

HySpeed® Plasma **HSD130™**



Remote High Frequency (RHF)

Instruction Manual

805510 – Revision 1

Hypertherm®

Register your new Hypertherm system

Register your product online at www.hypertherm.com/registration for easier technical and warranty support. You can also receive updates on new Hypertherm products and a free gift as a token of our appreciation.

For your records

Serial number: _____

Purchase date: _____

Distributor: _____

Maintenance notes:

HySpeed HSD130

Remote High Frequency (RHF)

Instruction Manual

(P/N 805510)

Revision 1 – April, 2011

**Hypertherm, Inc.
Hanover, NH USA
www.hypertherm.com**

© Copyright 2011 Hypertherm, Inc.
All Rights Reserved

Hypertherm, HySpeed, and HSD130 are trademarks of Hypertherm, Inc.
and may be registered in the United States and/or other countries

Hypertherm, Inc.

Etna Road, P.O. Box 5010
Hanover, NH 03755 USA
603-643-3441 Tel (Main Office)
603-643-5352 Fax (All Departments)
info@hypertherm.com (Main Office Email)
800-643-9878 Tel (Technical Service)
technical.service@hypertherm.com (Technical Service Email)
800-737-2978 Tel (Customer Service)
customer.service@hypertherm.com (Customer Service Email)

Hypertherm Automation

5 Technology Drive, Suite 300
West Lebanon, NH 03784 USA
603-298-7970 Tel
603-298-7977 Fax

Hypertherm Plasmatechnik GmbH

Technologiepark Hanau
Rodenbacher Chaussee 6
D-63457 Hanau-Wolfgang, Deutschland
49 6181 58 2100 Tel
49 6181 58 2134 Fax
49 6181 58 2123 (Technical Service)

Hypertherm (S) Pte Ltd.

82 Genting Lane
Media Centre
Annexe Block #A01-01
Singapore 349567, Republic of Singapore
65 6841 2489 Tel
65 6841 2490 Fax
65 6841 2489 (Technical Service)

Hypertherm (Shanghai) Trading Co., Ltd.

Unit A, 5th Floor, Careri Building
432 West Huai Hai Road
Shanghai, 200052
PR China
86-21 5258 3330/1 Tel
86-21 5258 3332 Fax

Hypertherm Europe B.V.

Vaartveld 9
4704 SE
Roosendaal, Nederland
31 165 596907 Tel
31 165 596901 Fax
31 165 596908 Tel (Marketing)
31 165 596900 Tel (Technical Service)
00 800 4973 7843 Tel (Technical Service)

Hypertherm Japan Ltd.

Level 9, Edobori Center Building
2-1-1 Edobori, Nishi-ku
Osaka 550-0002 Japan
81 6 6225 1183 Tel
81 6 6225 1184 Fax

Hypertherm Brasil Ltda.

Avenida Doutor Renato de
Andrade Maia 350
Parque Renato Maia
CEP 07114-000
Guarulhos, SP Brasil
55 11 2409 2636 Tel
55 11 2408 0462 Fax

Hypertherm México, S.A. de C.V.

Avenida Toluca No. 444, Anexo 1,
Colonia Olivar de los Padres
Delegación Álvaro Obregón
México, D.F. C.P. 01780
52 55 5681 8109 Tel
52 55 5683 2127 Fax

Hypertherm Korea Branch

#3904 Centum Leaders Mark B/D,
1514 Woo-dong, Haeundae-gu, Busan
Korea, 612-889
82 51 747 0358 Tel
82 51 701 0358 Fax

ELECTROMAGNETIC COMPATIBILITY (EMC)

Introduction

Hypertherm's CE-marked equipment is built in compliance with standard EN60974-10. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN60974-10 may not be adequate to completely eliminate interference when the affected equipment is in close proximity or has a high degree of sensitivity. In such cases it may be necessary to use other measures to further reduce interference.

This cutting equipment is designed for use only in an industrial environment.

Installation and use

The user is responsible for installing and using the plasma equipment according to the manufacturer's instructions.

If electromagnetic disturbances are detected then it shall be the responsibility of the user to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the cutting circuit, see *Earthing of the work piece*. In other cases, it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases, electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Assessment of area

Before installing the equipment, the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a. Other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the cutting equipment.
- b. Radio and television transmitters and receivers.
- c. Computer and other control equipment.
- d. Safety critical equipment, for example guarding of industrial equipment.
- e. Health of the people around, for example the use of pacemakers and hearing aids.
- f. Equipment used for calibration or measurement.
- g. Immunity of other equipment in the environment. User shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures.
- h. Time of day that cutting or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of reducing emissions

Mains supply

Cutting equipment must be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply.

Consideration should be given to shielding the supply cable of permanently installed cutting equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the cutting mains supply so that good electrical contact is maintained between the conduit and the cutting power source enclosure.

Maintenance of cutting equipment

The cutting equipment must be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the cutting equipment is in operation. The cutting equipment should not be modified in any way, except as set forth in and in accordance with the manufacturer's written instructions. For example, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Cutting cables

The cutting cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential bonding

Bonding of all metallic components in the cutting installation and adjacent to it should be considered.

However, metallic components bonded to the workpiece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode (nozzle for laser heads) at the same time.

The operator should be insulated from all such bonded metallic components.

Earthing of the workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steel work, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note: The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is provided in IEC 60974-9, Arc Welding Equipment, Part 9: Installation and Use.

Screening and shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire plasma cutting installation may be considered for special applications.

Attention

Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Any damage or injury caused by the use of other than genuine Hypertherm parts may not be covered by the Hypertherm warranty, and will constitute misuse of the Hypertherm Product.

You are solely responsible for the safe use of the Product. Hypertherm does not and cannot make any guarantee or warranty regarding the safe use of the product in your environment.

General

Hypertherm, Inc. warrants that its Products shall be free from defects in materials and workmanship for the specific periods of time set forth herein and as follows: if Hypertherm is notified of a defect (i) with respect to the power supply within a period of two (2) years from the date of its delivery to you, with the exception of Powermax brand power supplies, which shall be within a period of three (3) years from the date of delivery to you, and (ii) with respect to the torch and leads within a period of one (1) year from its date of delivery to you, and with respect to torch lifter assemblies within a period of one (1) year from its date of delivery to you, and with respect to laser heads within a period of one (1) year from its date of delivery to you, and with respect to Automation products one (1) year from its date of delivery to you, with the exception of the EDGE Pro CNC and ArcGlide THC, which shall be within a period of two (2) years from the date of delivery to you.

This warranty shall not apply to any Powermax brand power supplies that have been used with phase converters. In addition, Hypertherm does not warranty systems that have been damaged as a result of poor power quality, whether from phase converters or incoming line power. This warranty shall not apply to any Product which has been incorrectly installed, modified, or otherwise damaged.

Hypertherm provides repair, replacement or adjustment of the Product as the sole and exclusive remedy, if and only if the warranty set forth herein properly is invoked and applies. Hypertherm, at its sole option, shall repair, replace, or adjust, free of charge, any defective Products covered by this warranty which shall be returned with Hypertherm's prior authorization (which shall not be unreasonably withheld), properly packed, to Hypertherm's place of business in Hanover, New Hampshire, or to an authorized Hypertherm repair facility, all costs, insurance and freight pre paid by the customer. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph and with Hypertherm's prior written consent.

The warranty set forth above is exclusive and is in lieu of all other warranties, express, implied, statutory, or otherwise with respect to the Products or as to the results which may be obtained therefrom, and all implied warranties or conditions of quality or of merchantability or fitness for a particular purpose or against infringement. The foregoing shall constitute the sole and exclusive remedy for any breach by Hypertherm of its warranty.

Distributors/OEMs may offer different or additional warranties, but Distributors/OEMs are not authorized to give any additional warranty protection to you or make any representation to you purporting to be binding upon Hypertherm.

Consideration should be given to shielding the supply cable of permanently installed cutting equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the cutting mains supply so that good electrical contact is maintained between the conduit and the cutting power source enclosure.

Maintenance of cutting equipment

The cutting equipment must be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the cutting equipment is in operation. The cutting equipment should not be modified in any way, except as set forth in and in accordance with the manufacturer's written instructions. For example, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Cutting cables

The cutting cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential bonding

Bonding of all metallic components in the cutting installation and adjacent to it should be considered.

However, metallic components bonded to the workpiece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode (nozzle for laser heads) at the same time.

The operator should be insulated from all such bonded metallic components.

Earthing of the workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steel work, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note: The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is provided in IEC 60974-9, Arc Welding Equipment, Part 9: Installation and Use.

Screening and shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire plasma cutting installation may be considered for special applications.

TABLE OF CONTENTS

Electromagnetic compatibility (EMC).....	EMC-1
Warranty.....	W-1
Section 1 SAFETY.....	1-1
Recognize safety information	1-2
Follow safety instructions.....	1-2
Electrical hazards.....	1-2
Electric shock can kill.....	1-3
Cutting can cause fire or explosion.....	1-4
Toxic fumes can cause injury or death.....	1-5
Grounding safety.....	1-6
Static electricity can damage circuit boards	1-6
Compressed gas equipment safety.....	1-6
Gas cylinders can explode if damaged.....	1-6
A plasma arc can cause injury and burns.....	1-7
Arc rays can burn eyes and skin.....	1-7
Pacemaker and hearing aid operation	1-8
Noise can damage hearing.....	1-8
A plasma arc can damage frozen pipes	1-8
Dry dust collection information	1-9
Laser radiation	1-10
Symbols and marks	1-11
Additional safety information	1-11
Warning labels.....	1-12
Section 1a SÉCURITÉ	1a-1
Identifier les consignes de sécurité	1a-2
Suivre les instructions de sécurité	1a-2
Risques électriques.....	1a-2
Les chocs électriques peuvent être fatals.....	1a-3
Le coupage peut provoquer un incendie ou une explosion	1a-4
Les vapeurs toxiques peuvent provoquer des blessures ou la mort	1a-5
Mise à la masse et à la terre.....	1a-6
L'électricité statique peut endommager les cartes de circuits imprimés.....	1a-6
Sécurité des bouteilles de gaz comprimé.....	1a-6
Les bouteilles de gaz comprimé peuvent exploser en cas de dommages	1a-6
L'arc plasma peut provoquer des blessures ou des brûlures.....	1a-7
Les rayons de l'arc peuvent brûler les yeux et la peau.....	1a-7
Pacemakers et prothèses auditives.....	1a-8
Le bruit peut provoquer des problèmes auditifs.....	1a-8
Un arc plasma peut endommager les tuyaux gelés	1a-8
Information sur le dé poussi èrage	1a-9
Radiation au laser	1a-10
Symboles et marquage.....	1a-11
Étiquettes de sécurité	1a-12

TABLE OF CONTENTS

Section 1b SEGURIDAD.....	1b-1
Reconocimiento de información de seguridad	1b-2
Cumplimiento de instrucciones de seguridad.....	1b-2
Riesgos de electrocución	1b-2
Las descargas eléctricas pueden matar.....	1b-3
Los cortes pueden producir incendios o explosiones.....	1b-4
Los vapores tóxicos pueden producir lesiones o la muerte.....	1b-5
Seguridad de toma a tierra.....	1b-6
La electricidad estática puede dañar las placas de circuitos.....	1b-6
Seguridad de equipos de gas comprimido	1b-6
Los cilindros de gas pueden explotar si están dañados.....	1b-6
El arco de plasma puede producir lesiones y quemaduras	1b-7
Los rayos del arco pueden quemar los ojos y la piel.....	1b-7
Funcionamiento de marcapasos y audífonos	1b-8
Los ruidos pueden dañar la audición	1b-8
El arco de plasma puede dañar las tuberías congeladas.....	1b-8
Información acerca de la recolección de polvo seco	1b-9
Radiación láser	1b-10
Símbolos y marcas	1b-11
Etiquetas de advertencia.....	1b-12
Section 2 SPECIFICATIONS.....	2-1
System description.....	2-2
General	2-2
Power supply	2-2
Ignition console.....	2-2
Fuel-gas console	2-2
Off-valve	2-2
Torch	2-2
System diagram 1 — without a fuel gas console.....	2-3
System diagram 2 — with a fuel-gas console	2-4
Specifications	2-5
System gas requirements.....	2-5
Noise levels.....	2-6
Power supply.....	2-7
Fuel gas console — 078201	2-8
Ignition console — 078172	2-9
Standard off-valve — 229105.....	2-10
Fuel-gas off-valve — 229130.....	2-11
Torch — 228144	2-12
Section 3 INSTALLATION.....	3-1
Upon receipt	3-3
Claims.....	3-3
Installation requirements.....	3-3
Placement of system components	3-3
Torque specifications	3-3

TABLE OF CONTENTS

Installation requirements – standard system.....	3-4
System components.....	3-5
Cables and hoses	3-5
Customer-supplied power cable	3-5
Supply gas hoses.....	3-5
Installation requirements — system with optional fuel gas console.....	3-6
System components.....	3-7
Cables and hoses	3-7
Customer-supplied power cable	3-7
Supply gas hoses.....	3-7
System integration diagram.....	3-8
Components.....	3-9
Recommended grounding and shielding practices	3-10
Introduction	3-10
Types of grounding	3-10
Steps to take	3-11
Grounding diagram.....	3-14
Placement of the power supply	3-15
Install the ignition console.....	3-16
Install the off-valve	3-18
Torch mounting and alignment	3-19
Mounting the torch.....	3-19
Torch alignment	3-19
Torch lifter requirement	3-19
Install the fuel-gas console (optional component)	3-20
Cable and hose assembly from power supply to off-valve.....	3-21
Power supply to off-valve connections	3-22
Fuel-gas console to off-valve connections	3-23
Fuel-gas console to power supply connections.....	3-24
Power supply to ignition console leads	3-26
Ignition console power cable.....	3-28
Ignition console coolant hoses.....	3-29
Torch lead assembly	3-30
Connect the torch to the torch lead assembly	3-31
Work lead	3-34
Arc voltage connection.....	3-35
Power supply to CNC interface cable	3-36
Notes to CNC interface cable run list	3-37
Examples of output circuits.....	3-38
Examples of input circuits.....	3-40
Power requirements	3-41
General	3-41
Line disconnect switch	3-42
Power cable.....	3-42
Connect the power.....	3-43
Torch coolant requirements.....	3-44

TABLE OF CONTENTS

Premixed coolant for standard operating temperatures	3-44
Custom coolant mix for cold operating temperatures.....	3-45
Custom coolant mix hot operating temperatures.....	3-46
Water purity requirements.....	3-46
Fill the power supply with coolant.....	3-47
Gas requirements	3-48
Setting the supply regulators.....	3-48
Gas regulators	3-49
Supply gas plumbing	3-50
Connect the supply gases.....	3-51
Standard system.....	3-51
Fuel-gas system.....	3-51
Supply gas hoses	3-52
Section 4 OPERATION.....	4-1
Controls and indicators	4-2
Main power switch	4-2
Daily start-up.....	4-3
Check torch	4-3
System operation	4-4
Amps display	4-4
Fuel-gas console operation	4-5
Consumable selection	4-6
Mild steel	4-6
Stainless steel	4-6
Aluminum.....	4-7
Install and Inspect consumables	4-8
Torch maintenance	4-10
Torch connections.....	4-10
Replace torch water tube.....	4-11
Common cutting faults	4-12
How to optimize cut quality	4-13
Tips for table and torch	4-13
Plasma set-up tips.....	4-13
Maximize the life of consumable parts.....	4-13
Additional factors of cut quality.....	4-14
Additional improvements	4-15
Estimated kerf width compensation	4-16
Cut charts.....	4-18
Section 5 MAINTENANCE.....	5-1
Introduction	5-3
Routine maintenance.....	5-3
System description	5-4
Control and signal cables.....	5-4
Sequence of operation	5-5
Gas system purge cycle.....	5-6

TABLE OF CONTENTS

Gas system valve usage.....	5-6
Systems without a fuel-gas console	5-6
Systems with a fuel-gas console	5-7
PCB block diagram	5-8
Error codes.....	5-9
Error code troubleshooting – Error codes 000 to 024	5-10
Error code troubleshooting – Error codes 026 to 042	5-11
Error code troubleshooting – Error codes 043 to 047	5-12
Error code troubleshooting – Error codes 050 to 063	5-13
Error code troubleshooting – Error codes 065 to 075	5-14
Error code troubleshooting – Error codes 093 to 103	5-15
Error code troubleshooting – Error codes 195 to 116	5-16
Error code troubleshooting – Error codes 134 to 157	5-17
Power supply states	5-18
Plasma system operation with pump timeout.....	5-19
CNC operation with pump timeout.....	5-20
Initial checks.....	5-21
Automated diagnostic tests.....	5-22
Power measurement	5-23
Power supply coolant system servicing.....	5-24
Draining the coolant system.....	5-24
Coolant system filter replacement	5-25
Air filter replacement	5-26
Coolant flow test procedure.....	5-27
Testing the flow switch	5-28
Gas leak test procedure.....	5-29
PCB4: Power supply control board	5-30
PCB3: Power supply power distribution board.....	5-31
PCB2: Start circuit	5-32
Operation	5-32
Start-circuit functional schematic.....	5-32
Start-circuit troubleshooting	5-32
Pilot arc current levels	5-34
PCB2: Fuel-gas console control board.....	5-35
PCB1: Fuel-gas console power distribution board.....	5-36
PCB3: Fuel-gas console AC valve-driver board.....	5-37
Chopper tests.....	5-38
Phase-loss detection test	5-42
Torch lead test.....	5-44
Preventive maintenance.....	5-45
Section 6 PARTS LIST	6-1
Power supply	6-2
RHF Ignition console	6-8
Fuel-gas console.....	6-9
Off-valve (standard).....	6-10

TABLE OF CONTENTS

Off-valve (fuel-gas).....	6-10
HySpeed torch	6-11
Torch assembly.....	6-11
Torch leads	6-11
Mild steel consumable parts kit.....	6-12
Stainless steel / Aluminum consumable parts kit.....	6-13
Recommended spare parts	6-14
Section 7 WIRING DIAGRAMS	7-1
Introduction	7-1
Wiring diagrams.....	7-5
Appendix A HYPERTERM TORCH COOLANT SAFETY DATA.....	a-1
Section 1 Chemical Product and Company Identification.....	a-2
Section 2 Information on Ingredients.....	a-2
Section 3 Hazards Identification.....	a-2
Section 4 First Aid Measures	a-3
Section 5 Fire Fighting Measures.....	a-3
Section 6 Accidental Release Measures.....	a-3
Section 7 Handling and Storage	a-3
Section 8 Exposure Controls / Personal Protection	a-4
Section 9 Physical and Chemical Properties.....	a-4
Section 10 Stability and Reactivity.....	a-4
Section 11 Toxicological Information.....	a-4
Section 12 Ecological Information.....	a-5
Section 13 Disposal Considerations	a-5
Section 14 Transport Information	a-5
Section 15 Regulatory Information	a-5
Section 16 Other Information	a-5

Section 1

SAFETY

In this section:

Recognize safety information	1-2
Follow safety instructions.....	1-2
Electrical hazards.....	1-2
Electric shock can kill.....	1-3
Cutting can cause fire or explosion	1-4
Toxic fumes can cause injury or death.....	1-5
Grounding safety.....	1-6
Static electricity can damage circuit boards	1-6
Compressed gas equipment safety.....	1-6
Gas cylinders can explode if damaged.....	1-6
A plasma arc can cause injury and burns.....	1-7
Arc rays can burn eyes and skin.....	1-7
Pacemaker and hearing aid operation	1-8
Noise can damage hearing.....	1-8
A plasma arc can damage frozen pipes	1-8
Dry dust collection information	1-9
Laser radiation	1-10
Symbols and marks	1-11
Additional safety information	1-11
Warning labels.....	1-12



RECOGNIZE SAFETY INFORMATION

The symbols shown in this section are used to identify potential hazards. When you see a safety symbol in this manual or on your machine, understand the potential for personal injury, and follow the related instructions to avoid the hazard.



FOLLOW SAFETY INSTRUCTIONS

Read carefully all safety messages in this manual and safety labels on your machine.

- Keep the safety labels on your machine in good condition. Replace missing or damaged labels immediately.
- Learn how to operate the machine and how to use the controls properly. Do not let anyone operate it without instruction.
- Keep your machine in proper working condition. Unauthorized modifications to the machine may affect safety and machine service life.

DANGER WARNING CAUTION

Hypertherm uses American National Standards Institute guidelines for safety signal words and symbols. A signal word DANGER or WARNING is used with a safety symbol. DANGER identifies the most serious hazards.

- DANGER and WARNING safety labels are located on your machine near specific hazards.
- DANGER safety messages precede related instructions in the manual that will result in serious injury or death if not followed correctly.
- WARNING safety messages precede related instructions in this manual that may result in injury or death if not followed correctly.
- CAUTION safety messages precede related instructions in this manual that may result in minor injury or damage to equipment if not followed correctly.

ELECTRICAL HAZARDS

- Only trained and authorized personnel may open this equipment.
- If the equipment is permanently connected, turn it off, and lock out/tag out power before the enclosure is opened.
- If power is supplied to the equipment with a cord, unplug the unit before the enclosure is opened.
- Lockable disconnects or lockable plug covers must be provided by others.
- Wait 5 minutes after removal of power before entering the enclosure to allow stored energy to discharge.
- If the equipment must have power when the enclosure is open for servicing, arc flash explosion hazards may exist. Follow ALL local requirements (NFPA 70E in the USA) for safe work practices and for Personal Protective Equipment when servicing energized equipment.

- The enclosure shall be closed and the proper earth ground continuity to the enclosure verified prior to operating the equipment after moving, opening, or servicing.
- Always follow these instructions for disconnecting power before inspecting or changing torch consumable parts.



ELECTRIC SHOCK CAN KILL

Touching live electrical parts can cause a fatal shock or severe burn.

- Operating the plasma system completes an electrical circuit between the torch and the workpiece. The workpiece and anything touching the workpiece are part of the electrical circuit.
- Never touch the torch body, workpiece or the water in a water table when the plasma system is operating.

Electric shock prevention

All Hypertherm plasma systems use high voltage in the cutting process (200 to 400 VDC are common). Take the following precautions when operating this system:

- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or lie on – or touch – any wet surface when using the plasma system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Provide a disconnect switch close to the power supply with properly sized fuses. This switch allows the operator to turn off the power supply quickly in an emergency situation.
- When using a water table, be sure that it is correctly connected to earth ground.

- Install and ground this equipment according to the instruction manual and in accordance with national and local codes.
- Inspect the input power cord frequently for damage or cracking of the cover. Replace a damaged power cord immediately. **Bare wiring can kill.**
- Inspect and replace any worn or damaged torch leads.
- Do not pick up the workpiece, including the waste cutoff, while you cut. Leave the workpiece in place or on the workbench with the work cable attached during the cutting process.
- Before checking, cleaning or changing torch parts, disconnect the main power or unplug the power supply.
- Never bypass or shortcut the safety interlocks.
- Before removing any power supply or system enclosure cover, disconnect electrical input power. Wait 5 minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply covers are in place. Exposed power supply connections present a severe electrical hazard.
- When making input connections, attach proper grounding conductor first.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a safety hazard.



CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire prevention

- Be sure the area is safe before doing any cutting. Keep a fire extinguisher nearby.
- Remove all flammables within 35 feet (10 m) of the cutting area.
- Quench hot metal or allow it to cool before handling or before letting it touch combustible materials.
- Never cut containers with potentially flammable materials inside – they must be emptied and properly cleaned first.
- Ventilate potentially flammable atmospheres before cutting.
- When cutting with oxygen as the plasma gas, an exhaust ventilation system is required.

Explosion prevention

- Do not use the plasma system if explosive dust or vapors may be present.
- Do not cut pressurized cylinders, pipes, or any closed container.
- Do not cut containers that have held combustible materials.



WARNING

Explosion Hazard

Argon-Hydrogen and Methane

Hydrogen and methane are flammable gases that present an explosion hazard. Keep flames away from cylinders and hoses that contain methane or hydrogen mixtures. Keep flames and sparks away from the torch when using methane or argon-hydrogen plasma.



WARNING

Explosion Hazard

Underwater Cutting with Fuel Gases

- Do not cut aluminum underwater or with water touching the underside of the aluminum.
- Cutting aluminum underwater or with the water touching the underside of the aluminum can result in an explosive condition that can detonate during plasma cutting operations.



WARNING

Hydrogen Detonation with

Aluminum Cutting

- Do not cut under water with fuel gases containing hydrogen.
- Cutting under water with fuel gases containing hydrogen can result in an explosive condition that can detonate during plasma cutting operations.



TOXIC FUMES CAN CAUSE INJURY OR DEATH

The plasma arc by itself is the heat source used for cutting. Accordingly, although the plasma arc has not been identified as a source of toxic fumes, the material being cut can be a source of toxic fumes or gases that deplete oxygen.

Fumes produced vary depending on the metal that is cut. Metals that may release toxic fumes include, but are not limited to, stainless steel, carbon steel, zinc (galvanized), and copper.

In some cases, the metal may be coated with a substance that could release toxic fumes. Toxic coatings include, but are not limited to, lead (in some paints), cadmium (in some paints and fillers), and beryllium.

Gases produced by plasma cutting vary based on the material to be cut and the method of cutting, but may include ozone, oxides of nitrogen, hexavalent chromium, hydrogen, and other substances if such are contained in or released by the material being cut.

Caution should be taken to minimize exposure to fumes produced by any industrial process. Depending upon the chemical composition and concentration of the fumes (as well as other factors, such as ventilation), there may be a risk of physical illness, such as birth defects or cancer.

It is the responsibility of the equipment and site owner to test the air quality in the area where the equipment is used and to ensure that the air quality in the workplace meets all local and national standards and regulations.

The air quality level in any relevant workplace depends on site-specific variables such as:

- Table design (wet, dry, underwater).
- Material composition, surface finish, and composition of coatings.
- Volume of material removed.
- Duration of cutting or gouging.

- Size, air volume, ventilation and filtration of the work area.
- Personal protective equipment.
- Number of welding and cutting systems in operation.
- Other site processes that may produce fumes.

If the workplace must conform to national or local regulations, only monitoring or testing done at the site can determine whether the site is above or below allowable levels.

To reduce the risk of exposure to fumes:

- Remove all coatings and solvents from the metal before cutting.
- Use local exhaust ventilation to remove fumes from the air.
- Do not inhale fumes. Wear an air-supplied respirator when cutting any metal coated with, containing, or suspected to contain toxic elements.
- Assure that those using welding or cutting equipment, as well as air-supplied respiration devices, are qualified and trained in the proper use of such equipment.
- Never cut containers with potentially toxic materials inside. Empty and properly clean the container first.
- Monitor or test the air quality at the site as needed.
- Consult with a local expert to implement a site plan to ensure safe air quality.



GROUNDING SAFETY

Work cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

Work table Connect the work table to an earth ground, in accordance with appropriate national and local electrical codes.

Input power

- Be sure to connect the power cord ground wire to the ground in the disconnect box.

- If installation of the plasma system involves connecting the power cord to the power supply, be sure to connect the power cord ground wire properly.
- Place the power cord's ground wire on the stud first, then place any other ground wires on top of the power cord ground. Fasten the retaining nut tightly.
- Tighten all electrical connections to avoid excessive heating.



STATIC ELECTRICITY CAN DAMAGE CIRCUIT BOARDS

Use proper precautions when handling printed circuit boards:

- Store PC boards in anti-static containers.
- Wear a grounded wrist strap when handling PC boards.

COMPRESSED GAS EQUIPMENT SAFETY

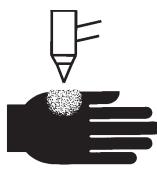
- Never lubricate cylinder valves or regulators with oil or grease.
- Use only correct gas cylinders, regulators, hoses and fittings designed for the specific application.
- Maintain all compressed gas equipment and associated parts in good condition.
- Label and color-code all gas hoses to identify the type of gas in each hose. Consult applicable national and local codes.



GAS CYLINDERS CAN EXPLODE IF DAMAGED

Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- Handle and use compressed gas cylinders in accordance with applicable national and local codes.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over valve except when the cylinder is in use or connected for use.
- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use a hammer, wrench or other tool to open a stuck cylinder valve.



A PLASMA ARC CAN CAUSE INJURY AND BURNS

Instant-on torches

Plasma arc comes on immediately when the torch switch is activated.

The plasma arc will cut quickly through gloves and skin.

- Keep away from the torch tip.
- Do not hold metal near the cutting path.
- Never point the torch toward yourself or others.



ARC RAYS CAN BURN EYES AND SKIN

Eye protection Plasma arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.

- Use eye protection in accordance with applicable national and local codes.
- Wear eye protection (safety glasses or goggles with side shields, and a welding helmet) with appropriate lens shading to protect your eyes from the arc's ultraviolet and infrared rays.

Skin protection Wear protective clothing to protect against burns caused by ultraviolet light, sparks, and hot metal.

- Gauntlet gloves, safety shoes and hat.
- Flame-retardant clothing to cover all exposed areas.
- Cuffless trousers to prevent entry of sparks and slag.
- Remove any combustibles, such as a butane lighter or matches, from your pockets before cutting.

Cutting area Prepare the cutting area to reduce reflection and transmission of ultraviolet light:

- Paint walls and other surfaces with dark colors to reduce reflection.
- Use protective screens or barriers to protect others from flash and glare.
- Warn others not to watch the arc. Use placards or signs.

Arc current (amps)	Minimum protective shade number (ANSI Z49.1:2005)	Suggested shade number for comfort (ANSI Z49.1:2005)	OSHA 29CFR 1910.133(a)(5)	Europe EN168:2002
Less than 40 A	5	5	8	9
41 to 60 A	6	6	8	9
61 to 80 A	8	8	8	9
81 to 125 A	8	9	8	9
126 to 150 A	8	9	8	10
151 to 175 A	8	9	8	11
176 to 250 A	8	9	8	12
251 to 300 A	8	9	8	13
301 to 400 A	9	12	9	13
401 to 800 A	10	14	10	



PACEMAKER AND HEARING AID OPERATION

Pacemaker and hearing aid operation can be affected by magnetic fields from high currents.

Pacemaker and hearing aid wearers should consult a doctor before going near any plasma arc cutting and gouging operations.

To reduce magnetic field hazards:

- Keep both the work cable and the torch lead to one side, away from your body.
- Route the torch leads as close as possible to the work cable.

- Do not wrap or drape the torch lead or work cable around your body.
- Keep as far away from the power supply as possible.

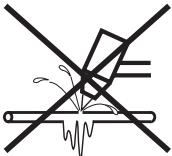


NOISE CAN DAMAGE HEARING

Cutting with a plasma arc can exceed acceptable noise levels as defined by local codes in many applications. Prolonged exposure to excessive noise can damage hearing. Always wear proper ear protection when cutting or gouging, unless sound pressure level measurements taken at the installed site have verified personal hearing protection is not necessary per relevant international, regional, and local codes.

Significant noise reduction can be obtained by adding simple engineering controls to cutting tables such as barriers or curtains positioned between the plasma arc and the workstation; and/or locating the workstation away from the plasma arc. Implement administrative controls in the workplace to restrict access, limit operator exposure time, screen off noisy working areas and/or take measures to reduce reverberation in working areas by putting up noise absorbers.

Use ear protectors if the noise is disruptive or if there is a risk of hearing damage after all other engineering and administrative controls have been implemented. If hearing protection is required, wear only approved personal protective devices such as ear muffs or ear plugs with a noise reduction rating appropriate for the situation. Warn others in the area of possible noise hazards. In addition, ear protection can prevent hot splatter from entering the ear.



A PLASMA ARC CAN DAMAGE FROZEN PIPES

Frozen pipes may be damaged or can burst if you attempt to thaw them with a plasma torch.

DRY DUST COLLECTION INFORMATION

At some sites, dry dust can represent a potential explosion hazard.

The U.S. National Fire Protection Association's 2007 edition of NFPA standard 68, "Explosion Protection by Deflagration Venting," provides requirements for the design, location, installation, maintenance, and use of devices and systems to vent combustion gases and pressures after any deflagration event. Consult with the manufacturer or installer of any dry dust collection system for applicable requirements before you install a new dry dust collection system or make significant changes in the process or materials used with an existing dry dust collection system.

Consult your local "Authority Having Jurisdiction" (AHJ) to determine whether any edition of NFPA 68 has been "adopted by reference" in your local building codes.

Refer to NFPA68 for definitions and explanations of regulatory terms such as deflagration, AHJ, adopted by reference, the Kst value, deflagration index, and other terms.

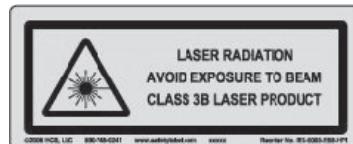
Note 1 – Hypertherm's interpretation of these new requirements is that unless a site-specific evaluation has been completed to determine that all dust generated is not combustible, the 2007 edition of NFPA 68 requires the use of explosion vents designed to the worst-case Kst value (see annex F) that could be generated from dust so that the explosion vent size and type can be designed. NFPA 68 does not specifically identify plasma cutting or other thermal cutting processes as requiring deflagration venting systems, but it does apply these new requirements to all dry dust collection systems.

Note 2 – Users of Hypertherm manuals should consult and comply with all applicable federal, state, and local laws and regulations. Hypertherm does not, by the publication of any Hypertherm manual, intend to urge action that is not in compliance with all applicable regulations and standards, and this manual may never be construed as doing so.

LASER RADIATION

Exposure to the laser output can result in serious eye injury. Avoid direct eye exposure.

For your convenience and safety, on Hypertherm products that use a laser, one of the following laser radiation labels has been applied on the product near where the laser beam exits the enclosure. The maximum output (mV), wavelength emitted (nm) and, if appropriate, the pulse duration is also provided.



Additional laser safety instructions:

- Consult with an expert on local laser regulations. Laser safety training may be required.
- Do not allow untrained persons to operate the laser. Lasers can be dangerous in the hands of untrained users.
- Do not look into the laser aperture or beam at any time.
- Position the laser as instructed to avoid unintentional eye contact.
- Do not use the laser on reflective workpieces.
- Do not use optical tools to view or reflect the laser beam.
- Do not disassemble or remove the laser or aperture cover.
- Modifying the laser or product in any way can increase the risk of laser radiation.
- Use of adjustments or performance of procedures other than those specified in this manual may result in hazardous laser radiation exposure.
- Do not operate in explosive atmospheres, such as in the presence of flammable liquids, gases, or dust.
- Use only laser parts and accessories that are recommended or provided by the manufacturer for your model.
- Repairs and servicing MUST be performed by qualified personnel.
- Do not remove or deface the laser safety label.

SYMBOLS AND MARKS

Your Hypertherm product may have one or more of the following markings on or near the data plate. Due to differences and conflicts in national regulations, not all marks are applied to every version of a product.



S mark symbol

The S mark symbol indicates that the power supply and torch are suitable for operations carried out in environments with increased hazard of electrical shock per IEC 60974-1.



CSA mark

Hypertherm products with a CSA mark meet the United States and Canadian regulations for product safety. The products were evaluated, tested, and certified by CSA-International. Alternatively the product may have a mark by one of the other Nationally Recognized Testing Laboratories (NRTL) accredited in both the United States and Canada, such as Underwriters Laboratories, Incorporated (UL) or TÜV.



CE marking

The CE marking signifies the manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of Hypertherm products with a CE marking located on or near the data plate have been tested for compliance with the European Low Voltage Directive and the European Electromagnetic Compatibility (EMC) Directive. EMC filters needed to comply with the European EMC Directive are incorporated within versions of the product with a CE marking.



GOST-R mark

CE versions of Hypertherm products that include a GOST-R mark of conformity meet the product safety and EMC requirements for export to the Russian Federation.



c-Tick mark

CE versions of Hypertherm products with a c-Tick mark comply with the EMC regulations required for sale in Australia and New Zealand.



CCC mark

The China Compulsory Certification (CCC) mark indicates that the product has been tested and found compliant with product safety regulations required for sale in China.

ADDITIONAL SAFETY INFORMATION

1. ANSI Standard Z49.1, *Safety in Welding and Cutting*, American Welding Society, 550 LeJeune Road
P.O. Box 351020, Miami, FL 33135
2. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, American National Standards Institute
1430 Broadway, New York, NY 10018
3. ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection*, American National Standards Institute, 1430 Broadway, New York, NY 10018
4. AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances*, American Welding Society
550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
5. AWS F5.2, *Recommended Safe Practices for Plasma Arc Cutting*, American Welding Society
550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
6. CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders*, Compressed Gas Association
1235 Jefferson Davis Highway, Arlington, VA 22202
7. CSA Standard W117.2, *Code for Safety in Welding and Cutting*, Canadian Standards Association Standard Sales
178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada
8. NFPA Standard 51B, *Cutting and Welding Processes*, National Fire Protection Association
470 Atlantic Avenue, Boston, MA 02210
9. NFPA Standard 70-1978, *National Electrical Code*, National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210
10. OSHA, *Safety and Health Standards*, 29FR 1910
U.S. Government Printing Office, Washington, D.C. 20402
11. AWS Safety and Health Fact Sheets, American Welding Society 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
www.aws.org/technical/facts/

SAFETY

WARNING LABELS

This warning label is affixed to some power supplies. It is important that the operator and maintenance technician understand the intent of these warning symbols as described.

	Read and follow these instructions, employer safety practices, and material safety data sheets. Refer to ANS Z49.1, "Safety in Welding, Cutting and Allied Processes" from American Welding Society (http://www.aws.org) and OSHA Safety and Health Standards, 29 CFR 1910 (http://www.osha.gov).	 WARNING	 AVERTISSEMENT
	Plasma cutting can be injurious to operator and persons in the work area. Consult manual before operating. Failure to follow all these safety instructions can result in death.	1. Cutting sparks can cause explosion or fire. 1.1 Do not cut near flammables. 1.2 Have a fire extinguisher nearby and ready to use. 1.3 Do not use a drum or other closed container as a cutting table.	1. Les étincelles de coupe peuvent provoquer une explosion ou un incendie. 1.1 Ne pas couper près des matières inflammables. 1.2 Un extincteur doit être à proximité et prêt à être utilisé. 1.3 Ne pas utiliser un fût ou un autre contenant fermé comme table de coupe.
	2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered. 2.1 Turn off power before disassembling torch. 2.2 Do not grip the workpiece near the cutting path. 2.3 Wear complete body protection.	2. L'arc plasma peut blesser et brûler; éloigner la buse de soi. Il s'allume instantanément quand on l'amorce; 2.1 Couper l'alimentation avant de démonter la torche. 2.2 Ne pas saisir la pièce à couper de la trajectoire de coupe. 2.3 Se protéger entièrement le corps.	
	3. Hazardous voltage. Risk of electric shock or burn. 3.1 Wear insulating gloves. Replace gloves when wet or damaged. 3.2 Protect from shock by insulating yourself from work and ground. 3.3 Disconnect power before servicing. Do not touch live parts.	3. Tension dangereuse. Risque de choc électrique ou de brûlure. 3.1 Porter des gants isolants. Remplacer les gants quand ils sont humides ou endommagés. 3.2 Se protéger contre les chocs en s'isolant de la pièce et de la terre. 3.3 Couper l'alimentation avant l'entretien. Ne pas toucher les pièces sous tension.	
	4. Plasma fumes can be hazardous. 4.1 Do not inhale fumes. 4.2 Use forced ventilation or local exhaust to remove the fumes. 4.3 Do not operate in closed spaces. Remove fumes with ventilation.	4. Les fumées plasma peuvent être dangereuses. 4.1 Ne pas inhaler les fumées 4.2 Utiliser une ventilation forcée ou un extracteur local pour dissiper les fumées. 4.3 Ne pas couper dans des espaces clos. Chasser les fumées par ventilation.	
	5. Arc rays can burn eyes and injure skin. 5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.	5. Les rayons d'arc peuvent brûler les yeux et blesser la peau. 5.1 Porter un bon équipement de protection pour se protéger la tête, les yeux, les oreilles, les mains et le corps. Boutonner le col de la chemise. Protéger les oreilles contre le bruit. Utiliser un masque de soudeur avec un filtre de nuance appropriée.	
	6. Become trained. Only qualified personnel should operate this equipment. Use torches specified in the manual. Keep non-qualified personnel and children away. 7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn (PN 110584 Rev C).	6. Suivre une formation. Seul le personnel qualifié a le droit de faire fonctionner cet équipement. Utiliser exclusivement les torches indiquées dans le manuel. Le personnel non qualifié et les enfants doivent se tenir à l'écart. 7. Ne pas enlever, détruire ni couvrir cette étiquette. La remplacer si elle est absente, endommagée ou usée (PN 110584 Rev C).	
			

WARNING LABELS

This warning label is affixed to some power supplies. It is important that the operator and maintenance technician understand the intent of these warning symbols as described. The numbered text corresponds to the numbered boxes on the label.



1. Cutting sparks can cause explosion or fire.
 - 1.1 Do not cut near flammables.
 - 1.2 Have a fire extinguisher nearby and ready to use.
 - 1.3 Do not use a drum or other closed container as a cutting table.
2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered.
 - 2.1 Turn off power before disassembling torch.
 - 2.2 Do not grip the workpiece near the cutting path.
 - 2.3 Wear complete body protection.
3. Hazardous voltage. Risk of electric shock or burn.
 - 3.1 Wear insulating gloves. Replace gloves when wet or damaged.
 - 3.2 Protect from shock by insulating yourself from work and ground.
 - 3.3 Disconnect power before servicing. Do not touch live parts.
4. Plasma fumes can be hazardous.
 - 4.1 Do not inhale fumes.
 - 4.2 Use forced ventilation or local exhaust to remove the fumes.
 - 4.3 Do not operate in closed spaces. Remove fumes with ventilation.
5. Arc rays can burn eyes and injure skin.
 - 5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.
6. Become trained. Only qualified personnel should operate this equipment. Use torches specified in the manual. Keep non-qualified personnel and children away.
7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn.

SAFETY

Section 1a

SÉCURITÉ

Sommaire de cette section :

Identifier les consignes de sécurité	1-2
Suivre les instructions de sécurité	1-2
Risques électriques	1-2
Les chocs électriques peuvent être fatals	1-3
Le coupage peut provoquer un incendie ou une explosion	1-4
Les vapeurs toxiques peuvent provoquer des blessures ou la mort	1-5
Mise à la masse et à la terre	1-6
L'électricité statique peut endommager les cartes de circuits imprimés	1-6
Sécurité des bouteilles de gaz comprimé	1-6
Les bouteilles de gaz comprimé peuvent exploser en cas de dommages	1-6
L'arc plasma peut provoquer des blessures ou des brûlures	1-7
Les rayons de l'arc peuvent brûler les yeux et la peau	1-7
Pacemakers et prothèses auditives	1-8
Le bruit peut provoquer des problèmes auditifs	1-8
Un arc plasma peut endommager les tuyaux gelés	1-8
Information sur le dépoussiérage	1-9
Radiation au laser	1-10
Symboles et marquage	1-11
Étiquettes de sécurité	1-12



IDENTIFIER LES CONSIGNES DE SÉCURITÉ

Les symboles indiqués dans cette section sont utilisés pour identifier les risques éventuels. Si vous trouvez un symbole de sécurité, que ce soit dans ce manuel ou sur l'équipement, soyez conscient des risques de blessures et suivez les instructions correspondantes afin d'éviter ces risques.



SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

Lire attentivement toutes les consignes de sécurité dans le présent manuel et sur les étiquettes de sécurité se trouvant sur l'équipement.

- Les étiquettes de sécurité sur l'équipement doivent rester lisibles. Remplacer immédiatement les étiquettes manquantes ou abîmées.
- Il est important d'apprendre à faire fonctionner l'équipement et à utiliser correctement les commandes. Ne laisser personne utiliser l'équipement sans connaître son fonctionnement.
- Garder l'équipement en bon état. Des modifications non autorisées sur l'équipement peuvent entraîner des problèmes de sécurité et raccourcir la durée de vie utile de l'équipement.

DANGER AVERTISSEMENT ATTENTION

Hypertherm adopte les lignes directrices de l'American National Standards Institute relativement aux termes et aux symboles de la signalisation de sécurité. Les signaux DANGER ou AVERTISSEMENT sont utilisés avec un symbole de sécurité. DANGER correspond aux risques les plus sérieux.

- Les étiquettes de sécurité DANGER et AVERTISSEMENT sont placées sur l'équipement pour situer certains dangers spécifiques.
- Les messages de sécurité DANGER précèdent les directives correspondantes dans le manuel qui, si elles ne sont pas suivies scrupuleusement, entraînent des blessures graves, voire mortelles.
- Les messages d'AVERTISSEMENT précèdent les instructions d'utilisation présentées dans ce manuel qui, si elles ne sont pas suivies scrupuleusement, peuvent entraîner des blessures graves, voire mortelles.
- Les messages de sécurité ATTENTION précèdent les directives associées dans le manuel qui, si elles ne sont pas suivies scrupuleusement, peuvent entraîner des blessures mineures ou endommager l'équipement.

RISQUES ÉLECTRIQUES

- Seul le personnel formé et autorisé peut ouvrir cet équipement.
- Si l'équipement est branché en permanence, mettez-le hors tension, puis coupez l'alimentation avant d'ouvrir le boîtier.
- Si l'équipement est mis sous tension à l'aide d'un cordon, débranchez-le avant d'ouvrir le boîtier.
- Dans un cas autre, des raccords ou des capots d'obturateurs verrouillables doivent être fournis.
- Attendre ensuite 5 minutes après la coupure de l'alimentation électrique avant l'ouverture du capot pour que l'énergie stockée se décharge.
- Si l'équipement doit être sous tension lorsque le capot est ouvert pour l'entretien, le coup d'arc peut se produire. Respecter TOUTES les exigences locales (NFPA 70E aux États-Unis) relatives aux pratiques de travail sécuritaires et à l'équipement de protection individuelle lors de l'entretien de l'équipement électrique.

- Vérifier que le boîtier est bien fermé et que la mise à la terre est bien effectuée avant de faire fonctionner l'équipement après l'avoir déplacé, ouvert ou après avoir effectué un entretien.
- Toujours suivre ces instructions concernant le débranchement de la source de courant avant d'inspecter ou de remplacer des consommables de la torche.



LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

Le contact avec les pièces électriques sous tension peut entraîner une électrocution ou de brûlures graves, voire la mort.

- L'utilisation d'un système plasma complète un circuit électrique entre la torche et la pièce à couper. La pièce ainsi que tout autre élément la touchant font partie du circuit électrique.
- Ne jamais toucher le corps de la torche, la pièce à couper ou l'eau de la table à eau lorsque le système plasma fonctionne.

Prévention des chocs électriques

Tous les systèmes plasma Hypertherm fonctionnent à haute tension pour le coupage (souvent de 200 à 400 V c.c.). Prendre les précautions suivantes lors de l'utilisation du système :

- Porter des bottes et des gants isolants et garder le corps et les vêtements au sec.
- Ne pas se tenir, s'asseoir ou se coucher sur une surface mouillée, ni la toucher pendant l'utilisation du système plasma.
- S'isoler de la surface de travail et du sol en utilisant des tapis isolants ou des couvertures assez grandes pour éviter tout contact physique avec le matériel de travail ou le sol. S'il s'avère nécessaire de travailler dans ou près d'un endroit humide, procéder avec extrême prudence.
- Installer un sectionneur avec fusibles appropriés, à proximité de la source de courant. Ce sectionneur permet à l'opérateur d'éteindre rapidement la source de courant en cas d'urgence.
- En cas d'utilisation d'une table à eau, s'assurer que cette dernière est correctement mise à la terre.
- Installer et mettre à la terre l'équipement selon les instructions du présent manuel et conformément aux codes locaux et nationaux.
- Inspecter fréquemment le cordon de puissance d'entrée pour vérifier qu'il n'est pas endommagé ni fendu. Remplacer immédiatement un cordon d'alimentation endommagé. **Un câble dénudé peut causer la mort.**
- Inspecter et remplacer les câbles de la torche qui sont usés ou endommagés.
- Ne pas saisir la pièce à couper, ni les débris lors du coupage. Laisser la pièce à couper en place ou sur la table de travail et le câble de retour connecté lors du coupage.
- Avant de vérifier, de nettoyer ou de remplacer les pièces de la torche, couper l'alimentation ou débrancher la source de courant.
- Ne jamais contourner ou court-circuiter les verrous de sécurité.
- Avant d'enlever le capot du système ou de la source de courant, couper la puissance d'entrée électrique. Attendre ensuite 5 minutes pour que les condensateurs se déchargent.
- Ne jamais faire fonctionner le système plasma sans que les capots de la source de courant ne soient en place. Les raccords exposés de la source de courant sont extrêmement dangereux.
- Lors de l'installation des connexions, attacher tout d'abord la prise de terre appropriée.
- Chaque système plasma Hypertherm est conçu pour être utilisé uniquement avec des torches Hypertherm spécifiques. Ne pas utiliser des torches inappropriées qui pourraient surchauffer et présenter des risques pour la sécurité.



LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

- Avant de commencer, vérifier que la zone de coupage ne présente aucun danger. Conserver un extincteur à proximité.
- Eloigner toute matière inflammable à une distance d'au moins 10 m du poste de coupage.
- Tremper le métal chaud ou le laisser refroidir avant de le manipuler ou avant de le mettre en contact avec des matériaux combustibles.
- Ne jamais couper des récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Aérer toute atmosphère potentiellement inflammable avant de commencer le coupage.
- Lors de l'utilisation d'oxygène comme gaz plasma, un système de ventilation par extraction est nécessaire.

Prévention des explosions

- Ne pas utiliser le système plasma en présence possible de poussière ou de vapeurs.
- Ne pas couper de bouteilles, de tuyaux ou autres récipients fermés et pressurisés.
- Ne pas couper de récipients qui ont servi à contenir des matières combustibles.



AVERTISSEMENT

Risque d'explosion

Argon-hydrogène et méthane

L'hydrogène et le méthane sont des gaz inflammables et potentiellement explosifs. Conserver à l'écart de toute flamme les bouteilles et tuyaux contenant des mélanges à base d'hydrogène ou de méthane. Maintenir toute flamme et étincelle à l'écart de la torche lors de l'utilisation d'un plasma d'argon-hydrogène ou de méthane.



AVERTISSEMENT

Risque d'explosion

Sous l'eau lors du coupage avec gaz combustibles

- Ne pas couper l'aluminium sous l'eau ou lorsque celle-ci touche la partie inférieure de la pièce d'aluminium.
- Le coupage de l'aluminium sous l'eau, ou l'eau qui touche la partie inférieure de la pièce d'aluminium peut rassembler les conditions propices à une explosion causant une détonation lors du coupage plasma.



AVERTISSEMENT

Détonation de l'hydrogène lors du coupage de l'aluminium

- Ne pas couper la pièce sous l'eau avec des gaz combustibles contenant de l'hydrogène.
- Cela peut entraîner une explosion suivie d'une détonation lors du coupage plasma.



LES VAPEURS TOXIQUES PEUVENT PROVOQUER DES BLESSURES OU LA MORT

L'arc plasma constitue la source de chaleur utilisée pour le coupage. Par conséquent, bien que l'arc plasma n'ait pas été reconnu comme une source de vapeurs toxiques, le matériau coupé peut être une source de vapeurs ou de gaz toxiques qui épuisent l'oxygène.

Les vapeurs produites varient selon le métal coupé. Les métaux qui peuvent dégager des vapeurs toxiques comprennent, entre autres, l'acier inoxydable, l'acier au carbone, le zinc (galvanisé) et le cuivre.

Dans certains cas, le métal peut être revêtu d'une substance susceptible de dégager des vapeurs toxiques. Les revêtements toxiques comprennent entre autres, le plomb (dans certaines peintures), le cadmium (dans certaines peintures et enduits) et le beryllium.

Les gaz produits par le coupage plasma varient selon le matériau à couper et la méthode de coupage, mais ils peuvent comprendre l'ozone, les oxydes d'azote, le chrome hexavalent, l'hydrogène et autres substances présentes dans le matériau coupé ou en émanant.

Certaines précautions s'imposent pour réduire au minimum l'exposition aux vapeurs produites par tout processus industriel. Selon la composition chimique et la concentration des vapeurs (ainsi que d'autres facteurs comme la ventilation), celles-ci risquent de causer une maladie physique, comme des déficiences de naissance ou le cancer.

Il incombe au propriétaire du matériel et du site de vérifier la qualité de l'air dans le secteur où le matériel est utilisé et de s'assurer que la qualité de l'air sur les lieux de travail répond aux normes et réglementations locales et nationales.

Le niveau de qualité de l'air dans tout lieu de travail dépend des variables propres au site comme :

- Type de table (humide, sèche, sous l'eau).
- Composition du matériau, fini de la surface et composition des revêtements.
- Volume de matériau enlevé.
- Durée du coupage ou du gougeage.

- Dimensions, volume d'air, ventilation et filtration de la zone de travail.
- Équipement de protection individuelle.
- Nombre de systèmes de soudage et de coupage en fonctionnement.
- Autres procédés du site qui peuvent produire des vapeurs.

Si les lieux de travail doivent être conformes aux réglementations nationales ou locales, seuls les contrôles ou les essais effectués au site peuvent déterminer si celui-ci se situe au-dessus ou au-dessous des niveaux admissibles.

Pour réduire le risque d'exposition aux vapeurs :

- Éliminer tout revêtement et solvant du métal avant le coupage.
- Utiliser la ventilation par extraction locale pour éliminer les vapeurs de l'air.
- Ne pas inhale les vapeurs. Porter un respirateur à adduction d'air lors du coupage des métaux revêtus d'éléments toxiques ou qui en contiennent ou sont susceptibles d'en contenir.
- S'assurer que les personnes qui utilisent un équipement de soudage ou de coupage ainsi que les dispositifs de respiration par adduction d'air sont qualifiées et formées pour utiliser adéquatement cet équipement.
- Ne jamais couper les contenants dans lesquels il peut y avoir des matériaux toxiques. En premier lieu, vider et nettoyer correctement le contenant.
- Contrôler ou éprouver la qualité de l'air du site au besoin.
- Consulter un expert local pour mettre en œuvre un plan du site afin d'assurer la qualité de l'air.



MISE À LA MASSE ET À LA TERRE

Câble de retour Bien fixer le câble de retour (ou de masse) à la pièce à couper ou à la table de travail de façon à assurer un bon contact métal à métal. Ne pas fixer le câble de retour à la partie de la pièce qui doit se détacher.

Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Puissance d'entrée

- S'assurer que le fil de terre du cordon d'alimentation est connecté à la terre dans le coffret du sectionneur.

- S'il est nécessaire de brancher le cordon d'alimentation à la source de courant lors de l'installation du système, vérifier que le fil de terre est correctement branché.
- Placer tout d'abord le fil de terre du cordon d'alimentation sur le plot de mise à la terre, puis placer les autres fils de terre par-dessus. Bien serrer l'écrou de retenue.
- Vérifier que toutes les connexions sont bien serrées pour éviter une surchauffe.



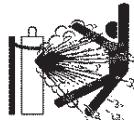
L'ÉLECTRICITÉ STATIQUE PEUT ENDOMMAGER LES CARTES DE CIRCUITS IMPRIMÉS

Les précautions qui s'imposent doivent être respectées lors de la manipulation des circuits imprimés :

- Les cartes de circuits imprimés doivent être rangées dans des contenants antistatiques.
- L'utilisateur doit porter un bracelet antistatique lors de la manipulation des cartes de circuits imprimés.

SÉCURITÉ DES BOUTEILLES DE GAZ COMPRIMÉ

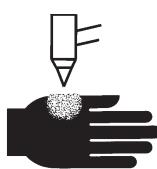
- Ne jamais lubrifier les robinets des bouteilles ou les régulateurs avec de l'huile ou de la graisse.
- Utiliser uniquement les bouteilles, régulateurs, tuyaux et accessoires appropriés et conçus pour chaque application spécifique.
- Entretenir l'équipement et les pièces d'équipement à gaz comprimé afin de les garder en bon état.
- Étiqueter et coder avec des couleurs tous les tuyaux de gaz afin d'identifier le type de gaz contenu dans chaque tuyau. Consulter les codes locaux ou nationaux en vigueur.



LES BOUTEILLES DE GAZ COMPRIMÉ PEUVENT EXPLOSER EN CAS DE DOMMAGES

Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

- Manipuler et utiliser les bouteilles de gaz comprimé conformément aux codes locaux ou nationaux.
- Ne jamais utiliser une bouteille qui n'est pas placée à la verticale et bien assujettie.
- Le capuchon de protection doit être placé sur le robinet sauf si la bouteille est en cours d'utilisation ou connectée pour utilisation.
- Éviter à tout prix le contact électrique entre l'arc plasma et une bouteille.
- Ne jamais exposer des bouteilles à une chaleur excessive, aux étincelles, aux scories ou aux flammes nues.
- Ne jamais utiliser des marteaux, des clés ou d'autres outils pour débloquer le robinet des bouteilles.



L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

L'arc plasma s'allume immédiatement après que la torche est activée.

L'arc plasma coupe facilement les gants et la peau.

- Rester éloigné de l'extrémité de la torche.
- Ne pas tenir de métal près de la trajectoire de coupe.
- Ne jamais pointer la torche vers soi ou d'autres personnes.



LES RAYONS DE L'ARC PEUVENT BRÛLER LES YEUX ET LA PEAU

Protection des yeux Les rayons de l'arc plasma produisent de puissants rayons visibles et invisibles (ultraviolets et infrarouges) qui peuvent brûler les yeux et la peau.

- Utiliser des lunettes de sécurité conformément aux codes locaux ou nationaux en vigueur.
- Porter des lunettes de protection (des lunettes ou masque muni d'écrans latéraux et un masque de soudure) avec des verres teintés appropriés pour protéger les yeux des rayons ultraviolets et infrarouges de l'arc.

Protection de la peau Porter des vêtements de sécurité pour se protéger contre les brûlures que peuvent causer les rayons ultraviolets, les étincelles et le métal brûlant :

- Gants à crispin, chaussures et casque de sécurité.
- Vêtements ignifuges couvrant toutes les parties exposées du corps.
- Pantalon sans revers pour éviter que des étincelles ou des scories puissent s'y loger.
- Avant le coupage, retirer de ses poches tout objet combustible comme les briquets au butane ou les allumettes.

Zone de coupage Préparer la zone de coupage afin de réduire la réverbération et la transmission de la lumière ultraviolette :

- Peindre les murs et autres surfaces d'une couleur sombre pour réduire la réflexion de la lumière.
- Utiliser des écrans et autres dispositifs de protection afin de protéger les autres personnes de la lumière et de la réverbération.
- Prévenir les autres personnes de ne pas regarder l'arc. Utiliser des affiches ou des panneaux.

Courant de l'arc (A)	Indice de protection minimum (ANSI Z49.1:2005)	Indice de protection suggéré pour assurer le confort (ANSI Z49.1:2005)	OSHA 29CFR 1910.133(a)(5)	Europe EN168:2002
Moins de 40 A	5	5	8	9
41 à 60 A	6	6	8	9
61 à 80 A	8	8	8	9
81 à 125 A	8	9	8	9
126 à 150 A	8	9	8	10
151 à 175 A	8	9	8	11
176 à 250 A	8	9	8	12
251 à 300 A	8	9	8	13
301 à 400 A	9	12	9	13
401 à 800 A	10	14	10	



PACEMAKERS ET PROTHÈSES AUDITIVES

Les champs magnétiques produits par les courants à haute tension peuvent affecter le fonctionnement des prothèses auditives et des pacemakers.

Les personnes portant ce type d'appareil doivent consulter un médecin avant de s'approcher d'un lieu où s'effectue le coupage ou le gougeage d'arc plasma.

Pour réduire les risques associés aux champs magnétiques :

- Garder loin de soi et du même côté du corps le câble de retour et le faisceau de torche.

- Faire passer le faisceau de torche le plus près possible du câble de retour.
- Ne pas s'enrouler le faisceau de torche ou le câble de retour autour du corps.
- Se tenir le plus loin possible de la source de courant.



LE BRUIT PEUT PROVOQUER DES PROBLÈMES AUDITIFS

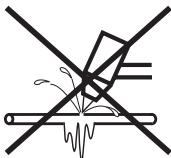
Le coupage avec l'arc plasma peut dépasser les niveaux de bruits acceptables conformément aux codes locaux relatifs à de nombreuses applications. Une exposition prolongée à un bruit excessif peut provoquer des problèmes auditifs. Toujours porter un dispositif de protection antibruit adéquat lors du coupage ou du gougeage, sauf si les mesures de niveau de bruits prises sur le site d'installation certifient que les prothèses auditives ne sont pas nécessaires, telles que spécifiées par les codes internationaux, régionaux et locaux.

Les bruits peuvent être considérablement réduits en ajoutant de simples dispositifs de sécurité intégrés aux tables de coupe, telles que des barrières ou des rideaux placés entre l'arc plasma et le poste de travail; et/ou en éloignant le poste de travail de l'arc plasma. Mettre sur pied des mesures administratives sur le site de travail afin de limiter l'accès et la durée d'exposition

de l'opérateur, délimiter les zones bruyantes à l'aide d'une paroi et/ou instaurer des mesures préventives visant à réduire la réverbération sur le lieu de travail en installant des dispositifs antibruit.

Utiliser des protecteurs d'oreille si le bruit est toujours dérangeant ou si des problèmes auditifs peuvent survenir après l'installation des dispositifs de sécurité intégrés et l'instauration des mesures préventives.

Si des protecteurs d'oreilles s'avèrent être nécessaires, porter uniquement des articles de protection personnelle approuvés, tels que des oreillères ou des bouchons d'oreille avec un coefficient de réduction de bruits approprié pour la situation sur le lieu de travail. Prévenir les personnes aux alentours des risques encourus en cas d'exposition au bruit. En outre, la protection des oreilles sert également de munition contre les projections chaudes.



UN ARC PLASMA PEUT ENDOMMAGER LES TUYAUX GELÉS

Tenter de dégeler les tuyaux gelés avec une torche plasma peut les endommager ou les faire éclater.

INFORMATION SUR LE DÉPOUSSIÈRAGE

À certains endroits, la poussière peut représenter un risque d'explosion potentiel.

La norme NFPA 68 de la National Fire Protection Association des É.-U. (édition 2007) « Explosion Protection by Deflagration Venting » établit les exigences relatives à la conception, à l'emplacement, à l'installation, à l'entretien et à l'utilisation de dispositifs et de systèmes pour évacuer à l'air libre les gaz de combustion et les pressions après une déflagration. Communiquer avec le fabricant ou avec l'installateur de tout système de dépoussiérage afin de connaître les exigences applicables avant d'installer un tel système neuf ou d'apporter des modifications importantes aux procédés ou aux matériaux utilisés par un système de dépoussiérage existant.

Consultez l'autorité compétente locale pour déterminer si une édition de la NFPA 68 a été adoptée en référence dans vos codes du bâtiment locaux.

Voir le document NFPA 68 pour obtenir des définitions et des explications des termes réglementaires tels que « déflagration, autorité compétente, adopté en référence, indice Kst, indice de déflagration » et autres termes.

Note 1 – L'interprétation d'Hypertherm de ces nouvelles exigences est que, sauf évaluation particulière du site, pour déterminer que toute la poussière produite n'est pas combustible, l'édition 2007 de la NFPA 68 exige l'utilisation d'événements d'explosion conçus pour l'indice Kst dans le pire des cas (voir annexe F) qui pourrait provenir de la poussière de sorte que l'on puisse concevoir la dimension et le type d'événement d'explosion. La NFPA 68 ne stipule pas particulièrement le procédé de coupure plasma ou d'autres procédés de coupure thermique, mais elle prescrit ces nouveaux règlements à tous les systèmes de dépoussiérage.

Note 2 – Les utilisateurs des manuels d'Hypertherm doivent consulter tous les règlements et lois fédéraux et locaux applicables et s'y conformer. Hypertherm n'a pas l'intention, en publiant un manuel d'Hypertherm, de demander des mesures qui ne sont pas conformes aux règlements et normes applicables et ce manuel ne peut jamais être interprété dans ce sens.

RADIATION AU LASER

L'exposition à une sortie laser peut provoquer des problèmes visuels graves. Éviter un contact direct avec les yeux.

Pour votre aisance et votre sécurité, l'une des étiquettes de radiation au laser suivantes a été installée sur les produits Hypertherm près de la sortie du faisceau laser du boîtier. Ont également été fournies la sortie maximale (mV), la longueur d'onde émise (nM) et au besoin, la durée d'impulsion.



Autres consignes de sécurité relatives au laser :

- Consulter un expert local pour les réglementations locales sur le laser. Une formation sur la sécurité relative au laser peut être nécessaire.
- Ne pas autoriser le personnel non formé à faire fonctionner le laser. Il peut s'avérer dangereux pour ce personnel.
- Ne jamais regarder l'intérieur ou le faisceau du laser.
- Positionner le laser selon les instructions afin d'éviter un éventuel contact avec les yeux.
- Ne pas utiliser le laser sur des pièces à couper réflectives.
- Ne pas utiliser des outils optiques pour visualiser le faisceau du laser.
- Ne pas démonter ou retirer le laser ou son capot.

- Toute modification du laser ou du produit peut accroître le risque de radiation au laser.
- L'utilisation des réglages ou le suivi des procédures autres que celles spécifiées dans ce manuel peut entraîner un risque de radiation au laser.
- Ne pas faire fonctionner l'appareil en présence d'explosifs tels que des liquides et des gaz inflammables ou la poussière.
- Utiliser uniquement les pièces et accessoires laser recommandés ou fournis par le fabricant pour votre modèle.
- Les travaux de réparation et d'entretien DOIVENT être effectués par un personnel qualifié.
- Ne pas retirer ou détruire l'étiquette de sécurité du laser.

SYMBOLES ET MARQUAGE

Votre produit Hypertherm peut comporter une ou plusieurs des marques suivantes sur sa plaque signalétique ou à proximité. En raison des différends et des conflits relatifs aux règlements nationaux, toutes les marques ne sont pas appliquées à chaque version d'un produit.



Symbol de marque S

Le symbole de marque S indique que la source de courant et la torche conviennent pour les travaux effectués dans les milieux à risque accru de choc électrique selon l'IEC 60974-1.



Marque CSA

Les produits Hypertherm portant la marque CSA sont conformes aux réglementations des États-Unis et du Canada pour la sécurité des produits. Les produits ont été évalués, testés et certifiés par CSA-International. Le produit peut autrement porter la marque d'autres laboratoires d'essais reconnus à l'échelle nationale (NRTL) agréés à la fois aux États-Unis et au Canada, par exemple : Underwriters Laboratories, Incorporated (UL) ou TÜV.



Marque CE

Le marquage CE signifie : déclaration de conformité du fabricant aux directives et normes européennes applicables. Seules les versions des produits Hypertherm portant la marque CE située sur ou à proximité de la plaque signalétique ont été testées pour conformité à la directive européenne « basse tension » et la directive européenne « compatibilité électromagnétique » (CEM). Les filtres CEM devant être en conformité avec la directive européenne CEM sont intégrés dans les produits portant la marque CE.



Marque GOST-R

Les versions CE des produits Hypertherm qui portent la marque de conformité GOST-R répondent aux exigences de sécurité du produit et de CEM en vue de l'exportation à la Fédération russe.



Marque c-Tick

Les versions CE des produits Hypertherm portant la marque c-Tick sont conformes aux règlements CEM prescrits pour la vente en Australie et en Nouvelle-Zélande.



Marque CCC

La marque de certification obligatoire en Chine (CCC) indique que le produit a été mis à l'essai et déclaré conforme aux règlements de sécurité du produit prescrits pour la vente en Chine.

SÉCURITÉ

ÉTIQUETTES DE SÉCURITÉ

Cette étiquette est affichée sur certaines sources de courant. Il est important que l'opérateur et le technicien d'entretien comprennent la signification des symboles de sécurité.

		 WARNING	 AVERTISSEMENT
	Read and follow these instructions, employer safety practices, and material safety data sheets. Refer to ANS Z49.1, "Safety in Welding, Cutting and Allied Processes" from American Welding Society (http://www.aws.org) and OSHA Safety and Health Standards, 29 CFR 1910 (http://www.osha.gov).		
1	   	1. Cutting sparks can cause explosion or fire. 1.1 Do not cut near flammables. 1.2 Have a fire extinguisher nearby and ready to use. 1.3 Do not use a drum or other closed container as a cutting table.	1. Les étincelles de coupe peuvent provoquer une explosion ou un incendie. 1.1 Ne pas couper près des matières inflammables. 1.2 Un extincteur doit être à proximité et prêt à être utilisé. 1.3 Ne pas utiliser un fût ou un autre contenant fermé comme table de coupe.
2	   	2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered. 2.1 Turn off power before disassembling torch. 2.2 Do not grip the workpiece near the cutting path. 2.3 Wear complete body protection.	2. L'arc plasma peut blesser et brûler; éloigner la buse de soi. Il s'allume instantanément quand on l'amorce; 2.1 Couper l'alimentation avant de démonter la torche. 2.2 Ne pas saisir la pièce à couper de la trajectoire de coupe. 2.3 Se protéger entièrement le corps.
3	   	3. Hazardous voltage. Risk of electric shock or burn. 3.1 Wear insulating gloves. Replace gloves when wet or damaged. 3.2 Protect from shock by insulating yourself from work and ground. 3.3 Disconnect power before servicing. Do not touch live parts.	3. Tension dangereuse. Risque de choc électrique ou de brûlure. 3.1 Porter des gants isolants. Remplacer les gants quand ils sont humides ou endommagés. 3.2 Se protéger contre les chocs en s'isolant de la pièce et de la terre. 3.3 Couper l'alimentation avant l'entretien. Ne pas toucher les pièces sous tension.
4	   	4. Plasma fumes can be hazardous. 4.1 Do not inhale fumes. 4.2 Use forced ventilation or local exhaust to remove the fumes. 4.3 Do not operate in closed spaces. Remove fumes with ventilation.	4. Les fumées plasma peuvent être dangereuses. 4.1 Ne pas inhaler les fumées 4.2 Utiliser une ventilation forcée ou un extracteur local pour dissiper les fumées. 4.3 Ne pas couper dans des espaces clos. Chasser les fumées par ventilation.
5	 	5. Arc rays can burn eyes and injure skin. 5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.	5. Les rayons d'arc peuvent brûler les yeux et blesser la peau. 5.1 Porter un bon équipement de protection pour se protéger la tête, les yeux, les oreilles, les mains et le corps. Boutonner le col de la chemise. Protéger les oreilles contre le bruit. Utiliser un masque de soudeur avec un filtre de nuance appropriée.
6	  	6. Become trained. Only qualified personnel should operate this equipment. Use torches specified in the manual. Keep non-qualified personnel and children away. 7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn (PN 110584 Rev C).	6. Suivre une formation. Seul le personnel qualifié a le droit de faire fonctionner cet équipement. Utiliser exclusivement les torches indiquées dans le manuel. Le personnel non qualifié et les enfants doivent se tenir à l'écart. 7. Ne pas enlever, détruire ni couvrir cette étiquette. La remplacer si elle est absente, endommagée ou usée (PN 110584 Rev C).

ÉTIQUETTE DE SÉCURITÉ

Cette étiquette est affichée sur certaines sources de courant. Il est important que l'opérateur et le technicien d'entretien comprennent la signification des symboles de sécurité. Les numéros de la liste correspondent aux numéros des images.



1. Les étincelles de coupe peuvent provoquer une explosion ou un incendie.
- 1.1 Ne pas couper près des matières inflammables.
- 1.2 Un extincteur doit se trouver sur les lieux et être prêt à être utilisé.
- 1.3 Ne pas utiliser un fût ou un autre contenant fermé comme table de coupe.
2. L'arc plasma peut blesser et brûler; ne jamais pointer la buse vers soi. L'arc s'amorce instantanément quand on appuie sur la gâchette.
- 2.1 Couper l'alimentation avant de démonter la torche.
- 2.2 Ne pas saisir la pièce à couper près de la trajectoire de coupe.
- 2.3 Se protéger entièrement le corps.
3. Tension dangereuse. Risque de choc électrique ou de brûlure.
- 3.1 Porter des gants isolants. Remplacer les gants s'ils sont humides ou endommagés.
- 3.2 Se protéger contre les chocs en s'isolant de la pièce et de la terre.
- 3.3 Couper l'alimentation avant de procéder à l'entretien. Ne pas toucher les pièces sous tension.
4. Les fumées du plasma peuvent être dangereuses.
- 4.1 Ne pas inhale les fumées.
- 4.2 Utiliser une ventilation forcée ou par extraction locale pour éliminer les fumées.
- 4.3 Ne pas utiliser dans des espaces clos. Éliminer les fumées avec la ventilation.
5. Les rayons d'arc peuvent brûler les yeux et blesser la peau.
- 5.1 Porter un bon équipement de protection pour se protéger la tête, les yeux, les oreilles, les mains et le corps. Boutonner le col de la chemise. Protéger les oreilles contre le bruit. Utiliser le masque de soudage avec le filtre ayant le bon indice de protection.
6. Suivre une formation. Seul le personnel qualifié doit faire fonctionner cet équipement. Utiliser les torches prescrites dans le manuel. Tenir le personnel non qualifié et les enfants à l'écart.
7. Ne pas enlever, détruire ou couvrir cette étiquette. La remplacer si elle est manquante, endommagée ou usée.

SÉCURITÉ

Sección 1b

SEGURIDAD

En esta sección:

Reconocimiento de información de seguridad	1-2
Cumplimiento de instrucciones de seguridad.....	1-2
Riesgos de electrocución	1-2
Las descargas eléctricas pueden matar.....	1-3
Los cortes pueden producir incendios o explosiones.....	1-4
Los vapores tóxicos pueden producir lesiones o la muerte.....	1-5
Seguridad de toma a tierra.....	1-6
La electricidad estática puede dañar las placas de circuitos.....	1-6
Seguridad de equipos de gas comprimido	1-6
Los cilindros de gas pueden explotar si están dañados	1-6
El arco de plasma puede producir lesiones y quemaduras	1-7
Los rayos del arco pueden quemar los ojos y la piel.....	1-7
Funcionamiento de marcapasos y audífonos	1-8
Los ruidos pueden dañar la audición	1-8
El arco de plasma puede dañar las tuberías congeladas	1-8
Información acerca de la recolección de polvo seco	1-9
Radiación láser	1-10
Símbolos y marcas	1-11
Etiquetas de advertencia.....	1-12



RECONOCIMIENTO DE INFORMACIÓN DE SEGURIDAD

Los símbolos incluidos en esta sección se usan para identificar posibles peligros. Cuando vea un símbolo de seguridad en este manual o en la máquina, debe tomar conciencia del riesgo de lesiones personales y seguir las instrucciones relacionadas para evitar ese riesgo.



CUMPLIMIENTO DE INSTRUCCIONES DE SEGURIDAD

Lea cuidadosamente todos los mensajes de seguridad de este manual y todas las etiquetas de seguridad de la máquina.

- Mantenga las etiquetas de seguridad de la máquina en buen estado. Reponga de inmediato las etiquetas dañadas o faltantes.
- Aprenda a operar la máquina y usar los controles de manera adecuada. No permita que nadie la opere sin las instrucciones correspondientes.
- Asegúrese de que la máquina esté en buenas condiciones operativas. Las modificaciones no autorizadas pueden afectar la seguridad y la vida útil de la máquina.

PELIGRO ADVERTENCIA PRECAUCIÓN

Hypertherm utiliza las pautas del American National Standards Institute en relación con los símbolos y las palabras de aviso de seguridad. Junto a los símbolos de seguridad, aparecen palabras de aviso como PELIGRO o ADVERTENCIA. La palabra PELIGRO identifica a los riesgos más graves.

- Las etiquetas de seguridad de PELIGRO y ADVERTENCIA están colocadas cerca de los riesgos específicos que presenta la máquina.
- Los mensajes de seguridad de PELIGRO aparecen en este manual antes de las instrucciones relacionadas a procesos que pueden producir lesiones o la muerte si no se siguen correctamente.
- Los mensajes de seguridad de ADVERTENCIA aparecen en este manual antes de las instrucciones relacionadas a procesos que pueden producir lesiones o la muerte si no se siguen correctamente.
- Los mensajes de seguridad de PRECAUCIÓN aparecen en este manual antes de las instrucciones relacionadas a procesos que pueden producir lesiones menores o daños en los equipos si no se siguen correctamente.

RIESGOS DE ELECTROCUCIÓN

- Sólo el personal capacitado y autorizado puede abrir este equipo.
- Si el equipo está conectado en forma permanente, apáguelo e implemente un cierre "con llave y etiqueta" de la energía antes de abrir el armazón.
- Si el suministro de energía se realiza a través de un cable, desenchufe la unidad antes de abrir el armazón.
- Otras personas deberán suministrar las cubiertas para enchufes bloqueables y los elementos de desconexión bloqueables.
- Espere 5 minutos luego de cortar la energía y antes de ingresar en el armazón, a fin de permitir que la energía almacenada se descargue.

- Si no se puede cortar el suministro de energía del equipo mientras se abre el armazón para realizar reparaciones, es posible que se produzcan peligros de explosión de arco eléctrico. Siga TODOS los requisitos locales (NFPA 70E en los EE. UU.) en relación con las prácticas de trabajo seguro y con el equipo de protección personal al realizar reparaciones en equipos energizados.
- El armazón debe permanecer cerrado y se debe verificar que la continuidad a tierra física al armazón sea la adecuada antes de operar el equipo y luego de moverlo, abrirlo o realizarle reparaciones.
- Siempre siga estas instrucciones para desconectar la energía antes de inspeccionar o cambiar las piezas consumibles de la antorcha.



LAS DESCARGAS ELÉCTRICAS PUEDEN MATAR

El contacto con piezas eléctricas con corriente puede causar una descarga mortal o quemaduras graves.

- Cuando el sistema de plasma está en funcionamiento, se completa un circuito eléctrico entre la antorcha y la pieza a cortar. La pieza a cortar y cualquier objeto que la esté tocando pasan a formar parte de este circuito.
- Nunca toque el cuerpo de antorcha, la pieza a cortar ni el agua de la mesa de agua cuando el sistema de plasma esté en funcionamiento.

Prevención de descargas eléctricas

Todos los sistemas de plasma Hypertherm usan voltajes altos en el proceso de corte (suelen ser de 200 a 400 VCD). Tome las siguientes precauciones al operar el sistema:

- Use botas y guantes aislados, y mantenga su cuerpo y su vestimenta secos.
- Asegúrese de que ninguna parte de su cuerpo esté en contacto con una superficie mojada mientras usa el sistema de plasma.
- Aíslense de la pieza de trabajo y la tierra con una alfombra o cubierta aislante de tamaño suficiente para prevenir cualquier contacto físico con la pieza de trabajo o la tierra. Tenga mucha precaución si el lugar de trabajo o los alrededores están húmedos.
- Instale un interruptor de desconexión con fusibles de tamaño apropiado cerca de la fuente de energía. Este interruptor permitirá al operador cortar la fuente de energía rápidamente ante una emergencia.
- Al usar una mesa de agua, asegúrese de que esté bien puesta a tierra.

- Instale y ponga a tierra el equipo respetando el manual de instrucciones y los códigos nacionales y locales.
- Inspeccione con frecuencia el cable de potencia de alimentación para detectar daños o rajaduras en la cubierta. Reemplace los cables dañados de inmediato. **Los cables pelados pueden ser mortales.**
- Inspeccione las mangueras de la antorcha y reemplace las que estén dañadas.
- No levante la pieza a cortar ni los residuos de corte durante la tarea. Deje la pieza a cortar en su lugar o en la mesa de trabajo con el cable de trabajo colocado durante el proceso de corte.
- Antes de controlar, limpiar o reemplazar piezas de la antorcha, desconecte la alimentación principal o desenchufe la fuente de energía.
- Nunca anule ni puentee los bloqueos de seguridad.
- Antes de quitarle la cubierta a una fuente de energía o recinto del sistema, desconecte la potencia de alimentación eléctrica. Espere 5 minutos antes de desconectar la alimentación principal, para permitir la descarga de los condensadores.
- Nunca opere el sistema de plasma sin las cubiertas de la fuente de energía en su lugar. Si las conexiones de la fuente de energía están expuestas, presentan un alto riesgo de electrocución.
- Al hacer las conexiones de entrada, una primero el conductor de puesta a tierra correspondiente.
- Cada sistema de plasma Hypertherm está diseñado para usarse únicamente con antorchas Hypertherm específicas. No utilice otras antorchas, ya que podrían sobrecalentarse y presentar un riesgo para la seguridad.



LOS CORTES PUEDEN PRODUCIR INCENDIOS O EXPLOSIONES

Prevención de incendios

- Compruebe la seguridad del lugar antes de realizar cortes. Tenga disponible un extintor de incendios cerca del lugar.
- Mantenga todas las sustancias inflamables a 10 m de distancia del área de corte.
- Temple o deje enfriar el metal caliente antes de manipularlo o que entre en contacto con materiales combustibles.
- Nunca corte envases que contengan materiales potencialmente inflamables; primero deben vaciarse y limpiarse bien.
- Ventile las atmósferas que puedan ser inflamables antes de realizar cortes.
- Al cortar con oxígeno como gas plasma, es obligatorio el uso de un sistema de ventilación de escape.

Prevención de explosiones

- No use el sistema de plasma si puede haber polvo o vapores explosivos.
- No corte cilindros presurizados, tuberías ni envases cerrados.
- No corte envases que tenían materiales combustibles.



ADVERTENCIA

Peligro de explosión
Argón-hidrógeno y metano

El hidrógeno y el metano son gases inflamables que presentan un riesgo de explosión. Mantenga las llamas alejadas de los cilindros y las mangueras con metano o mezclas de hidrógeno. Evite que las llamas y las chispas se acerquen a la antorcha cuando use plasma de metano o argón-hidrógeno.



ADVERTENCIA

Peligro de explosión
Cortes bajo el agua con
gases combustibles

- No corte aluminio bajo el agua o cuando el agua esté en contacto con la parte inferior del aluminio.
- Cortar aluminio bajo el agua o cuando el agua esté en contacto con la parte inferior del aluminio puede provocar una situación explosiva que podría detonarse durante las operaciones de corte por plasma.



ADVERTENCIA

Explosión de hidrógeno
al cortar aluminio

- No realice cortes bajo el agua con gases combustibles que contengan hidrógeno.
- Realizar cortes bajo el agua con gases combustibles que contienen hidrógeno puede provocar una situación explosiva que podría detonarse durante operaciones de corte por plasma.



LOS VAPORES TÓXICOS PUEDEN PRODUCIR LESIONES O LA MUERTE

El arco de plasma es la fuente de calor usada para el corte. Por lo tanto, aunque el arco de plasma mismo no sea fuente de vapores tóxicos, el material que se corta puede producir estos vapores o gases que agotan el oxígeno.

Los vapores producidos varían según el metal que se corte. Algunos de los metales que pueden producir vapores tóxicos son, entre otros, el acero inoxidable, el acero al carbono, el zinc (galvanizado) y el cobre.

En algunos casos, el metal puede estar recubierto por una sustancia que podría producir vapores tóxicos.

Los revestimientos tóxicos incluyen, entre otros, el plomo (de algunas pinturas), el cadmio (de algunas pinturas y tapaportas) y el berilio.

Los gases producidos por el corte por plasma varían según el material y el método de corte, pero pueden incluir ozono, óxidos de nitrógeno, cromo hexavalente, hidrógeno y otras sustancias contenidas o liberadas por el material de corte.

Se deben tomar precauciones para minimizar la exposición a los vapores producidos en cualquier proceso industrial. Según la composición química y la concentración de los vapores (junto con otros factores, como la ventilación), puede haber riesgo de contraer enfermedades físicas, como defectos congénitos o cáncer.

El propietario del equipo y las instalaciones debe analizar la calidad del aire del lugar donde se usa el equipo, para asegurarse de que cumpla con todas las normas y reglamentaciones locales y nacionales.

La calidad del aire de cualquier lugar de trabajo depende de variables específicas del lugar, como:

- Diseño de la mesa (con agua, en seco, bajo el agua).
- Composición del material, acabado de la superficie y composición de los revestimientos.
- Volumen de material descartado.
- Duración del corte o ranurado.

- Tamaño, volumen de aire, ventilación y filtración del área de trabajo.
- Equipos de protección personal.
- Cantidad de sistemas de soldadura y corte en funcionamiento.
- Otros procesos del lugar que pueden producir vapores.

Si el lugar de trabajo debe cumplir con reglamentaciones nacionales o locales, sólo los controles o pruebas realizados en el lugar pueden determinar si los niveles se encuentran dentro de lo permitido.

Para reducir el riesgo de exposición a vapores:

- Quite todos los revestimientos y solventes del metal antes de cortar.
- Use la ventilación de escape local para eliminar los vapores del aire.
- No inhale los vapores. Use un respirador con suministro de aire al cortar metales que contienen o pueden contener elementos tóxicos, o están recubiertos con estos elementos.
- Asegúrese de que las personas que usen equipos de soldadura o corte, y respiradores con suministro de aire estén calificadas y capacitadas en el uso adecuado de estos equipos.
- Nunca corte envases que contengan materiales potencialmente tóxicos. Vacíe y limpie bien el envase antes de cortarlo.
- Realice controles o pruebas de la calidad del aire del lugar, según sea necesario.
- Consulte a un experto local sobre la implementación de un plan para asegurarse de que la calidad del aire sea segura.



SEGURIDAD DE TOMA A TIERRA

Cable de trabajo Sujete el cable de trabajo firmemente a la pieza a cortar o la mesa de trabajo, estableciendo un buen contacto metal con metal. No lo conecte a la pieza que se caerá cuando se termine el corte.

Mesa de trabajo Ponga a tierra la mesa de trabajo, en cumplimiento con los códigos eléctricos locales y nacionales.

Potencia de alimentación (entrada)

- Asegúrese de conectar el conductor de puesta a tierra del cable de alimentación con la puesta a tierra de la caja de desconexión.

- Si la instalación del sistema de plasma implica la conexión del cable de alimentación a la fuente de energía, asegúrese de conectar adecuadamente el conductor de puesta a tierra del cable de alimentación.
- Coloque el conductor de puesta a tierra del cable de alimentación en el borne antes que los demás; los otros conductores de puesta a tierra deben ir encima del conductor del cable de alimentación. Ajuste bien la tuerca de retención.
- Ajuste todas las conexiones eléctricas para evitar el calentamiento excesivo.



LA ELECTRICIDAD ESTÁTICA PUEDE DAÑAR LAS PLACAS DE CIRCUITOS

Tome las precauciones necesarias para manipular placas de circuito impreso:

- Guarde las placas de PC en recipientes antiestáticos.
- Use una cinta de muñeca puesta a tierra para manipular las placas de PC.

SEGURIDAD DE EQUIPOS DE GAS COMPRIMIDO

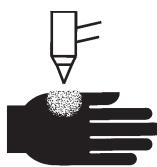
- Nunca lubrique los reguladores o las válvulas de cilindros con aceite o grasa.
- Use únicamente los cilindros de gas, los reguladores, las mangueras y los accesorios diseñados específicamente para esa aplicación.
- Mantenga todos los equipos de gas comprimido y las piezas relacionadas en buen estado.
- Etiquete e identifique con colores todas las mangueras de gas, para saber el tipo de gas que transporta cada manguera. Consulte los códigos nacionales y locales correspondientes.



LOS CILINDROS DE GAS PUEDEN EXPLOTAR SI ESTÁN DAÑADOS

Los cilindros de gas tienen gas bajo alta presión. Si se dañan, pueden explotar.

- Los cilindros de gas comprimido deben manipularse y usarse respetando los códigos nacionales y locales.
- Use únicamente cilindros que estén en posición vertical y bien sujetos en su lugar.
- Mantenga la tapa protectora colocada en la válvula, a menos que el cilindro esté conectado o en uso.
- Nunca permita que haya contacto eléctrico entre el arco de plasma y un cilindro.
- Nunca exponga los cilindros al calor excesivo, las chispas, la escoria ni la llama directa.
- Nunca use un martillo, llave ni otra herramienta para abrir una válvula de cilindro atascada.



EL ARCO DE PLASMA PUEDE PRODUCIR LESIONES Y QUEMADURAS

Antorchas de encendido inmediato

El arco de plasma se enciende de inmediato al activar el interruptor de la antorcha.

El arco de plasma puede cortar los guantes y la piel rápidamente.

- Evite el contacto con la punta de la antorcha.
- No ponga piezas de metal cerca de la ruta de corte.
- Nunca apunte la antorcha en dirección a usted o a otras personas.



LOS RAYOS DEL ARCO PUEDEN QUEMAR LOS OJOS Y LA PIEL

Protección ocular El arco de plasma produce rayos visibles e invisibles (ultravioletas e infrarrojos) que pueden quemar los ojos y la piel.

- Use la protección ocular que exigen los códigos nacionales y locales.
- Las lentes de la protección ocular (anteojos o gafas de seguridad con protección lateral, y careta de soldador) deben contar con el sombreado adecuado para proteger los ojos de los rayos ultravioletas e infrarrojos del arco.

Protección cutánea Use vestimenta de protección para evitar las quemaduras producidas por la luz ultravioleta, las chispas y el metal caliente.

- Guantes de seguridad, calzado de seguridad y casco.
- Vestimenta ignífuga para cubrir todas las áreas expuestas.
- Pantalones sin dobladillo, para evitar el ingreso de chispas y escoria.
- Antes del corte, saquese de los bolsillos todo material combustible, como los encendedores con butano o los fósforos.

Área de corte Prepare el área de corte para reducir el reflejo y la emisión de luz ultravioleta:

- Pinte las paredes y otras superficies de colores oscuros, para reducir el reflejo.
- Use pantallas o barreras protectoras para resguardar a los demás del centelleo y el resplandor.
- Advierta a las demás personas que no deben mirar el arco. Coloque carteles o anuncios.

Corriente del arco (amperios)	Número mínimo de sombra de protección (ANSI Z49.1:2005)	Número de sombra sugerido para confort (ANSI Z49.1:2005)	OSHA 29CFR 1910.133(a)(5)	Europa EN168:2002
Inferior a 40 A	5	5	8	9
41 a 60 A	6	6	8	9
61 a 80 A	8	8	8	9
81 a 125 A	8	9	8	9
126 a 150 A	8	9	8	10
151 a 175 A	8	9	8	11
176 a 250 A	8	9	8	12
251 a 300 A	8	9	8	13
301 a 400 A	9	12	9	13
401 a 800 A	10	14	10	



FUNCIONAMIENTO DE MARCAPASOS Y AUDÍFONOS

El funcionamiento de marcapasos y audífonos puede verse afectado por los campos magnéticos de las altas corrientes.

Las personas que usan marcapasos o audífonos deben consultar a un médico antes de acercarse a una operación de corte o ranurado por arco de plasma.

Para reducir el riesgo que presentan los campos magnéticos:

- Mantenga el cable de trabajo y los conductos de antorcha a un costado, alejados del cuerpo.

- Haga pasar las mangueras de la antorcha lo más cerca posible del cable de trabajo.
- No se enrosque ni apoye los conductos de antorcha ni el cable de trabajo en el cuerpo.
- Manténgase lo más alejado de la fuente de energía como sea posible.



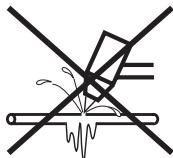
LOS RUIDOS PUEDEN DAÑAR LA AUDICIÓN

Realizar cortes con un arco de plasma puede superar los niveles de ruido aceptables, según se definen en los códigos locales en muchas aplicaciones. La exposición prolongada a ruidos excesivos puede dañar la audición. Siempre use una protección apropiada para los oídos al realizar cortes o ranurados, a menos que se haya verificado que, en función de las mediciones de los niveles de presión de sonido tomadas en el sitio instalado, no sea necesario utilizar protección auditiva personal, de acuerdo con los códigos internacionales, regionales y locales correspondientes.

Se puede obtener una reducción significativa de los ruidos mediante la incorporación de controles de ingeniería simples a las mesas de corte, como barreras o cortinas ubicadas entre el arco de plasma y la estación de trabajo; además, se puede ubicar la estación de trabajo en un lugar alejado del arco de plasma. Se deben implementar controles

administrativos en el lugar de trabajo para restringir el acceso, limitar el tiempo de exposición del operador, cubrir áreas de trabajo ruidosas o tomar las medidas necesarias para reducir la reverberación en áreas de trabajo al colocar mecanismos de absorción de ruidos.

Se debe utilizar una protección auditiva si el ruido es perjudicial o si existe el riesgo de que se produzcan daños a la audición una vez implementados todos los demás controles administrativos y de ingeniería. Si es necesario utilizar una protección auditiva, utilice sólo los dispositivos de protección personal aprobados, como protectores para las orejas o tapones para los oídos con una calificación de reducción de ruidos adecuada para la situación. Advierta a las demás personas que trabajan en el área sobre los posibles riesgos que presentan los ruidos. Además, la protección para los oídos puede evitar que salpicaduras calientes ingresen en la oreja.



EL ARCO DE PLASMA PUEDE DAÑAR LAS TUBERÍAS CONGELADAS

Las tuberías pueden dañarse o reventar si se intenta descongelarlas con una antorcha de plasma.

INFORMACIÓN ACERCA DE LA RECOLECCIÓN DE POLVO SECO

En algunos sitios, el polvo seco puede presentar un posible riesgo de explosión.

La edición 2007 de la norma 68 NFPA de la U.S. National Fire Protection Association, "Explosion Protection by Deflagration Venting" (Protección contra explosiones mediante ventilación en caso de deflagración) proporciona los requisitos para el diseño, la ubicación, la instalación, el mantenimiento y el uso de dispositivos y sistemas para ventilar presiones y gases de combustión después de un evento de deflagración. Consulte al fabricante o instalador de sistemas de recolección de polvo seco acerca de los requisitos aplicables antes de instalar un nuevo sistema de recolección de polvo seco o de realizar cambios significativos en los materiales o procesos utilizados con un sistema de recolección de polvo seco existente.

Consulte la "Autoridad con jurisdicción" (AHJ, Authority Having Jurisdiction) para determinar si la edición de la norma 68 de la NFPA se ha "adoptado por referencia" en los códigos de construcción locales.

Consulte la norma NFPA68 para conocer las definiciones y explicaciones de los términos aprobados como deflagración, AHJ, adoptado por referencia, valor Kst, índice de deflagración y otros términos.

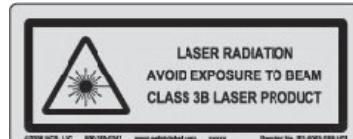
Nota 1 – La interpretación por parte de Hypertherm de estos nuevos requisitos implica que, a menos que se haya realizado una evaluación específica del lugar para determinar que el polvo generado no es combustible, la edición 2007 de NFPA 68 requiere el uso de ventilaciones de explosión diseñadas para el peor valor Kst (consulte el anexo F) que se podría generar a causa del polvo, de manera que se puedan diseñar el tipo y el tamaño de ventilación de explosión. La norma NFPA 68 no identifica específicamente que el corte por plasma ni otros procesos de corte térmico requieran sistemas de ventilación en caso de deflagración; sin embargo, sí aplica estos nuevos requisitos a todos los sistemas de recolección de polvo seco.

Nota 2 – Los usuarios de los manuales de Hypertherm deben consultar y cumplir todas las regulaciones y leyes federales, estatales y locales correspondientes. Mediante la publicación de sus manuales, Hypertherm no pretende instar la implementación de acciones que no cumplen los estándares y las regulaciones aplicables; asimismo, no se debe interpretar que este manual persigue dicho fin.

RADIACIÓN LÁSER

La exposición a la salida del láser puede provocar graves daños oculares. Evite la exposición ocular directa.

Para su conveniencia y seguridad, en todos los productos Hypertherm que usan un láser, se ha aplicado una de las siguientes etiquetas de radiación láser en el producto, cerca de lugar donde el haz láser sale del bastidor. También se proporcionan los valores de salida máxima (mV), la longitud de onda emitida (nM) y, si corresponde, la duración de pulso.



Instrucciones de seguridad adicionales sobre la utilización de productos con láser:

- Consulte a un experto para conocer las regulaciones locales sobre la utilización de láser. Es posible que se exija una capacitación de seguridad para el uso de láser.
- No permita que el personal no capacitado opere el láser. El láser puede ser peligroso si es utilizado por personal no capacitado.
- No mire el haz o la apertura del láser en ningún momento.
- Ubique el láser como se indica, a fin de evitar contacto ocular no deseado.
- No utilice el láser en piezas a cortar reflectantes.
- No utilice herramientas ópticas para visualizar o reflectar el haz del láser.
- No desarme ni extraiga el láser ni la cubierta de apertura.
- Las modificaciones realizadas al láser o al producto pueden aumentar el riesgo de que se produzca radiación láser.
- El uso de ajustes o la implementación de procedimientos que no sean aquellos especificados en este manual pueden provocar una exposición peligrosa a la radiación láser.
- No opere el producto en atmósferas explosivas, como en presencia de polvo, gases o líquidos inflamables.
- Sólo utilice los accesorios y las piezas del láser que el fabricante suministra o recomienda para su modelo.
- Las reparaciones y el mantenimiento SE DEBEN llevar a cabo por personal calificado.
- No extraiga ni mutile la etiqueta de seguridad del láser.

SÍMBOLOS Y MARCAS

Su producto Hypertherm puede contener alguna de las siguientes marcas en la placa de datos o cerca de ella. Debido a las diferencias y los conflictos con las regulaciones nacionales, no todas las marcas se aplican a todas las versiones de un producto.



Marca símbolo S

La marca símbolo S indica que la fuente de energía y la antorcha son aptas para operaciones llevadas a cabo en entornos en los que existe un alto peligro de descargas eléctricas, de acuerdo con la norma IEC 60974-1.



Marca CSA

Los productos de Hypertherm que tienen la marca CSA cumplen con los reglamentos de seguridad de los productos de los Estados Unidos y Canadá. Estos productos han sido evaluados, probados y certificados por CSA-International. De manera alternativa, es posible que el producto tenga una marca colocada por otro Laboratorio de pruebas reconocido a nivel nacional (NRTL, por sus siglas en inglés) autorizado en los Estados Unidos y en Canadá, por ejemplo, Underwriters Laboratories, Incorporated (UL) o TÜV.



Marca CE

La marca CE indica la declaración de cumplimiento del fabricante con las normas y las directivas europeas aplicables. Sólo se considerarán probadas para cumplimiento con las Directivas europeas de baja tensión y con las Directivas europeas de compatibilidad electromagnética (EMC) aquellas versiones de los productos Hypertherm que tengan la marca CE colocada sobre la placa de datos o cerca de ésta. Aquellos filtros de EMC que deban cumplir con las Directivas europeas de EMC se han incorporado a las versiones de los productos con la marca CE.



Marca GOST-R

Las versiones CE de los productos de Hypertherm que incluyen una marca de conformidad GOST-R cumplen los requisitos de compatibilidad electromagnética (EMC) y de seguridad del producto para exportación a la Federación Rusa.



Marca c-Tick

Las versiones CE de los productos de Hypertherm que incluyen una marca c-Tick cumplen las regulaciones de EMC para la venta del producto en Australia y Nueva Zelanda.



Marca CCC

La marca China Compulsory Certification (CCC) indica que se ha evaluado el producto y que este cumple las regulaciones de seguridad del producto requeridas para su venta en China.

ETIQUETAS DE ADVERTENCIA

Esta etiqueta de advertencia se coloca en ciertas fuentes de energía. Es importante que el operador y el técnico de mantenimiento entiendan las ideas que transmiten estos símbolos de advertencia.

	Read and follow these instructions, employer safety practices, and material safety data sheets. Refer to ANS Z49.1, "Safety in Welding, Cutting and Allied Processes" from American Welding Society (http://www.aws.org) and OSHA Safety and Health Standards, 29 CFR 1910 (http://www.osha.gov).	 WARNING	 AVERTISSEMENT
	1.1 Do not cut near flammables.	Plasma cutting can be injurious to operator and persons in the work area. Consult manual before operating. Failure to follow all these safety instructions can result in death.	Le coupage plasma peut être préjudiciable pour l'opérateur et les personnes qui se trouvent sur les lieux de travail. Consulter le manuel avant de faire fonctionner. Le non respect des ces instructions de sécurité peut entraîner la mort.
	1.2 Have a fire extinguisher nearby and ready to use. 1.3 Do not use a drum or other closed container as a cutting table.	1. Cutting sparks can cause explosion or fire. 1.1 Do not cut near flammables. 1.2 Turn off power before disassembling torch. 1.3 Wear complete body protection.	1. Les étincelles de coupage peuvent provoquer une explosion ou un incendie. 1.1 Ne pas couper près des matières inflammables. 1.2 Un extincteur doit être à proximité et prêt à être utilisé. 1.3 Ne pas utiliser un fût ou un autre contenant fermé comme table de coupage.
	2.1 Turn off power before disassembling torch. 2.2 Do not grip the workpiece near the cutting path. 2.3 Wear complete body protection.	2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered. 2.1 Do not cut near flammables. 2.2 Turn off power before disassembling torch. 2.3 Wear complete body protection.	2. L'arc plasma peut blesser et brûler; éloigner la buse de soi. Il s'allume instantanément quand on l'amorce; 2.1 Couper l'alimentation avant de démonter la torche. 2.2 Ne pas saisir la pièce à couper de la trajectoire de coupage. 2.3 Se protéger entièrement le corps.
	3.1 Wear insulating gloves. Replace gloves when wet or damaged. 3.2 Protect from shock by insulating yourself from work and ground. 3.3 Disconnect power before servicing. Do not touch live parts.	3. Hazardous voltage. Risk of electric shock or burn. 3.1 Wear insulating gloves. Replace gloves when wet or damaged. 3.2 Protect from shock by insulating yourself from work and ground. 3.3 Disconnect power before servicing. Do not touch live parts.	3. Tension dangereuse. Risque de choc électrique ou de brûlure. 3.1 Porter des gants isolants. Remplacer les gants quand ils sont humides ou endommagés. 3.2 Se protéger contre les chocs en s'isolant de la pièce et de la terre. 3.3 Couper l'alimentation avant l'entretien. Ne pas toucher les pièces sous tension.
	4.1 Do not inhale fumes. 4.2 Use forced ventilation or local exhaust to remove the fumes. 4.3 Do not operate in closed spaces. Remove fumes with ventilation.	4. Plasma fumes can be hazardous. 4.1 Do not inhale fumes. 4.2 Use forced ventilation or local exhaust to remove the fumes. 4.3 Do not operate in closed spaces. Remove fumes with ventilation.	4. Les fumées plasma peuvent être dangereuses. 4.1 Ne pas inhaler les fumées 4.2 Utiliser une ventilation forcée ou un extracteur local pour dissiper les fumées. 4.3 Ne pas couper dans des espaces clos. Chasser les fumées par ventilation.
	5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.	5. Arc rays can burn eyes and injure skin. 5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.	5. Les rayons d'arc peuvent brûler les yeux et blesser la peau. 5.1 Porter un bon équipement de protection pour se protéger la tête, les yeux, les oreilles, les mains et le corps. Boutonner le col de la chemise. Protéger les oreilles contre le bruit. Utiliser un masque de soudeur avec un filtre de nuance appropriée.
	6. Become trained. Only qualified personnel should operate this equipment. Use torches specified in the manual. Keep non-qualified personnel and children away. 7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn (PN 110584 Rev C).	6. Become trained. Only qualified personnel should operate this equipment. Use torches specified in the manual. Keep non-qualified personnel and children away. 7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn (PN 110584 Rev C).	6. Suivre une formation. Seul le personnel qualifié a le droit de faire fonctionner cet équipement. Utiliser exclusivement les torches indiquées dans le manuel. Le personnel non qualifié et les enfants doivent se tenir à l'écart. 7. Ne pas enlever, détruire ni couvrir cette étiquette. La remplacer si elle est absente, endommagée ou usée (PN 110584 Rev C).

ETIQUETAS DE ADVERTENCIA

Esta etiqueta de advertencia se coloca en ciertas fuentes de energía. Es importante que el operador y el técnico de mantenimiento entiendan las ideas que transmiten estos símbolos de advertencia. Los textos numerados corresponden a los cuadros numerados de la etiqueta.



1. Las chispas de corte pueden producir explosiones o incendios.
- 1.1 No corte cerca de sustancias inflamables.
- 1.2 Tenga disponible un extintor de incendios cerca del lugar y listo para usar.
- 1.3 No use tambores ni otros envases cerrados como mesa de corte.
2. El arco de plasma puede producir lesiones y quemaduras; mantenga la boquilla alejada del cuerpo. El arco arranca instantáneamente al apretar el gatillo.
- 2.1 Corte la fuente de energía antes de desarmar la antorcha.
- 2.2 No agarre la pieza a cortar cerca de la ruta de corte.
- 2.3 Use protección corporal completa.
3. Voltaje peligroso. Riesgo de descargas o quemaduras eléctricas.
- 3.1 Use guantes aislantes. Reemplácelos cuando estén húmedos o dañados.
- 3.2 Protéjase de las descargas aislándose de la pieza de trabajo y la tierra.
- 3.3 Desconecte la corriente antes de realizar reparaciones. No toque las piezas con corriente.
4. Los vapores de plasma pueden ser peligrosos.
- 4.1 No inhale los vapores.
- 4.2 Use ventilación forzada o la ventilación de escape local para eliminar los vapores.
- 4.3 No opere el sistema en espacios cerrados. Elimine los vapores con ventilación.
5. Los rayos del arco pueden quemar los ojos y lesionar la piel.
- 5.1 Use el equipo de protección correcto y adecuado para proteger la cabeza, los ojos, los oídos, las manos y el cuerpo. Abróchese el cuello de la camisa. Protéjase los oídos del ruido. Use una careta de soldador con el sombreado o filtro adecuado.
6. Capacítense. Sólo personal calificado debe operar este equipo. Use las antorchas especificadas en el manual. Mantenga al personal no calificado y a los niños alejados del área de trabajo.
7. No quite, destruya, ni cubra esta etiqueta. Reemplácela si falta o si está dañada o gastada.

SEGURIDAD

Section 2

SPECIFICATIONS

In this section:

System description	2-2
General.....	2-2
Power supply	2-2
Ignition console	2-2
Fuel-gas console.....	2-2
Off-valve	2-2
Torch	2-2
System diagram 1 – without a fuel-gas console	2-3
System diagram 2 – with a fuel-gas console	2-4
Specifications.....	2-5
System gas requirements	2-5
Noise levels	2-6
Power supply.....	2-7
Fuel-gas console – 078201	2-8
Ignition console – 078172.....	2-9
Standard off-valve – 229105.....	2-10
Fuel-gas off-valve – 229130	2-11
Torch – 228144.....	2-12

System description

General

The HySpeed HSD130 plasma system is designed to cut a wide range of thicknesses of mild steel, stainless steel and aluminum.

Power supply

The power supply is a 130-amp, 150-VDC constant-current supply. It contains the circuitry to ignite a torch plus a heat exchanger and a pump to cool the torch. The power supply has a discrete machine interface to provide communication with a CNC controller.

Ignition console

The ignition console uses a spark-gap assembly. The ignition console converts 120 VAC control voltage from the power supply into high-frequency and high-voltage pulses (9-10 kV) to break over the torch electrode-nozzle gap. The high-voltage, high-frequency signal is coupled to the pilot arc lead.

Fuel-gas console (optional, see system diagram 2)

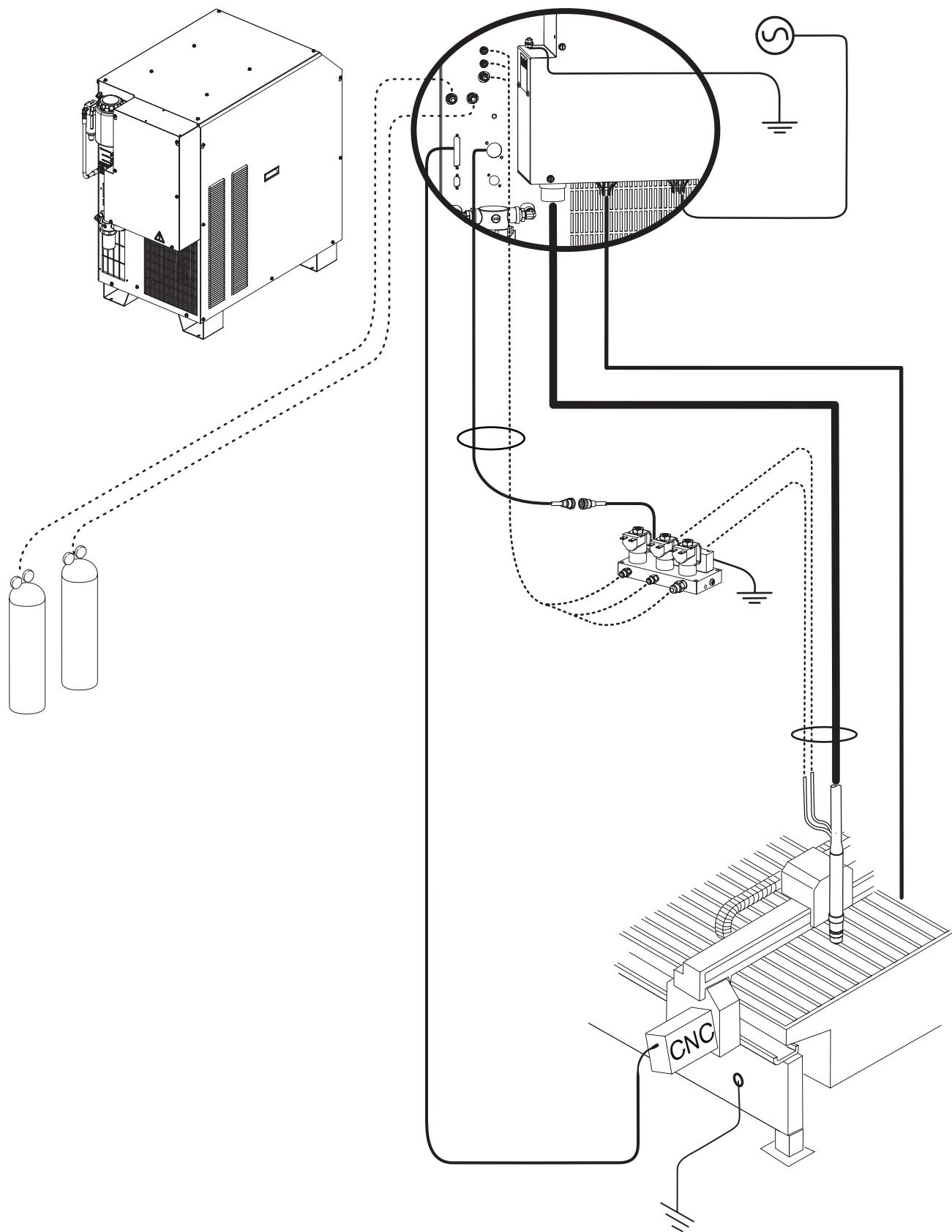
The fuel-gas console manages the selection and flow rate of incoming fuel-gases. The fuel-gas console includes a regulator, solenoid valves, check valves and a pressure transducer. The fuel-gas console also houses a relay PC board and a control PC board.

Off-valve

The off-valve consists of 3 solenoid valves, a manifold block and a wiring harness with connector. The assembly interfaces with the power supply.

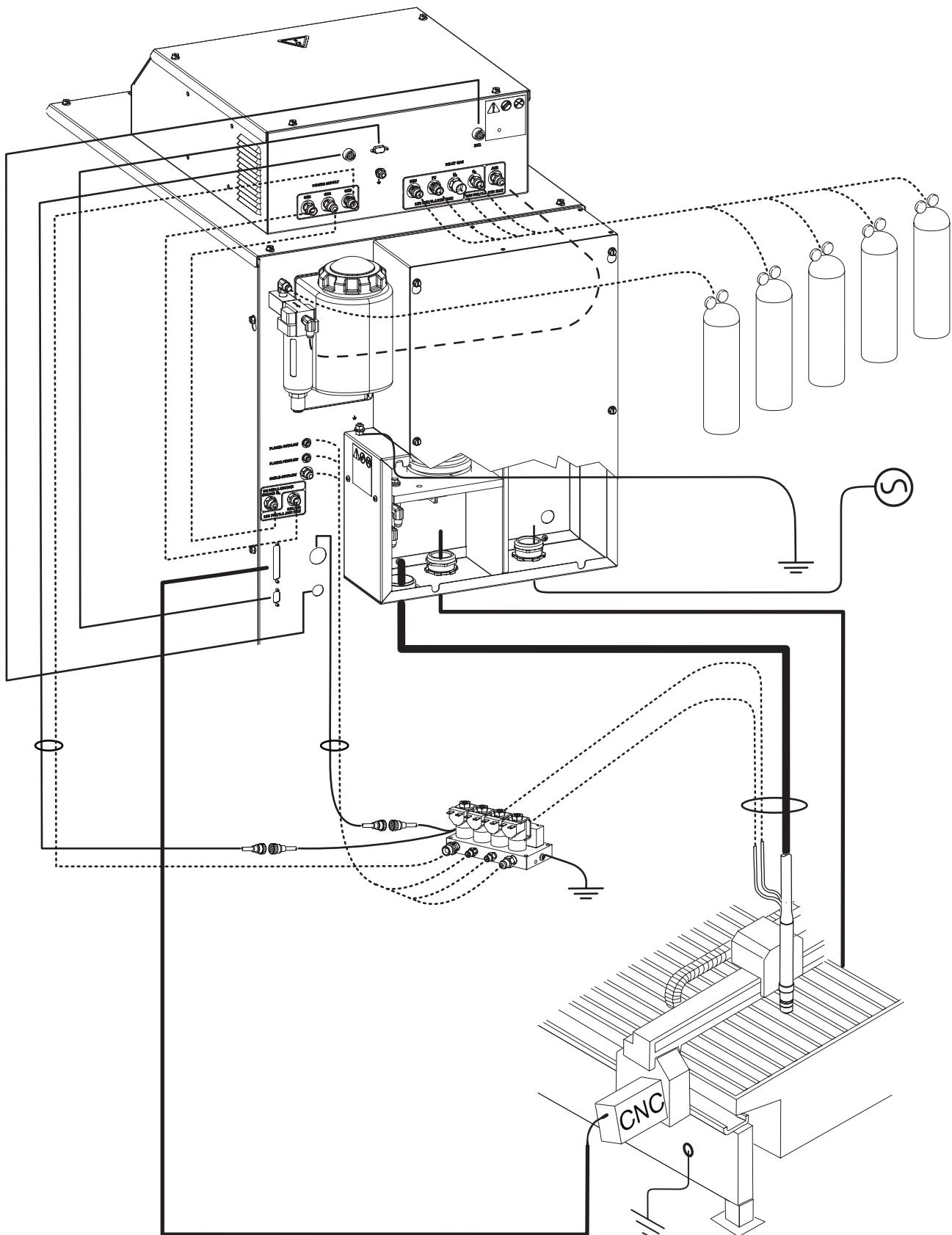
Torch

The torch can cut 12 mm mild steel at up to 2032 mm/min (1/2 inch at up to 80 ipm). The recommended production cutting capability of the torch is 16 mm (5/8 inch). Maximum pierce capability is 25 mm (1 inch) for mild steel and 19 mm (3/4 inch) for stainless steel and aluminum. The maximum severance capability is 38 mm (1.5 inch) for mild steel and 25 mm (1 inch) for stainless steel and aluminum.



System diagram 1 – without a fuel-gas console

SPECIFICATIONS



System diagram 2 – with a fuel-gas console

Specifications

System gas requirements

Gas quality and pressure requirements			
	Quality	Pressure +/- 10%	Flow rate
O ₂ Oxygen	99.5% pure Clean, dry, oil-free	793 kPa / 7.93 bar 115 psi	4250 l/h 150 scfh
N ₂ Nitrogen*	99.99% pure Clean, dry, oil-free	793 kPa / 7.93 bar 115 psi	8500 l/h 300 scfh
Air	Clean, dry, oil-free	655 kPa / 6.55 bar 95 psi	8500 l/h 300 scfh
H35 Argon-hydrogen*	99.995% pure (H35 = 65% Argon, 35% Hydrogen)	793 kPa / 7.93 bar 115 psi	4250 l/h 150 scfh
F5 Nitrogen-hydrogen*	99.98% pure (F5 = 95% Nitrogen, 5% Hydrogen)	793 kPa / 7.93 bar 115 psi	4250 l/h 150 scfh

* These gases are only needed for systems with a fuel-gas console.

	Mild steel		Stainless steel		Aluminum	
Gas types	Plasma	Shield	Plasma	Shield	Plasma	Shield
Cutting 45 A	Air	Air	Air / N ₂ / F5	Air / N ₂	Air	Air
Cutting 50 A	O ₂	Air	N/A	N/A	N/A	N/A
Cutting 130 A	O ₂ / Air	Air	Air / N ₂ / H35	Air / N ₂	Air / H35	Air / N ₂

SPECIFICATIONS

Noise levels

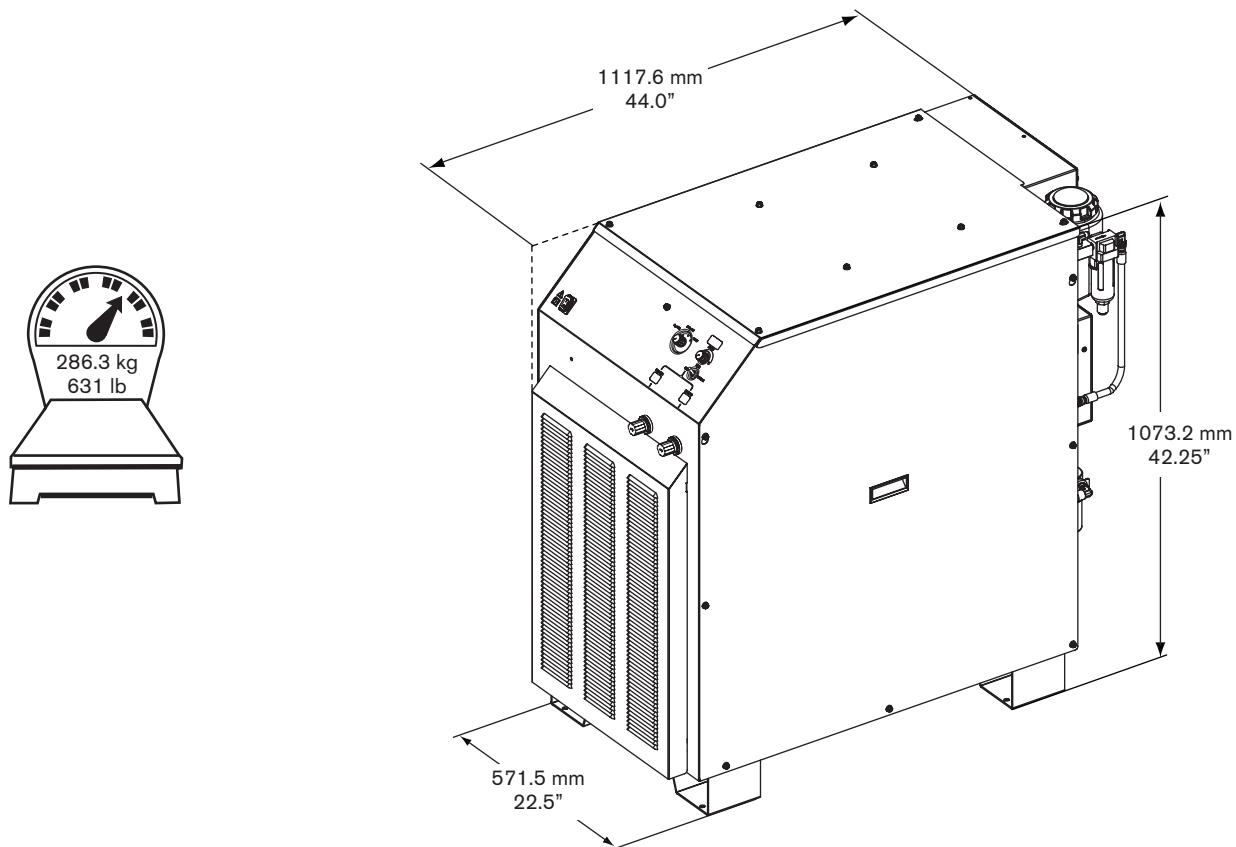
Measurements were made in a Hypertherm engineering laboratory, with other equipment operating nearby, in accordance with Hypertherm instruction ESI-034. These measurements only provide a general indication of the noise produced by the plasma system. Sound measurements should be taken after installation to determine the specific noise levels at the site. Measurements were taken at distances of 1 m, 2 m, 3 m, and 5 m (straight-line distance) from the center of the arc. An operator standing at the CNC controller would be approximately 1 m from the arc. All measurements were made with a Brüel & Kjaer sound meter mounted on a tripod at a height of 336.55 mm (13.25 inch) above the center of the arc.

Distance from the center of the arc	Ambient room noise	Process 1 H35/N ₂ 130 Amps	Process 2 Air/Air 130 Amps
1 m (3.3 ft)	80-84 dB	104-106 dB	106-108 dB
2 m (6.6 ft)	80-84 dB	97-99 dB	99-100 dB
3 m (9.9 ft)	80-84 dB	94-96 dB	96-97 dB
5 m (16.5 ft)	80-84 dB	93-97 dB	94-96 dB

Power supply

General						
Maximum OCV (U ₀)	311 VDC					
Part number	AC Voltage (U ₁)	Phase	Frequency (Hz)	Amperage (I ₁)	Regulatory approval	Power kW (+/- 10%) (U ₁ x I ₁ x 1.73)
078515	200/208	3	50/60	62/60	CSA	21.5
078516	220	3	50/60	56	CSA	21.5
078517	240	3	60	52	CSA	21.5
078518	380	3	*50/60	33	CCC	21.5
078519	400	3	50/60	32	CE/GOST-R	21.5
078520	440	3	50/60	28	CSA	21.5
078521	480	3	60	26	CSA	21.5
078522	600	3	60	21	CSA	21.5

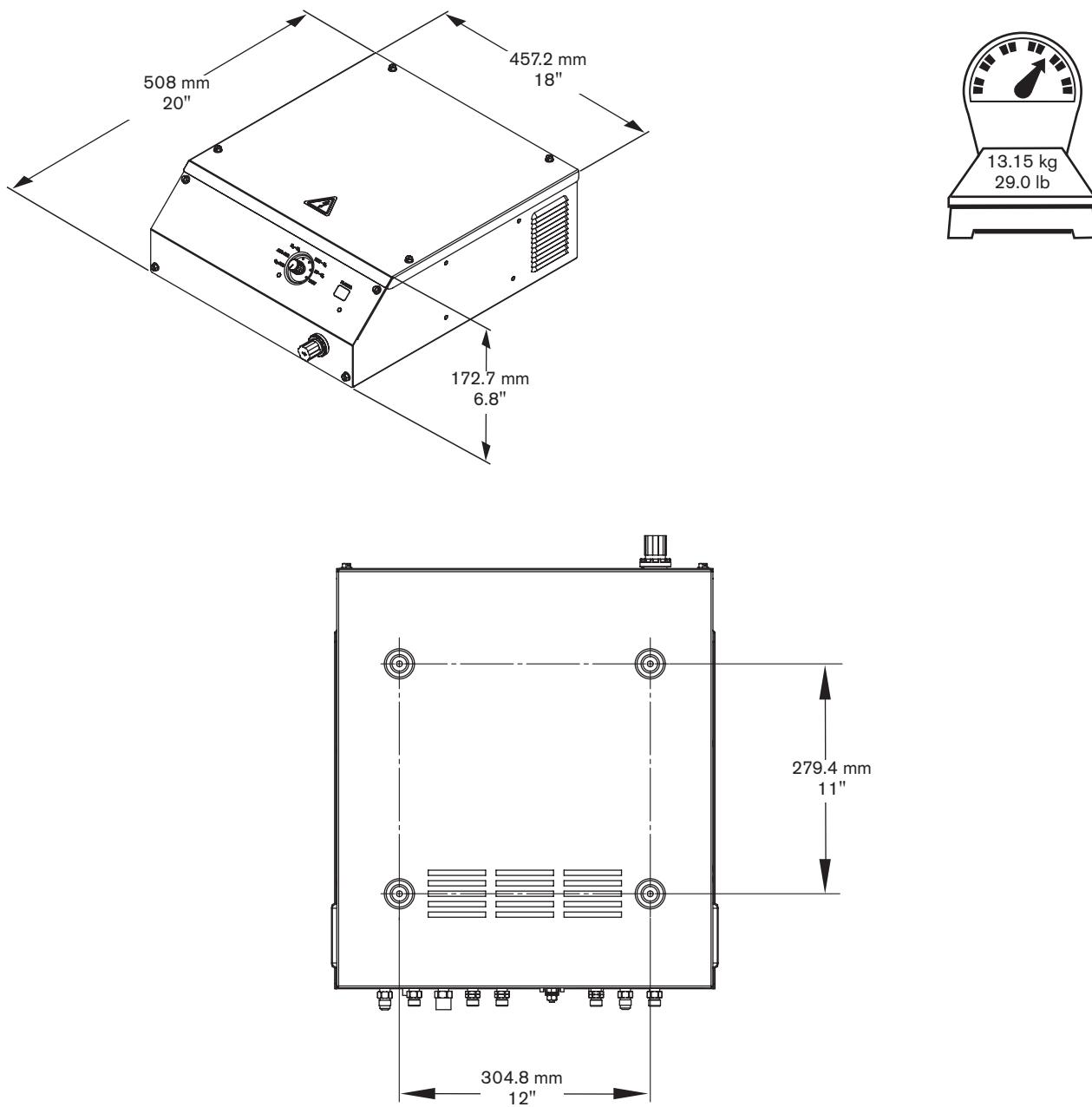
* 380 V CCC regulatory approval is for 50 Hz operation only.



SPECIFICATIONS

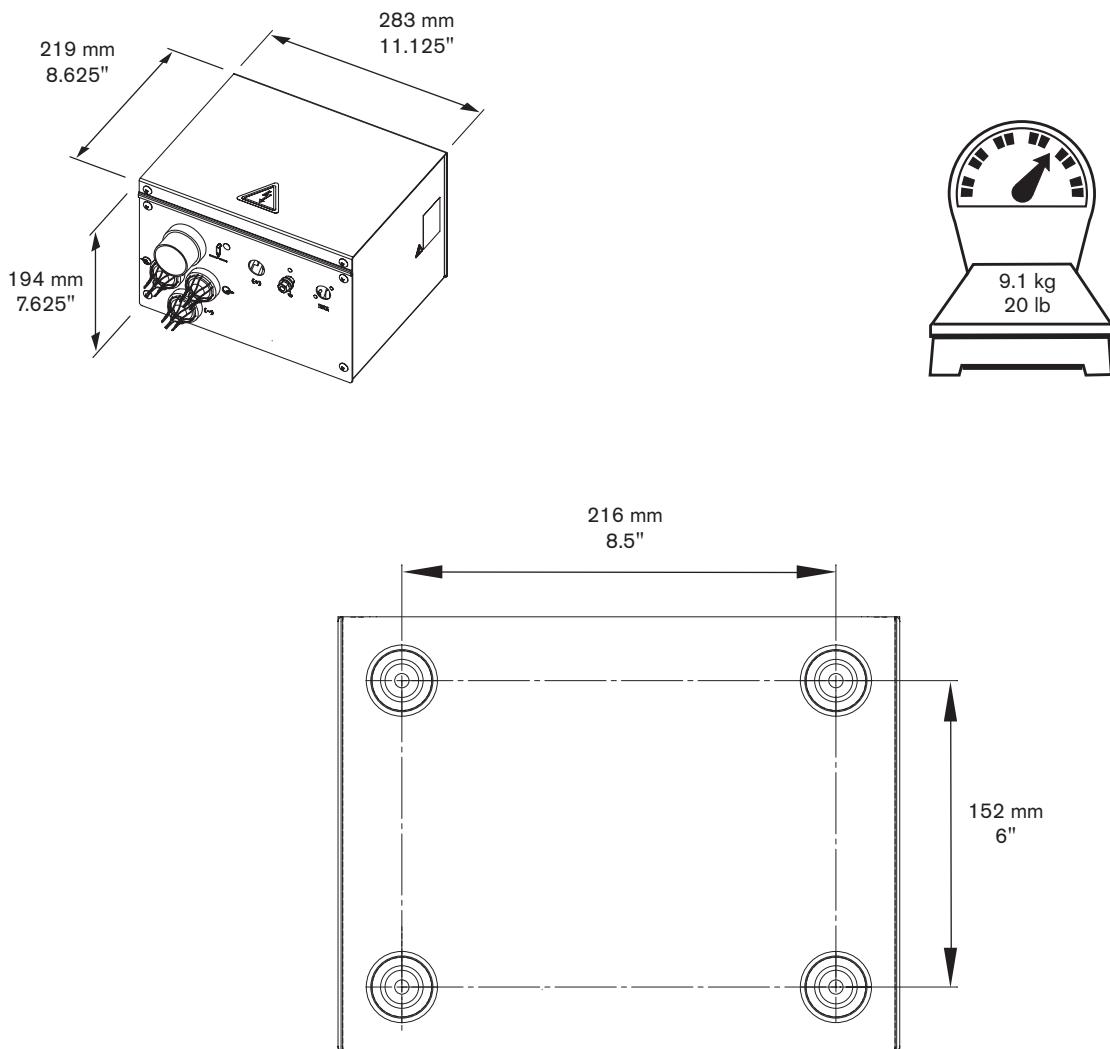
Fuel-gas console (optional) – 078201

- The fuel-gas console is mounted on the top of the power supply. Allow 1m (3 ft) on all sides of the console for servicing and ventilation.
- The maximum lead length, from the fuel-gas console to the off-valve, is 45.7 m (150 ft).



Ignition console – 078172

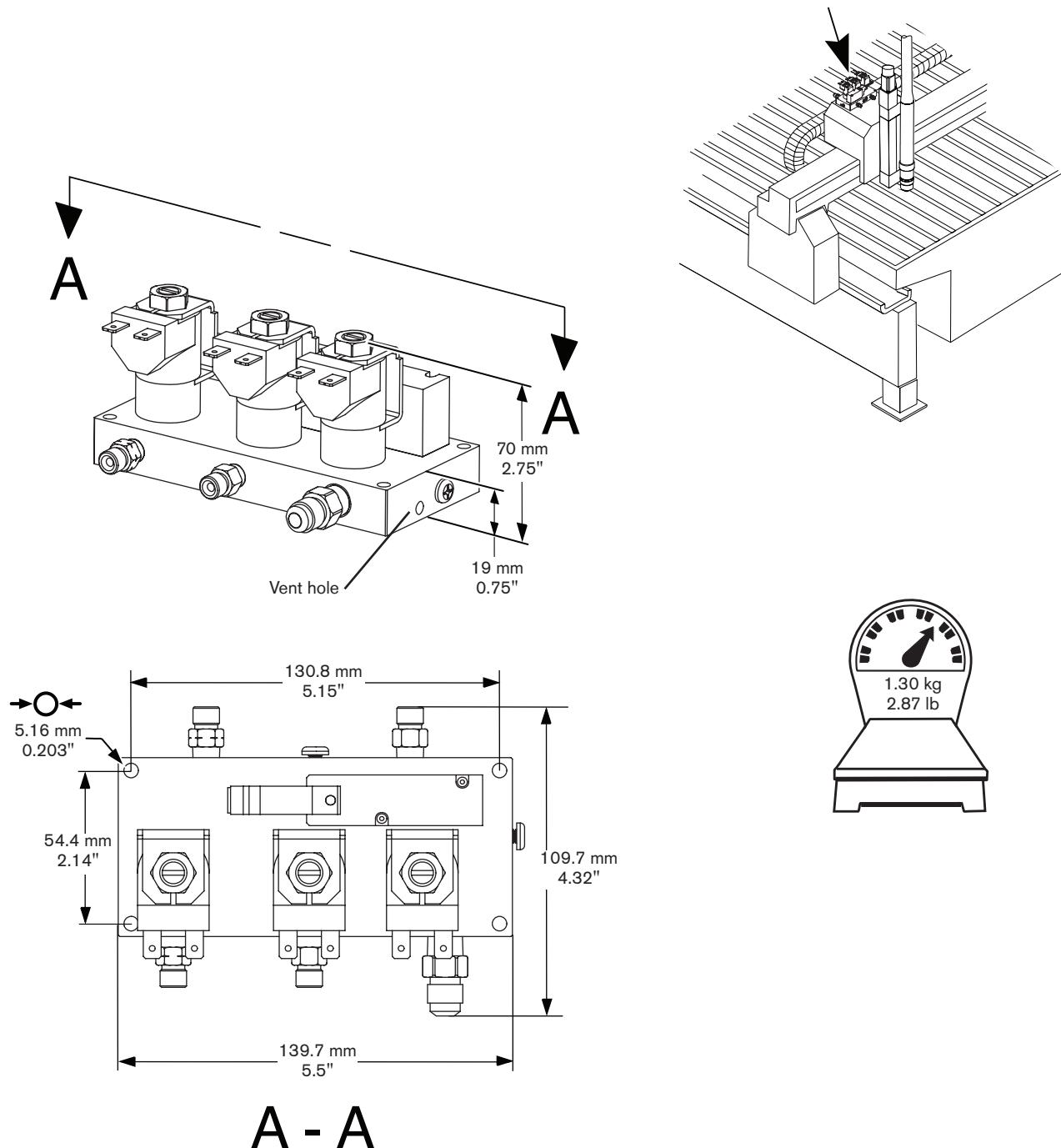
- The ignition console should be mounted on the cutting table's bridge. See *Installation* section for details.
- Maximum lead length from the ignition console to the torch lifter station is 15 m (50 ft). Allow room to remove the top for servicing.
- The ignition console may be mounted horizontally or vertically.



SPECIFICATIONS

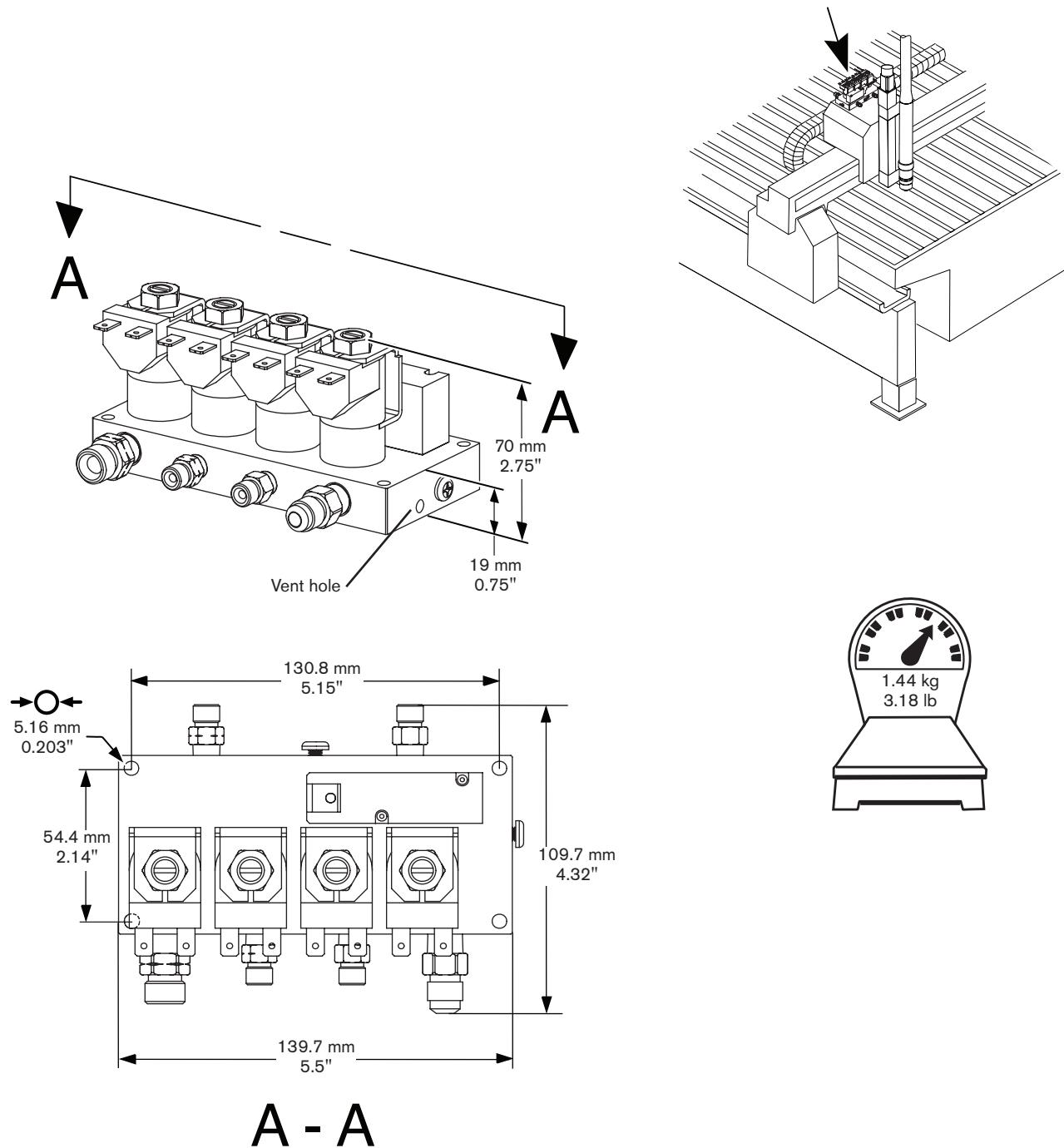
Standard off-valve – 229105

- Maximum cable length from the off-valve to the torch lifter is 1.8 m (6 ft).
- Mount the off-valve assembly on the torch carriage on large tables. On small tables it can be mounted on a bracket just above the bridge.
- The vent hole on the side of the manifold must be kept clear at all times.



Fuel-gas off-valve – 229130

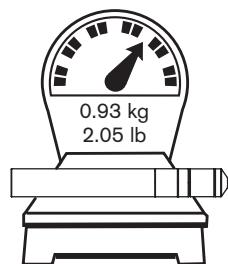
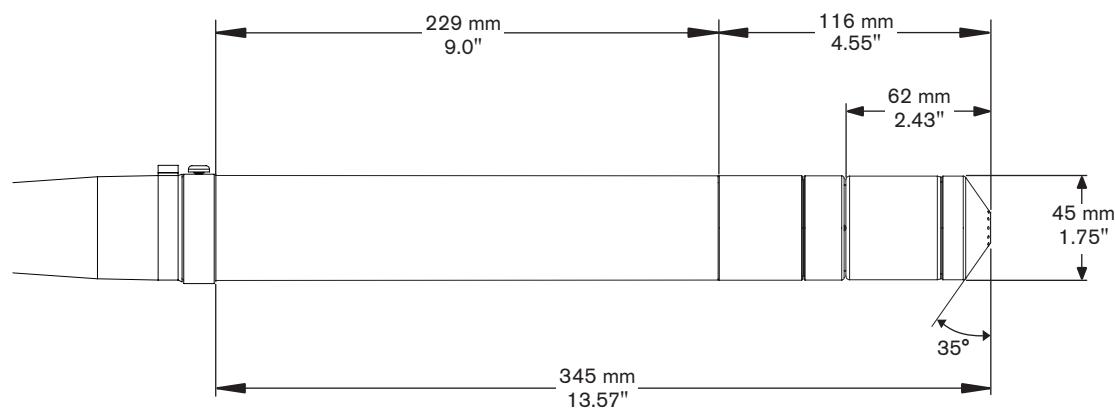
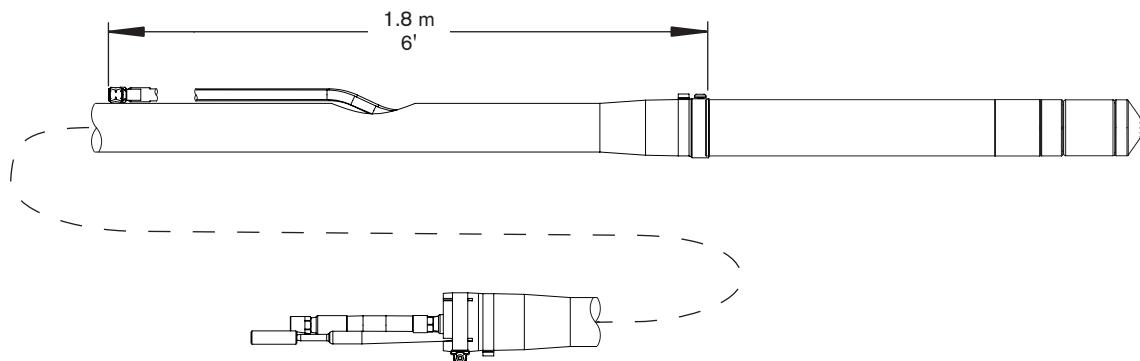
- Maximum cable length from the off-valve to the torch lifter is 1.8 m (6 ft).
- Mount the off-valve assembly on the torch carriage on large tables. On small tables it can be mounted on a bracket just above the bridge.
- The vent hole on the side of the manifold must be kept clear at all times.



SPECIFICATIONS

Torch – 228144 (includes mounting sleeve and consumables)

- The outside diameter of the torch mounting sleeve is 45 mm (1.75 inch).



Section 3

INSTALLATION

In this section:

Upon receipt	3-3
Claims	3-3
Installation requirements	3-3
Placement of system components	3-3
Torque specifications	3-3
Installation requirements – standard system	3-4
System components	3-5
Cables and hoses	3-5
Customer-supplied power cable	3-5
Supply gas hoses	3-5
Installation requirements – system with optional fuel gas console	3-6
System components	3-7
Cables and hoses	3-7
Customer-supplied power cable	3-7
Supply gas hoses	3-7
Recommended grounding and shielding practices	3-8
Introduction	3-8
Types of grounding	3-8
Steps to take	3-9
Grounding diagram	3-12
Placement of the power supply	3-13
Install the ignition console	3-14
Install the off-valve	3-16
Torch mounting and alignment	3-17
Mounting the torch	3-17
Torch alignment	3-17
Torch lifter requirement	3-17
Install the fuel-gas console (optional component)	3-18
Cable and hose assembly from power supply to off-valve	3-19
Power supply to off-valve connections	3-20
Fuel-gas console to off-valve connections	3-21
Fuel-gas console to power supply connections	3-22
Power supply to ignition console leads	3-24

INSTALLATION

Ignition console power cable.....	3-26
Ignition console coolant hoses.....	3-27
Torch lead assembly.....	3-28
Connect the torch to the torch lead assembly	3-29
Work lead.....	3-32
Arc voltage connection.....	3-33
Power supply to CNC interface cable.....	3-34
Notes to CNC interface cable run list.....	3-35
Examples of output circuits.....	3-36
Examples of input circuits.....	3-37
Power requirements	3-38
General	3-38
Line disconnect switch	3-38
Power cable.....	3-38
Connect the power.....	3-39
Torch coolant requirements	3-40
Water purity requirements.....	3-40
Fill the power supply with coolant.....	3-41
Gas requirements	3-42
Setting the supply regulators.....	3-42
Gas regulators	3-43
Supply gas plumbing	3-44
Connect the supply gases.....	3-45
Standard system.....	3-45
Fuel-gas system.....	3-45
Supply gas hoses	3-46

Upon receipt

- Verify that all system components on your order have been received. Contact your supplier if any items are missing.
- Inspect the system components for any physical damage that may have occurred during shipping. If there is evidence of damage, refer to *Claims*. All communications regarding claims must include the model number and serial number located on the back of the power supply.

Claims

Claims for damage during shipment – If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a copy of the bill of lading upon request. If you need additional assistance, call Customer Service listed in the front of this manual, or your authorized Hypertherm distributor.

Claims for defective or missing merchandise – If any of the merchandise is defective or missing, contact your supplier. If you need additional assistance, call Customer Service listed in the front of this manual, or your authorized Hypertherm distributor.

Installation requirements

All installation and service of the electrical and plumbing systems must conform to national or local electrical and plumbing codes. This work should be performed only by qualified, licensed personnel.

Direct any technical questions to the nearest Hypertherm Technical Service Department listed in the front of this manual, or your authorized Hypertherm distributor.

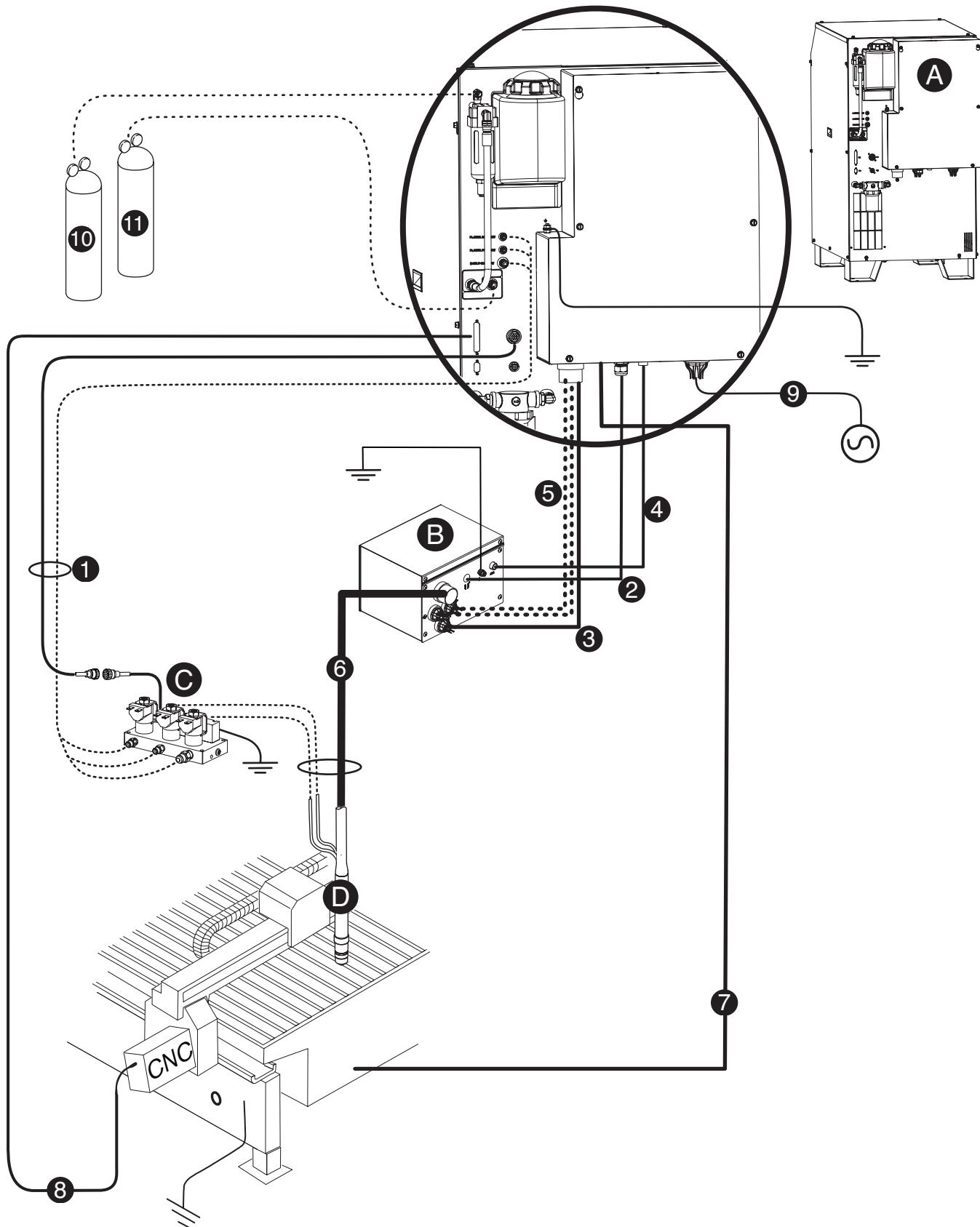
Placement of system components

- Place all system components in position prior to making electrical, gas and interface connections. Use the diagrams in this section for component placement guidelines.
- Ground all system components to earth. See *Recommended grounding and shielding practices* in this section for details.
- To prevent leaks in the system, tighten all gas and water connections as shown below:

Torque specifications			
Gas or water hose size	kgf-cm	Ibf-in	Ibf-ft
Up to 10 mm (3/8")	8.6-9.8	75-85	6.25-7
12 mm (1/2")	41.5-55	360-480	30-40

INSTALLATION

Installation requirements – standard system



System diagram 2 – without a fuel gas console

System components

- A** Power supply
- B** Ignition console
- C** Off-valve assembly
- D** Torch

Cables and hoses

- 1** Cable and hose assembly from power supply to off-valve
- 2** Pilot arc lead
- 3** Negative lead
- 4** Ignition console control cable
- 5** Ignition console coolant hoses
- 6** Torch lead assembly
- 7** Work lead
- 8** Power supply to CNC interface cable

Customer-supplied power cable

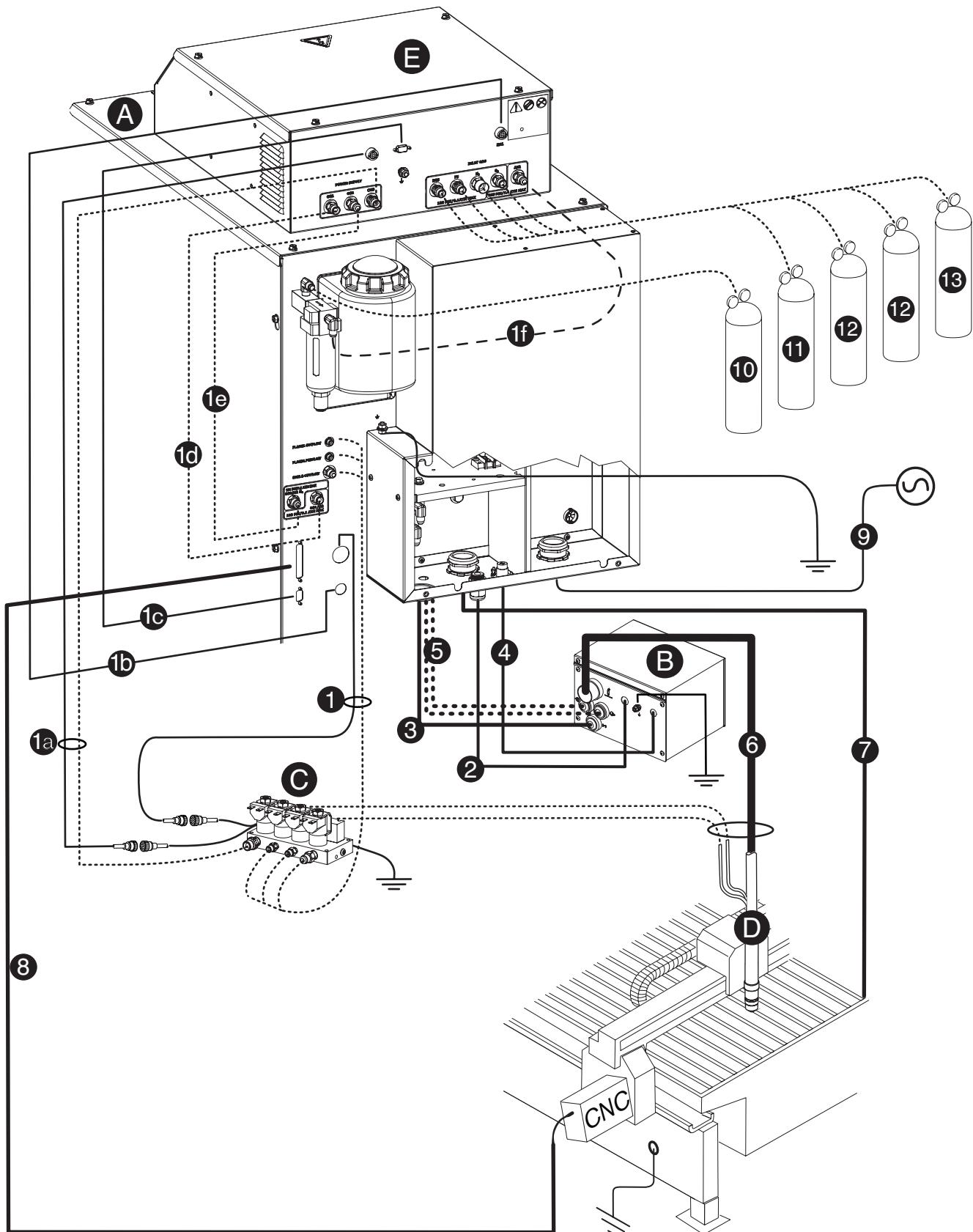
- 9** Main power cable

Supply gas hoses

- 10** Air
- 11** Oxygen

INSTALLATION

Installation requirements – system with optional fuel gas console



System diagram 2 – with a fuel gas console

System components

- A** Power supply
- B** Ignition console
- C** Off-valve assembly
- D** Torch
- E** Fuel-gas console

Cables and hoses

- 1** Cable and hose assembly from the power supply to the off-valve
- 1a** Cable and hose assembly from the fuel gas console to the off-valve
- 1b** Gas power cable
- 1c** Gas control cable
- 1d** Cut gas 1 hose
- 1e** Cut gas 2 hose
- 1f** Air hose from power supply air filter to the fuel-gas console
- 2** Pilot arc lead
- 3** Negative lead
- 4** Ignition console power cable
- 5** Ignition console coolant hoses
- 6** Torch lead assembly
- 7** Work lead
- 8** Power supply to CNC interface cable

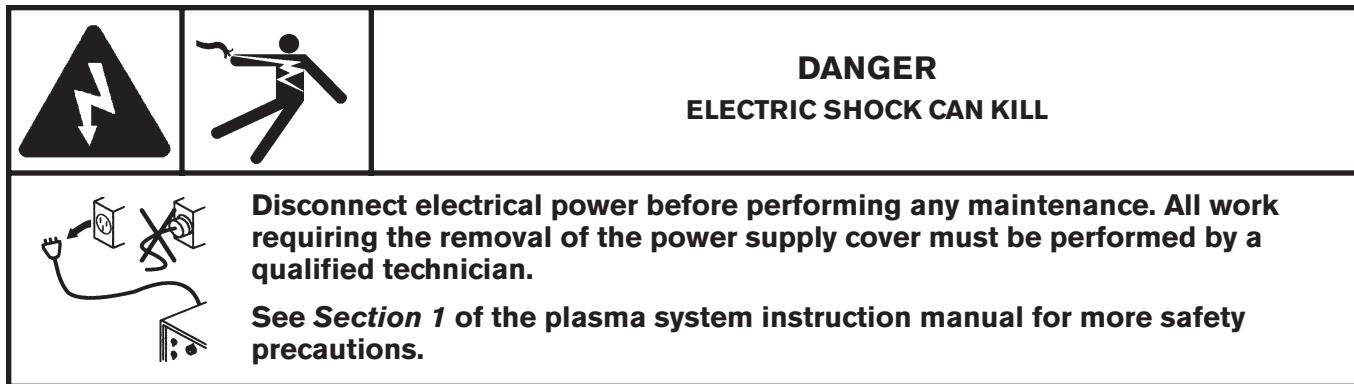
Customer-supplied power cable

- 9** Main power cable

Supply gas hoses

- 10** Air
- 11** Oxygen
- 12** F5 or H35
- 13** Nitrogen

Recommended grounding and shielding practices



Introduction

This document describes the grounding and shielding necessary to protect a plasma cutting system installation against radio frequency interference (RFI) and electromagnetic interference (EMI) noise. It addresses the 3 grounding systems described below. There is diagram on page 5 for reference.

Note: These procedures and practices are not known to succeed in every case to eliminate RFI/EMI noise issues. The practices listed here have been used on many installations with excellent results, and we recommend that these practices be a routine part of the installation process. The actual methods used to implement these practices may vary from system to system, but should remain as consistent as possible across the product line.

Types of grounding

- A. The safety (PE) or service ground. This is the grounding system that applies to the incoming line voltage. It prevents a shock hazard to any personnel from any of the equipment, or the work table. It includes the service ground coming into the plasma power supply and other systems such as the CNC controller and the motor drivers, as well as the supplemental ground rod connected to the work table. In the plasma circuits, the ground is carried from the plasma power supply chassis to the chassis of each separate console through the interconnecting cables.
- B. The DC power or cutting current ground. This is the grounding system that completes the path of the cutting current from the torch back to the power supply. It requires that the positive lead from the power supply be firmly connected to the work table ground bus with a properly sized cable. It also requires that the slats, on which the workpiece rests, make good contact with the table and the workpiece.
- C. RFI and EMI grounding and shielding. This is the grounding system that limits the amount of electrical "noise" emitted by the plasma and motor drive systems. It also limits the amount of noise that is received by the CNC and other control and measurement circuits. This grounding/shielding process is the main target of this document.

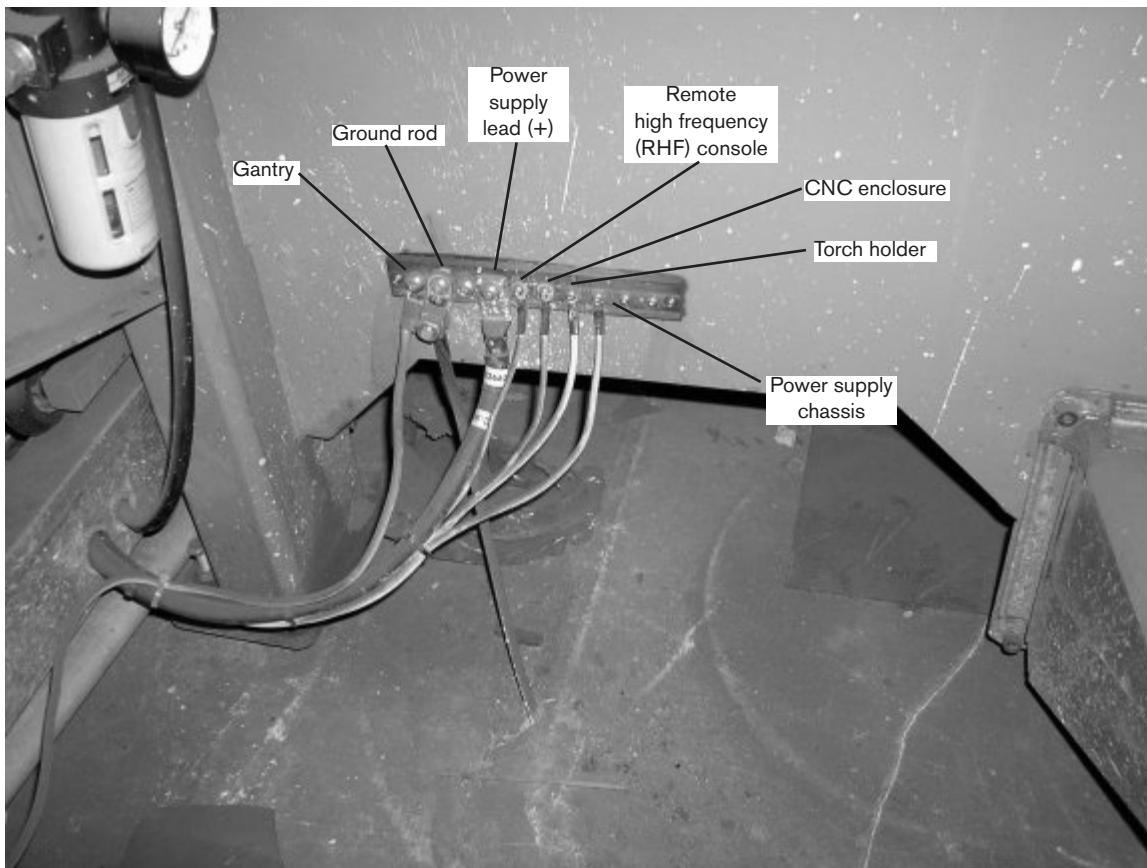
Steps to take

1. Unless noted, use only 6 AWG (16 mm²) welding cable (Hypertherm part no. 047040) for the EMI ground cables shown on the diagram (blue).
2. The cutting table is used for the common, or star, EMI ground point and should have threaded studs welded to the table with a copper bus bar mounted on them. A separate bus bar should be mounted on the gantry as close to each drive motor as possible. If there are drive motors at each end of the gantry, run a separate EMI ground cable from the far drive motor to the gantry bus bar. The gantry bus bar should have a separate, heavy EMI ground cable (4 AWG part no. 047031) to the table bus bar. The EMI ground cables for the torch lifter and the RHF console must each run separately to the table ground bus.
3. A ground rod that meets all applicable local and national electrical codes must be installed within 6 m (20 feet) of the table. This is a PE ground and should be connected to the ground bus on the cutting table with 6 AWG green/yellow grounding cable (Hypertherm part number 047121) or equivalent. All PE grounds are shown on the diagram in green.
4. For the most effective shielding, use the Hypertherm CNC interface cables for I/O signals, serial communication signals, power supply-to-power supply multi-drop connections, and interconnections between all parts of the Hypertherm system.
5. All hardware used in the ground system must be brass or copper. The only exception is that the studs welded to the table for mounting the ground bus can be steel. Under no circumstances should aluminum or steel hardware be used.
6. AC power, PE, and service grounds must be connected to all equipment according to local and national codes.
7. * The positive, negative, and pilot arc leads should be bundled together for as long a distance as possible. The torch lead, work lead, and the pilot arc (nozzle) leads may only be run parallel to other wires or cables if they are separated by at least 150 mm (6 in.). If possible, run power and signal cables in separate cable tracks.
8. * The ignition console should be mounted as close as possible to the torch, and must have a separate ground cable to the bus bar on the cutting table.
9. Each Hypertherm component, as well as any other CNC or motor-drive cabinet or enclosure, must have a separate ground cable to the common (star) point on the table. This includes the ignition console, even if it is bolted to the power supply or to the cutting machine.
10. The metal braided shield on the torch leads must be connected firmly to the ignition console and to the torch. It must be electrically insulated from any metal and from any contact with the floor or building.
11. The torch holder and the torch breakaway mechanism – the part mounted to the lifter, not the part mounted on the torch – must be connected to the stationary part of the lifter with copper braid at least 12.7 mm (1/2 in.) wide. A separate cable must run from the lifter to the bus bar on the gantry. The valve assembly should also have a separate ground connection to the gantry bus bar.

* Applies to systems that use a remote high frequency (RHF) console

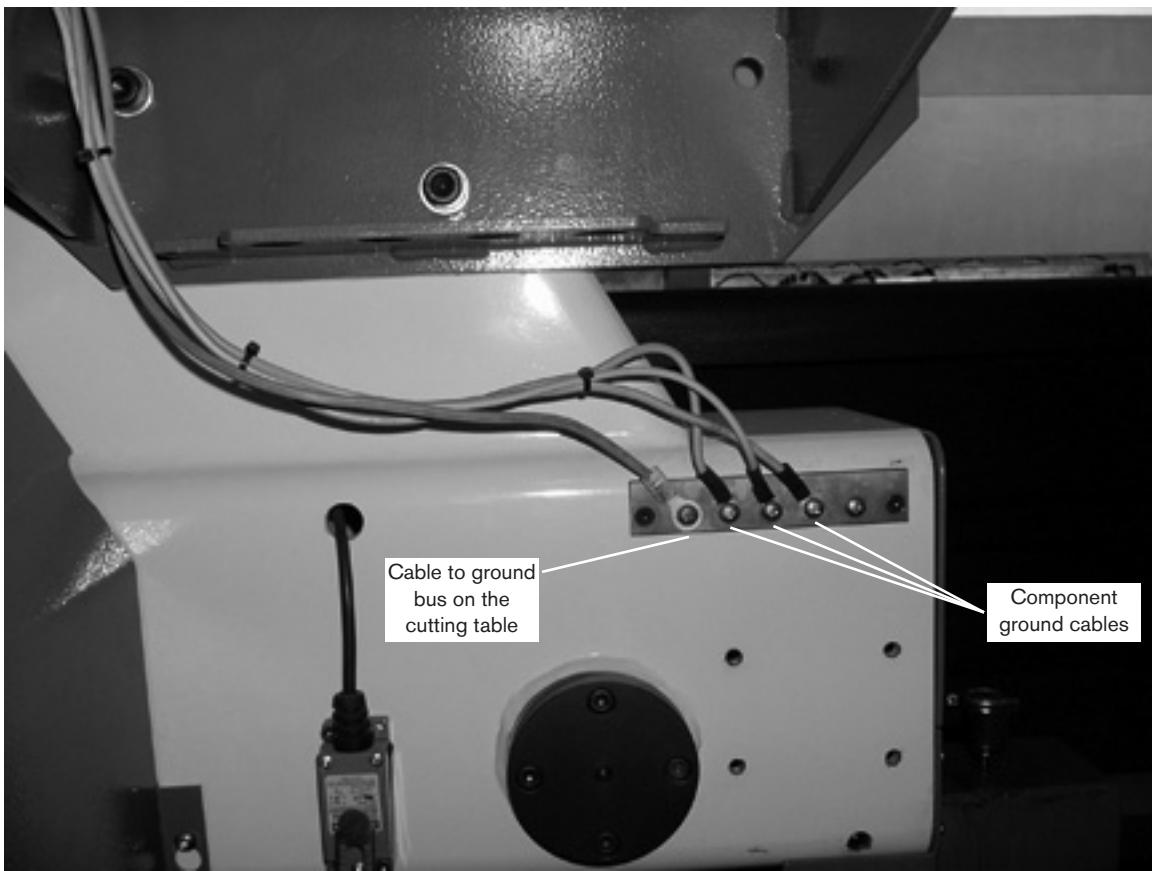
INSTALLATION

12. If the gantry runs on rails that are not welded to the table, then the rails need to be connected with a ground cable from each end of both rails to the table. These need not go to the common (star) point, but could take the shortest path to the table.
13. If the OEM is installing a voltage divider to process arc voltage for use in the control system, the voltage divider board should be mounted as close as possible to the point where the arc voltage is sampled. One acceptable location is inside the plasma power supply. If the Hypertherm voltage divider board is used, the output signal is isolated from all other circuits. The processed signal should be run in twisted, shielded cable (Belden type 1800F or equivalent). The cable used must have a braided shield, not a foil shield. The shield should be connected to the chassis of the power supply and left unconnected at the other end.
14. All other signals (analog, digital, serial, encoder) should run in twisted pairs inside a shielded cable. Connectors on these cables should have a metal housing and the shield, not the drain, should be connected to the metal housing of the connectors at each end of the cable. Never run the shield or the drain through the connector on any of the pins.



Example of a good cutting table ground bus. The picture above shows the connection from the gantry ground bus, the connection from the ground rod, the power supply positive lead, the RHF console*, the CNC enclosure, the torch holder, and the power supply chassis.

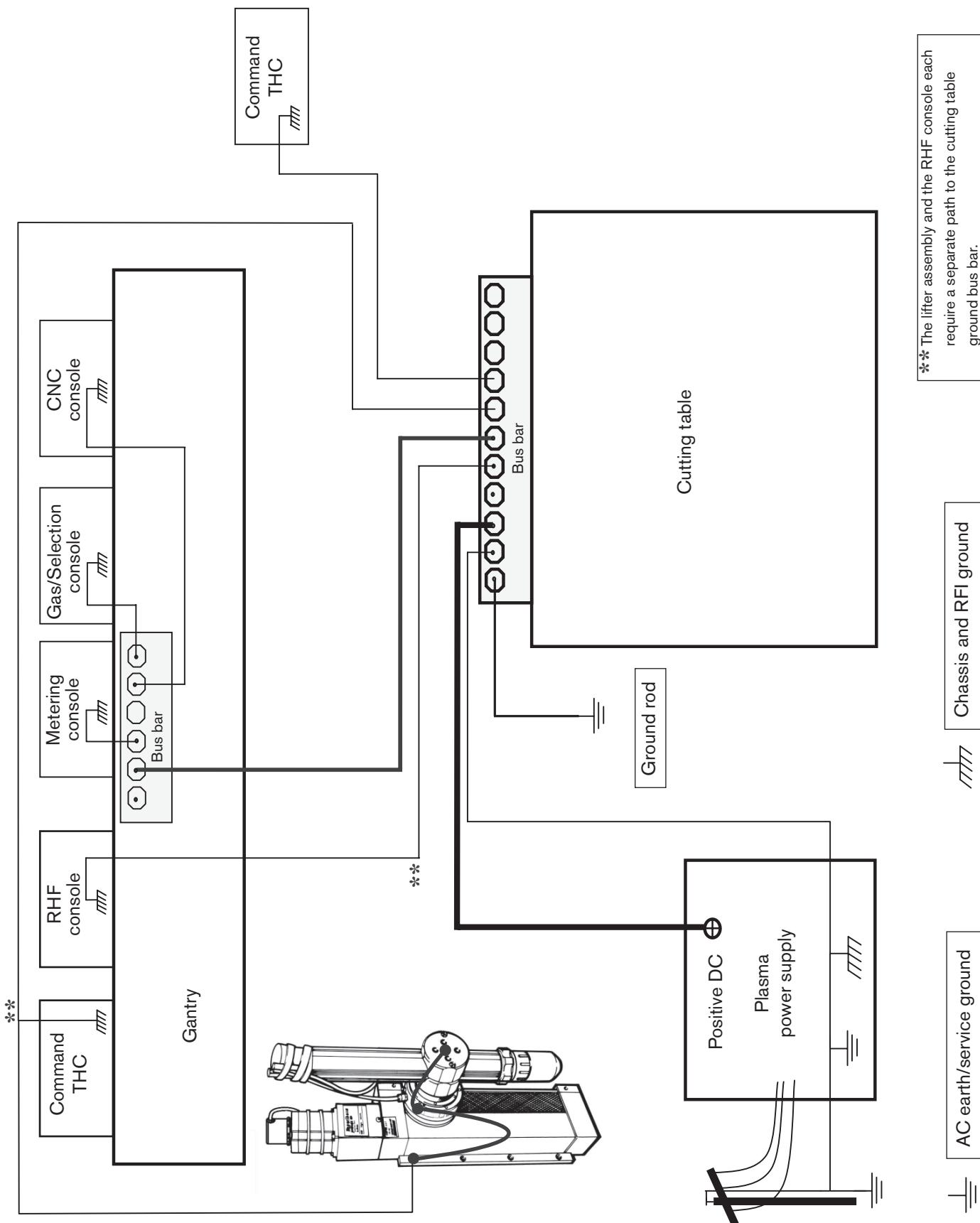
* Applies to systems that use a remote high frequency (RHF) console



Example of a good gantry ground bus. It is bolted to the gantry, close to the motor. All of the individual ground cables from the components mounted on the gantry go to the bus except those from the RHF console* and the torch holder. A single heavy cable then goes from the gantry ground bus to the ground bus bolted to the table.

* Applies to systems that use a remote high frequency (RHF) console

INSTALLATION



Grounding diagram (some systems will not include all the components shown)

** The lifter assembly and the RHF console each require a separate path to the cutting table ground bus bar.

/ / / / Chassis and RFI ground

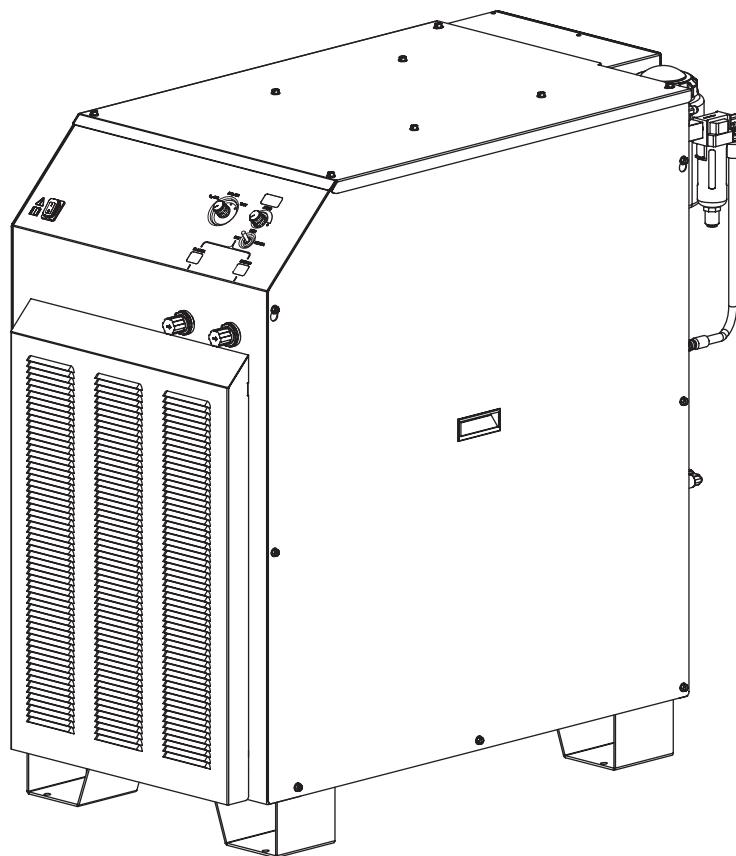
— — — AC earth/service ground

A Placement of the power supply

		DANGER ELECTRICAL SHOCK CAN KILL
Remove all electrical connections to power supply before moving or positioning. Transporting the unit can cause personal injury and equipment damage.		

The power supply can be moved by forklift but the forks must be long enough to extend the entire length of the base. Take care when lifting so that the underside of the power supply is not damaged.

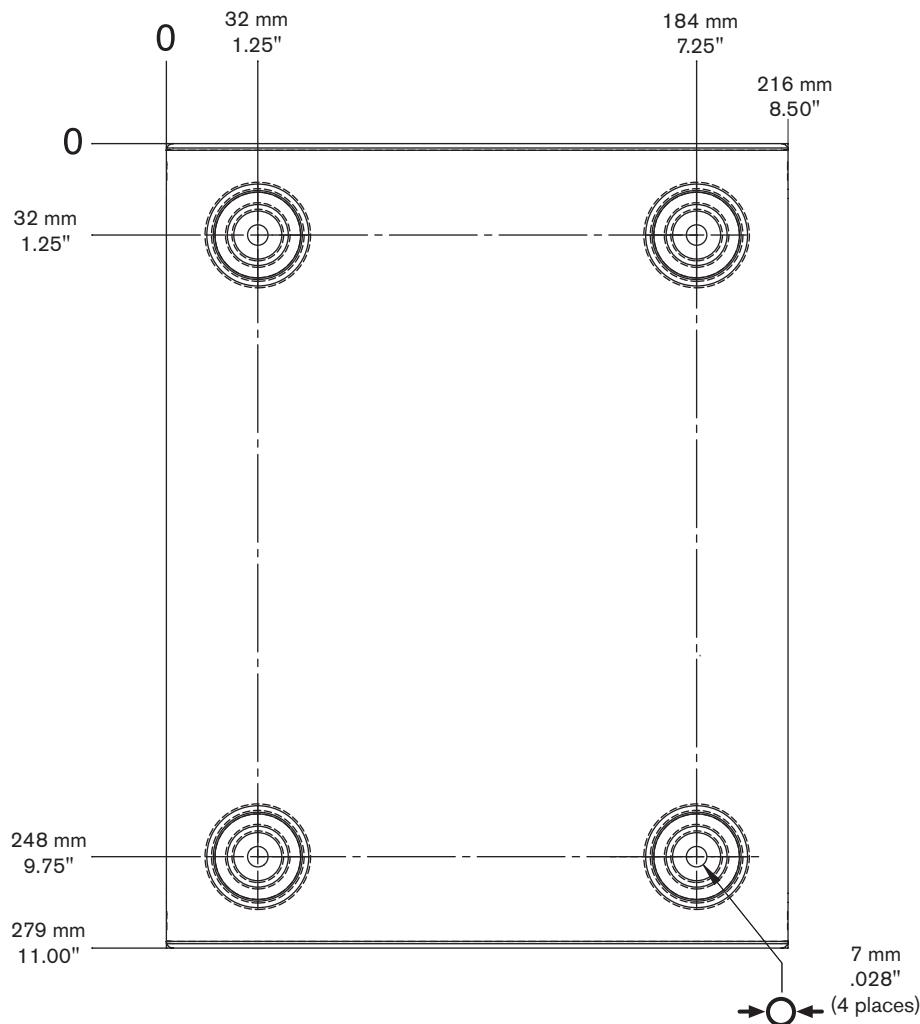
- Place the power supply in an area that is free of excessive moisture, has proper ventilation, and is relatively clean. Allow 1 m (3 ft) on all sides of the power supply for ventilation and servicing.
- Cooling air is drawn in through the front panel and is exhausted through the rear of the unit by a cooling fan. Do not place any filter device over the air intake locations, which reduces cooling efficiency and **VOIDS THE WARRANTY**.
- Do not place the power supply on an incline greater than 10° to prevent it from toppling.

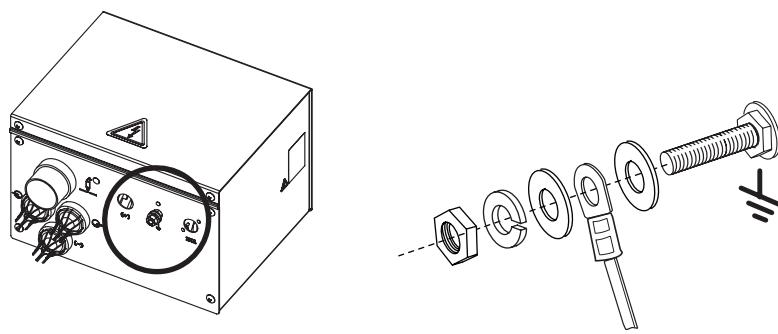
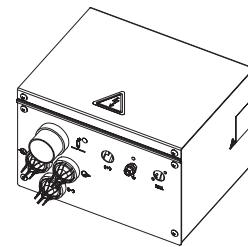
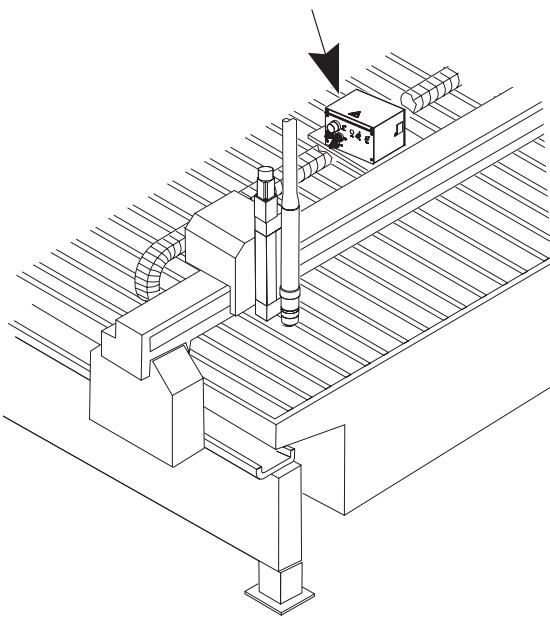
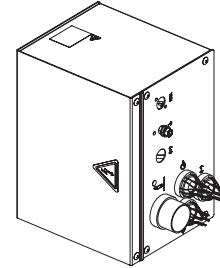


B Install the ignition console

- Mount the ignition console on the gantry (bridge).
- Allow room to remove the top for servicing.

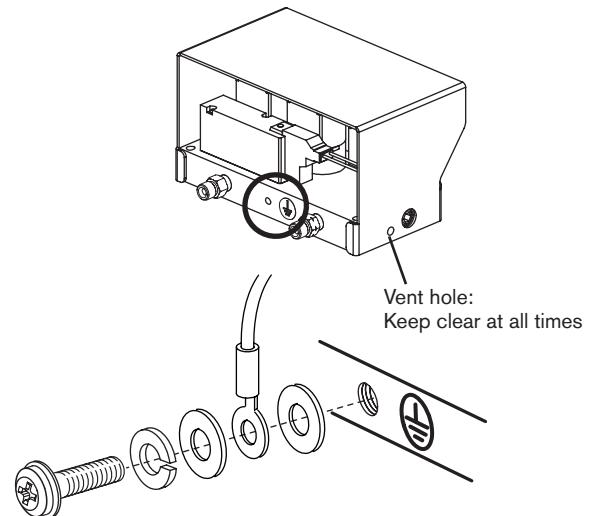
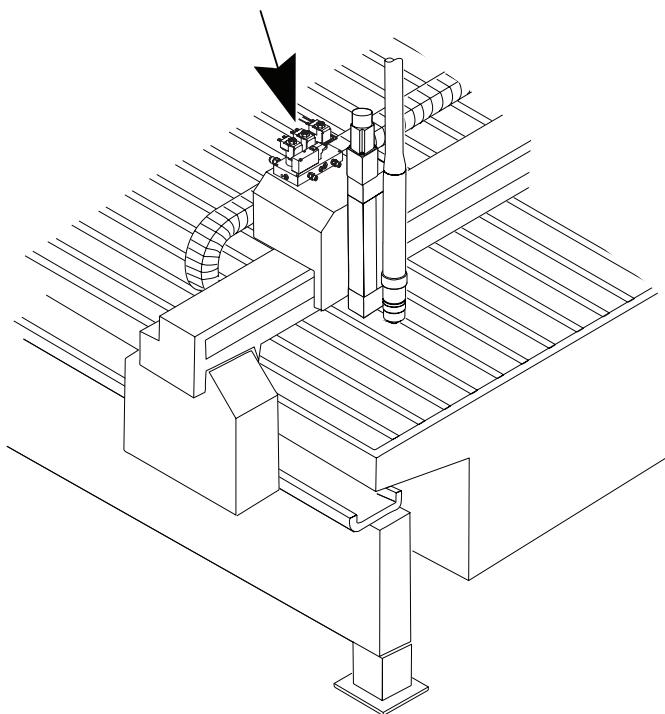
Note: verify the hose orientation before running the coolant hoses. The fittings are different on the ignition console end and the power supply end of each hose. The label marked IGN CSL on the end of each hose indicates that it is the end that is connected to the ignition console.



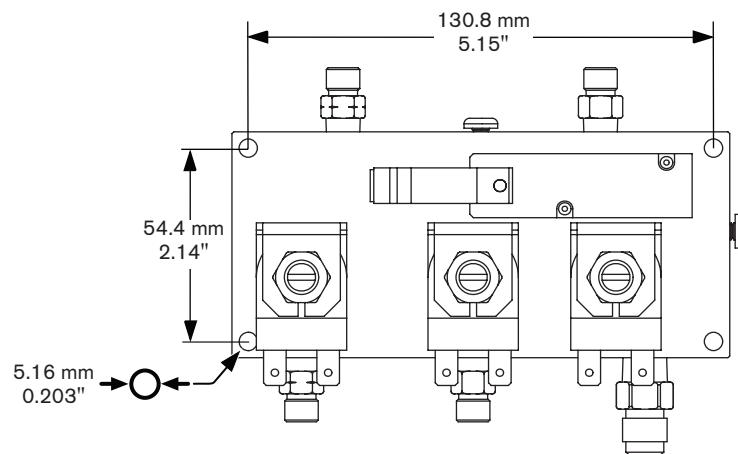
**Ignition console grounding****Horizontal RHF mounting****Vertical RHF mounting**

C Install the off-valve (standard and fuel-gas)

- Mount the off-valve assembly near the torch lifter. The maximum length of the gas hoses between the off-valve assembly and the torch is 1.8 m (6 ft).

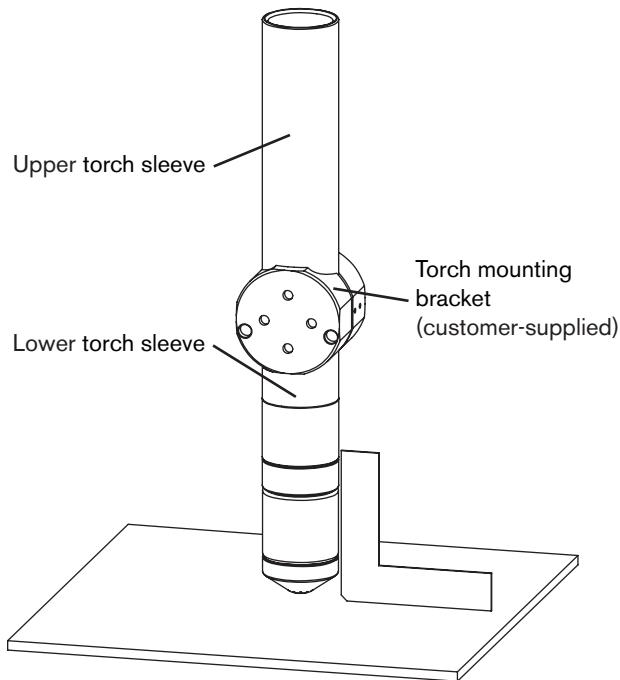


Off-valve grounding



D Torch mounting and alignment

Mounting the torch



Installation

1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch below the mounting bracket, so that the bracket is around the lower portion of the torch sleeve but not touching the torch body.
3. Tighten the securing screws.

Note: The bracket should be as low on the torch sleeve as possible to minimize vibration at the tip of the torch.

Torch alignment

To align the torch at right angles to the workpiece, use a square. See figure above.

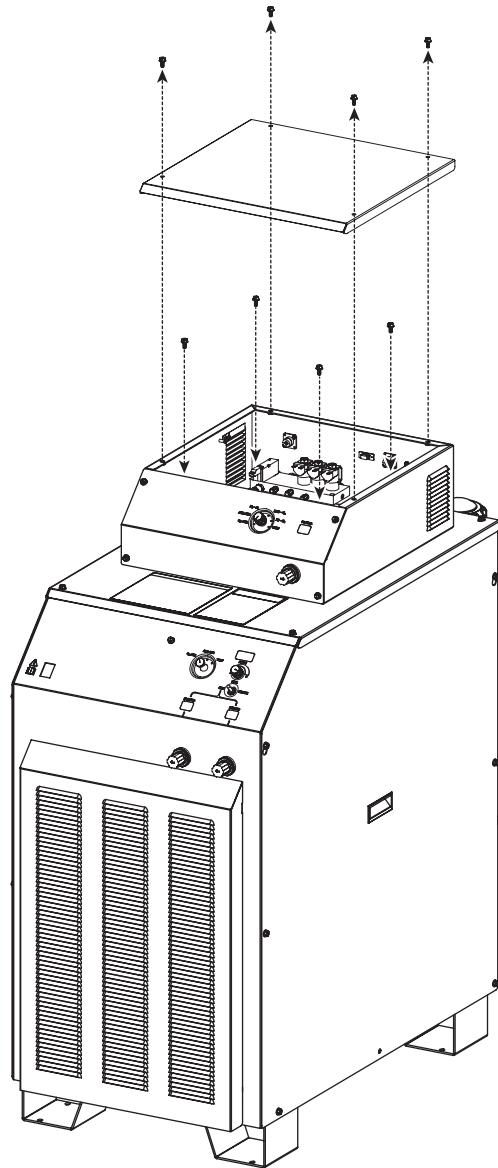
See also *Install consumables* in Section 4 to install consumables in the torch.

Torch lifter requirement

The system requires a high-quality, motorized torch lifter with sufficient travel to cover all cutting thickness requirements. The lifter must provide 203 mm (8 in.) of vertical travel. The unit should have the capability of maintaining a constant speed of up to 5080 mm/min (200 ipm) with positive braking. A unit which drifts through the stop point is not acceptable.

E Install the fuel gas console (optional component)

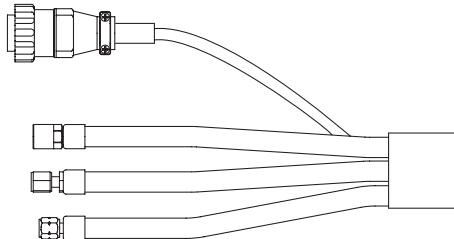
- The fuel gas console is mounted on the top of the power supply. Allow 1 m (3 ft) on all sides of the console for servicing and ventilation.
- The maximum lead length, from the fuel gas console to the off-valve, is 15 m (50 ft).



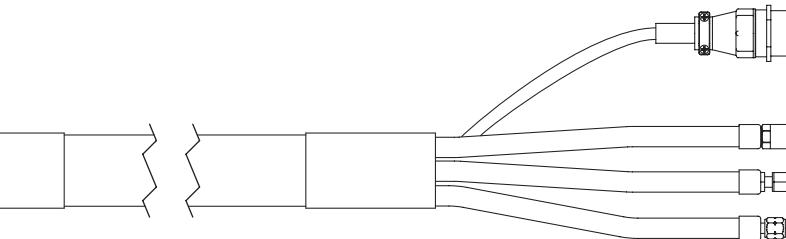
① Cable and hose assembly from power supply to off-valve

Part no.	Length
228053	7.5 m (25 ft)
228054	15 m (50 ft)

To power supply

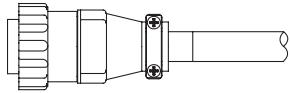


To off-valve solenoid cable

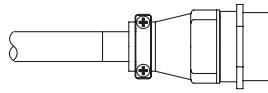


Power supply to off-valve cable

Male/Pins

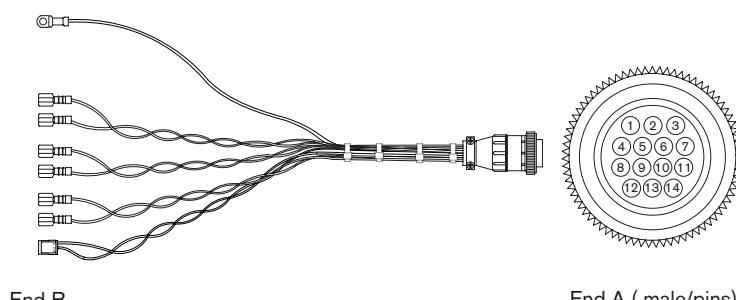


Female/Sockets



Cable signal list – power supply to off-valve cable		
Power supply end		Off-valve end
Pin #	Description	Pin #
1	120 Vac Hot – Shield	1
2	120 Vac Return – Shield	2
3	120 Vac Hot – Plasma preflow	3
4	120 Vac Return – Plasma preflow	4
5	120 Vac Hot – Plasma cutflow	5
6	120 Vac Return – Plasma cutflow	6
7	120 Vac Hot – Plasma vent	7
8	120 Vac Return – Vent	8
9	Ground	9

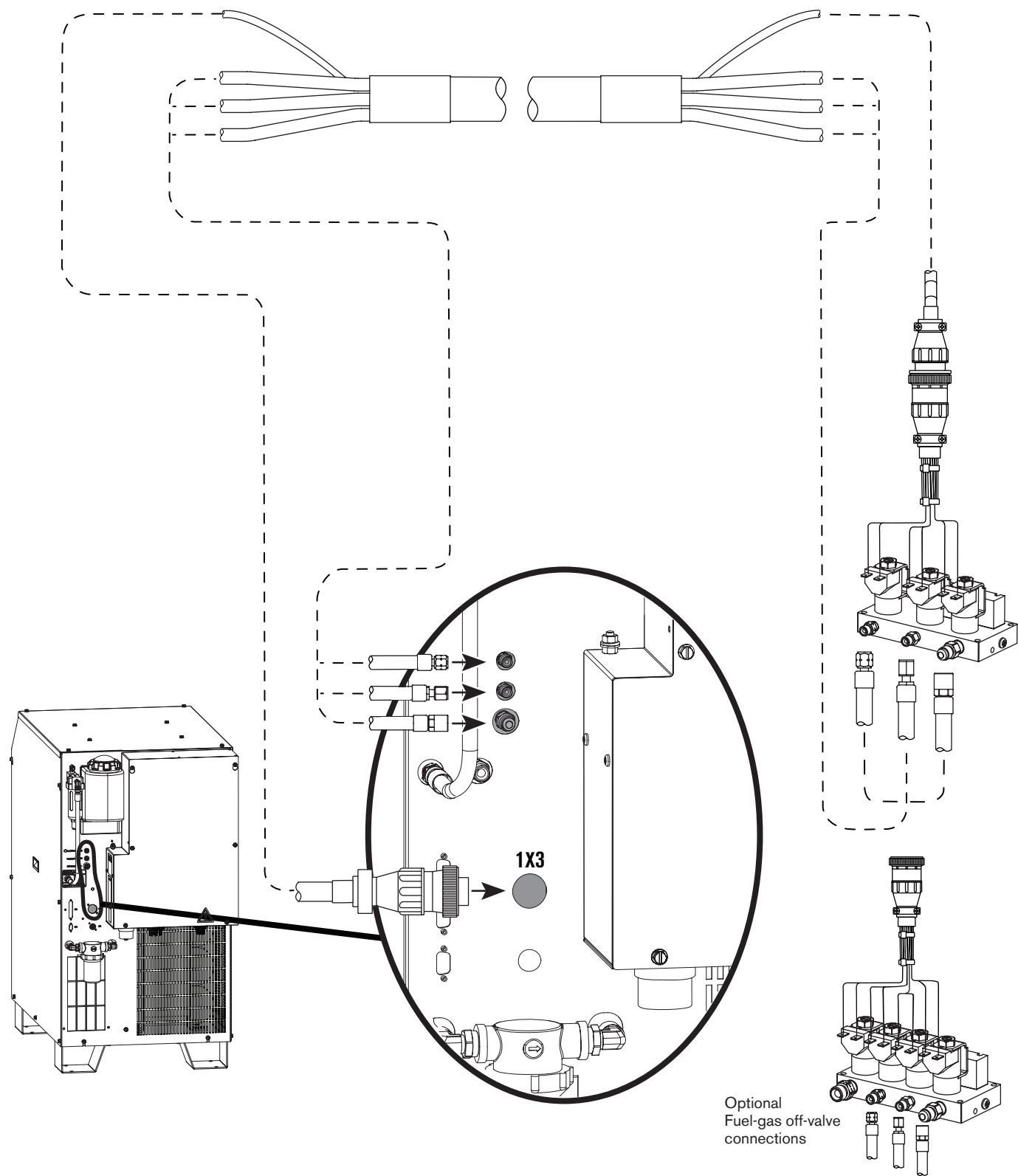
Off-valve solenoid cable



Function	End B	Color	End A
Shield	A	Blue	1
	C	Blue	2
Plasma Preflow	P	Red/Black	3
	P	Red	4
Plasma Cutflow	P	Red/Black	5
	C	Red	6
Vent	V	Red/Black	7
	V	Red	8
Not used			9
Not used			10
Ground	Ground	Green/Yellow	11
	Ground		12
	Ground		13
	Ground		14

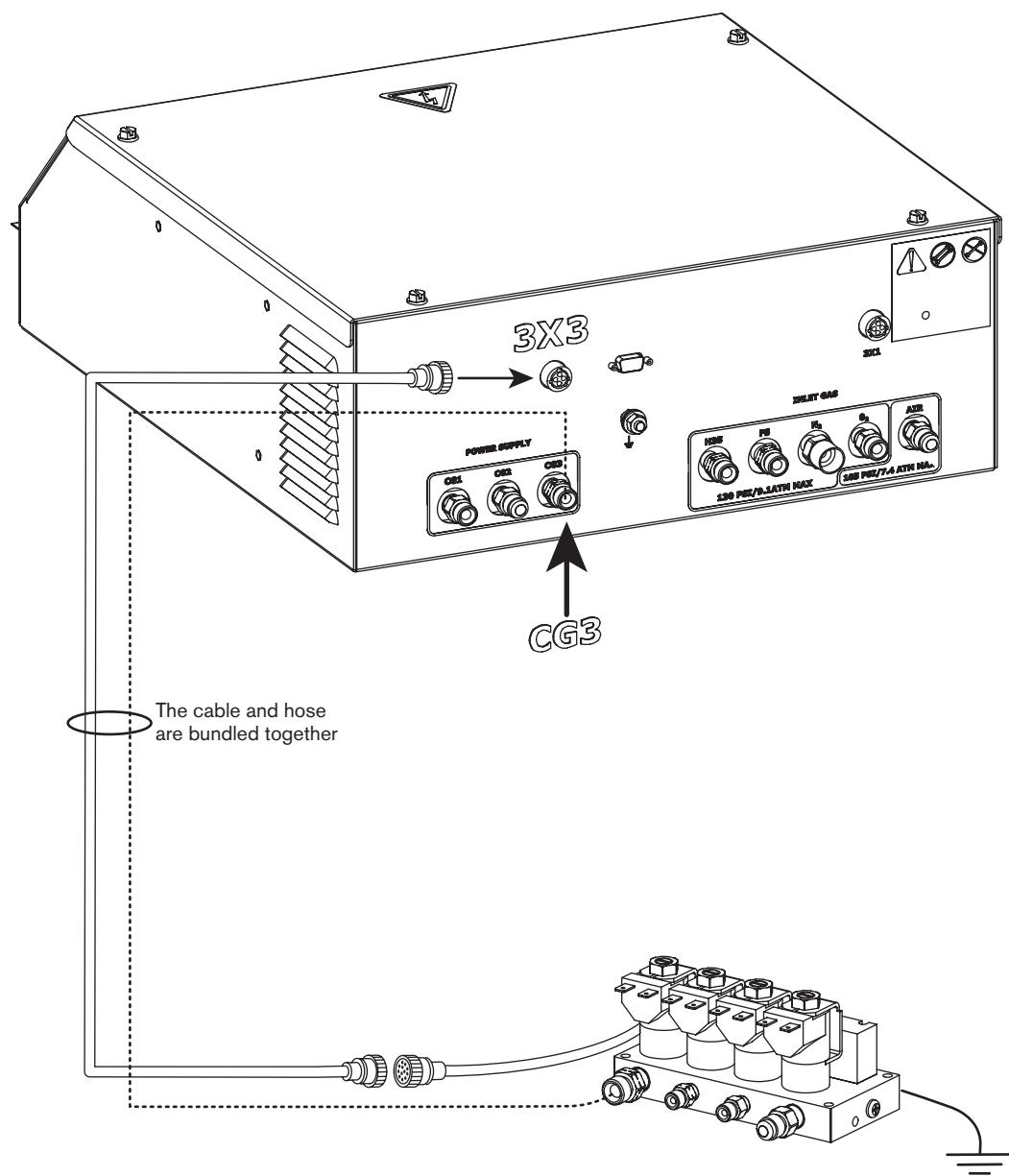
INSTALLATION

Power supply to off-valve connections



1a Fuel gas console to off-valve connections

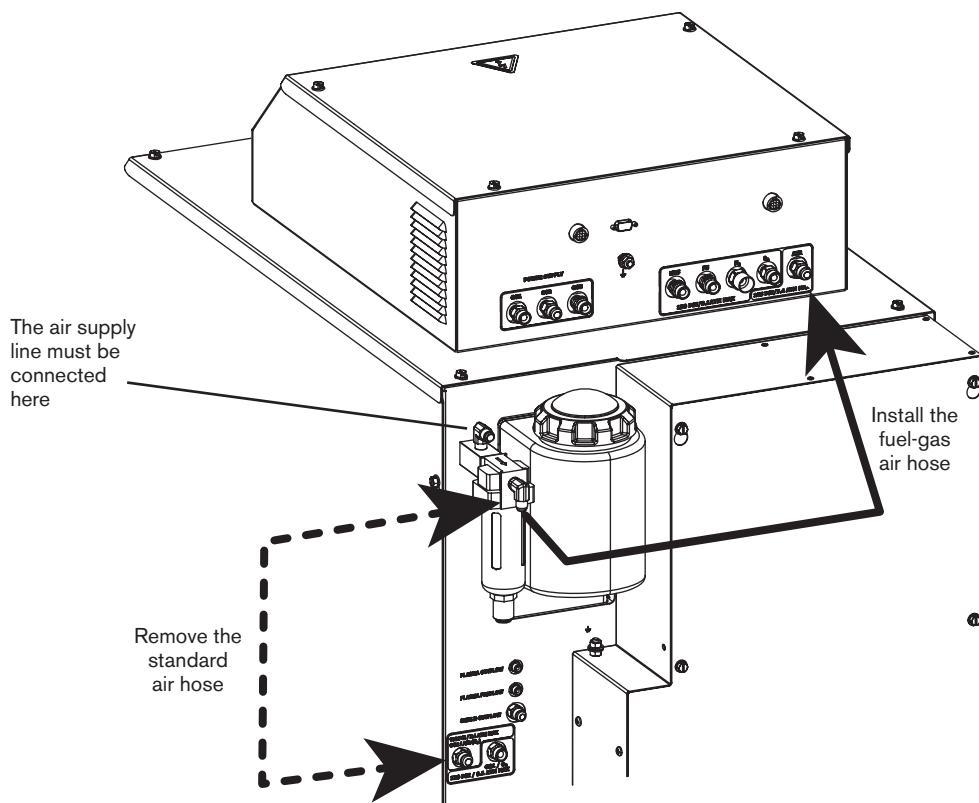
Part no.	Length
228148	7.5 m (25 ft)
228149	15 m (50 ft)



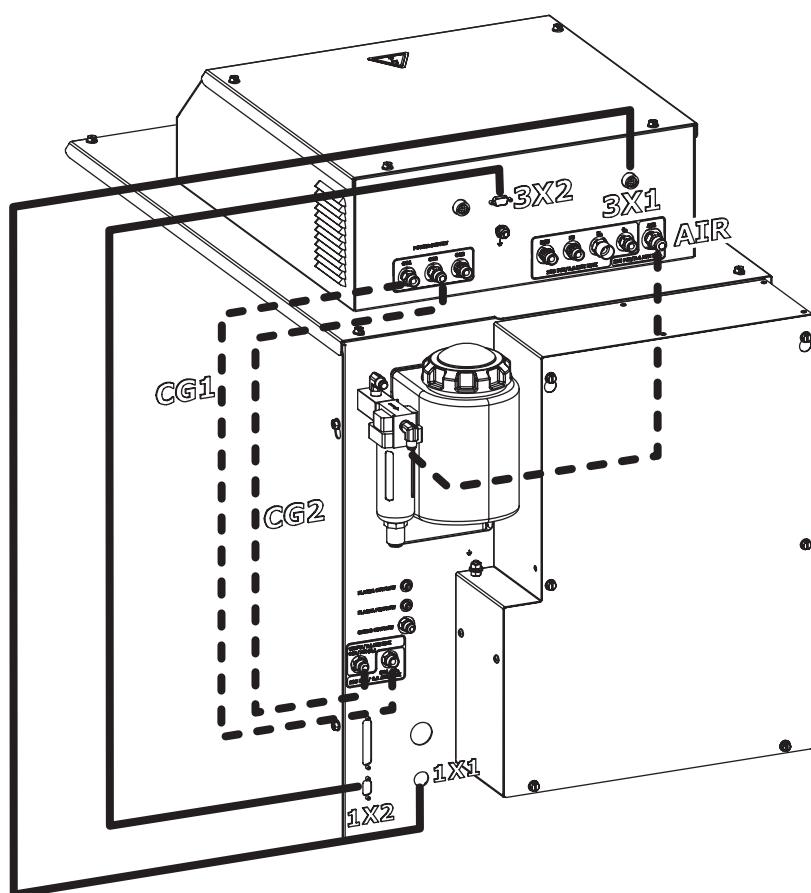
1b - 1f Fuel gas console to power supply connections

Before connections from the power supply to the fuel-gas console are made, the standard air hose must be removed from the power supply.

1. Remove and discard the standard air hose.
2. The air hose for the power supply to the fuel-gas console connection is supplied with the fuel-gas console. Connect the hose (024819) from the air filter on the power supply to the air inlet on the fuel-gas console.



Part no.	Description	Length
078203	Fuel-gas console lead set	
024819	Hose (black): CG1	1 m (3 ft)
024820	Hose (blue): CG2	1 m (3 ft)
123844	Cable: CAN Communication (3x2 to 1x2)	1.5 m (5 ft)
123684	Cable: Power (3x1 to 1x1)	1.5 m (5 ft)
024819	Hose: power supply air filter to fuel-gas console	1 m (3 ft)



INSTALLATION

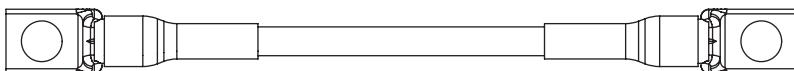
Power supply to ignition console leads

② Pilot arc lead

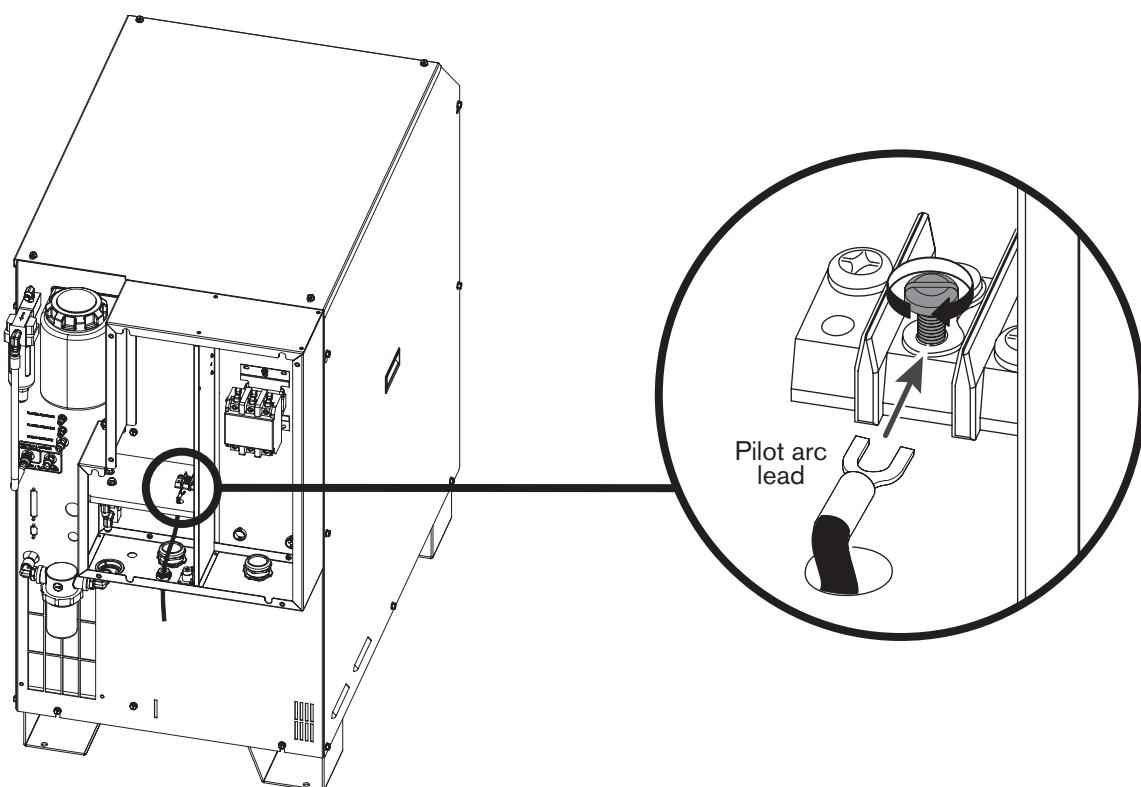


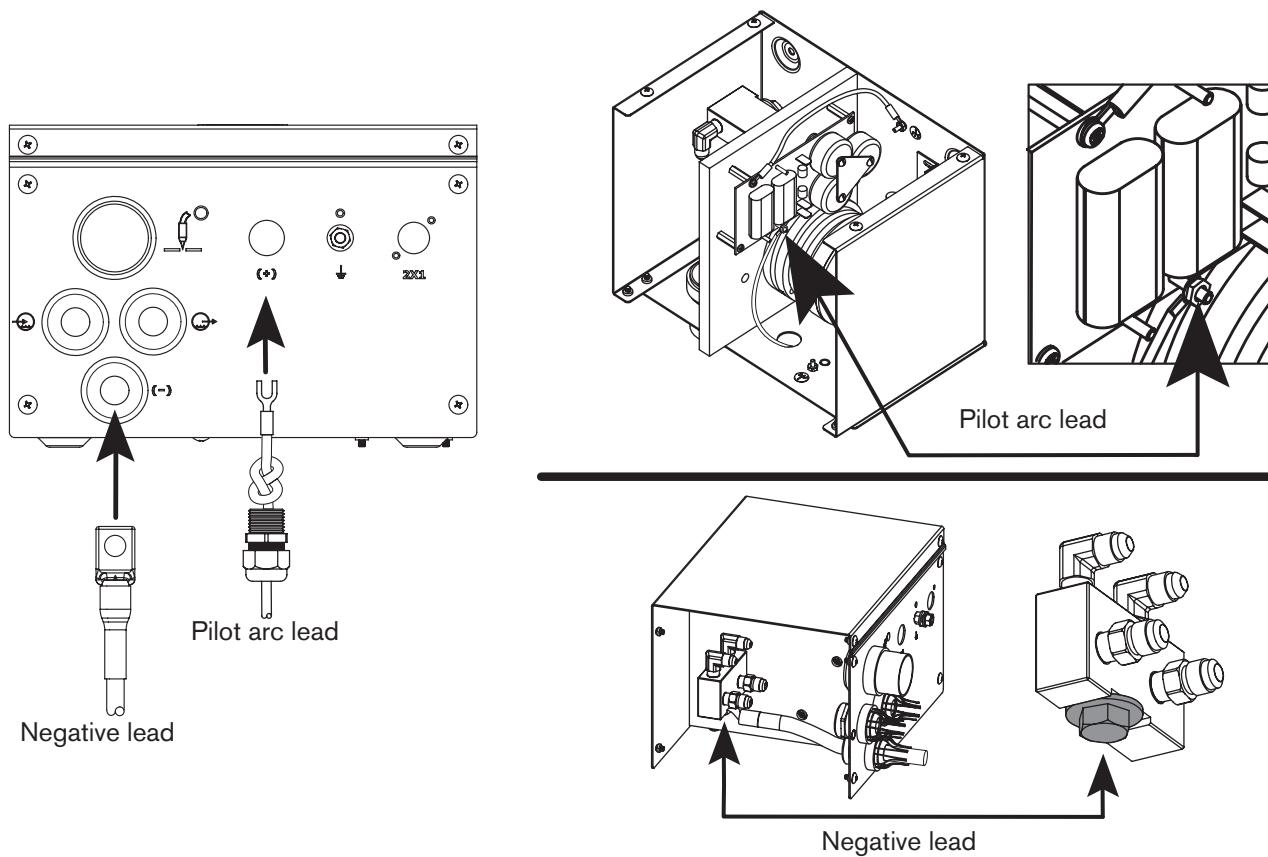
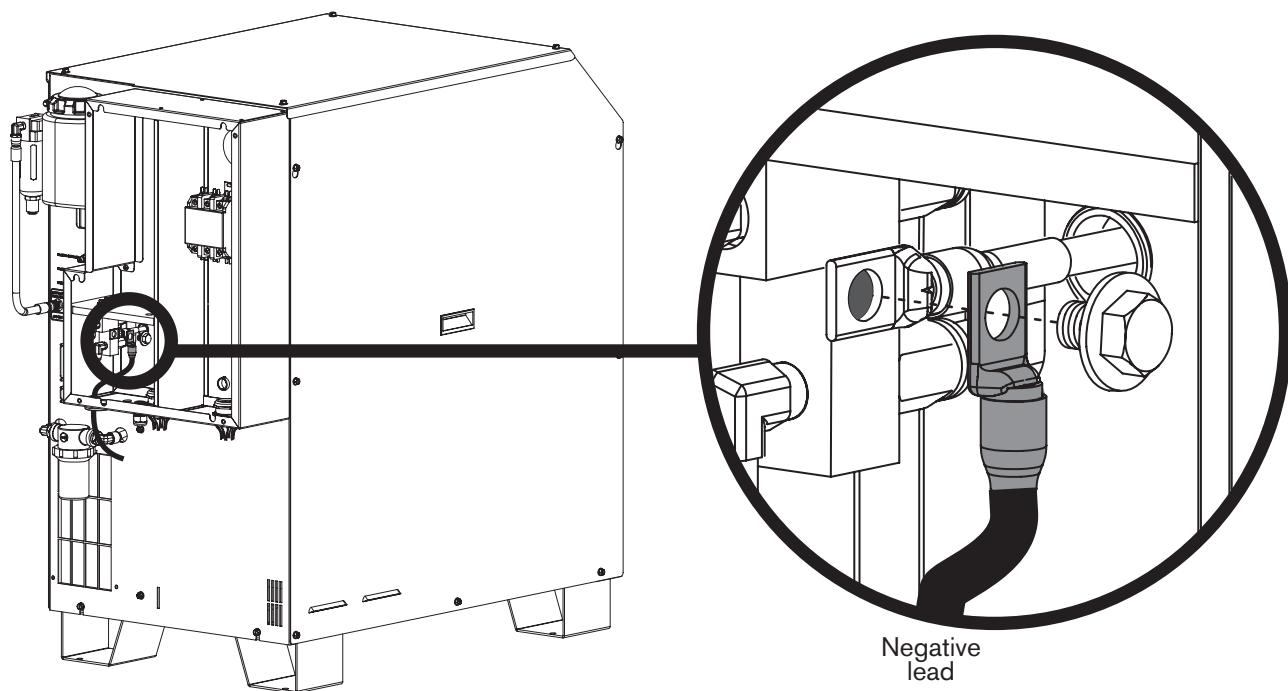
Part no.	Length
123932	7.5 m (25 ft)
123933	15 m (50 ft)
123934	23 m (75 ft)
123935	30.5 m (100 ft)
123936	38 m (125 ft)

③ Negative lead



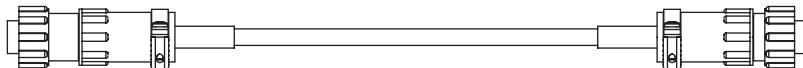
Part no.	Length
123926	7.5 m (25 ft)
123927	15 m (50 ft)
123928	23 m (75 ft)
123929	30.5 m (100 ft)
123930	38 m (125 ft)





INSTALLATION

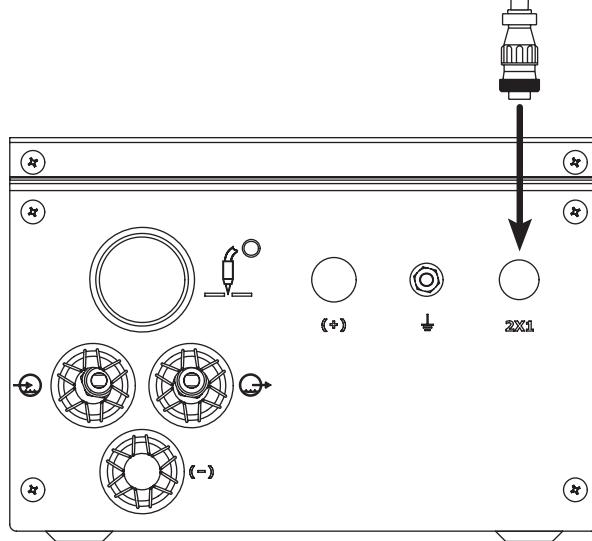
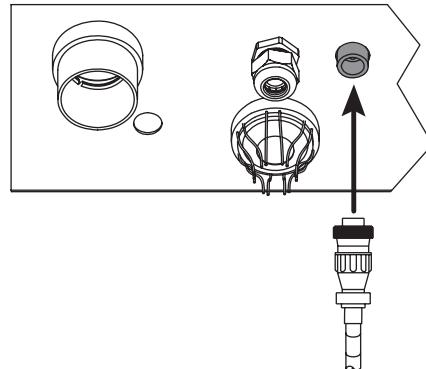
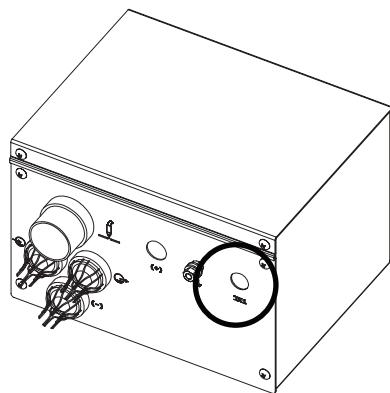
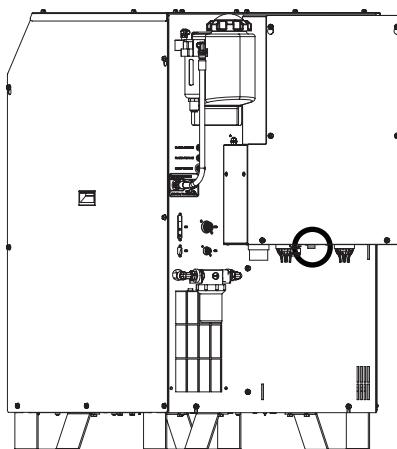
4 Ignition console power cable



Part no.	Length
123421	7.5 m (25 ft)
123424	15 m (50 ft)
123425	23 m (75 ft)
123426	30.5 m (100 ft)
123938	38 m (125 ft)

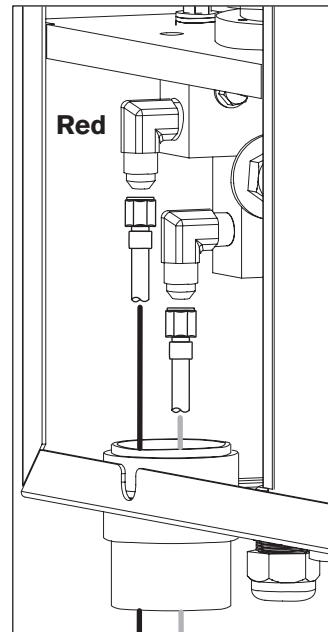
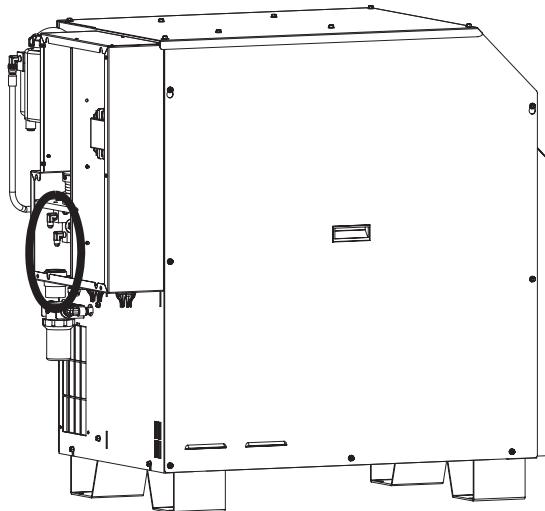
CABLE SIGNAL LIST – power supply to ignition console

Power supply end			Ignition console end	
Pin #	I/O	Description	Pin #	
1		120Vac Hot	1	
2		120Vac Return	2	
3		Ground	3	
4		Not connected	4	

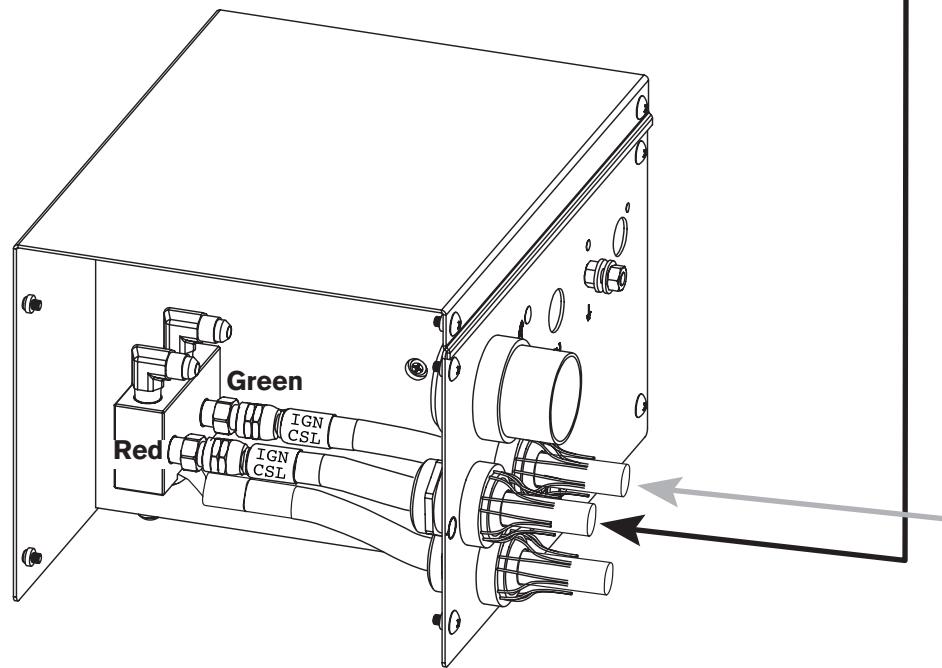


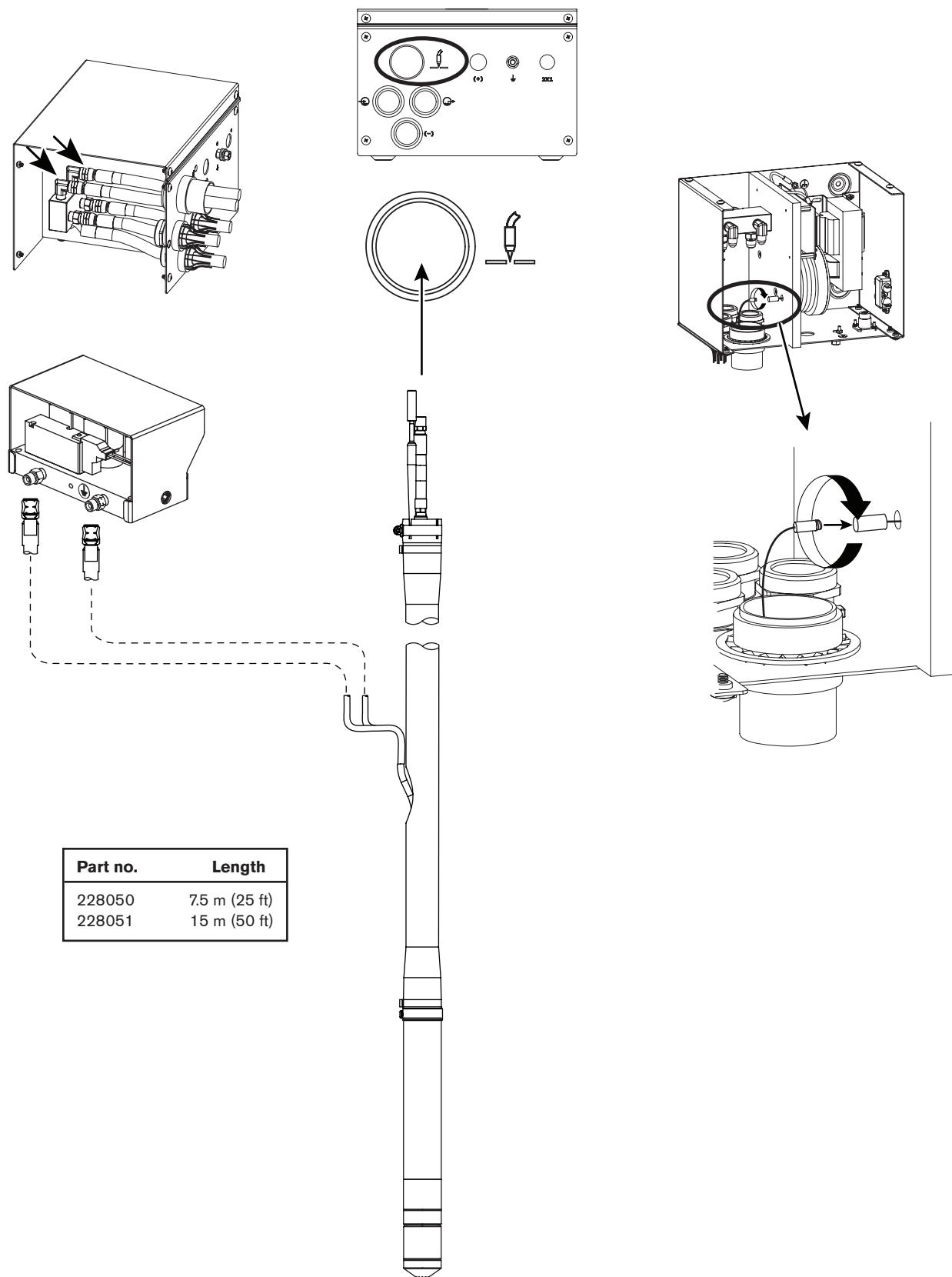
5 Ignition console coolant hoses

Note: verify the hose orientation before running the coolant hoses. The fittings are different on the ignition console end and the power supply end of each hose. The label marked IGN CSL on the end of each hose indicates that it is the end that is connected to the ignition console.



Part no.	Length
228157	7.5 m (25 ft)
228158	15 m (50 ft)
228159	23 m (75 ft)
228160	30.5 m (100 ft)
228161	38 m (125 ft)

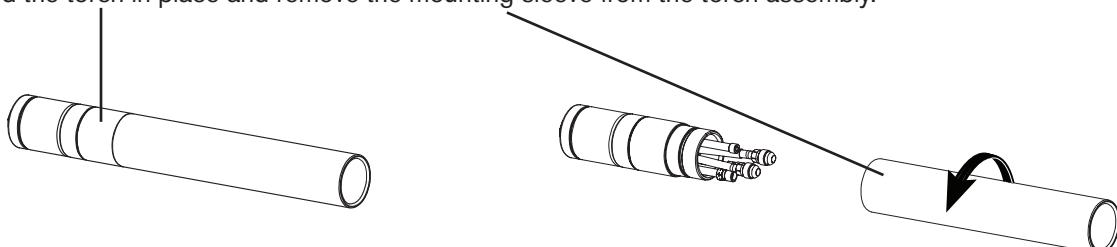


⑥ Torch lead assembly

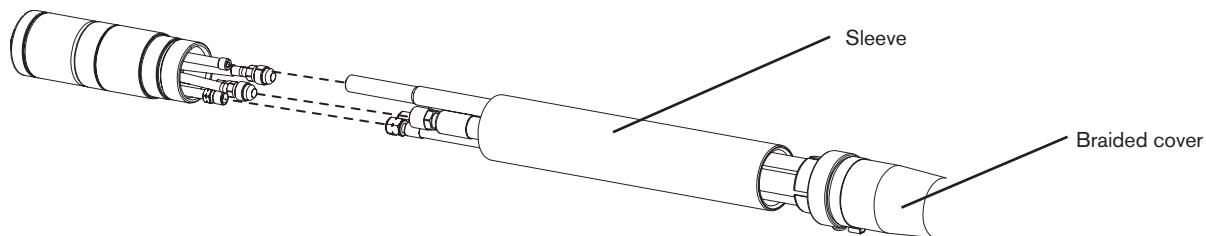
Connect the torch to the torch lead assembly

1. Route the leads through the cable track on the table. Leave 2 meters (6.5 ft.) of the leads loose at the torch end to install the torch.

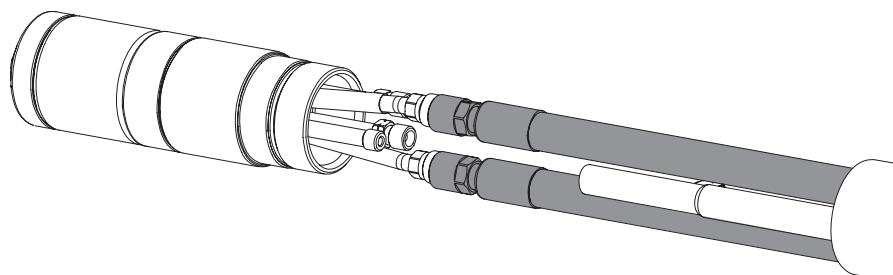
2. Hold the torch in place and remove the mounting sleeve from the torch assembly.



3. Push back the braided cover and slide the sleeve back over the leads. Align the torch connections with the hoses in the lead assembly. The hoses must not twist, and they are taped together to help prevent twisting.

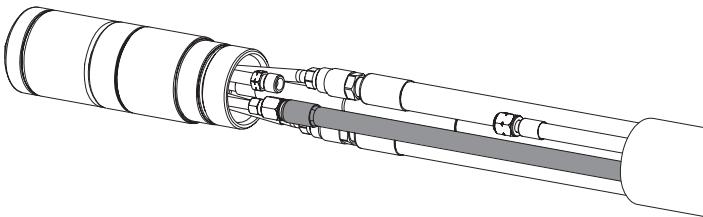


4. Connect the coolant hoses to the torch. Red connects to red. Use 2 wrenches to tighten gas and coolant fittings.

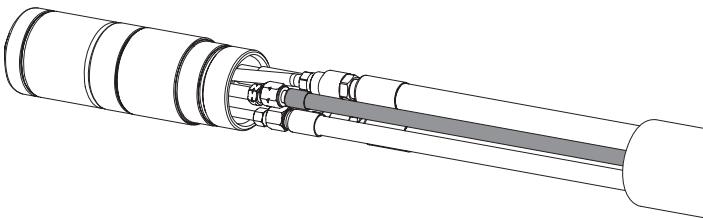


INSTALLATION

5. Connect the shield gas hose.

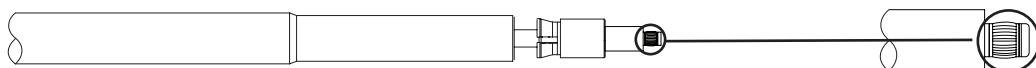


6. Connect the plasma gas hose. This connection has left-hand threads.

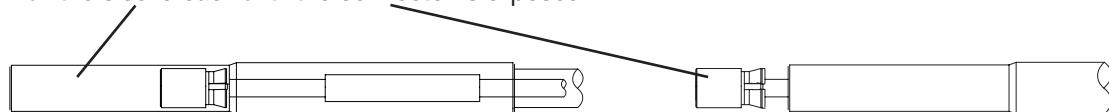


7. Connect the pilot arc lead.

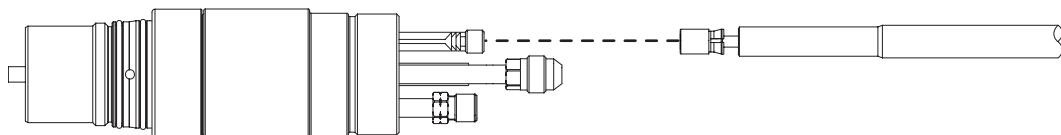
Note: Be careful not to damage or remove the small slotted metal band at the end of the pilot arc cable



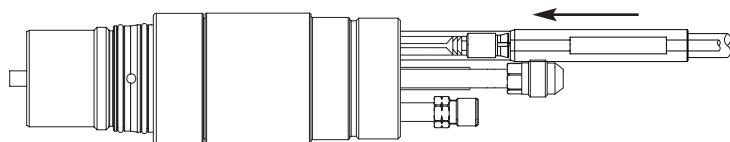
- 7a. Pull the sleeve back until the connector is exposed.



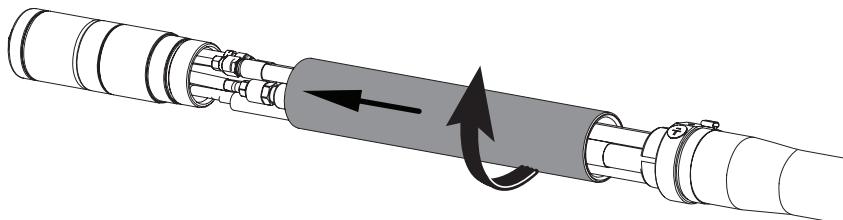
- 7b. Screw the connector onto the pilot arc connection from the torch. Tighten by hand until it is firmly seated.



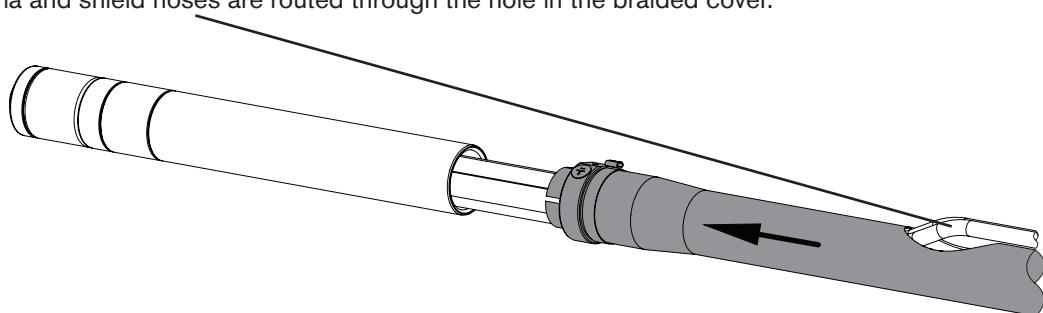
7c. Slide the sleeve forward until it clicks into place.



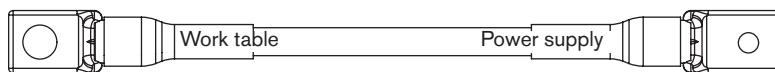
8. Slide the torch sleeve over the connections and screw it onto the torch body.



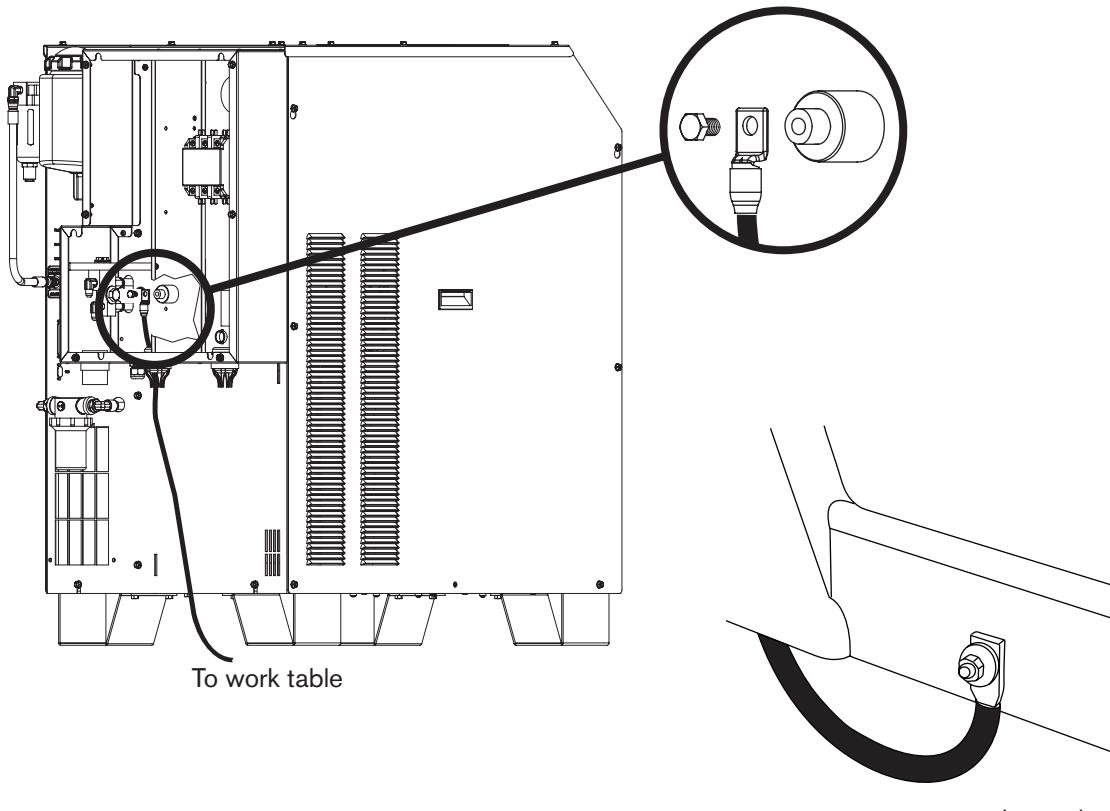
9. Slide the braided cover up to the torch sleeve. Push the brass collar into the torch sleeve. It is a snug fit. Make sure the plasma and shield hoses are routed through the hole in the braided cover.



7 Work lead

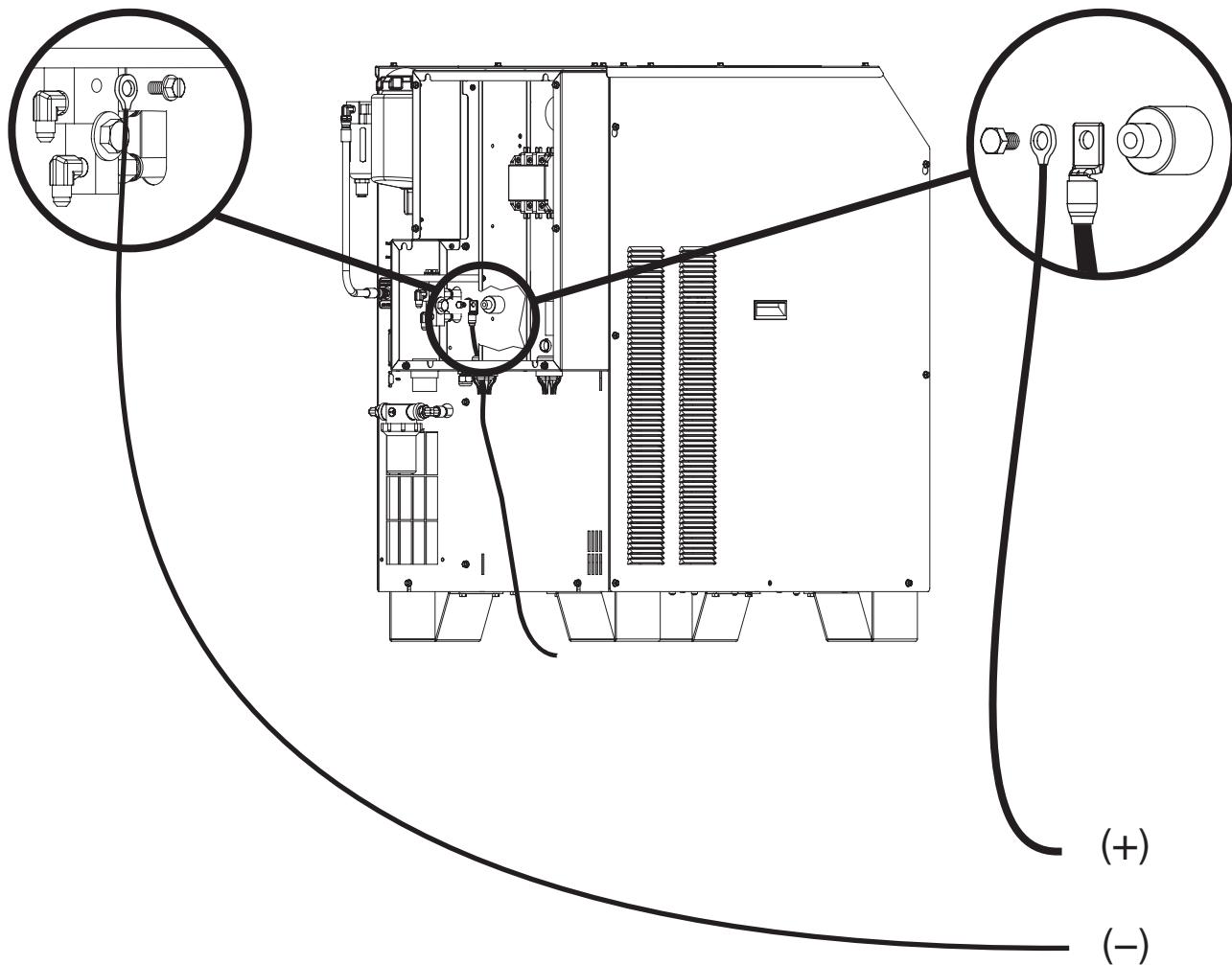


Part no.	Length
123662	7.5 m (25 ft)
123663	15 m (50 ft)

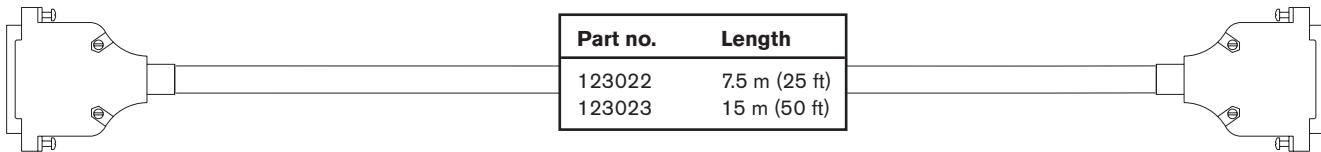


Arc voltage connection

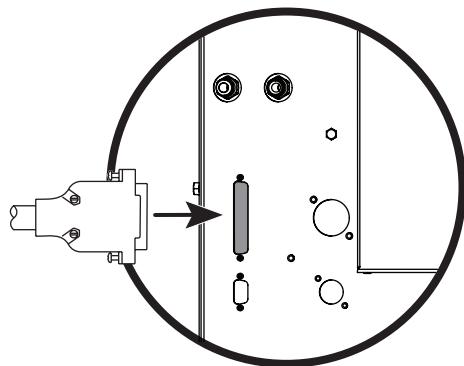
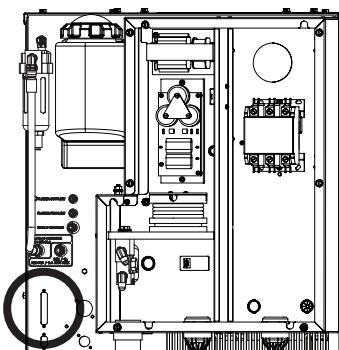
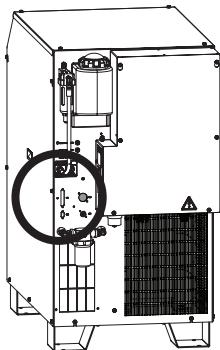
If a torch height control is installed, and undivided arc voltage (0 to 311 VDC) is needed, it can be accessed by making the connections shown in the figure on this page. The cables in the figure terminate at a voltage divider (supplied by the torch height control manufacturer).



⑧ Power supply to CNC interface cable


Power supply
CNC

Wire color	Pin no.	Input/Output	Signal name	Function	Input/Output	Notes
Black Red	1 20	Input Input	None None	Not used Not used	Output Output	
Black Green	2 21	Output Output	None None	Not used Not used	Input Input	
Black Blue	3 22		None None	Not used Not used		
Black Yellow	4 23	Output Output	Motion E (-) Motion C (+)	Notifies the CNC that an arc transfer has occurred and to begin machine motion once the CNC's pierce delay has timed out.	Input Input	2
Black Brown	5 24	Output Output	None None	Not used Not used	Input Input	2
Black Orange	6 25	Output Output	Rampdown error E (-) Rampdown error C (+)	Notifies the CNC that a rampdown error has occurred	Input	2
Red White	7 26	Output Output	None None	Not used Not used	Input	2
Red Green	8 27	Output Output	None None	Not used Not used	Input Input	2
Red Blue	9 28	Output Output	None None	Not used Not used	Input Input	2
Red Yellow	10 29	Output Output	None None	Not used Not used	Input Input	2
Red Brown	11 30		None None	Not used Not used		
Red Orange	12 31	Input Input	Corner - Corner +	CNC Notifies the plasma system that a corner is approaching and to reduce cut current (Cut current is CNC selectable or defaults to 75% of cut current)	Output Output	1
Green White	13 32	Input Input	Pierce - Pierce +	CNC Notifies the plasma system to maintain the shield preflow until the CNC releases the signal.	Output	1
Green Blue	14 33	Input Input	Hold - Hold +	Not required without Command THC. Command THC requires signal to preflow gases during IHS.	Output	1
Green Yellow	15 34	Input Input	Start - Start +	CNC initiates the plasma arc.	Output Output	1
Green Brown	16 35		None None	Not used Not used		
Green Orange	17 36		None Power ground	Not used Ground		
White Black	18 37		Power ground CNC +24 VDC	Ground Available 24 VDC (200 millamps maximum) See notes		3
	19		CNC + 24 VDC	Not connected		



Notes to CNC interface cable run list

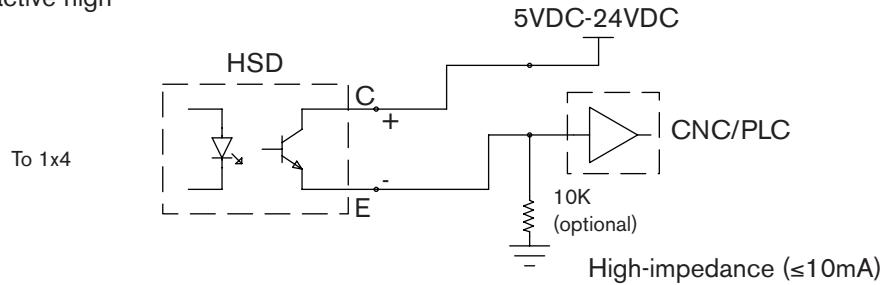
- Note 1. Inputs are relay coils. They require 24 VDC at 8.3 mA, or dry-contact closure.
- Note 2. Outputs are optically isolated, open-collector, transistors. The maximum rating is 24 VDC at 10 mA.
- Note 3. CNC +24 VDC provides 24 VDC at 200 mA maximum. A jumper is required on J300 to use 24 V power.

Caution: The CNC cable must be constructed using cable with 360 degree shielding and metal housing connectors at each end. The shielding must be terminated to the metal housings at each end to ensure proper grounding and to provide the best shielding.

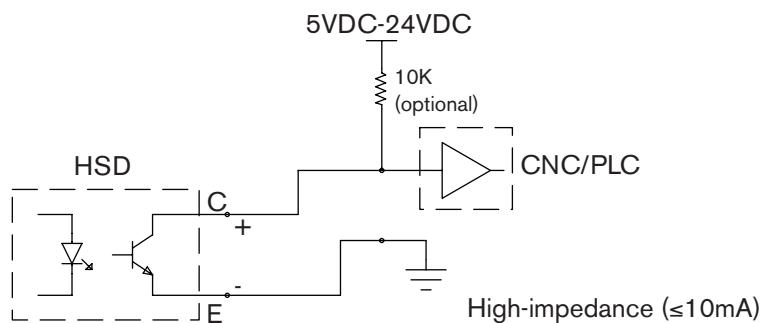
INSTALLATION

Examples of output circuits

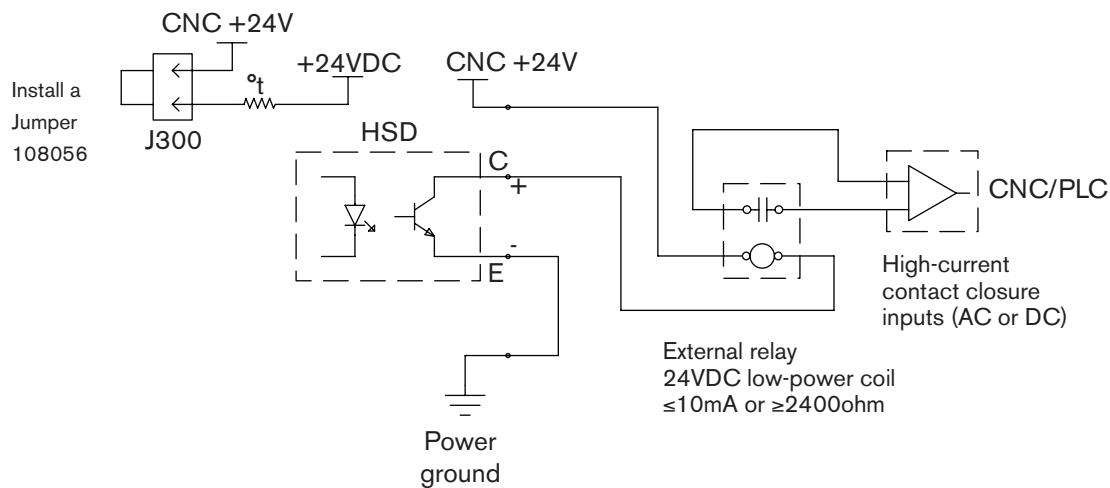
1. Logic interface, active-high



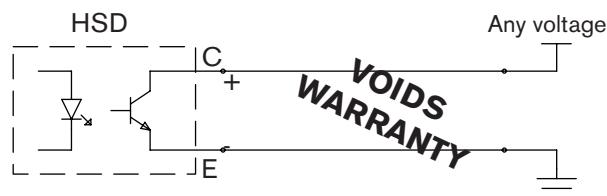
2. Logic interface, active-low



3. Relay interface

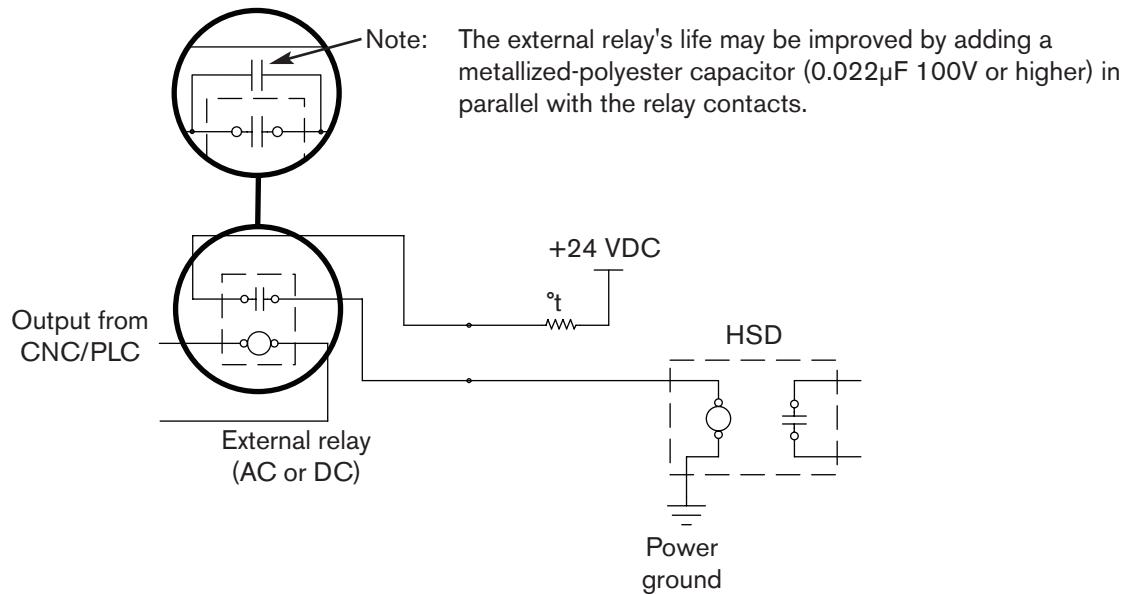


4. Do not use this configuration. Warranty will be void.

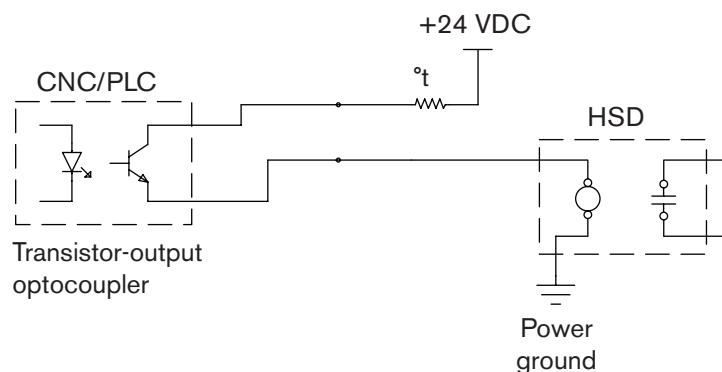


Examples of input circuits

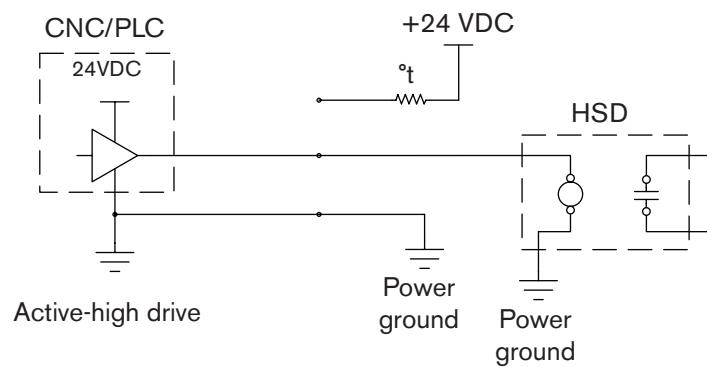
1. Relay interface



2. Optocoupler interface



3. Amplified-output interface

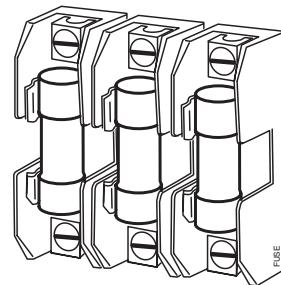


INSTALLATION

Power requirements

General

All switches, slow-blow fuses and power cables are customer-supplied and must be chosen as outlined by applicable national and local electrical codes. Installation must be performed by a licensed electrician. Use a separate primary-line disconnect switch for the power supply.



Input voltage	Phase	Rated input current @ 19.5 kW output	Recommended slow-blow fuse size	Recommended cable size for 15 m (50 feet) maximum length Rated for 60° C
200/208 VAC	3	62/58 amps	85 amps	30 mm ² (3 AWG)
220 VAC	3	56 amps	80 amps	30 mm ² (3 AWG)
240 VAC	3	52 amps	65 amps	26 mm ² (4 AWG)
400 VAC	3	32 amps	40 amps	10 mm ² (8 AWG)
440 VAC	3	28 amps	35 amps	8 mm ² (8 AWG)
480 VAC	3	26 amps	35 amps	8 mm ² (8 AWG)
600 VAC	3	21 amps	30 amps	6 mm ² (10 AWG)

Note: Cable AWG recommendations taken from table 310-16 of the National Electric Code handbook (USA).

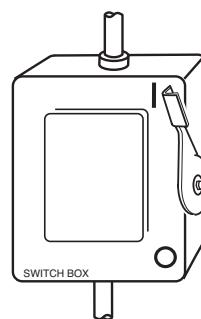
Line disconnect switch

The line disconnect switch serves as the supply-voltage disconnecting (isolating) device. Install this switch near the power supply for easy access by the operator.

Installation must be performed by a licensed electrician and according to applicable national and local codes.

The switch should:

- isolate the electrical equipment and disconnect all live conductors from the supply voltage when in the "OFF" position
- have one "OFF" and one "ON" position clearly marked with "O" (OFF) and "I" (ON)
- have an external operating handle capable of being locked in the "OFF" position
- contain a power-operated mechanism that serves as an emergency stop
- have slow-blow fuses installed for the proper breaking capacity (see table above).



9 Power cable

Cable sizes vary based on the distance of the receptacle from the main box. Use a 4-conductor Type SO input power cable with a conductor temperature rating of 60° C (140° F). Installation must be performed by a licensed electrician.

Connect the power



DANGER
ELECTRICAL SHOCK CAN KILL

The line disconnect switch must be in the OFF position before making the power cable connections. In the U.S., use a "lock-out/tag-out" procedure until installation is complete. In other countries, follow appropriate national and local safety procedures.

1. Insert the power cable through the strain relief at the rear of the power supply.
2. Connect the ground lead (PE) to the ground terminal as shown below.
3. Connect the power leads to the terminals as shown below.
4. **Check that the line disconnect switch is in the OFF position and remains in the OFF position for the remainder of the installation of the system.**
5. Connect the power cord leads to the line disconnect switch, following national and local electrical codes.

North American wire colors

U = Black

V = White

W = Red

(PE) Earth ground = Green/Yellow

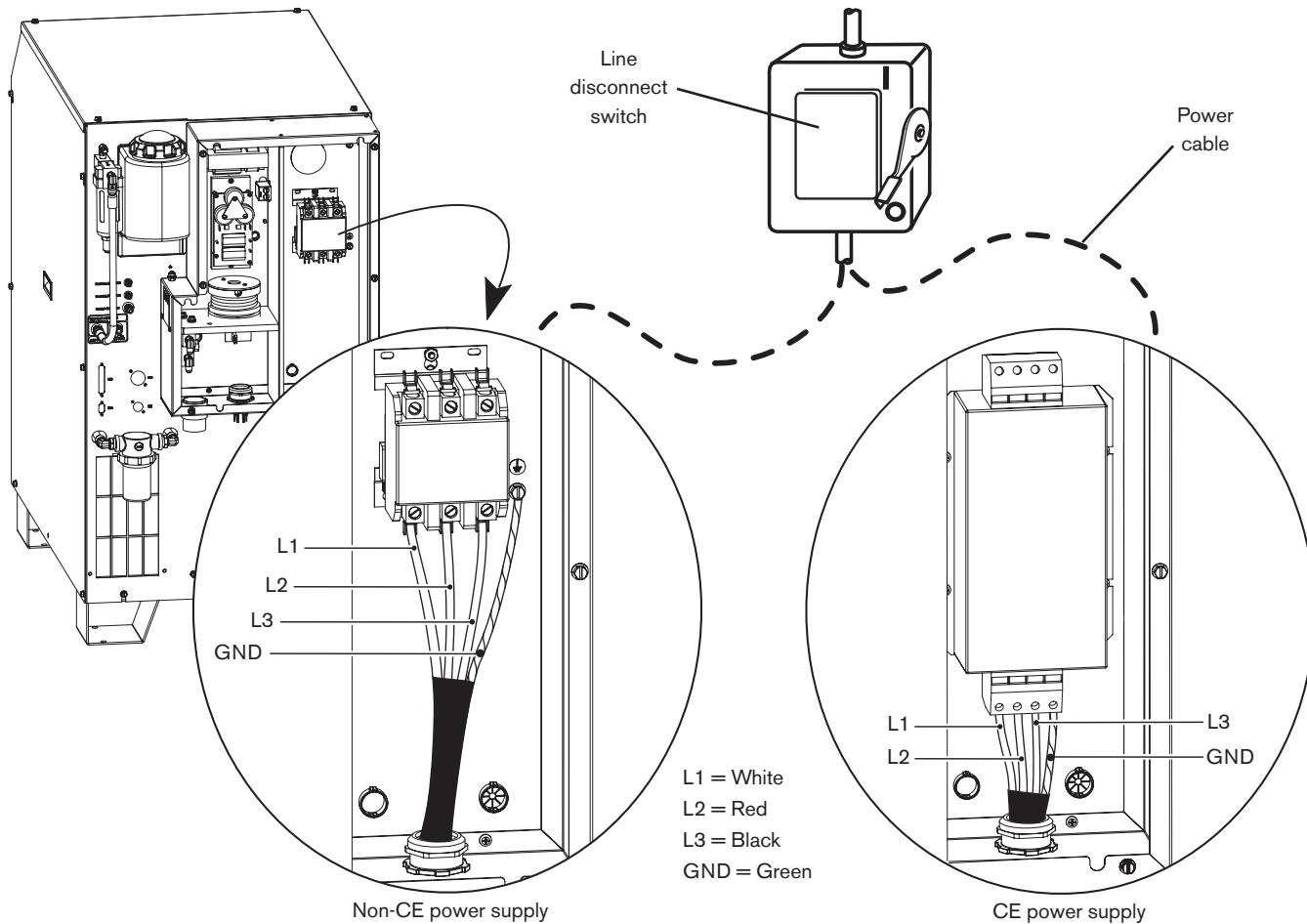
European wire colors

U = Black

V = Blue

W = Brown

(PE) Earth ground = Green/Yellow



INSTALLATION

Torch coolant requirements

The power supply is shipped without any coolant in the tank. Hypertherm recommends a mixture of 30% propylene glycol, 69.9% deionized water, and 0.1% benzotriazole. This mixture resists freezing to -12° C (+10° F) and contains a corrosion inhibitor to protect copper surfaces in the coolant loop. This mixture is available in 1-gallon (3.8 liter) containers by ordering 028872. 100% propylene glycol is available by ordering 028873.



Caution: **For operating temperatures colder than the temperature stated above, the percentage of propylene glycol must be increased. Failure to do so could result in a cracked torch head, hoses or other damage to the torch coolant system due to freezing.**

See *Material Safety Data Sheets Appendix* to determine if a stronger propylene glycol:purified water solution is needed for your particular application.

Observe the warning and cautions below. Refer to the *Material Safety Data Sheets Appendix* for data on safety, handling and storage of propylene glycol and benzotriazole.



DANGER
**COOLANT CAN BE IRRITATING TO SKIN AND EYES AND
HARMFUL OR FATAL IF SWALLOWED**

Propylene glycol and benzotriazole are irritating to skin and eyes, and harmful or fatal if swallowed. Upon contact, flush skin or eyes with water. If swallowed, induce vomiting and call a physician immediately.



Caution: **Always use propylene glycol in the coolant mixture. Do not use automotive anti-freeze in place of propylene glycol. Antifreeze contains corrosion inhibitors that will damage the torch coolant system.**

Always use purified water in the coolant mixture in order to prevent damage to the pump and corrosion in the torch coolant system.

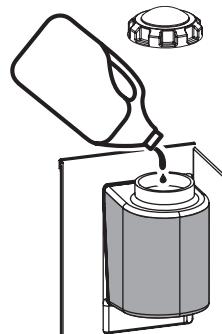
Water purity requirements

It is critical to maintain a low level of calcium carbonate in the coolant to avoid reduced performance of the torch or cooling system.

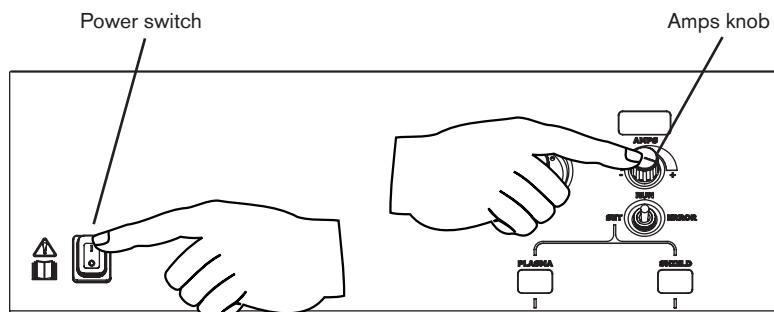
Fill the power supply with coolant

The system will take 11.4 – 15.1 liters (3 to 4 gallons) of coolant depending on the length of the torch leads and whether the system has a local or remote ignition console.

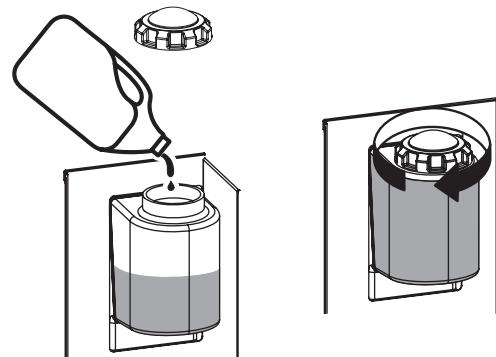
1. Add coolant until the tank is full.



2. Press and hold the Amps knob on the power supply control panel and turn ON the power to the power supply. This allows the user to override the 5-second pump time-out and fill the torch leads with coolant for the first time. Release the amps knob after 60 seconds. If the coolant flow switch is satisfied, the pump will continue to run and you are done. If the pump turns off, turn OFF the power to the power supply and repeat the process.



3. The level of coolant in the tank will have dropped. Add coolant until the tank is full and replace the filler cap.



Gas requirements

The customer must furnish all gases and gas-supply regulators for the system. Use high-quality, 2-stage pressure regulators located within 3 m (10 ft) of the power supply or optional fuel-gas console. See *Gas regulators* in this section for recommendations. See Section 2 for gas and flow specifications.

Caution: **Gas supply pressures not within the specifications in Section 2 can cause poor cut quality, poor consumable life, and operational problems.**



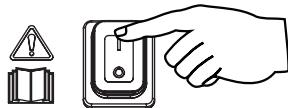
If the purity level of the gas is too low, or if there are leaks in the supply hoses or connections,

- **Cut speeds can decrease**
- **Cut quality can deteriorate**
- **Cutting thickness capability can decrease**
- **Parts life can shorten**

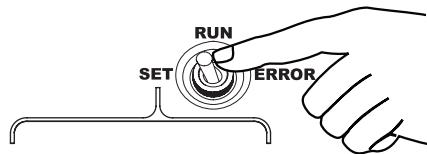
Setting the supply regulators

1. Make sure the power is OFF. Set the oxygen regulator pressure to 8.3 bar (120 psi). Set the air regulator pressure to 7.2 bar (95 psi). If an optional fuel-gas console is being used, set H35, F5, and N₂ pressures to 8.3 bar (120 psi).

2. Turn ON the power.



3. After the purge cycle stops, move the selection switch to the SET position.



4. Adjust all regulators while gas is flowing. Return to the supply regulators and adjust them to match the values in step 1.

5. Move the selection switch back to the RUN position (center).

Gas regulators

Low-quality gas regulators do not provide consistent supply pressures and can result in poor cut quality and system operation problems. Use high-quality, 1-stage, gas regulators to maintain consistent gas supply pressure, if using liquid cryogenic or bulk storage. Use high-quality, 2-stage, gas regulators to maintain consistent gas supply pressure from high-pressure gas cylinders.

The high-quality gas regulators listed below are available from Hypertherm and meet U.S. Compressed Gas Association (CGA) specifications. In other countries, select gas regulators that conform to national and local codes.

2-stage regulator



Single-stage regulator



Part Number	Description	Qty.
128544	Kit: Oxygen, 2-stage *	1
128545	Kit: Inert Gas, 2-stage	1
128546	Kit: Hydrogen (H₂, H₃₅ and methane) 2-stage	1
128547	Kit: Air, 2-stage	1
128548	Kit: 1-stage (for use with cryogenic liquid nitrogen or oxygen)	1
022037	Oxygen, 2-stage	1
022038	Inert gas, 2-stage	1
022039	Hydrogen/methane, 2-stage	3
022040	Air, 2-stage	1
022041	Line regulator, 1-stage	1

* Kits include appropriate fittings

Supply gas plumbing

Rigid copper plumbing or suitable flexible hose may be used for all gas supplies. Do not use steel or aluminum pipe. After installation, pressurize the entire system and check for leaks.

Recommended hose diameters are 9.5 mm (3/8 in) for lengths < 23 m (75 ft) and 12.5 mm (1/2 in) for lengths > 23 m (75 ft).

For flexible-hose systems, use a hose designed for inert gas to carry air, nitrogen or argon-hydrogen.



Caution: When configuring the gas console to the supply gases, make sure that all hoses, hose connections, and fittings are acceptable for use with oxygen, argon-hydrogen, and methane. Installation must be made in accordance with local and national codes.

Note: When cutting with oxygen as the plasma gas, air must also be connected to the gas console to achieve the proper mixtures in the preflow and cutflow modes.



WARNING **CUTTING WITH OXYGEN CAN CAUSE FIRE OR EXPLOSION**

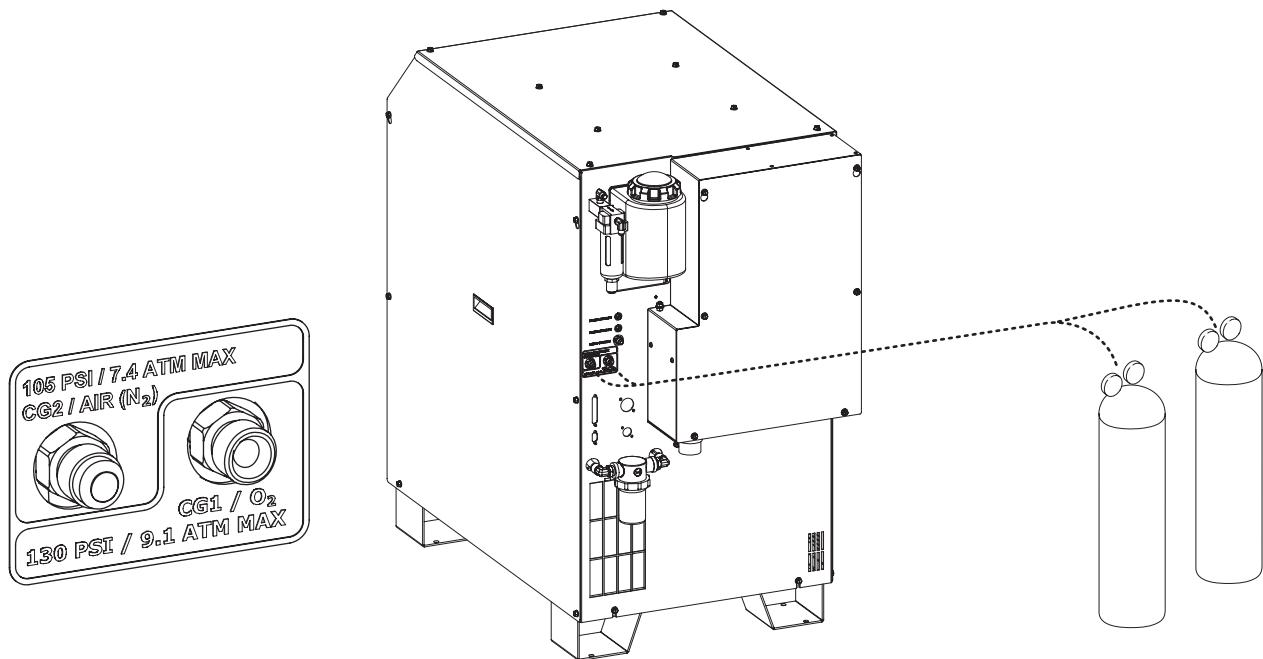
Cutting with oxygen as the plasma gas can cause a potential fire hazard due to the oxygen-enriched atmosphere that it creates. As a precaution, Hypertherm recommends that an exhaust ventilation system be installed when cutting with oxygen.

Flashback arrestors are required (unless not available for specific gases or required pressures) to prevent fire from propagating to the gas supply.

Connect the supply gases

Standard system

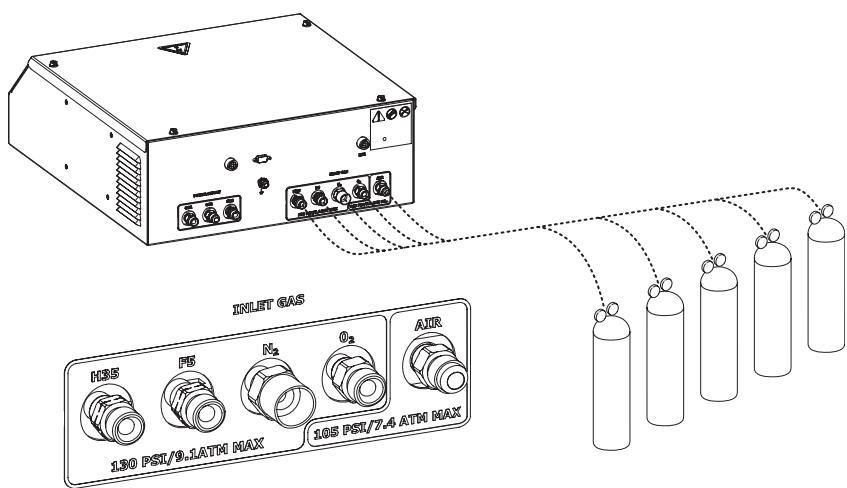
Connect the supply gases to the power supply.



Fuel-gas system

Connect the supply gases to the gas console. Torch leads must be purged between gas changes.

Fitting	Size
H35 / F5	9/16 – 18 LH, (fuel gas) "B"
N ₂	5/8 – 18, RH, internal (inert gas) "B"
O ₂	9/16 – 18, RH (oxygen) "B"
Air	9/16 – 18, JIC, #6



INSTALLATION

Supply gas hoses

⑩ Air hose



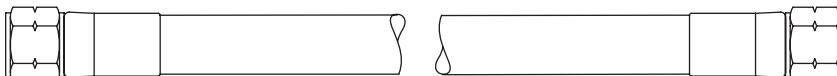
Part no.	Length
024659	7.5 m (25 ft)
024660	15 m (50 ft)

⑪ Oxygen hose



Part no.	Length
024205	7.5 m (25 ft)
024155	15 m (50 ft)

⑫ F5 or H35 hose



Part no.	Length
024384	7.5 m (25 ft)
024656	15 m (50 ft)

⑬ Nitrogen hose



Part no.	Length
024134	7.5 m (25 ft)
024112	15 m (50 ft)

Section 4

OPERATION

In this section:

Controls and indicators.....	4-2
Main power switch	4-2
Daily start-up.....	4-3
Check torch.....	4-3
System operation.....	4-4
Amps display.....	4-4
Fuel-gas console operation.....	4-5
Consumable selection.....	4-6
Mild steel.....	4-6
Stainless steel.....	4-6
Aluminum.....	4-7
Install consumables.....	4-8
Cut charts.....	4-9
Estimated kerf width compensation	4-9
Changing consumable parts	4-23
Remove consumables	4-23
Inspect consumables.....	4-24
Inspect torch.....	4-25
Inspect electrode pit depth.....	4-26
Replace torch water tube.....	4-27
Common cutting faults	4-28
How to optimize cut quality	4-29
Tips for table and torch.....	4-29
Plasma set-up tips.....	4-29
Maximize the life of consumable parts.....	4-29
Additional factors of cut quality.....	4-30
Additional improvements	4-31

Controls and indicators

Main power switch

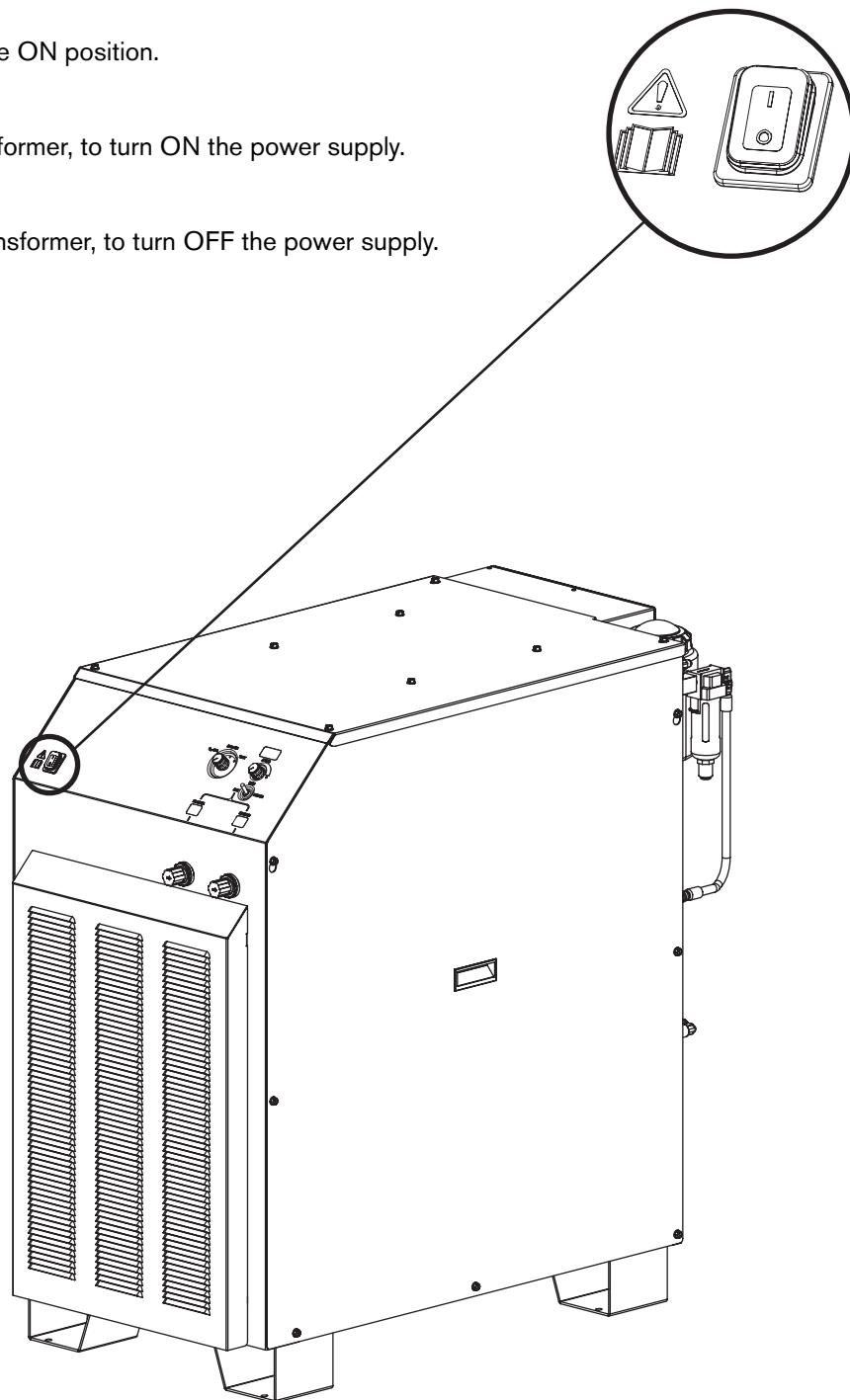
The switch illuminates when it is in the ON position.

On position (I)

AC power is sent to the control transformer, to turn ON the power supply.

Off position (O)

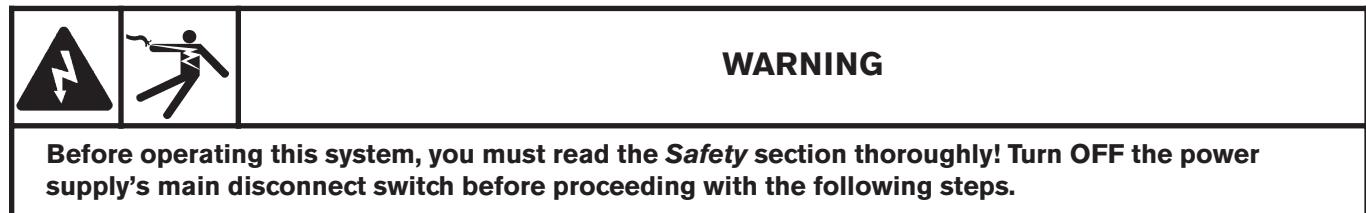
AC power is cut off to the control transformer, to turn OFF the power supply.



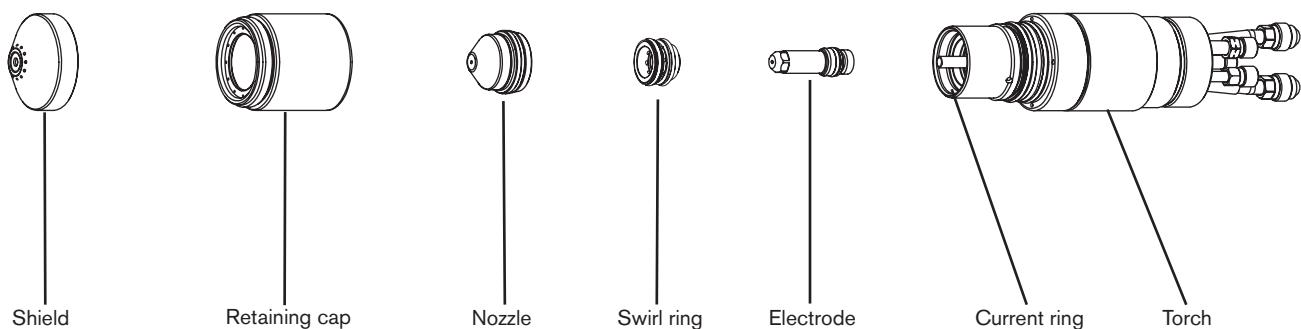
Daily start-up

Prior to start-up, ensure that your cutting environment and that your clothing meet the safety requirements outlined in the *Safety* section of this manual.

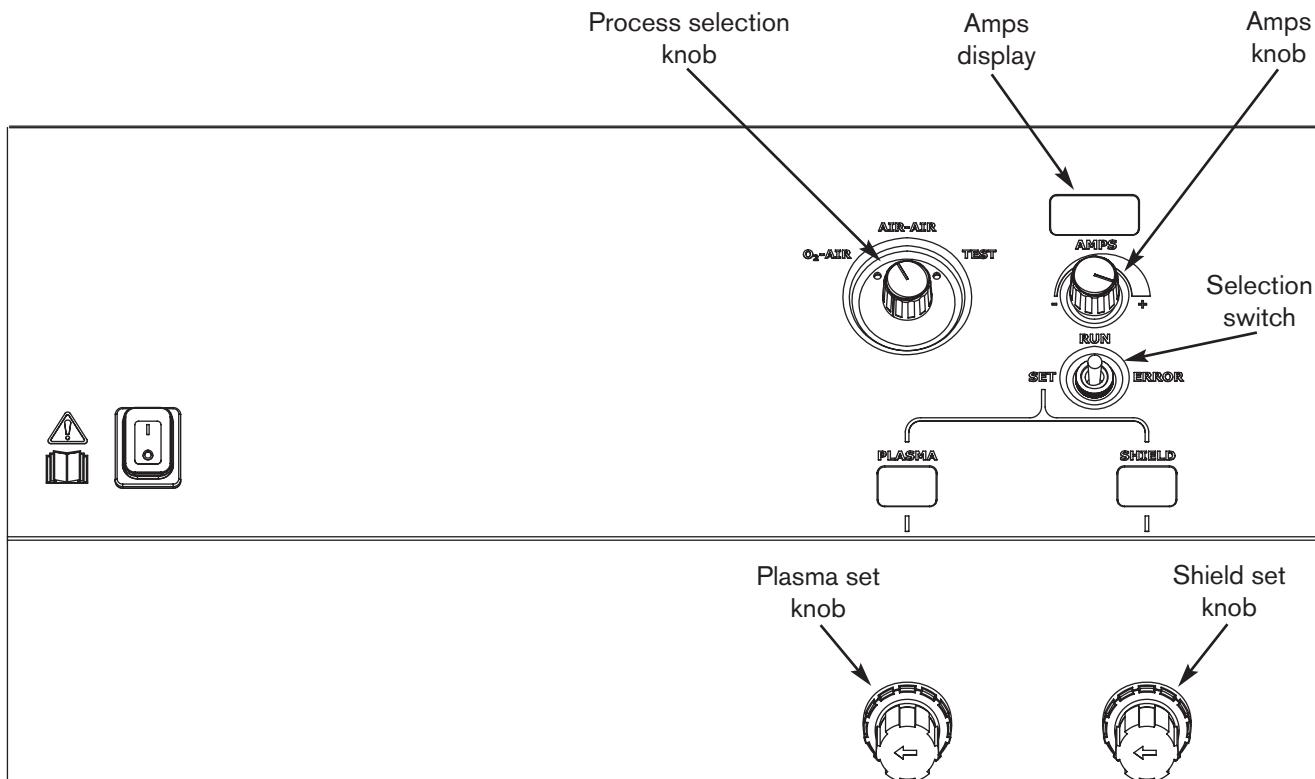
Check the torch



1. Turn OFF the main disconnect switch to the power supply.
2. Remove the consumables from the torch and check for worn or damaged parts. **Always place the consumables on a clean, dry, oil-free surface after removing. Dirty consumables can cause the torch to malfunction.**
 - Refer to *Changing consumable parts* later in this section for details and for consumable inspection tables.
 - Refer to *Consumable selection* to choose the correct consumables for your cutting needs.
3. Replace consumables. Refer to *Changing consumable parts* later in this section for details.
4. Ensure that the torch is perpendicular to the workpiece.



System operation

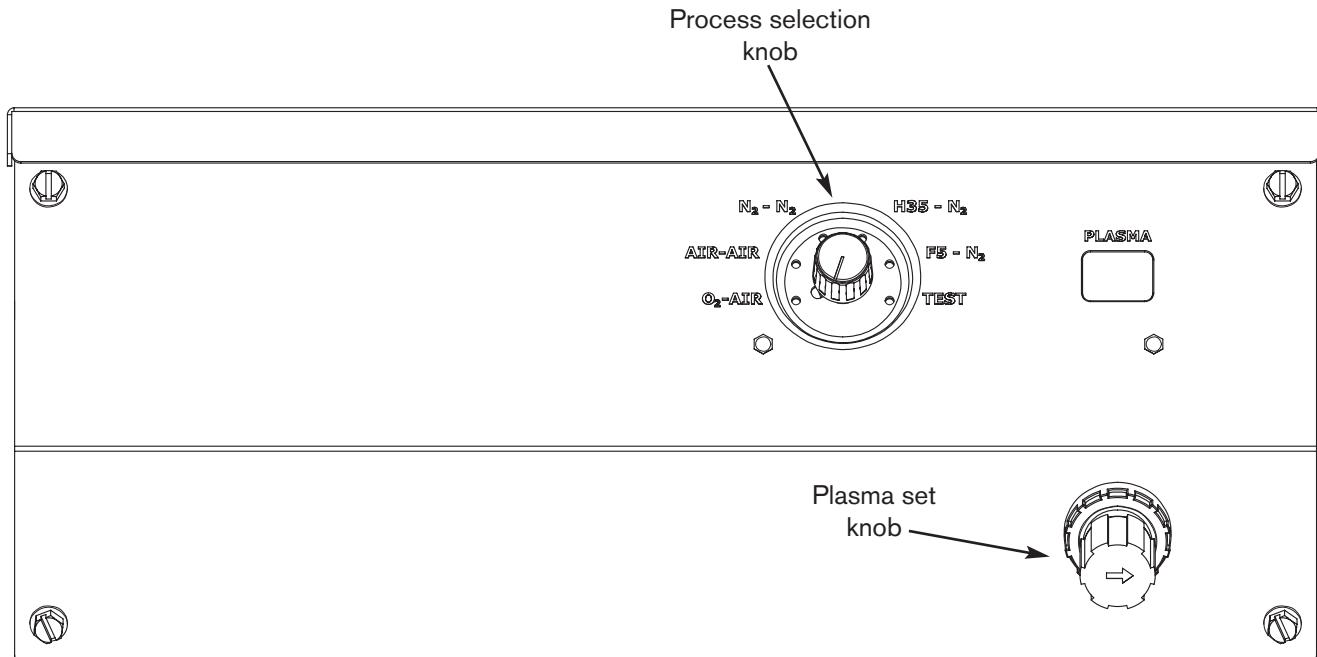


1. Turn ON the power with the selection switch in the RUN position.
2. Set the current using the AMPS knob.
3. Choose a process using the process selection knob.
4. Move the selection switch to the SET position.
5. Set the PLASMA and SHIELD gas pressures using the data in the cut chart for the desired process. Pull the knob towards you to unlock it and set the pressure. Push the knob towards the power supply until it clicks to lock it.
Note: when the selection switch is in the set position, the amps display shows the incoming shield supply pressure.
6. Move the selection switch to the RUN position.

Amps display

- When the selection switch is in the run position, the display shows the current set point.
- During a cut the display shows the actual cutting current.
- Push the amps knob during a cut to display the output voltage of the power supply.

Fuel-gas console operation



Note: The plasma set knob on the fuel-gas console is used when an H35 or F5 process is selected. The plasma set knob on the power supply is used (as described on the previous page) when an O₂, Air, or N₂ process has been selected.

1. Turn ON the power with the selection switch in the RUN position.
2. Move the selection switch on the power supply to SET and choose the current using the AMPS knob.
3. Choose a process using the process selection knob on the fuel gas console.
4. Set the PLASMA gas pressure on the fuel gas console (H35/F5).
5. Set the SHIELD gas pressure on the power supply using the data in the cut chart for the desired process.
6. Move the selection switch on the power supply to the RUN position.

OPERATION

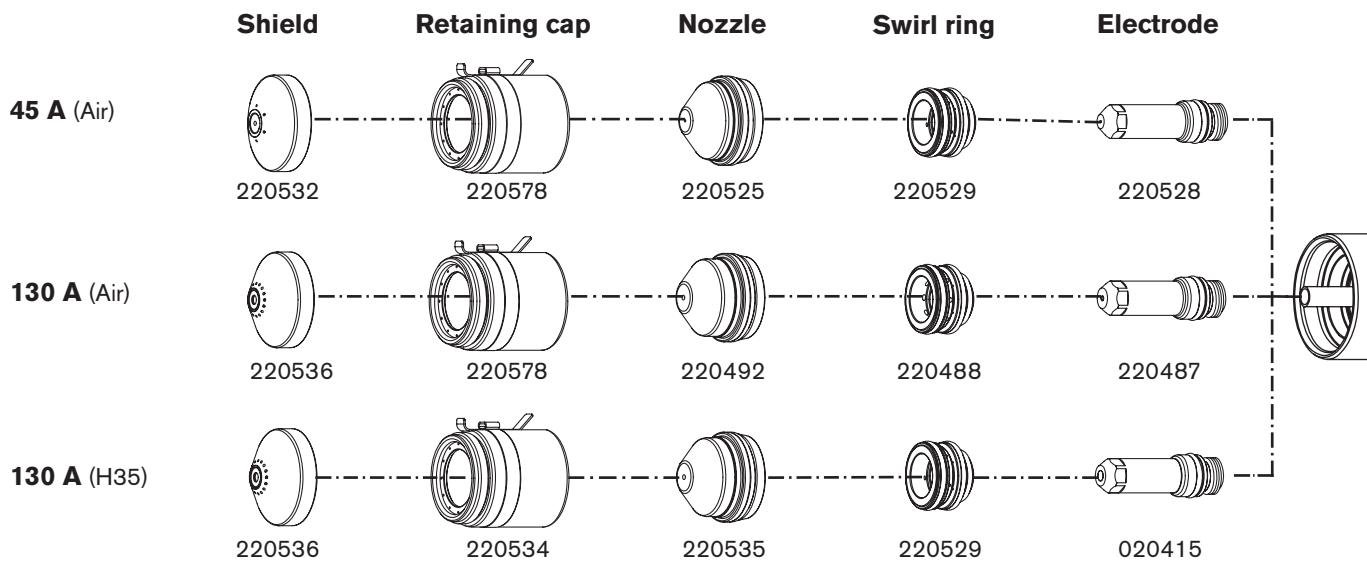
Consumable selection

Mild steel

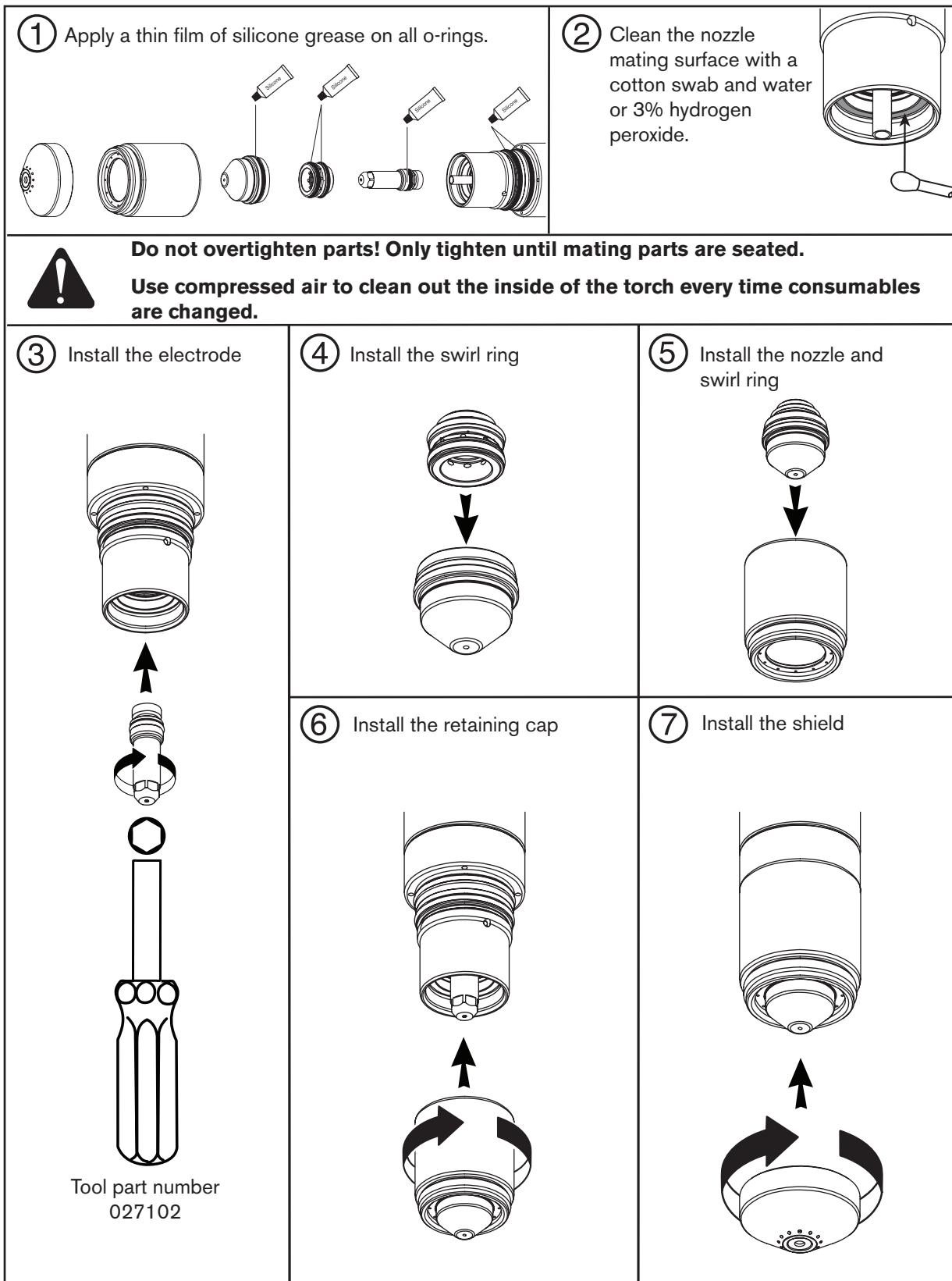
	Shield	Retaining cap	Nozzle	Swirl ring	Electrode
45 A (Air)					
	220532	220578	220525	220529	220528
50 A (O₂)					
	220532	220578	220530	220529	220528
130 A (Air)					
	220536	220578	220492	220488	220487
130 A (O₂)					
	220491	220578	220489	220488	220487

Stainless steel

	Shield	Retaining cap	Nozzle	Swirl ring	Electrode
45 A (Air)					
	220532	220578	220525	220529	220528
45 A (N₂ and F5/N₂)					
	220532	220534	220525	220529	220528
130 A (Air)					
	220536	220578	220492	220488	220487
130 A (H35)					
	220536	220534	220535	220529	020415
130 A (N₂)					
	220536	220578	220535	220488	020415

Aluminum

Install consumables



Cut charts

The following *Cut charts* show the consumable parts, cutting speed, and the gas and torch settings required for each process.

The numbers shown in the *Cut charts* are recommended to provide high-quality cuts with minimal dross. Because of differences between installations and material composition, adjustments may be required to obtain desired results.

Estimated kerf width compensation

	Material thickness (mm)						
Mild steel	1.524	3.429	6.350	9.525	12.70	19.05	25.40
130 O2/Air		1.549	1.778	1.981	2.235	2.336	3.073
130 Air/Air		1.346	1.574	1.879	2.082	2.717	3.251
50 O2/Air	1.041	1.168	1.473				
45 Air/Air	0.812	1.270	1.422				
Stainless steel							
130 Air/Air			1.651	1.930	2.133	2.768	
130 N2/N2			1.651	1.651	2.540	3.530	
130 H35/N2				2.870	2.768	2.590	2.946
45 Air/Air	0.812	1.117	1.270				
45 N2/N2	0.533	0.660	0.660				
45 F5/N2	0.609	0.635	0.812				
Aluminum							
130 Air/Air			2.082	1.930	2.159	2.692	2.819
130 H35/N2				2.235	2.184	2.006	1.168
45 Air/Air	1.168	1.193	1.219				

	Material thickness (inches)						
Mild steel	0.06	0.135	0.25	0.375	0.5	0.75	1
130 O2/Air		0.061	0.07	0.078	0.088	0.092	0.121
130 Air/Air		0.053	0.062	0.074	0.082	0.107	0.128
50 O2/Air	0.041	0.046	0.058				
45 Air/Air	0.032	0.050	0.056				
Stainless steel							
130 Air/Air			0.065	0.076	0.084	0.109	
130 N2/N2			0.065	0.065	0.100	0.139	
130 H35/N2				0.113	0.109	0.102	0.116
45 Air/Air	0.032	0.044	0.050				
45 N2/N2	0.021	0.026	0.026				
45 F5/N2	0.024	0.025	0.032				
Aluminum							
130 Air/Air			0.082	0.076	0.085	0.106	0.111
130 H35/N2				0.088	0.086	0.079	0.046
45 Air/Air	0.046	0.047	0.048				

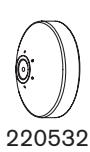
OPERATION

Mild steel

Air Plasma / Air Shield

45 A Cutting

Flow Rates - lpm/scfh	
	Air
Preflow	113 / 240
Cutflow	122 / 258



220532



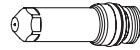
220578



220525



220529



220528

220490 (no IHS tab)

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	57	50	0.5	104	1.5	8930	3.0	200	0.0
				0.8	106	1.5	8400	3.0	200	0.0
				1.0	107	1.5	7750	3.0	200	0.1
				1.2	108	1.8	7250	3.6	200	0.1
				1.5	109	1.8	6500	3.6	200	0.2
				2.0	110	1.8	5800	3.6	200	0.2
				2.5	110	2.0	4700	4.0	200	0.2
				3.0	110	2.0	3300	4.0	200	0.3
				4.0	113	2.3	1950	4.6	200	0.4
				6.0	115	2.5	1575	5.0	200	0.5

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
Air	Air	57	50	.018	104	.060	360	0.120	200	0.0
				.024	105	.060	345	0.120	200	0.0
				.030	106	.060	335	0.120	200	0.0
				.036	107	.060	315	0.120	200	0.1
				.048	108	.070	285	0.140	200	0.1
				.060	109	.070	255	0.140	200	0.2
				.075	110	.070	235	0.140	200	0.2
				.105	110	.080	170	0.160	200	0.2
				.135	110	.080	90	0.160	200	0.3
				3/16	113	.090	70	0.180	200	0.4
				1/4	116	.100	60	0.200	200	0.5

Mild steel

O₂ Plasma / Air Shield
50 A Cutting

Flow Rates - lpm/scfh		
	O ₂	Air
Preflow	0 / 0	69 / 146
Cutflow	29 / 62	73 / 155



220532



220578



220530



220529



220528

220490 (no IHS tab)

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
O ₂	Air	72	36	.5	98	1.5	7550	3.0	200	0.0
				.8	98	1.5	7050	3.0	200	0.0
				1.0	98	1.5	6775	3.0	200	0.1
				1.2	98	1.5	6600	3.0	200	0.1
				1.5	98	1.5	6150	3.0	200	0.1
				2.0	98	1.5	5400	3.0	200	0.1
				2.5	100	1.8	4300	3.6	200	0.2
				3.0	102	1.8	3650	3.6	200	0.3
				4.0	104	2.0	2800	4.0	200	0.4
				6.0	108	2.5	1750	5.0	200	0.5

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
O ₂	Air	72	36	.018	98	.060	300	0.120	200	0.0
				.024	98	.060	290	0.120	200	0.0
				.030	98	.060	280	0.120	200	0.0
				.036	98	.060	270	0.120	200	0.1
				.048	98	.060	260	0.120	200	0.1
				.060	98	.060	240	0.120	200	0.1
				.075	98	.060	220	0.120	200	0.1
				.105	100	.070	160	0.140	200	0.2
				.135	103	.070	130	0.140	200	0.3
				3/16	106	.090	85	0.180	200	0.4
				1/4	108	.100	65	0.200	200	0.5

OPERATION

Mild steel

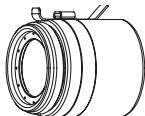
Air Plasma / Air Shield

130 A Cutting

Flow Rates - lpm/scfh	
	Air
Preflow	67 / 142
Cutflow	132 / 280



220536



220578

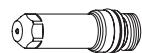
220490 (no IHS tab)



220492



220488



220487

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	72	35	3	136	3.1	6000	6.2	200	0.1
				4	13	3.1	4930	6.2	200	0.2
				6	138	3.6	3850	7.2	200	0.3
				10	142	4.1	2450	8.2	200	0.5
				12	144	4.1	2050	8.2	200	0.5
				15	150	4.6	1450	9.2	200	0.8
				20	153	4.6	810	10.5	230	1.2
				25	163	4.6	410	Edge Start		
				32	170	5.1	250			

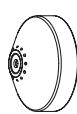
English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
Air	Air	72	35	0.1350	136	.120	220	.240	200	0.1
				0.1875	136	.120	160	.240	200	0.2
				0.2500	138	.140	150	.280	200	0.3
				0.3750	142	.160	100	.320	200	0.5
				0.5000	144	.160	75	.320	200	0.5
				0.6250	150	.180	50	.360	200	0.8
				0.7500	153	.180	35	.420	230	1.2
				1	163	.180	15	Edge Start		
				1-1/4	170	.200	10			

Mild steel

O₂ Plasma / Air Shield
130 A Cutting

Flow Rates - lpm/scfh		
	O ₂	Air
Preflow	0 / 0	90 / 190
Cutflow	48 / 102	92 / 195

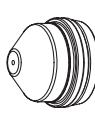


220491



220578

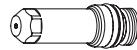
220490 (no IHS tab)



220489



220488



220487

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
O ₂	Air	65	48	3	128	2.5	6500	5	200	0.1
				4	129	2.8	5420	5.6	200	0.2
				6	130	2.8	4000	5.6	200	0.3
				10	134	3.0	2650	6	200	0.3
				12	136	3.0	2200	6	200	0.5
				15	141	3.8	1650	7.6	200	0.7
			43	20	142	3.8	1130	7.6	200	1
				25	152	4.0	675	8	200	1.5
				32	155	4.5	480	Edge Start		
				38	160	4.5	305			

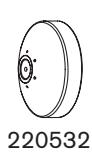
English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
O ₂	Air	65	48	0.1350	128	.100	240	0.2	200	0.1
				0.1875	129	.110	190	0.22	200	0.2
				0.2500	130	.110	150	0.22	200	0.3
				0.3750	134	.120	110	0.24	200	0.3
				0.5000	136	.120	80	0.24	200	0.5
				0.6250	141	.150	60	0.3	200	0.7
			43	0.7500	142	.150	50	0.3	200	1
				1	152	.160	25	0.32	200	1.5
				1-1/4	155	.180	20	Edge Start		
				1-1/2	160	.180	12			

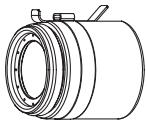
OPERATION

Stainless steel
Air Plasma / Air Shield
45 A Cutting

Flow Rates - lpm/scfh	
	Air
Preflow	149 / 315
Cutflow	161 / 342



220532



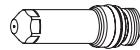
220578



220525



220529



220528

220490 (no IHS tab)

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	62	73	0.5	102	1.5	6800	3.0	200	0.0
				0.8	104	1.5	6100	3.0	200	0.0
				1.0	105	1.5	5600	3.0	200	0.1
				1.2	108	1.8	5100	3.6	200	0.1
				1.5	109	1.8	4500	3.6	200	0.2
				2.0	110	1.8	3650	3.6	200	0.2
				2.5	113	2.0	3000	4.0	200	0.2
				3.0	117	2.0	2250	4.0	200	0.3
				4.0	120	2.3	1500	4.6	200	0.4
				6.0	122	2.5	1050	5.0	200	0.5

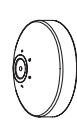
English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
Air	Air	62	73	.018	102	.060	270	0.120	200	0.0
				.024	103	.060	260	0.120	200	0.0
				.030	104	.060	245	0.120	200	0.0
				.036	105	.060	230	0.120	200	0.1
				.048	108	.070	200	0.140	200	0.1
				.060	109	.070	175	0.140	200	0.2
				.075	110	.070	150	0.140	200	0.2
				.105	113	.080	110	0.160	200	0.2
				.135	117	.080	70	0.160	200	0.3
				3/16	120	.090	50	0.180	200	0.4
				1/4	122	.100	40	0.200	200	0.5

Stainless steelN₂ Plasma / N₂ Shield

45 A Cutting

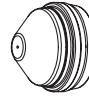
Flow Rates - lpm/scfh	
	N ₂
Preflow	74 / 157
Cutflow	91 / 192



220532



220534



220525



220529



220528

220533 (no IHS tab)

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
N ₂	N ₂	73	25	0.5	106	1.5	7000	3.0	200	0.0
				0.8	107	1.5	6500	3.0	200	0.0
				1.0	107	1.5	5850	3.0	200	0.1
				1.2	109	1.8	5350	3.6	200	0.1
				1.5	112	1.8	4600	3.6	200	0.2
				2.0	114	1.8	3950	3.6	200	0.2
				2.5	118	2.0	3300	4.0	200	0.2
				3.0	119	2.0	2450	4.0	200	0.3
				4.0	121	2.3	1700	4.6	200	0.4
				6.0	126	2.5	1125	5.0	200	0.5

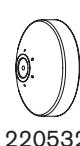
English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
N ₂	N ₂	73	25	.018	106	.060	280	0.120	200	0.0
				.024	106	.060	270	0.120	200	0.0
				.030	107	.060	260	0.120	200	0.0
				.036	107	.060	240	0.120	200	0.1
				.048	109	.070	210	0.140	200	0.1
				.060	112	.070	180	0.140	200	0.2
				.075	114	.070	160	0.140	200	0.2
				.105	118	.080	120	0.160	200	0.2
				.135	119	.080	75	0.160	200	0.3
				3/16	121	.090	60	0.180	200	0.4
				1/4	126	.100	40	0.200	200	0.5

OPERATION

Stainless steel
F5 Plasma / N₂ Shield
45 A Cutting

Flow Rates - lpm/scfh		
	F5	N ₂
Preflow	0 / 0	162 / 344
Cutflow	32 / 67	147 / 311



220532



220534

220533 (no IHS tab)



220525



220529



220528

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
F5	N ₂	82	82	0.5	122	2.3	7000	4.6	200	0.0
				0.8	124	2.3	6500	4.6	200	0.0
				1.0	125	2.3	5875	4.6	200	0.1
				1.2	128	2.5	5360	5.0	200	0.1
				1.5	129	2.5	4650	5.0	200	0.2
				2.0	132	2.8	3200	5.6	200	0.2
				2.5	137	3.0	2975	6.0	200	0.2
				3.0	138	3.0	2740	6.0	200	0.3
				4.0	140	3.3	2350	6.6	200	0.4
				6.0	148	3.6	1325	7.2	200	0.6

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
F5	N ₂	82	82	.018	122	.090	280	0.180	200	0.0
				.024	123	.090	270	0.180	200	0.0
				.030	124	.090	260	0.180	200	0.0
				.036	125	.090	240	0.180	200	0.1
				.048	128	.100	210	0.200	200	0.1
				.060	129	.100	180	0.200	200	0.2
				.075	132	.110	130	0.220	200	0.2
				.105	137	.120	115	0.240	200	0.2
				.135	138	.120	100	0.240	200	0.3
				3/16	140	.130	80	0.260	200	0.4
				1/4	148	.140	45	0.280	200	0.6

Stainless steel

Air Plasma / Air Shield

130 A Cutting

Flow Rates - lpm/scfh	
	Air
Preflow	67 / 142
Cutflow	132 / 280



220536



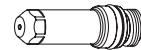
220578



220492



220488



220487

220490 (no IHS tab)

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	72	35	6	143	3.6	2600	7.2	200	0.3
				10	148	4.1	1700	8.2	200	0.5
				12	148	4.1	1380	8.2	200	0.8
				15	158	4.6	900	Edge Start		
				20	160	4.6	430			

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
Air	Air	72	35	1/4	143	.140	100	.280	200	0.3
				3/8	148	.160	70	.320	200	0.5
				1/2	148	.160	50	.320	200	0.8
				5/8	158	.180	30	Edge Start		
				3/4	160	.180	20			

OPERATION

Stainless steel

N₂ Plasma / N₂ Shield

130 A Cutting

Flow Rates - lpm/scfh	
	N ₂
Preflow	165 / 350
Cutflow	173 / 366



220536



220578

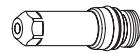
220490 (no IHS tab)



220535



220488



020415

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
N ₂	N ₂	46	71	6	130	3.0	2340	6.0	200	0.3
				10	132	3.6	1640	7.2	200	0.5
				12	141	3.6	1080	7.2	200	0.8
				15	144	3.8	700	Edge Start		
				20	153	4.3	300			

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
N ₂	N ₂	46	71	1/4	130	.120	90	.240	200	0.3
				3/8	132	.140	70	.280	200	0.5
				1/2	141	.140	35	.280	200	0.8
				5/8	144	.150	25	Edge Start		
				3/4	153	.170	15			

Stainless steel
H35 Plasma / N₂ Shield
130 A Cutting

Flow Rates - lpm/scfh		
	H35	N ₂
Preflow	0 / 0	164 / 348
Cutflow	61 / 130	141 / 298

**Metric**

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
H35	N2	70	75	10	150	4.6	980	7.8	170	0.3
				12	154	4.6	820	7.8	170	0.5
				15	157	4.6	580	7.8	170	0.8
				20	162	4.6	360	7.8	170	1.3
				25	167	4.6	260	Edge Start		

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
H35	N2	70	75	3/8	150	.180	40	.310	170	0.3
				1/2	154	.180	30	.310	170	0.5
				5/8	157	.180	20	.310	170	0.8
				3/4	162	.180	15	.310	170	1.3
				1	167	.180	10	Edge Start		

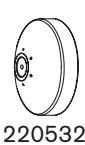
OPERATION

Aluminum

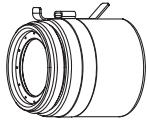
Air Plasma / Air Shield

45 A Cutting

Flow Rates - lpm/scfh	
	Air
Preflow	149 / 315
Cutflow	161 / 342



220532



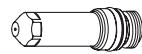
220578



220525



220529



220528

220490 (no IHS tab)

Metric

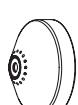
Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	62	73	0.5	113	1.5	7600	3.0	200	0.0
				0.8	116	1.5	6900	3.0	200	0.1
				1.0	117	1.8	6350	3.6	200	0.1
				1.2	118	1.8	5800	3.6	200	0.2
				1.5	119	1.8	5000	3.6	200	0.2
				2.0	120	2.0	3950	4.0	200	0.2
				2.5	120	2.0	2950	4.0	200	0.3
				3.0	121	2.0	2400	4.0	200	0.3
				4.0	122	2.3	1950	4.6	200	0.4
				6.0	130	2.5	1150	5.0	200	0.5

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
Air	Air	62	73	0.016	113	.060	310	0.120	200	0.0
				0.020	114	.060	300	0.120	200	0.0
				0.025	115	.060	290	0.120	200	0.0
				0.032	116	.060	270	0.120	200	0.1
				0.040	117	.070	250	0.140	200	0.1
				0.051	118	.070	220	0.140	200	0.2
				0.064	119	.070	185	0.140	200	0.2
				0.081	120	.080	150	0.160	200	0.2
				0.102	120	.080	110	0.160	200	0.3
				1/8	121	.080	90	0.160	200	0.3
				3/16	122	.090	65	0.180	200	0.4
				1/4	130	.100	40	0.200	200	0.5

Aluminum
Air Plasma / Air Shield
130 A Cutting

Flow Rates - lpm/scfh	
	Air
Preflow	67 / 142
Cutflow	132 / 280



220536



220578

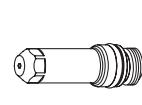
220490 (no IHS tab)



220492



220488



220487

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	72	35	6	147	2.8	2370	5.6	200	0.2
				10	148	3.0	1465	6.1	200	0.3
				12	152	3.0	1225	6.1	200	0.5
				15	162	3.3	1050	6.6	200	0.8
				20	166	3.6	725	7.8	220	1.3
				25	173	4.1	525	Edge Start		

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
Air	Air	72	35	1/4	147	.110	90	.220	200	0.2
				3/8	148	.120	60	.240	200	0.3
				1/2	152	.120	45	.240	200	0.5
				5/8	162	.130	40	.260	200	0.8
				3/4	166	.140	30	.310	220	1.3
				1	173	.160	20	Edge Start		

OPERATION

Aluminum

H35 Plasma / N₂ Shield
130 A Cutting

Flow Rates - lpm/scfh		
	H35	N ₂
Preflow	0 / 0	164 / 348
Cutflow	61 / 130	141 / 298



220536



220534

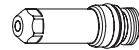
220533 (no IHS tab)



220535



220529



020415

Metric

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	mm	Volts	mm	mm/m	mm	factor %	seconds
H35	N2	70	75	10	150	4.6	1615	7.8	170	0.3
				12	151	4.6	1455	7.8	170	0.5
				15	152	4.6	1305	7.8	170	0.8
				20	155	4.6	940	7.8	170	1.3
				25	158	4.6	540	Edge Start		

English

Select Gases		Set Cutflow		Material Thickness	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	in	Volts	in	ipm	in	factor %	seconds
H35	N2	70	75	3/8	150	.180	65	.310	170	0.3
				1/2	151	.180	55	.310	170	0.5
				5/8	152	.180	50	.310	170	0.8
				3/4	155	.180	40	.310	170	1.3
				1	158	.180	20	Edge Start		

Changing consumable parts



WARNING

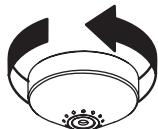
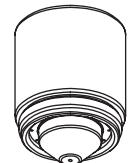
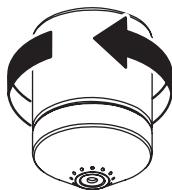
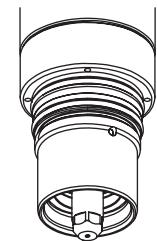
Always disconnect power to the power supply before inspecting or changing torch consumable parts.
Coolant will flow from the torch if there is power to the system.
Use gloves when removing consumables. The torch might be hot.

Remove consumables

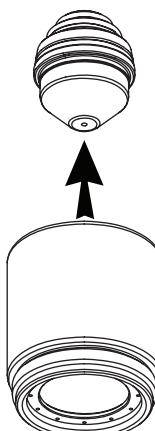
Check the consumable parts daily for wear before cutting. Before removing consumables, bring the torch to the edge of the cutting table, with the torch lifter raised to its highest point to prevent the consumables from dropping into the water of the water table.

- Turn OFF all power to the system.

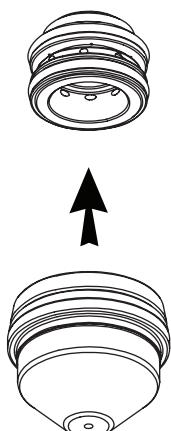
- Remove the retaining cap and shield



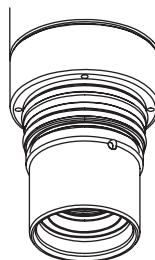
- Remove the nozzle and swirl ring



- Remove the swirl ring



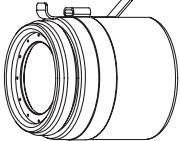
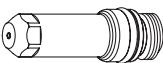
- Remove the electrode



Tool part number
027102

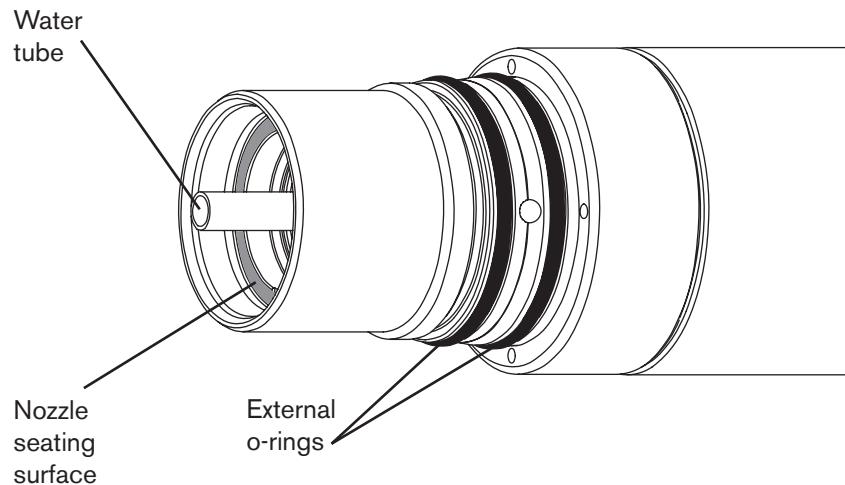
OPERATION

Inspect consumables

Part	Check for	Action
Cap 	Erosion, missing material Cracks Burn marks	Replace cap Replace cap Replace cap
Nozzle 	Erosion or missing material Blocked gas holes	Replace nozzle* Replace nozzle*
Center hole	1. Must be round 2. Signs of arcing	Replace nozzle if hole is no longer round* Replace nozzle*
O-rings	1. Damage 2. Lubricant	Replace nozzle* Apply a thin film of silicone lubricant if dry
Swirl ring 	Damage Dirt or debris	Replace swirl ring Clean and check for damage, and replace swirl ring if damaged
Gas holes	Blocked holes	Replace swirl ring
O-rings	1. Damage 2. Lubricant	Replace swirl ring Apply a thin film of silicone lubricant if dry
Electrode 		
Center surface	Wear	See <i>Inspect electrode pit depth</i> later in this section
O-rings	1. Damage 2. Lubricant	Replace electrode* Apply a thin film of silicone lubricant if dry

*Note: Always replace the nozzle and electrode as a set.

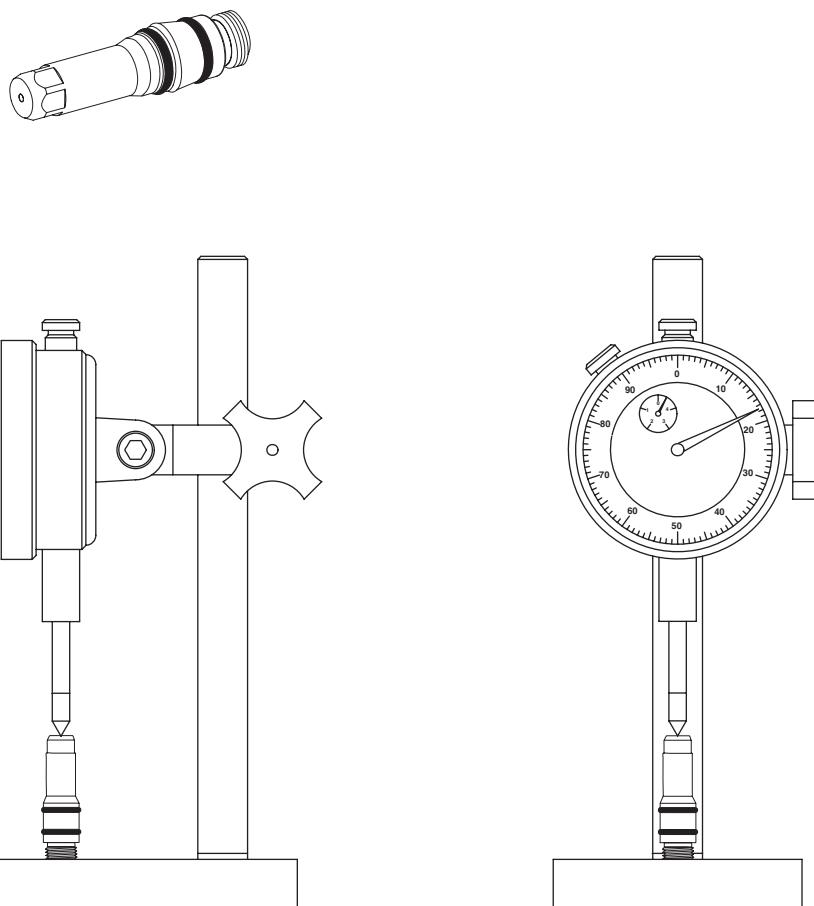
Inspect torch



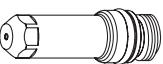
Inspect	Check for	Action
All surfaces	Dirt or debris Erosion, missing material Cracks Internal burn or arcing marks	Clean surfaces Replace torch Replace torch Replace torch
Nozzle seating surface	1. Dirt or debris 2. Pitted or missing material	Clean (use compressed air to remove debris) Replace torch
Threads	Wear or damage	Replace torch
External o-rings	1. Damage 2. Lubricant	Replace o-ring Apply a thin film of silicone lubricant if dry
Water tube*	1. Pitted or missing material	Replace water tube*

*Note: See *Replace torch water tube* later in this section.

Inspect electrode pit depth



Electrode pit depth gauge (004630)

Part	Check for	Action
Electrode 		
Center surface Wear		Replace electrode if pit is deeper than 1 mm (0.040 in.)*

*Note: Always replace the nozzle and electrode as a set.

Replace torch water tube



WARNING

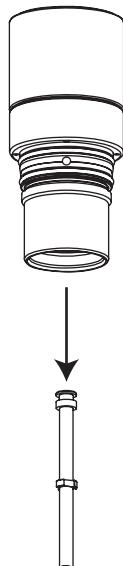
Always disconnect power to the power supply before inspecting or changing torch consumable parts.
Coolant will flow from the torch if there is power to the system.
Use gloves when removing consumables. The torch might be hot.

Note: The water tube may seem loose when correctly inserted, but any side-to-side looseness will disappear after the electrode is installed.

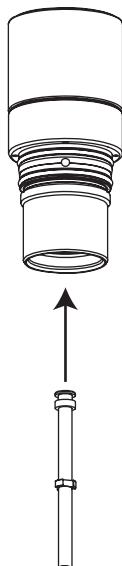
- ① Turn OFF all power to the system.

- ② Remove consumables from torch. See *Remove consumables* in this section.

- ③ Remove water tube



- ④ Install new water tube



- ⑤ Replace consumables.
See *Install consumables* in this section.

Common cutting faults

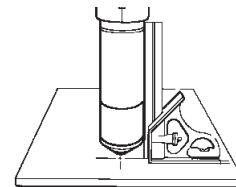
- Torch pilot arc will initiate, but will not transfer. Causes can be:
 1. Work cable connection on the cutting table is not making good contact.
 2. Malfunction in the system. See Section 5.
 3. Torch-to-work distance is too high.
- The workpiece is not totally penetrated, and there is excessive sparking on top of the workpiece. Causes can be:
 1. Current is set too low (check *Cut chart* information).
 2. Cut speed is too high (check *Cut chart* information).
 3. Torch parts are worn (see *Changing consumable parts*).
 4. Metal being cut is too thick.
- Dross forms on the bottom of the cut. Causes can be:
 1. Cutting speed is not correct (check *Cut chart* information).
 2. Arc current is set too low (check *Cut chart* information).
 3. Torch parts are worn (see *Changing consumable parts*).
- Cut angle is not square. Causes can be:
 1. Wrong direction of machine travel.
High-quality side is on the right with respect to the forward motion of the torch.
 2. Torch-to-work distance is not correct (check *Cut chart* information).
 3. Cutting speed is not correct (check *Cut chart* information).
 4. Arc current is not correct (check *Cut chart* information).
 5. Damaged consumable parts (see *Changing consumable parts*).
- Short consumable life. Causes can be:
 1. Arc current, arc voltage, travel speed, motion delay, gas flow rates, or initial torch height not set as specified in the *Cut charts*.
 2. Attempting to cut highly magnetic metal plate, such as armor plate with a high nickel content, will shorten consumable life. Long consumable life is difficult to achieve when cutting plate that is magnetized or becomes magnetized easily.
 3. Beginning or ending the cut off the plate surface. **To achieve consumable long life, all cuts must begin and end on the plate surface.**

How to optimize cut quality

The following tips and procedures will help produce square, straight, smooth and dross-free cuts.

Tips for table and torch

- Use a square to align the torch at right angles to the workpiece.
- The torch may travel more smoothly if you clean, check and “tune” the rails and drive system on the cutting table. Unsteady machine motion can cause a regular, wavy pattern on the cut surface.
- The torch must not touch the workpiece during cutting. Contact can damage the shield and nozzle, and affect the cut surface.



Plasma set-up tips

Follow carefully each step in the *Daily start-up* procedure described earlier in this section.

Purge the gas lines before cutting.

Maximize the life of consumable parts

Hypertherm's LongLife® process automatically “ramps up” the gas and current flows at the start and ramps them down at the end of each cut, to minimize erosion of the electrode's center surface. The LongLife process also requires that cuts start and stop on the workpiece.

- The torch should never fire into the air.
 - Starting the cut at the edge of the workpiece is acceptable, as long as the arc is not fired in the air.
 - To start with a pierce, use a pierce height that is 1.5 to 2 times the torch-to-work distance. See *Cut charts*.
- Each cut should end with the arc still attached to the workpiece, to avoid arc blow-outs (ramp-down errors).
 - When cutting drop parts (small parts that drop down after being cut from the workpiece), check that the arc stays attached to the edge of the workpiece, for proper ramp-down.
- If arc blow-outs occur, try one or more of the following:
 - Reduce the cutting speed during the final part of the cut.
 - Stop the arc before the part is completely cut, to allow completion of the cut during the ramp-down.
 - Program the path of the torch into the scrap area for ramp-down.

Note: Use a “chain cut” if possible, so the path of the torch can lead directly from one cut part into the next, without stopping and starting the arc. However, do not allow the path to lead off the workpiece and back on, and remember that a chain cut of long duration will cause electrode wear.

Note: It may be difficult to achieve the full benefits of the LongLife process in some conditions.

Additional factors of cut quality

Cut angle

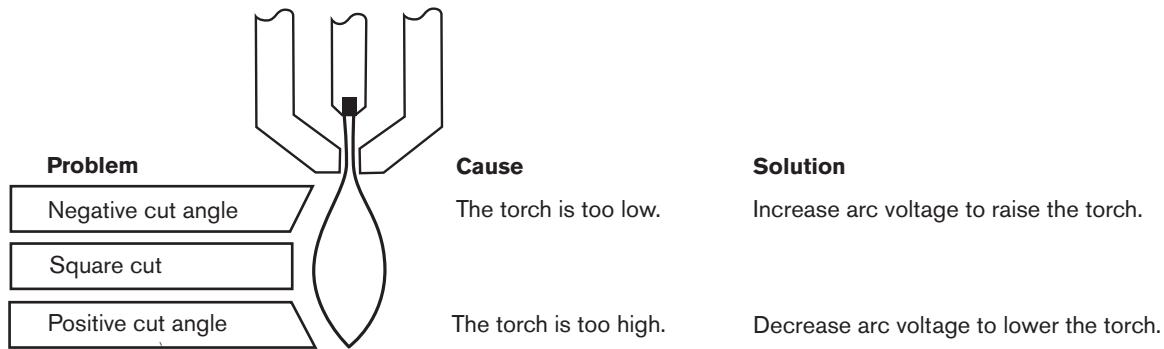
A cut part whose 4 sides average less than 4° of cut angle is considered acceptable.

Note: The squarest cut angle will be on the right side with respect to the forward motion of the torch.

Note: To determine whether a cut-angle problem is being caused by the plasma system or the drive system, make a test cut and measure the angle of each side. Next, rotate the torch 90° in its holder and repeat the process. If the angles are the same in both tests, the problem is in the drive system.

If a cut-angle problem persists after "mechanical causes" have been eliminated (see *Tips for table and torch*, previous page), check the torch-to-work distance, especially if cut angles are all positive or all negative.

- A positive cut angle results when more material is removed from the top of the cut than from the bottom.
- A negative cut angle results when more material is removed from the bottom of the cut.



Dross

Low-speed dross forms when the torch's cutting speed is too slow and the arc shoots ahead. It forms as a heavy, bubbly deposit at the bottom of the cut and can be removed easily. Increase the speed to reduce the dross.

High-speed dross forms when the cutting speed is too fast and the arc lags behind. It forms as a thin, linear bead of solid metal attached very close to the cut. It is welded to the bottom of the cut and is difficult to remove. To reduce high-speed dross:

- Decrease the cutting speed.
- Decrease arc voltage, to decrease the torch-to-work distance.
- Increase O₂ in the shield gas to increase the range of dross-free cutting speeds. (Only HyDefinition and HT4400 systems can accommodate mixed-gas shield gases.)

Notes: Dross is more likely to form on warm or hot metal than on cool metal. For example, the first cut in a series of cuts will likely produce the least dross. As the workpiece heats up, more dross may form on subsequent cuts.

Dross is more likely to form on mild steel than on stainless steel or aluminum.

Worn or damaged consumables may produce intermittent dross.

Straightness of the cut surface

A typical plasma cut surface is slightly concave.

The cut surface may become more concave, or convex. Correct torch height is required to keep the cut surface acceptably close to straight.

A strongly concave cut surface occurs when the torch-to-work distance is too low. Increase the arc voltage to increase the torch-to-work distance and straighten the cut surface.

A convex cut surface occurs when the torch-to-work distance is too great or the cutting current is too high. First, reduce the arc voltage, then reduce the cutting current. If there is overlap between different cutting currents for that thickness, try the consumables designed for the lower current.

Additional improvements

Some of these improvements involve trade-offs, as described.

Smoothness of cut surface (surface finish)

- (HyDefinition and HT4400 only) On mild steel, a higher concentration of N₂ in the O₂-N₂ shield mixture may produce a smoother cut surface.

Trade-off: This may produce more dross.

- (HyDefinition and HT4400 only) On mild steel, a higher concentration of O₂ in the O₂-N₂ shield mixture may increase the cutting speed and produce less dross.

Trade-off: This may produce a rougher cut surface.

Piercing

The pierce delay must be sufficiently long that the arc can pierce the material before the torch moves, but not so long that the arc "wanders" while trying to find the edge of a large hole.

When piercing maximum thicknesses, the ring of dross that forms during the pierce may become high enough to contact the torch when the torch begins to move after the pierce is complete.

- A "flying pierce," which makes the pierce while the torch is moving, may eliminate the torch vibration that follows contact between the torch and the ring of dross.
- In some Hypertherm systems, the shield gas pressure automatically increases during pierce delay.
- If the above steps do not solve the problem, increasing the setting of the shield gas pressure may help blow the molten metal away during piercing.
Trade-off: This may reduce starting reliability.

How to increase cutting speed

- Decrease the torch-to-work distance.
Trade-off: This will increase the negative cut angle

Note: The torch must not touch the workpiece while piercing or cutting.

MAINTENANCE

In this section:

Introduction.....	5-2
Routine maintenance.....	5-2
System description	5-3
Control and signal cables	5-3
Sequence of operation.....	5-4
PCB block diagram.....	5-5
Error codes	5-6
Error code troubleshooting – 1 of 8	5-7
Error code troubleshooting – 2 of 8.....	5-8
Error code troubleshooting – 3 of 8.....	5-9
Error code troubleshooting – 4 of 8	5-10
Error code troubleshooting – 5 of 8	5-11
Error code troubleshooting – 6 of 8	5-12
Error code troubleshooting – 7 of 8	5-13
Error code troubleshooting – 8 of 8	5-14
Power supply states.....	5-15
Plasma system operation with pump timeout.....	5-16
CNC operation with pump timeout.....	5-17
Initial checks.....	5-18
Automated diagnostic tests.....	5-19
Power measurement	5-20
Power supply coolant system servicing.....	5-21
Draining the coolant system.	5-21
Coolant system filter replacement	5-22
Air filter replacement	5-23
Coolant flow test procedure.....	5-24
Testing the flow switch.....	5-25
Gas leak test procedure.....	5-26
PCB4: Power supply control board	5-27
PCB3: Power supply power distribution board.....	5-28
PCB2: Start circuit.....	5-29
Operation	5-29
Start-circuit functional schematic	5-29
Start-circuit troubleshooting	5-29
Pilot arc current levels	5-31
PCB2: Fuel-gas console control board.....	5-32
PCB1: Fuel-gas console power distribution board	5-33
PCB3: Fuel-gas console AC valve-driver board.....	5-34
Chopper tests.....	5-35
Phase-loss detection test	5-38
Torch lead test	5-40
Preventive maintenance.....	5-41

Introduction

Hypertherm assumes that the service personnel that troubleshoots and tests the plasma systems are high-level electronic service technicians who have worked with high-voltage electro-mechanical systems. Knowledge of final isolation troubleshooting techniques is also assumed.

In addition to being technically qualified, maintenance personnel must perform all testing with safety in mind. Refer to the **Safety section** for operating precautions and warning formats.

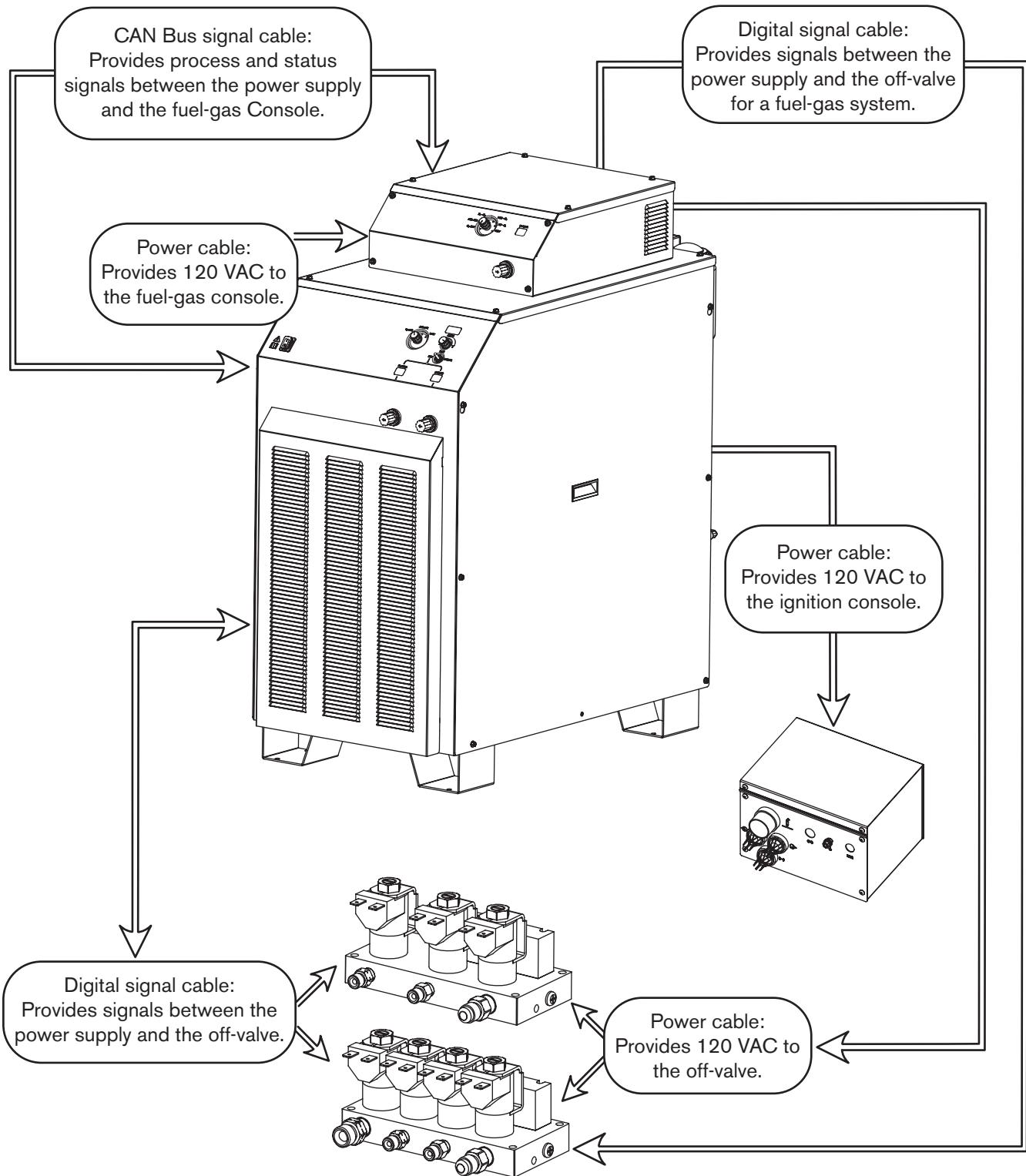
		WARNING Shock Hazard
Use extreme caution when working near the chopper components. The large blue capacitors store high voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the choppers, and the heatsinks. Discharging any capacitor with a screwdriver or other implement may result in an explosion, property damage, or personal injury. Wait at least 5 minutes after turning off the power supply before touching the chopper or the capacitors.		

Routine maintenance

For a complete list of routine maintenance recommendations, see the *Preventative Maintenance Schedule*, located at the end of this section. Contact the Technical Services department listed at the front of this manual with any questions regarding the maintenance schedule or procedures.

System description

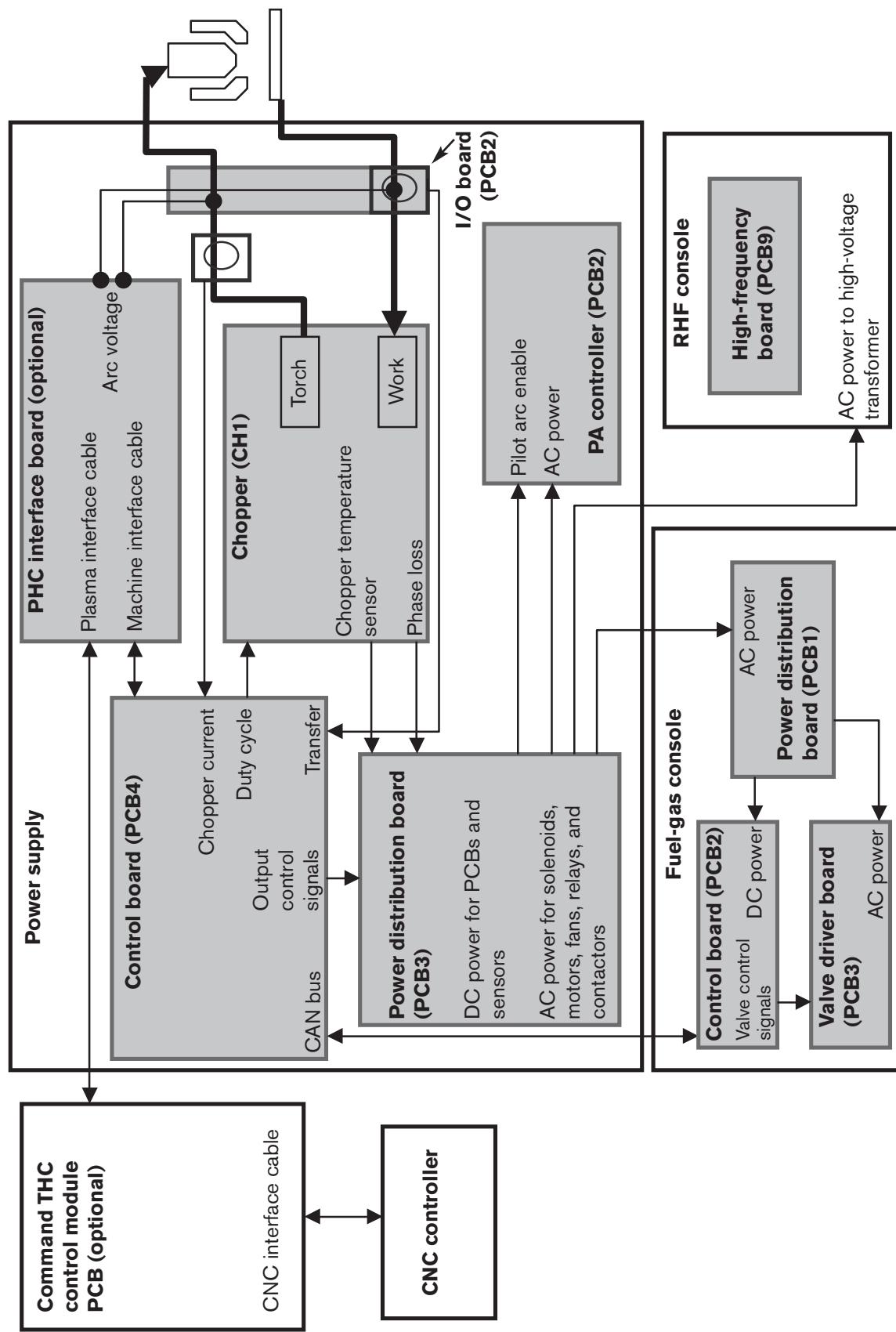
Control and signal cables



Sequence of operation

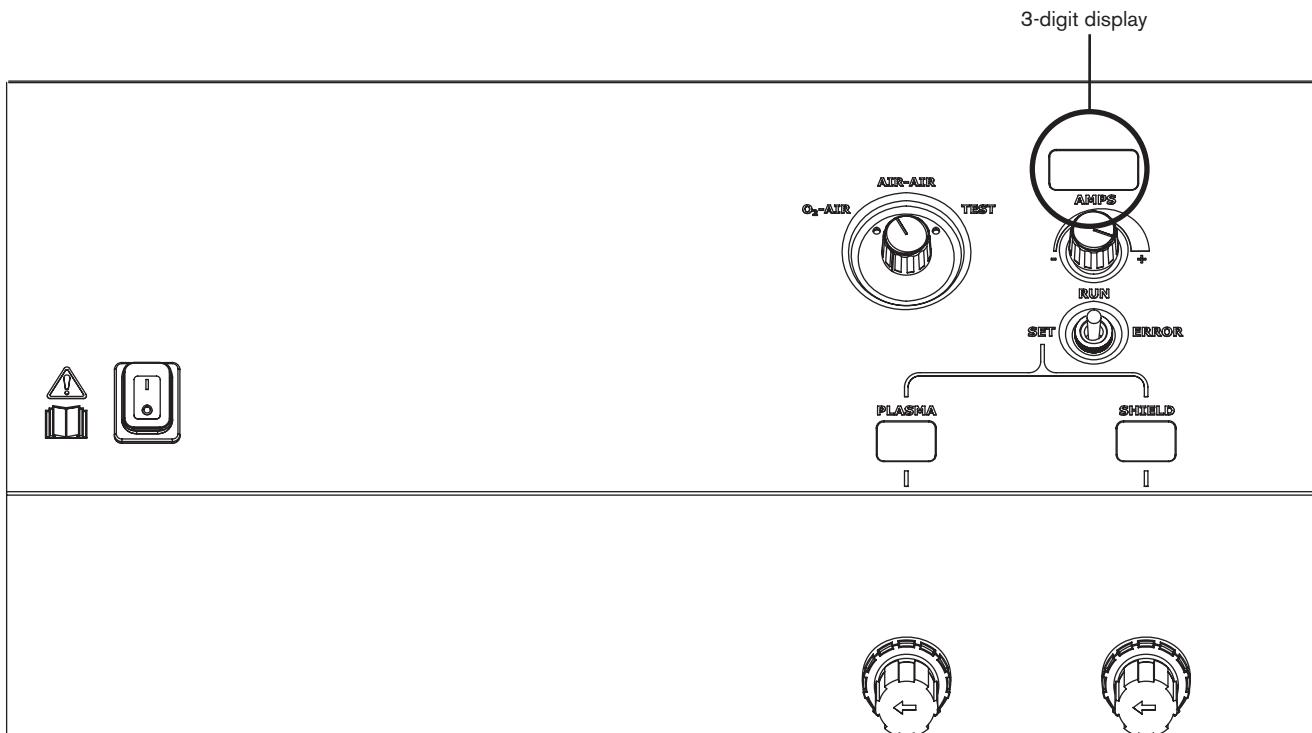
1. Power-up – The system verifies that all of these signals are off at power-up
 - Coolant flow off
 - Chopper current off
 - Transfer off
 - Phase Loss off
 - Chopper 1 over-temp off
 - Magnetics over-temp off
 - Coolant over-temp off
 - Plasma start off
2. Purge – Air or O₂ gas flows through torch for 24 seconds
 - Coolant flow on
 - Contactor closes and the chopper performs a chopper test and a current sensor test
 - Plasma start off
 - Contactor opens when the purge cycle ends
 - Gas pressure OK
3. Idle
 - Gas pressure OK
 - Coolant flow on
 - Chopper current off
 - Line voltage OK
4. Preflow – Gas flows for 1.25 seconds
5. Pilot arc – Current flows between electrode and nozzle
 - Chopper, main contactor, and pilot arc relay are on
 - High frequency present
 - Chopper current sensor = pilot arc current
6. Transfer – Pilot arc current sensed on the worklead
7. Ramp-up – Chopper current increases to set-point and the gas switches to cutflow
 - Coolant flow on
 - Gas pressure OK
 - Phase loss on
 - Line voltage OK
8. Steady state – normal operating parameters
 - Coolant flow on
 - Gas pressure OK
 - Phase loss on
 - Chopper over-temp off
 - Magnetics over-temp off
 - Coolant over-temp off
9. Ramp-down – Current and gas flow decrease after plasma start has been removed
 - Cutflow gas off
10. Auto Off – 10-second postflow
 - Main contactor off
 - Chopper off

PCB block diagram



Error codes

Set the selection switch on the power supply to ERROR. The power supply states are shown in the 3-digit LED display on the power supply. The state ID numbers are 2 digits with a dash in front of them and error codes have 3 digits. When the selection switch is set to ERROR, the state ID number will be displayed for 2 seconds. An error code number will then be displayed for 2 seconds. The display will continue to cycle through both numbers until the selection switch is moved.



Error code troubleshooting (1 of 8)

Error code number	Name	Description	Corrective action
000	No error	System is ready to run.	None needed.
012 fuel-gas console only	Test in progress	One of the gas tests is running.	The test will run for about 3 minutes.
014 fuel-gas console only	Plasma-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the plasma gas channel.	Check the plasma gas lines for leaks.
015 fuel-gas console only	Preflow-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the preflow gas channel.	Check the preflow gas lines for leaks.
016 fuel-gas console only	Shield-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the shield gas channel.	Check the shield gas lines for leaks.
017 fuel-gas console only	Fuel-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the plasma gas channel.	Check the fuel plasma line for leaks.
020	No pilot arc	No current detected from chopper at ignition and before 1-sec timeout.	<ol style="list-style-type: none"> Verify that the consumable parts are in good condition. Verify proper pre-flow and cut-flow settings. Fuel-gas only: Perform leak test. Verify spark across spark gap. Inspect CON1 for excessive wear. Perform torch lead test (see <i>Maintenance</i> section). Perform start circuit test (see <i>Maintenance</i> section). Perform chopper test (see <i>Maintenance</i> section).
021	No arc transfer	No current detected on work lead 500 milliseconds after pilot arc current was established.	<ol style="list-style-type: none"> Verify proper pierce height. Verify proper gas settings. Inspect work lead for damage or loose connections. Verify the condition of the current transfer sensor on the I/O PCB.
024	Lost current	Lost current from chopper after transfer.	<ol style="list-style-type: none"> Verify that the consumable parts are in good condition. Verify proper gas settings. Verify pierce delay time. Verify that the arc did not lose contact with plate while cutting (hole cutting, scrap cutting, etc). Perform chopper test (see <i>Maintenance</i> section).

Error code troubleshooting (2 of 8)

Error code number	Name	Description	Corrective action
026	Lost transfer	After transfer lost the transfer signal. The signal is < 3.5 amps.	<ol style="list-style-type: none"> Verify that the consumable parts are in good condition. Verify proper gas settings. Verify pierce delay time. Verify that the arc did not lose contact with plate while cutting (hole cutting, scrap cutting, etc). Inspect work lead for damage or loose connections. Try connecting work lead directly to the plate. Perform chopper test (see <i>Maintenance</i> section).
027	Lost phase	Phase imbalance to chopper after contactor engaged or while cutting.	<ol style="list-style-type: none"> Verify phase-to-phase voltage to power supply. Disconnect power to power supply, remove cover on contactor, and inspect contacts for excessive wear. Inspect the power cord, contactor, and input to chopper for loose connections. Inspect the phase-loss fuses on the power distribution board (PCB3). Replace board if fuses are blown. Perform phase-loss test (see <i>Maintenance</i> section).
031	Start loss	Start signal was received and then lost before an arc was established.	<ol style="list-style-type: none"> If a mechanical relay is being used to provide the HSD with a start signal, this relay is either bouncing when activated or the contacts are faulty. Replace the relay. Inspect interface cable for damage; faulty crimps, or poor electrical connections. If interface cable is good and a relay is not driving the start input, the CNC is dropping the start signal before a steady state arc has been established.
032	Hold timeout	Hold signal was active for longer than 60 seconds.	<ol style="list-style-type: none"> Check the interface cable for damage. The hold wires may be short-circuiting inside. The CNC is maintaining this input, it could be waiting for an IHS complete input from another torch. If CNC interface cable is good and it is a one-torch system, change PCB4.
035	Low preflow pressure	Preflow gas pressure under lower limit of 0.4 bar (5 psi).	<ol style="list-style-type: none"> Put the selection switch in the SET position. The 3-digit LED shows the preflow supply pressure. The pressure reading should be between 6.2 bar and 8.3 bar (90 psi and 120 psi). Verify that the Burkart valve is functioning properly.
042	Nitrogen gas purge error	Low or no nitrogen pressure during purge. Purge occurs when switching from a fuel gas process to an oxygen or air process.	<ol style="list-style-type: none"> Verify that the nitrogen supply is turned on, and inspect gas supply pressure and volume of gas remaining in supply tanks. Verify that the gas regulator is set to 7.2 bar (105 psi). See <i>Setting the supply regulators</i> (<i>Installation</i> section).

Error code troubleshooting (3 of 8)

Error code number	Name	Description	Corrective action
043	High preflow pressure	Gas pressure is above the upper limit of 6.8 bar (99 psi)	<ol style="list-style-type: none"> Verify gas supply pressure settings. Verify gas regulator settings on gas console with cut chart. See <i>Setting the supply regulators</i> (<i>Installation</i> section). Solenoid at off-valve is not opening. Verify power to valves, disconnect plasma and shield hoses exiting off-valve. If pressures decrease, a valve is not functioning or no power to the valve.
044	Low plasma gas pressure	Gas pressure is below the lower limit of 3.5 bar (50 psi)	<ol style="list-style-type: none"> Inspect gas supply pressure and volume of gas remaining in supply tanks. Verify gas regulator settings on the front panel of the power supply with cut chart. See <i>Setting the supply regulators</i> (<i>Installation</i> section). Fuel-gas only – Perform leak test procedure (<i>Maintenance</i> section).
045	High plasma gas pressure	Gas pressure above the upper limit of 6.8 bar (99 psi)	<ol style="list-style-type: none"> Verify gas supply pressure settings. Verify plasma gas regulator settings on the front panel of the power supply with cut chart. See <i>Setting the supply regulators</i> (<i>Installation</i> section). Solenoid at off-valve is not opening. Verify power to valves, disconnect plasma and shield hoses exiting off-valve. If pressures decrease, a valve is not functioning or no power to the valve.
046	Low line voltage	Line voltage is close to or below the lower limit of 102 VAC (120 VAC –15%). The normal lower limit for operation is 108 VAC (120 VAC –10%).	<ol style="list-style-type: none"> Verify input-line voltage. Voltage needs to be within 10 % of nominal (120 VAC). Verify fuses on PCB3. Verify 120 VAC voltage on plug J3.4, pins 3 and 4 on PCB3. If AC voltage on J3.4, pins 3 and 4, is greater than 108 VAC, replace PCB3.
047	High line voltage	Line voltage is close to or above the upper limit of 138 VAC (120 VAC +15%). The normal upper limit for operation is 132 VAC (120 VAC +10%).	<ol style="list-style-type: none"> Verify input-line voltage. Voltage needs to be within 10 % of nominal (120 VAC). Verify fuses on PCB3. Verify 120 VAC voltage on plug J3.4, pins 3 and 4 on PCB3. If AC voltage on J3.4, pins 3 and 4, is less than 132 VAC, replace PCB3.

Error code troubleshooting (4 of 8)

Error code number	Name	Description	Corrective action
050	Start signal is on at power-up	Plasma start signal input is active during power-up of the power supply.	<ol style="list-style-type: none"> Stop or clear the cutting program. The plasma start signal to the plasma was not dropped after the last cut. Verify that the CNC interface cable is not damaged. Remove CNC interface cable from PCB4 and look for an open circuit between pins 15 and 34. If the circuit is closed either the CNC is issuing a plasma start or the CNC interface cable is damaged. If circuit is open, and D44 is illuminated with the CNC Interface cable removed from PCB4, replace PCB4.
053	Low shield pressure	Shield pressure is below lower limit of 0.14 bar (2 psi).	<ol style="list-style-type: none"> Verify gas supply pressure and that a sufficient volume of gas remains in your supply. Verify gas regulator settings on the front panel with cut chart. See <i>Setting the supply regulators</i> (<i>Installation</i> section). Fuel-gas only – Perform leak test procedure (<i>Maintenance</i> section).
054	High shield pressure	Shield gas pressure is above upper limit of 6.8 bar (99 psi).	<ol style="list-style-type: none"> Verify gas supply regulator settings. See <i>Setting the supply regulators</i> (<i>Installation</i> section). Verify pressure settings on the front panel with cut chart. Solenoid at off-valve is not opening. Verify power to valves, disconnect plasma and shield hoses exiting off-valve. If pressures decrease, a valve is not functioning or no power to the valve.
061	No plasma gas type	Plasma gas has not been selected.	<ol style="list-style-type: none"> If you have a base system (no fuel-gas console), replace the control board (PCB4) If the system has a fuel gas console, replace the fuel-gas console control board (PCB2)
062	No shield gas type	Shield gas has not been selected.	<ol style="list-style-type: none"> If you have a base system (no fuel-gas console), replace the control board (PCB4) If the system has a fuel gas console, replace the fuel-gas console control board (PCB2)
063	Low preflow inlet pressure	Inlet pressure is < 4.1 bar (60 psi).	<ol style="list-style-type: none"> Verify Air or nitrogen gas supply pressure and that a sufficient volume of gas remains in your supply. Verify that the Burkart valve is functioning properly. Put the selection switch in the SET position. The 3-digit LED shows the supply pressure. The pressure reading should be between 6.2 bar and 8.3 bar (90 psi and 120 psi).

Error code troubleshooting (5 of 8)

Error code number	Name	Description	Corrective action
065	Chopper over temp	The chopper has overheated. The temperature is > 85° C (185° F).	<ol style="list-style-type: none"> Verify that both chopper fans are operating properly. Spinning fan blades should be difficult to see. Blow dust out of the system, especially from fans and the chopper's heat sink. Verify that the voltage on the back side of J3.19, pins 1 and 2 on PCB3, is less than or equal to 2.9 VDC. If the voltage is low, verify correct wiring between chopper temp sensor and J3.19 pins 1 and 2. If wiring is good and over temp error does not clear after 30 minutes, replace chopper. If voltage is higher than 2.9 VDC and over temp LED does not clear after 30 minutes, replace PCB3.
067	Magnetics over temp	The power transformer or inductors have overheated. The temperature is > 150° C (302° F).	<ol style="list-style-type: none"> Verify that the large fan is operating properly. Spinning fan blades should be difficult to see. Blow dust out of system, especially from fans and large power transformer. Verify that the voltage on the back side of J3.20 pins 3 and 4, is equal to or less than 3.2 VDC. If voltage is low, inspect wiring between the transformer's temp sensor and J3.20 pins 3 and 4. Look for short circuits to wires or ground. If wiring is good, the transformer has overheated. If voltage is higher than 3.2 V and over temp error does not clear after 30 minutes, replace PCB3.
071	Coolant over temp	Torch coolant has overheated. The temperature is > 70° C (158° F).	<ol style="list-style-type: none"> Verify that all fans in the coolant heat exchanger are running. Blow dust out of the system, especially from the heat exchanger. Verify that the voltage on the back side of J3.20 pins 1 and 2, is equal to or lower than 2.8 VDC. If voltage is low, inspect wiring between coolant sensor and J3.20, pins 1 and 2, for short circuits to wires or ground. If wiring is good, the coolant has overheated; let system stand for 30 minutes to cool. If voltage is higher than 2.8 VDC and the over temp error does not clear after 30 minutes, replace the temperature switch.
075	Low current on CS2	A Current < 10 Amps has been detected on chopper channel 2 by current sensor 2 during the chopper test at power-up.	<ol style="list-style-type: none"> Measure voltage across the current sensor (CS2). <ol style="list-style-type: none"> Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.

Error code troubleshooting (6 of 8)

Error code number	Name	Description	Corrective action
093	No coolant flow	Coolant flow signal was lost or was never satisfied. Coolant flow is < 2 lpm (0.6 gpm)	<ol style="list-style-type: none"> 1. If this is a new system, follow start procedure. 2. Verify that the coolant filter is in good condition. 3. Perform coolant flow test procedure (<i>Maintenance</i> section). 4. Verify that the CNC drives the plasma start signal for at least 10 seconds to allow the timed-out pump to turn on again.
098	Phase-loss at power-up	Voltage detected on the phase-loss circuit during the chopper test at power-up.	<ol style="list-style-type: none"> 1. Verify phase-to-phase voltage to the power supply. 2. Verify that the fuses on PCB3 (F5, F6, and F7) are good. 3. Verify the voltage from F5 to F6, F5 to F7, and F6 to F7. All 3 readings should be about 311 VAC. If the voltage readings are correct, U5 should be active and J8, pins 1 and 2 should be closed. If these conditions are not met, replace PCB3.
099	Chopper over temp at power-up	Chopper is indicating an over temp at power-up.	<ol style="list-style-type: none"> 1. Verify that the temperature sensor for the chopper has not been jumped out or the wires to the temp switch shorted out in the harness. 2. If no jumper is present, the chopper is overheated and needs time to cool to 83° C (181.4° F).
101	Magnetics over temp at power-up	The main transformer or inductors are indicating an over temp at power-up.	<ol style="list-style-type: none"> 1. Verify that the transformer temperature sensor for the chopper has not been jumped out or the wires to the temperature sensor are not shorted out in the harness. 2. If not, the main transformer is overheated and needs time to cool to 150° C (302° F).
102	Output current at power-up	Chopper current signal from CS1 is active (greater than 5 amps) at power-up.	<ol style="list-style-type: none"> 1. Verify proper electrical connections to chopper current sensor (CS1) and to J4.2 on PCB4. 2. Verify that the contactor is not stuck in the closed (on) position.
103	High current on CS1	A Current > 35 Amps has been detected on chopper channel "A" by current sensor 1 during the chopper test at power-up.	<ol style="list-style-type: none"> 1. Verify that there is not a short circuit between the negative lead and the work lead. 2. Measure voltage across the current sensor (CS1) <ol style="list-style-type: none"> a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.

Error code troubleshooting (7 of 8)

Error code number	Name	Description	Corrective action
105	Low current on CS1	A Current < 10 Amps has been detected on chopper channel 1 by current sensor 1 during the chopper test at power-up.	<ol style="list-style-type: none"> 1. Measure voltage across the current sensor (CS1). <ol style="list-style-type: none"> a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
107	High current on CS2	A Current > 35 Amps has been detected on channel 2 by current sensor 2 during the chopper test at power-up.	<ol style="list-style-type: none"> 1. Verify that there is not a short circuit between the negative lead and the work lead. 2. Measure voltage across the current sensor (CS2). <ol style="list-style-type: none"> a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
108	Transfer at power-up	The system has detected current on the work lead > 3.5 amps during power-up.	<ol style="list-style-type: none"> 1. Disconnect J6.6 on the I/O PCB (PCB6). If the problem is resolved, replace PCB6.
109	Coolant flow at power-up	Coolant flow is > 2 lpm (0.6 gpm) when the pump is off.	<ol style="list-style-type: none"> 1. The coolant flow sensor was bypassed or the flow switch is faulty. Replace the flow switch.
111	Coolant over temp at power-up	Coolant is indicating an over temp at power-up.	<ol style="list-style-type: none"> 1. Verify that the coolant temperature sensor has not been jumped out or the wires to the sensor are not shorted out in the harness. 2. If not, the coolant temperature is over the set point and needs time to cool to 70° C (158° F).
116	Watchdog interlock	An error occurred with the CAN communication system.	<ol style="list-style-type: none"> 1. Verify that the power supply to gas console control cable is not damaged and is properly connected to PCB4 and to the back of the gas console. 2. Verify that the power supply to gas console power cable is not damaged and is properly connected inside the power supply and to the back of the gas console. 3. Use the CAN bus tester to verify CAN bus communications.

MAINTENANCE

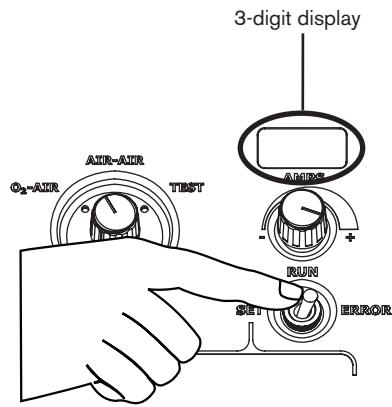
Error code troubleshooting (8 of 8)

Error code number	Name	Description	Corrective action
134	Chopper overcurrent	Chopper channel 1 current feedback has exceeded 90 amps.	<ol style="list-style-type: none"> Verify that the wiring between CS1 and PCB4 is correct and not damaged. Measure voltage across the current sensor. <ol style="list-style-type: none"> Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). If possible, take a voltage reading on the current sensor while trying to cut. Ratio is 4 VDC = 100 amps. If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
139	Purge time-out error	The purge cycle did not complete within 3 minutes.	This is a warning for a possible gas restriction in the leads. Verify that there are no restrictions in the plasma and shield hoses.
151	Software failure	The software has detected an incorrect state or condition.	<ol style="list-style-type: none"> Replace the power supply control board (PCB4).
152	Internal flash error	Communication problem to the flash chip on the power supply control board.	<ol style="list-style-type: none"> Replace the power supply control board (PCB4).
153	PS EEPROM error	EEPROM memory on power supply control board is not working.	<ol style="list-style-type: none"> Replace the power supply control board (PCB4).
154	Chopper overcurrent	Chopper channel 2 current feedback has exceeded 90 amps.	<ol style="list-style-type: none"> Verify that the wiring between CS2 and PCB4 is correct and not damaged. Measure voltage across the current sensor. <ol style="list-style-type: none"> Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). If possible, take a voltage reading on the current sensor while trying to cut. Ratio is 4 VDC = 100 amps. If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
157	Output current at power-up	Chopper current signal from CS2 is active (greater than 5 amps) at power-up.	<ol style="list-style-type: none"> Verify proper electrical connections to chopper current sensor (CS1) and to J4.2 on PCB4. Verify proper electrical connections to chopper current sensor (CS2) and to J4.2 on PCB4.

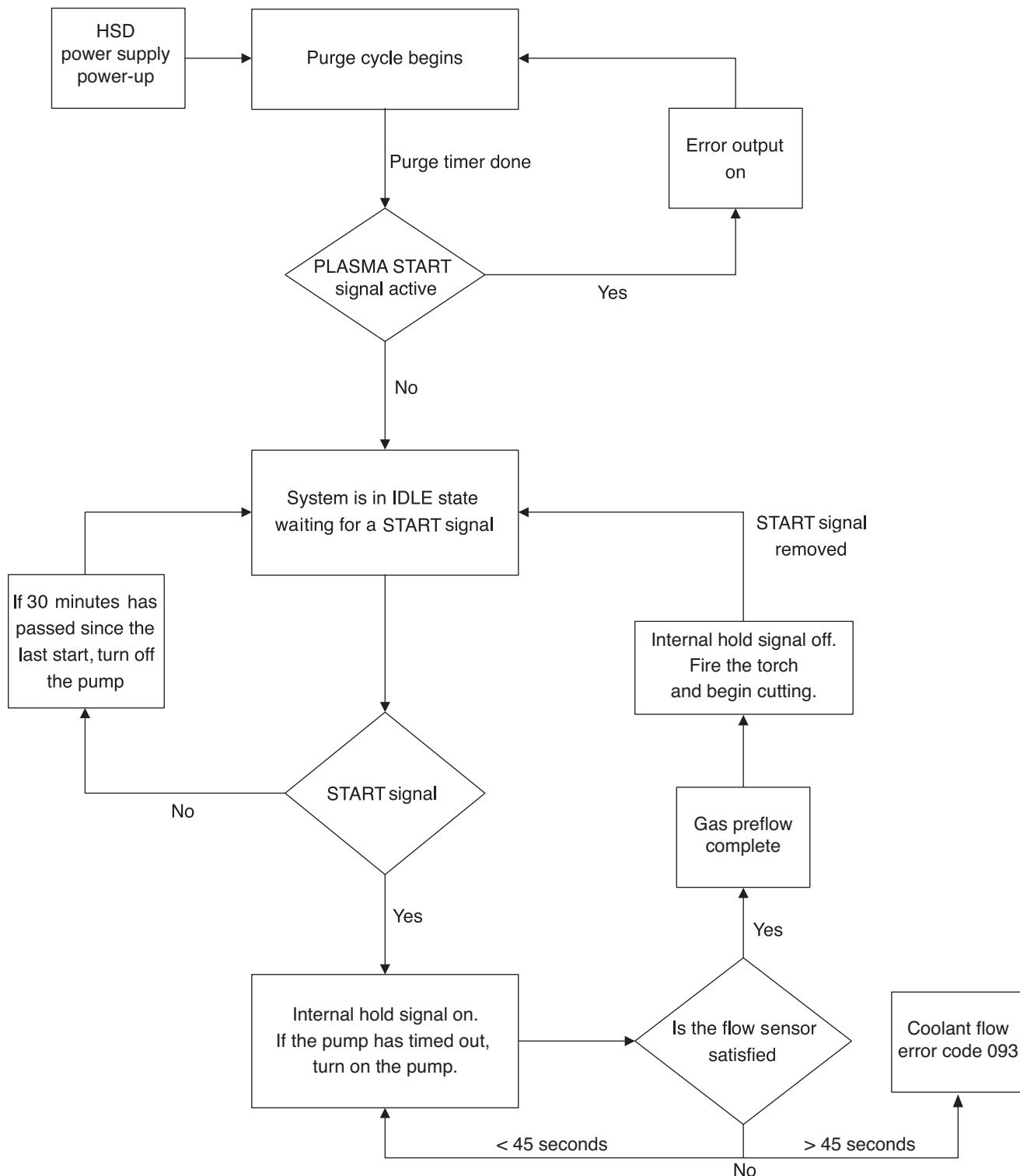
Power supply states

Set the selection switch on the power supply to ERROR. The power supply states are shown in the 3-digit LED display on the power supply. The state ID numbers are 2 digits with a dash in front of them and error codes are 3 digits. When the selection switch is set to ERROR, the state ID number will be displayed for 2 seconds. An error code number will then be displayed for 2 seconds. The display will continue to cycle through both numbers until the selection switch is moved.

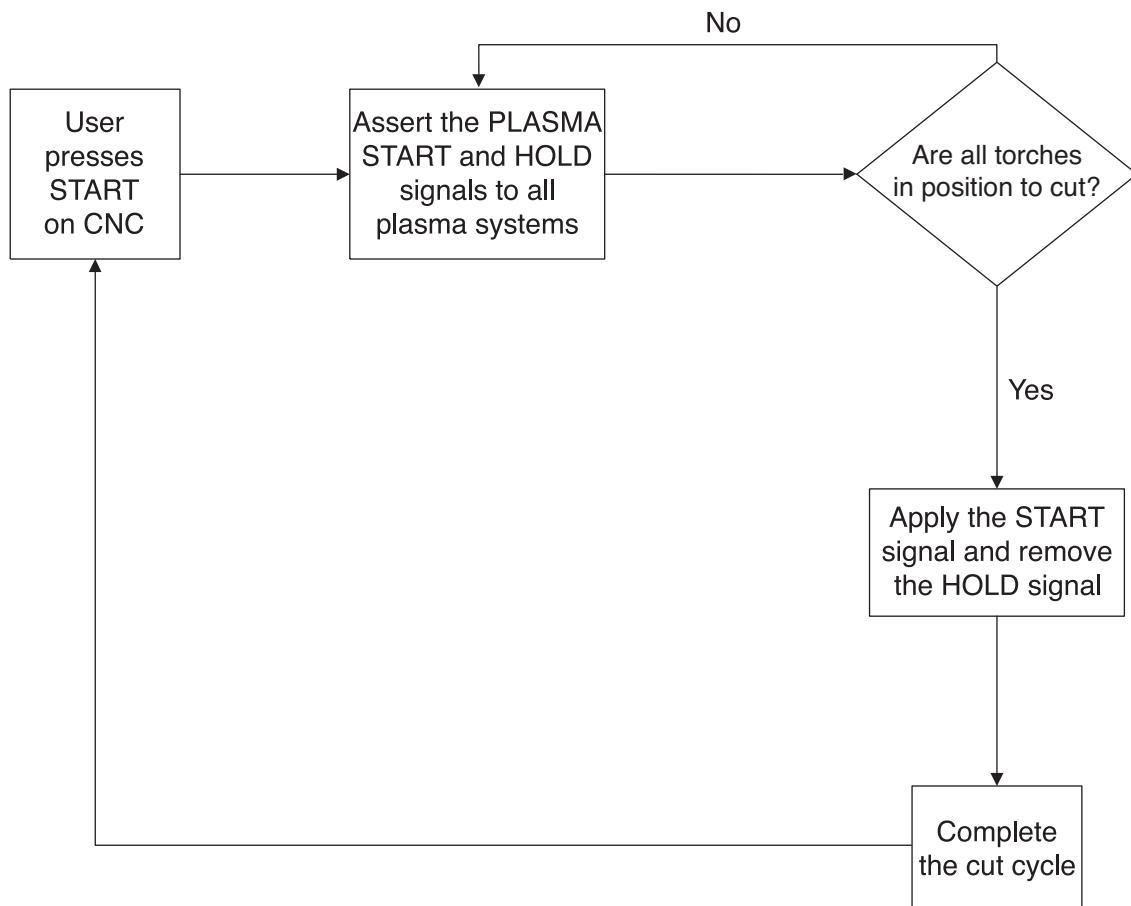
State ID	Name
-00	Idle
-02	Purge
-03	Idle 2
-04	Preflow
-05	Pilot arc
-06	Transfer
-07	Ramp-up
-08	Steady state
-09	Ramp-down
-10	Final ramp-down
-11	Auto off
-12	Test cutflow
-14	Shutdown
-15	Reset
-16	Maintenance
-22	Manual pump control
-26	System test state



Plasma system operation with pump timeout

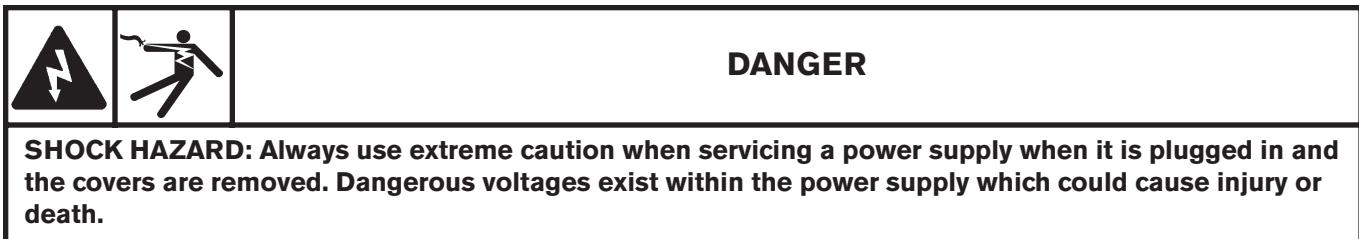


CNC operation with pump timeout



Initial checks

Before troubleshooting, do a visual check that proper voltages are present at the power source, transformers and power distribution board.



1. Disconnect line power by turning OFF the main disconnect switch.
2. Remove the power supply's top panel and 2 side panels.
3. Inspect interior of power supply for discoloration on PC boards, or other apparent damage. If a component or module is obviously defective, remove and replace it before doing any testing. Refer to the *Parts List* section to identify parts and part numbers.
4. If no damage is apparent, connect power to the power supply, and turn the main disconnect switch ON.
5. Measure the voltage between the W, V and U terminals of TB1 located on the right side of the power supply. See *Power measurement* later in this section. Also refer to the wiring diagram in Section 7, if required. The voltage between any 2 of the 3 terminals should be equal to the supply voltage. If there is a problem at this point, disconnect main power and check connections, power cable, and fuses at line disconnect switch. Repair or replace any defective component.

Automated diagnostic tests

Move the process selection knob on the power supply to the TEST position while the machine is idle and the system will run the following tests automatically:

1. The system tests the chopper. The Amps display will show the open circuit voltage (OCV). A normal reading is approximately 300 VDC.
2. The plasma select valve (SV1) turns on for 3 seconds.
3. The shield off-valve (SV2) turns on for 3 seconds.
4. The preflow off-valve (SV3) turns on for 3 seconds.
5. The plasma off-valve (SV4) turns on for 3 seconds.
6. The vent off-valve (SV5) turns on for 3 seconds.
7. **(Fuel Gas Console Only)** The off-valve closes and the inlet valves open until the system is pressurized, and then they close. The system should maintain pressure. If a leak is detected, the HSD130 will display an error code. Put the toggle switch in the Error position to monitor for errors.
8. **(Fuel Gas Console Only)** The inlet valve closes and the off-valve opens until the pressure in the system is released and then it closes. The system looks for an increase in pressure. The test ensures that the valves are closing properly and are not allowing gas to leak through. Put the toggle switch in the Error position to monitor for errors.

The following error codes may be seen during automated tests 7 and 8:

Error 012 – Test in progress – Wait for test completion.

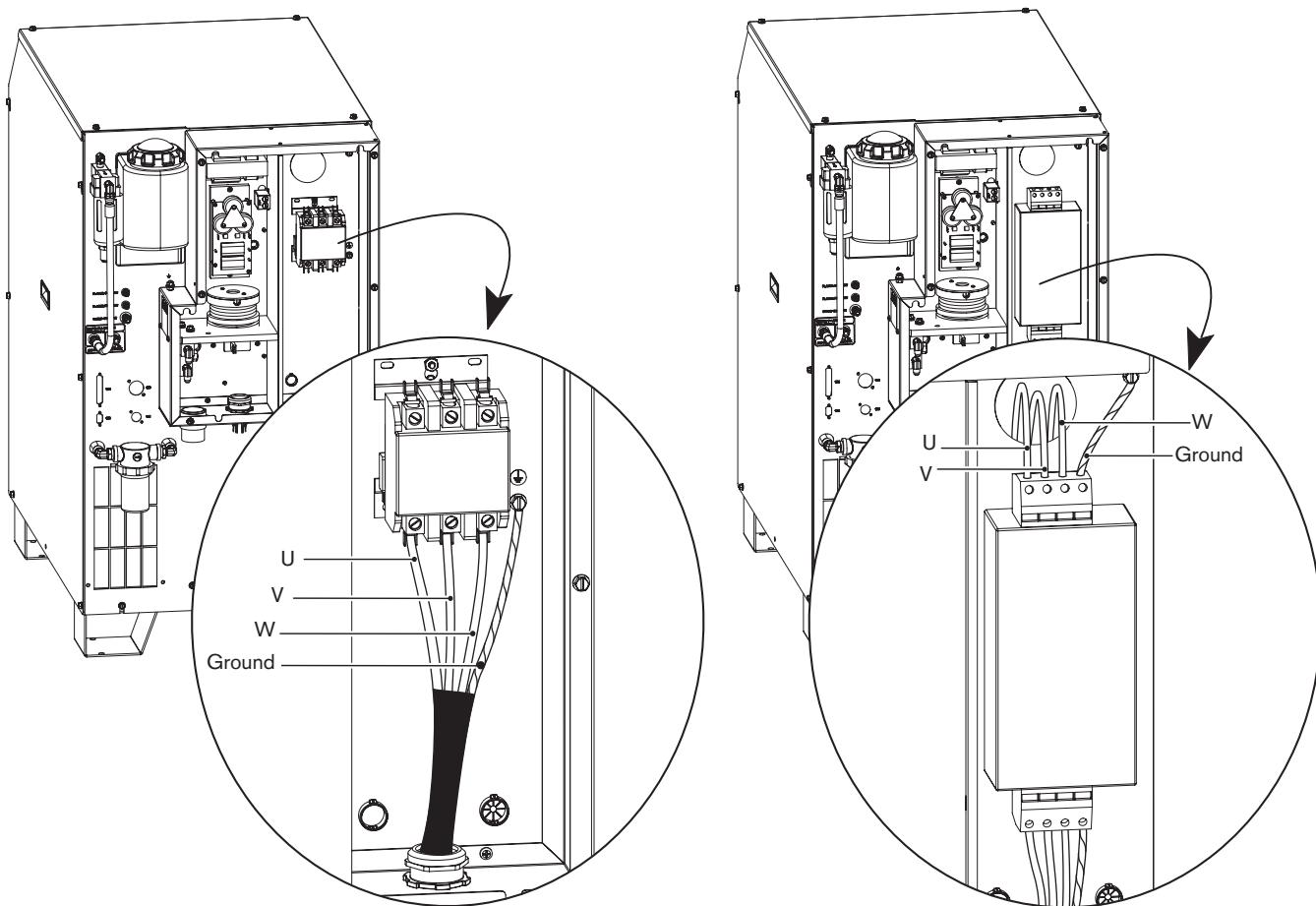
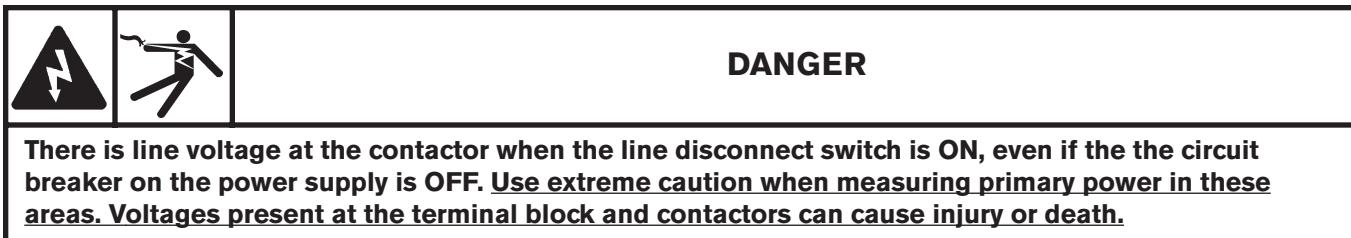
Error 014 – Test failed – Plasma gas channel

Error 015 – Test failed – Preflow gas channel

Error 016 – Test failed – Shield channel

Note: When the process selection knob is in the TEST position the display will alternate between “-26” (test position) and “012” (test in progress). If the error code changes from “012” to “000”, the system passed all tests.

Power measurement



Note: Check lines in the following order:

U to V

U to W

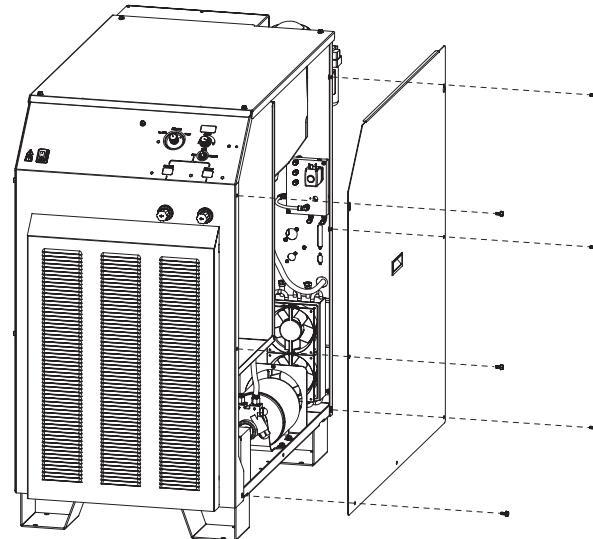
V to W

Check each line to ground. If one line is 10% or higher than the other two, put that leg on U.

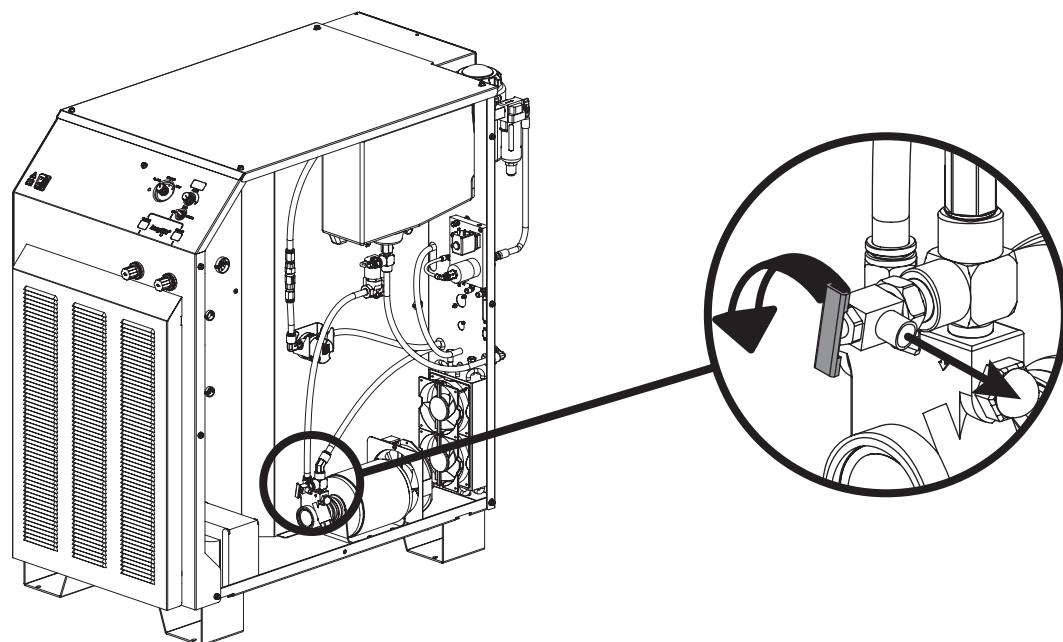
Power supply coolant system servicing

Draining the coolant system

1. Turn OFF the power, and remove the right-side panel from the power supply.



2. Locate the coolant drain valve and use a 20 liter (5 gallon) container to catch the coolant. Coolant will flow as soon as the drain is opened. Close the drain valve when the coolant stops flowing. Always dispose of coolant according to local and national codes.

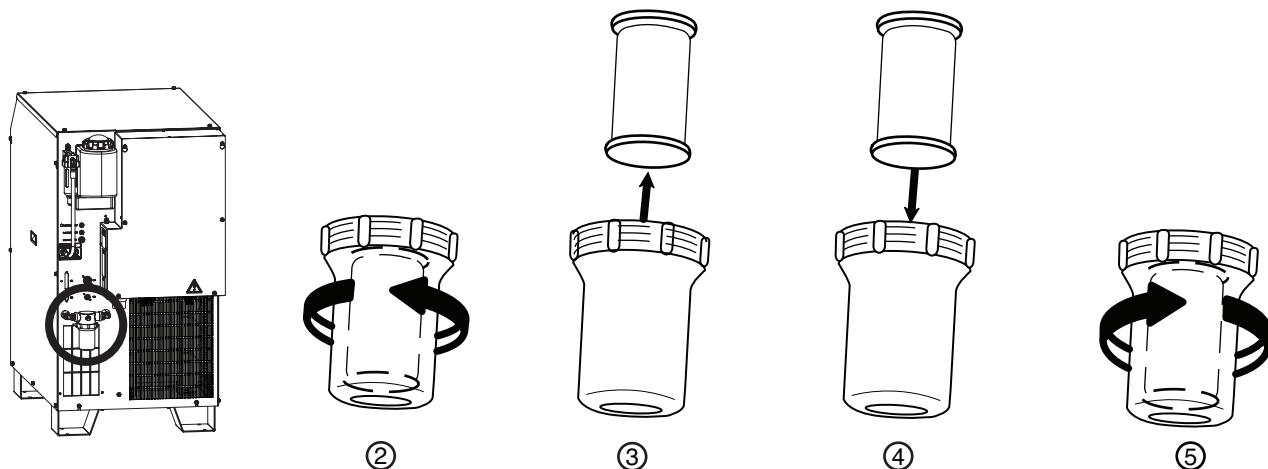




Caution: Coolant will flow from the filter when its housing is removed.
Drain coolant before replacing the filter.

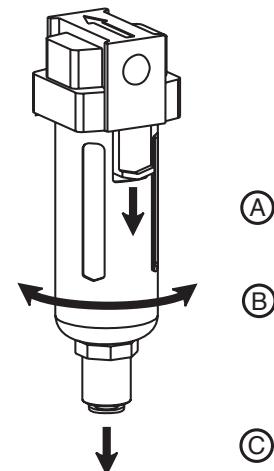
Coolant system filter replacement

1. Make sure that the coolant has been drained and then turn OFF all power to the system.
2. Remove housing.
3. Remove and discard the filter element.
4. Install the new filter element 027664.
5. Re-install housing.
6. Refill the power supply with coolant.



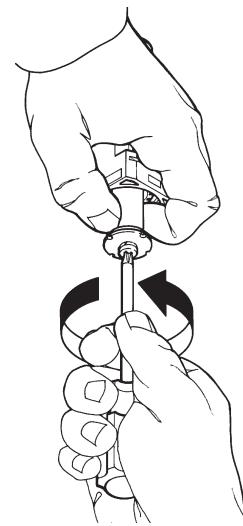
Air filter element replacement

1. Disconnect the electrical power and the gas supply.
Remove the filter bowl and the old filter element.
- a. Pull down and hold the black release tab. (If you do not see the tab, check the back of the filter bowl.)
- b. Rotate the filter bowl in either direction until it releases.
- c. Pull the filter bowl down to remove it. The bowl has an o-ring around the top. Do not discard the o-ring. If the o-ring needs to be replaced, use part number 011105.



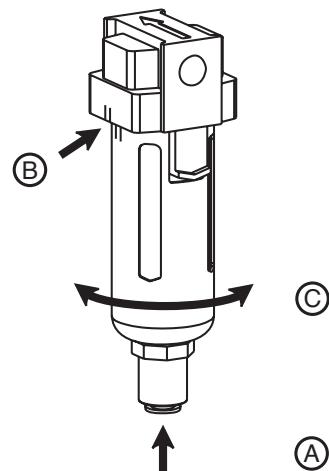
Use a screwdriver to remove the filter element from the filter housing. Then install the new filter element.

Note: Do not allow the filter element to turn when loosening the screw.



Re-install the filter bowl.

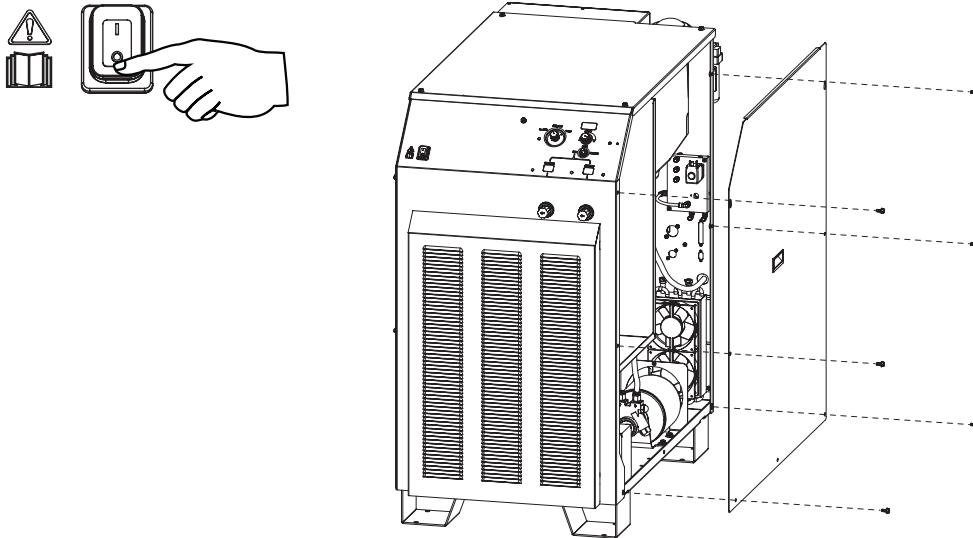
- a. Hold down the black tab and slide the filter bowl over the new filter element.
- b. Align the marks on filter bowl and the filter body.
- c. Rotate the filter bowl until it locks in place.



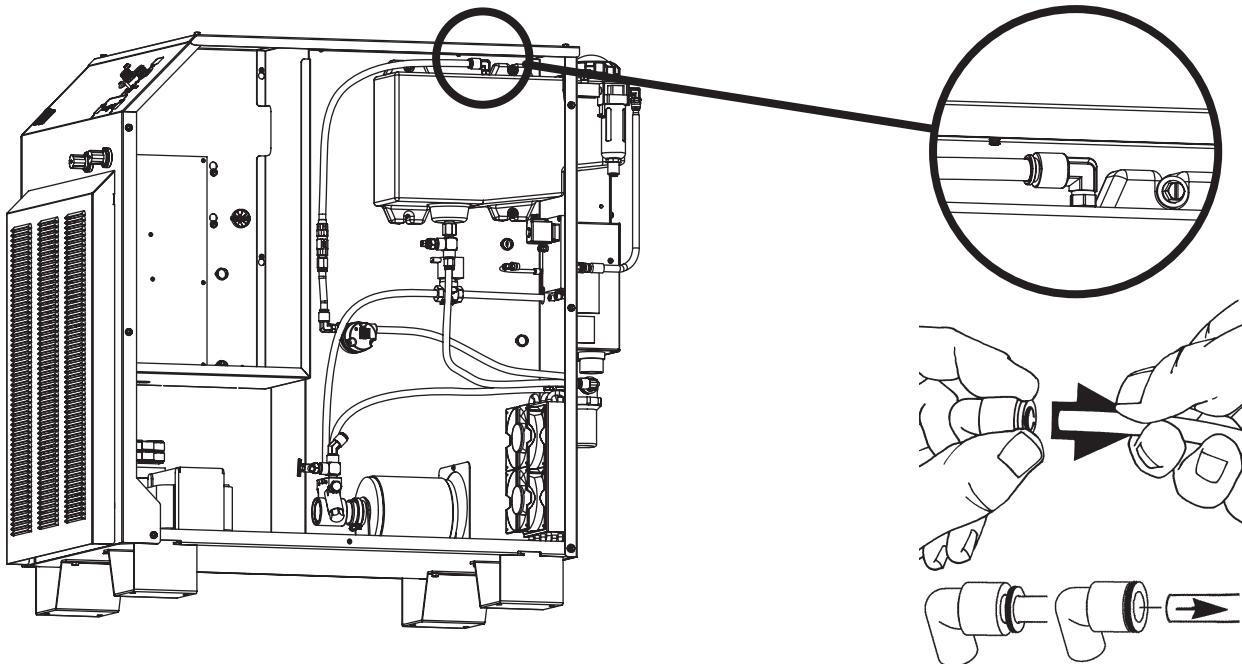
Coolant flow test procedure

The control board (PCB4) receives a contact closure signal from the flow switch when the flow rate is 2.3 lpm (0.6 gpm) or greater. Normal flow is 4.5 lpm (1.2 gpm), but this will vary depending on lead lengths and whether the power is 50 Hz or 60 Hz. PCB4 will allow the system to operate if the coolant flow is 2.3 lpm (0.6 gpm) or greater. If the system shows a coolant flow error (093) the system will need to be turned OFF and then ON again and the following test needs to be performed to determine if the problem is coolant flow or the flow switch.

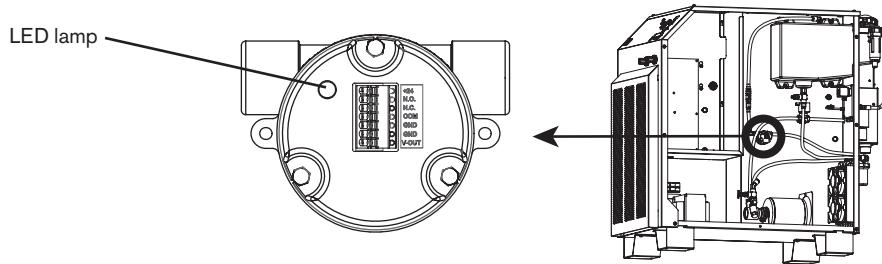
1. Turn OFF the power, and remove the right-side panel from the power supply.



2. Remove the return hose at the top of the coolant tank. Apply gentle pressure to the hose while pulling back on the collar of the elbow fitting. This will release the coolant hose. No tools required. Put the end of the return hose into a 20 liter (5 gallon) container.

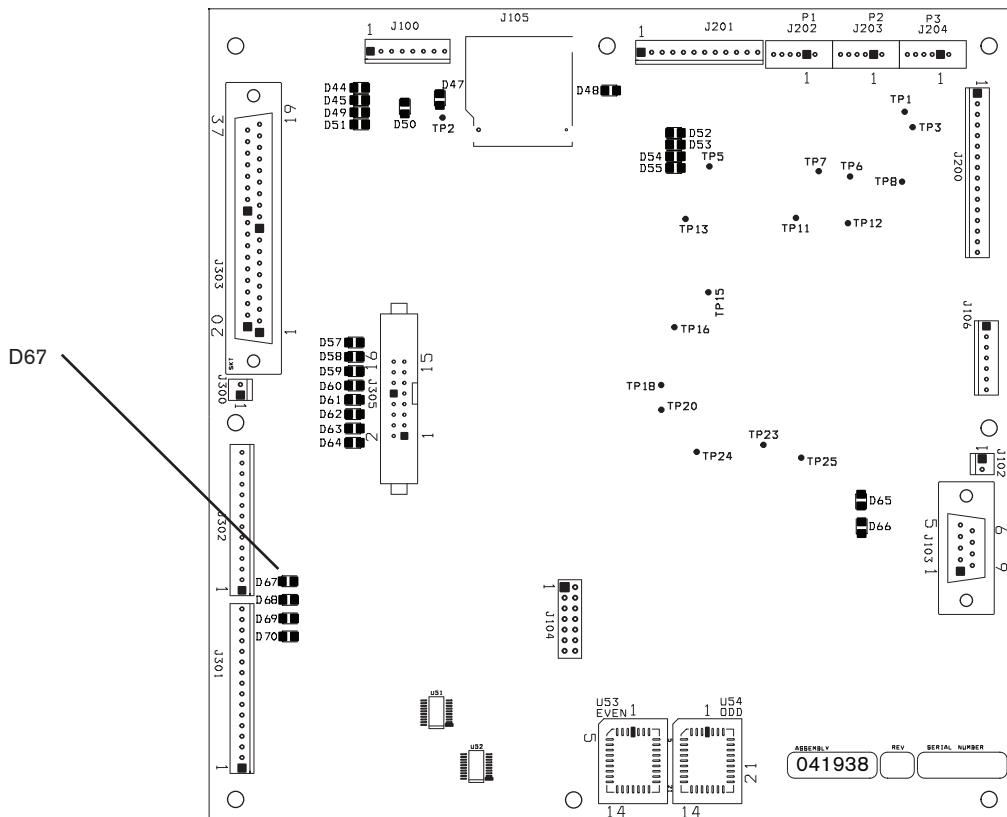


3. Turn ON the power and have another person push and hold the current knob, to override the flow time-out error. Allow the coolant to flow for 45 seconds, and turn OFF the power.
4. Measure the amount of coolant in the container. It should be about 4 liters (1 gallon). If there is less than 3 liters (3/4 gallon) there may be a restriction in the coolant system or a problem with the pump.
5. If the flow is 2.3 lpm (0.6 gpm) or higher, check the flow switch for contact closure at J11 (blue and white wires). The wires should be shorted. The LED lamp on the flow switch should be illuminated when the pump is running and the flow is > 2.3 lpm (0.6 gpm).



Testing the flow switch

6. Reconnect the return hose to the coolant tank and turn ON the power. Have another person push and hold the current knob to override the flow time-out error.
7. If the LED lamp on the flow switch is illuminated, D67 on the control board (PCB4) should also be illuminated.

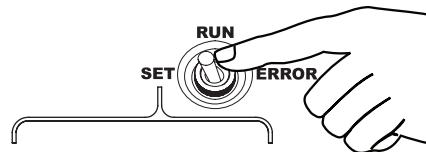


Gas leak test procedure (standard system)

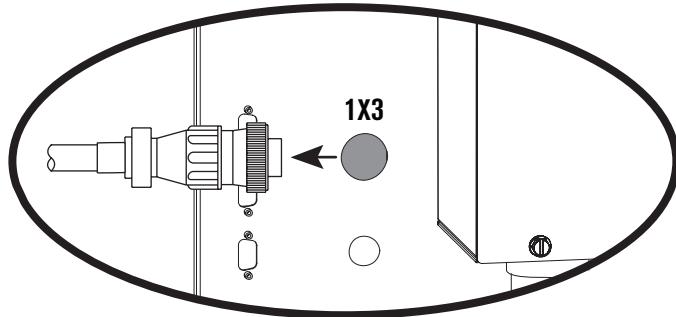
The fuel-gas system has 2 automated leak test modes. See *Automated diagnostic tests* in this section.

Leak test for a standard system (no fuel-gas console)

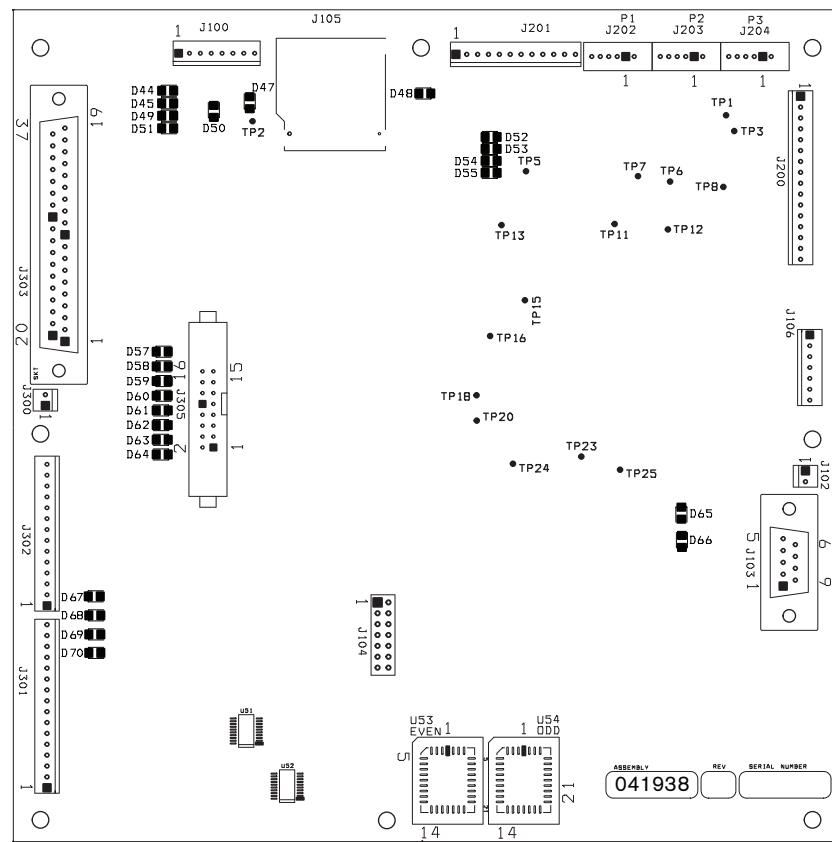
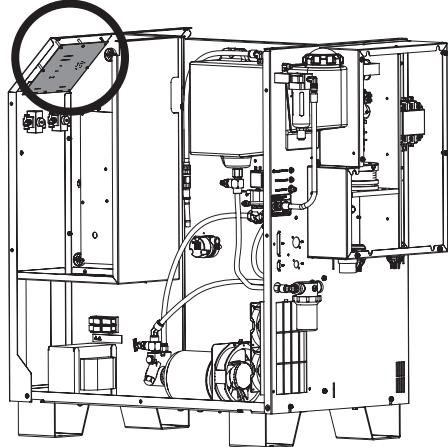
1. Turn ON the power to the system.
2. After the initial gas purge, move the process selection switch to SET.
3. Adjust the air supply regulator to 5.5 bar (80 psi).
4. Adjust the O₂ supply regulator to 5.5 bar (80 psi).
5. Move the process selection switch to RUN.
6. Disconnect the off-valve cable (1x3) from the rear panel of the power supply.



7. Move the process selection switch to SET.
8. Turn off the oxygen and the air at the supply.
9. Monitor the plasma pressure and the shield pressure displays for 10 minutes. The pressure should not decrease more than 0.7 bar (10 psi) in 10 minutes.
10. When the test is complete, reconnect the 1x3 cable, move the process selection switch to RUN, and reset the incoming gas supply pressures.



PCB4: Power supply control board



Control PCB4 firmware list

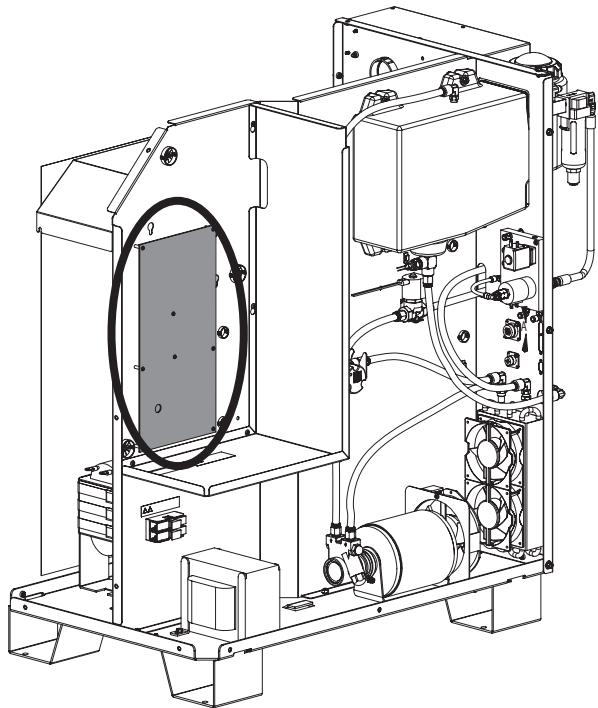
Item	Part number
U53	081118 EVEN
U54	081118 ODD

PCB4 LED list

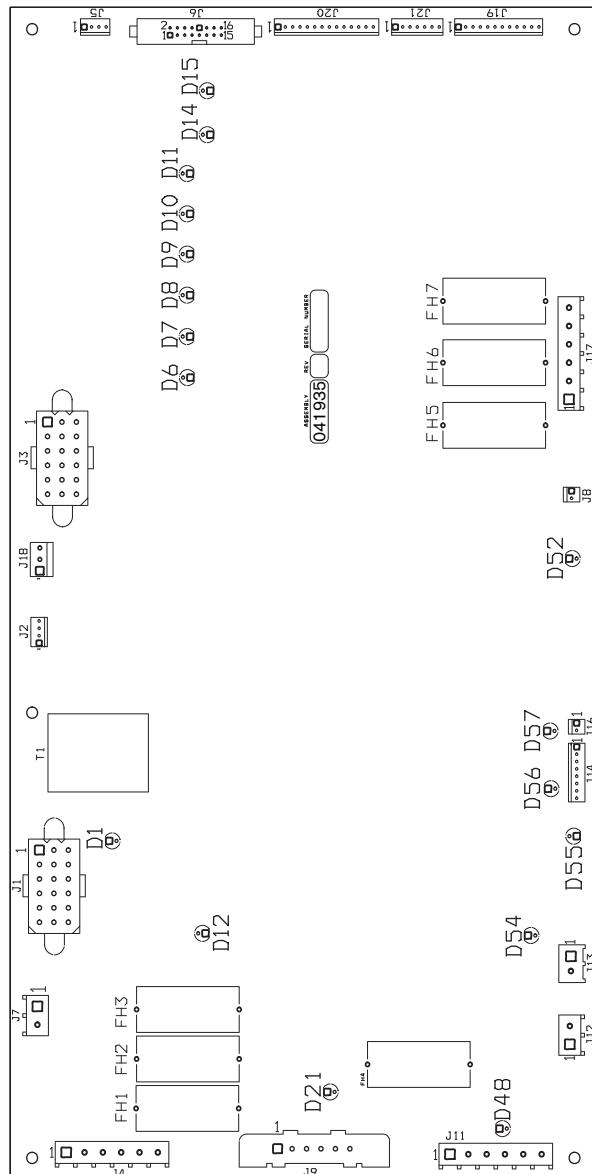
LED	Description	Color	LED	Description	Color
D44	Plasma start input	Green	D59	Hold output	Green
D45	Corner current input	Green	D60	Pilot arc enable output	Green
D47	+ 5 VDC	Green	D61	High-frequency enable	Green
D48	Coolant temperature	Green	D62	Pump enable	Green
D49	Hold ignition input	Green	D63	Contactor enable	Green
D50	+ 3.3 VDC	Green	D64	SVA drive	Green
D51	Pierce complete input	Green	D65	CAN transmit	Green
D52	Chopper temperature	Green	D66	CAN receive	Green
D53	Magnetics temperature	Green	D67	Flow switch	Green
D54	Chopper temperature 2	Green	D68	Work lead (transfer)	Green
D55	Magnetics temperature 2	Green	D69	Phase loss	Green
D57	Motion output	Green	D70	Overpressure (not used)	Green
D58	Ramp-down error output	Green			

MAINTENANCE

PCB3: Power supply power distribution board



Note: FH1, FH2, and FH3 are 6 Amp slow-blow fuses
 FH5, FH6, and FH7 are 3 Amp fast-blow fuses



PCB3 LED list

LED	Output	Color	LED	Output	Color
D1	120 VAC	Green	D15	Main contactor	Red
D6	Vent solenoid (SV5)	Red	D21	24 VAC	Green
D7	Plasma cutflow solenoid (SV4)	Red	D48	240 VAC	Green
D8	Plasma preflow solenoid (SV3)	Red	D52	+ 24 VDC	Red
D9	Shield off-valve solenoid (SV2)	Red	D54	Pump on	Green
D10	Plasma select solenoid (SV1)	Red	D55	+ 5 VDC	Red
D11	Shield select solenoid (SV0)	Red	D56	- 15 VDC	Red
D12	Power switch closed	Green	D57	+ 15 VDC	Red
D14	High-voltage transformer	Red			

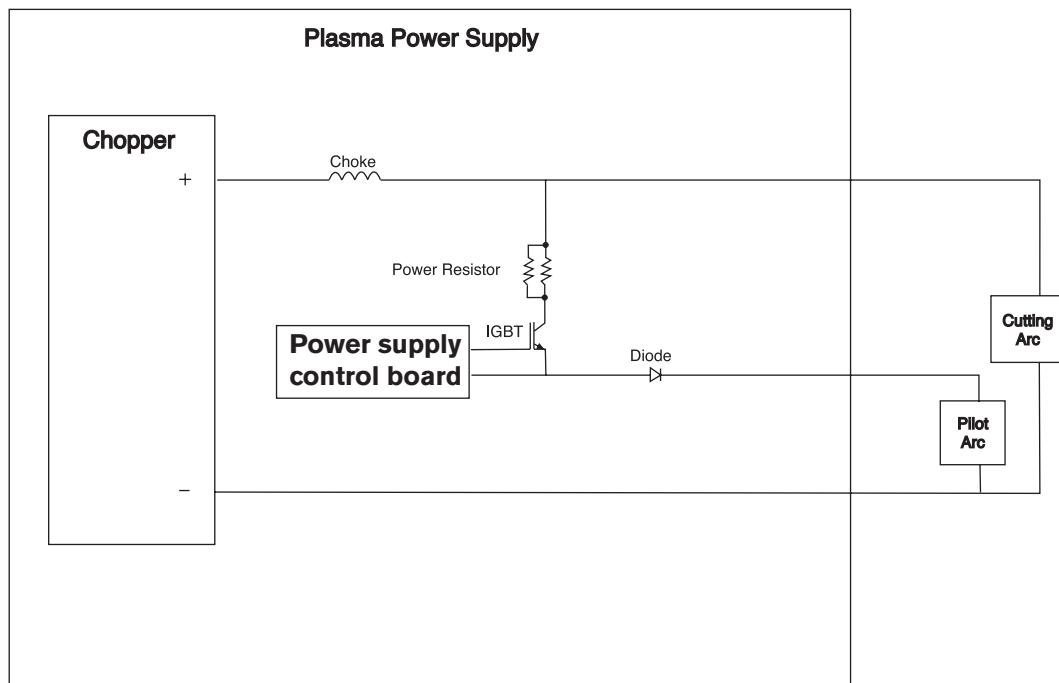
PCB2: Start-circuit

Operation

The start circuit is a high-speed switch that quickly transfers the pilot arc current from the pilot arc lead to the work lead. The start circuit performs 2 functions:

1. It allows the initial pilot arc current to flow through the pilot arc lead quickly, with little impedance.
2. After initial pilot arc current is established, the start circuit introduces resistance to the pilot arc lead to aid in transferring the arc to the workpiece. See schematic below.

Start circuit functional schematic



Start-circuit troubleshooting

		DANGER
SHOCK HAZARD: Always use extreme caution when servicing a power supply when it is plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.		

MAINTENANCE

D4 should always be illuminated.

D5 illuminates as soon as the torch fires and will extinguish as soon as the arc transfers to the workpiece. If arc transfer is immediate, the LED may not illuminate.

If there is no arc at the torch or if the arc will not transfer:

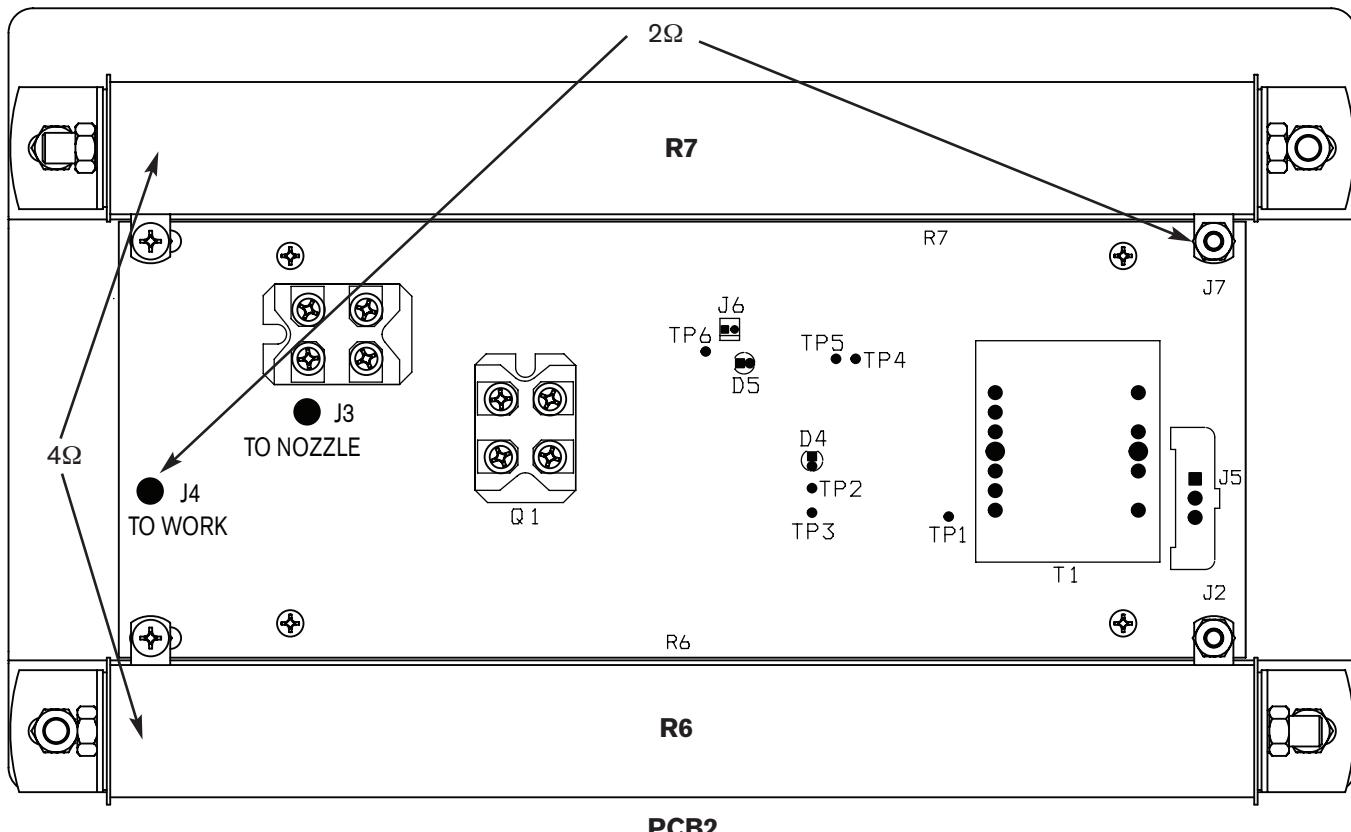
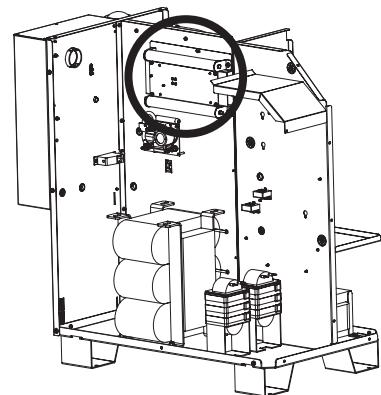
1. Turn OFF all power to the system.
2. Remove wires from J4 (TO WORK) and J3 (TO NOZZLE) studs on the board.
3. Verify a resistance of 2Ω between J4 and J7. If the resistance value is not correct, replace PCB2.

Note: Resistance value may slowly increase to the correct value due to the capacitance in the circuit.

4. Verify a resistance of 4Ω across R7 and R6.

- The work lead should not have any cuts or breaks. verify a resistance of 1Ω or less. The work lead connection to the cutting table should be clean and have good contact to the table.
- Verify that D4 is illuminated. If it is not illuminated the board may need to be replaced or the board may not be receiving power.
- Fire the torch in the air and verify that D5 is illuminated. If it is not illuminated, but a pilot arc is established, PCB2 may need to be replaced.

5. Place a 10 AWG (6 mm^2) jumper across J3 and J4. Perform a test cut. The nozzle will wear out after just a few starts. If the arc transfers, replace PCB2.



Pilot arc current levels

The pilot arc current level will change depending on the chosen process and arc current level. See table below.

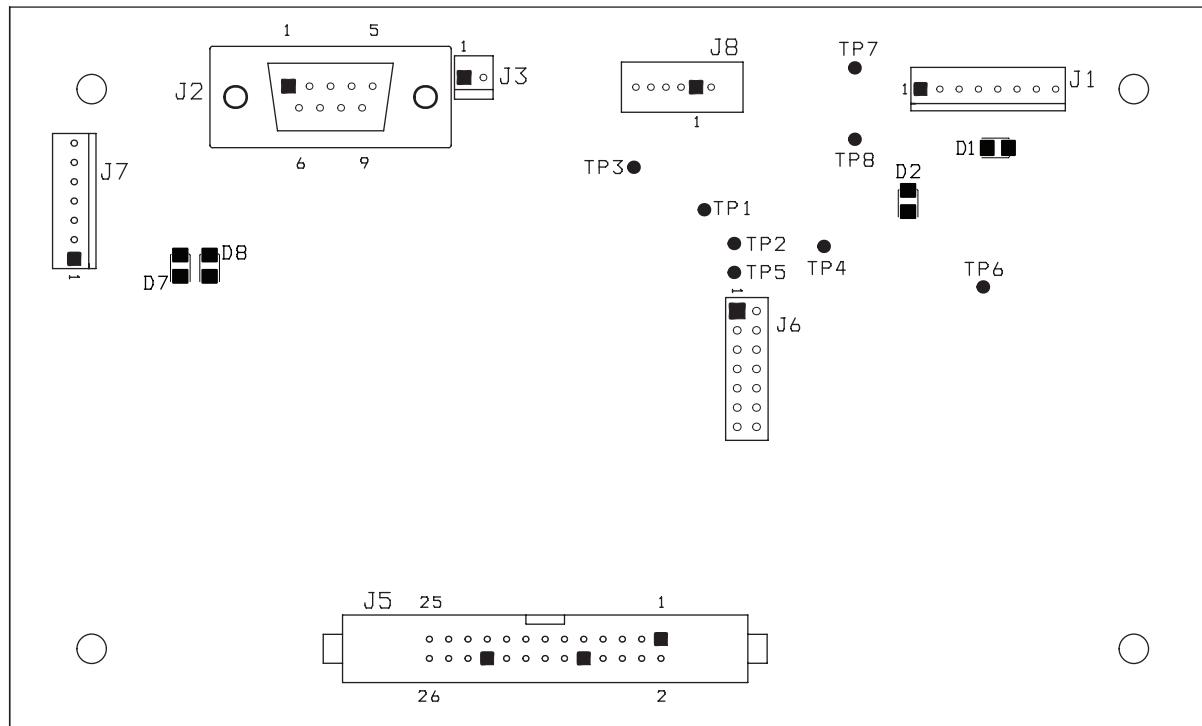
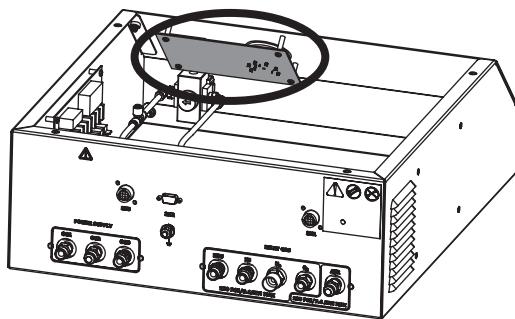
Pilot arc current

Plasma gas	45 Amps	50 Amps	130 Amps
O ₂	30	20	30
N ₂	30	20	35
H35	30	20	35
F5	30	20	35
Air	30	20	35

Transfer current

Transfer is determined by CS1 on PCB6. Transfer occurs when current on the work lead is > 3.5 Amps.

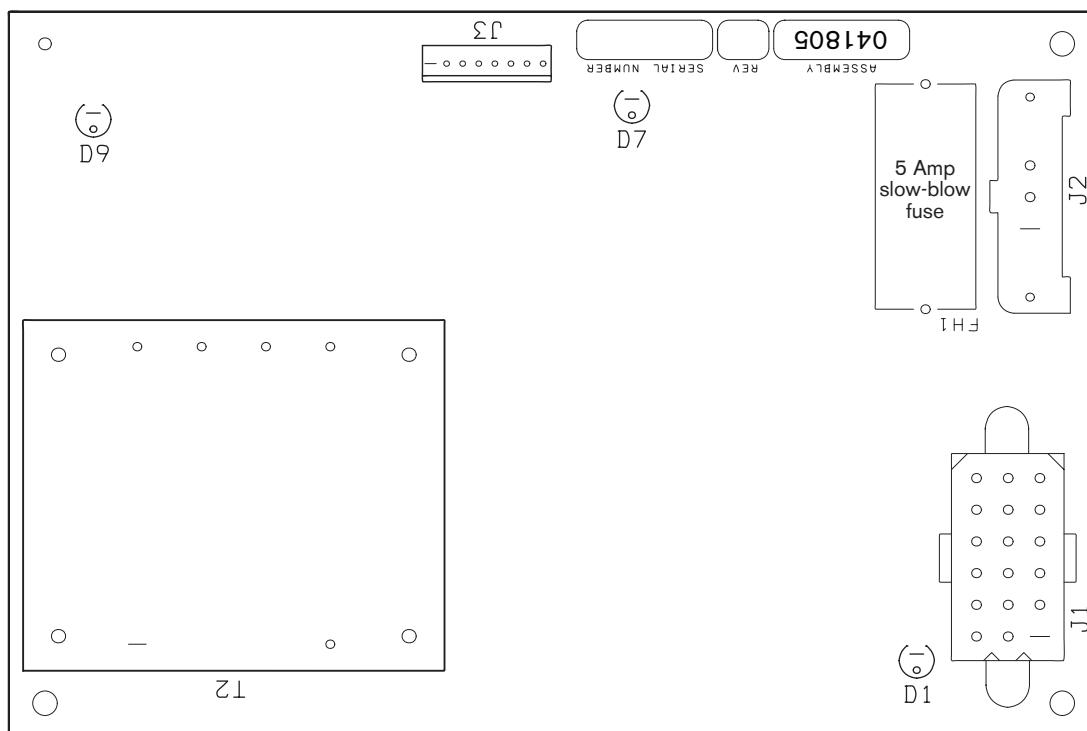
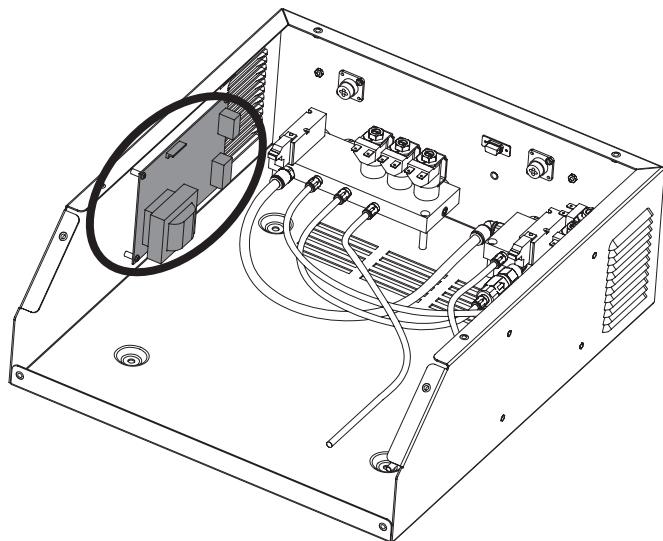
PCB2: Fuel-gas console control board



Gas console control board LED list

LED	Signal name	Color
D1	+ 5 VDC	Green
D2	+ 3.3 VDC	Green
D7	CAN transmit	Green
D8	CAN receive	Green

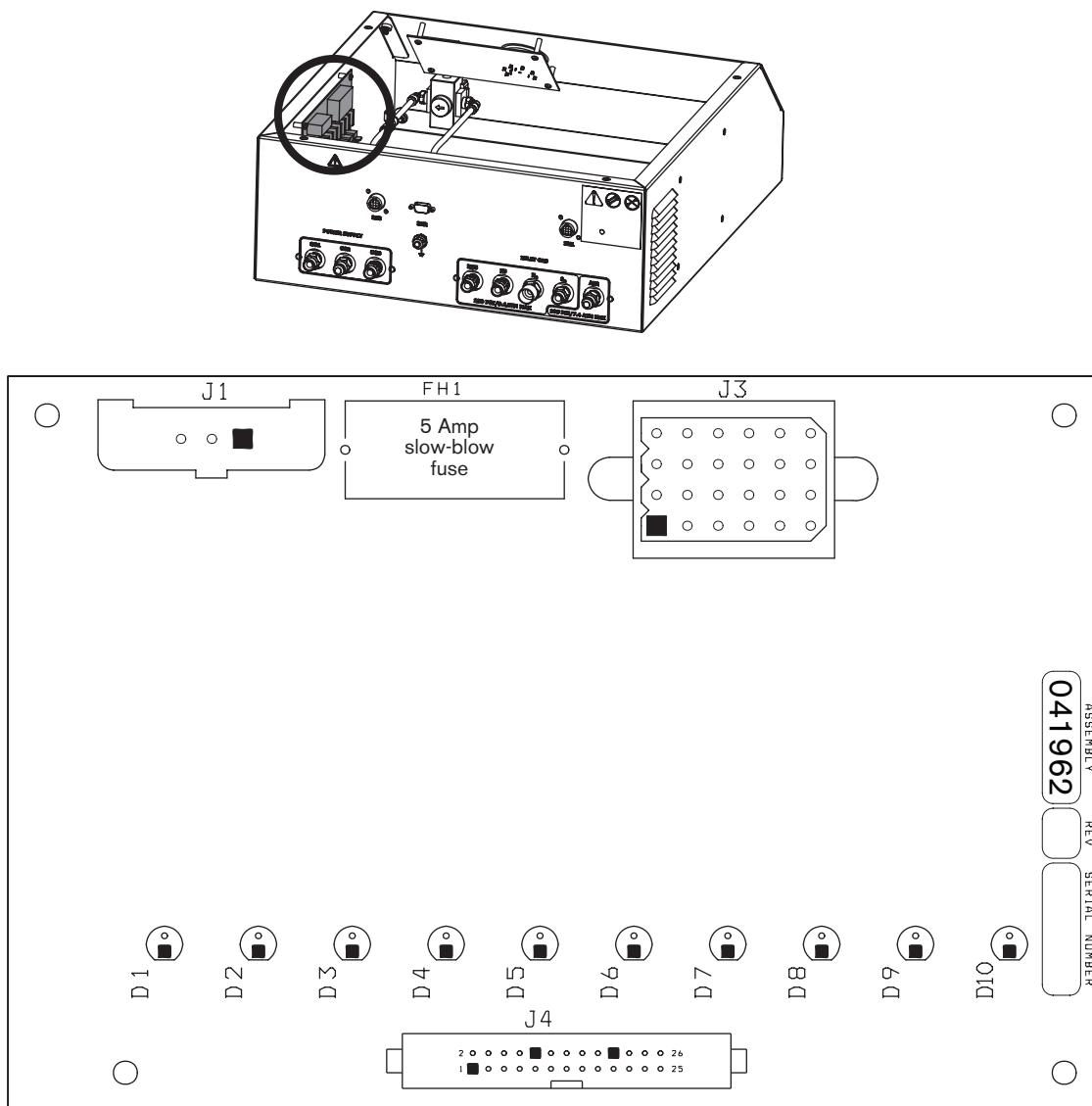
PCB1: Fuel-gas console power distribution board



Gas console power distribution board LED list

LED	Signal name	Color
D1	120 VAC	Green
D7	+ 5 VDC	Red
D9	+ 24 VDC	Red

PCB3: Fuel-gas console AC valve-driver board



Gas console AC valve driver board LED list

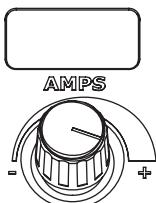
LED	Signal name	Color
D1	SV0	Red
D2	SV1	Red
D3	SV2	Red
D4	SV3	Red
D5	SV4	Red
D6	SV5	Red
D7	SV6	Red
D8	SV7	Red
D9	SV8	Red
D10	SV9	Red

Chopper tests

		WARNING
SHOCK HAZARD: Use extreme care when working near the chopper modules. Each large electrolytic capacitor (blue-cased cylinder) stores large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper, and the diode heatsinks. Never discharge any capacitor with a screwdriver or other implement ... explosion, property damage and/or personal injury will result.		

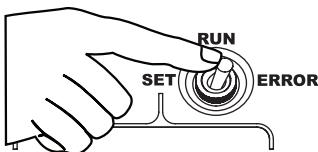
Test 1 – automatic chopper and current sensor tests during power-up

Turn ON the system. When the preflow starts, the contactor will close and the system will automatically test the chopper and current sensors. The system closes the contactor and turns chopper channel 1 on at 90% duty cycle. The chopper will charge the surge capacitor on the I/O board (PCB 6). The current that charges the capacitor should be between 10 amps and 35 amps. Error code 105 will show in the AMPS display if the current is < 10 amps or there is no feedback on current sensor 1 (CS1). Error code 103 will show in the AMPS display if the current is > 35 amps.



If Channel 1 passes the test, the system will repeat the test for channel 2 and current sensor 2. Error code 075 will show in the AMPS display if the current is < 10 amps. Error code 107 will show in the AMPS display if the current is > 35 amps.

Place the toggle switch in the ERROR position if the system completes the power-up sequence. If the system shows a status of -03 the test has passed. The chopper and current sensors are OK.



Troubleshooting low-current error codes 75 and 105

1. Verify that the current sensor (CS1 or CS2) and the cables are not damaged.
2. Exchange CS1 and CS2 to see if the error code switches channels. Replace the faulty sensor if the channel switches.
3. Measure the resistance between J6.2 and J6.3 on PCB6 with a meter. The value should be increasing as the capacitor charges. Replace PCB6 if a constant value is seen.
4. Check for loose wires or opens from chopper to PCB6.
5. Check for 220 VAC to 1A, 1B, and 1C on the chopper when the contactor closes.

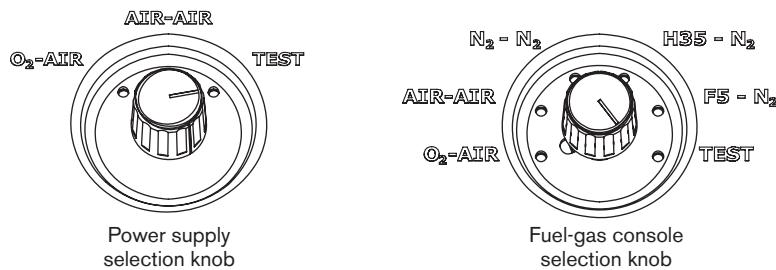
MAINTENANCE

Troubleshooting high-current error codes 103 and 107

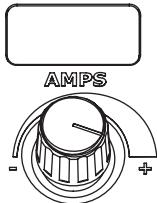
1. Verify that the current sensor (CS1 or CS2) and the cables are not damaged.
2. Exchange CS1 and CS2 to see if error the code switches channels. Replace the faulty sensor if the channel switches.
3. Look at the surge capacitor to ensure that it is not short circuited. Replace PCB6 if it is open.
4. Check for short circuits from work to negative. Resistance should be about 100K ohm from negative to work. Resistance will vary if you have a voltage divider for a height control system.

Test 2 – using the TEST position on the process selection knob.

1. Turn the process selection knob to TEST.



2. The contactor will close and the open circuit voltage (OCV) for the chopper will show in the AMPS display.



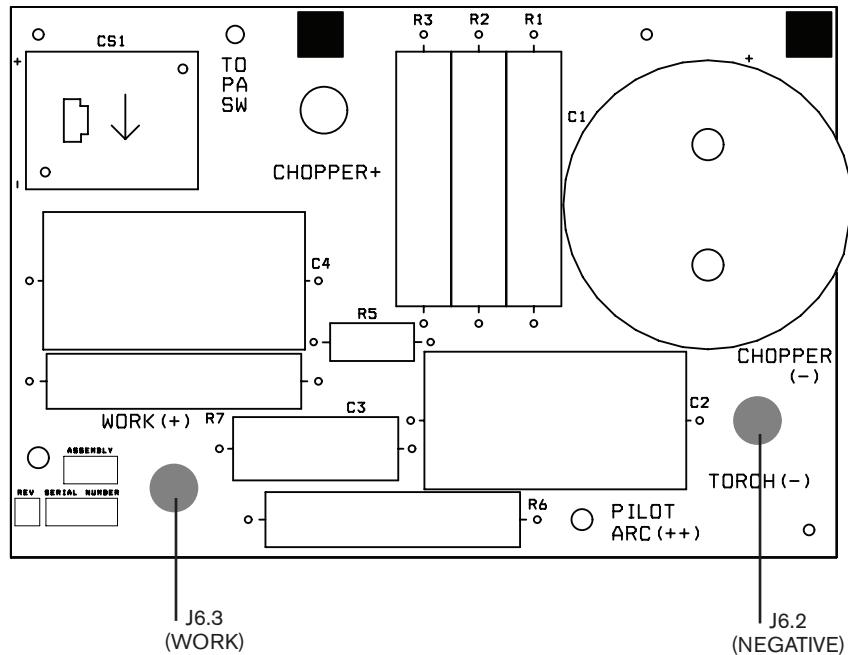
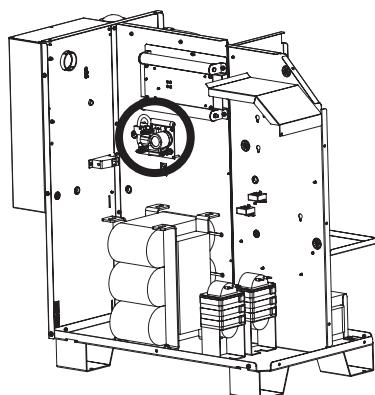
3. The OCV is 311 VDC. The AMPS display will show approximately 280 VDC for OCV based on where the measurement is taken.

Note: At any time while the system is cutting you can push in on AMPS knob to display the actual voltage while cutting. The refresh rate is slow but you can compare the value to the height control set point.

Test 3 – using a meter to measure open circuit voltage (OCV)**DANGER**

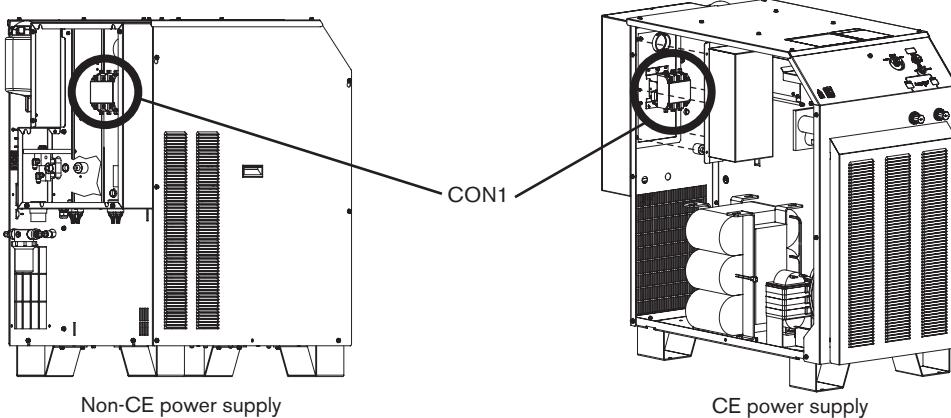
SHOCK HAZARD: The system will close the contactor and feed voltage to the I/O board (PCB6) with no input from the technician. Lethal voltages greater than 300 VDC will be present at times during power-up.

1. It is best to use clip-on test leads to keep your hands and the meter outside the power supply. Connect the meter to J6.3 (WORK) and J6.2 (NEGATIVE) on the I/O board (PCB 6).
2. Turn ON the system.
3. The automatic chopper test will begin when the purge cycle starts. You will hear the main contactor close and 0 to 5 seconds later the meter should show 311 VDC. This is the OCV for channel 1. The voltage will start to decrease to 0 VDC and will then spike back up to 311 VDC again. The second reading represents the OCV for channel 2.



Phase-loss detection test

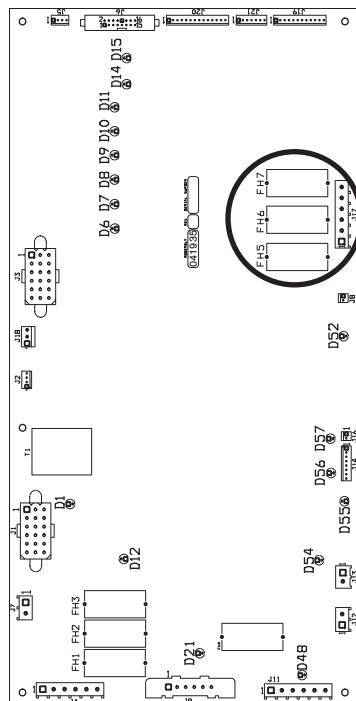
- Turn OFF all power to the system and remove the cover from CON1. On non-CE units the contactor is located on the back of the power supply. On CE units the contactor is located inside the power supply on the left side.



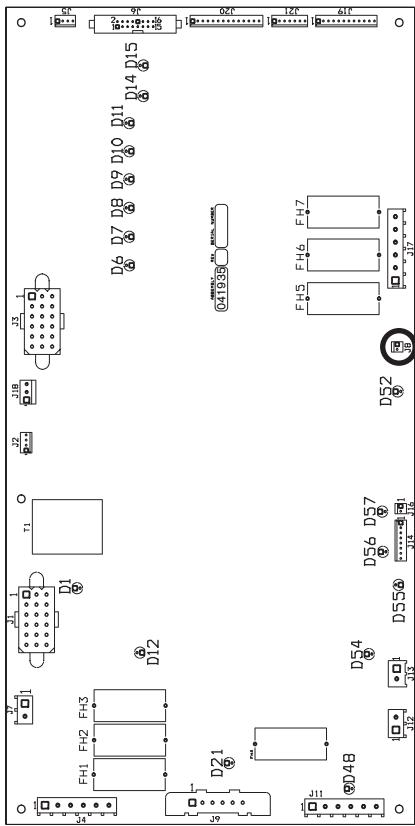
- Inspect the condition of the 3 contacts for excessive wear. If one or more of the contacts are worn excessively, replace CON1 and restart the system. If the error remains, perform the following steps.



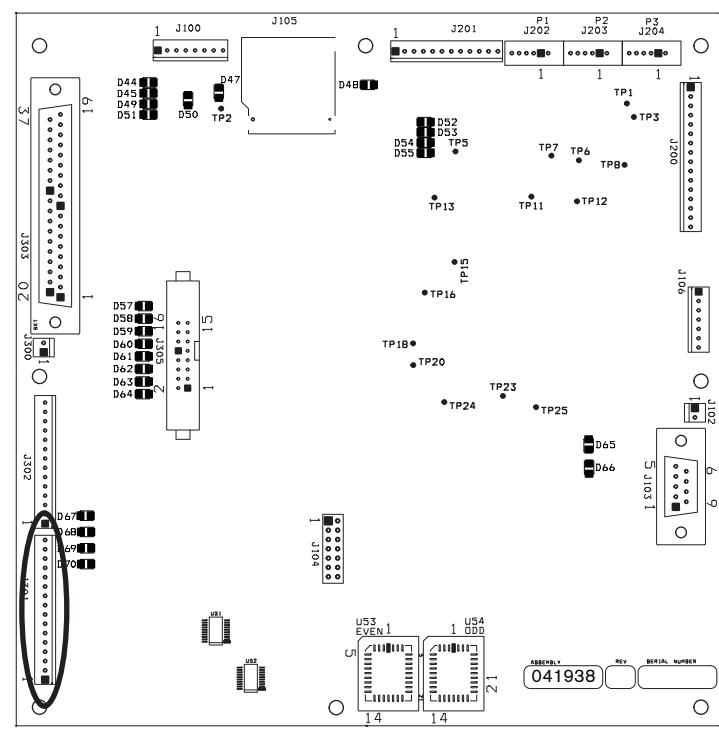
- Test the fuses F5, F6, and F7 on the power distribution board (PCB3). If any of the fuses are blown, replace PCB3.



4. Remove J3.8 from PCB3 and place a jumper wire between pins 1 and 2 on the cable connector.
- Make a test cut. If the phase-loss error continues, verify wiring between the connectors J3.8 on PCB3 and J4.301 on the power supply control board (PCB4) by verifying the continuity between
 - J3.8 pin1 to J4.301 pin13
 - J3.8 pin2 to J4.301 pin14.
 - If the wiring is OK, replace PCB4. If any wiring is damaged, repair or replace damaged wires.
 - If the phase-loss error goes away while the jumper is on J3.8, make another cut and measure the phase-to-phase voltage across the fuses F5, F6, and F7. The voltage should be 220 VAC +/-15%. If one of the 3 voltage readings is less than 187 VAC, check the contacts to the contactor, and check for loose connections between the power cord, contactor, power transformer, and the chopper.



Power distribution board (PCB3)



Power supply control board (PCB4)

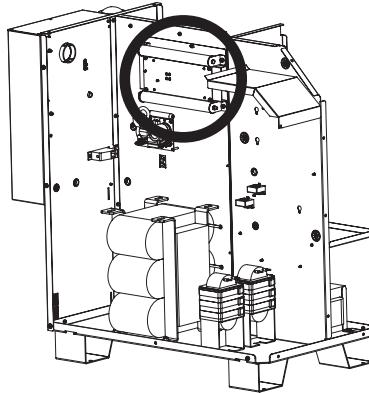


DANGER

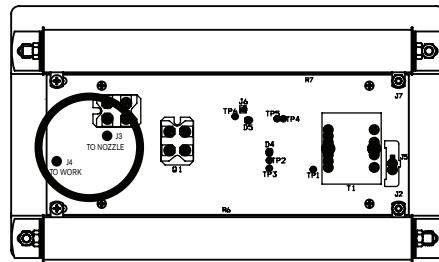
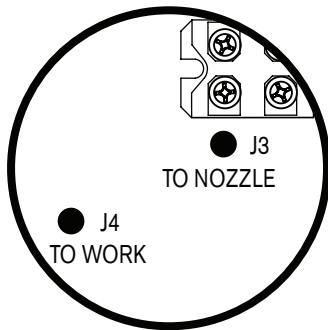
SHOCK HAZARD: Always use extreme caution when servicing a power supply when it is plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.

Torch lead test

1. Turn OFF all power to the system.
2. Locate the pilot arc controller.



3. Install a temporary jumper wire between J4 (work) and J3 (nozzle) on the start circuit PCB1.



4. Measure the ohm value between the nozzle and the plate. The reading should be < 3 ohms. A measurement > 3 ohms indicates a faulty connection between the torch and ignition console, or between the ignition console and the power supply.
5. Verify that the pilot arc wire on the torch lead is not damaged. If it is damaged, replace the lead. If it is not damaged, replace the torch head.

Preventive maintenance

Introduction

Deteriorating consumable parts life is one of the first indications that something is wrong with a plasma system. Reduced parts life increases operating costs in two ways: the operator must use more electrodes and nozzles to cut the same amount of metal, and the work of cutting must stop more often to change consumables.

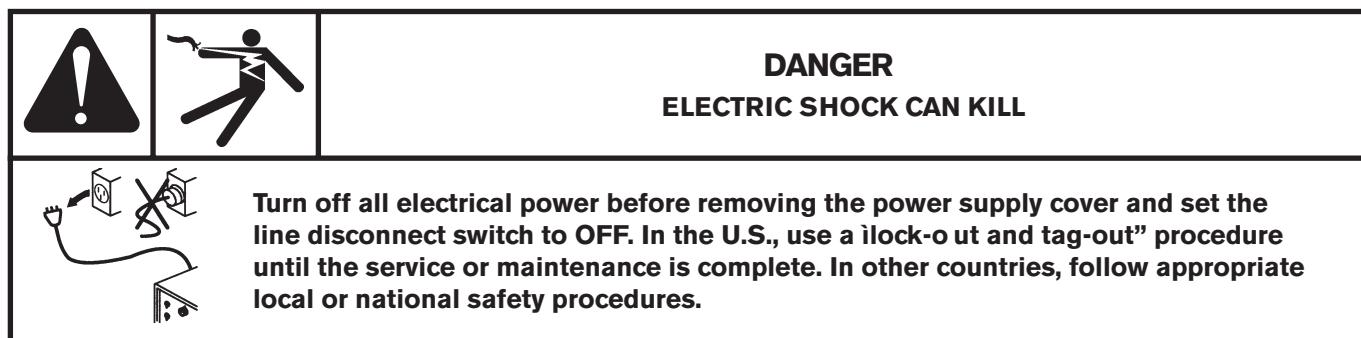
Proper maintenance often eliminates the problems that shorten the life of consumable parts. Since labor and overhead can account for 80% of the cost of cutting, improved productivity can reduce cutting costs dramatically.

Preventive maintenance protocol

The following protocol covers the basic elements of all Hypertherm HySpeed plasma systems.

If inspection suggests that a component is worn and might require replacement, and you would like confirmation of your decision, please contact Hypertherm's Technical Service department.

The power supply



1. With power to the power supply turned off, remove all side panels. Use compressed air to blow out any accumulation of dust and particulates.
2. Inspect wiring harnesses and connections for wear, damage or loose connections. If you see any discoloration that might indicate overheating, contact Hypertherm Technical Service.
3. Inspect the main contactor for excessive pitting on the contacts, characterized by a blackened, rough surface on any of the contacts. If this condition exists, replacement is recommended.

Cooling system

4. Inspect the coolant-circulating system's filter element at the rear of the power supply. If the filter is a brownish color, replace it. Consult the *Parts List* in this manual for part numbers.
5. Perform a coolant flow test as described in this manual, then check for coolant leaks. Primary locations to inspect are these:
 - A. The back of the power supply;
 - B. At the ignition console; and
 - C. At the torch main body.

Also, check the coolant tank for dirt and particulates. Verify that proper Hypertherm coolant is being used. Proper Hypertherm coolant (028872) is a red liquid.

Torch main body

6. Verify that the water tube is straight and has no pitting on the end.
7. Clean all threads on the front end of the torch head with hydrogen peroxide and a cotton swab, pipe cleaner or clean cloth. Do not use alcohol. Damage to the threads usually results from not cleaning the torch and retaining cap threads properly, so that dirt and particulates accumulate in the threads.
8. Inspect the torch insulator for cracks. Replace the torch if you find cracks.
9. Inspect all o-rings on the torch body and consumables. Make sure that the correct amount of lubricant, a thin film, is applied to these o-rings. Too much lubricant may obstruct gas flows.
10. Check that the retaining or shield cap is tightened securely to the torch main body.
11. Inspect all hose fittings at the rear of the torch for wear. Damage to the fitting threads may indicate that overtightening has occurred.
12. Check that all connections between the torch and torch leads are tight, but do not overtighten. See torque specs in the *Installation* section of this manual.

When removing consumables, always place them on a clean, dry, oil-free surface, since dirty consumables may cause the torch to malfunction.

Gas flows

13. Check each gas line from the gas supply, as follows:
 - A. Remove and plug the inlet gas fitting at the gas console.
 - B. Pressurize the O₂ gas line to 8.3 bar (120 psi) and the air gas line to 7.2 bar (105 psi).
 - C. Close the gas supply valve at the source. Watch for a pressure drop. If the gas supply line is a hose, there may be a 0.3 to 0.5 bar (5 to 7 psi) drop due to hose-stretch.
 - D. Repeat for each line from a gas supply source. If any pressure continues to drop, find the leak within the system.

14. If the gas line pressures hold steady, perform a system gas leak test as specified in this manual.
15. Check for hose restrictions, as follows:
 - A. Check all hoses to verify that they have no kinks or sharp bends, which can restrict gas flow.
 - B. If the cutting table uses a power track system to support leads from the power supply to the gas console or torch, check the position of the leads in the power track to ensure the leads do not twist or kink, causing a possible restriction.

Cable connections

16. All cables should be checked for chafing or unusual wear. If the outside insulation has been cut or otherwise damaged, replace the cable.

Ignition console

17. Open the cover and use compressed air to blow out any accumulation of dust and particulates. If moisture is present, dry the inside of the console with a cloth and try to identify the source of the moisture.
18. Inspect the spark gap assembly. Ensure that the wiring connections to the spark gap assembly are secure.
19. Inspect the torch leads. Ensure that they are fastened tightly to the outside of the ignition console.

System grounding

20. Verify that all components of the system are individually grounded to a driven earth ground, as described in the *Installation* and *Grounding* sections of this manual.
 - A. All metal enclosures, such as the power supply, ignition console and gas console, should be connected individually to a ground point. These connections should be made with 10 mm² (#8 AWG) wire (USA), or equivalent-size wire.
21. Check the work lead (+) connection, particularly where the work lead (+) connects to the cutting table. This must be a good, clean connection because a poor connection may cause arc-transfer problems.
22. Complete the Preventive Maintenance worksheet on the next page, for future reference.

MAINTENANCE

Preventive Maintenance Master Schedule

Daily:

- Verify proper inlet gas pressure.
- Verify proper gas flow settings. – Mandatory at every consumable change.
- Inspect torch and replace consumables as needed.

Weekly:

Week	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1												
2												
3												
4												
5												

- Clean power supply with dry, oil free compressed air or vacuum.
- Verify cooling fans are working properly.
- Clean torch threads and current ring.
- Verify proper coolant level.

Bi-Annually:

Year	1 st Service	2 nd Service

- Replace service parts per the Service Part Replacement Schedule.

Annually:

Year											

- Replace service parts per the Service Part Replacement Schedule.

Preventive Maintenance Protocol Checklist

Customer: _____
 Location: _____
 Contact: _____
 Date: _____

Hypertherm system: _____
 System serial #: _____
 System arc hours: _____
 (if equipped with an hour meter)

Comments **P** – Performed **NP** – Not present on system

Power supply

- NP** 1. Inspect for particulates and blow out
- NP** 2. Inspect wiring harnesses
- NP** 3. Inspect main contactor

Coolant system

- NP** 4. Inspect filter element
- NP** 5. Perform coolant flow test
 - A. Coolant flow checked at _____ gallons per minute (_____ l/min)

Torch main body

- NP** 6. Inspect water tube
- NP** 7. Clean threads on torch front end
- NP** 8. Inspect Vespel torch insulator
- NP** 9. Inspect torch and consumable o-rings
- NP** 10. Verify proper fit of retaining or shield cap
- NP** 11. Inspect hose fittings
- NP** 12. Inspect torch-to-torch-lead connections

Gas flows

- NP** 13. Inspect plumbing from gas supply
 - NP** A. Oxygen
 - NP** B. Nitrogen
 - NP** C. Air
 - NP** D. Nitrogen-Hydrogen
 - NP** E. Argon-Hydrogen
 - NP** F. Inspect compressed air filter system

Gas flows (cont.)

- NP** 14. Perform gas leak test
 - A. Oxygen pressure drop at _____ psi in 10 minutes (_____ bar)
 - B. Air pressure drop at _____ psi in 10 minutes (_____ bar)
- NP** 15. Inspect for hose restrictions
 - NP** A. Off-valve to torch body
 - NP** B. Gas console to Off-valve
 - NP** C. Hoses in power track

Cable connections

- NP** 16. Inspect cables
 - NP** A. Height control
 - NP** B. Control cable from off-valve to power supply
 - NP** C. From ignition console and gas console to power supply

Ignition console

- NP** 17. Inspect for moisture, dust and particulates
- NP** 18. Inspect spark gap subassembly
- NP** 19. Inspect torch leads

System grounding

- NP** 20. Inspect for proper system component grounding
- NP** 21. Inspect connection from cutting table to workpiece (+) lead

General comments and recommendations:

Preventive maintenance performed by: _____ Date: _____

MAINTENANCE

HSD130 Service Parts Replacement Schedule

Annual Kit
228167

Timeline	Component	Part Number	Quantity
6 months or 300 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
1 Year or 600 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
1.5 Years or 900 arc hrs.	Air filter	011093	1
	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
2 Years or 1200 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Coolant Pump	229126	1
2.5 Years or 1500 arc hrs.	Torch Leads	System Dependent	1
	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
3 Years or 1800 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Off-valve Assembly	System Dependent	1
	Cooling Fan	127039	System Dependent
	Cooling Fan	027079	1
3.5 Years or 2100 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
4 Years or 2400 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Coolant Pump	229126	1
4.5 Years or 2700 arc hrs.	Torch Leads	System Dependent	1
	Coolant Pump Motor	128385	1
	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
5 Years or 3000 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	High Voltage Transformer	129854	1
	Power Distribution Board	041935	1
5.5 Years or 3300 arc hrs.	Pilot Arc Lead	System Dependent	1
	Gas Leads	System Dependent	1
6.0 Years or 3600 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
6.5 Years or 3900 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Coolant Pump	229126	1
	Torch Leads	System Dependent	1
6.5 Years or 3900 arc hrs.	Off-valve Assembly	System Dependent	1
	Cooling Fan 6"	127039	System Dependent
	Cooling Fan 10"	027079	1
6.5 Years or 3900 arc hrs.			Repeat schedule starting at 6 months or 300 arc hrs.

Section 6

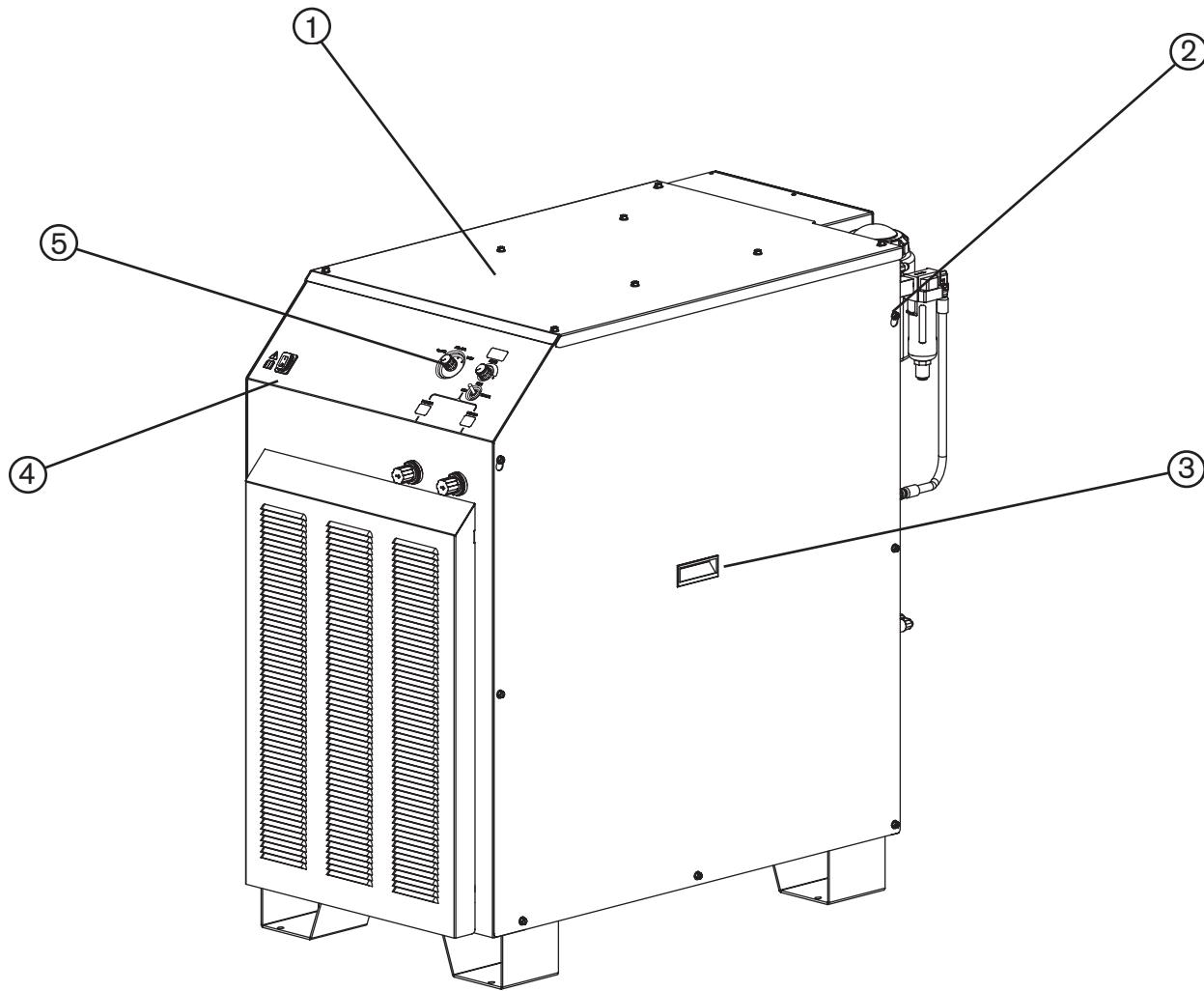
PARTS LIST

In this section:

Power supply	6-2
RHF Ignition console	6-8
Fuel-gas console	6-9
Off-valve (standard)	6-10
Off-valve (fuel-gas)	6-10
HySpeed torch	6-11
Torch assembly	6-11
Torch leads	6-11
Mild steel consumable parts kit	6-12
Stainless steel / Aluminum consumable parts kit	6-13
Recommended spare parts	6-14

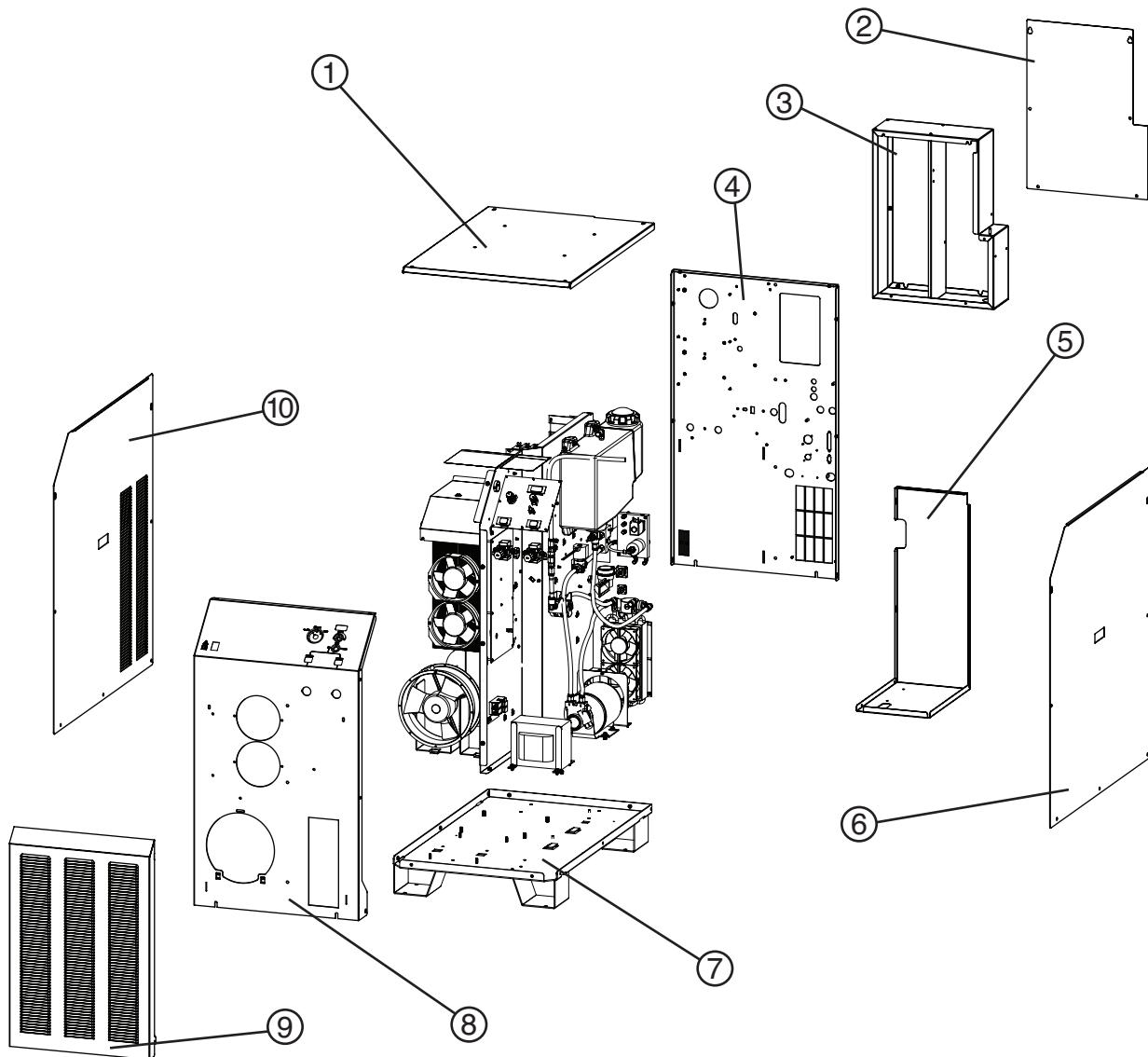
PARTS LIST

Power supply



Item	Part number	Description	Qty.
1	078515 078516 078517 078518 078519 078520 078521 078522	HySpeed (HSD) Plasma power supply: 200/208 volt HySpeed (HSD) Plasma power supply: 220 volt HySpeed (HSD) Plasma power supply: 240 volt HySpeed (HSD) Plasma power supply: 380 volt HySpeed (HSD) Plasma power supply: 400 volt HySpeed (HSD) Plasma power supply: 440 volt HySpeed (HSD) Plasma power supply: 480 volt HySpeed (HSD) Plasma power supply: 600 volt	
2	075241	Sheet metal screw	1
3	027967	Handle	2
4	005262	Power switch: green illuminated	1
5	108590 108591	knob Knob cover	2

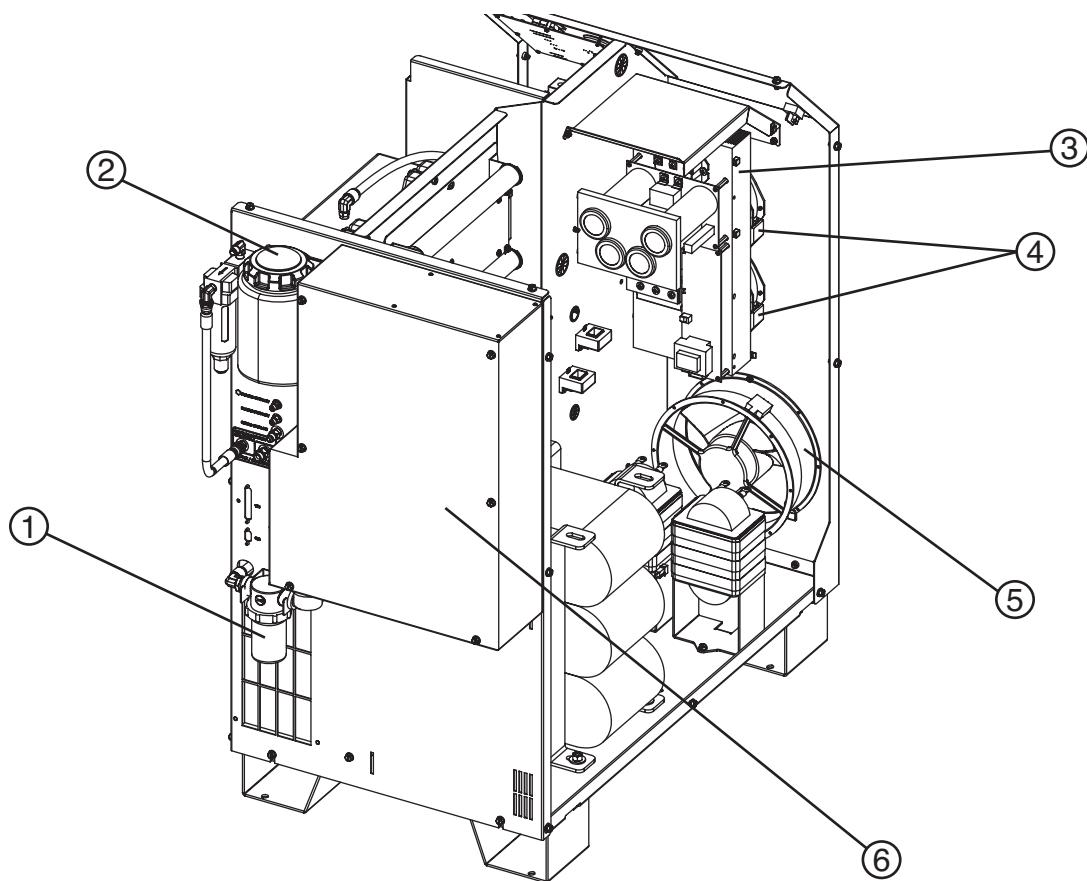
Power supply



Item	Part number	Description	Qty.
1	001963	Cover: power supply	1
2	001965	Cover: LHF rear box	1
3	001964	Enclosure: LHF rear box	1
4	001960	Panel: power supply rear	1
5	001966	Enclosure: power supply PCB	1
6	001962	Panel: power supply left side	1
7	001810	Base: power supply	1
8	001957	Panel: power supply front	1
9	001958	Panel: fan cover	1
10	001961	Panel: power supply right side	1

PARTS LIST

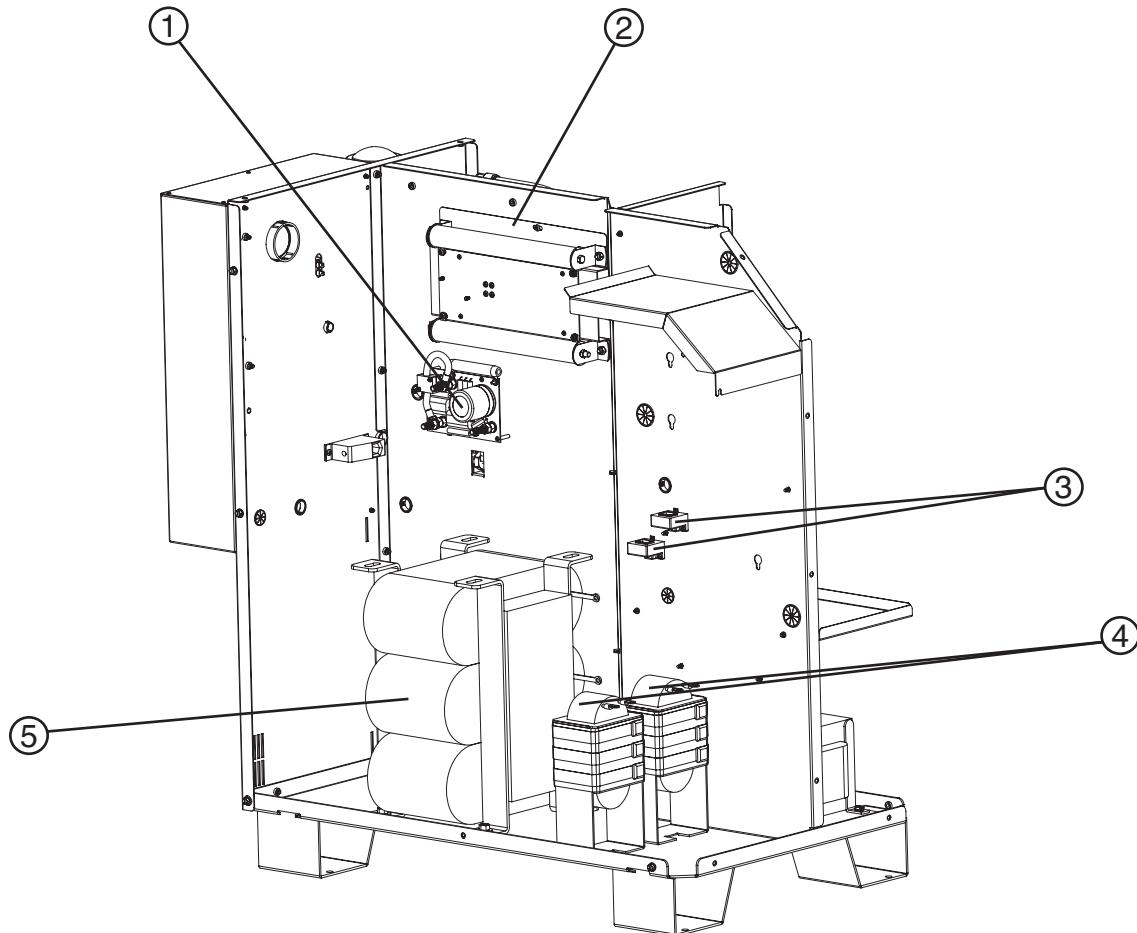
Power supply



<u>Item</u>	<u>Part number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	027634	Filter assembly		1
	027664	Filter element		1
2	127014	Cap: coolant reservoir		1
3	229107	Chopper assembly	CH1	1
4	127039	6" fan :230 CFM, 115 VAC 50-60 HZ		2
5	027079	10" fan :450-550 CFM, 120 VAC 50-60 HZ		1
6	109638*	EMI filter (not shown)		1

*400 volt power supplies

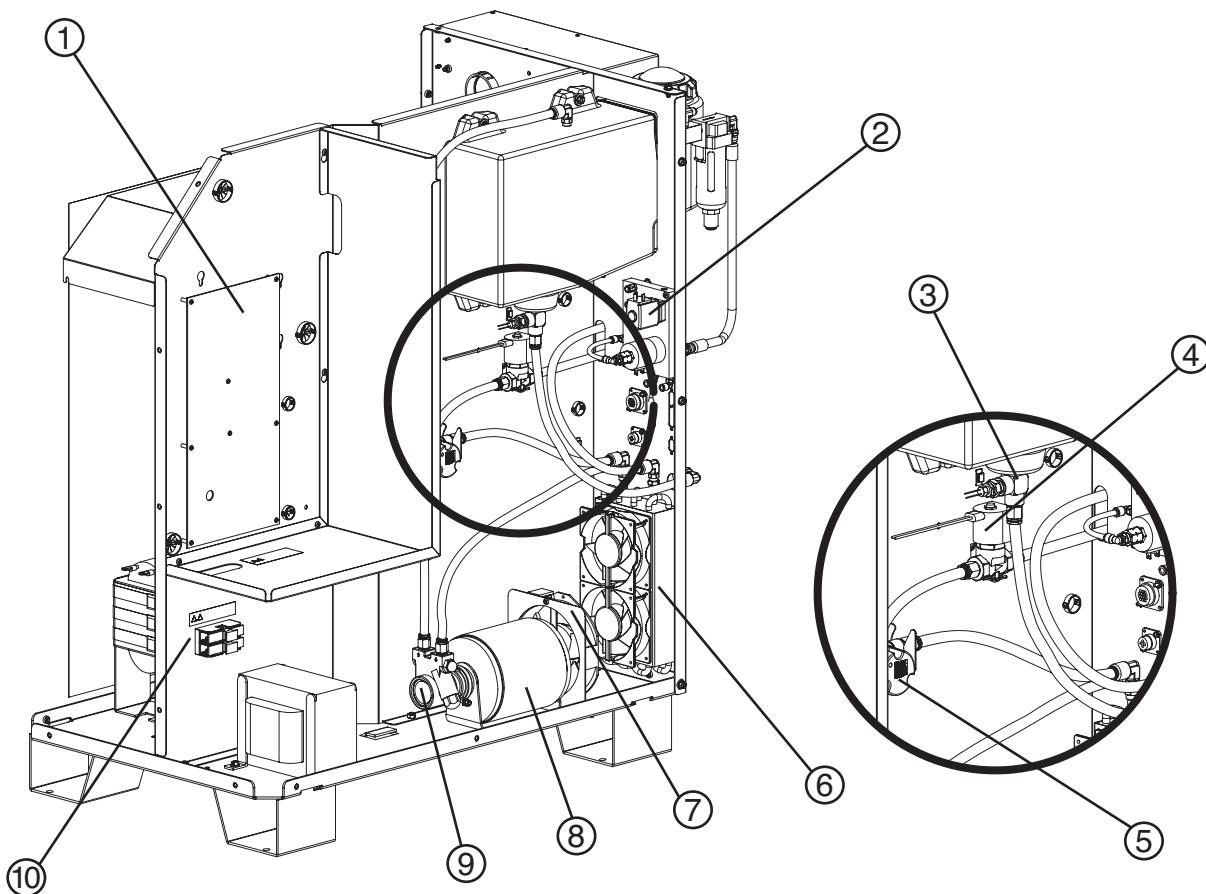
Power supply



Item	Part number	Description	Designator	Qty.
1	041932	PCB: I/O	PCB6	1
2	229106	Pilot arc start circuit assembly	PCB2	1
3	109004	Current sensor: hall 100 amp, 4 volt	CS1, CS2	2
4	014310	Inductor: 65A 1Mh	L1/L2	2
5	014283	Main transformer: 200V, 50-60 Hz	T1	1
	014284	Main transformer: 220V, 50 Hz	T1	1
	014282	Main transformer: 240V, 60 Hz	T1	1
	014303	Main transformer: 380V, 50-60 Hz	T1	1
	014283	Main transformer: 400V, 50-60 Hz	T1	1
	014284	Main transformer: 440V, 50 Hz	T1	1
	014282	Main transformer: 480V, 60 Hz	T1	1
	014281	Main transformer: 600V, 60 Hz	T1	1

PARTS LIST

Power supply



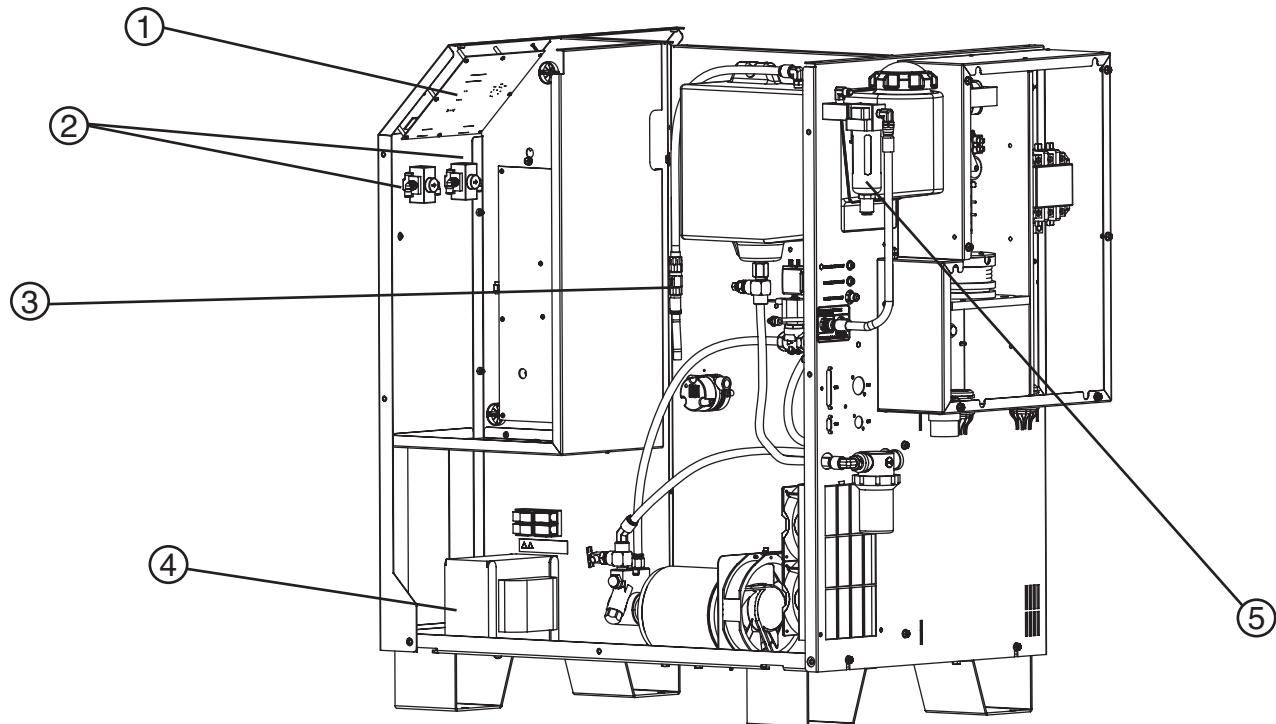
Item	Part number	Description	Designator	Qty.
1	041935	Power distribution PCB	PCB3	1
2	229102	Gas manifold		1
3	109393	Temperature switch		1
4	006046	Solenoid valve	CLT SOL	1
5	229119	Flow switch	FLS	1
6	027978	Heat exchanger assembly		1
7	127039*	6" fan :230 CFM, 115 VAC 50-60 HZ		1
8	128385	Motor assembly: 1/3HP 240 V 50-60 HZ		1
9	229126	Pump		1
10	008709**	Fuse: 20 amp, 500 volt	F1, F2	2
	008551***	Fuse: 7.5 amp, 600 volt	F1, F2	2

*200, 220, 380, 400 and 440, volt power supplies

**200, 220 and 240 volt power supplies

***380, 400, 440, 480 and 600 volt power supplies

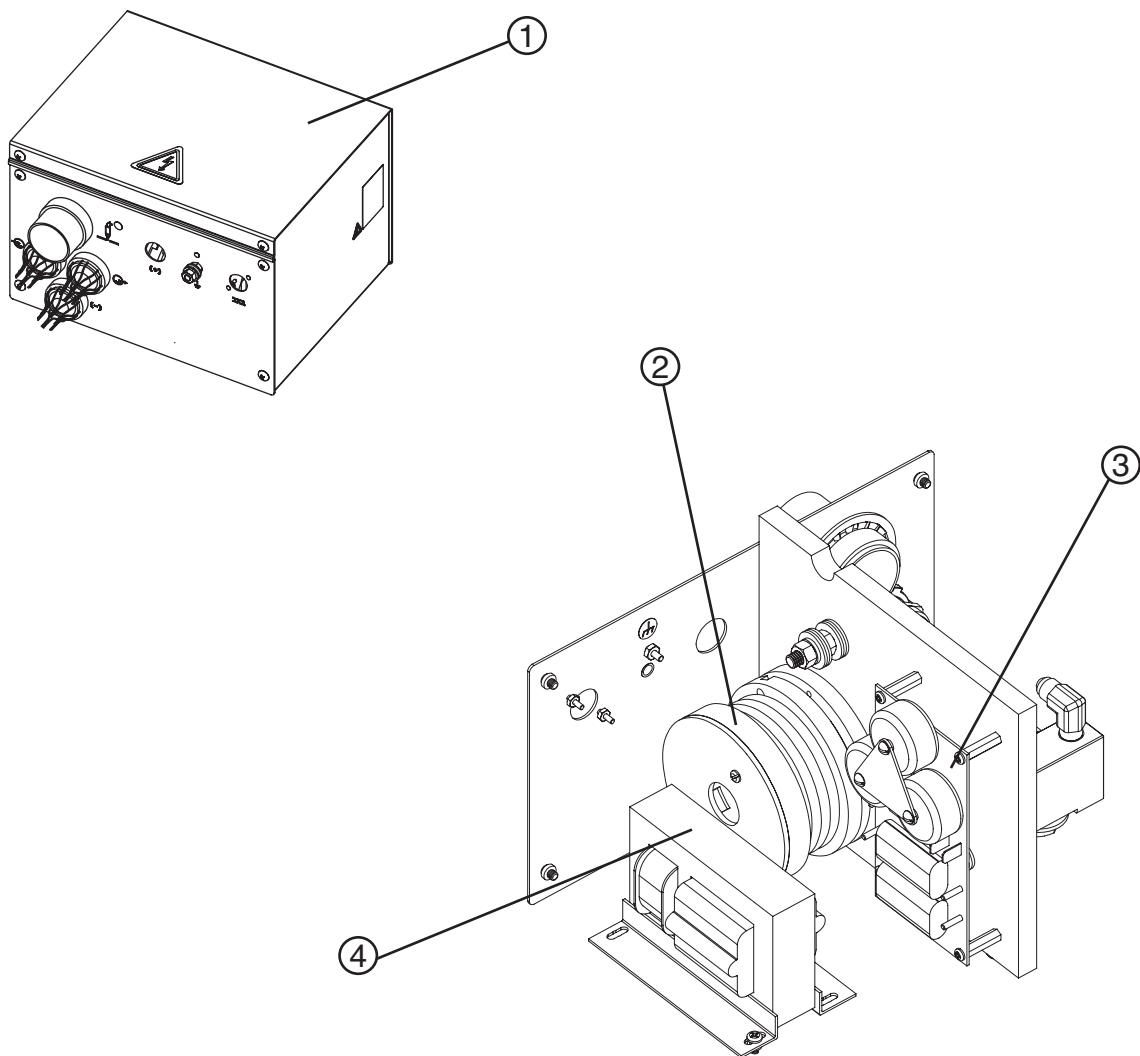
Power supply



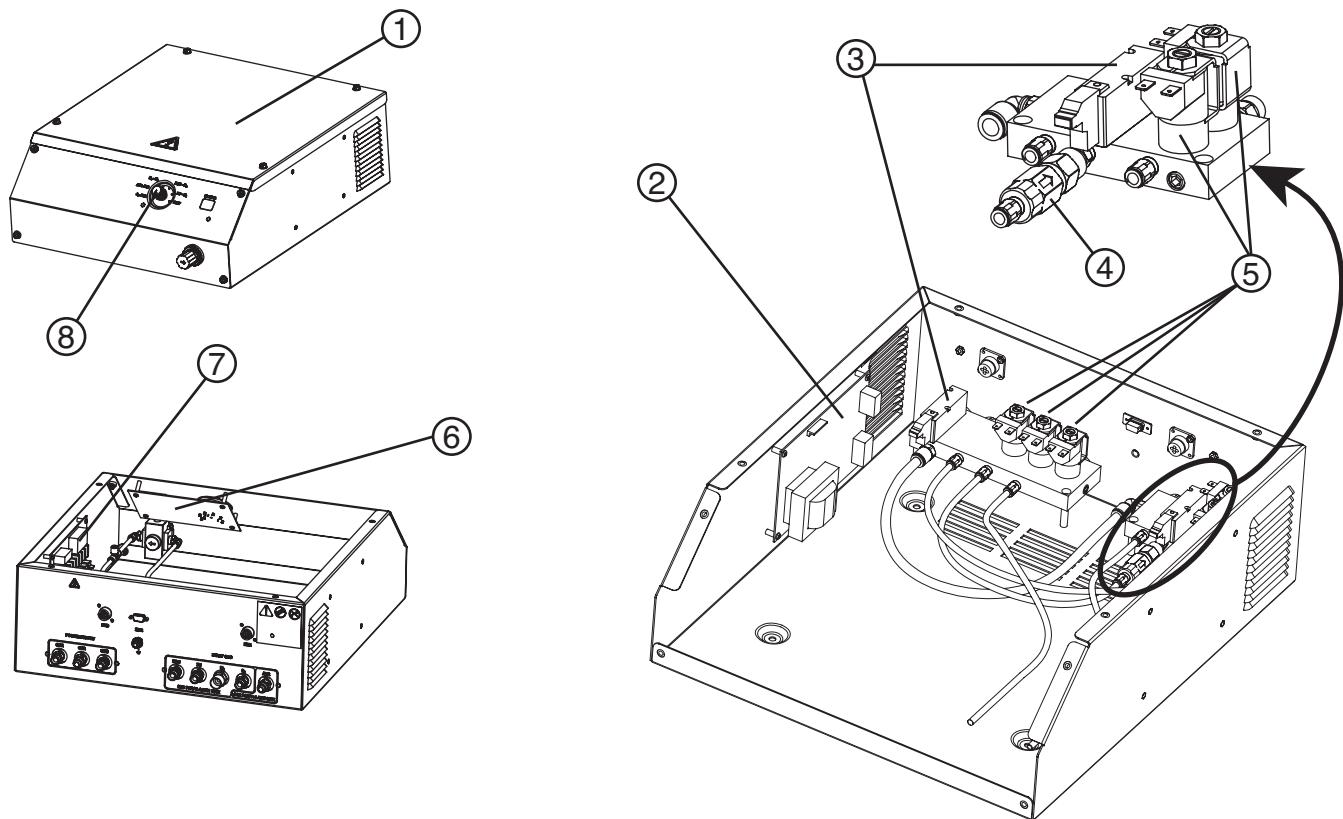
Item	Part number	Description	Designator	Qty.
1	041938	Control PCB	PCB4	1
2	011101	Regulator		2
3	006075	Check valve		1
4	129786 229117 129966 229094 129787 229013 129967 129989	Control transformer: 200 V power supply Control transformer: 220 V power supply Control transformer: 240 V power supply Control transformer: 380 V power supply Control transformer: 400 V power supply Control transformer: 440 V power supply Control transformer: 480 V power supply Control transformer: 600 V power supply	T2	1 1 1 1 1 1 1 1
5	011093 011105	Filter element O-ring: filter bowl		1 1

PARTS LIST

RHF Ignition console



<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	078172	Ignition Console		
2	129831	Coil assembly	T2	1
3	041817	HFHV Ignition PCB		1
4	129854	Transformer	T1	1

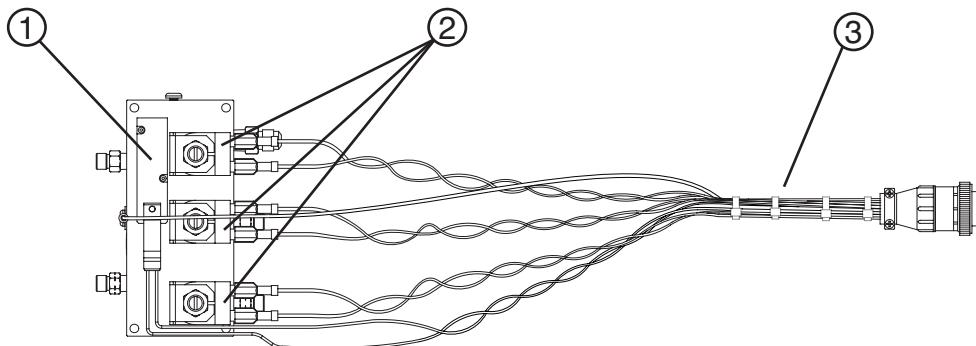
Fuel-gas console

Item	Part number	Description	Designator	Qty.
1	078201	Fuel-gas console		1
	001970	Cover: fuel-gas console		1
	001971	Front panel: fuel-gas console		1
2	041805	Power distribution PCB	PCB1	1
3	006135	Solenoid valve	SV0 and SV7	2
4	006075	Check valve		1
5	006109	Solenoid valve	SV1-SV5	5
	006112	Replacement solenoid coil		5
6	041971	Control PCB	PCB2	1
7	041962	Valve driver PCB	PCB3	1
8	108590	knob		2
	108591	Knob cover		2

PARTS LIST

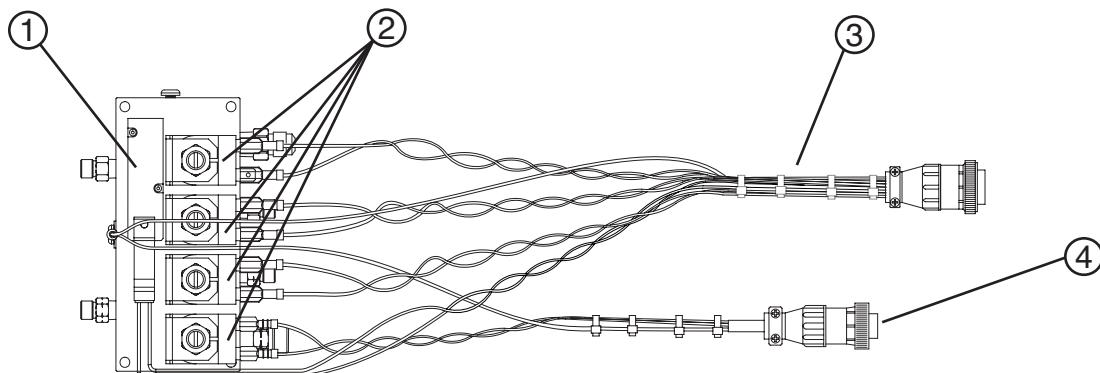
Off-valve (standard)

<u>Item</u>	<u>Part number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
	229105	Off valve assembly (includes cable)		1
1	006135	Solenoid valve	SV2	1
2	006109	Solenoid valve	SV3-SV5	3
	006112	Replacement solenoid coil		3
3	123870	Off-valve cable		1



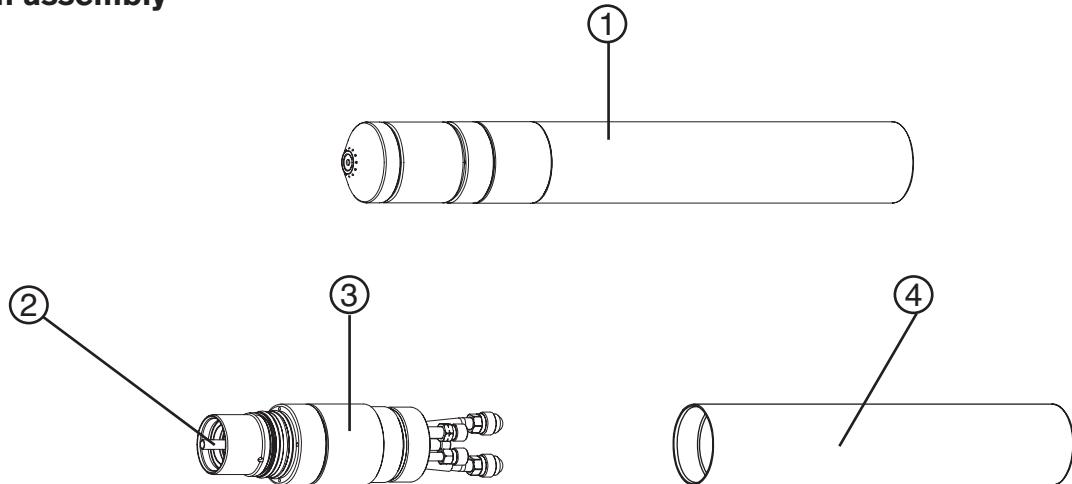
Off-valve (fuel-gas)

<u>Item</u>	<u>Part number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
	229130	Off valve assembly		1
1	006135	Solenoid valve	SV2	1
2	006109	Solenoid valve	SV3-SV6	4
	006112	Replacement solenoid coil		4
3	123870	Off-valve cable		1
4	123912	Off-valve cable (fuel-gas)		1



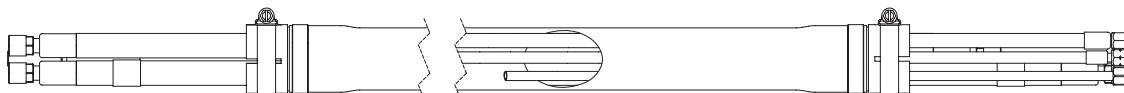
HySpeed torch

Torch assembly



<u>Item</u>	<u>Part number</u>	<u>Description</u>
1	228144	HSD machine torch assembly
2	220521	Water tube
3	220474	Torch main body
4	220473	Torch mounting sleeve

Torch leads



<u>Part number</u>	<u>Description</u>
228050	7.5 m (25 ft)
228051	15 m (50 ft)

PARTS LIST

Mild steel consumable parts kit - 228146

Note: See *Consumable selection* or *Cut charts* for specific applications

Part number	Description	Qty.
004630	Electrode gauge assembly	1
044026	O-ring: 1.239" X .070"	2
027055	Lubricant: silicone 1/4-oz tube	2
027102	Tool: electrode removal / replacement	1
220487	Electrode	3
220488	Swirl ring	1
220489	Nozzle	3
220490	Retaining cap	1
220491	Shield	1
220492	Nozzle	3
220525	Nozzle	2
220528	Electrode	2
220529	Swirl ring	1
220530	Nozzle	2
220532	Shield	1
220578	Retaining cap with IHS tab	1
220340	Water tube with o-ring	1

Stainless steel / Aluminum consumable parts kit - 228156

Note: See *Consumable selection* or *Cut charts* for specific applications

Part number	Description	Qty.
044026	O-ring: 1.239" X .070"	2
027055	Lubricant: silicone 1/4-oz tube	2
027102	Tool: electrode removal / replacement	1
020415	Electrode	3
220488	Swirl ring	1
220490	Retaining cap: clockwise	1
220491	Shield	1
220492	Nozzle	2
220525	Nozzle	2
220528	Electrode	2
220529	Swirl ring	1
220532	Shield	1
220533	Retaining cap: counter-clockwise	1
220534	Retaining cap: counter-clockwise with IHS tab	1
220535	Nozzle	3
220536	Shield	1
220578	Retaining cap: clockwise with IHS tab	1
220340	Water tube with o-ring	1

PARTS LIST

Recommended spare parts

Power supply

Part number	Description	Designator	Qty.
005262	Power switch: green illuminated		1
011093	Filter element		1
229107	Chopper assembly	CH1	1
127039	6" fan :230 CFM, 115 VAC 50-60 HZ		1
027079	10" fan :450-550 CFM, 120 VAC 50-60 HZ		1
041932	PCB: I/O	PCB6	1
229106	Pilot arc start circuit assembly	PCB2	1
109004	Current sensor: hall 100 amp, 4 volt	CS1, CS2	1
008709*	Fuse: 20 amp, 500 volt	F1, F2	2
008551**	Fuse: 7.5 amp, 600 volt	F1, F2	2
041935	Power distribution PCB	PCB3	1
041938	Control PCB	PCB4	1
229119	Flow switch	FLS	1
006075	Check valve		1
006046	Solenoid valve	CLT SOL	1
229126	Coolant pump		1
128385	Kit: motor, 1/3HP 240 V 50-60 HZ		1

*200, 220 and 240 volt power supplies

**380, 400, 440, 480 and 600 volt power supplies

Fuel-gas console (optional)

Part number	Description	Designator	Qty.
041805	Power distribution PCB	PCB1	1
041962	Valve driver PCB	PCB3	1
041971	Control PCB	PCB2	1
006135	Solenoid valve	SV0 and SV7	1
006109	Solenoid valve	SV1-SV5	2

Off-valve (standard)

Part number	Description	Designator	Qty.
006135	Solenoid valve	SV2	1
006109	Solenoid valve	SV3-SV5	1

Off-valve (fuel-gas)

Part number	Description	Designator	Qty.
006135	Solenoid valve	SV2	1
006109	Solenoid valve	SV3-SV5	1

Ignition console

Part number	Description	Designator	Qty.
041817	HFHV Ignition PCB	PCB9	1
129854	Transformer	T1	1

PARTS LIST

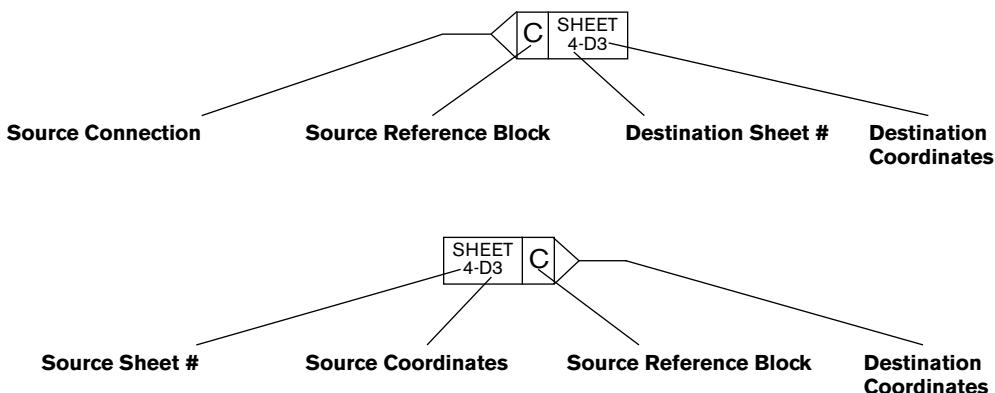
Section 7

WIRING DIAGRAMS

Introduction

This section contains the wiring diagrams for the system. When tracing a signal path or referencing with the *Parts List* or **Troubleshooting** sections, please be aware of the following format to assist you in understanding the wiring diagrams' organization:

- Sheet numbers are located in the lower right-hand corner.
- Page-to-page referencing is done in the following manner:



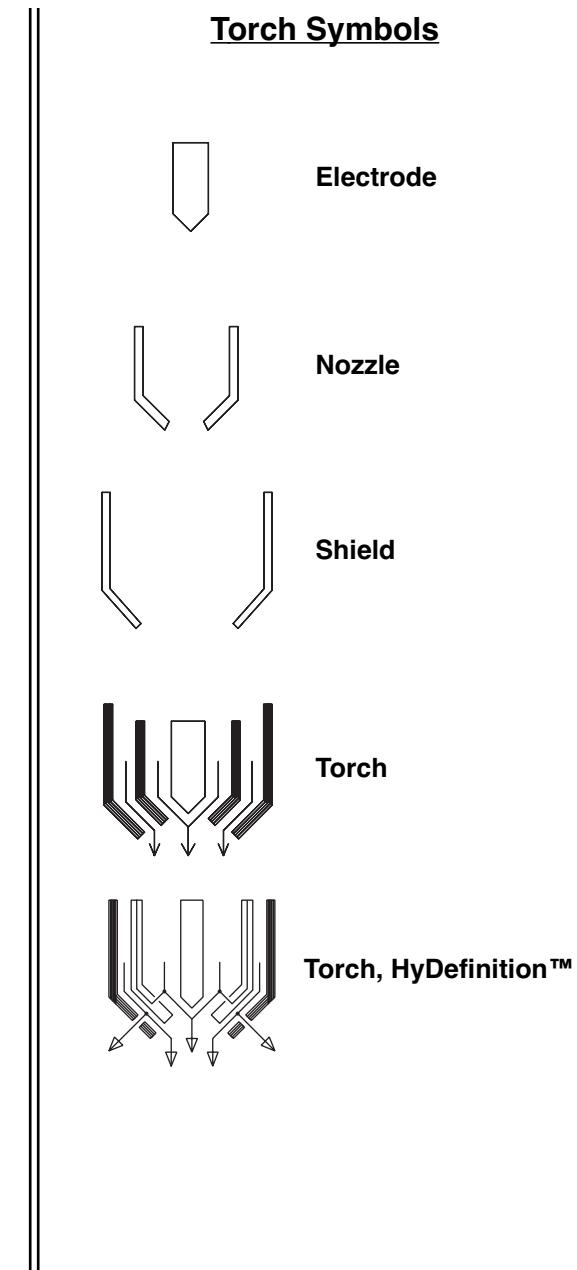
Destination and **Source Coordinates** refer to letters A-D on the Y-axis of each sheet and numbers 1-4 on the X-axis of each sheet. Lining up the coordinates will bring you to the source or destination blocks (similar to a road map).

Wiring diagram symbols

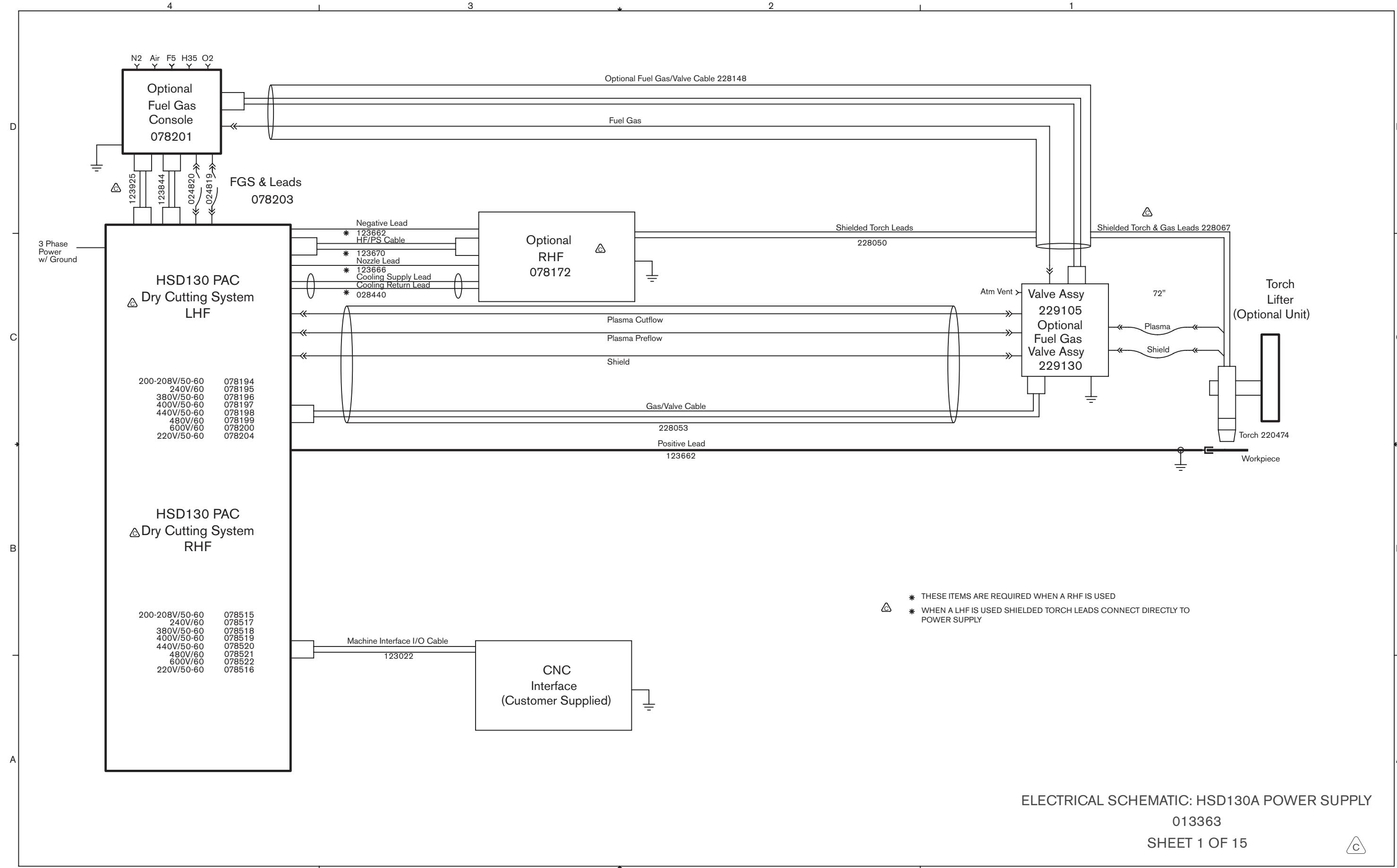
Wiring diagram symbols and their identification precede the system wiring diagrams in this section.

	Battery		Fuse		Push Button, Normally Closed
	Cap, polarized		Ground Clamp		Push Button, Normally Open
	Cap, non-polarized		Ground, Chassis		Receptacle
	Cap, feed-thru		Ground, Earth		Relay, Coil
	Circuit breaker		IGBT		Relay, Normally Closed
	Coax shield		Inductor		Relay, Normally Open
	Current Sensor		LED		Relay, Solid State, AC
	Current sensor		Lamp		Relay, Solid State, DC
	DC supply		MOV		Relay, Solid State, Dry
	Diode		Pin		Resistor
	Door interlock		Socket		SCR
	Fan		Plug		Shield
	Feedthru LC		PNP Transistor		Shunt
	Filter, AC		Potentiometer		Spark Gap

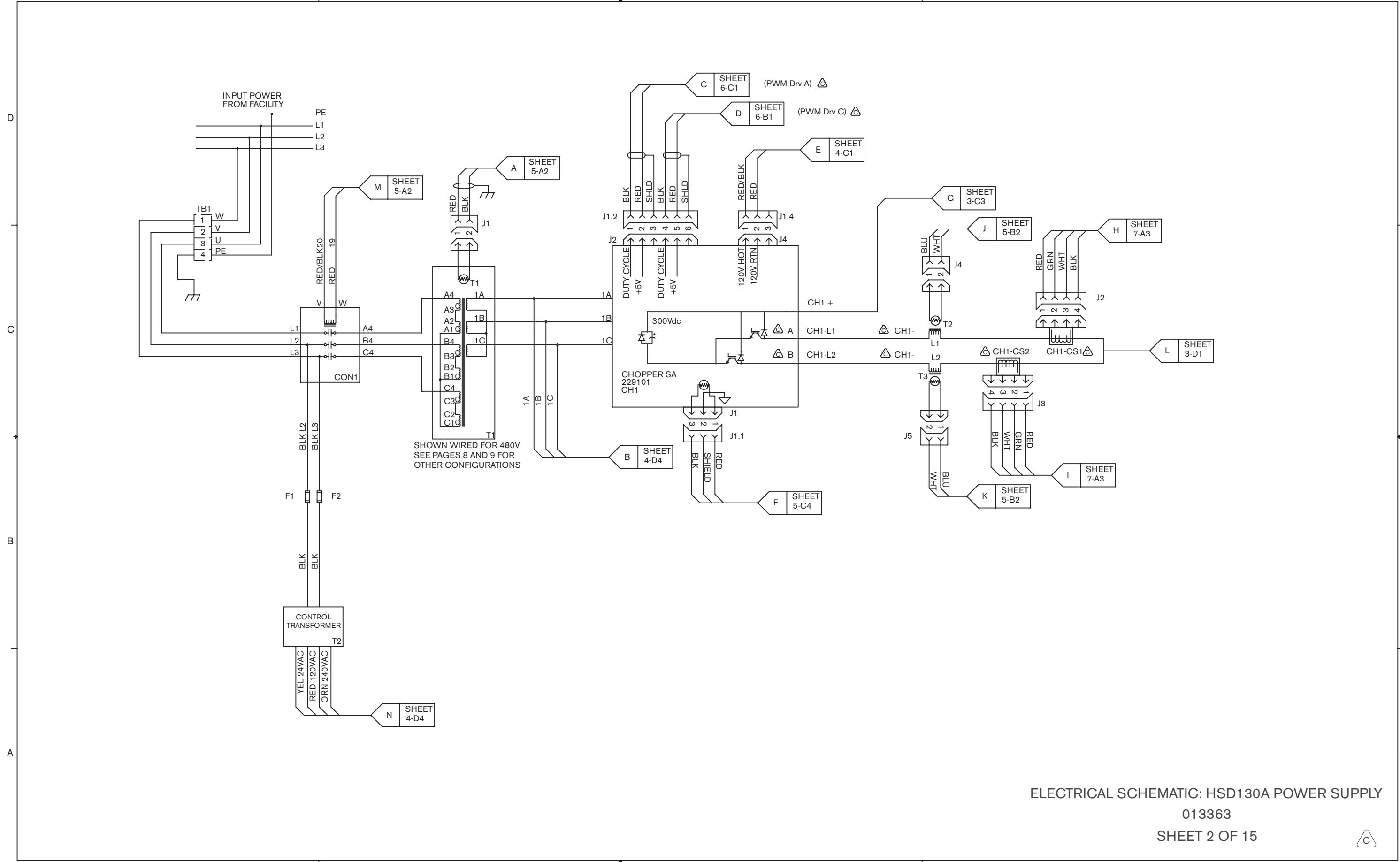
	Switch, Flow		Time Delay Open, NC/On
	Switch, Level, Normally Closed		Time Delay Closed, NO/Off
	Switch, Pressure, Normally Closed		Transformer
	Switch, Pressure, Normally Open		Transformer, Air Core
	Switch, 1 Pole, 1 Throw		Transformer Coil
	Switch, 1 Pole, 2 Throw		Triac
	Switch, 1 Pole, 1 Throw, Center Off		VAC Source
	Switch, Temperature, Normally Closed		Valve, Solenoid
	Switch, Temperature, Normally Open		Voltage Source
	Terminal Block		Zener Diode
	Time Delay Closed, NC/Off		
	Time Delay Open, NO/Off		

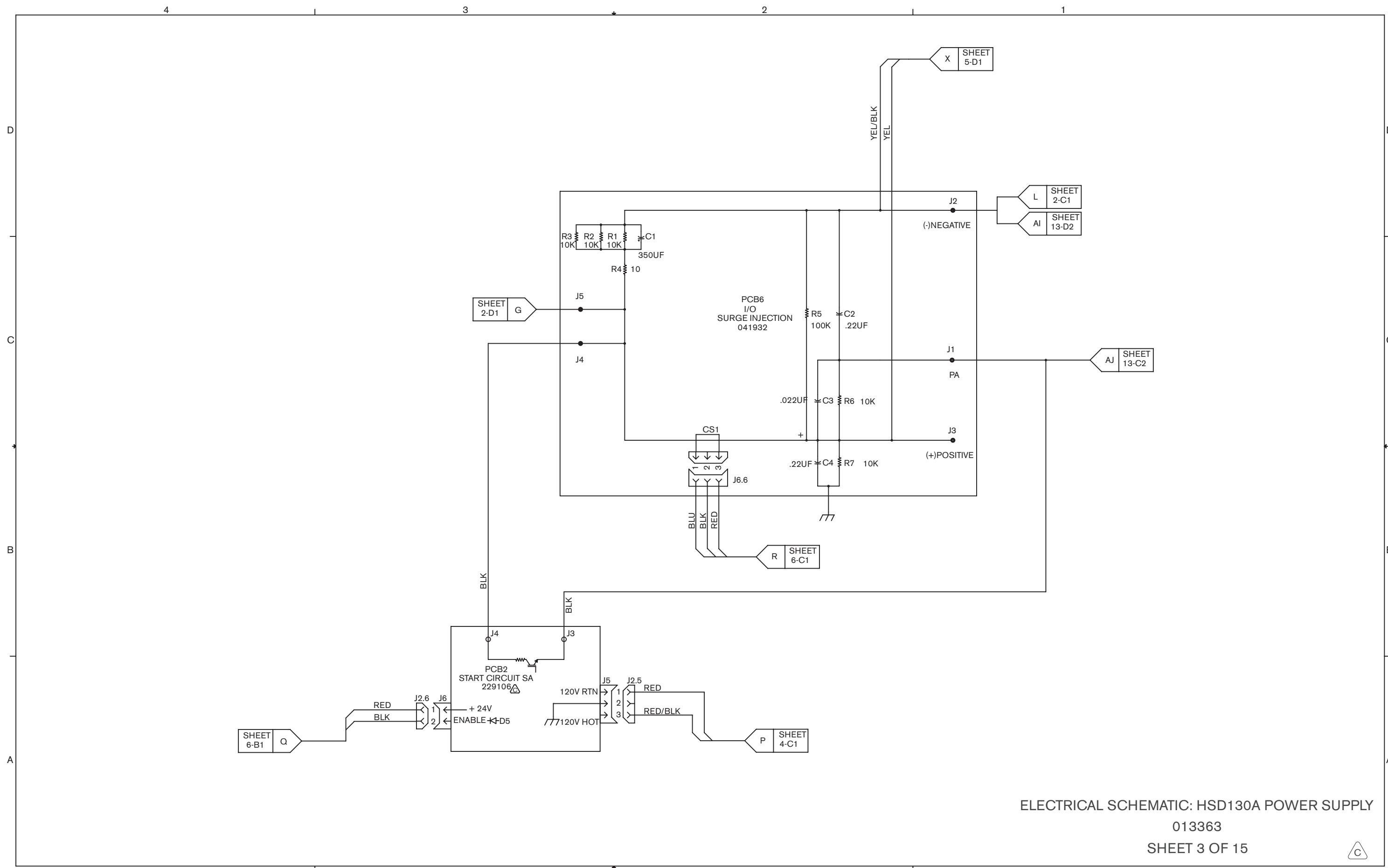


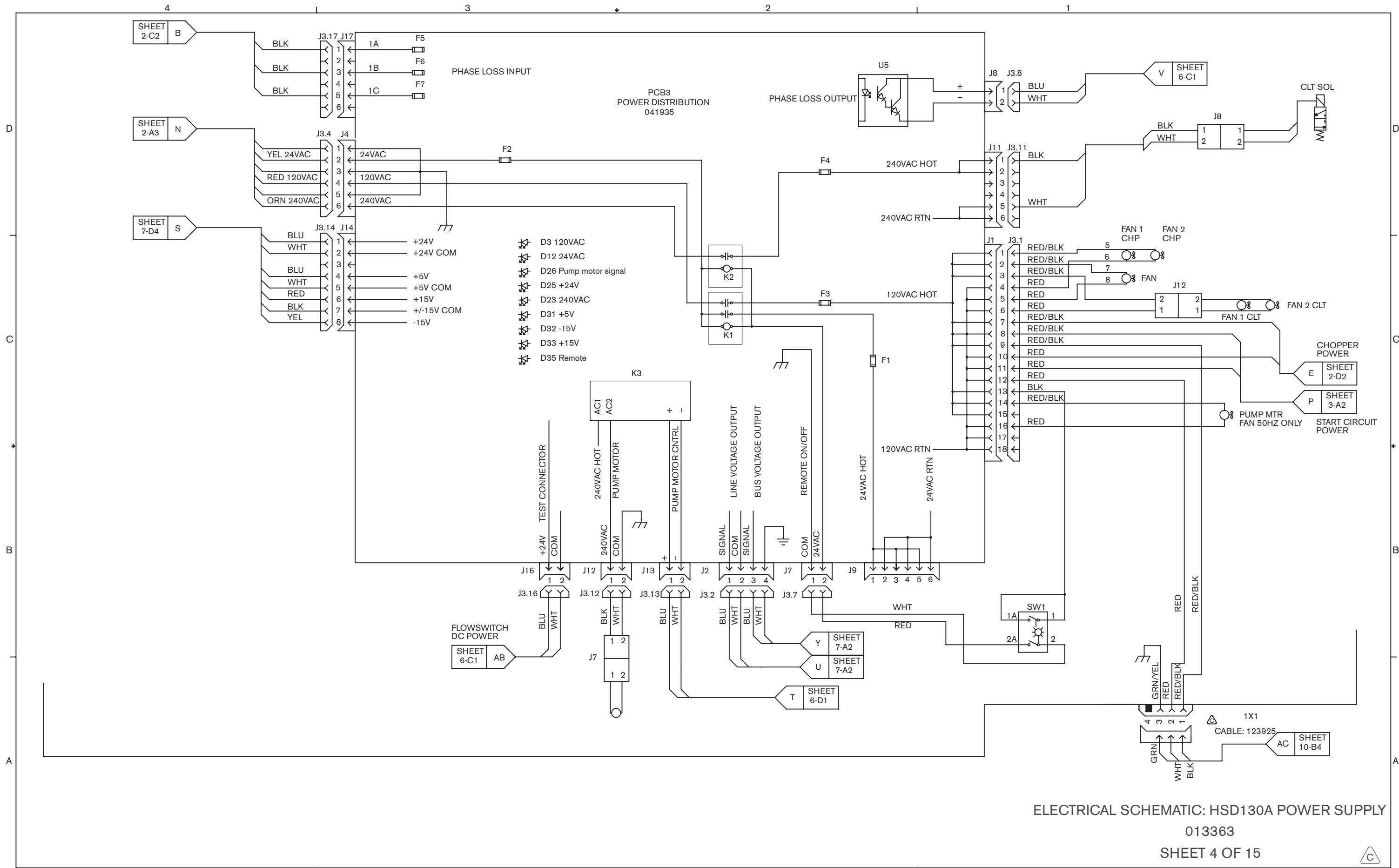
WIRING DIAGRAMS

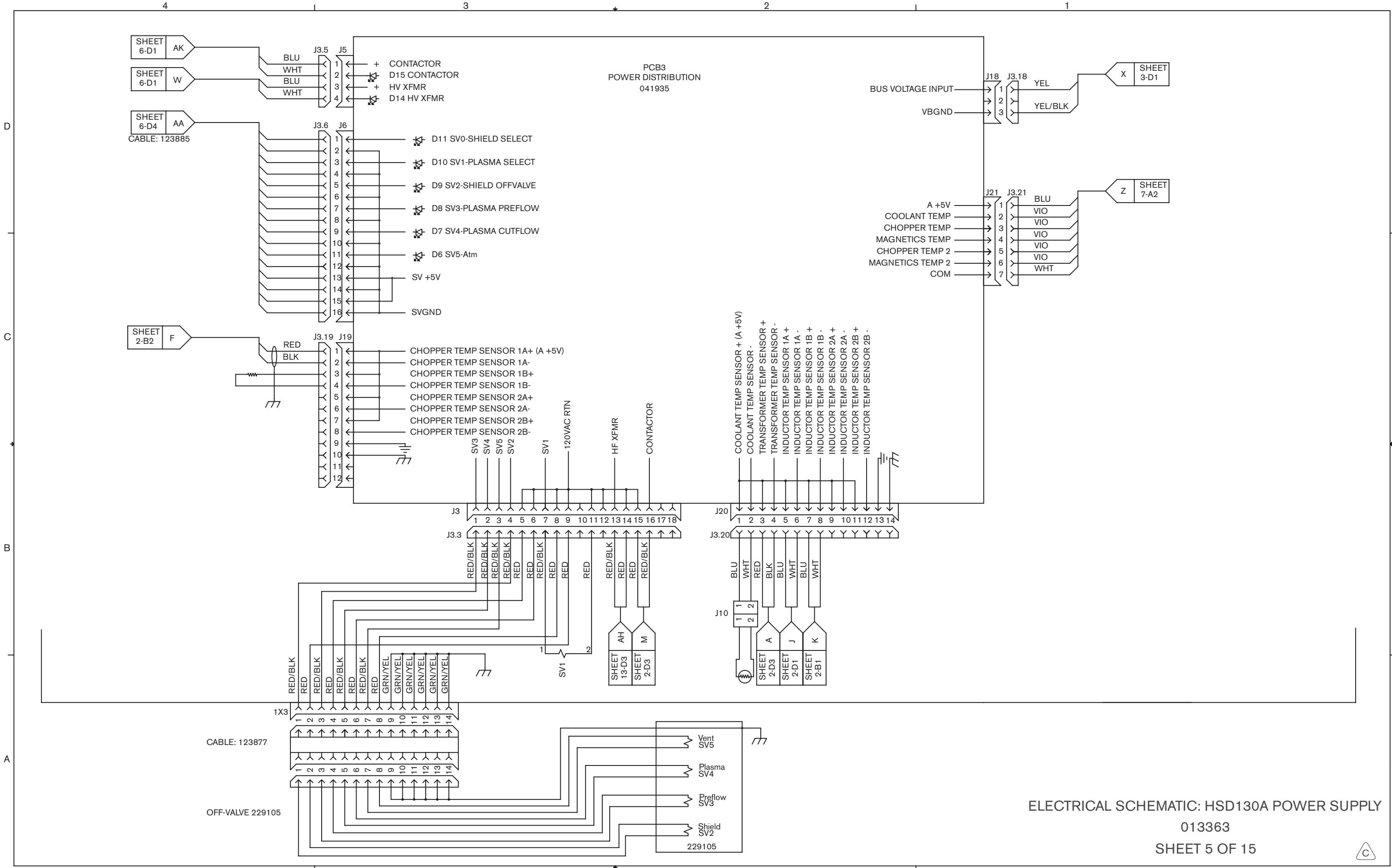


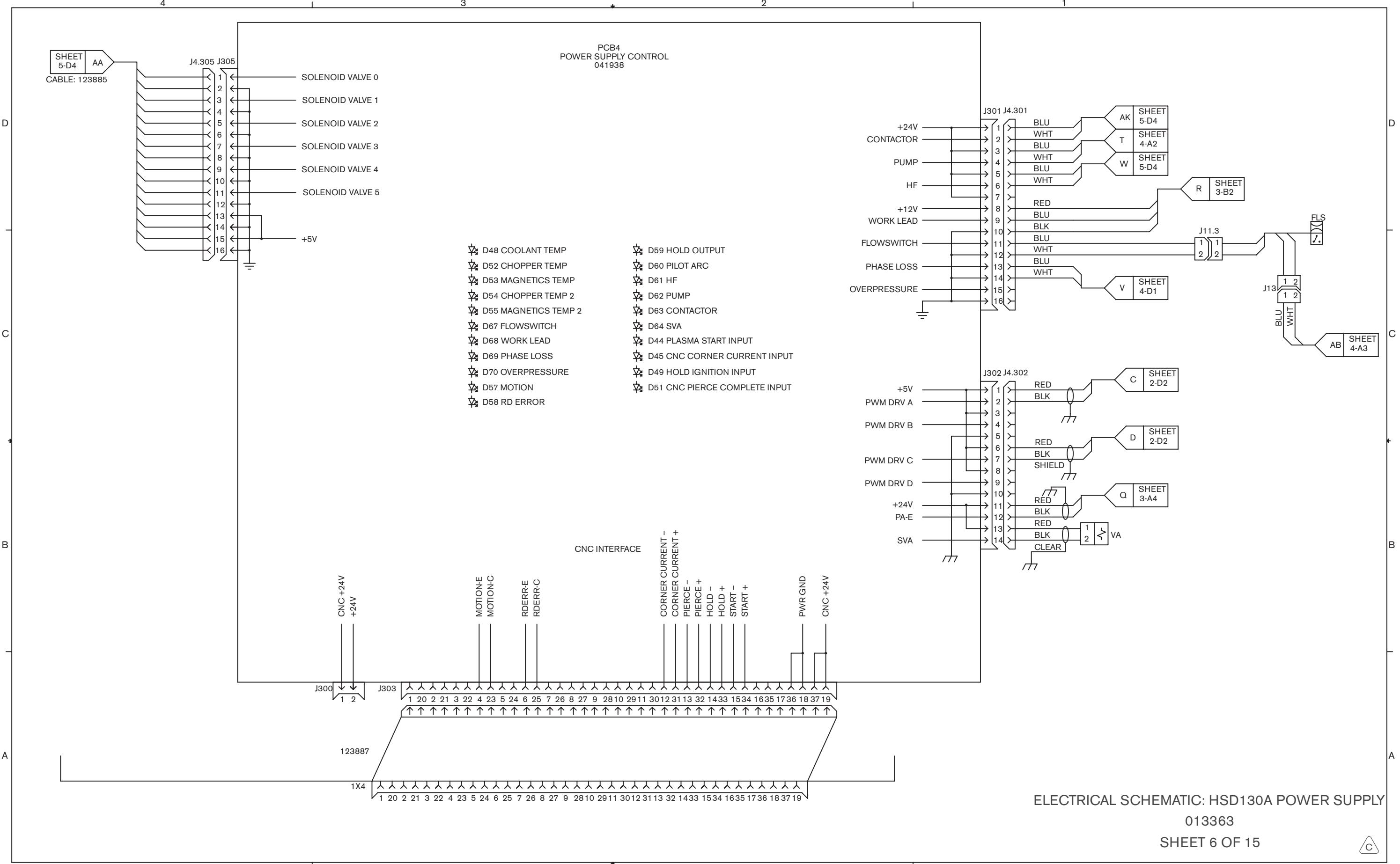
4 3 * 2 1

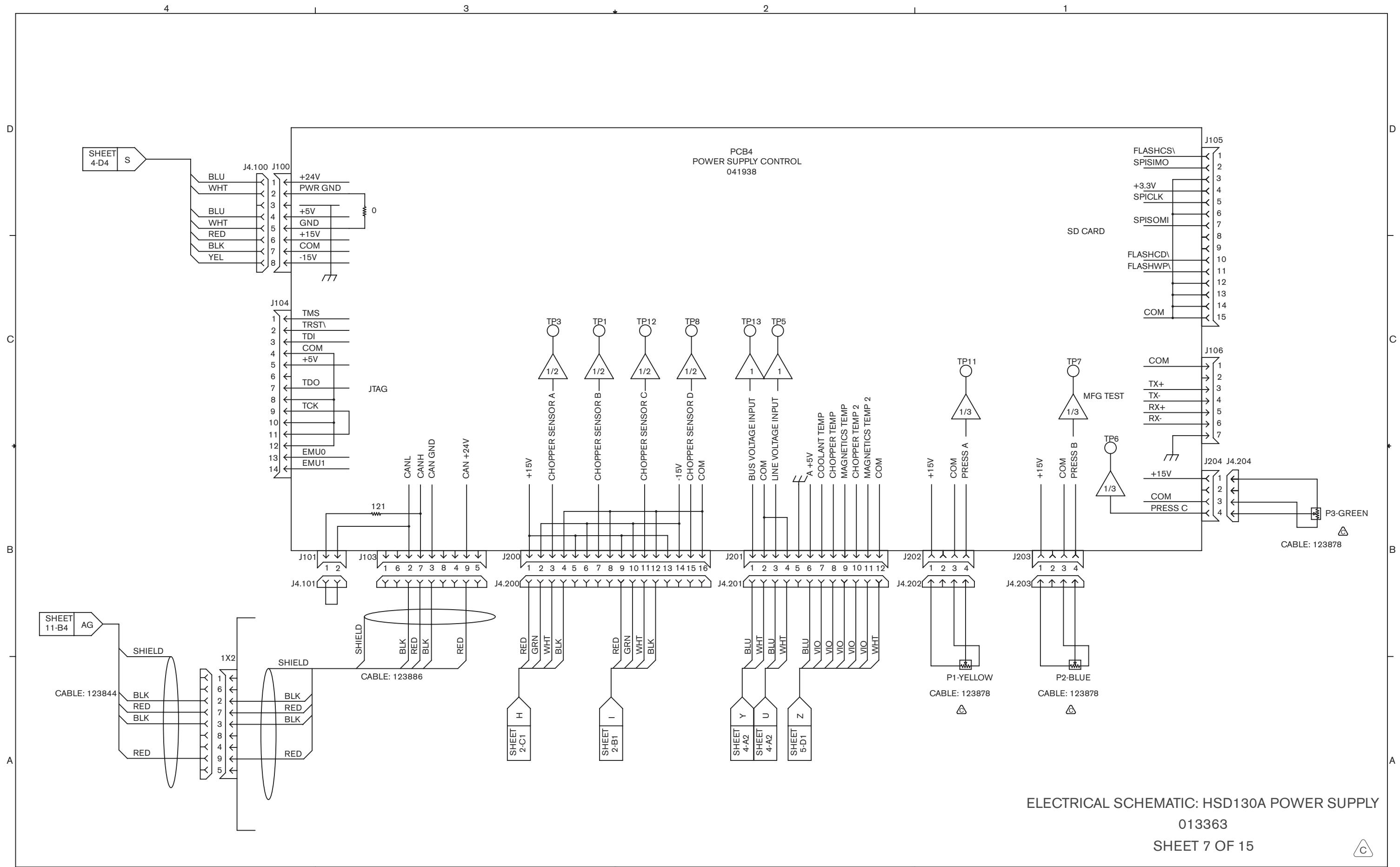


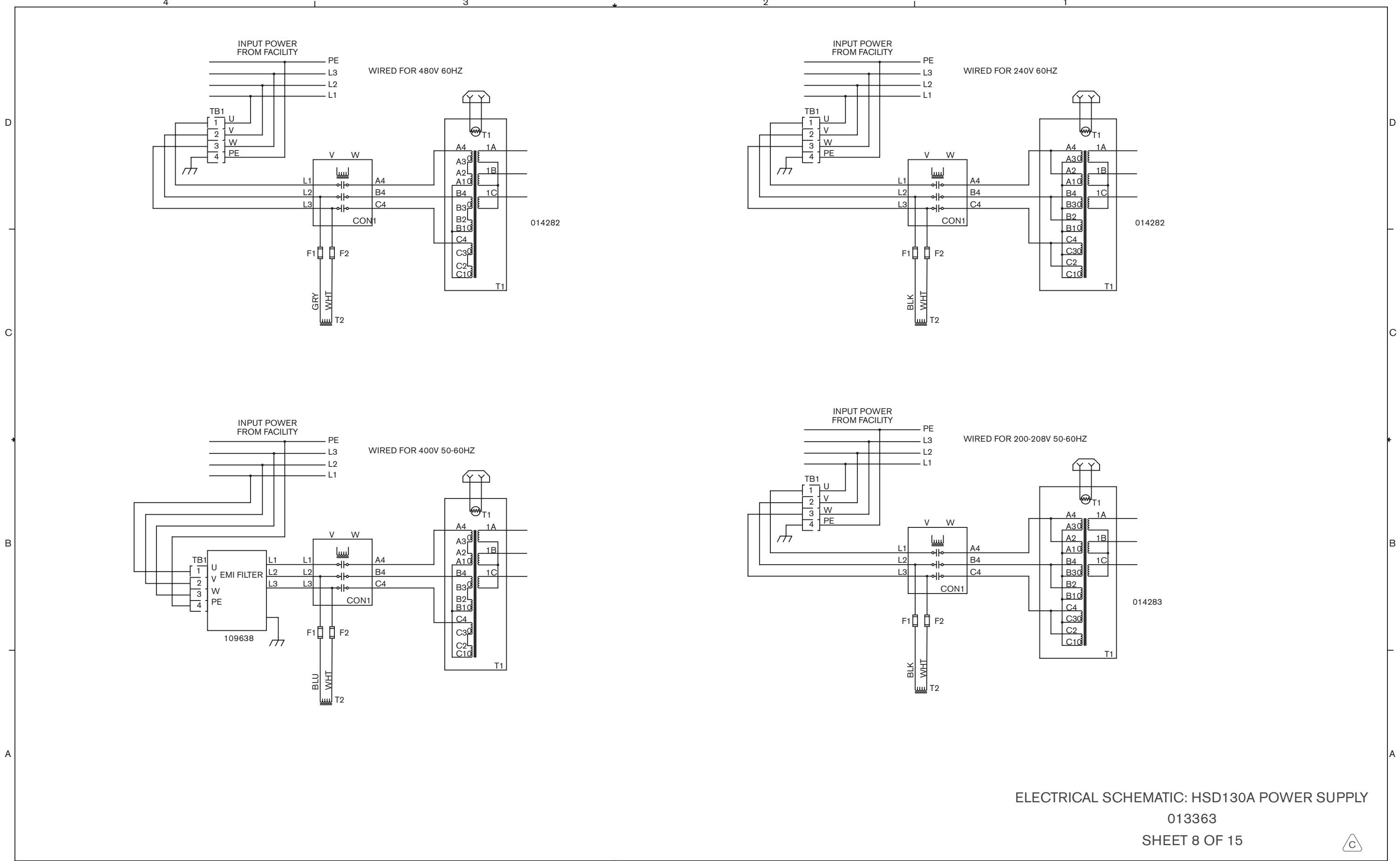










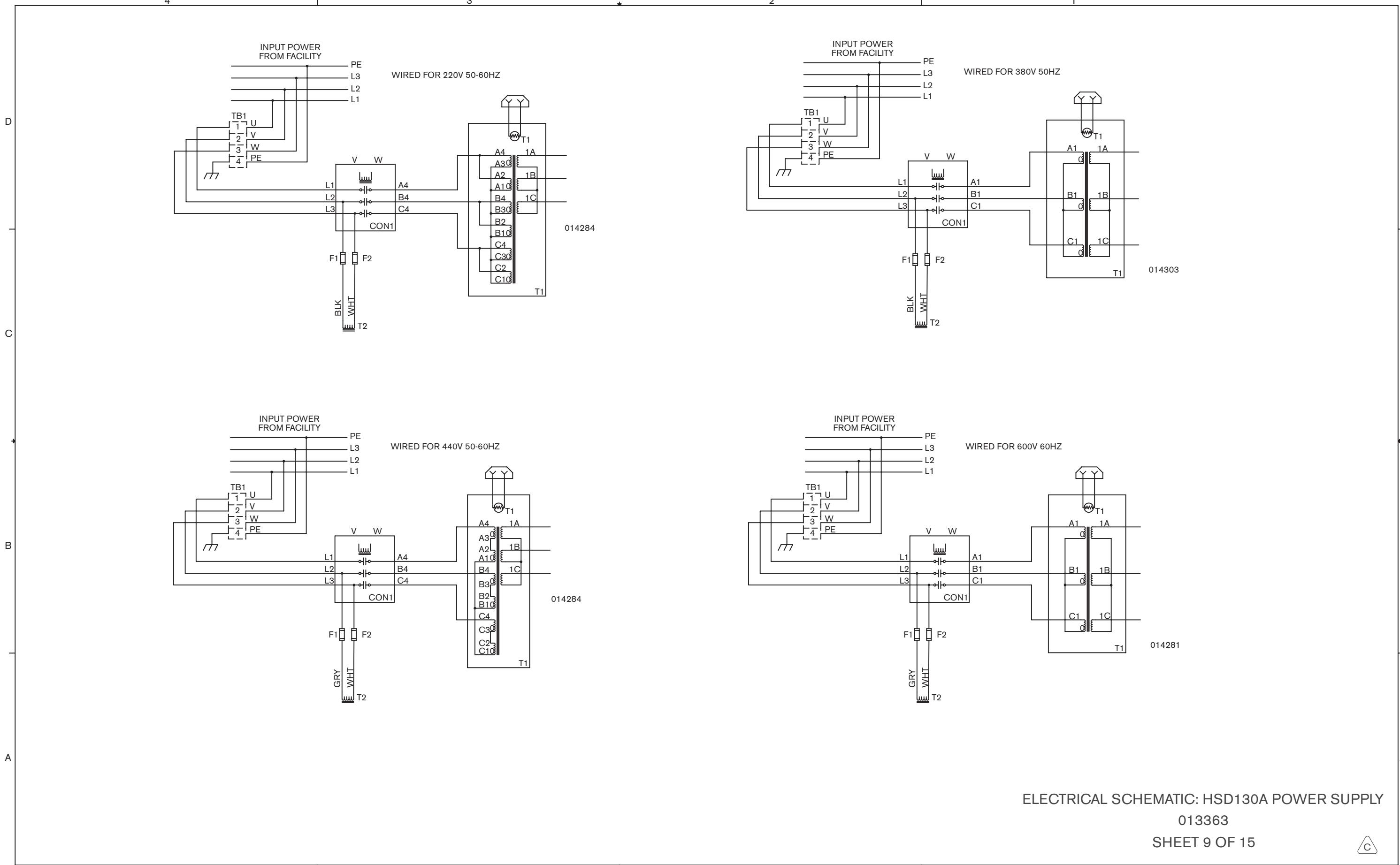


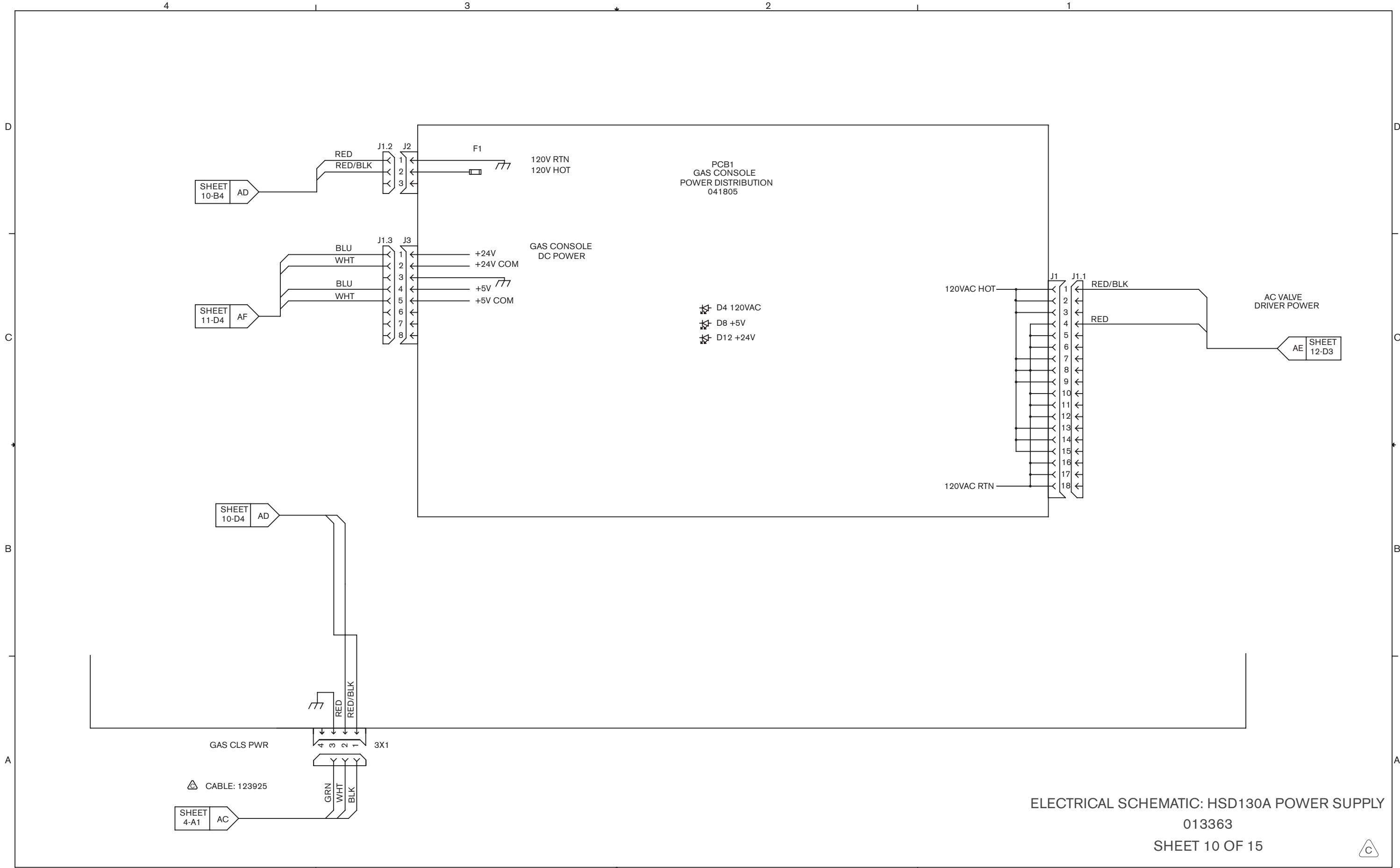
ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

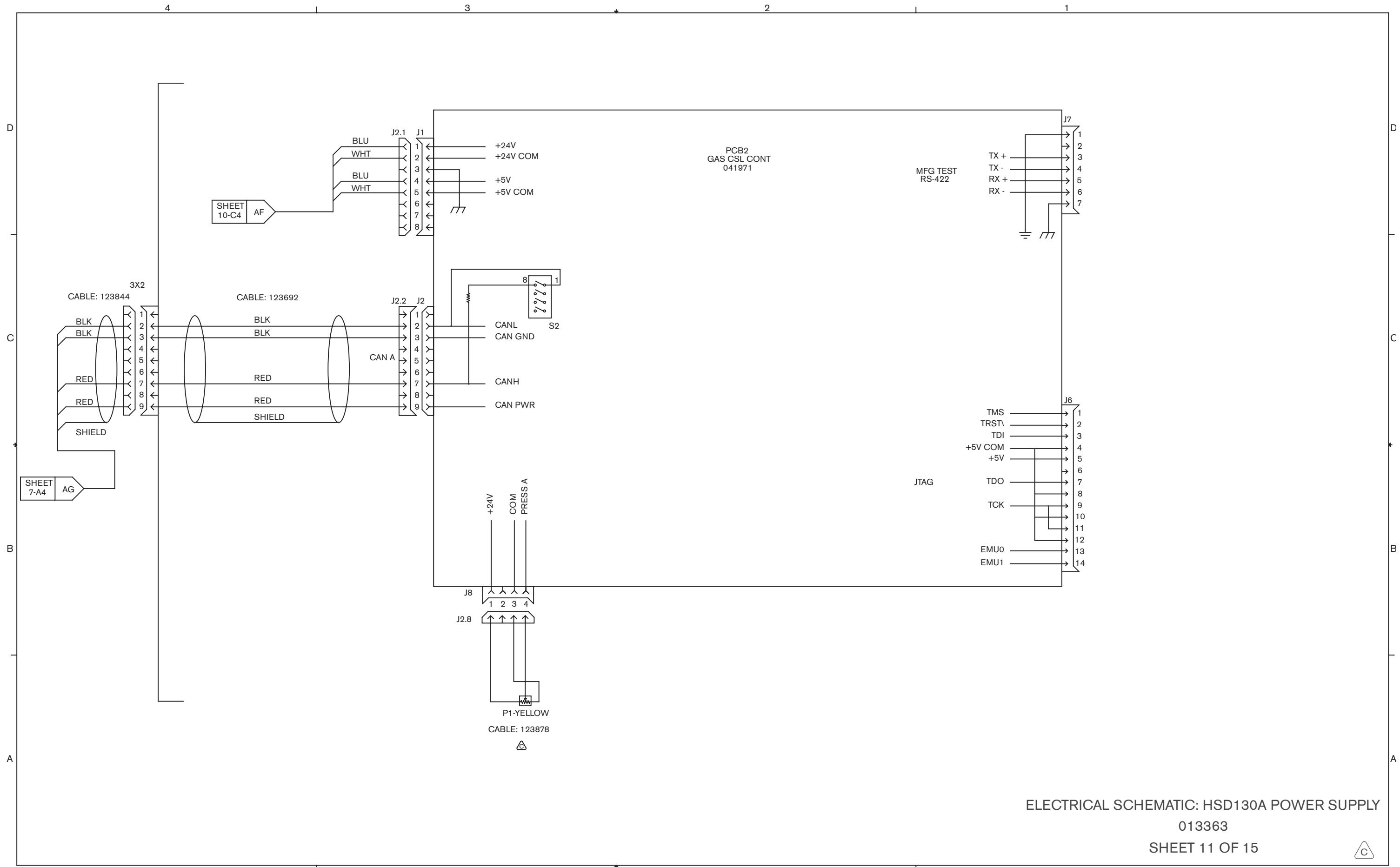
013363

SHEET 8 OF 15

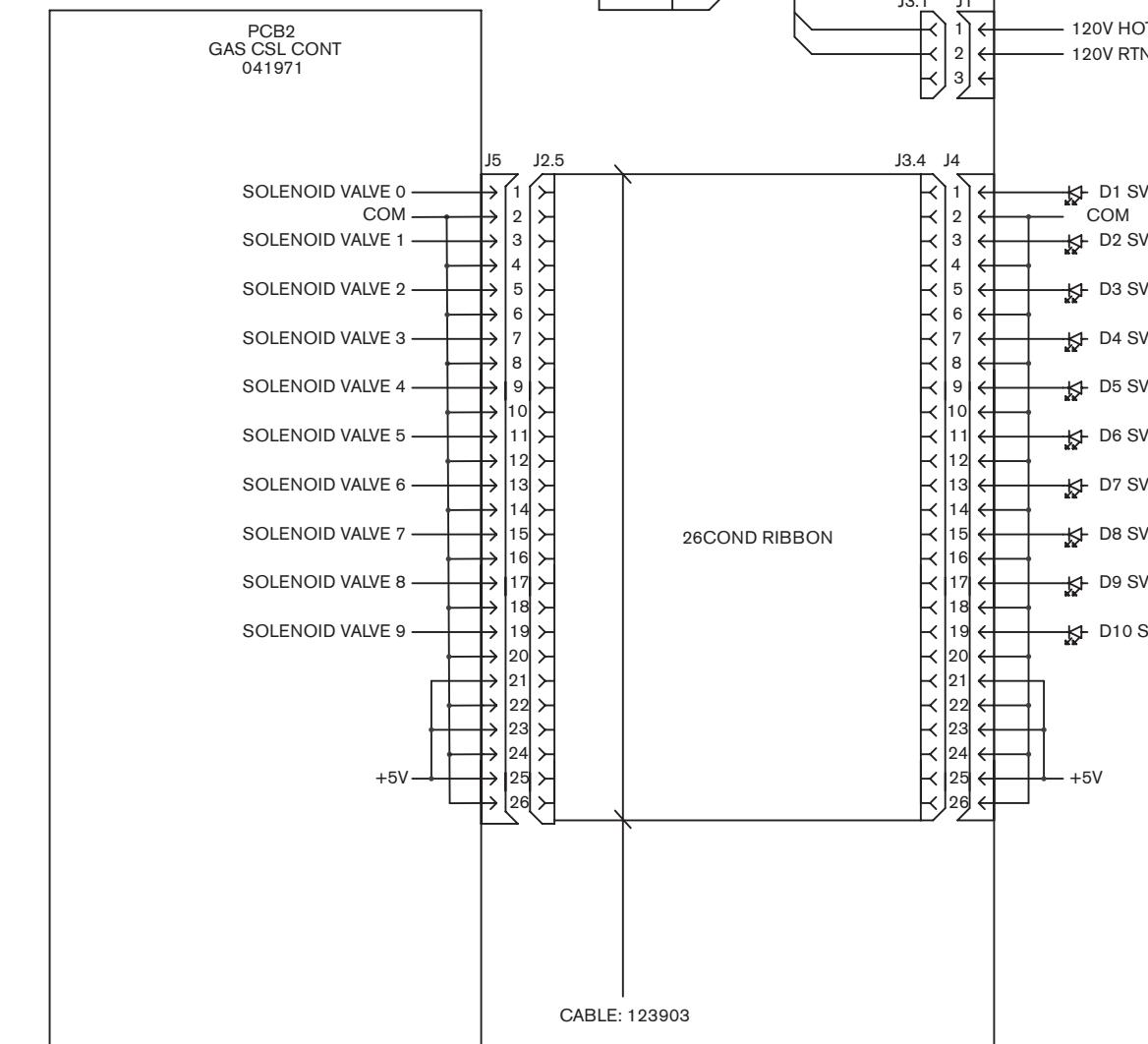








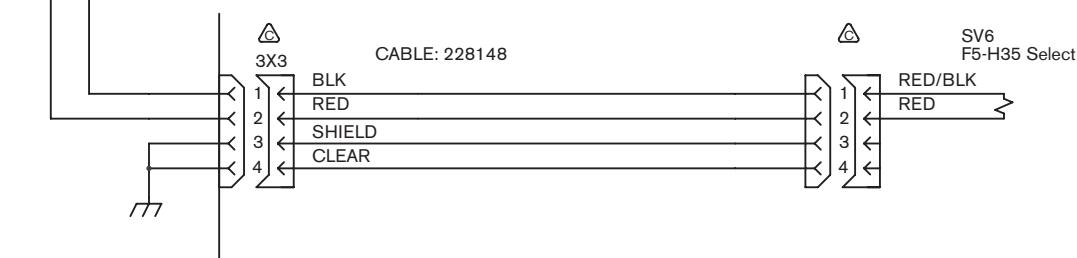
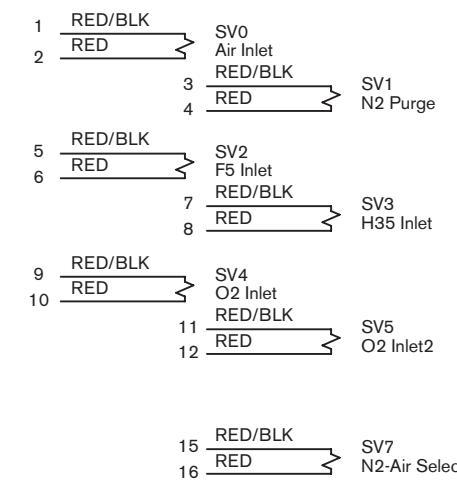
D



SHEET
10-C1 AE

PCB3
AC VALVE DRIVER
041962

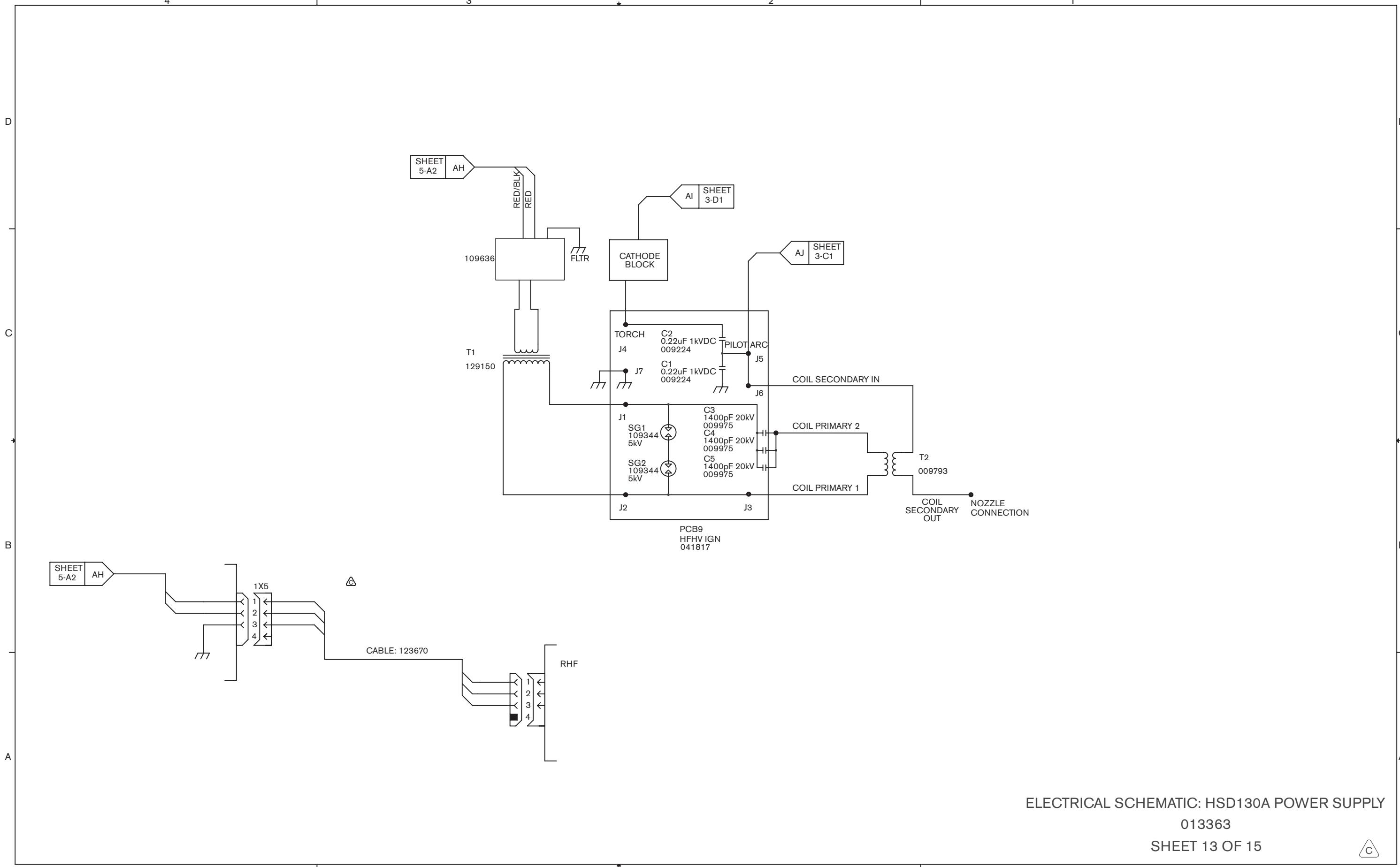
SV3 H35 Inlet	1	RED/BLK	7
SV2 F5 Inlet	2	RED/BLK	5
SV1 N2 Purge	3	RED/BLK	3
SV0 Air Inlet	4	RED/BLK	1
SV4 O2 Inlet	5	RED/BLK	9
SV2 RTN	6	RED	6
SV1 RTN	7	RED	4
SV0 RTN	8	RED/BLK	2
SV5 O2 Inlet2	9	RED	11
SV3 RTN	10	RED	8
120V HOT	11	RED/BLK	
120V HOT	12	RED/BLK	
SV6 F5-H35 Select	13	RED	10
SV4 RTN	14	RED	
120V HOT	15	RED/BLK	
120V HOT	16	RED/BLK	
SV7 N2-Air Select	17	RED	15
SV5 RTN	18	RED	12
SV6 RTN	19	RED	
SV7 RTN	20	RED	16
SV8 Spare	21		
SV9 Spare	22		
SV9 RTN	23		
SV8 RTN	24		



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 12 OF 15

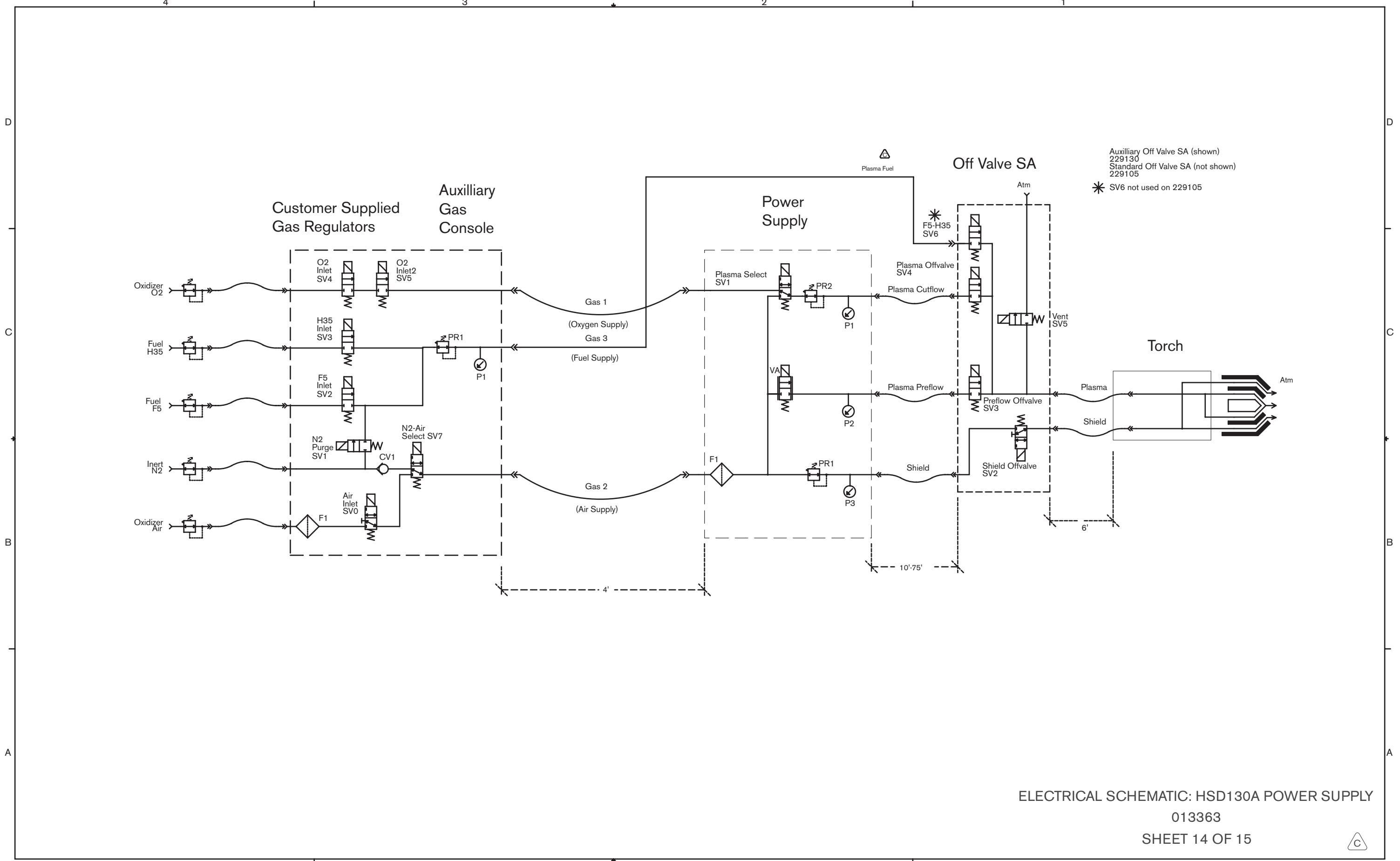


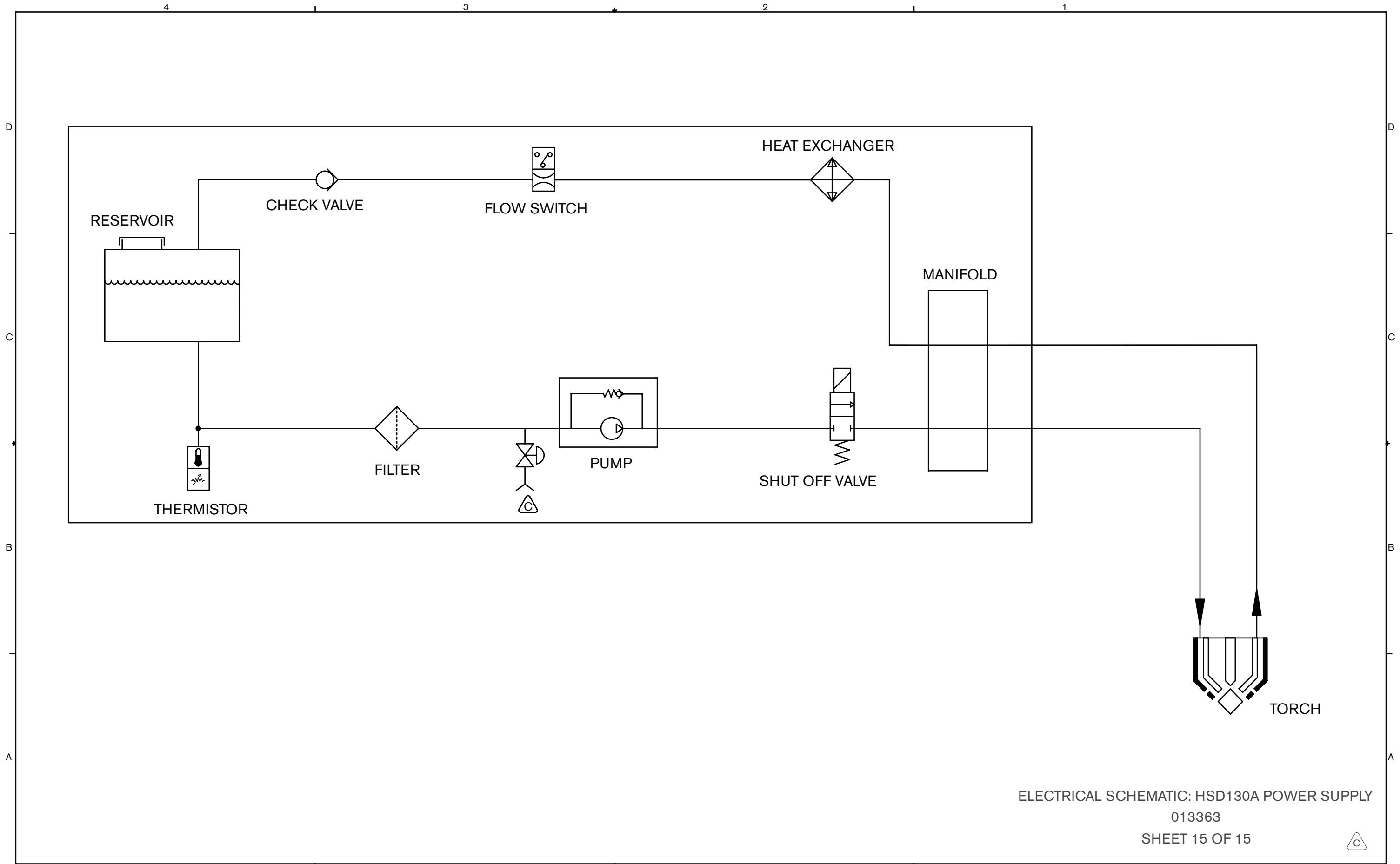
ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 13 OF 15

C





ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 15 OF 15

C

Appendix A

HYPERTHERM TORCH COOLANT SAFETY DATA

In this section:

Section 1	Chemical Product and Company Identification	a-2
Section 2	Information on Ingredients	a-2
Section 3	Hazards Identification.....	a-2
Section 4	First Aid Measures.....	a-3
Section 5	Fire Fighting Measures	a-3
Section 6	Accidental Release Measures.....	a-3
Section 7	Handling and Storage	a-3
Section 8	Exposure Controls / Personal Protection	a-4
Section 9	Physical and Chemical Properties	a-4
Section 10	Stability and Reactivity.....	a-4
Section 11	Toxicological Information	a-4
Section 12	Ecological Information.....	a-5
Section 13	Disposal Considerations	a-5
Section 14	Transport Information.....	a-5
Section 15	Regulatory Information.....	a-5
Section 16	Other Information	a-5

MATERIAL SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	Hypertherm Torch Coolant
Latest Revision Date	09-02-2004

ISSUE DATE	03-10-2005
------------	------------

EMERGENCY TELEPHONE NUMBERS

DISTRIBUTOR: **Hypertherm, Inc.**
Etna Road
Hanover, N.H. 03755

Transportation: (800) 424-9300 *
Product Information: (603) 643-3441

SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Component	CAS No.	% by wt.	EXPOSURE LIMITS		
			OSHA PEL	ACGIH TLV	R Phrases
Benzotriazole	95-14-7	<1,0	N.E.	N.E.	R22,36/37/38
Propylene Glycol	57-55-6	<50,0	N.E.	N.E.	R36/37/38

SECTION 3 - HAZARDS IDENTIFICATION

Emergency Overview	Causes eye irritation. May be harmful if swallowed. May cause skin irritation
--------------------	---

Potential Health Effects	
Ingestion	Oral LD 50 (rat) as reported for 100% Benzotriazole is 560 mg./Kg.
Inhalation	Mists are harmful.
eye contact	Causes eye irritation.
skin contact	Can cause skin irritation.

SECTION 4 – FIRST AID MEASURES

Ingestion	Never give anything by mouth to an unconscious person. Give several glasses of water. If vomiting is not spontaneous, induce vomiting. Keep airway clear. Get medical attention.
Inhalation	If affected, remove from exposure. Restore breathing. Keep warm and quiet. Get medical attention.
Eye Contact	Immediately flush eye with cool running water. Remove contact lenses if applicable. Continue flushing with water for at least 15 minutes. Get immediate medical attention.
Skin Contact	Wash with soap and water. If irritation develops or persists, get medical attention.
Note to Physician	Treatment based on judgment of the physician in response to reactions of the patient.

SECTION 5 – FIRE FIGHTING MEASURES

Flash Point / Method	None to boiling.	Flammable limits	Not Established
Extinguishing media	Product is an aqueous solution. Use Carbon Dioxide, Dry Chemical, Foam.		
special fire fighting procedures	Full protective equipment including self-contained breathing apparatus should be used. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Get medical attention.		
Fire and explosion hazards	Water base solution.		

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Response to spills	Small spills: Mop up residues and place in a covered waste disposal container. Large spills: Dike or dam spill. Pump to containers or soak up on inert absorbent. Place in covered waste disposal container.
--------------------	---

SECTION 7 – HANDLING AND STORAGE

Handling precautions	Keep container in upright position. Avoid breathing or creating airborne mists. Avoid contact with skin eyes, and clothing. Avoid inhalation of vapor or mists. DO NOT TAKE INTERNALLY. Clean up spills immediately.
Storage precautions	Store in a cool dry place. Keep from freezing. Keep containers tightly closed when not in use.

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

Hygienic practices	Normal procedures for good hygiene.		
Engineering controls	Good general ventilation. Eye wash station in immediate area of use. M.E.L./O.E.S Nil. U.K HSE EH:40 Not listed		

Personal protective equipment

X	Respirator	If exposed to mists.
X	goggles / face shield	Recommended
	APRON	
X	Gloves	Recommended; PVC, Neoprene or Nitrile acceptable
	Boots	

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Clear Pink/Red Liquid	Boiling point	100EC
ODOR	None	freezing point	Not established
pH of Concentrate	5,5-7,0	vapor pressure	Not applicable
Specific gravity	1,0	vapor density	Not applicable
solubility in water	Complete	evaporation rate	Not determined

SECTION 10 – STABILITY AND REACTIVITY

Chemical Stability		Stable	X		Unstable	
Conditions to avoid	None					
Incompatibility	None Known					
Hazardous products of decomposition	BY FIRE: Carbon Dioxide, Carbon Monoxide Nitrogen Oxides					
Polymerization		Will not occur	X		May occur	
Conditions to avoid	Not applicable					

SECTION 11 – TOXICOLOGICAL INFORMATION

Carcinogenicity

	THIS PRODUCT CONTAINS A KNOWN OR SUSPECTED CARCINOGEN
X	THIS PRODUCT DOES NOT CONTAIN ANY KNOWN OR ANTICIPATED CARCINOGENS ACCORDING TO THE CRITERIA OF THE NTP ANNUAL REPORT ON CARCINOGENS AND OSHA 29 CFR 1910, Z

Other effects

Acute	Not determined
Chronic	Not determined

SECTION 12 – ECOLOGICAL INFORMATION

Biodegradability		Considered biodegradable			Not biodegradable	
BOD / COD Value	Not established					
Ecotoxicity	As reported for 100% Benzotriazole: Bluegill Sunfish (96 hr. Tlm):28mg/l; Minnow (96hr. Tlm):28mg/l; Trout (96 hr. LC 50): 39mg/l; Algae(96hr. EC 50): 15.4mg/l; Daphnia magna (48 hr. LC 50): 141.6mg/l					

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste disposal method	Waste material must be disposed of in accordance with national/local legislative requirements.					
RCRA Classification	Non Hazardous					
Recycle container		Yes	X	CODE	2 – HDPE	No

SECTION 14 – TRANSPORT INFORMATION

DOT Classification		Hazardous			Not Hazardous	X
Description	Not applicable					

SECTION 15 – REGULATORY INFORMATION

REGULATORY STATUS: Benzotriazole

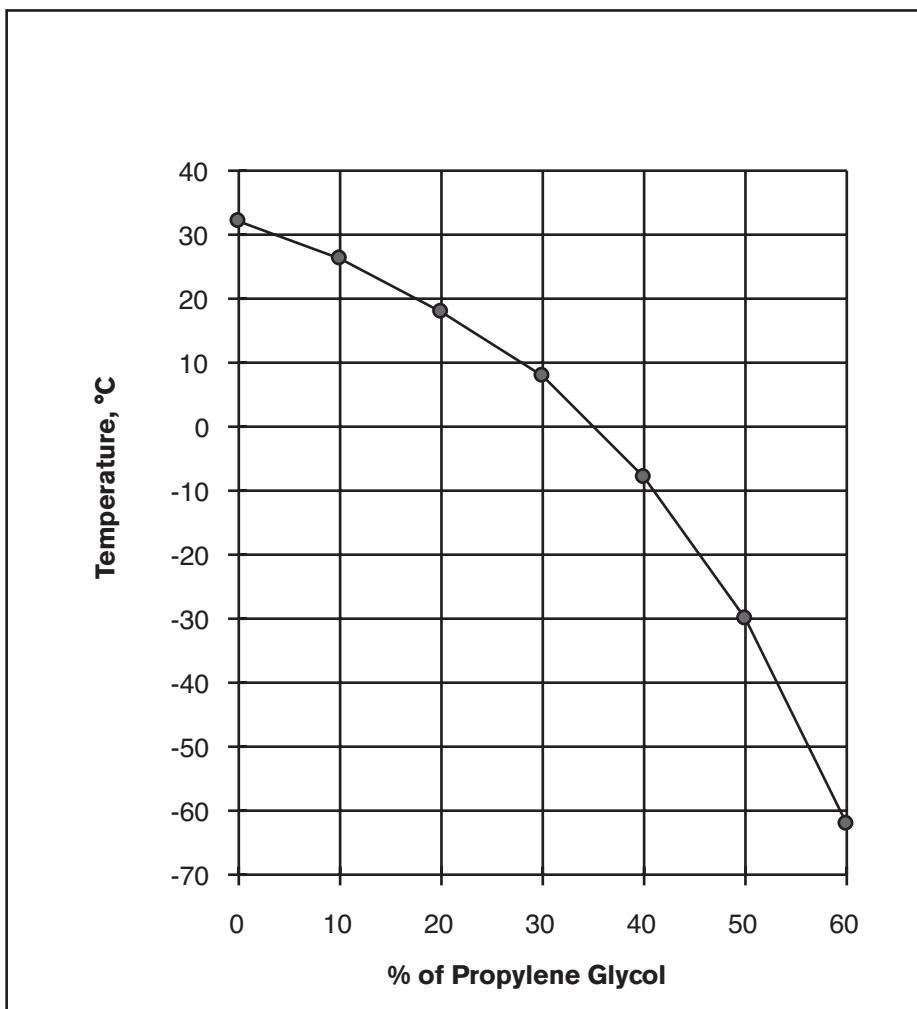
1.	Labeling Information	Irritant
2.	R Phrases	R 36/37/38, 22
3.	S Phrases	S 24/25, 26
4.	EI NECS No.	Not listed
5.	EC annex 1 Classification	Nil.
6.	German WGK	–

SECTION 16 – OTHER INFORMATION

NFPA Classification

1	BLUE	Health hazard
0	RED	Flammability
0	YELLOW	reactivity
–	WHITE	Special hazard

Information contained in this MSDS refers only to the specific material designated and does not relate to any process or use involving other materials. This information is based on data believed to be reliable, and the Product is intended to be used in a manner that is customary and reasonably foreseeable. Since actual use and handling are beyond our control, no warranty, express or implied, is made and no liability is assumed by Hypertherm, Inc., in connection with the use of this information.



Freezing Point of Propylene Glycol Solution