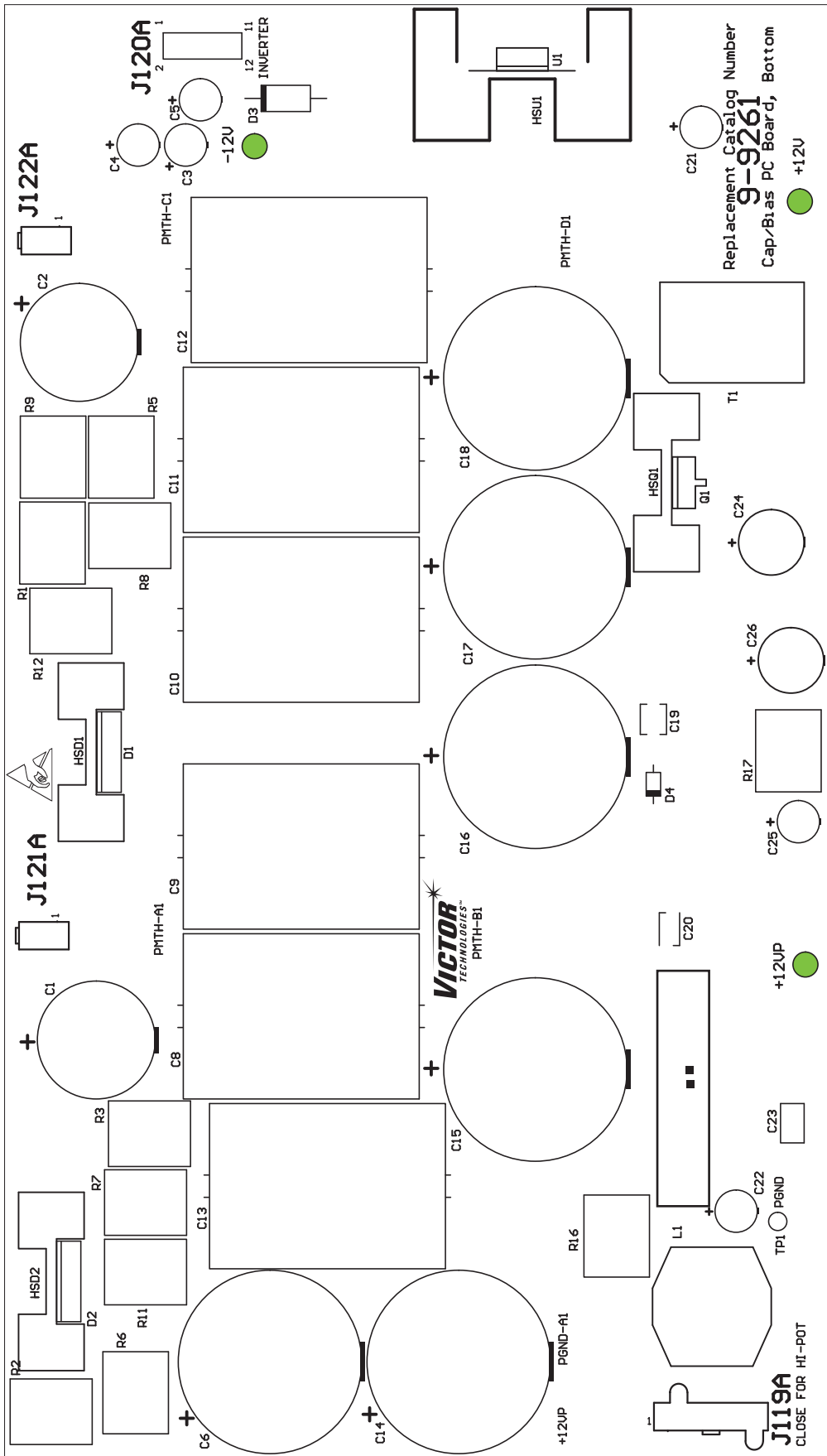
**Control and Fault PCB Test Points**

TP1	GND
TP22	+12VDC
TP23	+5VDC
TP24	GATE 1+
TP25	A_OUT1
TP26	B_OUT1
TP27	GATE 1-
TP28	I_SNS1
TP29	GATE 2+
TP30	I_DMD1 0.5V-6.7V
TP31	GATE 2-
TP32	-12VDC
TP33	START 2
TP34	SHDN
TP35	ENABLE
TP36	READY IN
TP37	READY OUT

**LED Reference**

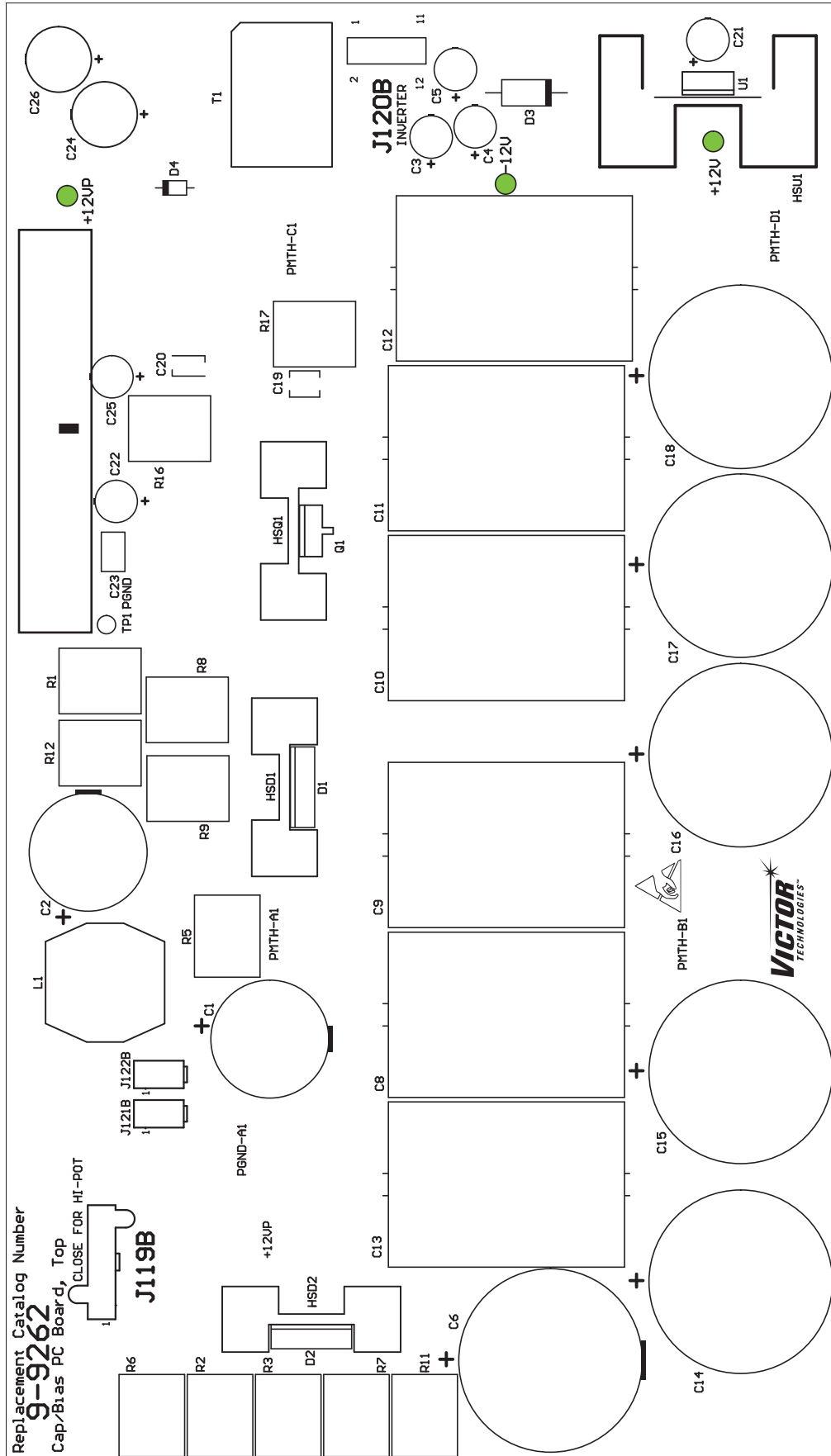
D1	Red	INV FLT
D14	Red	OVER TEMP
D24	Green	PWM ON
D32	Red	PRI OC

APPENDIX 17: Cap Bias Bottom PCB Layout

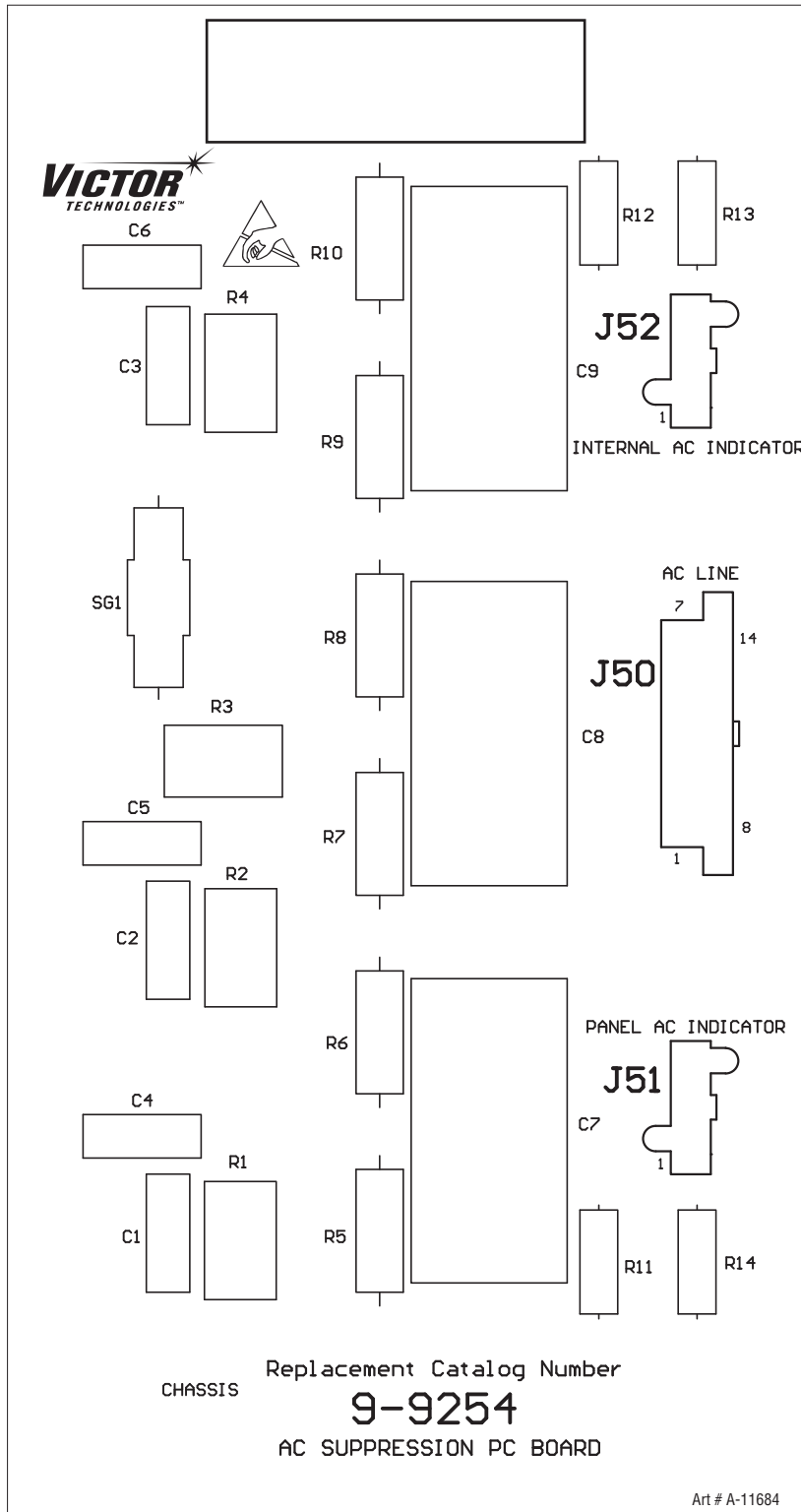


Art # A-11685

# APPENDIX 18: Cap Bias Top PCB Layout



APPENDIX 19: Suppressor PCB Layout

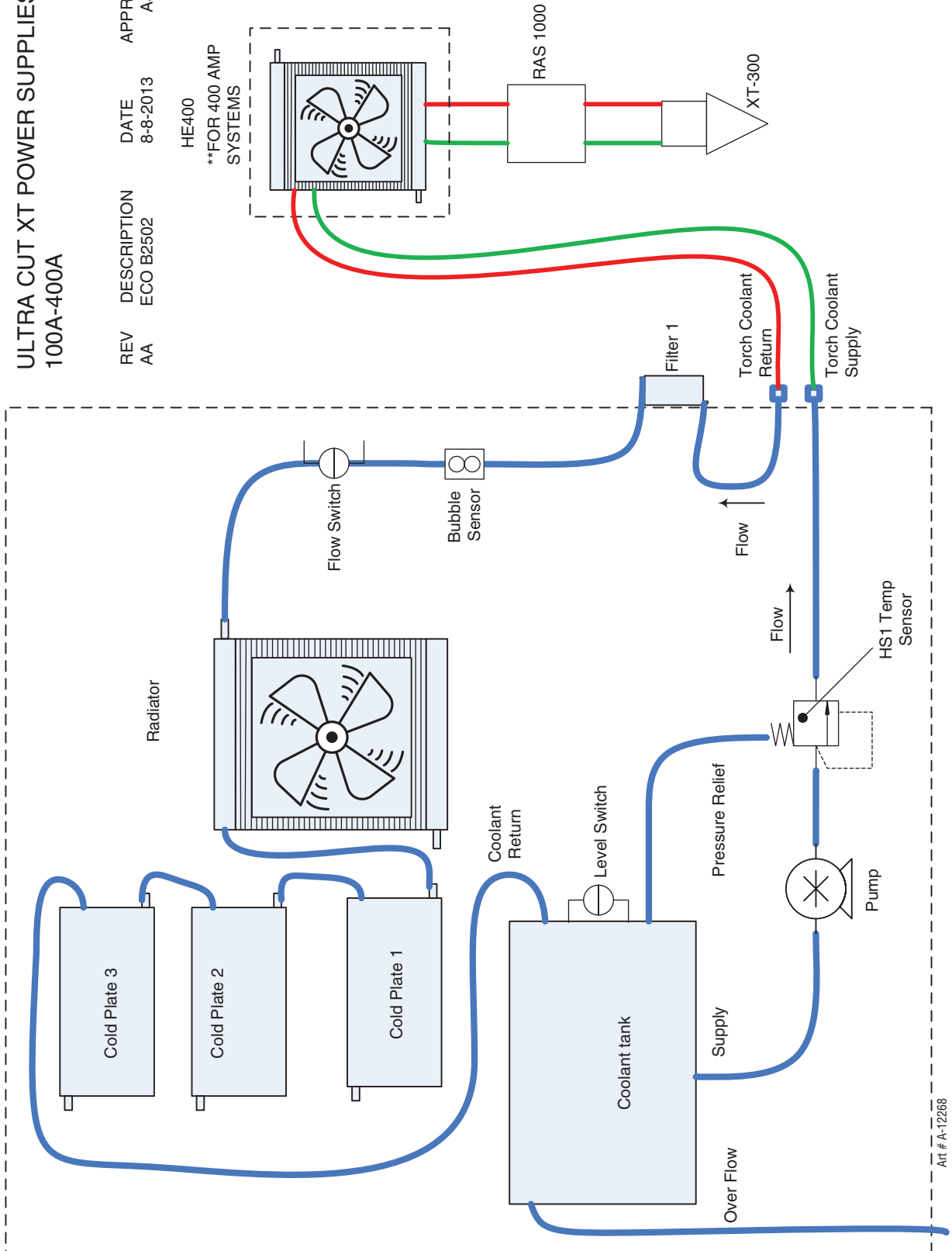


APPENDIX 20: COOLING DIAGRAM

ULTRA CUT XT POWER SUPPLIES  
100A-400A

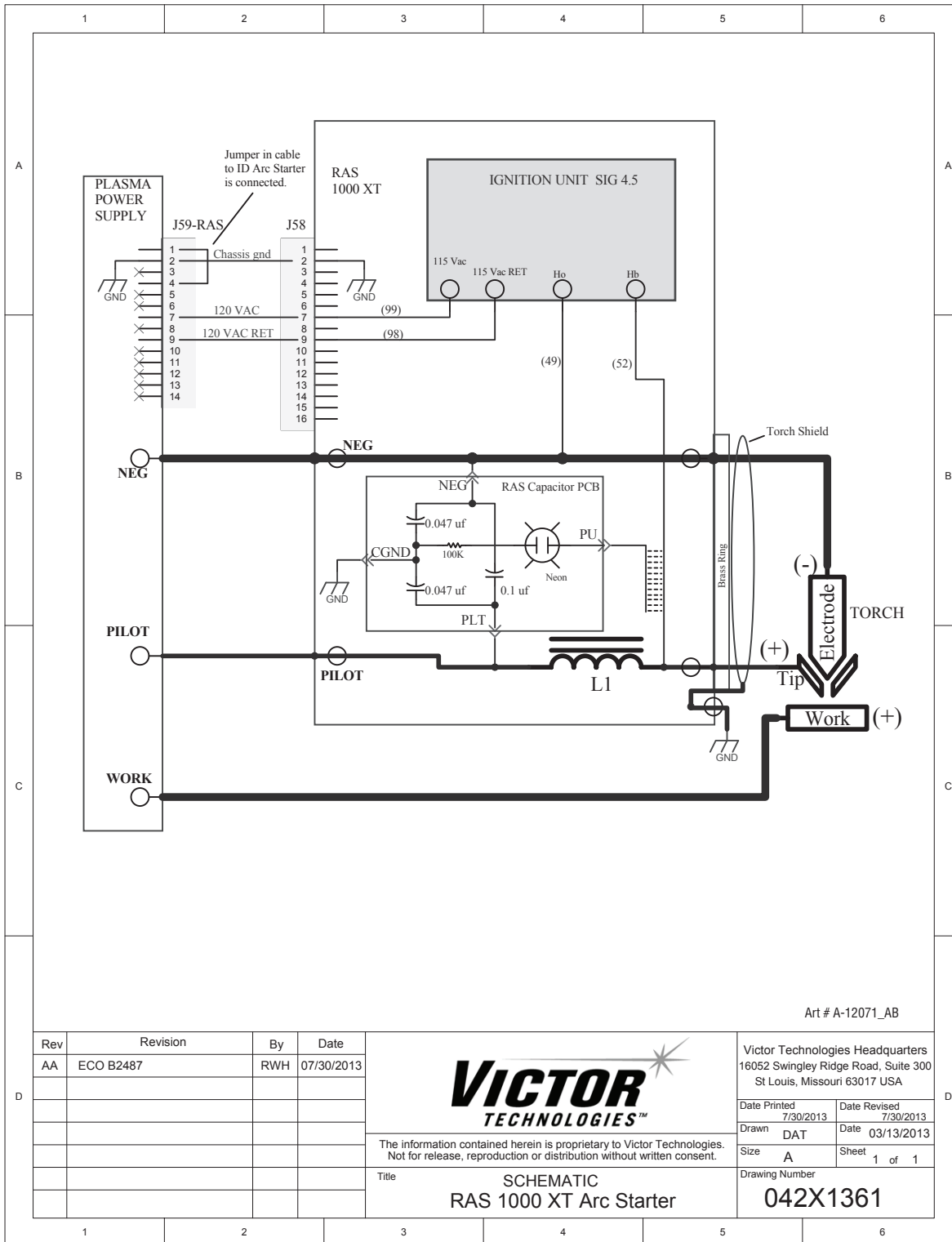
REV AA DESCRIPTION ECO B2502 DATE 8-8-2013 APPROVED AJR

HE400  
\*\*FOR 400 AMP  
SYSTEMS



Art # A-12268

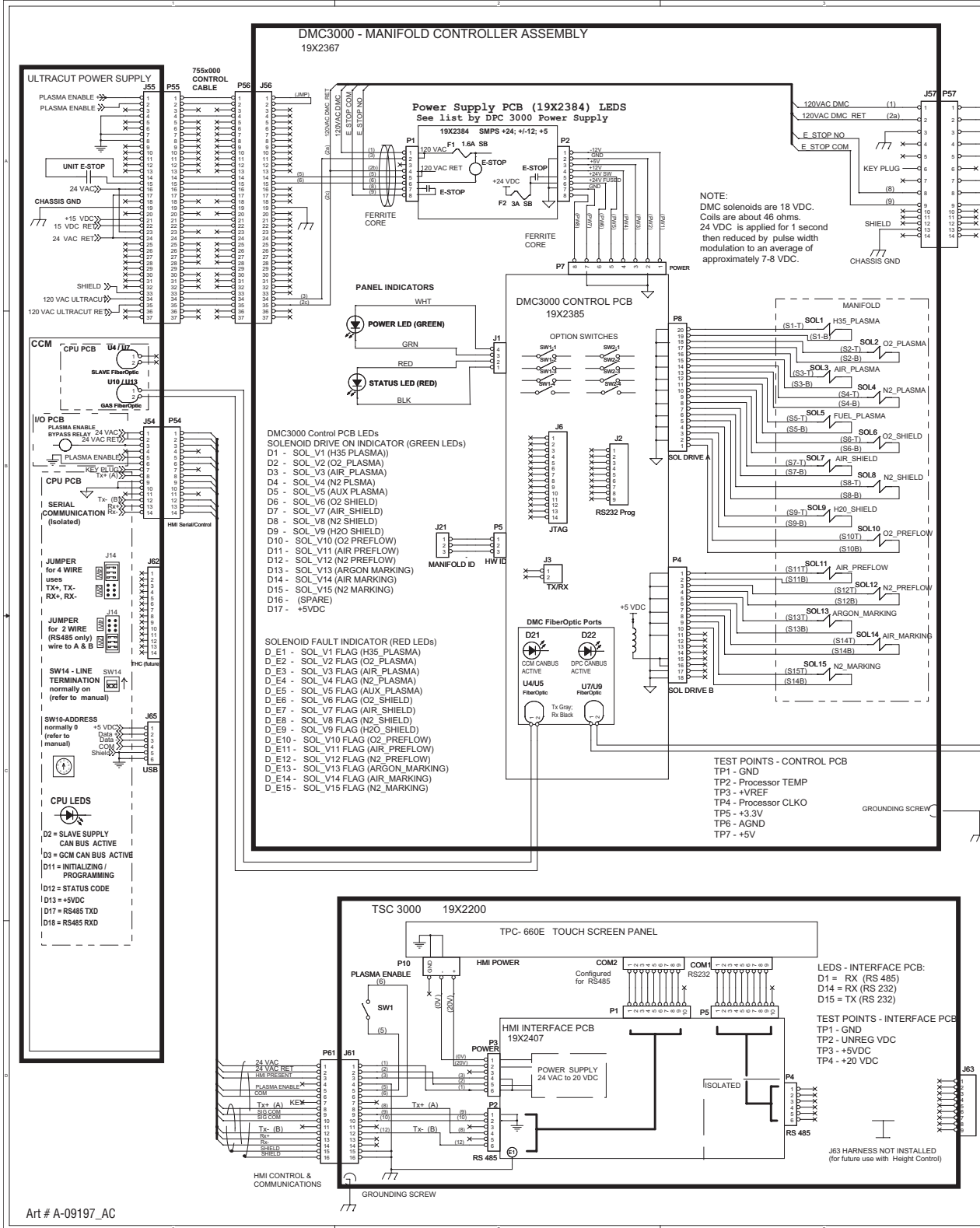
APPENDIX 21: Remote Arc Starter Schematic





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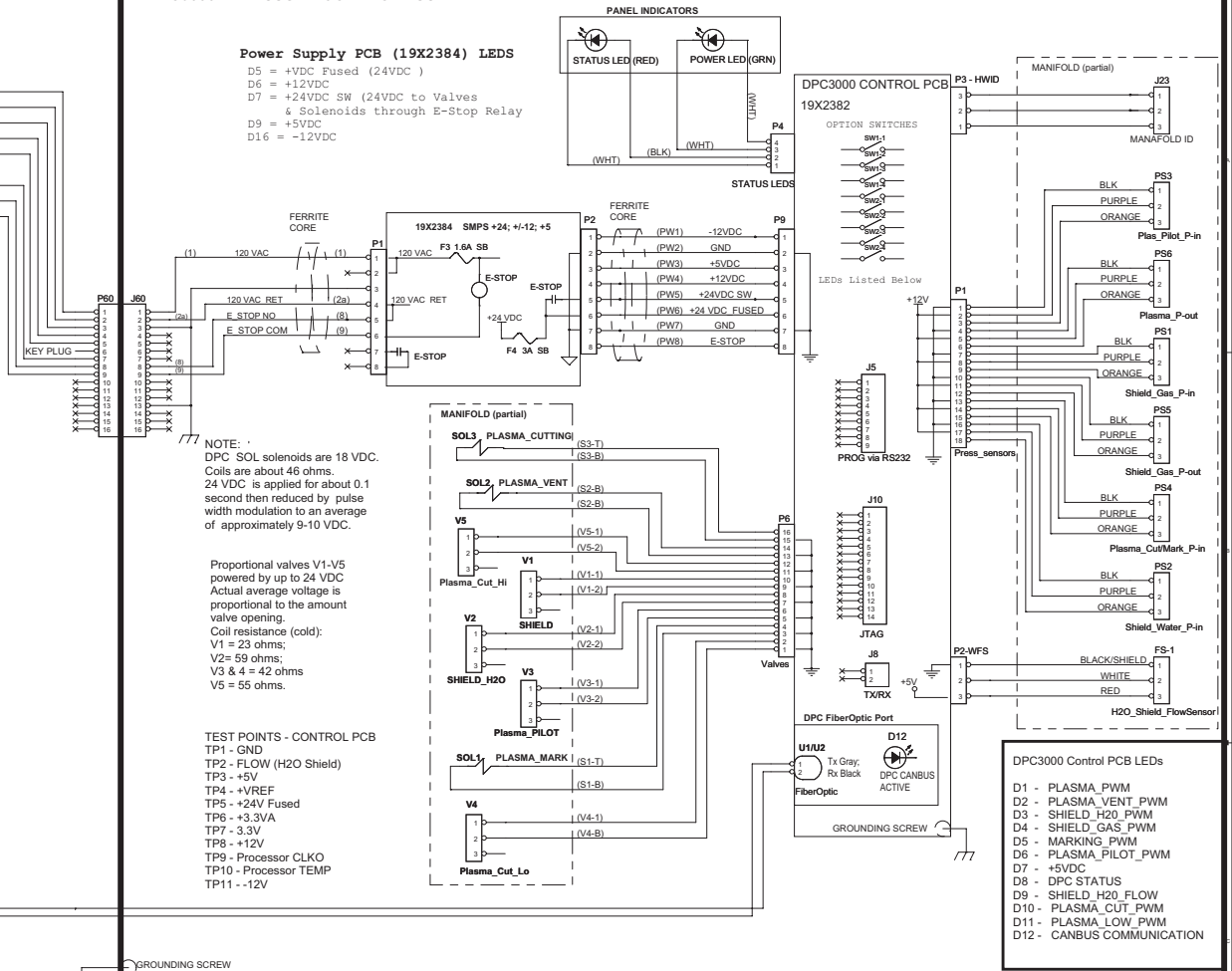
# APPENDIX 22: Schematic, DFC-3000 Auto Gas Box System



DPC3000 - PRESSURE CONTROL ASSEMBLY 19X2383

Power Supply PCB (19X2384) LEDs

- D5 = +VDC Fused (24VDC)
- D6 = +12VDC
- D7 = +24VDC SW (24VDC to Valves & Solenoids through E-Stop Relay)
- D9 = +5VDC
- D16 = -12VDC

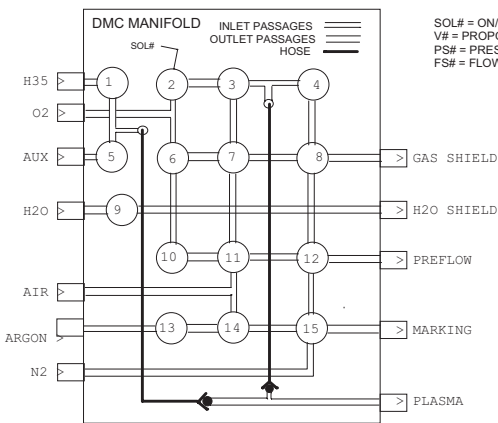


NOTE: DPC SOL solenoids are 18 VDC. Coils are about 46 ohms. 24 VDC is applied for about 0.1 second then reduced by pulse width modulation to an average of approximately 9-10 VDC.

Proportional valves V1-V5 powered by up to 24 VDC. Actual average voltage is proportional to the amount valve opening. Coil resistance (cold): V1 = 23 ohms; V2 = 59 ohms; V3 & 4 = 42 ohms; V5 = 55 ohms.

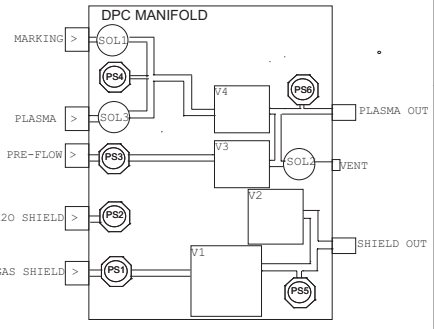
TEST POINTS - CONTROL PCB  
 TP1 - GND  
 TP2 - FLOW (H2O Shield)  
 TP3 - +5V  
 TP4 - +VREF  
 TP5 - +24V Fused  
 TP6 - +3.3VA  
 TP7 - 3.3V  
 TP8 - +12V  
 TP9 - Processor CLKO  
 TP10 - Processor TEMP  
 TP11 - -12V

- DPC3000 Control PCB LEDs
- D1 - PLASMA\_PWM
  - D2 - PLASMA\_VENT\_PWM
  - D3 - SHIELD\_H2O\_PWM
  - D4 - SHIELD\_GAS\_PWM
  - D5 - MARKING\_PWM
  - D6 - PLASMA\_PILOT\_PWM
  - D7 - +5VDC
  - D8 - DPC STATUS
  - D9 - SHIELD\_H2O\_FLOW
  - D10 - PLASMA\_CUT\_PWM
  - D11 - PLASMA\_LOW\_PWM
  - D12 - CANBUS COMMUNICATION



- NOTE:  
 1: DO NOT DAISY CHAIN GROUNDS. USE A SEPARATE GROUND CONDUCTOR FOR EACH ASSEMBLY TO STAR GND.  
 2: KEEP GROUNDS AS SHORT AS POSSIBLE.  
 3: USE #4 OR GREATER SIZE CABLE FOR GROUNDING  
 4: MAKE SURE ASSEMBLIES ARE SECURED PROPERLY BEFORE USE  
 5: ALL COVERS MUST BE FULLY INSTALLED BEFORE USE.

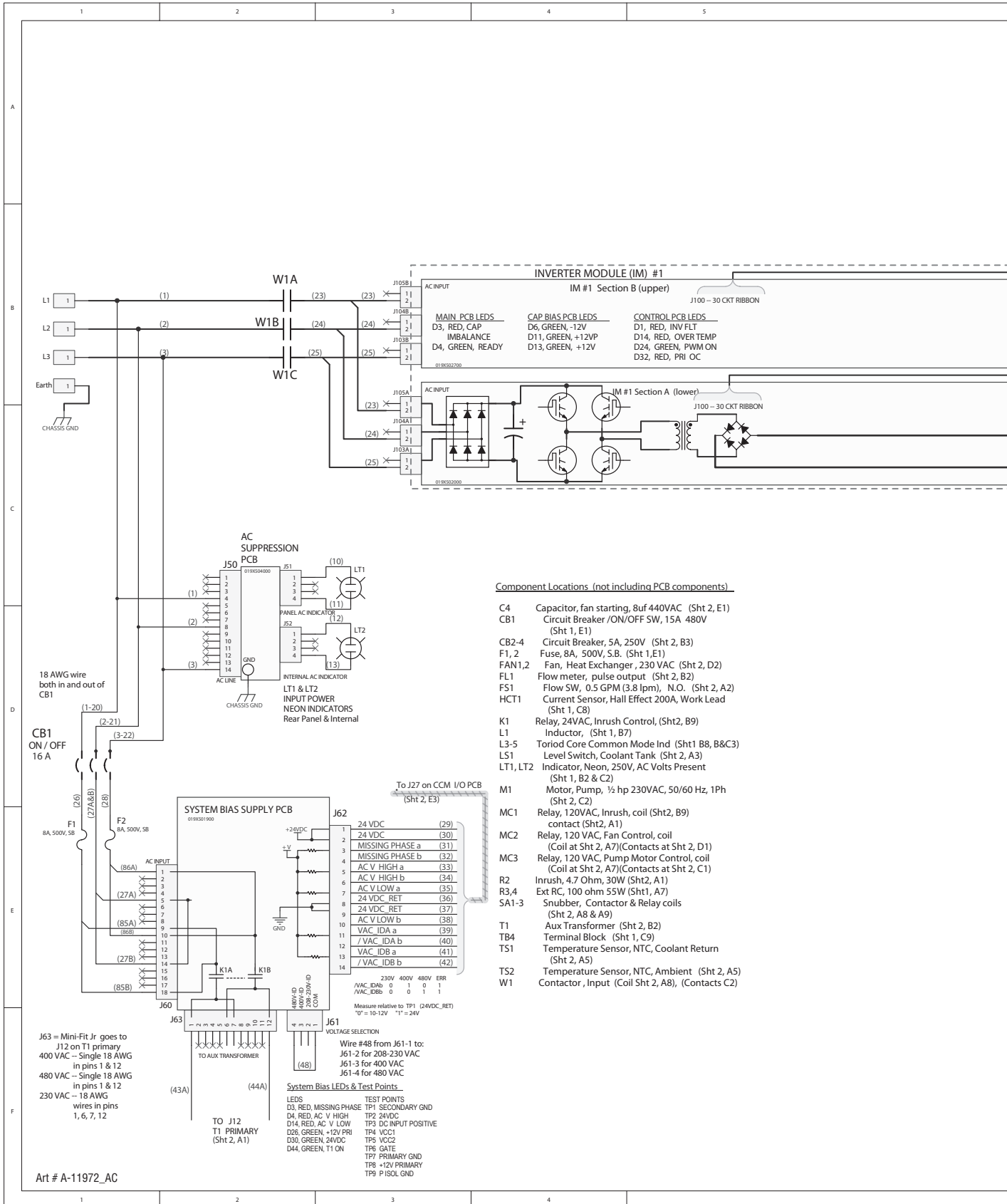
SOL# = ON/OFF CONTROL VALVE  
 V# = PROPORTIONAL VALVE  
 PS# = PRESSURE SENSOR  
 FS# = FLOW SENSOR (LIQUID)

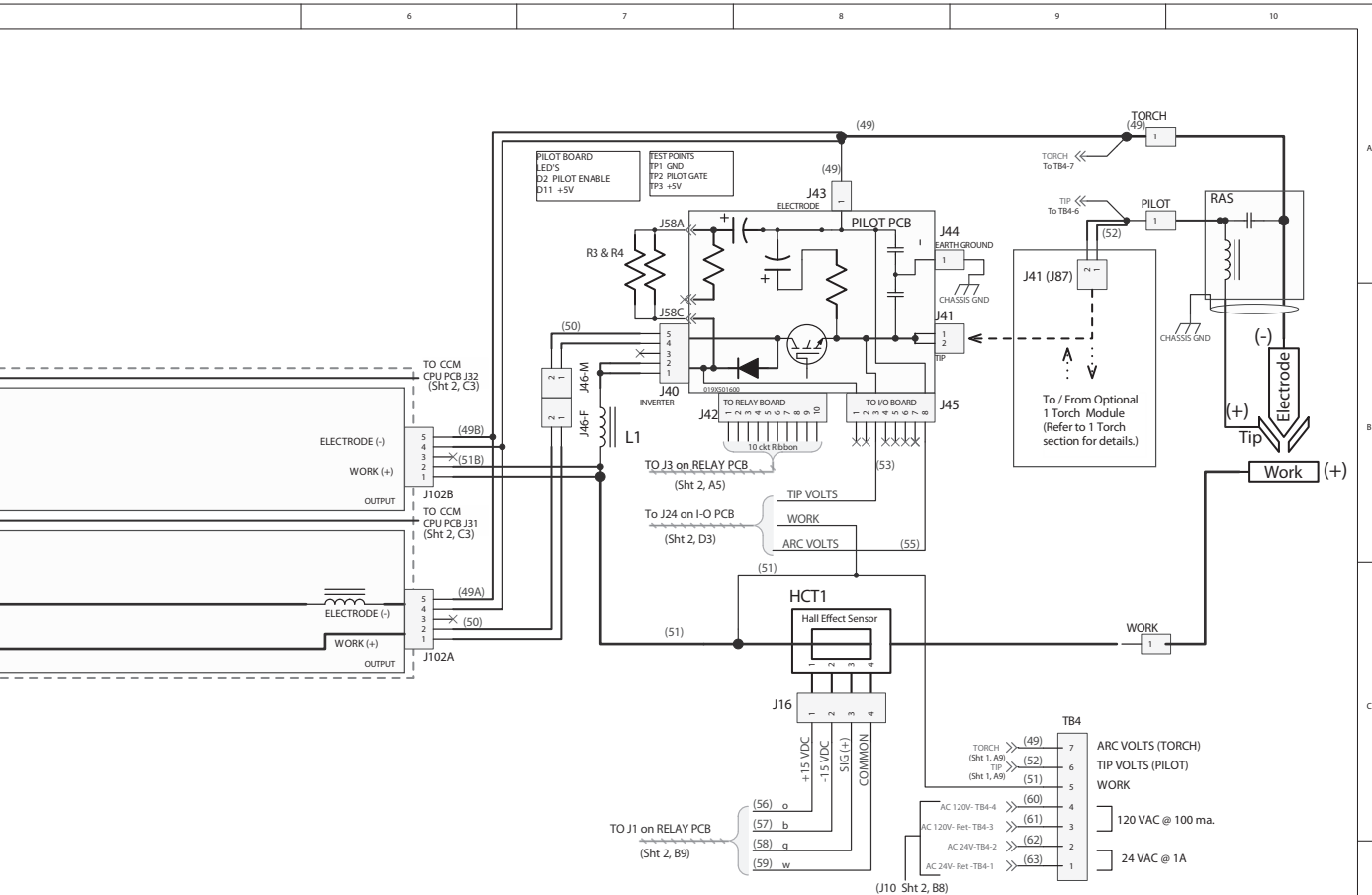


Art # A-09197\_AC

Rev	Revisions	By	Date	VICTOR THERMAL DYNAMICS		PCB No:
001	ECO-811391	DAI	03-20-2010	INTERNAL DYNAMICS	PROTECTIVE MARKS	PCB No:
002	ECO81567 - added test	DAI	07-19-2010	WEST LANSING, MI 48090	PHILADELPHIA	PCB No:
				Information Proprietary to THERMAL DYNAMICS CORPORATION. Not For Release, Reproduction, or Distribution without Written Consent.		Scale: Proportional
				NOTE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES (DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS).		Drawn: J. J. ...
				DATE MODIFIED: Monday, April 19, 2010 14:00:50		Checked: D. J. ...
				TITLE: SCHEMATIC, DFC 3000 SYSTEM SCHEMATIC		Size: DWG No: 42X1292

# APPENDIX 23: System Schematic 100A, 480V PG 1





**RIBBON CABLE 30 ckt.**

CCM (J31 & 32) - INVERTER (J100)

- 1 READY +
- 2 READY -
- 3 INVERTER\_FLT +
- 4 INVERTER\_FLT -
- 5 OVERTEMP\_FLT +
- 6 OVERTEMP\_FLT -
- 7 PWR\_PRESENT +
- 8 PWR\_PRESENT -
- 9 OUT\_COM (+3 to 5VDC)
- 10 VAC\_SELA
- 11 VAC\_SELB
- 12 IS\_IDA
- 13 IS\_IDB
- 14 IS\_IDC
- 15 ENABLE +
- 16 ENABLE -
- 17 START2 +
- 18 START2 -
- 19 SPARE
- 20 SYNC\_IN +
- 21 SYNC\_IN -
- 22 NC
- 23 NC
- 24 47 OHM to COMM
- 25 DEMAND +
- 26 DEMAND -
- 27 47 OHM to COMM
- 28 CURRENT +
- 29 CURRENT -
- 30 47 OHM to COMM

**RIBBON CABLE 40 ckt CCM (J23) - RELAY PCB (J4)**

- 1 COMMON
  - 2 /1TORCH START \*
  - 3 NA
  - 4 /1TORCH GAS SOL ON \*
  - 5 /MAIN TORCH IDLE \*
  - 6 /1TORCH PRESS OK \*
  - 7 FLOW SENSOR (pulses)
  - 8 LOW COOLANT FLOW
  - 9 COOLANT LEVEL OK
  - 10 COMMON
  - 11 NA
  - 12 /PLASMA ENABLE-HMI
  - 13 /COOLANT PUMP ON
  - 14 COMMON
  - 15 /PILOT ENABLE
  - 16 /RAS ON
  - 17 /CONTACTORS ON
  - 18 COMMON
  - 19 /COOLANT FANS ON
  - 20 /1TORCH CONTACTOR ON \*
  - 21 /PLASMA ENABLE RELAY
  - 22 COMMON
  - 23 PILOT CURRENT SIG-
  - 24 NC
  - 25 PILOT CURRENT SIG+
  - 26 COMMON
  - 27 WORK CURRENT SIG-
  - 28 WORK CURRENT SIG+
  - 29 NC
  - 30 AMBIENT TEMP
  - 31 COOLANT TEMP
- \* Used with 1 Torch Option

**RIBBON CABLE 16 ckt**

CCM (J37) - DISPLAY PCB (J17)

- 1,3,5,7 24 VDC
- 2,4,6,8 COMMON
- 9,10 NC
- 11-16 SERIAL DATA

**RIBBON CABLE 10 ckt**

RELAY PCB (J3) - PILOT PCB (J42)

- 1,2 24 VDC
- 3,4,7,10 COMMON
- 5 PILOT ENABLE +
- 6 PILOT ENABLE -
- 8 PILOT CURRENT SIG -
- 9 PILOT CURRENT SIG +

Rev	Revision	By	Date
00	Initial Design	DAT	10/03/2012
AA		DAT	9/16/2014
AB	ECO-B2687	DAT	10/17/2014

Rev	Revision	By	Date

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Title: SCHEMATIC  
Ultra-Cut XT 100A 480V

Art # A-11972\_AC

Victor Technologies Headquarters  
16052 Swingley Ridge Road, Suite 300  
St Louis, Missouri 63017 USA

Date Printed	12/16/2014	Date Revised	11/20/2014
Drawn	DAT	Date	10/05/2012
Size	C	Sheet	1 of 2
Drawing Number	042X1349		





**System Overview**

The Auto-Cut 200 & 300 XT, PAK200i & Ultra-Cut 100, 200, 300 & 400 XT power supplies include one, two or three inverter modules (IM). Each IM may have either 1 or 2 inverter sections designated A or B sections. The IMs are mounted one over the other numbered from bottom to top. The sections are also designated from bottom to top with section A being on the bottom of each module. An IM with one section is considered to be a ½ or “partial” module with the upper or “B” section missing. ½ modules are used with the 200A & 300A power supplies and will always be in the middle position. IMs with 2 sections are considered to be “full” modules.

Each inverter section can supply up to 67A but does not do so in all configurations:

- A 400A unit uses 6 sections.  $400A / 6 = 66.67A$  per section.
- A 300A unit uses 5 sections.  $300A / 5 = 60A$  per section.
- A 200A unit uses 3 sections.  $200/3 = 66.67A$  per section.
- A 100A unit uses 2 sections.  $100/2=50A$  per section.

**Unit configurations.**

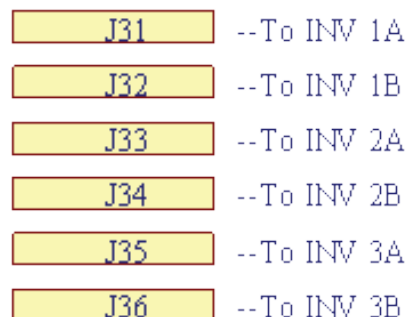
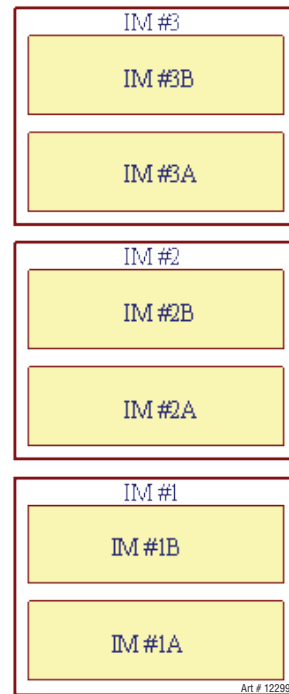
With the exception of the AC 200 XT and PAK200i all other units have the same chassis with room for up to 3 IMs. The unused areas have blank panels filling the empty locations which are required for proper air flow. A 100A system uses 1 full IM; 200A uses 1 and ½ modules with a full module in the bottom location and a ½ module in the middle position. A 300A unit has full modules top and bottom with the ½ module in the middle location. The AC 200 XT and PAK200i have only the bottom and middle locations for IMs. An internal Arc Starter and Gas Control are located in the place of the 3rd or upper IM.

**Inverter module cooling.**

The power semiconductors of the inverter modules are liquid cooled allowing us to get more power in a smaller area and at lower cost. Each IM has a liquid cooled heatsink or “cold plate” shared by the 2 inverter sections. The magnetic components, transformers and inductors, are air cooled and mounted on the back side of the IMs where they are exposed to high volumes of air flow from the cooling fans whose air also cools liquid coolant in the radiator or heat exchanger. It is important that lower right side panel be in place or the air flow will not be proper for cooling the magnetics.

**Inverter control.**

The inverter sections are operated as separate inverters whose outputs are connected in parallel. They are controlled independently from the Command and Control Module (CCM) which is the “brains” of the system. Each inverter section has a separate ribbon cable connected to it coming from the CCM which has 6 connectors, J31 – J36 corresponding to the inverter sections 1A through 3B. The ribbon cables



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are labeled on the inverter ends as INV with the number and section (INV 1A, INV 1B, etc.). A 100A unit will only have ribbon cables in J31 & J32; a 200A will have J31-J33 filled with the others empty. 300A will have J34 missing with the others filled.

Other boards in the system include the **System Bias Supply**, the **Relay & Interface PCB**, **Display PCB**, **Pilot PCB** and **AC Suppression PCB**. The CCM has 2 boards, the I/O (input/output) and the CPU (central processing unit) board. The CE units will also have one or more EMI Filter boards on the input power.

**System Bias supply PCB** is powered from the 3 phase AC input and works from about 150V to over 600V covering all the normal voltage ranges. It can operate from 2 phases (single phase) so it still provides bias power and can report a fault if a phase is missing. The supply's output is 24 VDC which powers the Relay board, the Display, the Pilot board and the 2 boards in the CCM. System Bias also contains circuits to detect missing phase and determine if the AC voltage is within the correct range, not too high or too low. It also signals to the CCM what voltage the unit is configured for. The System Bias supply PCB includes a relay, K1, which only applies voltage to Auxiliary transformer, primary, T1, primary when the input voltage is in the correct range.

The **Relay and Interface PCB** Accepts and distributed the output of the Aux Transformer. It has relay to control the pump, fans, input contactors, the Arc Starter and the Inrush relays. A circuit on the Relay board accepts input from the Work current sensor, HCT1, and Pilot current sensor (on the Pilot PCB) and sends the Enable signal to the Pilot boards IGBT switches via the J3 to J42 ribbon cable. Other inputs on the Relay board include those from the Negative Temperature Coefficient (NTC) ambient and coolant temperature sensors. Coolant tank level switch and coolant flow switch, which determines if the flow is above the required minimum rate, also send signals to the Relay Board. Ultra-Cut units include a flow sensor whose output to the Relay Board is a series of pulses whose frequency indicates the flow rate and can detect the presence of gas bubbles in the coolant. All these signals pass to the CCM via a 40 conductor ribbon cable going to the CCM I/O board.

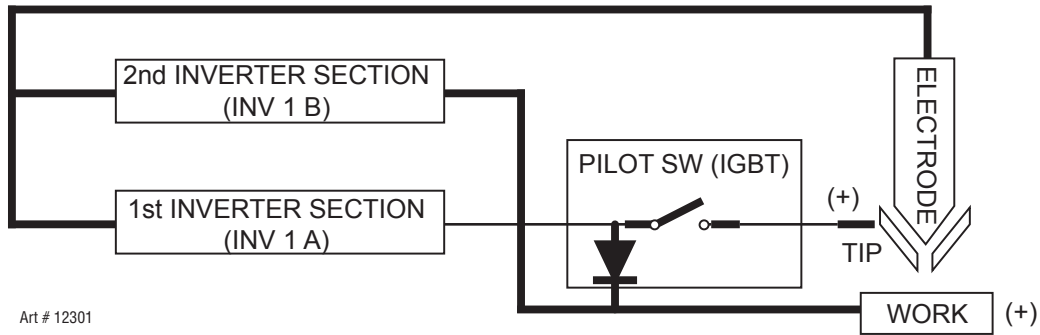
The **Display Board** Has LEDs for AC, TEMP, GAS & DC. It also has a 4 digit 7 segment display for status and fault information. AC LED indicates the input contactors to the inverters have been commanded to close, but does not mean they are closed. TEMP means one or more inverters or the coolant has exceeded the allowed temperature. GAS means gas is flowing and coolant flow is OK. DC means the inverters output voltage is above 60 VDC.

The first digit of the 7 segment display shows the letter, "C"; "E"; "L" or is blank. During the initial power up sequence the letter "C" followed by the other 3 digits, indicates the CCM code revision. Status or Fault codes which may occur during the power up sequence or any time thereafter are preceded by letters "E" for an active fault or "L" for a "latched" or "last" fault that stopped the process but is no longer active. When there is no Fault or active Status code, the output current setting is displayed with the first digit blank. If the system is an Ultra-Cut XT using the Auto Gas Control, DFC 3000, the display will show "0" until a process has been loaded. If there is a fault or other status showing the display will alternate between the current setting and the fault.

The **Pilot PCB** contains a pair of parallel IGBT transistors working as an electronic switch to connect and disconnect the torch tip from the 1st inverter section.

When the pilot electronic switch is closed and the pilot is ignited by the Arc Starter, current from the 1st section flows between electrode and tip. Then as transfer begins, a small current from the 2nd inverter flows from electrode to work. When transfer is detected the pilot switch is opened and current from the 1st section is free to flow to the work through the diode which is also on the Pilot board. The PAK200i and the optional 1Torch are exceptions in that the second section is not enabled during piloting. Both pilot and initial transfer come from the first section. Other sections are phased in as the current ramps up to the final level. The Pilot PCB also contains a pilot current sensor to detect and measure the level of pilot current. Additional resistor/capacitor (RC) circuits on the pilot PCB assist and stabilize the pilot and transferred arcs.

# ULTRA-CUT 100 XT



The **AC Suppression PCB** has capacitors and other transient suppression components to protect the system from transients on the AC lines. It also provides power for the neon AC present indicators which illuminate when AC power is connected even when the ON-OFF switch, CB1, is off.

## Differences between various models.

Auto-Cut 200, PAK200i and 300 XT units use the basic gas control/arc start circuits consisting of single gas inlets, one for Plasma, one for Gas Shield. Also included with the Auto-Cut 300 XT and optional for the Auto-Cut 200XT is a third inlet providing water for the H<sub>2</sub>O Mist shield.

There is a pressure regulator and gauge for each gas inlet and water flow meter/control when the H<sub>2</sub>O Mist option is used. All 3 are turned on/off with control solenoids. Changing gas types requires connecting different gasses to the rear panel and setting the gas switch on the rear panel to match the plasma gas type. There is no separate pilot (Prewflow) gas at this time.

The Auto-Cut 200 XT, Auto-Cut 300 XT and PAK200i Arc starter is the conventional spark gap type with water cooled coil that we've used for several years. This arc starter injects the HF onto the torch electrode via the negative lead with the return via the tip and pilot lead. The Ultra-Cut XT units use the remote arc starter, RAS 1000 XT. In place of the spark gap the RAS 1000 XT uses a solid state ignition module to create the HF pulses which are injected onto the tip and return via the electrode, the opposite direction of that used in the Auto-Cut, Auto-Cut XT and the older RAS 1000 used with the Ultra-Cut units.

The **AC 200 XT** and PAK200i have the gas control and arc starter built into the main enclosure in the area that is used for the top inverter module in other units of this family. The **AC 300 XT** has a separate gas control/ Arc Starter that sits on top of the main enclosure very similar to the GCM 1000 of our earlier Auto-Cut models. It is in fact called a **GCM 1000 XT**. Both Auto-Cut XT and the PAK200i models have an analog current control (Potentiometer). On the front panel of the main unit for the AC 200 XT and PAK200i and in the upper box, the GCM 1000 XT, for the AC 300 XT version. In either case the amperage setting is displayed on the front panel digital display.

Both Auto-Cut models have the gas mode switch on the rear, for the AC 300 XT next to the gas inlets of the GCM 1000 XT. On the AC 200 XT it's near the connectors, fuses & circuit breakers. The switch should be set according to the type of gas, AIR/O<sub>2</sub> or N<sub>2</sub>, H<sub>35</sub> or other non-oxidizing gas, being used for the plasma. The PAK200i does not have this switch.

In the AC 200 XT and PAK200i, the Pilot board is mounted on the upper section of the second inverter module (IM#2) the ½ module, in the place of the second or "B" section if it was a full module. The AC 300 XT and all Ultra-Cut XT models have the Pilot board on the opposite side from the inverters, the "circuit breaker" side, in the upper rear behind the CCM module. Refer to the Replacement Parts section of the manual for illustrations showing the locations.

Ultra-Cut XT units, 100, 200, 300 & 400A units all can use either the **GCM 2010 "manual" Gas control** or the **DFC 3000 Auto Gas Control**. These gas controls remain unchanged from earlier Ultra-Cut units.

Ultra-Cut XT units use the same flow switch, FS1, as the Auto-Cut XT units to detect and prevent operation when coolant flow is below the minimum of 0.75 GPM (2.8 l/m). However, the Ultra-Cut XTs include a coolant flow sensor, FL1, which also measures the flow and can detect if there are gas bubbles in the coolant which can reduce consumable part life. Detecting bubbles or low flow from FL1 will NOT prevent cutting but will show a code as a warning that something is not right. The code is E406.

Ultra-Cut XTs have standard consumables for cutting currents lower than those used for Auto-Cut XT, 15A vs. 55A as well as marking at lower currents. To improve operation at these lower currents an additional output inductor, L1, is added in series with the 1st inverter section (IM#1A).

## Optional 1Torch module

Starting early in 2015 all the Auto-Cut 300 XT and Ultra-Cut XT models may be ordered from the factory with an optional module allowing connecting an SL100 "1Torch" that cuts at a fixed 100A. The module is built into the XT supply front panel just above the coolant tank filler cover. Connect a shop air supply and an SL100 torch and you can use this torch with its relatively low cost consumables to hand cut scrap or whatever you wish without wearing the higher cost consumables of the XT torch.

## Status codes.

The codes for the power supply are displayed on the Display PCB 4 digit numerical display. Some codes refer to the Gas Controls but more detailed Gas Control codes will be found on the individual gas controls. The gas controls used with the XT family of plasma supplies have not changed. They have their own set of status codes which should be covered in another section. This guide assumes you have first considered the Status Code Tables in the Operation Section of the unit manual. Individual codes will point to different inverter sections while this guide groups similar codes together. For example code E (or L) 249 indicates an inverter fault in Inverter 2A. This guide covers codes 247-252 in one section as they are all the same, varying only by which inverter and section they refer to.

The codes are separated into 7 groups.

Group 1	Plasma Process -- Relating to pilot, transfer, torch voltages, etc.
Group 2	Plasma Power Supply -- Primarily the Inverter Sections
Group 3	Interface to Gas controls -- Mainly the DFC 3000
Group 4	Cooling System -- The liquid cooling system for the torch and inverters
Group 5	CCM -- Communications port to the gas controls
Group 6	CCM -- Status
Group 7	Accessories – 1Torch

For the XT units we are using a 3 digit code with group 1 codes in the 100's, group 2 in the 200s etc. These correspond to the older codes used in previous units, where 1-1 is now 101. For the most part the codes have the same meaning. Where an older code no longer applies to the XT system we don't use it over again and have left it reserved to avoid confusion. For example the code 204 (2-4) which meant the inverter module wasn't ready. We now detect that error in a different way that has a somewhat different meaning so we have reserved the 204 Code.

While most of the codes indicate a fault has occurred, a few of them, such as 304 (formerly 3-4), simply refer to the current status. 304 indicates either "priming" where the pump is filling the system with coolant or more often "purging" where the gas is flowing to dry the consumables after replacing them or purging the gas lines when a different gas type has been selected.

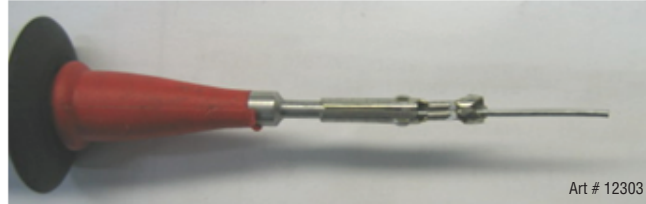
# ULTRA-CUT 100 XT

## Troubleshooting (General)

In many cases where the cause may be listed as a cable or wire disconnected but also includes loose or broken.

All Ribbon cables have an extra receptacle near one end for measuring signals on the cable.

A number of the measurements will require probing of some small connectors or measuring signal on ribbon cables. For probing the small connectors, standard meter probes are usually too big. We suggest making a couple probes using steel wire. Copper buss wire isn't stiff enough. A paper clip is a little too big. One idea is take a socket from an Amp mate-n-loc or similar connector into which your meter probe will fit and crimp a small piece of steel wire, (0.020 to 0.025" dia.; (0.5-0.6 mm) works best), into where wire would normally be crimped. The wire should be soldered and crimped. The steel wire may be found in hobby stores that cater to model building.



Insulate all but the end of the wire and slide these onto your meter probe. If your meter has alligator clip adaptors you could hold the wire in these as well, be sure they don't short together.

Not all problems are caused by the plasma system. If extra wires or other components have been added that were not part of the original system, if possible, remove them to see if they are causing the problem.

Connections to TB4 or the other TBs on the CCM may be bringing in noise or forming unexpected current paths that change how the system operates.

### Problems that do not set Status or Fault codes:

#### Coolant Problems

1. Blinking Gas Indicator. At power on the GAS indicator on the front panel blinks continuously. No code is showing. The actual Real problem is no, or low coolant flow but it takes 4 minutes before the code is set and most people don't wait that long. Go to code 404 to troubleshoot.
2. Pump doesn't start. The R2 Inrush resistor is open which prevents power from being applied to the T1 transformer. This will not allow the pump to start. This will set 404 code after 4 minutes but most people won't wait that long.

#### Pilot Problems.

3. Failure to start pilot. This actually sets failure code 102 after 15-18 seconds but it seems as though no code was set if you don't wait that long. Go to code 102 to troubleshoot.
4. A weak pilot that will only transfer with the torch very close to the work may be caused by the 30 pin ribbon cables being reversed on the A and B sections of inverter 1.

Start problems also reported as failure to pilot problems.

5. No response to the CNC Start or Pak200i torch trigger. Check on the CCM I/O board for the D6 CNC START LED being on all the time. If it is on, either the external CNC Start signal is on or the CCM is faulty. Remove the CNC cable from J15 or if Start is applied via the TB terminal strip on the CCM remove that. If D6 is still on replace the CCM.
6. No response to the optional 1Torch trigger (Start). Go to the beginning of the 700 code group to troubleshoot.

#### Communication problems.

7. Failure to communicate with the TSC 3000 or the cutting table controller over the RS 485 could be due to not having the J14 \_ 4W / 2W (4 wire / 2 wire) jumper set right. TSC3000 needs 2W. The iCNC controller needs 4W. Refer to section \_\_\_\_\_ in the manual.

## Power Supply Status Codes

### Group 1, Process Codes

#### 101 Plasma Enable Is Disabled

Code 101 is activated by either an open circuit between TB1-1 & 2 on CCM I/O PCB or Plasma Enable switched off on the GCM 2010 or on the TSC 3000. TB1-1 & 2 comes from the factory with a jumper installed. An installer may remove the jumper and connect a separate Plasma Enable switch or use the Plasma Enable wires included in the 37 pin CNC cable used with the Ultra-Cut XT & Auto-Cut 300XT. The Auto-Cut 200XT which uses a 14 pin CNC does not have the Plasma Enable in the cable. These may be used to connect to the cutting table E-Stop switch. In either case the jumper would be removed from TB1-1 & 2. 101 is not a latched code, it clears as soon as the condition is fixed.

Causes for 101 code other than one of the Enable switches being off (see detailed descriptions below):

- Gas Control Cable from J55 to gas control not connected.
- Input voltage too high, power not applied to GCM 2010.
- Ribbon cable from Relay board to I/O board not connected.
- CNC cable not connected (if using a Plasma Enable switch or output from the cutting table or robot).
- Defective Relay PCB
- Defective CCM I/O PCB

Special case: Display alternates between E101 and ----. This happens when there is both a missing phase and Plasma enable is off. It is probably a bug in the code, it should be showing E101 & E201 (missing phase code). We will likely fix this in a later code release but be aware of it for now.

Input voltage too high is detected on the System Bias PCB which will light its D4 (red LED) and will not energize it's K1 relay thus T1 transformer receives no power and any AC powered components including gas controls will not have power. This can cause the GCM 2010 to not satisfy the Plasma Enable circuit and falsely report (E101) as the fault.

#### External or CNC Plasma Enable D2, CNC PLASMA ENABLE LED, is not on.

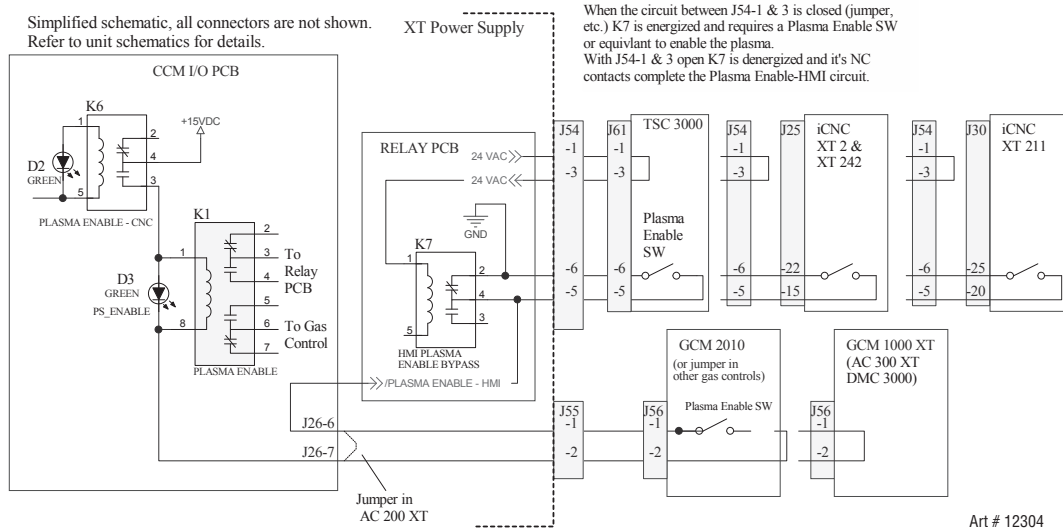
- LED D2 on the CCM will be on if this input is satisfied either with the jumper on TB1- 1 & 2 or an external or CNC switch. If the jumper is in place and the LED is not on, the CCM is most likely defective.
- If the jumper at CCM TB1-1 & 2 has been removed to use an external switch, install a jumper as a test. If D2 illuminates the problem is with the switch or it's wiring.
- If Plasma Enable is wired through the CNC cable remove the cable and jumper J15 pins 25 & 26. If D2 still not on there may be a problem in the wiring inside the power supply.



# ULTRA-CUT 100 XT

## Plasma Enable from Gas Control or TSC 3000

If the External or CNC Plasma Enable is satisfied, D2 is on, a relay K7 on the CCM I/O PCB energizes supplying +15V to another relay K1 on the I/O board. An active low signal, /Plasma Enable-HMI, comes from TSC 3000 Plasma Enable switch via the Relay PCB or if TSC 3000 is not installed the signal originates on the Relay PCB. This signal applies ground to the K1 relay energizing it and lighting the LED, D3 on the I/O board. K1's contacts go back to the Relay board and the Gas control connector J55 to allow turning on relays and solenoids on those devices. The AC 200 XT does not use the separate Gas Control or the TSC 3000.

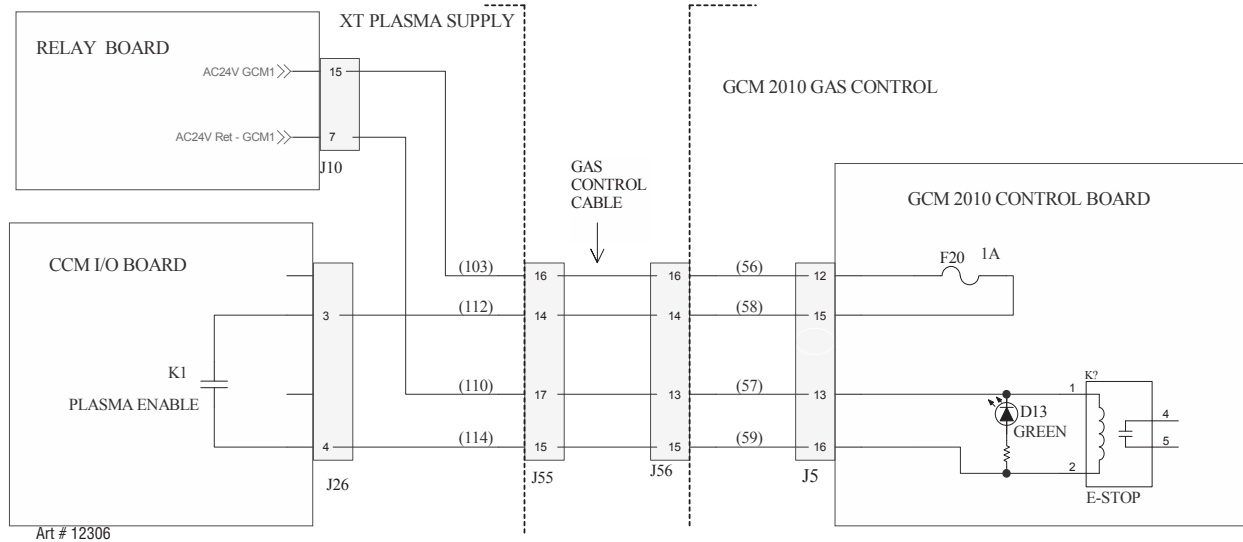


If a TSC 3000 is not connected or unit is an Auto-Cut, K7 on the Relay PCB is de-energized and GND is connected through its normally closed contacts. If the TSC is connected, 24 VAC through a jumper in the TSC 3000 energizes K7, opening its NC contacts and now GND connects through the TDC 3000 Plasma Enable switch. The GND obtained by either path passes through the GCM 2010 Plasma Enable switch or through a jumper (J56-1 to J56-2) present in the other gas controls (GCM 1000 XT or DMC 3000) and is connected to the coil of K1 on the I/O PCB. If the CNC Plasma Enable is also active (D2 is on) +15V will be connected to K1's coil through the relay K7 on the I/O PCB. This energizes K1 and turns on D3, Plasma Enable LED. The contacts of K1 go back to the Relay board and to the Gas control to enable power to connect to relays and solenoids in those items.

### Troubleshooting:

1. If both D2 and D3 are on and you still have 101 fault replace the CCM. Otherwise go to step 2 except if it's an AC 200 XT skip to step 4.
2. If D3 is not on and there is a TSC 3000 in use remove its cable from J54. K7 on the Relay board will de-energize and satisfy the Plasma Enable to K1. If D3 is now on problem was in the TSC 3000 or its cable. Otherwise reconnect the cable.
3. For an Ultra-Cut with DFC 3000 or GCM 2010 or an Auto-Cut 300 with a GCM 1000 XT remove the cable from J55 the gas control connector and jumper pins 1 & 2. If D3 is on now problem is in the Gas Control or its cable. If D3 still not on replace the Gas Control cable.
4. If neither of the above steps works, on the CCM I/O board, jumper J26-7 to GND (TP1 on I/O). If D2 is on and D3 still does not light then replace the CCM.
5. If D3 does light in the above step find the 40 pin ribbon cable plugged in to the top of the CCM. Confirm that it is plugged in to both the CCM and the Relay board and the connector tabs are locked in place. Now using the spare receptacle measure voltage between GND (TP1 on I/O) and the ribbon cable pin 12. It should be zero V. If not, if it's something like 10-15VDC, the ribbon cable is open or the Relay board is defective.

**GCM 2010 PLASMA ENABLE / E-STOP SIMPLIFIED CIRCUIT**



**102 Pilot Ignition Failure**

Code 102 is activated when there is no pilot current after 15 seconds of firing the Arc Starter. Pilot ignition requires the Pilot board to be enabled, pilot switch (IGBT) turned on and high voltage pulses (HF) from the arc Starter (either the Remote Arc Starter RAS 1000 XT or GCM 1000 XT or the arc starter built in to the AC 200 XT) applied between the tip and the electrode of the torch.

Possible Causes for 102 code:

XT Automation Torch ONLY:

- No HF to the torch due to broken pilot wire connection in the torch leads.
- No HF to the torch due to defective Arc Starter.
- Arc Starter not receiving power.

XT Torch or 1Torch option:

- Pilot board not enabled.
- Pilot board defective.
- Relay board defective.
- Work lead current sensor defective.
- CCM defective.
- W4, tip isolation contactor, not energized for automation cutting, refer to 700 code group.

1Torch ONLY:

- W5, 1Torch Isolation Contactor, not energized for 1Torch cutting, refer to 700 code group.

Troubleshooting:

1. Determine if the problem is a lack of HF (Arc Starter) or if it's due to the pilot circuit.

Auto-cut XT Arc Starter (inside main chassis for AC200 XT; in the GCM1000XT for AC300XT) has open spark gap. If the spark gap is firing it is receiving power. A few early Ultra-Cut XT units were shipped with the RAS1000 Arc Starter. Troubleshoot them the same as the GCM1000XT below. Most Ultra-Cut XT units now use the RAS1000XT Arc Starter which doesn't use a spark gap and is covered in the next section.

# ULTRA-CUT 100 XT

## Arc starter with Spark Gap (Auto-Cut)

### No spark at spark gap

1. Check that spark gap is set for 0.062" +/- 0.002". If gap is too high there may not be enough voltage from T1 to fire the gap.
2. Check for power to the high frequency (HF) transformer (T2 in AC 200 XT; T1 in GCM1000XT) during the 15 seconds following preflow (ignition phase). Arc starter power comes through the rear panel circuit breaker CB4, make sure it isn't tripped.
  - a. For the GCM1000XT (AC300XT) 120 VAC from J59-7 & 9 on the power supply rear panel connects to J58-7 & 9 on the GCM 1000XT. See diagram below. From J58 on the GCM1000XT it goes directly to the line filter and passes through the filter to primary of T1. During the ignition phase, check for 120 VAC on the T1 side of the line filter.
  - b. For AC200XT the HF transformer T2 has insulated Faston (also known as push on , stab-on, spade, etc.) on its primary wires. Disconnect these and measure for 120 VAC on the harness side during ignition phase.
3. If 120 VAC not present go to step 4.
  - a. If 120 VAC is present and still no spark, T1 (T2 in AC200XT) may be bad. Remove power and measure resistance of T1 (T2 in AC200XT) primary and secondary. The primary should measure about 3-7 ohms. The secondary about 25-35 K ohms. If either measurement not correct replace T1 (T2 in AC200XT).
  - b. If T1 (T2 in AC200XT) measures OK, check for shorted capacitors C1-C3 (very unlikely).
4. No 120 VAC to T1 (T2 in AC200XT) primary during the ignition phase (15 seconds following Preflow) check for 120 VAC into the line filter (GCM1000XT only). If it's there replace the filter. If 120 VAC isn't present at the line filter or if this is an AC 200XT go to step 5 in section Either Arc Starter below.

## Arc starter without Spark Gap (Ultra-Cut)

1. Check for power to the RAS 1000XT's Ignition Module during the 15 seconds following preflow (ignition phase). Arc starter power comes through the rear panel circuit breaker CB4, make sure it isn't tripped.
  - a. During the ignition phase, measure for 120 VAC at the input terminals marked 120 VAC on the Ignition module, a gray rectangular box with screw terminals on one side.



**WARNING!**

*Do not let the meter probes (or your hands) come in contact with the other terminals marked Hb and Ho or the other end of the wires connected to them. These can have 10,000 volt pulses which can cause physical harm and will damage your meter.*

2. If 120 VAC is not present go to step 3.
  - a. If 120 VAC is present and still no spark, the Ignition Module may be bad.
3. 120 VAC to the remote Arc Starter comes from J59-7 & 9 on the power supply rear panel and connects to J58-7 & 9 on the RAS1000XT. Remove the cable from J59 and during the ignition phase measure for 120 VAC between pins 7 & 9.
  - a. If 120 VAC is present problem is in the cable to the RAS 1000 XT or the J58 connector and internal harness in the Arc Starter.
  - b. If 120 VAC is present proceed to the next step.
4. 120 VAC to J59 comes from the relay board J8-3 with return on pin 11. On the Relay board, RF ON LED, D23, should be on during the igniting phase. If it is not skip to the next step.
  - a. If D23 is on and there is not 120 VAC at J8-3 & 11 then the Relay board is bad.



**Either Arc Starter**

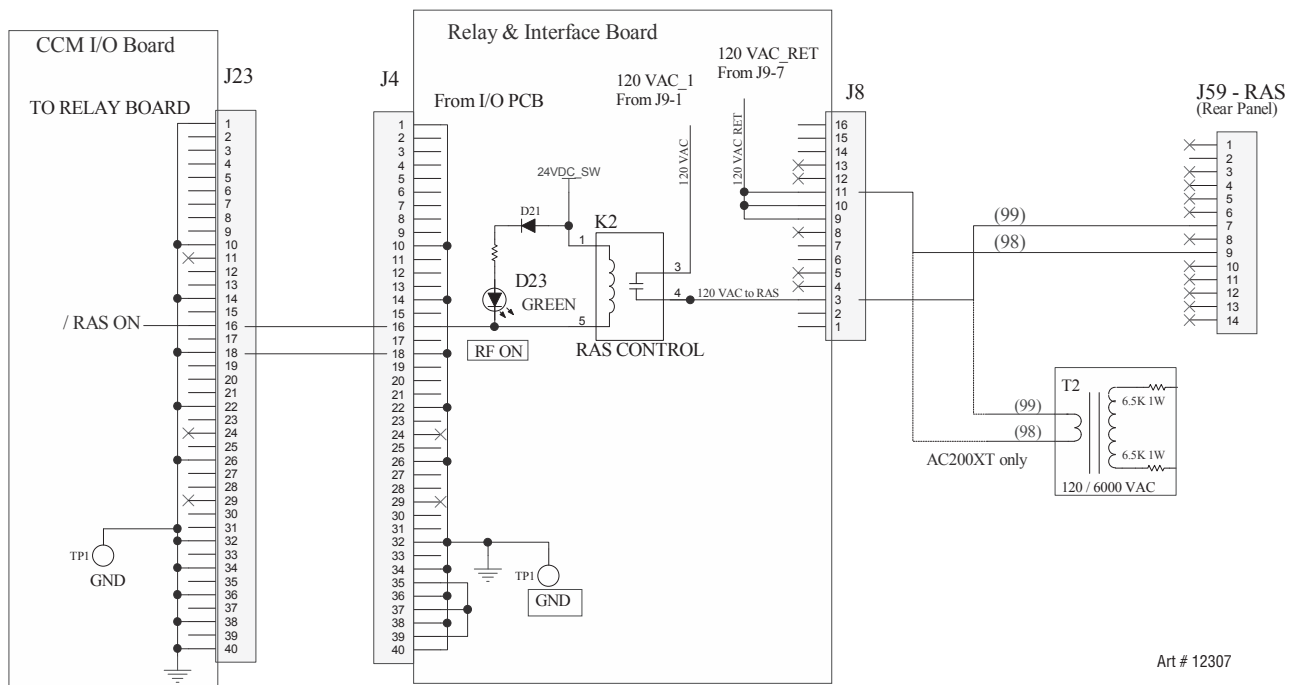
5. /RAS ON signal not on. CCM sends active low signal “ /RAS ON” over the 40 pin ribbon cable on pin 16 to the Relay & Interface board. On the relay board RAS Control relay (K2) closes (RF ON LED, D23 on) sending 120 VAC to J8-3 with return on J8-11. From here it either goes to the HF transformer T2 (AC200XT) or to J59 as described above.
  - a. Measure the signal “/RAS ON” on pin 16 of the 40 pin ribbon cable relative to TP1 on either the CCM I/O board or the Relay board. If it is low (less than 1V) skip to step 6. Otherwise continue this step.

**NOTE**

*If the CCM thinks there is already a pilot it would not enable the HF. Pilot board has a current sensor that sends a differential analog pilot current level signal to the Relay board which in turn passes that signal to the CCM. On the Relay board D11 LED “Pilot Current Detected” or just “PILOT” lights if it sees a signal from the pilot board.*

**Reasons why RAS Control relay would not close:**

6. Pilot current flowing. There actually is pilot current flowing somewhere. Unlikely as it would normally set the 208 fault but we have to rule it out.
  - a. Disconnect J41 on the Pilot board, if HF still doesn’t fire and the Relay board Pilot LED, D11, is still on, it’s due to a fault in the detection circuits.
7. Faulty detection circuit. There isn’t any pilot current but a fault in the circuits measuring pilot current is indicating there is current.
  - a. Measure between pins 8 (-) and 9 (+) on the Pilot ribbon cable from Relay board J3 to Pilot board J42. If there is no pilot current it should be zero. Anything else indicates the Pilot board current sensor is faulty causing the Relay board D11 to be on. Replace the Pilot board assembly.
  - b. If the Pilot current signal on the pilot ribbon cable was zero, measure between pins 23 (-) and 25 (+) on the 40 pin ribbon cable between the Relay board and the CCM. This would also normally be zero if there is no pilot current. Anything else would indicate the Relay board is faulty.



Art # 12307

8. If “ /RAS ON” signal is low on pin 16 of the 40 pin ribbon cable, relative to TP1 on the CCM I/O board, during the ignition time then we need to determine if the Relay board is defective. If /RAS ON signal is not low the CCM or the 40 pin ribbon cable may be defective.
  - a. If the Relay board RF ON LED, D23, is not on while the /RAS ON signal is low, then the Relay board is defective.
  - b. Is D23 is on, measure for 120 VAC on J8-3 to J8-11. If not present the Relay board is defective.
  - c. If 120 VAC is present at J8 during the ignition time go back and perform steps 2-4.

### Troubleshooting Pilot Board problems.

1. The Pilot board is behind the CCM in the AC 300 XT and all Ultra-Cut XTs or on the upper section of the second inverter module in an AC 200 XT and has two LEDs. The first one, D11, a green LED, indicates the board has bias power and should be on all the time when the unit is turned on. The second LED, D2, also green, is on when the pilot is enabled, that is the pilot IGBT switch is turned on. The pilot is enabled near the end of preflow time and remains on until the transfer is established or for 15 seconds after which a 102 code is displayed. If D2 performs as expected you know the CCM, Relay board and work current sensor are not causing the problem.
2. Test pilot IGBT operation. D2 on shows the pilot is enabled but you don't know if the pilot switch (IGBT transistor) actually closes the circuit. To test attach a jumper, 18 AWG or larger as follows:
  - a. Ultra-Cut XT or Auto-Cut 300 XT: connect a jumper wire from TB4-7 (arc volts) to TB4-6 (tip volts).
  - b. Auto-Cut 200 or Pak200i: connect jumper from the negative buss bar by the HF coil to where the pilot wires attach to the gas fitting on the torch bulkhead panel.

Apply CNC Start. If the pilot switch closes as it should, you'll get either 106 or 208 fault code within 3-5 seconds. If not, keep the CNC Start on for up to 20 seconds. The front panel DC LED will stay on for 15 seconds then shows 102 code again. This likely indicates the Pilot board is bad but If the XT supply includes the 1Torch option it could be the W4 contactor is not closing. Go to the 700 group instructions to bypass the W4 contactor.

3. If D11 on the Pilot board is not on check if the 10 pin ribbon cable is connected between the Pilot board (J42) and the Relay board (J3). Measure for 24 VDC on the Pilot ribbon cable test connector pin 2 (+) and pin 10 (-). If 24V is present and neither D11 nor D2 lights then the Pilot board may be defective. Pilot board end of the ribbon cable could also be the cause.

What should happen on the Relay board is LEDs D12, work Current Detected & D11, Pilot Current Detected should both be off. When you apply START after 2 seconds (Preflow time) D7, Pilot Enable, should come on. Also D23, RF ON, should come on indicating the Arc Starter is being enabled. Normally D23 would only be on for a moment until pilot current is detected. Then D11 would be on (and D23 off) until arc transfer or pilot timeout (15 sec.) Since a pilot has not been detected D11 should not come on.

4. If the work current sensor is defective it could be telling the relay board (and thus the CCM) that there is already a transferred arc so no need for pilot. D12, a green LED on the Relay board, is on if work current is detected. If D12 is not on skip to step 5, otherwise disconnect J1, the work sensor connector. If D12 is still on the Relay board is defective.
5. If D12 goes out when J1 is disconnected, plug it back in and measure voltage from TP1 (common) to J1-1, should be positive 12-15VDC. Now measure J1-2, should be negative 12-15VDC. Now measure J1-3, should be 0 +/- 0.05V. If any of these are wrong disconnect J1 and measure again (on the relay board, not the harness). If still wrong the relay board is defective. Otherwise it's the work sensor.
6. Pilot Enable signal comes from the CCM on pin 15 of the 40 pin ribbon cable between the Relay board (J4) and the CCM (J23). It should be low, less than 2V relative to TP1 on either the CCM I/O board or the Relay board. You can also measure this on TP11 of the I/O board. If the signal does not go low when the pilot should be enabled at the end of preflow time then the CCM is probably defective. You can also jumper TP11 on the CCM I/O board to TP1, also on the I/O, to see if that will light D7, the Pilot Enable LED, on the Relay board. If it does, that further confirms the CCM is bad. If jumping TP11 to TP1 does not light D7 on the Relay board, the problem is likely the Relay board or possibly the ribbon cable.

103 Lost Pilot

Code 103 occurs when Pilot has ignited as sensed by the pilot current sensor on the Pilot board , but went out on its own while CNC Start is still active before the pilot timeout (85 ms. or 3 sec.).

Possible causes:

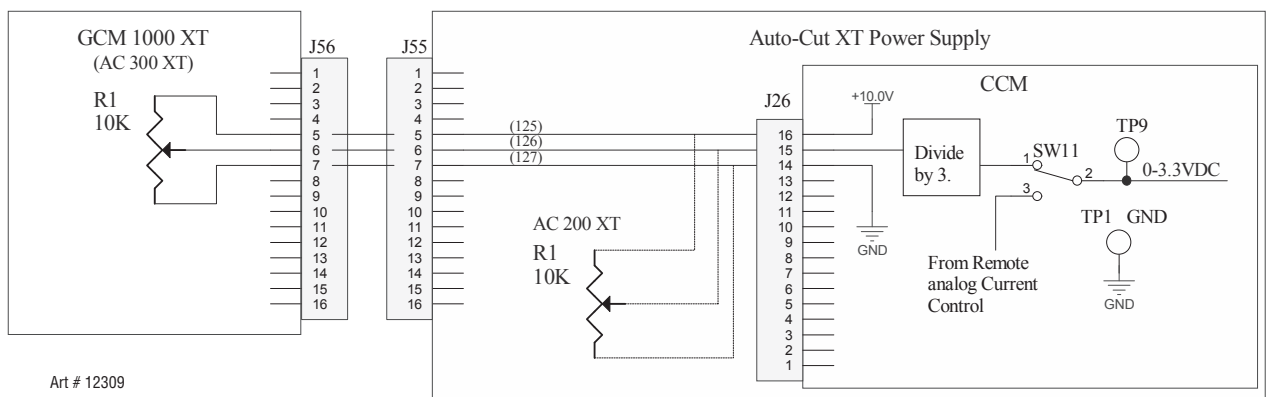
- Preflow gas pressure too high, for manual gas controls check cut charts for proper setting. For DFC 3000 check that the process is correct for the consumables.
- Cutting current set too low for the torch parts being used. Pilot current level is automatically set based on the cutting current. A low cutting current results in a lower pilot current that may not be able to sustain a pilot for higher current torch parts.
- Remote Analog Current Control switches set wrong can also result in lower than normal pilot current setting. See section on these switch settings under next section for code 104.
- Broken torch pilot wire.
- Defective Inverter module puts out less current than it's set for.

104 Transfer Lost

**Arc transferred to metal for at least 50 ms. then went out.**

Causes for 104 code:

- Cut demand set much lower than recommended for torch parts, i.e. 100A consumables in torch but cut current set for 30 or 50A (or zero). Current may be too low to keep arc on.
- Torch standoff too high for cutting process being used.
- Plasma gas flow too low due to a leak somewhere between the plasma regulator or the DPC 3000 and the torch. Check for leaks.
- Coolant flow goes too low while cutting causing the unit to shut the arc off. This normally should set 402 fault but for reasons currently unknown sometimes the fault is 104.
- o One cause of low flow is defective O-ring in the torch check valve assembly. Replacing the O-ring is the solution.
- Remote analog current control switches set wrong.
  - o If remote analog current control is being used, SW8-2 (CCM CPU PCB) is on and SW11 (CCM I/O PCB) is set to "A" (down) position, but no analog voltage connected to TB1-10 or J15-30 (CNC cable) then cut demand will be zero, pilot will be weak, depending on torch height it may still transfer but will immediately go out.
  - o If remote analog current control is not being used but either SW11 is set to the down position or SW8-2 is on also results in zero cut demand.
  - o If system is Auto-Cut XT, current control is an analog voltage from the GCM 1000 XT or the AC 200 XT front panel pot. The current control setting will be shown on the front panel 4 digit display. SW8-2 should be off and SW11 set to up position. With pot at max, check for 3.3V on CCM I/O PCB TP9 (TP1 common). While turning the pot toward minimum TP9 voltage should vary linearly to zero V.



Art # 12309

**105 Not Used. This is one of the reserved codes from the earlier product.**

**106 Pilot Timeout, no Transfer**

Pilot time is limited to either 0.085 seconds (85 ms.) with CCM SW8-1 off (default for pierce starting) or 3 seconds with SW8-1 on (used for cutting over holes, expanded metal, etc.). Arc must transfer before pilot time ends. Code 106 is set if no arc transfer (current in work lead) was sensed before pilot timed out. If the unit does not detect pilot current the arc starter will operate up to 15 seconds then set the 102 code. If you are getting 106 there is pilot current somewhere. If it's not visible perhaps it's inside the consumables or following some other part.

Causes for 106 code:

No Pilot Visible:

- Pilot inside the consumables

Visible Pilot:

- First the obvious, make sure the work lead is connected both to the work and the power supply. Also make sure the work itself is making good electrical contact with cutting table. If rusty or painted metal, you may need to clean a spot and attach the work lead directly to the metal.
- Torch too far from work.
- Cut current set too low for torch parts being used. Pilot current is set based on cut current. If cut current is too low pilot current will be lower and may not transfer at the height used for higher current consumables.
- Preflow pressure/flow too low.
- Remote Analog Current Control switches set wrong can also result in lower than normal pilot current setting. See section on these switch settings under section for code 104.
- Defective work lead current sensor circuit. If transfer is not sensed cut current remains at the lower starting level and pilot timer (85 ms. or 3 sec) will time out.

**107 Tip saver fault for Pak200i only.**

Torches with exposed tips can be damaged if the tip touches the work while cutting. Tip saver reduces the current to a level that the tip can handle for a while. Fault occurs with the Pak200i torch if the tip has contacted the work longer than 15 seconds. The 1Torch with the current reduced by the tip saver circuit is not limited in the time it can touch the work.

**108 Tip to Electrode Voltage Fault**

The Pilot voltage, measured between tip and electrode varies with different current and gas type, flow rate and consumable design.

Once the arc is transferred the pilot switch opens leaving the tip basically floating. The voltage then is determined by how much of a cold gas barrier surrounds the arc. Too much current or too little gas and the arc starts to contact the tip reducing the voltage difference between tip and electrode and leading to a double arc that destroys the consumables.

The CCM measures both electrode and tip voltage and calculates the difference. If the difference between tip and electrode is found to be less than a minimum voltage we stop cutting and set a fault for the 108 code. The normal tip to electrode voltage is different for different processes so the min value for each process is embedded in the cut charts when using the DFC 3000 or in the CCM code if using the GCM 2010 or for Auto-Cut XT gas controls (GCM 1000XT or the built in one in the AC 200 XT).

New for the Auto-Cut XT units is a switch on the rear of the power supply that needs to be set according to the plasma gas. If using an oxidizing gas (O2 or Air) set it as indicated for those gasses (left if AC 200 XT or up for AC300XT) or if using a non-oxidizing gas (N2, H35 or other inert gas) set it to the right or down as indicated for those gas types.. This switch adjusts the range of voltage for the gas type to better protect the torch. A wrong setting could result in false setting of the 108 code.

During piloting and ramping (the time from transfer until the current reaches full cut current), we lower the allowed tip to electrode voltage to about 80% of that allowed during cutting because the current is lower and the gas flow is lower during that time.

Causes for 108 code:

- Gas Flow/pressure too low for consumable parts being used.
  - o If gas source pressure is not well regulated it is possible pressure may be OK at times and drop too low at other times such as during a cut.
  - o A leak of the preflow/plasma gas after the pressure/flow control (GCM 2010, DPC, GCM 1000 XT) can reduce the pressure/flow to the torch because some if it is bypassing the torch, while seeming to have enough pressure/flow at the gas control.
- Cut current set too high for consumable parts being used.
- With DFC 3000 a faulty component would be expected to set a fault code in either the DPC or DMC. However, if a wrong process is selected which doesn't match the consumable type or if using a custom process where pressure has been set too low or current too high that could cause 108 without setting any faults in the DFC 3000.
- A broken pilot wire in the torch lead making intermittent contact can allow piloting or sometimes the torch can transfer using only HF (high frequency). This intermittent connection will upset the tip voltage measurement and can result in the 108 code. Symptom is - it may cut for a short time then fault. Check for an open/broken torch lead pilot wire.
- Physically shorted torch body between anode (tip) and cathode (electrode).

The fault resulting in a 108 code is measured while cutting. It is more likely a shorted torch body, depending on the resistance of the short, it will set code 208 (Unwanted Current) as that is measured prior to starting cut. However, it must be considered as a last resort.

**109 Part Process not Configured.**

This represents a status, not a fault. This is used with the DFC 3000 only. It means the operator hasn't loaded the cutting process from either the TSC 3000 or from the program embedded in the cutting table CNC controller. The solution is to load a process. The code will continue to be displayed until the CNC Start is applied at which time the code will clear.

**110 Device locked.**

This means the DPC or DMC is still in the process of downloading a new cutting process. This should only occur with the DFC 3000 if you apply CNC Start before the download process is finished. The optional 1Torch can be started while the automation process is being loaded.

**Group 2 – Plasma Power Supply codes**

**General:**

**LEDS**

Several LEDs are used as indicators on the different inverter module boards. RED LEDs indicate faults. Green LEDs should be on for the most part. Green LEDs are: On the main board, D4-READY; On the Cap Bias Board, D6, -12V, D11 +12VP (primary referenced), D13, +12V; On the Control board D24, PWM will only be on when the inverter is enabled and its brightness varies with the duty cycle of the PWM.

**Signals:**

General description of some Inverter Signals passed to the CCM that can generate fault codes in Group 2.

“Ready” also called AC IN FLT (D4, READY LED, green, on Main Inverter board)

# ULTRA-CUT 100 XT

On the inverter main board we measure the input voltage. The 3 phases are rectified and lightly filtered to achieve an average voltage. Due to the light filtering a missing phase will also lower the average voltage so it will be detected. Voltage in the correct range turns on the READY LED D4 (on the far left of the main boards, in the upper part of the "B" section or lower part of the "A" section). Voltage outside the correct range or missing phase will turn D4 off.

An AC Input Fault by itself (no other faults occurring at the same time) will set codes in the 241-246 group depending on which inverter sees the problem.

INV FLT (D1, INV FLT LED, red, on the Inverter Control and Fault board)

Several things can cause Inv Flt (Inverter Fault). Inverter fault is indicated by an LED, D1 on the Inverter Control and Fault board. Inverter Fault, when it occurs, is latched on. The latch is reset next time the inverter is enabled unless it is still active in which case it is immediately latched again. Inverter Fault will set the codes 247-252 unless it's in conjunction with another fault in which case that fault code may be set.

Things that can set the inverter fault:

- The local (to the inverter) +12V & -12V bias supplies out of tolerance. There are LEDs on the Cap/Bias board that light indicating these bias supplies are present but don't verify they are in tolerance. It's not likely this would happen. More likely that fault related to the +/-12V the supply would be missing and it's LED not on.
- Capacitor imbalance. In a cap imbalance condition D3, red Led on the main board (lower left corner of bottom or "A" section and upper left corner of the upper or "B" section), will latch on.
- Primary over current. This is an over current condition in main switching transformer's primary. This will latch on but is cleared when the inverter is enabled unless it is still active in which case it is immediately latched again.
- Inverter over temperature sets the Fault signal and LED but has its own fault signal to the CCM. See OT Flt below.

OT FLT (D14, OT FLT, Inverter Control and Fault board)

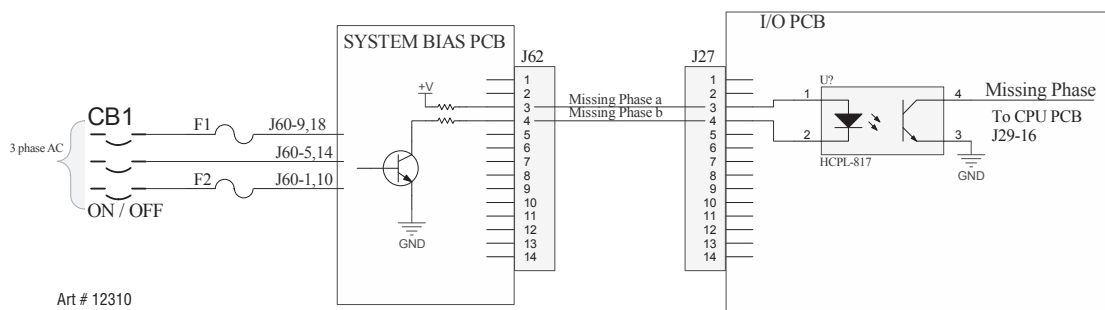
- Inverter over temperature lights LED D14 on the Inverter Control and Fault board and will latch the fault signal and it's LED but also has its own separate fault so that will be reported as a code in the range of 253-258 or 259-264.

## PWR Present

- When power is first applied to the inverter (contactor closed) CCM checks for presence of the +12V bias on the Inverter Control and Fault board. If not present will set codes in the range of 265-270.

## 201 Missing AC Phase

The System Bias Supply board contains circuits to detect if one of the 3 AC input phases is missing. Along with that it can also detect if the AC voltage is too low or too high. Three phase voltage is supplied from the input terminals through the ON/OFF Switch / circuit breaker CB1 to the System Bias board. The System Bias can operate on any 2 of the 3 phases to supply control power and fault detection.



Art # 12310

Normally when the phase is not missing the transistor is on which turns on the opto-isolator making the signal "Missing Phase" low.



**Causes for 201, missing phase code:**

Codes are displayed two different ways, with an “L” meaning “Latched” or “Last”, before the number meaning it was a problem but isn’t right now or with an “E” meaning the problem exists now.

**L201 :**

Most likely cause is an intermittent problem with the incoming power or possibly a loose connection on the power cord at the back or the Ultra-Cut or Auto-Cut plasma supply.

**E201:**

- Phase missing from the wall fuse box, blown fuse.
- F1 or F2, 8A 500V slow blow fuses blown.
- CB1 one phase open.
- System Bias board defective.
- I/O board defective.

Troubleshooting:

1. System Bias board has a red LED, D3, that lights if it detects a missing phase. If D3 is on, check J60 for all 3 phases.
  - a. If all 3 phases are not present at J60 check for incoming power, then the F1 & F2 fuses. Finally the CB1.
  - b. If all 3 phases present and about equal voltage then change the System Bias board.
2. If D3, Missing Phase LED, is not on check for voltage at J27-3 & 4 on the CCM. Normal voltage, with no missing phase, at J27 (or J62 on the System Bias board) pin 3 and pin 4, relative to I/O PCB ground. (TP1) should be between 10-14VDC with pin 3 being a couple volts higher than pin 4. If this is normal, problem may be in the CCM.
3. If the voltage at J27-3 & 4 is higher than 10-14VDC and up to 20-24VDC, make the same measurement at J62 pin 4. If still high there and you have confirmed all 3 phases are present at J60 then the System Bias is defective.
4. If the voltage at J62-4 is not high the wires between J27 and J62 may be broken.

**202-204 Not used. Reserved codes from the earlier product.**

**205 DC Output Low**

DC output (voltage) low means one or more inverter sections are enabled but the output voltage is below a preset voltage. Shortly after receiving the Start signal from the CNC, but before the end of preflow, both sections of IM#1 are enabled and CCM measures the power supply output voltage between negative (Torch) to positive (Work) at the output terminals. If this is less than a set value during preflow or if at any time during piloting or cutting it drops to below that value for a short time, the inverters are shut off and code 205 is set. 205 will almost always be indicated as an “L”, not an “E” fault because as soon as it’s detected the inverters are shut off and so no longer have the fault of low output voltage. Currently the low voltage value is -60VDC.

Causes of 205 code can include shorts outside the plasma power supply, shorts inside the plasma power supply and measurement errors.

- a. Short external to the plasma power supply:
  - The negative lead goes from the rear of the power supply to the remote arc starter or to the GCM 1000 XT in the case of the AC 3000 XT.
    - o Cable pinched in or exiting the power track
    - o Short inside the Arc Starter such as a wire coming loose and grounding to the chassis.
    - o Short inside the torch mounting tube.
  - Trouble shoot for external negative lead shorts by removing the lead from the rear of the power supply and try to start. It won’t start but if you get the same 205 code the problem is inside the unit.

b. Short inside the supply:

- All the inverters outputs except that of IM1A are in parallel. If any inverter's output is shorted it will appear as a short across the power supply output.

Troubleshoot by removing all (or one at a time) of the inverter output connectors except those on IM1A. Then apply Start to the unit. If it starts now one of the other inverters had shorted output. To find the defective one reconnect one at a time until the fault reappears.

**206 Not used. Reserved codes from the earlier product.**

**207 Unexpected Current in the Work Lead.**

HCT1, a Hall Effect current sensor on the positive (work buss bar) measures the work lead current. Inverter section 1A is enabled during preflow time but there should be no current in the work lead before the pilot is ignited and before the arc is transferred to the work. If current greater than 8A is detected before or during preflow something is wrong.

1. 207 code before START applied:

- Defective work current sensor, HCT1.
- Defective Relay PCB
- Defective CCM

Defective Sensor

- The work current sensor, HCT1, receives power, +15VDC and -15VDC from the Relay PCB. Both must be present for the sensor to work properly. Measure between Relay PCB TP1 (or J1-4) to J1-1 for +15VDC and to J1-2 for -15VDC.
- If either + or - 15VDC not present remove the J1 connector and repeat the measurement at J1-1 & 2 on the Relay board. If the voltage is now present the sensor is defective or shorted (the harness may be shorted). If voltages still not present, the Relay board is defective.

Relay PCB

- Relay board LED D12, Work Current Detected, will light if the current sensor signal exceeds 0.05V. If D12 is on, measure the sensor output signal at J1-3 with signal common on J1-1. This signal should be 0V +/- 0.04VDC. If greater than +/- 0.04VDC with no work lead current, the sensor is defective. If the signal voltage is within the limits and D12 is on, then the Relay board is defective.
- If D12 is not on and the 207 code is still active, either the Relay board or the CCM is defective.

CCM or ribbon cable

- The work current signal leaving the relay board is on the 40 pin ribbon cable (Relay J4 to CCM J23) pins 27 (-) & 28 (+). If the voltage here exceeds 0.1VDC with no work current the Relay board is likely defective. Another possibility is in the 40 pin ribbon cable either pin 27 or 28 is shorted to an adjacent pin. Otherwise the CCM is defective.

2. 207 code after START applied (during preflow):

- Short between power supply negative output and Work circuit.
- Short between power supply negative output and earth ground.
- Defective or incorrectly installed user supplied equipment such as torch height controls that make connections to power supply output.

Shorts are more likely to cause DC output voltage low (code 205). However, if the short has enough resistance it is possible to show code 207. To test, remove negative output cable and reapply Start. If 207 code does not appear problem is a short somewhere outside the power supply.

## User Installed Equipment

For user installed equipment to cause 207 code it would have to be connected on the output (to the rear) of the current sensors. To test, disconnect user equipment and apply CNC START. If code 207 is gone user equipment was defective or connected incorrectly.



## 208 Unexpected current in Pilot Circuit

The Pilot board includes a current sensor to measure the pilot current. There should not be any pilot current until the inverters and the pilot board are enabled and the arc starter has fired to ignite the pilot. Pilot current or the signal indicating pilot current should not be present until the arc starter has fired.

Unwanted current signal due to defective sensor or defective circuit boards will most likely be present as soon as the power up sequence completes and will be indicated as an active fault, E208. An actual short allowing real current to flow in the pilot circuit will not occur until the inverter and pilot board are enabled near the end of preflow. This will result in the inverters immediately being shut off and displaying a "last" or "latched" fault, L208. An LED, D2, on the Pilot board lights when the Pilot Board is enabled.

## 1. 208 code before START applied:

- Defective Pilot board (current sensor circuit).
- Defective Relay PCB
- Defective CCM

## Pilot PCB

Pilot current signal is on the 10 pin ribbon cable (Pilot J42, Relay PCB J3) between pins 8 (-) and 9 (+). With no current, the signal should be zero +/- 0.05 V. Also the Relay board has an LED, D11, "Pilot Current Detected", which will light if the pilot current signal exceeds 0.15V. If the signal is not zero V. Pilot PCB is likely the cause. To be sure, disconnect the Pilot board ribbon cable from the Relay board at J3. If D11 goes out, the Pilot board was the cause. Double check by measuring pin 8 & 9 again. If it's zero V. now, the Pilot board is defective. If D11 is still on or pin 8 & 9 voltage still high check the Relay board.

## Relay Board or CCM

If D11 on the Relay PCB is still on after the previous tests, measure the output to the CCM on the 40 pin ribbon cable (Relay J4 to CCM J23) between pins 23 (-) and 25 (+). It should be less than 0.1V. If not, the Relay board is bad. If voltage is zero then the CCM is defective.

## 2. 208 code comes on during preflow:

IM#1 and the Pilot board are enabled near the end of preflow. To have unwanted current there must be a path (short) for current to flow between the inverter negative output (negative cable/torch electrode) and the Pilot return/tip before the arc starter is enabled for pilot ignition.

Possible causes are:

- Short between electrode and tip due to mismatch of consumables, damaged consumables or foreign matter between tip and electrode. An electrode at the end of its life may lose material that can short between electrode and tip.
- Defective or incorrectly installed user supplied equipment such as torch height controls that make connections to power supply output.
- Short between power supply negative output cable and pilot cable.
- Shorted torch body.

## Troubleshooting:

1. Remove and insulate (may have voltage on it) the pilot cable from the rear of the unit. Attempt to pilot. If no 208 code shows, it confirms problem is outside the power supply.
2. Remove and check consumable for damage, cleanliness and missing (gas dist, etc.) or wrong components.
3. Disconnect user supplied equipment and see if fault still exists.
4. Inspect Arc Starter for broken/disconnected wires or burnt components.
5. Inspect inside the torch mounting tube for shorts.
6. If all else fails disconnect the pilot wire from the back of the torch head. Insulate it well or keep it away from any metal, it may have HF (high frequency) on it when you try to start. Try to start, if the 208 is gone now the torch head is shorted.

209 Not used. Reserved codes from the earlier product.

### 210–211 Output current, measured by the work lead current sensor, is too high (210) or too low (211).

These are warnings and do not shut down the process but may explain poor cut quality or poor parts life.

Individual inverter sections have their own current sensors and the work lead has a current sensor whose signal should equal the sum of the individual inverter sections. Each section is set to output a certain current based on its "demand" signal. If the current differs from the total "demand", sum of the individual demands, the individual sections are checked to determine if their output is correct compared with their demand signals.

If the individual sections are correct but the work current sensor signal differs from the total demand by more than 16% code 210 (too high) or 211 (too low) is displayed.

If an individual inverter section was found to be in error causing the total current to be wrong, a different code would be displayed in the range of 212 to 223 depending on which section was at fault.

Possible causes for work current signal too high:

- HCT1 Work Current Sensor
- Relay PCB
- CCM

Possible cause for work current to low.

- All the above plus a short to chassis caused by:
  - User installed equipment connect behind the current sensor that makes a connection to work or earth allowing current flow to bypass work sensor.
  - Inverter + output shorted to chassis.

Troubleshooting:

1. For current too low due to a short disconnect work lead from back of unit. Check for continuity to chassis, there should be none. Inspect for incorrectly connected user equipment.
2. If no shorts were found or if fault was current signal too high see section on code 207 for detailed description of the power and signal paths for the work lead current sensor.
3. In the section on code 207 for Relay PCB it describes measuring the work current sensor signal when there is no current. The signal should be zero and we assume it is or else you should have gotten the 207 code. If the zero current signal is correct but there is an error while cutting, measure the signal on the 40pin ribbon cable (Relay board J4 to CCM J23) pins 27 (-) & 28 (+). The signal voltage should equal the cutting current \* 0.0266. For example for 100A ( $100 * 0.0266$ ) = 2.66V.
  - If this signal is correct the fault is the CCM
  - If it's not correct the error may be in the Relay board or sensor. Follow the instructions for code 207 to measure the voltage to and signal from the current sensor at J1 on the Relay board. The signal voltage should equal the cutting current \* 0.0133. For example for 100A ( $100 * 0.0133$ ) = 1.33V. For 400A would be  $400 * 0.0133 = 5.33V$ .
  - If power and signal are correct Relay board is faulty. If not correct the HCT1 work current sensor is bad.

### 212-223 Incorrect output from an inverter section.

Work current high or low due to wrong output from one inverter section. Individual code indicates which section.

Causes may be:

- The named inverter section output connector, J102 A or B, is not plugged in or is damaged.
- Ribbon cable with bad connection, perhaps not fully locked in place at either the inverter or the CCM.
- Defective inverter section.

Troubleshooting:

1. If it reports the current of an individual inverter section is too high, the problem is the inverter.

2. If the report is current too low (which included no current) check the connections.
3. The ribbon cable for the first inverter section (IM#1A) must connect to that section only but if there are 2 additional sections, unit is 200A or greater, swap the ribbon cable going into those sections.
  - a. If it now reports a different section as bad, the one whose cable was moved, then the original section was bad.
  - b. If it still reports the original section the ribbon cable or the CCM is bad (unlikely).
  - c. Swap both ends of the ribbon cable with one next to it. If still reports the original section then the problem is with the CCM if not then it's the ribbon cable.
4. If it's the first inverter section or it's a 100A unit so there's no other inverter to swap cables with, replace the inverter.

Additional hint: Inverter control PCBs have a green LED, D24, PWM ON, that lights when that section is enabled and has a demand signal. The LED brightness is relative to the output so may be very dim if output is low. If that LED doesn't light may indicate a defective inverter (control board).

#### 224 Inverter 1 not found.

There must be an inverter connected in the 1st section, 1A, to be able to pilot. During the power up sequence, before power is connected to the inverters, the CCM does a continuity test to see if its section 1A ribbon cable (J31 on CCM) is connected.

Causes & troubleshooting:

- As this is just a continuity test it is very unlikely to be a bad inverter. Most likely a poor connection or defective ribbon cable.
  - o Check ribbon cable connections at both ends of INV1A to CCM J31 (1A) cable. Make sure it is plugged into J31, the top connector, on the CCM.
  - o Plug a different inverter cable into J31, doesn't matter which one for this test as long as it's plugged into an inverter on the other end. If still gives 224, "Inverter 1 not found" fault, it's a bad CCM. Otherwise it's the ribbon cable.

#### 225-230 Inverter Revision and CCM incompatible.

If sometime in the future we should make a change to the inverter making it incompatible with older CCM we have included a hardware key that would change to indicate this. During the power up sequence, before power is connected to the inverters, the CCM does a continuity test to determine what is the hardware key configuration. The key uses 3 lines of the CCM to inverter ribbon cable which are named IS\_ID\_A, IS\_ID\_B, IS\_ID\_C (on pins 12, 13 & 14) and checks for continuity to a 4th line OUTCOM (pin 9). The test consists of applying voltage to OUTCOM and looking for that voltage coming back on the 3 ID pins. The present configuration has all 3 lines connected to OUTCOM so all 3 should be high.

To get the 225-230 code now when we don't have any incompatible revisions would most likely be a bad connection in the ribbon cable between the CCM and the inverter or a defective CCM (unlikely).

- On the inverter section swap the ribbon cable with that of a different inverter section. If fault remains unchanged, still calls out the original inverter section, the problem is with either ribbon cable or CCM.
- On the inverter end put the ribbon cables back in their original positions. Now swap suspect ribbon cable with another one on the CCM. If the fault now moves to a different section it's the ribbon cable. If it remains with the original section the problem is the CCM.

## 231-236 Inverter VAC Mismatch.

Different inverter modules are manufactured for 480VAC, 380-415VAC & 208-230VAC operation voltages. There is a key, called inverter ID, read through the inverter's ribbon cable, to identify which voltage range the inverter is designed for. The unit itself is wired differently for the different input voltages and part of that includes a jumper at J61 on the System Bias board that indicates to the System Bias board what voltage the unit is wired to accept.

At power on, the System Bias board measures the incoming voltage, determines what input voltage range it fall into and sends that range information to the CCM. Before Applying power to the inverters by turning on the input contactors, the CCM checks that each connected inverter is of the correct voltage matching that of the System Bias board. The inverter ID's are read from the lowest section to the highest so in all cases if it truly is a wrong voltage inverter it should call out the A section whose code is read first. A VAC mismatch of a B section is likely another problem.

Possible causes:

- Wrong voltage inverter (very unlikely but easy to check).
- System Bias board wrong J61 jumper (unlikely but easy to check)
- Defective inverter.
- Ribbon Cable
- CCM
- System Bias board defective.

Troubleshooting:

1. If System Bias board has either the wrong jumper or is defective it will call out the first inverter section, code 231, because all the inverters won't match the incorrect signal and 1A is checked first.
  - a. For the jumper Wire #48 should be connected from J61-1 to:
    - i. J61-2 for 208-230 VAC
    - ii. J61-3 for 400 VAC
    - iii. J61-4 for 480 VAC

Check for proper connection and continuity.

- b. System Bias may be defective reporting the wrong voltage ID. On the output of the System Bias board at J62 measure relative to TP1 or ( J62-8, 24VDC\_RET) to J62-12 for signal /VAC\_IDAb and J62-14 for signal /VAC\_IDBb. The 2 signals should read according to this table. "0" = 10-12V; "1" = 24V.

signal	230V	400V	480V	ERR
/VAC_IDAb	0	1	0	1
/VAC_IDBb	0	0	1	1

2. Defective inverter, ribbon cable or CCM.
  - a. On the inverter section swap the ribbon cable of the inverter section whose fault was indicated with that of a different inverter section. If fault remains unchanged, still calls out the original inverter section, the problem is with either ribbon cable or CCM. If fault changes to the different section, the one the ribbon cable was swapped with, then it's the inverter that's defective.
  - b. If the fault remained unchanged in Step A, on the inverter end, put the ribbon cables back in their original positions. Now swap suspect ribbon cable with another one on the CCM. If the fault now moves to a different section it's the ribbon cable. If it remains with the original section the problem is the CCM.

**237 Too Few Inverters Found**

There must be a minimum of 2 inverter sections present to operate. We know the ribbon cable for inverter section 1A is connected or else we would have code 224. During the power up sequence, before power is connected to the inverters, the CCM does a continuity test through the ribbon cable to see if an inverter is connected. If it doesn't see continuity with at least one other inverter it assumes none are connected.

Possible causes:

- Ribbon cable disconnected or defective.
- Inverter defective
- CCM defective.

Troubleshooting:

1. Check that all cables are connected, latches locked down, at both the inverter and CCM ends.
2. If this fault occurs it's most likely on a 100A unit which only has one section (1B) in addition to the 1A section. If there were 2 or more additional sections it's extremely unlikely all ribbon cables or CCM connectors would be defective.
  - a. Swap the ribbon cables of the inverter section 1A and 1B. If fault remains unchanged, still 237, problem is with either ribbon cable or the CCM. If fault changes from 237 to 224 indicating inverter 1A missing, then it's the inverter that's defective.
  - b. If the fault remained unchanged in step a., on the inverter end put the ribbon cables back in their original positions. Now swap suspect ribbon cables on the CCM. If the fault now changes it's the ribbon cable. If it remains the same it is the CCM.
  - c. If there are 2 or more ribbon cables in addition to the one on section 1A then CCM is seeing none of them connected which indicates the CCM is faulty.

**238 System Bias voltage identification is invalid.**

At power up the System Bias board measures the input voltage and sends signals to the CCM indicating which range of voltage it has detected. See section 231-236 for details. If one of the 3 voltage ranges, 208-230V, 380-415V or 480V isn't identified then both ID signals are high resulting in an invalid signal.

Possible causes:

- Unit is connected to voltage below the 208-230V range or above the 480V range. (unlikely unless there is a problem with the incoming voltage.)
- Defective System Bias board
- Bad connection between System Bias output J62 and CCM input J27 on the I/O board.
- Defective CCM

Troubleshooting:

1. Measure all 3 phases of the input voltage and confirm they are within the tolerance specified in the unit manual.
2. Refer to section 231-236 Inverter VAC Mismatch and perform troubleshooting in step 1.b. If the 2 signals don't match the incoming voltage, if both are high, then the System Bias is defective.
3. If step 2 was OK make the same measurement at J27 on the CCM I/O PCB. If OK here the CCM is defective. Otherwise inspect the connections at J62 and J27.

**239 AC Voltage High**

Voltage OK -- At power up the System Bias board measures the input voltage and determined if it is within the range of voltage set by the J16 jumper. See section 231-236 Inverter VAC Mismatch Troubleshooting step 1.a for details of the jumper. Normally when the input voltage is OK the System Bias board turns on a relay K1 on the left die of the board to apply power to the T1 Auxiliary transformer. D44, a green "Transformer ON" LED, will light when K1 is energized. T1 provides power to the gas controls and the TSC 3000 as well as the pumps and fans.

Voltage High -- If the AC voltage is determined to be too high it lights D4, ACV HIGH, a red LED on the System Bias board, and sets the signal "AC V HIGH b" on J62-6 to a "high" about 24VDC (normal for a "low" here is 10-14VDC). To prevent the possibility of excessive voltage applied to several items (gas controls, pumps, fans etc.) K1 is opened removing power from T1 and D44 goes off. If it's more than a momentary glitch the gas controls and the TSC 3000 (if used) will reset. Communication with the cutting table may be interrupted. With the DFC 3000 Auto Gas Control and perhaps the cutting table control, the process will have to be reloaded.

D4 is on and the signal "AC V HIGH b" is high only while the voltage is actually high. The signal "AC V HIGH b" does not latch on.

If the fault is E239 that means it is currently active, that is, currently detected as being too high. If it's L239 that means the voltage too high previously but it is not too high now. Applying START will clear the fault unless it becomes active again.

The voltage that triggers an AC Voltage High fault is above 550V for 480VAC line; above 470V for a 380, 400 or 415V nominal line; above 270V for a 208 or 230VAC line.

Possible causes:

- Incoming voltage is or was too high.
- Bad connection at J62 or J27
- Bad connection at J61 jumper
- System Bias board defective
- CCM defective.

Troubleshooting:

1. If the fault is L239 applying START will clear the fault unless it becomes active again. An occasional problem may be due to incoming voltage swells (voltage increases lasting from ½ cycle to as much as a minute). Usually, if the plasma is at fault the problem will be present all the time.
2. It is unlikely that an open connection on the J61 jumper would result in a 239 fault, more likely to be a Voltage Mismatch fault. However, if it's intermittent at exactly the right time, perhaps not fully plugged in, it could possibly show up as 239. Check J61.
3. If the incoming voltage is OK and the problem persists it may be the System Bias board, the CCM or the connection between J62 and J27.
  - a. If the incoming voltage is OK and D4 is on or signal "AC V HIGH b" on J62-6 is "high" (about 24VDC, relative to TP1 or J62-8 ) the System Bias board is defective.
  - b. If D4 is not on and the signal "AC V HIGH b" on J62-6 is "low" (about 10-14VDC, relative to TP1 or J62-8) then System Bias is OK and problem is in the CCM.
  - c. If J62-6 is near zero volts there may be bad connection between J62-6 and J27-6 or J62-7 and J27-6.

### 240 AC Voltage Low

Refer to the first paragraph for code 239 for explanation of what should happen when the input voltage is correct.

Voltage Low -- If the System Bias board determines AC voltage is too low it lights a red LED, D14, ACV LOW, and sets the signal "AC V LOW b" on J62-10 to a "high", about 24VDC (normal for a "low" here is 10-14VDC). Power is not removed from T1 as low voltage won't damage anything, However, if it's too low for too long, some things like contactors, AC solenoids, the gas controls or TSC 3000 may stop working. A low voltage, if it's low enough, may also light D3, the red Missing Phase LED. This does not indicate the phase is actually missing.

The voltage that triggers an AC Voltage Low fault is 380V for a 480VAC nominal line; 300V for a 380, 400 or 415VAC nominal line; 175V for a 208 or 230 VAC line.



Possible cause:

- Incoming voltage is now, or was previously, too low.
  - o Power distribution wires or power cord too small for the load.
  - o Loose or high resistance connection somewhere in the power distribution or power cord connection.
- Bad connection at J62 on the System Bias board or J27 on the CCM.
- Bad connection at J61 jumper on the System Bias board.
- System Bias board defective.
- CCM defective.

Troubleshooting:

1. If the fault is L240, applying START will clear the fault unless it becomes active again. An occasional problem may be due to incoming voltage dips or sags (voltage drops lasting from ½ cycle to as much as a minute). Usually, if the plasma is at fault, the problem will be present all the time. After ruling out everything else we may have to attach a monitor to the power input to determine if this is the problem.
2. Voltage can be OK when not cutting or cutting at lower currents but at higher current too much voltage may be lost due to undersize power cord or distribution wires.
  - a. Measure the voltage while cutting at higher current to determine if the drop is excessive.
  - b. Verify all power connections are clean and secure.
  - c. Verify correct wires size for the current draw per the recommendations in our manual as well as the local electrical codes.
3. It is unlikely that an open connection on the J61 jumper would result in a 240 fault, it is more likely to cause a Voltage Mismatch fault. However, if it's intermittent at exactly the right time, perhaps not fully plugged in, it possibly could show up as 240. Check the jumper at J61.
4. If the incoming voltage is OK and the problem persists it may be System Bias, CCM or connection between J62 and J27.
  - a. If the incoming voltage is OK and D14, ACV LOW, is on or the signal "AC V LOW b" on J62-10 is "high" (about 24VDC, relative to TP1 or J62-8 ) the System Bias board is defective.
  - b. If D14 is not on and signal "AC V HIGH b" on J62-10 is "low" (about 10-14VDC, relative to TP1 or J62-8) then System Bias is OK and problem is in the CCM.
  - c. If J62-10 is near zero volts there may be a bad connection between J62-10 and J27-10 or J62-7 and J27-7.

#### 241-246 Inverter Section Input Voltage Error.

The System Bias board checks for input voltage high, low or missing a phase from the power coming in from the power cord. It is unlikely but not impossible that a problem with the incoming power could result in 241-246 codes. The 241-246 codes more likely point to problems with the power into or within a single inverter section or in the case of missing phase it may be the contactor that supplies up to 3 inverter sections.

Once the input contactors close, applying voltage to the inverters, they test for input too high or too low and for missing phase. When the input voltage is in the correct range, a green LED, D4, named READY, lights on the left side of the main inverter board. If D4 is not on, either the input voltage is out of range or the inverter is defective.

You can still get the 241-246 code with a missing phase with the READY LED on. The LED will be going on and off rapidly but appears to the eye to be on. In this case you can measure the signal on the ribbon cable. The signal previously called READY is now called AC\_INPUT\_FLT. It is a differential signal on pins 1(+) & 2(-) of the inverters 30 pin ribbon cable. If the AC input is correct you should read 5-6V between the pins. If AC\_INPUT\_FLT is true voltage on pins 1 & 2 will be less than 2V.

Some of the other faults such as Inverter Fault and Over Temperature also set the AC\_INPUT\_FLT (not Ready). However, they will latch on associated LEDs or set different fault codes. In the event of an Input Voltage Fault the CCM does not remove power from the inverter.

Things that can cause Input Voltage Fault codes:

1. Intermittently having the power drop out on one or more phases for at least 1 ms. a longer term loss would more likely trigger a different fault. If it's the incoming power it would be likely not always be the same inverter.
2. Phase missing or intermittent to a specific inverter the fault would always call out that inverter.
3. Intermittent connections on the fault signal internal to the inverter.

## 247-252 Inverter Fault

Once the input contactors close applying voltage to the inverters several tests are performed. The Inverter Fault signal latches on so even if the cause has gone away you can see that there was a fault as indicated by red LED D1, INV FLT on the inverter Control & Fault PCB. It is reset by applying start signal or cycling power. If the fault is still present it will come back on.

Things that cause an inverter fault:

- One or more of the local bias supplies (+/-12VDC) failed or out of spec. Green LEDs on Cap Bias board labeled +12V (D13) & -12V (D6) indicate the supplies are present but not necessarily that they are in tolerance.
- Input capacitor voltage imbalance indicated by D3 CAP IMBALANCE LED (red) on left side of main inverter board. Applies to units with series connected capacitors (380-480V units).
- Too much current in the main transformer (switching transformer) primary, D32, PRI OC LED (red), on inverter control board.

INV\_FLT is a differential signal on pins 3(+) & 4(-) of the inverters 30 pin ribbon cable. If there is not a fault you should read 5-6V between the two pins. If INV\_FLT is true voltage on pins 3 & 4 will be less than 2V.

## 253-258 Inverter Over Temperature.

Each inverter section (IS) contains one or more temperature sensors. If any of these detect an over temperature condition it activates the signal "OVERTEMP\_FLT going to the CCM over the inverter sections ribbon cable. Inverters semiconductors (transistors and diodes) are liquid cooled. Anything that increases the coolant temperature too high can cause overheating of the inverters. The inverters magnetics (transformer & inductors) are air cooled by the same fan(s) that cool(s) the liquid.

Possible causes:

- Cooling fan(s) not operating.
- Disrupted air flow.
- Defective inverter module.
- Inverter Ribbon cable bad connection.
- Defective CCM.

Originally 100 and 200A units had 2 smaller fans while 300 & 400A used a single larger fan along with a larger radiator. More recently, the single larger fan may be used in the 100 & 200A as well. Replacement fans for all units are a single fan kit.

Troubleshooting:

1. Confirm that air is exhausting from both the top (top fan)and bottom (bottom fan of units with 2 fans) of the opening in the right side panel. As the fan(s) are behind the radiator it's hard to see them to confirm they are turning but perhaps you can use an inspection mirror. Refer to section for code 403 for troubleshooting defective fans.



*Fan blades can be moving and accidental contact with a mirror or other inspection devise can cause personal injury or damage to the machine.*



2. Leaving the side panels and cover off, especially the left lower side or the top cover will reduce the air flow. Also if the radiator fins become clogged with dust it will reduce air flow. Clean the radiator periodically by blowing air into it to clear dirt from the fins.

**259-264 Inverter Over Temperature due to high Ambient.**

The CCM measures the ambient temperature where the cooling air enters the louvers on the left side of the front panel. If an inverter goes over temperature and we have determined that the ambient exceeds 40 deg C we will get one or more of the high ambient codes, 252-264. The sensor, TS2, is a NTC (Negative Temperature Coefficient) resistor whose resistance varies with temperature. It is mounted on the inside of the front panel next to the louvers on the left. To access it requires removing one or more of the inverter modules. If the ambient is high but no inverter is too hot there is no fault.

Possible causes:

- Ambient is too high.
- Cooling fan(s) not operating.
- Disrupted air flow.
- TS2, Ambient temperature sensor, shorted (very unlikely) or otherwise defective.
- Defective Relay board.
- Defective CCM.
- Defective Relay board.

Troubleshooting:

1. If room temperature exceeds 40 deg C, cool the room, or operate the unit at reduced duty cycle or lower current.
2. Confirm that air is exhausting from opening in the right side panel. As the fan(s) are behind the radiator it's hard to see them to confirm they are turning but perhaps you can use an inspection mirror. Be careful not to get the mirror or your hands into the blades. 100 & 200A units have 2 smaller fans, 300 & 400A have one larger one.
3. It is unlikely these high ambient temperature codes would be set before some other temperature related code but just in case we'll note that leaving the side panels and cover off, especially the left lower side or the top cover will reduce the air flow. Also the radiator fins clogged with dust will reduce air.
4. To test TS2 remove J2 from the Relay board and measure the resistance between pins 4 & 6 of the J2 harness connector. The resistance varies from about 33K ohms at 0 degrees C to about 12K ohms at 20C to 5.3K ohms at 40C.
5. If TS2 is within the correct range the problem may be with the Relay board or the CCM.
  - a. The output from the relay board going to the CCM is on pin 30 of the 40 pin ribbon cable (J4 of Relay board to J23 of the CCM I/O board). It is an analog voltage that should range between 0.44V at 0 deg C to 1.6V at 40C. If it is confirmed that the room ambient is not above 40C and Ambient temperature signal at pin 30 is higher than 1.6V then the Relay board is defective.
  - b. If Ambient temperature signal at pin 30 is OK, less than 1.6V, and the room ambient is not above 40C then the CCM is bad.

**265-270 Inverter No Input Power**

There are several digital signals on the ribbon cables between the inverter sections and the CCM that involve some level of voltage. These include AC\_INPUT\_FLT\, INVERTER\_FLT\, OVERTEMP\_FLT\ and POWER\_PRESENT. Normally all of these should be high. Before power is applied to the inverter modules the CCM has already performed a continuity check to see if that section is in place and it's ribbon cable connected (code 224 & 237). As soon as power is applied to the inverter modules the CCM checks these 4 signals and, having already confirmed there is an inverter whose ribbon cable is connected. If it finds none of the signals have voltage, it assumes there is no power into the section or something is wrong with that inverter section's bias power.

Possible causes:

- The 3 input phases, J103-105 to that inverter section not connected.
- The circuit breaker CB2 providing the 120 VAC to the contactor (and Remote Arc Starter) has tripped.
- The contactor powering that section (and others) defective.
- Relay board defective.
- Inverter defective.
- CCM defective.

Troubleshooting:

1. Check that the input power cables are connected to the inverters.
2. Check if the contactor for that section (W1 for 1A, 1B, 2A; W2 for 2B, 3A, 3B) is energized.
  - a. There is a rectangular section in the middle of each contactor top that can be used to attach auxiliary contacts. This can also be an indicator of contactor operation as it pulls in when the contactor is energized.
  - b. Check for CB2 on the rear panel being tripped. The white button marked "5" indicating it's 5 amps, will pop out if tripped. Reset it and if it pops out again something (contactor coil?) may be shorted.
  - c. Measure for 120 VAC on the contactor coil. If present, but the contactor isn't pulled in, it's probably a defective contactor.
3. On the Relay board D22, CONTACTOR ON LED (green) next to relay K1 lights if K1 is being told to energize.
  - a. If it's on check for 120 VAC between J8-1 and J8-9. If present the relay board is OK.
  - b. If D22 is on but 120 VAC is not present at J8-1 and J8-9 (make sure meter is set for ACV) then the relay board is defective.
  - c. D22 is not on, go to the 40 pin ribbon cable test connector and measure voltage on pin 17 (relative to TP1 on either the Relay board or the CCM I/O Board). It should be low, less than 1 volt. If it is the relay board is likely bad. If it's high, about 24VDC then the CCM may be bad, not telling the contactor to turn on.
4. The inverter section may be defective with a bad bias supply. Swap the inverter end of the ribbon cable with one next to it.
  - a. If it now reports a different code, that of the inverter that was swapped with, then the original section is bad.
  - b. If it still reports the same section even though the ribbon cable was swapped then the CCM is bad.

## 271 Inverter ID Reading Fault.

Refer to section for codes 225-230 for a description of the ID signals. If this code appears it means one of these ID signals has gone false some time after power up.

Possible causes:

- An intermittent ribbon cable or one not fully latched in place.
- EMI interference.

Troubleshooting:

1. First recycle power to see if the fault is still there. It may now show up as one of the 225-230 codes which will indicate which inverter.
2. Determine when the code shows up. If it is EMI it may not happen every time but if, when it happens, it is always at the beginning of piloting, it may be EMI interference. Check the system ground cables and if an AC200XT check the torch shield connection to the unit rear panel.

3. If it happens intermittently during cutting or idling it might be an intermittent ribbon cable. This code does not say which inverter section so you have to check each ribbon cable for proper connection on each end. It's highly unlikely for a ribbon cable to be intermittent but if you have more than 2 sections try disconnecting one section at a time and cut at lower current. See if you find one that causes the problem and if so replace that ribbon cable.

### Group 3 codes relate to the GAS Controls Status and Communication Protocol

Also refer to GCM 2010 Status Codes at the end of this Group 3 codes section.

#### 301 Gas Control Communication Fault

No signal detected over the fiber-optic link from the gas control. In the case where there are additional devices other than Gas Control connected to the CANBUS this code would indicate the Gas Control is having communication problems while the other CANBUS devices are OK. We don't currently have any other devices on the CANBUS so it is more likely that code 501 will be what is set. In any case troubleshooting is the same as for 501.

Possible cause:

- Most likely cause is dirty or defective fiber-optic cable or connector.
- Cable to GCM 2010, DMC or DPC not connected or broken.
- Defective control board or power supply in the Gas Control
- Defective CCM

Troubleshooting:

1. Check that the fiber-optic cable is fully plugged in to both sockets. Clean the cable ends with a soft cloth and blow out the sockets with air.
2. Check gas control cables. If any of the gas control cables are not connected there will be no communication as there will be no power to the control. This may show up as a 301 or 501 code. Also if the cable is broken or defective such that the gas control is not enabled it may have power but in the case of the DMC or DPC its fault light will blink error 101 while the CCM will only detect that there is no communication and it will show 301 or possibly 501.

#### 302 Gas Control communications reply fault

Communication has been established but Gas Control did not reply to a request from the CCM in the time allowed. Likely cause is Fiber-optic problems (see code 501) or if problem persists defective Gas Control main PCB.

#### 303 Gas Pressure fault

Gas pressure faults only show up when you try to start the torch, not during purging or setting flows .

With the Auto-Cut 200 XT and the Auto-Cut 300 XT (GCM 1000 XT), the gas pressure sensor is only on the plasma gas and is in series with Run/Set switch. A 303 code here indicates either plasma gas missing or very low pressure, less than 50 PSI, or RUN/SET switch is in SET position.

Starting with GCM2010 revision AG we measure inlet pressure of both plasma and shield gas at the inlet of the gas selection manifold. If pressure is either too low or too high it sets 303 code. Earlier revision should not display 303 code. GCM2010 will display which gas is the problem and its actual pressure. The pressure at the point where it is measured should be in the range of 100-135 PSI. Exception is for shield gas if the Gas switch is set to Pressure then the min pressure can be 85 PSI.

In the GCM 2010 Gas Control, on the main PCB, measure between test points TP1 (ground) and TP18 (shield) and TP19 (plasma) to measure the output of the pressure sensors. Voltage should be between 2.6V to 3.5V for 100-135 PSI. With shield switch set to pressure low limit is 2.1V. Whichever gas is outside those limits will be the one causing the fault. Remember the pressure may drop during operation, set the code, then recover displaying L303 when you are measuring it.

- To test for faulty pressure sensor or inadequate gas supply with too much restriction. On the GCM 2010 place the Mode switch to SET Plasma & Shield, turn the mechanical pressure regulators to max pressure and compare mechanical gauges with the pressure display. If the pressure display doesn't approximately match the gauge the sensor is likely defective. If the gauge and the pressure display both show low pressure the supply to the gas control has too much restriction. Perhaps the hose is too long or too small.

## 304 Gas Control not ready

This is the normal code when the gas control is conducting a purge at start up or when the process is loaded or changed or when the plasma system has been disabled and is returned to "Enable". If it is a GCM 2010 the Mode switch may not be set to the RUN mode.

Code 304 combined with 204 & 402 when the Plasma Enable on the GCM 2010 gas control is set to disable can indicate a fault in the CCM I/O PCB. When switching back to Enabled the pump will not restart so continues to display 4-2 indicating no coolant flowing.

Normally the code during a disable should be 101. Circuits on the I/O PCB detect the Plasma Enable is disabled and send signal to the microcontroller in the CCM. If a fault in the CCM prevents that signal from getting sent to the microcontroller it doesn't know the system is disabled so it sets these other 3 codes.

## 305 Gas Control Protocol Error

Application error or firmware incompatibility fault. Consult factory for latest firmware update. Possible electromagnetic interference from the Arc Starter; inspect grounding, bonding, and isolation.

## 306 Not Used. This is one of the reserved codes from the earlier product.

## 307 Gas Control returns wrong command sequence.

Firmware incompatibility. Consult factory for latest firmware update. Possible electromagnetic interference from the Arc Starter; inspect grounding; bonding; and isolation.

## 308 Mismatch between the CCM and gas control type.

The Auto-Cut XT CCM is designed to work with the GCM 1000 (AC 300 XT) or the built in gas control of the AC 200 XT. Attempting to use a GCM 2010 or DFC 3000 Auto Gas Control on an Auto-Cut will result in a 308 code. Similarly attempting to use a CCM from an Auto-Cut XT in an Ultra-Cut XT supply will also result in a 308 code.

## 309 Gas Control Communication reply fault.

Relay doesn't match what was requested. Possible firmware incompatibility. Consult factory for latest firmware update.

Possible electromagnetic interference from the Arc Starter; inspect grounding; bonding; and isolation.

## 310-313 DFC 3000 Auto Gas Faults.

These different codes displayed on the power simply indicate one of the Auto Gas modules (DPC for codes 310 or 311; DMC for 312 and 313 could be either) is reporting a fault. You need to refer to the specific modules blinking red LED status indicator and the Status code tables for more information.

## GCM 2010 Status Codes

GCM 2000 has an LED on the front panel which blinks various codes.

GCM 2010 has LCD display which displays many of the Status messages. However, there are a few relating to communications that aren't clear.

When there is a communication error it will be displayed but once it has recovered the display will show what the error was by displaying:

^E4 – Low level CAN bus error where the CCM did not acknowledge receiving a message from the Gas Control.

^E5 – Low level CAN bus error where the bus is off.

^E6 – CAN bus communication (the fiber-optic) has timed out.

## Group 4 codes relate to the Liquid Cooling System

Cooling system description. System includes a reservoir, a pump, one or more heat exchangers, flow switch, level switch and flow sensor on some models. Also included are a filter and various fittings and hoses. New coolant is installed into the reservoir or “tank” from an opening in the unit’s front panel where there is a visual level indicator. Coolant flows to the pump inlet from the bottom of the tank, is pumped through a pressure relief or “bypass” valve which limits MAX pressure to 150 PSI bypassing excess flow back into the reservoir. The coolant temperature sensor, TS1, a linear NTC sensor, is mounted on the bypass valve.

From the bypass valve in most systems coolant is plumbed to the rear panel coolant supply fitting where it goes to the torch via the RAS 1000 XT, the remote arc starter, The UC 400 XT had an additional external heat exchanger, the HE 400XT in the supply line between the power supply and the remote arc starter. In the AC 200 XT with built in arc starter coolant goes to the water cooled HF (high frequency) coil and then to the torch supply lead attached to the internal torch connection bulkhead. Coolant from the Torch returns to the RAS and on to the return fitting on the rear of the power supply. For the AC 200 XT return is to the torch bulkhead built in to the unit. Coolant returning from the torch is routed through the rear panel filter then through the radiator (internal heat exchanger) and through the flow switch. Ultra-Cut models also have a flow sensor in series the flow switch that can detect bubbles in the coolant. Upon leaving the radiator, coolant goes into the bottom inverter “cold plate” or liquid cooled heat sink. It flows through the inverters in series and returns to the tank. detect bubbles in the coolant. Upon leaving the radiator, coolant goes into the bottom inverter “cold plate” or liquid cooled heat sink. It flows through the inverters in series and returns to the tank.

### 401 Coolant Level Low

The coolant reservoir (tank) has a normally open (tank dry) float type level switch, LS1. When the coolant level in the tank is below about ½ full this fault will signal the need to add coolant. It will not stop the process during a cut but will instead show the 405 fault as a warning. As soon as the cut stops it will not allow another to start until the issue is corrected.

Possible causes:

- Coolant is low
- Level switch defective, disconnected or installed upside down.
- Relay board defective or J7 disconnected.
- CCM defective.

Troubleshooting:

1. Confirm visually that the level switch float is below the coolant, if not add more coolant to the tank.
2. Check J7 on the Relay board.
  - a. If properly connected remove J7 and check continuity between pins 2 and 4 (pins 2 & 3 of J71 on the switch itself).
  - b. If no continuity at J71 on the switch, if it is still open, replace the switch.
3. If there was continuity at J7 plug it back in and measure voltage on pin 9 of the 40 pin ribbon cable (Relay board J4 to CCM J23). Common is TP1 on either the Relay or the I/O board.
  - a. Pin 9 should be high, about +10 to +15V. If it’s not the relay board is bad or the ribbon cable is shorted.
  - b. To test the ribbon cable remove both ends, J4 on the Relay board and J23 on the I/O board and measure from pin 9 of the ribbon cable to both pin 8 and pin 10 of the cable. Both should be open. If not replace the ribbon cable. Otherwise it’s the Relay board.
4. If pin 9 of the 40 pin ribbon cable was high in step 3.a the CCM is defective.

## 402 Low coolant Flow

The flow switch FS1 is positioned in series with the radiator where it measures the flow returning from the torch. The flow switch serves two purposes, one to insure there is adequate flow for cooling needs and two, it insures the torch consumables are in place so the negative output of the power supply is not exposed. This function is called "Parts in Place" or PIP. The output cannot be enabled if parts are not in place. The normally open flow switch requires 0.7 GPM (2.65 liter/min.) +/- about 10% to close. PAK 200i uses a different flow SW set for 0.25 GPM (0.95 65 liter/min.).

When the system is turned on and enabled and fails to achieve proper coolant flow after 4 minutes code 404 will be set. Getting code 402 means it initially had enough flow but something has caused the flow to be reduced. Listed here are things that might happen during cutting to cause reduced flow. For other causes like component failures refer to code 404.

Possible causes for low flow:

- Coolant filter clogged.
- Defective O-ring in XT torch check valve.
- External pump bypass valve incorrect adjustment or defective. Call the factory for instructions.
- Defective pump.
- Coolant supply or return hose twisted or pinched reducing flow.

If coolant flow is not low but code is being set, possible causes:

- Flow switch disconnected or defective.
- Relay PCB.
- CCM.

Troubleshooting:

1. First note whether the fault is an "E" meaning it's currently low or an "L" meaning it was low but isn't now. Flow that remains low could indicate a failed component or a blockage such as clogged filter or pinched hose. It also means you should be able to measure the flow to determine if it is really low or the sensor has a problem.
2. First recycle power. If flow is still low or a component is defective the code should change to 404. Go to that section for further troubleshooting.
3. If after recycling power there is no code, continue cutting to see if it occurs again. Take note of when it occurs, for example if it's with the torch at one end of the table, perhaps the leads get pinched there? In any case go to code 404 section for more information.

## 403 Coolant overheated.

TS1 is a linear negative temperature coefficient (NTC) resistor sensor attached to the brass fitting at the exit of the bypass valve. Here we determine the coolant being supplied to the torch is below the required temperature which is currently 75 deg C (167F). The radiator is on the lower right side of the unit. The fan is behind it and blow out through the radiator.

Fans operate during cutting and for 4 minutes after last cut then shut off. Exception is AC 200 XT where the fans are on whenever power is on. The external heat exchanger, HE400, fan is thermostatically controlled so it only comes on when coolant is over 60 deg C. It will shut off when the other fans shut off.



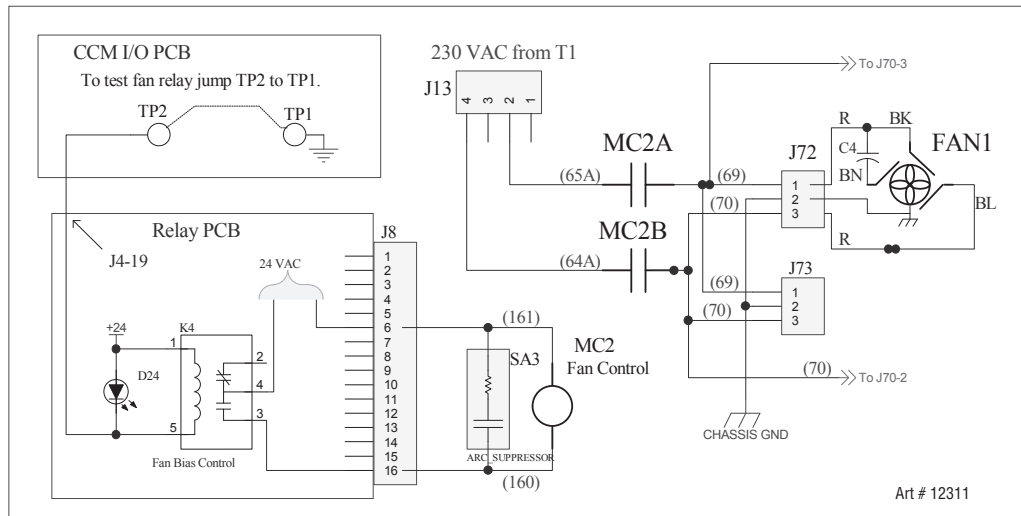
Possible reasons for coolant overheated:

Coolant fan(s) failed or defective fan control relay MC2.

- Radiator fins clogged with dirt.
- Duty cycle exceeded (ambient temperature above 40 deg C and operating at high duty cycle).
- Operating with an object placed in close proximity to the air outlet (right side of the unit) or the front panel inlet openings.
- Operating for extended time with right lower side panel removed.
- Defective Relay board.
- Defective CCM.

Troubleshooting:

1. Check for air blowing out of the unit. Remember, except for the AC 200 XT, the fans only run when CNC START is applied and for 4 minutes after cutting, you may have to apply start again to restart the 4 minute time. Fans may be forced on by jumping TP2 on the CCM I/O board to TP1 (ground).
  - a. If using the external HE400XT heat exchanger, optional for 300A, standard for 400A, check for air blowing out of it. Note that the HE400XT fan, controlled by a thermal switch in the HE400XT, only runs if the coolant is over 60 deg C and the internal fans are operating. With the 100 & 200A if it has 2 fans make sure both fans are operating by checking for air both top and bottom of the opening. The fans are difficult to see, perhaps you can use an inspection mirror. Be careful not to get the mirror or your hands into the blades.
2. Fans are powered by 230 VAC. The 230 VAC for the fan(s) is switched by the MC2 control relay (except the AC 200 XT where the fan(s) is powered directly from the T1 transformer at J13).



3. Check for 230 VAC at either of the fan connectors, J72 & J73. It may also be measured at the rear panel connector J70 for the HE400XT fan.
  - a. If the fans are not getting 230 VAC, measure for 24 VAC on the coil of MC2. If present and the relay contacts aren't closed the relay is defective. Note, the coil is rectified so you won't measure continuity of even a good coil.
  - b. If 24 VAC is not on the MC2 coil check for D24 on the relay board being ON. If it's on, the Relay board should be providing the 24 VAC so if it's not the Relay board must be defective.
  - c. If D24 is not on, measure on the CCM I/O board between TP2 and the common at TP1. It should be low, near zero volts. If not the CCM is probably defective. Jumper TP2 (I/O board) to TP1. If the fans now come on replace the CCM.
  - d. If jumping TP2 to TP1 does not turn the fans on then the Relay board or the 40 pin ribbon cable pin 19 is at fault.

## 404 Coolant System Not Ready

When power is applied to the system with External Plasma Enable satisfied and Plasma Power Supply Enabled (switch on 2010 or TSC 3000), assuming there is enough coolant in the tank, after some initial tests taking about 15-20 seconds (see manual section 4 for details of the Start-Up Sequence) the pump will start. Coolant will be pumped through the system. Flow is measured by the FS1 flow switch placed in the torch coolant return path just before the radiator (see plumbing diagram). If the flow doesn't reach at least 0.75 GPM (2.8 lpm) within 4 minutes it will set the 404 fault. The reason for the 4 minutes is a new dry system especially one with long torch leads will take some time before the leads, hoses, radiator and cold plates are full of coolant. More coolant may have to be added. On a system that has been run before it normally takes only a few seconds to establish proper flow. In any case the pump will run for 4 minutes before setting the 404 fault.

First determine if the pump motor is running and if so is there any coolant flowing. With the right lower side panel removed touch the pump and feel for vibration to indicate if the motor is running. Observe the clear coolant hoses to see if they are full of coolant. There are two hose fittings on the back of the tank. The upper one is the coolant return. Remove the tank filler cover. You should see a fairly strong stream of coolant from that fitting. The lower fitting is from the pump bypass valve. If the pump is operating some coolant may be exiting that fitting as well. If these fittings are below the coolant level you may have to drain out some of the coolant to see this. If a strong stream is exiting the bypass (lower) fitting but nothing from the upper fitting, you probably have some kind of blockage.

Reasons for 404 faults (Coolant not flowing):

- In new installation, coolant has not circulated all the way through the leads. Add more coolant if necessary and recycle the power to restart the pump and 4 minute timer.
- Coolant supply & return leads are reversed, check valve in torch coolant return prevents reverse flow.
- Torch parts removed or are wrong style so torch check valve shuts off flow.
- Torch coolant tube damaged or the tube extension (if required) missing.
- No power to pump motor.
- Pump/motor failure.
- Bypass valve defective or adjusted incorrectly.

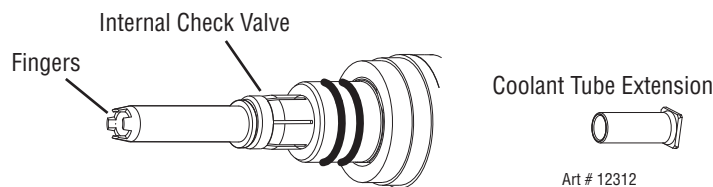
### Damaged Coolant Tube

Coolant tube includes a check valve at its upper end. When cartridge with consumables is not installed the spring loaded coolant tube is fully extended closing the check valve preventing coolant from leaking out.

When consumables are in place they push the tube inward, opening the check valve, allowing coolant to flow. The coolant tube has fingers on the end to contact the inside of the electrode and allow coolant to flow through the openings between the fingers.

The fingers can be bent over or broken if reasonable care is not taken when the cartridge is not in place. If the fingers are bent or broken it shortens the tube so the consumables may not push the tube in enough to open the check valve resulting in no coolant flow. The coolant tube assembly may be replaced separately from the torch head.

Some consumables use an extension on the coolant tube. A missing extension will not allow the check valve to open.

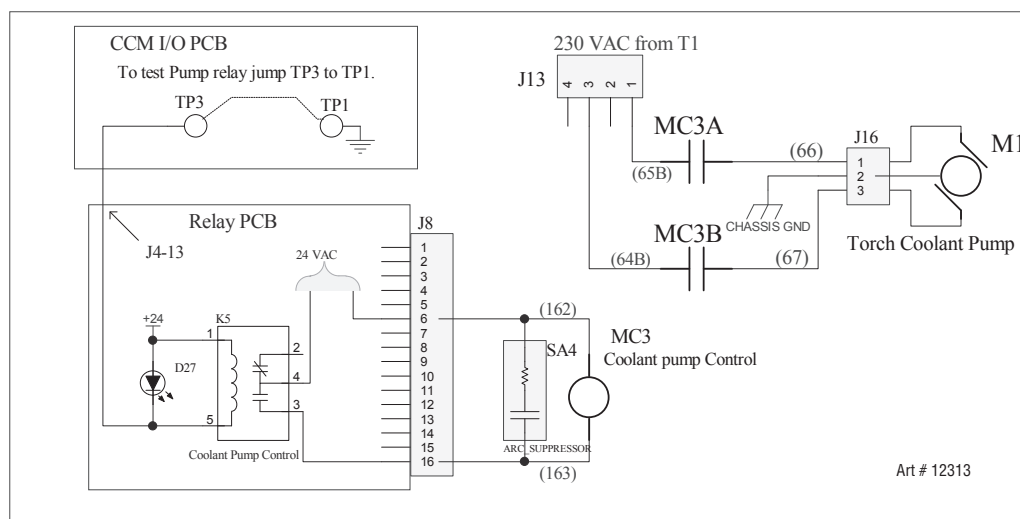




**No Power to the Pump Motor**

The pump motor is powered by 230 VAC controlled by the MC3 control relay. During the 4 minutes after turning on power, before the 404 fault code is displayed, measure for 230 VAC at the motor connector J16 pin 1 to pin 3.

- a. If the pump motor is not getting 230 VAC, measure for 24 VAC on the coil of MC3. If present and the relay contacts aren't closed the relay is defective. Note, the coil is rectified so you won't measure continuity of even a good coil.
- b. If 24 VAC is not on the MC3 coil check for D27 on the relay board being ON. If it's on the Relay board should be providing the 24 VAC so if it's not the Relay board may be defective. Measure for 24 VAC at J9-6 to J9-12 on the Relay board. If 24 VAC is present and D27 is on, the Relay board or the wire harness is defective.
- c. If D27 is not on, measure on the CCM I/O board between TP3 and the common at TP1. It should be low, near zero volts. If not the CCM is probably defective. Jumper TP3 (I/O board) to TP1. If the pump comes on now replace the CCM.
- d. If jumping TP3 to TP1 does not turn the fans on then the Relay board or the 40 pin ribbon cable pin 13 is at fault.



Coolant flows but flow is less than the required minimum:

Test and adjust the pump/bypass valve:

This test measures the “dead head” or blocked flow pressure at the rear panel coolant supply fitting. Perform this test only after the coolant system is fully primed, that is after the coolant is circulated throughout the system and is mostly free of bubbles. It requires a pressure gauge with #6 JIC fitting.

The gauge needs to be able to read at least 173 PSI. Remove the coolant supply hose and connect the pressure gauge in its place. For the Auto-Cut 200 XT connect the gauge in place of the torch coolant supply hose on the torch connection bulkhead. This is a #5 JIC fitting.

**NOTE:**

*Do not put the gauge in-line and attempt to pinch off the hose to block the flow. It is very difficult to totally block the flow and failure to do so will result in incorrect setting of the bypass.*

Turn the on the unit. You will have 4 minutes to perform the test/adjustment before the system times out with a coolant flow fault. If that happens recycling the power gives you another 4 minutes.

1. The pressure on the gauge should be close to 173 (170-175) PSI. If it is the pump and the bypass are OK.
2. If the pressure is less than 173 PSI adjust the bypass screw clockwise to raise the pressure. If you can change the pressure with the bypass screw but cannot reach 173 PSI it is likely the pump is worn out or damaged. If the pressure does not change using the bypass screw it is likely the bypass is defective.
3. If the pressure is above 173 reduce the pressure by adjusting the bypass valve screw counter clockwise.

## Coolant flow test:

In addition to the pressure test or in place of it if you don't have a gauge, determine if the flow returning from the torch (the flow that passes through the FS1), is greater than the required minimum. With the unit switched off remove the return hose from the back of the power supply. Place it in a container of a known volume. Turn the unit on and let the pump run exactly 30 seconds. It should pump at least 3/8 gal. (1.4 l). Use a larger container in case the flow is greater and it overflows.

If the flow is lower than 0.75 GPM (0.25 GPM for PAK200i):

- Look for restrictions such as sharp bends or something pinching the coolant hoses or torch leads.
- Other possibilities are the bypass valve has been adjusted wrong (someone may have turned the adjustment screw) see pressure test/adjustment above
- The pump is worn out (may be the case with an older unit).

Coolant flow is correct but system doesn't detect it due to defective components:

- Defective or disconnected FS1 flow switch.
- Relay board.
- CCM.

Flow Switch FS1 disconnected – FS1 comes with wire about 1 ft. long and a connector that connects to a 3 wire harness. This could be disconnected at either end, J74 or J5 on the relay board.

Defective FS1– The flow switch, normally open, closes when flow through it exceeds 0.75 GPM, could be open. Easiest place to measure the switch is at the J5 harness connector that plugs into the Pilot board. Assuming you have previously determined flow is sufficient, disconnect J5 from the Pilot board, start the unit so the coolant is flowing and measure continuity between the 2 pins of J5.

- If there is no continuity either the switch is open or the harness between J5 and J74 at FS1 is open.
- If there is continuity between the J5 pins with sufficient coolant flow then either relay board or the CCM is faulty.

## 405 Low Coolant Level Warning

If the coolant level becomes low while cutting it is not necessary to immediately stop the cut as there is still enough coolant to continue so we display E405 as a warning. Once the cut stops if the coolant is still low the display changes to E401 and prevents starting another cut. Refer to the section for code 401 for troubleshooting.

## 406 Coolant Flow Low Warning

This code is a warning, it does not prevent cutting but if it persists the cause should be investigated. Ultra-Cut XT units, in addition to a coolant flow switch, include a turbine flow sensor FL1, referred to in the plumbing diagram as a "bubble sensor", with a pulse output that accurately measures coolant flow and in addition can detect the presence of gas bubbles in the coolant. Gas bubbles from leaking seals in the torch or hose fittings have been proven to reduce consumable life. This code is a warning, it does not prevent cutting but if it persists the cause should be investigated.

## 407 Coolant Overheated due to High Ambient

As described in the section for codes 259-264 the CCM measures the ambient temperature using sensor TS2 and, like with the inverters, if the coolant is over temperature we first check the ambient and if it is above 40 deg C we attribute the cause of the coolant over temperature to high ambient and of course the solution is to lower the ambient or reduce the duty cycle.

The other possibility is the ambient measuring circuit is defective and the coolant is overheated. In that case you would have to go to the section for code 403 to find the cause of the coolant overheating and go to section for codes 259-264 to determine what is wrong with the TS2 circuit.

## The 5 Group relates to CANBUS (Fiber optic) communication errors

### 501 CANBUS Failure to Acknowledge fault.

The CCM communicates with the gas controls (except GCM 1000 XT) over a fiber-optic cable using the CANBUS protocol. The CCM is looking for a signal from the gas control (GCM 2010 or DMC) over the fiber-optic link. No signal has been detected. Communication with the DPC which is relayed through the DMC sets a different code, 301, if there is a problem with it.

Possible causes:

- Gas control is GCM 1000 XT (Auto-Cut 300XT) which has no fiber-optic, with Basic ID problem.
- CANBUS / Fiber-optic problem to either the GCM 2010 or the DMC (part of DFC 3000).
- Control Cable to DMC or GCM 2010 defective.
- Gas control (DMC or GCM 2010) main PCB blown fuse or defective.
- DMC power supply PCB blown fuse or defective.
- CCM defective.

Troubleshooting:

1. GCM 1000XT (also called a Basic Gas Control) does not use CANBUS (fiber-optic) communication. A jumper in the gas control connector J56 pins 8 & 9, gives the signal "Basic ID" telling the CCM not to expect any CANBUS. If somewhere this circuit is open, in the Gas Control cable, connector pins, connection from the rear panel GCM connector, J55, to the CCM (J26) CCM will expect to see a CANBUS connection and report this error because there is no CANBUS connected.
2. DFC 3000. If the gas control does not have power it will not communicate. Check for power to the gas control boards.
  - a. When using Auto Gas (DFC3000) with DMC & DPC if there is no power to the DMC main board, the green power light on the DMC front panel will not be lighted. The main board receives several voltages from its separate power supply board. For communication it needs +5VDC. There is a green LED, D17 (first on the left of the row of LEDs.) that lights when the main board has +5V power.
  - b. The DMC power supply board has several blue LEDs that light when it has power. If none of these are on check for the control cable being connected or the circuit breaker, CB2, on the plasma supply rear panel may be tripped in which case there is probably a short somewhere.
  - c. The DMC power supply which supplies several voltages could be missing one or more and still have some blue LEDs lighted. Check for voltages.
3. GCM 2010.
4. CANBUS / Fiber-optic communication errors can be difficult to troubleshoot, especially when they are intermittent. See "Test the Fiber" below. Things to look for are:
  - a. The connectors not locked in place at either end of the fiber.
  - b. The fiber is damaged or bent sharply. This should not be the case if the fiber is inside the protective hose and the hose properly secured in the strain relief but that is not always the case.
  - c. Dirt on the ends of the fiber or in the receiver/transmitter where the fiber plugs in. Blow out gently with clean dry air such as is used to clean a camera lens.
  - d. Excessive electrical interference. While the fiber is immune to EMI it can bother circuits at either end. Check that all the grounding connections are connected per the manual and are clean and tight. Check the resistance of the ground rod (with all wires disconnected from it). It may have increased due to dryer weather conditions. See the instructions in the Plasma Installation manual.
  - e. Defective receiver/transmitter or other circuits on either CCM or Gas Control main board. Otherwise replace either (or both) Gas Control main board or CCM.

Transmitter / Receiver Tests. The transmitter/receiver pair on the PCB and the fiber cable looks like this:



Test the fiber:

Note that the fiber goes from black on one end to blue on the other. Shine a bright light into one end and you should be able to see light from the other end. This tells you the light is getting through but doesn't prove it is strong enough.

The CCM is the communication master. It transmits then expects a reply from the Gas Control Module (GCM). The GCM does not transmit on its own, only in response to a request from the CCM.

The black end of the fiber cable is inserted into the transmitter which is the gray housing on the PCB. The other end of the transmitting fiber is blue and goes into the receiver with the black housing.

A few seconds after power is turned on and when the pump has started up the CCM will try to transmit continuously for a while. You can unplug the fiber from the CCM and should see the transmitter red LED on the CCM PCB blinking. It may stop after a while so recycle power before deciding it isn't working. If no light, check one of the other transmitter/receiver pairs. If none of them blink the problem is in the CCM.

If at least one transmitter blinks plug the fiber back into that one then at the Gas Control end of the fiber (unplugged) you should see the red light coming out of the blue end.

The Gas Control transmitter does not transmit except in response to a request from the CCM so you will not see any light from the GCM transmitter with the cable unplugged. However, if you turn the connector 90 deg and insert the blue end into the receiver (black housing), leaving transmitter open, then the GCM should receive the requests from the CCM and should blink it's transmitter (gray housing) in response. If not, problem is likely on the GCM board assuming it has power.

It is still possible even though you see the red light coming out the GCM end of the fiber that dirt in the transmitter or receiver or on the fiber ends or the fiber is damaged so the light even though visible is not strong enough for the GCM board. If all else fails replace the fiber cable and both CCM and GCM PCB.

## 502 CANBUS off due to excessive errors.

See 501 code for troubleshooting CANBUS faults.

## 503 CANBUS Data Error Warning.

This is a warning, does not shut the system down but is an indication that it probably will shut down soon (502 code). Troubleshooting is same as for 501.

## 504 Reserved for future use.

Should not get this but if it happens may be due to EMI. Contact customer service.

**Group 6 codes relate to the CCM and program updates. One exception is 619 which is a coolant flow switch FS1 fault.**

#### **601-611 Various CCM CPU board internal faults.**

For most of these faults try recycling the power but if the problem returns only thing to do is replace the CCM. Exceptions are:

1. 603 This is one of the reserved codes from the earlier product. Not used so it should never appear, if it does contact customer service.
2. 607 Processor over temperature could occur if the ambient in the area of the CCM is too high. Try opening the upper right side panel, perhaps blow some air to cool it off. If that doesn't help or the ambient was not too hot to begin with, replace the CCM.
3. 611 Code has various causes most of which require replacing the CCM. However, one possible cause is the programming jumper on the CPU board (under the Static suppression PCB) has been left in the PROG position. This is a factory setting used during initial programming and should never be found in the field. It is NOT used for application code updates However, if someone did move it 611 will be the result.

#### **612 USB port power fault.**

USB port supplies +5V to power some USB devices such as the flash drive (thumb drive, memory stick), used for program updates. A flash drive is the only device currently being used with this USB port. This fault detected no or low voltage to the port. This could be a shorted flash drive or some other device that draws too much current exceeding the limits of the USB power supply.

Try another flash drive or if you know this one is OK (it works with a computer), then replace the CCM.

#### **613 USB Log File Creation Fault**

When updating the CCM, DMC and DPC programs from a flash drive, a log file called CCM\_LOG.TXT is created on the flash which reports on the results of the update including any problems. If that log file can't be created you get 613. This may be a problem with the flash drive having too many other files on it or a problem with its format that may not be compatible with the CCM.

1. Try putting the update files on a different, preferably empty, flash drive.
2. Or save all the flash drive files in another place on your computer, then delete all the files on the flash drive. Now copy onto the flash drive only the files required for program updates.
3. If the above doesn't work, making sure you still have copies of the files, format your flash drive which erases everything on it. Now load only the files required for program update.

#### **614 No USF File**

The file VTCCMFV.USF is required on the flash drive along with the program files when performing a program update. If it's either missing or corrupted the display will show b614. The "b" indicates the fault is generated by the Bootloader program rather than the normal application program code. Note that each new revision of the program files is supplied with a new VTCCMFV.USF. Even though the name is the same it requires the new version of this file that is supplied with the application code.

1. Install the correct VTCCMFV.USF on the flash drive.
2. If you already have the correct version of VTCCMFV.USF perhaps the flash drive is the problem. Follow the instructions for code 613.

#### **615-617 No Update File for CCM, DPC or DMC found**

Program files for the CCM, DMC & DPC may be updated through the plasma supply's USB port. The GCM2010 is updated by other means. For a unit with GCM 2010 the CCM may still be updated using the USB. Program update files are in the format Cx\_x\_0.S (CCM); Mx\_x\_0.S (DMC) and Px\_x\_0.S (DPC).

If the Bootloader finds there are 3 devices, CCM, DMC & DPC on the CANBUS but the flash drive doesn't have all 3 update files it will go ahead and update those it has but will show a code indicating that one or more are missing (615 for CCM; 616 for DMC; 617 for DPC).

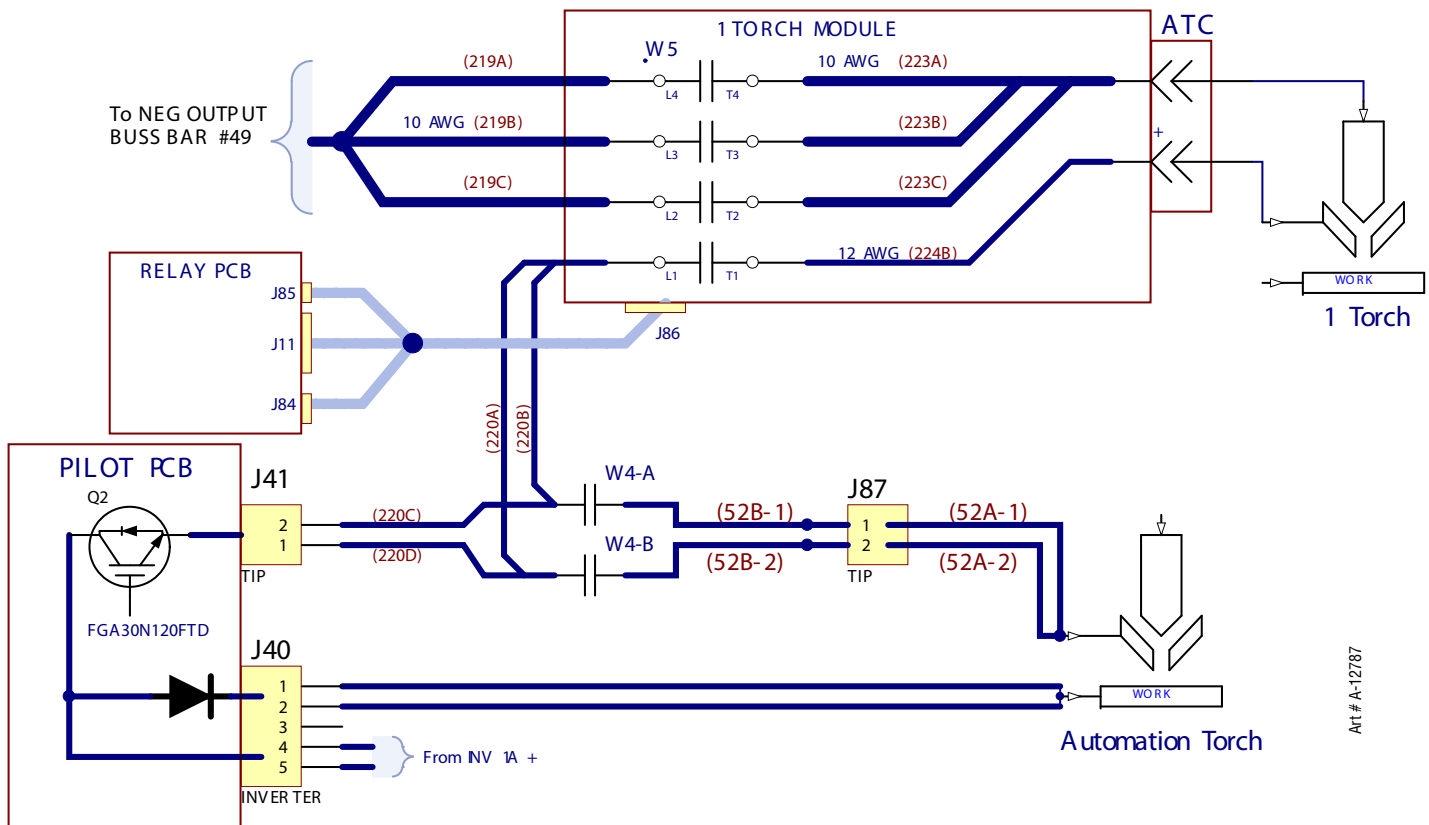
# ULTRA-CUT 100 XT

Try another flash drive or if you know this one is OK (it works with a computer), then replace the CCM.

## Group 7 codes relate to the optional 1Torch module

Simplified power schematic:

For more details and troubleshooting refer to the XT 1Torch Module & Interconnections schematic 042X1366.



Att# A-12787

## Operation of the 1Torch and its interlock circuits.

The 1Torch may be operated as soon as the power supply finishes its start up sequence. Downloading an automation process is not required. The 1Torch may be used while an automation process is downloading and purging. The 1Torch may not be operated when the automation torch is in preflow, pilot/cut or post flowing. It must be idle, not performing any cutting related processes before using the 1Torch.

Circuit conditions prior to pressing 1Torch trigger:

1. When the automation torch is operating, preflow, pilot/cut, postflow, K200 (1Torch module) is open preventing the signal from the 1Torch trigger (Start) from passing to the Relay board.
2. When the automation torch is idle K200 is energized, ready for the signal from 1Torch START SW to be applied.
3. Initially both K201 and W5 are not energized. W4, added to XT supply when 1Torch option is installed, is energized, via NC aux contacts on W5. W4 connects automation torch tip to pilot whenever the 1Torch is not enabled.



When the 1Torch trigger is pressed an interlock circuit first determines if the 1Torch consumables are in place and making proper contact as required to start a pilot.

1. -15V (J85-3) is applied to the 1Torch electrode via K201 NC contacts and returns from the tip on J85-1 where measurement is taken by U13A on the Relay Board. The signal “/Pressure OK 1Torch” on pin 6 of the 40 pin ribbon cable (between Relay and I/O boards (J4, J23)) is used for both the interlock and for confirming gas pressure. When this signal is pulled low during the parts continuity test, it indicates it’s OK to energize the 1Torch. There is an LED, D35, called T-E CONTACT that when on, indicates this test is satisfied. No continuity will set the fault code 702.
2. Once it is confirmed the consumables are in place, K201 and W5 are energized and W5’s normally closed auxiliary contact (W5 AUX) opens de-energizing W4 isolating the automation torch tip from the 1Torch tip. If for some reason K201 does not energize or if the PS2 pressure switch is shorted closed, it will set fault 703.
3. Now the 1Torch gas solenoid is turned on and gas should flow causing the 1Torch start cartridge to move away from the tip. At the same time the inverter is energized to put out open circuit voltage. If the start cartridge has separated from the tip the XT supply will detect the open circuit voltage between tip and electrode. If there is not enough air pressure, at least 35 PSI, the Pressure fault 704 will be set. If pressure is above 35 PSI and the cartridge does not separate then the Start Cartridge fault 705 is set.
4. Assuming there is enough gas pressure (should be 70-85 PSI) and the start cartridge works properly, gas is then shut off, the parts come together and pilot current flows through them, gas is turned on again and the parts separate drawing an arc between them which is blown out of the tip by the gas flow.

Interlock measurements during XT Automation torch operation:

1. Regardless of whether a 1Torch is plugged into the ATC, -15 V is applied via K201 to the 1Torch electrode circuit (ATC negative terminal) as previously explained. If W5, which should be open, has any of its 3 negative contacts closed (welded or stuck on) the -15V will be measured by U13B giving the signal “Contactor Fault 1Torch”. If the contactor fault is not detected it’s Ok to energize the automation torch.
2. If a 1Torch is plugged in and it parts are in place making contact, the -15V will also be seen on the tip circuit and if the W5 Pilot (tip) contact is closed (welded or stuck on), U13D will detect the -15V and give the signal “Contactor Fault 1Torch”. “Contactor Fault 1Torch” sets the 701 fault code. If contactor fault is not detected it’s OK to energize the automation torch. There is a green LED, D40, on the Relay board that is on when the circuit is satisfied, not in fault condition.

### **Troubleshooting the 1Torch module.**

First read the descriptions above. This guide assumes you have a copy of the XT 1Torch module & Interconnections Schematic 42X1366. The 1Torch Module is mounted in the XT front panel with screws that accept Torx T25 driver or 8 mm socket. If the procedure requires you to remove it, the wires are long enough to allow removing the module far enough from the panel to also remove the cover. You will have to support the module with something while working on it.

### **Removing and opening the 1Torch module.**

Should troubleshooting/repair require accessing the inside of the 1Torch module this is what is required. First remove the right side panels and make sure the connector J86 on the back of module is plugged in. There are 6 screws in the module’s front panel, 4 attach it to the panel and 2 hold the cover, remove them all. Pull the module out of the front panel until you can access its cover screws, 2 on each side and 2 in the rear. The harness and cables remain connected. The rear of the cover is slotted so you only have to loosen those screws. You will need to support the module while doing this.

No Fault Codes showing. Some problems may not result in fault codes such as:

1. Failure to respond to the 1Torch Trigger. To operate the 1Torch trigger the automation torch must be in idle state, not preflow, post-flowing, etc. When the XT automation torch is idle K200 in the 1Torch module should be energized connecting the torch trigger through to the Relay Board and CCM. On the CCM I/O board find D70, 1Torch Start LED, just to the left of J28. This should light whenever the 1Torch trigger is pressed. If not, check that the shield cup and consumables are in place. Check that the 1Torch ATC connector is fully seated.
  - a. If D70 is not on, first remove J11 from the Relay Board. Measure for 400-800 ohms (do not use meter's diode scale) between pins 2 & 3 of the J11 harness connector. If open or shorted then problem is in the 1Torch module.
  - b. If resistance at J11-2&3 is OK reconnect J11 and measure the voltage on J11-2 relative to TB1 on the Relay Board. It should be 24VDC. Next measure on J11-3. This should be low, less than 2 volts. If it's not low but instead is 24VDC then K200 is not turned on and the problem may be in the Relay board or the CCM.
  - c. Measure pin 5 on the 40 pin ribbon cable (J23/J4), if it is high, about 15VDC, the CCM may be faulty, not detecting that the automation torch is idle. If pin 5 is low, less than 2VDC, and J11-3 was not low then the Relay board is faulty.
2. W5 Contactor not energized. This will actually show a fault code 102, failure to pilot, after a few seconds because if W5 isn't on, power will not be connected to the 1Torch so there will be no pilot.
  - a. Measure for 24VAC on J11-1 to J11-12. If OK you will have to open the 1Torch module to investigate further.
  - b. If no 24VAC check that the rear panel circuit breaker CB3 is not tripped. Next measure the signal "/>Contactor Enable 1Torch" on pin 20 of the 40 pin ribbon cable (J23/J4). It should be low, less than 2VDC. If it is, the Relay Board is faulty. If pin 20 is not low the CCM is likely the cause.
3. W4 Contactor does not close when system is in idle or automation mode. This will prevent piloting with XT torch and sets 102 code after 15 seconds of trying to pilot.

Bypass the W4 to see if that allows XT torch pilot. Remove J41 (2 pin connector from W4 to the Pilot board) from the Pilot board. Remove connector J41(J87) that has wires 52A-1 & 52A-2, connecting to J87 on the other side of W4 and plug it into J41 on the Pilot board. This returns the unit to the way it was without the 1Torch Option. If it pilots now there was a problem with W4. The XT automation torch may be operated with W4 bypassed.

## Troubleshoot W4.

1. W4 coil measures 10-15 ohms at room temperature, typically 12-13 ohms. Remove one wire #210 or 210A from the coil before measuring resistance. If open or shorted replace W4.
2. W4 is powered by 24VAC. On the Relay Board J11 measure between pin 10 (wire 210A on W4 coil) and 12. Should have 24 VAC, if not check that the circuit breaker CB3 on the rear panel is not tripped.
  - a. Remove power and remove J11 from the Relay Board. Measure resistance from the J11 harness connector to the other side of W4 coil (wire 210). It should have continuity, near zero ohms. If not the normally closed W5 auxiliary contact (W5 AUX) may be open. You will have to open the 1Torch module. Refer to the section Removing and opening the 1Torch module near the beginning of this section.
  - b. Determine if W5 is stuck on keeping its AUX SW open. Find the contactor; it's big and black. In the middle of the cover is a rectangular hole with a slightly recessed plastic piece in it. This should move down and spring back up freely as you push and release it. If not replace the contactor. The AUX contact is on the side of the contactor toward the rear of the box. Determine if it is properly secured to the contactor. It snaps in place. If it is defective and cannot be fixed you have to replace the complete contactor.



**701 Isolation Contactor (W5) Fault.**

This fault occurs if one or more of W5 contacts are closed when they should not be. Either because W5 is energized when it shouldn't be due to a faulty circuit board or the contact(s) is physically stuck.

1. 1Torch tip contacting work piece or earth ground
  - a. If the 1Torch standard standoff tip is touching work or ground at power up the pump will not start, will not prime the cooling system. If while priming, the tip contacts work or ground the pump stops. Both cases show E701 fault which in this case is not W5 fault but is an artifact of the circuit that checks for the W5 fault.
  - b. After priming is finished the standoff tip contacting work does not stop the pump but does show E701.
  - c. Drag cutting with 1Torch. For best consumable life, drag cutting should use the special Drag Shield Cap or the Shield Cup Standoff guide which does not allow tip to work contact, does not set the 701 fault and allows cutting at the full 100A.

With the standard standoff tip, if it comes in contact with the work the current is reduced to 40A to prevent damage to the tip. You may drag cut this way at the reduced current but tip life may be reduced. With the standoff tip, because of the 701 fault, you must trigger the 1Torch with the tip above the work to start the preflow. At this Point the tip may be brought into contact with the work for cutting at reduced current.

2. W5 is not energized or stuck.
  - a. The Relay board LED, D40, should be on when W5 is OK. If it is not on, remove J84 from the Relay board. If D40 still does not come on the Relay board is defective.
  - b. If D40 is on with J84 removed and you still get a 701 fault, measure the 40 pin ribbon cable (CCM J23 to Relay J4) pin 20, relative TP1 on either the CCM or the Relay board. If pin 20 is low, less than 2VDC, then the CCM is likely at fault. If pin 20 is high with J84 removed the Relay board is bad.
3. W5 is energized. Before disassembling the 1Torch Module to inspect W5, look on the Relay Board to see if the green LED, D26, just above K3, is on. This would indicate the Relay Board or perhaps the CCM is turning W5 on when it shouldn't be. You could also measure for 24 VAC coming from the Relay Board at J11-1 and J11-12.
  - a. On the 40 pin ribbon cable (CCM J23 to Relay J4) if pin 20 is low, less than 2V, relative to TP1 on either the CCM or the Relay Board then the CCM is turning on W5. Replace the CCM.
  - b. If pin 20 is high, about 15VDC, but D26 is on, the Relay board is defective.
4. W5 is not energized but is stuck closed. You will have to open the module to inspect and probably replace W5. Remove all power from unit before disassembling.
  - a. Find the contactor; it's big and black. In the middle of the cover is rectangular hole with a slightly recessed plastic piece in it. This should move down and spring back up freely as you push and release it. If not replace the contactor. Remove the contactor cover, 2 screws, and inspect the contacts. They should not be burned excessively and should move freely. If not replace the contactor.

**702 Contact Start Consumable Fault.**

As explained above, a circuit on the Relay Board applies -15VDC to the electrode and expects to see that voltage on the tip insuring the electrode, start cartridge and tip are in place and making electrical contact.

1. Most common cause for this fault is arcing and pitting of the contact surface of the start cartridge and tip. These can be cleaned, or if too bad should be replaced. Do not use sand paper as the sand particles may get into the start cartridge.

2. On the Relay Board, green LED, D35, should be on when parts are making contact.
  - a. If D35 is on, measure on pin 11 of the 40 pin ribbon cable for a low, less than 2 VDC relative to TP1 of the Relay Board. If low then CCM or the 40 pin ribbon is faulty.
  - b. If D35 is off remove J85 from the Relay Board and measure for minus 12-15 VDC on pin 3 of J85 PCB header. If not there the Relay Board is defective. If voltage is present plug J85 back in and measure pin 3 again. If the voltage is not there now there is a short in the module or the wires.
  - c. Assuming the voltage is OK at J85-3, measure at J85-1. This should be more negative than -5V. If it is then the Relay Board is defective.
3. Problem inside the 1Torch Module. Refer to the Removing and opening the 1Torch module near the beginning of this section for directions to open the module.
  - a. Find the W5 contactor. With power applied and the system at idle, measure from W5's main terminal T2, 3 or 4. With meter negative lead on TP1 of either the XT Relay Board or the CCM boards. Should measure more than -5VDC negative, normally -12 to -15VDC. If the voltage isn't there measure for it on K201-5. If not there then perhaps the wire harness between J85 and J86 is bad or wire from J86 to K201.
  - b. Confirm that K201 is not energized by measuring across its coil, pin 7 to pin 8. Should be zero but if it's 24 VDC then the Relay Board is defective.
  - c. If voltage was OK at K201-5, measure from TP1 to K201-1. If not there K201's NC contact is open or the diode D201 is open. D202 in the wire 223/223D under shrink tubing.

### **703 Detection circuit fault.**

1. When the 1Torch trigger is pressed, circuits check for the consumable parts being in place (explained under 702 code). With the consumables in place and K201 not energized, the signal "/Pressure OK 1Torch" on the Relay Board will be low. As soon as K201 is energized, the tip with the -15VDC is no longer connected to J85-1 so D35 goes out. Since the gas solenoid SOL4 has not been turned on yet, the signal "/Pressure OK 1Torch" should go high. This checks that K201 is functioning and the pressure switch PS2 is normally open. If either of these is not correct you get the 703 fault. All this happens very quickly so it is nearly impossible to measure with a meter and will need to use a process of elimination.
  - a. Remove the 3 pin connector J85 from the Relay Board. Press the 1Torch trigger. You should get the 702 fault. If instead you get 703 the PS2 is shorted closed. This is an unlikely failure.
  - b. If you still get 703 with J85 removed, you will need to determine if the Relay Board is trying to turn on K201 or if the board is defective. Reconnect J85. In response to the fault even if the Relay board turns K201 on it will immediately turn it off again. Your meter should detect a momentary voltage pulse or just flicker if the voltage is being applied properly.
    - i. Measure between TP1 (common) on the Relay board and J11-9. Each time you trigger the torch the meter should flicker. If it does you will need to open the 1Torch Module to investigate problems there. Refer to the Removing and opening the 1Torch module near the beginning of this section for directions to open the module. If there is no sign of voltage at J11-9 the Relay Board may be faulty but first we need to check that K201 coil or D202 isn't shorted.
    - ii. Remove power. Remove J11 from the Relay Board. On the J11 harness connector measure for resistance of 400-800 ohms between pins 8 & 9. Do not use the meters diode scale. If resistance is less than 400 ohms reverse your leads, you may be measuring the diode D202. If you measure a short, much lower than 400 ohms, that may be the cause of not seeing any movement of the meter.
    - iii. A short or an open will require opening the 1Torch Module to determine the cause. Refer to the Removing and opening the 1Torch module near the beginning of this section for directions to open the module. In the case of a short determine if the D202 is bad or if the relay coil is shorted or open. K201 is the relay toward the front of the module; K200 is the one to the rear.

## 704 Pressure Fault

Normal 1Torch operating pressure is 70-85 PSI. However minimum pressure to satisfy the pressure switch is 35 PSI. When the 1Torch trigger is pressed and the tests to determine that the consumables are in place (702) and detection circuit is working (703) then the gas solenoid SOL4 is turned on. If the inlet gas pressure is above 35 PSI the pressure SW PS1 should close. Inlet Pressure below 35 PSI or the gas regulator not set above 35 PSI will result in the 704 fault.

1. Confirm that an air supply capable of 70-85 PSI is connected into the inlet fitting of the 1Torch Module. If an optional filter is used on the air line check that it is not plugged.
2. Trigger the torch momentarily to start the preflow. Adjust the regulator on the 1Torch Module clockwise to increase the pressure to at least 70 PSI (up to 85 PSI for longer leads.)
3. If no pressure shows on the gauge the solenoid may be defective or the Relay Board is not turning it on.
  - a. First see if D2, Torch Gas ON LED on the Relay Board lights when pressing the torch SW. If not there is a problem on the Relay Board or the CCM. If D2 is on skip to step 3c.
  - b. On the 40 ribbon cable between the CCM and the Relay Board (J23-J4) measure pin 4 relative to TP1. It should be low, less than 2VDC, when pressing the 1Torch trigger. If it does not go low the CCM (or the ribbon cable) is faulty. If pin 4 is low or goes low when the torch trigger is pressed but D2 on the Relay Board is not on, then the Relay Board is bad.
  - c. If D2 on the Relay Board is on, with the torch SW pressed, you need to see if the Relay Board is supplying power to the solenoid coil. First set up for measurement of 24 VAC between pins 13 & 14 on J11 of the Relay Board. Press the 1Torch trigger. If no voltage the Relay Board may be bad.
  - d. If there was 24VAC in the previous measurement disconnect J11 and measure the resistance between pins 13 & 14 of the J11 harness connector. It should be about 21 ohms. This is the solenoid coil resistance. If it's open or the resistance is significantly less indicating the coil may be shorted you will have to replace the solenoid assembly. The snubber RC, SA201, is NOT part of the solenoid assembly so do not discard it, you will need it on the new solenoid. Refer to the Removing and opening the 1Torch module near the beginning of this section for directions to open the module.

## 705 Start Cartridge Fault.

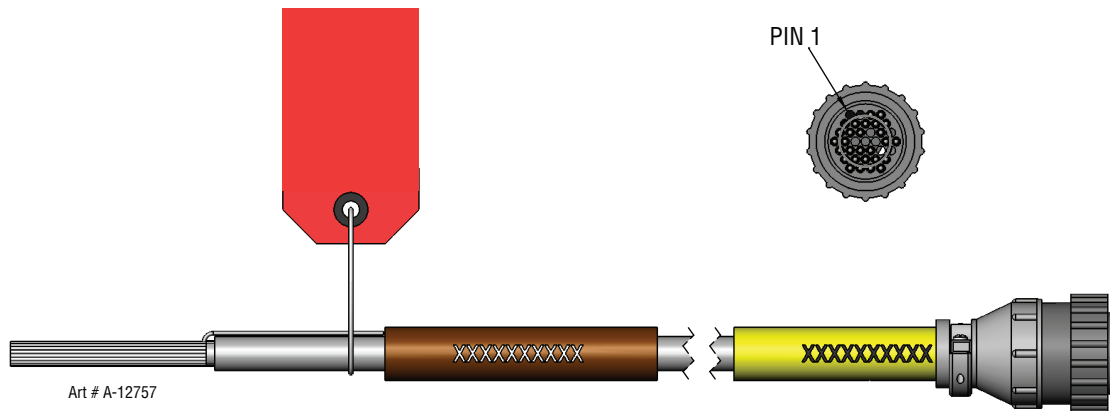
**As explained in the section Operation of the 1Torch and its interlock circuits, during the preflow time the gas pressure should cause the Start Cartridge to separate from the tip. After a slight delay allowing time for separation, the inverter is enabled to provide open circuit voltage which is measured and must be over 200 volts. If the cartridge does not move, does not separate from the tip or something else is causing a tip to electrode short it will set the 705 code. Also since it uses power from the inverter for this test, if the inverter does not put out OCV the measured voltage will be low and the 705 fault is set.**

1. If the DC indicator on the unit front panel flashes momentarily each time you press the 1Torch trigger it's a good sign the inverter is OK. Also try using the XT automation torch, if that works the inverter is good.
2. The most likely problem is the start cartridge is stuck. Disassemble the consumables and see if the cartridge moves freely. Try a new cartridge and new tip.

**This completes the Advanced Troubleshooting information.**

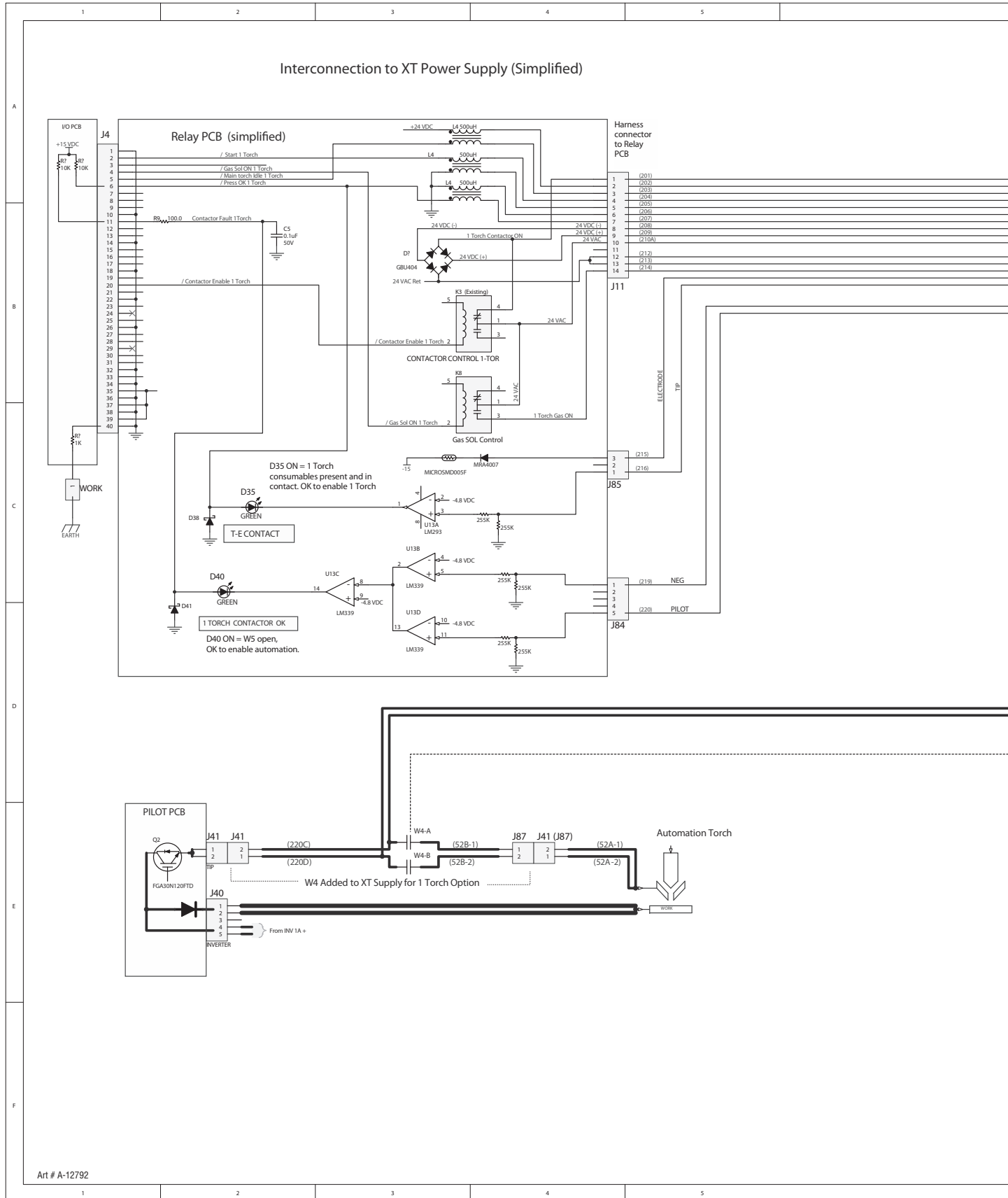
APPENDIX 26: CNC CABLE COLOR CODE

TABLE 1: CABLE ITEM#4 COLOR CODE TABLE		
PIN LOCATION	COLOR	SIGNAL DESCRIPTION
3	WHITE/BLUE	START CNC (+)
4	WHITE/VIOLET	START CNC (-)
5	WHITE/BROWN/VIOLET	DIV ARC (-)
6	WHITE/BROWN	DIV ARC(+)
7	YELLOW	PREFLOW ON (+)
8	GREEN	COMM 1K
9	WHITE/BLACK/BROWN	PREFLOW ON (-)
10	WHITE/BROWN/BLUE	CORNER CR (+)
11	WHITE/BLACK	CORNER CR (-)
12	BLACK	OK TO MOVE (-)
14	BLUE	OK TO MOVE (+)
16	WHITE/BROWN/YELLOW	/HOLD START (+)
17	WHITE/BROWN/GREEN	/HOLD START (-)
21	WHITE/BLACK/ORANGE	/PLASMA MARK (+)
22	WHITE/BLACK/RED	/PLASMA MARK (-)
23	WHITE/BROWN/ORANGE	/CUT EXPANDED METAL (+)
24	ORANGE	/CUT EXPANDED METAL (-)
25	RED	/CNC PLASMA ENABLE (+)
26	BROWN	/CNC PLASMA ENABLE (-)
29	WHITE/BROWN RED	REMOTE CC POT HIGH
30	WHITE	REMOTE CC (ANALOG)
31	GRAY	REMOTE CC POT LOW
32	VIOLET	STOP SW (MOMENTARY)
33	WHITE/BLACK/YELLOW	STOP SW RETURN
34	WHITE/BLACK/GRAY	PILOT IS ON (A)
35	WHITE/BLACK/VIOLET	PILOT IS ON (B)
36	WHITE/BLACK/BLUE	SPARE OUT #1 (A)
37	WHITE/BLACK/GREEN	SPARE OUT #1 (B)

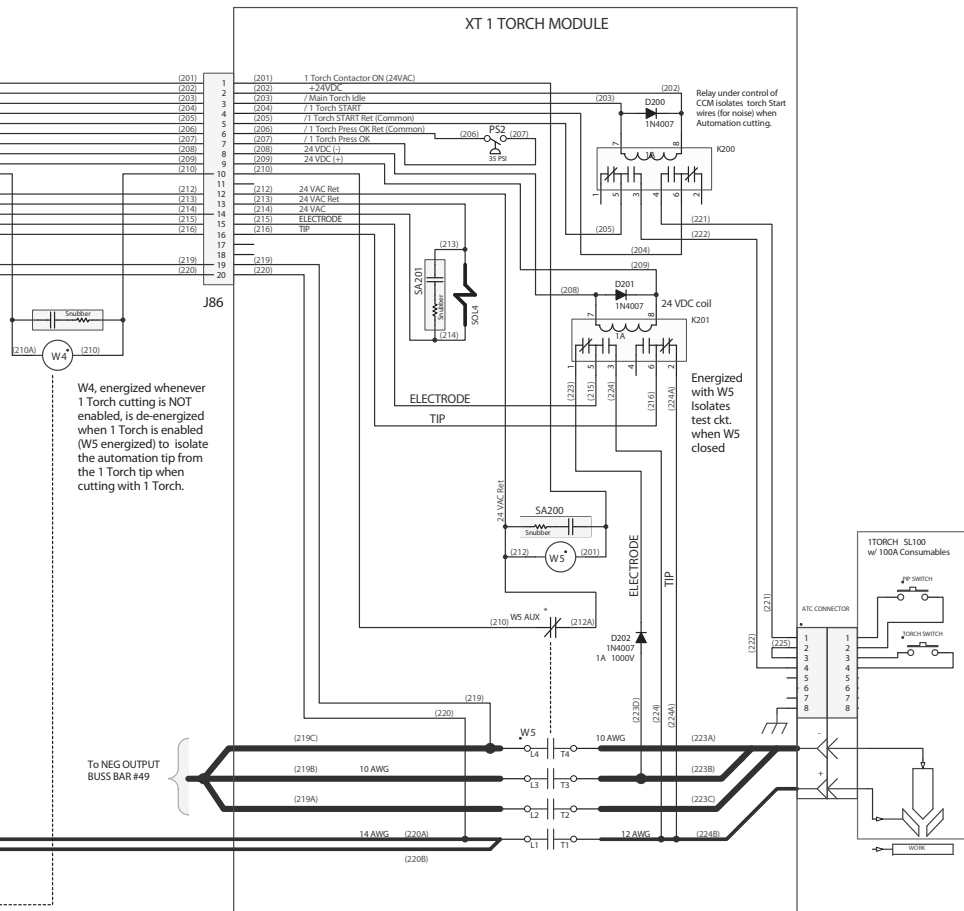




# APPENDIX 27: SL100 INTERCONNECTION



## Optional 1 Torch Module



### 1 Torch Module Component Locations

D200	Diode, 1A, 1kv	(A9)
D201	Diode, 1A, 1kv	(B9)
D202	Diode, 1A, 1kv	(C9)
K200	Relay, DPDT, 24VDC coil	(B9)
K201	Relay, DPDT, 24VDC coil	(B9)
SA200	RC Snubber,	(C8)
SA201	RC Snubber,	(B8)
PS2	Pressure SW, 35 PSI, N. O	(B8)
SOL4	Solenoid, 24VAC	(B8)
W4	Contactor, Pilot Isolation, 40A 2P, 24VAC coil	(6B, E3)
W5	Contactor, 1 Torch Isolation, 40A 4P, 24 VAC coil	(8D, 8C)

Art # A-12792

Rev	Revision	By	Date
AA	ECO-82687	DAT	10/20/2014

Rev	Revision	By	Date

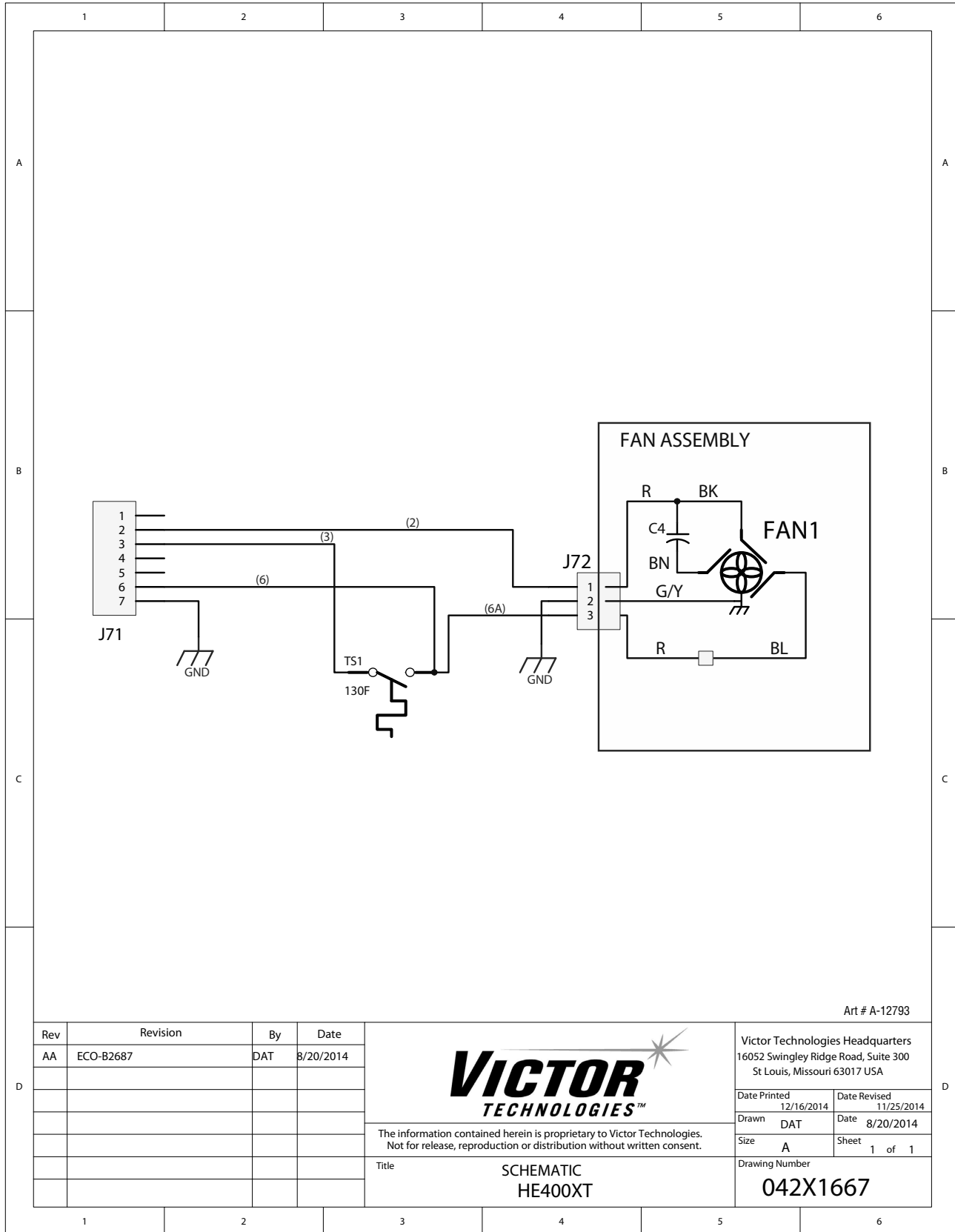
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Title: SCHEMATIC  
XT 1 Torch Module & Interconnections

Victor Technologies Headquarters 16052 Swingley Ridge Road, Suite 300 St Louis, Missouri 63017 USA	
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Drawing Number <b>042X1366</b>	

APPENDIX 28: HE 400 XT CONNECTION



Art # A-12793

Rev	Revision	By	Date
AA	ECO-B2687	DAT	8/20/2014



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Title SCHEMATIC HE400XT

Victor Technologies Headquarters 16052 Swingley Ridge Road, Suite 300 St Louis, Missouri 63017 USA	
Date Printed 12/16/2014	Date Revised 11/25/2014
Drawn DAT	Date 8/20/2014
Size A	Sheet 1 of 1
Drawing Number <b>042X1667</b>	



## APPENDIX 29: SL100 Torch Option

### Preparations for Operation

**NOTE:**

*Automated and manual plasma cutting cannot be performed at the same time. The 1Torch trigger is ignored when automation cutting is in process, and XT start signal is ignored during hand cutting.*

*Operators must wait until postflow is complete before cutting with the alternate torch*

At the start of each operating session:



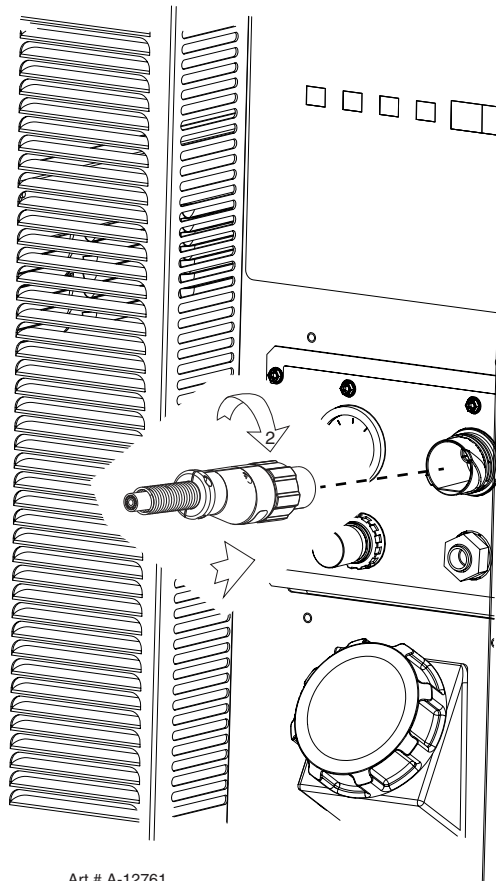
**WARNING**

*Disconnect primary power at the source before assembling or disassembling power supply, torch parts, or torch and leads assemblies.*

### Torch Connections

If necessary, connect the torch to the Power Supply. Connect only the Thermal Dynamics model SL100 Manual Torch to this power supply. Maximum torch leads length is 100 feet / 30.5 m, including extensions.

1. Align the ATC male connector (on the torch lead) with the female receptacle. Push the male connector into the female receptacle. The connectors should push together with a small amount of pressure.
2. Secure the connection by turning the locking nut clockwise until it clicks. **DO NOT** use the locking nut to pull the connection together. Do not use tools to secure the connection.



Art # A-12761

Connecting the Torch to the Power Supply

# ULTRA-CUT 100 XT

## Torch Parts Selection

The output of the power supply is fixed at 100 Amps. Torch is assembled with 100 Amp parts from the factory.

Refer to the SL100 torch manual for details.

## Drag cutting with 1Torch.

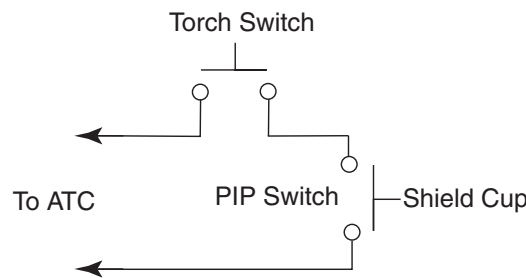
For best consumable life, drag cutting should use the special Drag Shield Cap or the Shield Cup Standoff guide which does not allow tip to work contact, and allows cutting with the full 100A

With the standard standoff 100A tip, if it comes in contact with the work the current is reduced to 40A to prevent damage to the tip. You may drag cut this way at the reduced current but tip life may be somewhat reduced.

With the standoff tip you must trigger the 1Torch with the tip above the work to start the preflow or you will get a 701 fault. Once in preflow the tip may be brought into contact with the work for cutting at reduced current.

## Parts - In - Place (PIP)

The torch includes a 'Parts - In - Place' (PIP) circuit. When the shield cup is properly installed, it closes a switch. The torch will not operate if this switch is open.



Art # A-12758

Parts - In - Place Circuit Diagram for Hand Torch

## Preflow

After the torch trigger is pulled, the air will flow for 2 seconds. This allows possible contamination to be eliminated from the torch before the arc is established.

## Postflow

After the torch trigger is released the arc will stop and the air will flow for 20 seconds. This allows the operator to safely switch modes at the XT power supply which will not allow the automated cutting to occur.

## Pilot Arc

When the torch leaves the workpiece the pilot arc restarts instantly, and the cutting arc restarts instantly when the pilot arc contacts the workpiece.

## Foldback Feature

The unit will automatically drop the cutting current down to 45 amps if the exposed tip touches the plate while cutting. This will dramatically improve tip parts life.

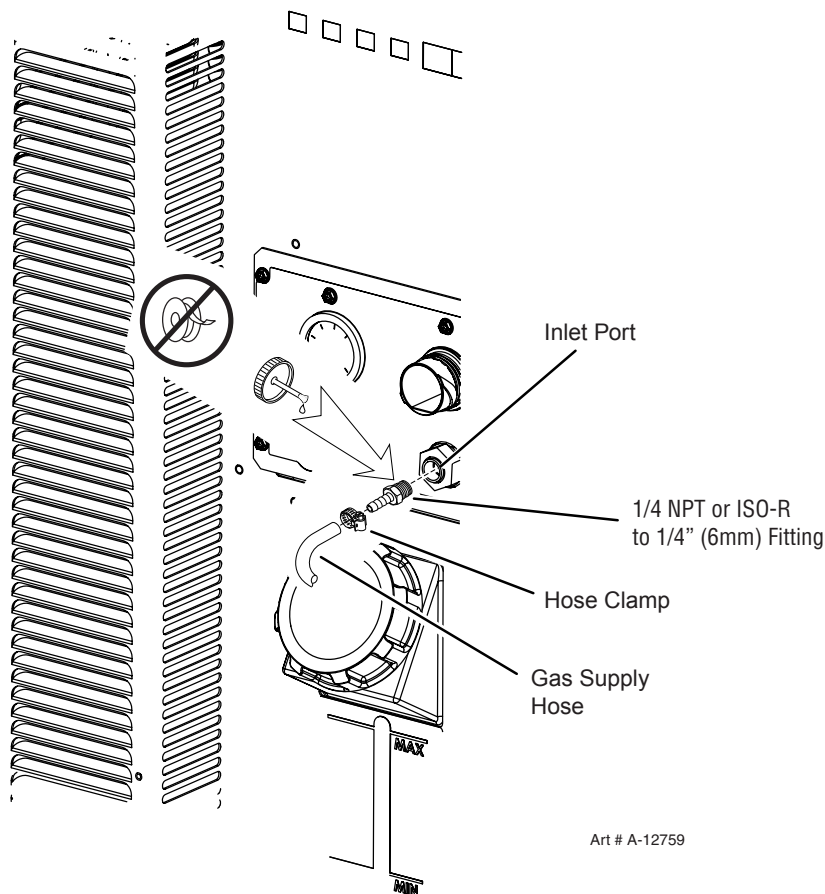
**Connecting Air Supply to Unit**

The SL100 torch option needs a separate air supply from that of the XT power supply. The connection is the same for compressed air or high pressure cylinders. Refer to the following two subsections if an optional air line filter is to be installed.

1. Connect the air line to the inlet port. The illustration shows typical fittings as an example.

**NOTE**

*For a secure seal, apply thread sealant to the fitting threads, according to manufacturer's instructions. Do not use Teflon tape as a thread sealer, as small particles of the tape may break off and block the small air passages in the torch.*



Air Connection to Inlet Port


**Check Air Quality**

Air must be free of oil and moisture. To test the quality of air:

1. Pull trigger momentarily to initiate gas/air flow.
2. Place a welding filter lens in front of the torch and turn ON the air. Do not start an arc!

Any oil or moisture in the air will be visible on the lens.

**Air Pressure Control**

The Pressure  Control is used to set the air pressure. Pull the torch trigger momentarily to start gas flow. To adjust the pressure pull the knob out and push in to lock.

1. Ensure source meets requirements.

Inlet Pressure: 90 psi min. - 120 psi max. (6.2 bar min - 8.3 bar max).

Inlet Flow: 6.7 CFM (189 lpm).

2. Check connections and turn air supply ON.
3. For cutting, adjust output air pressure from 70 - 85 psi / 4.8 - 5.9 bar. Refer to the chart for pressure setting details.

Gas Pressure Settings	
<b>Leads Length</b>	SL100 (Hand Torch)
Up to 25' (7.6 m)	70 psi 4.8 bar
Each additional 25' (7.6 m)	Add 5 psi 0.4 bar

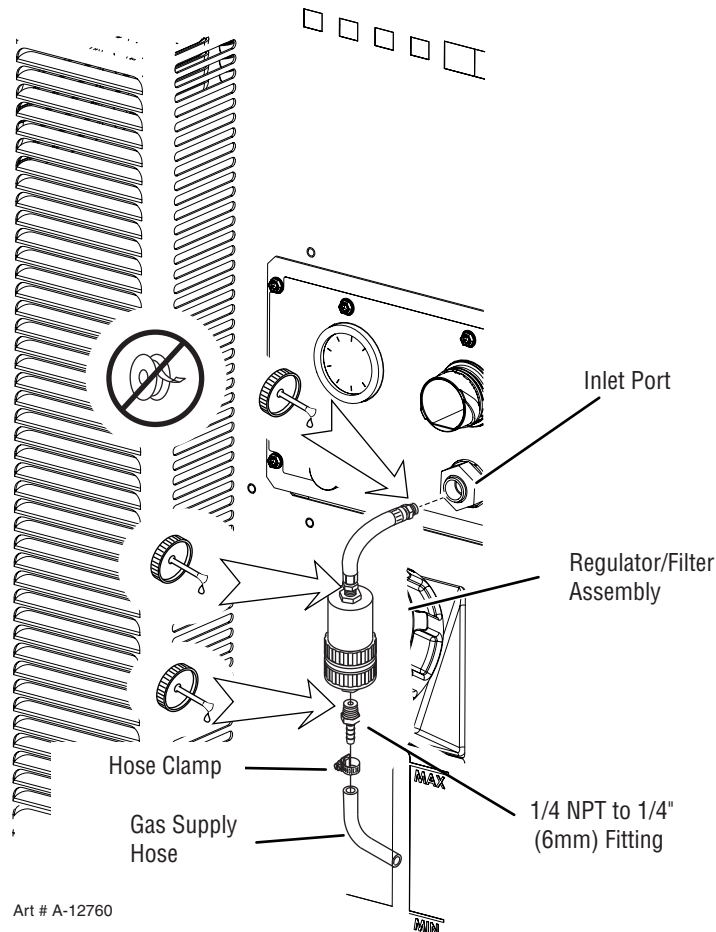
## Installing Optional Single - Stage Air Filter

An optional filter kit is recommended for improved filtering with compressed air, to keep moisture and debris out of the torch.

1. Attach the Single - Stage Filter Hose to the Inlet Port.
2. Attach the Filter Assembly to the filter hose.
3. Connect the air line to the Filter. The illustration shows typical fittings as an example.

### NOTE

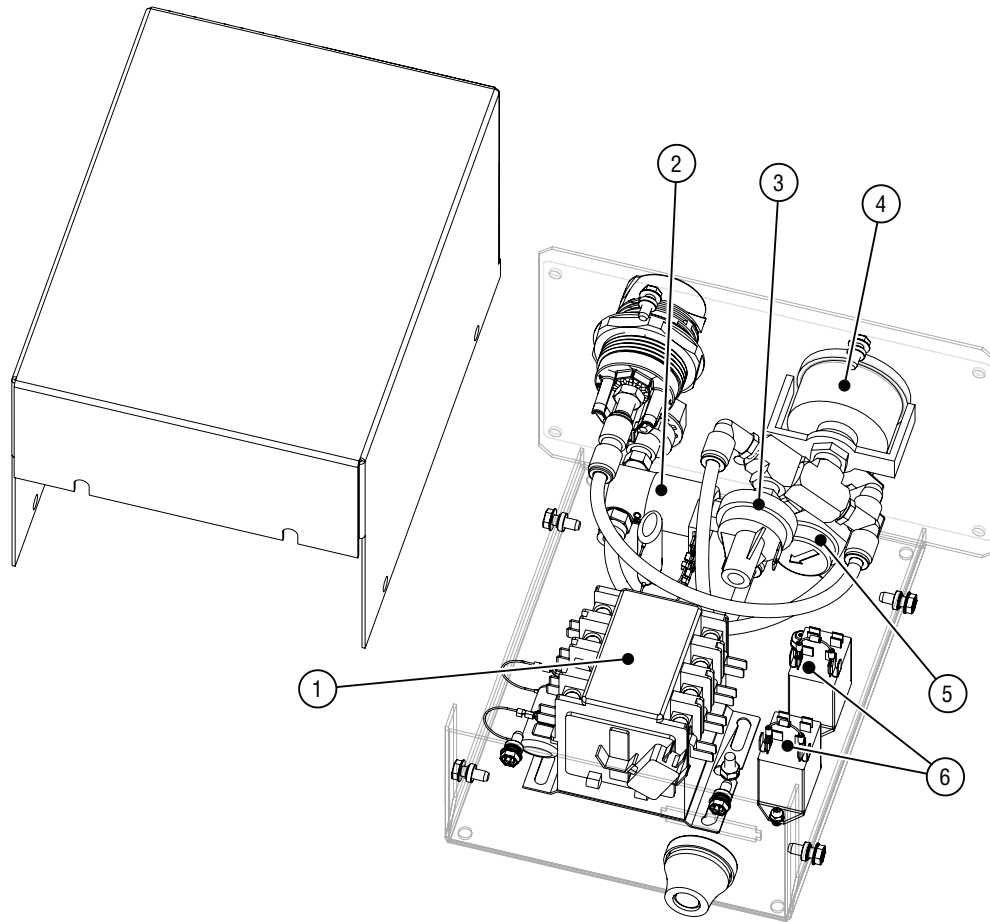
For a secure seal, apply thread sealant to the fitting threads, according to the maker's instructions. Do Not use Teflon tape as a thread sealer, as small particles of the tape may break off and block the small air passages in the torch. Connect as follows:



Art # A-12760

Single Stage Air Filter Attachment

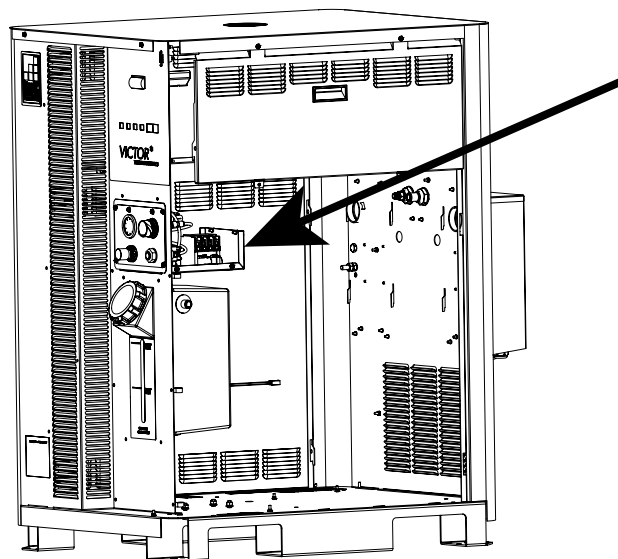
**Replacement parts**



Art # A-12762

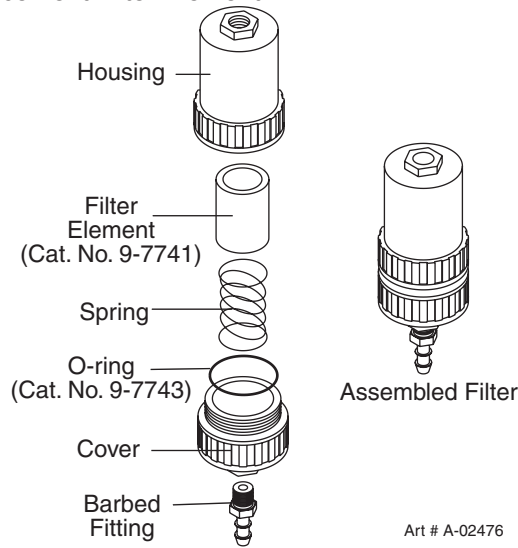
Description	BOM ID	Qty	Name
9-7379	1	1	Contactor
9-6319	2	1	Solenoid Assy
9-1044	3	1	Pressure Switch

Description	BOM ID	Qty	Name
8-6800	4	1	Pressure Gauge
9-9509	5	1	Regulator
9-7380	6	2	Relay



# ULTRA-CUT 100 XT

Qty	Description	Catalog #
1	Single - Stage Filter Kit (includes Filter & Hose)	7-7507
1	Replacement Filter Body	9-7740
1	Replacement Filter Hose (not shown)	9-7742
2	Replacement Filter Element	9-7741



## Optional Single-Stage Filter Element Replacement

These instructions apply to power supplies where the optional Single-Stage Filter has been installed.

When the Filter Element becomes completely saturated it will not be able to supply the required pressure to the SL100 module/torch. The Filter Element can be removed from its housing, dried, and reused. Allow 24 hours for Element to dry. Refer to Section 6, Parts List, for replacement filter element catalog number.

1. Remove power from power supply.
2. Shut OFF air supply and bleed down system before disassembling Filter to change Filter Element.
3. Disconnect gas supply hose.
4. Turn the Filter Housing Cover counter-clockwise and remove it. The Filter Element is located inside the Housing.
5. Remove the Filter Element from the Housing and set Element aside to dry.
6. Wipe inside of housing clean, then insert the replacement Filter Element open side first.
7. Replace Housing on Cover.
8. Reattach gas supply.

### **NOTE**

*If unit leaks between housing and cover, inspect the O-Ring for cuts or other damage.*

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**APPENDIX 30: PUBLICATION HISTORY**

<b>Cover Date</b>	<b>Rev</b>	<b>Change(s)</b>
April 29, 2013	AA	First issue
May 21, 2013	AB	Updated with new RAS 1000 XT info per ECOB2428
July 2, 2013	AC	Updated section 3 with information about V-D Board installation for height controller per ECOB2488
Jan. 16, 2014	AD	Updated many items, text and art throughout the manual. Added Advanced Trouble shooting and plumbing diagrams to Appendix per ECOB2552.
May 9, 2014	AE	Add Appx. CNC color code table. -ECO-B2512 Updated fan art Sect. 3. -ECO-B2554 Updated Sect. 6 catalog #s. -ECO-B2663 Sect 3 fan art label change. VCR00359 Updated Sect. 6 Leads Replacement Parts. -ECO-B2664 Add Appx. 'Serial Communications'. -ECO-B2675 Insert Sect. 3 'Ground rod tester' info. -ECO-B2676 Update Sect. 6 'Pilot cap' part #. -ECO-B2677 Update various Sect. 3 text. Update codes. -ECO-B2679 Remove DoC. -ECO-B2680 Add Sect. 6 'Current transducer'. -ECO-B2681 Updated Sect. 6 Radiator # / fan art. -ECO-B2689
Jan. 6, 2015	AF	In the Appdx, added SL100 1Torch to system and schematics, updated CNC cable color code art, updated all system schematics and updated the advanced trouble shooting information. In section 6, updated system part numbers cable and hose charts and part numbers. Section 3 updated cable hose art all per ECOB2694.



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## THE AMERICAS

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#### U.S. Customer Care

Ph 1-800-426-1888 (tollfree)  
Fax: 1-800-535-0557 (tollfree)

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## EUROPE

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#### Customer Care

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#### Customer Care

Ph +39 0236546801  
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## ASIA/PACIFIC

### Cikarang, Indonesia

#### Customer Care

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### Rawang, Malaysia

#### Customer Care

Ph +603 6092-2988  
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Ph 1300-654-674 (tollfree)  
Ph 61-3-9474-7400

Fax: 61-3-9474-7391

#### International

Ph 61-3-9474-7508  
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### Shanghai, China

#### Sales Office

Ph +86 21-64072626  
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#### Singapore

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